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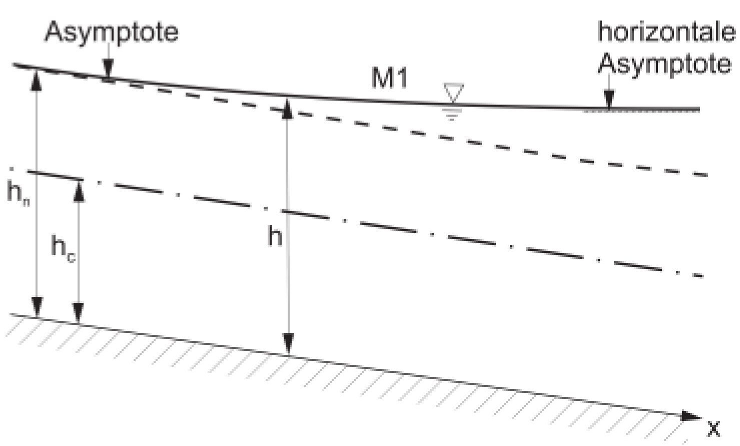
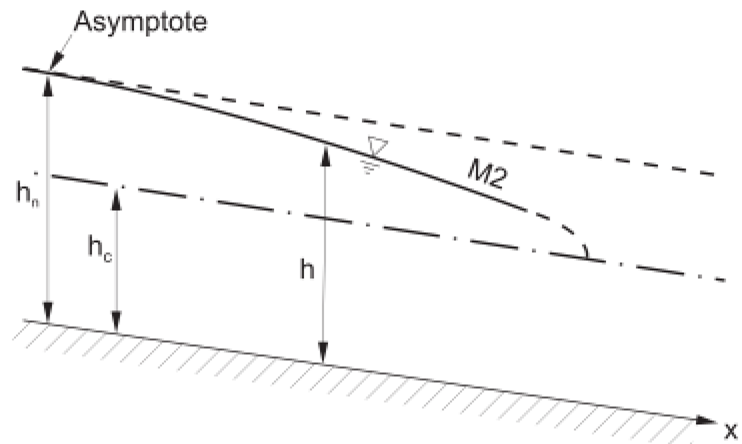
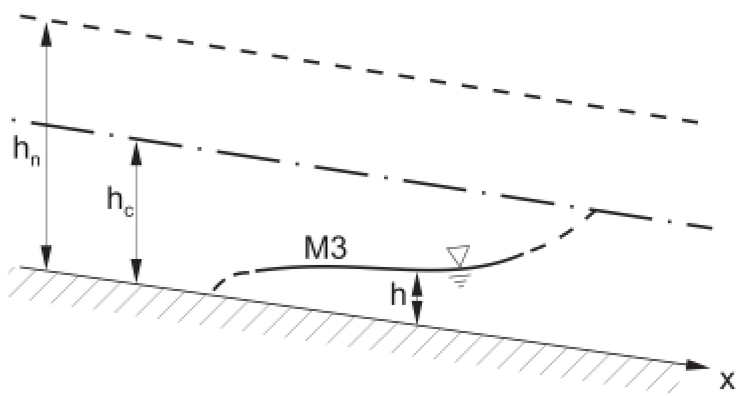
MECÂNICA DOS FLUIDOS AMBIENTAL II



