Japan International Cooperation Agency (JICA)

Ministry of Natural Resources and Environment Protection
Almaty City Government
Republic of Kazakhstan

The Study on

Solid Waste Management for

Almaty City in the Republic of Kazakhstan

Final Report

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

January 2000

Yachiyo Engineering Co., Ltd.
CTI Engineering International Co., Ltd.

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FINAL REPORT COMPOSITION

The Final Report is composed of the following reports:

1. SUMMARY REPORT
2. MAIN REPORT
3. SUPPORTING REPORT
4. DATA BOOK
5. ENVIRONMENTAL IMPACT ASSESSMENT REPORT

This report is the ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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PREFACE

This material presents the result of the draft Environmental Impact Assessment for the following priority projects which were selected in the Study on Solid Waste Management for Almaty City in the Republic of Kazakhstan:

(1) Construction of new West and Spasskaya transfer stations

(2) Improvement of Karasai Disposal Site

In accordance with the contents, the report comprises the following two parts:

- Part I. Draft of Environmental Impact Assessment (EIA) for construction of the new West and Spasskaya transfer stations.

- Part II. Draft of Environmental Impact Assessment (EIA) for improvement of Karasai Disposal Site.

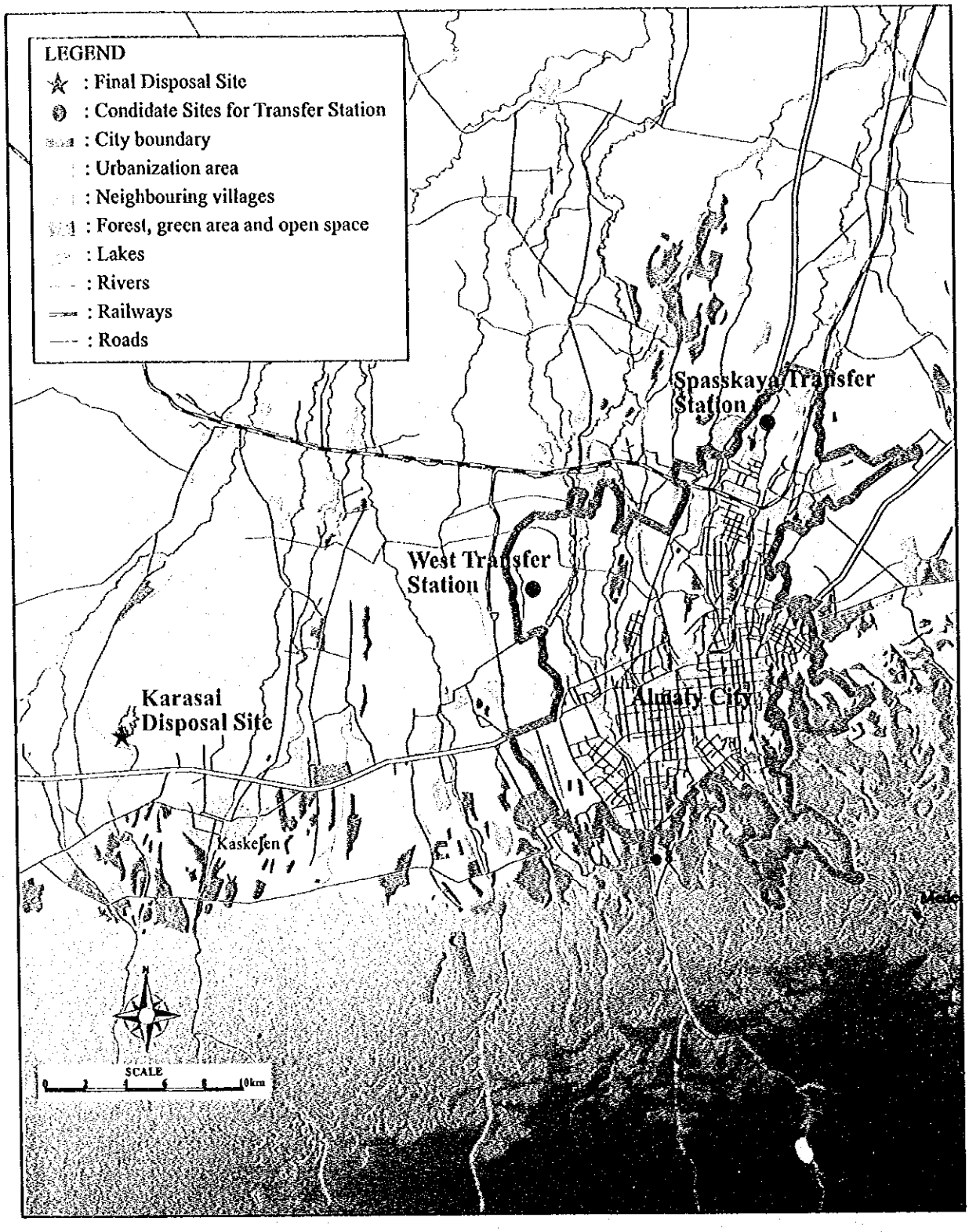
It should be noted that this assessment is not naturally a complete set of environmental impact assessment regulated in the Republic of Kazakhstan. Due to limited study time and schedule, the assessment described in this report is only a draft. During the development of the design documents for the construction of the facilities the Environmental Impact Assessment should be comprehensive and include the section on Environment Protection. The results of the State Ecological Examination (EIA) should be submitted to the following agencies:

- Concerning Karasai disposal site – to Oblast department

- Concerning Spasskaya and West transfer stations – to ACDEP

PART I

DRAFT
OF
ENVIRONMENTAL IMPACT ASSESSMENT
FOR
CONSTRUCTION OF NEW WEST AND SPASSKAYA TRANSFER STATIONS



LOCATION MAP

PART I SUMMARY

ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION OF WEST AND SPASSKAYA TRANSFER STATIONS

The West Transfer Station and the Spasskaya Transfer Station will belong to the sites on solid waste management system in Almaty and will be involved into the common technological process.

Waste transfer stations are practically similar by their purposes and tasks, transfer of solid wastes from the light-duty trucks into the heavy-duty vehicles. However, they differ in volume of waste treatment and characteristics of disposal sites.

The West Transfer Station is located considerably far (1.6 km) from the developed land and the adverse impact on health of local population is minimal. The Spasskaya Transfer Station is located practically at the Almaty border and the adverse impact resulting from the station operation may be more significant.

Production capacity of the Spasskaya Transfer Station is 2.4 times less than that of the West Transfer Station; 290 tons per day are treated by Spasskaya and 676 tons per day are treated by the West. This means that the level of impact of Spasskaya Transfer Station is not significant.

The various production capacities of waste transfer stations specify the difference in level of impact on the environment. The water diversion capacity at the West Transfer Station is about 150 m^3/day while the same capacity at Spasskaya Transfer Station is 100 m^3/day, and wastewater discharge is 7 and 3 m^3/day, respectively. Traffic intensity at the Spasskaya Transfer Station is 45-50% of the level of traffic intensity in the West Transfer Station.

This draft environmental impact assessment (EIA) of these stations takes into account all the above stated factors for obtaining valid characteristics of environmental conditions. This also considers prognoses of any alterations in the environment caused by project implementation including construction and operation of the stations.

During implementation of the draft EIA, data specifying the environmental and natural-climatic conditions of the project sites were collected and data analysis was made. The social and economic conditions, such as demographic conditions, public health conditions, medical services, economic condition and land use conditions of the project sites were surveyed. A large scope of field survey and analytical works was made concerning analysis of surface water pollution, quality of wind activity, condition of atmospheric air, and flora and fauna conditions.

Results of this draft EIA obtained during survey of the West and Spasskaya transfer stations have shown that the proposed activities may have a potential impact on the environment. However, the impact will not exceed permissible limits in case of performing preventive measures.

THE STUDY ON
SOLID WASTE MANAGEMENT
FOR ALMATY CITY
IN THE REPUBLIC OF KAZAKHSTAN

FINAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

PART I

DRAFT OF ENVIRONMENTAL IMPACT ASSESSMENT FOR
CONSTRUCTION OF NEW WEST AND SPASSKAYA TRANSFER STATIONS

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CHAPTER 1 INTRODUCTION

1.1 BACKGROUND OF THE ASSESSMENT

The major problems of solid waste management in Almaty City are the difficulty of separating wastes, transferring wastes from light-duty trucks to heavy-duty vehicles, and transporting wastes to the existing Karasai Disposal Site. To implement all of these activities, it is planned to construct two transfer stations, the West Transfer Station and the Spasskaya Transfer Station. The West Transfer Station will be constructed for waste collection in Auezovsky, Zhetysusky, Bostandyksky and Almalinsky. The Spasskaya Transfer Station will cover Medeusky and Turksibsky.

Construction and operation of these stations can have an adverse impact on the environment; therefore, it is necessary to implement an environmental impact assessment (EIA) to evaluate the level of impact. The State Research-and-Production Association of Industrial Ecology, "Kazmekhanobr", carried out environmental surveys required for the assessment based on an agreement with the JICA Study Team.

1.2 OBJECTIVE OF THE ASSESSMENT

The purposes of the draft environmental impact assessment (EIA) for the West Transfer Station and the Spasskaya Transfer Station are the following:

(1) Identification of economic, environmental and social consequences caused by construction and operation of the transfer stations; and

(2) Development of recommendations, which may mitigate adverse impacts on the environment.

In the process of implementation of the draft EIA, the following tasks were performed:

- Data collection and analysis of natural-climatic and social-economic conditions at the Waste Transfer Station and Spasskaya Transfer Station construction sites;
- Field survey of environmental and social-economic conditions;
- Identification of environmental impact types;
- Inventory of environmental pollution sources;
- Prognosis and assessment of environmental impacts of the projected sites;
- Development of measures minimizing environmental impact of the stations; and
- Specification of EIA directions taking into account obtaining more detailed project data on the West and Spasskaya transfer stations and performing additional research.

CHAPTER 2 RESULTS OF DATA COLLECTION ON ENVIRONMENTAL AND NATURAL CONDITIONS OF THE SITE AND DATA ANALYSIS

2.1 TOPOGRAPHIC CONDITIONS

Both stations are located in the southwestern part of the Ili depression whose structure is presented by alpine tectonic genesis with the intensive processes of underground structure denudation and debris accumulation. These are alluvial and prolluvial planes. Major topographic features of both sites are described as follows:

West Transfer Station: The site is located on the slope of the west aspect of the raised coast Boralday, which is 80m above the surrounding territory. The site is 40m above the bottom of the nearest slope. The slope is cut by surface runoffs and has 25% inclination in some places. The site with main constructions has marks approximately 800-805m above sea level. To the north from the site, there is a *talweg* (valley line) with area of 15 ha.

Spasskaya Transfer Station: The site is located between two rivers, namely, the Sultanka and Moyka rivers, and closely adjoins the steep slope of the Sultanka River rising 20m above its bottom. The slope is covered by ravines and cut by runoffs that show intensive water erosion and ground water discharge. The site with main constructions is located on the northwest part of the percolation bed. This part is divided by dams into plots and has average mark about 660-661m above sea level. Some plots are filled with soils and wastes, which are removed into the percolation bed.

Both sites are located on the elevated locality. Relief conditions in this locality are favorable for construction.

2.2 GEOLOGICAL CONDITIONS

2.2.1 West Transfer Station

A complex process of precipitation accumulation, lasting during neogene–quaternary periods, explains the accumulation of loose debris of heavy thickness. The neogene deposits are covered by layers of quaternary deposits, which uncovered thickness reaches 100m at the observation territory.

The quaternary deposits are developed all around the territory and differ in various genesis, sedimentology and thickness. Among them, there are alluvial-prolluvial deposits of the low-quaternary and middle quaternary-periods and alluvial deposits of the upper-quaternary and modern periods.

The low-quaternary alluvial-prolluvial deposits belong to the elevated raised coast "Boralday". The rock sequence of deposit strata is various: loam, wood loam, loamy sand with the interlayer of clay-fine-texture sand; in the floor there is gravel and pebble stone. These deposits are characterized by excessive content of carbonates. The total thickness of low-quaternary deposits is 100-250m in places where washout was not observed.

