INDEX:

1. DEFINITION OF THE RISK IDENTIFICATION ASSESMENT

River Shield project aims at the protection of rivers from pollution caused by industrial accidents, via the development and implementation of risk management, prevention and emergency measures.

Risk management is the overall process of identifying potential hazards and undesirable events, understanding their consequences and likelihood, and taking steps to reduce their risk if necessary.

2. DESCRIPTION OF THE LOCAL ENVIRONMENT

2.1. Definition of the area

Municipality of Koper is a maritime and a border municipality. It is surrounded by the Adriatic Sea from the west (Bay of Koper in the length of 17.6 km), the Republic of Italy on the north side (14 km of border length), Municipality of Hrpelje – Kozina from the east (37 km of border length), the Republic of Croatia (40 km of border length) and Municipality of Piran (12 km of border length) on the south, and Municipality of Izola on the southwest side (7 km).

Town of Koper, which is the largest settlement in the municipality, is an administrative-political, economical, and cultural centre of the municipality and it is situated at a latitude of 45^{O} 32.5' North and at longitude 13^{O} 45.5' East.

The selected analysis area comprises the area of Rižana river basin, Badaševica river basin, and intermediate catchment area between river basins with the town of Koper.

2.2. Demographical and settlement characteristics

The municipality of Koper has 46,700 residents in 104 settlements, which means an average density of settlements of 150 people per square kilometre.

Characteristic of the municipality is a strongly developed inshore strip, which is contracted to a to a more narrow strip along the Koper settlement (25,300 inhabitants) and the hinterland, which goes deep into the interior of Istra and is characterised by a large number of small settlements. Depopulation and deagrarization of the area with a low supply and worse municipal utility and transport regulation are still present in the hinterland, but the situation, especially in the last years, is improving.

Areas for settlement, industrial areas, and infrastructural facilities have been in the previous development directed towards the narrower inshore strip, which comprises the urban area of Koper with suburban settlements.

Concentration of employment positions in coastal settlements (only 3.5 % of workers are employed in agriculture and fishery) causes great daily migrations of work force.

Table 1: Basic socio-economic indicators in South Primorska (population)

Area (in km^2):	Population	Settlement density (in km^2)	Population growth rate	Ageing of the population index
311	49.272	158	9,36	133,8

Source: SURS, calculations Janja Pečar
Note: [1] Population register, state 30.6.2005
[2] population census

2.3. Description of the general characteristics of the river basin

River basin districts in Slovenia
Due to water management the territory of the RS is divided to two river basin districts, which are of international nature, that is the Danube river basin district and the Adriatic Sea river basin district, and within them to the Mura sub-basin, Drava and Sava, and Soča river basin in Adriatic rivers river basin.

Adriatic-Black Sea watershed divides Slovenia asymmetrically. Water from 80% of Slovenia's territory runs-off towards east and belongs to the Black Sea river basin or to the Danube river basin. Sub-basins of Sava, Drava, and Mura belong to it. Larger part of the Adriatic Sea river basin district belongs to the Soča river basin, and the rest to Adriatic rivers river basin with a direct estuary to the Adriatic Sea (Dragonja, Rižana).

The most important water courses in the area of the Municipality of Koper are: RIŽANA with tributaries, BADAŠEVICA with tributaries, and on the south edge of the municipality the upper part of DRAGONJA with tributaries. A general characteristic of all water courses are great fluctuations in the size of flows, because they are all (together with tributaries) very torrential. Especially the first two rivers, which flow down relatively short narrow valleys with torrent tributaries, which rise rapidly at heavy rain showers and with abundance of water bring into the main riverbed plenty of other material. Rižana and Badaševica are characterised by the presence of strong sea tide effects, especially at the estuary and partially in the downstream.

a) **Rižana** is a distinctive torrent; it flows in the sea northeast from Koper. The area of the karstic hinterland is 46,53 km^2, while Rižana encompasses 188,91 km^2. Its length is 13.5 km. Extreme quantities of flow are: the most of approx. 164 m^3/s and the least of approx. 200 l/s.

b) **Badaševica** is explicitly torrential, at the length 10,825 km and catchment area of 37,68 km^2. Badaševica tributaries have created numerous valleys and small valleys and in between there are hillocks and hills. They bring larger amounts of gravel and suspended material. After the completion of regulation and diversion to the south edge of Semedela Bonifika (Bonifika is a drained and improved land). Maximum flow is approximately 119 m^3 /s, while the flow in dry periods is equal to the biological minimum, which is regulated with the discharges from the Vanganel accumulation. Due to the fast rising of the flow at heavy rain showers, it represents (together with tributaries) a flood risk to agricultural areas in the Vanganel valley and the Šalara residential area.

   In the years of 1962 and 1963 a water accumulation Vanganel Barrier was built southeast from the Vanganel settlement. 4.2 ha of area were flooded and 230,000 m^3 of water accumulated, which serves for irrigation of agricultural areas and maintaining the biological minimum in the Badaševica.

c) **The seacoast** is 17.6 km long. Average depth of the inshore sea is 17 m. The main current goes along the whole shore in the direction from SW to NE.

   Even though the sea with its influences reaches deep in to the interior of the country, these are still most explicit at the coastal edge by the tides and waves. Waves that form as a result of strong winds (bora, sirocco, and mistral) reach a maximum height of 3.5 m and length of 10 m.

2.4. Topography

In the area of costal waters the forest was the primary natural vegetation, which man has changed with time. The forest was conserved only in higher parts, where there are not any natural conditions for agriculture due to steep slopes and worse land quality. Most of the forest is in the shady valley slopes, and it is mixed with pastures and meadows. Smaller complexes of the forest are scattered also among cultivated, there where the terrain is steeper. Medium-high trees and bushes prevail, mainly oak, and also beech. Individual evergreen sites are only in the vicinity of the coast.

In *Rižana and Badaševica river basin* meadow vegetation prevails in upper parts, and vegetables, crops, fruit trees, and vine in lower parts. In estuary areas there are enough of reeds and by riverbeds there are bushes, mainly willows and herbal plant species. Hinterland of river basins is covered mainly with tree-bush vegetation. Oak and hop hornbeam prevail among trees, and among bushes little ash tree, sumac, etc.
Meadow vegetation on flysch slopes and abandoned terraces, which hold the quick run-off of water, have an impact on the regulation of the precipitation run-off. For the Rižana and Badaševica river basin it is characteristic that they are well overgrown with forests, tree overgrow and bushes.

On the surface of the area, which belongs to Rižana and Badaševica river basins there are explicitly sedimentary rocks of the Tetide Sea from the cretaceous and older tertiary period, some freshwater and brackish tertiary sediments, and quaternary deposits. Sediments are partially carbonaceous: limestone and dolomite, partial clastic limy sandstone, marl, and slate clay. Quaternary deposits represent ground and crushed material of all these sediments. Cretaceous sediments are made explicitly of carbonate rock, older tertiary partially from limestone and partially from clastic rock in development of flysch like stratums. Areas of carbonate rock is strongly chipped, there is little vegetation on them. Areas of clastic rock are covered in some places with thick rich soil and on steep slopes the water carried away the humus cover and hollowed out numerous ditches and ravines. Water erosion did most damage to areas where marl prevails. Cretaceous and old-tertiary carbonate rock form anticlinal ridges, which rise above the rest of the area covered with Eocene clastic rock. Oldest formations, which come to the surface, are cretaceous stratums. In this area there are sediments, which have deposited during the lower cretaceous period: dark grey bituminous lime-stones, large grained dolomites, and dolomite breccia. Fossil remains are few and badly conserved. Sediments from upper cretaceous period are very rich with fossil remains.

Foraminifer lime-stones belong partially to Palaeocene and partially to Eocene. In Palaeocene there are also milioid and partially alveolinid-numulitid and operculina lime-stones. Lower part of stratums, which resemble flysch, is developed more limey, and in the middle and upper part marl and flint sandstones prevail.

Quaternary deposits are composed of lateral rubble, valley deposits of streams and rivers, sea-Holocene, and Aeolian sand. Sea-Holocene is actually also deposit of rivers and streams, but it deposited into the sea, which later retracted or the areas have been artificially drained.

In a geological-morphologic view the Slovene coast is divided on lower lying flysch hills, above which vast karst plateau rises. Sub-mountain karst sweeps towards the flysch hills in three structural levels. The Šavrini highlands are composed of Eocene sandstones and marl, and on the edges they are surrounded by a layer of Eocene lime-stones. These hills are very much distinct from the Karst, by the characteristics of the relief and nice green colour. Towards the west flysch rock prevails more and more and comprises the whole area towards the seacoast. Main rocks are sandstone and marl, fundamental components sand and clay with added limestone. Both rocks are badly resistant and decay rapidly under the influence of air and water. Weathering is swift and thus the erosion of slopes is strong. Cultured terraces with protective walls extenuate it in many places and there where there are no terraces (surroundings of Gradino and Pregara) bare flysch slopes are visible.

The shoreline is much subdivided: waters, which run out into the sea, have hollowed out valleys and gulfs into which they deposited sand and mud and so created vast coastal plains. And there where flysch layers extend to the sea, the sea quickly progressed in marl and created high steep walls and formed a cliff.

It follows from the above that the altitude motion of the municipality's area is relatively high. This way the town of Koper (old town centre) with the elevation above sea level of 12m is surrounded with depression area of Semedela and Ankaran bonifika, and Škocjnski zatok, which is being drained. Ridges rise gently towards the south and east – highest lying settlements somewhat exceed the height of 500m.

Flysch, non-carbonate rocks take up approx. 74% of the total Koper littoral area (334 km^2), lime-stones approx. 14%, and alluvial material along the coast and river valleys about the same share. The eastern part prevalently consists of humus accumulative soils (rendzine), which have mainly developed on a limey foundation and are considered to be the most sensitive soil. On the rest of the hill range cambisols are present, in particular eutric brown soils and carbonate brown soils on flysch, and hidromorf (alluvial soil) and hipogley in valleys of watercourses (Rižana, Badaševica).

2.5. Hydrology

Rižana catchment area extends beyond 200km^2. Rižana river basin encompasses a hill area to 500m of elevation above sea level. Geological substratum of tertiary sediments is cretaceous limestone and the deposits in valleys are of alluvial origin. On east, the flysch area crosses to the karst area with distinguishing limey walls.

Upper part of Rižana has features of a karst watercourse, which are gradually lost downstream by importing sediments from lateral torrents. The amount of water, which supplies Rižana, depends on water levels of groundwater, wetness of land, and Rižana tributaries. Rižana tributaries are karstic, short, steep, and have a torrential character.

Table 2: Characteristic flows of Rižana river basin.[1]

RIŽANE RIVER BASIN						
Watercourse	**Profile**	**Catchment area**	**Characteristic tributaries [m^3/s]**			
		F [km^2]	**Q_{min}**	**Q_{sr}**	**Q_{100}**	**Q_{20}**
Rižana	Kubed	203,65	0,08	5,09	131	100
Rižana	v.p. Bertoki	229,04	0,14	5,51	160	124
Rižana	estuary	235,01	0,14	5,60	164	-

Table 3: Characteristic flows of Rižana at the water-meter station Kubed II in the period 1966-1995.[2]

	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
sQs	5,14	5,61	5,30	5,47	3,73	3,14	1,02	1,16	2,48	4,49	5,96	5,90
nQs	0,914	1,222	1,169	1,214	0,929	0,688	0,279	0,255	0,299	0,580	0,690	0,878

sQs ... medium monthly flows
nQs ... the smallest medium monthly flows
medium annual tributary during the period under consideration: 4,11 m^3/s

[1] Water management groundwork of river basins of direct coastal waters tributaries (1993, VGI, unpublished)
[2] Water management groundwork of river basins of the slovenian coast (2002)

Table 4: Characteristic tributaries of Rižana at the water-meter station Kubed in the period 1999-2002.[3]

	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
sQs	3,79	3,40	4,20	5,46	1,69	0,98	0,59	1,15	2,54	2,88	6,75	4,58
nQs	0,868	0,568	0,525	0,827	0,606	0,149	0,107	0,097	0,131	0,557	0,718	0,948
vQs	13,605	14,863	18,515	20,950	5,081	6,365	4,643	10,574	16,333	15,340	20,933	16,345

sQs ... medium monthly flows
nQs ... the smallest medium monthly flows
vQs ... medium high monthly flows
medium annual tributary during the period under consideration: 3,l6 m^3/s

Length of *Badaševica* is 10,825km and the catchment area 37,68km^2. Badaševica tributaries have formed countless valleys and little valleys, and in between there are hills and hillocks. Badaševica tributaries bring larger quantities of gravel and suspended material. These streams have a small decline, riverbeds are overgrown with reeds, and despite individual up-keeping activities filling up is continuing, due to non-maintenance. These tributaries are of torrential nature, during summer the channels are mainly dry. Altitude of the river bed is up to 400m of elevation above sea level.

