



REPUBLIC OF SERBIA

**REPUBLIC AGENCY FOR SPATIAL PLANNING
PE 'ELECTRIC POWER INDUSTRY OF SERBIA'**

STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT OF THE SPATIAL PLAN OF KOLUBARA MINING BASIN AREA

REPORT ON STRATEGIC ASSESSMENT



Architecture and Zoning Institute of Serbia

Belgrade, December 2008

REPORT ON STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT OF THE SPATIAL PLAN OF KOLUBARA MINING BASIN AREA

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I EXPERT TEAM FOR REPORT DEVELOPMENT

Methodology and synthesis			
др	Божидар	СТОЈАНОВИЋ	дипл. инж. техн.
Baseline information			
др	Ненад	СПАСИЋ	дипл. инж. арх.
др	Миодраг	ВУЈОШЕВИЋ	дипл. економ.
Mining			
Рударски институт, Земун			
Колубара пројект, Лазаревац			
Energy			
проф. др	Ненад	ЂАЈИЋ	дипл. инж. маш.
Agriculture, forestry, reclamation			
др	Марија	НИКОЛИЋ	дипл. инж. агроном.
Economy			
др	Славка	ЗЕКОВИЋ	дипл. прост. планер
Settlements, population and social development			
проф. др	Ксенија	ПЕТОВАР	дипл. социолог
	Весна	ЈОКИЋ	дипл. прост. планер
Infrastructrural systems			
проф. др	Бранислав	ЂОРЂЕВИЋ	дипл. инж. грађ.
Environment protection			
др	Божидар	СТОЈАНОВИЋ	дипл. инж. техн.
Natural resources and cultural heritage			
мр	Тамара	МАРИЧИЋ	дипл. прост. планер
Graphical annexes			
мр	Тамара	МАРИЧИЋ	дипл. прост. планер
	Весна	ЈОКИЋ	дипл. прост. планер

II INTRODUCTION

Strategic environmental impact assessment was introduced into our plan development practice based on the Law on Environment Protection ('Official Gazette RS' № 135/2004). Pursuant to Article 35 of this Law 'Strategic environmental impact assessment is performed for the plans, programmes and bases in the field of spatial and zoning planning or land use, energy, industry, traffic, waste management, water management and other fields and it is an integral part of the plan, i.e. programme or basis.' Strategic environmental impact assessment should be harmonised with other environmental impact assessments, as well as environment protection plans and programmes and it is carried out in accordance with the procedure regulated by a special law: 'LAW ON STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT' ('Official Gazette RS' № 135/2004).

Decisions on the development of the strategic assessment are made pursuant to Article 9 of the Law on Strategic Environmental Impact Assessment. Decision on the development of the strategic assessment is made by an authority competent for plan preparation upon previously obtained opinion of the authority competent for environmental issues and other stakeholders and organisations. In accordance with this provision, the Republic Agency for Spatial Planning adopted a Decision on the Development of the Strategic Environmental Impact Assessment of the Spatial Plan of Kolubara Mining Basin Area (№359-208/2006-01; from 05.04.2006). Based on this decision, development of the strategic assessment is based on the study, spatial-planning and zoning documents and relevant regulations as well as on the basis of the results of previous investigations in the field of planning and environment protection. Methodological approach to the development of the strategic assessment and the contents of the report on the strategic assessment are provided in the Strategic Assessment Programme which is an integral part of the above decision.

Based on Annex I to the Contract on the Development of the Spatial Plan of CHP Kolubara B complex (№ 350-01-912/98-03 from 11.03.2005 – Ministry of Capital Investments, i.e. № 759 from 28.07.2005 – PE Electric Power Industry of Serbia and № 765 from 01.08.2005 – Architecture and Zoning Institute of Serbia, it was established that a Strategic Environmental Impact Assessment for the entire basin would be done within the Spatial Plan of Kolubara Mining Basin Area, covering the General Regulation Plan of TPP Kolubara B complex.

Strategic environmental impact assessment is developed for the purpose of providing environment protection and improvement of the sustainable development of the plan area by integrating the basic environmental principles into the procedures for preparation and adoption of plans and programmes. Pursuant to Article 5 of the Law, strategic assessment is done for the plans in the field of spatial and zoning planning, establishing the framework for approval of the future development projects stipulated by regulations governing environmental impact assessment of projects.

Pursuant to Article 4 of the Law on Strategic Environmental Impact Assessment, basic principles of the strategic assessment are as follows:

- 1) **Sustainable development principle** – Sustainable development is a harmonized system of technical-technological, economic and social activities within the total development using natural and man-made values in economically efficient and reasonable way aiming at preservation and improvement of quality of the environment for the present and future generations. Consideration and inclusion of significant environmental aspects in preparation and adoption of certain plans and programmes and setting of conditions for preservation of values of natural resources, landscapes, biological diversity, wildlife species and autochthonous eco-systems, and rational use of natural resources shall contribute to fulfilment of objectives of sustainable development.
- 2) **Principle of integration** – The environmental protection policy that is implemented through enactment and adoption of plans and programmes shall be based on the inclusion of environmental protection conditions, and conditions of preservation and sustainable use of biological diversity into the appropriate sectoral and inter-sectoral programmes and plans.
- 3) **Precautionary principle** – Each activity has to be carried out in the way preventing or reducing adverse effects of certain plans and programmes on the environment before their adoption, providing for rational use of natural resources and minimising the risk to human health, the environment and material resources.
- 4) **Principle of hierarchy and co-ordination** – The assessment of impact of plans and programmes shall be carried out at different hierarchy levels at which plans and programmes are adopted. The increased level of transparency in decision making within the procedure of strategic assessment of

plans and programmes shall be provided through mutual co-ordination of the competent authorities and authorities concerned in the procedure of granting the approval for the strategic assessment, through consultations, and informing and submission of opinions relating to plans and programmes.

- 5) **Principle of public character of work** – Aiming at informing public about certain plans and programmes and their potential impact on the environment, as well as at providing complete transparency of the procedure of preparation and enactment or adoption of plans and programmes, public has to have access to information relating to such plans and programmes or their amendments prior to adoption of any decision and after the adoption of plans and programmes.

Strategic environmental impact assessment is the process which should integrate sustainable development principles and objectives in spatial plans, taking into consideration the need to avoid or limit negative environmental and health impacts. Importance of the strategic environmental impact assessment is reflected in:

- Analysis of issues and impacts of broader importance, which may not be divided into projects, e.g. cumulative and social effects;
- Assistance in the verification of suitability of various variants of development concepts;
- Avoidance of restrictions emerging in the course of environmental impact assessment of the already defined project;
- Establishment of the corresponding context for impact analysis of concrete projects, including previous identification of issues and impacts requiring more detailed investigations, etc.

1. STRATEGIC IMPACT ASSESSMENT¹

Legal basis (Article 13 of the Law):

The background information in the strategic assessment shall include:

- The short outline of the content and objectives of plans and programmes and relationship with other plans and programmes;
- The outline of the current status and quality of the environment in the area that the report refers to;
- The characteristics of the environment in areas likely to be exposed to significant impact;
- The environmental protection issues and problems that have been considered in plans and programmes and the outline of reasons for omission of certain issues and problems out of the assessment procedure;
- The outline of the prepared alternative solutions relating to the environmental protection in plans and programmes, including the zero alternative solution for plans and programmes and the most favourable solution from the aspect of environmental protection;
- The results of previous consultations with authorities and organisations concerned that are relevant from the aspect of objectives and evaluation of potential impact of the strategic assessment.

1.1 Scope, subject and objectives of the Spatial Plan

Spatial Plan of Kolubara Mining Basin Area (hereinafter referred to as: 'Spatial Plan') was developed at the Architecture and Zoning Institute of Serbia based on the Contract № 350-01-672/98-03 from 23.07.1998 (Ministry of Construction), i.e. № 459-32 from 29.07.1998 (PE Electric Power Industry of Serbia) and Annex I to the Contract № 031-212/2006-01 from 01.04.2006 (Republic Agency for Spatial Planning), i.e. № II - 332/8 from 13.04.2006 (PE Electric Power Industry of Serbia).

Spatial Plan was developed completely on the basis of the Decision on the Development of the Spatial Plan of Kolubara Mining Basin Area ('Official Gazette RS' № 11/2000), Development Programme of the Spatial Plan of Kolubara Mining Basin Area (hereinafter referred to as: 'the Programme') verified by the Spatial Plan Expert Control Committee of the Ministry of Construction at the session held on April 29, 1998 and the Expert Council of PE Electric Power Industry of Serbia at the meeting held on June 25, 1998.

Plan solutions, contents and analysis method of the Spatial Plan have been aligned with the provisions of the Law on Planning and Construction ('Official Gazette № 47/2003) and the Rules on the Contents and Development of the Planning Documents ('Official Gazette № 60/2003), Law on the Spatial Plan of the Republic of Serbia ('Official Gazette № 13/1996), as well as other norms from the field of mining, water management, agriculture, environment, etc.

Spatial plan is based on the following:

- Strategic guidelines and solutions of the Spatial Plan of the Republic of Serbia, regional spatial plans for Kolubara District and the City of Belgrade, Energy Sector Development Strategy by 2015 (2005), other long-term strategies, bases and policies from the field of mining, energy, water management, agriculture, forestry, environment, etc.;
- SE Europe Energy Treaty;
- Economic Development Strategy of the Republic of Serbia and National Sustainable Development Strategy of the Republic of Serbia;
- Foreign Investments Stimulation and Development Strategy, Official Gazette RS, year LXII, 22/2006;
- Serbia and Montenegro EU Accession Strategy;
- Poverty Reduction Strategy in Serbia, Government of Serbia, Belgrade, 2003;
- Memorandum on the Budget and Economic – Fiscal Policy for 2006, with projections for 2007 and 2008 (2005);
- SME Development Strategy in the Republic of Serbia 2003 – 2008, Government of Serbia, Belgrade, 2003;

¹ Issues related to environment protection and state are analysed in Section 2 due to clarity.

- Operation and Development Plan of PE EPS from 2006 to 2010, Management Board of EPS, 2006;
- Long-term Mining Programme of Kolubara Mining Basic, MB Kolubara, 2002;
- Programmes and other development documents of regional, municipal and city level;
- EPS Restructuring Programme;
- Mining expertise 'Update of Area Reservation at Kolubara Mining Basin by 2020 with the Development Project by the End of Mining aimed at Open Cast Mining Development, Kolubara Projekt, Lazarevac, 2005 and Mining Institute, 2007;
- Results of scientific investigations related to the spatial development of Kolubara Mining Basin;
- Studies and documents developed in the previous period related to the spatial development of Kolubara Mining Basin; and
- Studies and documents developed during the development of the Spatial Plan.

In the course of the Spatial Plan development, solutions from the current zoning plans in the area of the Spatial Plan have been taken into consideration.

1.1.1 Scope and Subject of the Plan

Spatial Plan area covers the following: existing and planned open cast mines; overburden dumps and other waste materials; facilities for preparation, processing or transformation of coal; network of external and internal transport; water supply systems; locations of the facilities for technological and waste water; reclamation areas of degraded land; relocation sites for settlements, infrastructural and other facilities from the lignite mining zone and area of direct mining-energy system environmental impact.

Total planned area is 547.14 km². Boundaries of the Spatial Plan include: parts of territories of four municipalities: Lazarevac, Ub, Lajkovac and Obrenovac.

The Spatial Plan is developed in two volumes:

Volume I:	Spatial Plan of Kolubara Lignite Basin mining area (objectives, bases, planning solutions, spatial development rules, implementation guidelines, referral maps); and
Volume II:	Baseline information for the Spatial Plan

The Spatial Plan consists of: synthesis of the study documents, objectives and basic starting points of the Plan, objectives and strategy of long-term area development, basic concepts and rules for development, utilisation and revitalisation of the area, as well as policy, guidelines and measures for Spatial Plan realisation.

Graphic documents of the Spatial Plan developed in the form of maps in digital and analogous forms in the scale of 1:100 000 and 1:50 000.

Mining area of Kolubara Lignite Basin stretches along its longer side from Rudovci in the south-east to Radljevo and Sarban on north-west at the length of about 25.5 km and along its shorter side, at the width ranging from 2 to 8 km. Total mining area amounts to 133.9 km²; of which 51.14 km² or 38.2% already used for mining purposes. Reclamation in the previous period covered 12.6 km², of which 8.6 km² under forests. In the forthcoming period, overburden will be dumped only on inside dumps in the residual pits of open cast mines where mining operations have been finalised. In the last phases of lignite deposit mining, three relatively large permanent residual pits will be formed, one in the eastern (Field E) and two the western part of the lignite basin (Field Radljevo and Field Tamnava – South) to be filled with water. Spatial Plan area is shown on Map № 1.

Degraded area rehabilitation concept (settlements, ecosystems, landscape, etc) is based on the analysis and evaluation of traditional values of this area (architectural and cultural heritage, social and human values, natural environment, i.e. relief, landscape, flora and fauna characteristics, etc).

Planning covers the period until 2020, with the mid-term phases 2010 and 2015. Finalisation of coal mining at Kolubara Mining Basin is expected between 2050 and 2060.

The Spatial Plan contains planning concepts of the spatial development of Kolubara Mining Basin area and rules for spatial development in the following fields:

- (1) Mining
- (2) Energy

- (3) Water management
- (4) Agriculture
- (5) Forestry
- (6) Economy
- (7) Population
- (8) Network of settlements
- (9) Social Development
- (10) Relocation of settlements and resettlement of population
- (11) Traffic
- (12) Telecommunications
- (13) Environment protection
- (14) Reclamation of degraded areas
- (15) Nature preservation
- (16) Protection of cultural assets

1.1.2 Plan Objectives

Basic development objective of the Plan area is efficient, rational, organised and cost-effective use of human, natural and developed potentials, in socio-economic, spatial and environmental terms. Mining and energy will represent the most essential economic activities, as the main fields in the previous and future development of the Plan area. Environment protection and land reclamation of lignite mining areas will also be essential, especially in the reconstruction of existing electricity generation capacities and development planning of new facilities and their importance will continue to grow.

Special development objectives of the Plan area for individual fields are presented below:

1.1.2.1 Mining-Energy Complex

Starting from the fact that energy is the basis of social and economic development, having in mind both domestic and international energy policy, as well as the need for harmonisation of energy, economy and ecology development, future energy sector development in the Republic of Serbia is based on the following:

- Rational structure of total energy sector and harmonised development of individual energy sector branches;
- Higher reliance on domestic energy sources;
- Rational use of energy and energy efficiency increase;
- Economically feasible energy imports;
- Higher use of new and renewable energy sources;
- Realistically possible environment protection; and
- Creation of market environment for business operations of energy companies on economic bases.

Large lignite basins and construction of energy-industrial lignite based facilities are areas in which broader social objectives and interests are interlinked with local objectives and interests. However, planning level of thermal power facilities may not be the platform for confrontation of national and local objectives. Objectives established within the broader social community are accepted as a strategic framework, i.e. boundaries, not including critical relations towards them. This implies observation, especially in the area of objectives, of the corresponding hierarchical levels in case of different planning levels.

1.1.2.2 Waters and Water Management Infrastructure

- Gradual connection of all smaller water supply systems into the system of higher level, for the purpose of achieving high water supply reliability of settlements, at the level not lower than 97%, including the connection of villages with the higher level systems;
- For the purpose of reliability increase – connection of Lazarevac water supply sub-system with the higher-level systems: south part of the municipality with Kolubara regional systems, northern part with Belgrade water supply system;
- Provision of continuous water supply of all settlements, including those which will lose their local water supply sources due to mining operations;
- Preservation, protection and use of local springs which can be preserved under lignite mining conditions (Nepricava, Kalenic, Vreoci, Veliki Crljeni, Zeoke); regional systems only supply missing water amounts, while local springs continue the supply, based on their possibilities;

- Preservation and use of PPV Pestan whose position is not affected by mining operation; after existing wells stop operating, it is planned to supply water from the dewatering system wells;
- Provision of water for technological needs by using Kolubara river system; achievement of supply reliability at the level not lower than 97%, with the provision of prescribed guaranteed flow in Kolubara downstream from the waterintake, which may not be lower than the lowest monthly level even under the most unfavourable circumstances, i.e. it should be at the level of 95%;
- Highest quality water, coming from the water supply systems, may not be used for technological process not requiring potable water quality;
- Full sanitation and channelling of settlements under the principle of separation sewage systems, with separate swages for municipal waste waters and precipitation; gradual connection of sewage system of different settlements and waste water treatment plants (WWTP) for all settlements larger than 500 EI (equivalent inhabitants); settlements not having sewage systems have the priority in terms of sewage system introduction;
- Provision of conditions for introduction of industrial waste waters into the sewage systems of settlements only after sub-treatment, with the treatment up to the level on which they could be treated in WWTP of general type;
- Protection against floods depending on the value of the protected areas; varies from the so-called 20-year floods ($Q_{5\%}$), for the protection of agricultural areas outside melioration areas, to $Q_{0,1\%}$ floods which will affect the immediate area of the future TPP Kolubara B; open cast mines are protected against $Q_{0,2\%}$ floods by active and passive protection measures;
- Harmonisation of watercourse regulation with the REIS development needs, implying phased relocation of riverbeds in the area of future open cast mines;
- Protection of water quality by applying measures providing water quality class prescribed by the Water Management Master Plan of Serbia; this implies technological measures and water management measures;
- Ground water protection in the areas of ash and slag dumps;
- Erosion protection of the catchment area, as the protection measure of the catchment area, water quality and stability of regulated watercourses;

1.1.2.3 Agricultural Land

- Reduction of agricultural areas used for lignite mining to the technological minimum, by elaborating alternative solutions in the phase of investment designing of mining-energy facilities;
- Shortening of the period of temporary disabling of areas for biomass production, by selecting the most favourable solutions for successive reclamation of dump site areas;
- Prevention unplanned agricultural land occupation for housing development, infrastructural facilities and other non-agricultural purposes;
- Preservation of natural fertility of the pedologic cover, both through selective removal and dumping of top soil from affected areas for the purpose of their later biological reclamation, as well as through the prevention of harmful impacts of mining and energy on hydrologic, morphologic, chemical, physical and other environmental, i.e. production-economic properties of agricultural land in the surrounding area;
- Harmonisation of agricultural land uses with natural limitations, on one hand, and the need to improve environmental, landscape and general characteristics of the area on the other hand, by applying the following measures: forestation and grassing of soil of 5th and 8th class, as well as deposol; formation of plantation orchards and vineyards on land with low productivity; diversification of agricultural production by introducing the corresponding crop rotation and expansion of areas under various forage plants, especially leguminous plants; and formation of the protective greenery network for the purpose of water table regulation, prevention of air pollution and improvement of other environmental components;
- Improvement of production, supply and demand of high-quality local agricultural food products, for the purpose of achieving market competitiveness, by supporting restructuring and improvement of human and physical potentials of the agricultural sector;
- Usage of hot waste waters coming from thermal power plants for vegetable growing, production of early berry fruit, various seedlings, flower and decorative plants, edible mushrooms, etc in greenhouses;
- Long-term orientation towards agricultural activities of one part of affected areas, especially after 2020.

1.1.2.4 Forest and Forest Land

- Territorial differentiation of forestation schedule and objectives: it is essential to compensate the delays in dump site reclamation, with the usage of positive experience of their forestation until 1992, as well as forestation of water springs and terrains exposed to intensive air pollution; development and implementation of the programme for successive reclamation of dump site have mid-term priority, in

accordance with the schedule of mining operations until 2020 and final vision of revitalisation and development of degraded areas;

- Improvement of the state of existing forests: by improving quality and mixture ratio in high forests with short rejuvenation period; and application of preventive and repressive measures for the care of all preserved forests, i.e. other protected natural assets;
- Increase of growth level, intensive care and protection of 'line', natural hydrophilic forests along Kolubara and Tamnava watercourses;
- Planting of forest protection zone around road routes, settlements, industrial facilities, agricultural areas, etc;
- Increase of the level of biological diversity: by forming plantations with very wide range of dendroflora, and giving long-term priority to indigenous species of deciduous trees; by introducing wild fruit trees, horticultural forms of trees, decorative shrubs and other decorative plants into protective forest areas; and by taking into consideration the legally prescribed levels for micro-ecological conditions of the environment for the purpose of wild flora and fauna protection.

1.1.2.5 Economic Development

- Formation of economy based on know-how, by improving the support to all forms of innovations, accelerated adoption of technical progress and increased/improved investments into investigations and development, especially by the private sector;
- Establishment of sustainable industrial structure by supporting more efficient reorganisation and restructuring of mining-energy complex, modernisation of other production and service capacities and diversification of economic activities;
- Continuous growth of qualitative and quantitative results of business operation of all activities , by promoting effective allocation of resources oriented towards employment level increase;
- Modernisation of employment policy and creation of positive changes on the labour market, primarily by supporting the development of entrepreneurship and creation of the environment stimulating the development of SMEs within the sector of production and various services;
- Provision of favourable locations and other business-investment conditions for the development of different economic activities and attraction of domestic and foreign investors;
- Facilitating of expansion and efficient usage of information-communication technologies; and
- Strengthening of municipal administration institutions for the purpose of supporting the entire local development, with the improvement of inter-municipal cooperation, establishment of partnerships with all stakeholders of social and political life on the local level and achievement of the higher level of development-functional connections on inter and intra-regional levels.

1.1.2.6 Population

- Keeping of younger groups of population, especially in village areas, by improving schooling conditions and credit-financial and other support to the development of agricultural production and private entrepreneurs;
- Stimulation of the younger female population to stay in the villages, by adopting and implementation of specific programmes for improvement of living conditions of this social group; and
- Protection and support to older citizens, especially to old one member and two member households, with integration into old people care programmes (development of one form of compensation for such activities, *inter alia*, by usage and inheritance of the property of these households).

1.1.2.7 Development of the network of settlements and population resettlement

- Timely resettlement of the population, and compensation of utility infrastructure, roads, industrial facilities and public services in existing settlements/parts of settlements being relocated though the construction on new locations;
- Orientation of one part of improvement activities and works towards the corresponding locations and uses providing broader development interest;
- Orientation of the development of settlement functions to areas outside of mining-energy complex impact;
- Provision of functional flexibility/stability of the settlement network during and after the mining period;
- Development harmonisation of the local network of centres with the functional position compared to the ex-territorial centres of higher level; and
- Development of agglomerative and integrative functions of community centres in accordance with the policy of demographic and socio-economic revitalisation

1.1.2.8 Social Development

- Improvement of living quality, especially in villages within the Plan area;
- Provision of more equal availability and conditions for the usage of basic features from the field of social standard and public services;
- Achievement of economic, social and cultural rights of citizens;
- Adaptation of organisation and activities public services to the characteristics of this area;
- Employment level increase in this sector;
- Provision of availability of public services in zones to which the population is resettled; and
- Improvement of living conditions especially of more sensitive social groups (old people, persons with special needs, etc).

1.1.2.9 Traffic infrastructure

- Relocation of regional and local roads which should accompany the schedule of relocation and resettlement, as the consequence of open cast mine and industrial-energy complex development;
- Construction of alternative road section during mine activation phase;
- Relocation of one part of *Ibarska Magistrala* road (M-22) in the zone of Vreoci and Sopic settlements, due to the opening of the new open cast mine (South Field);
- Possible relocation of one railway section along Belgrade – Bar railway within the zone of Vreoci and Sopic settlements;
- Development of internal road network during the opening of new open cast mines;
- Development of the road and railway network in order to bring passenger and goods transport to the optimal level;
- Improvement of the railway system by constructing the second railway track Belgrade – Valjevo, development of the local railway system, as well as by including this area into the suburban system of Beovoz; and
- Improvement of speed, quality and safety of transport.

1.1.2.10 Telecommunications

- Construction of telecommunication network of landline telecommunications in all settlements covered by the Plan, primarily in those not included so far, thus improving the quality of living in village and slowing down population migrations from this area;
- Construction completion of the technical connection system enabling modern monitoring and control of these resources within the system; and
- Improvement of the business connection system in accordance with the needs, contributing to the successful and rational business operations.

1.1.2.11. Environment Protection

- Provision of optimal relocation of population, economic and other activities in accordance with the needs of harmonised spatial development, energy sector and environment protection development;
- Programming of the lignite consumption schedule by taking into consideration emission of harmful substances and environmental capacity of the area;
- Programming of the mining and reclamation schedule within shortened period for the purpose of timely return of degraded areas to their productive use;
- Undertaking of systematic population protection measures affected by the unsatisfactory environmental quality, especially in inhabited settlements of Vreoci and Veliki Crljeni;
- Improvement of polluted parts of environment and degraded areas, especially the ash disposal site;
- Emission reduction of sulphur-dioxide, nitrogen oxides, ash and other toxic substances into air;
- Provision of facility operation conditions and usage of facilities within the boundaries of designed systems;
- Elimination of 'dirty' technologies and environmentally non-efficient facilities;
- Application of air and water protection technology with the increased efficiency level, enabling the meeting of stricter environmental requirements;
- In case of possible chemical hazards, special protection measures should be anticipated;
- The concept of integral environment protection should be applied based on the balance of pollutants;
- Waste amounts should be reduced, together with the increase of waste recycling level;
- Provide conditions enabling the consideration and analysis of interests emerging from the sustainable development and environment protection concepts in the course of decision-making;

- Provision of the modern environmental monitoring system; and
- Improvement of the environmental management system.

1.1.2.12 Reclamation of Degraded Areas

- Reclamation through forestation is set as priority until 2020, considering the extremely low forestation level of the total area, multiple positive impact of forest ecosystems on the general state of environment, as well as due to limitations imposed by the mining technology applied so far;
- In the period until 2050, reclamation and revitalisation conditions and programmes should be provided for the area degraded by mining operations, establishing optimal environmental and socio-economic relations among agricultural areas, forests and terrains for sports and recreation, including the formation of water bodies in residual depressions, introduction of decorative elements into protective greenery, establishment and development of parks, etc;

Based on the above, the following special objectives until 2020 are determined:

- Accelerated improvement of degraded areas aimed at reproduction of renewable potential of the top soil and other biosphere elements (waters, air, flora and fauna), by developing reclamation programmes and projects in accordance with legal regulations;
- Increase of bio-capacity of the entire area by establishing more favourable relations among agricultural, forest, water and non-productive/constructed areas, in accordance with natural advantages and limitations;
- Increase of economic effectiveness of investments into technical and biologic reclamation of degraded areas; and
- Functional and development harmonisation of reclamation of degraded areas with planned activities and protection measures of natural values, as well as long-term improvement of infrastructural, utility, zoning, landscape, health and other socio-economic conditions in the entire Spatial Plan area.

1.1.2.13 Nature Preservation

- Preservation and maintenance of existing, previously identified natural assets (memorial natural monuments 'Sopicanski Lug' and 'Vrapce Brdo'), together with the settlement of their further legal status and protection model;
- Establishment of protection in other parts of the area, natural structures and phenomena identified to possess the features of natural assets, i.e. distinctive values of the natural complex based on detailed valorisation and development of planning documents;
- Development for the corresponding public uses and presentation of existing and future protected natural assets; preparation and implementation of protection and development programmes and improvement, conservation and development projects of natural assets and their relevant spatial framework;
- Preservation and restricted usage of plant and animal species covered by the Decree on the Protection of Natural Rarities, if these species are found in the Plan area, as well as wild species of fungi, lichen, plants and animals covered by corresponding laws and by-laws;
- Preservation and improvement of the forest cover state through the reduction of felling and caring of existing forest species, fragmented groves/preserves, groups, line of trees and zones of ligneous plants;
- Preservation and improvement of agro-bio-diversity, i.e. collection and multiplication of old types of agricultural (fruit, farming, etc) crops and old domestic animal species, as well as planning of measures oriented towards commercialisation of such activities;
- Preservation and increase of the number and area of surface water structures due to their manifold importance as biotope and nutritive basis for animal life, recreational values, microclimate regulators and attractive landscape elements;
- Preservation of riverbed sections in the natural state, and if they need to be regulated, models of natural, unobtrusive development should be applied; and
- Preservation and care for aesthetic landscape features, i.e. authenticity and beauty of less affected areas, as well as other parts of the area, development of recreational and tourist zones, preservation and development of cultural monuments, development of areas used for industrial purposes and raw material extraction, as well as areas containing water management structures, roads and watercourses, etc.

1.1.2.14 Protection of Cultural Heritage

- Protection of material monumental evidence about life of the people and previous cultures, in order to ensure the possibility to form identity both of people and places after lignite mining is finalised;
- Protection/renewal of national architecture monuments, especially from the 1st and the 2nd Serbian Uprising, during the reconstruction of the area affected by mining operations;
- Integral approach to the issue of cultural heritage protection, for the purpose of establishing relevant criteria and categorisation of newly-discovered monuments;
- Application of the revitalisation principle and guidelines for corresponding activation of these structures into the structures of economic and spatial development model; and
- Cultural monuments have to preserve their basic historic, artistic and ambient characteristics.

1.2 Development Variants of the Plan Area

Legal basis

Based on the requirement from Article 13 of the Law on Strategic Environmental Impact Assessment the following should be provided 'description of the prepared variant solutions related to environment protection in the plan and programme, including the variant solution in case the plan and programme are not implemented, as well as the most favourable variant solution from the aspect of environment protection.

Based on the Energy Sector Development Strategy of the Republic of Serbia by 2015, development of mining and energy capacities does not have any alternatives, i.e. in order to achieve the development objectives, TPP Kolubara B construction needs to be finalised and new mines need to be prepared for lignite production increase to the capacity meeting the needs of existing and new power plants. Due to legal requirements, this report considers the following two variants:

- Variant in case that the plan is not implemented (continuation of coal mining and electricity generation according to current programmes and plans – Scenario 'A'), and
- Variant in case that the coal mining and energy sector development plan is implemented (Scenario 'B').

1.2.1 Scenario 'A': development of the area in case that plan is not implemented

The Spatial Plan area covers: existing open cast mines, overburden dumps and ash and slag disposal sites, facilities for preparation, processing or transformation of coal, road network of external and internal transport, water supply systems and locations of facilities for technological and waste waters. Facilities from mining-energy complex are especially important for environmental impact assessment among numerous constructed industrial and infrastructural facilities, including ancillary industries of mining and energy.

1.2.1.1 Mining

Coal production at CE MB Kolubara in the past several years is at the level of about 26×10^6 t of coal and about 55×10^6 m³ of overburden. Any significant production increase should not be expected before the commissioning of the new thermal power capacity (TPP Kolubara B or its alternative), however, investments into existing mines are anticipated. The following open cast mines should be mined in the period until 2020:

- **Field 'D'** – the mine with the longest operation life. After mine expansion, mining will end in 2016.
- **Fields 'B' and 'C'** - Field B has been expanded to the part of geological area of Field C. Mining until 2016.
- **'Tamnava West Field'** – Only this mine will remain operational until 2020. This mine should start producing 12×10^6 t of coal annually, while from 2015 this amount will be reduced to 11×10^6 t of coal (due to selective excavator operation regime).
- **'Veliki Crljeni'** - planned mining start 2009.
- **'Radljevo'** – planned mining start 2014.
- **'Field E'** – planned mining start 2015.
- **'South Field'** - planned mining start 2016.

In addition to soil degradation, dominant negative impact of mining operations is related to air pollution, surface and ground water pollution and noise and vibration level increase. Within the open case mine area, air emission of dust is the highest, followed by emission from mining equipment and transport devices containing harmful gases: nitrogen oxides (NO_x), carbon-monoxide (CO), sulphur-dioxide (SO₂) and volatile organic substances. Testing of river Kladnica waters and water coming from the collector of Tamnava- West Field

indicates the increased ammonia concentration as well as iron and nickel². Increased noise and vibration levels are only present within mines and have not impact on the surrounding settlements.

Coal yards represent a potential sporadic air pollution source when coal dust cloud is lifted in windy weather, and occasionally self-combustion is caused creating carbon-monoxide, sulphur-dioxide and soot.

The largest amount of the produced coal (about 90%) is combusted in thermal power plants 'Nikola Tesla' – Obrenovac and 'Kolubara' – Veliki Crljeni, total capacity about 3.100 MW. Simultaneously, some 600 000 t of coal is dried in CE MB Kolubara for industrial needs and consumer spending, with 1 million t of raw coal processed. This coal consumption will be continued in the forthcoming period.

1.2.1.2 Energy

Electricity generation at TPP Kolubara A – Veliki Crljeni is performed in units I to V, total installed capacity 271 MW. This plant uses about 1.8 million tons of lignite annually and about 4000 tons of diesel fuel. After lignite combustion in boilers, one part is separated in the form of ash and slag, while the other part is led through electrostatic precipitators for the purpose of fly ash separation prior to the discharge into the atmosphere. Ash, separated in electrostatic precipitators is transported together with slag by means of hydraulic system to the disposal site 'Kovaceva Bara'.

The Spatial Plan does not cover the rehabilitation of TPP Kolubara A, however, Technical – Economic Analysis³ demonstrated the feasibility of rehabilitation and reconstruction of individual units A1 to A4 of this thermal power plants, with possible operation life extension of individual units until 2014, even later.

Certain amounts of CO₂, CO, SO₂, NO_x, ash and steam are discharged in the course of lignite combustion, together with other less important pollutants. Based on the results of the latest measurements, sulphur-dioxide concentrations in the emitted gas were above emission limit values⁴ prescribed by the law, ranging from 2.100 to 2.690 mg/m³. Nitrogen oxides and carbon-monoxide emission values are mainly lower than maximum permitted values. Measured dust concentrations in treated flue gases are higher than the maximum permitted value of 100 mg/m³ for about 4 to almost 40 times. Waste waters created in thermal power plant systems (saturated with sludge, salt and oil) are not treated and they are lead to the slurry station to be used for ash and slag transport.

OU 'Kolubara – Prerada' (Drying Plant and Heating Plant) represent the most significant air, soil and water pollution sources. Preliminary Analysis of Environmental Problems at Vreoci has been developed proposing possible technological solutions, however, it is uncertain whether existing unsatisfactory state will change within the planning period.

1.2.1.3 Water Management

One part of Kolubara catchment area within the plan area is an area of Serbia with low water amounts, with specific water outflows of about 2,5 l/s·km², more than two times lower than the average value for the Republic of Serbia (about 5,7 l/s · km²). This area contains large water consumers, primarily REIS and its ancillary industries. Open cast lignite mining causes radical changes in ground water regime, therefore stable water supply from underground aquifers may not be enabled on this territory in the far future. Due to ground water lowering, the increasing number of ground water springs will not be usable any more, causing the need to include the villages previously supplied with water from own wells into the regional water supply system.

Some 95% of flats have been connected to the water supply system in larger settlements of Lazarevac Municipality, while 70% of flats in villages are connected to local water supply systems. There are 10 water supply systems within the Plan area supply the local population. The most important systems are the ones at Nepricava and Pestan using ground waters. Considering that they have operated so far above their capacity, they have also caused ground water level lowering. Water supply system of Kalenic was designed for 100 l/s, so

² European Agency for Reconstruction, Electric Power Industry of Serbia – EPS: Environmental Impact Assessment of OCM Tamnava West Field Expansion, 2002.

³ Technical-economic Analysis and Energy Analysis of REhabilitation and/or REconstruction Feasibility of Individual Units of TPP Kolubara A1 to A4, Energoprojekt – ENTEL, Report, M05006, 2006.

⁴ Rules on Emission Limit Values, Measurement and Record-Keeping Manner and Deadlines Official Gazette RS, № 30/97

far executed with about 50% of its full capacity, supplying industrial facilities at Kalenic and surrounding settlements at the territory of Lazarevac, Ub and Lajkovac municipalities. Water treatment plan (WTP) and primary network have been constructed for the capacity of 100 l/s. All 10 existing water supply systems currently cover about 440 l/s, exclusively ground waters, which does not meet the needs. The key problem of all water supply systems is that the majority of them rely on basic, floor aquifers under a considerable impact of operations on the current and/or future mines.

Due to mine protection against river water infiltration, comprehensive works have already been done in terms of regulation and relocation of riverbeds. Works have included the relocation of one part of Kolubara riverbed, as well as the regulation of river Vranicina from the confluence with river Kolubara to the exit from the hydro-technical tunnel from Paljuvi-Vis reservoir, aimed at Tamnava –East Field mine opening. River Pestan is regulated along the section from the confluence until the profile upstream from the railway. River Lukavica is regulated through the town of Lazarevac and by means of field type regulation outside of the town. Regulation of Turija and Beljenica was executed in the area of Veliki Crljeni. River Kladnica is regulated from the confluence with old Kolubara riverbed until the bridge on the road going from Obrenovac to Lajkovac.

Based on the above, the following development conditions and limitations may be identified: (1) considered area may not meet water needs from its own territory, therefore, water should be led from other upstream parts of Kolubara catchment area; (2) development of water regimes and adequate flood protection may not be achieved only through measures undertaken within this area, but through works and management in the upstream part of the catchment area; and (3) water protection also requires undertaking of complex protection measures within the wider catchment area: technological measures – implementation of waste water treatment plant not only within the considered area but along the upstream part of the catchment area, water management measures – improvement of low water regime through corresponding management of Stuborovni reservoir, as well as organisational and other measures within Kolubara catchment area, surpassing the boundaries of the spatial plan area.

1.2.1.4 Agriculture

It is estimated that there are some 41.652 ha of agricultural land within the Plan area, making 76% of the total territory. High spatial differences in terms of agricultural land area in the total area have primarily been conditioned by the development of energy and mining sectors, which will also be continued in future regardless of the selected mining and energy variant. For the purpose of mine expansion by 2010, 432 ha of agricultural land will be reduced.

Apart from smaller areas of acid brown soils and overburden dumps belonging to the 5th class (about 5.600 ha), as well as unproductive areas under active mines and ash disposal sites, included into the 8th class (1.500 ha), the remaining 87% of total area may be used in agricultural production. Soil of the 4th class (22.254 ha) are the most widespread, mainly on the territory of Lajkovac and Ub municipalities. Soils of the 3th class (8.760 ha) are sufficiently fertile, but with numerous limitations in terms of farming crops cultivation and they are mainly present in the area of Obrenovac municipality. The soil of the highest quality, alluvial and clay soil, belonging to the 1st and the 2nd classes (16.800 ha) may be found within the area of settlements, roads and mining – energy complex. According to the use structure, agricultural land may be divided into: arable land – 73%, orchards – 4.3%, vineyards – 0.3%, meadows – 7.6%, pastures – 5.9%, marshes and fisheries – 8.9%.

1.2.1.5 Forestry

The Plan area contains 3100 ha of forests, making 5.7% of the total area. 864 ha are under plantations formed mainly through forest reclamation of overburden dumps and less frequently ash disposal sites (35 ha) between 1973 and 1993. Forests mainly consist of the pure cultures of black and white pine, followed by the mixed species of conifers. Occasionally there are pure cultures of deciduous trees (oak, maple, ash, etc). However, reclamation is not sufficient, primarily due to low level of forests within the area of the Spatial Plan (5.7%) which is far from optimal (27.3%) for administrative area of Belgrade according to the Spatial Plan of the Republic of Serbia.

