No.	Species	Nesting	OP1	OP2	0P3	OP4	OP5	OP6	OP7
103	*Motacillaflava*					+			
104	*Motacillafeldegg*	p		+	+	+		+	+
105	*Motacilla alba*	c	+	+	+				+
106	*Fringilla coelebs*	c	+	+	+	+	+	+	+
107	*Fringilla montifringilla*			+			+	+	+
108	*Coccothraustes coccothraustes*	c	+	+	+	+	+	+	+
109	*Pyrrhula pyrrhula*			+					
110	*Serinus serinus*	p	+	+	+	+		+	+
111	*Loxia curvirostra*					+			
112	*Carduelis chloris*	c	+	+	+	+	+	+	+
113	*Carduelis carduelis*	c	+	+	+	+	+	+	+
114	*Carduelis spinus*		+	+		+		+	+
115	*Carduelis cannabina*	p	+	+	+	+	+	+	+
116	*Emberiza calandra*	c	+	+	+	+	+		+
117	*Emberiza citrinella*	c	+	+	+	+	+	+	+
118	*Emberiza cia*						+		
119	*Emberiza hortulana*	c	+	+		+		+	+
120	*Emberiza schoeniclus*		+			+	+	+	
Total number of species		**58+19=77**	**88**	**87**	**72**	**79**	**58**	**60**	**77**
			119					**89**	
Total number of target species		**2+3=5**	**9**	**8**	**9**	**6**	**7**	**4**	**6**
		16						**8**	

Target species are particularly prominent (shaded and bold). Data on nesting are given in a separate column along the name of the species (c - certain nesting, p - potential nesting). At the bottom of Table 2.1. is the total number of all species and target species recorded by the observation points (OP - Figure 2.26) and total for the locations of the wind farm and for the control area. It can be seen that species are relatively evenly present in OP, with a minimum of 58 recorded on OP 5 and a maximum of 88 species recorded on OP 1. The number of target species recorded is relatively uniform. Observed collectively, and the number of all species and number of target species are smaller in the control area than in the subject area. In the subject area were registered 119 species, of which 16 were classified as targeted, while 89 species of birds were recorded in the control area, of which 8 were targeted. The only species recorded on the control, but not in the subject area, and belonging to the target category is *Halyaeetus albicila*.

Figure 2.26. *Layout of OP for monitoring birds in the area of the planned Kostolac wind farm (red color-control area)*

During 104 hours spent in the study of bird nesting in the subject area, two categories were recorded - certain and potential nesting birds.

Figure 2.27. *Nests positions in the research area in period April-July 2015*

In total, 58 species of birds were nested in the area, while 19 bird species were classified as potential nesting birds. Of the target species, only two of the most frequent species are certain nesting birds - mišar and vetruška, and three are marked as potential – jasteb, kobac and soko lastavičar. Such diversity of birds in the area envisaged for the Kostolac wind farm, was registered at individual observation points from which separate sites can be observed representing wind turbine groups, can be explained by the diversity and presence of particular types of habitat, their quality, as well as the location of the site, and their distance from Danube River. Based on the data from Table 2.2, of the total of 120 recorded species of birds 110 is on the Appendices of the Berne Convention (Official Gazette of RS, No. 102/2007), 82 of Annex II - strictly protected species, and 28 in Appendix III - protected species. In the framework of the Bonn Convention (Official Gazette of the RS, No. 102/2007), 44 of the species present are listed in Appendix II and 3 in the list of Appendix I. Under the EU Birds Directive [09/147/EC] in Appendix I is categorized 21 species, in Appendix II 22, and in Appendix III 4 species. In domestic legislation in the field of nature protection, out of 120 registered species, 94 were declared strictly protected, and 23 species were classified as protected (Official Gazette of RS, No. 36 / 2009a, 5/2010). A total of 15 species are classified into hunting game protected by closed season in a certain period of the year, while one is permanently protected (Official Gazette of RS, No. 18/10, 9/12). Only one of the species recorded has no protection status- domestic pigeons *Columba livia f. domestica*. They live in the surrounding settlements and occasionally live in smaller and larger flocks in the subject area for feeding on anthropogenic altered habitats under cultures, and only one locality has recorded their nesting.

Table 2.2. List of species of birds whose members are recorded on the area of potential wind power plant Kostolac and in the control area from December 2014 to November 2015 with protection categories

No.	Species	Berne	Bonn	Bird directive	Protection in Serbia	Close season
1	*Cygnus olor*	III	II	II	P	
2	*Anas platyrhynchos*	III	II	II, III	P	CS
3	*Coturnix coturnix*	III		II	P	CS
4	*Phasianus colchicus*	(III)		II, III	P	CS
5	*Perdix perdix*	III		II, III	P	CS
6	*Tachybaptus ruficollis*	II			SP	
7	*Phalacrocorax carbo*	III			P	CS
8	*Casmerodius albus*	II	II	I	SP	
9	*Ardea cinerea*	III			P	CS
10	*Ciconia nigra*	II	II	I	SP	
11	*Ciconia ciconia*	II	II	I	SP	
12	*Pernis apivorus*	II	II	I	SP	
13	*Circus cyaneus*	II	II	I	SP	
14	*Circus pygargus*	II	II	I	SP	
15	*Circus aeruginosus*	II	II	I	SP	
16	*Accipiter gentilis*	II	II		3	CS
17	*Accipiter nisus*	II	II		SP	
18	*Haliaeetus albicilla*	II	II	I	SP	
19	*Buteo buteo*	II	II		SP	
20	*Falco columbarius*	II	II	I	SP	
21	*Falco vespertinus*	II	II	I	SP	
22	*Falco subbuteo*	II	II		SP	

No.	Species	Berne	Bonn	Bird directive	Protection in Serbia	Close season
23	*Falco tinnunculus*	II	II		SP	
24	*Grus grus*	II	II	I	SP	
25	*Crex crex*	II	I	I	SP	
26	*Gallinula chloropus*	III		II	P	CS
27	*Larus ridibundus*	III		II	P	
28	*Larus canus*	III		II	P	
29	*Larus michahellis*	III				
30	*Columba livia f. domestica*					
31	*Columba palumbus*			II	P	CS
32	*Streptopelia decaocto*	III		II	P	CS
33	*Streptopelia turtur*	III		II	P	CS
34	*Cuculus canorus*	III			SP	
35	*Athene noctua*	II			SP	
36	*Otus scops*	II			SP	
37	*Asio otus*	II			SP	
38	*Strix aluco*	II			SP	
39	*Caprimulgus europaeus*	II		I	SP	
40	*Apus apus*	III			SP	
41	*Merops apiaster*	II	II		SP	
42	*Upupa epops*	II			SP	
43	*Jynx torquilla*	II			SP	
44	*Picus viridis*	II			SP	
45	*Dendrocopos major*	II			SP	
46	*Dendrocopos medius*	II		I	SP	
47	*Dryobates minor*	II			SP	
48	*Oriolus oriolus*	II			SP	
49	*Lanius minor*	II		I	SP	
50	*Lanius collurio*	II		I	SP	
51	*Lanius excubitor*	II			SP	
52	*Pica pica*			II	P	CS
53	*Garrulus glandarius*			II	P	CS
54	*Coloeus monedula*			II	P	
55	*Corvus frugilegus*			II	P	CS
56	*Corvus corone/cornix*				P	CS

No.	Species	Berne	Bonn	Bird directive	Protection in Serbia	Close season
57	*Corvus corax*	III			P	
58	*Parus caeruleus*	II		II	SP	
59	*Parus major*	II			SP	
60	*Parus palustris*	II			SP	
61	*Lullula arborea*	III		I	SP	
62	*Alauda arvensis*	III		II	SP	
63	*Riparia riparia*	II			SP	
64	*Hirundo rustica*	II			SP	
65	*Delichon urbicum*	II			SP	
66	*Aegithalos caudatus*	II			SP	
67	*Phylloscopus sibilatrix*	II	II		SP	
68	*Phylloscopus trochilus*	II	II		SP	
69	*Phylloscopus collybita*	II	II		SP	
70	*Acrocephalus arundinaceus*	II	II		SP	
71	*Hippolais icterina*	II	II		SP	
72	*Sylvia atricapilla*	II	II		SP	
73	*Sylvia borin*	II	II		SP	
74	*Sylvia nisoria*	II	II	I	SP	
75	*Sylvia curruca*	II	II		SP	
76	*Sylvia communis*	II	II		SP	
77	*Regulus regulus*	II	II		SP	
78	*Sitta europaea*	II			SP	
79	*Certhia brachydactyla*	II			SP	
80	*Troglodytes troglodytes*	II			SP	
81	*Sturnus vulgaris*			II	P	
82	*Turdus viscivorus*	III	II	II	SP	
83	*Turdus merula*	III	II	II	SP	
84	*Turdus pilaris*	III	II	II	SP	
85	*Turdus philomelos*	III	II	II	SP	
86	*Muscicapa striata*	II	II		SP	
87	*Ficedula hypoleuca*	II	II		SP	
88	*Ficedula albicollis*	II	II	I	SP	

No.	Species	Berne	Bonn	Bird directive	Protection in Serbia	Close season
89	*Saxicola rubetra*	II	II		SP	
90	*Saxicola rubicola*	III	II			
91	*Erithacus rubecula*	II	II		SP	
92	*Luscinia luscinia*	II	II		SP	
93	*Luscinia megarhynchos*	II	II		SP	
94	*Phoenicurus ochruros*	II	II		SP	
95	*Oenanthe oenanthe*	II	II		SP	
96	*Prunella modularis*	II			SP	
97	*Passer domesticus*				P	
98	*Passer montanus*	III			P	
99	*Anthus campestris*	II		I	SP	
100	*Anthus trivialis*	II			SP	
101	*Anthus pratensis*	II			SP	
102	*Anthus spinoletta*	II			SP	
103	*Motacilla flava*	II			SP	
104	*Motacilla feldegg*	II			SP	
105	*Motacilla alba*	II			SP	
106	*Fringilla coelebs*	III			SP	
107	*Fringilla montifringilla*	III			SP	
108	*Coccothraustes coccothraustes*	II			SP	
109	*Pyrrhula pyrrhula*	III			SP	
110	*Serinus serinus*	II			SP	
111	*Loxia curvirostra*	II			SP	
112	*Carduelis chloris*	II			SP	
113	*Carduelis carduelis*	II			SP	
114	*Carduelis spinus*	II			SP	
115	*Carduelis cannabina*	II			SP	
116	*Emberiza calandra*	III			SP	
117	*Emberiza citrinella*	II			SP	
118	*Emberiza cia*	II			SP	
119	*Emberiza hortulana*	III		I	SP	

No.	Species	Berne	Bonn	Bird directive	Protection in Serbia	Close season
120	*Emberiza schoeniclus*	II			SP	
Total number of species		111	45	43	117	15
Total number of target species		17	17	12	17	1

Although the total number of 119 species of birds in the subject area can be characterized as significant from a faunistic aspect, in quantitative terms the number of recorded individuals is relatively scarce.

Of the ecological groups of birds that are sensitive to wind turbines, and therefore was given special attention and which are especially classified in the so-called target species, only *Falconiformes* can be highlighted. It is surprising that in the subject area there were no significant *Anseriformes,* primarily geese (*Anser sp.).* In addition to the small number of wild ducks (*Anas platyrhynchos*) and a flyover of two *Cygnus olor* in autumn and winter months the usual *Anseriformes* flocks were not been recorded. Cloves and roe (*Ciconiiformes)* were recorded only sporadically either individually or several birds together. Although the subject area is not far from 3 rivers, and above all the Danube River, the lack of larger optimal water and humid habitats at the site does not favor the presence and retention of these two ecological groups of birds, which makes their nutrition, concealment and nesting difficult. Because of this, members of a small number of species of *Anseriformes* and *Ciconiiformes* are met in very small numbers and with very low frequency of recording.

Daily predators are constantly present at the site. This can be explained by the fact that there is a significant trophic base for the birds of this ecological group, which are primarily *Rodentia*, which are a significant element of fauna in agricultural habitats. For this reason, the most common are *Buteo buteo* and *Falco tinunnculus*, then seasonal and other predators such as *Circus sp.* and *Falcon sp.* A wider range of prey have *Accipiter gentilis* and *Accipiter nisus*, but members of these two species are recorded in an extremely low number. The finding of the *Haliaeetus albicilla*, which was observed only once in the control area, is also the only finding of eagles during more than 12 months of research. None of the flyover of the other target species can be characterized as significant. Night predators - owls (*Strigiformes*) were scarce in the subject area and presented with 4 species. Although their status of vulnerability is relatively high, they are not classified into target species due to their specific way of life and oriented hunting of rodents living on or in the surface, so the risk of kill during the operation of wind turbine infrastructure is low. Sing birds are represented by a large number of species, but mostly by a small number of representatives to which the potential wind farm would have no significant impact. Nevertheless, numerous examples of *Alauda arvensis*, *Sturnus vulgaris*, several species of herds and three types of swallow can be distinguished as important findings. Each of these species can be exposed in particular to the influence of the wind farm, but their classification into the lower categories of vulnerability, a positive population trend and a significant number do not give rise to concern. Other singers because of their ecological status and habitat use are even less likely to be endangered and at risk from the project of construction and operation of the Kostolac wind farm.

2.3.2. Conclusions of the one year ornithofauna monitoring

During the twelve-month study from the beginning of December 2014 until the end of November 2015, the presence of 119 species of birds was detected at the site in question (120 in the entire research area, which, in addition to the subject, would include control), most of which were in low numbers. As mentioned earlier, the greatest reason for the low number of specimens of recorded species in the investigated area is the extreme uniformity and the presence of sub-optimal habitats. Almost completely lack of the trees, as well as the middle floor vegetation (shrubs). For the investigated area are characteristic species that live on the surface. Of the species that would have potential damage from the wind generators, 17 target species were selected, which were specifically monitored and recorded. The extent, the height and the directions of the fly over speak about the potentially low effect and the intensity of any damage. Certain effects of wind turbine functioning can be assumed for some species of daily bird of prey that were the most numerous target species and recorded at critical heights such as *Buteo Buto* and *Falco tinnunculus*. Other species, such as the *Circus aeruginosus*, the *Accipiter gentilis*, *Accipiter nisus*, *Ciconia ciconia*, and the *Falco subbuteo*, were significantly less numerous and were flying at different heights from the surface but mostly up to 50m, i.e. height that would be beyond the reach of the future blade of the wind turbine generator.

In the survey period, a total of 252 observations/field works were realized, with 426 hours (322 + 104) realized within 36 field days. The largest number of species was recorded at OP 1- n= 88. In the whole area of the subject sites spring migratory activity were somewhat pronounced, while, on the other hand, wandering, autumn and wintering have less recognizable values. Out of a total of 513 findings (overflights) of the target species at the site, the most were on the observation points OP 5- 115 and OP 2- 110, although the remaining three OP numbers of the target species have similar, or somewhat less, values which correspond to sugnificant uniformity and monolithical habitat. The most overflights in the critical zone was on OP 3- 42% of the total number of overflights to that OP, and OP 4- 37%. This situation, observed during the one-year monitoring, given the number and behavior of the target species, speaks of the low likelihood of conflict in the case of the construction and functioning of wind power structures in the area in question.

