Nord Stream
The new gas supply route for Europe

Nord Stream Environmental Impact Assessment
Documentation for Consultation under the Espoo Convention

Nord Stream Espoo Report: Annex
National EIA Summary - Germany

February 2009

English version | National EIA Summary
Germany

ENG

Contents

1 Introduction

The present document is a non-technical summary of the Environmental Impact Assessment of the plan for the Nord Stream pipeline in the German area of responsibility according to §6 EIA Act.

Nord Stream AG is planning to lay a natural gas pipeline from Russia to Germany via the Baltic Sea. The Nord Stream pipeline will run from Vyborg on the Russian Baltic coast to Greifswald near Lubmin in Germany. The overall length of the natural gas pipeline is approx. 1,220 km (**Figure 1.1**).

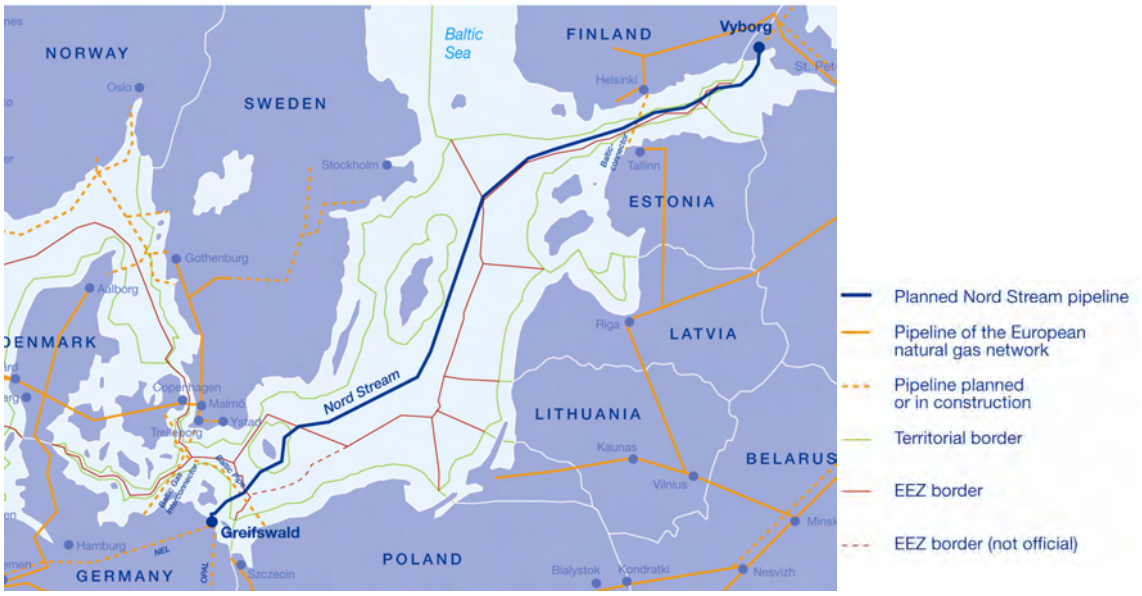

Figure 1.1 The route of the natural gas pipeline across the Baltic Sea

The plan is to lay two parallel pipelines. The first pipeline (the north-west pipeline), with a transport capacity of approx. 27.5 bcm(1) per year, should be finished in 2011. The second pipeline (the south-east pipeline), ready in 2012, will double the capacity to approx. 55 bcm per year. The construction of the land route to the point of delivery for the Nord Stream pipeline in Russia began in 2005. The connecting project in Germany is at the planning and permission stage.

In the German Baltic area, the planned route of the Nord Stream pipeline will enter the exclusive economic zone (EEZ) between the Adlergrund and Oderbank then travel into the Bodden Marginal Well around Landtief, and from there into the southeast of the Greifswald Bodden up to the

(1) Billion cubic metres

landfall at the EWN site (Energiewerke Nord GmbH) at Lubmin. Within the framework of the environmental impact assessment, a route alternative positioning the Nord Stream pipeline to the north of Usedom will be considered.

The competent authorities regarding the legal permits are the Stralsund Board of Mines (BA) as well as the Federal Bureau for Shipping and Hydrography (BSH).(1)

(1) The competences of the authorities for energy industry planning approval follow § 43 paragraph 1 clause 1 EnWG according to the state regulation § 2 of the state law for the determination of the authorities concerned according to EnWG (State Regulation about the Competence for the Energy Industry) from 29 December 2005 (GVOBl. M-V 2006, p. 13) determines the Stralsund Board of Mines to be responsible for the procedure of the plan establishment according to § 43 paragraph 1 clause 1 no. 2 EnWG. Regarding the mining legal permits there is a division of responsibility between the authorities. The competent federal state authority is, according to § 133 paragraph 1 clause 2 BBergG i.V.m. § 136 Federal Mining Act (BBergG), a regulatory authority in mining-legal terms. The mining office in Stralsund is, on the basis of the ordinance on the determination of the responsible authorities for the execution of the BBerg of the 22.09.1994 (GVOBl. M V 1994, S. 944), in favour of granting permission according to § 133 BBergG paragraph 1 clause 1. The permission under §133 (1) clause 1 No. 2 BBergG with respect to order of the utilization and use of the waters over the continental shelf and the airspace over these waters is given by the Federal Bureau for Shipping and Hydrography (BSH).
Under §3b in conjunction with No. 19.2.1 of Appendix 1 of the Environmental Impact Assessment Act (UVP Act), an EIA must be produced for the construction and operation of a gas service pipe for the purposes of the Law on the Fuel and Electricity Industries with a length of more than 40 km and a diameter of more than 800 mm. The project could have considerable or lasting impacts on elements that are important for the conservation objectives or protective purposes of an area of common importance or an European bird protection area as described in §18 LNatG M-V, §34 paragraph 1 BNatSchG in connection with Article 6 (3) of the Habitats Directive, as well as Article 4 paragraph 4 of the EU Birds Directive. Hence a Habitats Directive Impact Assessment is also to be carried out. The project is subject to impact regulation under nature conservation law: Under §18 BNatSchG and §14 LNatG M-V. Under §42 paragraph 1 BNatSchG, a special, strict assessment of the consequences of the plan is to be carried out. In addition, special authorization for affecting legally protected biotopes (§30 BNatSchG, LNatG M-V §20) are to be applied for.

2 Short Description of the Project

The Nord Stream pipeline [(1)] begins in Russia and follows an underwater route, consisting of two parallel pipes, via the Baltic Sea to Germany. The starting point of the Nord Stream pipeline is at the site of the compressor station at Vyborg in Russia. The terminating point of the Nord Stream pipeline is the natural gas receiving area in Greifswald (Greifswald Receiving Terminal, GRT). From there the natural gas flows through an installation measuring and analysing this gas flow into the OPAL (short for *Ostsee-Pipeline Anbindungsleitung* – the Baltic Sea Pipeline Link) and NEL (short for *Norddeutsche Erdgasleitung* – the North German Natural Gas Link) gas transmission pipes. The transport medium is non-toxic, single phase natural gas.[(2)]

The two parallel Nord Stream pipelines have a transport capacity of 27.5 bcm per year (standard temperature of 20°C, standard pressure 1 atm). The total capacity of the pipeline is roughly 55 bcm per year. For most of the route, the parallel pipelines will be laid in different years. Simultaneous laying of the pipes is planned in the German 12 nm zone on account of its ecological sensitivity. The installation work on both pipelines in this region is planned to last only one season because of the ecological sensitivity of the coastal waters within Greifswald Bodden to the north-east border of the Habitats Directive region 'Greifswald Bodden Marginal Well and part of Pomeranian Bay (DE 1749-302).

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(1) On the basis of hydraulic calculations and technical requirements, the basic features of the Nord Stream pipeline have been established as follows:

Pressure range of the Nord Stream pipeline

Section	Section length	Kilometre points	Design pressure	Volume
1	300 km	KP 0.. to KP 300	22 Mpa (g) = 220 bar	313,200 m^3
2	375 km	KP 300 to KP 675	20 Mpa (g) = 200 bar	391,500 m^3
3	545 km	KP 675 to KP 1220	17 Mpa (g) = 170 bar	569,000 m^3

Note: KP = kilometre point (chainage along the Nord Stream pipeline from Russia to Germany in relation to the eastern conduit)

- Outside nominal diameter ND 48" (DN 1200)
- Constant inside diameter ID = 1,153 mm
- Longitudinal seam UP (Unter-pulver) welded pipes with a single pipe length of approx. 12.2 m
- Pipe material SAWL 485 I FD to DNV OS-F101 with a minimum yield of 485 N/mm^2 (corresponds to X70)

  The pipeline has anticorrosion protection from a 3 layer PE (Polyethylene) and passive anticorrosive cathodic protection is ensured by aluminium sacrificial bracelet anodes.

  The pipes are further reinforced by a coating with a thickness of 60-100 mm and a density of 3,040 kg / m^3 of concrete with a surcharge of approx. 70% iron ore.

(2) This corresponds to category D of DNV OS-F101 and DIN EN 14161.

Within the scope of the EIA, the Nord Stream and Usedom routes have been investigated and assessed (see **Figure 2.1**).[(1)] An explanation of the technical performance of these variants is not included in this summary.

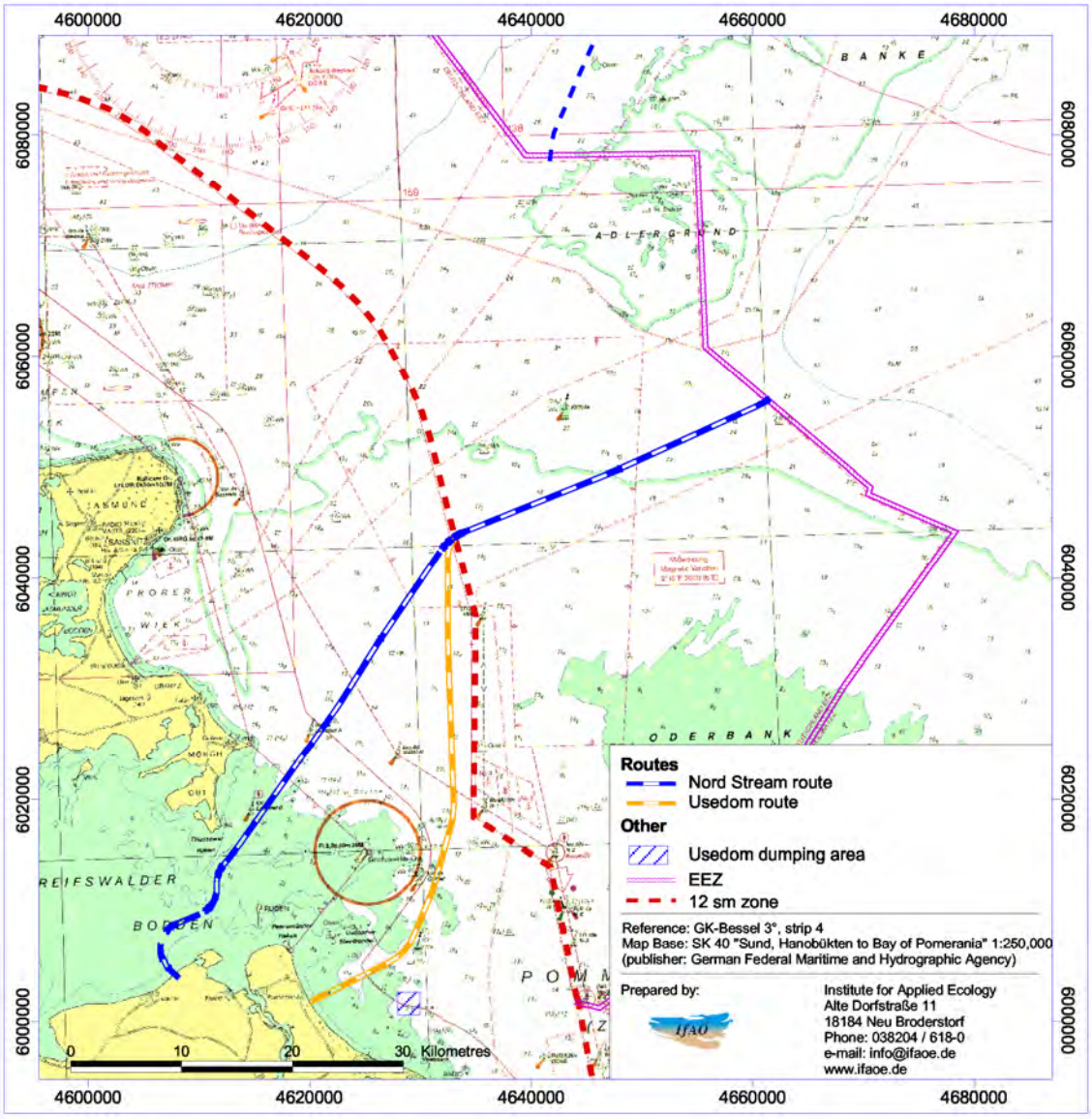

Figure 2.1 Route across German coastal waters and the EEZ

(1) The Nord Stream route shows the technical variations of pipe laying in the area of the Greifswald Bodden: the S-lay method in the Bodden Marginal Well, the floating assembly of the pipelines (float and sink), the floating assembly on a zigzag route in the pipeline corridor (after the Mecklenburg-Western Pomerania state development programme) and the installation of a tunnel.

