Table 5-1 Possible Impacts and proposed measures during Construction Phase

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
Natural Environment					
5.2.1.1. Topography and geology (including ground subsidence)	• Construction of the access roads and main collectors (left and right river bank)	• Negative impact -During construction of the access roads there will be disturbances of the local topography due to most likely embankments on which the roads should be constructed. The terrain is rather low and flat, and that is why it is expected that embankments would be needed. That will change slightly the topography; while changes in geology are not expected (design of the access roads will allow more information and more precise assessment). • Negative impact -As the route of the main collectors are passing through terrain which is mostly alluvium where high groundwater level is expected, during excavation and installation works on the main collector, possibilities for land slips and land slides exist. These land slips and slides could endanger the safety not only of the works but of the workers too.	C Local Permanent Immediate Irreversible A Local Temporary Immediate Reversible		• Design of the access roads shall be appropriate to the local conditions and geology on the routes. • The Final design for construction must integrate measures for preventing land slides and slips and to define protection measures for the workers and their safety. During construction, measures foreseen for slopes stability from the Final design must be fully respected.
	• Construction of the siphon structure across the River Vardar	• No impact			
	• Preparatory works at the location and Excavation works	• Negative negligible impact -There are not many trees and vegetation on the WWTP location, so during the preparatory works phase, there will be negligible disturbances of the local topography and no impact at all on the geology. • Negative impact	C Local Permanent Immediate Irreversible		• There is no need for special mitigation measure

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		-The geology on the location of the WWTP is defined as silty sands on the surface with low values of water permeability coefficient and gravely sands with high values of water permeability coefficient and zero cohesion. Due to this fact, there are high possibilities for land slips and land slides during excavation works for the WWTP structures. These land slips and slides could endanger the safety not only of the works but of the workers too.	A Local Temporary Immediate Reversible		• The Final design for construction of the WWTP must integrate measures for preventing land slides and slips during excavation works and to define protection measures for the workers and their safety. During construction, measures foreseen for slopes stability from the Final design must be fully respected.
	• Transport and disposal of surplus excavated material	• Negative impact - Due to large amount of excavated material, disposal on the construction site can temporary disturb the local topography and geology.	C Local Temporary Immediate Reversible		• Excavated materials shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining surplus material shall be disposed at designated area approved by the Investor.
	• Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• Negative impact - There will be low negative impact on the topography, due to constructed facilities of the WWTP. • Negative impact due to ground subsidence - Due to poor geo-mechanical features and low bearing capacity of the clayey sandy silts on surface layers, there should be no foundation on these layers at depth from 1 to 3 m. However, if foundation is necessary to be done in these layers, improvement of the geo-mechanical features of the soil has to be performed.	C Local Permanent Immediate irreversible B Local Temporary Delayed Irreversible		• During the preparation of the Final design, local topography conditions to be considered in order to minimize the disturbance of the topography (exp. to avoid high structures, final image of the facilities to fit with the local natural environment etc.) • Depending of the geo-mechanical features and bearing capacity of the soil, ground subsidence of the soil with material with better characteristics should be foreseen. The final design must include technical measures for improvement of the bearing capacity of the soil, where needed (appropriate type of foundation, replacement of the soil with better material, compacting

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					and etc.).
	• Disposal of construction waste	• Negative impact - Improper disposal of the construction waste on the construction site and surrounding can temporary disturb the local topography and geology.	C Local Temporary Immediate Reversible		• Construction waste shall be, regularly transported from the construction site and disposed at the designated landfill for construction waste.
	• Installation of the equipment	• No impact			
	• Construction of accommodation facilities for the workers	• No impact			
5.2.1.2. Water quality					
5.2.1.2.1. Groundwater	• Construction of the access roads and main collectors (left and right river bank)	• Negative impact -The routes for the access roads are mainly on flat area where higher groundwater level could be expected. Due to this, during excavations for some of the road accompany structures (rainfall water evacuation, crossings under the roads, culverts etc), possible disturbances of the groundwater table can be expected. More detailed information should be provided in the next phase of the roads designs.	B Local Temporary Immediate Reversible		• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied.
		• Negative impact -The routes for the main collectors are mainly on flat area where higher groundwater level could be expected. Due to this, during excavations for main collectors is very possible to expect disturbances of the groundwater table. These disturbances could result in disruptions of supply of the local wells which are used for domestic water supply or irrigation.	B Local Temporary Immediate Reversible		• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied. • Special attention should be given to safe evacuation of the pumped groundwater and

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		-Another negative impact is related to evacuation of the pumped groundwater from the construction trenches and its discharge downstream.	B Local Temporary Immediate Reversible		its discharges, in order to avoid possible suffusion.
	• Construction of the siphon structure across the River Vardar	• Negative impact -Construction of the siphon across the River Vardar could be one of the critical construction phases, due to the need for creation of river diversion structures. As the excavation and installation works shall be done on rather lower level than the river bed, large disturbances of the groundwater table can be expected. As at the actual phase of the project there is no information about the siphon design and technical characteristics or about the micro-geology at the site, there is no possibility for more accurate assessment of the impact. -The impact from the discharged pumped groundwater is expected to be negligible as the pumped groundwater could be discharged downstream, in the riverbed.	A Local Permanent Immediate Reversible C Local Temporary Immediate Reversible		• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied. • Fully to respect the measures foreseen in the Final design.
	• Preparatory works at the location and Excavation works for WWTP	• Negative impact -The geology on the location of the WWTP is defined as silty sands on the surface with low values of water permeability coefficient and gravely sands with high values of water permeability coefficient and zero cohesion. Due to this fact, there are high possibilities for land slips and land slides during excavation works for the WWTP structures. Due to this, large disturbances of the groundwater table can be expected during the excavation works. These disturbances could result in disruptions of supply of the local wells which are used for domestic	A Local Temporary Immediate Reversible		• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		water supply or irrigation. -Another negative impact is related to evacuation of the pumped groundwater from the construction trenches and its discharge downstream. -The structures of the WWTP are of significant sizes, so the excavation works would be rather voluminous. It is expected to have large areas "without" materials (holes) that are imposed to possible pollution due to soil erosion and possible increased turbidity.	B Local Temporary Immediate Reversible B Local Temporary Immediate Reversible		• Evacuation of the pumped ground water has to be done according to the Final design and to apply the foreseen measures. • Adopting proper erosion control and soil conservation practices during excavation and other measures defined in the Final design.
	• Transport and disposal of surplus excavated material	• No impact is expected due to transport of the surplus excavated material • Negative impact from disposal -There is very low possibility for negative impact due to improper disposal of the excavated material. As the excavated material is from the location (no pollution), the only possible impact is the weight of the large quantities of the excavated material disposed at the site near the excavation works. The weight can provoke instability of the ground and possible disturbances of the groundwater table can occur. Also as a result of overloading of vehicles with excavated material, part of the material might not reach the designated area for disposal.	C Local Temporary Immediate Reversible		• In order to minimize the surplus excavated materials, If possible to be reused as construction material, or used as covering material at Drisla landfill. Remaining surplus material shall be disposed, according to the Final design, at designated area approved by the Investor.
	• Construction of the structures of the WWTP (civil works, use of	• Negative impact -During construction works, the groundwater level shall be kept on low level in order to enable	B Local		• Final design for construction must integrate a design for safe drainage of the

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	heavy machinery and vehicles)	normal construction process. This will require drainage works which will disturb the groundwater level.	Temporary Immediate Reversible		groundwater. All foreseen measures should be fully respected and implemented, in order to avoid suffusion.
		-Construction of the WWTP will be done using heavy vehicles and machinery. During operation and maintenance of these machines and vehicles at the site, there is a possibility for pollution of the ground water due to leakages of fuel or oils or due to applied chemicals during construction phase. This pollution is even more possible due to high permeable ground on the construction site.	B Local Temporary Immediate Reversible		• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust). • Refuelling or servicing only on impermeable ground and treatment of the oils. • Special measures to be foreseen in order to avoid potential spills or leaks. • Restrict the washing of vehicles and equipment on the site. • Safe storage of chemicals during construction. • Construction to be done on time, according to the planned time schedule (to avoid prolonged works and prolonged pollutions).
	• Disposal of construction waste	• Negative impact - Improper disposal of the construction waste on the construction site and surrounding can impact the ground water quality.	C Local Temporary Immediate Reversible		• Construction waste shall be, regularly and timely transported from the construction site and disposed at the designated landfill for construction waste.
	• Installation of the equipment	• Negative impact -The installation of the equipment will be done using heavy machines and other supporting vehicles and tools. Equipment will be of significant dimensions which makes the installation rather complex process. During the operation of the heavy machines, vehicles and tools, possible pollution of the ground water may occur due to leakages and spills of fuels and oils. This impact is of local character and rather low, because the structures will be constructed	C Local Temporary Immediate Reversible		• Fully to respect the protection measures defined in the Final design for installation.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		and possibilities for infiltration of the fuels and oils into the groundwater will be limited.			
	• Construction of accommodation facilities for the workers	• Negative impact -The construction site will engage very big number of workers. Due to closeness of the city of Skopje, the workers might not be accommodated at the site during all the time. However, the accommodation facilities shall be constructed for daily accommodation of the workers, supervision staff and other utility offices. These facilities include water supply and sewerage systems. If there is no proper installation of systems and treatment of the wastewater, there is a possibility for pollution of the groundwater. Also, groundwater could be polluted due to improper management of the solid waste, generated from the accommodation facilities.	B Local Temporary Immediate Reversible		• Wastewater shell be collected and adequately treated. • Solid waste shall be collected and disposed on the Drisla landfill.
5.2.1.2.2. Surface water/ river Vardar water quality (including the bottom sediment)	• All constructional activities	• No impact on surface water • No impact on bottom sediment			
	• Construction of the access roads and main collectors (left and right river bank)	• Negative impact - At some locations of the access road on the left bank, the route goes very close to the river Vardar. Due to the strong connection of the water from the river and surrounding groundwater, there is a possibility for pollution of the water in the river due to increased surface runoff and soil erosion during excavations. The impact is assessed as indirect impact, because the original subject of pollution is the groundwater in the surrounding area.	B Local Temporary Immediate Reversible		• The Final design shall propose measures for prevention of the pollution of the water in the river through the contact with the groundwater. These measures shall be fully respected as well as the proposed construction technology.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		• Negative impact - At some locations of the main collector on the left bank, the route goes very close to the river Vardar. Due to the strong connection of the water from the river and surrounding groundwater, there is a possibility of pollution of the water in the river due to leakages of fuels and oils from the operation of heavy machinery and vehicles into the groundwater during excavation and installation works on the main collector. The impact is assessed as indirect impact, because the original subject of pollution is the groundwater in the surrounding area.	B Local Temporary Immediate Reversible		• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust). • Refuelling or servicing only on impermeable ground and treatment of the oils. • Special measures to be foreseen in order to avoid potential spills or leaks.
	• Construction of the siphon structure across the River Vardar	• Negative impact - Although the construction of the siphon shall be done in a dry surrounding (with evacuated and diverted flows of the River Vardar), still it is possible that during operation of heavy machinery and vehicles, water of the River Vardar can be polluted. The pollution is mainly due to leakages of fuel and oils from the machinery and vehicles. -There is a possibility of pollution of the water in the river due to soil erosion from exposed ground and possible increased turbidity and sediment in the river during excavation and installation works.	B Local Temporary Immediate Reversible B Local Temporary Immediate Reversible		• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust). • Refuelling or servicing only on impermeable ground and treatment of the oils. • Special measures to be foreseen in order to avoid potential spills or leaks. • Adopting proper erosion control and soil conservation practices during construction.
	• Preparatory works at the location and Excavation works	• No impact due to preparatory works • Negative impact - Due to the strong connection of the water from the river and surrounding groundwater, there is a possibility of pollution of the water in the river	B Local Temporary		• Measures listed above for protection of the groundwater during excavation works to be applied.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		due to increased surface runoff and soil erosion during excavations. The impact is assessed as indirect impact, because the original subject of pollution is the groundwater in the surrounding area.	Immediate Reversible		
	• Transport and disposal of surplus excavated material	• No impact			
	• Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• Negative impact - During heavy rainfalls there is a possibility for water pollution due to increased surface runoff on the construction site. - Water in the river Vardar can be polluted from fuels and oils coming from heavy machinery and vehicles through connection with ground water at the site (high coefficient of permeability $1{,}15x10^{-4}$ m/s). The impact is assessed as indirect impact, because the original subject of pollution is the groundwater in the surrounding area.	C Local Temporary Immediate Reversible B Local Temporary Immediate Reversible		• The Final design shall comprise measures for protection of the river water quality during construction. These measures shall be fully respected as well as proposed construction technology. • Measures listed above for protection of the groundwater from leakages to be applied.
	• Disposal of construction waste	• No impact			
	• Installation of the equipment	• Negative impact -The installation of the equipment will be done using heavy machines and other supporting vehicles and tools. Equipment will be of significant dimensions which makes the installation rather complex process. During the operation of the heavy machines, vehicles and tools, possible pollution of the water in the river	C Local Temporary Immediate Reversible		• Measures listed above for protection of the groundwater from leakages to be applied.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		may occur due to leakages and spills of fuels and oils through the strong connection between the groundwater and the water in the river. The impact is assessed as indirect impact, because the original subject of pollution is the groundwater in the surrounding area.			
	• Construction of accommodation facilities for the workers	• Negative impact -There is a possibility of pollution of the water in the river (or indirectly through the contact with the groundwater) due to discharges of untreated wastewater into the river or ground water and/or improper solid waste disposal.	B Local Temporary Immediate Reversible		• Measures for treatment of the wastewater to be applied and solid waste to be collected and disposed on the Drisla landfill, using good waste management practices.
5.2.1.3. Hydrology of the River Vardar	• Construction of the access roads and main collectors (left and right river bank)	• No impact			
	• Construction of the main collector (left and right bank)	• No impact			
	• Construction of the siphon structure across the River Vardar	• Negative impact -In order to construct the siphon across the River Vardar, different river diversions structures and tail dams shall be constructed. These structures will change the river bed morphology temporarily but the impact is rather high. With these structures, there will be impact on the river flow direction, while the river discharges will stay unchanged.	A Local Temporary Immediate Reversible		• Final design shall comprise the solutions for the river diversion with minimum disruption of the riverbed. The measures foreseen and the proposed construction technology shall be fully respected.
	• Preparatory works at the location and Excavation works	• No impact			

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	• Transport and disposal of surplus excavated material	• No impact			
	• Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• No impact			
	• Disposal of construction waste	• No impact			
	• Installation of the equipment	• No impact			
	• Construction of accommodation facilities for the workers	• No impact			
5.2.1.4. Biodiversity / Flora and Fauna	• All construction activities	• Negative impact - Impact on biota due to contaminated environmental media (air, water, soil) - Noise pollution/ vibration due to operation machinery/ equipment and due to traffic of construction vehicles. The enlarged frequency of vehicles on the road will cause negative impact on amphibians (amphibians are key indicators of the overall quality of a certain habitat), especially in the spring months i.e. within the period of the breeding season for these animals - Disturbance to habitats/ loss of flora and fauna species during construction works. The reptiles will use their habitat area and due the construction activities will accumulate heat from the warmed asphalt on the road and could easily become victims of the traffic	B Local Temporary (short-term)/ Immediate Irreversible		• Non-performance of any activities or interventions in the forest part of the locality of Ostrovo while construction of WWTP • Use of appropriate construction methods • To plan carefully construction works to minimize impact on habitats, flora and fauna, careful siting, alignment, design of associated infrastructure to minimize impacts • Careful timing of works and work seasonally, as appropriate • To avoid loud beep signals from vehicles and machinery in the areas where faunal species inhabit • Careful selection of sites to be used for constructional materials stockpiles/

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		- Concerning the birds and mammals, that are mainly concentrated within the protected area "Ostrovo" and the wetland "Ezerce", direct negative impact will appear during the construction phase of the WWTP into a form of increased noise, frequency of people and vehicle that will cause disturbance, especially within the breeding season			construction wastes disposals, thus selecting the site which will not affect the protected area Ostrovo. • Clean-up of construction sites • To rehabilitate work sites/ asphalt plant operation sites quarries/ borrow areas, access roads by planting grass and trees and other relevant measures
5.2.1.5. Air quality (including meteorology)	• Construction of the access roads and main collectors (left and right river bank) • Preparatory works at the locations	• Negative impact - Dust emission; - Air pollution by components of combustion gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC); - Increased emission of emitted gasses on existing roads connected with access roads, due to the increased frequency of construction vehicles. - Emissions from mobile/ statutory sources operating asphalt plant	B Local Temporary Immediate Reversible		• To plan carefully construction works to minimize air pollution; • To control construction methods and used machinery and equipment; • Careful timing of works in residential areas)/ restrict construction to certain hours; • Restrictions on speed of construction vehicles, especially in residential areas; • Control by water or other means/ water spaying twice a day during construction to avoid dust, watering of access roads to minimize dust formation, if applicable. • Vehicles delivering materials should be well maintained and covered to prevent/ reduce spills, emissions and dispersion.
	• Construction of the siphon structure across the River Vardar	• Negative impact - Dust emission; - Air pollution by components of combustion gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC).	C Local Temporary Immediate Reversible		• To plan carefully construction works to minimize air pollution; • To control construction methods and used machinery and equipment ; • Vehicles delivering materials should be well maintained and covered to prevent/ reduce spills, emissions and dispersion.
	• Excavation works • Transport and disposal of	• Negative impact - Dust emission; - Air pollution by components of combustion	B Local		• To plan carefully construction and excavation works to minimize air pollution;

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	surplus excavated material • Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC). - Emissions from mobile/ statutory sources operating asphalt plant - Air pollution by volatile hydrocarbons aggravated by unfavourable whether conditions (wind, hot, etc).	Temporary Immediate Reversible		• To control construction methods and used machinery and equipment; • Careful timing of works in residential areas)/ restrict construction to certain hours. • Restrictions on speed of transport vehicles, especially in residential areas; • Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.
	• Disposal of construction waste	• Negative impact - Dust emission; - Air pollution by components of combustion gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC).	C Local Temporary Immediate Reversible		• To control used transport machinery and equipment; • Careful timing of works in residential areas)/ restrict transport to certain hours; • Restrictions on speed of transport vehicles, especially in residential areas; • Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.
	• Installation of the equipment	• Negative impact - Air pollution by components of combustion gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC);	C Local Temporary Immediate Reversible		• To control used transport machinery and equipment; • Careful timing of works in residential areas)/ restrict transport to certain hours; • Restrictions on speed of transport vehicles, especially in residential areas; • Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.
	• Construction of accommodation facilities for the workers (water supply, sewerage, waste disposal)	• No Impact			

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	• Construction of the access roads (left and right river bank) • Preparatory works at the locations (tree cutting, humus removal and flattening of the location) • Construction of the main collector (left and right bank)	• Negative impact - Dust emission; - Air pollution by components of combustion gases of construction mechanization and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC); - Increased emission of emitted gasses on existing roads connected with access roads, due to the increased frequency of construction vehicles.	B Local Temporary Immediate Reversible		• To plan carefully construction works to minimize air pollution; • To control construction methods and used machinery and equipment; • Careful timing of works in residential areas)/ restrict construction to certain hours; • Restrictions on speed of construction vehicles, especially in residential areas; • Control by water or other means/ water spaying twice a day during construction to avoid dust, watering of access roads to minimize dust formation, if applicable. • Vehicles delivering materials should be well maintained and covered to prevent/ reduce spills, emissions and dispersion.
	• All construction activities	• No impact on meteorology			
5.2.1.6. Landscape and Visual effects	• All construction activities	• Negative impact - Local visual impacts/ disturbed landscape - Damage to vegetation along the construction - Damage or degradation to some natural and manmade landscape valuable sites, due to easier access - Loss of trees and other vegetation - Dust, waste, debris etc. during construction works, thus, visually non- esthetic conditions due to cluttering of waste, and spoils, dug up roads and pavements.	B Local Temporary Immediate Irreversible		• To minimize construction site's size in order to minimize impact on landscape/ careful planning, and design of works • Screening/ fencing of intrusive items • Good construction practices have to be implemented – including fencing and protection of building sites according to national legislation. • The design of large infrastructure objects (WWTP, pumping stations, etc…) should be made in most environments friendly way and by implementing BAT for these types of structures. • Careful de-commissioning of construction areas/ waste disposal sites/ clean up construction sites after road construction works are finished/ re-vegetation of work area, etc.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					• Excavated materials, if any, should be used for backfilling of borrows and gravel pits • Enhance non-esthetic through proper housekeeping of construction site • Disposal of construction wastes at the approved sites quickly • Repair pavements and roads after sewer laying work is completed • Completing the construction activity by removing all spoils
5.2.1.7. Water use	• Construction of the access roads and main collectors (left and right river bank)	• Negative impact -In order to reduce the emission of dust, spraying with water will be applied. This measure will minimize the dust on the construction sites, but it will increase the water use. The impact is assessed as low, because the water used can be of lower quality.	C Area affected depending on the water sources Temporary Immediate Irreversible		• To use water of lower quality for spraying • Water for spraying can be abstracted from the river Vardar or from wells at nearby locations. • To use cisterns with adequate characteristics that will allow efficient water use.
	• Construction of the siphon structure across the River Vardar	• No impact			
	• Preparatory works at the location and Excavation works	• No impact			
	• Transport and disposal of surplus excavated material	• Negative impact - In order to reduce the emission of dust, spraying with water on the WWTP site and access roads will be applied. This measure will minimize the dust on the construction site and access roads, but it will increase the water use. The impact is assessed as low, because the	C Area affected depending on the water		• To use water of lower quality for spraying • Water for spraying can be abstracted from the river Vardar or from wells at nearby locations. • To use cisterns with adequate characteristics that will allow efficient water

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		water used can be of lower quality.	sources Temporary Immediate Irreversible		use.
	• Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• Negative impact - In order to reduce the emission of dust, spraying with water on the WWTP site will be applied. This measure will minimize the dust on the construction site, but it will increase the water use. The impact is assessed as low, because the water used can be of lower quality. - Proposed activities can affect water drilling systems, downstream the locations of activities, as well private wells.	C Area affected depending on the water sources Temporary Immediate Irreversible		• To use water of lower quality for spraying • Water for spraying can be abstracted from the river Vardar or from wells at nearby locations. • To use cisterns with adequate characteristics that will allow efficient water use.
	• Disposal of construction waste	• Negative impact - In order to reduce the emission of dust, spraying with water on the disposal site for construction waste at WWTP site will be applied. This measure will minimize the dust on the disposal site, but it will increase the water use. The impact is assessed as low, because the water used can be of lower quality.	C Area affected depending on the water sources Temporary Immediate Irreversible		• To use water of lower quality for spraying • Water for spraying can be abstracted from the river Vardar or from wells at nearby locations. • To use cisterns with adequate characteristics that will allow efficient water use.
	• Installation of the equipment	• No impact			
	• Construction of accommodation facilities for the workers	• Negative impact - The accommodation facilities at the site will be supplied with drinking and sanitary water. Due to the size of the construction site, it is expected increased water use for drinking and sanitary purposes. As there is no water supply system in the surrounding, the possible solutions are to use the local groundwater (if	B Area affected depending on the water sources		• To use the water efficiently applying water saving measures.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		the water quality is adequate) or to supply the facilities by cisterns filled with water from the public water supply system. The impact is assessed as medium, due to the size of the site and number of workers and other staff present. -	Temporary Immediate Irreversible		
Social Environment					
5.2.1.8. Involuntary resettlement and land acquisition	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact - Impact on the land acquisition budget - Involuntary land acquisition on part of some land lords - Demolition of the existing objects and resettlement of the population • Positive impact - Material satisfaction on part of the landlords of the private owned land	A Local Permanent Immediate Irreversible	A Local Permanent Immediate Irreversible	• Launching campaigns and raising population awareness regarding the importance and gains from the project through public hearings, flyers, educative workshops etc.; • Procedures for land acquisition should be followed according to the related legislations.
5.2.1.9. Livelihood and local economy	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact -Derivation of greater financial means on part of the relocated population related to traveling to the work places, institutions and other needs • Positive impact	B Local Temporary Immediate Reversible		• Rerouting of the local population commutation towards the central city area • Involving population in construction of the WWT system • Stimulating the population to start local business associated with the project • Stimulating of the firms-contractors to involve local population in construction of the WWT system

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		- Greater rate of population employment/ decreasing rate of unemployment - Activation of private owned business - Increasing of the family incomes - Increased involvement of the firms		B Local Temporary Immediate Reversible	
5.2.1.10. Institution as local decision making	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact - Overlapping of the responsibilities of the involved decision making bodies on the central and local level, can affect implementation of the construction phase. • Positive impact - Resolved conflict of competences among social institutions to be involved in the project - More efficient passing of decisions - Emphasised citizens influence in passing decisions	C Local Temporary Immediate Reversible	A Local Permanent Immediate Irreversible	• Defining the city and municipalities competences • More efficient cooperation between the city and municipalities • Increasing of the budget assignments for the activities related to the water supply and waste water treatment • Drafting and realization of measures related to water pollution protection at municipal level; • Strengthening of the NGO sector
5.2.1.11. Public infrastructure and services	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact - Rerouting of the traffic - More complicated commuting of pedestrians and bicycles - Reorganization of population commutation - Disrupting of the existing traffic infrastructure - Greater possibility of traffic accidents occurrence; - Deterioration of the ambient air quality - Increased noise and vibrations - Possible disruption of the water supply to the downstream populated areas due to lowering of	B Local Temporary Immediate Reversible		• Installing adequate traffic rerouting road signalization • Facilitation of the local population commutation towards the central city area • Establishing road remediation measures for damages, caused by transportation and construction machinery during the construction of the WWT system • Putting adequate warning visuals in relation with the activities

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		the ground water level - Violation of the Skopje's protected areas - increased electricity consumption • Positive impact - Increased activation on part of the industrial capacities and services at local/city level		B Local Temporary Immediate Reversible	• Preventive measures for ambient air pollution prevention • Preventive measures against increased noise and vibration pollution • Rational consumption of electricity • Stimulating local industry and services to involve in WWT system construction
5.2.1.12.Misdistribution of benefits and loss/damage	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• No impact			
5.2.1.13. Local conflicts of interest	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact - Inadequate compensation to the citizens and transformation of the private owned land - Partial involvement of the project parties in decision making	B Local Temporary Immediate Reversible		• Abiding to the existing legal regulations at national and local level, pertaining to construction of such facilities • Broader and transparent participation of all immediate concerned and responsible parties in this project
5.2.1.14. Archeological and cultural heritage	• Construction of: the access roads and main collectors (left and right bank), siphon structure across the river Vardar and	• No impact			

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	WWTP				
5.2.1.15. Health and safety (including infection diseases)	• Construction of the access roads, construction of the main collector (left and right bank), siphon structure across the river Vardar and WWTP	• Negative impact - Decreased immunological resistance of the local population (increased number of respiratory and other diseases) - Deterioration of the project engaged workers health (respiratory diseases, dermatological diseases, eye and hearing illnesses) - Hazard of injuries on part of the workers and general population - Health deterioration resulting from increased noise and vibrations	B Local Temporary Immediate Reversible		• Providing measures for air pollution protection; • Providing occupational safety and health measures • Providing measures for transporting means and equipment protection • Providing measures for noise and vibration protection(acoustical shielding, vibration isolation etc.)
Public Hazard					
5.2.1.16. Noise and vibration	• Construction activities regarding: access roads and main collectors (left and right bank); siphon structure across the River Vardar; structures of the WWTP (civil works, use of heavy machinery and vehicles); accommodation facilities for the workers • Preparatory works at the location, Excavation works and	• Negative impact - During the construction phase, due to construction works and activities resulting from the use of constructional machinery ,increased levels of noise are expected to occur. It is estimated that the average SPLs will range between 65 db and 70 db, although there might be cases of increased levels up to 90 db in short time intervals.	B Local Temporary Immediate Reversible		• To plan carefully construction works to minimize acoustic pollution • Equipment emitting noise over 90 db should be avoided • To control construction methods and used machinery and enhanced equipment maintenance for the purpose of mineralization of possible high noise levels • Careful timing of works in residential areas)/ restrict construction to certain hours; • To avoid loud beep signals in settlements/ to minimize disturbance to residents; • Restrictions on speed of construction vehicles, especially in residential areas.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	transport and disposal of surplus excavated material • Disposal of construction waste • Installation of the equipment				
5.2.1.17. Waste	• Construction of the access roads and main collectors (left and right river bank)	• Negative impact - During construction of the access roads and main collectors (left and right river bank), there is generation of waste from excavation, destruction of the existing structures on the route and construction waste.	B Local Temporary Immediate Reversible		• Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the Investor.
	• Construction of the siphon structure across the River Vardar	• Negative impact - During construction of the siphon there is generation of waste from cleaning of the river bed, excavation and construction.	B Local Temporary Immediate Reversible		• Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the Investor.
	• Preparatory works at the location, excavation works, transport and disposal of surplus excavated material	• Negative impact - Waste from clearing of the site, humus and trees removal is generated. According to the conditions of the site, there shall be not a large quantity of this waste. There is no intensive vegetation or trees at the site. Due to this, the impact is assessed as low.	C Local Temporary Immediate Reversible		• Cut trees and humus can be used by the local population for heating, construction material and composting. Remaining waste shall be disposed on the designated location approved by the Investor.
		• Negative impact - The quantities of the excavations are expected to be large. During transport of the surplus	A Local		• Overloading of vehicles with excavated material should not be allowed.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		material, seepage on the construction site, but also on the access roads and wider areas should be avoided.	Temporary Immediate Reversible		• Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the Investor (excess materials not to be dumped at illegal dumps).
	• Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• Negative impact - During construction there is generation of construction waste and liquid waste from the vehicles and heavy machinery (fuel and oils). Improper handling especially of liquid waste can provoke large negative impact.	A Local Temporary Immediate Reversible		• Generated waste to be removed regularly and on time from the construction site. • If possible, construction waste to be reused by the Contractor. Remaining waste shall be disposed at designated area approved by the Investor. • Collection, treatment and disposal of the liquid waste shall be performed in compliance with the national regulations for the relevant type of liquid waste.
	• Installation of the equipment	• Negative impact - Improper handling and disposal of generated liquid waste from possible leakages and spills of oils during installation of equipment can have rather limited and low negative impact.	C Local Temporary Immediate Reversible		• Collection, treatment and disposal of the liquid waste shall be performed in compliance with the national regulations for the relevant type of liquid waste.
	• Construction of accommodation facilities for the workers	• Negative impact - Improper collection and disposal of the generated communal solid waste from accommodation facilities can have limited low negative impact.	C Local Temporary Immediate Reversible		• By applying best management practices, the waste shall be collected, transported and disposed on the Drisla landfill.
5.2.1.18. Soil pollution	• Construction activities regarding: access roads and main collectors (left	• Negative impact - The compaction of soil (loss of original quality, reduction in fertility) can be expected due to vehicle movement, ground contamination from the spillage of materials such as vehicle fuel,	C Local Temporary Delayed		• To plan carefully construction works to minimize land effects and ensure soil pollution prevention • To minimize construction site's size/ to

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	and right bank); siphon structure across the River Vardar; structures of the WWTP (civil works, use of heavy machinery and vehicles); accommodation facilities for the workers • Preparatory works at the location, Excavation works and transport and disposal of surplus excavated material • Disposal of construction waste • Installation of the equipment	sewage sludge, construction waste, chemicals. - Damage to soil structure due to traffic of vehicles and storage of constructional materials in the immediate vicinity of construction works - Due to excavation and earthwork: soil erosion, loss of top soil, silting and blocking of drainage, which can cause slush; damage to existing structures - Temporary uncontrolled surface run-off due to construction of drainage channels - Soil pollution due to leaks of lubricants of transport vehicles - Soil pollution by components of combustion gases emitted by construction vehicles (esp. heavy metals) - Soil contamination due to constructional materials - Soil contamination due to improperly arranged temporary accommodation facilitates	Reversible		minimize land affected/ to ensure soil pollution prevention • To restrict traffic movements and use low ground pressure machines • To ensure accuracy of construction works/ to avoid spills, leaks, etc. Thus, transportation vehicles should be enclosed to avoid potential leakage • Promptly clean-up spills of transported material on site • To avoid loss of vegetation along the construction • To avoid construction works during heavy rains/ to mitigate velocity and volume of polluted surface run-off • Carry out landslides prevention activities/ physical stabilization of slopes (retaining walls, piles, etc.), if needed • To provide proper construction waste disposals • To provide proper stockpiling of constructional materials • Organize properly temporary sewage facilities • To rehabilitate borrow areas, quarries and temporary haul /access roads by planting grass and trees and other measures • Proper design and installation drainage and retaining structures/ civil engineering structures/ clean up drainage channels/ culverts to minimize the risk of erosion and landslides on down lands • Planting / rehabilitation of vegetation (buffer strips) along the construction to minimize spreading of combustion gases/ particulates/ dust, if appropriate • Backfilling and restoration of eroded channels to natural conditions/ re-vegetation, if appropriate

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					• Clean up of the work site/ restoration of damaged areas after construction works are finished
5.2.1.19.Offensive odors		• No impact			

Legend for Impact Scale:

Magnitude: A – Large Impact; B – Medium Impact; C – Low/Uncertain Impact
Type of impact: (+) – Positive Impact; (-) - Negative Impact
Extent: Local Impact (at the site); Wider Impact (in the surrounding area)
Duration: Permanent Impact; Temporary Impact
Timing: Immediate; Delayed
Reversibility: Reversible; Irreversible

Table 5-2 Possible Impacts and proposed measures during Operational Phase

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
Natural Environment					
5.3.1.1. Topography and geology (including ground subsidence)	• Operation of equipment for sewerage treatment and effluent production	• No impact			
	• Operation of equipment for sludge production	• No impact			
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• Negative impact - Possible disturbance of the local topography is expected.	C Local Temporally Immediate Reversible		• To dispose sludge at landfill for hazardous waste
5.3.1.2. Water quality					
5.3.1.2.1.Ground water	• Operation of equipment for sewerage treatment and effluent production	• Negative impact - During operation of the WWTP, there is a possibility for pollution of the groundwater due to leakages of the system for sewerage treatment and effluent production.	B Local Temporary Immediate Reversible		• The system for the treatment should ensure minimization of leakages of wastewater to groundwater (connections between pipes and tanks should be water-tight).
		- Another possible pollution of the groundwater comes from refuelling of vehicles and equipment and washing of vehicles on the site. The infiltration of the fuel and washing wastewater into the groundwater can provoke negative impact assessed as medium.	B Local Temporary Immediate Reversible		• Strictly control and protect the refuelling of vehicles and equipment on the site. • Restrict the washing of vehicles and equipment on the site. • The quality of the effluent should be met with the standards.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		• Positive impact - The operation will impact positively on the quality of the groundwater as there will be no direct discharges of the wastewater into the River Vardar. The pollution of the groundwater in Skopje area is mainly due to polluted water from Vardar through strong connection with the groundwater and leakages of the collectors of wastewater.		A Wider Permanent Immediate	
	• Operation of equipment for sludge production	• Negative impact - During operation of the WWTP, there is a possibility for pollution of the groundwater due to leakages of the system for sludge production. - During the drying process of the sludge on the drying beds, there is high possibility for pollution of the groundwater due to infiltration of drying beds leachate . As the drying beds are covering area of 18 ha, the possible negative impact is assessed as large affecting wider area, actually wider groundwater aquifer	B Local Temporary Immediate Reversible A Wider Temporary Immediate Irreversible		• The system for the sludge production should ensure minimization of leakages of sludge to groundwater (connections between pipes and tanks should be water-tight). • All requirements for construction of the sludge drying beds, especially for providing water impermeable basis, efficient drainage system for leachate and flood protection structures must be respected. • Measurements of leachate should be taken.
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• Negative impact - There is a possibility for groundwater pollution with hazardous substances due to leakages and infiltration of the leachate	A Wider Temporary Immediate Irreversible		• To provide water impermeable basis and flood protection structures on the location for the temporary disposal of the sludge • Measurements of leachate should be taken.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
5.3.1.2.2. Surface water/ River Vardar water quality (including bottom sediment)	• Operation of equipment for sewerage treatment and effluent production	• Positive impact -The main positive impact from the operation of the WWTP is the Improved water quality of the River Vardar, on larger area (along the Skopje Valley and downstream of the city). • Negative impact - There is a possibility for indirect negative impact on the river Vardar water quality through the strong connection with the groundwater. The water of the river could be polluted from polluted groundwater due to leakages of the system for sewerage treatment and effluent production, as well as due to refuelling of vehicles and equipment and washing vehicles. • Positive impact - Before the existence of the WWTP, the bottom sediment was polluted due to the discharged wastewater in the river. When the wastewater will be treated, there will be no possibility for pollution of the bottom sediment	B Wider Permanent Immediate Irreversible	A Wider Permanent Immediate Irreversible A Wider Permanent Immediate Irreversible	• To apply the same measures as proposed for protection of the groundwater.
	• Operation of equipment for sludge production	• Positive impact -The main positive impact from the operation of the WWTP is the improved water quality of the River Vardar, on larger area (along the Skopje Valley and downstream from the city). • Negative impact - During operation of the WWTP, there is a possibility for pollution of the water in the river through the strong connection with polluted groundwater due to leakages of the system for	B Local Temporary Immediate	A Wider Permanent Immediate Reversible	• To apply the same measures as proposed for protection of the groundwater

