

# TERRA ET AQUA

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## WATER AMBASSADOR

Communicator seeks to raise water awareness globally

## RESOLUTION TOOL

Mediation is an effective strategy to resolve disputes

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## TURBIDITY LIMITER

# ASSESSING ENVIRONMENTAL TURBIDITY LIMITS FOR DREDGING

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TURBIDITY LIMITER

# ASSESSING ENVIRONMENTAL TURBIDITY LIMITS FOR DREDGING

Dredging is an essential activity to maintain and develop ports, harbours and waterways to allow for safe navigation, remediation, and flood management. The process involves the relocation of large volumes of sediment which can lead to sediment plumes from the release of suspended sediments into the water column. Excessive suspended sediment concentration has an impact on water transparency – as a result of increased turbidity – and may cause the degradation of water quality and marine ecosystems.

Mitigating the impacts of turbidity is usually managed by limiting the amount of suspended sediments released at the dredging sites or entering sensitive areas. A loose definition of the turbidity limits can have a huge impact on the local environment while a strict or ambiguous definition can have a serious impact on the project execution methodology proposed by bidding contractors and thus on their quoted price.

Setting turbidity limits requires a general understanding of dredging processes as well as the surrounding environment. The CEDA Environment Commission highlights a general integrated approach to set or discuss turbidity limits for dredging applications on page 27.





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## CONTENTS

### CONTRACTS

#### Mediation 101 for the dredging industry

The international dredging and maritime construction industry remains quite devoid of the use of mediation as a tool for Alternative Dispute Resolution. Mediation is outlined to broaden familiarity with mediation, increase confidence in the process, and inform about the benefits it can bring to the industry at large.



### INTERVIEW

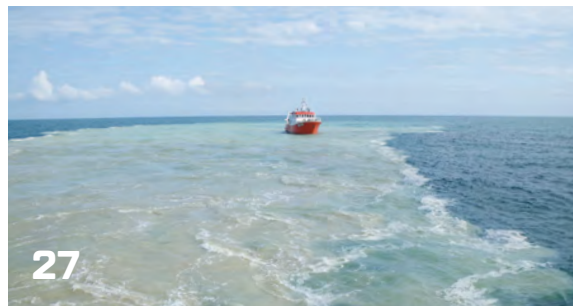
**'We have to make people aware that if you invest in water, there is a trickle-down effect outside of the water world, in *their* world.'**

Henk Ovink was appointed by the Dutch Government to increase awareness and action for water security across the globe, and travels the world spreading the word to citizens and leaders alike.

### ENVIRONMENT

#### Assessing and evaluating environmental turbidity limits for dredging

The maintenance and development of ports, harbours and waterways requires dredging, a process which relocates large volumes of sediment. A method to set limits on the release of suspended sediments into the water column is set forth.



### EVENTS

#### Take a networking rain check

CEDA and IADC launch the first edition of the Dredging for Sustainable Infrastructure Course in The Netherlands in December.



### BOOK REVIEW

#### Too Big: Rebuild by Design's Transformative Response to Climate Change

Rising sea levels and strong storms are society's new reality and it needs to be confronted. This book addresses the urgency of the problem and shows a way forward, informing and inspiring those ready to tackle the challenge.

# HOW CAN THE DREDGING INDUSTRY SPREAD HOPE DURING A PANDEMIC?



**Frank Verhoeven**  
President, IADC

In the name of public health, governments across the globe have taken diverse measures to reduce the spread of coronavirus: shuttering the doors of schools and non-essential businesses, closing borders, reducing public transportation options and isolating people in their homes. The last time the world saw a worldwide public health crisis where such intense measures were taken in response was over 100 years ago. It is clear from the patchwork quilt of government responses that the world was not better prepared to handle the situation this time around.

**While we don't know how long this situation will last, it is clear that the world has inevitably changed.**

Amidst the crisis, a glimmer of hope has been found. We have already seen improvement in air quality across the globe because of reduced emissions. The suspension of boat activity in Venice has led to the canals' water becoming transparent from the settlement of suspended sediments. Fish can be seen swimming.

The impact human activity has on nature is clear. Once this activity stops, we see nature's balance quickly returns. This reinforces the dredging industry's proactive stance on sustainability. Humans have an impact on the environment. The question is: do we want this impact to be negative or positive? The dredging industry chooses positive. The dredging industry has continued operations on projects which benefit society such as offshore wind projects to continue the global energy transition to renewable sources.

IADC's employees are working remotely and *Terra et Aqua* is published. Before the crisis set in, the editor interviewed Henk Ovinck, the Special Envoy for International Water Affairs and it can be read in this

issue. In addition, an article about how to mediate legal issues within the dredging industry is more relevant now as well as criteria to determine turbidity limits to apply to the construction and maintenance of global projects are presented.

**Amidst the crisis, a glimmer of hope has been found.**

**We have already seen improvement in air quality across the globe because of reduced emissions.**

# MEDIATION 101

## FOR THE DREDGING INDUSTRY



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Despite being a commercially mature industry, the international dredging and maritime construction industry, remains quite devoid of the use of mediation as an appropriate tool for Alternative Dispute Resolution. This is likely the result of unfamiliarity with the process as well as perceived uncertainty regarding enforceability in an international context.

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**In order to understand the mediation process properly, it is important that those involved are fully aware that the role of the mediator is not one of an active judge, adjudicator or other decision-making person...**

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The approval of the final draft for a Convention on the Enforcement of Mediation Settlements at the 51<sup>st</sup> Session of the United Nations Commission on International Trade Law in June of 2018 and its signing as the Singapore Convention on the Enforcement of Mediation Settlement Agreements in August 2019 heralds a new period in that context; making it directly relevant to the international maritime construction and dredging industry and warranting a closer look at this junction in time.

### **Introduction**

In an early discussion held on 2 January 1818 and in the application for Royal Chartership for the Institution of Civil Engineers (Anon, 1928), Henry Robinson Palmer – the British civil engineer who would later become famous for the design of the world's first elevated railway but possibly of more direct influence on the maritime construction industry by means of his description of the principle of containerisation for the transport of goods – probably made one of the more poetic references to mediation when he said 'an engineer is a mediator between the philosopher and the working mechanic; and like an interpreter between two foreigners must understand the language of both'.

Though clearly not intended as a reference to mediation as a form of Alternative Dispute

Resolution (ADR), it is intriguing to note the skills of interpretation and comprehension being put centre stage in a pure engineering context here whilst one would likely expect them to be of equal, if not more, relevance to ADR. It is even more intriguing when one considers that mediation as an ADR process has – to date – not found a large inroad at all in the world of international maritime civil engineering and construction. The latter is a particular pity as mediation offers some distinct advantages when it comes to dispute settlement or de-escalation that other processes simply cannot offer. This lacuna is more than likely the result of unfamiliarity with the process and some deep-rooted misconceptions.

### **What is mediation?**

For the sake of simplicity, mediation can be defined as a process supervised by a third independent party, in which the parties are facilitated in a strictly confidential setting in order to resolve the dispute between them.

There is another form of mediation, namely evaluative, in which the mediator is asked to give a (normally) non-binding Opinion on the merits of the matters in dispute. This Opinion can be provided at various stages of the mediation process. It could be provided before the participants meet with the mediator where the Opinion is thereafter

used as a basis of settlement discussion between the participants to the mediation at the mediation itself. An alternative to the provision of an Opinion prior to the participants meeting with the mediator is for the mediation to commence and then after a set time, the mediation is adjourned to another set date for the mediator to provide an Opinion in the meantime to be discussed at the next date. This has the advantage of the Opinion being able to take into account what has been said at the earlier part of the mediation. Also, a break in the mediation can let the dust settle and potentially wiser counsels to prevail.

In order to understand the mediation process properly, it is important that those involved are fully aware that the role of the mediator is not one of an active judge, adjudicator or other decision-making person resolving the matters in issue between the parties, but rather that of a supporting helping hand in negotiating their own settlement of the difference or dispute. It is therefore the participants to the mediation that are and remain the owners of the dispute and its solution. They and they alone decide whether there will be a settlement and on what terms and conditions it will rest. It is therefore important that the party representatives who are delegated to a mediation actually have the necessary decision-making power for the party they represent.

Thus an important difference between mediation and more formal dispute resolution processes, such as Court proceedings or tribunal or arbitration, is that the parties retain control over the dispute and its settlement. Once formal dispute resolution procedures have begun, they will often continue along established procedural routes and will be subject to a timetable set by the body that presides over the resolution of the disputes. For example, the parties in that situation no longer have any control over events and they often find their way to a final hearing and accompanying decision almost passively. All this is in stark contrast with mediation where the parties are in full control of the procedure, and in fact also participate fully in it. The parties are free to decide whether they wish to withdraw from the mediation process at any time and whether they come to a settlement or not. It is this control over the process that the parties obtain that gives them the full, true, ownership of the dispute and its resolution and probably also explains why when resolution is achieved, it tends to be honoured and respected by the parties later on.

Having said that, the mediator obviously plays a central role in assisting the parties in the mediation to reach a settlement. Mediators are generally well trained, not only in negotiation techniques, but also in techniques to break through the blockages or stalemates in the negotiation process between the parties and intervene where necessary in the unproductive deflections that all too often find their way inside a negotiation. In addition, a mediator should ideally have insight into the commercial and technical aspects of the dispute but he should not necessarily be an expert in the matter.

Another essential feature of the mediation process is its confidentiality. In fact, mediation is confidential on two levels: first, the entire

mediation process itself is a private and confidential process. Only the parties and their advisers are aware of the mediation and the details of the possible settlement that is reached. The latter will, however, lapse if the parties record a formal judicial agreement as these normally get openly published. More on that is set out further on in this article.

In the second instance, everything that is said in a private meeting between one of the parties and the mediator is also confidential. Such a meeting is usually called a 'caucus' after the old English term for a meeting of members of a certain political party without outsiders. The mediator – acting as a de facto broker – may not transfer information to the other participant to the mediation without the express permission of the participant imparting the information. The advantage of this is that the mediator and the relevant participant can safely talk about possible options which is obviously to the benefit of the mediation.

Since everything that is said within the mediation cannot be referred to in further legal proceedings and it is also not binding until an agreement is concluded, it is a very credible process for the parties to step into. It is important that the mediator is at all times independent from the parties, without interest in a particular outcome. It must be clear to the parties – and also clearly seen in this way – that the mediator actually does not choose a side and has no interest in a particular settlement.

### The process

In its most stylised form, mediation is truly a 'process' that people go through. There are no formal binding steps and various organisations tend to advocate slightly different templates or formats but in general, one can identify five steps or phases: Preparing, Opening, Exploring, Bargaining and Wrapping up.

Depending on the circumstances, some of these may be more pronounced or more blurred or there might be some iterative feedback between, say, the exploration and the bargaining phase, which may then get translated into some shuttle diplomacy in-between various caucuses or subsequent meetings, but in general the above gives a good thread for the novice to the process.

Apart from selecting a mediator, the preparation phase heralds a time where the mediator, once appointed, contacts the parties and gets the process moving. This tends to include the exchange of (a joint) written case summary. This period should not be underestimated as it offers the parties a time to reflect on their positions, their needs, their wants and, to put it bluntly: do their homework. Because no ownership of a process ever comes without responsibility, all should put in their best effort. The opening meeting is the point in time where all are reminded again of their respective roles, the process and when and where the respective formal opening statements can be made. This is often a good point in the process – under a ceaseless encouragement of thoughtful engagement and constructive dialogue – to also capture topics or agenda points for development later on in the process.

Once the exploration phase commences, the attention should be firmly coaxed from the past to the present and the future. This is where all have an invaluable opportunity to explore options, think around the problems, and essentially put forward possibilities. At some point, as the dialogue evolves, there will be an almost natural flow into the bargaining phase. Here it is important that offers get properly framed and conveyed either directly between the parties or with the help of the mediator. Gradually, as this progresses, the shape of a potential settlement will start to emerge. This is where the wrapping up phase comes into effect. This means conducting some sense checks on, for example, the detail and workability of terms, drawing up some Heads of Agreement, or even a full Settlement Agreement and, ideally, even signing off on it.

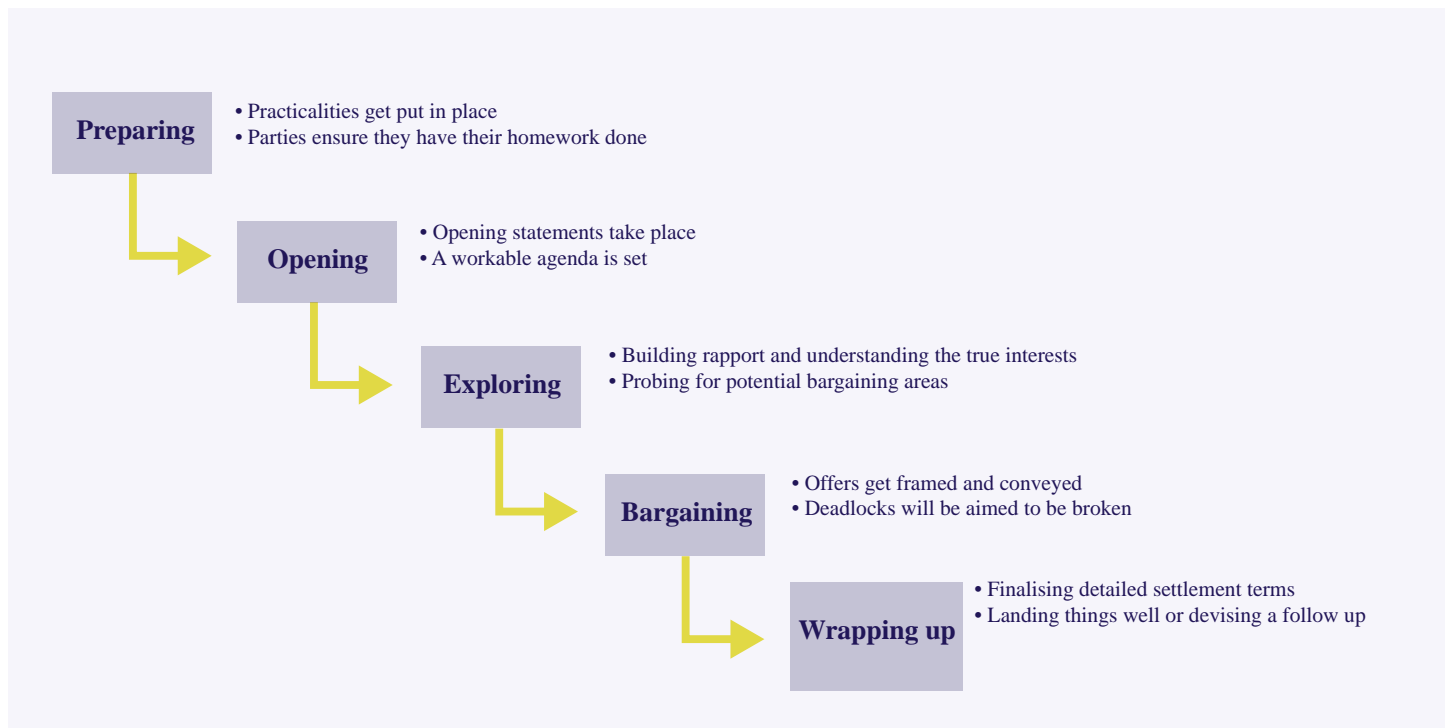
### Why does mediation work?

Tilman and Wijnant (2016) reported in their Mediation Barometer 2016 that the chances of achieving a (written) agreement during mediation are very high. For judicial mediation (i.e. a mediation imposed on the parties by

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**In its most stylised form, mediation is truly a 'process' that people go through.**





**FIGURE 1**  
Flow chart depicting the common stages of mediation.

the Court), their statistics show only a 63% success rate but as high as 74% for voluntary mediation. These numbers are also reflected in a recent report entitled 'The Eighth Mediation Audit' (CEDR Staff, 2018) which reports an overall mediation success rate of 89%.

These high chances of success are probably the result of the most obvious reason, and that is that it brings the parties together and gives them a chance – which otherwise would not occur – to genuinely resolve a dispute. With mediation, the senior management of a firm can, for example, hear the strengths and – perhaps even just as important – the weak points of the affairs of the various parties. Often, those in decision-making positions who are normally informed only by their own personnel or advisers – whose opinions and interpretations cannot by definition be taken at face value as being wholly impartial, and perhaps may even be self-administered – will have a chance to hear the different sides of the arguments.

Of course, in mediation, the mediator actually brings the parties together. His presence is

likely to contribute enormously to the process of reaching settlement because he can come to independent factual conclusions and independent insights that can help the parties in their own views. In addition, he tries to identify the real issues that separate the parties and to focus the participating people on them instead of on the differences perceived by themselves (which all too often tend to be incorrect). He can try to bring the real needs and interests to the forefront with the parties, instead of those that are put forward in public and that may well be somewhat different.