For safety reasons,[1] in water depths of less than 15 m the Nord Stream pipelines are laid in an excavated trench, and in depths of more than 15 m they are laid directly onto the seabed. Under present planning conditions burying the pipelines is not necessary in this area. Should such measures become necessary (for the correction of free sagging or for position stabilization in depths of more than 15 m), this can occur through localized grading of the seabed before laying or through removing the support points by means of plough and cover or "flushing" of the pipeline or rockfill.

In the whole of the Greifswald Bodden and the Bodden Marginal Well areas, pipeline laying is planned using the open cover method in an excavated ditch, the length of which will amount to about 15 km. The transfer of the Nord Stream pipeline by S-lay method (which means that the pipe is laid on the seabed using a barge, and results in an "S" form) is a practicable technical solution. In the area close to the coast of the landfall area in water approx. 15 m deep, a second generation lay-barge with an estimated capacity of 350 m/day will be used.

In order to transfer a pipeline onto the seabed using the S-lay method, a single pipe is built on the lay barge. This pipe is then transferred through the lay barge within a controlled S-curve onto the seabed.[2]

The coverage requirements of the pipeline, and therefore the depth of the laying trench, vary in the route sections due to changing requirements along the route.[3]

The wet excavation of the trench will be carried out with mechanical equipment[4]. The material debris resulting from this excavation will be stored temporarily and then transported by barges[5] to the Nord Stream dumping site near the island of Usedom (**Figure 2.1**) then separated and stored according to soil type. Rocks from the seabed will be taken up separately and stored in

(1) Buoyancy security and protection against external influences

(2) During the placement of the pipeline, the S-lay barge is supported by the following units and equipment:

- Anchor tug for transferring the anchor and towing the barge between positions
- Pipe transporter to provide the pipe-lay barge with pipes and other materials
- Survey ships to measure the pipe trench and laying direction
- Multi-purpose ships for different tasks (incl. towing, supply and moving anchors)

(3) The cover at the landfall point on the coast is 2.25 m. The pipeline will be laid approx. 5.30 m beneath the sea floor in the area of the "Neptungrund" shipping lane and approx. 2.70 m beneath the sea floor in the area of the "Schumachergrund" shipping lane (Peene river approach). The cover in the area of these shipping lanes takes the planned, future deepening of this waterway into account. In the other areas of the Greifswald Bodden and Bodden Marginal Well the Nord Stream pipeline will mostly be covered to a depth of 1.0 to 1.55 m.

(4) The preferred option is via a stilted pontoon excavator and trailing hopper suction dredger: alternatively, a grab dredger and/or multi-bucket excavator could be used.

(5) Automated split-barges or barges with ground weirs as well as a trailing hopper suction dredger

marked areas of the dumping site so as to be used in the restoration of the rock coverings after the laying of the pipeline.

After dredging, the pipe trench will be measured using an echo sounder to check that work has been completed according to plan. After the pipe installation, the backfilling of the ditch will take place using the material stored temporarily at the dumping site.(1)

Next to the wet excavation works, in the immediate coastal area, a temporary cofferdam is planned, extending approximately 550 m offshore to a water depth of about 1.5 m. The dam will protect the piping when it is winched ashore by the second generation lay barge. The excavated material of the seawards double cofferdam will be stored within a cofferdam compartment.(2)

After the construction of the corresponding pipeline section, the cofferdam ditch will be back-filled with the stored excavated material and the stakes and bulkheads will be pulled. If surplus waste should remain after the back filling of the cofferdam, this can be deposited at a suitable place at sea. Surplus material onshore can, where appropriate, be used for landscaping and piled up.

In one approx. 54 km long and 15 m deep section, extending from the Pomeranian Bay up to the border of the German EEZ, the pipelines will be laid on the seabed with a third generation lay barge or a dynamically positioned laying ship. A third generation lay barge (a semi-submersible floating rig) will have the effect of increasing the volume of the laying work with prefabricated double joints.(3) The typical laying rate is anticipated to be 1,500 – 3,000 m/day. To protect the pipeline against static and dynamic stresses (such as dead weight, current and waves) and external influences (among other things, trawl nets and anchors), excessive sagging is to be avoided or corrected after laying.

(1) This operation will be carried out using large and small trailing hopper suction dredgers. To reduce turbidity, temporary silt-/bubble screens can be installed to the left and right of the backfilling. If technically possible, soil of a suitable type can also be used for backfilling directly after excavation, obviating the need for temporary storage. Settling and excavator losses will be filled up where necessary by additional material.

(2) On this occasion, land based equipment will be used. The land section of the Nord Stream pipeline, including the seaward cofferdam bulkhead ditch, has an overall length of approx. 1,000 m and ends at a pig-trap station (the facility limit of the Nord Stream pipeline system) of the natural gas terminal (independent licensing procedure).

(3) Consisting of two welded pipes

If necessary, local rock embankments can protect the pipelines on the seabed.(1) Within German waters, only a small volume of the rock embankments are necessary, where appropriate.

The following building phases are planned for the implementation of the Nord Stream Project:

- Beginning of April 2010: start of the offshore pipeline laying outside the Habitats Directive zone
- Beginning of April 2010: start of construction work on the mainland with preparatory works in the landfall area at Lubmin
- Middle of May 2010: start of excavation work in Greifswald Bodden
- End June 2010: start of the insertion of the north-west pipeline on the mainland
- By the end of December 2010: conclusion of all structural work for both pipelines in the Greifswald Bodden and the Bodden Marginal Well as well as the subsequent border section to the north-east boundary of the Habitats Directive zone(2)
- By January 2011: conclusion of all structural work to the boundary of the German EEZ for the north-west pipeline
- April 2011 to September 2011: pre-commissioning and commissioning of the north-west pipeline
- By the end of April 2011: conclusion of construction work on the storage point(3) to the boundary of the EEZ for the south-east pipeline
- May 2012 to November 2012: pre-commissioning and commissioning of the south-east pipeline(4)

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(1) These large rock embankments can offer protection against hydrodynamic loads, against bending tensions at free sagging through sag reduction, protect against fatigue (vibration) through fixing and against external effects from fisheries or shipping (nets and anchors). The rock embankments are constructed, if required, corresponding to the respective conditions before or after the laying of the pipelines. The material from quarries has a typical grain size of 25 mm to 200 mm. The rocks are put into the desired position by special ships through a chute or a downpipe. The extent of the rock embankments is first defined in implementation planning.

(2) "Greifswald Bodden Marginal Well and part of Pomeranian Bay"

(3) In waters approx. 15 m deep

(4) Pre-commissioning and commissioning of the Nord Stream pipeline will follow in accordance with DNV–OS–F101. The pre-commissioning of the two 1,220 km long pipes will involve the following work procedures: Flooding, cleaning, surveying; Pressure testing; Connecting of pipeline sections; Draining; Drying.
Before the pipes are filled for the first time with natural gas, pre-commissioning must be successfully concluded.

In the case of later construction start, the whole construction time plan has to be postponed by one year.

During operating times the Nord Stream pipeline system will transport natural gas in contractually-specified quantities. The Nord Stream pipeline system contains no elements regulating pressure, but instead features safety, monitoring and shut-down arrangements. For the regulation of the operating pressure levels, the operators of the Nord Stream compressor stations will be requested to either reduce or increase the quantity initiated by the compressor station in the pipeline, or to carry out a combination of both measures.

Closure of the pipeline could occur after 50 years. Depending of the legal situation and interest at that time, the pipeline system could be preserved.(1) At present it is not planned to dismantle the pipeline or use it to transport other materials.

3 Analytical Framework for the Environmental Impact Assessment

As part of the analytical framework, the findings of the consultations with public authorities fall within the scope of the general public participation (scoping) of 20.01.2007.(2) The course of the Nord Stream route was adapted after the scoping date with respect to the technical feasibility in the Greifswald Bodden (letter of the 15.02.2008 to the regulatory authority) as well as in the Pomeranian Bay based on the modified constraint point crossing the EEZ boundary (decision in August 2008 by Nord Stream AG). In the Pomeranian Bay, the line passes about 3 km south, parallel to the original scoping route. Due to the small deviations in the route guidance applied in the scoping procedure, provisional investigation frameworks were applied to the adapted route. For the investigation of the planned Nord Stream dumping site, coordination with the responsible authorities was also undertaken.

When defining the investigation area, the intervention area of the pipeline route and the area of project-specific impacts were considered. The different “protection zones” defined so as to avoid impacts from the project on key areas of the route are described below:

Seaward route (12 nm zone and EEZ):

- Route and bilateral impact area of 50 m regarding the protection of soil
- Route and bilateral impact area of 100 m and impact area for the distribution of large area air emissions regarding the protection of climate/air

(1) In other words, the cathodic protection system could continue to operate and the pipe filled with nitrogen and locked.

(2) For the results of this, see http://www.bsh.de/de/Meeresnutzung/Wirtschaft/Rohrleitungen/NordStream.jsp

- Route and bilateral impact area of 150 m regarding the protection of culture and material objects and benthos
- Route and bilateral impact area of 500 m regarding the protection of water
- Route and bilateral impact area of 1000 m for fish and 3000 m for birds and sea mammals
- Especially for noise, exhaust emissions and visual impacts, investigation zones adapted (in some cases for large areas) regarding the protection of humans and landscape

Nord Stream dumping site (12 nm zone):

- Planned area of dumping site: sediment, morphology, biotope, benthos
- 100 m impact area and impact area for the distribution of large area air emissions regarding the protection of climate/air
- Minimum 3,000 m impact area on dumping site, especially for the effect of turbidity on water, marine habitats and organisms and on humans (fisheries, noise, etc.)
- Minimum 3,000 m impact area for impacts on sea birds, landscape, etc.

Landward route (landfall corridor):

- Route and bilateral impact area of 50 m for subjects of protection soil, water and cultural and material objects
- Route and bilateral impact area of 100 m and impact area for the distribution of large area air emissions regarding the protection of climate/air
- Route and bilateral impact area of 250 m for plants
- Route and bilateral impact area of 300 m for animals and 1,000 m for sensitive species
- Especially for noise, exhaust emissions and visual impacts, investigation zones adopted (in some cases for large areas) regarding the protection of the human environment and landscape

Within the scope of the project, surveys of flora and fauna were carried out for the marine and terrestrial biotope types, the benthos, the fish fauna, breeding birds in the landfall area and resting birds, as well as observations of sea mammals according to the scoping procedures agreed in the research programme. The results of these investigations are included in the written explanations of the EIA. Other specific investigations or further discussions are given in the form of separate expert reports, including geological investigation reports, geophysical investigations of the seabed (in particular side-scan-sonar surveys), expert reports of turbidity modelling, analy-

ses of selected sediment parameters, fishing data, noise, waste gas and light pollution analyses, and expert reports on the influence of the temperature of the natural gas in the pipeline on the environment.

4 Consideration of Alternatives

The following alternative solutions for the realization of the project, as regards its route, are presented and assessed:

- Wide area route alternatives
  - Lübeck
  - Rostock
  - Greifswald
- Medium scale route alternatives (of the wide area route alternative Greifswald)
  - Greifswald Bodden
  - Usedom
- Small area route alternatives (of the medium scale route alternative Greifswald Bodden)
  - Vierow
  - Spandowerhagen
  - West habour entrance Lubmin
  - East habour entrance Lubmin

According to the route alternatives different landfalls are planned.

For the alternative routes in the Greifswald Bodden, a development and checking of the pipeline corridor of the M-V State Regional Development Programme (LEP M-V[(1)]) is further conducted.

In the comparison of the wide area alternatives for the route and the landfall area for the Nord Stream pipeline, the shortest route in the German area of responsibility is to the

(1) MfABL M-V (2005): Landesraumentwicklungsprogramm Mecklenburg-Vorpommern. Ministerium f. Arbeit, Bau und Landesentwicklung Mecklenburg-Vorpommern, Schwerin 2005

landfall area at Greifswald/Lubmin. This route is highlighted as the preferred solution from the expert's point of view.

This conclusion results from the fact that the pipeline route to the landfall areas to the west of the island of Rügen (Lübeck and Rostock area) would be longer in total. Furthermore, the pipeline routes leading into the areas of Rostock and Lübeck would require a parallel course to the traffic separation zone of the Kadet channel. To guarantee safety in this route section, burying or ploughing of the pipeline would be necessary.

In the case of landfall in the area of Lübeck, areas with unsuitable sediment conditions (alluvium areas) would have to be crossed in parts, which would result in the need for special construction techniques and thus increase the environmental impact. For instance, laying the pipeline to the west of the island of Rügen in the areas of Rostock and Lübeck Bay would vastly increase the amount of digging material to be removed and stored than if landfall in the area of Lubmin is chosen. Similarly, because of the longer route into the areas to the west of the island of Rügen, the influence of the gas on the temperature conditions would be even stronger (due to the transportation of very cold gas over long sections of the route). This factor might impact on benthos communities. Likewise, with a route leading into the areas of Rostock and/or Lübeck, clear impacts could be observed on Natura 2000 interests.

