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Report to the EFTA Surveillance Authority regarding the implementation of Directive 91/271/EU on the treatment of wastewater from agglomerations.

Environment Agency of Iceland

March 2013

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Foreword

According to Article 16 of the Urban Waste Water Treatment Directive (UWWTD) Member States shall ensure that every two years the relevant authorities or bodies publish situation reports on the disposal of urban waste water and sludge in their areas. Equivalent provisions are in local Icelandic regulation on waste water collecting systems and waste water (No. 798/1999). These reports shall be transmitted to the Commission by the Member States as soon as they are published. This report is that report. As appropriate it can also be considered a report for information pursuant to paragraphs 2 and 3 of Art. 17 in the UWWTD on the national implementation programme for the directive.

1. The legalization of Directive 91/271/EEC (UWWD)

In 1992, the Icelandic Minister for the Environment established a committee whose remit was to assess the circumstances regarding sewerage and formulate a policy on the subject. The committee submitted its report at the end of November 1993 highlighting following six points:

1) Wastewater should be treated to meet the objectives of Directive 91/271/EEC on the treatment of sewage from agglomerations, the need for treatment being decided according to the quality norms of the receptor.
2) Local authorities should make long-term plans on projects regarding sewerage.
3) The Minister should implement the categorization of areas; cf. the Regulations on pollution control.
4) Environmental monitoring should be implemented under the auspices of local authorities.
5) General monitoring should be administered locally under the supervision of the Environmental and Food Agency of Iceland (now The Environment Agency of Iceland).
6) For the purpose of promoting this matter, the Minister should request that the state offers grants to local authorities for projects regarding effluents.

The EEC's provisions on sewerage were initially legalized in Iceland in 1994, resulting in an amendment to the Regulations on sewerage that same year. Current law contains provisions to the effect that the minister is to issue regulations with general provisions on sewerage systems and wastewater, providing, amongst other things, rules on the treatment of wastewater and guideline limits for sewerage systems and receptors. Since then, the regulation on waste water collecting systems and waste water (No. 798/1999) contains provisions on the treatment of wastewater consistent with UWWTD.

In 1995, the Althingi (the Icelandic Parliament) passed a law providing for support of projects regarding sewerage systems undertaken by local authorities. The purpose of this law (Act No. 53/1995 on support to the sewerage projects of municipalities) was to encourage local government to make progress regarding sewerage systems in their areas by offering them grants. The law provided that local authorities should take the initiative in making plans for sewerage systems as projects regarding such systems are the responsibility of local authorities. The Minister for the Environment established a committee on sewerage matters to advice him on matters of sewerage in local government areas. This committee dealt with applications for grants, implementation plans and cost estimates submitted by local authorities in connection with projects regarding matters of sewerage and assessed the feasibility of each project planned. On the basis of its assessment, the committee submitted its proposals to the minister on grants to each local authority for sewerage projects. Such grants were never to exceed 20% of the confirmed total actual cost of any feasible project.

The condition for financial support was that the project should be a part of a comprehensive solution for drainage affairs. All municipalities that were awarded grants for drainage projects had finished preparing comprehensive plans for the part of the municipality that the relevant projects cover.

The law gave support for projects which were carried out from 1995 to the end of the year 2008. Total financial support during this time was about 4.182 million ISK, at present value (calculated in December 2012).

The act on the development and operation of waste water collecting systems (No. 9/2009) was passed in 2009. The objectives of the act include defining the responsibilities of the municipalities and the rights and obligations of the owners and users of the collecting systems. The act lay's out and expands the obligations of the municipalities. Where needed the municipalities shall include provisions for collecting systems and waste water treatment in the local plan. In agglomerations the municipalities are responsible for both providing and operating collecting systems and treatment facilities for urban waste water within their boundaries. According to the law the minimum urban area for which a collection and a treatment system shall be provided is an area of 50 inhabitants where the distance between houses does usually not exceed 200 m. The municipalities are also responsible for establishing waste water collection systems and treatment for new development areas in rural areas where there are approximately 20 houses in an area 10 ha in size and/or businesses that discharge 50 p.e. or more from an area 10 ha in size. In rural areas the municipalities can own or operate the new systems if they choose. In exceptional circumstances, for instance because of excessive costs, the boards of public health can allow the use of other systems than collection systems and a collective treatment facility with regard for the abilities of the recipient to receive waste water and other environmental considerations. The law also states that in areas with summer cottages landowners or associations of the users of the cottages shall set up collection systems or make an agreement with the operators of a collection system to do so, having consulted the respective municipality.

The prevention of faecal pollution on the shores is addressed in the Icelandic regulation No. 798/1999 on waste water collecting systems and waste water.

2. Circumstances in Iceland and the availability of data

Iceland is an island in the middle of the North Atlantic Ocean and has a total area of 103,000 km^2. At the end of 2010 the total population of Iceland was 318,452. The majority of the inhabitants, approximately 90%, live by the coast and 88% live in agglomerations discharging more than 2,000 p.e. Iceland is one of the most sparsely populated countries in Europe, with about 3 inhabitants per square kilometre. Around 2/3 of the inhabitants live in the Capital city area in the Southwest, consisting of the Capital city Reykjavík (120,000) and neighbouring towns, Kópavogur (30,000), Hafnarfjörður (26,000), Garðabær (11,000), Mosfellsbær (8,000) and Seltjarnarnes (4,500). The coastal area around Iceland is considered a non-problem area regarding eutrophication as is explained in chapter 8.2.