The most sensitive monitoring subjects are the *Falconiformes* belonging to endangered species, which is why they are mainly in strict protection regime. Out of 17 target species, 12 of them belong to daily predators. The nesting of almost all kinds of predators has not been established, except for the most numerous - *Buteo buteo* and *Falco tinnunculus*. The most significant number of overflights was recorded for the two species mentioned, while the number of overflights recorded by other species is significant or extremely small.

Generally speaking, the most frequent range of flight altitudes of most species is from 0 to 50 m. Out of a total of 513 recorded overflights of target species, only 178 were in the critical altitude zone (equidistant height ranges 2, 3 and 4) from 60 to 180 m above the surface, which is about 35% of the total number of recorded overflights of the target species. However, most of such overflights belonged to the most frequent and most numerous predators on the site - *Buteo buteo* and *Falco tinnunculus*, which due to their numbers and permanent presence, but also on the basis of the characteristics of their flights, can not be described as endangered. The subject area does not provide optimal conditions for nesting of target species, so during the monitoring 5 active nests of the *Falco tinnunculus* and *Buteo buteo* were found mainly at the site.

Small flocks of *Streptopelia turtur*, small monotypic and mixed flocks of crow (*Corvidae*), as well as smaller flocks of *Sturnus vulgaris* and other bird singers are predominantly recorded outside the critical altitude zone, and in spite of the significant presence of representatives of these species, no significant negative impact of the future wind turbine park are not expected.

On the other hand, the original arrangement of positions of wind turbines was relatively acceptable from the point of the influence on bird fauna, except for the wind turbines that were predicted at the westernmost part of the investigated area, around the established OP 2.

Based on the foreseen layout of wind turbines on the future Kostolac wind farm and on the basis of data at the observation points, it can also be assumed that the significant negative impact of the construction and operation of the wind farm on the bird fauna should not be. The wind turbines at the future wind farm Kostolac, which are according to the project 20, according to the plan provided by the investor at the beginning of this monitoring, were located on four sub-locations on the location of the area. Based on the analyzed data on the presence and directions of the overflights of members of different bird species, as well as on the basis of the layout of wind turbines, it can be assumed that the greatest influence of the construction and operation of the future wind farm Kostolac will be on the members of the largest and most frequently present species. However, due to the registered characteristics of their overflights, and most often other target species that were flying at critical altitudes were very few, with considerable certainty it can be estimated that the influence of wind turbines on them will be minor. On the other hand, the original arrangement of positions of wind turbines was relatively acceptable from the point of view of the influence of bird fauna, except for the wind turbines that were predicted at the west part of the investigated area, around the established OP 2.

In synergy with preliminary findings and recommendations for the monitoring of bats, wind generators at the Petka location (OP 2) are therefore relocated. After the suggestions to the investor, the initial arrangement of the turbine, which is a compromise and satisfactory solution, was determined in the initial stages of the operation. The new situation in the area of the potential wind farm, besides meeting the requirements of preservation and protection of bird fauna, meets the criteria for protection and conservation of the fauna of the bats. Unlike bats, birds in the subject area do not have pronounced and strict flight corridors, but with minor investor movements of the wind generators it was been noticed that their new positions have a smaller effect on the area where there is a greater presence of target species, which can only increase the chances of safe passage of migratory and diurnal flight of the birds (and bats). The collected data and the performed analysis enable the assessment of the influence of the construction and operation of the wind farm on the birds. Guided by the recommendations based on previous international experiences, the targeted and other selected types were analyzed according to the possible impact, ie the effect of wind farms on them. Generally, the impacts are grouped into 4 large groups - disturb during the construction and operation of the wind farm, the barrier effect, direct collision with the wind turbines blades and the loss of habitats by the construction of a wind farm. Each of the impacts can be estimated if there is an insight into bionomy, autecology, number and behavior of birds.

Table 2.3. Impact assessment (XXX - large negative impact, XX - moderate, X - small, 0 - no impact) of the construction and operation of wind farm on birds target species

Species	Impact				
	Disturb	Barrier effect	Direct collision	Loss of habitats	Number
Cygnus olor	0	X	X	0	extremely small
Casmerodius albus	X	X	0	0	extremely small
Ciconia nigra	0	X	X	0	extremely small
Ciconia ciconia	X	X	XX	0	extremely small
Pernis apivorus	0	X	0	0	small
Circus cyaneus	0	0	X	0	small
Circus pygargus	0	X	X	0	small
Circus aeruginosus	0	0	0	0	small
Accipiter gentilis	0	0	X	0	small
Accipiter nisus	0	0	X	0	small
Haliaeetus albicilla	X	0	0	0	extremely small
Buteo buteo	0	0	XX	0	high
Falco columbarius	0	0	0	0	extremely small
Falco vespertinus	0	0	0	0	extremely small
Falco subbuteo	X	0	X	0	small
Falco tinnunculus	X	0	X	0	high
Grus grus	0	X	X	0	small

Table 2.4. Impact assessment (XXX - large negative impact, XX - moderate, X - small, 0 - no effect) on other selected birds species

Species	Impact				
	Disturb	Barrier effect	Direct collision	Loss of habitats	Number
Coturnix coturnix	0	0	0	0	medium
Columba palumbus	0	0	0	0	small
Streptopelia decaocto	0	0	0	0	small
Streptopelia turtur	0	0	0	0	small
Merops apiaster	X	X	XX	0	medium

Alauda arvensis	0	0	X	X	high
Hirundinidae	0	X	X	0	high
Corvidae	0	0	0	0	high
Turdus pilaris	0	0	X	0	small
Sturnus vulgaris	0	X	X	0	medium
Fringillidae	0	0	0	0	medium
Emberizidae	0	0	0	0	medium

As can be seen from Table 2.3. and 2.4, no strong negative intensity was assessed at the site for any influence. Of the target species, cumulatively the greatest effect would be on the storks and herons, buzzards, kestrels, and the swans, and among the other selected species of Bee-eaters, Eurasian skylarks and starlings. Although it is clear from the table what are intensities of impact on each species, it is important to say that the number of members of most of the mentioned species is relatively small and that therefore there should be no significant effect on them. It should be noted in particular that during the project period, i.e. in its winter aspect, extreme winter conditions were lacking, and therefore the water surface of the surrounding rivers Danube, Mlava and Mogila were not frozen. This conditioned that the migratory and wintering flocks of sailors and other birds of aquatic habitats did not undertake displacement in the area, which is why the expected overflights of flocks of these birds was probably missing. However, if extreme winter conditions occur in the future, flyovers pf these birds can be expected, so this observation should take into account when planning and constructing and recommending measures to prevent and reduce possible damage. On the other hand, it is necessary to emphasize the possible positive influence of the construction and operation of the wind farm and the accompanying infrastructure on certain types of birds. Thus, the construction of a transmission lines in terms of compulsory complementary infrastructure can have a significant effect on the nesting populations of those bird species that they favor for nesting. As it has already been established, many species are reluctant to nest on the transmission lines, such as *Passer spp.*, *Sturnus vulgaris*, *Corvus corax*, *Corvus cornix*, *Pica pica*. The raven`s nests are commonly use predators such as *Falco tinnunculus*, *Buteo Buteo*, *Falco subbuteo*, *Falco cherrugs*, and very rarely *Aquila heliac*. Maintaining the space around the base of the pillars of wind turbines in the form of grass mowing can contribute to the increase in the number of nesting breeds of species affected by high grass, such as *Anthus* spp., *Motacilla* sp. and *Alaudidae*.

2.3.3. Results of one-year monitoring of hiropterofauna

The monitoring of the bats fauna for the needs of the project of construction of the Kostolac wind farm, which was implemented from November 2014 to November 2015 in the area of the wind farm, the immediate surroundings and the control area, by the ultrasound audiotechnology the activity of 14 species has been registered whose members can be reliably differentiated by the echolocation signals: *Rhinolophus ferrumequinum*, *Miniopterus schreibersii*, *Myotis bechsteinii*, *Myotis emarginatus*, *Myotis nattereri*, *Barbastella barbastellus*, *Pipistrellus pygmaeus*, *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *Hypsugo savii, Nyctalus leisleri*, *Nyctalus noctula*, *Vespertilio murinus* and *Eptesicus serotinus*. In addition to these, the activity of representatives of the 4 groups of species whose members can not be reliably distinguished on the basis of echolocation signals is also registered - *Myotis myotis/oxygnathus*, *Myotis brandtii/mystacinus/alcathoe, Myotis* *daubentonii/capaccinii* and *Plecotus sp.* - so it is certain that at least one species from each of these groups is present at the site, which makes at least a total of 19. However, it is very likely that this number is actually higher, i.e. 23, because at least occasionally and/or sporadic the presence of 8 species from these groups (*Myotis brandtii*, *M. mystacinus*, *M. alcathoe*, *M. myotis*, *M. oxygnathus*, *M. daubentonii Plecotus austriacus* и *P. auritus*) is almost certain based on their wider distribution and the existence of appropriate ecological conditions at the site and in the immediate vicinity. In support of this, data on the presence of at least some of these species in the vicinity of the site are presented (Table 2.5).

Table 2.5. List of types of bat recorded at the locations of the Kostolac wind farm, in the immediate vicinity and in the control area

Area / Species / group	Region	Control (0)		Surroundings (1)		Locations								TOTAL	
						Ćirikovac		Petka		Klenovnik		Drmno			
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Rhinolophus ferrumequinum	+	12	0.9			4	0.6	1	0.3	2	0.3	15	3.4	**34**	**0.9**
Rhinolophus hipposideros	+														
Rhinolophus euryale	+														
Miniopterus schreibersii	+	3	0.2	**8**	**2.8**	2	0.3	11	2.8	9	1.5	4	0.9	**37**	**1.0**
M.brandtii/mystacinus/alcathoe Myotis oxygnathus Myotismyotis M.myotis/oxygnathus	+ +	36 2	2.8 0.2	**3**	**1.1**	33 2	4.5 0.3	101	2.6 0.3	9	1.5	3	0.7	**945**	**2.5** **0.1**
Myotis bechsteinii		8	0.6			3	0.4							**11**	**0.3**
Myotis emarginatus	+	1	0.1			3	0.4							**4**	**0.1**
Myotis nattereri								1	0.3					**1**	**0.0**
M.daubentonii/capaccinii		1	0.1					1	0.3	1	0.2	0	0.0	**3**	**0.1**
Myotis sp.		24	1.9			16	2.2	7	1.8	2	0.3	0	0.0	**49**	**1.3**
Plecotus sp.		1	0.1			1	0.1			1	0.2	0	0.0	**3**	**0.1**
Barbastella barbastellus						1	0.1	1	0.3			1	0.2	**3**	**0.1**
Pipistrellus pygmaeus		+*								+*		1	0.2	**1**	**0.0**
Pipistrellus pipistrellus	+	6	0.5			2	0.3			2	0.3	2	0.5	**12**	**0.3**
P.kuhlii/pipistrellus		2	0.2			1	0.1			1	0.2	0	0.0	**4**	**0.1**
Pipistrellus kuhlii		482	37.3	**142**	**49.8**	442	60.9	205	52.6	222	37.4	132	30.3	**1625**	**43.6**
P.kuhlii/nathusii		273	21.1	**64**	**22.5**	125	17.2	99	25.4	158	26.6	154	35.3	**873**	**23.4**
Pipistrellus nathusii		111	8.6	**28**	**9.8**	32	4.4	19	4.9	42	7.1	45	10.3	**277**	**7.4**
P.nathusii/H.savii		11	0.9	**3**	**1.1**	9	1.2	3	0.8	3	0.5	7	1.6	**36**	**1.0**
Hypsugo savii		4	0.3			2	0.3	1	0.3	2	0.3	13	3.0	**22**	**0.6**
Pipistrellus/Hypsugo sp.		30	2.3	**15**	**5.3**	21	2.9	8	2.1	16	2.7	11	2.5	**101**	**2.7**
Nyctalus leisleri		17	1.3	**6**	**2.1**	2	0.3	7	1.8	23	3.9	16	3.7	**71**	**1.9**
N.noctula/leisleri		14	1.1	**1**	**0.4**			1	0.3	14	2.4	0	0.0	**30**	**0.8**
Nyctalus noctula		220	17.0	**9**	**3.2**	4	0.6	5	1.3	69	11.6	17	3.9	**324**	**8.7**
N.noctula/lasiopterus												1	0.2	**1**	**0.0**
Vespertilio murinus								1	0.3					**1**	**0.0**
Eptesicus serotinus		4	0.3	**3**	**1.1**	4	0.6	1	0.3	6	1.0	4	0.9	**22**	**0.6**
E.serotinus/V.murinus/Nyctalus		4	0.3	**1**	**0.4**	1	0.1	2	0.5	6	1.0	5	1.1	**19**	**0.5**
Chiroptera *indet.*		27	2.1	**2**	**0.7**	16	2.2	5	1.3	6	1.0	5	1.1	**61**	**1.6**

Area / Species / group	Region	Control (0)		Surroundings (1)		Locations								TOTAL	
						Ćirikovac		Petka		Klenovnik		Drmno			
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total	8	1293	100.0	285	100.0	726	100.0	390	100.0	594	100.0	436	100.0	3724	100.0
Activity Index		23.0		26.6		19.4		16.7		9.6		7.1		14.8	
Minimum number of species		16		7		15		14		13		12		19	

The presence of representatives of the species *Rhinolophus hypposideros* can also be expected in the field of this study, but only in a small number (similar to the similar and ecologically somewhat similar type of *Rhinolophus ferrumequinum*), because for it there are at least somewhat suitable habitats and shelters; it is possible that eventual present representatives of this type are not registered during this monitoring due to the expected minority and very quiet ultrasound signals, which are therefore difficult to register with ultrasound audio-detection. At the locations of the wind farm, the presence of the species *Myotis dasycneme* can be expected, at least occasionally and in a small number, because for them in the immediate vicinity of the site there are optimal habitats and shelters, and since this species was previously recorded in the nearby parts of the neighboring regions of South Banat and the Carpathian Serbia; moreover, it is very likely that there were a small number of (6-8) flyovers registered on transects during this monitoring, which could not be reliably identified to the level of the species due to not very typical characteristics of echolocation signals (which is why they are marked as *Myotis sp.*). The presence of representatives of the species *Rhinolophus euryale* can not be expected, since there are no suitable underground shelters in the area of research (not in the immediate vicinity), and representatives of this type total daily activity spend in the vicinity of the shelter. For the same reason, the presence of representatives of ecologically similar species of *Rhinolophus blasii, Rhinolophus mehelyi* and *Myotis capaccinii* can not be expected in the field of research, although they are recorded in the nearby parts of the neighboring region of the Carpathian Serbia. Although it has recently been registered in Serbia, the presence of representatives of the distinctively alpine species *Plecotus macrobullaris* can not be expected in the field of research due to the specificity of its ecology and distribution. As a curiosity, it should be noted that this monitoring registered species *Myotis bechsteinii*, *Myotis nattereri*, *Barbastella barbastellus*, *Pipistrellus pygmaeus*, *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *Hypsugo savii, Nyctalus leisleri*, *Nyctalus noctula*, *Vespertilio murinus* and *Eptesicus serotinus*, and a group of types *Myotis brandtii/mystacinus/ alcathoe, Myotis daubentonii/capaccinii* and *Plecotus sp*. whose representatives were not previously recorded in the wider environment, i.e. in the region of Stig and Branicevo. With this number of species of bat fauna species of this region has been increased to at least 22, thereby confirming the initial monitoring hypothesis that a small number of previously recorded species was due to lack of research, and not measurements of the real state of the fauna.

