Preparation of regional pre-investment studies in the Western sector of the Russian Arctic
Stage 5 of consulting services
№ CS-NPA-Arctic-06/2008 dated 20.08.2008

Design and construction of complex of Waste Water Treatment Plant in Severomorsk of Murmansk region
Pre-investment study

Final Report

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BRIEF SUMMARY OF THE PROJECT

In the City of Severomorsk of the Murmansk Region, industrial and social facilities discharge over 7.9 mln m^3 of untreated wastewater yearly through 5 sewage outlets into the Kola Bay. The wastewater contains over 3,000 tons of pollutants. Untreated sewage discharge from the area of Severomorsk has an impact on the shore strip of the city and, consequently, on the environment of Severomorsk region with 68,000 population.

As a result of this project's completion, untreated wastewater discharge into Kola Bay (which is a fishery water object) in amount of more than 7900 thousand m3 per year will be stopped.

The cost of the project is RUR 1,817M. During the initial contact with initiators, the following donors expressed interest in this project: EBRD, IFC, NEFCO and NDEP.

The project is planned to be realized by MUE «Severomorskvodokanal».
MUP "Severomorskvodokanal" fulfills the main task – water supply and water discharge of Severomorsk, settlements of Roslyakovo, Roslyakovo – 1, Safonovo, Safonovo-1, Kortik, Schuk Lake, Severomorsk-3.

As regards the positive *environmental consequences*, the project's implementation will realize:

- reduction of pollutants in sewage in average by outlets:
    1. suspended substances – in 16 times
    2. BOD full - in 25 times,
    3. oil products - in 8 times
    4. iron - in 8 times,
    5. nitrites - in 2 times,
    6. fats – in 3 times,
    7. phosphates - in 5 times

- removal of anthropogenic pressure over the Kola Bay from the industrial and social objects;
- improvement of the environmental situation in the shore area of the Kola Bay and living conditions of the people resided at the Bay shore;
- together with other environmental actions, the increased probability of restoration of permanent residential areas and reproduction of biological resources in the Kola Bay of the Barents Sea and other north seas;
- compliance with RF and international legislation for water objects protection from pollution.

As to the *social consequences*, the realized project will

- elevate the environmental safety level for the local population;
- provide employment to the population of Severomorsk ZATO (organization of more than 50 work place is planned);
- to meet key stakeholders (population, budget and private organizations) expectations about water treatment.

The conducted analysis has shown that the proposed project is financially not feasible under the current circumstances. This is mainly caused by the revenues being smaller than the Operation & Maintenance costs. A further tariff increase or a decrease in O&M costs is therefore necessary to have a financially feasible project. However, as the economic benefits are likely to be large, the economic feasibility should also be calculated in order to estimate the overall feasibility of the project. Hence, a grant financing percentage might be needed in addition to debt financing.
Special econimic benefits include:

- Cuts in expenditures of industrial enterprises and community services for water treatment and maintenance of water treatment facilities;
- Decrease of water organisms contamination by sewage waters of industrial objects and community services, in particular:
    - Improvement of the habitat of water life organisms;
    - Increase of the general health care level (as a result, cuts in expenditures for health care);
- Infrastructure development.

This IEP can be replicated within the region considering the fact that the sewage water treatment problem is one of the most critical for Murmansk Region.

List of acronyms

BOD	Biochemical Oxygen Demand
EBRD	European Banc of Reconstruction and Development
EVD	The Agency for International Business and Cooperation: a branch of the Ministry of Economic Affairs of the Netherlands
GOUP	State Regional Unitary Enterprise
IFC	International Finance Corporation
IRR	Internal Rate of Return
LLC	Limited liability company
MPC	Maximum permissible concentration
FTIP	Federal Targeted Investment Programme
MUE	Municipal Unitary Enterprise
NDEP	Northern Dimension Environmental Partnership
NEFCO	Nordic Environment Finance Corporation
NPV	Net Present Value
O&M	Operation and Maintenance
OEC	Organization for Economic Cooperation
PPP	Public Private Partnership
SaNPiN	Sanitary Norms and Rules
SNiP	Construction Norms and Rules
SRLI	Safe Reference Levels of Impact
WWTP	Wastewater treatment plant

1 GENERAL PROVISIONS

1.1 Background

Main sources of the Arctic water contamination are the following:
• sea and river craft vessels;
• continental wastewater;
• shelf mining operations;
• long-range contamination transport by sea flows;
• atmospheric contamination transport;
• burial of radioactive waste and nuclear reactors.

Especially strong and various anthropogenic impact experience environmental systems of White, Barents and Kara Seas.

The natural condition of the Arctic Ocean water has a considerable influence on the spread and accumulation of contaminants. Climatic and hydrological peculiarities (width, flow speed and direction, temperature, salinity, water stratification, flow and total water balance) contribute to essential dilution of flow and intensive precipitation of contaminants, remaining in sea ecosystems for a long time.

Barents Sea – is the biggest shelf water body of Russia. The open part of the Barents Sea is characterized as “clean”. At the same time in the areas of active navigation the sea is widely contaminated with oil slick (5-7 MPC). High levels of contamination have the Kola Bay and the Teriberskiy and Motovskiy Bays (concentration of phenol and petroleum derivatives 6-12 MPC). Total wastewater discharge amount to about 150 million m^3. Soils actively accumulate contaminants (concentration of phenol – up to 5 ng/g, oil products – up to 3,5 mg/g, pesticides – up to 5 mg/g, PHB -40-60 mkg/g).

Objects of social sphere and others discharge annually through the ZATO Severomorsk settlement and sewerage systems more than 10 million m^3 of crude wastewater into the water bodies. This results in pollution of the rivers Srednyaya, Gryaznaya and Kola Bay. Because of water bodies’ contamination with crude wastewater their quality decreases considerably: the natural nutritive base is changing and dying, the quantity of spawning grounds and commercial fish inhabiting these water bodies is going down.

The biggest anthropogenic load in the basin of Barents Sea bears Kola Bay is household sewage and crude wastewater, dumped by about 40 enterprises of Murmansk and Kola cities and settlements located at its shore.

The objective of this project is decreasing the negative impact to the environment, improvement of the environment for living and reproduction of water biological resources in Kola Bay and Barents Sea, elevating of safety and health living level for Murmansk region population by design and construction of WWTP for Severomorsk in Murmansk Region.

A Sewage treatment plant is considered to be a nature-conservative facility. WWTP construction is carried out to provide sanitary, hygienic and antiepidemic protection of people and environment protection from contaminations, thrown along with wastewater into the sewage system. At the present time sewage treatment facilities are absent at all administrative bodies situated on the Kola Bay shore, except the city of Murmansk. In comparison with them the city of Severomorsk has the biggest amount of sources of negative environmental impact.

In the City of Severomorsk of the Murmansk Region, industrial and social facilities discharge over 7.9 mln m^3 of wastewater yearly through 5 sewage outlets without treatment into the Kola Bay. The wastewater contains over 3,000 tons of pollutants. This is not in compliance with current RF environmental legislation for water object protection and causes drastic deterioration of quality of life environment for marine organisms in the Kola Bay and negatively impacts Arctic seas.

Because of continuous pollution of Kola Bay of the Barents Sea by sewage waters, the marine productivity decreases: the number of traditional places for fish and other marine animals growing and spawning reduces, volumes of finished sea products and other marine animals decrease.

Pollution of Kola Bay near the city of Severomorsk has prevented the last 10 years the White Sea herring to enter the Bay. Many fish populations have been vanished, and caught trout and haddock have a specific smell of sewage waters. The situation with shore fishing in the Cola Bay has drastically degraded: caught fish is recommended to be consumed only after deep freezing. Major harm is done to the population of salmon because the spawning rout to the rivers of Vaenga, Cola, Tuloma is laid through Severomorsk water zone.

Untreated sewage waters discharge from the area of Severomorsk impacts the shore strip of the city and, consequently, to the environment of Severomorsk region with 68,000 population.

As a result of this project's completion, untreated wastewater discharge into Kola Bay (which is a fishery water object) in amount of more then 7900 thousand m3 per year will be stopped.

Due to the fact that the founder of MUE “Severomorskvodokanal” is the Committee for the Municipal Property Management of Severomorsk full administrative support of the IEP from local government bodies is guaranteed.

Administration of Severomorsk can support the project in the following parts:

- can be a customer of the design and estimates documentation and the object constructor based on availability of the appropriate license «For construction of buildings and objects of I and II categories in accordance with the state standard» № GS 2-51-04-27-0-511120236-002487-2 dated 30.06.2008;
- preparation of materials, intention declarations to pass state expertise for the construction area utilization;
- allocate construction areas for geological research and capital construction of the WWTP objects.;
- arrange for authorized admission of the WWTP investors in Severomorsk to see the current situation
- provide for realization of any necessary administrative and management solutions within delegated authority;

- approve the necessary solutions with the North Fleet authorities.

1.2 Economic effects of IEP implementation

If the requirements of the Russian nature-saving legislation would be followed, the charge for pollutants dumping into water bodies by MUE “Severomorskvodokanal” without treatment facilities and temporary approved limits would amount 83 million rubles.
Without treatment facilities and with temporary approved limits, with benefits i.e. without considering population - 637 100,0 rubles, without benefits, considering population -7 942 100, 0 rubles.
After WWTP commissioning the charge will amount accordingly considering population – 145 900,0 rubles, without considering population -16 500, 0 rubles.
Thus the difference in charge for negative impact over environment as per charge tariffs for negative impact in prices of the year 2009, considering population will account 82 862 260,0 rubles.

If the enterprise was profitable, and charge for polluted wastewater dumping was taken in the full range, then the given sum minus expenses for WWTP operation would have shown economic efficiency of the enterprise. Conventionally 82 862 260,0 rubles can be taken as annual preventable environmental damage if depart from determination of charge for negative impact over environment.

1.3 Possibility to reproduce IEP

Considerable contribution into pollution of regional water bodies with crude wastewater is done by enterprises of housing and communal services: State Regional Unitary Enterprise (GOUP) «Murmanskvodokanal», GOUP «Apatityvodokanal», GOUP «Kandalakshavodokanal», GOUP «Monchegorskvodokanal», GOUP «Olenegorskvodokanal», MUE «Severomorskvodokanal», LLC «Teplovodosnabzheniye» of Polyarnye Zori town, LLC «Teplovodokanal» of Kovdora town, Federal State Unitary Enterprise «Vodokanal» MO of Polyarniy town.

This IEP can be replicated to other villages within the region considering the fact that the sewage water treatment problem is one of the most critical for Murmansk Region.

1.4 Participants and flow chart of IEP implementation

The project is planned to be realized by MUE «Severomorskvodokanal».

Suggested arrangement:
Financial assets from the investor come to a special-purpose account of the enterprise run on a paying basis MUE «Severomorskvodokanal», acting as the customer of the realized projects. The administration of ZATO Severomorsk will act as a developer and provide necessary building control up to the key ready commissioning of the object on the basis of the existing license and tripartite agreement between an enterprise, administration and investor.

2 CHARACTERISTIC OF INITIATOR FACILITY AND ITS FINANCIAL STATUS

2.1 Details and brief characteristic of initiator's facility

MUP "Severomorskvodokanal's main tasks are water supply and water discharge of Severomorsk, settlements of Roslyakovo, Roslyakovo – 1, Safonovo, Safonovo-1, Kortik, Schuk Lake, Severomorsk-3.

The enterprise is located at address: Gadjieva 1a, Severomorsk, Murmansk Region, Russia
The enterprise consists of pump station service sites, water supply and sewage systems. There are 13 outlets for wastewater discharge, among which 11 discharge to the Kola Gulf, 1 outlet discharges into the Gryaznaya River through mechanical treatment plants, and 1 outlet discharges to the Srednyaya River. A design of biological treatment plants for wastewater discharge into the Srednyaya River has been developed.

Annual water consumption is 21000 thousand m3, water discharge is 9400 thousand m3. The length of water supply and sewage pipelines has increased to 162 km of water pipelines and 73 km of sewage pipelines.

An organization chart of MUP "Severomorskvodokanal" is presented below:

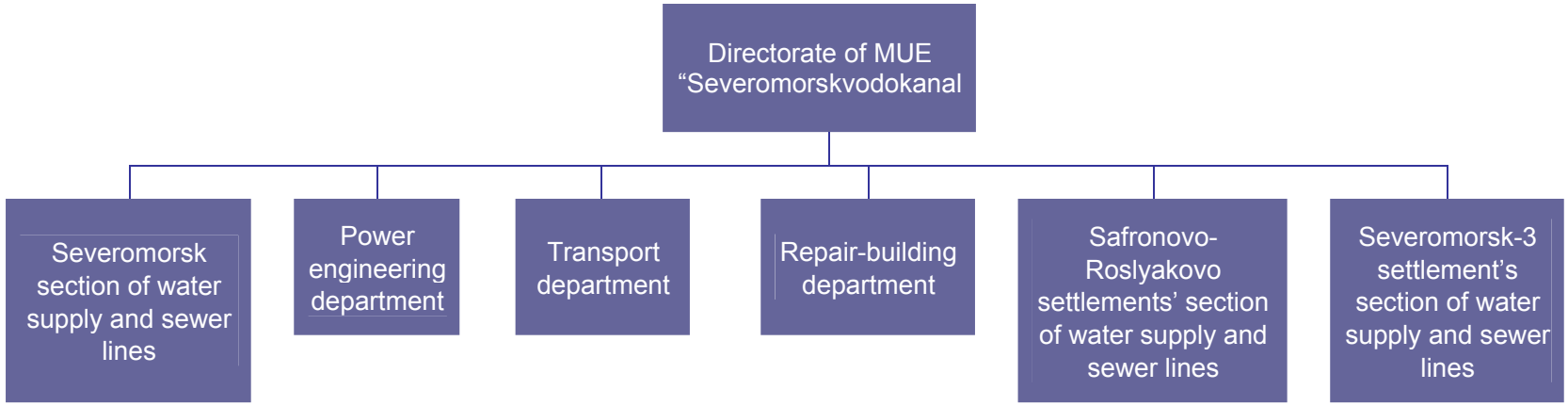
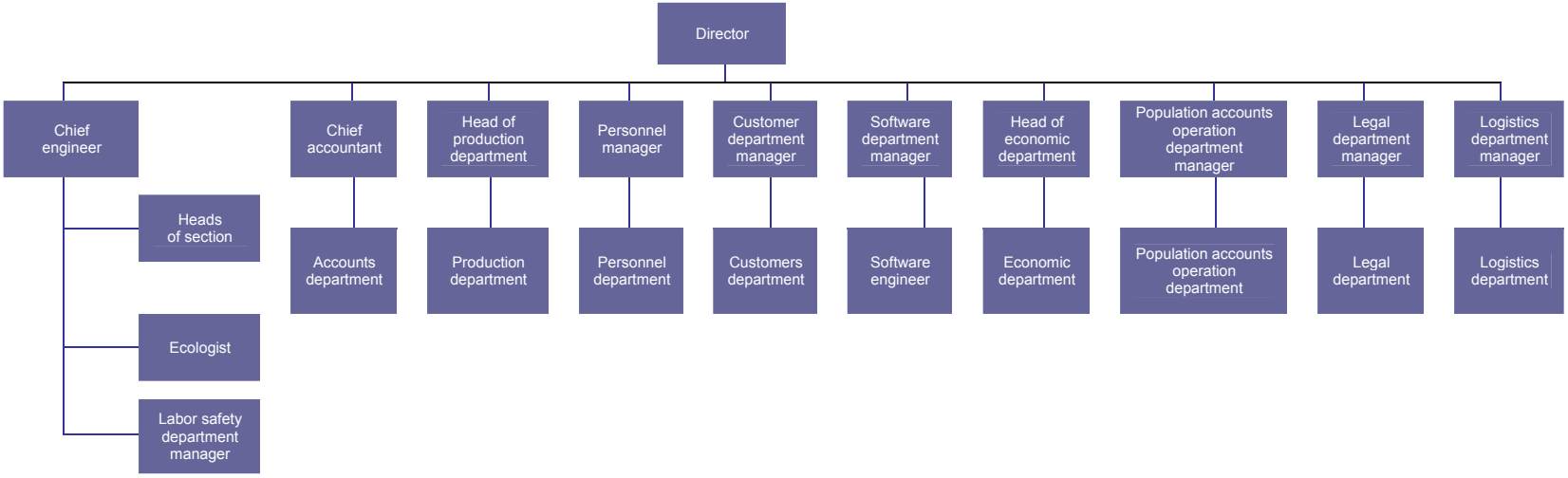


Figure 2-1 Organization chart of MUE "Severomorskvodokanal"



MUP “Severomorskvodokanal” has been present on the market of engineering and communal services since 1956, gained practical experience of operational and maintenance of water supply and sewage networks, servicing and repair of trucks and tractors, buildings and objects, implementation of innovated techniques. The company has implemented techniques for pipeline building with flexible foam insulation, pumping unit frequency control of rotation to enable energy saving, extend lifetime of the equipment and steady pressure increase in the water supply system.

The company includes the following departments: Energy Department (to maintain all electrical equipment of the company), Repair and Construction Department (to perform capital and preventive repairs of building and objects of the company), on-line Services (which all day around stay on-duty to monitor water supply parameters and correct emergency situations in different parts of the supply chain)

Today «Severomorksvodokanal» is involved in specific solutions in engineering and communal services market, actions implementation relating to communal services reconstruction and improvement.

2.2 Legal status

MUE Severomorskvodokanal has a municipal pattern of ownership. Legal address: 184600, Gadzhieva Str., 1-a, the city of Severomorsk

The enterprise is registered on the territory of the Russian Federation by state registration number 2035100101090 as of June 27, 2003.

Extract from Primary State Registration Number register as of 22.04.2008 No. 71157 contains data concerning MUE «Severomorskvodokanal» with Primary State registration Number 1025100711570.

MUE «Severomorskvodokanal» was tax registered since 03.11.1998 with Identification Taxpayer’s Number ИНН 5110120910. Number and address of Tax Inspectorate – Interdistrict Inspectorate of Ministry of taxes and Duties of Russia No. 2 in Murmansk Region No. 5110, Sgibneva Str., 13a, the city of Severomorsk.

Incorporator of Municipal Unitary Enterprise «Severomorskvodokanal» is municipal enterprise ZATO Severomorsk (184600, Lomonosova Str., 4, the city of Severomorsk, Murmansk Region, phone (8-815-37) 5-07-60).

In the name of municipal enterprise property rights of municipal unitary enterprise are exercised by the Head of municipal unitary enterprise ZATO Severomorsk, City deputy council, ZATO Severomorsk administration and Property Management Committee of ZATO Severomorsk in the limits of their competence, stated in the orders «About municipal enterprises of ZATO Severomorsk» and articles of association of the company.

The enterprise is a legal entity, has civil rights according to the object and aim of its activity, and bears responsibility connected with this activity.

Quotation of articles of association concerning credentials of general director – director of the enterprise is a sole executive body of the enterprise, acts in the name of the enterprise without power of attorney, including representation of its interests, executes deals in established order and in the name of enterprise, approves structure and staff of the enterprise. Director of enterprise organizes implementation of the decisions of the enterprise property owner.

2.3 Current state of production and sales of products, prospects of facility development

2.3.1 Current status

First attempts to design Sewage Water Treatment Complex for Severomorsk were made in the beginning of the 90ies. As a result feasibility study was prepared. Financing of the other design and construction stages was budgeted.. Today the feasibility study results are outdated. All works for designing and construction of WWTP shall be done again. Besides that designing and construction of WWTP is seen more difficult because of the existing infrastructure objects appeared since the initial designing times.

2.3.2 Characteristic of current production

The MUE "Severomorskvodokanal" produces 21000 thousand m^3 water and discharges 9400 thousand m^3 untreated sewerage annually.
Inputs of power and material resources are as follow:

а) electric power – more than 9 mln. kW for the sum of 17,5 mln. rubles;
б) other material assets – 4,3 mln. rubles.

Enterprise personnel amount to 286 people, out of which 63 with higher education, which make 22% of all employees. Fluctuation of personnel accounts 10% and mainly can be explained by the fact that people leave to the new places of living in accordance with the program of resettlement from the North.

2.3.3 Marketing and sales system of the manufactured products

Water supply to consumers and implementation of water disposal is done on the basis of agreements between enterprise and customers.

2.3.4 Characteristic of the environmental monitoring system (service) of facility

The Industrial laboratory of the MUE «Severomorskvodokanal» is accredited for technical competence and independence by Federal agency for technical regulation and metrology and is registered in the Unified registry of organizations, accredited by the Federal agency for technical regulation and metrology by the No. POCC RU. 0001.515897. Certificate of analytical laboratory accreditation registered on July 29, 2009. Term of validity – up to July 29, 2014.

In accordance with requirements of Sanitary rules СП 1.1.1058-01, approved by Chief sanitary doctor of the Russian Federation as of July 10, 2001 the enterprise has worked out a program (plan) of industrial control of water quality for the period of 2007 – 2011, approved by the first deputy head of municipal body ZATO Severomorsk and conformed with Territorial department of Russian Consumer Surveillance authority (Rospotrebnadzor) in Murmansk Region in ZATO Severomorsk.

In accordance with the said program industrial laboratory of MUE «Severomorskvodokanal» is conducting the following tests of water quality analysis:
- as per microbiological, organoleptic, generalized, inorganic factors – from water bodies;
- as per microbiological, organoleptic, generalized, inorganic, organic and radiological factors – before entering water supply network;
- as per microbiological, organoleptic, generalized, inorganic factors – from supply net.
- per microbiological, organoleptic, generalized, inorganic, organic and radiological factors – before entering water network;

In the flood period an intensified verification control mode as per chemical and bacteriological factors is introduced,

The Centre of laboratory analysis and technical measurements in Murmansk Region approved the Program of industrial environmental monitoring of sources of contamination of water bodies of MNUE «Severomorskvodokanal» till 01.01.2009. Test results are provided to the Centre of laboratory analysis and technical measurements in Murmansk Region, to the Department of water resources of Dvina-Pechora basin water directorate in Murmansk Region.

1. In control outlets of discharged wastewater:
- water quality control analysis is done in the river Srednyaya three times during spring-autumn period in control outlets – 50 m upstream and 250 m downstream the discharge outlet;
- water quality control analysis is done in the river Gryaznaya three times during spring-autumn period in control outlets – 50 m upstream and 250 m downstream the discharge outlet;
- water quality control analysis is done in Kola Bay 1 time per quarter in the control outlet in the radius of 250 m from the discharge outlet.

2. Monthly analysis of the discharged wastewater is done. Results of analysis are provided to the Centre of laboratory analysis and technical measurements in Murmansk Region, to the Department of water resources of Dvina-Pechora basin water directorate in Murmansk Region.

It is planned to sign an agreement with GO Murmanskoe GMS for carrying out of morphometric scanning of water bodies in the water intake area.

On the monthly basis a report of POD-13 form is provided to the Centre of laboratory analysis and technical measurements in Murmansk Region, to the Department of water resources of Dvina-Pechora basin water directorate in Murmansk Region;

Once a year, a report of 2-tp form (water industry) is provided to the Department of water resources of Dvina-Pechora basin water directorate in Murmansk Region.

2.3.5 Investment program and prospects of facility development

The enterprise developed an investment program for the years 2010-2017 on refurbishment and development of water supply and disposal systems of ZATO Severomorsk, assuming financial investment of enterprise, municipality, regional and federal budgets. Perspective development of the enterprise depends on construction of new objects of social and industrial structure, increase in water supply and disposal.
This investment program was submitted to Severomorsk administration for review but by the moment of our research it was not approved due to the lack of budget for program's action items.

2.4 Financial Situation at the Organization

This information can be obtained from the NPA Arctic Project Office or from the Executing Agency

3 DESCRIPTION OF THE INVESTMENT ENVIRONMENTAL PROJECT

3.1 Description of IEP

Annual volume of wastewater and pollutants therein, by outlets, 2007 actual data, thousand m^3 and tons accordingly:

Outlet 1, Severomorsk: 628 029 th. m^3, pollutants: 255.9
Outlet 2, Severomorsk: 1 805 583 th. m^3, pollutants: 791.1
Outlet 3, Severomorsk: 4 553.21 th. m^3, pollutants: 1604.7
Outlet 4, Severomorsk: 549 525 th. m^3, pollutants: 230.0
Outlet 5, Severomorsk: 314 014 th. m^3, pollutants: 131.7

Quality characteristic of the discharged wastewater at outlets 1 - 5 is determined monthly at the industrial laboratory of Severomorskvodokanal. Outlet characteristics are given in the table below:

Table 3-1 Pollutants discharge volume from outlet № 1

№	Pollutants	Average annual concentration mg/l	Discharge weigh tons/year	MAD	№	Pollutants
1	Suspended substances	76,61	48,1	3,26	61,36	14,8
2	BOD-full	108,2	68	2,3	88,21	29,6
3	Dry residue	148,72	93,4	122,72	-	-
4	Chlorides	29,64	18,6	30,68	-	-
5	Sulfides	9,45	5,9	7,67	-	-
6	Oil products	0,3	0,2	0,04	0,23	5,0
7	Ammonium ion	10,82	6,8	2,22	8,82	3,1
8	Nitrite	0,08	0,05	0,06	-	-
9	nitrate ions	1,89	1,2	1,53	-	-
10	Phosphate	0,18	0,1	0,15	-	-
11	Synthetic Surfactants	0,49	0,3	0,38	-	-
12	Iron	0,55	0,4	0,04	0,46	10,0
13	Fat	20,57	12,9	3,84	24,54	3,4
Total pollutants tons/year						255,95
Waste Water Volume thousand м3/year						628,0

Table 3-2 Pollutants discharge volume from outlet № 3

№	Pollutants	Average annual concentration mg/l	Discharge weigh tons/year	MAD tons/year	Conditional Discharge tons/year	Times of exceeding MAD
1	Suspended substances	82,86	149,61	9,37	198,46	16,0
2	BOD.	114,99	207,63	6,62	264,61	31,4
3	Dry residue	162,37	293,17	374,87	-	-
4	Chlorides	23,96	43,26	66,15	-	-
5	Sulfides	13,47	24,31	33,08	-	-
6	Oil products	0,29	0,53	0,11	0,66	4,8
7	ammonium ion	14,14	25,53	6,39	33,52	4,0
8	Nitrite	0,08	0,14	0,18	-	-
9	nitrate ions	1,84	3,32	4,41	-	-
10	Phosphate	1,22	2,21	0,44	3,31	5,0
11	synthetic surfactants	0,51	0,92	1,1	1,17	-
12	Iron	0,69	1,24	0,11	1,65	11,3
13	Fat	21,75	39,68	11,03	55,13	3,6
Total pollutants tons/year						791,55
Waste Water Volume thousand м3/year						1805,583

Table 3-3 Pollutants discharge volume from outlet № 3

№	Pollutants	Average annual concentration mg/l	Discharge weigh tons/year	MAD tons/year	Conditional Discharge tons/year	Times of exceeding MAD
1	Suspended substances	90,03	409,93	23,6	528,26	17,3
2	BOD.	89,16	405,96	16,7	511,58	24,3
3	Dry residue	107,69	490,34	639,5	-	-
4	Chlorides	17,79	81,0	111,2	-	-
5	Sulfides	13,67	62,24	83,4	-	-
6	Oil products	0,34	1,55	0,28	1,95	5,5
7	ammonium ion	4,81	21,9	16,1	28,36	1,4
8	Nitrite	0,08	0,36	0,44	-	-
9	nitrate ions	1,9	8,65	11,1	-	-
10	Phosphate	0,42	1,91	1,1	2,5	1,7
11	synthetic surfactants	0,48	2,19	2,8	-	-
12	Iron	0,37	1,68	0,28	2,22	6,0
13	Fat	25,7	117,02	27,8	194,62	4,2
Total pollutants tons/year						1604,73
Waste Water Volume thousand м3/year						4553,21