1.2.1.6 Economy

Dynamic development of mining-industrial complex Kolubara had a strong impact on the total socio-economic development of the Plan area. The city of Lazarevac has grown into the one of the leading industrial centres in the Republic, while other areas, especially at the territory of Ub and Obrenovac municipalities, have retained typical features of underdeveloped rural areas. Nowadays, the public sector has the leading importance in the formation of the gross national product (65.6%) of municipalities covered by the Spatial Plan. Relatively small

average share of tertiary and quaternary sectors in the formation of the gross national product (23.75%) maintains insufficient development level of private entrepreneurship.

With 30.045 workers, in 2005, the Plan area had relatively high employment level (28,1%, or for 0,6% higher than the republic average). In industrial sector, there were 54.2% of workers; therefore, the level of industrial employment was two times higher than the republic average (15.2% and 7.1%, respectively). More than half of industrial workers (58.7%) was employed in the coal production and processing complex. The complex of processing industry comes second with 5.344 workers or 32.8% of industrial workers. Metal processing (mechanical engineering, manufacture of electrical machines and devices) is especially developed in this sector, with 17.0% of the total number of industrial workers. Food processing complex, textile, wood processing industry, manufacture and processing of leather, rubber processing, construction material industry, manufacture and processing of non-metals have the share of about 15%. Thereby, the share of persons independently performing activities and the ones employed at private shops is 9.7% of the total number of workers.

1.2.1.7 Population

Total population in the Plan area has increased between 1948 and 2002 from 54.831 to 81.585 (index 149.3; growth rate 7.3%; annual average 501 inhabitants) with the reduction tendency. In the last period between the censuses, the population reduced for 709 persons (rate – 0.8‰). Basic characteristics of population changes include: (1) intensive population growth in the urban areas (rate 22.3‰), with Lazarevac as the most prominent town, (2) population growth in suburban areas (7.1‰) and (3) decrease of population in rural areas (index 85.1, rate 3.0‰), especially along the periphery of the municipalities; the majority of villages (19 out of 37) are characterised by population decrease, while 10 settlements with the most prominent population decrease are located within the zone of mining operations.

1.2.1.8 Network of Settlements

There are 52 settlements within the Plan area, with the total of 81.585 inhabitants. Average settlement network density in 2002 was 9.5 settlements/100km², while the population density is 150 inhabitants/km². Average values for the middle part of Serbia are as follows: 7.6 settlements/100 km² and 98 inhabitants/km².

According to the population level, the most numerous settlements fall into the category from 500 to 1000 inhabitants, with the share of 40.4%, followed by 500 inhabitants and the share of 30.8% and 1000 and 2000 inhabitants with the share of 13.5% in the total number of settlements. There are 6 settlements in the category of 2000 to 5000 inhabitants or 11.5% (Veliki Crljeni, Vreoci, Stepojevac and Sopic –Municipality of Lazarevac, Lajkovac and Jabucje – Municipality of Lajkovac), and only two settlements (Lazarevac and Ub) with over 5000 inhabitants.

Based on recorded population characteristics, as well as the factual state of development and allocation of basic public and economic activities, the following centre categories have been differentiated:

- a) Primary municipal centres: Lazarevac, Lajkovac and Ub;
- b) Secondary municipal centres: Vreoci and Veliki Crljeni (Municipality of Lazarevac);
- c) Centres of the group of settlements: Jabucje (Municipality of Lajkovac); Radljevo (Municipality of Ub);
and
- d) Junkovac, Stepojevac, Barosevac – Rudovci (Municipality of Lazarevac).

1.2.1.9 Social Development

After several years of the transition period, there is still a strong boundary between the state/public and private sectors, while the private sector neither has strong support nor stimulating environment in the so-called production-entrepreneurship group of activities (industry, forestry, water management, residential-utility activities), as well as in the sector of highly qualified and sophisticated services (finances, education, science, information, culture, health, etc). Private sector is regardless of the quantitative increase still not a large player in many important sectors of social organisation, especially in the sector of exercise of economic, social and cultural rights of citizens. Although there has been certain increase in the number of registered and non-registered private businesses in the past three years, there is not reliable answer to the question about the intensity of structural changes under current business conditions in the settlements at the territory covered by the Spatial Plan.

There is complete lack of services, especially the ones important for social and cultural development of an area and generally for the improvement of the living quality in all settlements. Such services include health,

education, culture, finances, business operations, etc, therefore, activities usually categorised in tertiary and quaternary sectors.

1.2.1.10 Relocation of Settlements

In the previous period, some 1.614 households have been resettled from the open cast mine development zone. Some settlements have been almost entirely resettled (Sakulja, Cvetovac, Kalenic), while in case of other settlements there was only partial resettlement. Majority of households have been relocated individually, primarily into the peripheral zones of municipal centres, suburban areas or by shifting inside their own area (Kalenic, Cvetovac, Barosevac). Minority of households have been relocated in an organised manner to completely developed settlements (part of Barosevac to the Jelav location and one part of Medosevac to Crne Medje location). Shifting of population caused by resettlement from the open cast mine zone also influenced the growth of urban settlements (Lazarevac, Lajkovac) and their suburban zone, as well as the growth of industrial centres (Veliki Crljeni, Vreoci). Employment possibilities in these settlements also influenced the inflow of other population from rural areas. In the past 10 to 15 years, employment possibilities at MB Kolubara have reduced, therefore, migrations have been more oriented towards Belgrade.

1.2.1.11 Traffic

In the Spatial Plan area, railway network is made from one section of Belgrade – Bar railway, with five official points – railway stations: Stepojevac, Vreoci, Lazarevac, Lajkovac and Slovac.

The Spatial Plan area is crossed by two thoroughfares, M-4 and M-22 located at the territories of Lajkovac and Lazarevac Municipalities. State road M-4 stretches at the length of 22.03km and M-22 at the length of 27.3km. Regional road network at the Plan territory consist of the following roads:

- Municipality of Ub territory – P-101, P-101a, P-270;
- Municipality of Lajkovac territory – P-101, P-101a, P-271;
- Municipality of Lazarevac territory – P-201, P-2016, P-203, P-205b; and
- Municipality of Obrenovac territory – P-201.

Local road network is developed on the entire Plan area, especially at the territory of Lazarevac municipality. Average density of categorised road network is 0.60 km/km², which is 10% more than the republic average. Perspective development of the network of centres and settlements and open cast mine opening schedule represent one of the basic limitations to the development of the traffic infrastructure.

1.2.1.12 Telecommunications

Phone exchanges of Lazarevac area possess transmission systems along optical cables, with the exception of exchanges of Junkovac and Mirosaljci, exchanges Radljevo and Brgule at the territory of Ub and Jabucje exchange in the area of Lajkovac. Total number of installed phone terminals within the region in 2000 was 25.944, of which 18.869 have been taken, while others are in the phase of network construction and reconstruction, with optical cables already planned in these cases.

1.2.1.13 Environment Protection

Negative environmental impacts of mining operations are caused by radical change in land use leading to spatial conflicts between open cast mine development and the surrounding area, whose effects include destruction of settlements, agricultural and forest areas, natural resources, water resources and watercourses, infrastructure, etc. Other form of negative impact of mining and energy is caused by processes of strong and permanent air, water and soil pollution, consequently affecting health of the population, plant and animal life. The third form of negative impacts is smaller and occasional exceedences of environmental standards, individually not important, but cumulatively causing significant consequences.

Current environmental state is the consequence of insufficient care about the environment in the previous period compared to: (1) applied technologies, (2) environmental regulations and (3) environmental monitoring. Existing technologies of energy and industrial facilities are outdated and without corresponding environmental devices. Domestic legal regulations fall behind the modern EU regulations, while existing legal regulations were not fully implemented. Environmental management has so far not been satisfactory both on the Republic, PE EPS levels and on the level of local communities.

1.2.1.14 Reclamation of Degraded Areas

In the previous period, mainly during the 80s, some 1.257 ha of overburden dumps have been reclaimed, of which 863.5 ha was forested, including the forest nursery, 366 ha was reclaimed with farming crops while 27 ha is under water. Consequently, close to 25% of total areas affected by mining operations (5.114 ha) by 2005 have been returned their productive state. Despite positive experience with reclamation of dump sites through forestation, previous reclamation results of area degraded by mining and energy activities are pretty modest, not only in quantitative but in qualitative terms. Agricultural reclamation has not caused permanent restoration of the previous economic potential of the soil, which can partly be ascribed to inadequate solutions of ownership-user rights. There are numerous limitations in this field; however the main problem is long-term delay in implementation of not only biological but also technical reclamation of overburden dumps and efficient rehabilitation of ash and slag disposal sites, as well as long-term economic difficulties of PE EPS.

1.2.1.15 Nature Preservation

Current state is characterised by inadequate nature preservation within the Plan area, especially:

- Preservation and maintenance of previously established cultural assets (memorial natural monuments 'Sopicanski Lug' and 'Vrapce Brdo') and settlement of their further legal status and protection model, i.e. adoption of new act on the protection of these assets;
- Lack of protection in other parts of the area, natural structures and phenomena identified to possess the features of natural assets, i.e. distinctive values of the natural complex based on detailed valorisation, as well as development of zoning documents, investment-technical documents, environmental impact analysis of such structures and strategic environmental impact assessment;
- Lack of corresponding public use and presentation of existing and future protected natural assets; preparation and implementation of protection and development programmes and rehabilitation projects.

1.2.1.16 Protection of Cultural Assets

Large number of national architecture monuments has been identified within the Plan area and a project has been developed for their relocation to other areas. Since these monuments affected by open cast mine operation are located at the territory of three municipalities, the problem is where to relocate them and make a folklore village, or something else, which should be the result of integral planning of the future profile and activities of this area. Monument protection division has done its share of the work, however, the municipalities have not agreed on whose territory should this project be implemented, while monuments deteriorate in the mean time.

1.2.2 Scenario 'B': Development of the area in case that the Spatial Plan is implemented⁵

1.2.2.1 Mining

Total operating reserves of the basin at the current moment (December 31, 2006) amount to 2.150.000.000 tons of coal. This includes coal reserves from fields Sopic-Lazarevac, Radljevo and Zvizdar. Coal reserves in the intermediate area of the mines containing industrial facilities, Belgrade – Bar railway and Ibarska Magistrala are 'confined', amounting to several hundred million tons. Geological reserves of Kolubara Mining Basin enable the planned growth of coal production within the planning period from 29.2×10^6 t to 36×10^6 t.

Table 1.1 – Projection of coal mining schedule in Kolubara Mining Basin up to 2020 (in 10^6 t annually)

Year	Field B	Field D	Tamnava East Field	Tamnava West Field	Veliki Crljeni	Field D (extended boundaries)	Field E	South Field	Radljevo	Kolubara
2007	1,0	14,3	5,0	9,0	/	/	/	/	/	29,3
2008	2,2	14,0	5,0	9,0	/	/	/	/	/	30,2
2009	2,5	14,0	2,0	9,0	2,5	/	/	/	/	30,0
2010	2,5	14,3	/	12,0	2,5	/	/	/	/	31,3
2011	2,5	/	/	12,0	3,0	12,50	/	/	/	30,0
2012	2,5	/	/	12,0	3,2	12,0	/	/	/	29,7
2013	3,0	/	/	12,0	5,0	12,5	/	/	/	32,5
2014	3,0	/	/	12,0	5,0	12,0	/	/	3,0	35,0
2015	0,7	/	/	12,0	5,0	12,0	3,0	/	3,3	36,0
2016	/	/	/	12,0	4,8	4,0	5,2	4,0	6,0	36,0
2017	/	/	/	12,0	/	/	11,0	6,0	7,0	36,0
2018	/	/	/	11,0	/	/	12,0	6,0	7,0	36,0
2019	/	/	/	11,0	/	/	12,0	6,0	7,0	36,0
2020	/	/	/	11,0	/	/	12,0	6,0	7,0	36,0
	19,9	56,6	12,0	156,0	31,0	65,0	55,2	28,0	40,3	464,0

Planned mining schedule of open cast mines in the period up to 2020:

- **Field 'D'** is a mine with the longest operational life. Coal mining will be finalised by 2015, overburden excavators are successively freed from 2007 and after revitalisation and modernisation transferred to Field E. Resettlement of Vreoci (2008 – 2011) creates conditions for possible mining continuation on Field D by 2016.
- **Fields 'B' and 'C'** – Field B was expanded in one part of geological boundaries of Field C. In the period until 2007 it is included into modern technologies. Mining until 2015. Area of OCM Field B is used as outside dump of Field E until the formation of the inside dump.

⁵Land use in the Plan area is shown on Map № 2.

- **'Tamnava West Field'** is the only mine remaining in operation until 2020 with the capacity of 9×10^6 t of coal (by 2010) and increase up to 12×10^6 t of coal (2011-2017) and reduction to 11×10^6 t of coal starting from 2018.
- **Field 'Veliki Crljeni'** possesses coal reserves of 31×10^6 t. In order to mine out the indicated coal amounts, river Kolubara first needs to be relocated. Overburden is dumped into the inside dump of OCM Tamnava West Field. Mining period 2009 – 2016.
- **'Tamnava South Field'** – Coal amounts to be mined out amount to more than 350×10^6 t. Unfavourable dipping of the coal seam, high inclination depth, high ground water content, vicinity of Belgrade – Bar railway represent significant restrictions for the mining of this deposit. Overburden removal starts 2012.
- **Field 'E'** - Overburden removal starts in 2010. River Pestan needs to be relocated after 2012 in order to mine the coal after 2015. In addition to river Pestan, road Barosevac – Arandjelovac needs to be relocated.
- **Field 'Radljevo'** – Coal mining will start in 2014 for the needs of TPP Kolubara B. Mine opening requires the resettlement of certain parts of Radljevo, Kalenic, Sarbane and Brgule settlements, relocation of the road Kalenic – Radljevo and relocation of river Kladnica with its tributaries. Inside dump of Tamnava – West Field will be used for overburden dumping in the course of mine opening.

1.2.2.2 Energy

Construction of TPP Kolubara B represents one of the priority tasks of PE 'Electric Power Industry of Serbia'. So far there have been many deadlines for its finalisation, however they were never observed. According to the Midterm Plan 2002 – 2006 developed in January 2002, the first unit, gross capacity 350 MW was anticipated for commissioning in the beginning of 2006, the second unit of the same capacity in the end of 2006, but this was not observed. Over 40 months are needed from the moment of turbine plant contract consolidation to the commercial operation of the first unit, while works on the second unit would be finalised 9 to 12 months later.

According to the current state, having in mind coal production possibilities and time necessary for redesigning and construction, it is anticipated that **the first TPP Kolubara B unit will be commissioned during 2013 and the second on 2014**. By 2020, some 405×10^6 t of coal will be used within Kolubara Mining Basin for electricity and heat generation needs (under average TPP engagement of about 5.700 hrs), while together with the consumer spending and amounts used for lignite drying, the total of about 450×10^6 t of lignite (Figure 1.1).

In the period until 2020, new drying plant will not be constructed, only the capacity of the existing heating and drying plants will be increased to one million tons of dry lignite, with possible construction of the briquetting plant.

TPP Kolubara B spatial development concept

Planning of TPP Kolubara B complex construction continuation and construction of the regional municipal waste dump was executed under the Spatial Plan of Kolubara Mining Basin and General Regulation Plan of the TPP complex itself. Location selected in the valley of river Kolubara, directly next to OCM Tamnava West Field at the territory of UB municipality, practically in the area between Ub, Lazarevac and Obrenovac municipalities, enables the continuous spatial development of TPP Kolubara B in the area of about 103 ha, with 36 ha in Phase I of construction.

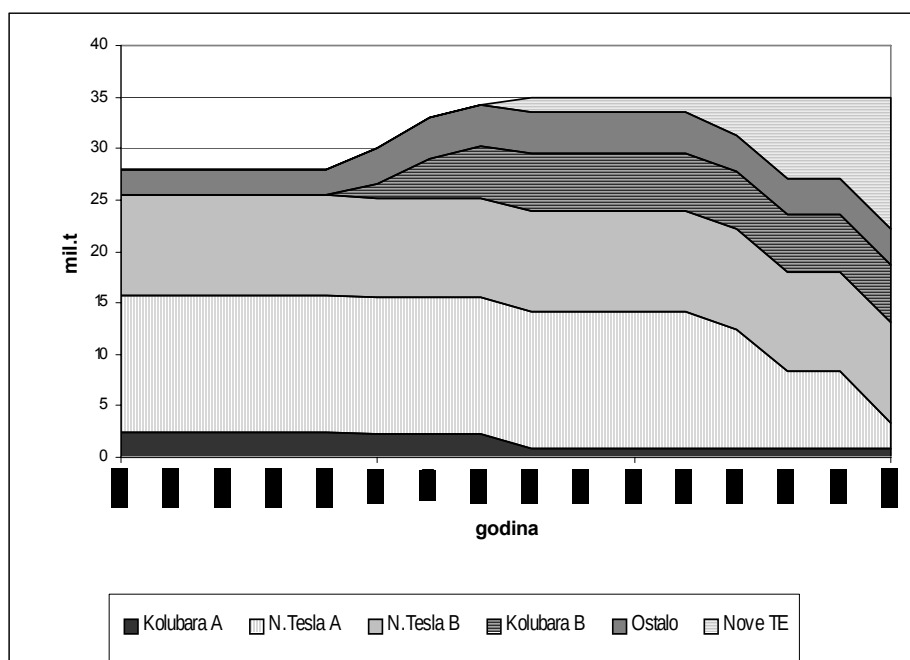


Figure 1.1 Production and structure of coal consumption in Kolubara Mining Basin until 2020 (in 10^6 t)

Organisation and development of TPP Kolubara B area are based on:

- Technical-technologic requirements of the basic function – energy generation,
- Conditions stemming from the existing construction level of the area, legal provisions, solutions and principles of development strategies, higher level plans, study and technical documents and other analytic-planning documents,
- Accompanying technical, infrastructural and other features, and
- Stimulation and protective measures directing future development and providing necessary environmental standards.

Plan concept is based on the functional and technical-technological principle with observation of zones and regimes essential for environment protection, also containing the division of the Plan area into areas and subareas.

Table 1.2 – Areas in the general regulation plan of the complex

Area	Area name with subareas	Area in ha
1	TPP complex with the pressurised pipeline route for raw water transport from the pumping station to the TPP	143,44
Subarea I	TPP complex	103,44
Subarea II	Internal railway with a green zone	4,3
Subarea III	Coal sale and loading with the parking lot for freight vehicles	7,74
Subarea IV	Marshalling yard 'Tamnava'	22,73
Subarea V	Raw water pipeline route	5,25
2	Ash, slag and gypsum disposal site	208,10
3	Infrastructure connection route	14,52
4	Regional solid municipal waste landfill	32,43
4.	Protective zone of the regional landfill	36,09

Anticipated gross construction areas for the construction of main civil structures of Phase I amount to about 28 000 m², some 21 500 m² for the construction of ancillary technical facilities and about 13 100 m² for secondary facilities.

Table 1.3 – Gross developed construction area of Phase I facilities

1. Main operation structures	27600 m²	3. Structures of secondary activities	13100 m²
1.1. Turbine hall and bunker structure	8000 m ²		
1.2. Boiler room structure	8500 m ²		

1.3. Lift tower structure - two	160 m ²	3.1. Maintenance unit	4100 m ²
1.4. Slurry station and electrostatic precipitator	8800 m ²		
1.5. Stack	500 m ²		
1.6. Flue gas treatment structure	1800		
2. Ancillary technical structures	21000 m²		
2.1. Cooling water pumping station	1000 m ²	3.2. Closed storage	5000 m ²
2.2. Cooling towers	10000 m ²		
2.3. Chemical preparation of water	7000 m ²		
2.4. Auxiliary boiler room	850 m ²	3.3. Open storage	4000 m ²
2.5. Liquid fuel facility	350 m ²		
2.6. Oil and lubricants storage	500 m ²		
2.7. Technical gases facility	1050 m ²		
2.8. Oily water treatment plant	250 m ²	Total Phase I Kolubara B	
		61860 m²	

Basic technical-technological characteristics of TPP Kolubara B complex important for environment protection

Main technological system comprises of the boiler and turbine plants. Boilers of tower type are fired with coal powder. Coal consumption under normal unit load is 988 t/h of guaranteed fuel and 1238 t/h with the combustion of lower quality fuel. Coal is transported from the coal yards by means of two belt conveyer lines.

Flue gases at the boiler outlet have the temperature of 146°C. Emission of harmful substances in flue gases is: 82,8 t/h of dust, 7 t/h sulphur-dioxide and 0,7 t/h nitrogen oxides, producing concentrations of the indicated pollutants of 24,9-96,2 g/m³, 2,53-4,1 g/m³ и 0,5-0,6 g/m³, respectively. Concentrations of pollutants in flue gases are critical for environment protection, considering that they considerably exceed the prescribed emission limit values⁶. For the purpose of ash separation, flue gases are led to the electrostatic precipitator with the ash handling efficiency of 99.91% under the flow of 774 m³/s. Output gases are then directed towards the flue gas desulphurisation plan (FGD) with the efficiency of 84% and finally discharged into the atmosphere through the stack 250 m high and the opening of 7.5 m. Selected wet FGD procedure (LB procedure) us based on limestone procedure in the absorber, where SO₂, HCl and HF are diluted in water, followed by neutralisation of created acids by calcium carbonate, oxidation of sulphite into sulphate, while the produced gypsum become crystallised (gypsum production 86 900 t/a; limestone consumption 55 000 t/a). FGD system additionally reduced dust concentration for 50%. After introduction of the above-indicated flue gas treatment plants, air emission of individual pollutants will be below the prescribed emission limit values, i.e. lower than: 50 mg/m³ for ash, 650 mg/m³ for SO₂ и 450 mg/m³ for NO_x.

Gas dispersion and sedimentation of fly ash in the area is shown on Figures 1.2, 1.3, 1.4 and 1.5.

Turbine plant consists of two turbines with ancillary systems are located in the turbine hall. Turbines are of heat extraction type with heat regeneration. Basic cooling system is made of the cooling tower of recirculation type with the ancillary equipment. One tower 112 m high and the base diameter of 70 m is anticipated for each of the units. Cooling tower is anticipated for cooling of 30.800 m³/h of hot water from the temperature of 40.7 °C to 28 °C. Total emission of cooling towers is about 860 MW of heat and steam created after evaporation of about 1100 t/h of water. Water lost in the cooling system is fed from the water decarbonisation plant. Water coming from the water desalting plant from the cooling system is used as additional water for hydraulic transport of ash and slag. Cooling water surplus of about 500t/m is conditioned and subsequently discharged into river Kladnica. Technical cooling water system is intended for equipment cooling in main facilities: turbine and generator, mills, post-combustion rack, pumps and other equipment. Technological water is supplied from river Kolubara with the usage of the existing waterintake of TPP Kolubara A and construction of an additional water pump system. During the low water period, water amount in River Kolubara is maintained with the support of upstream reservoirs Paljuvi Vis and Rovni. Hydraulic systems of TPP Kolubara B complex include sanitary water supply from existing water supply network of REIS Kolubara.

Waste waters from the TPP complex include the following waters: reactor de-slagging 40 m³/h, sand filter washing 50 m³/h, neutralisation 50 m³/h, 'Ljungstorm' washing 20 m³/h, oily waters 30 m³/h, demi waters 60 m³/h, cooling system desalting waters 500-600 m³/h. About 50m³/h of sanitary waters should be added to the above amount, treated aerobically and chlorinated on the Putox type plan, as well as up to 1000 m³/h of precipitation. 210 m³/h of the above water amount will be used for hydraulic transport of ash and slag, while other waters (treated sanitary waters, desalting waters and rainwater) will be discharged to rive Kladnica.

⁶ Rules on Emission Limit Values, Measurement Methods and Deadlines for Data Collection and Record-Keeping, Official Gazette RS, № 30/97

Waste water treatment is anticipated to enable their further safe application in the closed cycle of thermal power plants – ash disposal sites, i.e. discharge of certain amounts into river Kladnica.

Ash and slag are created as by-products of coal combustion: about 182t/h when guaranteed fuel is combusted and 337t/h when lower quality fuel is used. Anticipated annual ash and slag production from two units is about 1.100.000t. Ash and slag disposal is based on the new system concept, by preparing solid waste substances (ash, slag and gypsum) in the form of thick slurry (solids/water ratio $\approx 1:1$), with addition of lime serving to accelerate the solidification process when the slurry is discharged to the disposal site. This reduces the possibility of surface and ground water pollution. Three plastic pipelines will be installed for slurry transport from the power plant to the mine boundary, with the diameter of 200-250mm, led from the mine boundary towards the disposal cassettes located in the inside dump of OCM Tamnava West Field. *Simplified Mining Design for the Provision of the Area for Solid Waste Substances Disposal in the Inside Dump of OCM Tamnava West Field* (Faculty of Mining and Geology, Belgrade, March 2002) was adopted as the basis for development of necessary technical documents covering the issue of solid waste substances disposal from TPP Kolubara B. This design defines the disposal area:

- For gypsum disposal, the first cassette with the available area of 1 706 250 m³ was reserved, covering the area of 115 200 m²; and
- For ash and slag disposal, 5 (five) cassettes were anticipated with the following dimensions: 650m wide, 800m long and average depth of about 20m. Area of one cassette is 52ha, while the live storage amounts to about 10.000.000 m³.

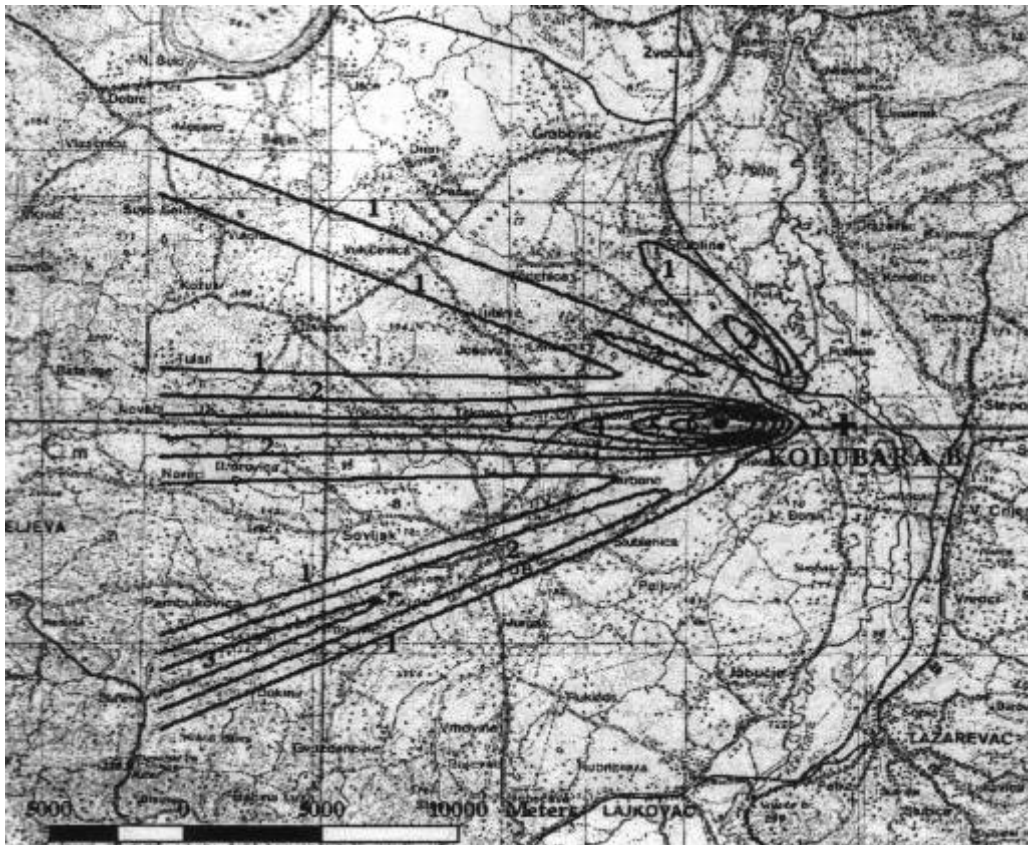


Figure 1.2 – Distribution of mean daily SO₂ concentration around the TPP for mean day in mg/m³

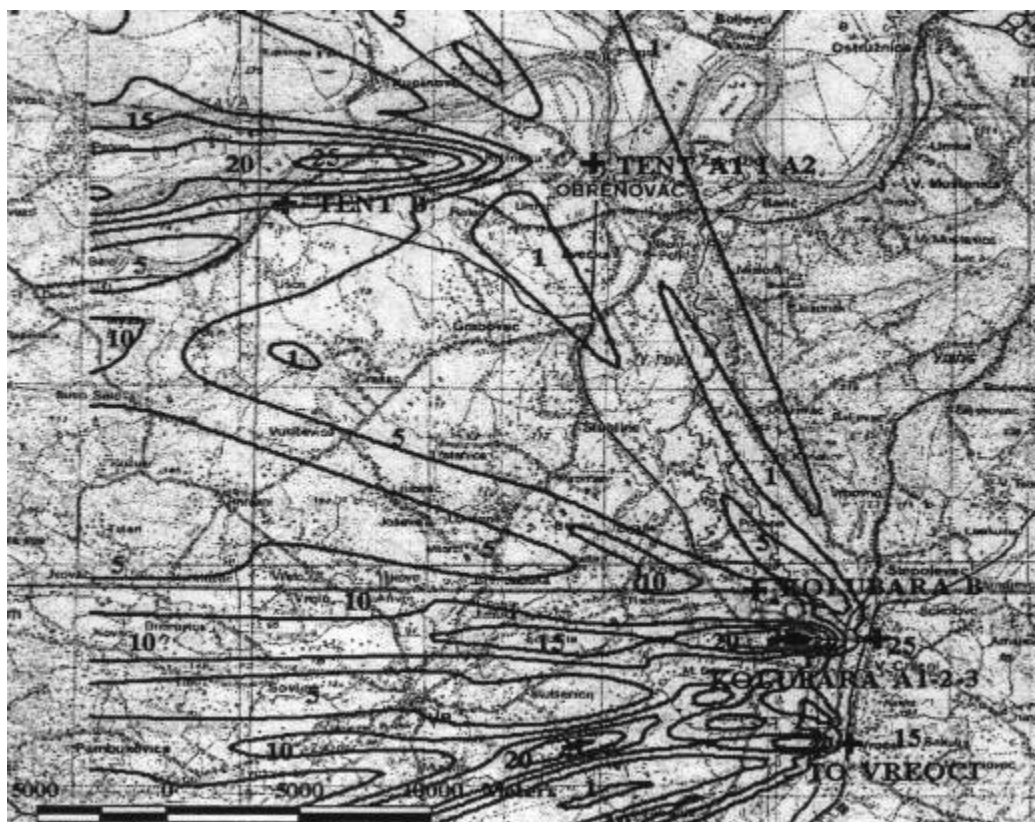


Figure 1.3 – Distribution of mean daily SO_2 concentration in Kolubara Mining Basin after commissioning of TPD Kolubara B for mean day in mg/m^3

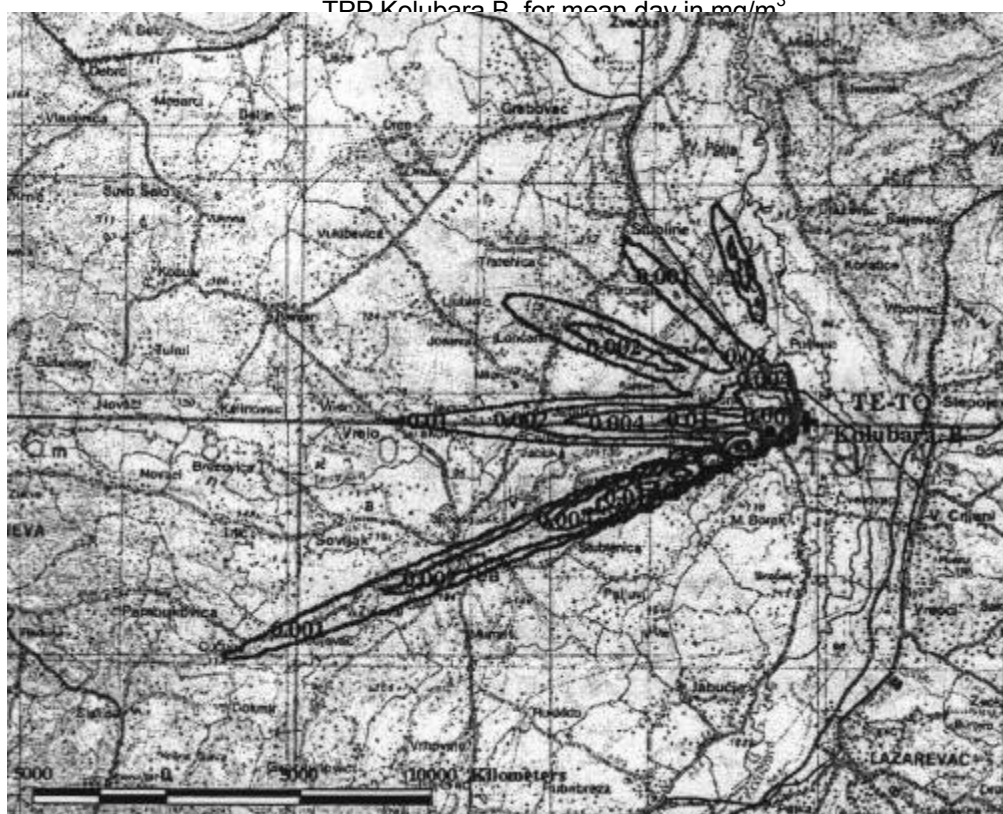


Figure 1.4 – Distribution of mean daily deposition of fly ash particles under normal ESP operation in $\text{g}/\text{m}^2/\text{day}$ (for mean day)

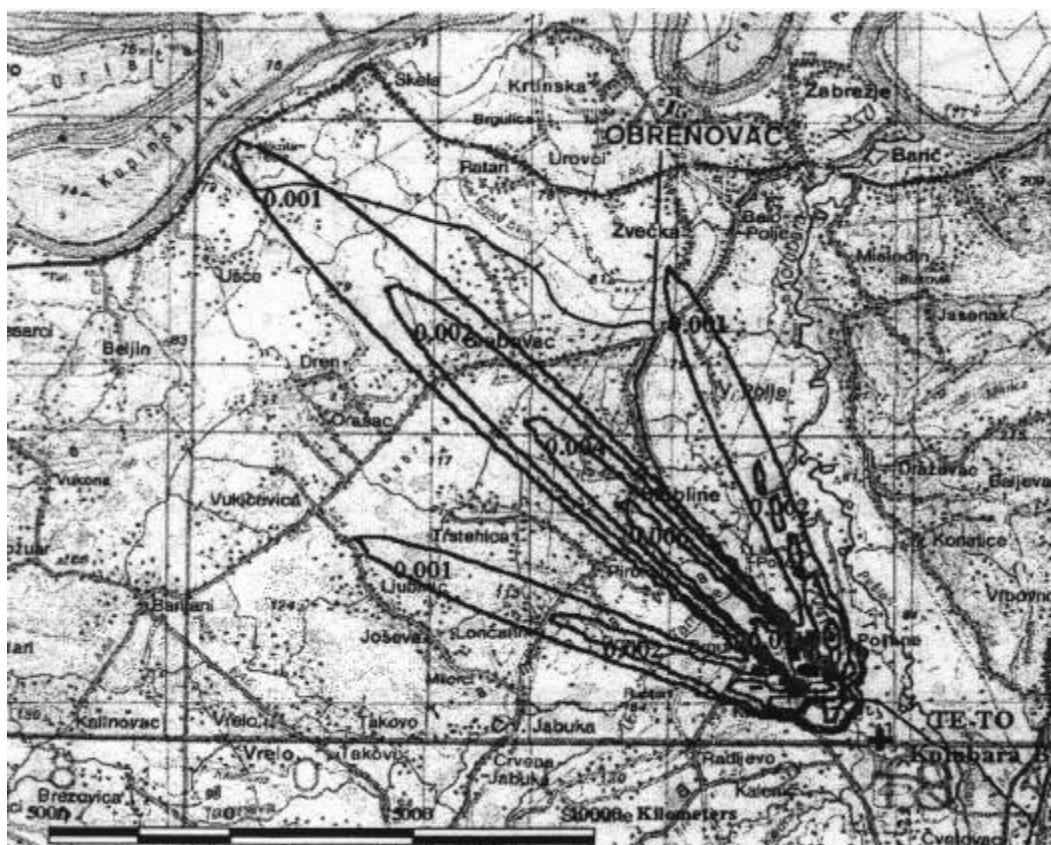


Figure 1.5 – Distribution of mean daily deposition of fly ash particles under normal ESP operation in g/m²/day (for a day with Kosava wind)

Ash contains SO_4 ions, heavy metals (As, Cd, Cr) and radio-nuclides. Since there is a water supply spring (Kalenic aquifer) in the vicinity of the disposal site, the disposal site bottom should be impermeable. For this purpose, gypsum and ash and slag disposal site slopes and bottom will be lined with a layer of consolidated clay 0.7m thick, with HDPE foil laid over it, 2mm thick. Foil joints have to overlap at the width of minimum 0.2m, i.e. welded. Gravel in the layer of 0.2 m should be placed over the foil for the purpose of stabilisation, which will also have a drainage role for the collection of free water. After every cassette is filled, its temporary reclamation should be performed by grassing over the buffer layer, which should have lower permeability than the deposited consolidated disposed material, for the purpose of preventing precipitation infiltration into the disposal site body.

Table 1.4 – Summary of main types of emissions and anticipated treatment technologies

	Emission	Type	Treatment system	Norm
1	Flue gases	Ash particles	ESPs	+
		Sulphur-dioxide	FGD	+
		Nitrogen oxides	NO_x reduction in boilers	+
		Carbon-monoxide	No treatment	No norm
2	Waste waters	Reactor de-slagging	Thin slurry transport	+
		Sand filter washing	Returned to the reactors	
		Oily waters	Double treatment	+
		Cooling tower waters	H_2SO_4 treatment + poly-phosphates	+
		Sanitary waters	'Putox' type plant	+
		Precipitation	No treatment	+
3	Solid waste	Ash and slag	Hydro-insulation, disposal site drainage, reclamation	+
		Municipal waste		+
4	Waste heat	Hot water	Cooling in the cooling tower	No norm
		Hot air and steam	No treatment	No norm

One part of main operating facilities and auxiliary facilities represents a noise source. Estimated design noise levels of the most important noise sources, indicated in dB(A), include the following: turbine hall (85-105), boiler plant (80-100), stack (95-100), towers (72-85), excavators (76) and pumping stations (72). Based on literature data, FGD plant creates the noise at the level of 110 dB(A).

Switchyard SF_6 RP400/220kV is located within TPP Kolubara B complex. Both switchyards 400 and 220 kV are located next to each other within one structure, while lines are allocated to enable free communication in the area in front of the structure.

Regional municipal waste landfill

This area is located in the middle part of TPP Kolubara B complex, between the inside dump of OCM Tamnava – East Field and the dump site of OCM Tamnava – West Field⁷. The complex covers the area of 65.44ha together with the accompanying traffic route and the protective zone. Different types of solid non-hazardous waste may be dumped at the landfill⁸.

⁷ Study on the Selection of Microlocation for the Regional Municipal Solid Waste Landfill with the Recycling Centre for Kolubara Region, IAUS, 2006.