All types of bats recorded by this monitoring are protected in Serbia by the Nature Protection Act (Official Gazette og RS, 36/2009a, 5/2010) and ratified international conventions (Official Gazette of the RS, No. 102/2007a, 102/2007b), as well as EUROBATS agreement with ratification in progress (EUROBATS 2015a), and in the European Union by the so-called European Directive on Habitats and Species [92/43/EEC]. In addition, 9 species registered by this monitoring, or considered potentially present in the field of research (*Rhinolophus ferrumequinum, Rh. hipposideros*, *Miniopterus schreibersii*, *Barbastella* *barbastellus*, *Myotis emarginatus*, *M. bechsteinii, M. dasycneme*, *M. myotis* and *M. oxygnathus*) are also found in Annex II of the European Habitats Directive, i.e. for them in the EU strict measures of special additional protection and monitoring of populations apply. Despite a significant number of species, it should be noted that most of them during the manual detection were recorded in a very small relative number, i.e. only several times compared to 3724 flights/contacts total recorded on transects.

Most, even 3099, that is, than 83% of all registered flyovers/contacts is on only 3 types: *Pipistrellus kuhlii*, *Pipistrellus nathusii* and *Nyctalus noctula*, with their real relative numbers even greater, as representatives of these species certainly have a significant share of an additional 252, 6.8%, the amount of flying/contacts that could not be identified more precisely than the level of gender, group of species or family (due to long distance and short duration). Additionally, among these species, a relative number of 43.6% (with the largest part of additional 27.9% of incompletely identified overflights) clearly distinguishes *Pipistrellus kuhlii*, so this species can be considered to be highly dominant in the entire field of research, while the species *Nyctalus noctula* with 8.7% and *Pipistrellus nathusii* with 7.4% subdominate. All other species were far less represented: 2.5% of the flyovers belonged to the representatives of the *Myotis brandtii/mystacinus/alcathoe* group and 1.9% to the representatives of the *Nyctalus leisleri* species, while all other species/groups, 14 of them, were recorded with an almost negligible relative number - below 1% (8 of them only sporadically - 5 or less during the entire duration of the monitoring). Very similar relative number of species are also observed on transects observed individually, i.e. at all locations of the wind farm, both in the vicinity and in the control area. And the situation on the planned positions of wind generators, i.e. the corresponding points of censuses are completely complementary, as here also there are clear domination of the group *Pipistrellus/Hypsugo/Miniopterus* spp. (in which belongs dominant species on the transects of *Pipistrellus kuhlii*), and the subdomination of the group *Nyctalus/Vespertilio spp.* (where the subdominant species of *Nyctalus noctula* belongs), although this is not so pronounced here. Significant deviations are noted only at the census points within the control area where the dominance of the *Nyctalus/Vespertilio spp.* and the subdomination of *Pipistrellus/Hypsugo/Miniopterus* spp.

Because of this distinct dominance of one but almost negligible number of the vast majority of other species, in spite of the significant total number of registered species, it can be estimated that the fauna of the bats of the research area, as well as the individual locations of the wind farm, but also the surroundings and the control area, in a qualitative sense scarce and that according to these characteristics of the quantitative composition resembles the edges of highly urbanized zones or to typical agroecosystems under monocultures.

This is confirmed by the fact that these characteristics (the most prominent domination of one species, the smallest number of registered species) are most pronounced on the transect around the site, but also on the transects on Ćirikovac and, in the zone of the research area characterized by the highest degree of urbanization, and that the dominant species of *Pipistrellus kuhlii* is also the most prominent synanthropized species of bats in this part of Europe.

2.3.4. Conclusions of a one-year monitoring of hyropterofauna

Based on the data collected from this monitoring and previous knowledge from the immediate and wider environment, in the previous part, an analysis of the ecological functions of the site of the wind farm's location and the immediate environment for bats was carried out, indicating that bats use this space and the present habitats and what is their significance for the presence of bats, as summarized in Table 2.6.

Table 2.6. Estimation of the importance of ecological functions, intensity of activities and relative numbers of members of different types of bats

Species	Shelters	Flight corridors	Hunting territories	Migration inflow	Migration corridors	Activity intensity	Relative abundance/ number
Pipistrellus kuhlii	not present	seasonally moderate	seasonally moderate	*not migrating*		seasonally and locally very high	very high
Pipistrellus nathusii	negligible	low	low	negligible	probably negligible	occasionally moderate	moderate
Nyctalus noctula	negligible	low to negligible	locally moderate	negligible	probably negligible	occasionally and locally high	low to moderate
Hypsugo savii	not present	potentially moderate	potentially moderate	*not migrating*		potentially high	potentially high to moderate
Other species	not present	negligible	negligible	negligible	negligible	negligible	negligible

Knowing the situation at the location (Table 2.6) and the characteristics of the planned project is necessary to identify possible conflicts that may occur during the different phases of project realization. However, to what extent can the identified conflicts during the project's realization reflect on the situation on the field, that is, how much and how much project impacts can be expected on the bats in the location does not depend solely on the ecological and faunistic situation on it.

The risk to which particular species can be exposed depends largely on their ecological and bionomical characteristics, so their knowledge is necessary for a full impact analysis and, in particular, for an appropriate risk assessment (importance of the impact).

An overview of the ecological and bionomical characteristics of the species (potentially) present at the site that may be relevant for this analysis is given in Table 2.7.

Table 2.7. Relevant ecological and bionomical characteristics of the types of bats present and potentially present at the location of the wind farm and in the immediate vicinity and possible influences

Species	Flight at low altitudes	Flight at high altitutes (> 40 m)	Hunting near habitats structures (vegetation, buildings, etc.)	hunting around lighting	Shelters in the wind generators gondola	Migration to long or medium distance	Risk of direct kill	The share of the identified victims of the direct kills in Europe
Rhinolophus	X		X				low	0.02%
Rhinolophus euryale	X		X				low	
Rhinolophus hipposideros	X		X				low	
Miniopterus schreibersii	X		?	X		X	high	0.20%
Myotis mystacinus	X		X				low	0.07%
Myotis brandtii	X	X	X				low	0.02%
Myotis alcathoe	X		X				low	
Myotis oxygnathus	X	X	X			X	low	0.09%
Myotis myotis	X	X	X			X	low	0.13%
Myotis bechsteinii	X		X				low	0.02%
Myotis emarginatus	X	X	X			?	low	0.04%
Myotis nattereri	X		X				low	
Myotis daubentonii	X	X	X			X	low	0.20%
Myotis dasycneme	X	X				X	low	0.07%
Plecotus auritus	X	X	X				low	0.13%
Plecotus austriacus	X	X	X				low	0.16%
Barbastella barbastellus	X		X				moderate	0.11%
Pipistrellus kuhlii	X	X	X	X	X		high	5.38%
Pipistrellus nathusii	X	X	X	X	X	X	high	20.19%
Pipistrellus pipistrellus	X	X	X	X	X		high	27.01%
Pipistrellus pygmaeus	X	X	X	X	X	X	high	4.89%
Hypsugo savii	X	X	X	X	X		high	5.03%
Nyctalus leisleri		X	X	X	?	X	high	10.72%
Nyctalus noctula		X		X	?	X	high	20.84%
Vespertilio murinus		X		X		X	high	2.98%
Eptesicus serotinus	X	X	X	X	X		moderate	1.66%

When the on-site situation is known (Table 2.6) and when the ecological and bionomical characteristics of the present species are known (Table 2.7), and when, on the other hand, the possible and potential impacts of the wind turbine projects on bats are known, it is possible to perform a reliable assessment of the impact of a specific wind turbine project on bats and to assess the risk and possible significance of each of these impacts (Table 2.8). The influence of ultrasound emitted by wind generators as well as the loss of hunting territories due to the avoidance of wind farms has not been considered here, because today it is known that these effects are not significant.

Table 2.8. Potential impacts on local and migratory populations of bats (potentially) present at the site and assessment of their significance

Species	During construction		During the work of the project		Population
	Loss of the shelters due to construction	Loss of hunting territories due to construction	Loss / disruption of flying corridors	Direct death (collision, barotrauma)	
Pipistrellus kuhlii	none	low (1)	low (1)	moderate (6)	Local
Pipistrellus nathusii	negligible (2)	negligible (3)	low (4)	moderate (7)	
Nyctalus noctula	negligible (2)	negligible (5)	negligible (5)	moderate to high (7)	
Hypsugo savii (8)	none	none	none	potentially moderate to high	
Other species (9)	negligible or none	negligible	negligible	negligible	
Pipistrellus nathusii (9)	negligible	negligible	negligible	negligible	Migratory
Nyctalus noctula (9)	negligible	negligible	negligible	negligible	

Even total removal of woody and bushy vegetation during the project implementation phase and maintenance of such condition during the operation of the project, as well as the positioning and operation of wind turbines or other infrastructure on important flying corridors, which for the members of the species *Pipistrellus kuhlii* the most important hunting territories in the locations, due to the specificity of bionomy and ecology of this species can only lead to a partial loss of these functions in these zones, which would have little significance for the local population of this species, in accordance with the significance of these functions and the fact that a substantial part of their flying corridors and hunting areas are not in the locations of the wind farm but in the surroundings, but can not be covered by this influence.

Even the complete removal of trees in which there is a negligible number of registered and potential shelters of individual members of these species, in accordance with their number and significance, would have a negligible significance.

Only total removal of woody and shrub vegetation on complete site locations during the project implementation phase and the maintenance of such condition during the operation of the project, which is not provided for by the General Project, could have an impact on the slightly less significant hunting area of this species on site.

Total removal of woody and shrubby vegetation during the project implementation phase and the maintenance of such condition during the operation of the project, as well as the positioning and operation of wind turbines or other infrastructure in zones on important flying corridors would have little significance for the local population of this species, in accordance with the significance these flying corridors.

Due to the specificity of bionomy and ecology of this species, the works on the execution of the project, as well as the operation of the wind farm, can not significantly impair the daily transitional or hunting activity of members of this species, which usually occur at altitudes above 40 m within corridors that are not strictly spatially defined, which is confirmed by the observations during this monitoring.

Members of this species are registered in Europe as victims of wind turbines, with a significant share in the identified victims but smaller than other species of this genus; to what extent this share is smaller because most of these data refer to parts of Europe in which this species is not present or are few and with possibly lesser risk due to the specificity of ecology and bionomy, it is not possible to be reliably estimated at this moment, but it is believed that there is a high risk of their direct death. Since the members of this species at the locations during the period of this monitoring are convincingly relatively numerous and, at least sometimes during the summer and spring, have a high and very high intensity of activities, and the risk of kills is high, it can be expected that the rate of direct death at least in this period would be high. However, since members of the local population of this species most of their activities realize outside the locations, and they are extremely numerous and dominant, not only in settlements in the immediate and wider surroundings of the site, but also in all urban habitats in Serbia, even the very high rate of deaths caused by the work of the subject wind turbine would not have a significant impact on the population of this species.

Members of the species *Pipistrellus nathusii* and *Nyctalus noctula*, due to the specificity of their bionomy, are among the most common victims of wind turbines in Europe. Because, therefore, a high rate of their death can be expected, and members of local populations of both species are present at all locations and, at least during the spring and/or summer in some cases, relatively numerous with moderate and high intensity of activity, in accordance with the characteristic spatial and the time dynamics of the activities of each of them, occasional and/or sometimes the impact of death on these populations can be expected.

Members of the *Hypsugo savii* species were not registered during this monitoring in a significant number or with significant activity, nor their significant ecological functions at the locations of the wind farm or in the vicinity were noticed, so they can not be exposed to the effects of the constrution and operation of the wind farm project. However, this species is expanding the areal in Serbia and relatively rapidly increasing its number, especially in urban areas, so it can be expected that in the locations zones in following years, their number and flight corridors and hunting territories will increase in (not shelters, which are potentially only found in the zones of neighboring settlements), and thus activities. For this reason, special attention should be paid to this species during the implementation of post-structural monitoring.

Members of all other species, i.e. populations, were registered at locations only sporadically and in extremely small numbers. Locations do not have an important function for these local/migratory populations, and therefore the project of a wind farm can not have any significant effect on their ecological functions. Although there is a significant risk for all species recorded as victims of wind turbines, given the negligible activity intensity of these species/populations at locations, this risk can be characterized as negligible and thus the impact of kills on their local/migratory populations.

2.4. Overview of cultural heritage

There are no registered and protected cultural heritage and archaeological sites at potential locations for the construction of the wind farm at the Kostolac site. Considering the richness of the surroundings with archaeological sites and protected cultural assets, it is necessary to pay special attention to the realization of the project, that is, to the foundation of wind turbines in order to avoid possible damage to the elements of cultural heritage.

On the wider area of the planned wind farm Kostolac B, there is a site called Rukumija - an archaeological site from the Bronze Age and a monastery. Today's monastery is from the time of Prince Miloš Obrenović (1852) and is located near the village of Bradarac, about 1km southeast of the closest wind turbine.

2.5. Overview of settlements and infrastructure

Anthropogenic activities are very present in the vicinity of sites, and the sites themselves are mostly the product of anthropogenic activities. Directly along the border of the locations are numerous settlements – town Kostolac and the village of Stari (Old) Kostolac, Drmno, Bradarac, Maljurevac, Ćirikovac, Petka and Klenovnik, as well as the complexes of administrative and/or industrial facilities of Thermal power plants and surface mines Kostolac.

The most spread activities are agriculture and, specifically, mining and energy, which is why a very different infrastructure is developed. The location and surroundings are intersected with a dense network of high-voltage power lines (Figure 2.28). Between the locations of Petka and Ćirikovac, and next to Klenovnik, the state road of the IIA order Požarevac-Kostolac (159) passes, while the state road of the IIB order Ram-Kličevac-Bratinac (372) passes along the Drmno site.

Figure 2.28. *Several high-voltage power lines are located in the planned area*

Figure 2.29. *Roads that intercross the area - the location of Ćirikovac*

Only the unpaved roads exist at the locations themselves, with at least one well maintained road from the crushed stone (Figure 2.29) which passes through the entire location and exits to one of the mentioned asphalt roads, while the side roads are mostly dirt roads and poorly maintained. In some parts of the unpaved roads there are initial landfills, especially in the zone around the settlement. Construction sites on the locations are rare, and the closest are the complexes of the administrative and industrial facilities of the Thermal Power Plant and the surface mine Kostolac. The settlements are located in the immediate vicinity, but at a minimum distance of about 500m from the nearest wind turbines.

Figure 2.30. *Part of the complex of adminisration buildings of the surface mine Ćirikovac*

3. PROJECT DESCRIPTION

Technical-technological description of wind farm

The complex of the wind farm (Figure 3.1) consists of the following functional units: wind turbines representing generator units (consisting of rotor, gondola, pillar and foundation, 690V/35kV voltage level), internal cable networks (underground cable lines of voltage level 35kV), substation 35/110 kV with command and administrative building (through which the wind farm connects to the transmission system for the placement of generated electricity and from where the power plant operates) and access roads (physical access for the transport of equipment, construction and installation of the equipment of the wind turbine and substation; it can coincide with the internal cable network route partially or completely). In the context of the above, it can be concluded that the complex of a wind farms consist of infrastructural facilities for the production of energy (wind turbines), facilities for transmission of energy (internal cable network and SS with administrative and command building) and traffic facilities (access roads).

