WHITE PAPER

# Unearthing the costs of overdredging

How tech brings depths into focus for more profitable operations

COMPILED: AUGUST 2025

**Overdredging, or dredging beyond the specified design dredge depth, comes with more risks and undesirable effects — many of which have the power to create cost inefficiencies and even sink profits for contractors.**

Often poorly defined or misinterpreted in contracts, the realities of overdredging can be a major source of costs and contention. It also presents a significant, untapped opportunity for potential savings.

Unlike land-based excavation that can achieve millimeter accuracies coupled with visual transparency, tolerances for quantities of material removed underwater are dependent on survey accuracies, soil conditions, the right equipment, and cutting-edge positioning technology to enable operators to accurately, prolifically and safely remove a defined quantity of material to detailed specifications.

Finding a balance begins with clear contractual expectations, as David Kinlan, Principal of Kinlan Consulting Pty Ltd., a Chartered Quantity Surveyor and Queensland Registered Adjudicator, confirms:

"The perennial issue with contract dredging specifications is a lack of detail.

**There will always be overdredging, but to what extent? And is that paid by the client or absorbed by the contractor?"**

# Room for error

Further, Dr. Donald Hayes, Research Environmental Engineer at the U.S. Army Engineer Research and Development Center reports: "Dredging is a high risk, thin margin business. When working in a dynamic environment, there is a maximum level of precision that makes sense."

**There's a difference between a tolerance and what's paid as overdredging,** Kinlan adds. While designers usually define design depth and maximum dredge depth, the paid specified tolerance is often an afterthought with little consideration given to the Preamble of the Bill of Quantities, which establishes the definition of paid volume.

Simon Burgmans, Principal Dredging Consultant at in 2Dredging, an international independent dredging consultancy, explains, "Certain contracts are written so that contractors do not get paid anything for dredging below the design. Other contracts pay e.g. 20cm (~8 inches) overdredging.

Given how costly it is to go back later to rectify problems or issues, it is much more efficient to remove all material before the dredge moves to a new location. Because of this, contractors are more likely to overdredge to avoid having to return. The specifications within a contract should clearly outline the amount of overdredging that is a paid volume so that there are no assumptions by either the owner or the contractor.

Case-in-point, a specification requires a one-meter dredge depth with a maximum paid tolerance of 0.5 meters. In this case, the contractor has to price that extra 0.5 meter of overdredging into the one-meter layer thickness rate. Now, if the contractor dredges to 1.65 meters, the extra 0.15 meter is definitely not paid — and the onus is on the contractor, of course, to work within the defined 0.5 meter tolerance limit.

Burgmans added, *"In the production estimate for any tender, you should always allow for overdredging. Depending on the project, a dredge can only cover so many square meters per hour. If there's a lot of square meters to cover it can be quite time consuming. Therefore, overdredging in an earlier stage can avoid the need of covering the entire area during each dredging maintenance campaign."*

# A Corps perspective

United States Army Corps of Engineers (USACE) defines paid allowable dredging as the dredging that "occurs outside the required authorized dimensions and advance maintenance (as applicable) prism" with the knowledge that there are conditions and inaccuracies in the dredging process, and the specifications should reflect a "balanced consideration of cost, minimizing environmental impact, and dredging capability considering physical conditions, equipment, and material to be excavated."[1]

The ER 1130-2-520[2] provides that District Commanders may authorize dredging of a maximum of 2 feet of paid allowable overdepth in coastal regions and in inland navigation channels. But it's the maximum depth to which material can be reasonably expected to be removed that often varies by a margin of error up to several feet using traditional methods. That's a risky margin to work within, and one that can cause environmental damage, equipment damage or costly rework that delays projects and adds sufficient cost to your project.

Because hydrographic surveying is used to measure the depth to the bottom before and after dredging, the accuracy of the hydrographic survey is critical in achieving the proper project specification.