This report is compiled by the Environment Agency of Iceland and the information is gathered from10 local hygiene and environmental control authorities. The data is fragmented and the agency has had to make some assumption regarding the state of waste water situation in some agglomerations. With the exception of the Capital area the information on the amount of industrial waste water entering the collecting system is often incomplete. In lack of information, the number of p.e. generated in some agglomerations is therefore assumed to have the same value as the number of inhabitants in the agglomeration. In some instances the agency has also had to calculate waste water from the fish processing industry based on figures for the quantity of processed fish in the fish processing facilities that are connected to the collecting systems for the urban waste water.

3. Agglomerations of more than 2,000 p.e.

Iceland has 29 agglomerations with more than 2,000 p.e., with inhabitants ranging from 218 to 201,000. The agglomerations are shown on a map in Figure 1 and their size-classes in Table 1. Only 12 of them have more than 2,000 inhabitants and 11 have fewer than 1,000 inhabitants. All of them have a system collecting the waste water. Most of the fish processing industry treat their industrial waste water separately and usually discharge through their own waste water outlet. The generated loads from some agglomerations are several times the number of inhabitants (Table 2). The main reason for that is the contribution of the fish processing industry in villages along the coast. The most extreme cases are Þórshöfn and Hólmavík having less than 400 residents but a load of almost 15,000 and 28,000 p.e. respectively.

Table 1. Size-classes of agglomerations in Iceland

Generated load	Number of agglomerations
2,000-10,000 p.e.	18
10,000-15,000 p.e	3
15,000-150,000 p.e.	7
>150,000 p.e.	1

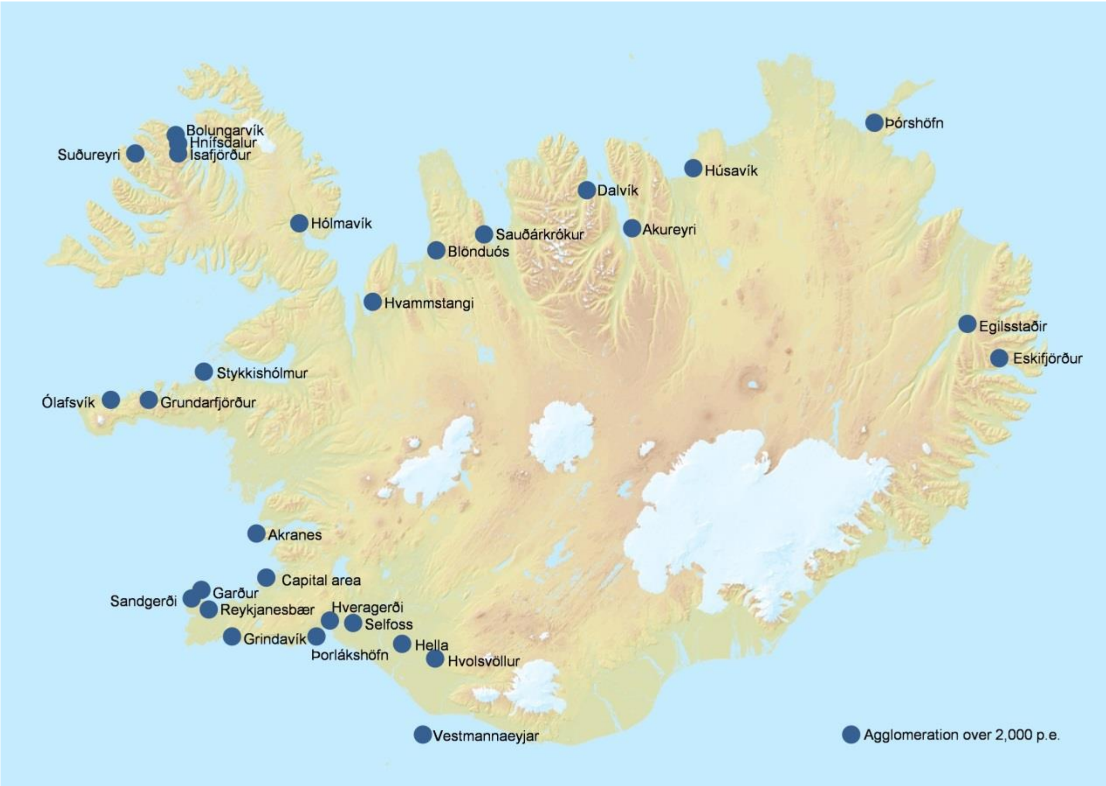

Figure 1: Agglomerations that generate more than 2,000 p.e. of waste water.

The total generated load from agglomerations with over 2,000 p.e. is approximately 807,000 p.e. for the year 2010, which is close to 95% of the total generated load in the country.

On the basis of available information all agglomeration are assumed to be in compliance with Article 3 in the UWWTD. The information is not complete but it is estimated that for most if not all of agglomerations, the collection system covers 90-100% of the area of the relevant agglomerations. More detailed information on how those agglomerations compy with article 3 in the UWWTD was planned to be included in this report. Regretfully sufficient information to do that is not available for 2010.