As seen from the geological description of the locality, the surface deposits are presented mainly by loam, clay sand and clay, which can protect penetration of pollutants from the surface into underground water. The most sensitive places for deep pollutant penetration are riverbeds presented by sand and gravel-pebble stone deposits.

Loam, clay sand and clay of surface deposits are very important by their geo-chemical properties and low coefficients of penetration.

The washout and water erosion widely spread at the area of transfer stations, especially during rain and periods of snow-melting in spring. Intensity of these processes depends on the relief structure and thickness of surface covering. Visible consequences of these processes are furrows, pits, and erosion channels.

Within the site there is probability of development of soil settlement and pseudocarstone processes, like those observed 1 km to the west from the heat-electric generating station (TES-2) construction site. The presence of these processes is connected with high ground watering by rainfall, snow water, drainage water, water pipeline and sewage leakage. The soil settlement is observed in the form of pits 15-25m in diameter located at the depth of 1m.

During construction and operational phases, there is probability of forming internal erosion of ground (ground boil) in the form of subsidence craters. Construction work at the site can lead to ground watering and its deformation and above-mentioned processes can take place.

2.2.2 Spasskaya Transfer Station

In the process of precipitation accumulation, thick strata of loose quaternary deposits were formed. The thickness of deposits is more than 200m. The deposits at places near the bottom of the Sultanka and Moyka rivers are presented by mixture of loam and clay, clayey sand and sand. The soil thickness is about 0.2m. The loam is yellow-gray and the thickness in interlayer is about 1.5m and more. The process of construction and operation of percolation bed and the process of filling sites with ground and waste changed mechanical and physical-chemical properties of ground. The properties have not been investigated in engineering and geological respect.

There is no washout at the site, however, erosion of the Sultanka river valley is very severe. Taking into account that deposits have layer-like structure and are influenced by anthropogenic factors, the process of ground settlement is scarcely probable, especially during ground watering. Additionally, the probability of landslide is very low although it can be eliminated at all. In future, the site should be thoroughly investigated in engineering and geological respect.

Generally, the site is suitable for construction of the station facilities, but additional researches will be necessary and useful.

2.3 HYDRO-GEOLOGICAL CONDITIONS

2.3.1 West Transfer Station

The groundwater within the site cannot be found at the depth less than 50 meters. This does not present influence for the construction conditions or environmental conditions.

2.3.2 Spasskaya Transfer Station

The groundwater within the site can be found at the depth more than 12 meters. The flow of this water moves to the valley of the Sultanka River. The conditions for the construction of the station at this territory are favorable. However, in case of engineering system failure, the level of groundwater can rise, which can lead to the groundwater discharge at the nearest embankment of the Sultanka river valley and be a cause of soil erosion.

2.4 METEOROLOGICAL CONDITIONS

The climatic conditions at both sites are characterized by the hydro-meteorological services of the republic according to the data of one meteorological station, i.e., Almaty MS (meteorological station). The site specifications are taken into account depending on the parameter to be measured at the site.

The climate of the region of the West and Spasskaya transfer stations is sharply continental with significant variations in season and daily temperatures. The summer period is warm and long, and the winter is cold, with thaws and fall in temperatures. According to the Sanitary Regulations and Rules 2.01.01-82 *"Construction Climatography and Geo-physics"* and the reference manual *"Construction Climatology"*, the average temperature of the coldest five days is 25 degrees centigrade below zero. The average maximum temperature of the hottest summer month is 29.5 degrees centigrade above zero. The absolute minimum temperature is 38 degrees centigrade below zero. The absolute maximum temperature is 42 degrees centigrade above zero. The air temperature of the coldest days and nights is 20 degrees centigrade below zero, and the average length is 9 hours. The heating period lasts 166 days, and the period without frosts lasts 141-169 days.

The data on the average monthly temperature, total sun radiation on the horizontal surfaces, relative humidity of the air, and the data on evaporation from the water surfaces are presented in Table 2.4.1. The Almaty Meteorological Station obtained the data during the long period of observations.

It is seen that the sufficient rise in temperature is observed in April and the fall in temperature is observed in November.

Table 2.4.1 Average Temperature, Sun Radiation, Air Humidity and Evaporation

Parameters	Month												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Temperature, ^{o}C	-7.4	-5.6	1.8	10.5	16.2	20.6	23.3	22.3	16.9	9.5	0.8	-4.8	8.7
Radiation, mJ/m^2	176	239	354	484	632	678	729	647	497	321	187	136	423
Humidity, %	82	82	82	68	65	60	51	50	56	70	83	84	69
Evaporation, mm	13	12	25	52	124	142	191	179	125	67	21	16	967

The city area is characterized by weak wind activity, and the wind force is usually 1-2 m/sec, as shown in Table 2.4.2. According to the annual time scale, the strongest summer winds become weaker in winter. It is connected with the stagnation of the Siberian air mass developing winter inversion along the mountains. The average wind force during heating period is 1.3 m/sec in December and 1.1 m/sec in February. The periodicity of wind force less than 1 m/sec is 59%, and the periodicity of the wind force more than 8 m/sec is 1%. The periodicity of weak winds in winter which speed is less than 1 m/sec is 77%.

In Almaty suburbs, the period of calm becomes less.

Table 2.4.2 Average Monthly and Annual Wind Force

Unit: m/sec

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Wind Force	1.1	1.2	1.5	1.9	2.1	2.2	2.2	2.2	2.1	1.7	1.2	1.1	1.7

The force of wind, which periodicity does not exceed 5%, is 3 m/sec. The wind force more than 10 m/sec is observed rarely and the periodicity of such wind is about 1%. In Almaty, the strong winds (more than15m/sec) are observed during 15 days per year. In winter, the strong wind blows 1-3 days per10 years, and in summer it blows 2-3 days annually, predominantly during the afternoon, and comes along with dust storm.

Table 2.4.3 Maximum Wind Force of Different Periodicity

Meteorological Station	Force of wind (m/sec) repeated 1 time per			
	Year	5 years	10 years	20 years
Almaty MS	14	18	20	23

Table 2.4.4 Periodicity and Force of Wind on Different Directions in January and July

Month	N	NE	E	SE	S	SW	W	NW	Calm
January									
%	9	12	7	23	16	20	7	6	34
m/sec	1.4	1.5	1.4	1.8	1.8	1.9	1.7	1.3	
July									
%	5	11,0	6	45	17	8	4	4	13
m/sec	1.9	2.0	1.6	2.8	2.8	2.4	2.2	1.9	

Note: N: North, NE: Northeast, E: East, SE: Southeast, S: South, SW: Southwest, W: West, NW: Northwest.

As mentioned above, the data of the Almaty Meteorological Station does not completely reflect the real situation on the sites. Taking into account that the main climatic characteristic important for the environmental impact assessment is wind condition, which determines transfer of dust and pollutants, the data obtained from the Burunday Meteorological Station during 1971-1975 were considered. The assessment of wind force on different directions in different seasons showed that the resultant of the forces is directed from the southwest to the northeast. The checking calculation obtained from data at the Airport in 1966-1975 provided the same result.

The same calculation of day and night winds proved the change of wind directions during the day and night.

Table 2.4.5 Average Monthly and Annual Precipitation

Unit: mm

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
Precipitatiopn	30	30	66	98	97	60	40	26	28	51	51	34	611

It is seen that in spring the annual precipitation amounts to 43%, in summer - 20%, and in autumn and winter - 15-22%. The summer rains are presented by showers. According to the observation made at the Almaty Meteorological Station, the maximum daily precipitation is 74mm.

On the average, it snows 40 days a year in Almaty. During this period, snow-cover reaches 80mm in height, which amounts to 14% of the total annual precipitation. The depth of ground frost penetration reaches 140 cm. In some years, the date of appearance of snow-cover may fluctuate from 4 to 5 weeks. The first snow-cover thaws quickly, but snowfalls occur several times a month. In December, snow covers the land and the snow-cover may exist for 100 days. During extreme years, the snow period may last longer, about 150 days, or less, about 30 days.

Thunderstorms are the most widespread phenomenon in Almaty and suburbs. The average number of thunderstorm days is 23-45 days; on certain years the number can reach 68 days. The main period of thunderstorms in the city is from April to September. Thunderstorms do not last more than one hour. The average duration of thunderstorm is 0.7-0.8 hours, and the maximum duration is 4-7 hours in summer.

Hailstorm is an occasional phenomenon in this region. On the average, it is observed 1-2 days, and the maximum is 7 days. In different regions, the number of hailstorm days varies depending on the altitude above sea level. The hailstorm period in Almaty lasts from March to October. The high occurrence of hailstorm is often observed in May, but usually this occurs once every two years. Usually, hailstorms last 7 minutes.

The soil-climatic conditions of the West Transfer Station region do not represent favorable condition for dust storms. Weak wind force, significant precipitation and plants protecting soil-cover can explain the minimum amount (7-8 times) of dust storms per year in Almaty.

Fogs are observed during cold seasons. The number of fog days in Almaty and suburbs is about 48-70. The average duration of fogs is 6 hours or less. In winter it is 4-5 hours; sometimes the fog may last for 2-3 days.

Snowstorms in Almaty are a rare phenomenon because the winds are weak and the weather is calm.

2.5 FLORA AND FAUNA

2.5.1 Flora

1) West Transfer Station

Unirrigated plowed fields occupied 300m around the West Transfer Station. In the western part of the observation territory, only a narrow area has not been plowed. It was located at both sides of the road, along the spring, at the bottom of the hill and on its surface. Root plants including autumn wormwood, turf (meadow) grasses, and ephemerals were observed.

In general, herbage is presented by desert-steppe plants. It includes plants growing in desert – autumn wormwood, ephemerals (bulbous meadow grass, rattle brome and sedge), and plants growing in steppe – turf grasses (sheep's fescue), some types of mixed grasses (desert sage, gay mallow, mullein).

In the farming respect, the territory is presented with spring-summer-autumn pastures, but practically these are not used for cattle pasture because there is plough land around this territory.

At the observed territory the most prevalent plants are: wormwood-ephemeral plant associations in combination with turfy-grasses-ephemeral-mixed grasses, ephemeral-sedge-mixed grasses, weed-ephemeral-autumn wormwood associations at the light-brown loam soil and liquorice-mixed grasses-sedge, sedge-gramineous at the hydro-morphologic soil along depressions and low land. It is indicated that in all plant associations there are weed infested plants (cotton thistle, hemp, etc.) and they usually grow at the territory under anthropogenic impact. In this case, it is seen that plants occupy a narrow area along the road, where the surface was violated during construction of this road and was disturbed by plough land gaps around the hill.

The gross crop productivity is sufficiently high and amounts 3.0 – 5.8 centner/ha of dry volume; 1.7-3.8 centner/ha of feed unit and 23.0 centner/ha at the zonal plants, and 11.3 centner/ha of feed units at the low land.

In general, 70.4 ha of agricultural land were investigated including 62.4 ha of plough land and 8.0 ha of pasture. The plough land includes the area of the transfer station project site.

2) Spasskaya Transfer Station

To the northeast from the proposed location of the Spasskaya Transfer Station, the territory is occupied by a dumpsite and a sewage station. From the southeast of the site, it is surrounded by percolation beds that are separated by forest plantings. Currently, the fields, except one or two of them, have overgrown with weed infested plants. From the west and north, the territory borders with depots and storage facilities of the Central Asian Company and other organizations.

In the southwest along the access road, there is a large cemetery, and at the fence of this cemetery there is a disposal site overgrown with weeds and annual plants.

The natural vegetation is still growing along the valleys of the Sultanka and Vesnovka rivers. The floodplain is occupied by grass and weed infested plants with prevalence of soft stem grasses – creeping dog's-tooth grass, couch and meadow grasses. Besides, the herbage is presented by mesophyllous grasses – hoary plantain, white clover, Asian mint and a big amount of weeds, such as spurge, cornflower, cotton thistle, weed hemp, candytuft cornflower, etc.

The surface of the floodplain is not plain. There are channels and several depressions with rod, cane and sedge marshes. The right bank of the river was planted with maples and elms, which have not become acclimatized.

