Nord Stream
The new gas supply route for Europe

Nord Stream Project

Rev.	Date	Description	Prepared	Checked	Approved	Checked	Approved
A	2014-04-14	Issue for use	JRV	MIBR	HRH	MRA	SAN
			Ramboll			Nord Stream AG	

RAMBØLL

Document Title

Environmental monitoring in Swedish waters, 2013

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PO. No.	:	PO13-1150
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Document Owner	:	Ramboll

Document-No.

G-PE-PER-MON-100-04100013

Rev.

A

Pipe line	Sub project	Discipline	Doc. Type	Originator ID	Unifier	

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Abbreviations and definitions

ADCP	Acoustic Doppler Current Profiler
AIS	Automatic Identification System
bcm	billion cubic metres
CTDO	Conductivity, Temperature, Depth and Oxygen recorder
DNV	Det Norske Veritas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
ES	Environmental Study
ESMS	Environmental and Social Management System
EU	European Union
FSSL	Fugro Subsea Services Ltd.
HELCOM	Helsinki Commission
HB	Hoburgs Bank (Natura 2000 area in the Swedish EEZ)
KP	Kilometre Point (starting with KP 0 at the Russian landfall)
MBES	Multi-Beam Echo-Sounder
MMT	Marin Mätteknik AB
NAVTEX	Navigational Telex
NM	Norra Midsjöbanken (Natura 2000 area in the Swedish EEZ)
PAM	Passive Acoustic Monitor
ROV	Remotely Operated Vehicle
SGU	Geological Survey of Sweden
SMHI	the Swedish Meteorological and Hydrological Institute
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
SwAM	Swedish Agency for Marine and Water Management
TW	Territorial Waters

1 Summary

A Swedish translation of this summary is attached as Appendix A.

1.1 Introduction

Nord Stream is an offshore natural gas pipeline from Russia to Germany. The Nord Stream Pipeline connects the large natural gas resources of Russia with the European natural gas pipeline network. At full capacity, it can provide 55 billion cubic metres (bcm) of natural gas per year to European consumers.

The length of the entire two-pipeline system (the Nord Stream Pipeline) is approximately 1,224 km. The pipeline crosses the exclusive economic zones (EEZs) of Russia, Finland, Sweden, Denmark and Germany and the territorial waters (TW) of Russia, Denmark and Germany. The construction of the first pipeline commenced in April 2010 and was completed in June 2011. Transportation of gas began in November 2011. Construction of the second pipeline, which runs parallel to the first, began in May 2011 and was completed in April 2012. Gas transport through the second pipeline began in October 2012. The Nord Stream Pipeline is designed to operate for at least 50 years.

As part of the permit requirements for construction of the pipelines, an environmental monitoring programme covering activities from 2010-2014 within the Swedish EEZ was elaborated by Nord Stream AG in collaboration with the Swedish authorities. The agreed monitoring programme is described in /1/.

The monitoring programme for Sweden covers environmental monitoring and monitoring of the socio-economic parameters listed below.

Environmental monitoring:

- Monitoring of munitions clearance /2/
- Monitoring of fish along the pipeline (reef effect) /3/
- Monitoring of fish inside Natura 2000 areas /3/
- Monitoring of benthic fauna /4/
- Monitoring of water quality /5/
- Monitoring of hydrographical conditions in the Bornholm Basin /6/
- Monitoring of ecotoxicological effects on mussels /5/.

Socio-economic monitoring:

- Monitoring of fishery /3/
- Monitoring/mitigation measures at national and international monitoring stations
- Monitoring of cultural heritage
- Monitoring of maritime traffic.

This document is the fourth of five planned annual reports, the purpose of which is to document the status of the environment prior to construction and the potential effects during the construction and operational phases. This will enable the evaluation of the potential project impacts in relation to and in compliance with the Swedish Permit /7/ and Environmental Study (ES) /8/. The previous reports cover monitoring carried out in 2010 /9/, 2011 /10/ and 2012 /11/. Topics monitored in 2013 included monitoring of fish along the pipeline, monitoring of benthic fauna, monitoring/mitigation measures at national and international monitoring stations, monitoring of cultural heritage and monitoring of maritime traffic. Detailed descriptions of monitoring activities and results for benthic fauna and fish monitoring are also presented in separate reports /22/ and /29/.

Some of the monitoring activities were finalised before 2013. The main results of the monitoring that took place before 2013 have however also been included in this summary in order to provide a complete overview of the monitoring results.

1.2 Construction activities in 2013

No construction activities took place in 2013.

A short description of all construction activities carried out for the Nord Stream Project in the Swedish EEZ (2010-2012) is provided in Chapter 3 of this report to give an overview of the environmental aspects related to the construction period. Such an overview is useful when assessing the environmental monitoring results in order to establish whether the construction activities have caused a measurable environmental impact. In addition, the monitoring programme aims at establishing the potential impact caused by the presence of the pipelines, i.e., impacts during the operational phase.

1.3 Monitoring of munitions clearance

Prior to construction clearance of seven munitions objects was deemed necessary along the Nord Stream Pipeline route in the Swedish EEZ. These objects were successfully cleared during the period 19 March to 3 April 2010 /9/, /12/.

Monitoring and mitigation measures were carried out for every clearing operation. No marine mammals were observed or registered on the passive acoustic monitor (PAM) system either before or after clearance of the seven munitions objects. Seal scrammers were activated prior to the mine clearance operation to further ensure that no marine mammals were injured or killed as a result of the activity.

The blast wave measurements for six of the seven clearance operations indicated that marine mammals could experience direct physical injury to gas-containing structures and auditory organs had they been within approximately 300 m of the blast site. However, the fact that marine mammal observers surveyed the blast site before and after the detonation and that no registrations of marine mammals were made by the PAM system it can be safely assumed that no marine mammals were injured or killed as a result of the clearance operation in the Swedish EEZ. Furthermore, it is safe to state that no sea birds were injured or killed as a result of the mine clearance campaign.

Acoustic fish surveys were made prior to the detonation of the explosive jig. There were no registrations of shoals of fish at the target location, and therefore none of the clearance operations were delayed by the presence of large shoals of fish. Unavoidably, the disposal procedure did result in the mortality of some fish. Dead fish were recovered following five of the seven blasts, amounting to approximately 10 to 18 specimens per blast.

The detonations created a small crater at each munitions site.

Finally, no chance finds of cultural heritage objects or cables were made during visual inspections by remotely operated vehicle (ROV) within 1 km of any of the detonation sites. Therefore, there were no unexpected adverse impacts due to munitions clearance activities.

1.4 Monitoring of fish along the pipeline

Monitoring of fish along the pipeline was undertaken in September 2013. The monitoring of fish at and close to the pipelines focused on demersal fish species, as no effects from the presence of the pipelines on the seabed are expected to occur for pelagic fish species. To acquire detailed information on species composition and to estimate quantitative changes due to a potential so-called “reef effect”, information was gathered through survey trawling and gill net fishery. In addition, echo-sounder surveys were carried out.

Fish monitoring at three monitoring areas relatively close to Hoburgs Bank and Norra Midsjöbanken began in 2010 with the collection of baseline data prior to the start of any construction works.

Fish composition during the 2013 survey was similar compared to the 2010 survey and strongly dominated by cod (*Gadus morhua*) and herring (*Clupea harengus*). Cod is a demersal fish species and common in the area. Herring, on the contrary, is a pelagic fish species and assumed to be less attracted to artificial structures on the seabed. The focus in the presentation of the results has been on cod because the remaining demersal fish species found during the fish survey, e.g., flounder (*Platichthys flesus*), plaice (*Pleuronectes platessa*) and shorthorn sculpin (*Myoxocephalus scorpius*), were found only in low numbers.

It is difficult to draw any long-term conclusions regarding impacts from the pipeline on the fish community. The results thus far should be regarded as short-term ecological effects on the demersal fish community in the Baltic Sea. Nevertheless, it can be stated that the abundance of fish along the pipeline has not decreased in the two years since the start of operation of the pipeline nor have there been any effects on the composition of demersal fish that can be attributed to the presence of the pipeline.

1.5 Monitoring of fish inside Natura 2000 areas

Monitoring of fish inside the two Natura 2000 areas Hoburgs Bank and Norra Midsjöbanken took place from 2010 to 2012 /11/. The overall objective of the programme was to enable the assessment of potential impacts on fish fauna inside the two Natura 2000 areas due to the construction work.
The monitoring programme included 40 stations at Hoburgs Bank and 40 stations at Norra Midsjöbanken, comprising 20 impact stations and 20 reference stations at each bank. The monitoring comprised gill net fishery with K072 gill nets; conductivity, temperature, depth and

oxygen (CTDO) and Secchi disk measurements; and habitat description by underwater video recordings of the seabed.

As described in /3/, effects on fish could be caused by increased turbidity during pipe-laying and trenching of the pipeline. Monitoring of water quality in 2010-2012 before, during and after pipe-laying and trenching showed that the assumptions regarding sediment spill and sediment dispersion for the ES were conservative (i.e. on the safe side). The modelling of sediment spreading carried out as part of the ES prior to construction showed that spilled sediments would not reach the border of the two Natura 2000 areas, and this was confirmed by monitoring of water quality for Line 1 /13/.

Monitoring of fish fauna inside the two Natura 2000 areas in the three monitoring campaigns showed natural variation in results. In addition, some differences in fish populations in the reference and impact areas were observed during the yearly monitoring campaigns. However, none of the differences (from year to year and between the impact and reference areas) could be attributed to any effects caused by the construction works and are instead believed to be due to natural variability.

Monitoring of fish inside the Natura 2000 areas was planned for the years 2010-2014. However, based on results from the years 2010-2012 it was decided in February 2013, together with the Swedish authorities, that there was no need for the monitoring to continue in 2013 and 2014 /14/.

1.6 Monitoring of benthic fauna

1.6.1 Benthic infauna communities

At Hoburgs Bank, the abundance of the benthic fauna has increased significantly due to natural variations since the baseline surveys in 2010. The between-station similarity of the benthic fauna was high due to a predominance of the same species of polychaetes (*Marenzelleria spp*. and *Pygospio elegans*), bivalves (*Macoma balthica* (especially biomass)) and crustaceans (*Monoporeia affinis* and *Saduria entomon* (biomass)). Total abundance and structure of the benthic community differed between 2010 and 2013, whereas the total biomass between the years was rather similar.

At Norra Midsjöbanken the abundance and biomass of the benthic fauna have increased significantly since the baseline surveys in 2010. The between-station similarity of the benthic fauna was high due to a dominance of the same few species of polychaetes (*Marenzelleria spp*. and *Pygospio elegans*) bivalves (*Macoma balthica*) and crustaceans (*Monoporeia affinis* and *Saduria entomon*). The structure of the benthic community between the impact surveys carried out in 2011-2013 was similar, but the results of these surveys were significantly different from the 2010 baseline results. This is due to the fact the abundance and biomass of the benthic fauna has increased significantly since the baseline surveys in 2010.

The analysis of the monitoring results showed that the deployment and trenching of Line 1 and Line 2 did not have any measurable immediate or prolonged negative impact on the qualitative or quantitative composition of the benthic fauna and the structure of the benthic community at the two banks.

1.6.2 Colonisation of the pipeline by epifauna

Monitoring of epifauna is carried out at four locations in Swedish waters. At each of these locations, 250 m of the pipeline is recorded by three video cameras mounted on an ROV covering the top and sides of the pipeline. Monitoring is planned to be carried out in the period between July and September each year from 2011 to 2014, with the overall objective of enabling the assessment of a potential reef effect from the Nord Stream Pipeline.

In 2013 the video recordings from the four analysed areas in Swedish waters revealed an establishment of blue mussels in the NMR_{new} area and a possible establishment in the HNB area (see Figure 4.3). One mobile species of epifauna, the crustacean *Saduria entomon*, was identified to be present on and next to the pipeline in higher numbers compared with previous surveys in 2011 and 2012. In addition, two species of fish, shorthorn sculpin and cod, were observed on and in close vicinity of the pipeline.

1.7 Monitoring of water quality

The purpose of the water quality programme in Sweden was (/5/):

- To monitor any increase in suspended sediment concentration (SSC) and sedimentation at the border of the two Natura 2000 areas Hoburgs Bank and Norra Midsjöbanken during trenching, including compliance with SSC thresholds as defined in the Swedish Permit /7/;

- To monitor the sediment plume during trenching, in order to validate the assumptions of the ES for the Swedish part of the pipeline /8/.

Monitoring of water quality was initiated in November 2010 by deployment of four fixed monitoring stations at the two Natura 2000 areas, which were considered sensitive with regard to impacts on the water environment. Furthermore, vessel-based monitoring was carried out during trenching to support the fixed station monitoring /5/.

Monitoring at the four fixed stations at the border of the two Natura 2000 areas took place during the period from November 2010 to August 2011. The results showed that the general turbidity level during trenching at the four long-term monitoring stations did not differ from the period before and after trenching, i.e. no impact from the trenching works could be measured at the long-term monitoring stations. The only high-turbidity event measured at the long-term monitoring stations during the period of trenching was documented as not being connected with the construction works – several natural high-turbidity peaks were measured before trenching took place /13/.

Vessel-based monitoring of sediment spreading was carried out during post-lay trenching in Swedish waters as part of the Nord Stream AG monitoring programme in 2011 and again in March 2012. Based on the results from the monitoring of water quality in connection with the construction of Line 1 it was agreed with the Swedish authorities that monitoring of Line 2 was not necessary to the same extent as for Line 1. The 2012 monitoring campaign therefore focused on vessel-based monitoring /11/.

Results from the 2012 monitoring in the Swedish EEZ show that the plough created a plume of suspended sediment. The highest SSC measured by water samples was 7.3 mg/l (during trenching of Section 8 south of Hoburgs Bank). The calibrated turbidity readings show a few peaks of slightly higher values but no peaks of excess concentrations above 15 mg/l were observed within Swedish waters even in the vicinity of the plough. Apart from these peak values measured just behind the plough, the SSCs were generally below 5 mg/l in all transects /11/.

The plume was most dense near the plough. The plume widened and the concentrations decreased further away from the plough. Concentrations 500 m behind the plough were less than 4 mg/l. This showed that the plume was diluted and that a significant quantity of the sediments had settled during the initial 500 m of transport behind the plough. The closest distance to the sensitive area from the monitored sections of post-lay trenching was approximately 4000 m (to Hoburgs Bank) /11/.

The sediment spill rate was estimated in three transects 300-600 m behind the plough. It was estimated that the spill rate was in the range of 3-25 kg/s. The three transects were chosen because they had the highest levels of turbidity observed during the monitoring of a total of 55 transects (within Danish and Swedish waters). The above interval therefore may be biased towards higher than average spill rates during the trenching activities. Spill rates of 3-25 kg/s are therefore likely to be more representative of the highest 10% of the spill rates. This is in line with the 2011 monitoring, where it was concluded that the spill rate was in the order of 7 kg/s /11/.

The results of the monitoring programme thus showed that the assumptions for the sediment spill modelling carried out as part of the ES prior to the construction works are conservative (i.e., on the safe side). The observed sediment spill rate and the increase in sediment concentrations were in line with the ES or less than assumed /13/.

1.8 Monitoring of hydrographical conditions in the Bornholm Basin

The purpose of the hydrographical monitoring programme was to investigate the influence of the pipelines on the inflowing, high-saline deep water in the Bornholm Basin. It was assessed that it is impossible to directly monitor the effect due to the presence of the pipelines. This is due to the natural variability being several orders of magnitude higher than a possible local effect. The scope, therefore, was focused on verifying the hypothesis of the previous investigations by the Swedish Meteorological and Hydrological Institute (SMHI) in their consulting report /15/.

Monitoring of hydrographical conditions in the Bornholm Basin was undertaken in January 2010 and ended in January 2011. The purpose of the hydrographical monitoring programme in Danish and Swedish waters was to establish documentation for the theoretical analysis of the possible blocking of the water inflow to the Baltic Sea caused by the presence of the Nord Stream Pipeline.

Oceanographical measurements (velocity, temperature, salinity) were carried out initially during a period of nine months (including a down period of approximately one month) at KP 1036 northeast of Bornholm at a water depth of approximately 90 m. In autumn 2010 the monitoring station was moved to KP 966 in order to also record measurements from shallower water depths (approximately 68 m).

In addition to the fixed station, line transects of current measurements were carried out by acoustic doppler current profiler (ADCP). A total of six transects were carried out.

The results of the monitoring were reported separately in 2011, in /16/. It was concluded that the maximum mixing caused by the pipelines in the Bornholm Basin would be 20% of the worst case estimations presented in /15/ and that even these estimates were well below any level of effect that could be measurable as being a result of the pipelines being established on the seabed.

At a meeting between Nord Stream AG and the Swedish authorities on 10 September 2012 it was decided that the hydrographical measurement programme could be terminated because earlier results had shown the effect of the pipelines to be insignificant /17/.

1.9 Monitoring of ecotoxicological effects on mussels

Monitoring of ecotoxicological effects on mussels was performed in the period from December 2010 to May 2011, during and after post-lay trenching of Line 1 /10/, /18/. The purpose of the monitoring of ecotoxicological effects on mussels was to evaluate and document the possible spreading of contaminants associated with sediments mobilised in the water column by seabed intervention (trenching) east of the two Natura 2000 areas Hoburgs Bank and Norra Midsjöbanken.

Monitoring of possible dispersion of contaminants associated with sediments mobilised by seabed intervention works was carried out by measuring the impact on common mussels (*Mytilus edulis*) in net bags at six fixed stations at the border of the two Natura 2000 areas.

No construction related effects on mussels could be found during the 2011 investigations; therefore no monitoring of ecotoxicological effects on mussels was carried out in 2012 /10/.

1.10 Monitoring of other parameters

1.10.1 Monitoring of fishery

At a meeting on 10 September 2012 between Nord Stream AG and Swedish authorities it was decided to postpone the report on changes in fishery patterns based on Automatic Identification System (AIS) data. It was agreed that a report covering all years up until 2014 shall be delivered in 2015 /17/.

1.10.2 Monitoring/mitigation measures at national and international monitoring stations

In order to determine whether the establishment of the Nord Stream Pipeline affects national or international monitoring programmes, the locations of the monitoring stations were identified in relation to the pipeline route and the related construction and operation activities.

Four of the existing monitoring stations in the Swedish EEZ (and one SMHI station in the Finnish EEZ) are located within ±1.5 km of the pipelines. Mitigation measures were proposed and agreed with the authorities.

