“Joint Management of Urban Wetland Areas in border region Latvia-Lithuania”
Urb-Area Nr.LLI-472

DAUGAVPILS AND ANYKŠČIAI URBAN WETLANDS MANAGEMENT PLAN

2021

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Introduction

Daugavpils City Council together with the Municipal Administration of Anykščiai Region within the framework of the Interreg V-A Latvia-Lithuania Cross-border Cooperation Programme 2014-2020 starts the implementation of a new cross-border project. On 5 October 2020 the contract on financing of the project No LLI-472 "Management of urban Wetlands in the Latvia-Lithuania cross-border region" was signed with the Ministry of Environmental Protection and Regional Development of the Republic of Latvia. The project will manage two urban Wetlands - the Esplanade Wetland in Daugavpils and the Green Pond in Anykščiai.

Both municipalities face a lack of awareness among authorities and citizens of the importance of the urban Wetland ecosystem for the natural balance. The project will organise the management of natural and semi-natural ecosystems of urban Wetlands in two neighbouring cities: Daugavpils (Latvia) and Anykščiai (Lithuania).

The project aims to develop a new and effective approach to the joint management of transboundary urban Wetlands. In addition, a joint action plan will be elaborated, an innovative, integrated approach to monitoring Wetland wildlife and inhabitants will be developed, and environmental education activities will be conducted.

The Management Plan has been developed in accordance with the strategic objective of the Sustainable Development Strategy 2030 of Daugavpils State City and Augšdaugava Municipality "Achievable and high quality rural and urban space" and the long-term priority "Climate-neutral environment", taking into account the strategic objectives defined in the Daugavpils State City and Augšdaugava municipality Development Programme 2022-2027, in line with the action line "RV19 Environment and natural resources" of the medium-term priority "MTP3 Sustainable Housing, Environment and Infrastructure".

Project title: **"Joint Management of Urban Wetland Areas in border region Latvia-Lithuania"**

Project acronym: Urb-Area

Project number: LLI – 472

ERDF funding: 319 719.36 EUR

Project start date: 01.10.2020

Project end date: 30.09.2022

1. DAUGAVPILS ESPLANADE WETLAND

1.1. LOCATION OF THE ESPLANADE WETLAND

The Esplanade Wetland is located between Daugavas Street, Esplanade Recreation Park, Kandavas Street, Vienības Street, Cietokšņa Street and the territory of the wastewater treatment plant (Figure 1). The total area of the Wetland is ~ 12 ha and includes the entire Esplanade Wetland area, which, according to the Daugavpils City Spatial Plan, is designated as an environmental area. A 20 m protection zone has been established around the Wetland area. Five of the land units within the Wetland area (cadastral no. 05000101104, 05000010606, 05000010015, 05000100902, 05000100901) belong to the municipality, while three land units (cadastral no. 05000010015, 05000010601, 05000100903) belong to physical persons (Figure 2).

According to the classification established in the Cabinet of Ministers Regulation No 562 of 21 August 2007 "Regulations on the Procedure for Classification of Land Use Types and Criteria for their Determination", the largest land areas in the territory of the Esplanade Wetland are occupied by marsh (5.86 ha), agricultural land and shrub (3.38 ha). The types of land use are shown in more detail in Table 1 and their distribution in the Esplanade Wetland is shown in Figure 3.

Table 1. ***Types of land use in the territory of Esplanade Wetland (classification according to Cabinet Regulations No 562 of 21 August 2007 "Regulations on the Procedure for Classification of Types of Land Use and Criteria for their Determination")***

Types of land use	Area (ha)	% of total area
Land for water objects	0,40	3,13
Forest	0,84	6,60
Shrub	2,38	18,75
Marsh	5,86	46,07
Agricultural land	3,24	25,45
Other land	0,001	0,01
Total:	12,72	100,00

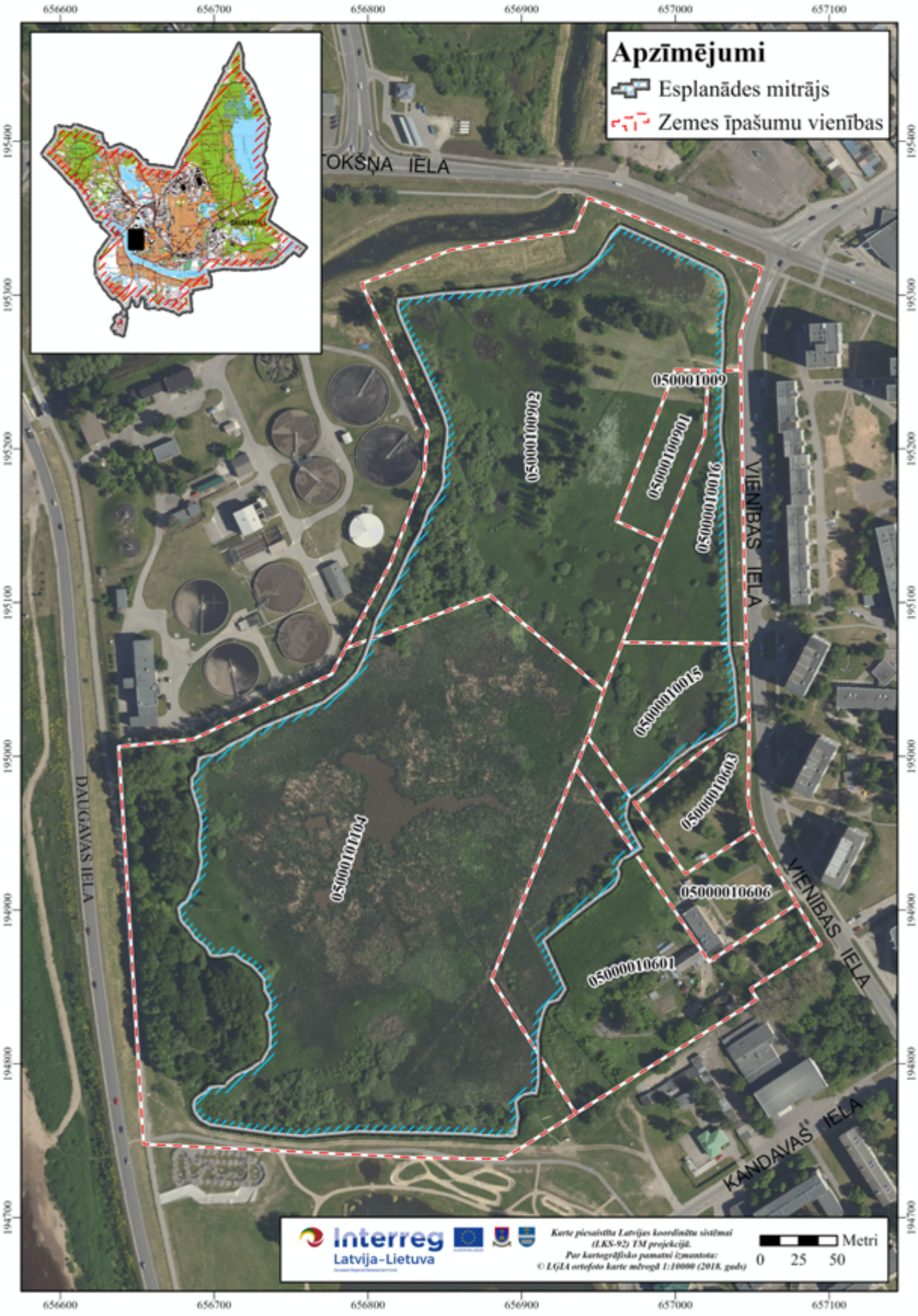


Figure 1. ***Cartographic representation of the Esplanade Wetland on the base of the 2017 orthophoto map***

Figure 2. ***Land ownership structure in the Esplanade Wetland***

Figure 3. ***Cartographic representation of land use types***

The Esplanade neighbourhood is a typical residential area with educational institutions (kindergartens, schools, Daugavpils University) and the necessary service infrastructure. There are

important business infrastructure and sports facilities (Daugavpils Olympic Centre, football stadium, Daugavpils University sports complex). The area has great potential for growth to the north. Large green areas: the Esplanade marsh area with a gull colony; the Latgale Zoo area and the landscaped Esplanade Park with a modern bike park in an urban environment with an adventure track, skate park, cycle track and children's activity area (Daugavpils City Spatial Plan, 2020).

The Esplanade area includes major road and rail transport nodes, as well as almost all possible functional zones in the urban environment (Figure 4).

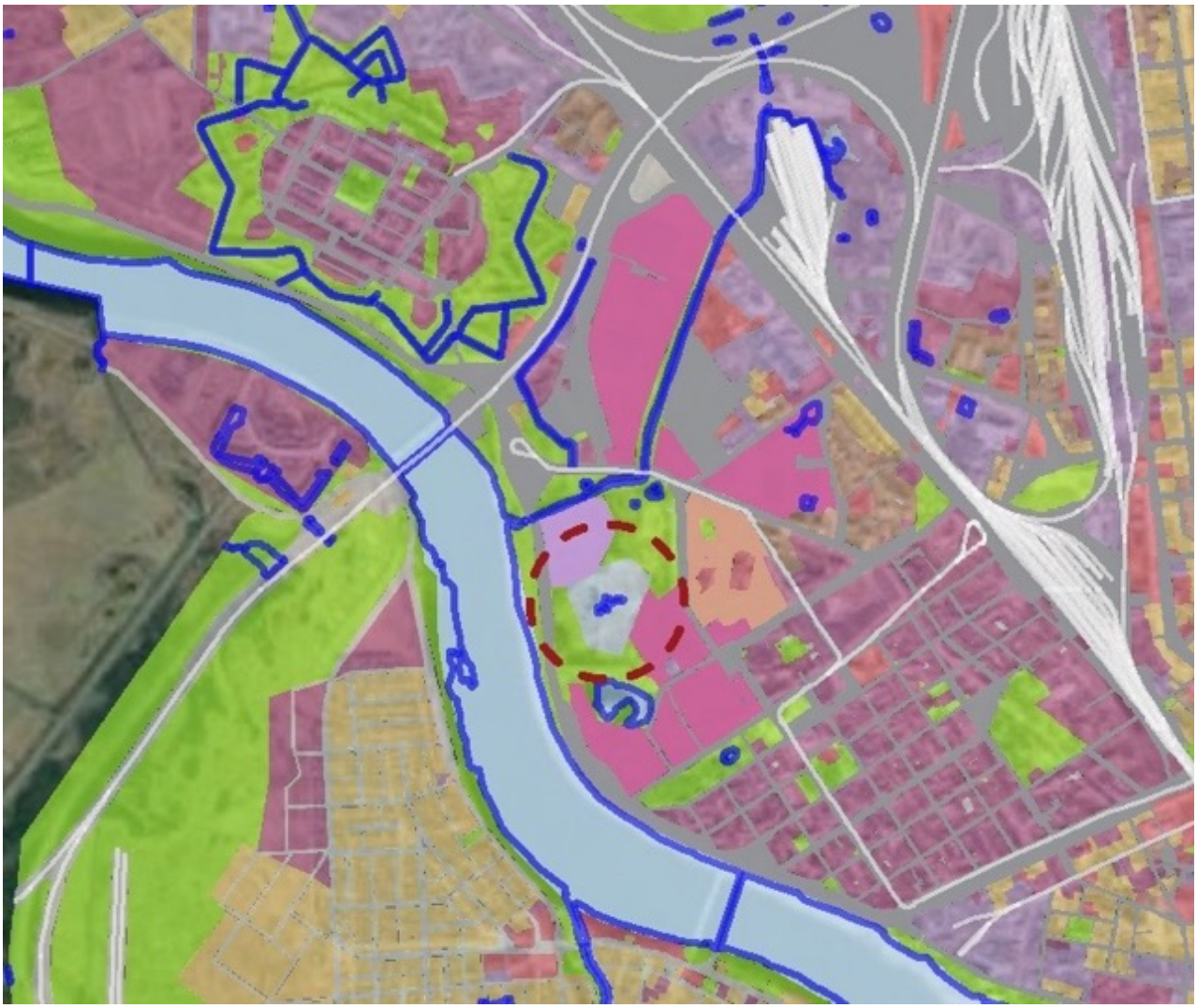


Figure 4. ***Esplanade Wetland and adjacent functional zones***

The direct contact of these areas with the Wetland area is both a threat and an opportunity for its future development. The most significant threat is posed by the directly adjacent industrial and technical zones, as well as transport interchanges, which have a significant impact on the ecological quality of the site. However, the direct presence of educational and scientific research areas, which are able to assess the site's qualities and take rational action to promote its protection and development, is an opportunity to protect the site and ensure a favourable microclimate for various species. Similarly, the creation of an organised infrastructure will benefit not only the overall protection and enhancement of biodiversity in the urban environment and the strengthening of the ecological network of the landscape, but also the local population, who could use these areas for quality everyday recreation, community building and nature exploration.

The E corner of the Wetland is included in the protection zone of the cultural monument - Daugavpils Fortress. The nearby Daugavpils Mark Rothko Art Centre, Latgale Zoo and the Daugavpils Innovation Centre, which is under reconstruction, also allow the Esplanade Wetland to be developed as part of the cultural and natural outdoor learning environments to be included in both local and national tourism routes.

In the future, the territory has an important role to play in the possible outdoor activities of the Latgale Zoo and the Daugavpils Innovation Centre. The Wetland area is also an important place for outdoor activities, including environmental education, for the neighbouring educational institutions - pre-schools, interest education, university. By improving the area, it becomes attractive, firstly, for local residents as a recreational place - for walking, mutual communication, active lifestyle and, secondly, also attractive for visitors as a place to explore nature alongside other cultural activities offered in the city. The adjacent Esplanade Park, with its infrastructure, supports physical activities such as swimming, jogging, walking, Nordic walking, cycling and street gymnastics. The Wetland area, on the other hand, offers opportunities for nature exploration and peaceful recreation activities, thus covering a wide range of public preferences and interests.

The Wetland area is visually accessible mainly from Daugavas Street and from the high-rise residential area. An artificial embankment has been created in the adjacent Esplanade Park as a viewing platform to the Wetland.

The area is poorly accessible. Along part E of the site, through the Esplanade Park area, there is an asphalt path illuminated in the dark of the day, leading from Kandavas Street to a pedestrian and cycle path along Daugavas Street. The path leads to a viewing platform in the SE corner of the Wetland. From Daugavas Street, the pedestrian and cycle path lead to the edge of the embankment along the NW side of the Wetland, which was created during the construction of the waste water treatment plant. There are some footpaths leading into the area from the side of the high-rise residential area. The area is heavily overgrown and not inviting.

1.2. HISTORICAL ASPECTS OF THE DEVELOPMENT OF THE ESPLANADE WETLAND LANDSCAPE

The Esplanade Wetland is located in the central part of Daugavpils, between the Daugavpils Fortress, the old town, the Daugava River, and the mixed centre, industrial and high-rise residential areas. The Wetland is formed in the floodplain meadows of the Daugava River at the mouth of the Šuņupe River. Maps from 1924 and 1927 show the extent of the floodplain meadow and the bed of the Šuņupe River (Figures 5 and 6). The existing Esplanade Wetland has been historically preserved as the lowest point and isolated from the Daugava River by the development of the urban transport network.

Figure 5. ***Map of 1924***

Figure 6. ***Map of 1927***

According to the geological survey data (Figure 7), the surface of the site consists of Upper Pleistocene alluvial deposits aQ_3, Holocene alluvial deposits aQ_4 and Holocene bog deposits bQ_3. This depositional pattern indicates that the site was formed as a floodplain of the Daugava River with the development of the Daugava valley during the late glacial and post-glacial periods.

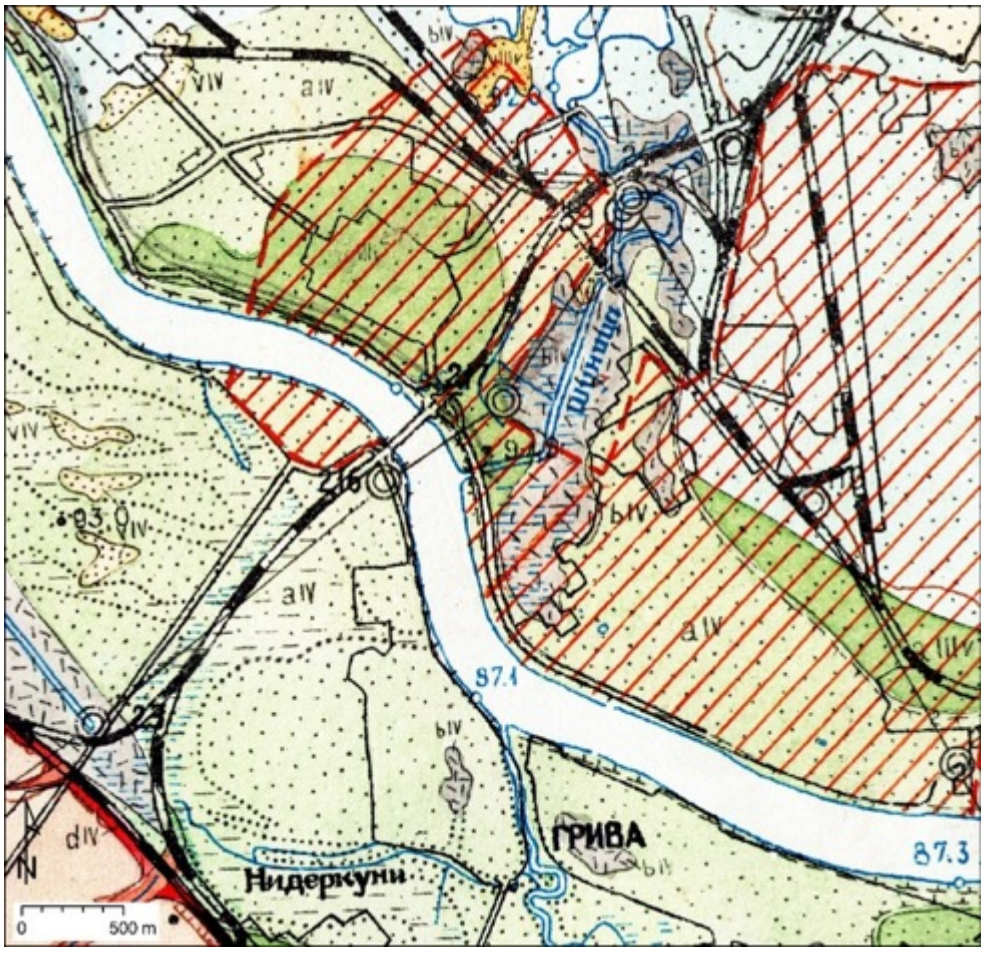


Figure 7. ***Map of Quaternary sediments of the study area and adjacent area (data source: Jušķevičs et al., 1978)***

The fact that the Esplanade Wetland is a former floodplain with characteristic annual inundation during spring floods is confirmed by the analysis of available historical maps. For example, the plan of Dinaburg Fortress of 1822 shows the situation on 22 April of that year and the areas flooded during the floods are also marked on the plan (Figure 8). As can be seen, the Esplanade Wetland area is actually entirely within the flood zone. Thus, before the Daugavpils Dam was built in 1830-1841, the hydrological regime of the Esplanade Wetland was determined by seasonal fluctuations in the water level of the Daugava River and its tributary the Šuņupe (Šunica) River. The Esplanade Wetland has historically supported a biodiversity characteristic to river floodplain complexes.

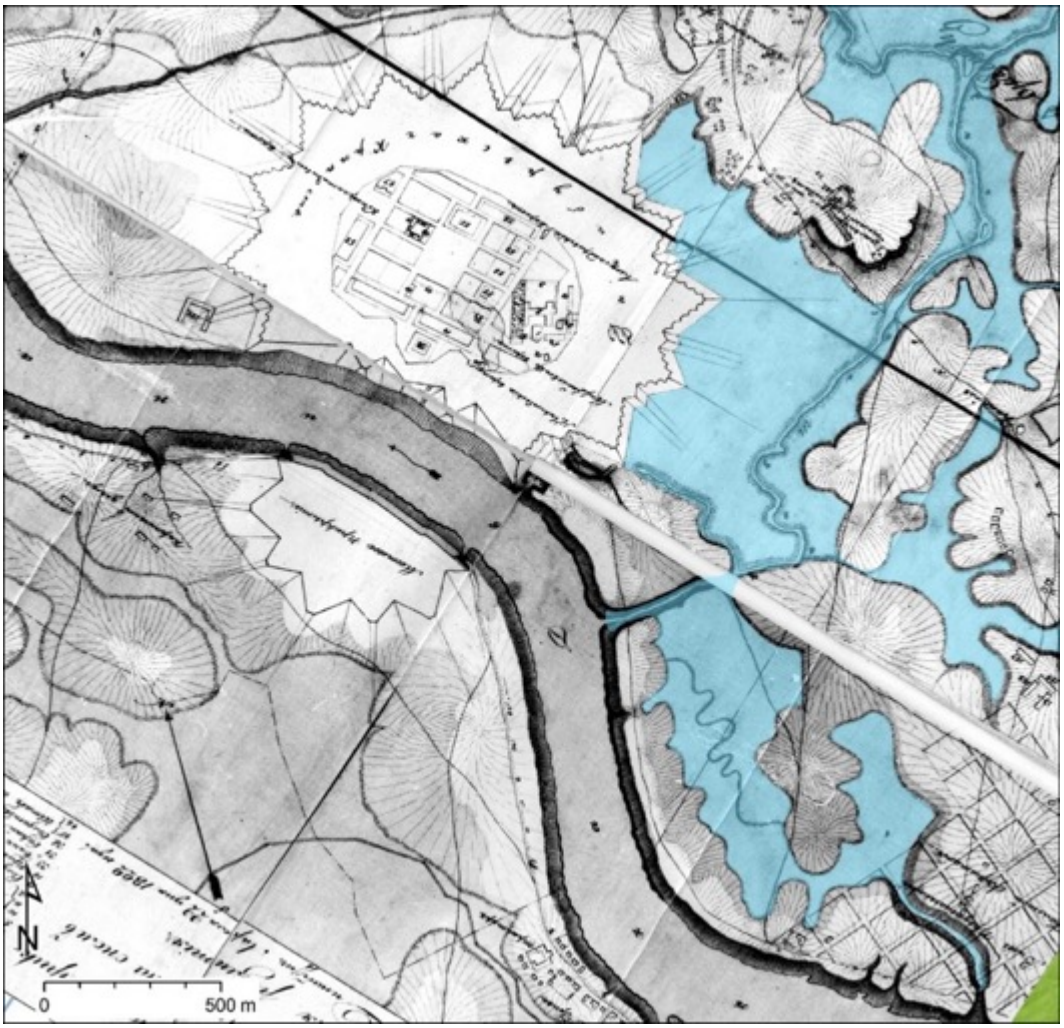


Figure 8. ***Georeferenced sketch of Dinaburg Fortress, 1822 (light blue areas indicate areas flooded in the spring floods of 22 April 1822)***

The course of Šuņupe River and its connection to the Šuņezers Lake have been preserved, but the natural hydrological regime of the area has changed significantly during the development of the city. As early as 1866, Russian army maps and Latvian army maps of 1920-1940 show a strong development of the railway and transport network, which fragmented the landscape of the Šuņupe River (Figures 9 and 10). Urban development has both altered the natural channel of the river and disrupted its course. Today, a fragmented riverscape has developed, which in its current state is not visually perceptible as a historically natural river landscape (Figures 11 and 12).

Figure 9. ***Map of 1866***

Figure 10. ***Latvian Army Map of 1920-1940***

Figure 11. ***The landscape of the Šuņupe River***

- The outlet of the Šuņupe River from the Šuņezers; - The outlet of the Šuņupe River into the Daugava River;

- The bed of the Šuņupe River and its course;

- Esplanade Wetland; - Artificial barriers in the riverscape - Urban transport infrastructure

Figure 12. ***Landscape of the Esplanade Wetland***

However, despite significant environmental changes, the site has retained its historic natural character, which should be protected in the future, not only in the context of the Esplanade Wetland, but also in the context of the entire Šuņupe landscape.

1.3. THE IDENTIFIED SCENIC AND NATURAL VALUES OF THE ESPLANADE WETLAND AREA

1.3.1. The scenic values of the Esplanade Wetland

The aesthetic quality of a landscape is made up of visual (what we see), sensory (what we hear, smell, taste and touch) and cognitive perception (what we feel through previous experience and interpretation). The aesthetic qualities of the Esplanade Wetland in an urban context are largely due to the presence of a large natural landscape in a sufficiently densely built-up area. This type of landscape, at the heart of an urbanised environment, significantly enhances the visual, sensory and cognitive well-being of people through visual, auditory, sensory, gustatory and spiritual perception.

In its current visual situation, the aesthetic qualities of the Wetland are undermined by the adjacent industrial areas and pollution from municipal waste. However, the Wetland vegetation also serves as a visual buffer, obscuring industrial areas and heavy traffic routes. This also helps to accumulate noise and fumes from traffic and odours from industrial sites.

The area is partially visible from Daugavas and Kandavas Streets and clearly visible from Cietokšņa Street and from high-rise residential buildings, especially the higher floors. The distant views provide a visual respite, which is not a common situation in densely built-up urban areas (Figure 13). As the Wetland is an important bird nesting site, the area is filled with bird sounds at certain times of the year, which provide a pleasure to the ear while at the same time reducing the noise from the urban environment.

Figure 13. ***Aesthetic qualities of the Esplanade Wetland.***

- open sight lines

- obstructed sight lines

- visual buffer

- visually inaccessible areas

Overall, the existing aesthetic qualities of the Wetland are based on natural environmental values with a high potential for aesthetic enhancement.

The ecological qualities of a landscape are related to the biodiversity found in the area and its importance in the overall urban ecological system. Daugavpils is a city rich in water, natural areas and plantations, however, for a city of its size and population, more areas are needed for targeted recreation in terms of urban ecology, including microclimate.

The Esplanade Wetland has a direct connection to the natural habitats of the area, which are mainly provided by the Šuņupe River and the green structures of the Daugava riverbank. One of the main obstacles to the landscape ecological corridors is the urban railway network, which is not only a physically difficult obstacle to overcome, but also a potential source of noise, odours and pollutants (Figure 14). The Wetland is important for breeding and migratory bird species, but under current

conditions, with the gradual degradation of the site, it is becoming unsuitable and significantly reducing the potential diversity of species.

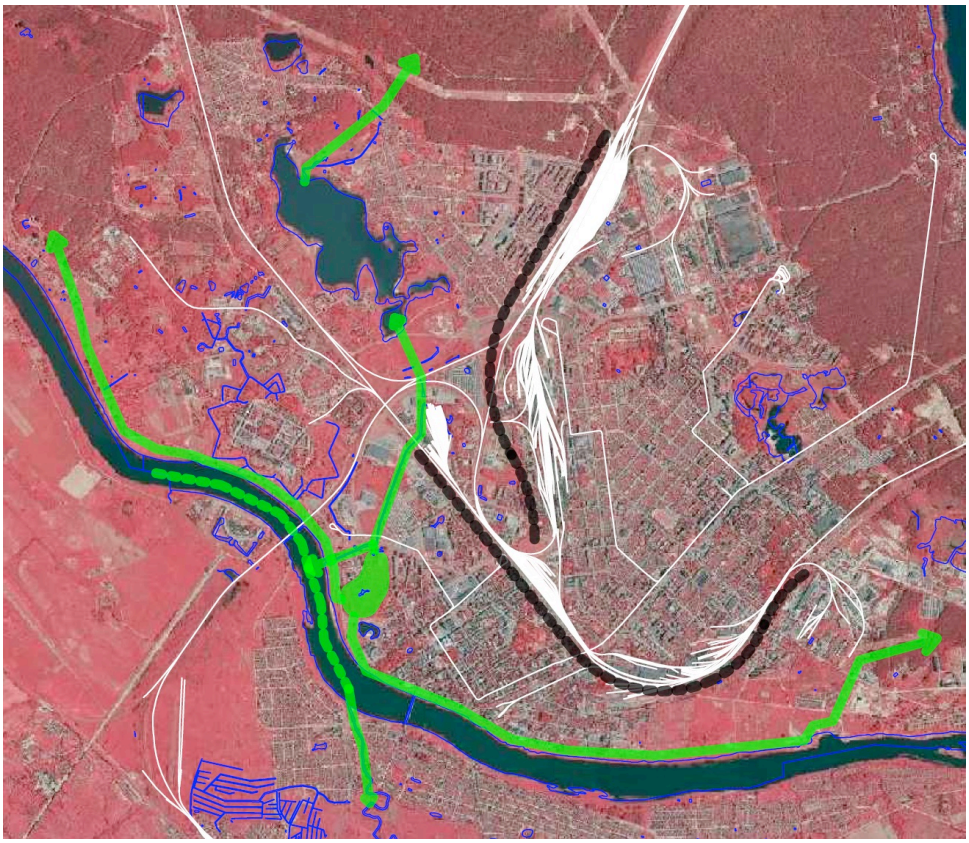


Figure 14. ***Esplanade Wetland connectivity with surrounding natural habitats and main barriers (Source: LVM GEO infrared orthophoto map)***

The ecological quality of the Esplanade Wetland landscape is closely linked to the increase in biodiversity it can support under appropriate management conditions. As it stands, the area is dominated by degraded soils and aggressive vegetation, which in general creates a homogeneous landscape ecology. The ecology of the site is negatively affected by municipal waste, which is more prevalent on the residential side of the high-rise housing. With future development of the site, it is essential to balance the needs of the community in the recreational use of the site and the undisturbed promotion of biodiversity.

