CURRICULUM VITAE

Position Title	Specialist on Scour and Erosion/Project Manager
Name of Firm:	Hoffmans Advice (self-employed)
Name of Expert:	Gijs HOFFMANS
Date of Birth:	6 August 1958
Nationality:	Dutch

Key qualifications

Mr. Hoffmans has more than 30 years of professional experience in the field of scour, internal erosion, river engineering, dike/dam engineering and flood protection projects and has acted several times as Expert as well as Project Manager. He started his career as a research engineer regarding scour and erosion and the corresponding geotechnical processes. In addition, he examined the erodibility of both bed protections around hydraulic structures in non-uniform flow conditions, and revetments at dikes (or embankments), for example grass covers. With this up-to-date knowledge he advised several clients all over the world with designing and assessing hydraulic structures. His design experience has been gained in various countries (Japan, Argentina, Germany, United Kingdom, Brazil, China, United States of America, France and the Netherlands) and covers the river training works and its geotechnical engineering and stability aspects. More specifically, this experience also focused on hydraulic structures such as estimating the dimensions of scour holes in relation to the magnitude of bed protection and the risks of shear failures and/or flow slides, considering several types of scour (general scour, bend scour, confluence scour, live-bed scour, clear-water scour). The combination of research and project-related advice on site has increased his insight in the mathematical modelling of internal erosion phenomena, especially (backward) retrogressing erosion or piping. At present, he is involved in similar projects as principal advisor to the Dutch water management agency Rijkswaterstaat and the National Water Boards/Regional Water Agencies for designing and/or assessing the flood protection river dikes along the rivers Rhine and Meuse. Currently he also advises the Water Board/Regional Water Agency Hollandse Delta and Rijkswaterstaat for monitoring and assessment of the many scour holes occurring in the national tidal rivers close to the city of Rotterdam. Throughout his career, he has always acted to bridge the gap between state-of-the-art research outcomes and the daily civil/hydraulic engineering practice all over the world.

Education:

- M.Sc. degree in Civil Engineering (1986), Delft University of Technology, The Netherlands. Main subjects: River and Hydraulic Engineering; Special subjects: Irrigation, Hydropower, Flood Control, Empolderment, Dams/Dikes.
- Ph.D. degree (Doctoral Thesis) in Civil Engineering (1992), Delft University of Technology, The Netherlands. Main subjects: Fluid Mechanics, River and Hydraulic Engineering; Special subjects: Scour and Erosion Processes at Hydraulic Structures due to Current and Waves, Overall Degradation, Local Scour, Constriction Scour, Bend Scour, Confluence Scour, Time-Dependent Scour, Live-Bed Scour, Clear-Water Scour and Bed Protections.

Other Training:

- Course Delft 3D, Flexible Mesh, River Modelling, Deltares, 2018.
- Geotechnical Course, Advanced course in Geotechnics and Soil Mechanics, GeoDelft, 2010.
- Post Graduate Course, ROI, Project Management course, 2007.
- Post Graduate Course, Bureau Zuidema, Project Management, 1998.
- Post Graduate Course, Sloping Sea Walls, Dikes and Revetments, 1997.
- Post Graduate Course, Course River Engineering, Reservoirs Management and Environmental Impact Assessment, 1996.

Membership of Professional Associations and Journals of Publications:

- 1996 – present: Member of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE).
- 1996 – present: Member of the International Association of Hydraulic Research (IAHR).
- 1998 – 2006: Secretary of the National Technical Advice Committee for Water Defences-Technology/Innovation Platform (TAW-T).
- 2006: Chair of International Conference on Scour and Erosion (ICSE-3) Amsterdam, The Netherlands.
- 2000 – present: Core-Member of International Technical Committee on Scour and Erosion (TC-213).
- 2000 – present: Member of Scientific Committee of International Conference on Scour and Erosion.
- 2000 – present: Reviewer of Journal of Hydraulic Engineering, Journal of Hydraulic Research.
- 2000 – 2006: Secretary of the Dutch Society for Soil Mechanics and Geotechnical Engineering.

- 2004. Consultant to OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY (US Army Corps of Engineers), received an award from the Corps for his contribution in mathematical modelling scour and erosion, PRESENTED FOR EXCELLENCE – SERVING THE NATION AND THE ARMY.

Keynote speaker
- 2002: Invited Lecture "On the Challenges of Scour Prediction" at the ICSE-1 (College Station, USA).
- 2012: Invited Lecture "Developments in Scour and Erosion" at the ICSE-6 (Paris, France).
- 2014: Invited Lecture "An overview of piping models" at the ICSE-7 (Perth, Australia).

