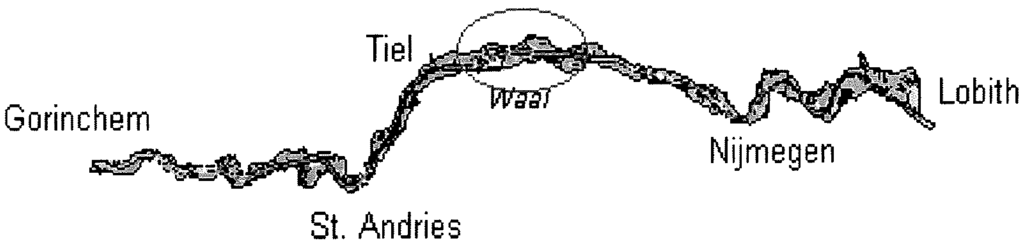
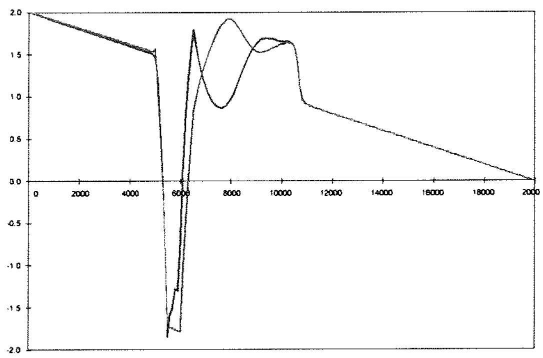
- One and two dimensional effects of floods on river morphology: a SOBEK model for River Waal

- 2D effects of channel narrowing

July 1998

Mário Franca





TU Delft
Delft University of Technology

Faculty of Civil Engineering and Geotechnics
Hydraulic and Geotechnical Engineering Division
Hydraulic Engineering Group

CONTENTS

APPENDICES

APPENDIX 1 - DATA

APPENDIX 2 - 1D MODEL

APPENDIX 3 – 2D MODEL

APPENDIX 4 – MAIN CHANNEL 2D MODEL

APPENDIX 5 – COMPUTATIONAL RESULTS OF THE 1D MODEL

APPENDIX 6 - COMPUTATIONAL RESULTS OF THE 2D MODEL

APPENDIX 7 – COMPUTATIONAL RESULTS OF THE MODEL WITH ONLY THE MAIN CHANNEL

APPENDIX 8 – RESULTS FROM THE SIMULATION OF A CONSTRICTION IN A CHANNEL

LIST OF FIGURES

LIST OF TABLES

PREFACE

This report is the result of my final project for obtaining the Civil Engineer degree, realised in TUDelft – Faculty of Civil Engineering. My presence in Delft was as an exchange student from Erasmus/Socrates programme.

The Civil Engineering Department of Instituto Superior Tecnico (IST) – Universidade Tecnica de Lisboa provides the chance for students, to trade the last semester of lectures by a practical project in a foreign faculty. In this way the opportunity is given to make the experience of studying abroad and to finish their course with a practical application.

To be valid, this project had to be in the field of one of the five final lectures that it is supposed to substitute. In this case the subject is River Hydraulics.

In the beginning of my stay in Delft, my background about River Hydraulics was very limited, since I hadn't any lectures about it. In almost five months I first had to learn some knowledge about these matters. After this learning stage, I was finally able to apply the new knowledge in this work.

This kind of work was new to me; I had to guide myself in what I needed to do, following the guidelines from my supervisors. I think it was a very profitable experience for my way of dealing with future projects.

Also the experience of living abroad is very profitable. Despite missing my friends in Portugal and all that things that I was used to, I think this was the best way to spend my final 5 months of the course. This way we can win really good friends and we can open our mind to different ways of living.

I advise all my colleagues to do it.

Acknowledgements

I start to express my gratitude to Prof. de Vriend for his kindness on accepting me to do this work, without any previous warning about my arrival, and for the trust and help during this four and a half months.

A special thanks to Fred Havinga that, more than a supervisor was a friend. He helped me during these five months not only in my work difficulties but also with some "out-faculty" problems.

My gratitude to Prof. Heleno Cardoso who helped me from Portugal, giving me good advice and sending me useful information for the success of this project.

I also want to express here my gratitude to some other persons that helped me with my work, Kees Sloff from Delft Hydraulics, Ard Wolters from Rijkswaterstaat/RIZA, Arthur Balsters that was also working with SOBEK here in the faculty, and to Mark Voorendt the network manager here in the faculty.

Thanks also to Dr. Van Mazijk, student exchange co-ordinator, for receiving me here in Delft as an Erasmus/Socrates student, and thanks to Prof. Hipólito from IST who supported and helped me in all the process that led me here to TUDelft.

Besides technical help I had lots of friends that supported me here, that I want to thank; a special gratitude to Pedro who was here in Delft with me, and to Grard my "room mate" here in the faculty.

And a very special mention to Luisa and my family that helped and supported me during my stay here in Delft (Obrigado pai e mãe).

Mário Franco

Delft, July 1998

ABSTRACT

The importance of the Rhine and its branches is unquestionable. It has an important role as an attraction point to human activities and as a navigation channel from the North Sea into Europe. The present report is one of the numerous studies made for the Rhine branches, in this case the River Waal.

The main "tool" used during this work is SOBEK, a software package developed by Delft Hydraulics and the Institute of Inland Water Management and Waste Water Treatment (RIZA) of the Dutch government.

In this report, a one-dimensional model for the river Waal is presented, see *Chapter 3*. This model was used for several simulations that led to the following conclusions.

By means of the 1D model SOBEK it was possible to conclude that the dominant discharge can be used to predict riverbed changes without losing accuracy, see *Chapter 6*. When using a variable discharge for river simulations a simplification can be made by averaging the peaks, see *Chapter 6*.

With the results from the 1D model some parameters of the Waal were computed as relaxation, wave and damping lengths, see *Chapter 6*.

In the present work an attempt was made to use the *quasi* two-dimensional option of SOBEK (Sedredge) to model the interaction between the floodplains and the main channel during periods of high water periods, see *Chapter 4*.

A two-dimensional model was built with this propose. This model was based on two parallel and laterally coupled channels, one simulating the main channel and the other the floodplains.

Unfortunately the simulations showed the impossibility of doing this. SOBEK didn't compute any sediment exchange between both channels probably due to the large difference of levels between them. Another incapacity of SOBEK is related with the fact that it doesn't work when one of the channels is not inundated, see *Chapter 7*.

With a one-dimensional model and with a two-dimensional model (2 parallel channels) for the main channel, it was possible to make conclusions about the relative importance of the bends and of the floodplains in the Waal, see *Chapter 8*.

Definitely the influence of the floodplains on the river morphology is minor when compared with the influence of the bends. The difference of levels between the two channels in the two-dimensional model is considerable. When neglecting them, this will have large morphological consequences. Hence it is suggested that any future study about this Rhine branch should include the bends.

In *Chapter 9* one simulation is presented to study river behaviour when there is a narrowing in a channel. For this simulation an academic model was built based on characteristics of the Waal.

The simulations were made for a permanent constriction and for a temporary one.

In the case of a permanent constriction the evolution of the riverbed to its equilibrium state can be seen. The local perturbation creates a sand wave, which propagates downstream before the river reaches the equilibrium. Upstream the river doesn't show any kind of perturbation.

After removing the obstacle after 3 years, the perturbation starts migrating downstream, damping as it proceeds. The riverbed takes a long time to re-establish the equilibrium bed along 15 km.

An important fact to remind is that the consequences of making the constriction are not only felt locally, but have a large influence downstream.

Two floppy disks are provided with this report, which contain all the model inputs used, for the benefit of future simulations and improvements, and two animations (avi files) related with the *Chapter 9*. The latter show the development of the riverbed in both simulations, the definitive and temporary constriction.

RESUMO

A importância do Rio Reno e das suas ramificações é inquestionável. Desempenha um importante papel como pólo de atracção para as mais diversas actividades humanas, e constitui uma porta à navegação do Mar do Norte para a Europa. O presente relatório é mais um de numerosos estudos feitos sobre as várias ramificações do Reno, neste caso o Rio Waal.

A principal "ferramenta" utilizada neste trabalho é o SOBEK, *software* desenvolvido pelo *Delft Hydraulics* e pelo *Institute of Inland Water Management and Waste Water Treatment (RIZA)* do governo holandês.

SOBEK é um modelo unidimensional que permite a resolução de equações que descrevem fenómenos relacionados com escoamento, intrusão salina, transporte de sedimentos, morfologia e qualidade da água em rios.

Apesar de ser um modelo unidimensional, dispõe de um módulo que permite simular de um modo grosseiro efeitos bidimensionais tais como: tratamento distinto entre leito de cheia e canal de estiagem; distinção entre processos de qualidade de água no leito de cheia e canal principal. Dispõe ainda de um método *quasi*-bidimensional para morfologia fluvial.

Neste relatório é apresentado um modelo unidimensional para o Rio Waal, ver *Capítulo 3.* Este modelo foi utilizado para várias simulações que levaram às seguintes conclusões.

Através da utilização do modelo unidimensional SOBEK foi possível concluir que a utilização do caudal dominante na previsão de alterações morfológicas no leito do rio é perfeitamente válida, sem com isso haver perdas significativas de precisão, ver *Capítulo 6.* Quando é utilizado um hidrograma correspondente a um caudal variável uma simplificação pode ser feita; substituindo os picos do gráfico pela sua média não introduz nenhuma perda de precisão, ver *Capítulo 6.*

Com os resultados do modelo unidimensional forem calculados alguns parâmetros para o Rio Waal como comprimentos de adaptação, comprimento da onda de sedimentos, e constante de decaimento da função onda de sedimentos, ver *Capítulo 1* e *6* .

No presente trabalho é apresentada uma tentativa de utilização do módulo *quasi* bidimensional do SOBEK para modelar a interacção entre o leito de cheia e o leito de estiagem em períodos de cheia, ver *Capítulo 4.* Para tal foi elaborado um modelo bidimensional. Este modelo é baseado em dois canais paralelos, lateralmente associados, um simulando o canal principal o outro o leito de cheia.

Infelizmente as simulações feitas demonstraram a impossibilidade de tal modelação. O programa SOBEK não permitiu calcular nenhuma troca de sedimentos entre os canais, provavelmente devido à grande diferença de níveis entre os dois. Outra incapacidade do modelo SOBEK está relacionada com o facto de este instabilizar quando um dos canais não está inundado, ver *Capítulo 7.*

No capítulo seguinte foram elaborados um modelo unidimensional e um modelo bidimensional (2 canais paralelos) só para o canal principal. Com estes foi possível chegar a conclusões acerca da importância relativa das curvas e do leito de cheia no Rio Waal, ver

Capítulo 8.

Sem dúvida a influência do leito de cheia na morfologia do rio é desprezável quando comparada com a influência das curvas. A diferença de níveis entre os dois canais resultantes do modelo bidimensional é importante. Se as curvas forem negligenciadas, o erro cometido pode originar graves e inesperadas consequências na morfologia do rio. Assim, sugere-se que em qualquer futuro estudo acerca do Rio Waal as curvas do rio sejam sempre incluídas.

No *Capítulo 9* é apresentada uma simulação que permite estudar o comportamento de um rio na presença de um estreitamento. Foi construído um modelo fictício, baseado em características do Waal para esta simulação.

Foram feitas experiências para estreitamentos definitivos e para estreitamentos temporários com a duração de 3 anos.

Pode ser observada uma evolução do leito do rio desde a colocação do estreitamento até atingir o estado de equilíbrio. A perturbação local cria uma onda de sedimentos que se encaminha para jusante, após a qual o rio atinge finalmente o estado de equilíbrio. O leito do rio não sofre qualquer perturbação a montante.

Se o obstáculo for retirado após 3 anos, inicia-se um movimento de translação da perturbação para jusante. A amplitude desta perturbação decai exponencialmente com a distância. O leito leva muito tempo a recuperar a sua forma inicial nos 15 km que constituem este trecho de rio.

Verifica-se que este tipo de singularidades num rio, exerce a sua influência não só localmente mas propagando-se para jusante.

Duas *diskettes* incluem-se neste trabalho onde estão disponíveis os modelos utilizados e que poderão ser utilizados para futuras simulações e para futuros melhoramentos. Nas *diskettes* encontram-se também dois filmes (ficheiros avi) que dizem respeito às simulações do *Capítulo 9*; desenvolvimento dos leitos quando a constrição é temporária e quando é definitiva.

1. INTRODUCTION

The use of the River Rhine and its branches for navigation and its influence as a caller of human activities justify the numerous studies that are developed around it.

This work is one more of these analyses, and it pretends to study long term morphological changes in one of the Dutch Rhine branches, the River Waal.

This Waal part in study is located between 900km and 910km relative to the Rhine datum. The figure shows its location in The Netherlands and relative to the Rhine branches.

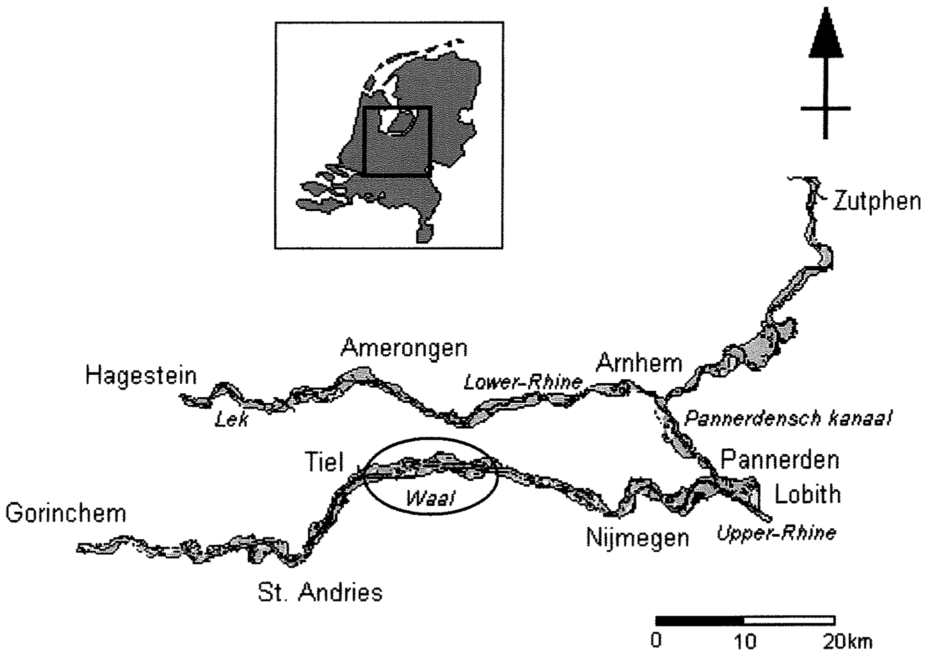


Figure 1.1 – Location of the Waal relative to Netherlands and to the Rhine branches (in Ref. 17)

In the present work the basic tool is SOBEK, a computational 1-D river model. This model is useful to simulate the morphological changes in a river in short and in long term. It provides an opportunity to deal in a coarse way with two-dimensional problems.

A model of a part of the River Waal will be modelled, and some model experiments will be made. These experiments have several objectives, such as:

- to calibrate and build a simple but efficient model of this part of the Waal;
- testing the use of the dominant discharge in river simulations, comparing it with the use of annual hydrographs;

- testing the suitability of the *quasi* two-dimensional option of SOBEK to model the interaction between the floodplains and the main channel in flood conditions;
- compare the importance of the floodplains influence with the bends influence in this Rhine branch, and evaluate them.

Also a fictitious model, with Waal characteristics will be build, to simulate the effects of a temporary and definitive constriction of the riverbed. Despite not being a real case, this model is quite useful, at least to have a notion of what is happening when a constriction exists in a river like the Waal.

In this chapter some basic notions about SOBEK and about the phenomena in study are given.

1.1. The one dimensional model SOBEK

SOBEK is a software package developed by Delft Hydraulics and the Institute of Inland Water Management and Waste Water Treatment (RIZA) of the Dutch government.

It is a one-dimensional open-channel dynamic numerical modelling system capable of solving the equations that describe unsteady water flow, salt intrusion, sediment transport, morphology and water quality.

It is very useful to solve several kinds of river management problems, like flood protection, design of canals, irrigation systems, water quality, navigation and dredging.

The main limitations of this programme are related to the one-dimensionality of the model, which means that it works only with cross sectional averaged values of parameters and variables.

However, the model is able to simulate in a coarse way two-dimensional effects like floodplains in the cross sections, distinction between water quality processes in main channel and in floodplain, and a method for *quasi* two-dimensional river morphology.

In the present work only the modules related with water flow, sediment transport and morphology will be used.

The basic equations

There is a coupled set of equations that SOBEK has to solve numerically, in order to describe the water flow in one dimension, and to describe also the bed level variations induced by the sediment transport, (see Ref. 12).

SOBEK uses the following equations:

The continuity equation for water:

$$\frac{\partial A_t}{\partial t} + \frac{\partial Q}{\partial x} = q_{lat} \qquad (1.1)$$

The momentum equation:

$$\frac{\partial Q}{\partial t}+\frac{\partial}{\partial x}\left(\alpha_b\cdot\frac{Q^2}{A_f}\right)+g\cdot A_f\cdot\frac{\partial h}{\partial x}+\frac{g\cdot Q\cdot|Q|}{C^2\cdot R\cdot A_f}-W_f\cdot\frac{\tau_{wi}}{\rho_w}+g\cdot A_f\cdot\eta+\frac{g}{\rho_w}\cdot\frac{\partial\rho}{\partial x}\cdot A_{1m}=0 \tag{1.2}$$

Continuity equation for bed material:

$$\frac{\partial A}{\partial t}-\frac{\partial S}{\partial x}=-s_{lat} \tag{1.3}$$

where

A_t – total cross section area [L^2]
Q – discharge [L^3T^{-1}]
q_{lat} – lateral discharge per unit length [L^2T^{-1}]
t – time [T]
x – distance along the river axis [L]
α_b–Boussinesq constant [-]
A_f – cross-section flow area [L^2]
g – gravity acceleration [LT^{-2}]
h – water level [L]
C – Chézy's coefficient [$L^{1/2}T^{-1}$]
R – hydraulics radius [L]
W_f – flow width [L]
τ_{wi} – wind shear stress [$L^{-1}MT^{-2}$]
ρ_w – water density [ML^{-3}]
η - additional resistance coefficient [-]
ρ – water density [ML^{-3}]
A_{1m} – first order moment cross-section
A – cross-section area [L^2]
S – sediment transport through the cross-section [L^3T^{-1}]
s_{lat} – lateral sediment supply [L^2T^{-1}]

More details of these equations can be found in Ref. 12.

The sediment transport is estimated by using of sediment transport formulas. The ones that are available in SOBEK are:

- Engelund & Hansen (1967)
- Meyer-Peter & Muller (1948)
- Ackers & White (1973)
- Van Rijn (1984)
- Parker & Klingeman (1982)
- general user adjustable formula

More information on these formulas can be found in Ref. 2, 5, 7, 8, 9 and 12.

The water movement equations, (1.1) and (1.2), are discretised using the Preissmann box scheme. The discretisation of their different terms is described in Ref. 12, as well as the explanation of the equation solutions. The equation (1.3) is solved by an explicit numerical method of the Lax-Wendroff type.

These equations are solved in a *quasi* uncoupled way. The flow and cross sections computations are executed alternately in an interactive time loop. The next scheme is from the Ref. 12 and illustrates this, for a better understanding it is advisable to consult it.

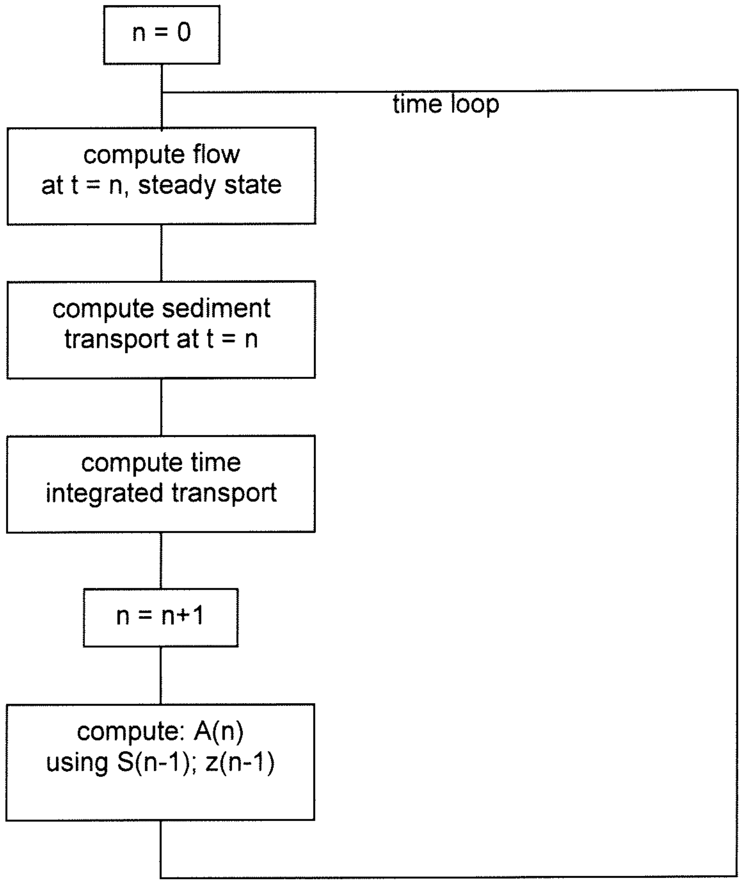


Figure 1.2 – Sequence of iterative morphodynamic computation in a river (Ref. 12)

Later in this report, the SOBEK's *quasi* two-dimensional morphology option will be used. To use this option the cross section of a river is schematised into two parallel and laterally coupled channels.

Water and sediment flow are computed in both channels, as well as in the transverse direction. This leads to bed changes both in the longitudinal, and in the transverse direction.

The sediment transport formula used to compute the longitudinal transport is also used for the transverse transport, using approximated exchange parameters calculated by SOBEK (see Ref. 12).

The following scheme is also from the Ref. 12 and shows a computational flow diagram of the *quasi* two-dimensional morphology option.

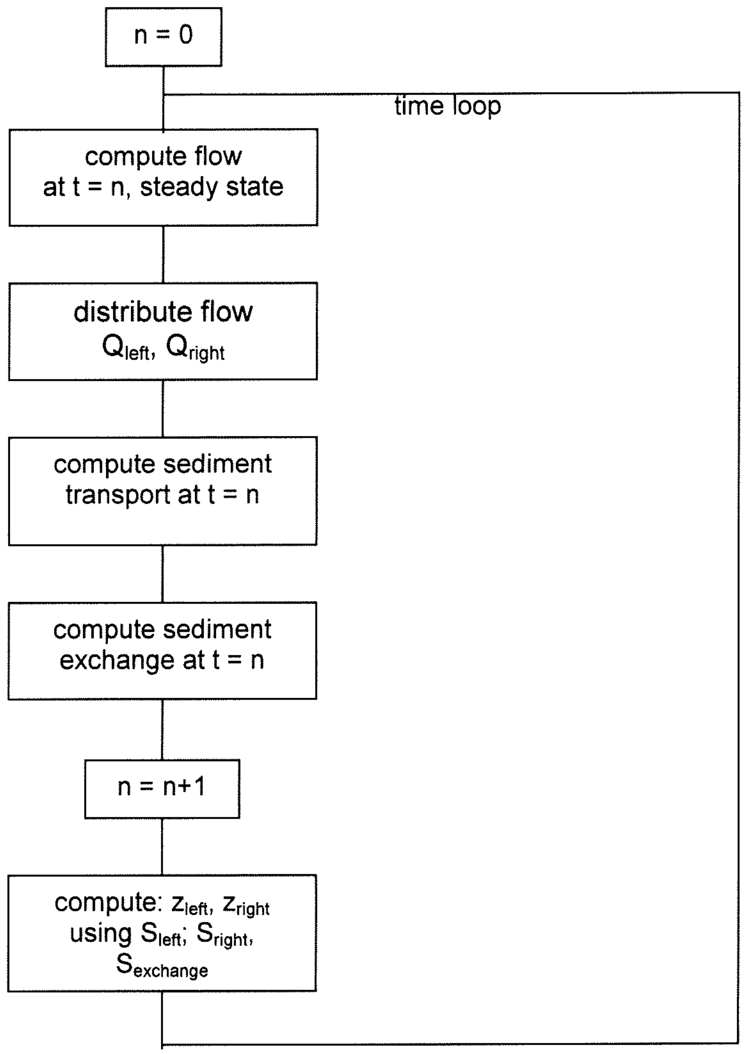


Figure 1.3 – Flow diagram of morphodynamic computation in a river using the 2D option (Ref. 12)

1.2. Dominant discharge

"The dominant discharge is defined as the constant discharge which, when maintained throughout the year, yields exactly the same yearly sediment load as the natural varying discharge" (Ref. 15).

It is logic that this discharge doesn't reproduce the exact river changes due to periodic variations, but it can be related with some river characteristics, and sometimes the results are quite satisfactory, (Ref. 8).

Its use was very popular, due to the limited computer capacity available until some years ago. Now the technology allows to use a complicated hydrograph in simulations of the river behaviour.

However, the use of a dominant discharge can still be a good choice, because of difficulties in determining the hydrograph, and of the extensive input process that it may entail.

The derivation of the dominant discharge calculation that follows is based on Ref. 15.

Consider one variable discharge for a river. The hydrograph, Q, can be schematised in several time intervals, Δt, corresponding to a discharge, Q_i, and with a probability of occurrence α_i.

When Δt tends to 0, Q_i can be considered as a stochastic variable. The probability density function is $p(Q)$, and by definition:

$$\int_{-\infty}^{\infty} p(Q) \cdot dQ = 1 \qquad (1.4)$$

There are no negative values of discharge, hence:

$$\int_{0}^{\infty} p(Q) \cdot dQ = 1 \qquad (1.5)$$

The expectation of the discharge, $E(Q)$, is given by:

$$E(Q) = \int_{0}^{\infty} Q \cdot p(Q) \cdot d(Q) \qquad (1.6)$$

The hydrograph referred above is discretised, hence it is possible to have:

$$E(Q) = \sum_i \alpha_i \cdot Q_i \qquad (1.7)$$

As the discharge is a stochastic variable, represented by a probability density function, the sediment transport is also one:

$$E(S) = \int_{0}^{\infty} S(Q) \cdot p(S) \cdot dS \qquad (1.8)$$

The total sediment load in a year can be computed as follows:

$$\forall = T \cdot E(S) = T \cdot \int_{0}^{\infty} S(Q) \cdot p(S) \cdot dS \qquad (1.9)$$

where

T - is the number of seconds in a year, $T = 31.5 \times 10^6$ s

Considering a transport formula of the kind $s = a \cdot u^b$ (like Engelund & Hansen), we have the total sediment transport give by:

$$S = W \cdot s = W \cdot a \cdot u^b \qquad (1.10)$$

where

W – the width oh the river [L]
b, a – transport formula coefficients
u – flow velocity [LT^{-1}]

$$u = \frac{Q}{W \cdot h} \qquad (1.11)$$

where

h – is the water depth [L]

If the flow is uniform, Chézy's law can be used to represent the relation between the velocity, u, the water depth, h, the Chézy's coefficient, C, and the riverbed slope, i:

$$u = C \cdot \sqrt{h \cdot i} \qquad (1.12)$$

Combining this last with the next relation:

$$Q = W \cdot u \cdot h \qquad (1.13)$$

it can be obtained:

$$Q = W \cdot C \cdot \sqrt{i} \cdot h^{3/2} \qquad (1.14)$$

Combining (1.10) with (1.11), eliminating h from this expression, and from (1.14) yields:

$$S = a \cdot W^{1-b/3} \cdot Q^{b/3} \cdot i^{b/3} \cdot C^{2b/3} \qquad (1.15)$$

The river characteristics considered are from the initial conditions of the riverbed.

With $V = T \cdot E(S)$, the dominant discharge, Q_d, is obtained by:

$$Q_d = \left(\frac{E(S)}{a \cdot W} \right)^{3/b} \frac{W}{C^2 \cdot i} \qquad (1.16)$$

in which W is assumed to be the same for every discharge.

1.3. Floodplains

The floodplain is the area that is inundated in periods of high water. During floods, the main channel doesn't have the capacity to transport all the water, hence the water level rises above the summer dikes and the floodplains are inundated.

Many works has been made in the Rhine branches in order to control and restrict the propagation of floods. However, the floodplains can be well used for several activities during the low water, like agricultural, nature development, and recreation. The next figure shows a scheme of the usual situation of the Rhine branches.

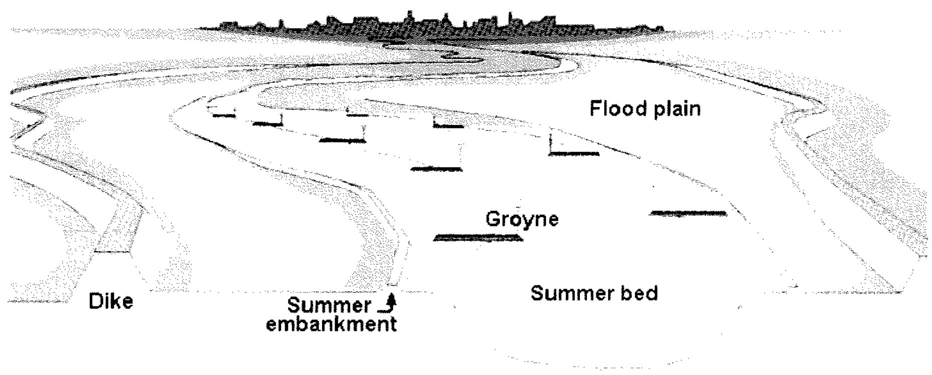


Figure 1.4 – Scheme from a Rhine branch (in Ref.17)

When the river floods, the floodplains add not only to storage but also to the conveyance of water. After a flood, significant amounts of sediment may remain here.

This sediment storage is due to the high amount of sediments transported in the main channel. When the water flows into the floodplains the velocities decrease and consequently accretion occurs.

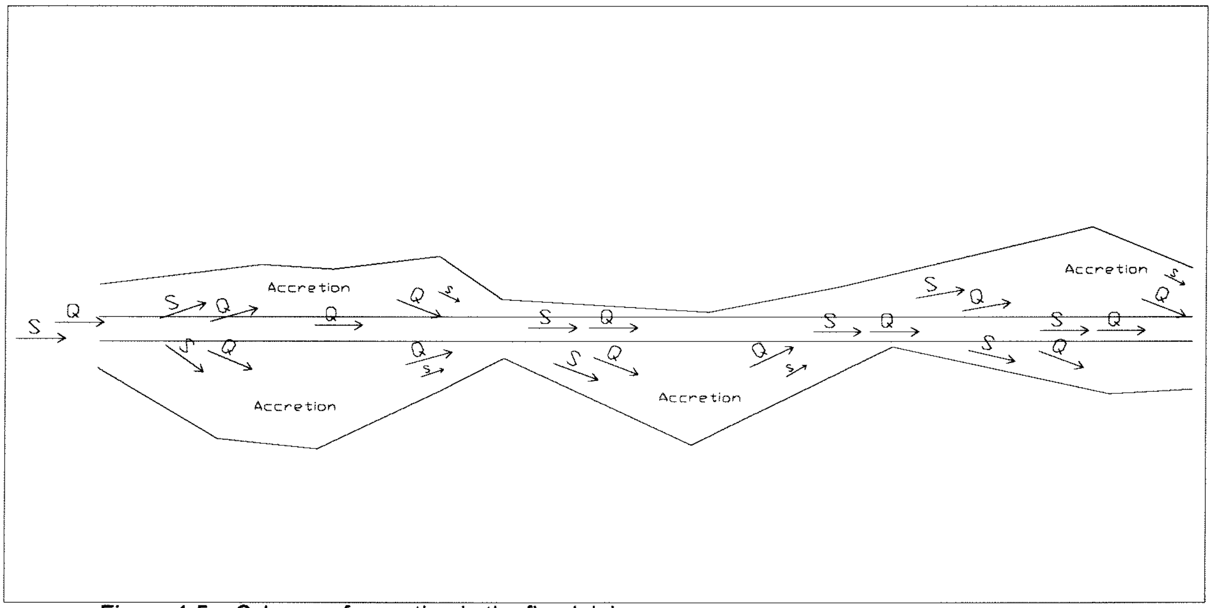


Figure 1.5 – Scheme of accretion in the floodplains

The next figure shows a scheme of the way the water flows in a high water period, and what effects are expected to happen.

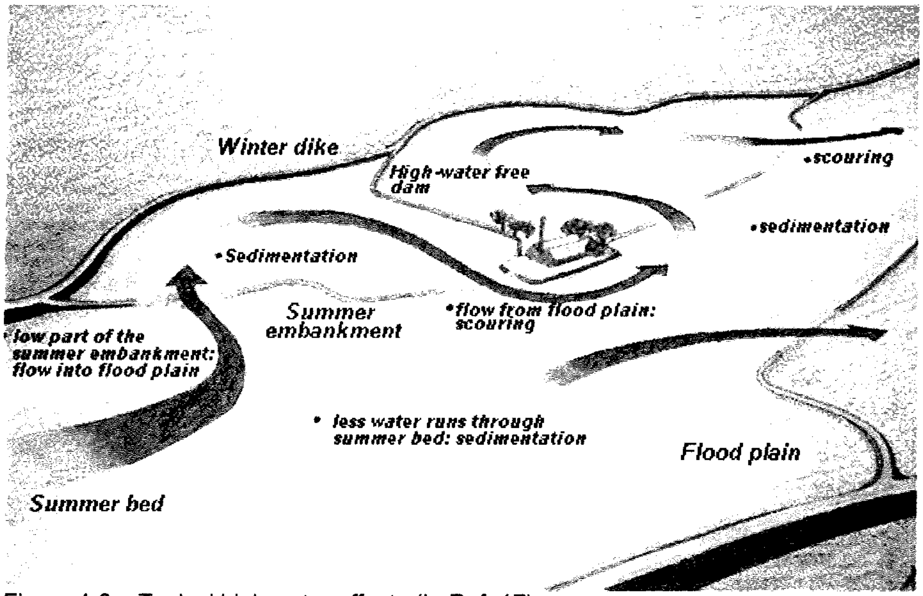


Figure 1.6 – Typical high water effects (in Ref. 17)

Later in this report an attempt will be made to model the interaction between the main channel and the floodplains, using the *quasi* two-dimensional option of SOBEK.

1.4. River bends

The presence of a bend in a river induces modifications in the transverse velocity profiles. The main characteristics of these new profiles are:

- the surface water will have a transverse velocity component towards the outer bend;
- the bottom water will have a transverse velocity component towards the inner bend;
- the distribution of the velocities in the horizontal plane will not be uniform, but asymmetrical, with the maximum velocity shifting gradually from the inner to the outer bend.

These alterations are related to the superelevation of the water level, due to the centripetal acceleration. More details are given in Ref. 3, 6, 9, and 15.

This superelevation can be estimated from the application of Newton's second law of motion to the centrifugal action in a channel of constant curvature (Ref. 3).

$$\Delta h = \frac{u^2 \cdot W}{g \cdot R} \qquad (1.17)$$

where

R – is the bend radius [L]

The water surface takes the shape shown in Figure 1.4:

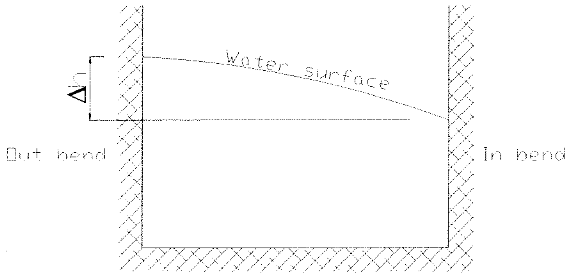


Figure 1.7 – Superelevation in a bend

This superelevation causes an inward force on the water particles, due to which they will follow a curved path. The curvature of that path is stronger near the bed, where the flow velocities are relatively low.

The resulting new motion can be decomposed in a downstream main flow and a transverse secondary flow, directed inwards near the bed and outwards near the surface. Continuity requires that the flow moves down near the outer bank and up near the inner bend. The resulting transverse circulation is namely called secondary flow.

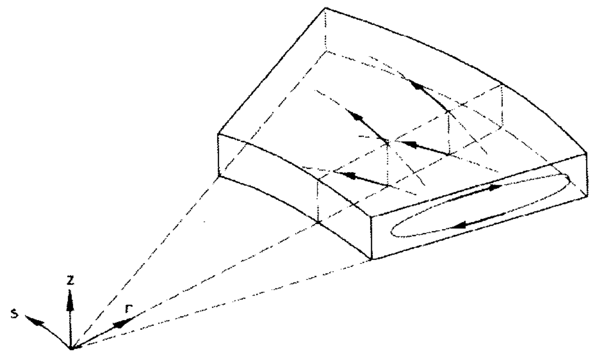


Figure 1.8 - Spiral flow in a river bend (in Ref. 8)

The combination of this secondary flow with the main flow through the downstream direction, gives a spiral flow (see Fig. 1.8).

This spiral flow induces also sediment motion in the transverse direction of the river. Consequently, there will be erosion near the outer bank, and accretion near the inner bank.

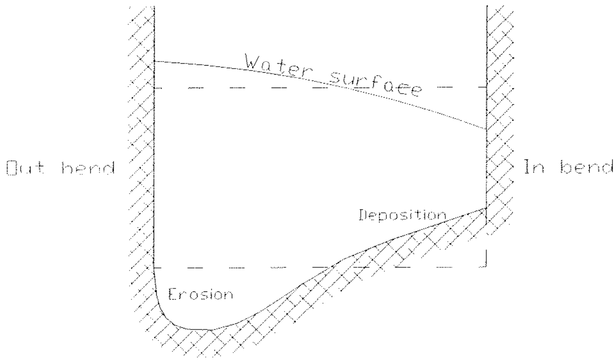


Figure 1.9 – Bend profile of a river

This phenomenon has some important implications to the river morphology such as (see Ref. 15):

- reduction of the effective navigable width;
- in the case of erodible banks, erosion of the outer bank occurs and accretion in the inner bank;
- the increased erosion of the outer bank has to be taken into account when designing bank protection works;
- any kind of structure to be placed in the bend, requires deeper foundations.

In SOBEK this river bend behaviour is modelled by schematising the river into two parallel and laterally coupled channels, which mutually interact (Ref. 15).

1.5. Relaxation, wave and damping lengths

In Ref. 15 the notion of flow relaxation length, sediment relaxation length, wave length and damping length of the morphological oscillating wave are introduced. These are indicators of how perturbations will behave downstream the river, i.e. the downstream distance over which morphological effects of a disturbance (e. g. bend) will extend.

In this chapter a first approach will be made on these lengths.

Flow relaxation length, λ_w, or adaptation length of main flow:

$$\lambda_w = \frac{C^2}{2g} \cdot h \qquad (1.18)$$

where

C – Chézy's coefficient [$L^{1/2}T^{-1}$]

h – water depth [L]
g – gravity acceleration [LT^{-2}]

This value indicates how the depth averaged flow field "recovers" from a perturbation. λ_W is the initial rate of the negative exponential function that reflects the evolution of the flow perturbation of decay.

Sediment relaxation length, λ_S, or adaptation length of bed topography development:

$$\lambda_s = \kappa(Y)\cdot\left(\frac{W}{h}\right)^2\cdot h\cdot\left(\frac{D_{50}}{h}\right)^{0.3}\sqrt{\theta} \tag{1.19}$$

where

$\kappa(Y)$ - factor which depends on the function that describes the transverse distribution of the bed levels [-]
W – channel width [L]
D_{50} – grain diameter for which 50% of the material is smaller [L]
θ – Shields parameter [-]

This length, λ_S, is related with the redistribution of sediment in the direction perpendicular to the flow, after a perturbation of the riverbed. It indicates how fast the system is able to redistribute.

The non-dimensional factor κ takes the value 1/8 in the case of a model where the river is schematised into two parallel channels. In this case the bed levels are distributed in the transverse direction following a step function.

Damping length, L_D, and wave length, L_P:

These two lengths, are related to the evolution of the river bed levels in a model in which the river is schematised into two parallel and laterally coupled channels, according to Ref. 15. This solution has the form:

$$Z_b(x,y,t\to\infty) = f(y)\cdot e^{-\frac{x}{L_D}}\cdot\sin\left(\frac{2\pi\cdot x}{L_P}-\Phi\right)-\Delta Z_b \tag{1.20}$$

As can be seen L_P is the wavelength of the perturbation, and the parameter L_D is the initial slope of the exponential that forms the envelope of this wave.

They can be computed from the following expressions, (Ref. 15):

$$\frac{2\pi}{L_P}\cdot\lambda_W = \frac{1}{2}\cdot\sqrt{(b+1)\cdot\frac{\lambda_W}{\lambda_S}-\frac{\lambda_W{}^2}{\lambda_S{}^2}-\frac{b-3}{2}} \tag{1.21}$$

$$\frac{\lambda_W}{L_D} = \frac{1}{2} \cdot \frac{\lambda_W}{\lambda_S} - \frac{b-3}{4} \tag{1.22}$$

where

b – is the exponent of a power transport formula of the kind $s = a \cdot u^b$

The parameter $I_P = \frac{\lambda_S}{\lambda_W}$ is an indicator of the way the wave develops. The amplitude of the wave can grow with x or can damp with x, depending on this ratio.

For example, when b = 5 (Engelund & Hansen), the value I_P = 1 is a limit, case in which the wave amplitude is exactly constant. If I_P < 1 the wave will decay exponentially, if I_P > 1 the wave grows exponentially.

2. DATA

For the Waal branch data was used supplied by the Rijkswaterstaat/RIZA.

The topographic data from this branch of the River Waal is presented in the *Appendix 1*. It is a grid with (X, Y, Z) co-ordinates, where X is the distance measured along the lines with the channel axis direction, Y is the co-ordinate in the transversal direction and Z is the bed level. This 2-D grid consists in 70 longitudinal lines and 108 cross sections.

Not all the grid co-ordinates are presented in this report, for practical reasons, but only the ones that are relevant for the work. In *Appendix 1* only the grid is represented.

The data that is used here is from the River Waal, recollected in the years of 1995/96.

In *Appendix 1* a drawing of the grid used, a coloured map of the branch that gives a perception of the altimetry, and a topographic map of the part of the Waal corresponding to the model is presented.

A hydrograph correspondent to the year 1997 will also be used further in this work. It can be found in *Appendix 1*.

3. CONSTRUCTION OF THE 1D MODEL OF THE RIVER WAAL

The construction of this model is not a static process. It is a mixture of definition and re definition of model characteristics, and computations which will lead to a final model that must be representative of the prototype.

The 1-D model is composed of one branch, with several cross sections.

To build a one dimensional SOBEK model of this Rhine branch, it is necessary to define the following inputs:

- Main channel axis
- Cross sections
- Bed friction
- Boundary conditions
- Initial conditions
- Transport formula
- Numerical parameters

The calibration was made for two types of discharge, one corresponding with low water flowing in the main channel, and another corresponding with high water where flow also takes place in the floodplains. The model was calibrated against the results of Delft 2D, a two-dimensional model also developed by Delft Hydraulics, and other data from Rijkswaterstaat.

The model was calibrated against water levels, flow velocities, and bed levels. The water levels and the bed levels were taken from the Delft 2D model, and the flow velocities were from measurements of the Rijkswaterstaat, see Ref. 11.

3.1. Main channel axis

The definition of a line to be considered as the main channel axis is essential to work with a 1-D model. This line is the basis of the whole model.

The data includes a 2-D grid, which consists of 70 longitudinal lines and 108 cross sections. One of the 70 longitudinal lines will be used as the main axis.

The grid is denser in the main channel, which is easy to locate. Therefore, one of the grid lines was chosen to be the channel axis.

The chosen line is the ETA 30. The next figure shows a sketch of the axis, and it co-ordinates can be found in *Appendix 2*.

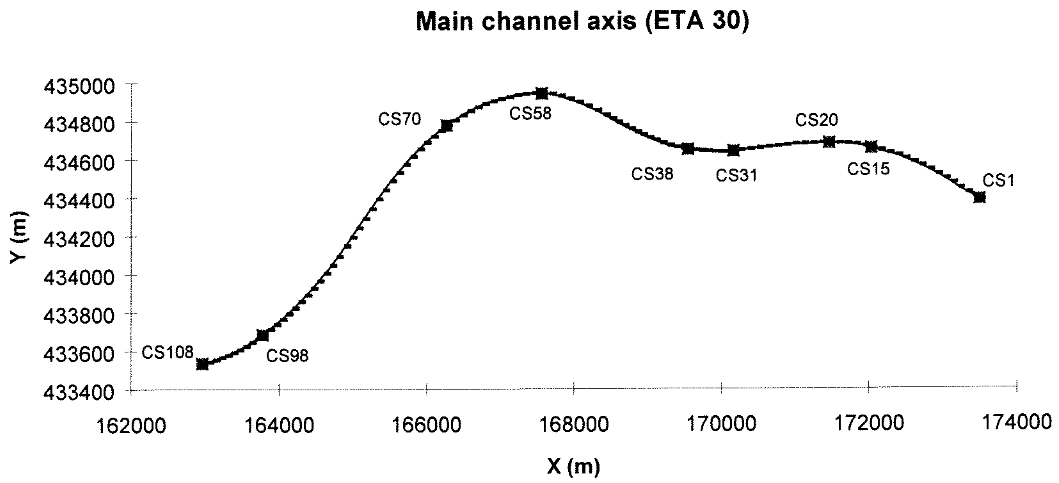


Figure 3.1 - Main axis (without any specific scale)

With the main channel axis chosen, the whole model will be based on it. The total length of the axis, and consequently of the model, is L = 10854.69 m. The model will be developed around this axis, but bends will not be considered in this 1D model.

3.2. Cross sections

The next step to take was to choose which of the 108 cross lines of the grid will be used to define the cross sections.

The objective is an approximate model which suites a one dimensional analysis with SOBEK, and which can also be adapted, easily, to a *quasi* two dimensional SOBEK model (see *Chapter 4*).

The cross sections chosen are in the transitions where the river changes from a mainly one-dimensional flow to places where the transverse dimension is important. In addiction cross sections are taken in upstream and downstream nodes.

Nine lines were selected, *viz.* 1, 15, 20, 31, 37, 58, 70, 98 and 108 (see *Appendix* 2). Their location is given in Figure 3.1. The next table shows the locations of the cross sections relative to the upstream node.

Cross sections	Location in the branch [m]
CS1	0.00
CS15	1492.43
CS20	2062.18
CS31	3361.72
CS38	3977.01
CS58	5987.70
CS70	7297.70
CS98	10026.68
CS108	10854.69

Table 3.1 - Location of the cross sections

The cross sections were introduced into the model via the tabular option of SOBEK. Hence they are considered symmetric.

It was decided that the cross sections of this model should have a very simple shape, similar to the one shown in Figure 3.2:

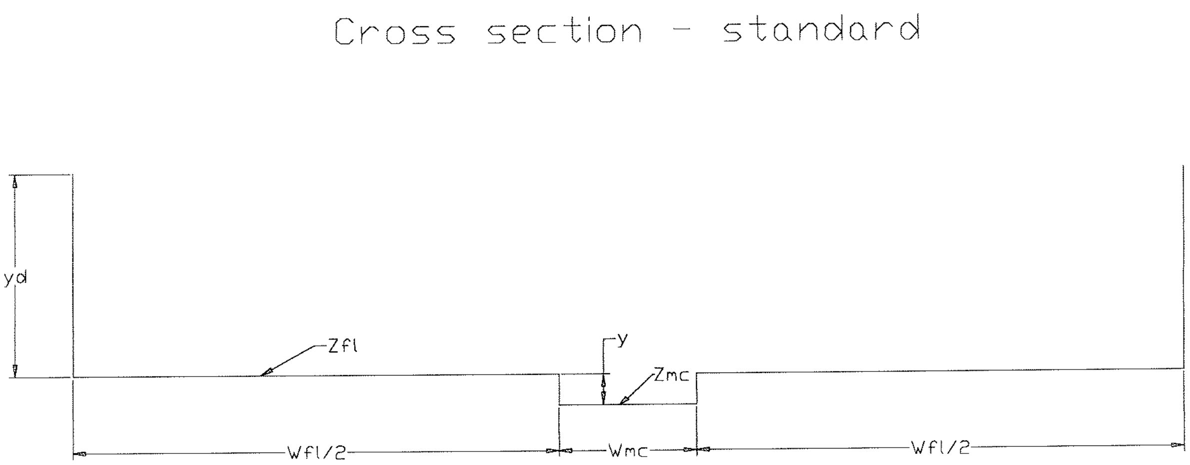


Figure 3.2 - General model of the cross sections for the 1D model

The meaning of the symbols on the figure is:

Zfl - bed level of the floodplain [L]
Zmc - bed level of the main channel [L]
Wfl - width of the floodplain [L]
Wmc - width of the main channel [L]
yd - height of the Winter dike [L]
y - difference of bed levels between the floodplain and the main channel [L]

The fact that some of the cross sections are not symmetric is not important. What matters is the width of the main channel and of the floodplain.

The original cross sections are very irregular. Hence, some simplifications had to be made in order to obtain more regularity and a shape that suites the one in Figure 3.2. The cross sections definition is shown in *Appendix 2*.

3.2.1. Bed level of the main channel

First it was necessary to have the main channel limits defined. The summer dikes are the boundaries of the main channel and their levels are around 7 m. Thus the main channel boundaries could be located.

For the calculation of the main channel bed level a weighted average was used. In this calculation only the lowest levels were used in order to eliminate singularities that are not representative of the usual main channel bed.

The bed level were computed from:

$$Zmc = \frac{S'}{Wmc} \tag{3.1}$$

where

$$S' = \sum_i Z_i \cdot l_i \tag{3.2}$$

where

Z_i - is the level of the point i from the cross section [L]

$$l_i = \left(\frac{Y_{i-1} - Y_i}{2} + \frac{Y_i - Y_{i+1}}{2} \right) = \frac{Y_{i-1} - Y_{i+1}}{2} \tag{3.3}$$

Thus to each point level a weight related to its influence on the cross section is given, via the width of the part it represents.

The data refers to a period just after a flood, so it does not represent very well the typical bed form of the river. Based on a model from Rijkswaterstaat, and after some calibration computations, the bed level of the upstream section was lowered around 0.20 m. Thus the results for the rest of the branch makes more sense.

The model results are described in detail in *Appendix* 2. The next table shows the final results.

Cross section	Main channel bed levels [m]
CS1	0.45
CS15	1.06
CS20	0.67
CS31	0.47
CS38	0.29
CS58	0.04
CS70	0.35
CS98	-0.43
CS108	-0.62

Table 3.2 - Bed levels of the main channel

3.2.2. Width of the main channel

With the main channel defined, its width is easy to compute. In the beginning it was computed from the cross co-ordinates (Y) of the summer dike points.

The following table shows the results.

Cross section	Main channel widths [m]
CS1	271.41
CS15	247.06
CS20	279.00
CS31	272.10
CS38	282.40
CS58	284.10
CS70	271.10
CS98	264.40
CS108	273.59
Average	271.68

Table 3.3 - Widths of the main channel

After the first computations for the calibration, the width of the main channel was taken constant and equal to the average, $W = 271.00$ m.

Only in the Cross section 15 the width was chosen different. In this section exists a side entrance in the river at the main channel level. Hence the velocities are decreased at this point, even with low water. With the decreasing velocities the river looses it erosion power what originates depositions in this area.

Hence the width could not be equal along this part; else this phenomena would not be represented in the model.

The width of the main channel in this cross section was taken by the difference between the summer dike cross co-ordinates, $W = 298.00$ m, which proved to give a better representation of reality.

3.2.3. Bed level of the floodplains

The limits of the floodplains is made by the Winter dike that is represented in the data by points with a high level, around 40.00 m.

The definition of the bed levels for the floodplains is similar to the one from the main channel except for places where excavation holes exist.

For the cross sections 15, 31, 38, 58 and 108 where there are no holes, the process is the same as before.

For the others cross section with holes, 1, 20, 70, 98, the influence of the holes was considered. After several computations with SOBEK it was decided to include the flow area corresponding to the hole in the Cross section 70 where it has a large influence on the river behaviour (it represents 22% of the plane area of the floodplain between the adjacent cross sections). The way it was made is described below.

In the other cross sections with holes, these were simply ignored in the computation of the bed levels.

Other singularities were included in these calculations.

The following table shows the resulting floodplain bed levels.

Cross section	Floodplain bed levels [m]
CS1	7.57
CS15	7.43
CS20	7.60
CS31	7.94
CS38	7.71
CS58	7.30
CS70	8.21
CS98	7.67
CS108	6.99

Table 3.4 - Bed levels of the floodplain

To introduce the flow area of the hole in Cross section 70 into the model, the summer dike option was used when making the input of the cross sections descriptions. In this option the summer dike level is the level of the floodplain, the floodplain base level is the bottom level of the hole, and the flow area behind the dike is the hole area. This is illustrated by Figure 3.3.

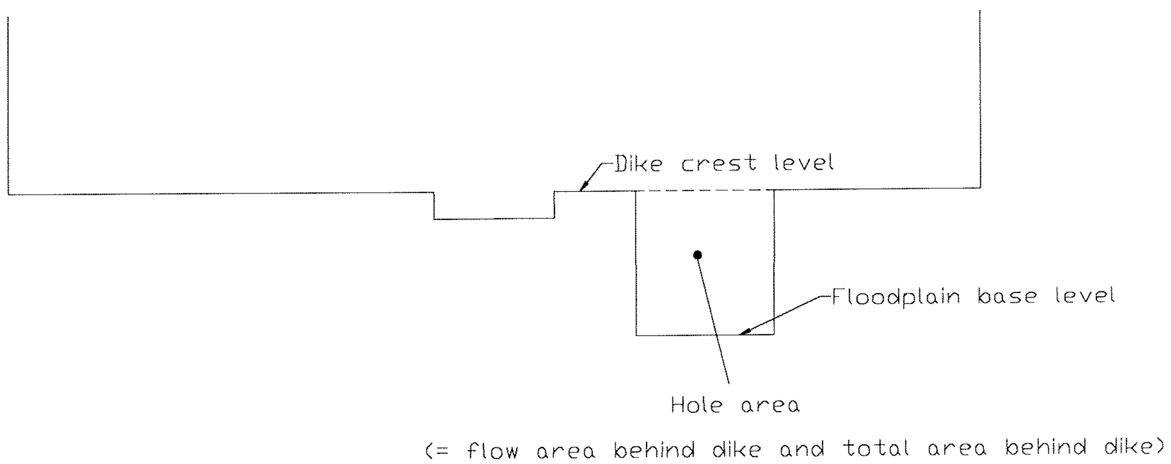


Figure 3.3 - Summer dike option used for holes in the floodplain

3.2.4. Width of the floodplains

The computation of the width of the floodplains is very trivial. It is obtained by the difference between the cross co-ordinates of the boundary points, subtracted by the width of the main channel, in other words is the subtraction of the width of the main channel in the total width of the river.

The real flow width sometimes doesn't match with the total flow of the floodplain. This is the result of the calibration process, and of observation of some maps of the region. In the floodplain are sometimes obstacles to the flow like dams, factories protections, and the factories itself. This reduces the flow width, making it not correspondent to the total width of the floodplain. The difference between the total width and the flow width corresponds to a storage width, i.e. to a cross-area where water exists but the velocities are zero.

Table 3.5 shows the total widths and the flow widths of the floodplains.

Cross section	Total width [m]	Flow width [m]
CS1	1899.19	1729.00
CS15	1354.69	900.00
CS20	1164.60	729.00
CS31	1344.40	1344.40
CS38	1366.00	1366.00
CS58	1283.10	916.00
CS70	1506.40	1145.00
CS98	1172.30	1172.30
CS108	1083.56	1083.56

Table 3.5 - Widths of the floodplains

3.2.5. Height of the winter dike

The height of the winter dike is set as 40.00 m, assuring this way that it will not influence the computations.

Figure 3.4 shows a schematisation of the model and *Appendix 2* can be consulted for all the information about the model.

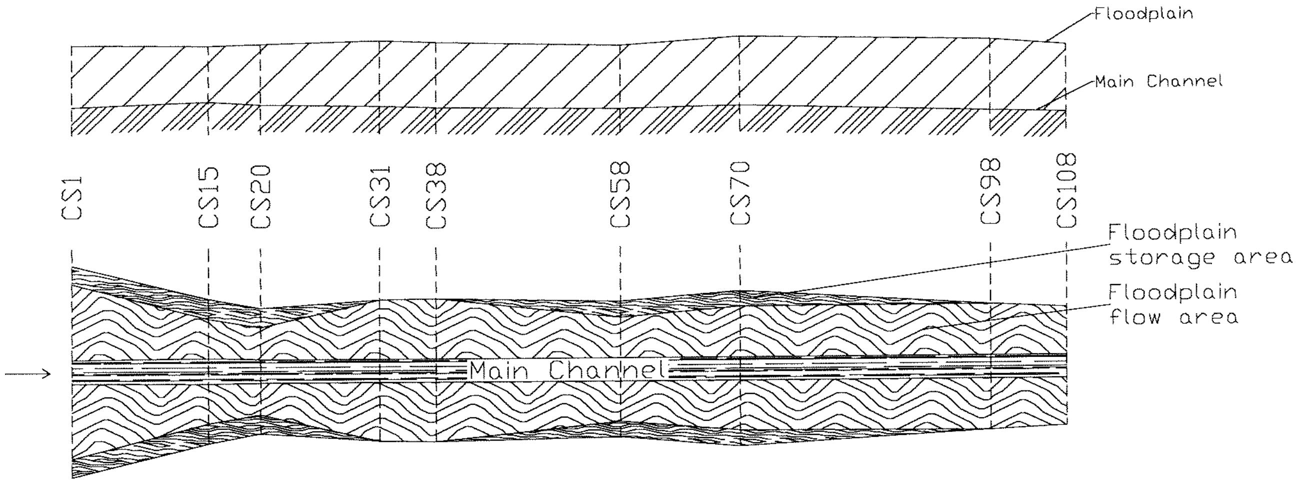


Figure 3.4 - Schematisation of the 1D model, plane and cross view (the vertical scale is larger than the horizontal).

3.3. Bed friction

The Chézy's coefficient was used to define the roughness of the river. This roughness is different from the main channel to the floodplain. The main channel is generally less rough than the floodplains what is shown by lower values of the Chézy's coefficient in these last ones.

The definition of this coefficient was an iterative process. Several computations and several attempts were made to reach equal results of water levels and velocities, apart from a small error, to the ones of the Delft 2D and from the Rijkswaterstaat.

First this calibration was only made to obtain the Chézy's coefficient from the main channel for low water, Q = 1600 m^3s^{-1}. After several computations the most suitable value for all the main channel of the model is C = 44 $m^{1/2}s^{-1}$. This Chézy's coefficient is within an expected range of values for the River Waal.

The calibration of the roughness for high water, Q = 52000 m^3s^{-1} was more complicated since it includes the calibration of the floodplain roughness, although the process was similar to the first. The big difference is that this time the Chézy's coefficient is variable with the stations, from cross section to cross-section.

The values obtained are exposed in the Tables 3.6 and 3.7.

