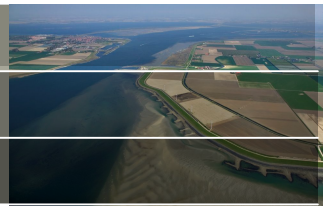

WANDA
Deltares
Wanda 4 Liquid

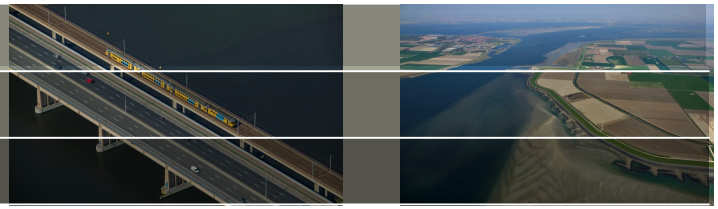
Wanda 4 Liquid

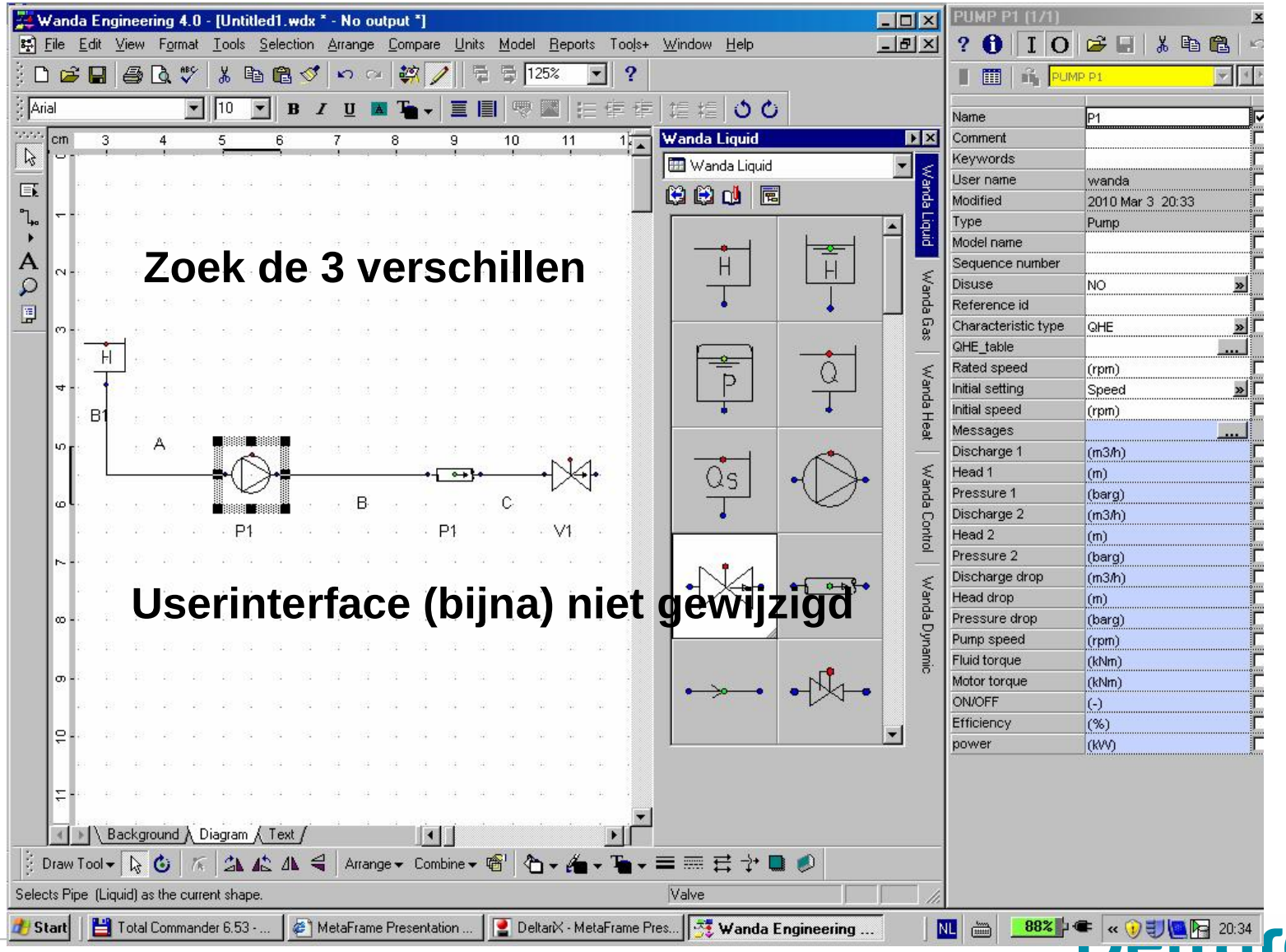


- Wat is nieuw
- Wat is veranderd
- Wat is ongewijzigd

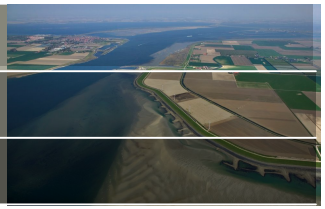
Deltares

Wanda 4 Liquid - GUI

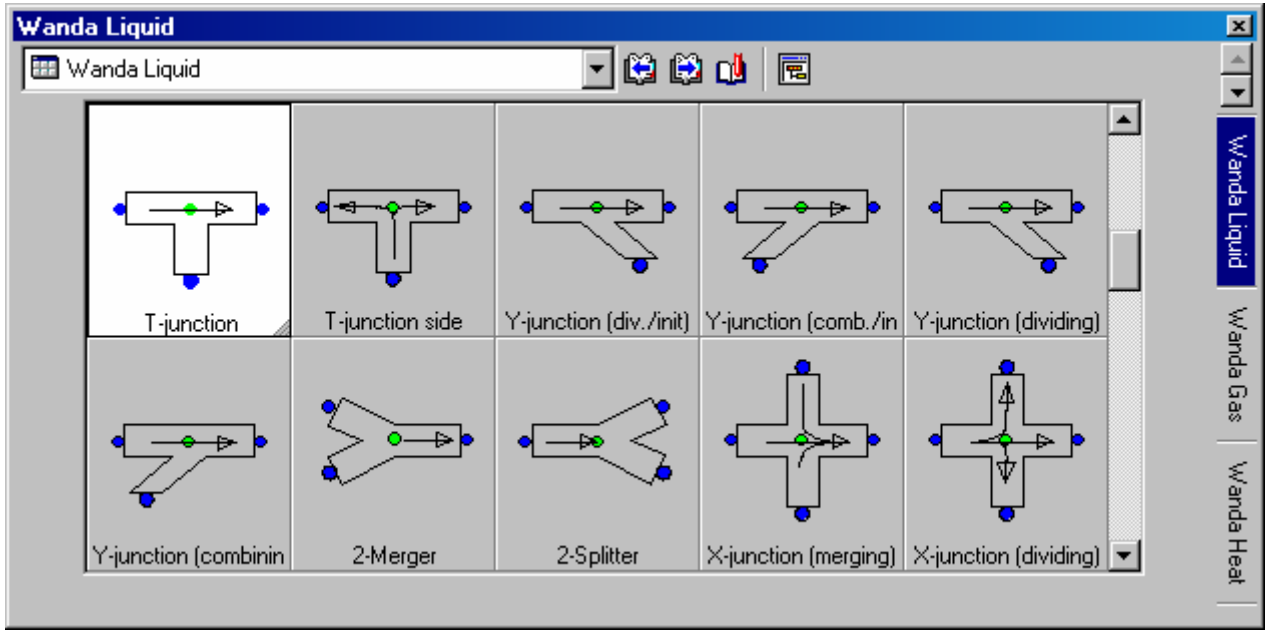


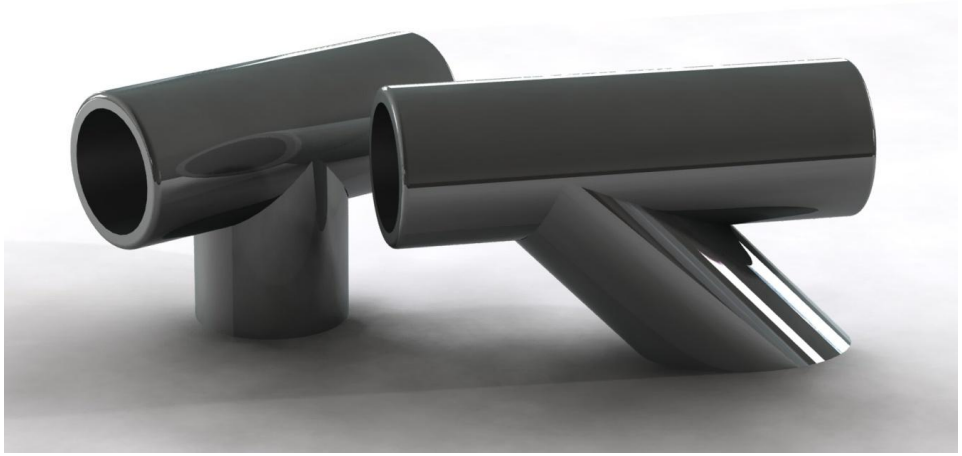


Wanda 4 Liquid - nieuw



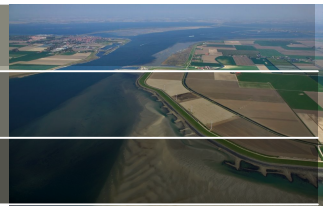
3 en 4 node componenten





Deltares

Wanda 4 Liquid - nieuw



3 en 4 node componenten

- Complex weerstandsmodel
- Locale verliezen afhankelijk van oppervlakte verhouding en debietverhouding
- Formules en tabellen in handboeken (Idelchik, Miller)

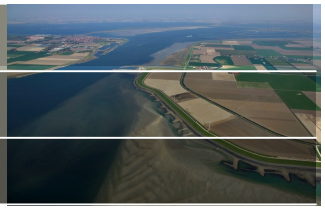
In WANDA 3 in feite niet correct te berekenen (iteratief bepalen)