Author
- Scour Manual, Balkema, Rotterdam (1997).
- Influence of Turbulence on Soil Erosion, Eburon, Delft (2012).
- Scour Manual, update of the Scour Manual of 1997, Taylor and Francis (2021).
- Shields-Darcy model, an alternative piping model? (to be published).

Course instructor of PAO Technology and management: Scour Manual (2021, 2022, 2023)
Scour and erosion almost always occur close to hydraulic structures. A good estimate of the scour process is important for the stability and functioning of bridges, quays, weirs, locks and dams. The course focuses on determining scour under the influence of currents. The updated Scour Manual provides a methodology for determining scour, including a safety approach. In addition, new insights and scour formulas including accuracy and area of validity are discussed. Much more attention is also paid to erosion and strength of clayey soil, peat and grass coverings. In addition to morphological aspects, geotechnical processes are also discussed. For example, if the slopes are too steep during scouring, shearing can occur and, with loosely packed sand, even settlement flows. Case studies show how these processes and formulas should be applied in practice.

Publications
At present author of more than 50 publications on scour prediction, stability of bed protection and granular filters, turbulence near hydraulic structures, stability of dikes, piping and heave, strength of grass cover on earthen dikes. More information about conference papers and journal manuscripts at
https://scholar.google.nl/citations?user=KGITXv0AAAAJ&hl=nl

Employment record relevant to the assignment:

Period	Employing organization and my title/position. Contact information for references	Country	Summary of activities performed relevant to the Assignment
1986-1992	**Employer:** Delft University of Technology, Delft, The Netherlands **Title/position:** Research Engineer **Contact Information for reference**: Laboratory of Fluid Mechanics, Delft, The Netherlands Prof. Dr. Ir. Wim Uijttewaal Tel. +31 (0)15 27 81953	Netherlands	• Guiding and mentoring students for master study, conducting scour experiments in laboratory, studying the processes of scour and erosion, writing scientific and conference papers. • Ph.D. research/doctoral thesis. • Giving lecture to civil engineering students in hydraulic structures design. • Co-organising and attending national and international conferences on hydraulic engineering research advances.
1992-2008	**Employer:** Rijkswaterstaat, Dutch Ministry of Water Management, posted in the city of Delft, The Netherlands **Title/position:** Research Engineer/ Project Manager **Contact Information for reference**: Ir. Hans Janssen, Janssen Hydraulic Engineering, Hydraulic Specialist M: +31 (0) 6 51034832	Netherlands	• Research engineer to study both the influence of turbulence on the local scour process downstream of sills and the flow characteristics in granular filters (1993-1997). These innovative studies were successfully carried out in a joint co-operation between the Kingston University (England), Bundesanstalt für Wasserbau Karlsruhe (Germany) and Deltares (The Netherlands). • Project manager (1999-2002) of the Bergambacht experiment, a prototype test in which the real strength of an earthen dike was examined. • Project manager of two Technical Reports, namely Piping and Heave in earthen dikes/dams (1998-1999) and Failure mechanism of dikes/dams (1999-2001). • Initiator and Technical Manager (2002-2007) of the

	Prof. Drs. Ir. Han Vrijling, Horvat & Partners, Delft, The Netherlands Tel: +31 (0)85 750 5050		European project ComCoast on coastal research (Interreg IIIB North Sea Program). • Project Manager (2004-2007) of the national research program Strength and Loading on Water Defences Infrastructures (SBW). • River engineer and river morphologist of the Dutch River guidelines programme Room for the Rivers (2003-2007).
2008-2019	**Employer:** Deltares **Title/position:** Senior Hydraulic Specialist/Project Manager **Contact Information for reference**: Deltares, Delft, the Netherlands Tel: +31 (0)88-335 8273	Netherlands	• Until 2012 managing different projects in the nationwide research program SBW on water infrastructures. • Project manager of WTI-VTV (until 2012), in charge of the project to establish new updated engineering guidelines, norms and standards for assessing primary water defences in the Netherlands. • Hydraulic expert in charge of study research on internal erosion (piping, contact erosion, suffusion, leakage); contributor to the ICOLD-bulletin. • Author of two books: Influence of Turbulence on Soil Erosion (2012) and Scour Manual (2019).
2019-present	**Employer:** Hoffmans Advice, self-employment **Title/position:** Director/Consultant **Contact Information for reference:** Prof. Dr. Ir. Bas Jonkman, Delft University of Technology, Delft, The Netherlands Tel: +31 (0) 15 27 85278	Netherlands	• Consultant for Rijkswaterstaat for predicting the scour and erosion processes in the National tidal rivers near Rotterdam for the engineering assessment of overall stability of bridges, tunnels, dikes and river training works. • Consultant to the National Water Boards/Regional Water Agencies for the assessment and designing of the primary flood defences, especially focussing on the risks of (mechanism) piping. • Guiding/Supervising M.Sc. and Ph.D. Research students at the Delft University of Technology, Delft, The Netherlands.