(a) Typus M1

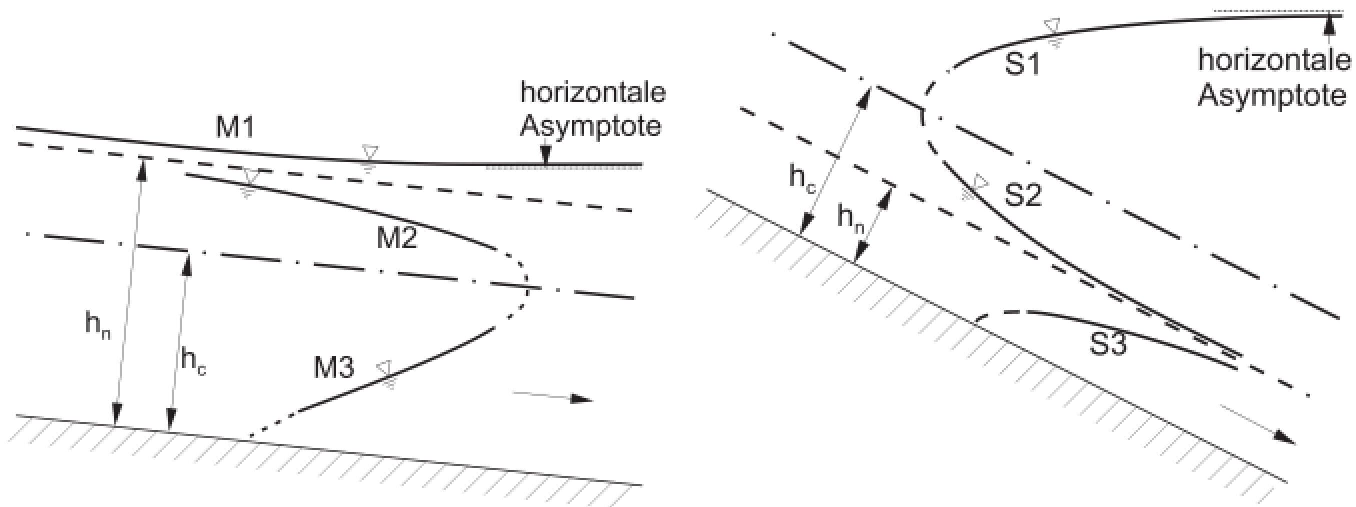


(b) Typus M2

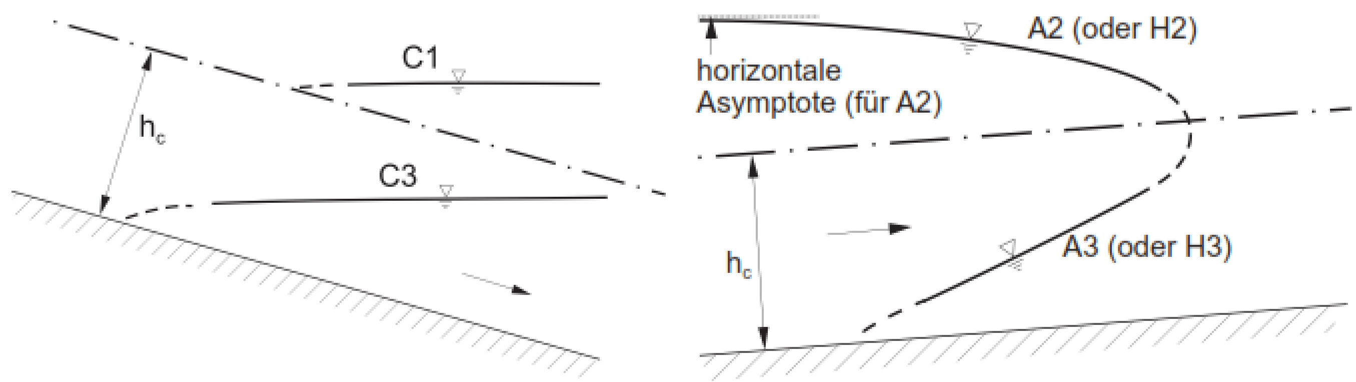


(c) Typus M3

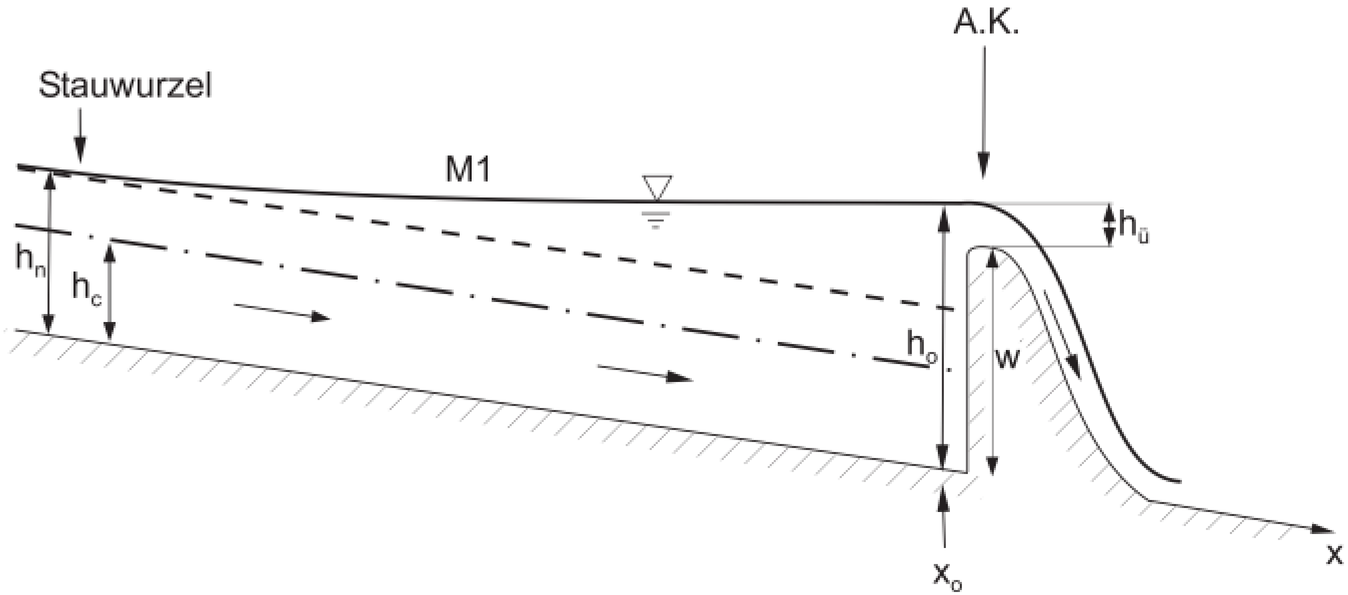
Fonte: Jirka e Lang, 2009



(a) Mildes Gefälle (b) Steiles Gefälle



Fonte: Jirka e Lang, 2009



Fonte: Jirka e Lang, 2009

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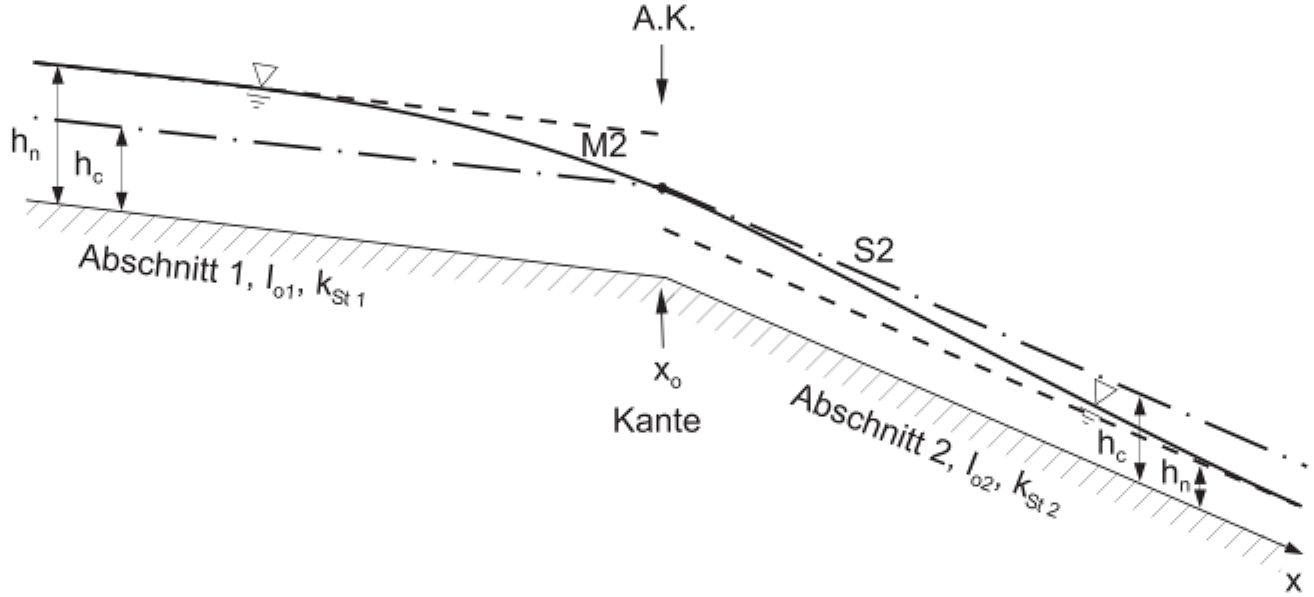
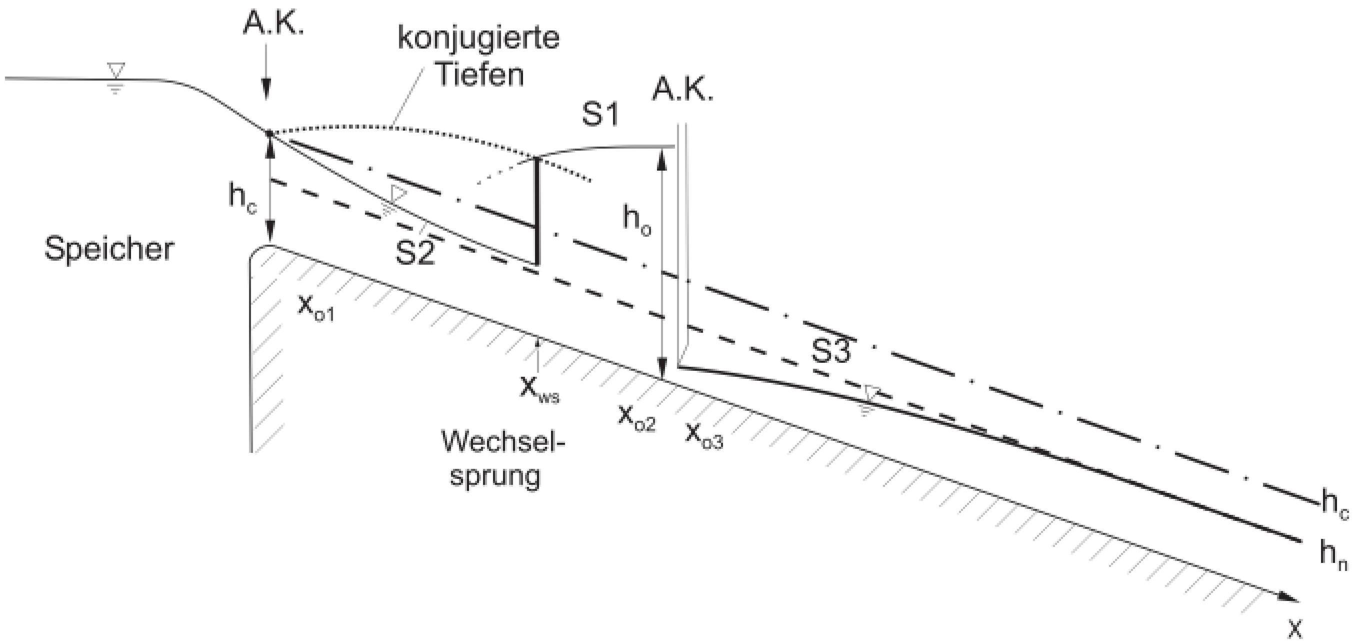


Fonte: Jirka e Lang, 2009



Fonte: Jirka e Lang, 2009

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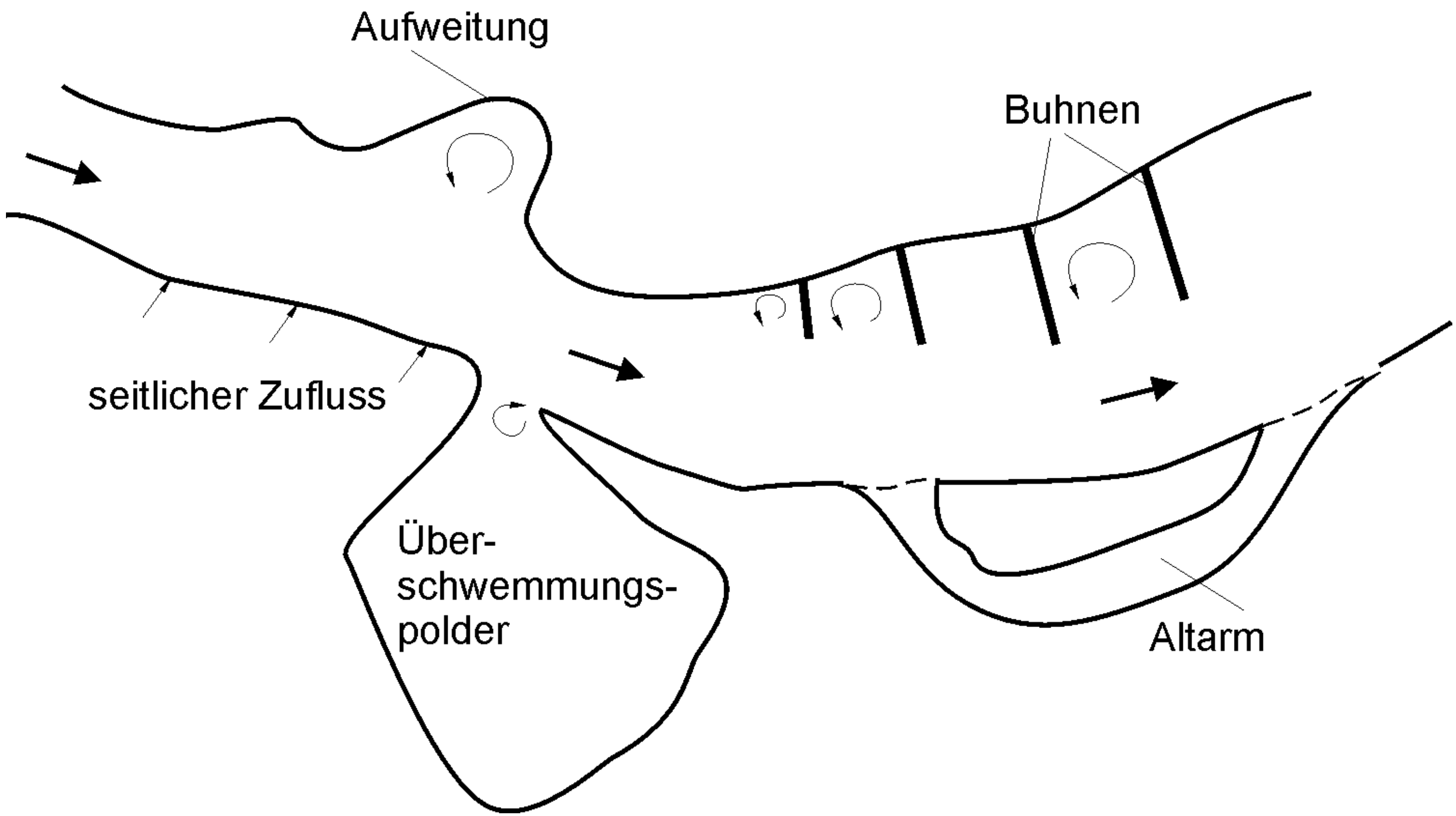
Variação espacial



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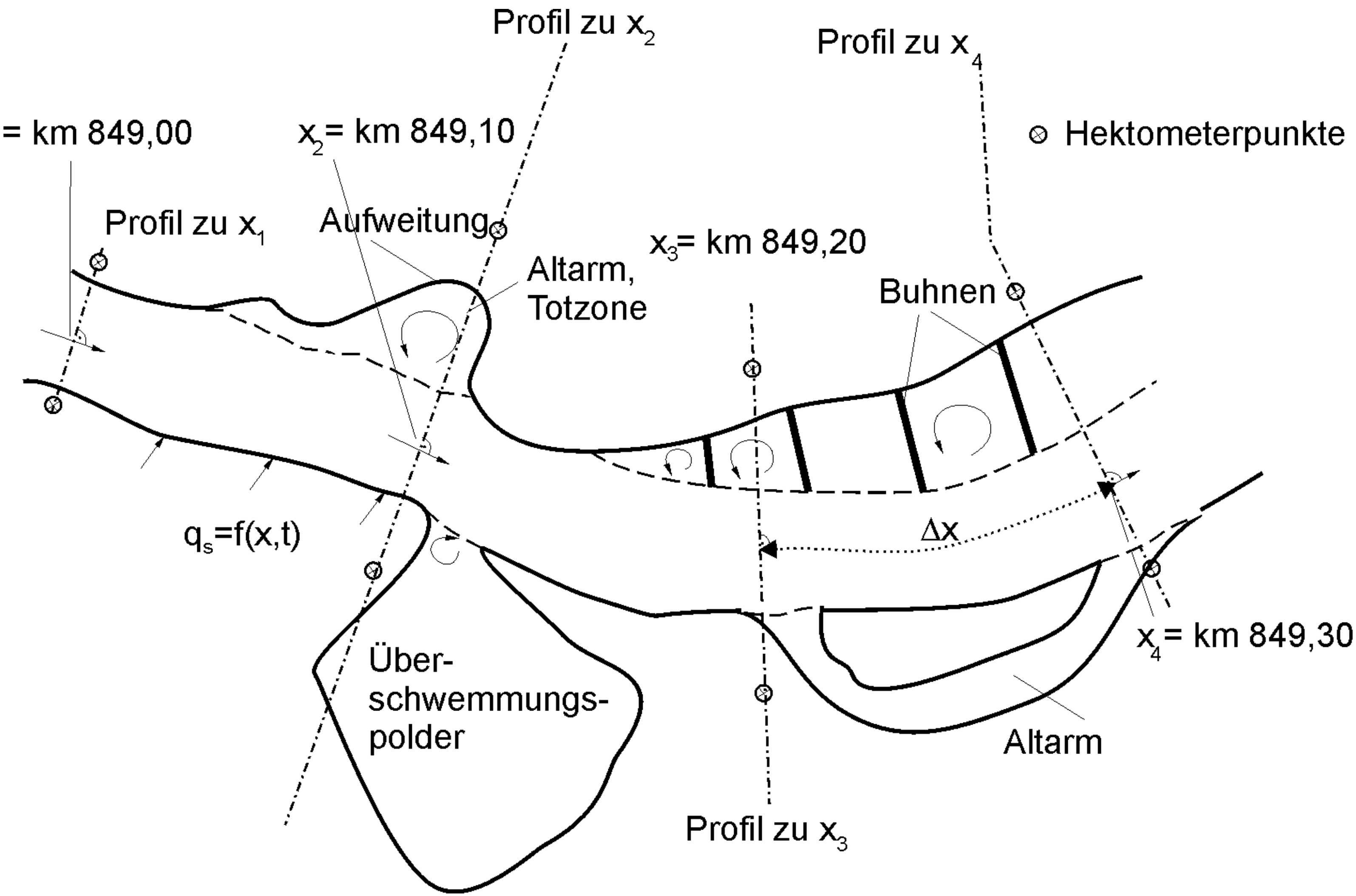
Sistema de coordenadas



