Preliminary Environmental Study 1994

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SUMMARY
This preliminary environmental study for the Tumen River Area Development Project (TRADP) constitutes the first stage of environmental assessment of the project. It identifies (i) the environmental values and sensitivities of the Tumen River Economic Development Area (TREDA); (ii) the existing environmental problems in the area; (iii) the environmental constraints on implementation of TRADP; and (iv) the potential impacts of the project. A series of activities is proposed which will contribute to further stages of environmental assessment of the project.

TREDA lies in a region of globally significant biodiversity values in the Amur-Sakhalin/Manchurian bioregion. It includes a wide range of ecosystems, many of which are themselves regionally or globally significant. Examples are:

the temperate mixed coniferous and broad-leaved forests with high levels of endemism among their plants and insects, 53 species of mammals and 280 species of birds. The mammals in this forest type include the Siberian Tiger (current total population estimated at between 200 and 400) and the whole population (30-40) of Amur Leopard;

the Tumen River/Posiet Bay wetlands which meet all of the Ramsar Convention criteria for wetlands of international significance and support a large number of rare and endangered species; and

the Posiet Bay marine environment which has very high levels of diversity and is the most productive area in the East Sea (Sea of Japan).

The Russian sector of TREDA has a long-established and well designed system of marine and terrestrial reserves, though under the present economic circumstances, these suffer from a lack of funds for staffing and management. In the Chinese sector the reserve system appears poorly designed and its management seems uncoordinated and generally inadequate.

Insufficient information is available to make any comment on the reserve system in DPRK.

In addition to their high biodiversity values, the ecosystems listed above,

together with other
parts of TREDA, have the potential to yield high economic returns from ecologically
sustainable development activities. Tourism ranks high among these activities, with
possibilities for development ranging from intensive use of the marine and coastal environment
for recreational activities to specialized nature-based tourism.
Posiet Bay is now the only warm water coastal area in the Russian Federation (with the
exception of a part of the Black Sea coast), giving it a very high potential value for domestic
tourism. In addition, the high productivity results in a diversity of marine organisms which, in
the shallow waters of the bay, provide high quality opportunities for scuba-diving and
recreational fishing. Increasing levels of affluence and infrastructure in the region will lead to
very high demand for access to the tourism and recreation values offered by this area.
The warm clean waters and high productivity of Posiet Bay also have a high potential for the
mariculture of scallops, mussels, oysters, clams and fish. The proximity of Japanese, Korean,
Chinese and North American markets increases the economic potential of these industries.
North American and Japanese companies are already exploring the Russian Far East for
sources of seafood.
The Tumen River/Posiet Bay wetlands and the marine environment of Posiet Bay are sensitive
to pollution. This sensitivity is increased by the partially closed nature of some of the waters in
the bay, including Expedition Bay and Novogorodskaya Bay. While existing levels of
population, industry and port activity in the vicinity do not appear to be having any significant
effect on this ecosystem, their expansion may not be compatible with maintenance of the
ecological, tourism and mariculture values.
The warm Korean Current that flows north along the coast and into Posiet Bay is a major factor
contributing to the high productivity of this ecosystem. Unfortunately, this current also has the
potential to carry pollution from areas in the south, including Rajin-Sonbong in DPRK and the
Tumen River. There is no information to suggest that the Sonbong area currently has a
pollution problem, but the same cannot be said of the Tumen River. Pollution from industrial
waste, sewage, and erosion has led to the destruction of most life forms in

parts of the lower
Tumen River. Various pollution impacts on industry, agriculture and domestic water supplies
have also been recorded in the Tumen River basin over the past two decades.
Air pollution is also a problem in the Chinese part of the Tumen River catchment, with national
standards for Total Suspended Particulates being exceeded for most of the year at more than
half the air quality monitoring stations here. Sulphur dioxide pollution problems also occur, but
to a lesser extent.
Vladivostok also has air pollution problems for part of the year and there are serious marine
pollution problems on parts of the Vladivostok-Nakhodka area caused by industrial wastes,
sewage, hydrocarbons and sediment.
At present, the only two sewage treatment facilities outside the DPRK sector are in
Vladivostok. In DPRK, treatment is only to primary level and plants are generally old and in
need of repair or replacement. There are no toxic waste treatment facilities in TREDA.
TREDA administrations generally suffer from the lack of an integrated approach to natural
resource management, arising partly from the lack of appropriately trained staff, partly from low
levels of coordination and communication between government agencies, partly from low
levels of funding of this administrative sector.
The information and data collected were analyzed and processed and then, the available
information was listed in the part of Appendices, such as wind, air quality, water quality,
species protection and staff in the sector of China, the climate, vegetation, plant and animal in
the sector of Korea. The preliminary study analyzed respectively the important environmental
problems such as the focuses of the service including air quality, water resource, water quality,
aquatic resources, wetlands, landuse, forest, ecological protection zone, marine and
biodiversity. The conclusions were drawn up as follows:

In the large delta, the forest ecosystem should be protected emphatically, mainly
including the protection of forest system providing habitat for Siberian Tiger and Amur
Leopard, water and soil conservation and forest management. The main protection
area contains Yanbian sector of China and part of Russia.

In the small delta, the Tumen River/Posiet Bay wetland, as the overwintering and

immigration place for many animals, which meet all of the Ramsar Convention Criteria for wetland of international significance and support a large number of rare and endangered species, is the main protection area. More attention should be paid to the impacts of Tumen River pollution on the wetland (tailings mainly from Mashan Iron Mine in DPRK and other three pollution sources) and the potential impact from development projects (the siltation transportation from the river dredging and ports building).

The high productivity of the marine ecosystem has a high potential for marine products. The warm Korean current that flows north along the coast and into Posiet Bay is a major factor contributing to the high productivity of this ecosystem. The current has the potential to carry pollution from this area to the north.

The Tumen River/Posiet Bay wetland and the marine environmental sensitivity must be paid more attention in the activities relevant to this area.

Water resource is a major constraint to regional economic development. It is not possible for the urbanization and industrialization to be developed to a large scale in the region. The water quality, air quality, high conservation values, limited institutional capabilities and lack of regional strategic plan will also have restrictive impacts on the regional economic development.

The tourism, transport and ports, the development projects which will be developed in this region, should be developed from the course of the Tumen River to the mouth. It is difficult to carry out development projects except ports in the whole small delta, especially in the sector of DPRK, because it is mainly mountainous region.

The further environmental management work is mainly to designate the use of every zone, typically including strict nature conservation zone, ecotourism/nature conservation zone, intensive tourism zone, extractive industry zone, urban zone, light industry zone, heavy industry zone and general use zone.

The environmental survey has not been done in the sector of DPRK, so the information in the region is not available. Most of the sector is mountainous and forest land, so it is listed as the protection zone and the development activities are not permitted. Therefore, the lack of information in this area is not significant to the EIA

of TRADP.
Two major requirements have been identified to provide an effective basis for environmental management of the TRADP impacts. First, some of regional strategic environmental plan is necessary to identify appropriate and inappropriate activities in specific environments. Second, institutional and personal development are necessary to equip natural resource management agencies to meet the challenges that will be generated by TRADP.
It must be pointed out that the countries relative to TRADP are very different in the economic development level and in the benefit from the TRADP, so the understanding of the environmental protection objectives is various. Furthermore, the national environmental regulations and standards are not the same and the limitation of the information provided by every country is great. Therefore, an environmental impact assessment of TRADP is not appropriate at this stage.
The most practicable method is that the regional development strategies are incorporated in the landuse plan and environmental quality control plan around the economic development activities, and environmental ideas of relative countries are coordinated and reach the common idea in the work plan, in order to lay a solid foundation for the sustainable development.
If the consistent idea could not be formed in the objectives, scope and scale of the economic development activities, it would not be possible to realize the sustainable development strategies and environmental protection objectives.
It is not difficult to work out the plan of environmental assessment in techniques only if the relative countries are consistent in the economic development objectives. With the law and standards frame established in the plan, the prospect of the environmental assessment work will be bright.

BACKGROUND
The Tumen River Area Development Program (TRADP) was initiated under the auspices of the United Nations Development Program (UNDP) in 1990 at the request of the People's Republic of China (PRC), the Democratic People's Republic of Korea (DPRK), Mongolia, Republic of Korea and the Russian Federation (Russia).
The Tumen River constitutes the boundary between DPRK and the PRC in its

upper reaches
and between DPRK and Russia nearer the mouth. The general area is located at a focus of
emerging development and trade in northeastern Asia.
Initially the impetus for the project came from the vision of an international shipping, trading
and manufacturing zone, possibly with a "super port" serving as an outlet to markets in Japan,
the Republic of Korea and North America in one direction and as a "gateway to Europe" in the
other. A central part of this notion was a Tumen River Economic Zone (TREZ) straddling the
borders of the PRC, DPRK and Russia which would be a focus for transport, industry,
communications and settlement. Since that time there has been an evolution of the concept,
so that now the focus is on a wider Tumen River Economic Development Area, with little or no
emphasis on TREZ. TREDA extends from beyond Vladivostok in the northeast to Yanji in the
west and Chongjin in the south.
The TRADP members are currently seeking to determine the feasibility of promoting joint
economic development in TREDA. The development activities under consideration include
construction or expansion of railways, roads and ports, setting up of telecommunications
systems, and creation or expansion of some key industries.
The project is in its late pre-feasibility stage. This initial phase is due to be completed by mid-
1994.
Until now no environmental studies have been conducted, though some very general
documents have been prepared, for example, on approaches to environmental management
of specific industries such as forestry. In early 1994 UNDP contracted for this preliminary
environmental study of the project, focusing on TREDA.