Language Skills (indicate only languages in which you can work):

Languages	Speaking	Reading	Writing
English	Excellent	Excellent	Excellent
German	Fair	Fair	Poor
French	Fair	Fair	Poor
Dutch	Mother Tongue		

Adequacy for the Assignment:

Name of Assignment or Project: Reinforcement of Norpipe
Year: 2024 - present**: Location:** The Netherlands
Client: Witteveen & Bos
Main Project Feature: To lower the exposed pipeline Norpipe at the coast of Juist, Germany, a temporary cofferdam is considered. The morphological effects of the cofferdam include accretion and erosion of the beach, and the local scour along and around the tip of the cofferdam. Especially the local scour of approximately 10 m can threaten the integrity of the pipeline and the stability of the cofferdam. One of the options to control the scour is to apply a bed protection to prevent local scour around the tip of the cofferdam.
Position held: Expert on Scour and Bed protection
Activities performed: A bed protection avoids the development of a scour hole. The study will present different design options for a possible bed protection and highlights some unknown factors that influence the decision making.

Name of Assignment or Project: Reinforcement of dikes, Piping
Year: 2019 - present **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat Agency
Main Project Feature: The Flood Protection Program (in Dutch: HWBP) is an alliance of National Water Boards and

Rijkswaterstaat. The objective of HWBP is that all main flood defences in the Netherlands will be reinforced in a sober and efficient manner by 2050, so that they meet the legal standards as laid down in the renewed National Water Law and thus guarantee the water-related safety in the Netherlands. This means that the total costs of a main flood defence system during the entire (remaining) lifespan are minimized (life cycle approach). The alternative piping model (Shields-Darcy model), which is physically correct, must be further validated, together with the current rule of thumb (Sellmeijer II), especially for practical situations. The expectation is that this research will lead to a better substantiated water-related safety with a substantial cost reduction on the HWBP program in the order of several hundreds of millions of euros.
Position held: Expert on Internal Erosion/Piping
Activities performed: Currently, as a piping specialist setting up a computational framework to assess and quantify the risks of piping according to the piping model Shields-Darcy in conjunction with experts of both Rijkswaterstaat and the National Water Boards; guiding and supervising several M.Sc. and Ph.D. research students in the same matter, at the Delft University of Technology, Delft, The Netherlands.

Name of Assignment or Project: Storstrøm Bridge
Year: 2021 **Location:** Germany
Client: Universität Stuttgart Institut für Geotechnik
Main Project Feature: The Storstrøm Bridge is a road and railway arch bridge that crosses Storstrømmen between the islands of Falster and Masnedø in Denmark. The study concerns the filling works necessary to restore the original seabed after the various dredging activities at the location of Pier P20S: particular focus is given to the design of the scour protection that will surround the Pier foundation, protecting it from the expected hydrodynamic loads.
Position held: Expert on Scour and Erosion
Activities performed: University of Stuttgart asked Hoffmans Advice to review the bed protection close to the Storstrøm bridge. It reflects a geometrically open filter which thickness has been verified by different stability predictors.

Name of Assignment or Project: Peer review scour assessment DP lay barges in shallow water
Year: 2020 **Location:** The Netherlands
Client: Advanced Consultancy Romke Bijker bv
Main Project Feature: Engineering consultant Ramboll of Nord Stream 2 has made an assessment of the seabed scour that is potentially caused by the thrusters of DP lay barges operating in shallow water with sandy seabed. The assessment shows significant scour. Given the possible consequences of this assessment, Nord Stream 2 requested a peer review of this assessment. The objective of this study is to perform a peer review of the scour assessment made by the engineering consultant.
Position held: Expert on Scour and Erosion
Activities performed: The peer review had been performed by Gijs Hoffmans as renowned expert on scour issues, including scour caused by ship propeller wake and Romke Bijker as advisor with broad experience with submarine pipeline engineering and environmental issues.

Name of Assignment or Project: Scour Analysis Simone Veil-bridge
Year: 2019 – 2020 **Location:** France
Client: Eiffage
Main Project Feature: Bordeaux is a port city in the Gironde department in the Southwestern France and counts many bridges that connect the left and right banks of the Garonne River. First we studied the scour and bed protection at the "Pont de Pierre" as the geotechnical and hydraulic conditions were similar to those of the Simone Veil Bridge. Later different types of scour/erosion were studied: bend scour, local scour, overall degradation, construction scour as function of time (with Breusers scour equation) in order to predict/review the scour at the piers of the Pont de Pierre and Simone Veil respectively.
Position held: Expert on Scour and Bed Protection
Activities performed: Eiffage asked Hoffmans Advice for information regarding the scour and erosion processes close to the bridge piers which form the foundation of the new bridge. Several items related to scour and erosion were discussed which were needed for a good understanding of the functioning of the bridge during both the construction phase and the phase afterwards.