⁸ Rules on the Criteria for Site Identification and Development of Waste Landfills (Official Gazette RS, № 54/92)

Municipal waste landfill is a fenced off area containing the following:

- Disposal area with traffic, operating and green surfaces;
- Area for the construction of the recycling centre with waste material separation, mechanical-biological waste treatment and composting,
- Area for the construction of ancillary structures (servicing plateau with storage facilities, workshop, administration building, guard house and laboratory for basic control analyses).

Necessary landfill volume for municipal waste disposal of about 2 million m³ for the period of 20 years will be provided through the formation of a closed disposal area and construction of the peripheral dyke at the level of 89.00 – 79.00 mASL, with average height of 15m. Water tightness of the landfill will be provided by lining of its slopes and bottom with a layer of consolidated clay ($\kappa < 1 \times 10^{-7}$ cm/sec), over which 2mm thick HDPE foil will be placed. Drained water – filtrate will gravitationally be led to the lagoon. Lagoon was anticipated for one-month separation – sedimentation of sludge, with the total depth of 2.5m. Open trapeze channel lined with concrete lining was anticipated for rainwater from the dyke crest, external dyke slopes, peripheral fire road and protective zone.

Safety landfill fence will be posted along the external periphery of the operating area, 3m high. Directly along the fence, from the outside, protective zone will be planted with trees, 30m wide, as an air pollution protection measure (methane separation, dust and unpleasant odour dispersion prevention).

Area for the construction of the Recycling Centre will have a special fence separating it from the rest of the Regional Landfill complex. This area is intended for the construction of facilities, plants and other structures necessary for waste acceptance and processing, storage and sale of secondary raw materials. Recycling plant consist of: separation hall with variable number of lines, area housing the primary selected waste and area for bundled waste and administrative building. Useful raw material is transported to the press where it is ground and compacted, and subsequently bundled and bound. Garbage from which all useful raw materials have been separated in the sorting unit and which may no longer be used is transported to the landfill, disposed and finally covered with inert materials.

1.2.2.3 Water Management

Two systems are developed in the catchment area of Kolubara, i.e. REIS zone: (1) **Regional Kolubara system for water supply of highest quality**, for the supply of settlements and industries using potable water; and (2) **Kolubara river system** providing water for technological needs and irrigation, as well as water protection. These two systems have certain facilities in common (flow regulation reservoirs) and mutual interactions. The key facility of both indicated systems is a multipurpose reservoir Stuborovni on river Jablanica, enabling multiannual flow regulation. The so-called average levelled flow of 1.140 l/s is provided from it, used for the regional water supply system, as well as for the needs of REIS Kolubara, at the level of 97%, while the prescribed guaranteed ecological flow of 130 l/s which has to be discharged from the reservoir has absolute priority. This flow is fully provided. Kolubara regional supply system providing water of the highest quality will only provide the missing water amounts, after usage of local springs which may be used only up to level not affecting ecological conditions of the surrounding area. This means that all local ground and surface water springs not affected by REIS development will be protected against pollution and degradation, revitalised and treated as an inseparable part of Kolubara regional system. Springs and their capacities are listed in the following text: Pestan (up to 200 l/s), Kalenic (100 l/s), Nepricava (min. 130 l/s), Veliki Crljeni (40 l/s) and Vreoci (50 l/s). Due to open cast mine development and their dewatering, ground water regime is radically affected in some of the surrounding settlements which have been supplied from their own wells and local water mains. These settlements have the first priority in implementation of water supply systems, which have to be constructed in the manner enabling their further connection to the regional system. Kolubara river system for the provision of technological water for other users and water protection uses the reservoir Paljuvi Vis on river Kladnica which will be reconstructed, in addition to the reservoir Stuborovni on river Jablanica. Water management infrastructure plan is shown on Map № 3.

For the purpose of water quality protection, construction of waste water treatment plant is anticipated in all settlements with the population higher than 5 000 EI (equivalent inhabitants). Integral water protection is also anticipated, implying technological, water management and organisational – economic protection measures. In addition to technological measures (construction and provision of the regular functioning of waste water treatment plant), the key water management measure is flow increase during the low water period by using reservoirs, primarily Stuborovni reservoir. Moreover, protective zones will be introduced in order to protect surface and ground water springs.

Regulation of river Kolubara and Kladnica as well as other Kolubara tributaries within REIS zone will be done in phases, for the purpose of freeing the area for further development of open cast mines and accompanying

facilities of REIS. Hydraulic elements of new riverbeds were adapted to the protection level of settlements and REIS facilities against floods in such zones.

1.2.2.4 Agriculture

Similarly as in the previous period, further development of mining and energy will primarily unfold at the expense of agricultural land degradation, whose share in the planned occupation of the new area between 2005 and 2020 is about 82% (2068ha, including 93ha of reclaimed areas). Negative effects of these quantitative losses in agricultural land areas are additionally amplified by indirect adverse impacts of areas affected by mining operations (open cast mines, dump sites and ash disposal sites) from 3.858ha in 2005 to 4636ha in 2020.

Reduction of total agricultural areas from 41.652ha in 2005 to 38.658ha in 2020, i.e. 2967ha is anticipated in the entire Plan area (1291ha at the territory of Lazarevac municipality, 598ha at the territory of Lajkovac, 80ha in Obrenovac area and 998ha in Ub area).

In order to compensate negative environmental effects of comprehensive open cast lignite mining, biological reclamation (forest and agriculture reclamation) is anticipated within the planning period, together with nature revitalisation. In this planning period, priority is given to forest reclamation as opposed to the agricultural reclamation. This solution is supported by limitations of economic and technical – technological nature, especially due to the lack of selective overburden dumping in the previous lignite mining period. Considering that this Plan anticipated a modern selective mining and disposal of top soil in accordance with the legal regulations, favourable conditions will be created for reclamation and revitalisation of agricultural land in the period after 2020.

Map № 4 shows mine impact on the change of agricultural areas.

With the aim of preservation and protection of agricultural land and other resources within the Plan area, special importance is given to the observation of specific development problems, limitation and potentials of the following areas:

- In rural areas directly under affected by previous and planned lignite deposit mining (settlements of Barosevac, Vreoci, Zeoke, Junkovac, Mali Crljeni, Medosevac, Prkosava, Sakulje and Cvetovac in the municipality of Lazarevac, followed by Mali Borak and Skobalj in Lajkovac municipality and Kalenic, Brgule, Sarban and Radljevo in Ub municipality) conditions for full and cost-effective farming of the remaining agricultural area should be provided. Total area of this district is about 16.5 thousand ha (30% of the total Spatial plan territory). Planned occupation of about 2062ha of agricultural land will between 2005 and 2020 cause the reduction of the share of agricultural areas in the total area, from about 59% to 45%. Simultaneously with the implementation of reclamation programmes by means of forestation leading to the gradual return as well as increase of the previous bio-capacity of the area in the long term, it is necessary to provide support to the increase of economic efficiency of agricultural production.
- Urban, suburban and other mostly non-agricultural areas (Veliki Crljeni, Burovo, Lazarevac, Sopic, Rudovci, Strmovno and Stepojevac in Lazarevac municipality, followed by Lajkovac, Rubribreza and Celije in Lajkovac municipality, as well as Ub and Trnjaci in Ub municipality). Total surface of this area whose agricultural resources have been exposed to the strong negative impact of various external factors (industrial-energy facilities, ash disposal sites, unplanned housing development, municipal waste, etc), amounts to about 11159ha, making about 20% of the total Spatial Plan territory. More significant reduction of absolute and relative share of agricultural areas for only 181ha is not anticipated until 2020. Share of agricultural areas in the total area will remain relatively high (about 78%).
- Areas of settlements suitable for complementary development of organic/ecological food production, village tourism and other recreational, educational and cultural activities (Leskovac, Sokolovo, Arapovac, Mirosaljci, Bistrica, Dren, Lukavica, Stubica, Susnjar and Petka in Lazarevac municipality, followed by Jabucje and Nepricava in Lajkovac municipality, as well as Pljuvi, Ruklada and Murgas in Ub municipality). Total surface of this area is 18399ha (33.6% of the total Spatial Plan area), while agricultural land accounts for 83%.
- Areas of dominantly agricultural settlements (Vrbovno in Lazarevac municipality, followed by Stublenica, Milorci, Loncanik and Liso Polje in Ub municipality, as well as Brovic, Piroman, Poljane and Konatice in Obrenovac municipality). Total surface of this, economically underdeveloped area is 8581 ha (about 16% of the total Spatial Plan area), while the share of agricultural land is 87.8%.

1.2.2.5 Forestry

Increase of areas under forests is planned in the period between 2005 and 2020 for 1.897ha, mostly through dump site reclamation by means of forestation (1527ha), and to a smaller extent by means of direct occupation of agricultural land, mainly of the 5th class. Change of forested areas in the period between 2005 and 2020 is shown on Map № 5. Simultaneously, open cast mines will spread onto the forests previously planted on deposol. After the implementation of the forestation plan, forested areas will be increased on the entire Plan area from the current 3.100ha to 4.804ha.

Considering that the applied technology of internal overburden dumping conditions delays in reclamation, compared to the open cast mine development schedule, conditions have to be provided within the planning period both for implementation of concrete programmes for quality forest planting on deposol and the development of corresponding long-term programmes, with observation of the need to implement combined agricultural-forest reclamation after 2020.

Reclamation and revitalisation plan of degraded/damaged soils (deposol) by means of forestation will be carried out based on long-term and midterm programmes and corresponding technical documents, which has to be stated immediately, with special observation of the following:

- Possibility for dendroflora range expansion, with dominant share of indigenous species of deciduous trees in the forest structure;
- Protection of such species of trees, shrubs and shrub-like plants spontaneously occurring in forest cultures and on other deposol areas of different category and use;
- Increase of imission (15ha) and other protective forests (15ha) outside open cast mine zones, in order to reduce negative emission effects of constructed and planned energy-industrial facilities; special attention should be paid during the planting of these forests to the improvement of landscape characteristics of the area;
- Slope sensitivity to erosion, on inclinations higher than 6% the slope needs to be protected while it the soil is still loose by sowing grass and leguminous plant mixtures, followed by shrub and tree planting whose leaves decay quickly, with inclusion of other species of deciduous trees, as well as conifers up to 20%;
- Forestation of soils unsuitable for profitable agricultural production, mainly soils belonging to the 7th and 8th cadastre class such as fields, orchards, vineyards, meadows and pastures, at the total area of 295ha, as well as 19ha of areas affected by strong erosion;
- Planting of protective forest zones along the route of the future motorway Belgrade – South Adriatic area, at the total area of about 45ha.

Summarily, forestation level will increase within the planning area from 5.7% to 8.8%. In addition, application of more intensive care measures will also reflect on the mitigation of unfavourable characteristics of the previous state of forests. As a result of this, the largest number of positive effects should be expected in the improvement of general environmental conditions.

1.2.2.6 Economy

In addition to the further development of mining-energy sector, basic long-term priority of the strategic development of local economy is diversification of economic structure for the purpose of overcoming REIS domination and existing underdevelopment of SME sector within the major part of the planning area.

Table 1.5 – Planned larger economic-industrial zone (without mining areas)

Area	Zones	Area (in ha)	Location policies
Lazarevac municipality	Vreoci	271,95	Development of existing capacities with further specialisation of production programme
	Veliki Crljeni	263,85	Active environment protection
	Lazarevac –economic-industrial zone, primarily production-business use*	100,0	SME development; possible formation of business incubators, technologic or industrial park with business activities Additional infrastructure development of the area Implementation of environment protection measures
Lajkovac municipality	Industrial zone**	104,4	SME development; Planned construction of missing infrastructure (industrial railway, unloading-loading terminal, connection to the main water supply system, main collector, roads)
Ub municipality	TPP Kolubara B	105,5	TPP complex completion
	Kalenic 'Tamnava West Field'	116,5	Storage, transport and other facilities
	Economic-industrial zones in the town of Ub	119	SME development Infrastructural development of missing installation
SP total	TOTAL	1.081,2	Location of production capacities and SMEs

*General Zoning Plan, Lazarevac. 2005.

**Detailed Regulation Plan of Industrial Zone Lajkovac and General Zoning Plan Lajkovac. 2005.

***General Zoning Plan of Ub and [Програм ППО УБ, 2005.](#)

Leading role in the spatial structure of the planning area industry will still be held by the existing economic-industrial centres and zones of mining-energy-industrial complex and economic-industrial and industrial zones in urban centres. Basic forms of future economy/industry allocation until 2020 include:

- Usage of locations within existing economic-industrial zones (Vreoci, Veliki Crljeni, Ub, Lajkovac);
- Activation of new locations and spatial models for the development industry, SMEs and other economic activities (technological parks, business incubators) within previously planned economic-industrial zones (Lajkovac, Lazarevac, Ub); and
- Dispersion of production and service capacities of SMEs within small entrepreneurship locations or individual locations in urban settlements and rural areas – Stepojevac, Dren, Celiје, Sarbane, Jabucje, Nepricava, Stublenica, Brajkovac, etc.

1.2.2.7 Population

In terms of migrations, it is anticipated that movements between villages and cities will be slower, having in mind the increasingly low level of demographic potential of villages, on one hand, and lower attractiveness of cities on the other hand. However, very intensive resettlements will still be conditioned by planned expansion of open cast mines. Projection results of population level changes according to settlements between 2002 and 2020, based on demographic (internal) and development (external) factors indicate the following:

- Negligible reduction of the population level within the planning area from 81 858 to 80 770;
- Continuation of already initiated de-population tendencies in village areas, where the population level will be reduced from 32 611 to 24 380 (rate - 16,0‰); in villages of Obrenovac and Ub municipalities, population level will be reduced under the rate of 4,4‰ and -13,9‰ (from 6 651 to 2 430 and from 6 650 to 5 170, respectively), in villages of Lazarevac municipality (due to large resettlements) under the rate of 18,2‰ (from 18.146 to 13.030) and Lajkovac municipality -12, 1‰ (from 4 659 to 3 750);

- Population growth in suburban settlements under the rate of 16,4‰ (from 9 868 to 13 300) and considerably lower in urban settlements under the rate of 5,0‰ (from 39 379 to 43 090);
- In terms of age structures of population, increase of the share of population with the age over 60 years and between 40 and 59 years will increase as the consequence of previous demographic tendencies, while the share of younger population will decrease; and
- Changes in the household structure will retain a downwards trend in terms of the number of members, including the increase of one-member households (especially in villages). Within the planning period until 2020, average household size will be between 2.8 and 2.9 members, while the total number of households will range from 27 900 to 28 900.

1.2.2.8 Network of Settlements

Development of mining-energy complex until 2020 will not have a significant impact to the change of existing functional organisation of the network of centres. Existing development and other centres will still be functioning, while basic changes in the network of settlements are related to the restricted scope of population resettlement. In the period up to 2020, mining-energy complex will cover the areas of 13 cadastre municipalities: Kalenic, Radljevo, Brgule and Sarbane (Ub municipality), Mali Borak, Skobalj (Lajkovac municipality), Vreoci, Sopic, Zeoke, Medosevac, Cvetovac, Veliki Crljeni and Barosevac (Lazarevac municipality).

According to the existing population level, perspective expansion of the mining-energy complex will condition the resettlement of about 1 900 households with about 5 670 inhabitants. The major part of the households intended for resettlements up to 2020 is located in the area of cadastre municipalities: Vreoci (1 030), Zeoke (276), Mali Borak (115), Medosevac (122), Radljevo (84), Sarbane (83). Compared to the total population level and scope of settlement relocation, in addition to Sakulje and Cvetovac already resettled, Vreoci, Zeoke and Mali Borak are settlements which will most probably be completely resettled between 2005 and 2010. Kalenic (Ub municipality) and Barosevac (Lazarevac municipality) may preserve a corresponding level of functional unity within the remaining part of the settlement in the course of resettlement procedure.

Lazarevac will still be dominant in the network of settlements. Generally speaking, municipal infrastructure should be improved within the Lazarevac zone (as well as in the area of Veliki Crljeni and Vreoci, in the central settlements of Lajkovac, Obrenovac and Ub municipalities). This is primarily related to the water supply and waste water channelling, as well as to local and regional roads. Economic matrix of Lazarevac should be diversified more significantly. In Lazarevac, as well as in Lajkovac and Ub, structural adaptations in economic and non-economic activities should be implemented to enable increasing employment of the female labour. This is also stimulated by the support policy of the service and SME sectors. Lajkovac and Ub will retain the function of municipal centres, i.e. they will develop the role of a city centre (Ub), or a smaller city centre (Lajkovac). However, these settlements need to undertake new roles in diversification of economic matrix, especially more intensive development of the tertiary sector. Until the new mine are activated, Barosevac (with Zeoke) and Vreoci will be the leading centres of the industrial-mining complex, while Veliki Crljeni will be the centre of smaller importance.

1.2.2.9 Social Development

Basic activities in terms of strengthening and improvement of the quality of services of the public offices, considering economic limitations and current reduction of rights in the field of social protection, are chiefly related to the change in organisation and the operation manner of public services and stimulation of private initiatives in this sector. On the other hand, measures need to be taken in order to instigate social development and integration of a higher number of stakeholders. Changes need to be erased between job security in public and private sectors.

Data on primary schools within the planning area indicate an inferior equipment level and schooling conditions in the so-called areal divisions or schools. The proposal is to introduce organised specialised transport of pupils, which might be a solution bringing improvements in education conditions of children coming from smaller villages.

Population level per one doctor in Lazarevac municipality (outside of the municipal centre) is about 1500, which is far worse than the general average in Serbia (about 500 people per one doctor). One dentist covers 4500 people. The above ratios would be considerably better if doctors and dentists employed at the medical centre of Lazarevac were to be included. This would significantly improve the above average.

1.2.2.10 Relocation of Settlements and Population

Resettlement of population is conditioned by planned development of the following open cast mines:

- Tamnava West Field: Mali Borak, Kalenic
- Filed D: Vreoci, Medosevac
- Tamnava South Field: Vreoci
- Field B: Barosevac and
- Field Veliki Crljeni: Vreoci, Veliki Crljeni, Cvetovac
- Field E: Zeoke, Barosevac
- Field Radljevo: Brgule, Kalenic, Sarban, Radljevo

For infrastructure system relocations purposes in the central part of the basin, smaller number of households in settlements of Vreoci, Sopic, Jabucje and Skobalj will be resettled.

Population projection was provided on the basis of the preliminary assessment of possible population resettlement zones from the settlements located within the area of mine expansion (Table 1.6), while the detailed and more precise data will be obtained through corresponding zoning plans and programmes of population resettlement from these settlements.

Table 1.6 – Estimate of resettlement schedule according to settlements and possible resettlement zones

Settlement	Resettlement schedule	RESETTLEMENT		Share of population resettled in the total population level 2002 (%)	Share of households resettled in the total number of households 2002 (%)	ESTIMATE OF POSSIBLE RESETTLEMENT ZONES FROM 2005 TO 2020*	
		Population number	Household number			Organised resettlement (on average 60% of households)	(Individual resettlement (on average 40% of households)
Mali Borak	2005-2010.	115	45	23.0	22.7	Jabucje, Paljuvi	Lajkovac
	2010-2015.	100	40	26.9	20.2	Jabucje	Lajkovac
	2015-2020.	75	30	15.3	15.1	Jabucje	Lajkovac
Kalenic	2005-2010.	48	14	5.4	5.3	Kalenic	Ub
	2010-2015.	95	28	9.6	10.6	Kalenic	Ub
	2015-2020.	7	2	0.8	0.8	Kalenic	
Radljevo	2010-2015.	135	45	22.2	22.3	Brgule, Paljuvi	Brgule, Jabucje Ub
	2015-2020.	117	39	16.8	16.8	Brgule, Paljuvi	Brgule, Jabucje Ub
Brgule	2010-2015.	83	26	6.7	6.7	Brgule	Brgule, Ub
Sarbane	2010-2015.	105	37	19.1	18.8	Brgule	Brgule, Ub
	2015-2020.	130	46	23.7	23.4	Brgule	Brgule, Ub
Vreoci	2005-2010.	1995	670	62.2	61.6	Lazarevac/Sopic	Lazarevac/Sopic outside the municipality area

Settlement	Resettlement schedule	RESETTLEMENT		Share of population resettled in the total population level 2002 (%)	Share of households resettled in the total number of households 2002 (%)	ESTIMATE OF POSSIBLE RESETTLEMENT ZONES FROM 2005 TO 2020*	
		Population number	Household number			Organised resettlement (on average 60% of households)	(Individual resettlement (on average 40% of households))
	2010-2015.	1045	360			Lazarevac/Sopic	Lazarevac/Sopic outside the municipality area
Veliki Crljeni	2005-2010.	120	40	0.6	0.6	Veliki Crljeni	Veliki Crljeni, Lazarevac
	2010-2015.	30	10	0.6	0.6	Veliki Crljeni	Lazarevac
Medosevac	2005-2010.	378	122	18.4	18.4	Sopic	Lazarevac/Sopic
Barosevac	2005-2010.	200	60			Barosevac	Lazarevac
Cvetovac	2005-2010.	60	18	25.7	25.7	Veliki Crljeni	Lazarevac
	2010-2015.	6	2	0.8	0.8	Veliki Crljeni	
Zeoke	2010-2015.	796	276	100.0	100.0	Sopic, Burovo, Dren	Lazarevac/Sopic
Sopic	2005-2010.	8	2			Sopic	
	2010-2015.	22	6			Sopic	Sopic
Total intended for resettlement by 2020		5670	1918				

Estimate of possible resettlement zones (from 2008 and 2020) includes on average: 40% (658 households) under the organised resettlement into suburban or neighbouring (village) settlements or shifting inside their own area; and 60% (1 245 households) under the individual resettlement into other (primarily) city settlements (Ub, Lajkovac, Lazarevac, Stepojevac and Belgrade). Resettlement modalities include: individual resettlement; organised resettlement into the zone of already formed settlements, with the provision of the construction lot and development of residential and auxiliary facilities; organised resettlement into the zones of formed settlements, with the provision of the construction lot, organised resettlement of agricultural households and special resettlement programmes for households with special needs.

1.2.2.11 Traffic

Traffic system development plan is based on the approach comprising of harmonisation between the reconstruction and functional substitution of the traffic infrastructure, in spatial and temporal terms with the development of mining fields. Rationality principles dictate the concentration of roads and other infrastructure system in zones of corresponding width. Similarly, maximum utilisation of existing zones is required which can successfully replace with certain interventions the zones which have to be abandoned due to advancement of mining operations.

Table 1.7 – Impact of opening and mining schedule according to mining fields on the road network

Open cast mine	Opening and mining schedule	Affected road	Possible alternatives
Tamnava West Field	• 2005-2010 • 2011-2015 • 2016-2020	• R-101a along the section Kalenic – Mali Borak • R-101a within Skobalj zone	L-1011 until 2012; R 270
Radljevo	• 2012-2015. • 2016.-2020.	• L-1002 within the zone Brgule - Sarbane • L-1011 within Radljevo zone • R-270 along the section Kalenic – Stublenica	Relocation along the periphery of Radljevo mine
South Field	• 2012-2020	• M-22, along the section Veliki Crljeni - Vreoci	• R-201, from Stepojevac, over Veliki Crljeni and Vreoci and P-203 up to Sopic with road connection in Sopic zone to existing route of M-22
Veliki Crljeni	• 2009-2014	• no directly affected	

Open cast mine	Opening and mining schedule	Affected road	Possible alternatives
		road	
Field D	• 2005-2015	• R 201	
Field B and C	• 2011-2015	• L-1807, within Barosevac zone	• Considering that one part of this settlement will be relocated, and that there are alternative connections of the remaining part of this settlements with Junkovac in the north, it is possible to form a new route
Field E	• 2011-2015	• R-201, within Zeoke and Medosevac zone	

According to the traffic system development objectives, the following roads need to be constructed, reconstructed, or in accordance with the open cast mining development, abolished:

- Construction of the motorway with the total length on Plan territory of about 28km (Variant B);
- Relocation of the state road M-22 section from the south-western boundary of OCM Veliki Crljeni to the crossing with M-4 into the existing or new zone;
- Construction of a detour around Lajkovac with the length of about 5.7km;
- Relocation of the regional road R-270 along OCM Radljevo periphery and abolishing of the local road L-1011;
- Abolishing of the section E-101a, from Staro Selo to the southern boundary of OCM Tamnava-West Field, in the vicinity of Jabucke Ciglane at the length of about 7.7km;
- Section R-101a, from the southern boundary of OCM Tamnava West Field to the crossing with the new route R-201 (in the vicinity of Gaj) becomes a local road according to its functional characteristics, at the length of 6.1km;
- Reconstruction
- Reconstruction of local roads L-1008 and L-7 (continuation of L-1011 in Lajkovac Municipality) to the crossing with R-270 near Trnjane (in the north) to the crossing with R-101a near Serink (in the south) and their transfer to the rank of a regional road – total length about 14.6 km (L-1008 at the length of about 8km and L-7 at the length of about 6.6km); connection with L-1806 (new route R-201) over Sopic;
- Abolishing of R-201 regional road section, near Kljucevo to the crossing with L-1806 through mining fields E and B, at the length of about 7km;
- Reconstruction of one part of L-1806 road, from the southern boundary of mining field E towards the crossing with R-201, at the length of 4.7km, enabling re-categorisation of this part of the road into the rank of a regional road according to its technical characteristics and construction of the new section of this road (at the rank of a regional road), as connection with R-201 in the vicinity of the south-western boundary of mining field B, at the length of 1.2km;
- Construction of one section of regional road R-201 as the connection of the old route R-201 and L-1806 with the western boundary of Field E, at the length of about 1.8km;
- Abolishing of one part of local road L-1806 through Field B at the length of about 3.2km and construction of alternative road network;

Provisional balance of areas intended for reconstruction and construction of new road sections is about 140-207 ha.

Some 165km are planned for the construction of the second railway track Belgrade-Valjevo-Pozega (in the Spatial Plan area about 33-35km).

1.2.2.12 Telecommunications

The Spatial Plan anticipates by 2010 the introduction of phone network in all settlement with the density of about 50 phones/100 inhabitants (current density for the entire area is about 23 phones/100 inhabitants). The following is also anticipated by 2020:

- Increase of the number of phone subscribers in every settlements up to the density of 65 phones/100 inhabitants;
- Capacity increase of the transmission system providing other non-telephone services to smaller settlements, capacity of minimum 2 x 2 Mbit/s, and in larger settlements the minimum of 10 x 2 Mbit/s; and
- Construction of base stations for mobile phones covering these settlements.

The system of connections and telecommunications in the REIS zone has to essentially different elements (developed according to the special EPS projects):

- Technical connections system for the needs of remote supervision and control of the power system, and
- Business connections system for the needs of industrial facilities and production process within REIS.

1.2.2.13 Environment Protection

Environmental solution indicated in the plan takes into account future alignment of our legal regulations with EU regulations in the field of environment protection, implying the application of best available techniques in the designing of new facilities⁹. With respect to air pollution, EU regulations about emission limit values for SO₂, NO₂ и NO_x, dust and led have been taken into consideration¹⁰.

Spatial-ecological differentiation of the Plan area was proposed based on categorisation from the Spatial Plan of the Republic of Serbia, establishing the land use regime conditioned by environmental quality criteria, as follows:

Table 1.8 - Environmental quality plan

Pollution category	Sites	Description
I	Open cast lignite mines, ash and slag disposal sites	Increased concentration of dust, noise
II	Zones of Veliki Crljeni, Vreoci, Medosevac, Junkovac, Cvetovac, Mali Borak and Kalenic	Occasional exceedence of ELV permitted ¹¹ for primary pollutants, however, without excessive pollution with radioactive, cancerous and mutagen substances
III	City zone of Lazarevac and Belgrade – South Adriatic motorway zone	ELV exceedence not expected, occurrence of unpleasant odours, industrial and municipal waste, increased noise and traffic impact, as well as 4 th class watercourse impacts
IV	Zones of Ub, Lajkovac and Sopic, suburban settlements of Lazarevac and <i>Ibarska Magistrala</i> zone and Belgrade – Bar railway	Pollution coming from food processing industry, other industries with installed air and water treatment devices, livestock farms, intensive farming, state roads and railways, suburban zones
V	Zones of regional and local roads and railways	Periodical noise level and air pollution increase
VI	Villages	Lower water and soil contamination
VII	Forests and meadows	No permanent environment pollution sources

The Plan also anticipated rules for spatial development and construction according to environmental criteria for residential zones, industrial zones and traffic route zones.

1.2.2.14 Reclamation of Degraded Areas

Reclamation and revitalisation of about 1011ha of degraded land (83.6ha ash of disposal sites and about 927.6ha of overburden dumps) is planned in the period between 2005 and 2020, making 45% of productive areas (2253ha) occupied by mine expansion. Occupation for mining and energy purposes will also include one part of areas already reclaimed in the previous period (93ha of fields и 1163ha of forests), in CM Barosevac

⁹ Modern technology according to the definition from the Law on Environment Protection (2004).

¹⁰ Council Directive 1999/30/EC.

¹¹ According to WHO norms.

and Zeoke – in areas affected by mining on Fields E and C, and in CM Veliki Crljeni – for ash disposal site. Due to restrictions imposed by the applied overburden dumping technology, more significant advance of reclamation is expected only after 2015. This includes forest planting on deposol, with previously executed technical soil reclamation and formation of water bodies in residual pits.

Reclamation plan is shown on Map № 6.

Due to restrictions imposed by the applied overburden dumping technology, the largest occupation of areas with active mining and energy activities is anticipated only after 2015. Measures intended for mitigation of adverse effects of such temporary area overload with mining activities have been included in agricultural land use plan, compatible with the forest and forest soil. In addition to comprehensive activities related to overburden and ash disposal sites, water bodies will be formed in residual pits in the area of about 97ha (Vreoci and Cvetovac).

1.2.2.15 Nature Preservation

The Spatial Plan obliges development entities and relevant local government factors to identify areas, facilities and phenomena of special importance in terms of bio and geo-diversity values and area aesthetics under the procedures anticipated for detailed planning/designing and licensing of future construction activities, spatial development and usage of natural resources by engaging relevant institutions. The above activities need to be initiated for the following:

- Well developed and in phytocenosis terms representative and important parts of forest communities for the purpose of preserving ecosystem variety of the area (examples of all ten identified phytocenoses and sub-associations of oak and other forests within the Plan area);
- Places, i.e. parts of forest and meadow-pasture areas with rare, indigenous, medicinal, edible and other important ligneous and herbaceous plants;
- Parts of habitats of rare animal species, especially aquatic and swamp biotopes (nesting, feeding and resting areas for birds, areas inhabited with bats, amphibian and reptilian fauna, etc);
- Significant geological areas (paleontological, stratigraphic, petrological structures of geological heritage), geo-morphological and hydrological phenomena (lookout points, meander parts of active and abandoned riverbeds, springs, natural watercourses and ponds);
- Representative, old, rare and in cultural-historic terms important trees; and
- Natural areas possessing high-quality aesthetic/landscape features.

1.2.2.16 Protection of Cultural Assets

Cultural assets protection plan anticipates timely identification and protection of all cultural monuments located in the zone of mining operations executed on open cast mines of Kolubara Mining Basin. Archaeological excavations have to follow open cast mine advance schedule in the manner enabling both the preservation of such localities and continuation of mining operations. Archaeological excavations will unfold according to corresponding annual programmes, aligned with the schedule of mining operations.

Cultural monuments of national architecture have a special treatment. The issue of dislocation of old buildings should be resolved together with their further use in accordance with the Study for Folk Village Formation. Folk village site needs to be developed and enable its future existence.

1.3 Relation of the Spatial Plan for this Area with the Spatial Plan of the Republic of Serbia, Energy Sector Development Strategy and other Strategic Documents

1.3.1 Spatial Plan of the Republic of Serbia (SPRS)¹²

Strategic orientations of SPRS in the field of environment protection include the following basic objectives:

- (1) Quality environment: clean air, sufficient amounts of quality water intended for drinking, recreation and production; preserved agricultural land, ecosystems and biological diversity; healthy food; developed settlements and pleasant conditions at the work place and the place of residence;
- (2) Rational use of natural resources, especially non-renewable or partially renewable ones (mineral and energy raw materials, water, soil); better efficiency of raw material and energy; reduction of waste

¹² Spatial Plan of the Republic of Serbia, Official Gazette RS, 1996

- and increase of recycling rate; secure disposal of municipal, industrial and hazardous waste; recovery of ecological and 'spatial' effects of mining; priority will be given to: extremely degraded and devastated areas, sites and landscapes; ecosystem rehabilitation; revitalisation and reclamation of areas containing intensive open cast mining of raw and energy materials; protection of the most valuable natural resources;
- (3) Stopping of further natural environment degradation (air, water, soil, vegetation, etc), primarily in critically polluted urban, mining-energy and industrial centres, in environmentally most valuable areas, and subsequently at the entire Serbian territory;
 - (4) Erosion prevention in the most affected area;
 - (5) Protection, rehabilitation and recovery of animal life; preservation of natural areas of special value and importance, endangered and rare plant and animal species; preservation of ecosystem equilibrium and recovery of the destroyed ecosystems; bio-diversity maintenance;
 - (6) Protection of natural areas and landscapes around cultural-historic monuments under the complex protection of these entities and natural landscapes in general;
 - (7) Support to educational programmes in the field of environment protection.

In additions to the above, SPRS establishes environmental requirements as an inseparable part of all plan elements, especially in terms of water and soil use and protection.

1.3.2 Energy Sector Development Strategy in Serbia¹³

Considering the possibilities of long-term energy sector development in the context of broader economic development of Serbia, especially in the context of inherited economic state from the previous period, basic principle for determination of energy sector priority development objectives is based on the idea of complementarity of economic development of the country and increase of production and energy efficiency.

Technological state of production capacities in these energy sectors is still extremely critical regardless of recoveries, rehabilitations and modernisations executed so far, both in terms of operational security of facilities, and in terms of energy efficiency, and especially in terms of environmental impacts almost completely unacceptable. In this sense, legislative and institutional framework needs to be established as soon as possible in accordance with existing national and international standards, for identification and implementation of the national environmental programme. Such programme needs to cover the organisation of corresponding logistics for reliable measurements and monitoring of all emissions from energy facilities, as well as development of the plan for introduction of technical and organisational measures on energy facilities/sources for generation of primary/secondary and final energy including facilities and devices in energy consumption sector with the aim of gradual reduction of effluent emission levels with harmful environmental impacts.

Implementation of specific – technological and environmental objectives increases facility operation security, as well as reliability equipment and essential systems of energy facilities, considering the inherited state of energy facilities/systems and technologies with reduced operational performance and harmful environmental impacts. Under this objective – oriented priorities of technological modernisation of energy facilities/plants/sources and installation of specific diagnostics and control equipment, including installation of emission reduction equipment from energy sources, it will be possible not only to increase operational reliability and productivity of the major part of existing energy sources, but to mitigate adverse environmental effects. Taking into consideration the structure and age of existing sources, high debt level of energy utilities and current socio-economic circumstances within the country, achievement of this objective should have the highest priority in the following midterm period.

Programme and system instruments include the development and adoption of programmes (for the period of 6 years, in accordance with the Energy Law), while the following programme is essential for the strategic environmental assessment of this spatial plan area:

'Environment Protection Programme', exceeding competences and authorisations of the Ministry of Mining and Energy of the Republic of Serbia due to diverse origin of harmful substances and various impacts i.e. manifestations of adverse effects on biological and non-biological elements of natural environment (on local, regional and global levels). In accordance with the above circumstances, a comprehensive national Programme needs to be developed covering all phenomena and effects relevant for the socio-economic system of Serbia, including the so-called cross-border emission. Since it is possible that there will be some overlapping in the contents of the Programme for Rational Energy Use and the Programme for the Use of

¹³ Energy Sector Development Strategy by 2015, Official Gazette RS, № 44/2005

Renewable Energy Sources with the Environment Protection Programme, other competent Ministries of the Serbian Government need to be included in the development and adoption of the above Programmes, including Scientific-Technological Development Programme, for the purpose of harmonisation and operative differentiation of implementation of individual programme sections, whose contents will be considered in detail under the document entitled Sustainable Development Strategy of the Republic of Serbia (currently being developed). Independently from this, pursuant to the Energy Law, Energy Sector Development Strategy stipulates conditions and manner for environmental protection in the course of operation of energy facilities, as well as during the fossil fuel combustion processes, both in energy production energy consumption sectors, primarily in the traffic sector and industry and construction.

Fossil fuel fired TPPs and oil and oil derivatives industry belong to the largest environmental polluters. Environment pollution may practically occur in all electric power activities: coal production, as well as in electricity generation, transmission and distribution, oil and gas sector, starting from investigations, extraction and especially processing and transport of oil and its derivatives. Sulphur-dioxide (SO₂), carbon-monoxide (CO), carbon-dioxide (CO₂), nitrogen oxides (NO_x) and dust represent the most hazardous substances emitted by energy facilities. All of these elements occur in the coal fired TPPs operation process. Intolerably high dust emission (over 50 000 t/a) will soon be ten times lower after the implementation of the phased replacement of electrostatic precipitators, while new technical solutions have to be found for the disposal of the large ash amounts (over 5.5 million t/a), having in mind high ground and surface water contamination. Considerable mined out non-reclaimed areas of open cast mines of Kolubara and Kostolac represent serious environmental problems for settlements located in the surrounding area. High soil contamination on ash disposal sites, overburden dumps and sludge coming from sedimentation tanks for waste waters also represent a large environmental hazard. Due to the fact that thermal power plants the highest environmental impact within our power system, application of domestic and EU environmental regulations is mandatory during the designing and construction of such facilities. These measures applied on new facilities will not be effective from the viewpoint of a considerable emission level reduction, considering that the average age of existing power plant is about 25 years, with protection measures dating back to the time when they were constructed and commissioned.

Having in mind that the level of current emissions from energy sources and facilities is many times higher than all norms stipulated by the corresponding EU strategy for this field, the Kyoto Protocol and Basel Convention, realistic objective for reaching EU and international environment standards represents a permanent objective which will gradually be achieved during the implementation of the Strategy. Objective defined in this manner may be realistically achieved under the Priority Programme of Technological Modernisation of Energy Facilities, i.e. through revitalisation and operation life extension of thermal power plants and other energy facilities, replacement of the current technologies by new ones with mandatory application of modern environmental technologies. Moreover, in the period up to 2015, all transformers and other energy devices filled with pyralene should be replaced.

Negligence of environmental aspects, possibly due to faster economic development may cause permanent environmental and health deteriorations, as well as higher costs of reconstructions imposed in the future. Due to global impact of local energy sources, no country should neglect environmental effects having an impact on sustainable development of the broader international community and its consequent obligations in terms of observation of international agreements. If the political objective of the Republic of Serbia is EU integration, it is natural that one of the politically important objectives of the Energy Sector Development Strategy is achievement of EU environmental standards, as well as the fulfilment of norms defined by international documents (Kyoto Protocol, international agreements, EU Directives, etc).

1.3.3 Water Management Master Plan of the Republic of Serbia¹⁴

Water Management Master Plan of the Republic of Serbia sets the following as its basic strategic objective 'maintenance and development of the water regime providing the most favourable and the most expedient technical, economic and environmental solutions for unique water management, protection against harmful impacts of water, water protection and water utilisation'. Basic environmental principles, requirements and tasks defined in the Water Management Master Plan are based on SPRS guidelines defined through special activities in case of spring protection and protection of zones along watercourses:

- Reduction and prevention of environment pollution,
- Prevention of eutrophication of water reservoirs,
- Prevention of tree felling, material dumping, material removal,

¹⁴Water Management Master Plant of the Republic of Serbia, Official Gazette RS, 2002

- Prevention of destruction of existing ecosystems,
- Preservation of areal characteristics,
- Mandatory development of the special water protection plan against contamination.