Table 2 Agglomerations with a discharge of more than 2,000 p.e.

Agglomerations	Number of inhabitants	Generated load, p.e.
Capital area	201,350	507,308
Akureyri	17,465	50,000
Hólmavík	379	27,880
Grindavík	2,827	24,946
Selfoss	6,503	16,000
Þórshöfn	387	15,655
Blönduós	836	15,636
Ísafjörður	2,699	15,090
Vestmannaeyjar	4,150	15,000
Reykjanesbær utan Hafna	13,801	13,972
Húsavík	2,248	12,184
Akranes	6,585	9,953
Garður	1,483	9,589
Dalvík	1,439	8,700
Eskifjörður	1,066	6,701
Grundarfjörður	835	6,485
Sauðárkrókur	2,646	6,089
Hnífsdalur	214	6,012
Sandgerði	1,691	5,797
Bolungarvík	960	5,284
Þorlákshöfn	1,557	5,000
Hveragerði	2,307	5,000
Hvammstangi	582	4,883
Stykkishólmur	1,108	2,668
Hella	783	2,500
Hvolsvöllur	849	2,500
Suðureyri	317	2,407
Ólafsvík	989	2,304
Egilsstaðir	2,289	2,289
Total	280,345	807,832

3.1 Discharge to freshwater and estuaries from agglomeration of more than 2,000 p.e.

Only six agglomerations discharge waste water into freshwater or estuaries. Compliance with article 4 in UWWD is shown in Table 3. Art. 4 lays down the general provisions for the treatment of waste water with secondary treatment or equivalent for discharge into areas that have not been identified as sensitive or less sensitive.

Table 3. Compliance with Art. 4 for collecting systems for agglomerations with more than 2,000 p.e. discharging into freshwater or estuaries.

	Number of residents	Total generated load (PE)	Compliant with Art. 4
Selfoss	6,503	16,000	0%
Blönduós	836	15,636	99%
Hveragerði	2,307	5,000	100%
Hvolsvöllur	849	2,500	100%
Hella	783	2,500	0%
Egilsstaðir	2,289	2,289	100%

The collecting systems for two agglomerations that discharge waste water to freshwater or estuarine are in full compliance with Art. 4, Hveragerði and Hvolsvöllur. Based on the number of p.e. discharged to freshwater, the overall compliance is 57%. Urban waste water from Selfoss is still untreated. Only 200 p.e. of the waste water in Blönduós is discharged to freshwater, all untreated. Waste water from the town Hella is also untreated. Most of the waste water from the town Egilsstaðir goes through secondary treatment and then partly UV treatment to reduce the amount of microorganisms (more stringent treatment). Other waste water from Egilsstaðir goes through a large septic tank without a leach field.

3.2 Discharges to coastal water from collective system for agglomerations of more than 10,000 p.e.

Agglomerations generate more than 10,000 p.e. with discharge to coastal waters and their status of compliance with Art. 6 in the UWWTD are given in Table 4.

Table 4. Agglomerations with discharge to coastal water and generated load of more than 10,000 p.e.

Agglomerations	Generated load	Compliant with Art. 6 (%)
Capital area	507,308	95.6
Akureyri	50,000	0
Hólmavík	27,880	0
Grindavík	24,946	0.1
Þórshöfn	15,655	0
Blönduós	15,636	98.7
Ísafjörður	15,090	3.4
Vestmannaeyjar	15,000	0
Reykjanesbær utan Hafna	13,972	41
Húsavík	12,184	0
Total	697,671	

Art. 6 lays down the provisions for the treatment of waste water from collecting systems in agglomerations that is discharged to less sensitive areas. Data for the Capital area are based on measurements but for other agglomerations on estimations. Discharges from the Capital area are close to being in full compliance with article 6. Off the other agglomerations, Blönduós scores high in compliance. However about 15,000 of the p.e. in Blönduós comes from a single industrial facility, a wool scouring facility.

4. Plans for sewerage and urban sites

Several plans for new or better treatment for waste water from agglomerations >2,000 p.e. are in place or are being developed. Work has either begun or is planned for new urban waste water treatment plants for a few agglomerations discharging over 2,000 p.e. These agglomerations are Akranes, Akureyri and Reykjanesbær that discharge into coastal water and Hella that discharges into a river. The receiving area for the first three have been categorised as less sensitive and therefore the waste water will be treated with primary treatment. In Hella a secondary treatment is planned.

5. Development in drainage affairs

Figure 2 shows the development of waste water treatment in Iceland since 1990. It is based on data for the whole population, also in rural areas and those urban areas that generate less than 2,000 p.e. For the generation of the data for 2010 some assumptions had to be made for rural areas and urban areas with under 500 p.e. Based on available data, which is incomplete, it was assumed that all households in rural areas had septic tanks, which is probably an overestimation to some degree, and that 56% of urban areas with 50-500 p.e. had some kind of treatment. Where data was lacking for agglomerations >2,000 p.e. (1%) no treatment was assumed to be in place.

The distinct progress in the treatment of drainage water that began in 1998 can clearly be seen in the figure.

