SUSTAINABLE GROUNDWATER MONITORING SYSTEM OF EAST-VIRU COUNTY, ESTONIA

Norwegian Financial Mechanism project 52/2006-EE0010
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Coordinator: Ministry of Environment, Estonia
Partners:
University of Tartu, Estonia
Tallinn Technical University, Estonia
Geological Survey of Estonia

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Geological Survey of Estonia

Improvement of the data collection and archive system of the groundwater monitoring data for additional quality control

2011

According to the project change the improvement of data collection and archive system of the groundwater monitoring data was additional task for Geological survey of Estonia.

The information provided by the national groundwater monitoring can be found by Environmental Register and Environmental Monitoring Programme carried out by Estonian Environment Information Centre Free access to the data allowed by Internet. The improved groundwater monitoring network is presented in Figure 1.

Geological Survey of Estonia has been responsible of state groundwater monitoring of Estonia. As a new EU Member State, Estonia is developing the new groundwater monitoring system that will be correspond to the EU regulations and takes into account the experience of the international networks.

Geological Survey collects data from its monitoring stations. Processed and analysed data, such as long time series, average values, minimum and maximum values of groundwater levels are available using improved Access database. Some examples from structure of database are presented in Figures 2–8 and Tables 1–5.

Table 5 presents the example of treated data, which are ready to upload and archive into improved groundwater monitoring database.

In Figures 8–13 are presented the first results of automatic measurements of changes of groundwater levels and comparison of manual and automatic measurements.

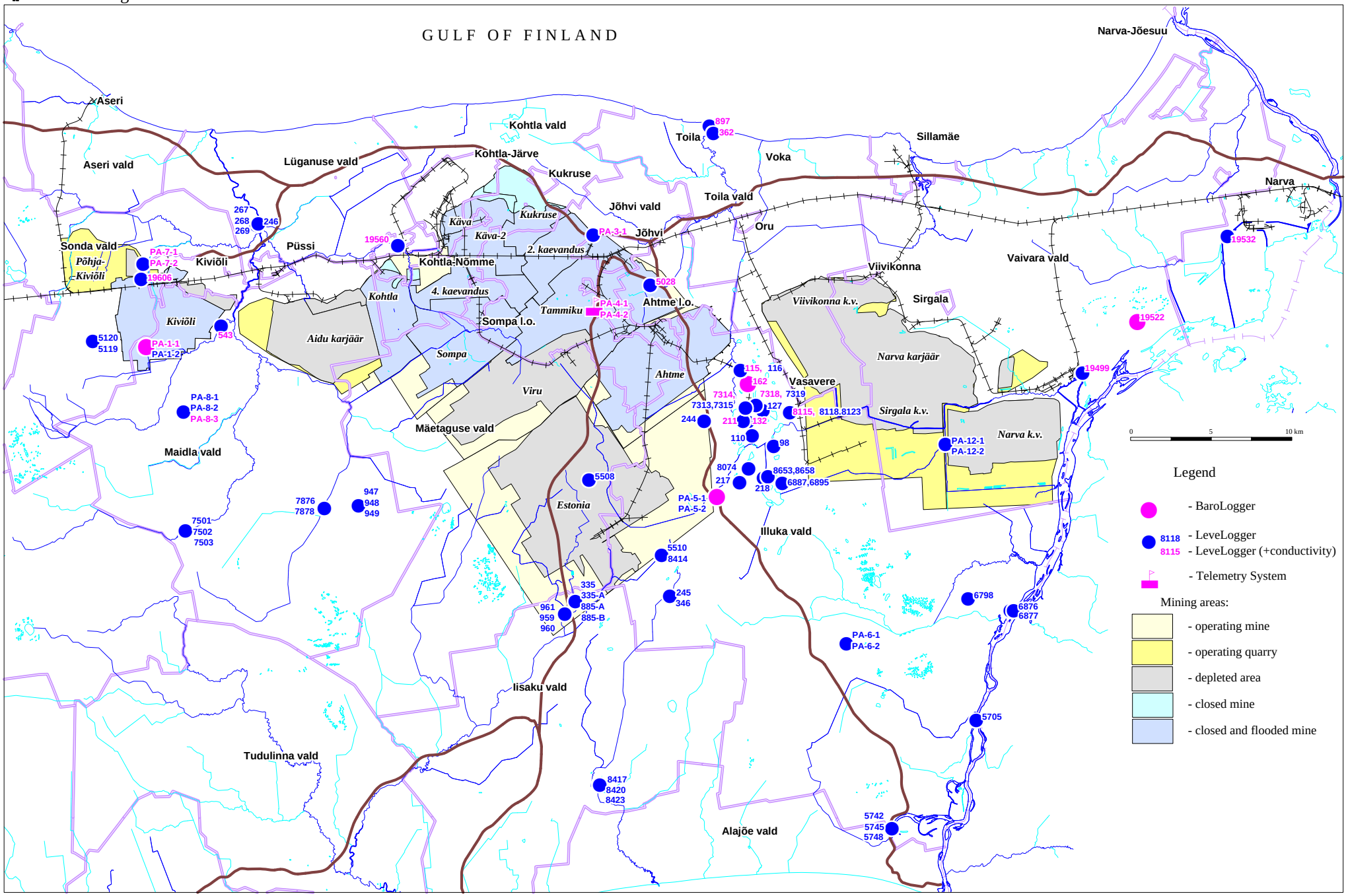

Figure 1. Location of automatic monitoring wells of East-Viru county.

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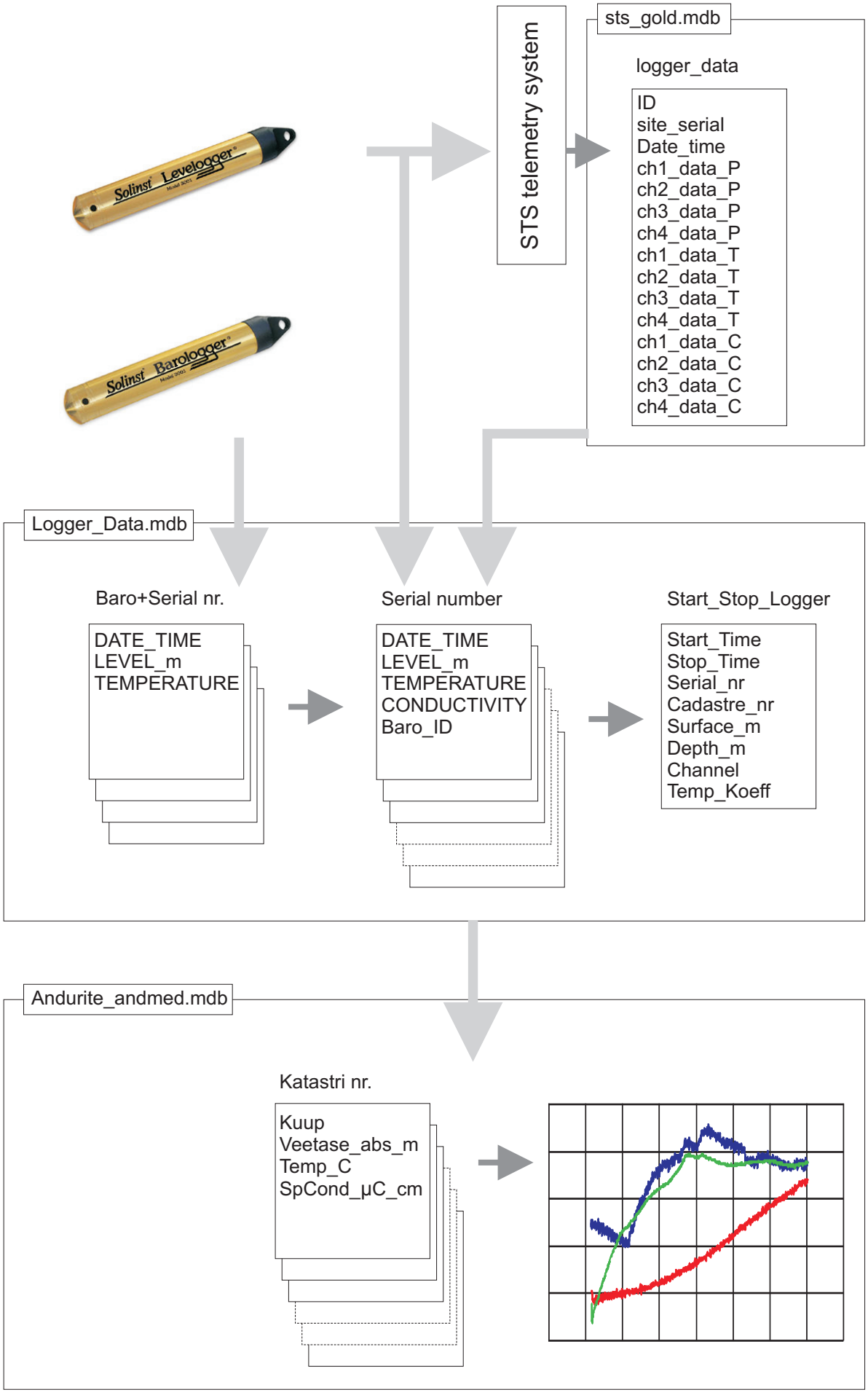


Figure 2. Structure of receiving and processing data of loggers.