The riverbanks lie at the floodplain along both sides of the riverbed. The banks are steep, cut with channels, and occupied with rare autumn wormwood-ephemeral and weed-ephemeral vegetation on the light-brown loam soil.

In the farming respect, the territory is presented with a spring-summer-autumn pasture, which is used privately for pasturing cattle.

The gross crop productivity at the light-brown soil amounts to 3.4-4.2 centner/ha of dry volume, and 1.8-2.4 centner/ha of feed units. The productivity of pastures with grasses and weed-infested grasses at the meadow soil is 5.1 centner/ha of dry volume and 2.9 centner/ha of feed units.

2.5.2 Fauna

1) West Transfer Station

The territory of the project site is separated from the plough land located upland. From all sides, the site is surrounded by anthropogenic landscape. From the west, the site adjoins the 10 meter strip of virgin soil. There is a flat hill planted with lucerne to the west behind the asphalt road. In terms of qualitative and quantitative analyses, vertebrates inhabiting this territory are very rare. The nearest water reservoirs are located a couple of kilometers

from the disposal site, therefore, fish will not be included in the list of vertebrates of this territory.

Green toads represent the Amphibian species as the most dry-resistant species. There is a probability of inhabiting lacustrine frogs at the low land planted with lucerne.

Reptilians are presented by horsfield's terrapin, colored lizard, rat-snake and mamushi.

Avifauna of the territory is poor. Some species of the mostly spread orders are not met. It is possible to meet rock-dove flying to the cut grain fields. Cuckoo species fly in spring and early in summer. The coraciiformes order is presented by roller, bee-eater and hoopoe. The passeriformes order is presented by swallow, sand martin, skylark, crested lark, black-headed wagtail, lesser grey shrike, common whitethroat, starling, common mynah, jackdaw, magpie, black-headed bunting, corn-bunting, tree sparrow, Spanish sparrow, Indian-sparrow and house-sparrow. The falconiformers order is presented by kestrel and montagu's harrier.

As for mammals, the insect-eaters order is presented by long-eared hedgehog and lesser shrew. It is possible to meet bats during night hunting along the west hill, and the bats order is presented by lesser mouse-eared bat, great noctule bat and serotine bat. The gnawing animals are presented by large-toothed suslik, field mouse, house mouse, modelike meadow mouse, grey hamster and Kirgiz vole. At this territory there are carnivores presented by weasel, steppe polecat, fox and corsac fox.

2) Spasskaya Transfer Station

The Spasskaya Transfer Station is located in the northwestern territory of the Almaty borderland. From one side it is surrounded by forest (City's cemetery) and from the other side it is surrounded by the valley of the Bolshaya Almatinka River. Since there is the river and rich plantation of trees and bushes, the list of vertebrate animals is larger and it includes fishes, amphibian species, reptilian species, birds and mammal species.

The specialists indicated, in terms of fishes, minnow, schizothorax genus, dudgeon, goldfish, sloth bear, stone loach and common loach at this territory.

At the floodplain of the Sultanks River and nearby, there are the following amphibian species: lacustrine frog, green toad and probably Siberia frog.

The reptilian is presented by colored lizard and snake-eyed lizard. The snakes are presented by water-snake, grass-snake and rat-snake. It is evident that this list of the reptilians inhabiting the territory is not complete, and to develop a more detailed list of the reptilian species, it is necessary to perform special observations.

Due to close neighboring with people and their constructions, the list of birds inhabiting the territory of the disposal site is more various by means of synantropic species. The water-logged ground of the Sultanka river floodplain is dwelled by mallard and garganey, and the water-logged ground planted with sedge and reed is a refuge for moorhen and little crake. The dove order is presented by gray-dove, turtle-dove, ring-dove, and senegal turtle dove. Owls are presented by long eared owl and scops owl. The many small birds are presented by cuckoo. The coraciiformes order is presented by hoopoe and kingfisher. In addition, it is possible to see sparrows at the disposal site. The hirundinidae family is presented by swallow, red-rumped swallow and sand martin. At

the nesting place there are black-headed wagtail, lesser gray shrike, red-backed shrike, blackbird, nightingale, common white throat, magpie, corn bunting and desert bull fish. Four species of sparrows bring to a conclusion the list, namely, tree sparrow, Spanish sparrow, Indian-sparrow and house sparrow.

As for mammals, the insect-eaters order is presented by long-eared hedgehog and lesser shrew. The bats order is presented by lesser mouse-eared bat, great noctule bat and serotine bat. The gnawing animals are presented by large-toothed suslik, field mouse, house mouse, modelike meadow mouse, gray hamster and Kirgiz vole. At this territory there are carnivores presented by weasel and fox.

CHAPTER 3 RESULTS OF THE DATA COLLECTION ON SOCIOECONOMIC CONDITIONS OF THE SITE AND DATA ANALYSIS

3.1 DEMOGRAPHIC CONDITIONS

The Akbulak village located close to the West Transfer Station and Turksibsky including the Pyatiletka-Turksiba village located 0.8 km from the construction site of the Spasskaya Transfer Station were considered to be surveyed.

The research shows that in the Akbulak Village the considerable increase in population per year was explained by the prevailing adult population, i.e., 16.4% in 1998 in comparison with adult rate in 1996 (see, Table 3.1.1). Child population practically has not changed. Increase in child population in 1998 as compared with 1996 was less than one percent.

The number of people who were born in 1998 decreased by twice the number in 1997. The number of people who died in 1996-1997 amounts to 15-16 persons per 1000 persons and decreased 1.4 times in 1998 (see, Table 3.1.2).

In 1998, the births increased by 1.5 times per 1000 persons.

The population of Pyatiletka-Turksiba Village has not changed for the last two years. The adult population has become older, and this may be due to decreasing fertile aged female population by 5.3 times and, as a result, birthrate decreased by 5.1 percent.

Thus, it is seen that in Pyatiletka-Turksiba Village, adult population as well as child population decreases constantly in comparison with Kaskelen City and Akbulak Village.

Number of people who were born is still on the same level, but number of people who had died exceeds by 1.5 times the average rate in the oblast. The reason is low rate of births and negative level in 1997.

Table 3.1.1 Population Rate in Populated Localities Adjacent to the West Transfer Station (Akbulak) and Spasskaya Transfer Station (Pyatiletka-Turksiba)

Locality	Akbulak village			Pyatiletka-Turksiba village		
Year	1996	1997	1998	1996	1997	1998
Total population including:	3,432	3,386	3,925	10,833	10,473	10,506
Men	1,051	794	1,323	3,693	3,553	3,466
Women	1,360	1,483	1,483	3,954	3,840	3,840
(Women of fertile age)	(690)	(692)	(692)	(1,821)	(1,726)	(1,726)
Children from 0 up to 14 years	1,021	1,109	1,119	3,186	3,080	3,200
(Children up to 1 year)	(55)	(52)	(49)	(157)	(145)	(290)

Table 3.1.2 Dynamic of Population Rate for 1996-1998 in Akbulak Village (West Transfer Station) and Pyatiletka Turksiba Village (Spasskaya Transfer Station)

	People birthrate Per 1000 persons			People death-rate Per 1000 persons			Natality Per 1000 persons			Baby death-rate Per 1000 born alive		
Year	1996	1997	1998	1996	1997	1998	1996	1997	1998	1996	1997	1998
Akbulak	16.0	23.3	13.1	15.1	16.0	11.6	0.9	7.3	1.5	-	31.7	-
Pyatiletka-Turksiba	14.5	13.8	14.4	13.2	13.9	12.9	1.3	-0.1	1.5	-	13.6	11.7
Average rating on Almatinsky oblast	16.2	14.6	14.3	9.0	8.8	8.7	7.2	5.8	5.6	20.8	19.5	15.2
The Republic of Kazakhstan	15.9	14.7	14.2	10.4	10.1	9.8	5.5	4.6	4.4	25.4	24.2	21.4

3.2 PUBLIC HEALTH CONDITIONS AND POPULATION RATE OF DISEASE

Rate of disease is the most accessible type of information on health conditions. The advantage of this information is that information on rate of disease contains reports from medical and prophylactic establishments. However, there are disadvantages of such information too, because it depends on the level of medical services and is based, generally, on a population appealing for aid, which was difficult to control last year. The reason is that several medical establishments whose statistical reporting may not be in order can treat the population of one locality. Accordingly, it is not possible to consider this rate of disease as a comprehensive rate. The rate should be checked by detailed medical examination of the population.

Table 3.2.1 shows the adult rate of disease and the child rate of disease for the most widespread types of diseases.

Respiratory diseases are the main pathology in all populated localities within the waste transfer stations in Almaty and in the Republic of Kazakhstan.

The dynamics of respiratory diseases for adults and children has decreased in 1998 in comparison with the previous two years.

Table 3.2.2 shows the classification of adult rate of disease and child rate of disease per 100 thousand people.

In Akbulak Village, the adult rate of disease increased by 43.3% in 1997 in comparison with 1996, and the child rate of disease increased by 35.2% at the same time. In 1998 the adult and child rates of disease decreased by 32.9 and 10.8 percent, respectively.

Adult rate of respiratory diseases in Pyatiletka-Turksiba in 1996 increased 1.5 times and this should be taken into consideration although after 1996 the rate of disease kept the same tendencies as in Akbulak Village.

Therefore, it is necessary to notice that the rate of respiratory diseases in Akbulak Village and in Pyatiletka-Turksiba Village considerably exceeds the rate of respiratory diseases in Almaty and in the Republic of Kazakhstan as a whole.

Environmental pollution causes increase in allergic diseases, which are widespread among the population of Pyatiletka-Turksiba where the rate of disease extremely exceeds the rate of disease in other populated localities and in the Republic as a whole. It is noticed that, in general, only the adult population suffers from diseases. This can be explained by adverse environmental conditions long affecting the health of people who had lived for a long time in that village. It is known that in 1997 the adult rate of diseases exceeded the average republic rate of diseases by 40 times, and during other years it exceeded by 4 times.

Rate of blood circulation diseases in villages is 2-3 times higher than the rate of this disease in Almaty and is 1.5-2 times higher than the republican rate. At the same time, the adult rate of blood circulation diseases in Pyatiletka-Turksiba is higher than in Akbulak Village. In Akbulak the rate of diseases has become lower but in Pyatiletka-Turksiba it has increased by 16.7 percent.

The spread of dermal diseases is an indicator of negative effects caused by environmental pollution on health. According to the data presented in the report, the highest rate of dermal diseases is registered at 12 among adult population in Pyatiletka-Turksiba Village. The level of population requiring dermal treatment is 2.5-7 times higher than the level in other populated localities and in the republic as a whole. At the same time, the frequency of child dermal diseases in Pyatiletka-Turksiba is lower than in Akbulak Village, Almaty City and in the republic as a whole.

The last years are characterized by decreasing adult rate of diseases at 11.6 percent in Akbulak and 2.4 times in Pyatiletka.

The rate of renal and urogenital diseases in Pyatiletka-Turksiba is 4 times higher than the rate in Akbulak, Almaty and in the republic. This can be explained by lack of special salts in drinking water and bad quality of drinking water.

The pathology of digestive organs is generally indicated among Akbulak population, although in Pyatiletka it is 2-3 times higher than in Almaty and 7-19 times higher than in the republic.

The rate of blood forming organ diseases in Pyatiletka-Turksiba is higher than the average republican rate but is lower than this rate in Almaty. Taking into account that this pathology is a result of chemical effect, which is less in a village than in a city, these rates can be easily explained.

In Akbulak, the level of population complaints on neoplasm was most excessive. In 1997 and 1998 the level had decreased.