One of the monitoring stations (SE-11) in the Bornholm Basin in the Swedish EEZ, which was measuring contaminants in sediments, was successfully relocated. Underwater photos and sampling

of seabed sediments for subsequent analysis were carried out at both the old and the new location. The ocular sediment examination and bottom photo results, together with the radiographical analyses, show that the physical demands placed on a national environmental monitoring station are met at the new location.

It is currently expected that samples will be taken from both locations (old and new) in 2014 but that only material from one (the new) station will be analysed and used, in case no unexpected results are found.

1.10.3 Cultural heritage

The purpose of cultural heritage monitoring is to document the condition of wrecks before construction (pipe-laying, anchor-handling, post-lay trenching and rock placement), to safeguard the wrecks during construction and to verify the condition of the wrecks after construction.

Monitoring of cultural heritage was carried out as a visual inspection by ROV. An ROV inspected nine archeologically significant wreck sites in the Swedish EEZ and recorded footage of the wrecks. The inspections were carried out in 2009 by Marin Mätteknik AB (MMT) before the start of construction. In 2012 and 2013, after the completion of construction, Fugro Subsea Services Ltd. (FSSL) conducted the underwater inspections.

According to the monitoring results, one shipwreck was impacted by an anchor chain during construction of the Nord Stream Pipeline. No construction related changes occurred with respect to the eight other shipwrecks.

1.10.4 Maritime traffic

The purpose of control and monitoring by Nord Stream AG in relation to marine traffic is to minimise the risk of collisions or other accidents involving commercial ship traffic and/or vessels performing construction activities for the project.

Prior to survey activities carried out for the Nord Stream Pipeline in 2013, Survey Notifications were submitted to the Swedish Maritime Administration.

2 Introduction

Nord Stream is an offshore natural gas twin pipeline system from Russia to Germany. The Nord Stream Pipeline connects the large natural gas resources of Russia with the European natural gas pipeline network. At full capacity, it can provide 55 billion cubic metres (bcm) of natural gas per year to European consumers.

The length of the entire two-pipeline system (the Nord Stream Pipeline) is approximately 1,224 km. The pipeline crosses the exclusive economic zones (EEZs) of Russia, Finland, Sweden, Denmark and Germany and the territorial waters (TW) of Russia, Denmark and Germany. Construction of the first pipeline began in April 2010 and was completed in June 2011. Transportation of gas began in November 2011. Construction of the second line, which runs parallel to the first, began in May 2011 and was completed in April 2012. Gas transport through the second line began in October 2012. The Nord Stream Pipeline is designed to operate for 50 years.

2.1 Construction permit and conditions for environmental monitoring

On 21 December 2007, Nord Stream AG applied for the Government's permission under section 15a of the Continental Shelf Act (1966:314) to lay two pipelines for the transport of natural gas on the continental shelf in the Swedish EEZ of the Baltic Sea.

The permit for construction of the Nord Stream Pipeline inside the Swedish EEZ was granted by the Swedish Government on 5 November 2009. The following conditions regarding environmental monitoring are stated in the permit /7/:

7. The Company shall have an environmental monitoring programme for supervision of the activity during the construction and operation phases of each pipeline. This monitoring programme shall be developed in consultation with the Swedish Coastguard, the Geological Survey of Sweden, the Swedish Environmental Protection Agency, the Swedish Maritime Administration, the Swedish Transport Agency, the Swedish Board of Fisheries and the Swedish Meteorological and Hydrological Institute. The form and scope of the environmental monitoring programme shall be established in good time before the work commences. The programme shall be subject to review on an ongoing basis and shall be revised as required. Any surveys, studies etc. carried out as part of this environmental monitoring programme shall be made available to the relevant authority.

8. The Company's environmental monitoring programme shall include inter alia the monitoring of bottom currents and stratification of bottom water in the Bornholm Basin, monitoring sediment spillage during the construction phase, and monitoring turbidity levels during underwater operations as provided by section 10.

10. Turbidity caused by seabed operations connected with the laying of each pipeline should, as a guideline, amount to a maximum of 15 mg/l at the boundaries of the Natura 2000 areas Hoburgs Bank and Norra Midsjöbank (in accordance with the classification of these areas as Natura 2000 areas). The measurement technique and procedure shall be governed by the environmental monitoring programme which the Company is to produce pursuant to section 7. If monitoring of the turbidity shows that this value has been exceeded, additional precautionary measures shall be taken

during seabed operations, such as cutting back on or temporarily ceasing seabed operations so that the value can be maintained. Thereafter, the Company shall, in so far as possible, ensure that any breach of the limit is not repeated.

2.2 Environmental monitoring within the Swedish EEZ

To accommodate the conditions laid out in the construction permit a programme for environmental monitoring within the Swedish EEZ was elaborated by Nord Stream AG in collaboration with the Swedish authorities. A final environmental monitoring programme was presented to, and discussed with, Swedish authorities at a meeting on 10 February 2010. Nord Stream AG received formal approval of the framework for the monitoring programme on 25 February 2010.

The environmental monitoring programme comprises the following documents:

- Nord Stream. Environmental monitoring programme Sweden. 01.03.2010. G-PE-PER-REP-000-EnvMonSE-B /1/;
- Nord Stream. Monitoring programme for fish and fishery within the Swedish EEZ. 17.03.2010. G-PE-PER-REP-100-04090000-B /3/;
- Nord Stream. Monitoring programme for benthic fauna within the Swedish EEZ. 18.03.2010. G-PE-PER-REP-100-04140000-B /4/;
- Nord Stream. Monitoring programme for turbidity, sediments and ecotoxicological effects within the Swedish EEZ. 06.04.2010. G-PE-PER-REP-100-04100000-B /5/;
- Nord Stream. Hydrographic effects: Deep water inflow in the Bornholm Basin (Danish EEZ). 15.03.2010. G-PE-PER-REP-000-HydrogSE-B /6/;
- Nord Stream. Monitoring measures for munitions clearance Sweden. 15.03.2010. G-PE-PER-REP-000-MunCleSE-B /2/.

In the Swedish ES (ES) /8/ all potential impacts from construction and operation of the Nord Stream Pipeline were assessed to be minor. Consequently, monitoring would not necessarily be required. However, it is considered important to employ additional effort to validate the accuracy of the impact assessment on certain fit-for-purpose activities and to deliver the main monitoring objectives for the project.

In order to measure the effectiveness of the monitoring and mitigation measures, relevant receptors and indicators identified within the monitoring programme are characterised by the following:

- Low natural variability and broad applicability;
- Measurability;
- Appropriateness to the scale of impact, the impact mechanism as well as the temporal and spatial dynamics.

Monitoring of potential environmental factors and related impacts considers:

- Emission intensity;
- Sensitivity of the receptor and conservation value.

A project-based concept in relation to overall oceanography follows the evaluation of potential environmental impacts with consideration to the following:

- Focus on shallow waters providing habitats for conservation objectives;
- A general approach on potential impact areas for waters at depth of 30-80 m;
- No biological investigations below the halocline at 80 m water depth if other options are available, in view of the anoxic conditions at these depths.

Environmental monitoring by Nord Stream AG in the Swedish EEZ therefore varies in spatial range, temporal frequency and duration depending on the nature of the monitored parameters, the potential predicted impacts and the potential receptors. According to local variations in environment and construction works, certain investigations are carried out only at selected sites.

The environmental and socio-economic monitoring comprises the following main objectives:

Change monitoring: to detect environmental changes that may have occurred as a result of project implementation. This includes monitoring undertaken before construction (baseline monitoring), during construction (not necessarily in direct connection with construction activities in a specific area) and post-construction (during the first years of operation);

Compliance monitoring: periodic sampling or continuous recording of specific environmental and social quality indicators for a defined purpose to ensure project compliance;

Pro-active monitoring: timely routine and periodic checks by observation, measurement and evaluation for a defined purpose, which includes corrective action.

2.2.1 Construction and environmental control

In addition to the environmental monitoring resulting from permit conditions and discussions with the respective authorities, which is the focus of this report, Nord Stream AG also has its own overall system in place to manage and control all aspects of environmental relevance. This control structure is called the Environmental and Social Management System (ESMS). The ESMS is to a large extent guided by the findings and recommendations of the national Environmental Impact Assessments (EIAs), the ESs and the Espoo Report, EU EIA Directive requirements, lenders' requirements and the requirements of the relevant authorities. The purposes of the ESMS are as follows:

- To establish a framework for implementing mitigation and management measures and to monitor the effectiveness of those measures;
- To provide assurance to authorities and other stakeholders that their requirements with respect to environmental and social performance will be met;
- To provide for the implementation of corrective measures where required;
- To establish a framework for performance monitoring to enable Nord Stream AG to ensure that its commitments and policies with respect to environmental and social performance are met.

A number of management plans were produced in order to structure the requirements for the different construction activities and/or areas. Each management plan provides detailed information,

requirements and minimum environmental standards relating to either a specific construction activity (e.g., seabed intervention) or an environmental/social issue (e.g., waste management). In this way the environmental and social management as well as mitigation and monitoring actions to be undertaken by Nord Stream AG and its contractors are clearly stated, the roles defined and adherence easily followed. Nord Stream AG also prepared bridging documentation to align the management system of the contractor with that of Nord Stream AG.

Contractor compliance, with regard to both documentation and the work itself, was further controlled and supervised by a number of internationally renowned independent environmental and technical consultants (such as Det Norske Veritas, Global Maritime and Environ). These companies provided support in ensuring that the contractors followed and implemented the obligations and commitments of Nord Stream AG as appropriate, as described in the management plans, during the first year of construction. The contractor's compliance with the defined procedures was carefully monitored through offshore inspections and reporting throughout the construction phase, e.g., through vessel safety audits by a marine warranty surveyor prior to mobilisation and periodic on-site environmental and safety inspections by an environment, health and safety representative.

2.3 Purpose of the document and reading instructions

This document provides an overview of the environmental and socio-economic monitoring activities carried out by Nord Stream AG in 2013 within the Swedish EEZ. It is the fourth of five planned annual reports, the purpose of which is to document the status and the results of monitoring activities in the Swedish EEZ and, if necessary, recommend appropriate adjustments to the monitoring scope. The reports will be submitted each year and cover all activities undertaken the previous year. The monitoring programme for the Swedish EEZ covers activities from 2010 to 2014.

This document is structured the following way:

Chapter 3: Summary of all Nord Stream Project construction activities carried out in the Swedish EEZ. No construction took place in 2013; the chapter includes a summary of the construction activities that took place during the period February 2010 to May 2012.

Chapter 4: Reporting of environmental monitoring carried out within the Swedish EEZ in 2013.

The environmental monitoring activities that required more detailed studies and/or field studies in 2013 were the following:

- Monitoring of fish along the pipeline (reef effect);
- Monitoring of benthic fauna.

Detailed monitoring results from the above are reported in separate monitoring reports. This report includes a summary only.

The following modules were concluded in 2010, 2011 and 2012 and therefore are not included in this year's annual report:

- Monitoring of munitions clearance;

- Monitoring of ecotoxicological effects in mussels;
- Monitoring of hydrographical effects;
- Monitoring of fish in the Natura 2000 areas;
- Monitoring of water quality.

Chapter 5: Reporting of socio-economic monitoring carried out within the Swedish EEZ in 2013.

The environmental monitoring activities that required more detailed studies and/or field studies in 2013 were the following:

- Monitoring/mitigation measures at national and international monitoring stations;
- Monitoring of cultural heritage.

Chapter 6: Comparison of the monitoring results with the assumptions in the Swedish ES, i.e., with regard to the expected potential environmental impacts.

Chapter 7: Conclusion.

3 Construction activities

3.1 Introduction

Construction of Nord Stream Line 1 and Line 2 in the Swedish EEZ took place during the period 2010-2012. These activities are summarised in the following, to provide an overview of the construction activities that could have had a potential impact on the environment.

The objective of monitoring in the Swedish EEZ in 2013 was to verify that the potential impacts of the construction and the presence of the Nord Stream Pipeline were as expected, as documented in the Swedish ES /8/:

The following main construction activities took place in the Swedish EEZ in 2010-2012:

- Clearing of seven munitions objects in 2010;
- Cable crossings (mattress installation) in 2010-2011;
- Pre-lay rock placement, Line 1 and Line 2 (2010);
- Pipe-laying Line 1 (2010-2011) and Line 2 (2011-2012);
- Post-lay rock placement, Line 1 (2011) and Line 2 (2011-2012);
- Post-lay trenching, Line 1 (2011) and Line 2 (2012);
- Underwater welding, pre-commissioning and commissioning, Line 1 (2011) and Line 2 (2012).

3.2 Munitions clearance

Clearance of conventional munitions objects took place in connection with construction of the Nord Stream Pipeline. The potential impacts on birds, fish and marine mammals caused by munitions clearance are related to sediment spreading, dispersion of chemical compounds from the munitions object and effects from the pressure wave generated by the explosion /8/. Seven mines in the Swedish EEZ were considered a risk to construction activities in the Swedish EEZ and were therefore cleared (see Figure 3.1).

Munitions clearance activities started on 19 March 2010 and were completed by 3 April 2010 by the vessel *Edda Freya*. The clearance operation included survey activities, installation and operation of environmental equipment and a controlled underwater explosion at each of the seven munitions locations, as described in /2/.

The detonations resulted in the creation craters at the munitions sites, with a maximum diameter of 10-12 m, which was smaller than expected. Due to the low number of munitions to be cleared in the Swedish EEZ the environmental impact caused by this activity was negligible.

A more detailed description of munitions clearance and environmental monitoring carried out in relation to clearance activities is provided in the report “Munitions Clearance in the Swedish EEZ” /2/.

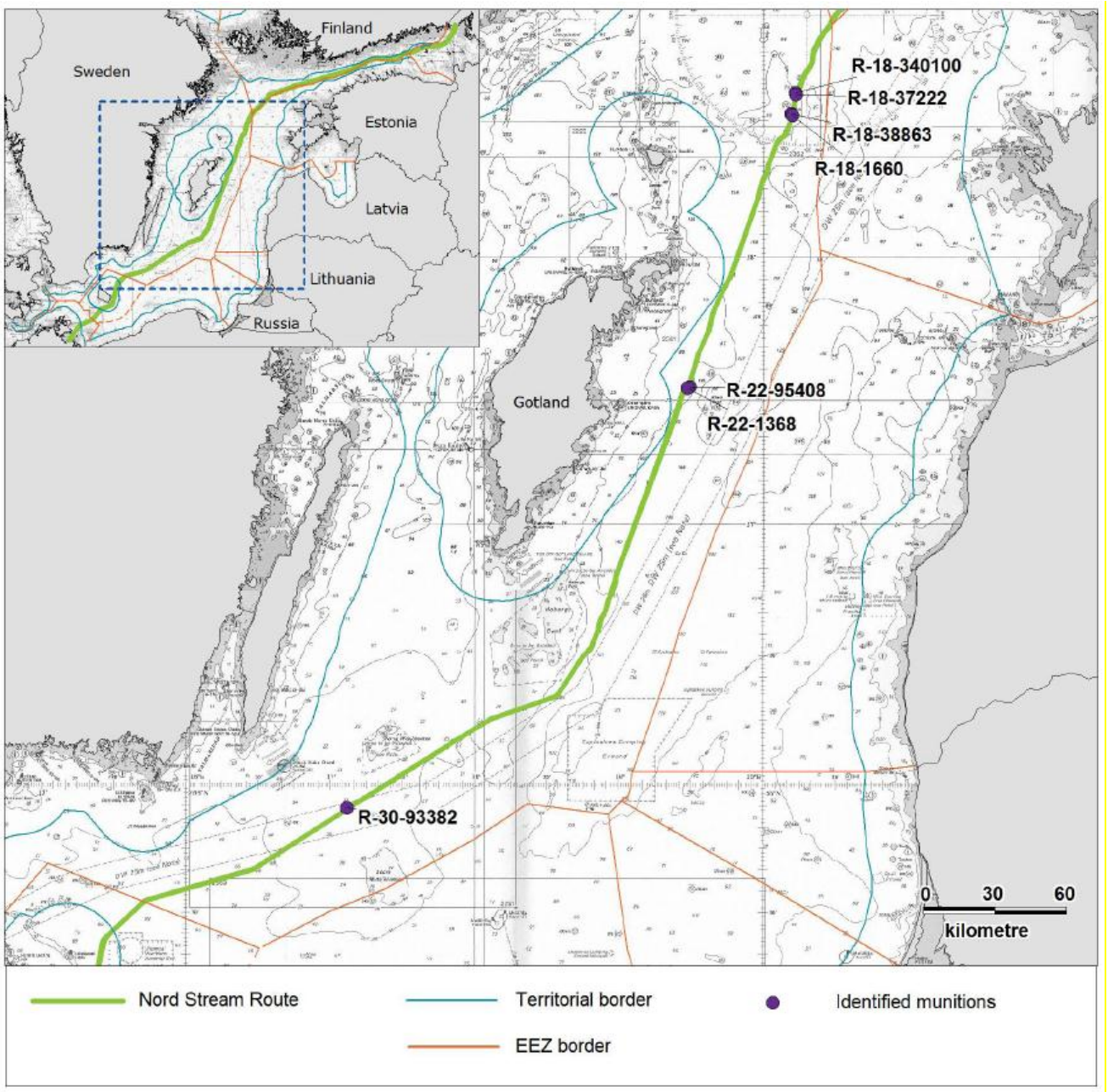

Figure 3.1 The seven munitions clearance sites in the Swedish EEZ.

3.3 Cable crossing (mattress installation)

Five telecommunication and power transmission cables were crossed by the Nord Stream Pipelines on the seabed in the Swedish EEZ. Each crossing was designed to take into consideration the crossing angle and the burial depth of the cable (e.g., specific survey results detailing the state of burial of an installed cable).

Flexible concrete mattresses were used for placement over the cables at the crossing locations to increase the bending radius imposed on the cables and to ensure a permanent vertical separation between the pipeline and the cables. In cases where the cables were buried at a lesser depth, neoprene pads were added to the lower surface of the mattresses. For some crossings, concrete beam mattresses were used for placement under the pipelines at locations adjacent to the crossing locations to provide additional bearing support to the pipeline, thereby reducing the load on the cables at the crossing locations.