Table 5: Characteristic flows of Badaševica river basin.[4]

Side of the tributary	**BREAKDOWN OF WATER COURSES**	**F** km^2	**Q_{100}** m^3/s	**Q_{50}** m^3/s	**Q_{20}** m^3/s	**Q_{10}** m^3/s	**Q_5** m^3/s	**Q_2** m^3/s
	Badaševica to Nigrinjan	21,1	73,5	61,7	47,0	36,8	26,5	18,4
	Badaševica under Nigrinjan	22,9	79,4	66,7	50,8	39,7	28,6	19,9
	Badaševica to Pjažentin (Paderna)	26,8	93,7	78,7	60,0	46,9	33,7	23,4
	Badaševica under Pjažentin (Paderna)	33,5	117,5	98,7	75,2	58,8	42,3	29,4
	Badaševica to Olmo	34,2	118,0	99,1	75,5	59,0	42,5	29,5
	Badaševica under Olmo	37,7	119,0	100,0	76,2	59,5	42,8	29,8
	Badaševica estuary	38,3	119,0	100,0	76,2	59,5	42,8	29,8

Table 6: Characteristic tributaries of Badaševice at the water-meter station Šalara in the period 1999-2002.[5]

	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
sQs	0,300	0,197	0,276	0,619	0,274	0,106	0,028	0,023	0,307	0,308	0,484	0,367
nQs	0,096	0,068	0,063	0,317	0,077	0,015	0,006	0,010	0,010	0,053	0,108	0,115
vQs	0,985	0,812	1,365	1,538	1,605	0,531	0,162	0,446	1,919	2,645	2,503	1,520

sQs ... medium monthly flows
nQs ... the smallest medium monthly flows

[3] Source: Hydrological Yearbook of Slovenia 1999, Hydrological Yearbook of Slovenia 2000, Hydrological Yearbook of Slovenia 2001, Hydrological Yearbook of Slovenia 2002
[4] Water management groundwork of river basins of direct coastal waters tributaries (1993, VGI, unpublished)
[5] Source: Hydrological Yearbook of Slovenia 1999, Hydrological Yearbook of Slovenia 2000, Hydrological Yearbook of Slovenia 2001, Hydrological Yearbook of Slovenia 2002

vQs ... medium high monthly flows
medium annual tributary during the period under consideration: 0,273 m^3/s

2.6. Land uses

Structure of the land use in the discussed area is quite specific in comparison with the whole country. Biggest differences are in percentage of fields (including the category of gardens) and vineyards, which is 19.3% in the Municipality of Koper and 11.6% in the Republic of Slovenia. Considerably high is also the percentage of pastures, which is 28.2% in the Municipality of Koper and 7.3% in the Republic of Slovenia. On the other hand there is a very low share of forests in the Municipality of Koper, only 23.7%, while in the Republic of Slovenia this share is 54%.

2.7. Water management

The adoption of the EU Water Framework Directive, which is a binding part of legislation for the Republic of Slovenia as an EU member state, has clarified some important fundamentals for the design of water management policy and activities in the future.

The Water Act, which has been adopted in year 2002, represents the fundamental legislation for the implementation of water policy, confirms the main principles and purposes of the Directive, which are to ensure high quality of waters and water ecosystems. At the same time, it exceeds the requirements of the Directive by laying out the basis for water management, with regard to the protection of people and material goods from waters.
The main objectives of the Act are:

- the protection and use of waters in order to ensure the sustainability of this natural resource;
- water management on the basis of integral hydrographical areas, i.e. river basins;
- the introduction of an economic price for the use and pollution of waters;
- public participation in water management.

The main objectives in the area of water management are:

- the protection of wetland and coastal areas in order to ensure sufficient space for water and its dynamics;
- the limitation of development in areas which are endangered by floods;
- the appointment of public service providers who will be required to work in the public interest.

The objectives and contents of the Water Act should be interpreted and implemented in close connection with the Environment Protection Act and the Nature Protection Act as

well as with other relevant regulations. The most important future activities in this area are:

- the definition of new organisational, financial and expert foundations for water management;
- preparation of legal provisions and standards for water management;
- preparation of fundamental strategic documents (the National Water Action Plan and the Strategy for the Preparation of Water Management Plans);
- preparation of regional water management plans (an international obligation);
- preparation of water management plans for individual river basins as the basis for implementation of water policy.

2.7.1. Water uses

Koper municipality area is supplied with water from the Public Corporation Rižanski aqueduct Koper, which meets the needs of households (16,090 connections), needs of the economy and other consumers (1.200 connections), and currently covers 96 % of all requirements, while the rest are mainly satisfied with local plumbing and some of them with rainwater tanks and other resources.

There are 9 plumbing resources in the municipality (Podpeč, Bezovica, Loka, Kastelec, Socerb, Dvori pri Movražu, Olika, Rakitovec, and Zazid) where mostly all the water is delivered to, in the summer months. In the perspective, a gradual substitution or connection of local plumbing systems in a single system of Rižana plumbing is planned due to objective difficulties at ensuring quality of drinking water in these systems.

Rižana river source and Sečovlje, by way of Sečovlje received quantity of water contracted, from Gradole, and the transit plumbing Klariči – Kraški aqueduct represent the base of the water supply system of Rižanski aqueduct. The system operates on the basis of drawing water and that is why there are 25 pumping stations, 65 tanks, 114 spillways, and approximately 800 pipelines built in and laid the whole area of water supply. A constant regular delivery of electricity on all treatment plants and pumping stations is necessary for regular system operation. Interruption of delivering electricity means also an interruption of water supply, especially because the volume of tanks in the whole system is too small to cover the supply in case of longer power failure.

Main source of drinking water is the Rižana river source. Rižana and Osap River are characterised by high-water level karst sources (cave Grad and Zroček) where the supply area consists of Čičarija, south Brkini slopes, and even Pivka basin, as is shown by the trace experiments carried out by the Karst Research Institute from Postojna and the Geological Survey Institute from Ljubljana. According to the latter institute the Zroček precipitated rear area amounts to 183 square kilometres. Main underground accumulation of Rižana is situated under the anticlinal building of Slavnik, where it flows across the area between Zanigrad and Podpeč towards the source. Waters from the contact karst fields on the east part of the considered area flow into Mirna and Rižana River.

Water-reservoir area is much endangered, because it is crossed by very busy traffic routes such as Koper-Kozina main road, Aver-Sočerga and Kozina-Podgrad, and Koper-Kozina railway.

We can also mention the unregulated sewage network and inadequate use of fertilisers and pesticides in agriculture, as the source for endangering the water-reservoir area.

2.7.2. Waste water treatment

The settlement area, which directly burdens the Bay of Koper, is confined by river basins of Rižana (its surface part) and Badaševica.

Systematic construction of sewerage network in the city of Koper started in 1962. Collected waste water was meant to drain into the central WWTP through a mixed sewerage network. The present location of WWTP, determined in 1969, provides the most economical collection of waste water from the entire planning zone of Koper and from the immediate hinterland. In the beginning of nineties, they started to extend the central sewerage system (CSS) in the form of separated collection. Urban waste water is lead through sanitary channels to CSS and then to WWTP. Rainwater is discharged in the shortest way into the sea, surface watercourses and ravines through the rainwater sewerage system. At the entry, the rainwater channels are equipped with grit remover while there are no facilities for waste water treatment at the discharge into recipients. The cadastre of sewerage system is incomplete and it exists only for 75 km of channels. According to the representative of CSS management, maintenance of channels is carried out annually in the framework of appropriations.

At present, the following areas are provided with separated sewerage system: a greater part of the old town centre, a part of Semedela, a part of Žusterna, eastern part of Šalara and north-eastern part of Olmo.

Separated sewerage system exists in the following areas: northern part of the old town centre, the area next to the main reservoir of the city of Koper at the section from the pumping station 1 (PS1) to the WWTP, parts of Semedela, Žusterna, Šalara and Olmo, Bonifika Sports Park, industrial zone between Badaševica and Bonifika Sports Park and the Port of Koper. More than a half of the town catchment area is drained through the separated sewerage system.

The whole area of South Primorska is defined as a sensitive area and that is why stricter criteria for equipping agglomerations with drainage and treatment of municipal waste water systems apply to it. These criteria are tied to:

- lower boundary size of agglomeration in the light of settlement density (10 resident/ha instead 20 resident /ha, which is a limit value in insensitive areas),
- higher required degree of waste water treatment in sensitive areas for larger agglomerations (tertiary waste water treatment until 31. December 2008 in settlement areas with more than 10.000 PE).

Settlement areas with more than 10.000 PE in sensitive areas must be equipped with public sewage system and a sewage- treatment plant until 31. December 2008, and till then at least 95% of load, which is a result of waste waters in these areas.

2.8. Pressures and impacts

2.8.1. Point sources of pollution

2.8.1.1. Municipal waste water

The unfinished Koper WWTP represents the largest land-based source of pollution. The existing plant performs pre-treatment, mechanical treatment, anaerobic sludge digestion and pre-condensation by filter press. Other pollution sources are the municipal landfill and various illegal waste dumps. The major polluters in the hinterland of the Bay of Koper are settlements, hamlets, and agricultural activities. Some settlements have their own treatment plants and others are connected to Koper WWTP sewerage system. The existing waste water treatment plants do not provide tertiary treatment. Concentration of inorganic nitrogen in Rižana is high, which indicates the impact of leaching from the surrounding areas of intensive agriculture.

It can be noticed from the quality of waste water in WWTP that saltwater breaks into the sewerage system, but less frequently than in the past due to the improvements on the network. The usual concentration of salt at the inflow to the WWTP is 2,000 mg/l. Occasional intrusions of saltwater into the sewerage system, when concentration reaches over 4,000 mg/l, are the consequence not only of extremely high tide but also of smaller or larger damage to channels, some of which are largely deteriorated. The target value of 1,000 ml/l of salt at the inflow to the WWTP has not been reached yet. Measurements of chloride content in waste waters are carried out regularly. Moreover, a favourable ratio between COD and BOD5, which was on the average 3.7 some years ago and 2.8 in 2003, has also not been achieved. This indicates that the share of industrial waste water is falling, but the ratio is still slightly higher than in normal urban waste water.

At present, 53.000 PE are connected to central sewerage system of Koper. Only the first phase of WWTP has been constructed so far, with the capacity of 65,000 PE. It consists of: two automatic parallely working rakes, a spiral transporter for particles removed by rakes, piping for collection of cesspit water, a pumping station (PS) with submersible pumps, an aerated grit remover and a grease trap with scrapers, pumps for grit removal, a grit washing system, two primary settling tanks, a sludge thickener, a sludge digester and filter presses for dehydration with addition of polymers.

Waste water treated only mechanically, including also the primary settling tanks, is then gravitationally discharged into the Rižana river.

In addition to the sewerage system of Koper, the quality of seawater in the bay is subjected also to the impacts of the sewerage system of the city of Izola. Its impact is

direct, because untreated waste water flows directly into the sea through the existing channels. The sewerage system of Ankaran is smaller and it ends in the local treatment plant, which is occasionally overloaded. Therefore, its impact on pollution is lower. The impact of hinterland settlements is indirect and only roughly assessed, because they lag behind the abovementioned settlements as regards their connection to sewerage systems and surface area. Treated, partly treated and even untreated waste water from these areas are discharged first to surface watercourses and through them into the sea.

