P-06-319

Oskarshamn site investigation

Flow logging in boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37, HLX39 and HLX43

Subarea Laxemar

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May 2007

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Keywords: Laxemar, Flow logging, Water sampling, Pump tests, Hydraulic parameters, Transmissivity, Hydrogeology, Hydraulic tests.

Abstract

Flow logging was performed in the percussion drilled boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37, HLX39 and HLX43 at the Laxemar area, Oskarshamn. In addition water samples were taken from each borehole and an extended pump test (pump phase and recovery phase) was performed in HLX43. The tests are part of the general program for site investigations and specifically for the Laxemar subarea. The aim of the flow logging was to identify the positions and size of flow anomalies. The purposes of the additional tasks (pump test and water samples) were to characterise the rock with respect to its hydraulic properties and the water quality. Data are subsequently delivered for the site descriptive model.

This report describes the results and primary data evaluation of the performed flow logging and pump test. The field work was carried out between the 31th of October and 3rd of December 2006.

The pump phase conducted during the flow logging was recorded and used for a transient analysis to achieve a borehole transmissivity. The derived borehole transmissivities ranges between $1.5 \cdot 10^{-5}$ m^2/s and $1.4 \cdot 10^{-4}$ m^2/s.

Sammanfattning

Flödesloggning utfördes i hammarborrhål HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37, HLX39 och HLX43 i Laxemarområdet, Oskarshamn. Efter flödesloggningen togs vattenprover från varje borrhål och längre hydraultester utfördes (pump- och återhämtningsfas) i borrhål HLX43. Flödesloggningen och hydraultesterna är del av de platsundersökningar som utförs vid Oskarshamnsverket, Laxemarområdet. Syftet med flödesloggningen var att identifiera storlek och läget av flödeszoner i bergmassan. Syftet med de kompletterande hydraultesterna och vattenproven var att karakterisera bergmassans hydrauliska egenskaper och grundvatten-kvalitet. Data överförs från testerna till den platsspecifika modellen.

Föreliggande rapport beskriver resultaten och primärdata från utvärderingen av flödesloggningar och hydraultester. Fältarbetet utfördes mellan den 31 oktober till och med den 3 december 2006.

Pumpfasen utförd under flödesloggningen registrerades och användes för bestämning av borrhålets transmissivitet med transient analys. Borrhålets transmissivet bestämdes till mellan $1.5 \cdot 10^{-5}$ m²/s och $1.4 \cdot 10^{-4}$ m²/s

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1 Introduction

SKB conducts site investigations for a future deep repository for spent nuclear fuel in Oskarshamn. A general program for site investigations presenting survey methods has been prepared /SKB 2001/, as well as a site-specific program for the investigations in the Oskarshamn area /SKB 2005/. The flow logging form part of the site characterisation program under item 1.1.5.5 in the work breakdown structure of the execution programme.

Measurements were carried out in percussion boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37, HLX39 and HLX43 during 31th of October and 3rd of December 2006 following the methodology described in SKB MD 322.009 (flow logging), SKB MD 321.003 (pump test) and according to the activity plan AP PS 400-06-110 (SKB internal controlling documents). Data and results were delivered to the SKB site characterisation database SICADA and are traceable by the activity plan number.

Flow logging was the main task of the measurements in all boreholes. The pump phase conducted during the flow logging was recorded and analysed to derive a borehole transmissivity. After flow logging in HLX 43 the pump phase was extended and after shutdown of the pump the recovery phase was also recorded to receive additional information about the hydraulic properties of the rock (pump test). In addition water samples were taken from each borehole. The commission was conducted by Golder Associates AB and Golder Associates GmbH.

The work was carried out in accordance with activity plan AP PS 400-06-110. In Table 1-1 controlling documents for performing this activity are listed. Both activity plan and method descriptions are SKB's internal controlling documents. Measurements were conducted utilising SKB's custom made flow logging and pumping equipment HTHB 2.

The investigated percussion boreholes are located in the Laxemar area west of the nuclear power plant of Simpevarp, Figure 1-1. The boreholes are drilled between spring 2004 and autumn 2006. The depth of the boreholes ranges from approximately 115 m to 200 m with an inner diameter of around 140 mm. The upper part (between 6 m and 12 m) of the boreholes is cased with large diameter telescopic casing ranging from diameter 140 mm to 190 mm.The boreholes are inclined with –58.7° to –68.6°.

Table 1-1. SKB internal controlling documents for the performance of the activity.

Activity plan	Number	Version
Flödesloggning I HLX14, HLX18, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37 och HLX39.	AP PS 400-06-110	1.0
Method descriptions	**Number**	**Version**
Metodbeskrivning för flödesloggning.	SKB MD 322.009	1.0
Mätsystembeskrivning (MSB) för HTHB – Allmän del.	SKB MD 326.001	1.0
Hydraulisk enhålspumptester.	SKB MD 321.003	1.0
Analysis of injection and single-hole pumping tests.	SKB MD 320.004e	1.0
Instruktion för rengöring av borrhålsutrustning och viss markbaserad utrustning.	SKB MD 600.004	1.0
Allmäna ordning-, skydds- och miljöregler för platsundersökningar Oskarshamn.	SKB MD SDPO-003	1.0
Miljökontrollprogram platsundersökningar.	SKB SDP-301	1.0
Hantering av primärdata vid platsundersökningar.	SKB SDP-508	1.0

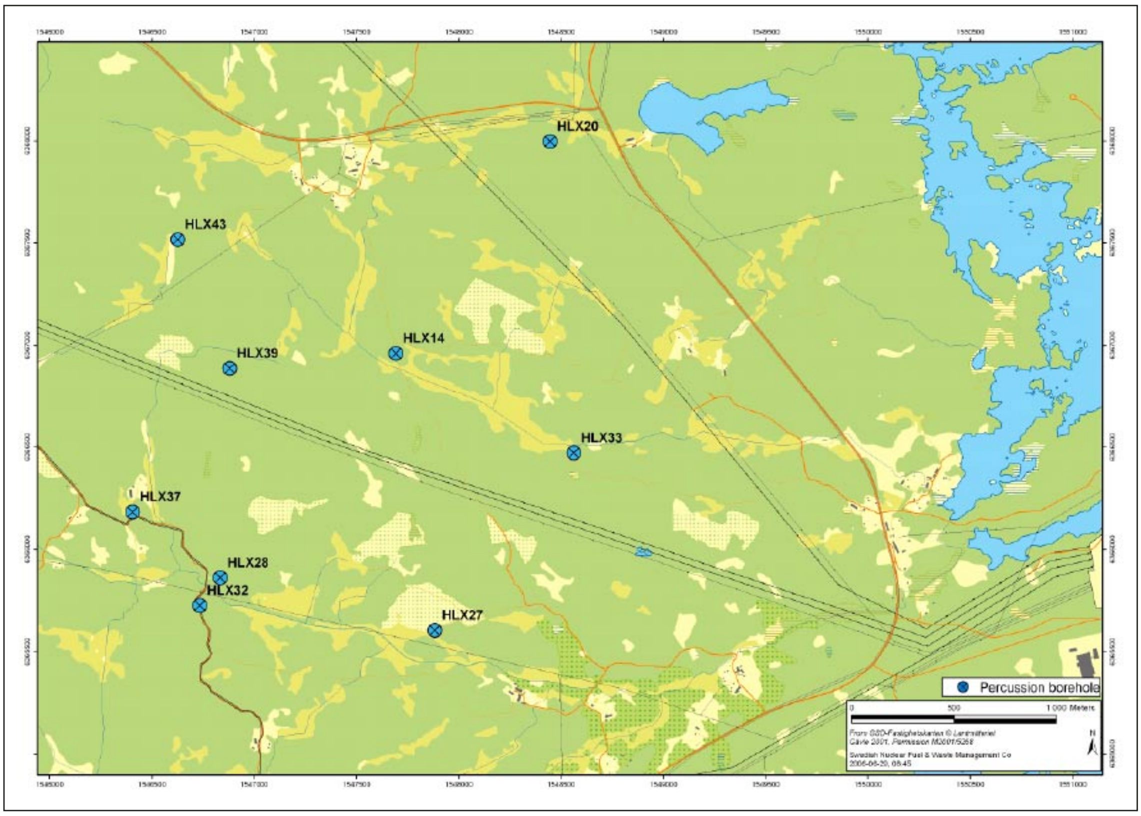

Figure 1-1. *Investigation area Laxemar, Oskarshamn with location of boreholes.*

2 Objective and scope

2.1 Objective

The objective of the flow logging in the percussion boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37, HLX39 and HLX43 was to identify the positions and size of flow anomalies. Based on the borehole transmissivities derived from a transient analysis and the measured inflow a cumulative transmissivity profile of each borehole was calculated.

The objective of the pump test in HLX43 was to describe the rock around the borehole with respect to hydraulic parameters, mainly transmissivity (T) and hydraulic conductivity (K). Transient evaluation during the pump and recovery period provides additional information such as flow regimes and hydraulic boundaries

The objective of the water sample in all boreholes was to investigate the water quality of the boreholes.

2.2 Scope

The scope of of work consisted of preparations of the testing equipment (HTHB 2 tool), which include cleaning of the down-hole equipment, synchronisation of the data logger clock, functional checks and checks of the calibration constants. Furthermore the scope of work consists of flow logging, water sampling and pump test (see Table 2-1 for details).

Preparation for testing was done according to the activity plan (AP PS 400-06-110) and relevant SKB method descriptions for flow logging (SKB MD 322.009) and pump tests (SKB MD 321.003). This step mainly consists of function checks of the equipment to be used, the HTHB 2 tool. Function checks were documented in the daily log and/or relevant documents.

The following test programme was performed:

Table 2-1. Performed test programme.

Borehole ID	Date	Activity
HLX14	2006-11-04	Flow logging, pumping test, water sampling.
HLX20	2006-11-10	Flow logging, pumping test, water sampling.
HLX27	2006-11-24	Flow logging, pumping test, water sampling.
HLX28	2006-11-08	Flow logging, pumping test, water sampling.
HLX32	2006-11-30	Flow logging, pumping test, water sampling.
HLX33	2006-11-12	Flow logging, pumping test, water sampling.
HLX37	2006-11-02	Flow logging, pumping test, water sampling.
HLX39	2006-11-06	Flow logging, pumping test, water sampling.
HLX43	2006-12-03	Flow logging, extended pumping test, water sampling.

2.2.1 Boreholes

Technical data of the tested boreholes are shown in Tables 2-2 to 2-10. The reference point in the boreholes is the centre of top of casing (ToC), given as elevation in the tables below. The Swedish national coordinate system (RT90) is used in the x-y direction and RHB70 in the z-direction. Northing and easting refer to the top of the boreholes at the ground surface. The borehole diameters in the tables refer to the final diameter of the drill bit after drilling to full depth.

Table 2-2. Information about HLX14 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	115.900				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2004-03-08	2004-03-11	0.000	115.900	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6366960.813	1547692.570	17.113	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	89.874	–68.647	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	12.000	0.190		
	12.000	115.900	0.139		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	11.810	0.160	0.168	
	11.810	11.900	0.147	0.168	

Table 2-3. Information about HLX20 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	202.200				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2004-06-15	2004-06-21	0.000	202.200	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6367996.256	1548446.085	11.179	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	0.405	–60.384	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	9.120	0.190		
	9.120	202.200	0.138		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	8.940	0.160	0.168	
	8.940	9.030	0.147	0.168	

Table 2-4. Information about HLX27 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	164.700				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2004-09-20	2004-09-22	0.000	164.700	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6365605.073	1547882.686	8.248	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	190.999	–59.412	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	6.100	0.190		
	6.100	164.700	0.137		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	5.940	0.160	0.168	
	5.940	6.030	0.140	0.168	

Table 2-5. Information about HLX28 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	154.200				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2004-09-29	2004-10-02	0.000	154.200	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6365861.704	1546834.473	13.424	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	201.375	–59.485	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	6.100	0.190		
	6.100	154.200	0.136		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	5.940	0.160	0.168	
	5.940	6.030	0.140	0.168	

Table 2-6. Information about HLX32 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	162.600				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2005-01-04	2005-01-11	0.000	162.600	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6365725.793	1546734.363	10.844	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	28.590	–58.669	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	12.300	0.191		
	12.300	162.600	0.140		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	12.210	0.160	0.168	
	12.210	12.300	0.140	0.168	

Table 2-7. Information about HLX33 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	202.100				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2004-12-17	2004-12-20	0.000	202.100	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6366471.744	1548562.705	12.201	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	21.769	–58.763	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	9.100	0.190		
	9.100	202.100	0.139		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	8.940	0.160	0.168	
	8.940	9.030	0.143	0.168	

Table 2-8. Information about HLX37 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	199.800				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2005-09-26	2005-09-28	0.000	199.800	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6366183.660	1546406.214	15.188	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	86.182	–59.246	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.000	12.100	0.190		
	12.100	121.500	0.140		
	121.500	199.800	0.139		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	11.940	0.160	0.168	
	11.940	12.030	0.142	0.168	

Table 2-9. Information about HLX39 (from SICADA 2006-09-25).

Title	Value				
Borehole length (m):	199.300				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2006-06-07	2006-06-14	0.30	199.30	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6366887.869	1546880.479	27.044	RT90-RHB70
	3.000	6366889.352	1546880.857	24.463	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.000	14.291	–59.348	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.300	6.100	0.190		
	6.100	121.000	0.138		
	121.000	199.300	0.138		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	5.930	0.160	0.168	
	5.930	6.020	0.140	0.168	

Table 2-10. Information about HLX43 (from SICADA 2006-11-29).

Title	Value				
Borehole length (m):	170.600				
Reference level:	ToC				
Drilling period (s):	**From date**	**To date**	**Secup (m)**	**Seclow (m)**	**Drilling type**
	2006-10-19	2006-10-26	0.30	170.60	Percussion drilling
Starting point coordinate:	**Length (m)**	**Northing (m)**	**Easting (m)**	**Elevation**	**Coord system**
(centerpoint of ToC)	0.000	6367517.45	1546626.60	24.20	RT90-RHB70
	3.000	6367517.40	1546624.70	21.88	RT90-RHB70
Angles:	**Length (m)**	**Bearing**	**Inclination (– = down)**	**Coord system**	
	0.00	268.55	–50.74	RT90-RHB70	
Borehole diameter:	**Secup (m)**	**Seclow (m)**	**Hole diam (m)**		
	0.30	6.00	0.180		
	6.20	101.20	0.140		
	101.20	170.60	0.140		
Casing diameter:	**Secup (m)**	**Seclow (m)**	**Case in (m)**	**Case out (m)**	
	0.000	5.910	0.160	0.168	
	5.910	6.000	0.143	0.168	

2.2.2 Tests

The hydraulic measurements performed in the boreholes were conducted according to the Activity Plan AP PS 400-06-110 (SKB internal document) and according to the instructions of the Activity leader (see Table 2-11 for details). Flow logging tests and the pump test were carried out with SKB's custom made equipment called HTHB 2 (Hydro Testutrustning i Hammar-Borrhål). The different test types were conducted and evaluated according to the corresponding methodology descriptions for impeller flow logging (SKB MD 322.009) and for pump tests (SKB MD 321.003 and SKB 320.004e). In conjunction with the flow logging an electric conductivity and temperature logging of the borehole was performed.

During the pump phases at all boreholes water samples were taken and submitted to the Äspö Laboratory for analysis.

Manual groundwater level measurements were performed in the investigated boreholes and documented in the relevant protocol (*Groundwater level for hydraulic tests*).

2.2.3 Control of equipment

Control of equipment was mainly performed according to the HTHB 2 tool description (Mätssystembeskrivning (MSB) för HTHB), SKB MD 326.001-015, which is composed of a general part and technical documents of the HTHB 2 tool components.

After the establishment of the equipment the calibration constants were entered into the data logger and/or checked against the calibration protocols. The following function checks were performed before and during the tests. Among these pressure sensors were checked at air pressure and in the hole calculated to the static head. Temperature and electric conductivity was checked at ground level and while running in. The impeller used in the flow logging tool was checked by the rotation of the impeller during the lowering into the borehole. The measuring wheel (used to indicate the position of the flow logging tool in the borehole) was checked with one turn and for comparison of the measured values with given standard.

Table 2-11. Tests performed.

Borehole ID	Test section (m)	Test type[1]	Test no	Test start Date, time (yyyy-mm-dd hh:mm)	Test stop Date, time (yyyy-mm-dd hh:mm)
HLX14	25.00–114.00	1B, 6, L-EC, L-Te	1	2006-11-04 10:46	2006-11-04 13:28
HLX20	22.00–196.00	1B, 6, L-EC, L-Te	1	2006-11-10 11:06	2006-11-10 15:03
HLX27	20.00–162.00	1B, 6, L-EC, L-Te	1	2006-11-24 11:07	2006-11-24 14:41
HLX28	22.00–141.00	1B, 6, L-EC, L-Te	1	2006-11-08 12:52	2006-11-08 15:58
HLX32	22.00–160.00	1B, 6, L-EC, L-Te	1	2006-11-29 14:17	2006-11-29 15:56
HLX33	19.00–111.00	1B, 6, L-EC, L-Te	1	2006-11-12 11:06	2006-11-12 14:22
HLX37	21.00–195.00	1B, 6, L-EC, L-Te	1	2006-11-02 10:52	2006-11-02 14:37
HLX39	35.00–197.00	1B, 6, L-EC, L-Te	1	2006-11-06 11:35	2006-11-06 15:52
HLX43	29.00–165.00	6, L-EC, L-Te	1	2006-12-02 11:27	2006-12-02 14:23
HLX43	6.00–170.60	1B	1	2006-12-02 09:26	2006-12-03 09:40

[1] 1B: pump test submersible pump, 6: flow logging-impeller, L-EC: electric conductivity logging, L-Te: temperature logging.

3 Equipment

3.1 Description of equipment

The equipment called HTHB 2 (Swedish abbreviation for Hydraulic Test System for Percussion Boreholes) is a modular tool for testing boreholes up to approximately 200 m depth. It is designed to perform pump tests and injection tests. It is possible to combine a pump test in an open borehole with a flow logging survey along the borehole (see conceptual drawing in Figure 3-1). Hydraulic tests can also be performed in discrete borehole sections sealed by expandable packers (not conducted during this test campaign).

The system components are stored inside a container suitable for transport to remote test sites and use at any weather. Briefly, the components consist of a submersible borehole pump with housing, expandable packers, pressure transducers, a pipe string and hoses. During flow logging, sensors for measuring electric conductivity and temperature as well as an impeller for measuring the downhole flow rate are used. On the surface, the total pump rate (or injection rate) is adjusted manually by a control valve and monitored by an electromagnetic flow meter. Data are sampled by a logger with automatically sequenced intervals or at intervals set by the test operator. An external power supply of 230V is necessary to run the HTHB 2 system.

The HTHB 2 equipment is documented in photographs 1–4.

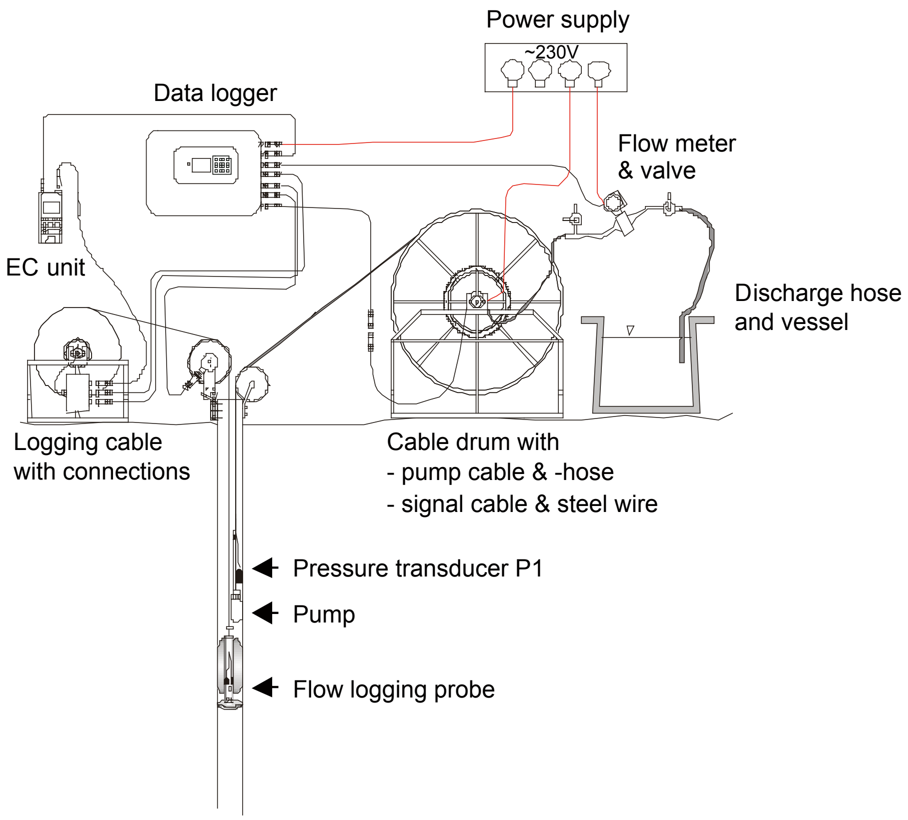

Figure 3-1. A view of the layout and equipment of HTHB 2 for a pump test and flow logging in an open borehole.

Photo 1. Container with spool for hose.

Photo 2. Equipment installed in a borehole with guiding spools on ToC.

Photo 3. Surface flow meter for measuring total flow rate.

Photo 4. Depth measuring wheel on ToC.

3.2 Sensors

Technical specifications of the sensors used together with estimated data specifications of the HTHB 2 test equipment for pump tests and flow logging are listed in Table 3-1.

Errors in reported borehole data (e.g. borehole diameter) may significantly increase the error in measured and calculated data. Especially the flow logging impeller is very sensitive to variations in the borehole diameter. A rough borehole wall or variations in borehole diameter may lead to a bypassing water flow, indicating a too low water flow at the flow logging.

In general, the flow logging impeller is calibrated for different borehole diameters. The nominal borehole diameter for all tested boreholes is 140 mm, however, the information provided from the SICADA database indicating borehole diameters ranging from 138 mm to 140 mm. After positioning of the flow logger to a measurement depth, sufficient stabilisation time should be provided. The stabilisation time may be up to 30 seconds at flow rates close to the lower measurement limit whereas at high flow rates this stabilisation time is almost of no importance.

Table 3-1. Technical specifications of sensors.

Parameter	Sensor	Unit	Sensor range	HTHB range	Comments
Pressure	Output signal	mA	4–20		
	Meas. range	kPa	0–1,500	0–1,500	
	Resolution	kPa	0.05		
	Accuracy	kPa	±1.5 *	±10	Depending on uncertainties of sensor position
Temperature	Output signal	mA	4–20		
	Meas. range	°C	0–50	0–50	
	Resolution	°C	0.1		
	Accuracy	°C	±0.6	±0.6	
Electric conductivity	Output signal	V	0–2		
	Meas. range	mS/m	0–50,000	0–50,000	With conductivity meter
	Resolution	% o.r. **		1	
	Accuracy	% o.r. **		±10	
Flow (spinner)	Output signal	Pulses/s	c 0.1–c 15		
	Meas. range	L/min		2–100	115 mm borehole diameter
				3–100	140 mm borehole diameter
				4–100	165 mm borehole diameter
	Resolution ***	L/min		0.2	140 mm borehole diameter
	Accuracy ***	% o.r. **		±20	and 100 s sampling time
Flow (surface)	Output signal	mA	4–20		Passive
	Meas. range	L/min	1–50	5–c 80****	Pumping tests
	Resolution	L/min	0.1	0.1	
	Accuracy	% o.r. **	±0.5	±0.5	

* Includes hysteresis, linearity and repeatibility.