In WANDA 4 correcte weerstandsberekening

- Snel
- In tijdsimulatie continue herbepaling coefficienten o.b.v. actuele Q’s

Deltares

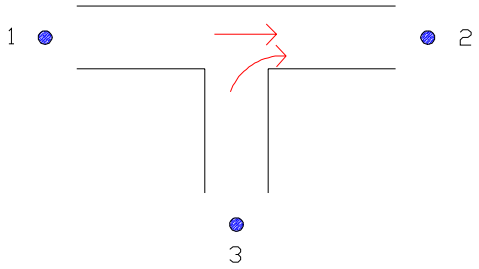
T – Junction

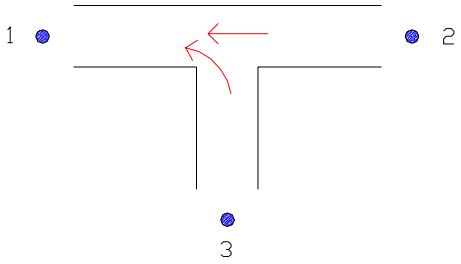


Positive flow

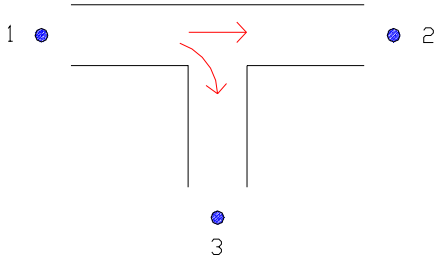
Negative flow

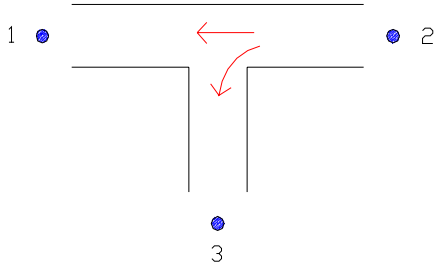
1) *COMBINING*



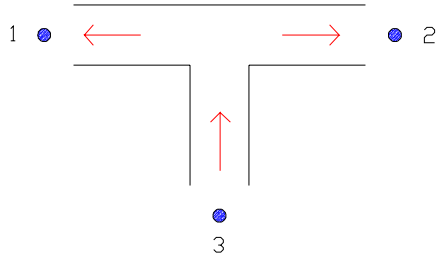


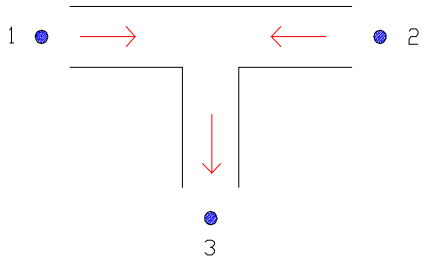
2) *DIVIDING*





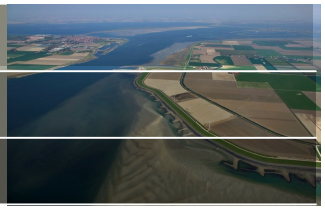
3) *UNKNOWN*





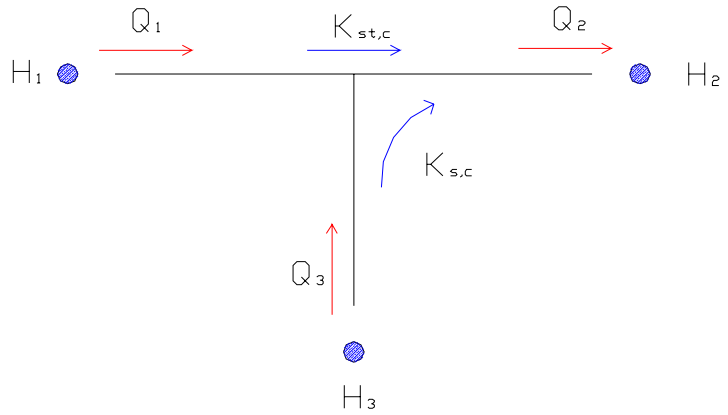
Deltares

T – Junction – combining flow



POSITIVE FLOW

Straight branch *Combined branch*



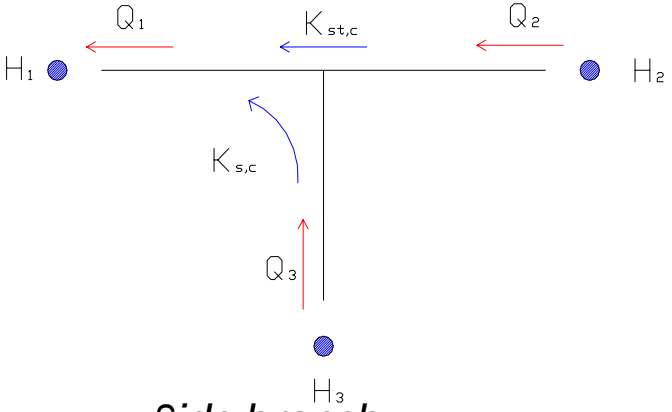
Side branch

Continuity equation:
- $Q_1 + Q_3 = Q_2$

Head loss:
- $H_1 – H_2 = K_{st} (w^2_2/2g)$
- $H_3 – H_2 = K_s (w^2_2/2g)$

NEGATIVE FLOW

Combined branch *Straight branch*



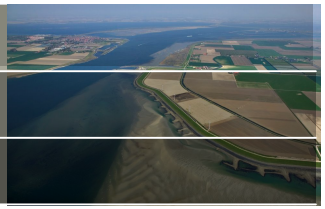
Side branch

Continuity equation:
- $Q_2 + Q_3 = Q_1$

Head loss:
- $H_2 – H_1 = K_{st} (w^2_1/2g)$
- $H_3 – H_1 = K_s (w^2_1/2g)$

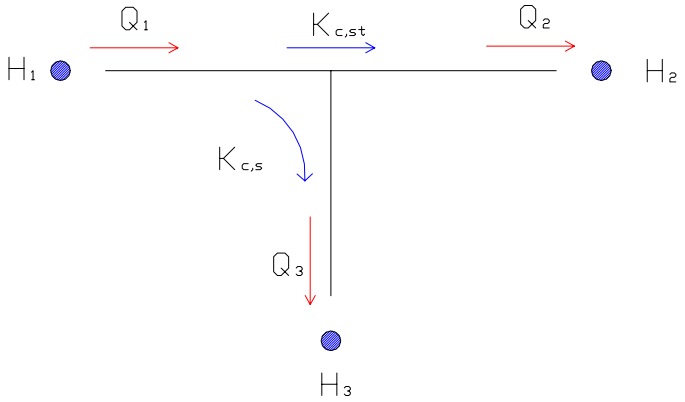
Deltares

T – Junction – Dividing flow



POSITIVE FLOW

Combined branch *Straight branch*



Side branch

Continuity equation:

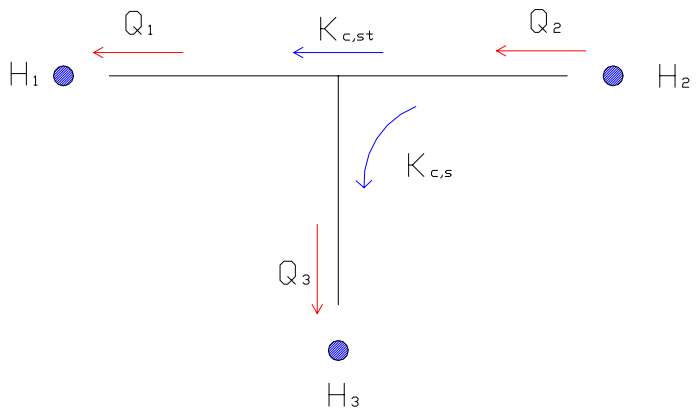
- $Q_2 + Q_3 = Q_1$

Head loss:

- $H_1 – H_2 = K_{st} (w^2_1/2g)$
- $H_1 – H_3 = K_s (w^2_1/2g)$

NEGATIVE FLOW

Straight branch *Combined branch*



Side branch

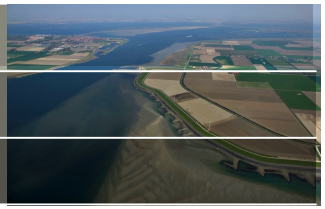
Continuity equation:

- $Q_1 + Q_3 = Q_2$

- $H_2 – H_1 = K_{st} (w^2_2/2g)$
- $H_2 – H_3 = K_s (w^2_2/2g)$

Deltares

T – Junction - verliescoefficienten



IDELCHIK HANDBOOK

1. COMBINING

Straight passage: $$K_{st} \approx 1.55\frac{Q_s}{Q_c} - \left(\frac{Q_s}{Q_c}\right)^2$$

Side passage: $$K_s = A\left[1 + \left(\frac{Q_s}{Q_c}\frac{A_c}{A_s}\right)^2 - 2\left(1 - \frac{Q_s}{Q_c}\right)^2\right]$$

2. DIVIDING

Straight passage: $$K_{st} = \tau_{st} \cdot \frac{Q_s}{Q_c}$$

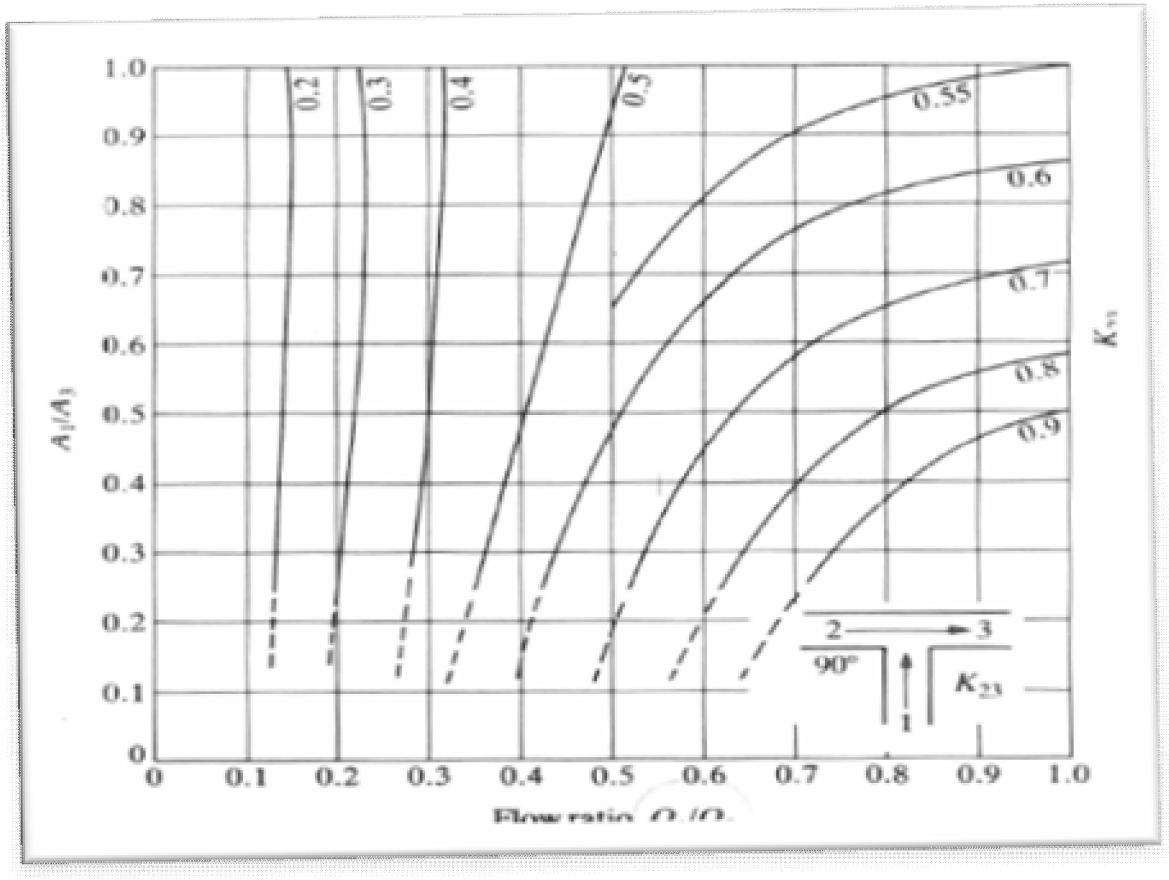
Side passage: $$K_s = A'\left[1 + \left(\frac{Q_s A_c}{Q_c A_s}\right)^2\right]$$