Table 3-4 Pollutants discharge volume from outlet № 4

№	Pollutants	Average annual concentration mg/l	Discharge weigh tons/year	MAD tons/year	Conditional Discharge tons/year	Times of exceeding MAD
1	Suspended substances	76,02	41,77	2,85	53,69	14,7
2	BOD.	96,1	52,81	2,01	67,11	26,3
3	Dry residue	180,13	98,99	127,51	-	-
4	Chlorides	22,21	12,2	16,78	-	-
5	Sulfides	13,59	7,47	10,07	-	-
6	Oil products	0,4	0,22	0,03	0,27	7,3
7	ammonium ion	6,12	3,36	1,95	4,3	1,7
8	Nitrite	0,07	0,04	0,05	-	-
9	nitrate ions	1,89	1,04	1,34	-	-
10	Phosphate	0,2	0,11	0,13	-	-
11	synthetic surfactants	0,49	0,27	0,34	-	-
12	Iron	0,47	0,26	0,03	0,34	8,6
13	Fat	20,85	11,46	3,36	23,49	3,4
Total pollutants tons/year						230
Waste Water Volume thousand м3/year						549,525

Table 3-5 Pollutants discharge volume from outlet № 5

№	Pollutants	Average annual concentration mg/l	Discharge weigh tons/year	MAD tons/year	Conditional Discharge tons/year	Times of exceeding MAD
1	Suspended substances	62,34	19,58	1,63	23,01	12
2	BOD-пол.	97,47	30,61	1,15	44,1	26,6
3	Dry residue	181,77	57,08	72,87	-	-
4	Chlorides	31,08	9,76	15,34	-	-
5	Sulfides	19,86	6,24	11,51	-	-
6	Oil products	0,57	0,18	0,02	0,23	8,9
7	ammonium ion	3,52	1,11	1,11	1,46	-
8	Nitrite	0,18	0,06	0,03	0,08	1,9
9	nitrate ions	1,95	0,61	0,77	-	-
10	Phosphate	0,19	0,06	0,08	-	-
11	synthetic surfactants	0,48	0,15	0,19	-	-
12	Iron	0,56	0,18	0,02	0,23	8,8
13	Fat	19,3	6,06	1,92	9,59	3,2
Total pollutants tons/year						131,68
Waste Water Volume thousand м3/year						314,014

The objective of this project is decreasing negative impacts to environment, improvement of the environment for living and reproduction of water biological resources in Kola Bay and

Barents Sea, elevating of safety and health living level for Murmansk region population by design and construction of WWTP for Severomorsk in Murmansk Region. The project will be accomplished in several stages: feasibility study, design and estimate documentation preparation, Severomorsk WWTP construction.

The project shall meet the following requirements:
- proved for biological treatment of sewage waters with extraction of biogenic elements;
- WWTP shall be compact with attractive appearance and without excessive air pollution;
- WWTP shall be robust, reliable in operation and durable;
- Energy efficiency;
- Meet the objectives

The main components of the WWTP will be:
1. Two-step bioreactor with uploading to immobilization of microbial flora;
2. Brush filters of finish treatment, made as a packed unit;
3. Main block of biological treatment includes: aeration-denitrification tank, settler, two-step bioreactor. The integral components are made such way to enable by unit shipment to minimize mounting operations at the construction site.
4. Automated control system.

Design, construction and operation of the WWTP in Severomorsk shall provide for:
- reduction of pollutants in sewage in average by outlets:
    1. suspended substances – in 16 times
    2. BOD full - in 25 times,
    3. oil products - in 8 times
    4. iron - in 8 times,
    5. nitrites - in 2 times,
    6. fats – in 3 times,
    7. phosphates - in 5 times:
- remove anthropogenic pressure over the Kola Bay from the industrial and social objects;
- improve environmental situation in the shore area of the Kola Bay and living conditions of the people resided at the Bay shore.;
- together with other environmental actions increase probability of restoration of permanent residential areas and reproduction of biological resources in the Kola Bay of the Barents Sea and other north seas;
- working places;
- and compliance with RF and international legislation for water objects protection from pollution.

3.2 Justification of the Selected Project Realization Methods and their Description

Technical and technological solutions for Severomorsk WWTP design will be similar to the project developed but not yet implemented for Severomorsk-3.

Preliminary technology scheme is presented in the Attachment 2.

The project employed the state-of-the-art methods and equipment from domestic manufacturers adjusted for operation under the conditions of the Far North, including the full cycle of water treatment operations (from wastewater treatment to sludge utilization and automated control systems). Similar project have not been realized in the region as of yet.

Regarding the technology selected:
According to the paragraph 9.35 of RF construction norms SNiP 2.04.03-85, for sewage treatment biological, biological and chemical, physical and chemical methods can be applied. The method selection can be determined by its technical and economical indicators, sewage discharge conditions, transportation network availability, district development, type of the residential area (permanent or temporary), reagents availability etc.

According to the paragraph 9.44. of SNiP 2.04.03-85, installations for physical and chemical treatment and biological and chemical treatment are preferable for temporary settlements, preventative clinics and settlements with high diversity of sewage content, low temperature and concentration of pollutants.
Based on SNiP 2.04.03-85, together with practical experience gained for number of years in communal sphere, input data about the settlement type, uniformity of coming sewage, quality of the coming waters and quality of the treatment, conditions of the water discharge etc. biological method of treatment has been selected for the project as the most technically and economically justified.

Two schemes of treatment are under consideration:

1. The first scheme of sewage treatment stipulates construction at each sewage outlet one sewage pumping station for sewage waters pumping to the biological treatment area, where the water will pass through all treatment stages. Theoretically the problem of sewage waters collection and treatment according to the scheme is solvable but practically some difficulties and additional expenses can appear during the object construction because the pipelines to the treatment plant object shall be laid in conditions of already existing infrastructure (roads, engineering networks, buildings).
2. The second scheme of sewage treatment stipulates for each outlet or for several outlets local sewage treatment plants but using a classical type of biological treatment. Realization of this scheme can cause problems with silt placement and odors because three outlets are located in the town boundaries.

Silt sediments utilization issue is not resolved yet.

WWTP operation requires energy resources, electricity and heat power. There are technologies commercially available to use the silt as raw material for biogas generation in bioreactor with its further usage in heat generation or electricity for the WWTP needs.

Using any other alternative treatment technique will require research of technical solutions and feasibility studies of the proposed techniques.

3.3 Territory characteristics

Severomorsk is a closed town in Murmansk Oblast, Russia. Population — 53,5 th. people. (2008). It is located about 25 kilometers north of Murmansk along the Kola Bay. Severomorsk is a marine on the eastern coast of ice-free Cola Peninsula of Barence Sea. This is the main administrative base of the Russian Northern Fleet

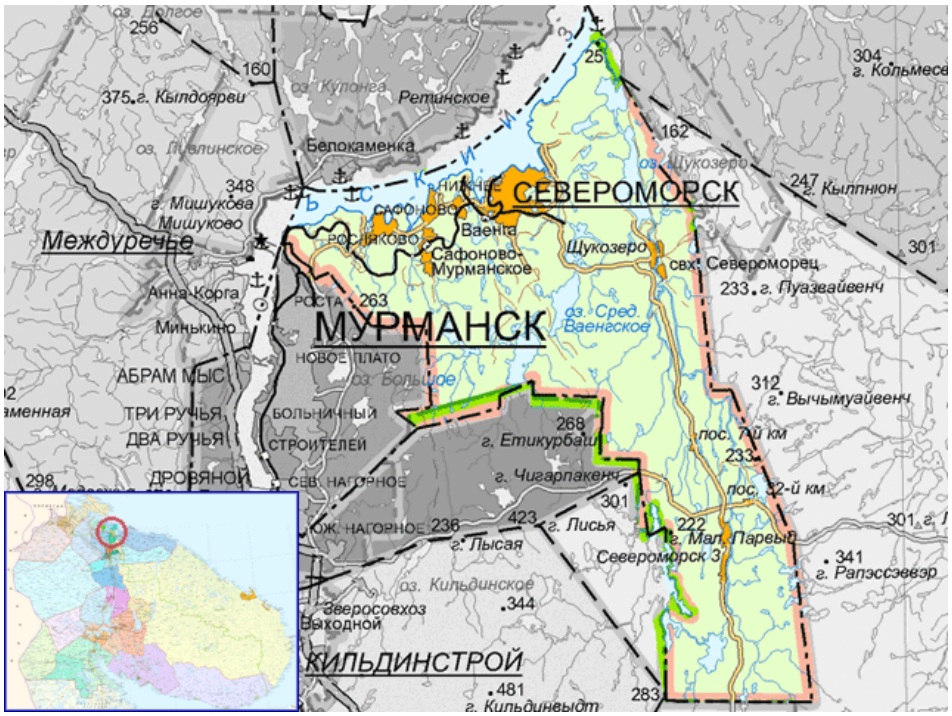


Figure 3-1 ZATO Severomorsk

Two plots are considered for construction of Severomorsk WWTP, points 1 and 2 at the sketch-map in Annex 1.

Figure 3-2 Planned WWTP construction plots

Point 1 (left bank of Varlamovo bay)
At this point in Soviet time construction of sewerage treatment facilities of the city of Severomorsk was planned but never executed. The left bank of Varlamovo bay is free from development, covered with greenery (bushes, small trees), has excess road (ground road comes down from main roadway Severomorsk-Murmansk). Laying of a collector main . through Varlamovo bay is the main disadvantage.

Point 2 (right bank of Varlamovo bay)

In the past a haulage company was situated there. Territory is partially laid with asphalt; there are deserted houses and constructions that can be used by designers during WWTP project development. Locality is flat and is situated rather near to sewer outlets No.1 and No. 5.

3.4 Technical, environmental and consumable properties of product

In accordance with SanPiN 2.1.5.980-00 «Hygienic requirements to surface water protection» the quality of treated wastewater discharged to the fish industrial water body of 1 category should correspond to facilities of deep biological purification as per following factors, stated in the table 3-5.

Table 3-5 – MPC of basic pollutants in treated wastewater

No.	Name of pollutants	MPC mg/l
1	Suspended substances	3,0
2	Biological oxygen demand (BOD)	3,0
3	Ammonium ion (NH_4^+)	0,39
4	Nitrate ion (NO_3^-)	9,1
5	Nitrite ion (NO_2^-)	0,02
6	Phosphates (P_2O_5)	2,0
7	Surface-active substances (SAS)	0,5

3.5 Technological risks

The main process risks are related to the correct implementation of the design solutions for the WWTP facility.

However, since similar projects have not been realized at the Kola region yet, some problems concerning disposal of produced dry sediments can arise. There are no specialized disposal sites for such sediments in Kola, which meet all the environmental requirements for solid waste disposal sites. Methods for the further disposal or recycling of sediments should be determined based on the results of the chemical analysis.

3.6 Procurement plan

Actual cost of materials used as per estimate norms and project for actually accomplished scope of work will be clarified on the basis of checks and verified by the Client.

Supply of the constructed object with technological equipment, building materials, half-finished products and other necessary goods will be carried out by project general contractor, the winner of the open tender for the right to negotiate municipal contract for WWTP construction.

Contractor's agreement is supposed to be signed with open contract price, settling for the actually carried out work, providing by the contractor of all necessary payment accounting documents.

Furthermore it should be considered that during clearing between client and contractor for actually carried out scope of work, the reserved for unforeseen work assets are to stay within customer disposal and are no to be given to contractor (MDS 81-35.2004 p. 4.33).

3.7 Compliance with international standards

Planned sewage treatment facility should be designed in accordance with the best available technology (BAT) according to technological normative document «Complex prevention and control of pollutions» as per the best available technologies of water treatment drawn up in the year 2006.

In accordance with this to technological normative document BAT the typical contemporary system of wastewater treatment consists of the following blocks:

- Mechanical preliminary treatment (mesh, grid)
- air tank
- dirt collector
- sediment thickener
- treated wastewater discharge to surface water
- sediment for further treatment for example in septic tank and biomethane utilizer.

In Russia there are no standards of water quality for water discharging at the end of the technological process (“end of pipe”). Instead of these there are quality standards of surface water where treated wastewater is discharged.

Being guided by the document «Complex prevention and control of pollutions» the quality of treated wastewater at the end of technological process in addition to Russian standards should as well meet European Standard requirements.

Particularly it is necessary to follow recommendations as per following criteria of «Complex prevention and control of pollutions» (the figure denotes the chapter in technological normative document BAT, which can be downloaded from the following address (http://ftp.jrc.es/eippcb/doc/wt_bref_0806.pdf) :

42. water usage and pollution
43. compliance of treated wastewater technical requirements with local system of wastewater system and outlet criteria
44. prevention of WWTP facility bypassing
45. wastewater gathering
46. wastewater separation
47. presence of full concrete basement at all treatment areas
48. rainwater gathering
49. reuse of treated wastewater and rain water
50. everyday control of treated wastewater managing system and data logging
51. determination of basic hazardous components of treated wastewater
52. suitable methods of wastewater treatment for each type of wastewater
53. increase of reliability of wastewater pollution control
54. basic components of treated wastewater
55. wastewater discharge
56. level of pollution as per chemical and biological oxygen demand and heavy metals, connected with BAT usage

67. methods of anaerobic digestion
68. decrease of emission into atmosphere of dust, nitric oxide, sulphur oxide, carbon monoxide, hydrogen sulphide and volatile organic compounds when using biogas as a fuel
69. methods of mechanical and biological treatment
70. influence decrease of smells of ammonia, nitrous oxide and mercury of mechanical and biological treatment
71. decrease of discharge into water of total nitrogen, ammonia, nitrate and nitrite

Physical and chemical methods of wastewater treatment

72. methods of treatment in physical-chemical reactors
73. additional wastewater parameters to be defined
74. process of neutralization
75. metals deposition
76. breakdown of emulsions
77. oxidation / resolution
78. wastewater containing cyanides
79. wastewater containing chromium compounds (IV)
80. wastewater containing nitrites
81. wastewater containing ammonia
82. decrease of air contamination by filtering and drying
83. flocculation and steam generation
84. cleaning of sifting processes

4 ENVIRONMENTAL IMPACT ASSESSMENT

4.1 Description of current state of environment at the area of IEP implementation

4.1.1 Social-economic characteristics

The Project will be implemented in Severomorsk of Murmansk Region. The Murmansk Region is one of the largest and most developed regions of the European North of Russia. The region is located in the Kola Peninsula. Most of its territory lies within the Arctic Circle. With the area of 145 thousand sq. km, the region represents a unique combination of abundant natural landscape, cultural and historic environment and developed economy. Advantageous geographic locations, significant natural resource potential, ice-free sea port, and proximity of the borders with the EU countries are the key factors of social and economic regional development.