** Maximum error in % of actual reading (% o.r.).

*** Applicable to boreholes with a borehole diameter of 140 mm and 100 s sampling time.

**** For injection tests the minimal flow rate is 1 L/min.

Table 3-2 shows the position of sensors for each test. Positions for the following equipments are given: Pump (bottom), pressure (P1) and flow logging equipment. The flow logging impeller and the sensors for temperature and electric conductivity are placed in the flow logging unit and therefore of variable depth during a test. Positions are given in metre from the reference point (ToC). Equipment affecting the wellbore storage coefficient (WBS) is given with diameter of the submerged tool. All pump tests were performed in open boreholes, therefore, all positions are "in section". The volume of the submerged pump (ca. 4 dm^3) is of minor importance.

3.3 Data acquisition system

The data acquisition system in the HTHB 2 unit contains a data logger (Campbell CR 5000) which transforms the raw data automatically to engineering units and a laptop with the software PC 9000 to download the data for further processing. A second laptop is connected to the HTHB 2 laptop containing evaluation software.

The data acquisition system can be set to sequenced logging intervals or can be manually set to fix logging intervals depending on the change of pressure versus time. According to the Activity plan the logging interval was set to at least 10 seconds during the flow logging survey. The pump phases were started and stopped by switching the pump on or off manually.

Table 3-2. Sensor positions and wellbore storage (WBS) controlling factors.

Borehole information			Sensors		Equipment affecting WBS coefficient		
ID	Test section (m)	Test no	Type	Position (m b ToC)	Position	Function	Outer diameter (mm)
HLX14	11.90–115.90	1	Pump (bottom)	21.00	in section	Pump string	37
			P1	18.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(25.0–114.0)		signal cable	
HLX20	9.03–202.20	1	Pump (bottom)	18.00	in section	Pump string	37
			P1	15.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(22.0–196.0)		signal cable	
HLX27	6.03–164.70	1	Pump (bottom)	16.50	in section	Pump string	37
			P1	15.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(20.0–162.0)		signal cable	
HLX28	6.03–154.20	1	Pump (bottom)	18.00	in section	Pump string	37
			P1	15.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(22.0–141.0)		signal cable	
HLX32	12.30–162.60	1	Pump (bottom)	18.50	in section	Pump string	37
			P1	17.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(22.0–160.0)		signal cable	
HLX33	9.03–202.10	1	Pump (bottom)	16.00	in section	Pump string	37
			P1	13.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(19.0–102.5)		signal cable	
HLX37	12.10–199.80	1	Pump (bottom)	18.00	in section	Pump string	37
			P1	15.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(21.0–195.0)		signal cable	
HLX39	6.10–199.30	1	Pump (bottom)	31.00	in section	Pump string	37
			P1	28.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(35.0–197.0)		signal cable	
HLX43	6.00–170.60	1	Pump (bottom)	24.50	in section	Pump string	37
			P1	23.00		(hose)	8
			Flow logging	variable		signal cable	13.5
			Equipment	(29.0–165.0)		signal cable	

4 Execution

4.1 General

After establishment and function checks of the equipment and running in with the dummy into the borehole the flow logging tool was assembled and lowered to the bottom of the borehole. The next step is to run in with the pump. The depth of the pump depends on the desired drawdown. For the measurements of this campaign the pump was lowered approximately 10 m below the water level. After approximately two hours from the pump start the flow logger is lifted in steps of two metres from the bottom to the top of the borehole. In case of a detected flow anomaly the measurement steps were refined to a length of 0.5 m. The execution of the work was done according to the relevant method descriptions (SKB MD 322.009 "Metodbeskrivning för flödesloggning", SKB MD 326.001, "Mätsystembeskrivning (MSB) för HTHB – Allmän del" and SKB MD 321.003 "Hydraulisk Enhålspumptester") and to the activity plan PS 400-06-110 (SKB internal documents).

The raw data and evaluated data were handed over to SKB. The evaluation was done according to the internal documents SKB MD 322.009 (Metodbeskrivning för flödesloggning) and SKB MD 320.004e (Analysis of injection and single-hole pumping tests).

The preparation and execution of work is explained in detail in the following chapters.

4.2 Preparations

All sensors of the HTHB system are calibrated at Geosigma's engineering workshop in Librobäck, Uppsala and maintenance of the equipment was done by Geosigma before starting this test campaign. Protocols of the performed calibration were submitted with the HTHB system description, a calibration protocol form including the actual calibration constants was submitted with the delivery of raw data after finishing the test campaign.

The following preparation work and functional checks were conducted prior to starting test activities:

- Placing the container beside the borehole.
- Cleaning of all in-hole equipment with alcohol.
- Synchronize clocks on all computers and on the data logger.
- Run in the borehole with a dummy to check if the hole is free.
- Lowering the flow logger to the bottom of the borehole respectively the lower logging depth.
- Check pressure gauges against atmospheric pressure and then on test depth against column of water.
- Check functionality of sensors for temperature and electric conductivity.
- Check functionality of measuring wheel against measured cable length.
- Measure and assemble test tool.
- Lower the pump according to the previous measured groundwater level considering the expected drawdown.

4.3 Execution of field work

4.3.1 Flow logging

As preparation for flow logging, the flow log impeller was lowered to the bottom of the holes respectively to the lowest flow log depth according to the observations during the borehole check with the dummy.

The flow logging was performed during the pump phase and started approximately 2 hours after start of pumping. Starting from the bottom, the flow logger was lifted in steps of 2 m and kept for measurements with a time period of 100 seconds. When a flow anomaly was detected, the flow logger was then lowered in 0.5 m steps until the previous flow rate was retrieved for a more detailed depth identification of the anomaly. The flow logging then continued in further 2 m intervals along the hole.

The uppermost flow logging was made with a minimum distance of 4 m to the bottom of the pump to avoid errors caused by turbulences from the pump. The duration of the flow logging was between 4 and 7 hours depending on the character of the borehole.

4.3.2 Pumping tests

In the boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37 and HLX39 the pump was started to get a water flow in the boreholes for the survey of the flow logging. It was not the aim to conduct a complete pump test including a recovery phase in these boreholes, whereas a complete test (pump and revovery phase) was carried out in borehole HLX43. The different test procedures are described below.

Boreholes HLX14, HLX20, HLX27, HLX28, HLX32, HLX33, HLX37 and HLX39

Generally, a short (approximately 20 min) flow capacity test was carried out prior to each pump test to choose an appropriate flow rate for the test. In some cases the chosen flow rate for the capacity tests was appropriate to carry out a pump phase for the duration of the flow logging survey. Therefore the capacity test was continued and used as pump phase.

Depending on the electric conductivity the extracted water was discharged in the field (electric conductivity below 300 ms/m) or collected in water tanks.

After the choose of an appropriate flow rate the pump was started for the duration of the flow logging which started two hours after pump start (see above). The sampling rate was set to 1 second at the beginning of the pump phase and after a slight stabilization of the pressure curve to 10 seconds. After stop of the pump no recovery phase was measured. The conducted pump phase was analysed to derive a borehole transmissivity.

Borehole HLX43

The conducted capacity test was continued after 20 min because the adjusted flow rate was appropriate for the subsequent pump phase and flow logging, respectively. After two hours of pumping the flow logging survey started (see above).

The extracted water was discharged in the field (due to the electric conductivity measurements during running in with the flow logging probe).

The duration of the pump phase was approximately 9 hours and of the following recovery phase approximately 15 hours. The sampling rate was set to 1 second at the beginning of the pump and recovery phase and after a slight stabilization of the pressure curve to 10 seconds. Both phases were analysed.

4.3.3 Water sampling

Prior to pump stop water samples were taken and submitted to the SKB Äspö laboratory. The samples are listed in Table 4-1.

4.4 Data handling/post processing

The data handling followed several stages and depends on the type of test (flow logging or pump test). The data acquisition software included in the logger (Campbell CR 5000) transformed the data already to engineering units. The download of the measured data was done with software called PC9000. These files are comma-separated (*.dat files) and contain the time, pressure flow rate, temperature and electric conductivity.

The *.dat files of the flow logging were synthesized with a macro written by Geosigma AB and designed for Microsoft Excel. This macro allows the evaluation and the graphical presentation.

The *.dat files of the pump test were synthesized in Microsoft Excel for plotting purposes of the Cartesian plot. The generated file was also used for the subsequent test analysis with Golder's analysis program FlowDim.

The raw data files and the processed Excel files were handed over to SKB at the end of the field work.

Table 4-1. Water samples analysed at Äspö Hard Rock Laboratory.

Borehole ID	Date	Time	Section (m)	Pumped volume (m^3)	Sample ID*	Electrical conductivity (mS/m)	Water density (g/mL)
HLX14	2006-11-04	13:26	11.90–115.90	11.0	11503	156	0.9985
HLX20	2006-11-10	13:21	9.03–202.20	6.7	11508	67.6	0.9973
HLX27	2006-11-24	14:40	6.03–164.70	13.1	11557	358	0.9985
HLX28	2006-11-08	15:57	6.03–154.20	19.6	11504	–	No data
HLX32	2006-11-30	15:56	12.30–162.60	2.6	11567	87.3	0.9974
HLX33	2006-11-12	14:20	9.03–202.10	20.3	11512	87.7	0.9975
HLX37	2006-11-02	14:37	12.10–199.80	5.1	11497	46	0.9978
HLX39	2006-11-06	15:50	6.10–199.30	12.3	11502	70	0.9978
HLX43	2006-12-02	14:25	6.00–170.60	35.0	11573	81.9	0.9975

* SICADA Code for all water samples WC 080

4.5 Analyses and interpretations

4.5.1 Flow logging

The parameters derived from flow logging (flow rate, temperature and electric conductivity of the borehole fluid) are plotted versus borehole length. Flow anomalies were identified along the borehole. The range of the inflow at a flow anomaly is determined by the relevant change in flow rate at the anomaly interval. In most cases, flow anomalies are accompanied by corresponding changes in temperature and/or electric conductivity.

Flow logging was performed in the borehole interval from approximately 2 m to 10 m above the bottom of the borehole to 4 m below the submersible pump. The upper part of the borehole (from 4 m below the submersible pump to the groundwater level) could not be flow-logged, although high inflow zones may be observed. Such superficial inflows were identified by comparing the cumulative flow at the top of the flow-logged interval (ΣQ_1) with the discharged flow rate (Q_p) from the hole according to the surface flow meter. One or more inflow zones are most likely to exist above the flow-logged interval if the latter flow rate is significantly higher than the cumulative flow rate.

The transmissivity (T) of the entire borehole is calculated from the analysis of the pump test during flow logging. The cumulative transmissivity at the top of the flow-logged interval (ΣT_i) is then calculated according to the SKB document "Methodology for flow logging" (SKB MD 322.009, Metodbeskrivning för flödesloggning) with the assumption of a zero natural flow in the borehole.

$$\Sigma T_i = T \cdot \Sigma Q_i / Q_p \qquad (5\text{-}1)$$

Flow anomalies above the flow-logged interval will lead to $\Sigma Q_i < Q_p$. In this case, the order of magnitude of the sum of these anomalies is estimated from equation (5-1).

The transmissivity of an individual flow anomaly in the flow logged interval (T_i) is calculated from the measured inflow rate (Q_i) of the anomaly and the calculated transmissivity of the entire borehole (T) according to the SKB document "Methodology for flow logging" (SKB MD 322.009, Metodbeskrivning för flödesloggning):

$$T_i = T \cdot Q_i / Q_p \qquad (5\text{-}2)$$

The lower limit of transmissivity ($T_{l\text{-}measl}$) in the flow logging interval is estimated similar to equation (5-1):

$$T_{Fmeasl\text{-}L} = T \cdot Q_{Fmeasl\text{-}L} / Q_p \qquad (5\text{-}3)$$

In a borehole with a diameter of 140 mm, the lower measuring limit for the flow rate is: $Q_{Fmeasl\text{-}L}$ = 3 L/min (see Table 3-1) whereas Q_p is the actual flow rate during flow logging measured with the surface flow meter.

The flow logging analysis diagrams and test data are summarized in Appendix 4 and Chapter 5.

4.5.2 Pumping tests

Analysis software

The pump tests were analysed using a type curve matching method. The analysis was performed using Golder's test analysis program FlowDim. FlowDim is an interactive analysis environment allowing the user to interpret constant pressure, constant rate and slug/pulse tests in source as well as observation boreholes. The program allows the calculation of type-curves for homogeneous, dual porosity and composite flow models in variable flow geometries from linear to spherical.

Analysis approach

Constant rate and pressure recovery tests are analysed using the method described by /Gringarten 1986/ and /Bourdet et al. 1989/ by using type curve derivatives calculated for different flow models.

Analysis methodology

Each of the relevant test phases is subsequently analyzed using the following steps:

- Identification of the flow model by evaluation of the derivative on the log-log diagnostic plot. Initial estimates of the model parameters are obtained by conventional straight-line analysis.
- Superposition type curve matching in log-log coordinates. A non-linear regression algorithm is used to provide optimized model parameters in the latter stages.
- Non-linear regression in semi-log coordinates (superposition Horner plot; /Horner 1951/). In this stage of the analysis, the static formation pressure is selected for regression.

The test analysis methodology is best explained in /Horne 1990/.

Correlation between Storativity and Skin factor

For the analysis of the conducted pump tests in rocks near the surface (about 100 m depth) a storativity (S) of $1 \cdot 10^{-3}$ is assumed (SKB MD 320.004e). Based on this assumption the skin will be calculated. In the following the correlation between storativity and skin will be explained:

- The wellbore storage coefficient (C) is determined by matching the early time data with the corresponding type curve. The derived C-value is introduced in the equation of the type curve parameter:

  $$(C_D e^{2\xi})_M = \frac{C \ \rho \ g}{2\pi \ r_w^2 \ S} e^{2\xi}$$

  The equation above has two unknowns, the storativity (*S*) and the skin factor (ξ) which expresses the fact that for the case of constant rate and pressure recovery tests the storativity and the skin factor are 100% correlated. Therefore, the equation can only be either solved for skin by assuming that the storativity is known or solved for storativity by assuming the skin as known.

Steady state analysis

In addition to the type curve analysis, an interpretation based on the assumption of stationary conditions was performed as described by /Moye 1967/.

Flow models used for analysis

The flow models used in analysis were derived from the shape of the pressure derivative calculated with respect to log time and plotted in log-log coordinates.

In several cases the pressure derivative suggests a change of transmissivity with the distance from the borehole. In such cases a composite flow model was used in the analysis.

If there were different flow models matching the data in a comparable quality the most simple model was preferred.

The flow dimension displayed by the test can be diagnosed from the slope of the pressure derivative. A slope of 0.5 indicates linear flow, a slope of 0 (horizontal derivative) indicates radial flow and a slope of –0.5 indicates spherical flow. The flow dimension diagnosis was commented for each of the tests. However, in all cases it was possible to achieve to acceptable analysis results (good match quality) by using radial flow geometry (flow dimension of 2).

Calculation of the static formation pressure and equivalent freshwater head

The static formation pressure (p*) measured at transducer depth, was derived from the pressure recovery (CRwr) following the constant pressure injection phase by using:

(1) straight line extrapolation in cases infinite acting radial flow (IARF) occurred,

(2) type curve extrapolation in cases infinite acting radial flow (IARF) is unclear or was not reached.

The equivalent freshwater head (expressed in metres above sea level) was calculated from the extrapolated static formation pressure (p*), corrected for athmospheric pressure measured by the surface gauge and corrected for the vertical depth considering the inclination of the borehole, by assuming a water density of 1,000 kg/m^3 (freshwater). The equivalent freshwater head is the static water level an individual test interval would show if isolated and connected to the surface by tubing full of freshwater. Figure 4-1 shows the methodology schematically.

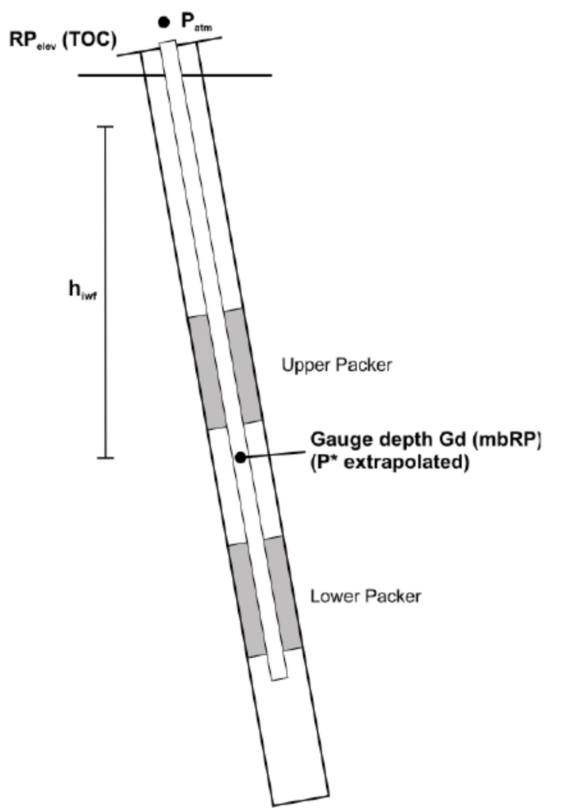

Figure 4-1. Schematic methodologies for calculation of the freshwater head.

The freshwater head in metres above sea level is calculated as following:

$$head = \frac{(p^* - p_{atm})}{\rho \cdot g}$$

which is the p* value expressed in a water column of freshwater.

With consideration of the elevation of the reference point (RP) and the gauge depth (Gd), the freshwater head hiwf is:

$$h_{iwf} = RP_{elev} - Gd + \frac{(p^* - p_{atm})}{\rho \cdot g}$$

Derivation of the recommended transmissivity and the confidence range

The pump phases (CRw) in all boreholes were analysed and also the recovery phase (CRwr) in HLX43. The parameter sets (i.e. transmissivities) derived from the analyses of a specific test usually differ (inner and outer zone transmissivity, differences in CRw and CRwr phases). In the case when the differences are small the recommended transmissivity value is chosen from the test phase that shows the best data and derivative quality. In cases when a composite flow model was deemed to be most representative for the hydraulic behaviour of the specific test section, than the inner zone transmissivity was selected as recommended value.

The confidence range of the transmissivity was derived using expert judgement. Factors considered were the range of transmissivities derived from the individual analyses of the test as well as additional sources of uncertainty such as noise in the flow rate measurement, numeric effects in the calculation of the derivative or possible errors in the measurement of the wellbore storage coefficient. No statistical calculations were performed to derive the confidence range of transmissivity.

4.6 Nonconformities

Following deviations from the Activity Plan PS 400-06-110 were performed:

- In borehole HLX18 no flow logging survey was conducted. This was attributed to a technical problem in HLX18 as proved not possible to remove the installed long term monitoring packer in the hole, it was stuck.
- Borehole HLX43 was added to this field campaign. Additionally a complete pump test (pump phase and recovery) was performed.
- The flow logging i HLX33 was only performed to 110 m borehole length instead of full length (202 m) since both the dummy and the spinner got stuck at that length.

5 Results

In the following the results of all tests are presented and analysed. Section 5.2 presents the pump tests and Section 5.3 the flow logging survey. The results are stored in the primary data base (SICADA). The SICADA data base contains data that will be used for further interpretation (modelling). The data are traceable in SICADA by the Activity plan number (AP PS 400-06-110; SKB controlling documents).

5.1 Nomenclature and symbols

The nomenclature and symbols used during evaluation and for presentation of the results of the pump tests and flow logging are according to the SKB documents "Instruction for analysis of single-hole injection and pump tests" (SKB MD 320.004e) and "Metodbeskrivning för flödesloggning" (SKB MD 322.009), respectively. If additional symbols are used, they are explained in the report text.

5.2 Pump tests

In the following the results of the single borehole pump tests are presented. Note that only the pump tests in borehole HLX43 consists of a complete pump test (pump phase and recovery phase). In the remaining boreholes only a pump phase was conducted to derive a borehole transmissivity, which was used for the evaluation of the flow logging survey.

The results of the pump tests are given as general comments to test performance, the identified flow regimes and calculated parameters and finally the parameters wich are considered as most representative are chosen and justification is given. The results are summarized in Tables 6-1 and 6-2 of the synthesis chapter and in the test summary sheets (Appendix 3).

5.2.1 Borehole HLX14 (Section 11.90–115.90 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 39.3 L/min and a duration of 4.7 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 40.1 L/min at the start of the CRw phase to 38.1 L/min at the end with a maximum drawdown of 53 kPa. No recovery phase (CRwr) was conducted. The CRw phase shows no problems and is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the derivative of the CRw phase shows a kind of horizontal stabilization at late times, indicating radial flow. For the analysis of the CRw phase a homogeneous flow model with wellbore storage and skin was used. The analysis is presented in Appendix 2-1.

Selected representative parameters

The recommended transmissivity of $8.0 \cdot 10^{-5}$ m^2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be $5.0 \cdot 10^{-5}$ to $1.0 \cdot 10^{-4}$ m^2/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.2 Borehole HLX20 (Section 9.03–202.20 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 19.4 L/min and a duration of 6.0 hours. The pumped flow rate decreased from 20.1 L/min at the start of the CRw phase to 18.6 L/min at the end with a maximum drawdown of 98 kPa. The flow rate control during the Crw phase was relatively good. However, the recorded pressure response shows some oscillations. No recovery phase (CRwr) was conducted. The CRw phase is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the CRw phase shows a relative flat derivative at middle and late times, indicating radial flow. For the analysis of the CRw phase a homogeneous flow model with wellbore storage and skin was used. The analysis is presented in Appendix 2-2.

Selected representative parameters

The recommended transmissivity of $1.5 \cdot 10^{-5}$ m²/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be $6.0 \cdot 10^{-6}$ to $5.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.3 Borehole HLX27 (Section 6.03–164.70 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 40.3 L/min and a duration of 5.5 hours. The pumped flow rate decreased from 40.4 L/min at the start of the CRw phase to 39.5 L/min at the end with a maximum drawdown of 81 kPa. The flow rate shows some oscilliations during the Crw phase. These oscilliations are seen in the pressure response as well. No recovery phase (CRwr) was conducted. The CRw phase is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the CRw phase shows a relative flat derivative at middle and late times, indicating radial flow. For the analysis of the CRw phase a homogeneous flow model with wellbore storage and skin was used. The analysis is presented in Appendix 2-3.

Selected representative parameters

The recommended transmissivity of $5.0 \cdot 10^{-5}$ m²/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be $1.0 \cdot 10^{-5}$ to $9.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.4 Borehole HLX28 (Section 6.03–154.20 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 63.8 L/min and a duration of 5.1 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 64.1 L/min at the start of the CRw phase to 63.5 L/min at the end with a maximum drawdown of 34 kPa. No recovery phase (CRwr) was conducted. The CRw phase shows no problems and is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the derivative of the CRw phase shows a horizontal stabilization at middle times, followed by an upward trend at late times. For the analysis of the CRw phase a two shell composite flow model with decreasing transmissivity away from the borehole was used. The analysis is presented in Appendix 2-4.