Name of Assignment or Project: Study of scour holes in tidal rivers near Rotterdam
Year: 2019 - 2021 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: Currently, the Rhine-Meuse estuary (near Rotterdam) contains more than 100 local scour holes or erosion pits, posing a genuine risk to the stability of dikes, bridges, tunnels, and other infrastructure. In the 1980s, these scour holes had led to a reinforcement of parts of the dikes along the tidal river stretch 'Dordtsche Kil'. At present, most of these scour holes are still growing in the ebb and flood directions, thus the dimensions of these pits increase within time. In addition, more scour holes are likely to develop in the nearby future, which ultimately can change the river regime seriously. In order to prevent instability problems of both dikes and hydraulic structures, emergency refunding has been

carried out repeatedly in recent years. The knowledge gaps and the shared responsibilities between the various managers and owners make a joint approach difficult. There is a need for a clear strategy with which management and maintenance can be affected to mitigate the problems and with which rapid and appropriate measures can be taken during future emergency situations.

Position held: Expert on Scour and Erosion, River Morphologist

Activities performed: As a scour specialist and river morphologist, coordinate and manage the study to strengthen the adopted strategy and approach with stakeholders such as Rijkswaterstaat, Water Board Hollandse Delta, Municipalities and the business community, aiming to provide input for future policy, sustainable proactive management and maintenance and a targeted approach in any emergency situations.

Name of Assignment or Project: Scour Manual 2021
Year: 2017 - 2021 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: Hydraulic structures are vulnerable to scour around their foundations. Scour can compromise the stability of the structure leading to a significant risk of damage or even failure. The first edition of the Scour Manual was written in the nineties after the completion of the Dutch Delta Works. The new manual has been an indispensable reference for river engineers and asset managers since its publication. It presents analytical formulas e.g. the Breusers-equilibrium method and new scour equations based on Newton's second law. Therefore, it can be applied directly in the engineering practice for all types of hydraulic structures.
Position held: Author and Expert on Scour and Erosion, Project Manager
Activities performed: Coordinating and managing a team of experts and scientists in updating theory and practice on scour, collecting data on all scour formulae under use in the world, providing engineers with a comprehensive manual Table of Content, review and editing of all submitted write-ups, delivering the latest research outcomes in this field. As member of the editorial committee contributing substantial sections of the state-of-the-art Manual, discussing the progress with the ministerial team at the Client Rijkswaterstaat, coordinating and disseminating the case studies with the relevant consultancy firms and contractors for further use in daily engineering practice (Project costs: EUR 650,000).

Name of Assignment or Project: Spijkenisse bridge
Year: 2017 - 2019 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: The traffic road bridge near Spijkenisse (Rotterdam) has been built in the early seventies over the lower reaches of the tidal river 'Oude Maas'. This waterway is one of the most important shipping routes from the North Sea, Hoek van Holland, towards inland cities of Dordrecht and Moerdijk. Due to the many passing ships, intense inland navigation and shipping and the strong semi-diurnal tidal currents in the waterway, scour holes have developed at an alarming rate and extent, both downstream and upstream of the bridge piers and abutments. Mitigation measures were devised.
Position held: Expert on Scour and Erosion. Project Manager
Activities performed: On behalf of Rijkswaterstaat in charge of a field assessment and a second opinion on the river bed, its impacts on the stability of the bridge pier according to the current guidelines and to establish the mitigatory measures for repair and improvement works. Although several alternatives were developed a classical solution was opted for, filling the very deep scour holes with sand quarried from the 'New Waterway' channel by dredging equipment. A design was made to protect the river bed close to the structures against the eroding effects of erosive tidal currents. The river bed and the embankments (toes and underwater side slopes) were protected by applying large fascine mattresses covered with rock materials.

Name of Assignment or Project: Railway Bridge
Year: 2015 **Location:** The Netherlands
Client: City of Nijmegen
Main Project Feature: The Spiegel Waal is a man-made bypass canal in the Dutch river Waal near Nijmegen. This canal was constructed between 2013 and 2015 as part of the 'Room for the River Waal' project, part of the national flood prevention program Room for the River. The Railway Bridge connects Nijmegen with the Lent district. As this bridge has three streamlined piers in which its width is relative large, special attention was paid to both the scour process downstream of the bed protection and the geotechnical stability of the piers.
Position held: Expert on Scour and Erosion, River Morphologist
Activities performed: As a specialist providing rapid field assessment to the Municipality of Nijmegen with respect to the scouring and the dimensions of the bed protection both downstream of the piers and along the adjacent right and left embankments. Also, the risk of failure was determined in relation to the frequency of occurrence of extreme flood water levels, based on the outcome of the statistical analysis of about 150 years long time series/water levels record.