The Murmansk Region has significant advantages compared to other Russian regions. This happens mostly because of its geopolitical and geographic location. The Murmansk Region is the northern gate of Russia; it links Russia with the European countries and handles huge cargo flow from our country and back.

Various natural resources exist in the region. More than 60 major fields of various minerals have been discovered in the Kola Peninsula area. Currently, nearly thirty types of fossils are produced; the most precious minerals are phosphor ore, titanium iron, aluminum, copper, nickel, zirconium, and other rare metals. The reserves of mica, ceramic raw material and raw materials for construction, facing stone, semi-precious and ornamental stones are extensive.

Figure 4-1 Murmansk Region map

Superb oil and gas reservoirs have been discovered in the Barents Sea in the last ten years. Shtokman gas and condensate field, with the reserves of 3.0 trillion cubic meters (tcm) of gas, is one of them. Development of such a unique field will satisfy the gas needs of the entire North-West of Russia for many years.

The economy of the Murmansk Region is targeted to the natural resources. The region delivers 100% of the Russian production of apatite concentrate and 12% of iron ore concentrate, 14% of refined copper, 43% of nickel, 14% of the fish production.

4.1.2 Climate conditions

Natural climatic conditions of Severomorsk ZATO are characterized by long and cold winter, strong winds, low daylight and UV factor, permafrost areas, and high humidity.

Severomorsk ZATO belongs to the Atlantic Arctic temperate climate zone dominated by warm air streams from North Atlantic and cold ones from the Atlantic sector of the Arctic, which is characterized by increased cyclone frequency in cold period of the year and increased anticyclone frequency in warm period. Proximity of warm Gulf Stream conditions the abnormally high winter temperatures, large temperature differences of the Barents Sea and the continent during summer and winter months—high temperature variability during changes in wind direction. The average temperature of the coldest winter months (January and February) is –9ºC at the shore of the Kola Bay. The average temperature of the warmest month (July) varies from +10ºC to +14ºC. Duration of no-frost period at the shore exceeds 100 days, while in other areas it varies from 50 to 100 days. All of the Severomorsk ZATO area lies within the humid zone. Annual precipitation reaches 600 700 mm (at the Kola Bay shore). Height of the snow cover varies from 80 cm in the south to 40 cm and less at the Kola Bay shore, where the snow is blown off by wind. Severomorsk ZATO is characterized by frequent snowstorms. They are most frequent in the January—March period. The Severomorsk ZATO area lies in two natural geographic zones: tundra and forest tundra. There are over a hundred lakes in the Severomorsk ZATO area. The lakes as well as the rivers are the sources of water supply for the cities, towns, and enterprises of Severomorsk ZATO. The main water area of Severomorsk ZATO is the Kola Bay, where navigation is year-round. The polar night lasts from December 2 until January 12, culminating on December 22. The polar day lasts from May 22 until July 22, when the Sun does not set. Storms are most frequent in the October—March period (average annual days—70-90), fogs and precipitation are most frequent in the July—August period. Poor visibility (less than 1 mile) may be observed throughout the year, its recurrence is 5-15%. Frequent and harsh weather changes sometimes cause abundant snowfall, forming snow banks on roads (the average daily precipitation is around 40 sm) storm winds (wind force of 25 m/s and more), strong frost (temperature of –25…30ºC, glaze ice on roads and power line wires.
All the above conditions complicate the operation of business, transportation, and education facilities, sometimes breaking the power lines, complicating search and rescue operations and accident recovery work.

4.1.3 Air

In Severomorsk ZATO, the greatest share in atmosphere pollution do the organized pollution sources of 6 heat districts – enterprise “Severomorsk heat networks” and 50 small boiler houses of Defense Ministry which run on stove fuel and coal, mobile sources – 20 thousand vehicles. Emission, produced by North navy ships and air force, can’t be estimated.

In atmosphere air emission of industrial enterprises are exposed by a complex of meteorological factors, which influence the existing level of the pollution. The dispersion of pollutants in Cola Peninsula mainly depends on active cyclonic activity with moderate or

heavy winds. North-West of RF European part is categorized as favorable area for air pollution dispersion.

At anti-cyclonic season with weak winds and lowed inversions with gauzes in cities and industrial centers of Murmansk region increased level of pollution concentrations can be observed.

Atmosphere pollution index on the territory of Severomorsk ZATO is 3. It is less than the average index in the country. The lower potential of atmosphere pollution determines transfer and dispersal of impurity substances disposed into air basin of Kola Peninsula cities, and creates favorable conditions of contaminants dispersion.
This day ambient air condition in the region evidences the satisfactory state. Nevertheless the total emission of contaminants from both organized and unorganized sources is around 15.000 ton a year i.e. 190 kg a year/habitant.

The background concentrations of contaminants in ambient air of Severomorsk are shown in Table 4-1 below.

Table 4-1 Background concentrations of contaminants in ambient air of Severomorsk

Substance	Concentration, mg/ m^3
Carbon oxide	2,6
Nitrogen dioxide	0,06
Suspended substances	0,2
Sulphur dioxide	0,03

The more detailed information about background concentrations of contaminants in the city of Severomorsk is shown in Annex 3.

4.1.4 Surface waters

There are more than 127 thousand hydro objects on the Kola Peninsula including 20,6 thousand stream flows, 107 thousand water reservoirs including lakes of Imandra, Umbozero, Lovozero, reservoirs at Tuloma, Voronya, Teriberka rivers. The region is very rich with water resources.
Regular monitoring of water reservoirs quality is carried out by Murmansk UGMS with frequency of 6-12 times per year at 55 regional rivers, lakes, springs and reservoirs.

It is very specific for the natural waters to include metal ions such as cupper, iron and manganese. High concentrations of metals when no water discharge form industrial enterprises takes place can be observed in low-water season when feeding is primarily done by ground waters.

However industrial activity at Kola North leads to pollution of water reservoirs by sewage waters as well as by dust emissions coming to water with rainfall. High and extremely high water pollution levels by metals, sulfates, ditiophosphate, nitrogen and phosphorus compounds, organic substances are limited and can be observed in small water objects. Rivers Nadui (Monchegorsk) and Kolos-yoki (Nikel) are classified as chronically polluted water objects due to they are exposed to direct water discharge from non-ferrous metallurgy companies without sufficient treatment.

Sewage water from enterprises, institutions organizations and military units located on the territory of Severomorsk ZATO is disposed in inner water basins via own and municipal sewer systems. Into surface water basins, the city of Severomorsk disposes 7,9 million m^3 of untreated sewage water. End receiver of rivers and brooks of fish-industrial importance is Kola Bay. That has a pernicious influence on reproduction of his biological resources. For last 10-20 years, some species of bottom fishes have become rare ones.

Table 4-2 Control results of background quality of water in a control cross-section of Kola Bay (in radius of 250 m from outlets of the city of Severomorsk.)

№	Pollutant name	Value mg/l	MPC mg/l
1	Sustained substances	1,68	0,85
2	BOD full	2,97	3,0
3	Iron	0,12	0,05
4	Oil products	0,06	0,05

The more detailed information is shown in Annex 4.

4.1.5 Soil

The main reasons for soil contamination is industrial and domestic waste as well as industrial enterprese discharges (aerogenic pollution). The problem of waste management (6 domestic waste landfills, 14 authorized dumps and 117 unauthorized dumps are functioning in the territory of Murmansk region) is at present the most burning issue. Pesticides are restrictedly used mainly in protected ground. During laboratory soil tests no pesticide detection cases were registered.

In accordance with the effective normative-legal acts: Federal Low “About sanitary-epidemiological safety of population” dated 30.03.1999 No. 52-FL with addenda and amendments, art. 21; SanPiN 2.1.7.1287-03 “Sanitary-epidemiological requirements as to soil quality”; GN 2.1.7.2041-06 “Maximum permissible concentration (MPC) of chemical substances in soil”; GN 2.1.7.2042-06 “Guiding permissible concentration (GPC) of chemical substances in soil” – the control of observance of requirements of sanitary legislation as to soils, maintenance of territories of urban and country supplements, accomplishment of measures on prevention of soil pollution.

In year of 2008, the soil examinations were carried out on all administrative territories, including Severomorsk ZATO. As compared with 2007, specific weight of samples exceeded sanitary standard of the heavy metals’ content in soil has been reduced.
The districts of region have been ranked taking into account K_{sum} – a summary index of soil pollution (Table 4-3). In accordance with the accomplished ranking, the territory of the Severomorsk ZATO takes the second place as to soil pollution grade.

Table 4-3 Ranking of region territories basing on soil pollution index (K_{sum})

Territory	Summary index of soil pollution Ksum
Kovdorskiy district	0,14
ZATO Polyarniy	1,23
Terskiy district	1,37
Apatity town	2,24
Kandalaksha town	2,27
Olenegorsk town	2,7
Kirovsk town	3,0
ZATO Skalistiy	3,02
Lovozerkiy district	3,62
ZATO Zaozersk	5,1
Monchegorsk town	6,0
the city of Murmansk	7,72
Kola District	10,32
ZATO Severomorsk	**32,8**
Pechengskiy district	45,92

4.1.6 Wastes

Major factor polluting soil is industrial and domestic wastes, as well industrial enterprises, emission (aerogenic pollution). At present the problem of waste disposal (on the territory of Murmansk region operates 6 domestic waste sites 14 approved landfills and 117 unapproved dumps) is an urgent one. Pesticides are applied in limited amount, mainly in closed ground. In laboratory examination of soil, pesticides were not found.

Annual amount of dangerous wastes is around 3,5 thousand ton. Industrial and domestic waste is disposed at the special enterprises of Murmansk region. Construction refuse gathered upon demolition and major repair of buildings and structures of the Defense Ministry's objects taken out of operation, the slag built by coal combustion in production of heat energy, are disposed on the territory of the city of Severomorsk, at an approved landfill). Solid domestic waste is neutralized at the thermal treating plant of the city of Murmansk. Waste utilization on ZATO territory is insignificant. This is mainly the waste motor and transmission oils, which are used as liquid fuel for enterprises of heat-power engineering. Separate gathering of the solid domestic waste is not organized due to the absence of attendant recycling plants in ZATO as well as on the territory of the region.

In spite of regulated procedure of handling some types of waste, we have a problem of collection of mercury-containing waste from population. Hitherto it has been failed to implement the organized collecting of fluorescent lamps, clinical thermometers and other mercury-containing devices from population. This waste has been going to thermal treating plant with domestic waste together.

Recently the necessity of quality utilization of biological waste has been recognized. First of all that concerns health care and prophylactic establishments which dispose organic wastes, used bandaging materials, waste packing. In future, purchase and installation of special equipment for the morbid anatomy department, being reconstructed now, of the central district hospital of the city of Severomorsk. Further, if monetary funds will be available, the issue on building of station for utilization of fallen animals will be examined. Regulation of processes of

industrial and domestic waste treatment at Severomorsk ZATO is carried out in accordance with unified system being working through on the territory of Murmansk region.

4.1.7 Demographic situation and population health

Demographic situation and population health in Murmansk region as well as in Russia in whole becomes worse and is determined by low birthrate and life expectancy, high death and sickness rate. For the year 2007 Region population decreased for 5902 people and by the 01.01.2008 it accounted 850 929 people (fig. 4-1)

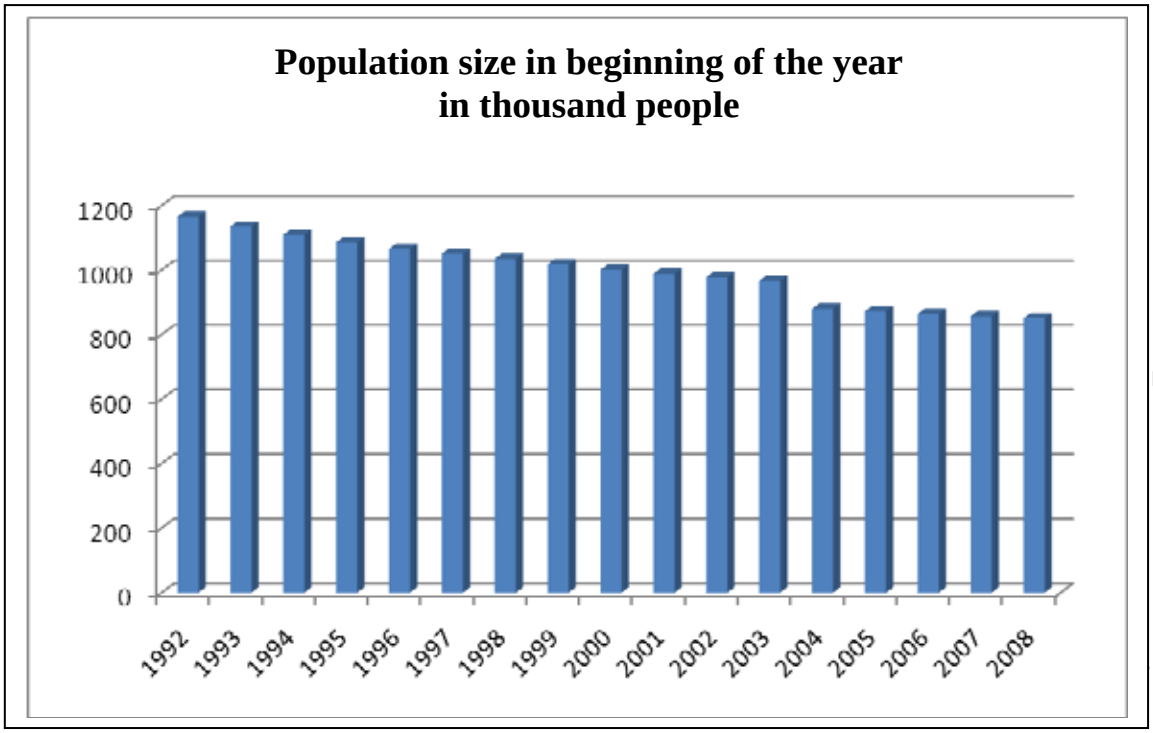


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Table 4-4 Dynamics of reproduction processes

	People quantity		Growth rate January – November 2007 in accordance with January – November 2006,%	Per 1000 people	
	2006 (January - November)	2007 (January - November)		2006 (January - November)	2007 (January - November)
Were born	702	692	98,5	10,4	10,3
Died	578	472	81,7	8,6	7,0
Natural increase	124	220	177,4	1,8	3,3
Registered marriages	524	590	112,6	7,8	8,8
Registered divorces	511	448	87,7	7,6	6,7

One of the constraints to increase of birth rate is social and demographic problems of career servicemen. In connection with despondency of life conditions and low money allowance the more military people live unmarried or have families with low number of children. Average age of Severomorsk ZATO has tendency to increase. Quantity of pensioners and their share in total quantity of population within last years is invariably increasing.