Investigations have shown that all the alternatives considered for the landfall areas of Lübeck bay, Rostock and Greifswald-Lubmin have different disadvantages. Landfall in the area of Lubmin, however, fits in well with the goals of regional planning and land use planning, as there is a "marine pipeline reservation area“ designated here for the grouping of offshore conduits and sea cables. In addition, synergy effects are anticipated for the development of the energy, industrial and business locations at Lubmin. Concerning the target positions of land use planning (and regulation) for a landfall, the endeavours and aims of a spatial grouping of infrastructure should be taken into account.(1) The landfall of the Nord Stream pipeline is planned to be situated to the east of the harbour approach at Lubmin, in the area of the “energy and industrial location Lubmin” near Greifswald, as this location includes an existing industrial area close to the sea with a corresponding infrastructure. Moreover, the area has already been proposed by the Mecklenburg-Western Pomerania State Regional Development Programme for industrial location purposes of this kind. Furthermore, with the “marine reservation corridor for pipelines and cables” there is already an area-regulated seaward corridor established in which the pipeline can be set up, without necessitating area regulation.

The EIA also provides a summary of the bases of the analysis used to determine the "marine reservation corridor for pipelines and cables" in the LEP M-V as a relatively low conflict corridor for the laying of sea cables and a pipeline into the Greifswald Bodden. As this route also has the potential for another conflict regarding environmental protection and nature conservation, the

(1) cf. LEP M-V – MFABL 2005

impacts of the project are analysed and assessed. This is done in order to identify critical factors and to analyse suggestions for optimising the plan for the Nord Stream pipeline with respect to environmental concerns within the scope of the EIA.

The EIA addresses the spatial alternatives for the Nord Stream route within the Pomeranian Bay and the Greifswald Bodden and the Usedom route, as well as technical options of the open laying of the pipeline along the Nord Stream route (laying by S-lay method with burying of the pipelines; laying on the seabed; laying during Float & Sink, as well as laying on a zig-zag route) and the laying in the tunnel (route section of the Greifswald Bodden, including the Bodden Marginal Well).

For the comparison of options within the scope of the EIA, see **Section 6**.

Figure 4.1 gives an overview of other options investigated and briefly explained in the EIA, and the spatial and technical options assessed in detail in the EIA.

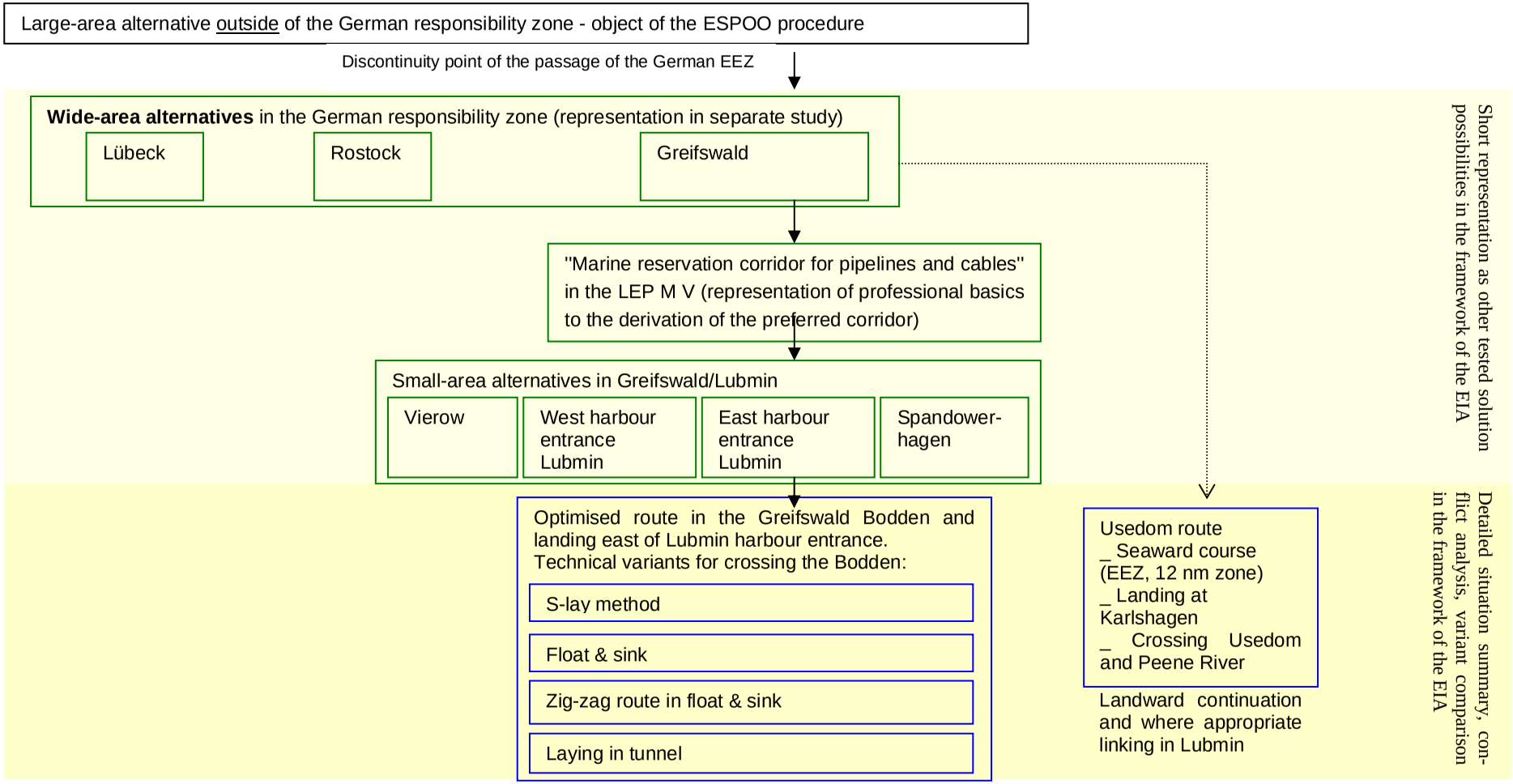

Figure 4.1 Overview of options investigated in the EIA

5 Summary of Project Impacts

Given the size of the area affected by the project (the section of the Nord Stream pipeline that crosses German waters is over 80 km long), the resultant diversity of marine and terrestrial abiotic factors, habitats, flora and fauna, and the various claims to usage taken into account in this assessment, no separate section is devoted here to the status analysis and evaluation. **Section 8.1** of the EIA ("General spatial categorization of the examined area") briefly outlines the natural and cultural area affected. The summarized conflict analysis outlined in this section lists existing conditions and constraints and discusses their importance and sensitivity in relation to the project.

The EIA covers all potential impacts of the project on the environment. By contrast, this summary concentrates solely on those key impacts that are of relevance to project decisions. Impacts of a negligible or very minor nature are therefore ignored in this discussion; for more details, the reader is referred to the in-depth treatment in the EIA. Moreover, the EIA contains additional explanations of special issues such as reciprocal effects between different assets in need of protection, cumulative effects with other projects and an assessment of cross border environmental impacts. The issue of biological diversity is dealt with in the discussion of the current status and the analysis of conflicts relating to flora, fauna and habitats, and is also explained in summary form in a separate section of the EIA.

The condensed discussion and assessment of the impacts of the project in **sections 5.1** and **5.2** refer to the laying of the pipelines using the S-lay method along the Nord Stream route through the Greifswald Bodden to the landfall corridor east of the access route to the port at Lubmin. Neither the alternative route via Usedom, coming ashore at Karlshagen, nor the technical alternatives that could be used to lay the pipelines in the Bodden are discussed in this summarized account of the conflict issues. These matters are treated in detail in the EIA. For a comparison of alternatives please refer to **section 6**.

No binding information is available about the procedures after decommissioning; however, removal or partial removal cannot be ruled out. The character, intensity, temporal and spatial reference of the environmental impacts caused by a possible removal of the Nord Stream Pipeline depend on its dimension (complete removal or partial removal e.g. only the pipelines laid on the seabed) and the technical methods and equipment which are available at this time. Thus, it is difficult to calculate the impacts of removal. For the worst case it is assumed that environmental impacts could occur which are comparable to those described and assessed for the construction phase of pipeline laying. Accordingly, regarding possible removal, refer to the explanations of the construction-related impacts on the environment. The possible removal-related impacts therefore correspond to the construction-related impacts, although they are of shorter duration. The potential impairment of the subjects of protection assessed for the construction phase is transferable to (possible) removal.

5.1 Impacts around the Seaward Pipeline Route and Dumping Site (12 nm zone and EEZ)

5.1.1 Construction-related impacts on the seaward pipeline route

Temporary *visual impacts* (during the day and the impacts of lighting at night) of pipe-laying work (including transportation) that influence the human environment

The route of the pipeline extends mainly in larger distances to land areas. Settlement-based and landward recreation areas in the relevant active area of the route are only present at Thiessow-Göhren (Mönchgut, Isle of Rügen) and in the landfall area at Lubmin.

The excavators and laying crew will integrate visually into the exiting shipping during the respective construction phase. For the Bodden and the coastal zone (to approx. 5 km off the coast) medium level impacts are to be expected for a short time. For those route sections in the Pomeranian Bay – especially in the EEZ – that are a considerable distance from the coast, only a temporary and very minor visual impact must be taken into consideration with regard to landward locations (see also statements about the countryside).

The impact of lighting at night during the construction phase is estimated in expert reports. For the area of Mönchgut (particularly Südperd with Thiessow) no infringement of the emission guidelines is predicted as a result of the lighting used in nightly dredging activities. At the landfall area at Lubmin, an impact on the sports boat harbour in the harbour basin (at a distance of approx. 400 m) cannot be ruled out. However, in view of the significant existing environmental impacts and uses (the sports boat marina is located in a flourishing port and commercial centre), these impacts can be regarded as minor. At distances of over 500 m from the light sources, the temporary, medium-scale impacts of lighting during the night are rated as being of low intensity. In the immediate vicinity of the light sources (up to around 500 m), the impacts are rated as of medium intensity.

Temporary *noise emissions* due to pipe-laying (including transportation) that influence the human environment

On the basis of the prognoses of the expert report into **noise emissions**, it is evident that similar emission levels are to be expected during the day and night (night being from 20.00 until 07.00). Because the allowable limits for night (35 dB(A)) are lower than for day (50 dB(A)), the report deals primarily with the night situation.(1) Thus, during construction in the sea area, at night the 35 dB(A) guideline could be exceeded to a distance of approx. 4 km due to the simultaneous use of several excavators of different size, and approx. 2.5 km during the laying of the pipelines in the offshore zone owing to the activity of the lay barge. With barge transportation, a comparable effective noise level is approx. 0.5 km from the noise source.

(1) As a "worst case scenario" the report assumes that noise emission ratios at night will be equal to those of the day

Therefore, in view of the noise emission load of coastal areas with residential areas, as well as landward recreational areas, the land areas at the south point of Mönchgut with the small town of Thiessow as well as Lubmin are to be considered. The emission guideline value for night time (35 dB(A) standard) for "pure residential areas" on the fringe areas of the nearest places Lubmin and Thiessow (Mönchgut peninsular) will be exceeded by no more than 5 dB(A). The level of possible infringement of AVV(1) building noise is considered tolerable under the guidelines if the construction equipment conforms to the current state of noise reduction technology.

During the "pre-commissioning" phase for draining and drying the pipeline,(2) very loud noise emissions will temporarily result from the use of diesel generators, which could lead work on the project exceeding the appointment guideline value at night for the most eastern areas of Lubmin as well as Spandowerhagen, unless extensive sound insulation measures are put in place. The marina in the harbour and the most eastern beach section (the western edge of marina) are both approx. 400 to 500 m from the route, so that louder noise effects are possible through excavation and pile driving at night in the area close to shores of the route.

In these cases, the possibility of exceeding the night time guideline of 50 dB(A) by factors of no more than 5 dB(A) cannot be excluded. In the report of the noise expert, options are presented outlining noise reduction measures (sound screens, a noise protection wall) so that exceeding the night guideline value within the vicinity of the sport boat harbour can be avoided.

In the area around the seaward route, significant noise emissions will, depending on the construction and laying technologies used, therefore mostly occur within a radius (impact zone) of approx. 4 km from the excavator work to approx. 2.5 km from the laying activities around what will usually be "occasional" moving noise sources.(3)

The impacts of noise emissions are thus temporary and limited to medium-scale distances. Depending on the distance from the source of the noise, these emissions could occur with high to low intensity and thereby result in slight to moderate functional degradation. Considerable, high intensity noise emissions will occur primarily due to the use of certain construction equipment (such as large excavators) and because of pile-driving. Attention must be paid to the potential for such impacts in the route section in the area around Mönchgut and at the landfall area.

Temporary *exhaust emissions* due to pipe-laying (including transportation) that influence the human environment

To assess the extent of possible harmful exhaust emissions, selected pollutant parameters were calculated according to a worst-case scenario. The potential geographic spread of these emis-

(1) AVV - Allgemeinen Verwaltungsvorschrift (General Administrative Regulation)

(2) Approx. 35 days for draining and approx. 25 days for drying the pipeline

(3) E.g. third-generation pipe-lay barges that cover around 1.5 km/day and second-generation pipe-lay barges that cover around 350 m/day

sions under certain wind conditions was also forecast on the basis of an expert report. Given the distance of around 2 km between the southern tip of Rügen and the Nord Stream pipeline route, there is no reason to expect that relevant per-hour emission thresholds will be exceeded in this area. Since the source of emissions is constantly on the move, and the regional wind distribution for the south-eastern part of Rügen is strongest for winds from a westerly or south-westerly direction, pipe-laying work will cause only temporary increased disturbances. Nor are prescribed emissions guidelines expected to be exceeded in the residential and recreational areas where the pipeline goes ashore near Lubmin. In very unfavourable situations, there could be a very brief impact close to the entry to the port at Lubmin.

