Croatia National Action Plan (NAP)

for the Protection of the Mediterranean Sea against
Pollution from Land-based Sources

Zagreb, August 2005

Croatia National Action Plan (NAP)

Table of Contents

Summary

National Action Plan (NAP) is a plan for mitigation of pollutant emission consistent with the Strategic Action Programme for the Reduction of Pollution of the Mediterranean from Land-Based Sources (SAP MED), which is prepared by the contracting parties to the Barcelona Convention, including the Republic of Croatia. The Guidelines for preparation of NAP are contained in SAP and pertaining documents. NAP is prepared on the basis of the earlier developed documents: National Diagnostic Analysis (NDA), 2003 Baseline Budget for the Republic of Croatia - Coastal Area (BB), Sectoral Plans for different types of pollutants (SPs) and Economic Instruments for Protection of Sea against Pollution from the Land-based Sources in the Republic of Croatia - Current Status and Possible Solutions (EI). All documents (NDA, BB, SP, EI and NAP) were prepared within the UNEP GEF SAP MED Project that gave them full financial support. The Inter-ministerial Commission was convened to follow up preparation of these documents, and it was available for consultations during all the stages of the documentation preparation.

NAP primarily focused on determining proposals for the environmental protection priority actions for the coastal area of the Republic of Croatia. Performance of these actions shall result in achieving the basic SAP objectives. It is underscored that NAP was prepared on the basis of the national environmental protection plans currently in effect in the Republic of Croatia, which were used to establish the basic concepts in this document. The summary of the most important plans is given in a separate section herein. In addition to the national environmental protection plans, the information on the Croatian legal and institutions framework is briefly described herein as particularly important.

NAP contains data on the current state of the coastal environment and sea (as a summary of the NDA, BB and SP data). Consistent with the SAP objectives, the NDA, BB and SP data, and postulates of the national environmental protection plans, the environmental protection priorities for the coastal area were determined. Further, NAP analyses technical solutions for separate priorities, and sets up the basic objectives to be realised by their implementation. Another topics related to the planned environmental protection activities in the coastal area of the Republic of Croatia are also elaborated (public participation, monitoring, economic aspects).

The major environmental issue in the coastal area is wastewater pollution. Consistent with the SAP objectives (resolving of wastewater collection and treatment issues for the cities with population over 100,000 by 2010), the priorities herein include resolving of this problem for the cities of Split and Rijeka. The priorities also include wastewater collection and treatment in other larger cities at the Adriatic coast (Pula, Zadar, Šibenik and Dubrovnik). The investment into the projects for resolving the wastewater problems in six largest cities at the Croatian coast is estimated at EUR 537.8 mil.

Two sets of priorities were singled out for addressing the pollution from the industrial wastewater (in line with the SAP objectives by 2010, with planned 50 percent emission reduction). The first group of priorities includes major industrial polluters with self-standing outfalls (MIRNA prerada ribe Rovinj, ADRIA prerada ribe Zadar and JADRANSKA PIVOVARA Split). The estimated investment into addressing the environmental pollution from wastewater generated in these industrial facilities is derived from the pollution load data, and it is set at about EUR 13.2 mil. Another group of priorities includes all other industries in

the coastal area which are to reduce pollution from wastewater pursuant to the provisions of applicable legislation.

Solid waste management and disposal poses an important environmental problem, so according to the SAP objectives (resolving of waste management issues for the cities with population over 100,000 by 2010) NAP foresees construction of two regional waste management centres for the cities of Split and Rijeka (i.e. for the Splitsko–Dalmatinska and Primorsko–Goranska County). Based on the technical documentation, the investment into the construction of these centres is estimated at about EUR 122 mil. Additionally, NAP envisages remediation of the largest dumpsites in the region which do not meet the provisions of the applicable laws and regulations and pose environmental risk (Karepovac – Split, Sovjak and Viševac – Rijeka). Based on the data available from the Ministry of Environmental Protection, Physical Planning and Construction, the remediation costs for these dumpsites are estimated at about EUR 47.7 mil.

In addition to the above environmental protection projects for resolving of wastewater and solid waste issues, the priorities related to hazardous waste management and disposal (used chemicals, POPs, waste oil, batteries/car batteries) are included in NAP in line with the SAP Guidelines. Resolving of these issues is directly linked to full compliance with the national and international legal provisions on the subject matter.

In order to determine feasibility of all environmental priority actions singled out for the coastal area of the Republic of Croatia, such projects were analysed from the economic point of view, the evaluation of funds available for investment made, and possible sources of finance presented. Total investment into performance of the said environmental priority actions in the coastal area is estimated at about EUR 720.7 mil. It is underscored that the total estimated investment does not include the costs of global resolving of the problems related to the industrial wastewater and hazardous waste management and disposal. For them, application of administrative measures is planned, assuming enforcement of national and international regulations. Each priority is attached with a pertaining Investment Portfolio, again consistent with the SAP Guidelines. A separate section describes the problems related to application of the economic instruments for the environmental protection.

NAP is a document prepared in co-ordination with the technical departments of the Ministry of Environmental Protection, Physical Planning and Construction. Harmonisation of positions and amendments of the document were carried out on the basis of the opinions of the UNEP/MAP experts, members of the Inter-ministerial Commission, and after consideration of proposals submitted by participants in public debates organised during the NAP preparation. The environmental priorities for the coastal area highlighted in NAP are to a great degree in harmony with the priorities specified within the national environmental protection plans, which is good having in mind their feasibility.

1. Background

1.1 NAP Preparation Basis

The Convention for the Protection of the Mediterranean Sea and the Coastal Region (The Barcelona Convention) and relating protocols represent the legal grounds for all activities aimed at conservation of the Mediterranean Sea and the coastal areas, and it is binding upon all the Contracting Parties, including the Republic of Croatia.

The Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol), and the United Nations Environment Programme of the Mediterranean Action Plan for the Prevention of Pollution of the Mediterranean Sea (UNEP/MAP), as well as the adopted Strategic Action Programme for the Reduction of Pollution of the Mediterranean from Land-Based Sources (SAP MED) require from each contracting party to the Barcelona Convention the preparation of the following documents:

- National Diagnostic Analysis (NDA)
- Baseline Budget (BB)
- Sectoral Programmes (SP)
- National Action Plan (NAP)

Funding for the implementation of the SAP and for preparation of the mentioned documents (NDA, BB, SP, and NAP) has been provided for by the Global Environmental Facility (GEF).

Objective of the mentioned documents is to determine intensity and characteristics of pollutant input into the sea, establishment of the program for reduction of the pollutant discharge, and drafting of National Action Plan (NAP).

National Action Plan (NAP) defines actions for remediation of contamination and determines time limits and required financing, always taking into account objectives (SAP) and priorities set out within national environmental plans.

1.2 NAP Preparation Approach and NAP Executive Summary

Guidelines for the preparation of the above documents (NDA, BB, SP and NAP) are contained in the Strategic Action Programme (SAP MED) and pertaining documentation (see Ref. 1-3). The basic SAP objectives, used to determine the NAP priorities, are described in section 5.1. In preparing NAP, recourse has been made to professional explanations and advice of UNEP MAP experts.

NAP concepts and objectives have been agreed upon in consultation with the established Inter-ministerial Committee, government administration bodies and other institutions which monitored the preparation of the said documentation.

NAP addresses all aspects of the issue of reduction of the environmental pollution in the coastal area of the Republic of Croatia, at the level as required by the SAP Guidelines and objectives.

It is structured to firstly give an overview of the national documents related to implementation of the LBS Protocol and SAP, in order to provide an insight into the current legislation, international treaties and institutional organisation of Croatia.

Then follows consideration of the current status of the marine and coastal pollution by individual administrative units (counties), as a summary of the earlier prepared documents, i.e. NDA, BB and SP.

After that, national priorities with respect to marine and coastal area protection are presented, which were separately elaborated in the national strategies for resolving the environmental issues, and in proposed plans for realisation of these activities.

Subsequently, taking into account SAP objectives, analysis performed within NDA, BB and SP, as well as the guidelines from the national environmental protection strategies, a list of priorities at the national level has been sorted out. For each selected priority a description of the current status and planned solution is given, always accompanied with indication of basic objectives of the planned actions. The issue of the manner of public participation and informing during the planning and implementation processes has also been addressed. Framework guidelines for implementation of the monitoring are also given, with the objective to receive a feedback on the effectiveness of actions undertaken in respect of the pollutant input reduction into the coastal sea.

For each selected national priority in terms of marine pollutant input reduction a cost estimate has been made of planned actions and activities, with indication of possible sources of finance. The pertaining Investment Portfolios have also been prepared in line with the SAP Guidelines. A separate section deals with economic instruments for the environmental protection and gives possible solutions for their correction in the forthcoming short-term and long-term periods.

The document ends with a list of literature and references used in National Action Plan (NAP) preparation.

2. Review of National Documents Relating to LBS Protocol and SAP

2.1 Introduction

The Republic of Croatia, as a Contracting Party to the Barcelona Convention, has committed itself to the implementation of the LBS Protocol and the adopted Strategic Action Programme for the Reduction of Pollution of the Mediterranean from Land-Based Sources (SAP MED).

Pursuant to the obligations undertaken, appropriate monitoring programs are in place in Croatia's coastal zone for determination of the status and trends of the marine pollution change, on the basis of which necessary environmental protection measures are planned and taken in compliance with the law.

The section that follows gives an overview of the legal measures in force in the Republic of Croatia, international commitments and description of the institutional framework, the tools that, together with economic financial mechanism, can be used for resolving of the environmental issues.

2.2 National Legislation

The Constitution of the Republic of Croatia

The importance of the environmental protection is highlighted already in the Constitution of the Republic of Croatia, which, inter alia, states that the conservation of nature and human environment are the highest values of the constitutional order of the Republic of Croatia and the basis for the interpretation of the Constitution. (Article 3). Article 48, guaranteeing the ownership right, further states: "Ownership implies obligations. Owners and users of property shall contribute to the general welfare."
Article 50
The exercise of entrepreneurial freedom and property rights may exceptionally be restricted by law for the purposes of protecting the interests and security of the Republic of Croatia, nature, environment and public health.
Article 52
The sea, seashore and islands, waters, air space, mineral assets and other natural resources, as well as land, forests, fauna and flora, other parts of nature, real estate, and assets of special cultural, historic, economic or ecological importance which are specified by law to be of interest to the Republic of Croatia shall enjoy its special protection.
Article 69
Everyone shall have the right to a healthy life. The State shall ensure conditions for a healthy environment.
Everyone shall be bound, within their powers and activities, to pay special attention to the protection of public health, nature and environment.

The Declaration on Environmental Protection of 1992 initiated the development of a legal system pursuant to international treaties and standards, aimed at providing for continual, systematic and efficient environmental protection. It led to promulgation of the Environmental Protection Act (Official Gazette 82/94 and 128/99) which guarantees an integral preservation of the environmental quality and conservation of natural communities. The law requires, *inter alia*, implementation of the environmental impact assessment procedures and taking of environmental measures within the framework of preparation and adopting of the land-use plans.

Protection of habitats and biodiversity is regulated by the Nature Protection Act (1994), the fundamental law that regulates conservation of biological and landscape diversity.

The Nature Protection Act differentiates between nine basic protection categories, depending on characteristics and intended use of a specific area. These are national park, nature park, strict reserve, special reserve, natural monument, park forest, protected landscape, horticultural monument, and special flora and fauna. About 7 percent of Croatia is under protection of some sort.
The most frequently used categories of protection are nature parks and national parks.

The Nature Protection Act stipulates that the protected areas are managed by specially established public institutions. Such institutions for management of national parks and nature parks are established by the Government of the Republic of Croatia, while institutions for management of other protected parts of nature are established by the county assemblies.
The national parks and nature parks are managed on the basis of the land-use plans, while other protected areas are covered by measures adopted by county governments and approved by the Ministry of Environmental Protection, Physical Planning and Construction.

Laws and Pertaining Regulations

The fundamental laws set out the principles, determine instruments and mechanisms of the environmental protection, and regulate environmental monitoring and information dissemination. They introduce responsibility for degradation of the environmental quality, set up control, penalties and incentives for the environmental protection. They also regulate protection of: water, sea, forest, agricultural land, soil, and air; harvesting of mineral resources; hunting and fishing; protection of cultural heritage; protection against noise, vibration and ionising radiation, fire protection; public health; management of specially controlled substances and goods (toxins, flammables and explosives) and concessions.

The Environmental Protection Act (Official Gazette No. 82/94 and 128/99)

The Environmental Protection Act, adopted in 1994, set up a basis for the implementation of the policy in line with the sustainable development principles.

The Act stipulates the environmental protection objectives as part of the conditions for sustainable development. It provides definitions of the environment and environmental quality, states the principles of the environmental protection, entities securing the environmental protection efficiency, environmental monitoring, and keeping of the environmental pollution inventory.
The Act provides for the adoption of the environmental protection documents: the environmental protection strategy and programs. It requires that the environmental protection relies on established protection standards, the environmental impact assessment, and the environmental protection measures in adopting physical plans, the environmental monitoring, and the keeping of the environmental pollution inventory.
The Act provides for the preparation of the environmental protection contingency plans. It provides for the eco-labelling system, recognition and awards. It prescribes labelling of products and packaging, economic incentives to entities which have more environmentally friendly effect than their peers or who otherwise reduce adverse environmental impact.
The Act provides for participation of the state in resolving international environmental issues. It establishes an environmental information system and secures the right of general public to be informed on the environmental issues. It further regulates liability for the environmental pollution, the environmental protection financing and issues relating to law enforcement with respect to the organisation, manner of operation and the performance of the environmental protection inspectors. The Environmental Protection Act provides that certain matters be regulated by the implementation legislation. The most important legislation items are:

- Regulation on Beach Water Quality Standards (Official Gazette No. 33/96)
- Regulation on Quality Standards for Liquid Oil Fuels (Official Gazette No. 83/02)
- Regulation on the Environmental Information System (Official Gazette No. 74/99, 79/99)
- Rules on the Environmental Impact Assessment (Official Gazette No. 59/00, 136/04)
- Rules on the Environmental Emission Inventory (Official Gazette No. 36/96)
- Environmental Protection Contingency Plan (Official Gazette No. 82/99, 86/99, 12/01)
- Contingency Plan for Accidental Marine Pollution in the Republic of Croatia (Official Gazette No. 8/97)
- National Environmental Action Plan (Official Gazette No. 46/02)

The Nature Protection Act (Official Gazette No. 162/03)

The Nature Protection Act regulates certain protected parts of the nature, the way of managing them, manner of conservation and supervision.
The nature is defined through its overall biological and landscape diversity. For the purpose of nature conservation, international treaties governing the nature conservation are implemented.
The act defines tasks and objectives in nature conservation:

- maintain the biological and landscape diversity in the state of the natural balance;
- establish the state of the nature and ensure status monitoring;
- ensure natural assets protection system;
- ensure sustainable exploitation of natural resources;
- contribute to the preservation of the natural state of the soil, preservation of quality, quantity and availability of water, conservation of atmosphere, oxygen production and climate;
- prevent harmful human activities and disturbances in the nature as a consequence of technological development and performing of activities.

The nature is protected by the following actions:

- determination and assessment of the state of the biological and landscape diversity,
- establishing requirements and measures in nature conservation,
- incorporating nature conservation requirements and measures into documents for physical planning and plans for management of natural resources in mining, agriculture, forestry, hunting, fisheries and water management,
- preparation of the state of the nature reports, adopting and implementation of the strategy, programs, action plans and management plans,
- establishment of natural assets and protected natural resources,
- setting up of systems for management of natural assets and protected natural resources,
- the harmonisation and interrelation of the government system with the international nature conservation system,
- stimulating scientific and professional activities related to the nature conservation,
- informing general public on the state of the nature and public participation in the decision-making process in the issues of nature conservation,
- raising public awareness of the need of nature conservation.

The Act determines the basic nature conservation documents:

- The National Biological and Landscape Diversity Protection Strategy and Action Plan for the Republic of Croatia (Official Gazette No. 81/99) and the nature conservation programs.

The Strategy defines long-term objectives and guidelines for the conservation of biological and landscape diversity and protected natural resources, and manner of their implementation.
The guidelines included in the Strategy are used in preparation of the physical planning documents and natural resources management plans.
The Ministry of Culture is responsible for nature conservation, and professional activities relating to nature conservation are performed by the State Institute for Nature Protection.

The Water Act (Official Gazette No. 107/95)

The Water Act and the Water Management Financing Act constitute the legal grounds for water management in Croatia.

The Water Act provides for the legal status of water, the method of and conditions for water management, water use, water protection, the competencies and duties of state administration bodies, other public bodies, local administration and self-government bodies, and other legal entities, and other issues important for water management.

According to Article 3, paras. 1 and 2 . *" water, as a public resource which, because of its natural properties, cannot be anybody's property. Water, as a public resource, enjoys special protection of the Republic of Croatia."*

Water management objectives are:

- securing of supply of water of appropriate quality for various uses,
- maintenance, improvement and creation of uniform water regime,
- protection of water from contamination, and protection from adverse impact of water,
- integrated water management in water basins and catchment areas.

Main principles of water management are:

- protection and use of the waters in accordance with the sustainable development principles,
- territorial water management units are water basins and catchment areas,
- the starting point of water management plans is the obligation of integrated environmental protection and achievement of integrated water management,
- payment of charge for water use exceeding the general use limits, as well as for deterioration of water quality (polluter-pays principle),
- determining of sources of finance for investments in improvement of the water system.

Pursuant to this Act, Hrvatske Vode (Croatian Waters), a legal entity responsible for water management, was established.
Pursuant to the Water Act, the following planning documents have been passed:

- National Water Protection Plan (Official Gazette No. 8/99).
- Contingency Plan for Accidental Marine Pollution in the Republic of Croatia (Official Gazette No. 8/97)
- National Flood Control Plan (Official Gazette No. 8/97, 32/97, 43/98 and 93/99)
- Water Management Master Plan (WMMP), a fundamental document defining the basis for water management, is under preparation.

Remark: The Contingency Plan for Accidental Marine Pollution in the Republic of Croatia (Official Gazette No. 8/97) was prepared on the basis of the Water Act , the Maritime Code (Official Gazette No. 17/94, 74/94, 43/96), and the Environmental Protection Act (Official Gazette No. 82/94, 128/99).

Water management in Croatia is also governed by a series of by-laws:

- Rules on the Issuance of Water Management Legal Acts (Official Gazette No. 28/96)
- Regulation on Water Classification (Official Gazette No. 77/98)
- Regulation on Hazardous Substances in Water (Official Gazette No. 78/98)
- Rules on Limit Values of Indicators, Hazardous and Other Substances in Wastewater (Official Gazette No. 40/99, 6/01 and 14/01)
- Rules on Drafting of the Water Management Master Plan of the Republic of Croatia (Official Gazette No. 120/03)

The Water Management Financing Act (Official Gazette No. 107/95, 19/96 and 88/98) defines:

- sources of funds for the financing of activities and uses aimed at establishing water management,
- the method of determination of rates and amounts of these funds,
- method of determination of individual payment liabilities and their collection; and
- other issues in connection with raising and utilisation of these funds.

The activities and tasks for the financing of which means are being provided pursuant to this Act are:

- technical, administrative and other activities and tasks having characteristics of public services,
- regulation of watercourses and other waters and protection from adverse impact of waters,
- water use (ensuring of water reserves),
- water protection,
- regulation and maintenance of land reclamation systems.

On the basis of this Act, the by-laws have been adopted regulating charges for water use and protection, water catchment charges, and sand and gravel mining fees.
In addition to the Water Act and the Water Management Financing Act, the water management is governed by other laws, which primarily concern the sectors of environment, nature conservation, physical planning, utilities sector, public health, agriculture, forestry, etc.

The Waste Act (Official Gazette No. 178/04)

The Act provides for the manner of waste management: management principles and objectives, planning documents, competencies and liabilities, costs, information system, requirements for waste management facilities, waste management procedures, transboundary movement of wastes, concessions and waste management supervision.
The waste management objectives are:

- avoidance and reduction of waste generation and reduction of hazardous properties of waste,
- recycling,

- adequate waste disposal practices,
- remediation of waste-contaminated environment.

Waste management is based on compliance with the environmental protection principles:

1. Polluter pays – the owner of the waste bears the cost of preventive measures, waste disposal measures, waste management measures, and is financially responsible for remediation of any damage caused by the waste;
2. Producer's liability – the producer of the waste-generating product is responsible for selection of the most environmentally acceptable solution depending on the product characteristics and production technology, including the product's life cycle and use of best available technology;
3. Proximity – recycling and/or waste disposal must be performed in the nearest appropriate plant or facility.

The Act requires adoption of the following planning documents for waste management:

- Waste Management Strategy of the Republic of Croatia,
- Waste Management Plan of the Republic of Croatia,
- The county (regional) waste management plans,
- City or municipal waste management plans,
- Waste producers' waste management plans.

Waste Act implementation by-laws:

- Rules on Types of Waste (Official Gazette No. 27/96)
- Rules on Packaging Waste Treatment (Official Gazette No. 53/96)
- Rules on Waste Management Requirements (Official Gazette No. 123/97, 112/01)
- Regulation on Hazardous Waste Treatment Requirements (Official Gazette No. 32/98)
- Guidelines for Treatment of Waste Generated by Health Services (Official Gazette No. 50/00)
- Rules on the Methods and Time Intervals of Billing and Payment of Charges for the Environmental Load Caused by Waste (Official Gazette No. 95/04)
- Rules on Waste Categories, Types and Classification with Waste Inventory and Hazardous Waste List.

Clean Air Act (Official Gazette No. 178/04)

This Act and pertaining regulations have been adopted with a view to ensure protection and better quality of the air and other environmental segments endangered due to air pollution.

Effective protection is ensured by implementation of the principles of balanced development, principles of integrated planning and use of state-of-the-art techniques, technical solutions and measures.

This Act regulates measures, manner of organisation, implementation and supervision of air quality protection and improvement.

Air quality protection, for the purpose of sustainable development, is based on the principles of the environmental protection as provided for by the Environmental Protection Act and requirements of the international law.

With the aim of air protection the Act provides for the following:

- determination and implementation of measures for air quality protection and improvement;
- air quality preservation and its improvement in cases of pollution;
- prevention and reduction of pollution causing the depletion of the ozone layer and climate change;
- establishment of an integrated air quality management system on the territory of the Republic of Croatia;
- collection and assessment of air quality data based on standardised methods and criteria, ensuring availability of the data to the general public;
- fulfilment of obligations undertaken by international treaties and agreements, participation in international co-operation in the sphere of air quality protection and improvement.

The Act provides for monitoring and determining air quality, emissions and emission sources, and measures for the prevention and reduction of air pollution.
It also requires setting up of an air quality information system, as an integral part of the environmental information system.
Air quality information system for the needs of the Ministry of Environmental Protection, Physical Planning, and Construction is operated by the Croatian Environment Agency.
Air Protection Act implementation by-laws:

- Regulation on Recommended and Limit Air Quality Values (Official Gazette No. 101/96,2/97)
- Regulation on Limit Values of Pollutant Emissions from Stationary Sources into the Air (Official Gazette No. 140/97,105/02)
- Regulation on Substances that Deplete the Ozone Layer (Official Gazette No. 7/99, 20/99)
- Regulation on Siting of National Network Stations for Continuous Air Quality Monitoring (Official Gazette No. 43/02).

Physical Planning Act (Official Gazette No. 30/94, 68/98, 61/00, 32/02)

This Act provides for the physical planning system, requirements and method of preparation, adoption and implementation of physical planning documents, as well as responsibilities of the central and local government and self-government in implementation of measures and activities aimed at securing the planning and regulation of the space of the Republic of Croatia.
Physical planning is based on the following principles:

- balanced economic, social and cultural development of the space of the State, fostering and developing regional spatial characteristics;
- sustainable development and rational utilisation and protection of the space;
- protection of integral values of the space and protection and improvement of the state of the environment,
- protection of cultural monuments and particularly valuable parts of nature;
- provision of better living conditions;

- harmonisation of interests between space users and priorities of interventions in the space;
- harmonisation of physical planning of various parts of the State;
- integration of the national space with European space organisation,
- publicity and free access to data and documents important for physical planning pursuant to this and other separate regulations;
- setting up of space information system for the purpose of the planning, utilisation and protection of the space.

To ensure efficient implementation of the physical planning policy, documents have been promulgated having the force of by-laws. Physical planning documents are the following:
1. Republic of Croatia Physical Planning Strategy and Program
2. land-use and zoning plans.

The Physical Planning Strategy was prepared by the Ministry of Environmental Protection, Physical Planning and Construction in 1997. The Strategy is a fundamental document regulating physical planning and a baseline document for decision-making on any interventions in space. It is also the basis for development of detailed land-use plans. The Physical Planning Strategy defines long-term objectives of the spatial development and planning in line with overall economic, social and cultural development.
The Physical Planning Program defines measures and activities for the implementation of the Strategy. In addition to the basic objectives set up for physical planning development, the Program defines criteria and guidelines for physical planning and proposes priorities in achieving the physical planning objectives.
One of the priorities is revival and establishment of all living functions in the war-stricken areas and stopping of negative demographic processes which result in abandonment of some regions.

Other relevant legislation

- Environmental Protection and Energy Efficiency Fund Act (Official Gazette No. 107/03)
- Maritime Goods and Sea Ports Act (Official Gazette No. 158/03)
- Maritime Code (Official Gazette No. 181/04)
- Act on the Utilities Sector (Official Gazette No. 26/03)
- Cultural Assets Conservation and Protection Act (Official Gazette No. 66/99, 151/03, 157/03)
- Poisons Act (Official Gazette No. 27/99, Official Gazette No. 37/99, 55/99)

2.3 International Conventions

Croatia is a member of a number of associations, and has signed and/or ratified numerous conventions. It has become a party to some of the conventions by notification of succession, and to some after gaining its independence.
One of the priorities is fulfilment of obligations, i.e. the creation of conditions for their implementation, provided that fulfilment of requirements in connection with the EU approximation procedure will have priority.
Additional emphasis shall be put on those environmental issues that are most important for Croatia, and to co-operation with neighbouring countries. Some of the issues which are the subject of the co-operation are the following:

- Climate change,
- Ozone layer protection,
- Natural heritage protection,
- Protection of water and sea,
- Transboundary movement and disposal of hazardous waste,
- Transboundary environmental pollution,
- Activities in the protection of the Adriatic and Mediterranean seas
- Problem resolving and improvement of the state of the environment together with neighbouring countries, on the principle of bilateral and multilateral co-operation.

Some of the conventions and protocols signed by the Republic of Croatia:

General
• **Convention on Environmental Impact Assessment in a Transboundary Context**
(Espoo 1991). Entered into force in Croatia in 1997
• **Protocol on Strategic Environmental Protection**
(Kiev 2003). Signed by Croatia in 2003
• **Convention on Transboundary Effects of Industrial Accidents**
(Helsinki, 1992). Entered into force in Croatia in 2000
• **European Landscape Convention**
(Florence, 2000). Entered into force in Croatia in 2002
• **Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters**
(Aarhus, 1998). Signed by Croatia in 1998
• **Protocol on Pollutant Release and Transfer Registers**
(Kiev, 2003). Signed by Croatia in 2003
• **Stockholm Convention on Persistent Organic Pollutants**
(Stockholm, 2003). Signed by Croatia in 2001

Climate
• **The United Nations Framework Convention on Climate Change**
(Rio de Janeiro, 1992). Entered into force in Croatia in 1996

• **Kyoto Protocol to the United Nations Framework Convention on Climate Change**
(Kyoto 1979). Signed by Croatia in 1999

Atmosphere
• **Convention on Long-range Transboundary Air Pollution**
(Geneva, 1979). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Long Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) (EMEP)**
(Geneva, 1984). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Further Reduction of Sulphur Emissions**
(Oslo, 1994). Entered into force in Croatia in 1996
• **Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants**
(Aarhus, 1998); Signed by Croatia in 1998
• **Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone**
(Goeteborg, 1999); Signed by Croatia in 1999
• **Vienna Convention for the Protection of the Ozone Layer**
(Vienna, 1985). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Montreal Protocol on Substances that Deplete the Ozone Layer**
(Montreal, 1987). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer**
(London, 1990). Entered into force in Croatia in 1994
• **The Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer**
(Beijing, 1999). Entered into force in Croatia in 2004

Sea
• **Convention for the Protection of the Mediterranean Sea against Pollution**
(Barcelona 1976). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircrafts - the Dumping protocol**
(Barcelona 1976). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991
• **Amendment to the Convention for the Protection of the Mediterranean Sea against Pollution**

(Barcelona ,1995) New title: Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean;
Came into force in Croatia in 2004

• **Amendment to the Protocol for the Prevention and Elimination of Pollution of the Mediterranean Sea by Dumping from Ships and Aircrafts or Incineration at Sea** (The Dumping Protocol)
(Barcelona, 1995). Published in Official Gazette, International Treaties No. 17/98.