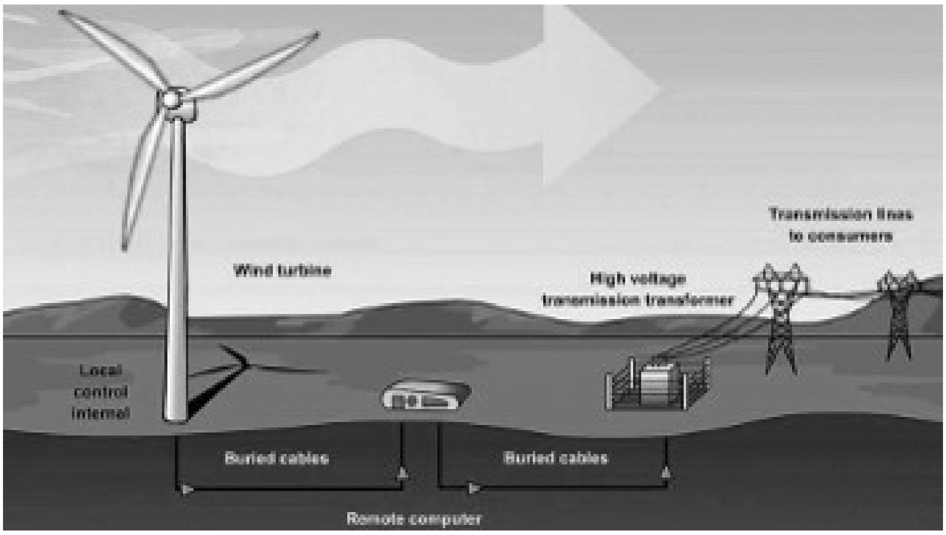

***Figure 3.1**. The principle of complex and functioning of the wind farm*

Spatial characteristics of the wind farm

The complex of the wind farm is located predominantly in the areas of external landfills in Kostolac, which were created as a result of mining activities. All functional units of the wind farm are located in the territory of the municipality of Požarevac, within the cadastral municipalities Bradarac (locality Drmno), Klenovnik (part of the locality Petka and part of the locality Klenovnik), Ćirikovac (part of the locality Petka and the entire locality of Ćirikovac) and Kostolac selo (part of the locality Klenovnik).

The layout of the wind turbines was determined by the wind resources (Figure 3.2) in order to maximize the use of primary energy and vary in the range of about 300 to 1000 meters. The wind farm is located in the zone of the Spatial Plan of the Special Purpose Area of the Kostolac coal basin (Official Gazette of RS, No. 1/2013) including additional updates of it (Official Gazzete of RS, No. 20/2018, which provides the use of renewable energy sources (Chapter 5.1.4 of the Plan) with a preliminary assessment of justification of the construction of a wind farm, which is based on the measurement of wind parameters. The aforementioned was processed through the Preliminary feasibility study with the general project of the "Kostolac" wind park - a variant with the maximum utilization of the wind potential from May 2015 (processors Netinvest doo and Elektroistok-inženjering d.o.o., PR-EPS-VP2 / 14 - rev.3.2), where the previous study proved the justification for the construction of a wind farm and gave an overview of the necessary steps for the further realization of the investment.

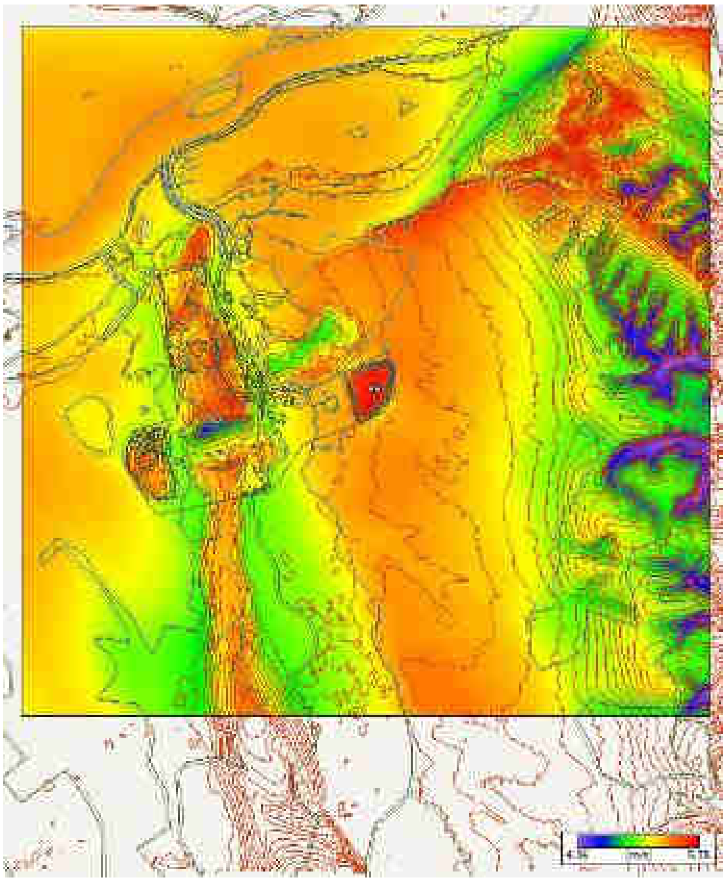

Figure 3.2. *Map of the wind resource in the Kostolac Basin*

Figure 3.3. *Disposition of wind turbines within the wind farm in Kostolac*

Table 3.1. Coordinates of wind turbines positions according to the locations on which they are located

No of WTG.	Coordinates for wind turbines		Cadaster plot No.	Cadaster municipality
	Y	X		
01	7,520,058.63	4,950,558.27	429	Bradarac
02	7,520,341.48	4,950,844.31	475	Bradarac
03	7,520,690.05	4,950,965.89	468	Bradarac
04	7,521,045.85	4,951,073.81	452/1	Bradarac
05	7,520,238.33	4,949,721.22	612, 613	Bradarac
06	7,520,579.29	4,949,985.23	547	Bradarac
07	7,520,923.42	4,950,293.97	522	Bradarac
08	7,514,114.83	4,948,955.24	2896	Klenovnik
09	7,513,893.13	4,948,359.10	1550	Cirikovac
10	7,514,336.57	4,948,295.17	1550	Cirikovac
11	7,517,042.52	4,948,913.09	1551/1	Cirikovac
12	7,516,721.82	4,948,448.70	1551/1	Cirikovac
13	7,516,390.04	4,948,159.02	1551/1	Cirikovac
14	7,515,767.36	4,948,122.53	1551/1	Cirikovac
15	7,516,280.40	4,950,439.97	2482/1, 2482/2	Klenovnik
16	7,516,061.38	4,951,403.63	1433, 1434	Klenovnik
17	7,515,811.00	4,952,203.00	2650/1	Kostolac selo
18	7,515,218.52	4,951,883.76	1417	Klenovnik
19	7,515,049.81	4,952,757.18	1640/1	Kostolac selo
20	7,515,040.65	4,953,925.17	1640/1	Kostolac selo

<u>Technical description of the temporary delivery point</u>

Temporary delivery point (TDP) is forceen on the existing asphalt plateau, which has been used for transhipment in building TPP Kostolac, and is located between the river Mlava and the coast fortification embankment.

In front of the TDP, a turnaround is foreseen in order to place the transport vehicles in the position so that the parts of the wind turbine could directly place to the transport vehicles from the barges with the appropriate mechanization of the transhipment. It is envisaged to raise the existing asphalt plateau to the level of the road, or about 3 m in relation to the existing asphalt plateau.

The dimensions of the plateau and the altitute of the gradient can endure the changes after specifying the dimensions of the barges and the way of transhipment, the required carrying capacity of the trrafic structure and the special conditions that can be prescribed by the equipment supplier. The longitudinal fall of the TDP follows the entire length of the road, on which individual wind turbines will be transported to the location. The TDP transversal drop is 1%.

The layers of trrafic structure envisaged on the plateau of the temporary delivery point:

- Asphalt concrete AB 11C = 4 cm
- BNS 22cA = 6 cm
- Crushed stone aggregate DK 0-31,5mm = 5 cm
- Crushed stone aggregate DK 0-63mm = 15 cm
- Sandy gravel material = 45cm

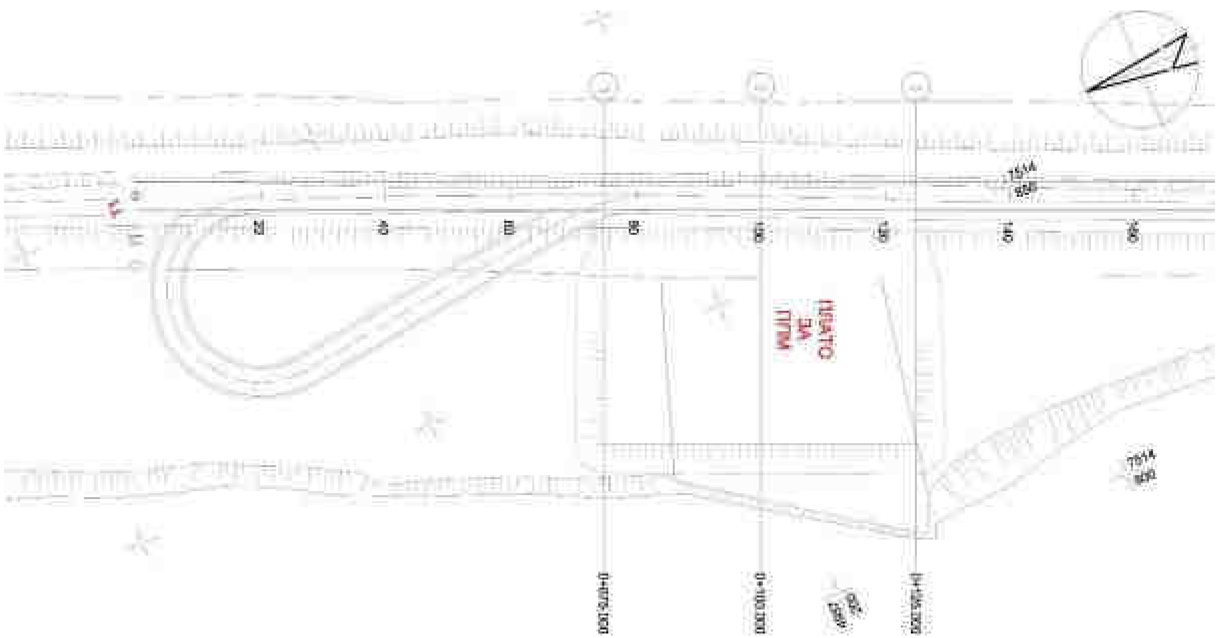

***Figure 3.4**. The situation of the temporary delivery point*

***Figure 3.5**. Position of the TDP in the macrolocation*

Transport, transshipment, further transport, installation and commissioning of wind turbine equipment is conditioned by the manufacturer's propositions in order to obtain a guarantee on the delivered equipment. In accordance with the above, the manufacturer/supplier also transports and supplies equipment to the sites of individual wind turbines. The TDP site is one of the points in the transport, but the transport technology is within the competence of the manufacturer/supplier of the equipment, in accordance with the indicative offer and the technology applied, depending on the case (which also affects the price). Because of this, the definitive technical solution for the equipment transhipment is not available at the time of development of this Study, but further options for carrying out the transhipment are presented (shown in chapter 4 of this study) and it is certain that the individual or combination will be applied in the transport process, i.e. equipment transshipment.

TDP location is located at the confluence of the Topla Mlava in the Danube, about 200 meters upstream from the confluence, on the right bank. The width of the water surface of the Topla Mlava at the TDP site is about 50 meters and can vary depending on the water level. The depth of the draught of the Topla Mlava at the TDP is about 2 meters and can also vary depending on the water level. This is the input data to be taken into account when dimensioning barges/ships that will transport equipment; if the equipment is transported with large cargo with a draught deeper than the existing, then it will be necessary to anticipate a smaller ship or barge that will partially transport equipment from the confluence of the Topla Mlava in the Danube to the TDP, and then carry over by one of the methods described in the following chapters. If a smaller barge/boat with a crane is used, then the pushed composition that brings the equipment to the confluence does not have to have its own crane (can be delivered by barges/boats), and by auxiliary barge/boat will be transshipped from the pushed composition to the auxiliary barge/boat, then transport to TDP, as well as transfer from auxiliary ship/barge to TDP. If the carriage is done by boat with a crane, then an auxiliary barge can be used to ship a part of the equipment from the ship, and then use the auxiliary barge to the TDP containing the transshipment crane. Optionally, and if the depth of the draught allows, it is possible to consider the transport of complete equipment with one boat with a crane that will tranship the equipment directly to the TDP, but remains unknown and problematic the acceptance of such a cargo or a pushed composition by the capacity of the ToplaMlava at TDP (the length of such a ship would be over 200 meters, 30 meters wide and more, and the question of the depth of the draught for such cargo remains).

The variant solutions for the transhipment of the wind turbine equipment include the following or the combination of the following options:

The use of a temporary crane on the TDP for the loading of barges/ships, and the same crane will later be used for the instalation of the wind turbines;
Use of ships/barges with crane, or their combination, if it is not possible to access the TDP by a larger ship;
Use of ships/barges with crane with supports, in the event that the riverbed of the Topla Mlava, and if the water level causes the ship/barge to become trained, i.e. additional factors of uncertainty regarding stability and functionality;
Use of the pontoon bridge or platform as a pre-access part of TDP, which should be combined with one of the above mentioned variants.

<u>Architectural and construction description</u>

The main objects of the wind farm are the pillars and foundations of the wind turbines whose height can vary depending on the selected type of wind turbine. The wind farm consists of a total of 20 wind turbines whose height of the rotor axis is 117 meters and the total height with the blade in the vertical position is 180 meters (117 + 63 = 180). Wind turbine consists the foundation, steel pillar made of segments that are connected, gondola in which a generator unit is located, rotor that mechanically drives the generator unit and the blades that transform the kinetic energy of the wind into mechanical and conveys to the rotor. For the needs of the construction of a wind turbine, the access ramps on which the crane is mounted for mounting the equipment (placement of steel segments of the pillar, then the gondola, rotor and the blades) are used which are located along the access roads. The positions of the pillars are predominantly located at sites that were formed by filling of the tailings from SM Ćirikovac and SM Drmno (the exception is the so-called Požarevačka greda, ie. the locality of Klenovnik).