3.4 Pipe-laying

As a result of the pipe-laying process, seabed sediments may be suspended into the water column, after which they settle again to the seabed. Theoretical analysis has shown that this mechanism only causes negligible amounts of seabed sediments to be re-suspended (in the order of magnitude of 300 kg/km pipeline) /8/.

Pipe-laying was performed by the *Castoro Sei*, supported by four pipe carriers and three anchor-handling tugs. The anchor-handling tugs positioned the 12 anchors of the lay vessel, moving it slowly forward as the pipeline was lowered onto the seabed. The anchors, which were moved by dedicated anchor-handling vessels, were placed up to approximately 1000 m from the pipeline alignment.

Pipe-laying of Line 1 commenced in the Swedish EEZ on 6 April 2010. Pipe-laying from KP 674 to KP 498 was successfully completed on 27 June 2010, and the operations continued into the Finnish EEZ.

The lay barge recommenced pipe-laying activities for Line 1 on 31 December 2010. Pipe-laying from KP 1004 to KP 674 was successfully completed, and the pipe was abandoned on the seabed on 5 May 2011 (see Figure 3.2).

Line 2 installation commenced towards the south on 25 July 2011. Pipe-laying from KP 498 to KP 674 was successfully completed, and the pipe was abandoned on the seabed on 22 September 2011 (see Figure 3.2).

Pipe-laying activities recommenced northwards from KP 1004 on 23 November 2011. Line 2 was finalised in the Swedish EEZ when pipe-laying was completed at KP 674 on 18 April 2012 (see Figure 3.2).

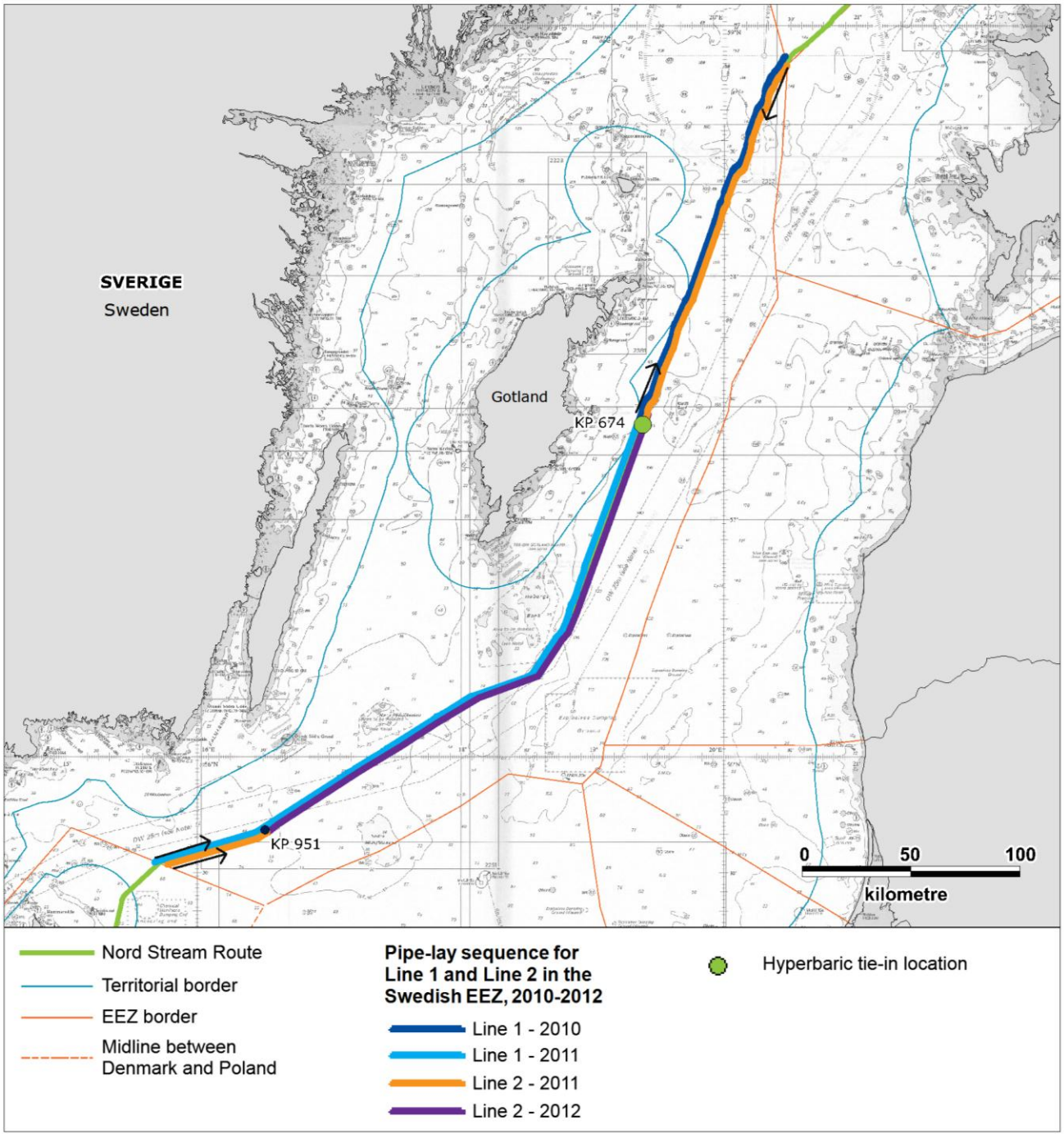

Figure 3.2 Pipe-lay sequence for Line 1 and Line 2 in the Swedish EEZ, 2010-2012.

3.5 Rock placement

Once the pipelines are laid, the pipe wall thickness and concrete coating provide substantial protection of the pipelines. However, the pipelines have varying needs for additional protection along the route to avoid:

- Stress due to free span development caused by an uneven seabed;
- Excessive movement due to hydrodynamic loading;
- Excessive movement (lateral and upheaval buckling) due to compressive pipeline loading.

In areas where one or more of these factors were present, additional protection was achieved by trenching the pipelines into the seabed or by rock placement.

Rock placement for on-bottom stability was performed with a dedicated dynamically positioned rock placement vessel. The use of a flexible fall pipe system made it possible to place the rock in a controlled manner with high accuracy and low impact on the pipelines and the seabed.

Rock placement was performed on several occasions during 2010, 2011 and 2012. Rock placements have been performed on different locations along the route, but especially along Hoburgs bank (see Figure 3.3).

Pre-lay rock placement activities for Line 1 and 2 commenced in February 2010 at the tie-in location at KP 674. In June/July 2010 and in December 2010 additional pre-lay rock placement for free span correction was undertaken along the route.

Post-lay rock placement for on-bottom stability of Line 1 was carried out in April, June and July 2011. Post-lay rock placement for on-bottom stability of Line 2 was performed in April, May and August 2012.

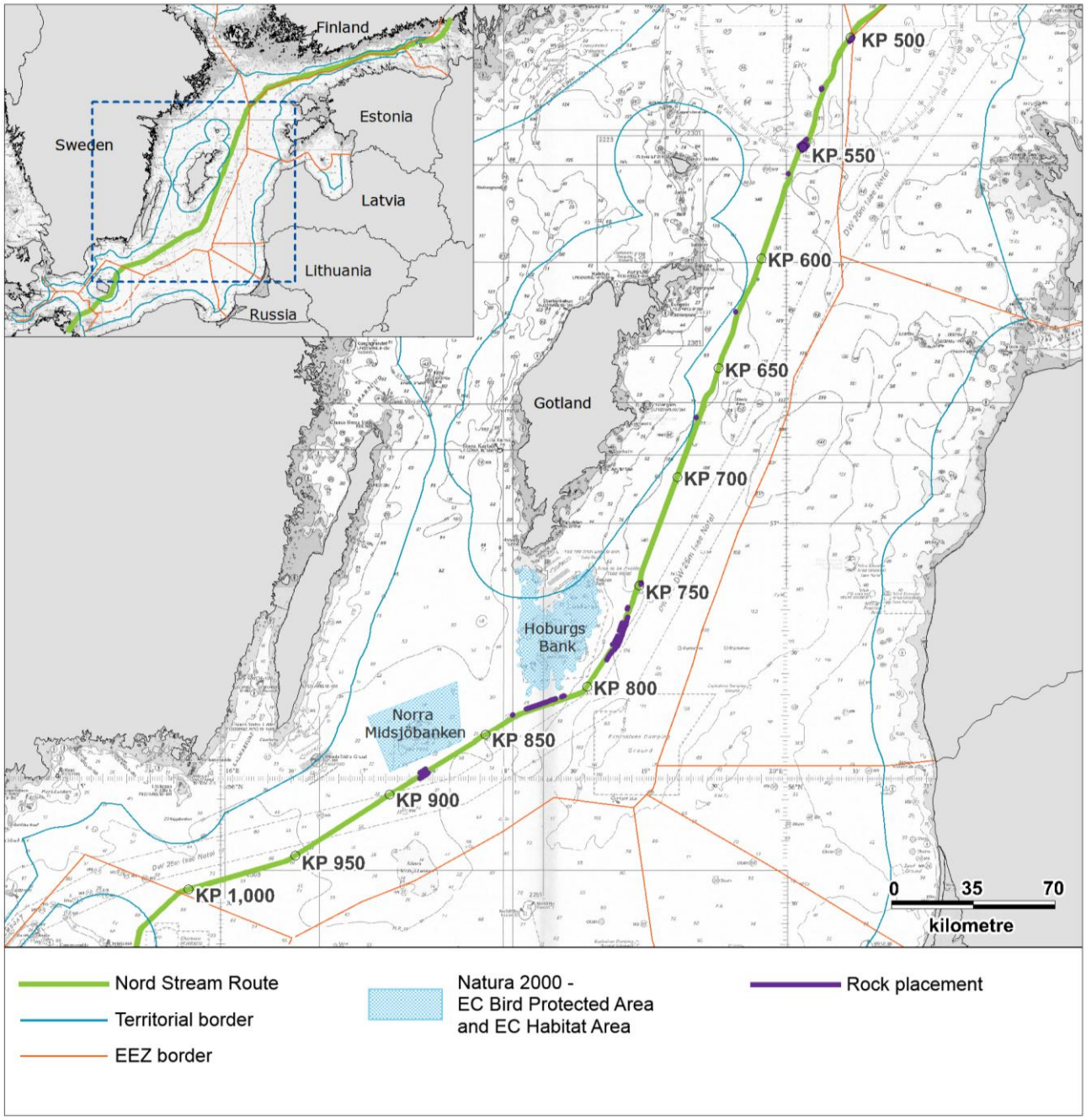

Figure 3.3 Rock placement locations in Swedish waters.

3.6 Post-lay trenching

Post-lay trenching of the pipelines into the seabed was carried out for parts of the pipeline for additional protection of the pipelines. This means that the pipeline was sunk into a trench made after pipe-laying by ploughing. With post-lay trenching, the removed material is left on the sea bottom and the trench is not backfilled. However, partial, natural backfilling will occur due to currents.

The plough mechanically moves the material on the seabed, resulting in a V-shaped furrow with the sediment pushed up on either side of the trench. The resulting sediment disturbance is very local, having little impact on the surrounding water. On the basis of experience from other marine construction works, assessments of the sediment spill from this activity prior to construction were assumed to be approximately 2% of the total handled volume of seabed. Applying an average nominal trench volume of 6.9 m^3/m, this resulted in a spill rate in the order of magnitude of 20 kg/s, which is distributed among the fine fractions of sediment only and released on average 5 m above the seabed /8/.

A pipe-lay and trenching corridor survey was performed prior to these activities in order to identify any obstructions or hazards not found on previous surveys within +/- 16m of the intended route and to obtain the bathymetric profile of the proposed plough corridor. Several boulders were identified and relocated before construction of Line 1 and Line 2. As-laid data proved that the construction activities did not reduce the water depth in the deep-water shipping lane (not less than 35 m water depth, in accordance with conditions).

Post-lay trenching was undertaken by the vessel *Far Sampson* pulling the plough PL3. Trenching of Line 1 and Line 2 was originally planned at seven sections along the pipeline route near Norra Midsjöbanken and Hoburgs Bank. However, due to a large number of subsea boulders and time constraints the planned trenching along Hoburgs Bank (Sections 8 and 9 of Line 1 and Section 9 of Line 2) was abandoned.

Post-lay trenching of Line 1 started at Section 3 on 19 February 2011 and ended at Section 7 on 19 March 2011 (see Figure 3.4). Post-lay trenching of Line 2 began at Section 3 on 19 February 2012 and ended at Section 8 on 15 March 2012.

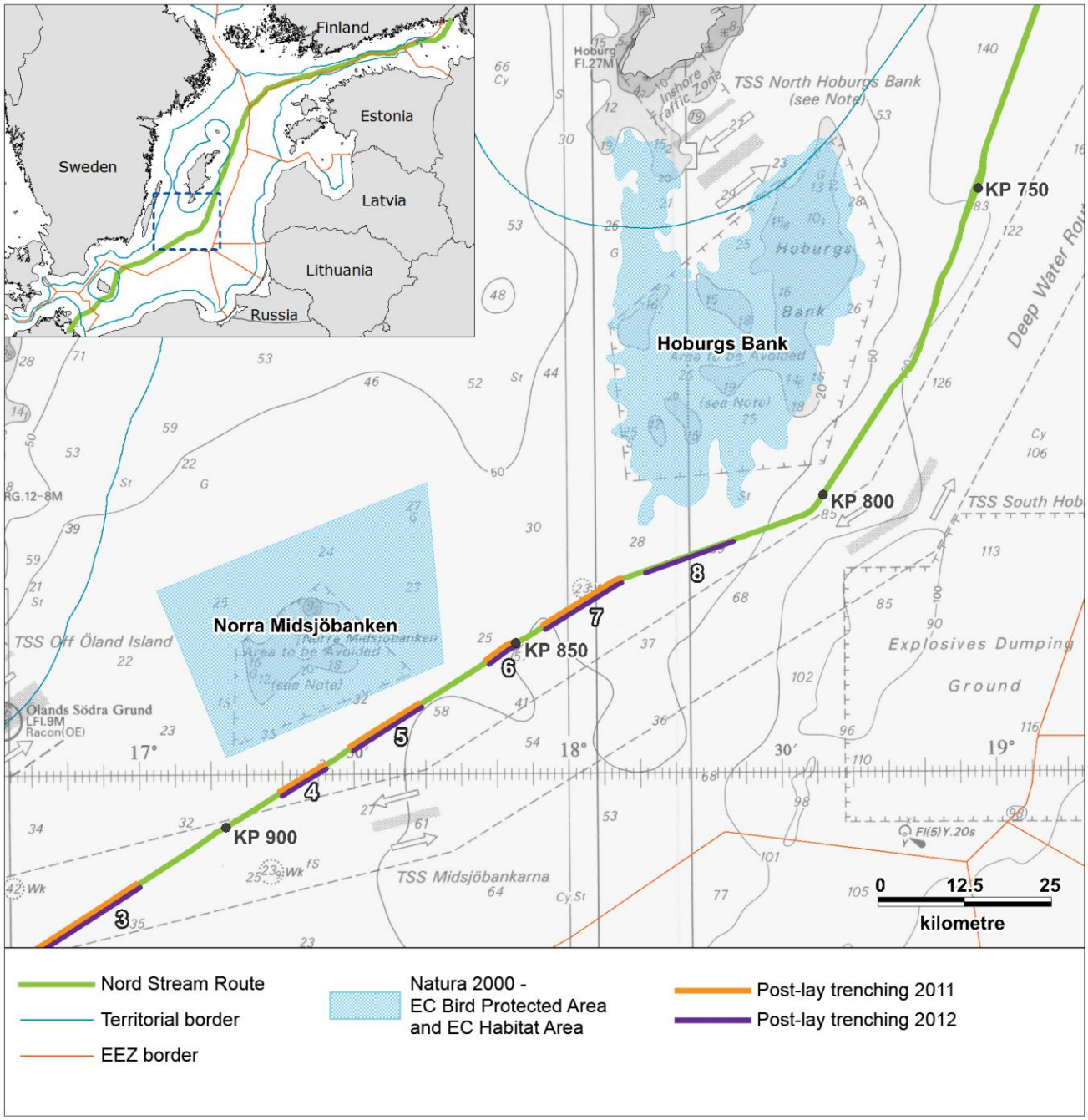

Figure 3.4 Post-lay trenching in Swedish waters.

3.7 Underwater welding, pre-commissioning and commissioning

Construction of the two pipelines included hyperbaric tie-in (underwater welding) of the three pipeline sections at KP 297 in Finnish waters and at KP 674 in Swedish waters (see Figure 3.2). Also pre-commissioning operations were performed prior to commissioning of the pipeline.

Hyperbaric tie-in/underwater welding commenced in the Finnish EEZ at KP 297 and continued to Swedish waters at KP 674. The tie-in operation relevant for Sweden at KP 674 commenced for Line 1 on 5 June 2011 and was completed on 21 June 2011. For Line 2, the tie-in operation relevant for Sweden at KP 674 was completed within three weeks in June 2012.

Pre-commissioning was performed by flooding, gauging and pressure testing both Line 1 and Line 2 in three different sections/zones. Section 1 was from KP 0 to KP 297, Section 2 was from KP 297 to KP 674 and Section 3 was from KP 674 to KP 1224, of which sections 2 and 3 were relevant for construction in the Swedish EEZ.

Pre-commissioning activities for Line 1 in the Swedish EEZ from cleaning to pressure testing were performed during spring and early summer 2011. After dewatering, pipeline drying was completed on 11 August 2011. Det Norske Veritas (DNV) issued an interim certificate on 25 August 2011, which allowed the commissioning and gas-in.

Commissioning of Line 1 commenced on 6 September 2011. Final nitrogen displacement by natural gas was completed when the content of nitrogen in the gas outlet, measured at the German landfall, was less than 5% on 10 September 2011. The construction of Line 1 was completed for the official inauguration and start of operation of Line 1 in November 2011.

Pre-commissioning activities for Line 2 in the Swedish EEZ from cleaning to pressure testing were performed during spring and early summer 2012 in the Swedish EEZ. Dewatering of the entire Line 2 was completed on schedule at the end of July 2012. After dewatering, pipeline drying was completed and accepted by DNV on 21 August 2012, which allowed the commissioning and gas-in.

Commissioning of Line 2 commenced in the beginning of September 2012. Final nitrogen displacement by natural gas was completed when the content of nitrogen in the gas outlet, measured at the German landfall, was less than 5% on 17 September 2012. The construction of Line 2 was completed for the official inauguration and start of operation of Line 2 in October 2012.

