Model Computations

Selected references

3rd of May 2023



NIRAS computes the models for all new structures

NIRAS has established a broad level of experience in numerical modelling various challenges in the coastal, and offshore waters through the many integrated coastal projects we have implemented across the world. Coastal engineering is a complex discipline that requires extensive theoretical knowledge and genuine practical experience. Additionally, coastal engineering projects are often multidisciplinary and concern several stakeholders making it crucial to successfully manage and combine all interfaces involved. This complexity sometimes require numerical modelling. NIRAS uses state of the art software like MIKE by DHI and CFD to solve complex marine challenges. NIRAS has a team of 17 skilled coastal engineers, several holding PhD's in Offshore coastal and estuarine engineering and several are authors of acknowledged international papers of coastal engineering. Together the team holds over 250 years of experience in coastal engineering and numerical modelling. NIRAS also holds dedicated models of large portions of the world.



Klavs Bundgaard
Head of Department
+45 6040 5670
KLBU@niras.dk



Signe Schløer
Team Manager
+45 6039 4411
SSC@niras.dk

Optimized and tailored solutions

NIRAS stresses the importance of establishing a fundamental understanding of the natural environment and local conditions when developing sustainable solutions. We hold state-of-the-art numerical models (MIKE-software and CFD-models), GIS and 3D CAD software, which enable us to assist our clients in managing and monitoring the coastal environment as well as developing, optimizing and presenting our assessments and designs.

We have extensive state of the art experience with modelling. Modelling is a tool which allows us to model, understand and visualize complex physical phenomena in the coastal zone. At NIRAS we take pride in understanding the physical phenomena before the model is setup in order to use the model correctly. NIRAS has also developed tools and methods to utilize the best available free data thereby saving time and money for the client.

A wide range of services

Our in-house specialists cover all required disciplines within numerical modelling and have decades of experience in solving complex coastal challenges including:

- Metocean studies, offshore windfarms and offshore installations. Hindcast, and forecast of waves and currents. 3D stratified flows. EVA.
- Coastal studies, harbors and sedimentation, cable landfalls and coastal structures. Estuarine management. Cohesive sediments and sand.
- Dredging, reclamation and beach nourishment studies
- Environmental engineering, outfalls, fish farms, spillage, water quality and bathing water
- Recirculation studies
- Reclamations, marine structures and subsea cables.



Restoration and Climate Adaptation of Liseleje Beach, Denmark

Liseleje beach is experiencing challenges with chronic erosion, causing a retreat of the beach. As a consequence of this, the citizens have difficulties accessing the beach, as the beach has disappeared on parts of the coast. Additionally, there are challenges with acute erosion in front of the revetments and the properties during storm events.

NIRAS has on behalf of Hyllingebjerg-Liseleje Coastal Protection Association made proposals for optimisation of the existing breakwaters, in close collaboration with the client and based on the long experience and knowledge that NIRAS has within the field. The proposed optimisation of the breakwaters included changes in the structural shapes as well as an extension of selected breakwaters, with the aim of improving the structures' ability to stabilise the beach. Moreover, NIRAS made an outline proposal for the construction of four new breakwaters. Finally, NIRAS was responsible for proposals on beach nourishment, both as a part of the beach restoration and also as a continuous element in creating a sustainable coastal protection at Liseleje.

The restoration of the beach at Liseleje contributes with increased recreational value to the landowners and to the visitors of Liseleje Beach. NIRAS has additionally assisted with the permitting in relation to the design for application. The presented proposals are in agreement with the municipal strategy on the area, known as Nordkystens Fremtid. The project is thereby an example of NIRAS's ability to apply a holistic perspective when completing projects. The project is an example of strong collaboration between landowners, local stakeholders and municipality in accordance with UN's sustainable development goal no. 11: Sustainable Cities and Communities, collaborating with the aim of ensuring the access to the nature at Liseleje beach.

Year
2018 - 2020

Customer
Hyllingebjerg-Liseleje Kystbeskyttelseslag

Contract Fee
142,585 DKK

Project Category
Harbours and Marine Structures

#11 Sustainable cities and communities

#13 Climate action



Aflandshage and Nordre Flint Offshore Windfarms, Denmark

Copenhagen Municipality is making a green transition of the capital energy production as a part of their strategy to become climate neutral. The Greater Copenhagen Utility, HOFOR, therefore wants to establish two offshore windfarms in Øresund, Aflandshage and Nordre Flint, with a joined capacity of 410 megawatts. Aflandshage Offshore Windfarm will be located east of Stevns and Nordre Flint Offshore Windfarm between Copenhagen and Malmø, Sweden. The establishment of the offshore windfarms might affect the environment, and HOFOR is therefore making an environmental impact assessment (EIA).

NIRAS is consulting HOFOR Vind A/S about this, and has made the EIA for the two offshore windfarms. Amongst others, the extensive work accounts for the impact on the marine flora, fauna and seabed. Additionally, the windfarms are constructed within the legal framework, which considers existing Natura 2000 areas in Øresund as well as the EU legislation on the Water Framework Directive and the Marine Strategy Framework Directive.