High death rate of population is connected with untimely death rate of blood circulation illnesses, high men death rate of accidents, traumas and poisonings, as well as high death rate of new growth.
Basic reasons of population health level and demographic situation decrease still remain: social stratification and poverty, increase of unemployed people amount, unbalanced structure and quality of food, adverse working conditions of employees, negative environmental and natural climatic conditions.

According to data of Directorate of state population placement service in Murmansk region as of March 03, 2009 total unemployment accounted 14963 people (as of February 01, it was 13178 people). Level of the registered unemployment (to economically active population) amounted 3%.

Quantity of employees supposed to be fired in accordance with staff reduction, liquidation according to data of enterprises themselves amount 1998 people.

Quantity of employees being on unpaid vocation as of March 03 amounts 128 people. Those who are idle because of employer's fault – 305. As far as vacancies concern Severomorsk ZATO is in the third place in Murmansk region: in Murmansk (2944), Kola district (526), Severomorsk (368), Kandalaksha (240), Pechengskiy district (171).

4.2 Requirements of Environmental Legislation applicable to the IEP

Waste water discharge is done into the fishery objects. Environmental legislative requirements applicable to the IEP are located in the following documents:

- Water Code of RF № 74-FZ, dated 3 June 2006.

  «Article 60, paragraph 6. When hydroeconomic system is being used it is prohibited:

1) discharge waste waters into hydro object without sanitary treatment, disinfection (taking into account impermissibility of exceeding water pollution standards and maximum admissible concentrations of hazardous substances in hydro objects), as well as it is prohibited to discharge waste waters which are not in compliance with technical regulations»

- GN 2.1.5.1315-03 «Maximum admissible concentrations (MAC) of chemical substances in hydro objects for drinking-economic and cultural-domestic usage» (dated 30 April 2003, revision 28 September 2007)

  «Paragrph 1.2. This standard is applicable at all RF territories and sets forth maximum admissible concentrations of chemical substances in water of hydro objects for drinking-economic and cultural-domestic usage »
- SanPiN 2.1.5.980-00 Hygienic requirements for superficial waters protection (dated 22 June 2000)

  «4.1. For the purpose of hydro object protection from pollution it is prohibited:
  4.1.1. To discharge in the hydro objects waste waters (industrial, economic-domestic, rainwaters ect) which:
  - can be avoided by arranging for low-waste production, lean production, water reuse systems after pertinent treatment and disinfection in industry, agriculture and urban activity.
  - include causal infection organisms of bacterial, virus and parasite nature. Waste waters which are hazardous due to epidemic criteria can be discharged into hydro objects only after pertinent treatment and disinfection to reduce the number of termotolerable coliform bacteria down to CFU/100 ml $\leq$ 100, of overall number of common coliform bacteria CFU/100 ml $\leq$ 500 and number of coliphage CFU/100 ml $\leq$ 100;
  - contain substances (or their transformation products) which do not have established hygienic MAC or ODU nor methods of their determination;
  - contain highly hazardous substances for which the standard does not allow any amount».
- SanPiN 2.1.4.1074-01 "Drinking water. Hygienic requirements for water quality in centralized drinking water supply systems. Quality Control. Sanitary-Epidemiologic rules and standards"

  «Paragraph 2.2. Quality of drinking water fed in by the water supply system shall be in compliance with this sanitary rules».
- GOST 30813-2002 Water and water preparation. Terms and definitions, dated 12 November 2002.
- Rules for usage of municipal water supply and sewage systems in Russian Federation (revision dated 23 May 2006)
- Government Act dated 12 February1999 N 167 Rules for acceptance of industrial waste waters in municipal sewage systems
- «This Rules regulate relationship between customers and water pipeline- sewage system owners in part of usage of centralized water supply and sewage systems of populated places»
- BREF – Best available technique for water treatment, 2006

4.3 Description of considered alternatives

Zero option

Pollution of Kola Bay near the city of Severomorks has caused that for last 10 years White Sea herring have not entered the Bay, many fish populations have been vanished, and caught trout and haddock have specific smell of sewage waters. This results in pollution of the rivers Srednyaya, Gryaznaya and Kola Bay. Because of basins' pollution with untreated sewage,

their productivity has being remarkably reduced. Natural forage base has being changed and perished, numbers of permanent sprawling places and value fish species, inhabiting these basins, have been decreasing.

The proposed project accomplishes a task of treatment of Severomorsk sewage, which has being disposed without treatment to Kola Bay up to day, creating ecology and sanitary tension. In these conditions, the construction of sewage treatment facilities for the city of Severomorsk only allows to provide the normal functioning of disposal objects and consequently to improve sanitary-epidemiological and environmental situation. Thus refusing a construction of the sewage treatment facilities is not acceptable.

Treatments methods

According to the paragraph 9.35 of RF construction norms SNiP 2.04.03-85, for sewage treatment biological, biological and chemical, physical and chemical methods can be applied. The method selection can be determined by its technical and economical indicators, sewage discharge conditions, transportation network availability, district development, type of the residential area (permanent or temporary), reagents availability etc.

According to the paragraph 9.44. of SNiP 2.04.03-85, installations for physical and chemical treatment and biological and chemical treatment are preferable for temporary settlements, preventative clinics and settlements with high diversity of sewage content, low temperature and concentration of pollutants.

Based on SNiP 2.04.03-85, together with practical experience gained for number of years in communal sphere, input data about the settlement type, uniformity of coming sewage, quality of the coming waters and quality of the treatment, conditions of the water discharge etc. biological method of treatment has been selected for the project as the most technically and economically justified.

Two schemes of treatment are under consideration:

The first scheme of sewage treatment stipulates construction at each sewage outlet one sewage pumping station for sewage waters pumping to the biological treatment area, where the water will pass through all treatment stages. Theoretically the problem of sewage waters collection and treatment according to the scheme is solvable but practically some difficulties and additional expenses can appear during the object construction because the pipelines to the treatment plant object shall be laid in conditions of already existing infrastructure (roads, engineering networks, buildings).

The second scheme of sewage treatment stipulates for each outlet or for several outlets local sewage treatment plants but using a classical type of biological treatment. Realization of this scheme can cause problems with silt placement and odors because three outlets are located in the town boundaries.

Silt sediments utilization issue is not resolved yet.

WWTP operation requires energy resources, electricity and heat power. There are technologies commercially available to use the silt as raw material for biogas generation in bioreactor with its further usage in heat generation or electricity for the WWTP needs.

Using any other alternative treatment technique will require research of technical solutions and feasibility studies of the proposed techniques.

4.4 Characteristic of sources and types of environmental impact resulted from IEP implementation

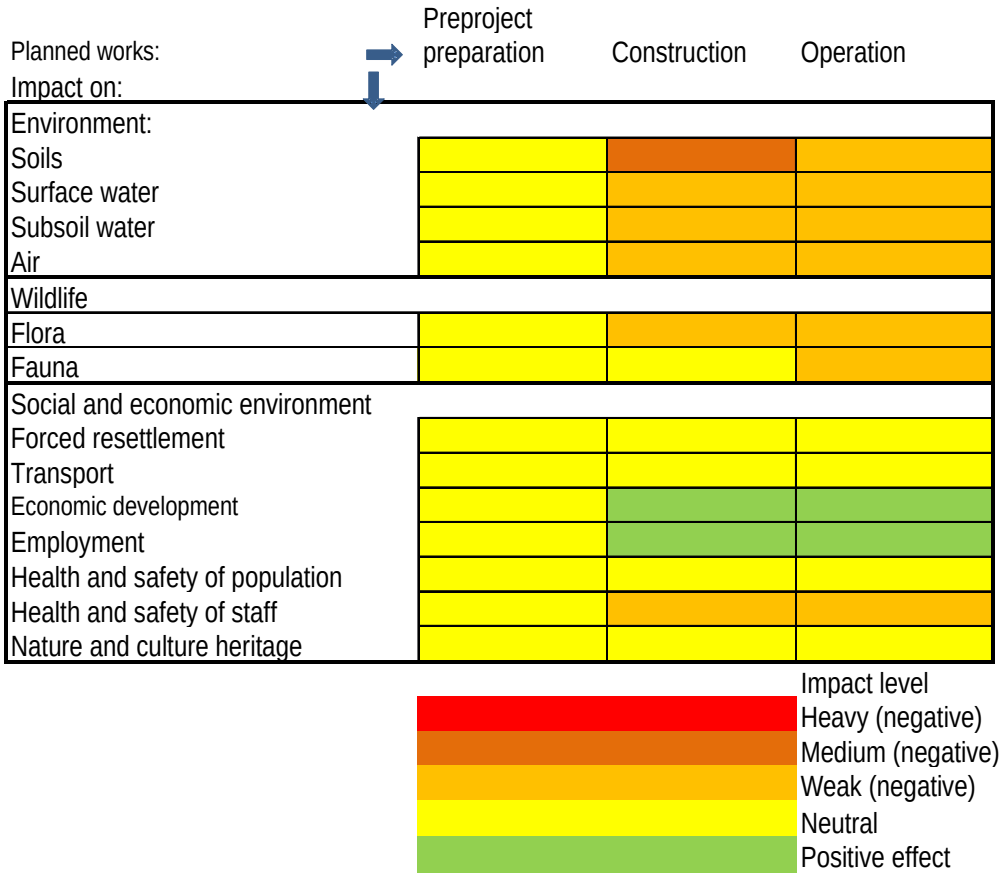
For estimation of impact level resulted from the project implementation, it is necessary to pick out main project stages. The project stages imply activities which will be different in their scale, influence scope and exposure; therefore the impact grade will be different in each of stages.

The project has been divided into stages as follow:

- Preproject preparation
  Surveying
- Construction
  Buildings' construction and application of communications
  Equipment mounting
- Operation
  WWTP operation at the city of Severomorsk in normal mode

Based on the information gathered at the moment of estimation, the possible impact on environment and population is as follow:

Table 4-4: Possible impacts on environment and population arisen from project's implementation



Expected positive consequences

WWTP construction and launching into operation in Severomorsk will enable:
As regards the positive *environmental consequences*, the project's implementation will provide:

- reduction of pollutants in WWTP effluent
    1. suspended substances – in 16 times
    2. BOD full - in 25 times,
    3. oil products - in 8 times
    4. iron - in 8 times,
    5. nitrites - in 2 times,
    6. fats – in 3 times,
    7. phosphates - in 5 times;
- removal of anthropogenic pressure in the Kola Bay from industrial and social activities;
- improvement of the environmental situation in the shore area of the Kola Bay and living conditions of the people residing at the Bay shore;
- together with other environmental actions, increase the environment for the population and fisherie resources in the Kola Bay of the Barents Sea and other north seas.

As to the *social consequences*, the project will realize:

- elevation of the environmental safety level for the local population;
- employment for 50 extra employees at Severomorsk ZATO ;
- meet key stakeholders (population, public and private organizations) expectations about water treatment.

During project's implementation, the negative effects on environment and population are unavoidable too. Description of the negative effects on environment and population is shown in the table below:

Table 4-5 Expected negative impact on environment and population

Production processes	Possible impact on:	Description
Construction		
Construction work	Soils Subsoil water Air Flora Health of staff Traffic flows	Construction works will directly influence upon soils and subsoil water – digging a ditch, removal of topsoil and vegetation under building up; air - building machinery emission; health of staff – it suffers from emission of pollutants;
Transportation of new equipment	Air Traffic flows Health of staff	Most likely that transport of new equipment will be carried out by trucks running on diesel fuel. Diesel engines are distinguished by the higher soot emission. Soot is saturated with carcinogenic hydrocarbons and microelements; their emission to atmosphere is inadmissible. Since truck waste gases are disposed to the lower atmosphere and process of their dispersal is essentially different from the dispersal processes of the higher stationary sources, harmful substance are practically in the zone of breath. Besides, at the time of transportation of new equipment, the load on current traffic flows increases lightly. However, it should be mentioned that any impact in construction stage have a temporary and local character.
Installation of new equipment	Health and safety of staff	In course of new equipment's installation, the work-related injuries of the staff engaged to mounting are possible.
Planning a territory, asphalt work	Soils Vegetation Health and safety of staff	Works connected with improvement of territory can entail an insignificant impact on soils (for example, removal of topsoil (0-5 cm) as well as on vegetation.
Operation		
Treatment processes	Ambient air Health of staff	During operation of sewage water treatment complex, the negative effects are possible as

Production processes	Possible impact on:	Description
		follow: - presence of objectionable odors at the mechanical treatment facilities due to anaerobic destruction of organic waste which begins in the sewage networks and septic; - emission of metabolism products to atmosphere; - emission of pathogenic microflora to atmosphere in airing processes;
Application sewage to WWTP	Soils Ground Subsoil water	Sewage leakage into ground as a result of seal failure of pipeline and fitting joints.
Operation of treatment facilities	Health and safety of staff	During operation of sewage treatment facilities, the work-related injuries of the staff are possible (for example, in repair works) Noise and vibration in zones where electro-mechanical equipment runs.