1 Overdepth Dredging and Characterization Depth Recommendations -https://apps.dtic.mil/sti/pdfs/ADA470164.pdf

2 Project operations: Navigation and dredging operations and maintenance policies (ER 1130-2-520) -https://publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/er_1130-2-520.pdf

In the relative calm of sheltered harbors, bays, and estuaries, typical hydrographic survey accuracies of +/- 0.5 feet are achievable for a majority of the soundings at a 95% statistical confidence level. But as exposure to the elements increases, so does the motion of the hydrographic survey vessel, reducing the accuracy of individual soundings.

Additionally, the water surface's relationship to the dredge datum must be established and measured during times of surveying and dredging[3]. This is typically achieved by using a tide gauge or real time kinematic (RTK) methodology. Both require accurate modeling to avoid height/time tide errors. For example, if the tide gauge is a long distance from the dredging area, the water surface at the dredging site can be a different elevation from the tide gauge, further reducing accuracy of the hydrographic survey.

There are inherent inaccuracies in dredging processes. No dredge excavates a perfectly flat bottom exactly on the required project grade. Excavation accuracy of a channel, for instance, relates to closeness of the dredge's completed work to the designed project (project and/or overdepth) grade as determined by an after-dredge hydrographic survey. *(See figure 1).*

Dredge excavation accuracies vary as a function of the type of dredging equipment used (mechanical or hydraulic) and its respective interaction with site-specific physical conditions (tides, currents, waves), type and thickness of sediment or rock being dredged, channel design (water depth, side slopes, etc.) and level of dredge crew skill and effort. Error components introduced by the dredge's positioning system and the hydrographic surveying techniques and equipment used to measure bathymetry will also contribute to overall excavation accuracy.