Table 3.2.1 Adult and Child Rates of Disease Depending on the Disease Classification (per 100 thousand people) at Akbulak Village (West Transfer Station) and Turksibsky District (Spasskaya Transfer Station)

Rates	Akbulak village			Turksibsky, Almaty			Almaty			The Republic of Kazakhstan		
	1996	1997	1998	1996	1997	1998	1996	1997	1998	1996	1997	1998
Respiratory diseases:												
Adults:	41435.0	59389.6	39878.8	70197.2	54637.6	33450.0	20702.6	13512.2	13756.5	11063.9	9919.4	9921.2
Children:	51217.3	79891.8	71224.3	39280.5	26088.0	8213.6	36252.7	34700.2	40548.6	32469.1	31330.3	36856.8
Allergic diseases:												
Adults:	290.3	229.7	285.1	950.6	8316.7	894.9	245.7	286.0	239.1	213.8	231.5	243.5
Children:	497.7	297.3	446.8	272.8	501.2	339.7	165.1	170.4	163.0	201.3	164.9	220.8
Hart and vascular system diseases:												
Adults:	29323.9	21956.8	24661.4	31465.2	29508.4	33450.0	83323.0	8046.0	8753.5	1450.7	1383.9	1499.2
Children:	979.4	891.9	446.8	395.3	456.6	590.3	580.2	610.1	736.8	241.2	248.9	337.3
Dermal diseases:												
Adults:	3875.3	3425.8	3159.2	22193.9	9072.5	8551.4	4579.5	4446.8	4395.0	-	3623.3	3593.4
Children:	5680.0	6541.2	5451.3	3140.6	1464.5	1063.6	6456.5	5354.1	5398.2	-	4642.5	4676.0
Renal diseases:	3608.5	3572.5	4169.6	16735.5	16452.4	18046.4	5297.1	5335.4	5740.0	2847.0	2863.6	3012.1
Digestive tract diseases:	37702.2	26412.5	22487.7	10719.2	11765.7	10921.1	7301.4	6278.4	6776.3	3221.8	2659.6	2873.8
Blood diseases:	1036.9	1423.9	997.8	969.8	443.2	617.2	1692.4	1828.8	2047.0	736.0	825.8	919.5
Oncologic diseases:	2156.8	1469.9	1710.6	1675.2	972.2	1547.6	1422.1	2473.5	1424.8	379.6	389.3	388.1
Virus hepatitis:												
Adults:	233.1	464.6	997.8									
Children:	180.3	1387.5	1519.2									

Table 3.2.2 Dynamics of Population Rate of Disease for 1996-1998 in Pyatiletka-Turksiba Village (Spasskaya Transfer Station) and in Akbulak Village (West Transfer Station)

Rate of disease	Pyatiletka-Turksiba				Akbulak				Almaty				
	1996	1997	1998	Increase, Decrease (-)%	1996	1997	1998	Increase, Decrease (-)%	1996	1997	1998	Increase, Decrease (-)%	Almaty Oblast (1996-1998)
General rate of disease	1898.4	1425.8	1518.9	-19.8	1019.2	1058.2	801.2	-21.4	776.2	743.9	794.6	+2.3	446.0
Rate of first diagnosed disease	1161.8	826.4	846.7	-27.2	523.6	622.3	421.9	-19.4	468.9	444.8	474.3	+1.15	446.0
Child rate of disease	721.5	436.4	3.78	-55.9	935.0	1200.1	620.1	-33.7	782.3	741.9	829.0	+5.9	570.2

By evaluating the dynamics of total rates of diseases for 1996-1998, the following general features become evident. While the rate of diseases in the republic has not changed (increase by 1.15-2.3%), the rate of diseases in Pyatilitka and Akbulak has been decreasing but not steadily. The general rate of diseases in 1998 decreased by 21 percent in comparison with 1996. The situation with registration of child primary diseases was the same. The same annual decrease in rate of diseases was observed.

At the same time, there is a considerable difference between the rate of diseases in different populated localities. The rate of general diseases prevails in Turksibsky (Pyatiletka). The rate of general diseases is 1.5-2 times higher than the same parameters in Akbulak.

The same situation is observed regarding first diagnosed diseases. The child rate of first diagnosed diseases is not the same: the rate of disease is higher in Akbulak than in Pyatiletka where the child rate of first diagnosed diseases is less than the republican rate.

3.3 HEALTH SERVICES

3.3.1 West Transfer Station

Until now, the population of the project site in Kokkaynar is serviced by medical establishments of Karasaysky or Kaskelen City and also by oblast medical establishments located in Almaty (oblast hospital). Since the village and the transfer station site belong to Almaty City, medical and sanitary establishments of Almaty provide services to the population of these areas. Currently, in connection with the continuing reformation of the health care system, it is difficult to define the establishments and types of medical services for the local population of the nearest villages.

The workers of the heat-electric generating station (TES-2) are provided with medical care services by TES-2 medical and sanitary establishments and also, at the places where they live, by local medical services such as first aid, prophylactic care of traumatism, etc. Probably, at the West Transfer Station the same combined system of medical care will be applied.

3.3.2 Spasskaya Transfer Station

The Spasskaya Transfer Station is located in the city. The population of the site is cared for domiciliary in regional polyclinics and outpatient departments of health establishments. The combined system of medical care by specialists from the Spasskaya Transfer Station can be used.

3.4 ECONOMIC CONDITIONS

Generally, economic problems are connected with land occupancy and making limits on use of sanitary-protection zones of the transfer stations.

The quality method for land assessment was used for both stations.

At the observation site, the soil assessment of the unirrigated plough land was made using the oblast standards for soil quality of tillable land of irrigated and unirrigated farming of

Almaty oblast. The standards were approved by the Ministry of Agriculture of the Republic of Kazakhstan (1978).

The estimation of soil quality index was made in accordance with the requirements stated in *"The book of Temporary Methodical Directions on Land Assessment of the Republic of Kazakhstan"*, 1979.

Taking into account that the exact size and regime of the sanitary-protection zone will be stated during the next project phase, two estimations were made. These are the cost of damage for the main production site of the transfer station and the cost of damage of the territory of the proposed location of the sanitary-protection zone.

3.4.1 West Transfer Station

Resulting from the soil assessment, the average quality index was defined: the average quality index for plough land is 27.4 and 22.7 for pastures and the average quality index of the whole site is 26.9.

In the process of estimation of cost of agricultural land, the area determined by the geo-botanical observation was taken as the assessment area. The main parameters of the assessment were the following:

- grain crop productivity (centner/ha) at plough land;
- feed unit productivity (centner/ha) at pastures; and
- cost of agricultural production.

Land assessment of unirrigated plough land was made on the basis of grain, the land assessment of pastures was made according to milk production, which is most effective for the present natural-climatic conditions.

The estimation of land was made in accordance with *"The Temporary Methodic on Determination of a Normative Cost of Agricultural Land"*; the methodology was approved by the State Committee of the Republic of Kazakhstan on land relations and land utilization, from December 21,1995.

The agricultural production losses at the West Transfer Station site whose territory is 3 ha is 2.197 millions of tenge.

3.4.2 Spasskaya Transfer Station

Resulting from the soil assessment, the average quality index was defined; the average quality index for virgin land is 22.3 and 24.6 for pastures, and the average quality index for the whole site is 8.1. The land, for example, dumps, sewage treatment lagoons, etc., damaged by technogenic activity has a zero quality index and reduces the total quality index of the whole site.

The land site with the area of 2 ha is located near the border of Almaty City.

According to the Regulation of the Government of the Republic of Kazakhstan from May 8, 1996, # 576, *"Statement of Payment Rate for Land, which is Sold by the State in*

Private Ownership or is Given for Land Use", the cost of 1 square km in Almaty is 717 tenge.

According to Clause 6.1 of the Regulation of the Government of the Republic of Kazakhstan from October 1, 1996, # 1203, *"Statement of Order Determining Estimation Cost of Land, which is Sold by the State in Private Ownership or is Given for Land Use"*, the correction coefficients shall be applied for land of populated localities that is given for construction or use. The coefficients were stated resulting from the zoning of the populated localities and depend on the location of a land site, environmental conditions, landscape and other factors.

According to the Almaty zoning plan approved by the Almaty authorities, the coefficient of site location is 0.5.

In the process of land allotment for industrial needs in the populated localities, agricultural production losses are not replaced.

The compensation payment for alienation of the urban territory (2 ha) allotted for the Spasskaya Transfer Station construction will be 7.170 million tenge.

It is necessary to remark, that for both stations, according to Article 88 of the Decree of the President of the Republic of Kazakhstan having the power of Law "on Land", the land of sanitary-protection zones shall not be withdrawn from owners and land users, but special conditions on land use shall be stated. The land use order and assessment of economic consequences were developed in "The project on development of sanitary-protection zone", which would be proposed for implementation during the next phase of the West and Spasskaya transfer stations designing.

3.5 Land Use Conditions

The land use conditions for the West and Spasskaya transfer stations are specified by the Decree of the President of the Republic of Kazakhstan having the power of Law "on Land", because both sites are located at the land belonging to Almaty (Article 82) and are given for allocation to industrial enterprises (Article 86) and must have sanitary-protection zones (Article 88).

Besides, the soil surface of these sites was damaged by technogenic activity (the Spasskaya Transfer Station) and is polluted (the West Transfer Station). Thus, *"The Provision on Order of Withdrawal, Protection and Use of Polluted and Damaged Land"* (from June 16, 1997, #976) shall be applied for these territories.

3.5.1 West Transfer Station

The land to the east from the main road Algabas-Burunday belongs to the city and the land to the west from the road belongs to Karasay of Almaty oblast. Plough-land and pastures occupy the industrial site and sanitary-protection zone of the station. The main natural and economic parameters are presented in Section 3.4.

3.5.2 Spasskaya Transfer Station

The site of the station is located within the city border at the former sewage treatment lagoon. The site adjoins the storage, industrial depots and a cemetery. The rest space is occupied by dumping sites and forest planting. The sanitary-protection zone of the station borders with the valley of the Sultanka River and crosses the water protection zone. The main natural and economic parameters are presented in Section 3.4.

CHAPTER 4 RESULTS OF FIELD SURVEY ON ENVIRONMENTAL AND NATURAL CONDITIONS OF THE SITE

4.1 SURFACE AND GROUND WATER SURVEY

4.1.1 West Transfer Station

At the territory of the West Transfer Station, there are no open water reservoirs, therefore, no technological impact on the surface water body is expected.

In hydro-geological respect, the territory of the West Transfer Station is located at the alluvial-prolluvial middle-quaternary deposits and alluvial-prolluvial down-quaternary deposits.

The alluvial-prolluvial deposits are presented by loam and clay-loam with interlayer of sand and pebble stone of small thickness. According to the results of work made before, at the distance of 1000-1500m from the disposal site there is no groundwater at the depth of 20m.

Artesian or confined aquifers were uncovered at the depth of 150m (the bore hole is located 3000m from the disposal site); the water content of rocks is low. The groundwater is practically protected and belongs to III category[1].

Down quaternary deposits of alluvial-prolluvial deposits were found in the form of residual mountain (outliers). The particular feature of the deposits is vertical alteration of water permeable layers, impervious strata and weakly permeable layers.

The sedimenthological structure of aquifers (water bearing layers) changes from clay-loam and sand to gravel deposits. The thickness of aquifers is not large. There is no groundwater.

Artesian water occurs at the depth of 150-300m. Additional survey is not required because of high safety of transfer station.

4.1.2 Spasskaya Transfer Station

In the hydro-graphical respect, the Sultanka River from the west and the Moika River from the east surround the Spasskaya Transfer Station, as shown in Figure 4.1.1. The considered waterways belong to Ili-Balkhash basin, because the Sultanka River and the Moika River, being tributaries of the Vesnovka River, flow into the Ili River through the Almatinka River and the Kaskelenka River. At this region, the stream frequency changes from 0.60 to 1.20 km/km^2 (according to *"Resources of Surface Water"* volume 13, edition 2, -L:Gidrometeoizdat, 1970, p. 645) and at the elevated territories, 2.5-3.0 km/km^2. According to stream classification, Sultanka and Moika belong to the

[1] Categories of groundwater protection are defined depending on permeability of ground deposits as follows:
I category – permeability of the ground is high, so groundwater is weakly protected;
II category – permeability of the ground is normal, so protection of groundwater is normal;and
III category – permeability of the ground is low, so protection of groundwater is high.

category of rivers with spring inflows. The length of the Sultanka River is 14 km, and the length of the Moika River is 11 km.

According to measurements of flow intensity made by the "Kazmekhanobr" association in August 1999, the flow intensity of the Sultanka River was 0.55 m^3/sec and the flow intensity of the Moika River was 0.25 m^3/sec.

