Deltares
Enabling Delta Life

Kwelvoorziening Perkpolder SeepCat

Bescherming van zoetwaterbel tegen lokale zeespiegelstijging

Perry de Louw

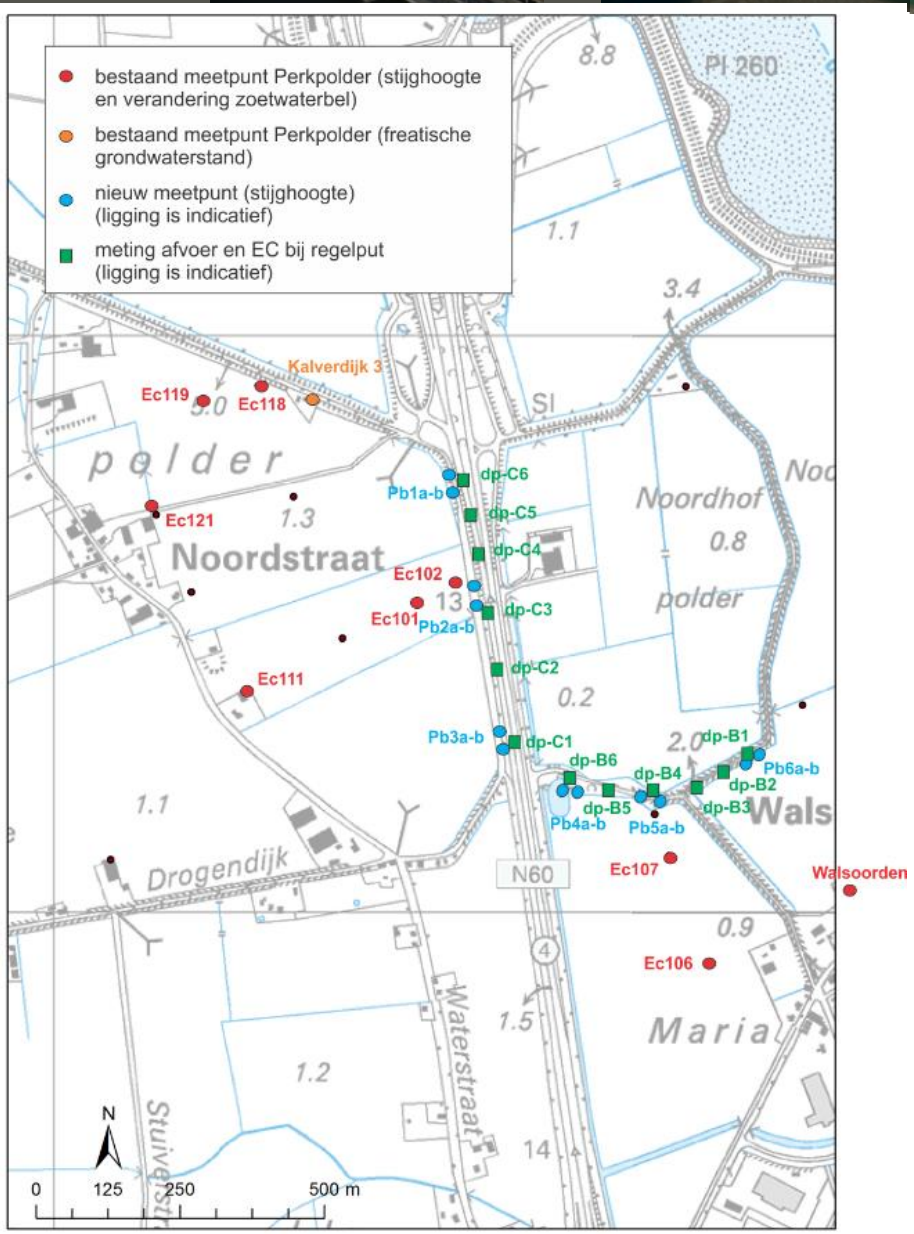
Perkpolder: herstel van 75 ha getijdenatuur

Deltares

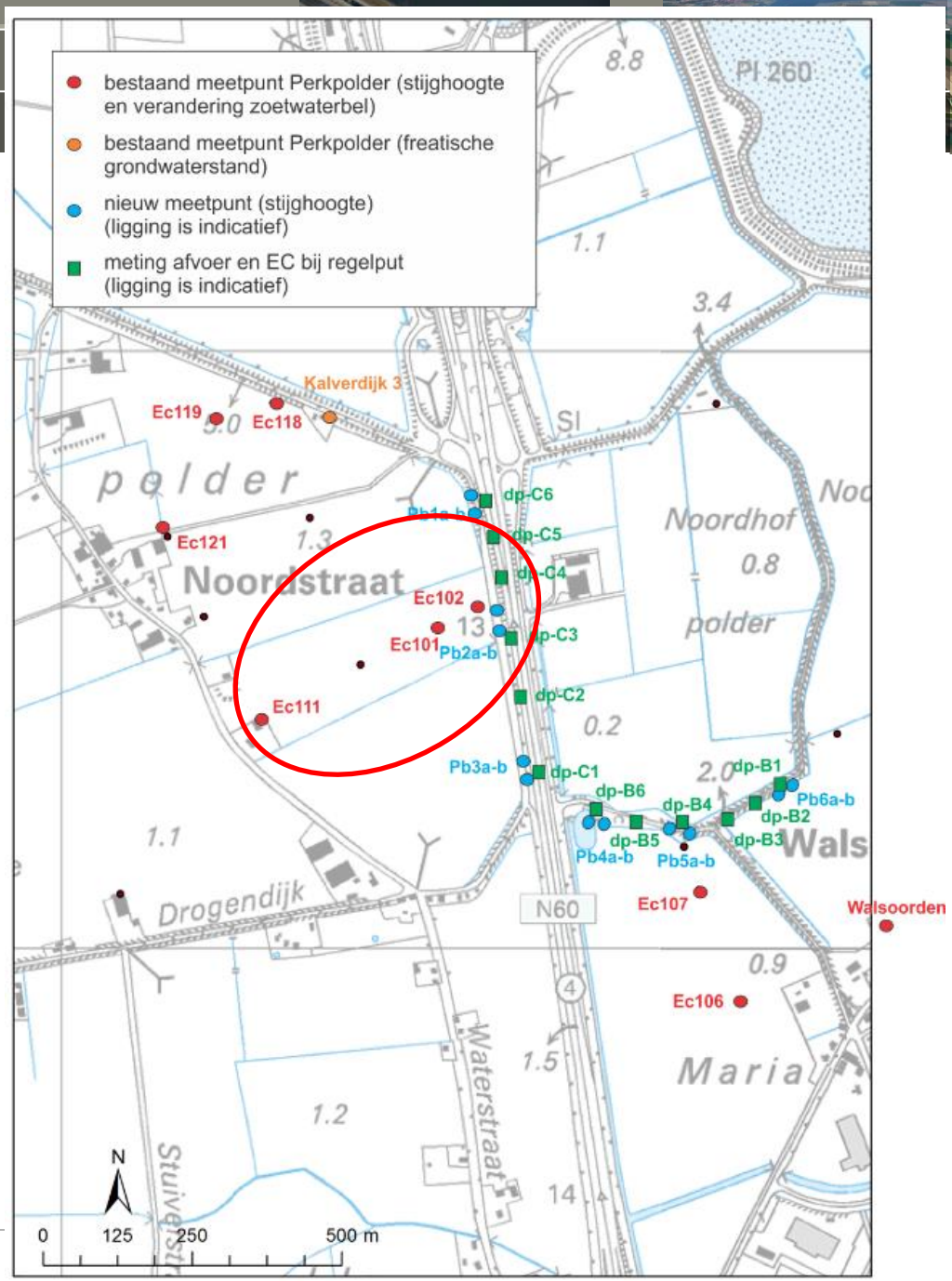
De-poldering of Perkpolder 25 juni 2015

Monitoringplan nulmeting Perkpolder

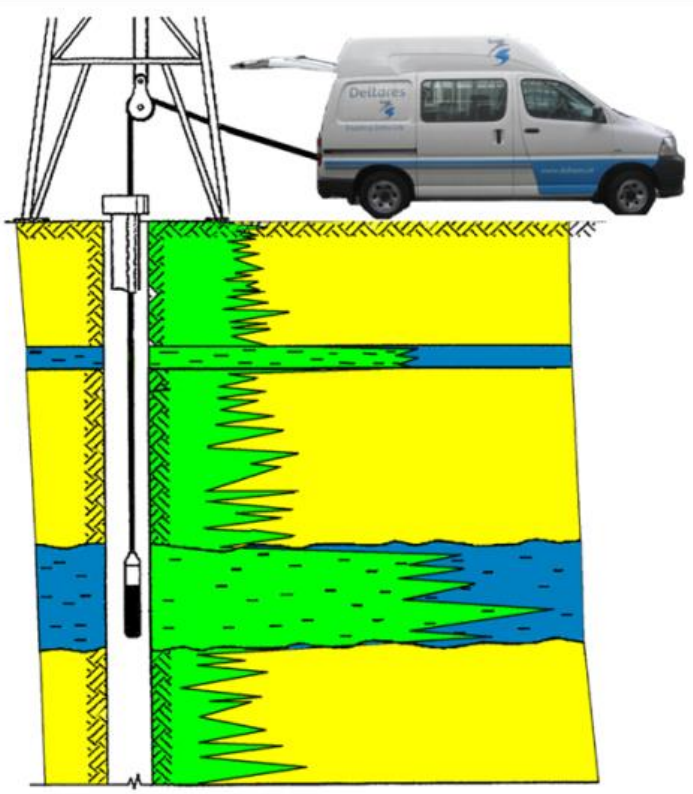
- Stijghoogte
- Grondwaterstand
- Zoet-zout grensvlak



Diepte grens zoet-brak grondwater



SlimFlex-EM metingen zoet-zout grensvlak



Deltares

Zoet-zout grensvlak

EC-111

meting 24 April 2013
meting 18 maart 2014
meting 27 Augustus 2014
meting 22 mei 2015
meting 1 december 2015

Zoet-zout grens: -11 m NAP

diepte t.o.v. NAP (m)

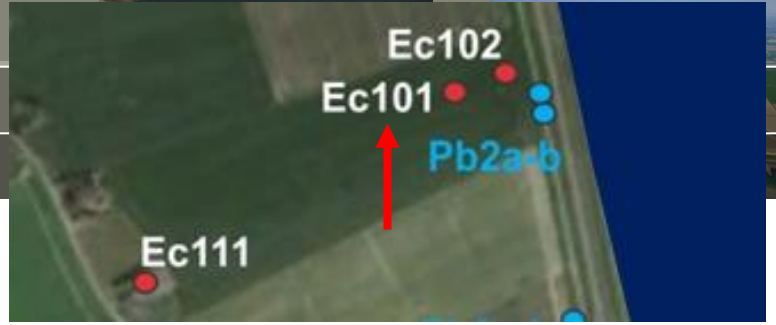
0
-2
-4
-6
-8
-10
-12
-14
-16
-18

0
100
200
300
400
500
600
700

schijnbare geleidbaarheid (mS/m)

Deltares

Zoet-zout grensvlak



EC-101

meting 24 April 2013
meting 18 maart 2014
meting 27 augustus 2014
meting 1 december 2015

Zoet-zout grens: -6 m NAP

m NAP

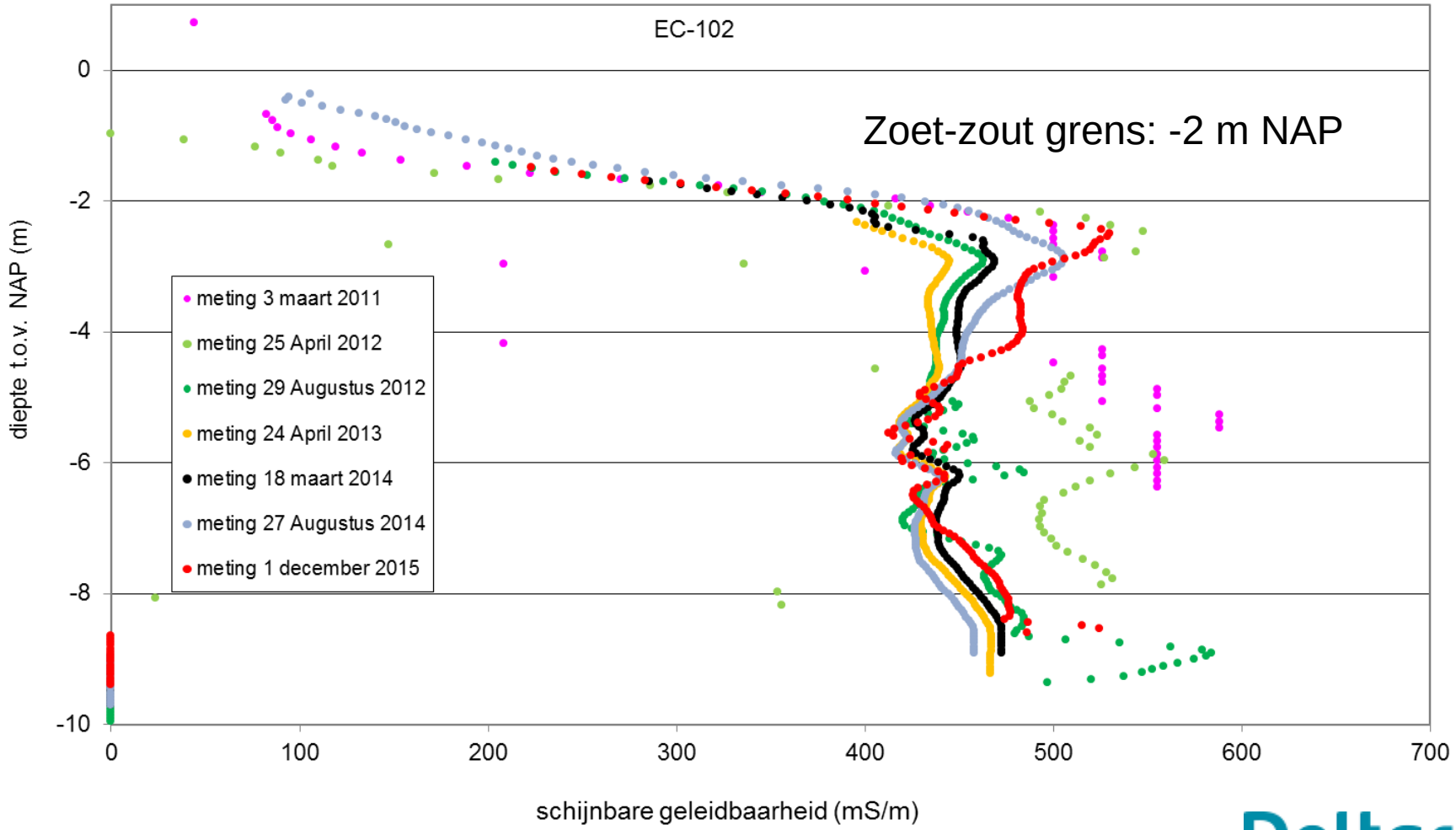
0
-2
-4
-6
-8
-10

0
100
200
300
400
500
600
700

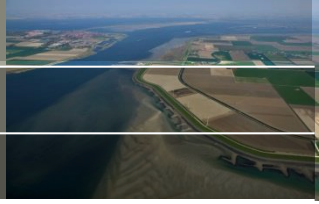
schijnbare geleidbaarheid (mS/m)