• **Protocol Concerning Co-operation in Preventing Pollution from Ships and, in cases of Emergency, Combating Pollution of the Mediterranean Sea** (The Prevention and Emergency Protocol)
(Malta, 2002). Came into force in Croatia in 2004

• **Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean**
(Barcelona, 1994, Monaco 1995). Came into force in Croatia in 2002

• **Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources**
(Athens, 1980). Based on the Notification of Succession Croatia has been the Party to the Convention since 1991

• **Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources and Activities (LBS Protocol)**
(Syracuse, 1996). Signed by Croatia

• **Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil-Offshore Protocol**
(Madrid, 1994); Signed by Croatia

• **Protocol for the Protection of the Mediterranean Sea against Pollution Resulting from Transboundary Transportation of Hazardous Wastes and their Disposal** (Hazardous Wastes Protocol)
(Ismir 1996). Not signed by Croatia

• **Convention for the Prevention of the Sea Pollution from Ships (MARPOL, 1973/78) (Official Gazette 1/92)**

Water

• **Convention on the Protection and Use of Transboundary Watercourses and International Lakes**
(Helsinki Convention, Official Gazette International Treaties, 4/96)

Soil

• **The United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa**
(Paris, 1994), Came into force in Croatia in 2001

Waste

• **Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal**
(Basel, 1992). Came into force in Croatia in 2000

2.4 Institutional Structures

State Council for Environmental Protection was established by the Government of Croatia, pursuant to the Environmental Protection Act. The task of the Council is to give opinions, recommendations and evaluations on issues concerning co-ordinated environmental protection and economic growth, to assess document drafts adopted by the Government and the Parliament, with the aim of achieving economic development in line with the fundamental principles of the environmental protection which are based on compliance with the international environmental laws, acceptance of scientific achievements and global practice.

2.4.1 National Structure

In terms of organisation, the environmental protection is located within the Ministry of Environmental Protection, Physical Planning and Construction. Since the environmental issues are inherent to numerous areas of activity (water, sea, forests, agricultural land, cultural heritage, human health), they are the concern of a series of structures in the country.

Within the legislative authority system, the environmental issues are dealt with by:

- Committee on Physical Planning and Environmental Protection
- Committee on Maritime Affairs, Transportation, and Communications
- Committee on Agriculture and Forestry

Within the executive authority system, the environmental issues are dealt with by state administration bodies:

Ministries

- Ministry of Environmental Protection, Physical Planning and Construction
  - Directorate for Physical Planning
  - Directorate for Environmental Protection
  - Directorate for Strategic and Integration Processes in Environmental Protection
  - Directorate for Inspection
  - Institute for Physical Planning
- Ministry of Agriculture, Forestry and Water Management
  - Directorate for Agriculture
  - Directorate for Fisheries (mariculture, aquiculture, fishing)
  - Directorate for Forestry (forest management and protection)
  - Directorate for Hunting
  - Directorate for Water Management
- Ministry of the Sea, Tourism, Transport and Development
  - Directorate for Seafaring Safety and Sea Protection
  - Directorate for the Infrastructural Projects
- Ministry of the Economy, Labour and Entrepreneurship
  - Directorate for Power and Mining
  - Directorate for Industry

- Ministry of Culture
  - Directorate for the Protection of Nature
- Ministry of Health
- Ministry of the Interior
- Ministry of Foreign Affairs and European Integration
  - Directorate for the Strategy of Integration – Department for Co-ordination of Implementation of Integration Activities

State administrative organisations:
Meteorological and Hydrological Service of the Republic of Croatia
Hydrographic Institute of the Republic of Croatia
State Directorate for the Protection of Nature
State Geodetic Administration
Central Bureau of Statistics
State Inspectorate of the Republic of Croatia
National Water Council

Ministry of Environmental Protection, Physical Planning and Construction is responsible for implementation of the laws, promulgation of implementation by-laws and other activities relating to general environmental protection policy in creating conditions for the sustainable development. It covers general issues of the protection of air, soil, water, sea and plant and animal life taking into account their interactions.
The Ministry is organised in several administrative units, of which the following are directly responsible for the environmental protection:

- Directorate for Physical Planning
- Directorate for Environmental Protection
- Directorate for Strategic and Integration Processes in Environmental Protection
- Directorate for Inspection
- Institute for Physical Planning

Directorate for Inspection performs inspection control of physical planning, construction and environmental protection with regard to the activities carried out by the relevant public authorities and local self-government and administration units, it monitors and supervises implementation of measures for improvement of law enforcement results in the Ministry, prepares reports for the Croatian Government and Parliament, proposes measures for improvement, renders expert opinions, gives instructions on changes in legislation, prepares technical documentation and participates in preparation of draft bills, technical and other regulations in the area of physical planning, construction and environmental protection, and provides other information on supervision carried out by the Directorate for Inspection.

Directorate for Strategic and Integration Processes in Environmental Protection performs, *inter alia*, activities related to the strategic documents in the environmental protection; prepares, co-ordinates preparation, monitors implementation of strategic documents in the environmental protection; performs activities related to the promotion of the environmental protection and sustainable

development. It is involved in international relations in environmental protection, and integration processes related to the EU accession. It is also involved in implementation of the European Union programs of aid and co-operation.

The Directorate has three departments: Department for Environmental Strategy, Department for International Relations, and Department for European Integration.

The Directorate for Environmental Protection performs activities relating to implementation of waste management measures, preservation of air quality, protection of the climate and the ozone layer, assessment of the environmental impact of interventions in the environment, contingency plans for environmental pollution accidents, conservation of the sea and coastal area quality, protection of the soil. It proposes measures to achieve the environmental protection quality standards and improve the state of the environment.

It monitors implementation of laws and regulations and proposes measures for their enforcement.

The Directorate grants permits for waste management, transit of hazardous waste, air quality monitoring and reduction in greenhouse gas emission; prepares decisions on project environmental impact assessment, carries out technical preparations for granting of waste management concessions, issues consents and keeps records within the scope of the Directorate activities. The Directorate participates in preparation of bill drafts, and drafts implementation regulations, programs, plans and reports, monitors their enforcement and implementation; it works on development of the Environmental Information System, Environmental Inventory, supervises implementation of the Waste Management Plan. The Directorate participates in expert activities in harmonisation with EU legislation. It co-operates with central government bodies, state administration offices in counties, local and regional self-government units, business sector and NGOs, as well as with the Croatian Environment Agency and the Environmental Protection and Energy Efficiency Fund.

The Directorate is organised in five departments: for waste management, for atmospheric protection, for environmental impact assessment and implementation of measures for prevention of the environmental pollution, for protection of sea and coastal area, and for soil protection.

Institute for Physical Planning prepares and monitors implementation of the Strategy and Physical Planning Program of the Republic of Croatia, of other physical planning documents passed by the Croatian Parliament, and the Program for Improvement in the State of the Space of the Republic of Croatia, prepares master plans and reports on the state of the Croatian space.

The Institute performs technical analyses of the physical planning and land use issues and documents, ensures financial resources for preparation of documentation within its responsibility; it sets up and manages information system and documentation on space and physical planning; the Institute participates in preparation and implementation of international projects in the area of physical planning and in development of separate programs of interest for the Republic of Croatia, co-ordinates physical planning components of the regional physical development and planning of urban areas, and co-ordinates, prepares and develops

the land-use plans for areas with particular characteristics; the Institute conducts technical activities to support the Physical Planning Council for the Republic of Croatia.

Ministry of Agriculture, Forestry and Water Management is responsible for and performs numerous activities interfacing with the environmental issues in many aspects. These activities are performed by the Ministry directorates and other organisational units, including:

- Directorate for Agriculture
- Directorate for Fisheries (mariculture, aquiculture, fishing)
- Directorate for Forestry (forest management and protection)
- Directorate for Hunting
- Directorate for Water Management
    - Water Use Department;
    - Water Protection Department;
    - Department for Protection Against Adverse Water Impact;
    - Water Policy and International Projects Department;
    - State Water Inspection.

Directorate for Agriculture is responsible, *inter* alia, for enforcement of regulations on seeds and planting material, recognition of cultivars, legislation regulating protection of agricultural cultivars, animal husbandry act, plant protection act, act on fertilisers and soil improvers, hail control act. Directorate for Agriculture prepares bills and performs activities related to promulgation of laws and by-laws in the area of agriculture and their harmonisation with the EU directives; performs inspection control of enforcement of law and general legislation that regulates the field of agriculture, plant protection, agricultural land management; it also conducts sanitary control of plants in production and those marketed across the border in accordance with the plant protection regulations; it is actively involved in international relations, and monitors and implements international projects in the field of agriculture.

Directorate for Fisheries performs, *inter alia*, monitoring of enforcement of laws and regulations in the field of fisheries; it proposes methods for monitoring of the state of biological resources in sea and water, for conservation of the fish and other maritime and aquatic organisms, and methods for their protection; it proposes the measures for improvement of fisheries, conservation of natural resources, ecological balance and biological diversity. The Directorate collaborates in preparation of draft international agreements and treaties and monitors their enforcement; it takes care about harmonisation of regulations and general legislation with the European Union legislation and directives; it performs the inspection control within the scope of its responsibilities; plans, organises and performs inspection in marine and fresh-water fisheries.

Directorate for Forestry follows, *inter alia*, enforcement of laws within its scope of responsibilities; renders expert opinions, interpretation and guidelines; participates in

international collaboration, supervises business performance of the Croatian Forests; maintains records on forests and other stipulated records; monitors the state and offers technical support and advise to private forest owners; performs inspection control, submits necessary reports to the Croatian Government and Parliament and other institutions and carries out other administrative and technical activities within its scope of responsibilities.

Directorate for Hunting prepares draft by-laws; follows implementation of international conventions and treaties, supervises activities related to the implementation of game husbandry program and game protection program; it cares about the natural balance of species, about protection of game and conservation of its natural habitats; the Directorate monitors the state of the hunting sector as regards hunting grounds and game farms, renders expert opinions and explanations on the law enforcement methods.

Directorate for Water Management is involved in implementation of the water management policy, particularly in preparation of legislation (drafting of bills and regulations, international and bilateral treaties and agreements; harmonisation with the EU legislation). It provides for preparation of the water management plans; training of rivers and other waters and protection against adverse impact of water and ice; erosion and torrential control; land drainage and irrigation; management of water resources and their utilisation; protection of water and sea against land-based pollution and contamination; ensuring water reserves necessary for potable water supply of settlements and process water supply to industry and businesses; waterpower harnessing; planning and construction of public waterworks and drainage systems; granting concessions for water use and use of water as public resource; setting up of a water information system and documentation control; conducting administrative and technical supervision of the Croatian Waters performing activities of particular interest for water management and of the local/regional authorities in charge of water management; inspection control of performed activities that have or could have an impact on the water regime and condition of water works and systems, protection against adverse impact of water, and protection of water against pollution and contamination .

Ministry of the Economy, Labour and Entrepreneurship scope of activity includes, in some of its segments, activities related directly to the environmental impact. These activities are performed by the Directorate for Power and Mining and Directorate for Industry.

Directorate for Industry performs activities related to the industrial sector and other activities on monitoring of the state and preparation of analyses for the industrial sectors, shipbuilding and other businesses. It proposes measures for sustainable industrial development and mitigation of environmental impact of industrial facilities; proposes improvements and encourages introduction of new technologies; collaborates with other public authorities and institutions in charge of development of science, scientific research and technologies; it harmonises production of new industrial capacities with the technological development strategy; the Directorate performs administrative and technical activities related to preparation of the industrial development strategy and industrial policy; prepares analyses and monitors implementation of operational plans and industrial development; monitors

implementation of economic policy and its effect on position and development of industry; participates in preparation and negotiations of international treaties and conventions imposing certain limitations and bans, including ordering of special control of entire handling of specific goods and chemicals (management procedure), including their development, production use and marketing and international exchange; it follows the work and contacts the international organisations and specialised agencies of the United Nations, and other international organisations in order to enable exchange of experience, programs and obtaining of various international technical aid for industrial development. The Directorate for Industry activities are performed by four departments: for industrial sectors, for development and restructuring of industry, for management of goods and chemicals, for development and restructuring of shipbuilding sector.

Directorate for Power and Mining monitors production, consumption, transport, import and export of fuels and energy resources; it monitors planning and construction of power generation facilities and their environmental impact, performs technical, administrative and inspection activities related to the construction and operation of facilities performing facilities involving nuclear materials and special equipment, it prepares energy efficiency programs and their implementation; grants building and operating permits for mining facilities and plants; participates in work of the Environmental Protection and Energy Efficiency Fund. The Directorate activities are performed in three departments: for power, mining and nuclear safety.

Hrvatske Vode (Croatian Waters)

The Croatian Waters has been established pursuant to the Water Act as a legal entity in charge of the Croatian water resources management.
Basic activities of the Croatian Waters in pursuing integrated water management according to the principle of sustainable development are the following:

- water training and protection from adverse impact of water,
- use of waters,
- water and sea protection against pollution and contamination.

The Croatian Waters perform monitoring of quality of surface water and sediment, groundwater, monitoring of urban and industrial wastewater. Their tasks are water training, construction of water training and protection structures and land drainage structures, training of watercourses, water resources, including regulation of waterways and structures erosion and torrent control, and drainage structures. They co-ordinate implementation of the National Water Protection Plan, co-ordinate planning of water protection in regional and local communities and participate in the processes of planning, preparation and implementation of wastewater collection and treatment.

Croatian Environment Agency

The need for the establishment of the Croatian Environment Agency was defined in the Environmental Protection Strategy of the Republic of Croatia, Implementation Plan for the Stabilisation and Association Agreement between the European Communities, the EU Member States and Croatia. The Croatian Environment Agency

has the obligation to analyse and interpret the environmental data collected and provide the information on efficient implementation of the environmental policy to the state administration, the Government and the Parliament.
In addition to these basic tasks, the Agency activities comprise also participation in planning and development of new environmental protection forms and follow-up of the environmental action plans and projects.
The Croatian Environment Agency is a national focal point for contact with the European Environmental Agency (EEA) and it is a member of the European Environment Information and Observation Network (EIONET).
Activities of the Agency are also directed to the setting up of an integrated Environmental Information System, using the state-of-the-art information technologies and communication standards in accordance with European requirements.

State Institute for Nature Protection
The State Institute for Nature Protection was established as an institution by a resolution of the Croatian Government. Its establishment was envisaged by the Strategy and Action Plan for Protection of Biological and Landscape Diversity for the Republic of Croatia (Official Gazette No. 81/99) and the Plan for the Stabilisation and Association Agreement.
Within its scope of Activities, the Institute performs technical work related to nature conservation, including: collecting and processing of data related to nature conservation, preparation of adequate databases, monitoring of the degree of conservation of biological and landscape diversity and proposing measures for its protection, preparation of technical documentation for protection and conservation of parts of nature, management of protected areas and use of natural resources, reports on the state and protection of nature.

The State Institute for Nature Protection prepares and conducts the projects and programs related to nature conservation, participates in enforcement of international treaties on nature conservation, and participates in work of international and national expert bodies.

2.4.2 Regional and Local Structures

The county and municipal departments for economy (physical planning, housing, construction and environmental protection) perform activities related to the environmental protection at the county/city territory and enforce the provisions of the Environmental Protection Act and Physical Planning Act. They also conduct the inspection controls.
They provide the conditions for the implementation of the environmental protection programs, preparation and implementation of remediation, ensure monitoring of the state of the environment and measuring imissions in cases where the latter is their responsibility, ensure conditions for keeping the environmental pollution inventory and a registry of the state of the environment, the environmental protection measures as well as the means for informing of general public.

.

2.4.3 Others

Environmental Protection and Energy Efficiency Fund
Fund for Regional Development
Croatian Chamber of Commerce
Central Bureau of Statistics of the Republic of Croatia
NGOs active in environmental protection and nature conservation in Croatia

2.5 Harmonisation of the National Legislation with EU Legal Framework

The positive opinion (avis) of the European Commission on the Croatian application for membership in the EU of 20 April 2004 and the European Council decision of 17 June 2004 granting Croatia the candidate status for membership in the European Union determined the opening of accession negotiations. One of the activities along this way is the drafting of the Environmental Legislation Approximation Strategy, which is being elaborated with support of the CARDS program.

For most of the international documents on the environmental protection Croatia is signatory to, and for the programs it is implementing, changes are needed in the Croatian legal system, and the conditions need to be ensured for their implementation, since they are often liming emission from specific technological processes, demand adjustments to new technologies, or most frequently retrofitting of the technological systems in order to meet the state-of-the-art and highly demanding production methods.

The basic law regulating the environmental protection is the Environmental Protection Law (Official Gazette No. 82/94, 128/99), which will be harmonised with EU environmental acquis and other regulations by 2006.

Legal aspects of air protection are regulated by the Environmental Protection Act, the Clean Air Act and international treaties signed by Croatia. The Clean Air Act (Official Gazette No. 178/04) of 2004 has been harmonised with the respective acquis communautaire.

Legal aspects of waste management are regulated by the Waste Act (Official Gazette No. 178/04) and international treaties (Basel Convention). The act has been harmonised with the provisions of the EU Waste Framework Directive 75/442/EC.

The Water Act (Official Gazette No. 107/95) as a basic legal framework for water management will be revised with respect to the keeping of the water management documentation and the manner of public participation. As regards the obligation to strengthen the water management planning, the priority action is the drafting of the Water Management Master Plan.

The Water Management Financing Act (Official Gazette No. 107/9519/96 and 88/98) and pertaining implementation by-laws will be revised in order to strengthen the infrastructural projects financing system.

There is no uniform legal framework for coastal and island area management – respective issues are governed by several laws and implementation by-laws. With respect to harmonisation of the national legislation with EU legislation, following activities are planned: preparation of the new regulation on the beach water quality, drafting of the national plan and program in case of accidental pollution of the Adriatic sea, further activities in preservation of satisfactory sea quality and implementation of

signed international agreements, continuation of the quality monitoring and sea research activities.

Nature conservation is regulated by the Nature Protection Act (Official Gazette No. 162/03) and the National Biological and Landscape Diversity Protection Strategy and Action Plan for the Republic of Croatia. It is also governed by the National Environmental Strategy and National Environmental Action Plan. Several activities are planned in this field, with priority having been set for the establishment of the National Environmental Network and the *Natura 2000* network. The issue of mandatory incorporation of the nature conservation requirements and measures in all physical plans and sectoral planning documents will also be addressed.

As regards chemical substances, activities will continue with respect to assuming and meeting commitments under the international agreements regarding chemicals management.
Ministry of the Economy, Labour and Entrepreneurship is currently preparing the rules which are to be harmonised during 2005 (Rules on Submittal of Data on Chemical Substances, Rules on Biocide Trading, Rules on Methods and Licensing Procedures for Production, Trading and Use of Hazardous Chemical Substances, Rules on Special Requirements for Trading with Hazardous Chemical Substances, Rules on Special Requirements for Trading with Highly Toxic and Toxic Chemical Substances). The Ministry of Agriculture, Forestry and Water Management has prepared the Plant Protection Preparations Bill (2005) which will be harmonised in 2005.

The Noise Abatement Act (Official Gazette No. 20/03) provides for measures for noise abatement on the ground, sea and in the air, as well as for the supervision of implementation of these measures. Priority measures deriving from the National Environmental Action Plan are adjustment of the legislation and adoption of implementation by-laws for the Noise Abatement Act, as well as the drafting of the National Noise Abatement Program.

On 4 February 2005, the Croatian Parliament adopted a 2005 Plan for Harmonisation of the Croatian Legislation with the EU Acquis Communautaire (Official Gazette No. 21/05).
According to the Plan, the following legislation related to the environment and nature is to be harmonised in 2005:
Genetically Modified Organisms Act, Nature Conservation Act, Forests Act, Marine Fisheries Act, Clean Water Act, Water Management Financing Act, Plant Protection Preparations Act, Plant Health Protection Act, Ionising Radiation Protection Act.

2.6 Conclusions

This section gives a presentation of the national laws and regulations and institutional organisation of the Republic of Croatia. Further, an overview is given of international commitments, and the process of harmonisation with the EU legal framework is described in brief.

The subsection on the national legislation enlists laws and regulations dealing with the environmental protection in the broadest sense, along with those whose which as *lex specialis* regulate the issues related to nature, air, waste, water and space.

It is underscored that the Constitution of the Republic of Croatia guarantees protection of the environment, and that the Republic of Croatia as the carrier of public governance and not as an owner takes care and renders specific protection to the nature and environment.
The framework documents used as background documentation for other regulations are the Declaration on the Environmental Protection and the Environmental Protection Act. The document elaborating long-term national strategy for the environmental protection is the National Environmental Protection Strategy, and a concrete action program detailing long-term and short-term objectives is the National Environmental Action Plan.

The overview of the legislation is followed by a list of international commitments (conventions) on nature conservation and environmental protection signed/ratified by the Republic of Croatia.

This section also presents the institutional organisation in the Republic of Croatia at the national, regional, and local level, particularly of the organisational segments in charge of the environmental protection issues.

The section is concluded with a brief description of issues that need to be addressed within the process of harmonisation of the Croatian legislation with the EU legal framework. It is underscored that due to its complexity, the environmental protection has been recognised as one of the most demanding fields in the process of harmonisation with the EU acquis communautaire. It has been determined that legal harmonisation with almost all the segments of the EU environmental acquis needs to be carried out.

3. Current Status of the Coastal Environment According to NDA, BB and SP

3.1 Introduction

The **National Diagnostic Analysis (NDA)** and **the Baseline Budget (BB)**, as well as the subsequently drafted **Sectoral Programmes (SPs)**, which represent basic documents, i.e. the baseline for the elaboration of National Action Plan, have identified the main problems related to the pollution of coastal areas and gravitating sea basins, analysed by individual administrative units within the Croatian borders.

Namely, as a result of analyses performed within the **National Diagnostic Analysis (NDA)** priority activities have been set, according to the contribution of each individual pollutant to marine pollution (wastewaters, solid waste, heavy metals, chlorinated hydrocarbons, radioactive substances, nutrient salts and suspended solids, hazardous waste), and according to the physical changes and devastation of habitats in coastal areas (uncontrolled construction, rocky shore depletion due to date shell fishing, fish farming effects, exploitation of minerals and sediment, modifications of the ecological factors in sea water, biological changes), all in the light of sea-food quality, public health, health of the eco-system in its entirety and socio-economical cost-benefit.

The **Baseline Budget (BB)** study has estimated the annual pollutant discharge in the sea and the atmosphere (for 2003), analysed by individual administrative units. The sum of the values obtained gives the Baseline Budget estimate for Croatia's coastal area, which comprises the territory of seven Croatia's counties (Istarska, Primorsko–Goranska, Ličko–Senjska, Zadarska, Šibensko–Kninska, Splitsko–Dalmatinska, and Dubrovačko–Neretvanska).

Sectoral Plans (SPs) constitute a basis for the drafting of National Action Plan and have been prepared for all priority actions defined in SAP, for the purpose of the control of the pollution from land-based activities. Sectoral plans have been prepared by administrative regions – the counties.
Each sectoral plan relies on data from NDA and BB to obtain information and data on sources and quantities of individual pollutants. Major sources that contribute to the environmental load have been described, and solution proposed for reduction of emissions.
The plans also contain national legislation dealing with wastewater discharge into the sea, prohibition of utilisation of nine pesticides, prohibition of production, trade and new utilisation of PCBs, as well as the introduction of the prior authorisation system by responsible authorities for works that cause physical changes in the natural status of the coast or degradation of coastal habitats.

These documents, which preceded preparation of NAP, had been prepared in line with the SAP Guidelines, and all available data obtained by monitoring of the state of the coastal environment and sea had been used.

Below is an excerpt from the NDA with an overview of the former and current monitoring programs.

The first systematic research and monitoring of pollution along the Croatian coast was carried out in 1973 and 1974, within a complex project dealing with the environmental protection in the Adriatic region funded by the UN Development Programme (UNDP). Some activities were continued in 1975, within the MED POL Pilot Programme supported by the UN Environmental Programme/Mediterranean Action Plan (UNEP/MAP). Within the first Programme phase, which was finished in 1980, all national institutions that participated in the national Programme (the public health institutes were involved along with the oceanographic institutions) were provided necessary equipment, the specialists were trained, and the initial research activities and measurements carried out. Since 1976, permanent control of the coastal sea from Vir to Konavle has been carried out.

The National Monitoring Programme for the Adriatic, carried out within the Mediterranean Pollution Monitoring Programme (MED POL Programme) and co-funded by the United Nations Environmental Programme/Mediterranean Action Plan (UNEP/MAP) was prepared in 1982, and its implementation started in 1983. The Programme was interrupted in summer 1991 by the war operations in Croatia, to be continued in 1992 to 1996, with intensity allowed by the local conditions. The Programme was reinitiated in 2000.. All the activities related to the MED POL Programme were co-ordinated by the Department for Protection of Sea and Coastal Area of the Ministry of Environmental Protection, Physical Planning and Construction as a national focal point for MED POL implementation. UNEP/MAP MED POL Programme helps the Mediterranean countries to prepare the pollution control measures and sea pollution abatement measures. The states participating in the MED POL Programme and parties to the Barcelona Convention committed themselves to systematic monitoring of the pollution trends and to compliance to values stipulated by law. The research results are used to prepare an adequate management of coastal areas.

Since 1996, Croatia has also been participating in the joint initiative within the UNEP/MAP Life Programme and in the Mediterranean Environmental Technical Assistance Programme (METAP) aimed at identification and setting up of a system of environmental indicators. As the activities within this initiative continued, a Project of 130 indicators of sustainable development in the Mediterranean was initiated within UNEP/MAP in mid-2000. The definitions of the indicators were borrowed from different international sources, such as: UN, FAO, OECD, Eurostat, etc. The publication National Environmental Data Gathering Capacities published by the Ministry of Environmental Protection and Physical Planning, enlists 77 indicators under the section on sea.

Pollutant intake from the land-based sources into the Adriatic Sea is monitored on regular basis through the monitoring programs for industrial and urban outfalls discharged into the sea directly or through the watercourses. The monitoring programs for urban and industrial wastewater and watercourses are carried out by

certified analytical laboratories (mainly the county Public Health Institutes), while data processing and pollutant input evaluation are the responsibility of the water management sector (Ministry of Agriculture, Forestry and Water Management and the Croatian Waters). The testing parameters are specified by water permits, and they depend on the industrial technology in question and type of contamination. According to the issued water permits, 61 municipal systems are currently monitored in 126 measurement stations (the number is not fixed because of economic fluctuations, opening/closing of facilities, etc. so it only illustrates the current state), while the economic sector is monitored in 710 industrial and tourist facilities. The outfalls considered important due to the pollution rates are entered into the annual national LBS Report submitted by the Republic of Croatia in accordance with the signed protocol on protection of the Mediterranean Sea.

The most important environmental monitoring program for the Croatian part of the Adriatic, Project Adriatic, was launched in 1998. The Project was based on the ongoing national monitoring and data collection programs, and on international activities in which the Croatian institutions participated. The primary objective of the Project is to determine the specific requirements for addressing of limitations which impede sustainable development of the Croatian Adriatic area, and it should encompass the issues of regional and global significance whenever they present an international commitment of Croatia (e.g. issues related to the Barcelona Convention, biodiversity or agreements on climate change). The outcomes of the Project are expected to be directly beneficial for the policy-makers and regulators. Therefore, monitoring of changes in the environment and of compliance with the national legislation is considered as high priority. The Project is also expected to make available the data necessary for improvement of national legislation on protection of the marine environment..