1.3.2. Habitat characteristics of the Esplanade Wetland

The Esplanade Wetland is one of the lowest areas of the city, surrounded by man-made embankments and dykes. The Wetland is covered by aquatic and wet-loving plants in the lower areas and low-demanding native and invasive tree species in the higher and therefore drier areas. Native species are mainly deciduous woody plants - willows, maples, aspen, birches, etc. Invasive species - dogwoods, ashleaf maples. The Wetland vegetation is mainly formed by the highest woody vegetation along the perimeter, which partially reduces the visual accessibility of the site. The N part of the site consists of a wider tree cover - mainly willows, birches, maples and a planted group of larches. See Figure 15 for the LIDAR vegetation cover pattern.

Figure 15. ***LIDAR vegetation surface model***

The Esplanade Wetland is a water body overgrown with common reed *Phragmites communis* and bulrush *Typha latifolia,* where these species form monodominant stands (Figure 16), dominated also by reed sweet-grass *Glyceria maxima* and sedges *Carex* sp. In addition to the species already mentioned, the Wetland supports a variety of Wetland vascular plants, such as great willowherb *Epilobium hirsutum*, marsh willowherb *Epilobium palustre*, gipsywort *Lycopus europaeus*, cowbane *Cicuta virosa, etc*.

Figure 16. ***Esplanade water body overgrown with common reed and bulrus (Photo: D. Krasnopolska)***

Figure 17. ***Part of the site is intensively overgrown with shrubs (Photo: D. Krasnopolska)***

The central part of the Wetland is covered by open water in small areas (Figures 18 and 19). The northern part of the Wetland is densely vegetated with shrubs (Figure 17), mainly dominated by willows *Salix* sp., but also with several invasive woody species.

Figure 18. ***Open water areas in the central part of the Wetland (Photo: A. Erts)***

Figure 19. ***Open water can also be found in some sections of ditches (Photo: D. Krasnopolska)***

No specially protected Latvian habitats[1] were identified during the survey, however, historical photographs and maps (Figures 20-22) clearly show that the site of the existing Esplanade Wetland was reclaimed grassland, which was subject to hay mowing. The 1931 topographic map shows that the Esplanade water body is replaced only by a drainage ditch system (Figure 21). It is possible that the water body began to form as a drainage outlet at a time when the adjacent areas were being drained and developed (Figures 22 and 23).

[1] Cabinet of Ministers Regulation No 350 of 20.06.2017 Regulations on the list of specially protected habitat types.

Figure 20. ***In the foreground, reclaimed hay meadows on the site of the existing Esplanade Wetland (Photo: Азан и.др. 1975***

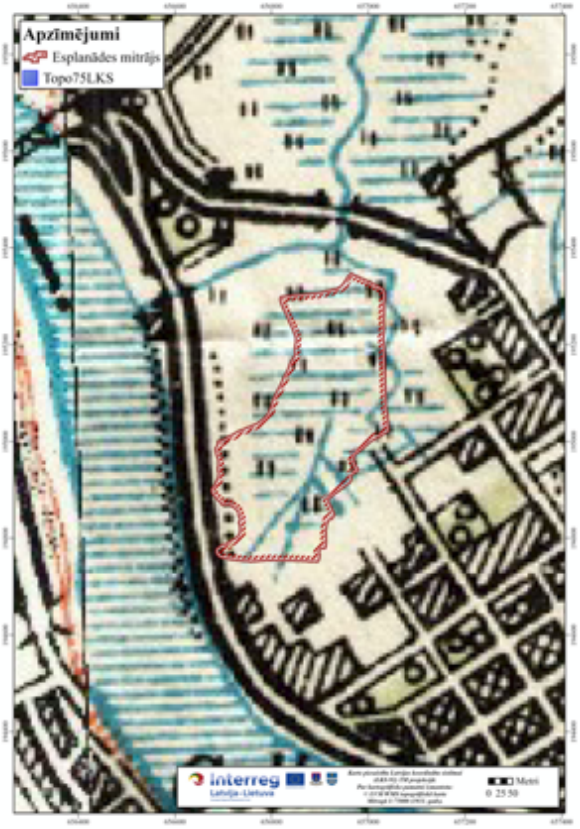


Figure 21. ***Esplanade Wetland area on the base of the Latvian Army topographic map of 1931***

Figure 22. ***Esplanade Wetland area on the base of the USSR General Staff map of 1963***

Figure 23. ***Esplanade Wetland area on the base of the 2012 topographic map prepared by the Latvian Geospatial Agency***

Even today, fragments of the biologically valuable moderately wet grassland species, the meadow foxtail *Alopecurus pratensis,* remain in the NE part of the site (Figure 24). In the Latvian territory, temperate wet grasslands are species-rich meadows on moderately fertile and fertile soils (Figure 25). Temperate wet grasslands can remain almost unchanged for long periods (decades), especially in floodplains, where they are regularly flooded and the floods provide both fertiliser and aeration. However, long-term use of grasslands without maintenance over several decades leads to vegetation changes. There is also an increase in large broadleaved species (cow parsley *Anthriscus sylvestris*, common nettle *Urtica dioca*, etc.). The potential for recovery depends on how much the grassland has been modified. The most appropriate method of restoration is mowing twice a season, with hay harvesting. If there are many expansive species, mowing up to three times a season with immediate collection of the grass cuttings is preferable to reduce the number of expansive species and prevent their reproduction by seeds. Mowing is the most important factor in determining the typical species composition, the herbage stand, the even distribution of all species (there is no single dominant plant species, they are polydominant communities). Mowing creates equal growth opportunities for all species (Rūsiņa 2017).

Figure 24. ***A fragment of a moderately wet grassland in the Esplanade Wetland with the meadow foxtail Alopecurus pratensis (Photo: D. Krasnopolska)***

Figure 25. ***Species-rich temperate wet grassland in the territory of the NP "Dviete floodplain" (Photo: D. Krasnopolska)***

1.3.3. Species found in the Esplanade Wetland

A total of 241 species have been recorded in the Esplanade Wetland or in the area immediately adjacent to it. See Annex 1 for a list of species recorded. Both standard methods and genetic monitoring methods have been used to identify species and to determine the distribution of the European pond turtle in the Esplanade Wetland. The genetic monitoring methods used are based on the collection of environmental DNA (eDNA) samples in the aquatic environment. Complementing standard monitoring methods with genetic monitoring methods increases the chances of correctly estimating population size, distribution and other population parameters in a given area, as well as verifying or confirming results obtained by other monitoring methods.

22 species of special conservation concern or otherwise important for nature conservation have been recorded in the surveyed area. 19 species are included in the list of specially protected species (Cabinet of Ministers Regulation No.396 of 14 November 2000 "Regulations on the List of Specially Protected Species and Specially Protected Species of Restricted Use"). Specially protected territories – micro reserves can be developed for protection of two species (black-headed gull *Chroicocephalus ridibundus* and European pond turtle *Emys orbicularis*), in accordance with the requirements of Latvian legislation (Cabinet of Ministers Regulation No 940 of 18 December 2012 “Regulations regarding the establishment and management of micro-reserves, their conservation, as well as determination of micro-reserves and their buffer zones”). 12 of the species found in the territory are included in the Latvian Red Data Book. 13 of the species found in the Esplanade Wetland are included in the European Council Directive 92/43/EEC (21.05.1992) "On the conservation of natural habitats and of wild flora and fauna", while four of the bird species found in the site are included in the European Council Directive 79/409/EEC "On the conservation of wild birds". Annex I (species that require special habitat protection measures to ensure their survival and reproduction within their range).

For a list of protected and rare species found in the Esplanade Wetland and adjacent area, see Annex 2 of the Action Plan, and for a mapping of sites, see Annex 3.

1.3.3.1. Bird fauna in the territory

The Esplanade Wetland is an important area for several species of birds specially protected in Latvia and the European Union. During various surveys carried out in the period 2015-2020, 7 species of

birds of special conservation concern in Latvia have been identified as potential breeders in the Esplanade Wetland, 4 of which are listed under the Birds Directive (79/409/EEC).

The most important asset of the study area is the colony of **black-headed gulls *Chroicocephalus ridibundus (***Figure 26). The number of breeding black-headed gulls in the colony varies from 1000 to 2000 pairs. The black-headed gull is a gregarious bird of the gull family *(Laridae)* and colonies can range from a few dozen to over 10,000 pairs (LOB 1999). The black-headed gull is defined as a keystone *species* - a species whose presence significantly alters the structure or function of a biocenosis or ecosystem. A 25-year study in Estonia found a direct, positive correlation between black-headed gull numbers and populations of other waterbird species (Leito *et al.* 2006). The nesting of other birds in the immediate vicinity of a black-headed gull colony has the advantage of protection against raptor species: crow *Corvus corone*, marsh harrier *Circus aeruginosus*, common raven *Corvus corax*.

The species has a wide range in Eurasia, from Western Europe to Kamchatka. The size of the breeding population in Latvia in the period 2013-2017 is estimated to be between 24539 and 38200 breeding pairs (Birdlife International 2019). Both in the short-term (2000-2017) and long-term (1980-2017), the species has shown a significant decline in Latvia. The species peaked in Latvia in the late 1980s, when the Latvian population estimate was at least 110 000 breeding pairs. With the collapse of the Soviet Union, a sharp decline in the number of black-headed gulls began. The causes of the change in numbers include the loss of anthropogenic food availability (bankruptcy of fish processing plants, closure of fur farms, better organisation of landfills), the rapid increase in the number and distribution of an invasive predator species, the mink *Mustela vison*, and the decline in suitable nesting sites (Viksne et al. 1996).

As the colony is located in an area inaccessible to humans, it is not possible to keep an accurate count of nests. The number of nesting birds in the colony is estimated from the number of birds that attack birds of prey. The bird counts were made in sequential photographs. It should be taken into account that some of the nesting black-headed gulls may have been foraging outside the colony at the time of the photographs, and that there may also be individuals in the colony that have not reached sexual maturity. The estimate of the number of breeding black-headed gulls in the area for the period 2014-2020 is between 1000 and 2000 pairs. No significant changes in numbers have been observed during the study period.

Figure 26. ***Black-headed gulls above the nesting colony in Esplanade Wetland (Photo: A. Erts)***

1-2 pairs of **little bittern** ***Ixobrychus minutus*** also nest regularly in the Esplanade Wetland. The estimated population size of the little bittern in Latvia is only 50 - 80 pairs (Birdlife International 2019), therefore the water bodies in the Daugavpils City area are an important breeding site for the little bittern in Latvia. A breeding population was discovered in the city in 2013 (A. Erts, G. Grandāns). The total number of nesting pairs in Daugavpils City territory is not less than 10 pairs.

The little bittern breeds in a variety of shallow waters, in the vegetation belt of lakes and ponds, fishponds and flooded quarries. Important habitat components in Latvia are submerged willow and other shrub clusters, islets inaccessible to humans, etc.

Until 2015, several pairs of little bitterns nested in the Esplanade Reservoir adjacent to the study area, which has become unsuitable for little bitterns and other specially protected bird species after the landscaping works.

1-2 **pairs of pochard** ***Aythya ferina*** nest in the Esplanade Wetland. The species is directly associated with colonies of black-headed gulls, in the periphery of which it nests. The breeding population size of *Aythya ferina* in Latvia is estimated at 500 - 600 breeding pairs (Birdlife 2019). Both in the short-term (2004-2018) and long-term (1991-2017), the species has shown a significant decline in Latvia. As recently as 2010, the number of breeding pochards in Latvia was estimated at 1500-2000 breeding pairs (Viksne *et al.* 2010). "BirdLife International" estimates that the European population of pochards has declined by 30-49% over the last 30 years, and the global population is also declining (http://datazone.birdlife.org/species/factsheet/common-pochard-aythya-ferina).

In the study area, 5-7 breeding pairs of **bluethroat** ***Luscinia svecica*** were recorded. The Esplanade Wetland is considered to be an important breeding site for this species in Latvia, as the population size of this species in the country is estimated to be only 150 - 300 pairs (Birdlife International 2019).

In 2013, a population of 50-100 pairs was discovered in and around Daugavpils city (A. Erts, G. Grandāns). The species inhabits various banks of water bodies overgrown with reeds and shrubs.

Corn crake *Crex crex* has been occasionally recorded in the Esplanade area. Vocal males of this species are mostly heard in the driest part of the study area, in the land parcel with cadastral number 05000100902.

1-2 pairs of **red-backed shrike *Lanius collurio*** nest in the driest and scrubbiest part of the study area. Both in the short-term (2005-2018) and long-term (1995-2018), the species has shown a significant decline in Latvia. Inhabits overgrown clearings, scrubby roadsides, orchards, woodlands, wet scrubby depressions in farmland, overgrown meadows.

Several species of passerine birds inhabiting wetland habitats have been recorded in the study area - reed bunting *Emberiza schoeniclus*, thrush nightingale *Luscinia luscinia*, sedge warbler *Acrocephalus schoenobaenus*, reed warbler *Acrocephalus scirpaceus*, great reed warbler *Acrocephalus arundinaceus*, common rosefinch *Carpodacus erythrinus*, yellow wagtail *Motacilla flava*.

Several waterbird species have been recorded in the study area as probable or confirmed breeders: mallard *Anas platyrhynchos*, tufted duck *Aythya fuligula*, garganey *Anas querquedula*, common shoveler *Anas clypeata*, common coot *Fulica atra*, moorhen *Gallinula chloropus*, water rail *Rallus aquaticus*.

During the autumn and spring migration, the Esplanade Wetland is an important feeding and resting area for migrating waders and waterbirds. The following species are regularly observed in the area: ruff *Philomachus pugnax*, wood sandpiper *Tringa glareola*, pempe *Vanellus vanellus*, common redshank *Tringa totanus*, greenshank *Tringa nebularia*, common snipe *Gallinago gallinago*, woodcock *Scolopax rusticola*, jack snipe *Lymnocryptes minumus.*

During the autumn migration, up to 10 000 common starlings *Sturnus vulgaris* and up to 1000 barn swallows *Hirundo rustica* roost in the reed and sedge beds of the Esplanade Wetland.

1.3.3.2. Invertebrate fauna of the area

The Esplanade Wetland is an area consisting mainly of monodominant stands of common reed *Phragmites australis* and bulrush *Typha latifolia*. Such areas are not characterised by a significant diversity of invertebrate species. The area is characterised by seasonal fluctuations in water levels, but in the central part of the area there is an open water area, which remains permanently. This water body is significantly eutrophicated and therefore suitable for invertebrate species that do not have strict water quality requirements. On the periphery of the Wetland there are several open areas with grassland vegetation. These areas are suitable for the development of butterfly larvae and also serve as feeding sites for adults. The periphery of the Esplanade Wetland is relatively rich in shrubs and trees. Some of the invertebrate species that can be observed in the Esplanade Wetland are patchy, such as several species of dragonflies, butterflies and beetles, but their development mainly takes place outside the site.

The most important invertebrate species of nature conservation value occurring in the Wetland area are the Roman snail *Helix pomatia*, jet black ant *Lasius fuliginosus* and the musk beetle *Aromia moschata*.

The **Roman snail*, Helix pomatia (***Figure 27), is found on the periphery of the site, mainly in the northern and western parts. The suitable habitat for the species, in the Esplanade Wetland, is non-flooded areas with tree cover. The species is included in Annex III of the Bern Convention, Annex V

of the EU Directive and in the list of specially protected species of restricted use in Latvia. The Roman snail is common in Latvia and can be found in a variety of forest habitats, grasslands, parks and synanthropic habitats.

Figure 27. ***Roman snail Helix pomatia (Photo: Uldis Valainis)***

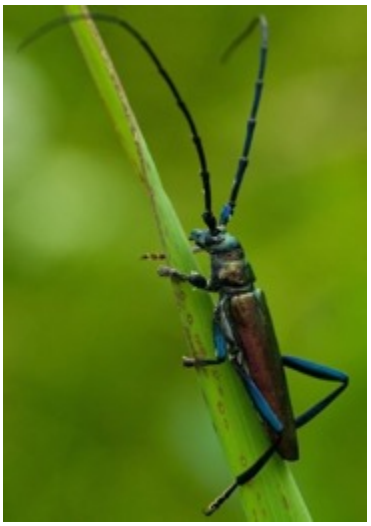


Figure 28. ***Musk beetle Aromia moschata (Photo: V. Vahrushev)***

The **jet black ant** ***Lasius fuliginosus*** is found in several hollow trees on the periphery of the site. It is a relatively widespread species in Latvia, occurring in various types of forests, parks and tree groves. They form nests mainly in the hollows of deciduous trees, but often also under the roots of conifers. It is a species of medium conservation value and is included in the list of protected species in Latvia. The cavity-forming trees of the area should be conserved for the sustainable existence of the jet black ant. Suitable trees for the species are localised in the northern and western parts of the site.

The **musk beetle** ***Aromia moschata***, a species listed in the Latvian Red Data Book (LSG), is found in the Daugava Valley and also in the Esplanade Wetland (Figure 28). This species is included in LRDB category IV. The nature conservation value is low. In Latvia, the musk beetle occurs in a variety of habitats (forests, grasslands, etc.) where willows grow. Larvae live in willow wood, while adult beetles feed mainly on hemlock flowers. A species of moderate frequency in Latvia. The population in the Esplanade Wetland is considered to be small. For the conservation of the species it is necessary to preserve part of the willows occurring in the area.

The **copse snail** ***Arianta arbustorum*** is a common species in the periphery of the site**.** This species is assessed as an agricultural pest, including frequent occurrence in home gardens. With its high abundance and biomass, it is considered to be one of the most common species in gardens, also occurring in forests, parks and ruderal areas. Individuals of the species are found throughout the periphery of the site.

The Esplanade Wetland is an area that can contribute to favourable conditions for species diversity in the urban environment. The range of other areas that support species diversity is a positive factor for the development of the area. The invertebrate fauna of the area is directly influenced by the proximity of the Daugava and Šuņupe river valleys and the Esplanade pond. These natural sites are the sites of migration of various invertebrate species, which enhances their survival in the urban environment.

<u>Negative factors affecting invertebrate fauna observed in the area:</u>

- The existing water body of the site is subject to high-intensity eutrophication processes, resulting in a reduction of aquatic invertebrate habitat as the surface area of the water mirror and the depth of the water body decrease.
- Parts of the site with grassland vegetation are prone to overgrowing due to long-term unmanagement. The overgrowth consists of both scrub and shrubs, mainly trees and shrubs of the willow genus. At the level of grassland vegetation, there is a high number of expansive plants and there are also localities of invasive species. Overgrowth and loss of plant species diversity have a direct impact on invertebrate species diversity.
- Much of the area is reed bed, with a very poor species composition of potentially hill-less species. The rest of the Wetland is highly fragmented and does not provide large areas of suitable habitat for invertebrates. Some of the species are found in the periphery, so that their fauna is also affected by processes outside the site, including anthropogenic impacts.

1.3.3.3. Mammal fauna of the area

To the NW of the Esplanade Wetland is the Daugavpils Fortress, which is inhabited by several protected bat species - Brandt's bat *Myotis brandtii*, brown long-eared bat *Plecotus auritus*, pond bat *Myotis dasycneme*, Daubenton's bat *Myotis daubentonii*, Northern bat *Eptesicus nilssoni,* and parti-coloured bat *Vespertilio murinus*. Given that bats are keen for foraging in estuaries and Wetlands, it is likely that at least some of the species recorded are also present in the Esplanade Wetland.

The current composition of mammal species in the Wetland is influenced by several factors, mainly anthropogenic. Due to the relatively high level of human activity around the Esplanade Wetland, only species that can tolerate or even benefit from human presence can establish here. Firstly, there are the invasive species mink and raccoon dog. Urban areas also tend to have a number of native species - fox, hedgehogs, shrews, moles, some mice and ermines. These species find it relatively easy to find food in habitats that have been modified by humans.

The presence of open water bodies has a positive impact on the diversity of the area. There are small stagnant ponds and overgrown drainage ditches within the site itself, while the Daugava River flows approximately 100 m from the Esplanade, the Šuņupe River is 200 m north of the Wetland (Figure 29), and Esplanade Park with its reservoir is immediately adjacent to the southern part of the site. All of these sites may be inhabited by species such as otter, mink and beaver. These species can tolerate human presence relatively calmly, especially if food resources are available in the area. All the species mentioned in the site are typical of near-water and waterlogged habitats, which they mainly use as feeding grounds, but some species may also use for denning. Although the site is located almost in the centre of the city, there are also relatively undisturbed areas.

Figure 29. ***Extension of the Šuņupe River to the north of the Esplanade Wetland***
(Photo: K. Dukule - Jekušenoka)

1.3.3.4. Amphibian and reptile fauna of the site

The amphibian and reptile fauna is relatively rich for such a small area within the administrative boundaries of a city. The Esplanade Wetland exceeds many nature reserves in species diversity, with 7-8 species of amphibians (including 1-2 species of green frogs, which require genetic analyses for taxonomic affiliation) and 2-3 species of reptiles (possibly including European pond turtle, for which future population restoration/enhancement measures are planned). The site is important for the conservation of specially protected species (2 or 3 amphibian species occur) and species whose protection is required by Latvia's international obligations (another 3-4 amphibian species are included in the Habitats Directive). Amphibian and reptile populations here are, however, relatively small.

The **smooth newt *Lissotriton vulgaris*** is a relatively common species for the area. This species breeds in the ditch in the NE part of the Esplanade and in the pond at the N end of the site, where adults have been recorded during the breeding season and larvae in the second half of summer. Several individuals were also found under various objects in the terrestrial habitat, in the forest fragment in the SE part. The lifestyle is hidden and the population size is unknown.

The **common spadefoot *Pelobates fuscus*** is a relatively rare species in the Esplanade area. The species is included in the list of specially protected species and in Annex IV of the Habitats Directive. Several years ago, breeding calls and chicks of some individuals were recorded in a ditch in the NE part of the Esplanade (observation by M. Pupiņš).

The **European toad *Bufo bufo*** has also been observed several times in the area, and has been recorded in the area of the Latgale Zoo adjacent to the Esplanade Wetland (observations by

M.Pupiņš), presumably inhabiting the Wetland periphery and the drier grasslands in the N part of the area.

The **green toad *Bufotes viridis*** also inhabits the periphery of the Wetland and adjacent areas. The species is listed as a specially protected species and is included in Annex IV of the Habitats Directive. The species has been recorded on several occasions in the grassy suburbs adjacent to Vienības Street, in the territory of Latgale Zoo, as well as at the DU pond south of the Esplanade Wetland. Some vocalisations have been recorded in the pond at the N end of the Wetland, the breeding population size here is estimated at ~20 adults.

The **common frog *Rana temporaria*** is a relatively common species in the Esplanade Wetland. The species is included in Annex V of the Habitats Directive. The species is regularly found in scrub and grassland habitats, as well as in the territory of the Latgale Zoo adjacent to the Wetland. The population size is unknown.

The **moor frog *Rana arvalis*** is a relatively rare species in the Wetland. The species is included in Annex IV of the Habitats Directive. Some juveniles have been recorded in the scrub on the periphery of the reed bed to the SE.

A relatively small population (20-50 adults) of **green frog (*Pelophylax esculentus* species complex)** has been recorded in the area. This species is included in Annex V of the Habitats Directive. Individuals have been found in pools and puddles on the periphery of the reed bed, in the ditch to the E, NW and in the pond at the N end of the site. The open water area in the middle of the reed bed is inaccessible for the purposes of the study, but such habitats are considered sub-optimal to poorly suitable for green frogs.

Common lizard (*Zootoca vivipara*) was found in small numbers on the periphery of the Esplanade Wetland. The species is mainly found in habitats of S exposure along the bush edge in S part and along the wastewater treatment plant in the NE part of the site. The total population size is estimated at 100-300 individuals.

Several records of **grass snake *Natrix natrix*** have been recorded in the Esplanade Wetland and adjacent area in recent years. The species has appeared in Esplanade Wetland relatively recently, 4-5 years ago (M.Pupiņš observation). Several specimens have been recorded near the pond at the N end of the site, along the E periphery of the site - in the grassland between reeds and shrubs, as well as near Vienības Street.

Historical records also exist for the **European pond turtle *Emys orbicularis*** in the Esplanade Wetland. The species is listed as a specially protected species and is included in Annex II of the Habitats Directive. A large female was found near the Esplanade Wetland in 1984, and after being brought to the Latgale Zoo, 12 eggs were laid, indicating that she had gone to the egg-laying site (observation by M.Pupiņš). There are no later records of European pnd turtles in or around the Esplanade, however, according to M.Pupiņš, the leading Latvian expert on the species, the presence of European pnd turtles is possible in the inaccessible middle part of the Wetland. After habitat improvement, the area will be used for population restoration using specimens propagated by the neighbouring Latgale Zoo.

Several species of exotic turtles have also been recorded in the Esplanade Wetland and adjacent water bodies. The **pond slider *Trachemys scripta*** was observed twice in the grassland near Vienības Street between 2006 and 2011, and once in the university pond adjacent to the south of the site (observations by M. Pupiņš). The **Chinese softshell turtle *Pelodiscus sinensis*** was found in 2014 in a terrestrial

habitat on the periphery of the reed bed in E part of the Esplanade Wetland (observation by M.Pupiņš). There are no permanent populations, records of both species refer to individuals released by residents.

Positive factors affecting amphibian and reptile fauna observed in the area:

- Geographical location - SE of Latvia. This location provides a relatively warm summer period for Latvian conditions and is close to the historical colonisation route along the Daugava-Dnieper corridor, which is favourable for southern species – common spadefoot, green toad, which are more common in the SE part of Latvia.
- It is close to important research and education centres - Daugavpils University and Latgale Zoo. This location gives the site significant potential for public education, indirectly contributing to the protection of the fauna of the area, and facilitating the re-establishment of populations (e.g. European pond turtle) using captive-bred specimens.

Negative factors affecting amphibian and reptile fauna observed in the area:

- Location in a densely populated area with strong anthropogenic impacts of various kinds. Anthropogenic impacts are manifested by the presence of people and pets (dogs, cats), as well as diffuse urban pollution. The human impact is mitigated by the fact that most of the area is marshy and inaccessible. However, exotic and invasive animals (Amur sleeper, exotic turtles) are released by residents.
- Isolation of populations. The area is surrounded by streets on 3 sides, the P67 road with heavy traffic separates the Esplanade Wetland from natural habitats on the banks of the Daugava. The isolation of the area is mitigated by the presence of the Šuņupe River, connected to the Daugava, but species such as the green toad have adapted to the surrounding urban landscape.
- Small size of the natural base area. The total area of the Esplanade Wetland is ~12 ha, of which ~5 ha or ~40% is reed bed, which is not suitable habitat for most species. This size cannot ensure the sustainability of populations for most species.
- Presence of the invasive fish species rotana and lack of breeding sites free of it. Amur sleeper is present in all permanent water bodies of the site. Amur sleeper is an important predator of amphibian larvae, consuming all species of amphibians found in the Esplanade Wetland.

1.3.3.5. Fish fauna of the area

The ichthyofauna of the water body in the central part of the Esplanade Wetland is species-poor, due to its small size and average depth (~1 m). A thick layer of mud has formed in its bed, and the water body is rich in vegetation. During the harsher winters, when the water body is covered by ice for long periods, fish suffocation is possible. In such conditions, ecologically low-demand fish species that have adapted to life with periodically low oxygen levels are more common: crucian carp *Carassius carassius*, tench *Tinca tinca* and sunbleak *Leucaspius delineatus*. The weatherfish *Misgurnus fossilis*, a protected species of EU importance, may also occur in such areas. This species was not recorded in the area during the survey, but is likely to occur.

The invasive fish species Amur sleeper *Percottus glenii* is also present in the water body. Amur sleeper is a predatory fish species and its prey includes arthropods (Cladocera, Diptera, Malacostraca), insects at various stages of development (Ephemeroptera, Odonata, Hemiptera, Diptera, Trichoptera, Coleoptera), molluscs, fish and amphibian (frog and newt) larvae (Kosco et al., 1999; Litvinov and O'Gorman 1996; Reshetnikov 2001, 2003). Special management measures are recommended to limit the spread of the species in the area (see management measure X).