1.3.4 National Waste Management Strategy¹⁵

National waste management strategy sets general as well as the following objectives in terms of waste management:

- Rational utilisation of raw materials and energy and usage of alternative fuels coming from waste;
- Reduction of hazards caused by disposed waste for future generations;
- Provision of stabile funds and incentives for investments based on the polluter-pays and/or beneficiary-pays principles;
- Implementation of an information system covering all costs, amounts and locations of waste, facilities for treatment, processing and reuse of materials from waste and waste disposal facilities;
- Increase of the population level covered by the municipal waste collection system;
- Defining of waste treatment standards;
- Reduction, reuse, recycling and regeneration of waste;
- Reduction of hazards caused by waste, by applying the state-of-the-art techniques and by substituting chemicals representing environmental and health risks;
- Raising of the public awareness on all society levels in terms of waste issues.

1.4 Relation of the Spatial Plan towards the Lower Level Plans

Development of locations of thermal power plants and industrial facilities REIS will be based on elaboration of basic Spatial Plan solutions at the level of general or detailed regulation plans, i.e. the act on zoning conditions. Basis for the settlement of property-legal relations, as well as more detailed conditions for development, use and revitalisation of areas of individual open cast mines will also be defined at the level of detailed regulation plans. Programmes will be developed in the scale of 1:25.000, 1:10.000 и 1:5000, and regulation solutions in 1:2.500 и 1:1.000.

New generation of spatial plans for municipalities covered by the Spatial plan will be developed, as well as zoning plans or replacement of existing ones, on new development bases, primarily for Lazarevac, Ub, Lajkovac, Vreoci, Veliki Crljeni and Stepojevac, as well as for the settlements in which the population will be resettled in accordance with the priorities to be established by the competent municipalities in cooperation with expert divisions of CE MB Kolubara.

Priorities in adoption of spatial and zoning plans:

1. Spatial Plans of Ub, Lajkovac, Obrenovac and Lazarevac municipalities by the end of 2008;
2. General (zoning) plans for Lazarevac, Lajkovac, Stepojevac and Veliki Crljeni by the end of 2008;
3. Regulation plans for:
 - The area of Vreoci by the end of 2007;
 - The area of Jabucje and Skobalj by the end of 2008
 - Spatial entities to resettlement of Vreoci is planned during 2007 and 2008;
 - Impact zones of mines Field B, Field C and Field E including (parts) of CM Barosevac, CM Zeoke, CM Medosevac and CM Burovo – by the end of 2009;
 - Impact zone of OCM Radljevo including (parts) of CM Radljevo, CM Kalenic, CM Brgule and CM Sarbane – by the end of 2009;
 - Area of CM Sopic (west from the railway station) by the end of 2009 and
 - For new infrastructural system zones – 5 years prior to the relocation of existing (priority: relocation of rivers Kolubara and Pestan, M-22 road) energy and telecommunication lines within the zone of OCM South Field – by the end of 2009.

1.5 Preliminary Consultations with Stakeholders

Pursuant to Article 11 of the Law of Strategic Environmental Impact Assessment, authority competent for the preparation of this plan (Republic Agency for Spatial Planning) performed consultations and requested

¹⁵National Waste Management Strategy with EU Integration Programme, RS Government, 2003

opinions from the body responsible for environment protection and relevant authorities and organisations in the course of preparation of the decision on the development of the strategic environmental impact assessment:

1. Ministry of Environment
2. Nature Preservation Office of Serbia
3. Republic Office for the Protection of Cultural Monuments;
4. Ministry of Mining and Energy;
5. PE Electric Power Industry of Serbia – Head Department for strategy and Investments;
6. Ministry of Capital Investments;
7. Ministry of Agriculture, Forestry and Water Resources Management and other relevant bodies.

Hydrological characteristics

The presence of watertight Neogene sediments as well as sufficient amount of precipitation enabled the existence of many watercourses: Kolubara, Tamnava, Ub, Ljig, Kladnica, Turija, etc. In hydrological respect, this area belongs to catchment area of Kolubara. River - lake environment is separated into two areas by river Kladnica valley: south-east, between valleys of Kladnica and Kolubara and north-west, between Kladnica, Ub and Tamnava. Right lowland side of Kladnica is fully cut into the upper Pontian sandy and alevrite sediments. This separates the river-lake water bearing environment on this side of Kladnica from the river water bearing environment in the alluvial plane. River-lake water bearing environment in the north-western part is fully separated from alluvium in the spring part of river Kladnica, while in the middle and lower flow of Kladnica on the left lowland side, river-lake and river water bearing environments are in direct contact. On the north-western boundary of river-lake terrace, right lowland side of Ub and Kolubara is cut into the upper Pontian sediments also separate the water bearing environment in the terrace area from the water bearing area in the alluvial plane of Ub and Tamnava.

Flow schedule is unfavourable – the lowest in the lowland part of the catchment area, with the highest water needs. Catchment area zone north from Lajkovac has the specific outflow of 1 – 2 l/s per km², and it is one of the areas of Serbia with the lowest water amounts. All watercourses are of torrential type, with high seasonal flow fluctuations (except river Ljig). The consequence of this unevenness is high amounts of littoral drift, while riverbeds are alternately deepened and clogged. Riverbeds are irregular, shallow, unstable and meandering, and in the period of higher precipitation they flood surrounding areas (total 45 00ha).

When it comes to river regulation and flood protection, this area is characterised by a high protection level of open cast mines against floods and relocation of watercourses due to expansion of mining fields. Surface water bodies include artificial ponds in residual pits of abandoned lignite mines, recreational lake Ogaca near Lazarevac and several lakes – ponds in the area of Radljevo village. The largest lake is an artificial reservoir near Paljuvi village, formed by Kladnica valley partitioning.

Ground water reserves are modest and amount to 85 l/s, therefore they have a very small role in water supply. There were some 6600 excavated wells, 2 – 3m deep within the planning area. About two thirds of the latter are no longer in operation because the settlements in this area are covered by municipal water supply systems, as well as due to land occupation, contamination of aquifers or ground water level lowering. Nowadays, there are some thirty wells in operation with low capacity (0.01 – 0.75 l/s).

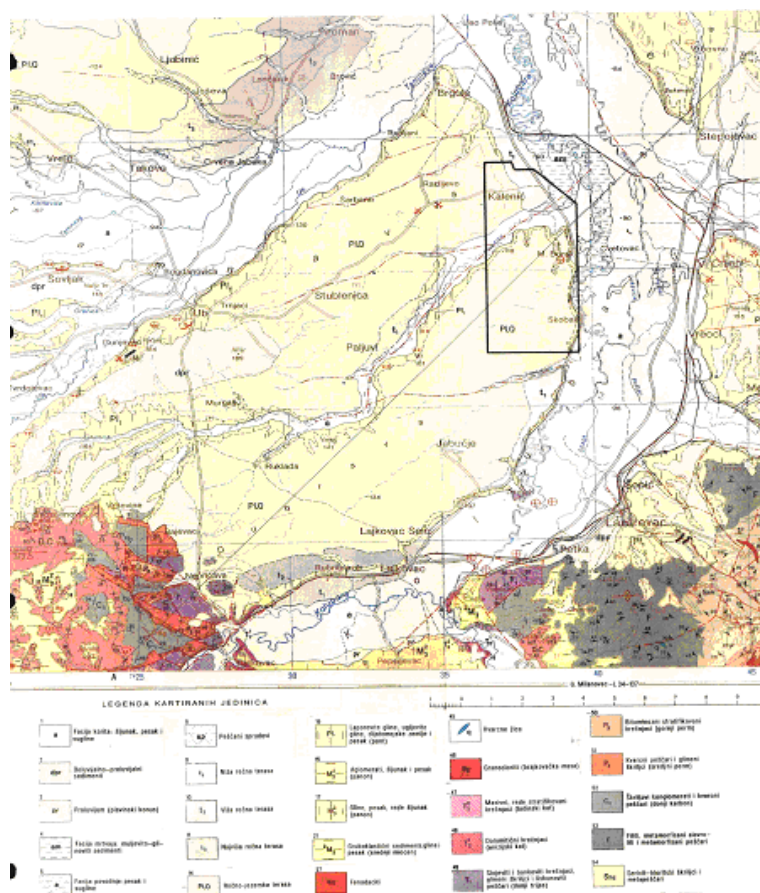


Figure 1.7 – Basic hydro-geological map of the area

Pedologic characteristics and soil quality

In the area of Kolubara Mining Basin there are 12 types of soil:

- Automorphic (autogenous) soils:
 - Colluvial soil (colluvium)
 - Clay soil (vertisol)
 - Brown forest soil (eutric cambisol)
 - Acid-brown soil (distric cambisol)
 - Illimerised soil (luvisol)
 - Dump site soils (deposol)
 - Flotation character (flotisol)
- Hydromorphic (hydrogenous) soils:
 - Pseudogley
 - Alluvial soil (fluvisol)
 - Meadow soil (humofluvisol)
 - Marsh black soil (humogley)
 - Black log soil (eugley)

Overview of quality classes according to soil types:

- 1st quality class (5424.1ha - 9,9%) – alluvial soil (fluvisol) loamy;
- 2nd quality class (11400.6ha - 20.8%) – alluvial soil (fluvisol) clay and brown forest soil (eutric cambisol);
- 3rd quality class (8762.2ha - 16,0%) – clay soil (vertisol) Colluvial soil (colluvium), illimerised soil (luvisol) and meadow soil (humofluvisol);
- 4th quality class (22253.9ha - 40,7%) – pseudogley and marsh black soil (humogley);
- 5th quality class (5600,5 ha - 10,2%) – acid-brown soil (distric cambisol) on shale or granite and dump site soil (deposol);
- 8th quality class (1273,1 ha - 2,3%) – technogenic soils and flotation material (waste water sedimentation – flotisol).

Majority of areas covered by the Plan may be categorised as arable land, since 87.4% is soil of 1st to 4th quality class. The soil with the highest value – 1st and 2nd quality classes mostly contains diverse building structures.

Climatic characteristics

Climate of Kolubara Mining Basin is pretty dry, with continental and steppe features. Winter months have low precipitation, whereby soil does not contain high humidity levels in the initial vegetation phase. Other half of spring, as well as summer months are characterised by high precipitation, still not sufficient to mitigate high temperature effects. In autumn, there are high levels of precipitation, but the plants then are at the end of their vegetation period.

Mean annual temperature from Zeoke and Tamnava stations are 11.3°C and in Barosevac 12.3°C. Annual temperature amplitudes are not prominent since summers are moderately warm (mean monthly temperatures range during the summer between 21 and 23°C), while winters are moderately cold (2.2 – 3.8°C). Mean maximum temperatures have the highest value in July (Zeoke 34.7°C And Barosevac 21.7°C), i.e. in June (Tamnava 25.8°C). Highest temperatures were measured in July (Zeoke 34.7°C and Barosevac 21.7°C), i.e. in June (Tamnava 25.8°C). The lowest temperature of -28.5°C was measured on Tamnava station in January and in Zeoke -14.5°C in February.

Average annual precipitation on three relevant gauge stations range from 508mm in Barosevac to 591.6mm in Tamnava. Compared to the data on pluviometric regime from gauge stations Vreoci and Ub (737mm and 688mm) from the previous period, these values are considerably lower. The highest level of precipitation was recorded in June (Zeoke 85.9mm) and in July (Barosevac 86mm, Tamnava 97mm).

Prevailing winds in this area include eastern, south-eastern, western and north-western winds: Barosevac – E, ESE, W и WNW during the entire year; Tamnava - ESE and WNW; Zeoke - SE and W. The highest average wind velocities occur in spring from the direction of ESE (5,3 m/s) and SE (6,3 m/s), in summer N (4,0 m/s) and NNW (4,1 m/s), in autumn E (4,7 m/s), ESE (5,6 m/s), SE (4,9 m/s) и SSE (4,7 m/s). On the annual level, the highest wind velocities were recorded from the following directions SE (5,7 m/s), ESE (4,8 m/s), E and SSE (4,5 m/s) и NNW (4,6 m/s). During spring, autumn and winter, winds from E, ESE, SE and SSE directions possess the highest velocity, while in the summer months, winds from NW direction are characterised with the highest velocity.

2.2 Environment Pollution and Degradation Sources

Facilities of the mining-energy complex have the highest importance for environmental impact assessment among the numerous constructed industrial and infrastructure facilities, including the ancillary industries. These facilities may have considerable environmental impacts and they are subject to the development of environmental impact assessment of as-built designs pursuant to Article 30 of the Environmental Impact Assessment Law (Official Gazette RS, № 135/2004).

Table 2.1 – Existing facilities of mining-energy complex with ancillary activities subject to environmental impact assessment

№	Name	Location
1	Open cast mines	Tamnava West Field, Tamnava East Field, Field B and Field D
2	Ash transport and ash disposal site	Veliki Crljeni - Sokolovo
3	Coal transport and coal yards	Veliki Crljeni, Vreoci, Obrenovac
4	TPP Kolubara A	Veliki Crljeni
5	TPP Kolubara B (under construction)	Kalenic
6	Kolubara-Metal	Vreoci
7	Kolubara-Prerada with the heating plant	Vreoci
8	Kolubara-Univerzal	Veliki Crljeni
9	Kolubara-IGM	Vreoci
10	Power grid	Veliki Crljeni

According to their scope and intensity, the most significant environmental aspects are related to works and activities on open cast mines, coal yards in thermal power plants and ash and slag disposal sites. Dominant unfavourable impacts of these facilities are reflected both on the quality of main environmental factors (air, soil and water) and health, flora and fauna, as well as on future economic development potentials.

Table 2.2 – Balance of areas under existing mining-energy complex facilities (ha)¹⁶

Name	Total mining areas	Total areas with altered use	Areas under building structures	Dump sites		Reclaimed areas			
				Inside	Outside	Forests	Arable Land	Orchards	Nurseries.
Field D	2754	115	66	1231	723	509	218	16	18
Field B	850	32	30	231		301			
T-East Field	2219	105	2	825	378	60	22		4
T-West Field	618	42		192	T-East Field				
TOTAL	6491	294	98	2479	1101	870	240	16	22

Overburden production scope is considerably higher than lignite production amounting to 55.700.000 m³ of overburden compared to 26.000.000 tons of coal in 2005. In addition to soil degradation, dominant negative impact of mining operations is related to air pollution, contamination of ground and surface waters and noise and vibration level increase.

Air emission of dust is most prominent in the zones of open cast mines, together with emissions from mining equipment and transport machinery containing harmful gases such as nitrogen oxides (NO_x), carbon-monoxide (CO), sulphur-dioxide (SO₂) and volatile organic substances. Water quality testing of river Kladnica and drainage water from the collector of Tamnava – West Field indicate increased concentration of ammonia, iron and nickel¹⁷. Increased noise and vibration level is present only on mines and it does not have an impact on the surrounding settlements.

Coal yards represent a potential occasionally air pollution source, on which during windy conditions coal dust clouds are lifted into the air. In addition to this, there is occasional self-combustion of coal dust creating carbon-monoxide, sulphur-dioxide and soot.

Two ash and slag disposal sites are located within the Plan area. Ash disposal site of TPP Kolubara A is located in the area between Veliki Crljeni and Sokolovo, covering the area of 32ha of the old reclaimed part and the new part consisting of two active cassettes A (18ha) and passive cassette B (20ha). Capacity of the disposal site is 300.000m³ of slurry, hydraulically transported from the thermal power plants. About 90% of the overflow and drainage waters are returned via recirculation to the thermal power plant, while the remaining

¹⁶ Republic Agency for Spatial Planning: Development Programme 'Strategic Environmental Impact Assessment of the Spatial Plan of Kolubara Mining Basin Area' April 2006.

¹⁷ EAR, EPS: Environmental Impact Assessment of OCM Tamnava West Field Expansion, August 2002.

amounts are discharged into river Turija. Ash and slag from the Heating Plant at Vreoci in the amount of 40.000t/annually are disposed hydraulically at Junkovac village (54ha). These disposal sites represent a potential soil, ground and surface water contamination sources due to toxic substances contained in the ash. Environmental pollution is also caused by direct overflow discharge of waste waters into the surrounding area and/or migration of heavy and toxic metals into deeper ground layers and ground waters. Ash particles are occasionally dispersed from dry surface of disposal sites, because of their looseness, low density and small grain size.

Electricity generation in Kolubara Mining Basin started in 1956 with the construction of the first TPP Kolubara A unit located at Veliki Crljeni. Nowadays, the complex of power generation units in this thermal power plant comprises of Units I to IV, total installed capacity 271 MW. This facility annually uses 1.8 million tons of lignite and about 4000 tons of diesel fuel. After lignite combustion in boilers, one part is separated in the form of ash and slag, while the other part is led in the form of flue gases through electrostatic precipitators for the purpose of fly ash separation prior to its discharge into the air via stacks. Ash separated in electrostatic precipitators is transported together with ash and slag by a hydraulic system to the ash disposal site Kovaceva Bara.

This power plant has two stacks, dimensioned to provide flue gas dilution. Flue gases from boilers 1 and 2 are emitted into the air through a joint stack 100m high and output diameter of 6.5m, while boilers 3 to 5 emit flue gases through a joint stack 110m high, with the output diameter of 6.5m. Kolubara lignite is characterised by calorific value from 6500 to 9930 kJ/kg. It contains 12 – 25% of ash and 46 – 52% of humidity. Total sulphur content varies between 0.4 and 0.7% with relatively stable average of about 0.53%. High amounts of CO₂, CO, SO₂, NO_x, dust and steam are discharged in the course of lignite combustion, as well as some other less important pollutants. Numerous emission measurement results for TPP Kolubara A indicate variability of individual parameters, conditioned by fluctuations in lignite quality, the state of boiler equipment and protective systems. According to the latest measurements results,¹⁸ concentrations of sulphur oxides in emitted gas were above legally prescribed emission limit values,¹⁹ ranging from 2.100 to 2.690 mg/m³. Registered exceedences were expected, considering the quality of used coal, as well as the absence of emission reduction measures. Nitrogen oxide emission values were mainly lower than maximum permitted values. Measurements on units 1 to 4 during 2001 may especially be singled out in this respect, when average recorded concentration amounted to 132mg/m³ and measurements done in 2002 on boilers 3 to 4, indicating higher value with the average of 433mg/m³, which is also within the legal limits. Average measured carbon-monoxide value in flue gases amounted to 133 mg/m³, which is considerably lower than the maximum permitted value of 250mg/m³. Specific CO₂ emission is not measured; however, based on the calculations, an average value of 140g/m³ (1680g/kWh) is obtained. Measured values of fly ash particle content in treated flue gases are considerably higher than the maximum permitted value of 100mg/m³ ranging from 375mg/m³ to even 3850mg/m³. Lowest values were recorded on boiler 5, average of 543mg/m³, while the highest ash particle content was recorded in gases coming from boiler 4, average 2512mg/m³. This is the consequence of extremely low ash handling levels, amounting to the average 93.87%, 95.26%, 90.38% and 98.92% for boilers 1, 3, 4 and 5 respectively. Considering that TPP Kolubara A units were commissioned some 50 to 60 years ago, it is clear that fly ash emissions would not be in the current legal limitations, even if the existing ESPs were operating under their design parameters.

Flue gases take away some 15% of energy produced by lignite combustion, while cooling waters take away another 40% of energy. Heat is mainly discharged through cooling towers in the form of steam, with about 2 litres of water evaporated per one kWh.

Waste waters created in the TPP systems may be classified as: sludgy (waters containing high solid particle content), salty (waters with high salt concentrations) and oily (waters containing high amount of oil derivatives). TPP does not have a waste water treatment plant for any of the indicated types of waste waters. They are led towards the slurry station and used for ash and slag transport in the form of thin slurry.

In addition to mining and TPP operations, other ancillary industrial facilities may be found in the area of REIS Kolubara, such as: Kolubara-Prerada, Kolubara-Metal, Kolubara-Gasbeton, Heating Plant at Vreoci and Kolubara Univerzal in Veliki Crljeni.

¹⁸ Техно-економска анализа и енергетска анализа оправданости санације и/или реконструкције појединих агрегата ТЕ Колубара А1-А4, Енергопроект-ЕНТЕЛ, Извештај М05006, 2006

¹⁹ Правилник о граничним вредностима емисије, начину и роковима мерења и евидентирања података, Сл. Гласник РС, бр. 30/97

Kolubara-Prerada deals with processing and valorisation of coal coming from open cast mines B and D, primarily for TPP use and partially for sale. Coal processing essentially includes three technologies: dry separation, wet separation and coal drying. Dry separation includes grinding and classification of coal (about 9.700.000t/annually). This process causes occasional pollution through coal dust emission and contamination with waste waters created during the washing of different operational units. Wet separation processes about 3.000.000 tons of lignite annually. The technology includes coal cleaning processes in the liquid environment, followed by drying and classification. Tailings and waste waters are created as waste products of these processes. About 200 000 tons of tailings, after washing, is transported by a cable railway to the disposal site at Junkovac. Coal drying is performed under the *Fleissner* procedure. Design capacity of the drying plant is 855 000t, but it has stabilised in the past several years to 450 – 650 000t annually. The following gases are discharged from the drying plant: about 410 g/h H₂S, 108 g/h SO₂, 23 g/h NO_x, 38 g/h phenols and their gases with unpleasant odours. In addition to this some 1.82kg/h of solid particles are also emitted. Although there are three particle handling and waste treatment systems, they are not functioning. Consequently, particle concentrations in discharged gases are considerably above ELV. Waste gases are discharged into the atmosphere through stacks.

The total of 208-218 m³/h of waste industrial and sanitary waters is produced in Kolubara-Prerada, including water from the chemical preparation of water at 'Toplana', with higher concentration of solid particles, inorganic and organic substances. Treatment of these waste waters is performed in a complex facility consisting of the following units: sedimentation tanks for waters coming from 'Susara', acceptance basins, filter tanks with aeration, fast mixing tank, 'Biodisk' for sanitary waters, 'Esmer' filter, secondary sedimentation tank, lagoons for oxidation of organic compounds and a channel going towards river Kolubara. River Kolubara water quality investigation results before and after waste water discharge (2001) indicate that water quality after the discharge is worse, although river Kolubara waters do not even meet the prescribed 2nd class before the discharge. By measuring water quality parameters in river Kolubara downstream from the waste water discharge, the following was determined: water has very strong colour, MPC are occasionally exceeded by nitrates, BOD₅, suspended substances, while ammonia and COD exceed MPC constantly. These data indicate that the waste water treatment plant does not have a satisfactory performance in terms of chemical and biological treatment, both due to outdated technology and bad maintenance of the facility.

'Toplana' (Heating Plant) operated within 'Kolubara-Prerada' generating heat (technological steam) necessary for the drying plant, as well as for heating of the industrial complex, greenhouse and Lazarevac. The Heating Plant has two steam generators, total capacity 140 tons of steam per hour, and lignite consumption of 63.2 tons per hour. According to the measurement results, some 42kg/h of carbon-monoxide, from 298 to 322kg/h sulphur-dioxide, 34 to 72 kg/h of nitrogen oxides and from 0.525 to 1.970 tons of solid particles is emitted from the Heating Plant per hour. These results demonstrate that ELVs were exceeded in all cases, except for nitrogen oxides. Flue gases are led through electrostatic precipitators for ash separation, and then through reinforced-concrete stack 80 m high. Design ESP efficiency ($\epsilon=98\%$) is not sufficient, considering that the design particle concentration is 646 mg/m³ compared to ELV of 100 mg/m³. Ash and slag are mixed with water (1:8) and hydraulically transported to the disposal site in Junkovac. Waste waters from the Heating Plant are joined together with other waste waters from Prerada and treated in the treatment plant. In addition to the above, increased noise level is also generated in Prerada. Increased radioactivity levels in the vicinity of these areas are also possible due to the presence of radioactive lighting arresters and radioactive level gauges.

Kolubara – Metal – Vreoci deals with the production, overhaul and erection of equipment and machinery for coal production and processing. It also has a foundry unit for grey sheet metal, silumine and bronze, with the installed capacity of 250 tons/a. The following pollutants are emitted from the dome furnace of the foundry unit: CO₂, CO, SO₂ and smoke, discharged into the atmosphere without any treatment through the stack 6 m high. Large amounts of solid waste is created in these operational units (steel, brass, aluminium waste, etc), sold for recycling. Waste waters coming from the foundry unit, contaminated with clay, sand and burnt remains of modelling mixture are led together with sanitary waters to the central treatment plant. In addition to this, special separators for primary separation of oils and lubricants are also used. This company has three radioactive lighting arresters, which may represent a radiation hazard.

Kolubara – Univerzal – Veliki Crljeni, consists of three operational units: raw rubber production, production of rubber-technical goods and production and regeneration of rubber belt conveyers. Annual installed capacities are 10.000 tons of raw rubber, 750 tons of rubber-technical goods and 90.000 m of belt conveyers. Classic rubber technology is used in the production process. The production process is accompanied by air pollution with solid particles and steam and gases primarily coming from organic diluters. Sanitary waste waters from the operational unit are treated in 'Biorol' facility prior to their discharge into river Turija. Ionising radiation sources are present in installed fire alarms. Solid waste consists of municipal waste and rubber waste.

Kolubara-IGM – Vreoci produces construction materials. Production unit Gasbeton – Vreoci produces blocks from light gas concrete. Raw materials used include quartz sand, lime, aluminium powder and cement. All raw materials are mixed in a closed cycle then poured into moulds and subsequently going to heat treatment. This company also has a Brickyard located at Veliki Crljeni, lime production and grinding unit at Celije and lime hydration at Nepricava. The above production processes are accompanied by air and soil pollution with solid particles, noise emission and creation of solid waste. Other environmental pollution sources are not individually significant; however, they are indicated due to possible cumulative impacts.

Kolubara – Gradjevinar in Lazarevac deals with the execution of construction works. Production of construction material is carried out in separate operational units located at: Sopic (concrete and concrete blocks), at Brajkovac and Dren (quartz stone and clay extraction). The above works have smaller environmental impacts in terms of air and water pollution, noise production and production of certain amounts of solid waste.

Extensive agricultural production and live-stock farms and agricultural product processing plants mainly do not have high adverse environmental impacts. Application of agricultural chemicals might be an exception (artificial fertilisers and pesticides) on larger areas, as well as liquid and solid waste from dairies and slaughterhouses, which have impacts on water pollution.

Harmful impacts of the regional road (Ibarska Magistrala) and railway traffic (Belgrade – Bar railway) in the Plan areas might be numerous; however they have neither been analysed nor quantified in any of the previous studies. Nevertheless, it may be said that impacts are possible in the zones along state roads at the distance (on both sides of road axis) of 180 m and along the railway up to 150 m.

All urban settlements of this area are characterised by the presence of diffuse pollution sources dispersed around the city territory, such as households, local traffic, trade, craftsmanship, etc. Other local environmental problems area related to environmental pollution with municipal waste waters, municipal solid waste and to a lesser extent noise and air pollution from small local sources. The main problem is insufficient construction level of water supply and sewage networks. In urban and suburban areas some 63% of the households are connected to the sewage systems, while other households use septic tanks. Due to low quality of septic tanks, ground waters are polluted especially in Veliki Crljeni, Sopic and Vreoci where ground water level is high. Used waters are led via sewage system to the watercourses, mainly without adequate treatment. Consequently, on river Lukavica there are 7 sewage discharges, 4 on river Susnjarica, 7 on river Pestan, 4 on the channel at Vreoci, 5 on river Turija with adjoining channels and 2 discharges on Krivaja brook. Municipal waste disposal is performed in Field D. The landfill is not equipped with proper infrastructure to be categorised as sanitary landfill.

2.3 Overview of Environment Pollution in the Plan Area

Systematic environmental monitoring is carried out within the Spatial Plan area on a restricted level. Under the air quality control programme at the territory of the City of Belgrade, City Healthcare Office of Belgrade only performs imission measurements of specific pollutants in Vreoci. The same institution also periodically monitors water quality in river Lukavica and Turija in Lazarevac zone. EPS has been organising periodical measurements for its own needs for many years in Veliki Crljeni and other locations due to environmental planning of thermal power system development within the construction programme of CHP Kolubara B and occasionally under the order of the Environmental Inspection. These investigations include a large number of authorised institutions: Mining Institute, Geoinstitut, ITNMS, INN Vinca, Republic Hydro-Meteorological Office, etc.

Air pollution

Discharge of flue gases from thermal power facilities potentially has large negative environmental impacts local and regional (all types of pollutants), state/international (SO₂, NO_x emission balance), and to a certain extent on the continental/global level (CO₂ emission share in global climate changes).

Having in mind that TPP Kolubara A and Heating Plant Vreoci facilities are more than 20 years old, their SO₂, CO and solid particle emissions exceed emission limit values from the Rules²⁰. High CO₂ emission values are characteristic for the existing TPP technology, which does not have an FGD plan. Unexpectedly high CO emissions are the consequence of boiler operation outside the prescribed regime, while dust emissions are the consequence of insufficient efficiency and irregular ESP operation.

However, pollutants created by these sources may be superimposed with emissions from TPPs Nikola Tesla A and B Obrenovac in the northern part under certain weather conditions. The resulting cumulative imission of pollutants on individual locations (Lazarevac, Veliki Crljeni, Vreoci, Lajkovac, Ub, Barosevac, Medosevac and along Ibarska Magistrala) might also include a significant share of other local pollution sources, such as traffic, households furnaces, industrial units, coal mining, dust dispersion on dump sites.

Table 2.3 – Overview of emission measurement results

Location	Year	Period	Institution	ILV exceedence
Vreoci	1994	3 months.	RZZZ ¹	Phenol, particulate matter
Medosevac	1996-97	1 year	Mining institute ²	Sooth, suspended substances, phenol*
Veliki Crljeni	1992-94	3 years	Geoinstitut ³	Pb and Cd in particulate matter
Veliki Crljeni	1991-93	3 years	Geoinstitut ⁴	ELV not exceeded (SO ₂ ,sooth)
Veliki Crljeni	1991-93	3 years	Geoinstitut	31.5% annual average particulate matter
Kolubara B site	1986-91	5 years	RHMZ ⁵	About 90% of samples, SO ₂ concentration lower than 1/3 ELV
Kolubara B site	1986-91	5 years	RHMZ ⁵	Mean annual imission below ELV (SO ₂ , NO _x , sooth)

* mainly during the winter period;

¹ M. Sovrilovic et al.: Midterm Environmental Protection Programme of Lazarevac Municipality, Volume VII, Book 18, Kirilo Savic Institute", Belgrade, 1998

² N. Jevtic et al.: XXVI Conference DCVS "Air Protection '98", Belgrade, 1998

³ M. Kacarevic, R. Ivankovic, XXIV Conference DCVS "Air Protection '96", Belgrade, 1996

⁴ M. Kacarevic: Impact of Thermal Power Facilities in Belgrade Zone on Air Quality, Volume II, EPS-SDITB, 1991.

⁵ Detailed Environmental Impact Assessment of CHP Kolubara B, Jaroslav Cerni Institute, 1998

Air is especially polluted in the settlement of Vreoci, which is confirmed by the results of long-term measurements and comprehensive investigations performed between 2002 and 2003²¹. Mean daily concentration of suspended substances exceed ILV on all five measurement points within the range from 14% to 82% of measurements (lowest exceedence on the measuring point Medosevac – water supply system, and the highest exceedence near the Cultural Centre at Vreoci). Sooth concentration exceeds ILV within the range from 3% to 69% of measurements on four measurement points, whereas, the highest pollution is present near the Cultural Centre. Both of these parameters are typically higher during the winter as opposed to the summer months on all measurement points. Total particulate matter indicates high exceedence of ILV on the measurement point Dry Separation and at Barska Street at Vreoci. Spatial distribution of ILV exceedence, from the highest to the lowest is as follows: Dry Separation – Barska Street – Cultural Centre – Waste Waters – Dump Site – Medosevac.

In addition to the indicated measurements, there were occasional measurements of short-term concentration of pollutants on other locations, indicating possible sporadic pollutions. Three sporadic measurements (February, May, July 1990) of three-hour SO₂ concentrations at Stublenica, Radljevo and Cvetovac demonstrated considerably lower sporadic pollution (338-551 µg/m³) only in one July day under strong western wind. On the same locations, there was also sporadic SO₂ and sooth pollution during winter months of 1989. Sporadic pollutions are created under unstable atmosphere stratification (stability class A and B) and stabile stratification in the presence of temperature inversions.

In the area of Vreoci, in addition to the extremely high pollution of the so-called classic pollutants (SO₂, NO_x, CO, sooth, suspended particles) there is also the pollution with the so-called specific pollutants such as: acrolein, phenol, formaldehyde and organic nitrogen and sulphur compounds (unpleasant odours).

²⁰ Rules on Emission Limit Values, Measurement and Record-Keeping Manner and Deadlines Official Gazette RS, № 30/97

²¹ E. Boti-Raicevic et al., Environmental Impact Analysis of EPS Facilities at the Local Council of Vreoci, EPS, 2003

Emissions of these substances come from dry separation, drying plant and PPOV. Concentrations of these substances in the area of this settlement vary considerably, with periodical high exceedence of ILV.

Moreover, on open cast mines and ash disposal sites there are also increased imissions of suspended substances and particulate matter, such as in Medosevac and Junkovac. The biggest problem is emission of flying particles and particulate matter; measurements of imission values have shown that ILV is exceeded in a large number of cases, especially in Vreoci, Veliki Crljeni and Medosevac. The presence of the following heavy metals was identified in suspended and particulate matter: nickel, chromium, cadmium, manganese, led, etc. Concentrations of nickel, chromium and manganese occasionally exceed ILV.

Water pollution

Surface and ground waters from the Plan area are exposed to intensive pollution by large concentrated polluters from REIS Kolubara complex, as well as by numerous diffuse polluters including various smaller discharges of used waste waters into recipients, followed by septic tanks not constructed in accordance with regulations and polluters from the agricultural complex.

River Kolubara water quality monitoring is performed on profiles Slovak, Beli Brod and Drazevac. Water quality on Slovak profile belongs to 2nd/3rd class, while on other two profiles to 3rd class. Measured diluted oxygen content and water load with bio-degradable organic substances on all tree profiles fall into the required 2nd class. In the period of high water level, the content of suspended substances exceeds values established by classes, with simultaneous reduction of electrical conductivity. Increased concentrations of mercury, phenol, mineral oils and other harmful substances occur on profiles Beli Brod and Drazevac.

River Pestan water quality is observed near Vreoci. Water quality mainly belongs to 2nd/3rd class. There is occasional exceedence of the content of suspended substances, phenols and iron and reduction of electrical conductivity. River Ljig near Bogovadja belongs to 3rd quality class, instead of the required 2nd class. Water quality in river Turija between 1986 and 1991 varied between the 3rd and extremely poor quality outside any category. Some disturbances have been registered in the water oxygen balance, significant pollutions with Cd, Pb, As, phenols, mineral oils, etc have also been identified. In addition to this, downstream from the ash disposal site, exceedence of sulphate, nitrate and arsenic content were identified. Unsatisfactory river Turija water quality is clearly the consequence of inadequate waste water treatment from industrial-energy complex and seepage waters from the ash disposal site. River Lukovica is degraded with waste municipal and industrial at the point of its exit from Lazarevac and it does not correspond to the prescribed 2nd class. Owing to excessive chemical and biological pollution, water quality of this river is exceeds all categories. River Kladnica water quality indicated an increased concentration of ammonia, iron and nickel, and it does not meet the anticipated 2nd class.

Ground water quality used in Tamnava and Kalenic watercourses indicate that these waters are correct in bacteriological terms, as well as according to the majority of other chemical parameters, and that maximum permitted concentrations are only exceeded in case of ammonia ions and iron. There are also occasional amounts of phenol substances²².

Measurement of ground water quality in the zone of existing ash disposal site indicates the presence of hazardous and harmful substances and a high contamination level. Increased presence of sulphates, suspended particles, arsenic and change of pH value has been identified.

Soil pollution

Data on soil pollution in the Plan area are scarce. Based on available impact analyses of individual mines and thermal power facilities (see the list of documents) it may be concluded that the highest soil pollution is caused at the pollution sources (mines, TPP Kolubara A, ash and slag disposal sites, the Heating Plant and other facilities located at Veliki Crljeni) due to direct contamination with harmful particles, waste waters and waste gases. Previous investigations have indicated MPC exceedence in case of arsenic and phenol, while heavy metal content (Cu, Zn, Cr, Pb, Ni, Hg) is mostly below MPC but higher than the natural composition of soil. The most affected zones are located at the distance from 250 to 500 m from the pollution source. Secondary contamination is created under unfavourable weather conditions by gas and flying particle sedimentation even on greater distances, covering Junkovac, Medosevac and one part of Kalenic in addition to Vreoci and Veliki Crljeni. Soil acidity varies (from poorly acid to strongly acid reactions), which may be

²² Supplementary Mining Design of Overburden Dumping at OCM Tamnava West Field, with Ash and Slag Diposal Cassettes from CHP Kolubara B: Technical Design of Ground and Surface Water Protection in Ash and Slag Disposal Site Zone, Jaroslav Cerni Institute, 1999

connected to the different sediment of acid gases on different distances from their sources. In addition to this, there is occasional increase of lead and cadmium concentrations in particulate matter, whose contamination density in soil exceeds ELV. The above data point out to soil contamination problems; however, without further investigations it is not possible to make definitive conclusions about soil pollution in the Plan area.

Deterioration of soil quality on overburden dumps is created due to non-selective material dumping, consequently leading to the creation of deposol in the surface layer representing a mosaic of basic materials from the geological profile above the coal seam. Deposol has reduced top soil content, lower content of nitrogen and phosphorus, as well as a high content of Ca and Mg, reducing the production capacity of soil. On the other hand, pH value and microbiological characteristics are suitable for plant growth, while metals and toxic substance do not hinder plant development (G. Drazic, INEP, Zemun, 2000).

Other environmental quality elements

Noise and vibration levels in potentially affected settlements are not measured systematically. Dedicated measurements in operational units of Kolubara-Prerada and unloading stations at Barosevac have indicated that the noise level of these sources exceeds norms. In Vreoci there is also intensive noise coming from the freight traffic. Noise sources are also present in operational units of the thermal power plant in Veliki Crljeni.

Radioactivity is systematically controlled in operational units of TPP Kolubara A and Kolubara-Prerada, as well as on ash and slag disposal sites. Results obtained from 1992 to date indicate an increased content of natural and artificial (Cz-134, Cz -137 and Be-6) radionuclide in ash and slag. However, it was concluded that they do neither pollute the environment nor the population. The level in which the population is affected by radioactive lighting arresters and fire alarms is not known.

Management of municipal, industrial and hazardous waste in the Plan area is not on a satisfactory level, both in terms of the collection systems and disposal systems. Municipal solid waste from Lazarevac, Lajkovac and Mionica is disposal in the residual pit created by coal mining in Barosevac, neither having adequate infrastructure nor meeting corresponding sanitary standards.