What follows is a summary of the current state of the coastal environment and identified environmental issues (according to the NDA and LBS Reports for 2002), analysed by individual administrative units (counties), various types of pollution (urban and industrial wastewater, solid waste, heavy metals, chlorinated hydrocarbons, radioactive substances, nutrient salts and suspended solids, hazardous waste), physical changes and depletion of coastal habitats, as well as the general environmental situation in that area, and sanitary quality of the sea beaches.

The basic data from the BB are then presented, along with the SP data on pollution from industrial wastewater, and issues related to hazardous waste management and disposal.

3.2 Identified Environmental Problems According to NDA and LBS Reports

Istarska County

The coastal area of Istarska County has a population of about 206,000. The most important localities in terms of the number of inhabitants and tourist industry development are situated on Istrian west coast (Umag, Poreč, Rovinj and Pula), while in the east coastal zone the area of Rabac can be pointed out as a centre of tourism. The most important centre (by population count and economic development) is the City of Pula (about 58,000 inhabitants).

- ***Wastewater***

On the territory of Istarska County, pollution characteristics of sixteen (16) major urban wastewater outfalls are monitored within the LBS program. Wastewater is ultimately disposed of through offshore outfalls, which are mostly equipped with diffusers and mainly incorporate pertaining mechanical wastewater treatment devices (coarse/fine screens or settling tanks). About 55 percent of Istarska County population is connected to the public sewerage system, while for the rest (around 45 percent) the issue has still not been resolved.

Industrial wastewaters in the coastal area of Istarska County (that are not discharged into the public sewerage system) run directly into the sea, through nearshore outfall, mostly with no pre-treatment whatsoever. The largest industrial polluters in Istria are Mirna Rovinj (fish processing) – Rovinj, Uljanik – Pula (shipyard) and Plomin Thermal Power Plant.

- ***Solid waste***

A total of 29 solid waste landfills have been registered in Istria (with a total area of 506,230 m^2), of which 11 are regional (containing 80 percent of the total waste volume, estimated at about 3.2 million m^3) and 18 local landfills. It has been determined that 6 landfills have been closed, so that currently only 23 landfills are operating on the territory of Istarska County. Landfills capacity utilisation has been estimated at around 47 percent. The Kaštijun Landfill in Pula receives also liquid waste.

- ***Heavy metals (cadmium, lead and mercury)***

Results of analyses performed within the NDA show that disposal of heavy metals into the coastal sea through urban and industrial wastewater outfalls and river watercourses are relatively low. Increased heavy metal concentrations have been detected in the area of the City of Pula (but generally still below maximum allowable concentration, MAC), while increased lead concentrations are attributed to intensive road traffic (use of leaded gasoline).

- ***Chlorinated hydrocarbons***

The highest concentrations of hydrocarbons have been determined on the territory of the City of Pula, due to impact of urban and industrial wastewaters. However, detected values are below maximum allowable concentrations (MAC).

- ***Radioactive materials***

Croatia does not have a commercial nuclear reactor. The radioactive sources are used in medicine, industry and scientific research. Disposal of radioactive waste has not been resolved, and temporary disposal sites are mainly safe and comparably well organised.

Potential radioactive waste in Istarska County is the Plomin Thermal Power Plant slag. The power plant stockpile contains about 106 tons of radioactive slag and ash, due to increased radioactivity of the Raša coal fired in the plant. The plant has recently started firing imported coal with 20 times lower radioactivity, and it plans is to use the slag in building construction.

- ***Nutrient salts and suspended solids***

In the coastal area of the Istarska County nutrient salts input is mostly of urban origin (urban wastewaters). Smaller portion is input by rivers (23 percent of total nitrogen, 18 percent of total phosphorus), while the input from industrial wastewater is negligible. Suspended solids input into the coastal sea is mostly from streams flowing into the sea, and smaller part (around 29 percent) is input by wastewaters.

- ***Hazardous waste (pollution by oil and oil products)***

No accidents have been recorded lately in the coastal area of the Istarska County that would have any significant impact on the eco-system and influence on the social and economic situation of the population. However, serious accidents have occurred occasionally (in the period from 1999 to 2001: 4 recorded marine pollution from vessels on the territory of Pula Port Authorities, gas explosion in Pula city sewerage system, fuel oil tank overturn near Pazin), so that the threat of pollution of the kind can not be excluded.
In addition, the whole northern Adriatic is a risk area as regards accidents, due to existence of important oil and oil products transportation routes (JANAF, Omišalj tanker port, and other tanker ports in the north Adriatic).

- ***Physical changes and habitat destruction***

Intensive development of the tourist industry is accompanied by growing construction activities in the coastal zone, which results in violation of the natural landscape and often leaves behind unresolved problems of wastewaters discharge and disposal. Backfilling and covering of the coastal zone, construction of marinas and

breakwaters, damages to rocky coastline, development of fish-farming facilities, etc. have an adverse effect on the overall balance of the eco-system.

Changes in marine ecosystem have been noticed in the coastal area of the Istarska County, caused by intrusion of eutrophic waters generated at the River Po mouth. The contamination is then carried by transverse currents to the Istrian west coast, where occasionally the “red-tide” bloom occurs. Changes caused by river basins on the Croatian territory are far less expressed. However, watercourses (the Mirna, Raša and Dragonja Rivers) are occasionally torrential in nature, and in the periods of heavy precipitations they release into the sea substantial contamination arising from the silt from gravitating catchment areas and soil erosion. The Mirna and Raša water quality in the estuary area is comparatively high. The Mirna River is under more intensive anthropogenic impact, as indicated by higher quantities of suspended solids and nutrient salts, and higher BOD_5. Karst ground allows for the pollutant input into the sea from groundwater (submarine springs).

- ***Environmental status assessment***

The environmental situation in Istria (analysis based on information from the Project Adriatic, whereby eutrophication degree and pollutant concentration in marine environment was analysed) has been evaluated as very good. However, occasional changes have been detected due to intrusion of eutrophic waters carried by transverse currents from the direction of the River Po mouth. For that reason, the North Adriatic highlighted as the most endangered area from the point of view of toxic algae blooming, and in connection with the accompanying effects of the occurrence of toxicity in shellfish.

Further, somewhat worse environmental situation was determined for the area of the City of Pula, as a consequence of input of untreated waters released into the semi-confined sea basin. In addition, poor environmental situation has also been determined in the interior parts of the Limski Kanal, due to nutrient salts input by groundwaters (submarine springs).

- ***Sanitary quality of sea beaches***

Sanitary quality of sea beaches in Istarska County is considered very good, which means that almost all beaches meet the legal criteria (according to the faecal pollution indicator concentration).

Primorsko–Goranska County

Some 283,000 inhabitants live in the coastal area of the Primorsko–Goranska County. The most important localities by number of inhabitants and tourist and economic development are: Rijeka, Lovran, Opatija, Kraljevica, Crikvenica, Novi Vinodolski, Cres, Mali Lošinj, Krk and Rab. The most important centre by the number of inhabitants and economic strength is the City of Rijeka, with population of about 144,000.

- ***Wastewaters***

On the territory of the County, pollution characteristics of twelve (12) major urban wastewater outfalls are monitored within the LBS program. Urban wastewater is ultimately disposed of mainly after mechanical pre-treatment (screens/settling tanks), and through respective offshore outfalls (Rijeka Delta, Lovran, Opatija, Crikvenica, Novi Vinodolski, Cres, Mali Lošinj, Krk and Rab). There are locations, however, where wastewaters are discharged directly into the sea without any treatment (partially Rijeka – Kantrida and Kraljevica). About 55 percent of Primorsko-Goranska County population is connected to the public sewerage system, while for the remaining 45 percent the issue has still not been resolved.

The most important self-standing industrial wastewater outfalls in Primorsko-Goranska County are Rafinerije nafte Rijeka – proizvodnja maziva i bitumena na Mlaki (Rijeka Oil Refinery – Mlaka Lubricant and Bitumen Production), Rafinerija nafte – Urinj (Urinj Oil Refinery), Petrokemijska industrija – Omišalj (Omišalj Petrochemical Industry) and Rijeka Thermal Power Plant.

- ***Solid Waste***

A total of 22 solid waste landfills have been registered in Primorsko-Goranska County (with a total area of 408,726 m^2), of which 13 are regional and 9 local landfills. Seven landfills have been closed, so that currently only 15 landfills are operating. Over 90 percent of total waste volume, estimated at about 6 million m^3, is disposed on regional landfills. Landfills capacity utilisation has been estimated at around 49 percent. The four main landfills (Sovjak, Osojnica, Pržić and Kalvarija), and the two local ones (Barbara and Cetin), receive also liquid waste.

- ***Heavy metals (cadmium, lead and mercury)***

Increased heavy metal concentrations have been detected in the area of Rijeka and Bakar (but generally still below MAC). The primary cause for increased lead concentrations is attributed to intensive road traffic (use of leaded gasoline).

- ***Chlorinated hydrocarbons***

The highest concentrations of chlorinated hydrocarbons have been detected in the sea on the territory of Rijeka, due to impact of urban and industrial wastewaters. However, detected values are below maximum allowable concentrations.

- ***Radioactive materials***

The radioactive waste is generated solely from application of radioactive materials in medicine, industry and scientific research. The radioactive waste is disposed on temporary disposal sites which are mainly safe and comparably well organised.

- ***Nutrient salts and suspended solids***

In the coastal area of Primorsko–Goranska County nutrient salts input is mostly of urban origin (urban wastewaters). Smaller portion is input by the Rječina River (about 22 percent of total nitrogen and only about 2 percent of total phosphorus), while the input from industrial wastewater is very low (about 7 percent of total nitrogen and negligible quantity of total phosphorus). There are no data available for input of suspended solids by river watercourses and groundwaters. Major part of suspended solids discharged into the sea originates from urban wastewaters, while the smaller part is wastewater generated by industry and tourism activities.

- ***Hazardous waste (pollution by oil and oil products)***

Primorsko–Goranska County has the worst accident track-record, compared to other coastal counties in Croatia. In the period 1999 – 2001, on the territory of the Rijeka Port Authorities 22 accidents occurred of marine pollution from vessels. In addition, the following accidents were recorded: pollution by hydrocarbons in Ičići Marina, Opatija and in the port of Vrbnik, spillage of motor oil and lubricants – Croatian Railways, Rijeka, oil film and fishkill in the Rječina River storage basin, extra light fuel oil accident in Ivan Zajc primary school in Rijeka, high sulphur fuel oil at Standard outlet into Rječina, hydrocarbons - in the coastal zone in Rijeka, oil fuel in Rijeka (PIK Agribusiness yard).

Since the Primorsko–Goranska County has a tanker port in Omišalj, which has been constructed for the local and international transportation and is connected to the Adriatic oil pipeline system (JANAF), the danger of accidents during oil and oil products transportation through the coastal area is realistic. The risk increases with the increase of capacities of the transportation system, which is planned within the Družba Adria Project. In addition to the threat of accidents caused by spillage of oil and oil products into the sea, the problem is a possible pollution of sea from ballast waters (input of foreign species).

- ***Physical changes and habitat destruction***

Coastal zones and coastal waters have been devastated in some parts of the coastal area of the Primorsko–Goranska County, due to increased construction for tourist purposes (mostly residential development). The County has the largest Croatian transportation port (Rijeka Port), which has a significant impact on the state of the coastal area and the sea.

Only one river, the Rječina, flows into the sea in the Primorsko–Goranska County. The Rječina environmental load as regards organic matter, nitrogen and phosphorus salts, faecal pollution indicators and toxic substances is relatively low, which leads to the conclusion that this watercourse is not to any substantial extent under the influence of the urban and industrial wastewaters. This being a karst area, there is a large number of groundwaters flowing into the sea.

- ***Environmental status assessment***

Based on eutrophication level and pollutant concentration analysis in the seawaters, two critical areas in the coastal zone of the Primorsko-Goranska County emerge – Rijeka and Bakar Bays. The environmental status in the rest of the coastal zone is deemed to be satisfactory.

The environmental status in the area of the Rijeka Bay, which is the location of the City of Rijeka, the transportation port, oil refinery and the gravitating industry, is not satisfactory, due to increased input of nitrogen nutrient salts (urban and industrial wastewater outfalls, the Rječina and groundwaters inflows), exceeding the oligotrophic limit. In addition, poor environmental conditions are recorded also in the area of Bakar Bay, which is under significant impact of groundwaters and accompanying increased nutrient salts input into the surrounding sea basin.

- ***Sanitary quality of sea beaches***

As regards detected concentrations of faecal pollution indicators, seawater sanitary quality (compared to other counties in the coastal zone of the Republic of Croatia) is worst in the Primorsko–Goranska County, particularly in the immediate vicinity of the City of Rijeka, where about 2/3 beaches did not meet the national legally prescribed criteria. In this area very high concentrations of faecal pollution have also been recorded sporadically. In addition, high concentrations of faecal pollution have been recorded occasionally on some beaches in the areas of Opatija, Volosko, Lovran, Omišalj, Mali Lošinj and Rab.

Ličko-Senjska County

The Ličko-Senjska County coastal area has a population of about 20,000. The largest settlement in this area is the City of Senj, with population of about 5,500.

- ***Wastewater***

On the territory of the Ličko-Senjska County pollution characteristics of urban wastewater outfalls of the City of Senj are monitored within the LBS program. Urban sanitary wastewater/sewage and the process waters from industrial facilities are disposed of without any pre-treatment into the so-called Potok which flows into the City port. About 56 percent of Ličko-Senjska County population is connected to the public sewerage system, while for the remaining 44 percent the issue has still not been resolved.

Results of analyses of specific pollutants in the wastewater (phenols, chlorinated hydrocarbons and heavy metals) prior to their discharge into the sea do not indicate any significant effect of industrial wastewater.

- ***Solid waste***

In the coastal area of the Ličko-Senjska County the number of registered landfills is the lowest compared to other coastal zone counties in the Republic of Croatia. The total area of registered 7 major landfills is about 90,600 m^2, and the volume of deposited solid waste amounts to about 224,000 m^3. Capacity utilisation of all the landfills is estimated at about 42 percent.

- ***Heavy metals (cadmium, lead and mercury)***

Determined heavy metal concentrations discharged into the sea by urban and industrial wastewater on the territory of the Ličko–Senjska County are low, substantially below maximum allowable concentrations.

- ***Chlorinated hydrocarbons***

Concentrations of chlorinated hydrocarbons in the sea, due to impact of urban and industrial wastewaters are below maximum allowable concentrations.

- ***Radioactive materials***

Croatia does not have a commercial nuclear reactor, hence the radioactive waste is generated solely from application of radioactive materials in medicine, industry and scientific research, and it is disposed on temporary disposal sites which are mainly safe and comparably well organised.

- ***Nutrient salts and suspended solids***

The nutrient salts input in the area of the Ličko–Senjska County is very low, the fact that reflects the level of urban development of the area.

- ***Hazardous waste (pollution by oil and oil products)***

The coastal zone of the Ličko-Senjska County does not have a large track-record of accidents (in the period 1999-2001, only one pollution event from vessels has been recorded); this leads to the conclusion that this part of the coast is relatively low-risk in terms of this type of pollution.

- ***Physical changes and habitat destruction***

Coastal zones and coastal waters have been devastated in some parts of the coastal area of the Ličko–Senjska County, due to increased construction for tourist purposes (mostly residential development).

No rivers flow into the sea on the territory of the Ličko-Senjska County. However, this being a karst coastal area, there is a large number of groundwaters flowing into the sea.

- ***Environmental status assessment***

The environmental status of the coastal zone of the Ličko–Senjska County is assessed as very good.

- ***Sanitary quality of sea beaches***

Sanitary quality of sea beach water satisfies the national legally prescribed criteria and is assessed as very good.

Zadarska County

The coastal zone of the Zadarska County has a population of about 133,000. The most important localities in terms of the number of inhabitants, tourist industry and economic development are Zadar and Biograd na Moru. The most important centre by population count and economic development is the City of Zadar with about 70,000 inhabitants.

- ***Wastewater***

On the territory of the Zadarska County, Zadar and Biograd na Moru urban wastewater outfalls are monitored for pollution characteristics within the LBS program. Urban wastewater is ultimately disposed of mainly after preliminary treatment (screens), and subsequent discharge into the sea through two offshore outfalls (Centar and Borik). In addition, there are several coastal nearshore outfalls discharging wastewaters directly into the sea. Biograd na Moru wastewater is discharged into the sea without any pretreatment. About 45 percent of the Zadarska County coastal area population is connected to the public sewerage system, while for the remaining about 55 percent the issue has still not been resolved.

The most important self-standing industrial wastewater outfalls in Zadarska County are: Kožara – Zadar (shut down), Sojara – Zadar, Adria – prerada ribe – Zadar.

- ***Solid waste***

A total of 30 solid waste landfills have been registered in the coastal area of the Zadarska County (4 regional and 26 local). The total area of all landfills amounts to about 246,000 m^2), and the landfilled solid waste volume amounts to about 915,000 m^3, whereby disposal on regional landfills accounts for about 92 percent of the total waste. Capacity utilisation of all the landfills is estimated at around 63 percent.

- ***Heavy metals (cadmium, lead and mercury)***

Heavy metal input into the sea by wastewater discharges on the territory of the Zadarska County are relatively low (results obtained by sampling shellfish in 16 hot spots in the coastal area of the Republic of Croatia). Increased values have however been occasionally detected in the area of Zadar (Borik), as a result of intensive road traffic and wastewater discharge impact.

- ***Chlorinated hydrocarbons***

Determined low concentrations of chlorinated hydrocarbons in the sea, due to impact of urban and industrial wastewaters are below maximum allowable concentrations, which leads to the conclusion that they do not constitute a problem on the territory of the Zadar County coastal zone.

- ***Radioactive materials***

The radioactive waste is generated solely from application of radioactive materials in medicine, industry and scientific research. It is disposed on temporary disposal sites which are mainly safe and comparably well organised.

- ***Nutrient salts and suspended solids***

Nutrient salts and suspended solids input in Zadarska County as a result of anthropogenic effect (wastewater) and through watercourses and groundwater is not particularly important. In the most part of the nutrient salts and suspended solids load is accounted for by urban wastewater, and the lesser is due to watercourses and industrial wastewater impact.

- ***Hazardous waste (pollution by oil and oil products)***

The coastal zone of the Zadarska County does not have a large track-record of pollution accidents (in the period 1999-2001, only 2 pollution accidents from vessels has been recorded); this leads to the conclusion that this part of the coast is relatively low-risk in terms of this type of pollution.

- ***Physical changes and habitat destruction***

Some parts of the coastal area of the Zadarska County show instances of devastation of coastal zones and waters, due to intensive construction for tourist industry purposes (mostly residential development). In addition to the natural landscape violation, these “hot spots” often lack solutions for the issue of collection and discharge of wastewaters. It can also be said that uncontrolled backfilling and covering of the coastal zone, construction of marinas and backwaters, damages to rocky coastline, development of fish-farming facilities, etc. are the cause of the environmental factors change, having an adverse effect on the overall eco-system balance.

The major watercourse flowing into the sea in the Zadarska County is the Zrmanja River. In the river estuary area, increased concentrations of faecal pollution indicators have been recorded, which points to unresolved wastewater issues in the gravitating catchment area.

- ***Environmental status assessment***

The most endangered area under strong anthropogenic impact, manifested by trophic degree increase, is the sea basin of the most developed urban centre – the City of Zadar. In addition, intensive development of cage fish breeding (tuna fish) has been recorded recently in Zadarska County. The fish farm impact on the sea environment is mostly reflected in degradation of benthonic settlements under the cages, and in certain cases water column and sediment have also been adversely affected.

- ***Sanitary quality of sea beaches***

According to the test control results, the sanitary quality of seawater in Zadarska County has been assessed as satisfactory. However, impact of sanitary wastewater has been detected on several beaches nearby Zadar, whereby, in individual cases, detected faecal pollution indicators have slightly exceeded the allowable concentrations.

Šibensko-Kninska County

The population count of the coastal area of Šibensko-Kninska County is about 88,000. The most important localities in terms of the number of inhabitants, tourist industry and economic development are Šibenik and Vodice. The most important centre by population count and economic development is the City of Šibenik with about 37,000 inhabitants.

- ***Wastewaters***

On the territory of the Šibensko-Kninska County pollution characteristics of major urban wastewater outfalls, which are located in the cities of Šibenik and Vodice are monitored within the LBS program. Šibenik urban wastewater is disposed of without any pretreatment from several nearshore outfalls into the waters of the Šibenik Bay, whereby environmental balance within these sensitive waters is violated. Vodice wastewaters are discharged through the offshore outfall directly into the sea after mechanical pretreatment. About 44 percent of Šibensko-Kninska County population is connected to the public sewerage system, while for the remaining 56 percent the issue has still not been resolved.

The most important self-standing industrial wastewater outfalls in Šibensko-Kninska County coastal zone is TLM – prerada lakih metala – Šibenik (light metal processing).

- ***Solid Waste***

A total of 6 regional and 4 local solid waste landfills have been registered in Šibensko-Kninska County, with total area of around 267,800 m^2, and total waste volume of about 2.6 million m^3. The most important landfill by volume of disposed solid waste is Bikarac by Šibenik, which receives also liquid waste. Capacity utilisation of all the landfills is estimated at around 45 percent.

- ***Heavy metals (cadmium, lead and mercury)***

Based on analyses performed within NDA it can be concluded that discharge of heavy metal pollution into the Šibensko-Kninska County coastal sea from urban and industrial wastewater outfalls and watercourses are relatively low.

- ***Chlorinated hydrocarbons***

Determined concentration values of chlorinated hydrocarbons in the sea, due to impact of urban and industrial wastewaters are below maximum allowable concentrations, so it can be concluded that they do not constitute a significant problem in the coastal area of the Šibensko-Kninska County.

- ***Radioactive materials***

The radioactive waste is generated exclusively from application of radioactive materials in medicine, industry and scientific research, and it is disposed on temporary disposal sites which are mainly safe and comparably well organised.

- ***Nutrient salts and suspended solids***

Nutrient salts input in the coastal area of Šibensko-Kninska County is partly of urban origin (urban wastewater), and partly comes from watercourses flowing into the sea. Nitrogen and phosphorus salts and suspended solids input from industrial wastewater is relatively low.

- ***Hazardous waste (pollution by oil and oil products)***

In the period from 1999 to 2001, only four instances of pollution from vessels were recorded in the Šibensko-Kninska County. Furthermore, in the same period the Solaris Hotel (Šibenik) beach and pertaining sea basin suffered land-based pollution by fuel oil and oil. However, it can be said that the mentioned accidents were not high-risk events, and no serious consequences for the coastal area eco-system have been detected.

- ***Physical changes and habitat destruction***

Some parts of the coastal area of the Šibensko-Kninska County (similar to other areas of Croatia's coastline) show instances of natural landscape devastation, due to intensive construction for tourist industry purposes (mostly residential development), whereby the issue of wastewater discharge in newly urbanised areas often remains unresolved. It can be said that uncontrolled backfilling and covering of the coastal zone, construction of marinas and backwaters, damages to rocky coastline, development of fish-farming facilities, etc. are the cause of the environmental factors change, having an adverse effect on the overall eco-system balance.

Only one major watercourse is flowing into the sea in the Šibensko-Kninska County - the Krka, which has a major impact on the Šibenik Bay sea basin. During the summer, massive phytoplankton blooming (diatomea) is frequent.

- ***Environmental status assessment***

Based on eutrophication level and pollutant concentration analysis in the seawaters, as a critical area in the coastal zone of the Šibensko-Kninska County emerge the Šibenik Bay sea basin, where significant changes occur of the environmental status, due to the combination of adverse effects of the Krka River and anthropogenic impact (wastewater input). This situation results in a high degree of sea eutrophication and occurrence of blooming during the summer period.

- ***Sanitary quality of sea beaches***

As regards detected concentrations of faecal pollution indicators, seawater sanitary quality in the coastal zone of the Šibensko-Kninska County was not assessed as satisfactory within the NDA, due to a high percentages of beaches not meeting sanitary standards. The reason is improper wastewater treatment and discharge of wastewater into the sea (particularly true for Šibenik area), whereby adverse impact of smaller local sewerage outfalls has also been recorded.

Splitsko-Dalmatinska County

The population count of the coastal area Splitsko-Dalmatinska County is about 382,000. The most important localities in terms of the number of inhabitants, tourist industry and economic development are Split, Trogir, Kaštela, Solin, Omiš, Makarska, Bol and Hvar. The most important centre by population count and economic development is the City of Split with about 188,000 inhabitants.

- ***Wastewater***

On the territory of Splitsko-Dalmatinska County pollution characteristics of ten (10) major urban wastewater outfalls are monitored within the LBS program. Urban wastewater from the major part of urbanised area is mostly discharged into the sea without any pretreatment. An exception are certain parts of the City of Split (which are connected to a mechanical wastewater treatment plant and pertaining offshore outfall) and the City of Makarska which disposes with a mechanical device and offshore outfall. The City of Omiš has built the offshore outfall, but the pertaining mechanical wastewater treatment plant is still not in operation. About 58 percent of Splitsko-Dalmatinska County population is connected to the public sewerage system, while for the remaining 42 percent the issue has still not been resolved.

Within the LBS program pollution characteristics of eleven (11) major self-standing industrial wastewater outfalls are monitored in the County: Brodotrogir – Trogir (shipyard), Pliva bilje – Trogir (pharmaceuticals), Adriavinil plastične mase – Kaštela (shut down), Adriachem – Kaštela (plastics), Petason – Solin (meat industry), Pivovara – Solin (brewery), Salonit – Vranjic (asbestos), INA – Solin (oil products storage), Dalmacija metalna industrija – Dugi Rat (shut down), Galeb – Omiš (textile industry), Omial – Omiš (aluminium processing).

- ***Solid waste***

A total of 31 solid waste landfills have been registered in Splitsko-Dalmatinska County (with a total area of 392,600 m^2), of which 12 are regional and 19 local. Five landfills have been closed, so that currently 26 landfills are operating. Major landfills received around 90 percent of the total waste volume, which is estimated at about 3.1 million m^3. Capacity utilisation of the landfills has been estimated at around 48 percent. Three major landfills (Tupinolom Mravince, Karepovac and Plano) receive also liquid waste. Regarding quantity of disposed solid waste, the Kerepovac near Split is the most important landfill.

- ***Heavy metals (cadmium, lead and mercury)***

Results of analyses performed within the NDA show that urban and industrial wastewater outfalls on the territory of the Splitsko-Dalmatinska County cause increased heavy metals concentrations. This pollution is occasionally detected in the area of Kaštela Bay (Vranjic), and in Omiš. Increased lead concentrations in larger

urban settlements periphery can be associated with intensive road traffic (use of leaded gasoline).

- ***Chlorinated hydrocarbons***

Increased concentrations of chlorinated hydrocarbons in the coastal sea have been detected occasionally on the territory of the Kaštela bay (Vranjic) and the City of Omiš, as well as in the urban parts of Split, as a result of increased effects of industrial wastewater. However, all detected values of individual compounds are below maximum allowable concentrations.

- ***Radioactive materials***

A slag and ash stockpile is located in the Kaštela Bay, but no researches have been performed on possible impact of that site on the surrounding environment and health of local population. Currently, the activities are carried out aimed at resolving of this issue.

- ***Nutrient salts and suspended solids***

In the coastal area of Splitsko-Dalmatinska County nutrient salts input is mostly of urban origin (urban wastewaters). Smaller portion is input by rivers flowing into the sea (Jadro and Cetina), while the input from industrial wastewater is relatively low. Suspended solids input by watercourses is substantial, higher than input by wastewater. It is supposed that a substantial part of nutrient salts input is accounted for by groundwaters (springs).

- ***Hazardous waste (pollution by oil and oil products)***

Splitsko-Dalmatinska County has a history of a rather high number of accidents in the period 1999-2001. On the territory of Split Port Authorities 7 accidents occurred of sea pollution from vessels. In addition, the following accidents were recorded: Dalmacijacement, Solin – cooling oil spillage into the River Jadro, Žnjan, fuel oil spillage into the Trstenik Stream and coastal sea, hotel Sirena, Hvar – fuel oil tank spillage, Dalmacijacement, Solin – pipe burst in the power duct and fuel oil spillage into the Jadro River, Obala Petrol Station storage, Split – sea pollution by oil products.

