SUMMARY IMPACT MATRIXES AND CUMULATED IMPACT AREAS

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22.1 SUMMARY IMPACT MATRIX

The primary purpose of the environmental impact study of Paks II Nuclear Power Plant was to determine the impacts of the various factors and processes of the planned activity of the individual elements/systems of the environment.

We evaluated the impacts by following the logical process of impact factors → impact processes → those impacted (affected by the impact), with regard to the current baseline load on the environmental elements/systems concerned and the changes which are expected to occur to the current environmental and natural conditions during the total lifetime of the project Paks II (e.g. climate change).

We examined the impact factors of the new nuclear power plant units and the adjacent facilities in chronological order (establishing-construction/assembly, operation and abandonment), with regard to the areas to be used:

We examined the individual phases by classifying them based on the most typical groups of impact factors. Among the various impact factors, we distinguished between traditional, non-radioactive and radioactive wastes and emissions with consideration to the nature of the facility.

- the use of environmental elements
- emissions and wastes
  - *the generation and management of traditional, non-radioactive emissions and wastes*
  - *The generation and management of radioactive emissions and wastes*
- spent fuel cassettes
  - *The treatment and storage of fuel cassettes removed from the reactor zone*

We carried out the examinations with regard to normal operation and abnormal operational conditions (operating troubles, emergency and events comprised in the design basis) alike.

The environmental baseline conditions, which have been determined in the environmental impact study with detailed measurements and calculations, describe and constitute part of the environmental impacts of the operation of the already operating Paks Nuclear Power Plant.

We examined the impacts of the combined operations expected to arise from the extension of the operating hours of Paks Nuclear Power Plant with consideration to the anticipated environmental baseline conditions.

We need to note that we determined the impact factors and calculated and modelled their impacts by taking the factors evoking the largest environmental impact into consideration, with regard to the principle of conservative approach of NBSZ as well besides environmental protection aspects.

In summary of the environmental impact study, we prepared a summary impact matrix to determine the impact processes evoked by the impact factors directly related to the construction and operation of Paks II. This summary impact matrix is also structured according to the logical sequence presented above, covering the events related to the periods of establishing, operation and abandoning.

The first column of the matrix contains the impact factors and activities, the second column presents the impacts and the impact processes, while in the third column you can find the environmental elements/systems affected by such impacts. The fourth and the fifth column contain qualifications, i.e. the specification of the areas directly impacted and the classification of the type of the impact.

When examining the impacts and impact areas, we distinguish between direct, indirect and cross-border impacts and the areas affected by such impacts based on the relevant legal rule (Gov. Decree 314/2005 (XII. 25)). We

can determine the scope of the environmental elements and systems where the impact processes (use of or burden on the environment) brought about by the various impact factors may evoke direct or indirect impacts based on our estimates. We also examine cross-border impacts. The direct impact area is the area which is demonstrably affected or expected to be affected by the given impact. Indirect impact and its area refer to an impact spreading through some transmission agent. This transmission agent may be some non-living element of the environment (e.g. underground water, soil, air) but some group of plants or animals as well (e.g. impacts transmitted through the food chain).

When estimating the impacts, we determined the nature of the individual impacts based on their durability, strength and significance.

In respect of its durability, the impact may be:

- *short term (lasting no more than a few months),*
- *mid-term (lasting no more than three years) or*
- *long-term (lasting longer than three years)*

In respect of its strength, the impact may be:

- **weak – modest – neutral,**
- **moderately strong – tolerable or**
- **strong – burdening.**

In respect of its significance, the impact may be:

- **of low significance,**
- **of *moderate significan*ce *or***
- **of high significance.**

We regard strong – burdening impacts and impacts of high significance to be significant impacts as defined in Government Decree No. 314/2005. (XII. 25.) on environment impact assessment and the uniform licensing procedure of the use of the environment.

We highlighted the impact factors anticipated to be significant with peach colour.

22.1.1 THE IMPACT MATRIX OF THE ESTABLISHING – CONSTRUCTION – ASSEMBLY OF PAKS II

22.1.1.1 Normal operation

22.1.1.1.1 The use of environmental elements

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Areas occupied: mobilisation area, construction area, „island", areas of unit wires, transmission lines	utilization	geological agent	direct: the land areas affected by the investment indirect: - cross-border: -	durability: long-term, strength: moderately strong, significance: of moderate significance
	creation and operation of the interim storage premises for the soil excavated	geological agent	direct: the interim storage premises for the soil excavated indirect: - cross-border: -	durability: long-term strength: moderately strong significance: of moderate significance
	Establishing and operation of workplace and plant waste collection sites, communal wastewater treatment plant and sludge drain-tank	geological agent	direct: workplace and plant waste collection sites, communal waste water treatment plant and the area of the sludge drain-tank indirect: - cross-border: -	durability: long-term strength: moderately strong significance: of low significance,
	diminishing of the living space of plants and animals, territorial fragmentation, tesselation, impeded succession, influencing of population dynamic processes	flora and fauna	direct: the land areas affected by the investment indirect: the environment of the land areas affected by the investment cross-border:	durability: long-term strength: strong significance: of moderate significance
Removal and depositing of fertile soil/topsoil	perishing of the underground parts and the propagation materials of plants, damage to and destroying of the habitats of plants and animals, dying of ground-dwelling animals	flora	direct: the construction sites affected by the investment indirect: - cross-border: -	durability: mid-term, strength: moderately strong, significance: terminating (soil, plants and animals)
		fauna	direct: the construction sites affected by the investment indirect: the surroundings of the land areas affected by the investment within a distance of 100 m cross-border:	
Drinking water supply from the waterworks of Csámpa	increasing of the volume of artesian water	underground water	direct: the surroundings of water exploitation wells indirect: - cross-border: -	durability: long-term, strength: moderately strong, significance: of moderate significance
Technological water supply	water retrieving from the Danube	above-ground water	direct: the surroundings of the place of water retrieving indirect: - cross-border: -	durability: long-term, strength: moderately strong, significance: of moderate significance

Table 22.1.1-1: The use of environmental elements during the phase of the establishing – construction – assembly of Paks II

22.1.1.1.2 Generation of traditional, non-radioactive emissions and wastes

Mobilization area				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Removal and transplantation of plants	destruction of the habitat of plants and animals, damage to habitats, spreading of invasive species of plants Diminishing of the population and numbers of animal species, disturbance animals	flora and fauna	direct: mobilization area indirect: within the boundaries of the premises cross-border: -	durability: long-term strength: strong significance: terminating: (vegetation cover, plants, habitats)
Removal and depo**siting** of fertile soil/topsoil	dying of ground-dwelling animals	fauna	direct: mobilization area indirect: - cross-border: -	durability: mid-term, strength: moderately strong, significance: terminating (ground-dwelling animals, plants and their habitats)
	perishing of the underground parts and the propagation materials of plants	flora		
	air burdening caused by the dusting of the soil	air environment	direct: mobilization area indirect: - cross-border: -	durability: short-term strength: moderately strong significance: of moderate significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machinery	air environment	direct: within a distance of 1000 m of the mobilisation area indirect: - cross-border: -	durability: short-term strength: moderately strong significance: of low significance,
	Noise burden caused by the noise emitted by machinery	the town environment (humans)	direct: mobilization area indirect: - cross-border: -	durability: short-term strength: moderately strong significance: of moderate significance