2.4 Overview of the State of Protected Natural Assets, Biodiversity and Landscape

Protected natural assets within the Plan area include two registered natural assets with established spatial boundaries:

1. Memorial natural monument 'Sopicanski Lug' established in 1965 after the treed of Raywood Ash (*Fraxinus oxycarpa*) were protected by the state in the broader area of 0.3917ha. In accordance with the Law on Environment Protection, this memorial natural monument may be declared as the natural monument and categorised as an important natural asset.
2. Memorial natural monument 'Vrapce Brdo' established in 1983 due to historical importance of this place on Dimitrije Tucovic was killed on the Battle of Kolubara 1914, as well as due to the need to preserve natural features and authentic traces of heavy fights and adequate development of this battlefield. Nowadays, the protected area and immediate surroundings of the monument are neglected. A repeated assessment should be made to establish whether the status of the area of 'Vrapce Brdo' should be renewed or deleted from the Register of Protected Natural Assets.

The Plan area covers some 45 representatives of animal life proclaimed by the Government of Serbia as natural rarities, representing protected natural assets at the Republic territory. Protected animal species include:

- All species of bats (Chiroptera) and their habitats: towers, bell towers, abandoned buildings, hollow trees, etc;
- Other mammals – shrew mouse, dormouse, hedgehog, small weasel, otter;
- Over twenty species of birds - serin, red-backed shrike, stonechat, common stonechat, ciril Bunting, falcon hobby, tawny owl, hoopoe, woodpecker, hawk, bunting, quail, snipe imperial, sandpiper blindworm, crane, black woodpecker, owl, wild lark, garden bunting, etc);
- Some ten species of amphibians and reptiles - forest lizard, lizard, terrapin, snake, toad, marsh frog and Greek frog; and
- Wood ant (*Formicarufa* L.) and its anthills.

The Law on Environment Protection also protects the habitats of the above species. Their type and size are uneven and owing to their disperse allocation their spatial identification may not be precisely performed. Out of 220 plant species identified as natural rarities, the Spatial Plan area does not include the habitat of any of them.

Orographic, climatic and human impacts had the greatest influence on vegetation development in the Plan area. Plant cover related to the category of arable land is dominant within this area (with over 70% of the entire area). In addition to agricultural crops, there are also the following vegetation types: marsh vegetation, lowland meadows, meadows and pastures on more hilly terrain and smaller areas covered with forest vegetation. Marsh vegetation is related to old and abandoned riverbeds and cut off river meanders. It covers low, flat terrains along Kolubara, Tamnava, Ub and their tributaries, flooded during high water levels. Vegetation of moorland and marshes with reed and cattail occurs in areas of this type. Cattail (*Facia* with *Typha angustifolia*) is usually located in pits filled with water, almost during the entire year. Marshy meadows (*Deschampsia caespitosa*) are also located in this area. Lowland meadows (*Arrhenatherion elatioris*) are located in parts of various valleys exposed to occasional flooding. They belong to secondary groups with habitats of oak and hornbeam.

Meadows and pastures on hilly terrains are outside the impact of floods and they develop in the conditions of normal humidity. Grass vegetation is represented with several meadow phytocenoses, consisting of species growing very well under the current conditions.

Over 100 species of autochthonous plants (from 37 genera and 32 families) were discovered on overburden dumps.

Forest vegetation previously covered large areas. Nowadays, there are some 2982ha of forest in the Plan area (5.4% of total area), of which 761ha were planted on reclaimed overburden dumps. Other forest areas represent offsets of oak forests, with altered composition compared to the natural potential and fragmented on a large number of smaller privately owned lots. There are over ten forest phytocenoses of floristic composition: white willow, bay oak, sessile oak and hornbeam, sessile oak and hornbeam with linden trees, sessile oak and elm trees with broom, oak and hornbeam with Italian oak, sub-mountainous beech forest of Italian oak and Adriatic oak, Italian oak, oak with moss, white lime stands. Larger forest areas are located along the southern periphery in the area of Zeoke. Forest stands planted on deposol contain black pine (*Pinus nigra*) and white pine (*Pinus alba*), as well as mixed conifer trees. There are occasional deciduous

trees (oak, elm, alder, and ash). Forests planted on dump sites are vital and spontaneously inhabited with autochthonous low forest vegetation, game and other fauna.

Along riverbanks, on more humid or marshy terrains, there are remains of alder, willow and poplar forests. Vegetation characteristics include natural lines of trees or individual trees of very large size (mainly oak), along boundaries of village farms and roads.

Apart from many species of trees and shrubs, numerous representatives of herbaceous flora inhabit forest, meadow-pasture and marshy habitats and dump sites.

Despite very low habitat variety and altered landscape and natural vegetation, animal life is highly numerous and diverse. There are 130 species of birds mostly nesting birds. In addition to usual species, in time of autumn migrations there is considerable number of wood snipes and in smaller ponds along rivers and brooks wild ducks may be found. Large number of different species of ducks, coot, little grebe, etc gather around the artificial lake at the Paljuvi village and nest there. Kolubara Mining Basin does not have area included into the list of bird habitats of international importance (IBA – Important Bird Areas). There are about 35 species of mammals. The most numerous rodents include bats, followed by beasts and insectivores. Game includes rabbits, roe, fox, pheasant, and field partridge. Herpetofauna is represented with some fifteen species of amphibians and ten species of reptiles. There are some 15 species of fish, mostly cyprinid species.

Basic landscape characteristics in Kolubara Mining Basin are plains (terraces) and river valleys. Lower Kolubara valley is asymmetric – right slopes are higher and steeper, while left ones have smaller slopes and distinct and flat plateaus. Meandering lower flow of river Kolubara has formed a wide alluvial plane which dominates over the area, with the surrounding terrain gradually lowering down in the form of terraces. Terrace height is small, ranging from 110 to 500mASL.

Areas belonging to Lazarevac and Lajkovac municipalities have very valuable landscape features owing to the ratio of arable land, orchards, meadows and pastures, while intensive agricultural production is dominant in the areas belonging to Ub and Obrenovac municipalities (corn and wheat). There are also some smaller forest areas and remains of the former vine country.

2.5 State of Cultural Heritage

Previous investigations have demonstrated that numerous important cultural monuments are located in the Kolubara Mining Basin, together with historical artefacts. This area is characterised by alteration of different cultures, starting from 6.000 years BC, through the middle and younger neolith, middle ages and newer history. There are more significant findings from the metal age, as well as from the period of Roman conquests of this area, as well as material remains of Byzantine and Serbian medieval culture. This area is also historically important as the battlefield of large conflicts in the period of Turkish rule and during Serbian Uprisings. Interesting buildings with elements of traditional architecture (old houses, taverns and halfway houses, mainly from 19th century), several churches from 19th and 20th centuries are also present in this area.

Cultural assets in the area of Kolubara region may be classified into three groups:

- Archaeological sites (over forty),
- Sacral architectural monuments (fifteen), and
- National architecture monuments (thirty).

Table 2.4 – Cultural monuments according to municipalities

Municipality	Archaeological sites	Sacral monuments	National architecture monuments
Lazarevac	"Selište", Šopić – neolith settlement	Baroševac, church dedicated to the Shroud of the Virgin Mary, 1851.	Village Prkosava: -old house - old hamlet
	"Ulica", Šopić – remains from the roman period	Baroševac, foundations of a wooden church	Village Rudovci: two old houses
	"Velinovac", Vreoci – church remains	Vreoci, church dedicated to the Shroud of the Virgin Mary	Vreoci, wooden church within the new church complex
	"Livade", Vreoci – pottery	Junkovac, Holy Trinity church	Village Leskovica, three houses from the 19 th century
	"Staro selo", Cvetovac – gravestones, former village	Lazarevac, St. Dimitrije's Church	Village Zaoke, house, 19 th century
	"Srpsko groblje", Cvetovac	Leskovac, St. Dimitrije's Church	Village Strmovno, two houses and a hamlet
	"Mađarsko groblje", V. Crljeni	Petka, St. Paraskeva's church	Village Miroslajci, dairy farm
	"Mađarsko groblje", ušće Bistričke reke u Peštan	Šopić, St. Archangel Gabriel church	Village Junkovac, two old houses
	"Petkovača", Mali Crljeni – Hungarian cemetery		Arapovac, kačara
	"Crkvine", Rudovci – church foundations		Baroševac, old municipal house
	"Kraljevac", between Bistricka Reka and Peštan - Bistričke reke i Peštana – earth tumulus		Vreoci, Miletić family house
	"Staro selo", Sakulje – Roman villa foundations		Petka, old primary school complex
	"Somalsko groblje", Junkovac - destroyed		Strmovno, hamlet
	"Manastirine", Arapovac		
	"Brekinje", Vrbovno		
	"Ravnica", village cemetery		
	"Prluša", Leskovac – small cemetery		
	"Staro mađarsko groblje", Prkosava		
Lajkovac	"Crkvine", Mali Borak – neolith, mediaeval necropolis	Skobalj, church	House in Lajkovac
	"Seosko groblje", Mali Borak – so-called Roman rocks	Jabučje, church	Jelića watermill, Kolubara river (First Serbian Uprising)
	"Kamalj", Skobalj – Roman necropolis	Lajkovac, church	Village Nepričava, house, 19 th century
	"Crkvine - Bare", Skobalj – Roman villa	Radljevo, church	Selo Mali Borak, Radić house, 19 th century
	"Manastirine", Skobalj – within open cast mine	Čelije, St. Gorge's church	Selo Mali Borak, Mihajlović house, 19 th century
	"Donji kaj", Skobalj – middle ages		
	"Popovac", Skobalj – Roman villa		
	"Stari rudnik", Skobalj		
Lajkovac	"Jaričište", Mali Borak – multilayer site		
	"Majske njive", Mali Borak		
	"Selo", D. Jabučje		
	"Ostenjak", D. Jabučje - graves		
	"Dabinovac", D. Jabučje – smaller Roman settlement		
	"Brelež", M. Borak – multilayer site		
	"Ušće", Čelije – late ancient castrum		
	"Zovljik", Jabučje		
	"Kod groblja", Mali Borak		

	"Ilića brdo - quarry", Nepričava		
	"Vingradine", Skobalj		
	"Đurđevića brdo", Skobalj		
	"Pristanište", Skobalj		
Ub	"Pljoštanica", Radljevo – Vinca age	Church dedicated to the Shroud of the Virgin Mary, on foundations of a wooden church	Old "Mehana", Murgaš
	"Mađarsko groblje - Popovac", Liso Polje, part of Roman settlement		Village Lončanik, house, 19 th century
	"Lončanik", Lončanik, remains of Roman settlement and cemetery		Village Lončanik, house, 19 th century
			Village Kalenić, 2 house, 19 th century
			Town of Ub, 2 houses and a school
Obrenovac		Village Konatice, church dedicated to St. Thomas the Apostle	Village Konatice, old school
		Village Piroman, church dedicated to St. Thomas the Apostle	

2.6 Environmental Issues considered in the Plan

The Spatial Plan considers numerous facilities which may have environmental impact, existing and planned open cast mines, overburden dumps and ash and slag disposal area, TPP Kolubara A and TPP Kolubara B network, road for external and internal transport, water supply systems, locations of technological and waste water facilities, degraded land reclamation areas, relocation sites for settlements, infrastructural and other facilities from the lignite mining zone and the area of direct environmental impact of mining-energy system. Facilities of the mining-energy complex, including auxiliary industries have special importance within the Plan area in terms of environmental impact assessment out of numerous constructed industrial and infrastructure facilities in the area. These facilities may have considerable environmental quality impact and they are subject to mandatory environmental impact assessment pursuant to Article 30 of the Law on Environmental Impact Assessment ('Official Gazette RS', № 135/2004).

The Plan contains detailed analysis of main environmental degradation sources, as well as the effects of their impact on environmental segments, as follows:

- Air quality
- Global climate change
- Water quality
- Hydro-geology
- Soil degradation and quality
- Areal characteristics
- Natural habitats and biodiversity
- Protected natural assets
- Noise and vibrations
- Radioactivity
- Waste management

After preliminary environment impact assessment of individual facilities and identification of their importance, issues and problems strategically important for environment protection have been identified, together with the ones not of strategic importance which will be analysed on lower planning and impact assessment levels.

2.7 Reasons for Exclusion of Certain Issues and Problems from the Assessment Procedure

Based on preliminary evaluation results of possible environmental impacts of planning solutions (according to the *Strategic Assessment Development Programme*, Republic Spatial Planning Agency, 2006), certain number of possible impacts do not have strategic importance neither according to their intensity nor spatial scale, whereby, they will be omitted from the Report on the Strategic Environmental Impact Assessment. These impacts include the following:

- Noise and vibrations,
- Radioactivity,
- Ionising radiation,

- Risk of technical hazards,
- Risk of natural disasters, and
- Industrial development.

In addition to the mining-energy complex, the Plan area also includes significant traffic infrastructure, several developed urban centres, as well as a certain number of smaller industrial organisations. The Plan area is cut through by significant road and railway connections: state roads M-22 (Ibarska Magistrala) and M-4 (Valjevo-Lazarevac-Arandjelovac), railway Belgrade – Bar, as well as a large number of regional and local roads and networks of local industrial railways. Possible harmful impacts of road and railway traffic in the Plan area may be numerous, however, they have not been analysed and quantified so far under the previous studies, therefore, they will not be analysed under the strategic impact assessment of the subject Spatial Plan. Future motorway leading towards Montenegro, whose route is planned in the peripheral zone of the lignite mining area will have environmental impacts much higher than the existing road network, and their impacts will be qualified under the Strategic Impact Assessment and the Spatial Plan of the motorway whose development is in progress.

The Plan area is dominated by villages, as well as settlements of the city character considered as municipal centres such as Lazarevac, Lajkovac and Ub. In addition, certain zoning level was achieved in Vreoci and Veliki Creljni containing production units of the thermal power plant and ancillary units. Possible environmental impacts of the settlements are not the subject of this Strategic Impact Assessment, but zoning plans.

Relatively modest industrial production capacities are installed in Lazarevac, Sopic, Lajkovac and Ub (manufacture of construction materials, metal and plastic parts, chemical products, textile production, etc). Agricultural production is mostly present on individual farms, characterised by smaller productions, low level of agricultural measures, etc. The only important public agricultural organisation is the Agricultural Cooperative *Lajkovac*. This cooperative includes a dairy, cold storage, plum drying facility, animal feed factory and a greenhouse in Sopic. Food industry *Tamnavac* from Ub consists of a mill, silo, slaughterhouse, dairy and children's food factory.

Based on executed preliminary impact assessments of individual operational units, it may be concluded that none of them has any significant environmental impact. Agricultural production impact is estimated as low, on local level, primarily due to the impact of agricultural chemicals (artificial fertilisers and pesticides) on soil and water contamination.

3. GENERAL AND SPECIAL OBJECTIVES OF THE STRATEGIC ASSESSESSMENT AND SELECTION OF INDICATORS

Legal basis (Article 14 of the Law):

General and specific objectives of the strategic assessment shall be defined on the basis of requests and objectives related to environmental protection in other plans and programmes, environmental protection objectives set at the Republic and international levels, data collected on the status of the environment and significant questions, problems and proposals related to environmental protection in plans or programmes. Based on the defined objectives, selection of corresponding indicators is performed to be used in the development of the strategic impact assessment.

3.1 General Environment Protection and Sustainable Development Objectives of the Spatial Plan Area

General objectives of the strategic assessment are defined on the basis of requirements and objectives in terms of environment protection from other plans and programmes, environmental objectives established on the Republic level (indicated in Section 1.3 of this Report) and environmental objectives defined in the international documents, such as *Conclusions of the World Summit on Sustainable Development* (Johannesburg 2002), *Environment for Europe* (Kiev 2003) and numerous conventions on environment protection signed by our country,

Table 3.1 – Environment protection, general and special objectives of the strategic assessment

№	GENERAL AND SPECIAL OBJECTIVES OF THE STRATEGIC ASSESSMENT
	Air quality management
1	Reduction of population exposure to polluted air
	Climate changes
2	Mitigation of GHG impact
	Water management
3	Preservation of amounts and improvement of surface and ground water quality
	Soil protection and use
4	Mitigation of the negative impact on arable agricultural land and forest land
	Waste management
5	Improvement of treatment and disposal of industrial and municipal waste
	Preservation of natural assets and biodiversity and landscape improvement
6	Preservation of biodiversity and natural assets, landscape improvement
	Protection of cultural assets
7	Preservation of protected and un-protected cultural assets
	Settlements, population
8	Mitigation of negative development impact on demography and settlements
	Health
9	Protection and improvement of health
	Environmental management system
10	Improvement of environmental management system
	Economic development of areas
11	Stimulation of economic development and employment
	Infrastructural systems
12	Mitigation of negative development impacts on traffic and water management infrastructure

3.2 Special Objectives and Selection of Indicators

Special objectives of the strategic assessment include the elaboration of general objectives. These objectives are defined on the basis of considered issues and problems related to environment protection on the national, regional and local level, as well as on the basis of collected environmental data and significant issues, problems and proposal in terms of environment protection in the Plan area. Indicator have been defined for each of the special objectives of the strategic assessment based on considerations of this problem under the scientific project TP 6501A (IAUS-EPS)²³.

²³ SCIENTIFIC PROJECT - TP 6501 A, Methods for starategic environmental assessment in the planning of the spatial development of lignite basins (Iterm Report for the First Investigation Year), Belgrade, January 2006

Table 3.2 – Special objectives of the Strategic Assessment and indicators

	Special Strategic Assessment objectives	Indicators
1	Reduction of population exposure to polluted air	
1.1	Reduction of air emission of harmful substances	Emission of dust, SO ₂ and NO _x
1.2	Reduction of population exposure to polluted air	Number of days with ILV exceedence for sooth, SO ₂ and NO ₂ Air quality indices
2	Mitigation of GHG impact	Change of carbon-dioxide emission and absorption (%)
3	Preservation of amounts and improvement of surface and ground water quality	
3.1	Mitigation of negative mining impact on hydrological regime and ground water quality	Change of ground water regime Change of ground water quality (% positive samples)
3.2	Mitigation of negative mining impact on hydrological regime and surface water quality	Change of surface water regime Change of watercourse quality class (% in the prescribed class)
4	Mitigation of the negative impact on arable agricultural land and forest land	
4.1	Preservation of arable agricultural land	Change of arable land area (%)
4.2	Increase areas under forests	Change of forest land areas (%)
5	Improvement of treatment and disposal of industrial and municipal waste	
5.1	Reduction of industrial waste amount disposed	% of industrial waste recycled
5.2	Reduction of municipal waste amount disposed	% of municipal waste disposed to the landfill
6	Preservation of biodiversity and natural assets, landscape improvement	
6.1	Preservation of biodiversity – avoidance of irrecoverable losses	% of lost species compared to the region
6.2	Avoidance of impacts on protected and significant natural assets	Area of protected and significant natural assets (%)
6.3	Reclamation of open cast mines and dump sites	% of reclaimed areas
7	Preservation of protected and un-protected cultural assets	Number and importance of affected cultural assets
8	Mitigation of negative development impact on demography and settlements	
8.1	Preservation of the number and structure of population	Change in the number and structure of population (%) Number of households for relocation according to settlements
8.2	Mitigation of impact on settlements and facilities	Number of facilities anticipated for demolition according to settlements
9	Protection and improvement of health	Mortality of children up to 5 years of age (%) Frequency of respiratory illnesses (%) % of inhabitants exposed to increased noise levels Number of doctors per 1000 inhabitants
10	Improvement of environmental management system	% of the budget intended for environment protection out of total investments Number of citizen complaints caused by environmental problems Number of environmental reports available to the public
11	Stimulation of economic development and employment	% of households with income above RS average % of employees out of population able to work
12	Mitigation of negative development impacts on traffic and water management infrastructure	
12.1	Minimisation of road network impacts	Length of roads intended for demolition according to sections (km) Length of relocated roads according to sections (km)
12.2	Minimisation of watercourse impacts	Number of destroyed watercourses according to rivers (km) Length of relocated watercourses according to rivers (km)

4. ASSESSMENT OF POTENTIAL IMPACTS AND MEASURES FOR NEGATIVE IMPACT REDUCTION

Legal basis (Article 15 of the Law):

The assessment of potential impact of plans and programmes on the Environment shall consist of the following elements:

- the outline of the assessed impact of alternative solutions of plans and Programmes that are favourable from the aspect of environmental, Protection, with the description of measures aimed at preventing and limiting of adverse or increase of positive effects on the environment;
- the comparison of alternative solutions and the outline of reasons for Selection of the most favourable alternative solution;
- the outline of the assessed impact of plans and programmes on the Environment with the description of measures aimed at preventing and limiting the adverse or increasing of positive effects on the environment;
- The way in which the environmental elements have been taken into consideration in the impact assessment, including the data on: air, water, soil, climate, ionizing and non-ionizing radiation, noise and vibrations, flora and fauna, habitats and bio-diversity, protected natural resources, population,
- human health, cities and other settlements, cultural-historic heritage, infrastructure, industrial and other structures or other man-made values;
- The ways in which the following impact characteristics have been taken into account: probability, intensity, complexity/reversibility, time dimension (duration, frequency, reversibility), spatial dimension (location, geographical area, size of the exposed population, trans-boundary nature of impact), cumulative and synergistic nature of impact.

4.1 Assessment of Environmental Effects of Planned Development Variants

- 1) Scenario 'A' – in case the plan is implemented
- 2) Scenario 'B' – in case the plan is not implemented

Meaning of symbols:

-  Completely positive impact;
-  Completely negative impact;
- 0** No direct impact or unclear impact

Table 4.1 – Impact assessment compared to the strategic impact assessment objectives in case the plan is not implemented (Scenario ‘A’)

Strategic Assessment Objectives

1	Reduction of population exposure to polluted air	7	Preservation of protected and un-protected cultural assets
2	Mitigation of GHG impact	8	Mitigation of negative development impact on demography and settlements
3	Preservation of amounts and improvement of surface and ground water quality	9	Protection and improvement of health
4	Mitigation of the negative impact on arable agricultural land and forest land	10	Improvement of environmental management system
5	Improvement of treatment and disposal of industrial and municipal waste	11	Stimulation of economic development and employment rate
6	Preservation of biodiversity and natural assets, landscape improvement	12	Mitigation of negative development impacts on traffic and water management infrastructure

Plan sector	Development trend scenario	Strategic Impact Assessment objectives											
		1	2	3	4	5	6	7	8	9	10	11	12
<i>Mining</i>	Anticipated mining of open cast mines in the period between 2005 and 2020 is as follows: Tamnava-East Field, Field D, Fields B and C. Field B was expanded to one part of geological area of Field C and Tamnava-West Field.	-	0	-	-	0	-	-	-	-	-	-	-
<i>Energy</i>	Rehabilitation and reconstruction of individual units at TPP Kolubara A with operation life extension of individual units up to 2014. Certain amounts of CO ₂ , CO, SO ₂ , NO _x ash and steam are released during lignite combustion. Drying Plan and Heating Plant in Vreoci represent significant air, soil and water pollution sources. Possible technical solutions are proposed. Unclear whether the existing unsatisfactory state will change within the Planning period.	-	-	-	-	-	-	0	0	-	-	-	0
<i>Water management</i>	Current capacity of all 10 existing water supply systems is about 440 l/s of exclusively ground waters, not meeting the needs. The key problem of these systems is that they use springs in basic, floor aquifers, under considerable impact of works on current and/or future mines. The most important systems <i>Nepricava</i> , <i>Pestan</i> and <i>Kalenic</i> .	0	0	-	0	0	0	0	0	-	0	0	-
<i>Agriculture</i>	Planning area has about 41652ha of agricultural land, which is 76% of the total area. Agricultural land will reduce for another 432ha due to mine expansion by 2010.	0	0	0	-	0	0	0	-	0	0	-	0
<i>Forestry</i>	Planning area has 3100ha of forests, making 5.7% of the total area. 864ha are mainly under forests planted on overburden dumps, and partially ash disposal sites (35ha). More intensive reclamation is not expected in future.	0	0	0	-	0	0	0	0	0	0	0	0
<i>Economy (without mining and energy)</i>	Some 54.2% percent of workers are employed in the industrial sector, of which 58.7% within the mining-energy complex. Other industrial sectors include: mechanical engineering, manufacture of electrical machines and devices, food processing complex, textile, wood processing industries, manufacture and process of leather and rubber, construction material industry, production and processing on non-metals.	-	0	-	0	-	0	0	-	-	0	-	0
<i>Population</i>	Basic characteristics of changes in the population level include: intensive population growth in urban settlements and suburban areas; decrease of population in villages, especially along municipal periphery. The majority of villages is characterised by depopulation, while 10 settlements characterised by depopulation are located within the zone of mining operations.	0	0	-	-	-	0	0	0	-	0	0	0

Plan sector	Development trend scenario	Strategic Impact Assessment objectives											
		1	2	3	4	5	6	7	8	9	10	11	12
Network of settlements	a) Primary municipal centres: Lazarevac, Lajkovac and Ub												
	b) Secondary municipal centres: Vreoci and Veliki Crljeni	-	0	-	0	-	0	0	-	0	0	-	0
	c) Centres of the group of settlements: Jabucje (Lajkovac); Radljevo (Ub); Junkovac, Stepojevac, Barosevac-Rudovci (Lazarevac)												
Social development	All settlements except Lazarevac lack services essential for social and cultural development of one area, such as services in the field of health, education, culture, finances, business operations, etc.	0	0	0	0	0	0	0	-	-	0	0	0
Relocation of settlements	In the previous period, the total of 1614 households has been resettled from the mine zones. Some settlements were almost entirely resettled (Sakulje, Cvetovac, Kalenic), others partially. The majority of households were resettled individually, while a smaller part in groups to previously developed locations. This trend will be continued based on mine advancement schedule.	+	0	0	-	0	0	-	-	+	0	0	0
Traffic	Average network density of categorised roads is 0.60 km/km ² , 10% more than the Republic average. Development perspective of the settlement network and development of new mines limit further development of traffic infrastructure	-	0	0	0	0	0	0	0	-	-	0	-
Telecommunications	Total number of installed phone connections within the region in 2000 is 25.944, of which 18.869 are taken, while the remaining number is in construction and reconstruction phases together with the installation of optical cables.	0	0	0	0	0	0	0	0	0	0	+	0
Environment protection	Current environmental state is the consequence of insufficient care in the previous period in terms of: applied technologies, environmental regulations and environmental protection and monitoring. Existing energy and industrial technologies are outdated and without corresponding environmental protection devices. Improvements of these aspects are expected within EPS and municipalities.	-	-	-	0	-	-	0	0	-	-	0	0
Reclamation of degraded areas	Restrictions occurring in this field are manifold; however, the main problem is long-term delay in implementation of both biological and technical reclamation of overburden bumps and efficient rehabilitation of ash and slag disposal sites, as well as long-term economic difficulties in PE EPS business operations. Improvement is possible through corresponding electricity price.	0	0	-	-	0	-	0	0	-	0	0	0
Nature preservation	Lack of protection and maintenance of existing, previously identified natural assets and resolution of their further legal status and protection model, i.e. adoption of new acts on the protection of these assets. Lack of corresponding public use and presentation of existing and future protected natural assets.	0	0	0	0	0	-	0	0	0	0	0	0
Protection of cultural assets	Large number of folk architecture monuments has been identified and a project developed for their dislocation, municipalities need to agree on whose territory the project should be implemented, while in the mean time these monuments are deteriorating. Archaeological sites will be analysed together with the Republic Office for the Protection of Cultural Monuments.	0	0	0	0	0	0	-	0	0	0	0	0

Table 4.2 – Impact assessment compared to the strategic impact assessment objectives under the plan implementation variant (Scenario ‘B’)

Strategic Assessment Objectives

1	Reduction of population exposure to polluted air	7	Preservation of protected and un-protected cultural assets
2	Mitigation of GHG impact	8	Mitigation of negative development impact on demography and settlements
3	Preservation of amounts and improvement of surface and ground water quality	9	Protection and improvement of health
4	Mitigation of the negative impact on arable agricultural land and forest land	10	Improvement of environmental management system
5	Improvement of treatment and disposal of industrial and municipal waste	11	Stimulation of economic development and employment rate
6	Preservation of biodiversity and natural assets, landscape improvement	12	Mitigation of negative development impacts on traffic and water management infrastructure

Plan sector	Development trend scenario	Strategic Impact Assessment objectives											
		1	2	3	4	5	6	7	8	9	10	11	12
<i>Mining</i>	Planned annual coal production growth from 27x10 ⁶ t (2005) to 35x10 ⁶ t (2012-2020). In addition to existing mines (Tamnava-East Field, Field D, Field B and C, Tamnava-West Field), new mines: Veliki Crljeni, Radljevo, expansion of Field D, Field E and South Field.	-	0	-	-	0	-	-	-	0	+	+	-
<i>Energy</i>	Rehabilitation and reconstruction of individual units at TPP Kolubara A, the Heating Plant and the Drying Plant. The first unit of TPP Kolubara B will be commissioned in the end of 2010, the second one by the end of 2011. Main technological system consists of the boiler and turbine plants. Electrostatic precipitators and desulphurisation plant are anticipated for flue gas treatment. Ash and slag transport in the form of thick slurry, disposed to the watertight disposal site. Waste waters are partially returned into the process, while the remaining amount is treated in the treatment plant. Hot water cooling is carried out by means of cooling towers. Regional municipal waste landfill will be built.	-	-	0	0	+	0	0	0	-	+	+	0
<i>Water Management</i>	Water supply of population, in addition to existing local springs, supply from the Regional Kolubara system anticipated. Springs will be protected by technical-technological measures against contamination from mines and TPPs, through the construction of water treatment plants. Regulation and relocation of Kolubara and its tributaries is planned in phases, based on advancement of mining operations.	0	0	+	+	0	+	0	0	+	0	+	0
<i>Agriculture</i>	Reduction from 41652ha in 2005 to 38561ha in 2020 is planned within the Plan area, i.e. for 3091ha (7.5%). The share of Lazarevac municipality is 1415ha, Obrenovac municipality 598ha and Ub municipality 988ha. Within the Plan area, advantage is given to forest rather than to agricultural reclamation.	0	0	0	-	0	0	0	0	0	0	0	0
<i>Forestry</i>	Increase of areas under forests is planned through reclamation by means of forestation (934ha), while smaller areas will be turned into arable land, mainly of the 5 th quality class. Implementation of the indicated forestation plan, areas under forest will be increased from the current 3100ha to 4124ha.	0	0	0	+	0	+	0	0	0	0	0	0
<i>Economy (without mining and energy)</i>	Priority of the strategic development of the local economy is diversification of economic structures towards overcoming REIS domination and existing underdevelopment of SME sector. Strengthening of existing economic-industrial zone and opening	0	0	0	0	+	0	0	+	0	0	+	0

Plan sector	Development trend scenario	Strategic Impact Assessment objectives											
		1	2	3	4	5	6	7	8	9	10	11	12
	of new sites is anticipated.												
<i>Population</i>	It is anticipated that migrations between villages and cities will slow down; however, resettlements caused by mine expansion will be intensified in the future. Changes in the household structure will retain the trend of reduction in the number of members.	0	0	0	-	0	0	0	0	0	0	0	0
<i>Network of settlements</i>	In the network of settlements, Lazarevac will still be dominant. In Lazarevac zone (Veliki Crljeni, Vreoci), as well as in the central towns of Lajkovac, Obrenovac and Ub municipalities, the level of municipal infrastructure should be significantly increased (water supply and waste water channelling, local and regional roads).	0	0	0	0	0	0	0	-	+	0	+	0
<i>Social development</i>	Basic activities on the strengthening and improvement of public service quality are mainly related to the change in organisation and manner of operation of public services as well as stimulation of private initiative in this sector.	0	0	0	0	0	0	0	0	+	0	0	0
<i>Relocation of settlements</i>	Perspective expansion of the mining-energy complex will cause the resettlement of about 1 900 households with the total of 5 670 inhabitants. The largest number of households planned for resettlement by 2020 is located in the area of CM Vreoci (1030), Zeoke (267), Mali Borak (115), Medosevac (122), Radljevo (84) and Sarbane (83). Assessment of possible relocation sites (from 2008 to 2020) includes on average: 40% of households under organised resettlement into suburban or neighbouring (village) settlements or shifting inside their own areas and 60% of households under individual resettlement into other (primarily) urban areas (Ub, Lajkovac, Lazarevac, Stepojevac, Belgrade).	0	0	0	0	0	0	-	-	+	0	+	0
<i>Traffic</i>	Construction, reconstruction or dislocation of numerous road sections is planned, the following being the most important ones: Motorway construction (28 km), relocation of M-22 road section, construction of the detour around Lajkovac, cancellation of P-101a road section, cancellation of P-201 section, construction of the new section P-201 and dislocation,, reconstruction and construction of several local road sections.	0	0	0	0	+	0	0	+	0	0	+	0
<i>Telecommunications</i>	The plan is to cover with the phone network all settlements with the density of about 50 phones/100 inhabitants by 2020 (current density for the entire area is about 23 phones/100 inhabitants). By 2020, it is anticipated to increase the number of phone subscribers in every settlements with the density of 65 phones/100 inhabitants.	0	0	0	0	0	0	0	0	0	0	+	0
<i>Environment protection</i>	Planned settlement of environmental issues is conditioned by the commitment to align legal regulations with EU environmental regulations, implying the application of best available techniques. Proposed spatial-environmental differentiation of the Plan area is based on the area utilisation regimes conditioned by environmental quality.	+	-	+	0	+	0	0	0	+	+	0	0
<i>Reclamation of degraded areas</i>	Reclamation and revitalisation of about 1011ha of degraded areas is planned (83,6ha of ash disposal sites and about 927,6ha of overburden dumps), which is close to two-thirds of productive areas (1600ha) which will be occupied by mine advancement. In addition, water bodies will be formed in residual pits in the area of about 97ha (Vreoci and Cvetovac).	0	+	0	+	0	+	0	0	+	0	+	0

Plan sector	Development trend scenario	Strategic Impact Assessment objectives											
		1	2	3	4	5	6	7	8	9	10	11	12
Nature preservation	Investors and local government bodies are under obligation to identify areas and facilities of special importance in terms of bio and geo-diversity and landscape aesthetics under the procedure of detailed planning/designing performed by reference institutions.	0	0	0	0	0	+	0	0	0	0	0	0
Protection of cultural assets	Cultural assets protection plan anticipates timely identification and protection of all cultural monuments located in front of the mining operations in Kolubara Mining Basin. Archaeological excavations need to follow the schedule of mining operations, in the manner not questioning the protection of these sites.	0	0	0	0	0	0	+	0	0	0	0	0

4.2 Reasons for the Selection of the Most Favourable Variant Solution

Mining

	Positive effects	Negative effects
With plan		– Exposure of population to polluted air in the vicinity of mines – change of (lowering) of ground water table – Contamination of ground and surface waters – Occupation of agricultural and forest land – Landscape degradation – Degradation of important cultural assets – Population resettlement – Health deterioration – Increased exposure to noise in the vicinity of OCM – Reduction of agricultural employment – Relocation of traffic and water management infrastructure
Without plan	– Bigger changes for economic development and increase of employment rate – Improvement of the environment management system	– Exposure of population to polluted area in the vicinity of mines – Change of ground water table (wells drying out), destruction of some springs – Contamination of ground and surface waters – Relocation of Kolubara and its tributaries – Occupation of agricultural and forest land – Landscape deterioration – Relocation of settlements, infrastructure, migrations, change of business structure – Health deterioration – Increase of noise exposure in the vicinity of OCMs – Reduction of employment rate in agriculture and increase in mining

Energy

	Positive effects	Negative effects
Without plan		– Increased exposure to polluted air – GHG emission – Soil and water contamination – Inadequate ash and slag disposal – Biodiversity deterioration – Increased noise levels – Reduction of employment rate
With plan	– Flue gas emission from TPPs within ELV – Reduced water contamination (after WTP construction) – Improvement of waste disposal – Health protection – Reduction of population exposure to noise due to resettlement – Increase of employment rate	– Carbon-dioxide emission – Emission of sulphur-dioxide, nitrogen oxides, dust and other substances

Water management

	Positive effects	Negative effects
Without plan		– Unresolved stable and long-term water supply of some settlements – Continuation of surface and ground water contamination – Health deterioration – Unsatisfactory water management infrastructure
With plan	– Improvement of surface and ground water quality – Water quality suitable for irrigation – More favourable conditions for aquatic ecosystems and biodiversity – Healthier potable water	

Agriculture

	Positive effects	Negative effects
Without plan		– Reduction of areas for 432ha with insufficient reclamation – Change in the business structure and reduction of employment rate
With plan	– Reclamation of 20% of agricultural areas	– Reduction of areas for 2502 ha

Forestry

	Positive effects	Negative effects
Without plan		– Reduction of areas under forests, low forestation level
With plan	– Increase of areas under forests for 1290ha – Preservation of biodiversity and landscape	

Economy (without mining and energy)

	Positive effects	Negative effects
Without plan		– Contribution to the increased air pollution – Water contamination – Inadequate waste disposal and lack of recycling – Health deterioration – Stagnation of economic development and employment rate reduction
With plan	– Waste recycling – Retention of population in the centres of the network of settlements – Development of SMEs and increase of employment rate	

Population

	Positive effects	Negative effects
Without plan		– Water contamination – Occupation of agricultural land in suburban settlements – Unresolved disposal of municipal waste – Depopulation of villages
With plan		– Occupation of agricultural land in suburban settlements

Network of settlements

	Positive effects	Negative effects
Without plan		– Air pollution along larger roads (existing settlement network stimulates travel) – Water contamination (no sewage and waste water treatment) – Inadequate waste disposal – Resettlement of population – Stagnation of economic development and employment rate
With plan	– Protection and improvement of health – Stimulation of economic development and employment	– Resettlement of about 3500 inhabitants

Social development

	Positive effects	Negative effects
Without plan		– Village depopulation – Lack of health services
With plan	– Improvement of healthcare	

Relocation of settlements

	Positive effects	Negative effects
Without plan	– Relocation of population into less polluted zones with lower noise exposure	– Reduction of agricultural production – Affected cultural assets – Village depopulation
With plan	– Relocation of population into unpolluted zone	– Relocation of significant cultural assets – Village depopulation

Traffic

	Positive effects	Negative effects
Without plan		– Increased air pollution – Health deterioration – Increased noise and vibrations exposure
With plan	– Improvement of waste management – Mitigation of village depopulation – Stimulation of economic development and employment rate	

Telecommunications

	Positive effects	Negative effects
Without plan	– Stimulation of economic development and employment rate	
With plan	– Stimulation of economic development and employment rate	

Environment protection

	Positive effects	Negative effects
Without plan		– Increased air pollution – GHG emission – Water contamination – Deterioration of health, flora and fauna – Inadequate disposal of industrial and municipal waste – Increase noise and vibrations – Unsatisfactory environmental management
With plan	– Reduction of air emission of harmful substances – Preservation of surface and ground water quality – Adequate waste disposal and recycling – Health preservation – Reduction of population noise and vibrations exposure – introduction of protection and monitoring systems	

Reclamation of degraded areas

	Positive effects	Negative effects
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Without plan	-	– Contamination and reduced ground water piezometer level – Insufficient agricultural and forest reclamation – Destroyed-devastated landscape – Health deterioration
With plan	– Increase of CO₂ absorption capacity – Increase of areas under forests – Improvement of landscape and preservation of biodiversity – Health improvement – Stimulation of economic development and employment rate	-

Nature preservation

	Positive effects	Negative effects
Without plan	-	– Insufficient protection of natural assets, protected plant and animal species and landscape
With plan	– Better protection of natural assets, protected plant and animal species and landscape	

Protection of cultural assets

	Positive effects	Negative effects
Without plan	-	– Inadequate protection of significant cultural assets
With plan	– Better protection of cultural assets	– Relocation of affected cultural assets

Possible positive and negative effects of the Plan variants indicate the following:

1. If the Spatial Plan is not adopted and the development is not continued according to the previous pace, negative effects in each of the sectors might be expected, together with some positive effects achieved under ongoing programmes for population resettlement and development of telecommunications.
2. If the Spatial Plan is implemented, numerous positive effects may be expected in each of the sectors, removing the majority of negative tendencies in the development of the Plan area which would be created if the Plan is not implemented. The key positive effects include:
 - Reduction of population exposure to polluted air due to application of modern environmental technologies in new and reconstructed facilities;
 - Reconstruction of existing and construction of new waste water treatment plants;
 - Increase of forested areas, contributing to preservation of biodiversity and carbon-dioxide absorption capacity;
 - Treatment and disposal of ash, gypsum and municipal waste is greatly improved by application of modern technologies;
 - Favourable socio-economic effects are achieved through compensation and resettlement of population, together with improvement of health conditions (Map № 6);
 - Economic development and employment increase;
 - Traffic and water management infrastructures will be relocated due to mine expansion (Maps № 7 and 8);
 - Environmental protection and monitoring plan creates conditions for establishment of a coordinated environment protection system in the Plan area;

Some individual negative effects might be anticipated under this variant in certain sectors. These effects are an inevitable cost of social-economic development of this area and satisfaction of the republic energy needs. The above-indicated effects include the following:

- Due to open cast mine development, negative effects related to numerous objectives and environmental indicators of the Spatial Plan cannot be avoided, which can be mitigated by certain environmental measures or compensation,
- CO₂ emission increases due to coal combustion in TPPs;
- Occasional exceedence of emission limit values for air occurs along state roads and in industrial zone;
- Reduction of agricultural areas caused by advancement of mining operations and construction of various facilities;
- Relocation of population and demographic changes in settlements affected by mining operations;
- Impact on cultural monuments and protected natural assets (Map № 9).