Location [m]	0.00	1492.43	2062.18	3361.72	3977.01	5987.70	7297.70	10026.68	10854.69
Q = 1600 m^3s^{-1}	44	44	44	44	44	44	44	44	44
Q = 5200 m^3s^{-1}	45	40	35	50	55	53	53	35	45

Table 3.6 - Chézy's coefficient for the main channel in function of the location and of the discharge [$m^{1/2}s^{-1}$]

Location [m]	0	1492.43	2062.18	3361.72	3977.01	5987.7	7297.7	10026.7	10854.7
C [$m^{1/2}s^{-1}$]	23	20	20	25	25	27	40	38	35

Table 3.7 - Chézy's coefficient for the floodplains in function of the location, independent of the discharge [$m^{1/2}s^{-1}$]

These values were used as input for SOBEK as function of the two discharges mentioned and as function of the distance from the upstream section. SOBEK interpolates when it is dealing with different discharges and different locations.

3.4. Boundary conditions

In SOBEK two types of boundary conditions have to be introduced; one related to water flow and the other related to morphology.

As water flow conditions, the discharge was introduced in the beginning node, N1, and the water levels in the end node, N2. The water levels are given by the results of a computation with the Delft 2D model, correspondent to the respective discharge.

As the second type of boundary conditions the bed level was used as input in the beginning node and the load in the last node. This last one is zero, so the sediment transport verified in the model has it origin in this branch.

The next table shows these boundary conditions only for calibration simulations.

		Water flow		Morphology	
		Discharge [m^3s^{-1}]	Water level [m]	Bed level [m]	Load [m^3s^{-1}]
Summer conditions	N1	1600	-	0.45	-
	N2	-	5.10	-	0
Winter conditions	N1	5200	-	0.45	-
	N2	-	9.50	-	0

Table 3.8 - Boundary conditions

3.5. Initial conditions

For the initial conditions it's also necessary to input two kinds, flow and sediment conditions. The first ones are also function of what is pretended, and the second ones are not used for the calibration but are constant to any kind of computation.

For the first a constant discharge for the entire branch and the related water depth that was similar to the one in the downstream section.

For the sediment initial conditions it was needed, in function of the sediment transport formula, the values of the D50 and the D90 from the sediments in the river. To obtain these grain diameters the Ref. 1 was consulted.

Average values for D50 and D90 for the whole branch were taken. In the Ref. 1 appear the grain diameters in function of the location along the river, so these values were averaged between the km 900 to km 910 from the River Waal, location of this branch.

The next table shows the D50 and the D90 used, and in *Appendix 2* the calculation can be consulted.

D50 (mm)	1.01
D90 (mm)	3.89

Table 3.9 - D_{50} and D_{90}

3.6. Sediment transport formula

The sediment transport formula was introduced in SOBEK as a User-define transport formula, but it is basically the Meyer Peter & Muller sediment transport formula.

The transport parameter ϕ from MP&M is computed as follows (see Ref. 12):

$$\phi = \frac{8}{1-\varepsilon} \cdot (\mu \cdot \theta - 0.047)^{1.5} \tag{3.4}$$

where

ε - porosity [-]
μ - ripple factor [-]
θ - Shields parameter [-]

Also in Ref. 12, can be seen that the transport parameter from the User-define transport formula is computed like this:

$$\phi = \frac{1}{1-\varepsilon} \cdot \beta_u \cdot (\mu \cdot \theta)^{\gamma_u} \cdot (\mu \cdot \theta - \theta_c)^{\alpha_u} \tag{3.5}$$

where α_u, β_u, γ_u and θ_c are coefficients supplied by the user.

Making

$\beta_u = 8$
$\gamma_u = 0$
$\theta_c = 0.047$
$\alpha_u = 1.5$

the MP&M is obtained.

Computing this way, for the initial conditions it's only necessary to input the D50 and the D90 instead of inputting Dm for the MP&M, see Ref. 12.

In order to obtain more realistic results, and according to Rijkswaterstaat, for the transport formula a multiplication factor of 0.3 was applied.

4. CONSTRUCTION OF THE 2D MODEL OF THE RIVER WAAL

With the 1D model the morphological changes can be predicted in the main channel of the river.

The 2D option of SOBEK allows studying the morphological changes in two parallels and laterally coupled channels and the interaction between both. In this model the floodplain and the main channel will be considered as two parallel and laterally coupled channels.

This will be an attempt to model the interaction between the floodplain and the main channel of a river, namely the deposition in the floodplain of large quantities of sediments originated in the main channel during high water.

The bends are neglected in this model. Their influence in the river behaviour is not pretended.

The 2D model is based on the 1D model. A simple adaptation from the 1D model was made to be suitable for a 2D computation with SOBEK, without changing any characteristics already calibrated.

Only the changed characteristics will be presented in this chapter. The others are the same as in the 1D model.

4.1. Cross sections

The locations of the cross sections are the same. The main change in the cross sections is its shape.

In this case the cross sections are not longer symmetric, with the floodplain distributed for both sides of the main channel, like in Figure 3.2. Now they are made of two parallel channels, one is the main channel and the other one the floodplain.

The model will have cross sections like the one in Figure 4.1.

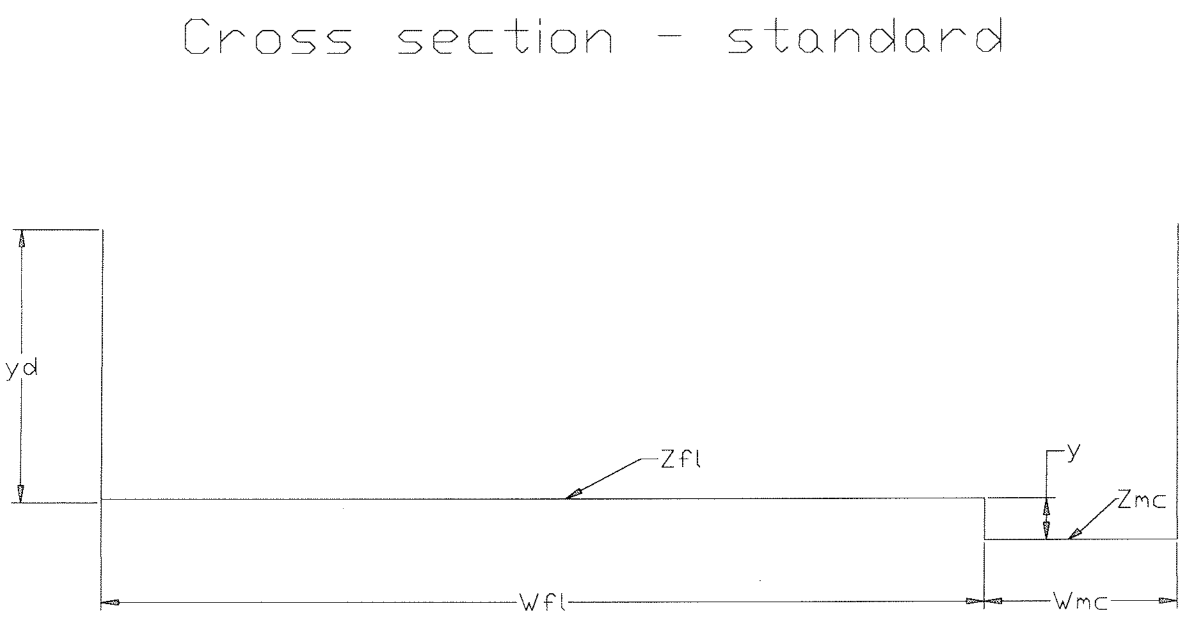


Figure 4.1 - General model of the cross sections for the 2D model

The symbols presented in the figure have the same meaning as the ones from the Figure 3.2, and generally have the same values.

Only in the cross section 70 there is a variation, due to the presence of the holes. Like in the *Chapter 3* in this case the hole will not be ignored. Once the summer dike option can not be used when dealing with the 2D option of SOBEK, the flow area from the hole has to be introduced in the model some other way.

The floodplain was made wider in order to obtain the total area equivalent to the one from the 1D model as is shown in Figure 5.2.

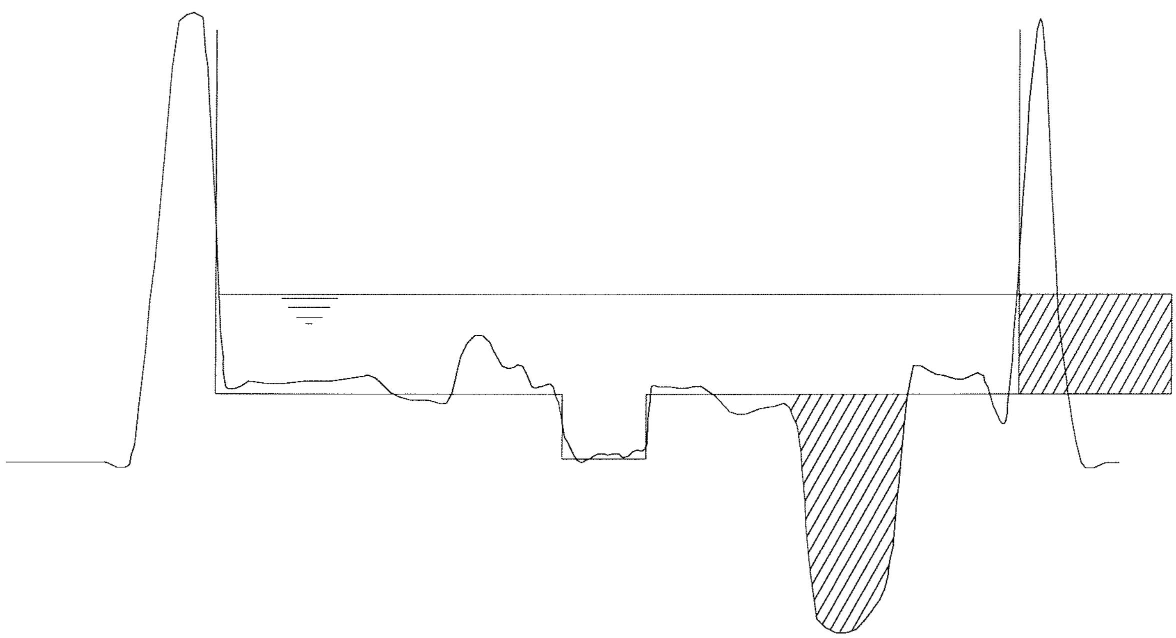


Figure 4.2 - Introduction of the hole flow area in the floodplain of the 2D model

The water level considered was Z = 10.00 m. The width of the floodplain in the cross section 70 in the 2D model is Wfl = 2138.00 m.

The bed levels for the main channel are the ones correspondent to the equilibrium computed with the dominant discharge, see *Chapter 6.1*.

The next figure shows a schematisation of the 2D model.

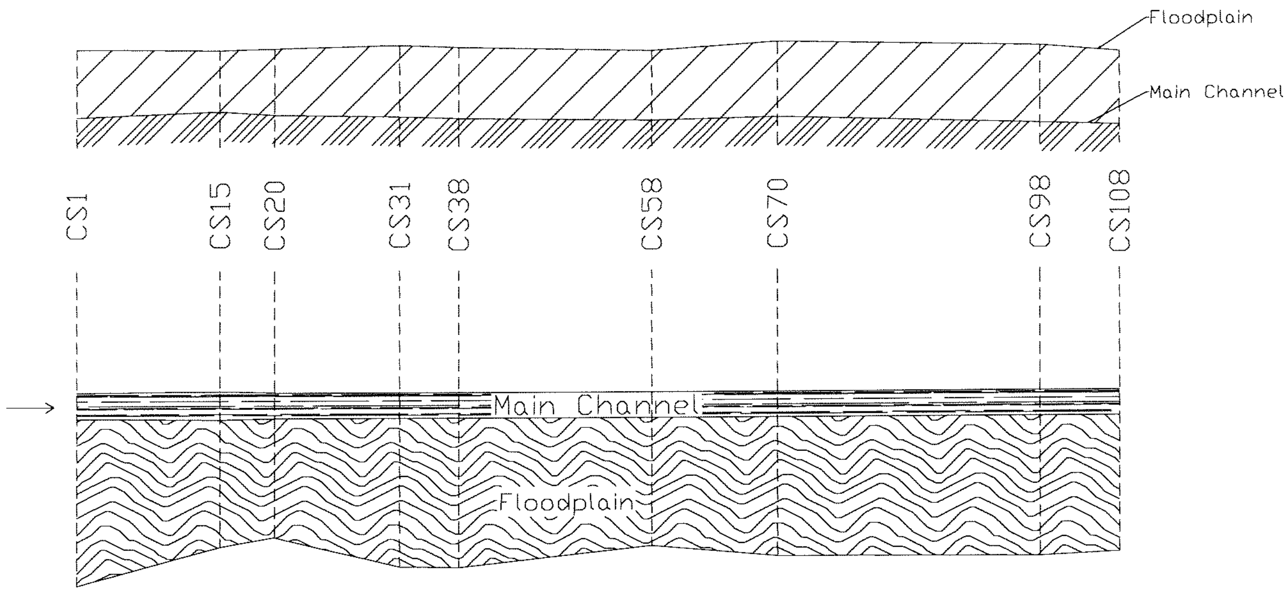


Figure 4.3 - Schematisation of the 2D model, plant and cross view (the vertical scale is larger than the horizontal).

4.2. Boundary conditions

In the boundary conditions the only difference is that where the flow is going through the main channel and the floodplain, it is necessary to give the distribution between these two channels.

In the chapters related to each computation they are referred. The distribution of the discharge between both channels was made with the use of Chézy's formula and continuity:

$$Q = W \cdot C \cdot \sqrt{i} \cdot h^{3/2} \tag{4.1}$$

where:

Q - discharge [L^3T^{-1}]
C - Chézy's coefficient [$L^{1/2}T^{-1}$]
i - bed slope [-]
h - water depth [L]

The total discharge is

$$Q = Q_{mc} + Q_{fl} \tag{4.2}$$

where

Q_{mc} - discharge in the main channel $[L^3T^{-1}]$
Q_{fl} - discharge in the floodplain $[L^3T^{-1}]$

So it's trivial to compute each parcel of it:

$$Q = \underbrace{W_{mc} \cdot C_{mc} \cdot \sqrt{i} \cdot h_{mc}^{\ 3/2}}_{Q_{mc}} + \underbrace{W_{fl} \cdot C_{fl} \cdot \sqrt{i} \cdot h_{fl}^{\ 3/2}}_{Q_{fl}} \tag{4.3}$$

4.3. Initial conditions

Here remains one of the most important aspects in the construction of this model, the sediment initial conditions.

One of the channels will be playing the role of floodplain. As it is known, the floodplain due to the revetment and it occupation is not erodible, so it has to be guaranteed that no erosion will happen in the floodplains of this model.

SOBEK asks in this case for the grain diameter of each one of the channels. To be sure that no erosion will occur in the floodplain, to the grain diameter has to be given a minimum value.

In order to avoid the motion of the grains of the floodplain one diameter was choose based on the Shields parameter θ, the adimensional critical shear stress, see Ref. 5. To guarantee that there is no movement θ must be lower than 0.047, the value correspondent to the threshold of transport, see Ref. 4.

Shields parameter:

$$\theta = \frac{u^2}{C^2 \cdot \Delta \cdot D} \tag{4.4}$$

where

θ - Shields parameter [-]
u - velocity $[LT^{-1}]$
Δ - relative density [-]
D - grain diameter [L]

Using averaged or estimated values to the other variables the grain diameter was computed. The next table shows the resume of the computation as well as the values for all the intervenients in (4.4).

θ [-]	0.047
u [ms^{-1}]	1.00
C [m$^{1/2}$s^{-1}]	50
Δ [-]	1.65
D_{min} [m]	0.005

Table 4.1 - Minimum grain diameter from the floodplain

The grain diameter adopted for D_{50} is higher than this minimum value.

4.4. Transport formula

For the two dimensional computations the transport formula was used in the same way as in the one-dimensional computations.

In this case it's necessary to include some calibration parameters that have to do with the two-dimensional effects in the flow, see Ref. 12, the 2D morphology parameters.

The next table shows the values attributed to these parameters:

E1	1.00
E2	0.10
E3	0.50
E4	-0.30
E5	0.10
E6	0.02
E7	1.00

Table 4.2 - 2D morphology parameters

These factors are related with the two-dimensionality of the flow namely intensity of the spiral flow (E1), slope effect on the shear stress (E2), influence of the current in the transverse bed slope (E3), influence of the water depth in the ripples (E4). The others parameters are also related with 2D phenomena, for more details see Ref. 12.

5. 2D MODEL FOR THE MAIN CHANNEL

Also a 2D model was made just for the main channel. The aim is to study the influence of bends on the riverbed, and to compare with the results if the bends are neglected.

Now, the floodplains will be ignored, and the main channel will be modelled as two parallel channels.

Most of the characteristics will remain the same; the principal difference is in the cross sections, and the introduction of the bends.

5.1. Cross sections

The main channel bed levels and the widths used for this model are the same as in the previous models.

The cross section of the main channel will be divided into two halves, as shown in the next figure, with half of the width at each side.

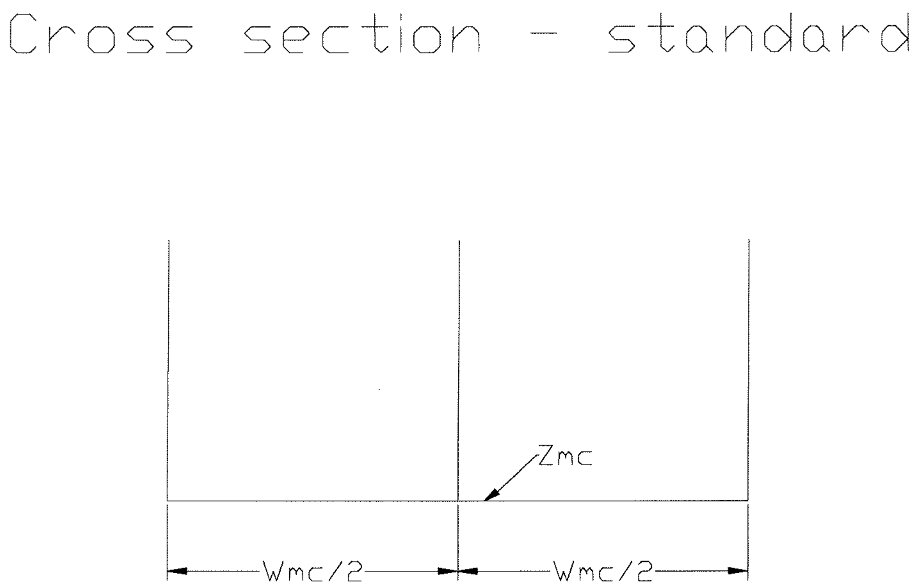


Figure 5.1 - General model of the cross sections for the main channel 2D model

5.2. Bends

For introducing the bends in the model, it is necessary to input their curvature in every grid point of the model.

To compute the curvature of the bends, use was made of the grid data, X and Y co-ordinates. The curvature is defined by the following equation:

$$\frac{1}{R} = \frac{\partial^2 Y}{\partial X^2} \qquad (5.1)$$

where

R - the radius of curvature (L)

The derivation of this equation can be found in *Appendix 4*. Table 5.1 gives the curvature and as well the radius of the various river bends.

S [m]	1/R [m^{-1}]	R [m]
0.00		
	-0.00017	-5776.46
2647.13		
	0.00015	6800.67
5100.30		
	-0.00025	-3950.06
8352.11		
	0.00023	4301.65
10854.69		

Table 5.1 - Curvatures of the river bends

This Rhine branch has 4 bends. For simplicity they were considered to have a constant curvature, corresponding to the average one. The next figure shows a resume of this model.

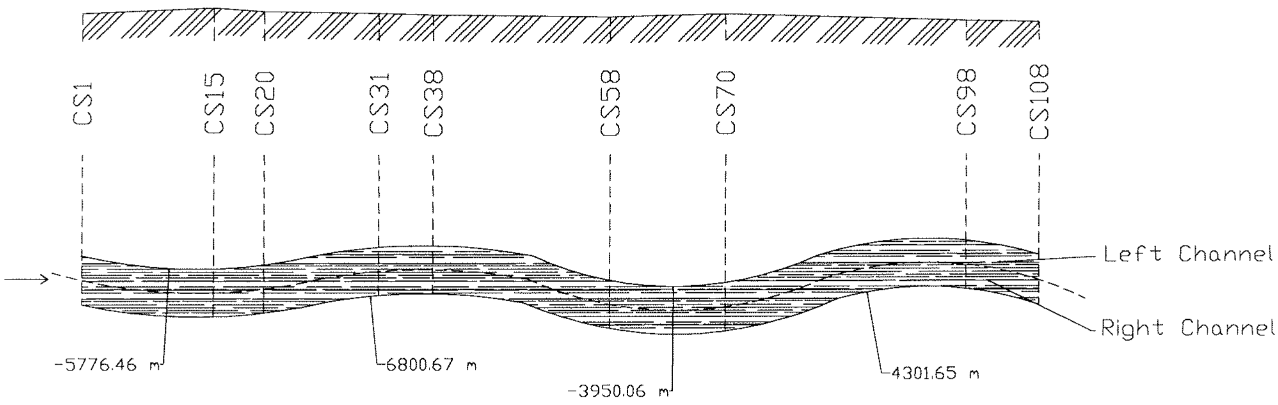


Figure 5.2 - Schematisation of the main channel 2D model, plane and cross view

The other model characteristics are the same as the previous ones.

6. COMPUTATIONS WITH THE 1D MODEL

The computations made with this model have various purposes.

First the simulations for the calibration of water levels and morphology with the discharges of Q = 1600 m^3s^{-1}, and Q = 5200 m^3s^{-1}, will be presented in chapter 6.1 and 6.2. With these some other considerations will also be made.

Two computations with variable discharges will be presented in the next chapters, one using a hydrograph with a discretization by several blocks, another with a discretization by one only block during the high water peak. For these computations the hydrograph from the year of 1997 was used.

6.1. Computation for low water: Q =1600 m^3s^{-1}

This computation was already mentioned in *Chapter 3* because it was used for the calibration of the model.

This discharge, Q = 1600 m^3s^{-1}, is the dominant discharge for the River Waal. That means that this discharge should be able to reproduce the periodic variations in the river morphology due to the variable discharge registered, see Ref. 15.

During this discharge, what could be considered as low water, the flow is only in the main channel.

A long simulation will lead to the equilibrium state of the riverbed. A river branch is in equilibrium when the sediment Inflow is equal to the sediment outflow and to the transport capacity, in practical terms, when the sediment transportation is constant along the river.

For the bed load transport the balance equation can be written as, see Ref. 15:

$$(1-\varepsilon)\cdot\frac{\partial z_b}{\partial t}+\frac{\partial s}{\partial x}=0 \qquad (6.1)$$

where

ε - porosity of the bed [-]
z_b - bed level [L]
t - time [T]
S - sediment transport [L^2T^{-1}]
x - distance along the model axis [L]

So, when there's no variation of the sediment transport along the river, there will be no changes in the bed levels, what means that the equilibrium of the riverbed is reached.

A general transport formula can be written like (4.2):

$$s = a\cdot u^b \qquad (6.2)$$

where

s - transport rate per unit width [L^2T^{-1}]
a – coefficient [$L^{-3}T^4$]
b - coefficient [-]
u - flow velocity [LT^{-1}]

The sediment transport is directly dependent on the velocity. This means that when the velocity is constant along the river, with constant flow area and discharge, the derivation of s in distance and consequently the bed level variation are null.

In order to obtain the equilibrium riverbed, the computation had to be made for 25 years.

6.1.1. Results and comments

The detailed results of the calibration and of the computation until the equilibrium depth can be consulted in *Appendix 5.*

The next figures show the comparison made for the calibration of the model. For the calibration of the water levels and the bed levels results from the Delft 2D model was used. For the velocities calibration it was used an expected averaged value u = 1.08 ms^{-1}.

The bed levels from Delft 2D correspond to the equilibrium, and are averaged in the cross section, since these results are given in several points along it.

The bed levels correspond to the equilibrium state of the river branch.

For the calibration only the bed levels at the cross sections were checked.

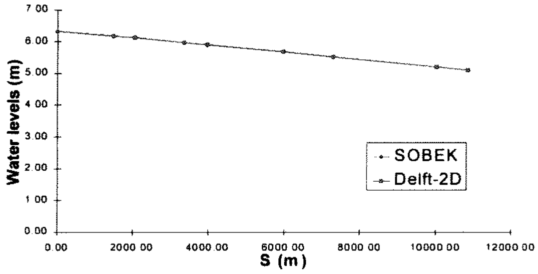


Figure 6.1 – Calibration of the water levels

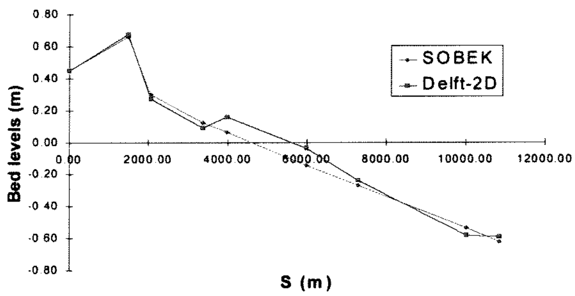


Figure 6.2 - Calibration of the bed levels (equilibrium)

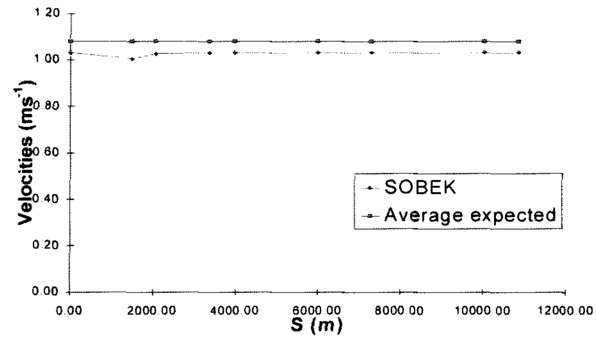


Figure 6.3 – Calibration of the velocities

Note that the bed levels showed, are the ones from the main channel.

As can be seen, the results from this SOBEK model are quite similar to the ones of Delft 2D, and the lines follow the expected tendency.

In the case of the water levels the major error is about 0.02 m what is quite accurate. In the bed levels the largest error is about 0.11 m, and for the velocities this is 0.08 ms^{-1}.

This means that a rough model as this one, with only 9 cross sections, can give some interesting results for some purposes. If a coarse estimation of some river parameters is desired, a model like this is sufficient and very easy and fast to build and to handle.

In the next figures the initial sediment transport (year 0), the equilibrium transport (year 25) and their respective bed levels are shown.

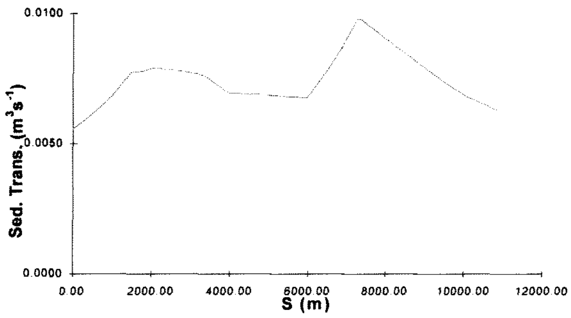


Figure 6.4 – Sediment transport in the year 0

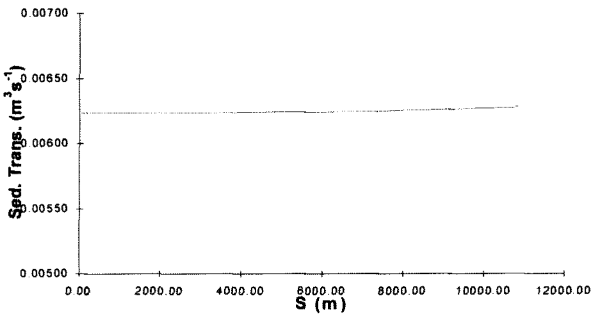


Figure 6.5 - Sediment transport in the year 25, end of the computation

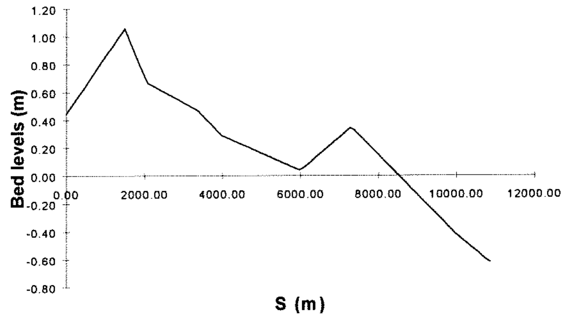


Figure 6.6 - Bed levels in the year 0

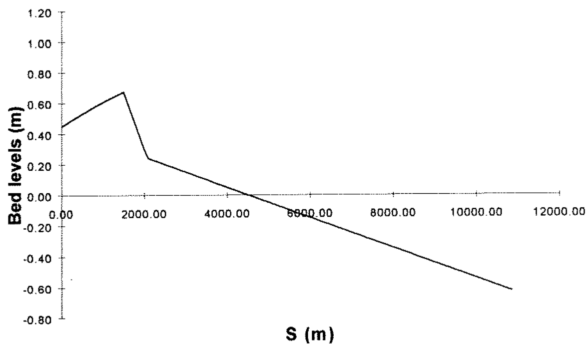


Figure 6.7 - Bed levels in the year 25, end of the computation

Figure 6.5 shows that the sediment transport doesn't change anymore along the river. So, like written before, it can be concluded by (6.1) that the bed level will not change anymore in time. The equilibrium is reached.

This can be confirmed when looking at the bed changes at a location in time, *Appendix 5*. The changes are smoothing in time until they vanish and the level doesn't change anymore.

As can be seen in the Figure 6.7 the equilibrium state of the riverbed is a straight line with the exception of the area around the cross section 15.

In that place exists a peak due to the side entrance in the river that reduces the flow velocity. This reduction of the flow velocity leads to decreasing of the erosion capability what originates deposition of the sediments.

In the beginning of the computation the sediment transport is variable due to the differences in the bed level that increase and decrease the flow area. After the 25 years the riverbed was adapted in a way that the flow area became equal along the entire branch, and so the sediment transport keeps the same value along it.

In the stretches where the width is constant, it was expected that the bed level became a straight line. Since the width is constant the flow velocities don't change along the river branch and neither the sediment transport, when the bed is plan. After the elimination of the singularities, peaks and holes, the bed tends to that straight line.

The final slope that the river takes in equilibrium is about $i = 0.99 \times 10^{-4}$, an expected value for the River Waal.

The equilibrium slope i_{eq} can be obtained by analytical way, see Ref. 15:

$$i_{eq} = \frac{q^2}{C^2 \cdot h^3} \qquad (6.3)$$

where

q - discharge per unit width $[L^2T^{-1}]$

Using the SOBEK results for the water calibration this slope can be computed.

q $[m^2s^{-1}]$	5.90
C $[m^{1/2}s^{-1}]$	44.00
h [m]	5.52
i_{eq} [-]	1.07×10^{-4}

Table 6.1 - Equilibrium slope - analytical calculation

This result matches quite well with the one from SOBEK, apart of one error of 8%.

6.2. Computation for high water: Q = 5200 m^3s^{-1}

Like the last simulation, this one was used for the calibration of the model, this time when the flow runs trough the floodplains.

This calibration was made for water levels with results from Delft 2D and for velocities with data from the Ref. 11, so only the SOBEK water flow module was used.

The initial bed levels used to run the model with this high discharge were the ones of the equilibrium state from the first computation. It is reasonable to start with it because usually when high water occurred the river is almost in equilibrium due to the low discharge.

The computation of this discharge for large time periods does not make sense since it is not realistic. However it was made for the same period of 25 years, just to compare the results with the ones from the 2D model, see *Chapter 7.*

6.2.1. Results and comments

The next group of figures shows the comparison made for the model calibration. The points that are represented are from the defined cross sections.

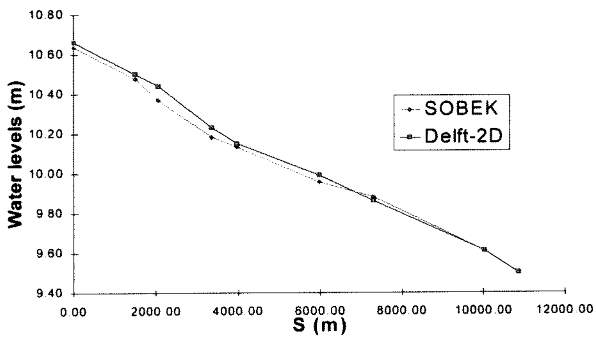


Figure 6.8 – Calibration of the water levels

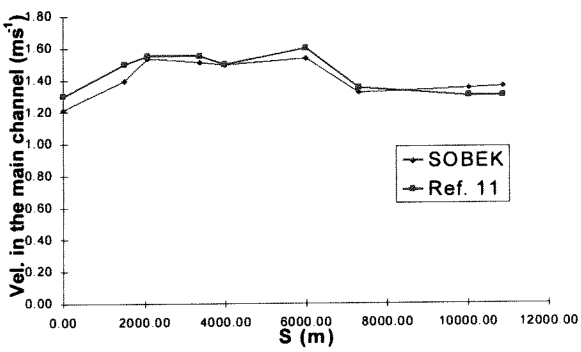


Figure 6.9 – Calibration of the velocities

The results are also satisfactory for the high water flow. The major error in the water levels is 0.07 m and in the velocities is 0.11 ms^{-1}.

The next results are from the 25 years computation. After all this time the whole branch was not in equilibrium yet. However, when looking at the results, there is an upstream part of the river that is already stable, i.e. without changes of bed levels and with sediment transport at equilibrium.

The next figures show that. More detailed information can be consulted in *Appendix 5.*

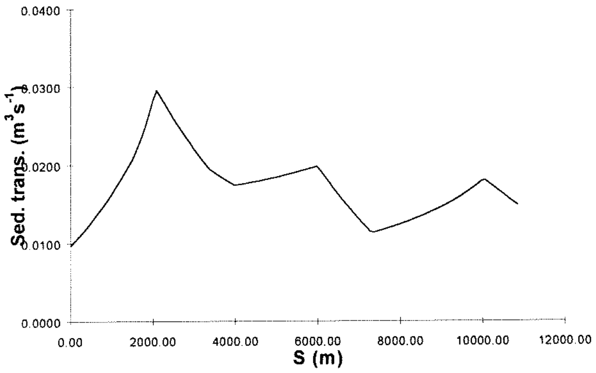


Figure 6.10 - Sediment transport in the year 0

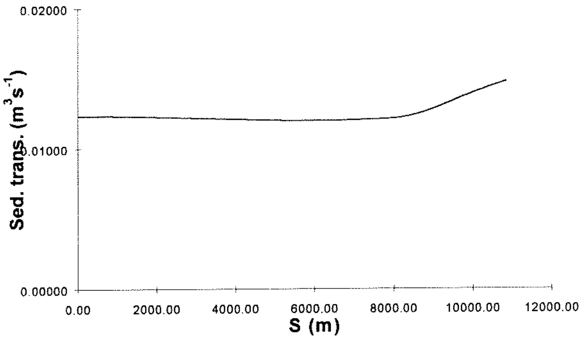


Figure 6.11 - Sediment transport in the year 25, end of the computation

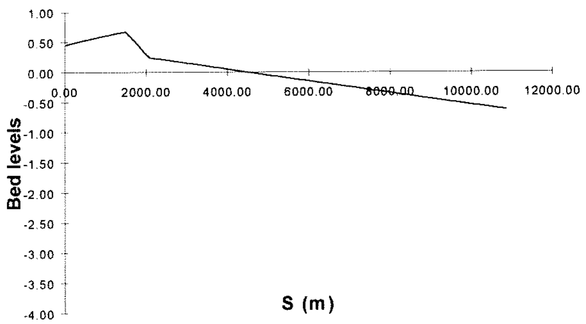


Figure 6.12 - Bed levels in the year 0

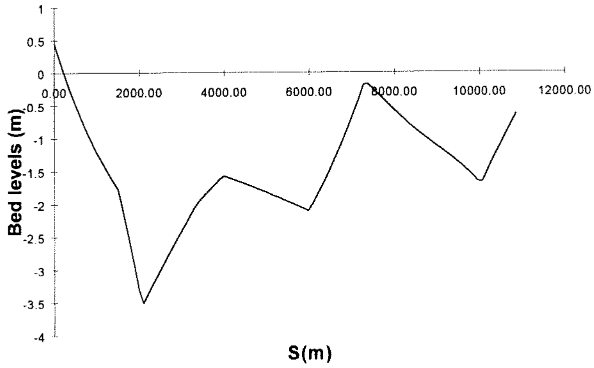


Figure 6.13 - Bed levels in the year 25, end of the computation

Figure 6.11 confirms that the whole branch is not totally in equilibrium yet. However the variation is not too large, being the upstream part of the branch already stabilised.

Figure 6.12 shows the initial conditions of the bed level, the equilibrium bed as said before. The last figure shows the final shape of the riverbed after 25 years of high discharge, a very unrealistic situation.

Now the equilibrium state of the river is not so regular as the equilibrium with Q = 1600 m^3s^{-1}. To reach the equilibrium the flow area from the branch should be all the same. In this case, high water, the flow width has large variations, due to the variation of floodplain areas.

The width variations induce to flow velocity variations which, according to (6.2), causes non-uniformity in the distribution of the sediment transportation in the branch.

In the places where the flow width is larger, deposition occurs due to the loosing of sediment transport capacity. Where the river becomes narrower, erosion takes place due to the increase of velocity.

The sediment transport will tend to be constant. With erosion in some places and deposition in others the bed river develop to a state where the flow area will be constant along the branch, what in this case does not correspond to a smoothed riverbed as in the last simulation.

6.3. Computation for variable discharge

A third computation was made with a variable discharge. Like in the computation before described, the initial topography of the riverbed considered was the equilibrium topography computed with the dominant discharge.

The hydrograph used was from the year 1997 and it was schematised in blocks like in the Figure 6.14.

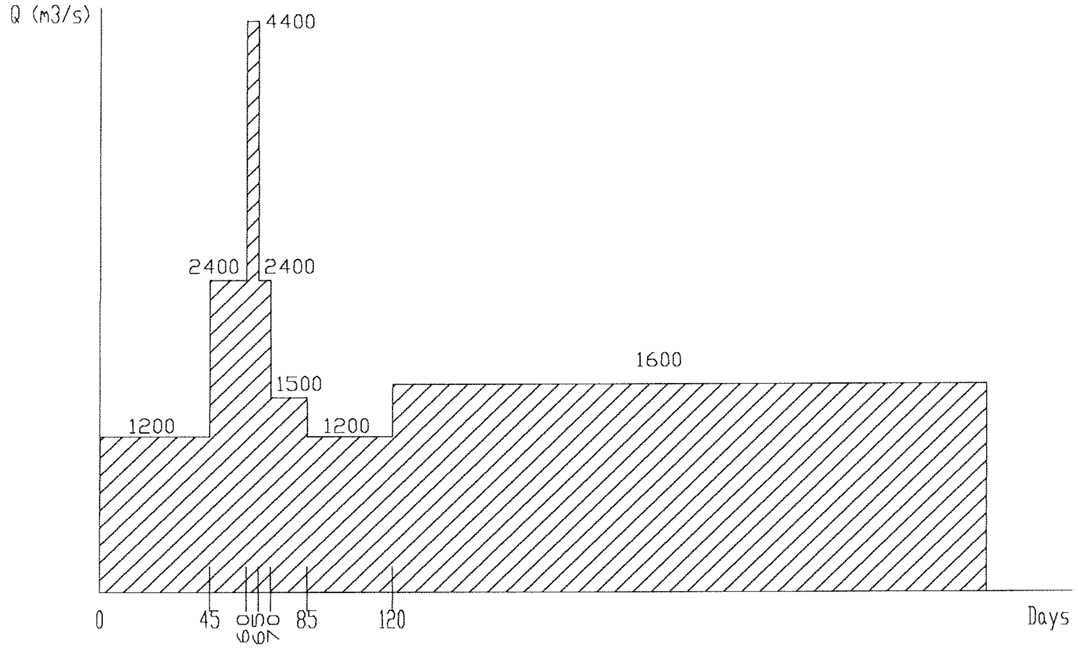


Figure 6.14 - Schematisation of the hydrograph from the year of 1997 for the River Waal

A computation was made for just one year to compare with results from the programme Delft 2D.

It was also pretended to compare the results of this computation with the dominant discharge for a long period. So, a cycle for several years was made, computing this hydrograph repeated every year. Some limitations related with the hardware available, imposed that the computation could not be longer than 16 years.

In this case the discharge was introduced in the model as function of time. Also the flow boundary conditions as the water level in the downstream section are not constant, being a function of the discharge. The values for the water levels in the downstream section are results from the Delft 2D and are shown in the next table.

Q [m^3s^{-1}]	1200	1500	1600	2400	4400
Water levels [m]	4.10	4.87	5.10	6.61	8.71

Table 6.2 - Boundary conditions for variable discharge

6.3.1. Results and comments

The results will be presented here, one after one year of computation, and other after 16 years. The charts shown here are the most important, the results also are in *Appendix 5.*

1 year of computation

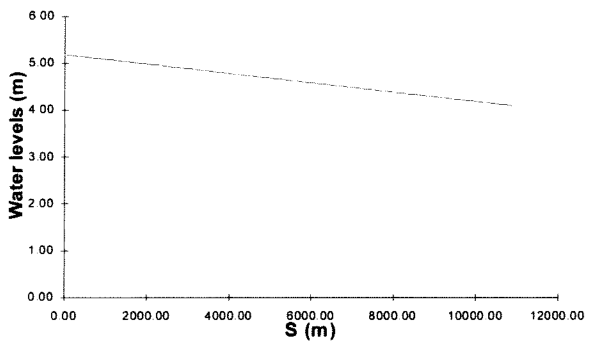


Figure 6.15 - Water levels in the first year

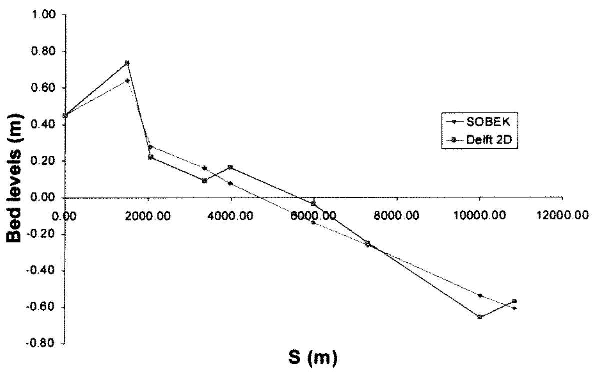


Figure 6.16 – Comparison between the bed levels computed with the results from Delft 2D

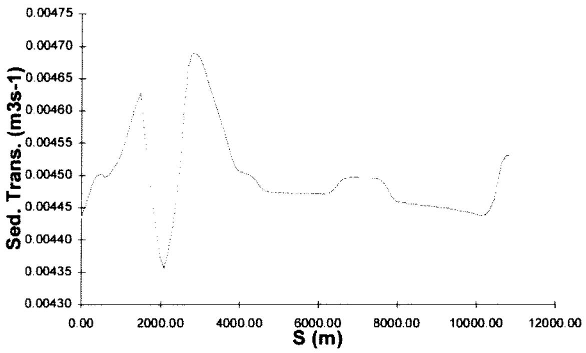


Figure 6.17 – Sediment transport in the first year

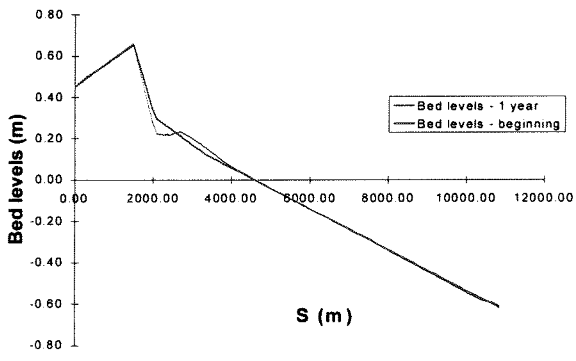


Figure 6.18 - Evolution from the bed levels, one year after the equilibrium

For the comparison of the results, again only the points correspondent to the cross sections were used. The results obtained after a year of computation with the hydrograph of 1997 are also acceptable, as the ones in previous chapters.

As can be seen in the figures, the bed levels are quite similar to the results from Delft 2D with the largest difference of 0.12 m.

One year after the equilibrium a small ripple shows up downstream to the peak from the cross-section 70. This sediment wave must have its origin in the hydrograph peak when the sediment transport increases and induces larger changes in the bed level.

16 years of computation

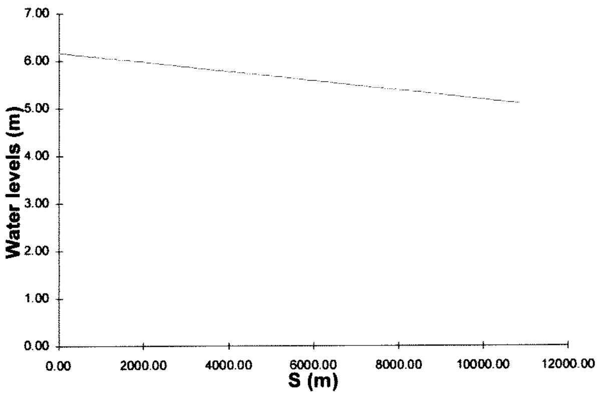


Figure 6.19 – Water levels in the year 16

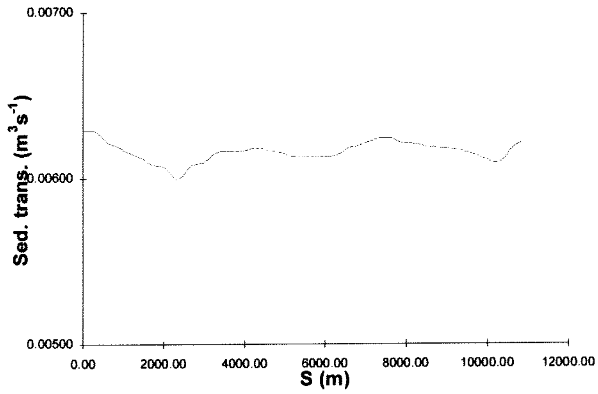


Figure 6.20- Sediment transport in the year 16

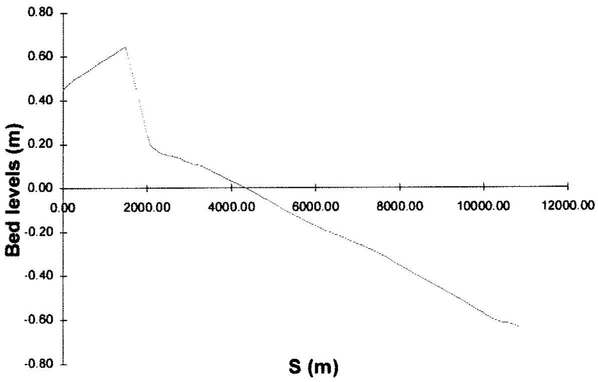


Figure 6.21 – Bed levels in the year 16

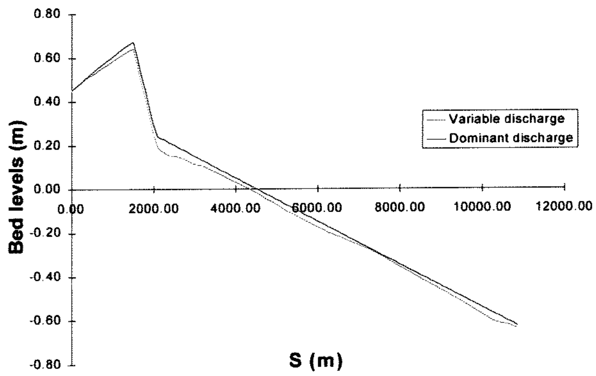


Figure 6.22 - Comparison between the bed levels In the year 16 computed with variable discharge and with the dominant discharge.

As can be seen the sediment transport is not constant along the branch in the end of computation, despite its small variation. It is obvious that, with variation of the discharge along the year, the sediment transport is variable in the same way along the time, see Figure 6.23.

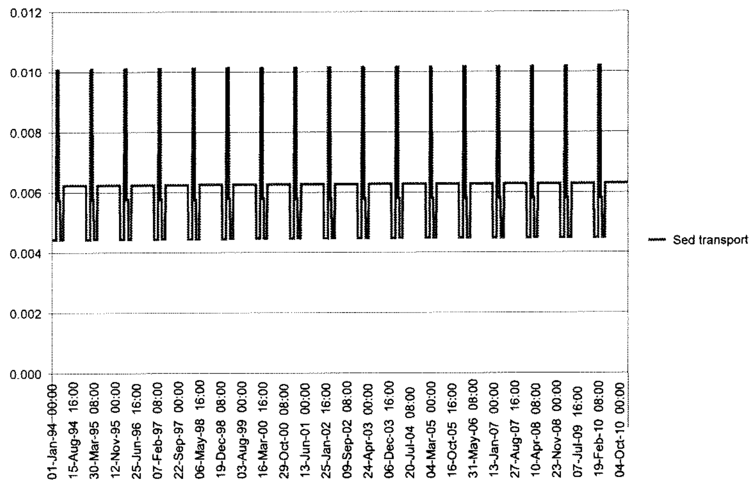


Figure 6.23 – Evolution of the sediment transport in the upstream section along the time

However, in the end of each annual cycle, the bed levels take approximately the same value. When the sediment transport is in the peak only some small ripples can be seen in the riverbed. They have no more than 0.05 m, see *Appendix 5.*

The riverbed reaches a state of dynamic equilibrium, where at any station the riverbed oscillates between fixed levels in time. This state is not achieved in a uniform way by the whole branch, but develops from upstream to downstream.

The next figures show the evolution of the bed levels with time, in some stations from all over the branch.

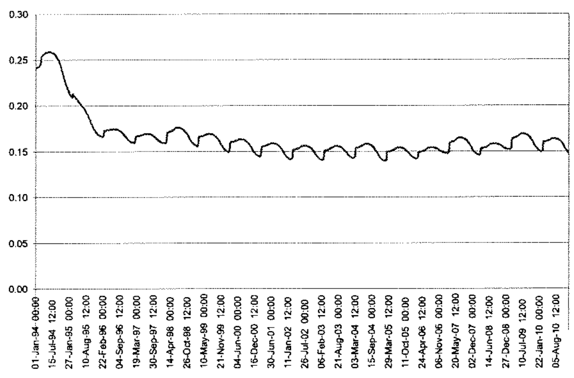


Figure 6.24 – Evolution in time of the bed levels, from km2.5

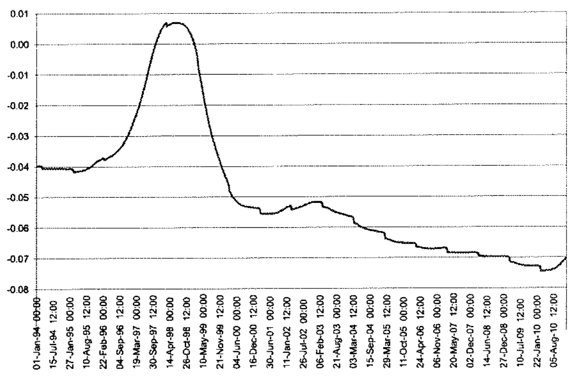


Figure 6.25 - Evolution in time of the bed levels, from km5.0

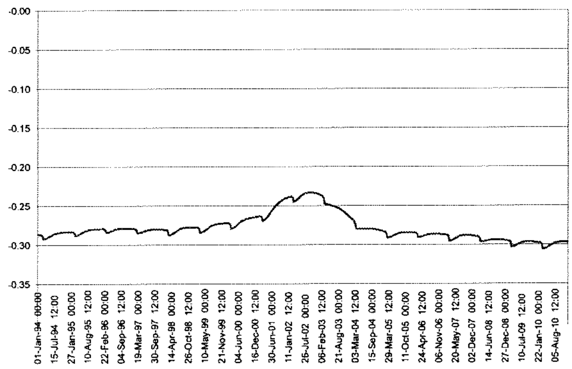


Figure 6.26 – Evolution in time of the bed levels, from km7.5

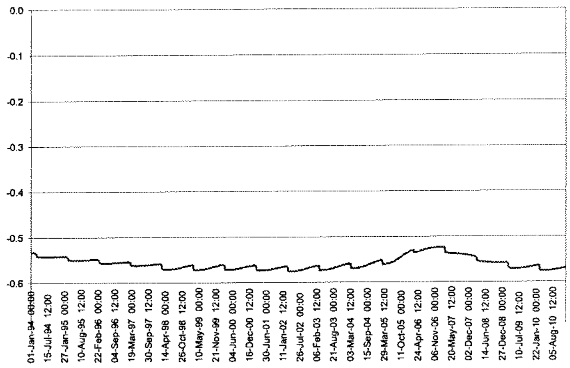


Figure 6.27 - Evolution in time of the bed levels, from km8.5 to final km

The figures confirm the considerations of the dynamic equilibrium. There is a small solitary sand wave that propagates to downstream. After the wave passes, the bed levels remain oscillating in a certain range of values.

When compared with the results of a simulation with dominant discharge, see Figure 6.22, the final shape of the riverbed is very similar. For one analysis where what is pretended is to know the shape of a river after a period of time, to use the dominant discharge doesn't introduce a discrepancy susceptible to introduce unbearable errors.

When the time variation of a riverbed is pretended, using the dominant discharge introduce some errors. The riverbed is not stable, and does never reach a static equilibrium as it seems when computing with Q = 1600 m^2s^{-1}. After the period of low water the riverbed reaches an almost equilibrium state but, with the discharge variation the sediment transport varies and consequently the bed levels.

However the oscillations due to the variable discharge are not significant. The maximum error introduced is less than 0.05 m, see *Appendix 5*.

It is always possible to define a range of values in which the levels oscillate, and depending of the purpose, define a riverbed composed by maximums, minimums, or averages bed levels.

The solitary sediment wave referred begins after the first year, see Figure 6.18, and it moves downstream along the years.

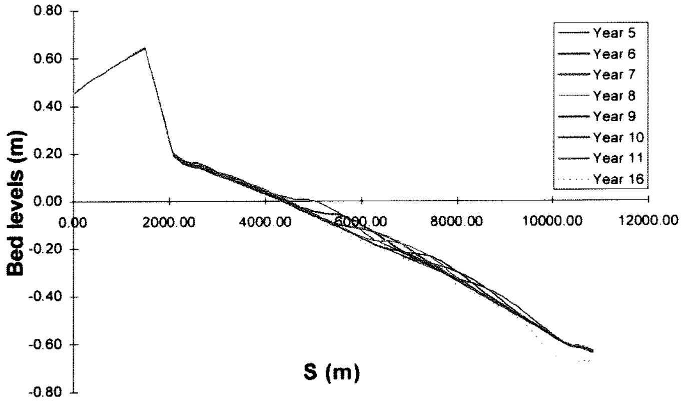


Figure 6.28 - Evolution of the sediment wave along the years

In Figure 6.28 one can see the sand wave propagating with a celerity of about 500 m per year, what means that c = 1.6×10^{-5} ms^{-1}.

The celerity of the sand waves can be computed analytically as well, see Ref. 4.

$$c = \frac{b \cdot s}{h} \tag{6.6}$$

MP&M is not a power law of sediment transport but the coefficient *b* can be obtained by, see Ref. 16:

$$b = \frac{3}{\left(1 - \frac{0.047}{\mu \cdot \theta}\right)} \tag{6.7}$$

where

μ – ripple factor [-]

The ripple factor is given by, see Ref. 8:

$$\mu = \left(\frac{C}{C_{90}}\right)^{3/2} \tag{6.8}$$

where, see Ref. 12,

$$C_{90} = 18 \cdot \log\left(\frac{12 \cdot h}{3 \cdot D_{90}}\right) \tag{6.9}$$

Taking the sediment transport equal to 0.0063 m^3s^{-1}, see Figure 6.20, an average water depth, the width W_{mc} = 271.00 m, the celerity can be computed:

u [ms^{-1}]	1.03
C [$m^{1/2}s^{-1}$]	44
Δ [-]	1.65
D_{50}[m]	0.001
θ [-]	0.332

Table 6.3 – Computation of the Shields parameter

h [m]	5.72
D_{90}[m]	0.004
C_{90} [$m^{1/2}s^{-1}$]	67.63

Table 6.4 – Computation of C90

C [$m^{1/2}s^{-1}$]	44
C_{90} [$m^{1/2}s^{-1}$]	67.63
μ [-]	0.525

Table 6.5 – Computation of the ripple factor

θ [-]	0.313
μ [-]	0.525
b [-]	4.20

Table 6.6 – Computation of the coefficient *b*

s [m^2s^{-1}]	2.3×10^{-5}
b [-]	4.20
h [m]	5.72
c [ms^{-1}]	1.7×10^{-5}

Table 6.7 – Sand wave celerity – analytical calculation

The result obtained by the analytical via, confirm the result measured in the Figure 6.28, apart a small error of 0.1 ms^{-1}.

6.4. Computation for variable discharge with an averaged peak

The next computation was to test the possibility to use a simpler form of the hydrograph instead of introducing all the blocks that compose it. This is useful to know, since to introduce a hydrograph in SOBEK is not an easy task.

This time an hydrograph very resembling to the previous was used, however the peak was averaged. So, the hydrograph from the Figure 6.7 was averaged between the instants 45 and 85 days, as shown in the next figure.

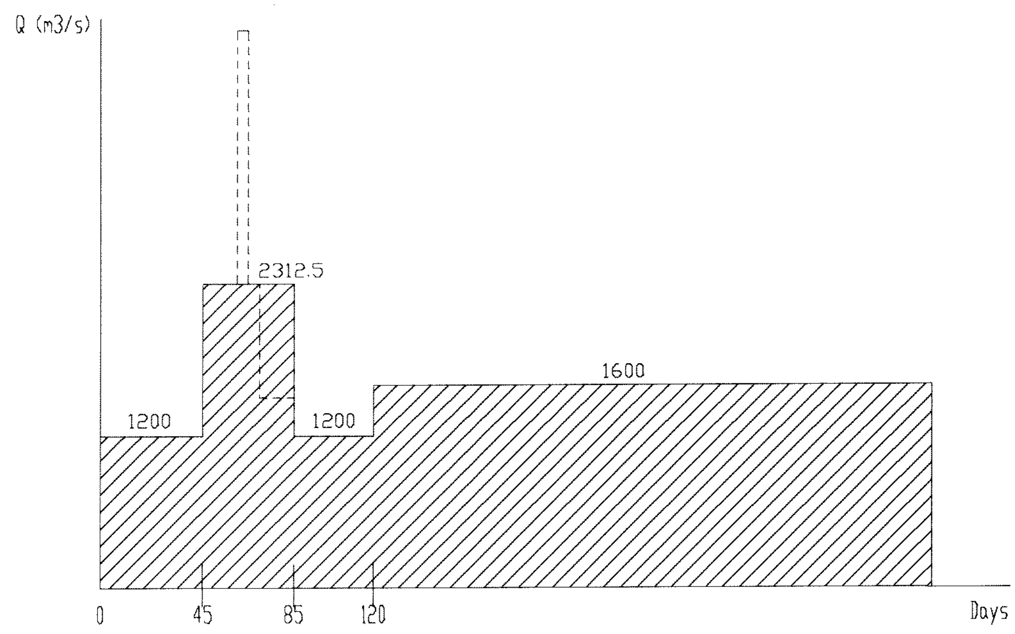


Figure 6.29 - Schematisation of the hydrograph from the year of 1997 for the River Waal - averaged peak

The hydrograph is the only difference between this and the last computation. Any other characteristic of the computation remains the same.

This computation was made for 16 years.

6.4.1. Results and comments

Here only the results correspondent to the year 16 are shown. They are compared with the ones from the computation from the *Chapter 6.1* and *6.4*.