Selected representative parameters

The inner zone transmissivity of $3.6 \cdot 10^{-4}$ m²/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be $9.0 \cdot 10^{-5}$ to $7.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.5 Borehole HLX32 (Section 12.30–162.60 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 11.9 L/min and a duration of 3.7 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 12.5 L/min at the start of the CRw phase to 11.7 L/min at the end with a maximum drawdown of 93 kPa. No recovery phase (CRwr) was conducted. The CRw phase shows no problems and is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the derivative of the CRw phase shows a downward trend at middle and late times, indicating a transition from wellbore storage and skin dominated flow to pure formation flow. For the analysis of the CRw phase a homogeneous flow model with wellbore storage and skin was used. The analysis is presented in Appendix 2-5.

Selected representive parameters

The recommended transmissivity of $2.0 \cdot 10^{-5}$ m²/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be $9.0 \cdot 10^{-6}$ to $7.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.6 Borehole HLX33 (Section 9.03–202.10 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 64.5 L/min and a duration of 5.3 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 65.9 L/min at the start of the CRw phase to 64.0 L/min at the end with a maximum drawdown of 63 kPa. No recovery phase (CRwr) was conducted. The CRw phase shows no problems and is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the derivative of the CRw phase shows a horizontal stabilization at middle times, followed by a downward trend at late times. For the analysis of the CRw phase a two shell composite flow model with increasing transmissivity at some distance from the borehole was used. The analysis is presented in Appendix 2-6.

Selected representative parameters

The inner zone transmissivity of $1.2 \cdot 10^{-4}$ m²/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be $7.0 \cdot 10^{-5}$ to $5.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.7 Borehole HLX37 (Section 12.10–199.80 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 14.6 L/min and a duration of 5.8 hours. The pumped flow rate decreased from 14.9 L/min at the start of the CRw phase to 14.5 L/min at the end with a maximum drawdown of 43 kPa. At start of the pump phase the rate control was very poor, but relative stable flow rate conditions were reached after approximately 15 minutes. Therefore the recorded pressure response shows some oscillations at early times. No recovery phase (CRwr) was conducted. The CRw phase is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. Due to the poor rate control at start of the pump phase the early time data of the CRw phase is noisy and not very conclusive. However, the middle and late time derivative shows a horizontal stabilization, indicating radial flow. A homogeneous radial flow model with wellbore storage and skin was used for the analysis of the CRw phase. The analysis is presented in Appendix 2-7.

Selected representative parameters

The recommended transmissivity of $3.7 \cdot 10^{-5}$ m²/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be $8.0 \cdot 10^{-6}$ to $8.0 \cdot 10^{-5}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.8 Borehole HLX39 (Section 6.10–199.30 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 33.1 L/min and a duration of 6.3 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 34.9 L/min at the start of the CRw phase to 32.5 L/min at the end with a maximum drawdown of 73 kPa. No recovery phase (CRwr) was conducted. The CRw phase shows no problems and is adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, the derivative of the CRw phase shows a horizontal stabilization at middle times, followed by an upward trend at late times. For the analysis of the CRw phase a two shell composite flow model with decreasing transmissivity away from the borehole was used. The analysis is presented in Appendix 2-8.

Selected representative parameters

The inner zone transmissivity of $1.5 \cdot 10^{-4}$ m²/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be $4.0 \cdot 10^{-5}$ to $5.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2.

The recommended transmissivity is used as borehole transmissivity for the evaluation of the flow logging survey.

5.2.9 Borehole HLX43 (Section 6.00–170.60 m)

Comments to test

The test was composed of a constant rate pump phase (CRw) with a mean flow rate of 63.1 L/min and a duration of 9.2 hours. The flow rate control during the CRw phase was good. The pumped flow rate decreased from 63.7 L/min at the start of the CRw phase to 62.7 L/min at the end with a maximum drawdown of 39 kPa. The recovery phase (CRwr) was measured for 15.0 h. Both phases show no problems and are adequate for quantitative analysis.

Flow regimes and calculated parameters

The flow dimension is interpreted from the slope of the semi-log derivative plotted in log-log coordinates. In case of the present test, both phases show a derivative with a horizontal stabilization, indicating radial flow. A homogeneous flow model with wellbore storage and skin was used for the analysis both phases. The analysis is presented in Appendix 2-9.

Selected representative parameters

The recommended transmissivity of $1.4 \cdot 10^{-4}$ m²/s was derived from the analysis of the CRw phase, which shows a slight better data and derivative quality. The confidence range for the transmissivity is estimated to be $7.0 \cdot 10^{-5}$ to $5.0 \cdot 10^{-4}$ m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth was derived from the CRwr phase using straight line extrapolation in the Horner plot to a value of 202.3 kPa.

The analysis of the CRw and CRwr phase show good consistency. No further analysis recommended.

5.3 Flow logging

The nomenclature used for the flow logging test evaluation is according to the SKB document “Method description for flow logging” (SKB MD 322.009, Metodbeskrivning för flödesloggning). The measured inflow (Q_i) at the detected flow anomalies together with the percentages of the total flow rate at the surface are presented in subsequent tables at logging results. The cumulative transmissivity (ΣT_i) at the top of the flow-logged borehole section was calculated according to equation (5-1) and the individual transmissivity of single flow anomalies (T_i) according to equation (5-2). This method is described in detail in Section 4.5.1.The specific flow (Q_i/s_{FL}) of single anomalies was also used for an interpretation of the transmissivity of these anomalies. The above mentioned parameters are summarized in Table 6-3 of the synthesis chapter.

Flow logging diagrams including the measured flow rates along the borehole during flow logging in combination with the electric conductivity (EC) and the temperature (Te) of the borehole fluid is shown in Chapter 5 and in Appendix 4. All flow logging was performed during the pump tests in the open boreholes.

5.3.1 Borehole HLX14

Comments to test

The flow logging in HLX14 was performed between 114.0 m and 25.0 m below ToC. There was no flow logging from 114.0 m to the bottom of the hole at 115.9 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below the first anomaly detected between 111.5 m and 110.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to $T = 7.99 \cdot 10^{-5}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 11.1 L/min. This indicates some minor inflows to the borehole are above the top of the logged section between 25.0 m and 11.9 m below ToC. This is consistent with the observations during the drilling of the borehole. The inflows detected during flow logging are covering 71.2% of the measured flow at surface. Both inflows are related to a decrease of electric conductivity.

Between 65 m and 55 m the measured flow rate was a litte bit noisy, but no inflow could be detected. This can be attributed to a cavernous borehole that can causes turbulences or a flow bypassing the flow logging tool.

The diagrams of the flow logging measurements in HLX14 are presented in Figure 5-1 and Appendix 4-1.

Table 5-1. Analyses results; flow logging HLX14.

HLX 14	**$Q_p = 6.42 \cdot 10^{-4}$ m³/s**	**$T = 7.99 \cdot 10^{-5}$ m²/s**		**$T_{Fmeasl-L} = 6.23 \cdot 10^{-6}$ m²/s**		**$s_{FL} = 5.39$ m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
110.5–110.0	0.5	$3.53 \cdot 10^{-4}$	55.1	$4.40 \cdot 10^{-5}$	$6.55 \cdot 10^{-5}$	main inflow
100.0–99.0	1.0	$1.03 \cdot 10^{-4}$	16.1	$1.29 \cdot 10^{-5}$	$1.92 \cdot 10^{-5}$	
Total (cumulative)		**$4.57 \cdot 10^{-4}$**	**71.2**	**$5.69 \cdot 10^{-5}$**	**$8.47 \cdot 10^{-5}$**	
Difference		$Qp - \Sigma Q_i =$ $1.85 \cdot 10^{-4}$	28.8	$T - \Sigma T_i =$ $2.30 \cdot 10^{-5}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

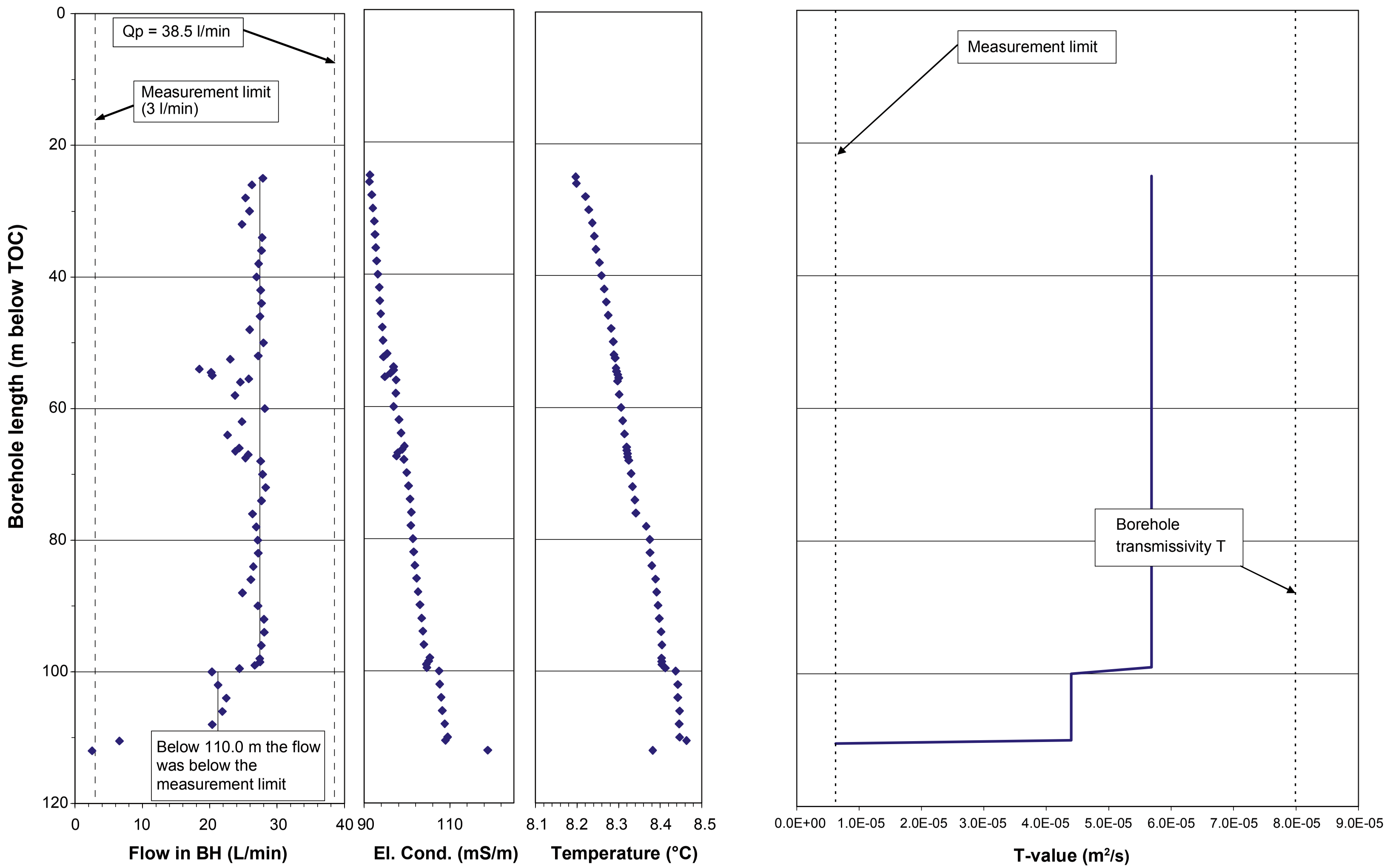

Figure 5-1. *Results of the flow logging survey in borehole HLX14.*

5.3.2 Borehole HLX20

Comments to test

The flow logging in HLX20 was performed between 196.0 m and 22.0 m below ToC. There was no flow logging from 196.0 m to the bottom of the hole at 202.2 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below the first anomaly detected between 76.5 m and 72.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to $T = 1.52 \cdot 10^{-5}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 4.6 L/min. The inflows detected during flow logging are covering 75.3% of the measured flow at surface. During the drilling of the borehole no inflows were detected above the flow logged section. The discrepancy could be attributed to a cavernous borehole or a slight increase in the borehole diameter which leads to a measurement of smaller flow rates.

The lower inflow is related to a decrease of electric conductivity. Between 160.0 m and 170.0 m a decrease of electric conductivity was observed. This decrease is not related to an inflow and can be attributed to a layering of water with different salinity and density.

The measured flow around the inflows shows some oscillations and the length of the inflows could not detected exactly. This can be attributed by a cavernous fracture zone causes turbulent flow.

The diagrams of the flow logging measurements in HLX20 are presented in Figure 5-2 and Appendix 4-2.

Table 5-2. Analyses results; flow logging HLX20.

HLX 20	**$Q_p = 3.10 \cdot 10^{-4}$ m³/s**		**$T = 1.52 \cdot 10^{-5}$ m²/s**		**$T_{Fmeasl-L} = 2.45 \cdot 10^{-6}$ m²/s**	**$s_{FL} = 9.99$ m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
76.5–72.0	4.5	$1.78 \cdot 10^{-4}$	57.5	$8.74 \cdot 10^{-6}$	$1.79 \cdot 10^{-5}$	main inflow
48.0–44.0	4.0	$5.50 \cdot 10^{-5}$	17.7	$2.70 \cdot 10^{-6}$	$5.51 \cdot 10^{-6}$	
Total (cumulative)		**$2.33 \cdot 10^{-4}$**	**75.3**	**$2.70 \cdot 10^{-6}$**	**$2.34 \cdot 10^{-5}$**	
Difference		$Qp - \Sigma Q_i =$ $7.67 \cdot 10^{-5}$	24.7	$T - \Sigma T_i =$ $3.76 \cdot 10^{-6}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

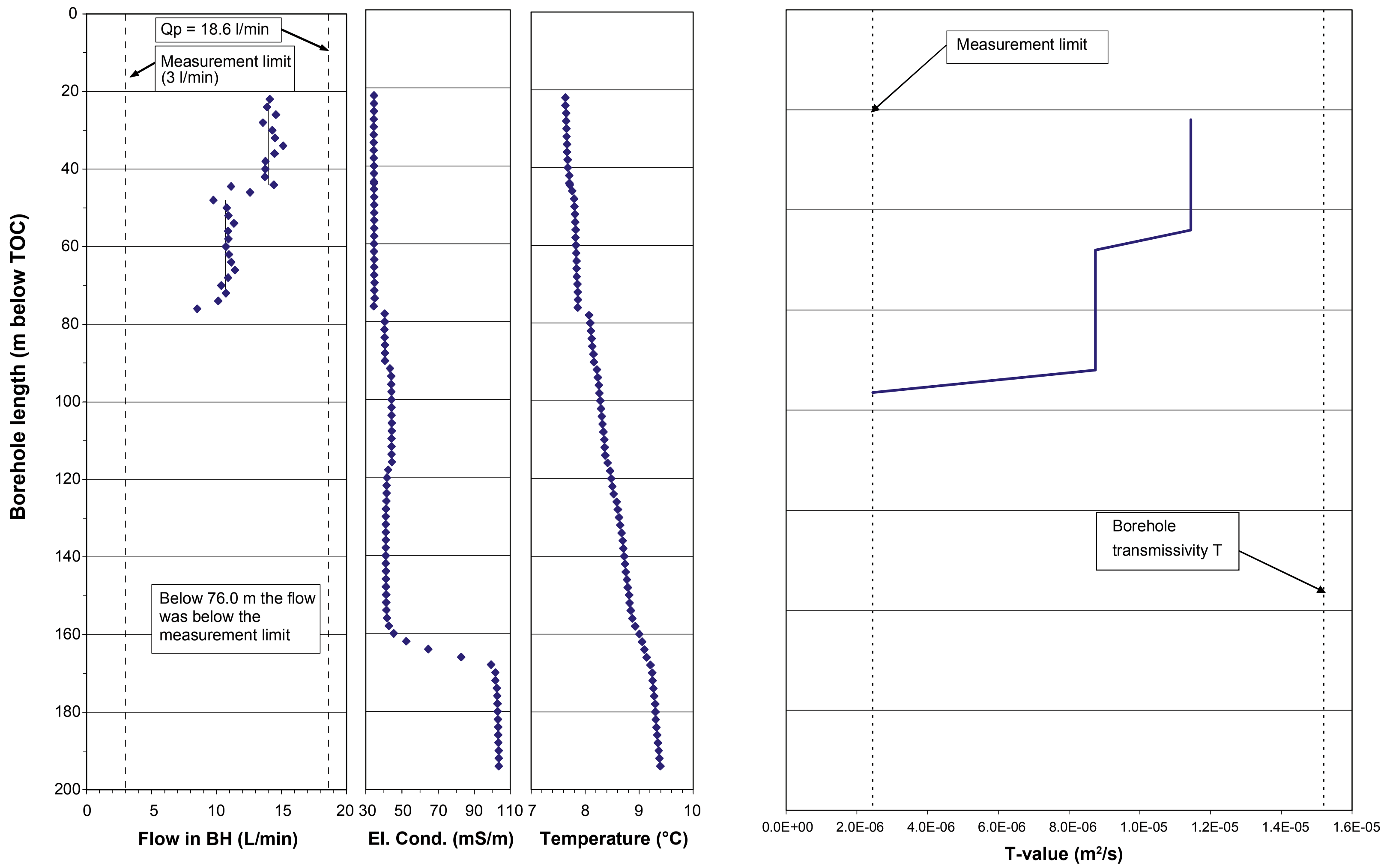

Figure 5-2. *Results of the flow logging survey in borehole HLX20.*

5.3.3 Borehole HLX27

Comments to test

The flow logging in HLX27 was performed between 162.0 m and 20.0 m below ToC. There was no flow logging from 162.0 m to the bottom of the hole at 164.7 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below the first anomaly detected between 159.0 m and 158.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to $T = 5.01 \cdot 10^{-5}$ m²/s.

The total flow of the logged interval (ΣQ_i) is slightly below the measured flow rate of the total flow at the surface (Q_p). The difference is small (1.4 l/min) and can be explained by the limited resolution of the flow logger and the flow meter at surface.

The inflows detected during flow logging are covering 96.5% of the measured flow at surface. The inflows are related to a decrease of electric conductivity.

The diagrams of the flow logging measurements in HLX27 are presented in Figure 5-3 and Appendix 4-3.

Table 5-3. Analyses results; flow logging HLX27.

HLX 27	**$Q_p = 6.58 \cdot 10^{-4}$ m³/s**		**$T = 5.01 \cdot 10^{-5}$ m²/s**	**$T_{Fmeasl-L} = 3.81 \cdot 10^{-6}$ m²/s**		**$s_{FL} = 8.24$ m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
159.0–158.0	1.0	$2.08 \cdot 10^{-4}$	31.3	$1.59 \cdot 10^{-5}$	$2.53 \cdot 10^{-5}$	
158.0–157.5	0.5	$2.87 \cdot 10^{-4}$	43.5	$2.18 \cdot 10^{-5}$	$3.48 \cdot 10^{-5}$	main inflow
105.5–104.0	1.5	$1.40 \cdot 10^{-4}$	21.3	$1.07 \cdot 10^{-5}$	$1.70 \cdot 10^{-5}$	
Total (cumulative)		**$6.35 \cdot 10^{-4}$**	**96.5**	**$4.83 \cdot 10^{-5}$**	**$7.71 \cdot 10^{-5}$**	
Difference		$Qp - \Sigma Q_i = 2.33 \cdot 10^{-5}$	3.5	$T - \Sigma T_i = 1.78 \cdot 10^{-6}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

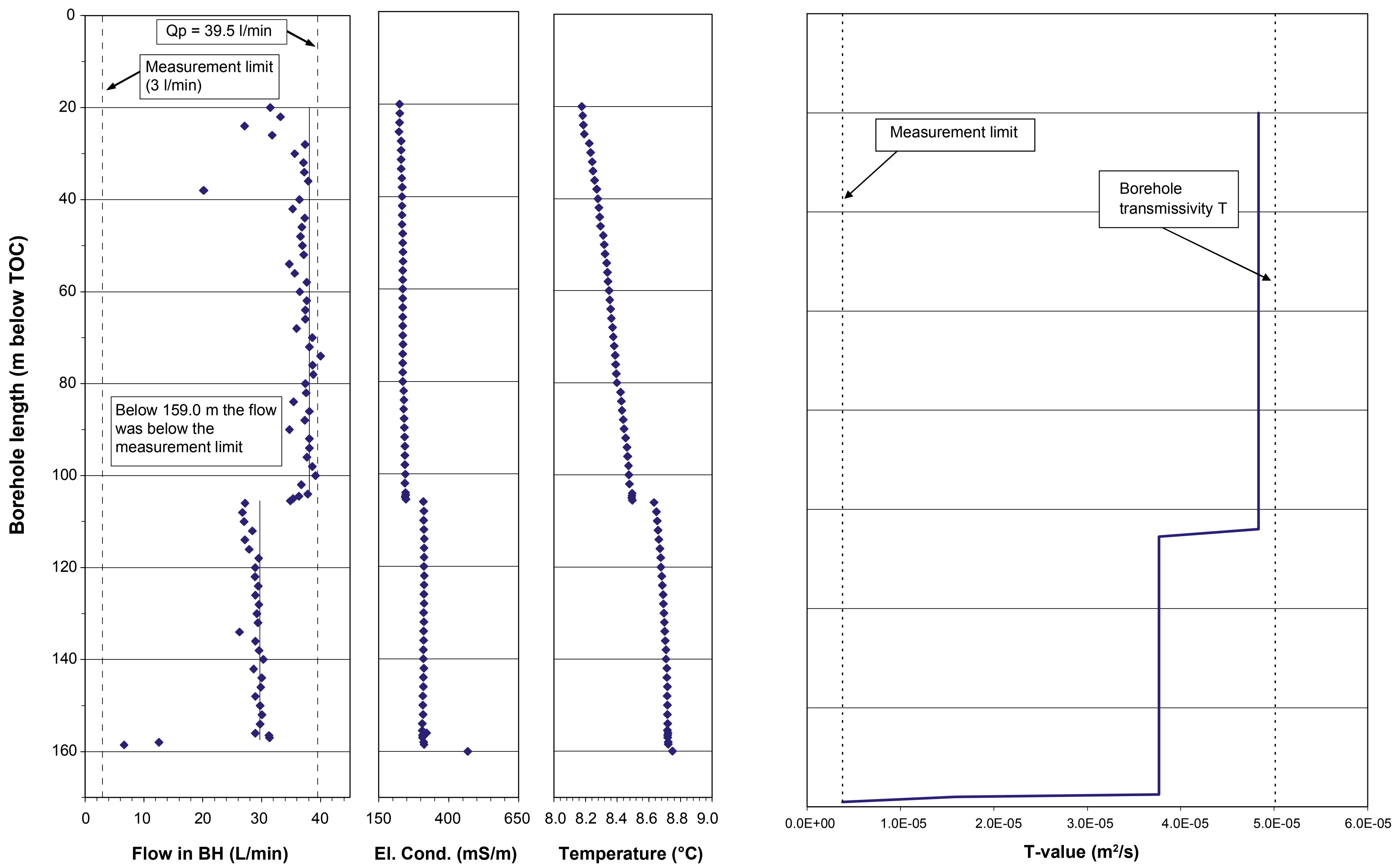

Figure 5-3. *Results of the flow logging survey in borehole HLX27.*

5.3.4 Borehole HLX28

Comments to test

The flow logging in HLX28 was performed between 22.0 m and 141.0 m below ToC. There was no flow logging from 141.0 m to the bottom of the hole at 154.2 m because of problems during the passage of the dummy at this depth. Below the first anomaly detected between 79.5 m and 78.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to T = $3.62 \cdot 10^{-4}$ m²/s.