As a part of the EIA, NIRAS has made a background report on coastal morphology, sediment spill and hydraulics. To determine these changes, NIRAS has setup a numerical depth-averaged 2D model in MIKE 21 HD FM and MIKE 21 SW by DHI. The results of the model is compared with the existing conditions to determine the impact of the offshore windfarms on the marine environment. Additionally, NIRAS has investigated the spread of sediment through modelling of spill in MIKE 3 MT.

Year
2019 - 2023

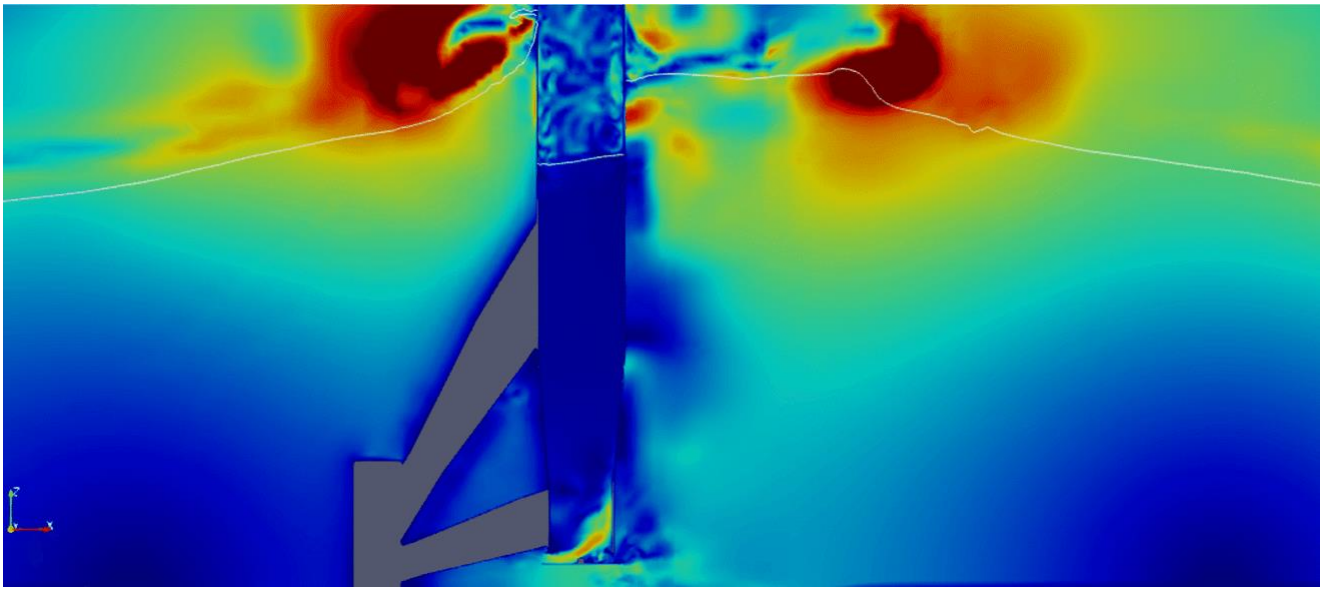
Customer
HOFOR A/S

Contract Fee
19.662.034 DKK

Project Category
Green Wind; Wind energy

#7 Affordable and clean energy

#14 Life below water



Trianel Offshore Wind Farm Borkum, Germany

Evaluation of the existing scour protection and design of new improved scour protection concept for the substructure at the Trianel offshore wind farm. Scope of work for the delivered services by NIRAS was divided into three steps whereof the two first where followed up by a gate meeting to discuss and make decision for the final phase. All work was handled by NIRAS internal specialists.

The Scope included but not limited to, site specific data review, analyzing of historic data, setup of 3D CFD model, and simulation and Computation Fluid Dynamic (CFD) calculation. Furthermore, basic design of the scour protection concept and scour protection installation and technical specification. The Trianel Windpark Borkum accommodated 40 turbines where 2 positions was chosen for the CFD simulation. The selected Tripod foundations was installed with Areva M5000-116, 5 MW turbines.

To find the best scour protection concept for the site in the fastest and most reliable way, NIRAS undertook the meticulous CFD-modelling, using the actual, up-to-date data from the site. Due to the wind farm having functioned since 2011, information about the actual current, waves and weather could be used to simulate closely how the scouring happens under different circumstances, at different times of year and in different weather. Based on these simulations, NIRAS proposed a plan for design of a scour protec-tion involving a wide graded single layer of rocks of a specific sizes. Due to the complex design of the structure NIRAS used the CFD analysis to determine the ideal properties of the rocks. The ideal rock material consisted of several rocks sizes where the biggest was heavy enough to stay at the seabed and the smallest small enough to prevent winnowing.

Year
2019

Customer
Trianel Windkraft Werk Borkum GmbH & Co.

Contract Fee
447.868 DKK

Project Category
Wind energy

#7 Affordable and clean energy

#14 Life below water



Tangkrogen Integrated Plan

Aarhus Municipality and Aarhus Water are facing the challenge of implementing the projects outlined in the Tangkrogen Integrated Plan, which includes the construction of a new large Marselisborg wastewater treatment plant (Aarhus ReWater) and the expansion of the existing Marselisborg Marina. The establishment of Aarhus ReWater will meet the increasing need for wastewater treatment and at the same time release space for urban development and climate adaptation. The expansion of the marina will result in 700 new boat slips and provide opportunities for the development of existing and future marina functions. In conjunction with the project, hydraulic modeling of the conditions around the marina will be conducted in order to illuminate how the new facilities will affect the conditions related to hydraulics, waves, seaweed, and sedimentation.