4.5 Mitigation measures

Prevention and mitigation measures are shown in Table 4-0 below:

Table 4-9 Impact to environment and staff caused by production processes and proposed measures

Production processes	Impact	Risk	Prevention /mitigation measures
Construction works	Soils – topsoil removal Vegetation – vegetation removal	High	Improvement of territory: additional gardening, creation of artificial landscape
	Staff – work-related injuries	Medium	In course of execution of construction and installation work, teaching all the co-workers at the object in accordance with SNiP 12-04-2002.
	Soils, surface and subsoil water, vegetation, staff - during activity related to waste treatment	High	Waste being gathered in course of construction should be accumulated in specially allotted place. Dangerous waste (1-3 class) should be stored in safe conditions: mercury lamps – within a closed metal container, waste oil and chemicals - in a sealed container with tray etc). All waste should be removed from the object's territory in proper time.
	Ambient air – emission of pollutants by transport	Medium	. Since this impact has temporary and local character and concerns contract enterprises, so any special measures from the side of project operator do not required.

Operation	Ambient air pollution	High	WWTP site should be chosen upon leeward of residential area and other enterprises of the city of Severomorsk. It should be also considered a sanitary buffer zone 400 m wide in accordance with Sanitary-epidemiological norms and regulations SanPiN 2.2.1/2.1.1.1200-03 “Sanitary buffer zones and sanitary classification of enterprises, constructions and other objects.” Main block of the sewage treatment facilities should be allocated in a building equipped with combined extract and input systems of general ventilation, as well with local units of suction from distribution chamber, sewage percolator. Also filters for air deodorization and neutralization should be installed.
	Surface water pollution	High	Sewage treatment system should bi designed in such a way that it will able to provide a reliability of the complex’s operation and higher effectiveness of treatment of applied to WWTP sewage and effective protection of a water object against pollutants. Previously decontaminated and dewatered waste should be removed by special motor transport regularly. For the purpose of prevention of equipment failures, its backup should be provided. Multi-stage treatment system is to prevent uncontrolled “breakthrough” of dirty or insufficiently treated sewage water.
	Noise impact on staff	High	For silencing and reducing a noise impact on workers, the should be taken, for example: - pumping stations are placed at the facility wherein is no personnel in normal operation; - the most part of operating pumps – submersible ones with reduced noise level.

	Work-related injuries of the staff Staff suffers from emission of pollutants at the object	Medium	Basing on the identification of dangers and risks for health of WWTP staff in operation of the object, it is necessary to develop a plan of labor protection including a register of risks, as well as to apply the mitigation measures according to the developed register of risks.

4.6 Characteristic of environmental effectiveness of IEP

In course of implementation of project construction of Severomorsk WWTP with productivity up to 30 thousand m^3 per day, it is planned to reduce the sewage pollution (in average on disposal) to parameters stated by standards, including:

- suspended substances - 16 times,
- BOD total.- 25 times,
- oil products - 8 times,
- iron - 8 times,
- nitrites-2 times,
- fats - 3 times,
- phosphates – 5 times:

4.7 Justification of necessity to perform additional engineering surveys

Development of design decisions is to be carried out, basing on materials of engineering surveys (for example, engineering-geological, engineering-environmental ones), because of there being not any information about construction site. If any alternative design of sewage treatment will be used, it is necessary to survey technical decisions and develop a technical and economic ground of the schemes being under consideration

4.8 List of environmental conditions

In course of designing, construction and operation of the object, the environmental requirements to the object should be taken in consideration, whose short list is presented below:

- Observance of key requirements on allocation of the object (for example, absence of objects residential area as well enterprises of food and pharmaceutical industries in the sanitary buffer zone of the design WWTP)
- Observance of key requirements regarding operations in water protection zone.
- Minimization of emission from stationary and mobile sources (compliance with permissible limits)
- Minimization of noise impact (compliance of noise level with permissible limits)
- Organization of industrial, domestic and storm water drainages providing for minimization of surface, subsoil water and relief pollution (compliance of pollutants' concentration with permissible limits)
- Waste disposal with regard to the safe conditions for environment (compliance of disposed volume with permissible limits and approved conditions of disposal).
- Minimization of waste / maximum recycling
- Norm-setting of impact on sewage treatment facilities (discharges, emission, waste and noise)
- Payable impact on sewage treatment facilities (discharges, emission, waste and noise)
- Safe handling chemicals
- Providing the safe labor conditions (observance of safety measures, providing the proper labor conditions, including work area air control)

5 FINANCIAL EFFICIENCY OF INVESTMENT ENVIRONMENTAL PROJECT

The financial analysis concentrates on assessing the financial feasibility of the proposed investment. The analysis will be based on constant prices, meaning that the effects of inflations are excluded from the analysis, which makes it possible to compare the costs and revenues in different years.

To be able to assess the financial feasibility of the Sewage Water Treatment Plant, the investment and costs of waste water treatment involved in the new plant, will be compared to the additional revenues to be generated by calculating the Net Present Value of these numbers with a discount rate of 13% (source CIA World Fact Book).

Paragraph 5.1 will first elaborate on the required investments. The next session assesses the additional revenues, whereas the additional costs are presented in paragraph 5.3. In the final section these numbers are compared by calculating the Net Present Value.

Analysis of financial feasibility of the project has been accomplished basin on the data provided by MUE “Severomorskvodokanal” which had been considered as reliable data.

5.1 Value and structure of investment to IEP

The complete environmental project for Severomorskvodokanal consists of a feasibility study during which the design of the investment will be determined. It is clear however that the investment will be substantial. Possible financing agencies include international finance institutes such as EBRD, EIB and IFC, that all have financed similar investments in the Russian Federation. Some examples are provided in the table below:

Table 5-1 Examples of investments for water and sewerage projects in Russia

Project	Financing Agency	Total value in Euro
Water and sewerage St Petersburgvodokanal II	EIB	20.0 million
Water and sewerage St Petersburgvodokanal III	EIB	17.5 million
Murmanskvodokanal water and sewage improvement program	EBRD	24.2 million
Improvement of municipal water and waste water services in Archangelsk	EBRD	8.3 million
Ufavodokanal Waste Treatment Plant	IFC	12.5 million

The total estimated investment to construct this Sewage Water Treatment Complex is 1,817 million RUR. Constructing the Complex consists:

1. Design and research works for the WWTP
2. Capital construction

The table below presents the details of the estimated investment per construction phase.

Table 5-2 Estimated investment Sewage Water Treatment Complex

№	Investment item	Cost (thousands of RUR)
1	Design and research works for the WWTP construction with productivity of 30,000 m³/day	97,000
2	Capital construction of Severomorsk WWTP with productivity of 30,000 m³/day	1,720,000

The design and research works are planned to take place over two years, whereas the construction is to take place in four years, after which the Sewage Water Treatment Complex will start its operations. The planning of the investment over the years is presented below.

Table 5-3 Project schedule

No	Stage	Year					
		2010	2011	2012	2013	2014	2015
1	Design and research works						
2	Capital construction						
Payment (000 RUR)		30 000	67 000	516 000	400 000	400 000	404 000
Total:					**1,817,000**		

5.2 Expected income of the project implementation

The projected additional financial revenues because of the new Sewage Water Treatment Plant for the next ten years are shown in the table below, starting in the year of operation of the new plant (2016).

These revenues are based on a current tariff of 3.81 RUR per m³ (2009) excluding VAT, which is charged for the transportation of waste water. This tariff is expected to increase with inflation (9%) every year. As the waste water will also be treated, the tariff is expected to increase with an additional 31% in 2010 and 2011 and 21% in 2012 (meaning a total increase including inflation of 40% and 30% in 2010-2011 and 2012 respectively) to cover the additional costs involved in waste water treatment. Subsequently, the tariff after ten years after start-up of the new plant will be 32.48 RUR per m³.

Table 5-4 Estimated additional revenues

Item	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Water discharge (000 m³)	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5	9 372,5
Tariff per m³ (excl. VAT)	7,48	9,72	10,59	11,55	12,59	13,72	14,95	16,30	17,77	19,36	21,11
Of which allowances to WWTPP	1,18	2,73	4,11	4,11	4,11	4,11	4,11	4,11	4,11	4,11	4,11
Additional revenues (000 RUR)	**11 059**	**25 587**	**38 521**	**38 521**	**38 521**	**38 521**	**38 521**	**38 521**	**38 521**	**38 521**	**38 521**

The following assumptions have been made for estimation of additional revenues:

- The additional revenues are based on the water discharge volumes per year and the allowances for the WWTPP. This means that inflation for O&M is not taken into account in the additional revenues.
- Water discharge volume is performed based on total volume of waste waters which are diverted to MUE “Severomorskvodokanal” exclusive of waste waters generated in Severomorsk-3;
- In calculation of total waste water volume the following conditions were accepted: tariffs for water discharge should be increased equally in the territory Severomorsk despite the absence of WWTP in the settlements of closed territory Severomorsk;
- Allowances for WWTPP have been calculated as a difference between existing and premium rate.

5.3 Operation & Maintenance costs

The Operation & Maintenance (O&M) costs of the new plant consist of:

- Power supply;
- Wages including Unified Social Tax;
- Expenses for reagents/coagulant, reagents/flocculant, reagents/ethane diacid;
- Water purchases;
- Residue transportation;
- Amortization.

The following table presents the O&M costs from the start up of the plant for the duration of ten years. Inflation has not been taken into account.

Table 5-5 Estimated O&M costs WWTPP

Project year:		6	7	8	9	10	11	12	13	14	15	16	17
Caleddar year:		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Затраты													
Неизменные цены													
Обслуживание и Эксплуатация													
Power supply	RUR	0	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745
Wages	RUR	0	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854
Reagents/ coagulant	RUR	0	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659
Reagents/ flocculant	RUR	0	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941
Reagents/ ethane diacid	RUR	0	123 872	123 872	123 872	123 872	123 872	123 872	123 872	123 872	123 872	123 872	123 872
Water purchase	RUR	0	219 819	219 819	219 819	219 819	219 819	219 819	219 819	219 819	219 819	219 819	219 819
Residue transportation	RUR	0	23 433	23 433	23 433	23 433	23 433	23 433	23 433	23 433	23 433	23 433	23 433
Amortization	RUR	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance costs	RUR	0	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000
Total		0	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323

5.4 Indices of financial efficiency of IEP

Based on the estimates above, a cashflow analysis has been carried out for the period necessary for constructing the plant and being operational for a period of ten years, based on constant prices in order to estimate the financial feasibility of the Sewage Water Treatment Plant (30,000 m³/day). The following parameters are used in the analysis:

- Internal Rate of Return (IRR). This parameter calculates the profitability of a series of cashflows. It is the interest rate at which the costs of investments lead to benefits of the investment. An investment is considered acceptable if its IRR is greater than the minimum acceptable rate of return (often the cost of capital, e.g. the CIRR which is 2.85% (source: OECD) in the EU region);
- Net Present Value. A positive NPV means that the proposed investment is acceptable, given a certain discount rate (13% in this case);
- Payback period. This parameter calculates the period of time required to return the on investment to repay the sum of the original investment. The shorter the payback period, the more preferable the investment.

The cashflow analysis is summarized below.

Table 5-4 Cash flow analysis

Project year:			1	2	3	4	5	6	7	8	9	10	11	12
Caleddar year:			2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Cost items														
Permanent prices														
O&M														
Power supply		RUR	0	0	0	0	0	0	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745	43 963 745
Wages		RUR	0	0	0	0	0	0	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854	1 535 854
Reagents/ coagulant		RUR	0	0	0	0	0	0	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659	4 186 659
Reagents/ flocculant		RUR	0	0	0	0	0	0	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941	1 206 941
Reagents/ ethane diacid		RUR	0	0	0	0	0	0	123 872	123 872	123 872	123 872	123 872	123 872
Water purchase		RUR	0	0	0	0	0	0	219 819	219 819	219 819	219 819	219 819	219 819
Residue transportation		RUR	0	0	0	0	0	0	23 433	23 433	23 433	23 433	23 433	23 433
Amortization		RUR	0	0	0	0	0	0	0	0	0	0	0	0
Maintenance costs		RUR	0	0	0	0	0	0	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000	32 250 000
Total			0	0	0	0	0	0	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323	83 510 323
Construction														
Design and surveys		000 РУБ	30 000	67 000	0	0	0	0	0	0	0	0	0	0
Capital construction		000 РУБ	0	0	516 000	400 000	400 000	404 000	0	0	0	0	0	0
Total			30 000	67 000	516 000	400 000	400 000	404 000	0	0	0	0	0	0
Revenue/Cost savings														
Income increase due to tariff rise		RUR	11 081 482	25 598 223	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660	38 480 660
Cash flows	000 РУБ	-30 000	-67 000	-516 000	-400 000	-400 000	-404 000	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133	-64 500 133
NNPV flow	000 РУБ	-30 000	-59 292	-404 104	-277 220	-245 327	-219 275	-30 980 609	-27 416 468	-24 262 361	-21 471 116	-19 000 988	-16 815 033	-14 880 560	-13 168 638	-11 653 662	-10 312 975	-9 126 526

5.5 Analysis of the project financial efficiency indices sensitivity

In order to test the sensitivity of the project, we have carried out a cashflow analysis for various scenarios:

- Best case scenario: revenues increased with +10%, operational costs and construction costs decreased with -10%;
- A scenario in which the revenues are increased with +10%;
- A scenario in which the revenues are decreased with -10%;
- A scenario in which the operational costs are increased with +10%;
- A scenario in which the operational costs are decreased with -10%;
- A scenario in which the investment is increased with +10%;
- A scenario in which the investment is decreased with -10%.

The following table summarized the results of the analysis.

Table 5-5 Results of the analysis

Assumption	IRR	NPV	Payback period
Base case scenario	NA	-1 239 182	NA
Best case scenario	NA	-1 034 400	NA
Revenues +10%	NA	-1 176 041	NA
Revenues -10%	NA	-1 219 745	NA
Operational costs +10%	NA	-1 216 012	NA
Operational costs -10%	NA	-1 179 774	NA
Investment + 10%	NA	-1 321 415	NA
Investment -10%	NA	-1 074 371	NA

The conducted analysis has shown that the proposed project is financially not feasible under the current circumstances. This is mainly caused by the revenues being smaller than the Operation & Maintenance costs. A further tariff increase or a decrease in O&M costs is therefore necessary to have a financially feasible project. However, as the economic benefits are likely to be large, the economic feasibility should also be calculated in order to estimate the overall feasibility of the project. Hence, a grant financing percentage might be needed in addition to debt financing.