Table 22.1.1-2: The impact matrix of the mobilization area during the phase of establishing of Paks II

The operational area of Paks II

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Demolition/replacement of the buildings, pavements and line structures (including roads, pipelines, cables etc.)	air burdening by the pollution caused by machines and vehicles used for demolition	air environment	direct: within a distance of 500 m of the operational area indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance
	noise burden caused by the noise emitted by machines used for demolition	the town environment (humans)	direct: mobilisation area, the surrounding agricultural, industrial and water management areas indirect: - cross-border: -	durability: short-term strength: moderately strong significance: of low significance
Removal, transplantation of the vegetation from the area of installation	disappearance of the vegetation, the spreading of invasive species of plants	flora and fauna	direct: area of establishing indirect: the surroundings of the area of establishing within a distance of 100 m cross-border: -	durability: mid-term strength: strong significance: terminating
Removal and depositing of fertile soil/topsoil	perishing of the underground parts and the propagation materials of plants destruction of the habitat of ground-dwelling animals, diminishing of the population and number of individuals of animal species	flora and fauna	direct: the construction sites affected by the investment indirect: the surroundings of the land areas affected by the investment within a distance of 100 m cross-border: -	durability: short-term strength: moderately strong significance: terminating
	air burdening caused by the dusting of the soil	air environment	direct: within the operational area indirect: - cross-border: -	durability: short-term strength: modest significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machines and vehicles	air environment	direct: within a distance of 1000 m of the operational area indirect: - cross-border: -	
	noise burden caused by the noise emitted by machines	the town environment (humans)	direct: the power plant areas and the surrounding agricultural, industrial and water management areas indirect: - cross-border: -	
Construction of excavation pit	air burdening by the pollution caused by machines and vehicles	air environment	direct: within a distance of 1000 m of the operational area indirect: - cross-border: -	durability: mid-term strength: modest significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora, fauna and soil		
	noise burden caused by the noise emitted by machines	the town environment (humans)	direct: the power plant areas and the surrounding agricultural, industrial and water management areas indirect: - cross-border: -	durability: short-term strength: modest significance: of low significance
	generation of non-radioactive waste (soil excavated)	geological agent	direct: the part of the operational area affected by the construction of the excavation pit indirect: - cross-border: -	durability: mid-term strength: moderately strong significance: of high significance

The operational area of Paks II				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Water drainage from the excavation pit	falling of the groundwater level	geological agent, underground water	direct: within the premises indirect: within the premises cross-border: -	durability: short-term strength: weak significance: of low significance
Channelling of the water drained from the excavation pit in river Danube	the emission of groundwater containing tritium in river Danube	above-ground water	direct: - indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance
Foundation	air burdening by the pollution caused by machines and vehicles	air environment	direct: within a distance of 1000 m of the operational area indirect: - cross-border:	durability: mid-term strength: moderately strong significance: of moderate significance
	noise burden caused by the noise emitted by machines	the town environment (humans)	direct: the power plant areas and the surrounding agricultural, industrial and water management areas indirect: - cross-border:	durability: mid-term strength: moderately strong significance: of moderate significance
	change to the flow conditions of groundwater	groundwater	direct: area of establishing indirect: - cross-border: -	durability: long-term strength: moderately strong significance: of moderate significance
Construction of buildings and structures Technological assembly works	air burdening	air environment	direct: within a distance of 1000 of the emissions indirect: - cross-border: -	durability: mid-term strength: moderately strong significance: of moderate significance
	noise burden	the town environment (humans)	direct: the boundaries of the premises indirect: along transport routes cross-border: -	durability: mid-term strength: moderately strong significance: of moderate significance

Table 22.1.1-3: The impact matrix of the installation area during the phase of establishing of Paks II

The cold water channel and surroundings

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Removal and depositing of fertile soil/topsoil Extension of the cold water channel section	removal of the vegetation, perishing of the underground parts and the propagation materials of plants Temporary destruction of the habitat of ground-dwelling animals, diminishing of the population and number of individuals of animal species, disturbance, pullulation of invasive animal species hydrological changes and morphological changes affecting the basin	flora and fauna	direct: cold water channel, its embankments, Island, the riverbank of Danube indirect: - cross-border: -	durability: mid-term, strength: moderately strong significance: terminating (soil, plants and animals)
	air burdening caused by the dusting of the soil	air environment	direct: the cold water channel and surroundings indirect: - the cold water channel and surroundings cross-border: -	durability: short-term strength: modest significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machines and vehicles	air environment		
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)	direct: the cold water channel and surroundings (the surrounding industrial and water management areas and the inhabited areas of village Dunaszentbenedek) indirect:- cross-border: -	
	generation of non-radioactive waste (soil excavated)	geological agent	direct: the part of the cold water channel affected by the expansion indirect: - cross-border: -	durability: mid-term strength: moderately strong significance: of high significance
Groundwater derived from draining the excavation pit (13 000 – 18 000 m3/day - max: 0,2 m3/s)	a minor increase in the suspended matter content of the cold water channel a minor increase of turbidity a minor increase in the amount of vegetal nutrients (primarily various nitrogen forms)	the phytoplankton, phytobenthos, MZB and fishes living in the cold water channel	direct: <500m indirect: <500m cross-border: -	durability: short-term strength: weak significance: of low significance

Table 22.1.1-4: The impact matrix of the cold water channel in the phase of establishing of Paks II

The warm water channel and surroundings

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Removal and depositing of fertile soil/topsoil extension of the warm water channel section	removal of the vegetation, perishing of the underground parts and the propagation materials of plants	flora	direct: the warm water channel with its embankments, the Island, the riverbank of Danube indirect: - cross-border: -	durability: mid-term, strength: moderately strong significance: terminating (soil, plants and animals)
	destruction of the habitat of ground-dwelling animals, diminishing of the population and number of individuals of animal species, disturbance, pullulation of invasive animal species hydrological changes and morphological changes affecting the basin	fauna		
	air burdening caused by the dusting of the soil	air environment	direct: the warm water channel and surroundings indirect: cross-border: -	durability: short-term strength: modest significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machines	air environment		
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)	direct: the warm water channel and surroundings (the surrounding industrial and water management areas and the inhabited areas of village Dunaszentbenedek) indirect:- cross-border: -	
	generation of non-radioactive waste (soil excavated)	geological agent	direct: the part of the area of the warm water channel affected by the expansion indirect: - cross-border: -	durability: mid-term strength: moderately strong significance: of high significance
Channelling of treated communal wastewater in the warm water channel (max. 1000 m3/day - 0,012 m3/s)	a minor increase in the amount of vegetal nutrients	the phytoplankton, phylobenthon, MZB and fishes living in the warm water channel	direct: <50m indirect: <50m cross-border: -	durability: long-term, strength: weak significance: of low significance

Note:
* Impact distance recorded from the point of emission in Danube based on calculations.

