3.7 Establishing and monitoring environmental conditions

Simultaneously with the development of the planning solution for the Tootsi Suursoo wind farm, the SEA process was carried out, which was necessary to prepare the best possible planning solution. A large part of the information analyzed in the SEA process and the proposals made based on it were used (taken into account) in the development of the planning proposal.

The strategic assessment of the environmental impact caused by the implementation of the activities planned in the thematic plan, the description of the measures and the measurable indicators planned for monitoring are presented in volume II of this document.

In accordance with the *Environmental Impact Assessment and Environmental Management System Act* (section 43), the following has been (partially) taken into account when preparing this plan:

- the results of the SEA (contained in the planning solution) and monitoring measures;
- opinions submitted by authorities and persons to the extent possible.

The implementation of the plan does not concern any construction works in the planned Tootsi Suursoo wind farm for the building design documentation of which an additional environmental impact assessment must be carried out.

This plan does not propose to specify, change or end the protection regime of land areas and individual objects under (nature) protection. Also, there are no proposals for taking land areas or individual objects under (nature) protection.

There are no environmentally hazardous objects or facilities requiring an environmental protection zone in the planned area, and none are planned. In the further development of land use, possible restrictions resulting from the noise emitting from wind turbines must be taken into account (primarily in the selection of the location of and construction of residential buildings).

In order to minimize possible risks and to comply with the principles of the best possible technology, this plan sets out the requirement to use new wind turbines (i.e. the erection of used wind turbines is prohibited).

Noise and shading

The total noise emitted from wind turbines must comply with established standards. The maximum permitted noise level emitted by a single wind turbine is 110 dB(A). If the plan is implemented, wind turbines that generate less noise emissions are likely to be chosen. Only permitted are wind turbines where the noise level of which is guaranteed to be a maximum of 40 dB(A)[7] or, with the owner's consent, 45 db(A) at residential buildings.
To reduce the noise level at a specific location, noise reduction measures can be used, such as reducing power (i.e. also the noise level) in the case of adverse wind directions.
The plan allows for the adjustment of the location of the wind turbine within the cadastral unit formed for the construction of the wind turbine. Although, even in the case of adjusted locations, compliance with noise standards must be ensured.

When the parameters of the wind turbines have been established and the locations adjusted, additional noise and shading modelling must be performed in the design stage.

No more than 30 hours of shading per year must be ensured at residential buildings.

Formation of water regime

During the construction of the wind farm (construction period and operation), negative effects on the water regime and water quality must be avoided. No significant negative effects on the water regime and water quality are foreseen for construction of the wind farm, if mitigating measures are implemented.

During excavation works, soil and peat particles are formed, which by being carried along by the drainage water can reach the artificial recipient. During construction works, suspended solids and larger particles are prevented and reduced from reaching the artificial recipient in specially built sediment basins or directly in drainage ditches and with the aid of dams or extensions built there. Drainage water does not significantly affect the amount of organic matter dissolved in the water and the water quality of the Are River, since a large part of the Are River catchment area is already formed from peat extraction areas.

---

[7] The basis for the condition is provided by Minister of Social Affairs Regulation No. 42 *Noise Limit Values in Residential and Recreational Areas, Residential Buildings, and Buildings in Common Use, and the Methods for Measuring Noise Levels* of 2002. In case of amendments of legal provisions, the amended provisions must be adhered to.
Due to the adequacy of the national standards in force and the compliance of this plan to the wind energy thematic plan of Pärnu County, it is unnecessary to establish stricter standards at the local government level, the consideration of which is indicated in section 3 of Minister of the Environment Regulation No. 16 *Requirements for Planning for the Purpose of Limiting Ambient Noise* of 2011.

When building a wind farm, it is not necessary to drain the entire planning area. Considering the length of the roads and the number of wind turbines, the approximate area to be drained is 124 ha.
The amount of drainage water that is diverted during the construction and operation of the wind farm is very small compared to the flow levels of the Are River, which is formed during the high water period. Thus, the direction of drainage water does not affect the occurrence of floods in the Are River, and in the summer period the flow levels of the river are significantly lower, which is also not significantly increased by the direction of drainage water. Drainage of the area in 2 days (4.8 m^3/s) would create the same flow volumes as during the period of high water in the Are River, which cannot be achieved by means of construction or naturally.

The long-term effects are the faster direction of rainwater and sediments from roadside ditches to the artificial recipient and the infiltration of bog water into the limestone-bound ground water in the area of sediment basins and foundations. Specific mitigation measures for both impacts can be developed during the design process.
Sediment basin can be made larger so that they can be used for additional water regulation. If there are suitable conditions, the water leaving the sediment basins can be directed to the prepared marsh area and allowed to filter into the ditch bordering it.