The mediator can investigate the strengths and weaknesses of a position in order to emphasise the possible weak points that may not have been observed by the party itself. Thus, a party can start the mediation process erroneously in the belief that it has few weaknesses if any, and the mediator can investigate the true strengths and weaknesses with that party in a safe setting such as a caucus. The mediator will also be able to investigate – and test – the strengths and weaknesses of the other party's position.

Mediation will often begin once the informal negotiation process has reached a deadlock. Here, also, the mediator is in a unique position because he can overcome such deadlocks or avenues that appear to lead nowhere and, perhaps most importantly, help the parties to save face by moving on from what would have been unshakeable positions in the public arena. This simplifies reaching the Zone of Possible Agreement (ZOPA). The mediator can propose ways to discover new avenues which may hold 'added value', or he can help to split up the problem into discrete elements, each of which can be developed independently and without regard to the apparent deadlock. Alternatively, at times a stepping back from the issues and finding a more neutral way of accounting may prove to be helpful. Those familiar with the work of Thaler (1999) will know that although we all tend to believe that we are 100% objective and matter-of-fact in our business dealings, the truth is that we tend not to be. The good news is, though, that in commercial matters and mediation, the options for resolution are really only limited by the human imagination.

**The only real requirement for mediation is for there to be a dispute between the parties.**

And mediation, unlike traditional litigation or arbitration, through the freedom and ownership it warrants, can bring that fully into play.

Finally, the mediator throughout the entire mediation process will focus the parties' thoughts on sustainable resolution and strive to look to the future instead of an approach of constantly re-examining and reviving the past. Above all, he will provide an invaluable embedding of what should be a driving axiom in the process, namely that of being hard on the facts and easy on the people. As the statistics show, this approach – though deceptively simple – does give a positive outcome in the majority of cases (CEDR Staff, 2018).

**When to use mediation?**

The only real requirement for mediation is for there to be a dispute between the parties. Except for the existence of a disagreement or dispute between the parties, there are actually no set rules for whether to mediate at all or when the right time has come to mediate.

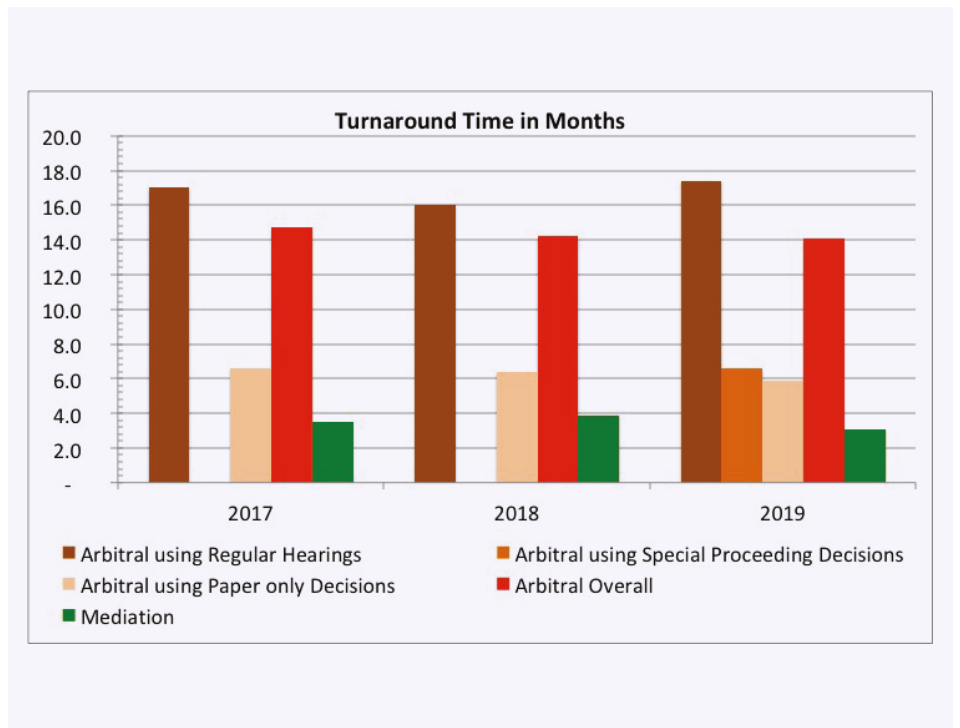
In some cases, especially when there is an imbalance between parties, the parties may find it appropriate to mediate their dispute before taking more formal legal proceedings such as arbitration or litigation. Perhaps this will be the case even if the dispute is still fresh and the positions of the parties are not yet anchored. As a matter of fact, and as an example of a budding trend, mediation is now encouraged by numerous civil Courts such as those in England and Belgium. The latter country has not yet reached the proportion

that it causes a real flow of legal resolution towards mediation (Tilman and Wijnant, 2016)but the trend is clearly present. CEDR Staff (2018) found a similar trend in England where scheme-related mediations – such as those used by the National Health Service, leading employers, the Court of Appeal and other Courts – now account for 37.5% of all mediation activity.

Regarding the timing of mediation during a more formal dispute resolution process, there are no hard rules (yet). In many aspects, however, it can also be argued here that the sooner the mediation is started, the better. This is because the costs of the legal process or arbitration will still be reasonably low and they will therefore be less of a factor in (not) reaching an agreement. If mediation only takes place shortly before the end of a lawsuit when both parties have incurred significant costs, the possible liability for the costs can conceivably form a stumbling block to the settlement of the actual subject of the dispute. This is possibly why legally enforced mediations tend to have a lower chance of success. However, it is not uncommon for at

least one of the parties to want to go through one or more stages of a formal legal procedure in order to be able to assess how outsiders perceive their case before actually entering into mediation. Nevertheless, one should also be aware that too early mediation can also have its own problems. For example, this is the case if insufficient preparation has been carried out by one or more parties, for instance when assessing the quantum of the requested amounts. Here, the lack of insight and knowledge about this can then become a stumbling block for reaching an agreement. P6, as it is often said in colloquial English, is apposite: Proper Planning & Preparation Prevents Poor Performance. There simply is no better recipe than sound preparation and planning to prevent poor performance.

Although it is thus clearly impossible to indicate with complete certainty when is the best time to mediate, the literature indicates that, if you want to save time and money, starting mediation – coupled with the aforementioned favourable chances of success – is a good choice regardless of the exact timing when it is undertaken. Carroll and



**FIGURE 2** FINRA data on the turnaround time in months for both Arbitration and Mediation.

Mackie (2006) give a sample calculation of a specific case in which the entire mediation in connection with a dispute of USD \$20 million in order to reach a commercial agreement lasted two to six months, took 100 hours of management time, notched up a mediation cost of USD \$17,000 and legal fees of USD \$90,000. Arbitration according to their estimate would have lasted 24–36 months, 700 hours of management time and USD \$400,000 to \$600,000 in legal fees with a further USD \$350,000 to \$750,000 in tribunal costs. Tilman and Wijnant (2016) in Belgium reported from their statistics that in civil and commercial matters, the standard runtime turns out to be two months, with the mediator seeing the parties three times for a session of three to four hours each. Presently, these tend to be smaller cases than those that tend to circle maritime projects but a look at England, where it is often said that cases tend to be of a larger nature, shows similar figures and reports that for a day's mediation participation the parties can expect to pay between GBP £1,512 to £3,627 in mediator fees (CEDR Staff, 2018). The Financial Industry Regulatory Authority or FINRA,

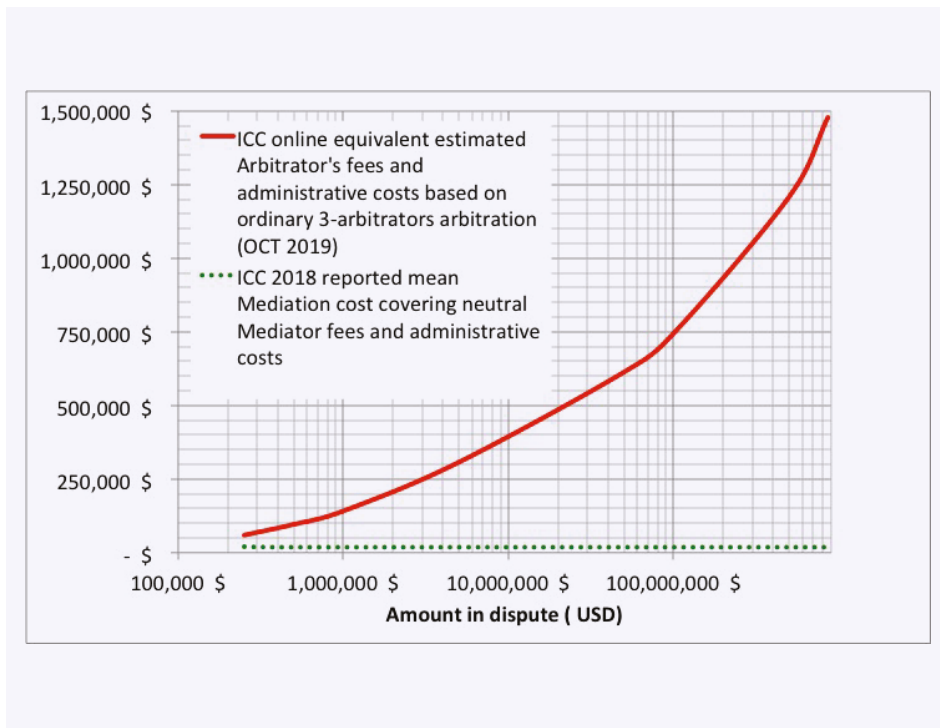
which is authorised by the USA Congress to protect America's investors by making sure the broker-dealer industry operates fairly and honestly, oversees more than 634,000 brokers across the USA and analyses billions of daily market events. In this capacity, they also operate the largest documented securities dispute resolution forum in the USA applying both arbitration and mediation. Their data set (FINRA Staff, 2019) shows mediation to be by far the most time effective methodology.

Although the foregoing only shows a large saving in time, it does not show the cost saving involved. This angle can be gleaned from e.g. the 2018 Dispute Resolution Statistics as published by the International Chamber of Commerce (ICC Staff, 2019). Here it is reported that in 2018, the disputes registered under mediation covered a wide range of business sectors whereby construction and engineering disputes were the most frequent, accounting for almost 35% of cases, followed by disputes relating to energy and telecommunication. The value of these disputes ranged from USD \$250,000

to \$860 million, while the reported average costs of proceedings in which mediators were appointed (covering ICC administrative expenses and the fees and expenses of the neutral) reached only USD \$18,500. Had these disputes been addressed using an ordinary tri-arbitrator approach, the costs would have been far higher as illustrated in figure 3.

The above does not only confirm the suitability of mediation for a wide range of disputes, including high value disputes, but also underlines its cost-effectiveness. These views had earlier already been echoed by de Castro and Schallnau (2013), who presented figure 4 to succinctly depict the findings of their study.

It is clear that all the above time and cost allocations are each far less than what would be the case if an arbitral or classical litigation approach was taken in the same matter and reflects what Glahn and Derugeris (2014) reported on the use of Courts for dispute resolution. It is probably from this realisation and similar views on the matter that legal



**FIGURE 3** ICC expected ordinary tri-arbitrator cost vs mean mediation cost therefore in 2018.

**There simply is no better recipe than sound preparation and planning to prevent poor performance.**

assistance insurances now also become more and more financially involved in mediation and no longer only in the traditional litigation cases (Cleeren, 2014).

Given its flexible nature and cost effectiveness, some readers may at this stage be pondering on the potential of mediation during the process of contract formation. It would lead us too far from the initial premise of this article but recent work indeed underlines its usefulness in that application because co-operative agreements between contractors, employers, consultants, legal advisers and public authorities will be needed more than ever (Kinlan, 2016). Traditionally, contracts have been for the most part based on a fairly standard form of contract, been static in nature and been provisioned with rather standard dispute resolution clauses. The reality of today, however, is that we and our projects all exist in a highly variable and interconnected space where these traditional approaches of contracts and their formation have come to meet their limits. There is a genuine need for all parties to come to a more adequate manner in which to address change and engage disagreement, and to embed those matters that can be agreed in a final, legally binding, contract to govern major long-term projects or programmes.

### The international view

Cleeren (2014) reported that Legal Assistance & Recovery (LAR) – one of the largest claims representative and legal aid firms on the Belgian market – stated that in 2014, 75% of the Belgian population had never heard of mediation. Worldwide, the numbers do not appear to be much better. Naturally, such low numbers do not help to make the process a go-to approach in cross-border disputes. This appears to be underscored by the study of Tilman and Wijnant (2016) who found that only 7% of the conducted mediations in their research contained cross-border elements. The element that was decisive in this respect was apparently for the most part that one of the parties was established abroad. They also found that this percentage was the same for both civil and commercial matters as for family matters. It is therefore not clear whether the topic of the mediation as such was deliberately cross-border by nature (e.g., as in the case of an overseas agency contract, an overseas commercial agency, an international build, or an international shipping contract, etc.) or that the

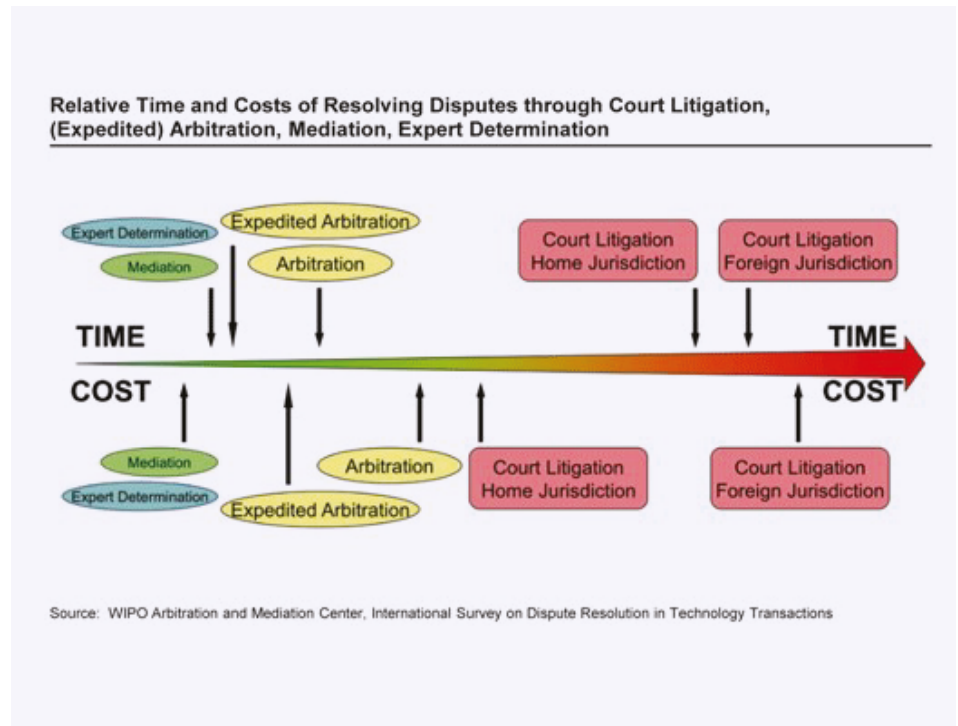


FIGURE 4

Depiction of the WIPO Center's survey result on cost and duration regarding dispute resolution.

element that one of the parties established abroad was rather coincidental. There is also no information available at the moment as to what extent we are dealing with European mediation only here or whether this finding also extends beyond European borders. Given mediation's procedural flexibility and increased mediation numbers, this is all likely to gradually change for the better in the sense that in an ever increasingly interconnected world, cross-border cases will continue to rise, leading to a much clearer picture on that side of the study.

### Mediator appointment

The appointment of a mediator tends to differ between legal territories and between mediation organisations. If we cast an eye on the Belgian situation we see that, as stated by the Belgian Federal Public Service (FPS) Economy, Small-to-Medium Enterprises (SMEs), Self-employed and Energy, there are two types of mediation:

- the free or voluntary mediation where the initiative comes from (one of) the parties in a dispute, and
- the judicial mediation that comes from the judge in a traditional piece of litigation.

The mediator in these can be accredited or unaccredited. The Belgian Federal Mediation Commission (FMC), based on if and when the mediator meets certain set criteria of initial and continued further professional training, does the accreditation in Belgium. The FPS Justice keeps a list of these accredited mediators – listed according to their specialty and place of residence – that can be requested via the Federal Mediation Commission (FMC). The use of an (un)accredited mediator is not without its consequences. The agreement reached in a Belgian Mediation can only be homologated by the Courts – at the request of the parties – if the services of an accredited mediator have been invoked. The agreement then obtains the same legal value as a judgment and becomes binding. Another important impact of using an (un)accredited mediator is that on legal timelines. The legal clock or timeline is suspended or frozen from the moment of the signing of the mediation agreement resulting in the staying of on-going litigations if an accredited mediator is appointed but not so if an unaccredited mediator is engaged. The parties are, however, not obliged to call on an accredited mediator,

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but then they lose the not unimportant benefits listed above; in a purely Belgian affair, of course.

