PORT, HARBOUR AND MARINE TERMINAL SERVICES

Providing planning and engineering solutions in challenging, environmentally sensitive locations in the marine environment
DEVELOPMENT OF ACAJUTLA PORT | Comision Ejecutiva Portuaria Autonoma Acajutla (CEPA) | Republic of El Salvador |

Improvement and extension of the existing bulk handling and storage system to meet the projected growth in exports and imports of dry bulk materials. The improved system was designed to handle simultaneous import/export with handling rates of up to 500 t/hr and buffer storage capacity of 18,000t. Black & Veatch was retained to provide study and design services which included:

- study and inspection of existing system
- preparation of master plan for development of the system
- recommendations on bulk loaders/unloaders
- detailed design of first stage improvement and extension of conveyor and mechanical handling systems

HOLYHEAD HARBOUR BREAKWATER MAINTENANCE STRATEGY STUDY | Stena Line Ports | Holyhead | UK |

The Port of Holyhead is protected by a 2.5 km long breakwater completed in 1873. The breakwater provides protection to commercial port operations, 50 properties and businesses in the town, a marina, a sailing club and a coastguard station. Black & Veatch developed an affordable maintenance strategy based on wave modeling that identified the most vulnerable sections.

LYMINGTON HARBOUR PROTECTION | Lymington Harbour Commissioners | UK |

Lymington Harbour has developed over the last 50 years as a major leisure boating centre, ferry terminal and base for commercial fishing. Historically protected by natural salt marshes, recent erosion has caused the standard of protection to be reduced. Black & Veatch designed a rubble mound breakwater to give a similar level of protection that the marshes originally provided and therefore maintain the viability of the harbour.

DINGLE HARBOUR DREDGING | Nicholas O'Dwyer | Ministry of Agriculture & Fisheries | Republic of Ireland |

Black & Veatch, in association with Nicholas O'Dwyer, undertook the planning and design of Dingle Harbour dredging works.

The scope of work includes:

- planning and design of dredging work in navigation access channel and the harbour basin
- optimisation of dredging design through real-time 360 degree bridge navigation simulation
- preparation of specification for offshore ground investigation and site surveys to gather information for detailed design
- specification for dredging and disposal works

BLACK & VEATCH OFFER THE FOLLOWING SERVICES FOR PORT, HARBOUR & MARINE TERMINALS:

- Site selection
- Master planning
- Feasibility studies
- Concept design
- Pre-Front End Engineering Design (Pre-FEED)
- Front End Engineering Design (FEED)
- Detailed design
- Technical & environmental due-diligence services
- Independent engineer services
- Owner’s Engineer services
- Expert witness
- Assessments management
- Asset assessment

SELECTED PROJECT EXAMPLES

PORTS, HARBOURS & MARINAS
SELECTED PROJECT EXAMPLES
PORTS, HARBOURS & MARINAS

FISHGUARD MARINA
Conygar Stenaline Ltd | UK
Black & Veatch was responsible for drawing up the marina proposals, developing a scheme that will provide additional land for port development and yet nor interfere with port operations on land or sea.

Black & Veatch’s scope includes: wave modelling, managing offshore site investigation, detailed design, waterfront structures and dredging.

DESIGN & SUPERVISION | PORT SUDAN
Sudan Development Sea Ports Corporation | Sudan
Black & Veatch, in association with Coopers & Lybrand Associates Ltd., reported on the development of the sea ports of the Sudan in which trends in many bulk and other commodities were considered. Stage 1 of the project included a container berth, roll-on/roll-off berth and extensive onshore works were designed and their construction supervised. Stage 2 included new wharves, a tanker terminal, grain silo improvements, and other onshore works.

PORT OF RICHMOND EXPANSION PROJECT
Port of Richmond Commission | Virginia | USA
Black & Veatch were selected by the Port of Richmond Commission to develop plans and specifications and provide construction services for a 365m extension to their existing cargo wharf. Planning included the analysis of alternative structure types, geological profile, dredge depth, and wharf elevations applicable to this site. This analysis resulted in the selection of a cellular sheet pile bulkhead as the least costly alternative.

The completed wharf included surfacing suitable for container cargo, tracked mobile cranes, container handling equipment, ship water and sewer connection points, provisions for a future rail-mounted crane, dredging to a depth of 7.5m along the new wharf and lighting levels to support container handling operations at night.

INDEPENDENT APPRAISAL OF PROPOSED CONTAINER TERMINAL
FINIDA funds | Vietnam
Black & Veatch undertook an independent appraisal of a proposed container terminal project prepared by Finnish consultants under FINIDA funds.

This project formed part of a wider Asian Development Bank (ADB) support.