Name of Assignment or Project: Wave overtopping Research program (SBW = Strength and Hydrodynamic Loading on Water Defences: Dike Technology)
Year: 2008 - 2014 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat

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Main Project Feature: Study on wave overtopping and grass cover strength on earthen dike, as part of the nation-wide research program SBW to develop the safety assessment tools for the main water defences in the Netherlands. In 2007 a project group was formed to study and answer the research questions concerning the application of a grass cover resistance in case of wave overtopping. Prototype tests were carried out with the Wave Overtopping Simulator on several Dutch, Belgium and Vietnamese dikes during the winter seasons. A closed grass sod cover proved to be very adequate against the erosive forces of massive wave overtopping volumes.
Position held: Hydraulic specialist, Project Manager
Activities performed: As a Specialist and Project Manager (Project costs: EUR 3,750,000), made contributions to establish a set of engineering design tools and computational framework to successfully calculate the erodibility of grass cover revetments. Author of many chapters and sections to the Assessment Manual 'Grass cover revetments on earthen dams/dikes'. This research had led to (co-)authoring different national and international conference papers and journal publications.

Name of Assignment or Project: Internal Erosion
Year: 2009 - 2013 **Location:** France
Client: Électricité de France (EDF)
Main Project Feature: Internal erosion is one of the major causes of embankment dam failure. When constructing new dams, protection against internal erosion is provided by zoning of constructional core materials and by providing filters. However, many existing dams are not adequately zoned and are not equipped with filters and may therefore be vulnerable to internal erosion. Internal erosion occurs when soil particles within an embankment and/or dam core material or its foundation parts are entrained downstream by seepage flow. It starts when the erosive forces imposed by the hydraulic loading exceed the resistance of the fine materials in the earthen structure against erosion. The erosive forces are directly related to reservoir water levels.
Position held: Principal Scour and Erosion Specialist
Activities performed: As a specialist, reviewing an existing earthen dam (owned by EDF). Special attention was paid to the mechanisms of internal erosion. Conducted site tests and laboratory experiments, with special attention to retrogressive erosion or piping, resulting in a joint contribution to the ICOLD bulletin Internal Erosion Processes and Engineering Assessment. This research contribution has also led to a re-examination of the assessment of piping of the riverine dikes along the French river Rhone. The research results were based on the piping models by Sellmeijer and Shields-Darcy and are considered crucial for the design practice of not only Rijkswaterstaat agency and the National Water Boards but also for the Water Authorities all over the world.

Name of Assignment or Project: National Safety Guidelines for Dike Technology
Year: 2008 - 2012 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: Rijkswaterstaat and Delft Hydraulics developed an innovative assessment method for the main flood defences (Statutory Assessment Instruments, WTI-VTV) for the Water Boards and Rijkswaterstaat (Client). The new method was developed to check whether the riverine, estuarine and coastal flood defences comply with the statutory safety standards. This new method focused on various dike structural components. The results of the study have been used to improve the assessment methods and, ultimately, to allow for a more precise assessment of the engineering performance of flood defences. All dikes in the Netherlands undergo periodical checks as prescribed by the National Law on water management.
Position held: Project Manager
Activities performed: The project consisted of different sub-projects in which the development of each specific failure mechanism of dikes and or earthen embankments could be analysed and discussed. As Project Manager, in charge of monitoring the overall project progress as well as the quality of the research results, in close cooperation with the external team of experts of the Expertise Network Water Safety organisation (Project costs: EUR 1,250,000).

Name of Assignment or Project: Special Dams
Year: 2010 - 2011 **Location:** Brazil
Client: Optipar Participacoes LTDA
Main Project Feature: Research has been carried out with respect to Special Dams for generating hydro-power. The objective of the study is to check both the feasibility and the constraints for application of the proposed conceptual design and construction of the dams. A gradual horizontal closure is the recommended construction method. It was assumed that during the closure alluvial material from the river bed will be eroded by the river flow itself. The rock bed should be checked if it is suitable as a foundation for a dam. Trucks for transporting rock material seem an economic construction method. If a flood discharge is expected to pass the dam during construction phase then a better method is a combined horizontal and vertical closure. Not only the construction method has been examined but also the mechanisms of piping, permeability of the dam, scour downstream of the dam and the stability of the rock.
Position held: River Engineer and River Morphologist
Activities performed: As an expert, in charge of investigating the closure of the special dams. This closure method as proposed is similar to the Dutch method used in the sixties, seventies and eighties during the implementation of the mega project Delta Works in the South-western part of the Netherlands. Moreover, as river morphologist, studied the

mechanisms of internal erosion and local scour downstream of the special dams.