Table 22.1.1-5: The impact matrix of the warm water channel in the phase of establishing of Paks II

The area of the „island" encompassed by the hot water channel and the warm water channel				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
The removal/transplantation of vegetation from the area of establishing of the new warm water channel and the recuperation power plant	removal of the vegetation, damage to habitats, edge effects and the fragmentation of habitats, the spreading of invasive species of plants	flora	direct: the construction zone of the new warm water channel and recuperation power plant on the embankment of river Danube indirect: - cross-border: -	durability: long-term strength: strong significance: terminating (vegetation cover, plants, habitats)
	diminishing and modification of the population and number of individuals of animal species, disturbance, interference the hazardous impact of wastes on birds pullulation of invasive animal species	fauna	direct: the total area of the island indirect: - cross-border:	
Removal and depositing of fertile soil	perishing of the underground parts and the propagation materials of plants, damage to habitats edge effects and fragmentation of habitats destruction of the habitat of animals, diminishing of the population and number of individuals of animal species, disturbance, interference Pullulation of invasive, synantrophic animal species	flora	direct: the construction zone of the warm water channel and recuperation power plant on the embankment of river Danube indirect: cross-border: -	durability: long-term strength: strong significance: of moderate significance
		fauna	direct: the total area of the island indirect: - cross-border: -	
	air burdening caused by the dusting of the soil	air environment	direct: the island and the surrounding areas indirect: cross-border: -	durability: short-term strength: weak significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machines	air environment		
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)		
Construction of the new section of the warm water channel and the shaping of the basin along this new section and the construction of the excavation pit for the recuperation power plant Construction of the recuperation power plant (foundation, construction of structures, technological assembly)	Disturbance the flora and fauna of the river bank of Danube	macrophites, macrozootobenthos, fishes	direct: construction site indirect: <250m cross-border: -	durability: short-term strength: weak significance: of low significance
	air burdening by the pollution caused by machines and vehicles	air environment	direct: the island and the surrounding areas indirect: cross-border: -	durability: short-term strength: weak significance: of low significance
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)		
	generation of non-radioactive waste (soil excavated)	geological agent	direct: the part of the island affected by the excavation of soil indirect: - cross-border: -	durability: mid-term strength: tolerable significance: of moderate significance

Table 22.1.1-6: The impact matrix of the island in the phase of establishing of Paks II

The track of the 400 kV unit wire and the 120 kV transmission line up to the new substation				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Removal of vegetation from the place of the transmission line poles	Damage to vegetation and habitats, edge effects and the fragmentation of habitats, the spreading of invasive species of plants	flora	direct: the track of the 400 kV unit wire and the 120 kV transmission line indirect: - cross-border: -	durability: mid-term strength: moderately strong significance: of moderate significance
	diminishing and modification of the population and number of individuals of animal species, disturbance, interference, pullulation of invasive species of animals	fauna		
Removal and depositing of the fertile soil from the place of transmission line poles	perishing of the underground parts and the propagation materials of plants, damage to habitats edge effects and fragmentation of habitats diminishing of the population and the number of individuals animal species, disturbance animals	flora	direct: the track of the 400 kV unit wire and the 120 kV transmission line indirect: - cross-border: -	durability: long-term strength: strong significance: of moderate significance
		fauna		
	air burdening caused by the dusting of the soil	air environment	direct: the track of the 400 kV unit wire and the 120 kV transmission line indirect: cross-border: -	durability: short-term strength: weak significance: of low significance
	dust settling on and being washed in the soil	geological agent		
	the influence of the dust settled on physiological processes	flora and fauna		
	air burdening by the pollution caused by machines and vehicles	air environment		
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)		
Foundation Installation of transmission line poles Wiring	air burdening by the pollution caused by machines and vehicles	air environment	direct: the track of the 400 kV unit wire and the 120 kV transmission line indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance
	noise burden caused by the noise emitted by machines and vehicles	the town environment (humans)		

Table 22.1.1-7: The impact matrix of the unit wire and the transmission line up to the new substation in the phase of establishing of Paks II

Transport routes				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Supply of building materials and technological equipment Supply of human resources	Emission of noise by vehicles	the town environment (humans)	direct: - indirect:- cross-border: -	durability: long-term strength: moderate significance: of low significance
	emission of exhaust fumes by vehicles	air environment	direct: within a distance of 100 m of the transport routes concerned indirect: - cross-border: -	
	disturbance diminishing of the number of individuals of certain species of animals	fauna	direct: the direct environment of the routes affected indirect: - cross-border: -	
	Pollutants settling on or being washed in the soil and accumulating in plants and animals	indirect: flora, fauna and soil	direct: - indirect: - cross-border: -	
Shipment of waste (non-radioactive)	emission of exhaust fumes by vehicles	air environment	direct: within a distance of 100 m of the transport routes concerned indirect: - cross-border: -	durability: long-term strength: moderate significance: of low significance
	emission of noise by vehicles	the town environment (humans)	direct: - indirect: - cross-border: -	durability: long-term strength: moderate significance: of low significance

Table 22.1.1-8: The impact matrix of shipments during the phase of the establishing and construction of Paks II

22.1.1.1.3 Emissions of radioactive pollutants

The operational area of Paks II				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Radiographic examinations	radiological impact	reference person	direct: the direct environment of the point examined indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance

Table 22.1.1-9: Emissions of radioactive pollutants during the phase of establishing Paks II

22.1.1.2 Operating troubles and events of emergency

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Damage to diesel oil tank	escape of diesel oil	geological agent	direct: the surroundings of the tank indirect: within the operational area cross-border: -	durability: short-term strength: moderately strong significance: of moderate significance
Operating trouble of the communal waste water treatment plant constituting an event of emergency	rising of the level of nutrients increase in the suspended matter content increase of turbidity	phytoplankton, phytobenthos, macrozoobenthos, fishes	direct: <500m* indirect: - cross-border: -	durability: short-term strength: moderately strong significance: of low significance
Dripping of lubricants and fuels during the operation and storage of machines and vehicles and the leakage of lubricants and fuels in the event of the breakdown of machines	escape of lubricants and fuels	geological agent	direct: the direct environment of the event of damage indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance
The dispersing or leakage of waste during their storage at workplace or plant waste collection sites	contamination of the geological agent	geological agent	direct: the direct area of the event of damage at the affected parts of the workplace or plant waste collection sites indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance
The dispersing or leakage of waste during their movement from workplace **waste collection sites** to plant waste collection sites	contamination of the geological agent	geological agent	direct: the direct area of the event of damage along the affected section of the route of waste movement indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance
The dispersing or leakage of waste during their movement from plant waste collection sites to external facilities performing the recovery or disposal of the waste (due to an accident occurring during transportation)	contamination of the geological agent	geological agent	direct: the direct area of the event of damage along the affected section of the transport route indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance
Damage control in the event of operating failures or events of emergency	generation of non-radioactive waste	geological agent, town environment	direct: the direct environment of the event of damage indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance

Note:
*Impact distance recorded from the point of emission in Danube based on calculations.