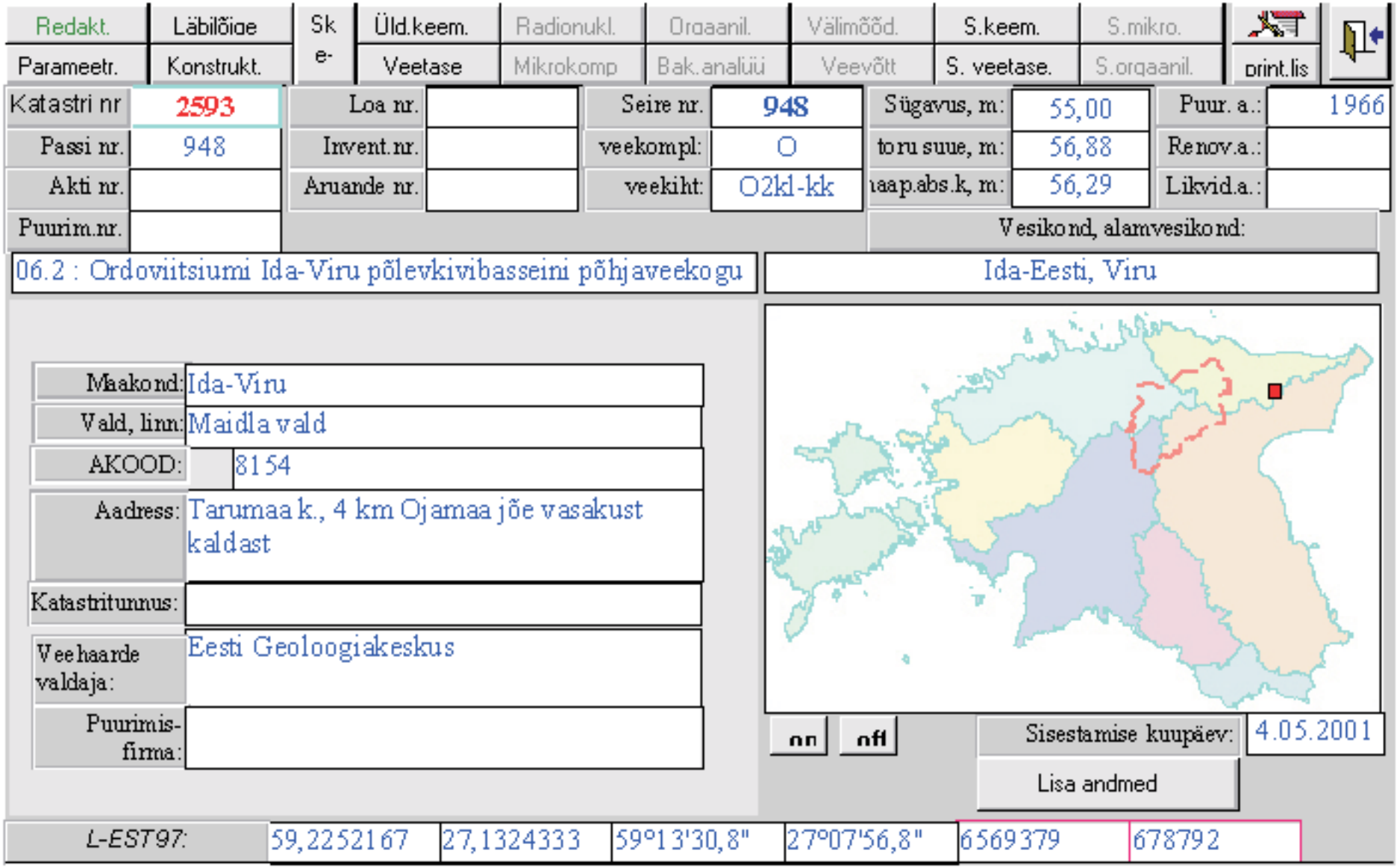


Figure 3. General information of monitoring well.

Toru	Nimetus	Diam	Algus	Lõpp
01	manteltoru	146	0,00	2,70
02	manteltoru	108	2,70	8,50
03	manteldamata	92	8,50	55,00
F1	filtrita	92	8,50	55,00

Kih	GeolVanus	KivimiNimetus	Lasumi_s	Lamami	Paksus	
1	QIV	muld	0,00	0,20	0,20	
2	gQIII	liivane savi (kuni 50% liiva)	0,20	0,40	0,20	
3	gQIII	lubjakivirähk	0,40	1,20	0,80	
4	O2rk	lubjakivi savi vahekihtidega	1,20	8,45	7,25	
5	O2on	savikas lubjakivi mergli vahekihtide	8,45	10,80	2,35	
6	O2kl	savikas lubjakivi mergli vahekihtide	10,80	20,00	9,20	
7	O2jh	savikas lubjakivi mergli vahekihtide	20,00	32,30	12,30	
8	O2id	savikas lubjakivi mergli vahekihtide	32,30	39,75	7,45	
9	O2kk	lubjakivi kukersiidi vahekihtidega	39,75	41,00	1,25	
10	O2kk	põlevkivi (kukersiit)	41,00	42,00	1,00	
11	O2kk	lubjakivi kukersiidi vahekihtidega	42,00	50,00	8,00	
12	O2kk	põlevkivi (kukersiit)	50,00	55,00	5,00	+

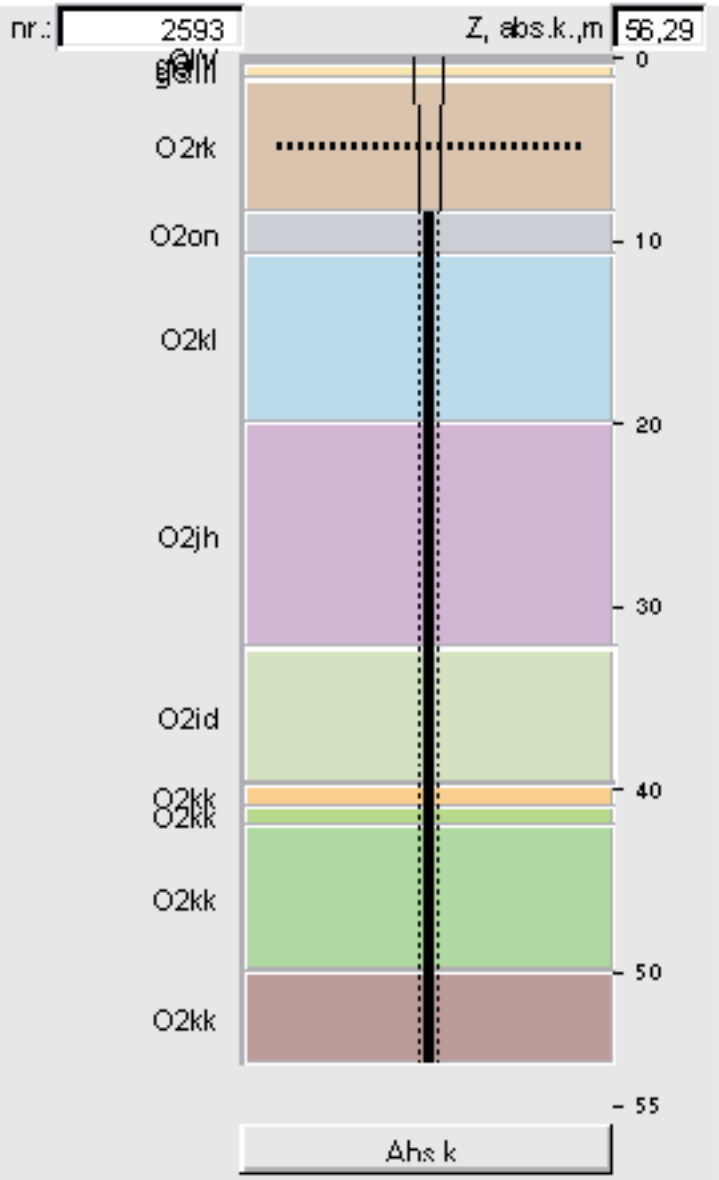


Figure 4. Geological cross-section and casing of monitoring well.