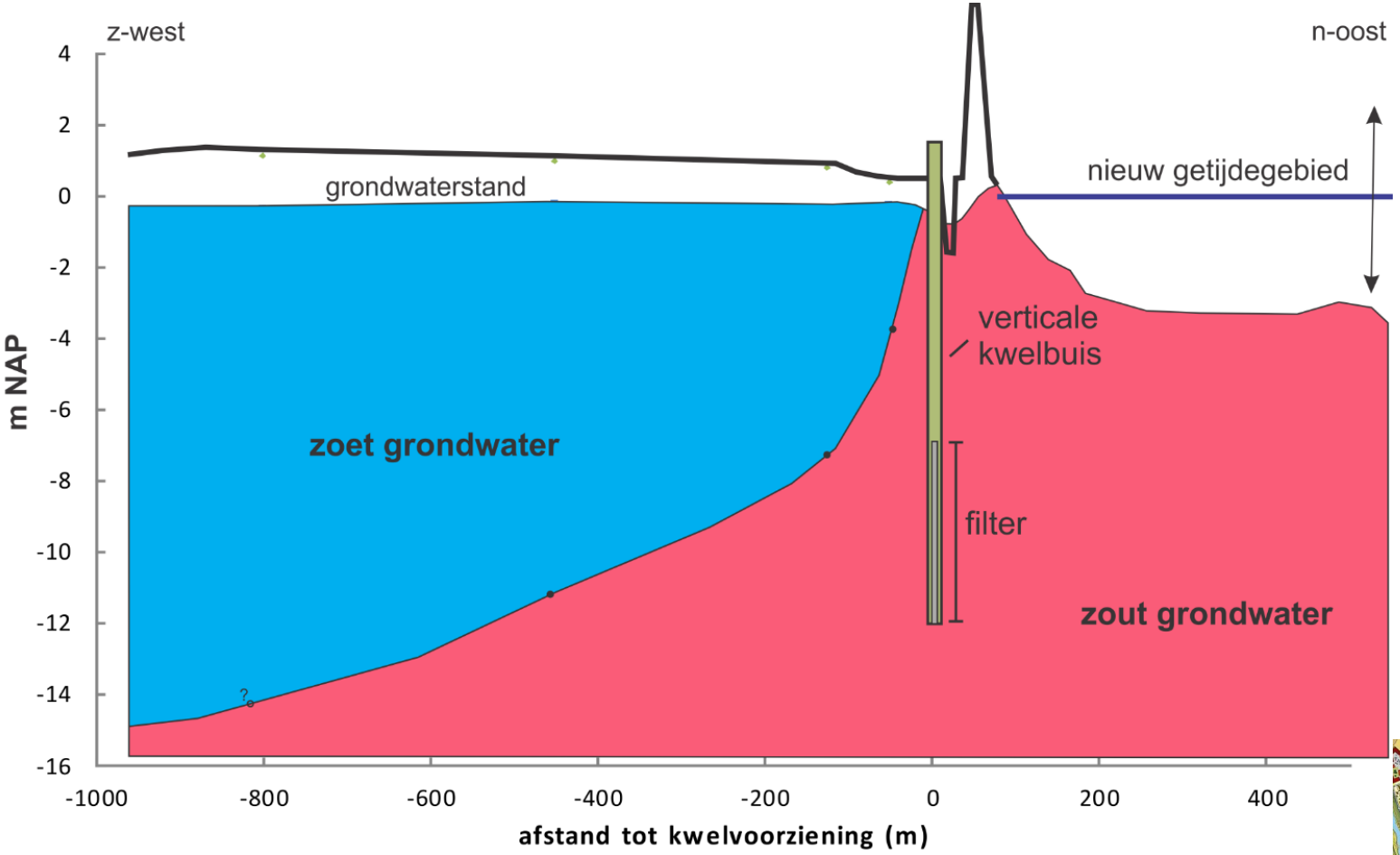
Deltares

Zoet-zout grensvlak



Zoetwater lens

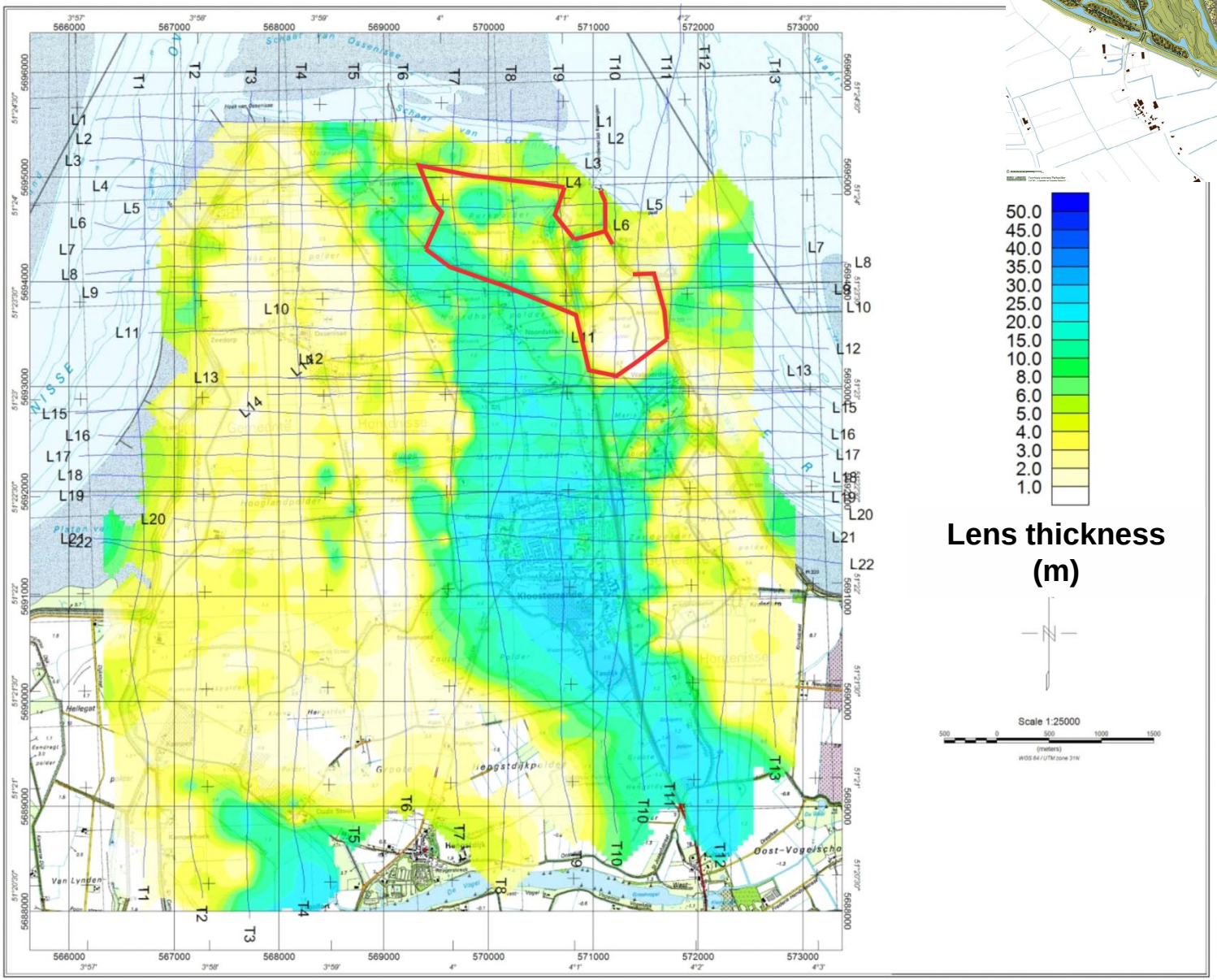




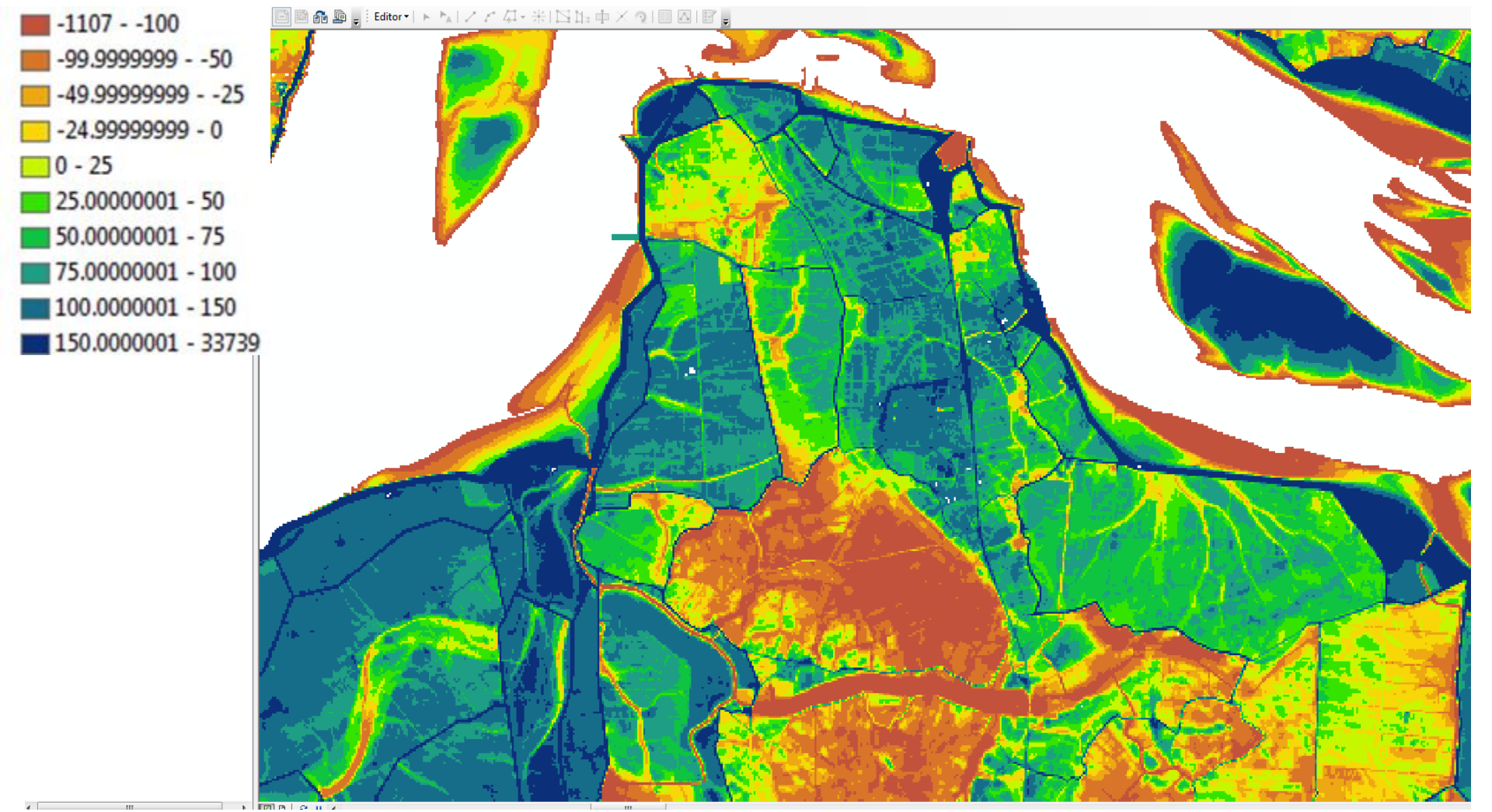
Electromagnetische metingen vanuit helikopter