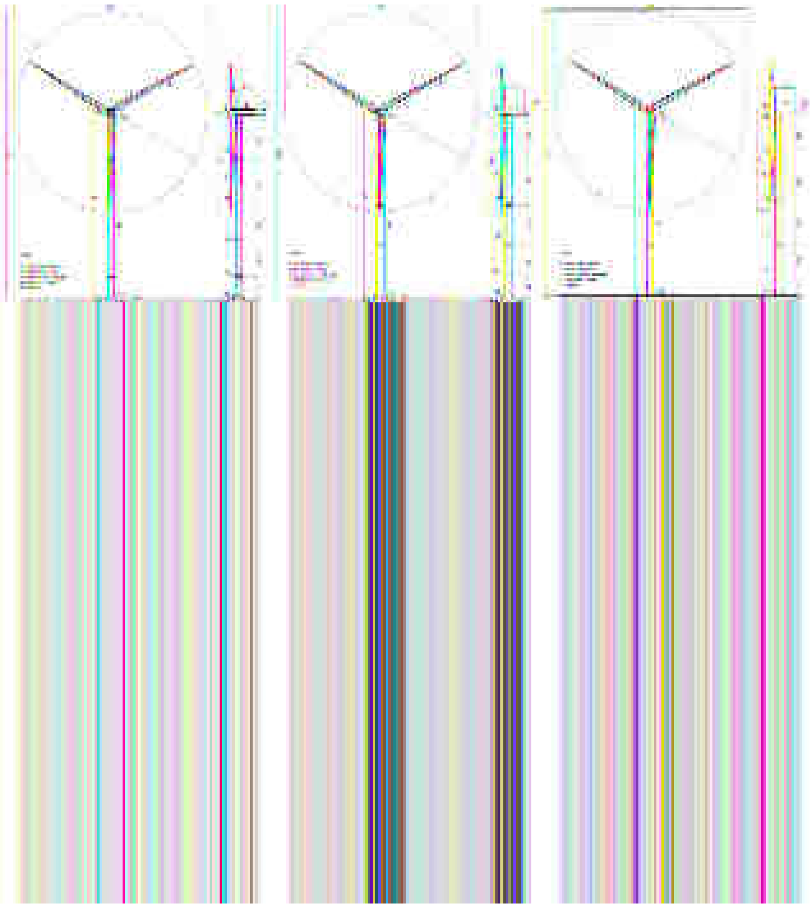

Figure 3.6. *Disposition of a typical wind turbine*

The foundation of the wind turbine pillars must ensure the stability of the wind turbine during the entire exploitation period. The pillar of the wind turbine usually has a shape of a hollow, sealed coupe, and is made of high quality steel.

Figure 3.7. *Example of wind turbines foundation*

Figure 3.8. *Photographs with an example of assembly of the blade parts*

In addition to the pillars of the wind turbines, this project envisages the construction of the 110/35 kV substation and the administrative building of the wind farm located on the common plateau. An open storage space is also provided on the same plateau. The plateau is 135 mx75 m and is completely enclosed with an outer fence. The administrative building of the wind farm is separated from the substation by the inner fence, as well as the storage space. Along the plateau, a tank for supply of the fire and technical water is planned (Figures 3.9 and 3.10).

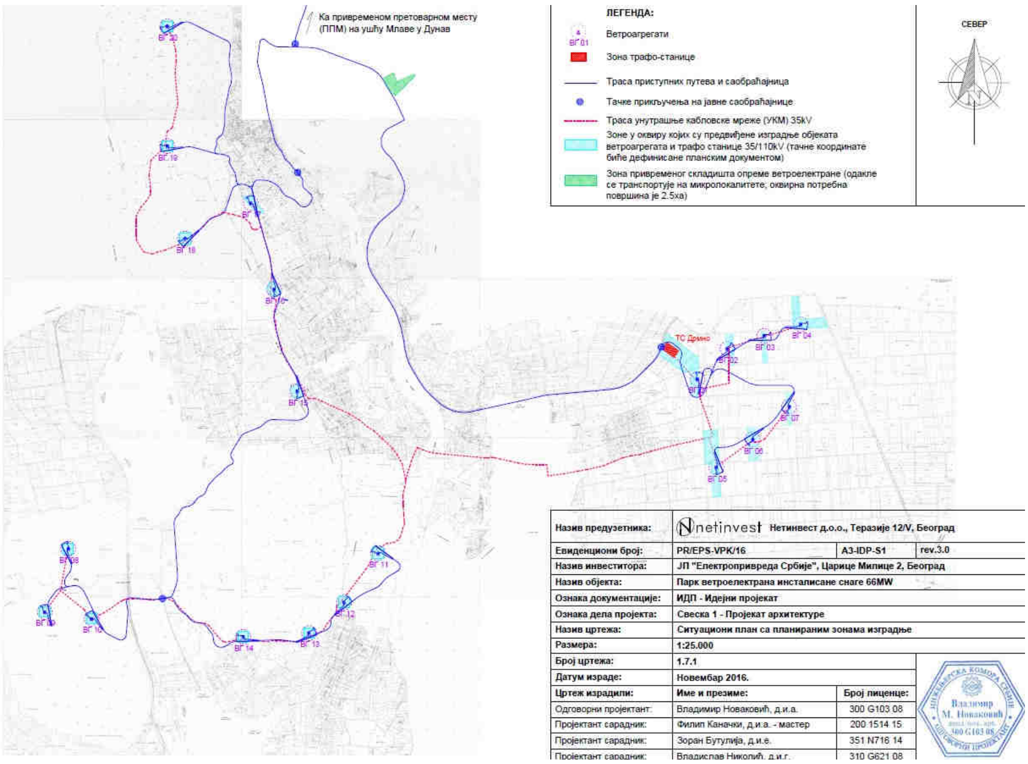

Figure 3.9. *Position of the 110/35 kV substation in the wind farm Kostolac*

The administration building of the distribution system is the ground level facility approximately 20x15. The building can be divided into two functional units- for equipment storing and people premises, who control the operation of the wind farm and servicing of equipment. Up to five people are foreseen to work in one shift. When choosing the floors, walls and ceilings treatment, resistance to fire must be taken into account. The facade walls, windows, doors and roof structure must meet the requirements of energy efficiency, and is recommended to use the autonomous systems to supply electricity and heat. The building is equipped with ventilation and air conditioning installations, lightning protection, lighting, grounding and heating.

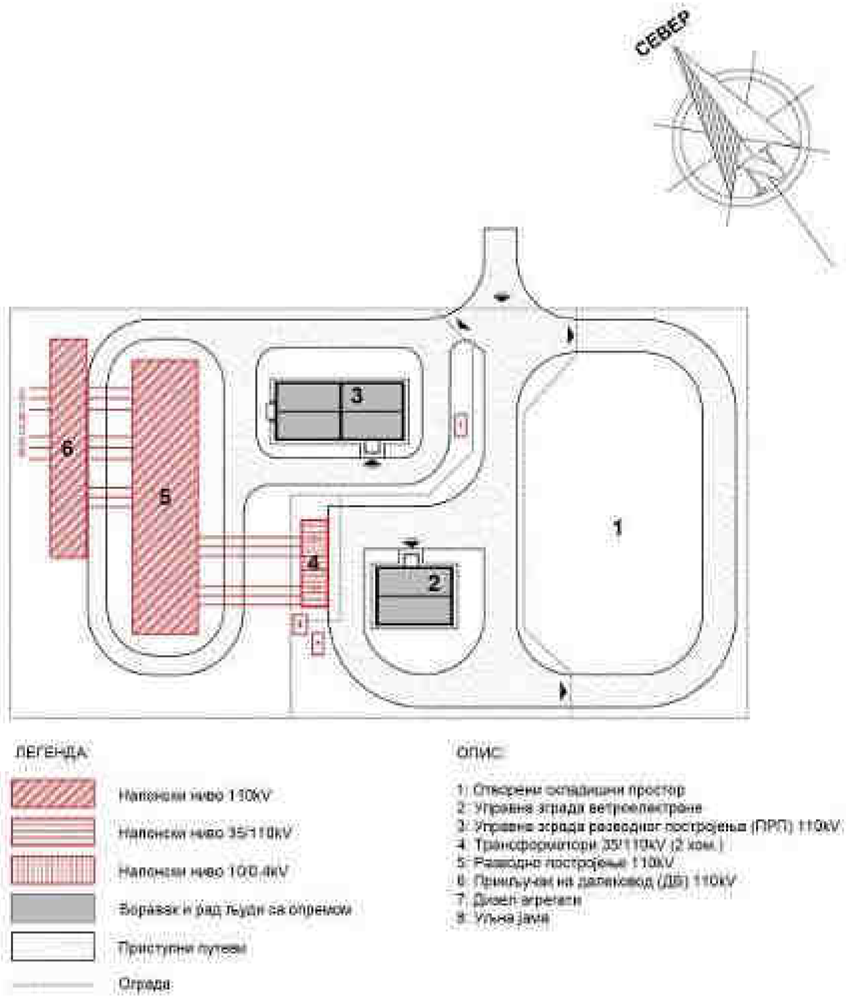

Figure 3.10. *Complex and organization of the 110/35 kVsubstation and the administrative building of the wind farm Kostolac*

In addition to the two above-mentioned buildings, in the 110kV outdoor distribution system, there are three relay housing is considered. The facilities are a system of supporting walls, with reinforced concrete ceiling, covered with sloping roof. The foundation of the building is on striped foundations.

Portals and carriers of the equipment are steel-lattice structures, based on the single foundations. The estimated depth of foundation of the portal is 2.5 m and for the carriers 1.5m.

Oil pit and transformer base are made from reinforced waterproof concrete and are connected by oil sewage when oil transformer solution is chosen (if so-called “dry” transformers are selected then this type of solution is not required due to environment protection is guaranteed from oil dripping). Between transformer bases fire wall is planned.

Grid connection utility has channels maid from reinforced concrete with covering slabs. Within the complex access roads and paths are designed.

Fire protection and technical water supply is provided with reservoir with pump station. Those two systems are independent each from another, with two chambers where one is for technical water supply while other is for fire protection water. Reservoir is to be supplied with water trucks. Reinforced waterproof concrete pit is designed for sewage, and it is to be serviced with sewage trucks.

For substation grid connection to existing 110 kV grid, additional columns may be provided between the substation and the grid line, according to the technical conditions issued by the grid operator. If such columns are required, their foundation should be done with separate reinforced concrete slabs 2.5m bellow the ground level.

Electro-energy description

The 110kV distribution system is designed for outdoor installation and is implemented with two bus systems, dispositively positioned to facilitate the introduction of a 110 kV transmission line. It consists of two transmission fields, two transformer fields, one coupling field and two measuring fields. All necessary switchgear and oxy-coupling equipment is installed in the fields. The distributio system should be dimensioned on the basis of short-circuit data that are valid for the electrical grid at the point where the wind farm is connected and according to the technical conditions of the transmission system operator. The distribution system is connected to the electrical grid over 110 kV transmission line in accordance with the requirements of the PE EMS.

Transformation 110/35 kV consists of two transformers 110/35 kV, 20(25) MVA and is dispositively located next to the command-power building and DS 110 kV. DS 35 kV is located in the administrative building of the wind farm, dispositively located to facilitate the introduction of connection cables according to the 110/35 kV transformation, according to condenser batteries and wind turbines. For the installation of secondary equipment in the field of 110 kV system, protective, command, signal and measuring equipment, as well as the 230V, 50Hz and 220V DC, relay cabinets are located along the transport path. In addition to the transport route, a cable channel will be provided for command-signal and power cables for interconnections of the relay cabins and relay cabins-command building connections. From the relay cabins to the equipment in the field cables are laid in the ground.

In the command-power building of the distribution system 110 kV, all standard equipment for this type of plant is envisaged: 10 kV facility, 10/0.4 kV transformers and 0.4 kV low voltage facility for own consumption of the plant, DC and safety power equipment (rechargeable batteries with rectifiers, inverters and diesel units with associated divisions), command-protection equipment, telecommunication equipment, as well as all necessary home installations.

Facility for own consumpion is powered through a power distribution grid, over a voltage level of 10 kV. The connection is performed by air (cable), according to the Investor's definition along the roadway of the Drmno-Bradarac-Kličevac road (Figure 3.11 - red line). The length of the 10 kV supply line that needs to be built is 6.1 km.

Figure 3.11*. Own consumption line*

The 10kV distribution system is in the form of a tin-plated internal installation. It consists of: feeding cells, transformer cells and connecting measuring cells. With the 10 kV distribution, a distribution plant of 0,4 kV is supplied through the transformer 10/0,4 kV. Transformers are dry for internal assembly, power 250(400kVA). The power of the transformer will be selected at later stages of design, when the basic energy equipment is contracted. Transformers are another`s 100% reserve. The safety power supply of the most important consumers at 0,4 kV, 50 Hz, is carried out using a diesel generator, power of 160 kVA, for which a special 0,4 kV distribution is foreseen. The safety supply of the most important consumers on DC voltage is provided through static, automatically controlled rectifiers 400/230V, 50Hz/220V, DC. The source of the safety DC voltage 220V are two rechargeable batteries with a capacity of 420Ah. Sources of the safety continuous voltage 230V, 50Hz are 220kV, DC/230V, 50Hz converters. Reserve power supply is provided via isolating transformer 230/230V, 50Hz.

Electricity produced in wind turbines through a cable network is transmitted up to 35 kV distribution system and further through the transformer 35/110 kV into the electric power system. The configuration of the cable network is conditioned by the disposition of the wind turbine pillars, the position of the substation and the 35kV facility. The type and cross-section of the cable network will be selected based on the load on the circuit, according to a separate calculation. The cables are freely laid into the ground in cable trunks, according to the applicable norms, standards and technical recommendations for such equipment. In addition to the cables, all necessary equipment for cable extension, cable endings as well as equipment for protection and marking of cables are foreseen.

In addition to the cable installation, an optical cable network in the field of a wind farm is envisaged, which aims to enable the transmission of information between the wind turbines in the field and the central control system located in the administrative building of the wind farm. The laying of optical cables is provided in the same trunks with power cables in the appropriate protective pipes or otherwise in accordance with the technology and technical conditions of the transmission system operator.

Transport and traffic description

Temporary delivery point

The transport of the equipment of the wind turbine (blade, gondola, pillar, rotor, etc.) is planned by water and ground road. By water, the equipment will be transported from the production facilities of the selected producer to the temporary delivery point (TDP) at the confluence of the Mlava River to the Danube. At the TDP site, the unloading is carried out by a crane, or a newly installed crane in a temporary port in the deeper riverbed of the Topla Mlava River. From TDP, the equipment is further transported by road on the reconstructed existing road along the defensive embankment on the right bank of the Mlava River to the Kostolac-B TPP (TEKO-B) where temporary storage of the wind turbines equipment will be established. From the temporary warehouse, the equipment is further transported by road to the individual locations of each of the wind turbines. The loading of equipment must not be carried out in the period from mid-March to the end of June and from the beginning of October to the end of November, during the migration and nesting cycle of birds. Examination and verification of the possibility of transporting equipment along the embankment was carried out and elaborated in the Study on geotechnical conditions for the use and reconstruction of embankment and plateau for the need of the preparation of the technical documentation of the Preliminary Design with the Feasibility study for the construction of the wind farm in Kostolac with an analysis of the temporary delivery point at the confluence of the hot water channel and the Mlava River in the Danube and the embankment for the need of transport of equipment of the wind farm (Geomehanika doo, 2016).

Depending on the location of the wind farm (Petka, Ćirikovac, Kostolac and Drmno) from the temporary warehouse, the transport of equipment is further planned using different existing and planned traffic surfaces, and below are given descriptions of the planned transport route by locations:

For the Drmno locality, transport from a temporary warehouse to Drmno is planned using the existing asphalt road TEKO-B - Drmno, which bypasses Drmno village. From the asphalt road, the locality of Drmno is directly accessible, and it is necessary to adapt and build new access roads, which will provide access to wind turbines no. 1, 2, 3, 4, 5, 6 and 7.