GENERAL DESCRIPTION OF TREDA
TREDA encompasses a diversity of landscapes and ecosystems and a diversity of levels of
development. As a generalization, the area is sparsely settled and much of it is forested.
Dense settlement is generally confined to the river valleys and coastal plains, though there are
inhabitants scattered throughout most of the region.
In the Russian sector of TREDA most of the population is in the Vladivostok-Nakhodka region.
In Khasan District, which stretches from Vladivostok to DPRK/PRC border and constitutes the

majority of the Russian sector, the total population is around 50,000. The majority are located in the towns of Slavyanka (the administrative centre of the District - 18,000), Barabash (5,000), Zarubino (6,000), Posiet (2,000) and Kraskino (5,000). Industry is focused heavily on Vladivostok, Nakhodka and to a lesser extent Slavyanka. Much of the remainder of the area is devoted to cattle grazing (on former rice farms), fur farming and tanning (seven fur farms) and deer raising (three farms). The ports of Zarubino and Posiet are also fish processing centres.

The Yanbian Korean Autonomous Region ("Yanbian Autonomous Region") encompasses the Chinese sector of TREDA. This region covers the major part of the Tumen River catchment in China. It is a generally hilly or mountainous region with the towns located in the narrow river valleys which account for only 6.6% of the land area. Some of the major industrial development in the Chinese sector originated in the 1930s, though this went through a period of stagnation in the late 1940s and 1950s. A significant phase of expansion of existing plants and new developments occurred in the early 1960s and is being repeated in the early 1990s.

The major industrial city in this sector is Yanji (population 274,000), with Longjing (287,000) and Tumen (121,000) making much smaller contributions to industrial output. Hunchun (72,000), previously mainly an administrative and market centre for the surrounding agricultural and mining district, is rapidly developing as an industrial focus. Coal, gold and copper mining occur in the Hunchun area.

Industry in the Chinese sector includes paper production, textiles, coal mining, manufacturing of cars, buses and agricultural machinery, energy production, pharmaceuticals and food processing.

The DPRK sector, covering the northern part of North Hamgyong Province, is very mountainous with small coastal plains generally associated with river estuaries. Chongjin is the major industrial centre in the northern part of DPRK, however the government has decided that the focus of development in the TRADP will be the zone from Rajin to the country's northern border, including the city of Sonbong and the proposed new port of Ungsang. The largest industrial plant in this zone is the Sungri oil refinery (called the Sungri

Chemical Plant). Oil is
supplied to the refinery by rail and by pipeline from the oil terminal in Sonbong port. Other
industries in the Rajin-Sonbong area include pharmaceuticals, chemicals, caustic soda
production, clothing, timber, and ship repair.
To the north and northwest of TREDA lies the northward-draining Amur River, one of China's
and Russia's major river systems. The basin of the Amur River includes major wetlands of
national and international significance, as well as forest ecosystems of very high global
biodiversity significance. It is part of what in Russia is called the Amur-Sakhalin bioregion, and
in China the Manchurian bioregion.
To the south-southwest of TREDA, in the headwaters of the Tumen River, is the Changbai
Shan forest region, one of the major centres of biodiversity in China.
South of TREDA in DPRK is a mountainous region whose environmental values are little
known outside of that country.

CLIMATE
The TREDA has a cool temperate climate with marked seasonal variations in precipitation and
wind direction. In the coastal parts of the Russian and DPRK sectors the climate is somewhat
moderated by oceanic influences. For example, the number of frost-free days increases from
80-150 in the Chinese part of the Tumen River catchment to 200 on the coast at Posiet. This
moderation has more effect on the length of the winter than on the temperature ranges
experienced. Throughout the TREDA monthly average temperatures range from around -12 C
in January to around 22 C in August. Extreme temperatures range from around 37 C down to -
34 C in winter.
Rainfall is similarly fairly constant throughout the area, generally being in the range 600-
900 mm/yr. However the rainfall is markedly seasonal, with the majority (around 60%) falling in
the summer (June-August).
Rivers in the region freeze for around 130 days each year. In the southern part of Khasan
District there are up to 100 days each year with sea temperatures of 18-20 C. This is regarded
as a good temperature for swimming.
Average wind speeds are relatively constant over the area, with monthly average wind speeds

in the vicinity of 2-3 m/sec. Spring and autumn are usually the seasons of highest wind speeds. Wind direction varies from mainly westerly in the winter and spring to generally easterly in the summer and autumn. This corresponds to the movement of air masses, from the west or northwest in the winter and from the east in the summer. No detailed information was collected on the rate of movement of air masses through the region, however it seems that it is not uncommon for weather patterns to remain stationary for several days at a time, allowing a build-up of air pollution which is then transported to other locations. Similarly, no information was available on the frequency of temperature inversions, which also have a propensity to allow levels of air pollution to build up.

AIR QUALITY

GENERAL DESCRIPTION

Russian Federation

No air quality data is available to the team for the Russian sector of TREDA. In part this is due to the very short time available for data gathering in that sector. However, there are no air quality monitoring stations in the central or southern part of Khasan District. Russian officials explained that this reflects the lack of industry in that area and the resultant high air quality. It is not certain that this assumption is justified, considering the air quality situation in northeastern China (see following) and the pattern of movement of air masses from China to this part of Russia in the winter.

There are six air quality monitoring stations in Vladivostok and six in the remainder of the Territory. Air quality standards, particularly for TSP and benzopyrenes, are often exceeded, especially under windless conditions in Vladivostok.

In the whole of Primorsky Krai there are around 300 air emission licences, none of which are for activities in the central or southern part of Khasan District.

DPRK

There are three air quality sampling sites in the Rajin-Sonbong area. No information is available on air quality in the DPRK sector or on the number of licences which have been issued.

China

China has several air quality monitoring stations in each city in the Chinese sector of TREDA,

including one background monitoring station in each. Of the parameters measured (TSP, SO2,
NOx), TSP most often exceeds air quality standards. This is in line with the situation in northern
China generally. In part the problem is due to high levels of background dust coming from as
far away as the central Asian deserts. However, the very high inputs from coal burning cannot
be overlooked.
Coal is the primary source of heating and industrial energy in this region. While some
municipal and industrial enterprises have tall stacks designed to penetrate inversion layers and
disperse pollution, the combination of locating towns and industries in valleys and the many
domestic sources of pollution means that pollutants are often trapped in the vicinity of
settlements. This is particularly the case in winter when frequent temperature inversions and
the increased use of heating lead to a build up of pollutants.
At more than half the measuring stations the TSP level always exceeded the Class II ambient
air quality standard. The maximum daily average TSP concentration of 2.8 mg/m3 was 5.6
times the Class III standard. The maximum seasonal average (during the heating season in
November to March) was 1.14 mg/m3, 2.28 times the Class III standard and in excess of the
maximum permitted value for Class II.
SO2 concentrations usually meet the Class II standards, except in Longjing where average
daily maximum concentrations were above Class II standards for much of the period November
to March.
Similarly, NOx concentrations generally met the Class II standards, except in Yanji where they
were exceeded during November to March.

INSTITUTIONAL ARRANGEMENTS

China

Responsible agencies

The agencies responsible for air quality control are:

- Pollution Protection and Management Office of the National Environmental Protection Agency;
- Jilin Environmental Province Protection Management Bureau;
- Yanbian Autonomous Region Environmental Protection Bureau; and
- City Environmental Protection Bureaus of Yanji, Tumen, Longjing and Hunchun.

Enforcement

Enforcement is carried out by city environmental protection bureaux. Each city has staff in an

Environmental Monitoring Office with responsibilities for sampling air quality (and water quality)
and staff for management of the air quality control system (issuing permits, collecting fees,
etc.).
Training
There are no minimum qualifications for either sampling or management staff. Sampling staff
are expected to have some technical qualification and receive training after recruitment.
Management staff are expected to have some kind of tertiary qualification, though no particular
field of expertise is emphasized. Levels of training are probably inadequate to carry out
informed and effective air quality management.
Russian Federation
The Federal Ministry of Environmental Protection and Natural Resources is responsible for air
quality control in Russia. Monitoring of air quality is supervised by the Federal Committee for
Hydrometeorology and Environmental Monitoring which is a branch of the Ministry of
Environmental Protection and Natural Resources.
At the territory or province level the equivalents of these bodies are the Territorial Committee
for Environmental Protection and Natural Resources (CEPNR) and the Hydrometeorology and
Monitoring Service. both of these agencies collect air quality data. The CEPNR has a
laboratory in Vladivostok which analyzes samples collected in the field. The Service has both a
base laboratory and a mobile laboratory.
Staffing/Enforcement
In Khasan District there are three inspectors responsible for air and water quality monitoring for
the whole district. (The thirty districts in Primorsky Krai each have between two and seven
inspectors).
The CEPNR issues licences for emissions and enforces air quality standards. Licences are
issued in Vladivostok where there are five staff responsible for assessing and issuing
procedures. Officials believe that staff resources are adequate for the present, but may
become over-extended with any rapid increase in the rate of development. However, since
licences are issued on an annual basis, and these staff are also required to provide inputs to
environmental impact assessments, it seems unlikely that there are sufficient staff to carry out
adequate assessment of licence applications and renewals. Similarly, there

does not seem to
be sufficient staff to enforce the regulations. In reality, it does not appear that fines or other
penalties are levied on polluters. The emission non-compliance levy is seen as a measure
which encourages plant operators to reduce emissions as soon as is economically and
technologically feasible.