History shows us that it is not uncommon for parties from different countries to fail to agree on the appointment of an arbitrator, a mediator or even an expert from one of the countries of origin of the parties in the dispute. It is therefore not unusual to appoint someone from a third country. The presence of, say, British professionals is then often a common occurrence. When they do not act independently, they are often found initially through such independent organisations such as the Centre for Effective Dispute Resolution (CEDR) from London or the International Chamber of Commerce (ICC) from Paris. In itself, this might be construed as a somewhat overly cumbersome approach. As it stands, mediators in Belgium, the UK and Europe as a whole are well aware of the European Code of Conduct for mediators and a clear mediation protocol or mediation agreement to which also the mediator is to adhere should be able to offer the parties adequate peace of mind. Although the European Code of Conduct for Mediators (European Commission Justice Directorate, 2004) started life as a voluntary code of conduct, its elements have been included in the legislation on mediation in most countries across Europe (Blake et al., 2012). However, despite this, in cross-border disputes, the previously described belt and braces approach is still rather the rule than the exception. It is perhaps surprising in this context that most mediation clauses in contracts or dispute-specifically drawn up mediation agreements or protocols do not specifically list, for example, London as the seat of the mediation which according to the 2018 International Arbitration Survey (Friedland and Brekoulakis, 2018) remains the most preferred seat for international arbitration and for good reasons. The latter (London) could easily offer further comfort to any disputing parties. One further point worth considering is whether any particular contract being drafted should have a 'mediation agreement' requiring any mediation to be done in a particular country with the mediator selected in a particular way. An 'arbitration agreement' is a common clause in contracts but it may well be sensible to include a 'mediation agreement' as well. Mediation provisions generally are discussed further on in this article.

## Confidentiality

When one goes beyond the scope of a monolithic jurisdiction and one deals with agreements, disputes and parties that extend across several legal territories, the management of (often unexpected) legal interactions becomes an almost inextricable tangle with many possible pitfalls for the parties.

Increasingly, mediation as a condition precedent to entering into a judicial or arbitral procedure is included in large international contracts. But even if this is not the case, the parties are encouraged to do so. For example, in the FIDIC Red Book (FIDIC Staff, 1999), a frequently used set of Conditions of Contract for Construction for buildings and engineering works designed by the Employer, Art 20.5 encourages the parties to settle the dispute amicably. Whether this should be done with or without mediation as a formal process is not explicitly stated but it is argued that it should – unless the parties decide otherwise – start the clock to possibly go to arbitration (being 56 days after the notice of dissatisfaction) at that point. This would contribute to:

1. encouraging the parties to come to an agreement quickly, but also
2. encouraging them not to hold their cards close to their chest.

The fear expressed in the second point – keeping cards close to their chest – may be the result of the consideration by a party who worries that, if they put their cards openly on the table, they may possibly be used against them later on. Specifically, the latter could for example be the case in the United Arab Emirates. 'Without prejudice', 'off the record offers', and 'private and confidential' communications are not accepted there by the local courts as an adequate shield and may be referred to in further legal proceedings (Essam Al Tamimi, 2014).

In order to address this fear of confidentiality and the possible undesirable interaction between different jurisdictions, the use of caucuses in international mediation has almost become a sine qua non. When applied properly, these offer – as mentioned above – a second layer of confidentiality that enormously promotes the safety of the entire process and still gives the parties a lot of peace of mind. Thus, the process of mediation is able to cope rather elegantly with the

thorny issue of confidentiality under various legislations without handicapping the process itself.

## Enforceability

It is sometimes argued that enforceability in a mediation is not an issue since the agreements resulting from a Mediation result from a negotiation between the parties. This is in sharp contrast to an arbitration or a judicial ruling that could be argued to be imposed on the parties to a large extent. Of course, it could be argued that this is a somewhat all too rosy depiction of the mediation process because rarely will parties be negotiating in a truly amicable state of mind throughout the entire process. The other view therefore states that the parties often still like to see the hard-earned result of mediation become legally binding. If the two parties are all of the same legal territory, say Belgian, and the dispute is located in that territory, Belgium, then this is normally less of an issue. However, if one of the parties is not Belgian and the subject of the dispute is possibly subject to yet another legislation, it will for sure no longer be obvious. The risk – or at least the fear that one of the parties might feel less compelled to comply with the agreements made after the mediation, and even after signing the joint agreement or settlement – will get a more prominent place in the minds of the parties.

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**History shows us that it is not uncommon for parties from different countries to fail to agree on the appointment of an arbitrator, a mediator or even an expert from one of the countries of origin of the parties in the dispute.**

On one hand, it is the recognition of that exact fear, but on the other hand the clear advantages that mediation offers, that have led to the United Nations Commission on International Trade Law (UNCITRAL) Working Group II (Dispute Settlement) also including this in the discussions at their 66<sup>th</sup> Congress in February 2017 at the United Nations headquarters in New York. Currently, some 157 countries have joined the 1958 New York Convention (NYC, UNCITRAL Secretariat, 2015) and the associated UNCITRAL Model Law (ML, UNCITRAL Secretariat, 1994) has sometimes been verbatim adopted in respective local legislation. The UNCITRAL Model Law is after all a pro-forma piece of commercial arbitration model legislation that can be implemented by nations in their national legislation framework. At the moment, 74 countries have introduced an arbitration legislation based on this model format to various degrees. The success of this is due in large part to the finality given by an arbitral award in that the award is enforceable in many places and thus actually 'definite' in form. Arbitration as a 'definitive' solution in an international commercial dispute would be much less attractive if one could not guarantee that outcomes would be recognised and enforceable by different national Courts. Such a lack of finality undermines legal certainty and, in turn, international trade; which in a period of the apparent reintroduction of trade barriers (Petersen et al., 2016) may become all the more important.

Looking at the success of international arbitration and its enforceability, the UNCITRAL had already been looking for a similar instrument for mediation that could also put mediation further on the international map. However, problems already started with the anomalies that existed on a language level with regards to mediation. The UNCITRAL traditionally refers to '(re)conciliation' rather than 'mediation'. In some jurisdictions these

can lead to quite different interpretations. In Belgium, for example, the term 'conciliation' would lead parties to have to consult the Judicial Code Articles 731 to 734, whilst the term 'mediation' would lead them to Judicial Code Articles 1676 to 1723. If language would already not be an obstacle, then there is the relative unfamiliarity with mediation that separates countries and their respective legal systems. Some of these countries have only just begun making their first steps in international arbitration even, let alone mediation. All of this makes the search for a national and international legal framework instrument for mediation not exactly uncomplicated. The UNCITRAL meetings work on a consensus model so it understandably takes quite some time before a clear picture is created of where matters are going. Some of the important issues that UNCITRAL was struggling with were among others:

- Whether the legal instrument resulting from the UNCITRAL discussions should be a Model Law (i.e. guidelines for nations to consider and accept or not, with or without their own changes) or a convention (i.e. a legal framework that countries simply adopt such as the 1958 New York Convention) or possibly both, and should the parties in the conciliation be asked to endorse it or not, should these come into being?
- How is it constituted that an agreement is the result of a mediation?
- What is to be done with partial agreements or possibly 'non-commercial' results?
- A particularly sensitive area is the formulation around the area of possible challenge by parties regarding recognition and enforcement, for example, resulting from the alleged (mis-) conduct of the mediator such as not disclosing conflicts of interest or inappropriate pressure on an individual party to reach an agreement.

It can be seen that these are not trivial matters at all. It is also worth noting that the previous UNCITRAL Model Law on International Commercial Conciliation (2002) at the time of writing has only been reflected by legislation based on or influenced by that very Model Law in 33 states in a total of 45 jurisdictions. Canada, for example, would be considered a state in this, and Nova Scotia considered a separate jurisdiction. Notably, in the context of the present article, it is perhaps worth pointing out that Belgium adopted it in 2005 as a suitable format under its legislation whilst the United Kingdom to date has not. However, having said that, the mediation process is well recognised in the Civil Procedure Rules and, in addition to that, steps have been taken to implement the Mediation Directive and implement the Cross-Border Mediation (EU Directive) Regulations 2011 for cross-border disputes. All the above does, however, not mean that mediation, due to a perceived lack in enforceability, will remain the poor cousin to arbitration that at first glance it appears to be. This is so because, following three years of debate by the UNCITRAL Working Group, the 26 June 2018 saw the final drafts for a Convention on the Enforcement of Mediation Settlements and accompanying Model Law being approved at the 51<sup>st</sup> Session of the United Nations Commission on International Trade Law (UNCITRAL). The Convention, which in its final form has now been named by way of shorthand the 'Singapore Mediation Convention', and applies specifically to the settlement of international commercial mediated disputes with the intention of making enforcement of them far easier, was signed at a ceremony in Singapore on the 7 August 2019 by, already, no less than 46 countries. The Convention must, post-signing, be ratified by at least three member states to come into effective force. After which, the world will have formulated an international framework and methodology for the enforcement of mediated settlements, similar to NYC, for the enforcement of arbitral awards. The full text approved on the 26 June 2018 as it stands can be found in the annexes of the Report of the United Nations Commission on International Trade Law - 51<sup>st</sup> Session (UN-CITRAL Secretariat, 2018 and 2019).

For the time being, though, one could say that we are not out of the woods yet and that until the above final evolution takes place fully, the outstanding questions concerning

**The use of caucuses in international mediation because of the mix of laws and their interactions has become the norm rather than the exception.**

international finality and enforceability of a post-mediation agreement remain. It might, however, now be assumed that the parties will be able to rely on the presumption that a renewed trust found during the mediation process between the parties will ensure that the agreement will be honoured no matter what jurisdiction it has been concluded under. This may not be unreasonable to presume if the parties still have a long future between them. However, this may just as easily not be the case in the settlement of a one-off deal or ad-hoc collaborations. If the parties still want to add extra security, it does not seem unwise for the time being to have their post-conciliation agreement or post-mediation agreement translated into, for example, a Tomlin or consent order by an appropriate tribunal.

### Conclusions

From the sections above, one can rightly conclude that mediation is a process that is flawlessly appropriate to be deployed in the international maritime construction and dredging industry. The mediator can perfectly use his or her skills to bridge cultural gaps, and the process itself can contribute to an

accelerated and cost-effective solution of a dispute; thus addressing the main concerns regarding traditional litigation and also arbitration, where time is not too infrequently found to slip away as fast as costs are found to be rising.

The use of caucuses in international mediation because of the mix of laws and their interactions has become the norm rather than the exception. This is both a logical and sensible approach. Although this apparently (partially) alleviates the concern about the creation of a safe environment for negotiation, some questions surrounding international enforceability of the mediation agreement reached remains. Until the point in time where the Singapore Mediation Convention comes into force, there is no clear solution and in this context, the authors suggest that the post-mediation parties might wish to have their mediation agreement translated into a consent order by an appropriate tribunal, should this be required. However, the parties can best (as discussed above) provide for this option when constructing the original underlying commercial agreement. This

issue should not, however, outweigh the overwhelming merits of mediation, for all the reasons set out above in this article.

There still remains some considerable work to be done to make mediation known, not only in domestic disputes but also international ones, as being an excellent tool to resolve them. The signing of the Singapore Mediation Convention, however, not only goes a very long way already to bolster the recognition of the process and its validity but it also considerably adds to the attractiveness of the finality and enforceability of the mediation process in an international setting. As such, given the nature of the international maritime and dredging construction industry, mediation is likely to become more and more prevalent in the commercial side of the business. So, when asking, in parallel to the question 'What is the next big thing?', the question 'Is mediation going to be the new and improved arbitration?', the authors believe that it will become so. Moreover, although not fully realised at the moment, it is clear that, as an industry, the international maritime construction and dredging industry stands only to gain from it.



Photo © DEME Group

### FIGURE 5

Given the nature of the international maritime and dredging construction industry, mediation is likely to become more and more prevalent in the commercial side of the business.

## Summary

This article aims to provide the reader with a solid introduction to what mediation is. It explains the process and elaborates on the steps that already presently can be taken to ensure confidentiality and address enforceability.

Mediation is outlined from a state-neutral perspective, and when the need arises for a more territorial setting, this is done against a Belgian or English legal backdrop. Given the nature of the industry, the outlook will be directed internationally to try and gauge the applicability of mediation in such a multinational setting. Questions that will be examined in that context are: what could be some of the special issues that possibly arise in cross-border mediations within such a context; and how can they be dealt with?

It is not possible to give a complete picture given the inherent limitation of the article's length. Nevertheless, the reader will find a number of thought-provoking points of interest which will be summarised briefly in the final discussion and conclusions. The goal is to help in broadening familiarity with mediation, increase confidence in the process and inform about the benefits mediation can bring to the industry at large.



### Erik van Wellen

Erik is an experienced Chartered Engineer and a registered International Professional Engineer who holds engineering degrees from the Universities of Antwerp, Liverpool and Plymouth. He currently works as a Project Director for the DEME Group. He is a Fellow of the Institution of Civil Engineers and a Member of the Chartered Institute of Arbitrators. He is a CEDR Accredited mediator as well as a fully accredited mediator in civil & commercial law by the Federal Mediation Commission of the Belgian Ministry of Justice. He also works in a broader international setting as a freelance independent expert, arbitrator & mediator in the field of alternative dispute resolution at Maverick Enterprise.



### Anthony Trace

Anthony graduated from Cambridge with a First in Law in 1980 and is a hugely experienced barrister who practised at the Bar for 36 years, 19 of them as a QC. He appeared in many of the most complex and high profile cases across his areas of expertise and was ranked in Chambers & Partners directory as a leading silk in 8 practice areas. Anthony is now doing both facilitative mediations and evaluative mediations (e.g. early neutral evaluation). He is accredited by CEDR and by the London School of Mediation who have accredited him as a mediator to international standards. He is a Member of the Civil Mediation Council, is a Civil Mediation Council registered mediator and on the CEDR Consumer Panel, and brings his extensive experience of litigation tactics and sound commercial sense to his mediation practice at 4 Pump Court. He was voted 'Mediator of the Year' in the Innovation & Excellence Awards 2019 and was voted 'Commercial Mediator of the Year in England' in the 2020 Global Law Experts Awards.



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**SPECIAL ENVOY  
FOR INTERNATIONAL  
WATER AFFAIRS  
HENK OVINK**

‘WATER IS MORE THAN  
A TOILET, TAP, DAM,  
DYKE OR LEVEE,  
**IT’S AN ENABLER!**’

Tapped by the Dutch Government in 2015 to increase awareness and action for water security across the globe, Henk Ovink is in the sixth year of his global mission. It should be no surprise that he finds water ‘critically important’. He travels the world spreading the word about the world’s water-related challenges to citizens and leaders alike, with a unique and informed approach infused with his diverse academic and professional experiences.

Photo @ Evert van de Worp

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**This interview was conducted early this year before the COVID-19 pandemic was exposed massively across the world. Henk Ovink advocates for a pro-active relief and recovery approach, integrating the SDGs and the Paris Agreement goals, and leaving no one behind. He also advocates for a rapid scaling up of WASH-related activities. Read also his CNN op-ed on WASH and COVID-19: <https://edition.cnn.com/2020/05/23/opinions/for-many-the-first-line-of-defense-against-covid-19-is-out-of-reach/index.html>**

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**Post-disaster response demands that future orientation, in partnership, not responding to the past disaster and only repairing but preparing for the future and building back better.**

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**What is your current role and what is your focus?**

I am a Water Envoy. An envoy is an ambassador dedicated to a specific topic, and for me that is water. There are water-related challenges everywhere such as climate, health, security and so forth. I have been in this role now for five years. I was asked to become the Water Envoy by the prior cabinet and the Ministers Schultz van Haegen, Ploumen, and Kamp from the Ministries of Infrastructure and Environment Development Cooperation and Economic Affairs. They said 'water is so critically important across the world and is connected to a lot of the challenges and opportunities that we face. We need a 24/7 representative of the Dutch cabinet to work around the world on water awareness and action'.

First, there is a need for better understanding and awareness. This can be done through research, capacity building, education and in partnerships, leading to political and societal awareness as well as awareness and understanding in the financial sector. With understanding and awareness comes partnerships, strong coalitions and collaborations for action because the second need is about action: helping the world to move beyond response and towards preparedness.

There are so many water-related disasters across the world, 90% of all natural disasters

are water-related! I believe that we need to limit these disasters – both the strength, the amount and their impact – with strong climate action and sustainable development. Nevertheless, disasters happen, so we better be prepared by building resiliency in our communities and environments. Post-disaster response demands that future orientation, in partnership, not responding to the past disaster, and only repairing but preparing for the future and building back better. Can we move the world from a response mode to a preparedness mode? Can we have those two in place – increased awareness and understanding – plus being prepared? What are then the opportunities to help leapfrog? In the context of a changing climate and the need for sustainable action in line with the Sustainable Development Goals (SDGs), we need scale and replication, and at a different speed and extent than we see now. What kind of innovative practices do we need?