Based on the above, it may be conclude that variant implying the adoption of the proposed plan is more favourable compared to no adoption variant.

4.3 Identification of Characteristics of Potential Impacts

The following text contains the evaluation of the size, spatial scale, probability, duration and total importance of the proposed (selected) plan variant, i.e. plan sectors and plan solutions including key environmental impacts, especially negative ones.

Table 4.3 – Planning solutions in the draft Plan covered by the impact assessment

Label	Planning solution
1	Mining
1.1	'Tamnava-West Field'- 156.5 million tons
1.2	'Radljevo' - 40.3 million tons
1.3	Field 'Veliki Crljeni' - 31.0 million tons
1.4	'Tamnava – South Field' - 28.0 million tons
1.5	Field 'B' – 19,9 million tons
1.6	Field 'D' - 56.6 + 65.0 million tons
1.7	Field 'E' - 55.2 million tons
1.8	Coal preparation and shipment
2	<u>Energy</u>
2.1	TPP 'Kolubara B'
2.2	Gypsum, ash and slag disposal site OCM ' Tamnava-West Field'
2.3	Switchyard 400 kV and 220 kV with transmission network 400, 220 and 110 kV
2.4	Reconstruction of TPP Kolubara 'A'
2.5	Reconstruction of the Heating Plant and Drying Plant in Vreoci
3	Water management
3.1	PPV 'Peštan' – CM Vreoci
3.2	New VS 'Zeoke' – CM Zeoke
3.3	VS 'Kalenic' – CM Kalenic
3.4	Relocation of River Kolubara 'Tamnava East Field', 'Tamnava South Field, 'V. Crljeni'
3.5	Relocation of River Kladnica - 'Tamnava West Field
3.6	Relocation of River Pestan - 'Tamnava South Field, Field 'E'
3.7	<i>Shortening of rivers Lukavica and Vranicina watercourses – Tamnava South Field</i>
4	<u>Relocation of settlements</u>
4.1	Kalenic (44 households) - 'Tamnava West Field', 'Radljevo'
4.2	Mali Borak (115 households) - 'Tamnava West Field'
4.3	Vreoci (1030 households) - 'Tamnava South Field', Field 'V. Crljeni', Field 'D'
4.4	V. Crljeni (50 households) - Field 'V. Crljeni'
4.5	Cvetovac (20 households) - Field 'V. Crljeni'
4.6	Medosevac (122 households) - Field 'D'
4.7	Barosevac (60 households) - Field 'B', Polje 'E'
4.8	Zeoke (276 households) - Field 'E'
4.9	Radljevo (84 households) – Field 'Radljevo'
4.10	Brgule (26 households) - Field 'Radljevo'
4.11	Sarbane (83 households) - Field 'Radljevo'
4.12	Sopic (8 households) - Field 'E'
5	Traffic
5.1	Relocation of M-22 road section from south-western boundary of OCM Veliki Crljeni
5.2	Cancellation of road R-101a (7,7 km), from Staro Selo to the southern boundary of OCM Tamnava West Field
5.3	Construction of detour around Lajkovac, 5.7km long
5.4	Reconstruction of local road L-1008 and L-7 (14,6 km) – CM Stublenica, Paljuvi and Jabucje
5.5	Reconstruction of one part of L-1806 road (4,7 km) – CM Lazarevac, Dren, Burovo
6	Reclamation of degraded areas

6.1	Reclamation of 908 ha of overburden dumps- Field 'V. Crljeni', 'Tamnava East Field', Field 'D', Field 'B', Field 'E'
6.2	Reclamation of 19.4 ha of ash disposal sites - CM V. Crljeni, Sokolovo, Stepojevac
7	Regional sanitary landfill
7.1	Regional sanitary landfill with the recycling plant

Criteria for impact assessment are shown in the following tables:

Table 4.4 – Criteria for impact size assessment

Impact size	Label	Description
Critical	- 3	Strong negative impact
Large	- 2	Large negative impact
Small	- 1	Small negative impact
No impact or unclear impact	0	No impact, no data or not applicable
Positive	+ 1	Small positive impact
Favourable	+ 2	Large positive impact
Very favourable	+ 3	Strong positive impact

Table 4.5 – Criteria for assessment of spatial scope of impact

Impact scope	Label	Description
Global	G	Possible global impact
State	N	Possible national impact
Regional	R	Possible regional impact
Plan area	P	Possible plan impact
Local	L	Possible impact in some zone (part) of the Plan area

Table 4.6 – Impact probability assessment scale

Probability	Label	Description
100%	W	Certain impact
More than 50%	V	Probable impact
Less than 50%	M	Possible impact
Less than 1%	N	Improbable impact

In addition to the above, additional criteria may be derived based on impact duration, i.e. effects. In this respect, the following may be defined: temporary-occasional (P) and long-term (D) effects. Impact importance is estimated based on *size (intensity) of impacts* (Table 4.4), *spatial scale* in which the impact might be realised (Table 4.5), *probability* of impact realisation (Table 4.6) and *effect duration*.

Based on the above, the following is **adopted**: Impacts of strategic importance for the Spatial Plan include the ones probable or certain having long-term, strong or larger (positive or negative) effect within the entire plan area, on the higher planning level, i.e. strong effect on critical locations, according to the criteria given in Table 4.7.

Table 4.7 – Criteria for evaluation of impact importance

Scale	Size		Label of important impacts
Regional level: R	Strong positive impact	+3	R+3
	Large positive impact	+2	R+2
	Strong negative impact	-3	R-3
	Large negative impact	-2	R-2
Plan area: P	Strong positive impact	+3	P+3
	Large positive impact	+2	P+2
	Strong negative impact	-3	P-3
	Large negative impact	-2	P-2
Local level: L	Strong positive impact	+3	L+3
	Strong negative impact	-3	L-3

Table 4.8 – Assessment of planning solutions impact size on environment and sustainable development elements*

STRATEGIC ASSESSMENT OBJECTIVES		PLANNING SOLUTIONS																																											
		1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	3.6	3.7	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	5.1	5.2	5.3	5.4	5.5	6.1	6.2	7.1			
1	Reduction of population exposure to air pollution	-1	-1	-2	-2	-1	-2	-2	-1	-1	-1	-1	0	+2	+2	0	0	0	0	0	0	0	0	+1	+2	+3	+1	+1	+2	+1	+2	+1	+1	0	+1	0	0	+1	0	0	+1	+2	-1		
2	GHG emission impact reduction	0	0	0	0	0	0	0	0	0	-1	0	0	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	
3	Preservation of amounts and improvement of ground and surface water quality	-3	-3	-2	-2	0	-3	-2	-3	0	-2	-3	0	0	+1	+1	+1	+1	+2	+2	+2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	Mitigation of negative development impacts on arable and forested land	-3	-3	-3	-3	-3	-2	-3	-3	0	0	0	0	0	0	0	0	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+3	+2	+1	
5	Improvement of industrial and municipal waste treatment and disposal	0	0	0	0	0	0	0	0	0	+2	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+3	
6	Preservation of biodiversity and natural assets, landscape improvement	-3	-3	-3	-3	-3	-2	-3	-3	0	0	-2	0	0	0	0	0	0	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+3	+2	-2

7	Preservation of protected and unprotected important cultural assets	-3	0	-3	0	0	-3	0	-3	0	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-3	-1	-1	0	0	0	-1	0	0	-1	0	0	0	0	0	0	0	0	
8	Mitigation of negative development impact on demography and settlements	-3	-3	-1	-1	-1	-3	0	-3	0	0	0	0	0	0	0	0	0	0	0	0	-3	-3	-3	-1	-2	-3	-1	-3	-3	-1	-3	-1	0	0	0	0	0	0	0	0	
9	Protection and improvement of health	-1	-1	-1	0	0	-1	0	-1	0	-1	-1	0	+1	+2	+1	+1	+1	0	0	0	0	+1	+3	+3	+2	0	+2	+1	+3	+1	0	0	+1	0	0	+2	0	0	+2	+3	+3
10	Improvement of environmental management system	+2	+1	+2	+2	+2	+1	+2	+2	+2	+3	+3	0	+3	+3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+3
11	Stimulation of economic development and employment	+1	+1	+2	+3	0	+2	+3	+1	+1	+3	+1	+1	0	0	0	0	0	+2	+2	+2	+2	+1	+3	+3	+2	0	+2	+1	+3	+1	0	0	0	+2	+1	+1	+1	+1	+1	+1	+1
12	Mitigation of negative development impact on road and water management infrastructure	-3	-3	-2	-3	-2	-3	-2	-3	0	0	0	0	0	0	0	0	0	+1	+1	+1	+1	0	0	0	0	0	0	0	0	0	0	0	0	+1	+1	0	+1	+1	0	0	0

- Assessment criteria according to Table 4.4

Table 4.9 – Assessment of the spatial scope of planning solutions impact on the environment and sustainable development elements*

STRATEGIC ASSESSMENT OBJECTIVES		PLANNING SOLUTIONS																																									
		1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.1	2.2	2.3	2.4	2.5	3.1	3.2	3.3	3.4	3.5	3.6	3.7	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	5.1	5.2	5.3	5.4	5.5	6.1	6.2	7.1	
1	Reduction of population exposure to air pollution	L	L	L	L	L	L	L	L	L	N	L		R	P									L	L	L	L	L	L		L						L			P	L	L	
2	GHG emission impact reduction										G			G	G																												G
3	Preservation of amounts and improvement of ground and surface water quality	P	L	L	L		L	L	P		R	L				L	L	L	L	R	R	R																					
4	Mitigation of negative development impacts on arable and forested land	P	P	P	P	P	P	P	P										R	R	R																				R	L	L
5	Improvement of industrial and municipal waste treatment and disposal										L	L																										L				R	
6	Preservation of biodiversity and natural assets, landscape improvement	L	L	L	L	L	L	L	L			L							R	R	R																				P	L	L
7	Preservation of protected and unprotected important cultural assets	L		L			L		L															L	L	L	L	L				L				L							
8	Mitigation of negative development impact on demography and settlements	L	L	L	L	L	L		L															L	L	L	L	L	L	L	L		L	L	L	L							

9	Protection and improvement of health	L	L	L			L		L	L	L	L	L							L	L	L		L		L	L			L			L			R	L	R		
10	Improvement of environmental management system	P	L	P	P	P	P	P	P	R	L		L	L																							R			
11	Stimulation of economic development and employment	P	L	P	P		P	P	P	P	L	L					R	R	R	R		R	R	R		R		R	R				R	R	R	R	R	L	L	R
12	Mitigation of negative development impact on road and water management infrastructure	P	P	P	P	P	P	P	P									L	L	L	L											R	L		L	L				

- Assessment criteria according to Table 4.5

Table 4.10 – Identification and evaluation of strategically important environmental impacts of planning solutions

Label	Planning solution	Identification and evaluation of important impacts*		Justification
		SEIA objective label	Rank	
1	Mining			
1.1	'Tamnava – West Field' – 170.5 million tons	3	P-3W	Hydrological network will be greatly altered due to river Kladnica relocation and construction of the reservoir and the pumping station. Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer. Strong degradation of agricultural land and destruction of vegetation and habitats. Affected cultural assets. Strong impact on the settlements of Kalenic and Mali Borak, necessary resettlement of large number of households. Strong negative impact on road and water management infrastructure. Large positive impact probably provided by protection and compensation measures, as well as improvement of environmental management and monitoring.
		4	P-3W	
		6	L-3V	
		7	L-2V	
		8	L-3W	
		10	P+2V	
		12	P-3W	
1.2	Field 'Radljevo'	3	L-3W	Hydrological network will be greatly altered due to river Kladnica relocation and construction of the reservoir and the pumping station. Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer. Strong degradation of agricultural land and destruction of vegetation and habitats. Strong impact on the settlements of Radljevo, Sarbane and Kalenic, necessary resettlement of large number of households. Strong negative impact on road and water management infrastructure. Large positive impact probably provided by protection and compensation measures on water management systems.
		4	P-3W	
		6	L-2V	
		8	L-3W	
		12	P-3W	
1.3	Field 'Veliki Crljeni - 31.0 million tons	4	P-3W	Strong degradation of agricultural land and destruction of vegetation and habitats. Large negative impact of traffic infrastructure. Large positive impact on employment and improvement of environmental protection measures.
		6	L-3V	
		10	P+2V	
		11	P+2V	
		12	P-2W	

1.4	'Tamnava – South Field' – 70,5 million tons	3	P-3W	Hydrological network will considerably be altered due to dislocation of parts of Kolubara, Lukavica and Pestan watercourses. Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer. Possible changes in geo-technical soil characteristics. Strong degradation of agricultural land and destruction of vegetation and habitats. Strong negative impact on the traffic network. Probable large positive impact on environmental measures.
		4	P-3W	
		6	L-3V	
		10	P+2V	
		11	P+2V	
		12	P-3W	
1.5	Field 'B' and 'C' - 41,3 million tons	4	P-3W	Strong degradation of agricultural land and destruction of vegetation and habitats. Strong negative impact on the traffic network. Probable large positive impact on environmental measures.
		6	L-3W	
		10	P+2V	
		12	P-2W	
1.6	Field 'D' – 69,0 + 65,0 million tons	3	P-3W	Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer. Strong degradation of agricultural land and destruction of vegetation and habitats. Strongly affected cultural heritage especially the cemetery in Vreoci. Strong impact on Vreoci and Medosevac settlements and resettlement of a large number of households. Strong negative impact on traffic infrastructure. Large positive impact probably provided by new jobs, protection and compensation measures, as well as improvement of environmental management and monitoring.
		4	P-2W	
		7	L-3W	
		8	L-3W	
		10	P+2V	
		11	P+2V	
		12	P-2W	
1.7	Field 'E' – 61,5 million tons	4	P-3W	Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer. Strong degradation of agricultural land and destruction of vegetation and habitats. Strong impact on Zeoke and Barosevac settlements and resettlement of a large number of households. Strong negative impact on traffic infrastructure. Large positive impact probably provided by new jobs, protection and compensation measures, as well as improvement of environmental management and monitoring.
		6	L-3W	
		10	P+2V	
		11	P+3V	
		12	P-2V	
1.8	Field Radljevo	3	P-3W	Hydrological network will be greatly altered due to river Kladnica relocation and construction of the reservoir and the pumping station. Strong disturbance of ground water table in the broader area caused by aquifer dewatering. Possible infiltration of pollutants caused by removal of insulation layers covering the aquifer.
		4	P-3W	

		6	L-3V	
		7	L-2V	
		8	L-3W	
		10	P+2V	
		12	P-3W	
1.9	Coal preparation and shipment	-	-	
2	Energy			
2.1	TPP 'Kolubara B'	3	R-2M	Large negative impact on surface water table due to cooling water capture from river Kolubara in the amount of 30.800 m ³ /h. Possible larger water contamination in case of failures on waste water treatment systems. It is certain that technological solutions will provide high environment protection level and that TPP construction will greatly contribute to the rise in employment levels and development of SMEs with ancillary programmes.
		10	R+3W	
		11	P+3W	
2.2	Gypsum, ash and slag disposal site at OCM 'Tamnava – West Field'	3	L-3M	Possible strong negative impact on ground water quality. Probable strong impact on flora and fauna. By applying the designed ash, slag and gypsum disposal technology, probable environmental improvements.
		6	L-3V	
		10	L+3V	
2.3	Switchyard 400 kV and 220 kV with transmission network 400, 220 and 110 kV	-	-	
2.4	Reconstruction of TPP 'Kolubara A'	1	R+2V	Reconstruction and modernisation of operational units and application of technological systems for waste gas and water treatment, significant contribution to air and water quality in accordance with EU standards.
		10	P+2V	
2.5	Reconstruction of the Heating Plant and the Drying Plant at Vreoci	1	R+2W	
		10	P+2V	

3	Water management			
3.1	WTP 'Pestan'	-	-	
3.2	New WS 'Zeoke'	-	-	
3.3	WS 'Kalenic'	-	-	
3.4	Relocation of one part of river Kolubara	3	R+2 W	Relocation of different parts of watercourses will mitigate negative impact of mining operations to surface and ground water tables. Relocation works will contribute to the increase of the employment level.
		11	R+2 V	
3.5	Relocation of one part of river Kladnica	3	R+2 W	
		11	R+2 V	
3.6	Relocation of one part of river Pestan	3	R+2 W	
		11	R+2 V	
3.7	Relocation of one part of river Lukavica	3	R+2 W	
		11	R+2 V	
4	Settlement relocation			
4.1	Kalenic (44 households) – 'Tamnava West Field'	8	L-3 W	Significant permanent reduction of the number of households and population level.
4.2	Mali Borak (115 households) – 'Tamnava West Field'	8	L-3 W	Significant permanent reduction of the number of households and population level. Considerably improved health conditions due to resettlement to unpolluted locations. New locations will probably have better employment conditions.
		9	L+3 V	
		11	L+3 V	
4.3	Vreoci (1030 households) – 'Tamnava South Field', Field 'Veliki Crljeni', Field 'D'	1	L+3 W	Resettlement of some 1030 households from Vreoci is planned. Significantly better environmental conditions on new locations (cleaner air and higher potable water quality) will contribute to health improvements. New locations will probably have better employment conditions. Strong negative impact of permanent reduction of the local population level. Cemetery in Vreoci affected by mining operations. It will have to be relocated together with population.
		7	L-3 W	
		8	L-3 W	
		11	L+3 V	
4.4	Veliki Crljeni (50 households) - Field "Veliki Crljeni"	11	R+2 V	
4.5	Cvetovac (20 households) - Field "Veliki Crljeni"	-	-	
4.6	Medosevac (122 households) – Field 'D'	8	L-3 W	Significant permanent reduction of the number of households and inhabitants.
4.7	Barosevac (60 households) – Field 'B', Field 'E'	-	-	
4.8	Zeoke (276 households) - Field "E"	8	L-3 W	Significant permanent reduction of the number of households and inhabitants. Significantly better environmental conditions on new locations (cleaner air and higher potable water quality) will contribute to health improvements. New locations will probably have better employment conditions.
		9	L+3 V	
		11	L+3 V	

4.9	Radljevo (84 households) – Field “Radljevo”	8	L-3 W	Significant permanent reduction of the number of households and inhabitants.
4.10	Brgule (26 households) - Field “Radljevo”	-	-	
4.11	Sarbane (43 households) - Field “Radljevo”	8	L-3 W	Significant permanent reduction of the number of households and inhabitants.
4.12	Sopic (83 households) - Field "E"	-	-	Significant permanent reduction of the number of households and inhabitants.
5	Traffic			
5.1	Relocation of M-22 road section from the south-western boundary of OCM ‘Veliki Crljeni’	11	R+2 V	Works on the relocation of the state road will contribute to the increase of employment level. Relocation of M-22 road section will provide continuity of Ibarska Magistrala route.
		12	N+2 W	
5.2	Cancellation of R-101a (7.7km) road section, from Staro Selo to the southern boundary of OCM Tamnava-West Field’	-	-	
5.3	Construction of detour around Lajkovac, 5.7km long	-	-	
5.4	Reconstruction of local roads L-1008 and L-7 (14,6 km)	-	-	
5.5	Reconstruction of one L-1806 (4,7 km) road section	-	-	
6	Reclamation			
6.1	Reclamation of 927,6 ha of overburden dump	4	R+3 W	Reclamation will partially compensate the loss of agricultural areas and considerably increase forested areas. Mitigation measures for temporary land occupation with mining operations are included into the agricultural land use plan, compatible with the forested land use plan. In addition to comprehensive forestation activities of about 920ha of overburden and ash dumps, water bodies will be formed in residual pits in the area of about 97ha (Vreoci and Cvetovac). After reclamation, flora and fauna development conditions will be re-established New forested areas will have favourable impacts on air pollution reduction and contribute to healthier living conditions of the population.
		6	P+3 W	
		9	R+2 W	
6.2	Reclamation of 83,6 ha of ash disposal site	9	L+3 V	

7	Regional sanitary landfill			
7.1	Regional sanitary landfill with recycling plant	5	R+3 W	Construction of the regional sanitary landfill for municipal waste and recycling centre will have a strong positive impact of waste disposal in 11 municipalities of Kolubara district and City of Belgrade area, with indirect improvement of health conditions in these municipalities. Изградња регионалне санитарне депоније комуналног отпада и рециклажног центра јако позитивно ће утицати на унапређење управљања отпадом у 11 општина Колубарског округа и са подручја града Београда, чиме ће индиректно допринети здрављу становништва у тим општинама.
		9	R+3 W	
		10	R+3 W	

4.4 Cumulative and Synergy Effects

In accordance with the Law on Strategic Environmental Impact Assessment (Article 15), strategic assessment should also include the assessment of cumulative and synergy effects. These effects were partially identified in Table 4.10; however, significant effects might be created as the result of interaction among numerous smaller impacts of existing facilities and activities and different planned activities in the Plan area.

Cumulative effects emerge when individual planning solutions do not have any significant impact, while several individual effects may jointly have a significant effect. Pollution of air, water or noise increase from different sources may be given as examples.

Synergy effects are created in the interaction of individual impact producing the total effect higher than a plain sum of individual impacts. Synergy effects are most frequently reflected in human communities and natural habitats.

Table 4.11 – Identification of possible cumulative and synergy effects

Interaction of plan solutions	Strategic assessment field
AIR QUALITY MANAGEMENT	
1.1, 1.3-1.8, 2.1, 2.2, 7.1	Dust emission is dominant on open cast mines in the course of coal mining and overburden removal, not causing ELV exceedence in the surrounding settlements. Dust emission from TPP Kolubara B after treatment does not exceed ELV. Dust emission from ash, slag and gypsum disposal sites, as well as from the municipal landfill is only possible during strong wind. Dust emission from the reconstructed units of TPP Kolubara A, heating plant and drying plant in Vreoci will be below ELV. Considering the there are other dust emission sources in the Plan area (traffic, industrial units and households), it is possible that ELV will be exceeded due to their cumulative effect under unfavourable weather conditions. SO ₂ and NO _x emission from TPP Kolubara B, after design treatments will not exceed ELV. However, these pollutants are not treated from other sources; therefore, ELV exceedence is possible due to cumulative effects.
2.4, 2.5, 4.1-4.8, 5.3, 6.1, 6.2	Positive cumulative effects in terms of population exposure to polluted air will be achieved in two ways: (1) reconstruction of TPP Kolubara A, drying and heating plants in Vreoci and (2) resettlement of population from affected areas.
CLIMATE CHANGES	
2.1, 2.4, 2.5, 7.1	Greenhouse gases (CO ₂ , CH ₄ , N ₂ O, O ₃ and halogen-carbohydrates) are released from all fossil fuel conversion processes into energy (TPPs, heating plants, traffic), as well as from the municipal landfill. Cumulatively, existing and new sources in the Plan area will increase GHG emission; however this increase is not relevant on the republic level, and especially not on the global level. Kyoto Protocol does not anticipate an obligation for Serbia (as a developing country) to reduce GHG emission.
-	
WATER MANAGEMENT	
1.1, 1.3, 1.4, 1.6, 1.7, 2.1, 2.2	Proposed development of mining activities will inevitably influence the hydro-geological regime inside the mines and cumulatively in the wider area. Water table disturbance may have direct impacts on surface water table, soil fertility and water supply. Certain number of watercourses will have to be relocated due to mine development. Possible infiltration of pollutants from mines and overburden dumps. Possible watercourse and ground water contamination by waste waters originating from the TPP and ash disposal site.
2.5, 3.1-3.6	Reconstruction of waste water treatment plant in Vreoci will reduce river Kolubara contamination. Modernisation of existing and construction of new water supply systems and connection with Kolubara regional system will provide stabile potable water supply of population. Relocation of affected parts of watercourses will improve regimes and quality of surface waters.

Interaction of plan solutions	Strategic assessment field
ЗАШТИТА И КОРИШЋЕЊЕ ЗЕМЉИШТА	
1.1-1.7	In the period up to 2020, areas affected by mining operations will increase for about 5% (1116ha), with consequent reduction of agricultural land for 7.5% (2502ha).
3.4-3.6, 6.1, 6.2, 7.1	Relocation of Kolubara, Pestan and Kladnica would to a certain extent have a favourable impact on agricultural land quality. The highest contribution could be achieved by reclamation of 1011ha of degraded areas (83.6 ha ash disposal sites и 927.6 ha overburden dumps). Forested areas will increase for 97% (1114ha). Regional landfill will successively be reclaimed within the planning period.
WASTE MANAGEMENT	
-	
2.1, 2.2, 7.1	New designed ash, slag and gypsum treatment, transport and disposal technology is environmentally friendly. Development of a watertight layer and recirculation of all waters to the disposal site for the purpose of land and water contamination is anticipated under the disposal site design. Construction of the regional municipal waste landfill and the recycling centre according to EU standards will greatly improve waste management in 11 municipalities of this region.
PRESERVATION OF NATURAL ASSETS AND BIODIVERSITY AND LANDSCAPE IMPROVEMENT	
1.1-1.7, 2.2, 7.1	Mining operations and strong degradation of agricultural land and vegetation destruction of locations of individual mines has cumulative effect on loss of habitats of the majority of animal species and it will cause their migration outside the wider mine zone, as well as from ash disposal sites and municipal landfill.
3.4-3.6, 6.1, 6.2	Relocation of rivers and watercourse development will have favourable impacts on the preservation on aquatic habitats. Reclamation of mines and disposal sites will create conditions for renewal of flora and fauna habitats, as well as improvement of landscape characteristics within the Plan area.
PROTECTION OF CULTURAL ASSETS	
1.1, 1.3, 1.6, 4.1-4.5	Cumulative very negative effect on the state of cultural heritage due to Tamnava-West Field, Field Veliki Crljeni and Field D development, as well as the resettlement of population from areas with identified cultural assets.
-	
SETTLEMENTS, POPULATION	
1.1, 1.3-1.7, 4.1-4.8	Cumulative negative impact on the number and structure of population and settlement characteristics due to open cast mine development (except Tamnava – East Field) and resettlement of 670 inhabitants, i.e. over 1 920 households.
-	
HEALTH	
1.1, 1.3, 1.6, 2.1, 2.2	Small local impacts of the indicated planning solutions may become cumulatively important with other air pollution and noise sources (traffic, industry) inside the boundaries of the mining area.
2.4, 2.5, 3.1-3.3, 3.7, 4.-4.4, 4.6-4.8, 5.3, 6.1, 6.2, 7.1	Indicated planning solutions have cumulative impact on health. On one hand, reduction of harmful substances (2.4, 2.5, 3.1-3.3, 7.1), and the other removal of population from the pollution sources (resettlement) and pollution absorption on forested reclaimed areas.
ENVIRONMENTAL MANAGEMENT SYSTEM	
-	
1.1, 1.3-1.8, 2.1, 2.2, 3.4-3.7, 4.1-4.4, 4.6-4.8, 5.1-5.5, 6.1, 6.2, 7.1	Conditions will be provided for integrated environment protection within the Plan area under the development of the proposed environmental management system.
ECONOMIC DEVELOPMENT OF THE AREA	
-	
1.1, 1.3, 1.4, 1.6-1.8, 2.1-2.3, 2.4, 2.5, 3.4-3.7, 4.1-4.4, 4.6-4.8, 5.1-5.5, 6.1, 9.2, 7.1	Interaction of planning solutions will cumulatively stimulate further economic development of the area in increase employment levels, not only in the mining-energy sector, but in other complementary activities.
INFRASTRUCTURAL SYSTEM	
1.1-1.7	Cumulatively, mining operations on mines will have a strong impact on the destruction of certain road sections and watercourses.
3.4-3.7, 5.1, 5.2, 5.4, 5.5	Indicated solutions will cumulatively contribute to the development and regulation of watercourses and improvement of the road network.

4.5 Planning of Environmental Measures

4.5.1 Overview of Estimated Significant Environmental Impacts of the Plan and Protection Measures

Based on the evaluation of the significance of environmental impacts of the planning solutions (Table 4.10) and assessment of cumulative and synergy effects in the Plan area (Table 4.11), the following significant environmental impacts of the Plan have been identified:

1) Air quality

High flue gas emissions exceeding emission limit values coming from the planned TPP Kolubara B are significant for air quality. However, selection of improved coal combustion technology and planning solutions involving high performance electrostatic precipitators for dust treatment, as well as FGD plants will reduce all emission below emission limit values prescribed by our and EU standards. Unacceptable emissions coming from TPP Kolubara A and B, drying plant and heating plants in Vreoci will be reduced under the programmed reconstruction activities. Nevertheless, concentration of pollutants on individual sites may temporarily exceed the prescribed ILVs due to cumulative effect of permitted emissions from the indicated sources with emissions from other sources such as open cast mines (dust), traffic (exhaust gases), household furnaces, other industry, etc.

2) Surface and ground water quality

Proposed development of mining activities will inevitably influence the hydro-geological regime inside the mines and cumulatively a wider area. Due to mine development, some watercourses will have to be relocated. Infiltration of pollutants from mines and overburden dumps is also possible. Waste waters coming from thermal power plants and ash disposal sites might also pollute surface and ground waters. In order to mitigate the indicated negative impacts of the planning solutions, the Plan anticipated construction and technical-technological protection measures. River Kolubara, Kladnica, Pestan and other smaller watercourses will be relocated in accordance with the mine development schedule. Reconstruction of waste water treatment plant in Vreoci will provide river Kolubara contamination reduction. Planned technological solutions for treatment and recirculation of used waters, as well as for ash and slag transport and disposal at TPP Kolubara B will prevent deterioration of ground and surface water quality under the influence of technological water from its facilities. Disturbance of ground water table due to mining operations can partially be mitigated by corresponding mine dewatering technology and establishment of the adequate ground water monitoring system. Water supply issues will be settled by modernisation of existing and construction of new water supply systems and integration with the Kolubara regional system.

3) Soil quality and landscape characteristics

Mining operations and overburden dumps, ash and slag disposal sites have the highest negative impact on degradation and potential soil contamination, as well as on the change of landscape features. Comprehensive reclamation and rehabilitation of agricultural land, together with the increase of forested areas are predicted in order to mitigate negative effects.

4) Nature preservation, biodiversity

Mining operations and strong soil degradation, as well as vegetation destruction will cause the loss of animal habitats and their migration outside the wider area of active mines, as well as from ash and municipal waste disposal sites. Rehabilitation of land through reclamation, watercourse development will create conditions for rehabilitation of plant and animal habitats, as well as improvement of landscape characteristics of the Plan area.

5) Protection of cultural heritage

Mining operations will have a high negative impact on the state of cultural heritage, as well as on the five settlements identified as cultural assets. Relocation of affected cultural assets and special relocation of Vreoci cemetery have been predicted.

6) Settlements and population

Mining operations will have a considerable negative impact on the number and structure of population and characteristics of Vreoci, Zeoke, Mali Borak, Medosevac, Barosevac, Cvetovac, Veliki Crljeni, Radljevo, Brgule, Sarbane and Kalenic. Mitigation of negative effects will be executed by property compensation and resettlement of population in organised or individual manner to new locations. This will help to create better health conditions for the affected population.

7) Infrastructure systems

Mining operations will have a strong impact on the destruction of certain road sections and watercourses. The following roads will be affected: zone between Tamnava East and West Fields, containing the regional road R-101a, zone north from Tamnava West Field and future Field Radljevo, containing the regional road R-270, zone east from Field Veliki Crljeni and Tamnava South Field with the state road M-22 and Belgrade – Bar railway, as well as the zone inside Field E containing the regional road R-201 and local road L-1806.

In addition to this, mining operations on OCM Tamnava West Field, Tamnava East Field, Tamnava South Field, Veliki Crljeni, Radljevo and Field E affect parts of rivers Kolubara, Kladnica, Pestan, Lukavica and Vranicina. The Plan anticipated mitigation measures of the indicated negative impacts through the relocation of affected roads and watercourses into safe zones.

8) Economic development

Implementation of this Plan is essential for the development of the Serbian power system, both locally and regionally. It will contribute to further economic development of the area and increase employment levels, not only in the mining-energy sector but also in other complementary activities.

4.5.2 Planned Concept of Environment Protection and Spatial Development

Planned concept is based on the fact that the Plan area consists of a large number of concentrated linear and dispersed polluters unevenly distributed in the area and in conflict with the sensitive areas such as settlements, ground and surface waters, agriculture, flora, fauna, etc. Moreover, it should be noted that the planned development of mines, thermal power plants and other industrial facilities may have additional negative environmental impact.

Planned environmental solutions are based on future alignment of our legal regulations with EU regulations in the field of environmental protection, implying the application of best available techniques in the designing of new facilities²⁴. In terms of air pollution, EU regulations on imission limit value for SO₂, NO₂ and NO_x, dust and lead have been taken into consideration²⁵.

Proposed spatial-environmental differentiation of the Plan area retains the basic categorisation from the Spatial Plan of the Republic of Serbia. Area use regime conditioned by environmental quality criteria is established in this manner, in the following manner:

Table 4.12 – Planned environmental quality

Pollution category	Sites	Description
I	Open cast mines, ash and slag disposal sites	Increased concentration of dust and noise
II	Veliki, Crljeni, Vreoci, Medosevac, Junkovac, Cvetovac, Mali Borak and Kalenic zones	Occasional ²⁶ exceedence of ILV for primary pollutants is permitted, but without excessive pollution with radioactive, cancerous and mutagen substances
III	City zone of Lazarevac and Belgrade – South Adriatic zone	ILV exceedence not expected, however, unpleasant odours, industrial and municipal waste, increased noise and road impacts and watercourse (4 th class) impacts will occur
IV	Zones of Ub, Lajkovac and Sopic, suburban areas of Lazarevac and zones of Ibarska Magistrala and Belgrade-Bar railway	Pollution coming from food processing industry, other industries with installed air and water treatment devices, animal farms, intensive agricultural production, state roads and railways, suburban zones
V	Zones of regional and local roads	With occasional noise emission and air pollution increase
VI	Villages	Lower soil and water contamination
VII	Forest and meadow areas	No permanent environmental pollution sources

4.5.3 Development and Construction Rules

Protective zones on mines

Along open cast mine boundaries, protective forest zones are established, 150 to 200m wide, by planting of corresponding tree and shrub mixes, in order to protect the population of the surrounding settlements agins air pollution and noise, as follows:

²⁴ Modern technologies according to the Law on Environmet Protection (2004)

²⁵ Framework Directive 96/62/EC and the first Daughter Directive 1999/30/EC

²⁶ According to WHO norms

- 1 – Fields B and C: towards Barosevac
- 2 – Field D: from Medosevac, through the zone and along the mine periphery in the area of Vreoci
- 3 – Tamnava – West Field: towards Kalenic and Radljevo
- 4 – South Field: along the northern mine boundary
- 5 – Field Veliki Crljeni: eastern mine periphery, along M-22 road
- 6 – Field E: from Zeoke to Barosevac
- 7 – Field Radljevo: towards Kalenic and Sarbane

Corresponding protective zones are established along the boundaries of ash and slag disposal sites, as well as around the sanitary landfill, whose dimensions are determined based on designs of these sites.

Noise protection

Highest noise levels according to the requirements of JUS 3.J6. 205/1992 are permitted for construction areas in the Plan area.

Table 4.13 – Criteria for acoustic zoning

Zone	Acoustic zone description	Permitted external noise levels Leq(dBA)	
		Day	Night
I	Areas for relaxation and recreation, hospitals and large parks	50	40
II	Tourist areas, smaller and village areas, camps and school zones	50	45
III	Residential areas	55	45
IV	Business-residential area, playgrounds	60	50
V	City centre, zones along motorways, state and city roads	65	55
VI	Industrial zone	70	70

Industrial zones

In the course of construction of new industrial facilities and zones, environmental conditions and construction rules are established for certain ecological categories of companies based on minimum protective distance between potential pollution sources inside industrial complexes and residential areas:

Table 4.14 – Industry allocation conditions

COMPANY CATEGORY*	A	B	C	D	E
Protective distance ²⁷ (m)	<50	50 - 100	100 -500	500 - 1000	1000-1500
Necessary zoning documents for environmental protection**	-	EIA	EIA, HA	EIA, HA, SEIA	EIA, HA, SEIA

*With several risks present, the company is categorised according to the highest risk

**EIA = environmental impact assessment, HA = chemical hazard impact assessment, SEIA = strategic environmental impact assessment

COMPANY CATEGORY - A

Smaller firms whose environmental load is small and below limit values may be located inside the residential areas. Projects not included in Lists I and II of the Decree on Identification of the List of Projects.²⁸

COMPANY CATEGORY - B

Small and medium enterprises which may have small and local environmental impact; possible presence of a smaller amount of hazardous substances, risk of chemical hazards- low, noise level – low. Projects included in the List II of the Rules on Identification of the List of Projects.²²

COMPANY CATEGORY - C

27 Protective distance represents the smallest distance between the pollution source and the closest residential or other sensitive facility. Established on the basis of guidelines of the Clean Air Association of Yugoslavia (1987): 'Protective Distances between Industries and Residential Areas'. Typically, protective distance is provided inside boundaries of the industrial complex.