At the end of 2010, about 73% of the population had sewage treatment. This principally involves projects in the capital area but also for instance in Reykjanesbær utan Hafna, Blönduós, Egilsstaðir, Hvolsvöllur and Hveragerði.

The percentage increase in the number of people having waste water treatment from 2008 to 2010 is mostly because of an increase in residents connected to a treatment plant in the town of Hafnarfjörður which is a part of the Capital area: That change alone caused about 2,5% increase since 2008. Also new treatment has been started in Egilsstaðir as well as in some smaller urban areas (<500 p.e.).

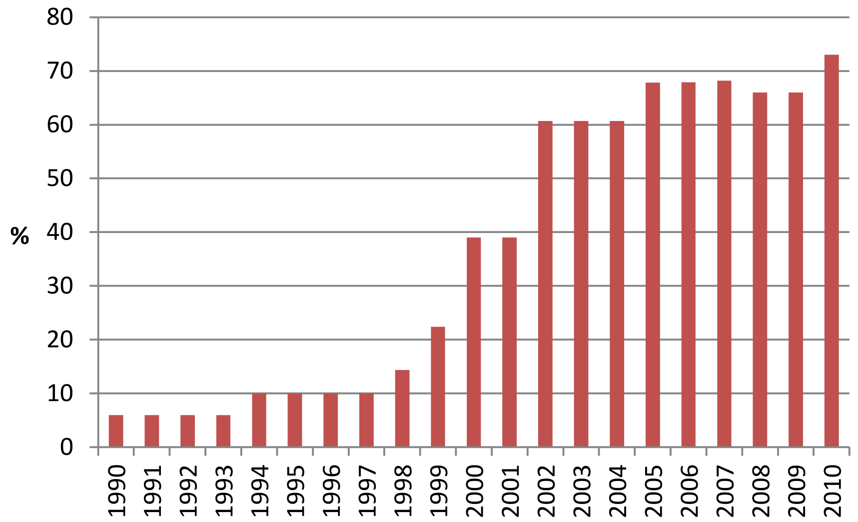

Figure 2. The percentage of Iceland's population (%) with waste water treatment.

In fig 3, an overview of the waste water treatment in Iceland is given. The most of the population, approximately 90%, live by the coast, a non-problem area in regard to eutrophication. Around 70% of the population is living in the southwest part of the country. Only about 5% of the population is living in rural areas and less than 1,000 people live above 200 m altitude. This explains a relatively high percentage of the use primary treatment and septic tanks.

In addition to the number of septic tanks for households used for Figure 2 and 3, there are septic tanks with drainage fields for the majority of the 12,000 summer cottages in rural areas in the country.

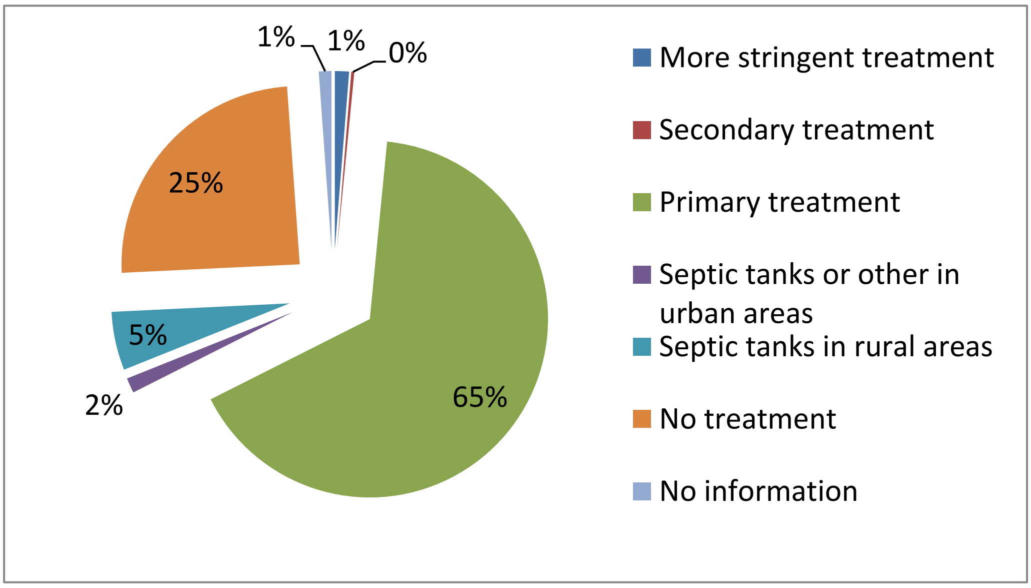

Figure 3. Waste water treatment shown as percentage of the population with secondary treatment, primary treatment and septic tanks with infiltration systems both in rural and urban areas.

The different treatment methods for the main regions are shown in Figure 4. In some of the most sparsely populated areas the percentage of treated waste water is low. The Capital area stands out with almost all of its waste water treated.