- A_s = Area of the side branch;
- A_c = Area of the combined branch;
- Q_s = discharge in the side branch;
- Q_c = discharge in the combined branch;
- A, A' and τ_{st} functions of Q_s,Q_c,A_s,A_c

Deltares

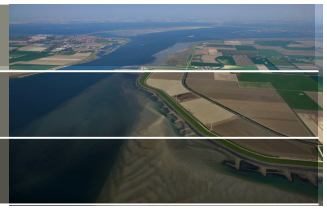
T – Junction - verliescoefficienten

MILLER HANDBOOK

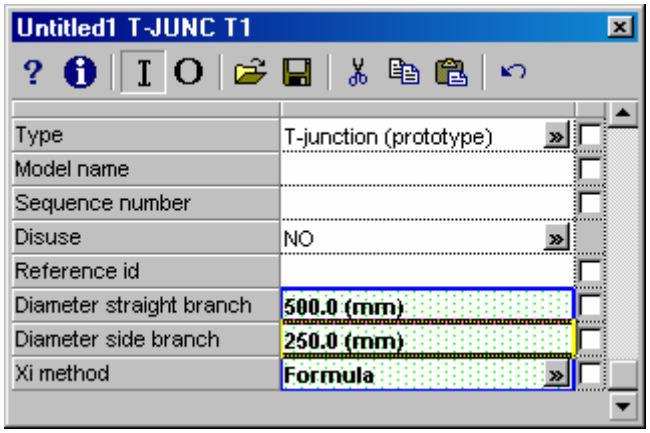


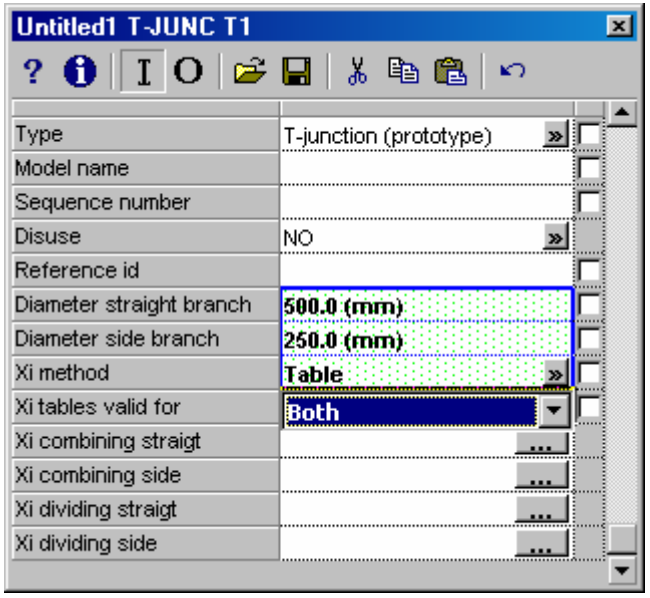
Deltares

T – Junction



Invoerparameter: formule / tabel (Idelchik of Miller of andere bron)