The most serious of the above mentioned pollution accidents was the sea pollution by oil products from Obala Petrol Station in Split – it was classified as 1st degree risk.

- ***Physical changes and habitat destruction***

Some parts of the coastal area of the Splitsko-Dalmatinska County show instances of coastal zones and waters violation, due to intensive construction for tourist industry purposes (mostly residential development). It can be said that uncontrolled backfilling and covering of the coastal zone, construction of marinas and backwaters, damages

to rocky coastline, development of fish-farming facilities, etc. are the cause of the environmental factors change, having an adverse effect on the overall eco-system balance. The Splitsko-Dalmatinska County accommodates the Split transportation port, which has a significant impact on the status of the coastal area and sea.

Two important river watercourses flow into the sea in the Splitsko-Dalmatinska County – the Cetina and Jadro Rivers. This being a karst area, there is a large number of groundwaters flowing into the sea.

- ***Environmental status assessment***

Based on eutrophication level and pollutant concentration analysis in the seawaters, as critical areas in the coastal zone of the Splitsko-Dalmatinska County emerge the Kaštela Bay sea basin (the Vranjica basin), which serves as a recipient for the greater Split area wastewater, and orthophosphates and nitrogen input by the Jadro River. The Vranjica basin eutrophication causes massive blooming, which regularly appears in summer periods, causing eco-system imbalance.

Intensive development of cage fish breeding (tuna fish) has been recorded lately in the County, resulting in the environmental changes in the marine environment in the neighbouring area.

- ***Sanitary quality of sea beaches***

As regards detected concentrations of faecal pollution indicators, seawater sanitary quality in the coastal zone of the Splitsko-Dalmatinska County is considered satisfactory. Solely in the Split area occasional change of the seawater sanitary quality has been recorded, as a result of direct discharge of untreated wastewater.

Dubrovačko-Neretvanska County

The population count of the coastal area of the Dubrovačko-Neretvanska County is about 120,000. The most important localities in terms of the number of inhabitants, tourist industry and economic development are Dubrovnik, Metković, Ploče and Korčula. The most important centre by population count and economic development is the City of Split with about 30,000 inhabitants.

It is pointed out that on this part of the Adriatic coast a part of the territory is associated to Bosnia and Herzegovina. This area is the location of the important economic centre and port – the town of Neum.

- ***Wastewater***

On the territory of Dubrovačko-Neretvanska County pollution characteristics of five (5) major urban wastewater outfalls are monitored within the LBS program. A portion of the City of Dubrovnik and Ston locality wastewater is treated in pertaining treatment plants (mechanical part), and the sewerage effluent is discharged into the sea through outfalls. The cities of Metković, Ploče and Korčula do not dispose of the treatment facility and wastewaters are discharged into the sea without pretreatment. About 38 percent of Dubrovačko-Neretvanska County coastal zone population is connected to the public sewerage system, while for the remaining 62 percent the issue has still not been resolved.

The most important coastal area self-standing industrial wastewater outfall is Jadranka – Vela Luka (fish processing).

- ***Solid waste***

A total of 8 regional solid waste landfills have been registered in Dubrovačko-Neretvanska County (containing around 92 percent of the total waste volume) and 21 local landfills, with the total area of about 213,400 m2 and total waste volume of around 0.9 million m^3. The Blato–Sitnica landfill receives also liquid waste. Only one landfill has been closed, so that currently 28 landfills are operating. Capacity utilisation of the landfills has been estimated at around 47 percent.

- ***Heavy metals (cadmium, lead and mercury)***

Results of analyses performed within the NDA show that wastewater outfalls on the territory of Dubrovnik cause increased heavy metals concentrations, which are occasionally detected in the sea basins of the port of Gruž and Rijeka Dubrovačka. Increased lead concentrations in larger urban settlements periphery can be associated with intensive road traffic (use of leaded gasoline).

- ***Chlorinated hydrocarbons***

Increased concentrations of hydrocarbons have been recorded occasionally on the territory of Rijeka Dubrovačka and the City of Ploče. However, all detected values of these compounds are below maximum allowable concentrations.

- ***Radioactive materials***

The radioactive waste is generated solely from application of radioactive materials in medicine, industry and scientific research, and it is disposed on temporary disposal sites which are mainly safe and comparably well organised.

- ***Nutrient salts and suspended solids***

Nutrient salts and suspended solids input in the territory of Dubrovačko-Neretvanska County is substantial. The Neretva River accounts for almost all input of nitrogen (94 percent), phosphorus (86 percent) and suspended solids, while the rest is accounted for by wastewater input.

- ***Hazardous waste (pollution by oil and oil products)***

In the period 1999-2001, only 5 instances of sea pollution from vessels have been recorded. In addition, in the same period several land-based accidents of oil and oil products spillage occurred (traffic accidents), which were not of high-risk events and did not cause any substantial impact on the coastal zone eco-system.

- ***Physical changes and habitat depletion***

Some parts of the coastal area of the Dubrovačko-Neretvanska County (similar to other areas of Croatia coastline) show instances of natural landscape degradation, due to intensive construction for tourist industry purposes (mostly residential development), whereby the issue of wastewater discharge in newly urbanised areas often remains unresolved. It can be said that uncontrolled filling and covering of the coastal zone, construction of marinas and breakwaters, damages to rocky coastline, development of fish-farming facilities, etc. cause the environmental factors change, having an adverse effect on the overall eco-system balance. The County is the location of transportation ports in Ploče and Neum (Bosnia and Herzegovina), which also have a significant impact on the environmental status of the coastal area and sea.

The Neretva River carries into the sea a substantial portion of the pollutant (compared to other watercourses flowing into the sea). Increased concentrations of faecal pollution indicators have been recorded, which points to unresolved wastewater issues in the gravitating catchment area.

The Neretva River valley is also exposed to flooding and salination of the coastal area, which is particularly intensive during the dry periods. The cause is related to an impact of the groundwater drawdown (due to the effect of the hydropower system, riverbed training, irrigation, water supply and the like) which results in uplifting of the sea water from the deeper layers on the surface. This affects the well fields within the water supply system serving the population in the area.

- ***Environmental status assessment***

Based on eutrophication level and pollutant concentration analysis in the seawaters, as critical areas in the coastal zone of the Dubrovačko-Neretvanska County emerge the sea basin of the ports of Gruž (Dubrovnik) and Ploče, as a consequence of anthropogenic impact (input from wastewater).

- ***Sanitary quality of sea beaches***

As regards detected concentrations of faecal pollution indicators, seawater sanitary quality in the area of the Dubrovačko-Neretvanska County has been generally assessed in the NDA as satisfactory. However, the impact of wastewaters has been recorded in greater Dubrovnik area, where certain beaches occasionally record excessive faecal pollution indicator concentrations.

3.3 Environmental Priorities According to the NDA

Based on analyses performed within NDA, the environmental protection issues have been identified for the Republic of Croatia coastal zone. Previous section gave a brief summary of respective situation, in order to get an insight into all the aspects of marine pollution from the land-based activities.

As a result of subsequent analyses, following priorities have been identified, resolving of which would contribute to reduction of the pollutant input into the sea. In concrete terms, a table is given (excerpt from NDA), containing priorities in resolving environmental protection issues in the Republic of Croatia coastal zone categorised in three groups – high, medium and low priority.

NDA – P R I O R I T I E S			
Croatian coastal zone	**High priorities**	**Medium priorities**	**Low priorities**
ISTRIA			
Istarska County	Wastewater Solid waste management	Nutrient salts and suspended solids Changes in sea/rivers Radioactive waste Physical interventions/changes	Heavy metals Oil and oil products Biological changes (invasive type)
HRVATSKO PRIMORJE			
Primorsko-Goranska County *Ličko-Senjska County*	Wastewater Solid waste management Hazardous waste (oil and oil products) Urban wastewater	Biological changes Physical interventions/changes	Heavy metals Radioactive waste Changes in sea/rivers
DALMATIA			
Zadarska County	Wastewater Physical interventions/changes	Solid waste management	Heavy metals Radioactive waste Biological changes (invasive type) Hazardous waste
Šibensko –Kninska County	Wastewater Changes in sea/rivers Nutrient salts and suspended solids	Solid waste management Physical interventions/changes	Heavy metals Radioactive waste Hazardous waste
Splitsko-Dalmatinska County	Wastewater Solid waste management Physical interventions/changes	Biological changes (invasive type) Nutrient salts and suspended solids Radioactive waste	Heavy metals Chlorinated hydrocarbons

Dubrovačko-Neretvanska County	Changes in sea/rivers Flooding/salination of the Neretva River valley	Solid waste management Biological changes (invasive type)	Nutrient salts and suspended solids Heavy metals Radioactive waste

An analysis of the above table shows that wastewaters are the main source of pollution in the Republic of Croatia coastal zone, whereby in terms of excessive pollutant input from wastewater, sea basins in the vicinity of larger cities, which receive discharge from industrial wastewaters outfalls, emerge as critical zones.

Additionally, the problem of solid waste management is very serious in the vicinity of the major urban centres in the Croatian coastal zone.

The issues of sewerage, treatment and ultimate discharge of wastewater as well as solid waste management have been classified as high priority, since their resolving can substantially reduce pollutant input into the sea and thereby contribute to the improvement of the environmental conditions on the whole coastal area of the Republic of Croatia.

3.4 The BB Data

This section shows the basic information from the study titled 2003 Baseline Budget (BB) for the Republic of Croatia - Coastal Area, intended as an overview of the level of pollution of the coastal environment and sea from the land-based activities.

The table given below shows the 2003 baseline budget for the Croatian coastal area.

Parameter	Total input (kg)
Liquid	
BOD5	20035046.15
Cd	35.94935
Cr	619.03
Cu	344.26
Cyanide	60.3525
Mineral oils	68671.55609
Pb	617.31465
Hg	25.91889
Ni	10.13306
Total fats	2106945.298
Phenols	6499.3
Total nitrogen	3113612.4
Total phosphorus	908934.75
Total suspended solids	14491564.34
Zn	8187.458

Atmospheric	
As	173.4222645
Benzo(a)anthracene	0.218083265
Benzo(a)pyrene	0.137489633
Benzo(b)fluoranthene	0.05507316
Benzo(b,j,k)fluoranthene	0.03185666
Benzo(b,k)fluoranthene	0.057181464
Benzo(g,h,i)perylene	0.167443767
Cd	22.3041425
Chlorobenzene	0.246704
Cr	243.7258982
Cu	5126.781306
Fluoranthene	0.381823164
Indeno(1,2,3-CD)pyrene	48.74932461
Pb	335.046526
Hg	147.2723244
Naphthalene	3.764878
NH3	9924.1767
Ni	4807.586
PAH-10 various	141.212984
PAH	168609.4064
PCDD/PCDF	0.142790269
Phenanthrene	1.22811698
VOC	11961.26

The pollutant inputs from the above table are calculated from the monitoring program results on physico-chemical parameters of industrial and urban wastewater, and by use of sectoral models.

Since the calculated quantities represent only a portion of total pollutant input into the Adriatic, they were completed with quantities from other significant sources. To that end, the pollution loads were calculated reaching the Adriatic with urban wastewater not included in public sewerage systems, tourist industry, mariculture (white fish and tuna fist breeding), and from the watercourses and submarine springs. Below, the analysis results are tabulated and the pertaining pollutant inputs shown.

Pollutant input (ton/year) from urban wastewater in/out of the public sewerage system (Model)

Parameter	*Sewerage in system*	*Sewerage out of system (Model)*	Total*
BOD5	17068.36	12803.3	29871.36
Mineral oils	42.574	-	42.574*

Total fat	1772.651	-	1772.651*
Phenols	2.600	-	2.600*
Total nitrogen	2885.225	2095.1	4980.325
Total phosphorus	873.983	232.8	1106.783
Suspended solids	12961.030	-	12961.030*
Cd	0.031	0.03	0.061
Cr	0.288	-	0.288*
Pb	0.609	0.32	0.929
Hg	0.114	-	0.114*
Zn	6.509	-	6.509*
Cu	0.237	-	0.237*

*Since the calculation model for pollutant input from households (UNEP/MAP, 2002) does not offer emission factors for all the parameters from the table (total suspended solids, mineral oils, total oils and fat, phenols, chromium, mercury, zinc, and copper), their input is probably higher.

Occupancy levels (bed/nights), and BOD5, total nitrogen and phosphorus loads (tons) in the coastal counties in 2002

County	*Bed/nights*	*BOD5*	*Total nitrogen*	*Total phosphorus*
Istarska	16135450	972.55	159.15	17.68
Primorsko-Goranska	9873152	595.10	97.38	10.82
Ličko-Senjska	665890	40.13	6.57	0.73
Zadarska	4282293	258.10	42.24	4.69
Šibensko-Kninska	2538034	152.99	25.03	2.78
Splitsko-Dalmatinska	6478955	390.52	63.90	7.10
Dubrovačko-Neretvanska	3340114	201.32	32.94	3.66
Total	43313888	2610.70	427.20	47.47

Nitrogen and phosphorus input (ton/year) into the Adriatic from white fish and tuna fish breeding

Parameter	*White fish*	*Tuna fish*	*Total (ton/yr)*
Dissolved nitrogen	364	975	1339
Particular nitrogen	28.65	27	55.65
Total nitrogen	392.65	1002	1394.65
Dissolved phosphorus	15.7	20	55.7
Particular phosphorus	15	1.1	16.1
Total phosphorus	50.7	21.1	71.8

Pollutant input into the Adriatic (ton/year) from major watercourses in 2002

Parameter	**Total**
Suspended solids	34669.648
BOD5	48513.644

Total nitrogen	6747.261
Total phosphorus	1048.338
Cu (liq)	51.756
Zn (liq)	292.4875
Cr (liq)	18.869
Pb (liq)	32.595
Total fats	891.776
Mineral oils	314.990

The above data indicate that the baseline budget is only a portion of the estimated input into the Adriatic. The highest input into the Adriatic for most of selected indicators is from the watercourses and submarine springs, except for total oils and fats where the input from urban wastewater is more significant. Input rates from the urban wastewater are second to the input from the watercourses.

Based on the BB data, the assessment of pollution reduction is made below (section 5.3) which would be achieved in case the environmental protection priority actions were carried out in the coastal area of the Republic of Croatia.

3.5 The SP Data

With regard to the SAP objectives, this section gives an excerpt from the SP study on the current state of the environment related to the pollution from industrial wastewater and hazardous waste (used chemicals, POPs, waste oil, batteries/car batteries).

3.5.1 Industrial Wastewater

In the Croatian coastal area, industrial facilities are generally located in the vicinity of larger agglomerations or in areas gravitating to the largest cities: Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik.

Wastewater from the industrial facilities is generally discharged into the sewerage systems, but some of them have their own nearshore outfalls.

The urban and industrial wastewater is tested by certified laboratories (mainly the county Public Health Institutes), while data processing and pollutant input evaluation are the responsibility of the water management sector (Ministry of Agriculture, Forestry and Water Management and the Croatian Waters). The testing parameters are specified by water permits, and they depend on the industrial technology in question and type of contamination. According to the issued water permits, 61 municipal systems are currently monitored in 126 measurement stations (the number is not fixed because of economic fluctuations, opening/closing of facilities, etc. so it only illustrates the current state), while the economic sector is monitored in 710 industrial and tourist facilities. The outfalls considered important due to the discharged pollutant quantities (hot spots) are entered into the annual national LBS Report submitted by the Republic of Croatia in accordance with the signed protocol on protection of the Mediterranean Sea.

The allowable pollutant concentration in industrial wastewater to be discharged into the public sewerage system or natural recipient is stipulated by the Rules on Limit Values of Indicators, Hazardous and Other Substances in Wastewater (Official Gazette 40/99, 6/01). The Rules permit for higher loads in industrial wastewater when they can be subsequently treated in an urban wastewater treatment plant (when discharged in public sewerage) and the requested treatment degree achieved. The water permits stipulate allowed wastewater quantities and testing indicators, while deadlines by which the wastewater discharge must comply with the Rules are determined by the permit orders. Industrial facilities pay the water quality protection charges according to the type and quantity of pollutants from wastewater, in order to stimulate reduction in pollutant input.

The LBS Report considers pollution from industrial wastewater only for industrial facilities with self-standing offshore outfall (24 industrial facilities were analysed).

The organic load caused by industrial pollution in included in the baseline budget (BB) using the available data and the sectoral model for industries not encompassed by the wastewater monitoring. Based on the analysis of the BB data, total BOD_5 load of the industrial wastewater was estimated at 1600 ton/year.

During the period from 1990 to 2002, a number of industrial facilities which were major coastal sea polluters closed down within the process of economic restructuring. Therefore, according to the NDA assessment, current pollution from industrial wastewater does not pose a significant problem in the coastal zone from the environmental protection standpoint. The below table shows major industries that closed down during the last ten years.

Facility	City, County	Production
Adriavinil	Split, Splitsko-Dalmatinska	PVC
Polikem	Zadar, Zadarska	PVC
Tvornica fero-legura	Dugi Rat, Splitsko-Dalmatinska	Metallurgy
TEF	Šibenik, Šibensko-Kninska	Metallurgy
Kožara	Zadar, Zadarska	Leather
TLM	Šibenik, Šibensko-Kninska	Aluminium electrolysis
Tvornica papira	Rijeka, Primorsko-Goranska	Cellulose
Istarski ugljenokopi	Labin, Istarska	Coal
Koksara	Bakar, Primorsko-Goranska	Coke

3.5.2 Hazardous Waste

This group of pollutants includes:

- Organohalogens (POPs)
- Heavy metals Hg, Cd, Pb
- Radioactive substances
- Different hazardous waste (previous pollution loads, waste containing PCBs, waste oils, used chemicals, used batteries and car batteries)

Organohalogens - Persistent organic pollutants **(POPs)** comprise twelve substances referred to in the LBS Protocol as organohalogens, which are divided into four groups: pesticides, polychlorinated biphenyls (PCB), polycyclic aromatic hydrocarbons (PAH), and dioxins and furans (PCDD/PCDF).

Croatia has no production, import or export of **POPs pesticides**, and their application is prohibited. There are no information on POPs pesticide stocks or any contaminated locations. POPs pesticides are covered by several laws and by-laws. POPs pesticides are entered on the List of Prohibited Toxins Manufacture, Trade and Application (Official Gazette 29/05). The applicable legislation stipulates only POPs pesticide monitoring in waters, and there is no obligation for their monitoring in other elements of the environment. Within the National Adriatic Pollution Monitoring Program, concentrations of PCB, indane and DDT are determined in shell tissues. According to NDA, the available data is not sufficient for relevant evaluation of possible sea contamination.

According to the available data, **PCBs** are not being produced in Croatia, but there is still a risk of contamination since these compounds had been used for different purposes, most frequently in manufacture of condensers and transformers, and as additives in pesticide mix designs. Main sources of PCB pollution in the environment are evaporation or leakage from transformers and condensers, sewage sludge, and illegal dumpsites on which the equipment containing PCBs has been dumped. Burning of waste under uncontrolled conditions can also be source of PCB pollution.

According to the SP data, the following has been recorded in the coastal counties:

- 7,126 condensers – 201,298 kg
- 47 transformers – 55,484 kg

This is equipment in operation, out of operation or standby equipment. Most of the operating equipment is obsolete with expired optimum lifetime, and they are to be removed, replaced and disposed of.

The National Implementation Plan for the Stockholm Convention gives an overview of the status of equipment containing PCBs and its distribution in the counties. The stocks are also presented, including the equipment with PCBs planned as standby equipment in the event of failure of a device or a liquid containing PCBs. The activities on phasing out and replacement of equipment containing PCBs are specified.

According to the data from the NDA and within the National Adriatic Pollution Monitoring Programme, concentrations of chlorinated insecticides and polychlorinated biphenyls in shell tissue were determined. The analyses show higher presence of PCBs in the areas of Pula, Rijeka, Bakar, Vranjic, Šibenik and Rijeka Dubrovačka, which is a sign of intensive industrial pollution. However, all obtained values are below the MAC stipulated by law. Permanent monitoring of PCBs is carried out in the Zrmanja, Krka, Jadro and Cetina Rivers. The obtained results did not exceed the MAC values stipulated by law.

It is obvious that urban areas suffer the highest pollution from chlorinated hydrocarbons, which is a clear indicator of intensive impact of industrial and urban wastewater.

According to the data from the APO Hazardous Waste Management Agency, the locations in the coastal area contaminated with PCBs are: Kaštel Sućurac, Komolac – Dubrovnik, Bilice – Šibenik, Zadar, Vruljice – Zadar.

The legislation regulates handling of equipment containing PCBs, disposal and transportation of waste containing PCBs, and maximum allowable concentration of PCBs in particular media. Pursuant to the Toxins Act, the List of Prohibited Toxins Manufacture, Trade and Application (Official Gazette 29/05) was adopted. The List

includes PCBs, and it is stipulated the devices or objects that contained PCBs before its coming into force may continue to be used.

However, Croatia has no legal provisions that prohibit:

- production of PCBs and equipment containing PCBs,
- import of PCBs and liquids containing PCBs,
- use of PCBs in closed-cycle systems, and there is no deadline by which the equipment containing PCBs is to be phased out.

There is also no provisions on deadlines for disposal of waste containing PCBs.

The most important sources of emission of polycyclic aromatic hydrocarbon **(PAH)** are fuel combustion processes in households, coke production and primary production of aluminium with Söderberg anodes. The major share (98 percent) is combustion in non-industrial furnaces (small fireboxes in households, small businesses, institutions, agriculture, forestry and aquaculture).

The PAH emission trend in Croatia is on decline. In 2001 and 2002, emission were reduced by approximately 20 percent. It should be noted that the coke production at Bakar stopped in 1994, and the primary aluminium production at Šibenik closed down in 1991.

Polychlorinated dibenzo-p-dioxins PCDD/Polychlorinated dibenzofurans PCDF are generated from different anthropogenic activities: waste incineration, ferrous and non-ferrous production, power and heat generation, manufacture of mineral products (cement, line, brick, glass, ceramic, asphalt), gasoline combustion in cars. The highest emissions are from firing the firewood in households.

Reports on PCDD/PCDF emissions are part of annual reports on pollutant air emission, as regulated by the Clean Air Act (Official Gazette 178/04).

The major sources of pollution from **heavy metals (Hg, Cd, Pb)** are combustion in thermal power plants, non-industrial furnaces, industry, use of solvents, waste treatment and disposal, road traffic, and distribution of fossil fuels.

Heavy metals are an important component of soil and water contamination, because they are easily transported through atmosphere, and due to their persistent nature and tendency to build up.

Deposition rate of heavy metals from urban and industrial wastewater and river into the coastal sea is relatively low. Increased rates have been recorded in the vicinity of urban centres and ports, and they are due to intensive traffic or impact of pollution stemming from industrial and urban wastewater, port wastewater and river deposits.
The increased concentrations were determined in the areas of Pula, Rijeka, Bakar, the Gruž Port in Dubrovnik, and in the Kaštela Bay. However, almost all increased values were lower than the maximum allowable values stipulated by law.

The road traffic has a dominant role in lead emission. Since most cars in Croatia still use leaded gasoline, this is considered to be the primary cause of increased lead values. The emissions trend is on decrease, as a consequence of increased number of vehicles using unleaded gasoline.

Although the concentrations outside the larger urban centres are increased compared to other stations, their maximum values are still significantly below the MAC, so the conclusion is that heavy metals in the Croatian coastal sea do not pose a serious problem.

Croatia does not have a commercial nuclear reactor, hence the **radioactive waste** is generated solely from application of radioactive materials in medicine, industry and scientific research. This waste is disposed on temporary disposal sites which are supervised and guarded, but it is not permanently disposed of.
Additional sources are ionising smoke detectors and radioactive lightning rods which are being phased out, thus increasing quantity of radioactive waste in Croatia.

At the Istarska county territory, potential radioactive process waste is slag from the Plomin Thermal Power Plant. The power plant stockpile contains about a million ton of radioactive slag and ash from the Raša coal fired in the plant which has increased radioactivity level. The plant has recently started firing imported coal with 20 times lower radioactivity, and it plans is to use the slag in building construction.

For monitoring of the radioactive waste impact on the environment, the Rules Requirements, Methods, Points and Time Limits for Systematic Testing of Ionising Radiation and Types and Activity of Radioactive Substances in the Environment (Official Gazette 86/2000) have been adopted. These Rules stipulate the requirements, methods, points and deadlines for systematic testing of ionising radiation, and types and activities of radionuclides in air, soil, sea, rivers, lakes, groundwater, solid and liquid precipitations, potable water and food, fodder, commodities and residential premises.

Of total waste quantity generated annually in Croatia, approximately 30,000 ton is **hazardous waste**. Hazardous waste management is well regulated by law and by-laws, however the facilities for its treatment and solutions for disposal on engineered landfills are inadequate in number.

Actually, no hazardous waste landfill has been built yet, and only about 10 percent of total waste volume is treated regularly and adequately. Some of it is exported for treatment and disposal (condensers with PCBs, Ni-Cd batteries, cyanide waste) in the EU countries, in line with the Basel Convention, and the rest is disposed of without control.
Monitoring of hazardous waste generation and management is regulated by the Rules on Types of Waste (Official Gazette 27/96). No analysed data on waste monitoring are available, so it is difficult to conclude whether the hazardous waste generation is in stagnation or on slow decrease because the production sector activities have declined.

The **hazardous waste**, as described below, includes the following groups of pollutants: past pollution loads, waste containing PCBs, waste oils, used batteries and car batteries, used chemicals and medications).

The “past pollution loads” are brownfield sites overloaded with waste after a long period of inadequate management of process waste. This includes waste from leather and textile industry, waste from oil production and processing, oil-contaminated soil and sludges around the deep wells, tank sludges, process waste – acids, bases, oils, organic solvents, by-products, heavy metal salts, fertiliser production waste, residual paint and varnish waste, packaging and pesticide, waste from photoindustry, tires, vehicles and waste from asbestos production, batteries and lead car batteries.

The process waste (inert and hazardous) has generally been disposed on municipal landfills, within the industrial zones and plant fences, particularly in the so called high-risk points, in depressions, excavation pits and elsewhere.

Particularly risky locations are the disposal sites specified as priorities: the Plomin 1 Thermal Power Plant slag stockpile, Jama Sovjak near Rijeka, soil contamination remaining after the Bakar Coke Works demolition, asbestos pollution in the Kaštela Bay (Mravinačka Kava dumpsite), slag stockpile in the Kaštela Bay, pools with alkaline water and red sludge on the former alumina works in Obrovac.

To a certain extent, waste is treated and disposed of in:

- deep wells, primarily waste from oil industry,
- power generation plants with capacity over 3 MW
- cement mills
- incinerators in business sector
- in-plant waste incinerators.

The most important problems in hazardous waste management are related to the NIMBY effect and lack of adequate financial instruments for construction of facilities for treatment, separate collecting and sorting of hazardous waste, and recording of waste stream from its generation to its ultimate disposal.

There are no legally approved locations in Croatia for disposal of waste containing **PCBs**, so this type of waste is exported for treatment. The waste is temporarily stored within the factory fences where the equipment containing PCBs is stocked, or in transfer stations within companies exporting waste containing PCBs. The waste containing PCBs is probably illegally dumped on municipal landfills.

According to the Regulation on Waste Categories, Types and Classification with Waste Inventory and Hazardous Waste List (Official Gazette 50/05), pollutants include PCB-contaminated oils (category Q12). PCBs are also referred to in relation

with the waste-generating activities. The Hazardous Waste List includes substances containing PCBs and/or PCT (e.g. dielectrics, etc.).

Pursuant to the Waste Act (Official Gazette 178/04), import of hazardous waste classified as PCB-contaminated waste into Croatia is prohibited.

All these types of waste are recommended for thermal treatment with prior conditioning. Devices containing PCBs and liquids with PCBs are incinerated only in the hazardous waste incinerators. Waste oils contaminated with PCBs are disposed in line with the Rules on Types of Waste (Official Gazette 27/96) depending on the PCB and halogen content, as requested by the Directive 74/439/EEC on disposal of waste oils.