The impact of harmful exhaust emissions will be for a limited time only (during the construction phase) and will cover only a medium-scale area. The potential intensity (as a function of wind conditions) diminishes with the distance from the source of the emissions. High to medium intensity impacts can be expected temporarily in the immediate proximity (up to around 500 m). Low intensity impacts can be expected temporarily at distances of over 500 m.

Construction-related impacts on the *countryside* and the *seascape* due to visual factors, lighting, noise and air pollution

The intrusion of pipe-laying vessels, supply ships and dredgers into the landscape around the pipeline route is expected to have a considerable visual impact within a radius of approx. 3 km, a moderate visual impact within a radius of approx. 5 km and an insignificant visual impact within a radius of approx. 10 km during the deployment of these ships and this equipment for construction purposes.

Construction work to lay the seaward pipeline in the 12 nm zone is forecast to have a considerable visual impact on the seascape within a radius of approx. 3 km around the building sites. These disturbances will remain a relevant factor at night due to the impacts of lighting, noise and air pollution (see the discussion above). Accordingly, the countryside in the southern part of the Mönchgut peninsula (around Klein Zicker, Thiessow and Göhren) and in the landfall area at Lubmin (on the coast to the west of the entrance to Lubmin port) will be substantially affected. Moderate visual impacts on the countryside and seascape, up to a distance of approx. 5 km, are also possible.

Construction activities within the landfall area will adversely impact upon the countryside in the immediate coastal region in the short term. In addition, noise emissions and pollution resulting from construction technology will negatively impact upon people's experience of the countryside.

In assessing the extent of this influence, however, it must be remembered that these effects will occur only temporarily during the construction phase and, to a lesser extent, during the pre-commissioning phase on land.

Given the considerable distance between the EEZ and the relevant land areas, construction activity in the EEZ will have only a minor impact on people's experience of the landward countryside. In the EEZ and in the Pomeranian Bay within the 12 nm zone, construction activity may indeed have a considerable visual impact on the countryside and seascape within a radius of approx. 1 km and, in some cases, approx. 3 km. However, since sports boats are few and far between and pass through these areas relatively quickly, the disturbance will be relatively minor.

In the seaward area around the Bodden, disturbances will primarily affect sports boats at anchor for leisure purposes. Apart from the sports boat marina at Lubmin, however, all other sports boat marinas are several kilometres from the pipeline route. Nor are any protected moorings situated in the immediate vicinity of the route. The nearest popular moorings are on Ruden, over 4 km away. Any major noise and exhaust emissions will occur within a radius of approx. 1 km (or up to 3 km in the case of visual disturbances) along the seaward route. These impacts will occur only for short periods (from a few days to a few weeks), whilst each section of the pipeline is being laid. Some of these impacts will be split into several periods. Sports boats use the areas affected around the pipeline route mainly for transit purposes.

The impacts on the countryside and on people's experience of the countryside can therefore be classified as short-term and localized with high intensity within a radius of up to approx. 3 km around the route (and also affecting Lubmin and Mönchgut), medium-term with moderate intensity at distances of over 5 km, and low-intensity at distances of over 10 km.

Temporary *impacts on morphological and hydrological conditions* due to creation of a pipeline trench[(1)]

Where open pipe-laying methods are used, a temporary trench will be created for the Nord Stream pipelines. This will cause a temporary change in relief conditions. Once the pipelines have been laid, the trench will be filled in again. The various construction and laying activities have been planned in such a way that, upon completion of the work, original relief conditions can be restored. Since pipeline construction itself will not change the relief conditions, no lasting impacts on the hydrography are expected.

While the pipeline trench is being excavated during the construction phase in the area of the Bodden Marginal Well, hydrographic conditions could be affected temporarily. The impact of these temporary changes has been analyzed by drawing analogous conclusions based on forecasts of the effect of enlarging shipping channels in general. The pipeline trench will enlarge the channel by a comparatively small amount (approx. 0.29% of the total flow cross). As a result, little or no verifiable impact on hydrographic conditions is expected. When the pipeline trench is excavated in the Bodden Marginal Well, the worst-case scenario would be shifts in hydrographic conditions within a small to medium-scale radius around the trench. Critical to evaluation of this

(1) Especially in the area of the Bodden Marginal Well, as well as laying the pipeline on the sea bed (at water depths of more than 15 m)

impact is the fact that, even if it did occur, it would be limited to a short period for a limited section of the construction phase.

With laying in water depths of more than 15 m in the 12 nm zone(1) to the boundary of the EEZ, depositing the pipelines on the seabed will result in a permanent variation of the local relief. Where appropriate, local rock embankments are planned, in order to ensure stability of the pipelines(2) and to correct free sagging, whereby only comparably slight environmental impacts will occur.(3)

To summarise, the project is not expected to cause any significant changes to relief on the pipeline route. Construction-related changes will be of a local nature and of a low intensity. They will have a considerable impact on the relief of the pipeline trench only temporarily. In the areas on the seabed around the pipeline (and, where applicable, rock embankments) any lasting changes will be localised and of low intensity. Altogether therefore, only minor overall structural and functional degradation is anticipated.

Temporary changes in sediment conditions **during excavation of the laying trench and laying of the pipelines on the seabed**

Excavation work to lay pipelines in the trench is scheduled to take place only within the 12 nm zone in the area of the Bodden, the Bodden Marginal Well and a section to the north-east of the Bodden Marginal Well up to approx. 15 m water depth. The associated temporary removal and subsequent refilling of sediment is planned in such a way that there will be no change to the nature of the **surface** sediment, although the geological stratigraphy (to the extent that it exists) will be eliminated as the sediment is mixed. In The trench is to be refilled with sediment that is as close as possible to the original. This will be guaranteed by specific management of stored sediment at the dumping site.

While the pipeline is being laid in the EEZ and the 12 nm zone in water depths of more than approx. 15 m, the prevailing sands in this area are to be replaced by the artificial material of the pipelines in the course of laying on the seabed.(4)

Within the 12 nm zone, excavation of the pipeline trench is therefore predicted to have a permanent, low-intensity impact of a local to medium-scale in those sections where the substrate (sand) is not changed. A medium- to high-intensity impact is predicted where silt and boulder clay is encountered. In the EEZ area where the pipelines are put on the seabed, the impacts will be local (linear and with very slight width), lasting and with a high intensity.

(1) From KP 1193.5

(2) Confirmation of this will not occur until implementation planning.

(3) Cf. in addition corresponding section on facility-related effects in **section 5.1.2**

(4) Cf. details in facility-related effects in **section 5.1.2**

To summarize: minor to moderate structural and functional degradation is to be expected with respect to seaward sediment conditions. Furthermore, if the proposed actions are taken to diminish impacts, and if these actions are monitored closely, both the structure and the function of the hard seabed layers (rock and detritus) can be restored in the medium term. For this reason, the level of degradation is rated as minor.

Construction-related disturbance of sediment with increased *turbidity and sediment deposits* during excavation and backfilling of the laying trench as well as laying pipeline on the seabed

The disturbance of sediment particles during construction and pipe-laying activities will make the water more turbid (and possibly create patches of turbidity). Depending on the size of these patches and the force of water currents, the swirled up particles may be deposited on the seabed at a greater or lesser distance from the source, thereby affecting the sedimentation rate.(1)

There is only a slight risk that the project might increase turbidity in the route section that runs through water more than 15 m deep in the 12 nm zone and in the entire EEZ, where the pipe-

(1) Simulated outcomes modelled in an expert report calculated that the majority of excavation and transportation activities during pipe-laying in the trench could lead to sedimentation deposits of between approx. 3 and 1 mm in the immediate vicinity (up to approx. 50 m), between approx. 0.7 and 0.5 mm at distances of approx. 100 m, approx. 0.3 mm at distances of approx. 150 m, and less than 0.1 mm at a distance of 500 m (given wind speeds of approx. 5 m/s). In the case of sediment that increases turbidity only slightly (mainly sand), suspended matter content of 1,000 mg/l could occur up to a distance of approx. 100 m, while content of 100 mg/l could occur at distances of up to approx. 500 m. Sediments that increase turbidity to a greater extent (silty sands, some of which have a higher organic content) could cause suspended matter content of between 50 and 500 mg/l to drift distances of between 500 and (in some cases) more than 2,000 m from the source (i.e. the dredger or dumping barge). To assess these simulated turbidity concentrations, suspended matter under conditions free from external influences is used for comparison purposes. In the area of shallow water off Lubmin, for example, concentrations of between 10 and 40 mg/l of suspended matter are a frequent occurrence. For short periods, these concentrations can even peak at between 70 and almost 100 mg/l. The majority of the particles swirled up in the water are forecast to cause such effects only during actual construction activity. Swirled up sediment should settle again quickly (within one hour or a few hours at most) after completion of this activity. Simulations of the project's influence on suspended matter indicate that, at certain points along the route through the Bodden and in the shallow water off Lubmin and to the east of the Schumachergrund, more sediment than usual could be swirled up during the construction phase. In light of this potential effect, our proposal is to deploy shielding constructions (gauze/bubble aprons) on the basis of specific measurements during excavation work and transportation of dredged material. The purpose of these measures would be to ensure compliance with a maximum threshold of 50 mg/l at a distance of 500 m from the source of the suspended matter (up to 100 mg/l should also be permitted within this radius for temporary periods under rougher sea conditions).

lines are to be laid on the seabed. In addition, water exchange in this section takes place at a high level, and most of the sediment affected has a low suspension propensity.(1)

Marine fauna is expected to be negatively affected only on certain sections of the route during the excavation and transportation of sediment with a higher propensity to turbidity. Even here however, installed shielding constructions (gauze/bubble aprons - see above) will limit these effects to the immediate vicinity around construction activity.(2) Since vagile fauna such as fish and marine mammals habitually avoid such areas, the potential for conflicts can be assumed to be slight. Ultimately, their avoidance of the habitats concerned will only be temporary. By placing the pipelines on the seabed in water depths of more than 15 m, negligible and slight influences are expected through sediment deposits on marine species.

In summary, construction activity for laying pipes in trenches is expected to have small to medium-scale impacts for only short periods. In the immediate vicinity of construction work (i.e. within a radius of 50 m), moderate impacts could arise. In a wider radius of up to approx. 500 m, minor to very minor impacts could arise. Since all these impacts are of a temporary nature, they can collectively be classified as low-intensity structural and functional degradations (even after factoring in possible impact mitigation measures).

For those sections where the pipelines are to be laid on the seabed, sediment is expected to be swirled up only to a very minor degree and will lead to the corresponding consequences (increased turbidity and sedimentation).

Therefore, no significant degradation through the re-suspension of nutrients and pollutants is anticipated.

Temporary *impacts on air quality* due to exhaust emissions from construction equipment during the construction and pre-commissioning phase

One major impact of the project will be construction-related emissions of air pollutants that will influence air quality. Accordingly, the CO2, SO2 and NO2 emissions produced by the construction equipment during the construction and pre-commissioning phase were analyzed. Vehicles

(1) In the case of necessary retroactive burial methods such as backfilling (when actually required, only locally relevant), current understanding is that sedimentation rates of under 1,200 g/m² are to be expected at a distance of 50 m. At distances of over 50 m, sedimentation will be scarcely detectable.

(2) In the localized sections of the route that are thus affected, possible effects include the migration of vagile individuals, physiological impairments (lower growth, less reproduction) and higher mortality rates (including mass mortality in the event of oxygen depletion). Regeneration of benthic fauna in the areas affected will probably take a year or, in the event of mass mortality driven by temporary oxygen depletion, two to three years. Given the low intensity of turbidity and sedimentation, the bulk of the pipe-laying and construction activities and the conflict mitigation measures (shielding aprons) should lead to only physiological effects (such as lower growth rates and lower filtering levels).

and equipment are to be used most intensively in the section in the 12 nm zone within the Bodden between the landfall area and the pipelines' deposition point at a depth of 15 m. This is therefore the area where most emissions are expected.

Work in the EEZ is expected to account for approx. 20 % of the total air pollution caused by construction-related emissions on German territory.(1) During the construction and pre-commissioning phase, the project is therefore likely to temporarily generate a higher concentration of pollutants with significant quantities of harmful exhaust emissions.(2)

Project-related impacts on air quality are rated as large-scale, temporary (during the construction and pre-commissioning phase) and of high intensity, leading to their classification as moderate structural and functional degradation.

Elimination of, damage to, or other *negative impacts on sites and artefacts of cultural and material importance*

In the course of the extensive investigations of sites and artefacts of cultural and material significance in the area of the Nord Stream route, existing information on wrecks and other underground obstacles was reviewed (information from BSH), and potentially affected areas surveyed using Side-Scan-Sonar photographs. Individual sites in the locality of the Nord Stream route are recorded (see details in the EIA); however only parts of the historic barrier of shipwrecks (the "Schiffssperre") that crosses the pipeline route at the Bodden Marginal Well(3) could possibly be affected by construction operations. Because encroachment on the wreck areas cannot be ruled out, after consultation with the MV State Bureau for Culture and Care and Preservation of Ancient Monuments and Artefacts and detailed line planning, the necessity arose to lift historic shipwreck no. 67 from the ship barrier before starting construction. In addition, suitable agreements have been made with the MV State Bureau for Culture and the Care and Preservation of Ancient Monuments and Artefacts in order to guarantee appropriate conservation and salvage.