Table 22.1.1-10: The impact matrix of operating failures and events of emergency during the period of establishing Paks II

22.1.2 THE IMPACT MATRIX OF THE OPERATION OF PAKS II

22.1.2.1 Normal operating conditions

22.1.2.1.1 The use of environmental elements

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Areas occupied (operational area, territory of the „island", unit wire and transmission line)	influencing of succession processes hindering of the development of plants, tesselation	flora and fauna	direct: The whole territory of Paks II (including the mobilisation area), the safety zones of transmission lines and the environment of the energy breaking structure and the recuperation power plant indirect: The whole territory of Paks II (including the mobilisation area), the safety zones of transmission lines and the environment of the energy breaking structure and the recuperation power plant cross-border: -	durability: long-term, strength: moderately strong significance: of moderate significance
	disappearance or modification of aboveground habitats pullulation of invasive species diminishing of the number of species			
	maintenance of the changed water balance conditions of the soil, soil compression, soil coverage	geological agent and underground water		
	operation of the workplace and plant waste collection sites, communal waste water treatment plant and the sludge drain-tank	geological agent	direct: workplace and industrial waste collection sites, communal waste water treatment plant and the area of the sludge drain-tank indirect: - cross-border: -	durability: long-term strength: tolerable significance: of low significance
Technological water extraction from the Danube	water extraction	aboveground water	direct: Danube indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance
Drinking water supply from the waterworks of Csámpa	utilization water extraction	underground water and geological agent	direct: the environment of the wells of Csámpa indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance

Table 22.1.2-1: The use of environmental elements during the phase of the normal operation of Paks II

22.1.2.1.2 Generation of traditional, non-radioactive environmental emissions and wastes

The operational area of the power plant				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
The operation and maintenance of Pak II Power Plant	noise burden caused by the noise emitted by equipment	the town environment (humans)	direct: varying between 1000-3500 m by directions, affecting: Paks, Dunaszentbenedek indirect:- cross-border: -	durability: long-term strength: moderately strong significance: of moderate significance
Operation of diesel-fuelled generators	noise burden	the town environment (humans)	direct: operational area indirect: operational area cross-border: -	durability: short-term strength: weak significance: of low significance
	emission of pollutants (CO, NOx, CxHy) in the air	air environment	direct: within a distance of 2000 m of point sources; indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance

Table 22.1.2-2: The impact matrix of the operational area of Paks II during the phase of normal operation of Paks II

The new warm water channel with the recuperation power plant at its end

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Channelling of the warmed-up cooling water in the Danube (132 m3/s)	modification of flow conditions near the inlet in the Danube	phytobenthos, MZB, fishes	direct: <250m* indirect: <250m* cross-border: -	durability: long-term strength: moderately strong significance: of low significance
	increase in the temperature near the inlet in the Danube spreading and competitive impact of invasive species	phytobenthos, makrozoobenthos, fishes	direct: cca. 1km* (Δt=2,5°C) indirect: cca. 1km* cross-border: -	durability: long-term strength: moderately strong significance: of high significance
	influencing of succession processes spreading of invasive species of plants thermal effect of the increase of the water temperature edge effects and fragmentation of habitats	flora	direct: the recuperation power plant and its surroundings indirect: the recuperation power plant and its surroundings cross-border: -	durability: long-term strength: moderately strong significance: of high significance
	change to the composition of the association of macroscopic invertebrates, diminishing number of species, change to the structure and density of the fish stock, spreading of invasive species of fish decreasing territory of dragonflies, growing productivity of the ecosystem, increasing growth, reproduction and activity of certain species	fauna	direct: the channel affected and its embankment, the appr. 1 km long section of the Danube and the floodplain forest below the water inlet, the Island indirect: the channel affected and its embankment, the appr. 1 km long section of the Danube and the floodplain forest below the water inlet, the Island cross-border: -	
Emission of technological wastewater (74 m3/hour – 0.02 m3/s)	minor increase in the toxic material content	the phytoplankton, phytobenthos, macrophytes, macrozoobenthos and fish populations of the warm water channel	direct: <1500m indirect: <1500m cross-border: -	durability: long-term strength: moderately strong significance: of moderate significance
Channelling of treated communal wastewater in the warm water channel (320 m3/day – 0.004 m3/s)	increasing nutrient content	the phytoplankton, phytobenthos, macrophytes, macrozoobenthos and fish communities of the warm water channel	direct: <50m indirect: <50m cross-border: -	durability: long-term strength: weak significance: of low significance
Rainwater drainage	increasing volume of toxic substances (oil) increasing nutrient content	the phytoplankton, phytobenthos, macrophytes, macrozoobenthos and fish communities of the warm water channel	direct: <50m indirect: <50m cross-border: -	durability: long-term strength: weak significance: of low significance
Operation and maintenance of the recuperation power plant	noise emission	the town environment (humans)	direct: within the 2000 m vicinity of the recuperation power plant indirect: - cross-border: -	durability: long-term, strength: moderately strong significance: of moderate significance

Note:
*Impact distance recorded from the point of emission in Danube based on calculations.

Table 22.1.2-3: The impact matrix of the new warm water channel and the recuperation hydroelectric power plant during the phase of the normal operation of Paks II

The track of the 400 kV unit wire and the 120 kV transmission line up to the new substation				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
The operation of the 400 kV unit wire and the 120 kV transmission line	electromagnetic fields collisions, electric shock birds can perch on them	**humans, fauna**	direct: the safety zone of transmission lines indirect: the safety zone of transmission lines cross-border: -	durability: long-term strength: medium significance: of moderate significance
	noise emission	humans, fauna	direct: <100 m indirect:- cross-border: -	durability: short-term strength: weak significance: of low significance
Removal of trees and bushes in the safety zone of the track, mowing	disturbance, interference influencing of succession processes spreading of invasive species of plants edge effects and fragmentation of habitats	flora	direct: the safety zone of transmission lines indirect: the safety zone of transmission lines cross-border: -	durability: long-term strength: weak significance: of moderate significance
	fragmentation of habitats corridor effect	fauna	direct: the safety zone of transmission lines indirect: the safety zone of transmission lines and the neighbouring areas cross-border: -	

Table 22.1.2-4: The impact matrix of the 400 kV unit wire and the 120 kV transmission line during the period of normal operation of Paks II

Transport routes				
Impact factor / activity	**Direct impacts / impact processes**	**Impacted**	**Impact area**	**Nature of the direct impact**
Shipments (operating personnel, materials, equipment, machines, devices)	emission of noise by vehicles	the town environment (humans)	direct: - indirect:- cross-border: -	durability: long-term strength: moderate significance: of low significance
	emission of exhaust fumes by vehicles	air environment	direct: within a distance of 100 m of the transport routes concerned indirect: - cross-border: -	
	disturbance diminishing of the number of individuals of certain species of animals	fauna	direct: the direct environment of the routes affected indirect: - cross-border: -	
	pollutants settling on or being washed in the soil and accumulating in plants and animals	flora, fauna and soil	direct: - indirect: - cross-border: -	
Shipment of waste (non-radioactive)	emission of exhaust fumes by vehicles	air environment	direct: within a distance of 100 m of the transport routes concerned indirect: - cross-border: -	durability: long-term strength: moderate significance: of low significance,
	emission of noise by vehicles	the town environment (humans)	direct: - indirect: - cross-border: -	