For the locations of Klenovnik, Ćirikovac and Petka route is planned to bypass as far as possible the use of inhabited zones, which, as a rule, have numerous limitations for the transport of equipment (low-altitude electricity cables from the traffic area, insufficient radii of curves for wind turbine equipment, etc.). In accordance with the above, the planned route starts from TEKO-B, over the existing bridge on Mlava, along the Mlava River and near the football field on km 5 + 909.00 comes to underpass of the existing coal conveyor belt on the line TEKO-A - TEKO-B, where the level it is lowered (buried) to allow the passage below the pipeline, and hence to the location Klenovnik with a rise of 6% to a relatively flat surface formed by filling of tailings. In this part, the access road for the delivery of the wind turbine equipment will pass over a hot water pipeline which must be secured by the construction of a concrete substrate or be moved if necessary. After mastering the climb, one part of the road goes along the conveyor belt in the direction of TEKO-A (west), from where it further branches to the individual positions of the wind farm 18, 19 (south) and 20 (north), while the other branch of the road goes south, along the Požarevačka greda from the position of the wind turbine, no. 17, through no. 16 and SS to position no. 15. From wind turbine no. 15 traffic line descends southwest along the periphery of the surface mine in the prescribed slope to the Ćirikovac locality and further south-eastwards by the route of the existing access roads to the wind turbine no. 11, 12, 13 and 14, ending with no. 11. From the location where the administrative building of SM Ćirikovac is located, by crossing the existing asphalt road Požarevac-Kostolac, it is possible to access the locality of Petka, where it is necessary to overcome the rise and bridging of the existing hot water pipeline and continue to reach the individual positions of the wind turbines 8, 9 and 10.

For the needs of assessing the usability of the existing defensive embankment for the transport of the planned wind farm equipment, as well as the possibilities of using the existing concrete plateaus as a temporary deliveri point, field and laboratory testing were carried out. On these jobs were engaged expert teams of companies "Geoput" Ltd. and "Geomehanika" Ltd. The works were carried out in the period from 09.05.-15.05.2016.

Embankment is mainly made of clay dust, brown to brown-gray, with a thickness of approximately 2.00 - 4.00 m. They are well consolidated, naturally moist, tough and poorly waterproof. In the substrate of the filled material there are alluvial sediments, fission of the inlet, and deeper riverbed "*ap*". In the roof area there are dusts of clay to gray clay dust, saturated with water, medium to soft plastic. Deeper dust sand lie, below them are dust gravel, registered with drilling of the concrete plateau and the CPT experiment. In the field were carried out:

1. 23 exploration drills
2. 9 exploration pits
3. 7 experiments of static penetration of CPT until exhaustion of nominal penetrometric force of 20 t.
4. 10 DCP experiments
5. 27 experiments with a light dropping weight.

Groundwater level is determined at a depth of 4.5-4.90 m from the surface of the road on the embankment, which corresponds to an angle of about 69.90-70.00 magl, that is, the level of Topla Mlava at the moment of carrying out of the exploration works. The allowed soil load is calculated according to method K. Tercagi for reinforced concrete slabs measuring 4.00 x 4.00 m. The values of Qa = 174 kN/m^2 were obtained, and this value meets the requirements of safe equipment handling. The analysis of the stability of the slopes of the embankment resulted in great security factors, even with the introduction of an extremely high load of 100 kN/m^2. The planum or embankment crown has the potential to receive a higher traffic load, but with the necessary minimum meliorative interventions in the form of replacing the surface material with a stone aggregate and preparing the bed of the road according to valid standards and regulations. The slopes of the embankments are stable even under heavy loads and it is not necessary to undertake any special measures to increase the stability of the slopes of the defensive embankment.

The conclusion is that: there are favorable geomechanical conditions for the use of a transshipment site and the embankment of Topla Mlava for the needs of transport of future wind farm equipment in Kostolac, within the frames of the adopted constructive parameters related to the facilities.

Docking bay „Kostolac“

In addition to the temporary delivery point, use the future "Kostolac" docking bay for the river transport of limestone, from the quarry "Jelenska stena" near Golupac to the Kostolac B TPP, equipment and the removal of ash, gypsum, etc. is planned as a place of delivery of the equipment of the future wind power plant "Kostolac"

Based on the Main design of the Port “Kostolac”, the project is done for the zone "A"- Docking bay for own needs of EPS - TE-KO Kostolac. In the Conceptual Design, it was designed as a basin, with two opposite quays - two operational banks. It is located in the former Danubian channel “Dunavac”, which is connected with the Danube by the Kostolac canal.

According to the purpose of the docking bay, it belongs to industrial ports, (Article 239 of the Law on Navigation and Ports on Inland Waterways - "Official Gazette of the Republic of Serbia" No. 73/10). As such, the docking bay is planned for the needs of river transport of TPP "Kostolac".

The docking bay has the following basic contents and functions:
• overloading - manipulative contents for river and road transport systems;
• temporary warehouses and landfills - distribution functions;
• administrative complex, including river police facilities;
• technical service for handling transport, manipulative and other means.

The dimensioning of the required capacities as well as the organization of work on the docking bay are provided in accordance with the need to perform named functions and the given types and quantity of cargo transhipment in the docking bay.

The location of the docking bay will be located on the "Dunavac" section east of the Kostolac channel. It is connected with the Danube by Kostolac channel, length about 1440 m. The entrance to Kostolac channel is at km 1094 + 500 survey mark of the Danube waterway.

Part of the "Dunavac", on which the aquatorium will be formed, and banks on which the docking bay will be built, has a form of a bay that closes the "Dunavac" at its eastern end. The two opposite banks are different. On the north side, the slope embarkment with concrete revetment was built (Figure 3.12.). This bank is in function of the dock, with embedded bollards on the top edge and a built concrete ramp for pulling/lowering of the boats. Along the bank the river police pontoon is connected. On the bank there is a concrete plateau and several ground buildings. This bank is supplied with electrical and plumbing installations. In addition to the connections of the river police pontoon, all these facilities are abandoned and out of use. The rest of the bank is covered with trees, shrub and other vegetation. Level of the bank is about 72 masl, i.e. in the zone of flooding at the time of extremely high Danube water levels.

Figure 3.12. *North side of the channel*

The bank on the opposite side of the "Dunavac" is steep, high, with level over 76 masl, on the periphery of the slope, a fence of the TPP Kostolac “A” is put. The slope is covered with vegetation. From the buildings on the slope of the bank, there is one concrete outlet from the direction of the TPP, while downstream of the docking bay area, a abstraction construction site and a pumping station for technical water TPP are located. Upstream from this pumping station there is a distribution plant TPP Kostolac "A". From this facility starts the branching of the transmission lines that crosses the “Dunavac” on the opposite bank. These transmission lines are under the jurisdiction of PE “Elektromreža Srbije” (EMS). As a part of the maneuvering docking bay is located under the transmission line, reconstruction is needed to overcome the individual power lines, in order to ensure a proper distance for the vessels.

At the height of the water cut on the level 70,20 masl, i.e. at water levels that last about 70% of the time on average annually, this bay is about 90m wide and about 150m long. The bottom is about 65 msl, except at the upstream area where they are heigher and transit in the mild slope of the bank. Here the bank and the bank belt covered with low marsh vegetation.

Over the site passes the local road - Kneza Lazara St., which connects the settlement built downstream along the Kostolac Canal and the Danube, with the central part of Kostolac. In this roadway, electrical and plumbing are installed. The traffic connection of the docking bay with the complex TPP "Kostolac B" is the existing road to the settlement Stari Kostolac and beyond, over the bridge on Mlava river to the TPP "Kostolac B". Road transport length is about 3,6 km. From the entrance to the docking bay to the access to the mentioned road, Kneza Lazara St. will be used as an external access road. For this purpose, at a length of about

450 m, this road is intended for reconstruction, and a part of the route leading over the docking bay will be removed from the docking bay.

Transportation of equipment from the future docking bay to specific locations Drmno, Petka, Ćirikovac and Klenovnik will depend on the selected manufacturer / supplier of equipment.

Remote control and monitoring system

Wind farm operation will be done from the operating building using appropriate monitoring room with central monitoring system. This system will be connected with each of the turbines using optical cable networking. Each turbine with the generator is supplied with its' own operating system. Functions of such system include the following:

- monitoring and supervision of the production
- generator synchronization with the grid
- wind turbine operation during restricted operation conditions
- automatic rotation of the nacelle
- blade feathering
- turbine curtailment
- noise control
- ambient control
- grid monitoring
- fire protection monitoring

Grounding and lighting system

Grounding system of the wind turbine consists from ring and foundation grounding parts. Mutual grounding part is incorporated foundation grounding system made from galvanized Fe/Zn ribbon 24x4mm placed in the concrete of the foundation and welded partially for the reinforced steel framework of the foundation. Total grounding resistance is calculated as a sum of parallel impedance of foundation grounding, ring grounding and parallel impedance of the cables between the turbines. Grounding system may be done in other way (according to the manufacturer) if it fulfills required parameters. Grounding system is provided for administrative building of the 110 kV distribution system with relay housing and administrative builing of the wind farm.

Lighting system (external lighting) is planned for substation complex with the administrative building. Obstruction lighting system for the wind turbines have to be in accordance with Civil Aviation Directorate; in case where different obstruction lighting systems may be selected, and according to the results of birds and bats monitoring study, the system which affects birds and bats in the smallest amount should be selected, so potential mortality should be reduced.

Aspects of the project related to the impact on the environment

In terms of previous works, they have not been implemented in physical terms. First of all, it is possible to talk about preliminary (preparatory) actions, which are related to the preparation of planning and project documentation and obtaining the conditions of the competent institutions in the regular procedure and other documentation necessary for the start of the construction of a wind farm. In addition, property-legal relations over land have been solved as one of the basic preconditions for commencement of construction. Due to the specific nature of the construction of a wind farm, it is not possible to speak precisely about the quantities of raw materials, construction materials, and waste materials by "technological units". Namely, almost the whole process of building a wind farm is based only on the assembly of objects/wind turbines that are delivered to the site in parts. Certain quantities of material and water will be used for foundation of the wind turbine pillars and construction of the SS administrative building, and all surpluses of construction material will be properly shipped from the location that will be defined in the Construction Design.

In the context of gas emissions, it can be talked about the work of construction machines, but it is about the minimum quantities that can not be predicted accurately. Hazardous substances that will be used in the regular operation of the wind farm are (1) hydraulic oils and lubricants, anti-freeze and other chemicals for cleaning and maintenance of wind turbines (necessary for operation) and (2) transformer oil for substation. The use of hazardous substances necessary for the operation of wind turbines are defined by the regulations of the manufacturer which is certified in accordance with the ISO 14001:2004 standard. The amount of oil contained in the lubrication systems in the type of wind turbine projected by the project is slightly more than 1000 liters. The replacement of the oil will be carried out periodically, as part of the regular preventive maintenance of the plant. The Investor has adequate capacities for the disposal and recycling of oils and lubricants within the existing SM Drmno, which will be used for the disposal of materials in the process of exploitation of the wind farm. Transformers are placed on separate foundations with a case. From the cases waterproof oil sewers are provided up to the watertight oil pit. The oil pit capacity is determined by the amount of oil from the transformer. Maintenance of the transformer (and replacement of the oil) will be the responsibility of the Investor.

Regarding the treatment of waste materials, according to the nature of the technological process of the wind farm, one can talk about waste oils in the transformer. In addition, waste will be generated during the construction of a wind farm (construction, utility and other waste), and it must be taken from the location to the designated landfill and in accordance with the propositions of the Law on Waste Management and in cooperation with the competent utility company. As for sanitary wastewater, it is necessary for the personnel involved in the construction to provide portable chemical WSs and their regular maintenance and discharge by an authorized legal entity.

The impact of the wind farm on the environment due to the specificity of the technological process and the application of "clean technology", is reflected above all in the possible impact on ornithofauna and hiropterofauna as the dominant potential impacts. Other impacts are of a temporary character (mainly in the construction phase) and have limited intensity and spatial conditions. Such impacts should not burden the capacity of the space in any segment, especially if the defined environmental protection measures, environmental monitoring and other procedures that will be implemented during the exploitation of the project.

4. REVIEW OF MAIN ALTERNATIVES

Locations of wind generators - The location of wind farms was determined by the performed wind estimation and electricity production in the specific area, as well as the existence of a planned basis, the possibility of solving property-legal relations over land, etc.

Based on these assumptions, the location in question has been identified as favorable. However, despite the basic benefits provided by wind farms, they can have a number of adverse environmental impacts, especially with regard to possible effects on: ornithofauna and hiropterofauna; landscape and ambient values of space; increasing the noise intensity, etc.

In this context, the possible impacts on the ornithofauna and the hiropterofauna of the area of subject and wider area are certainly the dominant ones. Namely, the wider area where the construction of the Kostolac wind farm is planned is characterized by the richness of the flying fauna, not so much at the site itself, as much in its surroundings, i.e. in the area of the Deliblatska peščara, while the Danube River represents a migratory corridor for birds.

In relation to the stated conclusion, in order to minimize possible negative impacts on ornithofauna and hiropterofauna, various alternatives for the spatial disposition of wind turbines have been elaborated in order to optimize the individual wind turbines in this context.

The most effective way to prevent the harmful effects of projects, including wind farm projects, on the birds and bats, is the application of the principle of preventive planning in the function of protecting bats and birds, which implies that the negative impacts of the construction and operation of the project are prevented or reduced to a minimum already during the design/planning phase.

The main alternatives considered by the project holder, taking into account the environmental impact, concerned the spatial disposition of the wind turbine pillars. The aforementioned alternatives were analyzed primarily in the context of the protection of ornithofauna and hiroftofauna, but also from the aspect of other possible environmental impacts. For the determination of the most favorable alternative solutions for the spatial disposition of wind turbine pillars, a special contribution was achieved through the results of a one-year monitoring of ornithofauna and hyropterofauna whose results are shown in section 2.3. of of the Study.

On the recommendation of the implementers of this monitoring, PE EPS adopted the principle of preventive planning from the very beginning of the monitoring of flying fauna - as a result of the findings and recommendations of the preliminary analysis of the conflicts carried out in the preparation of the preliminary Report on the performed analysis of the existing documentation. At the very beginning of the monitoring, plan of the wind farm, ie. changes in the position of individual wind turbines were made (Figure 4.1), in the direct function of preventing the harmful effects of the project on birds and bats.

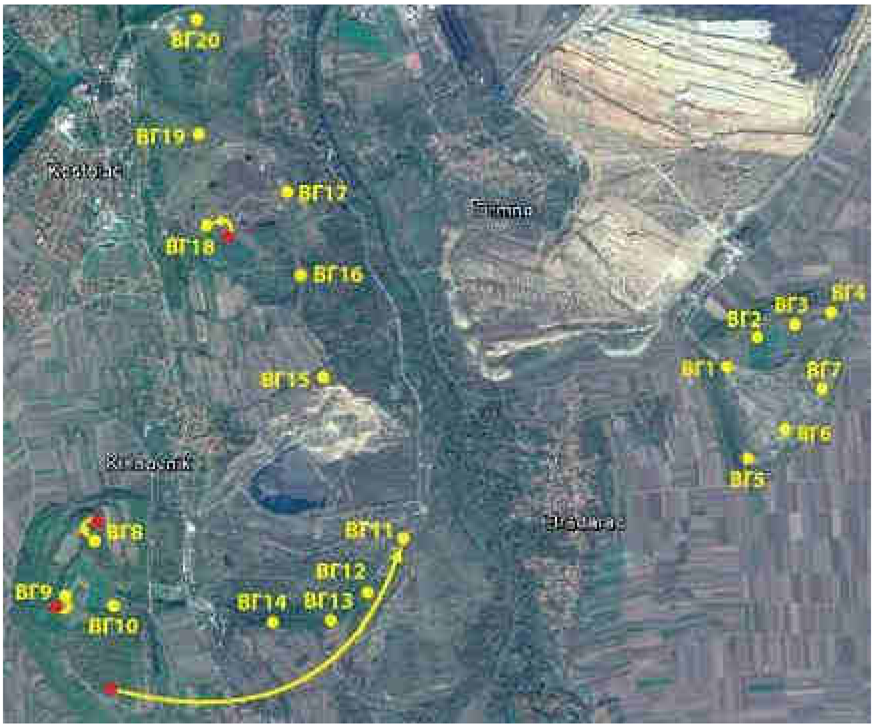

Figure 4.1. *Changes in the spatial disposition of the wind turbines as a result of the analysis of potential conflicts with the flying fauna (red - the position of the wind generators according to GD, yellow - the position of the wind turbines after the conducted monitoring of the flying fauna)*

Preliminary analysis of the conflicts found that the site of Petka was mostly covered with woody-bushy vegetation, with the largest part of its central part characterized by very thick plant stands - thickets, shrubs and young forests, while on its peripheral part there are older, but also dense, coniferous and deciduous stands.