Deltares

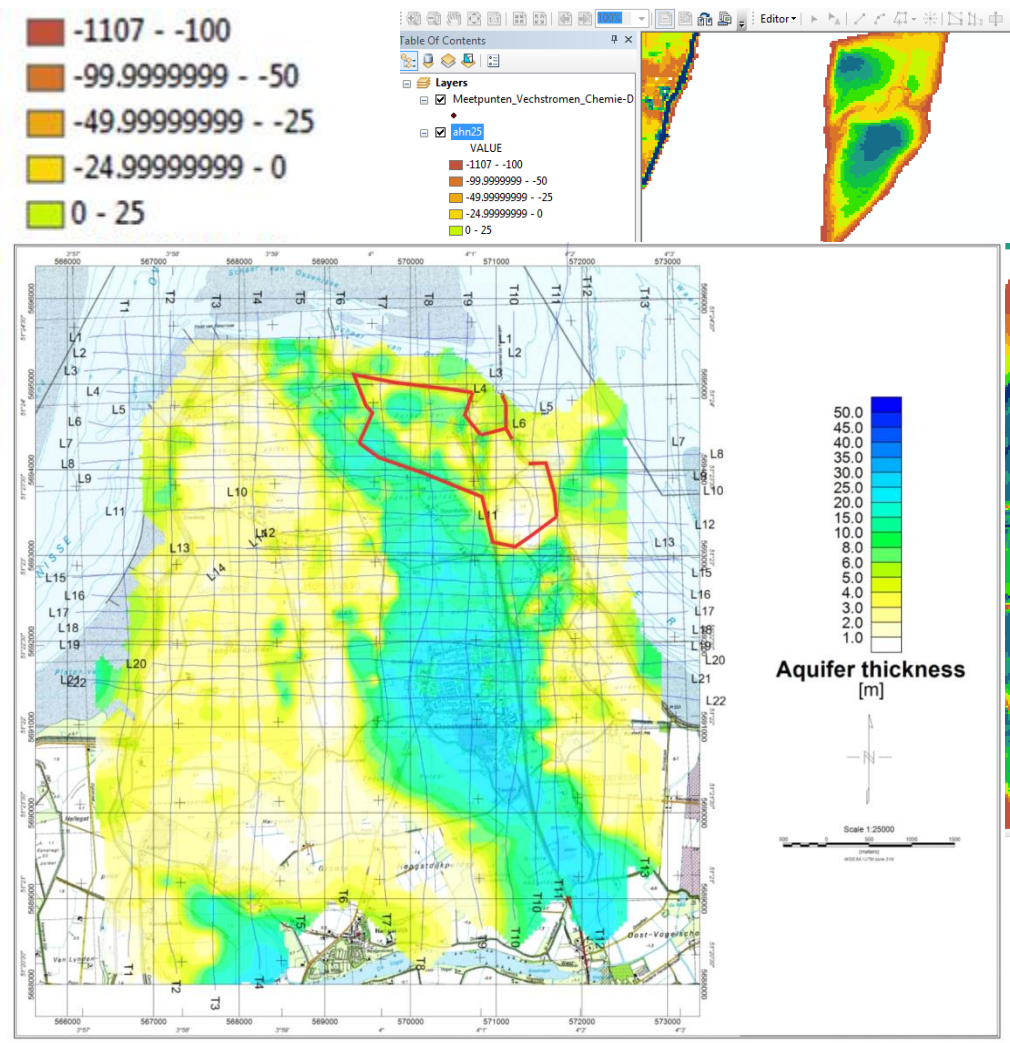
Dikte zoetwaterlens



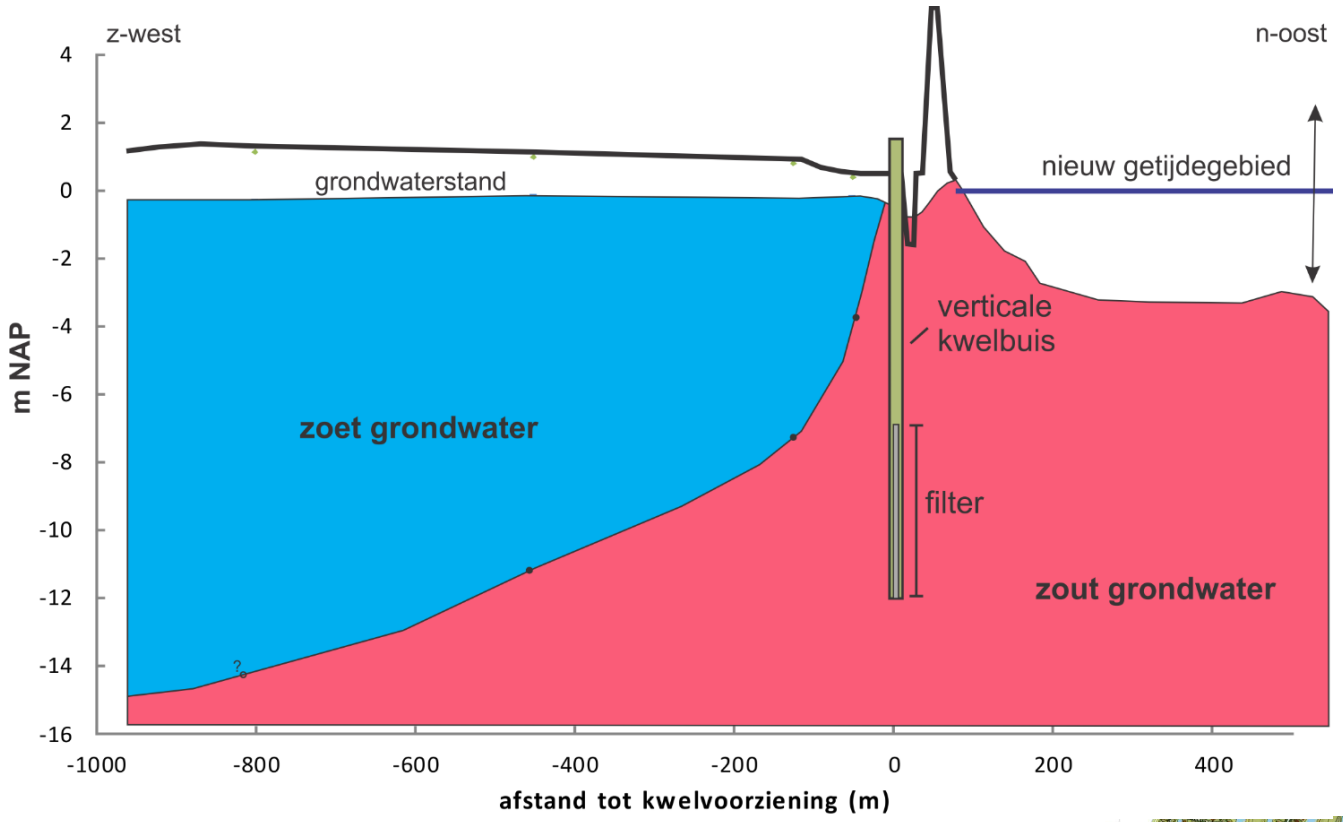
Maaiveldhoogte



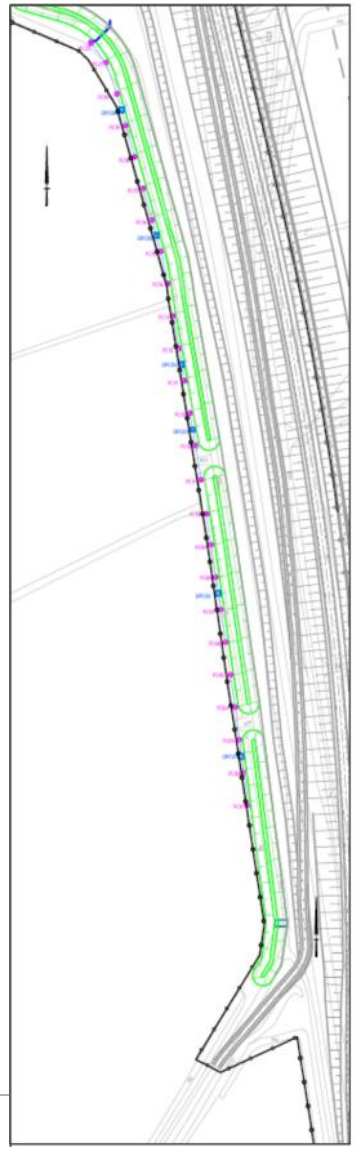
Maaiveldhoogte en zoetwaterlens



Kwelvoorziening

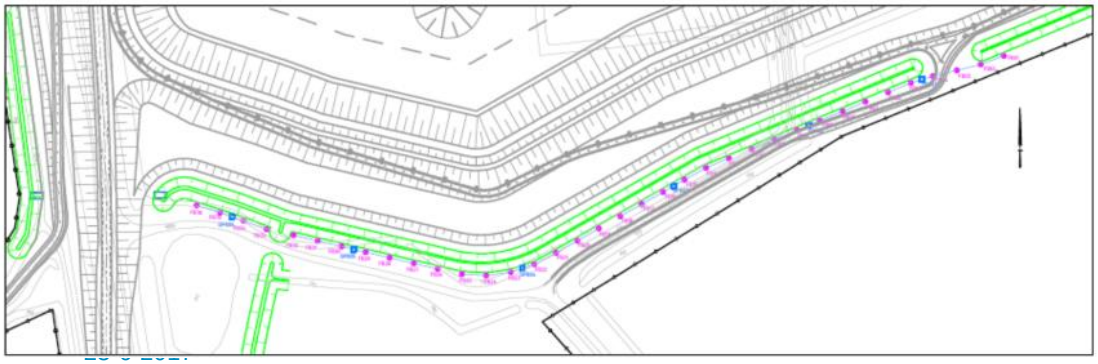


Kwelvoorziening: verticale kwelbuizen aangesloten op regelput

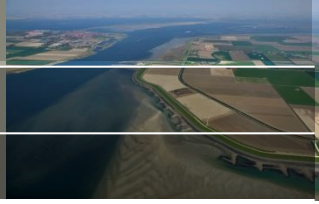


westelijk
kwelvoorziening

oostelijke
kwelvoorziening



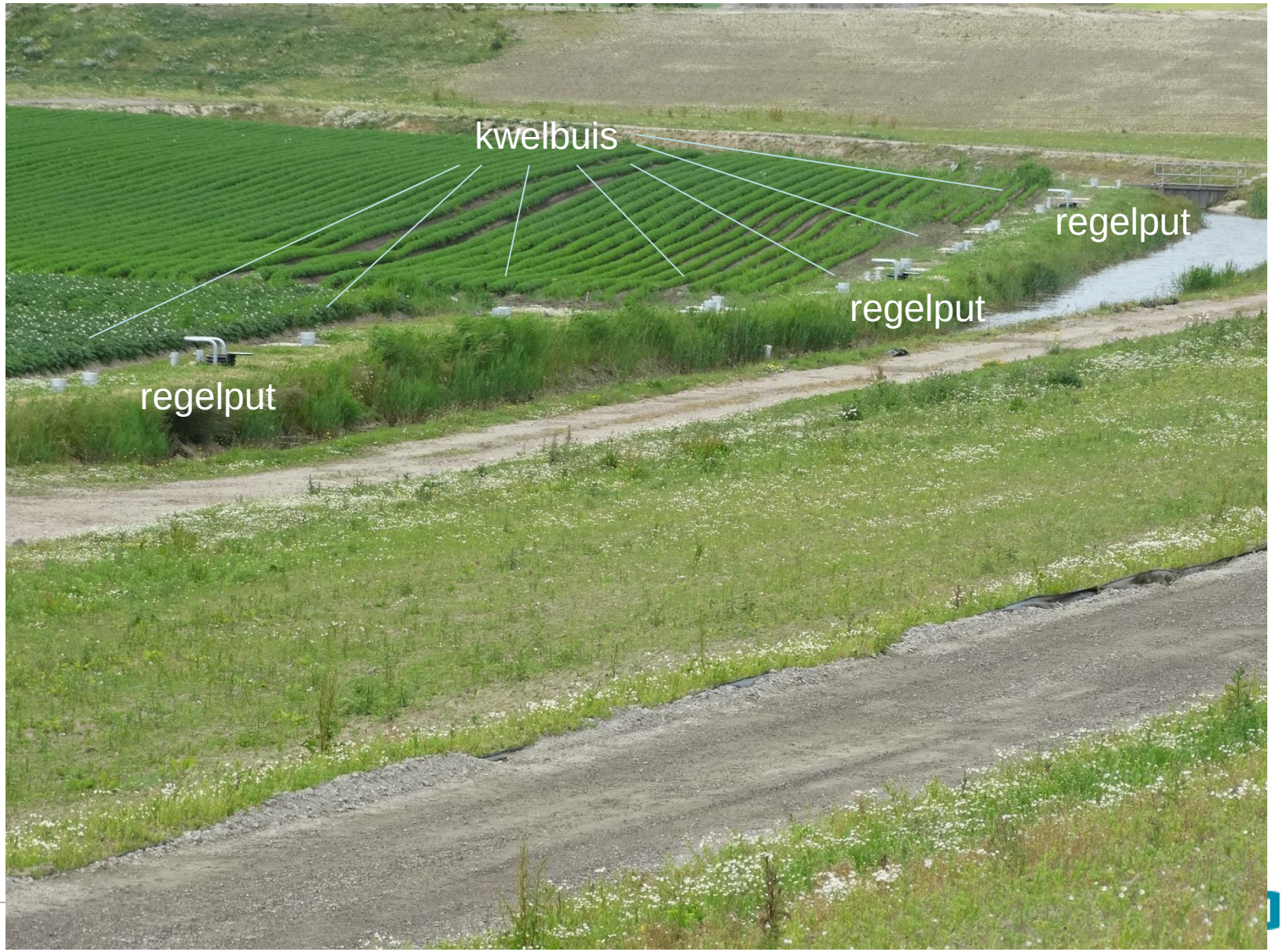
Kwelvoorziening afmetingen



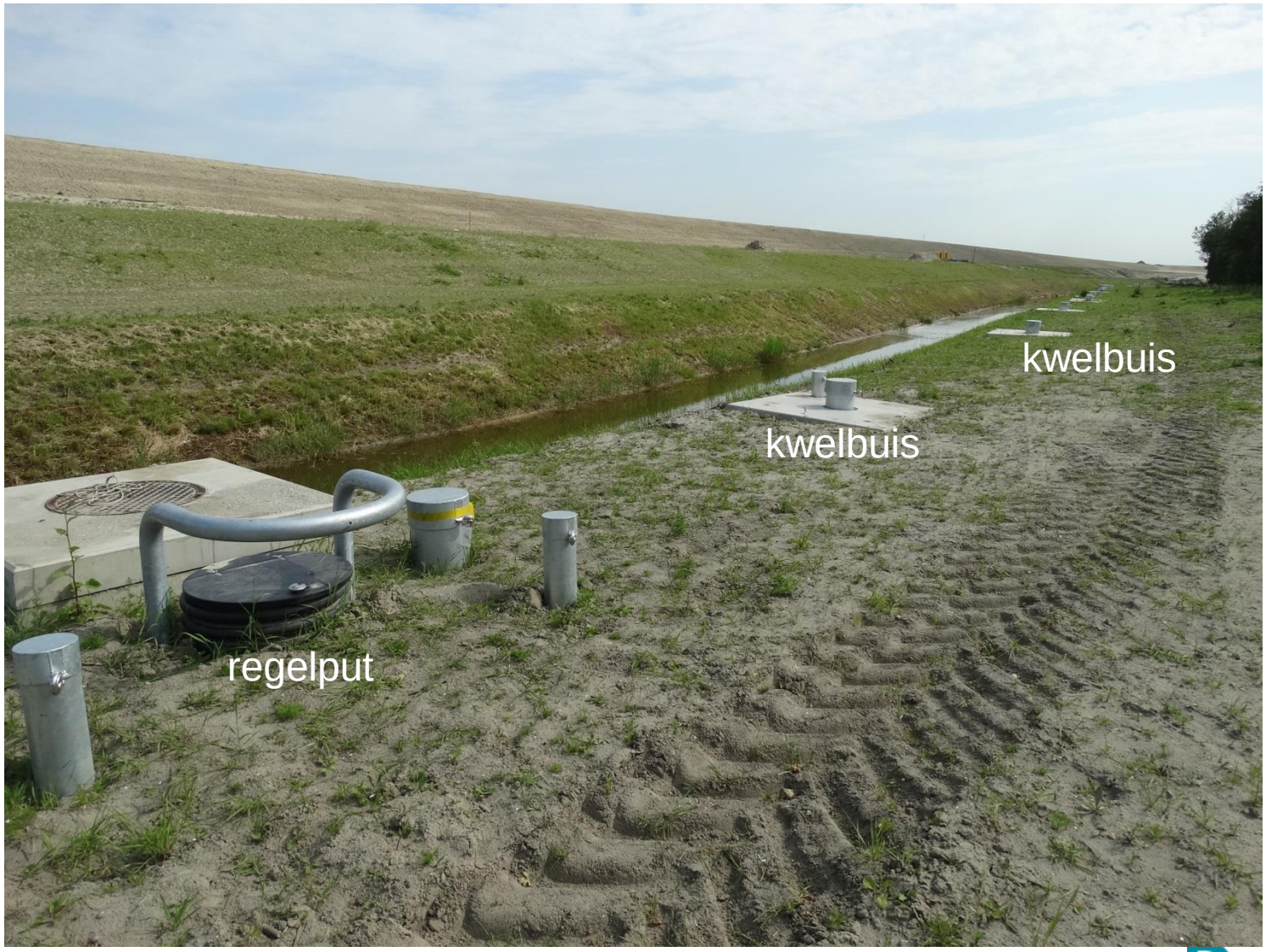
	Westelijke kwelvoorziening	Zuidelijke Kwelvoorziening
Aantal buizen	25	36
Totale lengte	500 m	500 m
Diepte kwelbuizen	12 m-mv	17 m-mv
Filterlengte	5 m	10 m
Afstand tussen kwelbuizen	20 m	15 m
Aantal kwelbuizen op de regelput	3 tot 5	4 tot 7

Deltares

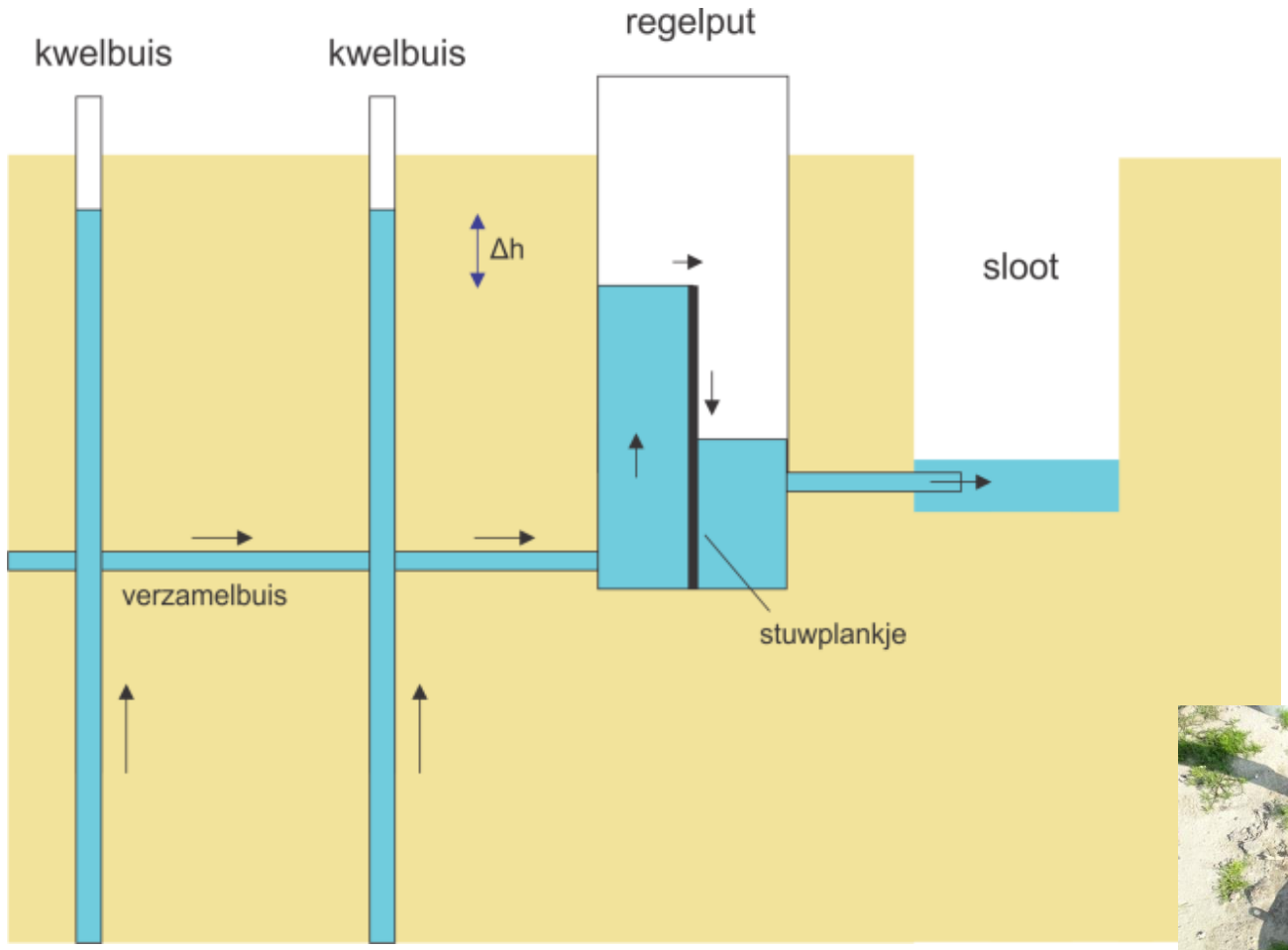
Kwelvoorziening (west)



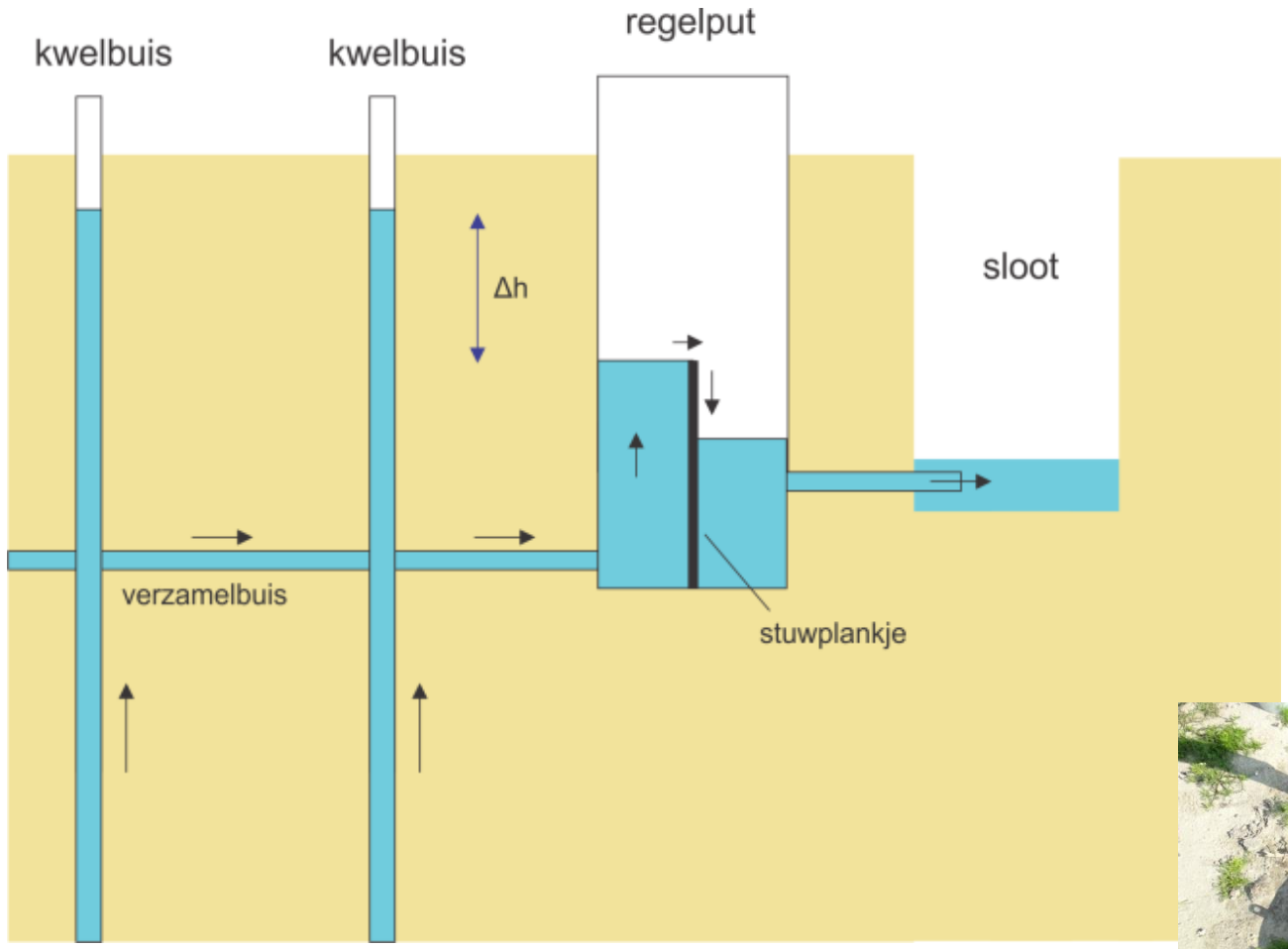
Kwelvoorziening (zuid)



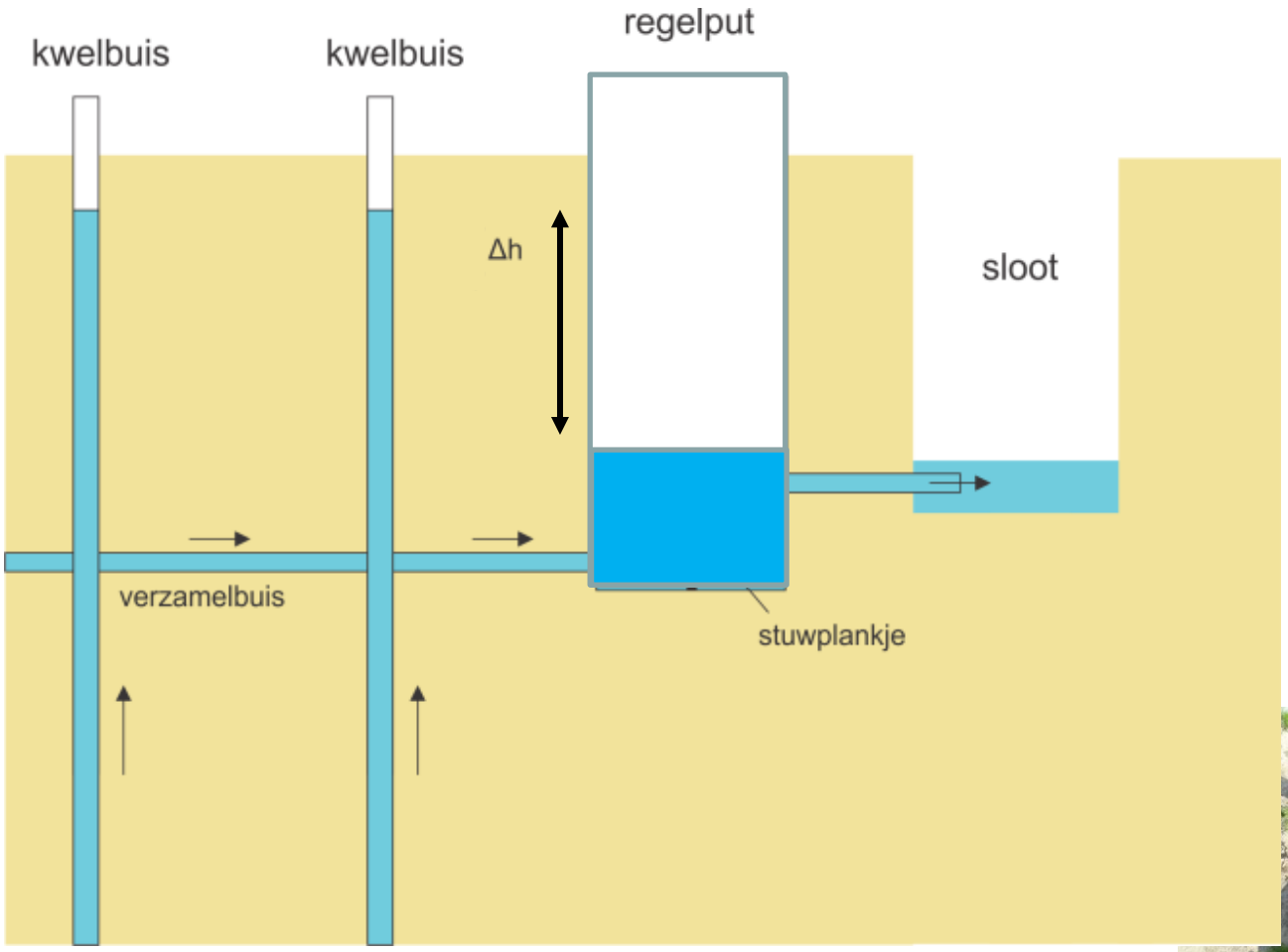
Kwelvoorziening regelen



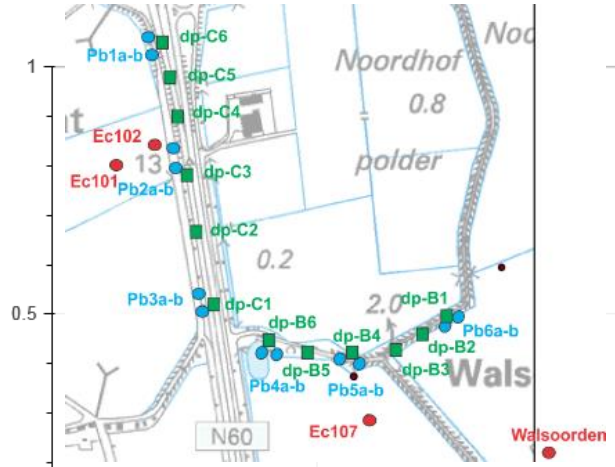
Kwelvoorziening regelen



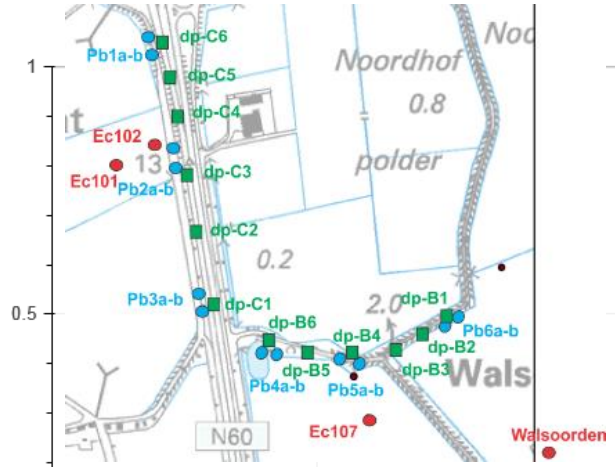
Kwelvoorziening regelen: of helemaal open



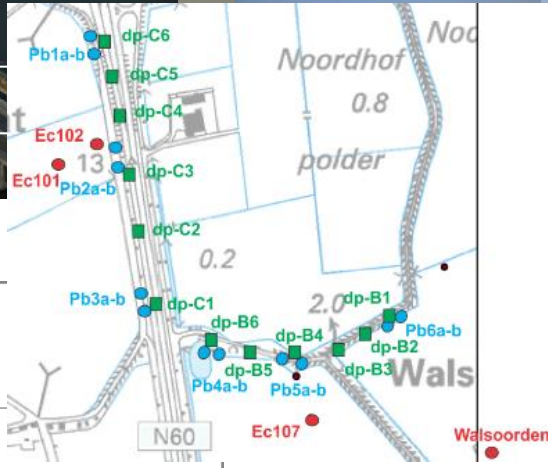
Effecten op stijghoogte bij kwelvoorziening