Training

Staff involved in assessing licence applications and renewals generally have relevant
specialized tertiary qualifications, though these are not mandatory. District inspectors are
expected to have tertiary qualifications and most have some type of biological qualification.
There are specialized training courses in the region and in Moscow for staff involved in air
quality control. These courses are conducted both within government departments and in
universities.

DPRK

The State Committee for Environmental Protection has overall national responsibility for air
quality. In the study area, the Rajin City administration has local responsibility.
At present there are not sufficient trained staff available to satisfactorily carry out air quality
control responsibilities for the planned development in the Rajin-Sonbong area.

CURRENT AIR QUALITY PROBLEMS AND SENSITIVITIES

China

Air pollution levels in the Chinese sector frequently exceed the lowest national environmental
standards in Total Suspended Particulates. This results from a combination of three factors:
extensive use of coal as a heating and energy source; high ambient levels of TSPs from dust
arising from aeolian soil erosion in other regions; and the topography of the Chinese sector.
Some problems also arise from SO2 levels.

Russian Federation

While no data are available for the Russian sector, it can be assumed on the basis of
topography and the lack of industry that air pollution levels will be low over the greater part of
the area. However, it is not certain that pollution is not entering the area from China and
studies need to be done to determine whether this is occurring and whether it is a potential
problem.
Around Vladivostok, the situation is different because of the much higher

levels of population
and industry and national standards are frequently exceeded. Further industrial development
will exacerbate this situation.
DPRK
Air quality is reported to be very good at present in the Rajin-Sonbong area. To some extent,
this reflects the current low level of development of the area. It may also reflect the siting of the
sampling stations. Anecdotal reports of very low air quality levels in Chongjin, to the south and
outside the proposed development zone, suggest that current air pollution controls in DPRK
may not be adequate to deal with high levels of heavy industry.

WATER RESOURCES, WATER QUALITY AND AQUATIC RESOURCES
HYDROLOGY
There is a clear difference between drainage patterns in the Russian and DPRK sectors of
TREDA and the Chinese sector. In the former sectors, rivers generally rise in the coastal
mountain ranges and are short and comparatively swiftly flowing, though some of those in the
Russian sector flow through coastal wetlands before reaching the sea. In the Chinese sector,
the Tumen River and its tributaries rise in inland ranges and have relatively large catchments
and long courses. The Tumen River has a length of 516 kilometres and a total catchment area
of 33,168 square kilometres, of which 22,168 square kilometres are in China. Its main
tributaries are the Gaya, Buerhatong, Hailan (partly in TREDA), Hunchun and Wangqing
Rivers (outside TREDA).
Run-off in rivers of TREDA is characterized by high variability both in total annual flow and in
seasonal flows. For example, in 1965, annual flow in the Buerhatong River was 16.52x106 cubic metres, but in 1978, the total annual flow was only 1.95x106 cubic metres.
Variations in flows over the course of the years are controlled mainly by the marked
seasonality of the rainfall, and the freezing of the rivers during four months each year. In the
lower Tumen River at the Quanhe monitoring station, 70.4% of the flow occurs during June to
September and only 4.7% in December to March.
Floods are highly seasonal in the Tumen River system (and probably in rivers in the other
sectors). Major floods generally result from typhoons. Significant floods have occurred in 1914,
1928, 1938, 1957, 1960, 1965, 1986. The maximum flow rate ever recorded at

Quanhe on the
Tumen was 10,300 cu.m./sec on 30 August 1986. More common are annual floods caused by
damming of the rivers by melting ice floes. In recent years floods are believed to have resulted
from shallowing of the river channels caused by sedimentation from erosion and waste
discharge.
Most cities in the Chinese sector previously derived their water supplies from the Tumen River
and its tributaries, though there are generally good supplies of groundwater in the river valleys.
Rivers in the central and southern parts of the Russian sector are similarly highly variable in
their annual and seasonal flows. Because of their smaller catchments, their flow volumes are
considerably lower than that of the Tumen River. As a result, though the southern Primorsky
Krai has a relatively high rainfall, rural and urban populations often suffer water shortages.
This is exacerbated by the poor reserves of underground water.
Vladivostok receives its main water supply from the storage reservoirs on the Artyomovka,
Pionerskaya and Bogataya Rivers. Slavyanka's water comes from underbed water intakes in
the Poima River. Posiet, Zarubino and Kraskino get their water from underground supplies.

WATER QUALITY

Pollution

Water quality in the Tumen River system appears to be considerably lower than that in other
rivers in TREDA and constitutes a very serious environmental problem. For example, by the
early 1970s, water pollution in the Tumen River had reached the stage where, even after
treatment, water quality at Tumen City was not acceptable for human consumption.
The results of water quality monitoring in the Tumen River system in the Chinese sector can be
summarized as:

- the most serious pollution levels occur in the Tumen River main stream and in the lower
reaches of the Gaya and Hailan Rivers;
- in the Tumen River, the most seriously polluted section is at Tumen and the least
polluted is the Chongshan section;
- in the Tumen River COD becomes a particular problem in the dry season, while
suspended solids predominate in the wet season;
- in the Gaya River the most likely polluted section is at the Xiaga Bridge where the main

problems are high COD and organic wastes;

in the Hailan River, the Dongsheng section is seriously polluted with volatile phenols;

the most seriously polluted of the Hunchun River's four stations is at Xiweizi and the cleanest is at Chunhua;

in the Buerhatong River the pollution is comparatively light, with the section down to Yanji being slightly more polluted than other parts. The main problem in this river is the NH3-N levels; and

pollution in the Huichun River is relatively light.

The high levels of pollution in the Tumen River system result from several factors, the chief among which is the much greater density of population (though still very low by Chinese standards) and the greater level of industry in the catchment of the Tumen.

There are no sewage treatment facilities in the Chinese sector and only two (both in Vladivostok) in the Russian sector. It is reported that the majority of towns in DPRK sector have primary treatment facilities, though these are old and in need of upgrading or replacement. In the Chinese sector all sewage discharges are into the Tumen or its tributaries.

There is no toxic waste disposal facility in any sector in TREDA. Toxic wastes are either at the production point or are discharged with other wastes.

Apart from sewage discharges, there are a number of significant pollution sources in TREDA.

Those that have been identified during this study are:

Maoshan iron mine in DPRK, adjacent to the Tumen River main channel. This mine is the largest in DPRK and has no tailings pond. It discharges a floury material directly into the river. Reports of the amount of tailings discharged vary greatly. One estimate gives 50 tons per day (18,250 tons/year) (1). Another gives 16 million tons per year (>40,000 tons/day) (This does not seem to be a translation error as the latter figure was presented in numerals in the draft report of the Chinese consultancy team). This figure seems highly unlikely (but should not be discounted without further investigation) because the total sediment load for the Tumen River is given in one source as 1.7 million tons/year).

Even the lower figure represents a major pollution source, particularly as much of the tailings material is deposited in the river bed during the dry season and is then carried

away during periods of high water flow;
dredging for gold in the Chinese sector, which has led to siltation of streams and water pollution;
Kaishantun chemical fibre pulp plant on the Tumen River main stream;
Shiyan paper mill causes serious pollution from Shiyan on the main stream of the Tumen River to the estuary;
Toudao and Longjing paper mills on the Hailan River;
Helin fibreboard factory on the Hailan River;
Dongcheng fibreboard factory on the Hailan River;
Helong chemical plant;
Yanji chemical fertilizer factory;
other paper mills and fibreboard factories in China;
sugar refineries in China;
other factories in China;
Awudi chemical plant in DPRK. It is reported that in winter, the high levels of pollution that build up in the lower Tumen River from this factory gives fish a "kerosene" smell.

It is reported that 90% of the water pollution in the Tumen River system comes from four major sources.

A few groundwater supplies in the Chinese sector are also being polluted, mainly by industrial and domestic waste.

Current Impacts of Pollution

From the information available, it seems likely that a combination of high chemical and nutrient pollution, heavy sediment loads and low levels of dissolved oxygen have rendered the lower reaches of the Tumen River biologically dead, at least in the winter.

There are a number of recorded impacts of the high water pollution levels in the Tumen River system, but it can be assumed that these represent only a small proportion of the environmental, economic and human health impacts that have occurred and are occurring.