All relevant information and preservation requirements will be met when recording hitherto unknown archaeological sites. It follows that the project is not expected to do any damage to the region's cultural heritage.

(1) In the German EEZ, in Germany's coastal waters and in the landfall area

(2) 2 % of CO_2, 57 % of SO_2, 37 % of NO_x emissions compared to the emissions given off by facilities requiring government approval in Mecklenburg-Western Pomerania in 2003

(3) The barrier was set up in the Great Nordic War (1700-1721) by Sweden, which sunk a line of ships requisitioned from the surrounding area to prevent Danish warships from accessing the strategically important Greifswald Bodden. Today, 20 wrecks covering a total distance of around 1.5 km have been discovered. The find is of singular importance to regional and northern European history. It is also a significant site for archaeological research into shipbuilding and shipping.

In the absence of potential damage to cultural and material goods on the seaward section of the route, the project's impacts in this regard can be classified as localized in nature. Since it is highly improbable that any such effects will occur, they are also classified as a minor structural and functional degradation.(1)

Temporary impacts on benthic communities and marine biotope types due to pipe-laying in trenches until regeneration (temporary impacts on habitats, including increased turbidity and sedimentation due to swirled up sediment)

Initially, the open laying of the pipeline using the S-lay method will temporarily remove and do considerable damage to benthic habitats. The loss of invertebrates due to construction work will be temporary and considerable in the localized area of the pipeline trench. Depending on the intensity of the damage done, it will probably take between one and three years for the benthic fauna communities to regenerate. Even longer regeneration periods must be assumed for long-lived shellfish populations (principally the butter clam, common mussel and Baltic tellin).

Given the overwhelming predominance of this kind of **long-lived**, filtering shellfish in the biomass of the affected area, this localized degradation of the age structure will have no measurable impact on the structure and function of the benthic communities in the Greifswald Bodden or the Pomeranian Bay. Epibenthic growth(2) on the restored hard surfaces(3) will likewise largely regenerate within two to three years. All in all, structural and functional degradation is classified as moderate in light of the mostly short- to medium-term potential for benthic regeneration.

Macrophytes (submergent seed plants and epiphytic algae) will be affected primarily in the landfall area off Lubmin, where they will be removed from a section of the pipeline route of approx. 50 m in the area of the seawards sheet piling trench during the construction phase. When the construction work is completed, the trench will be refilled with the dredged material. Natural coastal dynamics – high tides and wave action – will restore the relief of the seabed within a few months and also ensure that macrophyte seeds are returned. In the past, macrophytes have repeatedly been seen to repopulate the port area at Lubmin following significant natural or man-made disturbances. For this reason, it is assumed that interference caused by the project will give way to short- to medium-term regeneration.

In the course of pipe-laying activities, the sparse sea grass patches in the area of the Bodden Marginal Well may be removed. The red algae on the adjacent residual sediment to the east will also be eliminated for the duration of construction work. Once restoration of the rock and detri-

(1) This assessment of cultural and material goods is based on the assumption that, if one of the wrecks in the historic barrier is salvaged, this will be done with the support of archaeological researchers, in close liaison with the relevant authorities and subject to scientific consultation and analysis of the archaeological find. Likewise, professional protection and treatment are assured if hitherto unknown archaeological objects are concerned.

(2) I.e. the growth of small attached and free-moving organisms on the seabed

(3) Rock- and detritus-covered areas that are affected are to be restored after excavation

tus areas has been completed, macrophytes can begin to regenerate on identical substrates.(1) The loss of phytals caused by the entrenchment of the pipelines, followed by subsequent regeneration of macrophytes, is classed as a local, medium-term, high intensity impact in the area of the pipe-laying trench. Overall, this impact could lead to moderate structural and functional degradation.

Suspended particulate matter will be shielded by the sheet pilings along the pipeline trench in the shallow water off the coast of Lubmin in the landfall area. Especially in view of this fact and the planned prevention measures (such as the use of gauze/bubble aprons to contain turbidity patches), this study believes that neither swirled up sediment, turbidity nor sediment deposits will cause considerable changes to the macrophyte population.

The medium-scale, short-term and minor impairment caused by discoloration due to increased turbidity and sedimentation can be classed as a minor structural and functional degradation.

Temporary *visual, acoustic and other disturbances* (due to the 'rolling' pipe-laying site and construction work at the landfall area) to *various fauna groups* (above all sensitive species of fish, marine mammals, breeding birds, migratory birds, and otters)

Changes to natural habitats caused by the project are minor.(2) This being the case, construction work will expose fish, birds and marine mammals to only temporary visual, acoustic and other disturbances.

Fish can be expected to take fright and flee due to higher noise levels in the immediate vicinity of the pipeline route during the construction phase. In the landfall area at Lubmin, especially where sheet pilings will be used, fauna will probably be frightened away to a considerable degree for the duration of construction work.(3) In addition, turbidity patches will cause disturbance along those sections of the pipeline route in the Greifswald Bodden and in the area of the Bodden Marginal Well.

The loss of fish caused by excavation and interim storage activities will be insignificant. Most of the disturbances and impairments caused by construction work can be regarded as small-scale and temporary. The Bodden is a very important spawning ground for herring in particular. To avoid significant impairments to the spawning activity of these and other species of fish, no construction work will be done during the main spawning season in the spring. Special action will be taken (4) to largely avoid levels of turbidity that could lead to significant consequences.

(1) Gravel on the Bodden Marginal Well, hard substrates and adjacent residual sediment to the east.

(2) Due to regeneration and recovery of temporary degradation, localized changes caused by the body of the pipeline on the seabed, as well as possible local back filling and, if applicable, rock fill.

(3) Sheet piling construction, trench excavation, pipe laying, trench filling and removal of the sheet pilings

(4) Installation of gauze/bubble aprons, no dumping of dredged material with increased organic content

In bird resting grounds, visual and acoustic disturbances are likely to temporarily frighten away migrating birds in the area of the construction activities, within a maximum radius of 1-2 km per ship. These disturbances will only ever affect smaller parts of the resting grounds for individual species of birds. Along the pipeline route, disturbances to waterfowl will primarily affect birds that rest in summer in the shallow waters off Lubmin and in summer and autumn in the area of the Bodden Marginal Well, such as great crested grebe, cormorant, terns, little gull, and sea ducks.

In sections of the route in more than 15 m water in the 12 nm zone and the EEZ, winter resting areas are also relevant. However, based on the comparatively fast pace of the pipe-laying (approx. 1.5 km/day) and the way in which pipes will be laid (resting on the seabed), no disturbances that significantly exceed those of regular shipping traffic are to be expected in the EEZ. When the construction phase is completed, any disturbances that did occur will cease.

Bearing in mind that the pipeline route accounts for an insignificant proportion of the overall ecosystem needed by waterfowl and seabirds, the temporary loss of benthic organisms that serve as food for waterfowl (shellfish, aqueous plants and other benthic organisms) will have no measurable impact on these creatures' resting and eating habits.

No construction work will take place in the sea area from the Greifswald Bodden to the north-eastern boundary of the Habitats Directive area from the start of January till the end of April. During this period, which includes important resting times for birds (midwinter and spring), seabirds will not, therefore, be exposed to any negative influences in this section of the pipeline route.

During the construction phase, marine mammals will temporarily be disturbed, particularly by underwater noise emissions, but also by other factors. The noise emissions caused when sheet pilings are rammed into the landfall area at Lubmin along the Nord Stream route can obscure communication between grey seals. Noise emissions during excavation and pipe-laying work, the fact that the fish which the seals feed upon will be frightened off and the resultant increased turbidity could cause grey seals searching for food to avoid the area around the building site by a considerable distance. It is possible that, as a result, the 5 to 10 grey seals that currently inhabit the Greifswald Bodden might leave the area during the construction phase and spend the interim period primarily in other parts of the Baltic Sea. On the other hand, it is possible that they may simply "tolerate" the construction activity.

Porpoise, common seal and ringed seal are seldom seen in the Greifswald Bodden (they sometimes appear as "vagrants") and will therefore not be disturbed by pipe-laying work in this part of the sea. The Bodden Marginal Well, the coastal region around the island of Usedom and the Pomeranian Bay also number among the sea areas that are visited only on rare occasions by porpoises and the other sea mammals. It is therefore unlikely that these species will be disturbed significantly during the construction phase; any disturbance will at worst only affect indi-

vidual animals. Given the short duration of pipe-laying work in the EEZ and 12 nm zone in those areas where the water is more than approx. 15 m deep, and bearing in mind that the laying of pipelines on the predominantly sandy seabed will create scarcely any effects such as turbidity patches, it is expected that only individual porpoises will be disturbed, and only for short periods.

In summary, visual, acoustic and other disturbances could occur temporarily during the construction phase. In this context, particular attention must be paid to the fact that the "building site" is continually moving. The impact zone is primarily local for fish, medium-scale for migratory birds and medium- to large-scale for marine mammals. Disturbances that frighten fish away are regarded as low-intensity factors, given that fish mostly tend to circumnavigate disturbances anyway. In particular cases, some activities may even attract certain species.

For birds, disturbances of a moderate intensity are expected.(1) Grey seals in the Greifswald Bodden may be exposed to high-intensity disturbances. Other species of marine mammals appear only rarely in the Greifswald Bodden and the Pomeranian Bay. For them, the potential for project-related disturbances is therefore rated as minor, though this may increase to moderate intensity in the immediate vicinity of the pipeline route.

On the whole, minor functional degradation is therefore expected for marine mammals in general and (possibly) moderate functional degradation for grey seals in the Greifswald Bodden.

5.1.2 Facility-related impacts on the seaward pipeline route

Sediment exchange caused by artificial pipeline material **in the seabed and** ***changes in surface sediment*** **and local relief caused by laying the pipelines on the seabed and producing artificial fill substrates for sections of the seaward pipeline route – local changes to the habitat structure, including** ***settlement of benthic hard sedimentary soil community*** **(reef effect)**

In the section where the pipelines are to be buried completely (in the Greifswald Bodden and in areas where the water is less than 15 m deep), existing sediment will be permanently replaced by the technical materials used to lay the pipelines in the sediment. In light of the depth at which the pipelines are to be buried, this exchange will mainly affect sediment other than the layer close to the surface that is inhabited by benthic communities.

During laying in the EEZ and in the 12 nm zone with water depths of approx. > 15 m, the pipelines lie completely on the sea bed in this section (approx. 54 km) and the naturally present sediment will be covered by the artificial materials of the pipeline. Thus in the area of common soft substrates with extremely small width (1.2 m according to pipeline diameter) artificial hard grounds are created on the sea bed (predominantly with concrete covered pipelines). Artificial

(1) In light of the rapid pace of pipe-laying in water that is more than 15 m deep and existing disturbances in the area around regular shipping routes.

small relief structures result from the pipelines, although only very small-scale, local changes of hydrographic parameters are predicted as a result.1 Nevertheless, these impacts will only take place on a very small-scale (centimetre to decimetre in area, occasionally up to a few metres), so that substantial environmental impacts on sea-waters can be excluded.

If localized rock fills are used to maintain the stability of the pipeline, the concrete cladding around the pipelines and artificially deposited rocks used in construction create a hard, artificial substrate that will quickly be inhabited by epibenthic species of fauna. In areas of primarily soft substrates, laying the pipelines will introduce an alien substrate that will artificially increase the biotope diversity.

On the whole, the introduction of hard, artificial substrates will lead to localized, long-term, high-intensity impacts, albeit covering a comparatively small area.

Release of aluminium compounds **into sediment and water from the material used in sacrificial bracelet anodes**

The pipelines will be buried in a layer of sediment that is saturated by water. Accordingly, the release of substances from the material used in the anodes and the plastic cladding at the welding seams that join pipe segments has been analysed. Forecasts have been prepared only for emissions of aluminium compounds.(1) The release of aluminium compounds from the sacrificial bracelet anodes could lead to permanent, localized, high-intensity concentrations in sediment. The resultant impacts are therefore classed as a moderate structural and functional degradation.

Seepage into the water is of relevance only to those sections of the route where the plan is to lay pipelines on the seabed.(2) Significant water exchange will distribute materials that seep into the water into the open waters of the Baltic Sea and dilute them to a very considerable degree. Traceable water pollution in certain areas is not expected. The possible local to large-scale impacts of substances seeping out of the pipeline materials and into the water are permanent in

(1) According to the current state of the art, the plastics used in the cladding around the welding seams are of no or only negligible eco-toxicological relevance when they are buried in sediment and exposed to seawater. It is therefore assumed that they will cause no structural and functional degradation. During the pipeline's 50-year service life, part of the sacrificial bracelet anodes will dissolve (anticorrosion coating). It is fair to assume that around 40% of the sacrificial bracelet anodes will be consumed in 50 years.

In German territorial waters, an estimated 300 metric tons of aluminium could thus seep from the two pipelines into sediment and water. Evaluation of the environmental impact of these emissions takes account of the fact that sacrificial bracelet anodes fitted to shipping vessels also give off very considerable emissions into coastal waters and seawater. At the present time, there are known impairments to the properties of sediment and/or water that are directly attributable to these emissions. Permanent, localized aluminium concentrations can accumulate around the sacrificial bracelet anodes in the case of buried sections of pipeline.