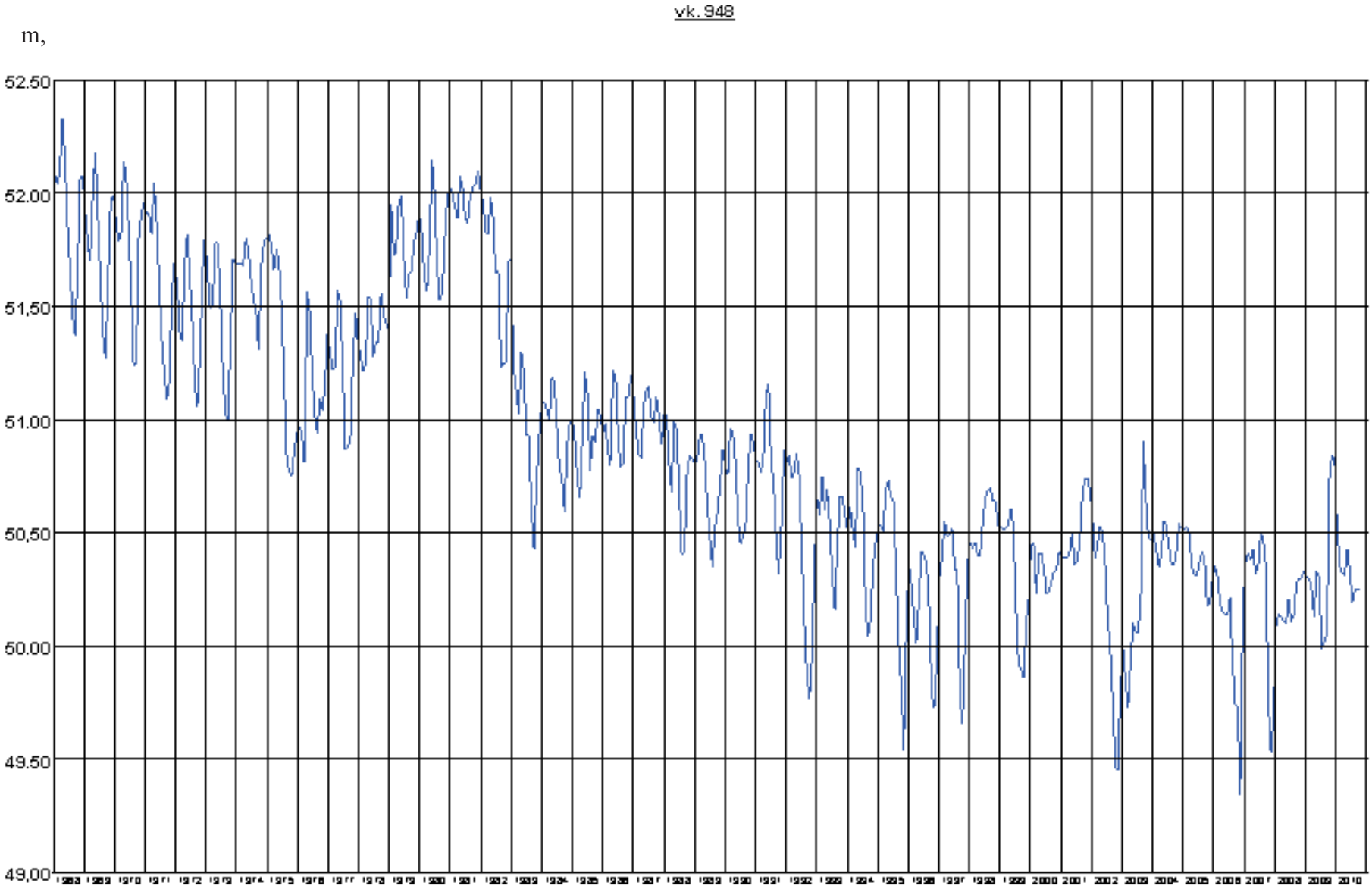


Figure 5. Monthly groundwater level (m, asl.).

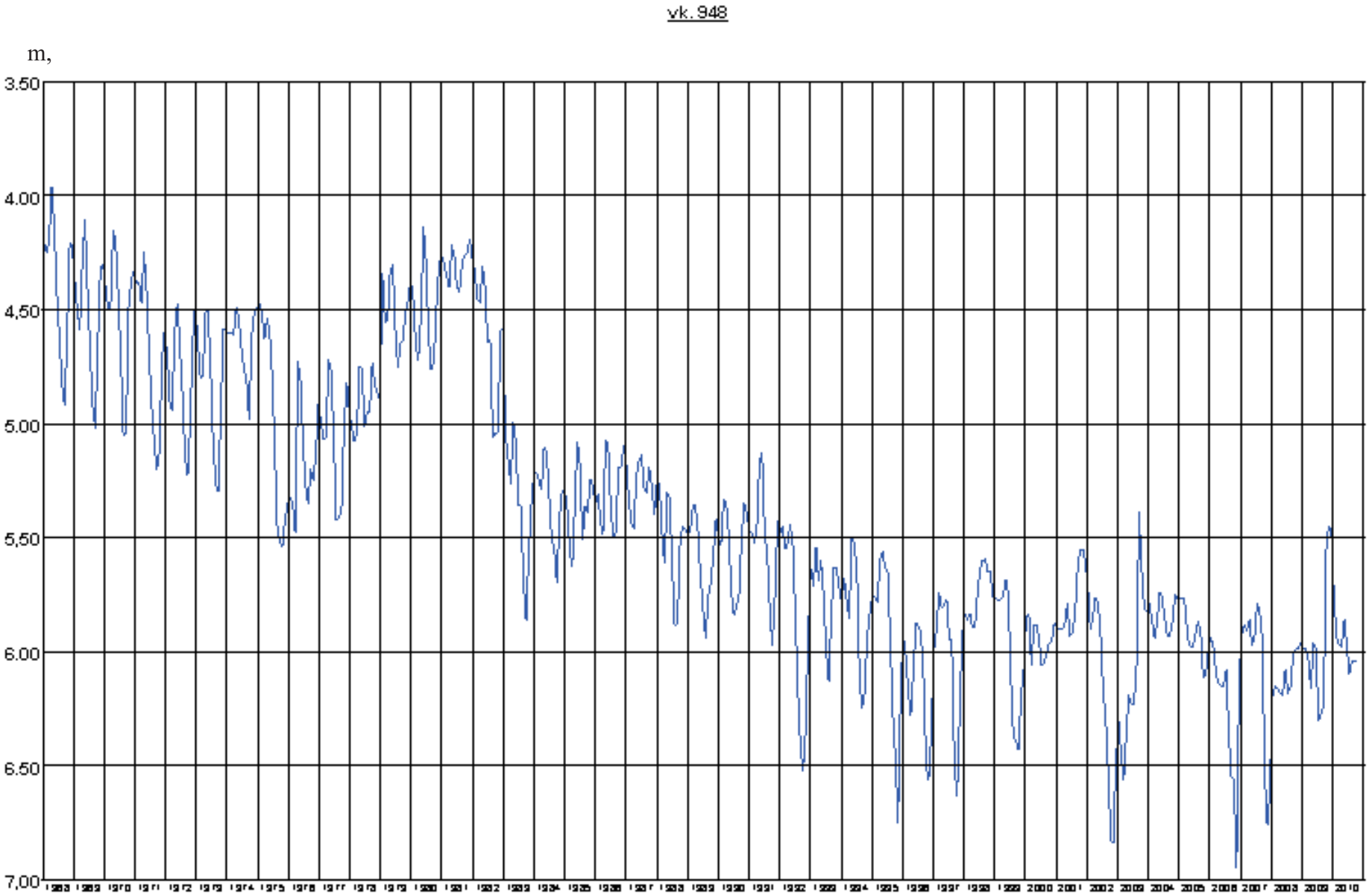


Figure 6. Monthly groundwater level from ground surface, m.

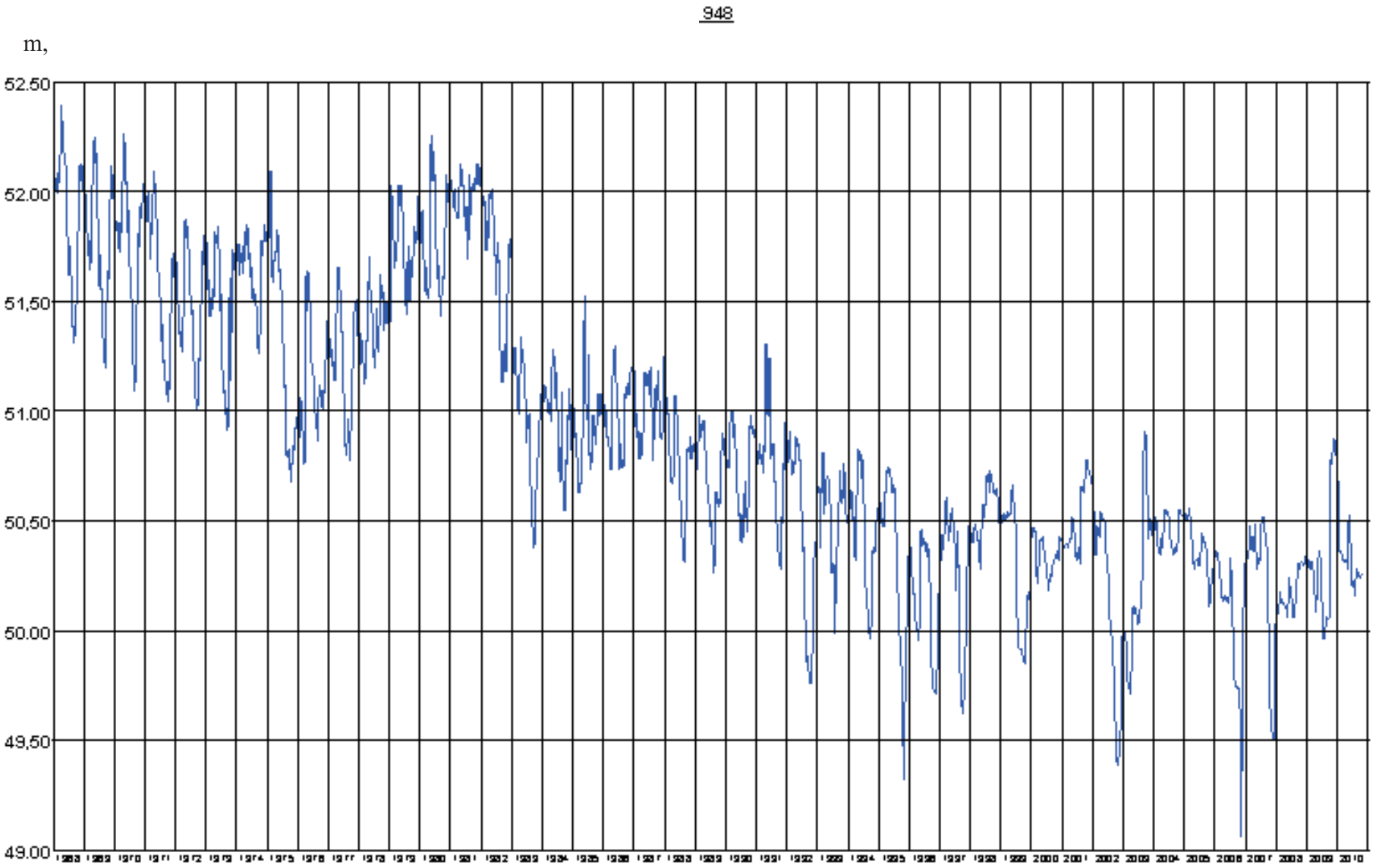


Figure 7. Daily groundwater level (m, asl.).