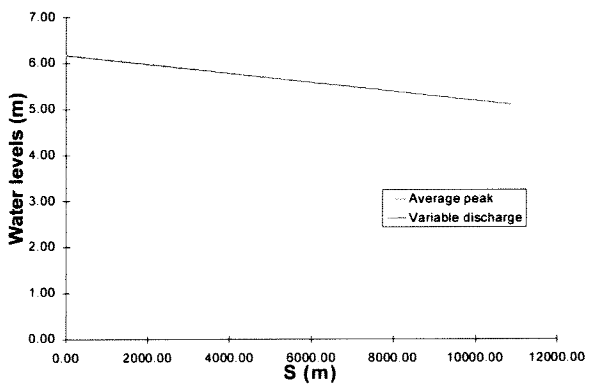


Figure 6.30 – Comparison between the water levels in the year 16 computed with variable discharge and with the average peak.

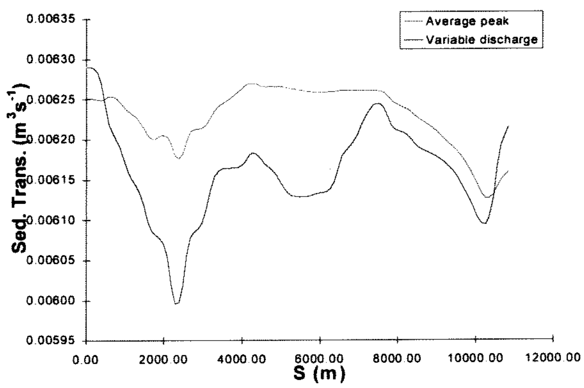


Figure 6.31 - Comparison between the sediment transport in the year 16 computed with variable discharge and with the average peak.

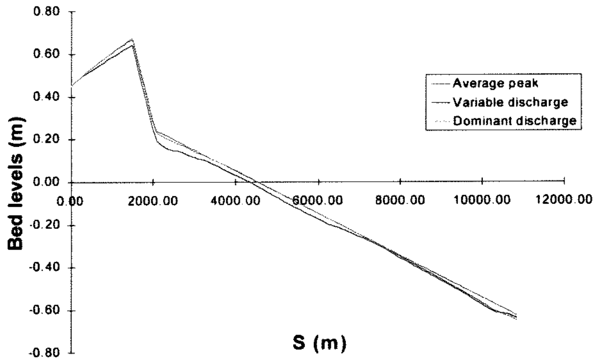


Figure 6.32 – Comparison between the bed levels in the year 16 computed with variable discharge, with the dominant discharge and with the average peak.

The main conclusion to take of the figures above is that the use of an average peak for the computation of an hydrograph doesn't introduce errors that may lead to false results.

It is a very good simplification that gives good results, simplifies indeed the input process of the model, and can be done without loosing accuracy.

The other results obtained with this computation are quite the same as the ones presented in the last chapter. They will be not shown here because they don't bring anything relevant.

In conclusion, to know the effects in a long term in the riverbed morphology, like to know the configuration of the equilibrium riverbed, the dominant discharge can be used. The maximum error that can be committed is to ignore some small ripples due to the winter peaks that vanish during the rest of the year.

To make an analysis in a short-term period, the use of the dominant discharge doesn't allow to observe phenomena that happen in the river before this one start to reach the so called dynamic equilibrium. However these phenomena are usually small ripples that are not significant, they can be neglected.

When using a hydrograph to compute morphological changes in river, the average of the peak can be made without loosing precision in the final results. It is an easy simplification that can simplify indeed the work of introducing data in a model like SOBEK.

6.5. Relaxation, wave and damping lengths

Using some results obtained with the simulation from *Chapter 6.1*, adaptation, damping and wave lengths were calculated for this Rhine branch, see *Chapter 1.5*.

C [$m^{1/2}s^{-1}$]	44
g [ms^{-2}]	9.8
h [m]	5.72
λ_W [m]	565.00

C [$m^{1/2}s^{-1}$]	44
W [m]	271.00
h [m]	5.72
D50 [m]	0.001
u [ms^{-1}]	1.03
Δ [-]	1.65
θ [-]	0.332
λ_s [m]	552.03

Table 6.8 - Computation of the adjustment lengths

L_P [m]	3703.83
L_D [m]	2668.35

Table 6.9 – Computation of the wave and damping lengths

The parameter l_P is $\frac{\lambda_S}{\lambda_W} = 0.98 \approx 1$ what means that damping of the wave will happen along this part of the Waal.

7. COMPUTATIONS WITH THE 2D MODEL - SEDREDGE

As written in *Chapter 4* now an attempt will be made to model the interaction between the floodplains and the main channel during high water.

First a computation will be made only with high water for several years, just like is done in *Chapter 6.2*. This will be done to check the behaviour of the model and to test the ability to predict the interaction between both channels.

Later, a computation with variable water will be done. This one is pretended to see the effects caused by the hydrograph of 1997 in one year and in several years.

In all these computations the boundary conditions are the same as mentioned in previous chapters.

The results of these following computations are presented in *Appendix 6*.

7.1. Computation for high water: Q = 5200 m^3s^{-1}

The next figures shows the final results of the 2D model computed with high water.

Some of the results, like water levels and bed levels, are compared with the ones from the 1D model.

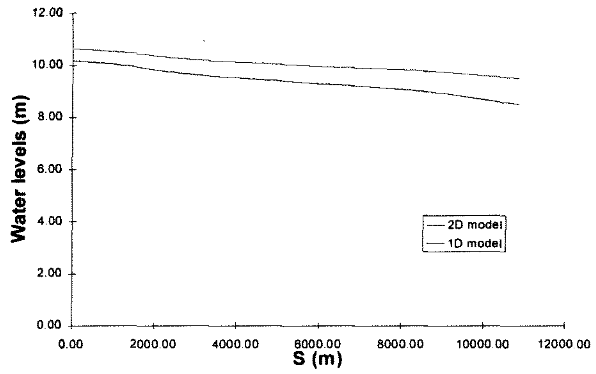


Figure 7.1 - Comparison between the water levels for high water, from the 2D and 1D models in the year 0

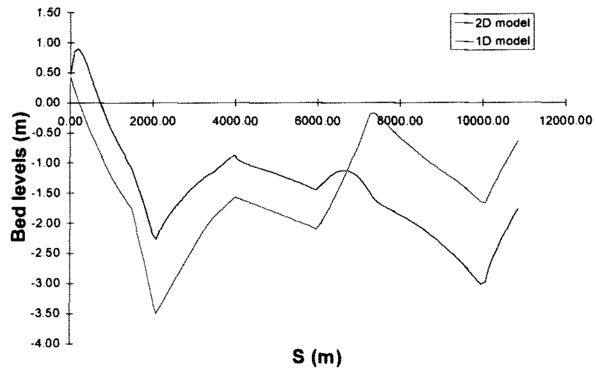


Figure 7.2 – Comparison between the bed levels for high water, from the 2D and 1D models in the year 25

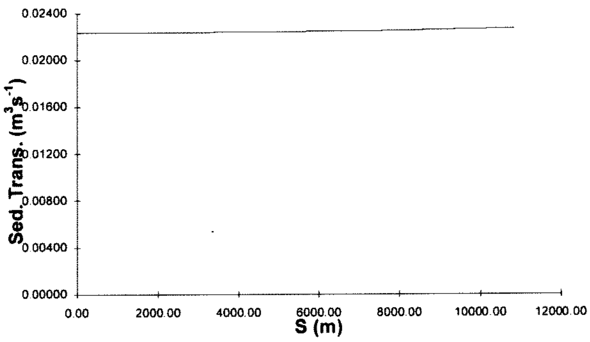


Figure 7.3 – Total sediment transport in the year 25

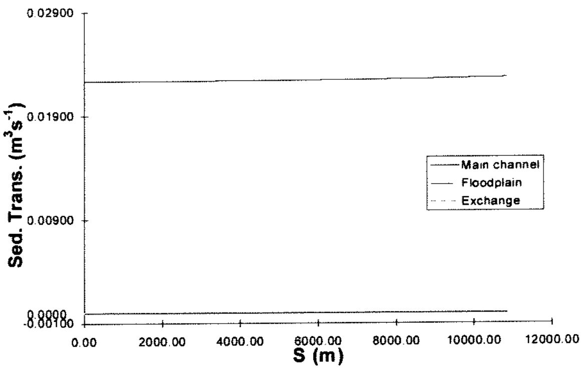


Figure 7.4 - Sediment transport in the year 25: left and right channel and exchange values

This model doesn't give such good results as the previous ones. When comparing the water levels, huge errors can be seen, about 1.00 m see Figure7.1, despite the line follows the one from the 1D model.

In Figure 7.2 the riverbed computed by the 2D model follows the tendency from the other in the first half of the branch. However the errors are also large, with a maximum of 1.43 m. In the downstream half of the branch the model is not good at all.

This must be related with the cross-section 70. The new width computed in *Chapter 4* shall be modify in order to obtain better results.

After these 25 years the river branch is already in equilibrium, as can be seen in Figure 7.3.

Figure 7.4 shows the sediment transport in the main channel and in the floodplain, as well as the exchange values.

The sediment transport in the floodplain is zero, exactly what was pretended in *Chapter 4.3*. Hence, it is possible to define a fixed layer in SOBEK based on the grain size.

The exchange sediment transport is also zero, and the sediment transport in the main channel is equal to the total. That means that it is not possible to model the interaction between the floodplain and the main channel with this application of SOBEK.

Probably due to the high difference of levels between both channels, SOBEK can not compute any transverse transport.

Due to this last conclusion about this impossibility of SOBEK, nothing was done to improve the 2D model in way to give better results than the ones in the Figures 7.1 and 7.2.

7.2. Computation for variable discharge

Despite the latter conclusions, an attempt to do a computation with variable discharge was made. The hydrograph used is the same from the Figure 6.7.

After several trials, unfortunately, the conclusion was that this type of computation is impossible for SOBEK.

The model only works with 2D option when there is flow in both channels. So, in low water periods, when only the main channel, left, has water flowing the programme just crashes.

One suggestion to solve this problem is to build a mixed model in time. Use a 1D model for the periods when the flow is running only through the main channel and a 2D model when the flow goes through the floodplains. One example of this is shown in Figure 7.5.

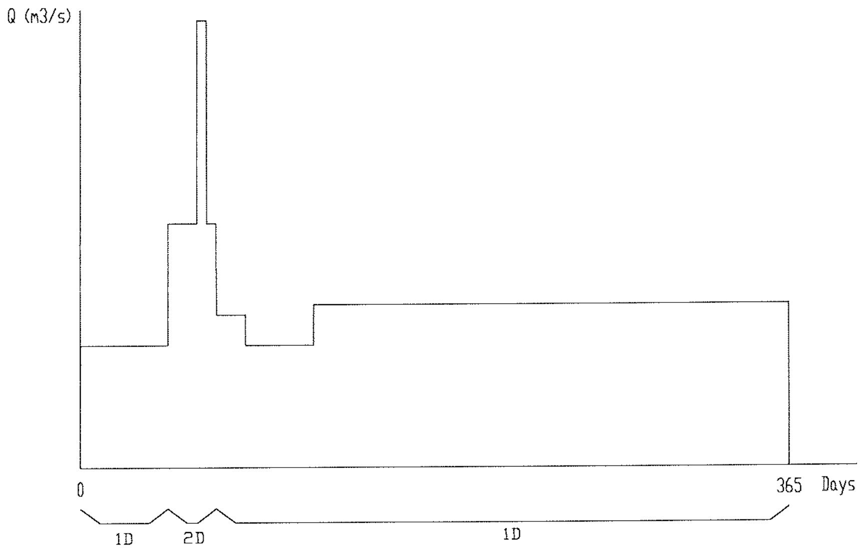


Figure 7.5 – Proposal of a mixed model

This implies to have more cross-sections, and coincident with grid points, in order to use the final results of one period in the next one. The output of the 1D model must always be used as input for the 2D model and *vice versa*. This causes a large amount of work.

Anyway this is not an easy and efficient thing to do and, as can be seen in the *Chapter 7.1*, it is not possible to model the floodplains this way.

The only solution is to appeal to a two-dimensional model.

8.1. Computation with the 1D model

The model used in this chapter is the same as described for the computations in *Chapter 6*. Only the summer dikes were risen up so the water level could not have chance to rise above them.

Since the flow is only in the main channel, the influence of the floodplains is not felt. The large variations of flow velocities due to the floodplain width variations are not present in this case.

Hence it is possible to obtain the effect of the discharge from the 1997 hydrograph in the main channel isolated from the floodplain. The computation was made for 8 years.

The results are shown next.

8.1.1. Results and comments

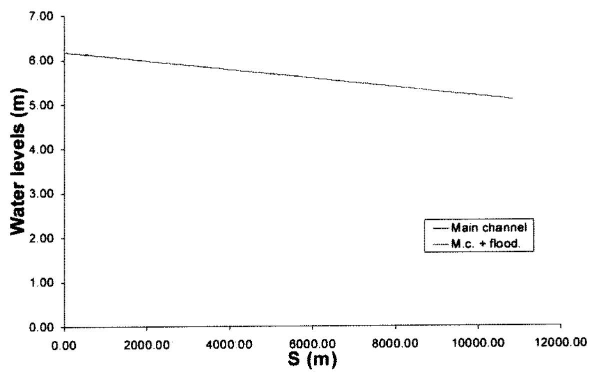


Figure 8.2 – Comparison between the water levels from the model only from the main channel, and the one with the floodplains (year 8)

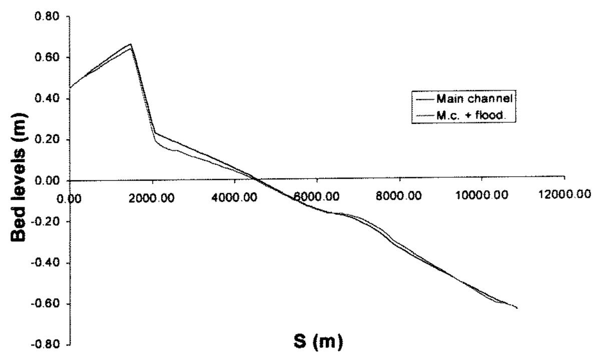


Figure 8.3 – Comparison between the bed levels from the model only from the main channel, and the one with the floodplains (year 8)

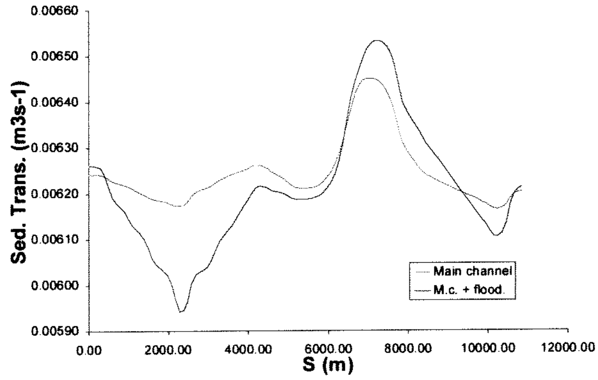


Figure 8.4 – Sediment transport in the year 8

The water levels resulted of the present simulation are equal to the ones from the *Chapter 6.3*. The presence of the floodplain doesn't affect the water levels anywhere.

The prediction of the bed levels effects is quite similar to the one from the *Chapter 6.3*, see Figure 8.3. After the same 8 years the shape of the bed level is the same. The solitary sediment wave that is coming downstream is in the same position as well, see *Chapter 6.3*.

In the sediment transport chart, see Figure 8.4, the results follow the same tendency from the ones from the *Chapter 6.3*, but with some major differences especially in the peaks. Here the floodplains seem to have a bigger influence.

In a primary analysis it can be concluded that the floodplain influence is not significant for the water and bed levels. For the determination of the sediment transport they have a relative more influence, but not really important.

Anyway, when looking at the results like from Figure 8.2, 8.3 and 8.4, the errors introduced by ignoring the floodplains can be negligible.

8.2. Computation with the 2D model – variable discharge

This computation is similar to the last one, except in the model used. It is pretended to see the effect of the bends in the flow through the main channel.

As is known, the secondary flow induced in the stream by the presence of bends, induces different types of behaviour in each side of a river, see *Chapter 1* (Ref. 8).

The helical current present in a bend causes erosion near the outer bank of the curve and consequent deposition in the inner bank. This originates a different response in each channel of the model from the *Chapter 5*.

These results are also from a period of simulation of 8 years.

8.2.1. Results and comments

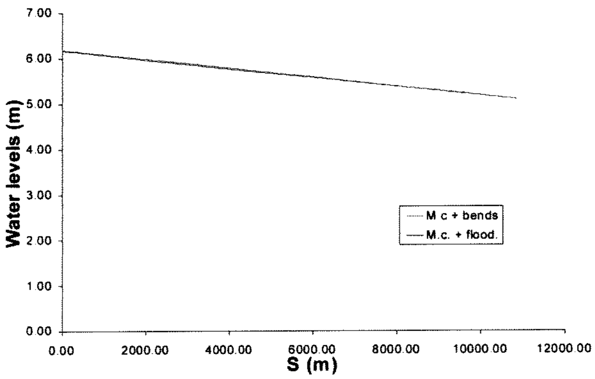


Figure 8.5 – Comparison between the water levels from the 2D model only from the main channel, and the one with the floodplains (year 8)

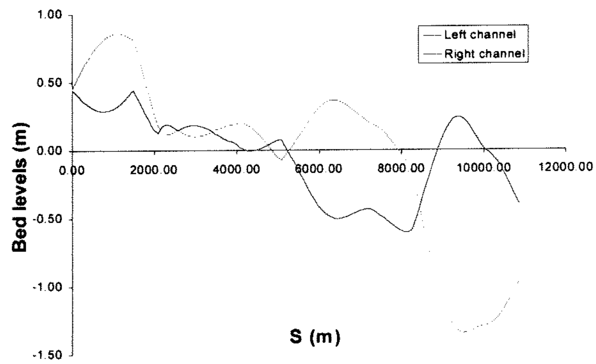


Figure 8.6 – Bed levels for both channels in the year 8

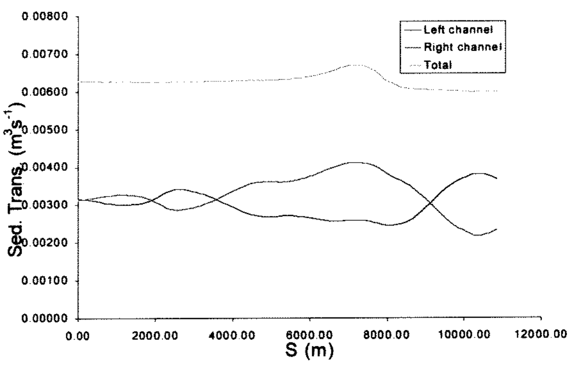


Figure 8.7 – Sediment transport in the year 8, total and for each channel

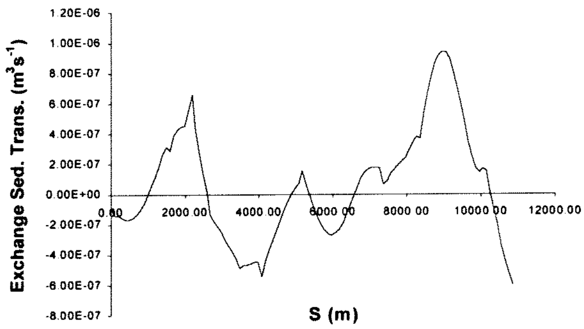


Figure 8.8 – Exchange sediment transport in the year 8

In terms of water levels, the results look like the ones from the last chapter. Also here, it appears that the floodplains doesn't influence in nothing the levels of the water. Actually, the floodplains do influence the water levels but, apparently this model give the same results as the model with the floodplains.

When looking at the bed levels results, a huge difference is noticed between both channels. Figure 8.6 shows differences of more than 1.50 m.

When dealing with a one-dimensional model, to the bed levels is given an averaged value. In this case errors of more than 0.75 m could be committed, half of the total amplitude.

The next figure shows the comparison of these results with the ones from the other simulations, all for 8 years of computation.

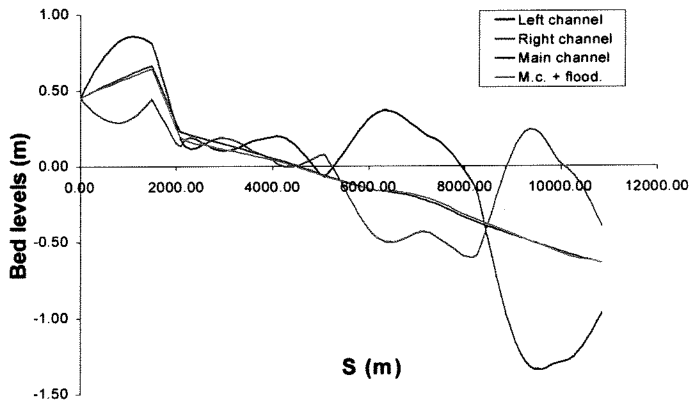


Figure 8.9 – Bed levels in the year 8 for the 3 simulations

This figure gives a better view of the differences between the other computations and this last one.

The effects from the bends can not be neglected in this Waal branch. When looking at the bed levels, the error of despising them is too big, in some cases almost 0.90 m, see Figure 8.9.

Especially for navigation, these differences can be significant.

Therefore, a correct analysis of this branch can not be done in a one-dimensional mode, where the bed levels are averaged in the cross section. A two dimensional approach seems to be necessary.

It can also be concluded that the major effect comes definitely from the presence of the bends. The floodplain effect is not important in the behaviour of the main channel.

The sediment transport is almost constant at this moment, but it can be observed some exchange between both channels in the Figure 8.8. Is this exchange that lead to a differential evolution of the bed levels in both channels. This is the main consequence in the river behaviour of a bend.

It is also interesting to see that in this case exists a kind of equilibrium like the one referred in *Chapter 6.3*. This equilibrium is concluded with the analysis of the next figure. The exchange sediment transport is almost zero, see Figure 8.8, what also is an indication of equilibrium state.

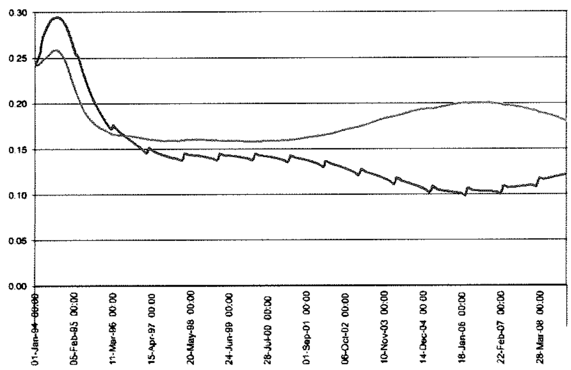


Figure 8.10 – Evolution in time of the bed levels in the left channel (red) and in the right channel (green) km2.5

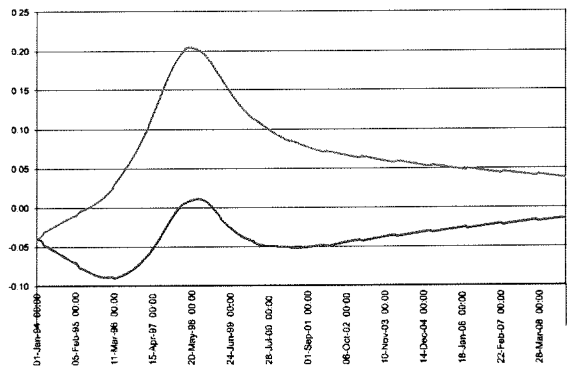


Figure 8.11 – Evolution in time of the bed levels in the left channel (red) and in the right channel (green) km5.0

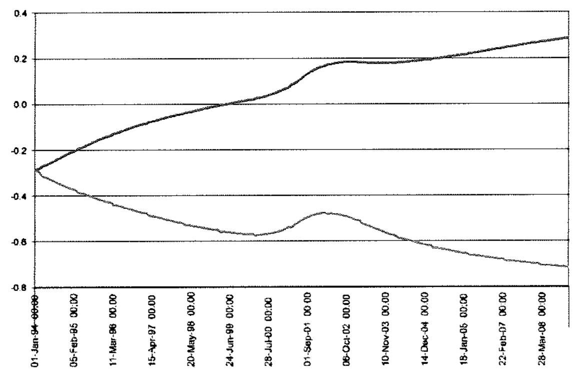


Figure 8.12 – Evolution in time of the bed levels in the left channel (red) and in the right channel (green) km7.5

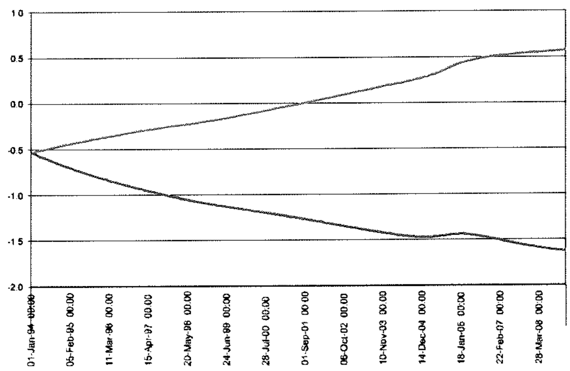


Figure 8.13 – Evolution in time of the bed levels in the left channel (red) and in the right channel (green) km10.0

Here the configuration of the curves is not so regular as the one in Figures 6.24 to 6.27, but also can be observed a wave that goes downstream and a tendency to the bed level stabilise after it. After that the bed levels keep an oscillation between a certain range of values.

8.3. Computation with the 2D model – dominant discharge

A simulation with the dominant discharge, Q = 1600 m^3s^{-1}, was also made. This was essentially to see once more if it is reasonable to use it in simulations like these, and to compare the results with others from Delft 2D

The bed levels from Delft 2D were averaged in the cross section, and the main channel was divided in two channels. They will be compared only in the cross sections from this model referred in *Chapter 3.2.*

8.3.1. Results and comments

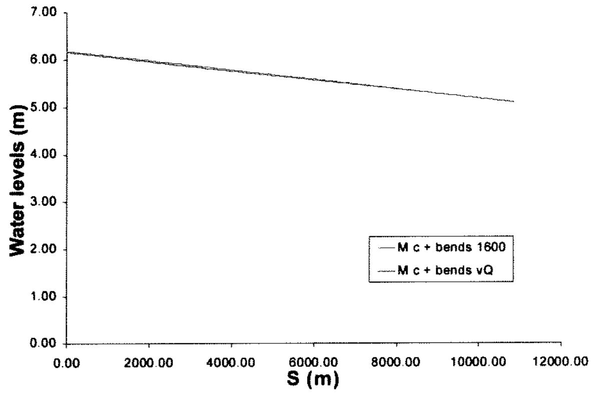


Figure 8.14- Comparison between the water levels from the 2D model only from the main channel (Q = 1600 m^3s^{-1}), and the one with the floodplains (year 8)

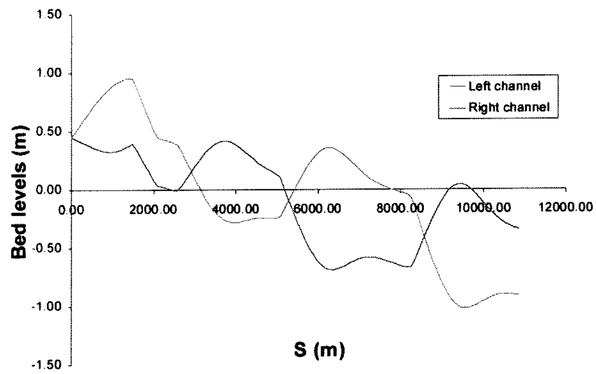


Figure 8.15 – Bed levels for both channels in the year 8

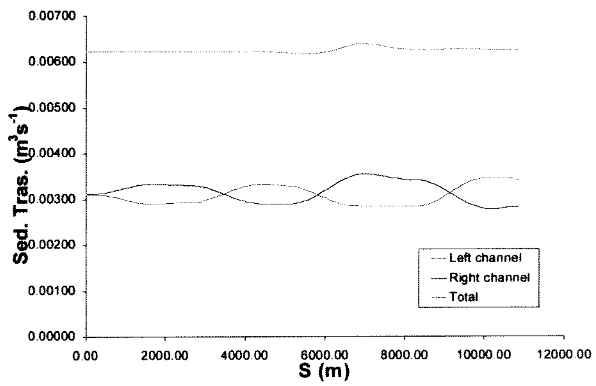


Figure 8.16 – Sediment transport in the year 8, total and for each channel

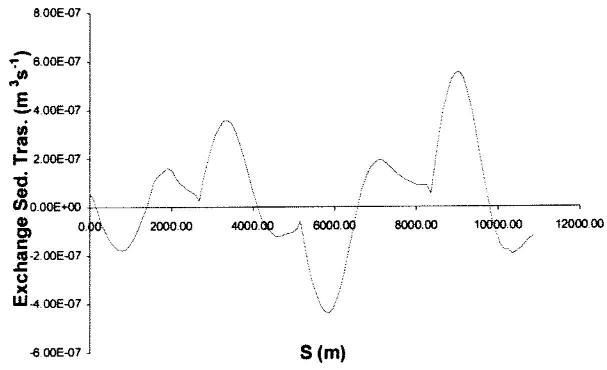


Figure 8.17 – Exchange sediment transport in the year 8

These results are not so optimistic as the ones from the *Chapter 6*, in relation to the utilisation of the dominant discharge.

In terms of water levels there is no problem in using the dominant discharge, see Figure 8.14, the results are quite good.

The sediment transport, total and for each channel, doesn't have too bad results, and show only some discrepancies. The exchange sediment transport presents some differences, introducing sometimes an error of about 50% of the value computed with variable discharge.

In the riverbed the results are more discrepant. The next figure helps this comparison.

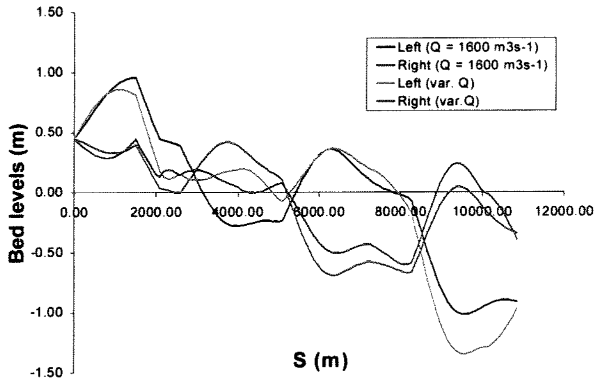


Figure 8.18 - Comparison between the bed levels in the year 8 computed with variable discharge and with the dominant discharge.

Despite both riverbeds follow a similar shape, the errors can reach large errors. For S ≈ 10000 m and S ≈ 4000 m the maximum error reaches 0.35 m. This is not a bad result, but anyway the errors are not so small as the ones referred in *Chapter 6*.

In the next figure, the results of the present simulation are compared with someone's from the Delft 2D. The results from Delft 2D correspond to equilibrium. They were averaged in the cross section divided in two parts. They correspond to the cross section defined for this model.

SOBEK results in this case are from a computation of 20 years.

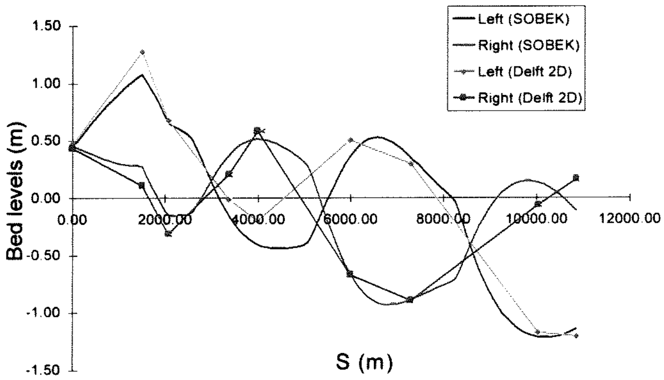


Figure 8.19 - Comparison between the bed levels computed with the results from Delft 2D

Generally the model can represents well what happens in the riverbed. Despite being a simple and rough model, the results for a two-dimensional approach with SOBEK are reasonable. With the improving of the model with just the introduction of some more cross sections, the results could get better.

The comparison is not too accurate, just using 9 cross sections from the Delft 2D, but is enough to get the idea of the model behaviour. In this case a view of what is happening in the river bends is obtained, and its importance is reaffirmed.

9. CASE: EFFECTS OF CHANNEL NARROWING

9.1. Introduction

In this chapter is pretended to simulate the consequences of a sudden narrowing in an erodible channel. For that, the 2D sedredge option from SOBEK will be used and the two dimensional effects occurred in this cases can be analysed.

This kind of occurrences is not so unusual. They can be result of some accident in the river banks that induce the occupation of a part of the cross width from the river, or can be result of the occupation of the river bed with some structure to support human activities, like digs for works in riverbed. The next figure has two examples of these cases.

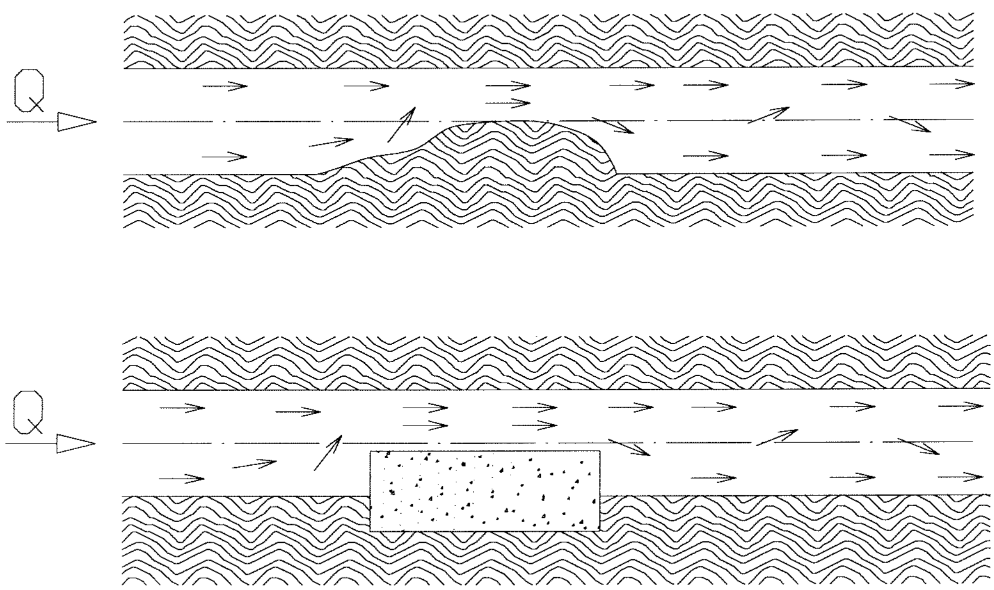


Figure 9.1 – Examples of a constriction in a channel

In this chapter two simulations will be presented. One will be with an obstacle permanently in the river i.e. the computation will be made until the equilibrium state of the river.

Other simulation corresponds to some temporary intervention in the river. The obstacle will remain just during 3 years and than it is removed. This way is possible to see the river response, and to check if and how long does it take to recover its initial shape.

The channel will be divided in two parallel channels, where one will remain with the width constant and the other will suffer the narrowing.

The characteristics needed for the construction of this model were based on characteristics from the River Waal.

9.2. The model

This model is a straight channel, with a constant width and with a singularity similar to the ones in the Figure 9.1.

It has just one branch, with 5 km to upstream of the singularity, and 13.5 km downstream.

The narrow section extends for 500 m, and there are transitions of 500 m after and before it. These transitions were introduced in the model in order to obtain a stable computation since SOBEK doesn't deal very well with sudden changes. Nevertheless these transitions are not important for the results.

The cross sections are rectangular and were used as input for the 2D morphology option. The main channel will remain inalterable along the whole model, and the right will suffer the narrowing. The model can be seen in Figure 9.2, where the location of the cross sections and it shape are shown. The right channel is not completely obstructed because it gives stability problems in SOBEK computation. However the reduction introduced in the width of the right channel is enough to simulate the effects pretended.

The total width of the model is 250 m, the average width of the main channel from the River Waal.

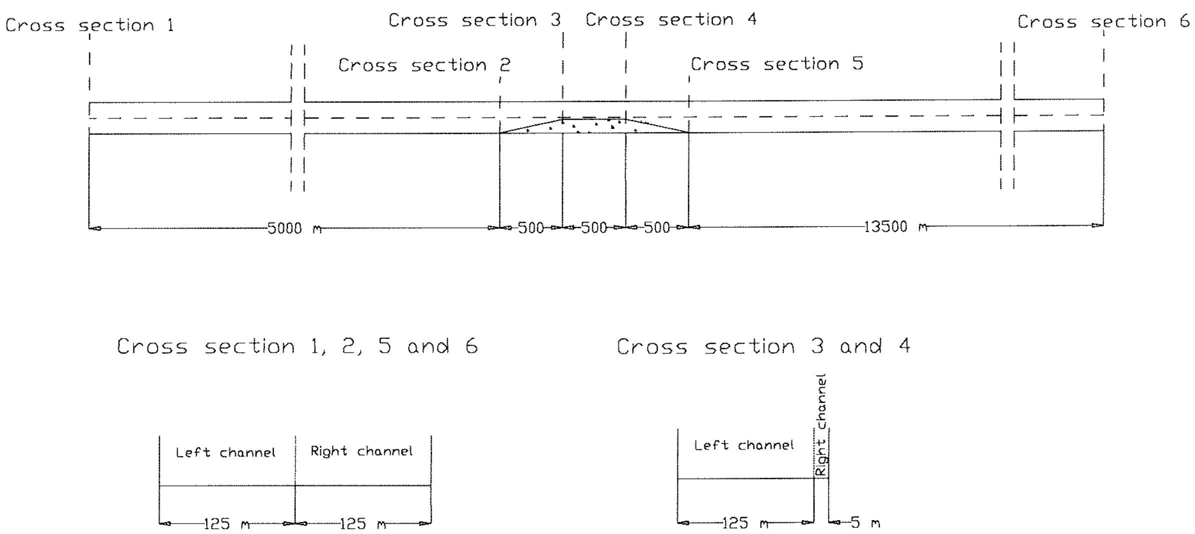


Figure 9.2 - Model for the case 2

As written before the characteristics of this channel are based in the usual values used in a River Waal model. In Table 9.1 some of these characteristics are shown.

C $[m^{1/2}s^{-1}]$	50
I [-]	10^{-4}
D50 [m]	0.001
D90 [m]	0.004

Table 9.1 - River characteristics

The sediment transport formula used by SOBEK was the same as in the previous models, see *Chapter 4.4*.

The discharge used for the computation was $Q = 1600\ m^3s^{-1}$, a low water discharge for the River Waal. The next tables show what flow and morphological boundary conditions were used, as well as the initial conditions.

Water flow

N1	$Q_{left} = 800\ m^3s^{-1}$
	$Q_{right} = 800\ m^3s^{-1}$
N2	Water level = 5.47 m

Morphology

N1	$Z_{left} = 2$ m
	$Z_{right} = 2$ m
N2	$Load_{left} = 0\ m^3s^{-1}$
	$Load_{right} = 0\ m^3s^{-1}$

Table 9.2 – Boundary conditions

Water flow	$Q = 1600\ m^3s^{-1}$
	Water depth = 5.47 m

Sediment	$D50_{left} = 0.001$ m
	$D50_{right} = 0.001$ m
	$D90_{left} = 0.004$ m
	$D90_{right} = 0.004$ m

Table 9.3 – Initial conditions

The model grid is very regular with grid points spaced of 100 m between from each other.

The duration of the first computation was of 20 years, and the time step was of 4 days. This duration guarantee that the equilibrium is reached, in other words, the sediment transport is constant and the bed levels remain inalterable.

The second computation was for a period of 30 years. This way the total recover of the river branch is guaranteed.

9.3. Results and comments from the simulation until equilibrium

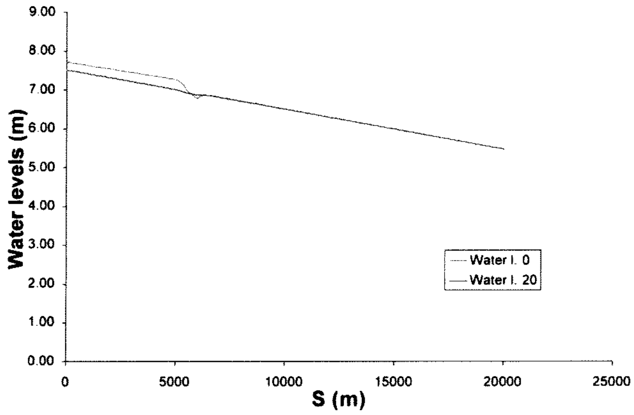


Figure 9.3 – Water levels in the beginning and in the end of the simulation (year 20)

It can be seen that, in the year 0, the constriction has an expected effect in the water levels, originating the *backwater of the constriction*, as in Ref. 3.

In this case the flow is subcritical. In subcritical flow a perturbation spreads upstream. The constriction induces a pronounced backwater effect that is extended a long distance as can be see in Figure 9.3. The water profile present upstream of the constriction is a M1 profile, see Ref. 15. A control section exists where the constriction is located, and after this the flow takes again the "uniform" water levels.

After 20 years the constriction doesn't influence in the backwater curve anymore, due to the river adaptation to the new conditions.

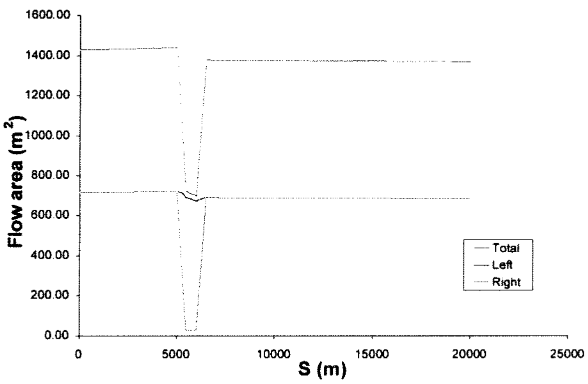


Figure 9.4 – Flow area in the year 0, total and for each channel

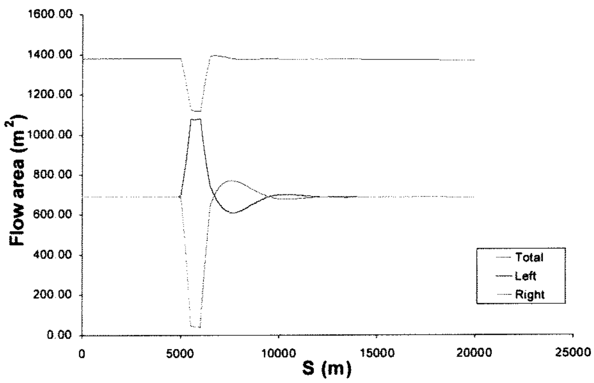


Figure 9.5 – Flow area in the year 20, total and for each channel

At the narrow section, all the flow is directed to the left channel. We can observe by the results of the Figure 9.4 that the flow area in this channel does not change too much. Since the flow area in the other channel is almost zero, the total flow area suffers an enormous decrease, almost to 50%. Being the discharge the same, the velocities increase in an inverse proportion of the flow area.

So, in the left channel the erosion capability is very large in the narrowed section. Erosion happens there, and a hole appears as the result of it.

After the 20 years, as result of the hole, the flow area in the left channel increases to values close to the flow area upstream of the constriction, see Figure 9.5.

The flow area upstream the singularity is not affected by the constriction.

In the next figures the sediment transport charts show better what was written before about the sediment transport.

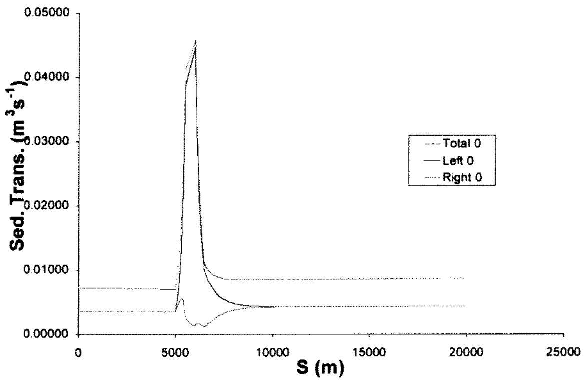


Figure 9.6 - Sediment transport for the year 0, total and for each channel

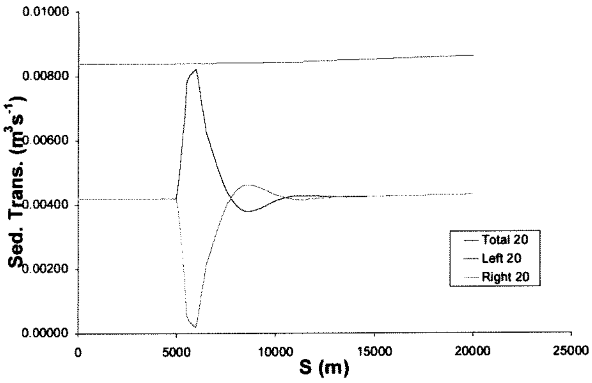


Figure 9.7 – Sediment transport for the year 20, total and for each channel

Figure 9.6 shows an enormous peak in the zone of the constriction. This was expected because of the area reduction referred.

After the 20 years the river branch reaches the equilibrium. The total sediment transport is constant along it.

However there remains a difference of sediment transport between both channels that goes until around 7.5 km above the singularity. Only after this the river recovers from the constriction.

The next figure shows the exchange of sediments between both channels.

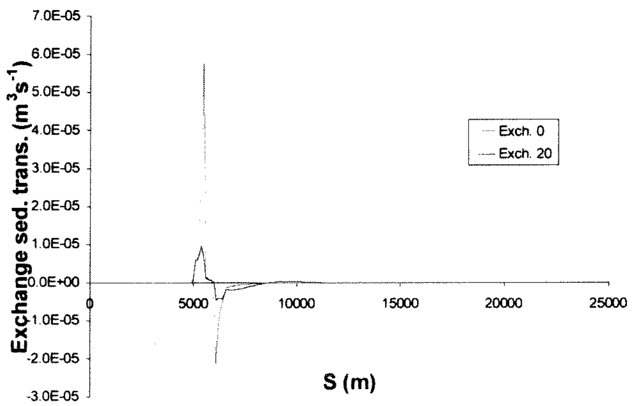


Figure 9.8 – Exchange sediment transport in the year 0 and in the year 20

In this last figure it can be seen that in the beginning of the simulation there is an intense transverse sediment transport. This is attenuated with the years.

This exchange is due to the different sediment rate in both channels, and due to the oscillation that the flow suffers after the constriction.

After the singularity a mass of water occupies the right channel again, and it will oscillate between both channels. This causes differential erosion and deposition in the channels what leads to the uprising of alternated bars in the riverbed.

The Figure 9.9 shows what happens to the bed level.

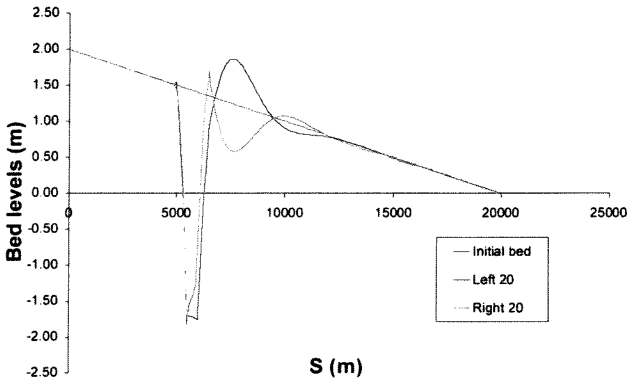


Figure 9.9 – Bed levels in the year 0 and in the year 20

In the last chart it can be seen the alternated bars existent in the riverbed. The bed gets a shape where the left and right channel alternates with bars and holes.

It is curious to denote that, in terms of bed levels, there is no influence upstream the singularity.

When looking at the evolution of the bed with time, until reach the equilibrium state of the Figure 9.9, the branch is crossed by a sediment wave. This is well understood by the next figures.

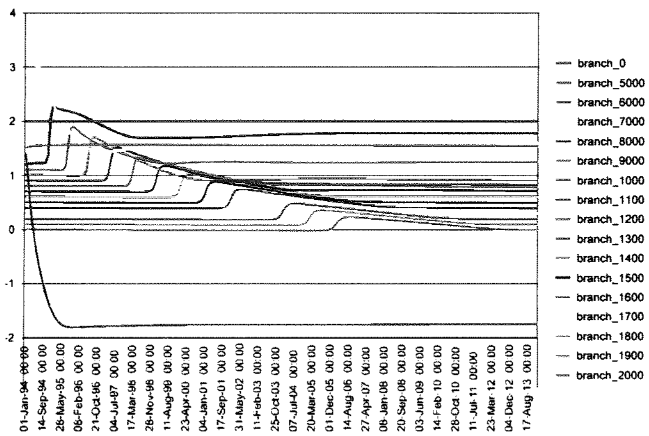


Figure 9.10 - Evolution of the bed level in time.

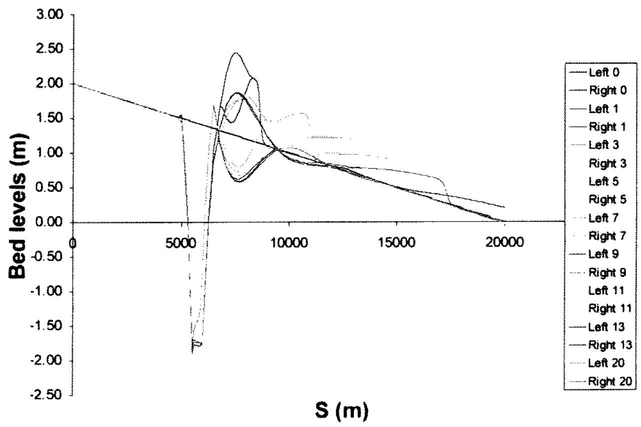


Figure 9.11 – Evolution of the sediment wave along the years

Both figures show that a wave passes by the branch before it reaches the equilibrium. A level of one point in the branch remains inalterable after the wave.

The wave keeps its way downstream. A singular constriction doesn't influence only locally, but also creates a solitary wave that develops downstream. This wave has about 0.40 m of height. Upstream, as said before there's no influence.

The solitary wave velocity can be estimated in a rough way by looking to the results. In the Figure 9.11 the wave takes about 2 years to cover a distance of 2000 m. In regular unites the wave velocity is about $c = 3.2\times10^{-5}$ ms^{-1}.

Identical considerations as the ones in *Chapter 6.3* about the sediment wave velocity can be made.

u [ms^{-1}]	1.15
C [$m^{1/2}s^{-1}$]	50
D [-]	1.65
D_{50}[m]	0.001
θ [-]	0.320

Table 9.4 – Computation of the Shields parameter

h [m]	5.56
D_{90}[m]	0.004
C_{90} [$m^{1/2}s^{-1}$]	67.41

Table 9.5 – Computation of C90

C [$m^{1/2}s^{-1}$]	50
C_{90} [$m^{1/2}s^{-1}$]	67.41
μ [-]	0.638

Table 9.6 – Computation of the ripple factor

θ [-]	0.320
μ [-]	0.638
b [-]	3.90

Table 9.7 – Computation of the coefficient *b*

s [m^2s^{-1}]	3.4×10^{-5}
b [-]	3.90
h [m]	5.56
c [ms^{-1}]	2.4×10^{-5}

Table 9.8 – Sand wave celerity – analytical calculation

This time there is a larger difference between the analytical computation and SOBEK results, about 0.8×10^{-5}. This may be explained by the way that SOBEK result was consulted in the graphic.

The parameters introduced in the *Chapter 1.5*, were calculated for this case. The following table shows this computation:

C [$m^{1/2}s^{-1}$]	50
g [ms^{-2}]	9.8
h [m]	5.56
λ_w [m]	709.18

C [$m^{1/2}s^{-1}$]	50
W [m]	250.00
h [m]	5.56
D50 [m]	0.001
U [ms^{-1}]	1.15
Δ [-]	1.65
θ [-]	0.321
λ_s [m]	478.93

Table 9.9 - Computation of the relaxation lengths

L_P [m]	4149.27
L_D [m]	1376.02

Table 9.10 – Computation of the wave and damping lengths

The parameter I_P in this case is $\frac{\lambda_S}{\lambda_W} = 0.68$.

9.4. Results and comments from the simulation after taking the constriction

The initial conditions of this simulation are the correspondents to the year 3 of the last computation. The model used now is similar to the first one, but with more cross sections.

The cross sections have the same shape but the space between them is different. When is verified bigger changes in the riverbed the distance between cross sections were reduced in order to have a more representative model for the new simulation.

Is good to remind that when is referred year 0 means the third year after the last computation, and all the other moments are related with this referential.

In the present chapter only the results related to the evolution of the riverbed will be presented.

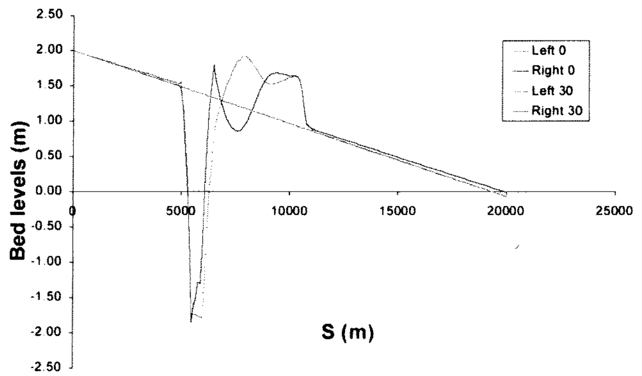


Figure 9.12 – Bed levels in the year 0 and in the year 30.

After several years the river recovers absolutely the original shape. The slope is the same, since the original riverbed corresponds to equilibrium.

Despite the computation was made for 30 years, the time that takes the river to reach the equilibrium bed again, is about 26 years, a long period of time.

The next figures show the main phenomena that happen in the riverbed during this time.

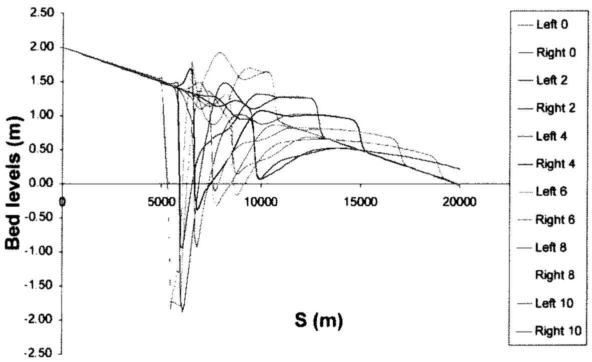


Figure 9.13 – Evolution of the sediment wave along the years

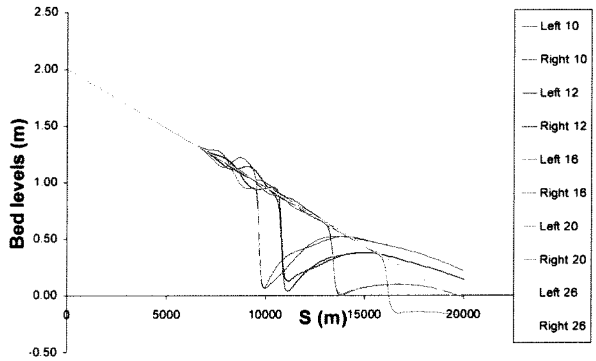


Figure 9.14 – Evolution of the sediment wave along the years (continuation)

A general view shows that all perturbation existent in the riverbed moves downstream.

The oscillation between both channels of the model soon damps and gives place to a bed elevation that moves downwards. This elevation is followed by the depression that stands in the place of the constrictions while this one is there.

This wave constituted by the elevation and the hole doesn't damp too fast. It can be seen that after almost 26 years of simulation, and after travelling almost 15 km, the hole still has a depth of about 1.0 m.

This is an important remark to make. If it is necessary to proceed to temporary works in a river that oblige the constriction of part of the river, this effect can not be forgotten. The amplitude of the wave can cause unexpected effects downstream.

10. CONCLUSIONS

During the work some comments and considerations has been made. The present Chapter pretends to be a resume of the most remarkable conclusions.

10.1. About the model

About the accuracy of the 1D model, it can be said that is very reasonable, see *Chapter 6*. The results obtain are reliable, apart of small errors. Adding some more representative cross sections would improve the model.

Also the 2D model for the main channel where the bends are represented can provide good simulations of reality.

This proves that is possible to obtain good results with a coarse SOBEK model like this, with only 9 cross sections.

With this work are floppy disks with the SOBEK models that can be used for future computations.

10.2. About the dominant discharge

The use of dominant discharge in simulations like these ones can be acceptable if what is pretended is the computation of an equilibrium riverbed. In the models used it was possible to have better results in the 1D model.

In the 2D model the results are nor too optimistic about the use of dominant discharge. It is advisable to do some more experiments with it to check its validity, see *Chapter 8*.

In *Chapter 6* is showed that are some phenomena that the use of dominant discharge doesn't allow to see. These phenomena are variations in time due to variable discharge. It can be seen that every year the peak in the hydrograph disturbs the equilibrium. However, these disturbances aren't more than small ripples without consequences and can be neglected.

Also in *Chapter 6* a simulation was made to see the validity of using a hydrograph with an averaged peak. It was concluded that it is valid to use it, and it is advisable due to it simplicity.

10.3. About the floodplain model

Unfortunately the conclusion was drawn that is not possible to model the interaction between the floodplain and the main channel resorting to the *quasi* two-dimensional option of SOBEK.

The reasons pointed to this failure are related with one aspect, the difference of levels between the main channel and the floodplain is too large to exist any kind of interaction computed by SOBEK, see *Chapter 7*. SOBEK is only able to simulate the exchange values between two parallel and laterally coupled channels if they are about the same level, like in the model of the *Chapter 9*.

Another conclusion was made about other incapability of SOBEK. It is not possible to compute a variable discharge with the two channels option if there is the possibility of one of the channels be without water. This also would disable the intention of making a computation to model the floodplain, see *Chapter 7*. A proposal, not very practical, to solve this problem is also made in this last chapter.

10.4. About the Waal branch

Some considerations can be made about this Waal branch that can be important for future studies.

The main conclusion reached in this work is about the importance of the bends in the river branch behaviour. In *Chapter 8* it can be seen that the bends causes large differences between the two channels of the main channel model.

These differences can never be simply ignored like it was made in the one-dimensional model. The 1D model averages the river characteristics in the cross section, which do not allow seeing the changes along the transverse direction.

For navigation this can be crucial because it might reduce the navigable width of the river indeed.

When compared with the 1D model that include the floodplains it is obvious from the results obtained in *Chapter 6* and *8* that its influence is nothing compared with the bend's influence.

Any future study about this Waal branch shall include the bends, while the inclusion of the floodplains is not really important when using the right discharge for the main channel.

The parameter I_P is $\frac{\lambda_S}{\lambda_W} = 0.98 \approx 1$ was computed in *Chapter 6.5*. By this value there is no damping in the River Waal sand waves.

10.5. About a channel constriction

In this case is possible to confirm the *backwater of the constriction* notion described in Ref. 3. The influence of a singularity like this one is only felt to downstream, being the upstream effect null.

Before reach the equilibrium bed topography a solitary sediment wave travels along the branch downstream.

It is also interesting to see the effects after taking the constriction. This causes a translation of the perturbation that showed with the obstacle, and a damping of it oscillations. The damping is not too intense and the perturbation takes a long time to vanish, 26 years until the effects are gone from 15 km of a river.

The translation of the perturbation will affect the downstream river. That's a fact important to remind; the consequences of taking off a constriction are not only felt in locally, but can have a large influence downstream.