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		sludge production. Reversible - During the drying process of the sludge on the drying beds, there is high possibility for pollution of the groundwater due to infiltration of leachate. Through the strong connection with groundwater, the water in the River Vardar could be polluted, as indirect impact of the polluted groundwater. • Positive impact - Before the existence of the WWTP, the bottom sediment was polluted due to the discharged wastewater in the river. When the wastewater will be treated, there will be no possibility for pollution of the bottom sediment	A Local Temporary Immediate Reversible	A Wider Permanent Immediate Irreversible	• To apply the same measures as proposed for protection of the groundwater.
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• Negative impact - There is a possibility for pollution of the water in the river as indirect impact through the strong connection with groundwater. The groundwater could be polluted due to leakages and infiltration of the leachate.	A Local Temporary Immediate Reversible		• To apply the same measures as proposed for protection of the groundwater.
5.3.1.3. Hydrology of the River Vardar	• Operation of equipment for sewerage treatment and effluent production	• Negative impact -Before the existence of the WWTP, the wastewater was discharged directly into the River Vardar, which increased the flows of the river. With collection of the wastewater by the main collectors, the quantity of the river flows shall be decreased up to the location of the WWTP. Accordingly, this impact is assessed as low on wider area of Skopje valley. • Positive impact	C Wider Permanent Immediate Reversible		• In summer period if the flow in the river is very low, additional quantities of water can be discharged in the river Vardar from upstream reservoirs Matka or Kozjak.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		- Downstream of the WWTP there will be increase of the river flows due to discharged treated wastewater.		C Local Permanent Immediate Irreversible	
	• Operation of equipment for sludge production	• No impact			
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• No impact			
5.3.1.4. Biodiversity/ Flora and Fauna	• All operational activities	• Negative impact - The operation of the WWTP, thus the facilities and human presence will approach the borders of the protected area Ostrovo and cause negative impact on the fauna of birds and large mammals, because they are sensitive on the disturbances caused by close human frequency. Hence, during this operational phase people's movement and truck or other vehicles movement will be with lower frequency. However, if certain mitigation measures will be properly implemented the operation phase will have low negative or even only positive impact on the conservation of the fauna in general. • Positive impact - The operation of the WWTP will have positive impact on the restoration and maintaining of the	C Local Temporary Immediate Irreversible	A Local Permanent	• Discharge of water from both side of the protected area. The water could be used from the WWTP after its treatment, or by pipeline, directly from the River Vardar. After the protected area the water will be diverted by natural flow in the River Vardar. In that way will be achieved restoration of the natural habitat Ostrovo ("Island"), that is significant habitat for numerous legally protected and threatened faunal species. Furthermore, the water barrier around the protected area Ostrovo will reduce the negative human impact on the wild fauna, caused by the close human presence. Especially the birds are much more tolerant on human approach when are isolated by water barrier.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		aquatic fauna in the River Vardar. Also, the operation of the WWTP will cause enrichment of the ornithological content during the year. Operation of WWTP and sludge during beds, thus creation of artificial areas, will increase the plant vegetation which absorbs anions-nitrates and phosphates and etc. Therefore, the food for breeding birds will be enriched.		Delayed Reversible	
5.3.1.5. Air quality (including meteorology)	• All operational activities	• Negative impact - The operation activities will cause emissions into air from energy sources –boiler facility (GHGs-methane, CO_2 , NO_x) and digesters for activated sludge.	C Local Temporary Immediate Reversible		• Minimize emissions of GHG from the technological processes – treatment by: – Routinely drain condensate traps to remove water and avoid back pressure, – Ensure that the digester system is balanced in respect of pressure to reduce emergency pressure relief operation, – If the gas is vented to a combustion unit for energy recovery, a stand-by flare should be provided in case of combustion system malfunction, – Regularly inspect the operation of the flare to check in particular that the pilot will light the flare even if the flare has been overloaded, – Avoid turbulence of the sludge after digestion, – Covering of digested-sludge feed channels, mixing wells and overflow take-offs, – Regular inspection of the seals of floating gasholders, – Any covers or equipment provided for this source will require careful evaluation in relation to safety and explosion control.

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
		- Air pollution by components of combustion gases of transportation trucks and vehicles (CO_2 , NO_x, SO_x, CO, NMVOC, CH_4); • No impact on meteorology is expected in all phases of operation	C Local Temporary Immediate Reversible		• All vehicles should be procured on the bases of fulfillment of the EURO 5 emission norms.
5.3.1.6. Landscape and Visual effects	• All operational activities	• Negative impact - Treatment work of WWTP site might pose an non- aesthetic sight but it affects only close residents • Positive impact - Improved manmade landscape	C Local Permanent Delayed Reversible	B Local Permanent Delayed Reversible	• Plantation of trees in and around the pumping stations/treatment plant would improve the aesthetics
5.3.1.7. Water use	• Operation of equipment for sewerage treatment and effluent production	• No impact -In general, water will be used for sanitary purposes, washing of vehicles and roads, but the quantity is not expected to be high.			

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	• Operation of equipment for sludge production	• No impact			
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• No impact			
Social Environment					
5.3.1.8. Involuntary resettlement and land acquisition	• All operational activities	• No impact			
5.3.1.9. Livelihood and local economy	• All operational activities	• Negative Impact -Rising of the operational and maintenance costs of WWT system (citizens, firms and other beneficiaries will be affected) • Positive Impact - Greater rate of population employment (permanent and contractual employment) - Decreasing of the unemployment rate - Increasing of the overall budget on municipal/city level - Activation of private owned businesses - Increasing of the family incomes	B Wider Permanent Immediate Irreversible	B Wider Permanent Immediate Irreversible	• Raising of the population awareness regarding the importance of constructing WWT system through public hearings, flyers, educational workshops etc. • Public announcement of job vacancies; • Promoting of the positive effects resulting from activation of the private owned businesses • Promotion of the project as a source of incomes for many families

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
5.3.1.10. Institution such as local decision-making	• All operational activities	• Positive Impact - The operation of the wastewater treatment system will have positive impact on the local decision-making institutions, because, the responsibilities of the WWTP operator will be clearly defined and control procedure which will be carried out by the relevant institutions regarding the compliance of WWTP operation with the requirements stated within the national regulations will be as well clearly defined.		A Local Permanent Immediate Irreversible	• More efficient cooperation between the city and municipalities • Strengthening of the NGO sector; • Increasing of the budget assignments concerning water supply and water treatment activities • Passing and realizing decisions and measures regarding water pollution protection on a municipal/city level
5.3.1.11. Public infrastructure and services	• All operational activities	• Negative Impact - Increased electricity consumption for the operation of WWT system • Positive Impact - Improved water supply of the downstream populated areas with good quality groundwater	B Local Permanent Immediate Irreversible	A Local Permanent Immediate Irreversible	• Construction of substation with power transformer for WWTP with proper capacity • Utilization of alternative energy sources
5.3.1.12.Misdistribution of benefits and loss/damage	• All operational activities	• No impact			
5.3.1.13. Local conflicts of interest	• All operational activities	• No impact			
5.3.1.14. Archeological and cultural heritage	• All operational activities	• No impact			

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
5.3.1.15. Health and safety (including infectious diseases)	• All operational activities	• Negative Impact - Deterioration of the workers health (respiratory diseases, skin diseases, eye and hearing diseases etc.) - Hazard of occupational injuries occurrence - deterioration of the workers health as a result of increased noise, vibrations and excessive odour - Epidemics occurrence due to increased presence of bugs in vicinity of the drying beds • Positive Impact - Improved health of the downstream population as a result of the improved quality of drinking water	C Local/ Wider Permanent Immediate Irreversible	A Wider Permanent Immediate Irreversible	• Providing occupational safety measures; • Providing workers with personal protective equipment due to increased noise, vibrations and odours; • Applying adequate measures for insect control
Public Hazard					
5.3.1.16. Noise and vibration	• All operational activities	• Negative impact - Potential noise source is equipment such as booster fans, pumps, etc. which may generate certain levels of noise and vibrations. The estimated sound pressure levels during the operation of WWTP are expected to be around 50 db, while the noise level at the nearest populated areas is expected to be negligible. Moreover, majority of the noise sources are located away from the WWTP border fence. Consequently, WWTP would have insignificant contribution to the cumulative background noise.	C Local/ Wider Permanent Immediate Reversible		• Ensure that equipment in the plant is properly located so that the overall noise meets environmental noise criteria. • Provide anti-vibration cushioning for specific parts of the noise emitting equipment to reduce vibration and noise. • Incorporate noise barriers, silencers or enclosures for any equipment emitting high levels of noise. • The WWTP shall be operated and maintained so as to ensure that it avoids causing nuisance through noise in

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					accordance with the national regulations (Decision on terms and conditions for noise annoyance on citizens (Official Gazette of RM No. 64/1993) as well as S.I. No. 787 of 2005 - European Communities (Waste Water Treatment, prevention of Odour and Noise) Regulations, 2005.
5.3.1.17.Waste (communal and commercial waste, solid waste from mechanical treatment, sludge and chemicals)	• Operation of equipment for sewerage treatment and effluent production	• Negative impact - Within this part of the treatment, there is generation of scrape waste from the screens, oil and sand traps. Beside that solid waste, the administrative premises, laboratory, etc produce communal and commercial waste. In general, there is a possibility of pollution due to generated waste on the site, although of rather low intensity.	C Local Temporary Immediate Reversible		• Good waste management practices to be applied and to dispose the waste at Drisla landfill. • Appropriate storage areas to be found for waste collected on screens and sand traps.
	• Operation of equipment for sludge production	• Negative impact - Generation of large quantity of sludge (72,4 m^3/day) provokes large negative impact on all media (soil, groundwater, air, etc). Improper treatment of sludge could lead to putrefaction and other related problems such as bad odour, health effects etc.	A Wider Permanent Immediate Irreversible		• Alternatives for sludge treatment and for reduction of quantity to be analyzed and to propose optimal solution according to the local conditions. • Dried sludge should be disposed of on a specified landfill site with proper precautions or to be given to the farmers for agricultural application, if meets the standards.
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• Negative impact -Generation of large quantity of sludge with hazardous substances provokes large negative impact on all media (soil, groundwater, air, etc).	A Wider Permanent Immediate Irreversible		• Final disposal of the sludge to be on landfill for hazardous waste.
5.3.1.18. Soil pollution	• Operation of equipment for sewerage	• Negative impact - During operation of the WWTP, there is a	B		• The system for the treatment should

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
	treatment and effluent production	possibility for pollution of the soil due to leakages of the system for sewerage treatment and effluent production. - Another possible pollution of the soil comes from refuelling of vehicles and equipment and washing of vehicles on the site. The infiltration of the fuel and washing wastewater into the soil can provoke negative impact assessed as medium.	Local Temporary Immediate Reversible		ensure minimization of leakages of wastewater to soil (connections between pipes and tanks should be water-tight). • Strictly control and protect the refuelling of vehicles and equipment on the site. • Restrict the washing of vehicles and equipment on the site.
	• Operation of equipment for sludge production	• Negative impact - During operation of the WWTP, there is a possibility for pollution of the soil due to leakages of the system for sludge production. - During the drying process of the sludge on the drying beds, there is high possibility for pollution of the soil due to infiltration of drying beds leachate . As the drying beds are covering area of 18 ha, the possible negative impact is assessed as large affecting wider area.	B Local Temporary Immediate Reversible B Wider Temporary Immediate Irreversible		• The system for the sludge production should ensure minimization of leakages of sludge to soil (connections between pipes and tanks should be water-tight). • All requirements for construction of the sludge drying beds, especially for providing water impermeable basis, efficient drainage system for leachate and flood protection structures must be respected.
	• Sludge (with dangerous substances) disposal on temporary storage at WWTP site	• Negative impact - There is a possibility for soil pollution with hazardous substances due to leakages and infiltration of the leachate	A Wider Temporary Immediate Irreversible		• To provide water impermeable basis and flood protection structures on the location for the temporary disposal of the sludge
5.3.1.19.Offensive odour	• Mechanical treatment (Inlet facilities)	• Negative impact - In general the inlet facilities are potentially considerable source of odour from incoming sewage, and storage and handling of debris from screenings and grits. In order to avoid odour complaint it is common to cover the inlet facilities and vent the air to odour filter equipment.	A Wider Permanent Immediate Reversible		• Regular cleaning and flushing of screens and influent channels • Grit and screenings transfer and storage in a manner to prevent spillage. Ideally, the screenings after washing should be dewatered and bagged (or stored in a covered skip).

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					• Lowering discharge points to minimise turbulence and evaporation of odours • Balancing the inlet waste water flow to equalize the load during the day • Imported sludge to go straight to sludge storage tanks and not through inlet works
	• Primary Sedimentation	• Negative impact - If there is anaerobic activity before or during the primary sedimentation operation, the size of these tanks can make them a significant source.	A Wider Permanent Immediate Reversible		• Pre-treatment of incoming septic sewage or possible chemical dosing with nitrate or iron salts • Reducing hydraulic retention times • Improving de-sludging both in efficiency and frequency and regular cleaning of the tanks, sumps, scum and grease removal equipment – aim to ensure that sludge is not held on the bases of the tanks for more than planned • Reduce turbulence at the overflow point by reducing the overflow height
	• Secondary Sedimentation	• Negative impact - At this stage the effluent and sludge should be oxidised and provided sludge retention time is carefully managed, odour release should not be a problem.	C Wider Temporary Immediate Reversible		• Odour emission can be avoided by minimising sludge retention time in the final tank.
	• Aeration Tank	• Negative impact - The turbulence at the Aeration Tank may reduce partial pressure of the liquid and facilitate evaporation of volatile odorous compounds	B Wider Temporary Immediate Reversible		• Ensure that conditions remain aerobic • Maintenance and inspection of the air diffusion system and liquid conveying are of great importance. • Measures that should be taken to minimise odour releases from this source, include: – Increased aeration by methods which minimise the generation of aerosols (for example sub-surface diffuse aeration) and maintain the activated sludge particles in suspension – Shrouding of the mechanical aerators to reduce aerosol formation

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					– Covering the inlet distribution chamber and anoxic zone
	• Sludge handling, Thickening and Drying beds	• Negative impact - Sludge and bio-solids handling are usually the most significant source of odour release and good sludge management is a key issue. All raw sludge and bio-solids will release odour largely dependent upon time of retention.	A Wider Temporary Immediate Reversible		• Sludge should be processed (thickened, digested or dewatered) as soon as possible after generation as retention will lead to anaerobic conditions. • It is good practice to minimise the potential storage of sludge before treatment and storage for un-stabilised sludge should be limited to a maximum capacity of 24-hours production • All tanks for un-stabilised sludge storage and processing should be covered and vented to odour filter equipment • Replacement of drying beds with mechanical dewatering plant will help to minimise retention and mitigate the odours • Avoid open storage of un-stabilised sludge or sludge cakes • Application of BAT for sludge treatment, transport and disposal at landfill
	• Anaerobic Digestion	• Negative impact - Anaerobic digestion will be performed within closed digester. The gas produced in an anaerobic digester will be odour and will only be vented untreated in the case of an emergency activation of a safety device. Normally the gas will be used as a fuel in boilers to heat the digester or used for fuel as combined heat and power system. In some cases an excess of gas production necessitates the operation of the pressure-relief valve and burning-off the surplus through a flare.	C Local Temporary Immediate Reversible		• Routinely drain condensate traps to remove water and avoid back pressure • Ensure that the digester system is balanced in respect of pressure to reduce emergency pressure relief operation • If the gas is vented to a combustion unit for energy recovery, a stand-by flare should be provided in case of combustion system malfunction • Regularly inspect the operation of the flare to check in particular that the pilot will light the flare even if the flare has been overloaded • Avoid turbulence of the sludge after digestion • Regular inspection of the seals of floating

Environmental components	Project activity	Type of Potential Impact	Scale of the impact		Suggested Mitigation Measures
			Negative (-)	Positive (+)	
					gasholders • Any covers or equipment provided for this source will require careful evaluation in relation to safety and explosion control

Legend for Impact Scale:

Magnitude: A – Large Impact; B – Medium Impact; C – Low/Uncertain Impact
Type of impact: (+) – Positive Impact; (-) - Negative Impact
Extent: Local Impact (at the site); Wider Impact (in the surrounding area)
Duration: Permanent Impact; Temporary Impact
Timing: Immediate; Delayed
Reversibility: Reversible; Irreversible

CONTENT

TABLES

6 ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is a specific plan developed to ensure that the project is implemented in an environmental sustainable manner and that all stakeholders understand the potential environmental risks arising from the proposed project and take appropriate actions to properly manage that risk. The EMP also ensures that the project implementation is carried out in accordance with the design by taking appropriate mitigation actions to reduce adverse environmental impacts during its life cycle. The plan outlines roles and responsibility of the key stakeholder for certain actions. The EMP is requested as legal obligation for obtaining permit / licence and according to the Sectorial EIA Guidelines – Waste Water Treatment Plant it should act as an Operational Manual for the WWTP.

The EMP is comprised of three main components: Mitigation Plan, Monitoring Plan and Capacity Development and Training Plan.

6.1 Mitigation Plan

Detailed description of the mitigation measures is given in the Table 6-1, where the impacts for each environmental component are defined together with appropriate mitigation measures. In the Mitigation Plan, each mitigation measure is accompanied with information about the environmental component, location, responsible institution/personnel and implementation schedule.
The Mitigation Plan is elaborated for the construction and operational phase and it is presented in the Table 6-1 and Table 6-2.

Table 6-1 Mitigation Plan – Construction Phase

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
Physical / Natural Environment				
Topography and geology (including ground subsidence)	Access roads and main collectors (left and right river bank) – construction works	• Design of the access roads shall be appropriate to the local conditions and geology on the routes. • The Final design for construction must integrate measures for preventing land slides and slips and to define protection measures for the workers and their safety. During construction, measures foreseen for slopes stability from the Final design must be fully respected.	Designer / Consultant Designer / Consultant Contractor	During preparation of the Final Design During preparation of the Final Design During construction
	WWTP site - Preparatory works at the location and Excavation works	• The Final design for construction of the WWTP must integrate measures for preventing land slides and slips during excavation works and to define protection measures for the workers and their safety. During construction, measures foreseen for slopes stability from the Final design must be fully respected.	Designer / Consultant Contractor	During preparation of the Final Design During construction
	WWTP site - Transport and disposal of surplus excavated material	• Excavated materials shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining surplus material shall be disposed at designated area approved by the Investor.	Contractor	During construction
	WWTP site -Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• During the preparation of the Final design, local topography conditions to be considered in order to minimize the disturbance of the topography (exp. to avoid high structures, final image of the facilities to fit with the local natural environment etc.)	Designer / Consultant	During preparation of the Final Design

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Depending of the geo-mechanical features and bearing capacity of the soil, ground subsidence of the soil with material with better characteristics should be foreseen. The final design must include technical measures for improvement of the bearing capacity of the soil, where needed (appropriate type of foundation, replacement of the soil with better material, compacting and etc.).	Contractor Designer / Consultant	During construction During preparation of the Final Design
	WWTP site / designated landfill for construction waste -Disposal of construction waste	• Construction waste shall be, regularly transported from the construction site and disposed at the designated landfill for construction waste.	Contractor	During construction
Groundwater	Access roads and main collectors (left and right river bank) – construction works	• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied. • The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied. • Special attention should be given to safe evacuation of the pumped groundwater and its discharges, in order to avoid possible suffusion.	Designer / Consultant Contractor Designer / Consultant Contractor Contractor	During preparation of the Final Design During construction During preparation of the Final Design During construction During construction
	Siphon across the River Vardar – construction	• The Final design must include measures for avoiding or minimizing the	Designer / Consultant	During preparation of the Final Design

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
	works	disturbance of the groundwater table. During construction, the foreseen measures should be fully respected and applied.	Contractor	During construction
		• Fully to respect the measures foreseen for evacuation of pumped ground water in the Final design.	Contractor	During construction
	WWTP site – Preparatory works at the location and Excavation works	• The Final design must include measures for avoiding or minimizing the disturbance of the groundwater table.	Designer / Consultant	During preparation of the Final Design
		• During construction, the foreseen measures should be fully respected and applied.	Contractor	During construction
		• Evacuation of the pumped ground water has to be done according to the Final design and to apply the foreseen measures.	Contractor	During construction
		• Adopting proper erosion control and soil conservation practices during excavation and other measures defined in the Final design.	Contractor	During construction
	WWTP site - Transport and disposal of surplus excavated material	• In order to minimize the surplus excavated materials, If possible to be reused as construction material, or used as covering material at Drisla landfill. Remaining surplus material shall be disposed, according to the Final design, at designated area approved by the Investor.	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
	WWTP site – Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• Final design for construction must integrate a design for safe drainage of the groundwater. All foreseen measures should be fully respected and implemented, in order to avoid suffusion.	Designer / Consultant Contractor	During preparation of the Final Design During construction
		• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust).	Contractor	During construction
		• Refuelling or servicing only on impermeable ground and treatment of the oils.	Contractor	During construction
		• Special measures to be foreseen in order to avoid potential spills or leaks.	Contractor	During construction
		• Restrict the washing of vehicles and equipment on the site.	Contractor	During construction
		• Safe storage of chemicals during construction.	Contractor	During construction
		• Construction to be done on time, according to the planned time schedule (to avoid prolonged works and prolonged pollutions).	Contractor	During construction
	WWTP site / designated landfill for construction waste -Disposal of construction waste	• Construction waste shall be, regularly and timely transported from the construction site and disposed at the designated landfill for construction waste.	Contractor	During construction
	WWTP site - Installation of the equipment	• Fully to respect the protection measures defined in the Final design for installation.	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
	WWTP site - Construction of accommodation facilities for the workers	• Wastewater shell be collected and adequately treated.	Contractor	During construction
		• Solid waste shall be collected and disposed on the Drisla landfill.	Contractor	During construction
Surface water/ river Vardar water quality (including the bottom sediment)	Access roads and main collectors (left and right river bank) – construction works	• The Final design shall propose measures for prevention of the pollution of the water in the river through the contact with the groundwater. These measures shall be fully respected as well as the proposed construction technology.	Designer / Consultant Contractor	During preparation of the Final Design During construction
		• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust).	Contractor	During construction
		• Refuelling or servicing only on impermeable ground and treatment of the oils.	Contractor	During construction
		• Special measures to be foreseen in order to avoid potential spills or leaks.	Contractor	During construction
	Siphon across the River Vardar – construction works	• Heavy vehicles and machinery to comply with standards requested in the Final design (maximum age and relative low emissions of gases and dust).	Designer / Consultant Contractor	During preparation of the Final Design During construction
		• Refuelling or servicing only on impermeable ground and treatment of the oils.	Contractor	During construction
		• Special measures to be foreseen in order to avoid potential spills or leaks.	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Adopting proper erosion control and soil conservation practices during construction.	Contractor	During construction
	WWTP site – Preparatory works at the location and Excavation works	• Measures listed above for protection of the groundwater during excavation works to be applied.	Contractor	During construction
	WWTP site – Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• The Final design shall comprise measures for protection of the river water quality during construction. These measures shall be fully respected as well as proposed construction technology. • Measures listed above for protection of the groundwater from leakages to be applied.	Designer / Consultant Contractor Contractor	During preparation of the Final Design During construction During construction
	WWTP site - Installation of the equipment	• Measures listed above for protection of the groundwater from leakages to be applied.	Contractor	During construction
	WWTP site - Construction of accommodation facilities for the workers	• Measures for treatment of the wastewater to be applied and solid waste to be collected and disposed on the Drisla landfill, using good waste management practices.	Contractor	During construction
Hydrology of the River Vardar	Siphon across the River Vardar	• Final design shall comprise the solutions for the river diversion with minimum disruption of the riverbed. • The abovementioned measures and the proposed construction technology shall be fully respected.	Designer/Consultant Contractor	During preparation of the Final design During construction
Biodiversity / Flora and Fauna	WWTP and surrounding - All construction activities	• Non-performance of any activities or interventions in the forest part of the locality of Ostrovo while construction of WWTP	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Use of appropriate construction methods	Contractor	During construction
		• To plan carefully construction works to minimize impact on habitats, flora and fauna, careful siting, alignment, design of associated infrastructure to minimize impacts	Contractor	During construction
		• Careful timing of works and work seasonally, as appropriate	Contractor	During construction
		• To avoid loud beep signals from vehicles and machinery in the areas where faunal species inhabit	Contractor	During construction
		• Careful selection of sites to be used for constructional materials stockpiles/ construction wastes disposals, thus selecting the site which will not affect the protected area Ostrovo.	Contractor	During construction
		• Clean-up of construction sites	Contractor	During construction
		• To rehabilitate work sites/ asphalt plant operation sites quarries/ borrow areas, access roads by planting grass and trees and other relevant measures	Contractor	During construction
Air quality (including meteorology)	Access roads and main collectors (left and right river bank) – construction works WWTP site – Preparatory works at the location and Excavation works	• To plan carefully construction works to minimize air pollution;	Contractor	During construction
		• To control construction methods and used machinery and equipment;	Contractor	During construction
		• Careful timing of works in residential areas)/ restrict construction to certain	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		hours; • Restrictions on speed of construction vehicles, especially in residential areas; • Control by water or other means/ water spaying twice a day during construction to avoid dust, watering of access roads to minimize dust formation, if applicable. • Vehicles delivering materials should be well maintained and covered to prevent/ reduce spills, emissions and dispersion.	Contractor Contractor Contractor	During construction During construction During construction
	Siphon across the River Vardar – construction works	• To plan carefully construction works to minimize air pollution; • To control construction methods and used machinery and equipment ; • Vehicles delivering materials should be well maintained and covered to prevent/ reduce spills, emissions and dispersion.	Contractor Contractor Contractor	During construction During construction During construction
	WWT P site - Excavation works, Transport and disposal of surplus excavated material, Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles)	• To plan carefully construction and excavation works to minimize air pollution; • To control construction methods and used machinery and equipment; • Careful timing of works in residential areas)/ restrict construction to certain hours. • Restrictions on speed of transport vehicles, especially in residential areas;	Contractor Contractor Contractor Contractor	During construction During construction During construction During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.	Contractor	During construction
	WWTP site / designated landfill for construction waste -Disposal of construction waste	• To control used transport machinery and equipment;	Contractor	During construction
		• Careful timing of works in residential areas)/ restrict transport to certain hours;	Contractor	During construction
		• Restrictions on speed of transport vehicles, especially in residential areas;	Contractor	During construction
		• Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.	Contractor	During construction
	WWTP – Installation of the equipment	• To control used transport machinery and equipment;	Contractor	During construction
		• Careful timing of works in residential areas)/ restrict transport to certain hours;	Contractor	During construction
		• Restrictions on speed of transport vehicles, especially in residential areas;	Contractor	During construction
		• Vehicles delivering materials should be well maintained and covered to prevent/ reduce emissions and dispersion.	Contractor	During construction
Landscape and Visual effects	WWTP and surrounding - All construction activities	• To minimize construction site's size in order to minimize impact on landscape/ careful planning, and design of works	Designer/Consultant Contractor	During preparation of the Final design During construction
		• Screening/ fencing of intrusive items	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Good construction practices have to be implemented – including fencing and protection of building sites according to positive national legislation.	Contractor	During construction
		• The design of large infrastructure objects (WWTP, pumping stations, etc…) should be made in most environments friendly way and by implementing BAT for these types of structures.	Designer/Consultant Contractor	During preparation of the Final design During construction
		• Careful de-commissioning of construction areas/ waste disposal sites// clean up construction sites after road construction works are finished/ re-vegetation of work area, etc.	Contractor	During construction
		• Excavated materials, if any, should be used for backfilling of borrows and gravel pits	Contractor	During construction
		• Enhance non-esthetical through proper housekeeping of construction site	Contractor	During construction
		• Disposal of construction wastes at the approved sites quickly	Contractor	During construction
		• Repair pavements and roads after sewer laying work is completed	Contractor	During construction
		• Completing the construction activity by removing all spoils	Contractor	During construction
Water use	Access roads and main collectors (left and right river bank) / WWTP site -	• To use water of lower quality for spraying • Water for spraying can be abstracted	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
	Transport and disposal of surplus excavated material; Construction of the structures of the WWTP (civil works, use of heavy machinery and vehicles); Disposal of construction waste	from the river Vardar or from wells at nearby locations. • To use cisterns with adequate characteristics that will allow efficient water use.	Contractor Contractor	During construction During construction
	WWTP site - Construction of accommodation facilities for the workers	• To use the water efficiently applying water saving measures.	Contractor	During construction
Social Environment				
Involuntary resettlement and land acquisition	WWTP and surrounding - All construction activities	• Launching campaigns and raising population awareness regarding the importance and gains from the project through public hearings, flyers, educative workshops etc. • Procedures for land acquisition should be followed according to the related legislations.	MOEPP, City of Skopje, Vodovod	Prior and during construction
Livelihood and local economy	WWTP and wider surrounding site - All construction activities	• Rerouting of the local population commutation towards the central city area • Involving population in construction of the WWT system • Stimulating the population to start local business associated with the project • Stimulating of the firms-contractors to involve local population in construction of the WWT system	City of Skopje, Vodovod and Contractor	Prior and during construction
Institution as local decision making	Skopje area - All construction activities	• Defining the city and municipalities competences • More efficient cooperation between the city and municipalities	City of Skopje, Vodovod	Prior and during construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Increasing of the budget assignments for the activities related to the water supply and waste water treatment • Drafting and realization of measures related to water pollution protection at municipal level; • Strengthening of the NGO sector		
Public infrastructure and services	WWTP and wider surrounding site - All construction activities	• Installing adequate traffic rerouting road signalization • Facilitation of the local population commutation towards the central city area • Establishing road remediation measures for damages, caused by transportation and construction machinery during the construction of the WWT system • Putting adequate warning visuals in relation with the activities • Preventive measures for ambient air pollution prevention • Preventive measures against increased noise and vibration pollution • Rational consumption of electricity • Stimulating local industry and services to involve in WWT system construction	City of Skopje, Vodovod and Contractor	Prior and during construction
Local conflicts of interest	Skopje area - All construction activities	• Abiding to the existing legal regulations at national and local level, pertaining to construction of such facilities • Broader and transparent participation of all immediate concerned and responsible parties in this project	MOEPP, City of Skopje, Vodovod	Prior and
Health and safety (including infection	WWTP and wider surrounding site - All construction activities	• Providing measures for air pollution protection; • Providing occupational safety and health measures	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
diseases)		• Providing measures for transporting means and equipment protection • Providing measures for noise and vibration protection(acoustical shielding, vibration isolation etc.)		
Public Hazard				
Noise and vibration	WWTP and surrounding site - All construction activities	• To plan carefully construction works to minimize acoustic pollution	Contractor	During construction
		• Equipment emitting noise over 90 db should be avoided	Contractor	During construction
		• To control construction methods and used machinery and enhanced equipment maintenance for the purpose of mineralization of possible high noise levels	Contractor	During construction
		• Careful timing of works in residential areas)/ restrict construction to certain hours;	Contractor	During construction
		• To avoid loud beep signals in settlements/ to minimize disturbance to residents;	Contractor	During construction
		• Restrictions on speed of construction vehicles, especially in residential areas.	Contractor	During construction
Waste	Access roads and main collectors (left and right river bank) – construction works	• Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		Investor.		
	Siphon across the River Vardar – construction works	• Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the Investor.	Contractor	During construction
	WWTP site – Preparatory works at the location, excavation works, transport and disposal of surplus excavated material	• Cut trees and humus can be used by the local population for heating, construction material and composting. Remaining waste shall be disposed on the designated location approved by the Investor. • Overloading of vehicles with excavated material should not be allowed. • Generated waste shall be, If possible reused as construction material, or used as covering material at Drisla landfill. Remaining material shall be disposed at designated area approved by the Investor (excess materials not to be dumped at illegal dumps).	Contractor Contractor Contractor	During construction During construction During construction
	WWTP site – construction works	• Generated waste to be removed regularly and on time from the construction site. • If possible, construction waste to be reused by the Contractor. Remaining waste shall be disposed at designated area approved by the Investor. • Collection, treatment and disposal of the	Contractor Contractor Contractor	During construction During construction During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		liquid waste shall be performed in compliance with the national regulations for the relevant type of liquid waste.		
	WWTP site – installation of equipment	• Collection, treatment and disposal of the liquid waste shall be performed in compliance with the national regulations for the relevant type of liquid waste.	Contractor	During construction
	WWTP site - Construction of accommodation facilities for the workers	• By applying best management practices, the waste shall be collected, transported and disposed on the Drisla landfill.	Contractor	During construction
Soil pollution	WWTP site – All construction works	• To plan carefully construction works to minimize land affected and ensure soil pollution prevention	Contractor	During construction
		• To minimize construction site's size/ to minimize land affected/ to ensure soil pollution prevention	Contractor	During construction
		• Restrict traffic movements and use low ground pressure machines	Contractor	During construction
		• To ensure accuracy of construction works/ to avoid spills, leaks, etc. Thus, transportation vehicles should be enclosed to avoid potential leakage	Contractor	During construction
		• Promptly clean-up spills of transported material on site	Contractor	During construction
		• To avoid loss of vegetation along the construction	Contractor	During construction
		• To avoid construction works during heavy rains/ to mitigate velocity and volume of polluted surface run-off	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Carry out landslides prevention activities/ physical stabilization of slopes (retaining walls, piles, etc.), if needed	Contractor	During construction
		• To provide proper construction waste disposals	Contractor	During construction
		• To provide proper stockpiling of constructional materials	Contractor	During construction
		• Organize properly temporary sewage facilities	Contractor	During construction
		• To rehabilitate borrow areas, quarries and temporary haul /access roads by planting grass and trees and other measures	Contractor	During construction
			Contractor	During construction
		• Proper design and installation drainage and retaining structures/ civil engineering structures/ clean up drainage channels/ culverts to minimize the risk of erosion and landslides on down lands	Contractor	During construction
		• Planting / rehabilitation of vegetation (buffer strips) along the construction to minimize spreading of combustion gases/ particulates/ dust, if appropriate	Contractor	During construction
		• Backfilling and restoration of eroded channels to natural conditions/ re-vegetation, if appropriate	Contractor	During construction
		• Clean up of the work site/ restoration of	Contractor	During construction