It is necessary to consider that the Sultanka and Moika rivers flowing near the Spasskaya Transfer Station may have a negative impact on the environmental components of Ili-Balkhash basin, because they may bring pollutions into the Vesnovka, Malaya Almatinka, Kaskelenka, and Ili rivers and the Balkhash Lake.

The results of chemical and bacteriological analysis of water of the Sultanka and Moika rivers were obtained in August 1999 (see, Table 4.1.1). According to the results, it can be concluded that:

(1) Quality of Sultanka river water over the whole site is characterized by high concentration of suspended matters, nitrogen compounds, and the total content of salts. Level of pH and organic pollution does not exceed permissible norms.

(2) As shown in Table 4.1.1, water of the Moika River is more mineralized than that of the Sultanka River, and more polluted by suspended matters, nitrates, phosphates and organic compounds.

Ground and pressure waters spread at the site of the Spasskaya Transfer Station. Groundwater occurs at the depth of 10-16m, the flow intensity is 1 l/sec in the upper quaternary alluvial-prolluvial deposits of gravel with layers of clay loam and loam. Water is contaminated by oil products (1.5 of the maximum allowable concentration factor - PDK) and nitrates (1.3 of PDK).

According to the groundwater self-protection conditions, the territory belongs to II category on pollution protection. The pressure water occurs at the upper-quaternary alluvial-prolluvial deposits at the depth of 100-500m. The aquifer (water bearing horizon) of the upper-quaternary alluvial-prolluvial deposits is presented by pebble gravel, sand, clay loam and loam. In connection with availability of impervious strata, it was observed that water pressures change from 3.6m up to 15-17m. The flow intensity is 3-8 l/sec. The groundwater is sweet and hydro-carbonated with magnesium-calcium-sodium content.

The aquifer of middle-quaternary alluvial-prolluvial deposits is widely used for water supply. The particular features of these deposits are as follows: sweet (0.2-0.3 g/dm^3) water, hydro-carbonated and calcium water, and the flow intensity is very high (30-50 l/sec) and over the depressions (10-35 m/sec).

The "Kazmekhanobr" association carried out the chemical and bacteriological analyses of groundwater at the Spasskaya Transfer Station site in August 1999. The results are presented in Table 4.1.2.

It is concluded that the groundwater of the Spasskaya site by its property, content of microelements and organic compounds complies with the groundwater requirements. The groundwater is lightly mineralized and includes cyanides contents, copper, iron, manganese, zinc, chrome, arsenic and fluorides within the values of maximum

permissible concentration. Lead and cadmium exceed the maximum allowable concentration factor (PDK), lead – in 1.5 times (bore-holes #1 and 2 at the depth of 20m), and cadmium by 10-24 times. The water pH reaction is lightly alkaline and does not exceed permissible concentrations. The data on hydro-chemical survey at the "West" site was not collected because during the drilling of bore-holes at this site groundwater was not found.

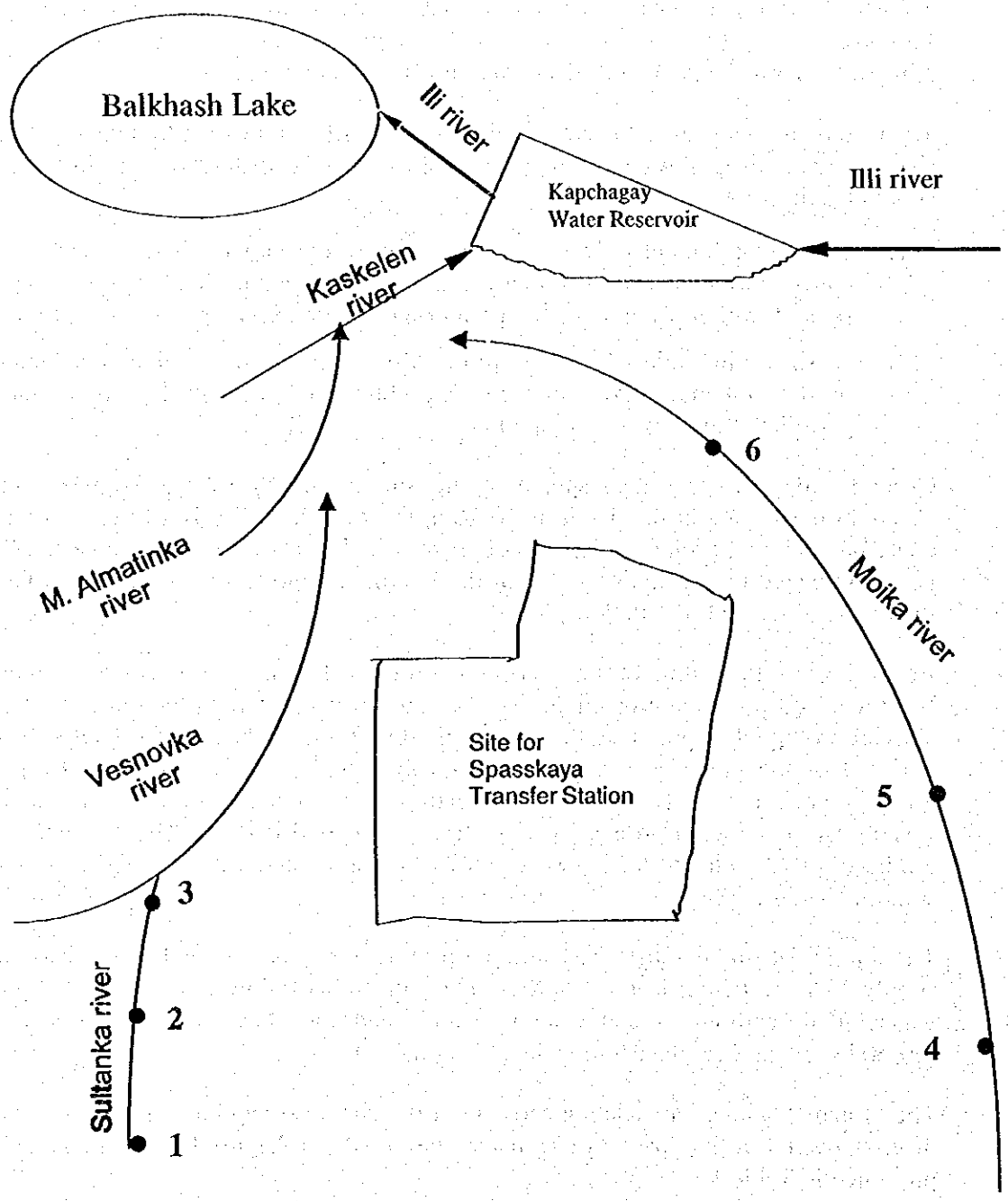


Figure 4.1.1 Scheme of River Water Sampling for Chemical and Bacteriological Analysis at the Spasskaya Transfer Station Site (August 1999, Kazmekhanobr)

Table 4.1.1 Analysis of Surface Water of the Sultanka and Moika Rivers

Surface water sampling place	Sampling Date	Temperature, °C Water/air	Color	Turbidity Mg/dm^3 SiO_2	pH	Electrical conductivity $mCm*cm^{-1}$	Quantity of intestinal bacteria	Solute oxygen, mg/dm^3	Chemical oxygen demand, mg/dm^3	Biochemical oxygen demand mg/dm^3	Suspended matters mg/dm^3	Total nitrogen content mg/dm^3	Total phosphorus content mg/dm^3
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sultanka river, site of TS	16.08.99	14.4/18.3	Colorless	31.0	8.35	0.58	$<2.4*10^5$	9.36	2.06	1.81	37.15	5.73	<0.01
Sultanka river, near the site of TS	16.08.99	14.2/18.4	Colorless	29.0	8.40	0.58	$<2.4*10^5$	9.21	2.47	2.05	21.15	5.73	<0.01
Sultanka river, down the site of TS	16.08.99	13.8/20.2	Colorless	29.0	8.43	0.58	$<2.4*10^5$	9.26	2.27	1.98	28.55	5.60	<0.01
Moika river, up the site of TS	19.08.99	16.4/25.7	Colorless	14.0	8.42	0.68	<23800	8.66	2.65	2.12	63.80	6.77	0.64
Moika river, near the site of TS	19.08.99	16.4/25.7	Colorless	25.0	8.44	0.68	<23800	8.66	3.47	2.81	6.75	6.50	0.96
Moika river, down the site TS	19.08.99	16.2/25.8	Colorless	24.0	8.42	0.71	<23800	8.52	0.73	0.60	8.75	6.77	1.06

Table 4.1.2 Results of Groundwater Analysis at the Spasskaya Transfer Station Site

Analyzed Parameters	Sampling place (Sampling date)				PDK
	Bore-hole #1 Sampling depth 20.0m (14.08.99)	Bore-hole #2 Sampling depth 20.0m (23.08.99)	Bore-hole #2 Sampling depth 34.0m (23.08.99)	Bore-hole #3 Sampling depth 14.0m (24.08.99)	Sanitary-hygienic
1	2	3	4	5	6
Nitrate - m^2/dm^2	52.0	37.5	58.5	14.0	45.0
Nitrite- m^2/dm^2	0.19	6.0	2.4	0.19	3.3
Chlorides - m^2/dm^2	177.5	113.6	92.3	102.9	350
Quantity of intestinal Bacteria	1100	>1100		>240000	
Total microbial quantity	2 10^3	$>10^6$		$>10^6$	
Cyanide mg/dm³	not/found	not/found	Not/found	not/found	0.10
Mercury mg/dm³	0.001	0.001	0.001	0.001	0.0005
Copper mg/dm³	0.014	0.036	0.040	0.020	1.0
Iron mg/dm³	0.38	0.50	1.06	0.70	0.5
Manganese mg/dm³	0.01	0.01	0.01	0.01	0.1
Zinc mg/dm³	0.040	0.140	0.856	0.036	1.0
Lead mg/dm³	0.048	0.045	0.023	0.035	0.03
Chrome VI-valence mg/dm³	0.01	0.01	0.01	0.01	0.05
Cadmium mg/dm³	0.024	0.010	0.005	0.010	0.001
Arsenic mg/dm³	0.01	0.01	0.01	0.01	0.05
Fluorine mg/dm³	1.3	1.36	1.4	2.72	1.5
Calcium mg/dm³	120.24	110.22	74.15	104.21	180.0
Magnesium mg/dm³	43.78	44.99	44.99	41.30	20.0
Total hardness mg/eq	9.60	9.20	7.30	8.60	
Distillation residual mg/dm³	770.0	832.0	546.0	799.0	0.001
Phenol mg/dm³	not/found	not/found	not/found	not/found	
Ammonia nitrogen mg/dm³	0.90	1.70	0.01	0.01	
pH	8.20	8.50	8.52	8.40	6.5-8.5
Taste	-	-	-	-	
Odor	Light odor of oil	Light odor of oil	Light odor of oil	Light odor of oil	
Color	Colorless	Colorless	Colorless	Colorless	
Turbidity mg/dm³ SiO_2	860.0	714.0	1371.0	1000.0	
Sulfides mg/dm³	Not/found	Not/found	Not/found	Not/found	Not/found
Sulfates mg/dm³	99.40	146.91	113.16	109.05	500.0
Chemical demand O_2 mg/dm³	4.06	5.66	5.45	2.83	30.0
Biochemical demand O_2 mg/dm³	3.58	5.01	4.73	2.15	6.0
Suspended particulate Matters mg/dm³	17.35	66.70	148.15	94.45	Background +0.2
Electric conductivity mCm. cm^{-1}	0.90	0.95	0.84	0.93	
Oxidation-reduction potential MV	185	180	185	182	
Water temperature °C	12.0	16.0	13.0	13.0	
Air temperature °C	29.0	30.0	29.0	27.0	

4.2 SOIL SURVEY

4.2.1 West Transfer Station

The territory of the West Transfer Station is located at the rolling piedmont plain of the northern part of the Zailisky Alatay mountains, within the desert-steppe vertical zone with the light-brown soil.