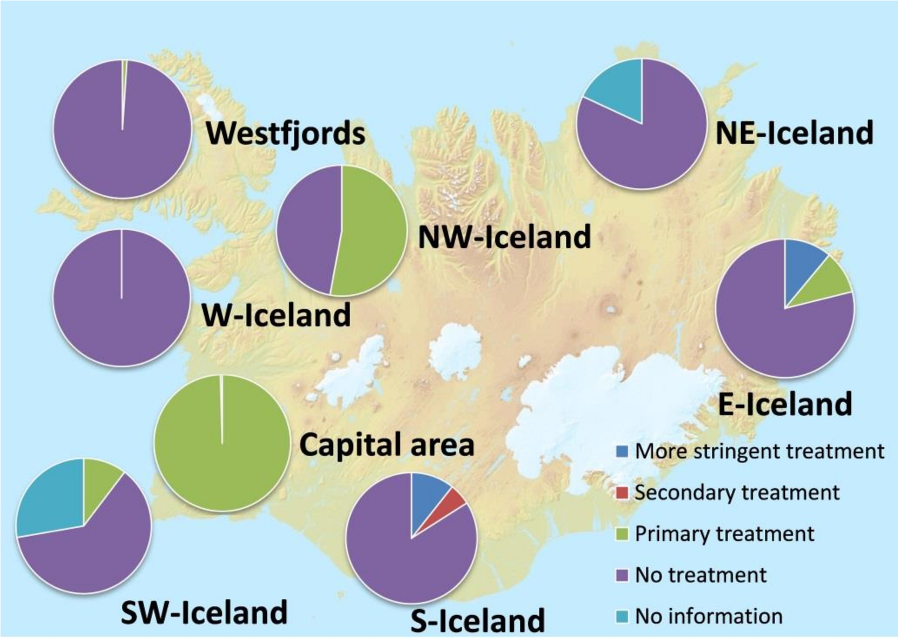

Figure 4. Waste water treatment methods in different regions in Iceland. Based on data on p.e. for agglomerations that generate >500 p.e.

6. Sewerage affairs in rural areas

Reports from the local hygiene and environmental control authorities indicate that actions to deal with drainage affairs in rural areas have widely been implemented. Drainage systems in provincial areas principally receive waste water from individual houses and small urban areas. It is assumed that septic tank systems are nearly exclusively used in these areas along with sub-surface drainage fields (soak away pipes). There are about 4,500 farms and 12,000 summer cottages in Iceland and therefore it can be roughly estimated that the number of rural septic tank systems are close to 16,000. In many of the main tourist locations, e.g. in the highland, either a septic tank system with soak away pipe is in place or can be installed. Where this is not applicable, for instance because of climatic conditions, a composting (biological) toilet may be used or other comparable solutions.

Problems with salmonella contagion of animals have occurred at least in two sites in agricultural districts in Iceland in the last two decades, where insufficient sewage treatment was a suspected cause for the perpetuation of the contagion cycles.

Most municipalities have taken measures and conducted an action plan in order to facilitate improvements in sewage affaires in provincial areas, and the situation there is described as acceptable or good. In other municipalities the situation is not known.

7. Definition of receptors

7.1 Identification of sensitive areas

The criteria for sensitive areas are as follows:

a. Natural freshwater lakes, other fresh water bodies, estuaries and coastal waters which are found to be eutrophic or which in the near future may become eutrophic if protective action is not taken.
b. Surface freshwaters intended for the abstraction of drinking water which could contain more than the concentration of nitrate laid down under the relevant provisions of the Drinking Water Abstraction Directive (75/440/EEC) concerning the quality required of surface water intended for the abstraction of drinking water in the Member states if action is not taken.
c. Areas where further treatment than that prescribed in Article 4 of Directive 91/271/EEC is necessary to fulfil Council Directives.

The oligotrophic Lake Thingvallavatn has been designated as a sensitive area for nitrates and faeces in regulation no. 650/2006 on the implementation of the protection of Lake Thingvallavatn and its basin with a later amendment, no. 449/2009. The regulation has basis in Act no. 85/2005 on the protection of Lake Thingvallavatn and its water basin with later amendments. There are no urban areas in the watershed of the lake, just a few tourist facilities, one of them a hotel, a few farms and about 6-700 summer cottages. Also the determination of the sensitivity does not have a basis in the Icelandic regulation on waste water collecting system and waste water. In addition a geothermal power plant discharges warm geothermal water to the lake.

The provisions for waste water treatment within the protected area are stricter than normally, for instance more stringent treatment than secondary should be used, urban or industrial areas cannot be planned and intensive agriculture or polluting industry is not allowed. In the legislation a transitional period is given before all provisions have to be met. However some provisions on structures are not retrospective.

No areas in Iceland have been identified as sensitive in accordance to the UWWTD or the provisions of the Icelandic regulation on waste water collecting systems and waste water.

7.2 Less sensitive areas

Less sensitive recipients or areas are defined in Section B in Annex II of the Council Directive of 21 May 1991 concerning urban waste water treatment (91/271/EEC):

A marine water body or area can be identified as a less sensitive area if the discharge of waste water does not adversely affect the environment as a result of morphology, hydrology or specific hydraulic conditions which exists in the area.

When identifying less sensitive areas, Member states shall take into account the risk that the discharged load may be transferred to adjacent areas where it can cause detrimental environmental effects.

The elements taken into consideration when identifying less sensitive areas are open bays, estuaries and other coastal waters with a good water exchange and not subject to eutrophication or oxygen depletion or which are considered unlikely to become eutrophic or to develop oxygen depletion due to discharge of urban waste water.