1.3.3.6. Vascular flora of the area

A total of 125 species of vascular plants have been recorded in the Esplanade Wetland and adjacent area during field surveys (Annex 1). No protected plant species were found in the Esplanade Wetland, however, according to the information available on www.dabasdati.lv, the Esplanade Wetland adjacent area was found to contain the specially protected plant species **early marsh orchid *Dactylorhiza incarnata***. The species is found in Latvia in moderately wet, marshy meadows, floodplain meadows, herbaceous marshes and wet depressions.

Although the Esplanade Wetland is currently poorly suited for the occurrence of specially protected and rare plant species, despite a long-standing lack of appropriate management, some of the grasslands in the area are still characterised by species-rich plant communities with a diverse vascular flora, suggesting a high potential for regeneration. The restoration and management measures planned for the grasslands in the site (see Management Measure V) aim to increase their biodiversity. By initiating regular management of the site, mowing with hay collection, the Wetland area will become potentially suitable for wet habitat species, including protected orchid species.

Species diversity is also enhanced by various landscape features such as individual trees, rock piles, etc. On the periphery of the Esplanade Wetland, there are plantations of several introduced woody plant taxa, such as the larch *Larix* sp. group (Figure 30) in the N part of the site. Although artificially planted, the larch stand is a valuable cultural and historic element of the landscape and should be preserved. When planning new planting in the area, preference should be given to natural species of indigenous origin.

Figure 30. ***A valuable landscape element of the Esplanade Wetland - a group of larch Larix sp. (Photo: D. Krasnopolska)***

1.4. FACTORS ADVERSELY AFFECTING THE SCENIC AND NATURAL VALUES OF THE ESPLANADE WETLAND

The **main problem and threat to the scenic qualities of the site** are the adjacent industrial and technical sites, which are not attractive to the public, including tourism. The area of the urban waste water treatment plant in the immediate vicinity is a rather aggressive environmental object, which mainly affects the aesthetic qualities of the landscape. Consequently, when developing the Wetland

area, it is essential to take actions that will ensure the visual demarcation of the WWTP area in the long term. The technical areas in the immediate vicinity, on the other hand, additionally give rise to noise, odour and possible leakage of harmful substances.

The future construction of ill-considered infrastructure for recreational purposes is also a major threat, as it could put additional pressure on the site's biodiversity. However, given the species' characteristics and ability to survive in a highly urbanised environment, the Wetland should be improved as a nature education site and made more accessible to the public, specifically in the context of environmental education.

The landscape and nature values of the Esplanade Wetland are negatively affected by **changes in the hydrological regime** due to several negative factors, the most important of which are 1) the drying effect of the drainage system, 2) increased evapotranspiration, 3) a decrease in the groundwater level due to natural hydrogeological fluctuations, and 4) a negative water balance due to increased evaporation and reduced rainfall. The last two factors, which depend on climatic conditions, are virtually impossible to regulate. However, it is possible to mitigate the effects of the first two factors.

The location of the Esplanade Wetland in the topography suggests that it is drained by groundwater from the right bank of the Daugava valley. However, during the low-water period, when the level of the Daugava is hypsometrically lower than the depression of the Esplanade Wetland, drainage to the Daugava also occurs due to alluvial deposits (Figure 31). Consequently, during periods of low rainfall and consequently reduced groundwater inflow, the Wetland may dry out. It is therefore essential to limit the surface runoff associated with the functioning of the drainage system.

Figure 31. ***Digital elevation model of the study area and adjacent area (top) with a line indicating the location of the topographic profile; topographic profile A-B (below) with a sketch indicating the groundwater balance of the study area***

It is the functioning of the drainage system mentioned above that has the most significant negative impact on the Esplanade Wetland, where the historically established open ditch drainage system has altered the hydrological regime. The depression of the Wetland is naturally drained by the Šuņupe River. With the excavation of the drainage ditch system (probably in the first half of the 20th century - Figure 32), the Wetland has been subject to long-term drainage impacts. The drainage system has not been cleaned for several decades, the ditches are saturated, naturally overgrown or already overgrown, but even in this state they contribute to the drainage of the marsh, albeit less intensively. Consequently, although the Wetland is naturally regenerating, the drainage system is still functioning and has a negative impact on the hydrological regime of the Wetland. Moreover, after the improvement works and the creation of a pond at the intersection of Vienības Street and Sporta Street and the cleaning of the outflow to the Šuņupe River, the drainage system's chilling effect may increase.

Comparing the 1995 and 2017 data (Figures 33 and 34), the open water area of the water body within the Wetland has decreased by 78%, therefore, to maintain the hydrological regime, a water level regulation system is needed to ensure that the water level in the Wetland is stabilised and the surrounding areas are not flooded. This in turn would bring the Wetland closer to its natural runoff regime.

Figure 32 ***Luftwaffe (Nazi German Air Force) vertical aerial reconnaissance photograph taken in 1944 - with blue lines indicating the location of drainage ditches***

The **increase in plant biomass** caused by eutrophication processes and the resulting increase in evapotranspiration from the leaf surface, the intensification of the dewetting effect of macrophytes, is another negative factor contributing to both the lowering of water levels in the open water bodies of the Esplanade Wetland and the alteration of the hydrological regime. Continued overgrowth of the site with monolithic stands of common reed and bulrush, and shrub encroachment are reducing the conditions suitable for specially protected bird species - areas of open water interspersed with areas of emergent and riparian vegetation.

One possible solution is to remove macrophyte vegetation from the Wetland. In this context, flushing is not considered to be an effective measure as it would have to be repeated every growing season, possibly even several times a season, and would be made more difficult by the inaccessibility of the site.

A more effective measure would be to excavate several small ponds within the Wetland (see Management Measure I), creating a larger area of open water, thereby reducing the area covered by macrophytes, mainly reeds and sedges. Studies elsewhere in the world have shown that under temperate conditions, evaporation from open water surfaces is lower than from reed-covered areas (Acreman et al, 2003; Mohamed et al., 2012). Consequently, the creation of ponds would reduce evapotranspiration and the sussipative effect of macrophytes, which in turn would have a positive

impact on the hydrological regime of the Wetland. The increase in open water areas is also positive in the context of waterbird nesting sites, as well as for the overall biodiversity of the area.

Figure 33. ***Open water fraction in the Wetland in 1995***

Figure 34. ***Open water fraction in the Wetland in 2017***

The periphery of the Wetland and its surroundings are characterised by high **anthropological disturbance**, which has a significant impact on the bird fauna of the area. Given the small size of the site and the planned development of environmental education facilities in the Esplanade area, an increase in anthropological impact is foreseeable in the future. In such a situation, it is necessary to understand the patterns that determine the response of birds to human disturbance and to introduce appropriate measures in the natural areas that will allow both natural ecosystems and recreation to coexist. The response of birds to disturbance is nest abandonment, and this behaviour can depend on many factors (Martinson, 2020). The most important factors that contribute to nest abandonment in birds are:

- habitat type at the nest site;
- the ability to detect people as potential disturbers, depending on the surrounding landscape;
- the distance at which the disturbance begins;
- the tolerance level of a particular species to a disturbance;
- sex of the bird;
- simultaneous presence of predators and human disturbance;
- the risk of overheating eggs when left exposed;
- the bird's inability to get used to the disturbance.

Disturbances also have a major impact on the physical condition of the birds. Disturbed birds have increased energy consumption, which leads to poor breeding success (Gómez-Serrano, 2020). In the long term, a decline in breeding success can lead to population declines.

The area is used as a dog walking area, and dogs are often off-leash, thus significantly increasing disturbance and affecting the breeding success of the Wetland's resident birds.

In the Wetland area, regardless of the lack of trails, there are negative human activities - household rubbish is often brought to areas overgrown with shrubs and tall plants (Figures 35 and 36).

Figures 35 and 36. ***Contamination with municipal waste in the NW part of the Esplanade Wetland (Photo: D. Krasnopolska)***

A significant factor negatively affecting the biodiversity of the site is the **spread of invasive species**. The presence of the invasive species mink *Neovison vison (*Figure 37) has an impact on the breeding bird species within the site. The mink destroys waterbird nests and nestlings as well as adults.

Figure 37. ***Mink Neovison vison (Photo: Karīna Dukule - Jekušenoka)***

Figure 38. ***Amur sleeper Percottus glenii (Photo: Yuriy Kvach)***

The invasive fish species Amur sleeper *Percottus glenii (*Figure 38), which is also found in the Esplanade Wetland and adjacent water bodies, can have a significant negative impact on the biodiversity of aquatic ecosystems. In small water bodies, Amur sleeper suppress macrozoobenthos and fish and amphibian communities because they are unable to breed successfully. There is a negative correlation between the abundance and number of individuals of Amur sleepers and the number of species in a water body, in fact the biodiversity of a water body is reduced in its presence. Cannibalism is also observed (Reshetnikov 2001, 2003; Spanovskaya et al., 1964). Fish species with which the habitats coincide are significantly affected. In general, Amur sleepers compete with and

displace carp species such as crucian carp *Carassius carassius*, sunbleak *Leucaspius delineatus*, European bitterling *Rhodeus amarus* and roach *Rutilus rutilus* (Grabowska et al., 2009).

Amur sleepers become the dominant species in water bodies with specific conditions. In large bodies of water, where many species, including predatory fish, are represented in the fish community, the number of individuals in Amur sleeper populations is low. In complex and structured ecosystems, the population of Amur sleepers is limited by predatory fish. It should be noted that an important factor determining the establishment of a large population of Amur sleepers in a water body/s is the suppression of fish during the sub-ice period. Under such conditions, most of the fish species do not survive and a fish community is formed in which the predatory fish pike and perch are not represented.

Invasive plant species in the area also threaten the native flora, suppressing native species and spreading over large areas. Invasive woody plant species in the Esplanade area include the red-osier dogwood *Swida alba* and the ashleaf maple *Acer negundo*. Invasive herbaceous species in the NW and N part of the Wetland include the Indian balsam *Impatiens glandulifera* and the small balsam *Impatiens parviflora*, in the NE part the Russian dock *Rumex confertus*, and in the SE and S parts the balsam-apple *Echinocystis lobata*. Poplars *Populus* sp, Northern red oak *Quercus rubra* and hawthorn *Crataegus* sp. also move from the greenery into the wild (Figures 39 and 40).

Figures 39 and 40. ***Hawthorn Crataegus sp. (Photo: D. Krasnopolska)***

One of the most widespread invasive plant species in the Esplanade Wetland is the ashleaf maple *Acer negundo* (Figures 41 and 42). This species was introduced to Latvia in the 19th century from North America, where it grows wild, as a shrub, but the first attempt to establish it in Latvia was unsuccessful - the young trees died. In Latvia, the ashleaf maple became established from the beginning of the 20th century and has now spread throughout Latvia. The species is most often found in mass reproduction in ruderal areas abandoned by humans. Water is thought to be one of the most effective dispersal routes for the species (Gudžinskas et al. 2014). The ashleaf maple can survive in both water-deficient and nutrient-poor habitats. As a dioecious plant, there are differences in habitat preference; both male and female trees are hardy, but under more extreme conditions females grow better in wetter and more nutrient-rich soils.

Ashleaf maple is a threat to the natural habitats of floodplain meadows and riverbank scrub, where it becomes the dominant plant species in just a few years. Ashleaf maples, especially those growing in riparian areas, often lean until they fall over or break off during ice or strong wind gusts. The fallen trunk takes root and sprouts new shoots, creating new trees in the long term. This creates a vegetation complex that is unusual for the local conditions, dominated by ashleaf maples. Chaotic shoots in green areas of settlements distort the aesthetic view, which in turn requires additional funds for management work. In addition, these trees often break, posing a threat to human safety and property.

The ashleaf maple is also one of the first trees to flower and spread pollen. Much of the pollen, which usually reaches high concentrations in urban green spaces, is produced by ashleaf maple pollen, causing hay fever in people prone to allergies.

Figure 41. ***Ashleaf maple Acer negundo in Esplanade Wetland (Photo: U. Valainis)***

Figure 42. ***Close-up of an ashleaf maple (Photo: D. Krasnopolska)***

The balsam-apple *Echinocystis lobata* (Figure 44) is an annual plant that is fully naturalised in the Latvian flora. The fruits have air chambers which allow the seeds to be dispersed by water. It moves into the wild where the soil is moist and rich in nutrients, growing more frequently on river banks, flooded meadows and coastal scrub. Often forms tangles of stems above shrubs or plants along the coast. Outcompetes other plants by shading them out. Blooms in July and August. Spreads only by seed. One plant produces 25-100 seeds with high germination capacity. Native plants therefore cannot compete for light and most of them die out, plant communities begin to degrade and the diversity of species is greatly reduced.

Figure 43. ***Indian balsam Impatiens glandulifera (Photo: N. Romanceviča)***

Figure 44. ***Balsam-apple Echinocystis lobata (Photo: U. Valainis)***

Indian balsam *Impatiens glandulifera* (Figure 43) is one of the invasive alien species in Latvia with a high invasion potential. Recent studies on the dynamics of the species show that it is quite widespread and closely associated with the settlement of the area and river corridors. Invasions are mainly restricted to ruderal habitats, wet depressions and ditches along roads and railways. In the Esplanade Wetland it has been observed in several places, but does not yet form monodominant stands. A single individual can produce between 95 and 390 buds with 500-2500 seeds. Seeds remain germinating for up to 18 months. Spreads only by seed. When the seeds are ripe, the seed buds open

rapidly and the seeds are shot out, spreading about 3-5 m from the parent plant. When it reproduces in large numbers, it forms dense stands and suppresses native species.

The small balsam *Impatiens parviflora* also competes with herbaceous plants and often becomes the dominant species in the herbaceous stand. They can grow even where only 5% of sunlight reaches the ground surface. They are therefore able to occupy ecological niches in forests where herbaceous cover has been destroyed or is absent due to lack of light.

Red-osier dogwood *Swida alba* is a common invasive species in parks and urban greenery in a variety of vegetation types, and grows well along water banks, where it forms extensive stands of shoots and leaning trees. The plant can form dense stands with its troughs and root suckers, thus reducing the biodiversity of native flora. Seeds are dispersed by birds. The seed requires both cold stratification and birds, as stream feeders, also spread by root suckers. The species has been found in several locations in the Esplanade Wetland.

The Russian dock *Rumex confertus* was probably introduced into Latvia accidentally in grain, forage seeds or other agricultural products. In natural or semi-natural meadows, this species suppresses native plants, especially low meadow plants. A single plant produces up to 4 000 seeds, the germination of which persists for several years. Reduces the economic value of meadows as it is not eaten by domestic animals. Can adapt to a wide range of ecological conditions, ranging from habitat-like conditions in moderately wet grasslands to ruderal habitats, roadsides and heavily altered soils on railway verges. Occurs in the N part of the Esplanade Wetland, where it forms large stands.

The Canadian goldenrod *Solidago canadensis* is one of the oldest ornamental plants introduced to Europe from North America. The plant spreads by seed and vegetatively by root fragments. Seeds are produced in large quantities - in Europe one plant can produce > 10 000 seeds. In Europe, the number of seeds can reach up to 10. Seeds are sown far and wide to ensure the colonisation of new areas.

The distribution of mammal species in the Esplanade Wetland is currently limited by **its isolation from other natural areas**. Currently, the area is bounded by roads with a relatively high traffic volume from the north and west. To the east is a residential area. These conditions make it difficult for species to enter the site. However, in the long-term planning of the development of the site, there are possible solutions that could facilitate the introduction of species into the Esplanade Wetland. Watercourses have always been one of the most important corridors for movement. Both the Daugava, a major river in Latvia, and its tributary, the Šuņupe, are located adjacent to the Wetland. The banks of these watercourses already function to some extent as ecological corridors, but the bridges and culverts built across the Šuņupe are an insurmountable barrier for several mammal species. As part of the development of the Action Plan, recommendations have been made for the adaptation of the bridges crossing the Šuņupe River where future reconstruction works are planned (see management measure X).

1.5. INFRASTRUCTURE DEVELOPMENT PROJECTS PLANNED BY THE MUNICIPALITY OF DAUGAVPILS CITY IN THE ESPLANADE WETLAND AND ITS ADJACENT TERRITORY AND THEIR POTENTIAL IMPACT ON THE NATURAL VALUES OF THE TERRITORY

According to the Daugavpils city planning documents, several important infrastructure development projects are planned for the Esplanade Wetland and the adjacent area.

In 2019, Daugavpils City Council organised a design competition "**Creation of tourist and nature educational facilities and landscaping of the territory of Latgale Zoo in Vienības iela 27, Daugavpils**". The aim of the competition was to obtain an architecturally high quality and functionally well-thought-out, economically justified and compliant with the technical specification and the Statute design for the creation of tourist and nature educational facilities and landscaping of the territory. Among the five competitors, the best one was the "Swamp footbridge", jointly developed by the architects "Trīs arhitektūra" and "Sudraba arhitektūra".

The architects of the “Swamp Footbridge” project propose to create a swamp footbridge system with one central footbridge connecting the existing zoo building complex with the new buildings - the Jungle House, the Swamp House and the proposed viewing tower (Figures 45, 46 and 47).

Figure 45. ***Location of planned tourist and nature education objects in the territory of Esplanade Wetland (1 - existing building of Latgale Zoo, 2 - planned Jungle House, 3 - planned Swamp House building, 4 - planned viewing tower; 5 - planned trail route*** **(image from the design prepared by "Trīs arhitektūra" and "Sudrana arhitektūra")**

Figure 46. ***View from the footbridge of the planned Swamp House building*** **(image from the design prepared by "Trīs arhitektūra" and "Sudrana arhitektūra")**

Figure 47. ***View from the Wetland of the planned Jungle House, Swamp House and observation tower*** **(image from the design prepared by "Trīs arhitektūra" and "Sudrana arhitektūra")**

The Wetland landscape is retained as the main dominating feature and the proposed architecture serves as a functional, subdued complement to it. The facades of the buildings use materials characteristic of the Wetland landscape - wood, reeds and tree branches. The Jungle House facade uses branches "fallen on the building" to evoke the surrounding birch trees, while the Swamp House facade is made of reed bundles. The facade of the lookout tower is made of braided branches. The interior of the exhibition spaces also uses materials that mimic material things and forms found in nature.

The project is based on the desire to preserve and enhance the Wetland as much as possible, using sustainable and environmentally friendly solutions. The design of the buildings aims to minimise the impact on the site and its flora and fauna during construction. The architecture uses materials that are friendly to nature and people, locally sourced, as well as environmentally friendly forms of energy generation.

The project "Swamp footbridge" also envisages the creation of a new nature trail route, for which specific solutions have been proposed in the construction project for the **Esplanade tourism and nature education object "Latgale marshland biodiversity",** developed for the Daugavpils City Council. The aim of the project is to create a high-quality tourism and nature education infrastructure in the Esplanade Wetland to educate visitors about the landscape, flora and fauna of the low grass marsh. The project area includes wooden footbridges with two connections to the Daugavas Street footpath and one connection to the Daugavpils Esplanade Park. A mineral-mixed surfacing path is provided at the connection points to the wooden footbridges, which are located in the wettest part of the site.
According to the construction project, the total length of the proposed wooden footbridges forms a ~1000 m long walking route through the Esplanade Wetland area (see Figure 50).

In addition to the central route, two additional thematic routes are to be developed - the "Herpetologist's Trail" and the "Ornithologist's Trail". The route of the planned "Ornithologist" trail is located in the forest area of the south-west side of the site along the Daugavas Street pedestrian and cycle path. "The Ornithologist's Trail is planned to be constructed of mineral surfacing (see Figure 49). The trail is designed to zigzag along existing trees, with natural obstacles such as fallen trees and other natural obstacles, as well as bird-watching hides. “The Herpetologist's Trail” is designed as a narrow wooden boardwalk on sleepers in places (see Figure 48), with a strip of mineral mix surfacing in places just to indicate the direction of travel.

Figure 48. ***Visualisation of the planned "Herpetologist's Trail" section according to the construction design developed by BM Projekts***

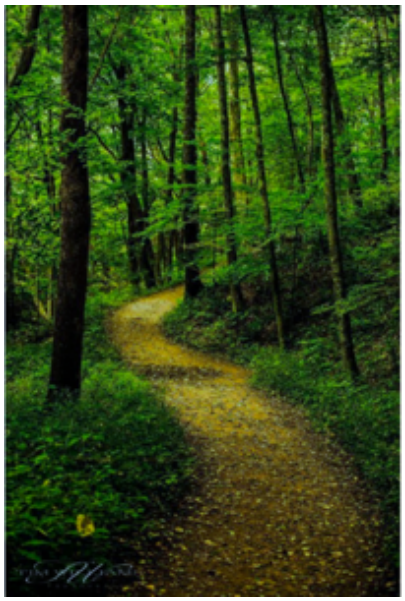


Figure 49. ***Visualisation of the planned section of the "Ornithologist's Trail" according to the construction project developed by BM Projekts***

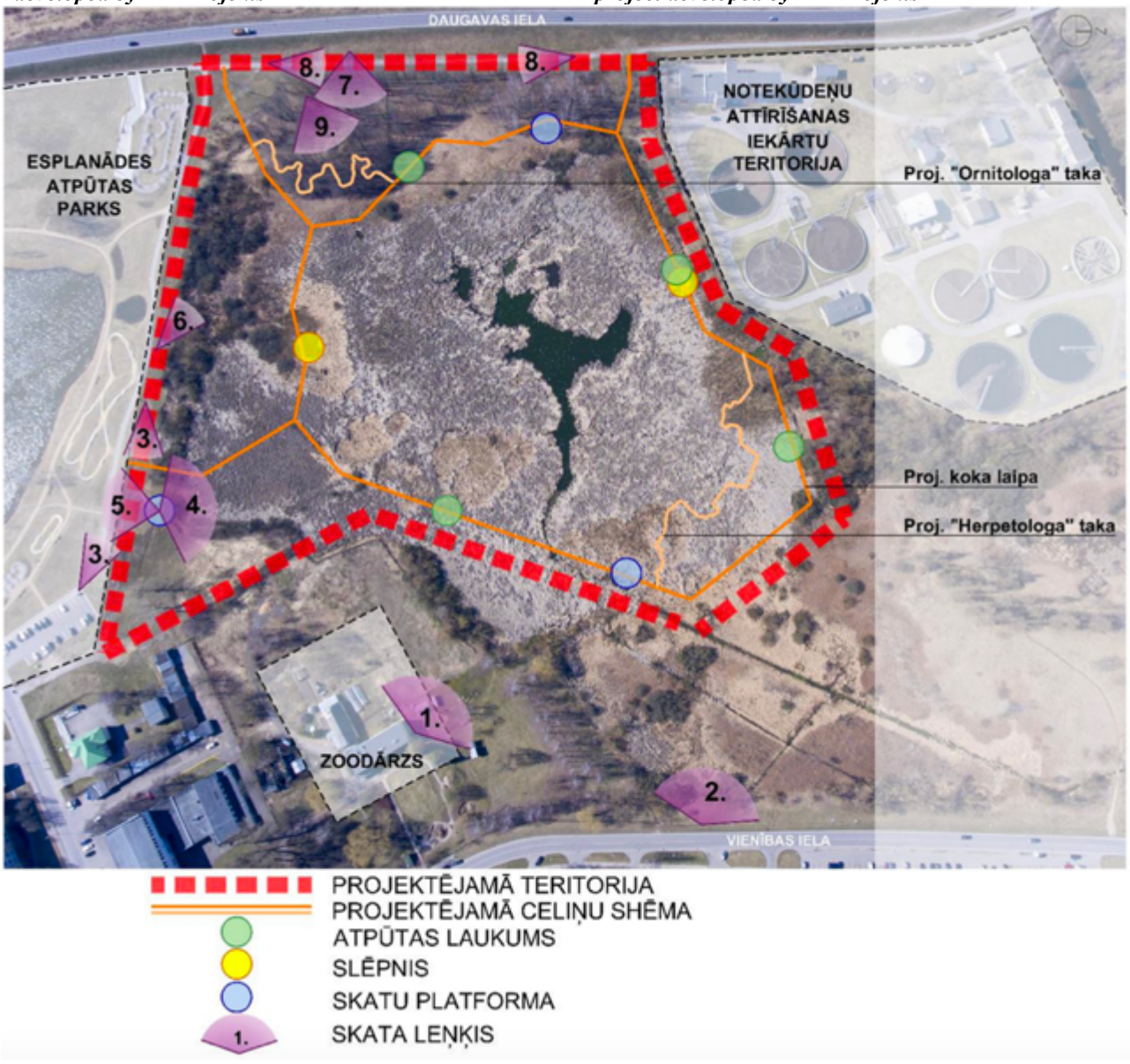


Figure 50. Schematic diagram of the planned Esplanade tourism and nature education facility "Latgale marshland biodiversity" according to the construction project developed by BM Projekts

Overall, the idea of creating a new environmental education facility is welcome and should be implemented. The planned infrastructure will diversify the city's tourism offer, contributing to an increase in the number of nature tourism-oriented visitors. However, when planning the future development of the site, it should be taken into account that most of the planned wooden footbridges are located too close to the central part of the Wetland, and **the construction project as currently designed will have a long-term negative impact on the biodiversity of the area**. In particular, the construction of the planned infrastructure will have a significant impact on the breeding success of protected bird species in the area. Between 1 000 and 2 000 pairs of black-headed gulls *Chroicocephalus ridibundus* nest in the area each year. In the central part of the Esplanade Wetland, 1-2 pairs of little bittern *Ixobrychus minutus* and 5-7 pairs of bluethroat *Luscinia svecica* also nest regularly. Several other species of specially protected birds have also been recorded in the central part of the Wetland. The area is also used as a foraging area by several species of bats of EU conservation concern.

Negative impacts are expected not only from increased disturbance by visitors, but also from predators that will penetrate deeper into the Wetland through the planned network of paths, threatening the Wetland's nesting bird species. The creation of new development in the central part of the Wetland would also reduce the amount of habitat suitable for Wetland and grassland species and fragment the landscape. In order to minimise the potential impact of new development on Wetland and grassland species in the area, in the case of the planned project “Swamp footbridge”, the construction of new buildings would be limited to the periphery of the Esplanade Wetland along Vienības Street and/or the property currently owned by an individual with cadastral number 05000010601, thus the construction and subsequent operation of new buildings would have minimal impact on the area. Such a scenario would require the purchase of the land currently owned by the natural person.

In order to mitigate the potential impacts of the planned infrastructure construction and operation, the team of experts involved in the implementation of the Urb-Area project No.LLI-472 developed recommendations (see Section 1.7 of the Action Plan) for further development of the Esplanade Wetland and the adjacent area, respecting both the Daugavpils City Municipality's intentions to create an environmental education facility there, and proposing specific solutions for biodiversity conservation and enhancement. In the development of the recommendations and the concept for the future use of the territory, the Esplanade Wetland has been considered as an ecologically united natural territory without taking into account the ownership of land properties, and therefore the recommendations have been developed also in relation to private properties in the territory (land units with cadastral numbers 05000010015 and 05000010601).

The basic concept for the future development of the area is to **shift the planned environmental education facilities and the associated development areas to the periphery of the Wetland and adjacent grassland areas**. This approach will minimise the impact of the planned infrastructure on the biodiversity of the area and will also provide the opportunity to add more varied content to the trail route, which will make it more interesting for visitors.

1.6. RECOMMENDED MANAGEMENT MEASURES FOR THE CONSERVATION AND ENHANCEMENT OF BIODIVERSITY IN THE ESPLANADE WETLAND

Based on the environmental problems identified in the Esplanade Wetland and the factors affecting biodiversity identified, 12 management measures are recommended to conserve and enhance biodiversity. See Annex 4 for a map of the overall management measures.

Measure I. Establishment of a pond system enclosing open water areas and Wetland areas

In order to mitigate the environmental impacts of the proposed activities, the management measure is to be implemented in two phases (Figure 53). Phase 1 will consist of the creation of a pond system on a total area of 0,25 ha and Phase 2 on an area of 0,97 ha. The planned activities are to be carried out outside the bird breeding season (breeding season: 1 March to 31 July).

The project included detailed planning of the Phase 1 works, defining the desired parameters of each water body to be excavated and the desired locations of the excavated subsoil to be levelled. The management works to be carried out in Phase 1 shall consist of the creation of a pond system consisting of 10 (ten) water bodies (see Annex 7). Within the approximate contour of each water body, excavation and levelling of aquatic vegetation, silt and subsoil material shall be carried out. Before planning the detailed works of Phase 2, it is necessary to monitor (see management measure XII) the effectiveness of the management measures implemented in Phase 1 in order to adjust, if necessary, the methods and progress of the management measures to be implemented in Phase 2.

The largest ponds in terms of area are planned to have an average depth of 1.5 m, while the smallest ponds, which are separated from the rest of the pond system, are planned to have an average depth of 0.5 m. When designing the pond system, it should be taken into account that the banks of the ponds should be sloping, with shallow water areas (preferably in the N parts of the ponds, where there would be a D exposure). Shallow water parts of the shoreline are more favourable for the development of zooplankton and other aquatic invertebrates, which serve as a food base for other animals. All the planned water clumps should sooner or later be connected (Figure 53) to form a closed ring of water to limit the entry of foxes and dogs into the gull colony. The relatively larger water clumps are planned at the mound in part D, as the mound may be landscaped and used as a bird watching platform in the future.