Some examples are:

agricultural lands have had their productivity decreased or have had to be taken out of production due to the results of using polluted water for irrigation. While the specific impacts are not known, it is likely that these will be a mixture of contamination which prevents the growth of crops, contamination with toxic materials which renders produce unacceptable, and development of soil hardpan which prevents water movement. Available data suggests that 10% of land irrigated by Tumen River water is known to have suffered reduced production; 2% has been rendered unsuitable for the

preferred
crops (this compares with 10% for the whole country) and 1% is no longer suitable for
agriculture;

fisheries in the Tumen River system have been virtually wiped out by the pollution
effects. The decrease in fish catches in the mid-1960s corresponds to a period of
expansion of existing industrial plants (including increased production from the
Maoshan mine) and commencement of many new plants. Studies have shown that the
fry and adolescents of the former main economic fish species are unable to survive in
the lower Tumen River water;

loss of stock in fish ponds when industrial effluent was used as a source of nutrient (but
probably more frequently due to unavoidable use of polluted water);

loss of industrial productivity due to inadequate water quality. For example, products of
the Kaishantun chemical fibre pulp factory (itself a major polluter) did not meet required
standards because of the effects of impurities in its water supply, despite 5-6 million
yuan having been spent on water treatment. This caused significant economic loss to
the factory; and

sedimentation of streams from wastes (but also from soil erosion), has led to increased
flooding, reduction in water transport capacity, destruction of pelagic and benthic
organisms.

No information is available for water quality in the Russian Federation or DPRK.

INSTITUTIONAL ARRANGEMENTS

China

The arrangements for water quality control in China are the same as those for air quality
control.

Russian Federation

The arrangements for water quality control in the Russian Federation are the same as for air
quality control.

DPRK

Probably the same as for air quality control.

WETLANDS

GENERAL DESCRIPTION

For the purposes of this environmental study, the definition of wetland contained in the
Convention on Wetlands of International Importance Especially as Waterfowl

Habitat (the
Ramsar Convention) has been used. The Ramsar Convention defines wetlands as:

areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six metres.

The major wetland in TREDA is actually a complex of three linked and ecologically inter-related wetlands:

the very extensive Tumen River coastal wetlands on the coastal plain to the north and south of the mouth of the river;

the Tumen River itself and the immediately adjacent wetlands, including the Jingxin wetlands in the Chinese sector; and

the shallow coastal waters, including much of Posiet Bay and waters around offshore seabird islands.

To avoid confusion, this complex will be referred here as the Tumen River/Posiet Bay Wetlands.

Tumen River/Posiet Bay Wetlands

This wetland complex of more than 450 square kilometres is the most environmentally significant part of the study area. It meets all the criteria of the Ramsar Convention for a wetland of international importance, and some criteria are met more than once. It consists of:

Tumen River Coastal Wetlands

This is a wetland complex of water meadows, marsh, and around 30 saline lagoons and freshwater lakes extending from Man Po Lake in the Unggi Lakes in DPRK to Expedition Bay, Posiet Bay and probably as far as the Gamova Peninsula in the north.

Talmi Lake (now known as Ptitchii (=bird) Bay) is the largest saline water lagoon with a surface area of 39 square kilometres and depths ranging from 0.3 to 1.0 metre.

In addition to Talmi Lake there are many shallow coastal lagoons. All have permanent or intermittent connections to the sea. Recharge with sea water happens at very high tides or as a result of storms or strong onshore winds. Freshwater inflow to these lagoons comes from local drainage from the higher parts of the wetland. As a result, the salinity of these waterbodies is highly variable and ranges from highly saline to near fresh. It is likely that the lagoons are highly productive under certain

conditions.

Further from the sea there are shallow freshwater lakes which are recharged by local runoff and which generally appear not to have any clear outflow channel.

The Unggi Lakes are located some 90 km northeast of Chongjin and 10-20 km east of the town of Unggi. The two largest waterbodies appear from topographic maps to be brackish lagoons with intermittent connections to the sea. These lakes have areas of 1,800 ha and 650 ha. They are bordered by marshes and mudflats. A third waterbody, a freshwater lake, lies further inland. The total wetland area here is around 3,000 ha. In general, this area resembles the wetlands further north across the Tumen River.

Tumen River and immediately adjacent wetlands

The Tumen River is the major river in the study area. For most of its length in this area, the river is constrained by higher and sometimes fairly steep country immediately adjacent to the river channel. However, in the vicinity of Hunchun, Jingxin and Fangchuan there are extensive floodplains with some riverine wetlands. These are best developed in the Jingxin wetlands, where there are several lakes and river channels. This wetland has an area of around 800 ha. The vegetation consists principally of water meadows and marshes. The main communities are Phragmites communis-Deyeuxia angustifolia-Carex dispalaea, Deyeuxia angustifolia-Carex dispalaea and Weed-Carex dispalaea.

The Tumen River contains numerous islands downstream from Hunchun which may have wetlands.

Posiet Bay and shallow coastal seas

The major part of Expedition and Novogorodskaya Bays, significant parts of Reyd Pallada Bay, and a narrow zone on the open sea coast from Unggi Lakes to Posiet Bay fall within the Ramsar definition of wetlands. These shallow coastal seas are part of what is reported to be the most productive area in the East Sea (Sea of Japan) (see Section "Marine"). As well as having intrinsic wetland values they form a crucial part of the overall coastal wetland ecosystem. For example, they provide feeding areas for wetland species breeding on offshore islands.

No detailed information is available to the team on the non-avian

fauna or the flora of these wetlands, though this information is expected to be held by the Institutes of the Far East Branch of the Russian Academy of Sciences, particularly the Institute of Marine Biology and the Institute of Marine Biochemistry.

Other Wetlands in TREDA include:

- several lakes or coastal lagoons on the northwestern and northern shores of Expedition Bay, Novogorodskava Bay and Troitsky Bay. These wetlands should probably be considered as part of the Tumen River/Posiet Bay wetlands (no information available);
- Lake Ryazanskoye in the coastal plain of Boysmana Bay (no information available);
- an extensive wetland (probably a marsh or bog) adjacent to Mandzhur Bay in the lower reaches of the Mutunenon River (no information available);
- marshes or bogs to the west of Slavyansky Bay (no information available);
- a large lagoon north of Slavyansky Bay (no information available).

AVAILABLE DATA

An extensive body of data on the wetlands in the Russian Federation is held by the institutes of the Far East Branch of the Russian Academy of Sciences. Institutes most likely to have relevant data are the Institute of Biology and Soil Science, Institute of Marine Biology, Pacific Institute of Marine Biochemistry, Pacific Institute of Oceanography, and the Pacific Institute of Geography. The Far East Regional Hydrometeorology Institute also has information on bathymetry and ocean currents.

In China, the following agencies can be expected to hold information on wetlands: Ministry of Forestry (Department of Forest Protection and Policy Administration, China Wildlife Conservation Association, National Crane Conservation Committee); the Ministry of Urban and Rural Construction and Environmental Protection; the National Environmental Protection Agency; National Bureau of Survey and Mapping; Beijing Institute of Zoology, Academia Sinica; Beijing Institute of Geography; Ornithological Society of China; National Bird Banding Centre; Jilin Provincial Forestry Bureau; Jilin Institute of Forestry; Jilin Institute of Biology; Jilin Institute of Environmental Protection; Changchun Institute of Geography; Department of Geography, Northeast China Normal University; Natural History Museum, Jilin Province; and Jilin Wildlife Conservation Association.

In DPRK the Institutes of Zoology, Forestry, and Environmental Protection within the Korean Academy of Sciences carry out research on the country's wildlife and natural resources. The Department of Forest Management has responsibility for management of nature reserves and may hold information on wetlands. The Union for Nature Conservation of DPRK and the Nature Conservation Society may also hold relevant information.

EXPLOITATION OF WETLAND RESOURCES

The following industries or activities exist or take place in the area. Most of these present environmental problems and sensitivities.

- Fishing;
- Non-finnish extraction;
- Mariculture/aquaculture;
- Use of wetland plants;
- Hunting;
- Hay cutting;
- Fires;
- Drainage;
- Sand extraction;
- Saltworks.

SPECIAL CHARACTERISTICS OF THE WETLAND ENVIRONMENT

A number of raptors, eagles and snakes winter in the wetlands. They are also an internationally important passage site for several groups of migratory birds. Several species of water fowl breed in these wetlands.

WETLAND PARKS AND RESERVES

Several Natural Monuments have been declared in the Russian sector of the Tumen River/Posiet Bay wetlands. In general, these are small areas of no more than a few hectares which do not provide realistic protection to the wetland ecosystem. Low levels of management staffing further reduce the effectiveness of these reserves.

The section of the Far East State Marine Reserve offshore from these wetlands includes shallow coastal seas and island breeding colonies of wetland bird species. Management of this section of the Marine Reserve should be integrated with management of the wetland. Any Ramsar Convention nomination of the wetlands should include the Marine Reserve.

Al Som (Egg Island) offshore from Sonbong in the DPRK sector of the wetlands is a Wildlife Protected Area for breeding birds (presumably seabirds, but possibly including waterfowl).

Jinxin Wetland Reserve is a Rare Animal Reserve, reportedly declared to protect Red-crowned Cranes and the three fish species endemic to the Tumen River, though the

latter have
apparently never been recorded in these wetlands. The wetlands are heavily used for fishing,
grazing and harvest of aquatic plants.

