Questions and Answers

Port & Waterway Engineering ■ Project Development

hydronamic bv
THE ANSWER PROVIDER

Hydronamic, independent Port and Waterway Engineers

Hydronamic, independent Port and Waterway Engineers, provides specialist consulting services in the field of 'wet' civil engineering. Founded in the late 1960s, the company has gained a thorough knowledge of the behaviour of water –under both natural and forced flow conditions– and of the interactions of water and its surrounding environment. This encompasses the knowledge domains of hydraulics, morphology, hydrology, coastal and river engineering, port construction, environmental engineering and offshore technology.

Studies are performed with the aid of physical and mathematical models, both 'in house' as –in close cooperation with the client– on site. Thanks to our association with Royal Boskalis Westminster, world leading dredging and construction contractors, the advisory skills of Hydronamic engineers are complemented by a thorough understanding of the actual execution aspects of construction projects, gained by active on site participation.

Hydronamic's specific fields of expertise are:

- dredging and reclamation
- soil mechanics
- coastal and shore protection works
- ports and waterways
- marine environment
- offshore earthworks and mining
- morphology and hydrology

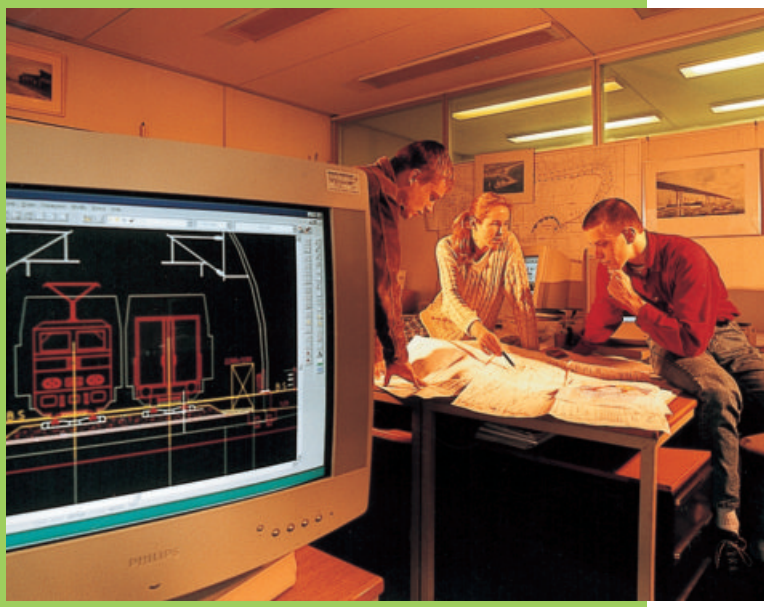
Within these fields, Hydronamic provides the following services:

- project studies, advice and design works
- project preparation and construction support
- project development studies
- research studies
- training programs

With a broad variety of studies and consulting tasks, Hydronamic holds a strong position in this area of specialist technology. The organisation and the people are innovative, creative and flexible. As a result, we can provide tailor-made solutions of reputed quality, within strict budget and time constraints. All activities are certified in accordance with ISO 9001.

Questions and Answers

Associated with Royal Boskalis Westminster, Hydronamic is a contractor's engineering company. But why does a contractor need an in house engineering company? And why should these engineering specialists provide consulting services to third parties? Two questions, one answer:



Because preparation and execution of a construction project requires both theoretical knowledge and a scientific approach, as well as practical experience and real-life construction insight. Clients such as project owners, other consultants and contractors can all benefit from this unique combination of 'thinking and doing' offered by Hydronamic. This experience proves especially valuable in the preparation of 'design and construct' projects. That's why!

Clients in many areas of the 'wet' civil construction field cope with many other questions. Hydronamic provides them with the answers. You'll find some of these questions and answers in this brochure. If you have any other questions, let us know!

Infrastructure projects

Betuwelijn, Netherlands:
Detailed design of embankment construction for new railway line: geotechnical analysis for crossing areas with very soft subsoils and establishment of operational procedures within very strict environmental licenses.

Martin Garcia, Uruguay:
Analysis of requirements for deepening and widening of access channel, using ship-manoeuvring simulation for navigational aspects.