In the area of the Municipality of Koper, there are the following waste water treatment plants in function: central WWTP Koper, WWTP Škofije (2x), WWTP Ankaran, WWTP Podgorje, WWTP Žgani, WWTP Kubed, WWTP Movraž and WWTP Osp Gabrovica. Considering the financial and environmental aspects, it is possible and appropriate that besides the central settlements, their treatment plants accept waste water also from smaller surrounding settlements.

2.8.1.2. Industrial waste water

The major industrial polluters (Kemiplas, Celanese Polisinteza, Hidria Tomos, Alcan Tomos, and Port of Koper) have their own treatment plants, which perform various processes of pre-treatment of industrial waste waters. All major industrial polluters have treatment plants that generally treat industrial waste water until it reaches the criteria for discharge into the sewerage system.

Industrial entities, which are also legal persons liable for operational monitoring of waste waters, produce approx. 100,000 m3 of industrial waste water. Industrial waste water is generated also in smaller industrial plants and crafts industries which are not liable for operational monitoring. These quantities of industrial waste water are included in the total quantity of waste water.

All major industrial polluters perform operational monitoring, which in principle meets the minimum regulatory requirements in the field of environmental protection. However, at times they exceed the regulatory criteria in some parameters, such as: COD, BOD5, total suspended solids, settleable solids, pH value, toxicity, ammonium nitrogen, total hydrocarbons, non-volatile lipophile substances, AOX, LKCH, TOC, BTX, total phosphorus, total tensides, copper, nickel, chromium, mercury, zinc, cyanide, sulphates.

Specific remediation measures aiming at reduction of the environment contamination are currently running in most enterprises. In some of them, these measures are related to abandonment of particular environmentally harmful programmes, other enterprises are trying to modernise their technological processes, while the third group is purchasing more efficient equipment for treatment of emissions into the environment.

In recent years, the emission of substances from industrial sources into water has reduced substantially, due to the following reasons:

- some major polluters abandoned hazardous activities (Mlekarna Dekani (diary), Cimos varnishing plant, Kemiplas production of softeners, etc.);
- some major polluters changed their technologic processes and reduced emission of substances into water (Vinakoper – shift to non-refillable bottles, Tomos Hidria – powder varnishing, introduction of cyanide-free galvanisation, Lama Dekani, Port of Koper (Car Repair)- abandonment of old methods of deconservation, itd.;
- some major pollutants modernised their treatment plants (Tomos Hidria, Lama Dekani).

Table 7: Review of industrial polluters and waste water treatment.

Polluter	Location	Status	Pre-treatment	Plan
Alcan Tomos d.o.o.	Tomos-Koper	operating	existing	new TP
Avtoservis, d.o.o.	Koper - Port	operating	existing	new TP
Celanese Polisinteza d.o.o.	Dekani - Iplas	operating	existing	no plan
Cimos d.d.	Koper	operating	not existing	no plan
Citroen Slovenija d.o.o.	Koper.	operating	existing	no plan
Gold Koper d.d.	Koper	operating	not existing	no plan
Instalacija d.o.o.	Fuel storage	operating	existing	no plan
Intereuropa d.d.	Koper	operating	not existing	no plan
Kemiplas d.o.o.	Dekani - Iplas	operating	existing	relocation
Komunalna deponija	Surroundings	operating	existing	to central WWTP
Lama d.d.	Dekani	operating	existing	processing of sludge from TP
Luka Koper d.d.	Koper - Port	operating	existing	no plan
Mlinotest kruh Koper d.o.o.	Koper	operating	not existing	no plan
ÖMV Istrabenz d.d.	Fuel storage	operating	existing	no plan
Tomos Hidria d.o.o.	Tomos-Koper	operating	existing	no plan
Vinakoper d.o.o.	Koper	operating	not existing	non-refillable bottles

2.8.2. Diffuse sources of pollution

Downstream to the Rižana and Badaševica Rivers, there is an occasional increase of chemicals in dry periods related to industrial and urban pollution. Therefore, water used for irrigation sometimes exceeds the normative values stipulated by the law.

Uncontrolled dumps in the Municipality of Koper present a significant problem, which is most urgent in the area of local resources and especially in the area of water-protection zones of Rižana water catchment. The thing that is typical for locations of illegal waste dumps is that most of them are situated next to roads outside settlements, along routes, forest margins, ditches, ravines and skinholes, abandoned cesspools and quarries. No cadastre has been made yet; Commune of Koper only keeps records of so-called illegal waste dumps.

2.8.3. River water quality

Monitoring of surface water quality inside the Municipality of Koper is carried out at three monitoring points: Rižana - source, Rižana – Dekani, and Dragonja - Podkaštel. Comparison of common quality evaluation for mentioned monitoring points is set out below. Quality assessments (e.g. results of physical, chemical, and biological analysis) and criteria, according to which the waters were sorted into individual classes, are more detailed.

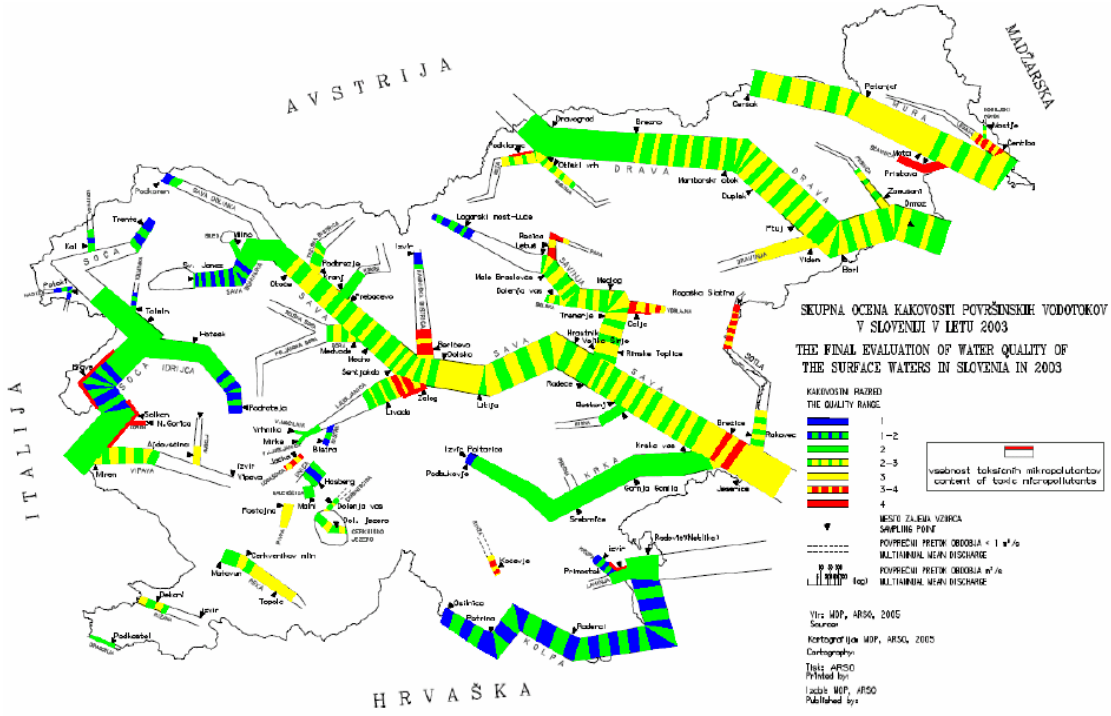
Table 8: Comparison of common quality evaluation of Rižane based on analysis at monitoring points Dekani and Rižana source.

Watercourse	monitoring point	Common evaluation								
		1995	1996	1997	1998	1999	2000	2001	2002	2003
Rižana	source	2	2 - 3	2 - (3)	2	2	2	1 - 2	2	-
	Dekani	2 - 3	(2) - 3	3 - 4	(2) - 3	3	3	2 - (3)	(2) - 3	2 - (3)

In 2005 the Municipality of Koper began implementing continued periodical monitoring of quality and physical parameters of Badaševica, at three sampling stations and canal Grande. Results indicate that the import of nutrients, heavy metal, and municipal sewage water in the river Badaševica and canal Grande is so intense that water quality at the estuary of Badaševica cannot be ensured, according to the required parameter threshold for bathing waters.

Map of Slovenia with common evaluations of surface watercourses:[6]

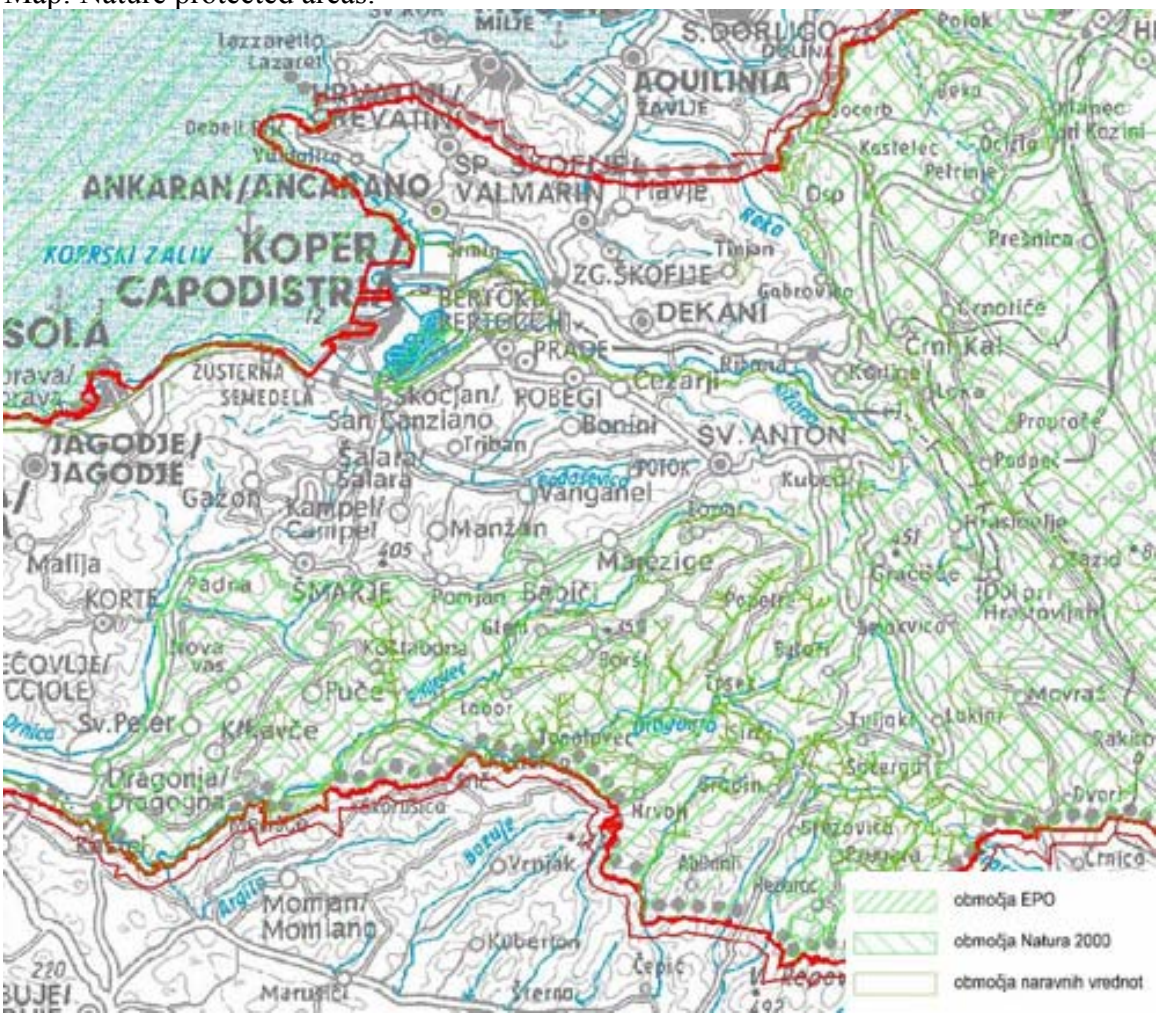
[6] Source: ARSO report: Monitoring of surface water quality in Slovenia for 2003