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		damaged areas after construction works are finished		

Table 6-2 Mitigation Plan – Operational Phase

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
Topography and geology (including ground subsidence)	WWTP site - temporary storage of the sludge with hazardous substances	• To dispose sludge at landfill for hazardous waste	MOEPP, Operator	During operation, up to 2013
Groundwater	WWTP - Operation of equipment for sewerage treatment and effluent production	• The system for the treatment should ensure minimization of leakages of wastewater to groundwater (connections between pipes and tanks should be water-tight).	Operator	During operation
		• Strictly control and protect the refuelling of vehicles and equipment on the site.	Operator	During operation
		• Restrict the washing of vehicles and equipment on the site.	Operator	During operation
		• The quality of the effluent should be met with the standards.	Operator	During operation
	WWTP - Operation of equipment for sludge production	• The system for the sludge production should ensure minimization of leakages of sludge to groundwater (connections between pipes and tanks should be water-tight).	Operator	During operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• All requirements for construction of the sludge drying beds, especially for providing water impermeable basis, efficient drainage system for leachate and flood protection structures must be respected	Operator	During operation
		• Measurements of leachate should be taken	Operator	During operation
	WWTP site, temporary storage of the sludge with hazardous substances	• To provide water impermeable basis and flood protection structures on the location for the temporary disposal of the sludge	Operator	During operation
		• Measurements of leachate should be taken.	Operator	During operation
Surface water/ River Vardar water quality (including bottom sediment)	WWTP site – All operational activities	• To apply the same measures as proposed for protection of the groundwater.	Operator	During operation
Hydrology of the River Vardar	WWTP site – Operation of equipment for sewerage treatment and effluent production	• In summer period if the flow in the river is very low, additional quantities of water can be discharged in the river Vardar from upstream reservoirs Matka or Kozjak.	Operator	During operation
Biodiversity/ Flora and Fauna	WWTP site and surrounding – All operational activities	• Discharge of water from both side of the protected area. The water could be used from the WWTP after its treatment, or by pipeline, directly from the River Vardar. After the protected area the water will be diverted by natural flow in the River Vardar. In that way will be achieved restoration of the natural habitat Ostrovo ("Island"), that is significant habitat for	Operator	During operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		numerous legally protected and threatened faunal species. Furthermore, the water barrier around the protected area Ostrovo will reduce the negative human impact on the wild fauna, caused by the close human presence. Especially the birds are much more tolerant on human approach when are isolated by water barrier.		
Air quality (including meteorology)	WWTP site and surrounding – All operational activities	• Minimize emissions of GHG from the technological processes – treatment by: – Routinely drain condensate traps to remove water and avoid back pressure, – Ensure that the digester system is balanced in respect of pressure to reduce emergency pressure relief operation, – If the gas is vented to a combustion unit for energy recovery, a stand-by flare should be provided in case of combustion system malfunction, – Regularly inspect the operation of the flare to check in particular that the pilot will light the flare even if the flare has been overloaded, – Avoid turbulence of the sludge after digestion, – Covering of digested-sludge feed channels, mixing wells and overflow take-offs, – Regular inspection of the seals of floating gasholders, – Any covers or equipment provided for this source will require careful evaluation in relation to safety and	Operator	During operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		explosion control. • All vehicles should be procured on the bases of fulfillment of the EURO 5 emission norms.	Operator	During operation
Landscape and Visual effects	WWTP site and surrounding – All operational activities	• Plantation of trees in and around the pumping stations/treatment plant would improve the aesthetics	Operator	During operation
Social Environment				
Livelihood and local economy	City of Skopje - All operational activities	• Raising of the population awareness regarding the importance of constructing WWT system through public hearings, flyers, educational workshops etc. • Public announcement of job vacancies; • Promoting of the positive effects resulting from activation of the private owned businesses • Promotion of the project as a source of incomes for many families	MOEPP, City of Skopje, Operator, NGOs	During operation
Public infrastructure and services	City of Skopje - All operational activities	• Construction of substation with power transformer for WWTP with appropriate capacity • Utilization of alternative energy sources	City of Skopje, Operator	During operation
Health and safety (including infectious diseases)	WWTP site and surrounding – All operational activities	• Providing occupational safety measures; • Providing workers with personal protective equipment due to increased noise, vibrations and odours; • Applying adequate measures for insect control	Operator	During operation
Public hazard				
Noise and Vibrations	WWTP site and surrounding – All operational activities	• Ensure that equipment in the plant is properly located so that the overall noise meets environmental noise criteria.	All measures should be undertaken by the Operator	All measures should be undertaken during operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		• Provide anti-vibration cushioning for specific parts of the noise emitting equipment to reduce vibration and noise. • Incorporate noise barriers, silencers or enclosures for any equipment emitting high levels of noise. • The WWTP shall be operated and maintained so as to ensure that it avoids causing nuisance through noise in accordance with the national regulations (Decision on terms and conditions for noise annoyance on citizens (Official Gazette of RM No. 64/1993) as well as S.I. No. 787 of 2005 - European Communities (Waste Water Treatment, prevention of Odour and Noise) Regulations, 2005.		
-Waste (communal and commercial waste, solid waste from mechanical treatment, sludge, and chemicals)	WWTP - Operation of equipment for sewerage treatment and effluent production	• Good waste management practices to be applied and to dispose the waste at Drisla landfill. • Appropriate storage areas to be found for waste collected on screens and sand traps.	Operator Operator	During operation During operation
	WWTP - Operation of equipment for sludge production	• Alternatives for sludge treatment and for reduction of quantity to be analyzed and to propose optimal solution according to the local conditions. • Dried sludge should be disposed of on a specified landfill site with proper precautions or to be given to the farmers for agricultural application, if meets the standards.	Operator Operator	During operation During operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
	WWTP site - temporary storage of the sludge with hazardous substances	• Final disposal of the sludge to be on landfill for hazardous waste	MoEPP, Operator	During operation, up to 2013
Soil pollution	WWTP - Operation of equipment for sewerage treatment and effluent production	• The system for the treatment should ensure minimization of leakages of wastewater to soil (connections between pipes and tanks should be water-tight). • Strictly control and protect the refuelling of vehicles and equipment on the site. • Restrict the washing of vehicles and equipment on the site.	Operator Operator Operator	During operation During operation During operation
	WWTP - Operation of equipment for sludge production	• The system for the sludge production should ensure minimization of leakages of sludge to soil (connections between pipes and tanks should be water-tight). • All requirements for construction of the river beds, especially for providing water impermeable basis, efficient drainage system for leachate and flood protection structures must be respected.	Operator Operator	During operation During operation
	WWTP site - temporary storage of the sludge with hazardous substances	• To provide water impermeable basis and flood protection structures on the location for the temporary disposal of the sludge	Operator	During operation
Offensive odour	WWTP site - Mechanical treatment (Inlet facilities)	• Regular cleaning and flushing of screens and influent channels • Grit and screenings transfer and storage in a manner to prevent spillage. Ideally, the screenings after washing should be dewatered and bagged (or stored in a covered skip). • Lowering discharge points to minimise	All measures should be undertaken by the Operator	All measures should be undertaken during operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		turbulence and evaporation of odours • Balancing the inlet waste water flow to equalize the load during the day • Imported sludge to go straight to sludge storage tanks and not through inlet works		
	WWTP site - Primary Sedimentation	• Pre-treatment of incoming septic sewage or possible chemical dosing with nitrate or iron salts • Reducing hydraulic retention times • Improving de-sludging both in efficiency and frequency and regular cleaning of the tanks, sumps, scum and grease removal equipment – aim to ensure that sludge is not held on the bases of the tanks for more than planned • Reduce turbulence at the overflow point by reducing the overflow height	All measures should be undertaken by the Operator	All measures should be undertaken during operation
	WWTP site - Secondary Sedimentation	• Odour emission can be avoided by minimising sludge retention time in the final tank.	Operator	During operation
	WWTP site - Aeration Tank	• Ensure that conditions remain aerobic • Maintenance and inspection of the air diffusion system and liquid conveying are of great importance. • Measures that should be taken to minimise odour releases from this source, include: – Increased aeration by methods which minimise the generation of aerosols (for example sub-surface diffuse aeration) and maintain the activated sludge particles in suspension – Shrouding of the mechanical aerators to reduce aerosol formation	All measures should be undertaken by the Operator	All measures should be undertaken during operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		– Covering the inlet distribution chamber and anoxic zone		
	WWTP site - Sludge handling, Thickening and Drying beds	• Sludge should be processed (thickened, digested or dewatered) as soon as possible after generation as retention will lead to anaerobic conditions. • It is good practice to minimise the potential storage of sludge before treatment and storage for un-stabilised sludge should be limited to a maximum capacity of 24-hours production • All tanks for un-stabilised sludge storage and processing should be covered and vented to odour filter equipment • Replacement of drying beds with mechanical dewatering plant will help to minimise retention and mitigate the odours • Avoid open storage of un-stabilised sludge or sludge cakes • Application of BAT for sludge treatment, transport and disposal at landfill	All measures should be undertaken by the Operator	All measures should be undertaken during operation
	WWTP site - Anaerobic Digestion	• Routinely drain condensate traps to remove water and avoid back pressure • Ensure that the digester system is balanced in respect of pressure to reduce emergency pressure relief operation • If the gas is vented to a combustion unit for energy recovery, a stand-by flare should be provided in case of combustion system malfunction • Regularly inspect the operation of the flare to check in particular that the pilot	All measures should be undertaken by the Operator	All measures should be undertaken during operation

Environmental components	Location / Activity	Suggested Mitigation Measures	Responsible	Implementation Schedule
		will light the flare even if the flare has been overloaded • Avoid turbulence of the sludge after digestion • Regular inspection of the seals of floating gasholders • Any covers or equipment provided for this source will require careful evaluation in relation to safety and explosion control		

6.2 Monitoring Plan

The Monitoring Plan on selected parameters enables collection of data which can be used for documenting the status of the media (air, water, soil etc), effectiveness of the applied mitigation measures and need for adoption or change of the mitigation measures, enables to establish interaction between the stakeholders and gives the ground to the decision makers to enforce the legislation and make the right decisions. The key objectives of the Monitoring Plan can be summarized as follows:

- To confirm that the conditions of project approval are implemented satisfactory,
- To verify that impacts are within predicted or permitted limits,
- To manage unforeseen impacts or changes and
- To ensure that environmental benefits are maximized through good practice.

The Monitoring Plan at the WWTP in Trubarevo includes monitoring on:

-surface water;
-groundwater;
-air;
-noise and vibration;
-offensive odour;
-wastewater;
-effluent;
-sludge,
-biogas production,
-energy generation.

In the construction phase, surface water, groundwater, air, noise and vibration will be monitored, while in the operation phase, the rest of the parameters will be added in the monitoring system: offensive odour, wastewater, effluent, sludge, biogas production and energy generation. As the first five parameters which would be monitored in the construction phase will continue to be monitored in operation phase, the selection of the locations and type of the installed equipment for monitoring should be suitable for both phases.

The proposed monitoring elements of each monitoring parameter are presented in the Monitoring Plan, in Table 6-3 for the construction phase and in Table 6-4 for the operational phase. The Plan contains the following information:

-which media and which parameter shall be monitored;
-the location where the parameter shall be monitored;
-how the parameter shall be monitored and/or what type of equipment for monitoring shall be used;
-what frequency of the monitoring is needed (in the tables is minimum required frequency according the related regulations);
-what are the reasons (why) the monitoring of that parameter is needed;
-what are the costs for installation of the equipment (if needed) and operation of the equipment;
-who is responsible for monitoring of that parameter.

It should be noted that for the monitoring and reporting, requirements from the national legislation and concerning directives shall be fully respected National monitoring Strategy, Law on Environment as well as:

-For monitoring of the surface and ground water: Water Framework Directive (2000/60 /EC) as amended by Decision 2455/2001/EC); Law on Waters (Official Gazette of RM No.87/2008).

-For monitoring of the air: Law on ambient air quality (Official Gazette of RM No. 67/2004, No. 92/2007); Rulebook on the criteria, methods and procedures for evaluation of the ambient air quality (Official Gazette of RM No. 82/06), Decree on limit values for the levels and the types of polluting substances in ambient air and alarm thresholds, terms for achievement of these limit values, margins of tolerance for the limit value, target values and long-term goals (Official Gazette of RM No. 50/2005); Rulebook on maximum permissible concentration and quantities on other harmful matters that may by released into the air by individual pollution sources (Official Gazette of RM No. 3/1990).

-For monitoring the noise and vibration: Law on Noise (Official Gazette of RM No. 21/1984, No. 10/1990, No. 62/1993; No. 79/2007); Decision on terms and conditions for noise annoyance on citizens (Official Gazette of RM No. 64/1993), S.I. No. 787 of 2005 - European Communities (Waste Water Treatment, prevention of Odour and Noise) Regulations, 2005.

-For monitoring offensive odour: Directive 2000/60/EC of 23rd October 2000 – The Water Framework; Committee European de Normalisation (CEN) Standard – EN 13725.

-For wastewater and effluent: Urban Wastewater Treatment Directive (91/271/EEC) as amended by Directive 98/15/EC and Regulation (EC) 1882/2003; Law on Waters (Official Gazette of RM No.87/2008).

-For sludge: Sewage Sludge Directive (86/278/EEC); Law on Waters (Official Gazette of RM No.87/2008).

Implementation Schedule of the monitoring is defined according the phases: construction and operational phase. Due to this clear division of the monitoring, there was no need to have additional column for this information.
Monitoring of the surface water (river Vardar) and ground water during both phases shall be responsibility of the city of Skopje as part of the local monitoring network. Law on waters allows the local self governments to establish local monitoring network for water bodies if they have need for data and resources to cover the costs. Since upstream and downstream of the location of the waste water treatment plant there are already monitoring stations (Radusha and Taor) as part of national monitoring network on river Vardar, is not likely that two new stations will be established on such as small section of the river.
During construction, monitoring of parameters for air and noise are the obligation of the contractor / investor as it is defined in the Laws. During operation monitoring of parameters for air, noise and vibration, offensive odour, wastewater, effluent, sludge, biogas production and energy generation are under responsibility of the Operator. Reporting for monitoring of all parameters during construction and operational phases should be done by the City of Skopje, Contractor and Operator towards the MOEPP.

Table 6-3 Monitoring Plan –Construction Phase

Parameter Monitored	Location of the parameter's monitoring	How is monitored/ type of monitoring equipment	Frequency of monitoring	Reason for monitoring of the parameter	Responsible
Surface water (River Vardar) **- quantity** **- quality** (BOD_5, COD, SS, pH)	-Upstream of the WWTP construction site -Downstream of the Construction site and of the outlet structure for the effluent	Monitoring by adequate monitoring devices/ laboratory analysis	According to the relevant regulation -quantity: once per month -quality: once per month	To document the status of the River Vardar during construction and to ensure implementation of the mitigation measures	City of Skopje
Groundwater **-water level** **-quality** (BOD_5, COD, SS, pH)	At the location of the WWTP construction site on different distance from the River Vardar (minimum 5 locations)	Monitoring by adequate monitoring equipment-piesometric and laboratory tests	According to the relevant regulation -water level: once per month -water quality: once per month	To document the status of the groundwater during construction and to ensure implementation of the mitigation measures	City of Skopje
Air	At the location of the WWTP construction site and surrounding site	Monitoring by adequate monitoring equipment - and laboratory tests	According to the relevant regulation -air quality: once per month	To document the status of the air quality during construction and to ensure implementation of the mitigation measures	Contractor
Noise and vibration	At the location of the WWTP construction site and surrounding site	Monitoring by adequate monitoring equipment	According to the relevant regulation -noise level and vibrations: once per month	To document the status of the noise level and vibration during construction and to ensure implementation of the mitigation measures	Contractor

Table 6-4 Monitoring Plan – Operation Phase

Parameter Monitored	Location of the parameter's monitoring	How is monitored/ type of monitoring equipment	Frequency of monitoring	Reason for monitoring of the parameter	Responsible
Surface water (River Vardar) - **quantity** **- quality** (BOD_5, COD, SS, pH, NH_4-N, NO_2-N, NO_3-N, N-tot, P-tot, heavy metals, colour, turbidity, organic matters)	-Upstream of the WWTP site -Downstream of the Construction site and of the outlet structure for the effluent	Monitoring by adequate monitoring devices/ laboratory analysis	According to the relevant regulation -quantity: once a week -quality: once a week	To document the status of the River Vardar during operation of the WWTP, to ensure implementation of the mitigation measures and to monitor fulfillment of the environmental requirements	City of Skopje
Groundwater **-water level** **-quality** (BOD_5, COD, SS, pH)	At the location of the WWTP site on different distance from the River Vardar and close to the drying beds	Monitoring by adequate monitoring equipment- piesometric and laboratory tests	According to the relevant regulation -water level: once per month -water quality: once a week	To document the status of the groundwater during operation, to ensure implementation of the mitigation measures and to monitor fulfillment of the environmental requirements	City of Skopje
Air	At the location of the WWTP	Monitoring by adequate monitoring equipment - and laboratory tests	According to the relevant regulation - air quality: four times per year - air emission: four times per year	To document the status of the air emissions and air quality during operation and to ensure implementation of the mitigation measures	Operator
Noise and vibration	At the borders of the location of the WWTP	Monitoring by adequate monitoring equipment	According to the relevant regulation -noise level and vibrations: twice per year	To document the status of noise level and vibrations during operation and to ensure implementation of the	Operator

Parameter Monitored	Location of the parameter's monitoring	How is monitored/ type of monitoring equipment	Frequency of monitoring	Reason for monitoring of the parameter	Responsible
				mitigation measures	
Offensive odour	At the borders of the location of the WWTP and surrounding	Monitoring by odor sensory test	According to the relevant EU regulation - odour concentration: once per month at the borders of the location - odour concentration: if necessary in the surrounding	To document the status of offensive odour during operation and to ensure implementation of the mitigation measures	Operator
Wastewater **-quantity** **-quality** (**(**BOD_5, COD, SS, pH, NH_4-N, NO_2-N, NO_3-N, N-tot, P-tot, heavy metals, colour, turbidity, organic matters)	At the inlet structure at the WWTP	Monitoring by adequate monitoring devices/ laboratory analysis	According to the relevant regulation -all parameters: twice a month	To document the status of the wastewater at inlet structure at the WWTP	Operator
Effluent **-quantity** **-quality** (**(**BOD_5, COD, SS, pH, NH_4-N, NO_2-N, NO_3-N, N-tot,	At the outlet structure into the River Vardar	Monitoring by adequate monitoring devices/ laboratory analysis	According to the relevant regulation -all parameters: twice a month	To document the status of the effluent, efficiency of the treatment process and to monitor fulfillment of the environmental	Operator

Parameter Monitored	Location of the parameter's monitoring	How is monitored/ type of monitoring equipment	Frequency of monitoring	Reason for monitoring of the parameter	Responsible
P-tot, heavy metals, colour, turbidity, organic matters)				requirements	
Sludge **-quantity** **-contents (dry solids, heavy metals. pH)**	-At the primary settling tanks for primary sludge -At final settling tanks for surplus sludge -At the digestion tanks -At the final exit for stabilized sludge	Monitoring by adequate monitoring devices/ laboratory analysis	According to the relevant regulation -all parameters: once per month	To document the status of the sludge and treatment process and to monitor fulfillment of the environmental requirements	Operator
Biogas production	- At entrance of the gas holder	Monitoring by adequate monitoring devices	Continuous	To document the quantity of produced biogas	Operator
Energy generation	- At energy generator	Monitoring by adequate monitoring devices	During energy production	To document the quantity of generated energy	Operator

CONTENT

TABLES

7 RISK ANALYSIS AND CONTINGENCY PLAN

The Contingency Measures Plan (CMP) is defined as a plan of actions (measures) that should be taken when emergences that may involve risks of serous environment or material harm could happen. The CMP has been prepared for:

- Wastewater treatment works that could reasonably be expected to cause significant environmental impacts as a consequence of operational disruption (e.g. maintenance, breakdown, repair, etc.), including access roads and main collectors;
- Accidents which may occur while laying sewers (main wastewater collectors) or during construction of the WWTP;
- Accidents which may occur during operational phase (for exp. discharge of effluent which does not meet the standards into environment from the WWTP) which could cause a significant public health impact, and which therefore requires a continuous system of influent/effluent monitoring to identify potential problems as and when they arise.

During preparation of the CMP:

- The most likely causes of process disruption/breakdown have been identified as risks;
- An attempt has been made to estimate their probability of occurrence;
- The possible resultant environmental adverse impacts are presented;
- The recommended courses of action to minimize the severity of the impacts have been highlighted;
- The responsible institution/organization who will act in case of emergencies has been indicated.

The Risks Assessment together with the CMP are presented in three tables related to operational disruptions, accidents that may occur during construction phase and accidents during operational phase.

7.1 Risks Assessment and the CMP for Operational Disruptions

During operation of the access roads, main collectors and WWTP, certain operational disruptions could happen, due to planned activities related to maintenance or due to defects. In general, these operational disruptions should be repaired in a short time, like half of a day or a day.

One of very common reasons for disruptions during operation phase is power cuts due to defects of the distribution electricity network or energy shortage. Special attention shall be given to the measures for providing back-up power supply (generators, alternative energy sources, etc.). It is very important to ensure continuity of the operation of the WWTP.

The possible operational disruptions together with assessed magnitude of the impact, measures to be undertaken and identification of the responsible institution/organization are presented in the Table 7-1.

Table 0-1 Risk Assessment and CMP for Operational Disruptions

Location	Risks	Magnitude of Impact	Measures	Responsibility
Access roads (limited for the purposes of the WWTP)	Maintenance activities might impair the operation of the WWTP or the collector system (asphalt paving, hole patching, lighting and signalization, maintenance of other underground infrastructure under the roads and etc.)	Significant	• To establish and to implement a regular preventive maintenance plan and programme for access roads (to be prepared as part of the Final design);	Designer/ Consultant Operator
Main collectors	Disruption due to breakdown / repair / replacement / cleaning of sewers cause temporal dysfunction	Significant	• To establish and to implement a regular preventive maintenance plan and programme for sewers (to be prepared as part of the Final design);	Designer/ Consultant Operator
WWTP	Disruption due to power shortage (power cuts) causes stop of operation of the WWTP and discharge of the untreated effluent discharge into the River Vardar	Significant	• The system shall be designed to be fail-safe (standby diesel pumps and generators)and with back-up facility (emergency overflow) that would allow normal operation in the coming few hours; (generator is included in the study); • The staff on the plant shall be trained to swiftly return the WWTP to normal operation.	Designer/ Consultant Contractor Operator
WWTP	Disruption due to breakdown / repair / replacement / cleaning of WWTP component requires partial shutdown of WWTP	Significant	• To establish and to implement a regular preventive maintenance plan and programme for WWTP (to be prepared as part of the Final design); • The staff for plant operation&maintenance shall be well trained and qualified;	Designer / Consultant , Contractor and Operator Contractor Operator

Location	Risks	Magnitude of Impact	Measures	Responsibility
			• To establish and maintain adequate inventory of spare parts and to be available at the plant any time; • To establish a procedure for using by-pass structure at the WWTP (to be defined as part of the Final design); • To establish a procedure for informing the stakeholders and competent authorities in the case untreated wastewater should be discharged (usually planned operational interruptions will not lead to a discharge of untreated wastewater).	Operator Designer / Consultant, Contractor and Operator Operator City of Skopje Ministry of Environment and Physical Planning
WWTP	Disruption due to breakdown / repair / replacement/cleaning of components and process of the sludge treatment	Significant	• To establish and to implement a regular preventive maintenance plan and programme for the process of the sludge treatment (to be prepared as part of the Final design); • The works on maintenance and repair shall be carried out in spring and summer period, when due to the high temperature stabilized sludge can be used for local agriculture; • There should be a possibility to bypass sludge thickening (defined in the Final design); • There should be a possibility to	Designer / Consultant, Contractor and Operator Operator Designer / Consultant and Operator Designer/ Consultant and

Location	Risks	Magnitude of Impact	Measures	Responsibility
			bypass sludge stabilization (defined in the Final design).	Operator
WWTP	Disruption due to inadequate plant operation	Significant	• The staff for plant operation & maintenance shall be well trained and qualified; • To elaborate and to implement a plant operational manual and check lists for normal operation and for operation during operational interruptions (to be defined as part of the Final design).	Contractor and Operator Designer/ Consultant, Contractor and Operator

7.2 Risk Assessment and CMP for Accidents during Construction

Accidents that could provoke environmentally relevant impacts during construction of the main collectors and the WWTP are presented in the Table 7-2, together with assessed magnitude of the impact, measures to be undertaken and identification of the responsible institution/organization.

In general, in order to minimize the risk related to injures and lost of lives (workers, pedestrians, visitors, supervision staff), effective safety and warning measures including all safety precautions measures must be fully respected by the Contractor. The Supervision Engineer has to control the compliance of the measures and action undertaken by the Contractor.

The staff of the Contractor must be trained for contingency management (including, fire, flood, earthquake etc) and first aid. The arrangement of the construction site is also crucial in order to avoid accidents and/or to mitigate incidental situation during construction. The Contractor must fully respect all legal binding obligations about the fencing, lighting, traffic regime, labeling different position, and to provide safe environment for the workers. Regarding the engaged machines and vehicles by the Contractor, they must comply with the requirements defined in the Final design.

Table 0-2 Risk Assessment and CMP for Accidents during Construction

Location	Risks	Magnitude of Impact	Measures	Responsibility
Sewers (main collectors)	Accidents due to pedestrians falling into the open trenches	Significant	• During excavation all foreseen measures for protection of the construction site such as fence or bars must be taken; • The construction site must have signboards in bold letters put at adequate locations.	Contractor Contractor
	Accidents due to intensive traffic and risk to pedestrians, workers, vehicle drivers	Significant	• Fully to respect the traffic plan defined in the Final design; • Traffic signalization (vertical and horizontal) shall be done properly; • Adequate lighting to be provided during nights; • Coordination with traffic police for coordination of the traffic.	Contractor Contractor Contractor Contractor
	Accidents due to failure of heavy machines like lifter, cranes, etc	Significant	• The Contractor must fully respect the safety manuals and safety regulation for workers protection; • Emergency medical help should be available immediately on the site.	Contractor Contractor
	Accidents due to carelessness of the workers	Significant	• Workers should have full protection equipment (clothing, helmets, etc); • Workers to be trained for contingency management and for first aid; • Emergency medical help should	Contractor Contractor Contractor

Location	Risks	Magnitude of Impact	Measures	Responsibility
			be available immediately on the site.	
	Breakage's of water supply pipes and other services connections (electricity, telephone, heating, etc)	Significant	• To perform all the preparatory activities related to public information; • To use underground cadastre if available; • If happen, to follow the recommendations and guidelines to mitigate the damage defined in the Final design.	Contractor City of Skopje Vodovod Contractor Contractor
WWTP	Accidents due to failure of heavy machines like lifter, cranes, etc	Significant	• The Contractor must fully respect the safety manuals and safety regulation for workers protection; • Emergency medical help should be available immediately on the site.	Contractor Contractor
	Accidents due to carelessness of the workers	Significant	• Workers should have full protection equipment (clothing, helmets, etc); • Workers to be trained for contingency management and for first aid; • Emergency medical help should be available immediately on the site.	Contractor Contractor Contractor
	Fire at the construction site causes damage to the construction works, surrounding environment and/or humans	Significant	• To establish and to ensure that appropriate fire prevention and protection measures are followed during construction; • Provide first aid equipment and	Contractor Contractor

Location	Risks	Magnitude of Impact	Measures	Responsibility
			implement an emergency plan;	
			• Provide adequate fire distinguish equipment at the site;	Contractor
			• Workers to be trained properly.	Contractor
	Flooding of the construction site	Significant	• To install adequate erosion and flood protection measures;	Contractor
			• To install pumps for drainage of excavation pits	Contractor
			• To protect the excavation pits from collapsing;	Contractor
			• To storage safely the construction equipment, material and chemicals;	Contractor
			• Workers to be trained properly.	Contractor

7.3 CMP for Accidents during Operation

Environmentally relevant accidents during operation phase at the WWTP and at the sewers have been assessed for the overall process. Together with the recommended measures for handling the accidents and responsible institution/organization are presented in the Table7-3:

Generally, the risks are divided into two main groups:

-risks raising from the technology process and the equipment (breakdowns, failures, not adequate treatment, fire and explosion),
-risk raising from external factors (floods, earthquake, vandalism) which could not be controlled or influenced, but the damage can be mitigate by applying adequate measures.

Fire and explosions are among the most harming and unpredictable incidents that might occur, even if all preventive and safety measures are applied. Therefore careful and detailed contingency planning should be done in advanced phase of the project implementation so that the plan encompasses as much contributing factors as possible.

Due to the location (close to the River Vardar banks), for the WWTP in Trubarevo, the floods represents a major hazard to the processes, humans and environment. It can cause pollution within the facility, pollution of the ground and surface water and consequently may pose health hazard to the downstream population. The operational plan for flood defence and mitigation of the adverse effects shall consist preventive measures and instruction to the staff at the plant.

The protection from earthquake starts with seismic design of the structures of the WWTP. The contingency plan shall be prepared in order to avoid injuries and minimize damage to the facilities and environment.

In the proposed measures, it is evident that training of the staff involved in the construction and in the operation of the WWTP and sewers is of crucial importance. The training covers procedures for normal operation as well as measures for prevention and mitigation of the adverse effects of the accidents. The training of the staff for operation of the WWTP and of the staff from the City of Skopje and MoEPP (mainly regarding informing the public and reporting) is included in the training mentioned under 6.3. Capacity Development and Training Plan.

In the construction phase the majority of the actions are under responsibility of the Contractor, while in the operational phase, as it could be expected, under responsibility of the operator – Vodovod. The local and central authorities are mainly involved in announcing and informing the public for the accidents and undertaken measures, as well as in controlling the compliance of the operator performance with the legislation in situations with risks for the facility, humans and environment.

Table 0-3 Risks Assessment and CPM for Accidents during Operation

Location	Risks	Magnitude of Impact	Measures	Responsibility
Sewers (main collectors)	Breakdown/cracks on the main collector and discharge of the wastewater in the ground	Significant	• To apply measures for protection of workers during the intervention, including protective clothing, helmets, mask etc; • Entering in the holes should be done in accordance to the operational manuals and under supervision of superiors; • Emergency medical services should be available at the site; • To ensure safe discharge of the wastewater.	Operator Operator Operator Operator
WWTP	Breakdown of wastewater treatment units	Significant	• To ensure implementation of the operational plan for regular maintenance; • To train properly the staff at the plant.	Operator Operator
	Breakdown of mechanical equipment	Not Significant	• To provide adequate standby for pumps and motors; • To provide sufficient quantity of spare parts at the site; • Regular check and maintenance of the mechanical equipment.	Operator Operator Operator
	Risk of groundwater pollution due to failure of the water impermeable basis improper of sludge drying beds	Significant	• Efficient groundwater monitoring and proper maintenance of sludge drying beds.	Operator
	Risk of increased population of insects	Not Significant	• To maintain properly the sludge	Operator

Location	Risks	Magnitude of Impact	Measures	Responsibility
	(mosquitoes, flies, etc.) at the drying beds		on the drying beds.	
	Risk of bad odours	Not Significant	• To rake the wet sludge frequently and to remove dry sludge and to store/dispose it.	Operator
	Industrial pollutants or other harmful chemicals which are not planned to be treated enter sewerage, endanger the treatment process and/or discharged in effluent	Significant	• To ensure that industrial pollutants and other harmful chemicals are not discharged into the sewerage system (the MoEPP and city of Skopje should control that the industries are respecting the legislation and perform the pre-treatment of the industrial wastewater and that the discharged wastewater is complying the required standards);	Operator City of Skopje MoEPP
			• If there is a failure of the biological process, that part of the treatment should be by passed and the water should be discharged after primary treatment;	Operator
			• The biological process should be revived;	Operator
			• To establish a procedure for informing the stakeholders and competent authorities for possible health risk to public;	Operator City of Skopje MoEPP
			• To elaborate operational plan for these kind of situations in order not to endanger the treatment process;	Operator

Location	Risks	Magnitude of Impact	Measures	Responsibility
			• To train properly the staff at the plant.	Operator
	Human health is impacted by water borne diseases due to contact with untreated wastewater	Not Significant	• Staff at the WWTP is trained on occupational safety and wear adequate protective clothes (defined in Final design); • Staff at the WWTP is vaccinated against Hepatitis A and B; • The WWTP is fenced and the entrance of the public is restricted (fence and gate are part of the Final design);	Operator Operator Operator
Downstream of the WWTP	Human health and aquatic flora and fauna are impacted by discharge of sub-standard treated/non-treated wastewater	Significant	• Operational manual and plan have to be fully respected; • Monitoring has to be carefully supervised in order to identify and announce potential problems; • To establish a procedure for informing the stakeholders and competent authorities on potential health risk to public in case untreated wastewater should be discharged.	Operator Operator City of Skopje Operator City of Skopje MoEPP
WWTP	Explosion at the gas unit	Significant	• To prepare operational plan for minimizing the damage of the structures and environment in case of explosion; • To train properly the staff at the plant.	Operator Operator
	Pipes freeze during cold weather	Not Significant	• To apply technical measures to	Operator

Location	Risks	Magnitude of Impact	Measures	Responsibility
			prevent freezing (to use pipe insulation, under floor construction, solutions shall be defined in Final design).	Designer/ Consultant
	Storm water/ the River Vardar water causes flooding of the WWTP	Significant	• To define in the Final design the flood protection system (structures, drainage system, evacuation facilities etc); • To elaborate operational plan for flood defense and mitigation of the adverse effects; • All reservoirs and tanks shall have sufficient freeboards in order to avoid overflowing due to storm water; • To train properly the staff at the plant.	Designer/ Consultant Operator Designer/ Consultant Operator
	Storm water/heavy rain or high ground water level causes flooding of the drying beds	Significant	• To include protection of the drying beds in the Final design, special attention to be paid to ground base and drainage system of the drying beds; • Proper maintenance of the drying beds; • Proper drainage to be assured.	Design/ Consultant Vodovod Operator Operator
	Earthquake causes structural damage to the WWTP	Significant	• To apply national seismic regulation in the static design in the Final design, considering the high seismic risk for Skopje region;	Designer/ Consultant

Location	Risks	Magnitude of Impact	Measures	Responsibility
			• To prepare operational plan for minimizing the damage of the structures and environment in case of earthquake; • To train properly the staff at the plant.	Operator Operator
	Fire at the construction site causes damage to the process, staff and surrounding environment	Significant	• To establish and to ensure that appropriate fire prevention and protection measures are followed during operation; • Provide first aid equipment and implement an emergency plan; • Provide adequate fire distinguish equipment at the site; • To train properly the staff at the plant.	Operator Operator Operator Operator
	Vandalism and damage to the equipment or structures	Not significant	• To ensure constant surveillance at the plant; • To install security and control devices (eg. video surveillance, locking mechanism, fence etc.)	Operator Operator

CONCLUSIONS

This chapter presents the major negative and positive impacts from the construction and operation of the WWTP and the main collectors.