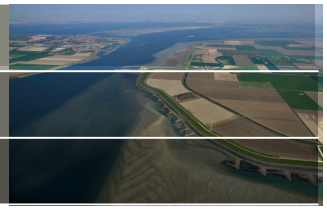




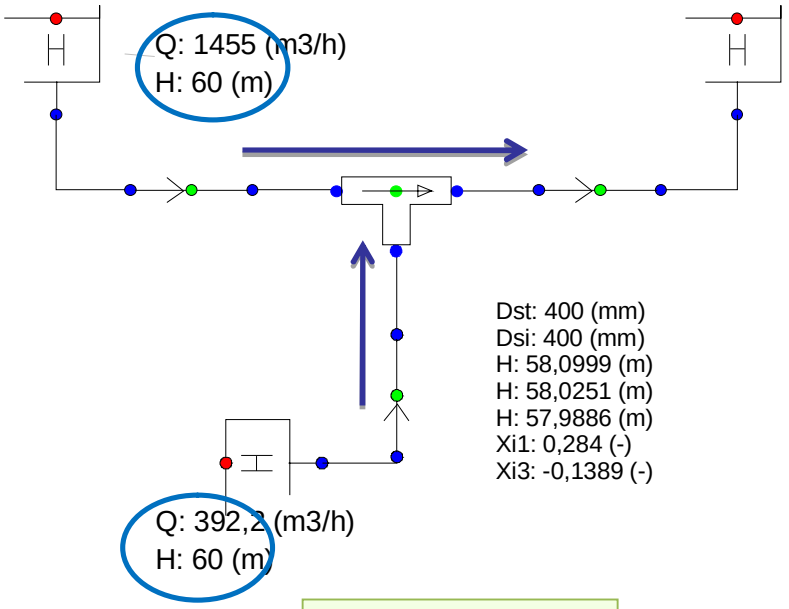
Tabel: Combining / Dividing / Both

Deltares

T – Junction - test resultaten

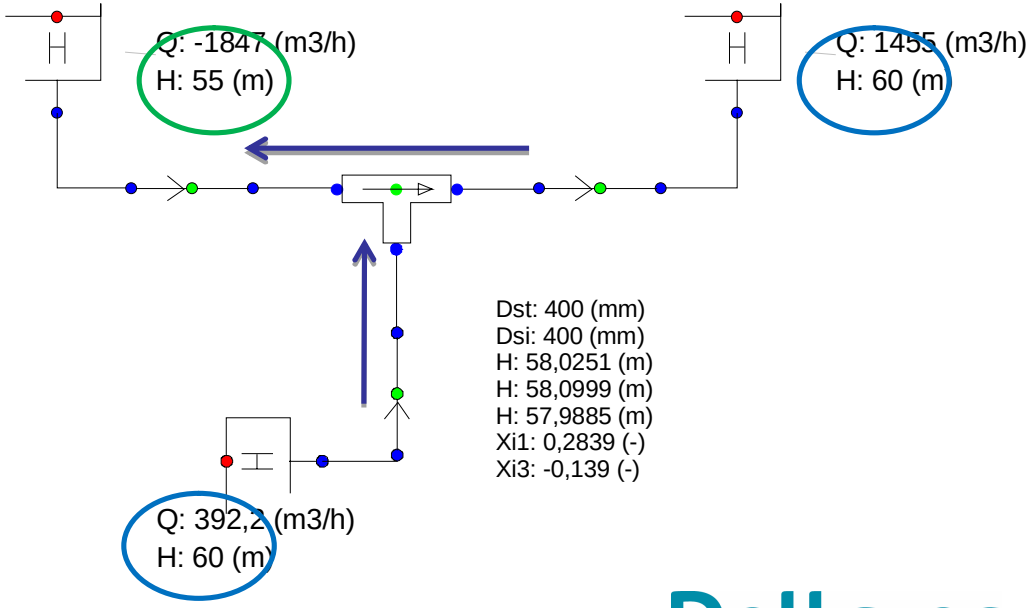


Positive flow



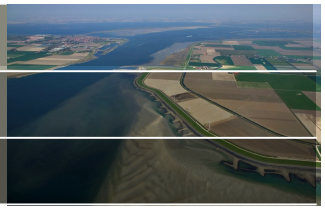
$K_{straight} = 0,28$
$K_{side} = 0,139$