Øresund, Denmark:
Design and site engineering of marine operations for construction of immersed tunnel between Copenhagen and Malmö.

Rosario, Argentinia:
Site engineering, method statements and planning works for 60 km long Rosario - Victoria Fixed Link consisting of a series of bridges and causeways over soft subsoils.

San Francisco, U.S.A.:
Concept design study and feasibility analysis of rock dike and earth fill platform construction for runway reconfiguration at international airport.

Schiphol, Netherlands:
Design studies for new airport on artificial island in the North Sea to alleviate traffic pressure on existing airport.

Q How to cope with the world's ever-growing need for more infrastructure, while environmental concerns call for limited development?

Will open-mindedness and creativity help in finding new technical solutions?

Who has insight in technically complex marine projects like immersed tunnels or artificial islands?

What can land reclamation mean for the development of airports, commercial ports, road and railroad links and industrial projects?

Who has experience-based knowledge about marine works for fixed links?

What financial structures can help reducing costs of marine transportation projects?

A **In recent years, Hydronamic has developed technical and commercial concepts for a variety of infrastructural solutions. Many of these proposals have resulted in the actual preparation and execution of projects. Others are being used as underlying studies for developments aimed at relieving traffic congestion.**

Port projects

Bahia Blanca, Argentina:
Field measurements and mathematical model study for maintenance requirements in 100 km long access channel.

Kerteh, Malaysia:
Design study with laboratory testing for construction of breakwater and groynes, for port protection.

Port Said, Egypt:
Detailed design of Access and Berthing Channel for new East Port, including dredging, breakwater construction, coastal protection works and navigational aids installation. Design and management plans for disposal sites for sand and soft unsuitable dredged materials. Site engineering of construction works.

Ruwais, U.A.E.:
Traffic analysis and forecasting simulation modelling for development of port extension, including economic and financial evaluation. Optimisation of alternatives, definition of Port Masterplan.

Tema, Ghana:
Design of port upgrading, including wave study, quay wall reinforcement and dredging works.

Q What defines the operational effectiveness of a port?

How can safe access for vessels be assured?

How much wave intrusion occurs as a function of the layout and will this affect the navigability to a great extent?

What are the requirements for maintenance dredging operations, from current behaviour and sedimentation patterns in the port?

A **To identify critical points and to provide solutions, Hydronamic employs mathematical models and computer manoeuvring simulations. Where knowledge and know-how end, physical models in laboratories and test flumes are implemented. Even field measurements –like sedimentation monitoring– during early stages of construction can be applied to define final adjustments of the design.**

Slope protection projects

Q When do coastlines, shores or riverbanks require stone protection works?

How heavy must this protection be and how can it be constructed with minimal disturbance of the present situation?

Will bottoms of canals or ports be eroded by currents from manoeuvring vessels or by flows around structures?

Can bottom protection with mattresses or stone filter constructions prevent these effects?

A **The typical Dutch craftsmanship of protecting the low-lying land from high seas and rivers belongs to the strongholds of Hydronamic. Dimensioning is provided for constructions and construction elements, often in combination with a selection of suitable quarries or other sources for materials.**

Gulf Islands, Abu Dhabi:
Design and construction engineering for slope protection of man-made islands, using sand filled geotextile tubes and bags.

LNG Terminal, Trinidad:
Technical and constructional design of terminal extension, including design of shore protection dikes in combination with method statement for landfill.

Niger River, Nigeria:
Design of bank protection schemes, using stone and other locally available materials.

Sohar, Oman:
Conceptual design of breakwater for new industrial port and fishery harbour in Wiayat Sohar, Oman, to provide shelter against waves in 1,5 km long approach channel and harbour basin.

Tonverlegung, Germany:
Study and field testing of method for installation of clay lining for bottom sealing layer in reservoirs, rivers and channels, including design of prototype vessel.

Tuas, Singapore:
Design and site engineering for coastal protection using geotextiles and stone pitching.

Water management projects

Q While water can be vital to local communities, how does water management contribute to optimally utilise –often scarce– resources?

Could water flows be guided into more useful directions?