4 Environmental monitoring within the Swedish EEZ in 2013

4.1 Monitoring of fish along the pipeline

4.1.1 Monitoring programme

The scope of the fish monitoring programme /3/ is to describe the qualitative and if possible the quantitative changes in the fish community in the area adjacent to the Nord Stream Pipeline and to compare them with the fish community of the surrounding seabed.

The purpose of the monitoring of fish along the pipeline is to investigate whether the pipelines lead to a so-called reef effect and to determine the extent of changes in fish abundance.

The monitoring of fish at and close to the pipelines focuses on demersal fish species, as no effects from the presence of the pipelines on the seabed are expected to occur for pelagic fish species. To acquire detailed information on species composition and to estimate quantitative changes due to a potential reef effect, information was gathered through survey trawling and gill net fishery. In addition, echo-sounder surveys were carried out.

Fish monitoring started in 2010 with the collection of baseline data prior to the start of construction works /21/. Three monitoring areas were surveyed: one for effects in areas where the pipeline was to be laid on the seabed (area HNB), one for effects in areas where the pipeline was to be trenched (area NMT) and one for effects in areas where the pipeline was to be stabilised with rock berms (area NMR). Rock placement in area NMR was later cancelled in the final construction design. Monitoring of fish in area NMR, however, was still carried out in relation to the reef effect of the pipelines on the seabed because baseline data were already collected in this area. Table 4.1 and Figure 4.1 show the locations of the fish monitoring areas.

Monitoring is planned to be carried out every year from 2010-2014 (see Table 4.2). The 2010 survey constitutes the baseline for future monitoring of fish along the pipeline in the Swedish EEZ.

Table 4.1 Locations of fish monitoring areas and reasons for monitoring in Swedish waters (see also Figure 4.1).

Location	Reason for monitoring	KP section
Area HNB	Pipeline on seabed	KP 855-867
Area NMT	Trenching	KP 867-879
Area NMR	Pipeline on seabed[1]	KP 900-905
[1] Rock placement was originally planned in this area, but it was cancelled in the final design.		

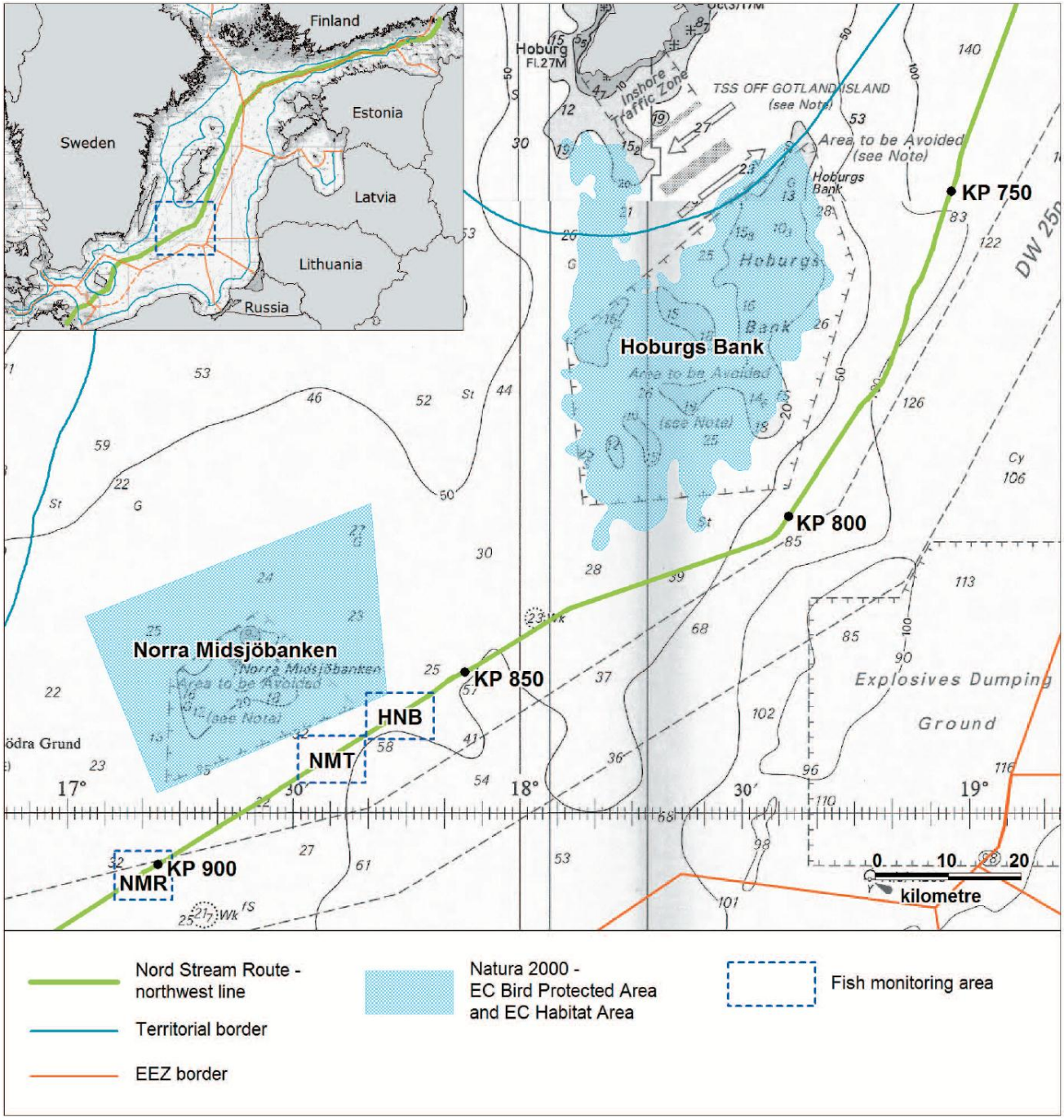

Figure 4.1 Areas for monitoring of fish along the pipeline (reef effect) in Swedish waters.

Table 4.2 Summary of the monitoring programme for fish along the Nord Stream Pipeline in Swedish waters.

Fish in Sweden	
Monitoring of fish along the Nord Stream Pipeline	
Purpose	To evaluate and document the qualitative and if possible the quantitative changes in the fish community in the area adjacent to the Nord Stream Pipeline
Areas to be monitored	Three selected areas in the vicinity of the Natura 2000 areas
Activities to be monitored	Presence of pipelines on the seabed, locations where the pipeline has been trenched into the seabed and rock placement[1]
Methods to be used	Fish investigations by survey trawl and/or gill net; hydroacoustic (echo-sounder) measurements for fish; CTDO profiles and Secchi depth at stations with trawling
Period of monitoring	September/October 2010-2014
Results	Documentation of changes in fish fauna along the pipelines compared with fish fauna in areas without pipelines on the seabed
[1] The baseline monitoring was conducted at a location where rock placement was originally planned. However, in the final design no rock placement was carried out and the pipeline was placed directly on the seabed at this location.	

4.1.2 Monitoring and results for 2013

As described above in Section 4.1.1, the programme included three areas (HNB, NMT and NMR), see Figure 4.1. Each area contained impact and reference stations. The stations and fishing methods used are listed in Table 4.3.

In order to avoid the impact of seasonal variations in the results, the aim has been to complete the fish survey during the same period each year. The baseline study at HNB and NMR was conducted on 20-23 September 2010. Due to weather conditions the fish survey with gill nets at NMT was conducted at the end of October and the beginning of November 2010. The impact fish surveys were conducted in all three monitoring areas on 23-26 September 2011, on 17-27 September 2012 and on 12-20 September 2013.

Table 4.3 Monitoring areas in Swedish waters (stations, fishery method, replicate and depth intervals).

Area	Station	Method	Replicate (number)	Depth interval (m)
HNB	HNB impact	TV3-520 trawl	3 hauls	51-64
	HNB reference			44-61
NMT	NMT impact	K072 gill net	8 nets	35-40
	NMT reference			38-44
NMR	NMR impact	TV3-520 trawl	3 hauls	42-45
	NMR reference			41-45

The monitoring results show that the hydrographical conditions at the impact and the reference stations were generally equivalent within each year of investigation. Hypoxia (< 2 ml/l) was not documented. However, during the survey in 2012 and 2013 the oxygen levels in the bottom water were somewhat higher compared with previous surveys in 2010 and 2011. Similar levels of salinity were observed in the bottom water between years. Differences in salinity between years were observed close to the bottom only at some stations in area NMR. Some fluctuations in the bottom water temperature were documented during the four years of surveys. Therefore, hydrographical variables are not expected to contribute to biased results in fish presence or composition of fish species within each year or between impact and reference areas.

The fish monitoring results showed a general increase in the amount of fish at impact as well as reference stations during sampling in 2011, 2012 and 2013 compared with the results from the baseline study in 2010. The structure of the fish assemblage obtained in 2011, 2012 and 2013 within the studied areas HNB, NMT and NMR showed variations compared with the survey in 2010 and was strongly dominated by cod (*Gadus morhua)* and herring (*Clupea harengus*). However, the focus in this study is on demersal fish and especially cod. The catches of cod were continuously high throughout the sampling from 2010 until 2013. Other demersal fish species such as shorthorn sculpin (*Myoxocephalus scorpius*), flounder (*Platichtus flesus*), plaice (*Pleuronectes platessa*) and the semipelagic whiting (*Merlangius merlangus*) were only documented in low numbers. On the contrary, herring as a pelagic fish is assumed to be less attracted to artificial structures placed on the seabed. All species that were documented during the baseline study and during the first three years of investigation after establishment of the pipeline are all common to the Baltic Sea fish community.

Within the studied areas for the fish survey in Swedish waters, the pipeline is either placed directly on the seabed or post-lay trenched into the seabed. These different methods of pipeline construction might influence the presence of fish (reef effect) in the impact areas because of different accessibility to new hard bottom substrate.

In the areas HNB and NMR, the pipeline is placed directly on the seabed. With regarding to all the measured parameters in the monitoring programme, area HNB shows the highest similarities between the baseline study and the surveys in 2011, 2012 and 2013 after the construction of the pipeline. There were no differences in the composition of the demersal fish assemblage between treatments (impact versus reference) or between years (2010-2013). No differences could be detected for biomass or abundance of the dominant demersal fish species cod. In the area NMR, the demersal fish composition showed a significant difference between the baseline survey and subsequent surveys in 2011, 2012 and 2013 with respect to both biomass and abundance. However, there was no difference in treatments within each year for biomass or abundance, indicating a natural variation between years.

In area NMT, the pipeline is established through post-lay trenching. The demersal fish composition in the NMT impact area differs between years for both biomass and abundance. During the three last years, 2011-2013, catches of cod increased in comparison with the baseline survey in 2010. Since there were no significant changes in the catches of cod, no reef effect within the impact area could be detected.

The length distribution patterns are of interest because they can indicate the function of an area for a fish community, e.g. if the fish community is comprised of small and young individuals the area might potentially serve as an nursery ground, or if an area has a lot of large individuals it might potentially be a feeding or a spawning area. In all areas (HNB, NMT and NMR) in both impact and reference areas a new cohort of cod individuals of approximately 12-22 cm in body length was documented during the survey in 2012. During the survey in 2013 a similar cohort was not as obvious. Instead the proportion of somewhat larger cod individuals (approximately 24-32 cm) was higher compared with the previous year. This is most likely due to growth of the smaller cohort documented in 2012. At the reference stations in area NMR during the fish survey in 2010 only 22% of the cod were below the size limit (38 cm) for commercial fishing in the Baltic Sea. However, during the following years of fish surveys (2011-2013) these patterns could not be seen. The majority of the cod documented in the three studied areas (HNB, NMT and NMR) were comprised of individuals below the limit for commercial landings. Similar length distributions of cod were documented in both the impact and reference areas within each year. The conclusion of these results based upon length distribution is that the areas HNB, NMT and NMR may function primarily as potentially nursery grounds for cod in the Baltic Sea during the autumn season.

It is difficult to draw any long-term conclusions regarding impacts from the pipeline on the fish community. The results thus far should be regarded as relatively short-term ecological effects on the demersal fish community in the Baltic Sea. The monitoring so far has not shown a general increase in the abundance of fish along the pipeline, and the monitoring results do not indicate any effects on the composition of demersal fish that can be attributed to the presence of the pipeline.

4.2 Monitoring of benthic fauna

4.2.1 Monitoring programme

The monitoring programme for benthic fauna is described in /1/ and /4/. The purpose of the monitoring of benthic fauna is:

- To evaluate changes and recovery in benthic infauna communities due to post-lay trenching;
- To describe the colonisation of the pipeline and rock berms by epifauna.

Benthic infauna communities
The monitoring focused on impacts from trenching, as this was the activity assessed to have the largest potential impact on the marine environment. Two monitoring areas for infauna were surveyed: between the pipeline route and Hoburgs Bank, and between the pipeline route and Norra Midsjöbanken. The two areas are shown in Figure 4.2.

The transects are located in north-eastern directions, in accordance with the prevailing current direction. The transects comprise 11 monitoring stations at Hoburgs Bank and 10 monitoring stations at Norra Midsjöbanken. Three Van Veen grab samples were collected at each station along with one core sample for analysis of physical and chemical properties of the seabed sediment.

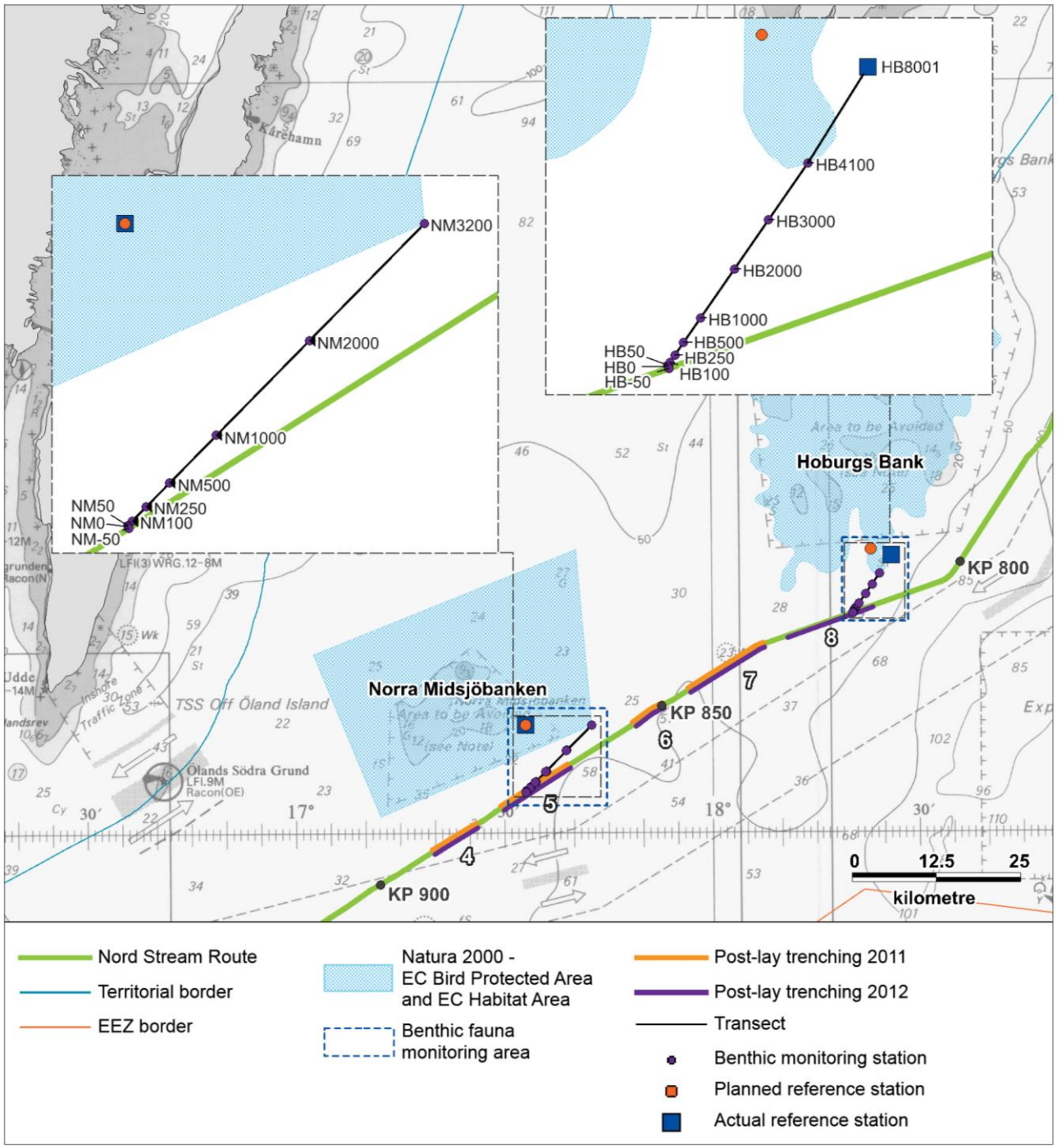

Figure 4.2 Areas for monitoring of infauna along the pipeline route, with locations for post-lay trenching indicated.

Monitoring of benthic infauna was carried out in 2010, 2011, 2012 and 2013. The data collected in 2010, prior to the start of construction activities, is used as a baseline. Further monitoring is planned to be carried out in 2014 (see Table 4.4).

Table 4.4 Summary of the monitoring programme for re-colonisation and recovery of benthic fauna in Sweden.

Benthic flora and fauna in Sweden	
Monitoring of re-colonisation and recovery of infauna	
Purpose	To evaluate and document re-colonisation and recovery of infauna
Areas to be monitored	One trenched area south of Hoburgs Bank and one trenched area south of Norra Midsjöbanken
Activity to be monitored	Post-lay trenching
Methods to be used	Samples collected by a Van Veen grab sampler; video inspections; sediment analysis, including grain size, dry matter, loss of ignition and total organic carbon at all stations; water measurements, including CTDO profiles at all stations
Period of monitoring	June to July 2010-2014. If the preliminary results from the monitoring show that the impact is insignificant or negligible, suggested changes for subsequent monitoring activities will be reported to the relevant authorities
Results	Documentation of the recovery and re-colonisation of infauna

Colonisation of the pipeline and rock berms by epifauna

The long-term presence of the pipeline on the seabed during operation may affect the epibenthic communities, as the pipeline may create a reef effect with the pipeline itself acting as a new substrate. The monitoring programme for benthic epifauna includes video inspections by ROV of the following pipeline sections:

- Where the pipeline is established directly on the seabed;
- Where the pipeline has been post-lay trenched into the seabed;
- Where the pipeline is supported by rock berms.