AVSTRIJA
MADŽARSKA
ITALIJA
HRVAŠKA
SKUPNA OCENA KAKOVOSTI POVRŠINSKIH VODOTOKOV V SLOVENIJI V LETU 2003
THE FINAL EVALUATION OF WATER QUALITY OF THE SURFACE WATERS IN SLOVENIA IN 2003
KAKOVOSTNI RAZRED
THE QUALITY RANGE
1
1-2
2
2-3
3
3-4
4
vsebnost toksičnih mikropolutantov
content of toxic micropollutants
MESTO ZAJEMA VZORCA
SAMPLING POINT
POVPREČNI PRETOK OBDOBJA < 1 m³/s
MULTIANNUAL MEAN DISCHARGE
POVPREČNI PRETOK OBDOBJA m³/s
MULTIANNUAL MEAN DISCHARGE
Vir: MOP, ARSO, 2005
Source:
Kartografija: MOP, ARSO, 2005
Cartography:
Tisk: ARSO
Printed by:
Izdala: MOP, ARSO
Published by:

3. Maps with the identification of vulnerable elements of the environment

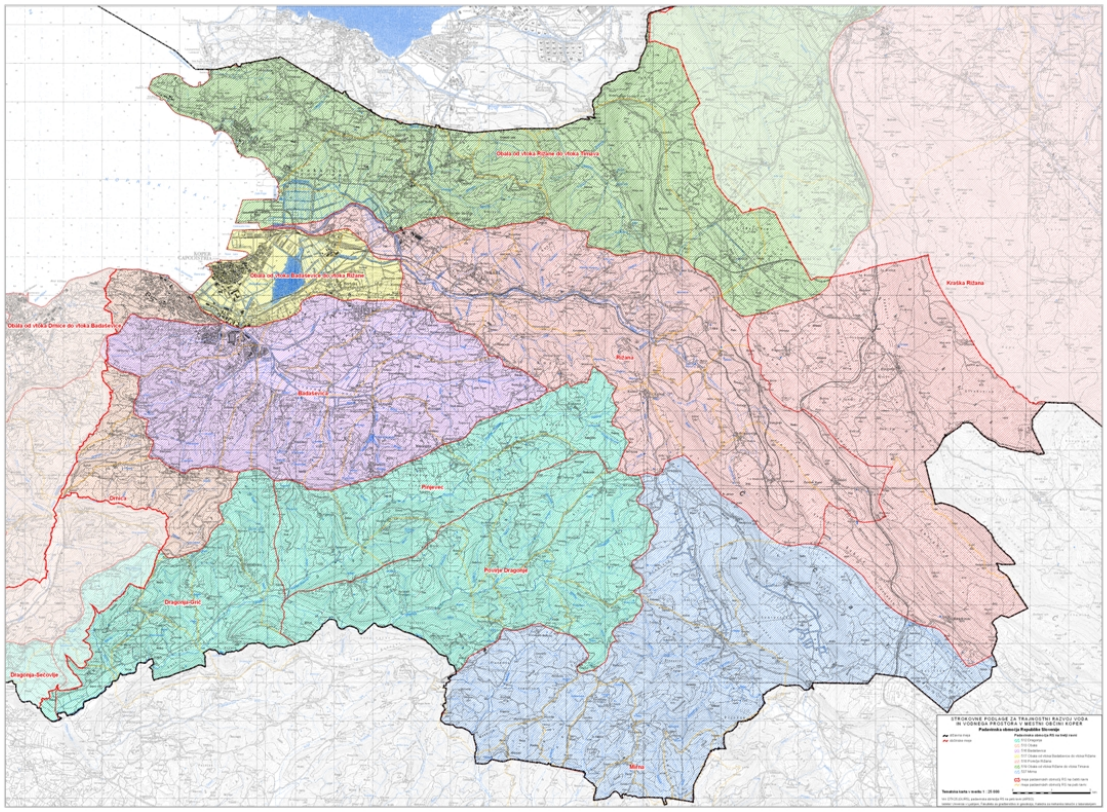
3.1. Local nature reserves and other protected areas

Map: Nature protected areas.

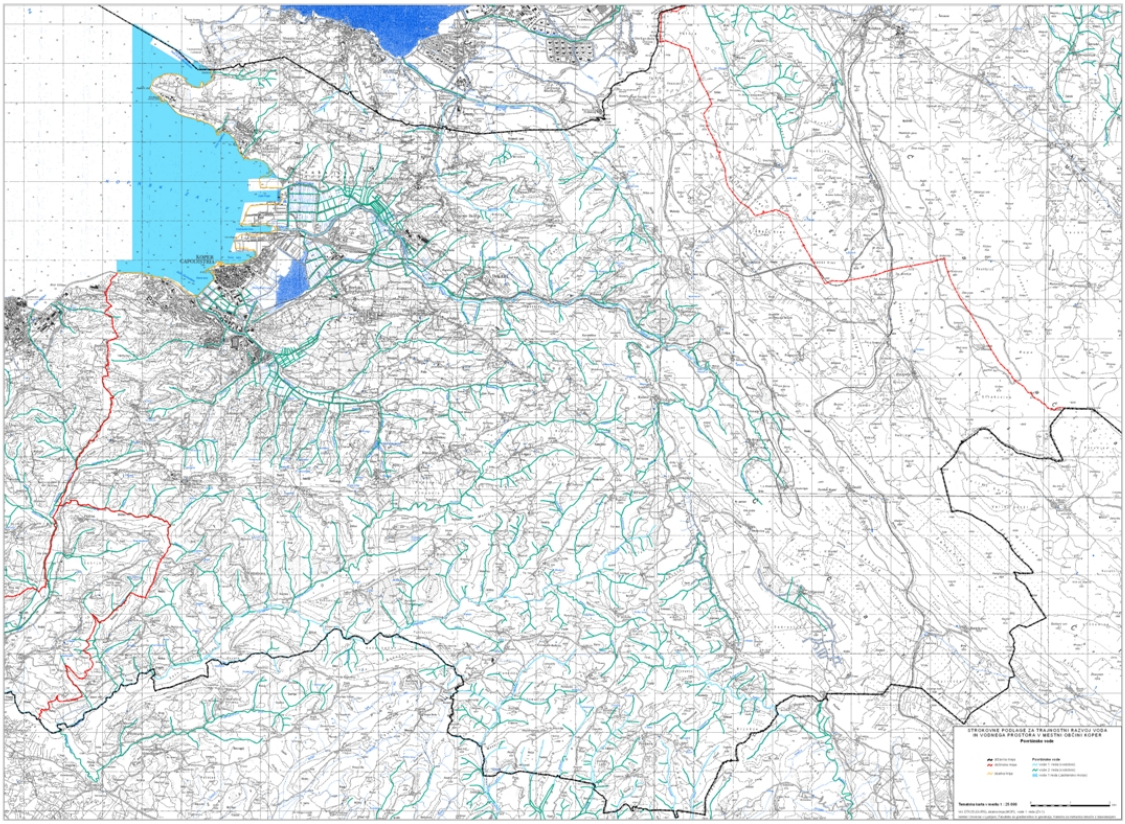


3.2. Water bodies and groundwater

Map: River catchment areas.

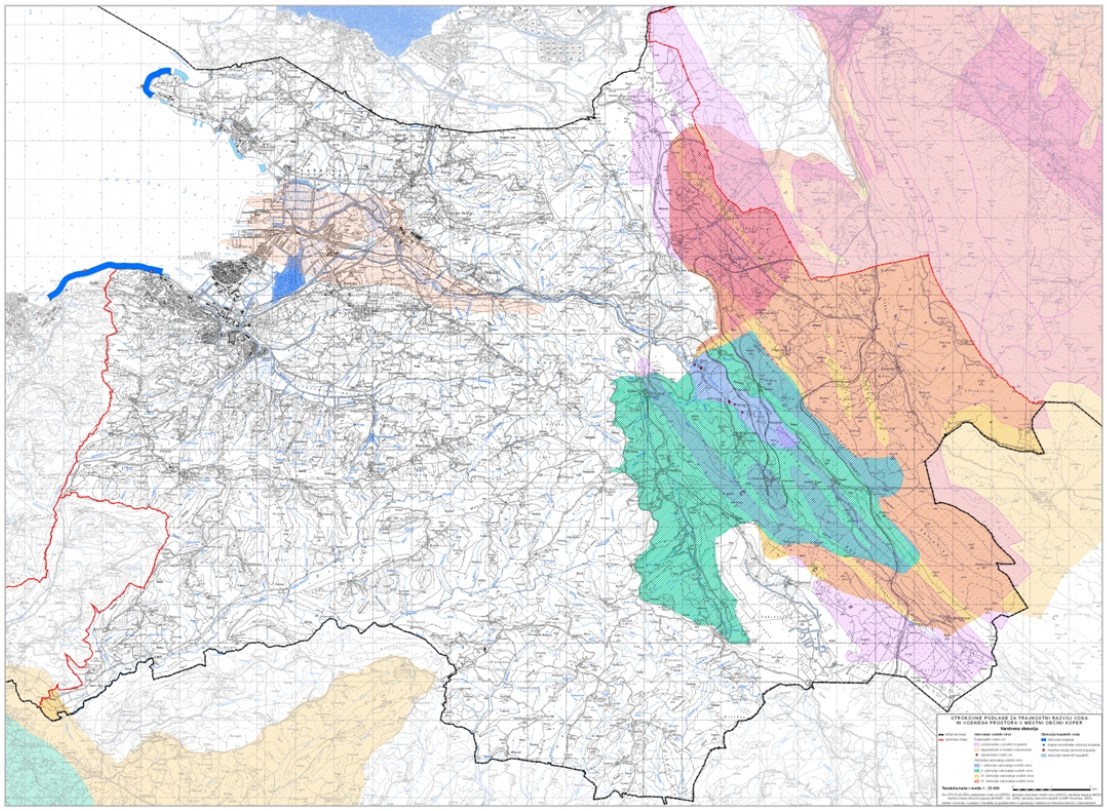


Map: Water bodies and ground water.



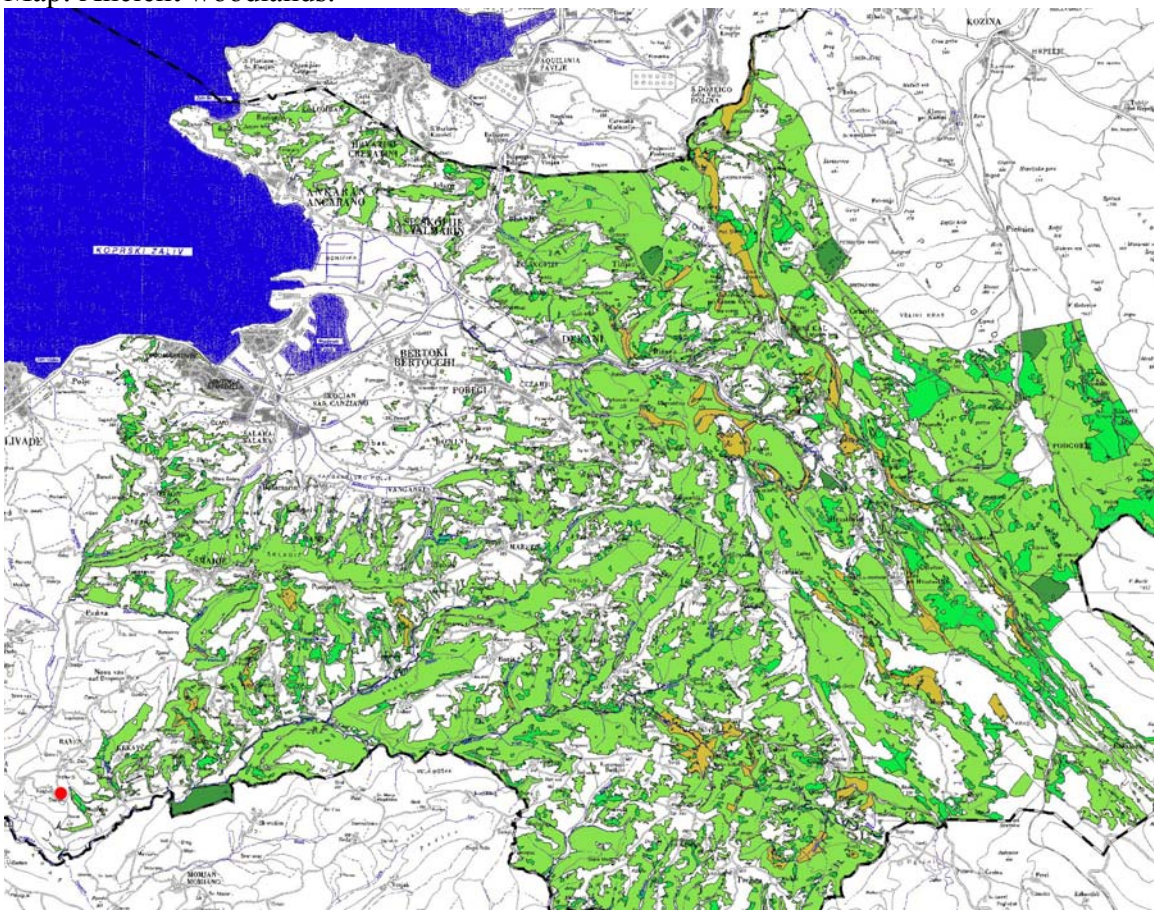
3.3. Water abstraction points

Map: Drinking water protection areas and drinking water abstraction points.