(2) EEZ and those areas of the 12 nm zone where the water is more than approx. 15 m deep

nature but of a low intensity (due to distribution in the water), and can therefore be rated as minor structural and functional degradation.

5.1.3 Operation-related impacts on the seaward pipeline route

Impacts on temperature conditions **caused by cold gas carried by the pipelines through the surrounding sediment and water**

As gas expands, decreasing pressure along the pipeline causes the gas to cool. As a result, gas in those sections of the pipeline that pass through German territorial waters can be cooler than the surrounding temperature and can thus influence the ambient sediment and water temperature.

In consultation with the relevant authorities, what is known as the "2 K criterion" is used to measure the significance of the influence of gas temperature on the environment. This criterion states that, for those sections of the pipeline that are completely covered with sediment, the difference between uninfluenced sediment and sediment influenced by the temperature of the gas at a depth of 20 cm below the surface of the seabed must not exceed 2 K.(1) An expert report was commissioned to investigate the influence of the temperature of the gas pipeline. Based on the findings, it is forecast that, for those pipeline sections that are completely buried, the temperature difference between influenced and uninfluenced sediment 20 cm below the surface of the seabed will be 1.8 K in summer and 1.2 K in winter. For those sections where the pipeline is layed on the seabed, temperature differences between the outer surface of the pipeline and the surrounding water will not exceed 0.7 K in summer and 0.2 K in winter. The 2 K criterion is therefore not exceeded.

Accordingly, the influence of the gas temperature on the environment surrounding the buried and largely open sections of the seaward Nord Stream pipeline and at the landfall can be rated as local, permanent and minor. At the same time is to be noted that for the section in which the pipelines are layed on the seabed, a quick heat exchange with the surrounded water takes place so that no measurable cooling of the surrounding water will occur.(2)

Altogether the structural and functional influences on the abiotic conditions are classified as slight.

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(1) This level is defined to preclude significant impairments to the benthos.

(2) A "theoretical" special case is the short route section of the transition from buried pipelines to that layed on the sea bed (KP 1193.5 to 1195.2). Because here the pipelines can be buried partially so that their upper edges lie flush with the sea bed ("0 m" sediment covering), a small excess of the "2 K criterion" can appear based on calculations from the expert report. This scenario, however, cannot be considered as representative as it only occurs in summer during periods of extreme temperature difference, as the potentially concerned area is only of low spatial dimension and as the resulting sediment overlay depends on the actual pipe-laying method and on the sediment dynamics, which changes over time.

To summarize: the 2 K criterion is not exceeded in relation to sediment 20 cm below the surface of the seabed. For those pipeline sections that lie on the seabed (in the EEZ and in those sections of the 12 nm zone where the water is more than 15 m deep), variant temperatures will quickly be dispersed in the water. This being the case, no significant impact on benthic communities (on fauna in sediment and epibenthos on the pipeline) or on creatures that swim in the sea is anticipated.

***Inspection, protection and repairs* with varying environmental impact**

The Nord Stream pipeline will be serviced and maintained primarily from within. On an operational level therefore, only inspection work(1) and – in exceptional cases – action to protect and repair the pipeline must be considered. Inspection work will therefore have a negligible impact on the environment.

Action to protect the pipeline is necessary if the degree to which the pipeline is covered changes.(2) Environmental impact depends heavily on the nature and scope of the action that must be taken to restore the original state of the pipeline.(3) The pipelines will be laid in such a way that protective action should be necessary only in isolated cases and could be taken at short intervals.(4) To the greatest extent possible, abiotic environmental conditions will be restored whenever such action is taken. This will ensure that habitats can regenerate and return to the form in which they previously existed. The resultant environmental impact will therefore be rare, temporary (during maintenance) and localized.

Repair work is expected to affect a comparable area to those discussed for construction-related impacts (**section 5.1.1**). However, since repair work is limited in both space and time, the overall impact will be much smaller than that of construction-related impacts. The intensity of the environmental impact caused by repair work depends on the nature and scope of the work done and can vary substantially. The impacts of repair work can therefore be rated as local to medium-scale, temporary and of a low to high intensity, depending on their scope. They could result in minor to moderate structural and functional degradation.

5.1.4 Impacts at the Nord Stream dumping site north-east of Usedom

The impact of the project at the dumping site will be restricted almost exclusively to excavation activities during the construction phase. Permanent impacts will occur only if different types of sediment to those already in place remain at the dumping site.

(1) Using geophysical methods for buried sections and visual and other inspections for sections laid on the seabed.

(2) E.g. if it is partially exposed or due to scouring

(3) Supplying sediment and/or reinforcing the pipeline, for example

(4) Basic inspections of the pipe-laying concept to ensure the stability of the pipeline

To minimize the environmental impact of the project, a dumping site should be used that is as close as possible to the pipeline route outside the Natura 2000 areas. The largest volume of dredged materials that will have to be temporarily stored at a dumping site during production of the pipe-laying trench will be generated in the area of Greifswald Bodden. In light of this fact and subject to due consideration for other uses (such as other dumping sites, sediment dredging and shipping), a site north-east of Usedom has been selected as the dumping site.(1)

With the exception of boulder clay, only sediments of the same kind that are already common in this area will be brought to the new Nord Stream dumping site, sorted by soil class.(2) If residual amounts of boulder clay remain at the dumping site, changes to the sediment structure will appear on the seabed which, where appropriate, will have negligible influences on the local relief (the elevation of the substrate). About 250,000 m³ of excavated material(3) is presumed not suitable for back-filling of the ditch and should remain permanently at the dumping site. For this excavated material a separate area is planned, sufficiently distant from the temporary storing ground. If possible, the unsuitable ground material can be put in other approved dumping sites in the surroundings.

Altogether, the construction-related consequences on sediment and morphology in the area of the dumping site have a local dimension which is predicted to be short-term (temporary storage) and cause low (spent sand) or medium to high intensity (spent boulder clay) and therefore a low structural and functional influence. For the areas with permanent storage of spent sediments at the dumping site the structural and function influences are evaluated as being medium to high.(4)

Regeneration of the temporarily covered benthic communities at the temporary storage facilities of the pipeline route is predicted to be approx. 1 to 3 years. However, at the dumping site the benthic biocoenosis will change permanently where excavated boulder clay remains permanently. At the same time a change in the dominance ratios and the settlement density of individual species is possible based on the changed substrate ratios. In summary, minor but also me-

(1) The planned dumping site is south of the designated Natura 2000 areas. Further dumping sites are already in use to the north-east of Usedom. KS 508: south-east of the Gänsegrund; KS 551: south-east of the Usedom "Steintrendel"; and a dumping site set aside for the project to expand the shipping channel to the port at Lubmin. The dumping site planned for the Nord Stream pipeline consists of a total of 4,000,000 m² of relatively homogeneous sandy areas on the seabed (fine-grained and medium-grained sand, in places coarse sand and silty surface sediment). Only parts of the site on the northern and south-eastern sides are covered with rocks and cannot be used for temporary storage (See the discussion of conflict avoidance in **chapter 8**) therefore a usable surface of about 3,350,000 m² remains for the storage of excavated earth. A few large rocks and blocks also exist in the relatively homogeneous sandy areas.

(2) Mostly sandy and, to some extent, silty sediments and rocks

(3) Cohesive soil types, like boulder clay/marl

(4) According to substrate: sand, boulder clay

dium to high structural and function influences are therefore possible from excavated material, particularly boulder clay.

As a general rule, with other environmental impacts such as increased turbidity and sedimentation and disturbance to fish, birds and marine mammals, both the intensity and the spatial radius should be comparable to those described for construction activities in the area of the pipeline route (see **section 5.1.1**). Accordingly, turbidity and sedimentation can increase considerably within a radius of approx. 50 to 100 m. To a lesser intensity, the same effects can also occur at greater distances from the source of swirled up sediment. To minimize the spread of turbidity patches, the use of gauze/bubble aprons is planned (in accordance with the criteria described in **section 5.1.1** for excavation work along the pipeline route). Disturbances caused by visual and acoustic factors are rated as relatively minor. This is because the area off the coast of Usedom is frequented only sporadically by occasional marine mammals in search of food. Nor are any significant groups of migratory birds known to rest here, with the exception of a few highly mobile species such as little tern, black tern and cormorant. It is expected that fish will temporarily be frightened away during dumping and excavation activities (there is isolated evidence of the presence in this area of migratory species of fish as defined by Appendix 2 of the Habitats Directive, e.g. river lamprey, sea lamprey and houting).

5.2 Impacts in the Landfall Area near Lubmin (Construction works, facility and operation in the terrestrial area)

5.2.1 Construction-related impacts in the landfall area

Temporary, construction-related *impacts on residential and recreational use* of land areas through noise, aerial pollutants and visual disturbances

In advance of the construction phase, the plan is to set up the construction site for the natural gas terminal. As a result, the forest – a characteristic feature of the countryside in this area – will be affected even at this early stage. Construction machinery and construction activities at the landfall point will have a **temporary** but significant negative impact upon the coastal countryside in the immediate landfall corridor. As a result, the natural beauty of the unspoiled coastlines is anticipated to experience major changes during the construction phase. In assessing the potential risks, it must be remembered that people pursuing leisure and recreation mostly stay to the west of the port entrance. For many of them, the construction corridor at the landfall point will therefore be visually obscured. Accordingly, the view will be adversely affected when looking from the Bodden and from the breakwater wall at the port entrance.

Construction activity will also be relatively clearly visible from higher vantage points in the pine forests on the dunes to the west of the breakwater wall, where a number of exit points from the beach are also situated. Since the line of sight is otherwise mostly obscured, however, construction activity is likely to have little or no visual impact at other landward points outside the imme-

diate landfall area. As a result, the temporary visual impacts during the construction phase can be categorized as localized and of moderate intensity for the immediate area, and as medium-scale and of low intensity for more distant locations (particularly the town of Lubmin).

According to the noise expert report, the noise emission guide values for residential and other settled areas will not be exceeded by the usual construction activities (welding, coating, transport, foundation works etc.). The highest noise emissions are produced temporarily by the establishment of the sheet piling by pile driving works, dredging works and the drainage and drying of the pipelines during the pre-commissioning phase. The main statements and assessments of those construction-related noise emissions are already included in the corresponding section on noise impacts in **section 5.1.1** (including potential effects on the sports boat harbour at the harbour entrance), so reference can be made to them. No impacts on the locality of Spandowerhagen are to be derived. In the boundary areas of Lubmin the emission guide value for night (35 dB(A) guide value) for exclusive residential areas will be exceeded by less than 5 dB(A). Possibilities for noise mitigation measures (baffle board, noise barrier) are displayed for the situation when the deduced night guide value for the sports boat harbour is exceeded. The noise expert report also describes possibilities for additional noise protection measures for a reduction of the emission level regarding the pre-commissioning phase with drainage/drying of the pipelines. For mitigation of the short-term high noise level during pile driving work, the use of vibratory pile drivers which cause a lower noise level than hammer pile drivers is planned.

With respect to the impact on residential and recreational functions of exhaust fumes, because of the distances involved (> 400-500 m) and screening by trees and shrubs, no significant conflicts arise.

Construction-related traffic will occur on the available access routes in the area of the EWN location. For the landfall building site, a driveway will be utilised to the area of the gas terminal; this is to be constructed during the course of this plan. Residential uses are not present here. Except for "EWN visitors," no recreational use takes place on these roads. On account of the existing use pattern of these roads and paths for trade-related traffic (pre-load), no influence on residential or recreational functions is anticipated.

To summarize: significant environmental impacts due to noise, visual disturbances, exhaust emissions, etc. can be expected in the area immediately surrounding the landfall corridor for the duration of the construction phase. However, this area is of no importance to residential and leisure functions. As a rule, residential and leisure areas will experience little noteworthy disturbance.

A more pronounced impact due to noise cannot be ruled out in nearby leisure areas such as the sports boat marina and the beach at the eastern extremity of the port, especially at night during very brief construction work and in the pre-commissioning phase.(1)

However, apart from the fact that these construction activities will be of very short duration, the areas affected are close to the port and Lubmin's industrial zone, and are therefore already used to certain levels of disturbance. Moreover, no leisure activities take place on the beach at night. On the whole, therefore, structural and functional degradation due to these activities is rated as minor, of very brief duration and of a moderate intensity.

Temporary *impacts on abiotic conditions* and temporary changes in *biotope types* in the terrestrial area of the landfall point until regeneration is complete

A sheet piling trench will be dug to lay the pipelines in the landfall corridor. The ground on either side will be levelled and soil may be deposited temporarily. With the exception of the area where the pipeline emerges from below ground and continues to run above ground, the original morphological conditions will be restored. This being the case, construction-related degradation of the relief conditions is rated as localized, short term and of moderate intensity.

On the landward side of the landfall corridor, excavation of the sheet piling trench and backfilling when the pipeline has been laid will lead to structural changes in the soil as its content is mixed. In the work area along the pipe-laying corridor, the ground will be levelled, topsoil will be mixed, some soil areas will be sealed and others will be temporarily covered. Since the landfall corridor contains immature soils that are to be levelled scarcely or not at all, as well as (initial) podzol soil that has experienced only a short development phase, and since sedimentation is very rapid on the shore, these construction-related impacts on the soil are rated as minor, localized and temporary.