Name of Assignment or Project: National Guidelines River Engineering
Year: 2003 - 2007 **Location:** The Netherlands
Client: Rijkswaterstaat, Ministry of Infrastructure and Water Management

Main Project Feature: This guideline provides recommendations for the design, construction, maintenance and management of river dikes and river widening measures. The most important topics at the heart of the new guidelines are safety standards, dike reinforcement and room for the river. Safety measures must often improve the spatial quality of the bordering riverine integrated land area development and widening of the river bed (lowering water level) has become a fully-fledged alternative to dike reinforcement. This national manual consists of four parts. Part 1 contains the general information that is important when designing river engineering works in the river area. The information includes a description of the river area and the river processes involved, legislation, safety policy and the interpretation of the concept of spatial quality, robust engineering design and the process from problem statement to project implementation stage of civil engineering works. Part 2 "Exploration and Design Process" elaborates on the activities and processes that take place in the phases of problem exploration, conceptual design and detailed engineering design (DED), for both river aspects and spatial quality. Moreover, it contains information about the preparation of the assessment framework. Parts 3 deals with the actual design of a river dike whereas Part 4 focuses on how to design and implement a river widening project.
Position held: River Engineer and River Morphologist
Activities performed: As the chief specialist and member of the project team, in charge of reviewing and safeguarding the overall quality of the Manual. Drafts were disseminated and subsequently discussed among the team of national experts and stakeholders and then finalized successfully, in a plenary session presentation to the high officials of the Ministry and Rijkswaterstaat (Client).

Name of Assignment or Project: Technical Report Stability Factors (including update of “Water-Retaining Earthen Structures”)
Year: 2003 - 2007 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: This Technical Report provides a design method for determining the geotechnical stability factors (angle of internal friction and cohesion). These parameters are valid for all Dutch flood defences. In the update of the Technical Report “Water-Retaining Earthen Structures” attention has been paid to the schematisation of the substrate and the water pore pressures, the consequences of roots of trees and buildings on dikes, drainage systems, filter structures, watertight screens in dikes and mode of execution of dike civil works. The uncertainties inherent to the soil survey, e.g. complexity of the layering, forgotten sand gullies, classification of soil layers are included by introducing a schematisation factor.
Position held: Project Manager and River Morphologist
Activities performed: As Project Manager (Project costs: EUR 750,000), in charge of overall coordination, management, reporting and quality control of all deliverables to be submitted to the stakeholders and then submitted to the Ministry (Client).

Name of Assignment or Project: ComCoast (= COMbined functions in COASTal defence zones)
Year: 2002-2007 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: ComCoast is a European Union funded and initiated project (EUR 5,775,538) aimed to develop and demonstrate innovative solutions for flood protection in coastal areas across Europe. ComCoast creates and applies new methodologies to evaluate multifunctional flood defence zones from an economic and social point of view. A more gradual transition from sea to land creates benefits for a wider coastal community and environment. The aim of ComCoast is to explore the spatial potentials for coastal defence strategies for current and future sites in the North Sea Interreg IIIb region, considering the impacts of climate change.
Position held: Initiator and Technical Manager
Activities performed: Early 2000 no engineering tools were available to assess grass revetments on sea dikes. These sea defences not only protect the Netherlands but also parts of Belgium, to be tested along the various types of coasts encountered in those respective countries. Focus was put on a better understanding of the failure mechanisms of coastal flood protection works, in particular the natural grass cover system found on many coastal earthen dikes. Theoretical and practical tools were compiled, tested and then shared with all experts and colleagues of the member countries. Publications were written in international journals and disseminated during various International Conferences in England, Germany and Denmark. Therefore, the governmental agency Rijkswaterstaat tried to initiate a European project to improve the existing assessment models. As Manager, in charge of managing the daily coordination and cooperation between the participating member countries to synchronise the actions on the ground and establish common modus operandi for solutions Conferences.