Construction Phase

Positive Impacts

- In this phase, large positive impacts are expected for two elements from the Social environment: **Involuntary resettlement and land acquisition** and **Local decision-making institutions**. The project will bring material satisfaction to the landowners whose land will be used for the purposes of the WWTP, on the other hand during the procedure of issuing the permits for construction and operation of the facilities the main obstacles and overlapping of the responsibilities between the relevant institutions will be resolved.. Also, during the procedure of EIA the public will be involved in the decisions making process.

Negative Impacts

- Construction works of the main collectors and the WWTP facilities might provoke large negative impacts on the **geology**, due to high probability for land slips and slides. These land slips and slides could affect the planed activities and safety of the involved workers, as well.

- Construction of the siphon across the River Vardar could be one of the critical elements of the construction phase, due to the need for creation of river diversion structures. As the excavation and installation works shall be done on rather lower level than the river bed, large disturbances of the **groundwater** table can be expected. Also, large disturbances of the **groundwater table** can be expected during the excavation works on the WWTP facilities. These disturbances could result in disruptions of supply of the local wells which are used for domestic water supply or irrigation.

- Different river diversions structures and tail dams will change the river bed morphology temporarily but the impact is rather high. With these structures, there will be impact on the **river flow direction**, while the river discharges will stay unchanged.

- The project implementation can have large negative impact related to the **involuntary resettlement and land acquisition** due to influence on the investor budget for land acquisition , involuntary land acquisition for part of the land owners due to inadequate compensation and destruction of the existing structures and resettlement.

- The quantities of the **excavated material** are expected to be large. During transport of the surplus material, seepage on the construction site, but also on the access roads and wider areas should be avoided.

During construction phase, generation of **construction waste** and **liquid waste** from the vehicles and heavy machinery (fuel and oils) are expected. Improper handling especially of liquid waste can provoke large negative impact of the environment,
In order to mitigate the negative impacts, extensive mitigation measures are proposed, described in details in Chapter 5. It is expected that with efficient implementation of these measures, there will be no large negative impacts on the natural and social environment and construction phase will not provoke public hazards.

Operational Phase

Positive Impacts

- **In general, operation of the WWTP will have large positive impact on the quality of life, the groundwater, the bottom sediment and the most of all on the water quality of the River Vardar. The main pollutant of the River Vardar, the domestic wastewater will be collected and treated before discharge into the river.**

- The operation of the WWTP will have positive impact on the restoration of the **aquatic fauna** in the River Vardar. Operation of WWTP and sludge drying beds, thus creation of artificial areas, will increase the plant vegetation which absorbs anions-nitrates and phosphates and etc.

- The operation of the wastewater treatment system will have positive impact on the **local decision-making institutions**, because, the responsibilities of the WWTP operator will be clearly defined and control procedure which will be carried out by the relevant institutions regarding the compliance of WWTP operation with the requirements stated within the national regulations will be as well clearly defined.

- There are two more large positive impacts on the Social Environment elements: improved **water supply** of the downstream populated areas due to good quality of the groundwater, and improved **health** of the downstream population as a result of the improved quality of drinking water.

Negative Impacts

- During the drying process of the sludge on the drying beds, there is high possibility for pollution of the **groundwater** due to infiltration of drying beds leachate. As the drying beds are covering area of 18 ha, the possible negative impact is assessed as large affecting wider area, actually wider groundwater aquifer.

- There is high possibility for **groundwater** pollution with substances due to leakages and infiltration of the leachate from the sludge with hazardous substances disposed on temporary storage at the WWTP site.

- Through the strong connection with groundwater, the **water in the River Vardar** could be polluted from infiltrated leachate from sludge drying beds.

- Generation of large quantity of sludge (72,4 m^3/day) provokes large negative impact on all media (**soil, groundwater, air**, etc). Improper treatment of sludge could lead to putrefaction and other related problems such as bad odour, health effects etc.

- Generation of big quantity of sludge with hazardous substances can provoke large negative impact on all media (**soil, groundwater, air**, etc).

- There is a possibility for **soil pollution** with hazardous substances due to leakages and infiltration of the leachate from the sludge with hazardous substances disposed on temporary storage at the WWTP site.

- In general, the inlet facilities are potentially considerable source of **odour** from incoming sewage, and storage and handling of debris from screenings and grits. That odour can provoke large negative impact.

- If there is anaerobic activity before or during the primary sedimentation operation, the size of these tanks can make them a significant source of **offensive odour**.

- Sludge and bio-solids handling are usually the most significant source of **odour** release and good sludge management is a key issue. All raw sludge and bio-solids will release odour largely dependent upon time of retention. Improper management of the sludge might provoke large negative impact through spreading offensive odour in the surrounding.

- One of the most likely events that could jeopardize and endanger the operation of the WWTP is the **flooding**. The existing embankment near the WWTP site is only partly constructed, and there is a need for extension of the embankment in order to protect the staff members for operation and maintenance of the WWTP as well as the WWTP facilities.

In order to mitigate the negative impacts, extensive mitigation measures are proposed, described in details in Chapter 5. It is expected that with efficient application of these measures, there will be no large negative impacts on the natural and social environment and operation phase will not provoke public hazards.

General Conclusion

A team of environmental consultants, who are specialists in their fields, have investigated the existing environment and the proposal to construct the WWTP and the main collectors for city of Skopje. Negative impacts have been considered and extensive mitigation measures will be included in the Feasibility Study and additional designs **to prevent, minimize and mitigate the identified negative impacts. Monitoring requirements are in line with legislation and will be used to ensure compliance with the performance specification. It is concluded that construction and operation of the WWTP and main collectors will generally have a positive impact on the environs.**

Annexes

Annex 1

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) STUDY

1. Objectives

EIA is the obligation for the project including the wastewater treatment plant with the capacity more than 10,000 populations by Macedonian Laws and Regulations, and EIA study should be conducted in the Feasibility Study stage. The Study is also categorized as "A" by JICA's Guidelines for Environmental and Social Considerations which requires the EIA level study at F/S stage. Based on the Macedonian Laws and Regulations and JICA's Guidelines, EIA Study shall be carried out in the Feasibility Study for Wastewater Management in Skopje.

2. Study Area

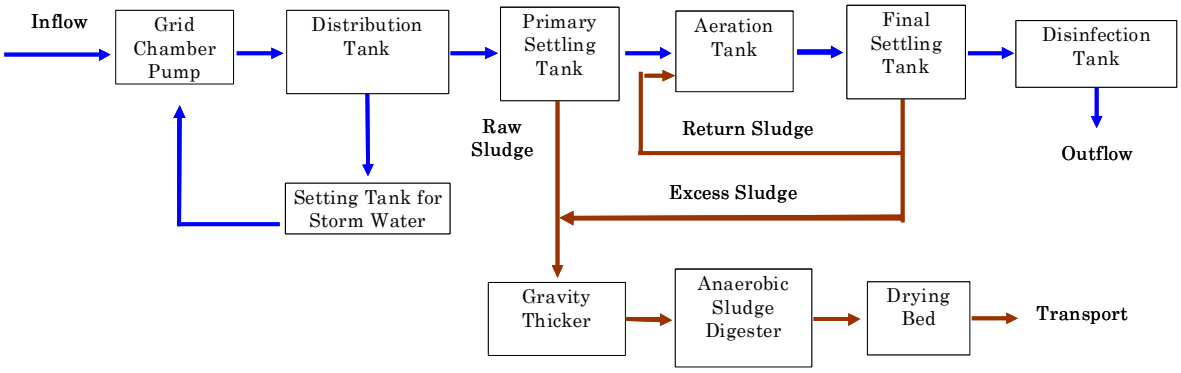
The Study Area for the EIA should cover the project sites and the area where potential impacts of the project will be occurred, which encompass the City of Skopje and its surroundings.

3. Anticipated Proposed Project for EIA Study

The major components of the Proposed Project for which an EIA study will be carried out are:

- Construction of WWTP in Trubarevo
  The location of WWTP will be within the "water economy facility zone" of General Urban plan of Skopje City. The exact location will be decided by technical experts of JICA Study Team.

  Treatment capacity: 164,000 m^3/d
  Treatment process: CASP (Conventional Activated Sludge Process)
  Sludge treatment process: Thickening, digesting, drying, landfill or reuse



Installation of Main Collector:
Main collector on left bank: diameter 1,500~1,600 mm, 4 km
Main collector on right bank: diameter 1,800 mm, 5 km

4. Scope of Works

4.1 Procedures on EIA

Necessary procedures related to the EIA study should be taken according to the Macedonia Laws and Regulations. The investor will be the Skopje City and the Consultants shall assist the Skopje City to take all necessary procedures in collaboration with MoEPP and the JICA Study Team.

4.2 EIA Study

Based on the results of screening and scoping by MoEPP (and the JICA Study Team), the Consultants shall conduct EIA and prepare the EIA report. The requirements of EIA are described below.

- Analysis of Guidelines, Policy, Legal and Administrative Framework
- Description of the Proposed Project
- Collection and Analysis of Baseline Environmental Data
- Analysis of Alternatives
- Identification and Prediction of Impacts
- Preparation of Environmental Management Plan (includes mitigation, monitoring, capacity development and training, implementation schedule and cost estimation, risk analysis/contingency plan, integration of EMP with the project)

4.3 Public hearing/Stakeholder Meeting

MoEPP has the obligation to hold public hearing. JICA's Guidelines requires stakeholder meeting as well. The objectives of stakeholder meeting are to inform the public contents of JICA Study, results of EIA and obtain the comments from the participants. The Consultants shall assist the MoEPP to hold public hearing during the Study period. But if the public hearing cannot be held during the study period, the Consultants shall assist the Skopje City to hold the stakeholder meeting.

5. Contents of EIA Study

The EIA Study should fulfill the requirements of "Ordinance on the content of the requirements that need to be fulfilled by the study on environmental impact assessment" and "Sectorial EIA Guidelines – Waste Water Treatment Plant".

5.1 Analysis of Guidelines, Policy, Legal and Administrative Framework

The analysis was done in the IEE level study conducted in B/P stage. The additional analysis should be conducted including "Draft Law on Waters", the administrative framework (organization wise analysis), Law on Expropriation, etc.

5.2 Description of the Proposed Project

- Description of the project wiht the information on location, character and the size of the project and the geographical extent of the project;
- Description of the characteristics of the technology used;
- Summary of the study submitted without technical details;

5.3 Collection and Analysis of Baseline Environmental Data

The baseline data was collected in the IEE level study conducted in B/P stage. The supplemental data should be collected including groundwater, land use, ecology, protected area.

- Description of the environment and its medias of location;
- Description of the natural, cultural nad historic haritage and on the landscape;

For the industries, the WWTP will accept the industrial wastewater as the IPPC system will force them to pre-treat the industrial wastewater till the acceptable level to the sewers.

However, if the industrial wastewater which is not pre-treated to the acceptable level, it will affect the quality of the effluent and the sludge from the WWTP and this will cause problem. The information about the industries in Skopje City and the progress of IPPC system and implementation should be collected. The information collected by the JICA Study Team and the results of industrial survey which was conducted in November 2007 will be available to the Consultants. As for groundwater, collect the information how the aquifers cover the Skopje City, amount and quality of groundwater.

5.4 Analysis of Alternatives

Description of the alternative solutions for realization of the project and the main reasons for the choice of the proposed option; the zero-option shall always be included. The alternatives such as treatment technology, sludge disposal will be prepared by the JICA Study Team and the Consultants should analysis the environmental and social impacts of each alternative and feed back the results to the experts of the JICA Study Team.

(1) Without Project Option (zero-option)
Future sanitary and environmental condition within Skopje City without project will be anticipated. The analysis of water quality of the Vardar River without project will be calculated by the JICA Study Team and the data will be provided to the Consultants.

(2) If negative impact is not negligible, alternative options such as application of a different method and relocation of the facility shall be compared and recommended.

5.5 Identification and Prediction of Impacts

Those environmental elements cover three categorized elements of social environment, natural environment and public hazard with further subdivided several elements, respectively as listed below.

- Social Environmental Element includes (i) involuntary resettlement and land acquisition, (ii) impact on livelihood and local economy, (iii) change in land use and local resources, (iv) social institution such as social infrastructure and local decision-making institutions, (v) existing social infrastructure and services, (vi) socially vulnerable groups, (vii) misdistribution of benefits and loss/damage, (viii) cultural heritage, (ix) local conflicts of interest, (x) water use, (xi) gender, children's rights and (xii) infectious diseases such as HIV/AIDS, et.
- Natural Environmental Element includes (i) topography and geology, (ii) groundwater, (iii) bottom sediment, (iv) hydrological situation, (v) wildlife and ecosystem, (vi) meteorology, (vii) landscape, (viii) global warming, and (ix) transboundary.
- Public Hazardous Element includes (i) air pollution, (ii) water pollution, (iii) soil pollution, (iv) waste, (v) noise and vibration, (vi) ground subsidence and (vii) offensive odors.

Description of the type and quantity of emissions and wastes expected, especially emissions in the air, solid wastes and waste water, as well as other information necessary for evaluation of significant effects of the project on the environment during construction and operation phase.

To assess the impacts, the surveys below should be conducted at least.

(1) Survey on Land Ownership
The proposed WWTP will be located within the "water economy facility zone" in General Urban Plan of Skopje City. The maps and lists are already obtained from Cadastre and the Consultant should identify the landowner (number of land ownership, names, area, present land use, etc.). If the information from Cadastre will not be

sufficient, the Consultant should make request to MoTC and the Cadastre to provide the information.

(2) Survey on Land Use and Protected Area

The area including "water economy facility zone" are used as hunting area by MAFWE and Skopje University. The survey on land use of "water economy facility zone" should be conducted to identify the type of animal/bird, number, and the situation of hunting. The protected area "Arboretum" of Skopje University is located near to the "water economy facility zone". The survey for the protected area should be conducted to identify the type and number of plant/tree, vegetation, groundwater use, etc. The impacts on land use and protected area should be identified caused by the construction and operation of WWTP in Trubarevo. The Arboretum is protected area under the IUCN category (belong to category III). The Consultants should check the IUCN regulations on protected area (whether it has force, if so to what extent?, etc.).

(3) Survey on Groundwater

As the area of "water economy facility zone" is used to be the riverbed of the Vardar River, the water runs under this area. The depth of groundwater will be surveyed by geotechnical survey by JICA Study Team. The construction method (the pile or concrete foundation) will be decided by the Study Team based on the results of geotechnical survey and the Consultants should identify the impacts on groundwater based on the construction method. The impacts on groundwater during the operational phase should be also identified.

(4) Survey on Odor

Assess the situation of odor diffusion from WWTP in Trubarevo using "air pollution diffusion model".

(5) Survey on Progress of Road Construction

The main collectors on both sides of the Vardar River are proposed to be installed along with the proposed roads in General Urban Plan of the Skopje City. The budget for the design of these roads is approved by City Council in 2008 and the progress should be closely monitored. The impacts by road construction are not caused by this Project, however, the survey on affected households should be identified through Skopje City, data and lists obtained from the Cadastre.

(6) Survey on Sludge Disposal

The sludge will be disposed of at Drisla Landfill site if the sludge does not include the hazardous elements. The disposal of the considerable sludge from WWTP will affect the expected lifetime and stability of landfill. The present situation (amount of waste, type, disposal method, etc.) and assess the impacts on Drisla Landfill by disposal of the sludge. Other sludge disposal method such as incinerator and retention facility within the WWTP will be considered by the JICA Study Team. The Consultants should identify the expected impacts by construction and operation of these facilities. The Consultants should survey how the other WWTP/project disposes the sludge.

(7) Survey on Water Quality

The industrial wastewater which will be discharged into the sewer should be pre-treated to the appropriate level to accept in the sewer by IPPC, however, there is the risk that the polluted industrial wastewater will be mixed with communal wastewater. It will lead the contamination of effluent and sludge. Assess the impacts on water quality if the industrial wastewater mixed with the communal wastewater.

(8) Survey on air pollution

During sludge digesting process, the methane gas will be generated and it will affect the air quality. The Consultants should assess the impact on air quality and examine the effective use of methane gas.

5.6 Preparation of Environmental Management Plan (EMP)

The environmental management plan consists of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels. The plan also includes the actions needed to implement these measures.

(1) Mitigation Measures

The feasible and cost-effective measures that may reduce potentially significant adverse environmental and social impacts to acceptable levels should be identified.

- Identify and summarize all anticipated significant adverse environmental and social impacts,
- Describe each mitigation measures for prevention, diminishing and elimination of the impacts with technical details including the type of impact to which it relates and the conditions under which it is required, together with designs, equipment descriptions, and operating procedures, as well as the substitution measures in case of intervention in the natural environment and landscape,
- Describe the effects of the project on the environment considering the level of scientific development and accepted evaluation methods,
- Estimate any potential environmental and social impacts of these measures, and
- Provide linkage with any other mitigation plans required for the project.

(2) Monitoring Plan

Environmental monitoring during construction and operation of facilities provides information about key environmental aspects of the project, particularly the impacts of the project and the effectiveness of mitigation measures. EMP identifies monitoring objectives and specifies the type of monitoring, with linkages to the impacts assessed and the mitigation measures. Specifically, the monitoring section should provide:

- A specific description and technical details of monitoring measures including the parameters to be monitored, methods to be used, sampling locations, frequency of measurements, detection limits, responsible organization and definition of thresholds that will signal the need for corrective actions, and
- Monitoring and reporting procedures to (i) ensure early detection of conditions that necessitate particular mitigation measures, and (ii) furnish information on the progress and results of mitigation.

The monitoring parameters should include surface water, groundwater, air, noise and vibration, offensive odor, wastewater, effluent and sludge.

(3) Capacity Development and Training

To support timely and effective implementation of mitigation measures, establishment of environmental unit in WWTP and Vodovod and training of staff to implement the mitigation measures and monitoring should be proposed. Specifically, the EMP provides a specific description of institutional arrangements – who is responsible for carrying out the mitigatory and monitoring measures (e.g. for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training).

(4) Implementation Schedule and Cost Estimation

For all three aspects (mitigation, monitoring and capacity development), the EMP should provide an implementation schedule for measures that must be carried out as part of the project, showing phasing and coordination with overall project

implementation plans, and the capital and recurrent cost estimation and sources of funds for implementing the EMP. These figures should be also integrated into the total project cost tables.

(5) Risk analysis/contingency plan
Contingency measures plans have been prepared for:

- Wastewater treatment works that could reasonably be expected to cause significant environmental impacts as a consequence of operational disruption (e.g. maintenance, breakdown, etc.),
- Accidents which may occur while laying sewers or during construction of the WWTP,
- Discharge of sub-standard wastewater into the environment from the WWTP which could cause a significant pubic health impact, and which therefore requires a continuous system of influent/effluent monitoring to identify potential problems as and when they arise.

In the preparation of the contingency measures,

- The most likely causes of process disruption/breakdown have been identified,
- An attempt has been made to estimate their probability of occurrence,
- The possible resultant environmental adverse impacts are presented,
- The recommended courses of action to minimize the severity of the impacts have been highlighted,
- The responsible agency who will act in case of emergencies has been indicated.

(6) Integration of EMP with the Project
Integration of EMP with the Project is necessary especially for mitigation measures, monitoring plan, and cost.

5.7 Review of the difficulties (technical defects or lack of knowledge) that the Consultants are faced with in the course of study preparation and the suggestion for the size and the characteristics under which the study on project environmental impact assessment should be updated.

6. Other information/requirement

(1) Laws and Regulations to be referred

EIA Study should be conducted according to the Macedonian Laws, Regulations and JICA's Guidelines. The regulations which should be referred are listed below.

- The Law on Environment,
- Ordinance regulating the procedure for carrying out environmental impact assessment,
- Ordinance on the information contained in the notification of intent to implement a project and the procedure for determining the need for environmental impact assessment of a project,
- Ordinance on the content of the requirements that need to be fulfilled by the study on environmental impact assessment,
- Guidance for conducting screening, scoping and review in environmental impact assessment,
- Sectorial EIA Guidelines – Waste Water Treatment Plant
- Others
- JICA's Guidelines for Environmental and Social Considerations

(2) The EIA Study Period will be from May to October 2008 (contract period will be end of

January). Draft final report of EIA should be submitted by the end of September 2008.

(3) IEE (Initial Environmental Examination) was conducted. The data and results are available for the Consultants.

(4) Close cooperation with Skopje City, MoEPP and MoTC is strongly required.

7. Required Experts

The following experts will be required for this Service at least. The Local Consultant shall have and assign these experts for required period.

1. Environmental Engineer,
2. Senior Sanitary and Sewerage Engineer,
3. Sociologist and Economist,
4. Institution Expert and Environmental Law Expert,
5. Biologist or Ecologist, and
6. Supporting Staff and Surveyors

The Local Consultant shall assign the most competent engineer/expert as a team leader who has similar study experiences and knowledge of many fields such as civil, sewerage, sanitation, economy and institutional aspects in addition to environmental aspect. The team leader also shall have good communication, writing and presentation skills in English. He should attend all-important meetings upon request of JICA Study Team. Other experts are also expected to be very competent in their field.

8. Reports/Output

The Local Consultant shall prepare and submit following reports to JICA Study Team by the time specifies.

(1) Inception Report (IC/R)
   1) This report shall be compiled based on the contents of the TOR and its proposal.
   2) Submission of the report shall be within 5 days after the contract agreement.
   3) Two (2) copies

(2) Progress Report (P/R)
   1) This report shall include brief explanation of study progress, problems encountered and the study items till 3 (analysis of alternatives) of the figure below.
   2) Submission of the report shall be by the end of July 2008.
   3) Two (2) copies

(3) Draft Final Report (DF/R)
   1) This report shall include all study results (including survey data, pictures)
   2) Submission of the report shall be by the end of September 2008.
   3) Two (2) copies

(4) Final Report (F/R)
   1) This report shall include all the study results (including survey data, pictures).
   2) After submission of Draft Report, JICA Study Team will give comments to the Report. The Local Consultant shall revise the Draft Report and submit Final Report by mid of October 2008.
   3) Three (3) copies
   4) All final products shall be submitted with electronic copy in CD-R in addition to hard copy.

Study Items	2008 May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
1. Analysis of Guidelines, Policy, Legal and Administrative Framework		▬					
2. Collection and Analysis of Baseline Environmental Data		▬	▬				
3. Analysis of Alternatives			▬				
4. Assessment of Environmental Impacts			▬	▬			
5. Mitigation / Management Plan				▬	▬		
6. Conclusions and Recommendations					▬		
Report Submission		Δ IC/R		Δ P/R	Δ DF/R	Δ F/R	

Annex 2

1.1 Legal EIA Introduction

Environmental Impact Assessment of certain projects is required to be carried out in the Republic of Macedonia in accordance with Articles 76-94 of the Law on Environment (Official Gazette of RM No. 53/2005, 81/2005, 24/2007). 'Projects' is a term used to describe, inter alia, developments for example such as the construction of WWTP, installation of collectors, building of roads, the extension of a factory or mining and etc.

The types of projects that require an EIA are determined in accordance with Article 77 of the Law on Environment 2005 which are specified by the Government of the Republic of Macedonia in the "Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out (Official Gazette of RM No. 74/2005).

The "Decree for Determining Projects for which and criteria on the basis of which the screening for an environmental impact assessment shall be carried out" stipulates the following two project categories:

- Projects for which compulsory environmental impact assessment procedure shall be carried out prior to the issuance of decision for the project implementation;
- Projects that may have significant environmental impact and are therefore subject to environmental impact assessment screening prior to the issuance of decision for the project implementation

Consequently, projects are classified in two groups: projects listed in Annex I are all subject to compulsory EIA while for projects in Annex II, for which projects an environmental impact assessment will be made on the basis of case-by-case examination of the characteristics, size and location, in light of the latest scientific and technical developments, and the provisions in the regulations, which specify the lowest limit values of emissions into the environment. Thus, the relevant project activity belongs to the Annex I of the mentioned Decree.

Therefore, in accordance with mentioned Macedonian Legislation (which complies to 85/337/EEC and other relevant EU directives), Environmental Impact Statements (EIS) is required for Waste Water Treatment Plants that have a capacity in excess of 10,000 Population Equivalent (P.E.). Hence, as the ultimate design population capacity of the proposed Waste Water Treatment plant is 500,000, the EIS is required.

1.2 Legal EIA Procedure description

The EIA procedure consists of several steps or phases, which are: notification on the intention of the project implementation, screening, scoping, assessment and evaluation of the direct and indirect impact on the environment from the project implementation or non-implementation. The impact of the project on the environment is assessed in accordance with the status of the environment in the area affected at the time of submission of the notification on the intention to carry out the project. When assessing the project environmental impact, the following is taken into account:

- the project preparation, execution, implementation and termination, including the results and effects arising from the completion of the project;
- removal of the polluting substances and restoration of the affected area into its original condition, if such obligation is prescribed by special regulations, and
- normal functioning of the project, as well as the likelihood of accidents.

Accordingly, the phases of the EIA Study preparation are presented in Figure1.

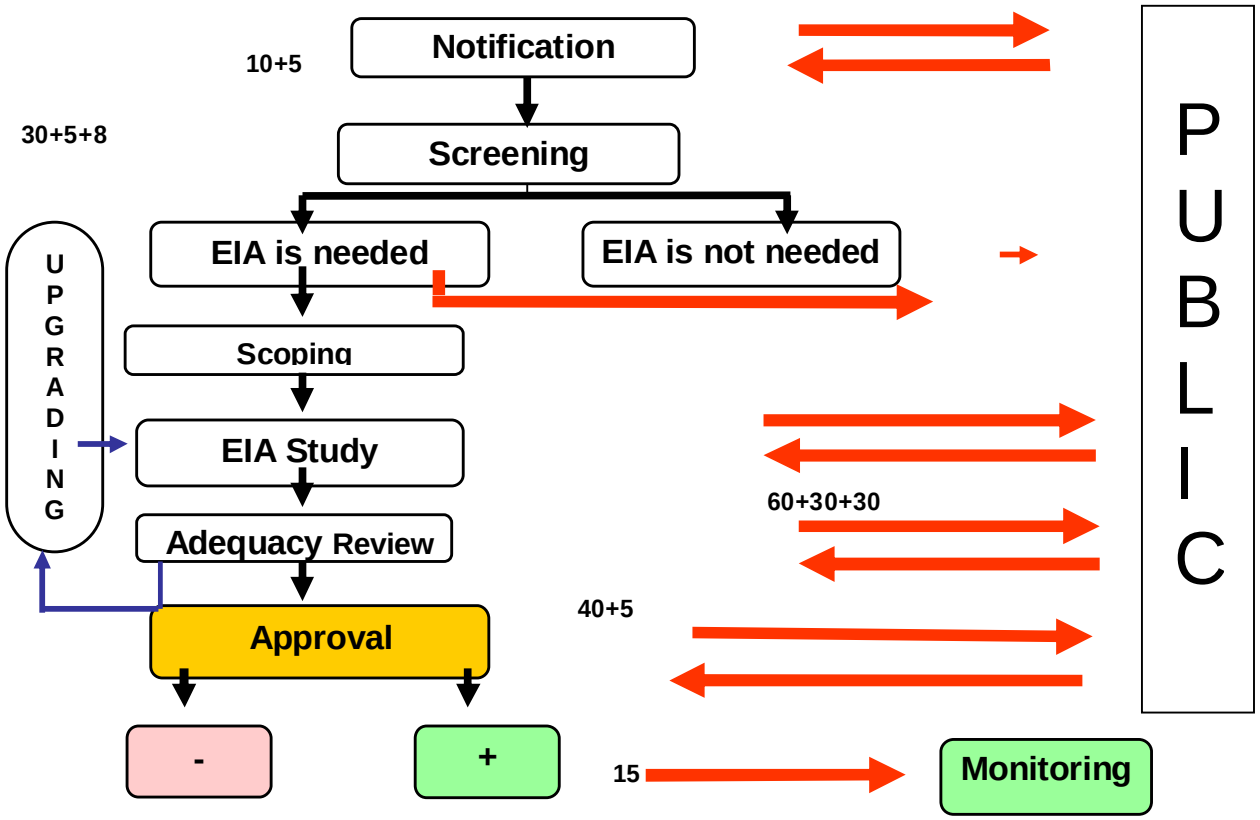


Figure 1 EIA Procedure

- **Projects which are subject to environmental impact assessment**

The procedures for **Environmental Assessment Process** cover the following aspects:

- Project Screening – (within CARDS 2004 Project the mentioned procedures are described more detailed)
- EA Document Content (Scoping)
- EA Review and Approval including Public Consultation
- Disclosure

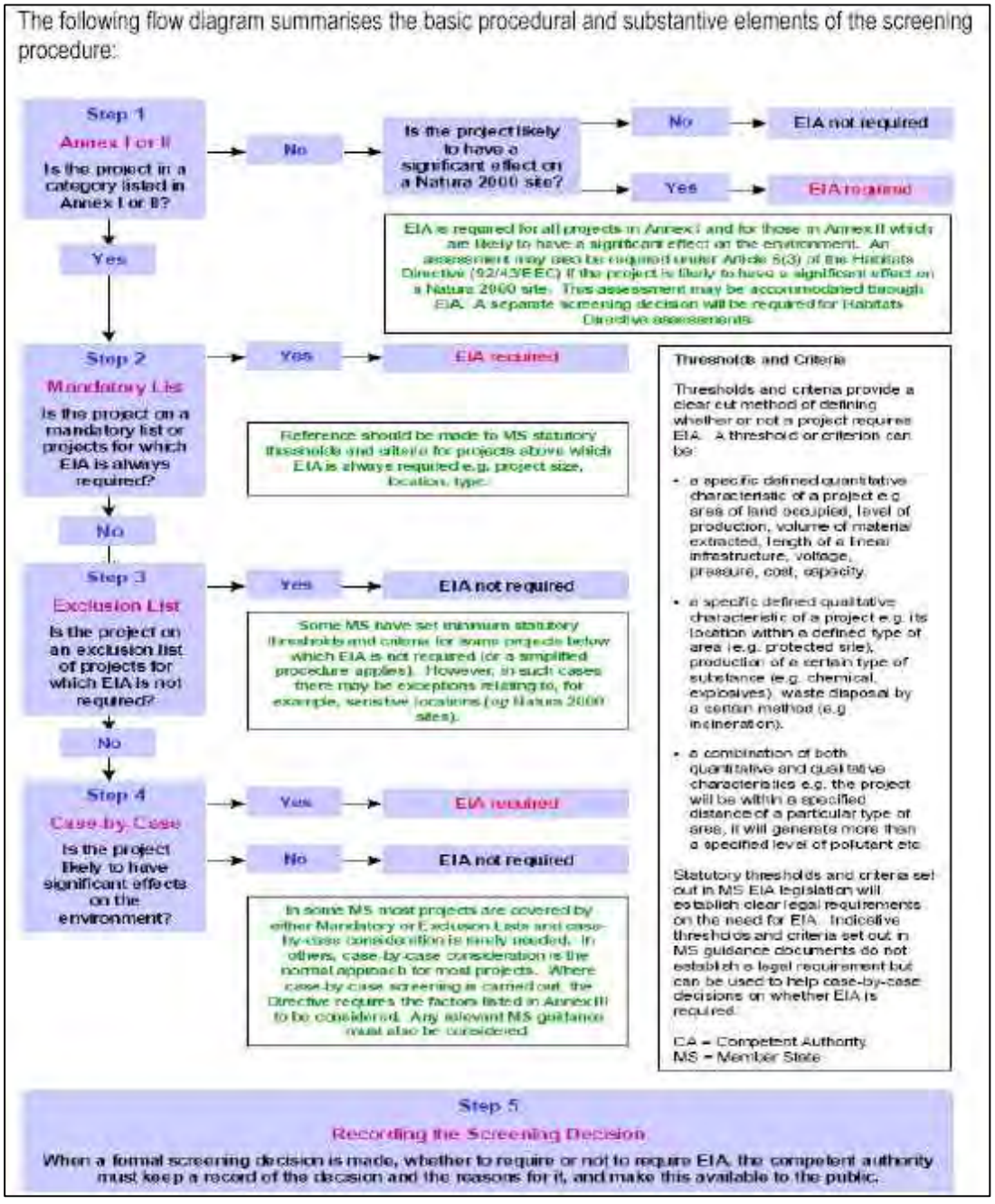
The EIA Study consists of a rigorous documentation of existing conditions, an identification of impacts, and a comparative examination of impacts arising from the relevant project alternatives. It should be conducted by national certified experts following the defined methodology, report structure and documentation requirements. The public is involved during the whole EIA process in accordance with provision stipulated in Law on Environment.

Investor who is intending to implement a project that is likely to fall under Article 77 and Article 78, of the Law on environment shall send a notification on its intention to implement the project, together with an opinion of the need of environmental impact assessment to the MoEPP. The MoEPP shall inform the investor within 10 days from the

date of the receipt of the notification on the need for supplementing the notification and within five working days of the receipt of the full notification, announce the notification in daily news paper.

Screening is the stage of the EIA process by which the body of the state administration responsible for the affairs of the environment determines whether an EIA is required for a particular project. Scoping follows screening and is the activity of deciding on the particular matters that shall be investigated within the EIA if the Screening Decision is positive, i.e., the Screening Decision indicates that an EIA is required to be carried out for the proposed project. The public shall be consulted at the screening stage. A number of steps are taken at the screening stage to determine whether EIA is required for a project.

Basic procedural and substantive elements of the screening procedure are presented on the diagram below.

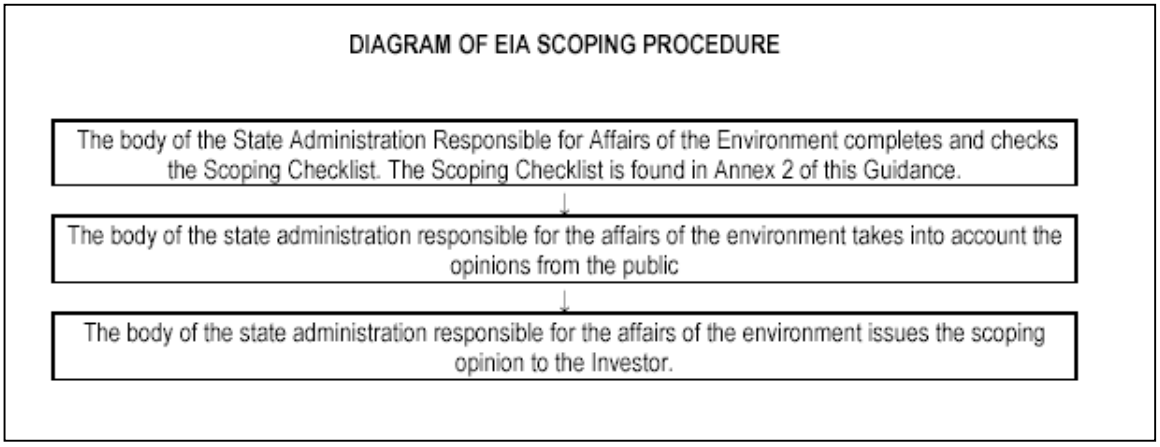


The **scoping** stage is the process during which the body of the state administration responsible for affairs of the environment determines the content and extent of the matters which should be covered by the EIA report on environmental impact assessment study (EIA Study), as per Article 8 of the Draft *Ordinance* and issues the 'Scoping Opinion' outlining this to the Investor.