The total flow of the logged interval (ΣQ_i) is slightly above the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is small (2.1 l/min) and can be explained by the limited resolution of the flow logger and the flow meter at surface.

The detected inflow at 81.0 m and 78.0 m below ToC is deemed to be the main inflow because it covers all of the measured flow at surface. This inflow is related to a decrease of electric conductivity. At approximately 90 m below ToC a decrease of electric conductivity was observed. This decrease is not related to an inflow and can be attributed to a layering of water with different salinity and density.

The diagrams of the flow logging measurements in HLX28 are presented in Figure 5-4 and Appendix 4-4.

Table 5-4. Analyses results; flow logging HLX28.

HLX 28	**$Q_p = 1.06 \cdot 10^{-3}$ m³/s**		**T = $3.62 \cdot 10^{-4}$ m²/s**	**$T_{Fmeasl-L} = 1.71 \cdot 10^{-5}$ m²/s**		**s_{FL} = 3.47 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
79.5–78.0	1.5	$1.09 \cdot 10^{-3}$	103.3	$3.74 \cdot 10^{-4}$	$3.15 \cdot 10^{-4}$	main inflow
Total (cumulative)		**$1.09 \cdot 10^{-3}$**	**103.3**	**$3.74 \cdot 10^{-4}$**	**$3.15 \cdot 10^{-4}$**	
Difference		$Qp - \Sigma Q_i$ = $-3.50 \cdot 10^{-5}$	–3.3	$T - \Sigma T_i$ = $-1.20 \cdot 10^{-5}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

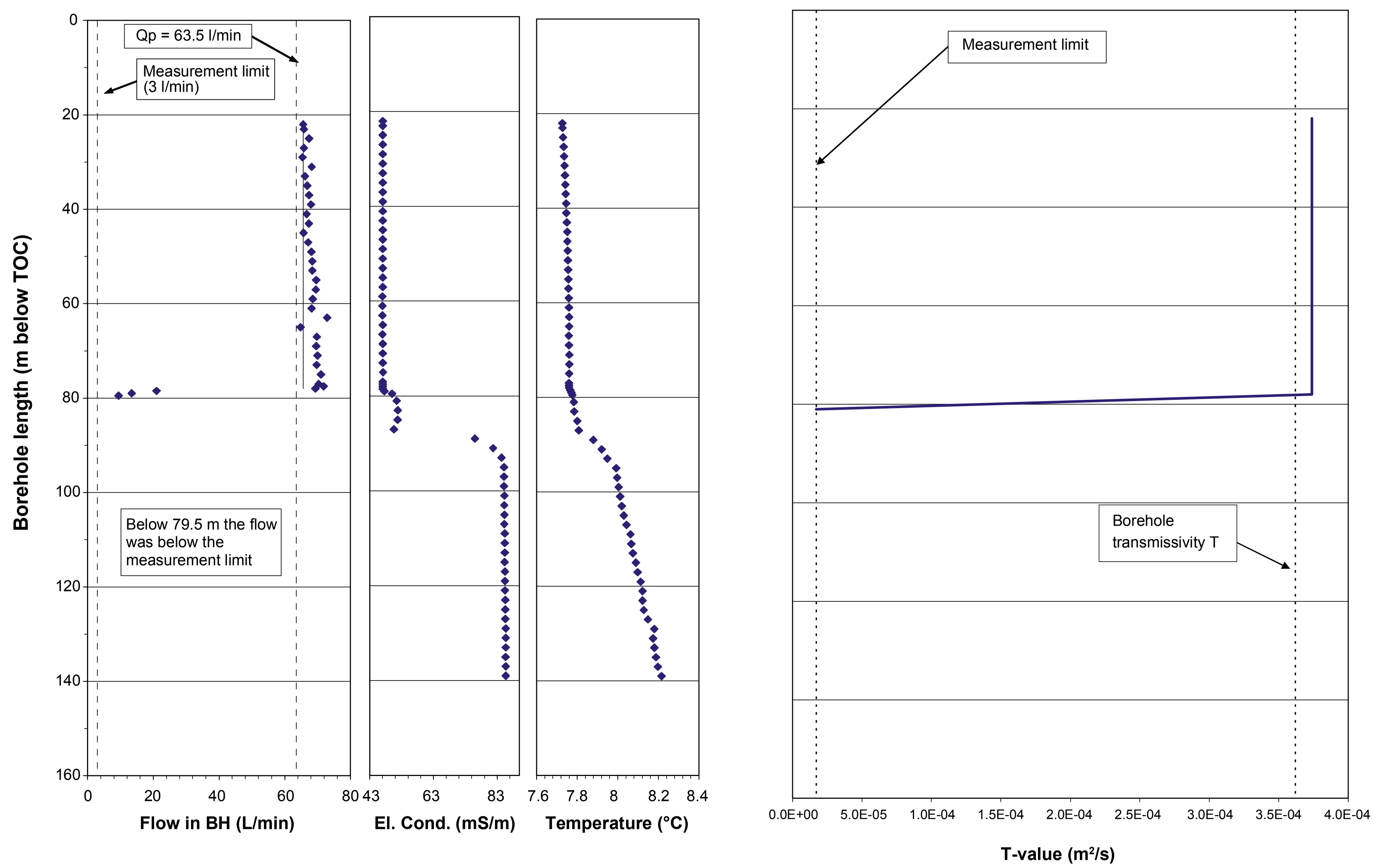

Figure 5-4. Results of the flow logging survey in borehole HLX 28.

5.3.5 Borehole HLX32

Comments to test

The flow logging in HLX 32 was performed between 22.0 m and 160.0 m below ToC. There was no flow logging from 160.0 m to the bottom of the hole at 162.6 m because of problems during the passage of the dummy at this depth. Below 26 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to T = $2.03 \cdot 10^{-5}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 7.7 L/min. This indicates some inflows to the borehole are above the top of the logged section between 22.0 m and 12.3 m below ToC. This is consistent with the observations during the drilling of the borehole. The inflow detected during flow logging is covering 34.2% of the measured flow at surface. The inflow is not related to a change of electric conductivity.

The diagrams of the flow logging measurements in HLX32 are presented in Figure 5-5 and Appendix 4-5.

Table 5-5. Analyses results; flow logging HLX32.

HLX 32	**Q_p = $1.95 \cdot 10^{-4}$ m³/s**		**T = $2.03 \cdot 10^{-5}$ m²/s**		**$T_{Fmeasl-L}$ = $5.21 \cdot 10^{-6}$ m²/s**	**s_{FL} = 9.56 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
28.0–26.0	2.0	$6.67 \cdot 10^{-5}$	34.2	$6.94 \cdot 10^{-6}$	$6.97 \cdot 10^{-6}$	
Total (cumulative)		**$6.67 \cdot 10^{-5}$**	**34.2**	**$6.94 \cdot 10^{-6}$**	**$6.97 \cdot 10^{-6}$**	
Difference		$Qp - \Sigma Q_i$ = $1.28 \cdot 10^{-4}$	65.8	$T - \Sigma T_i$ = $1.34 \cdot 10^{-5}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

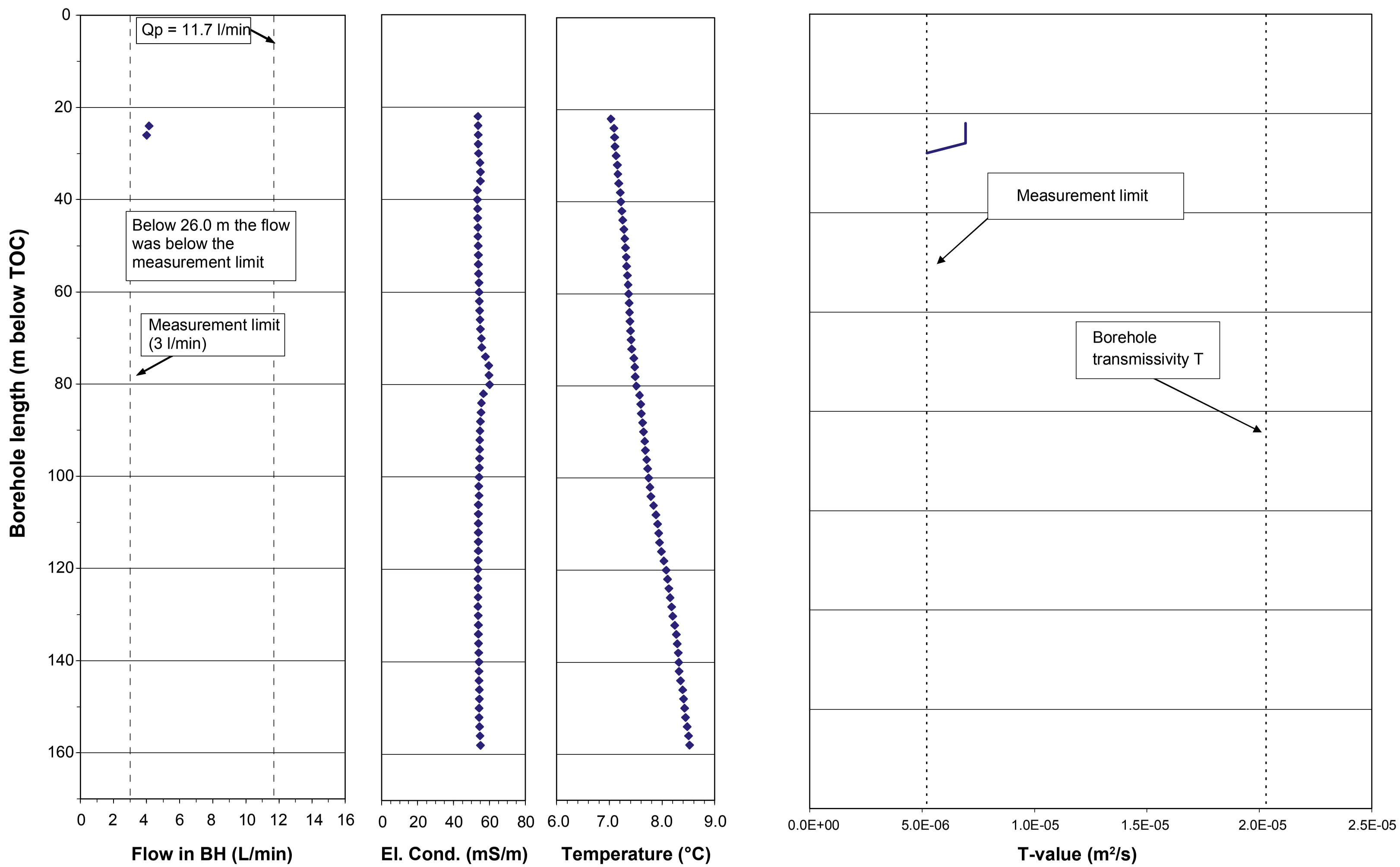

Figure 5-5. *Results of the flow logging survey in borehole HLX32.*

5.3.6 Borehole HLX33

Comments to test

The flow logging in HLX33 was performed between 19.0 m and 111.0 m below ToC. There was no flow logging from 111.0 m to the bottom of the hole at 202.1 m because it was not possible to lower either the dummy or the flow logger below 111.0 m. A flow of 14 L/min was detected at the bottom of the flow logged section.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to T = $1.21 \cdot 10^{-4}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 28.2 L/min. This indicates some inflows to the borehole are above the top of the logged section between 19.0 m and 9.1 m below ToC. This is consistent with the observations during the drilling of the borehole. The inflows detected during flow logging are covering 55.9% of the measured flow at surface. The inflows are related to a change of electric conductivity.

The diagrams of the flow logging measurements in HLX33 are presented in Figure 5-6 and Appendix 4-6.

Table 5-6. Analyses results; flow logging HLX33.

HLX 33	**$Q_p = 1.07 \cdot 10^{-3}$ m³/s**		**T = $1.21 \cdot 10^{-4}$ m²/s**		**$T_{Fmeasl-L} = 5.67 \cdot 10^{-6}$ m²/s**	**s_{FL} = 6.42 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
Below 111.0 m	–	$4.13 \cdot 10^{-4}$	38.8	$4.69 \cdot 10^{-5}$	$6.44 \cdot 10^{-5}$	
102.5–102.0	0.5	$5.67 \cdot 10^{-5}$	5.3	$7.75 \cdot 10^{-6}$	$8.82 \cdot 10^{-6}$	
39.0–34.0	5.0	$1.27 \cdot 10^{-4}$	11.9	$1.30 \cdot 10^{-5}$	$1.97 \cdot 10^{-5}$	
Total (cumulative)		**$5.97 \cdot 10^{-4}$**	**55.9**	**$6.77 \cdot 10^{-5}$**	**$9.29 \cdot 10^{-5}$**	
Difference		$Qp - \Sigma Q_i$ = $4.70 \cdot 10^{-4}$	44.1	$T - \Sigma T_i$ = $5.33 \cdot 10^{-5}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

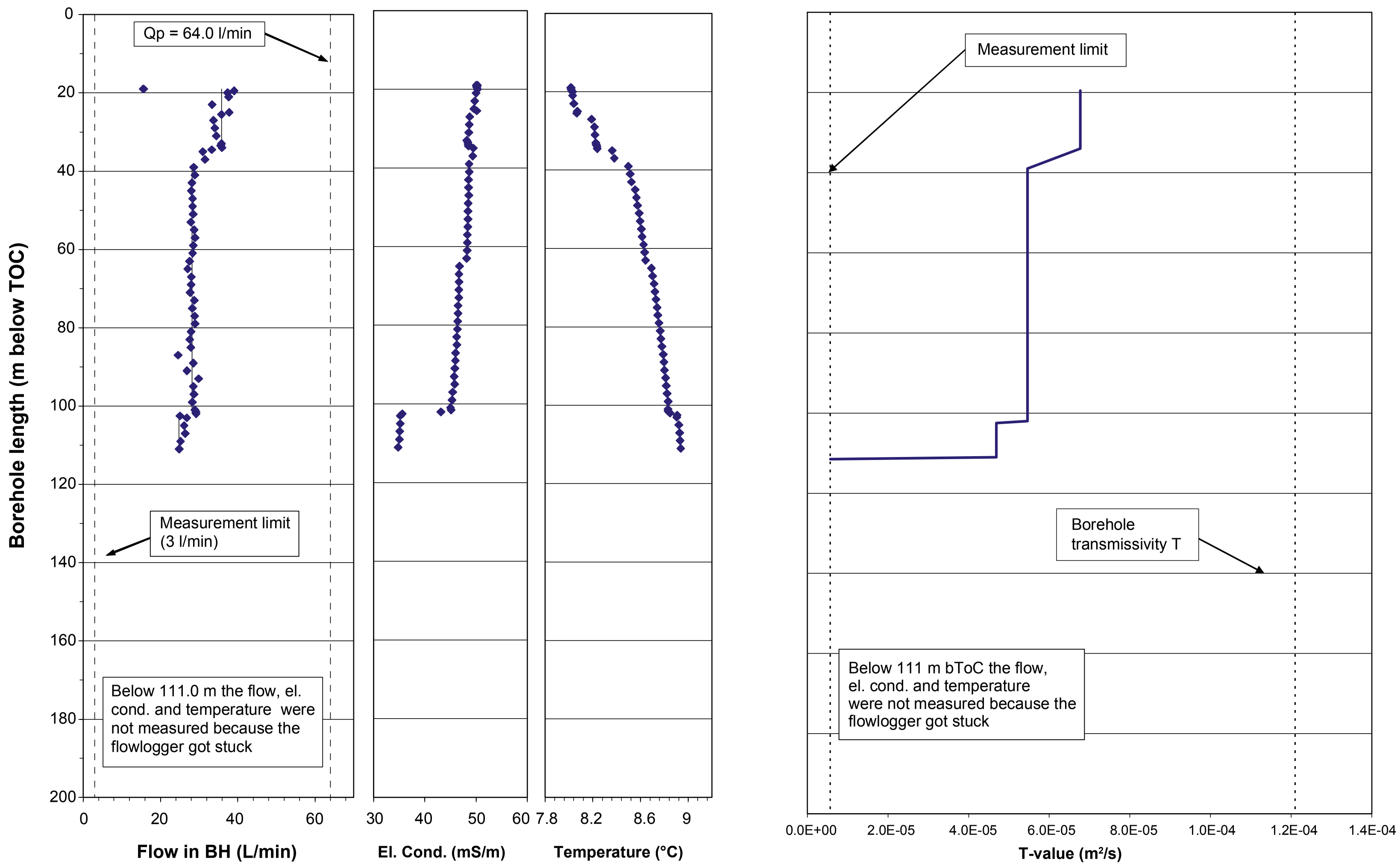

Figure 5-6. *Results of the flow logging survey in borehole HLX33.*

5.3.7 Borehole HLX37

Comments to test

The flow logging in HLX37 was performed between 21.0 m and 195.0 m below ToC. There was no flow logging from 195.0 m to the bottom of the hole at 199.8 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below 100.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to T = $3.68 \cdot 10^{-5}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is relatively small (3.1 L/min). Based on this difference and the observations during the drilling of the hole a minor inflow can be expected above the top of the logged section. The inflows detected during flow logging is covering 78.6% of the measured flow at surface. Therfore, this inflow can be deemed to be the main inflow into this borehole. The inflow is related to a change of electric conductivity.

The length of the anomaly could not be detected exactly, but stretches over a borehole section of 2.5 m length.

The diagrams of the flow logging measurements in HLX37 are presented in Figure 5-7 and Appendix 4-7.

Table 5-7. Analyses results; flow logging HLX37.

HLX37	**Q_p = $2.42 \cdot 10^{-4}$ m³/s**		**T = $3.68 \cdot 10^{-5}$ m²/s**	**$T_{Fmeasl-L}$ = $7.61 \cdot 10^{-6}$ m²/s**		**s_{FL} = 4.44 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
100.5–97.0	2.5	$1.90 \cdot 10^{-4}$	78.6	$2.89 \cdot 10^{-5}$	$4.28 \cdot 10^{-5}$	main inflow
Total (cumulative)		**$1.90 \cdot 10^{-4}$**	**78.6**	**$2.89 \cdot 10^{-5}$**	**$4.28 \cdot 10^{-5}$**	
Difference		$Qp-\Sigma Q_i$ = $5.17 \cdot 10^{-5}$	21.4	$T-\Sigma T_i$ = $7.87 \cdot 10^{-6}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

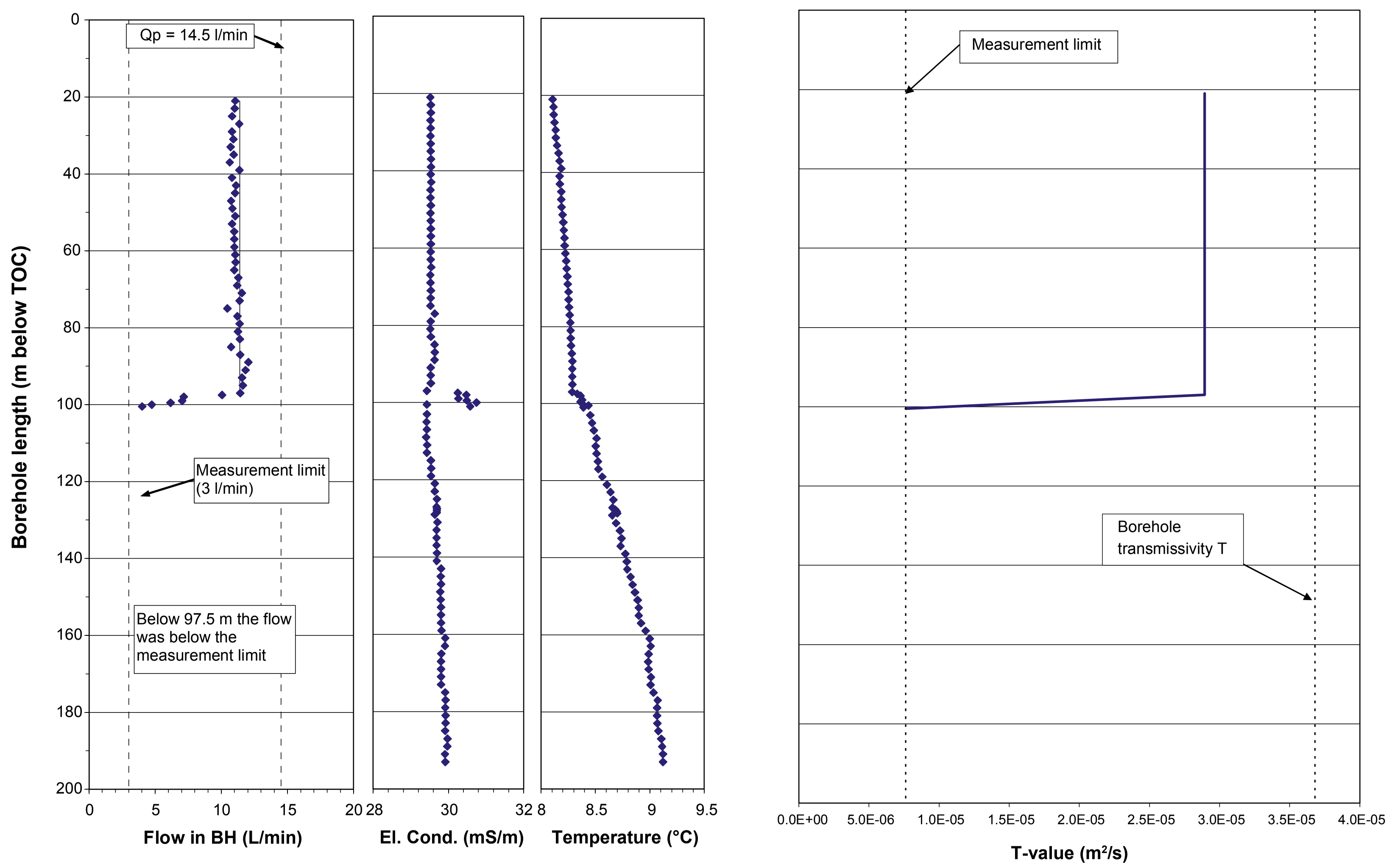

Figure 5-7. Results of the flow logging survey in borehole HLX37.

5.3.8 Borehole HLX39

Comments to test

The flow logging in HLX39 was performed between 197.0 m and 35.0 m below ToC. There was no flow logging from 197.0 m to the bottom of the hole at 199.3 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below 192.5 m the inflow was below or in the range of the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to T = $1.48 \cdot 10^{-4}$ m²/s.

The total flow of the logged interval (ΣQ_i) is slightly below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 1.3 L/min and can be explained by a minor inflow above the flow logged section. This is consistent with observation during the drilling of the borehole. The inflow detected during flow logging is covering 96.0% of the measured flow at surface. The inflow is related to a decrease of electric conductivity.

The diagrams of the flow logging measurements in HLX39 are presented in Figure 5-8 and Appendix 4-8.

Table 5-8. Analyses results; flow logging HLX39.