Croatia generates minimum 20,000 t/year of **waste oils** of category 1 and 2, oil-contaminated plastic packaging, filters and emulsions. A smaller portion is treated thermally by the mineral oil producers, in the Croatian Power Board (HEP) thermal power plants, cement mills, in some industrial heating plants and boiler plants with thermal capacity over 3 MW. A significant portion of waste mineral oil ends in sewerage, same as most of edible oils which might be used for generation of bio fuels following the practice of a number of European countries.

The main condition for waste oil management is setting up of a separate waste oil collecting system.

In Croatia, waste oil management is regulated by the Rules on Types of Waste (Official Gazette 27/96). The Rules stipulate waste oil management procedures, management data submittal procedure, testing of physico-chemical characteristics, sampling, contents and format of forms and application sheets, contents and format of forms of reports on testing of physico-chemical characteristics of waste and pecuniary clauses for violation of the Rules provisions.

Most of used **batteries and car batteries** are classified as hazardous waste. Separate collecting of waste is carried out within a rather limited scope in larger cities, in battery bins and recycling centres. Used batteries from watches, mobile phones and numerous other electronic equipment are collected in standardised red used battery bins, placed mostly in shopping centres and large stores, and in recycling centres.

The estimate shows that only about 3 percent of assessed total quantity of used batteries (about 1,000 t/year) is collected separately. Batteries collected separately are stored and certain amount is exported. The used car batteries are generally collected at the recycling centres.

There are no information of qualities and possible stocks of **medications and used chemicals**. The Chemicals Act defines waste and unused remains of chemicals, outdated chemicals, and packaging waste.

Management of this type of waste is regulated by the legislation on hazardous waste. Further, pharmaceutical and chemical waste is also regulated by the Chemicals Act (Official Gazette 173/03) and Instructions for Management of Waste Generated from Medical Care.

These Instructions define types of waste generated in medical care and treatments in general and specialised hospitals, clinics, health centres and private practice, and regulate management of waste as regards its sorting at the source, collecting, transportation, storage and treatment.

3.6 Conclusions

This section is a summary of documents that preceded preparation of NAP (NDA, BB and SP).

The documents present current state of the coastal environment in the Republic of Croatia and analyse impacts of different types of pollutants.

Preparation of these documents (NDA, BB and SP) was based on available data from monitoring of the state of the coastal environment and sea, and information collected by the Ministry of Environmental Protection and Physical Planning, Croatian Waters, and the data from published scientific papers and research projects.

These background documents offer a preliminary overview of the environmental protection issues and level of pollution in the coastal area of the Republic of Croatia from the land-based activities.

4. Priorities Identified within National Environmental Protection Plans

4.1 Introduction

The environmental problems in the Republic of Croatia and solutions to such problems have been considered in line with intergovernmental treaties and legal provisions and outlined in the document titled

- **The Environmental Strategy and National Environmental Action Plan**

Aside from this master document, specific environmental thematic issues at national level have been addressed within the framework of

- **Waste Management Strategy of the Republic of Croatia**

- **Water Management Master Plan of Croatia**

Both strategic documents are in the final phase of elaboration, i.e. are about to be adopted. Reference was made to these documents in the elaboration of this study.

In addition to the mentioned strategic plans, the priorities in water protection have been identified in the **National Water Protection Plan** and the program **Coastal Area Water Pollution Protection Project.**

In continuation, a brief comment is given on the contents and the most significant environmental priorities in the Republic of Croatia identified in the mentioned national planning documents.

4.2 Environmental Strategy and National Environmental Action Plan

The effective legislation (the Environmental Protection Act) makes the adoption of the Environmental Strategy of the Republic of Croatia obligatory, while international programs and recommendations command the elaboration of the National Environmental Action Plan.

The Environmental Strategy of the Republic of Croatia was drafted with the World Bank's financial and technical assistance. Being a document that complies with international commitments and guidelines, the Environmental Strategy of the Republic of Croatia (hereinafter referred to as the Strategy) is at the same time the National Environmental Action Plan.

Parts of the Strategy are cited below (Section 1 – Introduction). They define basic directions, objectives, content and priorities as identified in this planning document.

The Environmental Strategy was structured as a process that should enable an integrated setting of objectives and an efficient and effective implementation of the

environmental protection in Croatia. It provides directives and direction for a long-term environmental management consistent with the overall economic, social and cultural development, and also the basis for co-ordinating economic, technical, scientific, educational, organisational and other measures and measures for the implementation of international commitments in the field of environmental protection.

The Strategy attempted to reconcile two basic strategic directions of action. The first one is based on the stimulating-affirmative approach, while the actions of the other one are based on restrictions. Of the two, the stimulating-affirmative approach dominates.

The Environmental Strategy is entirely based on the principles of sustainable development. Furthermore, this document is based on the following basic principles: integration of the environmental protection policy into other sectoral policies; the principle of partnership and shared responsibility; the principle of subsidiary, change of behaviour in production; the use of a larger number of instruments, mainly economic ones.

The Strategy was outlined and structured in a manner to comprise as much as possible the complexity of the environmental protection, taking into consideration all the distinctive characteristics of Croatia. This is an essential condition of the future development since these distinctive characteristics encompass: two completely different climatic areas (continental and Mediterranean climate) and corresponding biological resources, numerous very sensitive areas (the karst region, the coastal zone and the islands), transboundary watercourses and the economy in the process of transition.

The Strategy was structured to firstly take into consideration all the institutional, human resources, technical and financial requirements that are described in detail in each thematic section of the document. Each thematic issue is than followed by a list of priority activities in that area. An open list that will be continuously amended highlights the priority investment activities that are expected on national, regional and local level.

The priorities were determined in accordance with the assessed environmental impact on health, ecosystems and socio-economic activities. In the later phase, some other criteria such as: the requirements stemming from the EU accession process, the level of completeness of projects, fulfilment of international commitments that Croatia has to comply with, limited technical and personnel capacities, and similar, were also taken into account.

A series of actions and large investments are essential so as to improve the quality of the environment. Solid waste and wastewater management are the priorities. Considerable investment will be required in the years to come. This, first of all, relates to the construction of a series of new waste landfills and remediation of the majority of existing ones, urgent construction of sewerage systems in some 70 cities and construction of some twenty wastewater treatment plants. Special attention has

to be given to hazardous waste disposal. Air quality has to be improved through the use of fuels with reduced lead and sulphur concentration or completely lead- and sulphur-free fuels. Additionally, this will be achieved through the environmentally friendly means of transportation for goods and passengers. Institutional strengthening will be of particular importance and will, among other things, include the establishment of an environmental agency and environmental fund and the establishment of a comprehensive monitoring and an integrated information system as well as training of personnel. Nature resources and protected areas management need considerable improvement.

Almost every thematic section/issue of the Strategy addresses the pollution of coastal areas, and the following sections in particular:

- **Coastal and Insular Zone Management**
- **Water Resources Management**
- **Waste Management**
- **Industry and Mining**

The mentioned thematic sections identify problems and priorities and outline objectives and measures for their implementation, set implementation deadlines and potential sources of financing (tabular presentation).

The thematic section titled Coastal and Insular Zone Management, for example, singles out the preservation of an appropriate sea quality as the priority objective (O1). In meeting this objective the most significant measures are: the construction/reconstruction of sewerage outfalls with the first stage treatment (M1) and the implementation of program to relocate industrial polluters presently situated in the coastal zone (M6). A mid-term implementation deadline (2-5 years) was set for both measures (M1 and M6), but a priority deadline (0-2 years) was set for the M1 measure, too. In addition to the said measures, this part of the Plan also underscores the maritime traffic as one of the pollution sources because of possible accidents (particularly in oil transportation), and for inadequate discharge of ballast water, sump drain and solid waste. Further, it is noted that the ports have not provided for adequate collection of oil-contaminated water from vessels, so a priority action in all international ports is construction of systems for sump drain and waste oil collection (M12). The Rijeka Port has resolved this issue by employing the existing industrial capacities. The Split Port project is currently under way, while other ports put resolving of this problem as their priority. This part of the Plan envisages measures for preparation of the operating bases for introduction of integrated planning principle for the coastal area.

The most important measures identified under the thematic section titled Water Resources Management, focused on stopping the trend of deterioration in surface and groundwater quality (O2) are the following:

- (M13) – to construct and complete public sewerage systems
- (M14) – to construct priority wastewater treatment plants (in settlements over 15,000 PE)
- (M15) – to construct other wastewater treatment plants (for population equivalent > 15000)
- (M16) – to construct wastewater treatment plants (in settlements of 2,000 – 15,000 PE)

A priority deadline was set for measures M13 and M14, while a priority deadline (0-2 years) and a long-term deadline (> 5 years) were set for the measure M15. The implementation of measure M16 has been envisaged in a long-term period (by the year 2025).

The thematic section titled Waste Management singles out the M24 measure to meet the C2 objective – Disposal of residual waste only. The M24 measure envisages the remediation and reconstruction of the existing and the construction of new waste landfills. The implementation of this measure is a long-term activity, but it also has some priority deadlines.

The thematic section Industry and Mining identifies the following most significant measures aimed at meeting basic environmental objectives:

- to gradually close down old plants and facilities in the coastal zone and the plants causing considerable environmental pollution, if it is not possible to cost-effectively retrofit such plants and facilities for the environmentally sound operation, and to replace them with new production facilities (deadline: 5 years)
- to construct emission abatement facilities wherever the emission limits are exceeded (deadline: 5 years);
- to construct facilities for *in situ* pretreatment and central wastewater treatment facilities (deadline: 5 years)
- to construct waste storage facilities and waste disposal facilities (deadline: 5 years).

4.3 Waste Management Strategy of the Republic of Croatia (draft)

The Waste Act stipulates the development of the Waste Management Strategy with an aim to provide long-term solutions and direction for waste management. This planning document addresses the following issues:

- Assessment of present waste management status;
- Key waste management objectives and measures;
- Hazardous waste management measures;
- Guidelines for waste recycling, treatment and disposal.

The Environmental Strategy and the National Environmental Action Plan of the Republic of Croatia identify waste management as a priority task, taking into account

the criteria such as: impact on human health, importance for the ecosystem and social and economic importance.

The Environmental Strategy and the National Environmental Action Plan of the Republic of Croatia have partly modified the priorities, depending on the development of the legislative framework and its application in practice in the past period and on the EU accession related activities. The following priorities were pinpointed within the framework of this planning document:

- to harmonise national regulations with those of the EU and ensure their implementation;
- to educate and train personnel in the environmental issues and waste management;
- to avoid waste generation – reduce waste volumes;
- to improve the collection of charges for the environmental load caused by waste – rise waste management funds;
- to improve separate collecting of waste;
- to improve ultimate waste disposal and remediate the existing landfills;
- to improve the quality and scope of data on waste volumes and waste streams;
- to construct waste treatment facilities and devices;
- to increase the share of controlled waste collecting and disposal.

The Waste Management Strategy identifies four key strategic objectives:

1. Reduction in waste volumes
2. Development of infrastructure for an integrated waste management
3. Reduction of waste caused risks
4. Contribution to improving the employment rate in Croatia.

To meet the above objectives, the Waste Management Strategy prescribes general measures (aimed at meeting such objectives) and specific measures (aimed at meeting individual objectives).

General measures encompass the following activities: waste management included in the priorities of the Government of the Republic of Croatia; research and assessment of actual status of waste management; improvement of the IT system and reporting on waste; harmonisation of national legislation in the field of waste management with that of EU; formulation of educational programs regarding waste, change public awareness and institutional strengthening.

Specific measures aimed at meeting the strategic objective O1 – Reduction in waste volumes – are: the implementation and dissemination of cleaner technology projects and practice; establishment of system for separate collecting and recycling of municipal waste; adoption of programs and secondary legislation harmonised with the EU guidelines; reduction in the environmental load caused by waste on islands; support to and improvement of the work/performance of the Croatian Waste Exchange.

The following measures are envisaged to meet the strategic objective O2 – Development of infrastructure for an integrated waste management: elaboration of a detailed construction program for infrastructure facilities and their incorporation in land-use plans; establishment of waste management centres; establishment of regional waste management centres; establishment of a hazardous waste management centre, construction of waste-to-energy plants – incinerating plants for hazardous and municipal waste.

To meet the strategic objective O3 – Reduction of waste caused risks, the following measures are envisaged: remediation of waste landfills and elimination of past loads; incentives for thermal treatment of waste in the existing capacities; development and increased implementation of hazardous waste injection into abandoned oil and gas wells; establishment of slaughterhouse waste management, establishment of hazardous waste management for hazardous waste treated through chemical and physical processes.

The Waste Management Strategy identifies quantitative objectives on the whole, concerning municipal waste volumes and capacities of landfills, per individual segment of the planning period up to the year 2025.

Furthermore, deadlines were set for the implementation of individual measures. For example, the sites for regional (county) waste management centres have to be selected by the year 2007, and have to start operating (with all permits in place) by the year 2010. The same deadlines apply for the establishment of hazardous waste management centres.

A modern waste management system envisages the establishment of controlled and engineered landfills and gradual closing up of other landfills with prior abatement of their environmental impacts.

Past activities of the Environmental Protection and Energy Efficiency Fund were directed mainly towards the remediation of the existing landfills. The envisaged completion date for this phase is by the year 2010. The Fund invests in the remediation of some 150 landfills of which work is already in progress at some 50 sites. In late 2004, the 2005-2010 Landfills Remediation Plan supported by the Fund encompassed a number of waste landfills in 20 counties. About 50 percent of Fund investment resources are earmarked for the remediation of 59 landfills situated on the territory of seven (7) coastal counties. Therefore, a certain priority in addressing the problem of waste management is given to the coastal zone of the Republic of Croatia.

The Waste Act mandates the development of the Waste Management Plan of the Republic of Croatia as an implementation document based on the Waste Management Strategy. This document details the time framework and investment funds needed for the implementation of activities aiming at sustainable waste management.

4.4 Water Management Master Plan of the Republic of Croatia (under development)

Pursuant to the Water Act, the Water Management Master Plan of Croatia is a long-term planning document that defines the basis for water management, water balance and the improvement in the hydro system, and on the basis of which an integrated and harmonised water regime will be ensured across the national territory

Key objectives of integrated water resources management in the Republic of Croatia are the following:

- to ensure sufficient quantities of potable water for public water supply;
- to ensure required water quantities of appropriate quality for different economic uses;
- to protect people and material goods against harmful effects of water;
- to protect and improve water quality and the quality of water-dependant ecosystems.

Water protection objectives are: preserving a good water quality; prevention of deterioration in the quality of waters that are under risk and remediation of deteriorated state of water, primarily for the purpose of protecting public health and environment. The following activities were highlighted to meet the basic objectives in the field of water protection:

- preservation of surface and groundwater as potable water reserves (existing and planned)
- preservation of surface and groundwater, the coastal sea and protected areas – zones of special water protection, to protect public health and ecosystems, within the framework of integrated management of water and land use
- improvement in the environmental functions of waters and the coastal sea where they have been disturbed; reaching prescribed water quality for intended uses where water does not meet such quality standards; participation in the planning and gradual implementation of protection measures and systematic monitoring of the effects of implemented measures in the river basin area and appertaining coastal sea
- reduction in the quantity of hazardous substances at the pollution source by implementing required water protection measures and supervising the operation of constructed wastewater treatment facilities and devices
- contribution to sustainable development by preventing inefficient use of area and water resources.

The Water Management Master Plan of Croatia provides general guidelines for the protection of water resources, aquatic ecosystems and inland ecosystems dependant on water resources. It has to be mentioned that in the period to come this process will significantly depend on Croatia's commitment to adopting the approach to water protection employed by highly developed countries and on the acceptance of obligations from the European legislation in the field of water protection. Among a number of measures that should be implemented in order to realise the water protection policy, the most significant ones are the following:

- the protection of protected areas (primarily potable water, water used in food processing industry, protection of endangered habitats and species, protection of "sensitive areas" and "vulnerable areas"),
- ensuring good condition of all waters.

Water protection firstly relates to the monitoring of the use and flows of hazardous substances that enter into water, namely:

- reduction and control of pollution point sources;
- reduction and control of dispersed pollution sources;
- implementation of measures in the field of land use, including the activities in the field of environmental protection.

The management of pollution sources is carried out in accordance with action priorities: reduction and removal of hazardous substances consistent with toxicity, degradability and bioaccumulation criteria; improvement of extremely unfavourable state of waters and the coastal sea and meeting international commitments.

However, when identifying priorities at national level accent should be put on the construction of new and upgrading of the existing public sewerage systems:

- considering the size of the system in relation to the existing and the planned pollution load (population and industry connected to public sewerage system)
- a system that will become functional as a whole, starting with the connection, collecting, transport and treatment of wastewaters to appropriate discharge of wastewaters, and will fully observe technical and sanitary conditions for carrying out the service
- systems in the areas where a deteriorated state of waters has been identified (surface and groundwater and the coastal sea)
- systems in the areas that have been identified as risky since they have underdeveloped public sewerage systems
- systems in the drainage areas exposed to a combined load from several pollution sources
- systems that balance the development of utility infrastructure and hygienic and sanitary living conditions of population on the national territory.

In addition to the construction of public sewerage systems, significant improvements in hygienic and sanitary living conditions and the environment can be achieved by improving the service. This calls for the expansion of service/distribution areas and introduction of the economic price for wastewater discharge and treatment.

In line with the set water protection targets, the Water Management Master Plan gives a list of activities and measures, classified as follows:

- water resources protection planning within the framework of an integrated water resources management;
- systematic monitoring of water quality;
- legislation and standardisation;
- water quality protection measures.

It has been assessed that the construction, reconstruction or completion of public sewerage systems is a priority task within the scope of planned activities in the field of water protection, since it is of public interest and has a pronounced social "sensitivity". The planned activities aimed at reducing pollution point sources, the completion date of which is scheduled for 2020, envisage the following:

- about 70 percent of public sewerage systems serving the population of 2,000 to 10,000;
- about 77 percent of public sewerage systems serving the population of 10,000 to 15,000;
- 100 percent of public sewerage systems serving the population over 15,000.

Depending on the recipient of discharged wastewater, the second stage of the wastewater treatment is planned, except for coastal areas that are less sensitive and in which the first stage treatment is envisaged followed by wastewater discharge through long offshore outfalls. Thus, a percentage connection of the total number of inhabitants to the public sewerage system on the territory of Croatia will be increased to 60 percent.

The incentives are envisaged for the activities aiming at a 50 percent reduction in the release of hazardous substances from industrial plants into waters by the year 2010, consistent with national and international regulations.

4.5 National Water Protection Plan

Under the Water Act, the protection of water resources and seawater from land-based and island-based pollution sources is carried out pursuant to the National Water Protection Plan adopted in 1999. The National Water Protection Plan defines the following:

- required research work and water quality testing;
- water classification;
- water protection measures;

- measures in case of unexpected and accidental water pollution;
- construction plan for wastewater treatment facilities and devices;
- sources and methods of Plan financing;
- list of physical persons and entities in charge of Plan implementation, their competencies and responsibilities.

Water protection measures have the following objectives:

1. To preserve surface and groundwaters that are still clean. In water classification system, such waters have been classified under water category 1.

2. To stop the trend of deterioration in water quality. This is achieved by the development of mid-term and long-term measures.

3. To remediate and remove pollution sources, primarily at the existing and planned potable water well fields and in other places where the water is used for purposes that require water category 2 or 3 (industry, agriculture, fishery, recreation, etc.)

4. Systematic monitoring of water pollution sources and potential accidental pollution and implementation of preventive measures to abate accidental pollution is the priority mid-term task.

A series of measures are employed to meet the above objectives. Such measures are classified in the following groups: administrative measures, measures for preservation of water quality, measures for prevention and mitigation of water pollution, and implementation measures. The time schedule for the implementation of measures has been defined for a short-term (by the year 2005), mid-term (by the year 2010) and long-term (by the year 2025) period.

The construction of wastewater treatment facilities and plants has been planned as follows:

a) Facilities – public sewerage systems

The recommended deadlines for the construction of public sewerage systems that discharge wastewater into a natural recipient ("less sensitive areas") are as follows:

- by the year 2005 for the facilities over 15,000 PE;
- by the year 2010 for the facilities between 2,000 and 15,000 PE and
- by the year 2005 for the facilities that discharge wastewaters into "sensitive areas", larger than 10,000 PE.

b) Wastewater treatment plants

The recommended deadlines for the construction of the "second stage" wastewater treatment facilities from which wastewater is being discharged into the watercourses ("less sensitive areas") are the following:

- by the year 2010 for the facilities larger than 15.000 PE;
- by the year 2015 for the facilities between 2,000 and 15,000 PE and
- by the year 2005 for the facilities discharging wastewaters into "sensitive areas", larger than 10,000 PE.

The recommended deadlines for the construction of "first stage" wastewater treatment plants that discharge wastewaters into the sea through corresponding offshore outfalls are the following:

- by the year 2010 for the facilities larger than 15,000 PE;
- by the year 2025 for the facilities between 2,000 and 15,000 PE and
- by the year 2005 for the facilities discharging wastewater with "second stage" treatment, larger than 2,000 PE.

The National Water Protection Plan contains a list of wastewater treatment facilities serving over 50,000 PE the construction of which is considered a priority. The deadline for the construction of such facilities has been optimistically scheduled for the year 2005.

4.6 Coastal Area Water Pollution Protection Project

This Project includes the construction, upgrading, reconstruction and improvement of wastewater discharge and treatment in the coastal zone of the Republic of Croatia.

The Croatian Waters developed the Implementation Program of the Project, with financial assistance and guidelines rendered by the World Bank.

Basic objectives of the Coastal Area Water Pollution Protection Project are the following:

- preservation and protection of the environment against pollution caused by urban wastewaters, and especially preservation and protection of seawater quality in the coastal zone prior to its deterioration;
- provision of basis for a safe and environmentally acceptable economic development (tourism, investment construction), and
- improvement in business performance of utility companies, i.e. development of services connected with the collecting, drainage, treatment and discharge of urban wastewaters.

In order to meet the set objectives, this Program will provide technical and financial support to the activities aimed at the improving the water protection and pollution control sector, such as:

- construction of facilities – wastewater collecting and treatment systems;
- improvement of institutional and regulative structure;
- development of program implementation monitoring system;
- enhancing the participation of general public in the planning and implementation of water protection measures;
- mobilisation of common technical, professional and financial resources at local and national level.

Project priorities have been defined with due consideration of the following criteria:

A. Population equivalent (the criterion reflecting the pollution rate);
B. Recipient sensitivity to wastewater discharge (the criterion reflecting the sensitivity of the area);
C. Impact on the development of tourism (the criterion reflecting the impact of system construction on the existing tourist capacities);
D. The degree of system completion (the criterion that gives advantage to those projects that enable the completion of the system in order to become fully functional);
E. The completeness of design documentation (the criterion that gives advantage to projects with more elaborated design engineering documents);
F. The level of development of the area (the criterion that gives advantage to less developed areas);
G. The size of investment with relation to population;
H. The size of investment into the 1st stage of construction related to population.

Thus, the rank of each project (sewerage system and treatment plant) on the list of priorities was defined. In addition to the mentioned criteria (A through H), financial capacities of end users (credit rating) will be taken into account in the final selection of projects.

4.7 Conclusions

The above considerations give an insight into the programs included in the national environmental plans. Furthermore, the corresponding environmental priorities have been highlighted, as well as their implementation schedule in general, i.e. solution to the related problems.

All the described national environmental plans and programs accentuate the coastal zone that has been enlisted among the most valuable economic and natural resources of the Republic of Croatia. Therefore, this particular area has been given priority in resolving the overall environmental situation.

Consequently, national environmental plans show national interest in the protection of the sea and the coastal zone. Main environmental concerns are wastewater discharge and treatment and solid waste disposal.

However, the envisaged activities require significant financial resources and are time consuming, which represents the main problem in meeting the set time schedule and environmental objectives in the coastal zone of the Republic of Croatia.

5 SAP National-Level Priorities

5.1 Identification of National Priorities

The explanations given in previous sections provide an insight into the state of the environment in the coastal zone as analysed within NDA, BB and SP documents.

The analyses of the national environmental protection plans give an insight into the environmental priorities on the national level which are almost identical with the environmental priorities determined for the coastal area as generally outlined within the NDA.

However, it should be noted that NAP is a Plan for pollution emission reduction reflecting the SAP objectives.

Therefore, the objectives have to be considered for the planning period up to the year 2010, which has been set as the deadline for the implementation of envisaged NAP priority actions in the environmental protection in the Croatian coastal zone.

Remark: The SAP objectives are given in detail in the used Guidelines (see references 1-3).

The most important SAP objectives with the deadline set for 2010 are:

- solution to sewerage systems and wastewater treatment in agglomerations exceeding 100,000 inhabitants; treated waters should be discharged in conformity with national legislation;

- solution to solid waste management and disposal in agglomerations exceeding 100,000 inhabitants;

- solution to reducing the emissions into the atmosphere in agglomerations exceeding 100,000 inhabitants, in conformity with the Kyoto Protocol and other international regulations;

- reducing the emissions caused by industrial polluters by 50 percent (industries using obsolete technology and those not complying with national environmental regulations);

- reducing pollutant input into the environment (heavy metals, chlorinated hydrocarbons, POPs, radioactive substances, nutrient salts and suspended solids, oil and oil products, waste oils, batteries and car batteries).

Having regard to the objectives set within the SAP, the state of the coastal environment as identified within NDA, BB, and SP, and priority actions outlined in the national environmental plans, the following NAP priorities are singled out:

1. **The City of Split wastewater collection and treatment**
2. **The City of Rijeka wastewater collection and treatment**
3. **solid waste management and disposal in the greater City of Split (Splitsko-Dalmatinska County)**
4. **solid waste management and disposal in the greater City of Rijeka (Primorsko-Goranska County)**
5. **wastewater treatment at MIRNA – fish processing industry, Rovinj**
6. **wastewater treatment at ADRIA – fish processing industry, Zadar**
7. **wastewater treatment at JADRANSKA PIVOVARA brewery, Split**
8. **reduction of pollutant intake from industrial wastewater**
9. **hazardous waste management and disposal**

The basic SAP objectives will be met by finding solution to the mentioned key environmental issues in the coastal zone of the Republic of Croatia.

This study deals with other priorities as well. These were singled out as significant ones in view of the protection of the coastal zone of the Republic of Croatia and were identified within NDA, BB, SP and the national environmental plans and the considerations thereon. The priorities are:

10. **The City of Pula wastewater collection and treatment**
11. **The City of Zadar wastewater collection and treatment**
12. **The City of Šibenik wastewater collection and treatment**
13. **The City of Dubrovnik wastewater collection and treatment**

Aside from basic documents and national plans, the SAP criteria/objectives, data from the LBA Program and EU guidelines and criteria (EU Directive on urban wastewater treatment – 91/271/EEC) have also been taken into consideration.

The cities of Pula, Zadar, Šibenik and Dubrovnik are, along with Split and Rijeka, the most important centres in the coastal zone with a population of about 50,000 inhabitants (Šibenik and Dubrovnik) or exceeding this number (Pula, Zadar). It has been assessed that the area gravitating to these settlements accounts for 65 percent of total number of inhabitants populating the coastal zone. Also, the majority of industrial plants are situated in the mentioned urban centres.

The implementation of priority actions 10 through 13 calls for significant investment funds, and the construction timeframe is also questionable. Only very optimistic assessments could schedule the deadline for completion of construction of such facilities for 2010.

The data from the LBA Report were used to identify major industrial polluters with self-standing outfalls into the sea, taking into consideration the type of industry and

estimated wastewater organic pollution load. More precisely, the priority was given to industrial plants with calculated organic load, expressed in PE, exceeding 2,000 PE. As a result, only three industries were singled out: MIRNA – fish processing industry, Rovinj, ADRIA – fish processing industry, Zadar and the JADRANSKA PIVOVARA brewery, Split.

Additionally, in line with the SAP objectives and legal provisions, gradual reduction in pollutant input is envisaged for all other industries, accompanied by improvement in monitoring programs and enforcement of available administrative measures.

Further, the measures are planned aimed at improvement of the hazardous waste management and disposal in conformance with the legal provisions. The following groups of pollutants are considered as hazardous waste: POPs, heavy metals, radioactive matter, past pollution loads, PCB-containing waste, waste oils, used batteries and car batteries, used chemicals and medicinals.