Table 22.1.2-5: The impact matrix of shipments during the phase of the normal operation of Paks II

22.1.2.1.3 Generation of radioactive emissions and waste

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
The operation of Paks II Nuclear Power Plant	controlled radionuclide emission, radiation load on the population	reference person	direct: within the boundaries of the safety zone to be determined (within a distance of 500 m under the dose limit) indirect: within the boundaries of the safety zone to be determined cross-border: -	durability: long-term strength: weak significance: of low significance,
	controlled changeling in Danube, mixing, dilution	reference person	direct: - indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance
	radiation load on plants and animals	reference plant or animal	direct: - indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance
Storage of solid and solidified radioactive wastes (temporary storage on the premises)	the impact of the radioactive waste generated in the direct environment of the facility	reference person, reference plant or animal	waste of low and medium activity: direct: premises indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance
			waste of high activity: direct: within the premises indirect: within the boundaries of the safety zone to be determined cross-border: -	durability: long-term strength: weak significance: of low significance

Table 22.1.2-6: The impacts of radioactive emissions and waste during the period of normal operation of Paks II

22.1.2.1.4 Spent fuel cassettes

Temporary storage of spent fuel cassettes on the premises	radiological impact	reference person, reference plant or animal	direct: within the boundaries of the safety zone to be determined indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance
Transportation of spent fuel cassettes	radiological impact	reference person, reference plant or animal	direct: along the railway line concerned indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance

Table 22.1.2-7: The impacts of spent fuel cassettes during the period of normal operation of Paks II

22.1.2.2 Abnormal operating conditions

22.1.2.2.1 Operating troubles and events of emergency

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Failure of the oil system of the turbine Failure of the transformer Failure of the diesel oil or lubricant tank or their pipelines Failure of the auxiliary oil system Failure of the containers of chemicals, the drawer or the pipelines	contamination of the geological agent	geological agent	direct: the direct environment of the event of damage indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance
Failure of the industrial wastewater tank or pipelines Damage to the communal wastewater pipelines	contamination of the geological agent	geological agent	direct: the direct environment of the event of damage indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance,
The emission of untreated wastewater in the receiving water due to the improper operation of the industrial wastewater treatment system	the sub-lethal intoxication of aquatic organisms caused by toxic substances	phythoplankton, phytobenthos, macrophites, macrozoobenthos, fishes	Theoretically, the impact of the emission of any untreated industrial wastewater in Danube may extend long downstream, however, with consideration to the diluting effect of the Danube, this cannot extend beyond 50 km	durability: short-term strength: strong significance: of high significance
Improper operation of the communal wastewater treatment system, emission of untreated wastewater in the receiving water	rising of the level of vegetal nutrients increase in the suspended matter content increase of turbidity	phythoplankton, phytobenthos, macrozoobentos, fishes	direct: <500m indirect: <500m cross-border: -	durability: short-term strength: moderately strong significance: of low significance,
Operation of diesel generators in the event of the failure of the external power supply	air pollution	air environment	direct: within a distance of 2000 m of point sources indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance
	noise burden	the town environment (humans)	direct: The premises of Paks Power Plant, the surrounding uninhibited territories, the Danube and certain real properties in the village Dunaszentbenedek indirect:- cross-border: -	
Forest fire along the track of the transmission line	damage to or destruction of plants	flora	direct: it may spread to an area of some m2 or even to several hectares in the environment of the power plant indirect: it may spread to an area of some m2 or even to several hectares in the environment of the power plant cross-border: -	durability: short-term strength: weak significance: of low significance,
	intoxication, suffocation or reduced viability of animals, the accumulation of pollutants in certain animal species, damage to or destruction of habitat complexes	fauna, humans		

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
The dispersing or leakage of waste during their storage at workplace or plant waste collection sites	contamination of the geological agent	geological agent	direct: the direct area of the event of damage at the affected parts of the workplace or plant waste collection sites indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance,
The dispersing or leakage of waste during their movement from workplace waste collection sites to plant waste collection sites	contamination of the geological agent	geological agent	direct: the direct area of the event of damage during the affected section of the route of waste movement indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance,
The dispersing or leakage of waste during their movement from plant waste collection sites to external facilities performing the recovery or disposal of the waste (due to an accident occurring during transportation)	contamination of the geological agent	geological agent	direct: the direct area of the event of damage along the affected section of the transport route indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance,
The dispersing or spilling of hazardous substances due to an accident occurring during transportation to the premises	contamination of the geological agent	geological agent	direct: the direct area of the event of damage along the affected section of the transport route indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance,
Damage control in the event of operating failures or events of emergency	generation of non-radioactive waste	geological agent, town environment	direct: the direct environment of the event of damage indirect: - cross-border: -	durability: short-term strength: moderate significance: of low significance,

Table 22.1.2-8: The impact matrix of operating troubles and events of emergency occurring during the operation of Paks II

22.1.2.2.2 Events comprised in the design basis

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Occurrence of events comprised in the design basis (with the containment remaining unharmed)	controlled emission of gases	reference person, reference plant or animal	direct: within the boundaries of the safety zone of the premises to be established indirect:- cross-border: -	durability: short-term strength: weak significance: of low significance,
Generation of contaminated equipment and devices during the occurrence of events comprised in the design basis and restoration works (with the containment remaining unharmed)	generation of waste of low and medium activity: (collection and preparation for treatment within the containment, transportation of the waste package for the purpose of treatment into the auxiliary building of the primary circuit)	reference person	direct: premises indirect:- cross-border: -	durability: short-term strength: weak significance: of low significance,
	the damaged fuel is dumped in the spent fuel storage pool within the containment	-	direct: containment indirect:- cross-border: -	durability: short-term strength: weak significance: of low significance,
Accident occurring during the shipment of radioactive waste	generation of waste of low and medium activity	reference person	direct: the edge of the road during transportation to the National Radioactive Waste Repository (NRHT) (at the moment of passing by) indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance,
Cumulated radiological impact (based on the calculation made concerning the occurrence of a TA4 event)	radiation load on the population	reference person	direct: within the boundaries of the safety zone to be determined indirect: - cross-border: -	durability: short-term strength: neutral significance: of moderate significance
	radiation load on plants and animals	reference plant or animal	direct: within the boundaries of the safety zone to be determined indirect: within the boundaries of the safety zone to be determined cross-border: -	durability: short-term strength: weak significance: of low significance,

Table 22.1.2-9: The impact matrix of operating troubles and events of emergency involving the emission of radioactive waste in Paks II