Monitoring of epifauna was undertaken at four locations on Line 1 in Swedish waters (see Table 4.5 and Figure 4.3). At each of these four locations 250 m of the pipeline was recorded by three video cameras covering the top and sides of the pipeline. The cameras were mounted on an ROV. Monitoring has been planned for July or September of every year from 2011 to 2014, with the overall objective of enabling assessments of a potential reef effect.

Table 4.5 Locations of monitoring areas for benthic epifauna on Line 1 in Sweden.

Station name	Reason for monitoring	Visual inspection[1]	Section
Area: HNB	Pipeline established directly on the seabed	ROV 250 m	KP 865.810-865.560
Area: NMT	Trenching	ROV 250 m	KP 873.370-873.120
Area: NMR	Pipeline established directly on the seabed	ROV 250 m	KP 900.830-900.580
Area: NMR_{new}[2]	Rock placement	ROV 250 m	KP 883.252-883.015

[1]: Cameras covering both sides and the top of the pipeline.

[2]: NMR_{new} was included after the original scope for epifauna monitoring as rock placement was cancelled in area NMR where monitoring was originally planned. Monitoring of epifauna at NMR, however, is still carried out as the area remains a part of fish monitoring in relation to a potential reef effect

The video data are analysed to qualitatively describe the succession patterns and processes, together with the epifauna community composition. If applicable, organisms or benthic communities recorded are identified and quantified. Furthermore, yearly data are analysed and compared to document the progress of succession and speed of fauna growth on the pipelines.

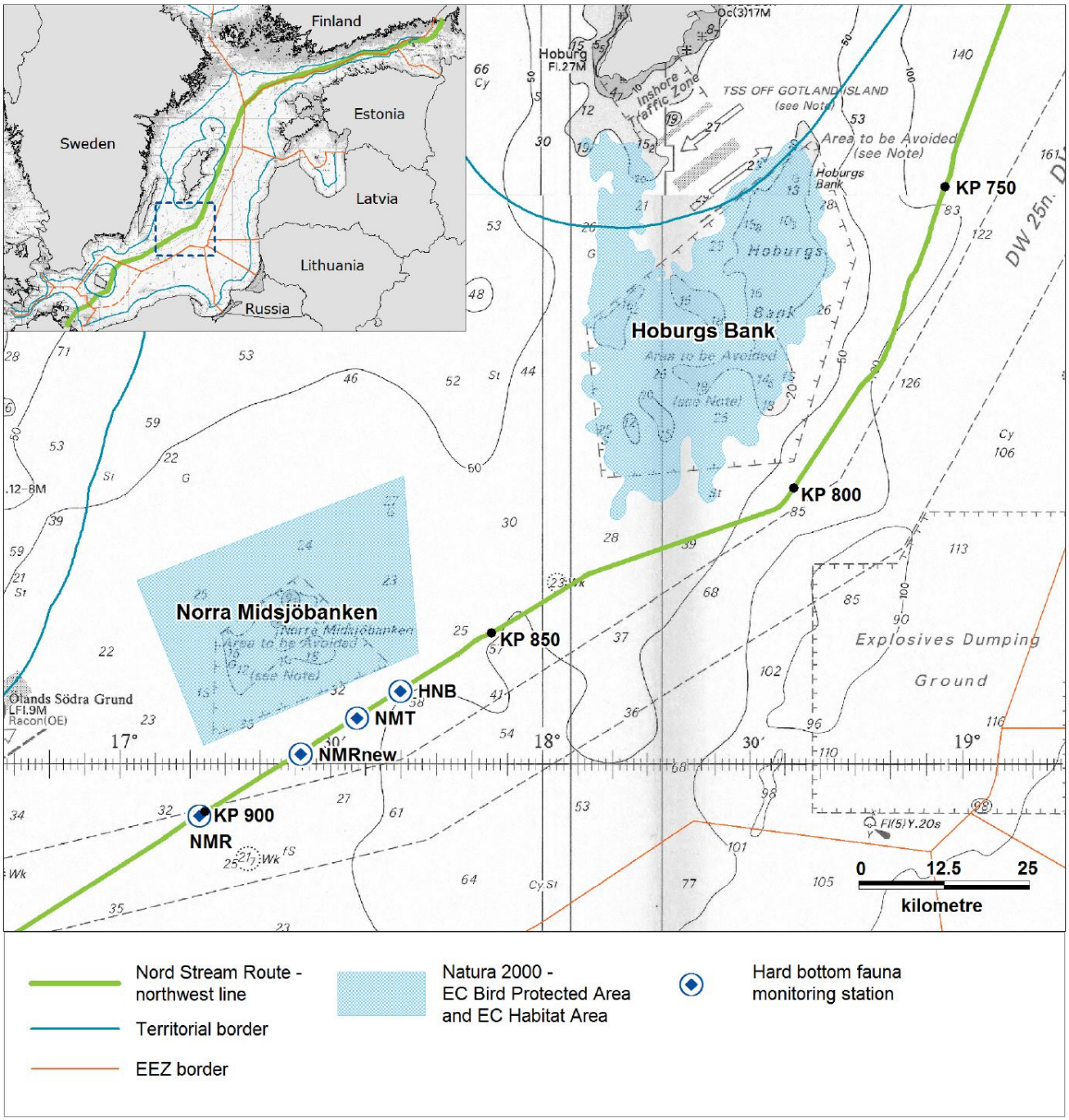

Figure 4.3 Areas for monitoring of benthic epifauna in Swedish waters.

Table 4.6 Summary of the programme for monitoring the establishment and growth of epifauna on the pipeline in Sweden.

Benthic flora and fauna in Sweden	
Monitoring of establishment and growth of epifauna on the pipeline	
Purpose	To evaluate and document the establishment and growth of epifauna on the pipeline
Areas to be monitored	Four selected locations near Norra Midsjöbanken along Line 1
Activities to be monitored	A trenched section, two sections with pipeline established directly on seabed and a section with rock placement
Method to be used	ROV video recording for qualitative assessment of epifauna on the pipelines and on rocks at rock placement location
Period of monitoring	September to October 2011-2014
Results	Documentation of the establishment and growth of epifauna on pipelines and rocks

4.2.2 Monitoring and results for 2013

Monitoring of infauna

In the Swedish ES it was calculated that even in roworst-case scenarios, only very small amounts of sediment would be suspended during pipe-laying and anchor-handling. It was therefore concluded that the effect of suspended seabed sediment and settling due to pipe-laying directly on the seabed on benthic flora and fauna was negligible or non-existent. The resulting net sedimentation from trenching and rock placement was calculated to settle within close vicinity (a few hundred metres) of the pipeline, resulting in very minor net sedimentation in areas up to a few kilometres from the pipelines /8/. Areas in close vicinity to the pipelines could experience a net sedimentation of >1 mm. The duration of a 1 mg/l concentration was calculated to be in the range of 1-24 hours, after which conditions would return to normal. For rock placement, the 1 mg/l concentration occurred at a maximum distance of 1-2 km from the pipelines and had a duration of less than 12 hours. It was concluded that the scale/intensity of effects would be minor, the geographical extent of effects would be local and the duration of effects would be short-term.

The sampling programme in 2013, at each of the ten (10) stations at Norra Midsjöbanken and eleven (11) stations at Hoburgs Bank, were carried out in the beginning of June and included the following activities at each station:

- Underwater video recording of the seabed;
- Measurement of conductivity (salinity), temperature and oxygen concentration in a profile with 1 meter intervals from the surface and close to the bottom;
- Collection of the uppermost 2 cm of the sediment using a Haps core sampler for analysis of selected physical and chemical variables;
- Three (3) van Veen samples (unit size: 0.1 m2) for analysis of the benthic fauna. Each sample was sieved in a 1 mm mesh sieve and the sieving residues (including the benthic fauna) were preserved in ethanol.

Results from the 2013 survey showed no stratification in salinity. Moreover, the salinity differences between the years 2010 to 2013 were small, with all values measured, from the entire water column at the measuring positions, in the range of 7.0-7.7 psu /22/. In 2013 there was, as in the other years,

a marked thermocline, separating water surface waters from colder water near the seabed. The oxygen concentrations in all the years 2010-2013 were high throughout the water column (within the range 8-12 mg/l at all the stations), also close to the seabed. Although conditions may have changed in late summer/early autumn, the measurements indicated oxygen conditions favourable for the benthic fauna. This is further supported by the fact that the surface of the sediment was oxidised at all stations at Norra Midsjöbanken and Hoburgs Bank during all measuring campaigns in 2010-2013, and no odour of hydrogen sulphide was recorded.

Hoburgs Bank:
The surface sediment at the potentially most affected station HB -50, located about 50 m from Line 1 and Line 2, consisted of fine sand. In 2010-2013 the changes in the median grain size of the sediment were limited at station HB -50 and most other stations. The silt and clay fraction of the sediment varied in the period 2010-2013. The highest values were measured at stations HB -50 and HB 0 in 2012 and at station HB 50 in 2013. However, an equally high value was measured at station HB 100 in 2010. The content of organic matter in the surface sediment was low at all stations and the variations were limited in the period 2010-2013.

The changes of the fine fraction (silt and clay) of the sediment at stations HB -50, HB 0 and HB 50 in 2012 and 2013 could be a potential impact of the marine construction work during the laying of Line 2. However, considering the time lapse between the last seabed works and the monitoring in 2012 it seems most likely that the changes in the fine fraction of the sediment were caused by a natural patchiness in the composition of the sediment. In addition, analysis of one sediment sample per year may not be fully representative of the sediment composition at the sampling stations, and variations from year to year must be expected.

Since the baseline surveys in 2010 the abundance and biomass of the benthic fauna has increased significantly due to natural variations. The similarity of the benthic fauna was high due to a predominance of the same species of polychaetes (*Marenzelleria spp*. and *Pygospio elegans*), bivalves (*Macoma balthica* (especially biomass)) and crustaceans (*Monoporeia affinis* and *Saduria entomon* (biomass)). In the analysis based on abundance the structure of the benthic community was different between each of the years 2010 to 2013. However the analysis based on biomass was similar in the period 2011-2013.

The significant general increase in abundance and biomass of the benthic fauna in the period 2010 to 2013 at Hoburgs Bank must be regarded as a natural variation. However, compared to the previous years the structure of the benthic community at station HB -50 and the other stations was significantly different in 2013 due to a decline in abundance and biomass. The deviating development in 2013 at station HB -50 closest to Pipeline No. 2, may be result of a weak and local delayed impact on the benthic fauna of the marine construction work in 2012.

Norra Midsjöbanken:
The median grain size of the surface sediment at the potentially most affected station NM -50 located between Line 1 and Line 2 has steadily increased from median sand in 2010 to very coarse sand in 2013. The silt and clay fraction of the sediment at station NM -50 was highest in 2010 and lowest in 2013. Compared with station NM -50 the changes in the median grain size of the sediment at the nearby stations NM 0 and NM 50 were different in the period 2010-2013.

It is therefore assumed that the recorded opposite temporal variations in the sediment composition at station NM -50 compared with stations NM 0 and NM 50 in the period 2010-2013 are a result of the combined effect of the heterogeneous sediment conditions in the area and the resulting difficulties in taking representative samples of surface sediments.

Outside the trenches themselves and the limited areas with trenched spoils along the trenches, there is no significant evidence of negative environmental effects on the sediment conditions caused by Nord Stream construction work and pipe-laying activities at Norra Midsjöbanken.

The abundance and biomass of the benthic fauna has increased significantly since the baseline surveys in 2010. The similarity of the benthic fauna is high due to a dominance of the same few species of polychaetes (*Marenzelleria spp*. and *Pygospio elegans*), bivalves (*Macoma balthica*) and crustaceans (*Monoporeia affinis* and *Saduria entomon*). The structure of the benthic community was similar in 2011, 2012 and 2013, but in each of the years it was significantly different from the community structure in 2010.

In spite of the overall high similarity of the benthic fauna the structure of the benthic community at station NM -50, closest to Line 2, was different from stations NM 0 and NM 50 and the remaining stations in 2013 and 2012, but not in 2011 and 2010.

The low abundance and biomass at station NM -50 and the significant difference in the structure of the benthic community between station NM -50 and the other stations could be a result of a weak and local immediate and prolonged impact of the seabed work in 2012. The steady increase in median grain size and the reduction in silt and clay fractions of the surface sediment at station NM -50 may be unfavourable for the mainly deposit feeding *Macoma balthica*. However, the changes in the sediment composition observed in 2010-2013 at station NM -50 are not assumed to be related to the marine construction work.

It is therefore unlikely that deployment and trenching of Line 2 had any measurable immediate or prolonged impact on the qualitative and quantitative composition of the benthic fauna and the structure of the benthic community at Norra Midsjöbanken in 2012 and 2013.

Monitoring of epifauna

The established pipeline is expected to create new habitats for hard-bottom associated fauna (fouling). Artificial hard-bottom habitats, with a function similar to natural hard bottoms, are called artificial reefs. Artificial reefs have been proven to be suitable substrate for sessile algae and organisms. Fouling on the artificial reefs creates new habitats and increases the availability of food, and can also attract mobile fauna. The new habitat not only creates a larger availability of food but also provides shelter from predators. This will increase the number of mobile fauna, such as fish, near the artificial reefs, potentially causing a reef effect.

The low salinity in the Baltic Sea is a limiting factor for the distribution of many species and leads to a reduction in predator pressure, especially on the common blue mussel. In the Baltic Sea, a monoculture of blue mussels and an increased abundance of fish have been found at artificial structures such as windmill foundations and bridges. It is assumed that the blue mussel will settle on the pipeline in the Swedish areas over time. Another common filter feeder in the Baltic Sea is the

acorn barnacle (*Balanus improvisus*). Barnacles can initially be rapid colonisers, especially on smooth surfaces where blue mussels are less capable of settling. However, in the long term blue mussels are able to outcompete the barnacles. It should be kept in mind that it may take several years before a hard-bottom community stabilises on a new hard-bottom substrate. Consequently, it may take several years to obtain solid analysis and conclusions concerning the potential new epifauna community.

The monitoring of epifauna was conducted in four areas along the pipeline (Line 1): HNB, NMT, NMR and NMR_{new}. Epifauna monitoring was initiated in July 2011 after the establishment of the first pipeline and placement of rock berms was completed, followed by monitoring in September 2012 and August 2013.

In 2013, the video recordings from the four analysed areas on Line 1 in Swedish waters revealed an establishment of blue mussels in the NMR_{new} area and a possible establishment of blue mussels in the HNB area (see Figure 4.4 and Figure 4.5). One mobile species of epifauna, the crustacean *Saduria entomon*, was identified to be present on and next to the pipeline in higher numbers compared with previous surveys carried out in 2011 and 2012. In addition, two species of fish, shorthorn sculpin and cod, were observed on and in close vicinity of the pipeline. No fish were observed in 2011.

Figure 4.4 Still photos from the west side of the pipeline (Line 1) at HNB (left) and NMT (right) in 2013. Two shorthorn sculpin and two *Saduria entomon* are visible in the HNB photo; one cod is visible in the NMT photo**.**

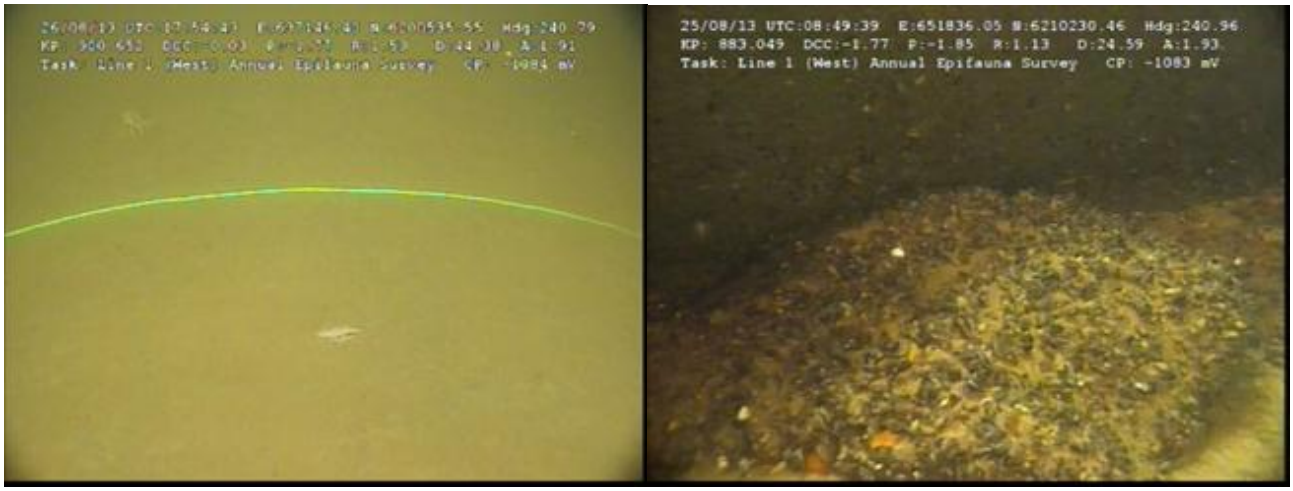

Figure 4.5 Still photos from NMR (top of Line 1) and NMR_{new} (west side of Line 1) in 2013. Two *Saduria entomon* are visible in the NMR photo; at NMR_{new} blue mussels are growing on rocks at the seabed and on the pipeline surface.

5 Socio-economic monitoring within the Swedish EEZ in 2013

5.1 Monitoring/mitigation measures at national and international monitoring stations

In order to determine whether the establishment of the Nord Stream Pipeline affected governmental or international monitoring programmes, the locations of these monitoring stations were identified in relation to the pipeline route and the related construction and operation activities. The coordinates of both national and international monitoring stations were investigated, and information concerning locations and measured parameters was compiled. Impacts on environmental monitoring stations could be caused if:

- The time of monitoring activities coincides with construction work;
- The monitoring stations are located close to areas with seabed intervention works (trenching or rock placement) and therefore potentially affected by re-sedimentation of sediment brought into suspension during construction;
- The monitoring stations are very close to the pipelines and thereby potentially affected by local changes in erosion/sedimentation patterns around the pipelines during operation.