HLX39	**Q_p = $5.42 \cdot 10^{-4}$ m³/s**		**T = $1.48 \cdot 10^{-4}$ m²/s**		**$T_{Fmeasl-L}$ = $1.37 \cdot 10^{-5}$ m²/s**	**s_{FL} = 7.41 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
192.5–191.0	1.5	$5.20 \cdot 10^{-4}$	96.0	$1.42 \cdot 10^{-4}$	$7.02 \cdot 10^{-5}$	main inflow
Total (cumulative)		**$5.20 \cdot 10^{-4}$**	**96.0**	**$1.42 \cdot 10^{-4}$**	**$7.02 \cdot 10^{-5}$**	
Difference		$Qp-\Sigma Q_i$ = $2.17 \cdot 10^{-5}$	4.0	$T-\Sigma T_i$ = $5.92 \cdot 10^{-6}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

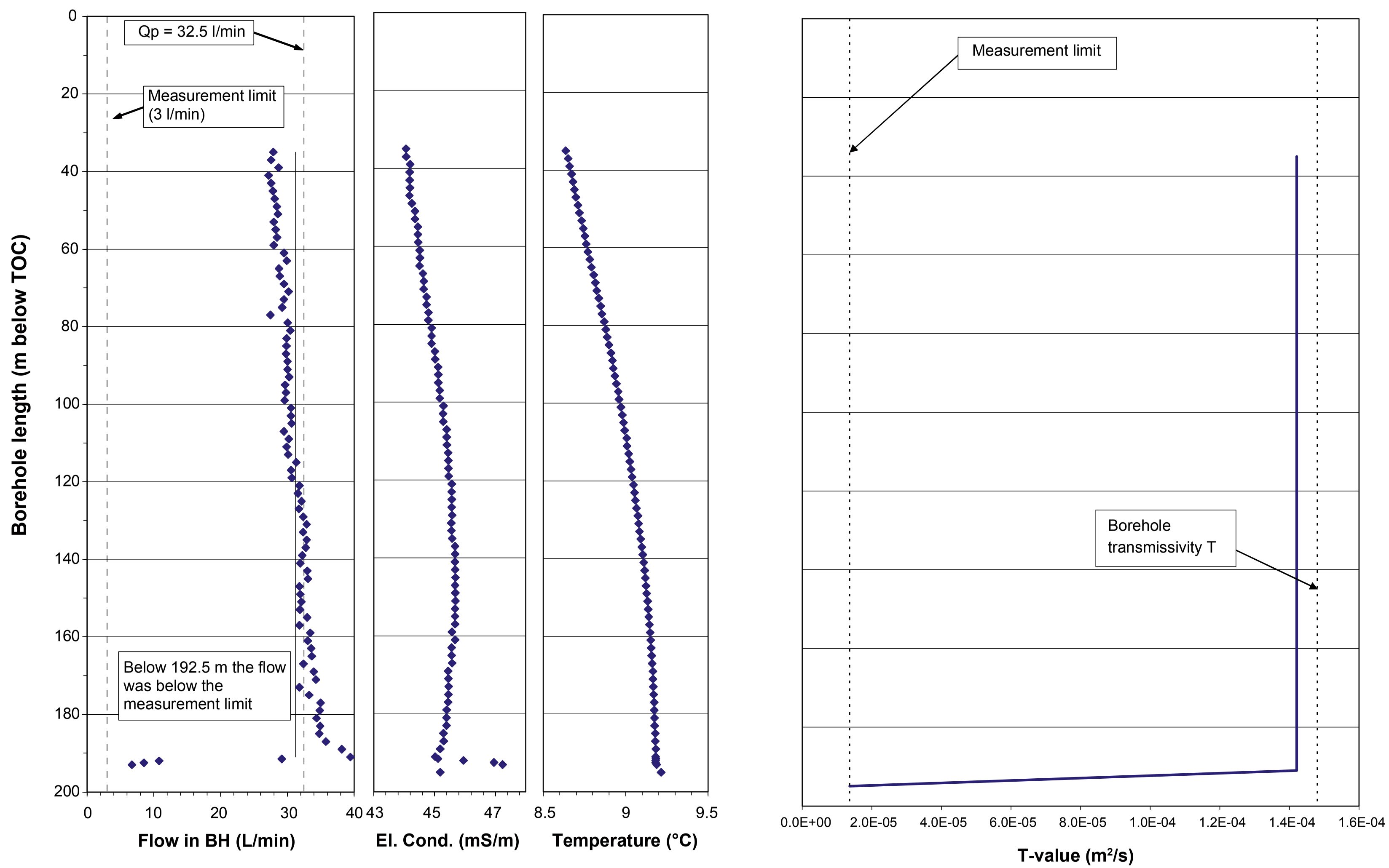

Figure 5-8. *Results of the flow logging survey in borehole HLX39.*

5.3.9 Borehole HLX43

Comments to test

The flow logging in HLX 43 was performed between 165.0 m and 29.0 m below ToC. There was no flow logging from 165.0 m to the bottom of the hole at 170.6 m to avoid lowering the flow logger in drill mud at the bottom of the hole. Below the first anomaly detected between 153.0 m and 151.0 m the inflow was below the measurement limit of 3 L/min.

Logging results

The transmissivity of the entire borehole was derived from the transient calculation of the pump phase during flow logging to $T = 1.43 \cdot 10^{-4}$ m²/s.

The total flow of the logged interval (ΣQ_i) is below the measured flow rate of the total flow at the surface (Q_p). The difference between the flow rates is 8.2 L/min. During the drilling of the borehole no inflows were detected above the flow logged section. The discrepancy could be attributed to a cavernous borehole which leads to turbulent flow and oscillating flow rate measurements. The fluctuating flow rate measurements rest upon this assumption.

The inflows detected during flow logging are covering 86.9% of the measured flow at surface. The inflows are related to a decrease of electric conductivity.

The diagrams of the flow logging measurements in HLX43 are presented in Figure 5-9 and Appendix 4-9.

Table 5-9. Analyses results; flow logging HLX43.

HLX43	**$Q_p = 1.05 \cdot 10^{-3}$ m³/s**		**$T = 1.43 \cdot 10^{-4}$ m²/s**		**$T_{Fmeasl-L} = 6.84 \cdot 10^{-6}$ m²/s**	**s_{FL} = 3.96 m**
Anomaly depth (m from ToC)	**Anomaly length (m)**	**Q_i (m³/s)**	**Q_i/Q_p (%)**	**T_i (m²/s)**	**Q_i/s_{FL} (m²/s)**	**Remarks**
153.0–151.0	2.0	$8.33 \cdot 10^{-5}$	8.0	$1.14 \cdot 10^{-5}$	$2.11 \cdot 10^{-5}$	
142.5–142.0	0.5	$3.38 \cdot 10^{-4}$	32.4	$4.63 \cdot 10^{-5}$	$8.55 \cdot 10^{-5}$	
78.0–77.5	0.5	$4.87 \cdot 10^{-4}$	46.6	$6.66 \cdot 10^{-5}$	$1.23 \cdot 10^{-4}$	main inflow
Total (cumulative)		**$9.08 \cdot 10^{-4}$**	**86.9**	**$1.24 \cdot 10^{-4}$**	**$2.30 \cdot 10^{-4}$**	
Difference		$Qp - \Sigma Q_i = 1.37 \cdot 10^{-4}$	13.1	$T - \Sigma T_i = 1.87 \cdot 10^{-5}$		

Q_i = measured inflow rate of a single anomaly, ΣQ_i = cumulative flow at the top of the logged section
Q_p = pumped flow rate at surface flow meter
T = transmissivity of the entire borehole, T_i = transmissivity of a single anomaly
$T_{Fmeasl-L}$ = transmissivity measurement limit
ΣT_i = cumulative transmissivity at the top of the logged section
s_{FL} = drawdown during pump test

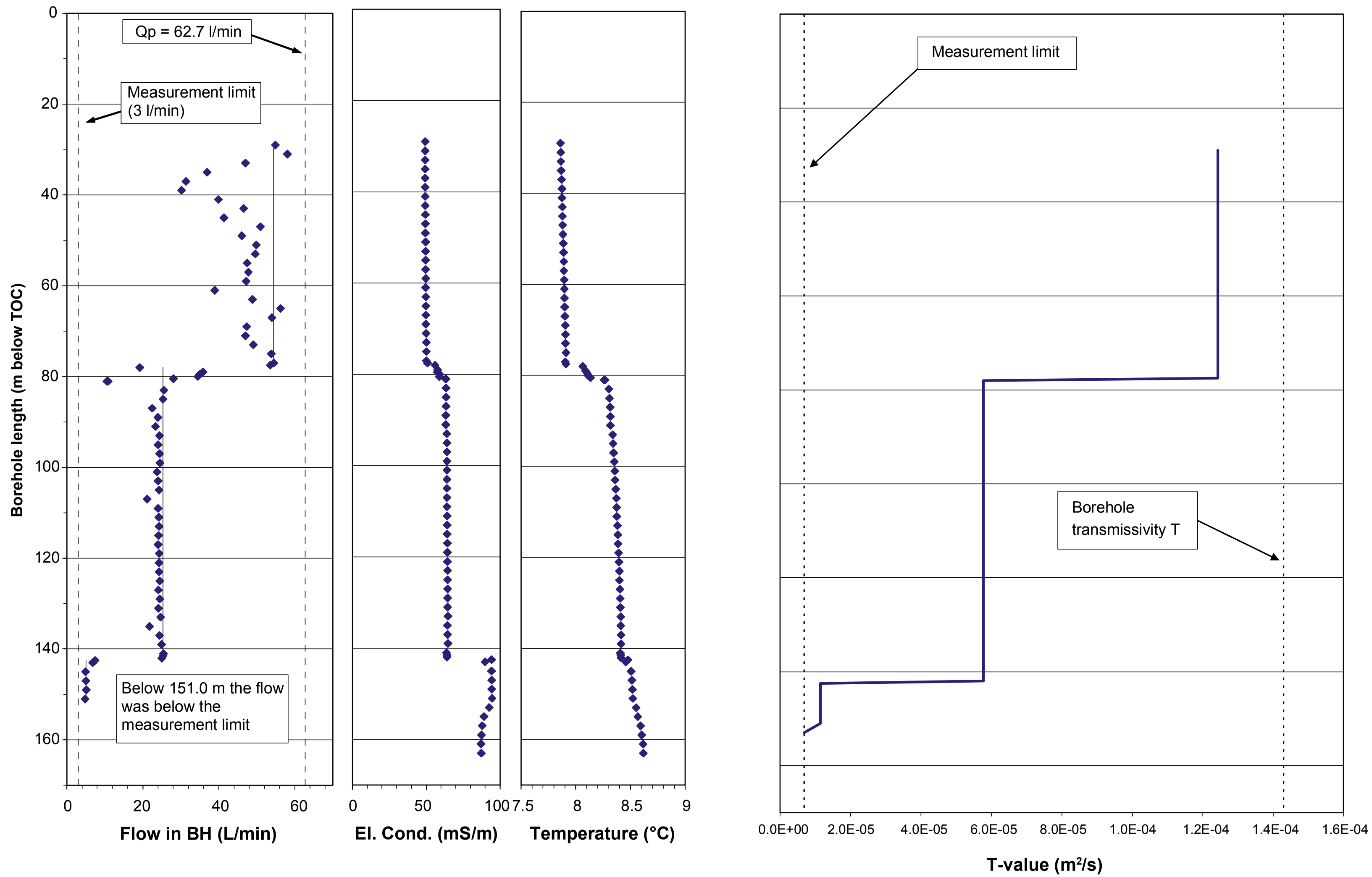

Figure 5-9. *Results of the flow logging survey in borehole HLX43.*

6 Summary of results

Table 6-1. General test data from constant rate pump tests.

Borehole ID	Borehole secup (m)	Borehole seclow (m)	Date and time for test start YYYYMMDD hh:mm	Date and time for test stop YYYYMMDD hh:mm	Q_p (m³/s)	Q_m (m³/s)	tp (s)	t_F (s)	p_0 (kPa)	p_i (kPa)	p_p (kPa)	p_F (kPa)	Te_w (˚C)	EC_w (mS/m)	Test phases measured *Analysed test phases marked bold*	
HLX14	11.90	115.90	2006.11.04 08:43	2006.11.04 13:43	6.42E–04	6.55E–04	17,090	#NV	#NV	210	157	#NV	8.3	107.5	**CRw**	
HLX20	9.03	202.20	2006.11.10 09:04	2006.11.10 15:30	3.10E–04	3.23E–04	21,498	#NV	#NV	211	113	#NV	8.6	34.6	**CRw**	
HLX27	6.03	164.70	2006.11.24 09:06	2006.11.24 14:45	6.58E–04	6.72E–04	19,960	#NV	#NV	210	129	#NV	8.6	340.0	**CRw**	
HLX28	6.03	154.20	2006.11.08 10:45	2006.11.08 16:20	1.06E–03	1.06E–03	18,516	#NV	#NV	205	171	#NV	8.0	47.1	**CRw**	
HLX32	12.30	162.60	2006.11.30 09:16	2006.11.30 16:05	1.95E–04	1.98E–04	13,202	#NV	#NV	204	111	#NV	8.5	55.6	**CRw**	
HLX33	9.03	202.10	2006.11.12 09:03	2006.11.12 14:43	1.07E–03	1.08E–03	19,037	#NV	#NV	196	133	#NV	8.5	37.1	**CRw**	
HLX37	12.10	199.80	2006.11.02 08:47	2006.11.02 14:52	2.42E–04	2.43E–04	20,899	#NV	#NV	201	158	#NV	8.9	29.3	**CRw**	
HLX39	6.10	199.30	2006.11.06 08:55	2006.11.06 16:03	5.42E–04	5.52E–04	22,705	#NV	#NV	228	155	#NV	9.2	41.7	**CRw**	
HLX43	6.00	170.60	2006.12.02 09:26	2006.12.03 09:40	1.05E–03	1.05E–03	33,273	53,913	#NV	205	166	201	7.8	54.5	**CRw**	**CRwr**

Nomenclature	
Q_p	Flow in test section immediately before stop of flow [m³/s].
Q_m	Arithmetical mean flow during perturbation phase [m³/s].
t_p	Duration of perturbation phase [s].
t_f	Duration of recovery phase [s].
p_0	Pressure in borehole before packer inflation [kPa].
p_i	Pressure in test section before start of flowing [kPa].
p_p	Pressure in test section before stop of flowing [kPa].
p_F	Pressure in test section at the end of the recovery [kPa].
Te_w	Temperature in test section.
EC_W	Electric conductivity in test section [mS/m].
Test phases	CRw: constant rate pump (withdrawal) phase.
	CRwr: recovery phase following the constant rate pump (withdrawal) phase.
#NV	Not analysed/no values.

Table 6-2. Results from analysis of constant rate pump tests.

Borehole ID	Borehole secup (m)	Borehole seclow (m)	Stationary flow parameters Q/s (m²/s)	T_M (m²/s)	Flow regime Perturb. phase	Recovery phase	Transient analysis Formation parameters T_{f1} (m²/s)	T_{f2} (m²/s)	T_{s1} (m²/s)	T_{s2} (m²/s)	T_T (m²/s)	T_{TMIN} (m²/s)	T_{TMAX} (m²/s)	C (m³/Pa)	ξ –	dt_1 min	dt_2 min	Static conditions p* kPa	h_{wif} masl
HLX 14	11.90	115.90	1.19E–04	1.44E–04	WBS2	#NV	8.0E–5	#NV	#NV	#NV	8.0E–05	5.0E–05	1.0E–04	2.0E–05	–3.5	141	252	#NV	#NV
HLX 20	9.03	202.20	3.10E–05	4.06E–05	WBS2	#NV	1.5E–5	#NV	#NV	#NV	1.5E–05	6.0E–06	5.0E–05	2.8E–07	–2.9	29	182	#NV	#NV
HLX 27	6.03	164.70	7.99E–05	1.02E–04	WBS2	#NV	5.0E–5	#NV	#NV	#NV	5.0E–05	1.0E–05	9.0E–05	7.4E–07	–3.3	4	230	#NV	#NV
HLX 28	6.03	154.20	3.05E–04	3.87E–04	WBS22	#NV	3.6E–4	8.0E–5	#NV	#NV	3.6E–04	9.0E–05	7.0E–04	1.5E–06	–2.5	6	21	#NV	#NV
HLX 32	12.30	162.60	2.04E–05	2.59E–05	WBS2	#NV	2.0E–5	#NV	#NV	#NV	2.0E–05	9.0E–06	7.0E–05	3.0E–06	0.0	#NV	#NV	#NV	#NV
HLX 33	9.03	202.10	1.66E–04	2.18E–04	WBS22	#NV	1.2E–4	2.4E–4	#NV	#NV	1.2E–04	7.0E–05	5.0E–04	2.3E–06	–2.1	12	40	#NV	#NV
HLX 37	12.10	199.80	5.44E–05	7.10E–05	WBS2	#NV	3.7E–5	#NV	#NV	#NV	3.7E–05	8.0E–06	8.0E–05	2.7E–07	–2.8	14	312	#NV	#NV
HLX 39	6.10	199.30	7.31E–05	9.57E–05	WBS22	#NV	1.5E–4	4.2E–5	#NV	#NV	1.5E–04	4.0E–05	5.0E–04	3.1E–06	2.9	31	60	#NV	#NV
HLX 43	6.00	170.60	2.66E–04	3.41E–04	WBS2	WBS2	1.4E–4	#NV	1.8E–4	#NV	1.4E–04	7.0E–05	5.0E–04	3.4E–06	–4.1	12	421	202.3	20.49

Nomenclature

Q/s	Specific capacity.
T_M	Transmissivity according to /Moye 1967/.
Flow regime	The flow regime description refers to the recommended model used in the transient analysis. WBS denotes wellbore storage and skin and is followed by a set of numbers describing the flow dimension used in the analysis (1 = linear flow, 2 = radial flow, 3 = spherical flow). If only one number is used (e.g. WBS2 or 2) a homogeneous flow model (1 composite zone) was used in the analysis, if two numbers are given (WBS22 or 22) a 2 zones composite model was used.
T_f	Transmissivity derived from the analysis of the perturbation phase (CRw). In case a homogeneous flow model was used only one T_f value is reported, in case a two zone composite flow model was used both T_{f1} (inner zone) and T_{f2} (outer zone) are given.
T_s	Transmissivity derived from the analysis of the recovery phase (CRwr). In case a homogeneous flow model was used only one T_s value is reported, in case a two zone composite flow model was used both T_{s1} (inner zone) and T_{s2} (outer zone) are given.
T_T	Recommended transmissivity.
T_{TMIN} / T_{TMAX}	Confidence range lower/upper limit.
C	Wellbore storage coefficient.
ξ	Skin factor (calculated based on a Storativity of $1 \cdot 10^{-3}$).
dt_1 / dt_2	Estimated start/stop time of evaluation.
p*	The parameter p* denoted the static formation pressure (measured at transducer depth) and was derived from the Horner plot of the CHir phase using straight line or type-curve extrapolation.
h_{wif}	Fresh-water head (based on transducer depth and p*).
#NV	Not analysed/no values.

Table 6-3. General results from flow logging survey.

Borehole ID	Test section secup (m)	seclow (m)	Date and time for test start YYYYMMDD hh:mm	Date and time for test stop YYYYMMDD hh:mm	Q_p (m^3/s)	ΣQ_i (m^3/s)	s_{FL} (m)	$Q_p – \Sigma Q_i$ (m^3/s)	T (m^2/s)	ΣT_i (m^2/s)	$T_{Fmeasl-L}$ (m^2/s)	$\Sigma Q_i/s_{FL}$ (m^2/s)	$T–\Sigma T_i$ (kPa)
HLX 14	25.00	114.00	2006.11.04 10:46	2006.11.04 13:28	6.42E–04	4.57E–04	5.39	1.85E–04	7.99E–05	5.69E–05	6.23E–06	8.47E–05	2.30E–05
HLX 20	22.00	196.00	2006.11.10 11:06	2006.11.10 15:03	3.10E–04	2.33E–04	9.99	7.67E–05	1.52E–05	2.70E–06	2.45E–06	2.34E–05	3.76E–06
HLX 27	20.00	162.00	2006.11.24 11:07	2006.11.24 14:41	6.58E–04	6.35E–04	8.24	2.33E–05	5.01E–05	4.83E–05	3.81E–06	7.71E–05	1.78E–06
HLX 28	22.00	141.00	2006.11.08 12:52	2006.11.08 15:58	1.06E–03	1.09E–03	3.47	–3.50E–05	3.62E–04	3.74E–04	1.71E–05	3.15E–04	–1.20E–05
HLX 32	22.00	160.00	2006.11.29 14:17	2006.11.29 15:56	1.95E–04	6.67E–05	9.56	1.28E–04	2.03E–05	6.94E–06	5.21E–06	6.97E–06	1.34E–05
HLX 33	19.00	111.00	2006.11.12 11:06	2006.11.12 14:22	1.07E–03	5.97E–04	6.42	4.70E–04	1.21E–04	6.77E–05	5.67E–06	9.29E–05	5.33E–05
HLX 37	21.00	195.00	2006.11.02 10:52	2006.11.02 14:37	2.42E–04	1.90E–04	4.44	5.17E–05	3.68E–05	2.89E–05	7.61E–06	4.28E–05	7.87E–06
HLX 39	35.00	197.00	2006.11.06 11:35	2006.11.06 15:52	5.42E–04	5.20E–04	7.41	2.17E–04	1.48E–04	1.42E–04	1.37E–05	7.02E–05	5.92E–06
HLX 43	29.00	165.00	2006.12.02 11:27	2006.12.02 14:23	1.05E–03	9.08E–04	3.96	1.37E–04	1.43E–04	1.24E–04	6.84E–06	2.30E–04	1.87E–05

Nomenclature	
Q_p	Pumped flow rate at surface flow meter.
ΣQ_i	Cumulative flow at the top of the logged section.
s_{FL}	Drawdown during pump test.
T	Transmissivity of the entire borehole.
ΣT_i	Cumulative transmissivity at the top of the logged section.