A similar view is taken of impact on the young, predominantly sandy biotopes in the landfall corridor. In the area of the sheet piling, existing biotopes will temporarily be replaced in their entirety by a technical facility. In the adjacent work area too, temporary uses will lead to heavy superimposition. Once construction activity has been completed, the existing biotope types will follow the natural stages of regeneration as the previous substrate and relief conditions are restored. The existing biotope structures have already recently experienced a brief development phase. In some cases, secondary development occurred on sites used for various construction purposes(2) and on abandoned farmland and gardens in the Freesendorf settlement. The shore biotopes (tide lines and cliffs) are naturally exposed to rapid shifts in sedimentation. With the

(1) Namely, the ramming of sheet pilings and, in the pre-commissioning phase, to drain and dry the pipeline (see **section 5.1.1**)

(2) Namely the storage of soil during expansion of the former outbound shipping channel and other construction activities

exception of trees and shrubs, the existing biotope types are forecast to regenerate quickly[1] in the landfall corridor. For this reason, these changes are rated as localized, short- to medium-term and (at times) of a high intensity. The resultant structural and functional degradation can thus be classed as minor overall.

Construction related effects on animal species

For the otter (*Lutra lutra*), which is very sensitive to disturbance and is seen along the whole coastal area, the laying of corridors is of minor significance. The southern Freesendorf meadows as well as the bank area are used by the otter; however its main focal points are in the area of the Freesendorf and the Spandowerhagener Wiek. The interferences limited to the building phase concern only the southern Freesendorf meadows, so considerable habitat restrictions or barrier effects are not expected. In addition there is the previous impact of the construction and operation of the natural gas terminal.

Breeding birds in the area immediately affected by construction activities in the landfall area include the woodlark (*Lullula arborea*), red-backed shrike (*Lanius collurio*) and barred warbler (*Sylvia nisoria*). Significant interference already exists for these species with the construction work for the natural gas terminal (a different scheme), so that medium to longer-term scaring off of the breeding birds by noise already takes place in the landfall area of the pipeline.

For breeding bird occurrence beyond the immediate landfall corridor there is no lasting interference; only temporary and brief impacts are anticipated.[2] No loss of breeding bird occurrence is thus forecast. The main resting areas, seaward as well as landward, lie only partially within the active zone with clear visual and acoustic disturbance (up to approx. 300-500 m). For resting birds which use the active area only when searching for food, there is loss of function during the construction phase. It is possible for them to avoid this by using adjoining areas beyond the active space. This applies to rest areas in the southern Freesendorf meadows and to feeding areas for waterfowl in the shallows close to the shore.

On account of the existing impact of the port entrance and the harbour breakwater and wide areas of evasion, the functional impact on waterfowl (mainly ducks and swans) will be low. In July and August, the mute swan (*Cygnus olor*), Eurasian wigeon (*Anas Penelope*) and mallard (*Anas platyrhynchos*), as well as great crested grebe (*Podiceps cristatus*) and Eurasian coot (*Fulica atra*), have been seen in the immediate landfall area in relatively low numbers. For these species, the construction phase may cause displacement from resting areas lying within the proposed construction area. The feeding areas in the Freesendorf meadows to the north of the stone path lie only partially within the proposed construction areas. Low functional influences are expected overall, due to the short-term nature of the impact of building on resting birds.

(1) See the section on facility-related impact

(2) E.g. during activities for the drainage and drying of both pipelines

Apart from these creatures, reptiles and insects are the main fauna groups to be taken into account in the landfall corridor. During the construction phase, the sheet piling trench and the adjacent working areas will not be habitable for reptiles and insects due to temporary changes in habitat structures. However, in the short to medium term, these habitat structures will regenerate. Focused action can minimize construction-related losses and other influences.(1) Only minor structural and functional degradation is anticipated.

5.2.2 Facility-related impacts in the landfall area

Permanent localized changes to abiotic conditions, biotope structures and the countryside in the landfall corridor

Due to the facilities put in place, substrate will be replaced by technical pipeline materials. However, the deeper sediment layers that are affected are only of secondary importance from the point of view of landscape ecology.

In addition, concrete foundations will be built for a variety of purposes over small areas of the natural gas terminal premises.(2) A total of approx. 1826 m^2 will be developed and/or sealed. These small developed areas will lead to permanent changes in the soil and biotope structure. The former forest area has already been replaced by a technical facility in the shape of the natural gas terminal.

The resultant impairments are rated as localised (covering very small areas), permanent and of high intensity.

In light of legacy disturbances before the project, the structural and functional degradation can be classed as moderate overall. With a view to their impact on the way people experience the countryside, the few above ground facilities necessitated by the Nord Stream pipeline can likewise be virtually ignored. This assessment has been reached because the existing compressor and transfer station (a densely developed technical facility) has already significantly impacted on the countryside.

The rampart-like covering at of the point at which the pipeline emerges from below ground also creates a permanent change. On the other hand, the use of sandy soil and the growth of vegetation in the medium term will allow this small covered area to be integrated almost seamlessly as a semi-natural feature in the surrounding countryside. In all other respects, the original condition of the relief, the biotope structure and the usage structure in the landfall area will be re-

(1) See avoidance of conflicts in **chapter 7**

(2) Reinforced concrete foundations for friction bearings, pig receivers, stop valves and bypass values in the pig station; foundation plates and backfilled cantilever retaining walls at the point where the underground pipeline surfaces; and temporary linear hoists to retract the pipe strands (the base plate of the linear winch is removed after the building phase).

stored after construction. Herbaceous vegetation will grow over the arid areas and dunes. In line with the earlier nature of the semi-open countryside, isolated woods and trees and shrubs will also be replanted. In light of this regenerative development, no other permanent degradation of the countryside is to be expected.

Since the fundamental nature of the countryside in the landfall area will not be affected (except by the natural gas terminal), the small changes to elements of the landscapes(1) are rated overall as a minor structural and functional degradation of the countryside.

Localised impacts on natural succession of terrestrial biotope types through the *removal of isolated trees and shrubs* and the permanent removal of larger trees and woodlands from the landward pipeline corridor

The individual trees and shrubs in the landfall corridor outside the natural gas terminal(2) will be removed and the (narrower) corridor around the pipeline will permanently be kept free of tree growth. This will change the biotope structure from mesophilic broad-leaved shrubland to pioneer vegetation on sandy areas. Neglected sandy grassland vegetation will grow in the short to medium term. This will be a permanent effect, although the selective planting of trees and shrubs in the landfall corridor (except directly above the pipelines) could create a comparable structure to the one that existed before the construction work (open biotopes with isolated trees and shrubs and bushes), subject to due provision for the medium-term development period required by the trees and shrubs.(3)

These permanent, localized impacts of a moderate to high intensity can be classed overall as a moderate structural and functional degradation.

5.2.3 Operations-related impacts in the landfall area

Operations-related impacts are largely restricted to individual activities within the natural gas terminal in the context of inspection. Seen in relation to the operation-related impacts of the natural gas terminal itself (which constitutes a separate project), these impacts are virtually negligible and can be integrated into ongoing operations without significantly increasing the latter's environmental impact.

Outside the natural gas terminal the pipelines will be buried. Inspection activities therefore will have a very minor impact. Most inspection work will be done in one of three ways: inside the

(1) A few trees and shrubs and the rampart-like covering

(2) A few isolated bushes and young pine trees as well as a part of a row of poplars

(3) See also the discussion of conflict reduction in **chapter 7**

pipelines; through geophysical measurements and through occasional visual inspections on land.(1)

The pipelines will be laid in such a way that protective action and repairs are virtually unnecessary. It is extremely unlikely that external mechanical influences will affect the pipelines on land in the landfall corridor (due to soil cover and the clearly marked route). The potential risk to the environment is therefore very minor.

5.3 Assessment of the Environmental Impacts of Accidents and Loss at Sea

With respect to the potential environmental impact of accidents and loss at sea the following circumstances have been considered and suitable assessments are carried out:

- **Risk of accident or loss at sea during the building phase of the pipe-laying and/or during repair work through the collision of a foreign ship with the laying technology**:
  - As a collision with the laying technology can only occur during construction or repair times, the risk is so slight that it is only negligibly higher than the existing collision risk of the ship traffic ("zero variation"). The overall ecological risk is therefore considered low, taking into account the potentially considerable environmental impact and the almost negligible likelihood of construction-related accidents and damage at sea
- **Risk of accident or loss at sea during pipe-laying from an anchor, with possibility of damage to the pipeline**:
  - The probability of such an incident is lower than 10-4 a-1 for the pipeline. Thus the estimated ecological risk is slight, in spite of possible environment impact of high intensity should this unlikely event occur (depending on the type and size of the accident or loss at sea)
- **Risk of accident or loss at sea with damage to the pipeline leading to the escape of natural gas and its subsequent impact**:
  - A detailed assessment of the environmental risk has not been carried out for the EIA. This is because of the very low probability of such an accident or loss at sea . Moreover, the impact on the environment and subsequent impacts would vary strongly depending on the type and size of the incident

Depending on the nature and scope of any accident or loss at sea, the potential threat to the environment could be considerable. An incident could cause large volumes of harmful emissions

(1) These will be undertaken, for example, to monitor the growth of vegetation in the immediate pipeline corridor where necessary.

near to the coast to have a significant impact on the marine environment. **However, since it is extremely unlikely that an accident or loss at sea will occur during construction and operation of the Nord Stream pipeline, the risk of significant environmental impacts is rated as very minor.**

5.4 Assessment of the Risks from Old Munitions

Extensive investigations with the most modern methods have been carried out with regard to old munitions for the seaward and landward routes (here primarily the landward Usedom route is relevant) in the approach (planning process), during pipe-laying and during construction and operation (in the case of safeguarding measures and repair measures). In the eventuality of munitions being discovered, their expert protection and recovery is guaranteed, in coordination with the responsible authorities.

In German waters there is a certain risk in relation to munitions only for the Usedom route.(1)

According to current investigations, no munitions have so far been found. Further investigations are planned. Therefore no significant environmental risk is expected in connection with old munitions in the area of the German EEZ and coastal waters.

5.5 Summary of the Analysis of Potential Impacts

The analysis of potential impacts clearly reveals that the main impacts of the project will occur during the construction phase. This will be temporary, lasting between a few weeks and a few months, depending on the section and the technology). These impacts will also be of a localized nature.(2) The temporary nature of the construction-related impacts is, for example, clearly demonstrated by the performance of the third generation pipe-lay barges (approx. 1.5 km/day) and the second-generation pipe-lay barges (approx. 350 m/day).

Most of the seaward and biotope habitat structures affected by the project have the potential to regenerate. Accordingly, it is fair to forecast the short- to medium-term restoration of ecological conditions with only minor degradation.(3)

The only medium- to long-term impacts in the landfall corridor will be caused by the removal of a few isolated trees and shrubs (which will later be replanted) and by development on small plots

(1) Crossing of reconstructed ammunition transport routes to Bornholmbecken after World War Two

(2) Along a route with a "building site" that is constantly advancing, using pipe-laying, excavation and transportation equipment whose impact normally occurs within a radius of up to 1 km and, in some cases, up to approx. 5 km.

(3) For example, a longer regeneration period for reef habitats, long-living species of shellfish and phytal and "ruderalisation" effects for specific terrestrial biotopes

of land of small, isolated foundations for machinery and warehousing on the premises of the natural gas terminal. These will be built before the pipeline is laid.

Permanent structural changes at sea will occur only in small areas and only in those sections where the pipelines are laid on the seabed, and where rock fill may be needed. However, the pipeline material itself will form an artificial hard substrate. In addition, long-term changes to the benthic community will appear in the area of the planned Nord Stream dumping site in those surfaces where excavated material, particularly boulder clay, remains permanently.

Significant impact on the human population and the countryside will only be of a temporary nature. They will mostly be attributable to construction-related noise and visual factors in the landfall area near Lubmin and on the southern tip of the Mönchgut peninsula.

6 Comparison of Alternatives

Within the EIA, in addition to the “Zero Alternative“[(1)] the following spatial and technical alternatives have been compared as regards their impact:

- Spatial alternatives: Nord Stream route (the length of pipeline going through the area of the “marine reservation corridor for pipelines and cables”) and Usedom length of pipeline (the landfall route close to Karlshagen, crossing the northern Usedom and Peene River) – see **Figure 2.1**

- Technical alternatives to laying for the crossing of Bodden Marginal Well and Greifswald Bodden along the Nord Stream route (for explanations see the explanation in the EIA: open laying using the S-lay method; open laying using the zig-zag method; open laying by float and sink; and laying in a tunnel)

As mentioned in **section 4** and **Figure 4.1**, large area alternatives for pipe-laying in the region under German jurisdiction are not analyzed and assessed in detail in the EIA.

The **technical alternatives for laying** correspond to the different technical views relating to laying in the Greifswald Bodden to the length of pipelines’ deposition point in approx. 15 m of water along the Nord Stream route. No technical alternatives are featured for the conduits lying in reach of the area in the north-east of the Habitats Directive “Greifswald Bodden Marginal Well and parts of the Pomeranian Bay" up to the border of the EEZ. However, the commonly practiced S-lay method, as well as the method of depositing the pipeline on the seabed, is assumed to be the optimal way to lay these conduits. The tunnel version only relates to the section of the

(1) "Zero Alternative“: comparative observation referring to environmental and ecological development without realizing the project (in the meaning of a “development without influences from the outside”).

pipeline including the crossing of Greifswald Bodden and its threshold (Bodden Marginal Well), whereas the S-lay method will be used for the remaining part of the length of pipeline.