LAND, FORESTRY, RESERVE SYSTEMS

TOPOGRAPHY, GEOMORPHOLOGY AND GEOLOGY

The topography of southern Primorsky Krai is dominated by a 10-20 kilometre wide coastal
plain backed by the Chernyye Mountains which mark the border between the Russian
Federation and China. In several places this coastal plain is interrupted by bays and coastal
lagoons which are generally shallow but becoming deeper toward the north.
Near the Tumen River, particularly to the north of the river mouth, the coastal plain reaches its
maximum development in the Tumen River coastal wetlands. These marshy plains are up to
25 kilometres wide and have a very low relief. In many places they are broken by
comparatively large water bodies which may be brackish coastal lagoons or freshwater lakes.
In DPRK, 67% of the Rajin-Sonbong zone is mountainous, with the Songjin range running
close to the coast from northeast to southwest. There is no continuous coastal plain here as
the ranges come to the coast in many places. Rajin city lies on a small coastal plain
surrounded by mountains. The Tumen River coastal wetlands extend about half way from the
Tumen River mouth to Sonbong.
The coastline in the DPRK sector is highly indented with many bays as Rajin, Chosan, Ungsan
and Kulpo Bays.
In the Chinese sector of TREDA drainage is dominated by the tributaries of the Tumen River.
River valleys are generally narrow and surrounded by relatively steep mountains. Nearly 70%
of the area of the Yanbian Autonomous Region is mountainous. Generally speaking, there is a
gradation in altitude from Baiyin Peak in the southwest to the northeast. However, the complex
topography frequently obscures this pattern.
Reconnaissance geological surveys have been done of Jilin Province and Yanbian
Autonomous Region and maps of geology have been produced at a scale of 1:200,000. Oil
maps are available at 1:100,000. A geological map of DPRK has been produced at a scale of
1:200,000. Geological maps of Primorsky Krai are available at a 1:100,000

scale.
The study area lies in the circum-Pacific earthquake zone. There have been sixteen earthquakes in recorded history, with intensities between 5 and 7 on the Richter scale.
Epicentres are generally deep, though shallow earthquakes do occur.

LANDSCAPE

The Russian and Korean sectors of the study generally have high landscape values. In the north, the complex coastline with a multitude of islands and deeply indented bays south of Vladivostok, is backed by wooded hills.
In the central part of the Khasan District, the coast is backed by low hills which are the foothills of the Chernyye Range. Further into the foothills, the main range becomes visible and the scenery appears largely natural. The forests of the Kedrovaya Pad Nature Reserve have high landscape values.
The east coast of the Gamova Peninsula has a number of bays with attractive beaches in a setting of rolling hills covered with shrubs and woodland.
The nearly-enclosed bays further south (Expedition Bay and Novogorodsksya) have a lake-like quality that, in places has high scenic value. Further south, the Tumen River coastal wetlands provide a different landscape with high wilderness values that are enhanced by the presence of wildlife.
The Rajin-Sonbong coast has high scenic values, with a complex coastline backed by forested mountains and around 30 small islands offshore.
An expert assessment and classification of the landscape values of the area is needed as one component of a regional identification of appropriate land uses.

Land Use

So far as the study team was able to discover, no comprehensive land use map of TREDA exists. Some attempts have been made to produce such maps but they are generally at inappropriate scales and do not show all significant land uses. This is a serious deficiency in the planning resources of the area and should be rectified as soon as possible.
No detailed land use information was obtained for the Russian sector of TREDA. However, apart from the few small towns much of the land is currently not intensively utilized. This is, in part, a result of the low levels of population in the Khasan District (50,000 - with around 20-25,000 in Slavyanka and many of the remainder in the other, smaller towns).

Major activities appear to be deer farming (three farms covering extensive areas), fur farming (mink and other species), grazing, agriculture, aquaculture (two small operations which apparently only raise fingerlings for release or breeding elsewhere).

No land use information is available for the DPRK sector. However, it is known that the area has been zoned into various land use types as a basis for decision-making.

Some basic land use information is available for the Chinese sector, though this is far from detailed and does not constitute a useful basis for planning.

EROSION

Erosion is a significant problem in the Chinese sector of TREDA. This results largely from uncontrolled clearing of forest on steep slopes and failure to revegetate. Areas with serious soil erosion problems range from 8.5% of the catchment of the Gaya River to 49% of the catchment of the Hailan River. Transport of soil into rivers has resulted in shallowing of rivers, increased flooding and deterioration in water quality. Suspended solids in rivers are always in excess of the national standards and are sometimes 90 to 100 times the standard.

VEGETATION

General situation

Natural vegetation communities in the Chinese sector, and to a lesser extent the Russian sector, have been heavily impacted. (No information is available for the DPRK sector).

In the Russian sector, the major impacts have been from logging and fires. Significant levels of logging probably commenced here 100-150 years ago. However, secondary communities are generally well established and this and the low levels of agriculture have helped to reduce soil loss and sedimentation. Not unexpectedly, the loss of natural vegetation communities has had a detrimental impact on wildlife. Impacts have been focused mainly in the southern part of the territory, where the original coniferous vegetation has been generally replaced by secondary deciduous forest with little exploitation value. In the northern part of this sector, significant areas of forest community are protected in the Kedrovaya Pad Nature Reserve and (to a lesser degree) in the adjacent zakaznik.

The condition of vegetation communities and the percentage of the area retaining primary natural communities is apparently much less in the Chinese sector. Here, 81.3% of the total

area of 42,700 sq.km of Yanbian Autonomous Region has some type of forest, with grassland occupying 5.4%. Most of the forest area is secondary. Logging and clearing for agriculture are severe and ongoing. Insufficient resources for management and poor management practices, including excessive cutting, poor cutting policies, and lack of nursery facilities are major problems.

Natural (primary) vegetation communities in the Chinese sector can generally be found only in the mountainous regions above 800 metres. Lower down, between 300 metres and 800 metres, there are secondary communities dominated by Querous mongolica, Populus davidiana, or Betula platyphylla, with scattered Salix gracilistla-dominated communities. Below 200 metres, agriculture predominates though there are scattered patches of secondary forest.

In the Changbai Mountains, there are more remnants of original vegetation than in other parts of this sector. Here, the mixed Korean Pine (Pinus koraiensis) and broad-leaved forest is found between 500 and 1,000 metres. Purer stands of Korean Pine are found between 1,000 and 1,700 metres. This overlaps with Betula ermanii which occurs on the volcano between 1,000 and 2,000 metres. Above 2,000 metres is an alpine scrubland with Rhododendron aureum, Vaccinium uliginosum and Vaccinium litisidaea.

PARKS AND RESERVES

Russian Federation

The system of protected areas in the Russian Federation is one of the oldest in the world. Its objective is to protect:

- natural complexes and ecosystems typical of every latitude zone and altitude belt;
- rare and endangered ecosystems;
- areas containing species that should be fully protected;
- biological communities and ecosystems having maximum productivity or diversity;
- areas with unique species assemblages and biological communities.

The categories of reserve that are available under the Russian system are:

State Nature Reserves (zapovedniks)

These are protected areas where all economic, recreational and other activities that may have a negative impact on the natural ecosystems are prohibited.

National Natural Parks

In this category of reserve recreational, economic and other activities which do not conflict with the objectives of the reserve are permitted.

Zakazniks

A zakaznik is the lowest category of nature reserve. All hunting and fishing are prohibited but there is no control on land use or habitat destruction.

Natural Monuments

Natural Monuments provide the same level of protection as zakazniks - in other words, they provide protection for particular species. However, they are generally small (of the order of a few hectares) and do not provide suitable mechanisms to protect highly mobile species.

China

The Chinese system of nature reserves was created in the 1950s by the Chinese Academy of Sciences. Over time, creation of nature reserves of various types has come to be seen as a solution to the widespread problem of degradation of natural environments and the loss of economically important natural resources. As a result, many government agencies have established reserve systems, including the National Environmental Protection Agency, Ministry of Agriculture, Ministry of Forestry, Ministry of Geology and Minerals, Ministry of Water Resources, the State Oceanographic Administration and agencies within provincial and municipal governments.

This has led to a diverse system in which there is much duplication of effort, little coordination, and very few reserves which have appropriately trained staff or adequate resources for management.

There are several reserves in the Chinese sector of TRADP:

Laoyeling Reserve in the northeast, has the principal function of protecting Amur Leopard and Siberian Tiger populations. This is a provincial reserve. The Korean Pine forests in the reserve are currently being logged. There is apparently no recent information to confirm that the target species still use the area. However, it is highly likely that they do, as the reserve is adjacent to the Barsoviy Zakaznik in Russia. Studies would be likely to show that this area is very important for biodiversity conservation and that logging is an entirely inappropriate activity.

Baijin Reserve, which was established to control the harvest of a particular mushroom species.

Maoershan Forest Park, a 1,500 ha reserve close to Yanji city.

Fenghu Gou is a small reserve covering a water supply area. Its boundaries apparently
do not coincide with the watershed, so that its usefulness is questionable.

The Changbai Shan Nature and Biosphere Reserve is a major forest area of 217,000
ha outside TREDA to the south. It adjoins a similar reserve in DPRK.

DPRK

No information is available on forest reserves in DPRK.

MARINE

GENERAL DESCRIPTION

The marine environment in TREDA can be divided broadly into Peter the Great Bay and the
Russian Federation, extending from the vicinity of Vladivostok in the north to the Tumen River
mouth in the south, and the coastal shelf of the northern DPRK.

Peter the Great Bay is characterized by a broad continental shelf which can be very generally
divided into three major areas. In the north is a complex of deep bays and groups of islands
extending south from Vladivostok/Nakhodka more or less to the vicinity of the Gamova
Peninsula. The southern area consists of the waters of Posiet Bay (including Expedition Bay,
Novogorodsksya Bay, Reyd Pallada Bay and outer Posiet Bay) and the waters off the Tumen
River wetlands. The third area is the outer Peter the Great Bay, generally more than 15 km
offshore.