Due to the small size and depth of the ponds to be created in the Daugavpils Esplanade, fish suffocation can occur during harsher winters, so to mitigate such risks, it is recommended to create 2 m deeper sections in the larger ponds.

A greater diversity of plant species above and below the water provides spatial structure, which in turn allows many species of invertebrates and other fauna, to inhabit a single body of water. In view of the poor aquatic flora of the area, it is recommended to plant biodiversity-enhancing aquatic species (e.g. water pineapple *Stratiotes aloides*, frogbit *Hydrocharis morsus-ranae,* bur-reed *Sparganium sp.*, yellow waterlily *Nuphar lutea*, waterlilies *Nymphaea sp.*) in the area (Figures 51 and 52).

Figures 51 and 52. ***Aquatic planting measures to enhance aquatic invertebrate diversity (Photo from M. Kalnins archive)***

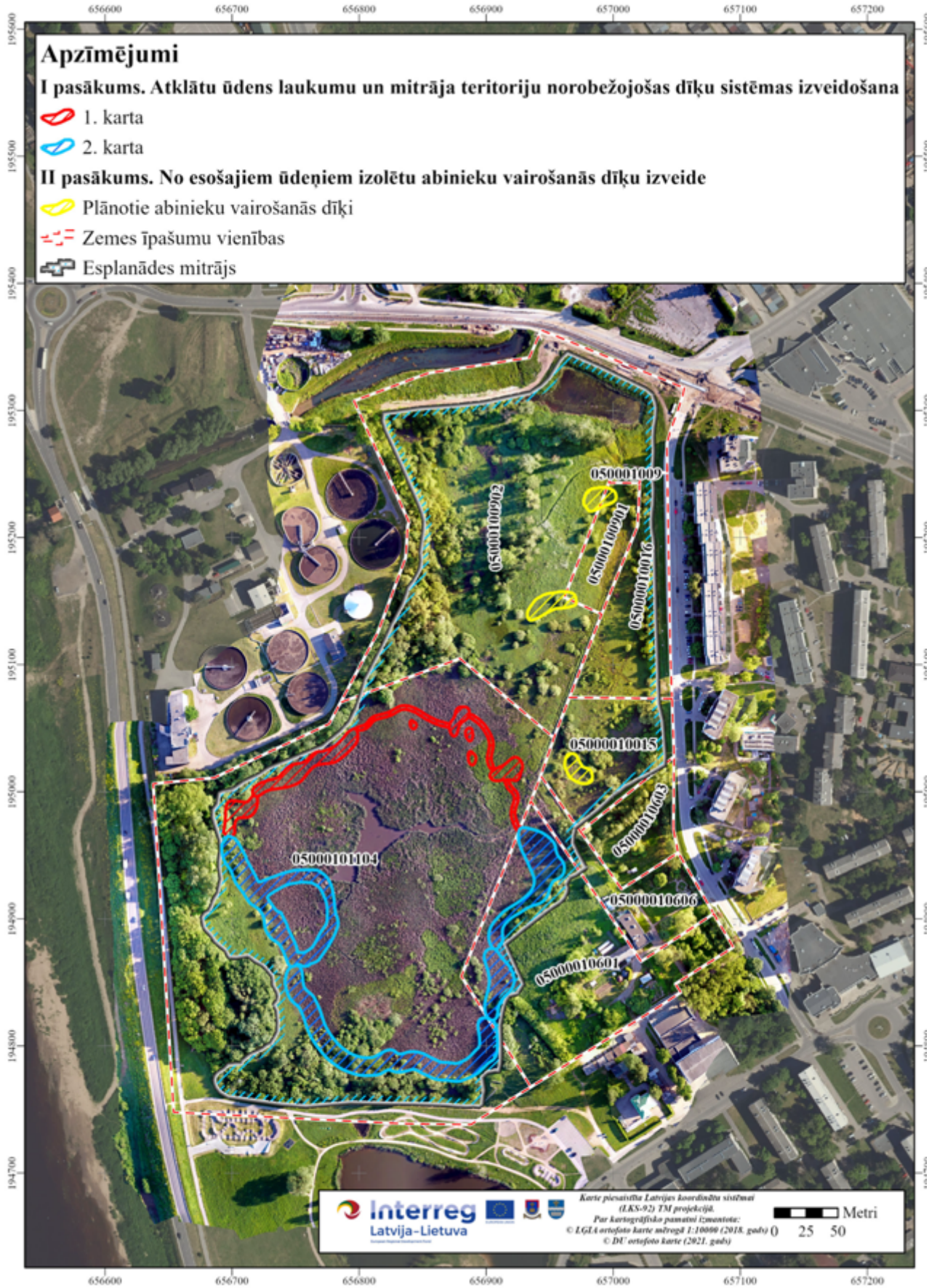


Figure 53. ***Locations of the open water areas and the pond system enclosing the site planned for Phase 1 and Phase 2, as well as the amphibian breeding ponds***

Measure II. Creation of breeding ponds for amphibians isolated from existing waters

The creation of three new ponds, not connected to existing water bodies and ditches, is needed to create amphibian breeding sites free of Amur sleepers. These ponds should be located outside the reed bed and the planned ring of ponds. This location will isolate the ponds from the Amur sleeper water bodies and allow access for possible maintenance works. Three ponds should be created, one (~0.03 ha) in the eastern part adjacent to the Latgale Zoo, where it could be used as a demonstration pond for Zoo and Wetland visitors, a second pond (~0.05 ha) should be created further to the N in the existing lawn and a third (~0.03 ha) at the N end of the site (Figure 53).

Ponds should have a maximum depth of ~1.2 m, at this depth the pond should be no more than ¼ of the longitudinal profile, with the deepest part of the pond shifted to the SE (north, central ponds) or SW (demonstration pond) so that it is approximately between the middle of the pond and the start of the last quarter of the profile (Figure 54). This is necessary to create large shallow water areas in the N parts of the ponds, where there would be a S exposure and warmer water in spring. In the event of a Amur sleeper emergence, such shallow water areas would be easily separated from the deepest and most fishable part of the pond by a gentle earth rampart. The ponds should be oval or slightly curved, with dimensions of approximately 40x15 m (central pond), 25x15 m (demonstration pond and northern pond). Locating the ponds in close proximity to the driest part of the Esplanade Wetland will allow them to be used for the purposes of European pond turtle population recovery and public education.

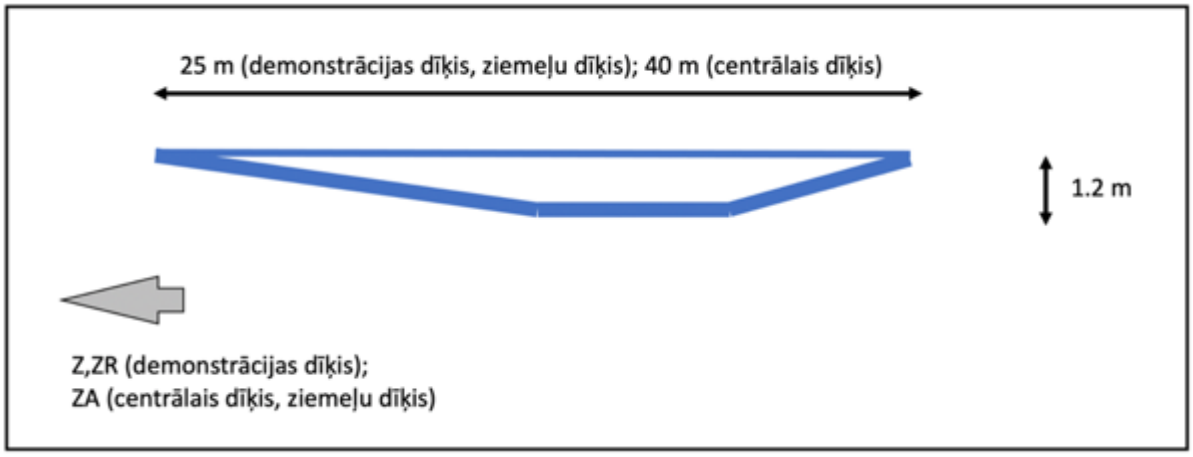


Figure 54. ***Longitudinal profile of amphibian ponds***

In order to minimise the cost of implementing the measure, the excavation of the amphibian breeding ponds shall be carried out at the same time as the pond excavation works planned in Phase 2 of Management Measure II.

Measure III. Mowing of offshoots of trees and shrubs

The tree stand along Daugavas Street (Figure 55) has overgrown shoots that need to be cut down and removed from the site. The total area to be cleared is 0.51 ha. In the course of further management of the area, the cutting of the regrowth should be repeated at least once every 3-5 years.

Figure 55. ***Shoots in the tree stand along Daugavas Street (Photo: U. Valainis)***

Figure 56. ***Location of the planned management measure***

Measure IV. Thinning of shrub overgrowth

The implementation of this particular management measure is planned in two phases (Figure 59) in order to reduce the impact on scrub-dwelling animal species. The total area to be thinned is 4.39 ha, of which 1.86 ha in Phase 1 and 2.53 ha in Phase 2.

The project has started the bush thinning works planned for the first phase (Figures 57 and 58). In the areas to be thinned, the work was planned in consultation with the expert team of the Urb-Area project No LLI-472. In July 2021, the project experts ensured the marking of the bush vegetation to be cleared in the field as part of the planning works. In order to reduce the spread of invasive species in the areas, the clearance of invasive species (mainly ashleaf maple) present in the area is planned as a priority. Taking into account the urban location of the site and the high potential of the Wetland periphery to develop as a recreational area, the impact of the planned activities on the landscape has also been taken into account when planning the thinning of the scrub cover, therefore the most scenic groups of trees and shrubs have been retained as the primary management measure.

Figure 57. ***Wetland area adjacent to Esplanade Park before shrub thinning (Photo: U. Valainis)***

Figure 58. ***Wetland area adjacent to Esplanade Park during management measures (Photo: U. Valainis)***

Figure 59. ***Sites of shrub thinning planned for Phase 1 and Phase 2***

Removal of tree and shrub overgrowth should be carried out outside the bird breeding season (breeding period - 1 March to 31 July). The cut shrubs shall be collected and removed from the site. Where possible, root pulling of shrubs should also be undertaken. In areas adjacent to pond and canal excavation sites, machinery used for pond excavation shall be used for the removal of shrub roots. In the rest of the area, the roots of the cut shrubs shall be milled, so that the trees and shrubs to be felled shall be cut as low as possible. It is also recommended to harvest the root mass that has been pulped, as this enriches the soil with plant nutrients that can encourage the introduction of nitrogen-loving species after restoration.

In the N part of the Wetland area, after thinning of shrub vegetation, restoration of biologically valuable grasslands is to be initiated. In the grassland areas it is also preferable to leave individual trees and shrubs or their clusters, as this increases the overall diversity of species in the grassland. A small amount of shrubs and trees in a meadow increases the number of plant, bird and invertebrate species, as shrubs can provide shade for plants that cannot exist in full light. When leaving trees and shrubs, the needs of plants, invertebrates and birds must be taken into account. Felled trees and shrubs should be collected and removed from the grassland. Root milling of trees and shrubs is desirable to facilitate future management of the lawn.

V Restoring biologically valuable grasslands

The site of the existing Esplanade Wetland and the adjacent area have been reclaimed grassland (Figures 60 and 61), where hay mowing has taken place. At the moment, these are species-poor grasslands, but with a high regeneration potential. Areas where management of biologically valuable grasslands is recommended are shown in Figure 62. The total area under management is 5,8 ha.

Figure 60. ***Former grasslands in the N part of the Wetland today (Photo: U. Valainis)***

Figure 61. ***Preserved grassland polygons with high regeneration potential in the W part of the Wetland (Photo: U. Valainis)***

Restoring and maintaining grasslands in a favourable condition and ensuring their ecological functioning will help to increase their biodiversity. With appropriate management measures, it is expected that the botanical quality of the grassland may improve over several years. If the grassland has become overgrown with trees or shrubs, removal of trees and shrubs is necessary before grazing or mowing is resumed (management measure IV). Due to lack of management, the grassland has accumulated a thick layer of litter and has a high proportion of expansive species forming monodominant stands. Expansive species are introduced into grasslands that are mismanaged or abandoned. Mechanical methods can be used to control expansive species: frequent mowing, grazing, cutting, pulling. In situations where there are many expansive species, it is preferable to mow twice a season and to graze intensively. Mowing, pulling of expansive species should be carried out at

flowering time, before seed ripening has started. Mowing at this time weakens the plant more quickly and results in poorer regeneration. Cock's foot *Dactylis glomerata* is abundant, a high proportion of this species is indicative of a previous cultivation or fallow stage, cock's foot persists very well and often begins to dominate, crowding out other plant species. The expansive species cow parsley *Anthriscus sylvestris* and common nettle *Urtica dioca* are also present in the area. Cow parsley grows almost everywhere, often forming large stands and crowding out other non-competitive species. It is a nitrogen-loving species, spreads well on fertile soils and becomes dominant in such areas. The cow parsley is controlled by grazing or mowing twice a season. The first mowing is at the beginning of flowering (around the end of May) and the second mowing when the rebloom begins. Both mowings should be followed by removal of the cuttings. Great nettle is found on moist, nutrient-rich soils. Regular mowing limits the spread of nettle stands.

Figure 62. ***Areas where management of biologically valuable grasslands is recommended***

Grazing as a method of grassland restoration has many more advantages than mowing, as proper grazing creates microniches for different organisms. The most effective way to increase species diversity through grazing is to move animals from one patch to another, thus allowing plants to spread across the area. In situations where animals do not eat the species that are so intensively expansive, additional mowing is necessary. It is important to regulate the animals' presence in the enclosures.

Restorative mowing can be a one-off measure, to be carried out only once, or repeated several times a season and over several years until the grass has recovered and no longer requires maintenance mowing.

The Esplanade Wetland grasslands are species-poor at the moment. Increasing the species composition is a relatively easy process. Seed-rich material can be obtained from species-rich natural grasslands. The type of natural grassland habitat to be restored should be the same (both areas should have similar soil fertility, reaction and moisture conditions). In this case, preference should be given to moderately wet grasslands with a high diversity of vascular plant species. In natural grasslands, seed production occurs gradually, however, the highest seed production occurs between mid-July and mid-August. Better results can be achieved by collecting seed several times a season, in which case both early-flowering and late-flowering species will be represented. A more efficient method of seed collection is by hand, selecting target species for habitat restoration. Other methods can also be used to collect seed from natural grassland: transporting dried hay, transporting freshly cut grass with flowering and seed-bearing plants, or sowing hay fines from a barn where hay has been stored. Care should be taken to avoid the spread of expansive and invasive species within the Wetland.

VI Installation of a small fence for amphibians on the periphery of the Esplanade Wetland

The creation of a small fence is recommended to prevent juvenile birds and the European pond turtle (whose population is to be restored) from entering the roads. The installation of the fence is planned in two sections (Figure 64) - along Cietokšņa and Vienības Streets (approximately 430 m) and along the P67 road (approximately 260 m). Material of the fence: galvanised mesh painted green (Figure 63), mesh 5x5 cm, height of the fence 50 cm, of which 10 cm are buried in the ground and 40 cm above the ground, the upper 10 cm of which are bent inwards at an angle of 45-90°; the fence is supported by metal posts at intervals of ~ 1.5-2 m (depending on the micro-relief).

Figure 63. ***Example of a fence - an example from the adjacent area of the amphibian breeding ponds created in the vicinity of the DU Study and Research Centre "Ilgas" (Photo: M. Pupiņš)***

Figure 64. ***Planned locations for the fence***

VII Creation of an artificial island

To increase the diversity of breeding and migratory bird species in the area, it is recommended to create an artificial island (Figure 65) suitable for the breeding of terns (common tern *Sterna hirundo*,

little tern *Sternula albifrons)*, Eurasian oystercatcher *Haematopus ostralegus* and little ringed plover *Charadrius dubius*. These species nest in small numbers in the Daugava Sera and islands near Daugavpils.

The island is to be created from the substrate of the pond bed to be dug in Phase 2 of Management Measure II. In order to provide favourable nesting conditions for the above bird species, the fertile soil layer of the created island shall be covered with geotextile or other material (to discourage dense vegetation) and a sand-gravel-pebble mixture shall be placed on top. Such an island can also be an important nesting site for terns and other bird species, as well as a resting place during migration periods. Therefore, the creation of such a site in the Esplanade Wetland would contribute to the development of the area as a bird-watching site.

Figure 65. ***Location of the planned artificial island in the Esplanade Wetland***

<u>VIII Removal of old metal fence or its replacement with a new fence that fits into the surrounding landscape</u>

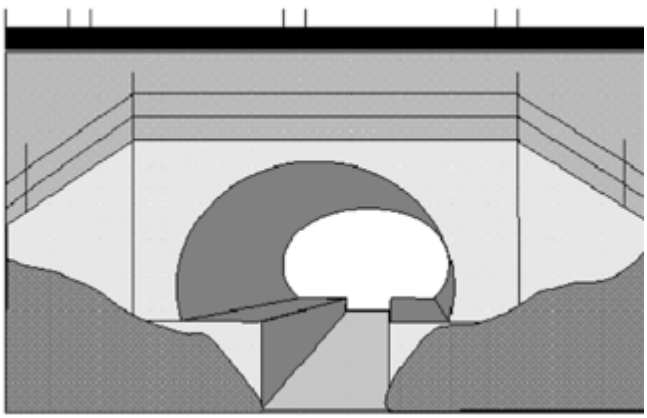
Fragments of old fencing (Figure 66) remain in several locations (Figure 67) and it is recommended that they be dismantled and removed from the site. The removal of the fencing would reduce the fragmentation of the site and make the site more attractive in landscape terms. Part of the fencing is located on privately owned land parcels with cadastral numbers 05000010601 and 05000010015. If the landowners do not agree with the concept of further development of the site and intend to retain the fencing, it is recommended that the existing fencing is replaced with a fence that is more ssuitable for the surrounding landscape.

Figure 66. ***Metal fencing to be dismantled (Photo: A. Erts)***

Figure 67. ***Location of the existing fence***

IX Adaptation of bridges crossing the Šuņupe River to ecological corridor functions

In cases when reconstruction of streets crossing the river is planned, it is recommended to provide technological solutions for adaptation of bridges and culverts (Daugavas Street Bridge, Cietokšņa Street Bridge and the bridge at the entrance to the water treatment plant) to ecological corridor functions during the development of technical projects. The adaptations include the creation of small shelves or additional culverts (Figures 68 and 69) under the bridges on both banks in such a way that animals from one side of the road can get under the bridge on the other side. Currently, roads are an insurmountable barrier for several mammal species. Shelving under bridges is also particularly important for otters. The tunnels should be designed to allow medium-sized mammals such as otter and fox to pass through. If necessary, the tunnel can also be adapted for human use.



Figures 68 and 69. ***Large culvert with shelves to allow animals to safely cross the road*** **(Photo: Grogan et al., 2001)**

Figure 70. ***Bridges crossing the Šuņupe River that need to be adapted to ecological corridor functions***

X Measures to control the spread of invasive species

For **the control of mink**, it is possible to use live traps in which mink gonad extract is placed as bait (Roy et al. , 2006). Given that otters are the main competitors of mink, the return of this species to the Esplanade Wetland could help to control mink populations in the future.

Given that the presence of the invasive fish species Amur sleeper has been recorded in the Esplanade Wetland and adjacent water bodies, there is a high probability that the newly created ponds will also

be affected by invasions of this species. **Amur sleeper control** is a measure with questionable outcome, as it is expensive, often unsuccessful and threatens native species (Simberloff 2009). Eradication of a species can be unsuccessful if it is not prevented from re-establishing in an area. This is obviously not possible in the case of the Daugavpils Esplanade, where the Amur sleeper population may recover as they migrate through the ditch system from adjacent water bodies.

Unlike large water bodies with considerable surface area and depth, in small isolated water bodies it is sometimes possible to eradicate the species using chemicals used to eradicate undesirable species in fisheries (Zaloznykh, 1984), but the use of such methods would mean the death of other hydrobionts, so the use of such methods in the area is not acceptable. Small water bodies could be pumped out or drained, but Amur sleeper can survive in the wet mud in the bed of the water body, so the use of such solutions is also not rational.

Many authors stress the dominance of Amur sleepers and the high population densities they form under certain conditions. The introduction of Northern pike *Esox lucius* and European perch *Perca fluviatilis* (recommended 5 kg/ha) into the Esplanade ponds could significantly limit the number of individuals in the Amur sleeper population, but this solution is not regarded as a clear-cut one, as the introduction of predators into the ponds would be a potential threat to the amphibian, reptile and invertebrate species found there.

Eradication measures for the **ashleaf maple** are divided into two types: physical and chemical (LIFE OSMODERMA project materials - https://www.osmoderma.lt/publications). Physical eradication methods include the following measures: uprooting or digging up young plants, sawing young or mature trees and pruning young shoots that appear after sawing.

Pulling young plants is one of the most effective methods for eradicating ashleaf maple, but it requires heavy physical labour, making it time-consuming and expensive over large areas. Both uprooting and grubbing have very low negative impacts on other plant and animal species, making it the most suitable technique for protected areas and natural habitats with high biodiversity. The most suitable time for pulling or uprooting ashleaf maple is mid-June to mid-August, when it can be easily distinguished from other tree and shrub species. If the roots are strong or the soil is heavily compacted, the roots can be cut with a spade. Ashleaf maples removed in this way rarely regrow. It is particularly important not to cut the trunk above the ground to avoid the formation of new shoots.

In cases of ashleaf maples that are too large to pull up or uproot, a chainsaw or brushcutter (depending on the thickness of the trunk) can be used to cut them down. Once the trees are felled, seed and pollen dispersal is stopped for at least five years, but the stumps that are left behind are active in producing new shoots. This method is only recommended if it is possible to ensure that the shoots are removed at least 1-2 times a year. Otherwise, it can be used as a secondary site management measure, cutting back ashleaf maples that die back after herbicide application.

Ashleaf maples are sensitive to glyphosate herbicides. A tree sprayed with a herbicide solution is weakened but not killed. To prevent shoot formation, it is necessary to inject herbicides into the trunk or stump of the ashleaf maple. Although chemical eradication uses herbicides, this method is environmentally benign because only the trunk of the individual tree is affected - neither the invasive tree nor the surrounding vegetation is sprayed. Herbicides can be applied in several ways: 1) by removing the bark and rubbing the trunk with herbicide solution; 2) by smearing herbicides on a fresh stump; 3) by injecting herbicide solution into holes drilled in the trunk; 4) by embedding herbicide capsules in holes drilled in the trunk. All four methods are relatively expensive, as each ashleaf maple tree must be treated with herbicides over the whole area, which requires a lot of time and effort, special tools and preparation. A more efficient and faster method is direct application of herbicides to the trunk at stump level. This method can be used when the diameter of the ashleaf maple trunk

exceeds 25 cm. This method allows the effective eradication of relatively large stands of ashleaf maple. Costs are higher if capsules filled with glyphosates are drilled into the holes in the trunk. This is due to the price of the capsules, which is quite high compared to other herbicides. Herbicides must be applied in compliance with all environmental and personal safety regulations. The worker must be provided with special clothing, footwear, gloves, respirator and goggles. Workers should preferably have skills and previous experience in handling plant protection products.

The most effective measures to control the spread of the **red-osier dogwood** are to cut down invasive woody plants to prevent further spread by seed. It should be noted that stumps shoot out a lot of shoots, so the measures will have to be repeated several times, destroying the roots of the woody plant. Young plants are best uprooted or dug up. To limit the spread of the species by seed, it is recommended to reduce the number of female trees.

Frequent mowing of the plants is an effective enough control measure for **Indian balsam**, preventing the seeds from forming and ripening; the cut stems can re-root, but the remaining lower part of the plant will regrow. Therefore, plants should be cut at least two to three times during the growing season. The cut material must be completely removed and disposed of. Mow when the first flowers appear and mow 2-3 years in succession, as the plants grow from seeds that remain germinating for several years (Rūsiņa 2017). Individual plants can be uprooted and destroyed.

Frequent mowing of the plants is an effective control measure to limit the spread of **small balsam**, preventing the seeds from forming and maturing. The plants are annuals and their seeds are short-lived in the soil, so this method of control and eradication gives good results. In cases where small balsam is not established in large numbers, it can also be controlled by uprooting. The best time to do this is at the beginning of flowering (approximately mid-June to early July).

Russian dock can be controlled by mowing at least twice during the growing season before seed set (as soon as the first flowers appear) (Rūsiņa 2017). Individual plants can be uprooted and the roots destroyed.

Regular mowing is an effective method of controlling the **balsam-apple**; if mowing is not possible, mechanical pulling of these plants before fruit ripening is recommended. The species is relatively easy to control as the plant does not regrow after mowing (Rūsiņa 2017).

Given the relatively small distribution of **Canadian goldenrod** in the Espalanade Wetland, it would be most effectively controlled by digging up individuals of this invasive plant species or by mowing before seed maturity.

If invasive species are found in the Wetland area, the occurrence of which has not been known so far, their control should be carried out in accordance with the recommendations included in the fact sheets on invasive alien species found in Latvia (https://www.daba.gov.lv/lv/invazivas-sugas) published on the DAP website.

XI Preparation of a technical project to ensure a stable hydrological regime in the Esplanade Wetland

As part of the technical design, it is necessary to develop solutions for a water level regulation system to stabilise the water level in the Wetland. It should be noted that the work on the hydrological structures in the area is to be carried out only during the period from 1 August to 1 March. Depending on the onset of spring and the spring migration phenology of the black-headed gulls, the deadline for completion of the works may be extended in agreement with the bird expert in the field of species and habitat conservation.

XII Monitoring the success of implemented management measures

In order to assess the effectiveness of the management measures, it is recommended to ensure **annual monitoring of birds nesting in** the Esplanade Wetland.

The number of nesting black-headed gulls in a colony is estimated based on the number of birds present and by photo-recording or by counting nests using drone imagery and camera analysis. It is also possible to carry out a total count of nests in plots and determine the nesting success, after which the number of nesting pairs and nesting success is extrapolated to the whole study area. Mapping of the spatial location of black-headed gull nests is to be implemented.

As far as possible, the breeding success of other birds nesting in the Esplanade Wetland should also be assessed. The inventory should be based on the methodology prepared by the Latvian Ornithological Society (A.Auniņš 2018. Monitoring of Latvian nesting birds). The counts are carried out in 4 counts within one season: from 20 March to 1 April, from 20 to 30 April, from 10 to 20 May, from 5 to 15 June. The aim of these surveys is to detect mainly passerine songbirds, including species common in Latvia: reed bunting, thrush nightingale, red-throated warbler, sedge warbler, etc. For the estimation of the number of breeding bluethroats, counts from provoking points should be used. Two repeat counts per season (15-30 April; 15-30 June).

The counts of nocturnally active birds (little bittern, bittern, spotted crake, little crake, water rail, corn crake) should be carried out according to the methodology for monitoring *Natura2000* sites developed by the Latvian Ornithological Society (Lebuss 2013). Three repeated point counts shall be carried out using the provocation method in the period 01.05. - 25.06. with at least 10 days interval between counts. For other species of importance in the area (goose-footed waterfowl, little grebe), a total count is carried out by combining the number of pairs present and the number of broods successfully fledged.

Monitoring of grassland management success is necessary when managing biologically valuable grasslands**.** Changes in the number and abundance of vascular plant species are the most commonly used measures of the success of grassland habitat restoration and management. At the same time, careful documentation of all management activities is needed to assess exactly which management methods have produced the best results and in what combination. The various external factors and processes affecting the grassland should also be documented. For vegetation monitoring, a number of plots should be established, permanently or randomly, in a different location each year. It is preferable to have at least 10 plots per homogeneous grassland; several vegetation monitoring studies in Latvia have shown that even 10 plots are sufficient to assess changes in vegetation in grasslands caused by management. Permanent plots are usually fewer, random plots more numerous. To locate plots accurately from year to year, it is necessary to have fixed points in the landscape over many years at which plots can be located. A stake dug in the ground can be used as a landmark. The corners of a sample plot (or one particular corner) can be located using a GPS unit. Another way is to arrange the plots in a transect at intervals of a certain distance. In this case, only two points will need to be located accurately each year - the start and the end of the transect. It is recommended to monitor all vascular plant species. In grasslands, the amount of each species shall be scored in percentages or points. A simplified scale for estimating the abundance of a species that can be used in grassland monitoring is the 5-point scale: 5 points - the species dominates the plot (75% or more); 4 - the species is abundant (50% to 75%); 3 - the species is common (25% to 50%); 2 - the species is relatively common but not dominant (5% to 25%); 1 - the species is rare, its cover is less than 5%; + - a plus sign can indicate species with only one or a few individuals in the plot. Such data provide a good

indication of changes in species diversity and abundance of particular species during restoration or maintenance[2].