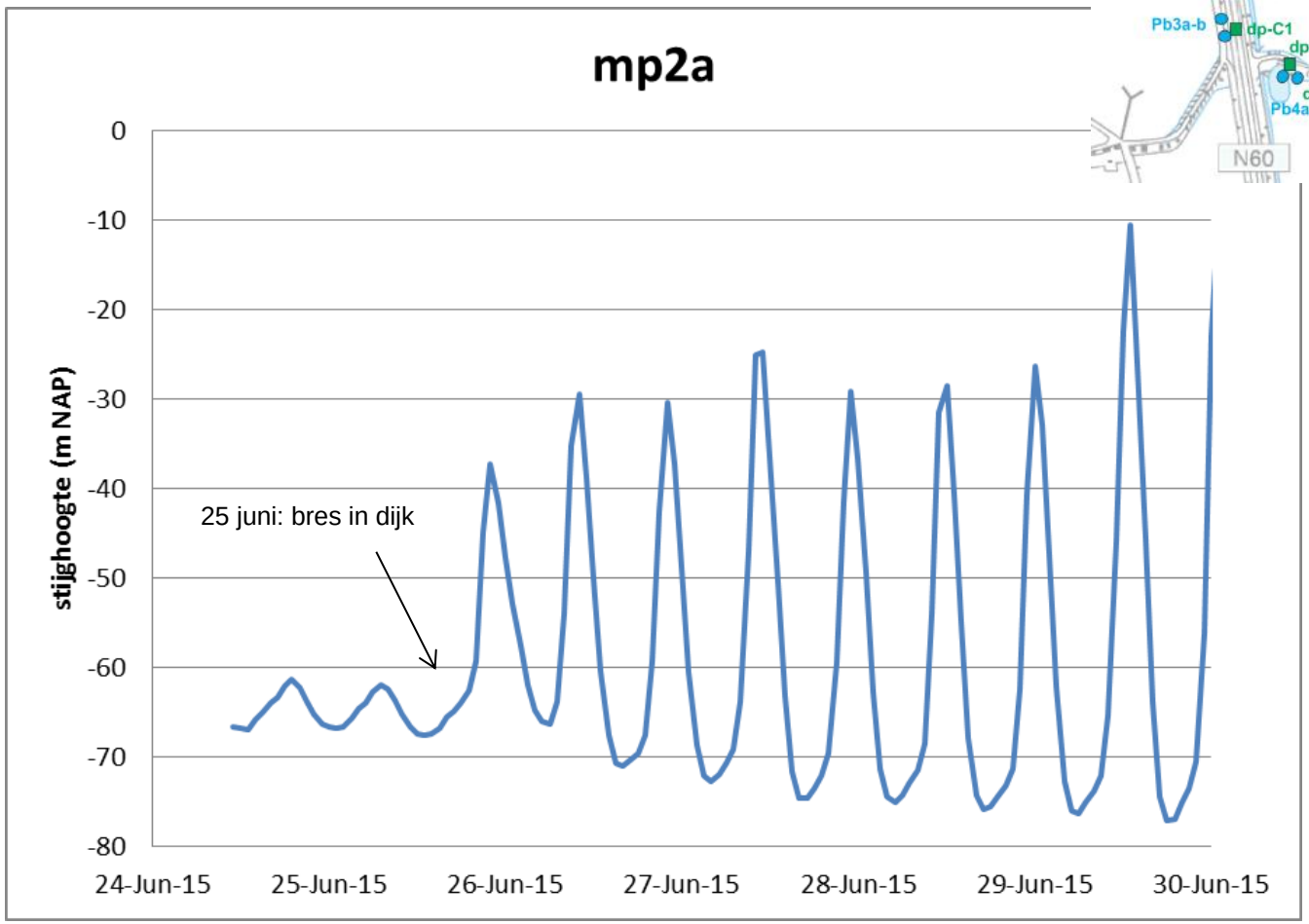


Effecten op stijghoogte bij kwelvoorziening

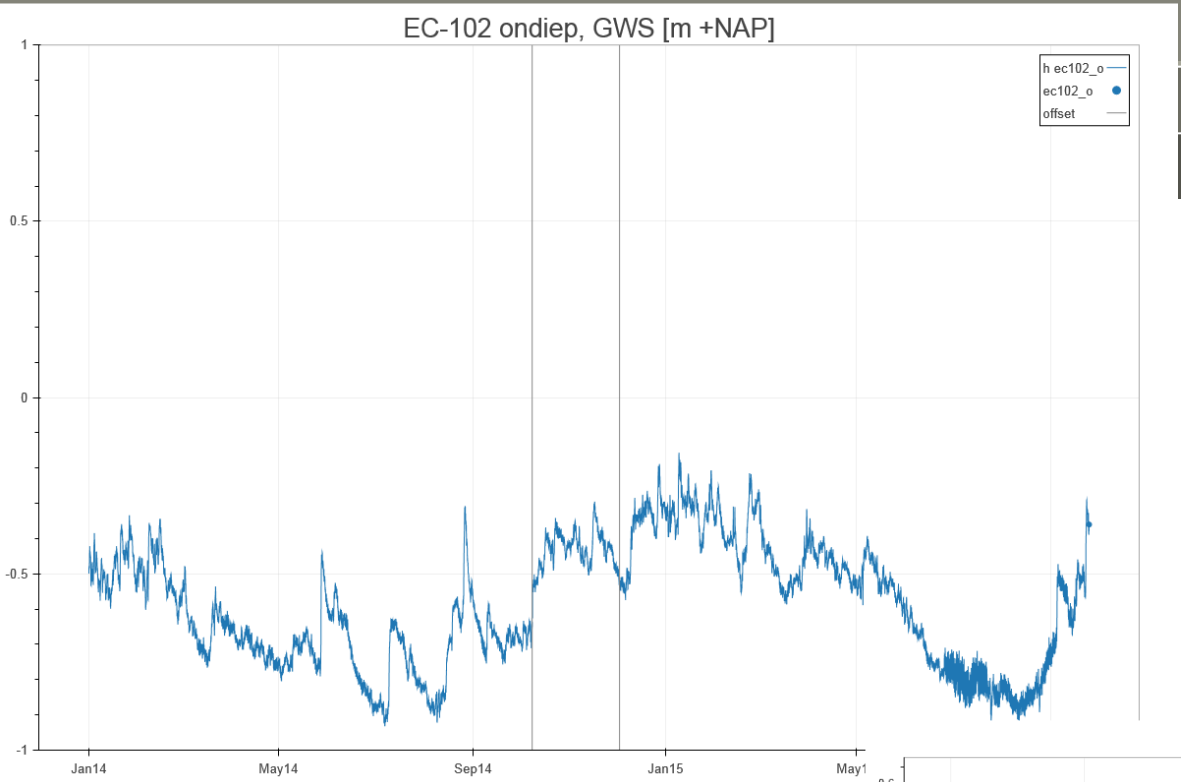


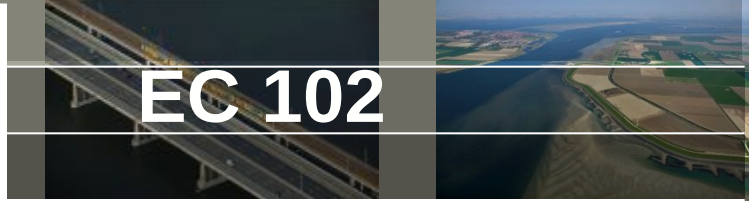
Effect van bres in dijk op stijghoogte

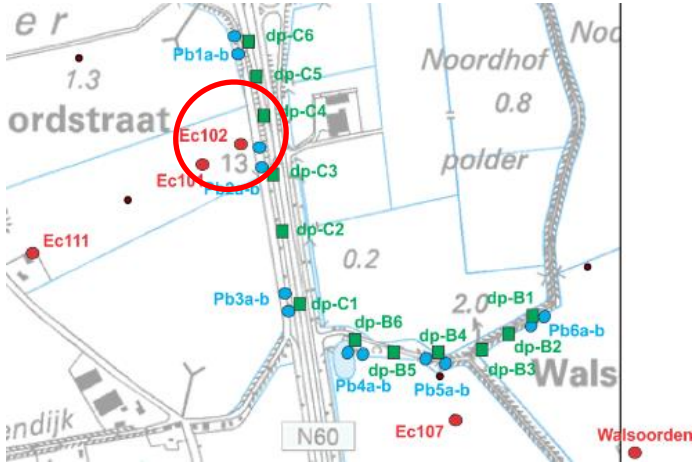




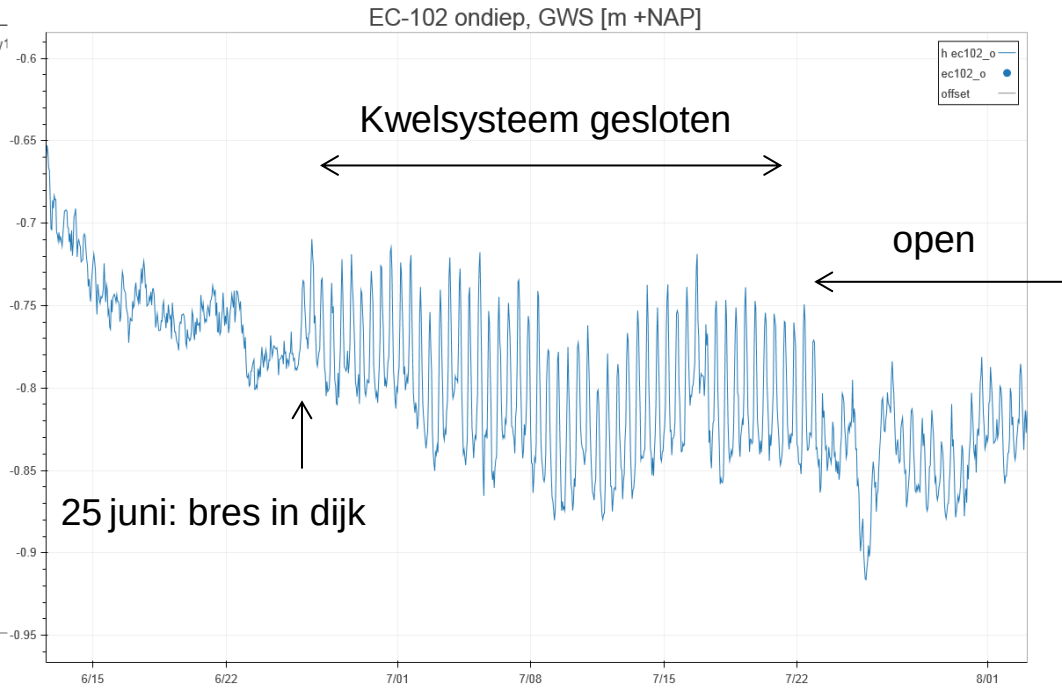
Deltares



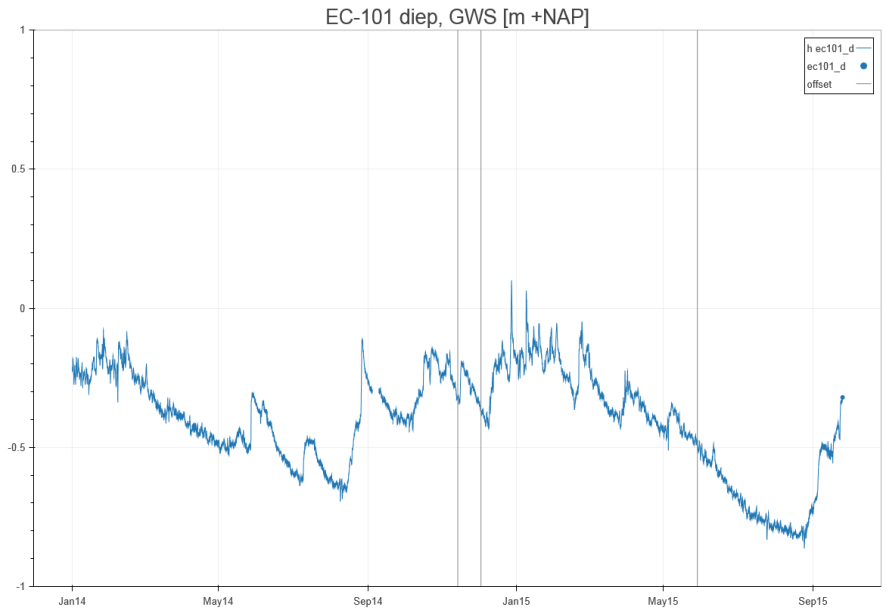


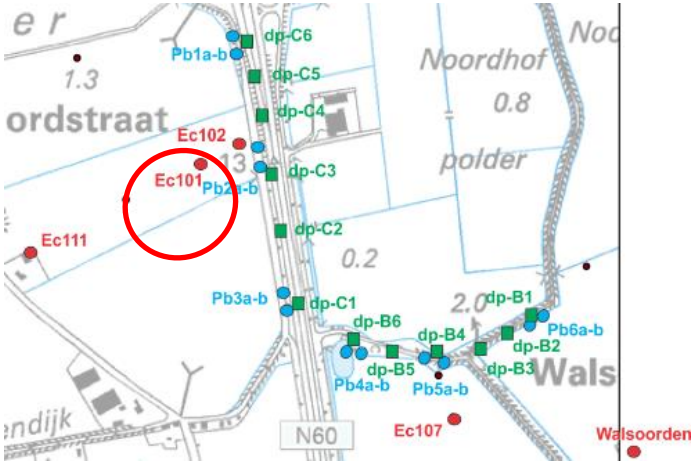


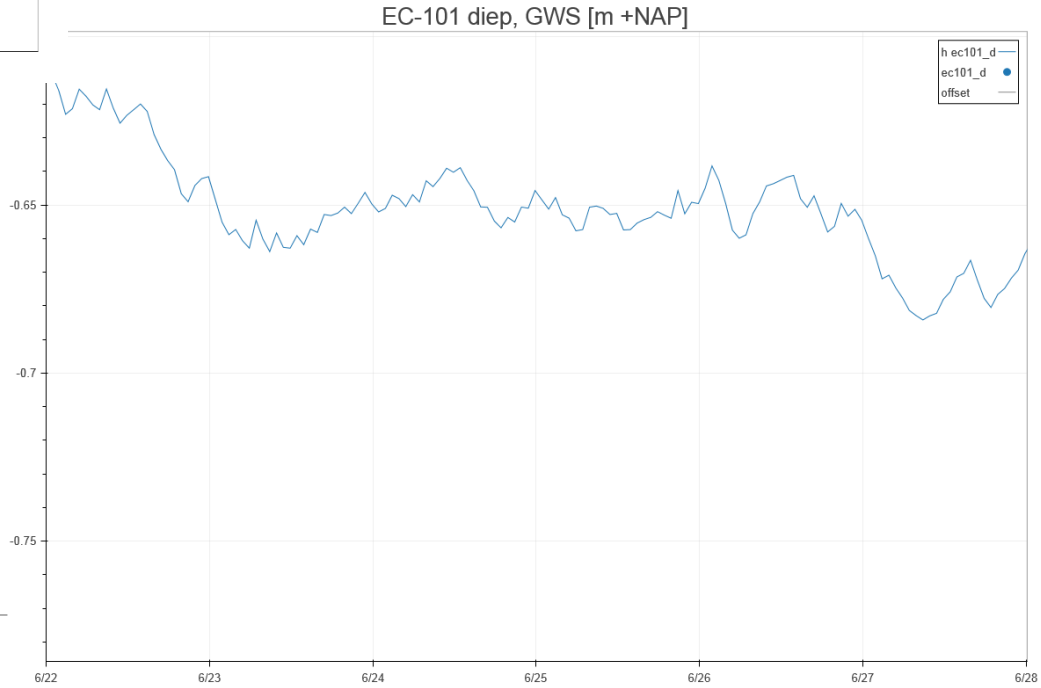
Effect op stijghoogte



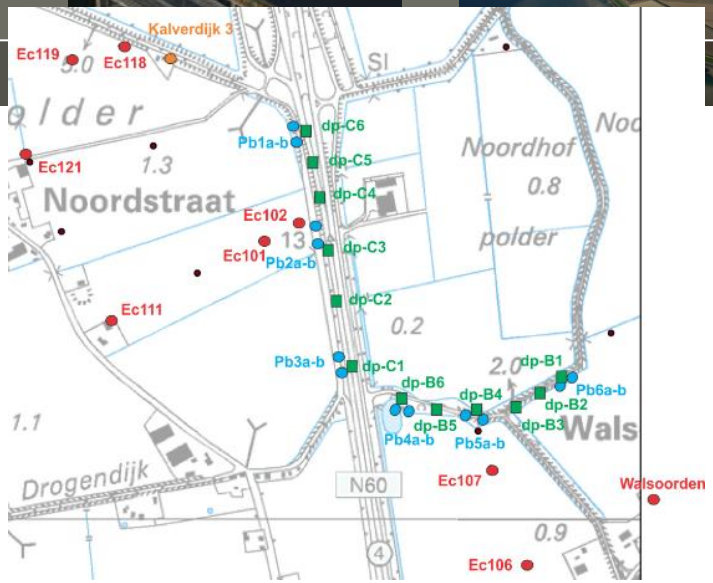
Meetpunt EC101

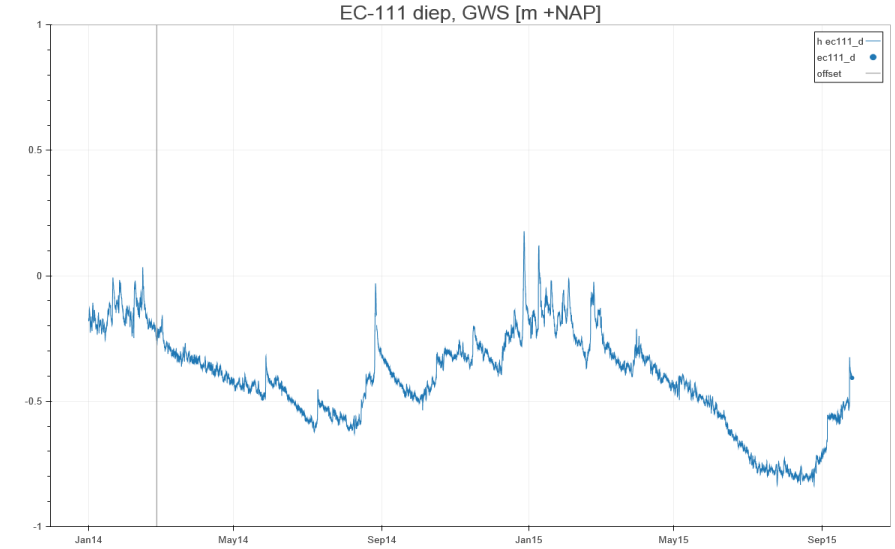


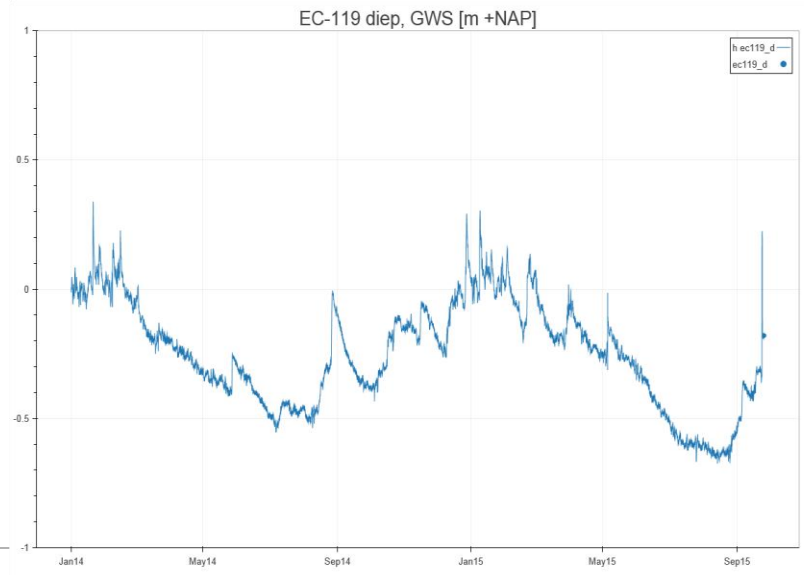


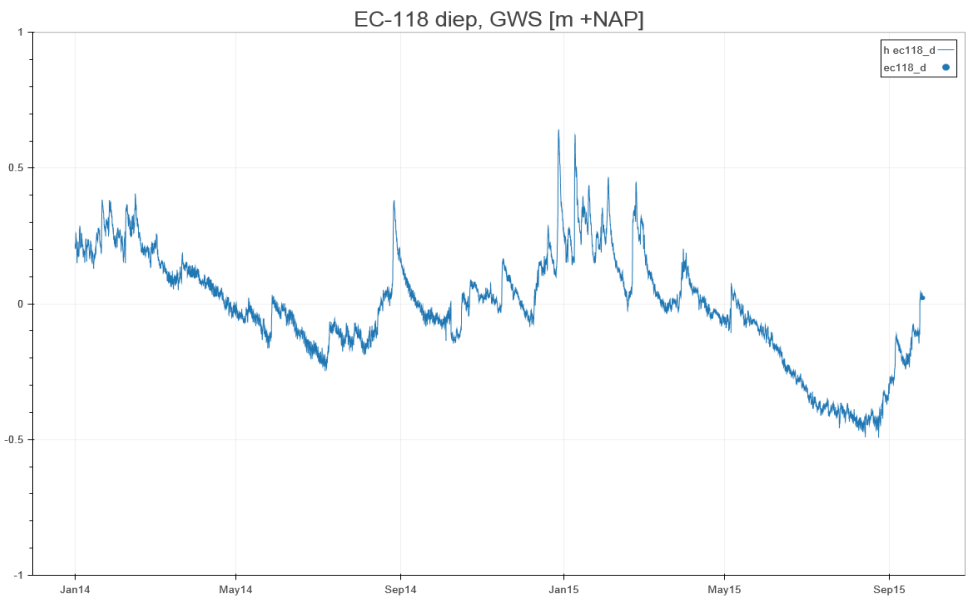


EC111, EC118, EC119

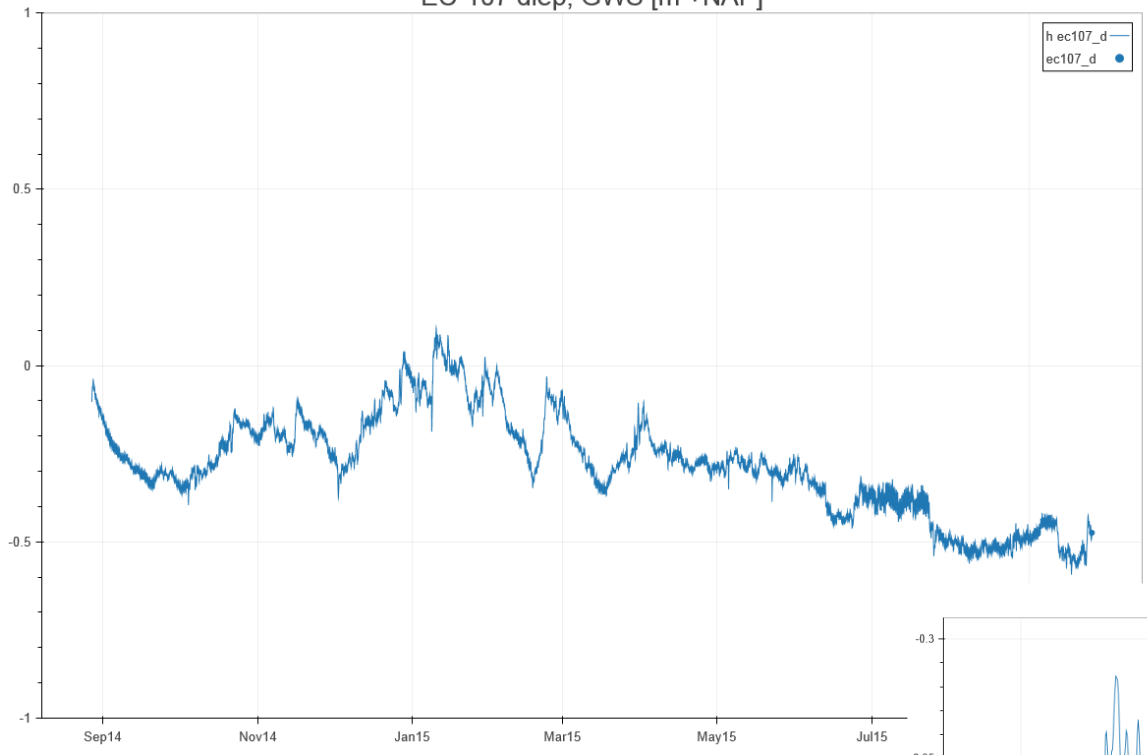








EC107


EC-107 diep, GWS [m +NAP]
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ec107_d
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-1
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Nov14
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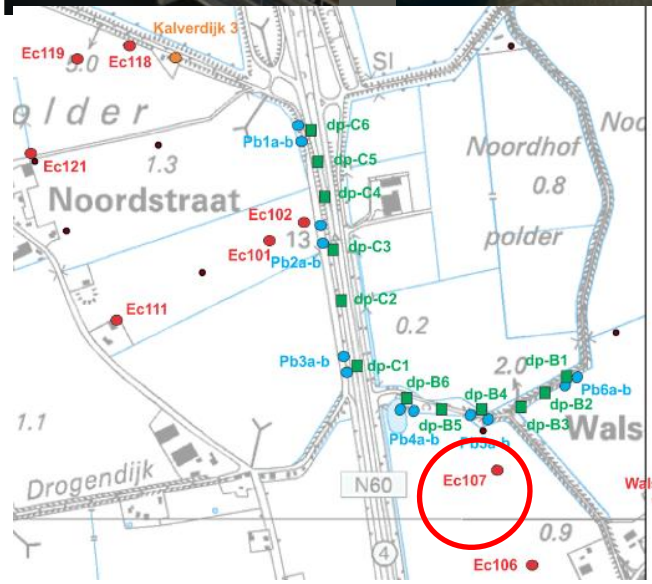
Mar15