The SEA report provides information on relevant mitigating measures, additional studies and monitoring.

Mitigation measures:

1. Suspended solids and larger particles can be prevented and reduced from reaching the artificial recipient in specially built sediment basins or directly in drainage ditches and with the aid of dams or extensions built there. Designing must be based on valid design standards and the best possible technology, and practical experience and solutions available in the industry.

2. It is not possible to significantly reduce the amount of organic matter dissolved in water within the sediment basins. As the water of the Are River in the area of the planned wind park is formed largely from water flowing from extracted peatlands, the content of dissolved organic matter in the river water is high, and the addition of drainage water with a similar composition does not significantly change this condition.

Both the composition of the water in the Are River and the composition of the water in the peat layer shall be determined by studies of the initial situation (presented in environmental monitoring chapter 3.7.1). Before adopting the plan, water samples are taken from the wells and the Are River within the area of influence in Are Rural Municipality to record the current situation, and the results of the samples are presented in the Annex to the plan. The state of the waters is taken into account when establishing mitigation measures, and the data on the water state of the Are River remains the basis for later monitoring.

3. When choosing the location of the sediment basins, the geological structure of the area must be taken into account, and a suitable sediment basin construction methodology must be chosen to exclude the increase of bog water infiltration into the limestone-bound ground water.
4. According to calculations, the amount of water directed to the artificial recipient per unit of time during drainage is marginal compared to the flow rate of the Are River. When regulating the amount of water flow during drainage, it must be ensured that the amount of water draining from the planning area does not exceed the capacity of the river sections

downstream and cause flooding.

5. Plantation must be planted on the banks of the ditches as soon as possible to reduce the introduction of peat particles into the ditches and the erosion of the banks.

Long-term effects and mitigation thereof

The following should be considered as long-term effects:

1. Ditches along the roads favor the faster flow of drainage water to the artificial recipient, and sediments are transported through them.

2. The infiltration of bog water into the limestone-bound ground water may increase, both in the area of sediment basins and due to the construction of wind turbine foundations.

Specific mitigation measures for both impacts can be developed during the design process. Sediment basins can be made larger so that they can be used for water regulation. If there are suitable conditions, the water leaving the sediment basins can be directed to the prepared marsh area and allowed to filter into the ditch bordering it.

As an additional measure, the peat excavated during road construction and from under the foundations can be used to fill existing drainage ditches or to build dams to decrease and stabilize the general runoff.

In order to reduce the infiltration of bog water, the locations of the sediment basins must be selected based on geological/hydrological conditions and, if necessary, artificial materials must be used to isolate the sediment basins.

The construction of foundations does not result in a significant reduction in the thickness of the impervious soil layer, as the dimensions of the foundation are very small, so the effect of foundation construction on infiltration is likely to be negligible. Nevertheless, according to the geotechnical survey results, the foundations must be dimensioned in the working design, and in the case of a small thickness of the impervious soil layer, additional measures must be implemented to reduce the vertical hydraulic conductivity of the foundation base. Infiltration into groundwater occurs from the bog even under current conditions, if the (pressure) level of the groundwater layer in the limestone is lower than the water level in the bogland.

3.7.1 Environmental monitoring

Based on the SEA report, the supervisor of the SEA, the Pärnu & Viljandi Unit of the Environmental Board, will after its own analysis and if deemed suitable upon the approval of the SEA report, record the monitoring of birds and bats on the conditions set out in chapter 3.3.16 of the SEA report and presented below.

Environmental monitoring measures:

Monitoring of birds

In the course of preparing this plan/SEA, it has been concluded that in order to ensure the improvement of the quality of the information used in the future (both concerning a specific area and more general use), it is necessary to carry out pre-monitoring and follow-up monitoring of birdlife in the area of covered by the Tootsi wind farm thematic plan.

Preliminary studies. Additional ornithological studies are necessary to specify the impact of the construction and operation period of the wind farm, to plan mitigating measures and to create a comparative benchmark for later monitoring:

1) survey of breeding birds.
2) the dynamics of the formation of the crane swarm and the specification of the entry and exit routes together with the modeling of collision risks.

The studies must be timed in such a way that their results can be taken into account in the future construction of the wind park (i.e. also after the adoption of the plan), for example, if necessary, by not building wind turbines that have a significant negative impact (i.e. partial realization of the plan). Ensure that the wind turbines being erected are equipped with controls that allow temporary stopping/reducing of the rotation speed (although these are generally already standard equipment on wind turbines).
Crane swarms must be counted at a frequency of once a week in the period approximately 4.09 to 8.10, a total of 6 times.
It is not necessarily needed to carry out the surveys before the establishment of this plan (and the SEA), it can also be carried out afterwards (but of course before commencing construction).

