



Van Oord equipment

Water Injection Dredgers

A brief explanation of the working principles

30 August 2023 | rev. 4

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Why WID?

Dredging works can be complex and costly, accounting for a substantial proportion of a maritime project's budget. Planning and executing dredging operations for maximum effectiveness and efficiency requires the careful selection of the most appropriate dredging vessel, knowledge of the material being dredged, and an understanding of environmental conditions.

Water Injection Dredging (WID) is a hydro-dynamic dredging technique that offers a cost effective and environmentally friendly solution tailored for many dredging solutions. When WID is applied in the appropriate situations, it has significant benefits.

One of the most common applications of WID is maintenance dredging in ports and waterways. Siltation of harbours and access channels is a constant challenge for Port Authorities and regular maintenance dredging is required in most ports to ensure safe navigation depths. WID uses natural processes to re-mobilise and transport sediment away from the siltated areas.

A WID vessel injects high volumes of water at a low pressure into the seabed to create a fluidised soil layer. Differences in gravity and density in combination with river and tidal currents allow this fluidised layer to move to a designated location or be taken up by tidal or river currents.

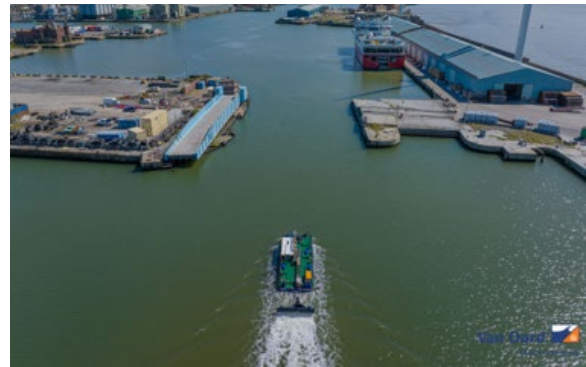
WID makes use of the free energy in the water column for the horizontal transport of the dredged sediment. This understanding of the natural processes contributes to a highly efficient and cost-efficient solution that can be tailored to a variety of applications.



Applications

WID can be utilised for the following:

- Maintenance dredging of recently deposited fine sediments in ports and navigation channels
- Maintaining river depths (sandy seabed)
- Removing high spots (bed-levelling)
- Assisting TSHDs, increasing productions and clean-up
- Removing silt from a reclamation area
- Pre- and post-trenching for pipeline and power cable installations
- Seabed intervention for pipelines and power cables (free span correction)
- Cleaning underwater structures such as rock revetments, locks, and docks
- Cleaning jetties and quay walls



Advantages

In certain circumstances, WID provides clear advantages over other dredging techniques:

Cost-efficient: Because WID uses natural processes for the horizontal transport of the sediment, costs are typically lower. WID vessels have low mobilization costs, smaller crews, and use less fuel per m³ of sediment dredged.

Flexible, simple, and effective: A WID vessel is relatively small and not connected to pipelines or anchors, making it highly manoeuvrable and ideal for areas with heavy marine traffic. Under the right conditions, high production rates can be achieved at low costs.

Low CO₂ footprint: WID has a considerably lower CO₂ footprint per m³ of dredged sediment than other dredging techniques.

Natural dynamics: WID lets nature do most of the work, which benefits the natural environment. The re-mobilised soil layer remains near the seabed and sediment is taken up into the environment at its own pace.

Limitations

WID is more dependent on local site conditions than other dredging techniques because the horizontal transport takes place in the water column and is driven by natural processes. A suitable bathymetry is necessary to enable the fluidised soil layer to be transported out of the dredged area. An over-depth in the near vicinity of the dredging area will contribute to high production rates.

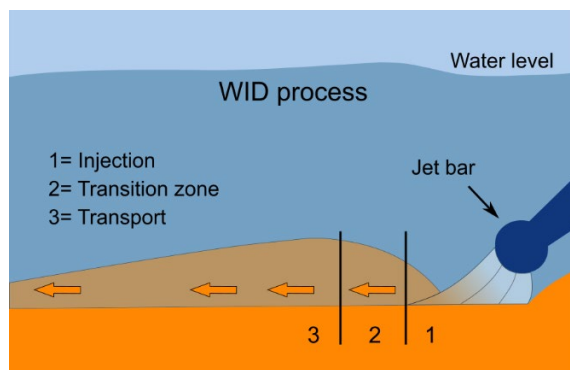
The technique is particularly suitable for recently deposited fine sediments. Production rates will decrease with increased grain sizes in the sand fraction and larger required transport distances.