NIRAS is responsible for the hydraulic calculations that will be performed using the numerical models MIKE21. This involves hydraulic calculations in relation to the discharge pipe in relation to the determination of the future discharge point, including the hygienic impact and bathing water quality. Additionally, hydraulic calculations are performed to determine terrain elevations, covering works, etc. Furthermore, NIRAS has set up a detailed wave and current model combined with calculations of sediment spread from the implementation of the project to determine changes in wave and current conditions and deposition patterns. The impact on the transport of seaweed and the dynamics of the coast south of Tangkrogen have also been examined in connection with the establishment of the Marselisborg Marina.

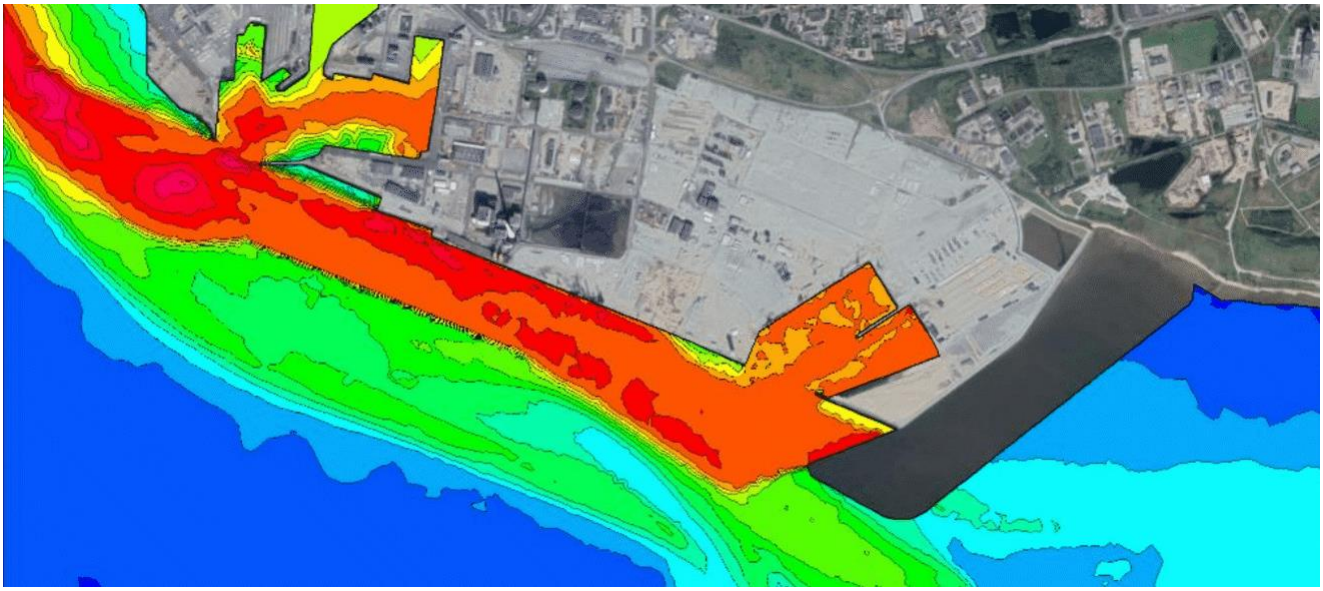
Year
2019 - 2024

Customer
Aarhus Kommune - Mobilitet, anlæg og drift

Contract Fee
20,099,698 DKK

Project Category
Environmental assessments

#6 Clean water and sanitation
#9 Industry, innovation and infrastructure
#14 Life below water



Model Calculations for Stage 5 of Esbjerg Harbour, Denmark

In connection with the EIA study for Stage 5 expansion of Esbjerg Harbor, modeling of hydraulic conditions, sediment dispersion, and morphology for former and future conditions was carried out. The EIA study identified the impact of the facility on the environment, with particular focus on hydraulic and morphological impacts in the Grådyb and Knudedyb tidal areas.

NIRAS was responsible for defining the calculations and analyses that DHI was to perform. In addition, NIRAS was responsible for assessing the numerical modeling and its consequences for the impact on current and wave conditions, as well as extreme water levels during storm surges (Storm Bodil, December 2013). This also included an assessment of the impact on water balance, salinity, fine-grained sediment, dredging quantities, and the impact caused by excavation waste in connection with dredging work. Furthermore, NIRAS was responsible for calculating the spill and spread of excavated sediment in connection with dumping in the North Sea.

Stage 5 expansion and filling towards the south was limited by the harbor boundary and the adjacent Ramsar and Natura 2000 area. The EIA study ensured that the expansion did not lead to critical impacts on the surrounding Natura 2000 wetland area, which is in line with Sustainable Development Goals number 14 and 15, which aim to protect and conserve marine and terrestrial ecosystems.