Water depths within the first two areas are less than 50 metres and in Expedition Bay and
Novogorodskaya Bay are less than 10 metres. Maximum depths in outer Posiet Bay are
generally less than 40 metres.

The general pattern of water movement in the study area is for a warm, north-flowing current
(known locally as the Korean Current) along the coast as far north as the Gamova Peninsula.
This current is diverted into Posiet Bay by the shape of the coastline. A cold, south-flowing
current (the Primorsky Current) meets the Korean Current in the vicinity of the Gamova
Peninsula, though it is likely that the actual zone of mixing moves north and south on a
seasonal basis.

The mixing of the cold, nutrient-rich Primorsky Current with the warm Korean Current gives rise
to high productivity levels in the marine ecosystem in the vicinity of the Gamova Peninsula and
Posiet Bay. Where this water moves into the shallow, more or less closed waters of inner

Posiet Bay, it is further warmed and productivity levels increase.
Within the complex of deep bays and island groups south of Vladivostok water movements are more complex but are generally from north to south. Productivity levels are lower here.

AVAILABLE DATA

The institute of Marine Biology at the Far East Branch of the Russian Academy of Science has extensive data on most aspects of the marine environment in the Russian sector of the study area. These data sets frequently cover a twenty-year period and sometimes go back for 50 years. In Posiet Bay, studies have been going on for 20 years in some branches of marine biology. Detailed information is available on the whole biological system, including community structure, productivity, temperature, salinity and water movements. The Institute is developing a geographic information system on the marine resources of Peter the Great Bay.

Other organizations have been conducting studies in the marine environment of this sector for equivalent periods.

SPECIAL CHARACTERISTICS OF THE MARINE ENVIRONMENT

Posiet Bay and adjacent waters

In addition to the high potential for mariculture and possibly for fisheries, the waters of Posiet Bay and the nearby parts of Peter the Great Bay are noteworthy for their very high levels of productivity. This is reported in the East Sea (Sea of Japan).

As with the terrestrial component of TREDA, the marine environment here, forms the southern limit for some species and the northern limit for others. This location at a biogeographic boundary leads to high species richness in the area.

On the basis of studies that they have carried out, researchers at the Institute of Marine Biology have concluded that the ecosystem in the complex of bays, shelves and islands in this area is unique on the northeast Asian coast. This judgement is supported by the importance of the area for wintering birds, the bird breeding colonies on the offshore islands and the importance of the shallow inshore waters for migratory ducks.

MARINE PARKS AND RESERVES

The Far East State Marine Reserve (Dalnevostochny Reserve) is believed to be the only marine reserve in the Russian Federation and is certainly the only marine reserve in the Russian Far East. The Reserve, which is in three sections, was created in 1978 and includes

areas of sea, all islands within its outer boundaries, and a coastal zone some 200 metres wide.

The Reserve serves to:

- conserve typical examples of the highly diverse fauna and flora of the coastal seas of Peter the Great Bay;
- protect fauna and flora on the islands (particularly breeding and wintering bird population); and
- provide an unpolluted, undisturbed area for reference and scientific research purposes.

The area of the Reserve is 63,000 ha of sea and 1,316 ha of land.

INSTITUTIONAL ARRANGEMENTS

Russian Federation

Research and data gathering

The Institute of Marine Biology of the Far East Branch of the Russian Academy of Science has 168 research staff grouped into a number of centres for the study. It is the main centre for study of the marine ecosystem in the Far East. However, other bodies, such as the Pacific Institute of Geography, the Pacific Institute of Marine Biochemistry, and the Pacific Institute of Oceanography also work in this field. In addition, the Institute of Biology and Soil Science carries out studies in coastal areas and on offshore islands.

The Far East Regional Hydro-meteorology Institute is a government service with responsibility for measuring environmental parameters including bathymetry and ocean currents.

DPRK

No information is available on the management of the marine environment in DPRK.

China

The People's Republic of China has no coastline and no marine territory in the TREDA.

ENVIRONMENTAL PROBLEMS AND SENSITIVITIES

Current problems

The marine ecosystem in TREDA is currently suffering from a variety of pollution impacts. In the north around Vladivostok, coastal waters have been particularly affected by industrial wastes, hydrocarbons, sewage and sedimentation. Government officials report that studies have shown that this pollution currently affects comparatively localized areas around Vladivostok and Nakhodka, reaching only about one-third of the way to Slavyanka to the south.

At Slavyanka there is some pollution from sewage and heavy metals. No figures are available on the extent or severity of this pollution.

Pesticide residues have been reported in Posiet Bay. The team has no information on the level or exact nature of these residues. However, they were told that it is unlikely that the pesticides originated in the hinterland of Posiet Bay, because of the generally low levels of agriculture here. It is most likely that this pollution originated in China and was transported down the Tumen River then along the coast by the Korean Current.

There are no sewage treatment facilities in any of the towns south of Vladivostok and only two plants in the suburbs of that city. Sewage from the major part of Vladivostok, including the central city area, is untreated. Sewage is discharged to streams (generally only short distances from the sea) or directly to the sea.

No information is available on whether current levels of extraction of marine resources (fish, shellfish, sea urchins, etc.) are sustainable.

Sensitivities

The regionally unique nature of the marine environment in Posiet Bay and offshore from the Tumen River wetlands is put at risk from pollution by two characteristics of the area. The first is the north-flowing Korean current which has the potential to move pollution from DPRK and the Tumen River into this sensitive area. The second is the more or less closed nature of Expedition Bay and Novogorodskaya Bay (and to some extent Reyd Pallada Bay) in the inner part of Posiet Bay. The rate of flushing of these water bodies is likely to be quite slow, so that there is the potential for a build-up of pollutants which enter them. At present this does not seem to be a significant problem because of the low levels of population and industrial development in the area. However, there has been at least one Red Tide (toxic marine algae) incident in Expedition Bay (1984), suggesting that under some conditions there is already a problem.

The potential impacts from industrial and urban development are not limited to the marine ecosystem. Many of the birds breeding on the offshore islands are dependent on the high levels of productivity in the marine ecosystem, as are the birds wintering on the sea ice.

Similarly, the many species of ducks and wading birds which use the shallow coastal waters and the intertidal areas during migration are sensitive to impacts on the marine environment.

It is not known whether any estimates have been made of the flushing rates of

these bays, but
it is likely that sufficient data exists in the Far East Branch of the Academy of Sciences to
make this calculation. No information is available on whether the technical expertise to do this
work exists in the area.

BIODIVERSITY
The term "biodiversity" refers to the variety in the natural world. This variety can be in the
range of taxa (species, genera, families, etc.), in the range of genetic material in an individual
or a population, or in the range within and among ecosystems. Biodiversity is valued for
several reasons. First, variety imparts a degree of robustness to the natural system. Species,
populations or ecosystems which have high levels of biodiversity are more able to withstand
potentially negative impacts. Second, greater diversity increases the potential for society to
benefit from a particular species or system. For example, the greater the genetic variety within
a species, the more potential it has for evolutionary changes of practical value in agriculture,
forestry, animal husbandry or fisheries production.
The region in which TREDA is located is a globally important reservoir of biodiversity. This high
level of biodiversity is due in part to the area having largely escaped the effects of glaciation in
the Quaternary glacial period, which meant that it became a refuge for numerous species and
communities now found nowhere else. The biodiversity is also enhanced by the meeting of the
boreal and Asian ecological divisions, with many species having their latitudinal limits here,
and by the range of altitudes in this mountainous area.
Ecosystems in TREDA include marine, coastal wetlands, mountain lakes and bogs, and cold
temperate, temperate and warm temperate forests.
The temperate mixed coniferous and broad-leaved forests of northeastern Asia provide
habitats for about 360 species of wild animals, including 53 species of mammals and 280
species of birds. Compared to other temperate ecosystems these forests have extraordinary
high levels of endemic plants and invertebrates. The mixed forest community was once widely
distributed in Far Eastern Russia, China, Japan and the Korean Peninsula, but has now been
largely destroyed or significantly degraded outside of Russia. Keystone species in these

forests include the globally highly endangered Siberian (Amur) Tiger Panthera tigris altaica and
the Amur Leopard Panthera pardus orientalis.
Responsibilities for biodiversity conservation at the national level are shared among several
agencies within the government of the Russian Federation, with the Ministry of Environmental
Protection and Natural Resources and the Ministry of Agriculture having the major
responsibilities. There is an increasing tendency to have this responsibility focused in the
Ministry of Environmental Protection and Natural Resources.
In China responsibility for biodiversity conservation is very widely distributed, to the extent that
effective conservation is hindered. For this reason the National Environmental Protection
Agency has established a Biodiversity Leading Group composed of those bodies with
significant responsibilities (Chinese Academy of Sciences, Ministry of Agriculture, Ministry of
Construction, Ministry of Finance, Ministry of Forestry, Ministry of Public Security, NEPA, State
Oceanic Administration, State Planning Commission, State Science and Technology
Commission) in this area to provide overall supervision, direction and coordination.
In the DPRK responsibility for biodiversity conservation is shared among the State
Environmental Protection Committee, Department of Forestry, Management, Bureau of Land
Management, and the Academy of Sciences (with equivalent status to a Ministry). In the latter
agency, the Institutes of Zoology, Forestry and Environmental Protection play a significant role.