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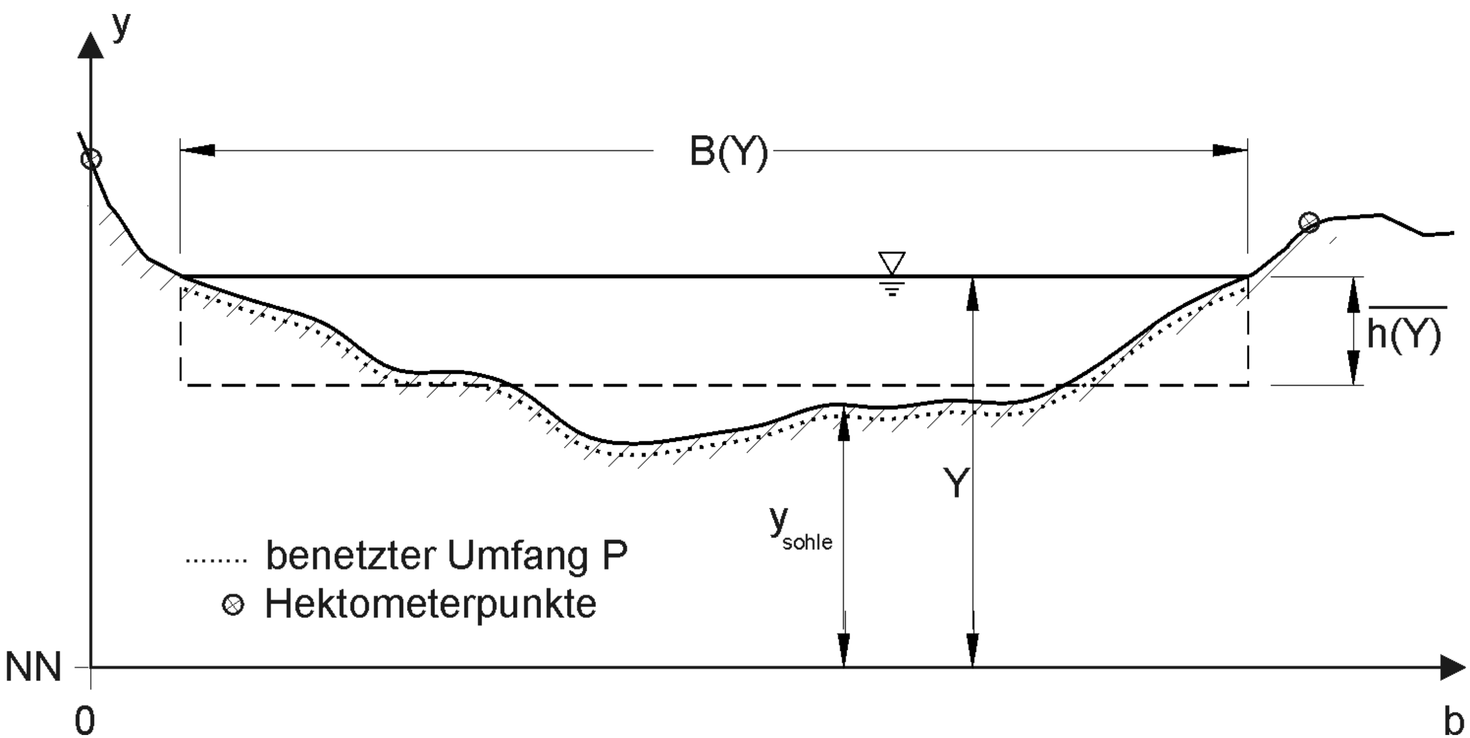

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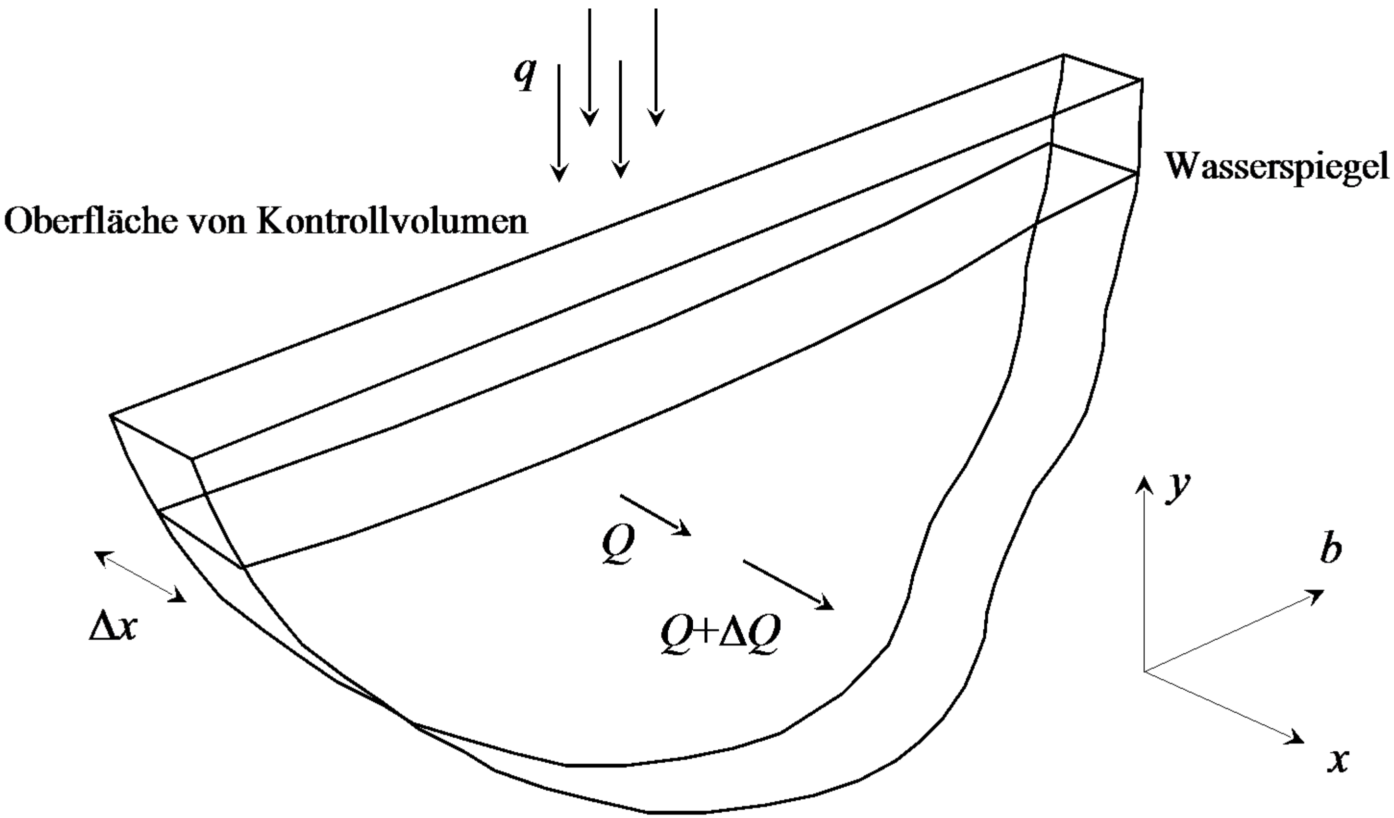
Volume de controle



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Escoamento permanente

Equations for Basic Profile Calculations

Water surface profiles are computed from one cross section to the next by solving the Energy equation with an iterative procedure called the standard step method. The Energy equation is written as follows:

$$Z_2 + Y_2 + \frac{a_2 V_2^2}{2g} = Z_1 + Y_1 + \frac{a_1 V_1^2}{2g} + h_e \qquad (2\text{-}1)$$

Where: Z_1, Z_2 = elevation of the main channel inverts

Y_1, Y_2 = depth of water at cross sections

V_1, V_2 = average velocities (total discharge/ total flow area)

a_1, a_2 = velocity weighting coefficients

g = gravitational acceleration

h_e = energy head loss

Fonte: HEC-RAS Hydraulic Reference Manual

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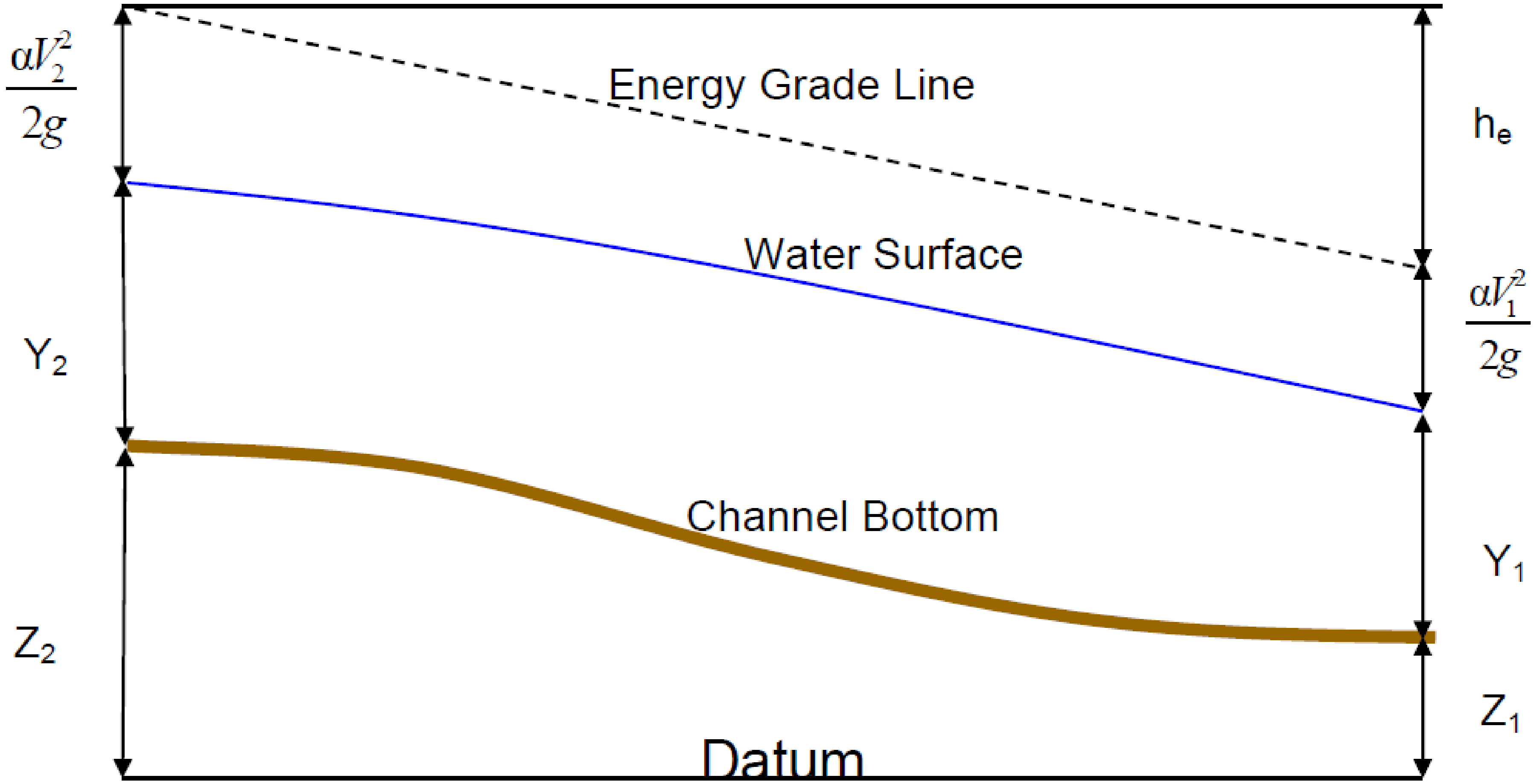
Escoamento permanente