The appraisal study scope of work included investigating planning aspects of the container terminal, selection of appropriate container handling equipment and its maintenance, geotechnical and structural of wharf and storage area design, cost estimates, implementation of the project, institutional organisation, technical assistance and training and financial and economic analysis of the project.
OUR PROFESSIONALS HAVE EXPERTISE IN ALL PHASES OF MARINE, PORT, HARBOUR AND COASTAL ENGINEERING PROJECTS

KEY PERSONNEL INCLUDE:

- Maritime Engineers
- Civil Engineers
- Hydraulic Engineers
- Structural Engineers
- Piping Engineers
- Geotechnical Engineers
- Seismic Engineers
- Marine Biologists & Sediment Chemists
- Marine Ecologists
- Coastal Engineers
- Oceanographers
- Environmental Engineers & Scientists
- Mechanical Engineers
- Process Engineers
- Electrical Engineers
- Architects
- Planners
- Economists
- Navigation Specialists /Master Mariners
- Port Operations Specialists
- GIS Specialists
- CAD Technicians
- Cost Estimators
- Construction Manager

SELECTED PROJECT EXAMPLES

MARINE TERMINALS

COAL UNLOADING FACILITY | PLN Adipala | Indonesia |
Black & Veatch served as PLN’s engineer for its 1 x 660 MW supercritical coal-fired power plant. The marine facilities were being constructed as part of an EPC contract and include two rock mound breakwaters with a total length of 2,100m, a coal unloading jetty for vessels up to 35,000 dwt and a dredged turning basin. Black & Veatch witnessed the 3D and 2D fume model testing of the harbor and breakwater and reviewed the contractor’s designs for the marine works.

OIL UNLOADING JETTY | RABEC | Rabigh | Saudi Arabia |
Black & Veatch was the Owner’s Engineer for the design and construction of two 660MW heavy fuel oil power plants. The project includes a new fuel unloading jetty for 20,000 to 100,000 dwt bulk carriers. Black & Veatch undertook design checks and reviews for all the marine works, including mooring dolphins, breasting dolphins, unloading platform, small boat berth and an approach causeway protected with concrete armour units.

PORT TALBOT ORE UNLOADING JETTY | Associated British Ports | South Wales | UK |
The dedicated iron ore unloading jetty serving Port Talbot steelworks was constructed in 1970 and provides a berth for up to 180,000dwt bulk carriers with a draught of 16m. Black & Veatch investigated the feasibility of upgrading to accommodate 250,000dwt carriers and undertook three separate detailed structural surveys of the jetty. The scope of the surveys includes; steel piling, concrete deck, dolphins, fendering and access bridges.

FALKLANDS JETTY | MARCHWOOD MILITARY PORT | Ministry of Defence | UK |
Upgrading this military jetty to accommodate vessels up to 25,000t displacement and 203m in length, enabling the MoD to continue to use the 30 year old jetty for modern commercial shipping. The scope of work includes:
- detailed inspection and structural assessment of the existing jetty
- Ro Ro and linkspan
- design of a new mooring dolphin, 200t storm bollards
- 28.5 metre access bridge
- new fender system
SELECTED PROJECT EXAMPLES
MARINE TERMINALS

PORTSMOUTH BOAT HOIST JETTY | Ministry of Defence | UK |
Black & Veatch were appointed to undertake the detailed design and provide construction support for two new finger jetties for a 50 tonne boat hoist within a military training facility.

The works consisted of two rows of tubular steel piles each supporting a reinforced concrete runway.

ERNESETTLE JETTY REFURBISHMENT | Ministry of Defence | UK |
The refurbishing of this late 1930’s reinforced 250m long concrete jetty, used by the military for loading munitions, consisted of the hydro-demolition of the existing beams and pile sides and soffits to reveal the existing reinforcement. Additional rebar is then fixed and the beam reformed using sprayed concrete.
In addition new timber fender piles replaced the old sawn off piles and a Fentek super cone fender installed between the fender and jetty.

SUAPE GRAIN TERMINAL | Suape-Complexo Industrial Portuado | Suape | State of Pernumbuco | Brazil |
The Suape Industrial Complex is a large port facility and industrial zone located in the State of Pernambuco. The port has an existing breakwater and is separated from the mainland by a natural reef. The breakwater was constructed to protect the entrance dredged through the natural reef parallel to the shoreline. Black & Veatch performed a feasibility study which included; review/evaluation of breakwaters and berths, geotechnical assessment, commodity forecast, market analysis, Terminal operations, master planning, analysis of Infrastructure and transport support, project schedule, finance, operations and environmental aspects.

LONG PHU 2 POWER PLANT MARITIME SCOPE | Tata Power International PTY. LTD | Vietnam |
Black & Veatch was appointed Owner’s Engineer for the basic design of the 1320 MW coal fired thermal power plant Long Phu 2 in Vietnam. The scope of work involved the design of three jetty structures comprising main platform areas supporting coal and ash loading/unloading equipment, capital dredging for vessel manoeuvring and berth pockets, three offshore mooring points designed to provide berth for 3,000-10,000dwt barges, causeways and cooling water intake and outfall structures.