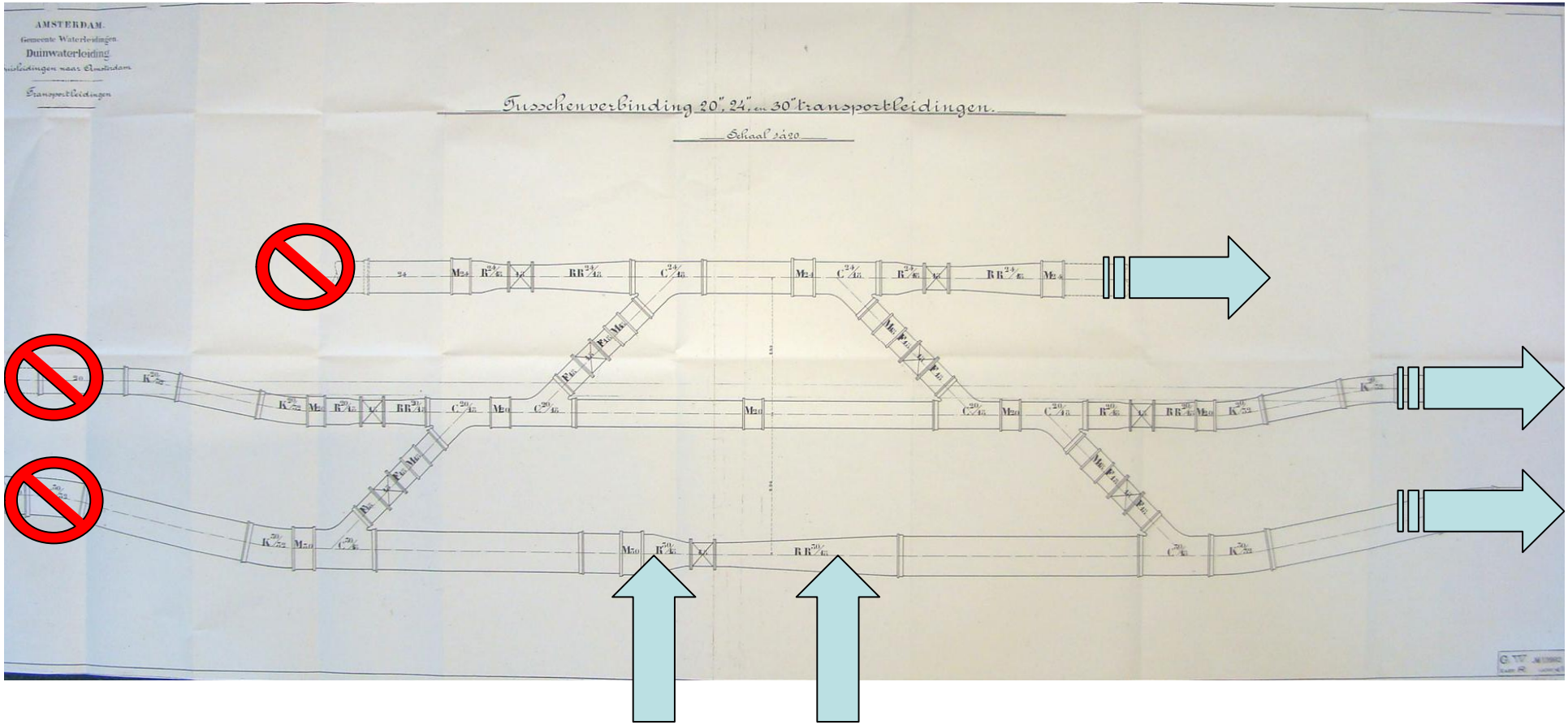
Negative flow



Deltares

T- Y – Junction praktijkgeval

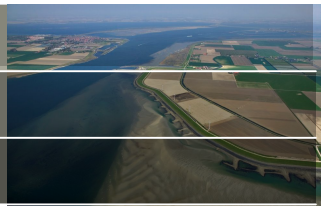




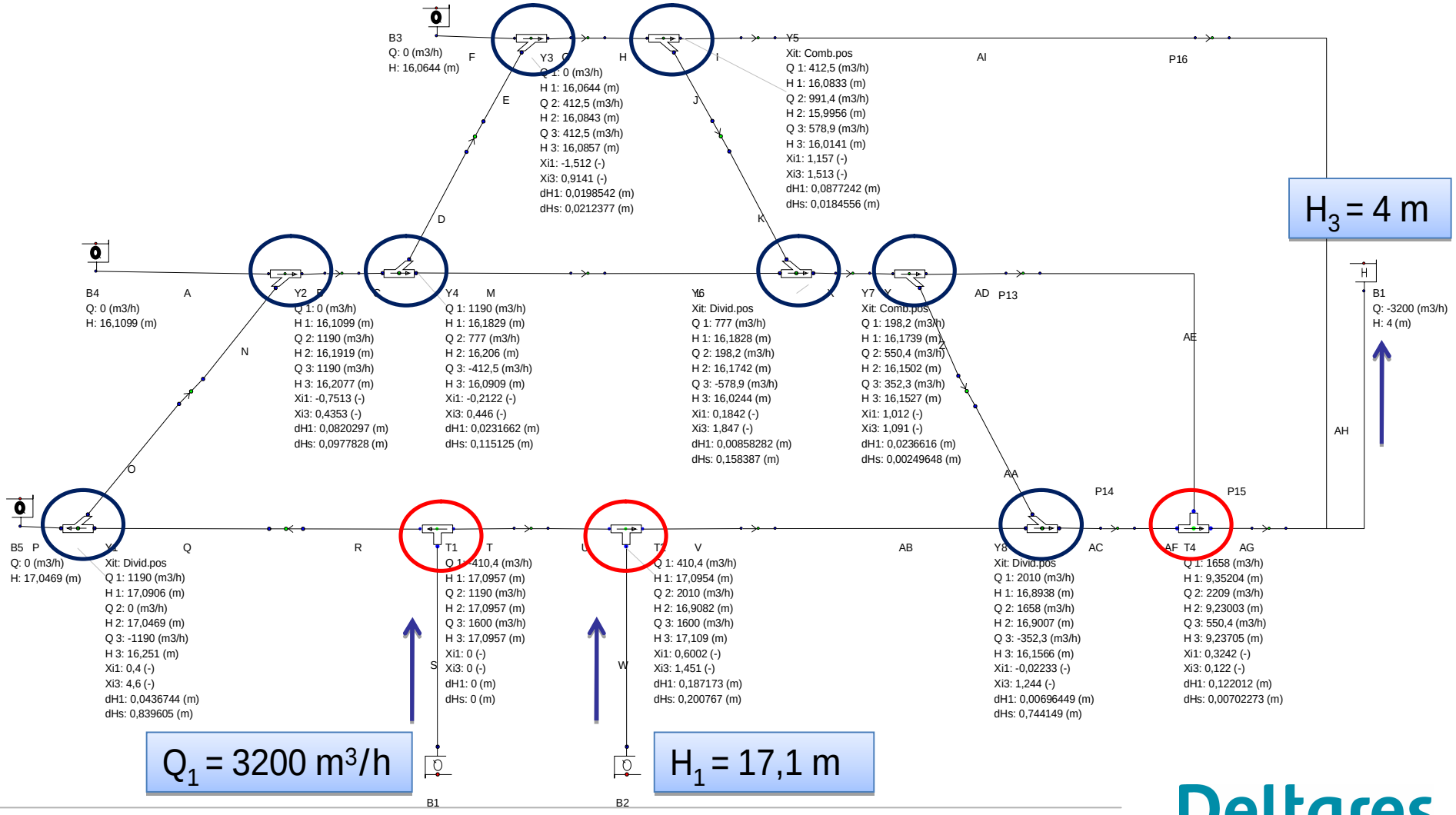
Nieuwe aansluitingen

Deltares

T- Y – Junction praktijkgeval

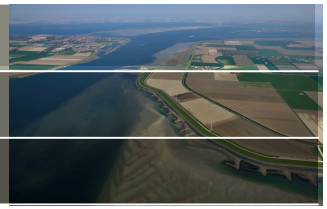


$H_2 = 16$ m → DH = 1,1 m



Deltares

Wanda 4 Liquid – “all in one” PIPE



Wanda 3 diverse “waterslag” PIPE’s:

PIPE – rough	input: k-waarde
PIPE – lambda	input: lambda
PIPE – xi-losses	input: k-waarde + tabel extra verliezen ksi
PIPE – eq.D	input: k-waarde + tabel extra verliezen L_eqD

t.b.v. EPANET import