Year
2019 - 2021

Customer
Esbjerg Havn

Contract Fee
931.345 DKK

Partnership
DHI

Project Category
Harbours and Marine Structures

#14 Life below water
#15 Life on land



International Port at Gulhifalhu, the Maldives

The capital of The Maldives is Male, which is an island with a population of over 140,000 people in approximately 2 km^2. The existing port of Male is the primary port in the Maldives and is used as the hub for import and general cargo to serve the local population as well as the numerous resort islands in the country. The current port is surrounded by rapid urban development which renders any expansion impossible. As such the Government of Maldives contracted NIRAS in partnership with MTBS and local consultants to lead the development of an ambitious project to relocate the primary international port to a new reclaimed island; creating much needed space for not only the port, but also further industrial development in the greater Male region.

The project consists of preparation of a detailed masterplan of the new commercial island of Gulhifalhu, encompassing the new international port, a local distribution port, residential and commercial space and associated utilities such as power, water and sewerage. As a part of the project, specifications and geotechnical investigations were made. Hydrodynamic studies were also undertaken to determine the design wave climate, future sea level rise and associated metocean parameters.

NIRAS has made the detailed design of the reclamation scheme for the new island, including the detailed design of shore- and flood protection revetments to protect the new island from extreme metocean conditions. The design of the revetments are made so that their appearance was in keeping with existing measures in the local area. The design of the port encompassed the design of all components to a level suitable for the letting of an EPC contract. A full Environmental Impact Assessment of the scheme was undertaken to identify any negative effects to the environment, as well as propose any mitigation measures. Finally, NIRAS has produced two sets of tender documents and will continue to support the client with technical assistance.

Year
2019 - 2021

Customer
Government of Maldives

Contract Fee
1.920.000 USD

Partnership
MTBS

Project Category
Harbours and Marine Structures

#9
Industry, innovation and infrastructure



Coastal Protection for Five Islands in the Maldives

Ministry of National Planning and Infrastructure has on behalf of the Government of Maldives engaged Riyan and NIRAS as a sub consult for conducting detailed investigations and Design development for Coastal Protection at M.Kolhufushi, M.Mulah, M.Dhiggaru, Buruni and Vandhoo in the Maldives. These are all settlements in remote atolls in the Maldives subject to erosion, flooding and are vulnerable to climate change and sea-level rise.

NIRAS has provided detailed coastal analysis regarding existing conditions of the five islands with regards to flooding and erosion. Based on the coastal analysis NIRAS has developed feasible concepts for coastal protection schemes with regards to flooding and erosion. The analysis forms the basis for a detailed numerical modelling study of waves, water levels and currents at the islands applying MIKE 21 SW and HD.

NIRAS has modelled 20 years of regional and local waves, water levels and currents around the Maldives to determine the local design parameters at each island. The focus is particularly on the technically challenging transformation of waves over steep coral reefs. The modelling includes the fully coupled waves and currents MIKE 21 model, that has high enough resolution to cover flow over complicated coral reefs. Furthermore, NIRAS has analyzed the littoral processes including annual littoral drift and stable shoreline orientations and cross-shore transport during storms at two of the islands applying LITPACK. Finally, NIRAS has analyzed the coastal processes and the complex hydrodynamics, suggested possible coastal protection solutions, carried out detailed numerical modeling of hydrodynamics and sediment transport, and provided design parameters for the design of the final coastal protection solution.