**What led you to working within the water sector?**

I think water is critically important and interestingly complex. If we invest in water, the benefits are usually outside the water world. With clean drinking water available, health costs go down, gender opportunities go up, equality goes up and education opportunities go up. With 24/7 guaranteed water with the right quality, conflict opportunities go down,

and food security goes up. If we mitigate climate risks by investing in water, risks go down and revenues go up. And so forth.

We have to make people aware that if you invest in water, there is a trickle-down effect outside of the water world, in *their* world. That demands collaboration. Water incentivises a collaborative approach, integrating needs and opportunities, and creating common values and benefits. Only through *inclusive* collaboration can we make that happen.

The goal is to go from a systems understanding all the way to sustainable investments in projects which means that parallel to investing in the project, you have to invest in the people *and* the process. I sometimes say you need a million to spend a billion wisely. You need to invest in understanding, awareness, capacity, the enabling environment and so forth, to be able to get to those solutions that are transformational, have sustainable impact, and help to build societies holistically. For that, we need better business cases including people, the environment and all values of our economies and societies.

**What influences have led to who you are professionally?**

My mother and father – both have passed away after long and rewarding lives – inspire

## INTERVIEW

me until this day. I try to combine the best of both of them and live up to their standards. My father was an architect engineer. No problem was ever too big or too crazy to take on. He would always look for a solution like a real engineer but he was a *people-oriented* engineer. He believed that only through collaboration will the best solutions come to life. Only by collaboration can values be shared.

My mother was the activist, lead community organiser and first female school director in the east of the Netherlands post-World War II. She was an amazing educator, always bringing groups of people together, bringing us all together. She was the personification of the UN's motto 'leaving no one behind'.

I think their upbringing really determined who I am today. It was about collaboration, bringing people together with a rigorously innovative and comprehensive approach aimed at getting things done. At the end of the day, we need to see change on the ground in the lives of people that need it most.

### What are your academic and professional backgrounds and how do they influence your work in your current role?

My academic background is in mathematics, arts and engineering, and a bit of public policy. I have an engineering and design background through my own practice and with a big engineering firm. I continue to do research with different universities in the Netherlands and abroad in the fields of water, governance, planning, and design.

After my first 15 years of work in the private sector, I led, for over five years, the department of Spatial Planning within the Ministry for Housing, Planning and the Environment. When we merged the two departments into the Ministry for Infrastructure and the Environment, I became acting Director General for Planning and Water.

In the Netherlands, water is about everything. It is about how we plan our cities and landscapes, how we secure better health and equal positions for all, how we work together through our 'polder model', and of course about keeping dry feet and securing safe drinking water for all. Water is as much about adaptation as it is about mitigation. This is done through innovative water-technology, inclusive



Photo @ Aad Hoogendoorn

collaborations, with old and new governance and public-private finance mechanisms. Water cuts across all challenges, needs, disciplines and opportunities. And through our planning practice, where the integration literally takes shape, we manage to bring all stakeholders, partners and interests together. With a perspective of the long-term and the future through research and scenarios, we turn our plans into realities of the near-term. Planning and water, a strong combination, helps find the collective rewards in the context of climate action and sustainable development.

At the time the Dutch government asked me to become their first Special Envoy for International Water Affairs, I was in the United States working for the Obama administration. I had the honour of serving under President Obama's Hurricane Sandy task force on the rebuilding of the New York region after the super storm's massive destruction. As special advisor to the chair of the task force, I worked on regional resiliency coordination, resilient infrastructure investments and guidelines, and on innovation for building again in a better way. I developed, set up and led the Rebuild

by Design Challenge which was aimed at building resiliency through collaboration, understanding and innovative opportunities. We brought everybody together, and from a systems' research across the region and with inspiring coalitions of local partners, we managed to develop transformative projects with the capacity to change communities. These projects were all opportunities we could replicate and scale up across the region, across the USA and possibly the world.

### As it was a new position, the Special Envoy for Water, how did you go about defining your new role?

At the time when I started in my new role, the three ministries for Foreign Affairs, Infrastructure and the Environment and Economic Affairs joined forces for an international water agenda. It was also the year, 2015, where we agreed upon the Sendai Framework for Disaster Risk Reduction, the Sustainable Development Goals (SDGs) and the Paris Agreement. The world wanted to change course and for that, we needed a new compass, a new horizon. The 2030 Agenda for Sustainable Development is that inspiring

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## Meet Henk Ovink

Henk Ovink's complementary backgrounds in art, architecture, mathematics and urban planning, in combination with his professional experiences such as drumming up proposals to help New York City rebound from Hurricane Sandy, propel his current role as the Special Envoy for International Water Affairs for the government of the Netherlands.

As Special Envoy, Henk works for the Ministries of Foreign Affairs, Infrastructure & Water Management, Economic Affairs & Climate Policy, and Agriculture, Nature & Food Quality. As a diplomat representing the Dutch Government on the international stage, he works around the world to help in identifying and tackling water-related problems. He works at home and abroad in partnership with public authorities, businesses, research institutions, multilateral organisations, embassies and consulates in the areas of research, policy, cooperation and negotiation, investment opportunities, and innovation.

He served as Sherpa to the High Level Panel on Water, is board member of Rebuild by Design – based in New York City – and researches and teaches at the University of Groningen, Harvard Graduate School of Design, and the London School of Economics.

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and very necessary horizon. In this context, I had to draft my agenda, finding out what made water so special and what the added value of a Dutch-led international water approach could be.

The importance of first, progressing best understanding and awareness, second, investing in pro-active preparedness and inclusive and sustainable disaster responses, and third, developing innovative water and climate actions were the three pathways along which I would develop and implement my agenda. Not in isolation but across the world through new and existing partnerships and inspiring coalitions.

Water matters to the world but we need to understand why and how. What are the interrelations between all these challenges, across the SDGs? And what is the impact of these relations, can it help in understanding the challenges and finding the opportunities to intervene? I initiated a research, led by the Netherlands Environmental Assessment Agency, to take the 2030 Agenda for Sustainable Development as a framework

and put all these water relations on the map of the world: water and food, pollution, health, floods, energy, biodiversity, and migration.

The first result is a publication, *'The Geography of Future Water Challenges'*, the base for next steps. And an inspiring document because it explains all these interdependencies clearly. This helps inform conversations with the worlds outside of water. With health for instance, water and health are so directly linked, but these worlds are too separated. Now we can inform that conversation and the investments and actions needed, leading to better health through water security. With this

approach, we can demonstrate that if one increases the quality and access to clean water, guaranteed 24/7, health costs go down, and opportunities for women and children go up. With safe sanitation facilities, school access and therefore opportunities for girls will go up. Water is more than a toilet, tap, dam, dyke or levee, water is an enabler. I think this is critically important: it is an enabler for a more just, sustainable and resilient society. With the researchers, we also looked at cities, across all the SDGs, across all the social, environmental, cultural and economic challenges in our cities where climate change rapidly exacerbates these challenges. Linking all these urban, water and climate challenges, we found the hotspots for climate action.

### What targets did you receive from the Dutch Government and have you reached them?

In my role as special envoy, I represent the Dutch Government on water issues around the world. Along the lines of awareness and capacity, preparedness and response, and sustainable and innovative water and climate action. With the PBL research and my work with water youth around the world, I hope to help, providing the *opportunity* to increase our understanding and raising awareness among many.

Awareness is a means to an end. When people have a better understanding, it really helps us to take *better* action but also to take more *collaborative* action.

I was one of the four initiators that helped start the High Level Panel on Water (HLPW), with Prime Minister Mark Rutte as one of the leaders among the eleven heads of Government from the panel. The HLPW really sparked a political debate for water and helped to raise the bar on

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**Water is as much about adaptation  
as it is about mitigation.**

## Why Focus on Water Affairs?

Water connects across all SDGs and due to climate change, global populations are increasingly affected by water-related problems such as heavy rainfall, hurricanes, tsunamis, soil subsidence, extreme droughts, water shortages and more. These problems often aggregate in the most vulnerable places and lead to food shortages, health problems, inequality, flooding, energy shortages and a degradation of nature. Without proactive intervention, these problems affect the lives of billions of people. Disasters like this will lead to more damage and despair, are costly to repair and the losses are avoidable.

The government of the Netherlands conceived the role of Special Envoy for International Water Affairs – the first such position of its kind – to raise water awareness worldwide and lead transformative action. After his appointment, Henk developed his agenda to create opportunities, develop partnerships, help set up projects and business cases. He mediates between stakeholders, launches new initiatives and projects to promote water security, flood protection, and sustainable development. He also developed the interactive platform World Water Atlas that enables partners to share their stories and solutions, and tackle their water-related problems together. Mapping the 'hotspots' to reveal where water-related challenges and opportunities co-exist.

[www.worldwateratlas.org](http://www.worldwateratlas.org)



water-related action. With the HLPW, we concluded on three pillars for water security: 1) better understanding of water's complexity, 2) valuing water more comprehensively and innovatively, and 3) managing water transparently and inclusively, across all interests and borders. Valuing water is the flagship program for the HLPW the Netherlands still leads. We focus on public-private partnerships, work with investors and indigenous peoples and with children across the world through water assessment and awareness programme, so they better understand the importance of taking care of *water* so water can take better care of *them*.

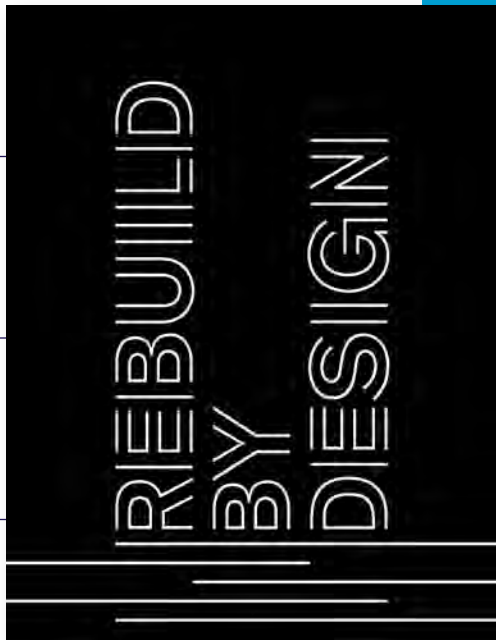
### Based on your experience in this role, what is your advice on disseminating important messages about the water-related challenges?

I think it is all tailored, it is different everywhere. In my role as Sherpa for the High Level Panel on Water, I have a different type of conversation than when I am in flood-prone Khulna, Bangladesh, a town of 500,000 people that is struggling with salinity in ground water, not enough sanitation and drinking water facilities, floods and droughts, and a doubling of the city's population. Therefore, it really depends with whom you sit and where in the world you are.

I learned a lot, about how to bring forth this complex water message; this is perhaps the main thing. Water is connected to *everything* but that doesn't always help in a conversation. For many people, that is way *too* complex. What I learned is to tailor the way I message the importance of water to the context where I am. Tailoring the message helps to increase the understanding and raise the level of awareness – and ownership – among the stakeholders and partners, so whatever they do, they still contribute to the full comprehensive agenda. It is not a siloed approach but a comprehensive approach for a higher level of impact on the full comprehensive agenda. That is not always easy, but 'easy' was not why I was appointed.

### What strategies have you learned about sharing these complex messages?

Water is so inspiringly complex, it has the amazing capacity to connect across all the SDGs and also across partners, stakeholders, and organisations with competing interests.



## Building Resilience Through Research and Design

Following Hurricane Sandy's devastation to the Northeastern United States, the Presidential Hurricane Sandy Task Force launched a competition – Rebuild by Design – to generate solutions to climate change. Rebuild by Design was developed and led by Henk with the goal of driving innovation and inclusivity to improve response, preparedness and resilience for the Sandy-affected region. The research-based, collaborative projects, produced by the competition's coalitions became a model for governments for future challenges.

It has since become the name of an NGO based in New York City which continues to research, design and develop projects as well as collaborate with cities and communities to build resilience. The NGO holds events and publishes research. The book *Rebuild by Design* – titled after the competition – offers insights into the approach and research which was performed and the projects which resulted. Together with researcher Jelte Boeijenga, Henk Ovink wrote a book – *Rebuild by Design: A Transformative Approach to Climate Change* – about his experiences on the Presidential Task Force, developing Rebuild by Design. Read a book review of the publication on page 45.

[www.rebuildbydesign.org](http://www.rebuildbydesign.org)

It can help to create a level playing field or better, a common ground. Based on a shared understanding of needs, challenges and opportunities, we can increase our impacts by collaborating and investing more holistically. This very much depends on the situation, culture, backgrounds, challenges and scale, and with that, the opportunities to intervene vary too. Leading to the need for a rooted understanding of culture and place, indigenous, individual, and institutional.

I do think it is important not to fall into the trap of simplifying the water message. The complexity is both the challenge *and* the opportunity. With all the interdependencies, we can add value by connecting the dots and increase the impact of our solutions, generating more values outside of the realm of the challenges.

### What would be your ideal vision of connecting stakeholders to solve these problems?

There is no ideal world [laughs]. And I'm very happy there is none, because on the edges of the world, in the 'in between', the often called

soft spaces of our world are rough, safe and challenging but are where new opportunities emerge. It is often on the fringes of the city where you find innovative and creative development. I think there is an opportunity with that roughness. At the same time, of course, we do not want to see despair, we must continue to leave no one behind and really continue to solve all our challenges.

### How do you link the diverse interests of parties?

You really need continuity, consistency and commitment to make things happen. A safe place, a platform of collaboration as well as

best understanding from real knowledge, capacity and talent. That can come from books and experts but also has to come from indigenous and local, cultural knowledge. Experience is as important as research, so we must continue to bring the diversity of talent together. The goal is to have comprehensive understanding, increased awareness across all parts of society rather than only bringing in the expert or scientist with 'a model'.

Look ahead. Take on the future. Be inspired by the SDGs and beyond. Make sure that when you enable this environment where people come together, when there is knowledge to tap

**We built coalitions, identified over 40 opportunities in the end, and had ten major programs developed by local-international coalitions.**



into, to unravel and connect, that there is an opportunity to ask: *'if we want a better world, where shall we go? Can we leapfrog? What would that mean for whatever we do today?'*.

In our current practices, we tend to focus only on the projects and solutions, and the business case that comes with them rather than on the process and the people. We single the solutions out so we can turn them into financial-economic business cases. And we find that there *is* always a business case for *'stupid infrastructure'*, it is the easy way forward, replicating our mistakes of the past; single focused, siloed and fragmented projects. If you build a road from A to B, there is always a financial opportunity but it does not take into account the losses that come with this financial, short-term gain; biodiversity loss, social problems and increased climate change vulnerability. We must change course, face the complexity of the challenges head on, and develop comprehensive solutions that add value across all needs. It means finding ways for holistic business cases to validate these investments. Including all stakeholders from day one and collaboratively developing a more future-proof, added-value type of investment, that can also rally people around.

To understand this complexity comes first. Value every action, need and opportunity across all the SDGs, comes next. Last, but

not least is to organise, govern and manage this in an enabling and inclusive way. With this ambition, it is really about 'how to get this done?' How to implement better, at scale? How to govern more inclusively and collaboratively? How to finance more holistically, adding values across all needs? How to maintain and operate with all upfront ambitions as continuous drivers for societal impact? That asks for a full-life-cycle approach, capturing the co-benefits while leaving no one behind.

**What came from the Rebuild by Design competition and is there a connection with what you are doing now?**

When I worked for the Obama administration post-Hurricane Sandy, I worked on the resilient infrastructure investment work. We asked ourselves: 'how can we use this momentum, with our leadership and the funding, to leapfrog, and identify opportunities that are transformative?' That's bring change on the ground for the communities at risk. To really build a better future instead of rebuilding the past'. On these premises, I developed a competition that was a little different. In the USA, they like to compete for best ideas, but here we needed the competition to rally support, bring people together and build an enabling environment. An environment that could shoulder the transformative projects so much needed for reform and resiliency.

We invited the talent of the world to come together with the talent of the region in ten cross-disciplinary teams, working together with communities, governments, businesses, and investors across the region. First, teams had to research the region's climate interdependencies and vulnerabilities, to get to a best understanding of the opportunities. Interventions should leverage needs and opportunities, reduce risks and build resiliency and capacity for all.

We built coalitions, identified over 40 opportunities in the end, and had ten major programmes developed by local-international coalitions. We selected the best six and awarded these with almost a billion dollars in federal disaster recovery funding. Based on this success, we were able to scale up Rebuild by Design to the National Disaster Resiliency Competition.

Most of the six winning programs will move towards the first step of implementation this year. It took a while to move from idea towards projects, from the call for projects towards an engaged process where all stakeholders really said 'OK this is what we need to do', and now towards implementation. Part of this *slow* progress comes from the inability in our current systems and culture to deal with these very innovative solutions. If we want to change the world, and seeing the current



crises and challenges ahead, we have to, then we need both a systems change and a cultural change. That will take time. Because these very comprehensive and innovative projects didn't fit current standards in policy, regulations and financing mechanisms. Stakeholders wanted to take them apart, to make them fit their – outdated – system! Instead of reinventing the future, they were trying with these innovative projects to replicate the past, in bits and pieces. We had to bring everything and everyone together again, it is like an SDG puzzle, it doesn't make sense looking at the pieces one by one, only the full set shows the transformative and enabling capacity these projects can bring.