Fonte: HEC-RAS Hydraulic Reference Manual

Escoamento permanente

The energy head loss (h_e) between two cross sections is comprised of friction losses and contraction or expansion losses. The equation for the energy head loss is as follows:

$$h_e = L\overline{S}_f + C\left|\frac{a_2 V_2^2}{2g} - \frac{a_1 V_1^2}{2g}\right| \qquad (2\text{-}2)$$

Where: L = discharge weighted reach length

$\overline{S}_f$ = representative friction slope between two sections

C = expansion or contraction loss coefficient

The distance weighted reach length, L, is calculated as:

$$L = \frac{L_{lob}\overline{Q}_{lob} + L_{ch}\overline{Q}_{ch} + L_{rob}\overline{Q}_{rob}}{\overline{Q}_{lob} + \overline{Q}_{ch} + \overline{Q}_{rob}} \qquad (2\text{-}3)$$

where: L_{lob}, L_{ch}, L_{rob} = cross section reach lengths specified for flow in the left overbank, main channel, and right overbank, respectively

Fonte: HEC-RAS Hydraulic Reference Manual

Sub - critico

$$x = 0 : \; Q_o = \mathrm{f}\,(0, t)$$

$$x = L : A_L = \mathrm{f}(L, t) \text{ bzw. } \left.\frac{\partial A}{\partial x}\right|_{x=L} = \mathrm{f}(t)$$

Super - critico

$$x = 0 : \; A_o = \mathrm{f}\,(t), Q_o = \mathrm{f}\,(t)$$

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Esquematização

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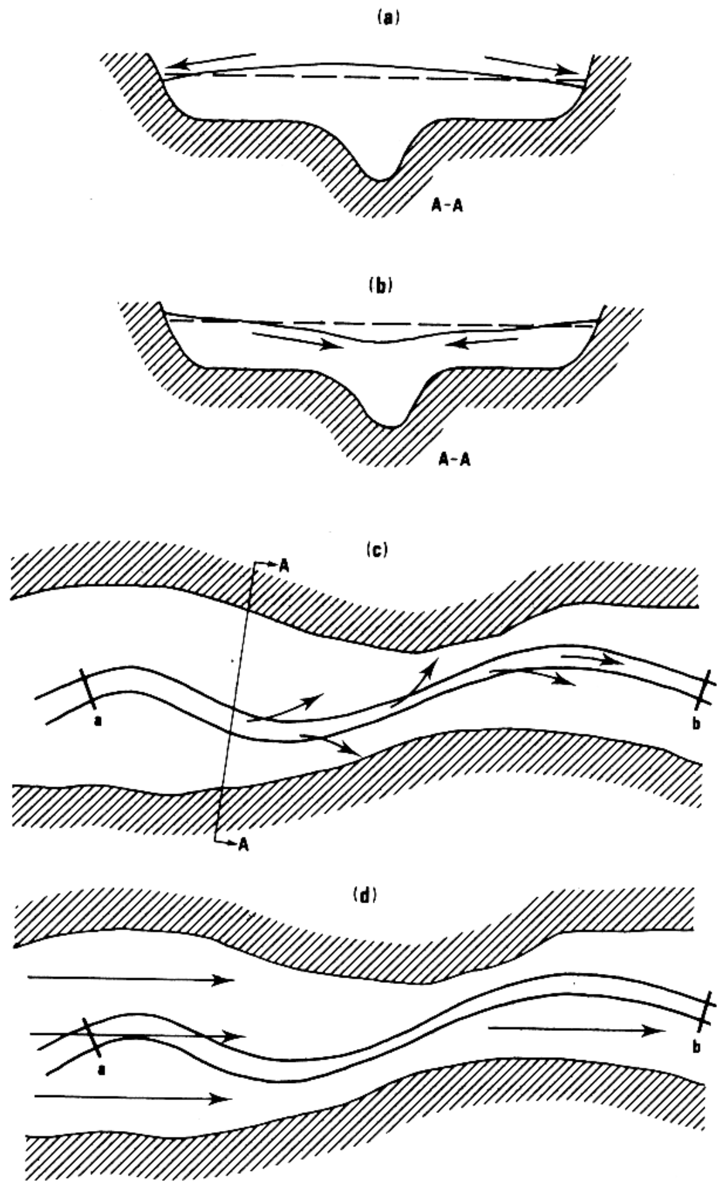
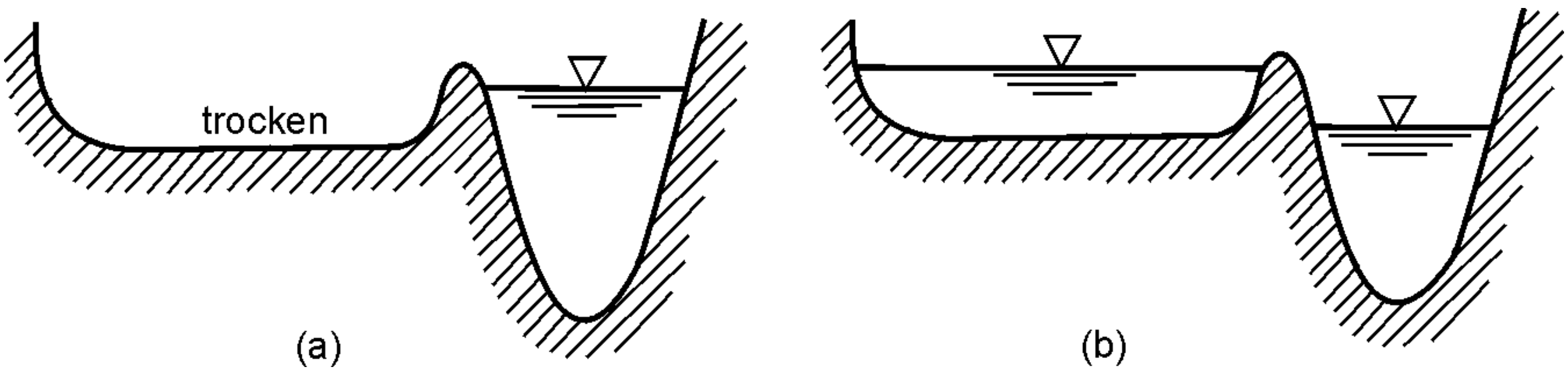
Esquematização



Fonte: Cunge et al., 1980

Esquematização



Fonte: Cunge et al., 1980

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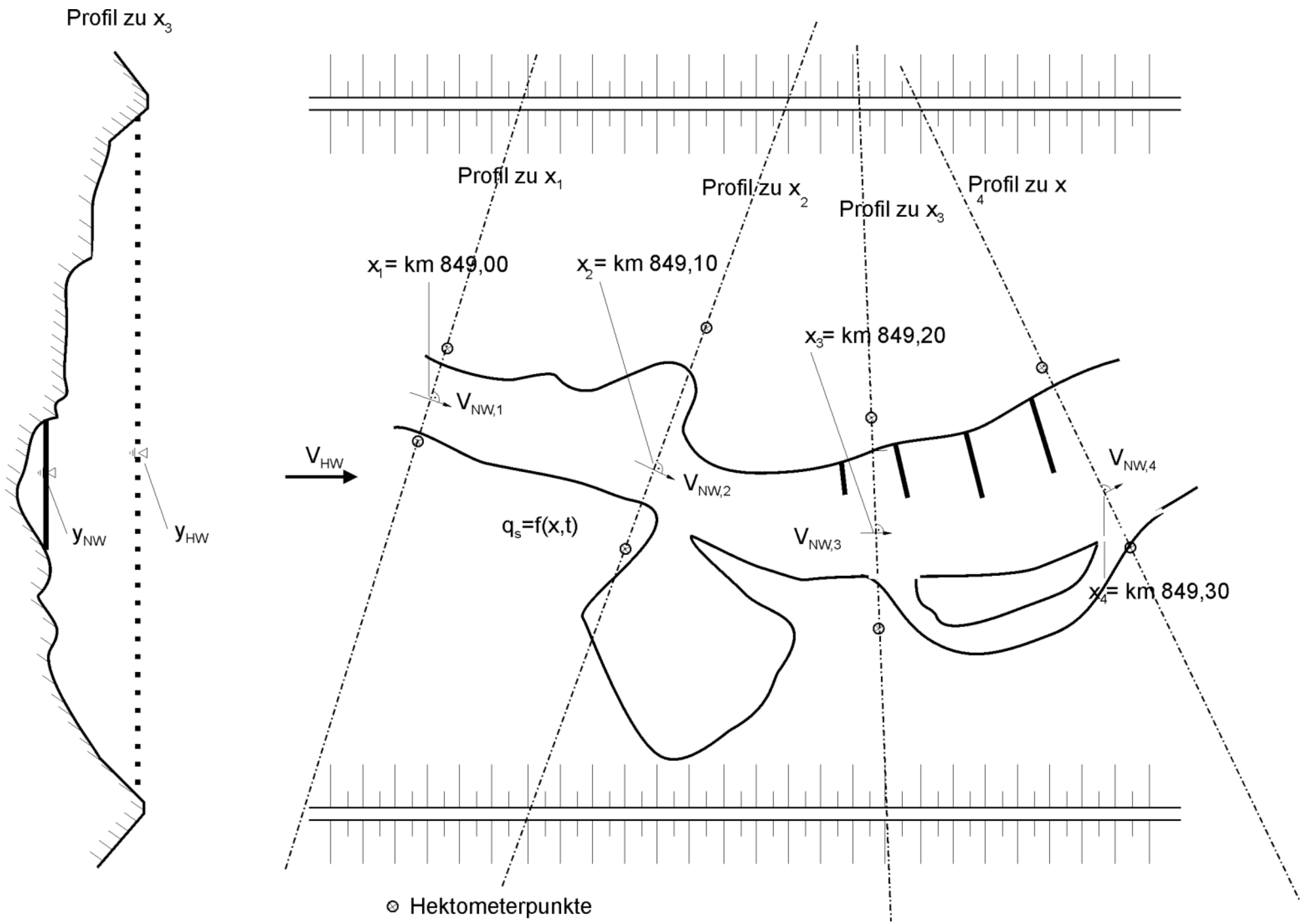
Esquematização