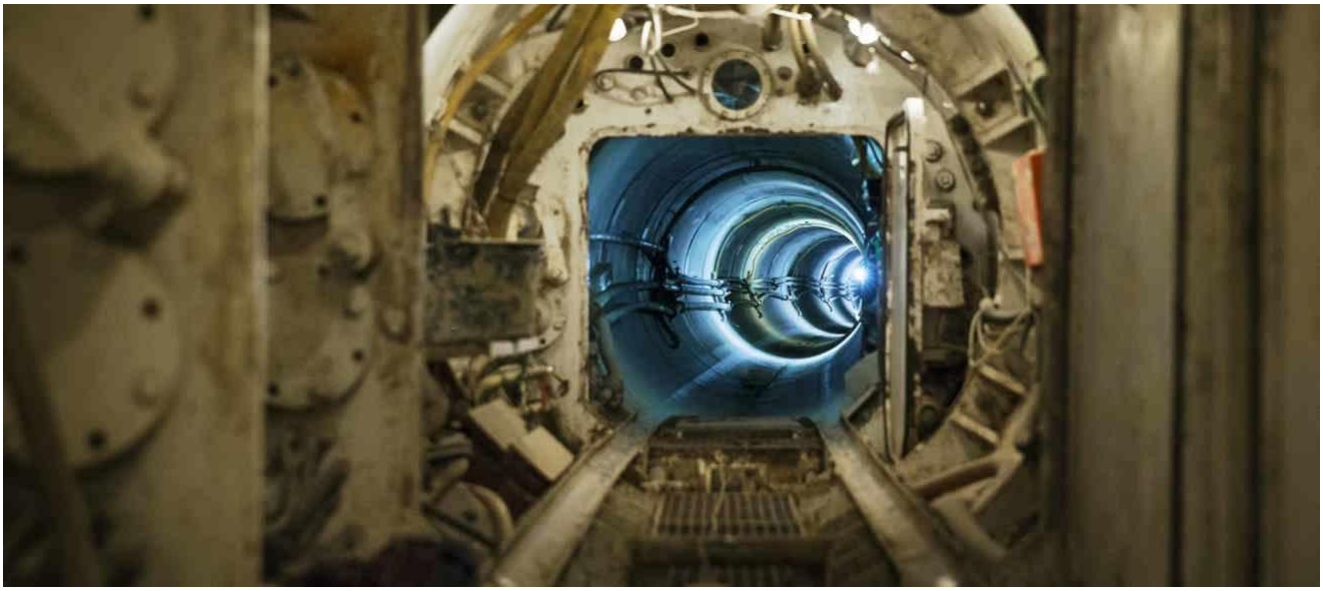
Year
2019 - 2020

Customer
Riyan Pte. Ltd

Contract Fee
84.000 EUR

Project Category
Harbours and Marine Structures

#13
Climate action



Valby Cloudburst Tunnel, Denmark

HOFOR is establishing a tunnel of Ø3,4m underneath Valby of a total of 2,4 km. The main goal is to secure the city against flooding from the sewage system during cloudburst. NIRAS is the main adviser on the project.

Valby cloudburst tunnel will run from the FLS-grounds just north of the railway area by the old Grønttorv, above the approach road Folehaven and with an outlet in Enghave Kanal in Valby Park – a complete distance of 2.400 m distributed over two tunnel stretches and four shafts.

The analysis phase and the sketch of the project is finished, here the hydraulic dimensioning is done and based on this the placement and shape of the necessary connecting constructions with the cloudburst valves, overflow functions and approach system. In spring 2023 the design phase is initialized.

With more frequent torrential rain and increased amount of everyday rain in the future, preventive measures are necessary to protect the city against flooding. The cloudburst tunnel will prepare the city for extreme cloudburst and at the same time the tunnel will also have a climate protection effect on the increased amounts of everyday rain, thus ensuring that the capacity of the sewage system is sufficient for the future.

Year
2020 - 2023

Customer
HOFOR A/S

Contract Fee
20.734.015 DKK

Project Category
Water environment

#11
Sustainable cities and communities



Sediment Dispersal Modelling of the Galatea-Galene Offshore Wind Farms, Sweden

Two offshore wind farms, Galatea and Galene, are to be constructed in the Swedish part of Kattegat Sea off the coast of Varberg and Falkenberg, Sweden. In the construction phase, the wind turbine foundations, offshore substation foundations as well as infield and export cables will all be established. This requires offshore operations such as dredging and drilling and will release sediment into the water column, which can then be dispersed around the marine environment by the current. In order to map if the dispersal will have an environmental impact, the spill must be quantified. As preliminary work, NIRAS has investigated the sedimentation at three sites and for three different offshore wind turbine foundations.

NIRAS has done the initial modelling of the sediment dispersal due to the above offshore installation works in order to quantify the sediment dispersal. This has been done through simulations of numerical models using DHI's particle model MIKE 21 PA. The models resolves the transport and sedimentation of spilled material in time and space. The driving forces of the dispersal are modelled through MIKE 21 HD FM. An extensive spatial setup is made, to ensure reasonable resolution of the tidal- and current pattern respectively at the three locations of interest. The model therefore covers the North Sea, Kattegat and the Baltic Sea.

The work allowed to identify weather the offshore installations would lead to a visible plume of suspended sediment or have potential biological effects. Finally, the deposition of sediment was mapped, making it possible to determine potential impacts on benthic fauna and flora.

Year
2020 - 2021

Customer
OX2 AB

Contract Fee
35.200 DKK

Project Category
Green Wind; Wind energy

#7 Affordable and clean energy

#14 Life below water



Kattegat Syd Offshore Windfarm Modelling of Sediment Dispersal, Sweden

Vattenfall has awarded NIRAS a study concerning the sediment spill from the seabed preparation for installation of gravity foundations and drilling a certain amount of the monopiles at the Offshore Wind Farm Kattegatt Syd in Sweden.

For some of the potential types of foundations, the construction phase will require drilling or seabed preparations to ensure the installation per the design requirements. Both drilling and seabed preparations may cause some spill of sediment. Likewise, for the installation of the inter-array cables and export cables.

NIRAS has investigated the dispersal of sediment from the installation activities for four different cases, where the hydrodynamics is simulated with the use of MIKE 3D HD and the spreading of the sediment with MIKE 21 PA which with input from the hydrodynamic model, site specific sediment grain sizes, settling velocities etc. can simulate the movement of the sediment in time and space (horizontal and vertical). Salinity and current speeds in five different levels of the water column, measured from within the boundaries of the wind farm, have been used to validate the hydrodynamics calculated by the MIKE 3D HD model.

To quantify the impact on the environment the sediment spill from these activities are simulated in time and space for an average hydrographic period.