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APPENDIX 1

File Description Table

HYDROTESTING WITH HTHB					**DRILLHOLE IDENTIFICATION NO.: HLX 14, HLX 20, HLX 27, HLX 28, HLX 32, HLX 33, HLX 37, HLX 39, HLX 43**		
TEST- AND FILEPROTOCOL					**Testorder dated: 2006-10-27**		
Teststart		Test Section					
Date	Time	Upper	Lower	Borehole	Data file	Testtype*	Comments
2006-11-04	08:43	11.90	115.90	HLX 14	Spinne_HLX14_061104.dat	6, L-EC, L-Te	
2006-11-04	08:43	11.90	115.90	HLX 14	FlowLo_HLX14_061104.dat	1B	No recovery phase conducted
2006-11-10	09:04	9.03	202.20	HLX 20	Spinne_HLX20_061110.dat	6, L-EC, L-Te	
2006-11-10	09:04	9.03	202.20	HLX 20	FlowLo_HLX20_061110.dat	1B	No recovery phase conducted
2006-11-24	09:06	6.03	164.70	HLX 27	Spinne_HLX27_061124.dat	6, L-EC, L-Te	
2006-11-24	09:06	6.03	164.70	HLX 27	FlowLo_HLX27_061124.dat	1B	No recovery phase conducted
2006-11-08	10:45	6.03	154.20	HLX 28	Spinne_HLX28_061108.dat	6, L-EC, L-Te	
2006-11-08	10:45	6.03	154.20	HLX 28	FlowLo_HLX28_061108.dat	1B	No recovery phase conducted
2006-11-30	09:16	12.30	162.60	HLX 32	Spinne_HLX32_061130.dat	6, L-EC, L-Te	
2006-11-30	09:16	12.30	162.60	HLX 32	FlowLo_HLX32_061130.dat	1B	No recovery phase conducted
2006-11-12	09:03	9.03	202.10	HLX 33	Spinne_HLX33_061112.dat	6, L-EC, L-Te	
2006-11-12	09:03	9.03	202.10	HLX 33	FlowLo_HLX33_061112.dat	1B	No recovery phase conducted
2006-11-02	08:47	12.10	199.80	HLX 37	Spinne_HLX37_061102.dat	6, L-EC, L-Te	
2006-11-02	08:47	12.10	199.80	HLX 37	FlowLo_HLX37_061102.dat	1B	No recovery phase conducted
2006-11-06	08:55	6.10	199.30	HLX 39	Spinne_HLX39_061106.dat	6, L-EC, L-Te	

HYDROTESTING WITH HTHB					DRILLHOLE IDENTIFICATION NO.: HLX 14, HLX 20, HLX 27, HLX 28, HLX 32, HLX 33, HLX 37, HLX 39, HLX 43		
TEST- AND FILEPROTOCOL					**Testorder dated: 2006-10-27**		
Teststart		Test Section					
Date	Time	Upper	Lower	Borehole	Data file	Testtype*	Comments
2006-11-06	08:55	6.10	199.30	HLX 39	FlowLo_HLX39_061106.dat	1B	No recovery phase conducted
2006-12-02	09:26	6.00	170.60	HLX 43	Spinne_HLX43_061202.dat	6, L-EC, L-Te	
2006-12-02	09:26	6.00	170.60	HLX 43	FlowLo_HLX43_061202.dat	1B	

* 1B: Pump test submersible pump, 6: flow logging-impeller, L-EC: electric conductivity logging,
L-Te: temperature logging