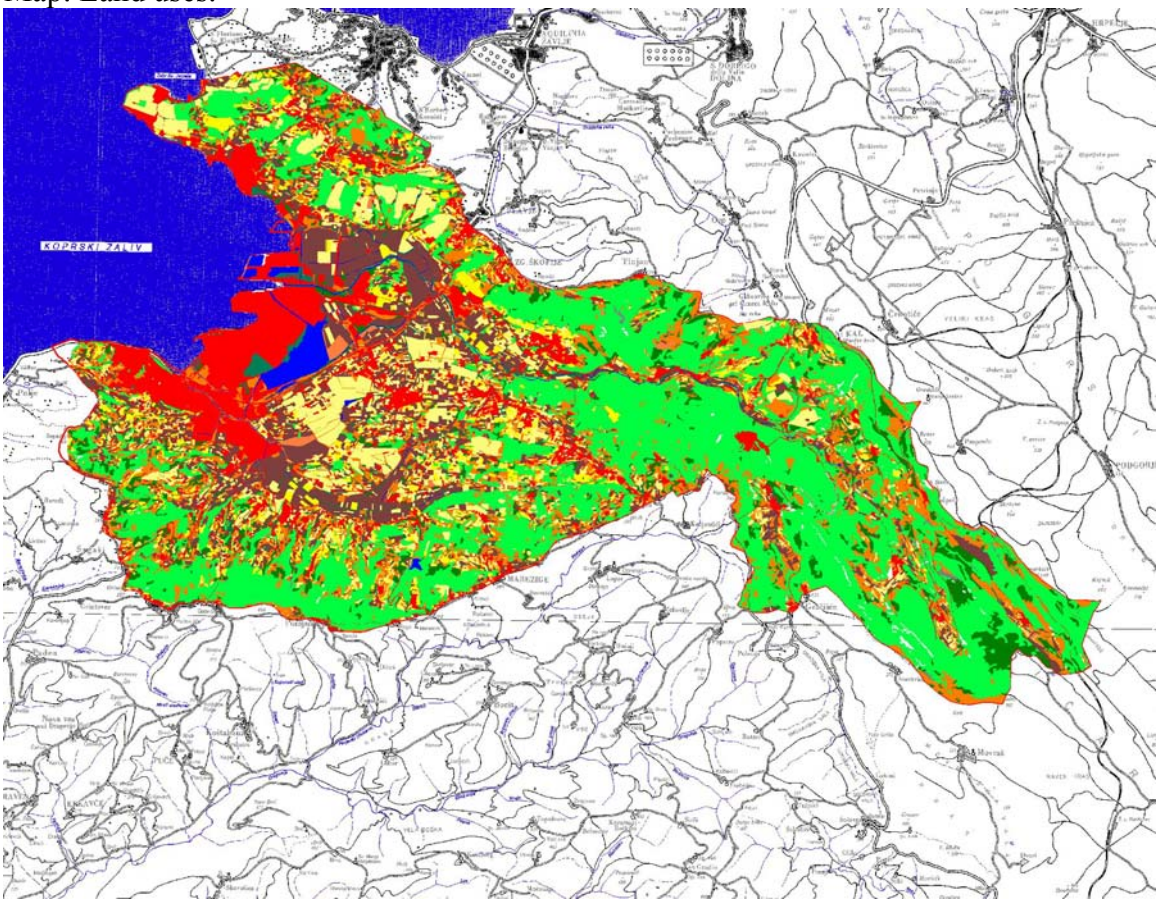
3.4. Ancient woodlands

Map: Ancient woodlands.



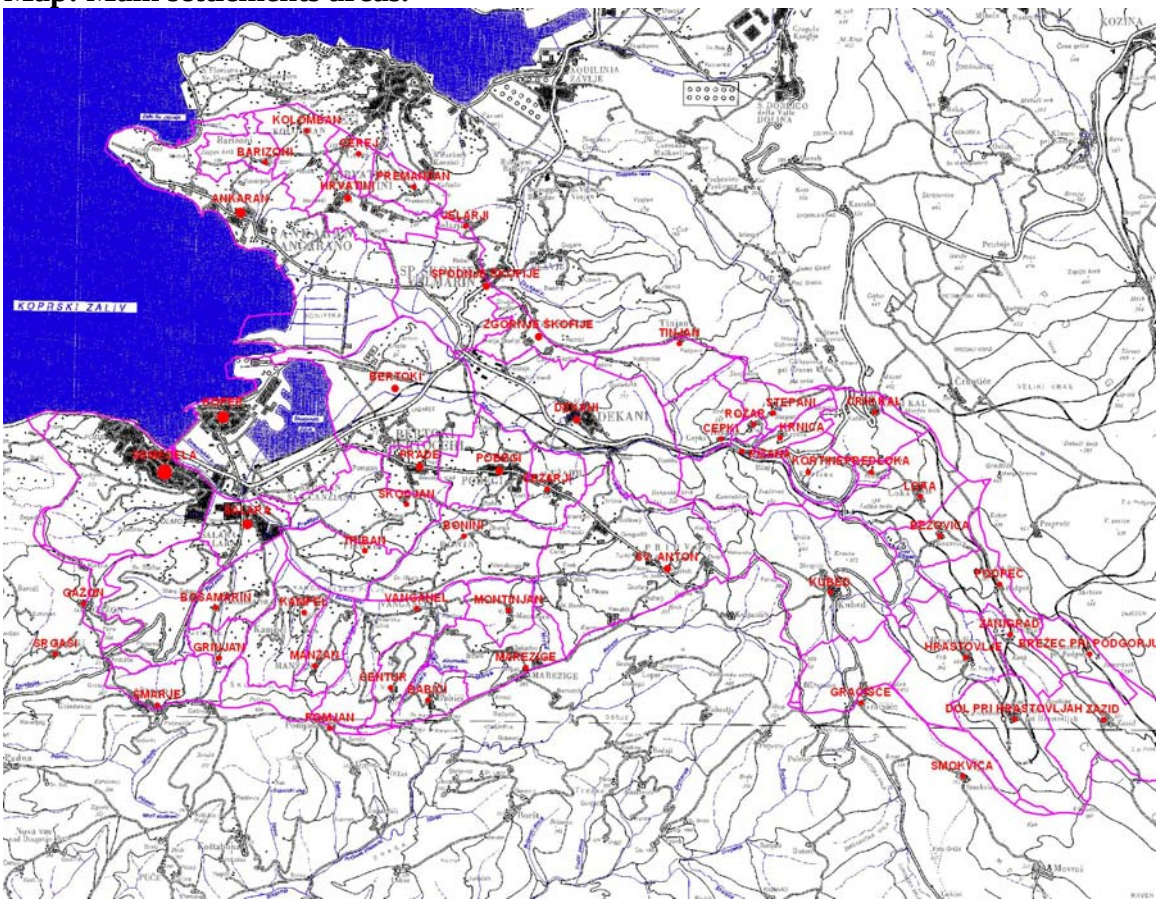
3.5. Land of economic importance (urban land, agricultural land)

Map: Land uses.



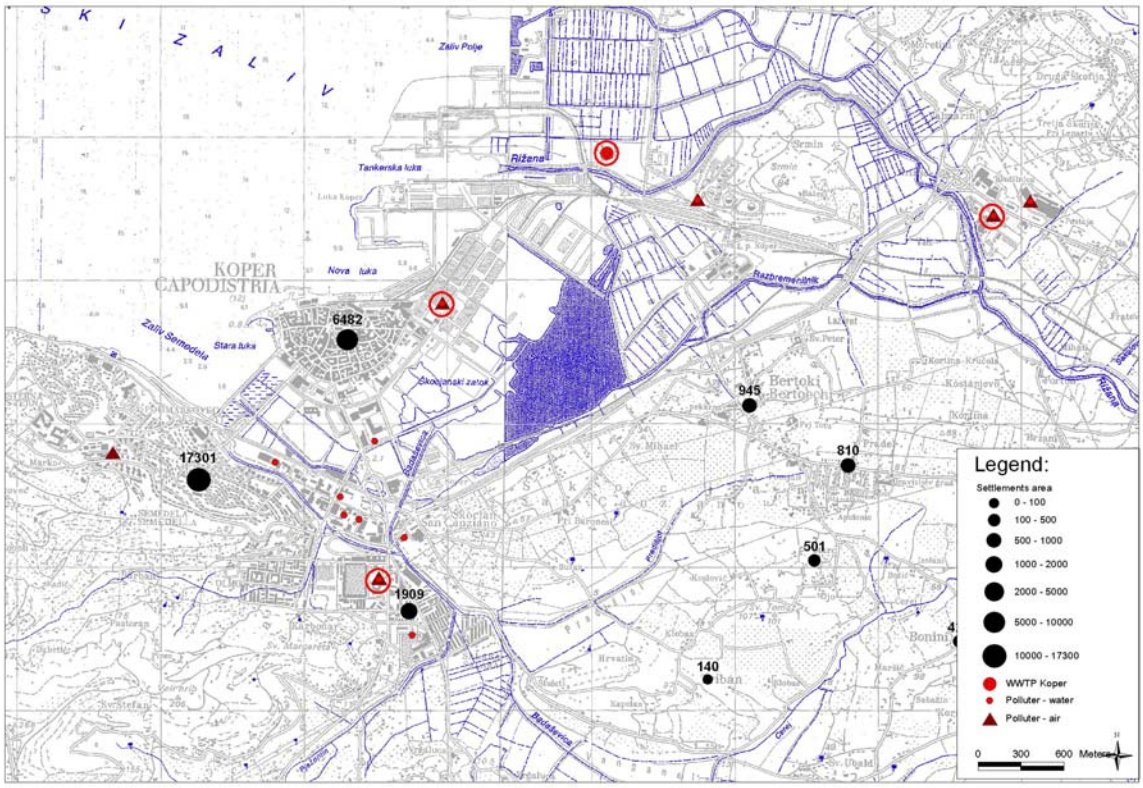
3.6. Human populations

Map: Main settlements areas.



3.7. Source point polluters

Map: Main polluters and main settlements areas.



3.8. Identification of particular sensitive receptors

Important nature protected areas regarding Habitats and Birds directive are included in map of nature protected areas in chapter 3.1.

4. Identification of routes (pathways)

Further explanation and assistance is needed.

5. Factors affecting the occurrence and behaviour of accidental releases in the environment

Further explanation and assistance is needed.

6. THE POTENTIAL ACCIDENTAL RISK

6.1. Characteristics of accidents with dangerous substances

Large quantities of different dangerous substances, which are present in the municipal area, constitute a continued source of hazard to people and the environment. It is a great and continued risk with consequences, which are difficult to foresee. Considering the location of use, production, processing, storage or transport of dangerous substances, we distinguish endangerment of:

- land and water course,
- sea and the narrower inshore strip, and
- atmosphere.