The purpose of the scoping stage and the Scoping Opinion is to inform the Investor of the issues that the final report on EIA Study should respond to. This should include the specific requirements on the basis of the characteristics of each particular proposed project.

Articles 81(4) and 82(1) of the Law on Environment provide that scoping is mandatory. The Investor therefore *must* request a scoping opinion from the body of the state administration responsible for affairs of the environment.

One aim of Scoping is to identify alternatives and mitigation measures which it may be appropriate for the Investor to consider in finalising the project proposal. For example, the Investor could take a different type of action, choose an alternative location or change the design of the project so as to reduce or mitigate the potential environmental impacts of the project.



Once scoping is completed the **EIA study can be undertaken**. Thus, the study on the project environmental impact assessment is required for the carrying out of the project environmental impact assessment procedure in accordance with Article 2 of the Decree on the content of the requirement that need to be fulfilled by the study on environmental impact assessment (Official Gazette of RM No. 33/2006).

After the environmental impacts have been identified and assessed by the Study on the Project Environmental Impact Assessment (the EIA Study), the EIA process continues with the **review stage**. The developer/investor will send the EIA study to MoEPP for review and approval. Public consultation is a Macedonian requirement, and is defined as a part of the reviewing process led by MoEPP (MLE, Article 91). Review is the process of checking the adequacy of the EIA study - 'Report on the adequacy of the study on project environmental impact assessment'. The review of the quality of an EIA study is one of the main 'safeguards' built into the EIA process. Often, the quality of the EIA study can be considerably improved by review, resulting in more informed approvals and better environmental outcomes.

The Review should identify any deficiencies in the EIA Study. The Review should also focus on any shortcomings in the EIA Study and any separate and crucial deficiencies

which may directly impede decision-making from less important ones. If no serious shortcomings are found, this should be stated.

Any remarks about less important deficiencies can be placed in a separate section or appendix in the Review. Finally, the Review should recommend how and when any serious shortcomings in the EIA Study shall be remedied to facilitate informed decision-making and appropriate measures for project implementation. In case there is at least one answer of "inadequate" in Review Checklist, the MoEPP shall require that further work on the EIA study be undertaken.

The EIA study shall be **accepted (approved)** by the MoEPP unless there is an answer of "inadequate". The MoEPP shall, on the basis of the study on the project environmental impact assessment, the report on the adequacy of the study on the project environmental impact assessment, the public debate referred to in Article 91 of this Law and the opinions obtained, issue a decision on whether to grant consent to or reject the application for the project implementation within 40 days from the date of submission of the report.
The decision shall contain assessment of whether the project environmental impact assessment study fulfils the requirements prescribed by this Law and the permit conditions for the project implementation, as well as measures for prevention and reduction of the harmful effects.

- **Projects which are not subject to environmental impact assessment**

The Government of the Republic of Macedonia may in exceptional cases decide on the basis of case-by-case examination not to carry out environmental impact assessment, either in whole or in part, of projects, in case of:

- War or state of emergency,
- Defense needs of the Republic of Macedonia, if it is found that the implementation of the procedures for environmental impact assessment would have adverse effect on the defense, or
- need for urgent prevention of events that could have not been predicted and are likely to have a serious impact on health, security or property of people, or on the environment.

In this case an alternative method of environmental impact assessment proposed by the MoEPP shall apply. For this purpose the Ministry shall:

- inform appropriately the public and explain the decision not to carry out an environmental impact assessment; and
- inform the public concerned on information obtained through alternative environmental impact assessment methods.

- **Other relevant guidelines and procedures**

In 2006 in the frame of CARDS 2004, GUIDANCE for conducting screening, scoping and review in environmental impact assessment in Republic of Macedonia was developed. This Guidance document is intended to be read in conjunction with the current laws that regulate the environmental impact assessment (EIA) process in the Republic of Macedonia. These laws are referred to in this document. An aim of this Guidance is to assist in the interpretation of the EIA laws so that they can be applied in practice. This Guidance is drawn in part from the screening, scoping and review Guidance provided by the European Commission. It accompanies the Republic of Macedonia efforts to implement the EIA Directive and is designed to help investors, bodies of the state

administration and other involved parties to undertake the highest standards of environmental impact assessment.

Sectorial EIA Guidelines - Waste Water Treatment Plant, prepared in 2006 as part of the Project: “Environmental Management Strengthening” is also relevant Guideline that is considered.

These Guidelines focus on providing guidance for the EIA procedure concerning wastewater treatment plant preparation as well as the development of the Environmental Impact Statement EIS. The guidelines are meant for operators, authorities and consultants. The main focus is environmental assessments relating to these activities and the EIA procedure itself. Thus, guidelines include the principal of cumulative collection of environmental information for subsequent use in the preparation of the EIA.
According to the Law on Environment, MoEPP stipulate the strategies, the plans and the programmes, including amendments to such strategies, plans and programmes, (planning documents), that are subject to a mandatory assessment of their impact on the environment and human health (strategic assessment). Strategic assessment shall be carried out on the planning documents prepared in the area of agriculture, forestry, fisheries, energy, industry, mining industry, transport, regional development, telecommunications, waste management, water management, tourism, spatial and urban planning and land use, on the National Environmental Action Plan and local environmental action plans, as well as on all strategic, planning and programme documents by which implementation of projects that are subject to environmental impact assessment are planned.

Annex 3

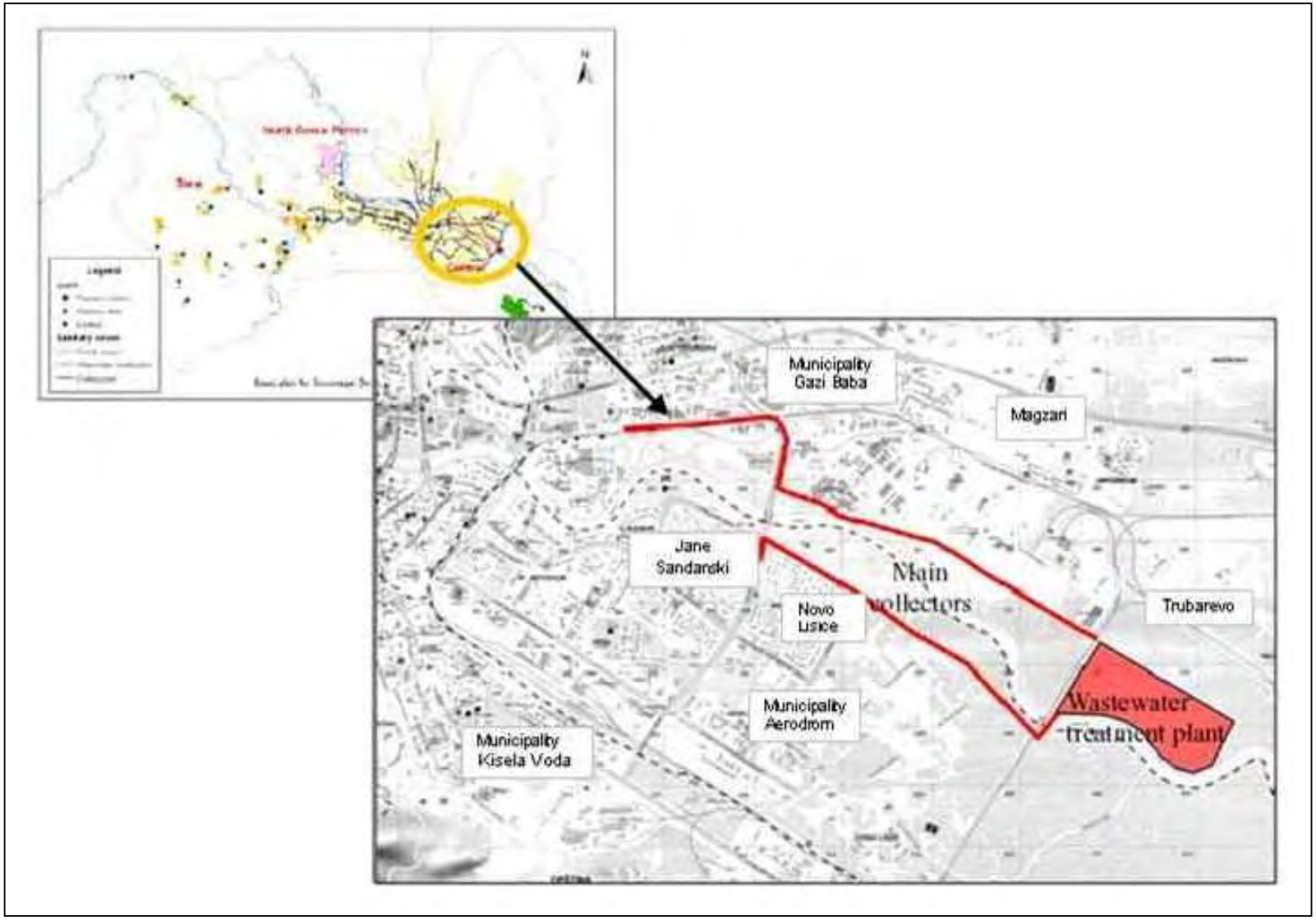


Figure: Location of the main collector and WWTP

Annex 4

Figure: Water Economy Facility Zone as proposed location of the WWTP in Trubarevo and natural protected heritage

Annex 5

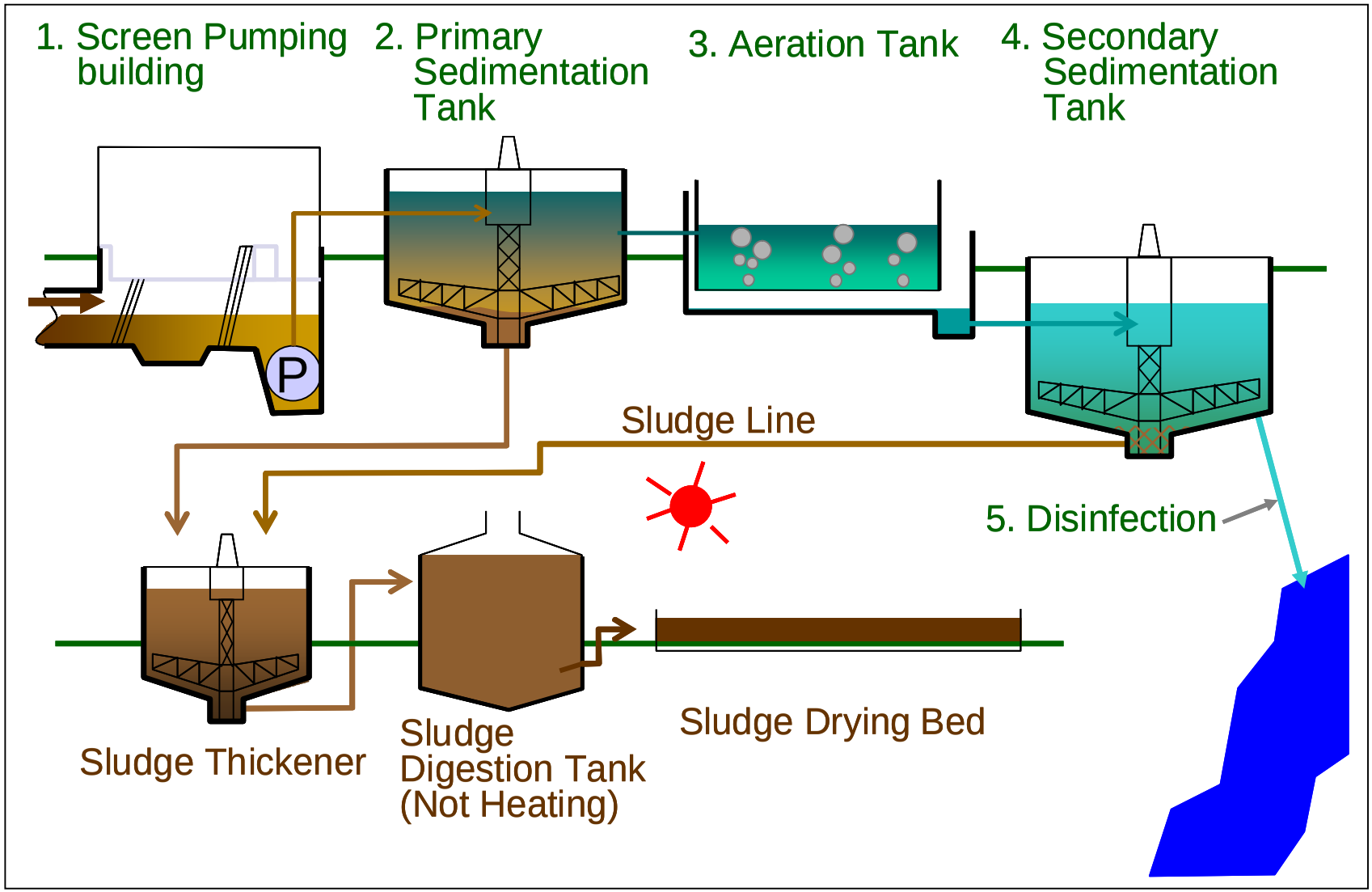


Figure: Process flow of CASP and treatment of its sludge in WWTP

Annex 6

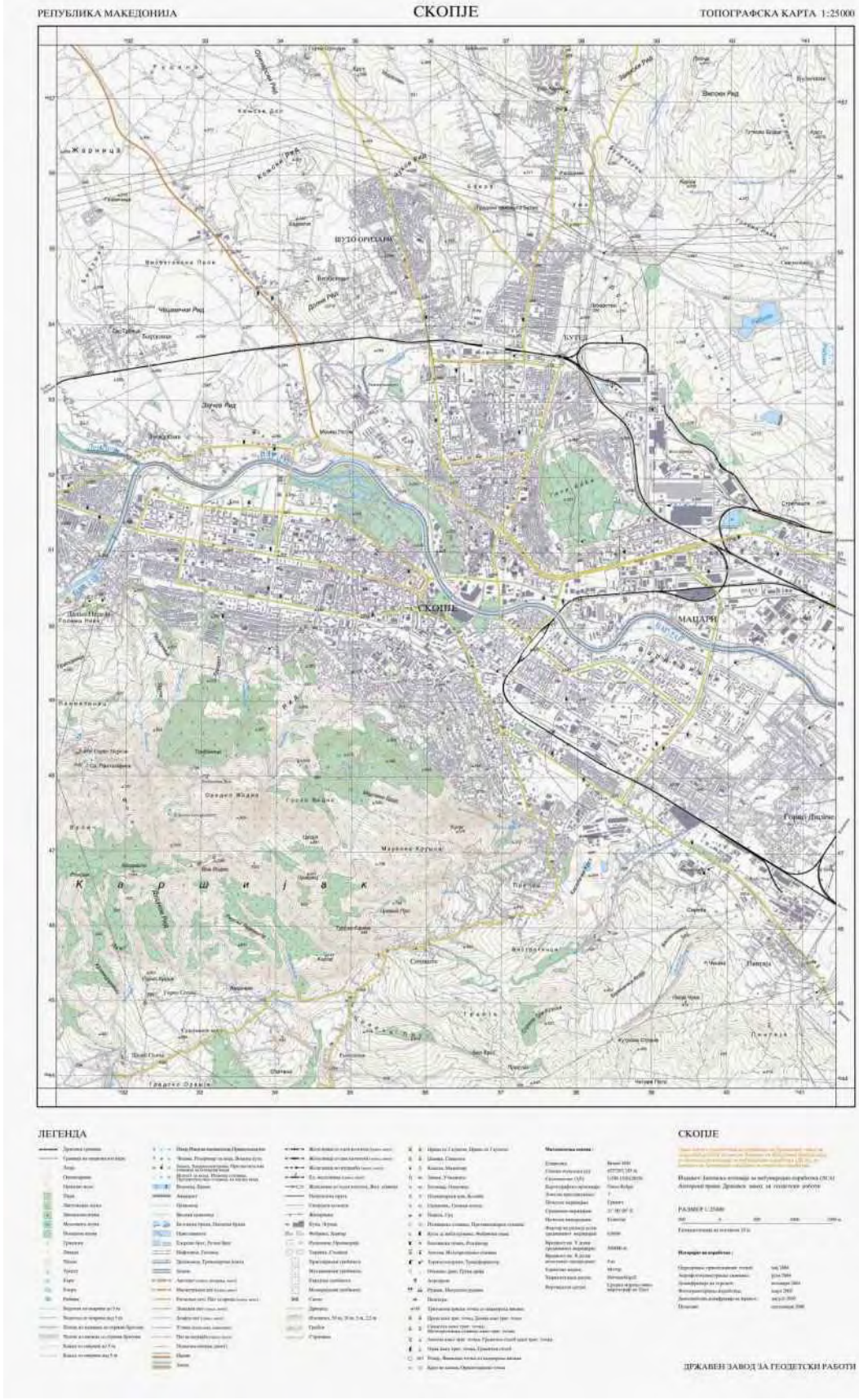


Figure: Topography map of Skopje City urban part

Annex 7

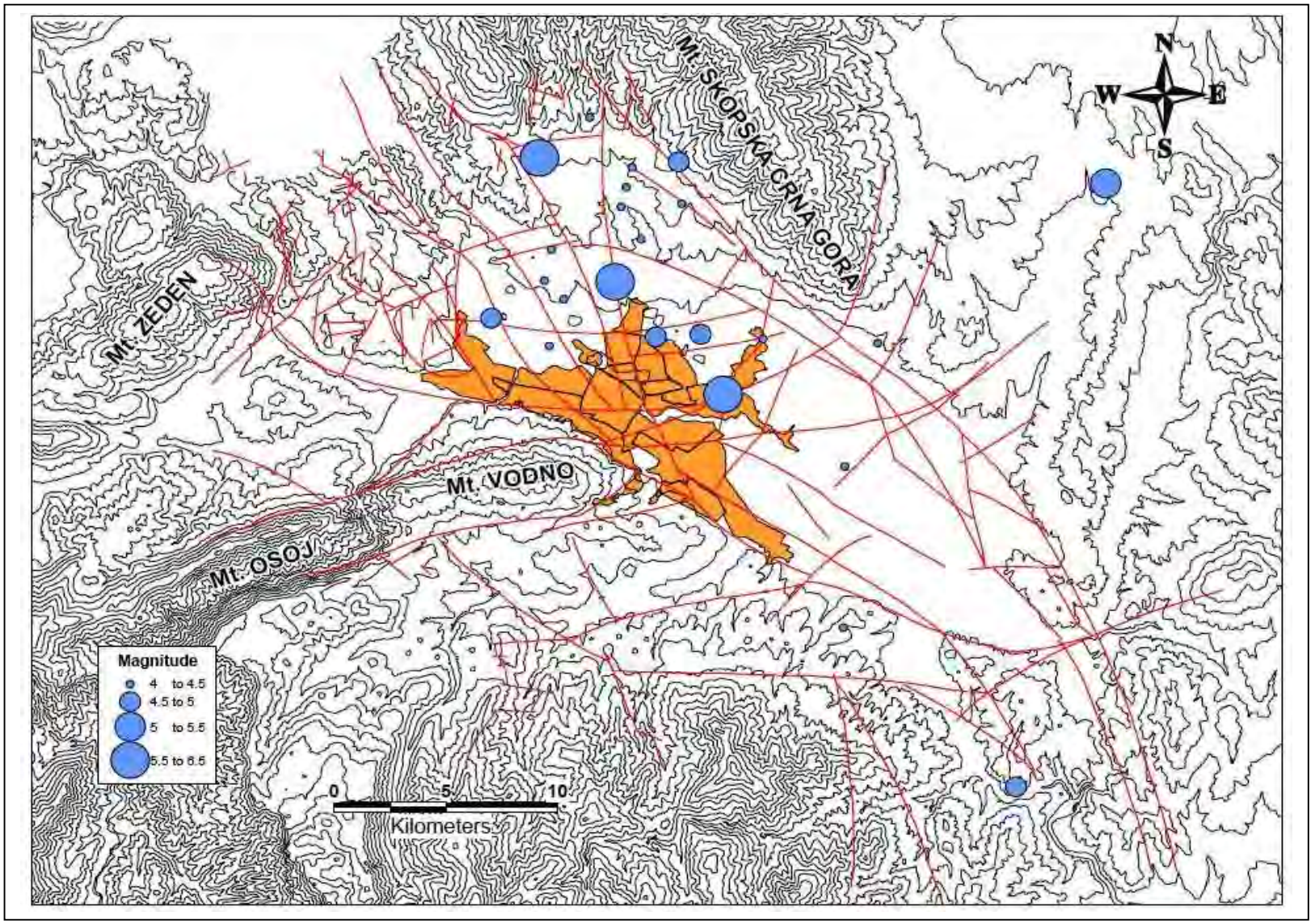


Figure: Seismotectonic Map of the Greater Skopje Region

Annex 8

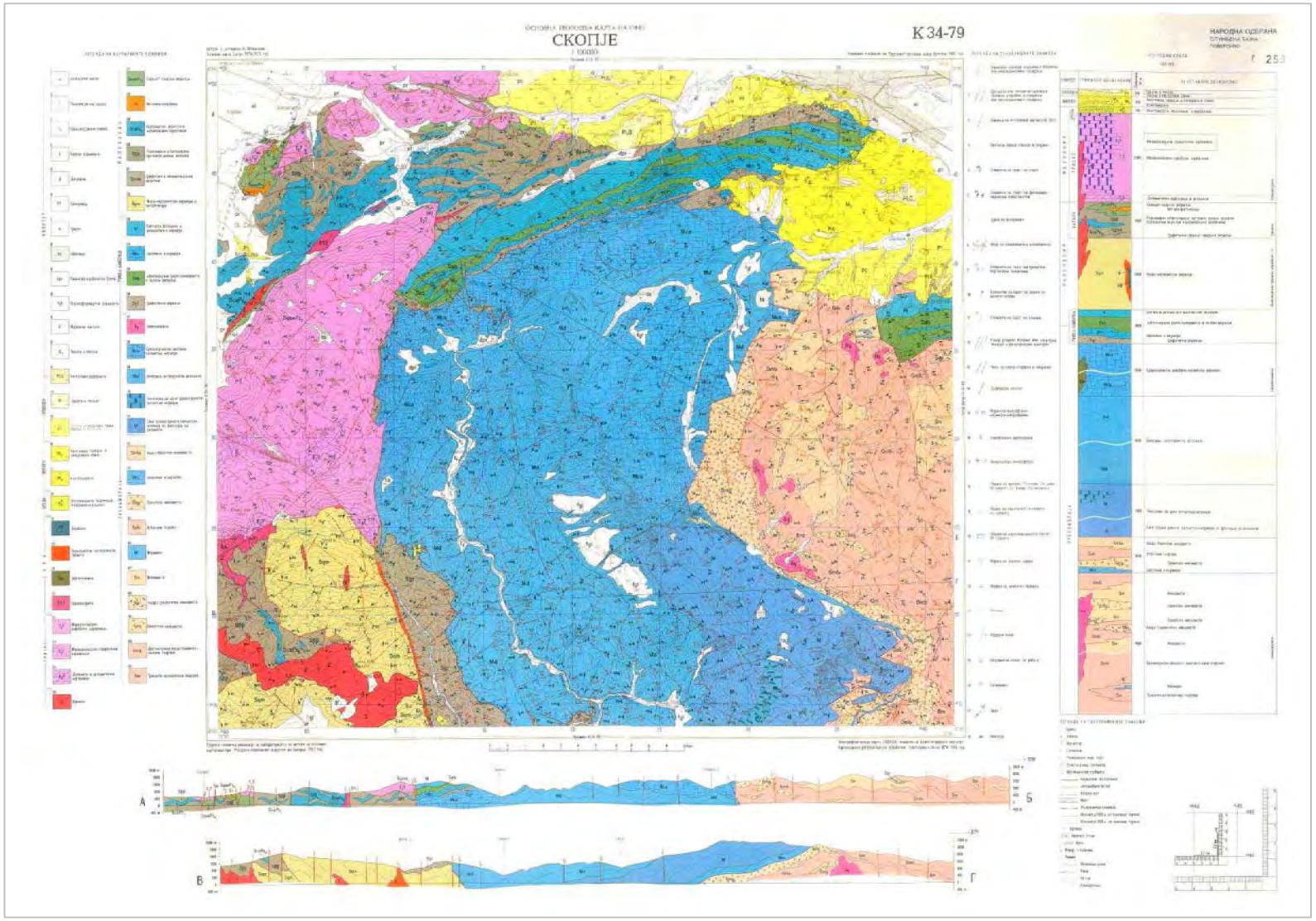


Figure: Geology map of Skopje City

Annex 9

The results from terrain test "*in sity*" (SPT) *Standard dynamic penetration*

Bor-hole	Deph [m']	Penetr-tion e [cm]	Number of impacts N	N'	N''	N*	Density/ consistence	Module of density according to Suklje Mv [MPa]	Symbol
B-1	1.00	23.00	30	23	30		compacted	19.84	SFs
B-1	2.00	20.00	30	23	34		compacted	22.52	SFs
B-1	3.00	7.00	30	23	98		Very compacted	81.17	GW
B-1	4.00	8.00	30	23	86		Very compacted	71.40	GW
B-1	5.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	6.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	7.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	8.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	9.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	10.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	11.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	12.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	13.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	14.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-1	15.00	8.00	30	23	86	50	Very compacted	71.40	GW

Bor-hole	Deph [m']	Penetr-tion e [cm]	Number of impacts N	N'	N''	N*	Density/ consistence hole	Module of density according to Suklje [m']	Symbol e [cm]
B-2	1.00	18.00	30	23	38		compacted	33.40	GW
B-2	2.00	16.00	30	23	43		compacted	37.20	GW
B-2	3.00	19.00	30	23	36		compacted	31.80	GW
B-2	4.00	17.00	30	23	40		compacted	35.19	GW
B-2	5.00	16.00	30	23	43		compacted	37.20	GW
B-2	6.00	17.00	30	23	40		compacted	35.19	GW
B-2	7.00	21.00	30	23	33	24	Medium	29.06	GW

							comp.		
B-2	8.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-2	9.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-2	10.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-2	11.00	20.00	30	23	34	25	compacted	30.36	GW
B-2	12.00	20.00	30	23	34	25	compacted	30.36	GW

Bor-hole	**Deph [m']**	**Penetr-tion e [cm]**	**Number of impacts**				**Density/ consistence hole**	**Module of density according to Suklje [m']**	**Symbol e [cm]**
			N	**N'**	**N''**	**N***			
B-3	1.00	23.00	30	23	30		Medium comp.	26.79	GW
B-3	2.00	20.00	30	23	34		compacted	30.36	GW
B-3	3.00	18.00	30	23	38		compacted	33.40	GW
B-3	4.00	17.00	30	23	40		compacted	35.19	GW
B-3	5.00	23.00	30	23	30	22	Medium comp.	26.79	GW
B-3	6.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-3	7.00	19.00	30	23	36	26	compacted	31.80	GW
B-3	8.00	18.00	30	23	38	27	compacted	33.40	GW
B-3	9.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-3	10.00	23.00	30	23	30	22	Medium comp.	26.79	GW
B-3	11.00	20.00	30	23	34	25	compacted	30.36	GW
B-3	12.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-3	13.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-3	14.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-3	15.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-3	16.00	23.00	30	23	30	22	Medium comp.	26.79	GW
B-3	17.00	20.00	30	23	34	25	compacted	30.36	GW
B-3	18.00	18.00	30	23	38	27	compacted	33.40	GW

		Penetr-	**Number of**	**Density/**	**Module of density**	

Bor-hole	Depth [m']	tion e [cm]	impacts N	N'	N''	N*	consistence	according to Suklje Mv [MPa]	Symbol
B-4	1.00	20.00	30	23	34		Solid	14.88	ML
B-4	2.00	16.00	30	23	43		Solid	18.30	ML
B-4	3.00	7.00	30	23	98		Very compacted	81.17	SFs
B-4	4.00	8.00	30	23	86		Very compacted	71.40	GW
B-4	5.00	8.00	30	23	86		Very compacted	71.40	GW
B-4	6.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	7.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	8.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	9.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	10.00	7.00	30	23	98	56	Very compacted	48.09	GW
B-4	11.00	9.00	30	23	76	46	compacted	39.40	GW
B-4	12.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	13.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-4	14.00	7.00	30	23	98	56	Very compacted	48.09	GW
B-4	15.00	7.00	30	23	98	56	Very compacted	48.09	GW
B-4	16.00	8.00	30	23	86	50	Very compacted	43.20	GW

Bor-hole	Depth [m']	Penetr-tion e [cm]	Number of impacts N	N'	N''	N*	Density/ consistence hole	Module of density according to Suklje [m']	Symbol e [cm]
B-5	1.00	26.00	30	23	26		half solid	11.72	ML
B-5	2.00	30.00	30	23	23		half solid	0.00	ML
B-5	3.00	17.00	30	23	40		compacted	35.19	GW
B-5	4.00	20.00	30	23	34		compacted	30.36	GW
B-5	5.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-5	6.00	10.00	30	23	68	42	compacted	36.36	GW
B-5	7.00	15.00	30	23	46	30	compacted	27.24	GW
B-5	8.00	9.00	30	23	76	46	compacted	39.40	GW

B-5	9.00	10.00	30	23	68	42	compacted	36.36	GW
B-5	10.00	13.00	30	23	53	34	compacted	30.05	GW
B-5	11.00	12.00	30	23	57	36	compacted	31.80	GW
B-5	12.00	10.00	30	23	68	42	compacted	36.36	GW
B-5	13.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-5	14.00	7.00	30	23	98	56	Very compacted	48.09	GW
B-5	15.00	9.00	30	23	76	46	compacted	39.40	GW
B-5	16.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-5	17.00	9.00	30	23	76	46	compacted	39.40	GW
B-5	18.00	8.00	30	23	86	50	Very compactd	43.20	GW
B-5	19.00	7.00	30	23	98	56	Very compactd	48.09	GW

Bor-hole	**Deph [m']**	**Penetr-tion e [cm]**	**Number of impacts**				**Density/ consistence hole**	**Module of density according to Suklje [m']**	**Symbol e [cm]**
			N	**N'**	**N''**	**N***			
B-6	1.00	30.00	30	23	23		Medium comp.	10.32	ML
B-6	2.00	25.00	30	23	27		Medium comp.	24.89	GW
B-6	3.00	23.00	30	23	30		Medium comp.	26.79	GW
B-6	4.00	19.00	30	23	36		compacted	31.80	GW
B-6	5.00	22.00	30	23	31	23	Medium comp.	21.44	GW
B-6	6.00	23.00	30	23	30	22	Medium comp.	26.79	GW
B-6	7.00	20.00	30	23	34	25	compacted	30.36	GW
B-6	8.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-6	9.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-6	10.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-6	11.00	20.00	30	23	34	25	compacted	30.36	GW
B-6	12.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-6	13.00	20.00	30	23	34	25	compacted	30.36	GW
B-6	14.00	23.00	30	23	30	22	Medium comp.	26.79	GW
B-6	15.00	22.00	30	23	31	23	Medium comp.	27.87	GW

B-6	16.00	25.00	30	23	27	21	Medium comp.	24.89	GW
B-6	17.00	23.00	30	23	30	22	Medium comp.	26.79	GW

Bor-hole	Deph [m']	Penetr-tion e [cm]	Number of impacts				Density/ consistence hole	Module of density according to Suklje [m']	Symbol e [cm]
			N	N'	N''	N*			
B-7	1.00	20.00	30	23	34		compacted	0.00	SFs
B-7	2.00	17.00	30	23	40		compacted	0.00	SFs
B-7	3.00	15.00	30	23	46		compacted	0.00	SFs
B-7	4.00	19.00	30	23	36	26	compacted	23.40	GW
B-7	5.00	7.00	30	23	98	56	Verycompactd	48.09	GW
B-7	6.00	9.00	30	23	76	46	compacted	39.40	GW
B-7	7.00	10.00	30	23	68	42	compacted	36.36	GW
B-7	8.00	6.00	30	23	11.4	65	Verycompactd	54.60	GW
B-7	9.00	8.00	30	23	86	50	Very compacted	43.20	GW
B-7	10.00	11.00	30	23	62	39	compacted	33.87	GW
B-7	11.00	13.00	30	23	53	34	compacted	30.05	GW
B-7	12.00	9.00	30	23	76	46	compacted	39.40	GW
B-7	13.00	8.00	30	23	86	50	Very compactd	43.20	GW
B-7	14.00	9.00	30	23	76	46	compacted	39.40	GW
B-7	15.00	7.00	30	23	98	56	Very compactd	48.09	GW
B-7	16.00	9.00	30	23	76	46	compacted	39.40	GW

Bor-hole	Deph [m']	Penetr-tion e [cm]	Number of impacts				Density/ consistence hole	Module of density according to Suklje [m']	Symbol e [cm]
			N	N'	N''	N*			
B-8	1.00	15.00	30	23	46		compacted	39.48	GW
B-8	2.00	13.00	30	23	53		compacted	45.09	GW
B-8	3.00	10.00	30	23	68		Very compacted	57.72	GW
B-8	4.00	20.00	30	23	34	25	compacted	30.36	GW
B-8	5.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-8	6.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-8	7.00	21.00	30	23	33	24	Medium comp.	29.06	GW

B-8	8.00	19.00	30	23	36	26	compacted	31.80	GW
B-8	9.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-8	10.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-8	11.00	26.00	30	23	26	21	Medium comp.	24.05	GW
B-8	12.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-8	13.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-8	14.00	20.00	30	23	34	25	compacted	30.36	GW
B-8	15.00	20.00	30	23	34	25	compacted	30.36	GW
B-8	16.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-8	17.00	24.00	30	23	29	22	Medium comp.	25.80	GW

Bor-hole	**Deph [m']**	**Penetr-tion e [cm]**	**Number of impacts**				**Density/ consistence hole**	**Module of density according to Suklje [m']**	**Symbol e [cm]**
			N	**N'**	**N''**	**N***			
B-9	1.00	22.00	30	23	31		Solid	13.64	ML
B-9	2.00	18.00	30	23	38		Solid	16.40	ML
B-9	3.00	16.00	10	8	14		Medium comp.	10.55	SFs
B-9	4.00	19.00	30	23	36		Medium comp.	23.60	SFs
B-9	5.00	11.00	30	23	62	39	compacted	33.87	GW
B-9	6.00	9.00	30	23	76	46	compacted	39.40	GW
B-9	7.00	8.00	30	23	86	50	Verycompactd	43.20	GW
B-9	8.00	11.00	30	23	62	39	compacted	33.87	GW
B-9	9.00	10.00	30	23	68	42	compacted	36.36	GW
B-9	10.00	12.00	30	23	57	36	compacted	31.80	GW
B-9	11.00	20.00	30	23	34	25	Medium comp.	22.68	GW
B-9	12.00	15.00	30	23	46	30	compacted	27.24	GW
B-9	13.00	18.00	30	23	38	27	Medium comp.	24.20	GW
B-9	14.00	19.00	30	23	36	26	Medium comp.	23.40	GW
B-9	15.00	17.00	30	23	40	28	Medium comp.	25.09	GW