Four of the existing monitoring stations in the Swedish EEZ are located within ±1.5 km of the pipelines, and one SMHI station is located in the Finnish EEZ. Mitigation measures were proposed and agreed with the authorities. During construction of both Line 1 and Line 2 the station owners and the relevant authorities were updated in the event of construction schedule changes in order to mitigate and avoid influencing the monitoring programmes.

In addition an alternative position for station SE-11 (in the Bornholm Basin in the Swedish EEZ), which was measuring contaminants in sediments, was investigated. The Geological Survey of Sweden (SGU) carried out these investigations, which included, e.g., seven core sites, sampled with six cores each, amounting to a total of 42 cores. All sediment cores were very uniform and exhibited reduced post-glacial clay from a recent accumulation bottom. Underwater photos showed a smooth bottom with white patches of sulphur bacteria (*Begiatoa sp*.) at the surface. Major and minor elements, organic carbon and nitrogen were analysed in the topmost 0-1 cm at each core site, while the analyses of organic contaminants were performed only on a mixed sample containing the same volume of topmost sediment from each of the seven sites. The mixed samples were also analysed for major and minor elements, organic carbon and nitrogen. Some retrospective analyses of deeper sediment layers were carried out in order to establish pre-recent background concentrations.

The conclusions have not yet been finalised but the results thus far are very promising. The ocular sediment examination and bottom photo results together with the radiographic analyses show that the physical demands placed on a national environmental monitoring station are met at the new location for the station SE-11 /23/.

The sediment sampling survey by SGU, which is part of the national sediment monitoring programme, is repeated approximately every five years. The next sampling survey is planned to take place in 2014. The detailed timeline is to be decided by SGU and the Swedish Agency for Marine and Water Management (SwAM) and the information is yet to be provided to Nord Stream AG.

It is currently expected that samples will be taken from both locations (old and new location) in 2014 but that only material from one (the new) station will be analysed and used, in case no unexpected results are found. The extra sampling is carried out in order to have samples from the old location in the event that the results from the new station should prove to be wrong or unexplainable. The time series thereafter will continue based only on samples taken at the new location. A final decision regarding the set-up of the survey, however, is yet to be taken by SGU and SwAM ahead of the sampling campaign in 2014.

5.2 Monitoring of cultural heritage

5.2.1 Monitoring programme

The purpose of cultural heritage monitoring is to document whether identified wrecks in the vicinity of the Nord Stream Pipeline have been affected by pipeline construction activities.

In 2009, prior to the construction of the Nord Stream Pipeline, detailed security and anchor corridor surveys were performed in order to investigate the presence of cultural heritage sites within the anchor corridor (± 1 km from the pipeline route). Additionally, areas of directly affected seabed were surveyed prior to rock placement, trenching and pipe-laying to verify the seabed conditions, i.e., that no new objects were present.

Figure 5.1 shows the locations of monitored wrecks in Swedish waters.

5.2.2 Monitoring and results for 2013

The monitoring programme includes nine archeologically significant wrecks in Swedish waters (see Figure 5.1. Seven of these were monitored in July 2012 (see Ref. /11/), whereas two of the wrecks were monitored and reported on in 2013; wreck R-32-92762 on 17 March 2013 and wreck R-32-92558 on 21 March 2013 (see Ref. /24/ and Ref. /25/).

The status of the seven wrecks surveyed in 2012 (Ref. /11/) is summarised below.

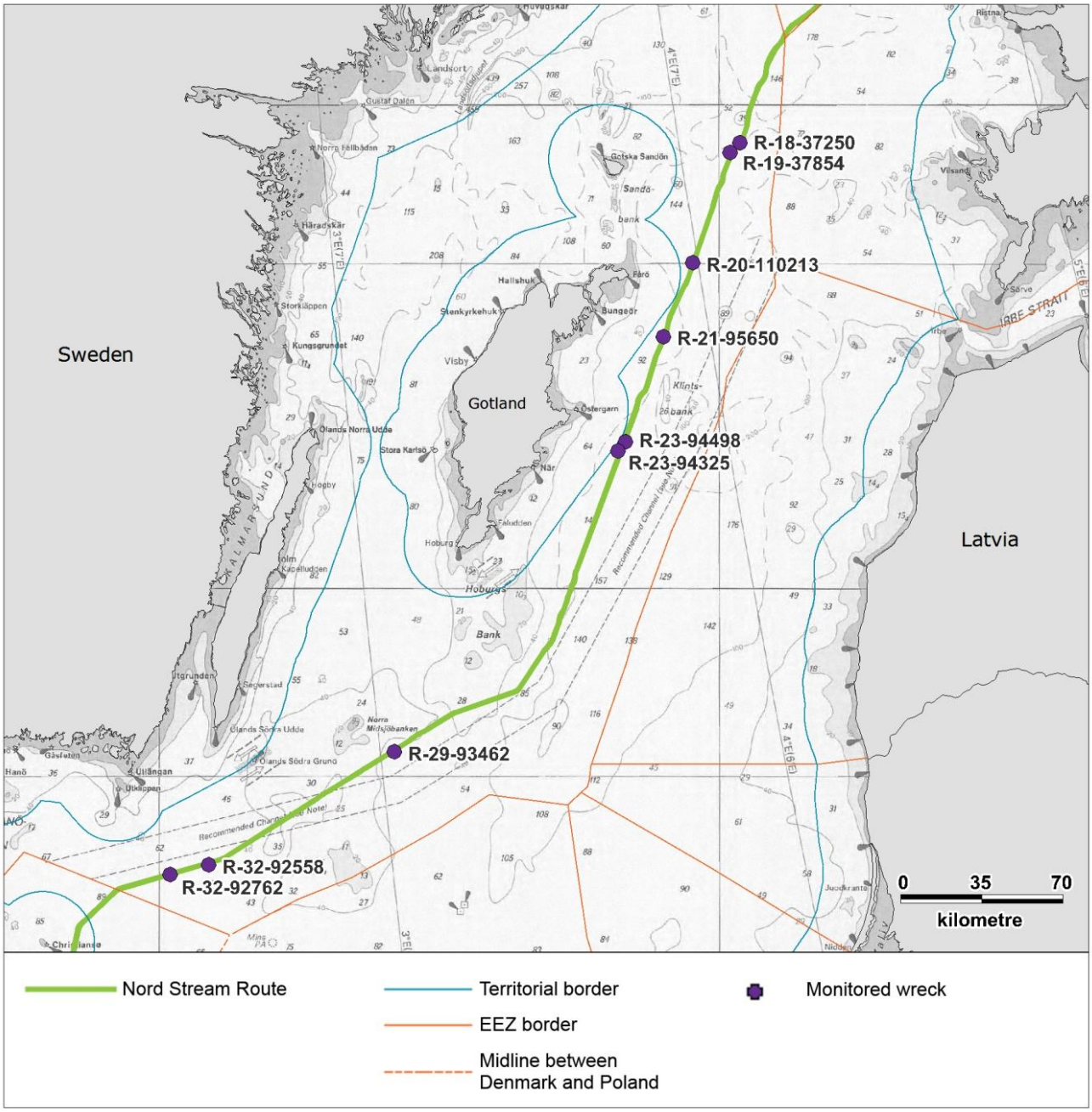

Figure 5.1 Locations of wrecks included in the Nord Stream monitoring programme in Swedish waters.

Wreck R-32-92762
In the area for inspection, a large amount of wreck debris was found. The debris consisted mostly of planking and other wooden details; no steel remnants of a ship were found. There was no distinguishable vessel shape, however, the planking area was more concentrated around one smaller area of the wreck site. Most small objects were found in this area during the inspection (see Figure 5.2).

Notable was a possible ship bell and bell trestle situated in the centre of the main target area. In the south-east part of the planking concentration, parts of a ship knee were found. In both the central area and spread outside the area, possible spars and rigging parts were distinguishable. Planking was found occasionally up to 100 m from the centre. The centre area measures 25 x 15 m heading 020° north (Ref. /24/).

The revisited events and the overall impression of the wreck are consistent with the survey results from the pre-lay investigation conducted in December 2009. Visibility during the inspection period was poor. Nevertheless all objects from the pre-lay survey of wreck ID R-32-92761/R-32-92762 were found.

The comparison demonstrates that the position and condition of the wreck ID R-32-92761/R-32-92762 appears unchanged providing the conclusion that the installation of pipeline Line 2 (East) has had no impact on wreck ID R-32-92761/R-32-92762 (Ref. /24/).

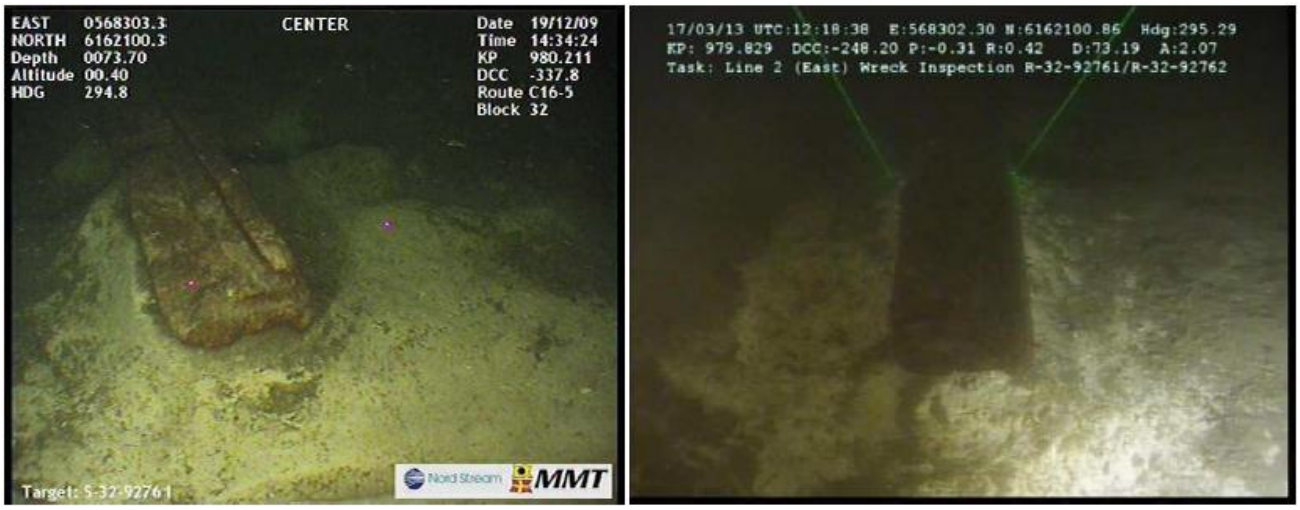

Figure 5.2 Wreck R-32-92762, Event ID 5 – side view of Event 4. Photo before construction left (pre-lay Line 1 inspection, 19 December 2009) and after construction right (post-lay Line 2 inspection, 17 March 2012). From Ref. /24/.

Wreck R-32-92558
The wreck ID R-32-92558, lying at an approximate bearing of 315º, consists of large amounts of debris, mostly of planks and other pieces of wood such as ribs which probably belong to the wreck. In addition, some bowls, a chain an anchor forward windlass, a rudder and a tiller were found (see

Figure 5.3). The depth of the wreck is approximately 70 m, lying on fine but relatively firm sediment. The debris covered an area of 140 x 160 m indicating that wreck ID R-32-92558 was most probably trawled over on several occasions, resulting in a wide scattering of debris. The large number of trawl scars that dissect the area as shown on the MBES image would appear to confirm this hypothesis (Ref. /25/).

By comparing the positions and features on each image with the pre-lay wreck investigation it was possible to establish whether the wreck had been interfered with or otherwise affected by pipeline installation activities.

The revisited events and the overall impression of the wreck are consistent with the survey results from the pre-lay investigation conducted in 2009. Visibility during this inspection period was comparatively worse than during the pre-lay survey. The position and condition of the wreck ID R-32-92558 appears to be unchanged and the comparison of images and positional data demonstrates that Line 2 (East) installation had no impact on wreck ID R-32-92558. From the evidence available it does not appear as though the wreck site has been disturbed since the pre-lay inspection conducted in 2009 (Ref. /25/).

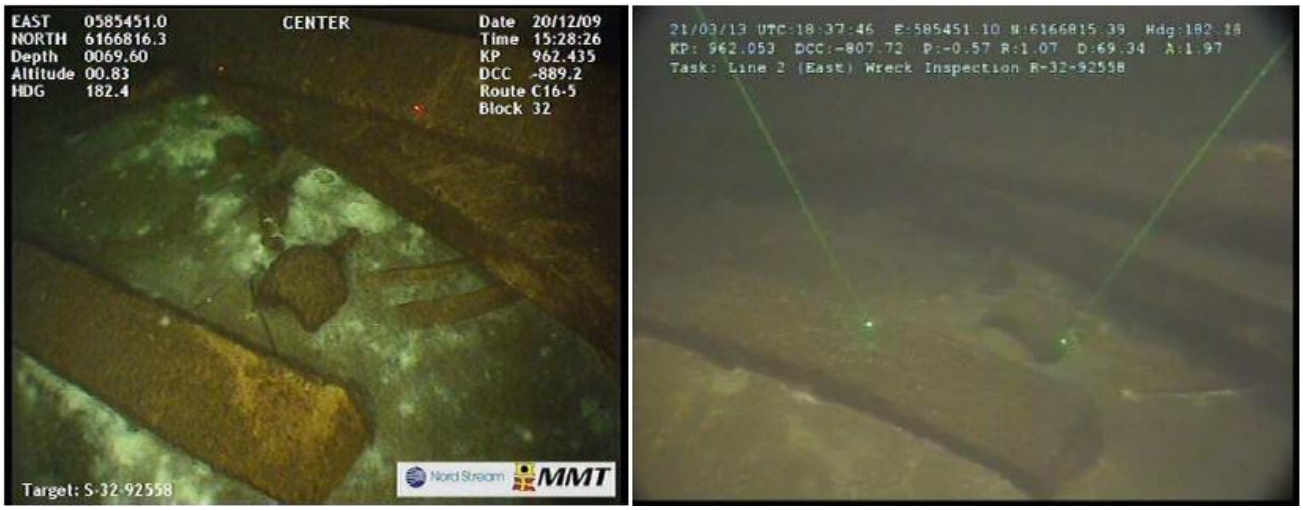

Figure 5.3 Wreck R-32-92558, Event ID 82 – debris including a possible bottle. Photo before construction left (pre-lay Line 1 inspection, 20 December 2009) and after construction right (post-lay Line 2 inspection, 21 March 2012). From Ref. /25/.

Wreck R-18-37250

The wreck R-18-37250 consists of part of the side of a ship, built up by ribbing, clinker and inside planking covering an area of approximately 16 x 6 m. Much of the ship is missing, so it is difficult to estimate the total length of the wreck. No other remains were found at the site and most probably were swept away by trawling (trawl marks can be seen close to the wreck site in SSS data).

Monitoring in 2012 showed that the wreck was not affected by pipeline construction.

Wreck R-19-37854
The wreck R-19-37854 is a wooden ship with a hull in caravel style. The stern of the ship is rounded with a steep slant, and the octagonal lower part of the bow sprit stretches out 6 m from the stern. On both sides of the bow, decorative carvings around the hawse hole were observed. The wreck is 29 x 7.8 m, heading east-northeast.

Monitoring in 2012 showed that e.g. the capstan had fallen over and was covered with broken planks and that the windlass was damaged. It is believed that during construction of Line 1 an anchor chain hit and impacted the wreck, mainly in the stern section.

Wreck R-20-110213
Wreck R-20-110213 is a wooden ship that appears to have been a Dutch Flute due to its simple construction, carvings and adornments. The wreck is semi-buried in fine sediment. It is possible that the ship may have hit the seabed heavily, as the bow displays major damage while the aft section seems to be complete, with only minor damage. The rudder and tiller are intact.

Monitoring in 2012 showed that the wreck was not affected by pipeline construction.

Wreck R-21-95650
Wreck R-21-95650 is a largely intact wooden ship. From its low freeboard and rectangular shape (with rounded corners) the wreck appears to have been some sort of barge, although the suggested existence of masts would indicate otherwise (a barge by definition lacks propulsion). Lying upright on the seabed, the site spans some 17 x 5 m with a heading of approximately 258º.

Monitoring in 2012 showed that the wreck was not affected by pipeline construction.

Wreck R-23-94498
Wreck R-23-94498 is an intact and well-preserved wooden vessel of significant historical and cultural value. Some 51 m in length and 9 m in width, the wreck sits on its keel and is tilted slightly towards its stern and portside. Lying on a bed of fine sediment, there is some scouring of sediment around the stern on the north-northeast side of the wreck and at the side of the bow.

Monitoring in 2012 showed that the wreck was undisturbed since the last inspection in 2009, although slightly more covered with sediment.

Wreck R-23-94325
Wreck R-23-94325 consists of the side of a ship (characterised by a row of ribs) and several other wooden artefacts. The debris sits on a flat area of soft clay and is partly buried in sediment. The extent of the wreck site spans some 50 x 5 m.

Monitoring in 2012 showed that the wreck was not affected by pipeline construction.

Wreck R-29-93462
Wreck R-29-93462 consists of scattered pieces of wooden wreckage. In addition, blocks of limestone and several rounded containers were found. No larger pieces of the wreck were found.

The wreck site (30 x 30 m) was most probably trawled over by fishing vessels, as indicated by the wide scattering of the wreck material.

Monitoring in 2012 showed that the wreck was not affected by pipeline construction.

5.2.3 Archaeological analysis of the wrecks in Swedish EEZ after construction

Ahead of the construction of the pipeline, 12 wrecks were visually inspected using an ROV. After the pipeline was laid down, the nine wrecks that were identified as cultural heritage monuments by the standards of the Swedish Heritage Conservation Act (1988:950) were visually inspected again. This was done to determine whether the construction of the Nord Stream Pipeline had affected those wrecks.

The ROV recordings were analysed by the Department of Archaeology at the Swedish Maritime Museum in Stockholm. The results with respect to the status of the identified cultural heritage wrecks in proximity to the pipeline route after the construction works were presented in a concluding report (Ref. /26/).

The analysis showed that one wreck (R-19-37854, see Section 5.2.2) had been damaged by an anchor cable (see Figure 5.4). The damage was mainly to the deck level, while the hull remains relatively intact. The anchor cable caused objects to break away from the wreck and in some cases these parts were not found.

On the other wrecks there were no changes that could be attributed to the pipeline work. On some wrecks minor changes were identified. However, these small changes (in two of the cases) can be attributed to trawling, since these wrecks already showed trawling damage in 2009.