The conclusion can be drawn that the solution to the identified priority problems can significantly reduce the input of pollutants into the sea and contribute to the protection of the environment in the coastal zone of the Republic of Croatia. The implementation of these activities shall result in fulfilment of the basic SAP objectives.

Still, pursuant to legal provisions, national environmental plans and international commitments, other problems related to the reduction of pollutant input into the environment in the coastal zone of the Republic of Croatia should also be gradually resolved.

A brief description of the current status and plans for the resolution of other environmental issues in the coastal zone of the Republic of Croatia that are neither directly related to the SAP objectives by 2010 nor included in NAP priorities is given below.

The national environmental plans, and especially the Project for Protection of Coastal Water against Pollution, envisage the construction, upgrade, reconstruction and improvement of sewerage systems and wastewater treatment systems with an aim to preserve and protect the coastal environment. The program implementation is planned in three 15-year phases encompassing all the settlements in the coastal area. Preliminary works are underway to implement individual sub-projects that are constituent parts of this comprehensive program.

A certain priority in resolving waste disposal problems on the territory of the Republic of Croatia was given to the coastal zone. The improvement of the environmental conditions can therefore be expected in the forthcoming period compared to the present situation.
The problem of disposal of sludge from the wastewater treatment plants must be stressed here. Waste sludge volumes will be significantly increased after the construction of the wastewater treatment plants. Therefore, the relevant technical

documentation should consider the solution to further treatment and disposal of such sludge. Proposed solutions should be in compliance with the waste management concept and envisaged solutions to solid waste treatment and disposal.

Due to general economic recession and reforms, and consequences of the war, the air emissions on the territory of Croatia were significantly reduced in the 1990-ties. The shutting down of large industries (e.g. in the coastal zone: Koksara Bakar Coke Works and TEF in Šibenik), the introduction of primary and secondary measures to reduce the emissions caused by major polluters, higher quality oil fuels and the increase in the number of vehicles using catalytic converters and unleaded gasoline, have resulted in significantly reduced input of pollutants into the atmosphere. The Environmental Strategy and the National Environmental Action Plan set basic objectives that include further reduction in emissions caused by traffic, industrial plants, thermal power plants and CHP plants and residential fireboxes. Appropriate measures were adopted for the implementation of these objectives, all in line with national legislation and international commitments.

Increased concentrations of chlorinated hydrocarbons are connected with the impact of important urban and industrial wastewater outfalls. The identified concentrations of chlorinated hydrocarbons are below MAC and do not represent a major environmental problem in the coastal zone of the Republic of Croatia.

Nutrient salts and suspended solids are discharged into the sea with wastewaters and natural watercourses and groundwater. The environmental condition will be improved by finding solution to the problem of wastewaters.

The NDA identifies the risk from accidental pollution of the sea by oil and oil products, taking into consideration the present status and planned development and safety of tanker transportation. There is a threat and a risk from importing foreign species in ballast waters. Measures should be taken that increase the safety and reduce the risks from accidental pollution caused by transportation of oil and oil products in the coastal zone of the Republic of Croatia, consistent with national legislation and international regulations.

5.2 National Priorities – Problems and Solutions

This section of the study gives a summary of the existing status, and the envisaged technical solution for the remediation of identified priority problems at national level in the coastal zone of the Republic of Croatia.

Priority 1 – The City of Split wastewater collection and treatment

The constructed sewerage system of the cities of Split and Solin is divided into two drainage areas:

- "the southern area" – covering central and southern parts of the City of Split gravitating towards the sea basin of the Brač Channel
- "the northern area" – covering northern part of the City of Split gravitating towards the sea basin of the Kaštela Bay and the City of Solin.

Technical design of the sewerage system located in the "southern" drainage area consists of the conveyance of wastewater to the Kalinića Brig wastewater treatment plant performing mechanical treatment (coarse and fine bar screens). Therefrom, sewage effluent is discharged in the seawaters of the Split Channel through pump station and the corresponding offshore outfall. Wastewaters are fed into the Kalinića Brig treatment plant from three directions (Riva, Bačvice and Kolektor uz prugu). Main sewers are of combined type and have safety spillways that activate during intensive precipitations. Wastewaters are conveyed through transfer stations. The Lora and Poljud drainage areas have a combined sewerage system with five nearshore outfalls that release wastewaters directly into the seawaters of the Kaštela Bay. The connection of this part of the drainage area to the "southern" sub-system is in progress.
The sewerage system of the "northern" drainage area of the City of Split consists of the constructed sewers that release wastewaters into the Kaštela Bay using the shortest way. Main sewers are: Duje, Dujmovača and Lateralni kanal. There are 15 additional smaller wastewater outfalls that discharge wastewaters into the sea. A part of wastewater from the drainage area of the City of Solin is fed into the Dujmovača sewer, while the sewerage system of the central part of this area consists of 2 outfalls that release sewage effluent into the Jadro River. Gravitating industrial zones are connected to the subsystem of the "southern" drainage area. Therefore, a part of industrial wastewaters is being discharged along with urban waters into the Kaštela Bay and the Jadro River.
The cities of Kaštela and Trogir have an uncompleted sewerage system routed directly towards the sea via the shortest path. Therefore, all collected wastewaters are discharged directly into the sea basin of the Kaštela Bay and the Trogir Channel (63 nearshore outfalls in the Kaštela area and 24 nearshore outfalls in the Trogir area).

The Eco-Kaštela Bay Project envisages an integrated solution to the problem of wastewaters from the cities of Split and Solin, including the gravitating area of the Podstrana settlement and the entire coastal area of the Kaštela Bay up to the City of

Trogir and the Island of Čiovo. The technical solution to the sewerage system in the area of Split and Solin and parts of the Podstrana settlement ("southern" and "northern" drainage area) envisages two subsystems connected to the appertaining wastewater treatment plants. The completion of the "southern" subsystem is envisaged through the construction of required sewers and buildings and upgrade of the Kalinića Brig treatment plant (higher stage of purification or transport to the TTTS plant). Technical solution to the sewerage system of the "northern" drainage area envisages the construction of a sewerage system and a transport system (transfer stations, hydrotechnical tunnel) to feed wastewaters into the TTTS wastewater treatment plant situated to the north of the Stobreč settlement. Wastewaters will thereafter be discharged through an offshore outfall into the sea basin of the Brač Channel. Furthermore, the conceptual design envisages the construction of an integrated sewerage system in the area gravitating to the Kaštela Bay and the Trogir Channel (from the Kaštel Sućurac settlement to the City of Trogir, including gravitating suburbs – Seget Donji and Medena and the Island of Čiovo). The designed transport system (gravity and pressure sewers, transfer stations) will feed the wastewaters into the Divulje wastewater treatment plant. Therefrom wastewaters will be conveyed across the Trogir Channel to the Island of Čiovo and through a hydrotechnical tunnel to the southern part of the island where a corresponding offshore outfall will be constructed. The implementation of individual parts of the Eco Kaštela Bay Project is in progress, and the implementation of an integrated solution to wastewater discharge and treatment for the cities of Split and Solin is scheduled for the forthcoming period. Subsequent phases envisage the same solution to be implemented in the area of the City of Trogir and gravitating parts of the Kaštela Bay.

Priority 2 – The City of Rijeka wastewater collection and treatment

Wastewater discharge in the greater area of the City of Rijeka, which encompasses the area of the Kvarner Bay from Preluk to Kostrena settlements, has been resolved by a sewerage system to which the majority of population is connected as well as gravitating commercial entities. Wastewaters are conveyed to the Delta treatment plant from the nucleus of the city located on the right riverbank of the Rječina and from the area of Sušak district (from Brajdica to Martinščica). The sewerage network serving western parts of the City of Rijeka (the Kantrida district, i.e. the route Preluk – Kostabela – Kantrida) comprises several nearshore outfalls into the sea (Remark: Some activities were recently taken to resolve this problem, some works were carried out to connect this drainage area to the central sections of the sewerage system serving the City of Rijeka, i.e. Delta treatment plant). There are parts of the urban area without a public sewerage system. The Delta treatment plant consists of coarse and fine bar screens, aerated sand/grease traps, a compressor and a transfer station and administrative and operating building. Wastewaters being fed into the Delta treatment plant are ultimately discharged through dosage basin and the corresponding offshore outfall.

The conceptual design envisages the connection of the western parts of the City (Preluk – Kostabela – Kantrida) to the Delta treatment plant and additional

construction of transfer stations, and pressure and gravity sewers in order to remove the existing direct outfalls into the sea (partly implemented). The connection of gravitating suburbs situated to the north of the sewerage system is also envisaged, provided that the corresponding sewerage network is constructed. Short- and mid-term plans envisage the construction/reconstruction of sewerage structures (sewers and transfer stations). Also, the reconstruction and upgrade of the Delta treatment facility is foreseen (construction of the second stage treatment).

Priority 3 – Solid waste management and disposal in the greater City of Split (Splitsko-Dalmatinska County)

According to the data contained in the NDA, there are a total of 31 solid waste landfills (occupying the surface area of 392,600 m^2) on the territory of the Splitsko – Dalmatinska County. The total volume of disposed solid waste is estimated at 3.1 million m^3. A poorly equipped Karepovac landfill located in the immediate vicinity of the urban area of Split on a karst terrain stores 2 million m^3 of municipal waste together with significant volumes of hazardous liquid waste.

In order to resolve this environmental problem, the Splitsko-Dalmatinska County has adopted an Environmental Program comprising the Waste Management Program (Official Gazette of the Splitsko-Dalmatinska County No. 7/00). This Program envisages the construction of a single waste management centre for the territory of the entire county and the remediation and closing up of the existing landfills. The Centre will employ the most advanced technologies to separate and treat residual wastes and to dispose off the inert component of the waste. Based on the study Analysis of Potential Sites for the Construction of Waste Management Centre and Pertaining Landfill on the Territory of the Splitsko-Dalmatinska County (EKO-INA, 2001), the location was selected in the settlement of Lećevica, which meets all natural, spatial, economic and other criteria that could be determined without additional research work. The municipality of Lećevica has agreed to site investigations required for the elaboration of the Environmental Impact Study (IPZ – Uniprojekt, MCF, 2005). The envisaged technology of mechanical and biological treatment (aerobic process of microbiological degradation – composting) of municipal waste with the disposal site for separated and pre-treated fractions, is the first step envisaged for implementation on the Centre site. Thermal use of pre-treated combustible fraction (bales) is envisaged as the second stage in the construction of the Centre, and it will be realised when conditions for such construction be fulfilled. The described solution is in compliance with the Croatian Waste Management Strategy.
The following environmental measures are envisaged to be taken at the Centre site:

- protection of soil by constructing an impermeable bottom layer in the section where the composting process is being carried out and on a part of the residual material disposal site;
- protection of water by preventing the leachate from the landfill site;

- protection of the atmosphere against odours and against the dispersion of light waste material by applying an appropriate composting process and maintaining and cleaning the surface area on the site.

State of the environment shall be monitored during the process of waste treatment and 20 years following the closing up of the landfill. Pursuant to the Rules on the Waste Management Requirements (Official Gazette 123/97), such monitoring consists of the following:

- data on the volume and intensity of precipitation, temperature, wind direction and speed, evaporation and humidity will be collected by a weather station sited on the location of the Centre;
- control of the dynamic of occurrence and analysis of physical and chemical properties of groundwater and leachate;
- air quality control.

In addition to construction of the Waste Management Centre for the Splitsko-Dalmatinska County (Lećevica), the actions within this national priority include remediation of the Karepovac landfill.

Priority 4 – Solid Waste Management and Disposal in the Greater City of Rijeka (Primorsko-Goranska County)

In the area of Primorsko-Goranska County the activity of municipal and industrial non-hazardous waste collecting and disposal is carried out by 9 municipal utilities. There are 10 registered waste landfills in the county. In 2003, 170 larger illegal landfills operating without permit were identified, of which some located in the water protection zones. The Primorsko-Goranska County generates some 200 ton of municipal and industrial waste per day. Basic characteristics of waste management in the existing landfills are:

- the capacity of the majority of existing landfills is mainly used;
- there are no records on the composition of disposed waste;
- waste disposed on daily basis is not covered;
- landfills have no protection systems in place;
- there is no control of landfill gases;
- there is no leachate treatment.

Under the provisions of the new national legislation and the EU Directive concerning waste management, the existing landfills cannot obtain a permit and would have to be remediated and closed down in due time. Therefore, it is essential to organise a new manner of waste management in compliance with the sustainable development principles stipulated for the environmental protection. The planned waste management system in this county complies with the National Environmental Strategy, the National Environmental Action Plan, draft Waste Management Strategy of the Republic of Croatia and EU directives concerning waste management.
On the basis of developed technical documentation, the County assembly of the Primorsko-Goranska County has reached a decision in 1999 which

- accepts the principle of integrated waste management;

- identifies the location Marišćina in the Viškovo settlement as the central waste management zone (CWMZ) site;
- adopts the Decision on indemnification to be paid to real estate owners and local self-government units for the CWMZ environmental impact;
- establishes the waste management company.

The central waste management zone will use the most advanced technology to separate and process residual waste, separate useful components of waste and dispose of its inert components. The new system gives priority to separate collecting of municipal waste by which the majority of useful components will be separated: paper, glass, plastics and tins. Further separation of waste is envisaged through a system of recycling centres serving as transfer stations for non-standard and other household-generated waste. Separated useful components of waste will be sold on the secondary raw material market, and the remaining useless components (accounting for 20 percent of collected and processed waste) will be stored in the Marišćina CWMZ landfill. Industrial non-hazardous waste will be processed by the producers themselves in a regulated way and disposed in accordance with the defined conditions on the Marišćina CWMZ landfill.
The waste treatment capacity of the Marišćina CWMZ has been determined considering the number of inhabitants in the Primorsko-Goranska County and the envisaged waste generation in the order of 250/kg/PE/year. This means that some 76,000 t of waste will be treated and disposed per year. Total surface area of this zone is about 42.5 hectares.
The construction of the Marišćina CWMZ has been planned in several phases, of which the first one encompasses the construction of

- operating zone with a sorting plant, composting plant and auxiliary facilities;
- ring road around the zone, about 800 m long;
- landfill gas treatment system, wastewater treatment plant and building material processing plant, and the first phase of the disposal site.

Subsequent phases will be implemented in accordance with the priorities identified later on, and will comprise:

- recycling centre;
- treatment of bulk waste and scrap cars;
- treatment of electronic waste and household appliances;
- detailed sorting of plastics and paper;
- additional composting;
- second and third stage of ultimate disposal site.

The envisaged start of construction of the Marišćina CWMZ is late in 2006, and the planned start of operation is mid-2007.

In addition to construction of the Marišćina CWMZ, remediation of Sovjak-Crna Jama and Viševac-Marinići landfills is planned.

Priority 5 – Wastewater treatment at MIRNA prerada ribe (fish processing industry), Rovinj

No satisfactory solution to the collection and discharge of the wastewaters generated by the Mirna – Rovinj factory (fish processing industry) has been found. Wastewaters are discharged untreated directly into the sea through a nearshore outfall. Wastewaters are extremely loaded by organic compounds with high grease concentrations. Oily stains are permanently present on the sea surface in the vicinity of the outfall. The sea at site has unnatural colour and contains visible remains of non-dissolved organic matter and is bacteriologically polluted.

Mirna – fish processing industry, situated in the City of Rovinj, is one of major polluters in the northern coastal zone of the Republic of Croatia. The problem of wastewaters in the area of this industrial complex could be resolved by the construction of the wastewater treatment plant with the second stage treatment and wastewater discharge through a separate offshore outfall. The connection to the municipal sewerage system can be considered as an alternative. The planned concept of ultimate discharge should fully comply with effective legislation.

Priority 6 – Wastewater treatment at ADRIA prerada ribe (fish processing industry), Zadar

Main activity of the Adria-Zadar company is fishing, fish processing and trade in fish. Industrial wastewaters are generated in the process of washing, fish processing and cleaning of the factory and plants. Such wastewaters are conveyed together with sanitary wastewaters to the settling tank and the oil/grease trap. Spillway waters are discharged into the sea through nearshore outfall. According to the data contained in the LBS Report, wastewaters have high concentration of organic pollutants.

This industrial plant is one of major industrial polluters in the central coastal zone of the Republic of Croatia. Ultimate discharge of wastewaters generated by this industrial complex is envisaged through the construction of a pre-treatment plant for industrial wastewaters (second stage treatment) and connection to the public sewerage system of the City of Zadar. The planned design of ultimate discharge should fully comply with effective legal provisions

Priority 7 – Wastewater treatment at JADRANSKA PIVOVARA Brewery, Split

The main line of business of the Jadranska Pivovara – Split is the production of beer as the main product, and the production of yeast, brewery pomace and carbon dioxide as secondary products.
Sanitary and process waters are treated in the pre-treatment plant consisting of the drain tank, a hydraulic sieve, the settling tank, a separator and the neutralisation basin. According to the data from the LBS Report, wastewaters discharged into the sea have very high concentrations of organic pollutants.

Jadranska Pivovara is one of major industrial polluters in the southern coastal zone of the Republic of Croatia. The concept of ultimate discharge of wastewaters generated by this industrial plant envisages the connection to the municipal sewerage system (sewerage subsystem Split-north/Solin). Besides, the

reconstruction/upgrading of the wastewater treatment plant is envisaged (second stage treatment) in order to meet legal provisions concerning the conditions for process water discharge into public sewerage systems.

Priority 8 – Reduction of pollutant intake from industrial wastewater

The industrial wastewater from industry is discharged into the existing sewerage system or directly into the sea through self-standing outfalls. The allowable pollutant concentration in industrial wastewater to be discharged into the public sewerage system or natural recipient is stipulated by the Rules on Limit Values of Indicators, Hazardous and Other Substances in Wastewater (Official Gazette 40/99, 6/01). The water permits stipulate allowed wastewater quantities and testing indicators, while deadlines by which the wastewater discharge must comply with the Rules are determined by the permit orders. Industrial facilities pay the water quality protection charges according to the type and quantity of pollutants from wastewater, in order to stimulate reduction in pollutant input. However, the practice shows that the provisions of the Rules and requirements from the water permits have not been respected, and that the deadlines from the permit orders have been postponed.

Present situation with the pollution from industrial wastewater indicates that the activities need to be undertaken for improvement of implementation of requirements and measures provided under the law (Rules, water permits and permit orders). The problems might be resolved by improved monitoring of industrial wastewater outfalls, and changes used as economic instruments. In this way, fulfilment of the SAP objectives to reduce industrial pollution (BOD) by 50 percent is planned. Reduction of pollutants in industrial wastewater mostly depends on technology used in an industrial process. Reduction of the pollutant input from the industrial wastewater can be achieved by employment of the best available technology (BAT), pollutant removal at the source, and construction of wastewater treatment plants. In case the industrial facilities cannot be cost-effectively retrofitted for the environmentally sound operation as envisaged by the national environmental protection plans, they will be gradually phased out and relocated. These activities, according to the SAP Guidelines, are not targeting the industrial facilities operating with the state-of-the-art technology and meeting the provisions of the national legislation.

Priority 9 – Hazardous waste management and disposal

Description of the current state of the management and disposal of the hazardous waste (POPs, heavy metals, radioactive matter, old loads, PBC-containing waste, waste oils, used batteries and car batteries, used chemicals and medicinals) and related issues is given under section 3.4.2.

Since the POPs pose a risk to the environment, the Stockholm Convention of the UN (2004) introduced an obligation of systematic monitoring and control of production, use and discharge of POPs into the environment, requested immediate termination of

their production, and gradual phasing out and reduced discharges. The Convention deals with products (PCBs, pesticides, insecticides, rodenticides, fungicides), by-products of human activities (PCDD/PCDF, HCB), products used for disease control (e.g. DDT against malaria). Production and application of DDT is permitted only in case it is used for disease transmitters control according to the guidelines of the World Health Organisation as an intermediary in dicophol production. Croatia has undersigned but has not ratified the Stockholm Convention. The problems related to the input of persistent organic pollutants (POPs) have been considered in the National Implementation Plan elaborated for the implementation of the Stockholm Convention in Croatia. Action plans and strategies were developed within NIP, comprising required actions and measures (amendments/adoption of legislation, identification of institutional competencies, phasing out of PCB-containing equipment, introduction of monitoring system for POPs compounds in the environment, identification of sites contaminated by POPs compounds, environmental awareness raising and educating general public on waste, financial costs, time schedule). By preparation of the NIP the conditions were met for fulfilment of the Convention requirements which shall be realised once the legislation on PCBs has been modified and amended.

Objectives and measures for reduction of the **heavy metal** emission are contained in the National Environmental Action Plan. The objectives are linked to creation of general conditions for clean and sustainable production (BAT, BEP), better control of pollutant emissions, and development of alternative procedures and products based on renewable resources. To achieve these objectives, it is necessary to: harmonise legislation and standards with EU directives, introduce economic measures, construct facilities for emission mitigation, construction landfills, create conditions for increased use of gas, introduce unleaded fuels and traffic regulation resulting in decrease in fuel use, waste-to-energy projects, quality system promotion, etc.

To resolve the problems related to management of **radioactive substances**, the Rules Requirements, Methods, Points and Time Limits for Systematic Testing of Ionising Radiation and Types and Activity of Radioactive Substances in the Environment (Official Gazette 86/2000) were adopted. These Rules stipulate the requirements, methods, points and deadlines for systematic testing of ionising radiation, and types and activities of radionuclides in air, soil, sea, rivers, lakes, groundwater, solid and liquid precipitations, potable water and food, fodder, commodities and residential premises.

The priority in resolving the problems related to the **hazardous waste** is taking measures for reduction of waste volume to be disposed, and triggering of technical/technological and professional capacities in the economic sector for accepting, treatment and reuse of certain types of waste.

The next step is resolving of the hazardous waste disposal along with finding solutions for disposal of other types of waste by:

- setting up regional (county) hazardous waste storage centres,

- setting up sites for collecting of special and hazardous waste,
- remediation and closing down of illegal landfills,
- organising pretreatment and storage of hazardous waste until its transportation to the treatment centres and ultimate disposal.

A separate program encompassed addressing of problems with priority locations with **prior pollution loads** (the Plomin 1 Thermal Power Plant slag stockpile, Jama Sovjak near Rijeka, soil contamination after the Bakar Coke Works demolition, asbestos pollution in the Kaštela Bay, Mravinačka Kava dumpsite, slag stockpile in the Kaštela Bay, pools with alkaline water and red sludge on the former alumina mill in Obrovac). The Program and its implementation is underway.

Thermal treatment with preconditioning is recommended for the **waste containing PCBs**. The devices containing PCBs and liquids with PCBs are incinerated only in the hazardous waste incinerators. Waste oils contaminated with PCBs are disposed in line with the Rules on Types of Waste (Official Gazette 27/96) depending on the PCB and halogen content, as requested by the Directive 74/439/EEC on disposal of waste oils. In 1994, the Republic of Croatia ratified the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Official Gazette 4/94). Under this Convention, the waste and objects containing or contaminated with polychlorinated biphenyls (PCBs), or polychlorinated terphenyls (PCTs), or polybromated biphenyls (PBBs) are classified as hazardous waste. According to the Convention, it should be ensured that transboundary movement of hazardous waste and other types of waste be reduced to minimum and carried out so as to avoid detrimental impact on public health and the environment.
The draft Waste Management Strategy for the Republic of Croatia plans construction of 10-15 regional centres for waste treatment with the hazardous waste storage facilities.
In order to meet the requirements of the Stockholm Convention on the ultimate treatment of waste containing PCBs, it is proposed to:

- build a temporary storage for waste containing PCBs within a single or a number of regional centres planned for construction in the Waste Management Strategy. The storage may be either state- or privately-owned by companies licensed for hazardous waste management or by other interested companies;
- Export of PCB waste for ultimate treatment abroad will continue, respecting international regulations, standards and guidelines on crossing international borders.

As regards disposal of **waste oils**, the Rules on Waste Oils, harmonised with the EU legislation, are in promulgation procedure. The basic principle of the EU legislation on waste oils (74/439/EEC) is that oil recycling is a priority, and when not possible it should be used as fuel or safely destroyed and ultimately disposed. In line with the European standards, collecting and treatment of waste oil (and other hazardous waste) should be entrusted to entities assuming an obligation to submit necessary

data to the authorities pursuant to the instruction from the Rules on Types of Waste (Official Gazette 27/96).
The Waste Management Strategy envisages setting up of a system for separate collecting of waste oils and outlines various options for its disposal (thermal treatment, biofuel production, etc.).

The Waste Management Strategy envisages the following measures for setting up an environmentally sound system for the disposal of **used batteries and car batteries**: ban on the sales of batteries predominantly composed of heavy metals (Hg, Cd), establishment and implementation of a system for integrated management of waste batteries and car batteries (incentives for and enabling of disposal at designated sites, achieving quotas with relation to production, labelling batteries and storage batteries in accordance with the heavy metal content, encouraging the use of rechargeable batteries).

Priority 10 – The City of Pula wastewater collection and treatment

Wastewaters in the region of the City of Pula are drained through the constructed sewerage system. However, a major part of wastewaters from the central part of the drainage area is discharged directly into the sea without pretreatment through several nearshore outfalls. Wastewaters from the southern parts of the City (accounting for about 15 percent of total population) are conveyed to the Valkane mechanical treatment facility (bar screens, sand trap), wherefrom they are discharged into the offshore zone through a dosage basin and the corresponding offshore outfall.
To the north of the city centre, a separate sewerage system has been constructed that serves the following settlements: Vodnjan, Fažana, Peroj and Barbariga. After pretreatment at the Peroj mechanical facility, wastewaters enter the sea through an offshore outfall.
In addition to the mentioned sewerage systems, a sewerage system has been constructed in the area of Banjole. Wastewaters from this drainage area are treated by the Bombište mechanical facility, and discharged into the offshore zone through the corresponding offshore outfall.
The Medulin settling tank was also constructed to which the internal sewerage system of this tourist complex is connected.

Short- and mid-term plans envisage the construction of a coastal sewer and connecting canals to convey wastewaters to the location of the Valkane wastewater treatment facility and remove the existing nearshore outfalls. The construction of the secondary sewerage network has also been envisaged. Long-term plan foresees the construction of a new wastewater treatment plant with the second stage treatment at the Stoja site and the corresponding offshore outfall. The upgrading of other structures for ultimate discharge of wastewaters has also been planned with an aim to increase the treatment degree in line with legal provisions.

Priority 11 – The City of Zadar wastewater collection and treatment

The City of Zadar area has two sewerage subsystems, Centar and Borik, with appertaining structures for ultimate discharge (wastewater treatment plant and offshore outfall). The drainage area of the Centar subsystem encompasses central parts of the city housing both commercial plants and residential buildings. Western and north-western parts of Zadar gravitate to the drainage area of Borik: Diklo, Seline, major part of the settlements Bokanjac and Dražnica, and gravitating tourist facilities. It has been assessed that approximately 60 percent of population is connected to the sewerage system. Wastewaters from the Centar drainage area are conveyed through gravity and pressure sewers assisted by corresponding transfer stations to the location of the wastewater treatment plant and the corresponding offshore outfall (Kolovare). In the Borik drainage area wastewater discharge is carried out via a sewerage network. With the assistance of transfer stations and pressure pipelines, wastewaters are conveyed to the Borik wastewater treatment plant and the corresponding offshore outfall. In the present stage of completion, there are several nearshore outfalls that pollute the sea and numerous sewage pits (about 7500) that are emptied occasionally.

The planned sewerage system development envisages the completion of the sewerage system with the construction of sewers, relief structures and transfer stations that will ensure the conveyance of wastewaters and a part of combined inflow to the location of the new wastewater treatment plant (Centar). Ultimate discharge of wastewaters is envisaged by the construction of the corresponding offshore outfall. Storm waters will be discharged into the sea via the Ričina watercourse and the existing Kolovare offshore outfall. The expansion of the sewerage network and construction of appertaining structures is envisaged for the Borik drainage area, too, in order to increase the percentage of population connected to the public sewerage system.