May15
Jul15


Kalverdijk 3
Ec119
Ec118
Sl
Noordhof
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polder
Noordstraat
Ec121
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Ec102
13
Ec101
Pb1a-b
Pb2a-b
dp-C6
dp-C5
dp-C4
dp-C3
dp-C2
dp-C1
Ec111
0.2
Pb3a-b
dp-B6
dp-B4
dp-B5
dp-B1
dp-B2
dp-B3
Pb6a-b
Pb4a-b
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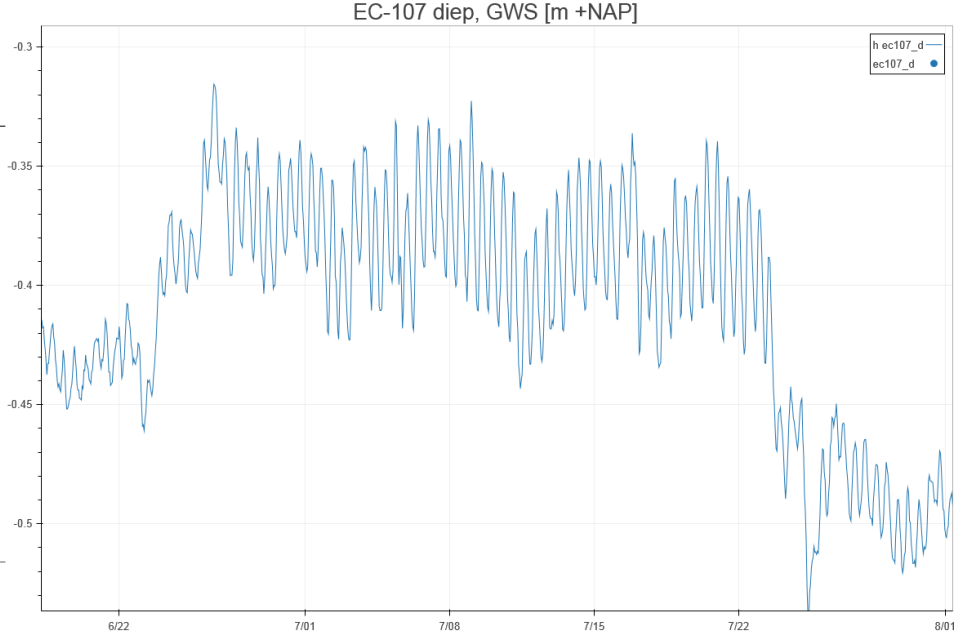
1.1
Wals
Drogendijk
N60
Ec107
Walsoorden
0.9
Ec106


EC-107 diep, GWS [m +NAP]
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ec107_d
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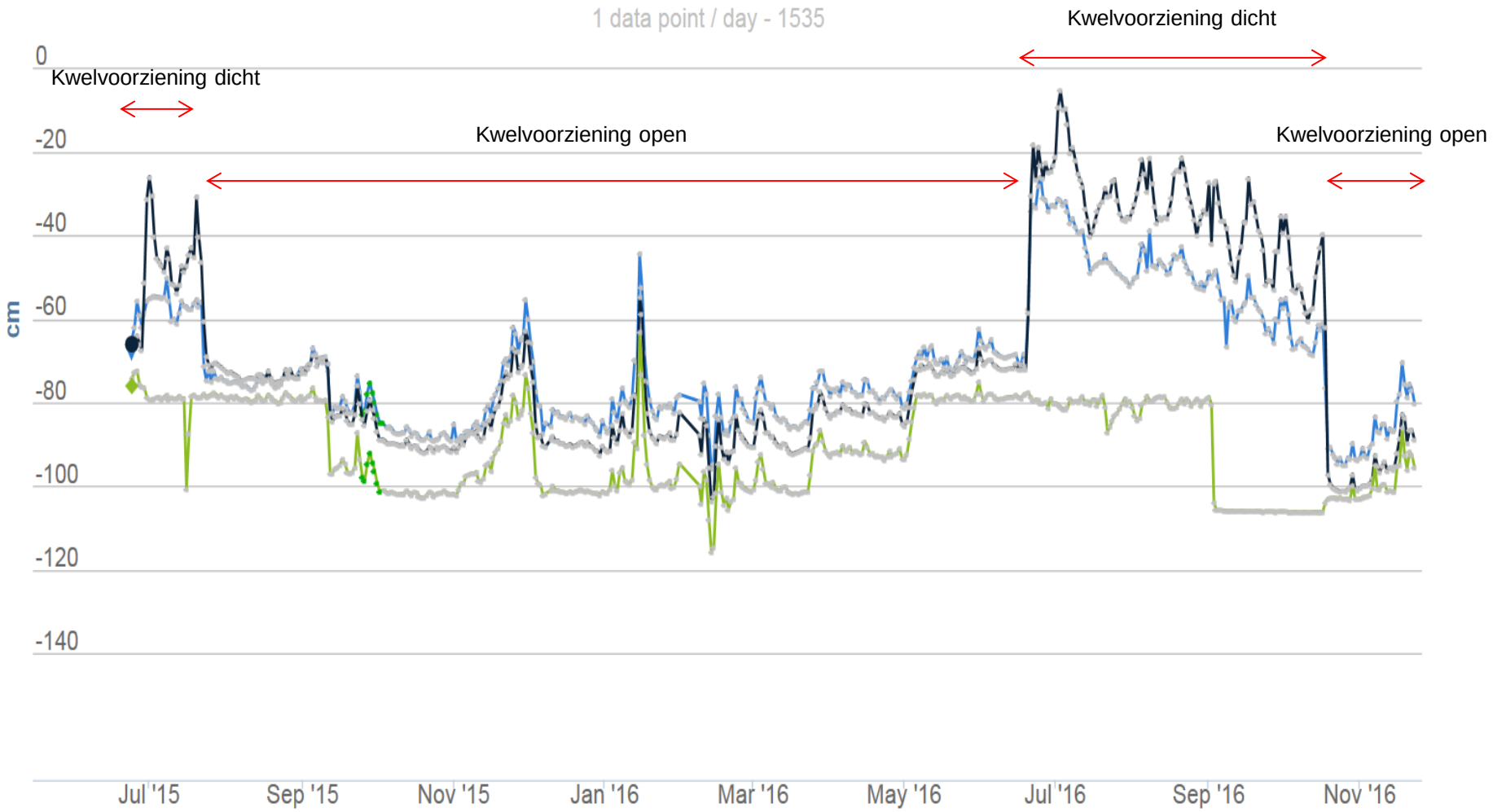
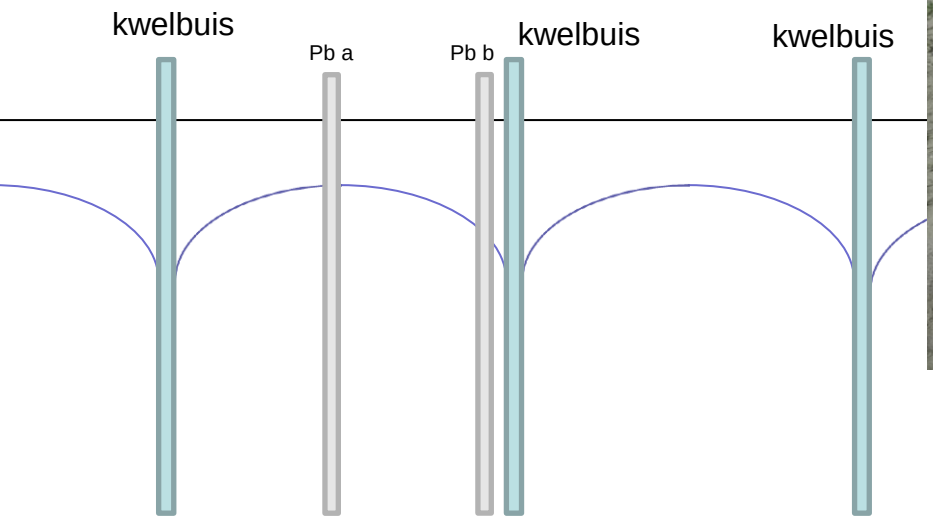
6/22
7/01
7/08
7/15
7/22
8/01

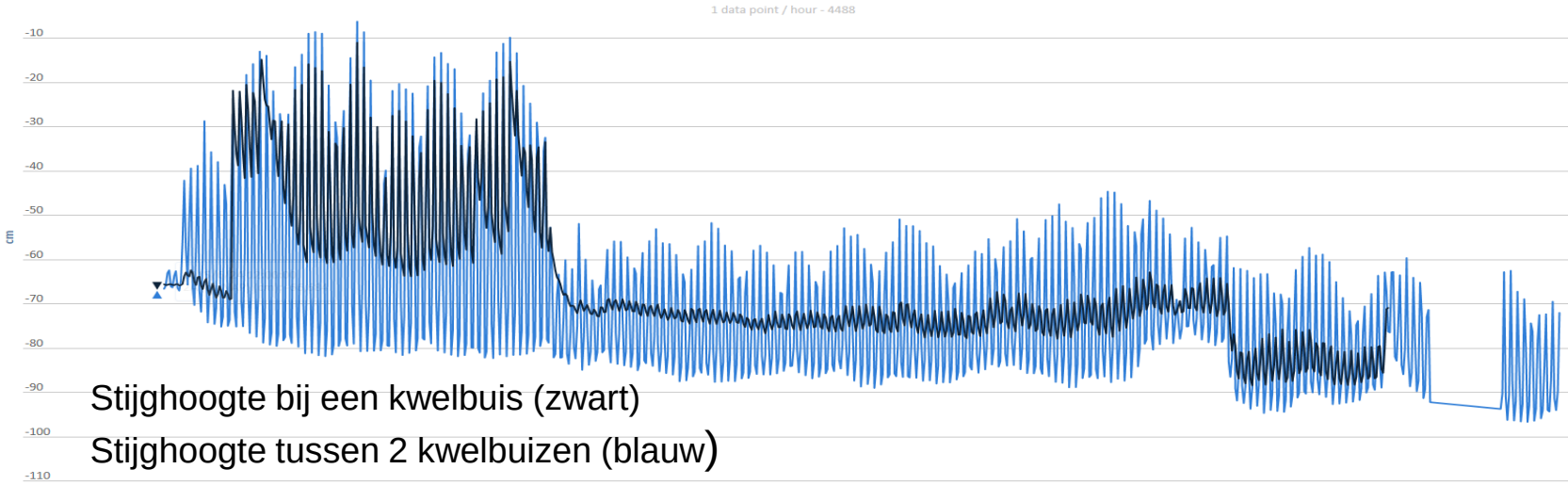
Metingen tot 10 november 2016



Meetpunt telemetrie 2-opp (groen), 2A (blauw) en 2B (zwart).

Stijghoogte

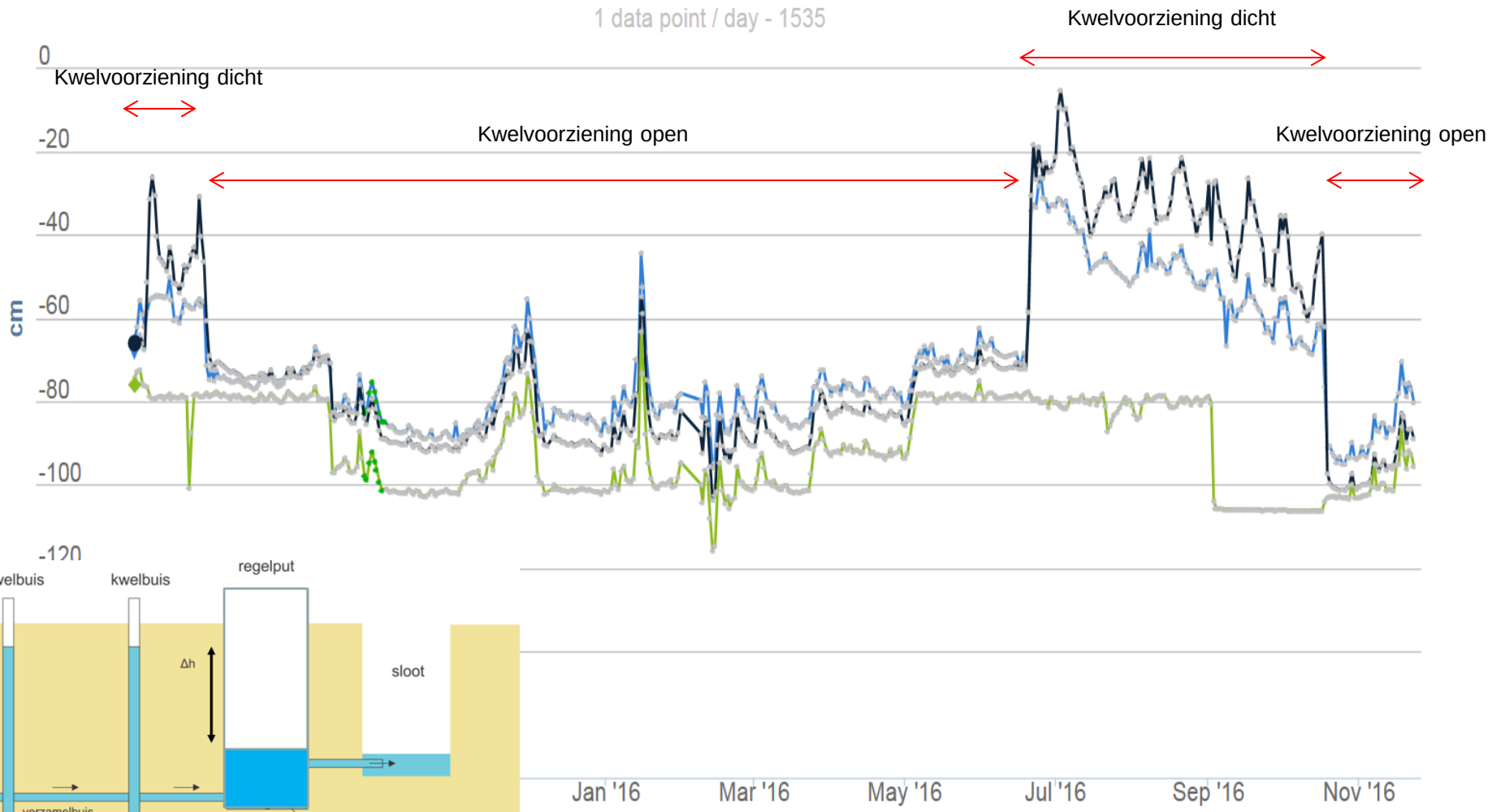




Stijghoogte bij een kwelbuis (zwart)

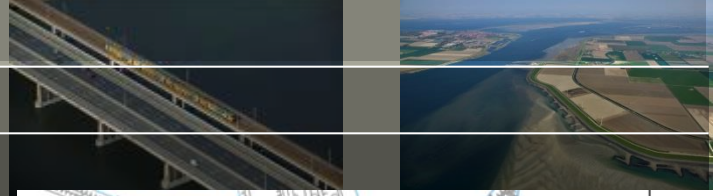
Stijghoogte tussen 2 kwelbuizen (blauw)