In addition, preparation of EPC tender package for marine works and EPC tender evaluation were included to Black & Veatch Maritime scope.
SELECTED PROJECT EXAMPLES

RECLAMATION

**TELUK TERING RECLAMATION**
**Mega Indah Development | Teluk Tering Bay | Batam Island | Indonesia**

The Teluk Tering Project involved the development of major reclamation, providing 200 hectares of land for the construction of commercial and residential development, marinas and other waterfront recreational facilities. Black & Veatch recommended and prepared specifications and drawings for data collection, including soil investigations, marine seismic profiling surveys, hydrographic and topographical surveys and aerial photography.

**SOUTH MANILA BAY RECLAMATION**
**Various | Manila | Philippines**

The Boulevard 2000 project involved the development of major reclamation along the shoreline of Manila Bay to provide over 1,000 hectares of land for future construction of commercial, residential and recreational facilities. Black & Veatch carried out studies, prepared designs and provided ongoing technical advice during construction for site investigation.

INTAKE & OUTFALL

**ESCONDIDA WATER SUPPLY**
**BHP Billiton | Chile**

Black & Veatch provided detailed design services for a major desalination and water transmission project for copper mining in the Chilean Andes. The scope included the Design Waves and Water Levels study, stability calculations under wave and current loadings for the intake structure and outfall diffuser and design and specification of subsea structures and rock armour protection.
SELECTED PROJECT EXAMPLES

LNG TERMINALS

**COSTA AZUL LNG IMPORT TERMINAL | Sempra LNG | Costa Azul | Mexico |**
Black & Veatch was a leading consortium partner in a front-end engineering design (FEED) contract for the first LNG receiving terminal on the Pacific coast of the Americas. The large scale LNG terminal encompasses LNG berthing and unloading facilities, two 160,000 M3 14-story LNG storage tanks, regasification and send-out facilities. The terminal is capable of receiving 7.6 million tons of LNG per year and regasifying one billion cubic feet of natural gas per day.

**JORDAN COVE ENERGY PROJECT | Jordan Cove Energy | Oregon | USA |**
Black & Veatch was selected to assist Jordan Cove Energy Project to develop a LNG import terminal, providing front end engineering design (FEED) work using our PRICO® LNG technology for a four train, 6 million ton per year LNG export facility. As part of the LNG production facility and FEED work, the project will include two, 160,000 m$^3$ full containment LNG storage tanks and marine facilities to receive and load approximately 90 LNG ships each year to transport the LNG to markets.

**SUAL LNG RECEIVING TERMINAL | PHINMA Energy | Philippines |**
Black & Veatch was appointed to undertake the feasibility and pre-FEED of the Sual LNG receiving terminal in Philippines. The maritime scope of work for the project involves the design of a jetty structure comprising main unloading platform supporting LNG unloading equipment, breasting and mooring dolphins for the 30,000 m$^3$ LNG carriers and a trestle connecting the unloading platform with the onshore LNG storage tanks and power plant.

**COMPASS PORT LNG TERMINAL | Compass Port LLC | Alabama | USA |**
Black & Veatch in association with J Ray McDermott Engineering, prepared a FEED for a 1 Bscfd Offshore LNG receiving storage and regasification terminal, including docking facilities for conventional LNG carriers, unloading facilities and two 110m diameter concrete LNG storage caissons fixed to the sea bed. Compass Port was designed to minimise potential environmental and socioeconomic impacts while providing an optimum location for the importation of LNG and the delivery of natural gas to market.
WHY BLACK & VEATCH?

WE WILL ...

- Listen to Client’s Ideas
- Deploy the Best Project Execution Models
- Provide Quality, Cost & Schedule Certainty
- Meet / Exceed Client’s Expectations
- Deliver Predictable Results
- Technology Neutral – Innovate & Create Value

WE HAVE ...

“...the capabilities to support every point in the lifecycle of clients’ projects.

For Black & Veatch, our clients’ reputation is as important to us as our own. This means that we are committed to delivering the best outcome for our clients’.

Our professionals are forward thinking, so finding the answers to clients’ needs always starts with a conversation about the outcome their customers want. ...”

BUILDING A WORLD OF DIFFERENCE®

Black & Veatch is an employee-owned, global leader in building Critical Human Infrastructure™ in Energy, Water, Telecommunications and Government Services. Since 1915, we have helped our clients improve the lives of people in over 100 countries through consulting, engineering, construction, operations and programme management. Our revenues in 2016 were US $3.0 billion. Follow us on www.bv.com and in social media.

BLACK & VEATCH
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