The form of the territory of this project site is rectangular, the size of the sides is 186m × 164m, that is, more than 2 hectares. In farming respect, the territory is presented by the agricultural land (plough land). The homogeneous soil covering is presented by one soil type, i.e., light-brown soil. There were taken single soil samples from the pits diagonally located at equal distance from each other (see, Figure 4.2.1).

The sampling depth is 0-20cm at the tillable horizon, and is 20-40cm at the subsoil (see, Figure 4.2.2). The total number of soil samples is 6.

Table 4.2.1 Characteristic of Soil Sampling for the West Transfer Station

Station #	Site #	Sample #	Sampling depth	Sampling time	Sampling date (day, month)
1	2	3	4	5	6
2 "The West"	1	7	20-40 cm	15:45	16.08.99
		8	0-20 cm	15:50	-"-
	2	9	20-40 cm	16:20	-"-
		10	0-20 cm	16:25	-"-
	3	11	20-40 cm	16:50	-"-
		12	0-20 cm	16:55	-"-

The soil sampling photo-documents are attached.

For assessment of radiation situation of the territory, the method on parallel crossing of the routes was used. This method is the most suitable for investigation of extended sites with plain relief.

The control site "CS-2" was located 15 km from the observation territory.

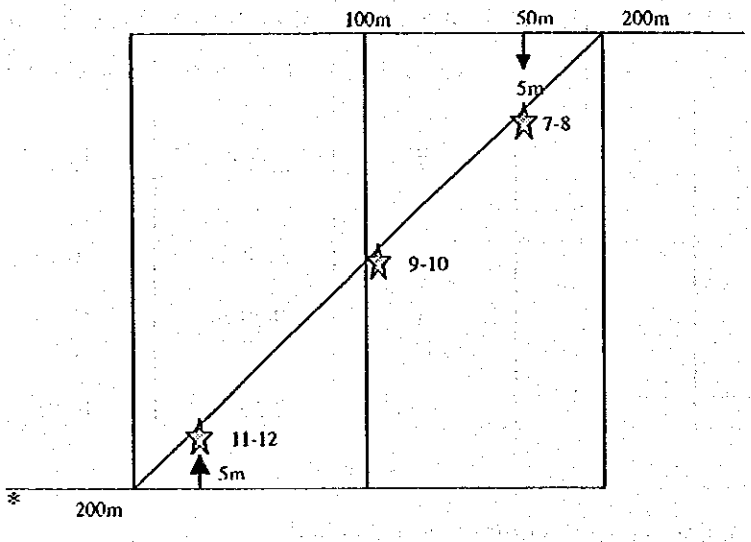
As shown in the results of measurements of the soil gamma-activity at the chosen contour 1-6-1 (see, Figure 4.2.3), the level of radioactivity is similar at the different sites and varies within 13.5-15.0 mcR/hour. Therefore, the results of route survey were extrapolated in relation to the whole observation territory.

The radiation condition of the project site is characterized by the following data:

Table 4.2.2 Results of Measurements of Soil Gamma-activity at the Routes for the West Transfer Station

Routes (pointed at Figure 4.2.3)	The results of measurements, mcR/hour
1-2	14.5-15.0
2-3	14.0-14.5
3-4	14.5-15.0
4-5	13.5-14.0
5-6	14.0-14.5
6-1	14.5-15.0
CS-1	19.0
CS-2	15.5

CS-1 – the territory of "Kazmekhanobr"
CS-2 – control site



* Marker; ☆ Sampling Site

Figure 4.2.1 Scheme of Sampling Sites Location for the West Transfer Station

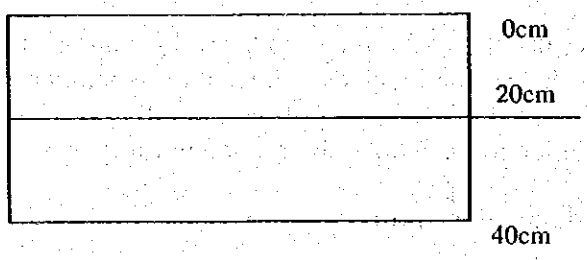


Figure 4.2.2 Soil Sampling Scheme on Vertical Section for the West Transfer Station

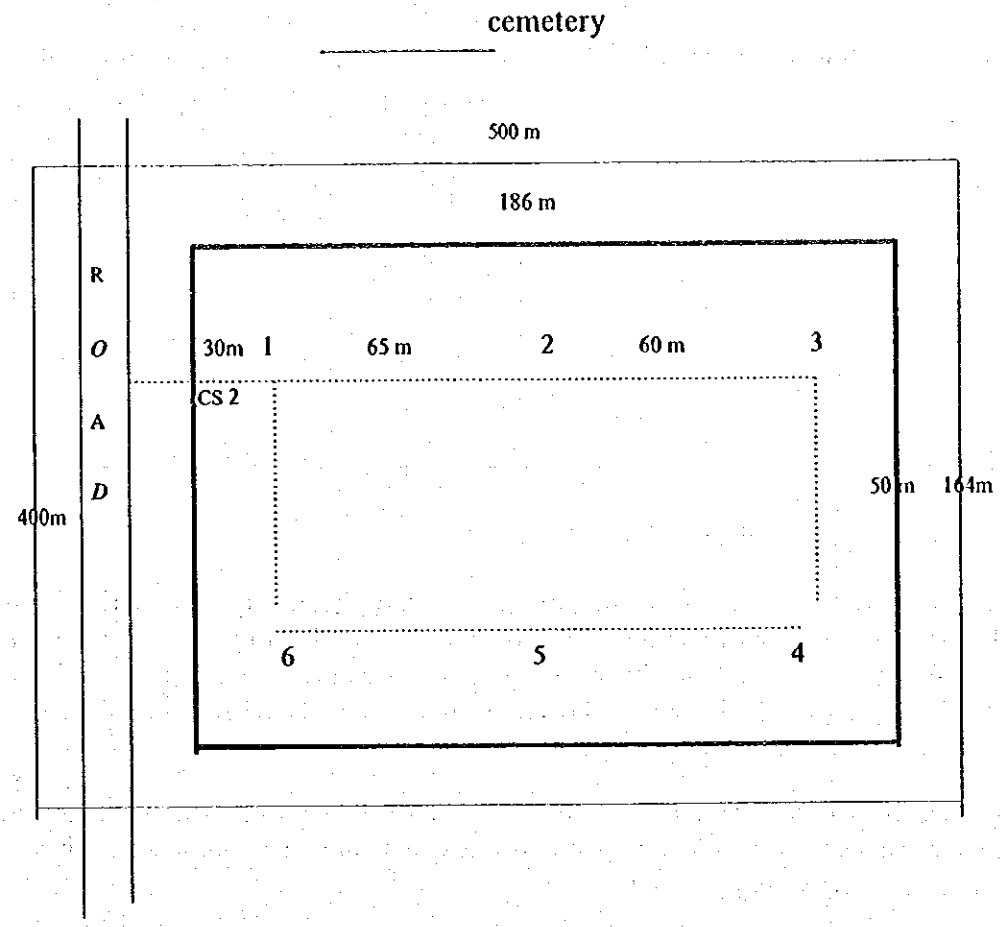


Figure 4.2.3 Routing Contours by Method of Parallel Crossing

4.2.2 Spasskaya Transfer Station

The relief of the Spasskaya Transfer Station territory is not homogeneous and the territory is divided into two parts. The southeastern part is located at the rolling piedmont plain within the desert-steppe vertical zone with light-brown soil. The northwestern part is located at the valley of the Sultanka and the Vesnovka rivers, at the meadow soil.

The area of the project site is 2 hectares. The form of the territory is not rectangular, and the size of the sides is 100m × 200m.

The soil structure of the site is natural, compact and middle eroded. The soil type is light-brown.

Since the relief of the territory is not very sinuous, three sampling sites were chosen on equal distances from each other. The area of one sampling site is 10m × 10m (see, Figure 4.2.4). Single samples (see, Figure 4.2.5) were taken from each sampling site and from the five points by the "envelope" method. The sampling depth was 0-5cm and 5-20cm (se, Figure 4.2.6). One composite sample was made from five single samples taken at the depth of 0-5cm, and the other composite sample was made from five single samples taken at the depth of 5-20cm. Thus, 6 composite samples were prepared.

Table 4.2.3 Characteristic of Soil Sampling for the Spasskaya Transfer Station

Station #	Site #	Sample #	Sampling depth	Sampling time	Sampling date (day, month)
1	2	3	4	5	6
1 "Spasskaya"	1	1	0-5 cm	10:55	16.08.99
		2	5-20 cm	11:00	-"-
	2	3	0-5 cm	12:15	-"-
		4	5-20 cm	12:20	-"-
	3	5	0-5 cm	12:45	-"-
		6	5-20 cm	12:50	-"-

The soil sampling photo-documents are attached.

For assessment of the radiation situation of the Spasskaya Transfer Station territory, used was the method on gamma-radiation survey by parallel crossing of the routes and method of extrapolation to the whole territory. The territory was investigated using radiometer CRP-68-01 registering the level of radioactivity over the soil surface along the route of chosen lines by parallel crossing (see, Figure 4.2.7).

The method of parallel crossing was chosen because of plain relief and simple linear contours of the observation territory that may allow indicating site borders and sites with different radioactivity very precisely.

As shown in the results of measurements of soil gamma-activity at the chosen contour 1-10-1, there are no anomalies at the site and the level of radioactivity is 14.5 to 17.5 mcR/hour. Therefore, the results of route investigation can be extrapolated for the whole observation territory.

The radiation condition of the project site is characterized by the following data:

Table 4.2.4 Results of Measurements of Soil Gamma-activity at the Routes for the Spasskaya Transfer Station

Routes (pointed at Figure 4.2.7)	The results of measurements, mcR/hour
1-2	15.5-16
2-3	16.5-17.5
3-4	14.5-15.0
4-5	15.5-16.0
5-6	15.5-16.0
6-7	15.5-16.0
7-8	17.0-17.5
8-9	16.5-17.0
9-10	17.0-17.5
10-1	16.0-17.0
CS-1	19.0
CS-2	16.0

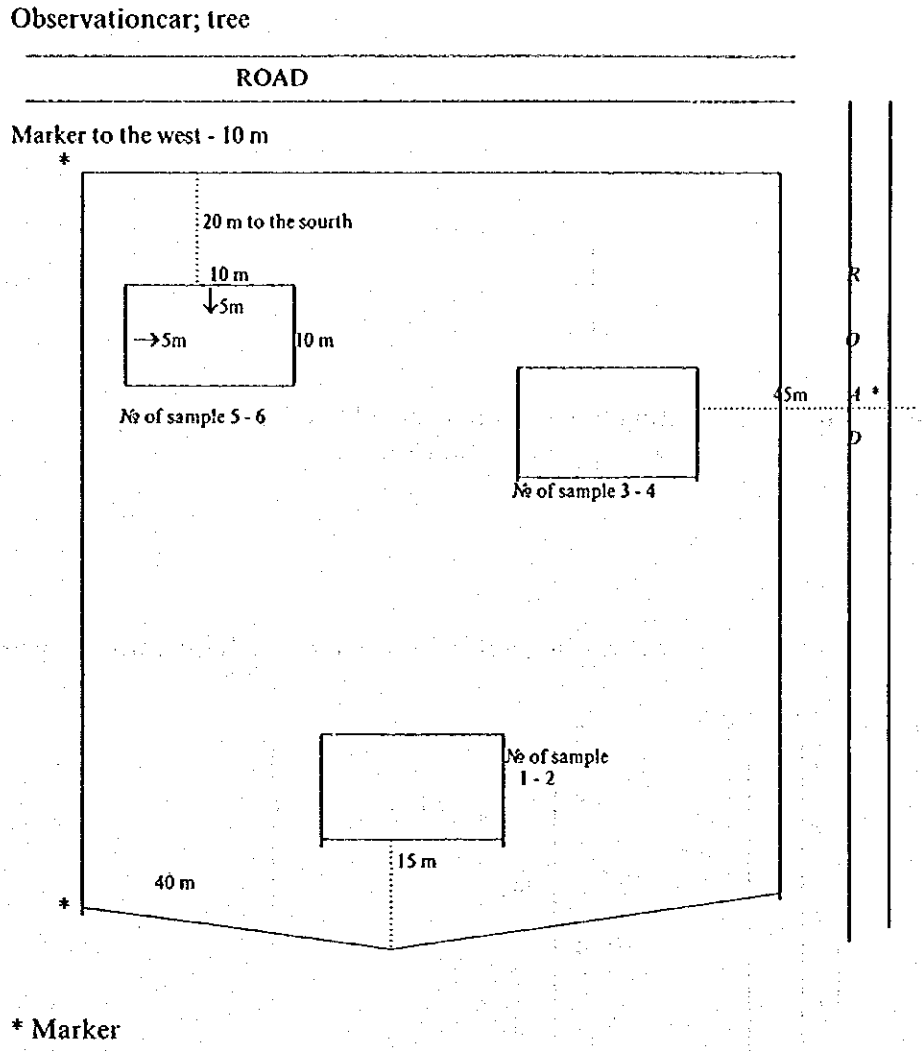


Figure 4.2.4 Scheme of Sampling Sites Location for the Spasskaya Transfer Station