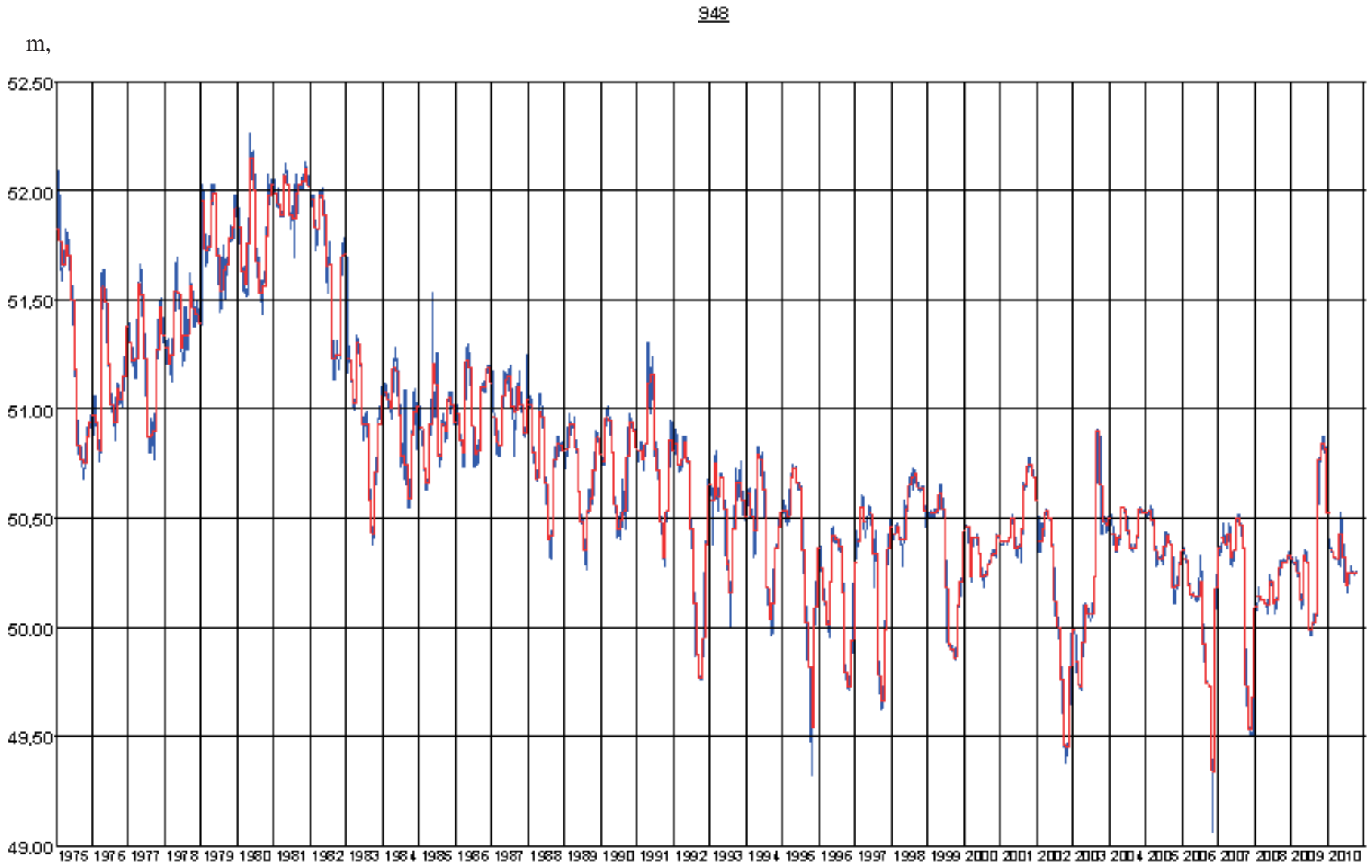
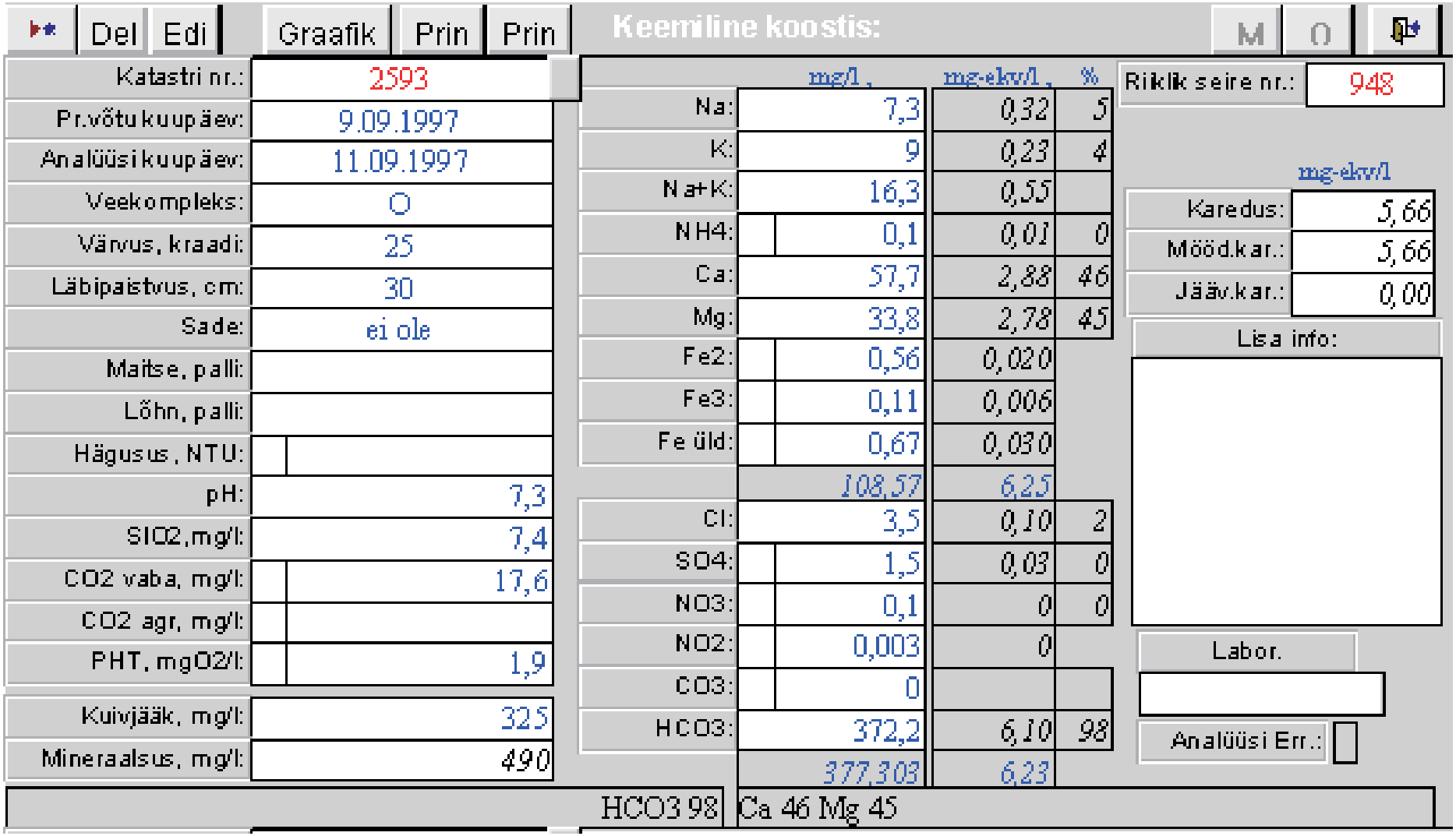


Figure 8. Daily and mean monthly groundwater level (m, asl.).

Table 1. Chemical composition of groundwater monitoring samples.