Other WID-specific limitations relate to survey and permit issues. WID productions can only be estimated by in- and out surveys since several tracks are required to re-mobilise and remove the dredged sediment. WID can also only be used where an in-water dredged material placement permit has been granted, as there is no dedicated disposal area. Furthermore, using WID on contaminated sediments is, in most cases, not allowed.

WID principle

Since Van Oord developed WID hydrodynamic dredging over 35 years ago, it has gradually become a more popular choice for maintenance dredging, bed-levelling, river maintenance, and other applications. The WID principle is based on the idea of allowing sediments to flow out of a port horizontally in the form of a density current, taking advantage of natural processes and forces. The fluidised sediment layer remains close to the seabed during the WID process.

A large volume of water is pumped at low pressure into the sediment using a horizontal jet bar with a series of nozzles. This activity overcomes the cohesion of fine-grained (cohesive) soils or the internal friction force of coarser-grained (granular) soils to fluidise the upper soil layer.



WID's main feature is that the horizontal transport takes place in the water column, using the combined effects of pressure and gravitational force. This eliminates the need for transporting and disposing of the dredged material. Dredging is only a matter of initiating a density current and letting natural processes take care of the rest.



Site conditions

As with all dredging projects, an understanding of the sediment type, bathymetry, and hydrodynamic conditions is essential for success.

There is a specific set of conditions in which WID will be most effective. Outside of this window, production is likely to be low. For example, if the soil cohesion is too high, the jetting water will not be able to disintegrate the sediment and fluidise the soil layer. If the average grain size in a non-cohesive (granular) soil is too large, sediment is likely to settle too quickly with the flow travelling only short distances, resulting in low productions. For the fluidisation of soil and the horizontal transport by natural processes to occur, soil conditions must be favourable. WID is not suitable for dredging rock.

The use of WID as a dredging technique is impacted by site-specific bathymetry and other environmental conditions. Production rates will be influenced by water depths, currents, water density, the dredging template, and bathymetric features.

After the soil layer is fluidised, the transport distance will affect production rates. For example, the presence of slopes can enhance the migration speed of the fluidised soil layer, but the presence of bathymetric obstructions can limit production. Furthermore, the magnitude and direction of river and tidal currents will also affect production rates. An analysis of the soil and environmental parameters is necessary to develop the most suitable work method for each individual project.

Environment

As mentioned above, the main difference between WID and other dredging techniques is that the dredged material is transported in the water column close to the seabed. Special consideration needs to be given to sensitive areas in and around the dredging site, such as shellfish beds, spawning habitats, and coral reefs. Van Oord's environmental engineering department specialises in the environmental management and monitoring of dredging projects around the world.

In order to minimize the risk of negative impacts, sensitive receptors must be identified and an understanding of the local environment gained during the preparation phase. This should be followed by close monitoring during the execution of the project.



Features of a WID

With a water pump capacity of 852 kW and a maximum dredging depth of 25m, the first purpose-built WID vessel, *Jetsed*, executed a number of small works from the 1980's onwards. Since then, the use of WID vessels has increased globally and Van Oord's fleet has expanded substantially.

The choice of WID vessel is site-specific and depends on various factors such as sediment type, hydrodynamic conditions, and maximum operating depths. The dredging depth of WID vessels varies from 0 to 26 metres. Their working speed is 1 to 2 knots, although most WID vessels are able to sail faster when in non-dredging mode. Van Oord's fleet ranges from road-transportable WIDs, which can be rapidly deployed, to large sea-going vessels.

WID vessels are highly manoeuvrable, easily mobilised, and capable of working in confined spaces. This makes them ideal for work in ports and marinas. These combined benefits make WID a versatile solution for dredging challenges.



The WID solution

Water Injection Dredging is an effective, cost-efficient, and environmentally sound dredging technique. Especially for fine unconsolidated sediments, WID provides an excellent dredging solution. By taking advantage of natural processes, WID reduces the CO₂ footprint and brings significant savings to project costs.

Van Oord has executed hundreds of WID projects worldwide. In Mumbai, India, our WIDs assist our trailing suction hopper dredgers; in Liverpool we keep the approach channel navigable and take care of maintenance dredging in the docks; in Germany we maintain the river Elbe to the Port of Hamburg; and in Brazil we maintain navigational depth in estuaries and rivers.

When the boundary conditions for WID are in place, WID is the most cost- and energy efficient dredging method, with less CO₂ emissions than any other dredging method. In this way, we can contribute an economical solution to the zero emission ambitions of our clients.



Watch video!

*Water Injection Dredging
How does it work?*