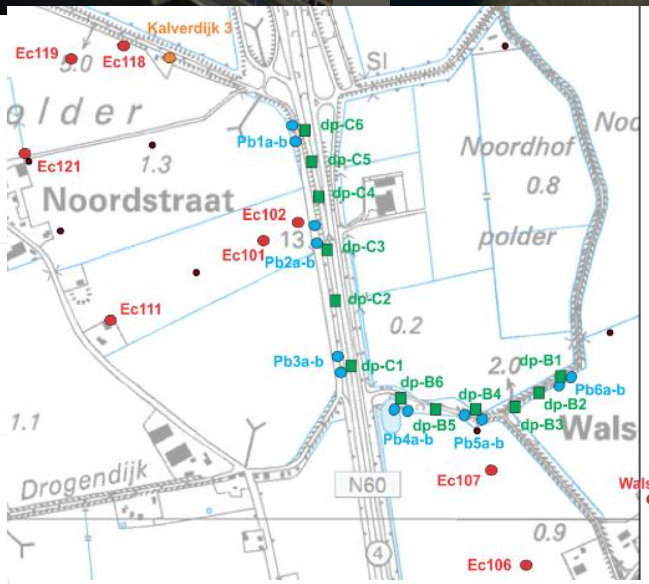
Metingen tot 10 november 2016

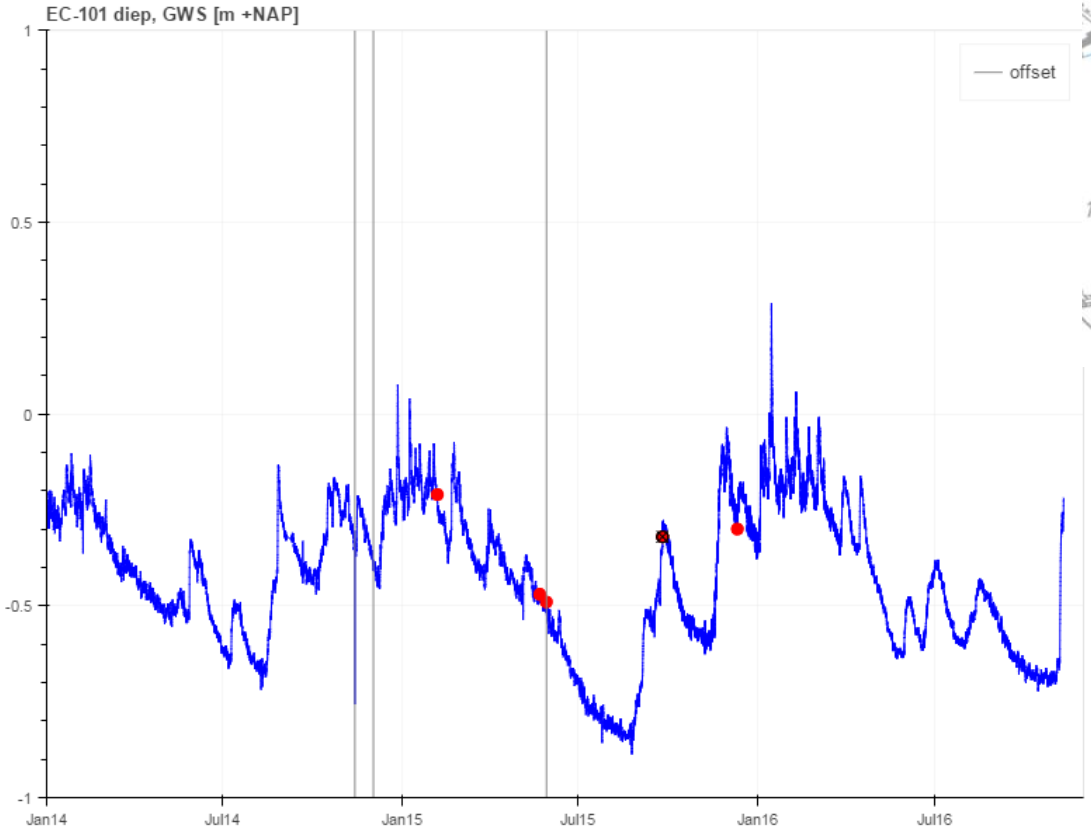


Deltares

EC101-diep

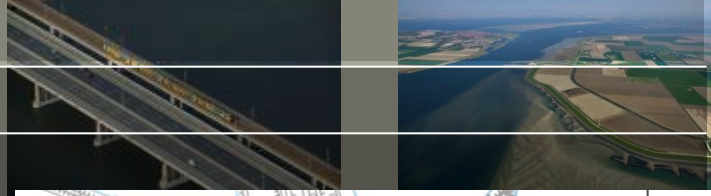


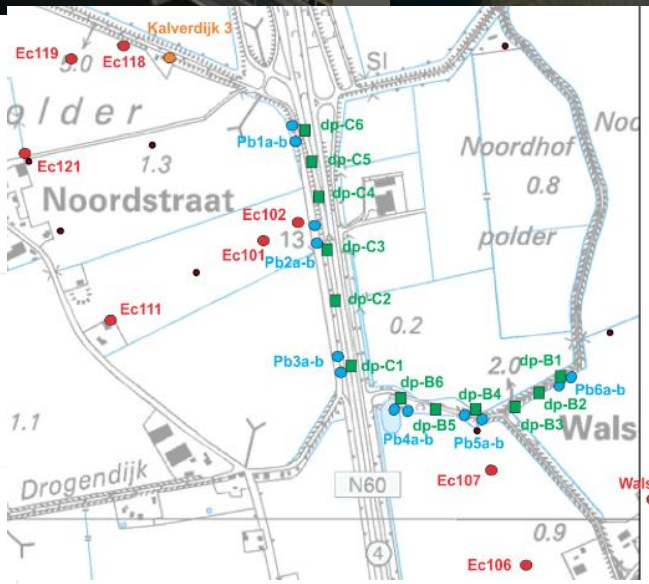




Deltares

EC121




Kalverdijk 3
Ec119
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Ec121
Noordstraat
Noordhof
polder
Ec102
Ec101
Pb1a-b
Pb2a-b
Pb3a-b
Pb4a-b
Pb5a-b
Pb6a-b
dp-C6
dp-C5
dp-C4
dp-C3
dp-C2
dp-C1
dp-B1
dp-B2
dp-B3
dp-B4
dp-B5
dp-B6
Ec111
Drogendijk
N60
Ec107
Walsoorden
Ec106
Wals


EC-121 diep, GWS [m +NAP]
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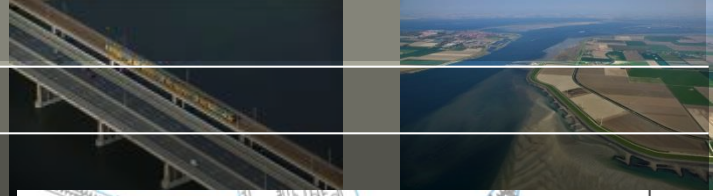
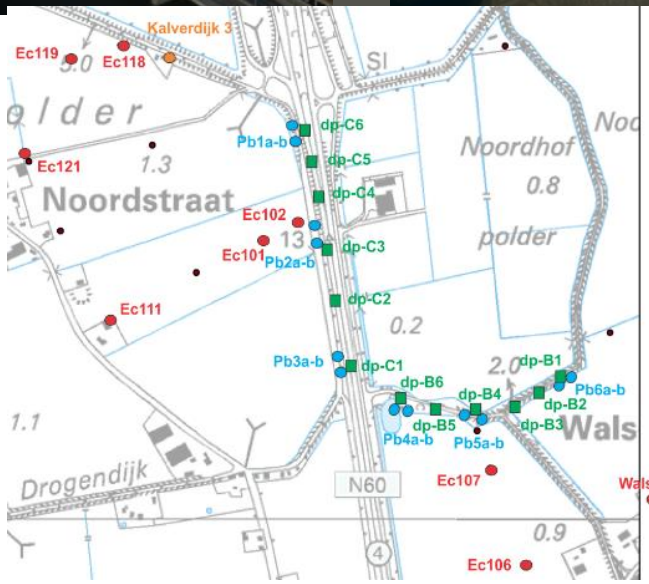
Jan14
Jul14
Jan15
Jul15
Jan16
Jul16

EC118




Kalverdijk 3
Ec119
Ec118
5.0
SI
Noordhof
0.8
polder
Noordstraat
Ec121
1.3
Ec102
13
Ec101
Pb1a-b
Pb2a-b
Pb3a-b
Pb4a-b
Pb5a-b
Pb6a-b
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dp-C4
dp-C3
dp-C2
dp-C1
dp-B1
dp-B2
dp-B3
dp-B4
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N60
Ec107
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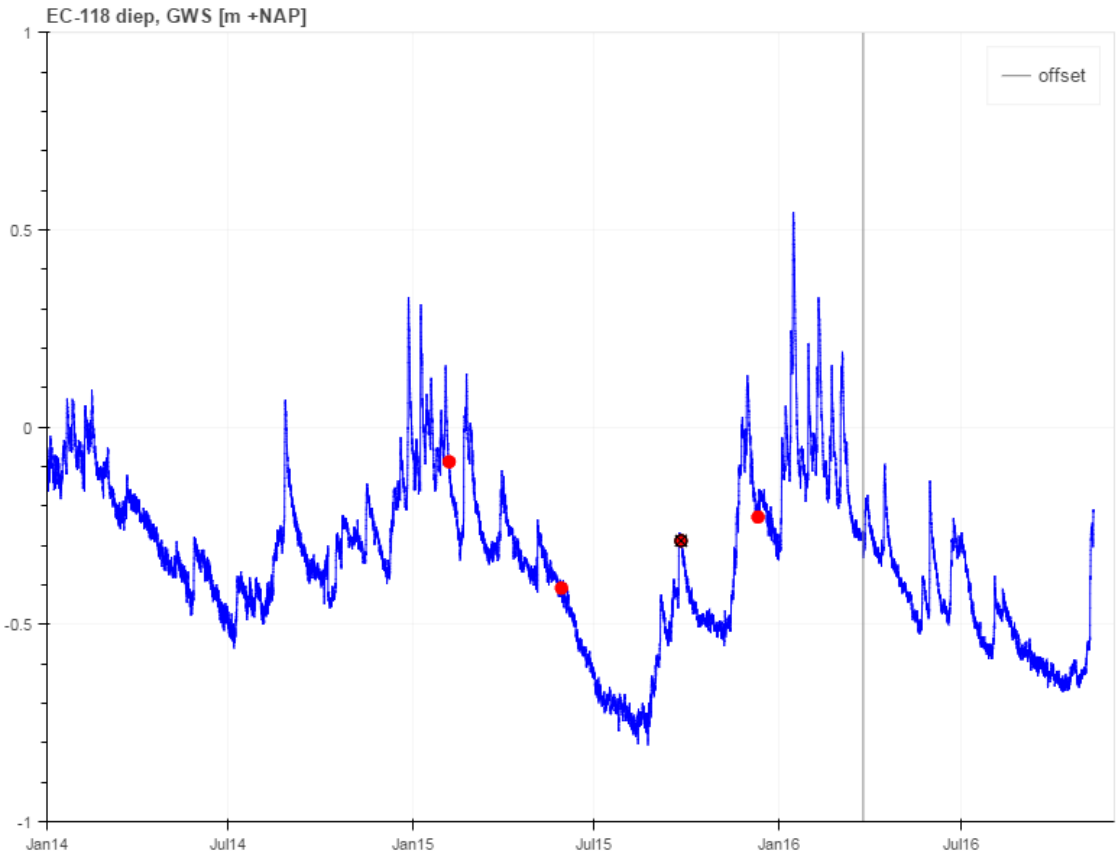
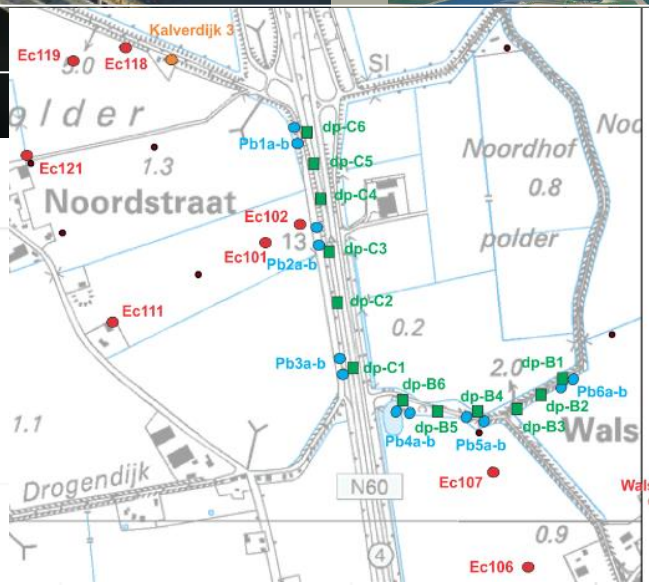
0.9
Ec106

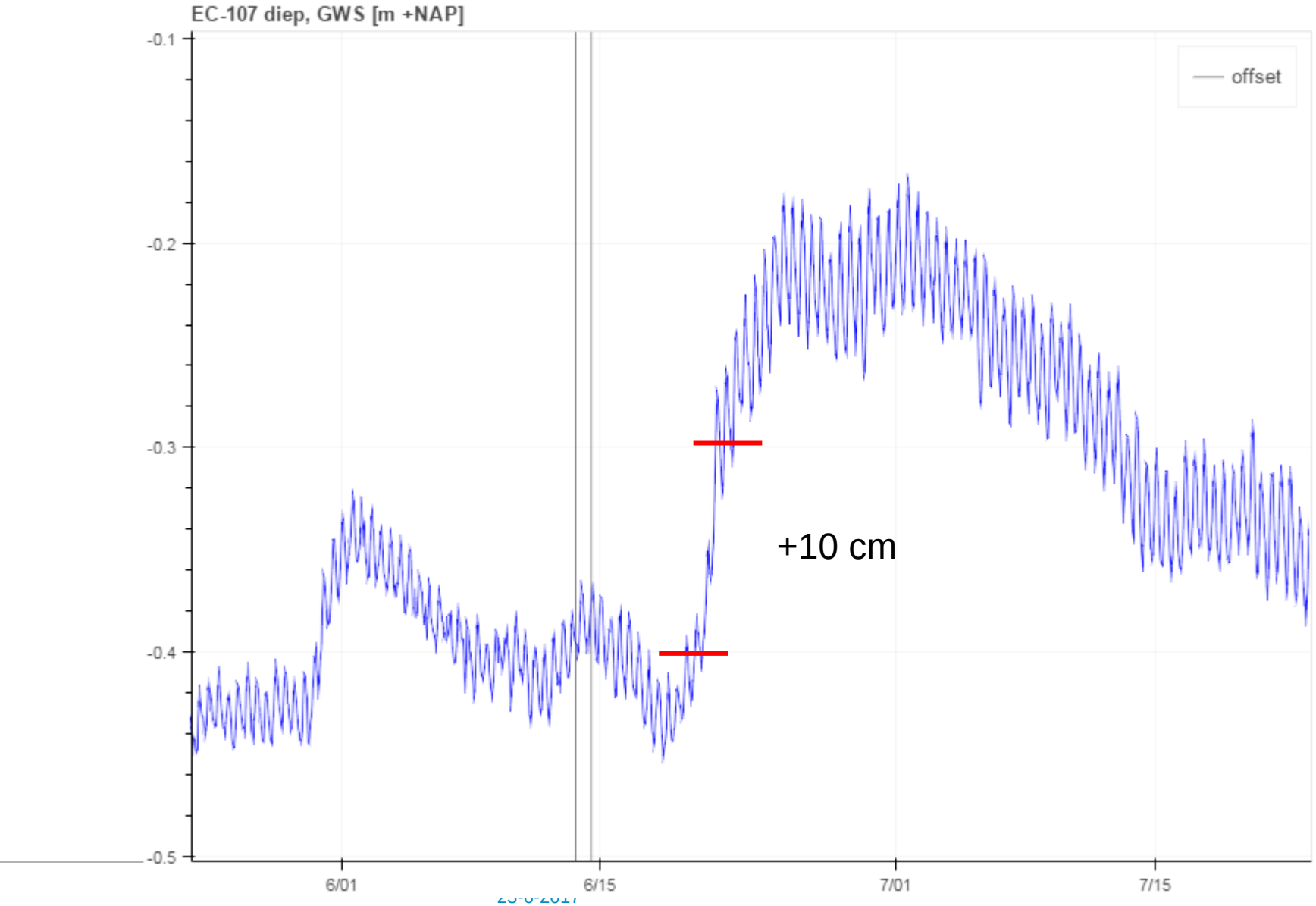

EC-118 diep, GWS [m +NAP]
offset
1
0.5
0
-0.5
-1
Jan14
Jul14
Jan15
Jul15
Jan16
Jul16

EC107

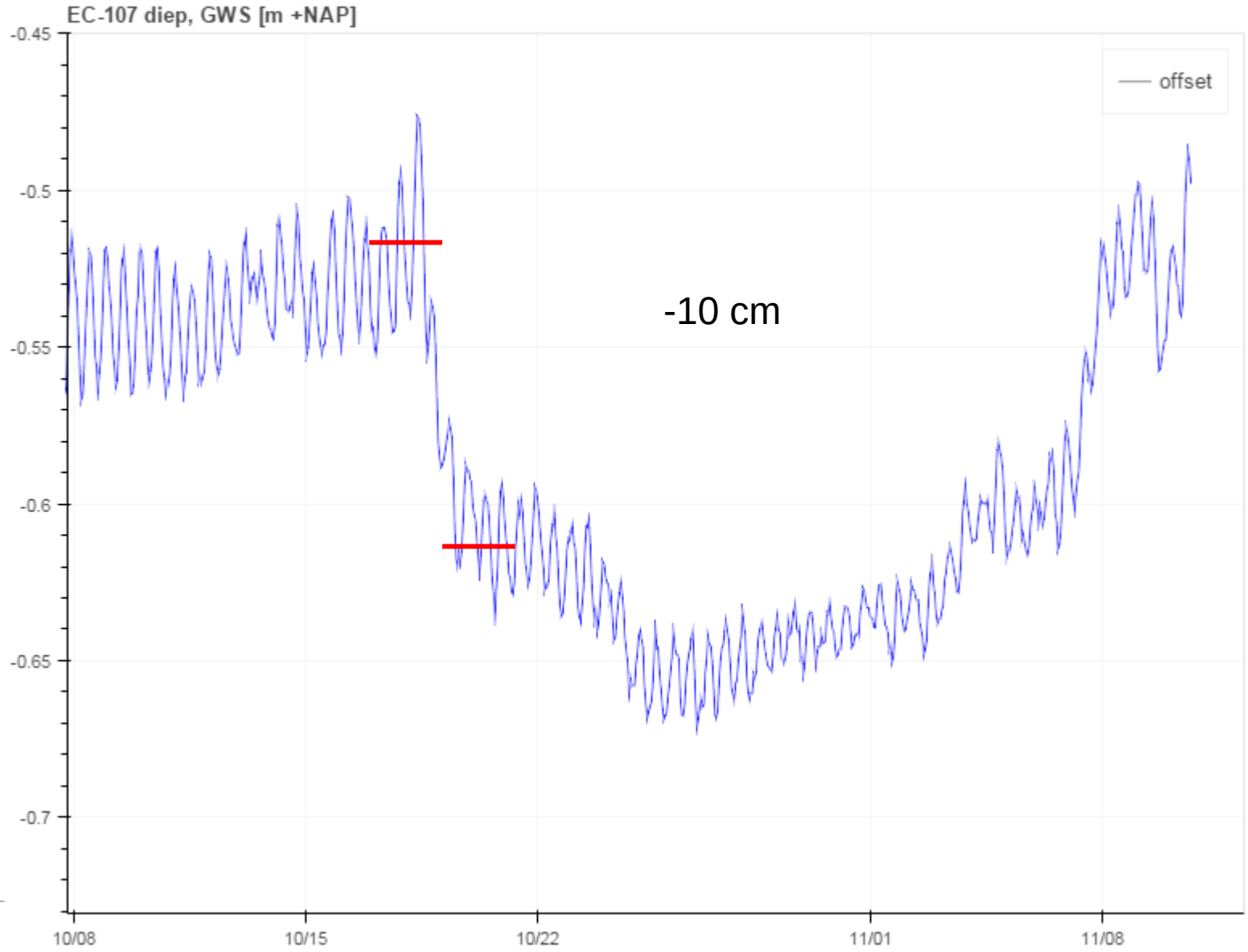

Kalverdijk 3
Ec119
Ec118
Ec121
Ec102
Ec101
Ec111
Ec107
Ec106
Noordstraat
Noordhof
polder
Drogendijk
N60
Wals
dp-C6
dp-C5
dp-C4
dp-C3
dp-C2
dp-C1
dp-B1
dp-B2
dp-B3
dp-B4
dp-B5
dp-B6
Pb1a-b
Pb2a-b
Pb3a-b
Pb4a-b
Pb5a-b
Pb6a-b
1.3
0.8
0.2
2.0
1.1
0.9