Name of Assignment or Project: MOU Netherlands - China
Year: 2002-2007 **Location:** The Netherlands
Client: Ministry of Water Resources of China (Dike Technology)

Main Project Feature: Based on the Memorandum of Understanding between China and the Netherlands, scientific and engineering information was exchanged with respect to all relevant mechanisms related to the hazards, risks and safety of the hinterland (polders) during high river and sea water level events, such as flood control, scour and erosion, rip-rap (bed protection) and stone stability.
Position held: Project Manager
Activities performed: Organised and coordinated International Conferences and seminars on Flood Defence in Beijing, co-organised workshops, key-note lectures, to achieve all project modalities to facilitate the exchange of data and information stemming from research conducted in the Netherlands and China on flood mitigation works and stability of river works against scour and erosion phenomena. Special attention was paid to local scour phenomena around and downstream of hydraulic structures, contact erosion and outlet erosion (or piping) underneath hydraulic structures.

Name of Assignment or Project: MoA Netherlands – United States of America
Year: 2002-2004 **Location:** The Netherlands
Client: US Corps of Engineers

Main Project Feature: In the United States, bridge scour is one of the three main causes of bridge failure (the others being accidental waterway collision and overloading). It has been estimated that about 60% of all bridge failures result from scour and other hydraulic-related causes. It is the most common cause of highway bridge failure in the United States, where several major bridge failures resulted from scour near piers in the nineties. As a result of these bridge collapses an American delegation of scour specialists visited Europe (United Kingdom, The Netherlands, Germany and Switzerland) to learn from the European knowledge and experience in design and mitigation. Based on the Memorandum of Agreement between US Corps of Engineers and Rijkswaterstaat, scientific and engineering information was exchanged with respect to the different types of scour and the relevant geotechnical processes, such as shear failures and flow slides.
Position held: Scour Expert and geotechnical engineer
Activities performed: As Chair, organised the International Conference on Scour and Erosion held in Amsterdam (2004), coordinated seminars on scour in Delft and The Hague, (co-organised) workshops, key-note lectures, to achieve all project modalities to facilitate the exchange of data and information stemming from research conducted in the Netherlands and United States of America. As a special assistant to the Assistant Secretary of the Army (US Army Corps of Engineers), received an award from the Corps for his contribution in modelling scour and erosion (presented for excellence – serving the Nation and the Army).

Name of Assignment or Project: Experiment Bergambacht (Research Dike Technology)
Year: 1999 - 2001 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: In the nineties, the Netherlands were severely hit by extremely high-water levels in the rivers. Inhabitants and manufacturing companies and factories located in the Meuse valley experienced a lot of problems and substantial flood-related damage as a result. The dikes along the Rhine withstood the high floods, whereas at several locations they could have failed according to theoretical predictions. Among other things, based on the advice of a team of geotechnical specialists, over 200,000 people were evacuated as a precautionary measure. However, during the high-water period of 1995 hardly any of the dikes in the Netherlands deformed seriously. Hence, the Government had decided to devise a system to conduct such test modalities, aiming at a better safeguard for flood protection works such as a dike stability. Desk studies, laboratory tests and an earthen dike prototype experiment known as the Bergambacht test, were initiated to determine the actual strength of dikes. The importance of a better insight in the actual strength of dikes is threefold: 1) During high-water the decision to evacuate could be delayed and fewer evacuations may occur in the future; 2) Insufficient knowledge of the actual strength of dikes may lead to unnecessary and expensive reinforcements of a dike. In the Netherlands it is enforced by law that all dikes are checked every five years to guarantee the detailed safety of the hinterland, and unsafe dikes must be reinforced; 3) Due to climate change, a reduction of the difference between the model strength and the actual strength could be established and further used for the said safety assessment procedures.
Position held: Project Manager, River Morphologist
Activities performed: In order to simulate the strength of a typical dike along the Dutch rivers the test dike near Bergambacht was used for benchmark testing. As a project manager, organised all activities needed for testing the dike, such as the preparations of the test, coordinating the predictions of the failure of the dike, communicating with the press. The project costs, including research and study were EUR 2,150,000.

Name of Assignment or Project: Research program granular filters
Year: 1999 - 2004 **Location:** The Netherlands/Germany/United Kingdom
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat, in cooperation with the Bundes Anstalt fur Wasserbau in Karlsruhe (Germany) and Kingston University London (United Kingdom)
Main Project Feature: Granular filter elements are robust and give a good contact interface between the filter and base layers of earthen structures such as dams, dikes and retaining walls. Granular filters can smoothen bed irregularities providing a more uniform construction base. Moreover, they are easy to repair. The major disadvantage of granular filters is the difficulty of achieving uniform construction underwater to ensure the required design thickness of each and every successive filter layer. Different loading parameters in horizontal granular filter layers have been established. The

turbulence in open channel flow acts on the protective bed and penetrates through the pores. Laboratory tests and theoretical mathematical modelling were set up and jointly conducted in close cooperation with the Bundesanstalt fur Wasserbau, Germany and Kingston University London, UK.
Position held: Initiator of FERC (Filter Erosion Research Club) and Project Manager
Activities performed: As a hydraulic engineering specialist, examined the flow characteristics in the open pores of granular filters. Based on Laser Doppler measurements, velocity profiles were derived in order to determine the thickness of both the top layer and filter layer (so-called geometrical-open filter). This bed protection differs from the traditional one as defined by Terzaghi and Peck (geometrical-closed filters). Although both filters are internally stable, the thickness of geometrical-open filters is significantly smaller and therefore cheaper, and hence interesting for practical use. Several international publications have been written on this topic. The total research costs were EUR 1,500,000.