1.7. RECOMMENDATIONS FOR THE FUTURE DEVELOPMENT OF THE SITE

Based on the results of the biodiversity survey of the Esplanade Wetland and the analysis of landscape values, proposals for the protection, conservation and development of the aesthetic, ecological and socio-economic qualities of the landscape have been prepared. The overall proposals for the site (zoning, pedestrian flows, sight lines and tree planting groups) are shown cartographically in Annexes 5 and 6.

According to the developed recommendations for biodiversity management measures, the Wetland territory includes not only the area surrounding the Wetland water body and grassland areas, but also the areas directly adjacent to the Wetland - the Latgale Zoo and private property areas. From the point of view of protection and preservation of landscape qualities, the Wetland area should be developed as a coherent landscape without administrative boundaries which fragment the landscape both visually and physically. It is therefore recommended that the future development of the Wetland should include the existing private properties (cad. 05000010601 and 05000010015) to form a coherent natural area.

In general, it is recommended to divide the Wetland area (including private properties) with recommended landscape development measures in planting maintenance, design and landscaping into five functional zones - Wetland zone, biologically valuable grassland restoration zone, peaceful recreation zone, Latgale Zoo territory zone, science communication activities platform zone.

Wetland zone - located around the existing water body and is the most extensive area of the site. This part should be developed in accordance with the recommendations for biodiversity management measures, preserving and extending as far as possible the rampart adjacent to the sewage treatment works.

Greenery. The Wetland perimeter, including the slope near the WWTP or the earth bank, requires maintenance of existing vegetation, removal of hazardous and invasive woody and herbaceous species and provision of new multi-stage planting, mainly of low-demand native species and varieties:

- coniferous species such as Norway spruce *Picea abies*, Baltic pine *Pinus sylvestris* and bog pine *Pinus mugo*;
- deciduous species such as maple *Acer platanoides*, silver birch *Betula pendula,* common alder *Alnus glutinosa,* Northern red oak *Quercus robur*, common lime *Tilia vulgaris*, rowan *Sorbus aucuparia*, white willow *Salix alba*, crack willow *Salix x fragilis var. bullata*, white weeping willow *Salix x sepulcralis*;
- shrub species such as fly honeysuckle *Lonicera xylosteum*, alpine currant *Ribes alpinum*, guilder rose *Viburnum opulus*, bird cherry *Padus avium*, spindle *Euonymus europaea*, osier *Salix viminalis*, goat willow *Salix caprea*, sharpleaf willow *Salix accutifolia*, rosemary-leafed willow *Salix rosmarinifolia*.

[2] Rūsiņa S. (ed.) 2017. Guidelines for the conservation of protected biotopes in Latvia. Volume 3. Natural meadows and pastures. Nature Conservation Agency, Sigulda

For existing trees to be preserved, crown maintenance measures are to be planned. It is recommended that a certified arborist be engaged prior to felling and maintenance.

When carrying out woody plant maintenance measures - mainly the removal of invasive species, take into account the basic principles of landscape composition - preserve woody plant groups, create view openings, provide new planting to strengthen existing woody plant groups, as well as new planting for the prospective replacement of old woody plants (Figures 71 and 72). New planting should be designed according to the principles of tiered planting and plant life (Figure 73).

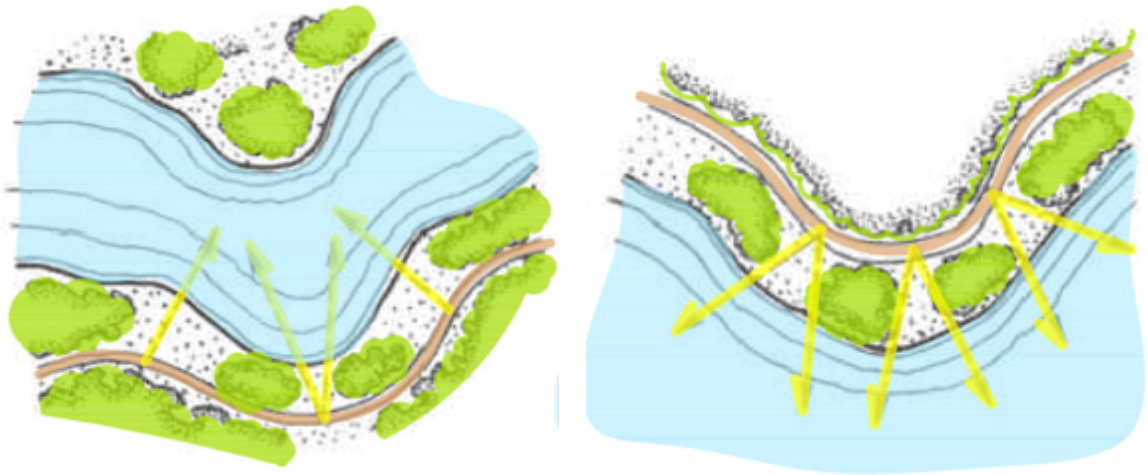


Figure 71. ***Basic principles for creating views and planting groups along water bodies***

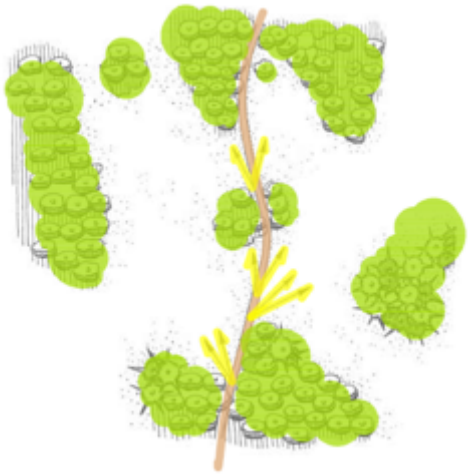


Figure 72. ***Basic principles of view and planting grouping along walking paths***

Figure 73. ***Vegetation evolution by year***

Landscaping. A nature trail or footbridge is planned around the perimeter of the Wetland area, to which it is recommended to create three entrances - two from the Esplanade Park side and one from the side of the pedestrian and bicycle path built along the Daugavas Street section. Two additional exits to the planned footbridge are recommended from the Latgale Zoo area and a private area, which is recommended to be added to the Latgale Zoo area and in the future also linked to the Daugavpils Innovation Centre, which is currently under reconstruction. It is recommended that the footbridges be located around the perimeter of the Wetland, preserving as much space as possible for wildlife

habitats. Along the rampart part of the WWTP, the footbridge should be built at the foot of the rampart, with small platforms in some places on the higher part of the rampart (Figures 74, 75, 76 and 77). It is recommended that the embankment in S part of the Wetland be used as a viewing platform and birdwatching site.

Figure 74. ***Sketch of the viewing platform (Author: K. Dreija)***

Figure 75. ***Example of a viewing platform***

Figures 76 and 77. ***Example of a viewing platform***

It is recommended to remove the existing footpath along the higher part of the revetment along the concrete fence of the WWTP area (Figure 78). The existing concrete fencing is recommended to be visually improved by painting it in a uniform shade, and by adding wooden plank panels in some areas that are visually accessible, such as the viewing platforms planned for the top of the rampart (Figures 79 and 80).

Figure 78. ***Existing concrete fencing and footpath (Photo: U. Valainis)***

Figure 79. ***Example of concrete fencing colour***

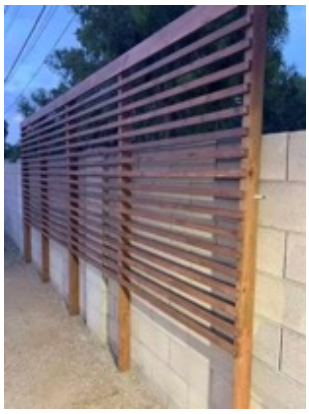


Figure 80. ***Concrete fencing wooden plank panels***

When creating the planned ponds along the perimeter of the Wetland area, take into account the area of the clearing embankment, keeping existing vegetation as far back as possible and planning new slope-enhancing plants. It is recommended to use the soil resulting from the excavation of the ponds to reinforce the embankment and to create a gentler slope.

It is recommended that the footbridges be elevated on stilts, with small hides and platforms for birdwatching in some places, and that some sections of the trails be closed so as not to disturb wildlife (Figures 81, 82, 83 and 84). It is recommended to add educational content to the observation points. It is also desirable to install information signs and signs in a uniform design along all sections of the boardwalk (Figures 85, 86 and 87).

Figures 81 and 82. ***Examples of observation hides***


Figures 83 and 84. ***Panels blocking the view of the path***



Figures 85, 86 and 87. ***Examples of information boards and signs***

In addition, walking paths can be created in the trees between the existing trees to be preserved in the part near the fenced off dog area, allowing to explore the surroundings from an elevated position (Figures 88 and 89).


Figures 88 and 89. ***Examples of walking trails in trees***

In order to create a walking circle and to ensure maximum undisturbed wild life processes, it is recommended to use the existing infrastructure of Esplanade Park - the constructed path along the vegetated part of the Esplanade Wetland on the S side. It is recommended that the

paths around the Esplanade Wetland are not illuminated or that subdued or low light media are used to minimise the impact on bat species in the area.

It is recommended not to provide waste bins in the Wetland area. Information boards should be placed on the collection and disposal of visitors' own household waste outside the Wetland area. It is recommended that the nearest litter bins be provided in the quiet recreation area.

Biodiverse grassland restoration area - created as a buffer habitat between the biodiversity of the Wetland and a potential peaceful recreation area for residents and visitors. The recommended method of grassland restoration in this zone is grazing (Figure 90), which will naturally shape the vegetation structures of the landscape - some larger groups of shrubs and woody plants will remain.

Greenery. It is recommended that no additional planting be created in this zone, and that existing native species be preserved as much as possible. The trees to be preserved need to have trunk and crown protection (Figure 94) to prevent damage to the young trees by grazing animals.

Landscaping. It is recommended to install a self-contained low fence or fencing (Figure 91) in the zone, thus visually and physically separating it from the rest of the freely accessible area - the quiet recreation zone. Along the SE and NW edges of the zone, create a network of footbridges connecting to the Wetland zone footbridges and the peaceful recreation zone footpaths. The boardwalks shall be constructed slightly elevated above the understorey, taking into account environmental accessibility and safety conditions. It is recommended that benches overlooking the pastures be built in some places in the footbridge extensions. It is recommended that the benches are made of natural material without backs, thus ensuring that people do not remain in one place for long periods, and that they are stylistically consistent throughout the Wetland area. Use timber (Figure 92) or galvanised steel grating (Figure 93) for the benches.

Figure 90. ***Grazing for restoration of biological grasslands***

Figure 91. ***Example of a wooden fence in a bio-meadow restoration area***

Figure 92. ***Example of a raised wooden footbridge with seating benches***

Figure 93. ***Example of a raised galvanised steel lattice walkway with seating benches***

It is recommended that the slopes around the Esplanade Wetland are not illuminated or that dim or low light media are used to reduce the negative impact of lighting on the bat species present in the area. It is recommended that no refuse bins are provided within the area of the biodiverse grassland. Information boards should be erected on the collection and disposal of visitors' own household waste outside the meadow area. It is recommended that the nearest litter bins be provided in the quiet recreation area.

A "herpetological trail" could be created in the area between the two planned amphibian breeding ponds, which could be used to organise environmental excursions and other activities.

Peaceful recreation area - created as a continuation of the restored biological meadows, in addition to the creation of infrastructure suitable for walking - a network of paths with small resting places, where benches are placed, natural material equipment, using, as far as possible, the wood of woody plants removed from the existing area.

Greenery. The area within the zone has the highest tree and shrub cover. A group of larch trees are of good visual quality and should be retained as the main framework of the green structure in this location. The area should be supplemented with new tree and shrub planting and, in some places, with planting of herbaceous perennials and grasses. Basically, herbaceous planting is recommended along the banks of the River Schuņupe and the pond connected to the river as bright accents. In the rest of the area, it is recommended not to create herbaceous beds, given their possible periodic grazing for the purpose of restoring the biological meadows. In areas where management grazing is planned, stem and crown protection should be provided for retained trees and new planting (Figure 94).

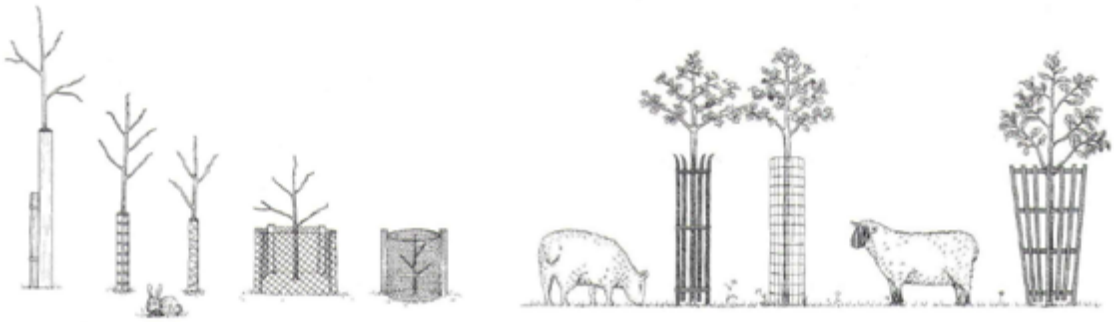


Figure 94. ***Examples of new trees and planting guards to be retained***

The most suitable species for planting in this zone are mainly Latvian wild species and their ornamental varieties without aggressive characteristics, i.e. without signs of uncontrolled expansion. It is recommended that planting groups in this zone should consist mainly of conifers, thus providing an aesthetic and ecological buffer or buffer zone from visual, noise and odour pollution of the urban environment in all seasons. Groups of coniferous trees should be complemented by groups of flowering trees.

Landscaping. The area is designed as a peaceful recreation area - mainly for local residents. A network of paths is recommended in the area, connected to the common Wetland and biological meadow walking route. Entrances to the park are planned from Vienības and Cietokšņa Streets. It is recommended that the walking paths be made of loose surfacing materials (Figure 95), and that wooden footbridges be built where the paths cross the existing ditch system. The area should be complemented by benches in a style consistent with the landscaping used in the rest of the Wetland. In addition, it is recommended to improve the approaches to the Šuņupe River and the adjacent pond by creating small platforms on their banks (Figure 96). It is recommended that this part of the site be illuminated to maximise accessibility and safety at all times of the year, especially at dusk.

Figure 95. ***Example of a paved path***

Figure 96. ***Example of platform near waterbodies***

To diversify the opportunities for peaceful recreation, the area can be complemented by smaller-scale plant-based spaces for relaxation, as well as by the provision of some simple wooden objects for children to play and explore nature (Figures 97 and 98).

Figure 97. ***Example of small natural enclosures***

Figure 98. ***Wood for children's play and nature exploration***

From the walking path on the S side of the park, it is recommended to create sight lines between the planting groups to the biological meadow and Wetland areas.

Latgale Zoo Territorial Zone - located around the existing zoo building and forms a direct link to the Wetland and biological meadow areas via a boardwalk. The area can be developed to meet the needs and interests of the zoo, creating outdoor exhibitions to the extent that they do not interfere with natural processes in the wild.

Greenery. Along the boundary of the interface zones it is recommended to retain existing high quality planting and to create a view opening to the Wetland zone and the bio-meadow zone.

Landscaping. The landscaping of the zone shall be designed in accordance with its functions, preserving as much as possible the atmosphere of the wild environment.

Development area - the recommended future development area is partly located in the territory of the existing private property (land parcel with cadastral No 05000010601), therefore for the full implementation of the developed concept it is recommended to purchase this land parcel. In order to reduce the impact of the planned construction of new infrastructure facilities (Jungle House, Swamp House, etc.) on the natural values of the Esplanade Wetland area, it is recommended to develop the development area (see Annex 5) on the land parcels with cadastral numbers 05000010606, 05000010603 and 05000010601.

Science Communication Activity Platform Area - the planned area is located on an existing private property, therefore the full implementation of the concept requires land acquisition. In case of land acquisition, the area is to be developed as an outdoor laboratory for the Latgale Zoo, as well as for the Daugavpils Innovation Centre, which is in the process of reconstruction. Access to the area is mainly from Vienības Street. This area is directly connected to the footbridges planned for the Wetland area. The zone could also serve as an outdoor educational platform (e.g. with green classrooms) for nearby educational institutions, both pre-school and schools, and for students of environmental science and biology at Daugavpils University.

Greenery. It is recommended that the existing high quality planting be retained between the Wetland zone and this zone, and that new multi-stage planting be added to create a protective buffer between the two zones. In general, planting of native species should be chosen, equivalent to that planned for the rest of the Wetland zone.
Landscaping. It is recommended that the area be landscaped to meet the needs of both the Latgale Zoo and the Daugavpils Innovation Centre. Contemporary and more striking solutions of landscaping elements are allowed in this zone.

2. ANYKŠČIAI GREEN POND

2.1. DESCRIPTION OF GREEN POND LOCATION

The territory researched is located in the north-eastern part of Lithuania and belongs to the Mūša-Nevėžis sub-region of the Central Lowland Climatic Region. The climate of the area has more continental features, due to the distance from the Baltic sea and the location of the territory in the Western Aukštaičiai plateau. The annual temperature range is noticeably higher in this area. Winters in this area are colder, more constant (average temperature in January is about -4.1 ° C). The maximum thickness of the snow cover is about 20 cm. Summer temperatures are quite high (average temperature in July is around +16.9 ° C).

The average annual amount of precipitation is about 650-700 mm (close to the national average and slightly higher than in central Lithuania). Most of the precipitation falls in the warm season - 440-460 mm, while in the cold season - 215-235 mm.

The average annual wind speed in Anykščiai is lower than in the Western part of Lithuania and reaches about 3-3.5 m/s. The effect of the wind at the site of Anykščiai Green pond is slightly reduced by its location in surface depression. The area researches is in the city, surrounded by buildings and trees, which also creates warmer microclimate.

Geologically, the territory is located in the Central physico-geographical area that has the bottom moraine, sometimes its depressions are filled by limnoglacial sediments. The lower surface areas along the rivers extend far to the east, deeply entering the Aukštaičiai upland district by the river valleys of Šventoji, Siesartis, Virinta. A particularly pronounced narrowing of Aukštaičiai plateau area can be seen at Anykščiai. The relief of the whole basin area has clear features that arose during the interglacial or inter-stage period. Anykščiai town is located on the Anykščiai hill (95–112 m above the sea level). The area is dominated by sandy soils.

The territory to be managed is located in Anykščiai town, a resort area in the North-Eastern part of Lithuania, Anykščiai district municipality. The Green pond is located in the Western part of Anykščiai town, near the crossroad of public highways connecting Anykščiai town with Ukmergė (as well as Vilnius and Kaunas) from the South-West and Panevėžys from the North-West (Figure 99).

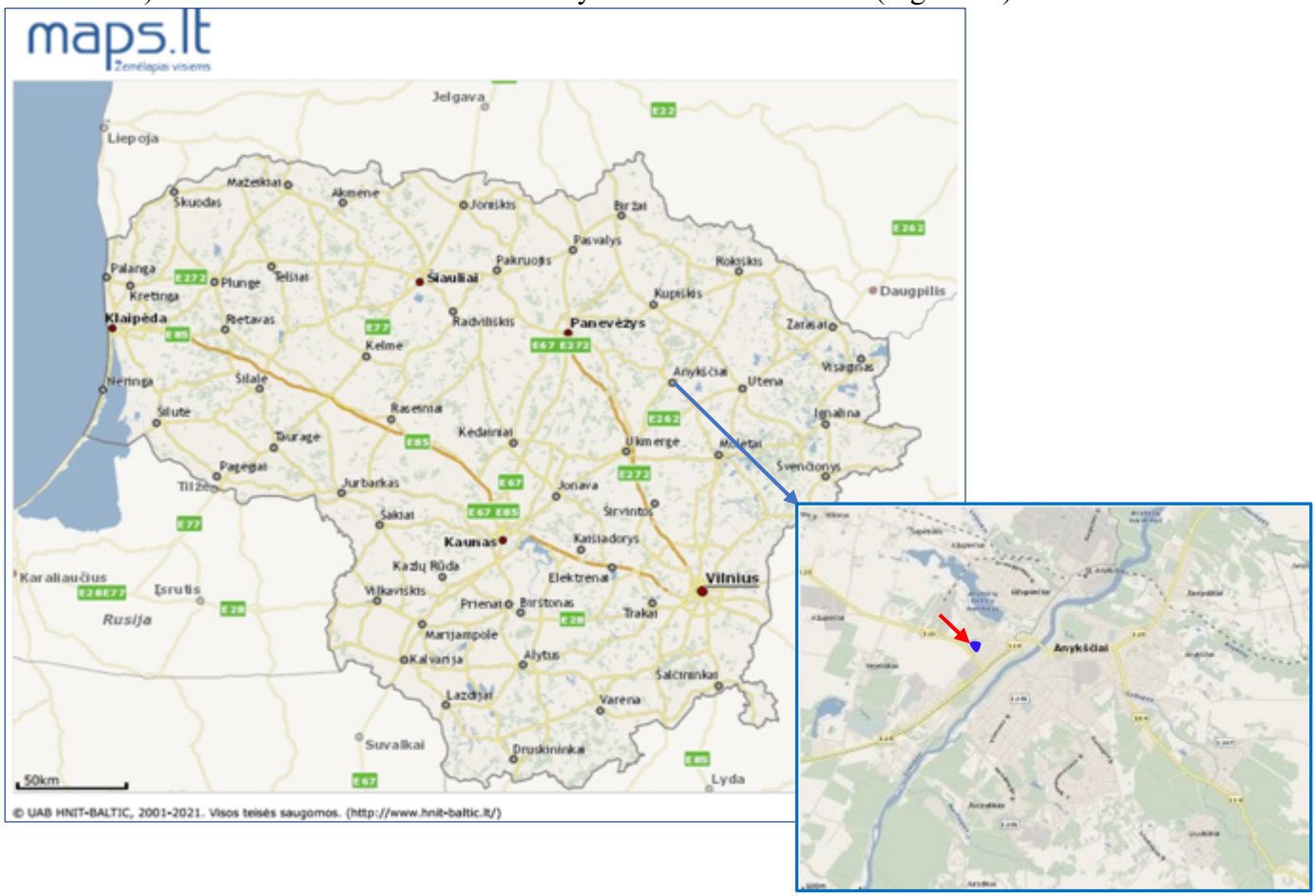


Figure 99. ***Location of the Anykščiai town and the Green pond (Maps from www.maps.lt)***

There is an urbanized territory with a police office building, city streets and individual houses surrounding the Green pond, but in the closest vicinities some semi-natural territories (small park planted with various trees from the West and apple tree garden from the East) exist as well (Figure 100). Pond has a small island. Geographical coordinates of the centre point of the territory in the LKS-94 system: 568860, 6155146 (LKS). The area of the Green pond is about 0,24 ha; but the territory which is planned to be managed covers adjacent ring of trees as well, so the total area to be managed is about 0,4 ha.

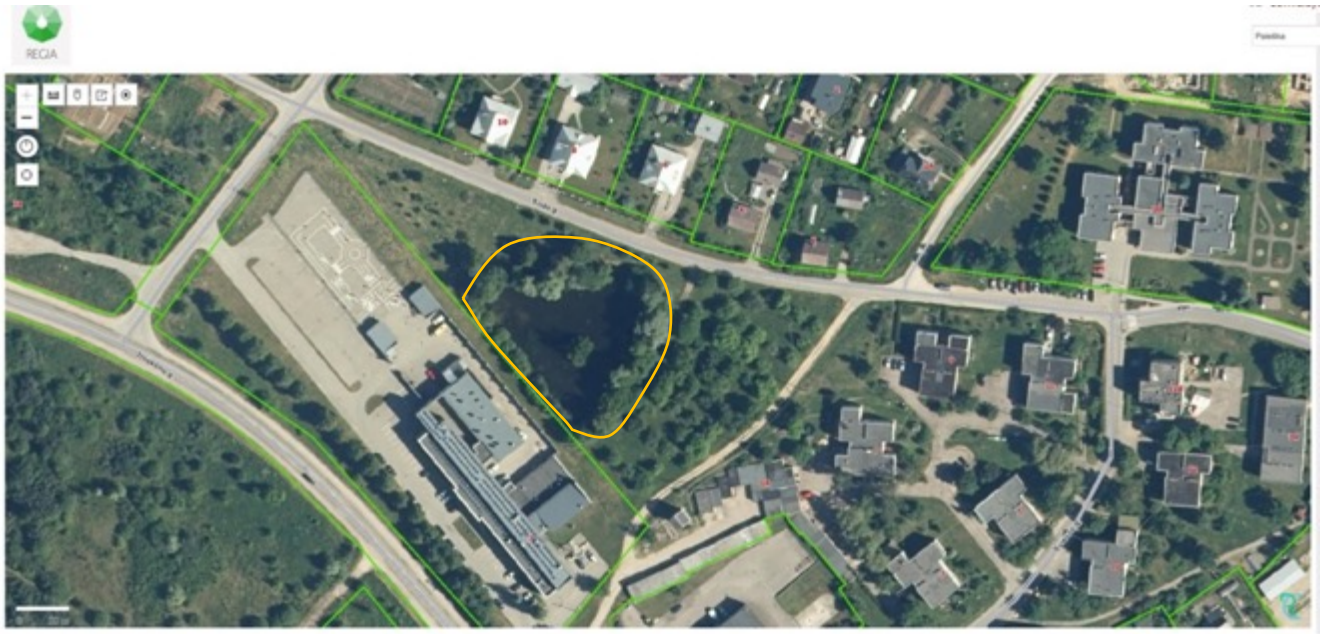


Figure 100. ***Location of the Anykščiai Green pond (Orthophotographic map (2018) from www.regia.lt; green lines – boundaries of the surrounding land parcels, yellow line – territory of the Green pond to be managed)***

In spring and summer of 2021 the water surface of the Green pond looked pretty different than in the orthophotograph made in 2018 (Figure 100). There was left about 1/3 of free water surface in May 2021 and even less in July-August 2021 (Figure 101 and 102). The shallow Northern and Western parts of the pond overgrown by dense helophyte (mainly *Typha latifolia* and *Equisetum palustre*) stands, it was possible to walk in these parts of the pond. Because of decreased water table in summer of 2021, the small island in the middle of the Green pond has joined to the shore. Rubber boots were not necessary to reach the island in August 2021.

Figures 101 and 102. ***A great part of water surface of the Green pond became into a land in 2021 (Photo: A. Balevičiu***

2.2. HISTORY OF THE TERRITORY FORMATION

Todays Green pond is the waterbody of an artificial origin. We could not find the exact date when it was excavated and for what purpose, but it could be excavated in VII – VIII decade of the 20th century. Pond clearly exists in old aerial photographs, but can't be seen in topographical maps (probably because of its' small size) (Figure 103).

Figures 103 and 104. ***Anykščiai Green pond place in old maps (1977 – 1986) and orthophotograph (1995-1999) (from www.geoportal.lt)***

The territory around the Green pond is rich in sand and gravel. Quartz sand factory is still working in 400 meters to the North and West, earlier there were quartz sand mining sites nearby the factory. So todays Green pond could be the remain of these massive excavations. Another purpose of the pond could be a water-body for fire extinguishing or watering the garden nearby.

Despite of its artificial origin, the pond is a valuable biotope for wildlife in this urbanized landscape

2.3. RESEARCHES IN THE ANYKŠČIAI GREEN POND AND THEIR RESULTS

2.3.1. Hydrological and chemical investigations

Visiting the Green pond, low water table in spring and even severe lack of water in summer and autumn was noticed. Looking to wide eulittoral it is clear that water table had been dropped for 40-60 cm or even more in May 2021. Lack of water was is even more obvious in July, when submerged macrophytes appeared into the air (Figure 105).

Figure 105. ***Anykščiai Green pond suffered from the lack of water in 2021 (Photo A. Balevičius)***

Various theories were elaborated regarding this question, but the most believable reason is that some years ago during the reconstruction of the police office building and yard nearby, the surface water runoff was redirected to the opposite direction than the Green pond. Also it could be that during the reconstruction of the police building the groundwater drainage system was installed around its basement. Therefore, more detailed hydrogeological research could be needed if the situation won't go better next years.

There could be other reasons like changes of a local hydrologoical regime, increased evaporation due to global warming as well as dense overgrowth by macrophytes and shrubs, which increase water evaporation as well. It was also noticed that people use pond water for watering their gardens and lawns in summer 2021. Such "stealing" of water must be stopped in the future if we want to sustain the ecosystem of the Green pond.

Water depth and thickness of accumulated sediments (sludge) was measured in the whole pond at 24th of May 2021. It was found that there is only 0,8-1,5 m of water depth left in the pond and half of the pond area has no water surface at all – this part of pond overgrown by dense *Typha latifolia* stands. Mineral bottom (grey sand and fine gravel) of the Green pond is covered by 0,6-1,1 m of sediments (Figure 106). This means that the pond was not deep enough already from the beginning, when it was excavated.