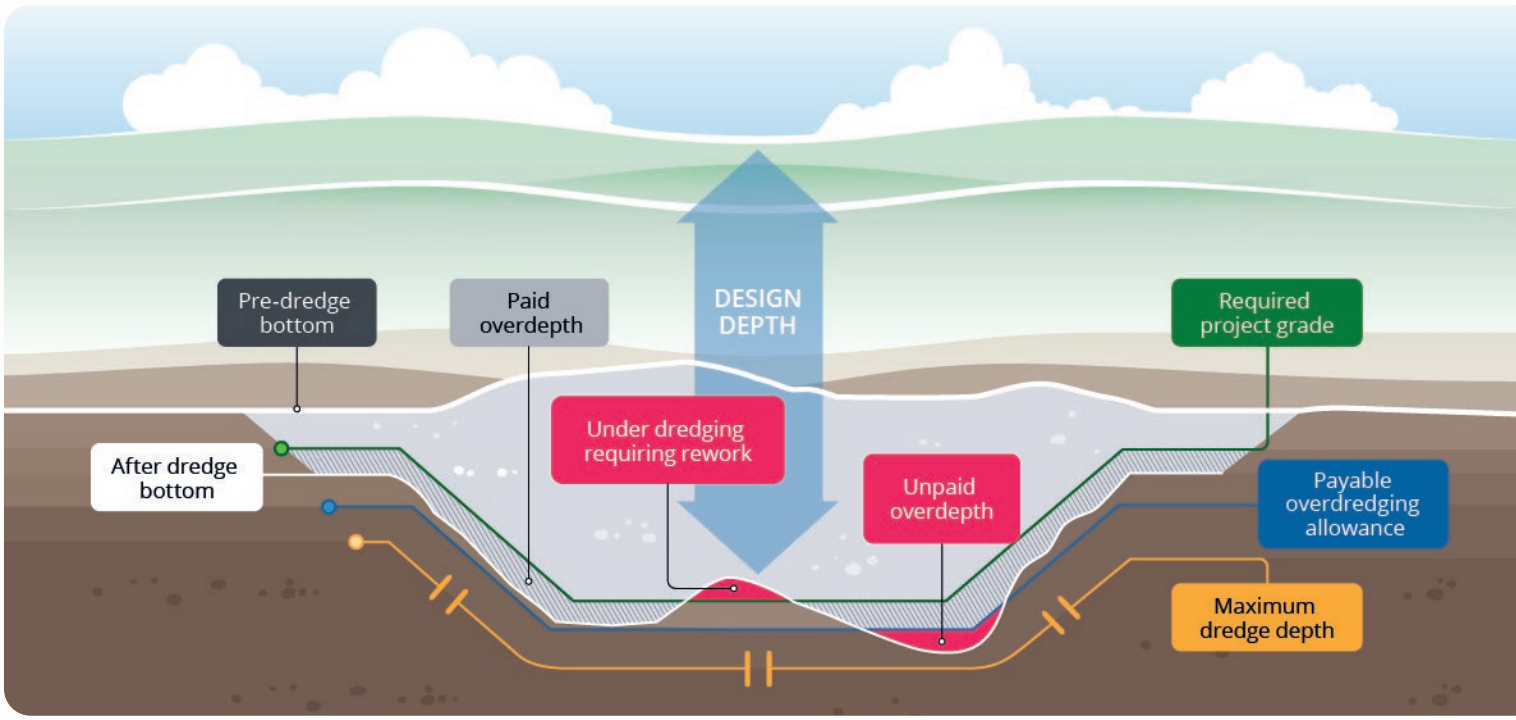


Figure 1. Various Dredging prism dimensions and zones.

3 Hydrographic Surveying Engineer Manual EM 1110-2-1003 -https://publications.usace.army.mil/Portals/76/Publications/EngineerManuals/EM_1110-2-1003.pdf

Since material removed beyond the limits of the overdredging allowance is not paid and **non-pay dredging is a costly exposure** from uncontrollable factors such as substrate variation, incidental removal of submerged obstructions, or wind/wave conditions reducing an operator's ability to control the excavation head — it's imperative to find other ways to build in more accuracy to keep costs in line.

With so many factors that make up dredging accuracy — some controllable, others not — dredge guidance systems offer a unique opportunity to provide reliable, redundant precision in the otherwise unruly and complex marine environment.

> Marine tech delivers the accuracy that speeds up operations by up to 50%, reports Britton Lawson, director of construction technology at Veit & Company, Inc. *"With the 3D visualization, we have greater assurance that cut depths are accurate as compared to a mark on the stick."*


# Environmental constraints

Placement capacity on environmental dredging projects that deal with contaminated material is a major challenge for any dredge operators. Over-dredged materials must align with resource consents for dumping the spoil. For the permit process, owners don't work with net volumes; they work with gross which includes over-dredged materials.

"Adequate thought must be given to the factors which may influence the amount of overdredging which may ultimately result so that the permits accurately reflect the likely dredge depth which is finally achieved," Kinlan explains.

For instance, if a client has a disposal permit for 100,000 cubic meters, that quantity must include the paid tolerance (e.g. 90,000 cubic meters plus 10,000 cubic meter tolerance). Reducing that tolerance as much as possible is key, explained Hayes — particularly in environmental dredging: “For example, if required to remove two million cubic yards, an owner does not want the dredge operator to remove anything more because of sediment management costs.

> *Anything technology developers can do to improve the process and reduce excess dredging, is valuable,"* added Hayes.

Many contracts will define under and over-dredge constraints. For example, some might say remove 10 meters (~30 feet), any more than that and the dredge operator has to pay the customer — cutting even deeper into profits.

These environmental requirements make accuracy mission critical. If the quantity of overdepth dredging is not properly estimated, it could lead to misleading conclusions concerning the environmental impacts that may occur at the disposal site[4]. Given the risk of environmental damage and associated fines, it’s the use of technology that empowers contractors to leave less of an environmental footprint, only touching what’s necessary and leaving the rest — such as fragile ecosystems — undisturbed.

# Visualization advantage

While dredge operators around the world have long used paint marks around the dipper arm or wire to measure quantities of dredged material, dredge visualization systems go even further to significantly finesse real-time measurements. Sonar integration helps validate work completed in real-time, driving better margins. What was impossible in the not-too-recent past, now provides a comparatively affordable ROI for both large and small operators today.