Figure 5.4 Rudder of R-19-37854, before (left, 2009) and after (right, 2011) damage caused by an anchor cable during construction (from Ref. /26/).

On the other wrecks there were no changes that could be attributed to the pipeline work. On some wrecks minor changes were identified. However, these small changes (in two of the cases) can be attributed to trawling, since these wrecks already showed trawling damage in 2009.

5.3 Monitoring of maritime traffic

The purpose of control and monitoring by Nord Stream AG in relation to marine traffic was to minimise the risk of collisions or other accidents involving commercial ship traffic and/or vessels performing construction activities for the project. Safety zones of varying sizes were established around all vessels performing underwater construction work and vessel management systems (such as the AIS for identification and locating of vessels) used. In accordance with agreements, information on upcoming and ongoing construction activities was provided regularly to the relevant authorities, who in turn shared this information via channels such as Notices to Mariners and NAVTEX.

Prior to survey activities carried out for the Nord Stream Pipeline in 2013, Survey Notifications were submitted to the Swedish Maritime Administration.

Nord Stream AG issued on 28 January 2013 a Survey Notification to the Swedish Maritime Administration concerning an ROV visual and instrumental external survey along Line 2 that was planned to be carried out within the period 24 February to 3 April 2013. Also included in the notification was a cathodic protection survey, a post-lay survey of wrecks and an epifauna survey along pre-defined sections of Line 1 /27/.

Nord Stream AG issued on 18 June 2013 a Survey Notification to the Swedish Maritime Administration concerning post-construction survey works along Line 1 in the Swedish EEZ, utilising an ROV deployed subsea from the vessel. The survey included determination of the position and condition of the pipeline together with any interventions works /28/.

6 Comparison of monitoring results with the assessment in the Swedish ES

The comparison of the monitoring results with the assessment of effects and impacts in the Swedish ES is only possible for monitoring programmes that have been fully finalised.

The monitoring carried out in the Swedish EEZ in 2013 (fish along the pipeline, infauna, epifauna) will be finalised in 2014, following which conclusions will be drawn relative to the assessment in the Swedish ES.

For the period 2010-2013 this includes environmental monitoring in connection with /11/:

- Munitions clearance for Line 1 and Line 2 (completed in 2010)
- Cable crossings for Line 1 and Line 2 (completed in 2010)
- Hydrographical conditions in the Bornholm Basin for Line 1 (completed in 2011)
- Ecotoxicological effects on mussels for Line 1 (completed in 2011).
- Water quality for Line 1 and Line 2 (completed in 2012)

The results from the munitions clearance and cable crossings show that impacts on the environment were restricted to the immediate vicinity of these activities. This is in line with what was assessed in the Swedish ES, where it was stated that the overall impact on the environment from munitions clearance and cable crossings would be insignificant, as effects would be local.

The results from monitoring of hydrographical conditions in the Bornholm Basin showed that the mixing between inflowing saline and oxygenated water and overlying water masses caused by the presence of the pipelines on the seabed in the Bornholm Basin was approximately five times less than estimated and presented in the Swedish ES, hence on a level which makes potential changes impossible to distinguish from natural variations.

The results from monitoring of ecotoxicological effects on mussels at the impact and reference stations inside the two Natura 2000 areas Hoburgs Bank and Norra Midsjöbanken showed no connection to Nord Stream activities and were therefore in accordance with the assessment in the ES. On the basis of the results from 2010-2011 it was assessed that monitoring for Line 2 would not be carried out.

After monitoring of Line 1, it was deemed unnecessary to carry out monitoring of water quality in connection with construction of Line 2 to the same extent as during construction of Line 1. Monitoring in 2012 for Line 2 was carried out on three sections considered the potentially most critical due to the fact that they were closest to the Natura 2000 areas Norra Midsjöbanken and Hoburgs Bank. On the basis of the results from the monitoring of water quality in 2010-2012 it was concluded that no impact from the trenching works could be measured at the long-term monitoring stations. Furthermore, it was shown that the assumptions regarding sediment spill and sediment spreading in the Swedish ES were conservative (i.e., on the safe side). The sediment spill rate and the increase in SSC were smaller than assumed. The modelling of sediment spreading carried out as part of the ES prior to construction showed that spilled sediments would not reach the border of the two Natura 2000 areas. This was confirmed by the monitoring for Line 1 and for Line 2.

In addition to the environmental monitoring, socio-economic monitoring was carried out for:

- Cultural heritage;
- National and international monitoring stations close to/relatively close to the Nord Stream Pipeline;
- Seabed morphology;
- Maritime traffic.

A post-lay wreck survey was undertaken in 2012 and 2013 to verify the condition of nine archeologically significant wrecks in Swedish waters after the establishment of Line 1 and Line 2. The conclusion, from the Swedish Maritime Museum assessment and the monitoring carried out by Nord Stream, was that one wreck had been impacted by an anchor chain during construction of the Nord Stream pipelines. No construction related changes could be seen on any of the other eight shipwrecks.

Monitoring/evaluation of effects on national and international monitoring stations in the Baltic Sea resulted in a successful search for an alternative location for the station SE-11, one of the Swedish monitoring stations in the northern part of the Bornholm Basin. SGU carried out investigations of the seabed around station SE-11 in 2010 and found a new location for the station 10 km from the Nord Stream Pipeline, where there would be no risk of impact on the station from construction activities. There was no risk of impact to the other national and international monitoring stations during Nord Stream construction activities in 2010-2012.

Monitoring of changes in seabed morphology during and after pipe-laying did not show any significant changes. Changes caused by pipe-laying and rock placement were local and only evident in the very close vicinity of the pipeline.

During construction in the Swedish EEZ, Nord Stream and its construction vessels followed the communication and reporting procedures that were agreed upon with Swedish authorities and organizations. Nord Stream provided the relevant authorities with notifications four weeks prior to commencement of new construction activities and with daily updates from the construction vessels as well as weekly and monthly forecasts. Information for the fishing community was provided regularly from the time construction activities started and continued throughout the construction period.

Throughout the project period there were no accidents or near misses in relation to maritime traffic, including fishing vessels. Also, the impacts on maritime traffic were found to be minor, local and short-term, as also assessed in the Swedish ES.

7 Conclusion

The results from the elements of the Nord Stream monitoring programme completed in 2010-2012 confirm the conclusions from the environmental surveys: that effects and impacts on the marine environment were limited to the immediate vicinity of the pipelines. This is in accordance with assessments in the Swedish ES. Furthermore, impacts were assessed to be local and of minor to insignificant effect.

The conclusions based on the monitoring up to and including 2013 are listed below. Final conclusions will be drawn after finalisation of the environmental monitoring activities in 2014.

Monitoring of fish along the pipeline:
The monitoring of fish along the pipeline has taken place yearly since 2010, before, during and after the period of construction of the pipeline. The monitoring has taken place at three impact stations (where the pipeline is laid on the seabed, where the pipeline is trenched into the seabed, and where the pipeline is stabilised with rock berms) and three reference stations, one for each of the nimpact stations.

It is difficult to draw any long-term conclusions regarding impacts from the pipeline on the fish community. The results thus far should be regarded as short-term ecological effects on the demersal fish community in the Baltic Sea. Nevertheless, it can be stated that the abundance of fish along the pipeline has not decreased in the two years since the start of operation of the pipeline nor have there been any effects on the composition of demersal fish that can be attributed to the presence of the pipeline.

Monitoring of benthic infauna:
The monitoring of benthic infauna at the two locations south of Norra Midsjöbanken and south of Hoburgs Bank showed a fauna community that was in accordance with the results from earlier monitoring undertaken by Nord Stream and HELCOM. Furthermore, it was concluded that the recorded temporal changes in benthic infauna since 2010 and the spatial differences in 2011, 2012 and 2013 were results of natural changes in the composition and structure of the benthic community.

Monitoring of benthic epifauna:
The monitoring of epifauna was conducted in four areas along the pipeline (Line 1). Epifauna monitoring was carried out yearly since July 2011, after the establishment of the first pipeline and placement of rock berms was completed.

As expected, epifauna has gradually established on the pipeline surface, which acts as a hard substrate for the benthic epifauna similar to a stone reef. In 2013, the video recordings from the four analysed areas on Line 1 in Swedish waters revealed an establishment of blue mussels in one area and a possible establishment of blue mussels in another area. Also other epifauna species has gradually established on the pipeline surface.

It is expected that the epifauna coverage on the pipeline surface will increase for a number of years until the epifauna communities has established in a mature stage.

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APPENDIX A

Sammanfattning (Svenska)

1 Sammanfattning

1.1 Inledning

Nord Stream är en offshore naturgasledning från Ryssland till Tyskland. Nord Streams rörledningar ansluter de stora naturgastillgångarna i Ryssland till det europeiska nätverket av naturgasledningar. Systemet har kapacitet att leverera 55 miljarder kubikmeter naturgas per år till de europeiska konsumenterna.

Rörledningssystemet ("Nord Stream Pipeline") är ca 1 224 km långt. Rörledningarna korsar de exklusiva ekonomiska zonerna (EEZ) i Ryssland, Finland, Sverige, Danmark och Tyskland och territorialvatten (TW) i Ryssland, Danmark och Tyskland. Byggandet av den första rörledningen inleddes i april 2010 och avslutades i juni 2011. Driften påbörjades i november 2011. Byggandet av den andra rörledningen, som ligger parallellt med den första, påbörjades i maj 2011, avslutades i april 2012 och togs i drift i oktober 2012. Nord Streams rörledningar är konstruerade för att kunna användas i minst 50 år.

I tillståndet till anläggning av rörledningarna anges ett krav på miljökontrollprogram. Programmet ska omfatta verksamheten från 2010 till 2014 inom den svenska ekonomiska zonen och har utarbetats av Nord Stream i samarbete med de svenska myndigheterna.

Kontrollprogrammet omfattar följande miljö- och socioekonomiska parametrar:

Miljöparametrar:

- Kontroll av röjning av stridsmedel
- Kontroll av fisk längs rörledningen (reveffekter)
- Kontroll av fisk i Natura 2000-områden
- Kontroll av bottenfauna
- Kontroll av vattenkvalitet
- Kontroll av hydrologiska förhållanden i Bornholmsbassängen
- Kontroll av ekotoxikologiska effekter på musslor

Socioekonomiska parametrar:

- Kontroll av fisket
- Kontroll/skyddsåtgärder vid nationella och internationella mätstationer
- Kontroll av kulturmiljön
- Kontroll av sjöfarten

Denna rapport är den fjärde av fem planerade årliga rapporter, vars syfte är att dokumentera statusen av miljön före byggande och de potentiella effekterna under bygg- och driftfaserna. Detta kommer att möjliggöra en utvärdering av de potentiella effekterna av projekt i förhållande till och i enlighet med det svenska tillståndet /7/ och Miljöredovisningen /8/. De tidigare rapporterna omfattar redovisningen av kontrollerna som genomfördes under 2010 /9/, 2011 /10/ och 2012 /11/. Parametrar som kontrollerades under 2013 omfattar fisk längs rörledningen, bottenfauna, skyddsåtgärder vid nationella och internationella övervakningsstationer, kulturmiljö och sjöfarten.

Detaljerade beskrivningar av kontroll och resultat redovisas i särskilda kontrollrapporter, en för varje kontrollområde. En del av kontrollaktiviteterna slutfördes innan 2013 och de viktigaste resultaten från dessa undersökningar har tagits med i denna sammanfattning för att ge en fullständig bild av resultatet av kontrollen.

1.2 Anläggningsarbeten 2013

Inga anläggningsarbeten genomfördes under 2013.

En kort beskrivning av alla anläggningsarbeten som utförts för Nord Stream-projektet i den svenska ekonomiska zonen (2010-2012) finns i kapitel 3 i denna rapport. Beskrivningen ger en översikt av de miljöaspekter som var aktuella under anläggningstiden. Översikt ligger till grund för bedömningen av kontrollresultaten i syfte att fastställa om anläggningsverksamheten har orsakat en mätbar miljöpåverkan.

Förutom att bedöma möjliga effekter som orsakats av anläggningsverksamhet, syftar kontrollprogrammet till att fastställa eventuell påverkan som orsakas av rörledningarna på havsbotten, d.v.s. påverkan under driftfasen.

1.3 Kontroll av röjning av stridsmedel

Inför anläggningsarbetena ansågs det vara nödvändigt att röja sju stridsmedelsobjekt längs Nord Streams rörledningar i den svenska ekonomiska zonen. Dessa objekt röjdes framgångsrikt under perioden 19 mars - 3 april 2010 /9/, /12/.

Kontroll genomfördes och skyddsåtgärder vidtogs vid varje röjningstillfälle. Inga marina däggdjur observerades eller registrerades i det passiva akustiska kontrollsystemet (PAM), vare sig före eller efter röjningen av de sju stridsmedelsobjekten. Sälskrämmor aktiverades innan minröjningen för att ytterligare säkerställa att inga marina däggdjur skadades eller dödades till följd av verksamheten.

Tryckvågsmätningar vid sex av de sju röjningar visade att marina däggdjur kunde fått direkta fysiska skador på gasinnehållande organ och hörselorgan om de hade varit inom cirka 300 m från röjningsplatsen. Observatörer av marina däggdjur undersökte röjningsplatsen före och efter röjningen och PAM-systemet hade inte några registreringar av marina däggdjur. Därför kan det konstateras att inga marina däggdjur skadades eller dödades till följd av röjningarna i den svenska ekonomiska zonen. Dessutom kan det konstateras att inga sjöfåglar skadades eller dödades till följd av röjningskampanjen.

Akustiska fiskundersökningar genomfördes innan stridsmedlet sprängdes. Inga fiskstim registrerades vid röjningsplatsen och därför försenades ingen av röjningarna till följd av närvaro av större fiskstim. Oundvikligen ledde röjningen till viss dödlighet för fisk. Döda fiskar observerades vid fem av de sju röjningarna, uppgående till cirka 10 till 18 fiskar per röjning.

Röjning genom sprängning orsakade ett antal mindre kratrar på röjningsplatserna.

Slutligen gjordes inga oväntade fynd av kulturmiljöobjekt eller av kablar vid de visuella inspektionerna med fjärrstyrd undervattensfarkost (ROV) inom 1 km från röjningsplatserna. Det

förekom därför inte några oväntade negativa effekter på kulturmiljön till följd av röjningen av stridsmedel.

1.4 Kontroll av fisk längs rörledningen

Kontroll av fisk längs rörledningssträckningen genomfördes under september 2013. Kontrollen av fisk på och i närheten av rörledningen fokuserade på bottenlevande fiskarter eftersom rörledningen på havsbotten inte förväntas ha någon effekt på pelagiska fiskarter. För att få detaljerad information om artsammansättning och för att uppskatta kvantitativa förändringar till följd av potentiell reveffekt har provtrålning och garnfiske utförts. Dessutom har ekolodundersökningar genomförts.

En nulägeskontroll av fisk utfördes 2010, innan anläggningsarbetena påbörjades. Tre kontrollområden relativt nära Hoburgs Bank och Norra Midsjöbanken har undersökts.

Fisksammansättning vid 2013 års undersökning var likvärdig med undersökning från 2010 och dominerades starkt av torsk (*Gadus morhua*) och sill (*Clupea harengus*). Torsk är en bottenlevande fiskart och vanlig i området. Sill däremot, är en pelagisk fiskart och antas vara mindre attraherad av konstgjorda strukturer på havsbotten. Torsk har varit i fokus i redovisningen av resultat, eftersom de övriga bottenlevande fiskarter som förekom i fiskundersökning, t.ex. skrubbskädda (*Platichthys flesus*), rödspätta (*Pleuronectes platessa*) och rötsimpa (*Myoxocephalus scorpius*), endast påträffades i låga antal.

Det är svårt att dra några långsiktiga slutsatser avseende effekter av rörledningen på fiskbestånden. Resultaten hittills bör betraktas som kortsiktiga ekologiska effekter på de bottenlevande fisksamhällena i Östersjön. Hur som helst kan konstateras att fisknärvaron längs rörledningen inte minskat under de två åren som transport av naturgas i rörledningar har pågått. Det har inte konstaterats några effekter på sammansättningen av bottenlevande fisk som kan hänföras till att rörledningarna ligger på havsbotten.

1.5 Kontroll av fisk i Natura 2000-områden

Kontroll av fisk i de två Natura 2000-områdena Hoburgs bank och Norra Midsjöbanken genomfördes från 2010 till 2012. Syftet med kontrollprogrammet var att möjliggöra en bedömning av eventuella effekter på fiskfaunan inom de två Natura 2000-områdena till följd av anläggningsarbetena.

Kontrollprogrammet omfattar 40 stationer på Hoburgs bank och 40 stationer på Norra Midsjöbanken, varav 20 är "påverkan"-stationer, och 20 är referensstationer på respektive bank. Kontrollen omfattade garnfiske med K072 nät, CTDO-mätningar av konduktivitet (salthalt), temperatur, djup, syrehalt och Secchiskive-mätningar samt habitatbeskrivning genom inspelningar av havsbotten med undervattensvideo.

Som beskrivs i /3/ kan effekter på fisk orsakas av ökad grumlighet till följd av rörläggning och dikning av rörledningen. Kontroll av vattenkvaliteten 2010-2012, före, under och efter rörläggning och dikning visar att de antaganden om sedimentspill och sedimentspridning som gjorts i Miljöredovisningen var konservativa (d.v.s. på den säkra sidan). Sedimentspridningsmodelleringen, som genomfördes som en del av Miljöredovisningen före anläggningsarbetena startade, visade att sedimentspill inte skulle nå gränsen till de två Natura 2000-områdena vilket också bekräftades

genom kontroll av vattenkvaliteten vid anläggningen av rör 1 /13/.

Resultaten av de tre kontrollkampanjerna av fiskfauna, inne i de två Natura 2000-områdena, visade på naturliga variationer. Vidare visade kontrollen på vissa skillnader i fiskpopulationen i referensstationerna jämfört med ”påverkan”-stationerna vid de årliga kontrollomgångarna. Ingen av dessa skillnader (mellan åren och mellan ”påverkan”/referens-stationer) kan tillskrivas några effekter orsakade av anläggningsarbeten utan förmodas istället vara naturliga variationer.

Tidigare var kontrollen av fiskfauna inne i Natura 2000-områdena planerad att genomföras under perioden 2010-2014. Baserat på tillgängliga rapporter och analyser beslutade svenska myndigheter och Nord Stream gemensamt i februari 2013 att denna kontroll inte behöver fortsätta under 2013 och 2014 /14/.