Priority 12 – The City of Šibenik wastewater collection and treatment

The sewerage system constructed in the area of the City of Šibenik serves about 75 percent of total number of inhabitants. However, ultimate disposal of sewage effluent has not been adequately resolved. Wastewaters are discharged through several nearshore outfalls into the sea basin of the Šibenik Bay without any treatment, thus aggravating the environmental status of the area that has been enlisted among extremely sensitive areas with high eutrophication degree. Records show that during intensive precipitation, this drainage area is partly flooded, which points out to poor operational condition of the constructed sewerage system.

The planned development of the sewerage system of the City of Šibenik envisages the connection of suburban settlements (Ražine, Jadrtovac, Vrpolje, Zablaće, Brodarica, Krapanj, Perišići and Solaris Tourist Resort), and the construction of necessary canals and a transport system with transfer stations and pressure pipelines. This way, sewage effluent will be conveyed to the wastewater treatment plant (Privije). The construction of a transport sewer is envisaged from the planned

location of the wastewater treatment device to the Solaris Tourist Resort, as well as the construction of an offshore outfall to discharge treated waters outside the sea basin of the Šibenik Bay.

Priority 13 – The City of Dubrovnik wastewater collection and treatment

Numerous direct outfalls into the sea are located in the greater area of the City of Dubrovnik and gravitating islands. However, public sewerage system was constructed in the central part of the studied area that drains the wastewaters. Approximately 80 percent of population is connected to the sewerage system (except for the city nucleus) and so are the gravitating tourist resorts. Wastewaters are treated in the wastewater treatment plant (bar screens and aerated sand trap) located on Lapad, and therefrom discharged into the sea through a hydrotechnical tunnel and the corresponding offshore outfall. Pump stations assist wastewater transport. Safety spillways are installed on sewers and activated during the rain season (due to the connection of storm water sewerage system). This results in an excessive intake of pollution into the port of Gruž. The old city nucleus has a separate collection system with nearshore outfalls that discharge wastewaters into the port.

The improvement of unsatisfactory situation with the sewerage system of the City of Dubrovnik is envisaged in the forthcoming period. The planned activities should consider the operation of sewerage systems in case of intensive rainfall and resolve the spillage of mixed waters that pollute the sea. Furthermore, the sewerage system has to be extended and the connection of urban parts of the City and its suburbs to the public sewerage system ensured. In this way nearshore outfalls into the sea will be removed. The reconstruction/upgrade of the wastewater treatment plant should also be envisaged in order to apply higher stage of treatment in line with legal provisions.

5.3 Objectives and Implementation of Planned Environmental Activities

The basic objective related to the identified national environmental priorities in the coastal zone of the Republic of Croatia is the reduction of pollutant input into the environment and improvement of the overall environmental status.

Having regard to the SAP baselines, the deadline for resolving these priorities was set by the year 2010. Large investment is needed for the resolution of subject environmental problems and the implementation itself is associated with required time periods. Therefore, the meeting of set up objectives should be considered cautiously, having in mind the specified deadlines. This relates first of all to the priorities under 10, 11, 12 and 13, the implementation of which can be somewhat prolonged relative to the SAP objectives.

Nevertheless, the implementation of planned activities connected with all identified national priorities will be considered in continuation as if they have the same time horizon, i.e. within the planning period by the year 2010.

In resolving the problem of wastewaters in the area of largest cities located in the coastal zone of the Republic of Croatia (Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik), the target is set at 90 percent of population being connected to the public sewerage system and at wastewater treatment. The construction/upgrade of wastewater treatment plants is also envisaged, which will achieve the required level of treatment of the sewage effluent in compliance with national and international regulations. Provided that the estimate is accepted that this urban area accounts for 65 percent of total population of the coastal zone of the Republic of Croatia, it can be concluded that significant reduction of pollutants input into the sea will be achieved upon the realisation of planned activities. These objectives are consistent with the SAP objectives.

The main objective of the solid waste disposal in major cities located in the coastal zone (Split and Rijeka) are also consistent with the SAP objectives. The establishment is planned of a modern waste management system in this area. To do so, the construction of controlled and engineered landfills is envisaged, and gradual closing up of other landfills with prior abatement of their environmental impact. In this way the environmental status in the greater area of most important agglomerations (Split and Rijeka) will be significantly improved and contribution will be made to resolving the overall environmental concerns in the entire coastal zone.

The objective of improved treatment and discharge of wastewaters generated by major industrial polluters located in the coastal zone (Mirna – Rovinj, Adria – Zadar and Jadranska Pivovara – Split) is a significant reduction of direct pollutant input into the sea, in conformity with national and international regulations. Additionally, in line with the SAP Guidelines, it is planned to improve monitoring of industrial outfalls and implementation of administrative measures in order to reduce the industrial wastewater pollution by 50 percent.

Resolving of hazardous waste management and disposal issues (used chemicals, POPs, waste oils and batteries/car batteries) is also linked to the basic SAP objectives set for 2010.

The environmental priority actions in the coastal zone of the Republic of Croatia can be considered for implementation in three main phases:

Preliminary work, which should encompass the analysis of available technical documentation, verification or updating/elaboration of required design documentation, required investigations, elaboration of the environmental impact studies, feasibility studies, financial aspects, presenting information on resolving the environmental priorities to general public.

Construction of all facilities and implementation of accompanying activities associated with identified national priorities that meet designated environmental objectives in the coastal zone.

Monitoring of the environmental status that will encompass the implementation of activities aiming at the resolution of national environmental priorities in the coastal zone, and the efficiency of activities undertaken during construction and operation.

Since the schedule for performance of the planned priority environmental actions in the coastal zone is very tight (by the year 2010), all projects have the same time schedule. The preliminary work should be completed by the year 2007 at the latest. The construction of facilities will start depending on the level of completeness of the technical documentation for each project, and so will the implementation of accompanying activities targeting at finding the solution to the considered problems. In parallel with all the activities, project development monitoring should be established, which will also include the post-planning period (beyond the year 2010).

The future planning and performance of activities planned under NAP will be carried out by the Ministry of Environmental Protection, Physical Planning, and Construction in collaboration with the Ministry of Agriculture, Forestry and Water Management. The planned activities will be performed in close collaboration with other ministries and stakeholders.

The table below gives a list of national environmental priorities in the coastal zone (with an exception of priority 9, which considers hazardous waste management and disposal), and shows basic data on the existing status, objectives and expected effects of planned activities.

The extent of pollution caused by urban wastewaters to the existing and planned status (expressed in kg/day BOD) has been calculated on the basis of estimated size of the wastewater treatment plant (source: National Water Protection Plan). The pollution caused by industrial wastewaters has been calculated on the basis of data presented in the LBS Report.

Wastewater pre-treatment or the first stage treatment is carried out in the existing wastewater treatment plants. Partly treated waters are discharged through corresponding offshore outfalls into the sea. The existing status of the urban wastewaters treatment and discharge does not meet either the conditions from the water permits and the National Water Protection Plan, or international guidelines/criteria (EU Directives 2000/60/EC and 91/271/EEC).

The table with the list of the national environmental priority actions in the coastal areas and basic data on the current status, planned activities and expected effect of pollution mitigation is followed by a table with comparison of expected results of planned priority NAP objectives together with the SAP objectives by 2010, for all considered groups of pollutants.

Remark:

The prevailing opinion is that urban wastewaters from urban areas in the coastal zone of the Republic of Croatia may be discharged, after partial treatment (first stage treatment) into the sea through corresponding offshore outfalls. This assumption is based on past results regarding the impact and efficiency of submarine discharge and proven natural self-purification capacities of a maritime environment connected with the effects of primary dilution and dispersion and favourable discharge conditions (e.g. deep coastal sea, sea currents, oligotrophy, stratification).
This approach was generally accepted. According to such concept, this manner of urban wastewater treatment and discharge was chosen in the majority of cases. However, it is considered that, in case of larger agglomerations, only first stage of wastewater treatment is insufficient, i.e. such solution may be adopted only as the first stage in resolving the subject issue. In the specific case the identified national priorities are connected with larger urban agglomerations (> 100,000 PE) with the presence of industrial wastewaters. Consequently, the treatment and discharge of wastewaters from the most important agglomerations in the coastal zone of the Republic of Croatia (included in national priorities) means the establishment of the second stage treatment of wastewaters prior to their discharge into the marine environment, consistent with international (EU Directives 2000/60/EC and 91/271/EEC) and national guidelines (National Water Protection Plan), and SAP objectives. The solutions with ultimate wastewater discharge through offshore outfalls have a priority, particularly since introduction of the second treatment stage shall result in additional safety and significant additional treatment effects.

Almost no landfill in the greater Split and Rijeka areas meets the applicable national regulations. In the future, the legal obligations under national and international (EU) legislation which stipulate remediation and closing up of landfills that do not meet the strict environmental protection criteria shall be respected. Therefore, a new waste management system must be introduced, providing for setting up of regional centres for treatment and ultimate disposal of waste. Such approach to the waste management shall result in imposing the requested environmental condition

standards pursuant to the sustainable development principles and implementation of the EU legislation stipulations.

The regional centres shall be built in the vicinity of the most important urban agglomerations in the coastal area of the Republic of Croatia, i.e. on the territory of the Splitsko–Dalmatinska County (Lećevica site) and Primorsko–Goranska County (Marišćina site). The technical documentation envisages phased construction of these regional centres. The first phase in construction of the regional waste management centres at Lećevica and Marišćina is planned to be completed by 2010.

The objective is clearly to set up an efficient waste management system for organised waste collecting, with increased coverage of population up to 95-100 percent. Further, sorting of municipal and non-hazardous industrial waste is envisaged, and consequently significant decrease in number of landfills and dump sites since the regional centres are planned for treatment and ultimate disposal of waste, all in line with the legal provisions and the environmental protection requirements.

The planned activities that include the national priorities 3 and 4, are aimed at remediation of the major landfills on the territory of the cities of Split and Rijeka (Karepovac near Split, and Sovjak – Crna Jama and Viševac – Marinići near Rijeka.

TABLE 1

TABLE 2

5.4 Public Participation in Implementation of the Environmental Protection Projects

The general public should be involved if the said environmental issues are to be resolved successfully.

Public support for the environmental programs to be implemented in the coastal area can be achieved through education and informing of the population, and presentation of projects conceived to resolve the existing issues.

Education of general population is an important step towards implementation of the environmental protection measures if the support is to be obtained and awareness raised.

The project preparation should include development of informational publications that will offer the essential data on the environmental projects planned for the coastal area.

The local population and media should be involved in preparation and monitoring of the work progress, and informed on all details regarding the undertaken environmental protection measures.

The environmental projects should be presented to the general public through public inquiries and consultations.

Regular reports on project monitoring, and effectiveness of actions taken shall also be available to the general public.

The environmental project presentations shall highlight direct and indirect benefits from implementation of the planned activities for the local community and the entire coastal area, which belong among the most valuable economic and natural assets of Croatia.

Therefore, involvement of general public in resolving of the environmental protection priorities in the coastal area is considered an imperative step for performance of the planned activities.

Considering the expressed interest of the local community for the subject issues to be resolved, and assuming that the priority environmental projects for the coastal area are generally acceptable, they are expected to get high public approval rates for their implementation and achieving of set up objectives.

In Croatia, civil society organisations include different associations, societies, trusts, private institutions and trade unions. The largest number of these organisations was established after the political changes in 1990.

According to the data of the Ministry of Environmental Protection, Physical Planning and Construction, 270 nongovernmental organisations currently registered in Croatia are involved in the environmental protection and preservation. The Ministry financially supports some projects of the environmental NGOs, mainly those for waste management education, prevention of illegal construction, preservation of coastal zones and islands, local population education, and arising public awareness about the environmental issues.

During preparation of the NDA, BB, SP and NAP documents, several workshops were organised for informing and involvement of general public in preparation and adopting of these documents.

The workshops analysed activities pursued in Croatia in relation to the Strategic Action Programme (SAP) within the UN Environmental Program/Mediterranean Action Plan (UNEP/MAP) to prevent pollution of the Mediterranean Sea. The workshop participants were informed about the elementary information contained in the NDA, BB, SP and NAP, and participated in public debate on particular environmental issues encountered in the Croatian coastal zone. The debate involved a large number of NGOs, and a presentation was held on Role of NGOs in Preparation, Adopting, and Implementation of NAP (Prepared by: Sunce Environmental Organisation, Split). Below, the basic positions from the presentation are described.

During the last ten years, Croatia has recognised the importance of the nongovernmental organisations, particularly of those involved in the environmental quality protection and improvement. The NGOs are attracting more professionals, and thus becoming equal partners in making decisions related to the environmental protection.
The NGOs have been attempting to achieve good communication with the authorities in order to encourage a dialogue that should result in meeting the needs while maximally preserving the environmental quality.
The NGOs have also striven to realise direct contacts with the local communities and thus strengthen their role in the environmental decision-making process.
Therefore, the NGOs have capacities to participate in preparation, adopting and implementation of NAP provided:

- they are enabled to participate in preparation of plans by giving comments and suggestions,
- they are enabled to disseminate information on national plans to local groups and general public,
- they get involved in implementation of plans on national and particularly on local level,
- they carry out evaluation and implementation of plans through public participation,
- they participate in implementation of plans through pilot projects,
- they encourage collaboration among different sectors towards better implementation of plans.

Therefore, the conclusion is that workshops enabled the NGOs and general public to get information on preparation of the subject documents (NDA, BB, SP and NAP), and thus become involved in the process of their adopting.

5.5 Monitoring Implementation of Planned Activities

In addition to the ongoing monitoring programs for the coastal area, a separate monitoring is planned for implementation of the singled out national priorities in environmental protection.

One of objectives intended to be achieved by setting up of the monitoring is acquisition of data necessary for preparation of technical documentation (investigations), by which the baseline state would be recorded.

Further, the monitoring activities would cover the construction period, so it would be possible to determine and assess direct effect of any environmental protection action performed in the coastal area.

The monitoring period would also encompass the time after completion of planned projects, so the effects of the taken environmental protection measures would be monitored continually.

Results of this monitoring would generally be verified against other monitoring programs carried out in the coastal area.

Remark: An overview of the previous and current monitoring programs in the coastal area of the Republic of Croatia is given in section 3.1.

5.6 Conclusions

Since NAP is the Plan for reduction of pollutant emission reflecting the SAP objectives, the priority actions in the environmental protection of the Croatian coastal zone were determined in line with these objectives and national environmental protection plans, along with the results of analyses carried out within the NDA, BB and SP.

Thirteen different projects/environmental priorities were singled out which are included in NAP, grouped as follows:

- wastewater collection and treatment in the cities of: Split, Rijeka, Pula, Zadar, Šibenik, Dubrovnik (6 priorities),
- solid waste management and disposal in the greater area of the cities of Split and Rijeka (2 priorities),
- treatment of wastewater from Mirna Rovinj, Adria Zadar and Jadranska Pivovara Split, and reduction of wastewater pollutant input in the overall industrial sector pursuant to the legal provisions (4 priorities)
- hazardous waste management and disposal (1 priority).

Each priority is briefly described and planned solution for a specific issue presented.

The basic objectives of the planned activities are highlighted, and problems related to their implementation considered. The deadline for implementation of all projects is by the year 2010, according to the SAP objectives. Additionally, the project implementation demands considerable financial resources, so fulfilling of the set up objectives is a very demanding process. It is underscored that deadlines for resolving of collection and treatment of wastewater in the cities of Pula, Zadar, Šibenik and Dubrovnik could be prolonged for some time relative to the SAP objectives.

Implementation of the priority actions in environmental projection has been considered through three basic stages: preliminary works, construction and monitoring, and they have specific deadlines. The preliminary works are planned for completion by 2007 as the latest. Depending on completeness of technical documentation for different projects, the construction of facilities will start along with performance of auxiliary activities for resolving the subject issues. Along with other activities, it is necessary to set up the implementation monitoring for the projects under consideration, inclusive of the post-planning period (beyond 2010).

All future planning and implementation of the NAP activities are responsibility of the Ministry of Environmental Protection, Physical Planning and Construction in collaboration with the Ministry of Agriculture, Forestry and Water Management in close co-operation with other ministries and stakeholders.

This section also gives a presentation of relation between the results expected to be obtained from the planned activities and the SAP objectives until 2010, for all considered types of pollutants.

Furthermore, a presentation is given of public participation in the environmental projects in Croatia. The general public participation is considered to be a key factor of successful NAP implementation. Organisation of workshops enabled the NGOs and general public access to information about preparation of the subject documents (NDA, BB, SP and NAP), and they have been involved in the process of their adoption.

The section is concluded with provisional guidelines for setting up of monitoring, aimed at confirmation of purpose of the actions aimed at reduction of pollutant input into the coastal sea.

6. Environmental Priority Actions Cost Estimate

6.1 Planned Activity Performance Costs

Cost estimate for performance of individual national environmental protection priority actions in the coastal area was mostly based on available technical documents for implementation of the planned projects.

It is pointed out that no adequate technical documentation is available for detailed evaluation of capital investments for the determined environmental protection priority actions in the coastal area of Croatia. The used documents are at different level of completion and detail, and they generally do not deal with the environmental projects as separate topics. However, such analysis has been performed in order to get a provisional information about the possible costs of implementation of the planned activities.

The assessment of necessary budget as presented in the National Water Protection Plan has been used to define project costs of wastewater treatment plants (for the cities of Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik).

Project costs for construction of the wastewater treatment plants for MIRNA – Rovinj, ADRIA – Zadar and JADRANSKA PIVOVARA – Split have been determined on the basis of the load data (data from the LBS reports), with an average unit price of 250 EUR/PE.

Cost estimate for upgrading of the considered sewerage systems (Pula, Rijeka, Zadar, Šibenik, Split and Dubrovnik) was based on the analysis of data obtained from two sources, i.e. the following studies:

- Coastal Area Water Pollution Protection Project, Croatian Waters

- Water Management Master Plan for Croatia – Analysis and Overview of Pollution Sources and Water Protection Measures Applied at the Croatian Territory, Draft Action Plan and Measures (documentation and attachments), Hidroprojekt – Ing

Comparison of data on capital needed for investment into the sewerage network construction presented in the above studies indicated certain differences as the result of different methodologies and procedures used for investment estimates. Further, some illogical items were found in the estimates because of different approach to consideration of the coverage of individual sewerage systems and resulting sums of the sewerage system construction items. Thus, it was necessary to interpret the data from both sources, which resulted in correction of some estimates.

The construction costs for the regional solid waste landfills for the greater Split and Rijeka are presented as shown in pertinent technical documentation.

- *Lećevica* Landfill Environmental Impact Study, (IPZ – Uniprojekt, MCF, 2005)

- CZGO *Marišćina* Waste Management Centre – Basic Design (ECOINA, Zagreb, 2003)

A provisional cost estimate for remediation of the existing dump sites: Karepovac (Split), Sovjak – Crna Jama and Viševac – Marinići (Rijeka), was obtained from the Ministry of Environmental Protection, Physical Planning and Construction.

The estimate of investment capital given herein is of provisional nature because of the differences in documentation used for the analysis. Some aspects of resolving the subject issues have not been elaborated in detail (e.g. phased construction, reconstruction of main sewers and sewerage network, construction of secondary network, remediation of the remaining dump sites, wastewater treatment plant sludge treatment, etc.), and there is no clear insight into the current state of investment into the ongoing projects (e.g. EKO – Kaštela Bay Project). However, it is still considered that the estimate of investment capital for performance of the national environmental protection priority actions at the coastal area given herein offers a general information on the order of magnitude for the required investment, and that it could be used in creating a scenario for implementation of the planned activities.
A more detailed analysis of possible construction and a more precise estimate of the investment into individual environmental protection priorities at the coastal area of Croatia, by the phases within the planning period, shall be carried out in the following implementation phases, i.e. during preparation of appurtenant technical documentation (Feasibility Studies, Conceptual Designs, etc.).

Below, a table is given with a list of the environmental protection priorities for the Croatian coastal area, and capital investment needed for their implementation. The cost estimate is not given for the priorities 8 and 9, whose implementation mainly depends on improvement of administrative measures and investments of the business sector, because relevant data are not available.

Total value of investment into implementation of the environmental priority actions (excluding the priorities 8 and 9) is estimated at approximately EUR 721 mil. However, all the projects are planned for phased construction with an intention to achieve the best possible results within a comparatively short period of time (by 2010). Such result would mean that the basic SAP objectives are fulfilled. Therefore, it should not be expected that the most important environmental projects for the Croatian coastal area will be 100 percent completed by the year 2010. The aim is to fulfil the set objectives to the maximum possible extent, and to create conditions for completing of the planned activities in the future. Such an approach should also be applied to the investment into implementation of the projects included in NAP.

TABLE 3

6.2 Sources of Finance

Since the available economic instruments do not ensure necessary investment capital for implementation of the priority environmental protection actions at the Croatian coastal area, their correction is planned in the future in order to increase the charges covering the environmental protection costs. This topic is elaborated in more detail in the following section.

However, considering the size of the investment and planned construction schedule, it will be necessary to use other sources of finance.

Therefore, in addition to regular financing methods (to be improved by correction of the economic instruments for environmental protection), the following sources of finance could also be used for performance of the planned priority actions:

Local sources:

National budget of the Republic of Croatia
County budgets
Municipal/city budgets
Loans from local banks
Croatian Bank for Reconstruction and Development (CBRD)
Commercial capital – leasing market and ownership interests
Concessions and other public-private partnerships
Own sources
Grants

Foreign sources:

EU funds
Bilateral donors
World Bank
European Bank for Reconstruction and Development (EBRD)
European Investment Bank (EIB)
Other international financial institutions
Global Environmental Facility (GEF)
Direct foreign investment (owner's equity)
Concessions
Swapping debts for sustainable development

Since most NAP priorities include development plans for the water management sector, the funding model basics for such projects are given below, as elaborated in the Water Management Master Plan - Water Management Strategy (in preparation) and within the Coastal Area Water Pollution Protection Project.

The Water Management Strategy reads as follows:

The water management measures and activities are funded from:

- original financial resources of the Croatian Waters (water abstraction charges, water quality protection charges, gravel mining fees, and drainage water charges)
- budget transfers, and
- other revenues.

Considering planned objectives and tasks facing the water management sector, the increase in revenues is necessary. On a short-term basis, it can only be achieved by change in bases of charges used within the existing collecting system. This will enable a more intensive capital investment and create conditions for gradual and systematic introduction of changes into the charge collection system.

In addition to the original financial resources collected through the fees and charges, the National Budget co-finances construction of certain sorts of infrastructural projects in areas of special state interest (areas of special state concern, islands, and the like). However, this is not a regular revenue of the water management sector, it is determined on annual bases, and may only become mandatory upon signing of long-term funding agreements.

Other water management sector revenues comprise the assets earmarked by the local self-government units for construction of infrastructure, and they include loan refunds and participation in new development projects. Further, the revenues include different grants received through international collaboration. These resources are also not regular revenue, so in the planning documents they could be referred to as possible "revenue" which, provided an adequate funding scenario, might become more economically viable.

Generally, the activities/investments planned for implementation in order to fulfil the strategic objectives of the water management are development investments. Since the financial resources needed for development are much higher than the annual revenues, the possibility has been considered of using loans for development of infrastructure.

Projections of possible investment into the development of municipal infrastructure combine the projections of funds that the water management sector may allocate and obligations and capacities for investment of utility companies and their founders (owners of infrastructure for public water supply and wastewater collection). Therefore, investment into the development of the municipal infrastructure aimed at fulfilment of the basic objectives of the water management sector has been calculated on the basis of the following assumptions:

- that the water management sector will co-finance on average 50 and 60 percent of the development costs of public water supply and wastewater collection,

respectively, while the remaining amount shall be covered by the utility companies and their founders

- that the construction will be funded from loans (15 year loan, grace period 5 years, loan repayment period 10 years, annual interest rate 4 percent),

- that the water management sector and utility companies will jointly repay the loan.

The proposed model of combined funding of the water management projects should make maximum use of grants (National Budget, grants and EU funds), and the revenues from implementation of economic instruments (economic water price), and reduce the bank loans (expensive funds) to minimum.

As an example, a financing model for implementation of the priority phases of the Coastal Area Water Pollution Protection Project is given below. Implementation of these activities is planned to be funded from the following sources and in the given ratios:

Main sources of finance during construction:

Loan	48%
Local authorities with utility companies (water price)	19%
Croatian Waters	8%
National Budget	21%
MEPPPC - Monitoring	2%
Croatian Waters - Monitoring	2%

Sources of finance - construction and loan repayment:

Local authorities with utility companies (water price)	53%
Croatian Waters	26%
National Budget	21%

Another group of singled out NAP priorities encompasses the solid waste management and disposal issues (priorities 3 and 4). The document Draft Waste Management Strategy of the Republic of Croatia highlights that the only stable source of financing the waste management programs and projects in Croatia is non-budgetary Environmental Protection and Energy Efficiency Fund. However, the Fund resources are mainly aimed at the environmental protection programs and projects, particularly for resolving of the waste management related issues. These resources are estimated at only one tenth of money needed for setting up of the state-of-the-art waste management system in Croatia, the one tailored to the EU requirements. Additionally, it is not certain that even these rather modest funds for waste management will be maintained in the future, since the waste management contribution to the Fund revenue is much smaller than its participation in expenditures. Thus, establishment of the Waste Management Fund is proposed within the National Budget of the Republic of Croatia to which the money would be

allocated from the taxes on all domestic and imported products generating waste relative to the quantity and adverse effects of the generated waste. Similar funds are proposed to be established in the local budgets. Further, other sources of finance are proposed, similar to the above enlisted sources for finding of the environmental protection projects in the coastal area of the Republic of Croatia. Also, improvement is planned in the economic instruments (increase in waste management charges in line with the polluter-pays principle).

6.3 Investment Portfolio

According to the UNEP/MAP, the Investment portfolio (IP) is to be prepared for each proposed priority (project) in the environmental protection of the coastal area, according to the accepted methodology.

The investment priorities are defined on the basis of criteria, including:

- project implementation cost estimate
- project implementation benefits
- contribution to the economic development
- feasibility within the existing legal and administrative institutional framework
- financial sustainability of the project

The project implementation cost estimate for the activities that ask for mobilisation of considerable financial resources for investment is given in the above section.

The benefits from implementation of the planned environmental protection projects have two main elements: the impact of inaction and social benefit achieved by resolving of the environmental issues. The adverse effect of inaction is related to further degradation of the coastal environment and sea (destruction/damage to flora and fauna, blooming, toxicity of fish and shellfish, unavailability of sea for recreational purposes, and the like), with possible serious threats to human and animal health. Additionally, such situation could significantly harm the economic growth which largely relies on tourism. Implementation of the planned activities would bring a significant progress in protection of the coastal area and sea and improve general sanitary conditions. The living, working and recreational conditions would improve, and the basis would be ensured for safe and environmentally sound economic growth (tourism).

The implementation of the environmental protection projects protect the economy based on tourism and recreation. Carrying out of the planned environmental protection activities would improve the economy based on tourism, and create the possibilities for new employment in and revenues from tourism. Development of tourism has positive effect on other economic sector components (transportation, agriculture, trade, etc.). Favourable conditions are created for development of other economic sectors (fisheries, shipbuilding).

The legislation and national environmental protection plans envisage implementation of the planned activities within NAP. The existing institutional and administrative framework ensures all the preconditions for implementation of the planned environmental priority actions. However, some actions are planned for the forthcoming period aimed at improvement of the institutional and administrative organisation.

Because of scarcity of the financial resources, it is necessary to identify and mobilise all available financing resources and allocate them for this program. Possible sources of finance and funding models are described in the previous section (6.2), and the economic instruments are shown the section 7 below.

The financial priorities have been determined on the basis of the mentioned criteria, and the methodology presented in the UNEP/MAP Guidelines was adopted (References, 4). The project scoring system is shown in the table below, along with the results of the analysis.

Project characteristics:	**Score 1**		**Score 2**
Benefits	5	Public health benefits	5
		Other benefits	3
		General	1
Development	4	Contribution to the leading economic sector	5
		Contribution to the less important sector	3
		General	1
Financial sustainability	3	Opportunities for application of economic instruments.	5
		Potential application of economic instruments	3
		Difficult to apply economic instruments	1
		Easy implementation	5
Feasibility	2	With minimum changes	3
		With major changes	1
Cost	1	Low cost	5
		Medium cost	3
		High cost	1

Total score for ranging of projects according to the financial priorities is obtained by multiplication of the score value from the “Scores 1” column with the selected score from the “Scores 2” column.