Fonte: Cunge et al., 1980

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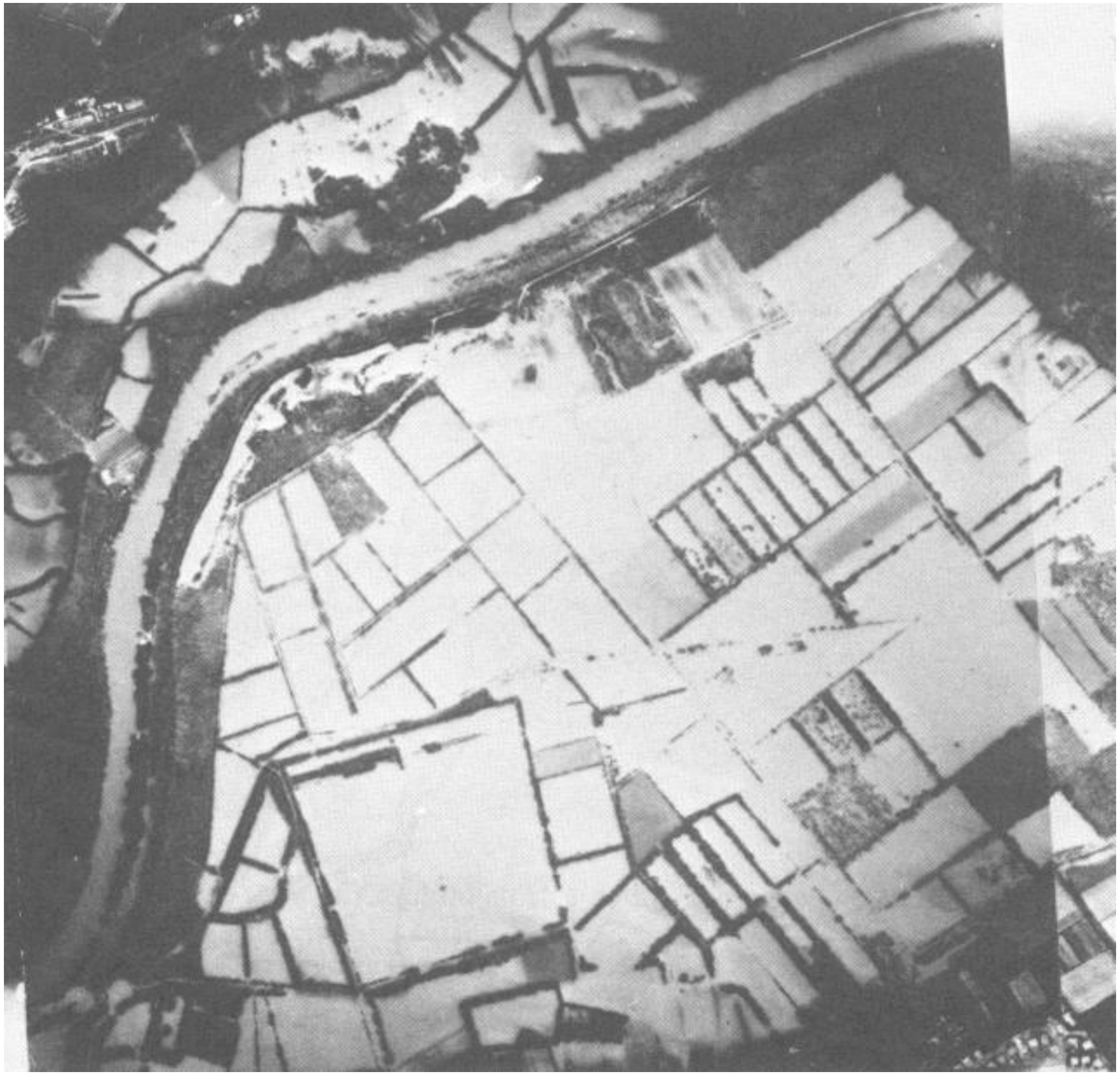

Fonte: Cunge et al., 1980

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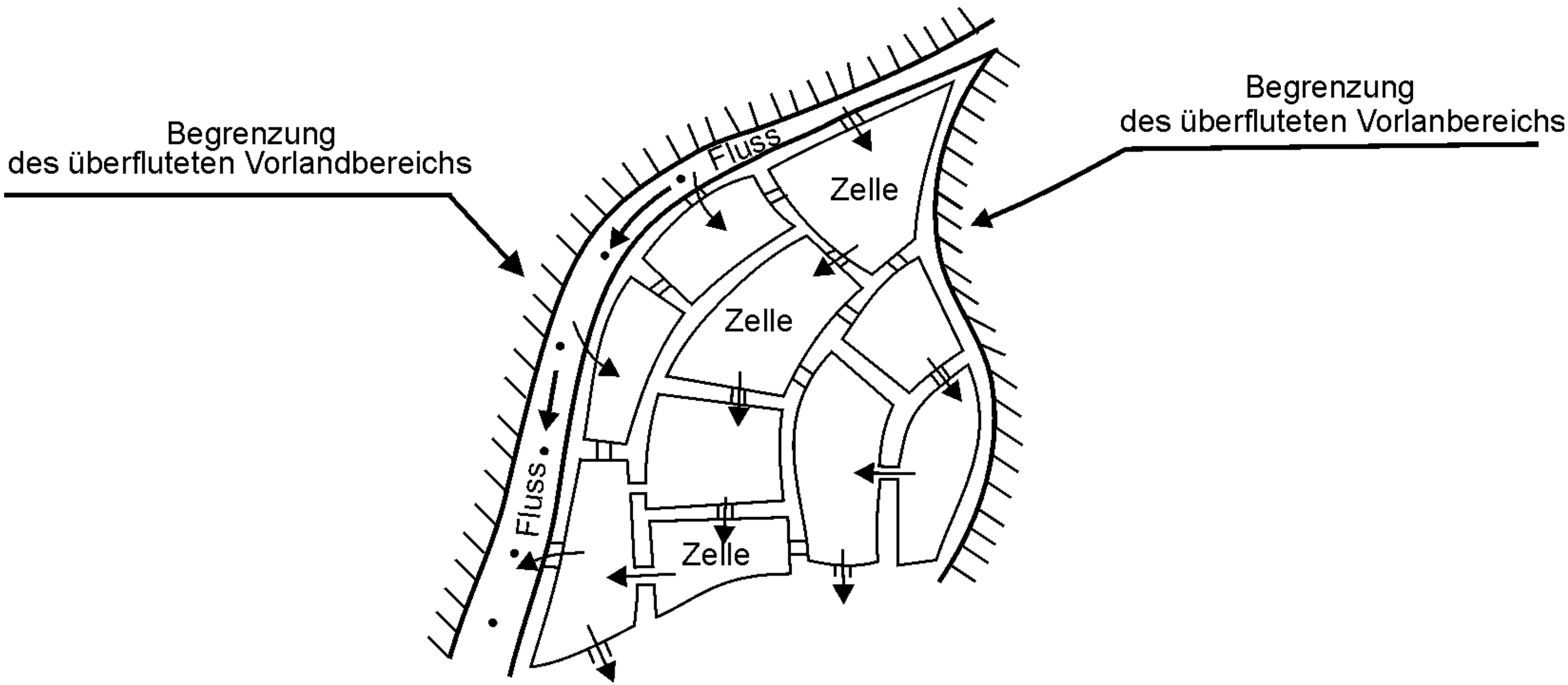

$$S_i(Y_i)\frac{\mathrm{d}Y_i}{\mathrm{d}t} = \sum_{\mathrm{k}} Q_{i,k}(Y_i, Y_k)$$

Fonte: Cunge et al., 1980

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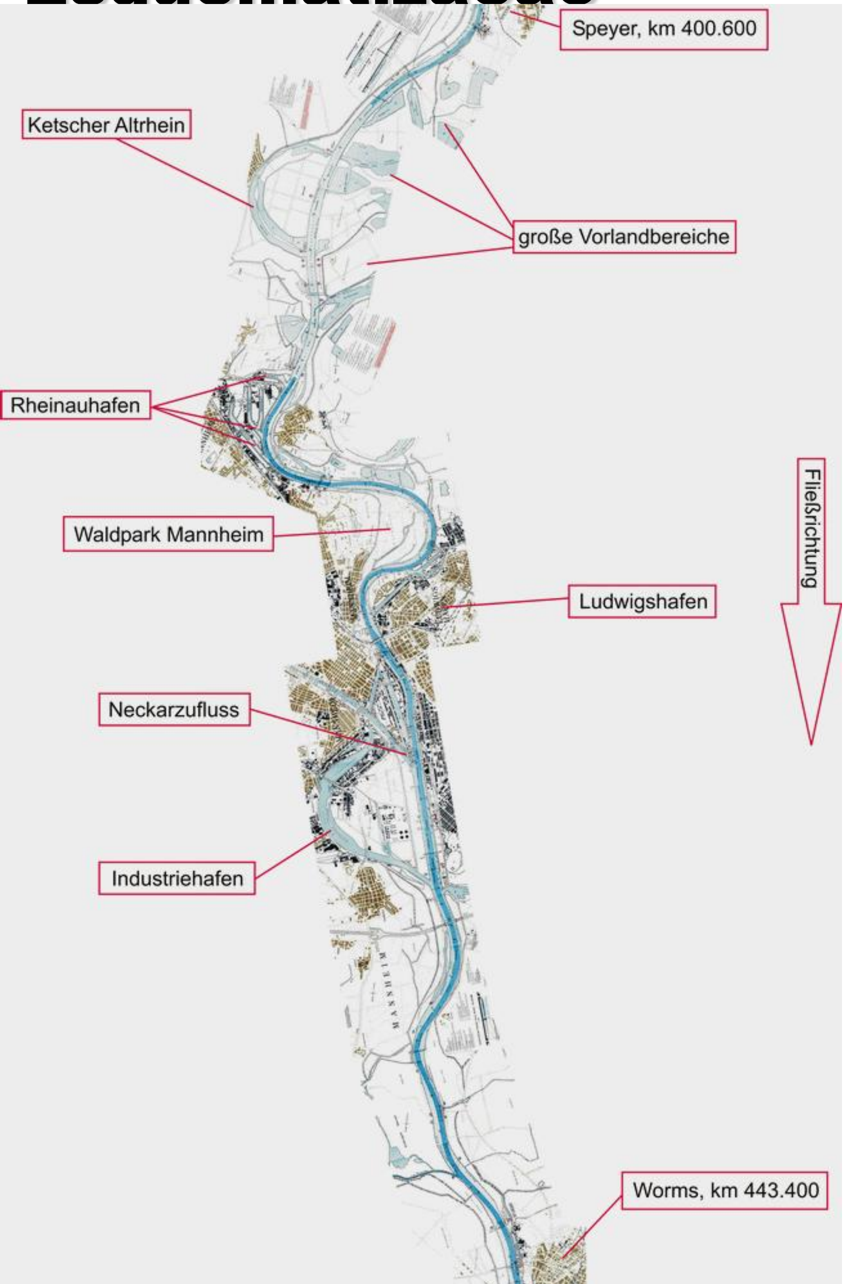