22.1.3 THE IMPACTS OF THE COMBINED OPERATION OF PAKS II AND PAKS POWER PLANT

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Use of water - drinking water supply from the waterworks of Csámpa	utilization water extraction change to water levels	groundwater	direct: the environment of the waterworks of Csámpa indirect: cross-border: -	durability: long-term, strength: moderately strong significance: of moderate significance
Channelling of cooling water (condenser, technological) in Danube (hydrological impact) (232 m^3/s)	modification of flow conditions near the inlet in the Danube	phytobenthos, MZB, fishes	direct: <500m* indirect: <500m* cross-border: -	durability: long-term strength: moderately strong significance: of low significance,
Thermal load caused by the emission of cooling water (condenser, technological) (232 m^3/s):	rise in temperature spreading and competitive impact of invasive species	phytobenthos, MZB, fishes	direct: cca. 11km* (Δt=2,5°C) indirect: cca. 11km* cross-border: -	durability: long-term (between 2030-2036) strength: strong significance: of high significance
The toxic load (chemicals, oils) caused by the emission of cooling water (232 m^3/s) and technological wastewater (cca. 148 m^3/hour – 0,041 m^3/s)	minor increase in the toxic material content	the phytoplankton, phytobenthos, macrophytes, macrozoobenthos and fish communities of the warm water channel	direct: <1500m indirect: <1500m cross-border: -	durability: long-term strength: moderately strong significance: of low significance,
Channelling of treated communal wastewater in the warm water channel (cca. 300+320 = 620 m^3/day – 0.007 m^3/s):	increasing nutrient content	the phytoplankton, phytobenthos, MZB and fish communities of the warm water channel	direct: <50m indirect: <50m cross-border: -	durability: long-term strength: weak significance: of low significance,
Emission of rainwater:	increasing volume of toxic substances (oil) increasing nutrient content	the phytoplankton, phytobenthos, MZB and fish communities of the warm water channel	direct: <50m indirect: <50m cross-border: -	durability: long-term strength: weak significance: of low significance,
Shipments (operating personnel, materials, equipment, machines, devices)	emission of noise by vehicles	the town environment (humans)	direct: - indirect:- cross-border: -	durability: long-term strength: moderate significance: of low significance,
	emission of exhaust fumes by vehicles	air environment	direct: within a zone of 100 m of the transport routes concerned indirect: - cross-border: -	
	disturbance diminishing of the number of individuals of certain species of animals	fauna	direct: the direct environment of the routes affected indirect: - cross-border: -	
	pollutants settling on or being washed in the soil and accumulating in plants and animals	indirect: flora, fauna and soil	direct: - indirect: - cross-border: -	

Impact factor / activity	Direct impacts / impact processes	Impacted	Impact area	Nature of the direct impact
Shipment of waste (non-radioactive)	emission of exhaust fumes by vehicles	air environment	direct: - indirect: - cross-border: -	durability: long-term strength: moderate significance: of low significance,
	emission of noise by vehicles	the town environment (humans)	direct: - indirect: - cross-border: -	
Shipment of radioactive waste	wastes of low and medium activity	reference person	direct: the edge of the road during transportation to the National Radioactive Waste Repository (NRHT) (at the moment of passing by) indirect: - cross-border: -	durability: short-term strength: weak significance: of low significance,
Cumulated radiological emissions	radiation load on the population	reference person	direct: within the boundaries of the safety zone to be determined indirect: within the boundaries of the safety zone to be determined cross-border: -	durability: long-term strength: weak significance: of low significance,
	radiation load on plants and animals	reference plant or animal	direct: - indirect: - cross-border: -	durability: long-term strength: weak significance: of low significance,

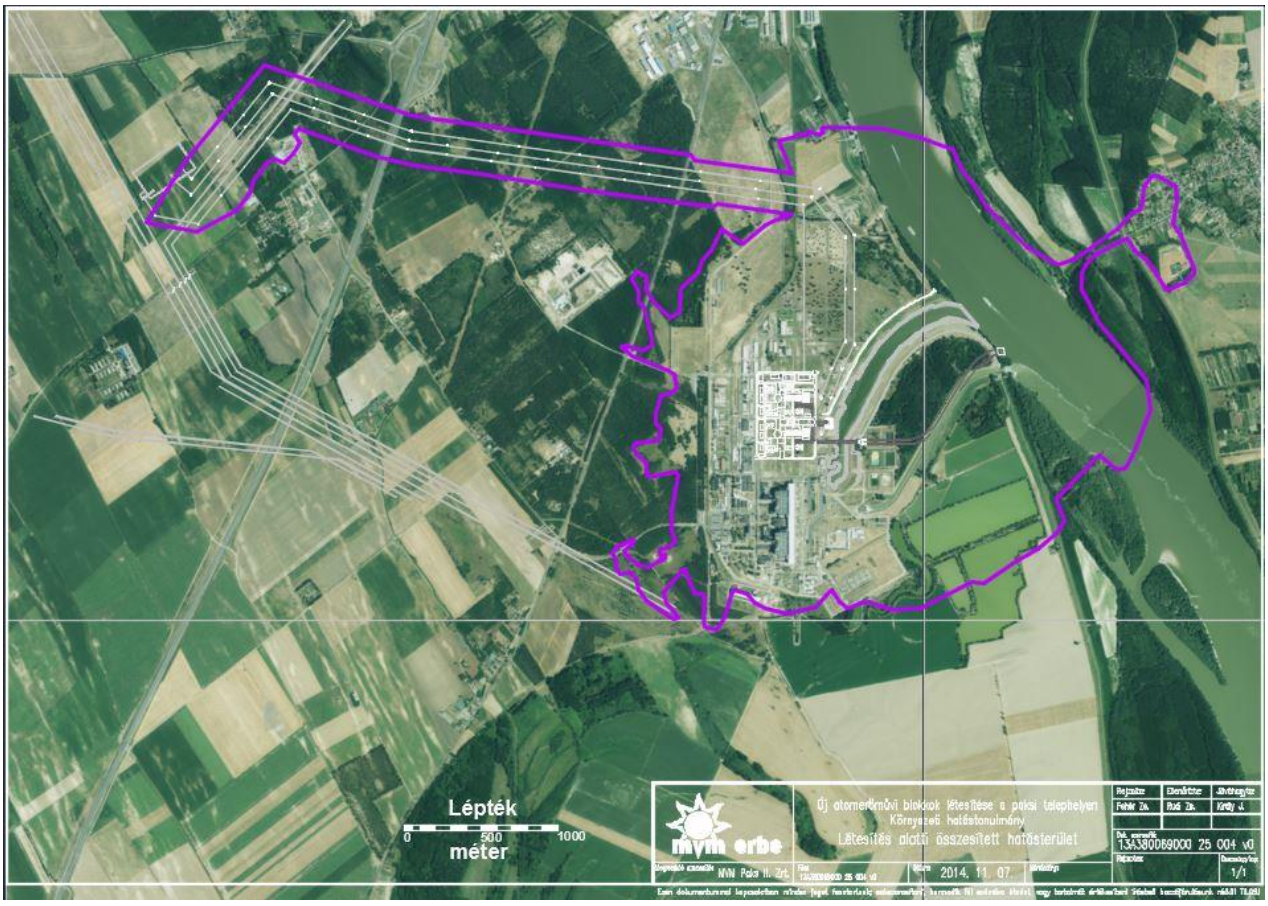
Note:
*Impact distance recorded from the point of emission in Danube based on calculations.