Contractors that adopt this technology significantly enhance their competitiveness — enabling them to submit more aggressive, higher margin bids, without overdredging eroding profits. When incorporated on hydraulic excavators, wire cranes, bucket dredgers, underwater ploughs, trailing suction hopper dredgers and cutter suction dredgers, 3D visualization systems are able to track the dredge head. In the cab, the operator can see the planned vs. actual surface in 3D, profile and plan views, simplifying workflows. The GNSS-guided system provides precise position and heading of the machine and guides the operator to the desired surface and determines the cut or fill, while optimizing dredging paths using real-time data — further streamlining the dredging process.

Utilizing 3D visualization software enables crews to set over- and under-dredge limits, which are reflected on the color grid map from within the cab — effectively allowing the operator to see beneath the water surface.

4 An Evaluation of Overdepth Dredging And Its Engineering and Environmental Implications: Case Studies From the Northeast -https://www.westerndredging.org/phocadownload/ConferencePresentations/2006_SanDiego/TAMU-38/12%20-%20Tavolaro%20-%20An%20Evaluation%20of%20Overdepth%20Dredging%20and%20Its%20Engineering%20and%20Environmental%20Implications.pdf

Adding sonar to a 3D visualization system empowers operators to access real-time feedback of the new surface, empowering operators to confirm progress against the design. Sonar sensor soundings can be displayed in real-time on the map in the cab, providing instant feedback that enables operators to get the job done right the first time. However, sonar alone is not enough as it can be impacted by turbidity/disturbance in the water column leading to extended periods without an updated 'picture' of the seafloor, making 3D visualization systems the cornerstone to precise dredging.

Integrated 3D visualization/sonar solutions, when combined with GNSS positioning systems, replace more conventional manual methods such as tide gauges and paint marks around the dipper arm or wire of the dredging machine, with more accurate results. This combination creates a scenario that has the power to save hundreds of thousands of dollars in rework, save days, weeks and months of time, and drive higher levels of efficiency and productivity. Savings that you could be missing out on and costing you project bids.

> *"If a dredge contractor is able to achieve even 1 or 2 inches more accuracy across an entire harbor or a river dredging project, that can be quite profitable especially in case of hard soil or rock,"* said Burgmans.

| Increase in accuracy | x | Project surface area | = | **Overdredging avoided** |
|---|---|---|---|---|
| **2" (0.167 ft)** | x | **1,000,000 $ft^2$** | = | **6,185 $yd^3$** |

Depending on operational costs of a contractor's project, a dredge visualization system could pay for itself from this savings alone.

When it comes to the role of 3D technology and sensors, Hayes points out that the cost of overdredging eats into already tight margins. "We have to move forward and take advantage of the technologies available. Dredging is an efficiency business. That's how they make money and margins are already thin." With lowest bid wins contracts, such as those for the USACE, accurate visualization is essential to remaining competitive and profitable.

# Your results are only as good as your positioning

Dredging even an inch deeper than necessary cuts into your profits in the form of unnecessary labor and fuel. Precise point positioning technology is the beacon that brings the murky details into focus, enabling contractors and operators to meet design specs with speed, competence and confidence — neutralizing over or under-dredging that compromises efficiency and jeopardizes equipment and infrastructure.

Trimble® Marine Construction systems and Trimble CenterPoint® RTX Marine provide the enhanced technological precision, accuracy and streamlined workflows that are essential for meeting the evolving demands of the industry today. And it bears repeating that the contract is key.

> *"The contract drafter should consider whether overdredging is paid as a measured quantity to the overdredge allowance or to be absorbed in an allowance in the contractor's unit rates and prices."*

A well-defined provision in both the technical specification and Bill of Quantity Preamble mitigates misinterpretation of any overdredging allowance.

Solid advice, as the dredging market size is expected to grow steadily in the coming years, reaching $15.89 billion by 2029 at a compound annual growth rate (CAGR) of 4.6%.[5]

5 Dredging Market Report 2025 -https://www.researchandmarkets.com/report/dredging