Post-construction monitoring. The purpose of the monitoring is to observe the changes in breeding birds and the behavior of the crane population following the construction and commissioning of the wind farm, and to assess the frequency of bird deaths in collisions with the turbines. Based on the collected data, it is possible to plan additional mitigating measures if necessary - for example, improving the quality of habitats, optimizing the operating mode of the turbines, etc. To achieve these objectives, the following monitoring works are necessary:

1) survey of protected breeding bird species in a phase of 5 years at least twice after the final or major part of the completion of the wind farm.
2) Repetition of the survey of the dynamics of the formation of the crane swarm and of flight paths during 2 or 3 autumns, according to the stages of commissioning the wind farm. 1. The first survey should take place after the first wind turbines start operating and another survey after the full-scale completion of the wind farm. If the wind farm does not have a significant negative impact on the swarm or if it can be mitigated sufficiently, monitoring can continue as part of the national crane monitoring (monitoring phase 3 years).
3) Search for dead birds together with the searcher's performance and predation load tests in two years - twice a month during snow-free periods after the commission of the first wind turbines and the full start-up of the wind farm.

The monitoring scheme can be specified based on the analysis of the results of the monitoring. The monitoring and survey plan must be coordinated with the Pärnu-Viljandi region of the Environmental Board, and their results must be made public.

Monitoring of bats

Although it can be thought that the impact of the proposed wind farm on bats is insignificant, we still consider it necessary to carry out a preliminary survey and post-completion monitoring of the wind farm (including for the general purpose of identifying the possible impact and determining the cumulative effect of wind farms, as well as defining the exact conditions for the measure of partial halting of wind turbines).
A preliminary survey is carried out before the wind turbines are erected (but can be done after the plan is adopted and building permits are issued) to map the species living in the area and their movement routes and feeding areas. After conducting the survey, potential danger spots and areas where bats fly more and therefore involve a greater risk of mortality can be identified. The results aid in the development of specific mitigation measures and thereby reduce the probability that there will be problems in the area in the future.
Study is definitely needed regarding the significance of temporary water bodies In the Tootsi planning area as a feeding ground for bats.

Time line: Since the habitat use of bats can be very different depending on the season, the preliminary survey should cover the entire period of activity of bats, including spring, summer birthing period and autumn. Migration monitoring must take into account the arrival and departure times of known migratory species.
The spring migration starts at the beginning of May and lasts until June, the autumn migration starts at the beginning of August (or the end of July) and lasts until approximately the middle of September. The birthing period lasts from June to the end of July.
Due to the large interannual variability in habitat use by bats, EUROBATS recommends the duration of surveys to be 2 years. In order to optimally organize the survey and ensure sufficient planning time, the scope and initial

task of the survey should be clear by the start of the year in which it takes place.

Parts and objectives of the preliminary survey:
- Migration monitoring. The aim of the survey is to find out whether bats are gathering in the area during migration, which may lead to a higher risk of mortality. The presence of a migration route is indicated by the increase in flybys of migratory species during the migration season compared to other times. The result of the survey makes it possible to find out the time period and weather conditions in which the flight activity of bats in the area is the highest. In case of high migration activity, it is possible to adjust the operating mode of wind turbines and minimize the risk (see Prevention and mitigation measures) during the determined migration period.

- Survey during the period of activity. The aim of the survey is to determine which species use the given area, which areas are used the most, and where the mortality risk is the greatest. The results of the survey can be taken into account when choosing the locations of wind turbines, which allows to reduce issues that may arise in the future.
The survey also provides important information about the necessity of possible mitigation measures.

Methodology:
- Migration monitoring. When conducting migration monitoring, it is recommended to use automatic bat recorders, which are placed in permanent locations throughout the migration period. If possible, the devices should be placed at the height of the operating zone of the blades. If this is not possible, then lower. For large areas, multiple devices should be used.
- Survey during the period of activity. When conducting the survey, it is optimal to use a combination of transect counts and point counts with automatic recorders. Since the flight activity of bats is variable throughout the season and strongly depends on weather conditions, it is necessary to conduct transect and point counts repeatedly during the activity period. It is recommended to carry out transect counts in the survey area twice a month, transects are selected before the survey according to the passability of the roads so that they cover the survey area as widely as possible. Locations of future wind turbines could be used as point counting locations.

Results:
- Migration monitoring. List of species found in the area; periods of higher activity and weather conditions are known, in which the number of bats passing through the area is the highest (correlation with weather). The results show the conditions with the highest risk.
- Survey during the period of activity. The species inhabiting the study area in summer are known, the most important feeding areas and movement routes have been determined. If it turns out that an important feeding area is located directly next to the planned wind turbine, appropriate prevention or mitigation measures can be developed.