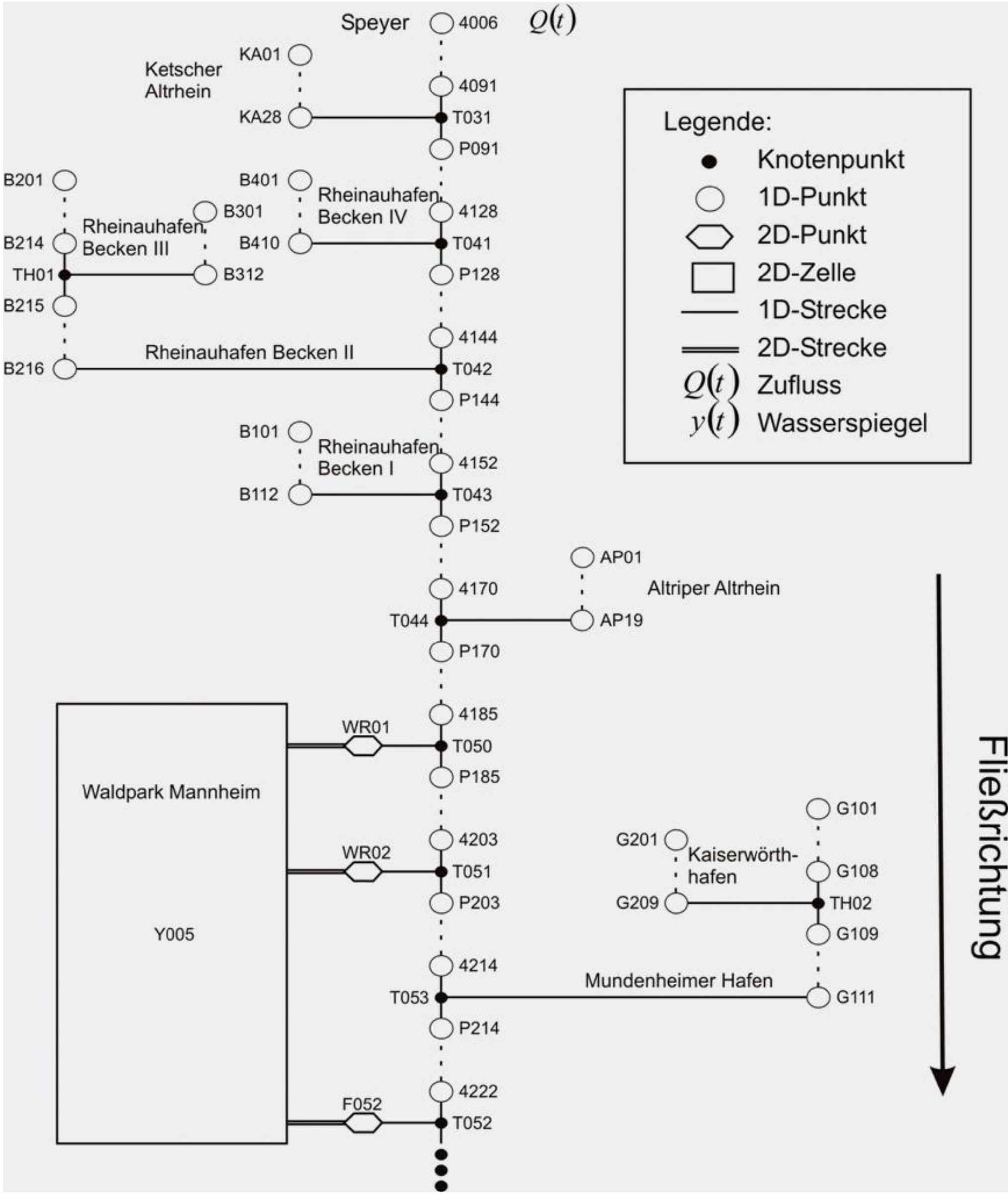

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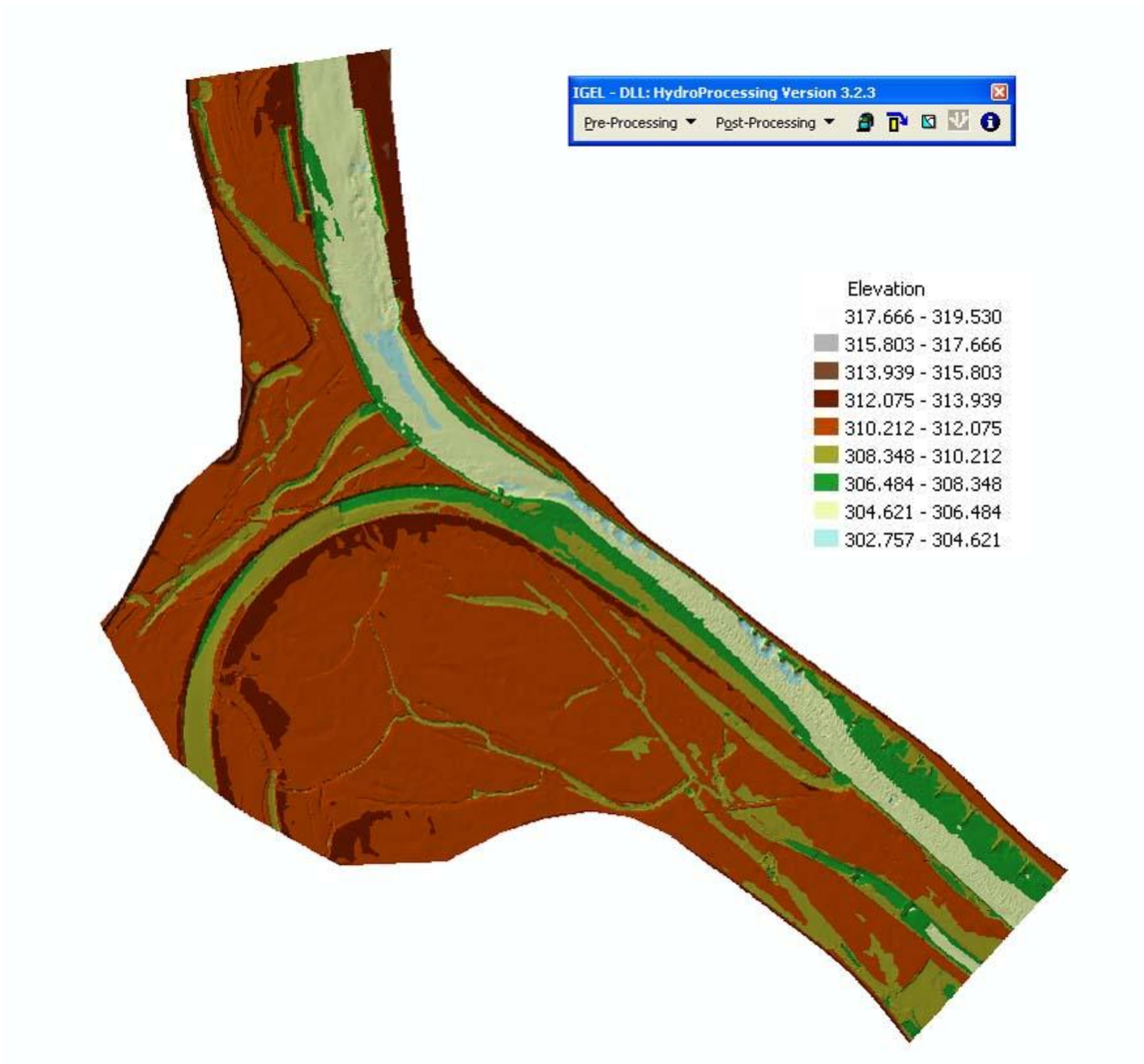
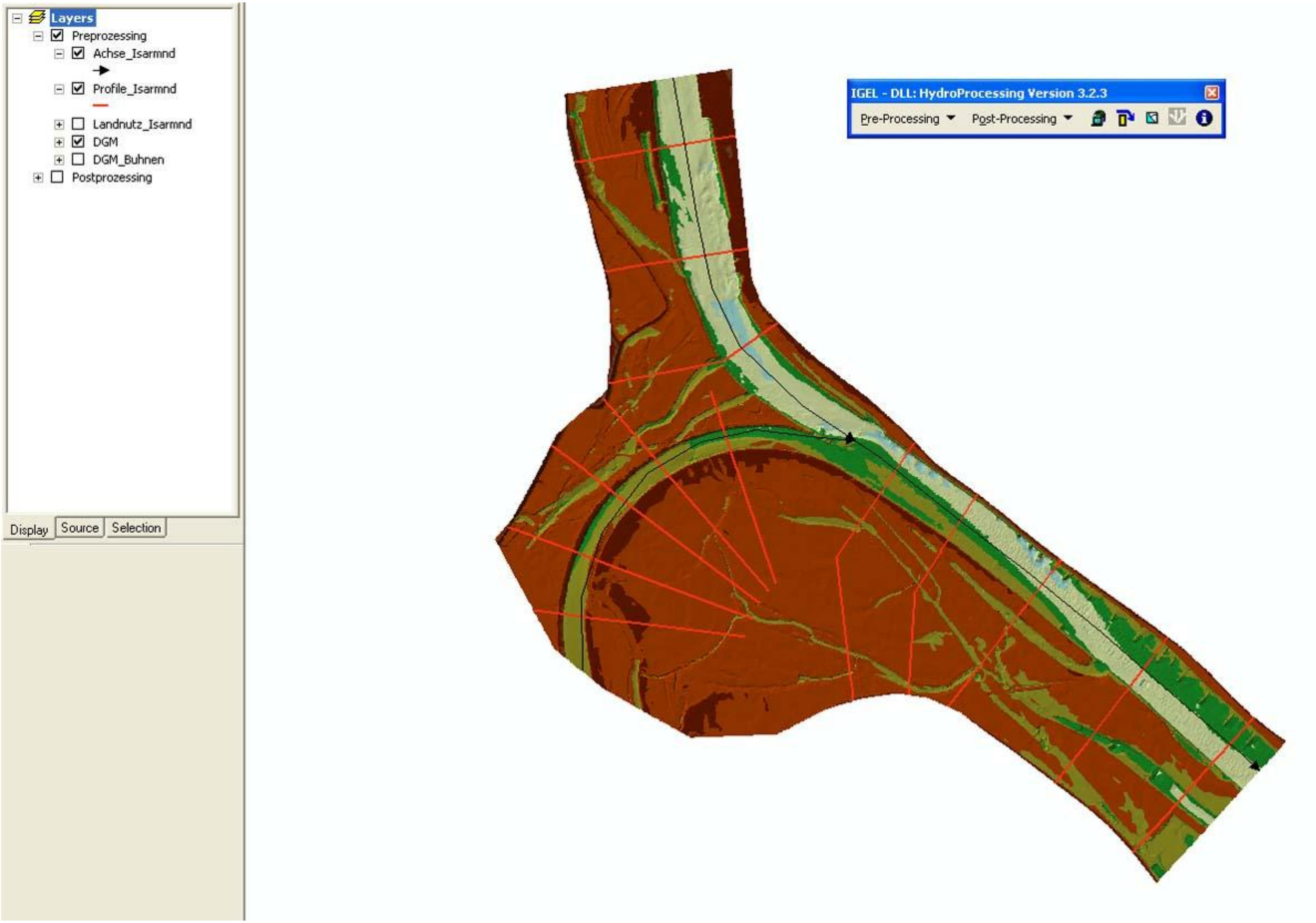
Topobatimetria