1.6 Kontroll av bottenfauna

1.6.1 Bentiska infaunasamhällen

Vid Hoburgs bank har förekomst av bottenfauna ökat kraftigt på grund av naturliga variationer sedan undersökningarna av nuläge under 2010. Kontrollen av stationerna mellan åren hade stora likheter i bottenfauna på grund av hög dominans av havsborstmaskar (*Marenzelleria spp*. och *Pygospio elegans*), musslor (*Macoma balthica* (särskilt biomassa)) och kräftdjur (*Monoporeia affinis* och *Saduria entomon* (biomassa)). Den totala förekomsten och sammansättningen av benthos varierade mellan 2010 och 2013, medan den totala biomassan mellan åren var ganska lika.

På Norra Midsjöbanken har förekomst och biomassa av bottenfaunan ökat kraftigt sedan nulägesundersökningarna 2010. Kontrollen av stationerna mellan åren hade stor likheter i bottenfauna på grund av hög dominans av samma fåtal arter av havsborstmaskar (*Marenzelleria spp*. och *Pygospio elegans*) musslor (*Macoma balthica*) och kräftdjur (*Monoporeia affinis* och *Saduria entomon*). Strukturen på det bentiska samhället mellan undersökningar 2011-2013 var liknande, men resultaten skiljde sig betydande från nuläget 2010. Detta beror på det faktum att förekomst och biomassa hos bottenfaunan har ökat kraftigt sedan de grundläggande undersökningarna under 2010.

Analysen av kontrollresultaten visade att anläggning och dikning av rör 1 och rör 2 inte hade någon mätbar direkt påverkan eller långvarig negativ påverkan på den kvalitativa eller kvantitativa sammansättningen av bottenfaunan och strukturen i bentiska samhället på de båda bankarna.

1.6.2 Kolonisering av epifauna på rörledningen

Kontroll av epifauna genomfördes på fyra platser i svensk ekonomisk zon. Vid varje av dessa fyra platser undersöktes 250 m av rörledningen med tre videokameror som täcker sidorna och ovansidan av rörledningen. Kamerorna var monterade på en ROV. Kontrollen är planerad att utföras mellan juli och september varje år från 2011 till 2014 med det övergripande målet att möjliggöra bedömning av rörledningens s.k. reveffekt.

Under videoupptagningar 2013 från de fyra kontrollerade områdena i svensk ekonomisk zon påträffades en etablering av blåmusslor i NMR_{new} området och en eventuell etablering i HNB-området (se figur 4.5). En mobil art av epifauna, kräftdjuret *Saduria entomon*, konstaterades på och

intill rörledningen i högre antal i förhållande till tidigare undersökningar under 2011 och 2012. Dessutom observerades två fiskarter, rötsimpa och torsk, på och i omedelbar närhet av rörledningen.

1.7 Kontroll av vattenkvalitet

Syftet med kontrollen av vattenkvaliteten i svensk ekonomisk zon har varit (/5/):

- Att kontrollera en eventuell ökning av suspenderade sediment och sedimentering vid gränsen till de två Natura 2000-områdena Hoburgs bank och Norra Midsjöbanken under dikning, inklusive efterlevnad av gränsvärden för suspenderade sediment som anges i det svenska tillståndet /7/,

- Att kontrollera sedimentplymen som uppkommer under dikning för att därigenom kontrollera antagandena som gjorts i Miljöredovisningen för den svenska delen av rörledningen /8/.

Kontroll av vattenkvaliteten påbörjades november 2010 genom utplacering av fyra fasta mätstationer vid de två Natura 2000-områdena Hoburgs bank respektive Norra Midsjöbanken som anses känsliga när det gäller påverkan på vattenmiljön. Vidare genomfördes fartygsbaserade kontroller under dikningsarbeten för att stödja kontrollen vid de fasta mätstationerna /5/.

Kontroll vid de fyra fasta stationer vid gränsen till de två Natura 2000-områden ägde rum under perioden november 2010 till augusti 2011. Resultaten visade att den generella grumlighetsnivån vid de fyra fasta kontrollstationerna under dikning inte visar någon skillnad från tiden före och tiden efter dikning, d.v.s. ingen påverkan kunde mätas vid de fasta mätstationerna under dikningsarbeten. Det enda tillfället då hög grumling uppmättes under dikningsarbetena dokumenterades som att inte vara orsakad av arbetena - flera naturliga toppar med hög grumlighet uppmättes innan dikningen påbörjades /13/.

Fartygsbaserad kontroll av sedimentspridning utfördes under dikning efter utläggning i svensk ekonomisk zon som en del av Nord Streams kontrollprogram under 2011 och igen i mars 2012. Baserat på resultaten för rör 1 beslutades det i samråd med svenska myndigheter att kontrollen av vattenkvaliteten vid anläggning av rör 2 inte var nödvändig i samma utsträckning som för rör 1. Därför fokuserade kontrollen under 2012 på fartygsbaserad kontroll /11/.

Resultat från 2012 visar att plogen vid dikning skapade en plym av suspenderade sediment. Den högsta koncentrationen av suspenderade sediment i vattenprov uppmättes till 7,3 mg/l (i sektion 8). De kalibrerade turbiditetsavläsningarna visar vid några tillfällen på något högre värden, men inga koncentrationer över 15 mg/l observerades i svenska ekonomisk zon, inte ens i närheten av plogen. Bortsett från dessa toppvärden som uppmätts strax bakom plogen, var koncentrationerna av suspenderade sediment i allmänhet lägre än 5 mg/l i alla transekter.

Plymen var tätast nära plogen. Plymen vidgades och koncentrationerna minskade med avståndet till plogen. På avståndet 500 m bakom plogen var koncentrationerna mindre än 4 mg/l. Detta visar på att plymen späddes ut och att en betydande mängd av sedimenten hade återsedimenterat under de initiala 500 m från plogen. Det kortaste avståndet till det känsliga området från de kontrollerade delarna av dikningen var ca 4 000 m (till Hoburgs bank) /11/.

Sedimentspillet mättes i tre transekter 300-600 m bakom plogen. Det uppskattades att spillhastigheten var i intervallet 3-25 kg/s. Dessa tre transekter valdes eftersom de hade de högsta observerade nivåerna av grumlighet under övervakning av totalt 55 transekter (inom danska och svenska vatten). Ovanstående intervall kan därför tendera att vara högre än genomsnittet för spill under dikning. Sannolikt är spillhastigheten 3-25 kg/s mer representativ för de högsta 10 % av spillhastigheten. Detta är i linje med kontrollen 2011, där spillet konstaterades vara i storleksordningen 7 kg/s /11/.

Resultaten från kontrollprogrammet visar att antaganden och resultat från sedimentmodelleringen som genomfördes som en del av Miljöredovisningen inför anläggningsarbetena var konservativa (d.v.s. på den säkra sidan). Det observerade sedimentspillet och ökningen av sedimentkoncentrationer var i linje med eller mindre än vad som antagits i Miljöredovisningen /13/.

1.8 Kontroll av hydrografiska förhållanden i Bornholmsbassängen

Syftet med det hydrografiska kontrollprogrammet var att undersöka rörledningarnas påverkan på inflödande djupvatten med hög salthalt i Bornholmsbassängen. Det bedömdes att det var omöjligt med direkta kontroller av effekterna av rörledningarna på havsbotten. Detta är på grund av att de naturliga variationerna är flera tiopotenser högre än en eventuell lokal effekt. Kontrollen har därför var inriktad på att verifiera den hypotes som tagits fram i tidigare undersökningarna av SMHI (Sveriges Meteorologiska och Hydrologiska Institut), konsultrapport /15/.

Kontroll av de hydrografiska förhållandena i Bornholmsbassängen påbörjades i januari 2010 och avslutades i januari 2011. Syftet med det hydrografiska kontrollprogrammet i danska och svenska vatten var att upprätta dokumentation för den teoretiska analysen av möjlig blockering av vatteninflöde till Östersjön orsakade av Nord Streams rörledning på havsbotten.

Oceanografiska mätningar (hastighet, temperatur, salthalt) genomfördes inledningsvis under en niomånadersperiod (inklusive ett uppehåll på ungefär en månad) vid KP 1036 nordost om Bornholm på ett vattendjup av cirka 90 m. Hösten 2010 flyttades mätpunkten till KP 966 för att också erhålla mätningar från grundare vattendjup (ca 68 m).

Som ett komplement till den fasta stationen, mättes strömmar i linjetransekter med instrumentet acoustic doppler current profiler (ADCP). Totalt mättes i sex transekter.

Resultaten av kontrollen överlämnades till myndigheterna under sommaren 2011 i en separat rapport /16/. Slutsatsen var att den maximala blandning orsakad av rörledningarna i Bornholmsbassängen kunde uppgå till 20 % av de worst-case-uppskattningar som presenteras i /15/ och att även dessa uppskattningar var långt under mätbara effekter av att rörledningarna läggs på havsbotten.

Vid ett möte mellan Nord Stream AG och svenska myndigheter 10 september 2012 beslutades att programmet för hydrografiska mätningar kunde avbrytas eftersom det bedömdes att rörledningarnas obetydliga påverkan var klarlagd /17/.

1.9 Kontroll av ekotoxikologiska effekter på musslor

Under perioden december 2010 - maj 2011 genomfördes kontroll av ekotoxikologiska effekter på musslor, under och efter dikning av rör 1 /10/, /18/.

Syftet med att kontrollera ekotoxikologiska effekter på musslor var att utvärdera och dokumentera möjlig föroreningsspridning i samband med att sediment mobiliseras i vattenmassan vid arbeten i havsbotten (dikning) öster om de två Natura 2000-områdena Hoburgs bank och Norra Midsjöbanken.

Kontroll av eventuell spridning av föroreningar i samband med att sediment mobiliseras vid havsbottenarbeten har genomförts genom att mäta effekten på blåmusslor (*Mytilus edulis*) i nätbehållare i sex fasta stationer vid gränsen till de två Natura 2000-områdena.

Ingen negativ effekt kunde härledas till konstruktionsarbetet under kontrollen 2011 och kontroll av ekotoxikologiska effekter på musslor genomfördes därför inte under 2012 /10/.

1.10 Kontroll av andra parametrar

1.10.1 Kontroll av fiske

Vid ett möte den 10 september 2012 mellan Nord Stream AG och svenska myndigheter beslutades att skjuta upp rapporteringen av förändringar i fiskemönstren som bygger på AIS-data (Automatic Identification System). Man enades om att en rapport som omfattar alla år fram till 2014 ska levereras under 2015 /17/.

1.10.2 Kontroll/skyddsåtgärder vid nationella och internationella mätstationer

För att avgöra om Nord Streams verksamhet påverkar nationella eller internationella övervakningsprogram har mätstationer identifierats som finns i nära anslutning till rörledningen med tillhörande anläggningsarbeten.

Fyra befintliga mätstationer i den svenska ekonomiska zonen (och en SMHI-station i den finska ekonomiska zonen) ligger inom ±1,5 km från rörledningarna. Riskreducerande åtgärder har föreslagits och överenskommits med myndigheterna.

En av övervakningsstationer (SE-11) i Bornholmsbassängen i den svenska ekonomiska zonen, där föroreningar mäts i sediment, har framgångsrikt flyttats. Undervattenfoton togs och provtagning och analys av sediment på havsbotten genomfördes på både den gamla och den nya platsen. Den okulära sedimentundersökning och resultaten av bottenfotograferingen, tillsammans med radiografiska analyser, visar att de fysiska kraven som ställs på en nationell miljöövervakningsstation var uppfyllda på den nya platsen.

För närvarande avses prover tas från båda platserna (gamla och nya) under 2014, men bara material från den ena (den nya) stationen kommer att analyseras och användas, om inga oväntade resultat erhålls.

1.10.3 Kulturmiljö

Syftet med kulturmiljökontrollen är att dokumentera skicket på vrak innan anläggningsarbetena (rörläggning, ankarhantering, dikning och stenläggning), att skydda vraken under anläggningsarbetena samt att kontrollera vrakens tillstånd efter anläggningsarbetena.

Kontrollen av kulturmiljön har genomförts genom visuell inspektion med ROV. En ROV har använts på nio arkeologiskt betydande vrakplatser i svensk ekonomisk zon för att spela in bilder av vraken. Inspektionerna genomfördes 2009 av Marin Mätteknik (MMT) innan anläggningsarbetena påbörjades. Under 2012 och 2013, efter det att anläggningsarbetena slutförts, genomförde Fugro Subsea Services Ltd förnyade undervatteninspektioner.

Av kontrollresultaten framgår att ett skeppsvrak har påverkats av en ankarkätting under anläggningsarbetena för Nord Streams rörledningar. Inga konstruktionsrelaterade förändringar har inträffat vid de övriga åtta vraken.

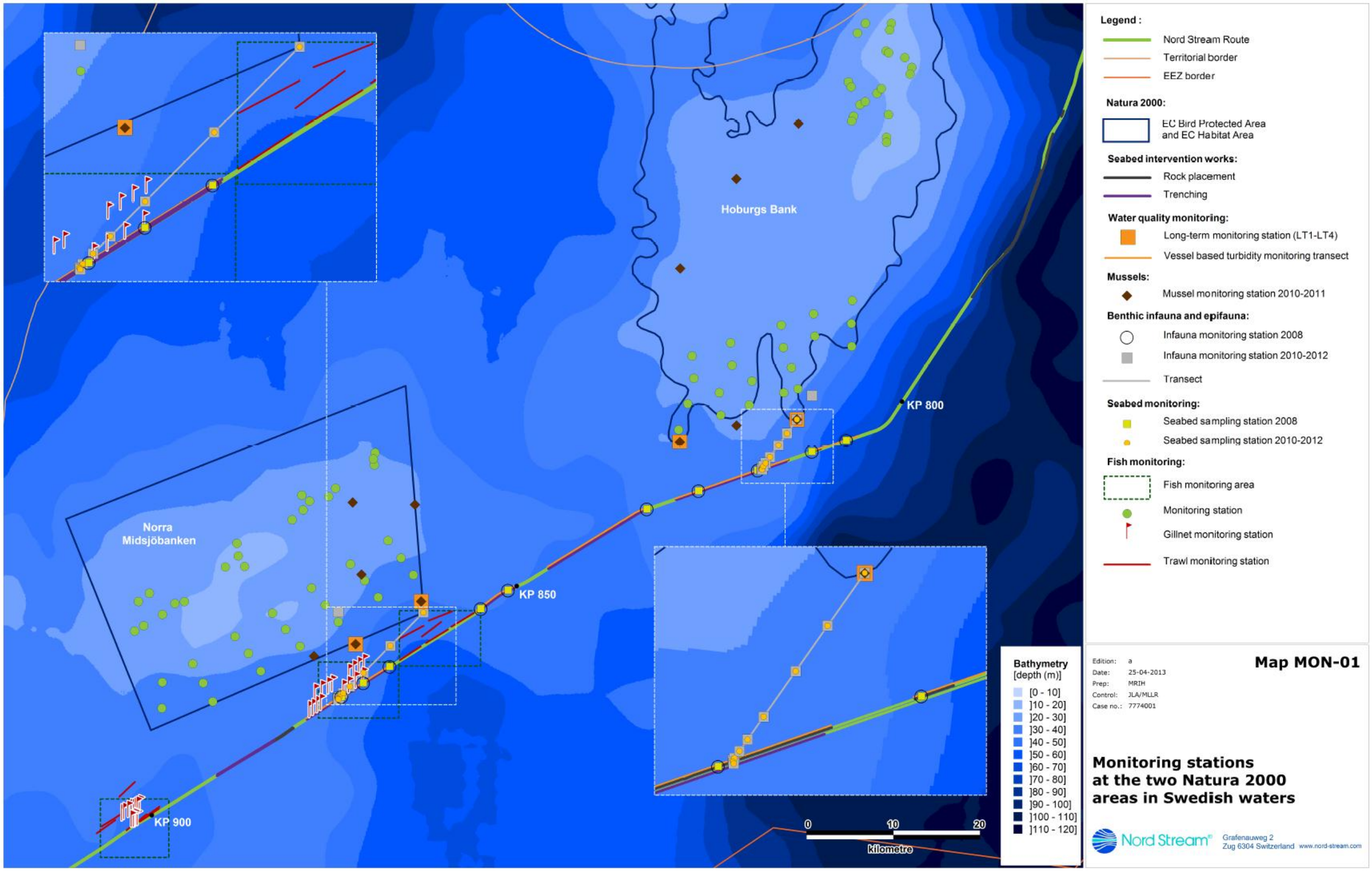
1.10.4 Sjöfart

Syftet med Nord Streams kontroll och övervakning avseende sjöfart är att minimera risken för kollisioner eller andra olyckor med kommersiell fartygstrafik och/eller fartyg som utför bygg- och anläggningsverksamhet för projektet.

Innan utförande av kontrollverksamhet för Nord Streams rörledningar under 2013, lämnades meddelande om undersökningarna till svenska Sjöfartsverket.

APPENDIX B

Nord Stream monitoring stations in the Swedish EEZ


Hoburgs Bank
Norra Midsjöbanken
KP 800
KP 850
KP 900
0
10
20
kilometre
Legend :
Nord Stream Route
Territorial border
EEZ border
Natura 2000:
EC Bird Protected Area and EC Habitat Area
Seabed intervention works:
Rock placement
Trenching
Water quality monitoring:
Long-term monitoring station (LT1-LT4)
Vessel based turbidity monitoring transect
Mussels:
Mussel monitoring station 2010-2011
Benthic infauna and epifauna:
Infauna monitoring station 2008
Infauna monitoring station 2010-2012
Transect
Seabed monitoring:
Seabed sampling station 2008
Seabed sampling station 2010-2012
Fish monitoring:
Fish monitoring area
Monitoring station
Gillnet monitoring station
Trawl monitoring station
Bathymetry [depth (m)]
[0 - 10]
]10 - 20]
]20 - 30]
]30 - 40]
]40 - 50]
]50 - 60]
]60 - 70]
]70 - 80]
]80 - 90]
]90 - 100]
]100 - 110]
]110 - 120]
Edition: a
Date: 25-04-2013
Prep: MRIH
Control: JLA/MLLR
Case no.: 7774001
Map MON-01
Monitoring stations at the two Natura 2000 areas in Swedish waters
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