Table 22.1.3-1: The impacts of the combined operation of Paks II and Paks Power Plant

22.2 CUMULATED IMPACT AREAS

In summary, we also indicated the cumulated impact area of the direct impacts on the map, which we derived by cumulating the impact areas of the individual specialist areas and indicating the outermost contour lines of the individual impact areas.

22.2.1 THE CUMULATED IMPACT AREA OF THE ESTABLISHING OF PAKS II



Új atomerőművi blokkok létesítése a paksi telephelyen – környezeti hatástanulmány – Construction of new nuclear power plant units at the Paks site – environmental impact study
Létesítés alatti összesített hatásterület – aggregated impact area during construction
Lépték - scale

Figure 22.2.1-1: The cumulated impact area of the establishing of Paks II

The establishing of Paks II affects the territories of Dunaszentbenedek and Paks.

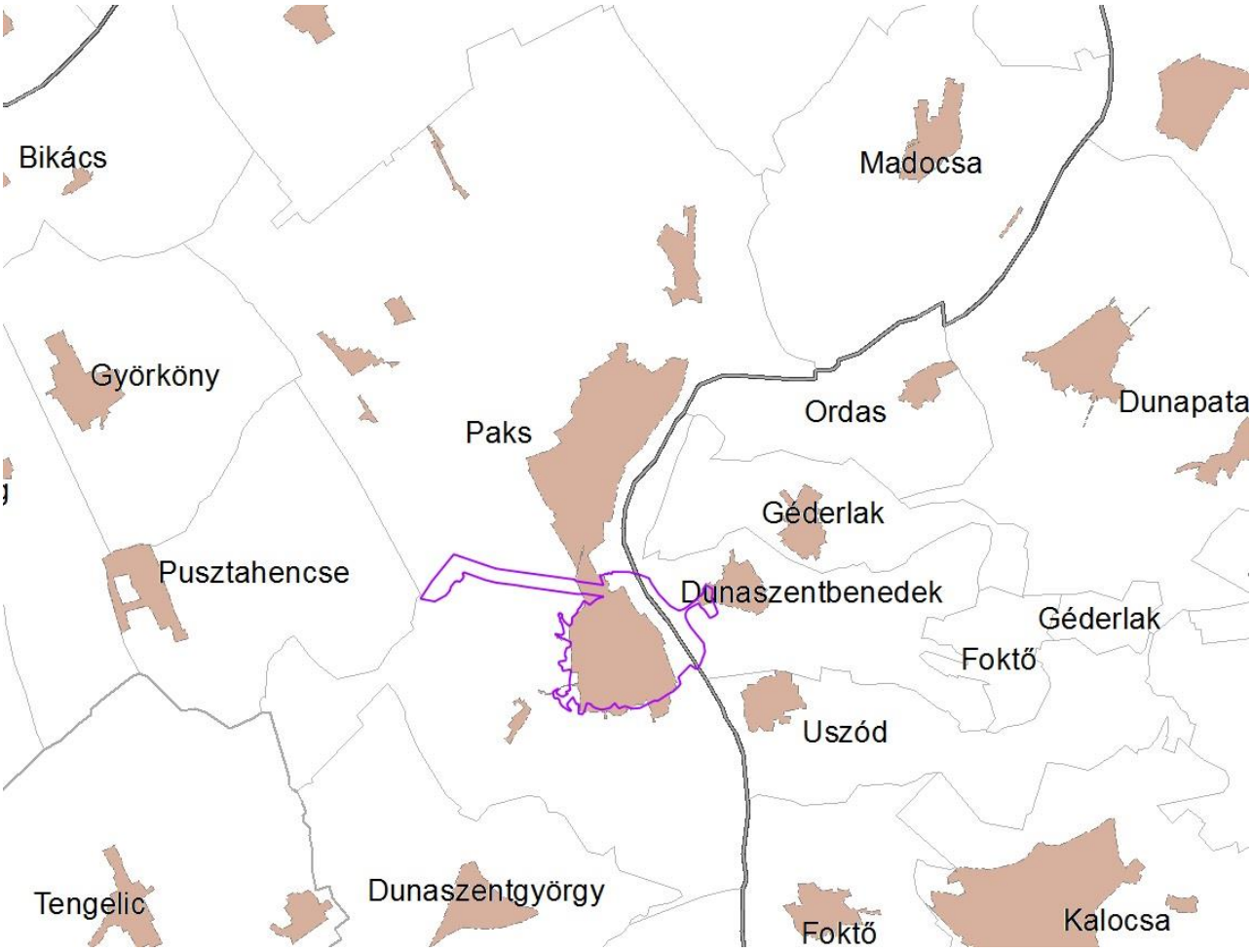
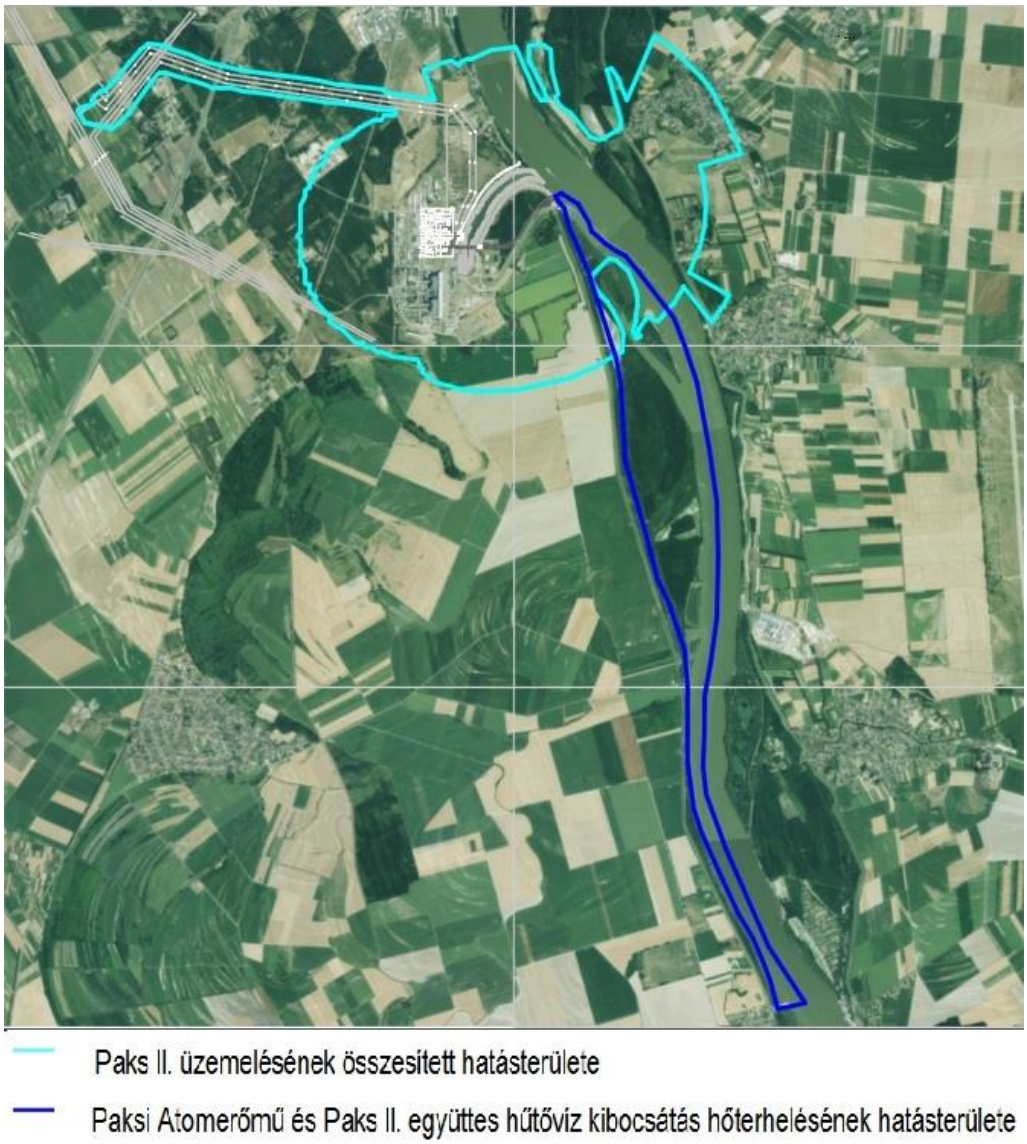