Figure 106. ***Measuring thickness of accumulated sludge (Photo: A. Balevičius)***

The chemical research of accumulated sediments showed that the sludge is not polluted by heavy metals and oil products, but it has low amount of organic matter as well (Laboratory protocols presented it the Appendix 9). Despite the fact that these sediments are not good as fertilizer, they can be used for land reclamation covering old mining sites or forming surface relief in town (I-st category sludge could be used without any restrictions accordingly to Order of the Minister of Environment of the Republic of Lithuania on the Description of the requirements for the management of surface water bodies No. D1-1038).

Investigations and inventory of biodiversity (plants, invertebrates, amphibian, reptilians, birds and mammals) in Anykščiai Green pond were carried out in 2020-2021 as well as sediment quality and thickness of accumulated sludge was researched

2.3.2. Natural values found in the territory

In the pond, its' eulittoral zone and nearest surroundings we found plants belonging to 41 species of, invertebrates – 42 species of, amphibians and reptiles –5, fish – 3. As the territory (~0,25 ha) is too small for great biodiversity, 7 bird species were found (list of species presented in the Appendix 8). Most of plants and animal species are common in whole the country, though some rare and protected species are also founded. The Anykščiai Green pond ant the territory around it is not included in the network of Lithuanian protected areas.

2.3.2.1. Rare and protected species

Two species of orchids *Epipactis sp*. and *Dactylorhiza sp*. were found in eulittoral of the pond, about 50 cm above the existing water level. It is a high probability, that there grow *Epipactis helleborine* and *Dactylorhiza incarnata,* but the individuals of *Dactylorhiza* were not flowering during the research in June and individuals of *Epipactis* had been already fructified during another visit in August (Figure 107), so there was no possibility to determine their species for sure (we had no possibility to perform genetical analysis). Despite of this, all orchid species are more or less protected in Lithuania so during management of the pond their habitats must be left untouched.

Figure 107. ***Orchids Epipactis sp. and Dactylorhiza sp. in eulittoral of the Anykščiai Green pond (Photo: J. Rimšaitė and A. Balevičius)***

The protected species of leeches was found during the investigation the Green pond – European medicinal leech *Hirudo medicinalis* (Figure 108). Medicinal leech (*Hirudo medicinalis*), the species is included in the list of protected animal plant and fungal species of the Republic of Lithuania (Order No. D1-340 of the Minister of Environment of the Republic of Lithuania of 9 June 2020), EC Habitats Directive V Annex III to the Berne Convention, CITES Appendix II, COMMISSION REGULATION (EU) No 1320/2014 of 1

December 2014 amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein.

Typical habitats of medical leech are allocated in muddy sediments of shallow eutrophic ponds and ditches overgrown by littoral vegetation. These shallow ponds or their littoral zones use to show high water temperature in summer. The survival of this species also depends on amphibians which permanently lives in the water body. Frogs use to be the main food source for leeches.

The need to save untouched habitats of the protected species must be taken into account when planning further management of the pond. Shallow overgrown muddy areas which characterized by warm water summer are necessary for leeches as well as *Hirudo medicinalis*. There are therefore difficulties in reconciling these requirements with the aim of protecting the water body from degradation.

Figure 108. ***European medical leech (Hirudo medicinalis) attached to the bottom of inflatable boat after the research of the Green pond (Photo: A. Balevičius)***

Amphibians and reptilians are globally endangered group of animals, due to habitat loss, fragmentation and scarcity of food sources (Table 2). Therefore, it is important to preserve all existing and possible habitats and/or abundance spots in a favourable condition, especially in city.

The Green pond in Anykščiai is a spot of amphibian and reptilian diversity in the city. The population of green frog *Pelophylax sp. complex* lives and breed in the pond, also other amphibian species such as European toad (*Bufo bufo*) and common frog (*Rana temporaria*) found refuge here. All these amphibian species are legally protected in Europe. Common toad (*Bufo bufo*) listed in Annex III to the Bern Convention. *Rana temporaria* is enlisted into EU Habitats Directive (Annex V: animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures) and the Bern Convention (Annex III: protected fauna species).

Green frogs (*Pelophylax esculentus* / *lessonae*), enlisted into Annex IV to the EC Habitats Directive, Annex III to the Berne Convention.

Important pressures and threats reported for these species include roads and motorways, use of biocides, hormones and chemicals, pollution of surface water bodies, forestry and agriculture, changes in hydrological conditions, urbanization and reduction of habitat connectivity. The IUCN Red List classifies the species as least concern due to its wide distribution, tolerance for a broad range of habitats and presumed large population. Conservation status of *Rana temporaria* is unfavorable in many countries of Central, Western and Southern Europe. Same is with green frog.

Reptile species found in the area: stable population of grass snake (*Natrix natrix*) (Figure 109) and viviparous (common) lizard (*Zootoca vivipara*) live in the territory. Both species listed in Annex III of the Berne Convention.

Figures 109 and 110. ***Grass snake (Natrix natrix) swimming and hunting in the Green pond (Photo: A. Balevičius)***

Roman snail, Burgundy snail or edible snail (*Helix pomatia*) are found in territory. This is a very common species in Lithuania, but protected in some other European countries. *H. pomatia* lives in open habitats, gardens, shrubland, especially near rivers and other water bodies. This species is listed in IUCN Red List, and in European Red List of Non-marine Molluscs as of least concern. *H. pomatia* is threatened in western Europe by continuous habitat destruction and drainage, uses of pesticides, usually less threatened by commercial collections, but in Lithuania commercial collection is quite popular. This snail is harvested as food. This species is included in EU Habitats Directive Annex V: animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures and Bern Convention Annex III: protected fauna species. In Lithuania conservation status of this species is favorable.

Table 1. Protected and otherwise relevant species identified in the Green pond and adjacent area

Nr. p.k.	Vernacular name (En, Lv, Lt)	Scientifical name	Protection of the species	Notes
Invertebrates				
1.	European medical leech	*Hirudo medicinalis*	RDB, BK III, HD V, CITES, EUTR	Found in pond
2.	Roman snail	*Helix pomatia*	HD V, BK III	Found nearby Green Pond
Amphibians				
3.	Common toad	*Bufo bufo*	BK III	Found in pond
4.	Common frog	*Rana temporaria*	HD V, BK III	Found in pond
5.	Green frog complexes	*Pelophylax*	HD IV, BK III	Found in pond

		esculentus/lessonae		
Reptiles				
6.	Common lizard	*Zootoca vivipara*	BK III	Found in territory
7.	Grass snake	*Natrix natrix*	BK III	Found in territory
Vaskulārie augi				
8.	Spotted orchid	*Dactylorhiza sp.*	CITES II	Found nearby Green Pond
9.	Helleborine	*Epipactis sp*	CITES II, EUTR B	Found nearby Green Pond

Explanation of the designations used in the table: **BK** - Bern convention, 1979, (Appendixes I, II, III). **HD** – EU Habitats Directive, Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora - consolidated version 01/01/2007 (EU Habitats Directive). Annex IV - animal and plant species of community interest in need of strict protection, Annex V animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures. **RDB** – Red data book of Lthuania , **CITES** – Convention on International Trade in Endangered Species of Wild Fauna and Flora, Annex II: (a) all species which, although not necessarily now threatened with extinction, may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and (b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control; **EUTR** Commission regulation (EU) No 1320/2014, of 1 December 2014, amending Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein (EU regulation of trade of fauna and flora), Annex B includes: All other CITES Appendix II species, except where EU Member States have entered a reservation; Some CITES Appendix III species * Some non-CITES species

2.3.2.2. Invasive plants

Invasive tree species ash-leaf maple *Acer negundo* had been found during the research (Figure 111). Recent years these invasive and aggressively spreading maples use to be cut in Lithuania, opening habitats for indigenous tree species.

Figure 111. ***Invasive ash-leaf maple Acer negundo (Photo: A. Balevičius)***

As ashleaf maple is a very competitive species which outcompetes natural tree and scrub species, it is recommended to cut ash-leaf maple growing near the Green pond. Canadian waterweed (*Elodea canadensis*) is another invasive species found in the Green pond (Figure 112 and 113). As the monodominant stands of Canadian waterweed predominate on the whole bottom of the Green pond, it outcompete the other limneid species. In order to increase plant diversity of the Green pond, there is a need to regulate amount of Elodea stands.


Figures 112. and 113. ***Canadian waterweed forms dense monodominant stands on the bottom of the Green pond (Photo: Balevičius)***

2.4. INFORMATION ABOUT FACTORS NEGATIVELY AFFECTING NATURE VALUES FOUND IN THE TERRITORY

As it was said in previous chapters, hydrological conditions (e.g. lowering of water level in the pond and, believable, groundwater table as well) is the main treat for the whole ecosystem of the Green pond. The Green pond is undergoing a rapid succession: pond depth (and water mass) is rapidly shrinking, overgrowing by macrophyte (especially helophyte) vegetation, silting up and turning into swamp.

Pond water is being used for irrigation, so the water level drops even more rapidly during dry periods of summer. Some alien and invasive plant species were noticed in the territory.

Significant anthropogenic pollution of the Green pond by different household waste was observed (Figure 114). Luckily, most of the rubbish looks to be from the past, neither present pollution.
The area is surrounded by residential and administrative buildings and from many sides bordered by streets, which greatly hinders amphibian migration and immigration. Probably because of this the area is not used as a spawning ground for common frog, moor frog and common toads, although several adult individuals had been found here.

A population of green frogs lives and breeds in the area, as amphibians of this species are less dependent on spring migrations.

Figure 114. ***Territory arround the Green pond is polluted by various rubbish (Photo: A. Balevičius)***

2.5. RECOMMENDED ACTIONS FOR THE CONSERVATION AND PROMOTION OF BIOLOGICAL DIVERSITY IN THE PROJECT TERRITORIES

The pond itself and pond-shore habitats is the main object of conservation. As it was said, the biggest threat for the pond ecosystem is low and/or unstable water level. Therefore, geological research before cleaning / deepening the pond and further groundwater monitoring is highly recommendable as well as all other measures to sustain sufficient water level in the Green pond.

As it was measured, the pond is very shallow and its bottom is silted, so increasing its depth (and water volume as well) will be beneficial for all water organisms.

On the other hand, hydrobionts which live on silted bottoms (e.g. protected species like medical leech) will be eradicated during pond cleaning and deepening. Keeping this in mind, it was decided to clean and increase water depth only in the certain part of the Green pond, the other part of the pond with silty bottom habitats leaving untouched (Figure 115).

Figure 115. ***Overgrown area of the Green pond to be cleaned (Base orthophoto map from www.maps.lt)***

As the whole territory of the Green pond is polluted by various kinds of rubbish (glass and plastic bottles, old car tires, metal parts and so on), it is necessary to collect all the rubbish, sort the recyclable materials and clean the territory before the sludge cleaning.

Sludge cleaning and deepening of the Green pond will be performed by long reach excavator. The deepest place (up to 3 m of water depth) to be excavated in the Western part of the pond (Figure 115). As the ground is predominated by sand and fine gravel, in order to create stable shores all the slopes (above and below the water level) must be formed at the ratio 1:3.

Excavated sludge and mineral ground (mostly sand) will be loaded to lorries and driven to the deponing site some kilometres away.

Creating deeper areas of the pond will help to stabilise thermal and hydrochemical (especially dissolved oxygen) conditions of the water mass. This deep part will serve as a wintering place for pond fauna as well as a shelter to escape from high water temperatures (= low dissolved oxygen concentrations) during hot periods of summer.

Cleaning of the pond must be performed in late summer or autumn. It is forbidden to perform digging jobs during fish and other fauna breeding season (1 April – 1 July).

The territory surrounding the Green pond is overgrown by the ring of dense trees and scrubs (Figure 116).

Figure 116. ***Anykščiai Green pond surrounded by ring of dense scrubs and trees (Photo: A. Balevičius)***

Most of trees are of valuable species (except of invasive *Acer negundo*) and must be left untouched, but the scrubs in many places are too dense and must be cleaned accordingly to the plan prepared by specialists of Anykščiai municipality. In order not to disturb nesting birds, invasive trees and excess scrubs must be cut in autumn or winter.

In order to maintain and/or improve the habitat conditions of protected species (European medicinal leech *Hirudo medicinalis*, green frog *Pelophylax esculentus / lessonae*, European toad *Bufo bufo*), some basic principles should be followed during the cleaning of the Green Pond:

1. For the survival and reproductive success of the medicinal leech, it is necessary to leave muddy, shallow water areas undisturbed.
2. Preserve shallow coastal areas with warm water in summer, suitable for amphibian spawning and successful egg development.
3. Cleaning and dredging a certain part of the pond to stop its degradation.
4. Leave part of the natural (untouched) banks in the eastern and north-eastern part of the pond.
5. In the excavated (cleaned and dredged) part of the pond, create new open, well heated, flat banks, which are needed for amphibians and some invertebrate species.
6. Removing invasive species, such as ashleaf maple, to encourage the growth of native species.
7. To improve wintering conditions for amphibians and reptiles, artificial shelters are recommended. Once the Green Pond is cleaned and its banks cleared of macrophyte growth, the number of natural shelters needed by amphibians and reptiles will decrease. This loss will therefore be compensated by the construction of 4-6 shelters (Figure 117) made of cut tree logs of varying thicknesses and stacked branches on the shore of the Green Pond.

Figure 117. ***Simple but effective: an artificial shelter for amphibians (Photo: J. Rimšaitė)***

It is useful to use locally felled wood (rotten logs and branches of taller shrubs are also suitable) that will appear during the clean-up. Gaps between branches in the pile can be filled ('insulated') with fallen leaves. Some of the shelters can be supplemented with nearby stones that store heat, so reptiles use them as warming places. Shelters should be sited in partly shaded areas, approximately 5-10 m from the shoreline of the pond (Figure 118).

Figure 118. ***Approximate locations of artificial shelters (Basic orthophoto map from www.geoportal.lt)***

It is recommended to install information boards at these artificial shelters. These should include information on amphibians and reptiles, their shelters and the need to protect them.

To attract more insect species to the Green Pond, some "insect hotels" could be set up. "Insect hotels are man-made structures designed to shelter insects (Figure 119). Most 'hotels' consist of several different

sections that provide nesting opportunities for insects - especially in winter, offering shelter or refuge to many types of insects such as pollinators, beetles and others.

The insect hotel can be used as a great educational tool. Insect hotels should be located in an open, well-heated, sunny place. It is also recommended to involve the local community in the production of insect hotels, e.g. students from nearby schools during biology and woodworking lessons.

Figures 119 and 120. ***Insect hotels (Photos P. Ivinskis, A. Balevičius)***

The area is compact and easily accessible, making it easy to observe the animals and plants that live there. After management, the Anykščiai Green Pond and the surrounding area will also be used for public visits and environmental education. A well-maintained public area with paths, a pontoon boardwalk, benches and other facilities will increase the attractiveness of this educational and recreational site.

To minimise the impact of visitors on the natural values, all infrastructure will be located in areas further away from the habitats of protected species. Architectural solutions for trails, pontoon walkways, benches, information boards and other small architectural details will be proposed by the architects of the Municipality of Anykščiai.

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ANNEX 1

LIST OF SPECIES FOUND IN THE ESPLANADE WETLAND DURING THE INVENTORY

	Latin	Latvian	Lithuanian	English
Koki un krūmi / medžiai ir krūmai / trees and shrubs				
1.	*Acer negundo*	Ošlapu kļava	Uosialapis klevas	Ashleaf maple
2.	*Acer platanoides*	Parastā kļava	Paprastasis klevas	Norway maple
3.	*Quercus rubra*	Sarkanais ozols	Ąžuolas raudonasis	Northern red oak
4.	*Betula pendula*	Āra bērzs	Karpotasis beržas	Silver birch
5.	*Betula pubescens*	Purva bērzs	Plaukuotasis beržas	Downy birch
6.	*Qurcus robur*	Parastais ozols	Paprastasis ąžuolas	Pedunculate oak
7.	*Salix cinerea*	Pelēkais kārkls	Pilkasis karklas	Grey willow
8.	*Populus balsamifera*	Balzama apse	Balzaminė tuopa	Balsam poplar
9.	*Crataegus sp.*	Vilkābeles	Gudobelė	Hawthorn
10.	*Swida sanguinea*	Asinssarkanais grimonis	Raudonoji sedula	Dogwood
11.	*Larix sp.*	Lapegle	Maumedis	Larch
12.	*Sorbus aucuparia*	Parastais pīlādzis	Paprastasis šermukšnis	Rowan
13.	*Fraxinus excelsior*	Parastais osis	Paprastasis uosis	Ash
14.	*Berberis vulgaris*	Parastā bārbele	Paprastasis raugerškis	Barberry
15.	*Padus avium*	Parastā ieva	Paprastoji ieva	Bird cherry
16.	*Salix fragilis*	Trauslais vītols	Trapusis gluosnis	Crack willow
17.	*Salix myrsinifolia*	Melnējošais (mirsīnlapu) kārkls	Juosvasis karklas	Dark-leaved willow
18.	*Salix viminalis*	Klūdziņu kārkls	Gluosnis žilvitis	Osier
19.	*Salix triandra*	Vicu kārkls	Krantinis gluosnis	Almond willow
20.	*Tilia cordata*	Parastā liepa	Mažalapė liepa	Small-leaved lime
Lakstaugi / Žolinė augalija / Herbaceous plants				
21.	*Typha latifolia*	Platlapu vilkvālīte	Plačialapis švendras	Bulrush
22.	*Phragmites australis*	Parastā niedre	Paprastoji nendrė	Common reed
23.	*Glyceria maxima*	Dižā ūdenszāle	Vandeninė monažolė	Reed sweet-grass
24.	*Epilobium palustre*	Purva kazroze	Pelkinė ožkarožė	Marsh willowherb
25.	*Epilobium hirsutum*	Pūkainā kazroze	Plaukuotoji ožkarožė	Great willowherb
26.	*Carex acuta*	Slaidais grīslis	Lieknoji viksva	Slender tufted-sedge
27.	*Carex nigra*	Dzelzszāle	Paprastoji viksva	Common sedge
28.	*Carex diandra*	Divputekšņlapu grīslis	Apvalioji viksva	Lesser tussock-sedge
29.	*Carex cespitosa*	Ciņu grīslis	Kupstinė viksva	Turfy *sedge*
30.	*Carex hirta*	Pūkainais grīslis	Plaukuotoji viksva	Hairy sedge
31.	*Dactylis glomerata*	Parastā kamolzāle	Paprastoji šunažolė	Cock's-foot
32.	*Anthriscus sylvestris*	Meža suņburkšķis	Krūminis builis	Cow parsley
33.	*Urtica dioica*	Lielā nātre	Didžioji dilgėlė	Common nettle
34.	*Alopecurus pratensis*	Pļavas lapsaste	Pievinis pašiaušėlis	Meadow foxtail
35.	*Capsella bursa-pastoris*	Ganu plikstiņš	Trikertė žvaginė	Shepherd's-purse
36.	*Scrophularia nodosa*	Gumainā cūknātre	Nariuotasis bervidis	Common figwort
37.	*Taraxacum officinale*	Ārstniecības pienene	Paprastoji kiaulpienė	Common dandelion
38.	*Galium album*	Baltā madara	Statusis lipikas	Upright hedge-bedstraw
39.	*Geum urbanum*	Pilsētas bitene	Geltonoji žiognagė	Wood avens
40.	*Geum rivale*	Pļavas bitene	Raudonoji žiognagė	Water avens
41.	*Lysimachia vulgaris*	Parastā zeltene	Paprastoji šilingė	Yellow loosestrife
42.	*Veronica chamaedrys*	Birztalas veronika	Paprastoji veronika	Germander speedwell
43.	*Ranunculus acris*	Kodīgā gundega	Aitrusis vėdrynas	Meadow buttercup
44.	*Pastinaca sativa*	Pļavas pastinaks	Paprastasis pastarnokas	Wild parsnip
45.	*Rubus idaeus*	Meža avene	Paprastoji avietė	Raspberry
46.	*Rumex confertus*	Blīvā skābene	Tankiažiedė rūgštynė	Russian dock
47.	*Galium aparine*	Ķeraiņu madara	Kibusis lipikas	Cleavers
48.	*Cirsium arvense*	Tīruma usne	Dirvinė usnis	Creeping thistle
49.	*Equisetum arvense*	Tīruma kosa	Dirvinis asiūklis	Field horsetail
50.	*Epipactis helleborine*	Platlapu dzeguzene	Plačialapis skiautalūpis	Broad-leaved helleborine

	Latin	Latvian	Lithuanian	English
Koki un krūmi / medžiai ir krūmai / trees and shrubs				
51.	*Impatiens glandulifera*	Puķu sprigane	Bitinė sprigė	Indian balsam
52.	*Poa pratensis*	Pļavas skarene	Pievinė miglė	Smooth meadow-grass
53.	*Chelidonium majus*	Lielā strutene	Didžioji ugniažolė	Greater celandine
54.	*Humulus lupulus*	Parastais apinis	Paprastasis apynys	Hop
55.	*Rorippa amphibia*	Abinieku paķērsa	Vandeninis čeriukas	Great yellow-cress
56.	*Ranunculus sceleratus*	Ļaunā gundega	Nuodingasis vėdrynas	Celery-leaved buttercup
57.	*Alisma plantago-aquatica*	Parastā cirvene	Gyslotinis dumblialaiškis	Water-plantain
58.	*Ranunculus repens*	Ložņu gundega	Šliaužiantysis vėdrynas	Creeping buttercup
59.	*Poa trivialis*	Parastā skarene	Paprastoji miglė	Rough meadow-grass
60.	*Plantago major*	Lielā ceļteka	Plačialapis gyslotis	Greater plantain
61.	*Aegopodium podagraria*	Podagras gārsa	Paprastoji garšva	Ground-elder
62.	*Agrostis stolonifera*	Ložņu smilga	Baltoji smilga	Creeping bent
63.	*Symphytum officinale*	Ārstniecības tauksakne	Vaistinė taukė	Common comfrey
64.	*Angelica sylvestris*	Meža zirdzene	Miškinis skudutis	Wild angelica
65.	*Ranunculus acris*	Kodīgā gundega	Aitrusis vėdrynas	Meadow buttercup
66.	*Bromopsis inermis*	Bezakotu zaķauza	Beginklė dirsuolė	Hungarian brome
67.	*Solidago canadensis*	Kanādas zeltgalvīte	Kanadinė rykštenė	Canadian Goldenrod
68.	*Mycelis muralis*	Mūru mežsalāts	Miškinė zuiksalotė	Wall lettuce
69.	*Vicia sepium*	Žoga vīķis	Patvorinis vikis	Bush vetch
70.	*Vicia cracca*	Vanagu vīķis	Mėlynžiedis vikis	Tufted vetch
71.	*Artemisia vulgaris*	Parastā vībotne	Paprastasis kietis	Mugwort
72.	*Valeriana officinalis*	Ārstniecības baldriāns	Vaistinis valerijonas	Common valerian
73.	*Stachys palustris*	Purva sārmene	Pelkinė notra	Marsh woundwort
74.	*Calamagrostis neglecta*	Necilā ciesa	Kamaninis lendrūnas	Narrow small-reed
75.	*Geranium palustre*	Purva gandrene	Pelkinis snaputis	Marsh Cranesbill
76.	*Erigeron canadensis*	Kanādas jānītis	Kanadinė konyza	Canadian Fleabane
77.	*Fallopia convolvulus*	Dārza vējgriķis	Vijoklinis pelėvirkštis	Black-bindweed
78.	*Convolvulus arvensis*	Tīruma tītenis	Dirvinis vijoklis	Field bindweed
79.	*Chenopodium suecicum*	Zaļā balanda	Žalioji balanda	Green goosefoot
80.	*Chenopodium album*	Baltā balanda	Baltoji balanda	Fat-hen
81.	*Lamium album*	Baltā panātre	Baltažiedė notrelė	White dead-nettle
82.	*Achillea millefolium*	Parastais pelašķis	Paprastoji kraujažolė	Yarrow
83.	*Deschampsia caespitosa*	Parastā ciņusmilga	Kupstinė šluotsmilgė	Tufted hair-grass
84.	*Echinocystis lobata*	Adatainais dzeloņgurķis	Dygliavaisis virkštenis	Balsam-apple
85.	*Heracleum sibiricum*	Sibīrijas latvānis	Sibirinis barštis	Hogweed
86.	*Euphorbia virgata*	Rīkšu dievkrēsliņš	Rykštinė karpažolė	Leafy spurge
87.	*Tussilago farfara*	Parastā māllēpe	Ankstyvasis šalpusnis	Colt's-foot
88.	*Phleum pratense*	Pļavas timotiņš	Pašarinis motiejukas	Timothy
89.	*Medicago falcata*	Sirpjveida lucerna	Geltonžiedė liucerna	Sickle medick
90.	*Melilotus albus*	Baltais amoliņš	Baltažiedis barkūnas	White melilot
91.	*Rubus caesius*	Zilganā kazene	Paprastoji gervuogė	Dewberry
92.	*Artemisia abrotanum*	Dievkociņš	Diemedis	Southernwood
93.	*Verbascum nigrum*	Melnais deviņvīruspēks	Juodoji tūbė	Dark mullein
94.	*Parthenocissus quinquefolia*	Pieclapiņu mežvīns	Penkialapis vynvytis	Virginia-creeper
95.	*Lycopus europaeus*	Eiropas vilknadze	Paprastoji vilkakojė	Gipsywort
96.	*Potentilla anserina*	Maura retējs	Žąsinė sidabražolė	Silverweed
97.	*Fragaria vesca*	Meža zemene	Paprastoji žemuogė	Wild strawberry
98.	*Leonurus quinquelobatus*	Piecdaivu mātere	Penkiaskiautė sukatžolė	-
99.	*Festuca pratensis*	Pļavas auzene	Tikrasis eraičinas	Meadow fescue
100.	*Impatiens parviflora*	Sīkziedu sprigane	Smulkiažiedė sprigė	Small balsam
101.	*Calamagrostis epigeios*	Slotiņu ciesa	Smiltyninis lendrūnas	Wood small-reed
102.	*Polygonum arenastrum*	Maura sūrene	Smulkialapė takažolė	Equal-leaved knotgrass
103.	*Cynoglossum officinale*	Ārstniecības suņmēle	Vaistinė šunlielė	Hound's-tongue
104.	*Barbarea arcuata*	Lokaugļu zvērene	Paprastoji barborytė	Winter- cress (s.l.)
105.	*Erysimum cheiranthoides*	Parastā pērkonene	Smalkinis tvertikas	Treacle mustard
106.	*Lolium perenne*	Daudzgadīgā airene	Daugiametė svidrė	Perennial rye-grass
107.	*Torilis japonica*	Japānas sārtburkšķis	Builinė dygūnė	Upright Hedge-parsley
108.	*Trifolium pratense*	Pļavas āboliņš	Raudonasis dobilas	Red clover