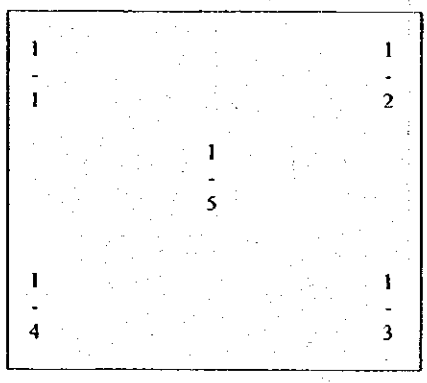


Figure 4.2.5 Scheme of Taking Single Samples for the Spasskaya Transfer Station

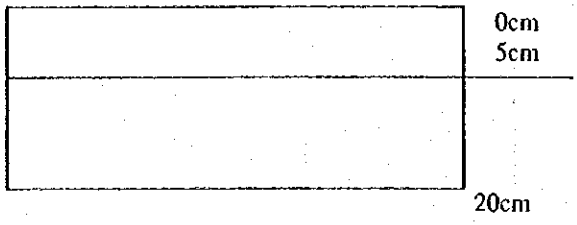
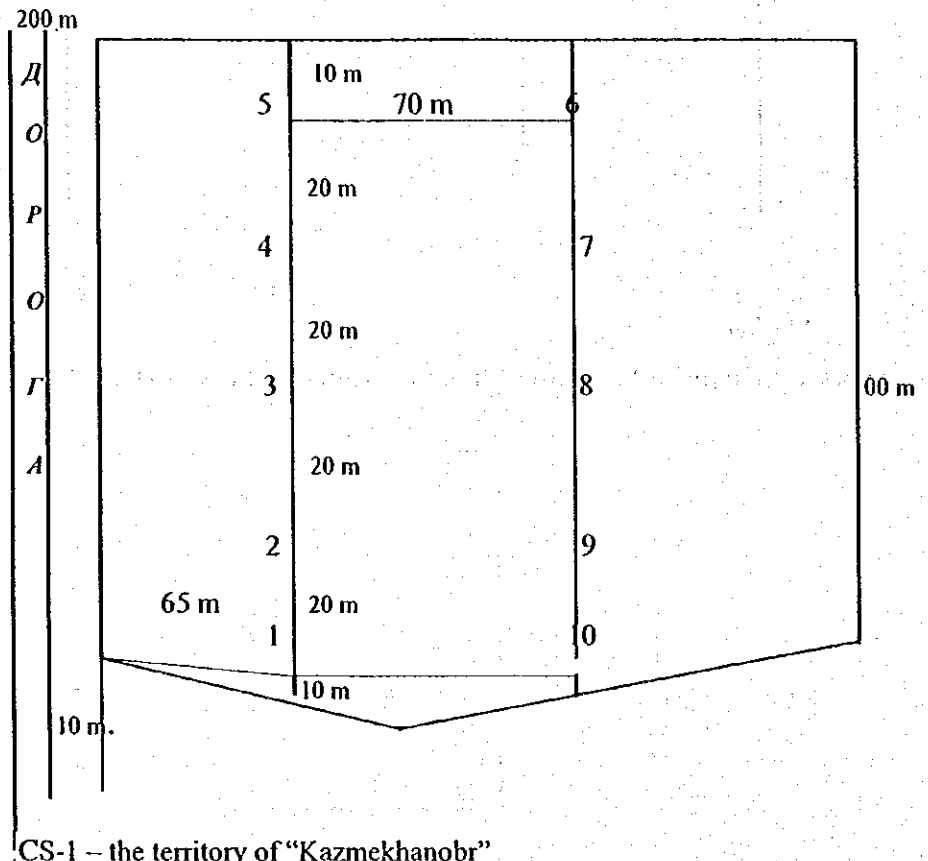


Figure 4.2.6 Soil Sampling Scheme on Vertical Section for the Spasskaya Transfer Station

Scheme of route where gamma-radiation was measured



CS-1 – the territory of "Kazmekhanobr"
CS-2 – control site

Figure 4.2.7 Routing Contours by Method of Parallel Crossing

The results of the chemical analysis of soil samples taken at the West and Spasskaya transfer stations are shown in Table 4.2.5 below.

Table 4.2.5 Content of Heavy Metals at the Candidate Sites of West and Spasskaya Transfer Stations

Unit: mg/kg

Number of sample	Sampling depth (cm)	Elements, mg/kg						
		Lead	Cadmium	Copper	Zinc	Chrome	Arsenic	Mercury
1	2	3	4	5	6	7	8	9
"SPASSKAYA"								
1/1	0 - 5	20.2	1.5	8.7	20.0	Not found	Not found	Not found
1/2	5 - 20	19.2	1.7	5.9	21.2	Not found	Not found	Not found
1/3	0 - 5	11.3	1.7	3.1	2.5	Not found	Not found	Not found
1/4	5 - 20	18.1	1.7	3.7	2.6	Not found	Not found	Not found
1/5	0 - 5	20.1	1.9	3.7	3.8	Not found	0.25	Not found
1/6	5 - 20	17.2	3.3	5.0	4.2	0.010	Not found	Not found
"WEST"								
2/7	20 - 40	17.5	2.7	2.9	1.7	Not found	Not found	Not found
2/8	0 - 20	15.1	2.2	3.5	0.6	Not found	0.73	Not found
2/9	20 - 40	19.0	3.1	2.9	0.1	Not found	Not found	Not found
2/10	0 - 20	18.3	3.6	3.0	1.1	Not found	0.25	Not found
2/11	20 - 40	21.1	3.5	3.4	0.1	0.025	0.24	Not found
2/12	0 - 20	10.9	2.7	3.1	0.1	0.010	0.18	Not found
PDK		**32.0**	**3.0**	**3.0**	**23.0**	**0.05**	**2.0**	**2.1**

The content of chemical substances belonging to the first class of hazardous substances (Pb, Zn, As, Hg) do not exceed the maximum allowable concentration factor (PDK). The content of Cadmium exceeds the PDK by 1.1 times in sample #6 taken at the Spasskaya Transfer Station, and by 1.03-1.2 times in sample #9, 10, 11 taken at the West Transfer Station. The soil is not contaminated with arsenic and mercury.

Strong copper concentration (Class II of hazard[2]) was observed at all project sites; the copper concentration exceeds PDK by 1.03-2.9 times at the Spasskaya Transfer Station and 1.03-1.2 times at the West Transfer Station.

[2] The chemical substances are divided into three hazard groups (GOST 17.4.1.02-83):
1- highly hazardous substances;
2- moderately hazardous substances; and
3- less hazardous substances.

Chrome (Cr^{+6}) content was not found in most of the samples.

4.3 WIND SURVEY

4.3.1 West Transfer Station

The nearest settlement Burunday is located 5.5 km to the northeast from the West Transfer Station. The Heating Electric Station (TES-2) is located 1 km to the southwest from the site.

The climatic data was obtained at the nearest meteorological station Burunday and was presented at the section specifying the Spasskaya Transfer Station.

Above stated climatic characteristics are to be considered as average multiyear observation data. Unfortunately, because of difficult economic situations in the Republic and consequently in the Republican State Enterprise "Kazgidromet", the number of meteorological stations and observations on them have been reduced. Hence, it was only in the Almaty Meteorological Station that data on climatic characteristics could be collected for the last week of August and presented as the example of current observations. This data was considered as correct, because the Almaty Meteorological Station is located close to the meteorological stations of Burunday and Kaskelen.

4.3.2 Spasskaya Transfer Station

The Spasskaya Transfer Station is located in Iliisky, 2 km to the north from Almaty and occupies an area of 2 hectares. The designated purpose of this land site is the transfer of solid wastes from light-duty trucks into heavy-duty vehicles or trailers, which will then transport the wastes to the Karasai Disposal Site. The nearest populated locality is Burunday, which is located 5 km to the southwest from the Spasskaya Transfer Station and Almaty that is 2 km to the south from the site.

The climatic data were obtained at the nearest meteorological station Burunday.

The average air temperature of the coldest month (January) is 7.4 degrees below zero, and the average air temperature of the hottest month (July) is 29.8 degrees above zero. The average annual periodicity (%) of wind direction for the eight main points, calm and prevalent wind directions are shown in the table below.

Table 4.3.1 Periodicity of Wind Direction

N	NE	E	SE	S	SW	W	NW	Calm
10	11	11	5	15	20	20	8	8

The maximum wind force with periodicity of 5% is 5 m/sec. The climatic characteristics of the region of the site are shown in Tables 4.3.2, 4.3.3 and 4.3.4.

Table 4.3.2 Average Monthly and Annual Wind Force

Unit: m/sec

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
1.2	1.3	1.6	1.9	2.1	2.2	2.9	2.2	2.2	1.7	1.2	1.1	1.8

Table 4.3.3 Average Number of Days when Wind Force > 15 m/sec

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
0.4	0.6	1.2	1.5	2.6	2.9	3.2	1.9	1.0	0.8	0.4	0.4	16.9

Table 4.3.4 Average Number of Days with Dust Storm

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
0	0	0.2	0.6	0.9	2.0	2.6	1.4	0.9	0.8	0	0	7.8

4.4 AIR SURVEY

4.4.1 West Transfer Station

For the region of site location, the background was measured at Site #16 located in micro-district Aynabulak-3. Data on background concentrations for the period 1995-1997 are presented in Table 4.4.1.

Table 4.4.1 Background Concentrations for the Period 1995-1997

Pollutant	Station #	Concentration, C=mg/m^3				
		Calm, 0-2 m/sec	Wind force (3-U_x), m/sec			
			North	East	South	West
Dust	16	0.25	0.1	0.15	0.1	0.1
SO_2	16	0.0265	0.0121	0.02115	0.0215	0.0175
NO_2	16	0.08	0.055	0.065	0.065	0.06
CO_2	16	4.0	3.0	3.0	3.0	2.5

Unfortunately, because of decreased in financing of the Republican State Enterprise "Kazgidromet", the number of monitoring sites has been reduced. Therefore, there was no opportunity to collect data on air pollution within the stations for the present period.

4.4.2 Spasskaya Transfer Station

The number of people living in the nearest populated locality, Pervomaisky, is less than 10 thousand people. There are not significant sources of air pollution at this site, so according to RD 52.04.186-89, M., 1991, the background concentrations for this site are not considered in the process of estimation of pollutant emissions in the surface air.

4.5 FLORA AND FAUNA SURVEY

4.5.1 Flora

Geo-botanical researches of the territory adjacent to the West Transfer Station were made in accordance with the *"Instructions on performing large-scale (1:1,000-1:100,000) geo-botanical researches of natural feed land of the Republic of Kazakhstan"*, made in

1995 and approved by the State Committee of the Republic of Kazakhstan on Land Relations and Land Utilization.

The researches were made during two phases. The field survey was performed 300m from the station using the "loop" method and 1:10,000 scale. The distance between the routes was 200 meters. Three geo-botanical contours were defined and two descriptions of plants explaining the crop productivity and floristic composition were made. Figures 4.5.1 and 4.5.2 show the vegetation map of each site for the transfer station.