Year
2021 - 2022

Customer
Vattenfall AB

Contract Fee
99,734 EUR

Project Category
Wind energy

#7 Affordable and clean energy

#14 Life below water



Detailed Design of Revetment on Fuvahmulah, the Maldives

NIRAS is a sub-consultant for MTH Højgaard in establishing coastal protection along a 2.6 km coastal stretch on Fuvahmulah, the Maldives, where the sea level rise already is very evident. Especially the Eastern side of the island is exposed to large waves due to the fetch from the South Pole. The island is located on a coral reef, and when the waves hit the reef, large amounts of water is pushed upon the reef. This can lead to flooding of the island, which is only 2 m above mean sea level at its highest point. The processes on the reef are special, which is why the project has included hydraulic model experiments to verify and adapt the numerical models as well as the design of the revetment.

The coastal protection is made to protect against erosion as well as flooding. The protection of the coastline consists of 2.6 km revetment and seawall, five staircases to access the beach, one rainwater drainage outlet as well as protection of swimming area using breakwaters.

NIRAS has made the preliminary design for tender, inspected the coastline and the existing facilities as well as made geotechnical investigations, made the outline proposal, detailed design and drawings for the contractor using CAD. Additionally, NIRAS has defined the setup for 2D physical model experiments, assisted with tests, made MIKE modelling regionally as well as locally and done CFD modelling of waves propagating across the reef.

Year
2021 - 2025

Customer
MT Højgaard Private Limited

Contract Fee
334.310 USD

Project Category
Harbours and Marine Structures

#11 Sustainable cities and communities

#13 Climate action



Modelling of Temperature Changes in Mariager Fjord, Denmark, due to Expansion of Dansk Salt A/S

In connection with their production expansion, Dansk Salt A/S has sought NIRAS' advice to determine whether the expansion will cause any undesirable impact on Mariager Fjord. The production expansion entails a number of changes, including increased discharge of condensate mixed with cooling water from the production plant. The discharge is into Mariager Fjord, and there are thus requirements for allowable temperature increases caused by the discharged condensate.

To investigate this, NIRAS has set up a three-dimensional model in DHI's MIKE 3 HD, which computes the distribution of salinity and temperature in the fjord. The model aims to determine the relative increase in the overtemperature in Mariager Fjord due to an increase in the amount of condensate resulting from the production expansion. The model is set up with bathymetry data and collected data on wind speed and direction. The flow in the model is driven by wind, tides, and density differences and is validated with compared water level measurements. NIRAS has used CTD profiles to determine input parameters for the model, including background temperature and salinity.

In addition to changes in the temperature of Mariager Fjord, the production expansion of Dansk Salt A/S will also cause increased shipping traffic in the fjord. NIRAS has investigated the impact through a Natura 2000 habitat area in the outer part of Mariager Fjord as a consequence of 100-150 extra ships annually. By using AIS data from ships, NIRAS has investigated the annual shipping traffic and quantified the changes resulting from the production expansion in terms of shipping traffic both in space and time.

Year
2022 - 2023

Customer
Dansk Salt A/S

Contract Fee
1.424.250 DKK

Project Category
Surface water

#12 Responsible consumption and production

#14 Life below water



Beach Nourishment Enø Kystvej

On the southern part of Enø is a low and coastal parking lot that also provides the access to the southernmost part of the island. This road is often flooded which won't be a problem as long as no erosion occurs. However this happens sometimes at medium-high water levels and strong water impact. Besides this the coast is also slowly moving further inwards. Through the years there has been built revetments and groynes, however these are now in bad shape and are no longer protecting the road from erosion. Since NIRAS has worked with Næstved municipal office on a larger coastal protection project nearby, where they have worked on large beach nourishments in the Autumn of 2022, Næstved municipal office wishes to expand the work to nourishment of the area close to the parking lot.

NIRAS has completed hydraulic calculations (concurrency statistics, MIKE 21, and LITPACK) in order to estimate how large a reduction of the wave impact on the road is necessary. Further, NIRAS has worked on a report on the design for application with suitable drawings (3D CAD), Natura 2000-evaluation of materiality (since the bay is appointed habitat nature types), application form on coastal protection and on EIA-screening.

During the summer of 2022 the application was sent and the beach nourishment is expected to be carried out during the Autumn/Winter 2022. NIRAS is drawing up the detail drawings and specifications for the entrepreneur.

Year
2022 - 2023

Customer
Næstved Kommune

Contract Fee
174,941 DKK

Project Category
Harbours and Marine Structures

#11 Sustainable cities and communities

#13 Climate action



Modelling of PFOS and PFAS concentrations in Vänern, Sweden

NIRAS Sweden has been tasked with determining the concentrations of the two environmentally hazardous substances, PFOS and PFAS-11, at two outlets to Sweden's largest lake, Vänern. The outlets are located in the southwestern part of Vänern and the purpose is to investigate and describe the spread of the substances, and compare the concentrations with the respective limit values for the substances within the project area.

It is assessed that the distribution of PFOS and PFAS-11 in the lake's water column, and thus the spread of the substances, is strongly dependent on the vertical stratification in the lake. Stratification is determined by temperature, and NIRAS has therefore set up a three-dimensional hydrodynamic model to include heat exchange between the lake and the atmosphere, inlets, and the surrounding and underlying bedrock. The modeling is performed using DHI's MIKE 3, and the flow in the lake is driven by meteorological and hydrological input data. Such data included atmospheric contributions in the form of precipitation, evaporation, air temperature, and solar radiation, as well as the flow and temperature of inlets from the catchment area. The lake's water depths are also included, from which volume and surface area were determined.