		Penetr-	**Number of**	**Density/**	**Module of density**	

Bor-hole	Depth [m']	Penetration [cm]	impacts N	N'	N''	N*	consistence hole	according to Suklje [m']	Symbole [cm]
B-10	1.00	23.00	30	23	30		Medium comp.	13.10	ML
B-10	2.00	20.00	30	23	34		Medium comp.	22.52	SFs
B-10	3.00	30.00	10	8	8			0.00	OI
B-10	4.00	19.00	30	23	36	26	compacted	31.80	GW
B-10	5.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-10	6.00	25.00	30	23	27	21	Medium comp.	24.89	GW
B-10	7.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-10	8.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-10	9.00	22.00	30	23	31	23	Medium comp.	27.87	GW
B-10	10.00	19.00	30	23	36	26	compacted	31.80	GW
B-10	11.00	18.00	30	23	38	27	compacted	33.40	GW
B-10	12.00	19.00	30	23	36	26	compacted	31.80	GW
B-10	13.00	19.00	30	23	36	26	compacted	31.80	GW
B-10	14.00	20.00	30	23	34	25	compacted	30.36	GW
B-10	15.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-10	16.00	18.00	30	23	38	27	compacted	33.40	GW
B-10	17.00	17.00	30	23	40	28	compacted	35.19	GW

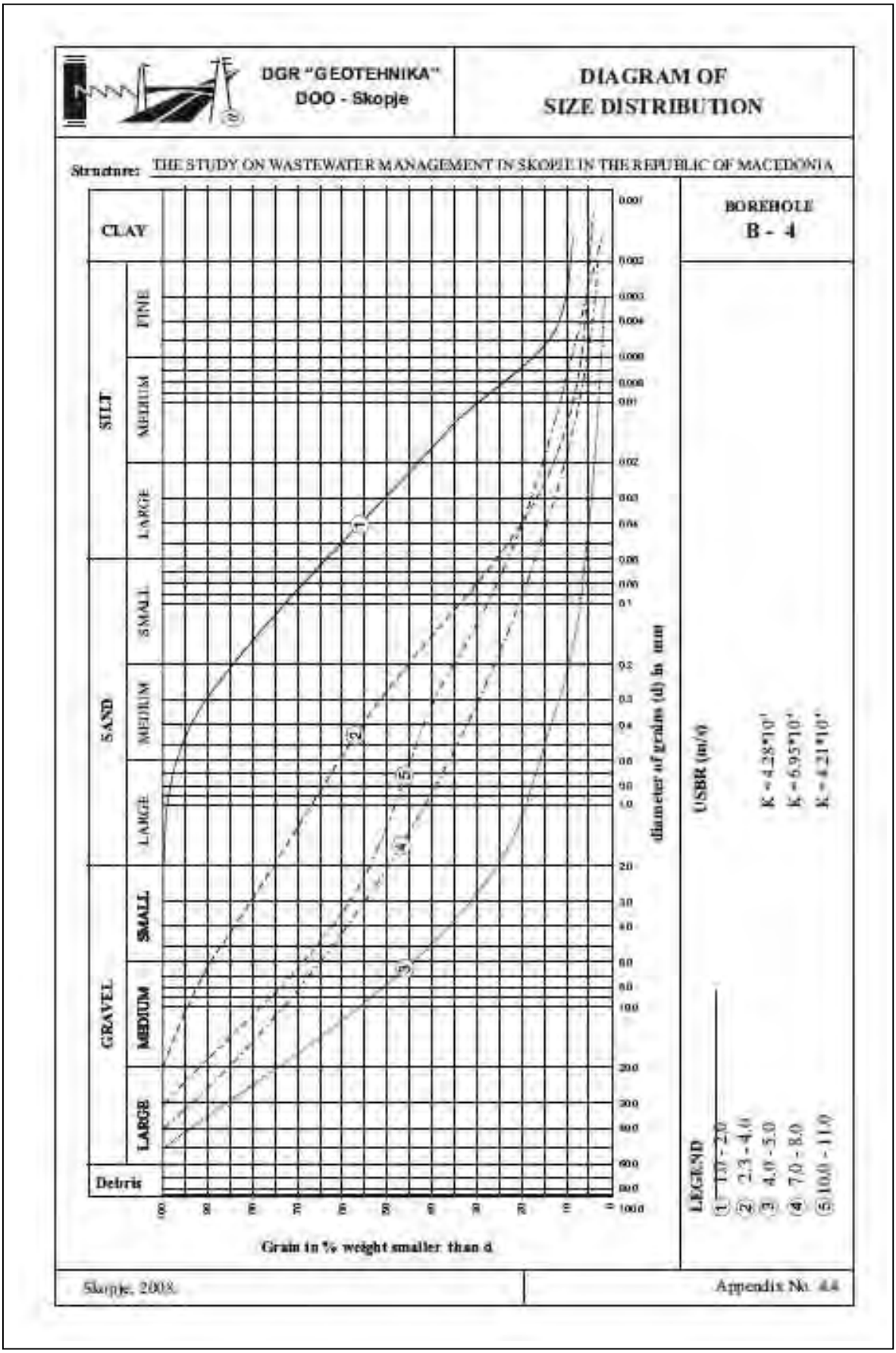
Bor-hole	Depth [m']	Penetration [cm]	Number of impacts N	N'	N''	N*	Density/ consistence hole	Module of density according to Suklje [m']	Symbole [cm]
B-11	1.00	25.00	30	23	27		half solid	12.14	ML
B-11	2.00	18.00	30	23	38		compacted	24.80	SFs
B-11	3.00	14.00	30	23	49		compacted	42.09	GW
B-11	4.00	17.00	30	23	40	28	Medium comp.	25.09	GW
B-11	5.00	15.00	30	23	46	30	compacted	27.24	GW
B-11	6.00	20.00	30	23	34	25	Medium comp.	22.68	GW
B-11	7.00	22.00	30	23	31	23	Medium comp.	21.44	GW
B-11	8.00	20.00	30	23	34	25	Medium comp.	22.68	GW
B-11	9.00	17.00	30	23	40	28	Medium	25.09	GW

							comp.		
B-11	10.00	19.00	30	23	36	26	Medium comp.	23.40	GW
B-11	11.00	16.00	30	23	43	29	Medium comp.	26.10	GW
B-11	12.00	15.00	30	23	46	30	compacted	27.24	GW
B-11	13.00	14.00	30	23	49	32	compacted	28.54	GW
B-11	14.00	18.00	30	23	38	27	Medium comp.	24.20	GW
B-11	15.00	16.00	30	23	43	29	Medium comp.	26.10	GW
B-11	16.00	19.00	30	23	36	26	Medium comp.	23.40	GW
B-11	17.00	18.00	30	23	38	27	Medium comp.	24.20	GW
B-11	18.00	15.00	30	23	46	30	compacted	27.24	GW
B-11	19.00	17.00	30	23	40	28	Medium comp.	25.09	GW
B-11	20.00	18.00	30	23	38	27	Medium comp.	24.20	GW

Bor-hole	**Deph [m']**	**Penetr-tion e [cm]**	**Number of impacts**				**Density/ consistence hole**	**Module of density according to Suklje [m']**	**Symbol e [cm]**
			N	**N'**	**N''**	**N***			
B-12	1.00	22.00	30	23	31		Medium comp.	13.64	ML
B-12	2.00	20.00	30	23	34		compacted	30.36	GW
B-12	3.00	19.00	30	23	36		compacted	31.80	GW
B-12	4.00	25.00	30	23	27	21	Medium comp.	24.89	GW
B-12	5.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-12	6.00	27.00	30	23	25	20	Medium comp.	23.27	GW
B-12	7.00	29.00	30	23	24	19	Medium comp.	21.87	GW
B-12	8.00	30.00	30	23	23	19	Medium comp.	21.24	GW
B-12	9.00	27.00	30	23	25	20	Medium comp.	23.27	GW
B-12	10.00	25.00	30	23	27	21	Medium comp.	24.89	GW
B-12	11.00	24.00	30	23	29	22	Medium comp.	25.80	GW
B-12	12.00	25.00	30	23	27	21	Medium comp.	24.89	GW

B-12	13.00	25.00	30	23	27	21	Medium comp.	24.89	GW
B-12	14.00	20.00	30	23	34	25	compacted	30.36	GW
B-12	15.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-12	16.00	21.00	30	23	33	24	Medium comp.	29.06	GW
B-12	17.00	19.00	30	23	36	26	compacted	31.80	GW
B-12	18.00	17.00	30	23	40	28	compacted	35.19	GW

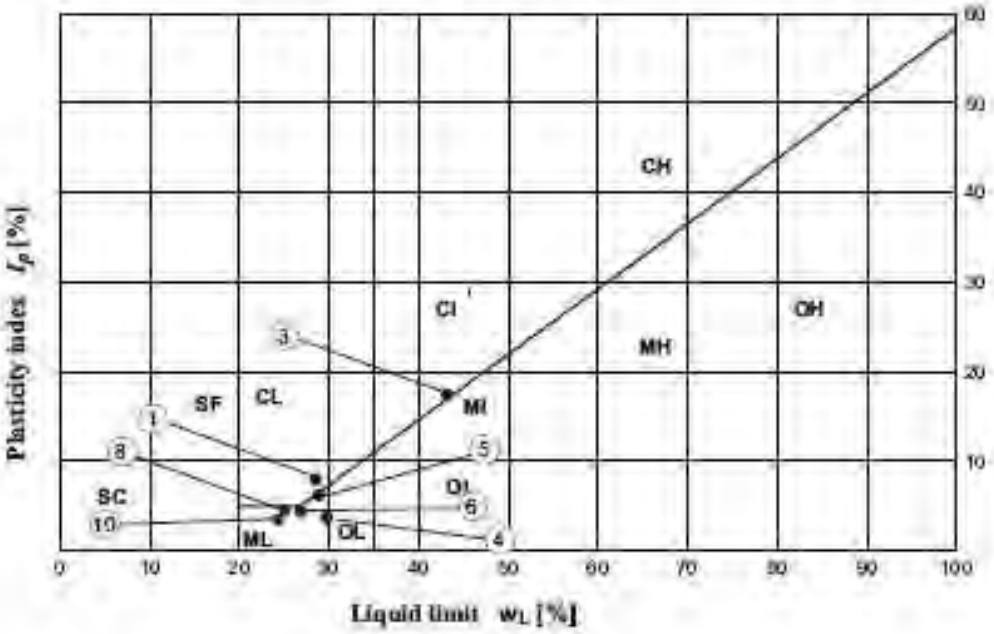
Annex 10


DGR "GEOTEHNIKA"
DOO - Skopje
DIAGRAM OF
SIZE DISTRIBUTION
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA
BOREHOLE
B - 4
CLAY
SILT
FINE
MEDIUM
LARGE
SAND
SMALL
MEDIUM
LARGE
GRAVEL
SMALL
MEDIUM
LARGE
Debris
diameter of grains (d) in mm
Grain in % weight smaller than d
USBR (m/s)
K = 4.28*10⁻¹
K = 6.95*10⁻¹
K = 4.21*10⁻¹
LEGEND
① 1.0 - 2.0
② 2.3 - 4.0
③ 4.0 - 5.0
④ 7.0 - 8.0
⑤ 10.0 - 11.0
Skopje, 2008.
Appendix No. 4.4

DGR "GEOTEHNIKA" DOO - Skopje

DIAGRAM OF PLASTICITY

Structure: THE STUDY ON WASTE WATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA



No	Borehole	Depth	W_l	W_p	I_p	Symbol
1.	B - 1	3.0 - 4.0	28.4	20.2	8.2	CL
2.	B - 3	11.0 - 12.0		SANDY		
3.	B - 4	2.0 - 3.0	43.0	25.4	17.7	CI
4.	B - 5	1.2 - 1.5	29.6	25.7	3.9	ML
5.	B - 5	2.2 - 2.5	28.7	22.3	6.4	ML
6.	B - 7	0.7 - 1.0	26.7	22.1	4.6	ML
7.	B - 8	6.0 - 7.0		SANDY		
8.	B - 9	1.3 - 1.4	24.9	20.1	4.8	ML
9.	B - 10	1.0 - 2.0		SANDY		
10.	B - 12	1.0 - 2.0	24.2	20.49	3.71	ML

Skopje, 2008. Appendix No. 5

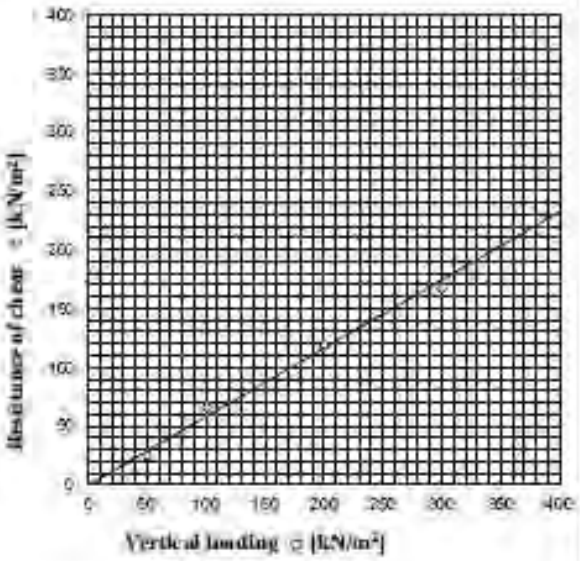
DGR "GEOTEHNIKA"
DOO -Skopje

CHART OF SHEAR STRENGTH

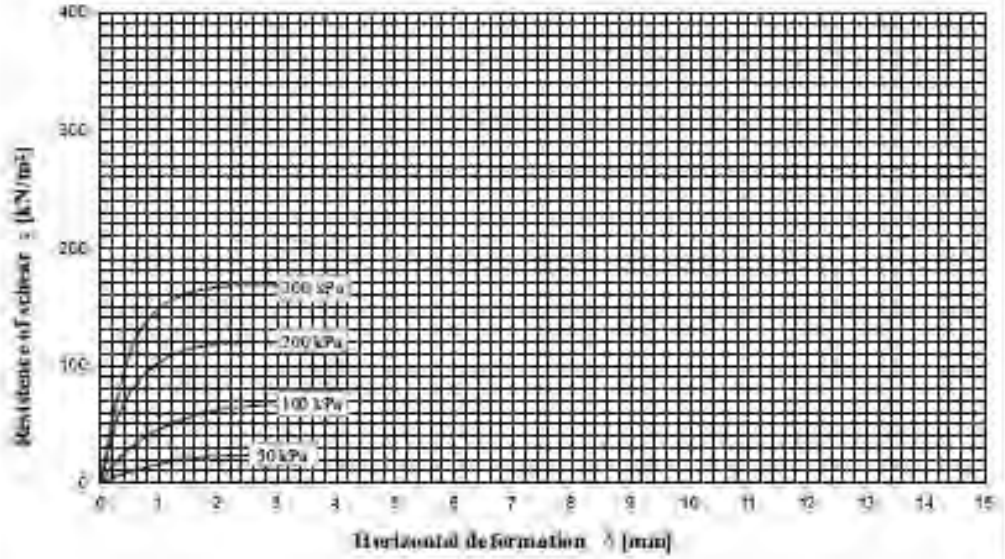
Structure: THE STUDY ON WASTEWATER MANAGEMENT IN SKOPJE IN THE REPUBLIC OF MACEDONIA

Borehole: B-4 Depth: 4.0 – 5.0 m

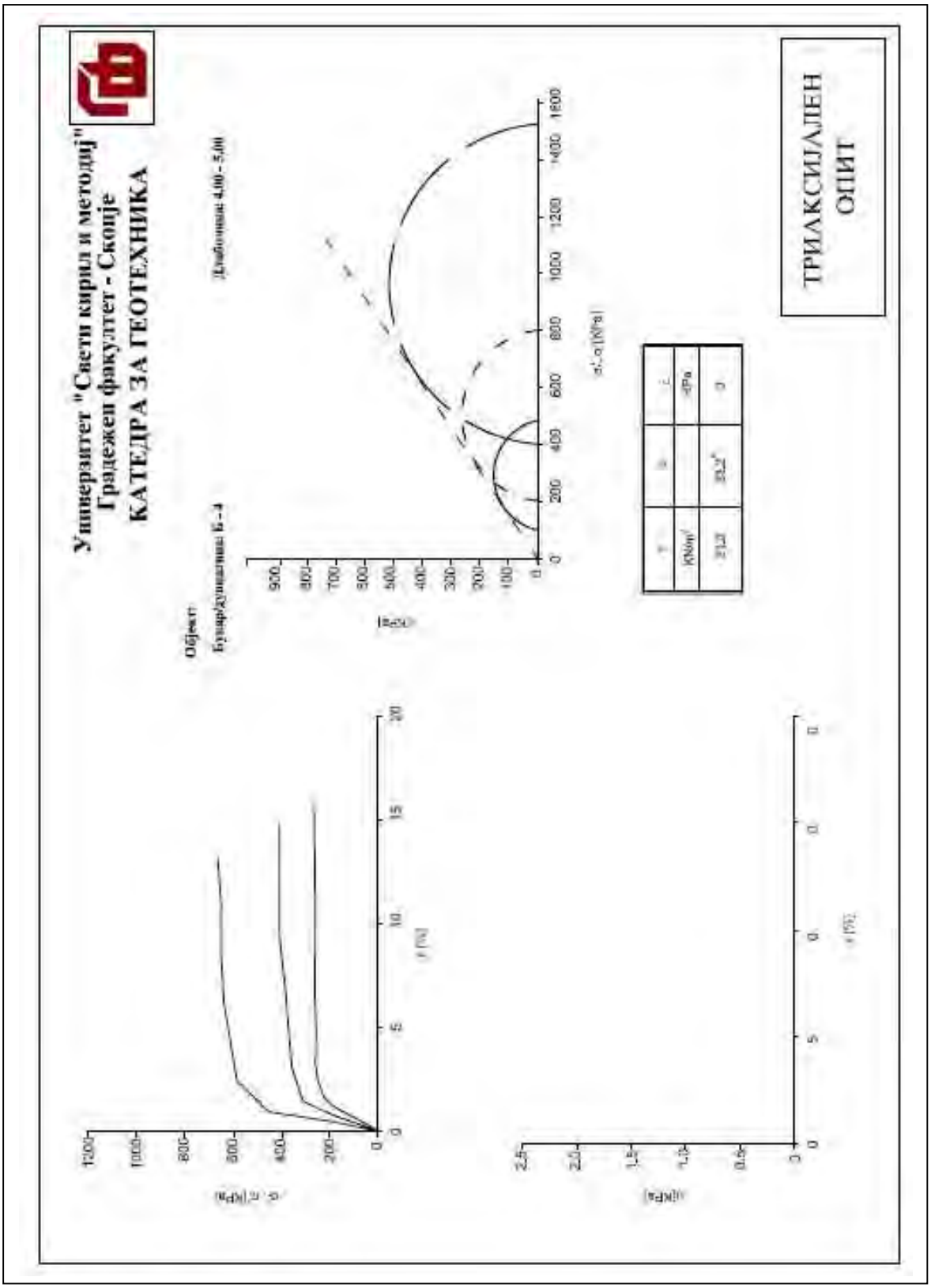
SAMPLE		
Dimension	[illegible]	[cm]
Moisture content before test	[illegible]	[%]
Moisture content after test	12.50	[%]
Bulk density	21.0	[kN/m³]
Dry density	19.31	[kN/m³]
Consolidation	24	[h]
tg φ	0.590	
Frictional angle - φ	30.0	[°]
Cohesion - c	0.0	[kPa]



SHEAR



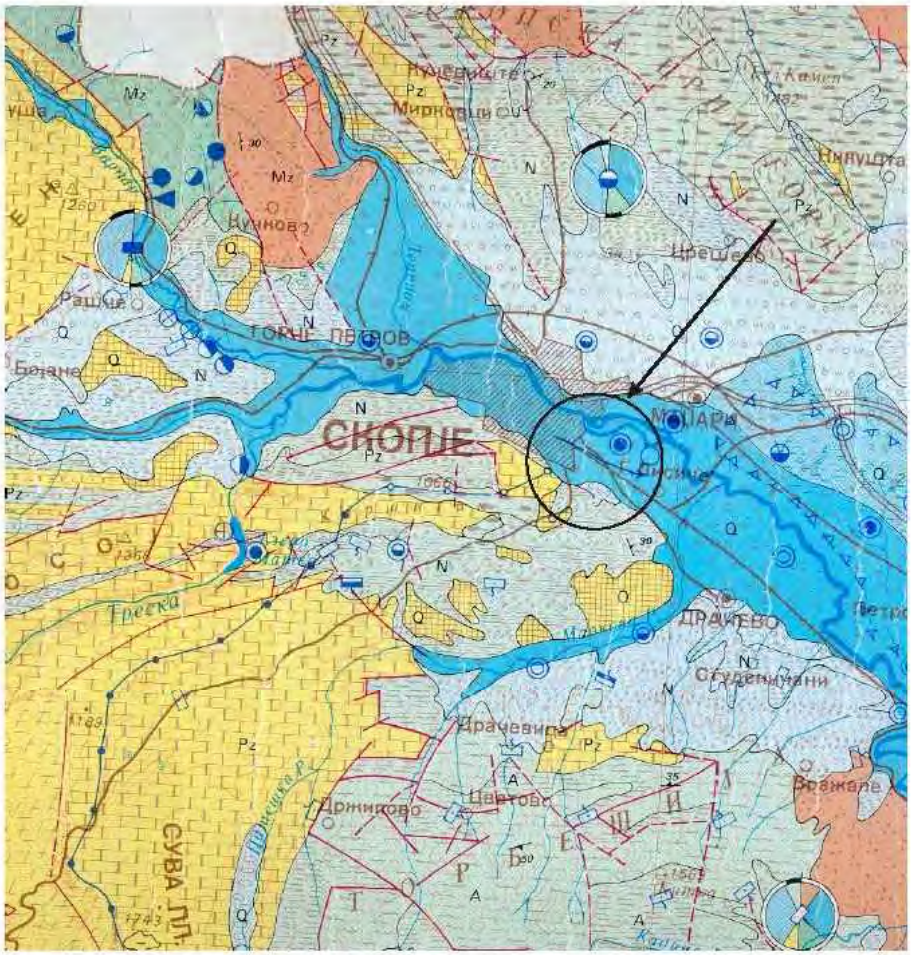
[illegible]

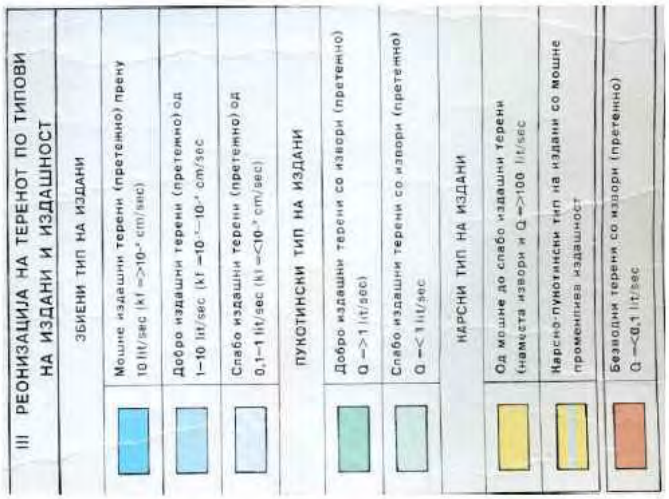

Универзитет "Свети кирил и методиј"
Градежен факултет - Скопје
КАТЕДРА ЗА ГЕОТЕХНИКА
ТРИЛКСИЈАЛЕН
ОПИТ

Annex 11

DGR "GEOTEHNIKA" DOO - Skopje

HIDROGEOLOGICAL MAP OF THE MICROLOCATION IN SKOPJE





Skopje, 2008 Appendix No.1.2

Figure: Hydrogeological Map of the area around Skopje

Annex 12

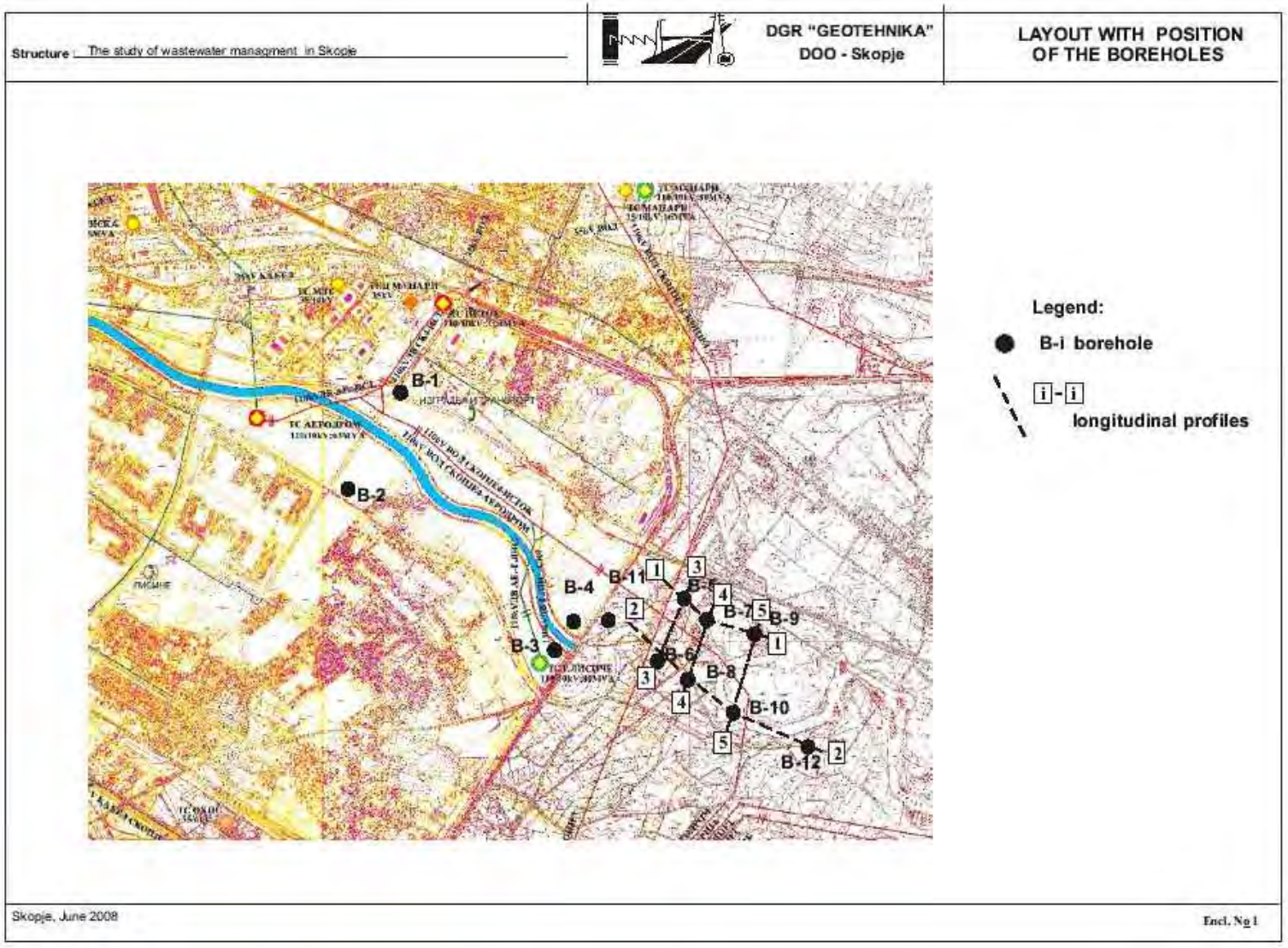


Figure: Position of the boreholes at the location of the WWTP

Annex 13

Permeability coefficient calculated according the USBR, terrain and laboratory test

No	Borehole	Depth	USBR	permiability coeficient			
				(k)- labaratory (m/s)			(k)-in situ
		(m)	(m/s)	0.5 bar	1.0 bar	2.0 bar	(m/s)
1	B-1	11.0-12.0	$4.88*10^{-4}$	$6.47*10^{-5}$	$9.61*10^{-5}$	$6.2*10^{-3}$	$1.36*10^{-4}$
2	B-2	8.0-9.0	$4.88*10^{-4}$	$2.1*10^{-5}$	$5.26*10^{-5}$	$2.65*10^{-5}$	$9.4*10^{-5}$
3	B-3	11.0-12.0	$4.21*10^{-4}$	$2.03*10^{-5}$	$2.62*10^{-5}$	$2.64*10^{-5}$	$5.11*10^{-6}$
		4.0-5.0	$6.95*10^{-4}$	$2.03*10^{-4}$	$2.62*10^{-4}$	$2.54*10^{-4}$	
		2.0-3.0	$4.06*10^{-3}$	$2.03*10^{-4}$	$2.62*10^{-4}$	$3.60*10^{-4}$	
4	B-4	7.0-8.0		$1.56*10^{-4}$	$1.72*10^{-4}$	$1.95*10^{-4}$	$1.53*10^{-4}$
5	B-5	5.0-6.0		$1.73*10^{-4}$	$1.89*10^{-4}$	$2.45*10^{-4}$	$1.45*10^{-4}$
6	B-6	9.0-10.0	$6.68*10^{-4}$	$1.10*10^{-3}$	$1.50*10^{-3}$	$1.50*10^{-3}$	$1.7*10^{-4}$
7	B-7	5.5-5.9	$7.23*10^{-4}$	$5.24*10^{-4}$	$5.77*10^{-4}$	punching	$1.7*10^{-4}$
8	B-8						$1.87*10^{-4}$
9	B-9	7.1-7.5	$2.26*10^{-3}$	$5.24*10^{-4}$	$3.15*10^{-4}$	punching	$1.87*10^{-4}$
10	B-10						$1.96*10^{-4}$
11	B-11	5.4-5.8	$1.42*10^{-3}$	$2.62*10^{-4}$	$3.15*10^{-4}$	$7.3*10^{-4}$	$1.96*10^{-4}$
		11.4-11.8		$4.66*10^{-5}$	$8.74*10^{-5}$	$1.66*10^{-4}$	$1.15*10^{-4}$
		15.5-15.9					$1.23*10^{-4}$
12	B-12	4.0-5.0	$1.43*10^{-3}$	$1.21*10^{-3}$	$1.62*10^{-3}$	$1.64*10^{-3}$	$1.7*10^{-4}$

Annex 14

Figure: Locations of the Monitoring stations (air quality) in Skopje

Annex 15

Table: Monitoring stations for ambient air quality measurements in Skopje

	Monitoring station	Site coordinates			Parameters measured	Type of the station	Type of area	Characterization of the zone
		N	E	Elevation				
Public Health Institute Skopje	CHPI Skopje DDD	42º 00.995’	21º 26.873’	254	SO_2, Black smoke	Background	Urban	Residential/commercial/ agriculture
	CHPI Skopje Evropa	41º 59.865’	21º 27.887’	249	Acidity, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Insitute for forensic medicine	41º 59.280’	21º 25.116’	279	SO_2, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Kinder garden Srnicka	41º 59.293’	21º 27.890’	256	Acidity, Black smoke	Background	Urban	Residential/commercial
	CHPI Skopje PHI	41º 59.253’	21º 26.482’	240	SO_2, Black smoke, Pb (twice a year)	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Elementary school Dimo Hadzi Dimov	42º 00.292’	21º 22.411’	268	SO_2, Black smoke	Background	Urban	Residential/commercial/ industrial
	CHPI Skopje Usje	41º 58.170’	21º 27.484’	247	Acidity, Black smoke	Background	Urban	Residential/commercial/ industrial
Hidro Metrological Administration	HMA AMSM	41º 59.657’	21º 25.233’	271	SO_2, Black smoke	Traffic	Urban	Residential/commercial/ industrial
	HMA Avtokomanda	41º 00.142’	21º 27.736’	251	SO_2, Black smoke	Traffic	Suburban	Residential
	HMA Dracevo	41º 55.792’	21º 32.023’	243	SO_2, Black smoke	Traffic	Suburban	Residential
	HMA Josip Broz Tito	41º 59.701’	21º 25.555’	263	SO_2, Black smoke	Traffic	Urban	Residential/commercial
	HMA Karpos 4	42º 00.253’	21º 23.452’	270	SO_2, NO_2, NO_x, O_3,, Black smoke	Traffic	Urban	Residential/commercial/ industrial

	Monitoring station	Site coordinates			Parameters measured	Type of the station	Type of area	Characterization of the zone
		N	E	Elevation				
	HMA Lisice	41º 59'03.23''	21º 28' 31.80''	236	SO_2, Black smoke	Traffic	Urban	Residential/commercial
	HMA UHMR	42º 00'59.57''	21º 23' 59.15''	291	SO_2, Black smoke, Temp., pressure, humidity, wind dir., wind vel.	Background/Traffic	Suburban	Natural
	HMA Univerzitetska	41º 59.281'	21º 25.116'	279	SO_2, Black smoke	Traffic	Urban	Residential/commercial
	HMA Agiculture insitut	41º 58.13'	21º 28'	243	SO_2, Black smoke		Urban	Residential/commercial
Ministry of Environment and Physical Planning (MoEPP)	MOEPP Centar	41º 59.343'	21º 26.015'	254	SO_2, CO, NO, NO_2, NO_x, PM_{10}, Meterological parameters	Traffic	Urban	Residential/commercial
	MOEPP Gazibaba + High sampler for PM_{10}	42º 00.139'	21º 27.078'	250	SO_2, CO, NO, NO_2, NO_x, Meterological parameters	Background Traffic	Suburban	Commercial
	MOEPP Karpos + High sampler for PM_{10}	42º 00.247'	21º 23.452'	302	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, Meterological parameters	Traffic	Urban	Residential/commercial
	MOEPP Lisice + Low sampler for PM_{10}	41º 58.660'	21º 27.874'	255	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, Meterological parameters	Industrial	Urban	Residential/commercial/ industrial
	MOEPP Rektorat	41º 59.943'	21º 26.458'	270	SO_2, CO, NO, NO_2, NO_x, O_3, PM_{10}, benzene, toluene, ethyl-benzene, orto-xylene, para-xylene	Traffic	Urban	Residential/commercial

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2006

Annex 16

Table : Average monthly data from the automatic monitoring stations of MOEPP regarding different pollutants (year 2007)

SO_2 [µg/m^3]													
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Karpos	max	189,3	99,1	73,3	50,4	29,9	23,8	29,3	31,3	32,9	58,0	82,2	119,4
	average	76,7	43,5	48,2	29,7	22,0	15,8	23,0	21,0	21,7	27,2	38,9	52,1
	min	23,2	4,1	28,0	20,7	16,9	1,6	14,2	15,2	17,3	15,6	20,9	23,6
Centar	max	183,0	115,3	72,6	41,6	22,9	16,5	19,9	19,3	25,9	37,1	26,9	48,1
	average	85,7	54,9	40,2	23,8	12,1	12,1	13,7	12,8	15,0	15,1	16,0	18,1
	min	19,5	22,0	14,1	10,0	8,3	9,7	8,4	6,7	8,2	6,2	8,9	7,5
Gazi Baba	max	69,0	49,6	24,5	24,9	16,1	101,6	10,6	15,6	14,2	23,1	32,3	35,8
	average	35,9	21,1	14,6	14,2	9,2	11,9	9,1	10,4	9,3	14,3	19,4	25,5
	min	8,1	6,4	6,6	9,5	3,6	6,2	7,7	6,4	7,2	9,0	12,1	12,8
Lisice	max	104,5	92,2	47,6	36,2	24,3	18,9	22,3	17,2	20,7	29,8	19,6	30,3
	average	59,4	43,7	31,0	22,2	14,0	14,8	16,3	11,9	14,4	15,5	13,2	12,5
	min	27,1	23,0	12,5	14,9	9,7	11,9	10,7	8,5	10,2	7,5	8,0	5,7
CO [mg/m^3]													
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Karpos	max	6,41	3,65	3,85	1,47	1,30	1,49	1,93	2,84	3,15	4,10	6,84	10,93
	average	3,69	2,51	2,56	0,92	1,05	1,28	1,37	1,89	2,21	2,74	2,87	5,11
	min	1,69	1,19	0,70	0,56	0,75	0,88	0,92	1,23	1,47	1,99	0,99	1,97
Centar	max	8,74	6,33	4,95	2,91	2,25	2,60	2,78	3,29	4,09	5,27	5,37	14,57
	average	5,26	3,73	3,58	1,83	1,97	2,20	2,18	2,32	2,68	3,43	3,41	6,85
	min	2,11	1,70	1,21	0,94	1,49	1,77	1,41	1,52	1,76	2,22	1,51	1,67
Gazi Baba	max	4,81	2,55	3,13	1,88	1,66	1,61	6,67	7,50	0,81	2,22	1,93	10,69
	average	2,34	1,32	1,58	1,23	1,18	1,04	1,08	1,30	0,40	1,20	3,43	6,48
	min	0,87	0,69	0,67	0,73	0,88	0,29	0,14	0,26	0,12	0,49	0,89	4,00
Lisice	max	12,20	8,13	4,55	2,93	1,69	1,78	2,73	3,14	3,19	6,03	7,47	8,52
	average	7,46	4,12	2,71	1,74	1,15	1,07	1,44	1,75	1,74	2,88	4,11	4,53
	min	2,34	0,97	0,93	0,80	0,62	0,64	0,42	1,01	0,71	0,73	0,77	0,67
Rektorat	max	7,82	4,94	4,67	2,65	1,84	4,90	5,04	3,02	1,70	4,31	4,56	6,94
	average	4,58	3,44	3,68	1,13	0,98	3,80	2,21	1,64	1,18	2,76	1,85	2,81
	min	1,96	2,07	0,22	0,43	0,70	2,62	1,20	0,62	0,73	1,48	0,67	0,24

Ozone – O_3 [µg/m3]												
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Karpos	max	43,9	44,6	83,4	106,1	105,1	105,8	156,1	128,1	100,4	83,8	60,5	57,4
	average	37,7	30,0	41,4	85,9	74,4	83,2	113,9	94,6	74,3	43,4	32,2	30,1
	min	29,3	6,4	7,8	63,2	31,3	61,3	77,6	21,6	44,6	10,6	10,9	5,3
Lisice	max	66,5	61,1	95,7	130,0	115,5	125,0	179,4	137,3	106,9	88,6	46,7	47,9
	average	29,7	35,7	69,5	99,4	78,8	101,5	130,7	104,1	78,5	43,2	17,3	17,9
	min	12,8	11,5	33,8	76,4	25,4	32,6	101,1	17,2	38,4	5,0	6,1	2,4
Rektorat	max	63,2	57,5	79,2	110,2	121,0	131,6	163,4	125,0	75,9	92,0	34,1	57,1
	average	23,6	36,8	53,9	89,5	81,0	97,1	122,6	87,4	51,9	35,6	11,8	16,5
	min	10,2	11,6	34,5	43,6	36,4	66,6	77,2	35,3	23,6	7,6	5,9	6,4
PM10 [µg/m^3]													
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Karpos	max	282,0	168,2	127,0	77,2	63,2	106,4	160,2	113,1	94,7	141,4	120,3	575,9
	average	131,8	76,9	68,5	54,4	46,2	57,8	67,0	61,1	50,7	76,6	76,7	178,9
	min	18,5	14,2	24,6	32,4	15,2	34,2	24,1	21,5	20,7	24,5	27,3	17,8
Lisice	max	500,3	239,4	146,0	131,8	60,9	96,7	187,0	164,9	106,6	254,7	47,0	601,0
	average	236,8	107,2	83,8	70,5	48,0	58,6	74,7	69,7	56,1	100,0	40,7	183,1
	min	23,0	13,1	25,1	35,6	37,4	34,8	29,3	30,5	19,0	24,1	34,5	16,6
Rektorat	max	386,4	193,4	152,8	127,7	79,4	121,5	211,6	129,5	74,4	170,5	319,4	472,3
	average	196,8	96,1	90,3	71,0	59,2	71,8	84,4	76,7	48,0	93,5	137,3	175,2
	min	16,0	24,0	31,2	36,4	29,3	45,6	35,1	42,1	31,0	32,6	42,3	33,8

Source:The Macedonian Environmental Information Center , MoEPP, Annual Report on Air Quality 2007

Annex 17

Figure: Locations of the noise monitoring stations in Skopje

Annex 18

Detailed explanation of Conventions, Directives and other relevant treaties with regard to the assessment and evaluation of the Fauna

Bern Convention

The Bern Convention (Emerald Network), aiming to ensure the conservation of wild plants and animals and their habitats, is an initiative of the Council of Europe. It is based on recommendations made in 1973 by the Consultative Assembly of the Council, asking for "a coherent policy for the protection of wildlife, with a view to establishing European regulations - if possible by means of a convention – and involving severe restrictions on hunting, shooting, capture of animals needing protection, fishing and egg-collecting, and the prohibition of bird netting". The final convention not only comprises fauna, but also flora, and came into force in 1982. The Convention includes a set of appendices:

Appendix I: Comprises a list of strictly protected floral species.
Appendix II: Comprises a list of strictly protected faunal species,
Appendix III: A list of protected faunal species for which a certain exploitation is possible if the population level permits.