PIPE – Epanet	keuze uit diverse weerstandsmodellen:
	Darcy-Weisbach (k-waarde)
	Chezy-Manning
	Hazen-Williams

t.b.v. adviesproject:

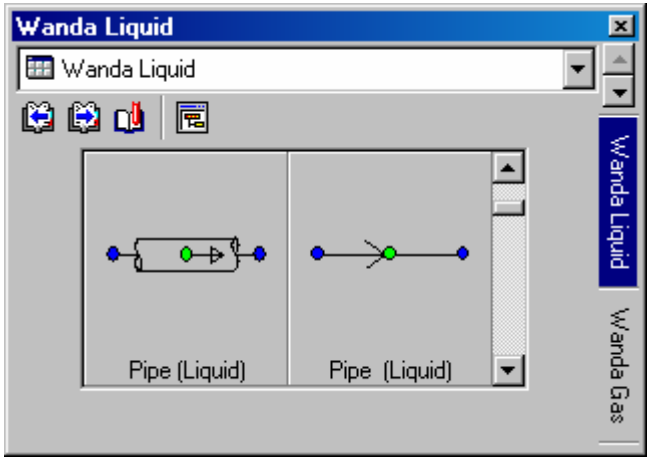
PIPE met bi-directionele extra locale verlies (ksi)

Deltares

Wanda 4 Liquid – “all in one” PIPE

Alle PIPE’s vervangen door 1 nieuwe alles omvattend type

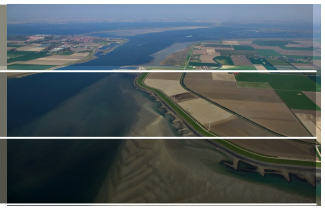
WENS: waterslag PIPE met rechthoekige doorsnede



Twee verschillende (maar vertrouwde) symbolen voor zelfde model

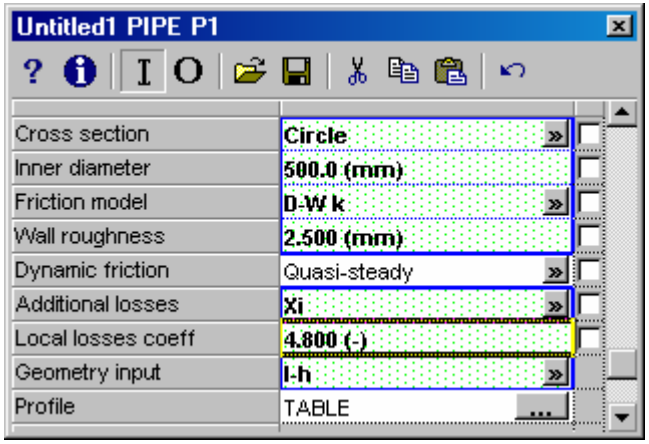
Deltares

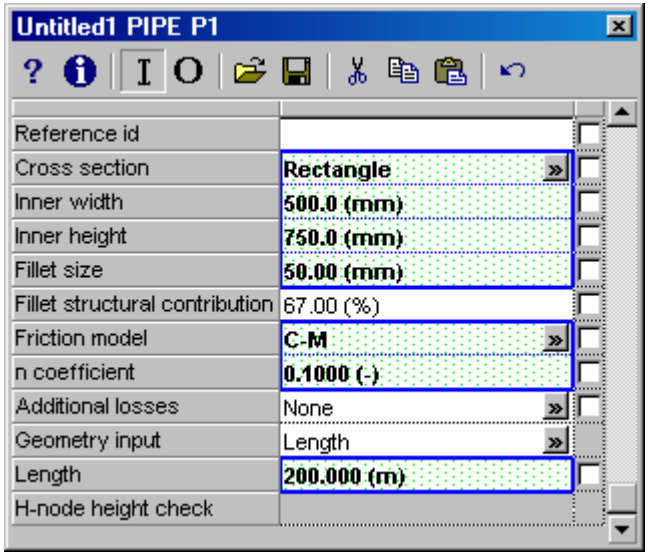
Wanda 4 Liquid – “all in one” PIPE



Keuze invoer m.b.v. drop-down list:

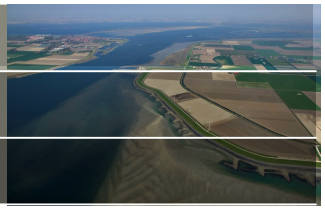
- Doorsnede:
  - **rond**
  - rechthoekig
- Wrijvingsmodel:
  - **Darcy-Weisbach k-waarde**
  - Darcy-Weisbach lambda-waarde
  - Chezy-Manning
  - Hazen- Williams





Deltares

Wanda 4 Liquid – “all in one” PIPE



Keuze invoer m.b.v. drop-down list (vervolg 2):

- Extra verliezen
  - **geen**
  - Xi waarde (onafh. stroomrichting)
  - Xi waarde Pos / Xi waarde Neg
  - Xi tabel
  - L_equivalente #D tabel
- Dynamic friction
  - **Quasi steady**
  - geen

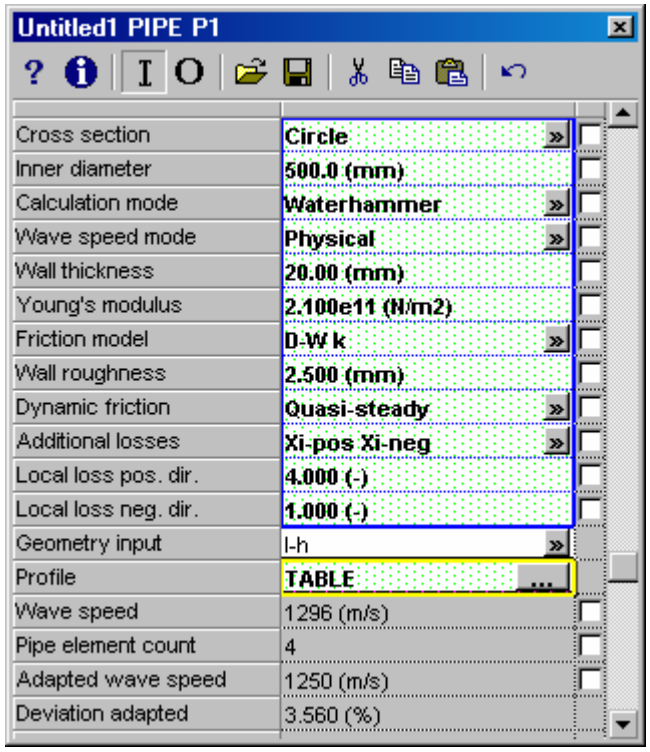
Deltares

Wanda 4 Liquid – “all in one” PIPE

Keuze invoer m.b.v. drop-down list (vervolg 3):

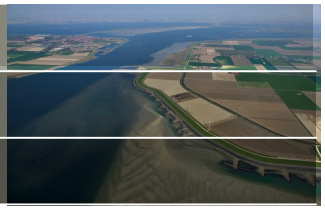
Alleen in Transient mode

- Calculation mode
  - **Waterhammer**
  - Rigid column
- Wave speed mode
  - **Physical**
  - Specified



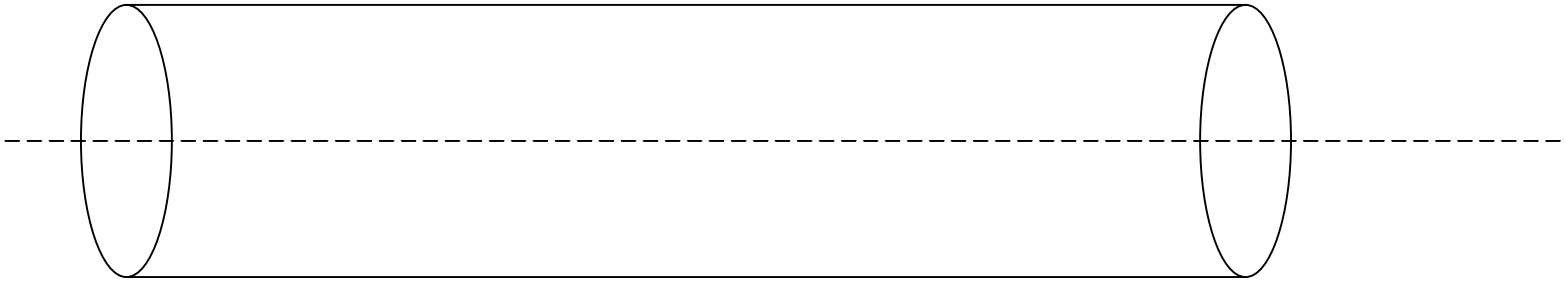
Deltares

Wanda 4 Liquid – “all in one” PIPE



Wijziging in geometry definitie / referentie hoogteligging:

Wanda 3.7	binnen bovenkant
Wanda 4	hartlijn

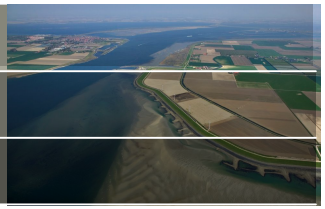


Voor cavitatiemodel is b.b.k. bepalend: hartlijn + ½ D

Min/Max pressure: t.o.v. hartlijn

Deltares

Wanda 4 Liquid – “all in one” PIPE

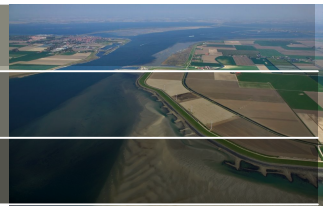


Alle WANDA 3.7 modellen (en ouder) worden automatisch geconverteerd naar de nieuwe PIPE

ingevoerde profielen worden ½ D naar beneden verschoven

Deltares

Wanda 4 Liquid – H-node types

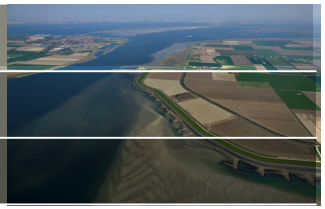


Meerdere type H-node:

- Standaard — invoer: elevation tbv Pressure bepaling
- Met demand: — extra invoer: Q of Q(t) tabel
  (ter vervanging van TAP)
- Init Head — tbv head specificatie in geisoleerde delen