Iceland covers an area of about 103,000 square kilometres and has a coastline of 4,970 km. Iceland is situated at a point where warm and cold ocean currents converge, the reason being its geographical position and the submarine ridges forming a natural barrier against the main ocean currents around the country. To the South, these currents are warm. The Irminger current has a temperature of 6-8°C and a flow of 2,000,000 m^3/sec. To the North the East Greenland current has a temperature of 0°C and a flow of 1,000,000-2,000,000 million m^3/sec., and the East Icelandic current a temperature of 0-2°C and unknown flow. At the continental shelf, there is a coastal current flowing clockwise around the country, which is created by the mixing of the ocean currents with fresh water from the land at a rate of about 1.000.000 m^3/sec. The average speed of all these currents is about 10 cm/sec., or about five nautical miles every 24 hours. However, this varies from place to place and from time to time. Water transport and nutrient status in Icelandic waters are discussed in detail in an overview report on nutrient status in Icelandic waters (Ólafsdóttir, Sólveig R. 2006).

The Capital area

The discharge of drainage water from the capital area (Reykjavik, Seltjarnarnes, Kópavogur, Garðabær, Mosfellsbær and Hafnarfjörður) is into SE Faxaflói Bay, which is about 90 kilometres wide and 50 kilometres long. Around 70% of the Icelandic population are living within the Faxaflói Bay area and most of the larger industries are within that area, located mostly at the coast. Treatment plants for the Capital area are at Ánanaust and Klettagarðar where the treated sewage is pumped out into the ocean through 4.1 km and 5.5 km long outlets respectively. Diffusers are situated on the last 0,5 km on the Ánanaust outlet and the last km of the Klettagarðar outlet. At the points of discharge depth is about 30-35 m and there is both good primary and secondary mixing. The treatment used is based on sieves with 3 mm openings, which is comparable to primary treatment.

Intensive research has been carried out in Faxaflói Bay around Reykjavik due to the categorization of the area as a less-sensitive area, cf. Art. 6 of the UWWTD Directive. The Reykjavik Director of Road Construction and Maintenance issued a report on various instances of research, summarizing the main conclusions, and listing 30 research reports which form the basis for the assessment of the area as a less-sensitive one (The Reykjavik Director of Road Construction and Maintenance, September 1997). The report was updated in summary to the Environmental and Food Agency in

2001. Mathematical models for ocean currents and the distribution of pollutants have been calibrated through comprehensive measurements covering a 30-year period. The eastward flow in Faxaflói Bay amounts to 5 cm/sec., and in addition, there are tidal flows and the effects of the weather; the difference between high and low tide varies from 1.7 to 3.8 metres. Calculated currents and flow models concur well with measurements, enabling the use of model calculations when surveying the distribution of pollutants. Thus, the flow at the point of discharge varies from 10 to 30 cm/sec., chiefly toward points east and west. Thus, there is considerable dispersion at the point of discharge at a depth of 18-30 metres. It could be expected that the concentration of pollutants will have reached the baseline level and is thus not discernible outside 50 metres from the point of discharge. Furthermore, the conclusions of sediment research indicate that the odds that no accumulation takes place around the outlets are overwhelming, and that the effluents are carried away during a period counted in hours rather than days. The Environmental and Food Agency of Iceland accepted the categorization of the area as less sensitive with a letter, dated 1 October 1997, and reaffirmed the classification on 11 December 2001, when the Klettagarðar treatment plant began operation.

A detailed summary report was published in 2006 (Guðjón Atli Auðunsson, 2006): "Summary and evaluation of environmental impact studies on the recipient of sewage from the STP at Ánanaust, Reykjavík". The report focuses on the recipient of sewage from the sewage treatment plant at Ánanaust, although results from the Klettagarðar site are also presented. The main conclusions are summarized as follows:

"The recipient is freely open to ocean water and is characterised as a high energy area due to strong tidal currents and wave motion. The exchange rates are therefore fast and result in a dilution factor of about 1,000 on average above the diffuser. The bottom of the recipient area reflects a high energy where sand and gravel dominate. The bottom sediment is moved several times each year, especially during the winter time. This study shows that the discharge of nutrients (nitrogen and phosphorus) will not cause increased rate of algal growth in the recipient with resulting adverse effects. This is shown by empirical and semi-empirical models of worst case scenarios. This indicates that the currently applied treatment of sewage up to the planned maximum rate of sewage discharge equivalent to 150,000 person equivalents is more than sufficient to fulfil international criteria."

"Studies and modelling of currents and wave motion indicate that the settling of sewage particles onto the sediments is highly improbable. This settling of particles is a prerequisite for any detrimental effects on the benthic community of organisms and sediment chemistry. Therefore, reduced oxygen above the sediments due to sewage particles alone will not occur."

"A survey of the benthic communities at the disposal site did not indicate any effects caused by the present discharge. Therefore, further treatment of sewage than applied at present will not result in any environmental improvement up to the planned maximum rate of sewage discharge equivalent to 150,000 person equivalents. Studies of the accumulation of trace elements, organ halogen compounds, and polyaromatic hydrocarbons in blue mussels show that the present discharge of sewage renders the recipient to fit the highest environmental quality criteria in Norway and well below maximum limits stipulated for seafood. Of all the chemicals studied, only silver seems to be affected by past discharge of sewage, a situation that has also been observed internationally. The present disposal of sewage has improved the situation markedly as compared with past disposal through provisional outlets. More stringent treatment of sewage or secondary treatment is not expected to reduce these concentrations of silver."