Name of Assignment or Project: Technical Report "Water-Retaining Earthen Structures"
Year: 1999 - 2004 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: This Technical Report is a tool to design and manage water-retaining earthen structures, in particular with regard to its geotechnical stability aspects. It covers all the geotechnical parameters that play a role in the static and dynamic stability of the structures. All state-of-the-art scientific and engineering references and design methods have been compiled and processed in a comparative analysis, including computations and standardisation rules. The structures under review related to water retaining functions of structures located in urban areas, along roads, highways, bridges and agricultural exploitations and the Project aimed at the uniformization of the nation-wide practice among consultants, professionals and practising engineers.
Position held: Project Manager
Activities performed: As Project Manager**,** coordinated and managed the team of researchers, scientists and engineers from various institutions and consulting firms to write, edit and publish the said Technical Report (Project costs: EUR 650,000).

Name of Assignment or Project: Technical Report "Sand Boils"
Year: 1997 **-** 1999 **Location:** The Netherlands
Client: Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat
Main Project Feature: Piping is a phenomenon which can threaten the stability of flood defences. This phenomenon can arise when particles of soil in an earthen dam or embankment under the action of extreme large-scale hydraulic head are likely to get eroded and being entrained and transported downstream underneath the flood defence structures (piping). Within the scope of designing new flood defences or reinforcing or monitoring existing ones, safeguards against the occurrence of these phenomena (piping hazards) must be verified. Various calculation rules are available to verify such safeguards, varying from simple empirical rules for the first (reinforcement) design for a flood defence or safety monitoring of an existing flood defence, to advanced calculation models to design or test more precisely.
Position held: Project Manager and River Morphologist
Activities performed: As chief Editor of the Technical Report and chair of the research project group wrote and edit and publish the Technical Report on Sand Boils, timely, successfully and within the given budget (Project costs: EUR 475,000).

Name of Assignment or Project: Revetments in Parana River
Year: 2000 - 2001 **Location:** Argentina
Client: Hydraulic Laboratory of the Argentina Institute for Water
Main Project Feature: The Paraná river is the second longest river in South America and of great importance for Argentina draining the large parts of the river basin. The lower reaches of the river form a delta which flows out into the Rio de la Plate. Between Rosario and Victoria, a bridge connection was built over this river with a width varying from 600 m to 2,000 m. The abutments and embankments were protected with a system of block mats placed on geotextile against the impacts of current and waves. The embankments consisted of sand, covered with a clay cover and vegetation.
Position held: Senior Hydraulic Engineer and River Morphologist
Activities performed: In charge of the design of the dimensions of both the bed protection and the scour holes close to the foundation of the bridge piers in the Paraná river (study costs: EUR 75,000). The design included the criteria and boundary conditions to ensure the geotechnical stability of the piers and abutments (occurrence of shear failures and flow slides) under all possible river hydrological scenarios. The design advice was widely reported (Revetments in Parana River).

Name of Assignment or Project: Design of Scouring and bed protection
Year: 1996 - 1998 **Location:** Japan
Client: Akashi National College of Technology (Scour & Erosion)
Main Project Feature: In order to establish a design of bed protection works, in-situ scour experiments were carried out in which the bed roughness was varied. The time-dependent scour including the equilibrium scour depth was investigated using both Japanese and Netherlands scour equations/models.
Position held: Chief Designer River Training Works

Activities performed: As a Chief Designer, exchanged scientific and engineering information regarding scour and erosion processes downstream of bed protections, writing memoirs for Akashi National College of Technology No.41 (1998). The study and research costs were EUR 175,000.

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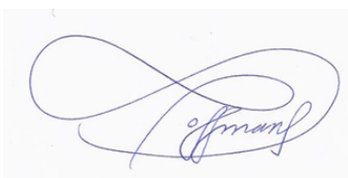
Certification:
I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience, and I am available, as and when necessary, to undertake the assignment in case of an award. I understand that any misstatement or misrepresentation described herein may lead to my disqualification or dismissal by the Client.

GIJS HOFFMANS		27 February 2024
Name of Expert	Signature	Day/month/year