Del | Edi | Graafik | Prin | Prin | Keemiline koostis: | M | O

Katastri nr.:	2593
Pr.võtu kuupäev:	9.09.1997
Analüüsi kuupäev:	11.09.1997
Veekompleks:	O
Värvus, kraadi:	25
Läbipaistvus, cm:	30
Sade:	ei ole
Maitse, palli:	
Lõhn, palli:	
Hägusus, NTU:	
pH:	7,3
SiO2, mg/l:	7,4
CO2 vaba, mg/l:	17,6
CO2 agr, mg/l:	
PHT, mgO2/l:	1,9
Kuivjääk, mg/l:	325
Mineraalsus, mg/l:	490

	mg/l	mg-ekv/l	%
Na:	7,3	0,32	5
K:	9	0,23	4
Na+K:	16,3	0,55	
NH4:	0,1	0,01	0
Ca:	57,7	2,88	46
Mg:	33,8	2,78	45
Fe2:	0,56	0,020	
Fe3:	0,11	0,006	
Fe üld:	0,67	0,030	
	108,57	6,25	
Cl:	3,5	0,10	2
SO4:	1,5	0,03	0
NO3:	0,1	0	0
NO2:	0,003	0	
CO3:	0		
HCO3:	372,2	6,10	98
	377,303	6,23	

Riiklik seire nr.: 948

	mg-ekv/l
Karedus:	5,66
Mööd.kar.:	5,66
Jääv.kar.:	0,00

Lisa info:

Labor.

Analüüsi Err.:

HCO3 98 | Ca 46 Mg 45

Table 2. Daily groundwater level from ground surface (m) and elevation above sea level (m).

Seire Nr	Kuupäev	Veetase, m	Veetase_abs, m
948	1.01.1968	4,10	52,19
948	3.01.1968	4,13	52,16
948	6.01.1968	4,14	52,15
948	9.01.1968	4,20	52,09
948	12.01.1968	4,19	52,10
948	15.01.1968	4,25	52,04
948	18.01.1968	4,28	52,01
948	21.01.1968	4,23	52,06
948	24.01.1968	4,25	52,04
948	27.01.1968	4,24	52,05
948	1.02.1968	4,28	52,01
948	3.02.1968	4,27	52,02
948	6.02.1968	4,26	52,03
948	9.02.1968	4,25	52,04
948	12.02.1968	4,20	52,09
948	15.02.1968	4,21	52,08
948	18.02.1968	4,25	52,04
948	21.02.1968	4,27	52,02
948	24.02.1968	4,26	52,03
948	1.03.1968	4,30	51,99
948	3.03.1968	4,24	52,05
948	6.03.1968	4,17	52,12
948	9.03.1968	4,24	52,05
948	12.03.1968	4,25	52,04
948	15.03.1968	4,20	52,09
948	18.03.1968	4,25	52,04
948	21.03.1968	4,23	52,06
948	24.03.1968	4,12	52,17
948	27.03.1968	4,00	52,29
948	1.04.1968	3,94	52,35
948	3.04.1968	3,90	52,39
948	6.04.1968	3,96	52,33
948	9.04.1968	3,94	52,35
948	12.04.1968	3,96	52,33
948	15.04.1968	3,97	52,32
948	18.04.1968	3,97	52,32
948	21.04.1968	3,99	52,30
948	24.04.1968	3,99	52,30
948	27.04.1968	4,00	52,29
948	1.05.1968	4,03	52,26
948	3.05.1968	4,07	52,22
948	6.05.1968	4,11	52,18
948	9.05.1968	4,12	52,17
948	12.05.1968	4,11	52,18
948	15.05.1968	4,14	52,15
948	18.05.1968	4,12	52,17
948	21.05.1968	4,13	52,16
948	24.05.1968	4,15	52,14

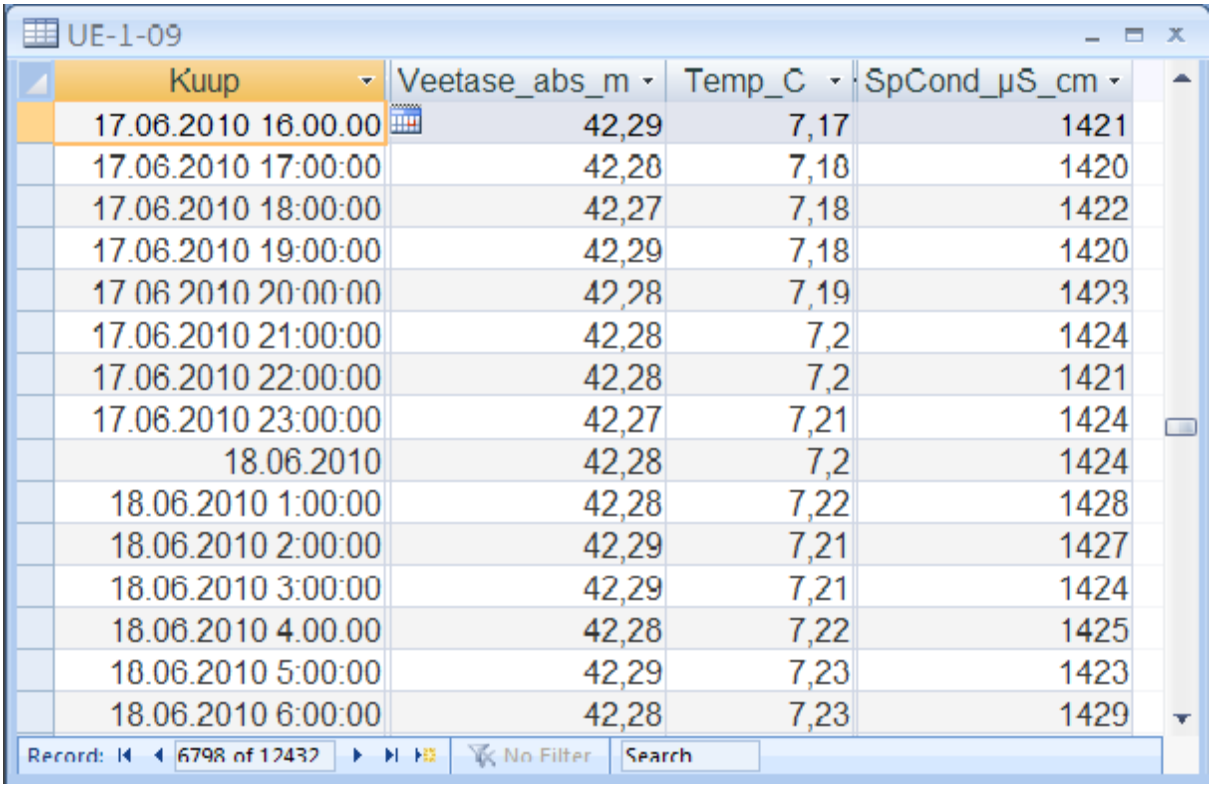
Table 3. Monthly mean and extreme observation values.

Seire nr	Aasta	Kuu	Veetase_ abs, m	Veetase, m	Veetase_ max	Kuup_ max	Veetase_ min	Kuup_ min
948	1968	1	52,09	4,20	4,10	1	4,28	18
948	1968	2	52,04	4,25	4,20	12	4,28	1
948	1968	3	52,09	4,20	4,00	27	4,30	1
948	1968	4	52,33	3,96	3,90	3	4,00	27
948	1968	5	52,17	4,12	4,03	1	4,17	27
948	1968	6	51,87	4,42	4,22	1	4,59	24
948	1968	7	51,68	4,61	4,54	15	4,67	3
948	1968	8	51,46	4,83	4,69	1	4,93	24
948	1968	9	51,37	4,92	4,83	27	4,98	6
948	1968	10	51,65	4,64	4,38	27	4,82	1
948	1968	11	52,08	4,21	4,17	6	4,24	18
948	1968	12	52,07	4,22	4,16	1	4,28	27
948	1969	1	51,92	4,37	4,30	21	4,44	24
948	1969	2	51,78	4,51	4,43	1	4,57	24
948	1969	3	51,70	4,59	4,51	6	4,65	18
948	1969	4	52,01	4,28	4,06	21	4,61	1
948	1969	5	52,18	4,11	4,04	18	4,16	12
948	1969	6	51,87	4,42	4,21	1	4,65	27
948	1969	7	51,62	4,67	4,58	18	4,74	6
948	1969	8	51,37	4,92	4,80	1	5,01	21
948	1969	9	51,27	5,02	4,81	27	5,09	15
948	1969	10	51,63	4,66	4,55	27	4,73	1
948	1969	11	51,98	4,31	4,17	21	4,52	3
948	1969	12	51,99	4,30	4,21	1	4,37	27
948	1970	1	51,89	4,40	4,30	1	4,47	18
948	1970	2	51,79	4,50	4,42	1	4,55	18
948	1970	3	51,81	4,48	4,38	27	4,56	6
948	1970	4	52,14	4,15	4,03	18	4,42	1
948	1970	5	52,09	4,20	4,10	1	4,34	27
948	1970	6	51,84	4,45	4,37	12	4,58	27
948	1970	7	51,57	4,72	4,63	1	4,82	27
948	1970	8	51,24	5,05	4,87	1	5,20	24
948	1970	9	51,25	5,04	4,55	27	5,20	1
948	1970	10	51,80	4,49	4,36	27	4,54	6
948	1970	11	51,91	4,38	4,34	24	4,41	9
948	1970	12	51,96	4,33	4,25	1	4,40	24
948	1971	1	51,91	4,38	4,33	24	4,46	3
948	1971	2	51,91	4,38	4,29	1	4,46	21
948	1971	3	51,82	4,47	4,38	27	4,60	1
948	1971	4	52,04	4,25	4,20	9	4,34	1
948	1971	5	51,87	4,42	4,31	1	4,53	27
948	1971	6	51,60	4,69	4,57	1	4,77	27
948	1971	7	51,37	4,92	4,86	1	4,99	27
948	1971	8	51,21	5,08	4,99	3	5,15	27
948	1971	9	51,09	5,20	5,16	1	5,25	27
948	1971	10	51,17	5,12	4,93	27	5,22	1
948	1971	11	51,57	4,72	4,59	21	4,84	1

Table 4. Years mean and extreme observation values.