We were able to replicate the resiliency competition in the San Francisco Bay Area as the Resilient by Design Challenge. I brought some of the work to the Water as Leverage challenge developed for the Asian cities of Chennai in India, Khulna in Bangladesh and Semarang in Indonesia. Rebuild by Design really became a global approach, a mechanism to speed up and scale up actions for the SDGs and the Paris Climate Agreement in a consistent inclusive manner.

### How will you bring the knowledge acquired through this competition to educational environments?

There were over 30 schools and universities engaged in Rebuild by Design. We had to capitalise on this capacity and we brought them together, co-led by Rebuild by Design, NY-University, Columbia University and the University of Pennsylvania, in partnership with the rest. Resilience by Design University (RBD\_U) is an ongoing programme aimed to engage academics from multiple disciplines around resilience, designed to bring together a diverse set of interests and structured to help students understand the complex environment around resilience in which design can – and should – play a role.

While working for the Sandy Task Force, I taught a planning studio at Harvard's Graduate School of Design. With my students, we really tried to digest what the needed governance, financial as well as institutional settings should be in a post-disaster context and which systemic changes are needed to build resilience. With Rebuild by Design, we developed a book on the projects. And together with Jelte Boeienga, I wrote a book

on the overall process, the cultural change. As we speak, I do research with the University of Groningen on parts of the Rebuild by Design approaches. So really taking the Rebuild by Design challenge apart and bringing it back together again. It is a continuous effort to learn and with that learning, to help scale up and replicate its transformative capacity. We developed the National Disaster Resiliency

Competition based on the first evaluation by the Urban Institute. We developed the Resilient by Design Challenge in the San Francisco Bay Area based on the evaluation two years after the announcement of the New York winners, mixed with our own research and with our partners's capacity. We try to bring this culture of inclusion, transformation and integration across the world, building an

## Resumé

### 2015–Present

Special Envoy for International Water Affairs for the Netherlands And Sherpa to the High Level Panel on Water at United Nations

### 2013–2015

Senior Advisor to Secretary Shaun Donovan, Chair of the Presidential Sandy Task Force / Secretary of the Department of Housing and Urban Development / White House Office of Management and Budget And Principal for 'Rebuild by Design' (now board member)

### 2012–2013

Acting Director General of the Department for Spatial Planning and Water for the Ministry for Infrastructure and the Environment

### 2009–2012

Co-curator of 5th International Architecture Biennale Rotterdam 'Making City'

### 2008–2012

Director for National Spatial Planning for Ministry for Infrastructure and the Environment

### 2007–2008

Director Research, Design and Strategy for the Ministry of VROM

### 2005–2007

Head of Spatial Planning, Development and Housing Department for the Province of South Holland

### 2002–2004

Practice Area Manager Spatial Planning and Design at Royal Haskoning

### 1999–2001

Founding Partner / Director of Bureau Kroner

### 1992–2000

Director of buro ovink

### Education:

#### 1998–1999

Architecture at Delft University of Technology

#### 1990–1992

Royal Academy of Art The Hague

#### 1987–1990

Art Academy Minerva

#### 1986–1987

Mathematics at Groningen University

enabling environment through innovative concepts. Water as Leverage, in three cities in Asia, is the latest development. Rebuild by Design's spirit really travels the world, taking on different roles and characteristics. There is a lot of spin-off, a lot of writing, a lot of research and a lot of increased capacity.

**Are the participants mostly university students or do you also target practicing professionals?**

I think it is a mix, it must be. We develop this within a university context because a lot of research and learning needs to happen there. That is and should not be, the only place to work with. It must have this broader opportunity to gain impact.

**What is your opinion about the progress of the dredging industry in terms of sustainability?**

We can learn a lot from the dredging industry. From its past and from its future. Our dredging industry in the Netherlands is pretty impressive. Both in scale as in intelligence. What we acknowledge more and more is the experience and expertise they have built up. While the dredgers, from a sole ecological and sustainability perspective, partially come from the 'wrong side of history', making us more vulnerable and challenging the climate and our environment, they more and more change course, and become part of the right side of the future. That is why they are such an inspiring industry and community. They are the real experts from practice and research. They have the people and the capacity, and they work from a systems' perspective. They really understand our biodiversity, the geomorphology and the way our oceans, rivers, and sediment systems work. They can turn human interventions into enablers for sustainability and resiliency, for faster recovery, mitigating biodiversity losses. They have a choice, like we all have, to do the right thing.

**Do you believe the dredging industry can be a force to achieve sustainability?**

I think an inspiring example, also from a collaborative perspective, is EcoShape also known as the Building with Nature consortium. Our dredgers, because of their scale and capacity, were able to help fund a coalition of partners - engineers, designers, innovators and researchers - and set up a consortium to collaborate and invest in research and

projects, to build more resiliency in our coasts, rivers and ecosystems. EcoShape is a showcase partnership. It started already 13 years ago, and nowadays everybody is talking about Building with solutions to mitigate climate and adapt to an ever faster changing world, for healthy environments, and strengthening biodiversity and protection along our coasts, our rivers, and in our cities. EcoShape, I think, has laid the foundation for global transformation in how nature can actually be the driver for the change we need. Providing answers for how to invest in our natural systems, increasing our resiliency and sustainability, strengthening biodiversity and ensuring a more sustainable future for all.

I think our dredgers helped us to show the way. We are in the first year of the decade of action for the 2030 Agenda for Sustainable Development. We have ten years - one decade - to bridge the gap on the SDGs. To deliver on this promise, we will need everything and everyone, coming together around this agenda. This moment is our best opportunity for sustainable impact, the ideal year to relaunch a new effort when it comes to Building with Nature and EcoShape - a renewed coalition for nature-based solutions, driving resiliency and sustainability to a next level, which is critically important for the world. We have a Global Commission on Adaptation that launched their Flagship report last year, with Nature Based Solutions, Water and Cities as three critical and connected tracks. Next year, we need to show the world that this is serious and that our commitment to change course can be inspirational and transformative too. We can and must do this together.

Van Oord launched its Sustainable Earth Actions (SEA), a sustainability initiative looking at making coasts more climate adaptive. They have a programme to accelerate climate initiatives and really look at innovative marine solutions for coastal and river deltas, so vulnerable to the impacts of climate change. Another example of how one of our lead dredging companies plays a critical role in driving the sustainability agenda.

**Who do you think should take the lead in this endeavor of collaboration?**

'The lead' is always complex because then you single out responsibilities and create unnecessary hierarchy between peers. Also, others can escape by outsourcing the problem to this 'lead' partner. It does not mean I don't like initiatives and activist partners, not at all. Do take the lead! However, this should not move us away from focusing on strong coalitions, partnerships and collaborative action. We have to carry the load together; the responsibility lies with all of us. Only together, in solidarity and leaving no one behind can we reach our goals.

**So you find collaboration taken on together to be the goal?**

Inclusivity, leaving no one behind, developing partnerships and investing in people, it is this collaborative process that drives change. A change built on a strong enabling environment where we all come together with shared understanding for collective action. Action with the very much needed transformative capacity, impact for everything, everywhere and for everyone.

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**Inclusivity, leaving no one behind, developing partnerships and investing in people, it is this collaborative process that drives change.**

**A change built on a strong enabling environment, where we all come together with shared understanding for collective action.**

---

A red and white research vessel is sailing on a body of water. The water in the foreground is a murky, yellowish-brown color, while the water further out is a clear, deep blue. The sky is a pale blue with some light clouds. The vessel is positioned in the center of the frame, moving towards the right.

ASSESSING AND  
EVALUATING  
ENVIRONMENTAL  
**TURBIDITY  
LIMITS FOR  
DREDGING**

Dredging is essential for the maintenance and development of ports, harbours and waterways to allow for safe navigation, remediation and flood management. The process, which relocates large volumes of sediment, can be accompanied by the release of suspended sediments into the water column referred to as sediment plumes.

**Introduction**

Excessive suspended sediment concentration has an impact on water transparency – as a result of increased turbidity – and may cause the degradation of water quality and marine ecosystems.

Mitigating the impacts of turbidity is usually managed by limiting the amount

of suspended sediments released at the dredging sites or entering sensitive areas. For dredging projects around the world, many different limit definitions and corresponding turbidity monitoring methods have been applied. However, the basis or background of these definitions is not always clear. Sometimes a very strict or alternatively very ambiguous definition of the turbidity limits

can have a serious impact on the project execution methodology proposed by bidding contractors and thus on their quoted price. A very loose definition of the turbidity limits can additionally have a huge impact on the local environment. In many cases, turbidity limits may even appear to be defined without consideration of the specific sensitive receptors that are supposed to be protected.



**FIGURE 1**

The process of relocating large volumes of sediment can be accompanied by the release of suspended sediments into the water column referred to as sediment plumes.

**This article is based on the assumption that setting turbidity limits requires a general understanding of dredging processes as well as the surrounding environment.**

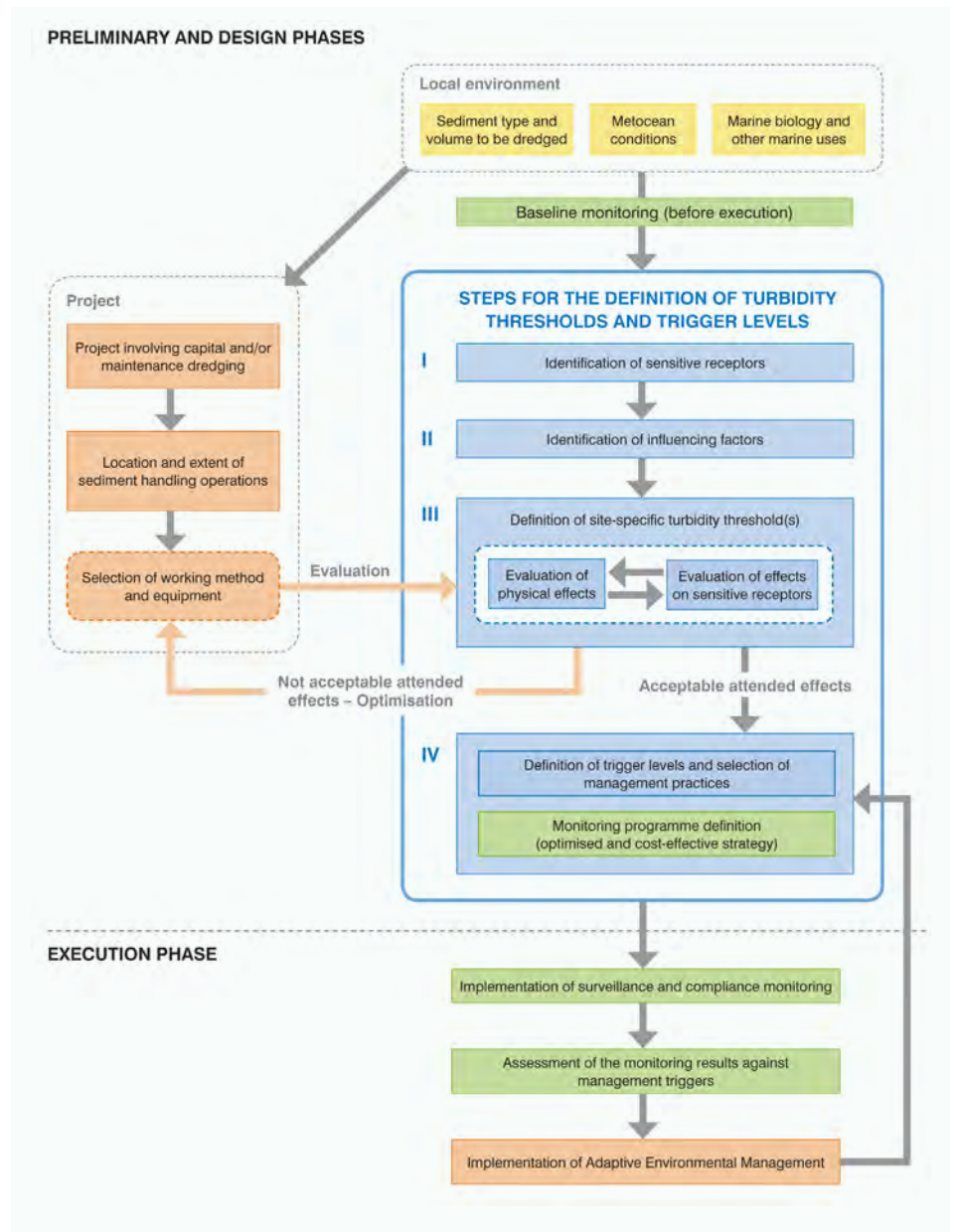
One potential risk that may result is that on the one hand, the turbidity limits may be overly conservative, while on the other hand, they may also be inadequate in protecting the sensitive receptors.

In 2016, the CEDA Environment Commission (CEC) conducted a survey among a wide range of companies and institutes working with dredging to investigate which environmental turbidity limits existed for dredging projects, how these limits were set and how the environmental limits affected the projects both financially and time-wise. Interestingly, the survey showed that compliance monitoring on average contributed about 1–5% to the cost of the dredging project.

The majority of the respondents indicated that they understood and supported the need for environmental turbidity limits. However, the replies also showed that a major proportion of the limits did not seem to be scientifically or environmentally founded. Limits varied regionally and by project but rarely seemed to be linked to local sensitive receptors. Taking into account the generally high costs of compliance monitoring and the environmental risk that a limit is set incorrectly, the CEC raised the following question: Is there a need for guidelines on how to set realistic and effective environmental turbidity limits for dredging?

The results of the questionnaire imply that there is such a need. However, setting a reasonable turbidity limit for a given dredging operation that provides adequate protection for the environment, but that gives sufficient flexibility in the selection of a dredging approach and does not entail excessive costs for monitoring the dredging operation, is not an easy task. It requires an understanding of the dredging operation and dredging spill processes as well as how the local environment works in terms of hydrodynamics, sediments and biology. Furthermore, it is necessary to consider socioeconomic aspects such as visual disturbances and impacts on water intakes.

The article aims to highlight a general approach to set or discuss turbidity limits for dredging applications. Connections to background information, monitoring and management measures (as relevant where exceedance occurs) are provided.



**FIGURE 2**

Typical flowchart for environmental management in a dredging operation.

### Approach

This article is based on the assumption that setting turbidity limits requires a general understanding of dredging processes as well as the surrounding environment. The approach is thus an integrated approach that takes all aspects into account. The main required aspects for a general integrated approach are:

- An understanding of the baseline conditions for hydrodynamics, sediments

and biology;

- An understanding of the dredging operations in terms of locations, volumes and spills;
- An understanding of the sensitive receptors and their tolerance levels;
- An understanding of possible monitoring programmes; and
- An understanding of possible response options.

**Local anthropogenic activities are connected to the various physical, legal and optical properties of the water body and are often vital to local communities and other sea users.**

To implement this approach, a typical flowchart for managing environmental turbidity limits in a dredging operation is shown below. In this figure, the different parts of the flowchart and the interactions between them are highlighted (see figure 1). This flowchart will form the basis of this article.

### Definition of turbidity used in this article

The term 'turbidity' is well established in the dredging world and is adhered to throughout this article. It is often used for a number of aspects related to sediment in the water, from actual concentrations to water clarity (Department of Water, 2009; Fearn et al., 2017; United States Environmental Protection Agency, US EPA, 2012; United States Geological Survey, USGS, 2017). However, in its correct usage, the term 'turbidity' solely refers to the effect of suspended sediment measured by a turbidity sensor (ISO, 2014). Therefore, one must understand that 'turbidity' is a proxy for 'suspended sediment concentration'.

Turbidity can be measured and reported in terms of NTU, FTU, SSC, TSS and several

other ways. However, it is important to note that NTU and FTU pertain to light scattering in the water whereas SSC and TSS relate to the amount of sediment suspended (e.g. American Society for Testing and Materials, 2013; Neukermans et al., 2012).

In this document, the term 'turbidity' refers to the popular use of the word and thus covers all kinds of measurable environmental parameters (e.g. turbidity, suspended solids, sedimentation, light attenuation) that can be directly linked to the creation of suspended sediment plumes and associated environmental impacts.

### Building a system understanding

Before setting any limits, it is important to understand the physical and biological patterns of the local system in term of its background turbidity, natural variations and adaptation of local sensitive receptors. The following factors need to be investigated:

- Metocean conditions;
- Sediment dynamics;
- Biological aspects; and
- Anthropogenic conditions.