28 Rules on Identification of the List of Projects with Mandatory Environmental Impact Assessment Development and the List of Projects for which Environmental Impact Assessment can be required, 'Official Gazette RS', № 84/05

Companies with potential medium environmental impact on the local level, higher amounts of hazardous substances present, risk of chemical hazards – medium, noise level – medium. Projects included in the List II of the Rules on Identification of the List of Projects.²²

COMPANY CATEGORY - D

Firm with high environmental impact on the city level, high amounts of hazardous substances present, smaller amounts of very toxic substances, risk of chemical hazards – high, noise level – very high. Projects included in the List I of the Rules on Identification of the List of Projects.²²

COMPANY CATEGORY - E

Firms with very high environmental impact; high amounts of hazardous and very toxic substances present, noise level above 70 dB(A). These companies may be located based on their level of environmental load at a great distance from residential areas to avoid unpleasant impacts on neighbouring population caused by its operation, such as larger chemistry industries, oil refineries, petro-chemistry, large drug companies, nuclear plants, airports, etc. Projects included in the List I of the Rules on Identification of the List of Projects.²²

Indicated protective distances are used for environmental valorisation of industrial and working zones within the Plan. In concrete cases, protective distance is identified based on Environmental Impact Assessment, i.e. based on the Strategic Environmental Impact Assessment for groups of facilities within the regulation plan of the industrial zone.

Traffic zones

Rules indicated here establish land use and facility construction regimes along the traffic zones taking into account possible road impacts on health and environment. For facilities whose construction is permitted, located within the road impact zone, protective measures for the facility are mandatory (noise protection, construction materials of highest quality, etc).

Road traffic

Land use regime within motorway zones²⁹, as follows:

- Direct protection zone – 150m wide from the edge of the road on both sides; all construction activities prohibited in this zone, except the ones related to motorway functioning;
- Wider protection zone – 300m wide from the boundary of the road zone in which only the construction of facilities related to motorway functioning is permitted and in which protective measures against negative motorway impacts are implemented.

²⁹ Proposed protective zone width is aligned with solutions from the Spatial Plan of the Motorway Belgrade - Pozega

In case of state roads in areas outside urban zones, there are three protection zones:

- Zone I – area of very large environmental load, 20m wide on both sides of the road, due to air emissions, increased noise and soil contamination. Protective greenery may be formed in this zone. Construction of residential, business and auxiliary facilities is not permitted. Construction of facilities related to motorway functioning permitted (petrol stations, service shops, warehouses, etc).
- Zone II – area of large environmental load, 50m wide on both sides of the road, due to increased noise and soil contamination. Construction of residential structures not recommended. Existing legally constructed facilities have to be protected by corresponding acoustic protection.
- Zone III – area of small environmental load, 180m wide on both sides of the road, due to increased noise. Construction of residential, business and industrial facilities permitted provided that noise protection measures are implemented.

Transport of hazardous and harmful substances is permitted along state road sections going through the areas with lower population density. This restriction is not related to the transport of oil derivatives in cisterns with the capacity up to 10 tons.

Railway traffic

Protective distance is established between main railway lines and residential areas of 25m, with mandatory implementation of acoustic protection measures on affected facilities, i.e. protection zone of 150m from the external edge of railway tracks, if protection measures are not undertaken.

4.5.4 Application of Protection Concept and Implementation of the Spatial Plan

Starting from environmental objectives and criteria defined in protection policies and strategies in adopted documents, with the consideration of the prior environmental state, as well as projections of industrial and spatial development, complex technical-technological, zoning-environmental, organisational and other protection measures need to be applied in the implementation of the Spatial Plan. In the course of programming and planning of activities for the implementation of the Spatial Plan, a preventive approach should be applied to the preservation of resources and environment protection, whereas, generally accepted criteria have to be observed, together with legal norms and environmental and health standards.

Environmental objectives and criteria established by this spatial plan are implemented by their integration into:

- Zoning plans and projects;
- Development plans and programmes and investments projects of companies, especially in the field of energy, mining and industry;
- Revitalisation and reclamation plans of degraded areas;
- Environmental programmes and action plans of the local government bodies and NGOs; and
- Monitoring programmes for air, water and soil, as well as other environmental segments.

Environmental requirements need to be integrated into the development of the zoning – planning documents:

- During the development of general (zoning) plans, detailed analysis of the existing environmental state should be done, together with environmental zoning of the plan area and defining of guidelines and restrictions for the use of each zone;
- During the development of regulation plans and zoning projects for production zones, environmental impact assessment should be done;
- Criteria should be defined and categorisation performed of industrial/production zones in terms of specific users;
- During the selection of landfill locations for municipal, industrial and hazardous waste, prescribed criteria should be applied and environmental impact assessment studies developed;
- Special attention should be paid to sanitary protection of landfills for waste, industrial waste (ash) and overburden located in the vicinity of settlements;
- Waste water treatment plant sites in the area of Lazarevac, Lajkovac and Ub and other larger settlements should be planned;

- During the issuing of zoning-technical conditions for the location for individual production and infrastructural facilities, environmental conditions should be formulated based on environmental impact assessment of such facilities; and
- Negative environmental impacts should be prevented, resulting from the routing of infrastructural systems (traffic, gas lines, transmission lines, heat lines, watercourse regulation, etc). Concrete measures should be implemented in the course of location analysis and issuing of zoning-technical conditions.

PE 'Electric Power Industry of Serbia' should anticipate environmental protection and improvement measures for the Basin in the course of further open cast mining operations, through special long-term protection programmes with full consideration of: EU environmental directives, characteristics of energy resources in Serbia, state and necessary characteristics of thermal power facilities and economic potentials of the country. With respect to this, the following measures should be applied in order to implement this Plan:

- Lignite mining schedule should be defined by ensuring that emission of harmful substances does not exceed the environmental capacity of the area;
- Special investigations about potential impact of deep mines ('South Field' and 'Field E') on direct environment should be executed (soil drying, structural stability, etc);
- Excavation and reclamation schedule should be defined in shorter periods, in order to provide timely return of degraded areas to their productive use;
- Ash disposal sites should be designed on inside dumps of open cast mines;
- Construction of disposal cassettes should be aligned in spatial and temporal terms with ash and slag production;
- Sufficient potable water amounts should be provided for settlements, technological and agricultural needs;
- Hydro-insulation of disposal sites for ash, industrial and municipal waste should be provided by using corresponding insulation materials, for the purpose of ground water protection against contamination;
- Diversity register of biological species from the area should be developed as the basis for biological reclamation of degraded areas and watercourses;
- Rehabilitation, reconstruction and revitalisation of 'Kolubara-Prerada' units in Vreoci should be carried out, i.e. upgrade and modernisation of treatment systems for waste gases, waste waters, tailings and sludge created at the Drying and Heating Plants;
- Rehabilitation, reconstruction and revitalisation of TPP 'Kolubara B' in Veliki Crljeni should be performed;
- Consistent implementation of conceptual solutions for construction of TPP Kolubara B, i.e. installation of FGD systems, nitrogen oxide reduction systems, high-efficiency ESPs, hydraulic transport of ash and slag and waste water treatment plants;
- Automatic control systems for electricity generation process should be introduced, together with continuous emission measurement systems on all outlets;
- *Best Available Techniques* should be used for reconstruction and revitalisation of existing TPP systems, with efficient dust handling systems, taking into account environmental criteria anticipated in the course of operational life of reconstructed facilities;
- Waste water register should be established and their quality monitored prior to the discharge into the recipient;
- Maintenance of existing and construction of new treatment devices for industrial and municipal waters should be improved in order to achieve the corresponding efficiency;
- Surface and ground water monitoring system should be supplemented on measuring points sensitive in terms of water supply spring contamination; and
- Soil contamination monitoring system on critical locations should be established.

Past experience of PE 'Electric Power Industry of Serbia' at the level of municipalities of Kolubara Mining Basin indicates the environmental issues have been addressed on a high level in order to meet the requirements of the Law on Environment Protection. However, in spite of this, adequate environmental results have not been achieved. The key problem is that there is not integrated environmental management system, which would cover all entities of the Plan area. Consequently, an environmental management system should be introduced based on JUS-ISO 14001 standard.

4.5.5 Environmental Projections in the Plan Area based on the Vision for the Period after Coal Mining Termination (2055/60)

Based on the coal mining projections in the Kolubara Mining Basin, it is expected that it will be finalised between 2055 and 2060. Considering that the Spatial Plan for the development of this area by 2020 anticipated successive reclamation of degraded areas, it may be said that environmental status after coal mining is finalised in this area will be much more favourable than today.

Vision of possible land use of the mining area in 2055/60 (see Map № 12) anticipates the creation of new reclaimed areas according to the following model: forest land about 65km², agricultural areas about 42km², artificial lakes and watercourses about 6km², sport and recreation areas about 7km² and areas occupied by infrastructural zones about 2km². It goes without saying that land use will be defined in more details through future spatial plans (for the period after 2020).

Starting from environmental objectives and criteria defined in environmental policies and strategies in documents adopted at the republic level, as well from orientation towards implementation of current and future EU environmental and sustainable development standards, strict application of regulations from this field may be expected in future. Compared to the environmental quality plan by 2020 (Table 4.12) considerable changes will be made, considering that after coal mining is finalised, highest pollution categories I and II will be excluded. Based on future land use within the mining area, pollution categories VI and VII will be dominant in this area, i.e. zones with good environmental status in which the presence of diffuse pollution sources is permitted (VI) and zones with no permanent pollution sources (VII).

5. GUIDELINES FOR DEVELOPMENT OF STRATEGIC ASSESSMENTS ON LOWER HIERARCHICAL LEVELS AND ENVIRONMENTAL IMPACT ASSESSMENTS

Legal basis (Article 16 of the Law):

The strategic assessment report shall include the developed guidelines for plans and programmes at lower hierarchy levels that include the determination of the need for the strategic assessment elaboration and elaboration of assessment of impact of projects on the environment. They also define the environmental protection aspects and other questions of relevance for assessment of impact of lower hierarchy level plans and programmes on the environment.

Spatial Plan of Kolubara Mining Basin area as the spatial plan of the special use area will be implemented primarily through the development and adoption of corresponding midterm plans and programmes for mining of individual parts of the lignite deposit, as well as through corresponding spatial and zoning plans for complexes and facilities of special use, settlements and parts of settlements. Development of locations of thermal power and industrial facilities of REIK will be based on elaboration of basic Spatial Plan solutions at the level of general or detailed regulation plans, i.e. the so-called act on zoning conditions.

By applying the criteria for establishment of possibilities of significant environmental impacts and adoption of the decision on the development of the strategic assessment from Article 5 contained in Annex I of the Law on Environmental Impact Assessment, it is proposed that special strategic assessments are developed for plans indicated in Table 5.1, as well as for capital projects according to the criteria from the Decree on Identification of the List of Project for which Impact Assessment is Mandatory and the List of Projects for which Environmental Impact Assessment may be required ('Official Gazette RS', № 64/2005).

Table 5.1 – Guidelines for Impact Assessments on Lower Levels (priorities)

№	Name of the plan/project	Type of impact assessment
A	Spatial and zoning plans	
1.	Spatial plans of Lazarevac, Ub, Lajkovac and Obrenovac municipalities	Strategic assessment
2.	General zoning plans for Lazarevac, Lajkovac and Veliki Crljeni	Strategic assessment
3.	Corresponding regulation plans for settlements (CM) Vreoci, Sopic, Jabucje and Zeoke	Strategic assessment
4.	Regulation plans for spatial entities planned for resettlement of population from affected areas	Strategic assessment
5.	Regulation plan for the relocation of infrastructural systems and watercourses	Strategic assessment
B	Municipal waste management plan for 11 municipalities of Kolubara district and the City of Belgrade	Strategic assessment
C	Technical documents (projects)	
1.	Project of regional municipal landfill with the recycling centre	Impact assessment
2.	Project for 'Field E'	Impact assessment
3.	Project for 'South Field'	Impact assessment
4.	Project for Field 'Radljevo'	Impact assessment
5.	Projects for reclamation and development of degraded areas	Impact assessment
6.	Ash, slag and gypsum disposal site project	Impact assessment
7.	River Kolubara relocation project	Impact assessment
8.	River Pestan relocation project	Impact assessment
9.	River Kladnica relocation project	Impact assessment
10.	State road M-22 relocation project	Impact assessment
11.	Transmission line relocation projects	Impact assessment

6. ENVIRONMENTAL MONITORING SYSTEM IN THE COURSE OF PLAN IMPLEMENTATION

Legal basis (Article 17 of the Law):

Environmental monitoring programme during the implementation of plans and programmes shall consist of the following in particular:

- 1) The description of objectives of plans and programmes;
- 2) The environmental status monitoring indicators;
- 3) The rights and obligations of the competent authorities;
- 4) Acting in cases of unexpected adverse effects;
- 5) Other elements depending on the type and scope of plan and programmes

6.1 Plan Objectives

Basic development objective of the Plan area is efficient, rational, organised and cost-effective use of human, natural and constructed potentials, in socio-economic, spatial and environmental terms. Mining and energy represent primary industrial activities, being the proponents of both current and future development of the Plan area. Environmental protection and land reclamation will have increasing importance, especially in the reconstruction of existing electricity generation capacities and development planning of new facilities.

General environmental objectives are defined on the basis of environmental requirements and objectives in other plans and programmes, environmental objectives established on the republic level (indicated in section 1.3 of this Report), as well as environmental objectives defined in international documents, such as 'Conclusions from the World Summit on Sustainable Development' (Johannesburg, 2002), 'Environment for Europe (Kiev, 2003) and numerous environmental conventions signed by our country.

Special environmental objectives of the Plan:

- Provision of optimal distribution of population, industrial and other activities in accordance with the needs of harmonised spatial development, energy sector and environment protection development;
- Lignite mining schedule should be defined by ensuring that emission of harmful substances does not exceed the environmental capacity of the area;
- Excavation and reclamation schedule should be defined in shorter periods, in order to provide timely return of degraded areas to their productive use;
- Measures should be undertaken to protect the population directly affected by unsatisfactory environmental quality, especially in Vreoci and Veliki Crljeni;
- Rehabilitation of polluted and degraded areas, especially ash disposal sites;
- Air emission of sulphur-dioxide, nitrogen oxides, ash and other toxic substances should be reduced;
- Conditions should be provided for operation and usage of facilities within prescribed boundaries;
- 'Dirty' technologies should be eliminated as well as environmentally inefficient facilities;
- High-efficiency air and water treatment technologies should be applied, enabling the satisfaction of future stricter environmental requirements;
- Special protection measures should be applied for possible chemical hazards;
- Integral environmental concept should be applied based on the balance of pollutants;
- Waste amounts should be reduced together with recycling level increase;
- Modern environmental monitoring should be provided; and
- Environmental management system should be improved.

6.2 Indicators

Pursuant to the Law on Environment Protection, environmental quality is defined as the set of natural and created assets whose complex mutual relations make the environment, i.e. the living area and conditions, as well as the state of environment expressed by physical, chemical, biological, aesthetic and other indicators. However, the Law does not define the indicators, whereas, in practice indicators are interpreted in different ways. In Serbian, indicators most frequently imply data related to air, water and soil quality. However, modern approach of the European Environmental Agency - EEA)³⁰ is based on the most complex DPSIR (driving force-pressure-state-impact-response) complex, which considers all phenomena in cause and effect chain, including reactions to unsatisfactory states. This concept implies active relationship towards environmental changes including socio-economic aspects, often being the driving forces of changes. This provides the inclusion of pure environmental indicators in the sustainable development indicator system.

Indicated concept is basically used in the formulation of strategic impact assessment objectives and indicators, as the means to monitor progress in achievement of objectives set by the plan and strategic assessment. Therefore, indicators shown in Table 3.2 will be also used for monitoring of fulfilment of strategic assessment objectives, i.e. environmental state in the course of Plan implementation. The list of environmental and sustainable development monitoring indicators at the Plan level (Table 6.1) includes objectives and indicators estimated as important in Section 4 of this report. Indicators not specified should be included into the integral monitoring system consisting of monitoring plans at the level of impact assessments of individual projects.

Table 6.1 – Indicators for environmental and sustainable development monitoring

	Special Strategic Assessment objectives	Indicators
1	Reduction of population exposure to polluted air	
1.1	Reduction of air emission of harmful substances	Emission of dust, SO ₂ and NO _x
1.2	Reduction of population exposure to polluted air	Number of days with ILV exceedence for sooth, SO ₂ and NO ₂ Air quality indices
2	Preservation of amounts and improvement of surface and ground water quality	
2.1	Mitigation of negative mining impact on hydrological regime and ground water quality	Change of ground water regime Change of ground water quality (% positive samples)
2.2	Mitigation of negative mining impact on hydrological regime and surface water quality	Change of surface water regime Change of watercourse quality class (% in the prescribed class)
3	Mitigation of the negative impact on arable agricultural land and forest land	
3.1	Preservation of arable agricultural land	Change of arable land area (%)
3.2	Increase areas under forests	Change of forest land areas (%)
4	Improvement of treatment and disposal of industrial and municipal waste	
4.1	Reduction of industrial waste amount disposed	% of industrial waste recycled
4.2	Reduction of municipal waste amount disposed	% of municipal waste disposed to the landfill
5	Preservation of biodiversity and natural assets, landscape improvement	
5.1	Preservation of biodiversity – avoidance of irrecoverable losses	% of lost species compared to the region
5.2	Avoidance of impacts on protected and significant natural assets	Area of protected and significant natural assets (%)
5.3	Reclamation of open cast mines and dump sites	% of reclaimed areas
6	Preservation of protected and un-protected cultural assets	Number and importance of affected cultural assets
7	Mitigation of negative development impact on demography and settlements	
7.1	Preservation of the number and structure of population	Change in the number and structure of population (%) Number of households for relocation according to settlements
8.2	Mitigation of impact on settlements and facilities	Number of facilities anticipated for demolition according to settlements
8	Protection and improvement of health	Mortality of children up to 5 years of age (%) Frequency of respiratory illnesses (%) % of inhabitants exposed to increased noise levels Number of doctors per 1000 inhabitants

³⁰ EEA, Technical Report No25, Environmental Indicators: Typology and Overview, Copenhagen, 1999.

9	Improvement of environmental management system	% of the budget intended for environment protection out of total investments
		Number of citizen complaints caused by environmental problems
		Number of environmental reports available to the public
10	Stimulation of economic development and employment	% of households with income above RS average
		% of employees out of population able to work
11	Mitigation of negative development impacts on traffic and water management infrastructure	
11.1	Minimisation of road network impacts	Length of roads intended for demolition according to sections (km)
		Length of relocated roads according to sections (km)
11.2	Minimisation of watercourse impacts	Number of destroyed watercourses according to rivers (km)
		Length of relocated watercourses according to rivers (km)

6.3 Guidelines for Monitoring Organisation in the Plan Area

Achievement of environmental objectives established by the plan is not only a planning and technical-technological issue, but the one largely depending on organisation of environmental protection of stakeholders, especially EPS and local communities. In this respect, it is necessary to implement the following priority activities:

- Strengthening of environmental divisions in municipalities and EPS subsidiaries in Kolubara Mining Basin, i.e. establishment of the latter in places where they do not exist;
- Development of the Local Environmental Action Plan by using the recommendations from Annex 8 of *Environmental Impact Assessment of OCM 'Tamnava – West Field' Expansion*; ³¹
- Development of the detailed environmental monitoring plan including elements defined in Annex 9 of *Environmental Impact Assessment of OCM 'Tamnava – West Field' Expansion*; ³²
- Development of a detailed monitoring plan of spatial and socio-economic indicators;
- Establishment of an environmental information system, used or data storage from city and republic institutions in addition to the results from the local monitoring system;
- Public notification on environmental problems of the area; and
- Public contribution in decision-making about environmental problems, including all potentially affected and interested parties;

Having in mind complex of authorisations of competent bodies according to the vertical order (republic level – EPS level – municipal level) and horizontal order (inside the Plan area), as well as difficulties in coordination of activities of various bodies, for successful implementation of the Environmental Monitoring Programme, a **Steering Committee for Environmental Protection and Sustainable Development** should be formed in charge for coordination, planning, programming, supervision and response concerning environmental issues in the Plan area. This body would integrate all information collected by the republic bodies, EPS and municipalities competent for supervision of the execution of legal provisions of primarily Law on Environment Protection and Law on Planning and Construction, as well as other relevant regulations.

7. OVERVIEW OF THE USED METHODOLOGY AND DIFFICULTIES IN THE DEVELOPMENT OF THE STRATEGIC ASSESSMENT

Legal basis (Article 12 point 7 of the Law)

7.1 Приступ развоју методологије

Главна намена стратешке процене утицаја на животну средину је да олакша благовремено и систематично разматрање могућих утицаја на животну средину на нивоу стратешког доношења одлука о плановима и програмима уважавајући принципе одрживог развоја. Стратешка процена је

³¹ Процена утицаја на животну средину проширења копа "Тамнава-Западно поље", Анекс 8- Обавезе на заштити животне средине и акциони план, Европска агенција за реконструкцију, ЕПС, Београд, 2002

³² Процена утицаја на животну средину проширења копа "Тамнава-Западно поље", Анекс 9-План мониторинга, Европска агенција за реконструкцију, ЕПС, Београд, 2002.

добила на значају доношењем EU Directive 2001/42/EC о процени еколошких ефеката планова и програма (са применом од 2004. године), а код нас доношењем Закона о стратешкој процени (са применом од 2005. године). Будући да су досадашња искуства недовољна у примени стратешке процене предстоји решавање бројних проблема. У досадашњој пракси стратешке процене планова присутна су два приступа:

- (1) **технички**: који представља проширење методологије процене утицаја пројеката (EIA) на планове и програме где није проблем применити принципе за EIA, и
- (2) **планерски**: који захтева битно другачију методологију из следећих разлога:
 - планови су знатно сложенији од пројеката, баве се стратешким питањима и имају мање детаљних информација о животној средини,
 - планови се заснивају на концепту одрживог развоја и у већој мери поред еколошких обухватају друштвена и економска питања,
 - због комплексности структура и процеса, као и кумулативних ефеката у Планском подручју нису примењиве софистициране симулационе математичке методе,
 - при доношењу одлука већи је утицај заинтересованих страна и нарочито јавности, због чега примењене методе и резултати процене морају бити разумљиви учесницима процеса процене.

Због наведених разлога у пракси стратешке процене користе се најчешће експертске методе као што су: контролне листе и упитници, матрице, мултикритеријална анализа, просторна анализа, SWOT анализа, Делфи метода, оцењивање еколошког капацитета, анализа ланца узрочно-последичних веза, процена повредивости, процена ризика, итд.

Као резултанта примене било које методе појављују се матрице којима се испитују промене које би изазвала имплементација плана и изабраних варијанти (укључујући и ону да се План не примени). Матрице се формирају успостављањем односа између циљева плана, планских решења и циљева стратешке процене са одговарајућим индикаторима.

Општа методологија процене утицаја планова на животну средину код нас развијана и примењивана у последњих 10 година^{33, 34, 35} на основу бројних радова и искустава из развијених земаља, а посебно у сагласности са новијим приступима и упутствима за израду стратешке процене у Европској Унији^{36, 37, 38}.

Специфично за просторне планове посебне намене, процедура и методологија стратешке процене и израде извештаја о СПУ просторног плана рударско-енергетског комплекса развијана је у оквиру програма истраживања из области технолошког развоја за период 2005-2007. године, кроз пројекат **ТП 6501 А:**

"МЕТОДЕ ЗА СТРАТЕШКУ ПРОЦЕНУ ЖИВОТНЕ СРЕДИНЕ У ПЛАНИРАЊУ ПРОСТОРНОГ РАЗВОЈА ЛИГНИТСКИХ БАСЕНА".

Овај пројекат реализују ИАУС и Архитектонски факултет универзитета у Београду, а финансирају Министарство науке и заштите животне средине и ЈП „Електропривреда Србије“. Досадашњи резултати истраживања омогућили су да се у овој стратешкој процени примени савремена методологија, која је упоредива и сагласна напредним методологијама за СПУ у Европи.

Кључни део стратешке процене је методологија процена могућих утицаја просторног плана на циљеве стратешке процене, односно на животну средину, који садржи следеће фазе:

1) Процена ефеката варијанти планираног развоја на животну средину (идентификација утицаја)

³³ Стојановић Б., Процена утицаја на животну средину и услови за заштиту и унапређење животне средине, Секторски прилог за „Генерални план Приштине“, ИАУС, 1996.

³⁴ Стојановић Б., Управљање животном средином у просторном и урбанистичком планирању – Стање и перспективе, у монографији "Новији приступи и искуства у планирању", ИАУС, 2002, стр.119-140.

³⁵ Стојановић Б., Н. Спасић, Критички осврт на примену закона о стратешкој процени утицаја на животну средину у просторном и урбанистичком планирању, ИЗГРАДЊА, Бр.1, 2006, стр. 5-11.

³⁶ A Source Book on Strategic Environmental Assessment of Transport Infrastructure Plans and Programs, European Commision DG TREN, Brussels, October 2005

³⁷ A Practical Guide to the Strategic Environmental Assessment Directive, Office of the Deputy Prime Minister, London, UK, Sept. 2005

³⁸ James E., O. Venn, P. Tomilson, Review of Predictive Techniques for the Aggregates Planning Sector, TRL Limited, Berkshire, UK, March 2004

Процена утицаја варијанти врши се помоћу матрица у којима се процењује утицај сценарија развоја по варијантама за сваки сектор плана у односу на посебне циљеве и индикаторе стратешке процене. Процена се врши квалитативним методом, са три оцене:

+	позитиван утицај	—	негативан утицај	0	нема или нејасан утицај
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2) Анализа и образложење разлога за избор најповољнијег варијантног решења

3) Одређивање карактеристика могућих значајних утицаја (квантификација утицаја)

У наставку стратешке процене утицаја врши се евалуација величине, просторних размера, вероватноће, трајања и укупног значаја утицаја предложене (изабране) варијанте плана, односно оних сектора плана и планских решења код којих су идентификовани утицаји, нарочито негативни, на животну средину. Критеријуми за оцењивање утицаја приказани су табеларно у одељку 4.3 овог извештаја, како следи:

Табела 4.3 - Критеријуми за оцењивање величине утицаја

Табела 4.4 - Критеријуми за оцењивање просторних размера утицаја

Табела 4.5 - Скала за процену вероватноће утицаја

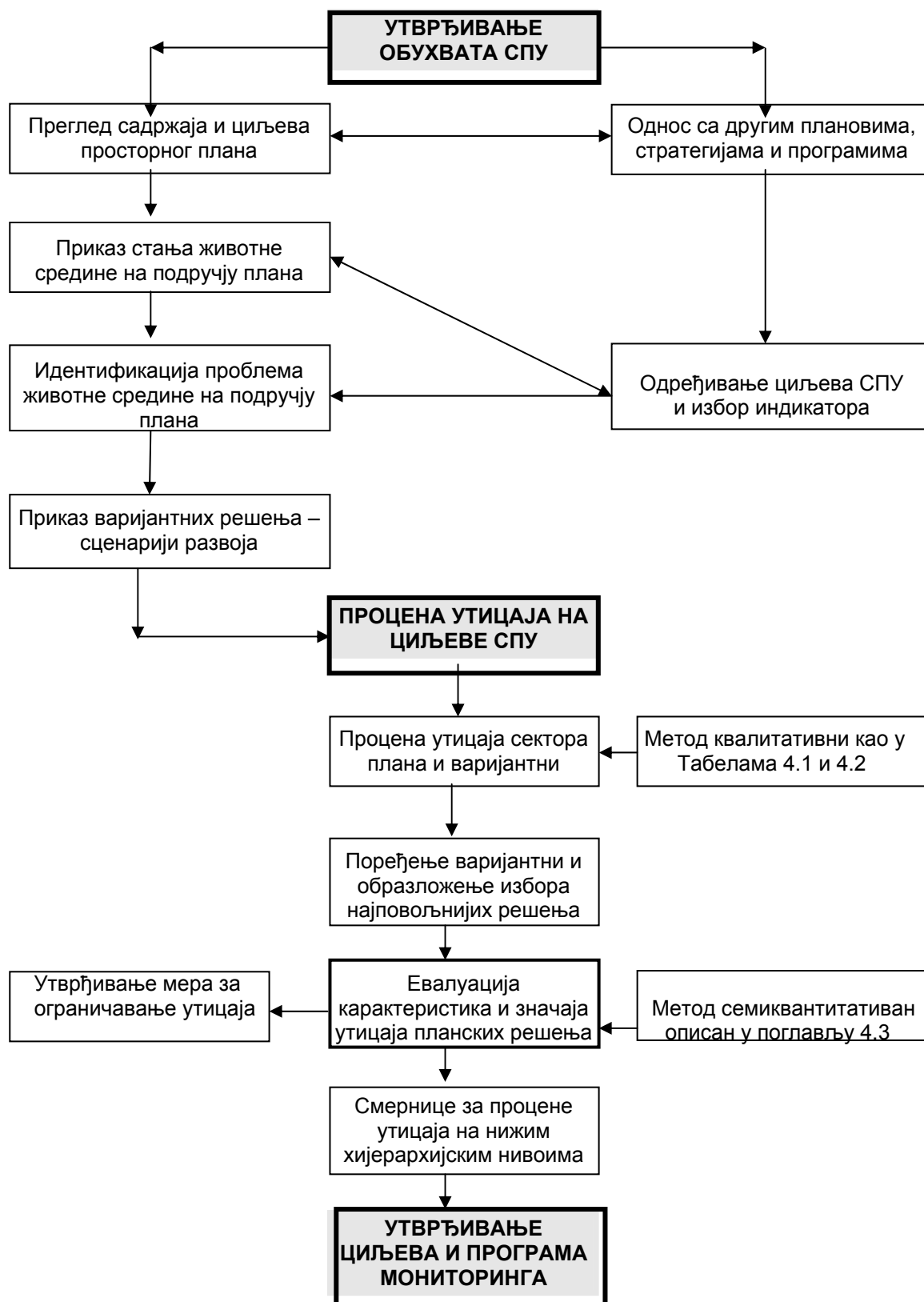
Табела 4.6 – Критеријуми за евалуацију значаја утицаја

- Према времену трајања утицаја дефинишу се привремени-повремени (P) и дуготрајни (D) ефекти.
- **Усвојено је** да су утицаји од стратешког значаја за просторни план су они који имају јак или већи (позитиван или негативан) ефекат на целом подручју плана или на вишем нивоу планирања, према критеријумима у табели 4.6.

На основу претходно наведених критеријума, синтетизованих у табели 4.6, врши се идентификација и квантификација стратешки значајних утицаја планских решења на животну средину и елементе одрживог развоја.

4) Одређивање кумулативних и синергетских ефеката

Значајни ефекти могу настати као резултат интеракције између бројних мањих утицаја постојећих објеката и активности са различитим планираним објектима и активностима у подручју плана.



Слика 7.1- Процедура и методологија израде извештаја о СПУ

8. ПРИКАЗ НАЧИНА ОДЛУЧИВАЊА, ОПИС РАЗЛОГА ОДЛУЧУЈУЋИХ ЗА ИЗБОР ПРОСТОРНОГ ПЛАНА СА АСПЕКТА РАЗМАТРАНИХ ВАРИЈАНТНИХ РЕШЕЊА И ПРИКАЗ НАЧИНА НА КОЈИ СУ ПИТАЊА ЖИВОТНЕ СРЕДИНЕ УКЉУЧЕНА У ПЛАН

Законски основ (члан 12. тачка 7. Закона)

Овај извештај је урађен на основу «Одлуке о изради стратешке процене утицаја Просторног плана подручја експлоатације Колубарског лигнитског басена на животну средину» (број 359-208/2006-01; од 05.04.2006.) коју је донео орган надлежан за израду Плана -Републичка агенција за просторно планирање.

У припреми одлуке о изради стратешке процене извршене су консултације и усаглашена мишљења са следећим надлежним органима и организацијама: Министарство науке и заштите животне средине-Управа за заштиту животне средине, Завод за заштиту природе Србије, Републички завод за заштиту споменика културе, Министарство енергетике и рударства, Ј.П. «Електропривреда Србије» - Сектор развоја и инвестиција, Министарство за капиталне инвестиције, Министарство пољопривреде, шумарства и водопривреде, и Министарство за законодавство.

Стратешка процена је рађена упоредо са финализацијом предлога Плана. Током припреме плана и извештаја о стратешкој процени обављене су консултације са надлежним органима: ЕПС (Дирекција за развој - Београд и Дирекција РЕИС Колубара), органи општина Лазаревац, Лајковац, Уб и Обреновац.

Према програму за израду «Стратешке процене утицаја Просторног плана подручја експлоатације Колубарског лигнитског басена на животну средину» предложене су за процену три варијанте развоја планског подручја:

- сценарио нултог развоја (ако се план не спроведе),
- изградња ТЕ-ТО Колубара Б,
- изградња ТЕ Колубара Б.

Будући да коначним предлогом Просторног плана није укључена варијанта изградње ТЕ-ТО Колубара Б, стратешком проценом су обухваћене преостале две варијанте. Резултати процене ефеката варијанти планираног развоја на животну средину, приказани у одељку 4.2, недвосмислено су показали предност развоја подручја Колубарског басена према предлогу Плана.

Имајући у виду да је финализација израде Плана и израде стратешке процене била синхронизована кључни налази и мере стратешке процене укључени су у Просторни план.

9. УЧЕШЋЕ ЗАИНТЕРЕСОВАНИХ СТРАНА У ПОСТУПКУ ИЗРАДЕ И РАЗМАТРАЊА ИЗВЕШТАЈА О СТРАТЕШКОЈ ПРОЦЕНИ

Законски основ

Члан 18. Закона - учешће заинтересованих страна

Орган надлежан за припрему плана и програма доставља заинтересованим органима и организацијама на мишљење извештај о стратешкој процени из члана 12. Закона. Заинтересовани органи и организације дужни су да доставе мишљење у року од 30 дана од дана пријема захтева. Ако се мишљење не достави у року сматра се да нема примедба на достављени извештај о стратешкој процени.

Члан 19. Закона - учешће јавности

Пре упућивања захтева за добијање сагласности на извештај о стратешкој процени, орган надлежан за припрему плана и програма обезбеђује учешће јавности у разматрању извештаја о стратешкој процени. Јавност члана разматра извештај у оквиру излагања плана и програма на јавни увид и одржавања јавне расправе.

На основу одредби Закона о планирању и изградњи и Закона о стратешкој процени предлаже се модел усклађене процедуре истовременог доношења одлука и о предлогу Плана и о извештају о стратешкој процени, који је приказан на схеми (Слика 9.1).



Слика 9.1 - Процедура доношења одлука о предлогу Плана и о извештају о стратешкој процени

10. ИЗВОД ИЗ СТРАТЕШКЕ ПРОЦЕНЕ (ЗАКЉУЧАК)

Законски основ (члан 12. тачка 7. Закона):

Закључци до којих се дошло током израде извештаја о стратешкој процени представљени на начин разумљив јавности.

Увод

Стратешка процена утицаја на животну средину уводи се у нашу праксу израде планова Законом о заштити животне средине (Службени гласник РС број 135/2004). Према члану 35 овог закона "Стратешка процена утицаја на животну средину врши се за планове, програме и основе у области просторног и урбанистичког планирања или коришћења земљишта, енергетике, индустрије, саобраћаја, управљања отпадом, управљања водама и других области и саставни је део плана, односно програма или основе". Стратешка процена утицаја на животну средину мора бити усклађена са другим проценама утицаја на животну средину, као и са плановима и програмима заштите животне средине и врши се у складу са поступком прописаним посебним законом: "ЗАКОНОМ О СТРАТЕШКОЈ ПРОЦЕНИ УТИЦАЈА НА ЖИВОТНУ СРЕДИНУ" (Службени гласник РС бр. 135/2004).

Одлучивање о изради стратешке процене врши се у складу са чланом 9 Закона о стратешкој процени утицаја. У складу са овом одредбом, Републичка агенција за просторно планирање донела је «Одлуку

о изради стратешке процене утицаја Просторног плана подручја експлоатације Колубарског лигнитског басена на животну средину» (број 359-208/2006-01; од 05.04.2006.). Према овој одлуци, израда стратешке процене заснована је на студијској, просторно планској и урбанистичкој документацији, релевантној регулативи, као и на резултатима досадашњих истраживања у области планирања и заштите животне средине. Методски приступ израде стратешке процене и садржај извештаја о стратешкој процени дати су у «Програму израде стратешке процене», који је саставни део наведене одлуке.

Анексом I Уговора о изради Просторног плана комплекса ТЕ-ТО «Колубара Б» (бр. 350-01-912/98-03 од 11.03.2005. године - Министарство за капиталне инвестиције, односно, бр. 759 од 28.07.2005. године - ЈП Електропривреда Србије и бр. 765 од 01.08.2005. године - ИАУС) утврђено је да ће се у оквиру Просторног плана подручја експлоатације Колубарског лигнитског басена урадити Стратешка процена утицаја на животну средину за цео басен, што обухвата и План генералне регулације комплекса термоелектране «Колубара Б».

10.1 Преглед садржаја и главних циљева Просторног плана

Подручје Просторног плана обухвата: постојеће и планиране површинске копове; депоније раскривке (јаловине) и других отпадних материја; објекте за припрему, прераду или трансформацију угља; мрежу спољног и унутрашњег транспорта; системе за водоснабдевање; подручја рекултивације оштећеног земљишта; локације за измештање насеља, инфраструктурних и других објеката из зоне експлоатације лигнита и подручја непосредног утицаја рударско-енергетског система на околину.

Укупна површина Планског подручја износи 547,14 km². Границама Просторног плана обухваћени су делови територије четири општине, и то: Лазаревац, Уб, Лајковац и Обреновац.

Просторни план се елаборира у две књиге:

Књига I:	Просторни план подручја експлоатације Колубарског лигнитског басена (циљеви, упоришта, планска решења, правила за уређење простора, смернице за спровођење, рефералне карте);
Књига II:	Документациона основа Просторног плана

Графичка документација (графички прикази) Просторног плана обрађена је на картографским подлогама у дигиталном и аналогном облику у размерама: 1:100 000 и 1: 50 000.

Експлоатационо подручје Колубарског лигнитског басена простира се, по дужој страни, од Рудоваца на југоистоку до Радњева и Шарбана на северозападу у дужини од око 25,5 km и, по краћој страни, у ширини од 2 - 8 km. Укупна површина експлоатационог подручја износи 133,9 km²; од тога је око 51,14 km² или 38,2% већ заузето за потребе рударства. Подручје Просторног плана приказано је на карти бр. 1.

Плански хоризонт је 2020. година, са средњорочним етапама 2010. и 2015. године. Завршетак експлоатације угља у Колубарском басену очекује се између 2050. и 2060. године.

Просторни план садржи планске концепције просторног развоја подручја Колубарског лигнитског басена и правила за уређење простора у следећим областима:

- | | |
|------------------|--|
| (1) Рударство | (9) Социјални развој |
| (2) Енергетика | (10) Измештање насеља и пресељење становништва |
| (3) Водопривреда | (11) Саобраћај |
| (4) Пољопривреда | (12) Телекомуникације |
| (5) Шумарство | (13) Заштита животне средине |
| (6) Привреда | (14) Рекултивација деградираних површина |
| (7) Становништво | (15) Заштита природе |
| (8) Мрежа насеља | (16) Заштита културних добара |

Основни развојни циљ Планског подручја јесте ефикасно, рационално, организовано и нерастрошно коришћење хуманих, природних и изграђених потенцијала, у социоекономском, просторном и еколошком погледу. Од привредних делатности, и надаље највећи значај имаће рударство и енергетика, као носеће области досадашњег и будућег развоја Планског подручја. Од велике важности, нарочито у реконструкцији постојећих капацитета за производњу електричне енергије и планирању развоја нових погона, имаће заштита животне средине и рекултивација земљишта где је експлоатисан лигнит, и тај значај биће у порасту.