Other areas

Research carried out at other locations around the country does not indicate that the circumstances there are much different from those in Faxaflói Bay. Fjords around Iceland are broad and open to ocean waters. Only two fjords have bottom threshold at the mouth and the thresholds are at deep water. Therefore the water exchange is rather effective in the Icelandic fjords. Water exchange rate has been estimated for two large fjords, Eyjafjörður in North Iceland and Reyðarfjörður in East Iceland. The residence time (based on summer current measurements) in Eyjafjörður was estimated as 9-10 days and 4-5 weeks in Reyðarfjörður (c.f. Ólafsdóttir, Sólveig R. 2006).

Measurements at Ísafjörður and Sauðárkrókur indicate that increased concentration of materials from waste water can only be detected very close to the sewage outlets, and that the effects on the living environment are negligible and greatly localized where they have been discerned. The merging of outlets for wastewater, the utilization of primary treatment and the directing of sewage outlets to places with advantageous conditions for dilution will minimize or even eliminate adverse effects on the ecology and hygienic condition of the recipient. Also, the removal of the points of discharge from industrial areas and areas intended for outdoor recreation will promote the reduction of bacterial pollution of the shoreline in the vicinity of urban areas and thus increase clean and hygienic conditions on beaches as places for outdoor recreation.

The aforementioned research projects give general background information that is used in the categorization of estuaries, beaches and ocean. The Environment Agency concludes, on this basis and general data on geographical circumstances in the vicinity of sparsely-populated areas, that country's entire coastline is in general a less-sensitive area. The necessary supervisory research for agglomerations of 10,000 p.e. or larger, cf. Art. 6 of UWWTD Directive will subsequently have to confirm or deny these categorizations, which have been approved by the agency. There is the possibility that Iceland's entire coastline could be categorized as a less-sensitive area in the light of the conditions set in UWWTD Directive on the treatment of urban wastewater and the conditions set in Annex II for the definition of less sensitive areas. Since 2008 the Environment Agency has approved one new area to be categorized less sensitive for discharges over 10,000 p.e. This area is the proposed discharge locations for Ísafjörður.

The Screening procedure since 1999 of the OSPAR Commission Common procedure for the identification of the eutrophication status of the maritime area clearly showed that the run-off from Iceland does not add to the nutritional load in the maritime area around Iceland. Based on those results it was concluded that the coastal area around Iceland is a non-problem area regarding eutrophication and will be monitored according to that. This has been further confirmed in the OSPAR Commission Quality Status Report 2000 for the Region I, Arctic Waters and again in the same report from year 2010. Nutrients are natural constituents of sea water play an important role since they form a basis for primary production in phytoplankton. Anthropogenic influences resulting in elevated nutrient concentrations can result in eutrophication and oxygen depletion. Such problems have not been observed in Region I, and nutrients are therefore not considered a pollution problem in that region. Typical winter values for nitrate, phosphate and silicate in the open ocean areas of Region I are 11 – 12 µmol/l, 0.8 – 0.9 µmol/l and 5 – 5.5 µmol/l respectively. During phytoplankton blooms the levels in the upper water column show a natural decrease and can approach zero.

8. Discharge monitoring in waste water treatment plants and recipients

The information on monitoring is not complete and will be better reported in the future with more detailed information at hand. For the Capital area monitoring of the waste water discharge and the recipients began in 1998 and is now done yearly.

In February 2000 an investigation conducted for the sewage discharge areas off Ánanaust indicated that the dispersal of sewage in the area is effective. The maximum sewage at the surface of the sea was 0.164%, which corresponds to a 600-fold dilution. The maximum total concentration of phosphorous was 1.38 µmol/l, of nitrogen 24.9 µmol/l and the maximum concentration of ammonia was only 2.1 µmol/L. In February-March (1991) the background nutrient concentration in the Atlantic water off the south and west coast was 0.95 µmol/l Phosphate and 13.9 µmol/l Nitrate (Stefánsson, Unnsteinn and Jón Ólafsson 1991). The conclusion is that the effect of the current discharge of nutrients from Reykjavik is limited to a relatively small area nearest the point of discharge off the coast, and the effect is insignificant or none in Faxaflói Bay. (See also Ólafsdóttir, Sólveig R. 2006).

Research on the treatment of sewage indicates that the efficiency of the treatment was about 20% of organic substances (as COD_{Cr}) and about 15% of particulate matter. The monitoring of the discharge in the two main treatment plants for the Capital area in 2010 showed that the release of the main pollution substances was 22 tonnes/day for TSS, 70 tonnes/day for COD, 0.5 tonnes/day for t-P and 2.8 tonnes/day for t-N.

Systematic measurements on the discharge are not done elsewhere since improvements in drainage affairs, in most places, at the planning or implementation stage. However, other measurements are in many cases carried out, e.g., measurements in the Western Fjords (NV-Iceland), are for the purpose of investigating the status of matters before construction begins (Helgason, Anton et. al 2002).