### Metocean conditions

Metocean conditions cover the actions of weather, waves and currents in an aquatic system. Waves and currents generate turbulence and hence control the erosion, transport and deposition of suspended sediments. One should always gather enough background knowledge to understand how the system works. More specifically:

- What kind of water system it is: marine, harbour, navigational channel, river, lake, transitional water, or combined system;
- Morphology and bathymetry within the area;
- Flow, tidal and wave conditions;
- Exposure of the area to waves: exposed, semi-sheltered or sheltered;
- River inflows, stratifications;
- Timescale of variations in hydrodynamic conditions (e.g. rapidly changing, seasonal, yearly); and
- Impact of the project design itself or adjacent project under construction.

This will provide a starting point to highlight which phenomena are important for the erosion, deposition and spreading of sediment. In many cases, simple observations of the hydrodynamics can provide valuable

information on the sediment transport patterns prevailing in an area. For instance, deep waters are not usually influenced by waves. Moreover, a high-energy open coast will not allow the long-term sedimentation of fine sediments, whereas low-energy marsh areas probably will. It is also important to establish whether there are seasonal variations as these may imply different impact levels for a dredging operation such as summer or winter or dry or wet season.

### Natural sediment dynamics

Once the metocean conditions have been characterised, it is important to establish how they affect the natural background turbidity levels and what these are. The interaction between the behaviour of the sediment under the influence of the metocean conditions is too complex to be described here (see Whitehouse et al. 2000 for detailed information). Information on sediment types and characteristics, natural background concentration levels and their variability as well as knowledge of local sources and sinks of sediments are crucial. Local flora and fauna are generally adapted to the local light and coverage conditions and thus knowledge of these aspects is essential as they govern the existing conditions for life.

Local waves and velocity fields typically generate a bottom shear stress that affects the erosion and deposition of sediments. In particular, sediment starts to be eroded when a certain shear stress threshold is exceeded and keeps eroding until either no more sediment is available or the shear stress falls below the threshold. The eroded sediment is transported for as long as the energy conditions allow it. At a lower threshold energy level, the sediment will be deposited. The frequencies of this determine the local concentration, light and coverage conditions.

In the case of fine sediment, flocculation may occur, influencing the settling velocities and thus deposition. Flocculation is a property of cohesive sediments during which individual particles tend to stick together to form flocks or larger aggregates (Grabowski et al. 2011; Winterwerp & Kesteren, 2004).

### Biology

The critical thresholds for turbidity and sedimentation as well as the duration of periods of high turbidity or excessive

sedimentation that affect a species' survival vary greatly among species and their distances from the intervention sites. Therefore, it is very important to recognise and evaluate the natural conditions of local flora and fauna before dredging activities start. Flora and fauna species in the marine environment are generally acclimatised to the local light and coverage conditions and to the prevailing hydrodynamics, water quality and sediment composition. Thus, knowledge of these aspects is essential as they govern the existing conditions for life. For example, light-sensitive species and species that are very sensitive to coverage by sediments will not generally be found in highly turbid environments while the opposite may be possible.

Moreover, other species might have a different degree of sensitivity to turbidity variations in relation to their geographical distribution (e.g. Anchor Environmental C.A. L.P. 2003; Bridges et al., 2008; Erftemeijer & Lewis, 2006; Erftemeijer et al., 2012; Paganelli et al. 2014; Tillin et al., 2011). The presence of certain species may also provide information about the sediment types and dynamics in an area. Usually the driving factors are available light and sensitivity to burial and it is important to note that there might be particular times of the year where the susceptibility to environmental stress caused by high turbidity may be greater, for example considering shellfish during the spawning period. Therefore, it is crucial to develop adequate knowledge of local light conditions and local species' sensitivity to changes in light. Furthermore, resilience to (cyclic) coverage by sediments needs to be studied. It is necessary to recognise the distribution and the ecology of the species present in an area, noting that the most sensitive species are often classified as sensitive receptors.

### Anthropogenic conditions

Local anthropogenic activities are connected to the various physical, legal and optical properties of the water body and are often vital to local communities and other sea users. Water intakes, local recreational areas such as beaches and tourist attractions may be of great socioeconomic importance, relating for example to water clarity and aquaculture in general. Therefore, it is important to map these anthropogenic activities.

### Planned works

Once an environment has been evaluated in terms of its metocean conditions, sediment and biology and present anthropogenic activities, the expected effects of planned works on turbidity and possible impacts on local conditions can be assessed. This generally involves describing the anticipated dredging plan, volumes and methods as well as the resulting turbidity that is expected to be created and how its impacts can be managed.

### Dredging methods, volumes and expected spills

It is important to clarify how the dredging operation will be performed. The turbidity created will be dependent on the dredging method and its duration. The possible long-term effects on the background turbidity depend on the volume of sediment released and the time period over which it is released, in addition to the metocean conditions. It is therefore crucial to estimate the short- and long-term turbidity variations that owe to the dredging operations. To estimate the impact on the environment, it is also essential to determine the type of material to be dredged or released, as the properties of the sediment may differ from the native surface sediment. In addition, it is essential to establish how, where and when the relocation of dredged material will occur. Typical spill rates can be seen in John et al. (2000). The parameters that are important when establishing the spill rate – amount of fines transferred to the far field – and the overall spilled volume or mass are the following (see e.g. Becker et al., 2015):

- Dredging method, location and planning,
- Dredged volume,

- Dredging production rates, and
- Composition and optical and physical properties of dredged material.

### Sensitive receptors, threshold and trigger levels

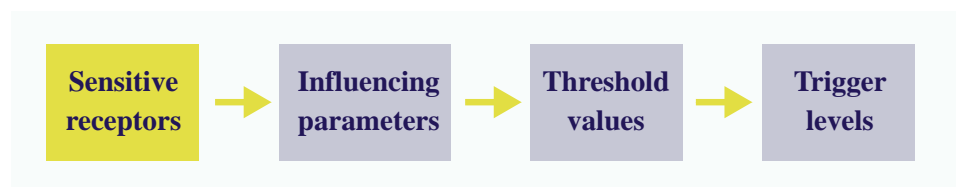
In the early phases of a project, a crucial step is to identify the presence of sensitive receptors and to build a proper system understanding in order to assess turbidity-related influencing factors, identify critical stress levels and finally select trigger levels to protect the sensitive receptors.

As far as possible, this approach should be performed based on local knowledge, available via (for instance) local consultants, research institutes, users of the water body in question and historic information. Moreover, one should implement one or several proper environmental baseline survey(s). The different terms will be defined in the following. A flowchart is shown in figure 3.

### Identification of sensitive receptors

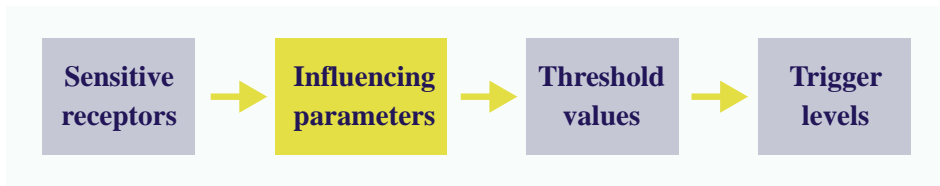
Identifying the sensitive receptors is a key step in the integrated approach to determine the turbidity limits. This step is marked in figure 3.

Sensitive receptors – sometimes referred to as receivers – may include species, habitats, resources, activities or items located in the area of influence of the project that are identified as being of importance and that might be affected by the increased turbidity associated with the dredging operations. The potential sensitivity of the receptors to dredging works – and induced turbidity – is determined by the combination of their own



**FIGURE 3**

Flowchart for selecting trigger levels with emphasis on sensitive receptors.



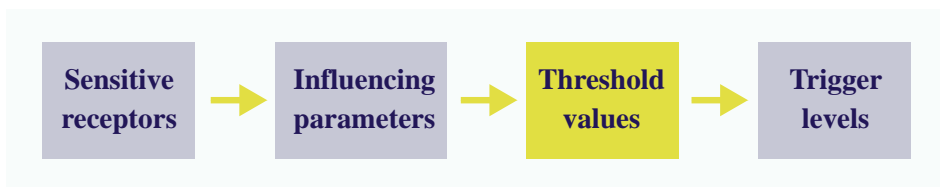
**FIGURE 4**  
Flowchart for selecting trigger levels with emphasis on the influencing parameters.

characteristics and functionalities on the one hand and the characteristics of the natural system in which they are located and where the works will occur (e.g. coastal morphology, sediment type, metocean and anthropogenic pressures) on the other. Sensitive receptors are generally adapted to their local ecosystem (e.g. offshore, coastal waters, coastal lagoon) and its natural variations (e.g. season, tide, flood). Any change could affect the sensitive receptors for a short duration (days to months), a longer period (months to years) or even lead to irreversible damage. Thus, the identification of the presence of sensitive receptors is crucial to properly assess the relationship between the physical effects (described in terms of intensity, duration and frequency) and the potential impacts caused by dredging.

**Identification of influencing factors**

Following the identification of sensitive receptors, it is important to recognise the factors related to the works influencing or stressing each receptor in order to plan proper monitoring and management measures (see figure 4).

Elevated turbidity due to dredging can affect the sensitive receptors, for example through light reduction, sediment re-deposition, contaminant and nutrient release and burial phenomena. For instance, in the case of corals, both increased light reduction and burial phenomena due to sedimentation are influencing factors, whereas for water intakes it is only the sedimentation and the increase in suspended sediment in the water column that are of concern. It should be taken into account that some sensitive receptors are more vulnerable during certain periods of the year (e.g. water quality is most important during the bathing season in bathing areas). For benthic species, critical or sensitive periods of the life cycle (e.g. recruitment, deposition, reproduction) must be taken into consideration in order to identify the optimal periods (i.e. environmental windows) in which dredging can be performed with an acceptable impact on biological resources. For instance, some mammals are only present seasonally and seagrasses are most vulnerable to coverage during the growth period.



**FIGURE 5**  
Flowchart for selecting trigger levels with emphasis on the threshold values.

Table 1 presents a list of receptors that are potentially sensitive to increases in suspended sediment and outlines the factors that influence them such as increase in turbidity and re-deposition. This table should be considered as a guidance tool to be used by project managers, consultants and decision makers in the early stages of a project. The information provided in the table should always be completed and confirmed with site-specific information, gathered during the environmental and social impact assessment studies to be performed during the design phases of the project.

**Definition of threshold values**

It is not only the sensitive receptors but also the threshold values at which the receptors may exhibit increasing impacts that need to be defined (see figure 5). The threshold values may be defined specifically at the receptor or alternatively as a more general parameter for the area. Note that the threshold values can be defined in many ways. They are often defined as stress levels for a given receptor at a given site.

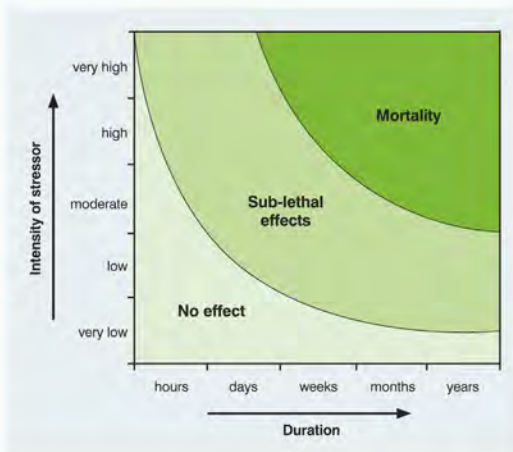
There is an important difference between turbidity thresholds and trigger levels. Threshold values for a dredging activity must be defined starting from information about site-specific environmental parameters, their variation and the tolerance of all receptors identified as sensitive. When a tolerance threshold value is exceeded, the sensitive receptor is expected to experience a certain amount of stress or disturbance. A nature-based approach demands that the acceptability of such effects always be evaluated against the characteristics of the system where the dredging activities occur. A scientifically sound approach by which to do this is through the use of a species response curve. Such curves describe the response of individual species – such as a specific coral type or seagrass type – as a function of the intensity and the duration of increased stress (after Erftemeijer et al., 2012). Figure 6 shows that a temporary slight elevation of turbidity may be considered unlikely to cause serious effects on a sensitive receptor. Instead, a short high peak of turbidity – leading for example to the total sediment coverage of a biotope caused by sediment re-deposition – or a slight elevation of turbidity over a long period of time may ultimately have serious consequences.



**TABLE 1**

List of sensitive receptors – categorised as ‘Habitats and species’ and ‘Marine uses’ – that are potentially affected by increased turbidity and suspended sediment re-deposition. The reader should refer to sector references for further details on receptors’ responses.

Sensitive receptor(s) type	How changes in turbidity or re-deposition may have negative impacts on sensitive receptor(s)	Sensitive receptor(s) type			
		Sensitive to turbidity	Sensitive to re-deposition	Fixed receptor	Mobile receptor
<b>Habitats and species</b>					
Seabed habitats/benthic communities	Increased turbidity and re-deposition may have temporary or permanent effects in terms of smothering, damage to feeding and respiratory systems and changes in benthic community structure and composition (e.g. abundance, diversity, biomass).	X	X	X	
Coral reef	Increased turbidity may affect photosynthetic ability. Re-deposition may lead to smothering and burial of polyps, and growth of bacteria in coral mucus. Turbidity and re-deposition may also reduce recruitment and survival of coral larvae.	X	X	X	
Aquatic macrophytes/ seagrasses	Increased turbidity may lead to light attenuation with significant effects on seagrass plants, microphytobenthos and macroalgae. Increased re-deposition may result in burial phenomena on plants and reduce vitality or death among associated benthic fauna.	X	X	X	
Mangroves	Increased turbidity does not per se affect mangroves unless the sediments are contaminated. Moreover, excessive re-deposition may smother the mangrove roots.		X	X	
Shellfish	Increased turbidity and re-deposition can affect filter-feeding systems of shellfish (e.g. oysters, mussels), with possible effects on pseudo-feces production, the amount of algal food ingested and on bivalve gills (clogging).		X	X	
Fish	Increased turbidity can affect visibility, reducing feeding and hunting ability, and growth rate in juveniles. High suspended sediment concentrations can affect fish gills, eggs and larvae.	X	X	X	X
Wildlife	Increased turbidity may affect the predatory capacity of wildlife (e.g. marine mammals, turtles, seabirds). Other potential effects may be related to noise production, food availability and collision risks.	X			X
<b>Marine uses</b>					
Bathing water quality	Increased turbidity can lead to temporary changes in water colour. Presence of contamination (e.g. faecal bacteria) associated with suspended sediment can directly affect public health, especially during the bathing season.	X		X	
Aquaculture/ shellfish farm	Increased turbidity can affect primary production and bivalve growth. Sediment re-deposition can damage farm structures (see fish and shellfish).	X	X	X	
Recreational areas and tourism	Increased turbidity can lead to temporary or long-lasting changes in water colour. Moreover, even in the absence of contamination, possible misunderstandings and complaints from beach users may see tourism and associated activities affected.	X		X	X
Infrastructure, navigation	Excessive re-deposition near structures (e.g. quay wall, jetties, outlets) and navigation channels may lead to functional issues (e.g. operability, maintenance).		X	X	
Fishery	For extensive dredging, increased turbidity can hinder some fishery practices. Fishery areas may be modified: on a short-term basis, if fish communities temporarily avoid turbid waters; on a long-term basis, if fish are affected during sensitive stages of the life cycle. Particular attention must be paid to the presence of nursery and reproduction areas (in particular demersal species with commercial value).	X		X	X
Cultural heritage	Increased turbidity can lead to change in water colour and re-deposition, with socioeconomic impacts on cultural heritage and historical sites.	X	X	X	
Water intake	Increased turbidity and re-deposition can lead to water supply shortages (e.g. industrial/drinking water supply) with both socioeconomic and sanitary impacts (e.g. public health).	X	X	X	



**FIGURE 6**  
Intensity – duration relationship (after Erfteimeijer et al., 2012) based on the species response curve for species and biological sensitive receptors.

campaign preceding the execution of the dredging works in order to determine the variation in the natural levels of turbidity. The reasoning here is that if a biological sensitive receptor is able to live in a certain location, it must be adapted to withstand the natural stress levels occurring, hence baseline monitoring can be crucial to determining reasonable and realistic thresholds (e.g. Clarke et al., 2000; Erfteimeijer et al., 2012). Depending on the environment and planning in question, it may be challenging to obtain a sufficiently large set of data when no proper assessment has been performed during the design phase of the project. It must be noted however that the processing and the interpretation of a baseline monitoring data set for the establishment of site-specific threshold levels represent a complicated matter. The more dynamic the natural background concentration levels, the more difficult it is to adequately define this reference state with only a moderately long time series. Therefore, this is a task that requires local insight and specialist knowledge.

Using the species response curve approach and borrowing the classification proposed by the Environmental Protection Agency (EPA, 2016) as a starting point, the next step is to define the threshold levels at which the receptor shifts from a status of acceptable effect to an impact with increasing severity (moderate and high).