Graafikud			Tabel, kuu keskmised	1967 / 2010		Tabel, algandmed	
Seire nr.	Aasta	veetase abs.k., m	veetase, m	max.		min.	
				veetase	kuup.	veetase	kuup.
948	1967	52,04	4,25	3,72	18.10	4,91	21.09
948	1968	51,91	4,38	3,90	03.04	4,98	06.09
948	1969	51,78	4,51	4,04	18.05	5,09	15.09
948	1970	51,77	4,52	4,03	18.04	5,20	24.08
948	1971	51,60	4,69	4,20	09.04	5,25	27.09
948	1972	51,49	4,80	4,31	24.12	5,28	12.09
948	1973	51,48	4,81	4,45	21.05	5,38	03.09
948	1974	51,65	4,64	4,44	27.04	5,03	09.09
948	1975	51,29	5,00	4,19	03.02	5,61	01.10
948	1976	51,13	5,16	4,65	24.04	5,53	12.03
948	1977	51,23	5,06	4,63	21.04	5,52	12.09
948	1978	51,38	4,91	4,59	24.04	5,17	03.03
948	1979	51,79	4,50	4,26	12.01	4,85	09.07
948	1980	51,79	4,50	4,03	01.05	4,86	01.09
948	1981	51,99	4,30	4,16	18.04	4,60	18.07
948	1982	51,66	4,63	4,28	03.04	5,16	24.08
948	1983	50,96	5,33	4,95	01.04	5,91	06.09
948	1984	50,95	5,34	5,01	24.04	5,74	01.09
948	1985	50,93	5,36	4,76	01.05	5,66	24.02
948	1986	51,01	5,28	4,99	27.04	5,56	09.03
948	1987	51,00	5,29	5,04	01.12	5,51	15.02
948	1988	50,77	5,52	5,22	15.04	5,98	06.08
948	1989	50,71	5,58	5,31	01.02	6,03	27.07
948	1990	50,75	5,54	5,28	24.02	5,89	01.07
948	1991	50,77	5,52	4,98	01.04	6,01	27.09
948	1992	50,43	5,86	5,38	12.01	6,53	12.09
948	1993	50,54	5,75	5,48	12.02	6,30	06.07

Table 5. Table of treated data (groundwater level, temperature and special conductivity)



UE-1-09

Kuup	Veetase_abs_m	Temp_C	SpCond_µS_cm
17.06.2010 16.00.00	42,29	7,17	1421
17.06.2010 17:00:00	42,28	7,18	1420
17.06.2010 18:00:00	42,27	7,18	1422
17.06.2010 19:00:00	42,29	7,18	1420
17.06.2010 20:00:00	42,28	7,19	1423
17.06.2010 21:00:00	42,28	7,2	1424
17.06.2010 22:00:00	42,28	7,2	1421
17.06.2010 23:00:00	42,27	7,21	1424
18.06.2010	42,28	7,2	1424
18.06.2010 1:00:00	42,28	7,22	1428
18.06.2010 2:00:00	42,29	7,21	1427
18.06.2010 3:00:00	42,29	7,21	1424
18.06.2010 4.00.00	42,28	7,22	1425
18.06.2010 5:00:00	42,29	7,23	1423
18.06.2010 6:00:00	42,28	7,23	1429

Record: 6798 of 12432 No Filter Search

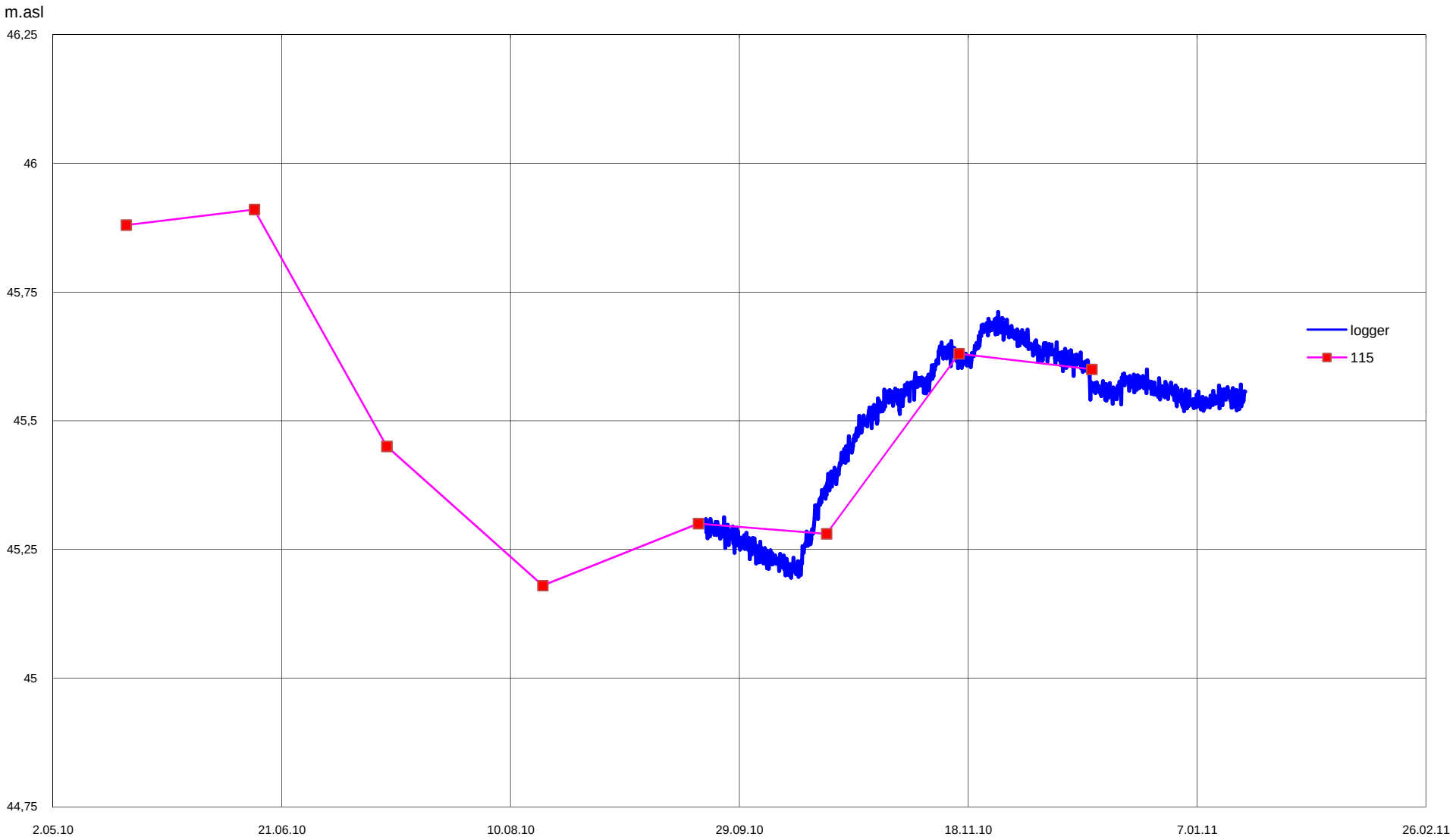


Figure 8. Changes of groundwater levels in groundwater monitoring well 115 and logger 1046173.