11. REFERENCES

Ref. 1 Brinke, W. B. M. ten: De bodemsamenstelling van Waal en IJssel in de jaren 1966, 1976, 1984 en 1995, Rijkswaterstaat/RIZA, 1997

Ref. 2 Cardoso, A. H. - Hidráulica Fluvial - Lecture notes, IST-UTL

Ref. 3 Chow, V.: Open-Channel Hydraulics, McGraw-Hill, Singapore, 1973

Ref. 4 Cursus 2D Riviermorfologie, Waterloopkundig Laboratorium/Technische Universiteit Delft, Delft

Ref. 5 Graf, W. H.: Hydraulics of Sediment Transport, McGraw-Hill, 1971

Ref. 6 Graf, W. H.: Hydraulique Fluviale - Tome 1, Presses Polytechniques et Universitaires Romandes, Lausanne, 1996

Ref. 7 Graf, W. H.: Hydraulique Fluviale - Tome 2, Presses Polytechniques et Universitaires Romandes, Lausanne, 1996

Ref. 8 Jansen, P. - Principles of River Engineering, Delftse Uitgevers Maatschappij, Delft, 1994

Ref. 9 Lebreton, J. C.: Dynamique Fluviale, Collection de la Direction des Etudes et Recherches d'Electricite de France – Eyrolles, 1974

Ref. 10 Leliavsky, S.: An Introduction to Fluvial Hydraulics, Constable & Company Ltd, London, 1955

Ref. 11 Regeling, H. J.: Stroomatlas Midden-Waal – Afvoer Potentialen en Dieptegemiddelde Stroomsnelheden, Waterloopkundig Laboratorium, 1994

Ref. 12 SOBEK - Technical Reference Guide, Delft Hydraulics/Rijkswaterstaat(RIZA)

Ref. 13 SOBEK - User's Guide, Delft Hydraulics/Rijkswaterstaat(RIZA)

Ref.14 Veen, R.; Pakes, U.; Essen, J.; Schutte, L.: Calibratie SOBEK – Rijntakken, Rijkswaterstaat/RIZA, 1997

Ref. 15 Vriend, H. J. de: River Hydraulics: lecture notes (f8), TUDelft, 1995

Ref. 16 Vries, M.: River Engineering: lectures notes (f10), TUDelft, 1996

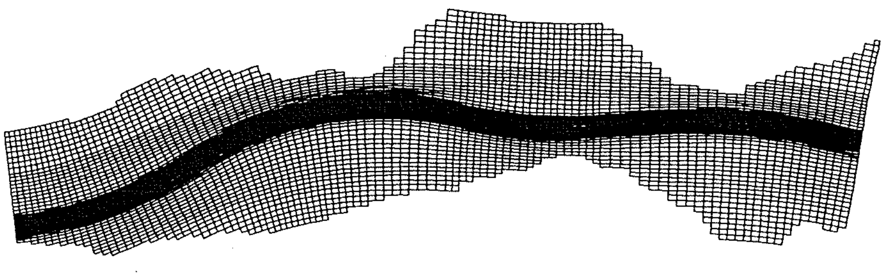
Ref. 17 CD-ROM Landscape Planning river Rhine, Ministry of Transport, Public Works and Water Management

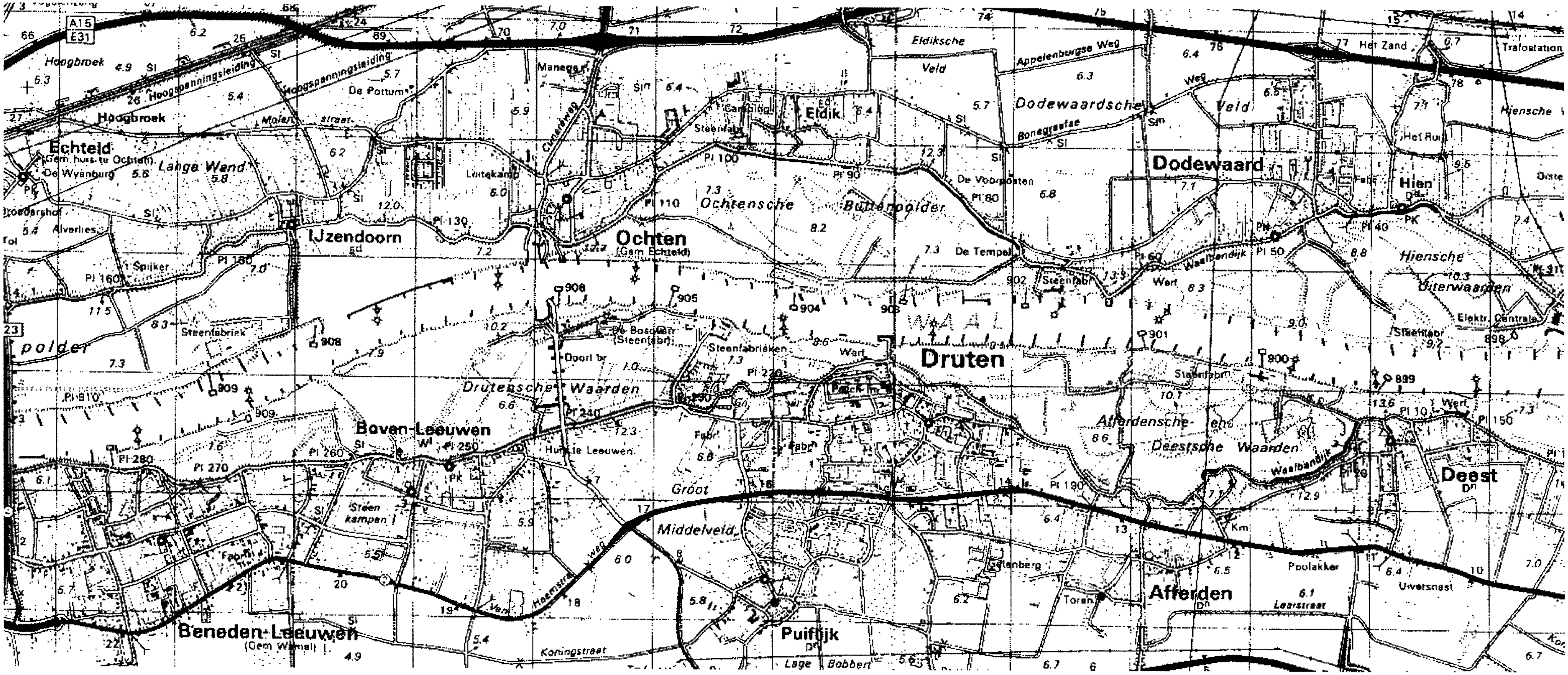
APPENDICES

APPENDIX 1: Data

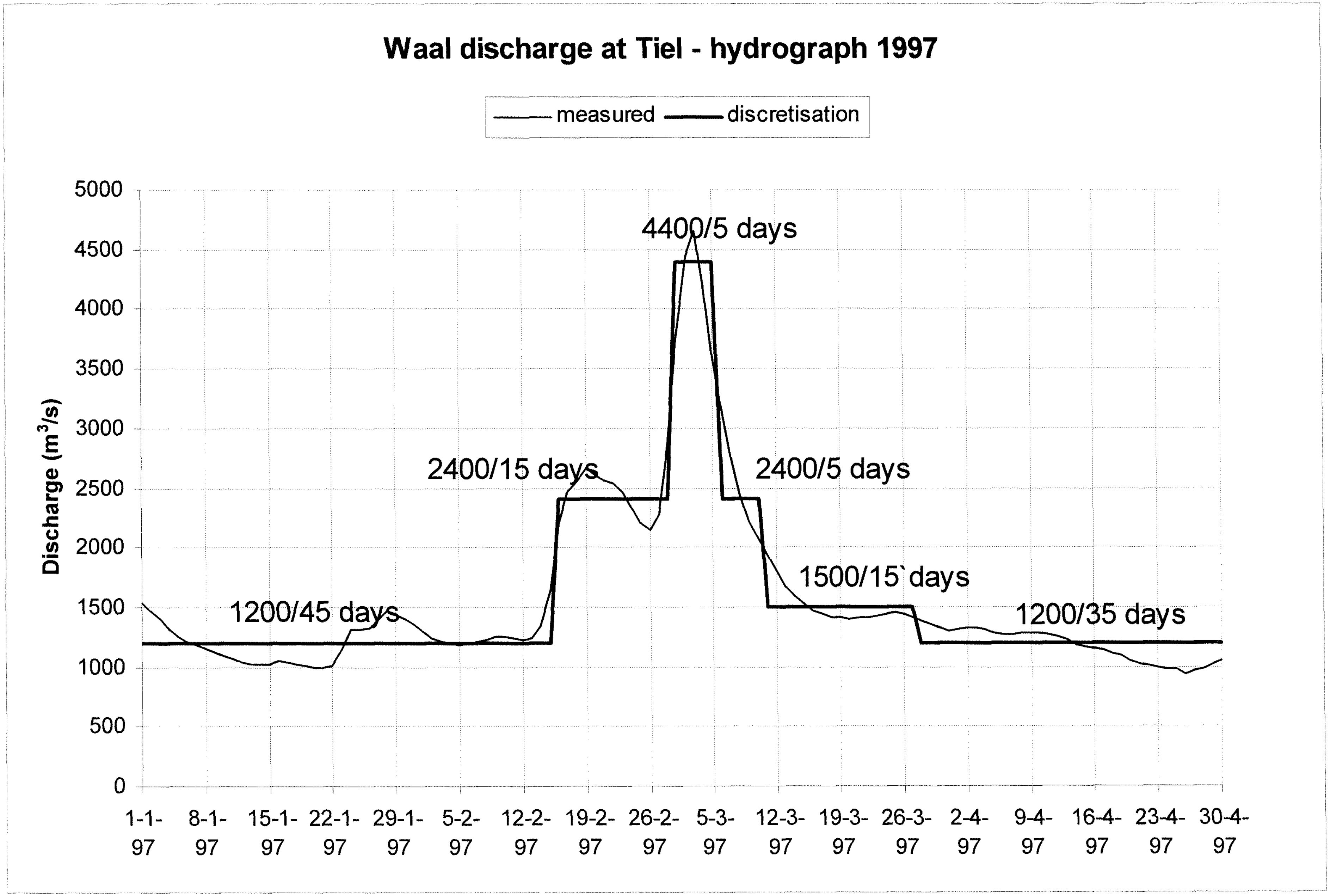
- Waal grid
- Altimetric Waal map
- Waal topographic map
- Hydrograph of 1997

Waal grid





Echteld
Hoogbroek
Lange Wand
IJzendoorn
Ochten
Eldik
Dodewaard
Hien
Deest
Druten
Puiflijk
Afferden
Boven-Leeuwen
Beneden-Leeuwen
Ochtensche
Buitenpolder
Hiensche
Uiterwaarden
Drutensche Waarden
Deestsche Waarden
Afferdensche
Dodewaardsche
Eldiksche
Veld
Groot
Middelveld
Koningstraat
De Tempel
De Voorpotten
Het Zand
Het Ruw
De Pottum
Appelenburgse Weg
Lage Bobbert
Luttekamp
Manege
Steenkampen
Spijker
Alverlies
Trafostation
Elektr. Centrale
Poolakker
Leenstraat
Toren
WAAL
A15
E31
polder



Waal discharge at Tiel - hydrograph 1997
measured
discretisation
Discharge (m3/s)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
4400/5 days
2400/15 days
2400/5 days
1500/15`days
1200/45 days
1200/35 days
1-1-97
8-1-97
15-1-97
22-1-97
29-1-97
5-2-97
12-2-97
19-2-97
26-2-97
5-3-97
12-3-97
19-3-97
26-3-97
2-4-97
9-4-97
16-4-97
23-4-97
30-4-97

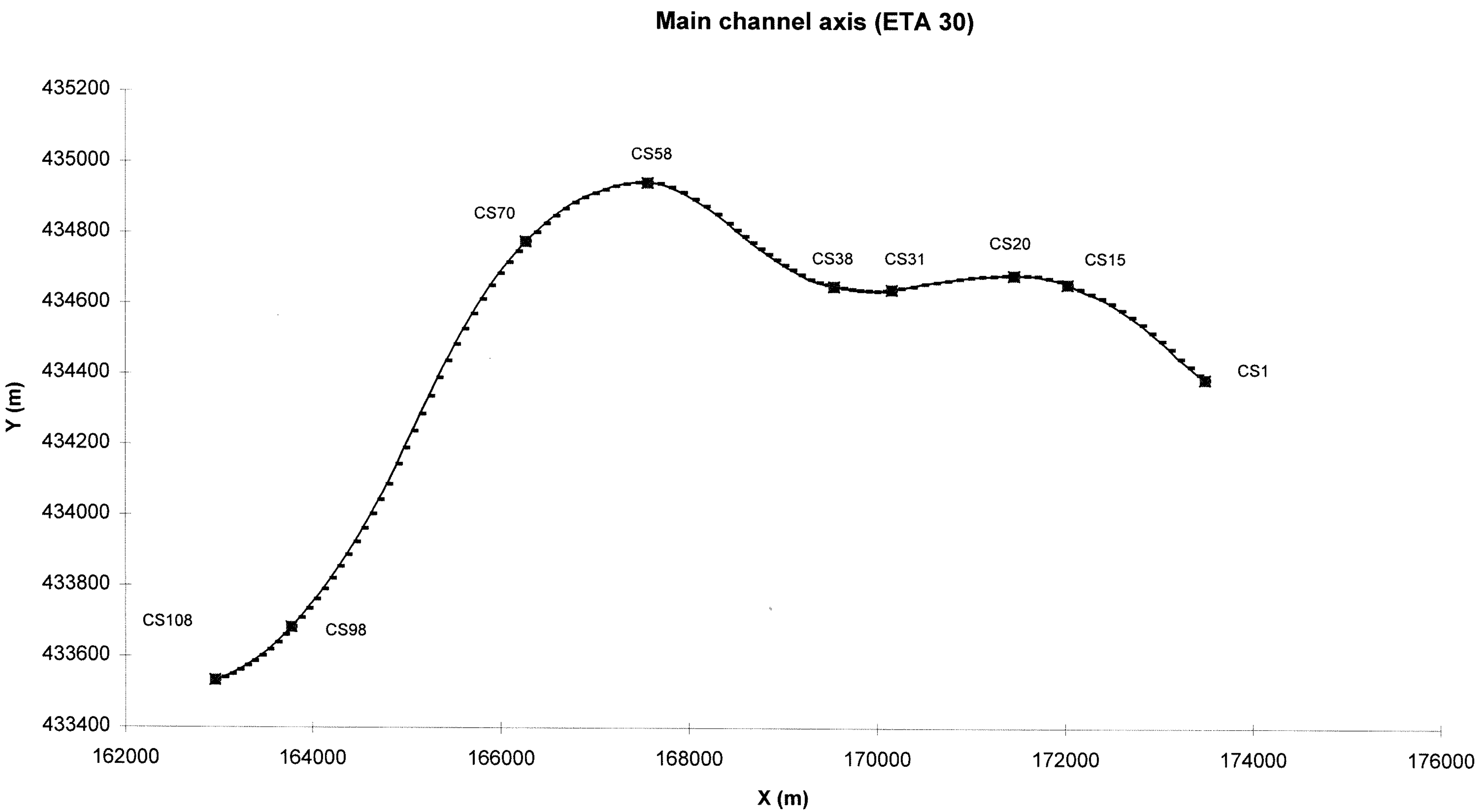
APPENDIX 2: 1D model

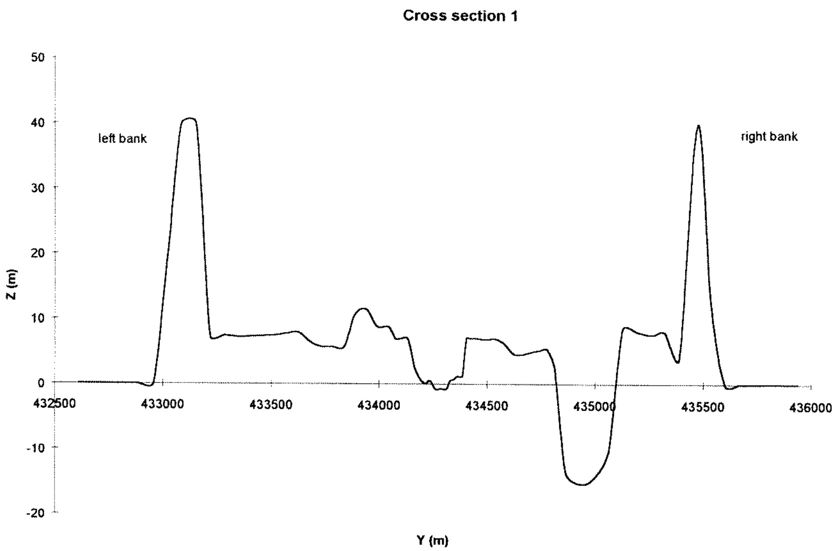
- Axis definition
- Cross sections
- Grain diameters
- Nodes and branches

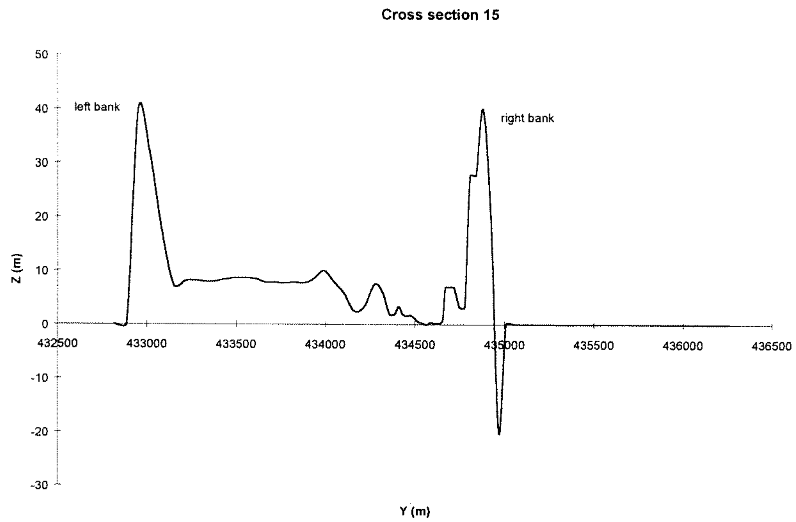
Main channel axis co-ordinates - ETA 30

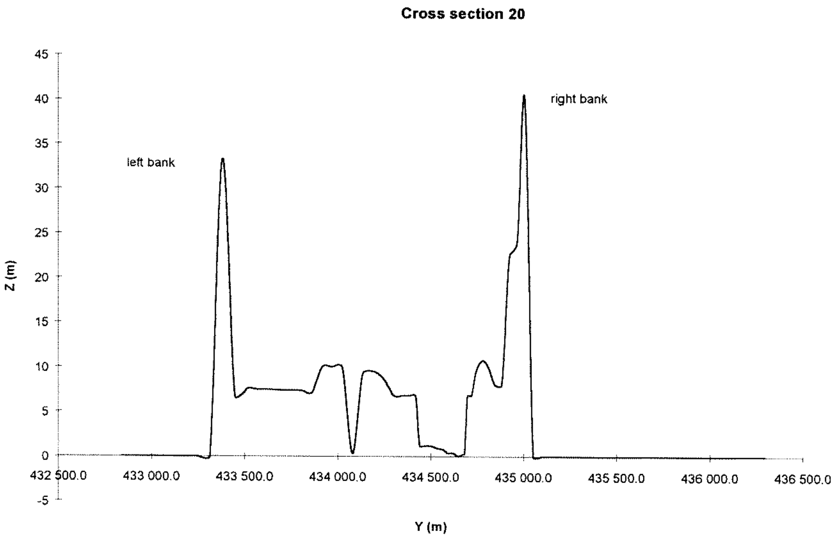
X (m)	Y (m)	
173496.9	**434386.7**	CS1
173424	434401.5	
173323	434423.7	
173218.8	434446.4	
173119.1	434472.9	
173020	434496.8	
172913.7	434520	
172811.3	434543.3	
172698.4	434564.2	
172590.2	434584	
172481.4	434602.8	
172377.3	434617.4	
172262.8	434629.9	
172145.2	434642.6	
172030.7	**434655.8**	CS15
171930.5	434666.3	
171810.1	434673.8	
171691.6	434680	
171578.7	434681	
171461.9	**434681.1**	CS20
171345	434681.9	
171226.1	434680	
171104.1	434678.2	
170985.2	434675.7	
170865.1	434671.2	
170742.4	434666.8	
170620.6	434661.7	
170495.2	434657	
170374.2	434650.1	
170244.9	434645.3	
170163.2	**434640.6**	CS31
170079.2	434638.3	
169990	434636.8	
169897.2	434638	
169806	434639.4	
169718.4	434641.9	
169634.8	434645.6	
169548.2	**434650**	CS38
169463.1	434655.3	
169375.6	434662	
169283.7	434669.8	
169184.7	434683.3	
169094.6	434697	
169008.2	434710.5	
168920.9	434725.4	
168837.4	434740.8	
168753.2	434757.2	
168668.3	434774.2	
168583.6	434791.8	
168499.4	434810	
168415.8	434828.8	
168294.7	434854.3	
168170.3	434876.8	
168050.8	434896.3	

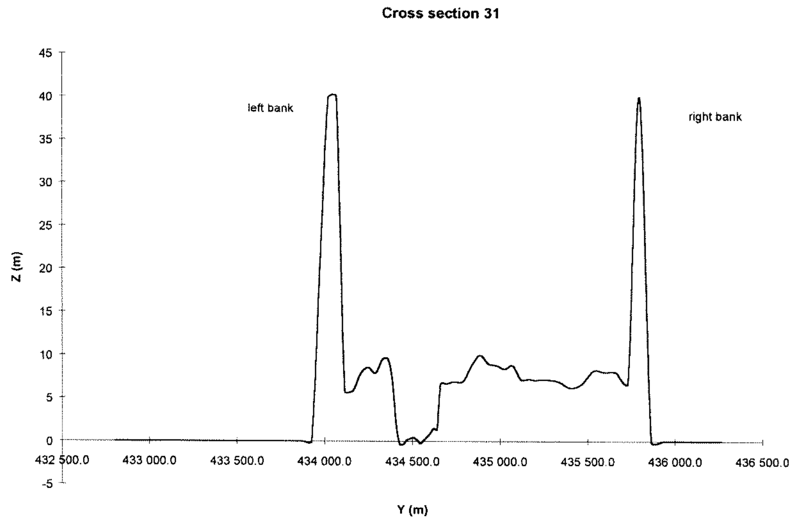
X (m)	Y (m)	
167927	434914.9	
167802.4	434929.5	
167680.5	434939.7	
167562	**434942.6**	CS58
167444.1	434943.1	
167319.6	434939.5	
167204.8	434932.9	
167096.2	434922.7	
166987	434912.7	
166876	434901.1	
166772.2	434886	
166669.8	434868.8	
166567.5	434848.9	
166467.9	434827.2	
166364.6	434802.3	
166266.9	**434776.4**	CS70
166170.7	434748.2	
166071.6	434716.8	
165979.4	434685	
165886	434650.3	
165789.6	434611.7	
165695.3	434570.9	
165602	434527.7	
165511.2	434483.7	
165418.8	434437.1	
165327.6	434388.7	
165236	434337.2	
165145.4	434285.8	
165059.1	434237.2	
164973.9	434189.5	
164894.5	434144.3	
164790.9	434087.4	
164703.4	434043.2	
164620.3	434003	
164532.8	433962.3	
164447.4	433924	
164362.1	433887.5	
164278.1	433854	
164192.6	433820.8	
164110.2	433790.3	
164025.5	433761.4	
163945	433735.3	
163862.1	433709.5	
163775	**433683.5**	CS98
163695	433661.2	
163612.5	433639.7	
163529.7	433619.8	
163447.8	433602.3	
163363.8	433587.1	
163285.8	433574.3	
163204.5	433561.9	
163124.2	433550.5	
163043.5	433540.4	
162962.1	**433533.2**	CS108

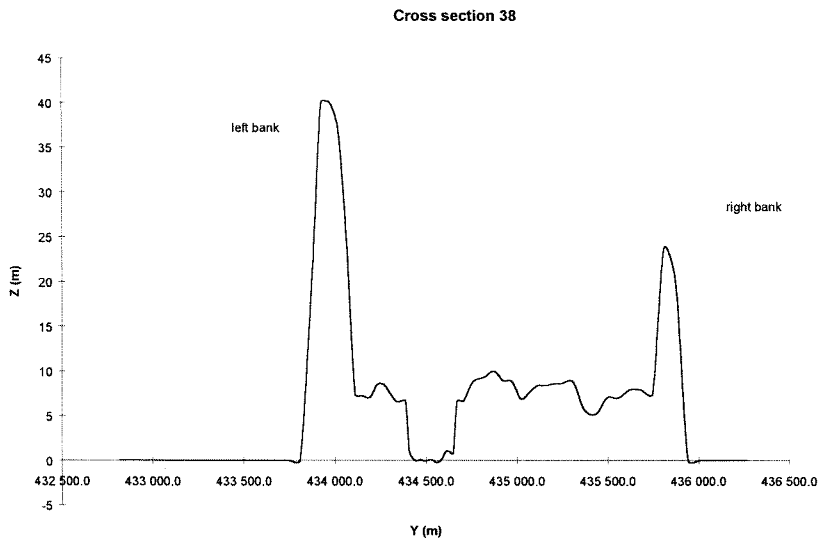

Main channel axis (ETA 30)
Y (m)
X (m)
435200
435000
434800
434600
434400
434200
434000
433800
433600
433400
162000
164000
166000
168000
170000
172000
174000
176000
CS1
CS15
CS20
CS31
CS38
CS58
CS70
CS98
CS108

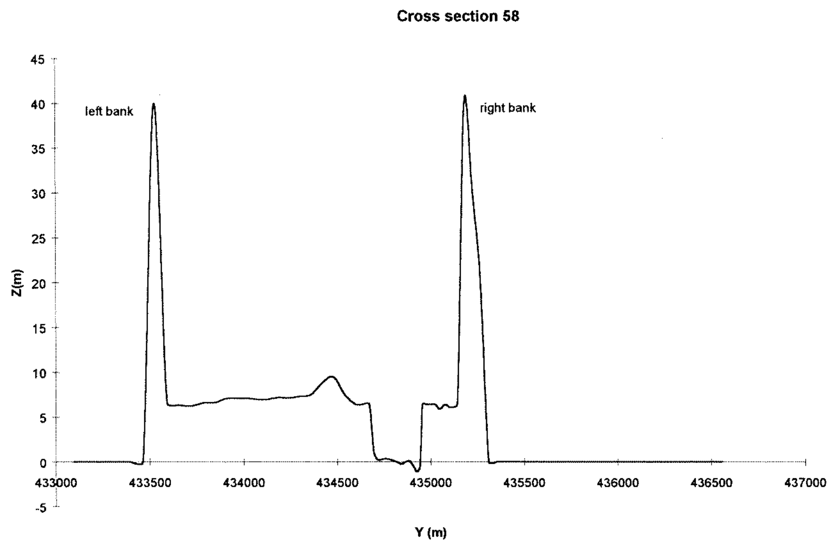

Cross section 1
left bank
right bank
Z (m)
Y (m)
50
40
30
20
10
0
-10
-20
432500
433000
433500
434000
434500
435000
435500
436000

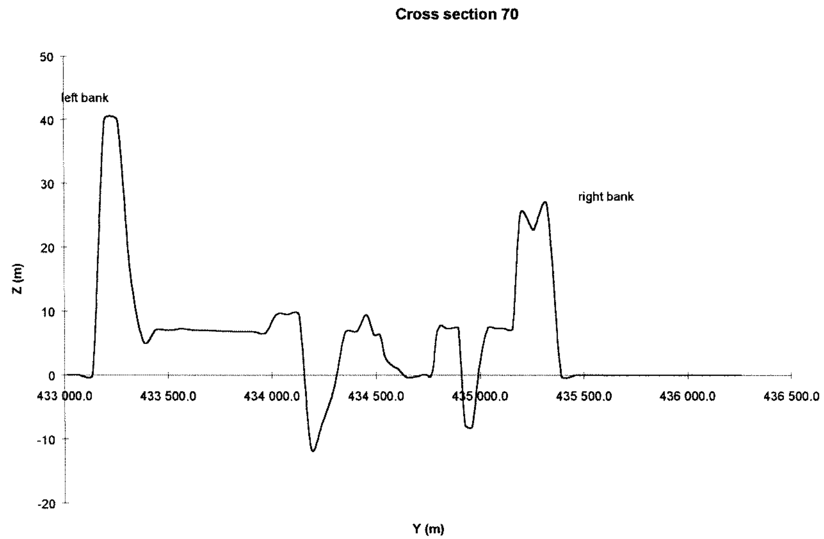

Cross section 15
left bank
right bank
Z (m)
Y (m)
50
40
30
20
10
0
-10
-20
-30
432500
433000
433500
434000
434500
435000
435500
436000
436500

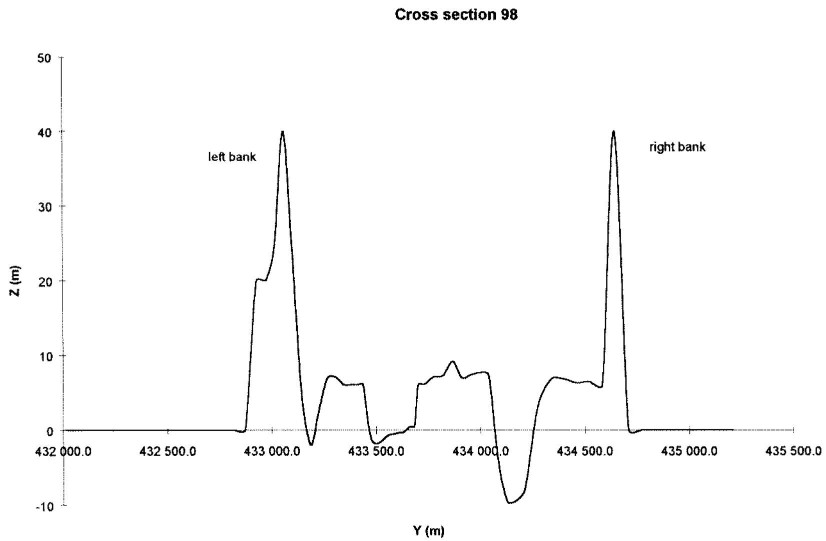

Cross section 20
left bank
right bank
Z (m)
Y (m)
45
40
35
30
25
20
15
10
5
0
-5
432 500.0
433 000.0
433 500.0
434 000.0
434 500.0
435 000.0
435 500.0
436 000.0
436 500.0

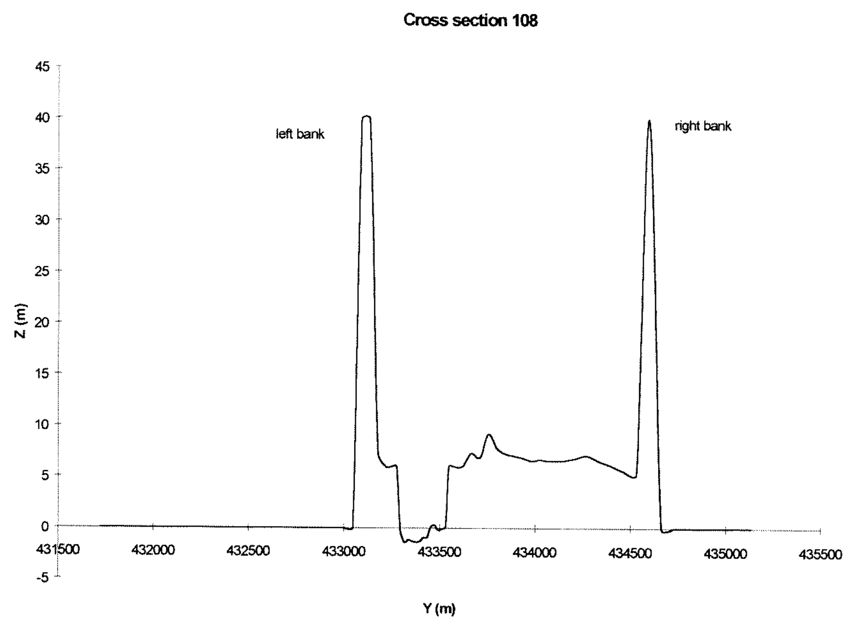

Cross section 31
left bank
right bank
Z (m)
Y (m)
45
40
35
30
25
20
15
10
5
0
-5
432 500.0
433 000.0
433 500.0
434 000.0
434 500.0
435 000.0
435 500.0
436 000.0
436 500.0


Cross section 38
left bank
right bank
Z (m)
Y (m)
45
40
35
30
25
20
15
10
5
0
-5
432 500.0
433 000.0
433 500.0
434 000.0
434 500.0
435 000.0
435 500.0
436 000.0
436 500.0


Cross section 58
left bank
right bank
Z(m)
Y (m)
45
40
35
30
25
20
15
10
5
0
-5
433000
433500
434000
434500
435000
435500
436000
436500
437000


Cross section 70
left bank
right bank
Z (m)
Y (m)
50
40
30
20
10
0
-10
-20
433 000.0
433 500.0
434 000.0
434 500.0
435 000.0
435 500.0
436 000.0
436 500.0


Cross section 98
left bank
right bank
Z (m)
Y (m)
50
40
30
20
10
0
-10
432 000.0
432 500.0
433 000.0
433 500.0
434 000.0
434 500.0
435 000.0
435 500.0


Cross section 108
left bank
right bank
Z (m)
45
40
35
30
25
20
15
10
5
0
-5
431500
432000
432500
433000
433500
434000
434500
435000
435500
Y (m)

CROSS SECTION 1 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
173500.16	434403.78	7.00	
173496.89	434386.66	1.33	17.64
173495.25	434377.22	1.11	13.93
173493.03	434361.47	1.21	20.26
173490.27	434343.66	0.68	11.72
173487.67	434327.00	0.49	7.89
173485.23	**434311.13**	**0.79**	15.70
173481.69	434287.16	0.70	17.82
173476.77	**434260.50**	**0.79**	20.17
173471.64	434236.16	0.52	11.84
173467.25	434214.63	0.12	2.61
173463.13	434193.34	0.55	9.49
173460.97	434180.13	1.37	21.55
173458.77	434161.84	2.77	170.60
173455.00	434132.38	7.00	

W (m)
271.41

Average level of the main channel

Zd (m) = 0.80

Weighted average depth of the main channel

Zd* (m) = 0.63 -> 0.45

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 1 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
173812.27	435938.41	0.00	
173803.81	435875.00	0.00	
173790.30	435802.47	0.00	
173772.16	435725.75	0.00	
173755.63	435668.31	0.00	
173742.95	435600.19	0.00	
173725.31	435534.50	13.33	
173717.83	435476.53	40.00	
173701.27	435390.22	4.00	301.19
173679.94	435325.94	7.93	501.14
173667.64	435263.88	7.60	504.69
173650.98	435193.13	8.10	547.38
173638.64	435128.72	8.50	552.10
173625.67	435063.22	-10.20	-696.95
173612.48	434992.06	-14.50	-973.54
173597.16	434928.94	-15.35	-980.48
173584.98	434864.31	-13.50	-771.40
173572.50	434814.66	2.30	96.56
173562.41	434780.34	5.30	180.70
173557.05	434746.47	5.20	202.64
173549.95	434702.41	4.90	208.71
173543.31	434661.28	4.50	182.04
173536.94	434621.50	4.70	188.37
173530.30	434581.13	6.22	242.09
173524.06	434543.59	6.95	277.02
173517.23	434501.41	6.85	288.13
173510.19	434459.47	7.00	271.90
173503.78	434423.72	7.00	194.91
173500.16	434403.78	7.00	69.78
Main channel			
173455.00	434132.38	7.00	111.56
173449.20	434100.50	7.00	202.35
173444.02	434074.56	7.00	199.17
173439.59	434043.59	8.80	360.39
173432.08	433992.66	8.80	458.43
173422.22	433939.41	11.50	598.54
173412.70	433888.56	10.70	545.70
173403.34	433837.41	5.70	293.64
173393.69	433785.53	5.70	294.35
173384.14	433734.13	5.70	295.78
173374.38	433681.75	6.43	341.65
173363.98	433627.91	7.90	403.27
173354.44	433579.66	7.80	387.20
173344.08	433528.63	7.53	412.08
173332.14	433470.25	7.40	411.51
173321.33	433417.41	7.30	438.11
173307.08	433350.22	7.20	479.25
173292.83	433284.28	7.47	486.06
173278.88	433220.03	7.23	470.26
173264.64	433154.25	40.00	8576.27
173249.84	433086.28	39.95	11998.64
173236.47	433024.63	19.95	
173221.72	432956.78	0.00	
173206.81	432888.16	0.00	
173192.39	432822.00	0.00	
173177.55	432753.69	0.00	
173162.80	432686.00	0.00	
173146.56	432611.00	0.00	

	W (m)
Difference between the Winter dikes	1898.78
Floodplain without holes	1584.72
Floodplain corrected when the main channel width is 271.00 m	1899.19

Average level of the floodplain

Zd (m) = 4.87

Weighted average level of the floodplain

Zd (m) = 4.52

Average level of the floodplain (without hole)

Zd* (m) = 6.89

Weighted average (without hole)

Zd* (m) = 7.57

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

Surrounded by the thick lines are the co-ordinates from the hole

The weighted average depth (without hole) will be used as the floodplain depth

CROSS SECTION 15 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
172032.20	434670.94	6.86	
172030.67	434655.84	0.89	13.70
172029.14	434640.13	0.24	3.96
172027.53	434623.09	0.22	3.87
172025.84	434604.50	0.21	4.08
172024.13	434584.59	0.38	7.68
172022.41	**434563.78**	**-0.13**	-2.64
172020.70	434542.28	0.28	6.07
172019.00	434520.13	0.44	9.75
172017.31	434497.66	1.16	25.95
172015.66	434475.31	1.75	39.01
172014.02	434453.13	1.51	33.34
172012.38	434431.00	1.95	43.28
172010.72	434408.78	3.31	73.13
172009.08	434386.81	1.95	261.17
172006.86	434357.91	1.95	
172004.06	434321.34	5.85	

W (m)
247.06

Average level of the main channel

Zd (m) = 0.94

Average depth of the main channel

Zd (m) = 1.06

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 15 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
172183.94	436254.63	0.00	
172176.89	436179.06	0.00	
172169.63	436104.59	0.00	
172162.28	436030.81	0.00	
172154.91	435957.31	0.00	
172147.58	435883.88	0.00	
172140.30	435810.66	0.00	
172133.06	435737.44	0.00	
172125.94	435664.47	0.00	
172118.89	435591.63	0.00	
172111.89	435518.88	0.00	
172104.92	435446.06	0.00	
172098.00	435373.34	0.00	
172091.19	435301.03	0.00	
172084.47	435229.31	0.00	
172078.05	435159.78	0.00	
172071.92	435093.63	0.00	
172068.03	435051.31	0.00	
172064.19	435009.63	0.00	
172060.30	434967.75	-20.00	
172056.31	434925.38	19.70	
172052.41	434883.75	40.00	
172048.70	434844.44	27.67	
172045.42	434809.44	27.67	
172042.48	434778.03	3.18	97.01
172039.72	434748.50	3.18	93.38
172037.00	434719.38	6.84	192.33
172034.52	434692.28	6.86	166.14
172032.20	434670.94	6.86	424.89
	Main channel		
172004.06	434321.34	5.85	437.93
172000.45	434274.16	7.47	384.32
171996.08	434218.41	3.37	191.55
171991.42	434160.38	2.50	144.10
171986.75	434103.13	5.80	329.33
171982.13	434046.81	8.00	447.62
171977.50	433991.22	10.00	553.43
171972.86	433936.13	8.45	465.54
171968.22	433881.03	7.70	422.18
171963.64	433826.47	7.83	421.02
171959.16	433773.53	7.63	394.77
171954.89	433723.03	7.80	430.46
171949.83	433663.16	7.83	439.38
171945.39	433610.84	8.45	496.30
171939.86	433545.69	8.60	560.08
171934.38	433480.59	8.57	558.33
171928.94	433415.34	8.17	533.28
171923.52	433350.00	7.85	514.30
171918.09	433284.31	8.10	532.96
171912.64	433218.41	8.07	532.29
171907.16	433152.34	7.20	476.32
171901.59	433086.09	17.17	10239.25
171895.95	433019.53	31.58	
171890.28	432953.00	39.90	
171884.67	432886.41	0.00	
171879.56	432820.28	0.00	

	W (m)
Difference between the Winter dikes	1378.62
Floodplain corrected when the main channel width is 271.00 m	1354.69

Average level of the floodplain

Zd (m) = 6.75

Weighted average level of the floodplain

Zd* (m) = 7.43

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

CROSS SECTION 20 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
171462.20	434696.50	6.80	
171461.90	434681.10	0.34	5.31
171461.60	434665.20	0.22	3.59
171461.30	**434648.20**	**-0.02**	-0.37
171461.00	434629.80	0.29	5.54
171460.70	434610.50	0.41	8.08
171460.30	434590.50	0.38	7.65
171459.80	434569.80	0.72	15.04
171459.30	434548.60	0.86	18.30
171458.70	434527.20	0.95	20.51
171458.00	434505.60	1.13	24.59
171457.20	434483.80	1.17	25.65
171456.40	434461.90	1.15	25.36
171455.60	434439.70	1.21	26.95
171454.80	434417.50	6.81	186.19

W (m)
279.00

Average level of the main channel

Zd (m) = 0.68

Weighted average depth of the main channel

Zd* (m) = 0.67

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 20 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
171534.90	436296.30	0.00	
171535.00	436222.10	0.00	
171534.40	436148.00	0.00	
171533.10	436074.10	0.00	
171531.30	436000.40	0.00	
171528.90	435927.00	0.00	
171526.20	435853.70	0.00	
171523.10	435780.60	0.00	
171519.80	435707.60	0.00	
171516.20	435634.90	0.00	
171512.30	435562.40	0.00	
171508.30	435490.20	0.00	
171504.00	435418.20	0.00	
171499.50	435346.60	0.00	
171494.70	435275.30	0.00	
171489.90	435205.60	0.00	
171485.30	435138.40	0.00	
171482.50	435094.90	0.00	
171479.80	435052.00	0.00	
171477.30	435009.40	40.00	
171474.70	434966.40	24.00	
171472.30	434924.00	22.30	
171470.10	434883.40	8.00	311.20
171468.20	434846.20	8.00	284.80
171466.50	434812.20	9.95	330.84
171465.00	434779.70	10.77	347.30
171463.70	434747.70	9.75	299.33
171462.70	434718.30	6.80	173.98
171462.20	434696.50	6.80	74.08
	Main channel		
171454.80	434417.50	6.81	100.43
171453.50	434388.00	6.81	229.12
171451.80	434350.20	6.81	293.81
171449.70	434301.70	6.81	352.71
171447.60	434246.60	8.73	486.43
171445.40	434190.30	9.53	536.71
171442.90	434134.00	9.20	514.28
171440.30	434078.50	0.30	16.56
171437.50	434023.60	10.00	547.00
171434.60	433969.10	10.00	543.00
171431.50	433915.00	10.00	538.50
171428.30	433861.40	7.15	377.88
171425.00	433809.30	7.35	376.32
171421.70	433759.00	7.40	407.37
171417.80	433699.20	7.40	414.77
171414.50	433646.90	7.45	441.79
171410.40	433580.60	7.45	493.94
171406.60	433514.30	7.55	501.32
171403.00	433447.80	6.70	446.22
171399.70	433381.10	33.30	8492.12
171396.50	433314.20	0.00	7955.41
171393.60	433247.10	0.00	
171390.80	433179.80	0.00	
171388.20	433112.40	0.00	
171385.60	433044.80	0.00	
171382.90	432977.10	0.00	
171380.00	432909.10	0.00	
171377.00	432840.30	0.00	

	W (m)
Difference between the Winter dikes	1156.60
Floodplain without holes	1046.20
Floodplain corrected when the main channel width is 271.00 m	1164.60

Average level of the floodplain

Zd (m) = 7.83

Weighted average level of this average is weighted with the distance with the same level

Zd (m) = 7.34

Average level of the floodplain (without hole)

Zd* (m) = 8.13

Weighted average (without hole)

Zd* (m) = 7.60

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

Surrounded by the thick lines are the co-ordinates from the hole

The weighted average depth (without hole) will be used as the floodplain depth

CROSS SECTION 31 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
170163.20	434660.80	6.69	
170163.20	434640.60	1.38	27.39
170163.30	434621.10	1.52	29.05
170163.30	434602.30	0.97	18.05
170163.30	434583.80	0.50	9.26
170163.20	434565.10	0.15	2.72
170163.10	434546.50	-0.28	-5.23
170163.00	434527.60	0.15	2.83
170162.90	434508.30	0.44	8.55
170162.90	434488.40	0.29	5.91
170162.90	434468.10	0.15	3.10
170163.00	**434447.90**	**-0.36**	-7.18
170163.20	434428.10	-0.33	-6.45
170163.40	434408.20	1.97	38.77
170163.70	434388.70	6.69	126.77

W (m)
272.10

Average level of the main channel

Zd (m) = 0.50

Weighted average depth of the main channel

Zd* (m) = 0.47

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 31 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
170207.00	436262.40	0.00	
170210.50	436196.50	0.00	
170212.90	436130.30	0.00	
170214.60	436063.80	0.00	
170215.60	435997.20	0.00	
170216.00	435930.60	0.00	
170215.90	435864.00	0.00	
170215.30	435797.50	40.00	
170214.20	435731.10	6.75	447.19
170212.60	435665.00	8.00	528.00
170210.70	435599.10	8.00	526.00
170208.30	435533.50	8.20	537.10
170205.40	435468.10	6.70	437.51
170202.20	435402.90	6.20	404.24
170198.50	435337.70	6.90	449.54
170194.50	435272.60	7.15	468.33
170190.00	435206.70	7.10	392.28
170186.80	435162.10	7.20	322.20
170183.50	435117.20	7.20	324.36
170180.20	435072.00	8.80	399.96
170176.90	435026.30	8.40	384.30
170173.60	434980.50	8.80	404.36
170170.60	434934.40	9.00	415.80
170167.90	434888.10	10.00	468.50
170165.70	434840.70	8.90	436.99
170164.20	434789.90	7.00	360.50
170163.30	434737.70	6.90	339.14
170163.00	434691.60	6.69	257.04
170163.20	434 660.8	6.685	102.95
	Main channel		
170163.70	434 388.7	6.687	85.59
170164.10	434363.10	9.50	274.55
170164.10	434330.90	9.50	341.05
170163.40	434291.30	7.90	323.11
170161.80	434249.10	8.55	366.37
170160.80	434205.60	7.80	343.59
170159.40	434161.00	5.80	260.71
170157.50	434115.70	5.80	265.64
170155.00	434069.40	40.00	10666.88
170152.20	434022.70	39.90	
170149.00	433975.40	20.30	
170145.60	433927.80	0.00	
170142.10	433879.70	0.00	
170138.40	433827.60	0.00	
170134.30	433764.80	0.00	
170131.10	433709.10	0.00	
170127.20	433635.80	0.00	
170123.70	433562.20	0.00	
170120.70	433488.10	0.00	
170118.20	433413.90	0.00	
170116.10	433339.40	0.00	
170114.70	433264.80	0.00	
170113.80	433189.80	0.00	
170113.80	433114.50	0.00	
170115.00	433038.50	0.00	
170117.60	432962.20	0.00	
170122.40	432885.10	0.00	
170130.50	432806.60	0.00	

	W (m)
Difference between the Winter dikes	1343.30
Floodplain corrected when the main channel width is 271.00 m	1344.40

Average level of the floodplain

Zd (m) = 7.66

Weighted average level of the floodplain

Zd* (m) = 7.94

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

CROSS SECTION 38 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
169549.30	434671.50	6.63	
169548.20	434650.00	0.79	16.42
169547.00	434630.10	1.00	19.48
169545.90	434611.20	1.03	19.45
169544.70	434592.40	0.31	5.77
169543.40	434573.60	-0.14	-2.66
169542.10	**434554.40**	**-0.21**	-4.02
169540.70	434534.60	0.04	0.89
169539.20	434513.80	0.03	0.66
169537.60	434491.80	-0.07	-1.59
169536.10	434469.70	0.08	1.78
169534.60	434448.40	-0.06	-1.15
169533.20	434427.80	0.26	5.35
169531.80	434407.90	1.06	20.41
169530.50	434389.10	6.63	80.80

W (m)
282.40

Average level of the main channel

Zd (m) = 0.32

Weighted average depth of the main channel

Zd* (m) = 0.29

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 38 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
169 638.4	436 266.2	0	
169 637.1	436 201.2	0	
169 634.9	436 135.9	0	
169 632.4	436 070.8	0	
169 630.0	436 005.8	0	
169 627.4	435 940.9	0	
169 624.8	435 876.5	20	
169 622.0	435 812.2	23.75	
169 619.2	435 748.3	7.45	474.57
169 616.2	435 684.8	7.9	500.86
169 613.0	435 621.5	7.925	500.46
169 609.8	435 558.5	7	439.60
169 606.3	435 495.9	7	436.80
169 602.8	435 433.7	5.2	324.22
169 599.0	435 371.2	5.7	356.54
169 595.1	435 308.6	8.8	554.84
169 591.0	435 245.1	8.6	458.81
169 588.0	435 201.9	8.6	374.96
169 584.9	435 157.9	8.4	371.70
169 581.8	435 113.4	8.4	376.32
169 578.5	435 068.3	7.65	349.22
169 575.1	435 022.1	6.9	324.30
169 571.6	434 974.3	8.85	427.45
169 568.0	434 925.5	8.95	443.47
169 564.3	434 875.2	10	534.00
169 559.8	434 818.7	9.3	542.19
169 555.0	434 758.6	8.8	495.44
169 551.0	434 706.1	6.628	288.65
169 549.3	434 671.5	6.628	114.66
Main channel			
169 530.5	434 389.1	6.628	76.22
169 528.9	434 366.1	6.628	168.02
169 526.8	434 338.4	6.628	200.50
169 524.3	434 305.6	7.5	255.00
169 521.7	434 270.4	8.5	308.13
169 518.9	434 233.1	8.5	327.25
169 516.0	434 193.4	7.05	282.00
169 513.0	434 153.1	7.25	297.61
169 509.9	434 111.3	7.45	315.51
169 506.6	434 068.4	24	10444.74
169 503.1	434 023.9	36.654	
169 499.5	433 977.8	40	
169 495.8	433 929.7	40	
169 491.7	433 875.6	19.95	
169 486.8	433 810.1	0	
169 482.6	433 751.8	0	
169 477.2	433 675.6	0	
169 471.9	433 599.4	0	
169 466.6	433 522.8	0	
169 461.4	433 446.0	0	
169 456.2	433 368.8	0	
169 450.9	433 291.3	0	
169 445.7	433 213.4	0	
169 440.4	433 135.2	0	
169 435.1	433 056.2	0	
169 429.7	432 976.7	0	
169 423.9	432 896.8	0	
169 417.5	432 816.4	0	

	W (m)
Difference between the Winter dikes	1354.60
Floodplain corrected when the main channel width is 271.00 m	1366.00

Average level of the floodplain

Zd (m) = 7.69

Weighted average level of the floodplain

Zd* (m) = 7.71

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

CROSS SECTION 58 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
167562.30	434957.40	6.45	
167562.00	434942.60	-0.51	-7.89
167561.70	**434926.50**	**-1.13**	-19.24
167561.30	434908.40	-0.52	-9.94
167560.80	434887.90	0.11	2.24
167560.20	434866.20	0.01	0.15
167559.60	434844.30	-0.27	-5.86
167559.00	434822.80	-0.02	-0.36
167558.30	434801.40	0.14	2.99
167557.60	434780.40	0.29	5.96
167557.00	434759.60	0.36	7.59
167556.40	434738.60	0.28	5.89
167555.70	434717.50	0.23	4.84
167555.10	434695.80	1.10	24.27
167554.60	434673.30	6.45	10.62

W (m)
284.10

Average level of the main channel

Zd (m) = 0.01

Weighted average depth of the main channel

Zd* (m) = 0.04

To compute the average depth only the
lower values are used (between double lines)

The weighted average depth will be used as the
main channel depth

This average is weighted by the distance
with the same level

CROSS SECTION 58 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
167586.70	436558.90	0.00	
167586.30	436473.70	0.00	
167585.60	436390.80	0.00	
167584.60	436309.60	0.00	
167583.30	436229.80	0.00	
167581.90	436151.40	0.00	
167580.30	436074.20	0.00	
167578.80	435997.90	0.00	
167577.20	435922.50	0.00	
167575.60	435847.80	0.00	
167574.20	435773.90	0.00	
167572.80	435700.80	0.00	
167571.50	435628.40	0.00	
167570.40	435556.60	0.00	
167569.40	435485.70	0.00	
167568.40	435417.40	0.00	
167567.50	435352.70	0.00	
167566.90	435311.00	0.00	
167566.40	435269.70	20.00	
167565.80	435228.20	30.13	
167565.30	435186.20	40.00	
167564.90	435144.80	6.50	258.05
167564.50	435106.80	6.10	209.54
167564.10	435076.10	6.44	182.55
167563.70	435050.10	5.90	148.09
167563.30	435025.90	6.45	156.34
167562.90	435001.60	6.45	155.37
167562.50	434977.70	6.45	142.48
167562.30	434957.40	6.45	65.44
	Main channel		
167554.60	434673.30	6.45	101.85
167553.60	434641.70	6.45	236.89
167552.20	434599.80	6.45	313.92
167550.40	434544.30	7.43	444.49
167548.50	434480.20	9.50	596.13
167547.10	434418.80	8.78	532.64
167545.90	434358.80	7.50	445.13
167545.00	434300.10	7.30	425.59
167544.40	434242.20	7.15	413.27
167544.00	434184.50	7.20	415.44
167543.90	434126.80	6.98	399.32
167544.00	434070.00	7.00	389.20
167544.20	434015.60	7.10	374.53
167544.60	433964.50	7.10	395.83
167544.90	433904.10	7.05	399.03
167545.20	433851.30	6.65	394.34
167545.40	433785.50	6.60	432.96
167545.40	433720.10	6.25	407.19
167545.20	433655.20	6.35	410.84
167544.80	433590.70	6.70	430.81
167544.10	433526.60	39.95	9277.24
167543.30	433463.20	0.00	
167542.30	433400.20	0.00	
167541.20	433338.00	0.00	
167539.90	433276.40	0.00	
167538.50	433215.70	0.00	
167536.90	433156.00	0.00	
167534.70	433097.20	0.00	

	W (m)
Difference between the Winter dikes	1270.00
Floodplain corrected when the main channel width is 271.00 m	1283.10

Average level of the floodplain

Zd (m) = 6.88

Weighted average level of the floodplain

Zd* (m) = 7.30

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

CROSS SECTION 70 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
166263.30	434790.90	6.33	
166266.90	434776.40	1.48	21.96
166270.70	434761.30	-0.22	-3.39
166274.80	434744.90	0.03	0.46
166279.30	434727.30	0.09	1.63
166284.00	434708.70	-0.09	-1.77
166288.90	434689.20	-0.27	-5.28
166294.10	**434669.00**	**-0.39**	-7.96
166299.30	434648.30	-0.33	-6.78
166304.60	434627.30	0.22	4.66
166309.90	434606.10	1.00	21.29
166315.30	434584.80	1.36	29.00
166320.70	434563.30	1.93	41.64
166326.10	434541.60	3.11	95.48
166331.50	434519.80	6.33	

W (m)
271.10

Average level of the main channel

Zd (m) = 0.40

Weighted average depth of the main channel

Zd* (m) = 0.35

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 70 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
165851.80	436254.20	0.00	
165875.90	436187.90	0.00	
165899.30	436121.60	0.00	
165922.10	436055.20	0.00	
165944.30	435988.80	0.00	
165966.00	435922.30	0.00	
165987.00	435856.00	0.00	
166007.50	435789.50	0.00	
166027.40	435722.90	0.00	
166046.90	435656.30	0.00	
166065.80	435589.80	0.00	
166084.20	435523.10	0.00	
166102.10	435456.60	0.00	
166119.60	435390.20	0.00	
166136.50	435324.20	26.67	
166152.60	435260.00	22.70	
166167.80	435198.40	25.40	
166177.50	435158.30	7.30	290.91
166187.10	435118.70	7.30	290.18
166196.60	435078.80	7.30	293.83
166206.20	435038.20	7.30	293.46
166215.50	434998.40	1.75	67.55
166224.20	434961.00	-8.15	-290.14
166231.80	434927.20	-7.68	-247.62
166238.80	434896.50	7.30	219.00
166245.40	434867.20	7.30	212.79
166252.00	434838.20	7.30	204.04
166258.30	434811.30	7.80	184.47
166263.30	434790.90	6.33	64.54
	Main channel		
166331.50	434519.80	6.33	90.25
166338.60	434491.30	6.33	205.82
166347.60	434454.80	9.50	396.15
166359.20	434407.90	6.80	344.76
166372.40	434353.40	6.65	369.08
166385.60	434296.90	-2.15	-121.15
166398.20	434240.70	-7.50	-419.25
166410.20	434185.10	-11.40	-628.14
166421.70	434130.50	9.50	516.80
166432.70	434076.30	9.50	513.95
166443.20	434022.30	9.50	510.15
166453.20	433968.90	6.60	347.82
166462.70	433916.90	6.80	346.12
166471.60	433867.10	6.80	369.58
166482.00	433808.20	6.85	377.78
166491.20	433756.80	6.90	396.75
166502.40	433693.20	7.00	443.80
166513.60	433630.00	7.03	442.38
166524.70	433567.40	7.27	453.82
166535.90	433505.10	7.00	435.75
166547.10	433442.90	7.10	440.91
166558.30	433380.90	5.25	324.19
166569.50	433319.40	16.33	7740.30
166580.80	433258.00	40.00	9379.05
166592.10	433196.90	39.90	
166603.60	433136.00	0.00	
166615.10	433075.30	0.00	
166625.80	433014.40	0.00	

	W (m)
Difference between the Winter dikes	1506.30
Floodplain without holes	1141.70
Floodplain corrected when the main channel width is 271.00 m	1506.40

Average level of the floodplain

Zd (m) = 4.97

Weighted average level of the floodplain

Zd (m) = 5.14

Average level of the floodplain (without hole)

Zd* (m) = 7.28

Weighted average (without hole)

Zd* (m) = 8.21

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

Surrounded by the thick lines are the co-ordinates from the hole

The weighted average depth (without hole) will be used as the floodplain depth

Hole - right

Located on the right side of the cross section

Level of the hole

Dh (m) = -8.15

Average level of the hole

Dh* (m) = -4.69

Width of the hole:

Wh (m) = 141.70

Cross area of the hole

Ah (m2) = 1829.01

Hole - left

Located on the right side of the cross section

Level of the hole

Dh (m) = -11.40

Average level of the hole

Dh* (m) = -7.02

Width of the hole:

Wh (m) = 222.90

Cross area of the hole

Ah (m2) = 3395.14

Plant ponderation

Length of the hole:

Lh (m) = 1115.90

Width of the hole:

Wh (m) = 245.00

Area of the hole

Ah (m2) = 273396.24

Length of the hole:

Lh (m) = 1115.90

Width of the hole:

Wh (m) = 343.00

Area of the hole

Ah (m2) = 382754.73

Area of the cross section surround floodplain

Afl (m2) = 3041958.98

R - factor = Ah/Afl

R = 0.22

Pondered flow area of the hole (R*Ah)

A (m2) = 1126.85

Summer dike option

Dike crest level (m)	8.21
Floodplain base level (m)	-5.85
Flow area behind dike (m2)	1127
Total area behind dike (m2	1127

CROSS SECTION 98 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
163769.50	433702.60	6.08	
163775.00	433683.50	0.48	9.02
163780.30	433664.80	0.53	9.74
163785.50	433646.40	0.08	1.54
163790.60	433628.10	-0.36	-6.62
163795.80	433609.70	-0.36	-6.57
163800.90	433591.20	-0.54	-10.00
163806.00	433572.60	-0.61	-11.37
163811.20	433553.80	-0.77	-14.63
163816.40	433534.60	-1.26	-24.55
163821.70	433514.90	-1.70	-33.22
163826.90	**433495.40**	**-1.82**	-35.40
163832.00	433476.00	-1.25	-24.10
163837.00	433456.90	1.76	33.32
163842.00	433438.20	6.08	-112.84

W (m)
264.40

Average level of the main channel

Zd (m) = -0.45

Weighted average depth of the main channel

Zd* (m) = -0.43

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 98 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
163398.20	435210.80	0.00	
163408.20	435148.00	0.00	
163419.10	435085.30	0.00	
163430.90	435022.80	0.00	
163443.40	434960.20	0.00	
163456.50	434897.50	0.00	
163470.20	434834.90	0.00	
163484.20	434772.60	0.00	
163498.50	434710.20	0.00	
163513.20	434648.10	40.00	
163528.20	434586.10	6.00	372.60
163543.50	434523.90	6.50	404.30
163559.20	434461.70	6.30	392.81
163575.10	434399.20	6.85	427.44
163591.30	434336.90	6.75	421.20
163607.80	434274.40	3.05	191.54
163624.70	434211.30	-7.87	-414.59
163636.20	434169.00	-9.44	-400.64
163648.00	434126.40	-9.50	-405.65
163660.00	434083.60	-3.95	-169.06
163672.10	434040.80	7.35	314.95
163684.40	433997.90	7.65	328.57
163696.80	433954.90	7.40	318.94
163709.20	433911.70	7.00	305.20
163722.00	433867.70	9.20	415.38
163735.40	433821.40	7.30	342.01
163749.10	433774.00	7.10	318.44
163761.10	433731.70	6.10	217.77
163769.50	433702.60	6.08	88.43
	Main channel		
163842.00	433438.20	6.08	73.60
163848.40	433414.00	6.08	166.37
163856.60	433383.50	6.08	206.52
163866.80	433346.10	6.08	233.59
163877.70	433306.70	7.10	281.51
163889.00	433266.80	6.95	281.13
163900.80	433225.80	2.61	107.40
163913.00	433184.50	-2.00	-83.00
163925.50	433142.80	4.65	194.83
163938.40	433100.70	23.70	4931.58
163951.60	433058.20	40.00	6297.12
163965.10	433015.80	24.75	
163978.90	432973.10	20.00	
163994.00	432926.90	19.95	
164012.30	432871.20	0.00	
164028.80	432821.80	0.00	
164050.70	432756.00	0.00	
164073.00	432690.00	0.00	
164095.60	432623.60	0.00	
164118.40	432557.10	0.00	
164141.60	432490.30	0.00	
164165.10	432423.30	0.00	
164189.00	432356.10	0.00	
164213.40	432288.70	0.00	
164238.20	432220.80	0.00	
164263.60	432152.80	0.00	
164289.60	432084.30	0.00	
164316.40	432015.60	0.00	

	W (m)
Difference between the Winter dikes	1178.90
Floodplain without holes	821.30
Floodplain corrected when the main channel width is 271.00 m	1172.30

Average level of the floodplain

Zd (m) = 4.05

Weighted average level of the floodplain

Zd (m) = 4.18

Average level of the floodplain (without hole)

Zd^* (m) = 6.53

Weighted average (without hole)

Zd^* (m) = 7.67

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with $Z = \sim 40$ m)

The level of the Winter dike is not considered.