During the laboratory work, the map of vegetation was created, where the colors of contours were chosen according to the dominance of plant cover. The figures indicate numbers of contours, numbers of geo-botanical sections, and crop productivity in centner/ha. The marks show the types of land and conditions of crops. Additionally, the list of plants growing at the observation site was made and the area of contours was evaluated.

According to the observation results, the assessment of land resources was made and the soil quality index was defined.

4.5.2 Fauna

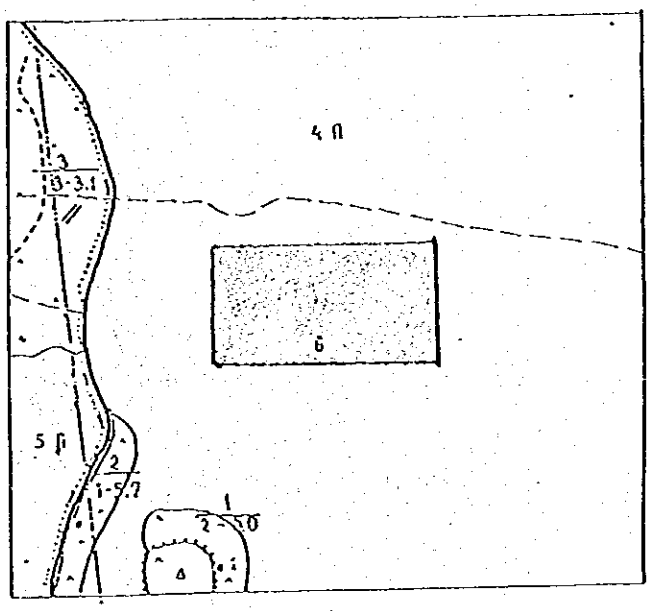
1) West Transfer Station

The survey of this site with the area of 4 hectares was made, by observing the narrow strip of plowed field where gnawing animals and rare flying birds were found.

2) Spasskaya Transfer Station

The land allocated for this station is located at the edge of the valley of the Sultanka River and borders with the cemetery. Within 200-300 meters, visually noticed were rock-dove, ring-dove, turtle dove, Senegal turtle dove, hoopoe, swallow, black-headed wagtail and blackbird. Often encountered were munah, jackdaw and magpie, and also sparrows.

Scale 1: 10 000



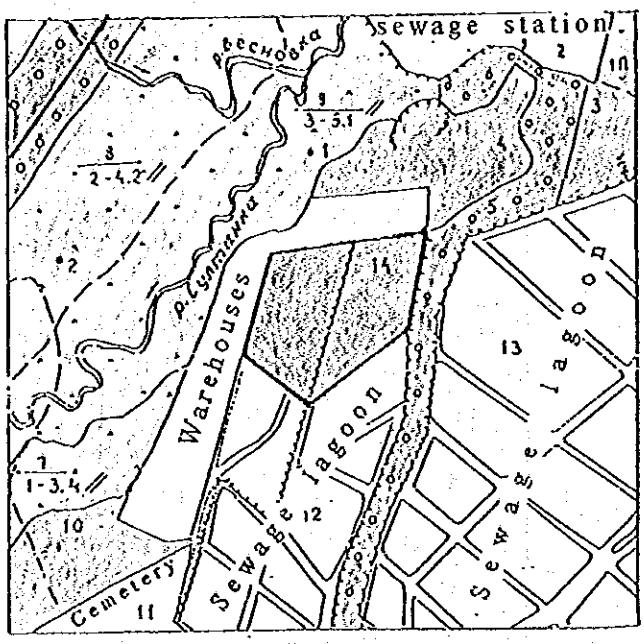
Keys

П - Plowed land, virgin land

\- Pastures

Figure 4.5.1 Vegetation Map of the West Transfer Station

Scale 1: 10 000



Keys

- Virgin land
- Pastures
- Wind forest strip
- Dumping

Figure 4.5.2 Vegetation Map of the Spasskaya Transfer Station

CHAPTER 5 RESULTS OF FIELD SURVEY ON SOCIOECONOMIC CONDITIONS OF THE SITE

5.1 TRAFFIC SURVEY

5.1.1 West Transfer Station

The environment of the West Transfer Station is affected by the transport passing along the:

- access road leading to the Burunday cemetery; and
- adjacent road linking Almaty – Aksai – Shemolgan – Burunday – Shilikemir.

The approach road leading to the Burunday cemetery will be used as approach road to the West Transfer Station. By technical characteristics, this road belongs to V class, the width of the roadway is 6m, it is paved by black gravel, the total width of roadbed is 9m, the traffic intensity is 450 cars/day.

Due to operation of the West Transfer Station, it is expected that the traffic intensity will increase to 270 cars/day, resulting from the trucks transferring wastes from Almaty – 150 units; refuse trucks and semitrailers removing wastes and secondary raw materials – 120 units. The total traffic intensity of the access road will be 720 cars/day, which will not exceed regulatory permissible traffic intensity stated for the V class road i.e., 1000 cars/day.

The adjacent road linking Almaty – Aksai – Shemolgan – Burunday – Shilikemir will be used for transportation of solid municipal wastes from Almaty to the West Transfer Station and for transferring the waste after treatment into the Karasai Disposal Site. The road belongs to III class, the width of the roadway is 7m, it is paved by black gravel, the total width of roadbed is 12m, the traffic intensity is 3000 cars/day.

The expected increase in traffic intensity of 130-150 cars/day is connected with the operation of the West Transfer Station. The total traffic intensity will be 3130 to 3150 cars/day, which complies with the regulatory permissible traffic intensity stated for the III class road, i.e., 3000 to 5000 cars/day.

5.1.2 Spasskaya Transfer Station

The access road leading to the Spasskaya Transfer Station is currently used as the access road to the existing unauthorized disposal site belonging to Turksibsky and has low traffic intensity – about 100 cars/day.

Due to construction of the Spasskaya Transfer Station, the traffic intensity will increase to 130 cars/day, resulting from trucks transferring wastes from Medeusky and Turksibsky of Almaty – 80 cars/day, and trucks transporting treated wastes into the Karasai Disposal Site – 50 cars/day.

If the existing disposal site at the Sultanka riverbank will not be closed, total traffic intensity will be 230 cars/day. If the disposal site will be closed, the road will serve only the Spasskaya Transfer Station and traffic intensity will be 130 cars/day.

The main impact on the air of the Spasskaya Transfer Station site is caused by the transport passing through the road Almaty-Yst-Kamenogorsk. The road adjoins the West Transfer Station site and is located 700m from the station.

This road belongs to I class. Traffic intensity is 7772 cars/day, the width of roadway is 15m, it has asphaltic concrete pavement, the width of wayside is 3.75m × 2m; asphaltic concrete reinforcement of wayside – 0.75m; the width of dividing strip – 5m; the total width of the roadbed – 27.4m. The traffic intensity of this road depends on the season; in spring and autumn, it increases. Therefore, at the end of July the traffic intensity of the road was 10841 cars/day, it is 40 % more than the average rate per year. The analysis of the transport type shows that 54.7% - cars, 21.2 % - trucks, and 11.6% - trailers.

5.2 PUBLIC AWARENESS SURVEY IN POPULATED LOCALITIES NEAR THE SITES

The public opinion questioning was conducted in the settlement named Kokkaynar-Kirova located 1.6 km from the West Transfer Station in order to find out population attitude to the construction of the West Transfer Station. In the process of questioning, 50 households living in this village were asked the question: "What is your attitude to the prospect of new transfer station construction 1.6 km west of your village?"

The households were suggested to take into consideration the fact that, the project will be developed together with Japanese specialists, and their experience gained in the process of construction of such facilities will be used; for example, a mitigation plan decreasing adverse environmental impact of the project activity will be used. In addition, new opportunities of employment for local population will be available at the new station.

Public opinion questioning showed that the population has a positive attitude to the projected construction. It is significant to note that nobody said it was difficult to answer the questions. This indicates a high level of environmental awareness of the local population. However, despite the fact that all people understood the probability of adverse environmental impacts of the project, all of them were agreeable to project implementation.

Most of them highly appreciated the participation of Japanese specialists in the project development; the population trusts the developments made abroad. However, the main reason of the positive evaluation of the proposed project was the desire of the population to find new employment at the sites. In the villages, the level of unemployment is very high, so that the projects, which may provide people with jobs, are of great importance to the population of these regions. The other reason of the positive decision to the proposed project is the location of the site. It is situated 1.6 km from the populated locality where the questioning was conducted.

In order to investigate population attitude to the construction of the Spasskaya Transfer Station, the public opinion questioning was conducted in Pervomaysky Village which is located 1.0 km from the project site. In the process of questioning, households living in this village were asked the following question: " What is your attitude to the prospect of new transfer station construction 1.0 km east of your village?"

The questioning results show that most of the people involved in the questioning (40 people or 83.2%) have a positive attitude towards the new transfer station construction. However, their affirmative attitude to the construction of this station is explained by the

closing of the existing disposal site on the Sultanka riverbank. Four households (8.3%) gave a negative answer concerning the waste transfer station construction and other four households (8.3%) chose the item "difficult to answer". The negative answer of four households was explained by disbelief of the local population in all innovations. They think that all preventive measures to be taken by the local authorities may only have negative effects on the environment.

In comparison with the West Transfer Station, the population of this district has less trust in the project. This is explained by the fact that the Spasskaya Transfer Station is located closer (1.0 km) to the Pervomaysky village.

CHAPTER 6 IDENTIFICATION OF ENVIRONMENTAL IMPACT OF THE SITE

For the waste transfer stations, the following impact types should be considered:

- chemical and biological pollution (emissions and discharges of pollutants in gas, liquid and solid condition);
- physical impact (noise, electro-magnetic and radioactive radiation, etc.);
- heat impact;
- damage of landscape and its components (soil covering, fauna); and
- withdrawal and depletion of resources (water, land, recreations)

Additionally, the following types of environmental impact are of current interest: pollution emissions and station discharges, noise, damage of landscape and ground water pumping for water supply. These types of impact have been considered in the EIA sections. It is necessary to pay attention that the impact of the transfer stations on the environment is not spread out on the borders of the sanitary-protection zones and can be easily eliminated by the system of green planting.

CHAPTER 7 INVENTORY OF SOURCES OF IMPACTS ON THE ENVIRONMENT

The main sources of pollutant emissions into the atmosphere are:

- Gas and dust emissions during sorting and transferring wastes, the volume (till 2005) is:

  West Transfer Station – 652 tons of wastes/day
  Spasskaya Transfer Station – 271 tons/day

- Emission of engine fuel combustion materials generated by vehicles that operate at the station and deliver and remove wastes, the volume (till 2005) is:

  West Transfer Station – 341 trip/day
  Spasskaya Transfer Station – 143 trip/day

- Emission of engine fuel combustion materials generated by vehicles passing through the roads:

  West Transfer Station – the road Almaty – Aksai – Shemolgan – Burunday - Shilekimir, the volume is 3130-3150 cars/day
  Spasskaya Transfer Station – the road Almaty-Kapchagay – the volume is 7800 cars/day;

- Emission of engine fuel combustion materials generated by engine of electric power generator which engine power is:

  West Transfer Station – 200 kW
  Spasskaya Transfer Station – 150 kW

- Emission of fuel combustion materials generated by boiler, which power is:

  West Transfer Station – 100 kW
  Spasskaya Transfer Station – 80 kW

Environmental pollution such as surface and ground water resulting from discharge of waste water is caused by:

- Washing wastes and their decay products by rain and snow water from the territory of transfer stations:

  West Transfer Station – from the area of 3 hectares
  Spasskaya Transfer Station – from the area of 2 hectares

Consequently, this wastewater will pollute the surface water sources and the soil, and at the vertical percolation, it will pollute ground and surface water.

- Emission of industrial and sewage water generated by production and household facilities (generator, boiler, baths, etc.), the volume is:

  West Transfer Station – 7 m^3/day
  Spasskaya Transfer Station – 3 m^3/day

The identification of the above stated pollution sources and impacts on the environment gives the possibility to predict and evaluate impact on the environment.