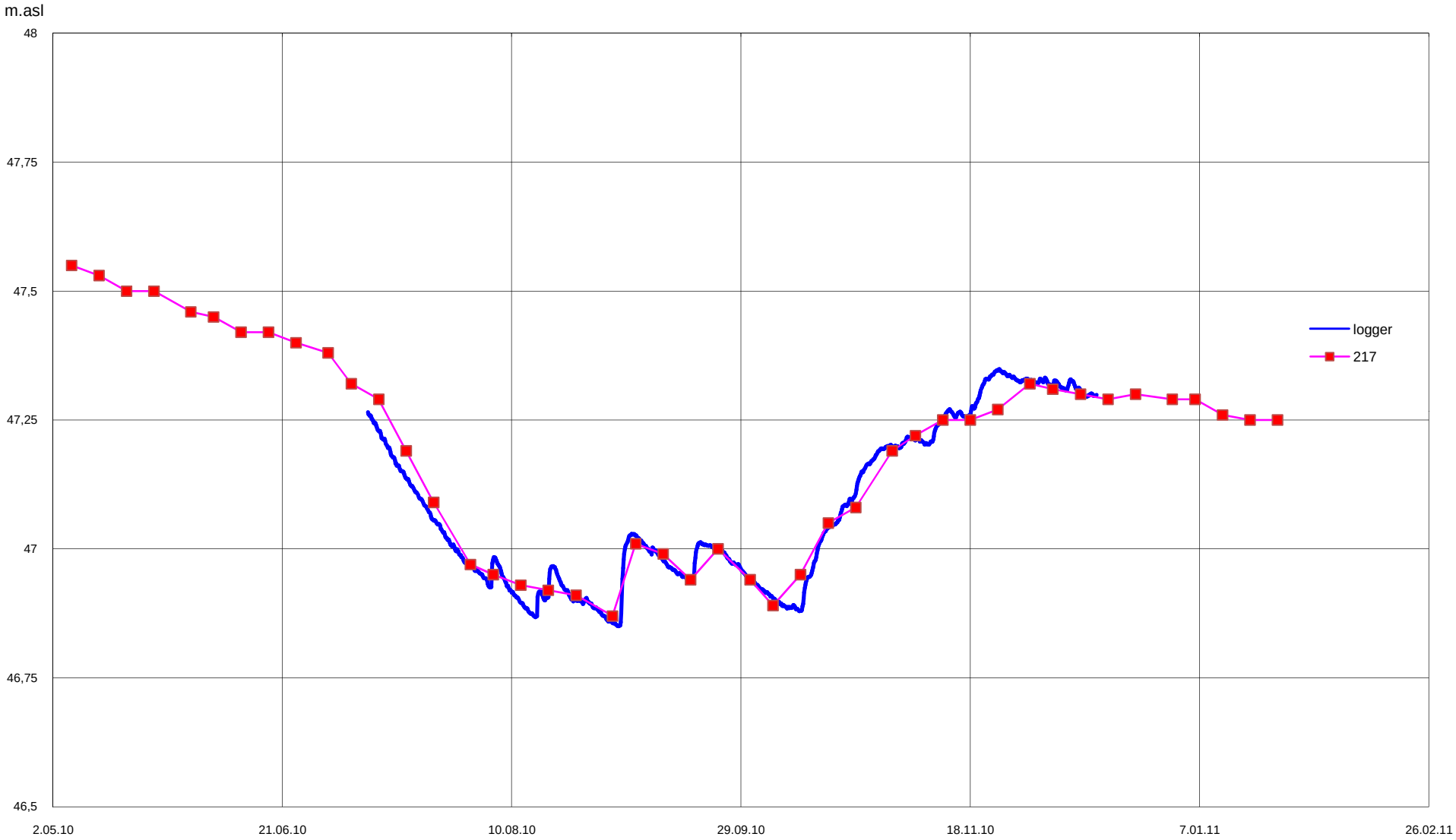


Figure 9. Changes of groundwater levels in groundwater monitoring well 217 and logger 1046969.

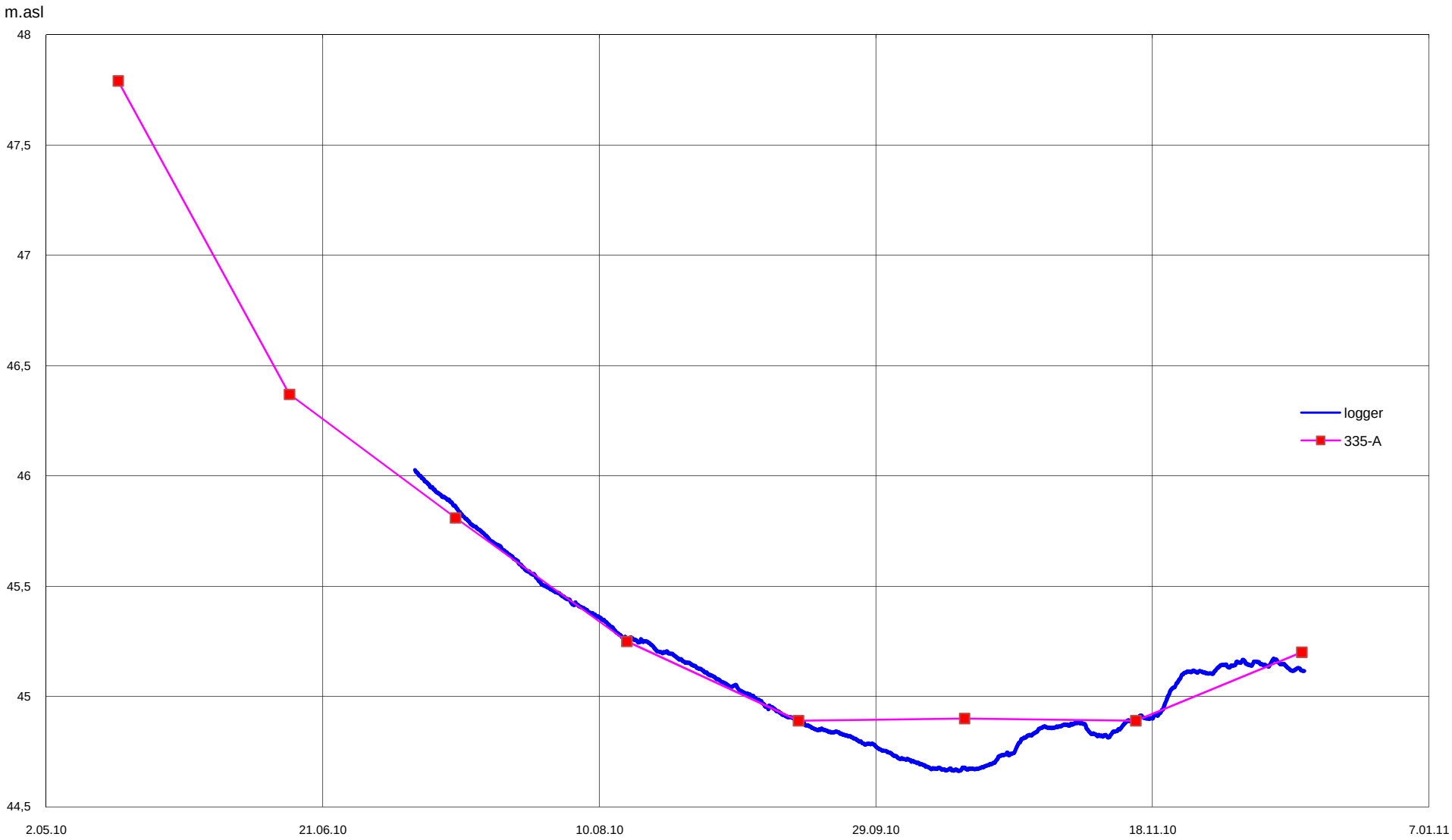


Figure 10. Changes of groundwater levels in groundwater monitoring well 335-A and logger 1047018.

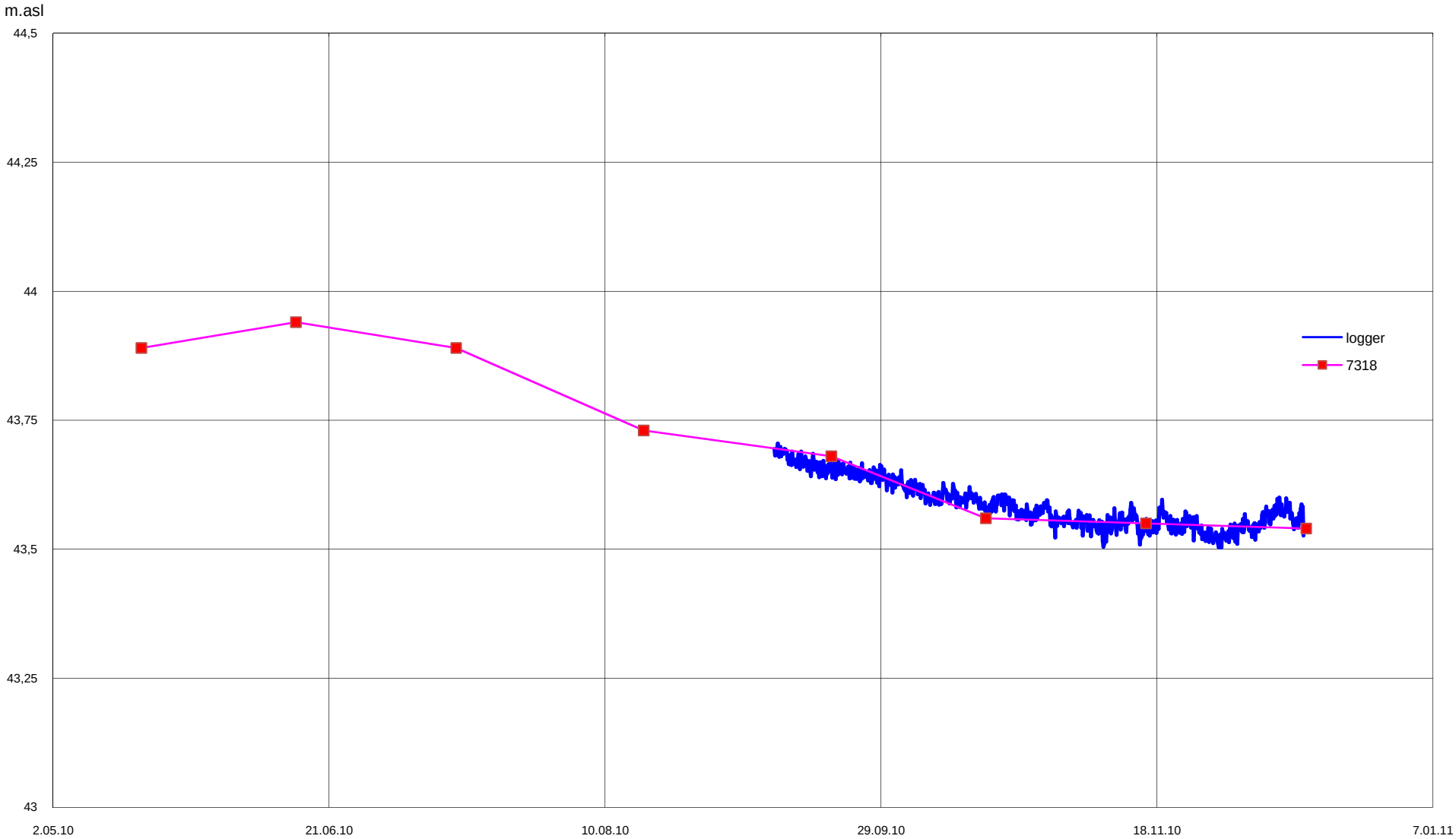


Figure 11. Changes of groundwater levels in groundwater monitoring well 7318 and logger 1046152.