Посебни развојни циљеве дати су за горе наведене секторе Просторног плана.

10.2 Проблеми заштите животне средине који су разматрани у Плану

Просторни план обухвата бројне објекте који могу имати утицаја на животну средину постојеће и планиране површинске копове, депоније раскривке (јаловине) и депоније пепела и шљаке, мрежу ТЕ «Колубара А» и ТЕ «Колубара Б», путеве спољног и унутрашњег транспорта, системе за водоснабдевање, локације постројења за технолошку и отпадну воду, подручја рекултивације оштећеног земљишта, локације за измештање насеља, инфраструктурних и других објеката из зоне експлоатације лигнита и подручја непосредног утицаја рударско-енергетског система на околину. Од бројних изграђених привредних и инфраструктурних објеката на Планском подручју посебан значај за процену стања животне средине имају објекти из рударско-енергетског комплекса, укључујући и пратеће индустрије које су у функцији рударства и енергетике. То су објекти који могу имати значајне утицаје на квалитет животне средине и подлежу обавези процене утицаја изведеног објекта према члану 30 Закона о процени утицаја (Службени гласник РС, бр. 135/2004).

У плану су детаљно анализирани главни извори деградације животне средине, као и последице њиховог утицаја на сегменте животне средине, и то:

• квалитет ваздуха	• природна станишта и биодиверзитет
• глобална промена климе	• заштићена природна добра
• квалитет вода	• буке и вибрација
• хидрогеологија	• радиоактивност
• деградација и квалитет земљишта	• управљање отпадом
• предеоне карактеристике	

Након прелиминарне процене утицаја појединих објеката на животну средину и одређивања њиховог значаја, дефинисано је која су питања и проблеми стратешки значајни за заштиту животне средине, а која нису од стратешког значаја, већ ће се третирали на нижим нивоима планирања и процене утицаја.

10.3 Посебни циљеви стратешке процене утицаја плана на животну средину и индикатори

	Посебни циљеви СПУ	Индикатори
1	Смањити изложеност становништва загађеном ваздуху	
1.1	Смањити ниво емисије штетних материја у ваздух	Емисије честица, SO ₂ и NO _x
1.2	Смањити степен изложености становништва загађеном ваздуху	Број дана са прекорачењем граничне вредности емисије (ГВИ) за чађ, SO ₂ и NO ₂ Индекси квалитета ваздуха
2	Ублажити утицај гасова сатаклене баште	Промена емисије и апсорпције угљендиоксида (%)
3	Очувати количине и унапредити квалитет површинских и подземних вода	
3.1	Ублажити негативан утицај рударства на хидролошки режим и квалитет подземних вода	Промена режима подземних вода Промена квалитета подземних вода (% поз. узорака)
3.2	Ублажити негативан утицај рударства на хидролошки режим и квалитет површинских вода	Промена режима површинских вода Промена класе квалитета водотока (% у проп. класи)
4	Ублажити негативан утицај на обрадиво пољопривредно и шумско земљиште	
4.1	Очувати обрадиво пољопривредно земљиште	Промена површина обрадивог земљишта (%)
4.2	Повећати површине под шумом	Промена површина шумског земљишта (%)
5	Унапредити третман и одлагање индустријског и комуналног отпада	
5.1	Смањити количину инд. отпада који се депонује	% инд. отпада који се рециклира
5.2	Смањити количину ком. отпада који се депонује	% ком. отпада који се одлаже на сан. депонију
6	Очувати биодиверзитет и природна добра и унапредити предео	
6.1	Очувати биодиверзитет-избећи неповратне губитке	% изгубљених врста у односу на регион
6.2	Избећи оштећење заштићених и значајних природних добара	Површина оштећених заштићених и значајних природних добара (%)
6.3	Извршити рекултивацију копова и одлагалишта	% рекултивисаних површина
7	Очувати заштићена и незаштићена	Број и значај угрожених објеката културног

	значајна културна добра	наслеђа
8	Ублажити негативан утицај развоја на демографију и насеља	
8.1	Очувати бројност и структуру становништва	Промена броја и структуре становништва (%) Број домаћинстава за пресељење по насељима
8.2	Минимизирати утицај на насеља и објекте	Број објеката за рушење по насељима
9	Заштити и унапредити здравље становништва	Морталитет деце до пет година (%) Учестаност респираторних обољења (%) % становника изложен повишеној буци Број лекара на 1000 становника
10	Унапредити систем управљања заштитом животне средине	% буџета намењен заштити животне средине од укупних инвестиција Број жалби грађана због еколошких проблема Број извештаја о стању животне средине доступних јавности
11	Подстицати економски развој и запосленост	% домаћинстава са приходом изнад просека РС % запослених од радно способног становништва
12	Ублажити негативан утицај развоја на саобраћајну и водопривредну инфраструктуру	
12.1	Минимизирати утицај на путну мрежу	Дужина путева за рушење по деоницама (km) Дужина измештених путева по деоницама (km)
12.2	Минимизирати утицај на водотоке	Дужина уништених водотока по рекама (km) Дужина измештених водотока по рекама (km)

10.4 Процена могућих утицаја и мере за смањење негативних утицаја

Процена ефеката развоја Планског подручја на животну средину разматрана је у две варијанте: „А“ – ако се план не спроведе и „Б“ – ако се план спроведе. Избор најповољније варијанте извршен је на основу анализе свих позитивно и негативно оцењених ефеката сваког сектора плана из табела 4.1 и 4.2 за оцењивање варијанти. Могући позитивни и негативни ефекти варијанти плана показују следеће:

- А) У варијанти да се Просторни план не донесе и да се развој настави по досадашњем тренду могу се очекивати негативни ефекти код сваког сектора, а неколико позитивних ефеката који би се остварили у оквиру текућих програма за измештање становништва и развоја телекомуникација.
- В) У варијанти да се Просторни план имплементира могу се очекивати бројни позитивни ефекти у сваком сектору, који отклањају већину негативних тенденција у развоју Планског подручја ако се План не би имплементирао. То су следећи кључни позитивни ефекти:
- смањење изложености становништва загађеном ваздуху због примене савремених технологија заштите животне средине у новим и реконструисаним постројењима,
 - реконструкција постојећих и изградња нових ППОВ за пречишћавање отпадних вода,
 - повећање површина шумског земљишта рекултивацијом, што доприноси очувању биодиверзитета и капацитету апсорпције угљендиоксида,
 - применом савремених технологија битно се унапређује третман и одлагање пепела, гипса и комуналног отпада,
 - кроз компензацију и расељавање становништва постижу се повољни социо-економски ефекти, услови за унапређење здравља становништва,
 - економски развој и повећање запослености,
 - применом плана заштите животне средине и програма мониторинга стварају се услови за успостављање координисаног система заштите животне средине на Планском подручју.

У овој варијанти могу се очекивати и појединачни негативни ефекти у одређеним секторима Плана, а који су неизбежна цена друштвено-економског развоја подручја и задовољења потреба Републике за енергијом. То су следећи ефекти:

- услед развоја површинских копова не могу се избећи негативни ефекти у односу на већину индикатора квалитета животне средине, који се могу ублажити одређеним мерама заштите или компензацијом,
- смањење површина пољопривредног земљишта због рударских радова и изградње објеката,
- измештање становништва и демографске промене у насељима захваћеним коповима,
- саобраћајна и водопривредна инфраструктура која је под утицајем развоја копова биће измештена,
- утицај на споменике културе и заштићена природна добра.

На основу изнетог може се закључити да је варијанта доношења предложеног плана повољнија у односу на варијанту да се План не донесе.

10.5 Одређивање карактеристика могућих значајних утицаја планских решења

Ознака	Планска решења у предлогу Плана обухваћена проценом утицаја
1	Рударство
1.1	"Тамнава-Западно поље"- 170.5 милиона тона
1.2	Поље "Радљево " – 40.3 милиона тона
1.3	Поље "Велики Црљени" - 31.0 милиона тона
1.4	"Тамнава - Јужно поље" - 70.5 милиона тона
1.5	Поље "Б" и "Ц" - 41,3 милиона тона
1.6	Поље "Д" - 69.0 + 65.0 милиона тона
1.7	Поље "Е" - 61.5 милиона тона
1.8	Припрема и допрема угља
2	Енергетика
2.1	ТЕ "Колубара Б"
2.2	Депонија гипса, пепела и шљаке у ПК "Тамнава Западно поље"
2.3	Разводно постројење 400 kV и 220 kV са преносном мрежом од 400, 220 и 110 kV
2.4	Реконструкција ТЕ Колубара "А"
2.5	Реконструкција «Топлане» и «Сушаре» у Вреоцима
3	Водопривреда
3.1	ППВ "Пештан" – к.о. Вреоци
3.2	Нова ВС "Зеоке". – к.о. Зеоке
3.3	ВС "Каленић" - к.о. Каленић
3.4	Измештање дела реке Колубаре - "Тамнава Источно поље", "Тамнава Јужно поље", "В. Црљени"
3.5	Измештање дела реке Кладнице - "Тамнава Западно поље"
3.6	Измештање дела реке Пештан - "Тамнава Јужно поље", Поље "Е"
3.7	Скраћивање тока река Лукавице и Враничине - "Тамнава Јужно поље"
4	Измештање насеља
4.1	Каленић (44 домаћинства) - "Тамнава Западно поље"
4.2	Мали Борак (115 д.) - "Тамнава Западно поље"
4.3	Вреоци (1030 д.) - "Тамнава Јужно поље", Поље "В. Црљени", Поље "Д"
4.4	В. Црљени (20 д.) - Поље "В. Црљени"
4.5	Цветовац (20 д.) - Поље "В. Црљени"
4.6	Медошевац (55 д.) - Поље "Д"
4.7	Барошевац (60 д.) - Поље "Б", Поље "Е"
4.8	Зеоке (276 д.) - Поље "Е"
4.9	Радљево (84 д.) – поље "Радљево"
4.10	Бргуле (26 д.) - поље "Радљево"
4.11	Шарбане (83 д.) - поље "Радљево"
4.12	Шопић (8 д.) - Поље "Е"
5	Саобраћај
5.1	Измештање деонице пута М-22 од југозападне границе површинског копа "В.Црљени"
5.2	Укидање деонице Р-101а (7,7 km), од Старог села до јужне границе ПК "Тамнава-Западно поље",
5.3	Изградња обилазнице око Лајковца у дужини од око 5,7 km
5.4	Реконструкција локалног пута Л-1008 и Л-7 (14,6 km) – к.о. Стубленице, Паљуви и Јабучје
5.5	Реконструкција дела пута Л-1806 (4,7 km) – к.о. Лазаревац, Дрен, Бурово
6	Рекултивација деградираних површина
6.1	Рекултивација 927 ha јаловишта- Поље "В. Црљени", "Тамнава Источно поље", "Д", "Б" и "Е"

6.2	Рекултивација 83,6 ha пепелишта - к.о. В. Црљени, Соколово, Степојевац
7	Регионална санитарна депонија
7.1	Регионална санитарна депонија са постројењем за рециклажу

Значајни кумулативни утицаји планских решења на животну средину и одрживи развој подручја

Интеракција планских решења	Област стратешке процене
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УПРАВЉАЊЕ КВАЛИТЕТОМ ВАЗДУХА

1.1, 1.3-1.8, 2.1, 2.2, 7.1	На коповима је доминантана емисија прашине у току ископавања угља и уклањања откривке, што не изазива прекорачење ГВИ о околним насељима. Емисија честица из ТЕ «Колубара Б», после третмана не прекорачује ГВЕ. Емисија честица са депоније пепела, шљаке и гипса, као и са комуналне депоније, могућа је само у случају јаког ветра. Емисије честица из реконструисаних погона ТЕ «Колубара А», топлане и сушаре у Вреоцима биће испод ГВЕ. Имајући у виду да у Планском подручју постоје и други извори емисије честица (саобраћај, индустријски погони и домаћинства) могућно је због кумулативног дејства прекорачење ГВИ у неповољнијим метеоролошким условима. Емисија SO ₂ и NO _x из ТЕ «Колубара Б», после пројектованих третмана неће прелазити ГВЕ. Међутим, ови полутанти се не пречишћавају из осталих извора, те је могућно прекорачење ГВИ услед кумулативног дејства.
2.4, 2.5, 4.1-4.8, 5.3, 6.1, 6.2	Позитивни кумулативни ефекти за смањење изложености становништва загађеном ваздуху остварују се на два начина: (1) реконструкцијом ТЕ «Колубара А», топлане и сушаре у Вреоцима и (2) пресељењем становништва из угрожених насеља.

КЛИМАТСКЕ ПРОМЕНЕ

2.1, 2.4, 2.5, 7.1	Гасови стаклене баште (CO ₂ , CH ₄ , N ₂ O, O ₃ и халогенугљоводоници) ослобађају се у свим процесима конверзије фосилних горива у енергију (термоелектране, топлане, саобраћај) и на комуналној депонији. Кумулативно посматрано постојећи и нови извори на подручју Плана повећаће емисију гасова стаклене баште, али то повећање није значајно на нивоу Србије, а поготову то није на глобалном нивоу. Кјото протоколом није предвиђена обавеза Србије (као земље у развоју) квантификованог смањења емисије гасова са ефектом стаклене баште.
-	

УПРАВЉАЊЕ ВОДАМА

1.1, 1.3, 1.4, 1.6, 1.7, 2.1, 2.2	Предложени развој рударских активности ће неизбежно утицати на хидрогеолошки режим унутар копова и кумулативно у ширем окружењу. Поремећај режима вода може имати индиректне утицаје на режиме површинских вода, плодност земљишта и водоснабдевање становништва. Због развоја копова мораће да се измести један број водотока. Могућа је инфилтрација загађујућих материја у коповима и јаловиштима. Могућно је загађивање водотока и подземних вода отпадним водама из термоелектране и депоније пепела.
2.5, 3.1-3.6	Реконструкцијом постројења за пречишћавање отпадних вода у Вреоцима обезбедиће се смањење загађености Колубаре. Модернизацијом постојећих и изградњом нових водоводних система и повезивањем са Колубарским регионалним системом обезбедиће се стабилно снабдевање становништва пијаћом водом. Измештањем угрожених делова токова река побољшаће се режими и квалитет површинских вода.

ЗАШТИТА И КОРИШЋЕЊЕ ЗЕМЉИШТА

1.1-1.7	У периоду до 2020. године предвиђа се повећање површина заузетих рударством за око 5% (за 1116 ha) и смањење површина пољопривредног земљишта на подручју Плана за око 6% (за 2502 ha).
3.4-3.6, 6.1, 6.2,	Измештање Колубаре, Пештана и Кладнице у извесној мери би повољно

Интеракција планских решења 7.1	Област стратешке процене
	утицало на квалитет пољопривредног земљишта. Највећи допринос ће се остварити рекултивацијом 1011 ha деградираних земљишта (83.6 ha пепелишта и 927.6 ha јаловишта). Површине под шумама ће се повећати за 37% (1163 ha). Регионална депонија комуналног отпада ће се sukcesивно рекултивисати у планском периоду.

УПРАВЉАЊЕ ОТПАДОМ

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2.1, 2.2, 7.1	Нова пројектована технологија третмана, транспорта и одлагања пепела, шљаке и гипса веома је повољна са становишта заштите животне средине. Пројектом депоније пепела предвиђена је израда водонепропусног слоја и рецикулација свих вода на депонију у циљу спречавање загађења земљишта и подземних вода. Изградња регионалне депоније комуналног отпада и рециклажног центра према европским стандардима значајно ће унапредити систем управљања отпадом у 11 општина региона.

ОЧУВАЊЕ ПРИРОДНИХ ДОБАРА И БИОДИВЕРЗИТЕТА И УНАПРЕЂЕЊЕ ПРЕДЕЛА

1.1-1.7, 2.2, 7.1	Рударске активности и јака деградација пољопривредног земљишта и уништавање вегетације на локацијама појединих копова има кумулативно дејство на губитак станишта већине животињских врста и изазваће њихово пресељење изван шире зоне активних копова, као и из депонија пепела и комуналног отпада.
3.4-3.6, 6.1, 6.2	Измештање река и уређење водотока ће повољно утицати на очување водених станишта. Рекултивацијом копова и депонија укупно се стварају услови за обнављање станишта биљног и животињског света, као и за побољшање пејсажних карактеристика подручја Плана.

ЗАШТИТА КУЛТУРНИХ ДОБАРА

1.1, 1.3, 1.6, 4.1-4.5	Кумулативан веома негативан утицај на стање културног наслеђа због развоја копова „Тамнава-3.поље“, поље „В. Црљени“ и поље „Д“, као и пресељења становништва из насеља у којима су евидентирана културна добра.
-	

НАСЕЉА, СТАНОВНИШТВО

1.1, 1.3-1.7, 4.1-4.8	Кумулативан негативан утицај на број и структуру становника и карактеристике насеља услед развоја свих површинских копова (са изузетком Тамнава-Источно поље) и пресељење укупно 5670 становника, односно око 1920 домаћинства.
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ЗДРАВЉЕ СТАНОВНИШТВА

1.1, 1.3, 1.6, 2.1, 2.2	Мали локални утицаји назначених планских решења могу постати значајни кумулативно са другим изворима загађеног ваздуха и буке (саобраћај, индустрија) унутар граница експлоатационог подручја.
2.4, 2.5, 3.1-3.3, 3.7, 4.4-4.4, 4.6-4.8, 5.3, 6.1, 6.2, 7.1	Назначена планска решења кумулативно доприносе здрављу становништва. Са једне стране смањењем емисије штетних материја (2.4, 2.5, 3.1-3.3, 7.1), а са друге удаљењем рецептора (становништва) од извора загађења (пресељење становништва) и апсорпцијом загађења на пошумљеним рекултивисаним површинама.

СИСТЕМ УПРАВЉАЊА ЗАШТИТОМ ЖИВОТНЕ СРЕДИНЕ

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1.1, 1.3-1.8, 2.1, 2.2, 3.4-3.7, 4.1-4.4, 4.6-4.8, 5.1-5.5, 6.1, 6.2, 7.1	У оквиру развоја предложеног система управљања заштитом животне средине надлежних и заинтересованих страна за реализацију наведених планских решења обезбедиће се услови за интегрисану заштиту животне средине на подручју Плана.

ЕКОНОМСКИ РАЗВОЈ ПОДРУЧЈА

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1.1, 1.3, 1.4,	Интеракцијом планских решења кумулативно ће се значајно подстаћи даљи

Интеракција планских решења	Област стратешке процене
1.6-1.8, 2.1-2.3, 2.4, 2.5, 3.4-3.7, 4.1-4.4, 4.6-4.8, 5.1-5.5, 6.1, 9.2, 7.1	економски развој подручја и повећати запосленост не само у рударско енергетском сектору, већ и у другим комплементарним делатностима.

ИНФРАСТРУКТУРНИ СИСТЕМИ

1.1-1.7	Кумулативно рударске активности на коповима изазваће јак утицај и деструкцију делова саобраћајница и речних токова.
3.4-3.7, 5.1, 5.2, 5.4, 5.5	Наведена решења ће кумулативно допринети уређењу и регулацији вовотокова и унапређењу путне мреже.

10.6 Приказ процењених значајних утицаја Плана на животну средину и мера заштите

На основу резултата евалуације значаја утицаја планских решења на животну средину (Табеле 4.10) и процене кумулативних и синергетских ефеката на подручју плана (Табеле 4.11) утврђени су следећи значајни утицаји Плана на животну средину:

1) Квалитет ваздуха

За квалитет ваздуха стратешки су значајне високе емисије димних гасова из планиране ТЕ «Колубара Б», које превазилазе дозвољене граничне вредности. Међутим, избором унапређене технологије сагоревања угља и планским решењима за високоефикасне електрофилтре за пречишћавање честица прашине и за постројење за одсумпоравање све емисије се свде на ниво испод граничних вредности прописаних нашим и европским стандардима. Програмираним реконструкцијама постројења ТЕ «Колубара А» у В. Црљенима и «Прераде» у Вреоцима смањиће се данас неприхватљиве емисије из тих извора. Ипак, концентрације загађујућих материја на појединим локалитетима могу повремено превазилазити прописане граничне вредности емисије услед кумулативног дејства дозвољених емисија из наведених извора са емисијама из осталих извора као што су површински копови (прашина), саобраћај (издвни гасови), кућна ложишта, остала индустрија, итд.

2) Квалитет површинских и подземних вода

Предложени развој рударских активности ће неизбежно утицати на хидрогеолошки режим унутар копова и кумулативно у ширем окружењу. Због развоја копова мораће да се измести један број водотока. Могућа је инфилтрација загађујућих материја у коповима и јаловиштима. Могућно је загађивање водотока и подземних вода отпадним водама из термоелектране и депоније пепела. За ублажавање наведених негативних утицаја планских решења на воде Планом су предвиђене грађевинске и техничко-технолошке мере заштите. У складу са динамиком развоја копова предвиђено је измештање делова река Колубаре, Кладнице, Пештана и других мањих водотока. Реконструкцијом постројења за пречишћавање отпадних вода у Вреоцима обезбедиће се смањење загађености Колубаре. Планирана технолошка решења за пречишћавање и рецикулацију употребљених вода, као и за транспорт и одлагање пепела и шљаке у ТЕ «Колубара Б» обезбедиће да технолошке воде из њених постројења не угрожавају квалитет површинских и подземних вода. Поремећај режима подземних вода услед рударских радова делимично се може ублажити одговарајућом техником одводњавања копова и успостављањем адекватног система мониторинга нивоа подземних вода. Проблем водоснабдевања насеља решаваће се модернизацијом постојећих и изградњом нових водоводних система и повезивањем са Колубарским регионалним системом.

3) Квалитет земљишта и карактеристике предела

Рударски радови и депоније јаловине, пепела и шљаке производе најјачи негативан утицај на деградацију и могуће загађивање земљишта, као и промену карактеристика предела. За ублажавање негативних ефеката предвиђена је обимна рекултивација и обнављање дела пољопривредног земљишта и знатно повећање површина под шумом.

4) Заштита природе, биодиверзитет

Рударске активности и јака деградација земљишта, те уништавање вегетације изазваће губитак станишта већине животињских врста и изазваће њихово пресељење изван шире зоне активних копова, као и из депонија пепела и комуналног отпада. Обнављањем земљишта рекултивацијом, уређењем водотока створиће се услови за обнављање станишта биљног и животињског света, као и за побољшање пејсажних карактеристика подручја Плана.

5) Заштита културних добара

Рударске активности имаће веома негативан утицај на стање културног наслеђа, као и на пет насеља у којима су евидентирана културна добра. Предвиђено је измештање свих угрожених евидентираних културних добара и посебно пресељење гробља из Вреоца.

6) Насеља и становништво

Рударске активности имаће веома негативан утицај на број и структуру становника и карактеристике насеља Вреоци, Зеоке, Мали Борак, Медошевац, Барошевац, Цветовац, В. Црљени и Каленић, Радљево, Бргуле и Шарбане. Ублажавање негативних ефеката извршиће се компензацијом имовине и пресељењем становништва кроз организоване форме или индивидуалним опредељењем на нове локације. На тај начин створиће се и услови за побољшање здравствених услова угроженог становништва.

7) Инфраструктурни системи

Рударске активности на коповима изазваће јак утицај и деструкцију делова саобраћајница и речних токова. Угрожене су следеће саобраћајнице: коридор између Источног и Западног поља Тамнава, у коме се налази регионални пут Р-101а, коридор северно од "Тамнава - Западно поље" и будућег поља "Радљево", у коме је смештен регионални пут Р-270, коридор источно од Поља "Велики Црљени" и "Тамнава-Јужно поље" у коме се налазе државни пут М-22 и пруга Београд-Бар, као и коридор унутар Поља "Е" у коме се налази регионални пут Р-201 и локални пут Л-1806. Поред тога, рударски радови на коповима "Тамнава Западно поље", Тамнава Источно поље", "Тамнава Јужно поље", роге "Radqevo", "В. Црљени" и Поље "Е" угрожавају делове река Колубаре, Кладнице, Пештана, Лукавице и Враничине. Планом су предвиђене мере за ублажавање наведених негативних утицаја тако што ће се угрожене саобраћајнице и водотоци изместити на безбедне зоне.

8) Економски развој

Имплементација Плана има кључни значај за развој енергетског система Србије, а на локалном и регионалном нивоу веома ће допринети даљем економском развоју подручја и повећати запосленост не само у рударско енергетском сектору, већ и у другим комплементарним делатностима.

10.7 План квалитета животне средине

Предложена је просторно-еколошка диференцијација простора подручја Плана (план заштите животне средине), на основу категоризацију из Просторног плана Републике Србије. Тако се успостављају режим коришћења простора условљени критеријумима квалитета животне средине, како следи:

Категорија загађености	Локалитети	Опис
I	површински копови лигнита, депоније шљаке и пепела	повишена концентрација прашине, бука
II	зоне В. Црљена, Вреоца, Медошевца, Јунковца, Цветовца, М.Борка и Каленића	дозвољава повремено ³⁹ прекорачење ГВИ примарних загађујућих материја, али без прекомерног загађивања радиоактивним, канцерогеним и мутагеним материјама
III	градска зона Лазаревца и коридор аутопута Београд-Јужни Јадран	не очекују прекорачења ГВИ, али ће се јављати непријатни мириси, индустријски и комунални отпад, повишена бука и утицаји саобраћаја и утицај водотока четврте класе
IV	зоне Уба, Лајковца и Шопића, периферна насеља Лазаревца и коридори Ибарске магистрале и магистралне пруге Београд-Бар	загађивања из прехранбене индустрије, осталих индустрија са уграђеним уређајима за пречишћавање ваздуха и вода, сточних фарми, интензивне пољопривредне производње, државних путева и пруга, приградских зона насеља
V	коридори регионалних и локалних путева и пруга	којима периодично долази до повећања емисије буке и аерозагађења
VI	сеоска насеља	мања загађивања земљишта и вода
VII	шумска и ливадска подручја	без перманентних извора загађивања животне средине

За остваривање овог плана дефинисана су правила заштите животне средине у уређењу простора и изградњи у односу на акустичко зонирање простора (заштита од буке, размештај индустрије и зоне саобраћајне намене.

Полазећи од циљева и критеријума заштите животне средине дефинисаним у политикама и стратегијама заштите у усвојеним документима, а уважавајући наслеђено стање животне средине, као и од пројекције привредног и просторног развоја, неопходно је у спровођењу Плана применити комплексне техничко-технолошке, урбанистичко-еколошке, организационе и друге мере заштите. Приликом програмирања и планирања активности за спровођење Просторног плана обавезан је превентивни приступ очувању ресурса и заштити животне средине, при чему се морају поштовати опште прихваћени критеријуми, законски нормативи и стандарди заштите животне средине и здравља људи. Циљеви и критеријуми заштите животне средине, који су утврђени овим просторним планом остварују се њиховим уграђивањем у:

- урбанистичке планове и пројекте;
- програме и планове развоја и инвестиционе пројекте предузећа, посебно у области енергетике, рударства и индустрије;
- програме ревитализације и рекултивације деградираних површина;
- програме и акционе планове заштите животне средине органа локалне самоуправе и невладиних организација; и
- програме мониторинга квалитета ваздуха, вода, земљишта и других сегмената животне средине.

³⁹ према нормама Светске здравствене организације

10.8 Смернице за организацију мониторинга на подручју Плана

Остваривање планских циљева заштите животне средине није само планерско и техничко-технолошко питање, већ у великој мери зависиће од организованости за заштиту животне средине свих заинтересованих субјеката, посебно у ЕПС-у и у локалним заједницама. У том смислу неопходно је спровести следеће приоритетне активности:

- ојачати стручне службе задужене за животну средину у општинама и предузећима ЕПС-а у Колубарском басену, односно успоставити их тамо где не постоје;
- урадити Локални акциони план за заштиту животне средине подручја (LEAP), користећи и препоруке из Анекса 8 Процене утицаја на животну средину проширења копа "Тамнава-Западно поље"⁴⁰;
- урадити детаљан план мониторинга квалитета животне средине који би обухватио елементе дефинисане у Анексу 9, Процене утицаја на животну средину ПК "Тамнава-Западно поље"⁴¹;
- урадити детаљан план мониторинга просторних и друштвено-економских индикатора;
- формирати информациони систем животне средине, који би поред резултата локалног система мониторинга водио евиденцију података и из извора градских и републичких надлежних институција;
- обезбедити информисање јавности о проблемима заштите животне средине подручја; и
- обезбедити учешће јавности у доношењу одлука о решавању проблема заштите животне средине, укључујући све потенцијално угрожене и заинтересоване стране.

Имајући у виду сложеност надлежности органа по вертикалној хијерархији (република-ЕПС-општине) и по хоризонталној надлежности (унутар Планског подручја) и тешкоће у координацији активности различитих органа, за успешно спровођење «Програма праћења стања животне средине» неопходно је формирати **«Координационо тело за животну средину и одрживи развој»**, које би било задужено за координацију, планирање, програмирање, надзор и реаговање у вези са проблемима животне средине на подручју Просторног плана. Ово тело би обједињавало информације које прикупљају органи Републике, ЕПС-а и општина надлежни за вршење надзора над извршавањем одредаба првенствено «Закона о заштити животне средине» и «Закона о планирању и изградњи», као и других релевантних закона.

⁴⁰ Процена утицаја на животну средину проширења копа "Тамнава-Западно поље", Анекс 8- Обавезе на заштити животне средине и акциони план, Европска агенција за реконструкцију, ЕПС, Београд, 2002

⁴¹ Процена утицаја на животну средину проширења копа "Тамнава-Западно поље", Анекс 9-План мониторинга, Европска агенција за реконструкцију, ЕПС, Београд, 2002.

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12. ПРИЛОЗИ

ПРИЛОГ I: СПИСАК ТАБЕЛА

Број табеле	Назив табеле
1.1	Пројекција динамике експлоатација угља Колубарског басена до 2020. године
1.2	Просторне целине у плану генералне регулације комплекса
1.3	Бруто развијена грађевинска површина објеката I фазе
1.4	Резиме главних врста емисија и предвиђених технологија третирања
1.5	Планиране веће привредно-индустријске зоне (без рударских површина)
1.6	Процена динамике пресељења по насељима и могућих зона насељавања
1.7	Утицај динамике отварања и експлоатације по пољима површинских копова на путну мрежу
1.8	План квалитета животне средине
2.1	Постојећи објекти рударско-енергетског комплекса са пратећим делатностима које подлежу процени утицаја на животну средину
2.2	Биланс површина постојећих објеката рударско-енергетског комплекса
2.3	Приказ резултата мерења имисије
2.4	Евиденција споменика културе по општинама
3.1	Области заштите животне средине, општи и посебни циљеви стратешке процене
3.2	Посебни циљеви СПУ и индикатори
4.1	Процена утицаја у односу на циљеве стратешке процене утицаја у варијанти да се план не примени (Сценарио „А“)
4.2	Процена утицаја у односу на циљеве стратешке процене утицаја у варијанти примене предложеног плана (Сценарио „Б“)
4.3	Планска решења у предлогу плана обухваћена проценом утицаја
4.4	Критеријуми за оцењивање величине утицаја
4.5	Критеријуми за оцењивање просторних размера утицаја
4.6	Скала за процену вероватноће утицаја
4.7	Критеријуми за евалуацију значаја утицаја
4.8	Процена величине утицаја планских решења на животну средину и елементе одрживог развоја
4.9	Процена просторних размера утицаја планских решења на животну средину и елементе одрживог развоја
4.10	Идентификација и евалуација стратешки значајних утицаја планских решења на животну средину и елементе одрживог развоја
4.11	Идентификација могућих кумулативних и синергетских ефеката
4.12	Критеријуми за акустичко зонирање простора
4.13	Услови за размештај индустрије
5.1	Смернице за процене утицаја на нижим нивоима
6.1	Индикатори за праћење стања животне средине и елемената одрживог развоја

ПРИЛОГ II: СПИСАК СЛИКА И КАРАТА

СПИСАК СЛИКА

- 1.1 Производња и структура потрошње угља у Колубарском басену у периоду до 2020. године
- 1.2 Расподела средњедневних концентрација SO₂ у околини ТЕ за средњи дан
- 1.3 Расподела средњедневних концентрација SO₂ у Колубарском басену после пуштања у погон ТЕ „Колубара Б“, за средњи дан
- 1.4 Расподела средњедневних депозиција честица летећег пепела при нормалном раду електрофилтера (за средњи дан)
- 1.5 Расподела средњедневних депозиција честица летећег пепела при нормалном раду електрофилтера (за дан са кошавом)
- 1.6 Геолошки профил Колубарског лигнитског басена
- 1.7 Основна хидрогеолошка карта подручја
- 7.1 Процедура и методологија израде извештаја о СПУ
- 9.1 Процедура доношења одлука о предлогу плана и о извештају о стратешкој процени

СПИСАК КАРАТА

1. Подручје просторног плана
2. Намена површина 2020. године
3. Водопривредна инфраструктура 2020. године
4. Промене површина пољопривредног земљишта у периоду 2005/2020. године
5. Промене површина шумског земљишта у периоду 2005/2020. године
6. План рекултивације до 2020. године
7. Утицај плана на насеља и пресељење становништва
- 7а Утицај рударских радова на смањење броја домаћинстава
8. Утицај плана на путну мрежу
9. Утицај плана на водотоке
10. Утицај плана на споменике културе и заштићена природна добра
11. План заштите животне средине
12. Визија могуће намене површина 2055-2060. године

ПРИЛОГ III: ЗАКОНСКИ ПРОПИСИ ОД ЗНАЧАЈА ЗА ИЗРАДУ СТРАТЕШКЕ ПРОЦЕНЕ

- Закон о планирању и изградњи
"Службени гласник РС", број: . 47/03
- Закон о заштити животне средине
"Службени гласник РС", број: 135/04
- Закон о заштити животне средине
ПРЕСТАЈЕ ДА ВАЖИ - са 135/04 - осим одредаба којима се уређује заштита ваздуха, заштита природних добара и заштита од буке
"Службени гласник РС", број: 66/91, 83/92, 53/93, 67/93, 48/94, 53/95, 135/04
- Закон о стратешкој процени утицаја на животну средину
"Службени гласник РС", број: 135/04
- Закон о процени утицаја на животну средину
"Службени гласник РС", број: 135/04
- Уредба о утврђивању Листе пројеката за које је обавезна процена утицаја и Листе пројеката за које се може захтевати процена утицаја на животну средину
"Службени гласник РС", број: 84/05
- Закон о интегрисаном спречавању и контроли загађивања животне средине
"Службени гласник РС", број: 135/04
- Уредба о врстама активности и постројења за које се издаје интегрисана дозвола
"Службени гласник РС", број: 84/05.
- Закон о превозу опасних материја
"Службени лист СФРЈ/СРЈ", број: 27/90, 45/90, 24/94, 28/96, 21/99, 44/99
- Уредба о превозу опасних материја у друмском и железничком саобраћају
"Службени гласник РС", број: 53/02
- Правилник о методологији за процену опасности од хемијског удеса и од загађивања животне средине, мерама припреме и мерама за отклањање последица
"Службени гласник РС", број: 60/94
- Правилник о начину поступања са отпаcima који имају својство опасних материја
"Службени гласник РС", број: 12/95
- Листа отрова разврстаних у групе
"Службени лист СРЈ", број: 12/00
- Закон о националним парковима
"Службени гласник РС", број: 39/93, 44/93, 53/93, 67/93, 48/94
- Уредба о заштити природних реткости
"Службени гласник РС", број: 50/93, 93/93
- Правилник о регистру заштићених објеката природе
"Службени гласник РС", број: 30/92
- Правилник о категоризацији заштићених природних добара
"Службени гласник РС", број: 30/92
- Закон о водама
"Службени гласник РС", број: 46/91, 53/93, 67/93, 48/94, 54/96
- Закон о режиму вода
"Службени гласник РС", број: 59/98
- Правилник о начину одређивања и одржавања зона и појасева санитарне заштите објеката за снабдевање водом за пиће
"Службени гласник РС", број: 33/78
- Правилник о опасним материјама у водама
"Службени гласник РС", број: 31/82
- Правилник о класификацији вода
"Службени гласник РС", број: 5/68
- Уредба о категоризацији водотока
"Службени гласник РС", број: 5/68
- Правилник о хигијенској исправности воде за пиће
"Службени. лист СРЈ", број: 42/98, 44/99
- Правилник о критеријумима за одређивање локације и уређење депонија отпадних материја
"Службени гласник РС", број: 54/92
- Правилник о граничним вредностима емисије, начину и роковима мерења и евидентирања података
"Службени гласник РС", број: 30/97, 35/97
- Правилник о дозвољеном нивоу буке у животној средини
"Службени гласник РС", број: 54/92

- Правилник о дозвољеним количинама опасних и штетних материја у земљишту и методама за њихово испитивање
"Службени гласник РС", број: 23/94
- Правилник о граничним вредностима, методама мерења и емисије, критеријумима за успостављање мерних места и евиденцији података
"Службени гласник РС", број: 54/92, 30/99
- Закон о заштити од јонизујућих зрачења
"Службени лист СРЈ", број: 46/96, 85/05
- Правилник о максималним границама радиоактивне контаминације човекове средине и о вршењу деконтаминације
"Службени лист СФРЈ" бр.8/87
- Правилник о границама излагања јонизујућим зрачењима
"Службени лист СРЈ", бр. 32/98
- Правилник о начину и условима, сакупљања, чувања, евидентирања, складиштења, обрадивања и одлагања радиоактивног отпадног материјала
"Службени лист СРЈ", бр. 9/99
- Закон о туризму
"Службени гласник РС", број: 35/94, 38/94, 48/99
- Закон о шумама
"Службени гласник РС", број: 46/91, 83/92, 54/93, 60/93, 53/93, 67/93, 48/94, 54/96
- Закон о пољопривредном земљишту
"Службени гласник РС", број: 49/92, 53/93, 67/93, 48/94, 46/95, 54/96, 14/00)
- Правилник о дозвољеним количинама опасних и штетних материја у земљишту и води за наводњавање и методама њиховог тестирања
"Службени гласник РС", број: 23/94
- Закон о рударству
"Службени гласник РС", број: 44/95, 85/05
- Закон о утврђивању и разврставању резерви минералних сировина и приказивању података геолошких истраживања
"Службени лист СРЈ", број: 12/98, 13/98
- Правилник о садржини документације која се односи на хидрогеолошке и инжењерско-геолошке подлоге
"Службени гласник СРС", број: 26/84
- Правилник о критеријумима на основу којих се одређује потенцијалност подручја у погледу проналажења минералних сировина
"Службени гласник РС", број: 51/96
- Закон о заштити од елементарних и других већих непогода
"Службени гласник РС", број: 20/77, 24/85, 27/85, 6/89, 52/89 и "Службен гласник РС", бр. 53/93, 67/93, 48/94