Surrounded by the thick lines are the co-ordinates from the hole

The weighted average depth (without hole) will be used as the floodplain depth

CROSS SECTION 108 - main channel

X (m)	Y (m)	Z (m)	$Z_i.l_i$
162960.52	433550.50	6.00	
162962.09	433533.25	0.18	3.60
162964.25	433510.91	-0.15	-2.95
162966.11	433492.63	-0.22	-3.83
162967.78	433475.28	0.29	5.49
162969.88	433454.22	0.09	1.69
162971.66	433435.44	-0.92	-17.36
162973.42	433416.59	-0.96	-18.13
162975.28	433397.50	-1.33	-26.28
162977.27	433377.19	-1.43	-28.74
162979.20	433357.25	-1.31	-26.38
162981.16	433336.84	-1.18	-22.88
162982.91	**433318.34**	**-1.43**	-27.91
162984.83	433297.75	-0.34	-7.09
162986.75	433276.91	6.00	-170.77

W (m)
273.59

Average level of the main channel

Zd (m) = -0.67

Weighted average depth of the main channel

Zd* (m) = -0.62

To compute the average depth only the lower values are used (between double lines)

The weighted average depth will be used as the main channel depth

This average is weighted by the distance with the same level

CROSS SECTION 108 - floodplain

X (m)	Y (m)	Z (m)	$Z_i.l_i$
162800.516	435134.031	0	
162804.938	435061.094	0	
162811.969	434994.75	0	
162819.078	434928.75	0	
162826.109	434861.719	0	
162833.188	434795.469	0	
162840.047	434729.812	0	
162847.031	434663.781	0	
162854.172	434597.625	40	347.07
162860.734	434533.438	5.3	361.79
162867.859	434466.656	5.55	396.12
162874.438	434403.062	6.1	433.83
162881.203	434336.781	6.55	460.06
162888.312	434270.594	7.1	446.57
162894.656	434207.188	6.8	445.30
162901.594	434139.25	6.6	367.85
162908.375	434072.25	6.6	302.13
162912.859	434027.781	6.677	299.78
162917.578	433981.75	6.6	307.29
162922.172	433936.938	6.85	317.47
162926.688	433892.031	7.05	326.36
162931.156	433846.875	7.25	353.80
162935.688	433802	7.8	407.10
162940.312	433756.156	9.2	306.83
162944.594	433713.5	6.9	341.73
162949.109	433667.219	7.3	269.44
162953.766	433619.875	6	208.13
162957.922	433577.406	6	80.72
162960.516	433550.5	6	73.13
	Main channel		
162986.75	433276.91	6.00	171.75
162989.14	433252.53	6.00	220.97
162992.40	433219.66	6.00	310.45
162996.48	433178.88	7.40	7555.66
163000.73	433135.75	40.00	
163004.98	433092.00	39.90	
163009.28	433047.84	0.00	
163013.63	433002.69	0.00	
163018.25	432955.34	0.00	
163022.88	432909.03	0.00	
163027.44	432863.06	0.00	
163031.89	432817.22	0.00	
163036.36	432771.88	0.00	
163041.47	432720.22	0.00	
163046.98	432663.81	0.00	
163052.13	432611.25	0.00	
163058.98	432541.41	0.00	
163065.88	432470.97	0.00	
163072.67	432401.09	0.00	
163079.94	432327.09	0.00	
163086.88	432256.28	0.00	
163094.06	432182.75	0.00	
163101.06	432111.59	0.00	
163108.33	432038.00	0.00	
163115.55	431964.84	0.00	
163122.92	431890.09	0.00	
163130.44	431814.00	0.00	
163139.42	431725.00	0.00	

	W (m)
Difference between the Winter dikes	1080.97
Floodplain corrected when the main channel width is 271.00 m	1083.56

Average level of the floodplain

Zd (m) = 6.65

Weighted average level of the floodplain

Zd* (m) = 6.99

To compute the average depth, only the values between the Winter dikes are used, levels between the double lines (the dikes are defined with Z = ~40 m)

The level of the Winter dike is not considered.

GRAIN DIAMETERS

For the sediment transport computation was used the User's Formula Defined

So, it is necessary to get the D50 and the D90 of the River Waal branch in study and for this purpose was consulted the Ref. 11

The data used is for the year 1995

The Waal branch is located between the 900 and the 910 km referred to the Rhine Datum

D50 (mm)

km	Left	Midlle	Right	Average
900	0.74	0.71	1.22	0.89
901	0.82	0.65	-	0.73
902	0.58	0.76	-	0.67
903	0.67	0.92	-	0.79
904	0.60	0.89	-	0.75
905	1.18	0.79	0.98	0.98
906	0.77	0.88	0.83	0.83
907	0.51	0.77	-	0.64
908	0.76	1.22	4.44	2.14
909	0.64	0.90	1.72	1.09
910	0.75	0.83	3.31	1.63
			Average	**1.01**

D90 (mm)

km	Left	Midlle	Right	Average
900	2.80	-	-	2.80
901	2.48	0.97	-	1.72
902	1.45	-	-	1.45
903	1.82	-	-	1.82
904	1.69	-	-	1.69
905	8.64	-	-	8.64
906	2.80	-	-	2.80
907	1.72	1.56	-	1.64
908	2.71	-	12.94	7.83
909	1.12	-	9.17	5.14
910	4.00	-	10.63	7.31
			Average	**3.89**

Nodes

	X (m)	Y (m)
N1	0.00	0.00
N2	10854.69	0.00

Branches

	Begin	End	Lenght
B1	N1	N2	10854.69

Cross sections

Descriptions

CS1

Levels (m)	W (m)	Flow W (m)
0.63	271.00	271.00
7.56	271.00	271.00
7.57	2170.19	2000.00
40.00	2170.19	2000.00

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1899.19	1729.00

CS15

Levels (m)	W (m)	Flow W (m)
1.06	298.00	298.00
7.42	298.00	298.00
7.43	1625.69	1198.00
40.00	1625.69	1198.00

W mc (m)	W Fp (m)	Flow W Fp (m)
298.00	1327.69	900.00

CS20

Levels (m)	W (m)	Flow W (m)
0.67	271.00	271.00
7.59	271.00	271.00
7.60	1435.60	1000.00
40.00	1435.60	1000.00

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1164.60	729.00

CS31

Levels (m)	W (m)	Flow W (m)
0.47	271.00	271.00
7.93	271.00	271.00
7.94	1615.40	1615.40
40.00	1615.40	1615.40

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1344.40	1344.40

CS38

Levels (m)	W (m)	Flow W (m)
0.29	271.00	271.00
7.70	271.00	271.00
7.71	1637.00	1637.00
40.00	1637.00	1637.00

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1366.00	1366.00

CS58

Levels (m)	W (m)	Flow W (m)
0.04	271.00	271.00
7.29	271.00	271.00
7.30	1554.10	1187.00
40.00	1554.10	1187.00

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1283.10	916.00

CS70

Levels (m)	W (m)	Flow W (m)
0.35	271.00	271.00
8.20	271.00	271.00
8.21	1777.40	1416.00
40.00	1777.40	1416.00

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1506.40	1145.00

CS98

Levels (m)	W (m)	Flow W (m)
-0.43	271.00	271.00
7.66	271.00	271.00
7.67	1443.30	1443.30
40.00	1443.30	1443.30

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1172.30	1172.30

CS108

Levels (m)	W (m)	Flow W (m)
-0.62	271.00	271.00
6.98	271.00	271.00
6.99	1354.56	1354.56
40.00	1354.56	1354.56

W mc (m)	W Fp (m)	Flow W Fp (m)
271.00	1083.56	1083.56

Location (m)

Cross section	In the branch	Rhine Datum
CS1	0.00	899.65
CS15	1492.43	901.14
CS20	2062.18	901.71
CS31	3361.72	903.01
CS38	3977.01	903.63
CS58	5987.70	905.64
CS70	7297.70	906.95
CS98	10026.68	909.68
CS108	10854.69	910.50

Node	Cross section	X (m)	Y (m)	ΔS (m)	Bed level (m)	Slope	W (m)	
							Main channel	Floodplain
				0				
1	1	173496.90	434386.70		0.45		271.00	1899.19
				1492.43		-0.0004		
	15	172030.70	434655.80		1.06		298.00	1327.69
				569.75		0.0007		
	20	171461.90	434681.10		0.67		271.00	1164.60
				1299.54		0.0002		
	31	170163.20	434640.60		0.47		271.00	1344.40
				615.29		0.0003		
	38	169548.20	434650.00		0.29		271.00	1366.00
				2010.69		0.0001		
	58	167562.00	434942.60		0.04		271.00	1283.10
				1310.00		-0.0002		
	70	166266.90	434776.40		0.35		271.00	1506.40
				2728.99		0.0003		
	98	163775.00	433683.50		-0.43		271.00	1172.30
				828.01		0.0002		
2	108	162962.10	433533.20		-0.62		271.00	1083.56
				10854.69				
					Total Slope	0.0001		

APPENDIX 3: 2D model

- Definitions

2-D Model

Nodes

	S (m)	Y (m)
N1	0.00	0.00
N4	10854.69	0.00

Branches

	Begin	End	Lenght
B1	N1	N2	10854.69

Location (m)

Cross section	In the branch	Rhine Datum
CS1	0.00	899.65
CS15	1492.43	901.14
CS20	2062.18	901.71
CS31	3361.72	903.01
CS38	3977.01	903.63
CS58	5987.70	905.64
CS70	7297.70	906.95
CS98	10026.68	909.68
CS108	10854.69	910.50

Node	Cross section	X (m)	Y (m)	ΔS (m)	Bed level (m)	Slope	W (m)	
							Main channel	Floodplain
1	1	173496.90	434386.70		0.45		271.00	1729.00
				1492.43		0.0000		
	15	172030.70	434655.80		0.48		298.00	900.00
				569.75		0.0001		
	20	171461.90	434681.10		0.42		271.00	729.00
				1299.54		0.0001		
	31	170163.20	434640.60		0.28		271.00	1344.40
				615.29		0.0001		
	38	169548.20	434650.00		0.22		271.00	1366.00
				2010.69		0.0001		
	58	167562.00	434942.60		0.00		271.00	916.00
				1310.00		0.0001		
	70	166266.90	434776.40		-0.14		271.00	2138.00
				2728.99		0.0001		
	98	163775.00	433683.50		-0.42		271.00	1172.30
				828.01		0.0001		
2	108	162962.10	433533.20		-0.51		271.00	1083.56
				10854.69				
					Total Slope	0.0001		

APPENDIX 4: Main channel 2D model

- Curvature calculation

Computation of the bends curvature

X (m)	Y (m)	Curvature (1/m)	
173496.9	434386.7		
173424.0	434401.5		
173323.0	434423.7	0.00017	
173218.8	434446.4	-0.00002	
173119.1	434472.9	0.00048	
173020.0	434496.8	-0.00025	
172913.7	434520.0	-0.00022	
172811.3	434543.3	0.00009	
172698.4	434564.2	-0.00038	
172590.2	434584.0	-0.00002	
172481.4	434602.8	-0.00009	
172377.3	434617.4	-0.00031	
172262.8	434629.9	-0.00027	
172145.2	434642.6	-0.00001	
172030.7	434655.8	0.00006	
171930.5	434666.3	-0.00010	
171810.1	434673.8	-0.00035	
171691.6	434680.0	-0.00008	
171578.7	434681.0	-0.00038	
171461.9	434681.1	-0.00007	
171345.0	434681.9	0.00005	
171226.1	434680.0	-0.00019	
171104.1	434678.2	0.00001	
170985.2	434675.7	-0.00005	Average
170865.1	434671.2	-0.00014	-0.00017
170742.4	434666.8	0.00001	
170620.6	434661.7	-0.00005	
170495.2	434657.0	0.00004	
170374.2	434650.1	-0.00016	
170244.9	434645.3	0.00015	
170163.2	434640.6	-0.00025	
170079.2	434638.3	0.00036	
169990.0	434636.8	0.00012	
169897.2	434638.0	0.00032	
169806.0	434639.4	0.00003	
169718.4	434641.9	0.00015	
169634.8	434645.6	0.00019	
169548.2	434650.0	0.00008	
169463.1	434655.3	0.00013	
169375.6	434662.0	0.00016	
169283.7	434669.8	0.00009	
169184.7	434683.3	0.00052	
169094.6	434697.0	0.00017	
169008.2	434710.5	0.00005	
168920.9	434725.4	0.00017	
168837.4	434740.8	0.00016	
168753.2	434757.2	0.00012	
168668.3	434774.2	0.00006	
168583.6	434791.8	0.00009	
168499.4	434810.0	0.00010	Average
168415.8	434828.8	0.00010	0.00015
168294.7	434854.3	-0.00012	
168170.3	434876.8	-0.00024	
168050.8	434896.3	-0.00015	

When the curvature is mainly positive, the average is make without counting with the negatives values, and *vice versa*.

X (m)	Y (m)	Curvature (1/m)	
168170.3	434876.8		
168050.8	434896.3		
167927.0	434914.9	-0.00010	
167802.4	434929.5	-0.00027	
167680.5	434939.7	-0.00027	
167562.0	434942.6	-0.00050	
167444.1	434943.1	-0.00017	
167319.6	434939.5	-0.00027	
167204.8	434932.9	-0.00025	
167096.2	434922.7	-0.00034	
166987.0	434912.7	0.00002	
166876.0	434901.1	-0.00012	
166772.2	434886.0	-0.00039	
166669.8	434868.8	-0.00022	
166567.5	434848.9	-0.00026	
166467.9	434827.2	-0.00023	
166364.6	434802.3	-0.00022	
166266.9	434776.4	-0.00025	
166170.7	434748.2	-0.00029	
166071.6	434716.8	-0.00024	
165979.4	434685.0	-0.00030	
165886.0	434650.3	-0.00028	
165789.6	434611.7	-0.00030	
165695.3	434570.9	-0.00034	
165602.0	434527.7	-0.00033	
165511.2	434483.7	-0.00024	
165418.8	434437.1	-0.00021	
165327.6	434388.7	-0.00029	
165236.0	434337.2	-0.00034	Average
165145.4	434285.8	-0.00006	-0.00025
165059.1	434237.2	0.00005	
164973.9	434189.5	0.00004	
164894.5	434144.3	-0.00012	
164790.9	434087.4	0.00019	
164703.4	434043.2	0.00050	
164620.3	434003.0	0.00026	
164532.8	433962.3	0.00021	
164447.4	433924.0	0.00020	
164362.1	433887.5	0.00024	
164278.1	433854.0	0.00035	
164192.6	433820.8	0.00012	
164110.2	433790.3	0.00022	
164025.5	433761.4	0.00034	
163945.0	433735.3	0.00021	
163862.1	433709.5	0.00016	
163775.0	433683.5	0.00015	
163695.0	433661.2	0.00025	
163612.5	433639.7	0.00022	
163529.7	433619.8	0.00024	
163447.8	433602.3	0.00033	
163363.8	433587.1	0.00039	
163285.8	433574.3	0.00022	
163204.5	433561.9	0.00014	
163124.2	433550.5	0.00013	
163043.5	433540.4	0.00021	Average
162962.1	433533.2	0.00045	0.00023

APPENDIX 5: Computational results of the 1D model

- Dominant discharge

- High water

- Variable discharge

- Variable discharge with averaged peak

Results from the computations with dominant discharge - Q = 1600 m^3s^{-1}
Calibration

S (m)	Water levels - year 0 (m)		Velocities - year 0 (ms^{-1})		Bed levels - equilibrium (m)	
	SOBEK	Delft 2D	SOBEK	Rijkswaterstaat	SOBEK	Delft 2D
0.00	6.33	6.32	1.03	1.08	0.45	0.45
99.58	6.32		1.03		0.47	
199.17	6.31		1.03		0.48	
298.75	6.30		1.02		0.50	
398.34	6.29		1.02		0.52	
497.92	6.28		1.02		0.53	
597.51	6.27		1.02		0.55	
697.09	6.26		1.02		0.56	
796.68	6.25		1.01		0.58	
896.26	6.24		1.01		0.59	
995.84	6.23		1.01		0.61	
1095.43	6.21		1.01		0.62	
1195.01	6.20		1.01		0.63	
1294.60	6.19		1.00		0.65	
1394.18	6.18		1.00		0.66	
1493.77	6.17	6.17	1.00	1.08	0.67	0.68
1593.35	6.16		1.01		0.60	
1692.93	6.14		1.01		0.53	
1792.52	6.13		1.02		0.46	
1892.10	6.12		1.02		0.38	
1991.69	6.11		1.03		0.30	
2091.27	6.09	6.12	1.03	1.08	0.24	0.27
2190.86	6.08		1.03		0.23	
2290.44	6.07		1.03		0.22	
2390.03	6.06		1.03		0.21	
2489.61	6.05		1.03		0.20	
2589.19	6.04		1.03		0.19	
2688.78	6.03		1.03		0.18	
2788.36	6.01		1.03		0.17	
2887.95	6.00		1.03		0.16	
2987.53	5.99		1.03		0.15	
3087.12	5.98		1.03		0.14	
3186.70	5.97		1.03		0.13	
3286.29	5.96		1.03		0.12	
3385.87	5.95	5.96	1.03	1.08	0.11	0.09
3485.45	5.94		1.03		0.10	
3585.04	5.92		1.03		0.09	
3684.62	5.91		1.03		0.08	
3784.21	5.90		1.03		0.07	
3883.79	5.89		1.03		0.06	
3983.38	5.88	5.9	1.03	1.08	0.05	0.16
4082.96	5.87		1.03		0.04	
4182.54	5.86		1.03		0.03	
4282.13	5.85		1.03		0.02	
4381.71	5.84		1.03		0.01	
4481.30	5.83		1.03		0.00	
4580.88	5.82		1.03		-0.01	
4680.47	5.81		1.03		-0.02	
4780.05	5.80		1.03		-0.03	
4879.64	5.79		1.03		-0.04	
4979.22	5.78		1.03		-0.05	
5078.80	5.77		1.03		-0.06	
5178.39	5.76		1.03		-0.07	
5277.97	5.75		1.03		-0.08	
5377.56	5.73		1.03		-0.09	
5477.14	5.72		1.03		-0.10	
5576.73	5.71		1.03		-0.11	
5676.31	5.70		1.03		-0.12	
5775.90	5.69		1.03		-0.12	
5875.48	5.68		1.03		-0.13	
5975.06	5.67	5.69	1.03	1.08	-0.14	-0.04
6074.65	5.66		1.03		-0.15	
6174.23	5.65		1.03		-0.16	
6273.82	5.64		1.03		-0.17	
6373.40	5.63		1.03		-0.18	
6472.99	5.61		1.03		-0.19	
6572.57	5.60		1.03		-0.20	
6672.16	5.59		1.03		-0.21	
6771.74	5.58		1.03		-0.22	
6871.32	5.56		1.03		-0.23	
6970.91	5.55		1.03		-0.24	
7070.49	5.54		1.03		-0.25	
7170.08	5.52		1.03		-0.26	
7269.66	5.51	5.53	1.03	1.08	-0.27	-0.24

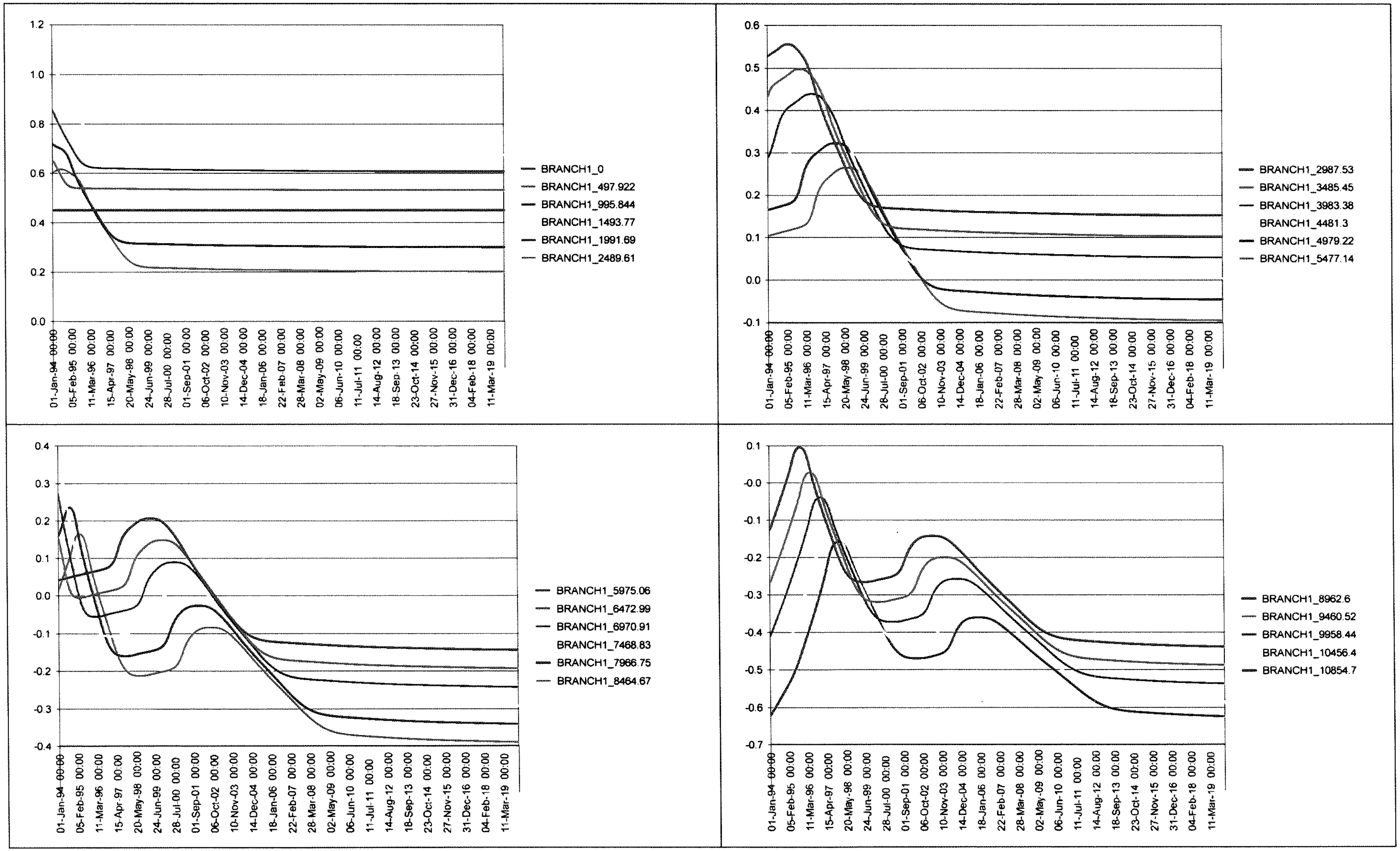
S (m)	Water levels - year 0 (m)		Velocities - year 0 (ms^{-1})		Bed levels - equilibrium (m)	
	SOBEK	Delft 2D	SOBEK	Rijkswaterstaat	SOBEK	Delft 2D
7369.25	5.49		1.03028		-0.282336	
7468.83	5.48		1.0303		-0.292146	
7568.42	5.47		1.03033		-0.301953	
7668.00	5.45		1.03035		-0.311755	
7767.58	5.44		1.03037		-0.321554	
7867.17	5.43		1.0304		-0.33135	
7966.75	5.42		1.03043		-0.341141	
8066.34	5.40		1.03045		-0.35093	
8165.92	5.39		1.03048		-0.360716	
8265.51	5.38		1.03051		-0.370498	
8365.09	5.37		1.03054		-0.380278	
8464.67	5.36		1.03057		-0.390056	
8564.26	5.34		1.0306		-0.399832	
8663.84	5.33		1.03063		-0.409606	
8763.43	5.32		1.03066		-0.419379	
8863.01	5.31		1.03069		-0.429151	
8962.60	5.30		1.03072		-0.438923	
9062.18	5.29		1.03075		-0.448693	
9161.77	5.28		1.03078		-0.458465	
9261.35	5.26		1.03082		-0.468236	
9360.93	5.25		1.03085		-0.478007	
9460.52	5.24		1.03088		-0.487779	
9560.10	5.23		1.03091		-0.497551	
9659.69	5.22		1.03095		-0.507323	
9759.27	5.21		1.03098		-0.517093	
9858.86	5.20		1.03101		-0.526864	
9958.44	5.19		1.03105		-0.536632	
10058.00	5.18	5.19	1.03108	1.08	-0.546396	-0.58
10157.60	5.17		1.03112		-0.556161	
10257.20	5.16		1.03115		-0.565922	
10356.80	5.15		1.03119		-0.57568	
10456.40	5.14		1.03123		-0.585433	
10555.90	5.13		1.03126		-0.595171	
10655.50	5.12		1.0313		-0.604913	
10755.10	5.11		1.03135		-0.614649	
10854.70	5.10	5.1	1.03139	1.08	-0.624379	-0.59

Results from the computations with dominant discharge - Q = 1600 m^3s^{-1}

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 25	year 0	year 25	year 0	year 25
0.00	6.33	6.18	0.00558	0.00624	0.45	0.45
99.58	6.32	6.17	0.00568	0.00624	0.49	0.47
199.17	6.31	6.16	0.00578	0.00624	0.53	0.48
298.75	6.30	6.15	0.00589	0.00624	0.57	0.50
398.34	6.29	6.14	0.00601	0.00624	0.61	0.52
497.92	6.28	6.13	0.00613	0.00624	0.65	0.53
597.51	6.27	6.12	0.00626	0.00624	0.69	0.55
697.09	6.26	6.11	0.00639	0.00624	0.73	0.56
796.68	6.25	6.11	0.00653	0.00624	0.78	0.58
896.26	6.24	6.10	0.00668	0.00624	0.82	0.59
995.84	6.23	6.09	0.00684	0.00624	0.86	0.61
1095.43	6.21	6.08	0.00700	0.00624	0.90	0.62
1195.01	6.20	6.07	0.00717	0.00624	0.94	0.63
1294.60	6.19	6.06	0.00736	0.00624	0.98	0.65
1394.18	6.18	6.05	0.00755	0.00624	1.02	0.66
1493.77	6.17	6.04	0.00775	0.00624	1.06	0.67
1593.35	6.16	6.03	0.00775	0.00624	0.99	0.60
1692.93	6.14	6.02	0.00777	0.00624	0.92	0.53
1792.52	6.13	6.01	0.00780	0.00624	0.85	0.46
1892.10	6.12	5.99	0.00784	0.00624	0.79	0.38
1991.69	6.11	5.98	0.00788	0.00624	0.72	0.30
2091.27	6.09	5.97	0.00792	0.00624	0.67	0.24
2190.86	6.08	5.96	0.00789	0.00624	0.65	0.23
2290.44	6.07	5.95	0.00787	0.00624	0.63	0.22
2390.03	6.06	5.94	0.00785	0.00624	0.62	0.21
2489.61	6.05	5.93	0.00782	0.00624	0.60	0.20
2589.19	6.04	5.92	0.00780	0.00624	0.59	0.19
2688.78	6.03	5.91	0.00778	0.00624	0.57	0.18
2788.36	6.01	5.90	0.00775	0.00624	0.56	0.17
2887.95	6.00	5.89	0.00773	0.00624	0.54	0.16
2987.53	5.99	5.88	0.00770	0.00624	0.53	0.15
3087.12	5.98	5.87	0.00768	0.00624	0.51	0.14
3186.70	5.97	5.87	0.00765	0.00624	0.50	0.13
3286.29	5.96	5.86	0.00763	0.00624	0.48	0.12
3385.87	5.95	5.85	0.00759	0.00624	0.46	0.11
3485.45	5.94	5.84	0.00748	0.00624	0.43	0.10
3585.04	5.92	5.83	0.00737	0.00624	0.40	0.09
3684.62	5.91	5.82	0.00726	0.00624	0.38	0.08
3784.21	5.90	5.81	0.00716	0.00624	0.35	0.07
3883.79	5.89	5.80	0.00705	0.00624	0.32	0.06
3983.38	5.88	5.79	0.00696	0.00624	0.29	0.05
4082.96	5.87	5.78	0.00695	0.00624	0.28	0.04
4182.54	5.86	5.77	0.00694	0.00624	0.26	0.03
4282.13	5.85	5.76	0.00693	0.00624	0.25	0.02
4381.71	5.84	5.75	0.00692	0.00624	0.24	0.01
4481.30	5.83	5.74	0.00691	0.00624	0.23	0.00
4580.88	5.82	5.73	0.00690	0.00624	0.21	-0.01
4680.47	5.81	5.72	0.00689	0.00624	0.20	-0.02
4780.05	5.80	5.71	0.00688	0.00624	0.19	-0.03
4879.64	5.79	5.70	0.00687	0.00624	0.18	-0.04
4979.22	5.78	5.69	0.00686	0.00624	0.17	-0.05
5078.80	5.77	5.68	0.00685	0.00624	0.15	-0.06
5178.39	5.76	5.67	0.00684	0.00624	0.14	-0.07
5277.97	5.75	5.66	0.00683	0.00624	0.13	-0.08
5377.56	5.73	5.65	0.00682	0.00624	0.12	-0.09
5477.14	5.72	5.64	0.00681	0.00624	0.10	-0.10
5576.73	5.71	5.63	0.00680	0.00624	0.09	-0.11
5676.31	5.70	5.62	0.00679	0.00624	0.08	-0.12
5775.90	5.69	5.61	0.00678	0.00624	0.07	-0.12
5875.48	5.68	5.60	0.00677	0.00624	0.05	-0.13
5975.06	5.67	5.59	0.00676	0.00624	0.04	-0.14
6074.65	5.66	5.58	0.00692	0.00624	0.06	-0.15
6174.23	5.65	5.57	0.00711	0.00624	0.08	-0.16
6273.82	5.64	5.56	0.00731	0.00624	0.11	-0.17
6373.40	5.63	5.55	0.00752	0.00624	0.13	-0.18
6472.99	5.61	5.54	0.00773	0.00624	0.15	-0.19
6572.57	5.60	5.53	0.00796	0.00624	0.18	-0.20
6672.16	5.59	5.52	0.00819	0.00625	0.20	-0.21
6771.74	5.58	5.51	0.00843	0.00625	0.23	-0.22
6871.32	5.56	5.50	0.00868	0.00625	0.25	-0.23
6970.91	5.55	5.49	0.00894	0.00625	0.27	-0.24
7070.49	5.54	5.48	0.00921	0.00625	0.30	-0.25
7170.08	5.52	5.47	0.00949	0.00625	0.32	-0.26
7269.66	5.51	5.46	0.00979	0.00625	0.34	-0.27

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 25	year 0	year 25	year 0	year 25
7369.25	5.49	5.45	0.00978	0.00625	0.33	-0.28
7468.83	5.48	5.44	0.00966	0.00625	0.30	-0.29
7568.42	5.47	5.43	0.00954	0.00625	0.27	-0.30
7668.00	5.45	5.42	0.00942	0.00625	0.24	-0.31
7767.58	5.44	5.41	0.00931	0.00625	0.22	-0.32
7867.17	5.43	5.40	0.00919	0.00625	0.19	-0.33
7966.75	5.42	5.39	0.00907	0.00625	0.16	-0.34
8066.34	5.40	5.38	0.00896	0.00625	0.13	-0.35
8165.92	5.39	5.37	0.00884	0.00625	0.10	-0.36
8265.51	5.38	5.36	0.00873	0.00626	0.07	-0.37
8365.09	5.37	5.35	0.00861	0.00626	0.04	-0.38
8464.67	5.36	5.34	0.00850	0.00626	0.02	-0.39
8564.26	5.34	5.33	0.00839	0.00626	-0.01	-0.40
8663.84	5.33	5.32	0.00828	0.00626	-0.04	-0.41
8763.43	5.32	5.31	0.00817	0.00626	-0.07	-0.42
8863.01	5.31	5.30	0.00806	0.00626	-0.10	-0.43
8962.60	5.30	5.29	0.00795	0.00626	-0.13	-0.44
9062.18	5.29	5.28	0.00784	0.00626	-0.15	-0.45
9161.77	5.28	5.27	0.00774	0.00626	-0.18	-0.46
9261.35	5.26	5.26	0.00763	0.00626	-0.21	-0.47
9360.93	5.25	5.25	0.00753	0.00626	-0.24	-0.48
9460.52	5.24	5.24	0.00742	0.00627	-0.27	-0.49
9560.10	5.23	5.23	0.00732	0.00627	-0.30	-0.50
9659.69	5.22	5.22	0.00722	0.00627	-0.33	-0.51
9759.27	5.21	5.21	0.00712	0.00627	-0.35	-0.52
9858.86	5.20	5.20	0.00702	0.00627	-0.38	-0.53
9958.44	5.19	5.19	0.00692	0.00627	-0.41	-0.54
10058.00	5.18	5.18	0.00683	0.00627	-0.44	-0.55
10157.60	5.17	5.17	0.00676	0.00627	-0.46	-0.56
10257.20	5.16	5.16	0.00669	0.00627	-0.48	-0.57
10356.80	5.15	5.15	0.00663	0.00627	-0.51	-0.58
10456.40	5.14	5.14	0.00656	0.00627	-0.53	-0.59
10555.90	5.13	5.13	0.00650	0.00628	-0.55	-0.60
10655.50	5.12	5.12	0.00643	0.00628	-0.57	-0.60
10755.10	5.11	5.11	0.00637	0.00628	-0.60	-0.61
10854.70	5.10	5.10	0.00630	0.00628	-0.62	-0.62

Evolution of the bed levels in time – Q = 1600 m^3s^{-1}



Results from the computations with high water - Q = 5200 m^3s^{-1}
Calibration

S (m)	Water levels - year 0 (m)		Velocities - year 0 (ms^{-1})	
	SOBEK	Delft 2D	SOBEK	Ref. 11
0.00	10.63	10.66	1.21	1.30
99.58	10.63		1.23	
199.17	10.62		1.24	
298.75	10.61		1.25	
398.34	10.60		1.27	
497.92	10.59		1.28	
597.51	10.58		1.29	
697.09	10.57		1.30	
796.68	10.55		1.32	
896.26	10.54		1.33	
995.84	10.53		1.34	
1095.43	10.52		1.36	
1195.01	10.50		1.37	
1294.60	10.49		1.38	
1394.18	10.48		1.39	
1493.77	10.46	10.50	1.41	1.50
1593.35	10.45		1.43	
1692.93	10.43		1.45	
1792.52	10.41		1.48	
1892.10	10.39		1.50	
1991.69	10.37		1.53	
2091.27	10.34	10.44	1.56	1.55
2190.86	10.33		1.56	
2290.44	10.31		1.55	
2390.03	10.29		1.55	
2489.61	10.28		1.55	
2589.19	10.26		1.54	
2688.78	10.25		1.54	
2788.36	10.24		1.54	
2887.95	10.22		1.53	
2987.53	10.21		1.53	
3087.12	10.20		1.52	
3186.70	10.19		1.52	
3286.29	10.18		1.51	
3385.87	10.17	10.23	1.50	1.55
3485.45	10.16		1.50	
3585.04	10.16		1.50	
3684.62	10.15		1.50	
3784.21	10.14		1.50	
3883.79	10.13		1.49	
3983.38	10.12	10.15	1.49	1.50
4082.96	10.12		1.49	
4182.54	10.11		1.50	
4282.13	10.10		1.50	
4381.71	10.09		1.50	
4481.30	10.08		1.50	
4580.88	10.08		1.50	
4680.47	10.07		1.50	
4780.05	10.06		1.51	
4879.64	10.05		1.51	
4979.22	10.04		1.51	
5078.80	10.03		1.51	
5178.39	10.03		1.51	
5277.97	10.02		1.52	
5377.56	10.01		1.52	
5477.14	10.00		1.52	
5576.73	9.99		1.52	
5676.31	9.98		1.53	
5775.90	9.97		1.53	
5875.48	9.96		1.53	
5975.06	9.95	9.99	1.54	1.60
6074.65	9.95		1.52	
6174.23	9.94		1.50	
6273.82	9.93		1.49	
6373.40	9.93		1.47	
6472.99	9.92		1.45	
6572.57	9.92		1.44	
6672.16	9.91		1.42	
6771.74	9.90		1.40	
6871.32	9.90		1.39	
6970.91	9.89		1.37	
7070.49	9.89		1.35	
7170.08	9.88		1.34	
7269.66	9.88	9.86	1.32	1.35

S (m)	Water levels - year 0 (m)		Velocities - year 0 (ms^{-1})	
	SOBEK	Delft 2D	SOBEK	Rijkswaterstaat
7369.25	9.87		1.31	
7468.83	9.87		1.31	
7568.42	9.86		1.32	
7668.00	9.85		1.32	
7767.58	9.84		1.32	
7867.17	9.84		1.32	
7966.75	9.83		1.32	
8066.34	9.82		1.32	
8165.92	9.81		1.32	
8265.51	9.80		1.32	
8365.09	9.80		1.32	
8464.67	9.79		1.32	
8564.26	9.78		1.32	
8663.84	9.77		1.32	
8763.43	9.76		1.33	
8863.01	9.75		1.33	
8962.60	9.74		1.33	
9062.18	9.73		1.33	
9161.77	9.72		1.33	
9261.35	9.70		1.33	
9360.93	9.69		1.33	
9460.52	9.68		1.34	
9560.10	9.67		1.34	
9659.69	9.65		1.34	
9759.27	9.64		1.34	
9858.86	9.62		1.34	
9958.44	9.61		1.35	
10058.00	9.59	9.61	1.35	1.30
10157.60	9.58		1.35	
10257.20	9.57		1.36	
10356.80	9.55		1.36	
10456.40	9.54		1.36	
10555.90	9.53		1.36	
10655.50	9.52		1.36	
10755.10	9.51		1.36	
10854.70	9.50	9.50	1.36	1.30

Results from the computations with high water - Q = 5200 m^3s^{-1}

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 25	year 0	year 25	year 0	year 25
0.00	10.63	10.36	0.00969	0.01234	0.45	0.45
99.58	10.63	10.35	0.01025	0.01234	0.47	0.23
199.17	10.62	10.34	0.01081	0.01234	0.48	0.04
298.75	10.61	10.33	0.01141	0.01234	0.50	-0.15
398.34	10.60	10.32	0.01202	0.01234	0.52	-0.33
497.92	10.59	10.31	0.01267	0.01234	0.53	-0.50
597.51	10.58	10.30	0.01334	0.01233	0.55	-0.65
697.09	10.57	10.29	0.01404	0.01233	0.56	-0.80
796.68	10.55	10.29	0.01477	0.01233	0.58	-0.95
896.26	10.54	10.28	0.01552	0.01232	0.59	-1.08
995.84	10.53	10.27	0.01631	0.01232	0.61	-1.21
1095.43	10.52	10.26	0.01712	0.01232	0.62	-1.33
1195.01	10.50	10.25	0.01797	0.01231	0.63	-1.45
1294.60	10.49	10.24	0.01884	0.01231	0.65	-1.56
1394.18	10.48	10.23	0.01974	0.01230	0.66	-1.67
1493.77	10.46	10.22	0.02068	0.01230	0.67	-1.77
1593.35	10.45	10.21	0.02184	0.01229	0.60	-2.04
1692.93	10.43	10.21	0.02316	0.01228	0.53	-2.33
1792.52	10.41	10.20	0.02466	0.01228	0.46	-2.63
1892.10	10.39	10.19	0.02636	0.01227	0.38	-2.95
1991.69	10.37	10.18	0.02832	0.01226	0.30	-3.29
2091.27	10.34	10.17	0.02958	0.01225	0.24	-3.50
2190.86	10.33	10.16	0.02867	0.01224	0.23	-3.38
2290.44	10.31	10.15	0.02778	0.01223	0.22	-3.25
2390.03	10.29	10.14	0.02691	0.01223	0.21	-3.13
2489.61	10.28	10.13	0.02606	0.01222	0.20	-3.00
2589.19	10.26	10.12	0.02523	0.01221	0.19	-2.88
2688.78	10.25	10.11	0.02442	0.01220	0.18	-2.76
2788.36	10.24	10.10	0.02364	0.01219	0.17	-2.64
2887.95	10.22	10.10	0.02287	0.01218	0.16	-2.53
2987.53	10.21	10.09	0.02213	0.01218	0.15	-2.41
3087.12	10.20	10.08	0.02140	0.01217	0.14	-2.29
3186.70	10.19	10.07	0.02070	0.01216	0.13	-2.18
3286.29	10.18	10.07	0.02001	0.01215	0.12	-2.07
3385.87	10.17	10.06	0.01941	0.01215	0.11	-1.96
3485.45	10.16	10.05	0.01905	0.01214	0.10	-1.89
3585.04	10.16	10.05	0.01870	0.01213	0.09	-1.83
3684.62	10.15	10.04	0.01836	0.01212	0.08	-1.76
3784.21	10.14	10.04	0.01802	0.01212	0.07	-1.70
3883.79	10.13	10.03	0.01769	0.01211	0.06	-1.63
3983.38	10.12	10.02	0.01740	0.01210	0.05	-1.57
4082.96	10.12	10.02	0.01749	0.01209	0.04	-1.60
4182.54	10.11	10.01	0.01758	0.01209	0.03	-1.62
4282.13	10.10	10.01	0.01767	0.01208	0.02	-1.64
4381.71	10.09	10.00	0.01777	0.01207	0.01	-1.67
4481.30	10.08	10.00	0.01787	0.01206	0.00	-1.69
4580.88	10.08	9.99	0.01798	0.01205	-0.01	-1.72
4680.47	10.07	9.98	0.01808	0.01204	-0.02	-1.74
4780.05	10.06	9.98	0.01819	0.01204	-0.03	-1.77
4879.64	10.05	9.97	0.01831	0.01203	-0.04	-1.80
4979.22	10.04	9.97	0.01843	0.01202	-0.05	-1.82
5078.80	10.03	9.96	0.01855	0.01201	-0.06	-1.85
5178.39	10.03	9.96	0.01867	0.01201	-0.07	-1.88
5277.97	10.02	9.95	0.01880	0.01200	-0.08	-1.91
5377.56	10.01	9.94	0.01893	0.01199	-0.09	-1.93
5477.14	10.00	9.94	0.01907	0.01199	-0.10	-1.96
5576.73	9.99	9.93	0.01921	0.01199	-0.11	-1.99
5676.31	9.98	9.93	0.01935	0.01199	-0.12	-2.02
5775.90	9.97	9.92	0.01950	0.01199	-0.12	-2.05
5875.48	9.96	9.91	0.01965	0.01198	-0.13	-2.07
5975.06	9.95	9.91	0.01981	0.01198	-0.14	-2.10
6074.65	9.95	9.90	0.01918	0.01198	-0.15	-2.01
6174.23	9.94	9.90	0.01845	0.01199	-0.16	-1.88
6273.82	9.93	9.89	0.01773	0.01199	-0.17	-1.76
6373.40	9.93	9.89	0.01703	0.01199	-0.18	-1.63
6472.99	9.92	9.88	0.01634	0.01200	-0.19	-1.49
6572.57	9.92	9.88	0.01567	0.01200	-0.20	-1.35
6672.16	9.91	9.87	0.01502	0.01201	-0.21	-1.20
6771.74	9.90	9.87	0.01438	0.01202	-0.22	-1.05
6871.32	9.90	9.86	0.01376	0.01203	-0.23	-0.89
6970.91	9.89	9.86	0.01316	0.01204	-0.24	-0.73
7070.49	9.89	9.85	0.01257	0.01205	-0.25	-0.56
7170.08	9.88	9.84	0.01200	0.01205	-0.26	-0.38
7269.66	9.88	9.84	0.01144	0.01206	-0.27	-0.19

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 25	year 0	year 25	year 0	year 25
7369.25	9.87	9.83	0.01137	0.01207	-0.28	-0.17
7468.83	9.87	9.83	0.01152	0.01208	-0.29	-0.24
7568.42	9.86	9.82	0.01168	0.01209	-0.30	-0.30
7668.00	9.85	9.81	0.01184	0.01210	-0.31	-0.37
7767.58	9.84	9.80	0.01200	0.01211	-0.32	-0.43
7867.17	9.84	9.80	0.01217	0.01213	-0.33	-0.50
7966.75	9.83	9.79	0.01235	0.01215	-0.34	-0.56
8066.34	9.82	9.78	0.01253	0.01217	-0.35	-0.62
8165.92	9.81	9.77	0.01271	0.01220	-0.36	-0.68
8265.51	9.80	9.77	0.01291	0.01224	-0.37	-0.74
8365.09	9.80	9.76	0.01311	0.01229	-0.38	-0.80
8464.67	9.79	9.75	0.01332	0.01234	-0.39	-0.86
8564.26	9.78	9.74	0.01354	0.01241	-0.40	-0.91
8663.84	9.77	9.73	0.01376	0.01249	-0.41	-0.96
8763.43	9.76	9.73	0.01400	0.01258	-0.42	-1.01
8863.01	9.75	9.72	0.01424	0.01267	-0.43	-1.06
8962.60	9.74	9.71	0.01450	0.01277	-0.44	-1.11
9062.18	9.73	9.70	0.01476	0.01288	-0.45	-1.16
9161.77	9.72	9.69	0.01504	0.01299	-0.46	-1.20
9261.35	9.70	9.68	0.01533	0.01311	-0.47	-1.25
9360.93	9.69	9.67	0.01564	0.01323	-0.48	-1.30
9460.52	9.68	9.66	0.01596	0.01335	-0.49	-1.36
9560.10	9.67	9.65	0.01630	0.01347	-0.50	-1.41
9659.69	9.65	9.64	0.01665	0.01358	-0.51	-1.47
9759.27	9.64	9.62	0.01703	0.01369	-0.52	-1.53
9858.86	9.62	9.61	0.01743	0.01380	-0.53	-1.59
9958.44	9.61	9.60	0.01785	0.01391	-0.54	-1.66
10058.00	9.59	9.59	0.01805	0.01402	-0.55	-1.67
10157.60	9.58	9.58	0.01762	0.01412	-0.56	-1.53
10257.20	9.57	9.56	0.01720	0.01422	-0.57	-1.39
10356.80	9.55	9.55	0.01678	0.01431	-0.58	-1.26
10456.40	9.54	9.54	0.01637	0.01441	-0.59	-1.13
10555.90	9.53	9.53	0.01597	0.01450	-0.60	-1.00
10655.50	9.52	9.52	0.01559	0.01459	-0.60	-0.88
10755.10	9.51	9.51	0.01521	0.01468	-0.61	-0.76
10854.70	9.50	9.50	0.01484	0.01477	-0.62	-0.64

Results from the computations with variable discharge

S (m)	Water levels (m)			Sed. transport (m^3s^{-1})			Bed levels (m)		
	year 0	year 1	year 16	year 0	year 1	year 16	year 0	year 1	year 16
0.00	5.18	5.18	6.17	0.00444	0.00443	0.00629	0.45	0.45	0.45
99.58	5.17	5.17	6.16	0.00444	0.00445	0.00629	0.46	0.47	0.47
199.17	5.16	5.16	6.15	0.00445	0.00447	0.00629	0.48	0.48	0.48
298.75	5.15	5.15	6.14	0.00446	0.00449	0.00628	0.49	0.50	0.50
398.34	5.14	5.14	6.13	0.00447	0.00450	0.00627	0.51	0.51	0.51
497.92	5.13	5.14	6.12	0.00448	0.00450	0.00624	0.52	0.52	0.52
597.51	5.12	5.13	6.11	0.00449	0.00450	0.00622	0.53	0.54	0.53
697.09	5.11	5.12	6.10	0.00451	0.00450	0.00621	0.55	0.55	0.55
796.68	5.11	5.11	6.09	0.00452	0.00451	0.00620	0.56	0.56	0.56
896.26	5.10	5.10	6.08	0.00454	0.00452	0.00619	0.58	0.57	0.57
995.84	5.09	5.09	6.08	0.00456	0.00453	0.00617	0.59	0.59	0.58
1095.43	5.08	5.08	6.07	0.00458	0.00455	0.00616	0.60	0.60	0.60
1195.01	5.07	5.07	6.06	0.00460	0.00457	0.00615	0.62	0.61	0.61
1294.60	5.06	5.06	6.05	0.00462	0.00459	0.00614	0.63	0.63	0.62
1394.18	5.05	5.05	6.04	0.00465	0.00461	0.00613	0.65	0.64	0.63
1493.77	5.03	5.04	6.03	0.00467	0.00463	0.00612	0.66	0.65	0.64
1593.35	5.02	5.03	6.02	0.00466	0.00456	0.00610	0.60	0.58	0.57
1692.93	5.01	5.02	6.01	0.00466	0.00451	0.00609	0.53	0.50	0.49
1792.52	5.00	5.00	6.00	0.00466	0.00446	0.00608	0.47	0.43	0.41
1892.10	4.99	4.99	5.99	0.00467	0.00441	0.00608	0.41	0.35	0.34
1991.69	4.98	4.98	5.98	0.00469	0.00437	0.00607	0.34	0.28	0.26
2091.27	4.97	4.97	5.97	0.00470	0.00436	0.00605	0.30	0.22	0.19
2190.86	4.96	4.96	5.96	0.00469	0.00438	0.00602	0.28	0.22	0.18
2290.44	4.95	4.96	5.95	0.00467	0.00441	0.00600	0.27	0.22	0.16
2390.03	4.94	4.95	5.94	0.00465	0.00446	0.00600	0.25	0.22	0.15
2489.61	4.93	4.93	5.93	0.00463	0.00452	0.00602	0.24	0.22	0.15
2589.19	4.92	4.92	5.92	0.00462	0.00461	0.00606	0.23	0.23	0.15
2688.78	4.91	4.91	5.91	0.00460	0.00467	0.00608	0.21	0.23	0.14
2788.36	4.90	4.90	5.90	0.00458	0.00469	0.00608	0.20	0.22	0.13
2887.95	4.89	4.89	5.89	0.00456	0.00469	0.00609	0.19	0.21	0.12
2987.53	4.88	4.88	5.88	0.00454	0.00468	0.00610	0.17	0.20	0.12
3087.12	4.87	4.87	5.87	0.00453	0.00467	0.00611	0.16	0.19	0.11
3186.70	4.86	4.86	5.86	0.00451	0.00465	0.00614	0.14	0.18	0.10
3286.29	4.85	4.85	5.85	0.00449	0.00463	0.00615	0.13	0.16	0.10
3385.87	4.84	4.84	5.84	0.00448	0.00461	0.00616	0.12	0.15	0.09
3485.45	4.83	4.83	5.83	0.00448	0.00459	0.00616	0.11	0.13	0.08
3585.04	4.82	4.82	5.82	0.00448	0.00457	0.00616	0.10	0.12	0.07
3684.62	4.81	4.81	5.81	0.00448	0.00455	0.00616	0.09	0.11	0.06
3784.21	4.80	4.80	5.80	0.00448	0.00453	0.00616	0.08	0.09	0.05
3883.79	4.79	4.79	5.79	0.00448	0.00451	0.00617	0.07	0.08	0.04
3983.38	4.78	4.78	5.78	0.00448	0.00451	0.00617	0.06	0.07	0.03
4082.96	4.77	4.77	5.77	0.00448	0.00450	0.00617	0.05	0.05	0.02
4182.54	4.76	4.76	5.76	0.00448	0.00450	0.00618	0.04	0.04	0.02
4282.13	4.75	4.75	5.75	0.00448	0.00450	0.00618	0.03	0.03	0.01
4381.71	4.74	4.74	5.74	0.00448	0.00449	0.00618	0.02	0.02	0.00
4481.30	4.73	4.73	5.73	0.00448	0.00449	0.00618	0.01	0.01	-0.02
4580.88	4.72	4.72	5.72	0.00448	0.00448	0.00617	0.00	0.00	-0.03
4680.47	4.71	4.71	5.71	0.00448	0.00447	0.00617	-0.01	-0.01	-0.04
4780.05	4.70	4.70	5.70	0.00448	0.00447	0.00616	-0.02	-0.02	-0.05
4879.64	4.69	4.69	5.69	0.00448	0.00447	0.00616	-0.03	-0.03	-0.06
4979.22	4.68	4.68	5.68	0.00448	0.00447	0.00615	-0.04	-0.04	-0.07
5078.80	4.67	4.67	5.67	0.00448	0.00447	0.00614	-0.05	-0.05	-0.08
5178.39	4.66	4.66	5.66	0.00448	0.00447	0.00613	-0.06	-0.06	-0.09
5277.97	4.65	4.66	5.65	0.00448	0.00447	0.00613	-0.07	-0.07	-0.10
5377.56	4.64	4.65	5.64	0.00448	0.00447	0.00613	-0.08	-0.08	-0.11
5477.14	4.63	4.64	5.63	0.00448	0.00447	0.00613	-0.09	-0.09	-0.12
5576.73	4.62	4.63	5.62	0.00448	0.00447	0.00613	-0.10	-0.10	-0.13
5676.31	4.61	4.62	5.61	0.00448	0.00447	0.00613	-0.11	-0.11	-0.14
5775.90	4.60	4.61	5.60	0.00448	0.00447	0.00613	-0.12	-0.12	-0.15
5875.48	4.59	4.60	5.59	0.00448	0.00447	0.00613	-0.13	-0.13	-0.16
5975.06	4.58	4.59	5.58	0.00448	0.00447	0.00613	-0.14	-0.14	-0.17
6074.65	4.58	4.58	5.57	0.00448	0.00447	0.00613	-0.15	-0.15	-0.18
6174.23	4.57	4.57	5.56	0.00448	0.00447	0.00613	-0.16	-0.16	-0.19
6273.82	4.56	4.56	5.55	0.00448	0.00447	0.00614	-0.17	-0.17	-0.20
6373.40	4.55	4.55	5.54	0.00448	0.00448	0.00615	-0.18	-0.18	-0.21
6472.99	4.54	4.54	5.53	0.00448	0.00448	0.00616	-0.19	-0.19	-0.21
6572.57	4.53	4.53	5.52	0.00448	0.00449	0.00618	-0.20	-0.19	-0.22
6672.16	4.52	4.52	5.51	0.00448	0.00450	0.00619	-0.21	-0.20	-0.23
6771.74	4.51	4.51	5.50	0.00448	0.00450	0.00619	-0.22	-0.21	-0.24
6871.32	4.50	4.50	5.49	0.00448	0.00450	0.00620	-0.23	-0.22	-0.25
6970.91	4.49	4.49	5.48	0.00448	0.00450	0.00621	-0.24	-0.23	-0.25
7070.49	4.48	4.48	5.47	0.00448	0.00450	0.00622	-0.25	-0.24	-0.26
7170.08	4.47	4.47	5.46	0.00448	0.00450	0.00623	-0.26	-0.25	-0.27
7269.66	4.46	4.46	5.45	0.00448	0.00450	0.00624	-0.27	-0.26	-0.28