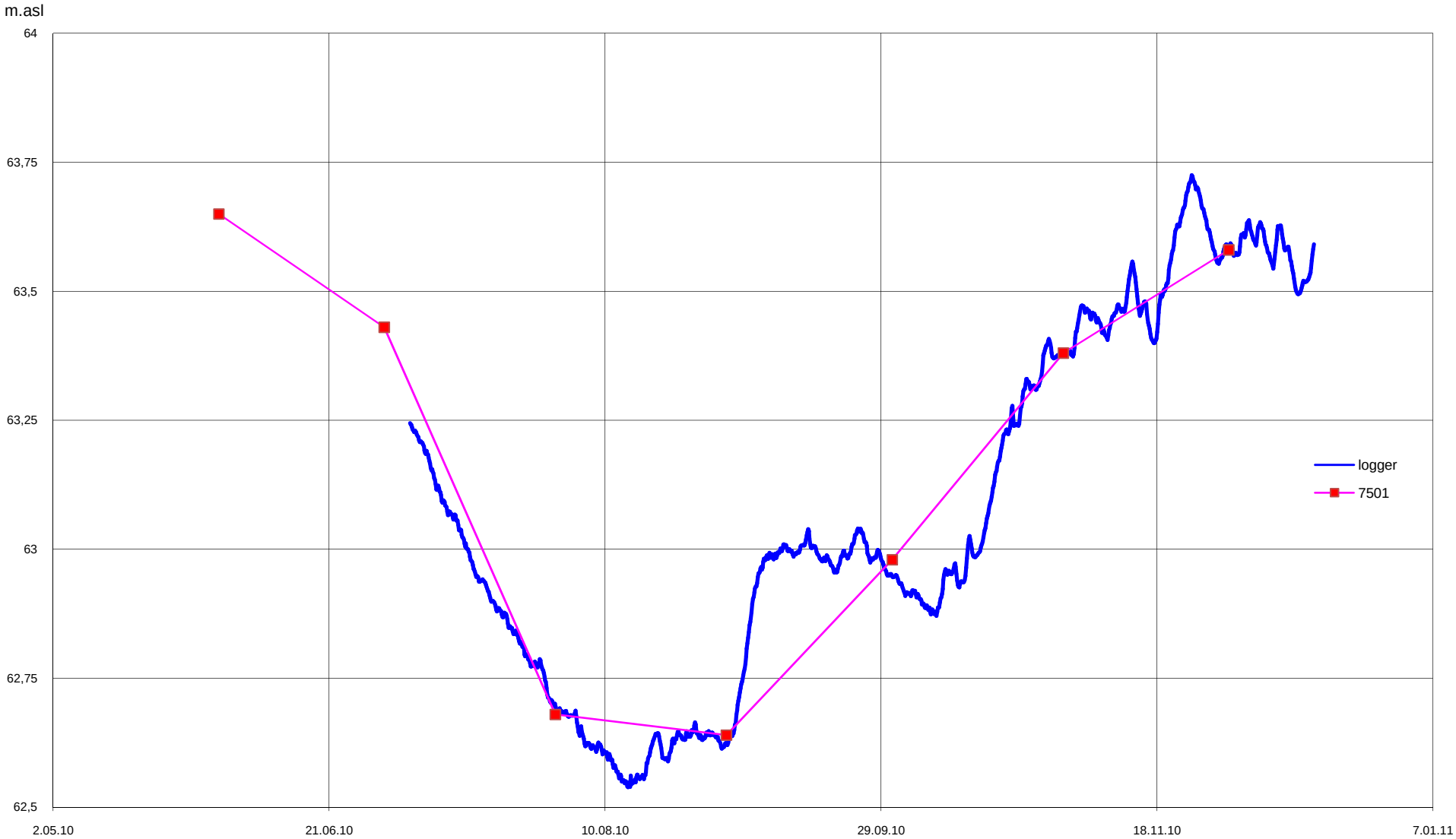


Figure 12. Changes of groundwater levels in groundwater monitoring well 7501 and logger 1046760.

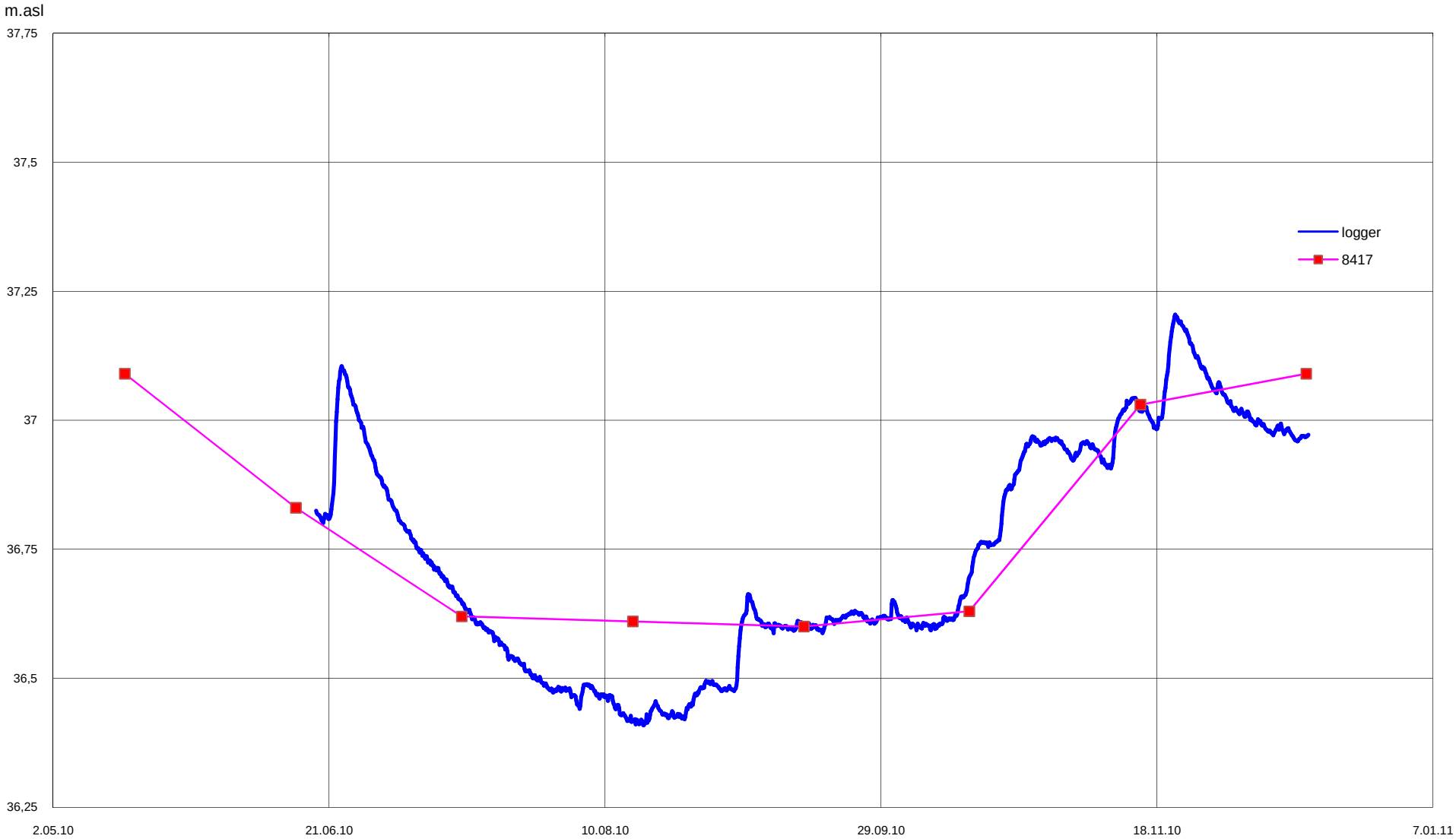


Figure 13. Changes of groundwater levels in groundwater monitoring well 8417 and logger 1047019.