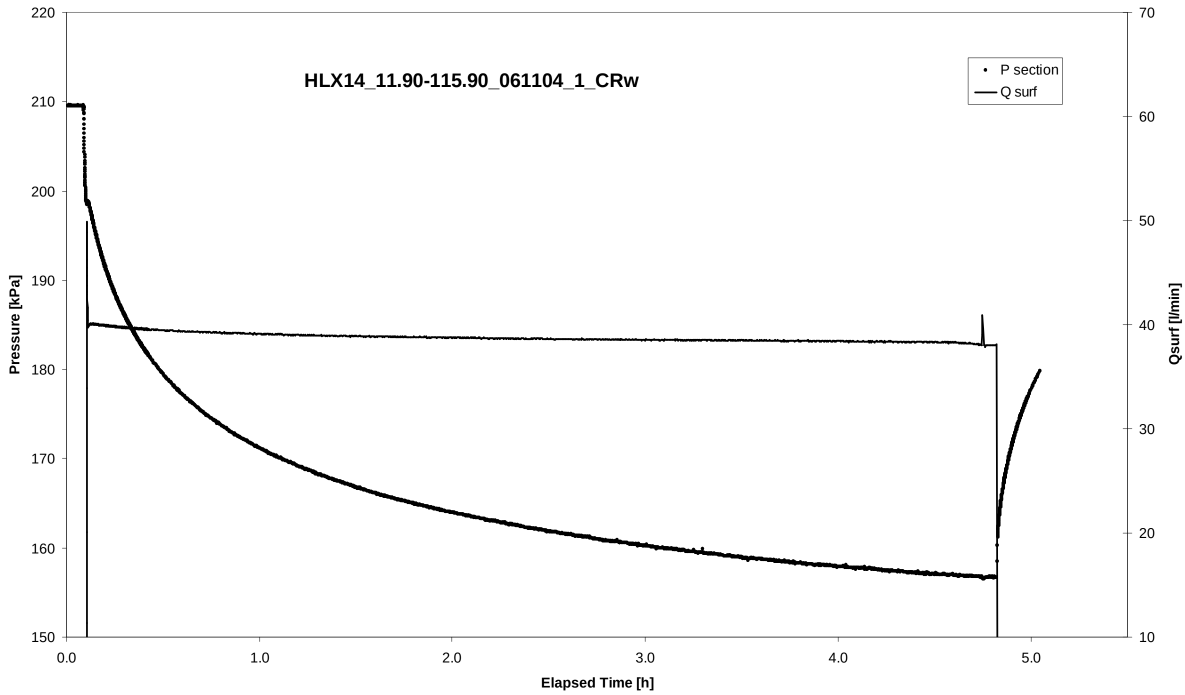
APPENDIX 2

Pump Test Analysis diagrams

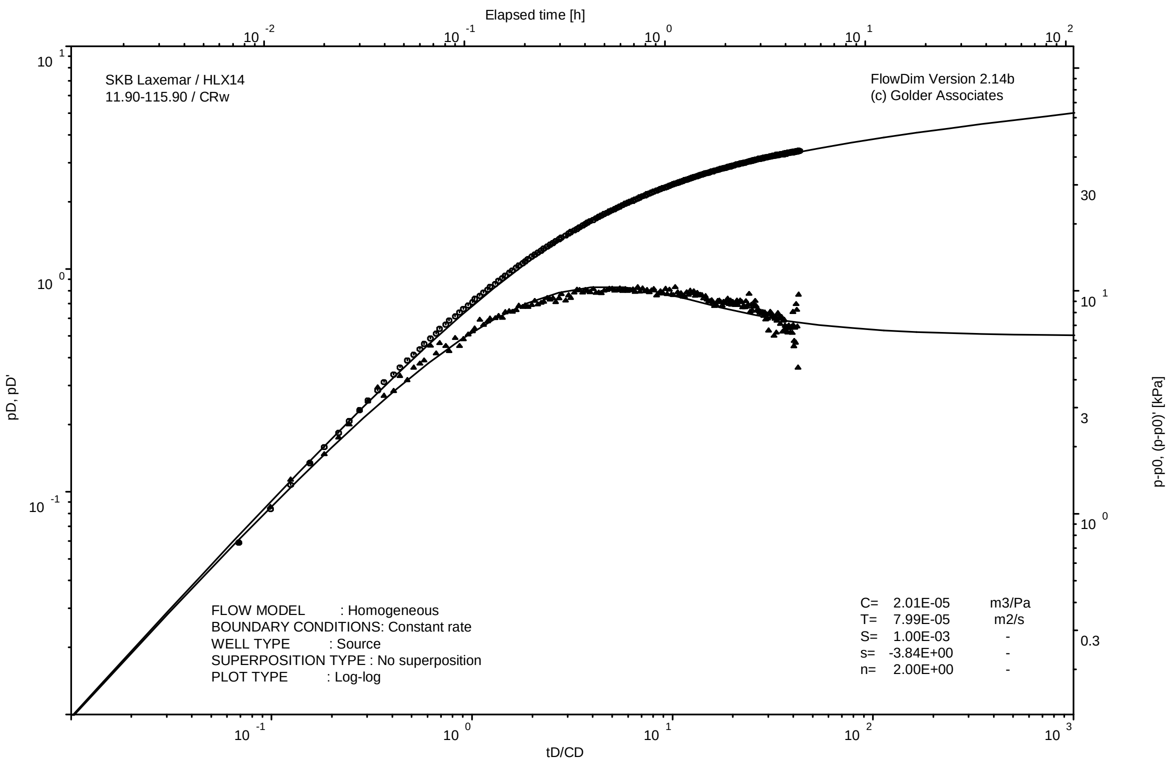
APPENDIX 2-1

HLX 14

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

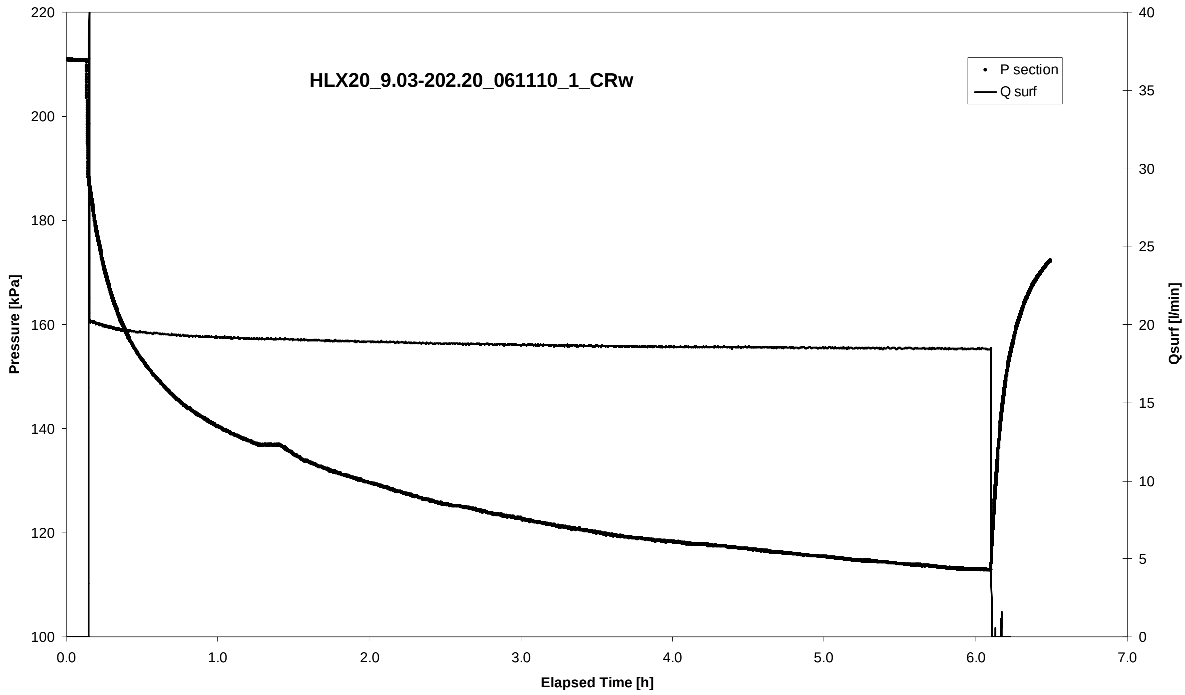


CRw phase; log-log match

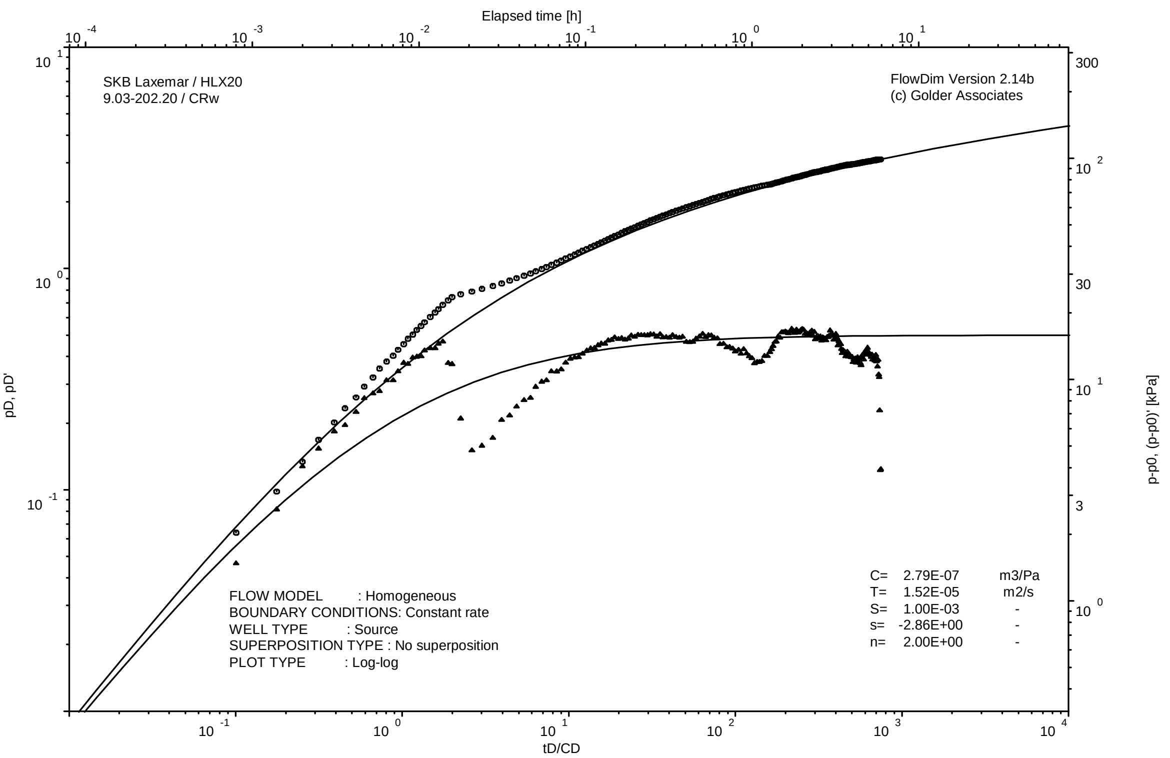
APPENDIX 2-2

HLX 20

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

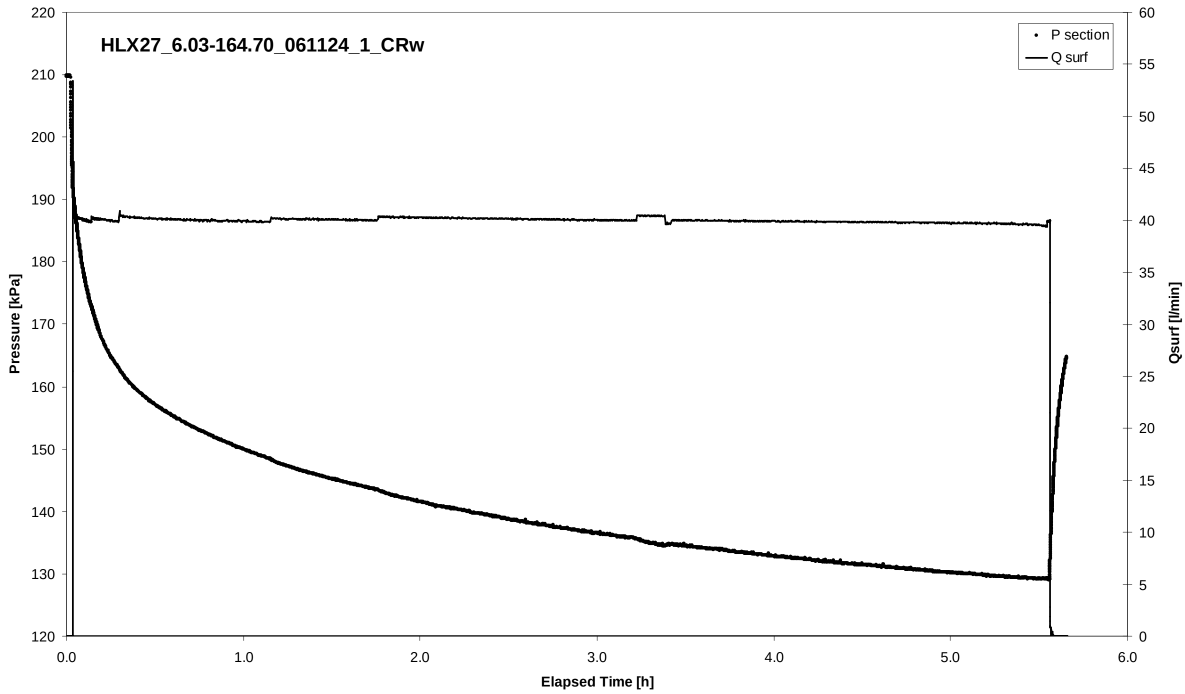


CRw phase; log-log match

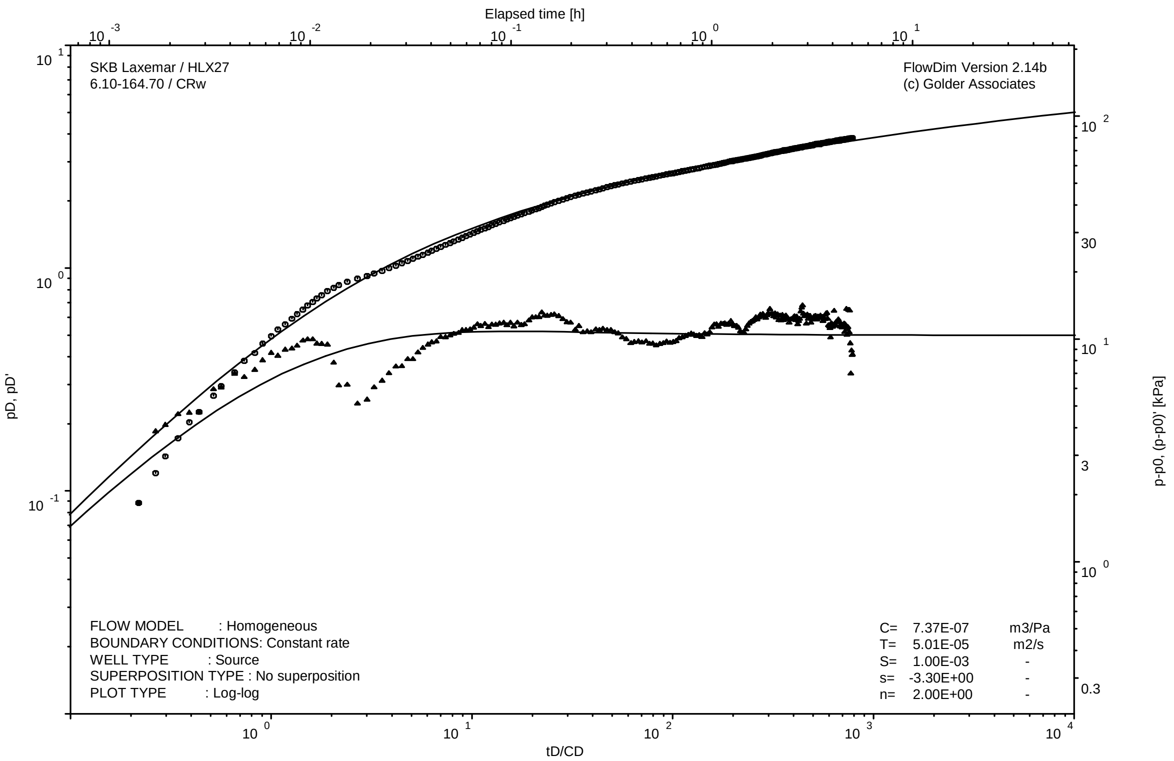
APPENDIX 2-3

HLX 27

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

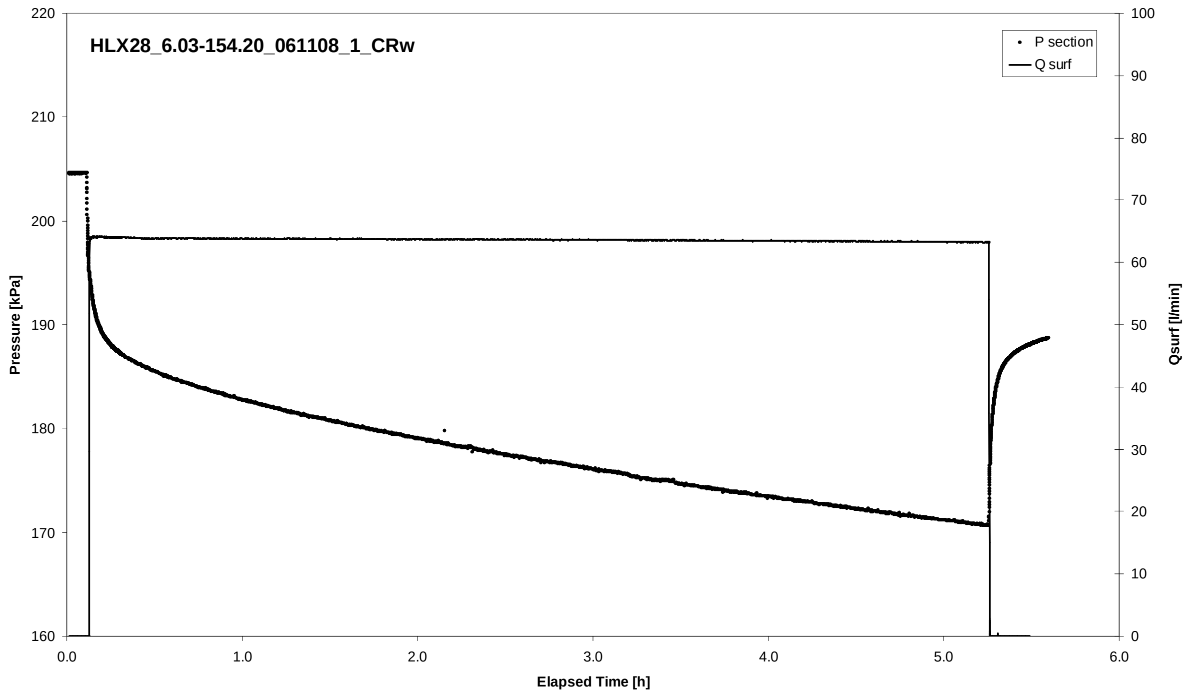


CRw phase; log-log match

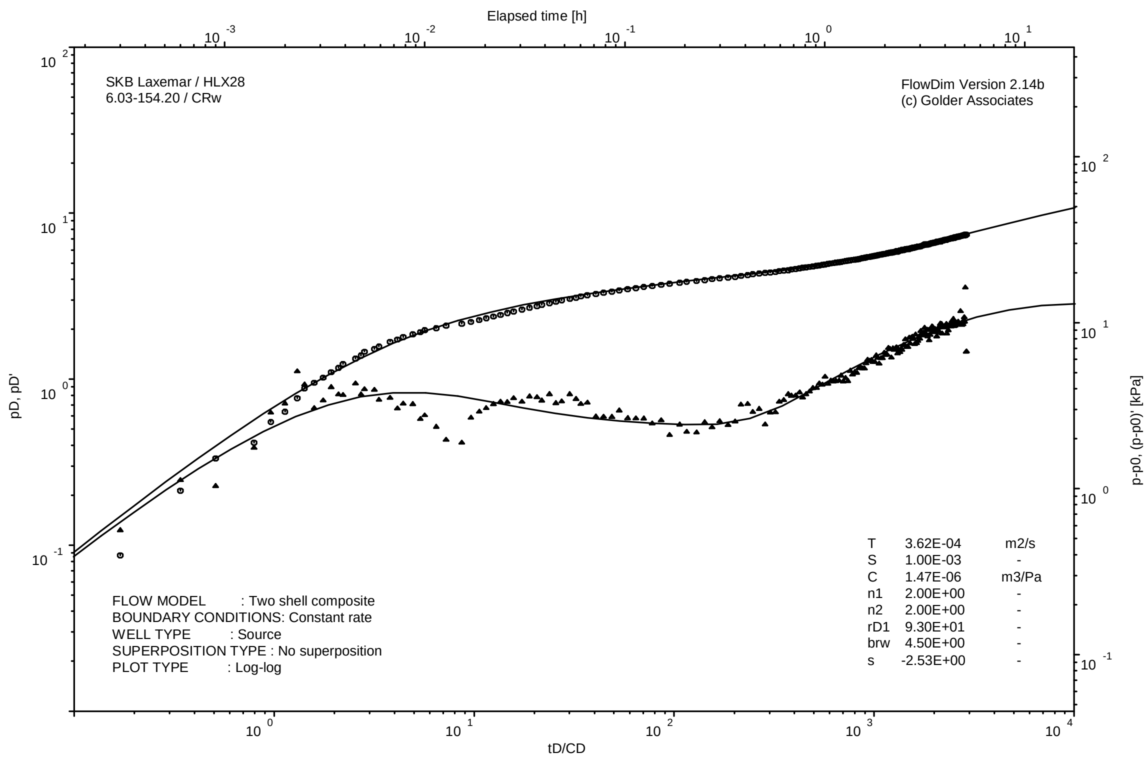
APPENDIX 2-4

HLX 28

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

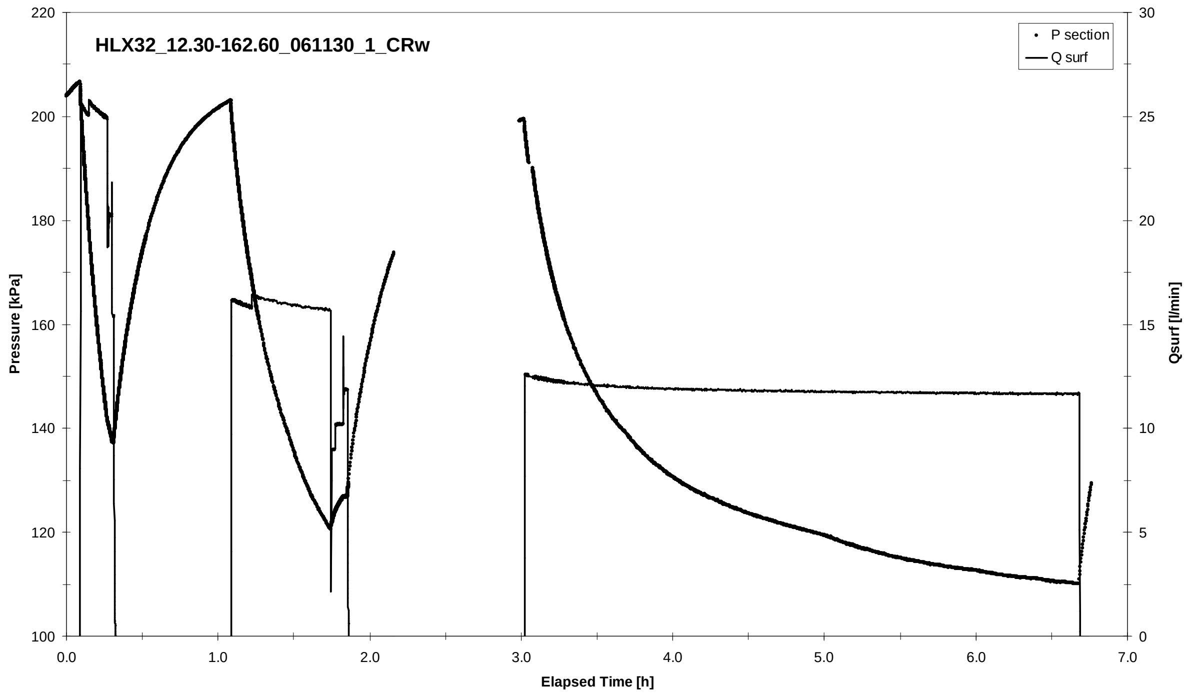


CRw phase; log-log match

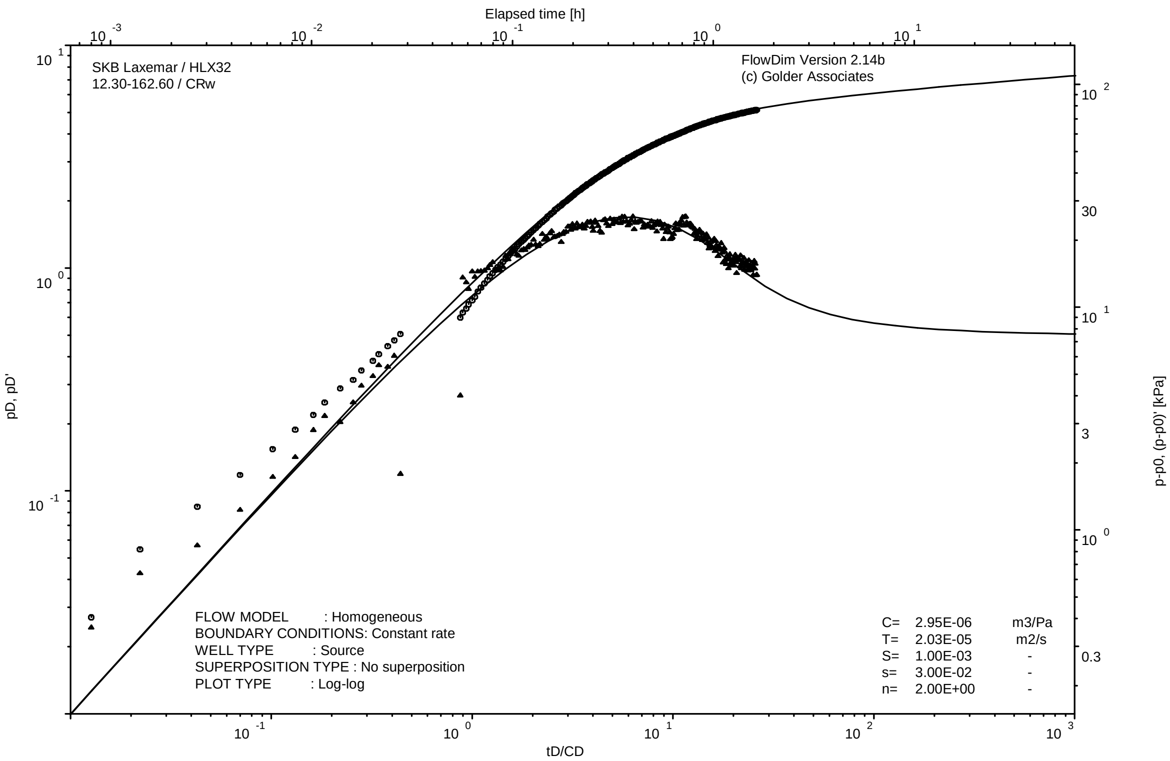
APPENDIX 2-5

HLX 32

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

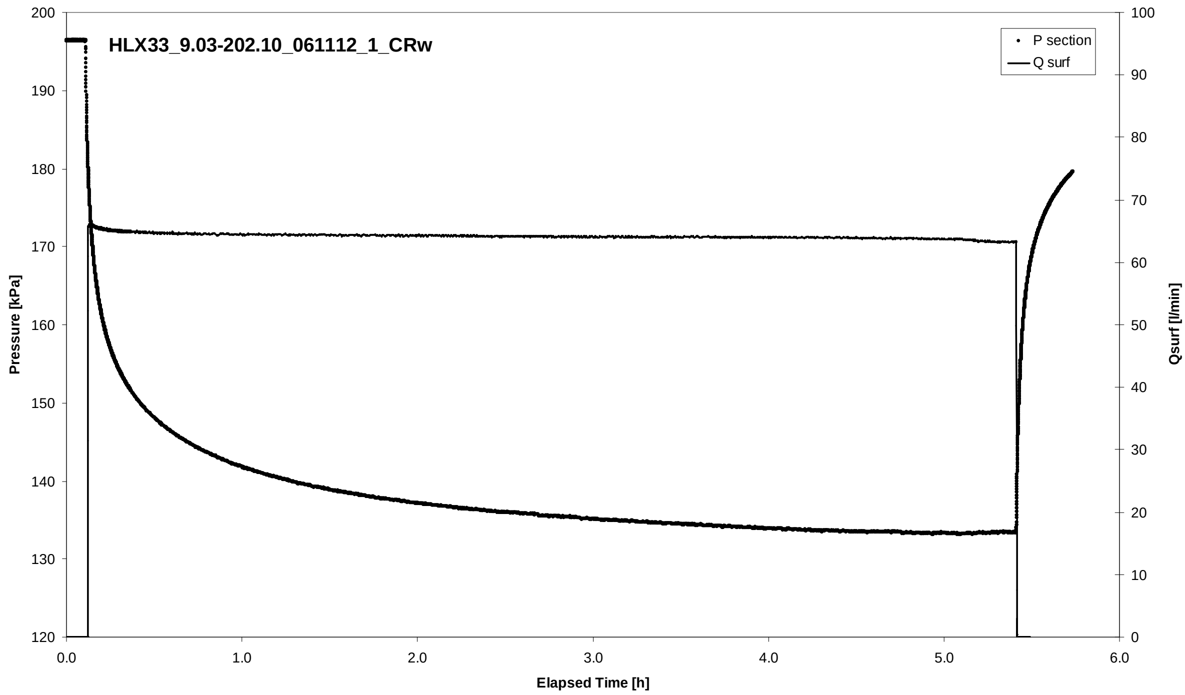


CRw phase; log-log match

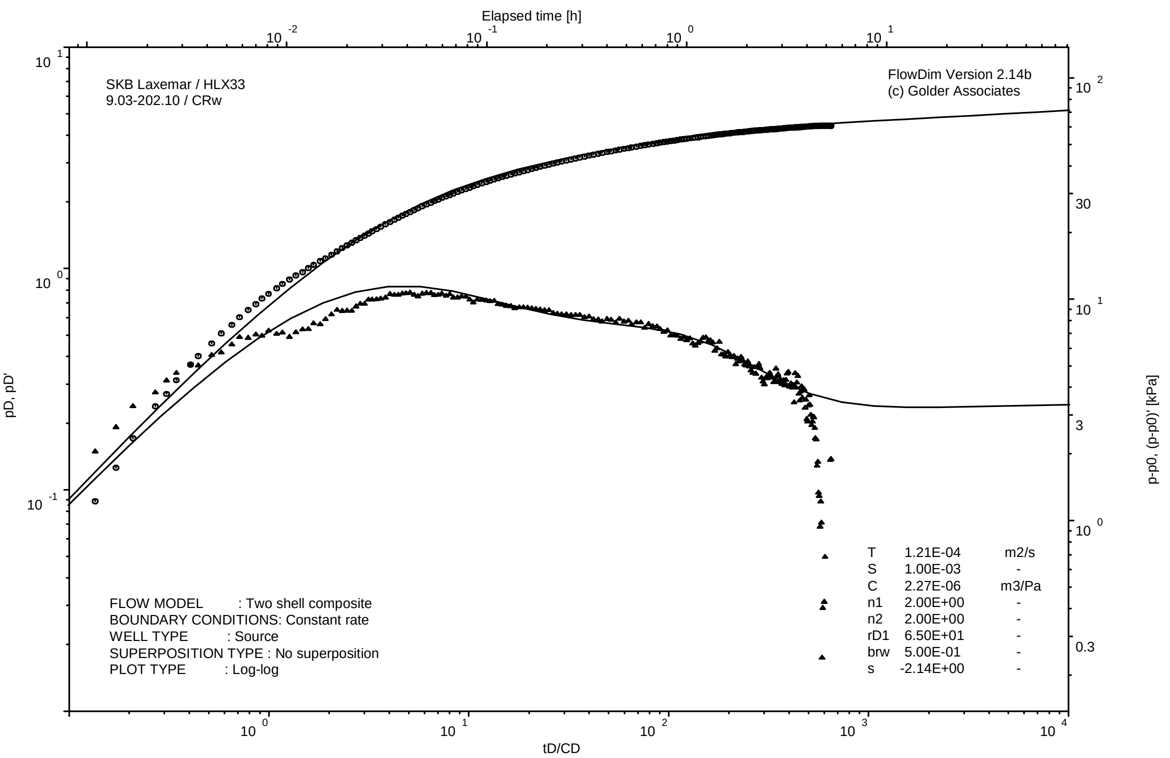
APPENDIX 2-6

HLX 33

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

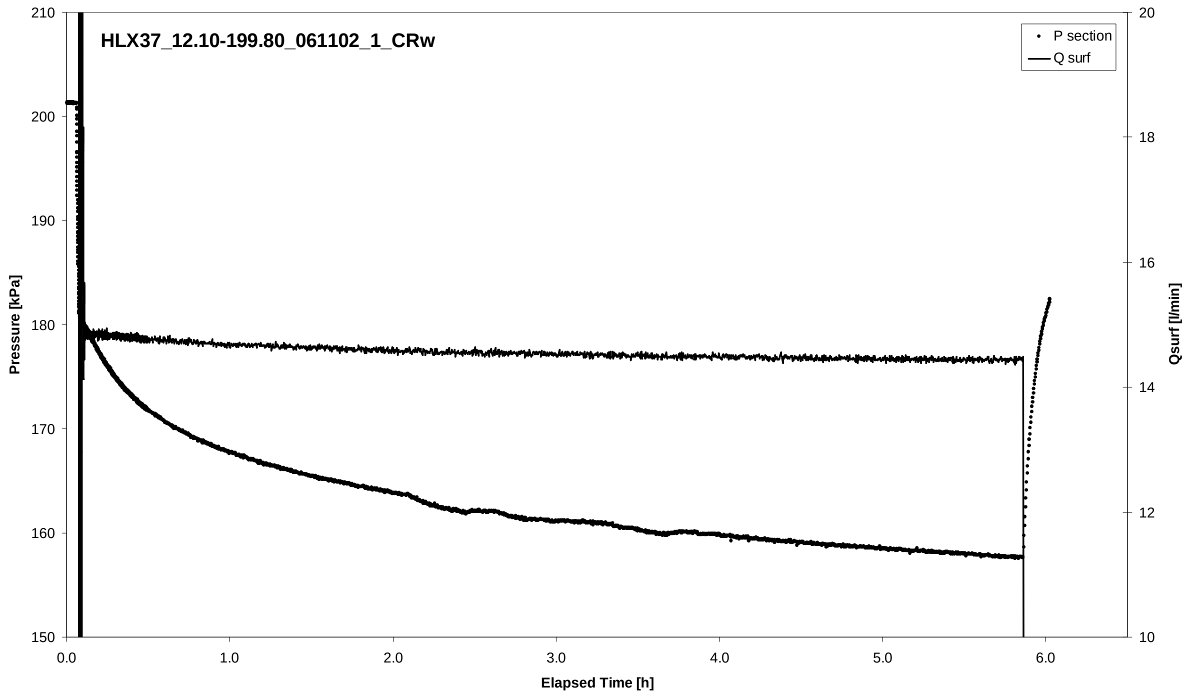


CRw phase; log-log match

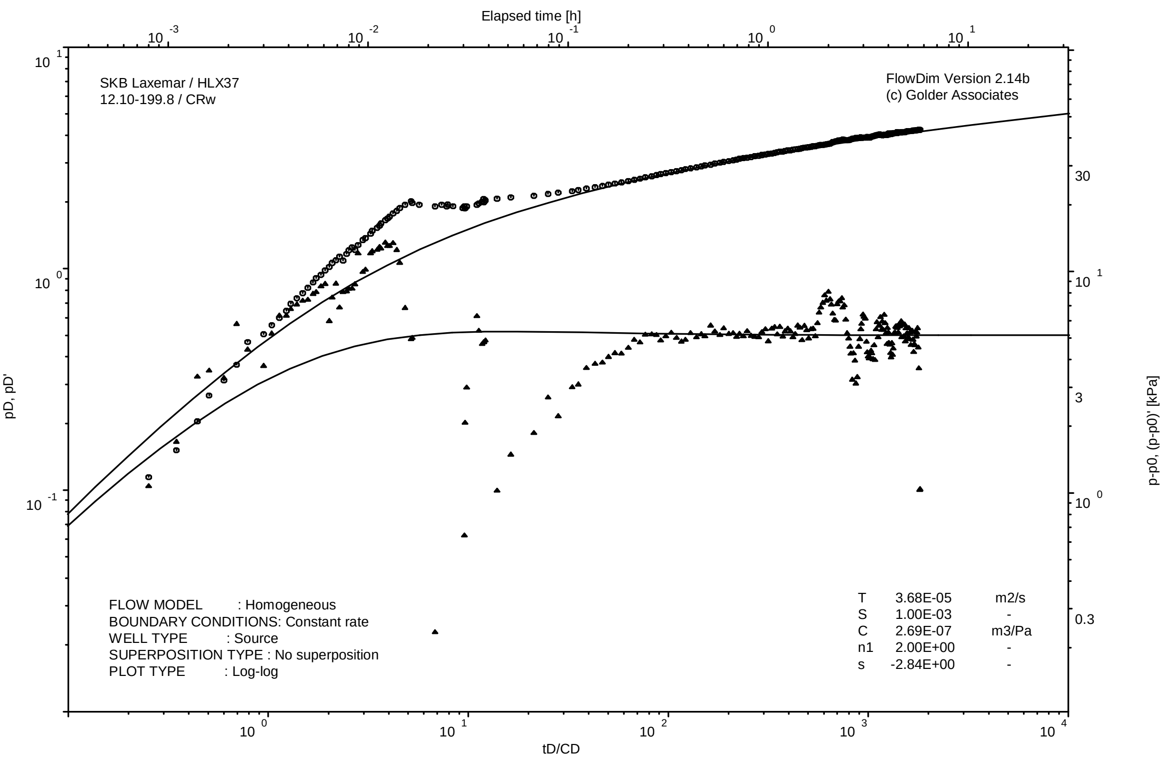
APPENDIX 2-7

HLX 37

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

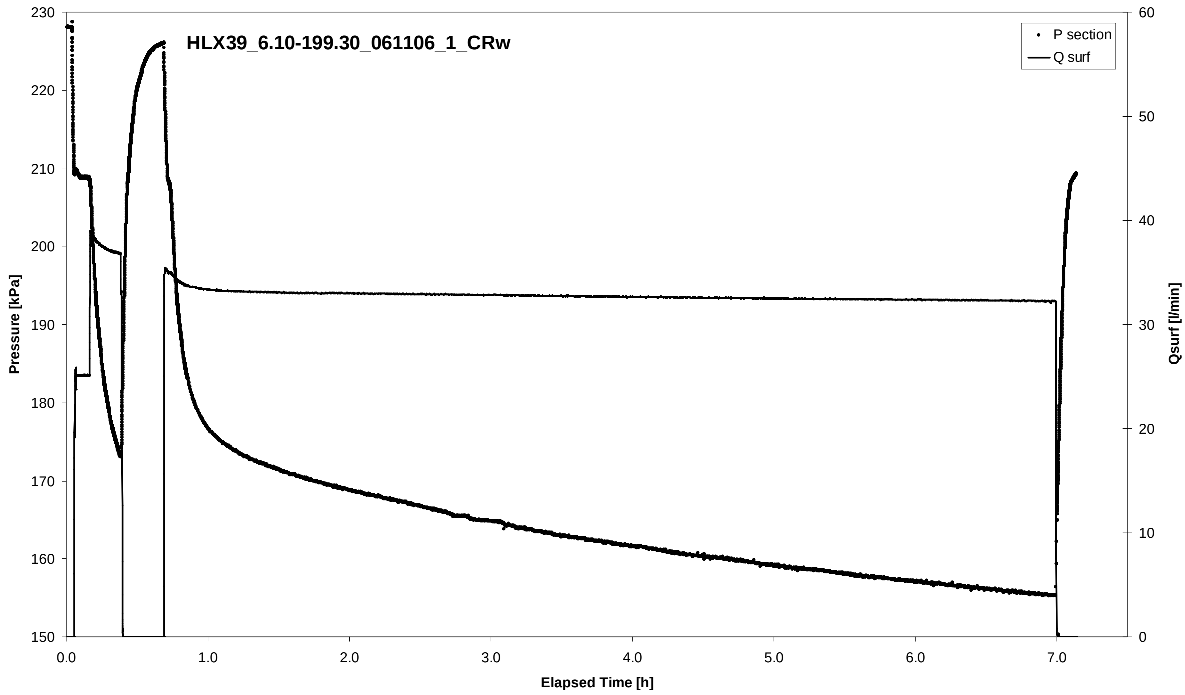


CRw phase; log-log match

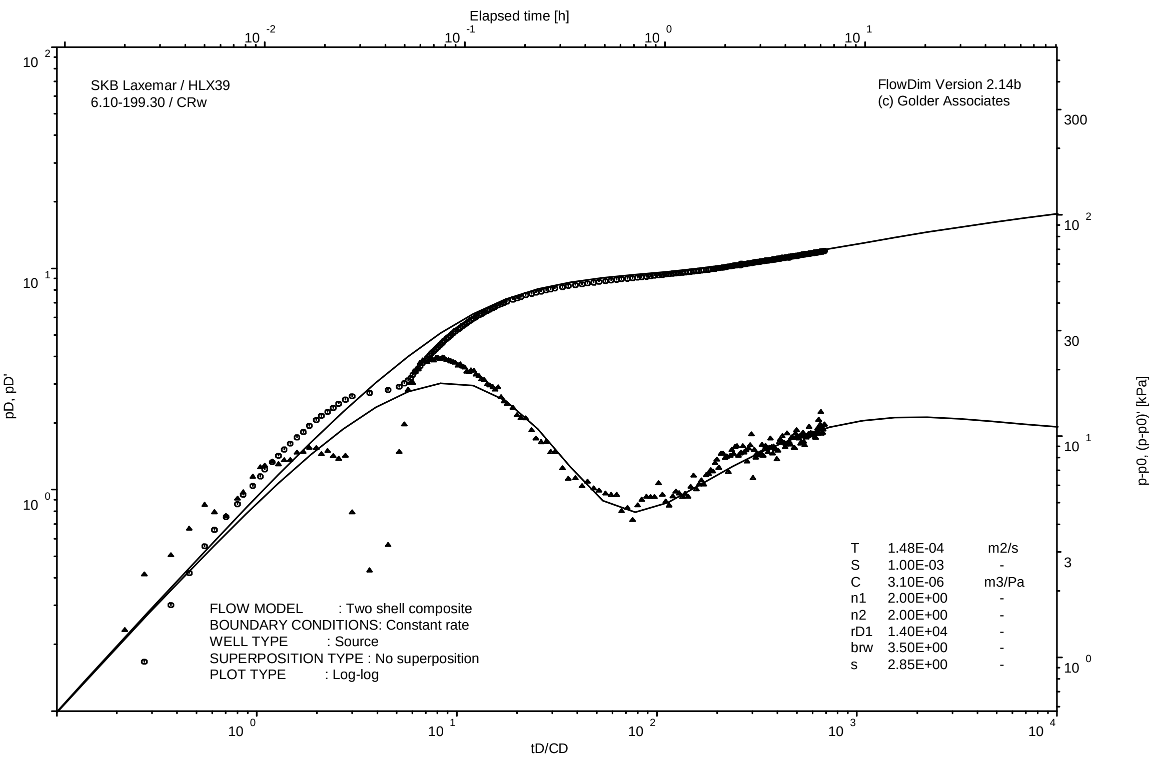
APPENDIX 2-8

HLX 39

Pump Test Analysis diagrams



Pressure and flow rate vs. time; cartesian plot

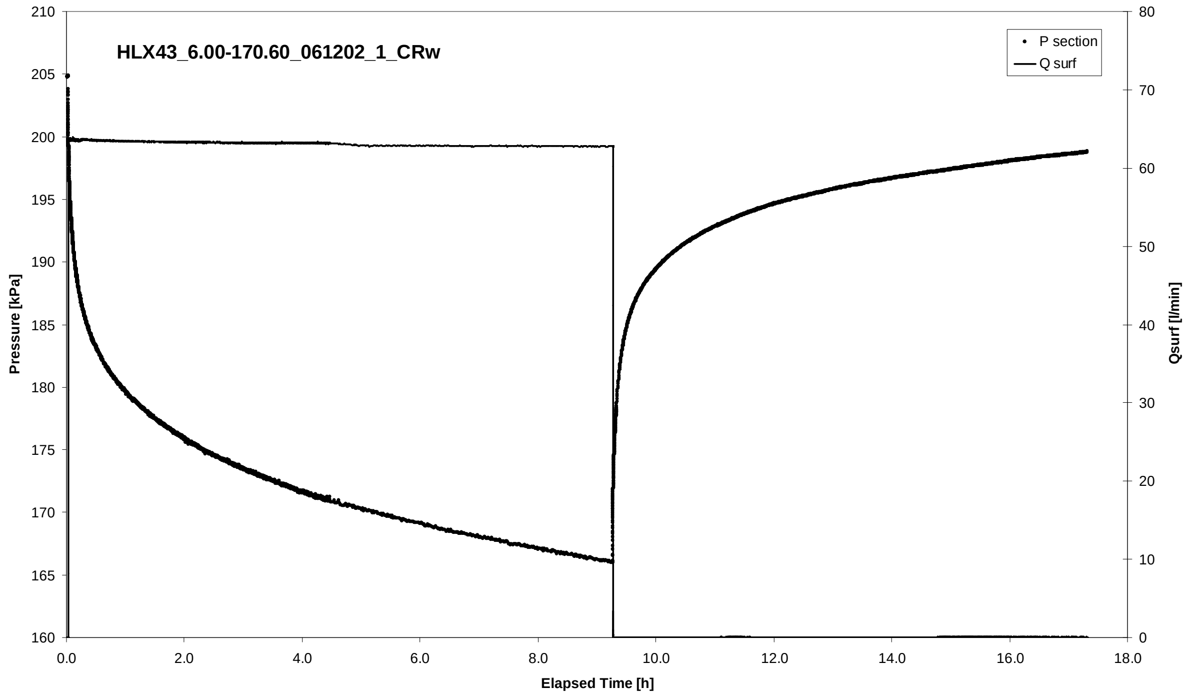


CRw phase; log-log match

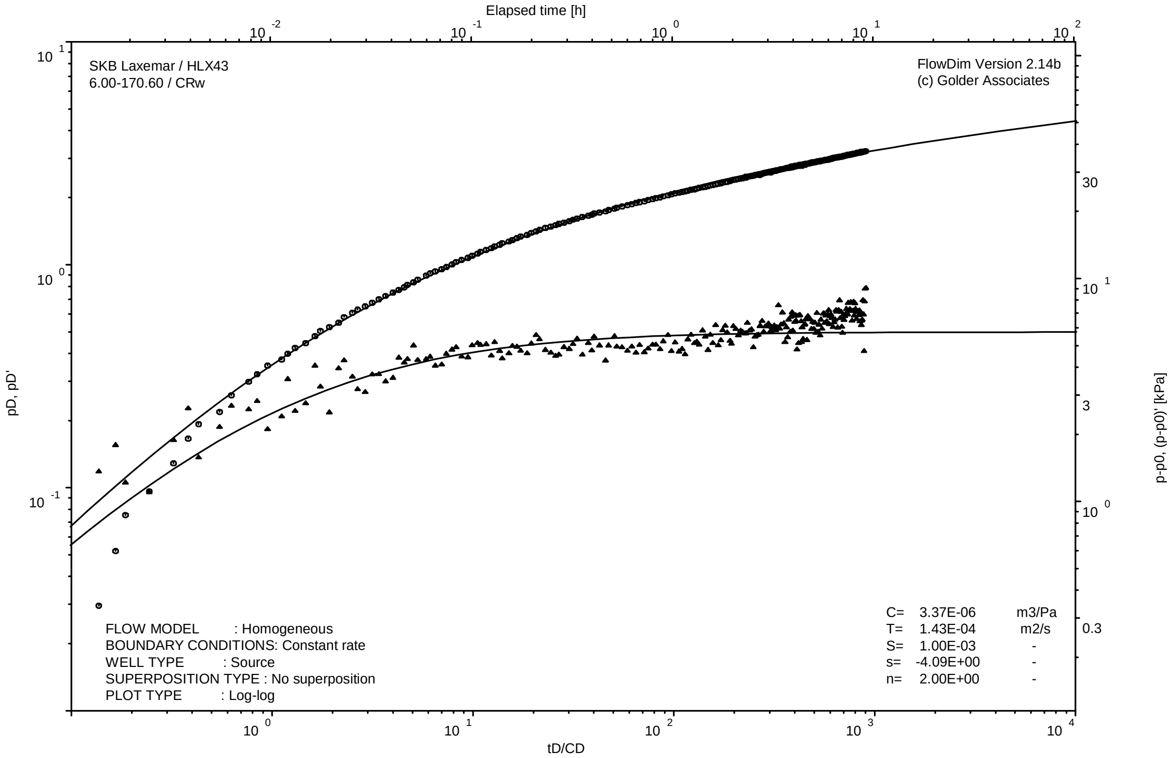
APPENDIX 2-9

HLX 43

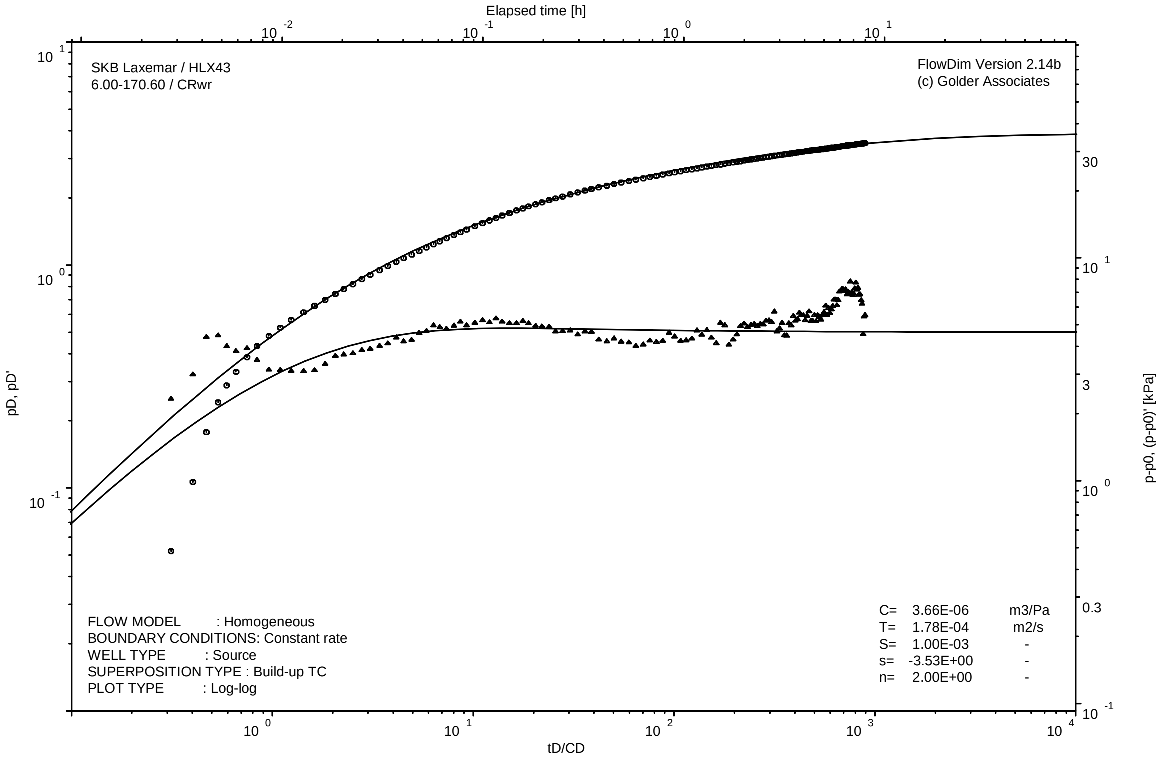
Pump Test Analysis diagrams



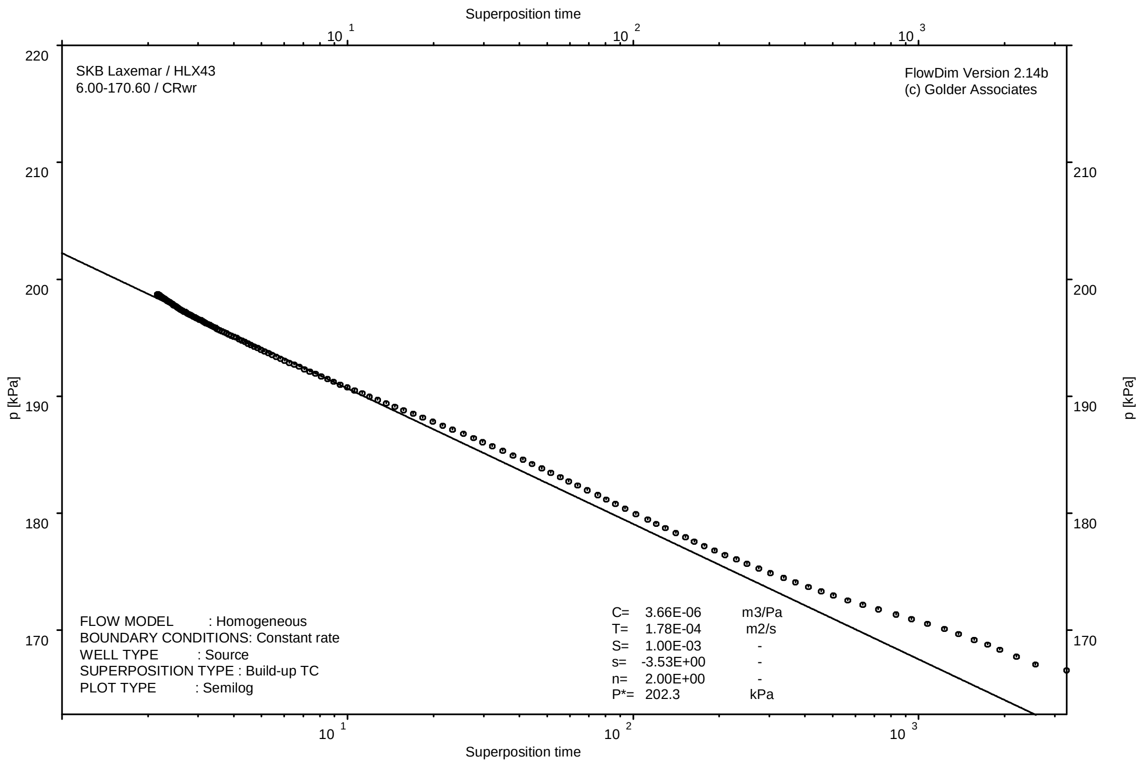
Pressure and flow rate vs. time; cartesian plot



CRw phase; log-log match



CRwr phase; log-log match



CRwr phase; HORNER match

APPENDIX 3

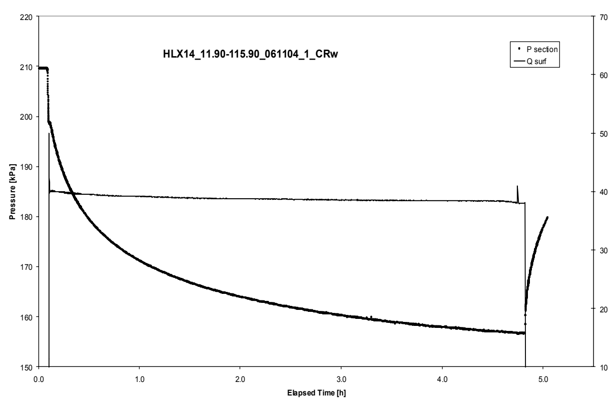
Pump Test Summary Sheets

Borehole: HLX14

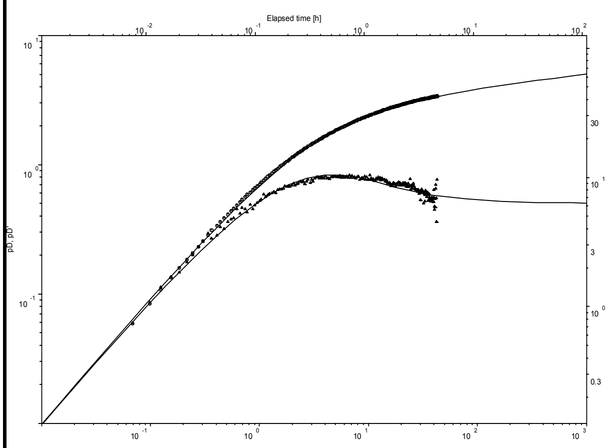
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX14	Test start:	061104 08:43
Test section from - to (m):	11.90-115.90	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	210		
p_p(kPa) =	157	p_F (kPa) =	-
Q_p (m^3/s)=	6.42E-04		
tp (s) =	17090	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	107.5		
$Temp_w$(gr C)=	8.4		
Derivative fact.=	0.04	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	1.2E-04		
T_M (m^2/s)=	1.4E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	141.07	dt_1 (min) =	-
dt_2 (min) =	252.01	dt_2 (min) =	-
T (m^2/s) =	8.0E-05	T (m^2/s) =	
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	7.7E-07	K_s (m/s) =	-
S_s (1/m) =	9.6E-06	S_s (1/m) =	-
C (m^3/Pa) =	2.0E-05	C (m^3/Pa) =	-
C_D (-) =	6.5E-01	C_D (-) =	-
ξ (-) =	-3.5	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.			
dt_1 (min) =	141.07	C (m^3/Pa) =	2.0E-05
dt_2 (min) =	252.01	C_D (-) =	6.5E-01
T_T (m^2/s) =	8.0E-05	ξ (-) =	-3.5
S (-) =	1.0E-03		
K_s (m/s) =	7.7E-07		
S_s (1/m) =	9.6E-06		

Comments:

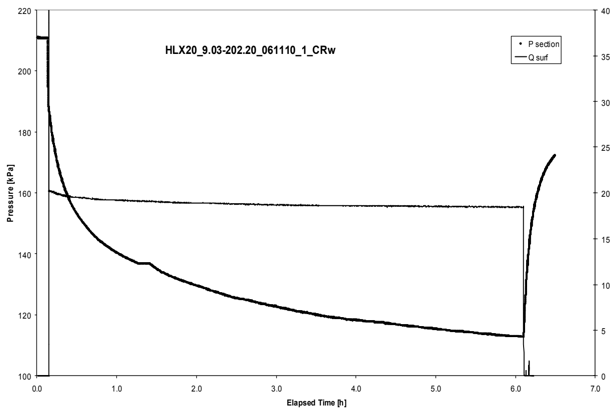
The recommended transmissivity of 8.0E-5 m2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be 5E-5 to 1E-4 m2/s. The flow dimension displayed during the test is 2.

Borehole: HLX 20

Test Summary Sheet

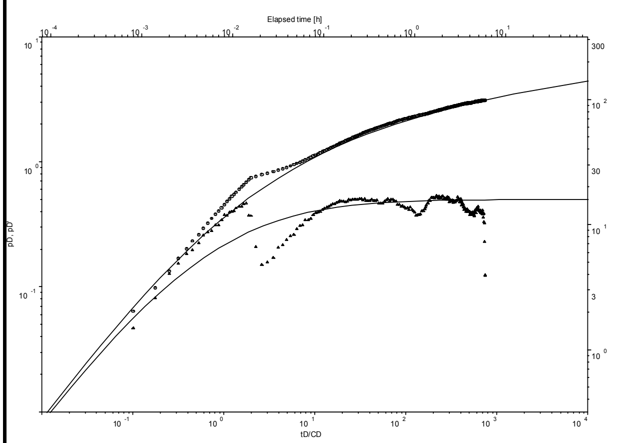
Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX20	Test start:	061110 09:04