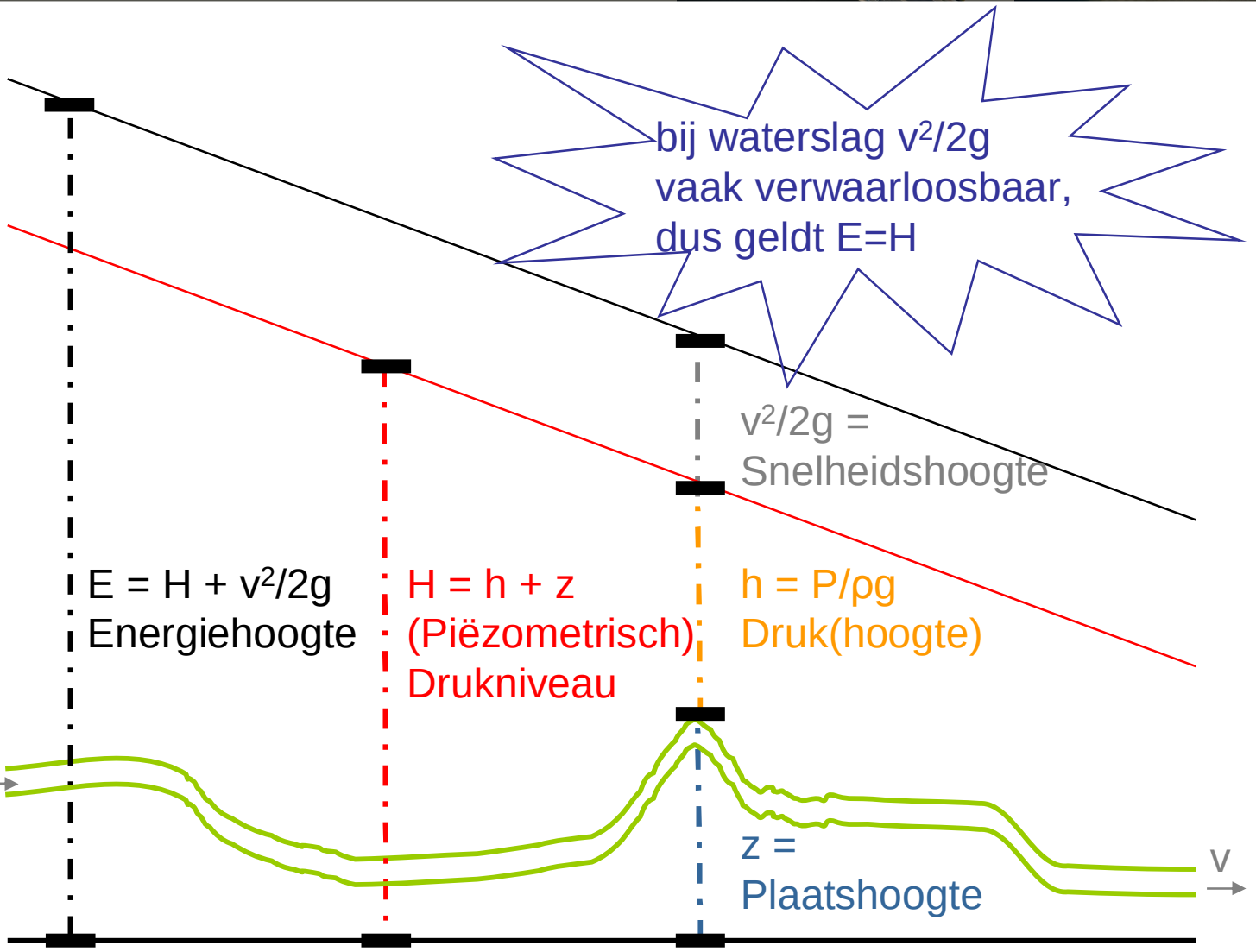
Deltares

Wanda 4 Liquid - snelheidshoogte



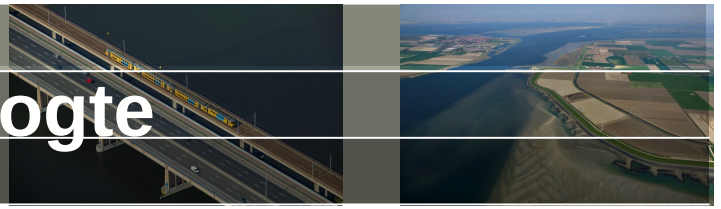
Energie Gradiënt

Hydraulische Gradiënt



Deltares

Wanda 4 Liquid - snelheidshoogte



In WANDA 4 wordt snelheidshoogte term **wel** in rekening gebracht

Orde grootte: $v = 1$ m/s $v^2/2g \approx$ 0,05 m

$v = 3$ m/s $v^2/2g \approx$ 0,46 m

Alleen voor die componenten waarbij een snelheid bekend is (dus bijvoorbeeld PUMP niet)

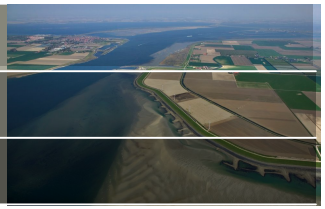
Gevolg: Pressure in WANDA 4 is klein beetje lager dan in WANDA3

(0,005 – 0,05 Bar ; 0,5 - 5 kPa)

HEAD berekening ONGEWIJZIGD

Deltares

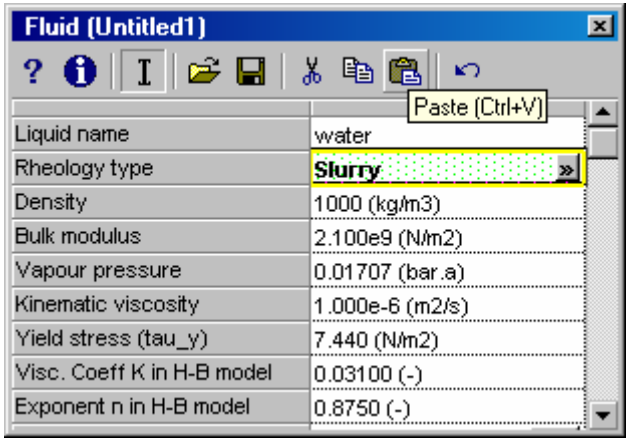
Wanda 4 Liquid – Fluid window



NIEUW (Optie): weerstandsmodel voor slurries
(Niet-Newtons gedrag)

Keuze in Fluid window: **Newtonian** / Slurry

I.g.v. Slurry: extra invoerparamterers voor Herschel-Bulkley model



Deltares

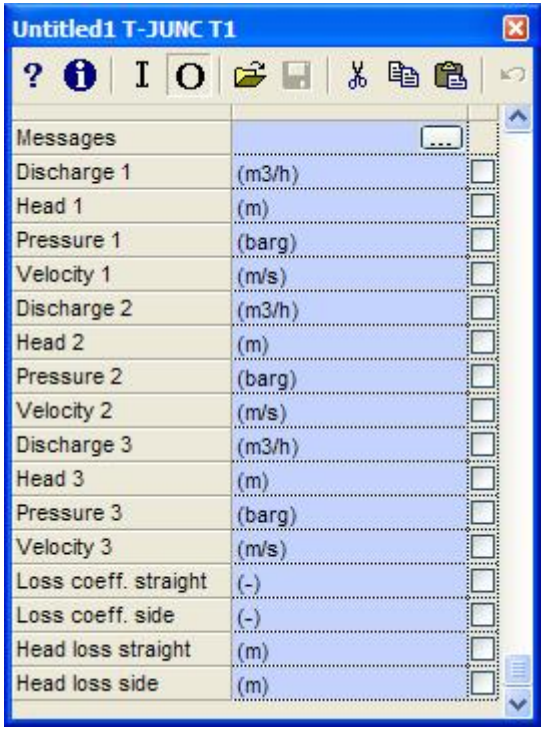
Wanda 4 Liquid – Output property

Veranderd:

Volgorde output propertie

Per connect node Q, H, P, v

(eerst primaire rekengrootheden,
daarna afgeleide rekengrootheden)



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