Special econimic benefits include:

- Cuts in expenditures of industrial enterprises and community services for water treatment and maintenance of water treatment facilities;
- Decrease of water organisms contamination by sewage waters of industrial objects and community services, in particular:
  - Improvement of the habitat of water life organisms;
  - Increase of the general health care level (as a result, cuts in expenditures for health care);
- Infrastructure development.

5.6 IEP funding

The project realization is not specified in the program for socio-economic development of ZATO Severomorsk because of the high cost. Accordingly, this object was not included in the title list of the capital construction objects in ZATO Severomorsk financed from the federal budget. Therefore, the question of these projects financing that involves federal budget recourses is within the competence of Russian Federation government and can be addressed in state program of Arctic zone of the Russian Federation in the period till 2020.

According to the information provided by the Administration of ZATO Severomorsk the project financing from the regional budget is not expected in the short term. The elaboration of appropriate regional program that will involve financial recourse of the federal budget equity participation is necessary for the implementation of the project.

The local budget of ZATO Severomorsk is subsidized. The involvement of the local budget in the implementation of this project may be in the amount of grants and subsidies allocated by the regional budget to local budget for the arrangements realization of the programs of regional significance. In the existing regional programs, these arrangements are not specified, for the same reason (the high cost of these projects). Realizing the importance of the arrangements, ZATO Severomorsk administration is ready to find the sum of money in the local budget equal to 5 % of the cost of works for the design of sewage water treatment complex in Severomorsk according to verbal agreement between MUP "Severomorskvodokanal" and Severomorsk administration.

The participation of MUE "Severomorskvodokanal" enterprise in the shared financing of the projects is possible. The company may allocate the necessary equipment and manpower for an account of expenses for the construction activity in the amount determined by the volume of actual works performed within construction activities. The investment program prepared by the MUE "Severomorskvodokanal" which deals with the wastewater treatment was not included in any regional programs and has died on the vine. Thus, ZATO Severomorsk administration cannot estimate the possibility of financing of these projects from the regional and federal budgets. Currently, the financing of the project under consideration/discussion may be represented the following way.

The name of investment project	Appraisal costs of the project realization (thousand roubles)	Possible sources of financing				
		Financing from the enterprise (thousand roubles)	Financing from the local budget (thousand roubles)	Financing from the regional budget (thousand roubles)	Financing from the federal budget (thousand roubles)	Financing from other investors (thousand roubles)
Design and construction of WWTP in Severomorsk Including:	**1 817 000**	**3 000**	**4 850**	**0**	**0**	**1 809 150**
Design	**97 000**	**3 000**	**4 850**	**0**	**0**	**89 150**
Construction	**1 720 000**		**0**	**0**	**0**	**1 720 000**

It seems logical, given the amount of the investment, to opt for a co-financing mechanism whereby the Russian authorities provide for part of the required funds and one or more international financing institutes for the rest.

Direct funding by Russian authorities can be provided in the frame of federal, regional and departmental targeted programs as well as the federal targeted investment programs.

Federal targeted investment program (FTIP) is the most traditional tool of investment policy which is originated from Soviet time practice of social and economic development. In general, FTIP cad be characterized as a list of projects which are implemented out of funds of federal budget. According to the Russian legislation FTIP funds are the capital government investments into stimulation of social and economic development of the country. However, the FTIP tool can't be used for this project as the project initiator is unprofitable organization.

The state program "Clean water" is a complex of interrelated package of measures performed by public authorities and local governments, industrial organizations, financial sector, academic institutions, the implementation of which is aimed at reformation and modernization of the water supply and wastewater discharge sector. One of the key elements of the program is the realization of regional and local programs in the water sector (water supply & wastewater discharge sector). The support of the regional programs in the water sector is carried out in the form of target co-financing of regional programs from the federal budget based on the results of competitive selection. More detailed information about the program is available on the website www.gos-water.ru.

As of the time of the estimate the program "Clean water" was in the process of approval and the issue concerning investment securing for the Russian government was still open.

Public-private partnership (PPP) in housing and public utilities covers investment projects on construction (reconstruction, upgrade) of gas-, water-, heat- and energy supply, water discharge, counting and waste water treatment, waste processing and disposal. These projects are being implemented to the benefit of state and branch development with attracting of private funding which can be substantiated by the profits gained by private partner during the project operation and services payment.

There are some examples of projects implemented in the area of waste water supply and discharge in Russia in the framework of public-private partnership (PPP), like GUP "Vodokanal Saint-Petersburg", Rostov Vodokanal and others. According to the expert's opinion one of the main conditions of PPP-projects implementation in water supply and discharge is settlement's population where the project will be implemented (not less than 300 thousands residents). Due to the fact that the population in Severomorsk is 53.47 thousands residents according to the information 2009, the probability to attract business into the project seems to be low.

During the project implementation Interviews with representatives of the following organization – potential donors were conducted by the Royal Haskoning project team in August 2009:

- European Bank for Reconstruction and Development
- International Finance Corporation
- EVD
- Barents Euro-Arctic Council
- Nordic Environment Finance Corporation (NEFCO)
- Northern Dimension Environmental Partnership (NDEP)
- Coordinator of the target long-term program of Murmansk region "Wastes" - Committee of Nature Use and Environment of Murmansk region and "Environmental protection and hygiene and provision of environmental safety in Murmansk region" – Committee of Nature Use and Environment of Murmansk region

During the initial contact with initiators, the following donors expressed interest in this project: EBRD, IFC, NEFCO and NDEP. EBRD has recently signed a framework of cooperation with Murmanskvodokanal indicating a desire of that institution to start supporting this organization. Project summary document as published on the EBRD website is provided in Attachment 3.

However, it is advisable for Severomorskvodokanal to focus on IFC, NEFCO and NDEP under the assumption that EBRD does not want to expand its focus by including Severomorskvodokanal in their approach towards Murmansk region.

More detailed information about the organizations expressed their interest is provided below.

5.6.1 European Bank for Reconstruction and Development

Name of funding agency	EBRD
Logo of organization	European Bank for Reconstruction and Development
Name of contact person/ respondent	Mr. Alexander Rogachevsky
Contact details of respondent	St Petersburg Office 25 Nevsky Prospect 191186 St Petersburg Russia Tel. +7 812 703 5540 Fax +7 812 703 5526
Programmatic priorities of funding agency for Murmansk	1. Projects with an environmental component
	2. Water supply
	3. Heating systems
	4. Transport
	5. Solid waste
	Others: for Russian Federation as a whole the priorities are: infrastructure, economic diversification, competitiveness, entrepreneurship, environment and energy efficiency, and regional development. EBRD finances in many sectors, so its focus is rather broad.
Types of funds administered by agency:	1. Long-term financing (10 years)
	2. Equity in private companies
Type of fund relevant for project	Long-term financing
Type of assistance (grant, loan, ….):	Long-term financing, so a loan
Objectives:	- To strengthen institutionally the clients of the bank; - Normal banking objectives, e.g. profit making, however, EBRD is able to invest in more risky projects than that commercial banks would do.
Time frame of current round:	Continuous: there are no rounds, but EBRD looks for opportunities by themselves
Next budget round:	Not applicable

Total value for current round:	About one billion euro for Russian Federation as a whole.
Eligibility criteria/ conditions:	1. Public utilities must be prepared to increase their tariffs 2. Government authorities need to provide a guarantee for the loan 3. Financing amount needs to be higher than 10 million euro
Information materials on fund:	See Russian strategy in annex (in English) See website: www.ebrd.com. For applications: http://www.ebrd.com/apply/index.htm And for Russia: http://www.ebrd.com/country/country/russia/index.htm See also: strategy of EBRD Russia in Russian language

5.6.2 International Finance Corporation

Name of funding agency	**International Finance Corporation (IFC)**
Logo of organization	
Name of contact person/ respondent	Pavel Kochanov
Contact details of respondent	36, bld.1, Bolshaya Molchanovka str., Moscow, 121069, Russia Tel: +7 (495) 411-7555 (ext.2014) Fax: +7 (495) 411-7563 www.ifc.org
Programmatic priorities of funding agency	1. Private sector development, e.g. industry, financial institutes, agriculture
	2. To a lesser extent: public sector support e.g. infrastructure and health
Types of funds administered by agency:	1. Loans
	2. Equity
	3. Intermediate forms between loans and equity
	4. Guarantees
	5. Purchasing of bonds
	Grants only for preparation of programs – technical assistance
Type of assistance (grant, loan, ….):	Long-term financing which is not available through local commercial banks. Conditions are market-rate.
Objectives:	- Promote private business development in private markets; - Invest is public sector development in order to set conditions for further private sector growth
Total value for current round:	Russian Federation: 1 billion USD in 2008. More in 2007.
Eligibility criteria/ conditions:	No formal criteria, but IFC conducts an appraisal of a project, looking at technical, environmental, social, and financial performance. See: http://www.ifc.org/ifcext/about.nsf/Content/Investment_Proposals
Average amount	Starting from 200 million Russian Rubles, so 7 – 8 million USD.

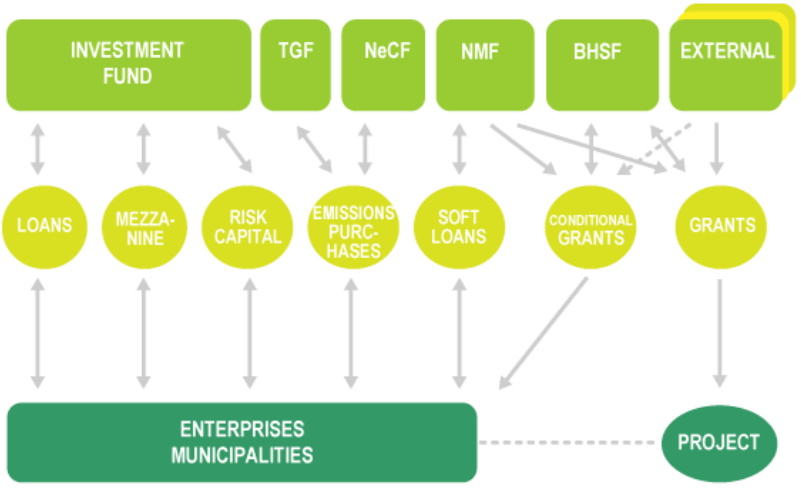
of funding per approved project:	

5.6.3 Northern Dimension Environmental Partnership (NDEP)

Name of funding agency	Northern Dimension Environmental Partnership (NDEP)
Logo of organization	Northern Dimension Environmental Partnership
Name of contact person/ respondent	Jaakko Henttonen NDEP Manager
Contact details of respondent	EBRD, One Exchange Square London EC2A 2JN Tel. +44-2073387186 Fax +44-2073387486 Mobile +44-7802510609 Email: henttonj@ebrd.com
Programmatic priorities of funding agency	1. Waste water
	2. Energy efficiency and heating
	3. Solid waste
Types of funds administered by agency:	1. Grants
Type of assistance (grant, loan, ….):	Grants
Objectives:	The purpose of NDEP is to mobilise support for environmental and nuclear safety investments in the Northern Dimension Area by providing grants for concrete projects prepared by the IFIs. The grants are allocated from the NDEP Support Fund which pools significant contributions from partner governments.
Time frame of current round:	Continuous, though decisions of council on project proposals is either in November or December of each year.
Eligibility criteria/ conditions:	The following: 1. Impact on the environment; 2. Geographical location; 3. Co-financing required: they provide 10 – 20 % maximum of a project costs. So other funds to be provided by other agencies through e.g. loan.
Average amount of funding per approved project:	5 million Euro
Information materials on fund:	www.ndep.org and in Russian: http://www.ndep.org/RUS/index.asp For an overview of projects in pipeline: http://www.ndep.org/projects.asp?type=nh&cont=prjh&pageid=15&content=projectlist

5.6.4 Nordic Environment Finance Corporation (NEFCO)

Name of funding agency	Nordic Environment Finance Corporation (NEFCO)
Logo of organization	
Name of contact person/ respondent	Henrik G Forsström, Senior Adviser
Contact details of respondent	Henrik G Forsström Senior Adviser NEFCO P.O. Box 249, FIN-00171 HELSINKI, FINLAND Office: Fabianinkatu 34 Telephone: +358 10 618 0638 Mobile: +358 400 888 541 (Russia +7 952 240 5405) Fax: + 358 9 630 976 E-mail: henrik.forsstrom@nefco.fi http://www.nefco.org
Programmatic priorities of funding agency	1. Water and sewerage
	2. Cleaner technologies in industry
	3. Waste
	4. Renewable Energy & Energy Efficiency
	5. Consultancy & Environmental services
	Others: NEFCO targets all forms of environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutant.
Types of funds administered by agency:	1. NEFCO Investment Fund
	2. Nordic Environmental Development Fund (NMF)
	3. Environmental Hotspots in the Barents Region (BHSF)
	4. NEFCO Carbon Funds (TGF & NeCF)
	5. Arctic Council Project Support Instrument (PSI)
	6. Project Specific Funds
	Please note that information on each of these funds can readily be obtained through: *http://www.nefco.org/nefco/financing/*
	NEFCO's funding resources (derived from http://www.nefco.org/introduction/funding_resources):

	
Type of assistance (grant, loan, ….):	NEFCO offers loans, subordinated loans and soft credits to enterprises and municipalities, for projects which aim at reducing environmentally hazardous emissions and discharges, such as greenhouse gases and toxic pollutants, within NEFCO's area of operation (Russia, Ukraine and Belarus, and the Baltic countries). NEFCO administers several funds and facilities that in certain cases can provide grants or other funding (such as carbon financing for JI projects under the Kyoto Protocol) for development and implementation of projects of particular benefit to the environment. NEFCO works within a network of partners including other IFIs, international and national organisations (such as the Arctic Council, Barents Euro-Arctic Council and the NPA-Arctic), bilateral and multilateral donors (including the Nordic governments, the EU and the NDEP). NEFCO may also enter into partnerships with local enterprises which carry out environmental projects in countries where it operates. Each project financed by NEFCO must fulfil certain environmental criteria and the reductions in emissions and discharges must be quantifiable. Each project application is carefully analyzed by NEFCO's legal advisors, investment managers and environmental experts.
Objectives:	The basic mission of NEFCO is to promote cost-effective ways to reduce the environmental pollution emanating from regions adjacent to the Nordic countries.
Average amount of funding per approved project:	N/A - NEFCO works with small and medium-sized projects (sometimes through specialized facilities using intermediaries for smaller projects). NEFCO may provide up to 5 MEUR as an investment in a single project.
Information materials on fund:	Website www.nefco.org where information can be found and downloaded. Contact NEFCO's information department for paper copies and further information.
Contact person for Murmansk region:	Mr Amund Beitnes Investment Manager Telephone: +358 10 618 0658

	Mobile: +358 50 311 3684 (Russia +7 921 165 9885) Fax: + 358 9 630 976 E-mail: amund.beitnes@nefco.fi
Tips:	NEFCO works within the framework of the Arctic Council and the Barents Euro-Arctic Council (BEAC). The Energy Efficiency Centers in NW Russia have long experience of working with NEFCO.