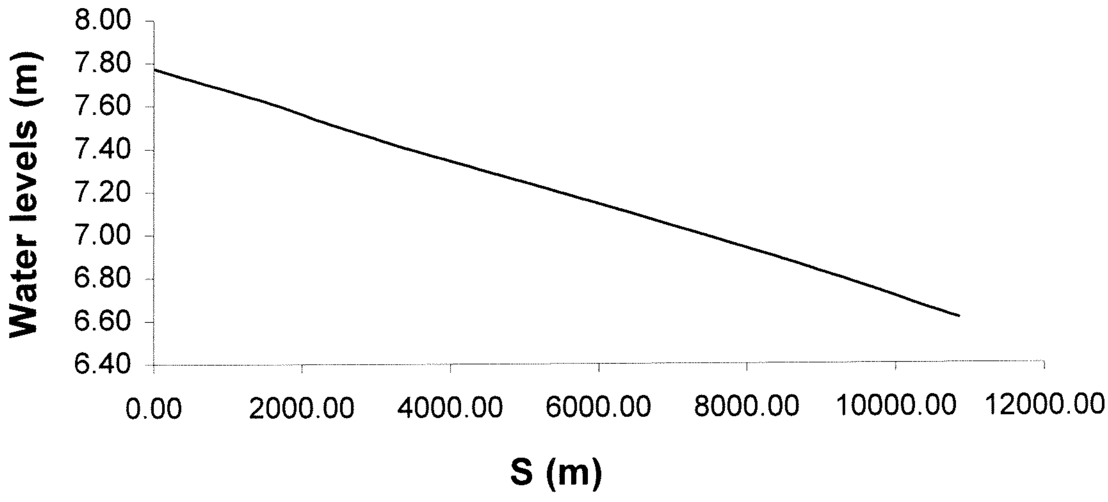
S (m)	Water levels (m)			Sed. transport (m^3s^{-1})			Bed levels (m)		
	year 0	year 1	year 16	year 0	year 1	year 16	year 0	year 1	year 16
7369.25	4.45	4.45	5.44	0.00448	0.00450	0.00624	-0.28	-0.27	-0.29
7468.83	4.44	4.44	5.43	0.00448	0.00450	0.00624	-0.29	-0.28	-0.30
7568.42	4.43	4.43	5.42	0.00448	0.00449	0.00624	-0.30	-0.29	-0.31
7668.00	4.42	4.42	5.41	0.00448	0.00449	0.00624	-0.31	-0.30	-0.32
7767.58	4.41	4.41	5.40	0.00448	0.00448	0.00623	-0.32	-0.32	-0.33
7867.17	4.40	4.40	5.40	0.00448	0.00447	0.00622	-0.33	-0.33	-0.34
7966.75	4.39	4.39	5.39	0.00448	0.00446	0.00621	-0.34	-0.34	-0.35
8066.34	4.38	4.38	5.38	0.00448	0.00446	0.00621	-0.35	-0.35	-0.36
8165.92	4.37	4.37	5.37	0.00448	0.00446	0.00621	-0.36	-0.36	-0.37
8265.51	4.36	4.36	5.36	0.00448	0.00446	0.00621	-0.37	-0.37	-0.38
8365.09	4.35	4.35	5.35	0.00448	0.00446	0.00620	-0.38	-0.38	-0.39
8464.67	4.34	4.34	5.34	0.00448	0.00445	0.00619	-0.39	-0.39	-0.41
8564.26	4.33	4.33	5.33	0.00448	0.00445	0.00619	-0.40	-0.40	-0.42
8663.84	4.32	4.32	5.32	0.00448	0.00445	0.00619	-0.41	-0.41	-0.43
8763.43	4.31	4.31	5.31	0.00448	0.00445	0.00618	-0.42	-0.42	-0.44
8863.01	4.30	4.30	5.30	0.00448	0.00445	0.00618	-0.42	-0.43	-0.45
8962.60	4.29	4.29	5.29	0.00448	0.00445	0.00618	-0.43	-0.44	-0.46
9062.18	4.28	4.28	5.28	0.00448	0.00445	0.00618	-0.44	-0.45	-0.47
9161.77	4.27	4.27	5.27	0.00448	0.00445	0.00617	-0.45	-0.46	-0.48
9261.35	4.26	4.26	5.26	0.00448	0.00445	0.00617	-0.46	-0.47	-0.49
9360.93	4.25	4.25	5.25	0.00448	0.00445	0.00616	-0.47	-0.48	-0.50
9460.52	4.24	4.24	5.24	0.00448	0.00445	0.00616	-0.48	-0.49	-0.51
9560.10	4.23	4.23	5.23	0.00448	0.00445	0.00615	-0.49	-0.50	-0.52
9659.69	4.22	4.22	5.22	0.00448	0.00444	0.00614	-0.50	-0.51	-0.53
9759.27	4.21	4.21	5.21	0.00448	0.00444	0.00613	-0.51	-0.52	-0.55
9858.86	4.20	4.20	5.20	0.00448	0.00444	0.00612	-0.52	-0.53	-0.56
9958.44	4.19	4.19	5.19	0.00448	0.00444	0.00611	-0.53	-0.54	-0.57
10058.00	4.18	4.18	5.18	0.00448	0.00444	0.00610	-0.54	-0.55	-0.58
10157.60	4.17	4.17	5.17	0.00448	0.00444	0.00609	-0.55	-0.56	-0.59
10257.20	4.16	4.16	5.16	0.00448	0.00444	0.00609	-0.56	-0.57	-0.60
10356.80	4.15	4.15	5.15	0.00448	0.00445	0.00610	-0.57	-0.58	-0.61
10456.40	4.14	4.14	5.14	0.00448	0.00446	0.00613	-0.58	-0.59	-0.62
10555.90	4.13	4.13	5.13	0.00448	0.00449	0.00617	-0.59	-0.59	-0.62
10655.50	4.12	4.12	5.12	0.00449	0.00452	0.00619	-0.60	-0.59	-0.62
10755.10	4.11	4.11	5.11	0.00449	0.00453	0.00620	-0.61	-0.60	-0.63
10854.70	4.10	4.10	5.10	0.00449	0.00453	0.00622	-0.62	-0.61	-0.64

Results from the computations with variable discharge (continuation)

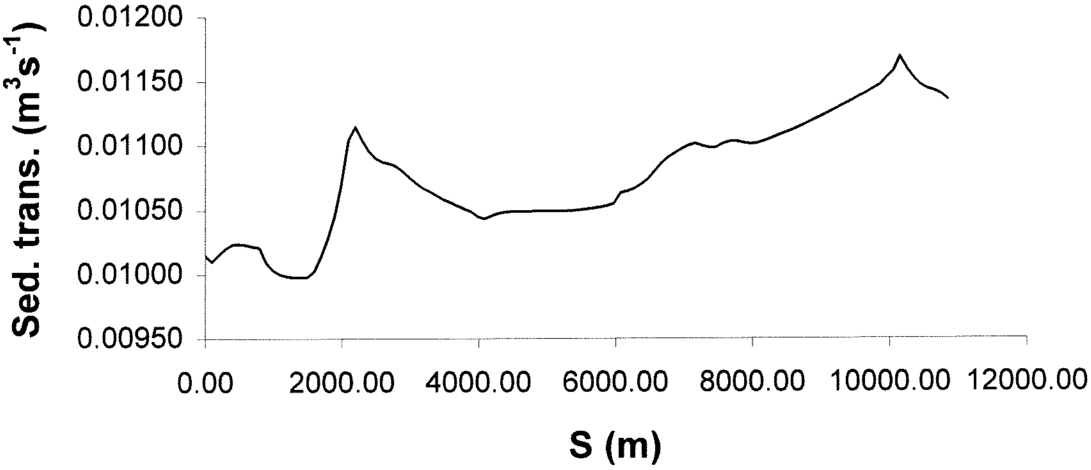
S (m)	Water levels (m)	Sed. transport (m^3s^{-1})	Bed levels (m)
	year 8 - after a peak	year 8 - after a peak	year 8 - after a peak
0.00	7.77	0.01015	0.45
99.58	7.76	0.01010	0.45
199.17	7.75	0.01016	0.47
298.75	7.74	0.01020	0.49
398.34	7.73	0.01023	0.50
497.92	7.72	0.01024	0.51
597.51	7.71	0.01023	0.52
697.09	7.70	0.01022	0.54
796.68	7.69	0.01021	0.55
896.26	7.68	0.01009	0.57
995.84	7.67	0.01003	0.58
1095.43	7.66	0.01000	0.59
1195.01	7.65	0.00998	0.60
1294.60	7.64	0.00998	0.61
1394.18	7.63	0.00998	0.62
1493.77	7.62	0.00998	0.63
1593.35	7.61	0.01002	0.55
1692.93	7.60	0.01014	0.47
1792.52	7.59	0.01028	0.39
1892.10	7.57	0.01045	0.31
1991.69	7.56	0.01071	0.22
2091.27	7.55	0.01105	0.18
2190.86	7.54	0.01115	0.19
2290.44	7.52	0.01105	0.18
2390.03	7.51	0.01096	0.16
2489.61	7.50	0.01090	0.15
2589.19	7.49	0.01088	0.15
2688.78	7.48	0.01086	0.14
2788.36	7.47	0.01084	0.14
2887.95	7.46	0.01080	0.13
2987.53	7.45	0.01075	0.12
3087.12	7.44	0.01071	0.11
3186.70	7.43	0.01067	0.11
3286.29	7.42	0.01064	0.10
3385.87	7.40	0.01061	0.09
3485.45	7.39	0.01058	0.08
3585.04	7.38	0.01056	0.08
3684.62	7.37	0.01053	0.07
3784.21	7.36	0.01051	0.06
3883.79	7.35	0.01049	0.06
3983.38	7.34	0.01045	0.04
4082.96	7.33	0.01043	0.03
4182.54	7.32	0.01045	0.02
4282.13	7.31	0.01048	0.02
4381.71	7.30	0.01049	0.01
4481.30	7.30	0.01049	0.00
4580.88	7.29	0.01049	-0.01
4680.47	7.28	0.01049	-0.02
4780.05	7.27	0.01049	-0.03
4879.64	7.26	0.01049	-0.04
4979.22	7.25	0.01049	-0.05
5078.80	7.24	0.01049	-0.07
5178.39	7.23	0.01049	-0.08
5277.97	7.22	0.01049	-0.09
5377.56	7.21	0.01050	-0.10
5477.14	7.20	0.01050	-0.11
5576.73	7.19	0.01051	-0.12
5676.31	7.18	0.01051	-0.13
5775.90	7.17	0.01052	-0.14
5875.48	7.16	0.01053	-0.14
5975.06	7.15	0.01055	-0.15
6074.65	7.14	0.01063	-0.15
6174.23	7.13	0.01065	-0.16
6273.82	7.12	0.01067	-0.16
6373.40	7.11	0.01070	-0.17
6472.99	7.10	0.01074	-0.17
6572.57	7.08	0.01080	-0.17
6672.16	7.07	0.01086	-0.17
6771.74	7.06	0.01091	-0.18
6871.32	7.05	0.01094	-0.18
6970.91	7.04	0.01097	-0.19
7070.49	7.03	0.01100	-0.19
7170.08	7.02	0.01101	-0.20
7269.66	7.01	0.01099	-0.21

S (m)	Water levels (m)	Sed. transport (m^3s^{-1})	Bed levels (m)
	year 8 - after a peak	year 8 - after a peak	year 8 - after a peak
7369.25	7.00	0.01098	-0.23
7468.83	6.99	0.01098	-0.24
7568.42	6.98	0.01101	-0.26
7668.00	6.97	0.01103	-0.27
7767.58	6.96	0.01103	-0.28
7867.17	6.95	0.01102	-0.30
7966.75	6.94	0.01101	-0.32
8066.34	6.93	0.01101	-0.33
8165.92	6.92	0.01103	-0.35
8265.51	6.91	0.01105	-0.36
8365.09	6.90	0.01107	-0.37
8464.67	6.89	0.01109	-0.39
8564.26	6.88	0.01111	-0.40
8663.84	6.86	0.01113	-0.41
8763.43	6.85	0.01116	-0.43
8863.01	6.84	0.01119	-0.44
8962.60	6.83	0.01121	-0.45
9062.18	6.82	0.01124	-0.46
9161.77	6.81	0.01126	-0.48
9261.35	6.80	0.01129	-0.49
9360.93	6.79	0.01132	-0.50
9460.52	6.77	0.01135	-0.51
9560.10	6.76	0.01138	-0.53
9659.69	6.75	0.01140	-0.54
9759.27	6.74	0.01143	-0.55
9858.86	6.73	0.01146	-0.57
9958.44	6.72	0.01152	-0.58
10058.00	6.70	0.01157	-0.58
10157.60	6.69	0.01168	-0.56
10257.20	6.68	0.01159	-0.58
10356.80	6.67	0.01152	-0.59
10456.40	6.66	0.01146	-0.60
10555.90	6.64	0.01143	-0.61
10655.50	6.63	0.01142	-0.61
10755.10	6.62	0.01139	-0.62
10854.70	6.61	0.01135	-0.62

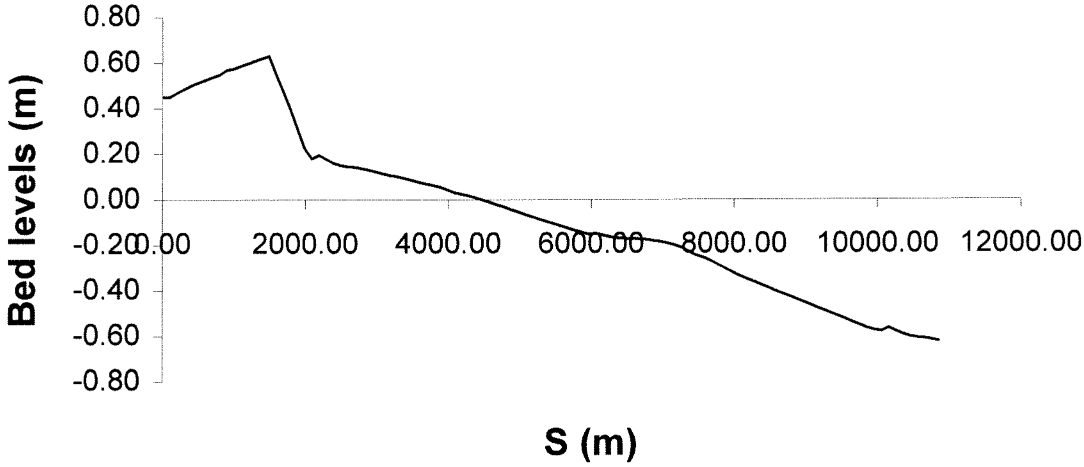
Water levels after a peak



Sed. transport after a peak



Bed levels after a peak



Results from the computations with variable discharge - averaged peak

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 16	year 0	year 16	year 0	year 16
0.00	5.18	6.18	0.00444	0.00625	0.45	0.45
99.58	5.17	6.17	0.00444	0.00625	0.46	0.47
199.17	5.16	6.16	0.00445	0.00625	0.48	0.48
298.75	5.15	6.15	0.00446	0.00625	0.49	0.50
398.34	5.14	6.14	0.00447	0.00625	0.51	0.52
497.92	5.13	6.13	0.00448	0.00625	0.52	0.53
597.51	5.12	6.12	0.00449	0.00625	0.53	0.55
697.09	5.11	6.11	0.00451	0.00625	0.55	0.56
796.68	5.11	6.10	0.00452	0.00625	0.56	0.58
896.26	5.10	6.09	0.00454	0.00625	0.58	0.59
995.84	5.09	6.08	0.00456	0.00624	0.59	0.60
1095.43	5.08	6.07	0.00458	0.00624	0.60	0.62
1195.01	5.07	6.06	0.00460	0.00623	0.62	0.63
1294.60	5.06	6.05	0.00462	0.00623	0.63	0.64
1394.18	5.05	6.04	0.00465	0.00622	0.65	0.66
1493.77	5.03	6.03	0.00467	0.00621	0.66	0.67
1593.35	5.02	6.02	0.00466	0.00620	0.60	0.59
1692.93	5.01	6.01	0.00466	0.00620	0.53	0.52
1792.52	5.00	6.00	0.00466	0.00620	0.47	0.45
1892.10	4.99	5.99	0.00467	0.00620	0.41	0.37
1991.69	4.98	5.98	0.00469	0.00621	0.34	0.29
2091.27	4.97	5.97	0.00470	0.00620	0.30	0.23
2190.86	4.96	5.96	0.00469	0.00619	0.28	0.22
2290.44	4.95	5.95	0.00467	0.00618	0.27	0.21
2390.03	4.94	5.94	0.00465	0.00618	0.25	0.20
2489.61	4.93	5.93	0.00463	0.00618	0.24	0.19
2589.19	4.92	5.92	0.00462	0.00620	0.23	0.18
2688.78	4.91	5.91	0.00460	0.00621	0.21	0.17
2788.36	4.90	5.90	0.00458	0.00621	0.20	0.16
2887.95	4.89	5.89	0.00456	0.00621	0.19	0.15
2987.53	4.88	5.88	0.00454	0.00621	0.17	0.14
3087.12	4.87	5.87	0.00453	0.00622	0.16	0.14
3186.70	4.86	5.86	0.00451	0.00623	0.14	0.13
3286.29	4.85	5.85	0.00449	0.00624	0.13	0.12
3385.87	4.84	5.84	0.00448	0.00624	0.12	0.11
3485.45	4.83	5.83	0.00448	0.00624	0.11	0.10
3585.04	4.82	5.82	0.00448	0.00625	0.10	0.09
3684.62	4.81	5.81	0.00448	0.00625	0.09	0.08
3784.21	4.80	5.80	0.00448	0.00625	0.08	0.07
3883.79	4.79	5.79	0.00448	0.00626	0.07	0.06
3983.38	4.78	5.78	0.00448	0.00626	0.06	0.06
4082.96	4.77	5.77	0.00448	0.00627	0.05	0.05
4182.54	4.76	5.76	0.00448	0.00627	0.04	0.04
4282.13	4.75	5.75	0.00448	0.00627	0.03	0.03
4381.71	4.74	5.74	0.00448	0.00627	0.02	0.02
4481.30	4.73	5.73	0.00448	0.00627	0.01	0.01
4580.88	4.72	5.72	0.00448	0.00627	0.00	0.00
4680.47	4.71	5.71	0.00448	0.00627	-0.01	-0.01
4780.05	4.70	5.70	0.00448	0.00627	-0.02	-0.02
4879.64	4.69	5.69	0.00448	0.00627	-0.03	-0.03
4979.22	4.68	5.68	0.00448	0.00627	-0.04	-0.04
5078.80	4.67	5.67	0.00448	0.00626	-0.05	-0.05
5178.39	4.66	5.66	0.00448	0.00626	-0.06	-0.06
5277.97	4.65	5.65	0.00448	0.00626	-0.07	-0.07
5377.56	4.64	5.64	0.00448	0.00626	-0.08	-0.08
5477.14	4.63	5.63	0.00448	0.00626	-0.09	-0.09
5576.73	4.62	5.62	0.00448	0.00626	-0.10	-0.10
5676.31	4.61	5.61	0.00448	0.00626	-0.11	-0.11
5775.90	4.60	5.60	0.00448	0.00626	-0.12	-0.12
5875.48	4.59	5.59	0.00448	0.00626	-0.13	-0.13
5975.06	4.58	5.58	0.00448	0.00626	-0.14	-0.14
6074.65	4.58	5.57	0.00448	0.00626	-0.15	-0.15
6174.23	4.57	5.56	0.00448	0.00626	-0.16	-0.16
6273.82	4.56	5.55	0.00448	0.00626	-0.17	-0.17
6373.40	4.55	5.54	0.00448	0.00626	-0.18	-0.18
6472.99	4.54	5.53	0.00448	0.00626	-0.19	-0.19
6572.57	4.53	5.52	0.00448	0.00626	-0.20	-0.20
6672.16	4.52	5.51	0.00448	0.00626	-0.21	-0.21
6771.74	4.51	5.50	0.00448	0.00626	-0.22	-0.22
6871.32	4.50	5.49	0.00448	0.00626	-0.23	-0.23
6970.91	4.49	5.48	0.00448	0.00626	-0.24	-0.24
7070.49	4.48	5.47	0.00448	0.00626	-0.25	-0.25
7170.08	4.47	5.47	0.00448	0.00626	-0.26	-0.26
7269.66	4.46	5.46	0.00448	0.00626	-0.27	-0.27

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 16	year 0	year 16	year 0	year 16
7369.25	4.45	5.45	0.00448	0.00626	-0.28	-0.28
7468.83	4.44	5.44	0.00448	0.00626	-0.29	-0.29
7568.42	4.43	5.43	0.00448	0.00626	-0.30	-0.30
7668.00	4.42	5.42	0.00448	0.00626	-0.31	-0.31
7767.58	4.41	5.41	0.00448	0.00625	-0.32	-0.32
7867.17	4.40	5.40	0.00448	0.00625	-0.33	-0.34
7966.75	4.39	5.39	0.00448	0.00624	-0.34	-0.35
8066.34	4.38	5.38	0.00448	0.00624	-0.35	-0.36
8165.92	4.37	5.37	0.00448	0.00624	-0.36	-0.37
8265.51	4.36	5.36	0.00448	0.00624	-0.37	-0.38
8365.09	4.35	5.35	0.00448	0.00623	-0.38	-0.39
8464.67	4.34	5.34	0.00448	0.00623	-0.39	-0.40
8564.26	4.33	5.33	0.00448	0.00622	-0.40	-0.41
8663.84	4.32	5.32	0.00448	0.00622	-0.41	-0.42
8763.43	4.31	5.31	0.00448	0.00622	-0.42	-0.43
8863.01	4.30	5.30	0.00448	0.00622	-0.42	-0.44
8962.60	4.29	5.29	0.00448	0.00621	-0.43	-0.45
9062.18	4.28	5.28	0.00448	0.00621	-0.44	-0.46
9161.77	4.27	5.27	0.00448	0.00620	-0.45	-0.47
9261.35	4.26	5.26	0.00448	0.00620	-0.46	-0.48
9360.93	4.25	5.25	0.00448	0.00619	-0.47	-0.49
9460.52	4.24	5.24	0.00448	0.00619	-0.48	-0.51
9560.10	4.23	5.23	0.00448	0.00618	-0.49	-0.52
9659.69	4.22	5.22	0.00448	0.00618	-0.50	-0.53
9759.27	4.21	5.21	0.00448	0.00617	-0.51	-0.54
9858.86	4.20	5.20	0.00448	0.00616	-0.52	-0.55
9958.44	4.19	5.19	0.00448	0.00615	-0.53	-0.56
10058.00	4.18	5.18	0.00448	0.00614	-0.54	-0.57
10157.60	4.17	5.17	0.00448	0.00613	-0.55	-0.59
10257.20	4.16	5.16	0.00448	0.00613	-0.56	-0.60
10356.80	4.15	5.15	0.00448	0.00613	-0.57	-0.61
10456.40	4.14	5.14	0.00448	0.00613	-0.58	-0.62
10555.90	4.13	5.13	0.00448	0.00614	-0.59	-0.62
10655.50	4.12	5.12	0.00449	0.00615	-0.60	-0.63
10755.10	4.11	5.11	0.00449	0.00615	-0.61	-0.64
10854.70	4.10	5.10	0.00449	0.00616	-0.62	-0.65

APPENDIX 6: Computational results of the 2D model

- High water

Results from the computations with high water - Q = 5200 m^3s^{-1}

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 25	Total	Main channel	Floodplain	Exchange
0.00	10.17	9.79	0.01931	0.01931	0.00000	0.00000
99.58	10.16	9.78	0.01806	0.01806	0.00000	0.00000
199.17	10.15	9.76	0.01720	0.01720	0.00000	0.00000
298.75	10.14	9.74	0.01669	0.01669	0.00000	0.00000
398.34	10.12	9.73	0.01650	0.01650	0.00000	0.00000
497.92	10.11	9.71	0.01659	0.01659	0.00000	0.00000
597.51	10.10	9.70	0.01692	0.01692	0.00000	0.00000
697.09	10.08	9.68	0.01748	0.01748	0.00000	0.00000
796.68	10.07	9.67	0.01822	0.01822	0.00000	0.00000
896.26	10.05	9.65	0.01914	0.01914	0.00000	0.00000
995.84	10.04	9.64	0.02021	0.02021	0.00000	0.00000
1095.43	10.02	9.63	0.02143	0.02143	0.00000	0.00000
1195.01	10.00	9.61	0.02277	0.02277	0.00000	0.00000
1294.60	9.98	9.60	0.02423	0.02423	0.00000	0.00000
1394.18	9.96	9.58	0.02581	0.02581	0.00000	0.00000
1493.77	9.94	9.57	0.02751	0.02751	0.00000	0.00000
1593.35	9.92	9.56	0.02899	0.02899	0.00000	0.00000
1692.93	9.90	9.54	0.03047	0.03047	0.00000	0.00000
1792.52	9.88	9.53	0.03201	0.03201	0.00000	0.00000
1892.10	9.85	9.51	0.03367	0.03367	0.00000	0.00000
1991.69	9.83	9.50	0.03547	0.03547	0.00000	0.00000
2091.27	9.80	9.48	0.03665	0.03665	0.00000	0.00000
2190.86	9.78	9.46	0.03597	0.03597	0.00000	0.00000
2290.44	9.76	9.45	0.03510	0.03510	0.00000	0.00000
2390.03	9.73	9.43	0.03419	0.03419	0.00000	0.00000
2489.61	9.71	9.42	0.03328	0.03328	0.00000	0.00000
2589.19	9.70	9.40	0.03240	0.03240	0.00000	0.00000
2688.78	9.68	9.39	0.03157	0.03157	0.00000	0.00000
2788.36	9.66	9.38	0.03079	0.03079	0.00000	0.00000
2887.95	9.65	9.36	0.03006	0.03006	0.00000	0.00000
2987.53	9.63	9.35	0.02938	0.02938	0.00000	0.00000
3087.12	9.62	9.34	0.02874	0.02874	0.00000	0.00000
3186.70	9.60	9.33	0.02814	0.02814	0.00000	0.00000
3286.29	9.59	9.32	0.02758	0.02758	0.00000	0.00000
3385.87	9.58	9.30	0.02709	0.02709	0.00000	0.00000
3485.45	9.56	9.29	0.02671	0.02671	0.00000	0.00000
3585.04	9.55	9.28	0.02631	0.02631	0.00000	0.00000
3684.62	9.54	9.27	0.02589	0.02589	0.00000	0.00000
3784.21	9.53	9.26	0.02546	0.02546	0.00000	0.00000
3883.79	9.52	9.25	0.02503	0.02503	0.00000	0.00000
3983.38	9.51	9.24	0.02463	0.02463	0.00000	0.00000
4082.96	9.50	9.24	0.02467	0.02467	0.00000	0.00000
4182.54	9.49	9.23	0.02473	0.02473	0.00000	0.00000
4282.13	9.48	9.22	0.02481	0.02481	0.00000	0.00000
4381.71	9.47	9.21	0.02491	0.02491	0.00000	0.00000
4481.30	9.46	9.20	0.02503	0.02503	0.00000	0.00000
4580.88	9.45	9.19	0.02515	0.02515	0.00000	0.00000
4680.47	9.44	9.18	0.02529	0.02529	0.00000	0.00000
4780.05	9.43	9.17	0.02544	0.02544	0.00000	0.00000
4879.64	9.41	9.16	0.02560	0.02560	0.00000	0.00000
4979.22	9.40	9.15	0.02577	0.02577	0.00000	0.00000
5078.80	9.39	9.14	0.02595	0.02595	0.00000	0.00000
5178.39	9.38	9.14	0.02614	0.02614	0.00000	0.00000
5277.97	9.37	9.13	0.02634	0.02634	0.00000	0.00000
5377.56	9.36	9.12	0.02655	0.02655	0.00000	0.00000
5477.14	9.35	9.11	0.02677	0.02677	0.00000	0.00000
5576.73	9.33	9.10	0.02700	0.02700	0.00000	0.00000
5676.31	9.32	9.09	0.02725	0.02725	0.00000	0.00000
5775.90	9.31	9.08	0.02750	0.02750	0.00000	0.00000
5875.48	9.30	9.07	0.02777	0.02777	0.00000	0.00000
5975.06	9.29	9.06	0.02805	0.02805	0.00000	0.00000
6074.65	9.28	9.05	0.02780	0.02780	0.00000	0.00000
6174.23	9.27	9.04	0.02735	0.02735	0.00000	0.00000
6273.82	9.26	9.04	0.02682	0.02682	0.00000	0.00000
6373.40	9.25	9.03	0.02627	0.02627	0.00000	0.00000
6472.99	9.24	9.02	0.02574	0.02574	0.00000	0.00000
6572.57	9.23	9.01	0.02526	0.02526	0.00000	0.00000
6672.16	9.22	9.00	0.02485	0.02485	0.00000	0.00000
6771.74	9.21	8.99	0.02452	0.02452	0.00000	0.00000
6871.32	9.20	8.98	0.02428	0.02428	0.00000	0.00000
6970.91	9.19	8.97	0.02416	0.02416	0.00000	0.00000
7070.49	9.18	8.96	0.02416	0.02416	0.00000	0.00000
7170.08	9.17	8.95	0.02430	0.02430	0.00000	0.00000
7269.66	9.16	8.94	0.02461	0.02461	0.00000	0.00000

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 25	Total	Main channel	Floodplain	Exchange
7369.25	9.15	8.93	0.02509	0.02509	0.00000	0.00000
7468.83	9.13	8.92	0.02557	0.02557	0.00000	0.00000
7568.42	9.12	8.91	0.02599	0.02599	0.00000	0.00000
7668.00	9.11	8.90	0.02637	0.02637	0.00000	0.00000
7767.58	9.10	8.89	0.02673	0.02673	0.00000	0.00000
7867.17	9.09	8.88	0.02708	0.02708	0.00000	0.00000
7966.75	9.07	8.88	0.02743	0.02743	0.00000	0.00000
8066.34	9.06	8.87	0.02778	0.02778	0.00000	0.00000
8165.92	9.05	8.86	0.02815	0.02815	0.00000	0.00000
8265.51	9.03	8.85	0.02853	0.02853	0.00000	0.00000
8365.09	9.02	8.83	0.02894	0.02894	0.00000	0.00000
8464.67	9.00	8.82	0.02937	0.02937	0.00000	0.00000
8564.26	8.99	8.81	0.02983	0.02983	0.00000	0.00000
8663.84	8.97	8.80	0.03033	0.03033	0.00000	0.00000
8763.43	8.96	8.79	0.03086	0.03086	0.00000	0.00000
8863.01	8.94	8.78	0.03144	0.03144	0.00000	0.00000
8962.60	8.92	8.77	0.03206	0.03206	0.00000	0.00000
9062.18	8.90	8.75	0.03274	0.03274	0.00000	0.00000
9161.77	8.88	8.74	0.03347	0.03347	0.00000	0.00000
9261.35	8.86	8.73	0.03426	0.03426	0.00000	0.00000
9360.93	8.84	8.72	0.03511	0.03511	0.00000	0.00000
9460.52	8.82	8.70	0.03604	0.03604	0.00000	0.00000
9560.10	8.80	8.69	0.03706	0.03706	0.00000	0.00000
9659.69	8.77	8.68	0.03816	0.03816	0.00000	0.00000
9759.27	8.75	8.66	0.03936	0.03936	0.00000	0.00000
9858.86	8.72	8.65	0.04068	0.04068	0.00000	0.00000
9958.44	8.69	8.63	0.04212	0.04212	0.00000	0.00000
10058.00	8.66	8.62	0.04274	0.04274	0.00000	0.00000
10157.60	8.64	8.60	0.04139	0.04139	0.00000	0.00000
10257.20	8.61	8.58	0.04004	0.04004	0.00000	0.00000
10356.80	8.59	8.57	0.03872	0.03872	0.00000	0.00000
10456.40	8.57	8.55	0.03744	0.03744	0.00000	0.00000
10555.90	8.55	8.54	0.03621	0.03621	0.00000	0.00000
10655.50	8.53	8.53	0.03505	0.03505	0.00000	0.00000
10755.10	8.52	8.51	0.03394	0.03394	0.00000	0.00000
10854.70	8.50	8.50	0.03288	0.03288	0.00000	0.00000

Results from the computations with high water - Q = 5200 m^3s^{-1} (continuation)

Sed. transport (m^3s^{-1}) - year 25				Bed levels - main channel (m)	
Total	Main channel	Floodplain	Exchange	year 0	year 25
0.02233	0.02233	0.00000	0.00000	0.45	0.45
0.02233	0.02233	0.00000	0.00000	0.46	0.86
0.02233	0.02233	0.00000	0.00000	0.48	0.89
0.02234	0.02234	0.00000	0.00000	0.49	0.79
0.02234	0.02234	0.00000	0.00000	0.51	0.63
0.02234	0.02234	0.00000	0.00000	0.52	0.44
0.02234	0.02234	0.00000	0.00000	0.53	0.25
0.02234	0.02234	0.00000	0.00000	0.55	0.06
0.02234	0.02234	0.00000	0.00000	0.56	-0.12
0.02234	0.02234	0.00000	0.00000	0.58	-0.28
0.02235	0.02235	0.00000	0.00000	0.59	-0.44
0.02235	0.02235	0.00000	0.00000	0.60	-0.58
0.02235	0.02235	0.00000	0.00000	0.62	-0.72
0.02235	0.02235	0.00000	0.00000	0.63	-0.85
0.02235	0.02235	0.00000	0.00000	0.65	-0.97
0.02235	0.02235	0.00000	0.00000	0.66	-1.09
0.02235	0.02235	0.00000	0.00000	0.60	-1.28
0.02235	0.02235	0.00000	0.00000	0.53	-1.49
0.02235	0.02235	0.00000	0.00000	0.47	-1.71
0.02235	0.02235	0.00000	0.00000	0.41	-1.94
0.02236	0.02236	0.00000	0.00000	0.34	-2.17
0.02236	0.02236	0.00000	0.00000	0.30	-2.27
0.02236	0.02236	0.00000	0.00000	0.28	-2.09
0.02236	0.02236	0.00000	0.00000	0.27	-1.98
0.02236	0.02236	0.00000	0.00000	0.25	-1.88
0.02236	0.02236	0.00000	0.00000	0.24	-1.79
0.02236	0.02236	0.00000	0.00000	0.23	-1.70
0.02236	0.02236	0.00000	0.00000	0.21	-1.61
0.02236	0.02236	0.00000	0.00000	0.20	-1.54
0.02237	0.02237	0.00000	0.00000	0.19	-1.47
0.02237	0.02237	0.00000	0.00000	0.17	-1.40
0.02237	0.02237	0.00000	0.00000	0.16	-1.34
0.02237	0.02237	0.00000	0.00000	0.14	-1.28
0.02237	0.02237	0.00000	0.00000	0.13	-1.23
0.02237	0.02237	0.00000	0.00000	0.12	-1.18
0.02238	0.02238	0.00000	0.00000	0.11	-1.15
0.02238	0.02238	0.00000	0.00000	0.10	-1.09
0.02238	0.02238	0.00000	0.00000	0.09	-1.04
0.02238	0.02238	0.00000	0.00000	0.08	-0.98
0.02238	0.02238	0.00000	0.00000	0.07	-0.92
0.02239	0.02239	0.00000	0.00000	0.06	-0.88
0.02239	0.02239	0.00000	0.00000	0.05	-0.97
0.02239	0.02239	0.00000	0.00000	0.04	-1.00
0.02239	0.02239	0.00000	0.00000	0.03	-1.02
0.02239	0.02239	0.00000	0.00000	0.02	-1.04
0.02240	0.02240	0.00000	0.00000	0.01	-1.07
0.02240	0.02240	0.00000	0.00000	0.00	-1.09
0.02240	0.02240	0.00000	0.00000	-0.01	-1.11
0.02240	0.02240	0.00000	0.00000	-0.02	-1.13
0.02241	0.02241	0.00000	0.00000	-0.03	-1.16
0.02241	0.02241	0.00000	0.00000	-0.04	-1.18
0.02241	0.02241	0.00000	0.00000	-0.05	-1.21
0.02241	0.02241	0.00000	0.00000	-0.06	-1.23
0.02241	0.02241	0.00000	0.00000	-0.07	-1.26
0.02242	0.02242	0.00000	0.00000	-0.08	-1.28
0.02242	0.02242	0.00000	0.00000	-0.09	-1.31
0.02242	0.02242	0.00000	0.00000	-0.10	-1.34
0.02242	0.02242	0.00000	0.00000	-0.11	-1.37
0.02243	0.02243	0.00000	0.00000	-0.12	-1.40
0.02243	0.02243	0.00000	0.00000	-0.13	-1.43
0.02243	0.02243	0.00000	0.00000	-0.14	-1.45
0.02243	0.02243	0.00000	0.00000	-0.15	-1.38
0.02244	0.02244	0.00000	0.00000	-0.16	-1.31
0.02244	0.02244	0.00000	0.00000	-0.17	-1.25
0.02244	0.02244	0.00000	0.00000	-0.18	-1.19
0.02245	0.02245	0.00000	0.00000	-0.19	-1.16
0.02245	0.02245	0.00000	0.00000	-0.20	-1.13
0.02245	0.02245	0.00000	0.00000	-0.21	-1.13
0.02246	0.02246	0.00000	0.00000	-0.22	-1.14
0.02246	0.02246	0.00000	0.00000	-0.23	-1.18
0.02247	0.02247	0.00000	0.00000	-0.24	-1.23
0.02247	0.02247	0.00000	0.00000	-0.25	-1.30
0.02247	0.02247	0.00000	0.00000	-0.26	-1.39
0.02248	0.02248	0.00000	0.00000	-0.27	-1.50

Sed. transport (m^3s^{-1}) - year 25				Bed levels - mai channel (m)	
Total	Main channel	Floodplain	Exchange	year 0	year 25
0.02248	0.02248	0.00000	0.00000	-0.28	-1.60
0.02249	0.02249	0.00000	0.00000	-0.29	-1.67
0.02249	0.02249	0.00000	0.00000	-0.30	-1.71
0.02250	0.02250	0.00000	0.00000	-0.31	-1.75
0.02250	0.02250	0.00000	0.00000	-0.32	-1.78
0.02251	0.02251	0.00000	0.00000	-0.33	-1.82
0.02251	0.02251	0.00000	0.00000	-0.34	-1.85
0.02252	0.02252	0.00000	0.00000	-0.35	-1.89
0.02252	0.02252	0.00000	0.00000	-0.36	-1.93
0.02253	0.02253	0.00000	0.00000	-0.37	-1.97
0.02253	0.02253	0.00000	0.00000	-0.38	-2.02
0.02254	0.02254	0.00000	0.00000	-0.39	-2.06
0.02254	0.02254	0.00000	0.00000	-0.40	-2.11
0.02255	0.02255	0.00000	0.00000	-0.41	-2.16
0.02255	0.02255	0.00000	0.00000	-0.42	-2.21
0.02256	0.02256	0.00000	0.00000	-0.42	-2.27
0.02256	0.02256	0.00000	0.00000	-0.43	-2.32
0.02257	0.02257	0.00000	0.00000	-0.44	-2.38
0.02258	0.02258	0.00000	0.00000	-0.45	-2.44
0.02258	0.02258	0.00000	0.00000	-0.46	-2.51
0.02259	0.02259	0.00000	0.00000	-0.47	-2.57
0.02260	0.02260	0.00000	0.00000	-0.48	-2.64
0.02260	0.02260	0.00000	0.00000	-0.49	-2.72
0.02261	0.02261	0.00000	0.00000	-0.50	-2.79
0.02261	0.02261	0.00000	0.00000	-0.51	-2.87
0.02262	0.02262	0.00000	0.00000	-0.52	-2.95
0.02263	0.02263	0.00000	0.00000	-0.53	-3.03
0.02263	0.02263	0.00000	0.00000	-0.54	-2.99
0.02264	0.02264	0.00000	0.00000	-0.55	-2.76
0.02265	0.02265	0.00000	0.00000	-0.56	-2.59
0.02266	0.02266	0.00000	0.00000	-0.57	-2.43
0.02266	0.02266	0.00000	0.00000	-0.58	-2.29
0.02267	0.02267	0.00000	0.00000	-0.59	-2.15
0.02268	0.02268	0.00000	0.00000	-0.60	-2.02
0.02268	0.02268	0.00000	0.00000	-0.61	-1.89
0.02269	0.02269	0.00000	0.00000	-0.62	-1.77

APPENDIX 7: Computational results of the model with only the main channel

- 1D model – variable discharge
- 2D model - variable discharge
- 2D model - variable discharge with averaged peak

Computation with the 1D model from the main channel - variable discharge

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 8	year 0	year 8	year 0	year 8
0.00	5.18	6.18	0.00444	0.00624	0.45	0.45
99.58	5.17	6.17	0.00444	0.00624	0.46	0.47
199.17	5.16	6.16	0.00445	0.00624	0.48	0.48
298.75	5.15	6.15	0.00446	0.00624	0.49	0.50
398.34	5.14	6.14	0.00447	0.00624	0.51	0.52
497.92	5.13	6.13	0.00448	0.00623	0.52	0.53
597.51	5.12	6.12	0.00449	0.00623	0.53	0.54
697.09	5.11	6.11	0.00451	0.00622	0.55	0.56
796.68	5.11	6.10	0.00452	0.00622	0.56	0.57
896.26	5.10	6.09	0.00454	0.00622	0.58	0.59
995.84	5.09	6.08	0.00456	0.00621	0.59	0.60
1095.43	5.08	6.08	0.00458	0.00621	0.60	0.61
1195.01	5.07	6.07	0.00460	0.00620	0.62	0.63
1294.60	5.06	6.06	0.00462	0.00620	0.63	0.64
1394.18	5.05	6.05	0.00465	0.00620	0.65	0.65
1493.77	5.03	6.04	0.00467	0.00619	0.66	0.66
1593.35	5.02	6.03	0.00466	0.00619	0.60	0.59
1692.93	5.01	6.02	0.00466	0.00619	0.53	0.52
1792.52	5.00	6.01	0.00466	0.00618	0.47	0.44
1892.10	4.99	5.99	0.00467	0.00618	0.41	0.37
1991.69	4.98	5.98	0.00469	0.00618	0.34	0.29
2091.27	4.97	5.97	0.00470	0.00618	0.30	0.23
2190.86	4.96	5.96	0.00469	0.00617	0.28	0.22
2290.44	4.95	5.95	0.00467	0.00617	0.27	0.21
2390.03	4.94	5.94	0.00465	0.00617	0.25	0.20
2489.61	4.93	5.93	0.00463	0.00618	0.24	0.19
2589.19	4.92	5.92	0.00462	0.00619	0.23	0.18
2688.78	4.91	5.91	0.00460	0.00620	0.21	0.17
2788.36	4.90	5.90	0.00458	0.00621	0.20	0.17
2887.95	4.89	5.90	0.00456	0.00621	0.19	0.16
2987.53	4.88	5.89	0.00454	0.00621	0.17	0.15
3087.12	4.87	5.88	0.00453	0.00622	0.16	0.14
3186.70	4.86	5.87	0.00451	0.00622	0.14	0.13
3286.29	4.85	5.86	0.00449	0.00623	0.13	0.12
3385.87	4.84	5.85	0.00448	0.00623	0.12	0.11
3485.45	4.83	5.84	0.00448	0.00624	0.11	0.10
3585.04	4.82	5.83	0.00448	0.00624	0.10	0.09
3684.62	4.81	5.82	0.00448	0.00624	0.09	0.08
3784.21	4.80	5.81	0.00448	0.00625	0.08	0.07
3883.79	4.79	5.80	0.00448	0.00625	0.07	0.07
3983.38	4.78	5.79	0.00448	0.00625	0.06	0.06
4082.96	4.77	5.78	0.00448	0.00626	0.05	0.05
4182.54	4.76	5.77	0.00448	0.00626	0.04	0.04
4282.13	4.75	5.76	0.00448	0.00626	0.03	0.03
4381.71	4.74	5.75	0.00448	0.00626	0.02	0.02
4481.30	4.73	5.74	0.00448	0.00625	0.01	0.01
4580.88	4.72	5.73	0.00448	0.00625	0.00	0.00
4680.47	4.71	5.72	0.00448	0.00624	-0.01	-0.02
4780.05	4.70	5.71	0.00448	0.00624	-0.02	-0.03
4879.64	4.69	5.70	0.00448	0.00623	-0.03	-0.04
4979.22	4.68	5.69	0.00448	0.00622	-0.04	-0.05
5078.80	4.67	5.68	0.00448	0.00622	-0.05	-0.06
5178.39	4.66	5.67	0.00448	0.00621	-0.06	-0.07
5277.97	4.65	5.66	0.00448	0.00621	-0.07	-0.08
5377.56	4.64	5.65	0.00448	0.00621	-0.08	-0.09
5477.14	4.63	5.64	0.00448	0.00621	-0.09	-0.10
5576.73	4.62	5.63	0.00448	0.00621	-0.10	-0.11
5676.31	4.61	5.62	0.00448	0.00621	-0.11	-0.12
5775.90	4.60	5.61	0.00448	0.00622	-0.12	-0.13
5875.48	4.59	5.60	0.00448	0.00622	-0.13	-0.14
5975.06	4.58	5.59	0.00448	0.00623	-0.14	-0.15
6074.65	4.58	5.58	0.00448	0.00625	-0.15	-0.15
6174.23	4.57	5.57	0.00448	0.00626	-0.16	-0.16
6273.82	4.56	5.56	0.00448	0.00629	-0.17	-0.17
6373.40	4.55	5.55	0.00448	0.00631	-0.18	-0.17
6472.99	4.54	5.54	0.00448	0.00635	-0.19	-0.17
6572.57	4.53	5.53	0.00448	0.00638	-0.20	-0.18
6672.16	4.52	5.52	0.00448	0.00641	-0.21	-0.18
6771.74	4.51	5.51	0.00448	0.00643	-0.22	-0.19
6871.32	4.50	5.50	0.00448	0.00644	-0.23	-0.19
6970.91	4.49	5.49	0.00448	0.00645	-0.24	-0.20
7070.49	4.48	5.48	0.00448	0.00645	-0.25	-0.21
7170.08	4.47	5.47	0.00448	0.00645	-0.26	-0.22
7269.66	4.46	5.46	0.00448	0.00644	-0.27	-0.23

S (m)	Water levels (m)		Sed. transport (m^3s^{-1})		Bed levels (m)	
	year 0	year 25	year 0	year 25	year 0	year 25
7369.25	4.45	5.45	0.00448	0.00644	-0.28	-0.25
7468.83	4.44	5.44	0.00448	0.00642	-0.29	-0.26
7568.42	4.43	5.43	0.00448	0.00640	-0.30	-0.27
7668.00	4.42	5.42	0.00448	0.00637	-0.31	-0.29
7767.58	4.41	5.41	0.00448	0.00634	-0.32	-0.31
7867.17	4.40	5.40	0.00448	0.00631	-0.33	-0.32
7966.75	4.39	5.39	0.00448	0.00629	-0.34	-0.34
8066.34	4.38	5.38	0.00448	0.00628	-0.35	-0.35
8165.92	4.37	5.37	0.00448	0.00627	-0.36	-0.36
8265.51	4.36	5.36	0.00448	0.00626	-0.37	-0.37
8365.09	4.35	5.35	0.00448	0.00625	-0.38	-0.38
8464.67	4.34	5.34	0.00448	0.00624	-0.39	-0.40
8564.26	4.33	5.33	0.00448	0.00623	-0.40	-0.41
8663.84	4.32	5.32	0.00448	0.00623	-0.41	-0.42
8763.43	4.31	5.31	0.00448	0.00622	-0.42	-0.43
8863.01	4.30	5.30	0.00448	0.00622	-0.42	-0.44
8962.60	4.29	5.29	0.00448	0.00622	-0.43	-0.45
9062.18	4.28	5.28	0.00448	0.00621	-0.44	-0.46
9161.77	4.27	5.27	0.00448	0.00621	-0.45	-0.47
9261.35	4.26	5.26	0.00448	0.00620	-0.46	-0.48
9360.93	4.25	5.25	0.00448	0.00620	-0.47	-0.49
9460.52	4.24	5.24	0.00448	0.00620	-0.48	-0.50
9560.10	4.23	5.23	0.00448	0.00619	-0.49	-0.51
9659.69	4.22	5.22	0.00448	0.00619	-0.50	-0.52
9759.27	4.21	5.21	0.00448	0.00618	-0.51	-0.54
9858.86	4.20	5.20	0.00448	0.00618	-0.52	-0.55
9958.44	4.19	5.19	0.00448	0.00618	-0.53	-0.56
10058.00	4.18	5.18	0.00448	0.00617	-0.54	-0.57
10157.60	4.17	5.17	0.00448	0.00617	-0.55	-0.58
10257.20	4.16	5.16	0.00448	0.00617	-0.56	-0.59
10356.80	4.15	5.15	0.00448	0.00617	-0.57	-0.60
10456.40	4.14	5.14	0.00448	0.00617	-0.58	-0.61
10555.90	4.13	5.13	0.00448	0.00619	-0.59	-0.61
10655.50	4.12	5.12	0.00449	0.00620	-0.60	-0.62
10755.10	4.11	5.11	0.00449	0.00620	-0.61	-0.63
10854.70	4.10	5.10	0.00449	0.00620	-0.62	-0.64

Computation with the 2D model from the main channel - variable discharge

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 8	Total	Left channel	Right channel	Exchange
0.00	6.19	6.16	0.00448	0.00226	0.00223	2.3E-07
99.58	6.18	6.15	0.00450	0.00225	0.00225	2.3E-07
199.17	6.17	6.14	0.00452	0.00225	0.00227	2.2E-07
298.75	6.16	6.13	0.00454	0.00226	0.00228	2.2E-07
398.34	6.15	6.13	0.00456	0.00227	0.00229	2.2E-07
497.92	6.14	6.12	0.00458	0.00228	0.00230	2.2E-07
597.51	6.13	6.11	0.00460	0.00230	0.00231	2.1E-07
697.09	6.12	6.10	0.00463	0.00231	0.00232	2.1E-07
796.68	6.11	6.09	0.00466	0.00234	0.00232	2.1E-07
896.26	6.10	6.08	0.00469	0.00236	0.00233	2.1E-07
995.84	6.09	6.07	0.00472	0.00238	0.00233	2.0E-07
1095.43	6.08	6.06	0.00475	0.00241	0.00234	2.0E-07
1195.01	6.07	6.05	0.00479	0.00244	0.00235	2.0E-07
1294.60	6.06	6.04	0.00483	0.00247	0.00235	2.0E-07
1394.18	6.05	6.03	0.00487	0.00251	0.00236	2.0E-07
1493.77	6.04	6.02	0.00491	0.00254	0.00237	1.9E-07
1593.35	6.03	6.01	0.00494	0.00256	0.00237	2.0E-07
1692.93	6.02	5.99	0.00496	0.00259	0.00237	2.1E-07
1792.52	6.01	5.98	0.00500	0.00263	0.00237	2.1E-07
1892.10	6.00	5.97	0.00504	0.00267	0.00237	2.2E-07
1991.69	5.99	5.96	0.00510	0.00272	0.00237	2.3E-07
2091.27	5.98	5.95	0.00512	0.00277	0.00235	2.4E-07
2190.86	5.97	5.94	0.00507	0.00279	0.00228	2.4E-07
2290.44	5.96	5.93	0.00503	0.00279	0.00223	2.4E-07
2390.03	5.95	5.92	0.00498	0.00278	0.00220	2.4E-07
2489.61	5.94	5.91	0.00493	0.00275	0.00218	2.4E-07
2589.19	5.93	5.90	0.00487	0.00271	0.00217	2.4E-07
2688.78	5.92	5.89	0.00482	0.00266	0.00216	-2.1E-07
2788.36	5.91	5.88	0.00477	0.00261	0.00216	-2.1E-07
2887.95	5.90	5.87	0.00471	0.00256	0.00216	-2.1E-07
2987.53	5.89	5.86	0.00466	0.00250	0.00216	-2.1E-07
3087.12	5.88	5.85	0.00461	0.00244	0.00217	-2.1E-07
3186.70	5.87	5.84	0.00456	0.00238	0.00218	-2.0E-07
3286.29	5.86	5.83	0.00450	0.00232	0.00219	-2.0E-07
3385.87	5.85	5.82	0.00446	0.00226	0.00220	-2.0E-07
3485.45	5.84	5.81	0.00444	0.00221	0.00223	-2.0E-07
3585.04	5.83	5.80	0.00441	0.00216	0.00225	-2.0E-07
3684.62	5.82	5.79	0.00439	0.00212	0.00227	-2.0E-07
3784.21	5.81	5.78	0.00437	0.00207	0.00229	-2.0E-07
3883.79	5.80	5.77	0.00434	0.00203	0.00231	-2.0E-07
3983.38	5.79	5.76	0.00432	0.00199	0.00233	-2.0E-07
4082.96	5.78	5.75	0.00433	0.00195	0.00237	-2.0E-07
4182.54	5.77	5.74	0.00433	0.00192	0.00240	-2.0E-07
4282.13	5.76	5.73	0.00433	0.00190	0.00243	-2.0E-07
4381.71	5.75	5.72	0.00433	0.00188	0.00245	-2.0E-07
4481.30	5.74	5.71	0.00433	0.00186	0.00246	-2.0E-07
4580.88	5.73	5.71	0.00433	0.00185	0.00248	-2.0E-07
4680.47	5.72	5.70	0.00433	0.00184	0.00248	-2.0E-07
4780.05	5.71	5.69	0.00433	0.00183	0.00249	-2.0E-07
4879.64	5.70	5.68	0.00432	0.00183	0.00250	-2.0E-07
4979.22	5.69	5.67	0.00432	0.00182	0.00250	-2.0E-07
5078.80	5.68	5.66	0.00432	0.00182	0.00250	-2.0E-07
5178.39	5.67	5.65	0.00432	0.00182	0.00250	3.4E-07
5277.97	5.66	5.64	0.00432	0.00181	0.00250	3.4E-07
5377.56	5.65	5.63	0.00432	0.00181	0.00250	3.4E-07
5477.14	5.64	5.62	0.00432	0.00181	0.00250	3.4E-07
5576.73	5.63	5.61	0.00431	0.00181	0.00250	3.4E-07
5676.31	5.62	5.60	0.00431	0.00181	0.00250	3.4E-07
5775.90	5.61	5.59	0.00431	0.00181	0.00250	3.4E-07
5875.48	5.60	5.58	0.00431	0.00182	0.00249	3.4E-07
5975.06	5.59	5.57	0.00431	0.00182	0.00249	3.4E-07
6074.65	5.58	5.57	0.00430	0.00182	0.00248	3.4E-07
6174.23	5.57	5.56	0.00430	0.00182	0.00248	3.4E-07
6273.82	5.56	5.55	0.00429	0.00182	0.00247	3.4E-07
6373.40	5.55	5.54	0.00429	0.00182	0.00247	3.4E-07
6472.99	5.54	5.53	0.00428	0.00182	0.00247	3.4E-07
6572.57	5.53	5.52	0.00428	0.00182	0.00246	3.4E-07
6672.16	5.52	5.51	0.00428	0.00182	0.00246	3.4E-07
6771.74	5.51	5.50	0.00427	0.00182	0.00246	3.4E-07
6871.32	5.50	5.49	0.00427	0.00182	0.00245	3.4E-07
6970.91	5.49	5.48	0.00426	0.00181	0.00245	3.4E-07
7070.49	5.48	5.47	0.00426	0.00181	0.00245	3.4E-07
7170.08	5.47	5.46	0.00426	0.00181	0.00244	3.4E-07
7269.66	5.46	5.45	0.00425	0.00181	0.00244	3.4E-07

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 8	Total	Main channel	Floodplain	Exchange
7369.25	5.45	5.44	0.00426	0.00181	0.00245	3.4E-07
7468.83	5.44	5.43	0.00427	0.00181	0.00246	3.4E-07
7568.42	5.43	5.42	0.00429	0.00182	0.00246	3.4E-07
7668.00	5.42	5.41	0.00430	0.00183	0.00247	3.4E-07
7767.58	5.41	5.40	0.00431	0.00185	0.00246	3.4E-07
7867.17	5.40	5.39	0.00432	0.00186	0.00246	3.4E-07
7966.75	5.39	5.38	0.00434	0.00188	0.00245	3.4E-07
8066.34	5.38	5.38	0.00435	0.00191	0.00245	3.4E-07
8165.92	5.37	5.37	0.00437	0.00193	0.00244	3.4E-07
8265.51	5.36	5.36	0.00438	0.00195	0.00243	3.4E-07
8365.09	5.35	5.35	0.00439	0.00198	0.00241	-3.1E-07
8464.67	5.34	5.34	0.00441	0.00201	0.00240	-3.1E-07
8564.26	5.33	5.33	0.00443	0.00204	0.00239	-3.1E-07
8663.84	5.32	5.32	0.00444	0.00207	0.00238	-3.1E-07
8763.43	5.31	5.31	0.00446	0.00210	0.00236	-3.1E-07
8863.01	5.30	5.30	0.00448	0.00213	0.00235	-3.1E-07
8962.60	5.29	5.29	0.00449	0.00216	0.00233	-3.1E-07
9062.18	5.28	5.28	0.00451	0.00220	0.00232	-3.1E-07
9161.77	5.27	5.27	0.00453	0.00223	0.00230	-3.1E-07
9261.35	5.26	5.26	0.00455	0.00227	0.00229	-3.1E-07
9360.93	5.25	5.25	0.00458	0.00230	0.00227	-3.1E-07
9460.52	5.24	5.24	0.00460	0.00234	0.00226	-3.1E-07
9560.10	5.23	5.23	0.00462	0.00238	0.00224	-3.1E-07
9659.69	5.22	5.22	0.00465	0.00242	0.00223	-3.1E-07
9759.27	5.21	5.21	0.00467	0.00246	0.00221	-3.1E-07
9858.86	5.20	5.20	0.00470	0.00250	0.00220	-3.1E-07
9958.44	5.19	5.19	0.00472	0.00254	0.00218	-3.1E-07
10058.00	5.18	5.18	0.00473	0.00258	0.00215	-3.1E-07
10157.60	5.17	5.17	0.00471	0.00261	0.00210	-3.1E-07
10257.20	5.16	5.16	0.00468	0.00261	0.00207	-3.1E-07
10356.80	5.15	5.15	0.00465	0.00260	0.00204	-3.1E-07
10456.40	5.14	5.14	0.00461	0.00258	0.00203	-3.1E-07
10555.90	5.13	5.13	0.00458	0.00255	0.00203	-3.1E-07
10655.50	5.12	5.12	0.00455	0.00251	0.00203	-3.1E-07
10755.10	5.11	5.11	0.00451	0.00247	0.00204	-3.1E-07
10854.70	5.10	5.10	0.00448	0.00243	0.00205	-3.1E-07

Computation with the 2D model from the main channel - variable discharge (continuation)