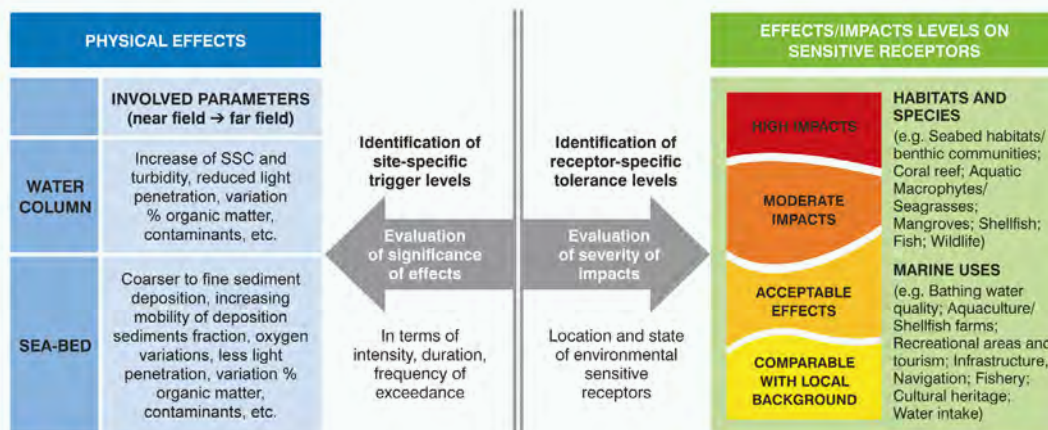
The relationship between the intensity, duration and frequency of perturbation, and the associated environmental effects on the specific receptor can be derived on the basis of site-specific data, on literature data, or by expert judgement concerning the

site-specific receptor's tolerance limits. For this purpose, site-specific data should be available and/or inferred from specific stress response curves related to the expected water quality variation during execution (see figure 7). These studies should ideally be based on either direct experience in the context of dredging from previous projects or specific tests performed on sensitive receptors.

Nevertheless, information from the literature is not always available or useful. It may therefore be necessary to deduce site-specific thresholds from a baseline monitoring

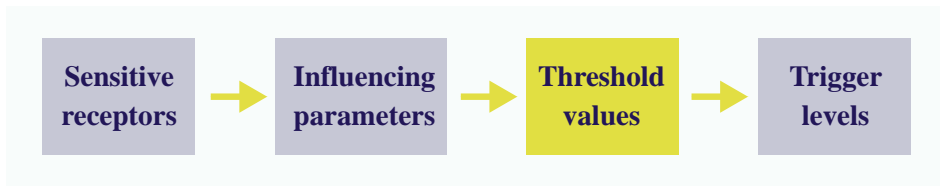
**Definition of trigger levels**

Once the thresholds levels related to the sensitive receptor(s) present in the area of influence of the works have been determined, it is good practice to define a set of trigger levels for each type of material to be dredged and their receptors; moreover, one should



**FIGURE 7**

Scheme of the relationships between the significant physical effects and the effects on the sensitive receptors related to the threshold levels defined as a function of the status of the sensitive receptors. Refer to the EPA (2016) for the classification of moderate and high impacts related to changes from the background conditions. Modified from Lisi et al. (2019).



**FIGURE 8**  
Flowchart for selecting trigger levels with emphasis on the trigger values.

define each trigger's response in terms of how the dredging operations should proceed (see figure 8).

The trigger level is the turbidity level that needs to be respected to ensure that the threshold levels are not reached. It is thus a specified criterion used for the management of the dredging operations. When a trigger level is exceeded, the need for a management action will be assessed and if necessary, implemented to prevent undesired/negative impacts.

A typical approach is to define three different types of trigger levels:

- **Warning level:** indicating an increase in turbidity levels, providing time to investigate the causes and anticipate/identify possible solutions;
- **Action level:** indicating that the levels have continued to rise and that mitigation measures need to be taken to prevent the impact level from being reached;
- **Impact level:** indicating that the increased turbidity levels have the potential to harm the sensitive receptors and that urgent action needs to be taken to reduce them below the impact level or the action level.

Trigger levels should be monitored either at the receptor or at a location at which the response at the receptor is known.

### Trigger level evaluation and monitoring programme definition

There are many different ways in which trigger levels and monitoring programmes are defined worldwide. Typical environmental questions to be answered in the early preliminary planning phases are:

- What types of sediment spill sources could be expected/distinguished (e.g. single point spill event, continuous point spill over a certain period)?

- Will suspended sediments leave the dredging or relocation site?
- Where will the material go and how much material will remain in the water column after a certain period of time?
- Which sensitive receptors could be involved and how?

Listed below are the criteria that need to be addressed in order to provide a clear definition of limits and to develop a monitoring programme that can effectively implement them:

- parameters,
- intensity and duration,
- location,
- frequency, and
- depth.

A good monitoring strategy involves an analysis of the sensitive receptors at risk and the selection of relevant monitoring parameters, equipment and locations (CEDA, 2015; CEDA/IADC, 2018). It is also important to recognise that the monitoring of sensitive receptors that are not directly at risk may help to constantly redefine the baseline (or background) conditions and prove the validity of assumptions regarding the absence of impacts on the sensitive target receptors specifically selected before the operations proceed.

### Parameters

The parameters that need to be monitored must be clearly defined. This is typically undertaken when determining the influencing factors as these parameters govern the possible impacts. Typical (not limited) monitoring parameters may be defined in terms of:

- Turbidity (e.g. NTU, FTU),
- Total suspended solids (TSS, SSC),
- Photosynthetically active radiation (PAR),
- Metocean conditions (e.g. wind, waves,

- tide, currents, temperature, salinity),
- Sediment properties and deposition rate, and
- Biological response (e.g. marine conditions of habitats and species) and other parameters related to environmental impacts.

Even though reduced PAR, elevated sedimentation and elevated TSS levels constitute the parameters that are ultimately related to environmental impacts, their principles of measurement have limitations and present challenges that are not within the scope of this article (for these, the reader should refer to CEDA/IADC, 2018). For this reason, one often defines limits in terms of the simplest parameter that can be measured, such as NTU.

**The trigger level is the turbidity level that needs to be respected to ensure that the threshold levels are not reached.**

**As mentioned before, any evaluation of the significance of effects must necessarily consider different aspects of the induced perturbations to the environment, not only in term of intensity, but also in terms of the duration and frequency of events exceeding the defined levels.**

Measurements of physical parameters not directly related to water quality (e.g. currents, waves, tides) can provide information on the plume dispersion in a particular area as well as on the factors that cause additional turbidity.

#### Intensity and duration

Trigger levels may be defined as absolute values, levels relative to background or baseline conditions in terms of a so-called 'spill budget', or in more complex ways. All these approaches have specific advantages and limitations.

When using absolute fixed turbidity trigger levels, one can argue that naturally elevated turbidity levels – due, for example, to tidal and storm events – may result in limitations when dredging the site, regardless of the contractor's efforts, resulting in a considerable degree of uncertainty with respect to operational downtimes.

Turbidity trigger levels defined as a fixed value above background conditions have the advantage of allowing the contractor to develop an understanding of the additional turbidity that can be generated by the works. On the other hand, it is important to understand that regardless of the source of the elevated turbidity, sensitive receptors may undergo a certain amount of stress once their specific turbidity threshold levels are exceeded (e.g. Eftemeijer & Lewis, 2006; Feola et al, 2016;

Fisher et al., 2018; Fraser et al., 2017; Jones et al., 2016; Permanent International Association of Navigation Congresses, PIANC, 2010; Wilber et al., 2001). In other words, it is questionable whether it is wise to allow additional stress on the sensitive receptors at a time when they are already experiencing naturally elevated turbidity levels. Care should also be taken with levels that are expressed in terms of a percentage increase in turbidity above background as these may lead to unrealistically low trigger values during periods of very low natural turbidity (for example 50% of 0 NTU = 0 NTU) and unrealistically high trigger levels during periods of high turbidity. While establishing trigger levels expressed as excess concentration, attention should also be paid to natural spatial heterogeneity in terms of the turbidity of certain areas.

As mentioned before, any evaluation of the significance of effects must necessarily consider different aspects of the induced perturbations to the environment, not only in term of intensity, but also in terms of the duration and frequency of events exceeding the defined levels. Mathematical models are regarded as valuable tools in forecasting variations in turbidity and supporting decision makers – before, during and after execution – to optimise the interventions and monitoring actions with regard to environmental and project objectives while maintaining desired

production rates (Lisi et al., 2019). Another method used for defining trigger levels is the 'spill budget' method. The contractor is limited to the release of a certain amount of (fine) material that can be put into suspension over a certain period of time and within a certain spatial boundary. The 'spill budget' is usually estimated through modelling studies because in reality the execution of accurate monitoring campaigns within the dredging (spill) are very difficult. Given that modelling hypotheses can give an unrealistic estimation if spill data are unavailable for validation, best practice should include an optimised interaction between models and monitoring as part of a cost-effective approach.

#### Location

A further item that needs to be clearly addressed is the area within which the trigger levels are to be controlled and respected. Sometimes limits are defined within the dredging zone itself. However, in most cases this does not make sense as the creation of turbidity is inherently connected to the dredging process and turbidity levels close to the dredger may become very high and are related to near-field processes. While assessing turbidity levels and impacts, we should consider far-field processes – unless dredging occurs very close to a sensitive receptor – and their temporal scale – especially in the case of contaminated sediment.

Another location where trigger levels are often defined is at a certain fixed distance from the dredger (for example at 500 metres which may still be within the dredging zone). Here it must also be noted that most dredgers – Cutter Suction Dredgers and Trailing Suction Hopper Dredgers – move during the dredging process, possibly making it difficult to define the exact location, in addition with respect to safe work and sailing practices. One example of a more pragmatic method is to define trigger levels at a specified distance from the dredging zone perimeter.

The most logical location at which to measure environmental impacts is close to the sensitive receptor itself. Depending on the location of the sensitive receptor relative to the dredging zone, it is possible to define monitoring locations in between the dredging zone and the sensitive receptor to act as early warning sites. The distances between the monitoring locations should also be taken into account in

the monitoring strategy as considerable sailing distances may render a plan unpractical or unnecessarily costly.

Understanding the advantages and limitations of the various available sampling techniques is important in determining the most cost-effective approach for sediment plume monitoring. In general, fixed stations are required for comprehensive and regular monitoring over time, for collecting the background conditions during different environmental conditions before the execution of the works and for verifying the selected reference levels during their execution.

Furthermore, during the execution phase, mobile sampling stations (e.g. samplings from a vessel) may also be required to track the near-field plume through the water column and to perform measurements at various locations over short periods.

### Frequency

Frequency criteria regarding monitoring should be clearly defined. Distinctions need to be made between:

- sampling frequency of monitoring devices,
- monitoring campaign frequency and
- frequency at which the trigger levels are checked to ensure compliance.

Trigger levels can, for example, be compared to a moving average taken over several hours of data measured every minute. The monitoring campaign frequency may range for instance from once before or after the project, to a continuous regime of acquiring data. Indeed, the frequencies imposed in checking compliance often determine the eventual monitoring method that will be chosen. When a turbidity measurement is only sought once per day or per week, it may make sense to use a monitoring vessel to travel to each location in turn and collect a reading. By contrast, when monitoring is to be carried out more frequently, it may be necessary to install continuous monitoring sensors either on buoys or monitoring beacons, often with a telemetry link to deliver the data in real time onboard the dredger.

### Depth

The depth at which the trigger level applies (i.e. depth of turbidity measurements) also needs to be clearly defined. In terms of technical challenges (and thus costs), there is a big

difference between the installation of surface sensors that can be mounted directly below a single moored turbidity buoy and sensors placed near the bed that require a more robust mooring solution to prevent damage to data and power cables arising from the motions of the surface buoy as a result of the forces acting upon it.

### Turbidity monitoring

Turbidity measurements are described in detail in CEDA/IADC (2018) but can roughly be divided into direct and indirect measurements (e.g. Cutroneo et al., 2012). Direct measurements are measurements that do not require transfer functions. Examples include:

- Water samples as well as sediment analyses (e.g. SSC) in the laboratory;
- Light dampening and scattering of light (e.g. NTU, FTU);
- Sediment traps as well as sediment analyses in the laboratory; and
- Grain-size distributions (LISST, Malvern).

Indirect measurements can be derived from transfer functions. Typical examples are:

- Calculated SSC values (typically from NTU or ADCP) and
- Remote sensing (e.g. satellite images).

If carried out correctly, the results of direct measurements are indisputable whereas indirect measurements require an understanding of the limitations of the transfer function which often implies a significant level of uncertainty. Transfer functions may depend on the suspended sediment's grain-size distribution, type of material (mineral, organic), shape, concentration, gradation and colour (Downing, 2006). Furthermore, under dynamic conditions, the relationship may change across time and space; see Bundgaard et al. (2019) and Fettweis et al. (2019) for further information. This means that the correlation has to be properly determined for each measuring device to cover both quiescent conditions and the more hydrodynamically energetic conditions that might occur under storm waves.

It is therefore very important to understand that indirect measurements are only useful for environmental limits if the transfer function is

**TABLE 2**

Overview of parameters which can be used as measures of turbidity limit and possible measurement methods. \*Only using a locally obtained transfer function. \*\*Only with proper local calibration data.

Turbidity limit related to	Optical (NTU/FTU)	Light dampening	Water samples	Sediment traps	Remote sensing
Light	X	X	{x}*	-	{x}**
Coverage	-	-	-	X	-
Visibility	X	X	{x}*	-	X
Sedimentation	-	-	-	X	-
SSC	{x}*	-	X	-	{x}**

valid for the local environment and the specific device. A turbidity limit based on indirect measurements should thus be based on a locally determined transfer function valid for local sediment as well as dredged sediment. The physical limitations of sensors must also be considered. In these ways, understanding the technical limitations to measurements when choosing a parameter for a turbidity limit is crucial. An overview of applicable parameters for various types of turbidity limits is displayed in Table 2. The trigger level regarding sedimentation and SSC can be assessed with the table or sediment traps can be used to check for compliance.

**Discussion and recommendations for setting turbidity limits**

The goal of this article has been to provide the crucial concepts for setting turbidity limits, intended as a balance between protecting the environment and still allowing for dredging in a cost-effective way. The article has presented the various steps of a methodology, ultimately leading to a set of limits that together both protect the environment and allow for a given dredging operation to commence in an environmentally safe way.

In particular, the turbidity limit is considered as consisting of two parts: a series of trigger levels and a threshold level. A threshold level for a specific sensitive receptor is defined as the level at which an impact can start to occur. More generally, it can be specified as multiple levels with increasing criticality and identified referring to the intensity and the duration of the stressor. The trigger levels consist of a series of intermediate levels established so as

to prevent, at an early stage, the occurrence of threshold values.

The methodology involves four steps, identifying: sensitive receptors, what they are influenced by, their stress levels, and what reasonable trigger levels are beyond the measurements that must be taken before the threshold levels are reached (see figure 9).

Defining case-specific threshold values and trigger levels should be based on an understanding of the local system and the impact arising from dredging operations. The limits represent a balancing decision based on the relevant environmental concerns, the needs of the project and the stakeholders. This article has aimed to list the key aspects of the system and the project needs. The basis for defining threshold values and trigger levels is a combination of these. It has been demonstrated that any impact should be assessed in relation to the biological and anthropogenic sensitive receptor(s) and therefore requires a good understanding of the system. For each receptor, it is necessary to determine the influencing factors and the corresponding threshold levels. This includes ascertaining time and space variations. Once one knows the sensitive receptors and their expected responses to dredging activities both in space and time, it is possible to plan the dredging process accordingly.

The selection of the dredging plan and the series of trigger levels that both protect the environment and allow for an ‘executable’ project, implies an evaluation of the dredging-

induced excess in turbidity (in terms of type, amount and intensity in both the near and the far field) acceptable for the environment. To this end, it is necessary to estimate the impact of turbidity limits on the dredging operation and align the dredging project to match the environmental concerns.

Finally, it is necessary to understand what can actually be measured and monitored. Not everything can be measured in a practical, cost-effective way and not all sites can be monitored. A proper set of parameters is important to match the requested environmental protection.

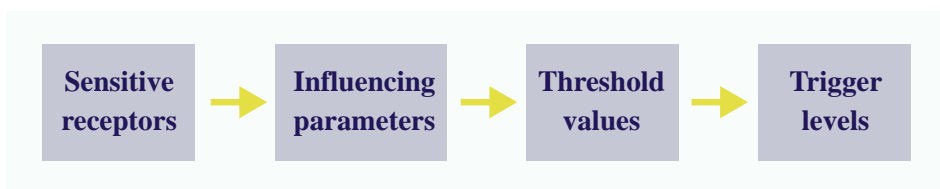
Briefly, the turbidity limit should:

- be based on a system understanding of local hydrodynamics, sediments and biology.
- be manageable in a dredging operation and provide reasonable response times.
- be based on a clear definition of where to measure and what to measure.
- be site-specific and based on the critical stress levels for the local sensitive receptors.