It is estimated that especially these older stands may have the significance of retaining some of the strictly protected species of birds such as Falconiformes and owls, and that the whole site has high trophic potential for bats, which was later confirmed by the findings of this monitoring. Pointing to the explicit position of EUROBATS that wind turbines should not be installed in forests or at a distance of less than 200 m from the forest due to the extremely high risk for all bats, it was concluded that in positions of all wind generators at that moment in the location Petka, according to the General Design, there was a high risk of death of protected and endangered species of birds and bats. Therefore, in order to prevent this potentially very harmful effect, it was proposed to consider the repositioning of these wind turbines into zones where the risk will be smaller and/or where the extensive removal of trees and shrubery on this site will be realized. Such logging is considered acceptable because this vegetation does not have much significance for the conservation of bats and bird fauna in the surrounding area, as there are many natural optimal habitats of this type in the immediate vicinity, and drastically increases the risk of their death.

After the implemented and very extensive additional analyzes that included detailed mapping and assessment of the habitat at the location of Petka, the most optimal solution was reached (Figure 4.1) - the position of the VG11 wind generator, previously planned in the zone of a larger continuous thicket in the south of the location of Petka, was transferred to the location of Ćirikovac (in the safe environment of open ruder habitats, as confirmed by this monitoring), the positions VG08 and VG09 are moved to a safe distance from the older stands on the slopes, and in all positions complete remove of shrubs and woody vegetation is planned in the entire areas of wind turbines for the smooth functioning of the wind turbines and security areas of 200 m around them, which is considered as the general measures for risk reduction which are carried out at all positions of wind turbines.

At the site of Klenovnik, preliminary analysis of the conflicts pointed to the existence of pockets of deposited tailing material in zone of closed mine where ponds were formed with a large complex of aquatic, marsh and humid habitats. Expected, and confirmed by this monitoring, these habitats are attracted by birds of aquatic habitats, insects and bats, and they also represent significant watering place on the site, which is why they have the significance for retaining and taking place of the life cycle of birds and bats. Therefore, it was concluded that in the position of the VG18 wind generator, which according to the General design was at that location, there was a high risk of death of the protected and endangered bird species and bats in this zone. To prevent this potentially highly detrimental effect, it was suggested and accepted by reposition the VG18 out of the risk zone (Figure 4.1). It was considered possible to dry out these ponds and reconfiguration, i.e. even out the tailings material in order to prevent the future accumulation of water and the formation of such habitats; this would reduce the risk of deaths, and the loss of this habitat would not have a significant negative impact since there are a large number of optimal natural habitats of this type in the immediate soroundings.

Variant solutions of the temorary delivery point (TDP)- According to the Law on Navigation and Ports on Inland Waterways (Official Gazette of RS No. 73/2010), it is possible to establish a temporary delivery point where the goods would be storaged and further forwarded. The duration of the granted authorization can not be longer than a year and it is necessary to contact the institutions referred to in paragraph 2, Art. 240 of the Law on Navigation and Ports on Inland Waterways for the purpose of issuing the conditions under which a temporary delivery point may be created. According to the above legal provisions, the Temporary Delivery Point shall be established upon the approval of the Agency for the Administration of Ports with the prior consent of the Ministry competent for water management, the competent authority of the local government unit, the Directorate i.e. an authorized legal entity for the technical maintenance of state waterways, or an authorized legal entity for technical maintenance state waterways in the territory of the Autonomous Province and Port Authority.

The variant solutions for the transhipment of the wind turbine equipment include the following or the combination of the following options:

1. The use of a temporary crane on the TDP for the loading of barges/ships, and the same crane will later be used for the instalation of the wind turbines;
2. Use of ships/barges with crane, or their combination, if it is not possible to access the TDP by a larger ship;
3. Use of ships/barges with crane with supports, in the event that the riverbed of the Topla Mlava, and if the water level causes the ship/barge to become trained, i.e. additional factors of uncertainty regarding stability and functionality;
4. Use of the pontoon bridge or platform as a pre-access part of TDP, which should be combined with one of the above mentioned variants.

1. <u>Installation of crane on the existing plateau</u> – for loading is used mobile crawler crane, which is later moved to a new place of loading (place of instalation or similar). Data on the gauze depth of the water surface are elaborated in the Study on geotechnical usage conditions and reconstruction of embankments and plateaus for the purpose of making technical

documentation Preliminary design with the feasibility study of consrtuction of a wind park in Kostolac with the analysis of temporary delivery point at the confluence of the channel of hot water and the river Mlava and the Danube and embankment for wind farm equipment transport (Geomehanika doo, 2016.) and indicate shallow draught. Figure 4.2 preliminarily identifies similar conditions as with TDP in Kostolac.

Figure 4.2. *Transhipment of a transformer from the river barge on Nile (Egypt) (mass of the transformer about 150 tons)*

2. <u>Using the ship or barge with crane</u> - for this type of transport, it remains unresolved whether it can access the TDP due to its characteristics, but this or similar ship (Figure 4.3) can be used to deliver equipment to the confluence of the Hot Mlava in the Danube.

Figure 4.3. *The crane ship transports the equipment of the wind turbine*

In Figure 4.4. a barge with self-supporting crane for wind turbine equipment lifting is shown (the picture shows blades). Such equipment works in the way that from a larger vessel by its own crane, equipment can be transshipped on such barge, and then the barge is drawn to a transhipment site, the equipment is lifted through a self- supporting crane and vehicle that will accept the cargo goes underneath it, and transported further (see Figure 4.7.) (where the stator's load is placed on a towing vehicle). Such barges are conviniant for partial unloading of equipment (individual elements) because they can access various terrains due to the relatively low load capacity and shallow gauze. The details of their use will depend on the particular transport case, which for this analysis also depends on the general transport to the TDP (whether the equipment will arrive by boat or barges, with or without cranes, etc.). Crane on this barge is not a classic type and through it the equipment can not be transshipped out of the barge.

Figure 4.4. *Barges with self-supporting crane for the transhipment of wind turbine equipment*

3. Use of a ship or barge with a crane and supports **-** This type of transport and transhipment is typical of offshore wind farms. The construction technology for this type of wind farm presupposes ensuring stability of the crane on the water surface (Figure 4.5), which in practice means establishing contact with the bottom of the water surface. This ensures the safety and stability required for instalation of the equipment, as well as the safety and reliability of the work. The following pictures show the listed cases.

Figure 4.5. *The ship with crane and supports mounting and transporting of wind turbines*

In the case of TDP near Kostolac, it is expected to use equipment of smaller load, due to the possibility of transporting such equipment and the price/justification of the works. In the following figure, a sketch of the barge is provided with the supports and the crawler for the loading of the equipment.

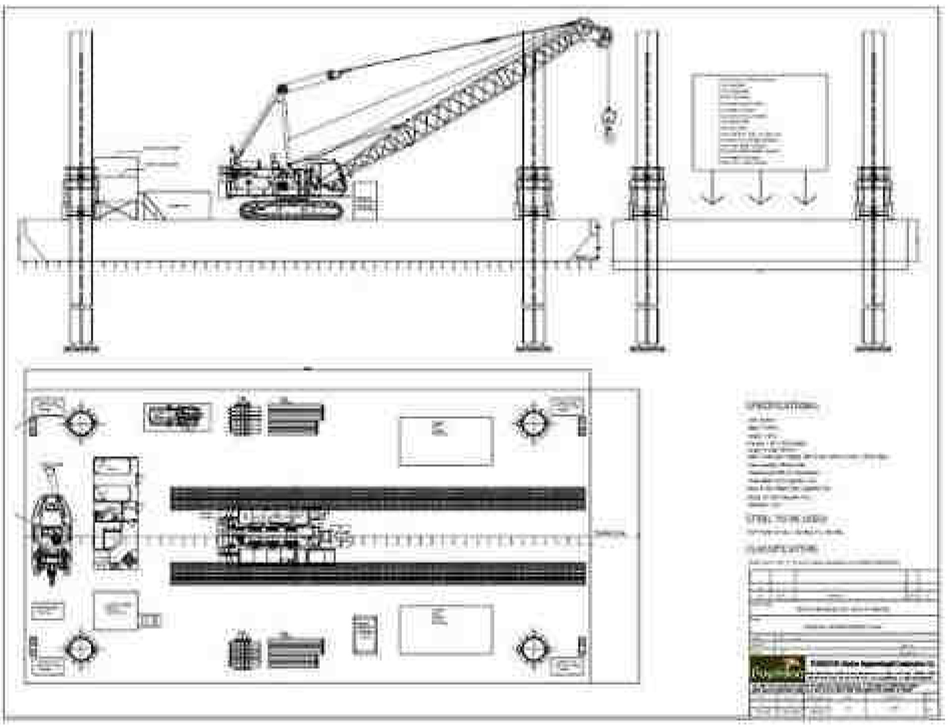

***Figure 4.6**. Disposition of the barge with supports and cranes on it*

Such equipment can be used in cases where the use of a crane on the existing plateau is not planned or it is not possible to access TDP by the ship/barge with the crane; in such cases, the equipment is delivered in one of the previously described ways and through such a barge transhipted to TDP, ie vehicles that will be positioned on the TDP for the acceptance of the cargo. Such a solution can be adopted as acceptable if the depth of the gauze in the existing TDP is not sufficient for access of the vessels with the intended cargo, and secures the distance to the middle of the riverbed (and a greater depth of draught), using temporary equipment which will be disassembled and sail after the the transhipment is completed.

4. Use of the pontoon bridge/barge **-** The use of a pontoon bridge or barge is a solution that can be used in combination of insufficiently deep gauze and ships/barges with conveyor cranes. Such a solution is aplicable to direct loading of loads on towing vehicles to be connected to a tractor or other suitable vehicle capable of further carrying cargo. In Figure 4.7. an example of this solution of a stator of an approximate weight of about 400 tons transported at the site of Thailand. The dimensions of this stator are approximately the same dimensions of the wind turbine gondola, but the mass is about five times bigger.

***Figure 4.7.** Pontoon bridge/barge with a stator load of about 400 tons*

<u>Summary of the variant solutions for TDP</u> - It should be noted that the final variant of TDP solution will depend on the manufacturer/supplier of the equipment. It is possible to apply individual variant solutions, as well as a combination of the mentioned variants. The preliminary assessment concludes that the entire equipment of the wind farm (more precisely - wind turbines) will be delivered to the confluence of the Hot Mlava in the Danube, and then transported by a smaller barge/ship to the TDP where the overloading will be carried out. The exact way of transhipment will be subsequently determined according to the primary and main cargo, the capacity of the Topla Mlava gauze during the period of cargo deliery (May-September) and the mass and gabarit of the contracted equipment for delivery. When selecting the method of transhipment, the timing of the technical solution should be taken into account – forming of TDP is conducted for a period of one year, and due to the specific opinion of the Institute for Nature Protection, the transshipment cannot be carried out only during the period from the half of March to the end of June and from the beginning of October to the end November, at the time of the migration and breeding cycle of birds. This means that preparatory actions such as adjustment of the plateau (if necessary), and in particular the provision of administrative permits and approvals in a timely manner in order for the TDP woud be in operation at the beginning of an approved period of exploitation. The proposed variant solutions should be harmonized with the manufacturer/supplier of the equipment in order to obtain credible data on the technical solution based on which the competent authorities will issue the approvals.

Technology and working methods - Wind farms can play an important role in the energy system of a country. In addition to certain negative impacts that can have on environmental elements, wind farms also imply numerous benefits in relation to the quality of the environment. Thanks to their constructive and operational characteristics, they produce electricity in an ecologically clean way, and it is known that every kW of electricity produced from renewable sources represents kW less energy from non-renewable sources, which production often requires devastation and degradation of large land surfaces which disturbs the quality of the environment and has a marked negative impact on biodiversity, and also on the health of the population in the influential area. In practice, there are no significant differences in the technological process and methods of work itself, and different variants in this respect are not significant. However, the possibility of placing a larger number of wind turnines of less installed power, on the one hand, and a lower number of wind turbines of greater power, on the other hand, was considered. Taking into account the economic and ecological benefits, the decision of investors was for the second variant.

Site map - The results of one-year observations of ornithofauna and hiropterofauna have been consulted for the selection of microlocation of wind turbines, thus applying the principle of preventive protection of the flying fauna, which is considered the most dominant influence of the wind farm.

Type and selection of materials - The wind farm, according to its structural and energy elements, is a typical, constructional and technical-technological solution, where it is known in advance which type of material is used. Materials for construction are delivered by the selected manufacturer. These are parts of wind generators that are assembled at the site itself. In that sense, one can only be discused about the choice of equipment manufacturers and the choice of materials that is always the same or similar (steel, concrete or hybrid), and the decision to choose a company is based primarily on the quality of the equipment that produces steel pillars that require a smaller quantity materials for the same characteristics. In addition, the choice of concrete pillars could involve spilling parts of pillars on the site itself, which is less favorable from the aspect of environmental protection.

Timetable for the execution of the project - The order of works is: 1. Construction of the foundation, 2. Electrical works, 3. Access roads and work plateaus, 4. Transport of the equipment and 5. Installation of equipment. The dynamics and eventual changes in the order of execution of the works are directly conditioned by the dynamics of development of project technical documentation and the provision of appropriate documentation necessary for the start of the construction.

Functioning and cessation of operation - The working life of the wind farm is from 20 to 25 years. When the working life is nearing its end, it will be assessed whether the wind farm should stop working and be removed or turbine replacement will be made. There are various options: general overhaul and equipment renewal for extended service life, turbine replacement, etc. These alternatives will be considered in accordance with the circumstances that will exist at the time.

Date of commencement and completion of the execution - The framework period for the works on the construction of the wind farm is from 2018 until the end of 2020. Alternate dates will be determined in accordance with the dynamics of obtaining the appropriate documentation needed to the construction start.

Production volume - The production volume will depend on the wind speed during the year, and is directly conditioned by the choice of wind turbines, ie the height of the pillar and the diameter of the rotor (blade).

Pollution control - Power transformers for the Kostolac wind farm are not manufactured as dry transformers, so in that context there were no alternative solutions. Continuous monitoring of the condition of the devices containing oil and periodic testing and replacement of oil is foreseen.

Disposal of waste - Disposal of waste generated during the construction of a wind farm will be disposed in accordance with the provisions of the Law on Waste Management and in accordance with defined *Waste Management Measures*, which will be implemented in the Detailed design and is not the subject of this Study.