EC-107 diep, GWS [m +NAP]
1
0.5
0
-0.5
-1
Jan14
Jul14
Jan15
Jul15
Jan16
Jul16

EC-107: kwelvoorziening dicht 20 juni 2016



EC-107: kwelvoorziening open 18 oktober 2016



Directe effecten samengevat (handmatig bepaald)

	getijdeamplitude (m)			effect door	effect door
	voor 25 juni	na 25 juni	na 25 juni	getijdegebied	kwelvoorziening
meetpunt		kwelv. dicht	kwelv. open	(m)	(m)
EC-101 diep	0.02	0.02	0.02	0	0
EC-102 ondiep	0.04	0.08	0.05	0.02	-0.03
EC-102 diep	0.11				
EC-106 diep	0.07	0.07	0.07	0	0
EC-107 diep	0.03	0.06	0.03	0.02	-0.08
EC-111 ondiep	0.02	0.02	0.02	0	0
EC-111 diep	0.02	0.02	0.02	0	0
EC-118 diep	0.03 tot 0.06	0.03 tot 0.06	0.03 tot 0.06	0	0
EC-119 diep	0.02	0.02	0.02	0	0
EC-121 diep	0.01	0.01	0.01	0	0
Walsoorden ondiep	0.10	0.12	0.11	?0.02	?-0.04
Walsoorden diep	0.10	0.13	0.08	?0.02	?-0.04
Kalversdijk	0.04	0.05	0.05	0	0
Pb1a	0.08	0.78	0.43	0.16	-0.26
Pb2a	0.05	0.80	0.35	0.23	-0.28
Pb2b	0.03	0.50	0.08	0.29	0.36
Pb3a	0.04	0.35	0.24	0.06	-0.10
Pb4a	0.08	0.60	0.20	0.13	-0.22
Pb5a	0.07	0.55	0.13	0.12	-0.29
Pb5b	0.06	0.44	0.01	0.12	-0.38
Pb6a	0.24	0.90	0.32	0.17	-0.39

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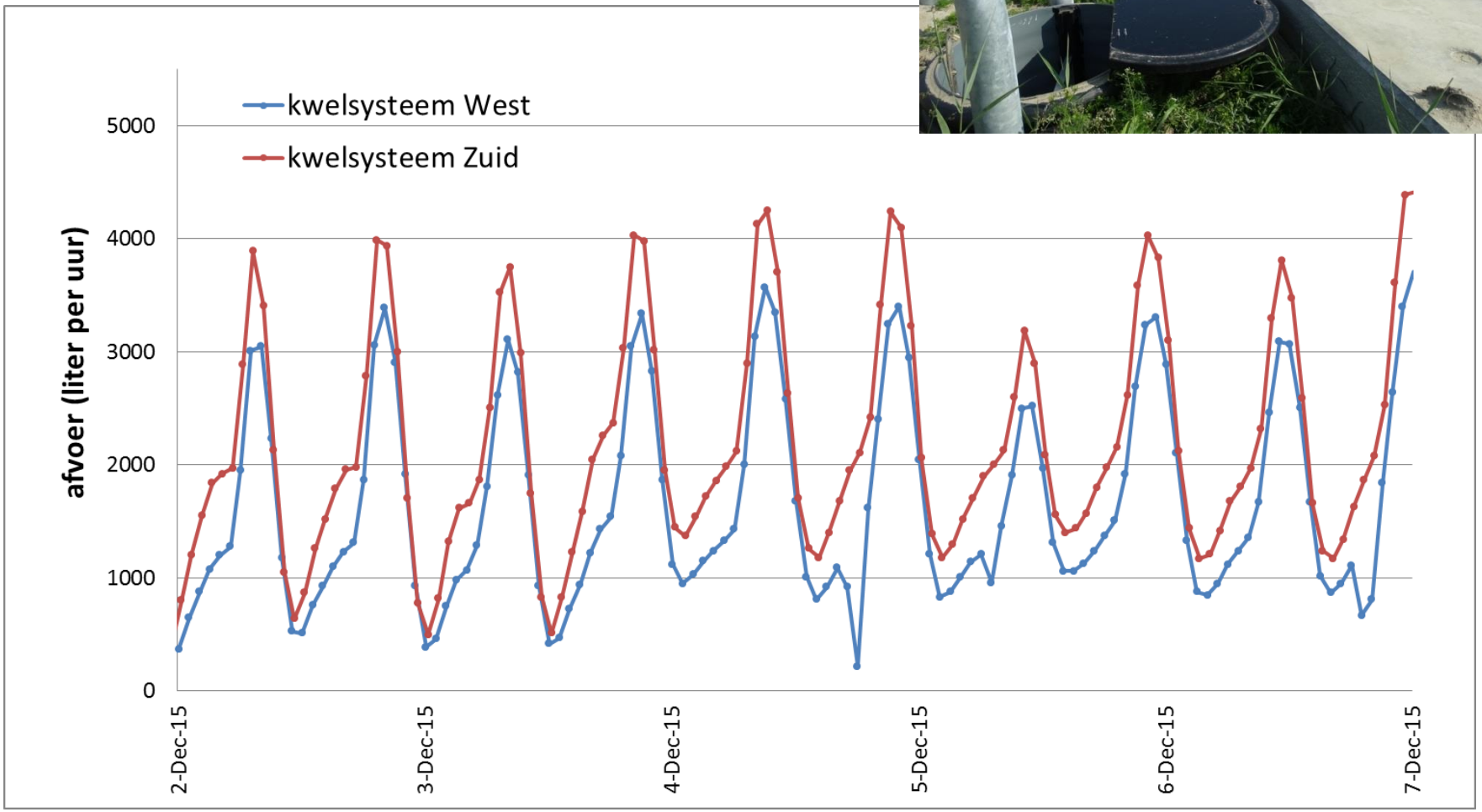
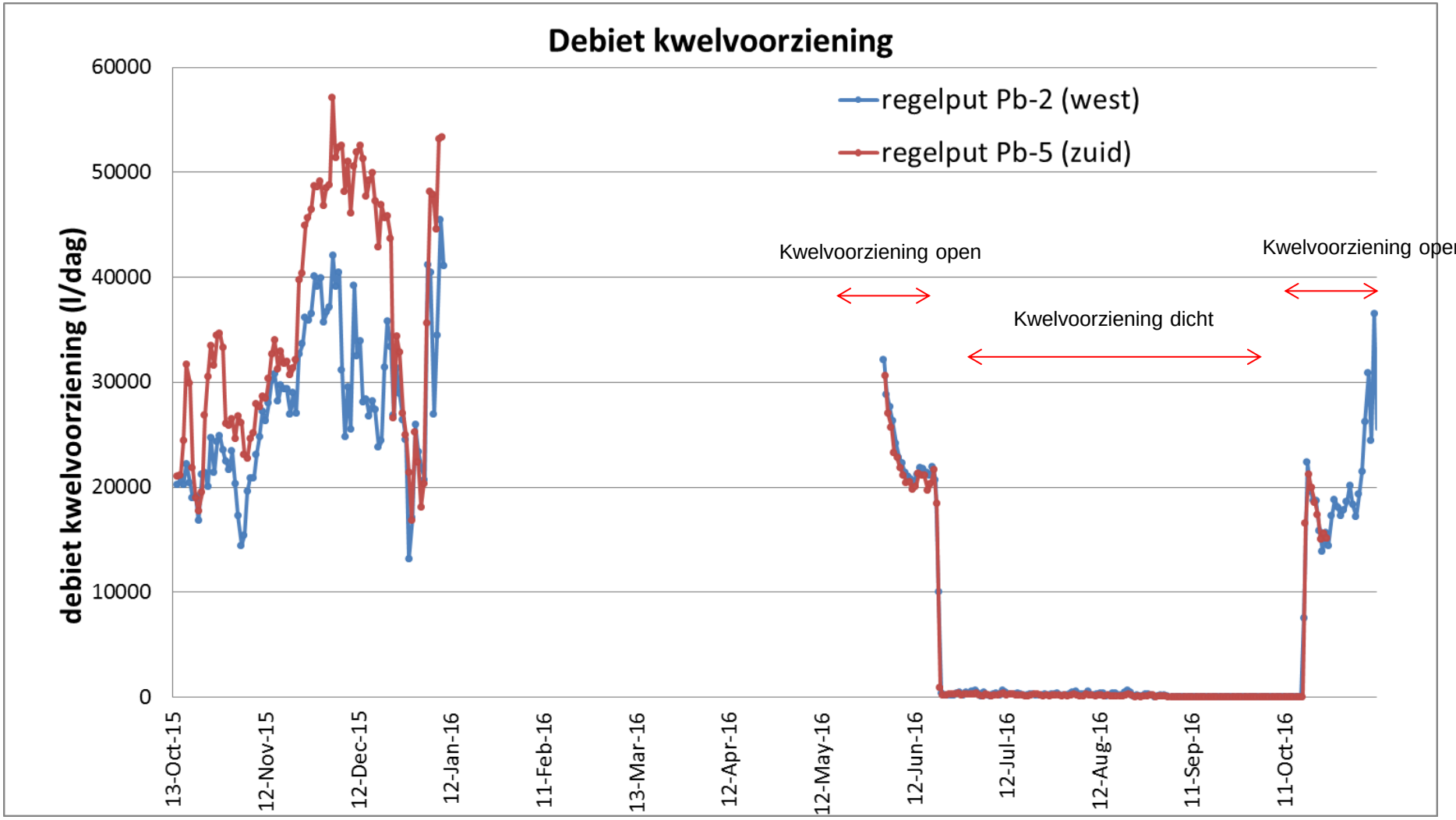
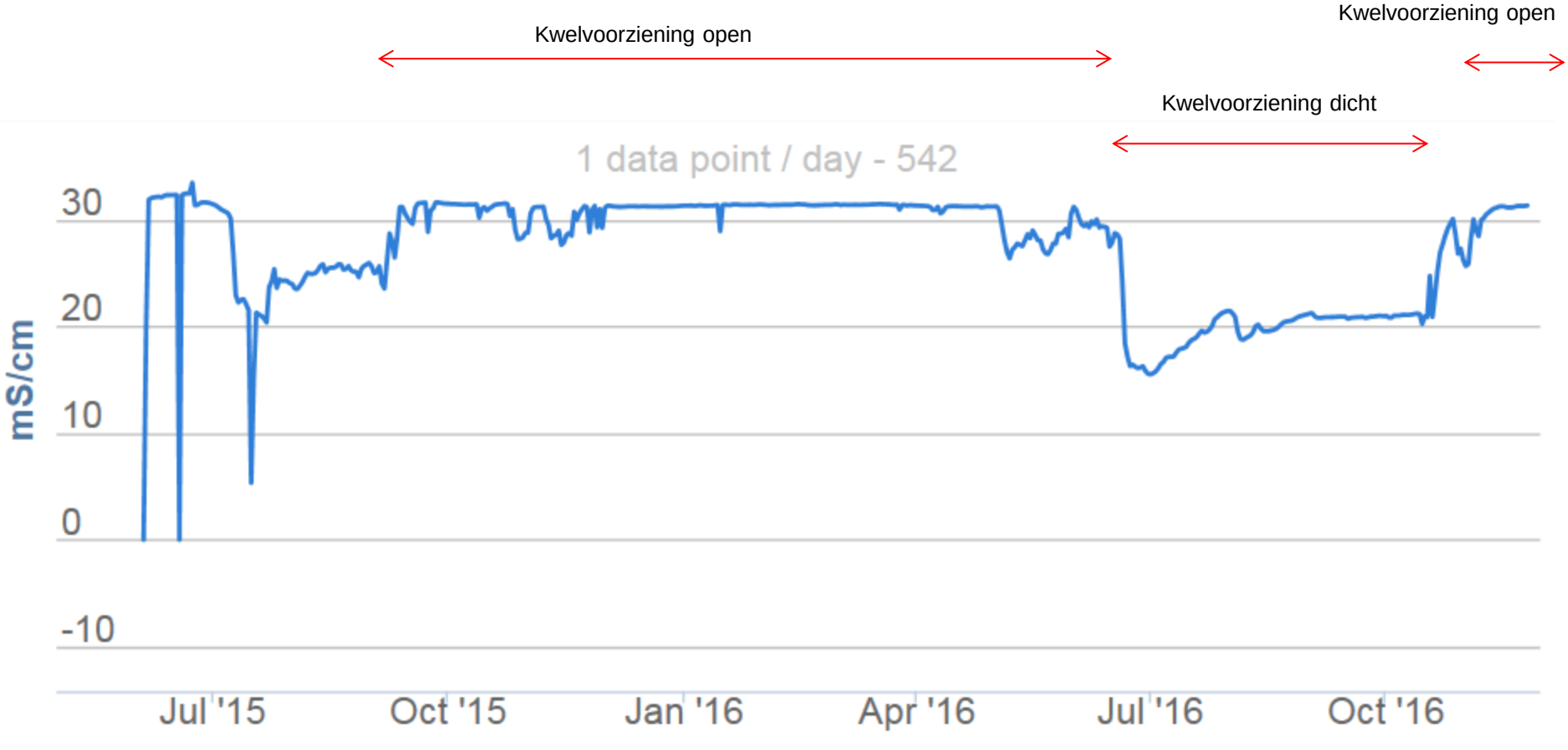
Afvoer kwelsysteem



Afvoer kwelvoorziening: totaal ~400 m³/dag



Zoutvracht kwelvoorziening: 8 ton zout per dag



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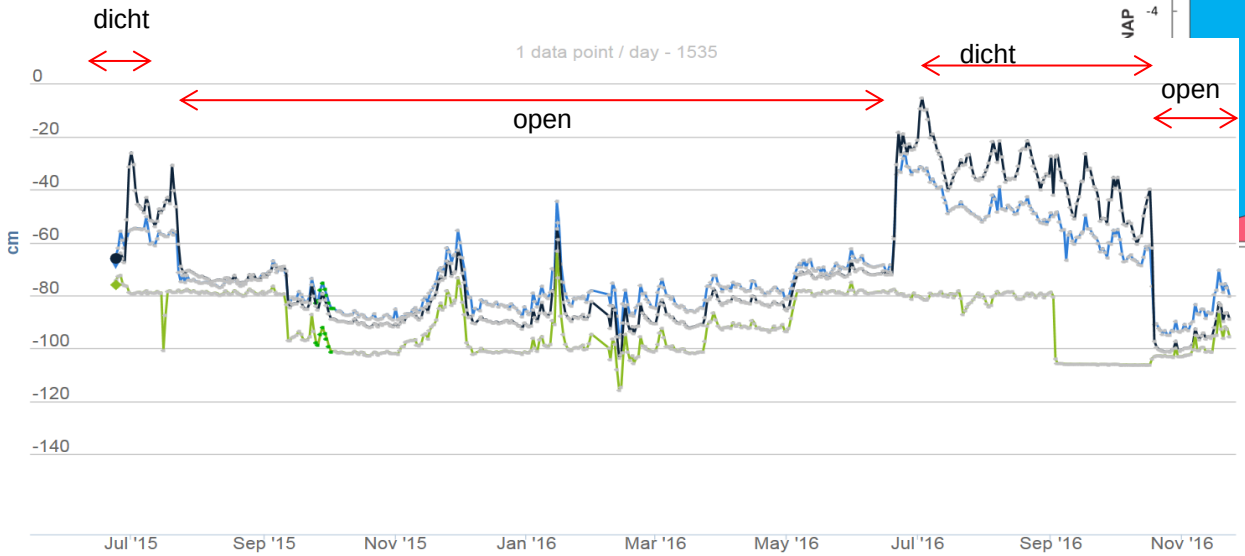
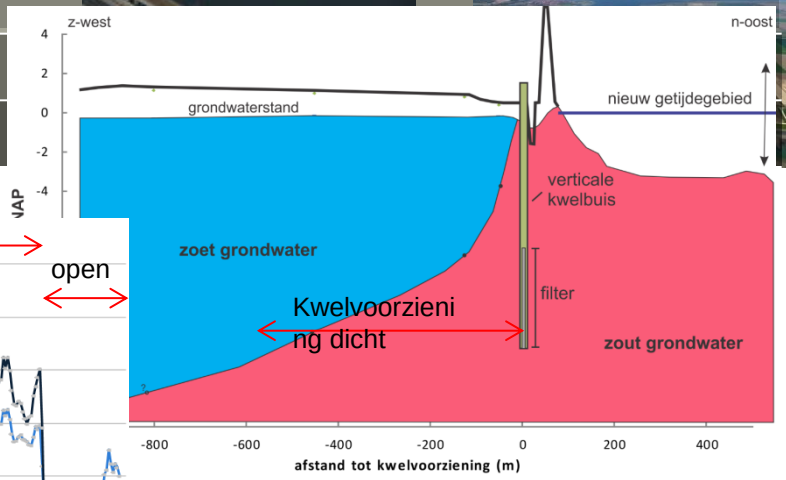
Inregelen kwelvoorziening





- Winter kwelvoorziening helemaal open:
  - hoogste stijghoogte -> door die te verlagen evt. groei lens door neerslagoverschot
  - zoute kwelafvoer wordt verdund
- Zomer kwelvoorziening helemaal dicht:
  - geen zoutbelasting op oppervlaktewater,
  - geen extra verlaging van stijghoogte en grondwaterstand, daardoor mogelijk iets hogere grondwaterstanden

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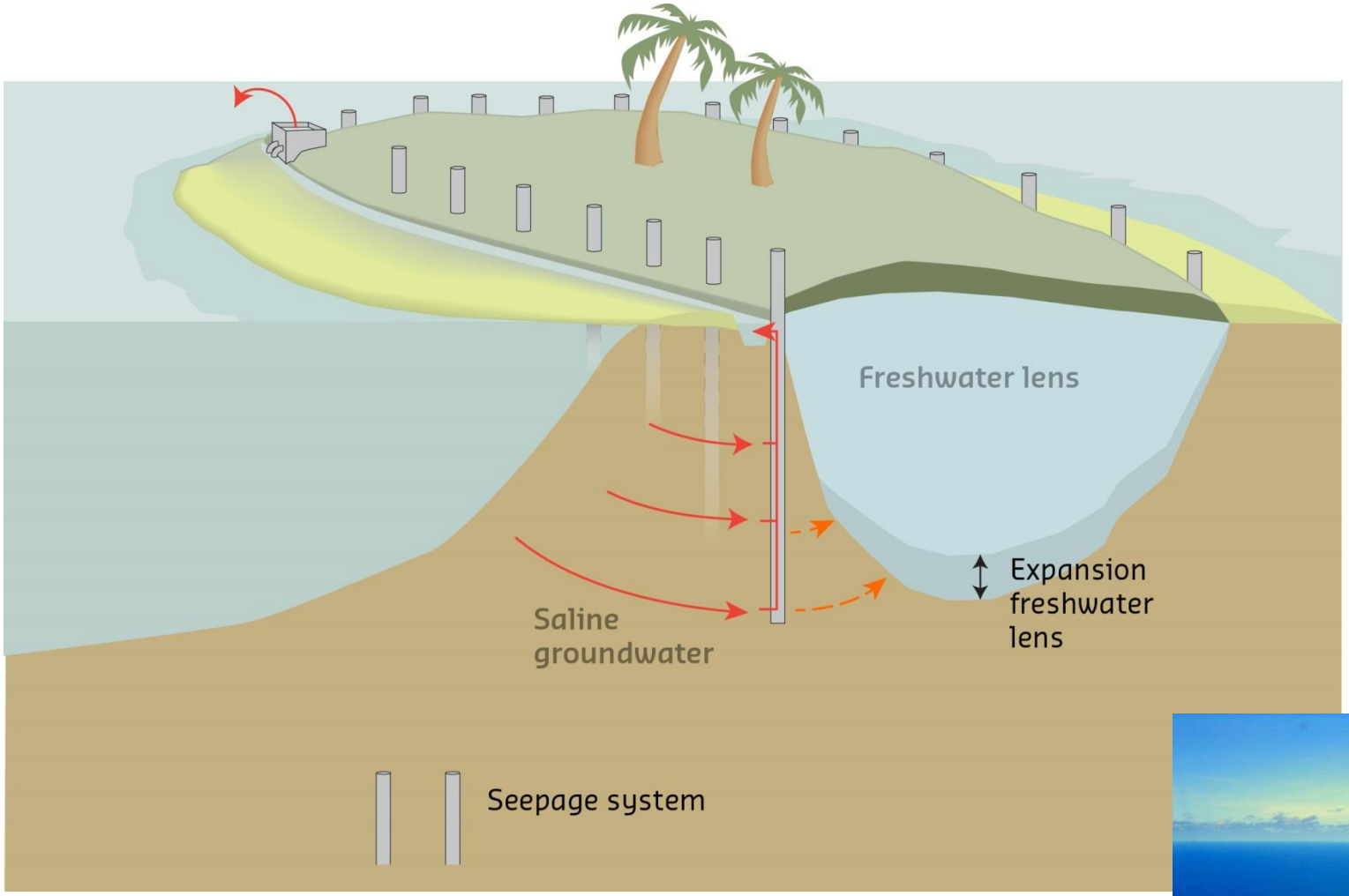
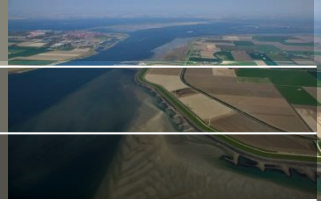
SeepCat voor bescherming zoet grondwater voorraad op kleine oceanische eilanden tegen zeespiegelstijging