6.1.1. Land and water courses

Land and water courses are endangered with dangerous substances:

a) at transport of dangerous substances, which passes:
- along roads (main road section G1-10 Kastelec-Rižana is the most critical one)
- through railway traffic;

b) with operations of organizations, which in their operating process use, produce, process or storage dangerous substances.

Formation of a toxic cloud can cause contamination of people, flora and fauna in the near and far surroundings. Leakage of dangerous substances into the land in water-reservoir areas and the contamination of ground waters would cause uselessness of Rižana and local plumbing and also the possibility of extinction of aquatic life. Failure of Rižana resource shall mean a lack of drinking water, which will be very difficult to compensate. Leakage of dangerous substances directly in the watercourses would cause their contamination, kill of aquatic life, and a shorter or longer uselessness of water in agriculture and aquaculture. Land and plants in the accident area would also be directly endangered due to the leakage of dangerous substances into the environment. Level of endangerment is in all the mentioned cases great, mostly with long-term and irreparable consequences. It depends on the type and the quantity of the dangerous substance, which goes out of control, and of weather conditions.

6.1.2. Sea and the narrower inshore strip

Sea and the narrower inshore strip are endangered by:

- cargo of dangerous substances, which arrives in Port of Koper,
- direct leakage of dangerous substances from ships,
- activities, which include dangerous substances on the mainland with a possible spillage or release into the sea.

Type, form, and level of endangerment are directly conditional and dependent on quantity and type of dangerous substance, which could leak, and Hydrometeorological conditions. We estimate that the level of endangerment is great, due to large quantities of dangerous substances, which emerge in this area and the catastrophic consequences, which would be caused by any bigger pollution of the sea and parts of the coast in mariculture and tourist economy.

Significant part of the economy on the Slovene coast is vitally dependent on the clean sea. Any major pollution in these parts of the coast could evoke ecological damage difficult to repair and the loss of income in the tourist economy and fishery. Exceptionally, the spill of chemicals into the sea can cause a formation of harmful gases, which could directly compromise the population. Consequences of smaller pollution are limited and of local relevance. Ecological disaster, which would entail a large emission of dangerous substances into the sea aquatorium, would have catastrophic consequences, which would endanger mainly living conditions of marine life and natural heritage. Consequences would be severe, long-lasting, and their rehabilitation would be very demanding.

6.1.3. Atmosphere

Fatalities and deaths would occur at the directly affected – contaminated workers, residents and other people, and animals. Others, which would be reached by the consequences of the accident, would suffer bigger or smaller (depends on the distance and the type of dangerous substance) injuries of the respiratory system. Result of the accident would be larger or smaller contamination and uselessness of the affected land and watercourses. In case of an accident at the water-reservoir area there is a potential hazard of polluting groundwater resources and also the most important one among them – Rižana.

Endangerment of the atmosphere may occur due to accidents with dangerous substances as well as on the mainland as on the sea and the narrower inshore strip, because of the emissions of dangerous substances into the air. At such accidents weather conditions (wind) have a substantial effect on the endangerment of the environment and the population.

6.2. The most endangered areas by accidents with dangerous substances

Considering the great frequency of transport of dangerous substances both by sea and land (road, railway), and also the large quantities of dangerous substances, which are stored, processed or manufactured by the labour organizations it is estimated that **accidents with dangerous substances are very likely to happen**. Although with minor consequences there is also a high likelihood of deliberate pollution (emissions from ships, unsuitable handling with hazardous waste - sprays) and pollution due to inappropriate use

and storage of dangerous substances in households (heating oil) and agriculture. This is, not least, also confirmed by the statistical data as we record one or two larger accidents with dangerous substances annually.
There is a large probability of a traffic accident with the spillage of dangerous substances in a water-reservoir area. Such accidents have already happened but fortunately without effects to the drinking water.

At the examination of critical points, which in the municipal area present a potential threat of accidents with dangerous substances, we need to point out:

- Quantities of dangerous substances in Port of Koper, Kemiplas plant at the Ankaran crossing, and storage facility of fuel and gas under Srmin constitute the biggest potential threat of accidents with dangerous substances with possible immediate effects, which would reflect in densely populated areas and in the wider environment.
- Cargo of dangerous substances on traffic routes (road and rail traffic) presents a very large potential threat of an accident with possible immediate and long-term severe consequences for the wider area of the municipality. Great density of dangerous substance transport and the alignment of (old) main road across the water protection zone present great vulnerability of drinking water sources.
- Potential threat of a catastrophic marine and coast pollution with oil and petroleum products constitutes danger with long-term effects to the coastal tourist economy and the mariculture.

6.3. Inventory of potential accidental risk spots

Those who constitute the greatest hazard for industry accidents are:

- Instalacija d.o.o. Koper, Sermin 10/a, 6000 Koper
- Istrabenz plini d.o.o. Koper, Sermin 8/a, 6000 Koper
- Luka Koper d.d., Vojkovo nabrežje 38, 6000 Koper
- Istrabenz plini d.o.o., Dolinska cesta nm, 6000 Koper
- Kemiplas, kemična industrija in trgovina, d.o.o., Dekani 3/a, 6271 Dekani

Name of the company

LUKA KOPER D.D.

Location

Vojkovo nabrežje 38, 6501 Koper, Slovenia

Port of Koper comprises an area northeast from the town of Koper and it borders directly with the old town centre. Around the area of the Port there are settlements, which hold the highest concentration of population in the Municipality of Koper (old town centre, Semedela, Žusterna, Olmo-Prisoje, Šalara, Bertoki-Prade, Ankaran). There are approximately 25,000 residents in this area, here are the most important businesses and infrastructure, and most of the economical organizations – all this within the radius of 3 km from the Port.

Geographical co-ordinates

Recipient river

All these dangerous substances go through the Port in direct manipulation (as at explosives) or they are temporarily stored in port facilities. All in all, there is a conclusion that there is a potential threat of accidents with dangerous substances in the Port, which may be of danger for the:

- Port area – at each uncontrolled release of dangerous substances
- Environment outside the Port – at a strong emission of poisonous and harmful gas or smoke
- Coastal sea – at running-off or washing out dangerous substances from port facilities in the ground or directly into the sea

Type of activity of the company

Luka Koper provides port and logistics services in the Port of Koper.

Type of dangerous substances and toxic properties

- Chemicals of different types and variable quantities on the Liquid cargo Terminal (possible chemicals: acetone, butyl acetate, butanol, ethyl acetate, isobutanol, isopropanol, xylene, methanol, styrene, toluene, vinyl acetate, ethanol, hexane, methyl-ethyl ketone, and phosphorous acid)
- Explosive substances (1.1 class), in direct manipulation (wagon or truck-ship, or vice versa), quantities up to 100 tonnes at once
- Oil and petroleum products and other flammable material, radioactive material, corrosive substances, toxic substances, and other dangerous substances in different quantities
- gas oil, Jet A-1 (jet fuel), orthoxylene, phosphorous acid, ethanol, ammonia, toxic gases at combustion, soot

Dangerous substance	Toxic properties
Acetone	**Inhalation:** sore throat, cough, confusion, headache, dizziness, drowsiness, unconsciousness. **Skin:** dry skin. **Eyes:** redness, pain, blurred vision, possible corneal damage. **Ingestion:** nausea, vomiting (further see Inhalation).

Butyl Acetate	R10: Flammable. R20/21: Harmful by inhalation and in contact with skin.
Butanol	**R12**: Extremely flammable **R19**: May form explosive peroxides **R22**: Harmful if swallowed **R66**: Repeated exposure may cause skin dryness or cracking **R67**: Vapours may cause drowsiness and dizziness
Ethyl Acetate	**Inhalation:** Inhalation can cause severe irritation of mucous membranes and upper respiratory tract. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. High concentrations may cause lung damage. An irritant to the nose, throat, and upper respiratory tract. Exposure to high concentrations has a narcotic effect and may cause liver and kidney damage. **Ingestion:** Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhoea. **Skin Contact:** Causes irritation to skin. Symptoms include redness, itching, and pain. Repeated or prolonged contact with the skin has a defeating effect and may cause dryness, cracking, and possibly dermatitis. **Eye Contact:** Causes irritation, redness and pain. **Chronic Exposure:** Chronic overexposure may cause anaemia with leukocytes (transient increase in the white blood cell count) and damage to the liver and kidneys. **Aggravation of Pre-existing Conditions:** Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance.
Isobutanol	**Inhalation**: Cough. Dizziness. Drowsiness. Headache. **Skin**: Dry skin. **Eyes**: Redness. Pain. Blurred vision. **Ingestion**: Diarrhoea. Nausea. Vomiting (further see Inhalation).
Xylene	Effect of xylene on the central nervous system is comparable with other organic solvents. Inhalation of larger concentrations leads to headache, fatigue, irritation to the respiratory tract, gastrointestinal damages, in extreme cases to loss of conscience and death.
Methanol	**Inhalation:** cough, dizziness, headache and nausea. **Skin:** dry skin, redness (may be absorbed!) **Eyes:** redness, pain. **Ingestion:** abdominal pain, shortness of breath, unconsciousness, vomiting (further see Inhalation).
Styrene	Possible human carcinogen.

Toluene	Increased risk of developing chronic respiratory system diseases in children and maybe also development of some cancerous diseases.
Vinyl acetate	**Inhalation:** at room temperature health hazard is negligible. Avoid inhalation of vapours and aerosols. **Skin:** repeating or longer exposure may degrease skin, which causes irritation and dry skin. **Eyes:** contact with eyes causes temporary redness and pain. **Ingestion:** no data available.
Ethanol	**Inhalation**: Cough. Drowsiness. Headache. Fatigue. **Skin**: Dry skin. **Eyes**: Redness. Pain. Burning. **Ingestion**: Burning sensation. Confusion. Dizziness. Headache. Unconsciousness.
Hexane	Preparation may be very flammable – already at temperatures lower than 0°C. In contact with skin the preparation acts corrosive – it causes slight skin burns, rash in skin defects. When inhaling vapours may cause drowsiness and dizziness. Toxic to aquatic organisms: may cause long-term harmful effects on aquatic environment.
Methyl-ethyl ketone	Cardiovascular or blood toxicant, development toxicant, gastrointestinal or liver toxicant, kidney toxicant, neuro toxicant, reproductive toxicant, respiratory toxicant, skin or sense organ toxicant.
Phosphorous acid	**Inhalation:** burning sensation, cough, laboured breathing, shortness of breath, sore throat, unconsciousness (symptoms may be delayed). **Skin:** redness, pain, blisters. **Eyes:** redness, pain, blurred vision, severe deep burns. **Ingestion:** abdominal cramps, burning sensation, confusion, laboured breathing, sore throat, unconsciousness, weakness.
Amount of the handled (stored) dangerous substances	

Name of the company
KEMIPLAS D.O.O.,
Location
Dekani 3a, Dekani Kemiplas – Chemical industry production plants are placed in the direct surroundings of Ankaran crossing, where main roads Koper-Ljubljana and Koper-Trieste cross on the east side. In close vicinity, on the south side, there is also a railway line Koper-Kozina. The most densely populated area (town of Koper) is distant approximately 4.5 km of air distance in the southwest direction. Nearby (to 600 m of air distance) are also Dekani Cold store, Dekani Dairy factory, Lama factory, and the gas station OMV-Istrabenz.
Geographical co-ordinates
Recipient river
At uncontrolled discharge of dangerous chemicals, the pollution of lower stream of the Rižana river may occur
Type of activity of the company
Chemical industry & Trade
Type of dangerous substances and toxic properties

Until now there haven't been any larger accidents with dangerous substances in the area of Kemiplas plant, which would endanger or harmfully affect the health of workers or people outside the plant area. On occasion there are emissions of very smelly (possibly even harmful) gases, which are sensed in the wider area of the plant (Bivje crossing, Lama factory, Dekani village, Spodnje Škofije settlement).