All species of birds (with the exception of eleven species), amphibians and reptiles occurring on the territories of the States that had elaborated the Convention and not covered by Appendix II have been included in Appendix III. The selection of species for Appendix I and II of the Bern Convention is mainly based on threat and endemism, whereas rareness is not included as a criterion. Only Appendix I and II are used in the present study as a selection criterion for "evaluation".

Bonn Convention on Migratory Species

The Bonn Convention on Migratory Species aims to conserve terrestrial, marine and avian migratory fauna throughout their range. The need for countries to co-operate in the conservation of animals that migrate across national boundaries was recognized in a recommendation of the 1972 United Nations Conference on the Human Environment, held in Stockholm. This statement gave way to the elaboration of the convention which came into force in November 1983. The Bonn Convention is an example of an intergovernmental treaty concerned with the conservation of wildlife and wildlife habitats on a global scale.

- Migratory species that have been categorized as being in danger of extinction throughout all or a significant proportion of their range are listed on *Appendix I* of the Convention.
- Migratory species that have an unfavorable conservation status or would benefit significantly from international co-operation organised by tailored agreements are listed in *Appendix II* to the Convention.

Since Appendix II gives no strict legal protection, only Appendix I is used in the present study as a selection criterion for "evaluation".

Habitats Directive

The Habitats Directive (Directive 92/43/EEC), adopted in 1992, is a Community legislative instrument in the field of nature conservation that establishes a common framework for the conservation of wild animal and plant species and natural habitats of Community importance; it provides for the creation of a network of special areas of conservation within Natura 2000, to "maintain and restore, at favorable conservation status, natural habitats and species of wild fauna and flora of Community interest" (European Commission 2003). The Habitats Directive sets the goal of establishing a European network for nature conservation, so called '*Special Areas of Conservation*' (SACs).

Annex I: Natural and semi-natural habitat types of community interest whose conservation requires the designation of special areas of conservation.
Annex II: Animal and plant species of community interest whose conservation requires the designation of special areas of conservation.
Annex IV: Animal and plant species of community interest in need of strict protection.
Annex V: Animal and plant species of community interest who's taking in the wild and exploitation may be subject to management measures.

Birds Directive

The Directive for the conservation of wild birds (79/409/EEC) was adopted in 1979 by nine Member States, and was the first EU Directive on nature conservation. Since its adoption it has been a vital legal instrument for the conservation of all birds that occur naturally across the EU, acting in the broadest public interest to conserve Europe's natural heritage for present and future generations.
The Birds and Habitats Directives both require the EU Member States to take a number of measures in order to protect all listed species and habitats, as well as their sites. Measures required by the Birds Directives include:

- Classify as *Special Protection Areas* (SPAs) the most suitable territories for species in need of special habitat protection as listed on Annex I.
- Regulate the hunting of species listed in Annex II.
- Regulate the trade of species listed in Annex III.

Threat Status

The IUCN Red Lists are widely recognized as the most comprehensive, apolitical global approach for evaluating the conservation status of plant and animal species. The IUCN Red List Categories and Criteria are intended to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk (IUCN 2001). The Red List distinguishes nine hierarchically related Red List Categories The present IUCN criteria are based on estimates of rates of decline and extinction risk as well as rarity, and produce a different, but more useful, assessment compared to the former criteria which had a more subjective basis.

All taxa listed as Critically Endangered (CR), Endangered EN) and Vulnerable (VU), qualify as Threatened. The threatened categories form a part of the overall scheme. It will be possible to place all taxa into one of the categories. The category Data Deficient (DD) is not a threatened category, although it indicates a need to obtain more information on a taxon to obtain the appropriate listing. The old IUCN category Lower Risk (LR) in (IUCN 1994) is replaced by Near Threatened (NT), close to qualifying for Vulnerable and Least Concern (LC), evaluated but not threatened.

The species identified by Bird Life International (2004a,b) as being "Species of European Conservation Concern' are listed in three SPEC categories. According to BirdLife International (2004) there are 40 species in the SPEC 1 category of globally threatened species, 45 species in the SPEC 2 category, which is the category that includes species with "unfavourable conservation status" in Europe and their global population concentrated in Europe, and 141 species in the SPEC 3 category, the species group with "unfavorable conservation status" in Europe but whose global population is not concentrated in Europe.
The fact that many long-distance migrants are declining (Birdlife International 2004a) highlights the need for the European Union to look behind its borders.

Annex 19

Figure: Surrounding of the planed location for the Project

Annex 20

WWTP TRUBAREVO ODOUR IMPACT ASSESSMENT

INTRODUCTION

Wind movement in the atmosphere carries away odorous gases emitted from a source. Odour annoyance occurs when a person exposed to an odour perceives the odour as unwanted. Significant odour annoyance may trigger a complaint to a regulatory authority. The major factors relevant to perceived odour annoyances are:

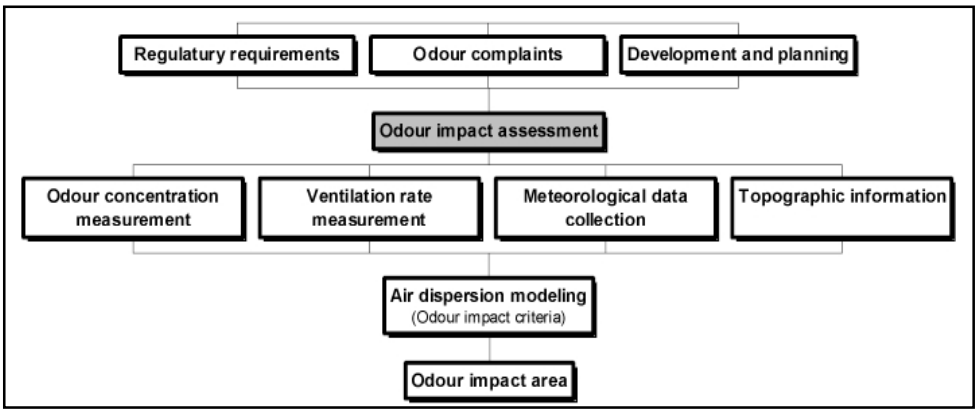
- Offensiveness (a mixture of odour concentration, odour intensity, odour character and hedonic tone),
- Duration of exposure to the odour,
- Frequency of the odour occurrence,
- Tolerance and expectation of the receptor.

Odour Impact Assessment can provide an effective tool for the following purposes:

- Preparation of environmental management plans.
- Development of appropriate regional and local planning and development control instruments.
- Odour regulation.

In essence, odour Impact assessment uses inputs of source odour concentration, ventilation rate and emission strength (odour emission rates), topography information together with meteorological data (one-year data), and an air dispersion model to model odour dispersion about the source. Odour impact areas can be defined by plotting isopleths of odour concentration corresponding to selected values for odour impact criteria. The approach can be illustrated in the following flow chart.

Odour Impact assessment flow chart



Odour impact criteria are parameters derived from experimental results and scientific evidence from countries such as Australia, Ireland, Nederland, USA etc. Using odour dispersion modelling together with odour impact criteria, odour impact areas can be defined. Within an odour impact area, typical receptors (e.g. residents) may be expected to experience a certain degree of odour nuisance. Odour impact criteria are not ambient air quality standards but rather provide a scientifically derived benchmark for the making of informed decisions in planning, design, environmental management and regulation.

A wide range of odour impact criteria has been reported and the question could be asked as to why there is so much variation. One reason is that in recent years, modern

performance based forced choice dynamic olfactometry has greatly improved the sensitivity of odour measurement but as yet not all criteria values are based on such measurement. Correspondingly, a nuisance threshold determined as 1 ou/m^3 using the less sensitive earlier equipment could be rated at 3 - 20 ou/m^3 using modern equipment. In summary, the use of advanced olfactometer based methods could result in nominally much higher odour concentration limits being specified in odour impact criteria.

There are a number of sources of benchmark values including the current Irish Environment Agency Guidance value of 1.5 ouE/m^3 as a 98th percentile of hourly averages for more unpleasant odours and a Dutch standard is 0.5 ouE/m^3 as a 98th percentile of hourly averages. It should also be noted that not only are averaging periods in the order of 1-hour, but they are expressed as percentage. The 98% percentage is the hourly odour concentration that is achieved for 98% of the year and consequently this value will be exceeded, potentially by very high concentrations of odour over short periods that may themselves be a nuisance by definition.

Some of the major glossary terms regarding the impact criteria are presented as it follows:

Detection threshold is the point at which an increasing concentration of an odour sample becomes strong enough to produce a first sensation of odour in 50% of the people to whom the sample is presented. This is a laboratory-based test and should be conducted according to the relevant CEN standard. The odour concentration at the detection threshold is one odour unit.

European odour unit That amount of odourant(s) that, when evaporated into 1 cubic **ouE/m^3** metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in one cubic metre of neutral gas at standard conditions.

Odour unit The amount of odourant(s) that, when evaporated into 1 cubic metre of neutral gas at standard conditions, elicits a physiological response from a panel (detection threshold) equivalent to that elicited by one European Reference Odour Mass (EROM), evaporated in one cubic metre of neutral gas at standard conditions

Recognition threshold The odour concentration which has the probability of 0.5 of being recognised under the conditions of the test. The recognition threshold is generally a higher concentration than the detection threshold. It is generally two or three odour units in a laboratory setting but may be higher than this outside the lab.

In keeping with the stated odour elimination goal of “no objectionable off-site odour”, an odour assessment has been performed, which includes predicted values, to depict sources that are going to be effectively controlled and sources that will require treatment. Hence these survey has been based on odour predicted values and analysis, odour source ranking and short description of the Air dispersion modelling.

ODOUR SOURCES AT TRUBAREVO WWTP

The collection, treatment, and disposal of municipal and industrial wastewater often results in the generation of objectionable odour. Consequently, wastewater treatment facility design, construction, and operation must address odour control as a high priority. In addition to odour, hydrogen sulphide (H_2S) can also cause corrosion and pose a safety risk in the collection system and at the treatment plant, so solving an odour problem can also minimize corrosion and alleviate safety concerns. Today, in addition to operating wastewater treatment facilities to meet water-quality objectives, operators must control

odour emissions. This is a difficult task because odour is subjective and individuals in the community can have widely varying sensitivity to odour.

To address public concerns, a comprehensive odour elimination program should be initiated.

Such a program assumes precise identification, ranking and analysis of all odour sources within the Trubarevo WWTP. For the purpose of this study we have identified the following primary odour sources:

Liquid Process Units
- Head works (Pre Aerated Grit)
- Primary Clarifier – Surface
- Aeration Basin – Air Zones
- Secondary Clarifier

Solids Processing Units
- Anaerobic Digester PRVs (pressure relieve valves)
- Digester Gas Storage – Ambient
- Gravity Sludge Thickener (GBT) – Primary Sludge
- Sludge drying beds

Odour Generation

Certain odours are associated with the operation of wastewater collection, treatment, and disposal systems. Most odorous compounds found in wastewater and bio solids are by-products of anaerobic biological activity that consumes organic material, sulphur, and nitrogen found in the wastewater. Domestic wastewater normally contains enough organic sulphur and inorganic sulphates to cause an odour problem.

Odorous compounds include organic or inorganic compounds. The two major inorganic compounds are hydrogen sulphide and ammonia. Organic odours are usually the result of biological activity that decomposes organic matter and forms a variety of malodorous gases including indoles, skatoles, mercaptans, and amines.

Hydrogen sulphide (H_2S), the most common odorous gas found in wastewater collection and treatment systems, has a characteristic rotten-egg odour. The gas is corrosive, toxic at high levels, and soluble in wastewater. H_2S results from the reduction of sulphate to sulphide by bacteria under anaerobic conditions. At pH 9, more than 99 percent of the sulphide dissolved in water occurs in the form of hydrosulphide ion, which is not released to the air. However, at the typical wastewater pH of 7, H_2S is released from the wastewater.

At very high levels, H_2S can pose significant health hazards. For example, at levels of 100 parts per million (ppm), eye injury and a loss of the sense of smell occur. For this reason, OSHA has developed time-weighted limits for exposure to H_2S. These limits include an 8-hour average of 10 ppm, a limit of 20 ppm for 10 minutes, and a maximum peak exposure limit of 50 ppm in an 8-hour shift. The immediately dangerous to life and health (IDLH) limit established by OSHA[1] is 300 ppm. Solving any odour problem begins with sampling and analyzing gases to identify and characterize their odours. Sensory analyses involve the human nose and the use of odour panels to establish threshold odour concentrations. Analytical testing identifies the specific chemical components of the odorous gas.

[1] OSHA - Occupational Safety & Health Administration

Odour source ranking

Based on the predicted and calculated H_2S and odour values, odour sources at the Trubarevo WWTP were ranked according to the estimated severity of off-site impact.

The results shown on **Table 1** indicate the range predicted at each location in WWTP Trubarevo.

The odorous emissions from the aeration basins and final clarifiers are not predominately H_2S, but mixtures of other odorous organic compounds. Emissions from primary clarifiers are often due to H_2S, and should be compared with the aeration basins and sludge drying beds, as these are the largest uncovered processes of concern for odour emission.

Table 1- Summary of predicted Odour Sampling Data

Location	Sulphide (mg/L)	H_2S (ppm)	Detection Threshold (DT)
Liquid Process Units			
Head works (Pre Aerated Grit)	0.4 – 0.8	0.034 – 3.5	–
Primary Clarifier – Surface	0.1 – 0.6	0.012 – 0.27	1900
Aeration Basin – Air Zones	–	0.001 – 0.007	150 – 320
Secondary Clarifier	–	0.002 – 0.003	140
Solids Processing Units			
Anaerobic Digester PRVs	–	0.1	–
Digester Gas Storage – Ambient	–	0.006	–
Gravity Belt Thickener (GBT) – Waste Activated Sludge	–	2.9 – 4.1	–
Gravity Belt Thickener (GBT) – Primary Sludge	–	30 – 31	–
GBT = Gravity Belt Thickener PC = Primary Clarifier; PRVs = Pressure Relief Valves.			

At the Trubarevo WWTP, all the sources of odour are relatively close to the ground with a low-velocity discharge from an open liquid surface. The main difference in the sources is their size, so a comparison must consider the overall surface area. Essentially, if two similar area sources have equal odour values and one is twice as large as the other it will have twice the off-site impact.

The aeration basins have a central portion with jet aeration and the outer periphery is relatively quiescent, whereas the primary clarifiers have a quiescent surface area in the middle of the basin and turbulence at the outer weirs. Given their similarities, it is reasonable to use a simplified approach and compare the two processes solely on the basis of their surface areas.

The surface areas of the sources at WWTP location are shown in ***Table 2***, along with the peak odour values predicted or calculated from the available data. The surface area is then multiplied times the odour value to obtain an estimation of the relative magnitude of severity.

Table 2 – Predicted/ calculated odour levels at the WWTP location

Facility	Dimension / Number	Total Surface Area (SA, m2)	Maximum Detection Threshold (D/T)	DT x SA x 1000 Total
Influent /Head works	-	100	26	2.600,0
Primary Settling Tank	Dia. 24.0m × 8 tank	3617,28	1,9	6.872,8
Aeration Tank	16.0m × 67.0m × 5.0m × 8 tank	8576	0,47	4.030,7
Secondary Settling Tank	Dia. 24.0m × 16 tank	7234,56	1,8	13.022,2
Gravity Sludge Thickener	Dia. 21.0m × 2 tank	692,37	16	11.077,9
Sludge Drying Bed	100000	Including transportation aisle (16*0,01)	0,16	16.000,0
			TOTAL	53.603,6

AIR DISPERSION ASSESMENT

Using an air dispersion model, it is possible to predict the downwind odour concentrations on the basis of odour emission rates, topography and meteorological data. The results can be used to derive an odour impact area. Within this area, it may be expected some degree of odour annoyance.

Odour dispersion modelling provides a benchmark/yardstick for the prediction of odour impact from odour sources. It is best to be used when a comprehensive study is carried out and then the same methodology is used to compare the likelihood odour impact.

The CALPUFF software has been chosen for the purpose of modelling. In absence of precise meteorological data regarding the location it self, Skopje City data concerning wind speed, frequency and direction has been taken in consideration, which effected as it is in the software calculated resultant impact area. Wind rose data, used for the purpose of the odour impact simulation are presented in Figures from 1 to 4. Finally, the dispersion model of odour affected area has been shown in Figure 5.

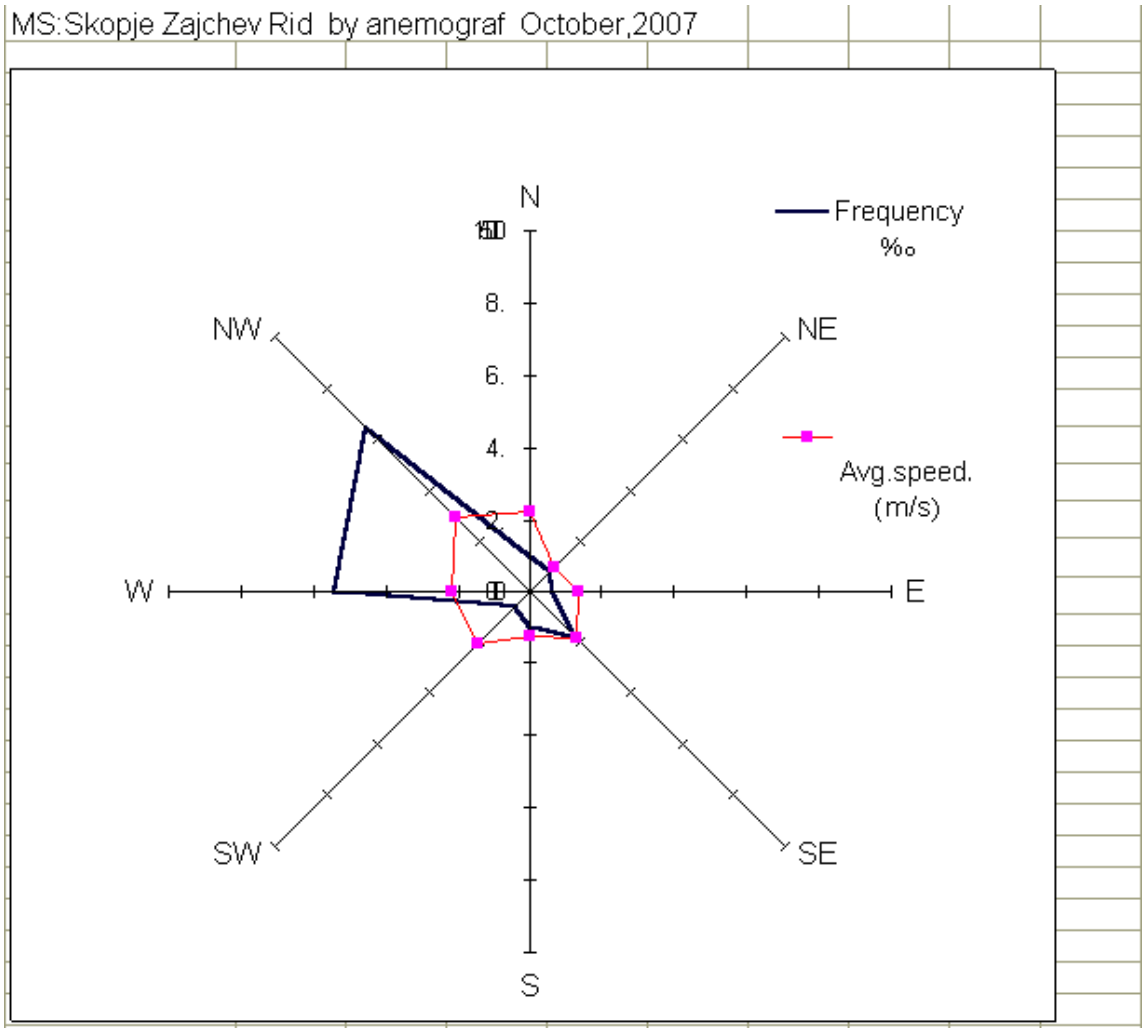
For the purpose of impact analysis there are a number of sources of benchmark values including the current Irish Environment Agency Guidance value of 1.5 ouE/m3 detection level as a 98th percentile of hourly averages for more unpleasant odours and a Dutch standard is 0.5 ouE/m3 as a 98th percentile of hourly averages. It should also be noted that not only are averaging periods in the order of 1-hour, but they are expressed as percentiles. The 98% percentage is the hourly odour concentration that is achieved for 98% of the year and consequently this value will be exceeded, potentially by very high concentrations of odour over short periods that may themselves be a nuisance by definition. For the purpose of this assessment 1.5 ouE/m^3 has been used as referent value, since this value is above the detection threshold of 1.0 ouE/m^3 and therefore is considered as viable criteria

Threshold of annoyance is approximately 3 - 5 times detection level.

• Generally at 5 ou/m3 or 5 D/T people become consciously aware of the presence of an odour

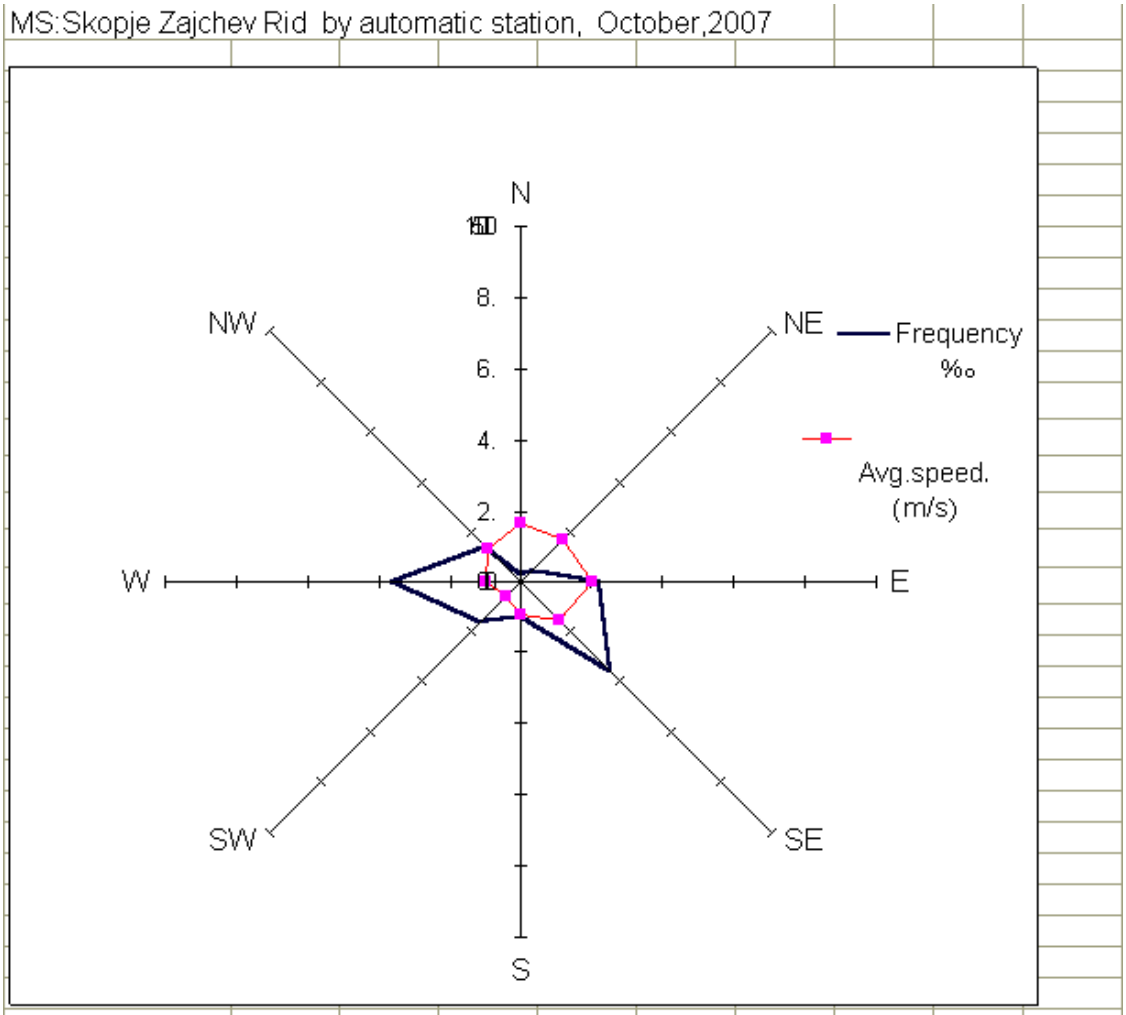
• 5-10 ou/m3 or 5-10 D/T odours are strong enough to evoke registered complaints

For the purpose of the assessment we have used the following gradation:
1.0 ouE/m3 - detection threshold (D/T)
1-1.5 ou/m3 - detection level
3.0 ouE/m3 - recognition threshold
3-3.5 ou/m3 - recognition level
5.0 ouE/m3 - faint annoying odour
10.0 ouE/m3 - distinct annoying odour



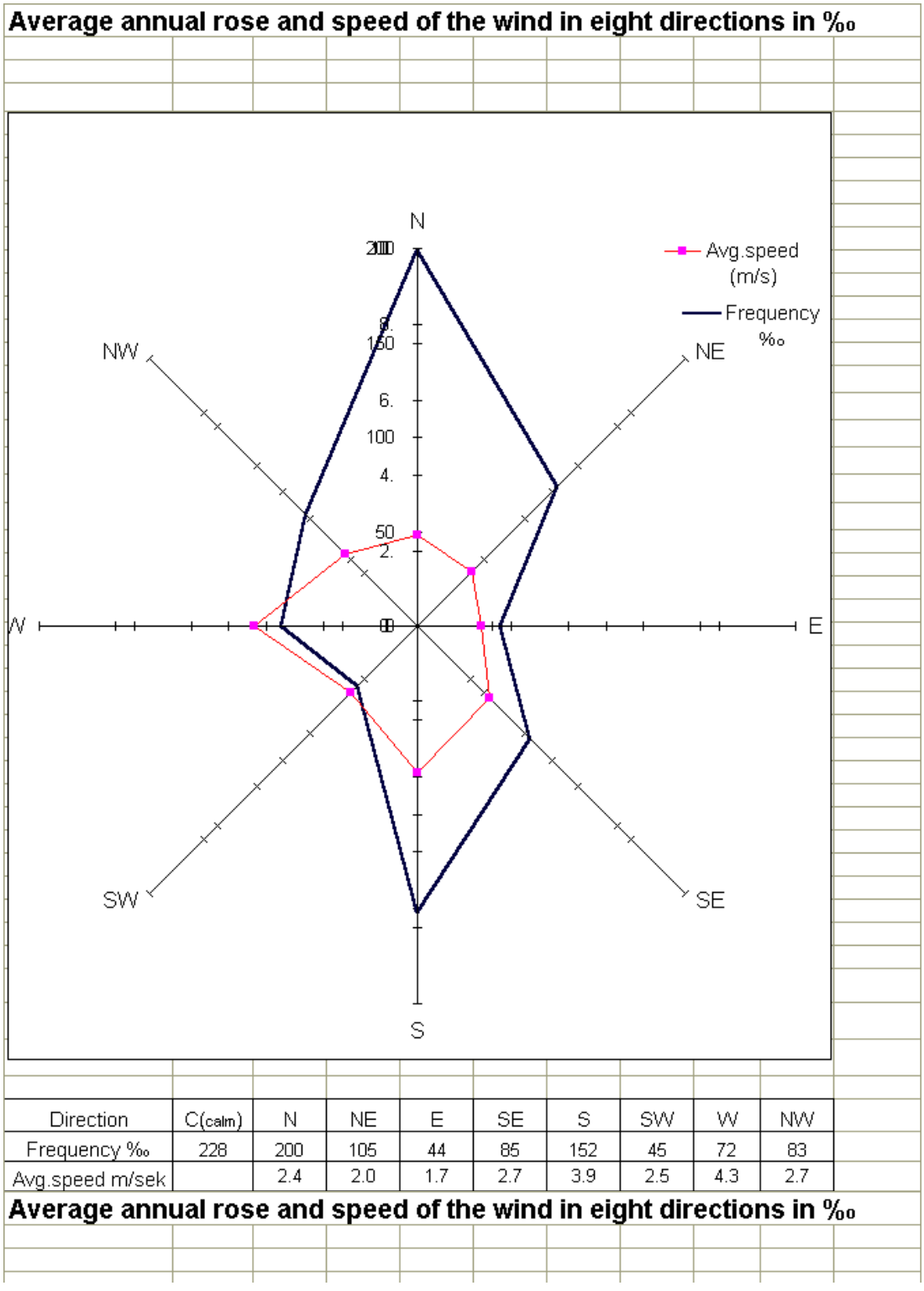
Direction	C(calm)	N	NE	E	SE	S	SW	W	NW
Frequency	5	5	4	3	9	5	3	27	32
Avg.speed m/sek		2.2	1.0	1.3	1.9	1.2	2.0	2.2	2.9

Figure 1: Wind rose from Zajcev Rid measurement station by anemograph, October 2007



Direction	C(calm)	N	NE	E	SE	S	SW	W	NW
Frequency	23	1	2	11	18	5	8	18	7
Avg.speed m/sek		1.7	1.6	2.0	1.5	0.9	0.6	1.0	1.3