Eixo e perfil



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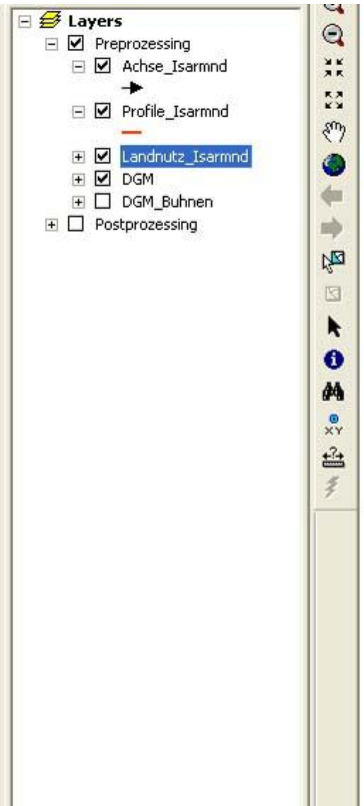
Uso do solo e rugosidade



OID	OBJART	Rauheit_St	Nutzung
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1	3402	17	Parallelwerke
2	3501	18	Altarme mit Anschluss
3	4101	25	Wiese
4	4102	10	Wald
5	4105	15	Sumpf mit Wald
6	4120	5	Anlandungszonen
7	5101	43	Fluss Ol (unterstrom)
8	5103	5	Schöpfwerk
9	5110	37	Fluss Ol (oberstrom)
10	5112	40	Altarme ohne Anschluss
11	5120	39	Fluss Ul
12	Buhnenfeld	40	Buhnen

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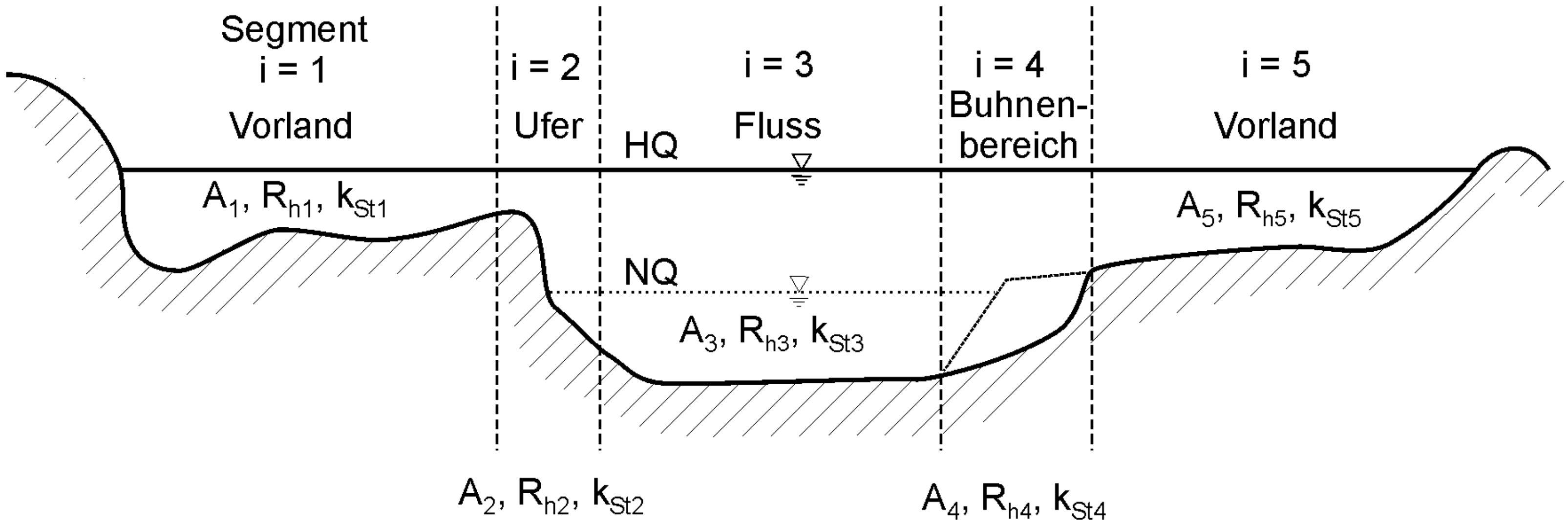
Esquematização



$$K_i = A_i R_{h,i}^{1/2} \sqrt{\frac{8g}{\lambda_i}}$$

$$K_i = A_i \, R_{h,i}^{2/3} k_{St,i}$$

$$Q = \sum_i^N Q_i = \sum_i^N K_i \sqrt{I_e} = K \sqrt{I_e}$$

ou

$$I_e = Q^2/K^2$$

$$v_i = K_i / A_i \, I_e^{0.5}$$

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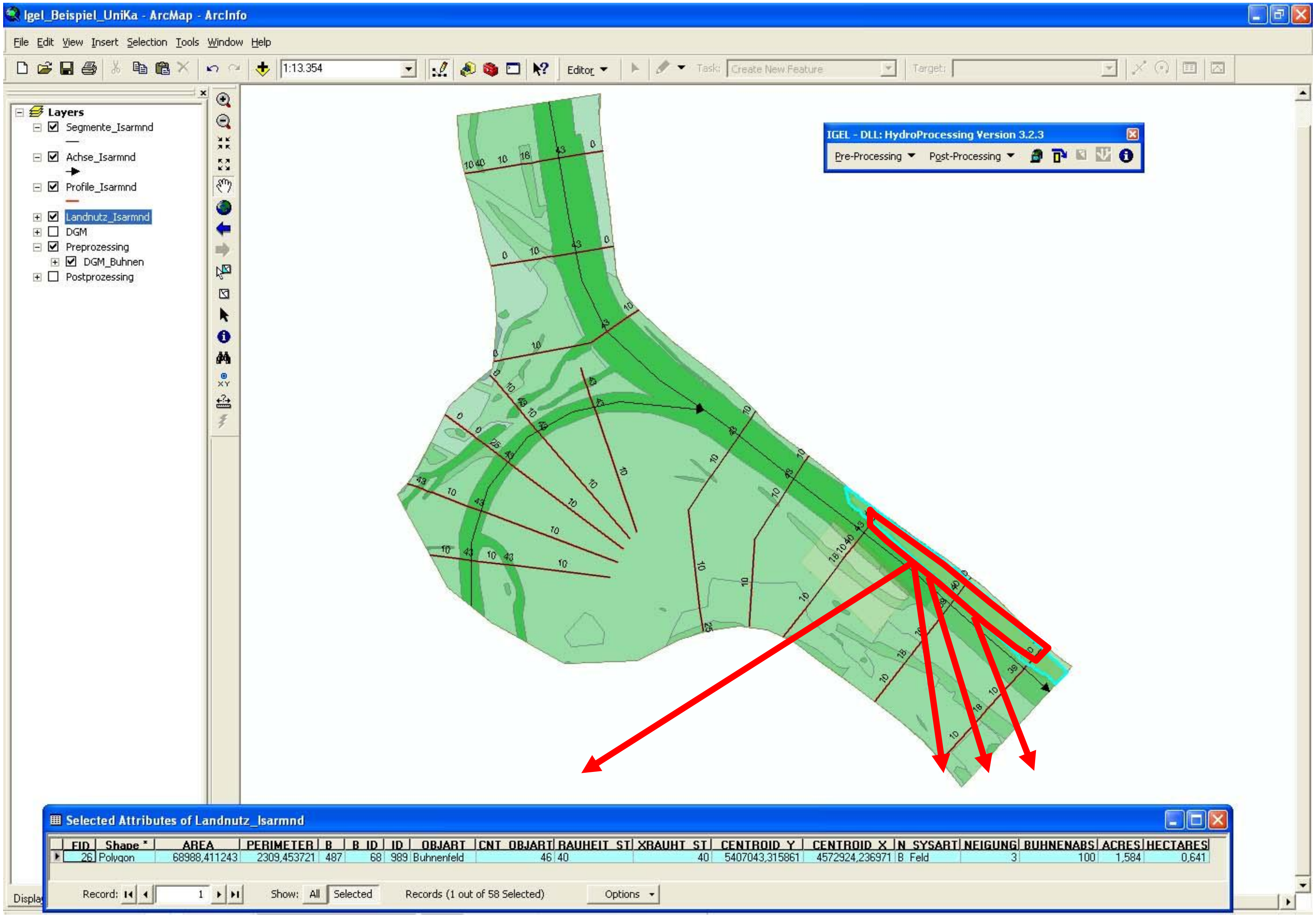
Espigoes



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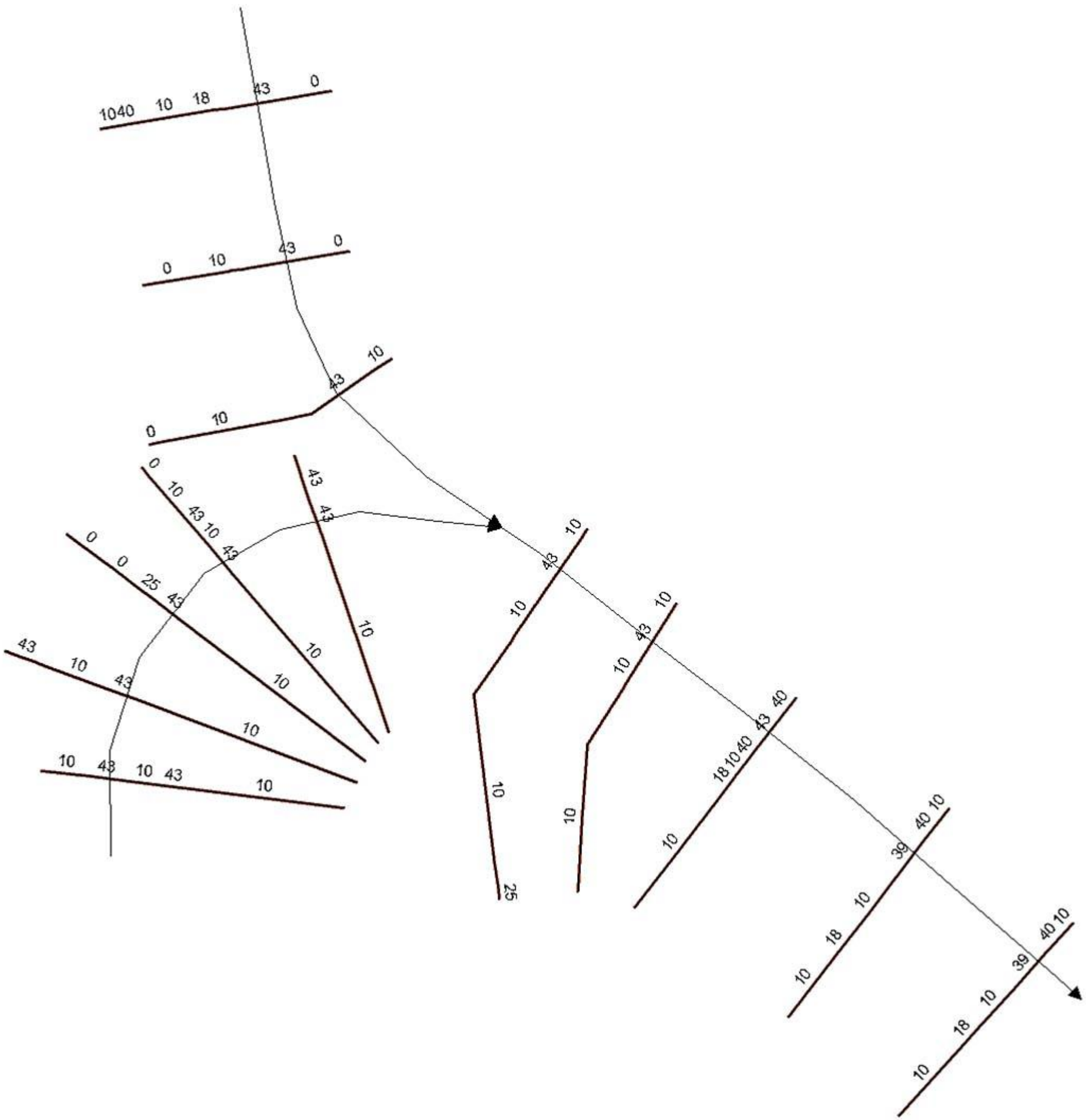
Modelo