The specified quantities of dangerous substances, which are present in the plant area constitute a potential threat of accidents, which can harm:

- Health and life of factory workers
- At strong emissions of toxic and harmful gases or smoke: traffic through the Ankaran crossing
- Traffic along the railway track, nearby cold store, dairy factory, Lama factory, gas station
- More remote populated areas
- At uncontrolled discharge of dangerous chemicals, the pollution of lower stream of the Rižana river may occur.

Dangerous substance	**Toxic properties**
Orthoxylene	Increased risk of developing chronic respiratory system diseases in children and maybe also development of some cancerous diseases.
Anhydride of phthalic	Danger of fire and explosion:

acid	Flammable solid substance. At heavy heating the fumes and the air form an explosive mix. Health hazard: Harmful if swallowed. Vapours severely irritate the eyes and respiratory tracts. The melt causes burns (melt temperature > 130^{o}C) APA at presence of humidity causes cracking of skin, which heals difficultly
Vinyl acetate	Increased risk of developing chronic respiratory system diseases in children and maybe also development of some cancerous diseases.
Sulphur dioxide	Irritating to respiratory system.
2-ethylhexanol	May irritate the skin and eyes. Inhalation may irritate the respiratory tract.
Butanol	R12: Extremely flammable. R19: May form explosive peroxides. R22: Harmful is swallowed. R66: Repeated exposure may cause skin dryness or cracking. R67: Vapours may cause drowsiness and dizziness.
Hydrazine hydrate	Toxic, and may be fatal, if inhaled, swallowed or absorbed through the skin. Expected to be a human carcinogen. Eye contact may cause serious damage. May cause CNS, eye, liver, kidney and lung damage. Possible sensitizer. Corrosive. Material is very irritating to respiratory tract, even at low concentrations.
Tetrabutyl-titanate	
Ammonium hydroxide	**Inhalation:** burning sensation, cough, laboured breathing, shortness of breath, sore throat. **Skin:** corrosive, redness, serious skin burns, pain, blisters. **Eyes:** corrosive, redness, pain, blurred vision, severe deep burns. **Ingestion:** corrosive, abdominal cramps, abdominal pain, sore throat, vomiting (further see Inhalation).
Maleic acid	R22: Harmful is swallowed. R36/37/38: Irritating to eyes, respiratory system and skin.
Maleic anhydride	Harmful if swallowed. Causes burns (melt temperature > 52^{o}C) Can cause respiratory sensitisation and sensitisation in contact with skin.
Ethyl Acetate	**Toxicity**: oral, dermal, inhalation **Irritation**: eyes, skin
Toluene	Increased risk of developing chronic respiratory system diseases in children and maybe also development of some

	cancerous diseases
Hydrochloric acid	**Ingestion**: severe irritation of mucous membranes, toxic **Inhalation**: toxic fumes, irritation of respiratory system **Skin**: can cause burns **Eyes**: dangerous
Sodium hydrochloride	Very corrosive. Causes severe burns. May cause serious permanent eye damage. Very harmful by ingestion. Harmful by skin contact or by inhalation of dust.
Sodium hydroxide (40 %)	**Inhalation:** burning sensation, cough, laboured breathing. **Skin:** corrosive, redness, serious skin burns, pain. **Eyes:** corrosive, redness, pain, blurred vision, severe deep burns. **Ingestion:** corrosive, abdominal pain, burning sensation, collapse.
Heating oil	Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, light-headedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapours for long periods may cause kidney damage and lower your blood's ability to clot. Drinking small amounts of kerosene may cause vomiting, diarrhoea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

Amount of the handled (stored) dangerous substances

According to the data from the end of 1995 the following dangerous substances in the manufacturing process of Kemiplas plant are:

Dangerous substance	**Current stock**
Orthoxylene	6600 m3
Anhydride of phthalic acid	490 m3
Vinyl acetate	100 m3
Sulphur dioxide	20 m3
2-ethylhexanol	200 m3
Butanol	50 m3
Hydrazine hydrate	500 kg
Tetrabutyl-titanate	1500 kg
Ammonium hydroxide	600 kg
Maleic acid	450 m3
Maleic anhydride	30 m3
Ethyl Acetate	12 m3

Toluene	12 m3
Hydrochloric acid	15 m3+900 kg
Sodium hydrochloride	10 m3+1000 kg
Sodium hydroxide (40 %)	25 m3
Heating oil	760 m3

All these chemicals are stored in underground and aboveground reservoirs, in various containers (liquid) or as solid substances (grained or in powder) in an appropriate packaging, in the area of the plant.

Name of the company

INSTALACIJA d.o.o.

Location

Srmin 10a, Koper

It lies on the west slope of Srmin hill, approx. 3 km of air distance northeast of Koper's old town centre.

Geographical co-ordinates

Recipient river

All reservoirs are in leak proof concrete collecting containers. Uncontrolled leakage of larger quantities of petroleum products from reservoirs and collecting containers could pollute ground water in the west part of Ankaran bonifika and the coastal sea in the northeast part of the Bay of Koper.

Type of activity of the company

Storage and transhipment of petroleum products.

Type of dangerous substances and toxic properties

Dangerous substance	Toxic properties
Gas oil	
Petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
Leadless petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis

Amount of the handled (stored) dangerous substances

In aboveground steel reservoirs it is possible to store:

- gas oil D2 50.000 m3
- petrol 45.000 m3
- leadless petrol 18.000 m3

Name of the company

ISTRA BENZ PLINI D.O.O. KOPER

Location

Srmin 8a, Koper

It is located south from the Koper cargo railway station (in immediate vicinity), alongside the local road Bertoki-cargo railway station. It is approximately 3 km east from the town of Koper and 500 m from Bertoki settlement.

Geographical co-ordinates

Recipient river

Uncontrolled leakage of larger quantities of petroleum products from reservoirs and collecting containers could pollute ground water in the west part of Ankaran bonifika and the coastal sea in the northeast part of the Bay of Koper.

Type of activity of the company

Distribution of gas fuels by pipeline network.

Type of dangerous substances and toxic properties

Dangerous substances	**Toxic properties**
Butane-propane	At low concentrations is essentially non-toxic. At high concentrations, it can cause depression of the central nervous system (CNS) with symptoms such as headache, nausea, dizziness, drowsiness and confusion
Carbon dioxide	Increased concentrations of carbon dioxide replace the oxygen content of the mine air thus producing a toxic atmosphere. ***Health Effects:*** At 5 %, stimulated respiration. At 7 % to 10 %, unconsciousness after few minutes of exposure.
Acetylene	R5: Heating may cause an explosion. R6: Explosive with or without contact with air. R12: Extremely flammable.
Liquid oxygen	Irritating, allergic, toxic, carcinogenic.
Liquid argon	Is odourless & non-toxic, but may produce suffocation by diluting the concentration of O2 in air below levels necessary to support life.
Liquid nitrogen	**Inhalation:** Simple asphyxiant.

	Eye contact: Tissue freezing and severe cryogenic burns if contacted into eyes. **Skin contact:** Tissue freezing and severe cryogenic burn of skin. **Chronic effect:** None established.
Chlorine	Chlorine reacts with organic matter in drinking water to produce trihalomethanes, which may cause cancer and possibly developmental effects. Exposure to extremely high levels of pure chlorine gas can cause lung collapse and death. Exposure to high levels can cause pulmonary edema, rapid breathing, wheezing, blue coloring of the skin, vomiting, anxiety, accumulation of fluid in the lungs, severe eye and skin burns, loss of vision, and lung pain. Exposure to low levels of pure chlorine gas is irritating to the respiratory tract, eyes, and skin. Exposure can cause sore or swollen throat, coughing, choking, sneezing, pneumonia, chest tightness and pain, headache, dizziness, watery eyes, blurred vision, nausea, vomiting, vomiting blood, severe abdominal pain, skin blisters and irritation, difficulty breathing, and pain or burning in the stomach, nose, eyes, ears, lips, or tongue. If your skin touches pure liquid chlorine, you can get frostbite. Some people may develop an inflammatory reaction to chlorine called reactive airways dysfunction syndrome, a type of asthma.
Ammonia	**Inhalation:** burning sensation, cough, laboured breathing, shortness of breath, sore throat. **Skin:** corrosive, redness, serious skin burns, pain, blisters. **Eyes:** corrosive, redness, pain, blurred vision, severe deep burns. **Ingestion:** corrosive, abdominal cramps, abdominal pain, sore throat, vomiting (further see Inhalation).
Petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory

	diseases, dermatitis
Leadless petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
Gas oil D2	
Gas oil D1	
Heating oil	Irritating, allergic, toxic, carcinogenic
Motor petroleum	
Pure gasoline	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
White spirit	Fatal, if ingested.

Engine fuel for vehicles (gasoline and diesel), CO and soot at burning.

Amount of the handled (stored) dangerous substances

Storage facilities enable the storage of the following quantities of dangerous substances:

Dangerous substance	Quantity in m^3
Butane-propane	450
Carbon dioxide	50
Acetylene	500
Liquid oxygen	30
Liquid argon	27
Liquid nitrogen	12
Chlorine	1200
Ammonia	750

Beside the mentioned the following quantities are stored at this location (capacity of reservoirs is mentioned, average stock is approx. 60% of capacity):

Dangerous substance	Quantity in m^3
Petrol	50
Leadless petrol	150
Gas oil D2	100
Gas oil D1	50
Heating oil	150
Motor petroleum	75
Pure gasoline	25
White spirit	50

The stated stock is stored in suitable two-layer reservoirs.

Name of the company
ISTRA BENZ PLINI D.O.O.
Location
Dolinska cesta nm, 6000 Koper
Geographical co-ordinates
Recipient river
Type of activity of the company
Distribution of gaseous fuels.
Type of dangerous substances and toxic properties

Engine fuel for vehicles (petrol and diesel), CO and soot at burning.

Dangerous substances	**Toxic properties**
Butane-propane	At low concentrations is essentially non-toxic. At high concentrations, it can cause depression of the central nervous system (CNS) with symptoms such as headache, nausea, dizziness, drowsiness and confusion
Carbon dioxide	Increased concentrations of carbon dioxide replace the oxygen content of the mine air thus producing a toxic atmosphere. ***Health Effects:*** At 5 %, stimulated respiration. At 7 % to 10 %, unconsciousness after few minutes of exposure.
Acetylene	R5: Heating may cause an explosion. R6: Explosive with or without contact with air. R12: Extremely flammable.
Liquid oxygen	Irritating, allergic, toxic, carcinogenic.
Liquid argon	Is odourless & non-toxic, but may produce suffocation by diluting the concentration of O2 in air below levels necessary to support life.
Liquid nitrogen	**Inhalation:** Simple asphyxiant. **Eye contact:** Tissue freezing and severe cryogenic burns if contacted into eyes. **Skin contact:** Tissue freezing and severe cryogenic burn of skin. **Chronic effect:** None established.
Chlorine	Chlorine reacts with organic matter in

	drinking water to produce trihalomethanes, which may cause cancer and possibly developmental effects. Exposure to extremely high levels of pure chlorine gas can cause lung collapse and death. Exposure to high levels can cause pulmonary edema, rapid breathing, wheezing, blue coloring of the skin, vomiting, anxiety, accumulation of fluid in the lungs, severe eye and skin burns, loss of vision, and lung pain. Exposure to low levels of pure chlorine gas is irritating to the respiratory tract, eyes, and skin. Exposure can cause sore or swollen throat, coughing, choking, sneezing, pneumonia, chest tightness and pain, headache, dizziness, watery eyes, blurred vision, nausea, vomiting, vomiting blood, severe abdominal pain, skin blisters and irritation, difficulty breathing, and pain or burning in the stomach, nose, eyes, ears, lips, or tongue. If your skin touches pure liquid chlorine, you can get frostbite. Some people may develop an inflammatory reaction to chlorine called reactive airways dysfunction syndrome, a type of asthma.
Ammonia	**Inhalation:** burning sensation, cough, laboured breathing, shortness of breath, sore throat. **Skin:** corrosive, redness, serious skin burns, pain, blisters. **Eyes:** corrosive, redness, pain, blurred vision, severe deep burns. **Ingestion:** corrosive, abdominal cramps, abdominal pain, sore throat, vomiting (further see Inhalation).
Petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
Leadless petrol	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
Gas oil D2	

Gas oil D1	
Heating oil	Irritating, allergic, toxic, carcinogenic
Motor petroleum	
Pure gasoline	Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis
White spirit	Fatal, if ingested.