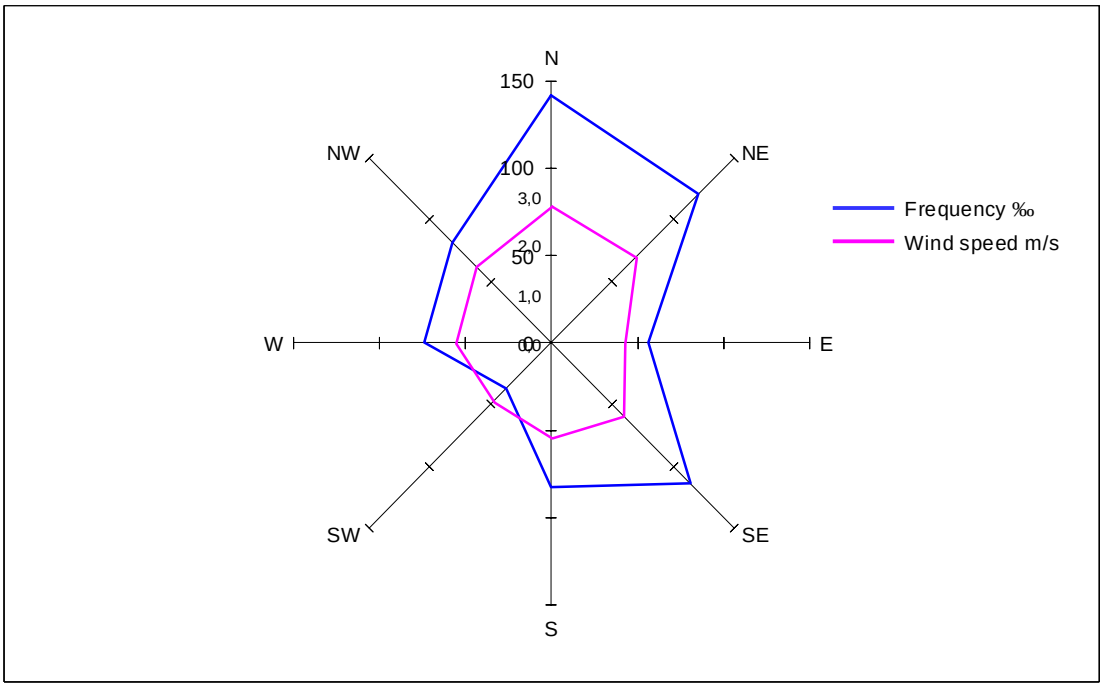
Figure 2: Wind rose from Zajcev Rid measurement station by automatic station, October 2007



Direction	C(calm)	N	NE	E	SE	S	SW	W	NW
Frequency ‰	228	200	105	44	85	152	45	72	83
Avg.speed m/sek		2.4	2.0	1.7	2.7	3.9	2.5	4.3	2.7

Average annual rose and speed of the wind in eight directions in ‰

Figure 3: Wind rose from Zajcev Rid measurement station, average annual wind speed and frequency, 2007



direction	N	NE	E	SE	S	SW	W	NW
frequency	142	120	56	114	82	37	74	81
wind speed	2,8	2,5	1,5	2,1	1,9	1,7	2,0	2,2

Figure 4: Wind rose from Petrovec measurement station, average annual wind speed and frequency, 2003

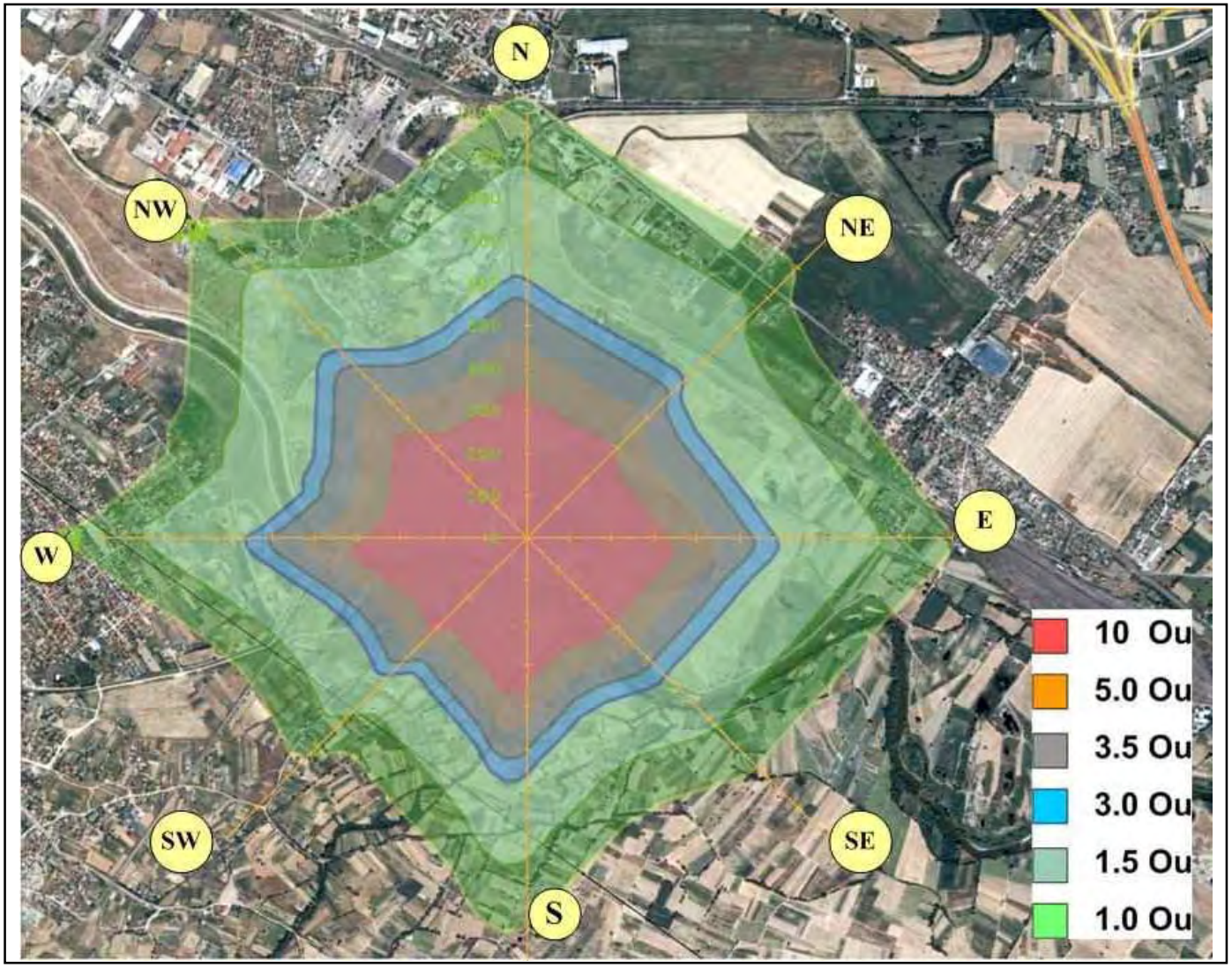


Figure 5: Odour affected area

It should be noted that 3.0 Ou m^{-3} at the 98th percent is the odour limit established by the Irish Environmental Protection Agency for WWTPs, based on the provisions of EU Council Directive 91/271/EEC of 21st May 1991, as amended concerning urban waste water treatment, and Directive 2000/60/EC of 23rd October 2000 – The Water Framework.

Based on the impact area it is obvious that the closest populated area which is 465 meters away from the WWTP facilities in north-western direction is at the outskirts of the 3 Ou m^{-3} boundaries. Translated through the European regulation (Committee European de Normalisation (CEN) Standard – EN 13725), it means that these areas will be subjected to recognisable odour for the 98th percentile of the time, which would be readily detected and probably regarded as a nuisance and can eventually cause some complaints on part of the affected population. Nevertheless, the western direction should not be neglected as well, since the impact area shows that some considerable portion of the populated area is located within the boundaries of 1 Ou m^{-3} and 3 Ou m^{-3}. The eastern direction shows somewhat better situation in terms of the lower density of the affected population, although the vicinity of the sludge drying beds should also not be neglected, since under various meteorological and drying conditions these areas may be subjected to much higher odour concentrations then predicted.

MITIGATION MEASURES

There are certain baseline measures that should be put in place at all WWTPs, as a matter of good practice, to minimise the risk of odour nuisance occurring. These baseline good practice measures should be implemented regardless of whether complaints are received or not.

The basic odour control techniques which would be expected to be put in place include:

- select locations of major sources away from sensitive receptors at the design stage
- good housekeeping and raw material handling practices
- control and minimisation of odours from residual materials and waste
- preparation of an Odour Management Plan
- maintaining the effluent aerobic other than in processes which are specifically anaerobic
- avoiding anaerobic conditions and prevent septicity
- containment of strong odour sources and treatment in odour control equipment.

Design and operation of the process steps to minimise odour, including:

- minimise sludge retention time in primary settlement
- consider avoiding primary settlement by applying extended aeration
- cover (or allow for covering at a later stage where odour effects are difficult to quantify prior to commissioning)

Other baseline mitigation measures that should be put in place at Trubarevo WWTP are described as it follows:

Good housekeeping

Lack of good housekeeping can result in elevated levels of residual odour, and at times more serious sources of odour. The majority of good housekeeping is, in any case, good working practice and additional costs for odour control are minimal.

Location of odour sources
So far as is practicable, sources of odour shall be located at positions on the site that are likely to minimise the odour impact on nearby receptors. Account should be taken of distance, prevailing wind direction and obstructions. In practice, this will often mean locating the source of odour as far as practicable from the site boundary.

Tanks
The build up of scum or foam on tank surfaces can at times lead to odour and should generally be avoided. (However, a stable scum layer can reduce odour in some instances, e.g. sludge storage).
Draining tanks for cleaning has been implicated as a source of odour complaints. This should be scheduled to minimise impact. Where practicable, appropriate chemicals should be used to minimise this impact.

Storage of sludge
Storage of sludge product on site should be minimised.

Screenings and grit
Screenings and grits should be washed to reduce odour potential. Skip containing screenings and grit should be covered, and removed from site as soon as is practicable.

Spillages
Spillages are usually due to plant failure but sources of possible spillage should be considered and avoided at the design stage. Often, spillages involve sludge: an interruption to continuous sludge processing could lead to spillage from a storage tank or cause sludge levels to build up in settlement tanks, one of the known risk factors for odour at WWTPs.

Inlet Works
In general the inlet works are potentially a considerable source of odour from incoming sewage particularly if it is septic sewage at the inlet, odorous imported wastes (such as septic tank emptying), storm conditions and storage and handling of screenings and grit. In the case of WWTP that are subject to odour complaint, it is common to cover the inlet works and vent to odour equipment. Measures that should be taken to minimise odour releases from this source, include:

- Regular cleaning and flushing of screens and influent channels
- Grit and screenings transfer and storage in a manner to prevent spillage. Ideally screenings after washing should be dewatered and bagged (or contained in a covered skip).
- Lowering discharge points to minimise turbulence and volatilisation of odours
- Balancing the flow of sludge liquors to equalise the load over the day
- Imported sludge to go straight to sludge storage tanks and not through inlet works

Primary Sedimentation

The principal odour sources in primary tanks are excessive turbulence in the inlet distribution channel or stilling chamber, the overflow point and the tank surface. Minimisation of the sludge retention time in the primary tanks can reduce the odour. However, if there is anaerobic activity before or during the primary sedimentation operation, the size of these tanks can make them a significant source.

Measures that should be taken to minimise odour releases from this source, include:
• Pre-treatment of incoming septic sewage or possible chemical dosing with nitrate or iron salts
• Reducing hydraulic retention times,

• Improving sludge removal both in efficiency and frequency and regular cleaning of the tanks, sumps scum and grease removal equipment–aim to ensure that sludge is not held on the base of the tanks for more than planned

• Reduce turbulence at the overflow point by reducing the overflow height

Secondary Aerobic Treatment

Ensure that conditions remain aerobic. Maintenance and inspection of the air diffusion system and liquid distribution are of great importance. Measures that should be taken to minimise odour releases from this source, include:

• Increased aeration by methods which minimise the generation of aerosols (for example sub-surface diffuse aeration) and maintain the activated sludge flocks in suspension

• Shrouding of the mechanical aerators to reduce aerosol formation

• Covering the inlet distribution chamber and anoxic zone may be sufficient in cases where odours occur

Final Settlement

At this stage the effluent and sludge should be oxidised and provided sludge retention times are carefully managed, odour release should not be a problem. De-nitrification may be a problem with fully nitrified effluents giving rise to rising sludge and surface solids. This can be avoided by minimising sludge retention periods in the final tank.

Sludge Handling, Storage and Thickening

Sludge and bio-solids handling are usually the most significant source of odour release and good sludge management is a key issue. All raw sludge and bio-solids will release odour largely dependent upon age. In general, sludge handling, storage and processing should be enclosed or covered and provided with ventilation to odour- control equipment.

Measures that should be taken to minimise odour releases from this source, include:

- Sludge should be processed (thickened, digested or dewatered) as soon as possible after generation as retention will lead to anaerobic conditions. It is good practice to minimise the potential storage of sludge before treatment and storage for un-stabilised sludge should be limited to a maximum capacity of 24-hours production
- All tanks for un-stabilised sludge storage and processing should be enclosed or covered and vented to odour equipment
- Replacement of drying beds with mechanical dewatering plant will help minimise retention and contain odours.
- Avoid open storage of sludge or sludge cakes

Anaerobic Digestion

The gas produced in an anaerobic digester will be odorous. It should not be released to air in an uncontrolled manner and will only usually be vented untreated in the case of an emergency activation of a safety device. Normally the gas will be used as a fuel in boilers to heat the digester or used for fuel a combined heat and power system. In some cases an excess of gas production necessitates the operation of the pressure-relief valve and burning-off the surplus through a flare. Measures that should be taken to minimise odour releases from this source, include:

- Routinely drain condensate traps to remove water and avoid back pressure
- Ensure that the digester system is balanced in respect of pressure to reduce emergency pressure relief operation
- If the gas is vented to a combustion unit for energy recovery, a stand-by flare should be provided in case of combustion system malfunction
- Regularly inspect the operation of the flare to check in particular that the pilot will light the flare even if the flare has been overloaded
- Avoid turbulence of the sludge after digestion
- Covering of digested-sludge feed channels, mixing wells and overflow take-offs
- Regular inspection of the seals of floating gasholders
- Any covers or equipment provided for this source will require careful evaluation in relation to safety and explosion control

Whilst these full enclosure techniques are available, they carry a significant cost and may not be
cost-effective. A more traditional approach to containment is the use of ventilated buildings for certain plant and equipment and covers for tanks.

In general the following sources will require containment at source and venting:

- Sludge digestion plants, dewatering facilities and tanks
- Entire inlet works
- Grit removal, coarse screens, skips (leak proof and enclosed).
- In general it is not necessary to contain emissions from:
- Primary tanks (may require covers in sensitive locations odour control but can often be sufficient by good management and maintenance)
- Aerobic tanks (need to avoid excessive aerosols from aeration lanes and aerobic tanks–these can act as an odour stripper and could be a health and safety problem)
- Final settlement.

The selection of process stages will have a significant impact on both water quality and odour generation. It is therefore recommended that the investor justifies the selection of technology and controls at the planning stage. At the design stage of new works, it is essential that systems are designed to be free from leaks and offer good source containment of odours.

CONCLUSION

Having in mind the air dispersion assessment, as well as all above mentioned factors, it can be concluded that Trubarevo WWTP within it's proposed design parameters (without employing odour control equipment), will certainly cause some medium impact in terms of odour annoyance within the perimeter of 500 m distance from it's fence. Nevertheless, these impacts can easily be reduced by covering and filter - treating air from the inlet works and gravity sludge thickener, which is estimated to reduce the impact by 26%, and accordingly the impact ranking, would be heading from medium towards mild. The affected area resulting from 26% odour abatement scenario is shown in Figure 6.

Should there be provision for including filter treated sludge drying facility in future, as an addition to the present design of the WWTP, the overall odour impact may be reduced towards negligible, or in terms of numbers by over 55% in total, compared to the initial values. The affected area resulting from 55% odour abatement scenario is shown in Figure 7.

A plant-wide odour sampling and impact area investigation ought to be conducted at the Trubarevo Wastewater Treatment Plant (WWTP) immediately after the start of its normal operation.

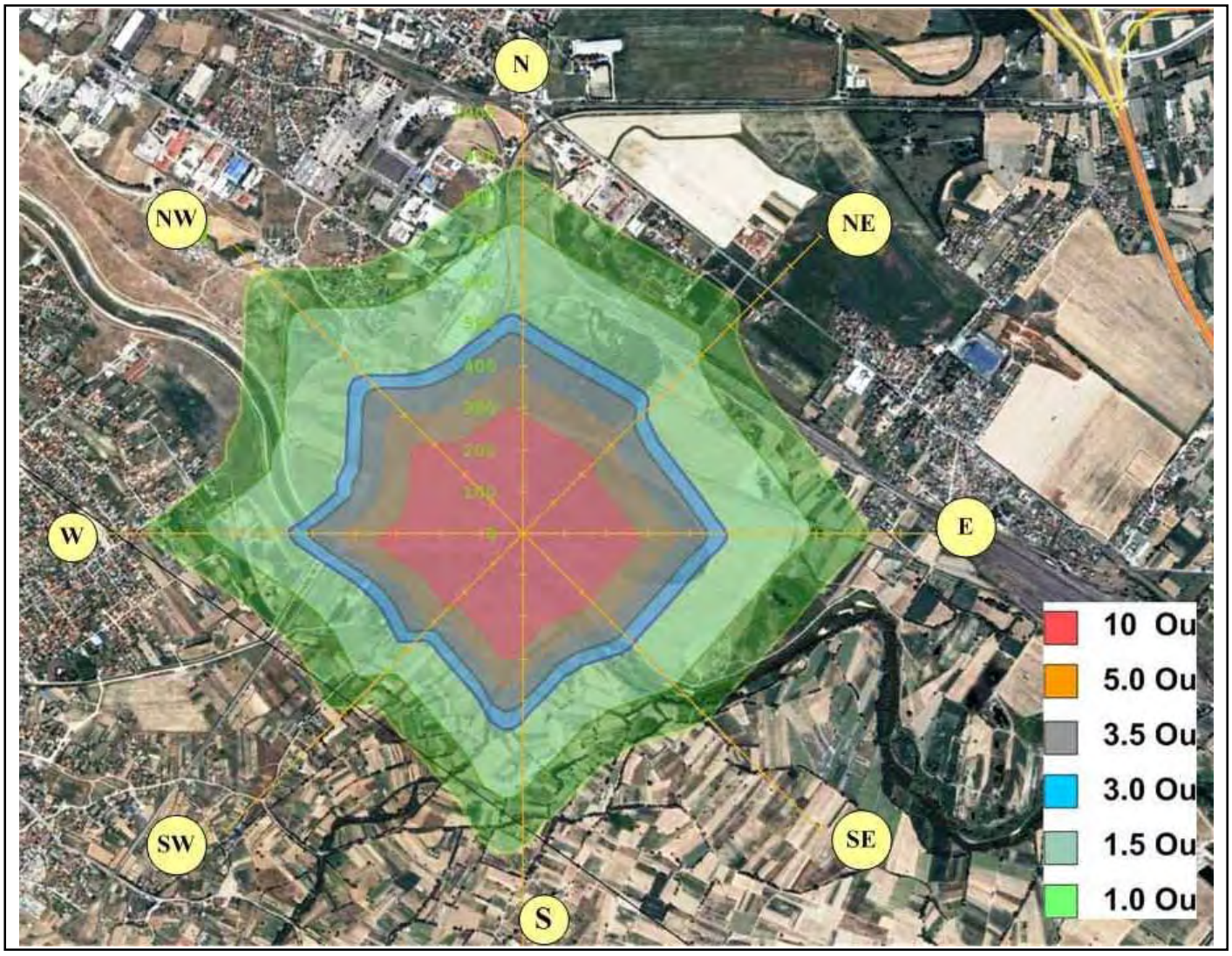


Figure 6: Affected area resulting from 26% odour abatement scenario

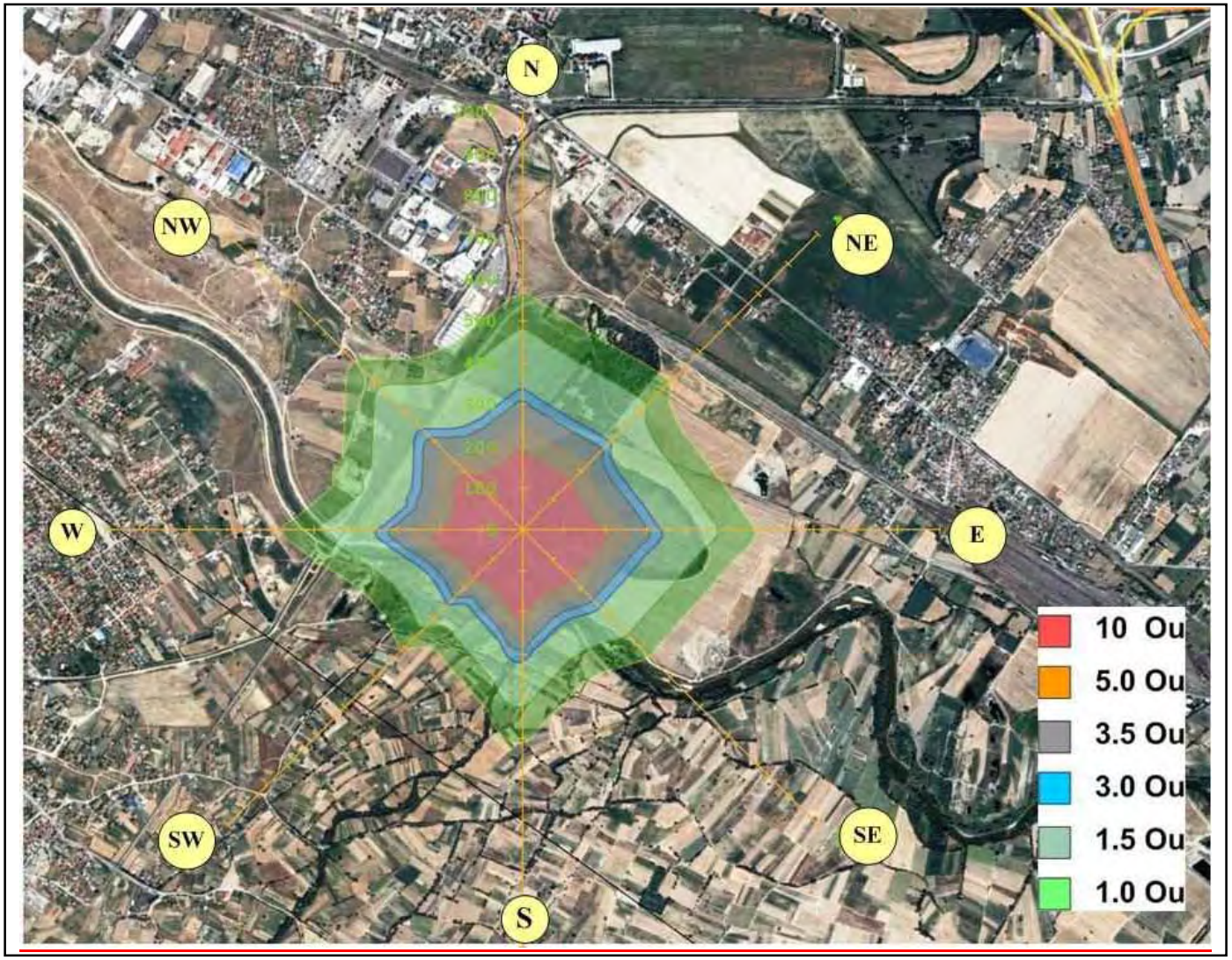


Figure 7: Affected area resulting from 55% odour abatement scenario

6.4 Minutes of 3rd Stakeholder Meeting

MINUTES OF THE 3RD STAKEHOLDER MEETING SUGGESTIONS AND COMMENTS

THE STUDY ON WASTEWATER MANAGEMENT
IN SKOPJE CITY IN THE REPUBLIC OF MACEDONIA

Skopje City in collaboration with MTC, MEPP and JICA Study Team organized a 3rd stakeholder meeting on 16th October 2008 at City Hall in Skopje City.

INTRODUCTORY SPEECH WAS GIVEN BY:

- LILJANA ONCEVSKA – Sector for Protection of Environment under the City of Skopje;

Ms. Oncevska introduced the present parties at the meeting and gave a brief description of the JICA Study Team and its purpose of study. She explained the purpose of the meeting and that any comments or suggestions would be recorded and anything that they saw fit would be included in the final version of the Feasibility Study.

- KAJA SUKOVA – MOEPP,

Ms. Sukova spoke about the relation between JICA's Project and the environmental policies and how it fits in the national strategies. She explained that this Project was classified as a Unique Project, since it exceeds the limit of 100 million Euros and therefore cannot be prioritized within its own category. She said that after funding has been secured for this Project, it shall be realized in the following few years. She further explained that waste waters had been identified as a major issue for a long time now and that according to the national development plan from last year, in the area of investments for environmental protection, apart from waste management, waste waters had been set as one of the priorities. She added that in the following year 200 million Euros had been planned for investments in waste water projects and that half of that amount shall go to the WWTP project for Skopje.

- SLOBODAN DIMITRIOVSKI – PE VODOVOD I KANALIZACIJA;

Mr. Dimitriovski gave short introduction of the background of the study. He explained the critical situation of the surface waters of the river Vardar and how the PE Vodovod and Kanalizacija are conducting only primary treatment of waste waters with primitive technology inherited from the past. He also emphasized the benefits from the Study being conducted by JICA, explaining that although there have been studies in the past this one is the first complete study by international standards and that with this study applying for funds to international organization is made possible, as well as fulfilling the obligations of the Macedonian side in international agreements concerning the environmental protection of the river Vardar as well as meeting public health interests. He added that all of these benefits would be realized through the construction of the WWTP, for which maintenance costs will be covered by a water tariff hike that would be affordable for the users.

Presentation 1: JICA Study and Feasibility Study

Mr. Kazufumi Momose, Team Leader of JICA Study Team announced that a presentation of the EIA would follow. He explained that the EIA had considered possible negative environmental impacts from the Project and that it was made according to both JICA and EU directives. He explained that they had been working on the Project for a year now and that many engineers and experts had been involved, and that they set a 20-25% water tariff increase which they considered was affordable for the users. He announced that a Public Hearing would be held January next year, at the earliest, but the Stakeholder Meeting had been organized in order to include comments so he asked the present parties to feel free to make comments and suggestions.

Presentation 2: Results of EIA Study

Ms. Magdalena Trajkovska Trpevska, Tehnolab. Ltd which conducted the EIA Study under JICA

Study Team explained the objectives of the EIA study, the results of EIA Study including alternative study, assessment, mitigation measures, monitoring plan and risk analysis.

Questions and Answers

1. Petko, Faculty of Civil Engineering

I would like to comment on a couple of points from this and the previous two workshops that were held.

We were informed that wastewaters from Saraj and Dracevo shall not be transported to the WWTP. The arguments we heard - that technical documentation for the above mentioned wastewaters hadn't been prepared yet - were not convincing enough and I believe it is JICA's study that should give a solution to this issue. The wastewaters from Saraj would consist only 1%-2% of the total quantity that is going to be treated in the WWTP so the load on the collectors would be insignificant. So it is in my opinion that the wastewaters from Saraj should be brought to and treated at the Trubarevo WWTP.

Another point I would like to comment is the target year set for 2020. From what your have presented I have understood that the construction phase will be finalized around the target year so I believe it should be set a few years after 2020.

As for the environmental impact of the wastewater treatment processes, as you had presented, N and P shall be removed only if Vardar is designated as a sensitive area. I believe that it would have been more appropriate if a decision had already been made concerning the designation of a sensitive area in order for your study to propose an appropriate method of treatment.

As for the sludge treatment, you had proposed a method using drying beds, in my opinion a very primitive method. Some WWTPs that had been using this method either have converted to a more up to date technology or are in the phase of conversion. I believe that drying beds are inappropriate for Skopje, since it would mean open beds where fecal waters are to be dried outdoors and with negative environmental effects on the immediate surrounding. Perhaps a more modern technology would be more costly, but I think it would not make much of a difference if the price were increased for 25% or 30%; the important thing would be that an appropriate method would be implemented.

I would just like to add in the end that if EIA studies were conducted by our side and not by a donor, certainly more attention would have been paid on negative environmental impacts.

Mr. Momose: We had already discussed the first question in one of the previous stakeholder meetings. Feasibility studies had already been conducted for Saraj and Dracevo. We had accepted the proposals from those studies that Saraj has a population of approximately 3,000 living in scattered settlements. As for Dracevo, the situation is a bit different, being a semi-urban area with a population of approximately 30,000 and at an altitude lower than that of Trubarevo. In any case we didn't include them from a purely engineering aspect since we would need very long conveying pipes and a separate pump station to pump the wastewaters from there to Trubarevo.

For your comment on the target year being 2020, we agree with you. That is why we decided on 2030 as the target year for the main collectors. As for the WWTP itself we were following the decision of the governments of Macedonia and Japan. For the target year 2020 the quantity of wastewater to be treated is 166.000 m^3/day, on the other hand the quantity for 2030 is 177.000 m^3 which only an increase of less than 10%. Some overload can be managed by the WWTP, as well as having the possibility of increasing the capacity stage by stage. That is why we are following the proposed target year as 2020.

As for your comment on the removal of P and N, I would like to say that we certainly

considered this option but if we had chosen it we would need a 50% increase of the facility; that is additional sedimentation and aeration tanks. In case the area is designated as sensitive there is the possibility of further expansion of the WWTP since we included enough land in the site for these purposes. We suggested a piece of land on the west bank of Vardar where these facilities may be constructed if necessary.

For the sludge treatment, we had also discussed this matter internally, that Macedonia is very lucky to have large land and the chance to utilize its natural resources. I understand that you feel the sludge drying beds aren't a very modern technology, but I believe that it is a very natural and environmentally friendly technology. In Japan, even if we wanted to use this technology, we wouldn't have the conditions for that, because of shortage of land so we have to use dewatering machines, which as you mentioned are very costly. So in the future, when Skopje comes to a rapid growth and more land will be needed, you can convert the technology and have the further tariff increase then. Before making this recommendation we had also visited the WWTPs in Struga and Kumanovo where they have introduced this dewatering equipment, but I think it's a very costly move.

As for the odour issue, as you know, dewatering machines would have less impact on odour, so that is why we conducted the odour simulations and have confirmed that there will be no problem concerning offensive odours.

Ms. Trajkovska, Tehnolab: As I already presented the odour assessment that we conducted, the critical points for odour will be the input points of the WWTP and the sludge digester. We suggested that those should be covered which would reduce the odour by 26% which is within the acceptable limits. We also presented a third simulation with an odour decrease of 55% which would mean the odour is insignificant.

Petko: But the simulation is only a mathematical model. And why haven't you presented a simulation using more sophisticated technology?

Ms. Trajkovska, Tehnolab: We were working according to the recommendations of the Feasibility Study.

Ms. Sukova, MOEPP: The sludge drying beds have been recommended, that's why they are in the EIA. I also received some comments from my colleagues during the break, so we will consider asking the Japanese side to include the alternative with a more up to date technology.

Mr. Momose: These two types of sludge treatment are already included in the Feasibility Study. It was in our presentation, the table on slide 18 for comparison of types of sludge treatment. You can see there are differences between the two alternatives in cost and surface of land required.

2. Prof. Bosnjakovski PhD

I was very impressed by the presentation. This model for treating wastewaters can be used in other urban areas alongside the river Vardar and its tributaries. I must admit I'm not an expert on water but I'm a radio-biologist, so this question might sounds a bit amateur. I also apologize if you had already addressed this issue in previous workshops which I hadn't attended. I would like to know if it is possible to recycle the wastewaters and if the sludge, as long as it's not hazardous, may be used in agriculture as organic fertilizer. I had the chance to visit Israel and learned that they recycle the wastewaters 4 times. Is it possible that in Skopje too the treated water from WWTP would be used by the industries? As for the sludge, I've also heard that in Serbia they use it on farms for breeding californian worms, fertilization etc.

Mr. Momose: We also studied the possibilities of reuse of treated water and sludge. Unfortunately we couldn't find any agricultural land near the WWTP because it is located in a low area and their concern isn't watering but drainage. As for recycling water, as Mr. Izawa mentioned in his presentaion the factories themselves should carry out the recycling of wastewaters. If the WWTP were to recycle

the water, it would have to be pumped back to the factories which would greatly increase energy consumption.

As for the sludge, we agree and recommend its use as fertilizer since it's rich with nutrients. But for this, we would have to control the inflow of heavy metals in the sewerage system and that is why we are proposing that together with the WWTP, industrial waste management should also be conducted.

Ms. Trajkovska, Tehnolab: Reuse of sludge is also included in the study. We can discuss it in more details at the Public Hearing.

3. Ms. Kaja Sukova, MOEPP

If there are no more comments, I would like to inform you all that you will be able to find the EIA which will be posted on the MOEPP's website, and I believe on the website of the City of Skopje. It will also be announced in the media. You will have time to read it carefully and think of comments and suggestions for the Public Hearing to be held in January.

As for the Feasibility Study, I can't think of a case where such a study had been presented and commented, but today was a good opportunity to do that. In case you have any additional comments you may send them to the JICA Study Team's email address.

4. Attendance Lists

	Name	Organization
1	Kaja Sukova	MoEPP
2	Bexhet Abazi	MoEPP
3	Iirije Memedi	MoEPP
4	Toni Kostov	City of Skopje
5	Irina Shentevska	City of Skopje
6	Rajna Drenkovska	City of Skopje
7	Remzi Rahmani	City of Skopje
8	Slagjana Georgievska	City of Skopje
9	Lidija Klimoska	City of Skopje
10	Saso Mladenovski	City of Skopje
11	Lilijana Oncevska	City of Skopje
12	Zvonko Smiljkov	Municipality Gjorce Petrov
13	Ljupco Gjorgjiovski	Municipality Gjorce Petrov
14	Vesna Jankova	Municipality Centar
15	Slavica Jovanovska	Municipality Kisela Voda
16	Snezana Piperevska	Municipality Kisela Voda
17	Elica Vugreshek	Municipality Aerodrom
18	Viktorija M.Zdravkovska	Municipality Aerodrom
19	Slobodan Dimitrovski	P.E Vodovod i Kanalizacija
20	Dragi Mitkovski	P.E Vodovod i Kanalizacija
21	Ilinka Sazdova	P.E Vodovod i Kanalizacija
22	Zoran Bozinovski	P.E Vodovod i Kanalizacija
23	Brankica Andonovska	P.E. Solid Waste
24	Milco Biljanovski	P.E. Solid Waste
25	Ilija Kondinski	PE Strezevo - Bitola
26	Pavle Kondinski	PE Strezevo - Bitola
27	Jovan Dojcinovski	PE Strezevo - Bitola
28	Blagoj Vrzovski	PE Strezevo - Bitola
29	Petko Pelivanoski	Faculty of Civil Engineering
30	Jovan Boshnjakovski	Self researcher （Ph.D)
31	Mihail Kochubovski	PHI
32	Viktorija Duridanska	ZZZ - Skopje (PHI)
33	Biljana Stevanovska	ORT (NGO)
34	Atanas Ivanov	Skopski Leguri (Skopje Alloys - smelter)
35	Slavko Gjorgjiovski	Skopski Leguri (Skopje Alloys - smelter)
36	Dragan Hristovski	KOMUNA AD
37	Magdalena Trajkovska	Tehnolab - Skopje
38	Jelena Dimitrijevic	Tehnolab - Skopje
39	Brankica Kostova	Tehnolab - Skopje
40	Elena Trpcevska	Tehnolab - Skopje
41	Ljubomir Ivanovski	Tehnolab - Skopje
42	Sandra Andovska	Geing
43	Svetozar Petkovski	Prirodonaucen Muzej (Museum)
44	Marija Andreevska	Hydro-Meteo
45	Slobodan Prendzov	TMF
46	Saso Dimitrov	JICA Skopje
47	Stanislava Dodeva	Swiss Cooperation Office
48	Kazufumi Momose	JICA Study Team
49	Tetsuo Izawa	JICA Study Team
50	Shoko Yamada	JICA Study Team
51	Norio Tanaka	JICA Study Team