	Latin	Latvian	Lithuanian	English
Koki un krūmi / medžiai ir krūmai / trees and shrubs				
109.	*Melandrium album*	Baltā spulgotne	Baltasis šakynis	White campion
110.	*Glechoma hederacea*	Efeju sētložņa	Šliaužiančioji tramažolė	Ground-ivy
111.	*Amaranthus retroflexus*	Liektais amarants	Šiurkštusis burnotis	Common amaranth
112.	*Rumex acetosa*	Pļavas skābene	Valgomoji rūgštynė	common sorrel
113.	*Oenothera biennis*	Divgadīgā naktssvece	Dvimetė nakviša	Common evening-primrose
114.	*Lathyrus pratensis*	Pļavas dedestiņa	Pievinis pelėžirnis	Meadow vetchling
115.	*Linaria vulgaris*	Parastā vīrcele	Paprastoji linažolė	Common toadflax
116.	*Stellaria graminea*	Zāļlapu virza	Siauralapė žliūgė	Lesser stitchwort
117.	*Prunella vulgaris*	Parastā brūngalvīte	Paprastoji juodgalvė	Selfheal
118.	*Scutellaria galericulata*	Bruņu ķiverene	Pelkinė kalpokė	Skullcap
119.	*Leontodon autumnalis*	Rudens vēlpiene	Rudeninė snaudalė	Autumn hawkbit
120.	*Sisymbrium loeselii*	Lēzeļa žodzene	Šiurkščioji pikulė	False Rocket
121.	*Carex vulpina*	Lapsu grīslis	Lapinė viksva	True fox-sedge
122.	*Carex cinerea*	Iesirmais grīslis	Žiloji viksva	Silvery *sedge*
123.	*Carex pseudocyperus*	Dižmeldru grīslis	Šiurkščioji viksva	Cyperus sedge
124.	*Carex vesicaria*	Pūslīšu grīslis	Pūslėtoji viksva	Bladder- sedge
125.	*Dactylorhiza incarnata* ***	Stāvlapu dzegužpirkstīte	Raudonoji gegūnė	Early Marsh Orchid
Putni / Paukščiai / Birds				
126.	*Chroicocephalus ridibundus*	Lielais ķīris	Rudagalvis kiras	Black-headed gull
127.	*Luscinia svecica*	Zilrīklīte	Mėlyngurklė	Bluethroat
128.	*Emberiza schoeniclus*	Niedru stērste	Nendrinė starta	Reed bunting
129.	*Ixobrychus minutus*	Mazais dumpis	Mažasis baublys	Little bittern
130.	*Fulica atra*	Laucis	Laukys	Common coot
131.	*Gallinula chloropus*	Ūdensvistiņa	Nendrinė vištelė	Moorhen
132.	*Rallus aquaticus*	Dumbrcālis	Ilgasnapė vištelė	Water rail
133.	*Anas platyrhynchos*	Meža pīle	Didžioji antis	Mallard
134.	*Motacilla flava*	Dzeltenā cielava	Geltonoji kielė	Yellow wagtail
135.	*Acrocephalus schoenobaenus*	Ceru ķauķis	Ežerinė nendrinukė	Sedge warbler
136.	*Corvus corone*	Pelēkā vārna	Varna	Crow
137.	*Circus aeruginosus*	Niedru lija	Nendrinė lingė	Marsh harrier
138.	*Corvus corax*	Krauklis	Kranklys	Common raven
139.	*Aythya ferina*	Brūnkaklis	Rudagalvė antis	Pochard
140.	*Crex crex*	Grieze	Griežlė	Corn crake
141.	*Lanius collurio*	Brūnā čakste	Poprastoji medšarkė	Red-backed shrike
142.	*Luscinia luscinia*	Lakstīgala	Lakštingala	Thrush nightingale
143.	*Acrocephalus scirpaceus*	Ezera ķauķis	Mažoji krakšlė	Reed warbler
144.	*Acrocephalus arundinaceus*	Niedru strazds	Didžioji krakšlė	Great reed warbler
145.	*Carpodacus erythrinus*	Mazais svilpis	Raudongalvė sniegena	Common rosefinch
146.	*Aythya fuligula*	Cekulpīle	Kuoduotoji antis	Tufted duck
147.	*Anas querquedula*	Prīkšķe	Dryžgalvė kryklė	Garganey
148.	*Anas clypeata*	Platknābis	Šaukštasnapė antis	Common shoveler
149.	*Philomachus pugnax*	Gugatnis	Gaidukas	Ruff
150.	*Tringa glareola*	Purva tilbīte	Tikutis	Wood sandpiper
151.	*Vanellus vanellus*	Ķīvīte	Northern lapwing	Pempė
152.	*Tringa totanus*	Pļavu tilbīte	Raudonkojis tulikas	Common redshank
153.	*Tringa nebularia*	Lielā tilbīte	Žaliakojis tulikas	Greenshank
154.	*Gallinago gallinago*	Mērkaziņa	Perkūno oželis	Common snipe
155.	*Scolopax rusticola*	Sloka	Slanka	Woodcock
156.	*Lymnocryptes minumus*	Vistilbe	Oželis nykštukas	Jack snipe
157.	*Sturnus vulgaris*	Mājas strazds	Varnėnas	Common starling
158.	*Hirundo rustica*	Bezdelīga	Šelmeninė kregždė	Barn swallow
159.	*Remiz pendulinus*	Somzīlīte	Remeza	Eurasian Penduline tit
160.	*Tachybaptus ruficollis*	Mazais dūkuris	Mažasis kragas	Little Grebe
Zīdītāji / Žinduoliai / Mammals				
161.	*Arvicola terrestris*	Ūdensstrupaste	Vandeninis pelėnas	Northern water vole
162.	*Myotis brandtii****	Branta naktssikspārnis	Branto pelėausis	Brandt's bat

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Koki un krūmi / medžiai ir krūmai / trees and shrubs				
163.	*Plecotus auritus****	Brūnais garausainis	Rudasis ausylis	Brown long-eared bat
164.	*Myotis dasycneme****	Dīķu naktssikspārnis	Kūdrinis pelėausis	Pond bat
165.	*Myotis daubentonii****	Ūdeņu naktssikspārnis	Vandeninis pelėausis	Daubenton's bat
166.	*Eptesicus nilssoni****	Ziemeļu sikspārnis	Šiaurinis šikšnys	Northern bat
167.	*Vespertilio murinus****	Divkrāsainais sikspārnis	Dvispalvis plikšnys	Parti-coloured bat
168.	*Neovison vison*	Amerikas ūdele	Kanadinė audinė	Mink
169.	*Mustela nivalis*	Zebiekste	Žebenkštis	Weasel
170.	*Vulpes vulpes*	Rudā lapsa	Rudoji lapė	Red fox
Rāpuļi / Ropliai / Reptiles				
171.	*Natrix natrix*	Zalktis	Paprastasis žaltys	Grass snake
172.	*Emys orbicularis***	Purva bruņurupucis	Balinis vėžlys	European pond turtle
173.	*Trachemys scripta**	Sarkanausu bruņurupucis	Raudonausis vėžlys	Pond slider
174.	*Pelodiscus sinensis**	Ķīnas mīkstbruņurupucis	Kinijos minkštašarvis vėžlys	Chinese softshell turtle
175.	*Zootoca vivipara*	Pļavas ķirzaka	Gyvavedis driežas	Common lizard
Abinieki / Varliagyviai / Amphibians				
176.	*Pelobates fuscus*	Varžkrupis	Česnakė	Common spadefoot
177.	*Bufotes viridis*	Zaļais krupis	Žalioji rupūžė	Green toad
178.	*Bufo bufo*	Parastais krupis	Paprastoji rupūžė	European toad
179.	*Pelophylax sp.*	Zaļās vardes sugu komplekss	Valgomos varlės rūšių kompleksas	Edible frog species complex
Zivis / Žuvys / Fish				
180.	*Carassius carassius*	Karūsa	Auksinis karosas	Crucian carp
181.	*Tinca tinca*	Līnis	Lynas	Tench
182.	*Percottus glenii*	Rotans	Rotanas	Amur sleeper
Spāres / Žirgeliai / Odonata				
183.	*Coenagrion puella*	Gaišzilā krāšņspāre	*Pasaginė strėliukė*	Azure Bluet
184.	*Coenagrion hastulatum*	Zaļganā krāšņspāre	*Ietinė strėliukė*	Spearhead Bluet
185.	*Calopteryx splendens*	Upju zilspāre	Blizgančioji gražutė	Banded Demoiselle
186.	*Sympetrum sanguineum*	Sarkanā klajumspāre	Kruvinoji skėtė	Ruddy Darter
187.	*Sympetrum danae*	Melnā klajumspāre	Juosvoji skėtė	Black Darter
188.	*Cordulia aenea*	Agrā smaragdspāre	Bronzinė skėtė	Downy Emerald
189.	*Libellula quadrimaculata*	Plankumainā platspāre	Keturtaškė skėtė	Four-spotted Chaser
Dienas tauriņi / Drugiai / Butterflies				
190.	*Pieris brassicae*	Kāpostu baltenis	Kopūstinis baltukas	Cabbage white
191.	*Pieris rapae*	Rāceņu baltenis	Ropinis baltukas	Small white
192.	*Gonepteryx rhamni*	Krūkļu baltenis	Citrinukas	Brimstone
193.	*Aglais urticae*	Parastais nātru raibenis	Dilgėlinukas	Small tortoiseshell
194.	*Inachis io*	Acainais raibenis	Spungė	European peacock butterfly
195.	*Aphanthopus hyperanthus*	Parastais samtenis	Tamsusis satyras	Ringlet
196.	*Maniola jurtina*	Pļavu vēršacītis	Paprastasis jautakis satyras	Meadow brown
197.	*Coenonympha pamphilus*	Parastais sīksamtenis	Gelsvasis satyriukas	Small heath
198.	*Lycaena phlaeas*	Parastais zeltainītis	Mažasis auksinukas	Common copper
199.	*Polyommatus icarus*	Parastais zilenītis	Dirvinis melsvys	Common blue
Vaboles / Vabalai / Beetles				
200.	*Melolontha melolontha*	Lauka maijvabole	Paprastasis grambuolys	Common cockchafer
201.	*Carabus cancellatus*	Lauka skrejvabole	Raudonšlaunis puošniažygis	Cancellate ground beetle
202.	*Dytiscus marginalis*	Zeltmalu airvabole	Geltonkraštė dusia	Great diving beetle
203.	*Acilius sulcatus*	-	-	-
204.	*Acilius canaliculatus*	-	-	-
205.	*Necrophorus vespillo*	Raibā kapračvabole	Paprastasis duobkasys	Common Burying Beetle
206.	*Rhagonycha fulva*	Rūsganais mīkstspārnis	Skėtinis minkštavabalis	Common red soldier beetle
207.	*Coccinella septempunctata*	Septiņpunktu mārīte	Septyntaškė boružė	Seven-spot ladybird
208.	*Adalia bipunctata*	Divpunktu mārīte	Dvitaškė adalija	Two-spot ladybird

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Koki un krūmi / medžiai ir krūmai / trees and shrubs				
209.	*Cetonia aurata*	Zeltītā rožvabole	Paprastasis auksavabalis	Green rose chafer
210.	*Aromia moschata*	Zaļais vītolgrauzis	Muskusinis ūsuotis	Musk beetle
211.	*Agelastica alni*	Zilais lapgrauzis	Mėlynasis alksniagraužis	Alder leaf beetle
212.	*Chrysomela populi*	Lielais apšu lapgrauzis	Tuopinis gluosninukas	Poplar leaf beetle
213.	*Phyllobius urti*	-	-	-
Taisnspārņi / Tiesiasparniai / Orthoptera				
214.	*Phaneroptera falcata*	-	Pjautuvinis krūmžiogis	Sickle-bearing bush-cricket
215.	*Decticus verrucivorus*	Pļavu dižsienāzis	Margasis žiogas	Wart-biter Bush-cricket
216.	*Tettigonia cantans*	Parastais dziedātājsienāzis	Žiogas giesmininkas	Uppland Green Bush-cricket
Spīļastes / Auslindos / Earwigs				
217.	*Forficula auricularia*	Parastā spīļaste	Paprastoji auslinda	Common earwing
Gliemji / Moliuskai / Mollusca				
218.	*Helix pomatia*	Parka vīngliemezis	Vynuoginė sraigė	Roman snail
219.	*Arianta arbustorum*	Raibais vīngliemezis	Taškuotoji *arianta*	Copse Snail
220.	*Arion subfuscus*	Rūsganais kailgliemezis	Kislusis smalžys	Dusky slug
221.	*Lymnaea stagnalis*	Lielais dīķgliemezis	Didžioji kūdrinukė	Great pond snail
222.	*Planorbarius corneus*	Lielā ūdensspolīte	Ratavija	Great ramshorn
Dēles / Dėlės / Leeches				
223.	*Haemopis sanguisuga*	Parastā žokļdēle	Kumeldėlė	Horse - leech
Blaktis / Blakės / Heteroptera				
224.	*Aphrophora alni*	Alkšņu putcikāde	Alksninė cikada	European alder spittlebug
225.	*Gerris argentatus*	-	-	-
226.	*Gerris lacustris*	-	Kūdrinis čiuožikas	Common water-strider
227.	*Nepa cinerea*	Parastais ūdensskorpions	Pilkoji skorpionblaktė	Water scorpion
228.	*Notonecta glauca*	Parastā mugurpelde	Paprastoji nugarplauka	Common backswimmer
Divspārņi / Dvisparniai / True flies				
229.	*Culex pipiens*	Pagraba ods	Paprastasis uodas	Common house mosquito
230.	*Anopheles maculipennis*	Malārijods	Maliarinis uodas	Marsh mosquito
Plēvspārņi / Plėviasparniai / Hymenoptera				
231.	*Myrmica rubra*	Rudā dzēlējskudra	Rudoji mirmika	Common red ant
232.	*Lasius niger*	Melnā skudra	Juodoji skruzdėlė	Black garden ant
233.	*Lasius fuliginosus*	Spožā skudra	Juodoji medžių skruzdėlė	Jet black ant
234.	*Vespula germanica*	Vācu lapsene	Germaninė vapsva	German wasp
235.	*Vespula rufa*	Rudā lapsene	Rudoji vapsva	Red wasp
236.	*Apis mellifera*	Medusbite	Naminė bitė	European honey bee
237.	*Bombus lucorum*	Melnā kamene	Šilinė kamanė	White-tailed bumblebee
Simtkāji / Lūpakojai / Centipedes				
238.	*Lithobius forficatus*	Parastā kaulene	Akmenlindė	Brown centipede
Tūkstoškāji / Dviporiakojai / Millipedes				
239.	*Ommatoiulus sabulosus*	Svītrainais tūkstoškājis	Juodasis šimtakojis	Striped millipede
Vienādkājvēži / Lygiakojai / Isopods				
240.	*Trachelipus rathkii*	Mitrene	Vėdarėlis	Rathke's Woodlouse
Zirnekļi / Vorai / Spiders				
241.	*Dolomedes fimbriatus*	Svītrainais krastmalu zirneklis	Juostuotasis plūdvoris	Raft spider

* No permanent populations, observations refer to population releases

** Historical observations

*** The species has been recorded in the area adjacent to the Esplanade wetland

ANNEX 2

SPECIES OF SPECIAL CONSERVATION CONCERN AND NATURE CONSERVATION IMPORTANCE FOUND IN THE ESPLANADE WETLAND

No.	Title of the species in English	Title of the species in Latin	Species status	Remarks
Birds				
1.	Black-headed Gull	*Chroicocephalus ridibundus*	ĪAS, MIK, BK III	Found in the territory
2.	Corncrake	*Crex crex*	ĪAS, PD I, LSG 2, BK II	Found in the territory
3.	Little Bittern	*Ixobrychus minutus*	ĪAS, PD I, LSG 1, BK II	Found in the territory
4.	Red-backed Shrike	*Lanius collurio*	ĪAS, PD I, BK II	Found in the territory
5.	Bluethroat	*Luscinia svecica*	ĪAS, PD I, LSG 4, BK II	Found in the territory
6.	Eurasian Penduline-Tit	*Remiz pendulinus*	ĪAS, LSG 3, BK III	Found in the territory
7.	Little Grebe	*Tachybaptus ruficollis*	ĪAS, LSG 3, BK II	Found in the territory
Invertebrates				
8.	Musk beetle	*Aromia moschata*	LSG 4	Found in the territory
9.	Roman snail	*Helix pomatia*	ĪAS, DD V, BK III	Found in the territory
10.	Jet black ant	*Lasius fuliginosus*	ĪAS	Found in the territory
Amphibians				
11.	European green toad	*Bufotes viridis*	ĪAS, DD IV, LSG 3, BK II	Found in the territory
12.	European pond turtle	*Emys orbicularis*	ĪAS, MIK, DD II, LSG 0, BK II	Found outside the territory in 1984. There are no additional data on European green toad in Esplanade or its vicinity.
13.	Common spadefoot	*Pelobates fuscus*	ĪAS, DD IV, LSG 4, BK II	Found in the territory
14.	Edible frog species complex	*Pelophylax esculentus/lessonae*	DD IV, BK III	Found in the territory
15.	Moor frog	*Rana arvalis*	DD IV, BK II	Found in the territory
16.	Common frog	*Rana temporaria*	DD V, BK III	Found in the territory
Zīdītāji				
17.	Pond bat	*Myotis dasycneme*	ĪAS, DD II, LSG 2, BK II	Found outside the territory
18.	Daubenton's bat	*Myotis daubentonii*	ĪAS, DD II, BK II	Found outside the territory
19.	Brandt's bat	*Myotis brandtii*	ĪAS, DD IV, LSG 3, BK II	Found outside the territory
20.	Brown long-eared bat	*Plecotus auritus*	ĪAS, DD IV, BK II	Found outside the territory
21.	Northern bat	*Eptesicus nilssoni*	ĪAS, DD IV, BK II	Found outside the territory
22.	Parti-coloured bat	*Vespertilio murinus*	ĪAS, DD IV, LSG 3, BK II	Found outside the territory
Vaskulārie augi				
23.	Early Marsh Orchid	*Dactylorhiza incarnata*	ĪAS	Found outside the territory

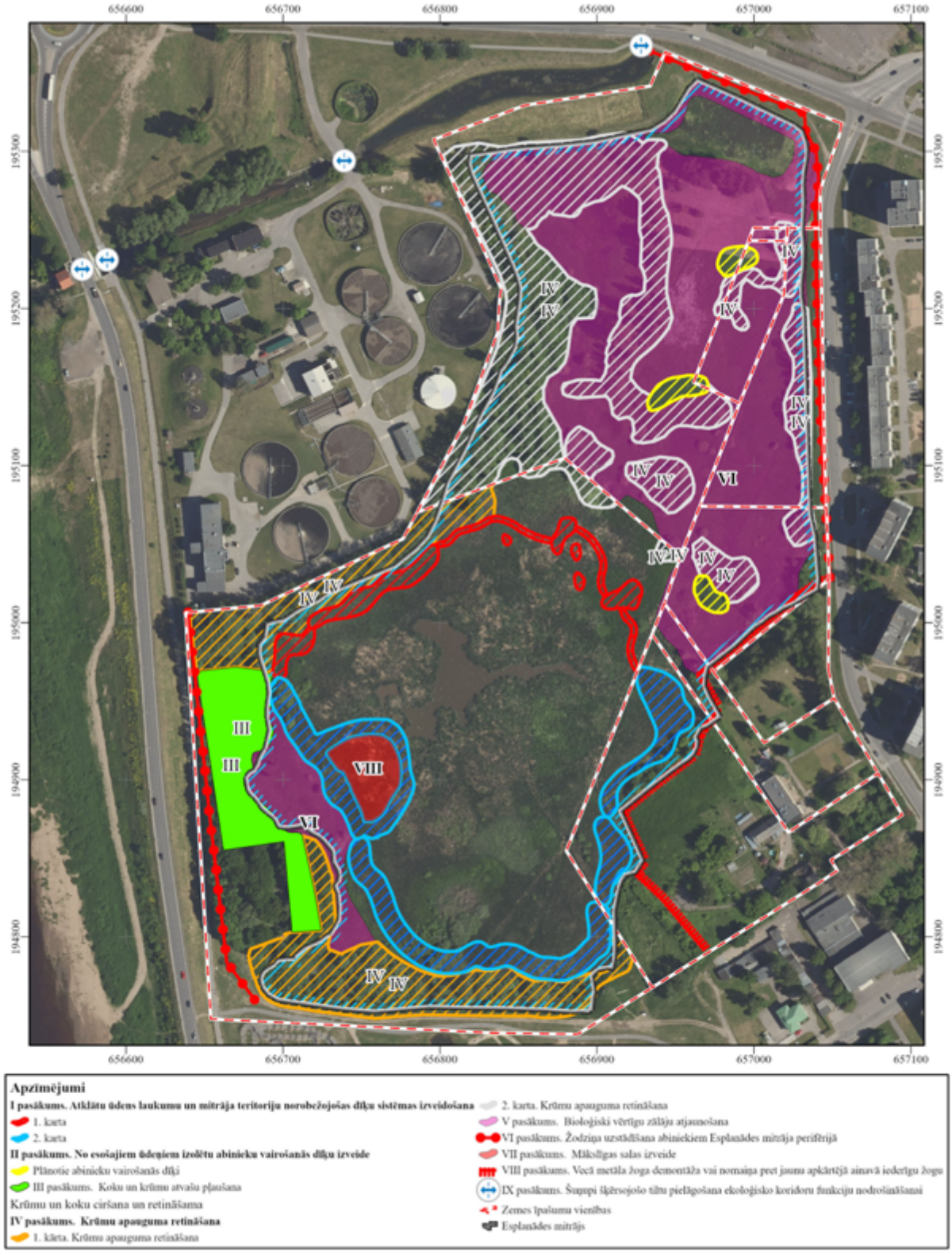
Explanation of terms used in the table: **BK** - Berne Convention 1979. Annex **II**. Species of specially protected animals for the protection of which a specially protected area is to be established. Annex **III**. Species of protected animals for which no special area is to be established. ***** - Reservations to the Appendices to the 1979 Convention on the Conservation of European Wildlife and Natural Habitats, species not requiring the establishment of a special area of conservation. **PD** - European Council Directive 79/409/EEC on the conservation of wild birds. Annex I. Species for which special habitat protection measures must be applied to ensure their survival and reproduction within their range. **DD** - European Council Directive 92/43/EEC (21.05.1992) on the conservation of natural habitats and of wild flora and fauna. Annex II. Species of animals and plants which are of Community interest and whose conservation requires the designation of specially protected areas. Annex V. Species of animals and plants which are of Community interest and the taking and exploitation of which in the wild may be permitted. **ĪAS** - Specially Protected Species, Annexes 1 and 2 to Cabinet Regulation No 396 of 14 November 2000 on the List of Specially Protected Species and Specially Protected Species of Restricted Use. **MIK** - Microreserve to be established for the protection of a species, Annex 1 to Cabinet of Ministers Regulation No 940 of 18 December 2012 "Regulations on the establishment and management of microreserves, their protection, as well as the designation of microreserves and their buffer zones. **LSG** - Latvian Red Book (Spuris 1998). The LSG uses the following categories of threatened species, which correspond to the old IUCN categories: category **0** - extinct species; category **1** - endangered species; category **2** - declining species; category **3** - rare species; category **4** - little-known species.

ANNEX 3

MAPPING OF OCCURRENCES OF SPECIALLY PROTECTED SPECIES AND SPECIES OF SPECIAL CONSERVATION CONCERN FOUND IN THE ESPLANADE WETLAND AND ITS IMMEDIATE SURROUNDINGS

ANNEX 4

CARTOGRAPHIC REPRESENTATION OF MANAGEMENT MEASURES PROPOSED FOR THE CONSERVATION AND ENHANCEMENT OF BIODIVERSITY IN THE ESPLANADE WETLAND ECOSYSTEM



Apzīmējumi

I pasākums. Atklātu ūdens laukumu un mitrāja teritoriju norobežojošas dīķu sistēmas izveidošana
- 1. karta
- 2. karta

II pasākums. No esošajiem ūdeņiem izolētu abinieku vairošanās dīķu izveide
- Plānotie abinieku vairošanās dīķi
- III pasākums. Koku un krūmu atvašu pļaušana

Krūmu un koku ciršana un retināšana

IV pasākums. Krūmu apauguma retināšana
- 1. kārta. Krūmu apauguma retināšana
- 2. karta. Krūmu apauguma retināšana
- V pasākums. Bioloģiski vērtīgu zālāju atjaunošana
- VI pasākums. Žodziņa uzstādīšana abiniekiem Esplanādes mitrāja perifērijā
- VII pasākums. Mākslīgas salas izveide
- VIII pasākums. Vecā metāla žoga demontāža vai nomaiņa pret jaunu apkārtējā ainavā iederīgu žogu
- IX pasākums. Šķērsojošo tiltu pielāgošana ekoloģisko koridoru funkciju nodrošināšanai
- Zemes īpašumu vienības
- Esplanādes mitrājs

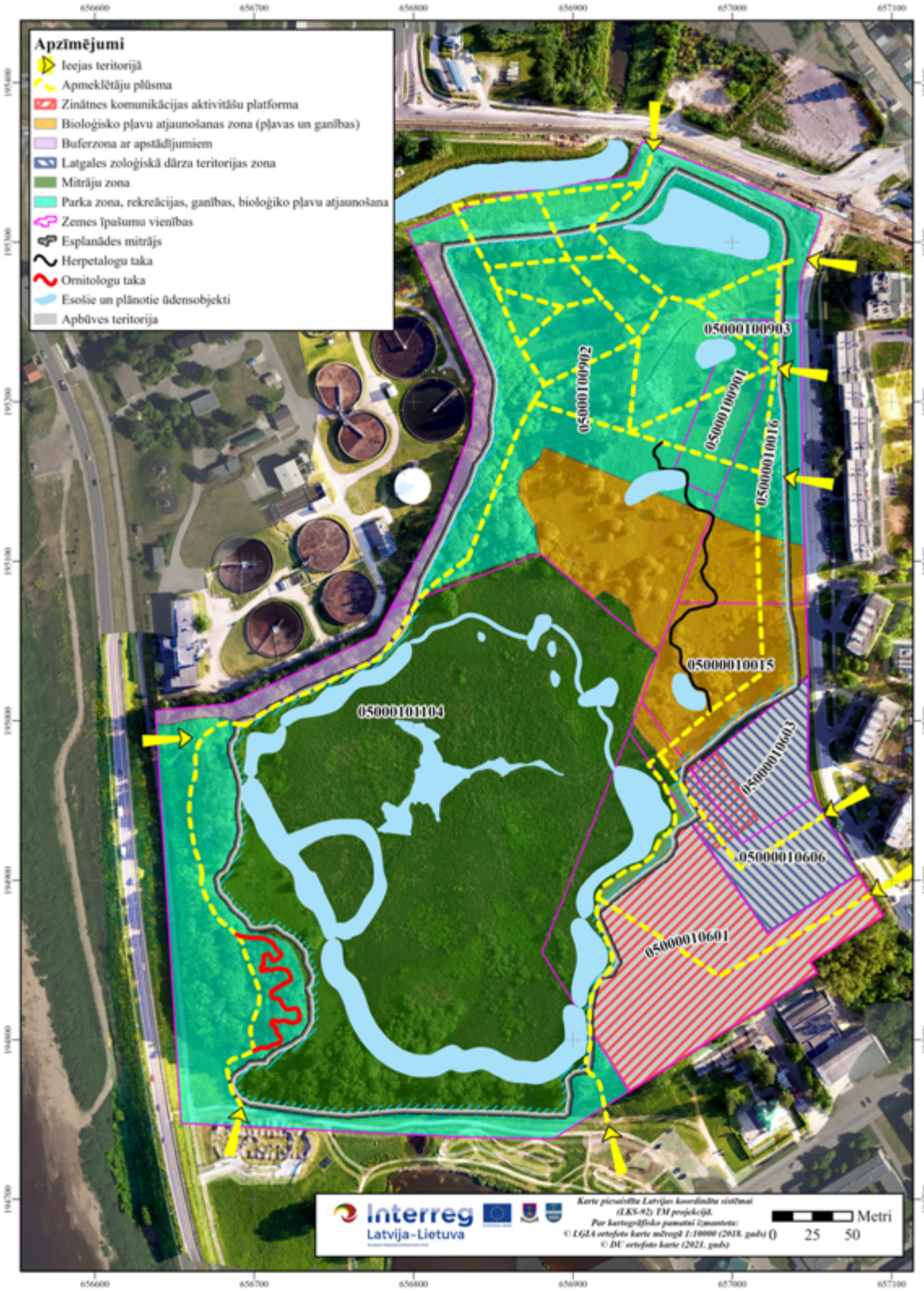
Interreg Latvija-Lietuva

Karte piesaistīta Latvijas koordinātu sistēmai (LKS-92) TM projekcijā.
Par kartogrāfisko pamatni izmantota:
© ĢGA ortofoto karte mērogā 1:10000 (2018. gads)