Amount of the handled (stored) dangerous substances

Name of the company
OMV Istrabenz d.d., Ferrarska ulica 7, Koper
Location
Individual gas stations in the Municipality of Koper
Geographical co-ordinates
Recipient river
Stated reservoirs are all underground and built in accordance with relevant regulations. As such they represent a relatively small source of hazard, except in settlements where they are directly by the neighbourhoods (Šalara, Škofije village). All these buried reservoirs also represent a potential threat for the ground water, should any substance leak into the ground water due to damages to the reservoirs.
Type of activity of the company
Istrabenz Koper labour organization distributes and sells fuels, lubricants, and industrial gases through gas-service stations.
Type of dangerous substances and toxic properties

Dangerous substance	**Toxic properties**
Petroleum products	**Oil**: Irritating, allergic, toxic, carcinogenic **Gasoline**: Narcotic, liver, kidney and lung damage, respiratory system paralysis, disorders of consciousness, CNS, blood, respiratory diseases, dermatitis

Amount of the handled (stored) dangerous substances

Dangerous substances (mainly petroleum products) are stored in reservoirs of gas stations, which are located in the whole area of the municipality, as follows:

Order No.	**Gas station**	Address	MB 98 in m3	NO 95 in m3	NO 91 in m3	D2 in m3	KO in m3
1	2	3	4	5	6	7	8
1.	BERTOKI	C. med vinogradi 52, KP	50	50	30	50	-
2.	GRAČIŠČE	Gračišče 4a, Gračišče	25	25	-	25	25
3.	HRVATINI	Hrvatini 47a, Ankaran	50	20	-	20	20
4.	KOPER II	Istrska cesta, Koper	100	50	-	50	-
5.	KOPER III	Istrska cesta 53, Koper	50	50	25	50	25
6.	LAZARET	Jadranska c. 1, Ankaran	50	50	-	50	-
7.	LUKA	Vojkovo nab. 38, Koper	20	20	-	140	-
8.	MARINA	Kopališko nab. 5, Koper	10	-	-	10	5
9.	OSP	Osp, Črni kal	70	20	-	20	-
10.	PLAVJE	Plavje 35a, Škofije	100	20	-	20	-
11.	TOMOS	Šmarska 1, Koper	50	100	-	40	10
12.	ŠALARA	C.Marežg. upora 17, KP	20	20	-	20	20
13.	ŠMARJE	Sergaši 42a, Šmarje	40	25	-	50	35
14.	ŠKOFIJE BI	Sp. Škofije 260, Škofije	150	50	-	50	-
15.	ŠKOFIJE BII	Sp. Škofije 260a, Škofije	100	50	-	50	-
16.	ŠKOFIJE VAS	Sp. Škofije 178a, Škofije	50	50	-	50	20
17.	SKL. SRMIN	Srmin 8a, Koper	50	150	-	100	150
		TOTAL:	985	750	55	795	310

Beside the stated highest possible quantities of petroleum products (reservoirs are not always full!) some gas stations still have daily supplies (up to 500 kg) of liquid petroleum gas (propane-butane) in gas bottles for households.

Name of the company
Celanese Polisinteza d.o.o.
Location
Dekani 3a, Dekani
Geographical co-ordinates
Recipient river
Type of activity of the company
Proizvodnja sintetičnih disperzij
Type of dangerous substances and toxic properties
Vinyl acetate, butyl acrylate, neodecanoic acid vinyl ester, methyl methacrylate, butyl acrylate, diisobutil, phthalate, dibutyl, maleinat

Dangerous substance	**Toxic properties**
Viniyl acetate	Increased risk for the development of chronic respiratory diseases in children and maybe also for some cancerous diseases.
Butyl acrylate	Immunotoxicant, respiratory toxicant, skin or sense organ toxicant
Neodecanoic acid vinyl ester	Severe skin irritant. Eye irritant. May be harmful if swallowed, inhaled or absorbed through the skin. Toxicology not fully investigated.
Methyl methacrylate	**Inhalation:** Irritates the respiratory system. Exposure may cause difficult breathing, cough, nausea and tonsillitis. Prolonged and repeated exposure to large quantities may cause lung damage. **Ingestion:** Irritation of mouth, throat and oesophagus. Exposure may cause tonsillitis, nausea, vomiting, and bladders. Prolonged and repeated exposure may cause unconsciousness and coma. **Skin:** Irritation of the skin. Exposure may cause redness, swelling, and pain. Prolonged and repeated exposure may cause burns and bladders. At very sensitive people exposure to small quantities causes an allergic reaction. **Eyes:** Irritation of the eyes. Exposure may

	cause disruption of sight, lachrymation, redness and pain.
Diisobutil	
Dibutyl phthalate	Inhalation exposure, at high levels, of dibutyl phthalate may include irritation of the eyes, nose and throat. It may cause nausea, tearing of the eyes, vomiting, dizziness, and headache. Prolonged exposures may cause liver and kidney damage. Dibutyl phthalate may harm the developing foetus and the male testes.
Maleinat	
Amount of the handled (stored) dangerous substances	

Name of the company
Lama Dekani d.d., Dekani 5, Dekani
Location
Geographical co-ordinates
Recipient river
Type of activity of the company
Type of dangerous substances and toxic properties
LPG (for heating) and substances used at the galvanization of furniture hardware:

Dangerous substance	**Toxic properties**
Hydrochloric acid	**Ingestion:** corrosion of mucous membrane, toxic. **Inhalation:** vapours are toxic, irritates respiratory system. **Skin:** may cause burns **Eyes**: dangerous.
Sodium hydroxide	**Inhalation:** burning sensation, cough, laboured breathing. **Skin:** corrosive, redness, serious skin burns, pain. **Eyes:** corrosive, redness, pain, blurred vision, severe deep burns. **Ingestion:** corrosive, abdominal pain, burning sensation, collapse.
Sodium hypochlorite	Too long exposure or concentration of vapours and solution above 5 % causes skin and eye damage, and inflammation of respiratory tract and pulmonary oedema.
Sulphoric acid, etc.	

Amount of the handled (stored) dangerous substances

Name of the company

Lex d.o.o.

Location

Vanganelska 26, Koper

Geographical co-ordinates

Recipient river

Type of activity of the company

Trade in high-quality active ingredients, excipients and packaging material, substances for cosmetic production and the food industry, and industrial chemicals.

Type of dangerous substances and toxic properties

Numerous substances in liquid, solid (powder), and paste form; quantity of single substances is small to medium (bottles, bags, metal containers 200 L; the biggest containers are for ethanol, up to 1 ton); usage in pharmacy or health care.

Dangerous substance	Toxic properties
Ethanol	**Inhalation:** cough, drowsiness, headache and fatigue. **Skin:** dry skin. **Eyes:** redness, pain, burning. **Ingestion:** burning sensation, confusion, dizziness, headache, unconsciousness.

Amount of the handled (stored) dangerous substances

7. FATE AND TRANSPORT ASSESSMENT

Text is under consideration and execution.

8. RISK MANAGEMENT

8.1. Frequency reducing measures

Individual producers are responsible for industry and craft hazardous waste and must have a contract with companies, which are authorized for collection and transport of these. For domestic hazardous waste there are campaigns within the Koper municipal company for collecting this waste presumably twice a year, and throughout the whole year citizens can deliver bulky waste to the disposal facility. Kemis Company from Radomlje is authorised for collection and transport of this waste.

Table 9: Specifically collected waste from the waste collection campaign in May and June 2001

Type of waste	**kg**	**%**
Accumulators	4.122,1	35
Motor oil	4.185,7	35
Edible oil	321,5	3
batteries	29,5	0
Medicinal products	41,6	0
Sprays	546,1	5
Chemicals	266,0	2
aerosols	16,5	0
Other waste (paint, varnish)	2.383,0	20
Together in kg	**11.912,0**	**100**

(Source: Report on collecting domestic hazardous waste within the framework of Koper municipal company, Kemis d.o.o., Preserje, June 2001 Kemis)

It is evident from the table that in collected quantities accumulators and oils prevail, and a lot of waste paint, adhesives, mastics, detergents, cosmetics and other various hazardous wastes have also been collected. Share of other collected types of fractions was less than 10%, but the quantities are still encouraging, as those are domestic most hazardous waste (chemicals, sprays, medicinal products, etc.).

But the analysis of the campaign revealed that participation was only 2%. From 17.391 households in the municipality only approximately 300 participated. Difference between the collected quantity (0.25 kg) and the optimal one, which should be by west-European standards somewhere between 1.5 and 2kg waste per resident, which is 70,000 kg in the Municipality of Koper, probably ends at the municipal waste facility, groundwater, soil, or at illegal waste dumps.

8.2. Consequence reducing measures

Protection and rescue plan in case of accidents with dangerous substances is made on all levels (plants, local community, and the state). Fundamental plan is the regional plan.

Protection and rescue plan in case of fire or industrial accident is made by companies, institutes, and other organizations in the area of the Municipality of Koper, for fire or other accidents, which are caused by their activity and can endanger people, animals, property, cultural heritage or the environment outside the organization's area.

The State makes a protection and rescue plan in case of accidents with dangerous substances, which could harm several municipalities or surpass the abilities of the Municipality of Koper to act.

Activities in the field of protection against accidents with dangerous substances are carried out through the whole life cycle of accidents with dangerous substances. At minor events, where the matter is handled by individuals (owners and users of property) or organizations (operators and owners of infrastructure), with their own resources, intervention or help from protection, rescue and assistance services is normally not necessary. In case of accidents that exceed or could exceed abilities of an individual to act, intervention of protection, rescue and assistance services is necessary.

Interventions are carried out in various extents, depending on the size of accidents with dangerous substances:

- **Smaller accidents with dangerous substances** – routine interventions, which are made daily by regular services (fire department, police, and emergency medical service).
- **Medium accidents with dangerous substances** – interventions, which involve more services and the accident is manageable with resources on the municipality level.
- **Large accidents with dangerous substances** – municipal resources are not enough to manage the accident, therefore wider assistance of neighbouring municipalities is necessary (from the whole region).
- **Major accidents with dangerous substances** – municipality's ability to act is limited, most of the resources is provided from neighbouring municipalities in the region area and wider (from several regions).

In the area of the Municipality of Koper, accidents with dangerous substances may happen especially:

- in the natural environment,
- on buildings in residential environment,
- in the industry, and
- on means of transport.

Accident with dangerous substances can happen suddenly or gradually.

Sudden accident (without prior signs)
Accidents with dangerous substances mostly happen suddenly. Immediately upon the occurrence (report) of an accident with dangerous substances the procedure goes along the operative fire plan.

Gradual accident
In case of circumstances, which cause increased risk for an accident with dangerous substances to happen, observation and information with the aim to discover the accident in time is organized and protective (preventive) measures are taken to prevent the accident from happening.

Municipality of Koper has a "Protection and rescue plan in case of accidents with dangerous substances". The plan defines:
1. Characterisation of accidents (characterisation of accidents with dangerous substances, most endangered areas by accidents with dangerous substances, effects of accidents with dangerous substances on people and the environment, possibility and probability of creation of chain-reaction accident).
2. Scope of planning (levels of planning, possible accident consequences).
3. Concept of protection, rescue and assistance (hypothesis, idea of executing protection, rescue and assistance, application of plan).
4. Services and resources and available resources (persons conducting tasks of protection, rescue and assistance, material-technical resources for implementing the plan, financial resources for implementing the plan, intervention costs).
5. Observation, information, and alert (collecting, processing, and transmission of data, observing and alerting endangered people and persons conducting tasks).
6. Activation of services and resources (activation of services and resources, help in services and resources).
7. Management (bodies and their tasks, operative management, financial powers, organization of associations).
8. Measures and tasks of protection, rescue and assistance (protective measures, tasks of protection, rescue and assistance).
9. Personal and reciprocal protection (instructions for preventing and alleviating effects of accidents, solutions for effective personal and reciprocal protection).
10. Damage assessment and elimination of consequences