Therefore only the technical construction of the S-lay method is considered for the Usedom route. Furthermore the various possibilities of construction methods which could be used for the Usedom length of pipeline crossing the Peene River, either by using open laying (culvert) or HDD(1)/microtunnelling, will be compared.

The status analysis and status evaluation, as well as the predicted impact on the EIA, form the basis for the comparison of alternatives. The status analysis describes the conditions for the Usedom length of pipeline and, in order to predict the impact, examines the predicted impact of these various technical laying alternatives in such a way as to enable a comparison of alternatives.(2)

For the crossing of Peene River close to the Usedom section it has been determined that within the EIA the HDD method or microtunnelling are preferable to open laying. Therefore, the comparison of the possible alternative for Usedom with the Nord Stream route running through the Greifswald Bodden will consider the laying by HDD/microtunnelling in the area of the Peene River.

The findings of the alternative comparison of environmental compatibility for the Nord Stream route and its technical variants as well as the Usedom route are described below.

A **comparison of the possible technical outcomes** for laying the length of pipeline along the Nord Stream Route in the Greifswald Bodden shows that, in terms of the potential impact on the environment, the S-lay method and the zig-zag method have almost equal impacts. The marginal disadvantages of the zig-zag method compared to the S-lay method include:

- The greater technical effort (more visual and acoustic impacts and higher emissions)
- The use of artificial materials for securing the stability of pipeline length in a lying position at the inflexion points
- Unforeseeable risks due to methods relatively untested in the field

(1) HDD - Horizontal Directional Drilling

(2) For the Usedom length of pipeline, an explanation and evaluation follows for the seaward side, the landing zone and the crossing of Usedom island and the northern Peene River. This spatial extension for the length of pipeline about the actual disembarking point near Karlshagen is urgent for an objective comparison of versions, as in the further run of pipeline with the northern Peene River a water body is crossed again, which might cause significant environmental conflicts. Therefore the status analysis and evaluation is observed for the length of pipeline from the EEZ to and including the crossing of the northern Peene River.

The float and sink method can be categorised in a similar way. However, for this method further disadvantages such as possible impacts on the environment can be expected, because laying requires two vegetation periods and hence medium-term influences cannot be ruled out.

The laying of the pipeline in the tunnel in the Greifswald Bodden area and Greifswald Bodden Marginal Well is considered less appropriate than the S-lay method for the following reasons:

- Visual effects
- Noise and emissions at the seven tunnel ducts
- Busy contractor traffic influencing a larger area of the Greifswald Bodden and Greifswald Bodden Marginal Well

Due to the three-year construction period, the impact can be categorised as medium term and there are risks of lasting consequences in the form of animals avoiding the area (e.g. grey seal in Greifswald Bay). The tunnel duct in the shallow water reach at the Freesendorf meadows will affect this relatively undisturbed zone, which is a valuable resting place for birds, for about three years. In addition, excavations for a temporarily used access channel will be necessary, and this will lead to further medium-term disturbances.

In the landward direction, the tunnel version would result in a larger area within the reach of the coastal area coming under stress due to the erection of a chute construction to the tunnel duct, involving further installations (also for a three-year construction period). Changes in the Habitats Directive priority habitat type 2130* “grey dune”, and in other marine biotopes, would take place.

The tunnel version is a method whose risks are hardly foreseeable and which could lead to a further extension of the construction period and additional use of engineering; this would entail stronger, as yet unconsidered, impacts on the environment.

Regarding the **spatial alternatives for the length of the pipeline**, the Nord Stream route through the Greifswald Bodden is considered more appropriate. The status analysis indicates that in the area of the Usedom length of pipeline, seaward marine habitats including larger reaches of boulder and rock habitats(1) - which are classified as important components of Natura 2000 areas - will be affected. The Nord Stream route crosses the Greifswald Bodden Marginal Well and the bay. This means that, especially through the use of reduction procedures (such as shielding procedures or the deposition of sediments likely to cause blurring on the spoil ground), the impact on the environment caused by swirling up sediment during digging could be structurally optimised.

(1) Habitats Directive habitat type 1170 “reefs”

For the Usedom length of pipeline, stronger temporary impacts on important habitats (e.g. sand dune pine forests and wetland forest areas) and impacts on the habitats of sensitive animal species are also expected. Accordingly, impacts on the Natura 2000 interests could also be anticipated, especially in the crossing of the Peene river. For the Usedom alternative a higher environmental risk(1) is likely – due to the proximity to significant areas of tourism, recreation and human habitation – than for landfall at the energy and industrial site near Lubmin. In the case of Usedom, the construction of a transfer station near Karlshagen could possibly lead to a lasting impact on the tourist areas of the region.

To conclude: the preferred method – within the limits of the alternatives compared according to the EIA – is open laying using the S-lay method alongside the Nord Stream route running through the Greifswald Bodden.

7 Prevention and Mitigation Measures and Suggestions for Monitoring

Suggestions for the prevention and mitigation of the impact on the environment caused by the project, within the limits of the conflicts analysis (see **section 5**), are summarized in the following **Table 7.1**:

Table 7.1 Suggested prevention and mitigation measures

Suggested prevention and mitigation measures
General prevention and mitigation measures
• The construction phase in German waters near to the north-eastern boundary of the Habitats Directive area should be concentrated in as short a time period as possible between May and December (open laying following the S-lay method). The aim here is to reduce the construction time in general, with only one reproduction or vegetation period affected, rather than extending the project over two or more years • Only engineering equipment and vehicles that operate within emission and noise limits(2) should be used • Ecological monitoring is recommended in order to ensure the prevention and mitigation measures suggested in these papers are properly implemented, as well as for project-related monitoring

(1) Noise, visual disturbances, emissions, etc.

(2) Regulations of the BImSchG and the relevant BImSchV, in particular noise

Suggested prevention and mitigation measures
Length of pipeline in the coastal area (EEZ and 12 nm zone)
• The reduced emission of light during digging at night can be ensured by the use of specially balanced lighting systems • Primary use of vibrating rams instead of pile-drivers • Use of digging technologies which cause less diffusion of sediment as well as the installation of shielding constructions to avoid the drift of particulates during excess of target levels, in order to ensure compliance of 50 mg/l in addition to background turbidity within 500 m from the suspension source (short-termed 100 mg/l possible) • Management of the deposition of dredged material at the Nord Stream dumping site and reassembly in the laying trench: spatially separated interim storage according to the type of substrate, and the reassembly adapted to the substrate conditions • Reduction of the permanently deposited excavation material at the Nord Stream dumping site • Avoidance of storage of excavated material at the Nord Stream dumping site in the areas with denser rock cover (reef habitat) • Deposition of dredged material with a high organic content on a spoil ground • Remedial action for rock and boulder fields • Restriction of construction between end of January and end of April in the Habitats Directive area during the herring spawning season and the seabirds' winter and spring resting periods • Reducing the alluring effects of works lighting on birds and insects: emergency lighting during construction breaks

Suggested prevention and mitigation measures
Length of pipeline in the landfall area (coast zone and landward side of route)
• Noise mitigation measures regarding emissions for the sports boat harbour at the harbour entrance in Lubmin, as well as noise barriers and/or muffling for compressors in when draining and drying the pipelines in the pre-commissioning phase • Schemes for vegetation protection (for example, the protection of roots) within tree and shrub areas • Use of previously affected biotopes for working areas, working site construction and approach zones • Use of protection and guiding devices for amphibians, reptiles, smaller mammals and insects • Schemes for avoiding impurities caused by organic or in-organic auxiliary products used for construction • Regrading the landfall point construction zone according to the pre-construction surveys(1) • Creation of natural ground-sand proportions (especially for the upper ground surface) in the construction zone • Planting of single, habitat-suitable trees and shrubs in the working zone of the landfall corridor after laying the pipeline(2) according to the natural situation(3) • Avoiding the dumping of material (especially organic material) on the ground, which can lead to ruderal effect on the coastal and dry zones • Shield construction lamps and construction site lighting in the direction of Freesendorf Wiesen and Greifswald Bodden • Shield further visual effects in the direction of Freesendorf Wiesen and Greifswald Bodden (temporary hoardings)(4)

(1) Except for the junction between the underground and above-ground section of the pipeline, as well as the reach of the natural gas terminal

(2) Except for an area of approx. 6 m along every conduit, which has to be kept free of bigger trees.

(3) In the construction zone single trees or smaller groups have to be removed during the construction period.

(4) The suggested procedures refer to the landfall point near Lubmin, as the preferred version according to the comparison – see **section 6**.

To ensure the proper implementation of the various suggested methods for prevention and mitigation, monitoring by selected experts is recommended. This can be combined with other monitoring tasks.

Difficulties in the evaluation of the Nord Stream project's environmental impact primarily relate to uncertain predictions of individual project-related impacts. This is due to the fact that a project on this scale has not previously been carried out in the area of the Baltic Sea. Monitoring, particularly based on the inspections relating to project impacts, is therefore especially important: it will enable predicted impacts to be verified and conclusions to be drawn for comparable projects.

For the monitoring of environmental impact, evaluations are necessary before, during and after the completion of different parts of the construction work. The exact nature and scope of the monitoring scheme has to be developed in the course of further procedures, in cooperation with competent technical authorities and, if necessary, with the institutions involved. The EIA lists those monitoring topics that are considered appropriate according to the predicted impact.

8 Summary of Impacts

In summary, construction of the Nord Stream pipeline from the border of the EEZ to the landfall point at Lubmin is assessed as being environmentally acceptable. This is on condition that the suggested methods for prevention and conflict mitigation described in the EIA are realized, the compensation outlined in the Landscape Conservation Support Plan (Landschaftspflegerischer Begleitplan, LBP) is paid, further stipulations made by authorities (e.g. referring to potentially affected registered monuments) are met, and monitoring of the project takes place.

The EIA – according to §§ 18 in combination with 28 LNatG M-V, §§ 33 and 34 BNatSchG in combination with Article 6 (3) of the Habitats Directive as well as Habitats Directive Impact Assessment following Article 4 paragraph 4 VSRL – is described in a Habitats Directive compatibility study and presents the basis for the realization of the Habitats Directive compatibility assessment. The Habitats Directive compatibility study concludes that if the itemized measures of damage limitation, conflict avoidance and mitigation of environmental impacts are implemented, no substantial impairment is to be expected as a result of the project to the Habitats Directive habitat types listed in Appendix I and II of the Habitats Directive, including priority habitat types or species, or regarding conservation goals for resting species of bird and migratory species of bird listed in the Birds Directive. The experts consider the Nord Stream pipeline project compatible in the sense of § 34 paragraph 2 BNatSchG. An additional "exception procedure" under § 34 paragraph 3-5 BNatSchG or investigation of alternative solutions under Articles 6 (4) Habitats Directive is therefore not considered necessary.

A landscape conservation monitoring plan for the implementation of the impact regulations according to § 14 LNatSchG M-V is available for the project. Accordingly there are considerable changes in the sense of § 18 BNatSchG (intervention in nature and landscape) for benthic organisms and their habitats in the area of the laying channel and/or the pipelines laid on the seabed, as well as the adjacent impact area of the pipeline route (directly adjacent work area and impact area with increased sedimentation, as well as the neighbouring impact zone with increased turbidity and other environment impacts). Measures are therefore proposed to compensate the intervention.

In addition to the studied “specially” and “strictly protected species” in the landscape conservation monitoring plan, also examined is whether the prohibitions concerning species conservation according to § 42 BNatSchG are kept by the project according to all species of appendix IV of the Habitats Directive (strictly protected species), all species listed in column 3 of Appendix 1 of the Federal Ordinance on the Conservation of Species (Bundesartenschutzverordnung – BartSchV), all species which are mentioned in the EG VO 338/97 (EC regulation) and all “European bird species”. To that extent it is examined if prohibitions concerning species conservation are opposed to the project.

Under reference to the regulations of § 19 paragraph 3 BNatSchG the existing SAP here to the Nord Stream pipeline yielded, that no habitats and/or biotopes of "strictly protected species" in accordance with § 10 paragraph 2 no. 11 BNatSchG are destroyed, that are not replaceable for these species. For all surveyed “strictly protected species” of Appendix IV of the Habitats Directive, “strictly protected” European bird species of art. 1 of the Birds Directive and “specially protected bird species”, the prohibitions according to § 42 BNatSchG are kept if the avoidance and mitigation measures are taken into account.

Through inclusion of the proposed avoidance and mitigation measures, a lasting threat to the local populations can be excluded for all species so that the maintenance condition of the populations (with birds related to the biogeographical population) in its natural distribution zone does not deteriorate.

The study shows that by implementation of the tested avoidance and mitigation measures, as well as the preferred compensatory measures (CEF measures) no requirements concerning species conservation according to § 42 (1) no. 1 and 2 of the Federal Nature Conservation Act (BNatSchG) for all observed species groups will be affected. For some of the surveyed species it was concluded that from a nature conservation point of view an exception from the prohibitions of § 42 para. 1 no. 3 BNatSchG according to § 43 para. 8 BNatSchG can be given.