TABLE 4

6.4 Conclusions

In this section, the cost evaluation was made of implementation of the environmental protection priority actions included in NAP on the basis of available data and technical documentation used to consider implementation of the planned projects.

Remark: Because the relevant inputs were insufficient, cost estimate was not carried out for priorities 8 and 9.

It should be noted that the inputs and documentation used to estimate financial resources are at different development stages, and they do not deal with the subject environmental projects as individual items.

Consequently, the cost estimate is for orientation purposes only. However, it still illustrates the range of financing resources required for the planned activities.

A more accurate estimate will be possible in the next NAP realisation phase, when implementation of individual projects will be analysed considering their technical and financial aspects.

The section on cost estimate is followed by the section containing data on possible sources of finance for the environmental projects. The basic concepts elaborated in the national environmental protection plans are presented, and pertaining funding models outlined.

In line with the SAP Guidelines, the Investment Portfolio is prepared which shows the financing priorities for the subject environmental projects included in NAP. The implementation cost estimate is prepared and possible sources of finance enlisted.

7. Economic Instruments for Marine Pollution from Land-Based Activities

7.1 Background

To support preparation of the basic NDA, BB, SP and NAP documents, as requested by the Strategic Action Programme for the Reduction of Pollution of the Mediterranean from Land-Based Sources for the reduction of pollutant input into the sea (SAP MED), the following study was developed:

- Economic Instruments for Combating the Sea Pollution from the Land-Based Activities in the Republic of Croatia - Current Status and Possible Solutions (Regional Activity Centre, Split 2005)

The study analyses the existing economic instruments used in the environmental protection in Croatia and compares the Croatian practices with the OECD countries. It also highlights possible development of some instruments that might be used by specified planning periods (2007, 2008-2010, 2011– 2015, and 2016– 2025).

Considering the current situation, the study reads: *Transition to the market economy forced Croatia to intensify its activities towards the environmental pollution abatement, but insufficient economic activities and financial resources have hindered implementation of the protection measures, investment into the treatment facilities and implementation of efficient environmental management policies. Croatia has managed to implement some economic instruments, primarily those related to exploitation of natural resources and environmental pollution. The economic instruments do not create an integrated system which would, along with the laws and implementation legislation, ensure a comprehensive, continual, and efficient environmental protection and sustainable development. Development of economic instruments focuses primarily on use of natural resources (waters, forests), and than on the activities related to the environmental protection. In water and forest management sectors, in forestry, agriculture and mining, and in utilities sector, based on the legislation regulating these fields of activities and regulations ensuing from them, the user charges and emission (pollution) fees have been introduced. such as water abstraction charges. The water management sector and forestry have the longest tradition in development of charges which are most frequently used economic instruments, along with fees and contributions.*

The economic measures used in the environmental protection have been considered within the following topics:

- Water use and contamination
- Air pollution
- Noise pollution
- Traffic-induced pollution
- Waste pollution
- Soil contamination, biological diversity and nature

7.2 Analysis of Currently Used and Proposed Economic Measures

Water usage and contamination

Economic instruments applied to water abstraction and contamination are:

- water abstraction charges
- water quality protection charges
- drainage water charges
- water price (water supply, collection and treatment)
- fines for non-compliance to water protection legislation
- sand and gravel mining fees.

The conclusions based on the conducted analyses are as follows:
Although the economic instruments used in Croatia to regulate research, protection, collecting, treatment and supply of water, and collection and treatment of wastewater have been adequately implemented, the revenue they generate is not sufficient to meet the wastewater treatment and discharge requirements.
In comparison with the OECD countries, Croatia has implemented most of the instruments these countries use in water management, with the exception of those related to the market creation, i.e. tradable permits issued for quality management, water contamination, and water abstraction rights.
The water quality protection charges (collected by the Croatian Waters) cover only about 25 percent of the protection costs. Therefore, the prices should be gradually adjusted to bring the required funds in line with the environmental protection costs.
Generally, regardless of differences in water prices between cities and municipalities, the funds collected are most often not sufficient to cover the cost of new research, procurement of modern equipment and potable water treatment..
Considering the fact that the rates set for the water quality protection charge are considerably lower than the actual protection costs, it should be gradually increased. The water should be priced so as to cover the costs and yield return on investment.

It is proposed that the following economic instruments be introduced by 2007:

a) *charge for water abstraction, water quality protection, and water catchment charge*

b) *additional urban wastewater treatment and discharge charge*

Item a)
Currently, the water abstraction charges, water quality protection charges, and water catchment charges are stipulated by the laws and regulations of the Republic of Croatia. Croatian waters should prepare programs for water abstraction, water quality protection, and protection of catchment areas for the period 2005-2007, and they should be discussed and approved by the Croatian Parliament. The programs should include investment plans, and they should be used as a baseline for adjustment of allocation rates for the water management purpose and new sources of finance.

Item b)
This new economic instrument is introduced primarily in order to improve public services in the coastal area and, ultimately, to reduce the marine pollution from the urban wastewater.
Proposed introducing of additional charges for the wastewater treatment and discharge in the counties is presented in the tables below:

Initial discussions and framework agreement	90 days
Consultation period	90 days
Legal review and drafting	60 days
Administrative plan	30 days
Designing of economic instruments	60 days
Implementation period	360 days
Monitoring of results achieved	720 days

Framework for objectives for introduction of the wastewater treatment and discharge charge in the county water protection zones for the period by 2007

Objectives hierarchy	Key roles, indicators	Monitoring and evaluation	Critical issues
Development goals	More extensive wastewater collecting, treatment and collection coverage. Target - 90% coverage	Monitoring at county level	Implementation not possible
Environmental goals	Wastewater treatment degree increase (from 1st to 2nd and 3rd degree) by 2015	County public health offices	Lack of qualified monitoring staff
Financial goals	Polluter pays principle (PPP)	County self-government	Impossible to collect
Assets as goals			

Framework for implementing of additional wastewater treatment and discharge charge in county water protection zones by 2007

Activity	Action/Inputs	Outputs	Critical issue
Consultations	Meeting and discussions with national, regional and local entities	Reports and public documents on instrument implementation	Lagging negotiations
Administrative/legal measures	Defining county implementation legislation	Ensuring legal approval	Revenues transferred to the Government
Designing of economic instruments	The wastewater treatment charge to be calculated at 1/4 of the current water price; differential rates for households, business sector and seasonal use. Payment into county fund	This instrument would enable, e.g. Istrian catchment area to collects about HRK 12.5 –12.9 mil. a year	
Review	Review scheduled to follow two years after implementation. Monitoring by county administration	Review and monitoring plan report	

In case the Project proposal for introduction of wastewater collection and treatment charges is not accepted, the following alternative option is proposed:

a) The Water Management Sector Funding Act should specify who should receive the resources from the water quality protection charges in the Adriatic counties intended for: protection of well fields in the water protection zones (Article 42 Water Act) to be used for both soil and water.
Within this framework, the Water Resources Master Plans and Water Management Plans should be promulgated in counties based on the proposal of Croatian Waters and accompanied by the consent of the Ministry of Agriculture, Forestry and Water Management. Such plans shall enable determination of the needs, construction schedules, financing sources and determination of those responsible for project implementation.
This would be the grounds for increase in water quality protection charges that would enable complete regulation of the wastewater collection and treatment issues, and finally result in better protection of sea;
b). Renewal of county water abstraction concession, since the present concession holders, the utility companies in municipalities and cities, have contracts for the time period up to 30 years. Such approach would enable safer and integrated water distribution, and collection and treatment of water at the county territory. The funds would be raised for water supply, and for collection and treatment of waste water in the local self-government units which have no sufficient capacities to cover current costs (50%).

Air pollution

Economic instruments for abatement of air pollution:

- polluter charges (charges for CO_2, SO_2, NO_2 emission)
- special environmental charge for motor vehicles
- fines for excessive pollutant emissions
- taxes on cigarettes and other tobacco products (excise taxes)

The conclusions based on the conducted analyses are as follows:
Market incentive mechanisms (market creation) are not used in Croatia, as the total possible pollution loads in a given area has not been determined yet. In OECD countries, tradable permits are issued for high-risk air emission, tree felling, grassland burning, ozone depletion, and other types of air pollution.
Monitoring of air emission from power generation plants and other industrial facilities could result in determination of total pollution load and thus create the conditions for introduction of tradable permits.

Noise pollution

Economic instruments for the environmental protection against the noise pollution include only fines or imprisonment for exceeding the noise levels stipulated by law that could cause serious damage to public health. Special noise-free areas are designated at the airports and in their vicinity, where the noise level exceeds 65 and

75 dB, respectively. The physical persons and entities sustaining losses due to introduction of such protected areas are granted compensations for special building conditions (however, no by-laws have been passed so the compensation is still not being paid).

It is highlighted that the noise abatement has also not been properly addressed in the OECD countries. Attempts to collect specific taxes from the airports have been made. Stringent measures are, however, observed regarding the maximum noise levels.

Traffic-induced pollution

Economic instruments applied to traffic include:

- excise tax (included in fuel price)
- charges for financing of public roads construction and maintenance (included in fuel price)
- special tax on cars, vessels and aircrafts.

Other traffic-related economic instruments are also used in Croatia, such as: annual fee for use of public roads paid at the motor or trailer vehicle registration; road tolls paid for use of highways and other chargeable facilities; the same charges paid by vehicles registered abroad; extraordinary transportation fees; charges for excessive use of public roads; charges for right-of-way; charges for services rendered at the public roads; concession fees and charges for financing of public roads construction and maintenance.

However, the only genuinely environmental economic instrument related to the traffic-induced pollution is:

- special environmental charge for motor vehicles.

The conclusions based on the conducted analyses are as follows:
The way in which OECD countries regulate this matter differs from one country to another. Croatia imposes no charge for disposal of scrap vehicles, or for disposal of used tires and waste oil. The cost estimate for disposal and removal of harmful components would enable the charge to be determined for disposal of scrap and abandoned motor vehicles with uniform rate for the entire country, which would vary according to the vehicle size. Mandatory submittal of registration plates to the police and a certificate issued by a responsible waste management organisation would ensure proper implementation of this measure. Disposal of used tires should be stimulated by incentive economic instruments.

Waste pollution

Economic instruments used to prevent the environmental pollution from waste include the following measures:

- municipal waste charge
- the environment user charge (however, no by-laws have been passed so the compensation is not paid)
- hazardous waste charges
- incentives for producers who organise recovery of useful and non-useful products or packaging
- deposit-refund systems (mainly for bottles)
- different state incentives (benefits, e.g. tax reduction or exemption, adjustment to new environmental standards, etc.)
- fines for non-compliance to law.

The conclusions based on the conducted analyses are as follows:
Having in mind numerous illegal dump sites, a large portion of municipal waste in Croatia is not adequately treated, so resolving of this issue must be intensified.. The changes to be implemented primarily concern a pricing system that would enable covering of all waste management needs in line with the regulations and standards. Further, charges should be introduced for the utilities which do not manage their waste according to the environmental standards. There are no benefits stipulated for recycling or reuse of waste, but such activities could be encompassed in the general incentive schemes. Furthers, no benefits have been determined for cleaner product promotion, and there are no schemes for vehicle repurchase. In order to improve their competitive capacities, some companies accept old vehicles when their new vehicles are purchased, which creates a favourable environmental atmosphere.

For implementation of these measures, the Waste Management Strategy envisages:
- direct funding of some measures
- stimulating implementation of certain measures (tax reduction, custom duty abolition, etc.)
- gradual increase of waste management charges
- discouraging measures (supplementary custom duties and levies on some products, etc.)
- penalisation of environmentally adverse behaviour in waste management (quantity-based levy or tax)
- swapping debt for sustainable development.

The National Environmental Action Plan envisages payment of charges for all types of waste, and introduction of other economic mechanisms, and funds earmarked for advancement made in development of waste collecting and removal system. Further, charges are planned for packaging waste, for environmental load, charges for hazardous waste producers, charges for disposal of scrap cars, used tires, household appliances, electrical and electronic devices, and bulk waste.

Depending on the type of waste, the following measures are envisaged:

a) municipal waste pollution

Economic measures for pollution from municipal waste are actually regulated by the existing laws and regulations. A questionable issue is pricing of the waste treatment, since the price should enable covering of costs for the treatment in accordance with the applicable environmental standards. In order to foster resolving of the problems with the illegal dump sites, introduction of charge is planned which would be determined on the basis of a number of landfills and estimated waste volume, and such charge would be paid by the local authorities until completion of remediation of such landfills. The basic development goal of these measures is to improve services in the local communities, and considering the environmental aspects, these measures are aimed at reduction in degradation of the coastal area

b) pollution from industrial and other forms of waste

Introduction of a tax on sold and imported products is planned (electrical and electronic devices, scrap vehicles, used tires, used car batteries, plastic packaging, fertilisers, waste oil, beverage containers). An alternative is that the producers introduce refunds for such products. Introducing of economic instruments for pollution from non-hazardous industrial waste has sustainable development as its basic developmental goal, while considering environmental aspects it is primarily aimed at reduction of degradation of coast and islands and decreased risks of pollution in this region. The instruments would incorporate the polluter pays principle which would be implemented through the price of purchased products.

After conducting necessary consultations provided for under the law and convening of responsible bodies, some of the proposed instruments could become effective by 2007, and other instruments ask for preparation and would be implemented during the period until 2015. The proposed charges for industrial and other waste forms are shown in the tables below.

Timetable for introduction of charges for industrial and other waste for the period 2008-2010

Initial discussions and framework agreement	90 days
Consultation period	90 days
Legal review and drafting	60 days
Administrative plan	30 days
Designing of economic instruments	60 days
Implementation period	365 days
Monitoring of results achieved	720 days

Framework for goals for introduction of charges for industrial and other waste for the period 2008-2010

Goals hierarchy	Key roles, indicators	Monitoring and evaluation	Critical issues
Development goals	Sustainable development of maritime and coastal system	Monitoring on county level	Implementation not possible
Environmental goals	Mitigation of degradation of sea, coast and islands	National inspection	Lack of staff and equipment
Financial goals	Polluter pays principle (PPP) through price	State and county self-government	Payment evasion
Assets as goals			

Framework for implementation of charges for industrial and other waste for the period 2008-2010

Activity	Action/Inputs	Outputs	Critical issue
Consultations	Meetings and discussions with national, regional and local institutions, local self-government, and some businesses	Reports and public documents on instrument implementations	Lagging negotiations
Administrative/legal measures	Defining of national and county implementation legislation	Legal framework and provisions for implementation in counties	Revenues transferred to the government fund
Designing of economic instruments	Charge based on selling price (VAT not included) on kg or litre: - electrical and electronic products 4-5% - scrap cars 3-4% - used tires 3-4% - used car batteries 6-8% - plastic packaging, HRK 20 per kg - pesticides and fertilisers 2-3% - waste process oil 2-3% - beverage containers HRK 0.5-1 per 1 litre	Model application results in HRK mil./year: 14-18 47-63 10-13 3-4 ... ... 7-11 ...	
Review	Plan and monitoring by national and county administration	Review and monitoring plan report	

c) hazardous waste pollution

The following is elaborated about this type of waste:
The hazardous waste management is an activity of interest for the Republic of Croatia, which ensures implementation of measures pursuant to the Strategy and National Waste Management Plan for this type of waste.
The Croatian Waters, pursuant to the Water Act and Billing Rules collect the water quality protection charges based on the quantity of water discharged and degree of contamination determined by the water permit. Therefore, the existing instruments provide for coverage of damage caused by the industrial pollution (cadmium, lead, mercury and chlorinated hydrocarbons). Additional instruments for industrial pollution will be proposed when the Strategic Action Programme for Combating of Land-Based Pollution in the Mediterranean is finished. Treatment of sewage effluent and construction of an adequate sewerage network in Croatia, especially in its coastal area, demand substantial investments. This issue is made even more difficult by the hospitality industry capacities, which in some regions case the sewage load to double or triple during the summer months. The facilities meeting such peak demands are usually an enormous financial burden for local self-government, business sector and local population.

Soil contamination, biological diversity and nature

The Republic of Croatia has not stipulated any charges or taxes on fertilisers, pesticides, and similar substances. Agricultural land contamination is compensated

by indemnification of the land owners. A compensation fee has been introduced for the agricultural land-use change (mining of sand/gravel or setting up of landfilling facilities).
Within forest and forest land management, charges have been introduced for forest simple production-capacity expansion and forest resources use. The so called forestry contribution has also been imposed on the wood product traders.
The charge for exploitation of mineral resources has also been introduced.
The Hunting Act stipulates indemnification for damage caused to the wildlife, and fines for non-compliance to law.
For non-compliance to the Nature Protection Act, i.e. changes or damage inflicted on protected nature fines and indemnification (for protected animals) are imposed. The fines are also stipulated for illicit use of GMOs.

The conclusions based on the conducted analyses are as follows:
In OECD countries, taxes or charges are imposed on fertilisers, pesticides, for soil protection, public pastures, hunting and fishing, hunting and fishing of prohibited species, deep-sea fishing and forest-related activities.
It is recommended to consider the possibility of introducing the environmental pollution charges on the fertilisers and pesticides, since other instruments have already been in use in Croatia. However, as vast area of the coastal region of Croatia is karst, it is recommended to consider a possibility of introducing taxes and charges as shown in the table.
Further, the OECD countries use different subsidies for promotion of organic food production, fish stocking and afforestation, to determine forest condition and their productivity and biological diversity, and for cleaner food and fish processing industry.
So far, no incentives for promotion of organic agriculture have been provided in Croatia, but numerous organisations, tourist companies and civil groups strongly support such production, so the state should grant some subsidies.
To implement the program for afforestation, determination of the forest soundness and its productivity, the funds are earmarked for forest reproduction and production-capacity expansion.
As regards biological diversity, the fines are stipulated for non-compliance to the nature conservation laws. The damage to protected animals or specially protected parts of nature on land and at sea must be compensated for, and the fines paid for non-compliance to regulations, even the imprisonment is foreseen for cruelty to animals.
Croatia has not introduced any special fishing rights, and permits are only granted for catching of particular fish species. Further, trading in permits is still not possible. However, there are considerations about introduction of international quotas for fishing in the Croatian part of the Adriatic.

Other economic instruments

These instruments include the following concession compensations:

- concession fees for abstraction of water for public water supply and industry

- concession for sand mining
- concession on maritime domain

Further, the Administrative Levies Act regulates the taxes for:

- environmental protection
- protection of natural and cultural heritage.

The fees are stipulated for sand and gravel mining, concessions for exploitation of mineral resources and stone, and charges for fossil resources. The industry pays taxes for air emission, charges for discharge of wastewater and process water, as well as the charges for protection and abstraction of water (if the water for public waterworks is used). In case the emission is extremely excessive, the indemnification is paid for determined damage along with the fines. The state incentives and tax exemptions are used for development of the environmentally sound industry, while use of other instruments is not so common. The market creation is not present in this segment.
The following is elaborated regarding the wastewater pollution:
The urban and industrial waters, along with the watercourses, carry into the sea considerable quantities of heavy metals (cadmium, lead, mercury), chlorinated hydrocarbons, nutrient salts, nitrogen and phosphorus, which are slowly degraded and distributed in living and non-living organisms. Based on granted water permits and externality cost estimate, it would be necessary to determine the charges for individual polluters. Since it is very difficult to determine actual costs of externalities, it will be necessary to compare these pollutants and calculate the rates to be used accordingly.
Since the charges for carbon dioxide, sulphur and nitrogen oxide emissions have already been imposed, a possibility should be considered of introduction of charges which would cover the costs of pollution from heavy metals, chlorinated hydrocarbons, nitrogen and sulphur.

The problems related to the transportation ports, marinas, wastewater discharge from vessels are highlighted, and proposals given for introduction of specific environmental charges.

Government incentives

The law also stipulates environmental protection incentives intended for removal or prevention of damage to the environment or natural resources, for achieving of the environmental standards, or for encouragement of conservation of nature and its resources.

7.3 Long-Term Aspects of Economic Instruments Development

Consistent with the National Environmental Action Plan - the Water Management Measures by the year 2025, it is necessary to build the wastewater facilities for the

settlements with population equivalent of 2,000 to 15,000. To achieve this objective, it is necessary to continue with application of the instruments introduced for the period until 2015 that will cover the wastewater discharge costs.

Application of most instruments introduced in the past will continue beyond 2015, and new instruments will probably be introduced for the sea protection against the land-based activities.

7.4 Conclusions

High concentration of business activities and population along the coastal areas, both world-wide and in Croatia, cause considerable pollution of sea, which is divided into the urban, industrial and other pollution.
The OECD countries use a wide range of different economic instruments for the environmental protection. In different countries, these instruments are applied in different ways, depending on their contents, scope and applicable criteria.
Croatia also has a wide range of different economic instruments among which different charges are dominant.
Economic instruments for water abstraction and contamination applied in the Republic of Croatia are very similar to those applied in the OECD countries, with the exception of the instruments encouraging market relations (market creation). The collected charges are generally not sufficient for covering of the water protection costs. To that end, gradual increase in some charges is planned along with introduction of additional county charges for the urban wastewater treatment and discharge. The latter charges might be introduced by 2007.
Economic instruments used for air pollution in the Republic of Croatia are similar to those used in the OECD countries, with the exception of market stimulation mechanisms (market creations), so a proposal is presented for introduction of this instrument in Croatia in the period 2011-2015.
The noise pollution problems and economic instruments have not been adequately resolved in the OECD countries and Croatia alike, so no new instruments are proposed.
The charges for traffic-induced environmental pollution are similar to those used in the OECD countries, and the special environmental charge for motor vehicles has also been introduced. Introduction of charges for disposal of scrap cars and used tires was proposed for the period 2008-2010.
The OECD countries use various economic instruments for resolution of the waste-related problems. Croatia uses similar instruments, but the instruments encouraging recycling and reuse of products are not available, same as those for PET, glass, metal, fluorescent tubes, batteries, car batteries, TV sets, computer monitors, cans, pesticides and lubricants. The draft Waste Management Strategy envisages gradual harmonisation of this segment with the EU legislation.
At the local level, the charges for remediation of illegal dumpsites should be introduced. Additionally, the counties are planned to introduce charges for electrical and electronic devices, scrap vehicles, used tires, used car batteries, plastic packaging, pesticides and fertilisers, waste oil, beverage containers paid by the

retailers into the county environmental protection fund. This program should be realised in 2008-2010.
Incentives for adequate disposal of hazardous waste are planned for possible introduction during the period 2011-2015.
Charges for use of pesticides and fertilisers, preferences for promotion of organic agriculture, introduction of international quotas for fish catch in the Croatian part of the Adriatic and other measures for the soil contamination mitigation and preservation of biological diversity are planned to be introduced by 2007.
By 2025, the wastewater treatment systems have to be built for the population equivalent of 2,000 – 15,000. To that end, it will be necessary to continue using the water quality protection instruments at the county level beyond 2007. Application of most instruments introduced by the year 2015 will continue, and new economic instruments will probably be introduced for the sea protection against the land-based activities.
This document has only presented the basic directions of development of some economic instruments that might be used for the sea pollution in Croatia. A more precise defining of new instruments to be introduced asks for a comprehensive discussion, and it is necessary to anticipate the environmental and economic effects, sources of finance, measures and institutions in charge of implementation.

8. References

1. UNEP – Mediterranean action plan MED POL, Strategic action programme to address pollution from land-based activities, Athens, 1999

2. UNEP – Mediterranean action plan, Strategic action programme SAP, working document for the training course on the preparation of NAPs as part of the SAP, Athens, 2004

3. UNEP – Mediterranean action plan MED POL, Strategic action programme, Guidelines, Athens, 2003 and 2004

4. UNEP – Mediterranean action plan, Strategic action programme SAP, Training course for the preparation of SP i NAPs in the framework of the SAP - Guidelines for the preparation of Investment Portfolio for the implementation of the SAP/NAP, Izmit (Turkey), 2004

5. Strategija zaštite okoliša RH i nacionalni plan djelovanja za okoliš, 2001. (*Environmental Strategy and National Environmental Action Plan*)

6. Državni plan za zaštitu voda (*National Water Protection Plan*)

7. Strategija gospodarenja otpadom Republike Hrvatske (nacrt prijedloga), (Ministarstvo zaštite okoliša, prostornog uređenja i graditeljstva) (*Waste Management Strategy for the Republic of Croatia, draft, Ministry of Environmental Protection, Physical Planning and Construction*)

8. Vodnogospodarska osnova Hrvatske – VOH, Analiza i prikaz izvora onečišćenja i mjera zaštite voda na području RH, te prijedlog akcijskog plana mjera, podloge i prilozi, (Hidroprojekt – Ing, Zagreb, 2002) (*Water Management Master Plan - WWMP, Analysis and Overviews of Pollution Sources and Water Quality Protection Measures for the Croatian Territory, and Proposal of Action Plan for Measures, Inputs and Documents, Hidroprojekt-Ing*)

9. Vodnogospodarska osnova Hrvatske – Strateška osnova za upravljanje vodama (poglavlje br. 4 i br. 5, radni materijal), (Hrvatske vode) *(Water Management Master Plan - WWMP, Strategic Bases for Water Management, sections 4 and 5, working material, Croatian Waters)*

10. Projekt zaštite od onečišćenja voda na priobalnom području, Izvješće o projektu, (Hrvatske vode) *(Coastal Area Water Pollution Protection Project, Project Report, Croatian Waters)*

11. Nacionalna dijagnostička analiza – NDA, priobalno područje RH, (Prof.dr.sc. Nada Krstulović, Institut za oceanografiju i ribarstvo, Split, 2005)

(National Diagnostic Analysis – NDA, Coastal Area of the Republic of Croatia, prof. Nada Krstulović, Institute for Oceanography and Fisheries)

12. Republika Hrvatska - Temeljni unos onečišćenja za 2003. godinu - BB, (Dr.sc. Grozdan Kušpilić, Institut za oceanografiju i ribarstvo, Split, 2005)
(Republic of Croatia - 2003 Baseline Budget - BB, Dr.sc. Grozdan Kušpilić, Institute for Oceanography and Fisheries)

13. Sektorski planovi - SPs, podloga za izradu NAP-a za smanjenje onečišćenja Sredozemnog mora od aktivnosti s kopna (Dunja Barišić, dipl. ing., Zagreb, 2005)
(Sectoral Plans - SPs, Documentation for Preparation of NAP for Reduction of Mediterranean Pollution from Land-based Activities, Dunja Barišić, B.Sc.)

14. Ekonomski instrumenti onečišćenja mora od kopnenih aktivnosti, (Regional Activity Centre, Split 2004)
(Economic Instruments for Combating the Sea Pollution from the Land-Based Activities in the Republic of Croatia - Current Status and Possible Solutions Regional Activity Centre)

15. LBA program za 2002. godinu u Istarskoj županiji, (Zavod za javno zdravstvo Istarske županije)
(2002 LBA Program for Istarska County, Istarska County Public Health Institute)

16. Izvještaj o onečišćenju Jadrana s kopna na području Kvarnerskog zaljeva u 2002. godini, (Zavod za javno zdravstvo Primorsko – goranske županije)
(2002 Report on Adriatic Sea Pollution in Kvarner Bay, Primorsko–Goranska County Public Health Institute)županije)

17. Izvješće o onečišćenju Jadrana s kopna (LBS) na području Dalmacije za 2002. godinu, (Zavod za javno zdravstvo Županije Splitsko – dalmatinske)
(2002 Report on Adriatic Sea Land-Based Pollution (LBS) in Dalmatia, Splitsko–Dalmatinska County Public Health Institute)županije)

18. "Studija utjecaja na okoliš odlagališta *Lećevica*", (IPZ – Uniprojekt, MCF, 2005
(Lećevica Landfill Environmental Impact Study, IPZ – Uniprojekt, MCF)

19. CZGO *Marišćina* – Bazni projekt, prezentacija projekta (ECOINA, Zagreb, 2003)
(CZGO Marišćina – Basic Design, Project Presentation, ECOINA)