The model has been calibrated with two measured temperature profiles in the eastern and western parts of the lake. After satisfactory calibration, the spread of PFOS and PFAS-11 is modelled, and the concentrations are also determined over time with respect to the respective limit values. NIRAS has thereby mapped the magnitude of the spread of PFOS and PFAS-11 in the southwestern part of Vänern.

Year
2022 - 2022

Customer
NIRAS Sweden AB

Project Category
Water environment

#14
Life
below water



Coastal and Mangrove Rehabilitation Study, Vietnam

The Vietnamese government has appointed NIRAS, GOPA and GFS to do a coastal rehabilitation study for the coastlines at Ca Mau and Kien Giang. A stretch of 650 km. During many years the coastline has receded and valuable mangrove habitats have been lost.

The project is located in a complicated cohesive environment in the Mekong Delta near the Mekong River outlet. The sedimentation in the area is partially governed by the decrease in sediment supply from the Mekong and thus the chosen solution should not only protect the coast and the mangroves but also preserve to more sediment and be functional when located on highly under-consolidated soil. To account for this using local customs for coastal protection is also required. It is thus a very complicated coastal zone management project.

The task is to do a coastal protection study and as part of this protect and extend the existing mangrove areas. Additionally, NIRAS is also doing flood protection of local villages and residence areas in the form of dikes.

The project is founded by KFW and also consist of a mangrove replanting, livelihood analysis, stakeholder interaction, knowledge transfer and training, and detailed design and supervision of construction of the selected scheme.

Year
2022

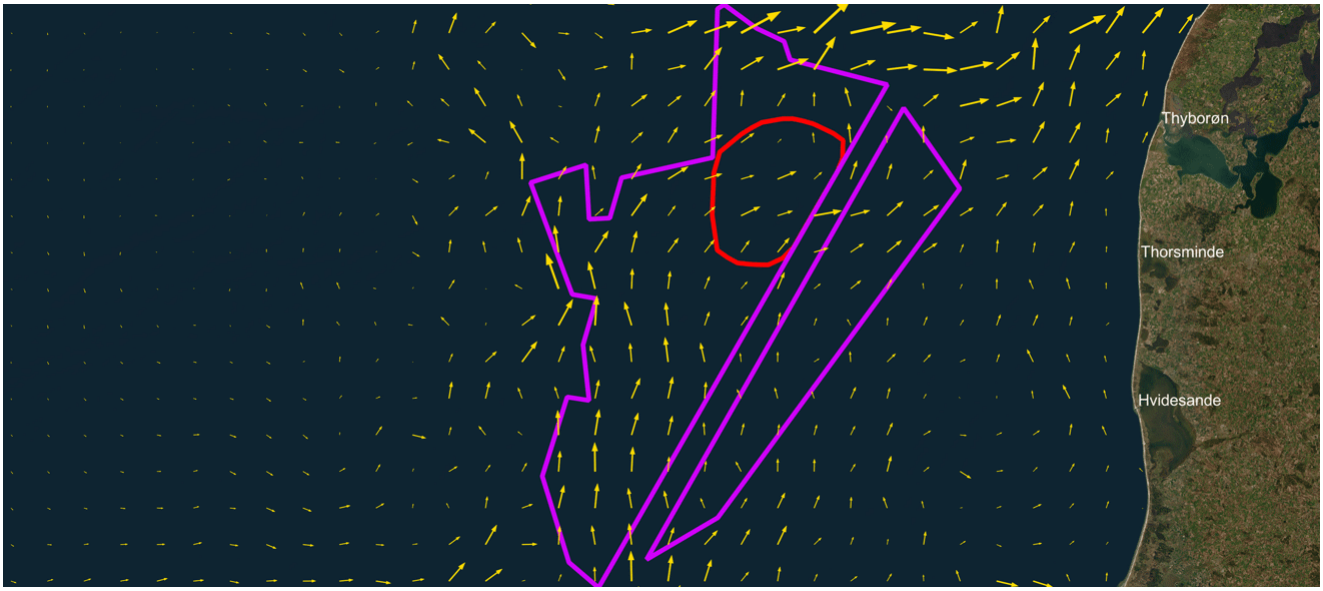
Customer
GOPA Gesellschaft für Organisation, Planung und Ausbildung mbH

Contract Fee
120.000 EUR

Project Category
Climate Change and Disaster Risk Management

#11 Sustainable cities and communities

#13 Climate action



Energiø – Hydrodynamics and Sediment Dispersal, Denmark

The Energiø will be located in the Eastern part of the North sea of the coast of Jutland. Phase 1 of the project will consist of the island itself and 12 GW offshore wind, further Phase 2 will consist of Phase 1 plus an additional 28 GW offshore wind. Energinet decided to undertake a preliminary study of the impact on the marine environment during both the construction and operation phase.