5.7 Existing sources and conditions of IEP funding

Severomorskvodokanal does currently not have any contract with an international financing agency. Given the fact that the organization is operating at a financial loss, it is not able to handle competitive loan conditions. It therefore seems imperative for a financing agency to combine possible fund provision with an institutional development program, so that the organization will become a financially healthy organization in the investment period.

5.8 Evaluation of demand in additional foreign resources for IEP funding and preferable conditions of their employment

Budget of Severomorsk ZATO is subsidized one, the own budget receipts are 20%, the rest 80% are inter-budget transfers provided by both federal and regional budgets. Therefore participation of municipal authority of Severomorsk ZATO in co-financing these projects will entirely depend on the provided transfers.

In fact, without necessary funds in the budget of Severomorsk ZATO as well in the budget of the municipal enterprise “Severomorskvodokanal”, the project’s implementation is possible only under support of international foreign organizations concerned with protection of marine environment against anthropogenic pollution in the arctic region of the Russian Federation. Besides, this object is non-profit one, since the operation costs should be included to fresh water rates. The fresh water rates as well as sewage treatment rates are stated by decision of municipal authorities of Severomorsk ZATO.

6 CONCLUSIONS

6.1 Brief conclusions

In the City of Severomorsk of the Murmansk Region, industrial and social facilities discharge over 7.9 mln. m^3 of wastewater yearly through 5 sewage outlets without treatment into the Kola Bay. The wastewater contains over 3,000 tons of pollutants. This contradicts with current RF environmental legislation for water object protection and causes drastic deterioration of quality of life environment for marine organisms in the Kola Bay and negatively impacts Arctic seas.
Untreated sewage waters discharge from the area of Severomorsk impacts the shore strip of the city and, consequently, to the environment of Severomorsk region with 68,000 population.

As a result of this project's completion, polluted wastewater discharge into Kola Bay (which is a fishery water object) in amount of more than 7900 thousand m3 per year will be stopped.

The project is going to be implemented by MUP “Severomorskvodokanal”. MUP “Severomorskvodokanal” fulfills the main task on water supply and discharge of Severomorsk, settlements of Roslyakovo, Roslyakovo – 1, Safonovo, Safonovo-1, Kortik, Schuk Lake, Severomorsk-3

The enterprise consists of pump station service sites, water supply and sewage systems. There are 13 outlets for wastewater discharge, among which 11 discharge to the Kola Gulf, 1 outlet discharges into the Gryaznaya River through mechanical treatment plants, and 1 outlet discharges to the Srednyaya River. Designs of biological treatment plants for wastewater discharge into the Srednyaya River have been developed.

Annual water consumption is 21000 thousand m3, water discharge is 9400 thousand m3. The length of water supply and sewage pipelines has increased to 162 km of water pipelines and 73 km of sewage pipelines.

At present the municipal unitary enterprises “Severomorskvodokanal” is unprofitable one, whereof the consolidated budget of monetary funds flow for period of 2004-2004 is evidence.

As regards the positive *environmental consequences*, the project’s implementation will provide:

- reduction of pollutants in WWTP effluent
    1. suspended substances – in 16 times
    2. BOD full - in 25 times,
    3. oil products - in 8 times
    4. iron - in 8 times,
    5. nitrites - in 2 times,
    6. fats – in 3 times,
    7. phosphates - in 5 times;
- removal of anthropogenic pressure in the Kola Bay from industrial and social activities;
- improvement of the environmental situation in the shore area of the Kola Bay and living conditions of the people residing at the Bay shore;

- together with other environmental actions, increase the environment for the population and fisherie resources in the Kola Bay of the Barents Sea and other north seas.

As to the *social consequences*, the project will realize:

- elevation of the environmental safety level for the local population;
- employment for 50 extra employees at Severomorsk ZATO ;
- meet key stakeholders (population, public and private organizations) expectations about water treatment.

The main negative effects on environment are supposed to be during the construction of the WWTP facility. These effects can be considered as acceptable when using mitigation measures.

The conducted analysis has shown that the proposed project is financially not feasible under the current circumstances. This is mainly caused by the revenues being smaller than the Operation & Maintenance costs. A further tariff increase or a decrease in O&M costs is therefore necessary to have a financially feasible project. However, as the economic benefits are likely to be large, the economic feasibility should also be calculated in order to estimate the overall feasibility of the project. Hence, a grant financing percentage might be needed in addition to debt financing.

Special econimic benefits include:

- Cuts in expenditures of industrial enterprises and community services for water treatment and maintenance of water treatment facilities;
- Decrease of water organisms contamination by sewage waters of industrial objects and community services, in particular:
    - Improvement of the habitat of water life organisms;
    - Increase of the general health care level (as a result, cuts in expenditures for health care);
- Infrastructure development.

This IEP can be replicated within the region considering the fact that the sewage water treatment problem is one of the most critical for Murmansk Region.

6.2 Major risks and uncertainties in connection with IEP implementation

In studying of the project have been revealed the major risks as follow:

Technological risks
From the technological viewpoint, the project is a feasible one, provided the project will be implemented by experienced contractors.

However, since similar projects have not been realized at the Kola region yet, some problems concerning disposal of produced dry sediments can arise. There are no specialized disposal sites for such sediments in Kola, which meet all the environmental requirements for solid waste disposal sites. Methods for the further disposal or recycling of sediments should be determined based on the results of the chemical analysis.

Environmental risks

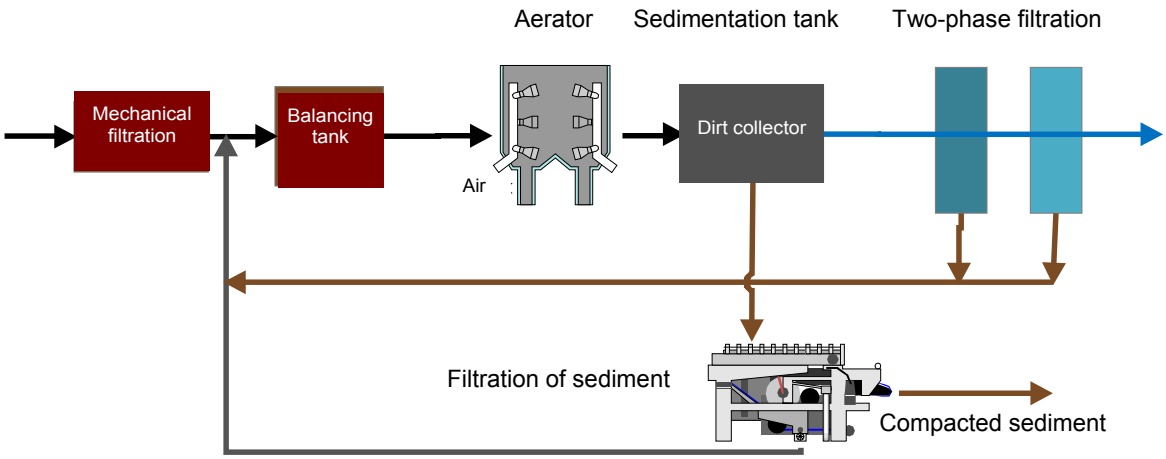
This project is aimed at the improvement of a current environmental situation. Provided that all the planned preventive measures will be realized, Impact level is considered to be as acceptable.

Social risks
The proposed investment project supposes the improvement of social environment by means of creation of additional work places as well improvement of living conditions of local population.

Financial risks
The major financial risk is insufficient financing, increase of costs for maintenance and operation, low numbers of consumers, impossibility to put up the tariffs. One of the measures to mitigate this risk can be involving of foreign financial organization in the project to win a grant and/or a credit.

Annex 1. Design WWTP allocation map

Annex 2. Proposed technological scheme of Waste Water Treatment Plant



Annex 3. Background impurity concentration in the atmosphere

Atmosphere stratification factor			A=160
Average maximum temperature of outer air of the hottest month of the year			+ 17,5 ^{o}C
Average maximum temperature of outer air of the coldest month of the year			- 10,4 ^{o}C
Average annual wind rose, %			
N - 17	E- 3	S - 42	W – 6
NE - 6	SE - 3	SW - 15	NW – 8
Wind speed, exceedance probability of which amounts 5%			9 m/sec
Air temperature data aggregated for the observation period from 1935 till 2007; wind direction and speed data aggregated for the observation period from 1985 till 2007.			

Background concentration (mg/m^3) for carbon oxide
(substance name)

Concentration	3	3	2	3	2
Wind speed, m/sec	0 - 2	3 - 9			
Wind direction	Calm	N	E	S	W

Background concentration (mg/m^3) for nitrogen dioxide
(substance name)

Concentration	0,07	0,06	0,05	0,07	0,06
Wind speed, m/sec	0 - 2	3 - 9			
Wind direction	Calm	N	E	S	W

Background concentration (mg/m^3) for suspended solids
(substance name)

Concentration	0,2	0,2	0,2	0,2	0,2
Wind speed, m/sec	0 - 2	3 - 9			
Wind direction	Calm	N	E	S	W

Background concentration (mg/m^3) for sulphur dioxide
(substance name)

Concentration	0,04	0,03	0,02	0,03	0,02
Wind speed, m/sec	0 - 2	3 - 9			
Wind direction	Calm	N	E	S	W

Annex 4. Results of background quality water control in the control point of Kola bay (in the radius of 250 m from dischargers)

No.	Measures	September 2009	April 2009	October 2008	June 2008	Average value
1	pH value	-	-	-	-	
2	BOD full	2,98	2,94	3	2,96	2,97
3	Suspended solids	2,00	1,75	1,5	1,5	1,6875
4	Solid residual	-	-	-	-	
5	Chlorides	-	-	-	-	
6	Phosphates (as per P)	1,37	1,4	1,36	1,42	1,3875
7	Ammonium-ion	0,60	0,57	0,51	0,54	0,555
8	Nitrate-ion	-	-	-	-	
9	Nitrite-ion	-	-	-	-	
10	Fe	0,13	0,11	0,12	0,13	0,1225
11	Fats	-	-	-	-	
12	ASAS	0,209	0,206	0,2	0,202	0,20425
13	Sulfates	-	-	-	-	
14	Petroleum derivatives	0,062	0,061	0,059	0,057	0,05975

No.	Measures	September 2009	April 2009	October 2008	June 2008	Average value
1	pH value	-	-	-	-	
2	BOD full	3	2,98	2,98	3	2,99
3	Suspended solids	1,5	1,25	1,25	1	1,25
4	Solid residual	-	-	-	-	
5	Chlorides	-	-	-	-	
6	Phosphates (as per P)	1,26	1,21	1,2	1,18	1,2125
7	Ammonium-ion	0,49	0,46	0,42	0,45	0,455
8	Nitrate-ion	-	-	-	-	
9	Nitrite-ion	-	-	-	-	
10	Fe	0,15	0,13	0,14	0,11	0,1325
11	Fats	-	-	-	-	
12	ASAS	0,201	0,202	0,206	0,199	0,202
13	Sulfates	-	-	-	-	
14	Petroleum derivatives	0,057	0,055	0,055	0,051	0,0545

Appendix 5. MUE Murmanskvodokanal project

Project Summary
(source – EBRD website http://www.ebrd.com/projects/psd/psd2009/40856.htm)

Project name:	Murmansk Water Improvement Program
Country:	Russia
Project number:	40856
Business sector:	Municipal and environmental infrastructure
Public/Private:	Public
Environmental category:	B
Board date:	1 September 2010
Status:	Passed concept review, Pending final review
Date PSD disclosed: **Date PSD updated:**	20 October 2009
Project description and objectives:	The EBRD is considering financing construction, rehabilitation, upgrade of water supply and wastewater infrastructure in the City of Murmansk within the Murmansk Oblast. The priority investments to be financed by EBRD will be defined by consultants in a feasibility study.
Transition impact:	Transition impact is expected to be achieved through: • Introduction of transition related performance indicators, to be identified during due diligence; • Skills and knowledge transfer during the Corporate Development Support Programme and training for the Project Implementation Unit; • Cost restructuring (demonstration effect), the project will assist the client in its effort to control its costs, including through reduction in operating and maintenance costs and a decline in water and energy losses; • Introduction of a service agreement to further commercialise the operations of the Company; • Tariff reform (improved methodology). The new tariff methodology will be adopted to ensure full cost recovery tariffs including investment costs and possibly a shift to multi-year tariff setting. • Providing an economic rate of return to ensure prudent use of public funds (municipal

	guarantee) • Corporatisation of the water utilities in order to improve the service provision and improving financial performance. Development and implementation of an Environmental and Social Action Plan (ESAP) which will significantly improve the Company's environmental management and overall performance.
The client:	"Murmanskvodokanal" MUE (the "Company"), a company providing water and wastewater services to both residential and industrial customers in the City of Murmansk and 7 neighbouring settlements and wholly owned by the Murmansk Oblast
EBRD finance:	Senior corporate loan to the Company of up to RUB 650 million (equivalent of around EUR 14.5 million), guaranteed by the Murmansk Oblast.
Total project cost:	Up to RUB 1 090 million