CULTURAL PROPERTIES
Comparatively little information is available to the study team on the cultural properties of
TREDA. However, given the long and complex history of the area, it can be assumed that
there are many historically and socially important sites in the area.
In the Russian sector there are more than 120 historical monuments. Many of these have
some connection with the Russo-Japanese conflict and are of considerable significance to the
local population who lost many of their members at that time.
There are 17 cultural properties in the Chinese sector of TREDA. These include revolutionary
relics, ruins of ancient buildings and cities and ancient graves.

ENVIRONMENTAL IMPACT ASSESSMENT

RUSSIAN FEDERATION

The description of procedures presented below is believed to be a relatively accurate description of the current situation in Primorsky Krai. Because of the overwhelming changes which have been, and still are, affecting the administration of the Russian Federation, procedures at the territorial level are not necessarily the same as those advocated or required at the federal government level. In the Russian Far East, these differences are sometimes exaggerated by a desire for some level of regional independence from the central government.

The rules and procedures for environmental impact assessment in the Russian Federation are set out in the Instructions on the Mandatory Use of Environmental Impact Assessment Procedures during Preparation of Pre-feasibility and Feasibility Studies and Project Documentation which were issued by the Ministry of Environmental Protection and Natural Resources (MEPNR) in December 1993. These rules and procedures are intended to ensure that EIA meets the requirement of the 1992 Law on Environmental Protection that short-term and long-term environmental, economic, demographic and social impacts will be adequately addressed prior to approval of any project. The Instructions are supplemented by the Norms and Regulations of Construction which have been approved by the MEPNR.

CHINA

Environmental Impact Assessment is required to be carried out under the Management Guidelines on Environmental Protection for Construction Projects (1986-86GH--003) and the Environmental Protection Management Procedure for Construction Projects issued in 1990.

Under the 1979 Environmental Protection Law, environment impact assessment is required before approval can be given to new developments. After some initial teething problems, this requirement is now generally being met - in 1989 it was estimated that 90% of all new projects, and 96% of large and middle-scale projects were being subjected to EIA (28). This law contains the "three steps at the same time" policy which provides that the environmental impact assessment prepared during the feasibility phase becomes a basis for the next three stages of environmental modification of design, environmental impact management during

construction, and environmental monitoring during the operational testing phase.
Environmental Protection Agencies at national, provincial and municipal levels are responsible
for overseeing environmental impact assessment in China.
DPRK
Environmental impact assessment in DPRK is the responsibility of the State Committee on
Environmental Protection (SCEP). EIA documents will be prepared by the proponent and
assessed by a committee appointed by the SCEP. There is no government agency in the
Rajin-Sonbong area that has responsibility for impact assessment.
No information is available on the procedures which apply, or will apply, for EIA. Similarly,
there is no information on staffing arrangements or capability for EIA.
ENVIRONMENTAL IMPACT ASSESSMENT OF TRADP ACTIVITIES
The riparian partners in TRADP have been discussing approaches to environmental impact
assessment in TREDA. A draft Memorandum of Understanding on Environmental Principles
Governing the Tumen River Economic Development Area has been prepared. This document
contains an agreement that there will be joint environmental impact assessment of
development projects in "the Region" (presumably TREDA). If such an arrangement is to
proceed in a productive and harmonious fashion, there will need to be (i) agreed procedures
for EIA; and (ii) staff in each of the participating countries who have similar degrees of
expertise and understanding of the EIA process. At present, the procedures of all countries are
different (and all differ from what could be regarded as "best international practice"), and staff
of relevant agencies have different levels of expertise in EIA. If joint (and jointly acceptable)
environmental impact assessments of projects are to be carried out, a start will need to be
made in the very near future to agreeing on procedures and training staff.

POTENTIAL IMPACTS OF TRADP
It is not appropriate to present a list in this study of the potential impacts of each of the
proposed developments in TRADP. The current early stage of development of the TRADP
concept and the limited amount of accurate environmental information that could be collected
during this study would render any attempt at producing a list of specific impacts meaningless.
A general list of impacts could be presented, however this would occupy

several tens of
pages. There are many comprehensive manuals and sets of guidelines on environmental
impact assistance which will provide much more complete lists of potential impacts than can be
given here (for example, 23 and 25). However, the appropriate time for using those detailed
lists will be the scoping of environmental assessments of project components. At this stage of
project development, it is more important to identify environmental sensitivities, and to identify
broad classes of impact which might be overlooked in the assessment process. Some important general categories of impact which should receive early consideration will be
discussed.

GENERAL CATEGORIES OF IMPACT FOR EARLY CONSIDERATION

Incremental Loss of Environmental Quality

There is a very real danger with a project like TRADP that individual components will be
considered as separate developments for the purposes of planning and environmental impact
assessment. It is clear that there is some preference among parties involved in TRADP for
avoiding a comprehensively planned approach to development, or even to broad spatial
planning.

Environmental impact assessment cannot be relied on to avoid incremental loss of
environmental quality. Some form of strategic environmental planning is required that will
indicate appropriate and inappropriate activity types for particular environments.

Cumulative Impacts

In some respects, cumulative impacts can be regarded as a sub-set of the problems dealt with
in the foregoing section. However, in many cases the accumulation of many individual impacts
does not lead to any significant deterioration of environmental quality until some critical level is
reached. At this stage, the assimilative or adaptive capacity of the impacted system is
exceeded and sudden, frequently irreversible, changes occur.

While some notice can be taken of cumulative impacts in the environmental assessment
process, they can be dealt with successfully only in the context of an environmental quality
management regime that sets overall limits on the total discharges to each system. The
TRADP riparian countries (or at least the relevant regional administrations of those countries)
will need to change their approach to pollution control if this problem is to

be addressed
adequately. Assistance will be required to develop management measures and to increase
technical expertise.

"Induced Development"

Major development projects do not occur in isolation as separate packages of activities that
have a clearly described and limited set of actions and results. There is an almost universal
tendency for a planned development activity to beget a host of unplanned activities which
frequently have environmentally undesirable results. This is a fact that the world's leading
development assistance agencies are slow to recognize.

While induced development might be regarded as an inevitable and even desirable corollary of
development projects, its impacts are not often considered in the environmental assessment of
those projects. As a result, finance and staffing are not made available to ensure that
appropriate planning and management measures can be developed by the local government
agencies.

Impacts Arising from Increases in Population

Apart from the obvious impacts of increased population associated with economic
development (demand for services, etc.), there is the potential for a range of impacts that are
usually overlooked by development planners. Many of these are related to recreational
activities. For example, increased levels of population will mean increases in hunting and
poaching of wild animals, increased fires in natural areas, impacts from recreational vehicles in
natural areas, increased cutting of firewood in forests, etc.

These impacts should not be overlooked in environmental assessment of TRADP activities and
the environmental management process should include appropriate measures to deal with
them. Such measures should include institutional development and any necessary
improvements to physical infrastructure.

Increased Demands on Government Agencies

As will be obvious from the foregoing, economic development projects frequently place
demands on government agencies. Of particular relevance to environmental quality in the
TRADP countries are the increased responsibilities for pollution control agencies, fauna and
flora protection agencies, and reserve management agencies. If development projects are

assessed on a case-by-case basis, these increased demands will not be likely to be detected.
This will lead to a deterioration in the monitoring and control of pollution and in the level of
protection of fauna, flora, reserves and historical and cultural sites.
While it might be argued that economic development will improve the funding base for
government and thereby allow the expansion of these services, in reality increases in staffing
and in the levels of expertise in government agencies generally lag several years behind
increases in economic development. Action will be needed from the outset (preferably from the
beginning of the next phase of TRADP) to help government agencies in the riparian countries
to prepare for and deal with these increased demands if there is not to be a major diminution
of environmental quality.

Off-site Impacts

There are two categories of off-site impacts that need to be considered here. The first relates
to impacts of actions that happen in TREDA. For example, air and water pollution generated in
TREDA have the potential to move away from their source to impact on areas which might be
far outside the area. The second has to do with the impacts arising indirectly because of
activities conducted in TREDA. For example, a particle-board plant in TREDA will need to
obtain its raw material from forests outside TREDA. This will have environmental impacts.
Some views of environmental assessment hold that these second order impacts of obtaining
necessary inputs should be assessed as part of the EIA for a project.
The TRADP partners will need to address this question in developing their joint approach to
environmental management.

LOCATION-SPECIFIC ENVIRONMENTAL SENSITIVITIES IN TREDA

This section will examine the most important environmental sensitivities in TREDA and give a
brief overview of their character.
Unfortunately, the quality and level of detail of information available for the Chinese sector
does not permit any identification of any area-specific environmental sensitivities other than
the Laoyeling Reserve. Similarly, the lack of detailed information from DPRK does not allow
any identification of environmental sensitivities in that sector. Despite these shortcomings, the
areas highlighted in this report are almost certainly the most

environmentally significant in
TREDA.

Tumen River/Posiet Bay Wetlands

These wetlands are internationally significant because of their biodiversity and because of their
important position on the East Asian Flyway.

Far East State Marine Reserve (Dalnevostochny)

Kedrovaya Pad Nature Reserve and Barsoviy Zakaznik

These reserves are important for the protection of the biodiversity of the region, and
particularly for protecting the remaining population of the Amur Leopard.

Offshore Wintering Areas for Avifauna

The wintering areas between the mouth of the Tumen River and Furugelma.