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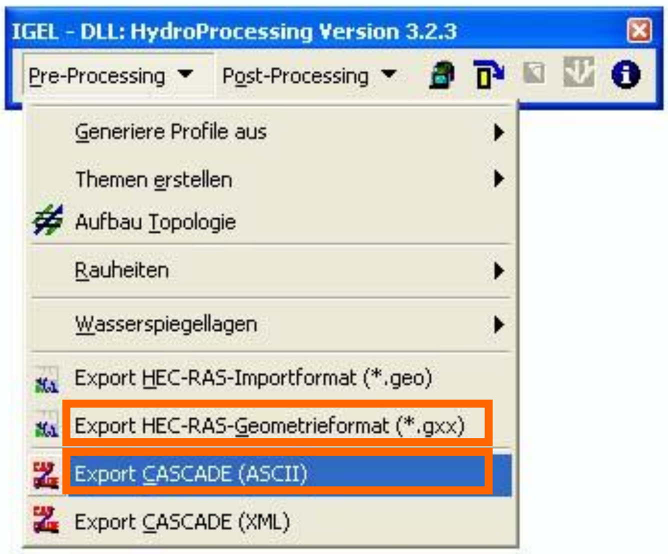

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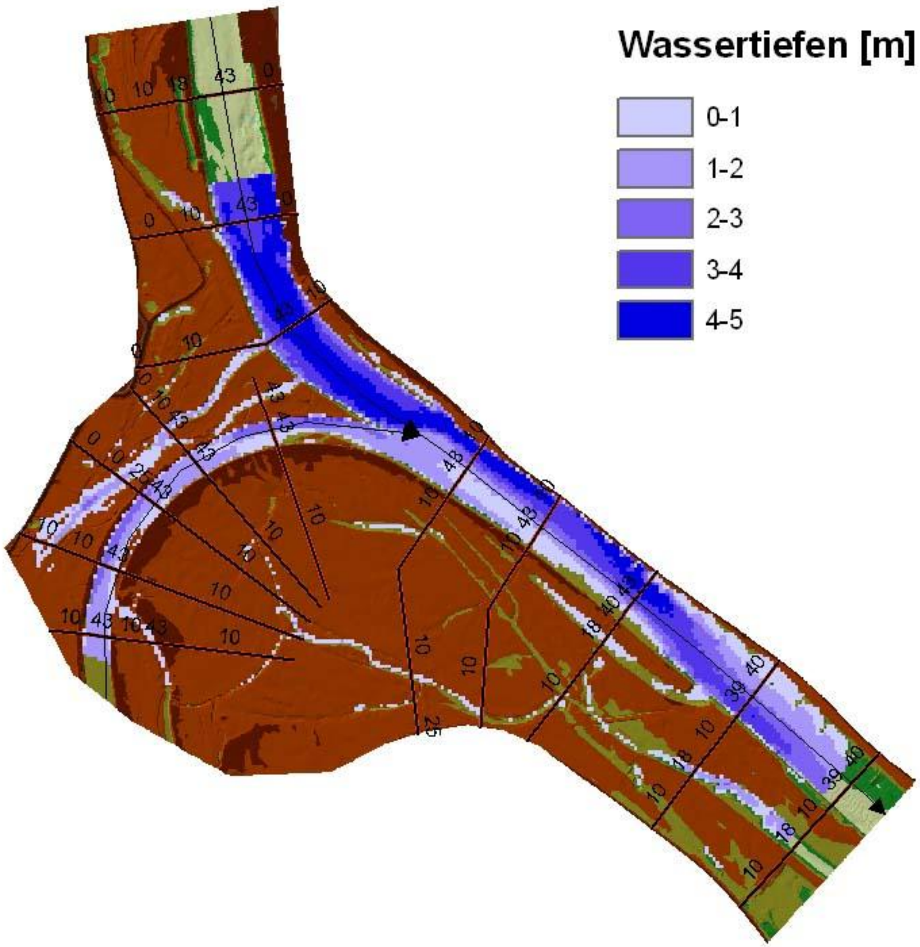
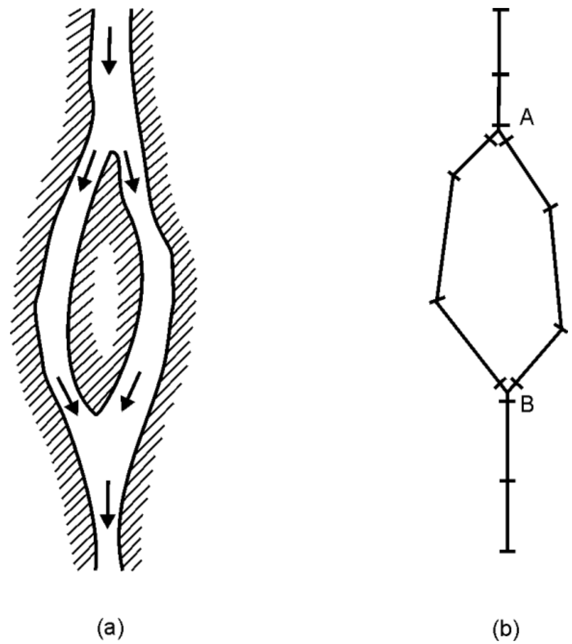
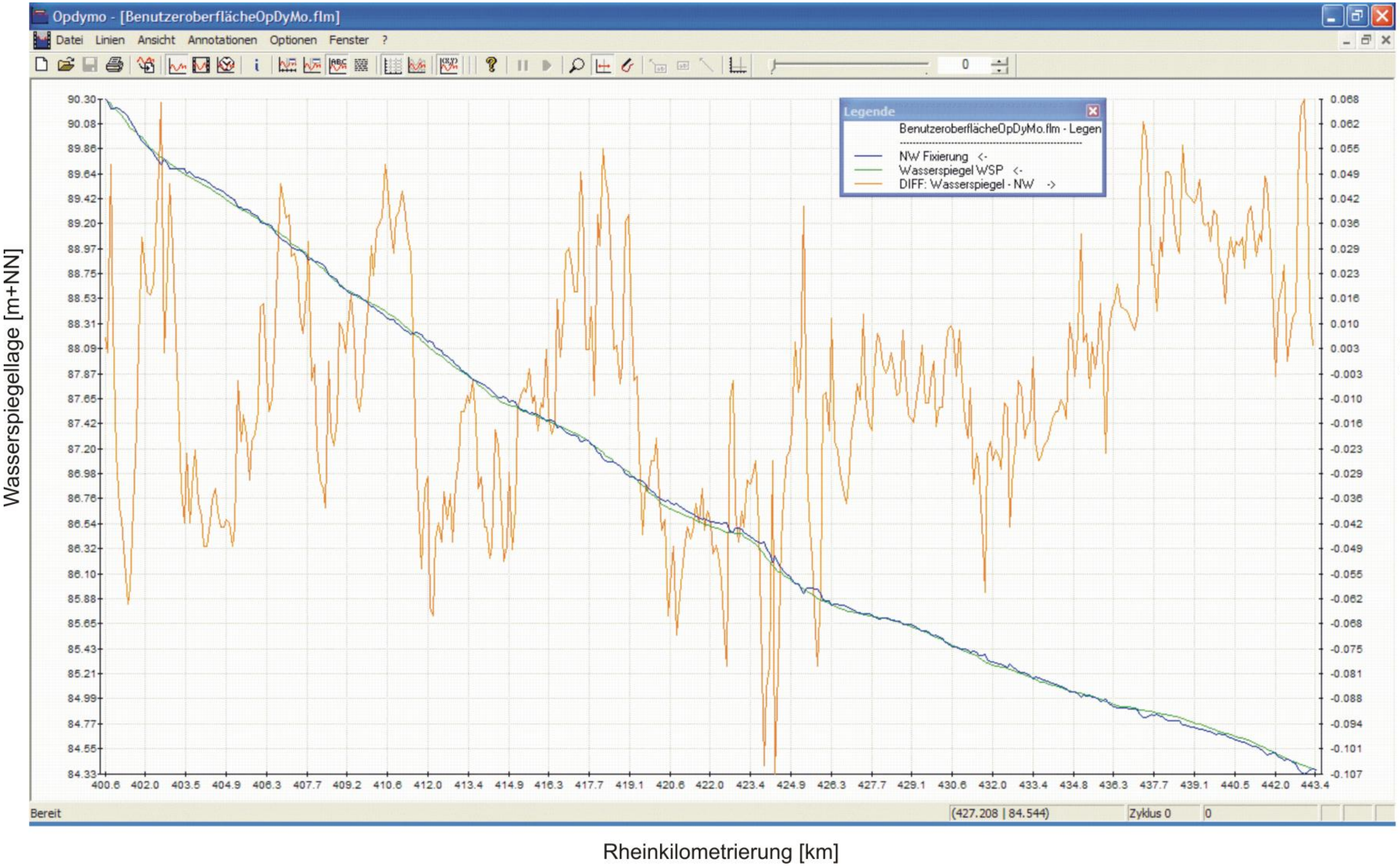
Modelo





Fonte: Cunge et al., 1980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Datei Linien Ansicht Annotationen Optionen Fenster ?
Legende
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Wasserspiegel WSP <-
DIFF: Wasserspiegel - NW ->
Wasserspiegellage [m+NN]
Differenz [m]
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Referencias

- Lista de livros recomendados sobre Hidráulica Fluvial: www.iahr.net --> E-library --> Ressources --> River Engineering Textbook list
- Graf, W.H. (1998). Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry. In collaboration with M.S. Altinakar, John Wiley and Sons, England, 681 pages [ISBN 0-471-97714-4] (capitulo de transporte de sedimentos online)
- Gerhard H. Jirka, Cornelia Lang. 2009. Einführung in die Gerinnehydraulik. Universitätsverlag Karlsruhe. ISBN: 978-3-86644-363-1. http://digbib.ubka.uni-karlsruhe.de/volltexte/1000011374
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