Metri
0 25 50

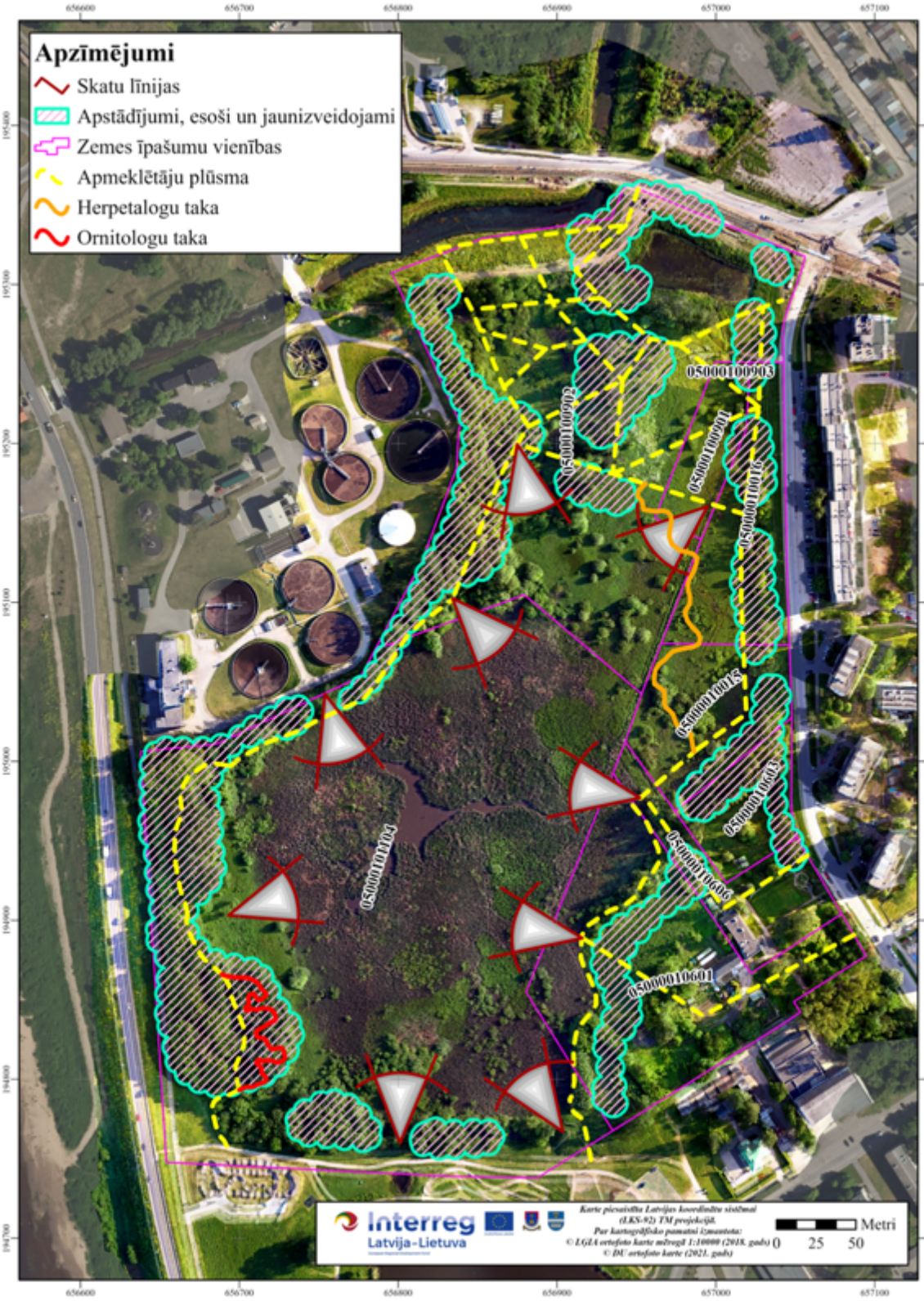
ANNEX 5

RECOMMENDED DEVELOPMENT ZONES AND FLOWS FOR THE ESPLANADE WETLAND AND ADJACENT AREAS



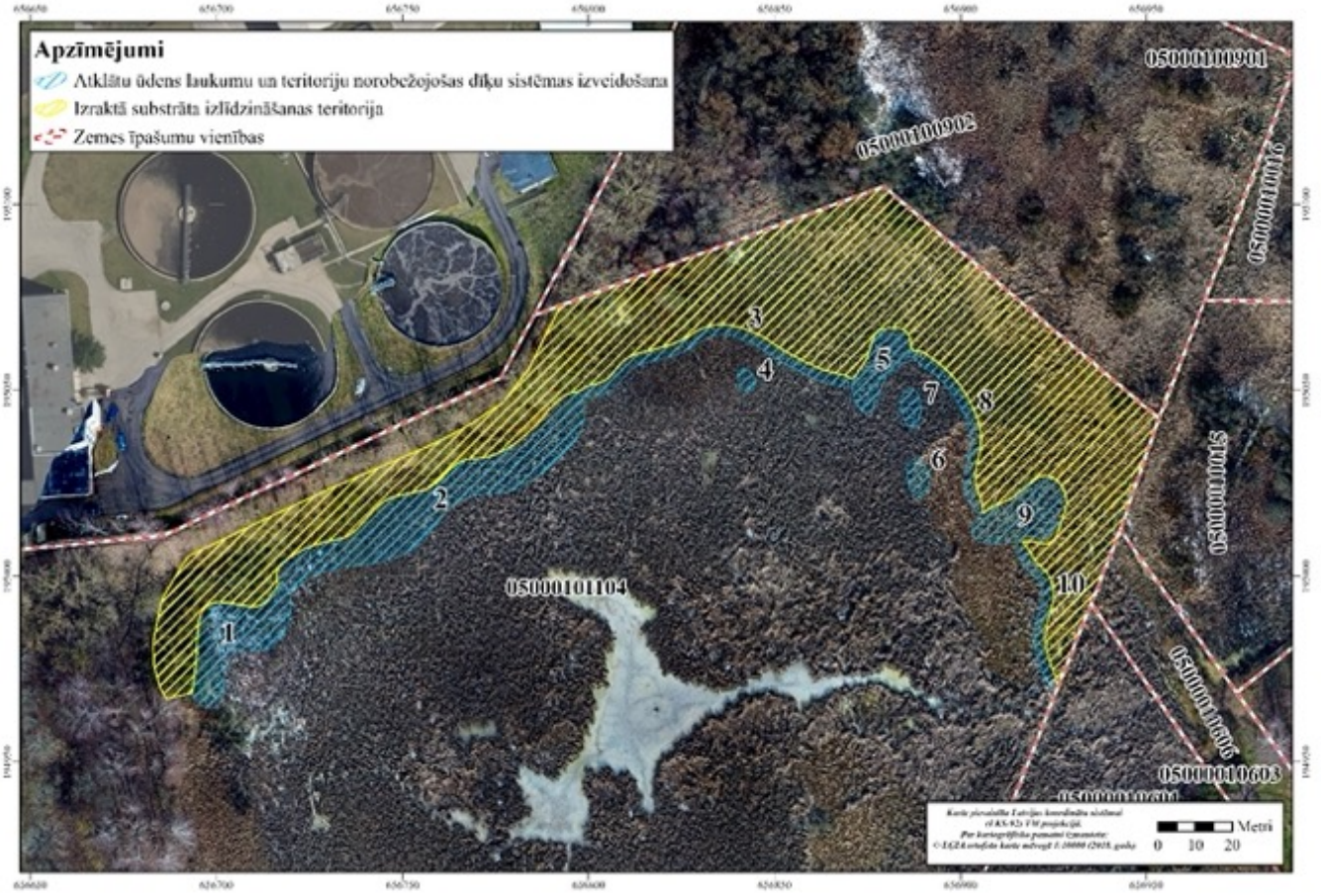
ANNEX 6

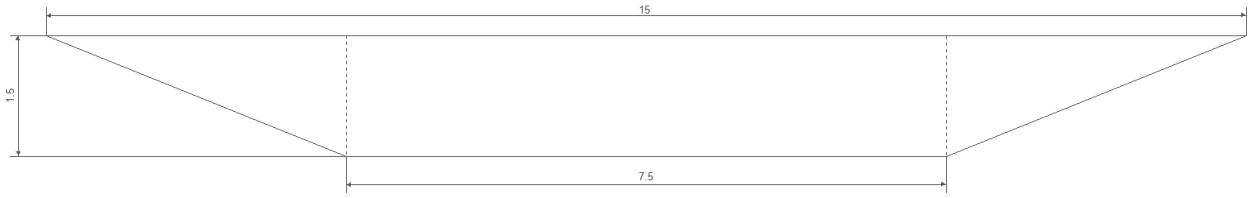
RECOMMENDED PLANTING GROUPS AND VIEW OPENINGS FOR THE ESPLANADE WETLAND AND ADJACENT AREAS

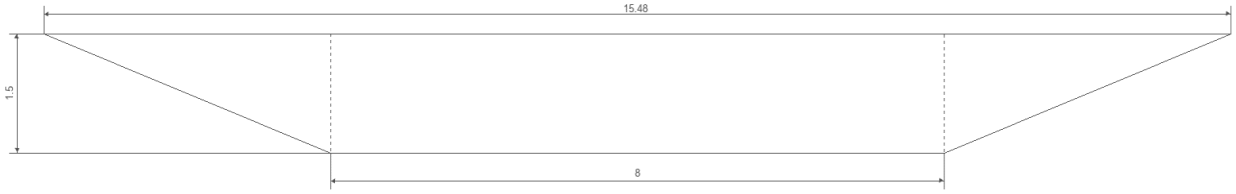
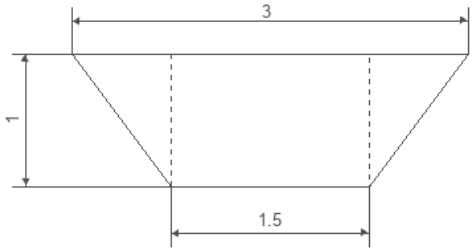
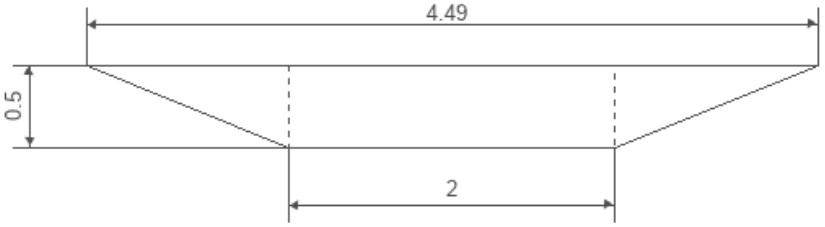


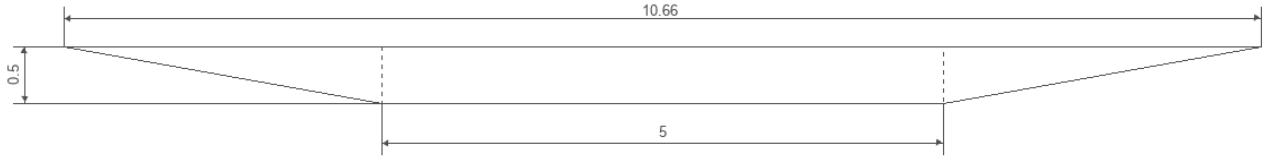
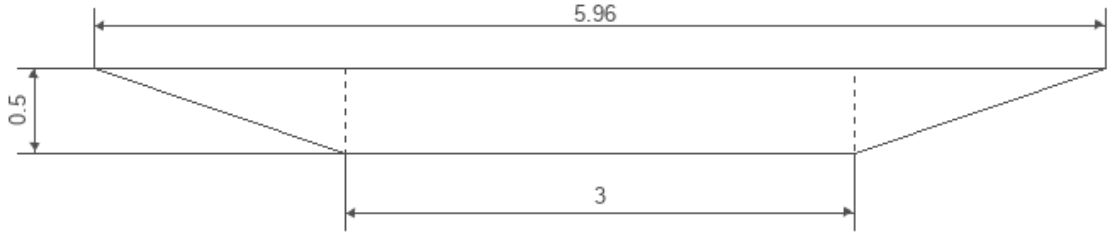
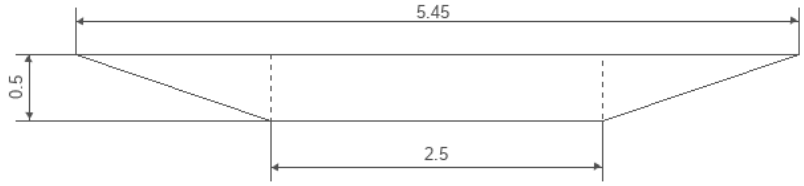
ANNEX 7

THE PARAMETERS OF THE WATER FEATURES TO BE EXCAVATED IN PHASE I AND THE CONDITIONS FOR LEVELLING THE EXCAVATED MATERIAL



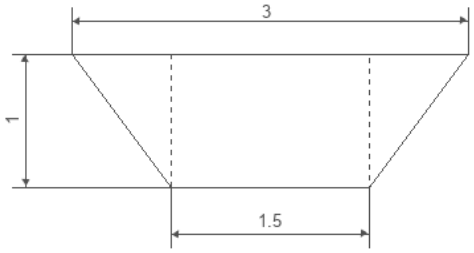
No. p.k.	**Intended characteristics of the water body to be made**		
1.	**<u>Water body (pond)</u>** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted along the edge of the embankment adjacent to the treatment works site.		
	Pond depth	m	1,5
	Average pond width	m	15
	Length of pond	m	38
	Planned open water area of the pond	m ^{2}	429,36

	Planned volume of excavated soil	m ^{3}	~ 641,25
2.	**Water body (pond)** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted along the edge of the embankment adjacent to the treatment works site.		
	Pond depth	m	1,5
	Average pond width	m	15,48
	Length of pond	m	99.78
	Planned open water area of the pond	m ^{2}	964.15
	Planned volume of excavated soil	m ^{3}	~1683,16
3.	**Water body (canal)** Approximate cross-section of the planned canal profile:  The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the canal.		
	Canal depth	m	1
	Average canal width	m	3
	Canal length	m	81.73
	Planned open water area of the canal	m ^{2}	242,22
	Planned volume of excavated spoil	m ^{3}	~183,89
4.	**Water body (pond)** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the pond.		
	Pond depth	m	0,5
	Average pond width	m	4,49
	Length of pond	m	6.45

	Planned open water area of the pond	m ^{2}	21.91
	Planned volume of excavated soil	m ^{3}	~10,38
5.	**Water body (pond)** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the pond.		
	Pond depth	m	0,5
	Average pond width	m	10,66
	Length of pond	m	24.66
	Planned open water area of the pond	m ^{2}	189,34
	Planned volume of excavated spoil	m ^{3}	~96,82
6.	**Water body (pond)** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the pond.		
	Pond depth	m	0,5
	Average pond width	m	5,96
	Length of pond	m	10.61
	Planned open water area of the pond	m ^{2}	47,69
	Planned volume of excavated spoil	m ^{3}	~23,63
7.	**Water body (pond) No 7** Approximate cross-section of the planned pond profile:  The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the pond.		
	Pond depth	m	0,5
	Average pond width	m	5,45
	Length of pond	m	10.04
	Planned open water area of the pond	m ^{2}	42,99
	Planned volume of excavated soil	m ^{3}	~19,88

8. **Water body (canal)**

Approximate cross-section of the planned canal profile:

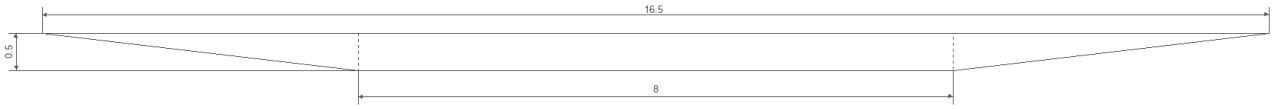


The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the canal.

Channel depth	m	1
Average channel width	m	3
Channel length	m	51,02
Planned open water area of the canal	m^2	152,11
Planned volume of excavated soil	m^3	~114,75

9. **Water body (pond)**

Approximate cross-section of the planned pond profile:

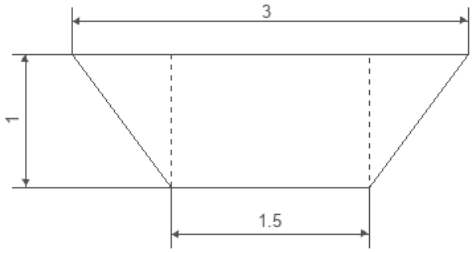


The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the pond.

Pond depth	m	0,5
Average pond width	m	16,5
Length of pond	m	c
Projected open water area of the pond	m^2	311.19
Planned volume of excavated spoil	m^3	~166,29

10. **Water body (canal)**

Approximate cross-section of the planned canal profile:



The excavated soil shall be spread in a uniform layer and compacted in the area adjacent to the canal.

Canal depth	m	1
Average canal width	m	3
Canal length	m	43,39
Planned open water area of the canal	m^2	130,66
Planned volume of excavated soil	m^3	~97,65

ANNEX 8

LIST OF SPECIES FOUND IN THE GREEN POND DURING THE INVENTORY

	Latin	Latvian	Lithuanian	English
Koki un krūmi / medžiai ir krūmai / trees and shrubs				
1.	*Acer negundo*	Ošlapu kļava	Uosialapis klevas	Ashleaf maple
2.	*Acer platanoides*	Parastā kļava	Paprastasis klevas	Norway maple
3.	*Betula pendula*	Āra bērzs	Karpotasis beržas	Silver birch
4.	*Betula pubescens*	Purva bērzs	Plaukuotasis beržas	Downy birch
5.	*Salix cinerea*	Pelēkais kārkls	Pilkasis karklas	Grey willow
6.	*Crataegus sp.*	Vilkābeles	Gudobelė	Hawthorn
7.	*Sorbus aucuparia*	Parastais pīlādzis	Paprastasis šermukšnis	Rowan
8.	*Fraxinus excelsior*	Parastais osis	Paprastasis uosis	Ash
9.	*Padus avium*	Parastā ieva	Paprastoji ieva	Bird cherry
10.	*Salix fragilis*	Trauslais vītols	Trapusis gluosnis	Crack willow
11.	*Salix viminalis*	Klūdziņu kārkls	Gluosnis žilvitis	Osier
12.	*Tilia cordata*	Parastā liepa	Mažalapė liepa	Small-leaved lime
Lakstaugi / Žolinė augalija/Herbaceous plants				
13.	*Typha latifolia*	Platlapu vilkvālīte	Plačialapis švendras	Bulrush
14.	*Phragmites australis*	Parastā niedre	Paprastoji nendrė	Common reed
15.	*Glyceria maxima*	Dižā ūdenszāle	Vandeninė monažolė	Reed sweet-grass
16.	*Epilobium palustre*	Purva kazroze	Pelkinė ožkarožė	Marsh willowherb
17.	*Carex acuta*	Slaidais grīslis	Lieknoji viksva	Slender tufted-sedge
18.	*Carex cespitosa*	Ciņu grīslis	Kupstinė viksva	Turfy *sedge*
19.	*Carex rostrata*	Uzpustais grīslis	Snapuotoji viksva	Beaked sedge
20.	*Urtica dioica*	Lielā nātre	Didžioji dilgėlė	Common nettle
21.	*Lysimachia vulgaris*	Parastā zeltene	Paprastoji šilingė	Yellow loosestrife
22.	*Epipactis helleborine (?)*	Platlapu dzeguzene	Plačialapis skiautalūpis	Broad-leaved helleborine
23.	*Poa pratensis*	Pļavas skarene	Pievinė miglė	Smooth meadow-grass
24.	*Chelidonium majus*	Lielā strutene	Didžioji ugniažolė	Greater celandine
25.	*Humulus lupulus*	Parastais apinis	Paprastasis apynys	Hop
26.	*Rorippa amphibia*	Abinieku paķērsa	Vandeninis čeriukas	Great yellow-cress
27.	*Alisma plantago-aquatica*	Parastā cirvene	Gyslotinis dumblialaiškis	Water-plantain
28.	*Ranunculus repens*	Ložņu gundega	Šliaužiantysis vėdrynas	Creeping buttercup
29.	*Plantago major*	Lielā ceļteka	Plačialapis gyslotis	Greater plantain
30.	*Aegopodium podagraria*	Podagras gārsa	Paprastoji garšva	Ground-elder
31.	*Artemisia vulgaris*	Parastā vībotne	Paprastasis kietis	Mugwort
32.	*Stachys palustris*	Purva sārmene	Pelkinė notra	Marsh woundwort
33.	*Tussilago farfara*	Parastā māllēpe	Ankstyvasis šalpusnis	Colt's-foot
34.	*Carex pseudocyperus*	Dižmeldru grīslis	Šiurkščioji viksva	Cyperus sedge
35.	*Carex vesicaria*	Pūslīšu grīslis	Pūslėtoji viksva	Bladder- sedge
36.	*Dactylorhiza incarnata*	Stāvlapu dzegužpirkstīte	Raudonoji gegūnė	Early Marsh Orchid
37.	*Potamogeton natans*	Peldošā glīvene	Plūduriuojančioji plūdė	Floating-leaf pondweed
38.	*Potamogeton lucens*	Spīdīgs glīvene	Blizgančioji plūdė	Shining pondweed
39.	*Elodea canadensis*	Kanādas elodea	Kanadinė elodėja	Canadian pondweed
40.	*Ceratophyllum demersum*	Iegrimusī raglape	Paprastoji nertis	Rigid hornwort
41.	*Chara sp.*	Hara sp.	Maurabragis	Stoneworth
Putni / Paukščiai / Birds				
42.	*Anas platyrhynchos*	Meža pīle	Didžioji antis	Mallard
43.	*Motacilla alba*	Baltā cielava	Baltoji kielė	White wagtail
44.	*Corvus corone*	Pelēkā vārna	Varna	Crow
45.	*Phylloscopus collybita*	Čuņčiņš	Pilkoji pečialinda	Common chiffchaff

46.	*Parus major*	Lielā zīlīte	Didžioji zylė	Great tit
47.	*Fringilla coelebs*	Parastā žubīte	Kikilis	Common chaffinch
48.	*Sturnus vulgaris*	Mājas strazds	Varnėnas	Common starling
Rāpuļi / Ropliai / Reptiles				
49.	*Natrix natrix*	Zalktis	Paprastasis žaltys	Grass snake
50.	*Zootoca vivipara*	Pļavas ķirzaka	Gyvavedis driežas	Common lizard
Abinieki / Varliagyviai / Amphibians				
51.	*Rana temporaria*	Parastā varde	Pievinė varlė	Common frog
52.	*Bufo bufo*	Parastais krupis	Paprastoji rupūžė	European toad
53.	*Pelophylax sp.*	Zaļās vardes sugu komplekss	Žaliųjų varlių rūšių kompleksas	Edible frog species complex
Zivis / Žuvys / Fish				
54.	*Carassius carassius*	Karūsa	Auksinis karosas	Crucian carp
55.	*Tinca tinca*	Līnis	Lynas	Tench
56.	*Rutilus rutilus*	Rauda	Paprastoji kuoja	Common roach
Spāres / Žirgeliai / Odonata				
57.	*Coenagrion puella*	Gaišzilā krāšņspāre	Pasaginė strėliukė	Azure Bluet
58.	*Coenagrion pulchellum*	Tumšzilā krāšņspāre	Gražioji strėliukė	Variable Bluet
59.	*Calopteryx virgo*	Strautu zilspāre	Grakščioji gražutė	Beautiful Demoiselle
60.	*Pyrrhosoma nymphula*	Lielā ugunsspāre	Kruvinoji strėliukė	Large Red Damsel
61.	*Sympetrum sanguineum*	Sarkanā klajumspāre	Kruvinoji skėtė	Ruddy darter
62.	*Sympetrum vulgatum*	Parastā klajumspāre	Paprastoji skėtė	Vagrant darter
63.	*Cordulia aenea*	Agrā smaragdspāre	Bronzinė skėtė	Downy emerald
64.	*Libellula quadrimaculata*	Plankumainā platspāre	Keturtaškė skėtė	Four-spotted Chaser
Dienas tauriņi / Drugiai / Butterflies				
65.	*Pieris brassicae*	Kāpostu baltenis	Kopūstinis baltukas	Cabbage white
66.	*Pieris napi*		Griežtinis baltukas	Green-veined white
67.	*Pieris rapae*	Rāceņu baltenis	Ropinis baltukas	Small white
68.	*Gonepteryx rhamni*	Krūkļu baltenis	Citrinukas	Brimstone
69.	*Aglais urticae*	Parastais nātru raibenis	Dilgėlinukas	Small tortoiseshell
70.	*Inachis io*	Acainais raibenis	Spungė	European peacock butterfly
71.	*Coenonympha pamphilus*	Parastais sīksamtenis	Gelsvasis satyriukas	Small heath
72.	*Lycaena virgauree*		Ugninis auksinukas	Scarce copper
73.	*Lycaena tityrus*	Brūnais zeltainītis	Tamsusis auksinukas	Sooty copper
74.	*Polyommatus icarus*	Parastais zilenītis	Dirvinis melsvys	Common blue
75.	*Polyommatus amandus*	Vīķu zilenītis	Didysis melsvys	Amanda's blue
Vaboles / Vabalai / Beetles				
76.	*Melolontha melolontha*	Lauka maijvabole	Paprastasis grambuolys	Common cockchafer
77.	*Amphimallon solstitiale*	Jūnijvabole	Vasarinis grambuolys	Summer chafer
78.	*Phyllopertha horticola*	Dārza vabole	Grikinukas, sodinis grambuoliukas	Garden chafer
79.	*Carabus cancellatus*	Lauka skrejvabole	Raudonšlaunis puošniažygis	Cancellate ground beetle
80.	*Coccinella septempunctata*	Septiņpunktu mārīte	Septyntaškė boružė	Seven-spot ladybird
81.	*Cetonia aurata*	Zeltītā rožvabole	Paprastasis auksavabalis	Green rose chafer
82.	*Chrysomela populi*	Lielais apšu lapgrauzis	Tuopinis gluosninukas	Poplar leaf beetle
Spīļastes / Auslindos / Earwigs				
83.	*Forficula auricularia*	Parastā spīļaste	Paprastoji auslinda	Common earwing
Gliemji / Moliuskai / Mollusca				
84.	*Helix pomatia*	Parka vīngliemezis	Vynuoginė sraigė	Roman snail
85.	*Lymnaea stagnalis*	Lielais dīķgliemezis	Didžioji kūdrinukė	Great pond snail
86.	*Planorbarius corneus*	Lielā ūdensspolīte	Ratavija	Great ramshorn
Dēles / Dėlės / Leeches				
87.	*Haemopis sanguisuga*	Parastā žokļdēle	Kumeldėlė	Horse - leech
88.	*Hirudo medicinalis*	Medicīnas dēle	Medicininė dėlė	European medicinal leech
Blaktis / Blakės / Heteroptera				
89.	*Gerris lacustris*		Kūdrinis čiuožikas	Common water-strider

90.	*Nepa cinerea*	Parastais ūdensskorpions	Pilkoji skorpionblaktė	Water scorpion
91.	*Notonecta glauca*	Parastā mugurpelde	Paprastoji nugarplauka	Common backswimmer
92.	*Ilyocoris cimicoides*	Saucer bug	Paprastoji vandenblakė	Saucer bug
Divspārņi / Dvisparniai / True flies				
93.	*Culex pipiens*	Pagraba ods	Paprastasis uodas	Common house mosquito
Plēvspārņi / Plėviasparniai / Hymenoptera				
94.	*Vespula germanica*	Vācu lapsene	Germaninė vapsva	German wasp
95.	*Vespula rufa*	Rudā lapsene	Rudoji vapsva	Red wasp
Simtkāji / Lūpakojai / Centipedes				
96.	*Lithobius forficatus*	Parastā kaulene	Akmenlindė	Brown centipede
Vienādkājvēži / Lygiakojai / Isopods				
97.	*Trachelipus rathkii*	Mitrene	Vėdarėlis	Rathke's Woodlouse
Zirnekļi / Vorai / Spiders				
98.	*Dolomedes fimbriatus*	Svītrainais krastmalu zirneklis	Juostuotasis plūdvoris	Raft spider

ANNEX 9

LABORATORY PROTOCOLS FOR SLUDGE CONTAMINANTS

Vandens tyrimai Žirmūnų g. 106, Vilnius 8(5)2325287

Tyrimų protokolas Nr. **210525LG069** | Ėminio gavimo data 2021-05-25
Užsakovas: UAB "Senasis ežerėlis" | ausrys@senasisezerelis.lt

Naftos produktų ir organinės anglies analizės grunte rezultatai

Paėmimo data	Objektas	Nr.	Gylis, m.	ID	% Sausų medžiagų	mg NP /kg sauso grunto	% C org. sausame grunte
21 05 25	Kūdra	Anykščių m., Sodų g.		41289	51.4	<50	4.06

Naftos produktų analizė atlikta svorio metodu.
Naftos produktų analizę atlikta nepažeidžiant Europos Parlamento ir Tarybos reglamento dėl ozono sluoksnį ardančių medžiagų.
Organinės anglies analizė atlikta deginant rūgščioje terpėje su K2Cr2O7.

Tyrimų protokolą parengė Chemikė-analitikė Edita Pusvaškienė

LIETUVOS RESPUBLIKA UAB „Vandens tyrimai" VILNIUS

Rezultatai susiję tik su tirtais objektais, taikytini tokiam ėminiui, koks buvo gautas. Tyrimų protokolą dalimis dauginti leidžiama tik su UAB „Vandens tyrimai" sutikimu. Tyrimas baigtas ir protokolas paruoštas (2021-06-09)

Vandens tyrimai

Žirmūnų g. 106, Vilnius ☎ 8(5)2325287

Tyrimų protokolas Nr. **210525LG069** | Ėminio gavimo data 2021-05-25
Užsakovas: UAB "Senasis ežerėlis" | ausrys@senasisezerelis.lt

Sunkiųjų metalų analizės grunte rezultatai

Data	Objektas	Punktas	ID	Cd	Cr	Cu	Ni	Pb	Zn	Hg
				mg/kg sauso grunto						
21 05 25	Kūdra	Anykščių m., Sodų g.	41289	<0.15	13	15	13	2	<20	<0.05

Rezultatas, mažesnis už nustatymo ribą, žymimas (<...).

Sunkiųjų metalų analizė atlikta atominės absorbcijos spektrometrija, naudojant grafitinę krosnį (ISO 11047:2004).

Gyvsidabrio analizė atlikta pagal ISO 16772:2004.

LIETUVOS RESPUBLIKA UAB „Vandens tyrimai“ VILNIUS

Tyrimų protokolą parengė chemikas-analitikas Rimantas Akstinas

Tyrimas baigtas ir protokolas paruoštas (2021-06-03)