The study will include models of changes in currents, wave conditions, sediment transport, seabed composition, and the overall transport of water due to the construction and operations of the island and the wind turbines. The sediment spill during the construction phase is modelled in MIKE 2D hydrodynamic model and MIKE Particle is used for the sediment. To estimate the pressure in the operation phase on the hydrodynamics and the dispersal of sediment three types of numerical models are used: a hydrodynamic model to simulate the water level and currents, a wave model to simulate the wave climate, and a sediment model to simulate the spread and deposit of the sediments dispersed due to the installation activities.

By installing offshore wind turbines in the ocean around Denmark NIRAS is working towards creating more sustainable and clean energy in the world. The purpose of Energiø is to supply Denmark and other European countries with clean and affordable energy. This is aligning with the SDG number 7, which is working to ensure affordable, reliable and clean energy to the world.

Year
2022 - 2023

Customer
Energinet Eltransmission A/S

Contract Fee
642.920 DKK

Project Category
Wind energy

#7 Affordable and clean energy

#14 Life below water



Metocean data, hydrodynamic and dispersion modelling, Inishturk, Ireland

It has been proposed, by BIM, to establish a salmon farm in the ocean between the island Inishturk and the Irish main land. In order to gain insights of the metocean data for the chosen position and to estimate the concentration and dispersion for a number components NIRAS has done the modelling of these. The components investigated are ammonia, salmon lice, chemicals used to treat for salmon lice, concentration and deposition of wasted feed/feces all as input to an environmental impact assessment.

A local wave model was set up using MIKE21 SW and a hydrodynamic model, MIKE 3HD FM, was set up in order to simulate the water level, current, salinity and temperature. On top of the HD a dispersion model was run to simulated the concentration in time and space for selected substance. In order to simulate this the dispersion models MIKE21 PA and MIKE21 Mud models were used. The MIKE 21/3 Particle model was used in order to simulate salmon lice, ammonia, Alphamax (treatment), Excis (treatment), Slice (treatment) and extension time/flushing time.

The development of the salmon farm is in line with the UN's sustainable development goals which works to ensure a sustainable life on earth. Goal number 2, called Zero Hunger, tries to ensure that no one is starving or is malnourished, developing more fish farms in a sustainable way can be a way to obtain this. Further, by doing studies on the ocean conditions and simulating the conditions with the components as mentioned, goal number 14, Life Below Water, is met, and it is ensured that the fish farm won't have a negative impact on the climate in the water.

Year
2015

Customer
NIRAS CONSULTING LTD

Project Category
Water environment

#2 Zero hunger #14 Life below water



Storm Surge Protection and Climate Adaptation of Enø, Denmark

The low-lying connected islands of Enø and Lungshave near Karrebæksminde, have several times been flooded due to storm surge. The area is exposed to the sea from two sides and is therefore especially vulnerable to rising sea levels and more frequent events of storm surges.

On the request of Næstved Municipality, NIRAS is doing total consultancy on the project. In this context, NIRAS has performed a comprehensive study of the area and the complex issues that its inhabitants are facing. This includes registration and digitalisation of existing conditions, drone surveying of the terrain, geotechnical investigations and geomorphological assessment of the area. Based on the preliminary studies, NIRAS has made extensive GIS-analyses, assessed the chronic erosion along the seaside and reviewed the hydraulic conditions on all sides of the islands by analysing historical flooding and storm events as well as controlling meteorological scenarios. Additionally, NIRAS has applied its expertise in modelling of the wave impacts (MIKE LITDRIFT and LITPROF) and has set up the constructions as 3D models in CAD.

NIRAS has made a solution securing that Enø and Lungshave will be resilient in the future, in accordance with UN's Sustainable Development Goal no. 13 on Climate Action. The project area contains a Natura 2000 habitat area. NIRAS has therefore made the application for an EIA-screening and made the Environmental Impact Assessment, in order to protect the significant and preserved nature, which especially Enø offers. Thereby, the project works within the framework of UN's 14th and 15th Sustainable Development Goals: Life Below Water and Life on Land.

Year
2017 - 2020

Customer
Næstved Kommune

Contract Fee
2,175,000 DKK

Project Category
Harbours and Marine Structures

#11 Sustainable cities and communities
#13 Climate action
#14 Life below water
#15 Life on land



Coastal Erosion & Flood Relief in Rosslare, Ireland

NIRAS is providing specialist sub-consultancy services to Nicholas O'Dwyer who have been engaged by Wexford County Council to deliver the Rosslare Coastal Erosion and Flood Relief Scheme.

Rosslare Strand in County Wexford, Ireland comprises a low-lying village adjacent to an extensive coastal dune system and is fronted by a sandy beach. The coastline is soft sand and has been subject to erosion over many decades. Since the 1950s a series of coastal protection measures have been introduced along the coastline to reduce the rate of erosion. Some of the existing protection measures have now reached the end of their design life. In addition, there are unprotected areas of the coast that need to be protected in order to safeguard properties, businesses and the community itself.

NIRAS' specialist services include data review and gap analysis, hydrological model-ling, hydraulic modelling, and option identification and preliminary design, all of which inform the scheme climate change adaption plan.

Year
2022 - 2023

Customer
Nicholas O'Dwyer Ltd

Contract Fee
59,930 EUR

Project Category
Harbours and Marine Structures

#13 Climate action #15 Life on land