VRAGEN ?

perry.delouw@deltares

06-30548000

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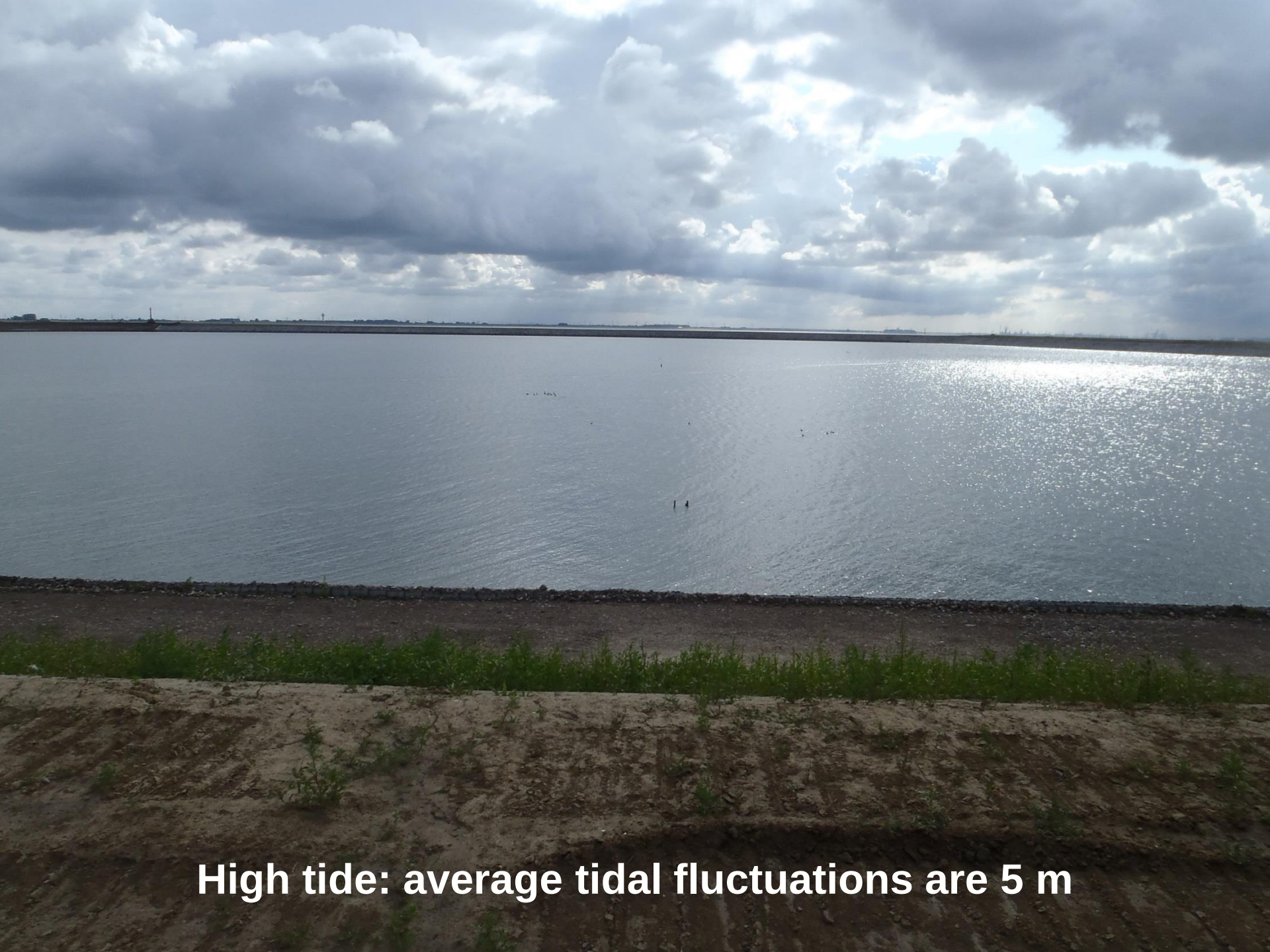
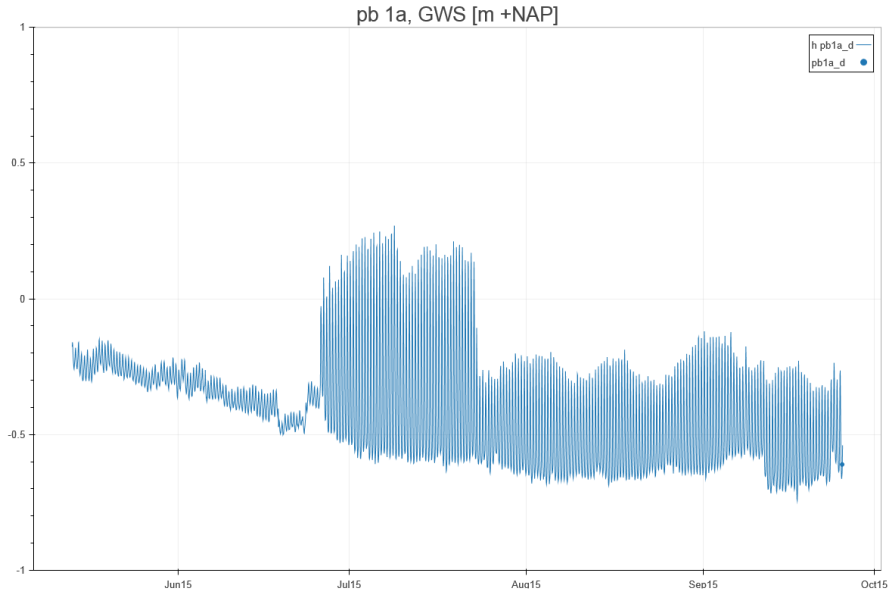
Piezometers at 2, 8 and 12 m depth to measure tidal propagation in subsoil

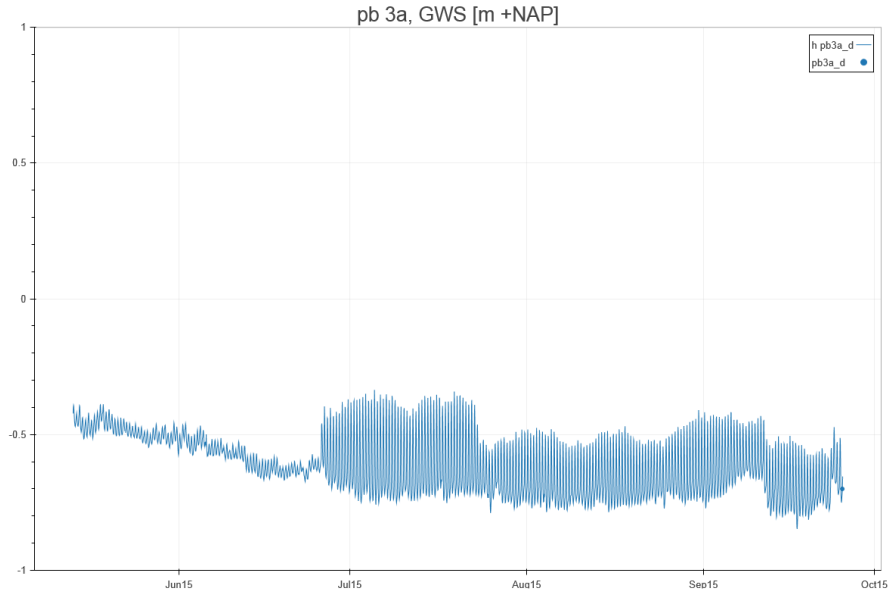


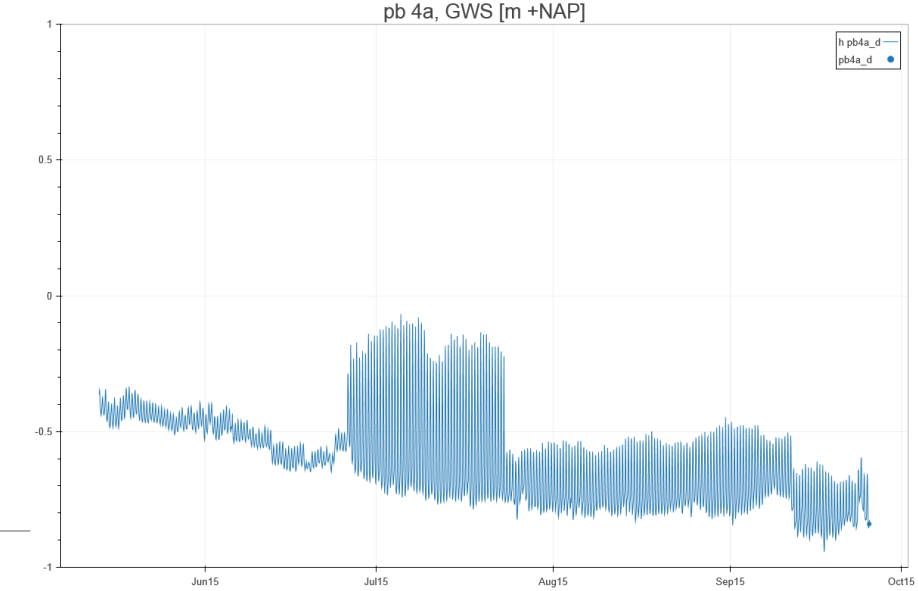
High tide: average tidal fluctuations are 5 m

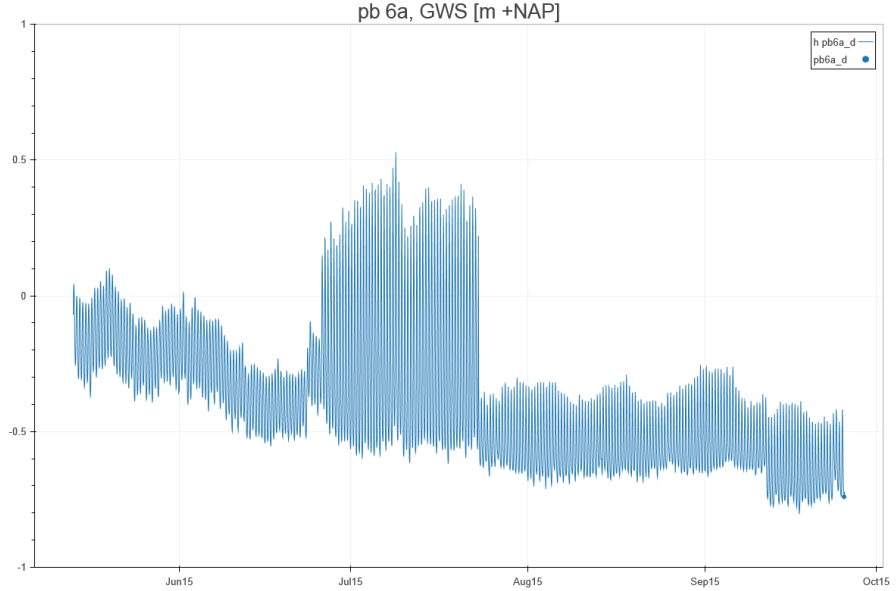

Low tide

4 meetpunten bij kwelvoorziening

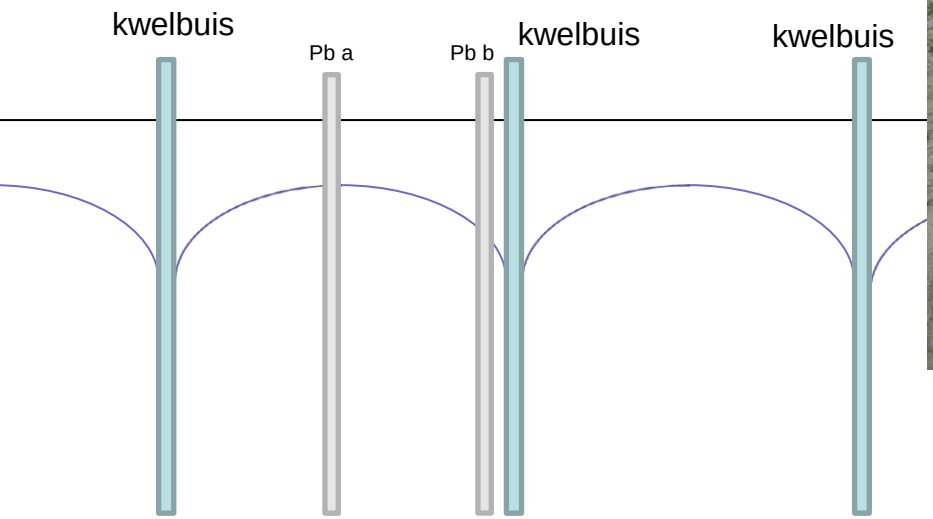


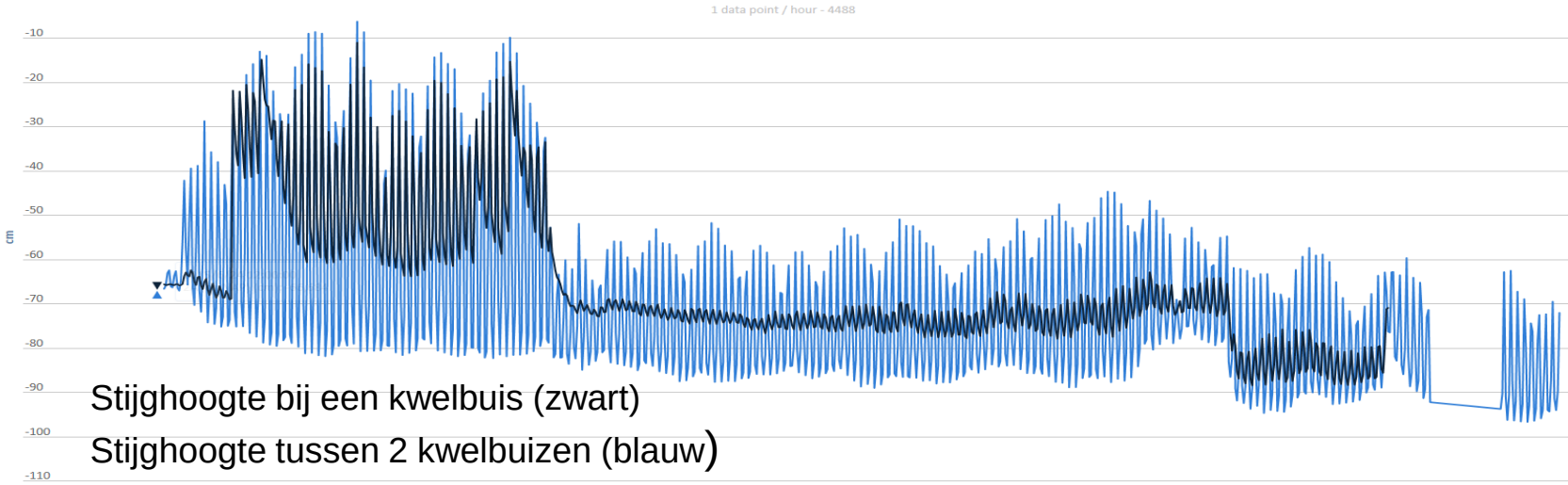






Stijghoogte

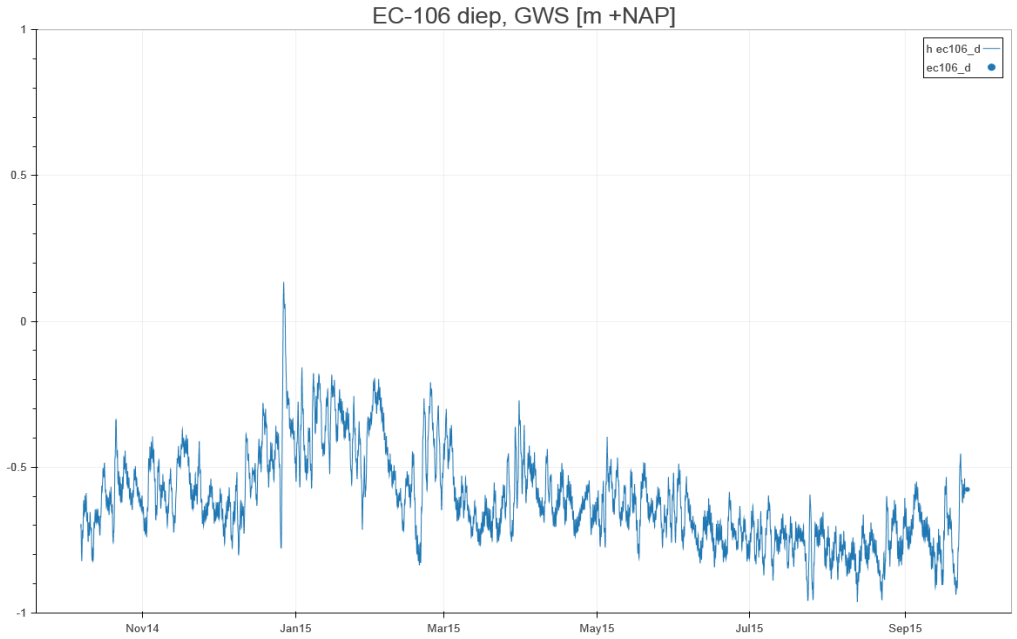


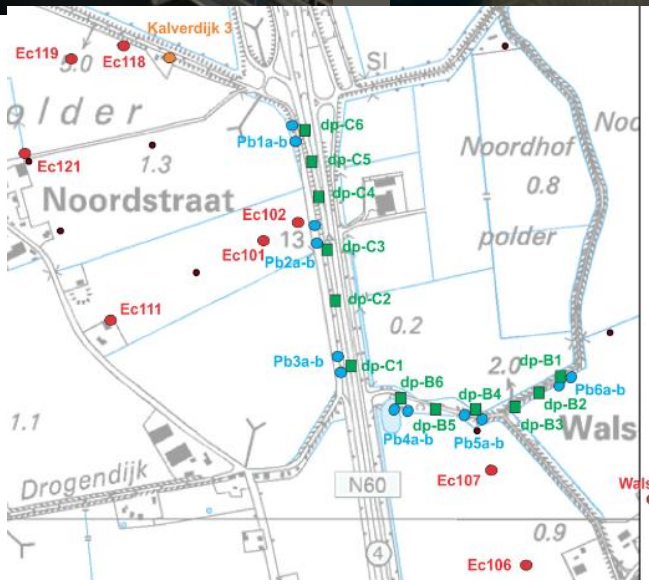


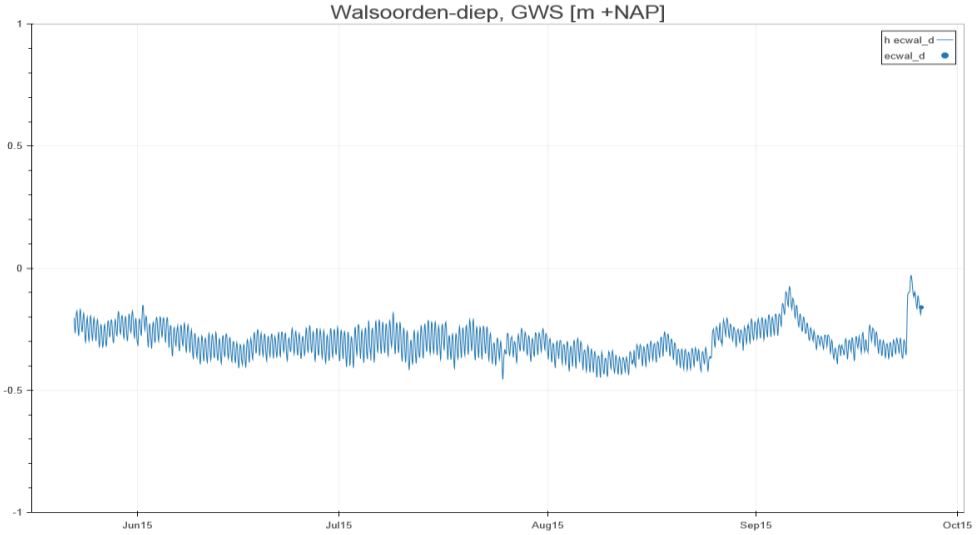
Stijghoogte bij een kwelbuis (zwart)

Stijghoogte tussen 2 kwelbuizen (blauw)

EC106 en nieuw meetpunt Walsoorden







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