Figure 22.2.1-2: The cumulated impact area of the establishing of Paks II with municipal boundaries [22-1]

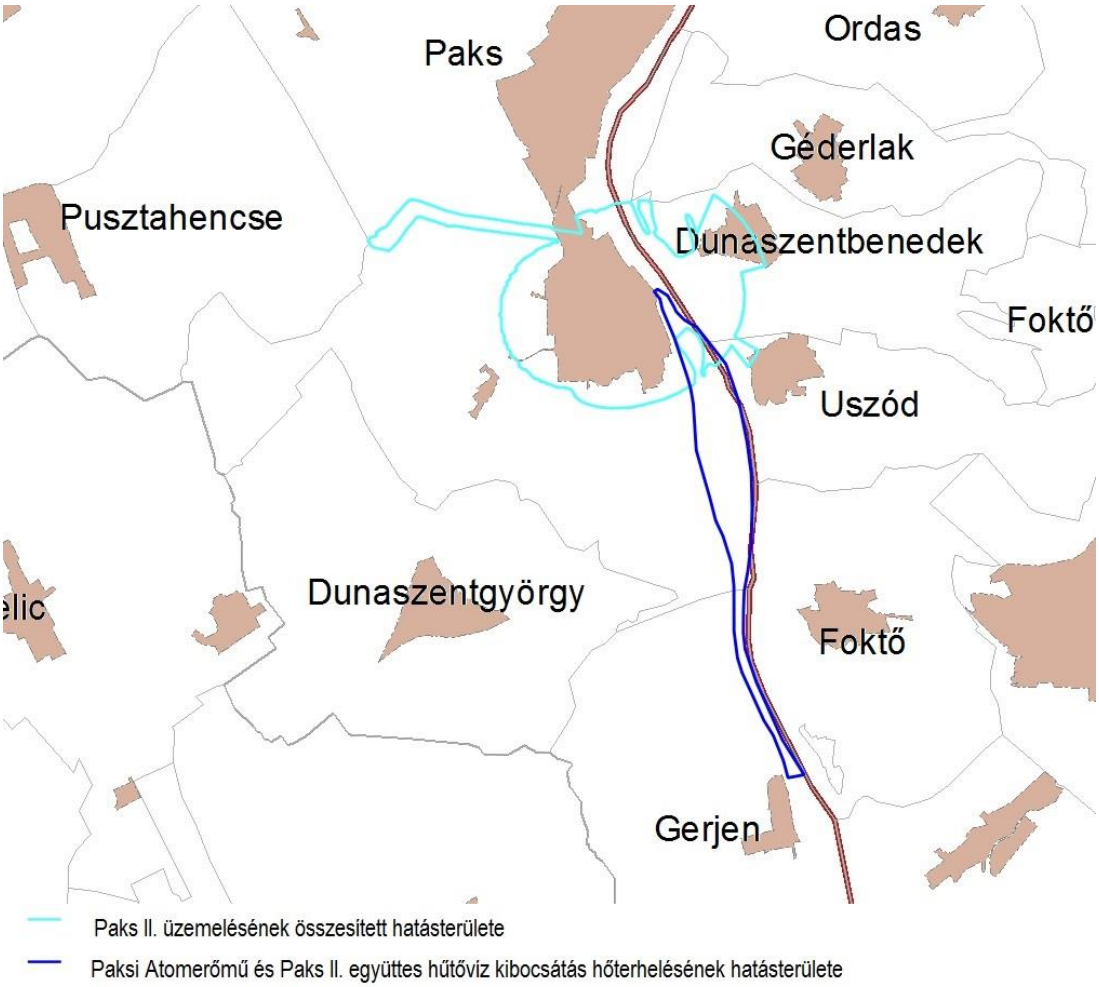
22.2.2 AGGREGATED IMPACT AREA DURING THE OPERATION OF PAKS II, AS WELL AS THE COMBINED IMPACT AREA OF PAKS II AND THE PAKS NUCLEAR POWER PLANT REGARDING THE THERMAL LOAD OF THE RIVER DANUBE



Paks II. üzemelésének összesített hatásterülete – aggregated impact area during the operation of Paks II
Paksi Atomerőmű és Paks II együttes hűtővíz kibocsátás hőterhelésének hatásterülete – combined impact area of the heat load caused by the cooling water discharges from Paks II and the Paks Nuclear Power Plant

Figure 22.2.2-1: Aggregated impact area during the operation of Paks II, as well as the combined impact area of Paks II and the Paks Nuclear Power Plant regarding the thermal load of the River Danube

The impact area of thermal load of the River Danube affects during the operation of Paks II the areas of the settlements of Dunaszentbenedek, Paks and Uszód. The impact area of thermal load caused by combined cooling water discharges from both power plants into the River Danube affects during the operation of Paks II and the Paks Nuclear Power Plant the areas of the settlements Paks, Dunaszentbenedek, Uszód, Foktő and Gerjen.



Paks II. üzemelésének összesített hatásterülete – aggregated impact area during the operation of Paks II
Paksi Atomerőmű és Paks II együttes hűtővíz kibocsátás hőterhelésének hatásterülete – impact area of thermal load caused by combined cooling water discharges from Paks II and the Paks Nuclear Power Plant

Figure 22.2.2-2: Aggregated impact area during the operation of Paks II, as well as the impact area during the operation of Paks II and the Paks Nuclear Power Plant regarding the thermal load caused by the combined cooling water discharges from both power plants into the River Danube, and the administrative borders [22-1]

22.3 BIBLIOGRAPHY

[22-1] http://gis.teir.hu/arcgis/services/TeIR_GIS/teirgis_kozigazgatas/MapServer/WMSServer