We propose the following steps which can be derived from a dedicated study, an ESIA or a local survey undertaken in connection with the project. All of these steps are applicable in time and space:

1. Develop a system understanding.
2. Identify receptors sensitive to turbidity.
3. Determine critical stress levels for sensitive receptors (threshold value).
4. Choose a measurable turbidity limit based on the critical stress levels for the receptors and select a relevant measurable parameter.
5. Determine the trigger levels that need to be respected to avoid reaching the threshold levels and related management.
6. Determine where the turbidity limit applies based on the influence areas, the sensitive receptors and the dredging plan.
7. Define a sufficient, practical and cost-efficient monitoring strategy.

Regular and transparent communication with local stakeholders and experts during the establishment of turbidity thresholds and trigger levels for a project often increases the possibilities of mutual understanding and success during its execution.



**FIGURE 9**

Flowchart for selecting trigger levels with emphasis on sensitive receptors.



Environmental turbidity limits for dredging operations should always be site-specific and based on ecosystem functioning in order to protect sensitive environmental receptors. By setting realistic limits, monitoring can be made more cost-effective and both environmentally and socially relevant.

**FIGURE 10**

Monitoring turbidity plume generated by a TSHD.

**TABLE 3**

Glossary of Terms.

Receptor	Receptors comprise species, habitats, resources, activities or items identified as being of importance that may be affected by dredging.	
Turbidity	A popular term for water clarity or sediment concentration. Turbidity is a measure of water clarity that indicates how much the material suspended in the water decreases the passage of light through it (United States Environmental Protection Agency, US EPA, 2012).	
NTU	Light dampening	Nephelometric turbidity unit
FTU	Light dampening	Formazin nephelometric unit
SSC	Concentration	Suspended sediment concentration
TSS	Concentration	Total suspended sediment
PPT	Concentration	Parts per thousand
PAR	Light dampening	Photosynthetically active radiation
CSD	Cutter Suction Dredger	
TSHD	Trailer Suction Hopper Dredger	
Trigger level	The levels at which management actions can or should be implemented to avoid environmental impacts based on identified sensitive receptors.	
Threshold level	The level at which a receptor can show an impact.	
Dredging works	Dredging in this article is the maritime transportation of natural materials from one part of the water environment to another by specialised dredging vessels. It involves collecting and bringing up, fishing up or clearing away or out material or another object from the bed of a river, sea, etc., transporting it to the relocation site and unloading the material or object.	
Sediment spill	The release of sediments into the water body during dredging or reclamation activities.	
Turbidity plume	The horizontal (2D) and vertical extent of the water body containing suspended sediments. Due to the complexity of sediment-water interactions, variability in sediment properties, variations in dredging activities and natural hydrodynamics, turbidity plumes exhibit very dynamic behaviour in terms of both extent and sediment concentration (CEDA/IADC, 2018).	

## Summary

Dredging relocates large volumes of sediment and can be accompanied by the release of suspended sediments into the water column referred to as sediment plumes. Excessive suspended sediment concentration has an impact on water transparency – as a result of increased turbidity – and may cause the degradation of water quality and marine ecosystems.

Mitigating the impacts of turbidity is usually managed by limiting the amount of suspended sediments released at the dredging sites or entering sensitive areas. For dredging projects around the world, many different limit definitions and corresponding turbidity monitoring methods have been applied.

In 2016, the CEDA Environment Commission (CEC) conducted a survey among a wide range of companies and institutes working with dredging to investigate which environmental turbidity limits existed for dredging projects, how these limits were set and how the environmental limits affected the projects both financially and time-wise. Interestingly, the survey showed that compliance monitoring on average contributed about 1–5% to the cost of the dredging project.

The majority of the respondents indicated that they understood and supported the need for environmental turbidity limits. However, the replies also showed that a major proportion of the limits did not seem to be scientifically or environmentally founded.

Taking into account the generally high costs of compliance monitoring and the environmental risk that a limit is set incorrectly, the CEC raised the following question: Is there a need for guidelines on how to set realistic and effective environmental turbidity limits for dredging? The results of the questionnaire imply that there is such a need. The article aims to highlight a general approach to set or discuss turbidity limits for dredging applications. Connections to background information, monitoring and management measures (as relevant where exceedance occurs) are provided.



### Klavs Bundgaard

Klavs holds an Msc in civil engineering from Technical University of Denmark specialised in Coastal and Ocean Engineering. He has a strong background working with fine grained sediments and measuring techniques, first as senior hydraulic engineer with DHI and later as team leader, senior consultant, and senior project manager for SWECO and NIRAS. Klavs was the project manager for the spill investigations for the EIA for Europe's largest marine infrastructure project, Fehmarnbelt for DHI and has been involved in numerous marine studies on cohesive sediments in Denmark and around the world, affirming his expertise in modelling and measuring cohesive sediments. Klavs is also a member of CEDA's environmental committee.

### Members of the CEDA Working Group on Guidelines for Assessing and Evaluating Environmental Turbidity Limits for Dredging Operations

**Klavs Bundgaard (Chair)**  
NIRAS, Denmark

**Johan Henrotte**  
Boskalis

**Mark Bollen**  
IMDC, Belgium (until  
February 2019)

**Joël L'Her**  
Cerema

**Stijn Claeys**  
Flanders Hydraulics  
Research

**Iolanda Lisi**  
ISPRA (corresponding  
member)

**Jos de Cubber**  
Jan De Nul

**Yves Planke**  
Port of Antwerp

**Boudewijn Decrop**  
IMDC (from February 2019)

**Bastian Schlenz**  
Femern A/S

**Frederik Goethals**  
DEME

**Jonathan Taylor**  
HR Wallingford

**Lucie Evaux**  
Van Oord

**Lynnyrd de Wit**  
Svasek Hydraulics

**Alessandra Feola**  
ISPRA (corresponding  
member)



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**The article aims to highlight a general approach to set or discuss turbidity limits for dredging applications.**

# TAKE A NETWORKING RAIN CHECK

## 60<sup>th</sup> Seminar on Dredging & Reclamation

7-11 September 2020  
IHE Delft Institute for Water Education  
Delft, The Netherlands  
<http://bit.ly/SeminarDelft>

## 61<sup>st</sup> Seminar on Dredging & Reclamation

5-9 October 2020  
Singapore  
<http://bit.ly/SeminarSGP2020>

For (future) decision makers and their advisors in governments, port and harbour authorities, off-shore companies and other organisations that have to execute dredging projects, IADC organises their International Seminar on Dredging and Reclamation for the 57<sup>th</sup> time. This time the seminar will be held in cooperation with the IHE Delft Institute for Water Education, in Delft, The Netherlands. Since 1993, this week-long seminar has been continually updated to reflect the dynamic nature of the industry and is successfully presented in cities all over the world. IADC's Seminar on Dredging and Reclamation is a five-day course which covers a wide range of subjects, from explanations about dredging equipment and methods, rainbowing sand and placing stone to cost estimates and contracts.

## Programme

The in-depth lectures are given by dredging experts from IADC member companies, whose practical knowledge and experience add an extra value to the classroom lessons. Amongst the subjects covered are:

- the development of new ports and maintenance of existing ports
- project development: from preparation to realisation
- descriptions of types of dredging equipment
- costing of projects
- types of dredging projects
- environmental aspects of dredging

Activities outside the classroom are equally as important. An on-site visit to the dredging yard of a IADC member is therefore an

integral element in the learning process.

This gives the participants the opportunity to see dredging equipment in action and to gain a better feeling of the extent of a dredging activity. Face-to-face social contact is invaluable. A mid-week dinner where participants, lecturers and other dredging employees can interact, network and discuss the real, hands-on world of dredging provide another dimension to this stimulating week. Each participant receives a set of comprehensive proceedings and a Certificate of Achievement in recognition of the completion of the coursework.

## For further questions, contact:

Ria van Leeuwen, Senior PR & Communications Officer of IADC  
Email: [vanleeuwen@iadc-dredging.com](mailto:vanleeuwen@iadc-dredging.com)

**The Dredging  
for Sustainable  
Infrastructure  
Course fills a gap.**



Photo © Marco Hofste

## FIGURE 1

A mock tender is part of the Dredging & Reclamation Seminar and the winners get their names emblazoned upon the highly coveted pickpoint trophy!

## EVENTS

### FIGURE 2

Thomas Vijverberg – deputy manager at Hydronamic, Boskalis' engineering department – is one of the lecturers for the December edition of the Dredging for Sustainable Infrastructure Course.



### Dredging for Sustainable Infrastructure Course

1-2 December 2020

Hotel Van Der Valk Den Haag

Nootdorp, The Netherlands

<https://dfsi-course-0620-nl.iadc-events.com>

For professionals involved in dredging-related activities for water infrastructure development, CEDA and IADC launch the Dredging for Sustainable Infrastructure Course. The course is based on the association's flagship guidebook with the same title. At this two-day course, participants will learn how to achieve dredging projects that fulfil primary functional

requirements while adding value to the natural and socio-economic systems by acquiring an understanding of these systems in the context of dredging as well as stakeholder engagement throughout a project's development. This course, just like the book it is based on, fills a gap: it gives guidance to professionals on how to bring into practice the new thinking that in many ways has transformed dredging in the last decade. Therefore, the course is essential for professionals driven by the ambition to achieve sustainable and resilient water infrastructure with a dredging component that contribute to the UN's Sustainable Development Goals. Professionals involved in designing or implementing such projects – such as port development, river deepening and flood defence to name a few – as well as those working in government, port authorities, consultancy firms, dredging companies, NGOs, suppliers, or ship-builders – would benefit

from this course. Engineers, ecologists, nature and social scientists, regulators or financiers will all return home from this course with new insights and knowledge that can be put to practice right away. This course is based on the CEDA-IADC guidebook *Dredging for Sustainable Infrastructure* which was published in 2018. Experienced lecturers will inform about the latest thinking and approaches, explain methodologies and techniques as well as demonstrate – through numerous practical examples – how to implement this information in practice with challenging workshops and case studies.

**This course, just like the book it is based on, fills a gap: it gives guidance to professionals on how to bring into practice the new thinking that in many ways has transformed dredging in the last decade.**

# TOO BIG.

## REBUILD BY DESIGN'S TRANSFORMATIVE RESPONSE TO CLIMATE CHANGE

Every year, rising sea levels and increasingly stronger storms are society's new reality. It is necessary for society to confront this challenge now. Strategies used in the past will not be able to handle the large scale of the problem. How then can society confront climate change?

Co-written by authors Henk Ovink and by Jelte Boeijenga, *Too Big* is a book about the development and execution of Rebuild by Design. Launched in response to the extensive damage caused to the New York and New Jersey region by super storm Sandy, Rebuild by Design turned out to be an unprecedented exercise in collaboration and innovative thinking initiated by President Barack Obama by an Executive Order in 2012 and supported at the federal level. Government, community groups and the ten international teams of designers, engineers, researchers, and scientists came together – along with their diverse expertise – to participate in the experimental approach.

The conception of the out-of-the-box approach, the process and its results are recounted through the lens of Henk's first-

hand experience and also includes the diverse perspectives and voices which shaped the outcome. *Too Big* is not only the story of a competition but also a story of political dynamics, collaboration, research and the design approach in action. The act of writing the publication was the author's exercise in synthesising the information learned from the process, extracting the many lessons learned and through sharing this insight, aiming to inspire others to engage in a similar process when tackling society's large-scale challenges.

Henk states: 'complexity is the new normal. It challenges us to change, to seek real innovation, and thus to inspire coming generations. Complexity demands a new approach, one that steps outside existing frameworks and agreements based on assumptions made in the past'.



**Authors:** Henk Ovink, Jelte Boeijenga  
**Publisher:** nai010 publishers  
**Published:** May 2018  
**Language:** English  
**Price:** € 34,95  
**ISBN:** 978-9462083158

**Available from**  
<http://rebuildbydesign.org/resources/book>

An Editorial Note by Jelte Boeijenga hammers the point home, reminiscing upon the moment he joined forces with Henk to embark upon making a publication about Rebuild by Design. Jelte helped transform Henk's first-hand account – from his diary, notes, memories and inner-most thoughts

**This book provides the evidence that Rebuild by Design is a model with a method for change.**



– into a book infused with the culture of the experience.

Henk believes ‘it is an important story because what we did – complete with its imperfections, improvisations and inevitable failures – is a harbinger of what all of us will need to do as climate change affects us. Our approach was rooted in embracing complexity and uncertainty because we believed doing so would produce better results, even though this was difficult for every one of us’.

The book is comprised of five sections which break down the challenge into distinct phases.

The first part begins with President Obama’s Executive Order establishing the Sandy Task Force to rebuild New York and New Jersey, and the process of fusing Dutch-style innovation within the existing American legal frameworks. The second part expounds upon the task force’s conception and development of the competition which needed to embrace the complexity of the challenge at hand while the third section discusses a vital component of the site-specific project: research of the region’s vulnerabilities. The fourth part dives into the design teams and their multi-dimensional proposals. To support each of the first four parts, Jelte conducted interviews

with key figures from diverse professional backgrounds – from Shaun Donovan, then Secretary of the US Department of Housing and Urban Development and Chair of the Hurricane Sandy Rebuilding Task Force to Dawn Zimmer, the Mayor of Hoboken, New Jersey, and members of the design teams – are included to share their personal experiences from the process, insights and lessons learned. The final section presents the final stage of Rebuild by Design – funding the projects – and sets forth an approach for the design teams and communities to move forward with making these resilient solutions a reality.

### Henk Ovink

Henk is the first Special Envoy for International Water Affairs for the Kingdom of The Netherlands. He is also Sherpa to the UN / World Bank High Level Panel on Water. He served on President Obama’s Hurricane Sandy Rebuilding Task Force and was principal for Rebuild by Design. Before joining the task force, he was acting director general for Spatial Planning and Water Affairs and director National Spatial Planning for The Netherlands. He was curator for the 5<sup>th</sup> International Architecture Biennale Rotterdam 2012 ‘Making City’ and chief editor for the publication series *Design and Politics*. Henk teaches and lectures all over the world on water, climate change, design and politics as well as the urgency and opportunity to act, now.

### Jelte Boeijanga

Jelte is a Rotterdam-based, independent researcher, consultant, author and editor. He authored and edited various publications including the *Vinex Atlas* (2008), *Landscape Architecture and Town Planning in the Netherlands* (2010) and *Design and Politics: The Netherlands in Projects* (2013). He consults on local, regional and national spatial planning issues where he focuses on the interaction between design, policy, and politics. From 2013 to 2017, Jelte volunteered on the board of the local Rotterdam energy cooperative Blijstroom.

## MAIN MEMBERS

### Adani Ports and Special Economic Zone Ltd.

Head office India  
+91 79 2656 5555  
dredging@adani.com  
www.adani.com

### DEME Group

Head office Belgium  
+32 3 250 5211  
info@deme-group.com  
www.deme-group.com

### Dutch Dredging

Head office The Netherlands  
+31 184 411 999  
info@dutchdredging.nl  
www.dutchdredging.nl/en

### Group De Cloedt – DC Industrial N.V.

Head office Belgium  
+32 2 647 12 34  
office@groupdecloedt.be  
www.groupdecloedt.be

### Gulf Cobla (L.L.C.)

Head office United Arab Emirates  
+971 4 803 7777  
gc-info@gulfcobla.com  
www.gulfcobla.com

### Hyundai Engineering & Construction Co., Ltd.

Head office South Korea  
+82 2 746 1114  
webmaster@hdec.co.kr  
www.hdec.co.kr

### Jan De Nul Group

Head office Luxembourg  
+352 39 89 11  
info@jandenuigroup.com  
www.jandenuigroup.com

### National Marine Dredging Company

Head office United Arab Emirates  
+971 2 5130000  
nmdc@nmdc.ae  
www.nmdc.com

### Penta-Ocean

Head office Japan  
+81 3 3817 7181  
poc\_international\_web@  
mail.penta-ocean.co.jp  
www.penta-ocean.co.jp

### Rohde Nielsen A/S

Head office Denmark  
+45 33 91 25 07  
mail@rohde-nielsen.dk  
www.rohde-nielsen.dk

### Royal Boskalis Westminster N.V.

Head office The Netherlands  
+31 78 6969 000  
royal@boskalis.com  
www.boskalis.com

### TOA Corporation

Head office Japan  
+81 3 6757 3800  
webmaster@toa-const.co.jp  
www.toa-const.co.jp

### Van Oord

Head office The Netherlands  
+31 88 8260 000  
info@vanoord.com  
www.vanoord.com

## COLOPHON

### Editorial

For editorial enquiries, please email [editor@iadc-dredging.com](mailto:editor@iadc-dredging.com) or call +31 (0)70 352 3334.

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IADC stands for 'International Association of Dredging Companies' and is the global umbrella organisation for contractors in the private dredging industry. IADC is dedicated to promoting the skills, integrity and reliability of its members as well as the dredging industry in general. IADC has over one hundred main and associated members. Together they represent the forefront of the dredging industry.

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