Can training works be performed to divert rivers or should structures of sluices and dams be used to control level changes?

Can storage reservoirs be inserted without damaging downstream development?

Is it possible to extend the lifetime of reservoirs, for instance by bypassing inflowing river sediment?

How can water quality be improved by restoring lakes?

A **Although not every natural flow of water should be tamed by man, better utilisation to the benefit of nature and mankind is often possible. Based on mathematical models, calibrated by field measurements and supported by studies of historical riverbed development, Hydronamic can accurately predict where and how interference will be most effective with least disturbance of the natural environment.**

Deltaplan Maas, Netherlands:
Development of masterplan to increase safety against flooding of river, in combination with optimal use of available land and mineral resources.

Gorai River, Bangladesh:
Design study, technical design and site engineering for dredging solution to zero-flow-conditions on Gorai River, extending from Ganges off-take to 30 km downstream.

Niger Study, Nigeria:
Feasibility study for improvement of navigability of river for shipping of ore.

Lac Nord, Tunisia:
Hydraulic studies of flushing performance of modified lake geometry to improve water quality.

Tunisian Reservoirs, Tunisia:
Technical design and economic appraisal of rehabilitation schemes for silted reservoirs.

Bar Beach, Nigeria:
Study to improvement of effectiveness of regular beach nourishment scheme, by application of near-shore berms.

Berbice, Guyana:
Study to efficiency of hydrodynamic dredging on coastal transport systems.

Beach-nourishment:
Comparison of applicability of fore-shore / near-shore suppletion compared to direct beach-nourishment, on morphological and economical criteria, for various beaches over the world.

Forcados, Nigeria:
Design and site engineering for various sections of shore protection by combination of beach nourishment, slope revetment and groyne construction along eroding coast.

Linord, Lebanon:
Preliminary design of coastal protection for development of Corniche Nord, Beirut.

Coastline projects

Q How will coastlines develop over time, with granular materials migrating by current and waves?

How will construction works affect the balance in littoral transport and how can deficiencies effectively be compensated?

Will nourishment schemes be economically justifiable and how can sediment be prevented from returning to deeper waters?

Should foreshore suppletion be preferred over traditional schemes?

A **Based on experience from field measurements and model studies, Hydronamic has developed a range of tools for the prediction of coastline behaviour and the design of coastal protection schemes.**

Aroaima, Guyana:
Feasibility study, final design and method statement for overburden dredging works at open bauxite mine.

Diamond mining, Namibia:
Technical and environmental feasibility appraisal for offshore diamond mining by dredging and underwater processing techniques

Manganese noodles, US:
Technical design for deep sea mining of manganese ore with remote controlled underwater vehicles.

Oslo tarsands, Canada:
Feasibility design study for overburden removal and tarsand mining by dredging techniques.

Para Mines, Surinam:
Economic appraisal and technical proposal for bauxite mine development by dredging and hydraulic transport.

Syncrude tailings, Canada:
Study and prototype testing of tailings rehandling by hydraulic dredging.

Mining projects

Q Depending on the conditions, can 'wet mining' be more efficient than 'dry mining'?

How can large volumes of overburden best be removed by dredging techniques?

Is it feasible to transport and handle tailings by hydraulic pipeline processes?

Should deep-sea mineral reserves be considered mineable?

A **Hydronamic has studied all these questions for several projects in various parts of the world. Advice given, based on studies and large-scale trials, has in many cases led to (more) profitable mining.**

Offshore projects

Q What are the options for platform seabed preparation?

How can offshore pipelines for the energy industry be stabilised and protected by berms of granular material?

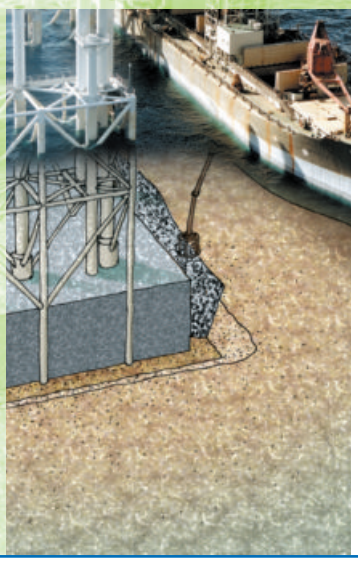
Can these materials also be used for thermal insulation?