Gamova Peninsula

The east coast of the Gamova Peninsula is reported to have potential for intensive tourism.

Laoyeling Reserve

This reserve has the potential to complement the Kedrovaya Pad and Barsoviy reserves in
Russia in protecting major wildlife species and vegetation communities. Unfortunately,
government-sanctioned logging is reducing the habitat values and creating access for
poachers.

GENERAL ENVIRONMENT SENSITIVITIES
IN TREDA

A number of aspects of the current environmental situation in TREDA point to potential non-
area-specific impacts from TRADP.

Air Pollution

The current situation in the industrialized valleys of the Tumen River catchment and in
Vladivostok shows that the area is susceptible to air pollution problems. These are already
reaching serious proportions in some places for parts of the year. Appropriate measures will
need to be taken to improve administrative control systems and pollution licensing policies and
to ensure that existing pollution is controlled.

The pattern of movement of air masses in the region has the potential to carry air pollution
impacts in important natural areas, both within TREDA and outside.

Water Pollution

Water pollution is already a problem in the Tumen River system and in the vicinity of
Vladivostok and Nakhodka. The situation is the same as that with air pollution in that existing
administrative controls and licensing policies do not appear to be working. While some significant impacts have already been reported, there is the potential for the
situation to become much worse.

ENVIRONMENTAL CONSTRAINTS

With the level of information currently available, it is possible to discuss environmental constraints on TRADP at only a general level. These general categories include:

Water supply

Water storage capacity in TREDA is currently fairly limited. The uncertainty of annual rainfall and its highly seasonal nature means that there is a need for a comparatively large storage. Construction of water storages would be likely to impact areas with the high conservation values (primarily by flooding but also by constructing access to these areas which would be likely to be used for illegal harvesting of wildlife and forest products), or to alienate areas with agricultural production values. Since agricultural land, at least in the Chinese and DPRK sectors, is in fairly short supply because of the topography, this should be seen as a constraint.

Groundwater supplies are limited in some areas (e.g. southern Khasan District) and this may be a constraint on development.

Water quality

The low water quality in parts of the Tumen River system is a constraint on the development of industries which require clean water supplies. In those parts of this system where water quality does not currently exceed standards, the existing levels of pollution will often reduce the remaining assimilative capacity of the ecosystem, thereby limiting the amount of additional waste that can be discharged. In some places, groundwater quality may be a limiting factor.

Air quality

While air problems are not as serious as those with water pollution, the same arguments apply in relation to the remaining assimilative capacity of the environment in parts of the area.

High conservation values

In some regards, the high conservation values of significant areas in TREDA should be seen as a constraint on development. However, it is equally appropriate to see these as a development opportunity which has the potential to provide long-term sustainable economic benefits to the region.

The sensitivities of the areas with high conservation values place

some constraints on
certain types of development. These are discussed in detail in the relevant sections of
this report.

Limited institutional capabilities

The current limited institutional capability to ensure sustainable management of natural
resources in the region should be seen as a constraint on any development which may
result in increased demands on agencies with natural resource management responsibilities.

Lack of a regional strategic plan

The lack of any kind of integrated strategic planning document (whether regional or
country-based) which takes into account the environmental potentials and limitations of
the area should be seen as a constraint on development. Without such a document, it
is not possible to ensure that individual development proposals will be sustainable and
to ensure that the resultant mix of activities will result in optimal benefits being derived
from the area's resources.

WORK PLAN FOR ENVIRONMENTAL AND IMPACT MANAGEMENT

DISCUSSION

The Terms of Reference of the consultants calls for, inter alia,

A detailed work plan (i) for completing an environmental assessment, (ii) for
preparing a regional environmental management and pollution mitigation plan, and (iii) for undertaking other priority environmental tasks identified by the
mission.

The requirement appears to be based on a belief that TRADP is not dissimilar to most major
development projects and that similar environmental and impact management procedures are
required.

ENVIRONMENTAL ASSESSMENT

This would include:

broadscale identification of environmental sensitivities and possible environmental impacts

This process typically occurs at the project identification or concept stage in major
projects. The product of this stage is a report which broadly describes the environment
in the project area, highlights environmental sensitivities, describes in broad detail the
categories of environmental impact which might occur, and lists factors likely to

exacerbate environmental impacts. Preparation of this evaluation requires information
on the project type and of the general location.

Initial environmental evaluation

Initial environmental evaluation (IEE) screens the project proposal to identify potential
environmental impacts and their likely significance and to determine whether
environmental assessment (frequently called environmental impact assessment - EIA)
is necessary. IEE typically occurs at the project preparation or pre-feasibility stage. It
results in a general description of the likely environmental impacts and their likely
significance, a recommendation as to whether environmental assessment is necessary
and, if so, a scoping document defining the content of the assessment study and
report.

IEE requires a project brief for the proposed development with a clear statement of
project objectives, identification of the conditions necessary for successful completion
of the project (technical, institutional, economic, social and financial) and identification
of the proposed location.

Environmental assessment

The environment assessment (EA) identifies and quantifies the potential impacts of the
project in detail, as well as giving some attention to the justification for the project and
to alternatives to the proposed action (e.g. not proceeding with the project, using
another site, using alternative technologies). The EA concept has evolved over the past
two decades to a point where the initial impact identification and quantification is seen
as only the first stage in impact management. During this first stage, an environmental
management, monitoring and impact mitigation plan is developed which is frequently
put into effect before the commencement of construction and continues through the
operational phase of the development and frequently beyond. This is an ongoing
iterative process based on a recognition that EA is not a "one shot" process which can
infallibly identify all significant impacts and produce failsafe mitigation plans.

Environmental assessment requires a clear and detailed description of the objectives
and nature of the proposed activities and their location. It presupposes a

process in
which project designers work in cooperation with those carrying out the assessment in
order to refine/revise project elements as significant impacts are identified.
The current stage of TRADP is somewhat ambiguous. The overall concept is still evolving, with
no clear vision of what activities will occur in TREDA or where activities might occur. On the
other hand, many activities which are integral components of the TRADP concept are already
being implemented unilaterally and bilaterally. For example, the Hunchun-Zarubino rail link,
and the extensive harvesting and export of timber resources in the Russian Far East.
The fact that TRADP is still in the concept stage means that no initial environmental
examination can be carried out at this time. The appropriate activity at this stage is a
broadscale identification of environmental sensitivities and possible environmental impacts
such as is presented in this report. Yet, the pace of development of individual components and
the fact that participating countries are likely to continue to develop and execute project
components prior to any overall feasibility study gives the development of impact management
and mitigation mechanisms a very high priority.
ENVIRONMENTAL MANAGEMENT PLANNING
The characteristics of the region and of the project suggest that not only can environmental
impacts be considerably reduced by identifying appropriate activities for each broad
environmental system, but the overall effort and cost associated with impact mitigation will be
considerably reduced. Further, the increased benefit to be derived from appropriate utilization
of environmental values will add considerably to the total benefit from the project.
The example of Posiet Bay will serve to illustrate this last point. This complex of bays appears
to have very high potential for recreation and tourism, mariculture and wildlife conservation.
Even taken separately, these sectors have the potential to make a very significant contribution
to regional economies. However, they all depend on, inter alia, the quality of the marine
environment. While it is physically possible to develop major ports, industrial developments
and urban complexes in the Posiet Bay area, there would be a major conflict between these

activities and those mentioned above. Mitigation of their impacts so as to allow both sets of activities to coexist in the region would be an ongoing expense and might not be wholly successful. However, it is likely that appropriate locations outside Posiet Bay can be identified for the latter group of activities which would lead to an overall optimum level of benefit to the region.

Regional Management Planning

In order to identify broad areas suitable for different types of economies, a regional planning exercise is required. Such a regional plan might have different forms, depending on the different level of commitment to this approach to resource management that the TRADP partners decide is appropriate.

An indicative plan would identify broad ecosystem or environment types and broadly define their potentials and environmental/economic values and sensitivities. General categories of industry which are appropriate or not appropriate for each ecosystem would be identified.

At the other end of the spectrum would be a regional management plan which would define zones around and within the ecosystems and establish management guidelines for each zone.

Such guidelines might identify, for each zone, those activities which are allowed to occur without requiring permission, those that require permission (and some level of environmental impact assessment), and those which are

prohibited because of potentially serious conflicts with permitted uses or with the environmental values of the zone. A zoning system could be developed from the basis of the existing zones in the State Marine Reserve in the Russian sector and other reserves. Typical zones might include:

- general use zone;
- heavy industry zone;
- light industry zone;
- urban zone;
- extractive industry zone;
- intensive tourism zone;
- ecotourism/nature conservation zone;
- strict nature conservation zone.

This is not an exhaustive list of zone types but serves to illustrate the approach.

The consultants recommend that environmental management planning of this

central area
commence as soon as possible. If it is decided that a regional environmental management
plan will be developed, the team preparing the Tumen River/Posiet Bay plan might become a
sub-unit (or a central core) for this larger exercise.

WORK PLANS FOR ENVIRONMENTAL MANAGEMENT PLANNING

The time and information available to the team for conducting this preliminary study did not
allow the preparation of a detailed work plan for developing environmental management plans.
It is questionable whether such a work plan can usefully be developed before the TRADP
partners have reached at least a tentative conclusion on the question of strategic
environmental planning for the region.