Follow-up monitoring. In the wind farm, it is necessary to carry out bat monitoring covering the entire period of activity (from the spring migration in early May to the end of the autumn migration in mid-September) within at least 2 years after the installation of the wind turbines, which includes two activities:
1) bat detector survey,
2) searching for dead bats under/around wind turbines.
As a result of the study, an estimate of the total number of dead animals is provided, which takes into account adjusting factors such as the amount of specimen killed by predators between search periods, the search efficiency of searchers, the size of the search area compared to the area of the wind farm.
There are several suitable methods for carrying out the survey, and the exact method is agreed upon in advance between the client and the executor, and it must be coordinated with the Pärnu-Viljandi region of the Environmental Board.
During the search for dead specimens, it is possible to validate whether the periods of higher risk revealed during the preliminary investigation cause real danger after the erection of the wind turbines, and if necessary, mitigation measures can be implemented. Second, the spring and autumn migration of bats must be observed during post-monitoring, which allows to assess changes in behavior of bats compared to the period before the wind farm.
The monitoring scheme can be specified based on the analysis of the results of the monitoring. The monitoring and survey plan must be coordinated with the Pärnu-Viljandi region of the Environmental Board, and their results must be made public.

Water regime and surface and groundwater monitoring

In order to monitor water regime and water quality mitigation measures, a monitoring project must be prepared, which determines the locations of surface and ground water monitoring points necessary for construction and post-construction monitoring, indicators to be analyzed, sampling frequencies and other monitoring criteria.

Extract from the thematic plan for the Tootsi Suursoo area and wind farm: summary of the strategic environmental assessment

The annexes to the plan include monitoring results of water samples of wells in the area of influence of Are Rural Municipality and of the Are River (Annexes 2 and 3, respectively).
Geological, geotechnical and hydrological activities and studies for the implementation of the plan are presented in the table below.
Some of the studies have already been carried out by now.
Overview of geological, geotechnical and hydrological studies and activities in the implementation of the plan.

Activity		**Step**	**Content**	**Performed by**	**Time**
1	Determining the initial situation	The state of the artificial recipient (Are River).	Modeling the water regime of Are River	Modeling of Are River flow rates and characterization of the catchment area done by the Environment Agency	completed
			Water samples from the Are River to determine water quality	Performed by IPT Projektijuhtimine OÜ according to the contract	March 2016
		Groundwater status	Determining the state of drinking water in utility wells in the area of influence of the wind farm	Carried out by IPT Projektijuhtimine OÜ in accordance with the contract and data provided by Are Rural municipality	March 2016
			The groundwater regime in the planning area is determined based on the observation wells to be built (water level and water composition) both in the peat layer and in the aquifer tied with limestones	An institution with appropriate competence, which has been issued a permit to perform hydrogeological works	Before the construction of the foundations
		Determining the condition of the existing drainage system	The functioning of the existing drainage system and its role as an influence on the surface and groundwater regime are determined	A designer with relevant competence and experience	Upon designing a drainage system
2	Specifying the potential impacts of the construction and operation of the wind farm on groundwater and surface water and the development of specific initial mitigation measures			Performed by IPT Projektijuhtimine OÜ according to the contract	completed
3	Design documentation for drainage with mitigation measures during construction			A designer with relevant competence and experience	Upon designing a drainage system
4	Post-construction water drainage system design with mitigation measures			A designer with relevant competence and experience	Upon designing a drainage system

5	Geological-geotechnical surveys	During the survey, the geological conditions in the area, the thickness of the impervious soil layer, the hydraulic conductivity of the layers, and the geotechnical conditions for the design of the civil engineering work will be determined. Survey data is the basis for designing mitigation measures. The geotechnical part of the survey must be carried out in accordance with the procedure for conducting constructional-geological surveys and section 2 of EVS-EN 1997-2:2007.		Authority with appropriate competence	Before the working designs of the foundations
		Construction of groundwater monitoring wells		Authority with appropriate competence	Before the construction of the foundations
6	Preparation of monitoring design	Surface water monitoring during construction	Monitoring points for surface water sampling, indicators to be analyzed, sampling frequency, and monitoring criteria are determined	An institution with appropriate competence, which has been issued a permit to perform hydrogeological works	After completion of the design for drainage and mitigation measures during construction
		Groundwater monitoring during construction	Monitoring points (monitoring wells) for surface water sampling, indicators to be analyzed, sampling frequency, and monitoring criteria are determined		
		Follow-up monitoring	Monitoring points (monitoring wells) for surface and ground water sampling, indicators to be analyzed, sampling frequency, and monitoring criteria are determined, monitoring data obtained during construction is taken into account		After the completion of the design for post-construction water drainage system

The technical condition and operating mode of the wind turbines shall be monitored by the operator of the wind farm.