Sed. transport (m^3s^{-1}) - year 8				Bed levels (m) - year 0		Bed levels (m) - year 8	
Total	Left channel	Right channel	Exchange	Left channel	Right channel	Left channel	Right channel
0.00629	0.00316	0.00313	-8.1E-08	0.45	0.45	0.45	0.45
0.00629	0.00315	0.00314	-1.4E-07	0.46	0.46	0.51	0.41
0.00629	0.00314	0.00315	-1.4E-07	0.48	0.48	0.57	0.38
0.00629	0.00312	0.00317	-1.6E-07	0.49	0.49	0.63	0.36
0.00629	0.00311	0.00318	-1.7E-07	0.51	0.51	0.68	0.33
0.00629	0.00309	0.00320	-1.7E-07	0.52	0.52	0.72	0.31
0.00628	0.00307	0.00321	-1.6E-07	0.53	0.53	0.76	0.30
0.00628	0.00305	0.00323	-1.4E-07	0.55	0.55	0.80	0.29
0.00628	0.00304	0.00324	-1.1E-07	0.56	0.56	0.82	0.29
0.00628	0.00302	0.00325	-6.3E-08	0.58	0.58	0.84	0.29
0.00627	0.00301	0.00326	-9.1E-09	0.59	0.59	0.85	0.30
0.00627	0.00300	0.00327	5.3E-08	0.60	0.60	0.86	0.32
0.00627	0.00300	0.00327	1.1E-07	0.62	0.62	0.85	0.34
0.00627	0.00300	0.00326	1.9E-07	0.63	0.63	0.85	0.37
0.00626	0.00301	0.00326	2.6E-07	0.65	0.65	0.83	0.41
0.00626	0.00302	0.00324	3.1E-07	0.66	0.66	0.81	0.44
0.00626	0.00303	0.00323	2.9E-07	0.60	0.60	0.71	0.38
0.00625	0.00305	0.00321	3.9E-07	0.53	0.53	0.60	0.33
0.00625	0.00308	0.00318	4.2E-07	0.47	0.47	0.49	0.27
0.00626	0.00311	0.00314	4.4E-07	0.41	0.41	0.39	0.21
0.00626	0.00316	0.00310	4.5E-07	0.34	0.34	0.28	0.15
0.00626	0.00321	0.00305	5.5E-07	0.30	0.30	0.18	0.13
0.00627	0.00328	0.00299	6.6E-07	0.28	0.28	0.13	0.18
0.00626	0.00333	0.00293	4.2E-07	0.27	0.27	0.12	0.19
0.00626	0.00337	0.00289	2.7E-07	0.25	0.25	0.12	0.18
0.00627	0.00340	0.00287	1.3E-07	0.24	0.24	0.13	0.16
0.00627	0.00341	0.00286	1.8E-08	0.23	0.23	0.15	0.15
0.00627	0.00341	0.00287	-1.4E-07	0.21	0.21	0.13	0.16
0.00628	0.00339	0.00288	-1.8E-07	0.20	0.20	0.11	0.18
0.00628	0.00338	0.00290	-2.2E-07	0.19	0.19	0.11	0.18
0.00628	0.00335	0.00292	-2.6E-07	0.17	0.17	0.10	0.19
0.00628	0.00333	0.00295	-3.0E-07	0.16	0.16	0.10	0.18
0.00628	0.00330	0.00298	-3.4E-07	0.14	0.14	0.11	0.17
0.00628	0.00327	0.00302	-3.8E-07	0.13	0.13	0.12	0.16
0.00629	0.00323	0.00306	-4.3E-07	0.12	0.12	0.13	0.14
0.00629	0.00319	0.00310	-4.9E-07	0.11	0.11	0.15	0.12
0.00629	0.00314	0.00315	-4.7E-07	0.10	0.10	0.16	0.10
0.00629	0.00309	0.00320	-4.7E-07	0.09	0.09	0.17	0.09
0.00629	0.00305	0.00324	-4.6E-07	0.08	0.08	0.18	0.07
0.00629	0.00300	0.00329	-4.5E-07	0.07	0.07	0.18	0.06
0.00629	0.00296	0.00334	-4.5E-07	0.06	0.06	0.19	0.05
0.00630	0.00290	0.00339	-5.5E-07	0.05	0.05	0.20	0.02
0.00630	0.00285	0.00345	-4.4E-07	0.04	0.04	0.19	0.00
0.00630	0.00281	0.00349	-3.7E-07	0.03	0.03	0.18	0.00
0.00630	0.00277	0.00353	-3.1E-07	0.02	0.02	0.16	0.00
0.00630	0.00274	0.00356	-2.4E-07	0.01	0.01	0.13	0.00
0.00630	0.00272	0.00358	-1.7E-07	0.00	0.00	0.10	0.01
0.00630	0.00270	0.00360	-1.1E-07	-0.01	-0.01	0.07	0.02
0.00630	0.00269	0.00361	-5.3E-08	-0.02	-0.02	0.03	0.04
0.00630	0.00268	0.00362	-3.7E-09	-0.03	-0.03	-0.01	0.06
0.00630	0.00268	0.00362	3.7E-08	-0.04	-0.04	-0.05	0.07
0.00630	0.00268	0.00362	6.9E-08	-0.05	-0.05	-0.07	0.07
0.00631	0.00269	0.00361	1.5E-07	-0.06	-0.06	-0.04	0.03
0.00632	0.00270	0.00361	6.7E-08	-0.07	-0.07	0.00	-0.03
0.00632	0.00271	0.00362	-8.7E-09	-0.08	-0.08	0.05	-0.08
0.00633	0.00271	0.00362	-7.4E-08	-0.09	-0.09	0.09	-0.14
0.00634	0.00270	0.00364	-1.4E-07	-0.10	-0.10	0.14	-0.20
0.00635	0.00269	0.00366	-2.0E-07	-0.11	-0.11	0.18	-0.26
0.00636	0.00268	0.00368	-2.4E-07	-0.12	-0.12	0.23	-0.31
0.00638	0.00266	0.00371	-2.7E-07	-0.13	-0.13	0.27	-0.36
0.00639	0.00265	0.00375	-2.8E-07	-0.14	-0.14	0.30	-0.41
0.00641	0.00263	0.00378	-2.6E-07	-0.15	-0.15	0.33	-0.44
0.00643	0.00261	0.00382	-2.3E-07	-0.16	-0.16	0.35	-0.47
0.00646	0.00260	0.00386	-1.9E-07	-0.17	-0.17	0.36	-0.49
0.00648	0.00258	0.00390	-1.4E-07	-0.18	-0.18	0.36	-0.50
0.00651	0.00257	0.00394	-7.3E-08	-0.19	-0.19	0.36	-0.50
0.00654	0.00257	0.00398	-6.0E-09	-0.20	-0.20	0.35	-0.50
0.00658	0.00257	0.00401	5.1E-08	-0.21	-0.21	0.33	-0.49
0.00662	0.00257	0.00405	1.1E-07	-0.22	-0.22	0.30	-0.47
0.00665	0.00257	0.00408	1.5E-07	-0.23	-0.23	0.28	-0.46
0.00668	0.00258	0.00410	1.7E-07	-0.24	-0.24	0.26	-0.45
0.00670	0.00259	0.00411	1.8E-07	-0.25	-0.25	0.23	-0.44
0.00670	0.00259	0.00411	1.8E-07	-0.26	-0.26	0.21	-0.43
0.00670	0.00259	0.00411	1.7E-07	-0.27	-0.27	0.19	-0.44

Sed. transport (m^3s^{-1}) - year 8				Bed levels (m) - year 0		Bed levels (m) - year 8	
Total	Main channel	Floodplain	Exchange	Main channel	Floodplain	Main channel	Floodplain
0.00668	0.00258	0.00410	6.4E-08	-0.28	-0.28	0.18	-0.46
0.00665	0.00256	0.00409	8.6E-08	-0.29	-0.29	0.16	-0.48
0.00660	0.00254	0.00406	1.4E-07	-0.30	-0.30	0.13	-0.50
0.00654	0.00252	0.00402	1.6E-07	-0.31	-0.31	0.10	-0.52
0.00646	0.00249	0.00397	1.9E-07	-0.32	-0.32	0.06	-0.55
0.00636	0.00246	0.00390	2.2E-07	-0.33	-0.33	0.02	-0.57
0.00628	0.00245	0.00384	2.4E-07	-0.34	-0.34	-0.02	-0.59
0.00623	0.00244	0.00378	2.9E-07	-0.35	-0.35	-0.06	-0.60
0.00618	0.00245	0.00373	3.4E-07	-0.36	-0.36	-0.11	-0.60
0.00613	0.00246	0.00367	3.8E-07	-0.37	-0.37	-0.18	-0.59
0.00611	0.00248	0.00363	3.7E-07	-0.38	-0.38	-0.32	-0.50
0.00608	0.00251	0.00357	5.3E-07	-0.39	-0.39	-0.46	-0.40
0.00607	0.00256	0.00351	6.7E-07	-0.40	-0.40	-0.60	-0.30
0.00606	0.00262	0.00343	7.8E-07	-0.41	-0.41	-0.73	-0.20
0.00605	0.00270	0.00335	8.6E-07	-0.42	-0.42	-0.86	-0.11
0.00605	0.00278	0.00326	9.2E-07	-0.42	-0.42	-0.98	-0.01
0.00605	0.00288	0.00317	9.4E-07	-0.43	-0.43	-1.08	0.07
0.00604	0.00297	0.00307	9.3E-07	-0.44	-0.44	-1.17	0.14
0.00604	0.00307	0.00297	8.9E-07	-0.45	-0.45	-1.24	0.19
0.00604	0.00317	0.00287	8.1E-07	-0.46	-0.46	-1.29	0.23
0.00604	0.00327	0.00277	7.1E-07	-0.47	-0.47	-1.32	0.24
0.00603	0.00336	0.00267	5.9E-07	-0.48	-0.48	-1.34	0.24
0.00602	0.00344	0.00258	4.7E-07	-0.49	-0.49	-1.35	0.21
0.00602	0.00352	0.00250	3.5E-07	-0.50	-0.50	-1.34	0.18
0.00601	0.00358	0.00243	2.5E-07	-0.51	-0.51	-1.32	0.13
0.00600	0.00363	0.00237	1.7E-07	-0.52	-0.52	-1.31	0.08
0.00600	0.00368	0.00232	1.4E-07	-0.53	-0.53	-1.30	0.03
0.00599	0.00372	0.00227	1.7E-07	-0.54	-0.54	-1.29	0.00
0.00598	0.00377	0.00222	1.5E-07	-0.55	-0.55	-1.28	-0.02
0.00598	0.00380	0.00218	-8.4E-10	-0.56	-0.56	-1.26	-0.05
0.00599	0.00381	0.00218	-1.1E-07	-0.57	-0.57	-1.23	-0.09
0.00599	0.00381	0.00218	-2.0E-07	-0.58	-0.58	-1.19	-0.14
0.00599	0.00379	0.00220	-3.4E-07	-0.59	-0.59	-1.14	-0.20
0.00599	0.00376	0.00223	-4.4E-07	-0.60	-0.60	-1.08	-0.26
0.00599	0.00372	0.00227	-5.2E-07	-0.61	-0.61	-1.03	-0.33
0.00599	0.00367	0.00232	-6.0E-07	-0.62	-0.62	-0.97	-0.40

Computation with the 2D model from the main channel - dominant discharge

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 8	Total	Left channel	Right channel	Exchange
0.00	6.19	6.18	0.00622	0.00311	0.00311	2.3E-07
99.58	6.18	6.17	0.00620	0.00310	0.00310	2.3E-07
199.17	6.17	6.16	0.00619	0.00310	0.00310	2.2E-07
298.75	6.16	6.15	0.00618	0.00309	0.00309	2.2E-07
398.34	6.15	6.14	0.00617	0.00308	0.00308	2.2E-07
497.92	6.14	6.14	0.00616	0.00308	0.00308	2.2E-07
597.51	6.13	6.13	0.00615	0.00307	0.00307	2.1E-07
697.09	6.12	6.12	0.00614	0.00307	0.00307	2.1E-07
796.68	6.11	6.11	0.00614	0.00307	0.00307	2.1E-07
896.26	6.10	6.10	0.00613	0.00307	0.00307	2.1E-07
995.84	6.09	6.09	0.00613	0.00306	0.00306	2.0E-07
1095.43	6.08	6.08	0.00613	0.00306	0.00306	2.0E-07
1195.01	6.07	6.07	0.00613	0.00306	0.00306	2.0E-07
1294.60	6.06	6.06	0.00613	0.00306	0.00306	2.0E-07
1394.18	6.05	6.05	0.00613	0.00306	0.00306	2.0E-07
1493.77	6.04	6.04	0.00614	0.00307	0.00307	1.9E-07
1593.35	6.03	6.03	0.00619	0.00309	0.00309	2.0E-07
1692.93	6.02	6.02	0.00624	0.00312	0.00312	2.1E-07
1792.52	6.01	6.01	0.00630	0.00315	0.00315	2.1E-07
1892.10	6.00	6.00	0.00637	0.00318	0.00318	2.2E-07
1991.69	5.99	5.99	0.00645	0.00322	0.00322	2.3E-07
2091.27	5.98	5.98	0.00650	0.00325	0.00325	2.4E-07
2190.86	5.97	5.97	0.00648	0.00324	0.00324	2.4E-07
2290.44	5.96	5.96	0.00646	0.00323	0.00323	2.4E-07
2390.03	5.95	5.95	0.00644	0.00322	0.00322	2.4E-07
2489.61	5.94	5.94	0.00642	0.00321	0.00321	2.4E-07
2589.19	5.93	5.93	0.00640	0.00320	0.00320	2.4E-07
2688.78	5.92	5.92	0.00638	0.00319	0.00319	-2.1E-07
2788.36	5.91	5.91	0.00636	0.00318	0.00318	-2.1E-07
2887.95	5.90	5.90	0.00635	0.00317	0.00317	-2.1E-07
2987.53	5.89	5.89	0.00633	0.00316	0.00316	-2.1E-07
3087.12	5.88	5.88	0.00631	0.00315	0.00315	-2.1E-07
3186.70	5.87	5.87	0.00629	0.00314	0.00314	-2.0E-07
3286.29	5.86	5.86	0.00627	0.00313	0.00313	-2.0E-07
3385.87	5.85	5.85	0.00625	0.00313	0.00313	-2.0E-07
3485.45	5.84	5.84	0.00626	0.00313	0.00313	-2.0E-07
3585.04	5.83	5.83	0.00626	0.00313	0.00313	-2.0E-07
3684.62	5.82	5.82	0.00626	0.00313	0.00313	-2.0E-07
3784.21	5.81	5.81	0.00626	0.00313	0.00313	-2.0E-07
3883.79	5.80	5.80	0.00626	0.00313	0.00313	-2.0E-07
3983.38	5.79	5.79	0.00626	0.00313	0.00313	-2.0E-07
4082.96	5.78	5.78	0.00626	0.00313	0.00313	-2.0E-07
4182.54	5.77	5.77	0.00626	0.00313	0.00313	-2.0E-07
4282.13	5.76	5.76	0.00626	0.00313	0.00313	-2.0E-07
4381.71	5.75	5.75	0.00626	0.00313	0.00313	-2.0E-07
4481.30	5.74	5.74	0.00626	0.00313	0.00313	-2.0E-07
4580.88	5.73	5.73	0.00626	0.00313	0.00313	-2.0E-07
4680.47	5.72	5.72	0.00626	0.00313	0.00313	-2.0E-07
4780.05	5.71	5.71	0.00626	0.00313	0.00313	-2.0E-07
4879.64	5.70	5.70	0.00626	0.00313	0.00313	-2.0E-07
4979.22	5.69	5.69	0.00626	0.00313	0.00313	-2.0E-07
5078.80	5.68	5.68	0.00626	0.00313	0.00313	-2.0E-07
5178.39	5.67	5.67	0.00626	0.00313	0.00313	3.4E-07
5277.97	5.66	5.66	0.00626	0.00313	0.00313	3.4E-07
5377.56	5.65	5.65	0.00626	0.00313	0.00313	3.4E-07
5477.14	5.64	5.64	0.00626	0.00313	0.00313	3.4E-07
5576.73	5.63	5.63	0.00627	0.00313	0.00313	3.4E-07
5676.31	5.62	5.62	0.00627	0.00313	0.00313	3.4E-07
5775.90	5.61	5.61	0.00627	0.00313	0.00313	3.4E-07
5875.48	5.60	5.60	0.00627	0.00313	0.00313	3.4E-07
5975.06	5.59	5.59	0.00627	0.00313	0.00313	3.4E-07
6074.65	5.58	5.58	0.00627	0.00313	0.00313	3.4E-07
6174.23	5.57	5.57	0.00627	0.00313	0.00313	3.4E-07
6273.82	5.56	5.56	0.00627	0.00313	0.00313	3.4E-07
6373.40	5.55	5.55	0.00627	0.00313	0.00313	3.4E-07
6472.99	5.54	5.54	0.00627	0.00313	0.00313	3.4E-07
6572.57	5.53	5.53	0.00627	0.00313	0.00313	3.4E-07
6672.16	5.52	5.52	0.00627	0.00313	0.00313	3.4E-07
6771.74	5.51	5.51	0.00627	0.00313	0.00313	3.4E-07
6871.32	5.50	5.50	0.00627	0.00313	0.00313	3.4E-07
6970.91	5.49	5.49	0.00627	0.00314	0.00314	3.4E-07
7070.49	5.48	5.48	0.00627	0.00314	0.00314	3.4E-07
7170.08	5.47	5.47	0.00627	0.00314	0.00314	3.4E-07
7269.66	5.46	5.46	0.00627	0.00314	0.00314	3.4E-07

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 8	Total	Main channel	Floodplain	Exchange
7369.25	5.45	5.45	0.00627	0.00314	0.00314	3.4E-07
7468.83	5.44	5.44	0.00627	0.00314	0.00314	3.4E-07
7568.42	5.43	5.43	0.00627	0.00314	0.00314	3.4E-07
7668.00	5.42	5.42	0.00627	0.00314	0.00314	3.4E-07
7767.58	5.41	5.41	0.00627	0.00314	0.00314	3.4E-07
7867.17	5.40	5.40	0.00627	0.00314	0.00314	3.4E-07
7966.75	5.39	5.39	0.00628	0.00314	0.00314	3.4E-07
8066.34	5.38	5.38	0.00628	0.00314	0.00314	3.4E-07
8165.92	5.37	5.37	0.00628	0.00314	0.00314	3.4E-07
8265.51	5.36	5.36	0.00628	0.00314	0.00314	3.4E-07
8365.09	5.35	5.35	0.00628	0.00314	0.00314	-3.1E-07
8464.67	5.34	5.34	0.00628	0.00314	0.00314	-3.1E-07
8564.26	5.33	5.33	0.00628	0.00314	0.00314	-3.1E-07
8663.84	5.32	5.32	0.00628	0.00314	0.00314	-3.1E-07
8763.43	5.31	5.31	0.00628	0.00314	0.00314	-3.1E-07
8863.01	5.30	5.30	0.00628	0.00314	0.00314	-3.1E-07
8962.60	5.29	5.29	0.00628	0.00314	0.00314	-3.1E-07
9062.18	5.28	5.28	0.00628	0.00314	0.00314	-3.1E-07
9161.77	5.27	5.27	0.00628	0.00314	0.00314	-3.1E-07
9261.35	5.26	5.26	0.00628	0.00314	0.00314	-3.1E-07
9360.93	5.25	5.25	0.00628	0.00314	0.00314	-3.1E-07
9460.52	5.24	5.24	0.00628	0.00314	0.00314	-3.1E-07
9560.10	5.23	5.23	0.00628	0.00314	0.00314	-3.1E-07
9659.69	5.22	5.22	0.00629	0.00314	0.00314	-3.1E-07
9759.27	5.21	5.21	0.00629	0.00314	0.00314	-3.1E-07
9858.86	5.20	5.20	0.00629	0.00314	0.00314	-3.1E-07
9958.44	5.19	5.19	0.00629	0.00314	0.00314	-3.1E-07
10058.00	5.18	5.18	0.00629	0.00314	0.00314	-3.1E-07
10157.60	5.17	5.17	0.00629	0.00315	0.00315	-3.1E-07
10257.20	5.16	5.16	0.00629	0.00315	0.00315	-3.1E-07
10356.80	5.15	5.15	0.00629	0.00315	0.00315	-3.1E-07
10456.40	5.14	5.14	0.00630	0.00315	0.00315	-3.1E-07
10555.90	5.13	5.13	0.00630	0.00315	0.00315	-3.1E-07
10655.50	5.12	5.12	0.00630	0.00315	0.00315	-3.1E-07
10755.10	5.11	5.11	0.00630	0.00315	0.00315	-3.1E-07
10854.70	5.10	5.10	0.00630	0.00315	0.00315	-3.1E-07

Computation with the 2D model from the main channel - dominant discharge (continuation)

Sed. transport (m^3s^{-1}) - year 8				Bed levels (m) - year 0		Bed levels (m) - year 8	
Total	Left channel	Right channel	Exchange	Left channel	Right channel	Left channel	Right channel
0.00623	0.00311	0.00312	6.0E-08	0.45	0.45	0.45	0.45
0.00623	0.00312	0.00311	2.9E-08	0.46	0.46	0.50	0.44
0.00623	0.00311	0.00312	-2.2E-08	0.48	0.48	0.55	0.42
0.00623	0.00311	0.00312	-7.3E-08	0.49	0.49	0.60	0.40
0.00623	0.00310	0.00313	-1.1E-07	0.51	0.51	0.64	0.39
0.00623	0.00309	0.00314	-1.4E-07	0.52	0.52	0.69	0.37
0.00623	0.00307	0.00316	-1.6E-07	0.53	0.53	0.74	0.36
0.00623	0.00305	0.00318	-1.8E-07	0.55	0.55	0.78	0.34
0.00623	0.00303	0.00320	-1.8E-07	0.56	0.56	0.82	0.33
0.00623	0.00301	0.00322	-1.7E-07	0.58	0.58	0.86	0.33
0.00623	0.00299	0.00324	-1.6E-07	0.59	0.59	0.89	0.33
0.00623	0.00297	0.00326	-1.3E-07	0.60	0.60	0.91	0.33
0.00623	0.00295	0.00328	-8.9E-08	0.62	0.62	0.93	0.34
0.00623	0.00293	0.00330	-4.7E-08	0.63	0.63	0.94	0.36
0.00623	0.00292	0.00331	-3.2E-09	0.65	0.65	0.95	0.38
0.00623	0.00290	0.00333	5.5E-08	0.66	0.66	0.95	0.40
0.00623	0.00290	0.00333	1.1E-07	0.60	0.60	0.87	0.34
0.00623	0.00289	0.00333	1.3E-07	0.53	0.53	0.78	0.28
0.00623	0.00289	0.00333	1.4E-07	0.47	0.47	0.69	0.22
0.00623	0.00290	0.00333	1.6E-07	0.41	0.41	0.60	0.15
0.00623	0.00290	0.00333	1.5E-07	0.34	0.34	0.51	0.09
0.00623	0.00291	0.00332	1.3E-07	0.30	0.30	0.45	0.03
0.00623	0.00291	0.00332	1.0E-07	0.28	0.28	0.43	0.03
0.00623	0.00292	0.00331	8.5E-08	0.27	0.27	0.42	0.02
0.00623	0.00292	0.00331	7.1E-08	0.25	0.25	0.41	0.01
0.00623	0.00292	0.00330	6.3E-08	0.24	0.24	0.40	0.00
0.00623	0.00293	0.00330	5.0E-08	0.23	0.23	0.39	0.00
0.00623	0.00293	0.00330	2.4E-08	0.21	0.21	0.32	0.04
0.00623	0.00293	0.00329	1.1E-07	0.20	0.20	0.25	0.09
0.00623	0.00294	0.00328	1.9E-07	0.19	0.19	0.18	0.14
0.00623	0.00296	0.00326	2.5E-07	0.17	0.17	0.10	0.19
0.00623	0.00299	0.00324	3.0E-07	0.16	0.16	0.04	0.24
0.00623	0.00302	0.00321	3.3E-07	0.14	0.14	-0.03	0.29
0.00623	0.00305	0.00318	3.5E-07	0.13	0.13	-0.09	0.33
0.00623	0.00308	0.00315	3.6E-07	0.12	0.12	-0.14	0.36
0.00623	0.00312	0.00311	3.4E-07	0.11	0.11	-0.19	0.39
0.00623	0.00315	0.00308	3.1E-07	0.10	0.10	-0.23	0.41
0.00623	0.00319	0.00304	2.6E-07	0.09	0.09	-0.25	0.42
0.00623	0.00322	0.00301	2.0E-07	0.08	0.08	-0.27	0.42
0.00623	0.00325	0.00298	1.4E-07	0.07	0.07	-0.28	0.41
0.00623	0.00327	0.00296	7.9E-08	0.06	0.06	-0.28	0.39
0.00623	0.00329	0.00293	2.1E-08	0.05	0.05	-0.28	0.37
0.00623	0.00331	0.00292	-2.9E-08	0.04	0.04	-0.27	0.34
0.00622	0.00332	0.00291	-6.8E-08	0.03	0.03	-0.26	0.31
0.00622	0.00333	0.00290	-9.5E-08	0.02	0.02	-0.25	0.28
0.00622	0.00333	0.00289	-1.1E-07	0.01	0.01	-0.25	0.25
0.00621	0.00333	0.00289	-1.2E-07	0.00	0.00	-0.24	0.22
0.00621	0.00332	0.00289	-1.2E-07	-0.01	-0.01	-0.24	0.20
0.00620	0.00331	0.00289	-1.2E-07	-0.02	-0.02	-0.24	0.18
0.00620	0.00330	0.00289	-1.1E-07	-0.03	-0.03	-0.24	0.15
0.00619	0.00330	0.00289	-1.0E-07	-0.04	-0.04	-0.24	0.13
0.00618	0.00328	0.00290	-9.5E-08	-0.05	-0.05	-0.24	0.10
0.00618	0.00328	0.00290	-5.8E-08	-0.06	-0.06	-0.17	0.01
0.00617	0.00327	0.00291	-1.7E-07	-0.07	-0.07	-0.10	-0.08
0.00617	0.00324	0.00292	-2.5E-07	-0.08	-0.08	-0.03	-0.17
0.00617	0.00322	0.00295	-3.2E-07	-0.09	-0.09	0.04	-0.26
0.00617	0.00318	0.00298	-3.7E-07	-0.10	-0.10	0.10	-0.34
0.00617	0.00315	0.00302	-4.1E-07	-0.11	-0.11	0.16	-0.42
0.00617	0.00311	0.00307	-4.3E-07	-0.12	-0.12	0.22	-0.49
0.00618	0.00307	0.00312	-4.4E-07	-0.13	-0.13	0.27	-0.56
0.00619	0.00303	0.00317	-4.2E-07	-0.14	-0.14	0.31	-0.61
0.00621	0.00299	0.00322	-3.8E-07	-0.15	-0.15	0.33	-0.65
0.00623	0.00295	0.00328	-3.2E-07	-0.16	-0.16	0.35	-0.67
0.00625	0.00292	0.00333	-2.5E-07	-0.17	-0.17	0.36	-0.69
0.00628	0.00290	0.00338	-1.7E-07	-0.18	-0.18	0.35	-0.69
0.00631	0.00288	0.00343	-8.5E-08	-0.19	-0.19	0.34	-0.68
0.00633	0.00286	0.00347	-4.7E-09	-0.20	-0.20	0.31	-0.67
0.00635	0.00285	0.00350	6.5E-08	-0.21	-0.21	0.28	-0.65
0.00637	0.00285	0.00353	1.2E-07	-0.22	-0.22	0.25	-0.63
0.00639	0.00284	0.00354	1.6E-07	-0.23	-0.23	0.22	-0.61
0.00639	0.00284	0.00355	1.8E-07	-0.24	-0.24	0.18	-0.60
0.00638	0.00284	0.00355	1.9E-07	-0.25	-0.25	0.15	-0.59
0.00638	0.00284	0.00354	1.9E-07	-0.26	-0.26	0.12	-0.58
0.00637	0.00284	0.00353	1.8E-07	-0.27	-0.27	0.09	-0.58

Sed. transport (m^3s^{-1}) - year 8				Bed levels (m) - year 0		Bed levels (m) - year 8	
Total	Main channel	Floodplain	Exchange	Main channel	Floodplain	Main channel	Floodplain
0.00635	0.00284	0.00351	1.6E-07	-0.28	-0.28	0.07	-0.58
0.00634	0.00284	0.00350	1.5E-07	-0.29	-0.29	0.05	-0.59
0.00632	0.00284	0.00348	1.3E-07	-0.30	-0.30	0.03	-0.60
0.00630	0.00284	0.00346	1.2E-07	-0.31	-0.31	0.02	-0.61
0.00629	0.00284	0.00345	1.1E-07	-0.32	-0.32	0.00	-0.63
0.00627	0.00284	0.00344	9.9E-08	-0.33	-0.33	-0.01	-0.64
0.00627	0.00284	0.00343	9.2E-08	-0.34	-0.34	-0.02	-0.65
0.00626	0.00284	0.00342	8.8E-08	-0.35	-0.35	-0.03	-0.66
0.00625	0.00284	0.00342	9.0E-08	-0.36	-0.36	-0.04	-0.67
0.00625	0.00284	0.00341	8.7E-08	-0.37	-0.37	-0.07	-0.67
0.00625	0.00284	0.00341	5.2E-08	-0.38	-0.38	-0.17	-0.59
0.00625	0.00285	0.00340	1.9E-07	-0.39	-0.39	-0.28	-0.51
0.00625	0.00287	0.00338	3.1E-07	-0.40	-0.40	-0.39	-0.42
0.00625	0.00290	0.00335	4.0E-07	-0.41	-0.41	-0.49	-0.34
0.00625	0.00294	0.00332	4.7E-07	-0.42	-0.42	-0.60	-0.26
0.00625	0.00298	0.00327	5.2E-07	-0.42	-0.42	-0.69	-0.18
0.00625	0.00303	0.00322	5.5E-07	-0.43	-0.43	-0.78	-0.11
0.00626	0.00309	0.00317	5.5E-07	-0.44	-0.44	-0.85	-0.05
0.00626	0.00314	0.00312	5.3E-07	-0.45	-0.45	-0.91	-0.01
0.00626	0.00320	0.00306	4.7E-07	-0.46	-0.46	-0.96	0.03
0.00626	0.00325	0.00301	4.0E-07	-0.47	-0.47	-0.99	0.04
0.00626	0.00330	0.00296	3.1E-07	-0.48	-0.48	-1.01	0.05
0.00626	0.00334	0.00292	2.1E-07	-0.49	-0.49	-1.02	0.03
0.00626	0.00338	0.00288	1.1E-07	-0.50	-0.50	-1.02	0.01
0.00626	0.00341	0.00285	2.2E-08	-0.51	-0.51	-1.00	-0.02
0.00626	0.00343	0.00282	-5.5E-08	-0.52	-0.52	-0.99	-0.06
0.00625	0.00345	0.00280	-1.2E-07	-0.53	-0.53	-0.97	-0.10
0.00625	0.00346	0.00279	-1.6E-07	-0.54	-0.54	-0.95	-0.14
0.00625	0.00346	0.00279	-1.8E-07	-0.55	-0.55	-0.93	-0.18
0.00625	0.00346	0.00279	-1.8E-07	-0.56	-0.56	-0.92	-0.21
0.00625	0.00346	0.00279	-1.9E-07	-0.57	-0.57	-0.91	-0.25
0.00625	0.00345	0.00280	-1.9E-07	-0.58	-0.58	-0.90	-0.27
0.00625	0.00345	0.00281	-1.7E-07	-0.59	-0.59	-0.90	-0.30
0.00625	0.00344	0.00282	-1.5E-07	-0.60	-0.60	-0.90	-0.31
0.00625	0.00343	0.00282	-1.3E-07	-0.61	-0.61	-0.91	-0.33
0.00625	0.00342	0.00283	-1.2E-07	-0.62	-0.62	-0.91	-0.34

Computation with the 2D model from the main channel - dominant discharge (continuation)

Bed levels (m) - year 20	
Left channel	Right channel
0.45	0.45
0.50	0.44
0.55	0.42
0.60	0.40
0.64	0.39
0.69	0.37
0.74	0.35
0.79	0.34
0.83	0.32
0.87	0.31
0.92	0.30
0.95	0.29
0.99	0.29
1.02	0.28
1.05	0.28
1.08	0.28
1.02	0.19
0.95	0.12
0.88	0.04
0.80	-0.04
0.71	-0.11
0.65	-0.16
0.62	-0.15
0.60	-0.15
0.58	-0.15
0.55	-0.14
0.51	-0.12
0.42	-0.06
0.33	0.01
0.23	0.08
0.14	0.15
0.06	0.22
-0.03	0.28
-0.10	0.34
-0.17	0.38
-0.23	0.43
-0.28	0.46
-0.32	0.49
-0.36	0.50
-0.38	0.51
-0.40	0.52
-0.42	0.51
-0.43	0.50
-0.44	0.49
-0.44	0.48
-0.44	0.46
-0.44	0.43
-0.43	0.41
-0.43	0.38
-0.42	0.35
-0.41	0.32
-0.39	0.28
-0.30	0.17
-0.21	0.05
-0.12	-0.06
-0.03	-0.17
0.06	-0.29
0.14	-0.39
0.22	-0.49
0.29	-0.58
0.36	-0.65
0.41	-0.72
0.46	-0.78
0.49	-0.83
0.51	-0.87
0.53	-0.89
0.53	-0.91
0.52	-0.92
0.51	-0.93
0.49	-0.93
0.46	-0.92
0.43	-0.91
0.40	-0.90
0.36	-0.89

Bed levels (m) - year 20	
Main channel	Floodplain
0.32	-0.87
0.29	-0.86
0.24	-0.84
0.20	-0.82
0.16	-0.80
0.12	-0.78
0.08	-0.77
0.04	-0.75
0.01	-0.73
-0.04	-0.71
-0.16	-0.61
-0.29	-0.51
-0.41	-0.42
-0.52	-0.33
-0.62	-0.24
-0.72	-0.17
-0.80	-0.10
-0.88	-0.04
-0.95	0.01
-1.00	0.05
-1.05	0.09
-1.09	0.11
-1.13	0.13
-1.16	0.14
-1.18	0.15
-1.20	0.15
-1.21	0.14
-1.22	0.13
-1.22	0.12
-1.22	0.10
-1.21	0.07
-1.21	0.04
-1.19	0.01
-1.18	-0.03
-1.16	-0.07
-1.14	-0.11

APPENDIX 8: Results from the simulation of a constriction in a channel

- Definitive constriction
- Temporary constriction

Results for a simulation of a constriction in a channel - definitive constriction

S (m)	Water levels (m)		Flow area (m^2) - year 0			Flow area (m^2) - year 0		
	year 0	year 20	Total	Left channel	Right channel	Total	Left channel	Right channel
0.00	7.72	7.52	1429.36	714.68	714.68	1379.58	689.79	689.79
100.00	7.71	7.51	1429.57	714.79	714.79	1379.58	689.79	689.79
200.00	7.70	7.50	1429.78	714.89	714.89	1379.58	689.79	689.79
300.00	7.69	7.49	1430.00	715.00	715.00	1379.58	689.79	689.79
400.00	7.68	7.48	1430.21	715.11	715.11	1379.58	689.79	689.79
500.00	7.67	7.47	1430.43	715.21	715.21	1379.58	689.79	689.79
600.00	7.66	7.46	1430.64	715.32	715.32	1379.58	689.79	689.79
700.00	7.65	7.45	1430.86	715.43	715.43	1379.57	689.79	689.79
800.00	7.64	7.44	1431.08	715.54	715.54	1379.57	689.79	689.79
900.00	7.64	7.43	1431.30	715.65	715.65	1379.57	689.79	689.79
1000.00	7.63	7.42	1431.52	715.76	715.76	1379.57	689.79	689.79
1100.00	7.62	7.41	1431.74	715.87	715.87	1379.57	689.79	689.79
1200.00	7.61	7.40	1431.96	715.98	715.98	1379.57	689.78	689.78
1300.00	7.60	7.39	1432.18	716.09	716.09	1379.56	689.78	689.78
1400.00	7.59	7.38	1432.41	716.20	716.20	1379.56	689.78	689.78
1500.00	7.58	7.37	1432.63	716.32	716.32	1379.56	689.78	689.78
1600.00	7.57	7.36	1432.86	716.43	716.43	1379.56	689.78	689.78
1700.00	7.56	7.35	1433.09	716.54	716.54	1379.55	689.78	689.78
1800.00	7.55	7.34	1433.32	716.66	716.66	1379.55	689.78	689.78
1900.00	7.54	7.32	1433.55	716.77	716.77	1379.55	689.77	689.77
2000.00	7.54	7.31	1433.78	716.89	716.89	1379.54	689.77	689.77
2100.00	7.53	7.30	1434.01	717.00	717.00	1379.54	689.77	689.77
2200.00	7.52	7.29	1434.24	717.12	717.12	1379.53	689.77	689.77
2300.00	7.51	7.28	1434.47	717.24	717.24	1379.53	689.76	689.76
2400.00	7.50	7.27	1434.71	717.36	717.36	1379.52	689.76	689.76
2500.00	7.49	7.26	1434.95	717.47	717.47	1379.51	689.76	689.76
2600.00	7.48	7.25	1435.18	717.59	717.59	1379.51	689.75	689.75
2700.00	7.47	7.24	1435.42	717.71	717.71	1379.50	689.75	689.75
2800.00	7.46	7.23	1435.66	717.83	717.83	1379.49	689.75	689.75
2900.00	7.45	7.22	1435.90	717.95	717.95	1379.49	689.74	689.74
3000.00	7.44	7.21	1436.14	718.07	718.07	1379.48	689.74	689.74
3100.00	7.44	7.20	1436.39	718.19	718.19	1379.47	689.73	689.73
3200.00	7.43	7.19	1436.63	718.32	718.32	1379.46	689.73	689.73
3300.00	7.42	7.18	1436.87	718.44	718.44	1379.45	689.72	689.72
3400.00	7.41	7.17	1437.12	718.56	718.56	1379.44	689.72	689.72
3500.00	7.40	7.16	1437.37	718.68	718.68	1379.43	689.71	689.71
3600.00	7.39	7.15	1437.62	718.81	718.81	1379.42	689.71	689.71
3700.00	7.38	7.14	1437.87	718.93	718.93	1379.40	689.70	689.70
3800.00	7.37	7.13	1438.12	719.06	719.06	1379.39	689.70	689.70
3900.00	7.36	7.12	1438.37	719.18	719.18	1379.38	689.69	689.69
4000.00	7.35	7.11	1438.62	719.31	719.31	1379.36	689.68	689.68
4100.00	7.35	7.10	1438.88	719.44	719.44	1379.35	689.67	689.67
4200.00	7.34	7.09	1439.13	719.57	719.57	1379.33	689.67	689.67
4300.00	7.33	7.08	1439.39	719.69	719.69	1379.32	689.66	689.66
4400.00	7.32	7.07	1439.64	719.82	719.82	1379.30	689.65	689.65
4500.00	7.31	7.06	1439.90	719.95	719.95	1379.28	689.64	689.65
4600.00	7.30	7.05	1440.16	720.08	720.08	1379.26	689.61	689.65
4700.00	7.29	7.04	1440.43	720.21	720.21	1379.24	689.53	689.71
4800.00	7.28	7.03	1440.69	720.34	720.34	1379.23	689.25	689.98
4900.00	7.27	7.02	1440.95	720.48	720.48	1379.23	688.03	691.20
5000.00	7.26	7.01	1441.22	720.61	720.61	1380.78	683.28	697.50
5100.00	7.24	6.99	1299.61	718.81	580.80	1339.54	749.28	590.25
5200.00	7.21	6.98	1157.02	715.98	441.04	1293.46	808.54	484.92
5300.00	7.16	6.96	1013.18	711.50	301.68	1243.34	877.91	365.44
5400.00	7.09	6.94	867.62	704.24	163.38	1188.19	964.31	223.88
5500.00	6.98	6.92	719.29	691.62	27.66	1123.31	1079.54	43.77
5600.00	6.94	6.91	715.20	687.69	27.51	1118.91	1076.58	42.33
5700.00	6.90	6.90	711.01	683.66	27.35	1118.29	1076.43	41.86
5800.00	6.86	6.89	706.71	679.53	27.18	1118.04	1076.51	41.53
5900.00	6.81	6.88	702.30	675.29	27.01	1117.94	1077.24	40.70
6000.00	6.77	6.87	697.77	670.94	26.84	1115.57	1077.58	37.99
6100.00	6.81	6.87	835.36	678.05	157.31	1184.26	988.87	195.39
6200.00	6.84	6.87	971.59	682.29	289.29	1244.32	918.74	325.58
6300.00	6.85	6.87	1107.29	685.21	422.09	1297.33	855.91	441.42
6400.00	6.86	6.86	1242.84	687.41	555.43	1345.48	798.11	547.37
6500.00	6.86	6.86	1378.42	689.21	689.21	1390.36	745.29	645.07
6600.00	6.85	6.85	1378.36	689.18	689.18	1394.28	722.26	672.02
6700.00	6.84	6.84	1378.31	689.15	689.15	1395.29	700.92	694.37
6800.00	6.83	6.83	1378.25	689.13	689.13	1395.27	682.02	713.26
6900.00	6.82	6.82	1378.20	689.10	689.10	1394.31	665.49	728.82
7000.00	6.81	6.81	1378.14	689.07	689.07	1392.68	651.26	741.43
7100.00	6.80	6.80	1378.09	689.04	689.04	1390.66	639.25	751.41
7200.00	6.79	6.79	1378.03	689.02	689.02	1388.45	629.43	759.01
7300.00	6.78	6.78	1377.97	688.99	688.99	1386.21	621.72	764.50

S (m)	Water levels (m)		Flow area (m^2) - year 0			Flow area (m^2) - year 0		
	year 0	year 20	Total	Left channel	Right channel	Total	Left channel	Right channel
7400	6.77	6.77	1377.92	688.96	688.96	1384.10	616.01	768.08
7500	6.76	6.76	1377.86	688.93	688.93	1382.18	612.20	769.98
7600.00	6.75	6.75	1377.80	688.90	688.90	1380.54	610.15	770.39
7700.00	6.74	6.73	1377.75	688.87	688.87	1379.20	609.70	769.50
7800.00	6.73	6.72	1377.69	688.84	688.84	1378.16	610.67	767.49
7900.00	6.72	6.71	1377.63	688.82	688.82	1377.42	612.89	764.53
8000.00	6.71	6.70	1377.57	688.79	688.79	1376.94	616.16	760.78
8100.00	6.70	6.69	1377.51	688.76	688.76	1376.69	620.30	756.39
8200.00	6.69	6.68	1377.45	688.73	688.73	1376.63	625.11	751.51
8300.00	6.68	6.67	1377.39	688.70	688.70	1376.71	630.43	746.28
8400.00	6.67	6.66	1377.33	688.67	688.67	1376.88	636.07	740.81
8500.00	6.66	6.65	1377.27	688.64	688.64	1377.12	641.89	735.23
8600.00	6.65	6.64	1377.21	688.61	688.61	1377.38	647.72	729.66
8700.00	6.64	6.63	1377.15	688.58	688.58	1377.62	653.25	724.37
8800.00	6.63	6.62	1377.09	688.55	688.55	1377.88	658.94	718.94
8900.00	6.62	6.61	1377.03	688.52	688.52	1378.09	664.42	713.68
9000.00	6.61	6.60	1376.97	688.48	688.48	1378.27	669.60	708.67
9100.00	6.60	6.59	1376.91	688.45	688.45	1378.40	674.43	703.97
9200.00	6.59	6.58	1376.84	688.42	688.42	1378.49	678.88	699.61
9300.00	6.58	6.57	1376.78	688.39	688.39	1378.53	682.91	695.62
9400.00	6.57	6.56	1376.72	688.36	688.36	1378.54	686.53	692.01
9500.00	6.56	6.55	1376.65	688.33	688.33	1378.52	689.72	688.80
9600.00	6.55	6.54	1376.59	688.29	688.29	1378.50	692.49	686.02
9700.00	6.54	6.53	1376.52	688.26	688.26	1378.46	694.83	683.63
9800.00	6.53	6.52	1376.46	688.23	688.23	1378.41	696.78	681.63
9900.00	6.52	6.51	1376.39	688.20	688.20	1378.34	698.35	679.99
10000.00	6.51	6.50	1376.33	688.16	688.16	1378.27	699.56	678.71
10100.00	6.50	6.49	1376.26	688.13	688.13	1378.19	700.43	677.76
10200.00	6.48	6.48	1376.20	688.10	688.10	1378.11	700.99	677.13
10300.00	6.47	6.47	1376.13	688.07	688.07	1378.04	701.26	676.78
10400.00	6.46	6.46	1376.06	688.03	688.03	1377.97	701.29	676.69
10500.00	6.45	6.45	1375.99	688.00	688.00	1377.91	701.08	676.83
10600.00	6.44	6.44	1375.93	687.96	687.96	1377.85	700.68	677.17
10700.00	6.43	6.43	1375.86	687.93	687.93	1377.79	700.11	677.69
10800.00	6.42	6.42	1375.79	687.90	687.90	1377.75	699.41	678.34
10900.00	6.41	6.41	1375.72	687.86	687.86	1377.70	698.61	679.10
11000.00	6.40	6.40	1375.65	687.83	687.83	1377.68	697.74	679.94
11100.00	6.39	6.39	1375.58	687.79	687.79	1377.61	696.81	680.81
11200	6.38	6.38	1375.51	687.76	687.76	1377.59	695.88	681.71
11300	6.37	6.37	1375.44	687.72	687.72	1377.51	694.95	682.56
11400	6.36	6.36	1375.37	687.69	687.69	1377.43	694.02	683.41
11500	6.35	6.35	1375.30	687.65	687.65	1377.36	693.14	684.22
11600	6.34	6.34	1375.23	687.61	687.61	1377.27	692.30	684.97
11700	6.33	6.33	1375.16	687.58	687.58	1377.17	691.51	685.66
11800	6.32	6.32	1375.08	687.54	687.54	1377.06	690.78	686.28
11900	6.31	6.31	1375.01	687.51	687.51	1376.95	690.11	686.84
12000	6.30	6.30	1374.94	687.47	687.47	1376.83	689.51	687.32
12100	6.29	6.29	1374.86	687.43	687.43	1376.72	688.98	687.74
12200	6.28	6.28	1374.79	687.39	687.39	1376.60	688.50	688.10
12300	6.27	6.26	1374.71	687.36	687.36	1376.50	688.08	688.42
12400	6.26	6.25	1374.64	687.32	687.32	1376.41	687.71	688.70
12500	6.25	6.24	1374.56	687.28	687.28	1376.32	687.37	688.95
12600	6.24	6.23	1374.49	687.24	687.24	1376.24	687.08	689.16
12700	6.23	6.22	1374.41	687.21	687.21	1376.17	686.82	689.36
12800	6.22	6.21	1374.33	687.17	687.17	1376.11	686.58	689.53
12900	6.21	6.20	1374.26	687.13	687.13	1376.04	686.38	689.67
13000	6.20	6.19	1374.18	687.09	687.09	1375.98	686.20	689.78
13100	6.19	6.18	1374.10	687.05	687.05	1375.92	686.05	689.87
13200	6.18	6.17	1374.02	687.01	687.01	1375.85	685.94	689.92
13300	6.17	6.16	1373.94	686.97	686.97	1375.79	685.86	689.93
13400	6.16	6.15	1373.86	686.93	686.93	1375.72	685.82	689.90
13500	6.15	6.14	1373.78	686.89	686.89	1375.65	685.81	689.84
13600	6.13	6.13	1373.70	686.85	686.85	1375.57	685.85	689.73
13700	6.12	6.12	1373.62	686.81	686.81	1375.50	685.92	689.58
13800	6.11	6.11	1373.54	686.77	686.77	1375.43	686.02	689.41
13900	6.10	6.10	1373.46	686.73	686.73	1375.35	686.15	689.20
14000	6.09	6.09	1373.38	686.69	686.69	1375.27	686.31	688.97
14100	6.08	6.08	1373.30	686.65	686.65	1375.19	686.48	688.71
14200	6.07	6.07	1373.21	686.61	686.61	1375.12	686.67	688.45
14300	6.06	6.06	1373.13	686.57	686.57	1375.04	686.86	688.18
14400	6.05	6.05	1373.05	686.52	686.52	1374.96	687.04	687.92
14500	6.04	6.04	1372.96	686.48	686.48	1374.88	687.22	687.66
14600	6.03	6.03	1372.88	686.44	686.44	1374.80	687.37	687.43
14700	6.02	6.02	1372.79	686.40	686.40	1374.72	687.51	687.21
14800	6.01	6.01	1372.71	686.35	686.35	1374.64	687.62	687.02
14900	6.00	6.00	1372.62	686.31	686.31	1374.56	687.70	686.86

S (m)	Water levels (m)		Flow area (m^2) - year 0			Flow area (m^2) - year 0		
	year 0	year 20	Total	Left channel	Right channel	Total	Left channel	Right channel
15000	5.99	5.99	1372.53	686.27	686.27	1374.47	687.75	686.73
15100	5.98	5.98	1372.44	686.22	686.22	1374.39	687.77	686.62
15200	5.97	5.97	1372.36	686.18	686.18	1374.30	687.76	686.54
15300	5.96	5.96	1372.27	686.13	686.13	1374.21	687.72	686.48
15400	5.95	5.95	1372.18	686.09	686.09	1374.12	687.67	686.45
15500	5.94	5.94	1372.09	686.05	686.05	1374.02	687.59	686.43
15600	5.93	5.93	1372.00	686.00	686.00	1373.93	687.50	686.43
15700	5.92	5.92	1371.91	685.96	685.96	1373.83	687.40	686.44
15800	5.91	5.90	1371.82	685.91	685.91	1373.74	687.29	686.45
15900	5.90	5.89	1371.73	685.86	685.86	1373.65	687.17	686.48
16000	5.89	5.88	1371.64	685.82	685.82	1373.55	687.06	686.50
16100	5.88	5.87	1371.54	685.77	685.77	1373.46	686.95	686.52
16200	5.87	5.86	1371.45	685.73	685.73	1373.38	686.84	686.54
16300	5.86	5.85	1371.36	685.68	685.68	1373.29	686.74	686.55
16400	5.85	5.84	1371.26	685.63	685.63	1373.21	686.65	686.56
16500	5.83	5.83	1371.17	685.58	685.58	1373.13	686.57	686.56
16600	5.82	5.82	1371.07	685.54	685.54	1373.05	686.49	686.56
16700	5.81	5.81	1370.98	685.49	685.49	1372.98	686.43	686.55
16800	5.80	5.80	1370.88	685.44	685.44	1372.91	686.37	686.53
16900	5.79	5.79	1370.79	685.39	685.39	1372.84	686.33	686.51
17000	5.78	5.78	1370.69	685.34	685.34	1372.77	686.28	686.48
17100	5.77	5.77	1370.59	685.30	685.30	1372.70	686.25	686.45
17200	5.76	5.76	1370.49	685.25	685.25	1372.63	686.21	686.41
17300	5.75	5.75	1370.39	685.20	685.20	1372.56	686.19	686.37
17400	5.74	5.74	1370.29	685.15	685.15	1372.49	686.16	686.33
17500	5.73	5.73	1370.19	685.10	685.10	1372.42	686.13	686.29
17600	5.72	5.72	1370.09	685.05	685.05	1372.35	686.11	686.24
17700	5.71	5.71	1369.99	685.00	685.00	1372.28	686.08	686.20
17800	5.70	5.70	1369.89	684.95	684.95	1372.21	686.06	686.15
17900	5.69	5.69	1369.79	684.89	684.89	1372.14	686.03	686.11
18000	5.68	5.68	1369.68	684.84	684.84	1372.07	686.01	686.06
18100	5.67	5.67	1369.58	684.79	684.79	1372.00	685.98	686.02
18200	5.66	5.66	1369.48	684.74	684.74	1371.92	685.95	685.97
18300	5.65	5.65	1369.37	684.69	684.69	1371.85	685.92	685.93
18400	5.64	5.64	1369.27	684.63	684.63	1371.77	685.89	685.89
18500	5.63	5.63	1369.16	684.58	684.58	1371.70	685.85	685.85
18600	5.62	5.62	1369.06	684.53	684.53	1371.62	685.82	685.81
18700	5.61	5.60	1368.95	684.47	684.47	1371.55	685.78	685.77
18800	5.60	5.59	1368.84	684.42	684.42	1371.47	685.74	685.73
18900	5.58	5.58	1368.73	684.37	684.37	1371.39	685.71	685.69
19000	5.57	5.57	1368.62	684.31	684.31	1371.31	685.67	685.65
19100	5.56	5.56	1368.51	684.26	684.26	1371.24	685.63	685.61
19200	5.55	5.55	1368.40	684.20	684.20	1371.16	685.59	685.57
19300	5.54	5.54	1368.29	684.15	684.15	1371.08	685.55	685.53
19400	5.53	5.53	1368.18	684.09	684.09	1371.00	685.51	685.49
19500	5.52	5.52	1368.07	684.04	684.04	1370.92	685.47	685.46
19600	5.51	5.51	1367.96	683.98	683.98	1370.84	685.43	685.42
19700	5.50	5.50	1367.84	683.92	683.92	1370.76	685.39	685.38
19800	5.49	5.49	1367.73	683.87	683.87	1370.68	685.34	685.33
19900	5.48	5.48	1367.62	683.81	683.81	1370.59	685.30	685.29
20000	5.47	5.47	1367.50	683.75	683.75	1370.49	685.25	685.24

Results for a simulation of a constriction in a channel - definitive constriction (continuation)

Sed. transport (m^3s^{-1}) - year 0				Sed. transport (m^3s^{-1}) - year 20			
Total	Left channel	Right channel	Exchange	Total	Left channel	Right channel	Exchange
0.00722	0.00361	0.00361	3.9E-11	0.00839	0.00419	0.00419	6.4E-12
0.00721	0.00361	0.00361	4.1E-11	0.00839	0.00419	0.00419	5.8E-12
0.00721	0.00360	0.00360	5.1E-11	0.00839	0.00419	0.00419	-2.7E-12
0.00720	0.00360	0.00360	5.2E-11	0.00839	0.00419	0.00419	-7.1E-12
0.00720	0.00360	0.00360	4.3E-11	0.00839	0.00419	0.00419	-8.6E-12
0.00719	0.00360	0.00360	4.2E-11	0.00839	0.00419	0.00419	5.2E-12
0.00719	0.00359	0.00359	5.1E-11	0.00839	0.00419	0.00419	7.1E-12
0.00718	0.00359	0.00359	3.8E-11	0.00839	0.00419	0.00419	4.1E-12
0.00718	0.00359	0.00359	4.1E-11	0.00839	0.00419	0.00419	7.8E-12
0.00718	0.00359	0.00359	4.9E-11	0.00839	0.00419	0.00419	5.1E-12
0.00717	0.00359	0.00359	4.8E-11	0.00839	0.00419	0.00419	1.4E-11
0.00717	0.00358	0.00358	4.4E-11	0.00839	0.00419	0.00419	-1.2E-11
0.00716	0.00358	0.00358	4.2E-11	0.00839	0.00419	0.00419	2.1E-12
0.00716	0.00358	0.00358	4.1E-11	0.00839	0.00419	0.00419	-7.0E-12
0.00715	0.00358	0.00358	4.8E-11	0.00839	0.00419	0.00419	2.5E-12
0.00715	0.00357	0.00357	4.1E-11	0.00839	0.00419	0.00419	-1.0E-11
0.00714	0.00357	0.00357	3.4E-11	0.00839	0.00419	0.00419	-7.2E-12
0.00714	0.00357	0.00357	3.8E-11	0.00839	0.00419	0.00419	-4.0E-12
0.00713	0.00357	0.00357	3.9E-11	0.00839	0.00419	0.00419	1.2E-11
0.00713	0.00356	0.00356	4.5E-11	0.00839	0.00419	0.00419	-8.5E-13
0.00712	0.00356	0.00356	4.4E-11	0.00839	0.00419	0.00419	-8.1E-12
0.00712	0.00356	0.00356	2.8E-11	0.00839	0.00419	0.00419	3.3E-12
0.00711	0.00356	0.00356	3.3E-11	0.00839	0.00419	0.00419	-5.2E-12
0.00711	0.00355	0.00355	3.4E-11	0.00839	0.00419	0.00419	7.7E-12
0.00710	0.00355	0.00355	3.7E-11	0.00839	0.00419	0.00419	-1.9E-11
0.00710	0.00355	0.00355	3.5E-11	0.00839	0.00419	0.00419	1.3E-12
0.00709	0.00355	0.00355	3.9E-11	0.00839	0.00419	0.00419	-6.4E-12
0.00709	0.00354	0.00354	2.8E-11	0.00839	0.00419	0.00419	-4.2E-12
0.00708	0.00354	0.00354	3.4E-11	0.00839	0.00419	0.00419	-6.9E-13
0.00708	0.00354	0.00354	3.8E-11	0.00839	0.00419	0.00419	-1.1E-11
0.00707	0.00354	0.00354	3.9E-11	0.00839	0.00419	0.00419	2.0E-11
0.00707	0.00353	0.00353	3.9E-11	0.00839	0.00419	0.00419	2.9E-12
0.00706	0.00353	0.00353	3.0E-11	0.00839	0.00419	0.00419	-1.1E-12
0.00706	0.00353	0.00353	3.6E-11	0.00839	0.00419	0.00419	-7.6E-12
0.00705	0.00353	0.00353	3.1E-11	0.00839	0.00419	0.00419	-5.6E-12
0.00705	0.00352	0.00352	2.9E-11	0.00839	0.00419	0.00419	-7.8E-12
0.00704	0.00352	0.00352	3.9E-11	0.00839	0.00419	0.00419	-1.2E-11
0.00704	0.00352	0.00352	3.9E-11	0.00839	0.00420	0.00420	-9.5E-12
0.00703	0.00352	0.00352	2.8E-11	0.00839	0.00420	0.00420	-3.7E-12
0.00703	0.00351	0.00351	3.2E-11	0.00839	0.00420	0.00420	1.4E-12
0.00702	0.00351	0.00351	3.3E-11	0.00839	0.00420	0.00420	3.9E-12
0.00702	0.00351	0.00351	3.5E-11	0.00839	0.00420	0.00420	-3.2E-12
0.00701	0.00350	0.00350	2.5E-11	0.00839	0.00420	0.00420	9.9E-12
0.00700	0.00350	0.00350	2.3E-11	0.00839	0.00420	0.00420	-5.2E-12
0.00700	0.00350	0.00350	2.5E-11	0.00839	0.00420	0.00420	-1.1E-11
0.00699	0.00350	0.00350	2.1E-11	0.00839	0.00420	0.00420	-2.9E-11
0.00699	0.00349	0.00349	2.1E-11	0.00839	0.00420	0.00420	-1.6E-10
0.00698	0.00349	0.00349	2.1E-11	0.00839	0.00420	0.00420	-1.2E-09
0.00698	0.00349	0.00349	2.4E-11	0.00839	0.00420	0.00420	-2.7E-09
0.00697	0.00349	0.00349	3.1E-11	0.00840	0.00420	0.00420	-9.6E-09
0.00697	0.00348	0.00348	8.9E-07	0.00840	0.00421	0.00419	1.7E-07
0.00941	0.00518	0.00423	5.2E-06	0.00840	0.00462	0.00378	5.9E-06
0.01289	0.00791	0.00498	9.0E-06	0.00840	0.00516	0.00323	6.0E-06
0.01811	0.01256	0.00554	1.6E-05	0.00840	0.00585	0.00255	7.5E-06
0.02648	0.02112	0.00536	3.2E-05	0.00840	0.00672	0.00167	9.6E-06
0.04151	0.03871	0.00281	5.8E-05	0.00839	0.00782	0.00057	7.6E-06
0.04214	0.03991	0.00223	1.5E-06	0.00840	0.00795	0.00045	1.1E-06
0.04292	0.04110	0.00183	1.1E-06	0.00840	0.00804	0.00035	8.2E-07
0.04381	0.04226	0.00155	8.7E-07	0.00840	0.00811	0.00029	6.2E-07
0.04478	0.04342	0.00135	6.6E-07	0.00840	0.00817	0.00023	4.6E-07
0.04581	0.04459	0.00122	-8.8E-06	0.00840	0.00820	0.00020	2.0E-07
0.03217	0.03046	0.00171	-2.1E-05	0.00839	0.00788	0.00051	-4.7E-06
0.02389	0.02219	0.00170	-1.2E-05	0.00839	0.00750	0.00089	-4.1E-06
0.01826	0.01674	0.00152	-7.8E-06	0.00839	0.00709	0.00130	-4.2E-06
0.01416	0.01286	0.00130	-5.3E-06	0.00839	0.00668	0.00171	-4.2E-06
0.01107	0.00999	0.00108	-3.3E-06	0.00840	0.00626	0.00214	-3.1E-06
0.01042	0.00906	0.00136	-1.4E-06	0.00840	0.00608	0.00232	-1.8E-06
0.00994	0.00830	0.00164	-1.2E-06	0.00840	0.00589	0.00251	-1.9E-06
0.00957	0.00767	0.00190	-1.1E-06	0.00840	0.00570	0.00270	-1.9E-06
0.00929	0.00715	0.00214	-9.3E-07	0.00840	0.00551	0.00289	-1.9E-06
0.00908	0.00671	0.00237	-8.1E-07	0.00840	0.00533	0.00307	-1.8E-06
0.00892	0.00635	0.00257	-7.1E-07	0.00840	0.00515	0.00326	-1.8E-06
0.00880	0.00604	0.00276	-6.2E-07	0.00840	0.00497	0.00343	-1.7E-06
0.00871	0.00578	0.00293	-5.3E-07	0.00840	0.00481	0.00360	-1.6E-06