Responsibility and procedures for environmental management, training, monitoring, emergency plans - After the construction of a wind farm, a responsible person will be chosen who will be trained for carrying out tasks and implementation of procedures related to environmental management and monitoring of the operation of the wind farm. In addition, the Emergency Plan, or the Accident Plan, will be developed and implemented in a manner as presented in the section of the *Accident Protection Measure*.

Mode of decomision, regeneration of the site and further use - Planned working life of the wind farm is about 25 years. After this period, unless the decision on the extension of the working life of the wind farm is made, the plant will be closed and removed. Before the removal of the plant begins, it will be necessary to make a project for closing and removing of the wind farm that will include a detailed plan for the rehabilitation of the previous wind farm area. As part of the project, it will be necessary to formally establish a list of protective measures and requirements that need to be met, based on possible specific conditions that may arise at that time. The mentioned project will need to be harmonized with the Conditions issued by the competent institutions. The project with a recovery plan should be accepted by the competent environmental authority as well as all other stakeholders (including the financial institutions that participate in the project financing). In addition, the defined *Measures of prevention and mitigation during the closure of the wind farm* will be implemented.

5. REPRESENTATION OF THE ENVIRONMENTAL STATE

The environmental quality of the area where the construction of the Kostolac wind farm is planned is influenced by several different industrial complexes: TPP Kostolac A (two power blocks of 110 and 210 MW), TPP Kostolac B (two power blocks of 348.5 MW each), surface lignite mine Drmno, ash and slag landfills at the locations of the Kostolac Middle Island and Ćirikovac, as well as local sources of pollution within the settlements Stari i Novi Kostolac, Petka, Bradarac, Klenovnik, Klicevac, Drmno. Since the implementation of the technological process of using eol energy in wind farms does not imply negative impacts on the quality of the basic environmental factors (water, air and soil), these environmental factors will be described descriptively with the status score. Data on the quality of the basic environmental factors (air, land, water) were taken from the Environmental Report of PE EPS.

Air - The most important air pollutant emitters in the area of interest are TPP Kostolac A and B. In order to monitor and control the emission of pollutants, TPP Kostolac A and B have developed systems for continuous monitoring of emissions into the air for pollutants that are regulated by appropriate regulations, i.e. for sulfur dioxide, nitrogen oxides and PMs. At the time of design and construction on the blocks of TPP Kostolac A and B, no measures were taken to reduce air emissions, except for electro-filter plants, since at that time the emission limit values (ELV) were not prescribed, but the impact on air quality was assessed on the basis the imision values of certain pollutants in the vicinity of the TPP. In the past period, after the adoption of the regulation on ELV in the air, as the first measure in order to harmonize with the set emission limits, reconstruction of the electro-filter plants was carried out at the mentioned power plants, which contributed to a significant reduction in emissions of PMs through gas. Individual measurements of air pollutant emissions in 2016 confirmed the deviation of mass concentrations of PMs at the exit from electro-filters in relation to the guarantees of the suppliers, on both blocks of TPP Kostolac A, where the increased gas temperature at the entrance to the electrofilters in relative to the projected values. The obligation to examine all parameters influencing the efficiency of the EF operation was undertaken in order to take appropriate measures in order to improve the efficiency of the EF operation in TPP Kostolac A. Mass concentrations of SO_2 in gas are significantly above the ELVs prescribed by RS and EU regulations. In order to reduce the emissions of sulfur oxides, it is planned to install gas desulphurization plants according to the agreed dynamics defined with the European Commission. Environmental impact assessment study of the gas desulphurization plant TPP Kostolac B was carried out (which was approved by the Ministry of Environment in August 2015). Also, construction of desulphurization plant at TPP Kostolac B is in progress.

Soil – The TPP Kostolac branch has been monitoring the quality of land every two years in the past period, and since 2015 every year. During 2012, measurements were carried out in the wider area of the company, which covers about 450 km^2. The results of these tests indicate that the average value of the total content of heavy metals in the soil of the test area is common for agricultural land. The total content of most heavy metals such as zinc (Zn), mercury (Hg), lead (Pb), cadmium (Cd), copper (Cu) does not exceed the threshold limit value (TLV) in none of the samples. The total content of arsenic (As) and chromium (Cr) in two samples ate above the TLV while nickel (Ni) is in 40% of the samples above the TLV. The program of soil control includes: field and laboratory measurements at representative measuring points that are entered on the topographic map, which will enable monitoring of the changes of the tested parameters at the same measuring points in the following period.

The tests are carried out 2 times a year. Measuring points are defined depending on the distance from the landfill:

- from the landfill (ash),
- in the influence zone: zone 1 – up to 1 km to landfill, zone 2 – from 1 km to 3 km to landfill and zone 3 – from 3 km to 5 km to landfill,
- outside landfill impact zone (control points).

Regarding the content of heavy metals, the exceedance of nickel content in relation to TLV in 25 soil samples in the vicinity of each landfill has been recorded, as well as exceeding the lead content in two samples around each landfill. For other analyzed substances, no exceedance was recorded in any sample. The content of heavy metals and other toxic elements in ash and soil was in the usual concentrations and below the remediation values for: chromium (Cr), cadmium (Cd), mercury (Hg), arsenic (As) and iron (Fe). Measured values are far below remediation, when sanation measures are required. Taking into consideration all the results of the soil survey, it can be concluded that the investigated area is not polluted by most heavy metals. As a more pronounced pollutant, nickel (Ni) occurs, whose high content is largely determined by the geochemical composition of the parent substrate. Also, the differences in the average values of metals by zones do not clearly indicate the impact of the distance from the pollutant to the content of the pollutants, especially due to the large variation in values within the same zone.

Water - The program of quality control of surface and wastewater in the area under the influence of TPP Kostolac includes measurements of physico-chemical, bacteriological and radiological parameters: air and water temperature, turbidity, pH, el. conductivity, soluble O2, saturated O2 %, COD BOD5, residual evaporation of unfiltered water, residual evaporation of filtered water, total suspended matter, sedimentary matter, total surfactants, mineral oils, phenols, alkalinity, F, Cl, NO2, NO3, PO4, NH4, Ca, Mg, hardness, Al, Fe, Mn, Cd, Cr6 +, total Cr, Cu, Ni, Zn, Pb, Hg, As, B, and ß activity, microbiological analysis. Control includes: wastewater at the place of production and/or the discharge point in the river and/or discharging into the heat channel; and waters of the river - water recipient on the profiles upstream and downstream from the waste water discharge site. By analyzing the data, it can be concluded that Mlava does not suffer significant negative impacts of TPP Kostolac B, because the concentrations of pollutants are below the TLV. The most significant adverse impacts of ash and slag landfills come from arsenic and sulphates that migrate from the deposited mass into underground and surface waters. Sulphate ion migrates quickly and is considered an excellent indicator of pollution of groundwater due to the operation of the landfill. Measurement of pollutants in groundwater was carried out in pyrometers in the landfill area. The water temperature in Mlava downstream of the waste water influent from the TPP Kostolac B increased on average by 1^{o}C, and after the Mlava flows into the Danube, the water temperature in the Danube did not change.

Noise - The occurrence of noise which is registered further from the main building of the TPP Kostolac B is created by the regular operation of the blocks, especially when blocks are moving as well as in special situations during regular operation (activation of the safety valve). Another source of noise, which is manifested at the very location of the planned Kostolac wind farm, comes from the roads connecting the settlements in the zone of the wind farm and, to a lesser extent, from the conveyor belt that crosses the location. Measurement of noise was carried out in 2014 at six measuring points: TEKO A - River police, FIO Minel, TEKO B - Viminacium, Zatvaracnica at Mlava and SM Drmno - Vidikovac, the road to Kličevac, of which the most significant measuring points are the last two for the Kostolac wind farm. Measurements were performed during the summer period during the day and night, and the measurement results show that the relevant noise level exceeds the values of 50 dB (A) at all measuring points except at the measuring point "FIO Minel" and "road to Klicevac", whereby the highest value recorded was at the Viminacium measuring site.

Population - At the periphery of the area that is located in the scope of the planned wind farm project, there are several settlements - Kostolac, Drmno, Bradarac, Maljurevac, Ćirikovac, Petka and Klenovnik, as well as the complexes of administrative and/or industrial facilities of Thermoelectric power plants and mines Kostolac. The settlements are mainly agricultural households, and the project of the wind farm will not significantly impede the usual agricultural activities in the area in question.

Flying fauna - During the twelve-month monitoring at the site, the presence of 119 bird species was detected (120 in the entire research area, which, in addition to the subject, would include control), most of which were in low numbers. As mentioned earlier, the greatest reason for the low number of specimens of recorded species in the investigated area is the extreme uniformity and the presence of sub-optimal habitats. there are almost no trees, as well as the middle floor vegetation (shrubs). For the investigated area characteristic are species that live on the ground. Of the species that would have potential damage from the wind generators, 17 target species were selected, which were specifically monitored and recorded. The extent, the height and the directions of the flyovers speak about the potentially low effect and the intensity of any damage. Certain effects of wind turbine functioning can be assumed for some species of Falconiformes that were the most numerous target species and recorded at critical heights such as *Buteo Buteo* and *Falco tinnunculus*. Other species, such as *Circus aeruginosus*, *Accipiter gentilis, Accipiter nisus, Ciconia ciconia, and Falco subbuteo*, were significantly less numerous and were flying at different heights from the surface but mostly up to 50m, a height that would be beyond the reach of the future blades of the wind turbine generator. The nesting of almost all kinds of predators has not been established, except for the most numerous - *Buteo buteo and Falco tinnunculus*. The most significant number of flights was recorded for the two species mentioned, while the number of overflights recorded by other species is significant or extremely small. Based on the foreseen layout of wind turbines on the future Kostolac wind farm and on the basis of data at the observation points, it can also be assumed that the will not be significant negative impact of the construction and operation of the wind farm on the bird fauna.

At the location of the wind farm with ultrasound audiodetection, the activity of 14 species of bats is registered, whose members can be reliably distinguished on the basis of echolocation signals: *Rhinolophus ferrumequinum*, *Miniopterus schreibersii*, *Myotis bechsteinii*, *Myotis emarginatus*, *Myotis nattereri*, *Barbastella barbastellus*, *Pipistrellus pygmaeus*, *Pipistrellus pipistrellus*, *Pipistrellus kuhlii*, *Pipistrellus nathusii*, *Hypsugo savii, Nyctalus leisleri*, *Nyctalus noctula*, *Vespertilio murinus* and *Eptesicus serotinus*. In addition to these, the activity of representatives of 4 groups of species whose members cannot be reliably distinguished on the basis of echolocation signals is also registered- so it is certain that at least one species from each of these groups is present at the site, which makes at least a total of 19. However, it is very likely that this number is actually higher, i.e. 23, because at least occasionally and/or sporadic there is the presence of 8 species from these groups (*Myotis brandtii*, *M. mystacinus*, *M. alcathoe*, *M. myotis*, *M. oxygnathus*, *M. daubentonii Plecotus austriacus* and *P. auritus*) almost certainly based on their wider distribution and the existence of appropriate ecological conditions at the site and in the immediate vicinity.

Climatic characteristics - Based on the analyzed climatic conditions, it can be concluded that the area of the planned wind farm Kostolac has a moderate-continental climate with certain specificities. The transition season, spring and autumn, are distinguished by the variability of the weather, with the warmer autumn of the spring. In the summer, due to the movement of the subtropical high-pressure belt to the north, this area is under the influence of the so-called Azores anticicyclone, with fairly stable weather conditions and occasional spillovers of local character. In winter, this area is under the influence of cyclonic activity from the Atlantic Ocean and the Mediterranean Sea, as well as winter so called Siberian anticyclone. Data on air flow characteristics, from measuring points at the location of the planned wind farm Kostolac, are presented in point 2.2.3. of the Study.

Buildings, cultural haritage, archaeological sites and ambient units - In the context of the architectural heritage and cultural values of the location concerned, the objects of settlement structures on the perimeter of the site and the sites identified in point 2.4 of this Study can be discussed. There are no significant ambient units on the location in question.

Landscape - Due to the dominant effect of anthropogenic factors on the site, primarily mining activities, the landscape values of the site can be characterized as low quality. The anthropogenic altered areas altered by the mining activities in the previous period dominate, and the objects of thermal power plants dominate the space in a visual sense.

Relationship between named factors - In summary, it can be noted that the quality of the basic environmental factors at the microlocation of the planned wind farm Kostolac is somewhat distorted as a result of primarily mining activities and the operation of thermal power plants in the environment. However, due to the nature of the technological process in wind farms, there is no significant interaction between the elements of the environment in which, as a result of cumulative and/ or synergetic factors, increased environmental pollution could not occur. Although Article 6 of the Rulebook on the content of the Environmental Impact Assessment Study explicitly states that this chapter must include all the above factors, it should be pointed out that the project concerned, due to the nature of the aforementioned technological procedure, will not have influence on most of the above mentioned environmental elements (climatic characteristics), some elements may have a minor impact (flora, soil, water, air), while the effects on other elements, especially on theflying fauna, can be significant, which is given in more detail further in the Study.

6. DESCRIPTION OF POSSIBLE SIGNIFICANT IMPACTS OF THE PROJECT ON THE ENVIRONMENT

6.1. General assessment of possible environmental impacts

The construction of infrastructure objects may impair the components of the structure of unequal ecosystems. In addition, a negative effect can implicate a number of different factors, with different time and space coverage. Considering the basic purpose of the wind farm facility, the way it operates and the expected environmental impacts, it can be concluded that the following impacts will occur during the construction phase:

- increased noise level due to the operation of construction machines and transport means;
- increased level of air pollution due to emission of exhaust gases from construction machines and transport means;
- temporary deposit of surplus land during the foundation of facilities, stones and other waste materials.

These effects are inevitable in the construction phase and can not be avoided, but they are, for example, level of noise and air pollution during the construction of the wind farm are far lesser than the increased noise and pollution levels obtained by the mining and other mechanization on the surface mine and TPP, which is of significance for the area in question. The possibility of prevention refers to the regular maintenance of means of transport and construction machinery in order to prevent the occurrence of higher noise levels and increased emissions of exhaust gases due to malfunction of means of transport and construction machinery.

In the construction phase, there will be the excavation of smaller quantities of soil, stone and other waste materials from the excavation of foundations for the planned facilities. However, this deposit will be only temporary, and the investor will be obliged to organize the permanent deposit of these materials as soon as possible in accordance with the relevant legislation. Free desposal will be prohibited. The evacuation of the surplus of land, stone and other waste materials during the construction phase will be regularly organized and, if necessary, in cooperation with the competent institutions. Free disposal of these waste materials will be prohibited by measures of environmental protection. Waste magagement during the construction of a wind farm will be defined within the Detailed design and is not the subject of this Study, except for the guidelines that will be defined in that context in Chapter 8 of the Study.

Generally speaking, the implementation of special requirements that ensure the exploitation, maintenance and supervision of the Kostolac wind farm do not condition the removal of facilities, nor the change in the purpose of the land on which the construction of the wind farm is planned.

In addition, since it is about the exploitation of a renewable energy source (wind energy), that is, the application of "clean" technology, no pollution is expected in terms of emission of waste matter into the basic environmental factors (water, air and soil). The realization of the planned project will not produce waste materials nor create other types of pollution. The possibility of occurrence of accidents has been minimized. The facilities will be built on an