How accurate and in which ambient conditions can these constructions be made?

Is it feasible to dredge or plough trenches for pipeline burial or for landfalls and outfalls?

Can these trenches be efficiently and effectively backfilled?

How can long-term assurance of a safe burial depth be achieved?



A For these and other complex aspects of pipeline and platform intervention, Hydronamic is able to provide innovative viewpoints. Based on a thorough understanding of dredging and trenching processes, and of sea-bottom behaviour, Hydronamic has prepared cost-effective schemes, several of which have found their way to industry-wide implementation.

Caspian Sea, Kazakhstan:
Design and site engineering for construction of artificial islands for oil exploration drilling: rock islands to survive winter conditions in shallow waters.

Europipe II, Norway:
Design and site engineering for pipeline intervention works, including soft soil removal, boulder clearing, gravel dumping/backfilling.

Hanze F2A platform:
Design and site engineering support for seabed preparation works before and erosion protective construction installation after GBS installation. Dynamically stable lifetime design based on laboratory model testing.

Takoradi, Ghana:
Design and engineering, preparation of method statement, QA- and HSE procedures for Landfall project, incorporating trenching, pipepull and backfill.

Terra Nova, Canada:
Work method assessment and construction engineering for glory hole dredging, largely increasing the operating limits of trailing suction hopper dredgers. Site engineering using developed operation support models.

Westerschelde, Netherlands:
Design and Construction of lowering life product pipeline, crossing river estuary, by burial through jet flow methods.

Environmental projects

Q To what extent does a marine construction process impact the environment?

How much sediment plume transport will dredging generate?

Where will dredged spill migrate, that originates from overflow processes or outlet boxes?

How attractive are artificial stone reefs to shellfish, lobsters and seabirds? And to fishermen?

Can dredged materials be beneficially used, either 'as is' or after treatment?

If a disposal site is needed, what options are available?

Where and how can a disposal site best be constructed, managed and monitored?

A Hydronamic, in close co-operation with other group members, operates at the forefront of studies and developments to answer these questions. Investigations are initiated at projects under construction to learn and benefit from experience. A wealth of knowledge and state-of-the-art technology are the basis of design and construction advice.

Ketelmeer, Netherlands:
Design of construction method for artificial island confined disposal site for contaminated dredged material in environmentally sensitive area

Elburg, Netherlands:
Design and site engineering for clean-up scheme of contaminated port, including environmental dredging, treatment and beneficial use of material

Ras Laffan, Qatar:
Environmental impact study of dredging and breakwater / slope protection works for port construction

Various projects, U.S.A.:
Technical advice for contaminated sediment remediation projects: dredging, treatment and storage of material.

Zevenhuizenplas, Netherlands:
Assessment and field verification of sediment re-suspension (turbidity) during dredging and disposal operations

And exactly what is the basis of Hydronamic's capabilities?

Hydronamic is a think tank of some 40 engineers, including Masters of Science in civil engineering, as well as hydraulics, morphologists, environmentalists, geophysicists, mining engineers and geologists. For specific projects, the company may seek the back up of mechanical, survey and electronics specialists in the Boskalis group.
In addition, Hydronamic closely collaborates with internationally distinguished institutes for specialist model testing, to monitor how the company's own practical and theoretical knowledge relates to the results of scientific tests.

Mathematical models are based on theoretical knowledge, extended by in-house studies in cooperation with universities, and verified with field measurements. Services may often be provided from behind the desk, but in many cases assignments are completed on site, with the essential local involvement of the client. Some studies may be large and extensive, but Hydronamic is also well prepared to provide short-term expert opinions, verification of conceptual ideas or feasibility assessment.

Through courses, study and special training, Hydronamic strives for continuous improvement of its capabilities. Convinced of the importance of exchanging knowledge and opinions with professional associates, training and education in Hydronamic's own specialist fields are also a part of the company's service proposition.

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ISO 9001
JANUARY 2001