Sed. transport (m^3s^{-1}) - year 0				Sed. transport (m^3s^{-1}) - year 20			
Total	Left channel	Right channel	Exchange	Total	Left channel	Right channel	Exchange
0.00864	0.00556	0.00308	-4.7E-07	0.00841	0.00465	0.00375	-1.5E-06
0.00859	0.00537	0.00322	-4.0E-07	0.00841	0.00451	0.00390	-1.4E-06
0.00856	0.00521	0.00334	-3.5E-07	0.00841	0.00438	0.00403	-1.2E-06
0.00853	0.00508	0.00345	-3.1E-07	0.00841	0.00426	0.00414	-1.1E-06
0.00851	0.00496	0.00355	-2.7E-07	0.00841	0.00416	0.00425	-9.6E-07
0.00849	0.00486	0.00363	-2.3E-07	0.00841	0.00407	0.00434	-8.3E-07
0.00848	0.00477	0.00371	-2.0E-07	0.00841	0.00400	0.00441	-6.9E-07
0.00847	0.00470	0.00377	-1.8E-07	0.00841	0.00394	0.00447	-5.6E-07
0.00847	0.00464	0.00383	-1.5E-07	0.00841	0.00389	0.00452	-4.4E-07
0.00846	0.00458	0.00388	-1.3E-07	0.00841	0.00385	0.00456	-3.3E-07
0.00846	0.00453	0.00392	-1.2E-07	0.00841	0.00382	0.00459	-2.2E-07
0.00846	0.00449	0.00396	-1.0E-07	0.00841	0.00381	0.00461	-1.3E-07
0.00846	0.00446	0.00400	-8.7E-08	0.00842	0.00380	0.00462	-4.5E-08
0.00846	0.00443	0.00403	-7.6E-08	0.00842	0.00380	0.00462	1.9E-09
0.00846	0.00440	0.00405	-6.6E-08	0.00842	0.00381	0.00461	8.9E-08
0.00846	0.00438	0.00408	-5.7E-08	0.00842	0.00382	0.00460	1.5E-07
0.00846	0.00436	0.00410	-5.0E-08	0.00842	0.00384	0.00458	1.9E-07
0.00846	0.00434	0.00411	-4.3E-08	0.00842	0.00386	0.00456	2.3E-07
0.00846	0.00433	0.00413	-3.8E-08	0.00842	0.00388	0.00454	2.6E-07
0.00846	0.00432	0.00414	-3.3E-08	0.00842	0.00391	0.00451	2.8E-07
0.00846	0.00431	0.00416	-2.8E-08	0.00842	0.00394	0.00449	2.9E-07
0.00846	0.00430	0.00417	-2.5E-08	0.00842	0.00396	0.00446	3.0E-07
0.00847	0.00429	0.00418	-2.2E-08	0.00842	0.00399	0.00443	3.0E-07
0.00847	0.00428	0.00418	-1.9E-08	0.00842	0.00402	0.00440	3.0E-07
0.00847	0.00428	0.00419	-1.6E-08	0.00842	0.00405	0.00437	2.9E-07
0.00847	0.00427	0.00420	-1.4E-08	0.00843	0.00408	0.00434	2.8E-07
0.00847	0.00427	0.00420	-1.2E-08	0.00843	0.00411	0.00432	2.6E-07
0.00847	0.00426	0.00421	-1.1E-08	0.00843	0.00413	0.00429	2.4E-07
0.00847	0.00426	0.00421	-9.3E-09	0.00843	0.00416	0.00427	2.2E-07
0.00848	0.00426	0.00422	-8.1E-09	0.00843	0.00418	0.00425	2.0E-07
0.00848	0.00426	0.00422	-7.0E-09	0.00843	0.00420	0.00423	1.8E-07
0.00848	0.00426	0.00422	-6.1E-09	0.00843	0.00421	0.00422	1.6E-07
0.00848	0.00426	0.00423	-5.3E-09	0.00843	0.00423	0.00420	1.3E-07
0.00848	0.00425	0.00423	-4.6E-09	0.00843	0.00424	0.00419	1.1E-07
0.00849	0.00425	0.00423	-4.0E-09	0.00843	0.00425	0.00418	8.9E-08
0.00849	0.00425	0.00423	-3.5E-09	0.00843	0.00426	0.00417	6.8E-08
0.00849	0.00425	0.00424	-3.0E-09	0.00843	0.00427	0.00417	4.9E-08
0.00849	0.00425	0.00424	-2.6E-09	0.00844	0.00427	0.00416	3.2E-08
0.00849	0.00425	0.00424	-2.3E-09	0.00844	0.00428	0.00416	1.7E-08
0.00849	0.00425	0.00424	-2.0E-09	0.00844	0.00428	0.00416	6.2E-09
0.00850	0.00425	0.00424	-1.7E-09	0.00844	0.00428	0.00416	-6.4E-09
0.00850	0.00425	0.00424	-1.5E-09	0.00844	0.00428	0.00416	-1.5E-08
0.00850	0.00425	0.00425	-1.3E-09	0.00845	0.00428	0.00416	-2.2E-08
0.00850	0.00425	0.00425	-1.1E-09	0.00845	0.00428	0.00417	-2.8E-08
0.00850	0.00425	0.00425	-9.9E-10	0.00845	0.00428	0.00417	-3.2E-08
0.00851	0.00426	0.00425	-8.6E-10	0.00845	0.00428	0.00418	-3.5E-08
0.00851	0.00426	0.00425	-7.5E-10	0.00846	0.00427	0.00418	-3.6E-08
0.00851	0.00426	0.00425	-6.4E-10	0.00846	0.00427	0.00419	-3.7E-08
0.00851	0.00426	0.00425	-5.6E-10	0.00846	0.00427	0.00419	-3.8E-08
0.00851	0.00426	0.00426	-4.9E-10	0.00846	0.00427	0.00420	-3.8E-08
0.00852	0.00426	0.00426	-4.1E-10	0.00847	0.00426	0.00420	-3.8E-08
0.00852	0.00426	0.00426	-3.6E-10	0.00847	0.00426	0.00421	-3.8E-08
0.00852	0.00426	0.00426	-3.1E-10	0.00847	0.00426	0.00421	-3.8E-08
0.00852	0.00426	0.00426	-2.7E-10	0.00847	0.00425	0.00422	-3.8E-08
0.00852	0.00426	0.00426	-2.4E-10	0.00848	0.00425	0.00422	-3.8E-08
0.00853	0.00426	0.00426	-1.9E-10	0.00848	0.00425	0.00423	-3.7E-08
0.00853	0.00426	0.00426	-1.8E-10	0.00848	0.00425	0.00423	-3.6E-08
0.00853	0.00426	0.00426	-1.5E-10	0.00848	0.00424	0.00424	-3.5E-08
0.00853	0.00427	0.00427	-1.3E-10	0.00848	0.00424	0.00424	-3.3E-08
0.00853	0.00427	0.00427	-1.2E-10	0.00848	0.00424	0.00424	-3.1E-08
0.00854	0.00427	0.00427	-8.7E-11	0.00849	0.00424	0.00425	-2.8E-08
0.00854	0.00427	0.00427	-7.5E-11	0.00849	0.00424	0.00425	-2.4E-08
0.00854	0.00427	0.00427	-8.2E-11	0.00849	0.00424	0.00425	-2.0E-08
0.00854	0.00427	0.00427	-6.9E-11	0.00849	0.00424	0.00425	-1.6E-08
0.00854	0.00427	0.00427	-5.4E-11	0.00849	0.00424	0.00426	-1.1E-08
0.00855	0.00427	0.00427	-3.6E-11	0.00849	0.00424	0.00426	-7.0E-09
0.00855	0.00427	0.00427	-2.9E-11	0.00850	0.00424	0.00426	-2.2E-09
0.00855	0.00428	0.00427	-3.5E-11	0.00850	0.00424	0.00426	2.1E-09
0.00855	0.00428	0.00428	-2.1E-11	0.00850	0.00424	0.00426	6.0E-09
0.00855	0.00428	0.00428	-2.6E-11	0.00850	0.00424	0.00426	9.4E-09
0.00856	0.00428	0.00428	-2.6E-11	0.00850	0.00424	0.00426	1.2E-08
0.00856	0.00428	0.00428	-2.0E-11	0.00851	0.00424	0.00426	1.4E-08
0.00856	0.00428	0.00428	-1.5E-12	0.00851	0.00424	0.00426	1.6E-08
0.00856	0.00428	0.00428	-5.0E-12	0.00851	0.00425	0.00426	1.6E-08
0.00857	0.00428	0.00428	-1.5E-12	0.00851	0.00425	0.00426	1.6E-08
0.00857	0.00428	0.00428	-5.0E-12	0.00851	0.00425	0.00426	1.6E-08

Sed. transport (m^3s^{-1}) - year 0				Sed. transport (m^3s^{-1}) - year 20			
Total	Left channel	Right channel	Exchange	Total	Left channel	Right channel	Exchange
0.00857	0.00429	0.00428	-3.0E-12	0.00852	0.00425	0.00426	1.5E-08
0.00857	0.00429	0.00429	-1.3E-11	0.00852	0.00426	0.00426	1.4E-08
0.00857	0.00429	0.00429	-1.3E-11	0.00852	0.00426	0.00426	1.2E-08
0.00858	0.00429	0.00429	-1.3E-11	0.00852	0.00426	0.00426	1.0E-08
0.00858	0.00429	0.00429	-1.0E-11	0.00853	0.00426	0.00426	8.2E-09
0.00858	0.00429	0.00429	3.0E-12	0.00853	0.00426	0.00426	6.3E-09
0.00858	0.00429	0.00429	1.2E-11	0.00853	0.00427	0.00426	4.4E-09
0.00859	0.00429	0.00429	3.5E-12	0.00853	0.00427	0.00427	2.7E-09
0.00859	0.00429	0.00429	-5.0E-12	0.00854	0.00427	0.00427	1.1E-09
0.00859	0.00430	0.00430	3.0E-12	0.00854	0.00427	0.00427	-2.3E-10
0.00859	0.00430	0.00430	1.2E-11	0.00854	0.00427	0.00427	-1.3E-09
0.00860	0.00430	0.00430	8.1E-12	0.00854	0.00427	0.00427	-2.2E-09
0.00860	0.00430	0.00430	1.0E-11	0.00855	0.00428	0.00427	-2.8E-09
0.00860	0.00430	0.00430	3.0E-12	0.00855	0.00428	0.00427	-3.3E-09
0.00860	0.00430	0.00430	8.6E-12	0.00855	0.00428	0.00427	-3.5E-09
0.00861	0.00430	0.00430	-3.5E-12	0.00855	0.00428	0.00427	-3.5E-09
0.00861	0.00430	0.00430	8.1E-12	0.00855	0.00428	0.00428	-3.4E-09
0.00861	0.00431	0.00431	7.1E-12	0.00856	0.00428	0.00428	-3.2E-09
0.00861	0.00431	0.00431	-1.0E-11	0.00856	0.00428	0.00428	-2.9E-09
0.00862	0.00431	0.00431	-1.5E-12	0.00856	0.00428	0.00428	-2.6E-09
0.00862	0.00431	0.00431	-6.6E-12	0.00856	0.00428	0.00428	-2.2E-09
0.00862	0.00431	0.00431	-3.5E-12	0.00856	0.00428	0.00428	-1.8E-09
0.00862	0.00431	0.00431	3.5E-12	0.00856	0.00428	0.00428	-1.4E-09
0.00863	0.00431	0.00431	-6.6E-12	0.00857	0.00428	0.00428	-1.1E-09
0.00863	0.00431	0.00431	-5.1E-12	0.00857	0.00428	0.00428	-7.7E-10
0.00863	0.00432	0.00432	-1.5E-12	0.00857	0.00429	0.00429	-4.9E-10
0.00863	0.00432	0.00432	-2.0E-12	0.00857	0.00429	0.00429	-2.4E-10
0.00864	0.00432	0.00432	1.3E-11	0.00857	0.00429	0.00429	-4.4E-11
0.00864	0.00432	0.00432	1.0E-11	0.00858	0.00429	0.00429	1.2E-10
0.00864	0.00432	0.00432	0.0E+00	0.00858	0.00429	0.00429	2.3E-10
0.00864	0.00432	0.00432	3.0E-12	0.00858	0.00429	0.00429	3.2E-10
0.00865	0.00432	0.00432	1.2E-11	0.00858	0.00429	0.00429	3.7E-10
0.00865	0.00433	0.00433	5.1E-12	0.00858	0.00429	0.00429	3.9E-10
0.00865	0.00433	0.00433	-3.0E-12	0.00859	0.00429	0.00429	4.1E-10
0.00866	0.00433	0.00433	-1.2E-11	0.00859	0.00429	0.00429	3.9E-10
0.00866	0.00433	0.00433	-3.6E-12	0.00859	0.00429	0.00429	3.7E-10
0.00866	0.00433	0.00433	2.0E-12	0.00859	0.00430	0.00430	3.5E-10
0.00866	0.00433	0.00433	-1.0E-11	0.00859	0.00430	0.00430	3.0E-10
0.00867	0.00433	0.00433	-3.1E-12	0.00860	0.00430	0.00430	2.7E-10
0.00867	0.00433	0.00433	-8.6E-12	0.00860	0.00430	0.00430	2.3E-10
0.00867	0.00434	0.00434	5.1E-12	0.00860	0.00430	0.00430	1.8E-10
0.00868	0.00434	0.00434	3.1E-12	0.00860	0.00430	0.00430	1.5E-10
0.00868	0.00434	0.00434	1.0E-11	0.00860	0.00430	0.00430	1.1E-10
0.00868	0.00434	0.00434	-1.5E-12	0.00861	0.00430	0.00430	9.1E-11
0.00868	0.00434	0.00434	-5.1E-12	0.00861	0.00430	0.00430	6.1E-11
0.00869	0.00434	0.00434	0.0E+00	0.00861	0.00430	0.00430	2.5E-11
0.00869	0.00435	0.00435	1.5E-12	0.00861	0.00431	0.00431	2.4E-11
0.00869	0.00435	0.00435	5.1E-12	0.00861	0.00431	0.00431	2.1E-12
0.00870	0.00435	0.00435	1.5E-12	0.00862	0.00431	0.00431	-8.8E-12
0.00870	0.00435	0.00435	6.6E-12	0.00862	0.00431	0.00431	-1.2E-11
0.00870	0.00435	0.00435	6.6E-12	0.00862	0.00431	0.00431	-5.1E-11

Results for a simulation of a constriction in a channel - definitive constriction (continuation)

Bed levels (m) - year 0		Bed levels (m) - year 20	
Left channel	Right channel	Left channel	Right channel
2.00	2.00	2.00	2.00
1.99	1.99	1.99	1.99
1.98	1.98	1.98	1.98
1.97	1.97	1.97	1.97
1.96	1.96	1.96	1.96
1.95	1.95	1.95	1.95
1.94	1.94	1.94	1.94
1.93	1.93	1.93	1.93
1.92	1.92	1.92	1.92
1.91	1.91	1.91	1.91
1.90	1.90	1.90	1.90
1.89	1.89	1.89	1.89
1.88	1.88	1.88	1.88
1.87	1.87	1.87	1.87
1.86	1.86	1.86	1.86
1.85	1.85	1.85	1.85
1.84	1.84	1.84	1.84
1.83	1.83	1.83	1.83
1.82	1.82	1.82	1.82
1.81	1.81	1.81	1.81
1.80	1.80	1.80	1.80
1.79	1.79	1.79	1.79
1.78	1.78	1.78	1.78
1.77	1.77	1.77	1.77
1.76	1.76	1.76	1.76
1.75	1.75	1.75	1.75
1.74	1.74	1.74	1.74
1.73	1.73	1.73	1.73
1.72	1.72	1.72	1.72
1.71	1.71	1.71	1.71
1.70	1.70	1.69	1.69
1.69	1.69	1.68	1.68
1.68	1.68	1.67	1.67
1.67	1.67	1.66	1.66
1.66	1.66	1.65	1.65
1.65	1.65	1.64	1.64
1.64	1.64	1.63	1.63
1.63	1.63	1.62	1.62
1.62	1.62	1.61	1.61
1.61	1.61	1.60	1.60
1.60	1.60	1.59	1.59
1.59	1.59	1.58	1.58
1.58	1.58	1.57	1.57
1.57	1.57	1.56	1.56
1.56	1.56	1.55	1.55
1.55	1.55	1.54	1.54
1.54	1.54	1.53	1.53
1.53	1.53	1.52	1.52
1.52	1.52	1.52	1.51
1.51	1.51	1.52	1.49
1.50	1.50	1.54	1.43
1.49	1.49	1.00	1.15
1.48	1.48	0.51	0.68
1.47	1.47	-0.06	0.07
1.46	1.46	-0.77	-0.78
1.45	1.45	-1.71	-1.83
1.44	1.44	-1.70	-1.55
1.43	1.43	-1.71	-1.47
1.42	1.42	-1.72	-1.42
1.41	1.41	-1.74	-1.26
1.40	1.40	-1.75	-0.73
1.39	1.39	-1.04	0.13
1.38	1.38	-0.48	0.73
1.37	1.37	0.02	1.13
1.36	1.36	0.48	1.44
1.35	1.35	0.89	1.70
1.34	1.34	1.07	1.47
1.33	1.33	1.23	1.28
1.32	1.32	1.37	1.12
1.31	1.31	1.49	0.99
1.30	1.30	1.60	0.88
1.29	1.29	1.68	0.79
1.28	1.28	1.75	0.71
1.27	1.27	1.80	0.66

Bed levels (m) - year 0		Bed levels (m) - year 20	
Left channel	Right channel	Left channel	Right channel
1.26	1.26	1.84	0.62
1.25	1.25	1.86	0.60
1.24	1.24	1.86	0.58
1.23	1.23	1.86	0.58
1.22	1.22	1.84	0.58
1.21	1.21	1.81	0.60
1.20	1.20	1.77	0.62
1.19	1.19	1.73	0.64
1.18	1.18	1.68	0.67
1.17	1.17	1.63	0.70
1.16	1.16	1.57	0.74
1.15	1.15	1.52	0.77
1.14	1.14	1.46	0.81
1.13	1.13	1.41	0.84
1.12	1.12	1.35	0.87
1.11	1.11	1.30	0.90
1.10	1.10	1.25	0.93
1.09	1.09	1.20	0.96
1.08	1.08	1.15	0.99
1.07	1.07	1.11	1.01
1.06	1.06	1.07	1.03
1.05	1.05	1.03	1.04
1.04	1.04	1.00	1.05
1.03	1.03	0.97	1.06
1.02	1.02	0.95	1.07
1.01	1.01	0.92	1.07
1.00	1.00	0.90	1.07
0.99	0.99	0.89	1.07
0.98	0.98	0.87	1.06
0.97	0.97	0.86	1.06
0.96	0.96	0.85	1.05
0.95	0.95	0.84	1.03
0.94	0.94	0.83	1.02
0.93	0.93	0.83	1.01
0.92	0.92	0.82	0.99
0.91	0.91	0.82	0.98
0.90	0.90	0.82	0.96
0.89	0.89	0.81	0.94
0.88	0.88	0.81	0.92
0.87	0.87	0.81	0.91
0.86	0.86	0.80	0.89
0.85	0.85	0.80	0.87
0.84	0.84	0.80	0.86
0.83	0.83	0.79	0.84
0.82	0.82	0.79	0.83
0.81	0.81	0.78	0.81
0.80	0.80	0.78	0.80
0.79	0.79	0.77	0.78
0.78	0.78	0.77	0.77
0.77	0.77	0.76	0.76
0.76	0.76	0.75	0.75
0.75	0.75	0.75	0.73
0.74	0.74	0.74	0.72
0.73	0.73	0.73	0.71
0.72	0.72	0.72	0.70
0.71	0.71	0.71	0.69
0.70	0.70	0.70	0.67
0.69	0.69	0.69	0.66
0.68	0.68	0.69	0.65
0.67	0.67	0.68	0.64
0.66	0.66	0.67	0.63
0.65	0.65	0.66	0.62
0.64	0.64	0.64	0.61
0.63	0.63	0.63	0.60
0.62	0.62	0.62	0.60
0.61	0.61	0.61	0.59
0.60	0.60	0.60	0.58
0.59	0.59	0.59	0.57
0.58	0.58	0.58	0.56
0.57	0.57	0.56	0.55
0.56	0.56	0.55	0.55
0.55	0.55	0.54	0.54
0.54	0.54	0.53	0.53
0.53	0.53	0.52	0.52
0.52	0.52	0.51	0.51
0.51	0.51	0.50	0.50

Bed levels (m) - year 0		Bed levels (m) - year 20	
Left channel	Right channel	Left channel	Right channel
0.50	0.50	0.49	0.49
0.49	0.49	0.47	0.48
0.48	0.48	0.46	0.47
0.47	0.47	0.45	0.46
0.46	0.46	0.44	0.45
0.45	0.45	0.44	0.44
0.44	0.44	0.43	0.43
0.43	0.43	0.42	0.42
0.42	0.42	0.41	0.41
0.41	0.41	0.40	0.40
0.40	0.40	0.39	0.39
0.39	0.39	0.38	0.38
0.38	0.38	0.37	0.37
0.37	0.37	0.36	0.36
0.36	0.36	0.35	0.35
0.35	0.35	0.34	0.34
0.34	0.34	0.33	0.33
0.33	0.33	0.32	0.32
0.32	0.32	0.31	0.31
0.31	0.31	0.30	0.30
0.30	0.30	0.29	0.29
0.29	0.29	0.28	0.28
0.28	0.28	0.27	0.27
0.27	0.27	0.26	0.26
0.26	0.26	0.25	0.25
0.25	0.25	0.24	0.24
0.24	0.24	0.23	0.23
0.23	0.23	0.22	0.22
0.22	0.22	0.21	0.21
0.21	0.21	0.20	0.20
0.20	0.20	0.19	0.19
0.19	0.19	0.18	0.18
0.18	0.18	0.17	0.17
0.17	0.17	0.16	0.16
0.16	0.16	0.15	0.15
0.15	0.15	0.14	0.14
0.14	0.14	0.13	0.13
0.13	0.13	0.12	0.12
0.12	0.12	0.11	0.11
0.11	0.11	0.10	0.10
0.10	0.10	0.09	0.09
0.09	0.09	0.08	0.08
0.08	0.08	0.07	0.07
0.07	0.07	0.06	0.06
0.06	0.06	0.05	0.05
0.05	0.05	0.04	0.04
0.04	0.04	0.03	0.03
0.03	0.03	0.02	0.02
0.02	0.02	0.01	0.01
0.01	0.01	0.00	0.00
0.00	0.00	-0.01	-0.01

Results for a simulation of a constriction in a channel - temporary constriction

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 30	Total	Left channel	Right channel	Exchange
0.00	7.52	7.51	0.00722	0.00361	0.00361	3.9E-11
100.00	7.51	7.50	0.00721	0.00361	0.00361	4.1E-11
200.00	7.50	7.49	0.00721	0.00360	0.00360	5.1E-11
300.00	7.49	7.48	0.00720	0.00360	0.00360	5.2E-11
400.00	7.48	7.47	0.00720	0.00360	0.00360	4.3E-11
500.00	7.47	7.46	0.00719	0.00360	0.00360	4.2E-11
600.00	7.46	7.45	0.00719	0.00359	0.00359	5.1E-11
700.00	7.45	7.44	0.00718	0.00359	0.00359	3.8E-11
800.00	7.44	7.43	0.00718	0.00359	0.00359	4.1E-11
900.00	7.43	7.42	0.00718	0.00359	0.00359	4.9E-11
1000.00	7.42	7.41	0.00717	0.00359	0.00359	4.8E-11
1100.00	7.41	7.39	0.00717	0.00358	0.00358	4.4E-11
1200.00	7.40	7.38	0.00716	0.00358	0.00358	4.2E-11
1300.00	7.39	7.37	0.00716	0.00358	0.00358	4.1E-11
1400.00	7.38	7.36	0.00715	0.00358	0.00358	4.8E-11
1500.00	7.37	7.35	0.00715	0.00357	0.00357	4.1E-11
1600.00	7.36	7.34	0.00714	0.00357	0.00357	3.4E-11
1700.00	7.35	7.33	0.00714	0.00357	0.00357	3.8E-11
1800.00	7.34	7.32	0.00713	0.00357	0.00357	3.9E-11
1900.00	7.33	7.31	0.00713	0.00356	0.00356	4.5E-11
2000.00	7.32	7.30	0.00712	0.00356	0.00356	4.4E-11
2100.00	7.31	7.29	0.00712	0.00356	0.00356	2.8E-11
2200.00	7.30	7.28	0.00711	0.00356	0.00356	3.3E-11
2300.00	7.29	7.27	0.00711	0.00355	0.00355	3.4E-11
2400.00	7.28	7.26	0.00710	0.00355	0.00355	3.7E-11
2500.00	7.27	7.25	0.00710	0.00355	0.00355	3.5E-11
2600.00	7.26	7.24	0.00709	0.00355	0.00355	3.9E-11
2700.00	7.25	7.23	0.00709	0.00354	0.00354	2.8E-11
2800.00	7.24	7.22	0.00708	0.00354	0.00354	3.4E-11
2900.00	7.23	7.21	0.00708	0.00354	0.00354	3.8E-11
3000.00	7.22	7.20	0.00707	0.00354	0.00354	3.9E-11
3100.00	7.21	7.19	0.00707	0.00353	0.00353	3.9E-11
3200.00	7.20	7.18	0.00706	0.00353	0.00353	3.0E-11
3300.00	7.19	7.17	0.00706	0.00353	0.00353	3.6E-11
3400.00	7.18	7.16	0.00705	0.00353	0.00353	3.1E-11
3500.00	7.17	7.15	0.00705	0.00352	0.00352	2.9E-11
3600.00	7.16	7.14	0.00704	0.00352	0.00352	3.9E-11
3700.00	7.15	7.13	0.00704	0.00352	0.00352	3.9E-11
3800.00	7.14	7.12	0.00703	0.00352	0.00352	2.8E-11
3900.00	7.13	7.11	0.00703	0.00351	0.00351	3.2E-11
4000.00	7.12	7.10	0.00702	0.00351	0.00351	3.3E-11
4100.00	7.11	7.09	0.00702	0.00351	0.00351	3.5E-11
4200.00	7.10	7.08	0.00701	0.00350	0.00350	2.5E-11
4300.00	7.09	7.07	0.00700	0.00350	0.00350	2.3E-11
4400.00	7.08	7.06	0.00700	0.00350	0.00350	2.5E-11
4500.00	7.07	7.05	0.00699	0.00350	0.00350	2.1E-11
4600.00	7.06	7.04	0.00699	0.00349	0.00349	2.1E-11
4700.00	7.05	7.03	0.00698	0.00349	0.00349	2.1E-11
4800.00	7.04	7.02	0.00698	0.00349	0.00349	2.4E-11
4900.00	7.03	7.01	0.00697	0.00349	0.00349	3.1E-11
5000.00	7.02	7.00	0.00697	0.00348	0.00348	8.9E-07
5100.00	7.02	6.99	0.00941	0.00518	0.00423	5.2E-06
5200.00	7.02	6.98	0.01289	0.00791	0.00498	9.0E-06
5300.00	7.02	6.96	0.01811	0.01256	0.00554	1.6E-05
5400.00	7.02	6.95	0.02648	0.02112	0.00536	3.2E-05
5500.00	7.03	6.94	0.04151	0.03871	0.00281	5.8E-05
5600.00	7.02	6.93	0.04214	0.03991	0.00223	1.5E-06
5700.00	7.02	6.92	0.04292	0.04110	0.00183	1.1E-06
5800.00	7.02	6.91	0.04381	0.04226	0.00155	8.7E-07
5900.00	7.02	6.90	0.04478	0.04342	0.00135	6.6E-07
6000.00	7.01	6.89	0.04581	0.04459	0.00122	-8.8E-06
6100.00	7.00	6.88	0.03217	0.03046	0.00171	-2.1E-05
6200.00	6.99	6.87	0.02389	0.02219	0.00170	-1.2E-05
6300.00	6.98	6.86	0.01826	0.01674	0.00152	-7.8E-06
6400.00	6.96	6.85	0.01416	0.01286	0.00130	-5.3E-06
6500.00	6.94	6.84	0.01107	0.00999	0.00108	-3.3E-06
6600.00	6.94	6.83	0.01042	0.00906	0.00136	-1.4E-06
6700.00	6.93	6.82	0.00994	0.00830	0.00164	-1.2E-06
6800.00	6.92	6.81	0.00957	0.00767	0.00190	-1.1E-06
6900.00	6.91	6.80	0.00929	0.00715	0.00214	-9.3E-07
7000.00	6.90	6.79	0.00908	0.00671	0.00237	-8.1E-07
7100.00	6.89	6.78	0.00892	0.00635	0.00257	-7.1E-07
7200.00	6.88	6.77	0.00880	0.00604	0.00276	-6.2E-07
7300.00	6.87	6.76	0.00871	0.00578	0.00293	-5.3E-07

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 20	Total	Left channel	Right channel	Exchange
7400	6.86	6.75	0.00864	0.00556	0.00308	-4.7E-07
7500	6.84	6.74	0.00859	0.00537	0.00322	-4.0E-07
7600.00	6.83	6.73	0.00856	0.00521	0.00334	-3.5E-07
7700.00	6.82	6.72	0.00853	0.00508	0.00345	-3.1E-07
7800.00	6.81	6.71	0.00851	0.00496	0.00355	-2.7E-07
7900.00	6.80	6.70	0.00849	0.00486	0.00363	-2.3E-07
8000.00	6.79	6.69	0.00848	0.00477	0.00371	-2.0E-07
8100.00	6.77	6.68	0.00847	0.00470	0.00377	-1.8E-07
8200.00	6.76	6.67	0.00847	0.00464	0.00383	-1.5E-07
8300.00	6.75	6.66	0.00846	0.00458	0.00388	-1.3E-07
8400.00	6.74	6.65	0.00846	0.00453	0.00392	-1.2E-07
8500.00	6.72	6.64	0.00846	0.00449	0.00396	-1.0E-07
8600.00	6.71	6.63	0.00846	0.00446	0.00400	-8.7E-08
8700.00	6.70	6.62	0.00846	0.00443	0.00403	-7.6E-08
8800.00	6.68	6.61	0.00846	0.00440	0.00405	-6.6E-08
8900.00	6.67	6.60	0.00846	0.00438	0.00408	-5.7E-08
9000.00	6.66	6.59	0.00846	0.00436	0.00410	-5.0E-08
9100.00	6.64	6.58	0.00846	0.00434	0.00411	-4.3E-08
9200.00	6.63	6.57	0.00846	0.00433	0.00413	-3.8E-08
9300.00	6.62	6.56	0.00846	0.00432	0.00414	-3.3E-08
9400.00	6.60	6.55	0.00846	0.00431	0.00416	-2.8E-08
9500.00	6.59	6.54	0.00846	0.00430	0.00417	-2.5E-08
9600.00	6.57	6.53	0.00847	0.00429	0.00418	-2.2E-08
9700.00	6.56	6.52	0.00847	0.00428	0.00418	-1.9E-08
9800.00	6.54	6.50	0.00847	0.00428	0.00419	-1.6E-08
9900.00	6.53	6.49	0.00847	0.00427	0.00420	-1.4E-08
10000.00	6.51	6.48	0.00847	0.00427	0.00420	-1.2E-08
10100.00	6.50	6.47	0.00847	0.00426	0.00421	-1.1E-08
10200.00	6.48	6.46	0.00847	0.00426	0.00421	-9.3E-09
10300.00	6.47	6.45	0.00848	0.00426	0.00422	-8.1E-09
10400.00	6.45	6.44	0.00848	0.00426	0.00422	-7.0E-09
10500.00	6.44	6.43	0.00848	0.00426	0.00422	-6.1E-09
10600.00	6.43	6.42	0.00848	0.00426	0.00423	-5.3E-09
10700.00	6.42	6.41	0.00848	0.00425	0.00423	-4.6E-09
10800.00	6.42	6.40	0.00849	0.00425	0.00423	-4.0E-09
10900.00	6.41	6.39	0.00849	0.00425	0.00423	-3.5E-09
11000.00	6.40	6.38	0.00849	0.00425	0.00424	-3.0E-09
11100.00	6.39	6.37	0.00849	0.00425	0.00424	-2.6E-09
11200	6.38	6.36	0.00849	0.00425	0.00424	-2.3E-09
11300	6.37	6.35	0.00849	0.00425	0.00424	-2.0E-09
11400	6.36	6.34	0.00850	0.00425	0.00424	-1.7E-09
11500	6.35	6.33	0.00850	0.00425	0.00424	-1.5E-09
11600	6.34	6.32	0.00850	0.00425	0.00425	-1.3E-09
11700	6.33	6.31	0.00850	0.00425	0.00425	-1.1E-09
11800	6.32	6.30	0.00850	0.00425	0.00425	-9.9E-10
11900	6.31	6.29	0.00851	0.00426	0.00425	-8.6E-10
12000	6.30	6.28	0.00851	0.00426	0.00425	-7.5E-10
12100	6.29	6.27	0.00851	0.00426	0.00425	-6.4E-10
12200	6.28	6.26	0.00851	0.00426	0.00425	-5.6E-10
12300	6.27	6.25	0.00851	0.00426	0.00426	-4.9E-10
12400	6.25	6.24	0.00852	0.00426	0.00426	-4.1E-10
12500	6.24	6.23	0.00852	0.00426	0.00426	-3.6E-10
12600	6.23	6.22	0.00852	0.00426	0.00426	-3.1E-10
12700	6.22	6.21	0.00852	0.00426	0.00426	-2.7E-10
12800	6.21	6.20	0.00852	0.00426	0.00426	-2.4E-10
12900	6.20	6.19	0.00853	0.00426	0.00426	-1.9E-10
13000	6.19	6.18	0.00853	0.00426	0.00426	-1.8E-10
13100	6.18	6.17	0.00853	0.00426	0.00426	-1.5E-10
13200	6.17	6.16	0.00853	0.00427	0.00427	-1.3E-10
13300	6.16	6.15	0.00853	0.00427	0.00427	-1.2E-10
13400	6.15	6.14	0.00854	0.00427	0.00427	-8.7E-11
13500	6.14	6.13	0.00854	0.00427	0.00427	-7.5E-11
13600	6.13	6.12	0.00854	0.00427	0.00427	-8.2E-11
13700	6.12	6.11	0.00854	0.00427	0.00427	-6.9E-11
13800	6.11	6.10	0.00854	0.00427	0.00427	-5.4E-11
13900	6.10	6.09	0.00855	0.00427	0.00427	-3.6E-11
14000	6.09	6.08	0.00855	0.00427	0.00427	-2.9E-11
14100	6.08	6.07	0.00855	0.00428	0.00427	-3.5E-11
14200	6.07	6.06	0.00855	0.00428	0.00428	-2.1E-11
14300	6.06	6.05	0.00855	0.00428	0.00428	-2.6E-11
14400	6.05	6.04	0.00856	0.00428	0.00428	-2.6E-11
14500	6.04	6.03	0.00856	0.00428	0.00428	-2.0E-11
14600	6.03	6.02	0.00856	0.00428	0.00428	-1.5E-12
14700	6.02	6.01	0.00856	0.00428	0.00428	-5.0E-12
14800	6.01	6.00	0.00857	0.00428	0.00428	-1.5E-12
14900	6.00	5.99	0.00857	0.00428	0.00428	-5.0E-12

S (m)	Water levels (m)		Sed. transport (m^3s^{-1}) - year 0			
	year 0	year 20	Total	Left channel	Right channel	Exchange
15000	5.99	5.98	0.00857	0.00429	0.00428	-3.0E-12
15100	5.98	5.97	0.00857	0.00429	0.00429	-1.3E-11
15200	5.97	5.96	0.00857	0.00429	0.00429	-1.3E-11
15300	5.96	5.95	0.00858	0.00429	0.00429	-1.3E-11
15400	5.95	5.94	0.00858	0.00429	0.00429	-1.0E-11
15500	5.94	5.93	0.00858	0.00429	0.00429	3.0E-12
15600	5.93	5.92	0.00858	0.00429	0.00429	1.2E-11
15700	5.92	5.90	0.00859	0.00429	0.00429	3.5E-12
15800	5.91	5.89	0.00859	0.00429	0.00429	-5.0E-12
15900	5.89	5.88	0.00859	0.00430	0.00430	3.0E-12
16000	5.88	5.87	0.00859	0.00430	0.00430	1.2E-11
16100	5.87	5.86	0.00860	0.00430	0.00430	8.1E-12
16200	5.86	5.85	0.00860	0.00430	0.00430	1.0E-11
16300	5.85	5.84	0.00860	0.00430	0.00430	3.0E-12
16400	5.84	5.83	0.00860	0.00430	0.00430	8.6E-12
16500	5.83	5.82	0.00861	0.00430	0.00430	-3.5E-12
16600	5.82	5.81	0.00861	0.00430	0.00430	8.1E-12
16700	5.81	5.80	0.00861	0.00431	0.00431	7.1E-12
16800	5.80	5.79	0.00861	0.00431	0.00431	-1.0E-11
16900	5.79	5.78	0.00862	0.00431	0.00431	-1.5E-12
17000	5.78	5.77	0.00862	0.00431	0.00431	-6.6E-12
17100	5.77	5.76	0.00862	0.00431	0.00431	-3.5E-12
17200	5.76	5.75	0.00862	0.00431	0.00431	3.5E-12
17300	5.75	5.74	0.00863	0.00431	0.00431	-6.6E-12
17400	5.74	5.73	0.00863	0.00431	0.00431	-5.1E-12
17500	5.73	5.72	0.00863	0.00432	0.00432	-1.5E-12
17600	5.72	5.71	0.00863	0.00432	0.00432	-2.0E-12
17700	5.71	5.70	0.00864	0.00432	0.00432	1.3E-11
17800	5.70	5.69	0.00864	0.00432	0.00432	1.0E-11
17900	5.69	5.68	0.00864	0.00432	0.00432	0.0E+00
18000	5.68	5.67	0.00864	0.00432	0.00432	3.0E-12
18100	5.67	5.66	0.00865	0.00432	0.00432	1.2E-11
18200	5.66	5.65	0.00865	0.00433	0.00433	5.1E-12
18300	5.65	5.64	0.00865	0.00433	0.00433	-3.0E-12
18400	5.64	5.63	0.00866	0.00433	0.00433	-1.2E-11
18500	5.63	5.62	0.00866	0.00433	0.00433	-3.6E-12
18600	5.62	5.61	0.00866	0.00433	0.00433	2.0E-12
18700	5.61	5.60	0.00866	0.00433	0.00433	-1.0E-11
18800	5.59	5.59	0.00867	0.00433	0.00433	-3.1E-12
18900	5.58	5.58	0.00867	0.00433	0.00433	-8.6E-12
19000	5.57	5.57	0.00867	0.00434	0.00434	5.1E-12
19100	5.56	5.56	0.00868	0.00434	0.00434	3.1E-12
19200	5.55	5.55	0.00868	0.00434	0.00434	1.0E-11
19300	5.54	5.54	0.00868	0.00434	0.00434	-1.5E-12
19400	5.53	5.53	0.00868	0.00434	0.00434	-5.1E-12
19500	5.52	5.52	0.00869	0.00434	0.00434	0.0E+00
19600	5.51	5.51	0.00869	0.00435	0.00435	1.5E-12
19700	5.50	5.50	0.00869	0.00435	0.00435	5.1E-12
19800	5.49	5.49	0.00870	0.00435	0.00435	1.5E-12
19900	5.48	5.48	0.00870	0.00435	0.00435	6.6E-12
20000	5.47	5.47	0.00870	0.00435	0.00435	6.6E-12

Results for a simulation of a constriction in a channel - temporary constriction (continuation)

Sed. transport (m^3s^{-1}) - year 30				Bed levels (m) - year 0		Bed levels (m) - year 30	
Total	Left channel	Right channel	Exchange	Left channel	Right channel	Left channel	Right channel
0.00839	0.00419	0.00419	6.4E-12	2.00	2.00	2.00	2.00
0.00839	0.00419	0.00419	5.8E-12	1.99	1.99	1.99	1.99
0.00839	0.00419	0.00419	-2.7E-12	1.98	1.98	1.98	1.98
0.00839	0.00419	0.00419	-7.1E-12	1.97	1.97	1.97	1.97
0.00839	0.00419	0.00419	-8.6E-12	1.96	1.96	1.96	1.96
0.00839	0.00419	0.00419	5.2E-12	1.95	1.95	1.95	1.95
0.00839	0.00419	0.00419	7.1E-12	1.94	1.94	1.94	1.94
0.00839	0.00419	0.00419	4.1E-12	1.93	1.93	1.93	1.93
0.00839	0.00419	0.00419	7.8E-12	1.92	1.92	1.92	1.92
0.00839	0.00419	0.00419	5.1E-12	1.91	1.91	1.91	1.91
0.00839	0.00419	0.00419	1.4E-11	1.90	1.90	1.90	1.90
0.00839	0.00419	0.00419	-1.2E-11	1.89	1.89	1.89	1.89
0.00839	0.00419	0.00419	2.1E-12	1.88	1.88	1.88	1.88
0.00839	0.00419	0.00419	-7.0E-12	1.88	1.87	1.87	1.87
0.00839	0.00419	0.00419	2.5E-12	1.87	1.86	1.86	1.86
0.00839	0.00419	0.00419	-1.0E-11	1.86	1.85	1.85	1.85
0.00839	0.00419	0.00419	-7.2E-12	1.85	1.84	1.84	1.84
0.00839	0.00419	0.00419	-4.0E-12	1.84	1.83	1.83	1.83
0.00839	0.00419	0.00419	1.2E-11	1.83	1.82	1.82	1.82
0.00839	0.00419	0.00419	-8.5E-13	1.82	1.81	1.81	1.81
0.00839	0.00419	0.00419	-8.1E-12	1.81	1.80	1.79	1.79
0.00839	0.00419	0.00419	3.3E-12	1.80	1.79	1.78	1.78
0.00839	0.00419	0.00419	-5.2E-12	1.79	1.78	1.77	1.77
0.00839	0.00419	0.00419	7.7E-12	1.78	1.77	1.76	1.76
0.00839	0.00419	0.00419	-1.9E-11	1.77	1.76	1.75	1.75
0.00839	0.00419	0.00419	1.3E-12	1.76	1.74	1.74	1.74
0.00839	0.00419	0.00419	-6.4E-12	1.75	1.73	1.73	1.73
0.00839	0.00419	0.00419	-4.2E-12	1.74	1.72	1.72	1.72
0.00839	0.00419	0.00419	-6.9E-13	1.73	1.71	1.71	1.71
0.00839	0.00419	0.00419	-1.1E-11	1.72	1.70	1.70	1.70
0.00839	0.00419	0.00419	2.0E-11	1.71	1.69	1.69	1.69
0.00839	0.00419	0.00419	2.9E-12	1.70	1.68	1.68	1.68
0.00839	0.00419	0.00419	-1.1E-12	1.69	1.67	1.67	1.67
0.00839	0.00419	0.00419	-7.6E-12	1.68	1.66	1.66	1.66
0.00839	0.00419	0.00419	-5.6E-12	1.67	1.65	1.65	1.65
0.00839	0.00419	0.00419	-7.8E-12	1.66	1.64	1.64	1.64
0.00839	0.00419	0.00419	-1.2E-11	1.65	1.63	1.63	1.63
0.00839	0.00420	0.00420	-9.5E-12	1.65	1.62	1.62	1.62
0.00839	0.00420	0.00420	-3.7E-12	1.64	1.61	1.61	1.61
0.00839	0.00420	0.00420	1.4E-12	1.63	1.60	1.60	1.60
0.00839	0.00420	0.00420	3.9E-12	1.62	1.59	1.59	1.59
0.00839	0.00420	0.00420	-3.2E-12	1.61	1.58	1.58	1.58
0.00839	0.00420	0.00420	9.9E-12	1.60	1.57	1.57	1.57
0.00839	0.00420	0.00420	-5.2E-12	1.59	1.56	1.56	1.56
0.00839	0.00420	0.00420	-1.1E-11	1.58	1.55	1.55	1.55
0.00839	0.00420	0.00420	-2.9E-11	1.57	1.54	1.54	1.54
0.00839	0.00420	0.00420	-1.6E-10	1.56	1.53	1.53	1.53
0.00839	0.00420	0.00420	-1.2E-09	1.55	1.52	1.52	1.52
0.00839	0.00420	0.00420	-2.7E-09	1.54	1.51	1.51	1.51
0.00840	0.00420	0.00420	-9.6E-09	1.53	1.50	1.50	1.50
0.00840	0.00421	0.00419	1.7E-07	1.56	1.44	1.49	1.49
0.00840	0.00462	0.00378	5.9E-06	1.00	1.16	1.48	1.48
0.00840	0.00516	0.00323	6.0E-06	0.51	0.68	1.47	1.47
0.00840	0.00585	0.00255	7.5E-06	-0.07	0.06	1.45	1.45
0.00840	0.00672	0.00167	9.6E-06	-0.79	-0.80	1.44	1.44
0.00839	0.00782	0.00057	7.6E-06	-1.74	-1.86	1.43	1.43
0.00840	0.00795	0.00045	1.1E-06	-1.74	-1.59	1.42	1.42
0.00840	0.00804	0.00035	8.2E-07	-1.75	-1.51	1.41	1.41
0.00840	0.00811	0.00029	6.2E-07	-1.76	-1.28	1.40	1.40
0.00840	0.00817	0.00023	4.6E-07	-1.78	-1.30	1.39	1.39
0.00840	0.00820	0.00020	2.0E-07	-1.79	-0.76	1.38	1.38
0.00839	0.00788	0.00051	-4.7E-06	-1.07	0.14	1.37	1.37
0.00839	0.00750	0.00089	-4.1E-06	-0.51	0.75	1.36	1.36
0.00839	0.00709	0.00130	-4.2E-06	-0.01	1.18	1.35	1.35
0.00839	0.00668	0.00171	-4.2E-06	0.43	1.52	1.34	1.34
0.00840	0.00626	0.00214	-3.1E-06	0.83	1.80	1.33	1.33
0.00840	0.00608	0.00232	-1.8E-06	0.98	1.60	1.32	1.32
0.00840	0.00589	0.00251	-1.9E-06	1.11	1.45	1.31	1.31
0.00840	0.00570	0.00270	-1.9E-06	1.23	1.31	1.30	1.30
0.00840	0.00551	0.00289	-1.9E-06	1.33	1.20	1.29	1.29
0.00840	0.00533	0.00307	-1.8E-06	1.42	1.11	1.28	1.28
0.00840	0.00515	0.00326	-1.8E-06	1.51	1.03	1.27	1.27
0.00840	0.00497	0.00343	-1.7E-06	1.59	0.97	1.26	1.26
0.00840	0.00481	0.00360	-1.6E-06	1.66	0.92	1.25	1.25

Sed. transport (m^3s^{-1}) - year 20				Bed levels (m) - year 0		Bed levels (m) - year 20	
Total	Left channel	Right channel	Exchange	Left channel	Right channel	Left channel	Right channel
0.00841	0.00465	0.00375	-1.5E-06	1.73	0.89	1.24	1.24
0.00841	0.00451	0.00390	-1.4E-06	1.80	0.87	1.23	1.23
0.00841	0.00438	0.00403	-1.2E-06	1.85	0.86	1.22	1.22
0.00841	0.00426	0.00414	-1.1E-06	1.87	0.87	1.21	1.21
0.00841	0.00416	0.00425	-9.6E-07	1.91	0.89	1.20	1.20
0.00841	0.00407	0.00434	-8.3E-07	1.92	0.93	1.19	1.19
0.00841	0.00400	0.00441	-6.9E-07	1.91	0.98	1.17	1.17
0.00841	0.00394	0.00447	-5.6E-07	1.89	1.04	1.16	1.16
0.00841	0.00389	0.00452	-4.4E-07	1.85	1.11	1.15	1.15
0.00841	0.00385	0.00456	-3.3E-07	1.81	1.19	1.14	1.14
0.00841	0.00382	0.00459	-2.2E-07	1.76	1.27	1.13	1.13
0.00841	0.00381	0.00461	-1.3E-07	1.71	1.35	1.12	1.12
0.00842	0.00380	0.00462	-4.5E-08	1.66	1.42	1.11	1.11
0.00842	0.00380	0.00462	1.9E-09	1.62	1.49	1.10	1.10
0.00842	0.00381	0.00461	8.9E-08	1.58	1.55	1.09	1.09
0.00842	0.00382	0.00460	1.5E-07	1.55	1.59	1.08	1.08
0.00842	0.00384	0.00458	1.9E-07	1.53	1.63	1.07	1.07
0.00842	0.00386	0.00456	2.3E-07	1.52	1.66	1.06	1.06
0.00842	0.00388	0.00454	2.6E-07	1.52	1.68	1.05	1.05
0.00842	0.00391	0.00451	2.8E-07	1.53	1.68	1.04	1.04
0.00842	0.00394	0.00449	2.9E-07	1.54	1.69	1.03	1.03
0.00842	0.00396	0.00446	3.0E-07	1.55	1.68	1.02	1.02
0.00842	0.00399	0.00443	3.0E-07	1.57	1.68	1.01	1.01
0.00842	0.00402	0.00440	3.0E-07	1.58	1.67	1.00	1.00
0.00842	0.00405	0.00437	2.9E-07	1.59	1.66	0.99	0.99
0.00843	0.00408	0.00434	2.8E-07	1.61	1.65	0.98	0.98
0.00843	0.00411	0.00432	2.6E-07	1.62	1.65	0.97	0.97
0.00843	0.00413	0.00429	2.4E-07	1.62	1.64	0.96	0.96
0.00843	0.00416	0.00427	2.2E-07	1.64	1.65	0.95	0.95
0.00843	0.00418	0.00425	2.0E-07	1.63	1.64	0.94	0.94
0.00843	0.00420	0.00423	1.8E-07	1.62	1.62	0.93	0.93
0.00843	0.00421	0.00422	1.6E-07	1.57	1.57	0.91	0.92
0.00843	0.00423	0.00420	1.3E-07	1.42	1.42	0.90	0.91
0.00843	0.00424	0.00419	1.1E-07	1.12	1.12	0.89	0.90
0.00843	0.00425	0.00418	8.9E-08	0.97	0.96	0.88	0.88
0.00843	0.00426	0.00417	6.8E-08	0.92	0.92	0.87	0.87
0.00843	0.00427	0.00417	4.9E-08	0.90	0.90	0.86	0.86
0.00844	0.00427	0.00416	3.2E-08	0.89	0.88	0.85	0.85
0.00844	0.00428	0.00416	1.7E-08	0.87	0.87	0.84	0.84
0.00844	0.00428	0.00416	6.2E-09	0.86	0.86	0.83	0.83
0.00844	0.00428	0.00416	-6.4E-09	0.85	0.85	0.82	0.82
0.00844	0.00428	0.00416	-1.5E-08	0.84	0.84	0.81	0.81
0.00845	0.00428	0.00416	-2.2E-08	0.83	0.83	0.80	0.80
0.00845	0.00428	0.00417	-2.8E-08	0.82	0.82	0.79	0.79
0.00845	0.00428	0.00417	-3.2E-08	0.81	0.81	0.78	0.78
0.00845	0.00428	0.00418	-3.5E-08	0.80	0.80	0.77	0.77
0.00846	0.00427	0.00418	-3.6E-08	0.79	0.79	0.76	0.76
0.00846	0.00427	0.00419	-3.7E-08	0.78	0.78	0.75	0.75
0.00846	0.00427	0.00419	-3.8E-08	0.77	0.77	0.74	0.74
0.00846	0.00427	0.00420	-3.8E-08	0.76	0.76	0.73	0.73
0.00847	0.00426	0.00420	-3.8E-08	0.75	0.75	0.72	0.72
0.00847	0.00426	0.00421	-3.8E-08	0.74	0.74	0.71	0.71
0.00847	0.00426	0.00421	-3.8E-08	0.73	0.73	0.70	0.70
0.00847	0.00425	0.00422	-3.8E-08	0.72	0.72	0.69	0.69
0.00848	0.00425	0.00422	-3.8E-08	0.71	0.71	0.68	0.68
0.00848	0.00425	0.00423	-3.7E-08	0.70	0.70	0.67	0.67
0.00848	0.00425	0.00423	-3.6E-08	0.69	0.69	0.65	0.66
0.00848	0.00424	0.00424	-3.5E-08	0.68	0.68	0.64	0.65
0.00848	0.00424	0.00424	-3.3E-08	0.67	0.67	0.63	0.64
0.00848	0.00424	0.00424	-3.1E-08	0.66	0.66	0.62	0.63
0.00849	0.00424	0.00425	-2.8E-08	0.65	0.65	0.61	0.62
0.00849	0.00424	0.00425	-2.4E-08	0.64	0.64	0.60	0.61
0.00849	0.00424	0.00425	-2.0E-08	0.63	0.63	0.59	0.60
0.00849	0.00424	0.00425	-1.6E-08	0.62	0.62	0.58	0.59
0.00849	0.00424	0.00426	-1.1E-08	0.61	0.61	0.57	0.58
0.00849	0.00424	0.00426	-7.0E-09	0.60	0.60	0.56	0.57
0.00850	0.00424	0.00426	-2.2E-09	0.59	0.59	0.55	0.56
0.00850	0.00424	0.00426	2.1E-09	0.58	0.58	0.54	0.55
0.00850	0.00424	0.00426	6.0E-09	0.57	0.57	0.53	0.53
0.00850	0.00424	0.00426	9.4E-09	0.56	0.56	0.52	0.52
0.00850	0.00424	0.00426	1.2E-08	0.55	0.55	0.51	0.51
0.00851	0.00424	0.00426	1.4E-08	0.54	0.54	0.50	0.50
0.00851	0.00424	0.00426	1.6E-08	0.53	0.53	0.49	0.49
0.00851	0.00425	0.00426	1.6E-08	0.52	0.52	0.48	0.48
0.00851	0.00425	0.00426	1.6E-08	0.51	0.51	0.47	0.47
0.00851	0.00425	0.00426	1.6E-08	0.50	0.50	0.46	0.46

Sed. transport (m^3s^{-1}) - year 20				Bed levels (m) - year 0		Bed levels (m) - year 20	
Total	Left channel	Right channel	Exchange	Left channel	Right channel	Left channel	Right channel
0.00852	0.00425	0.00426	1.5E-08	0.49	0.49	0.45	0.44
0.00852	0.00426	0.00426	1.4E-08	0.48	0.48	0.44	0.43
0.00852	0.00426	0.00426	1.2E-08	0.47	0.47	0.43	0.42
0.00852	0.00426	0.00426	1.0E-08	0.46	0.46	0.42	0.41
0.00853	0.00426	0.00426	8.2E-09	0.45	0.45	0.41	0.40
0.00853	0.00426	0.00426	6.3E-09	0.44	0.44	0.40	0.39
0.00853	0.00427	0.00426	4.4E-09	0.43	0.43	0.39	0.38
0.00853	0.00427	0.00427	2.7E-09	0.42	0.42	0.38	0.37
0.00854	0.00427	0.00427	1.1E-09	0.41	0.41	0.37	0.36
0.00854	0.00427	0.00427	-2.3E-10	0.40	0.40	0.36	0.35
0.00854	0.00427	0.00427	-1.3E-09	0.39	0.39	0.35	0.35
0.00854	0.00427	0.00427	-2.2E-09	0.38	0.38	0.33	0.34
0.00855	0.00428	0.00427	-2.8E-09	0.37	0.37	0.32	0.33
0.00855	0.00428	0.00427	-3.3E-09	0.36	0.36	0.31	0.32
0.00855	0.00428	0.00427	-3.5E-09	0.35	0.35	0.30	0.31
0.00855	0.00428	0.00427	-3.5E-09	0.34	0.34	0.29	0.30
0.00855	0.00428	0.00428	-3.4E-09	0.33	0.33	0.28	0.29
0.00856	0.00428	0.00428	-3.2E-09	0.32	0.32	0.27	0.27
0.00856	0.00428	0.00428	-2.9E-09	0.31	0.31	0.26	0.26
0.00856	0.00428	0.00428	-2.6E-09	0.30	0.30	0.25	0.25
0.00856	0.00428	0.00428	-2.2E-09	0.29	0.29	0.24	0.24
0.00856	0.00428	0.00428	-1.8E-09	0.28	0.28	0.23	0.23
0.00856	0.00428	0.00428	-1.4E-09	0.27	0.27	0.22	0.22
0.00857	0.00428	0.00428	-1.1E-09	0.26	0.26	0.21	0.21
0.00857	0.00428	0.00428	-7.7E-10	0.25	0.25	0.20	0.20
0.00857	0.00429	0.00429	-4.9E-10	0.24	0.24	0.19	0.19
0.00857	0.00429	0.00429	-2.4E-10	0.23	0.23	0.18	0.18
0.00857	0.00429	0.00429	-4.4E-11	0.22	0.22	0.17	0.17
0.00858	0.00429	0.00429	1.2E-10	0.21	0.21	0.16	0.16
0.00858	0.00429	0.00429	2.3E-10	0.20	0.20	0.15	0.15
0.00858	0.00429	0.00429	3.2E-10	0.19	0.19	0.14	0.14
0.00858	0.00429	0.00429	3.7E-10	0.18	0.18	0.13	0.13
0.00858	0.00429	0.00429	3.9E-10	0.17	0.17	0.12	0.12
0.00859	0.00429	0.00429	4.1E-10	0.16	0.16	0.11	0.11
0.00859	0.00429	0.00429	3.9E-10	0.15	0.15	0.10	0.10
0.00859	0.00429	0.00429	3.7E-10	0.14	0.14	0.09	0.09
0.00859	0.00430	0.00430	3.5E-10	0.13	0.13	0.08	0.08
0.00859	0.00430	0.00430	3.0E-10	0.12	0.12	0.07	0.07
0.00860	0.00430	0.00430	2.7E-10	0.11	0.11	0.06	0.06
0.00860	0.00430	0.00430	2.3E-10	0.10	0.10	0.05	0.05
0.00860	0.00430	0.00430	1.8E-10	0.09	0.09	0.04	0.03
0.00860	0.00430	0.00430	1.5E-10	0.08	0.08	0.03	0.02
0.00860	0.00430	0.00430	1.1E-10	0.07	0.07	0.01	0.01
0.00861	0.00430	0.00430	9.1E-11	0.06	0.06	0.00	0.00
0.00861	0.00430	0.00430	6.1E-11	0.05	0.05	-0.01	-0.01
0.00861	0.00430	0.00430	2.5E-11	0.04	0.04	-0.02	-0.02
0.00861	0.00431	0.00431	2.4E-11	0.03	0.03	-0.03	-0.03
0.00861	0.00431	0.00431	2.1E-12	0.02	0.02	-0.04	-0.04
0.00862	0.00431	0.00431	-8.8E-12	0.01	0.01	-0.05	-0.05
0.00862	0.00431	0.00431	-1.2E-11	0.00	0.00	-0.06	-0.06
0.00862	0.00431	0.00431	-5.1E-11	-0.01	-0.01	-0.07	-0.07