The concerns of people are mostly about the effect of faecal pollution from urban areas. Icelandic standards have been set for faecal coliforms and faecal streptococci in recipients. Solutions in waste water treatment and discharge therefore also aim at reducing faecal pollution on beaches by position outlets deep enough and far enough from the shore that good mixing and dispersion of sewage in the sea water is ensured.

The discharge from the two main treatment plants for the Capital area is monitored every year. In 2010 waste water from 232,851 p.e. was discharged from the Ánanaust plant and 234,851 p.e. from Klettagarðar plant. That year measurements were done 4 times in 2010 for TSS, COD, fat, t-P and t-P and twice for trace elements (metals). The mean concentrations in treated waste water from the Ánanaust plant are 123.9 mg/l for TSS, 383 mg/l for COD, 3.2 mg/l for t-P and 17.7 mg/l for t-N. For Klettagarðar waste water treatment plant the concentrations are 112.3 mg/l for TSS, 387 mg/ for COD, 2.3 mg/l for t-P and 13.6 mg/ for t-N. Every fourth year the Reykjavík Public Health authorities monitor the effect of the sewage overfalls in Reykjavík on their recipient.

Monitoring of the faecal bacteria by the coast in the Capital area is also carried out on a yearly basis (cf. Ólafsdóttir, Kristín Lóa and Svava S. Steinarsdóttir 2010, Davíðsson, Árni and Þorsteinnn Narfason 2011a, 2011b). The results show that over the last years the situation has improved and in 2010 93.5% of the samples contain faecal coliforms lower than 100 in 100 ml (Ólafsdóttir, Kristín Lóa and Svava S. Steinarsdóttir 2010). Similar monitoring is carried out to some degree for many other agglomerations.

Regarding other monitoring measurements, reference is made to a report of the Committee of the Ministry for the Environment on Monitoring (AMSUM), which gives an account of the measurement of pollutants and nutrients in the environment.

9. Treatment of sludge

The amount of sludge produced from waste water treatment in those urban areas that produce most of the recorded sludge is shown in Table 5 for the time period 2002-2010. In Table 6 an overview of the handling of the sludge in 2010 is given, based on information from the local hygiene environmental control authorities. For comparison the generated load within the respective agglomerations or regions is also given in Table 6. The data on sludge also includes sludge from septic tanks, in some instances even from adjacent rural areas. Most of the sludge is disposed at approved waste landfill sites.

The information on the amount of sludge and sludge treatment and handling is not complete and will be better reported in the future when more detailed information is available. Information now is only available for the sludge generated from approximately 62% of the total number of p.e. generated in the country

Table 5. Sludge (tonnes/year) from sewerage and waste water treatment.

	2002	2003	2004	2005	2006	2008	2010
Blönduós	50	66	40	40	ND	ND	ND
Egilstaðir	ND	ND	ND	ND	ND	151	290
Hveragerði	ND	123	120	120	140	189	ND
Reykjanesbær	ND	12	14	26	17	ND	12
Capital area	1,034	1,108	1,200	1,600	1,300	1,255	1,254
Total tonnes:	1,084	1,309	1,374	1,786	1,457	1,595	1,556

Sludge from septic tanks in urban areas, e.g., Mosfellsbær and Egilsstaðir, is usually landfilled at approved sites. Sludge from the septic tanks of individual buildings is to be landfilled at approved sites, but is also used for revegetation and has occasionally been discharged into drainage systems of urban sites.

Table 6. Amount of sludge and sludge handling 2010.

Region	Agglomerations	Population Equivalents (p.e.)	Wet weight of sludge [tonnes/year]	Handling
Austurland	Egilsstaðir	2,289	290	Recycled
Suðurland	Suðurland	46,900	ND	ND
Reykjanes	Reykjanesbær	13,972	12	Landfilled
Reykjanes	Grindavík	24,946	ND	ND
Reykjanes	Sandgerði	5,797	ND	ND
Reykjanes	Garður	9,589	ND	ND
Reykjanes	Vogar	1,206	ND	ND
Capital area		507,308	1,254	Mostly landfilled[1]
Vesturland		23,360	ND	ND
Vestfirðir	Bolungarvík	5,284	ND	ND
Vestfirðir	Ísafjörður	15,090	ND	ND
Vestfirðir	Patreksfjörður	648	ND	Recycled
Norðurland vestra		29,177	ND	ND
Norðurland eystra	Akureyri	50,000	<5	Recycled
Norðurland eystra	Dalvík	8,700	ND	Recycled
Norðurland eystra	Húsavík	12,184	ND	Partly recycled, partly discharged to sea

[1] Methane is extracted from the landfill.

Sludge from sewage treatment plants and septic tank is not used for agriculture in Iceland. Untreated sludge may be used for revegetation and afforestation after visible objects have been removed if the sludge is ploughed into the soil far from routes used by the general public. In some locations, receptions for sludge have been set up where the sludge is stabilized, either with hydrate lime or by anaerobic pit/pond digestion, for later use as fertilizer/soil conditioner.

10. Emptying of septic tanks

In many municipalities, regular, organized, obligatory emptying of septic tanks has been established, e.g. in Mosfellsbær, where septic tanks are emptied every other year according to a certain plan. The sludge from Mosfellsbær, which is part of the Capital area, is disposed of at an authorized landfill (Álfsnes landfill).

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