Test section from - to (m):	9.03-202.20	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	211		
p_p(kPa) =	113	p_F (kPa) =	-
Q_p (m^3/s)=	3.1E-04		
tp (s) =	21498	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	34.6		
$Temp_w$(gr C)=	7.7		
Derivative fact.=	0.06	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	3.1E-05		
T_M (m^2/s)=	4.1E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	29.42	dt_1 (min) =	-
dt_2 (min) =	181.75	dt_2 (min) =	-
T (m^2/s) =	1.5E-05	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	7.9E-08	K_s (m/s) =	-
S_s (1/m) =	5.2E-06	S_s (1/m) =	-
C (m^3/Pa) =	2.8E-07	C (m^3/Pa) =	-
C_D (-) =	9.1E-03	C_D (-) =	-
ξ (-) =	-2.9	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Selected representative parameters.			
dt_1 (min) =	29.42	C (m^3/Pa) =	2.8E-07
dt_2 (min) =	181.75	C_D (-) =	9.1E-03
T_T (m^2/s) =	1.5E-05	ξ (-) =	-2.9
S (-) =	1.0E-03		
K_s (m/s) =	7.8E-08		
S_s (1/m) =	5.2E-06		

Comments:

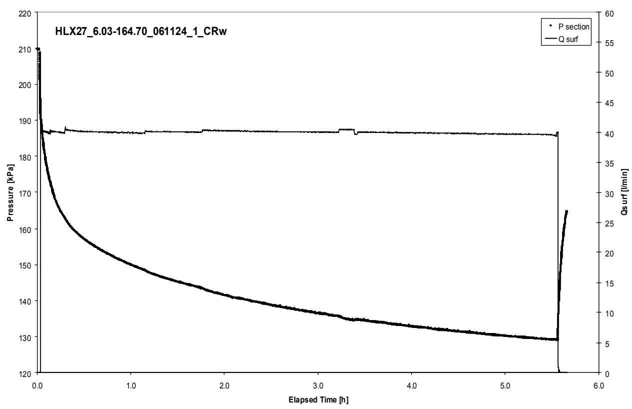
The recommended transmissivity of 1.5E-5 m2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be 6E-6 to 5E-5 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 27

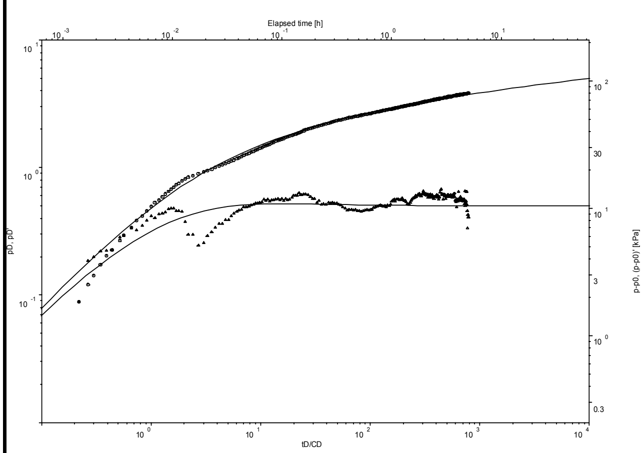
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX27	Test start:	061124 09:06
Test section from - to (m):	6.03-164.70	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	210		
p_p(kPa) =	129	p_F (kPa) =	-
Q_p (m^3/s)=	6.6E-04		
tp (s) =	19960	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	340		
$Temp_w$(gr C)=	8.6		
Derivative fact.=	0.06	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	8.0E-05		
T_M (m^2/s)=	1.0E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	3.79	dt_1 (min) =	-
dt_2 (min) =	230.49	dt_2 (min) =	-
T (m^2/s) =	5.0E-05	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	3.2E-07	K_s (m/s) =	-
S_s (1/m) =	6.3E-06	S_s (1/m) =	-
C (m^3/Pa) =	7.4E-07	C (m^3/Pa) =	-
C_D (-) =	2.4E-02	C_D (-) =	-
ξ (-) =	-3.3	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.			
dt_1 (min) =	3.79	C (m^3/Pa) =	7.4E-07
dt_2 (min) =	230.49	C_D (-) =	2.4E-02
T_T (m^2/s) =	5.0E-05	ξ (-) =	-3.3
S (-) =	1.0E-03		
K_s (m/s) =	3.2E-07		
S_s (1/m) =	6.3E-06		

Comments:

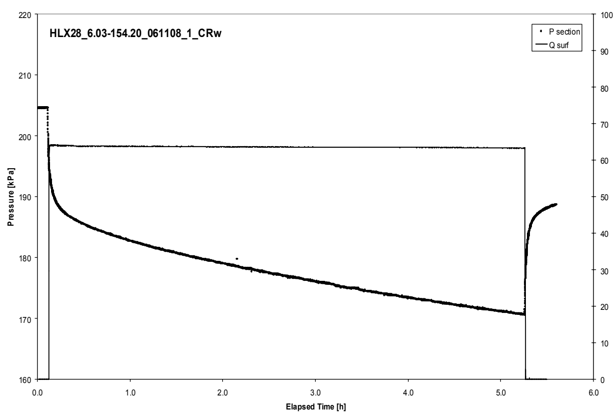
The recommended transmissivity of 5.0E-5 m2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be 1E-5 to 9E-5 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 28

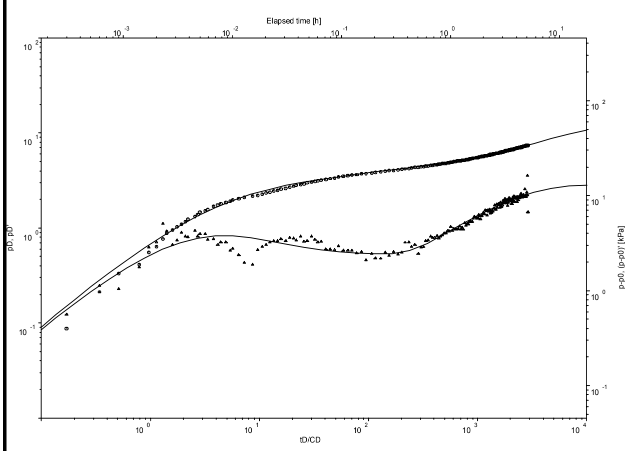
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX28	Test start:	061108 10:45
Test section from - to (m):	6.03-154.20	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	171		
p_p(kPa) =	171	p_F (kPa) =	-
Q_p (m^3/s)=	1.1E-03		
tp (s) =	18516	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	47.1		
$Temp_w$(gr C)=	7.8		
Derivative fact.=	0.05	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	3.1E-04		
T_M (m^2/s)=	3.9E-04		
Flow regime:	IARF	Flow regime:	-
dt_1 (min) =	5.85	dt_1 (min) =	-
dt_2 (min) =	20.87	dt_2 (min) =	-
T (m^2/s) =	3.6E-04	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	2.4E-06	K_s (m/s) =	-
S_s (1/m) =	6.7E-06	S_s (1/m) =	-
C (m^3/Pa) =	1.5E-06	C (m^3/Pa) =	-
C_D (-) =	4.8E-02	C_D (-) =	-
ξ (-) =	-2.5	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.

dt_1 (min) =	5.85	C (m^3/Pa) =	1.5E-06
dt_2 (min) =	20.87	C_D (-) =	4.8E-02
T_T (m^2/s) =	3.6E-04	ξ (-) =	-2.5
S (-) =	1.0E-03		
K_s (m/s) =	2.4E-06		
S_s (1/m) =	6.7E-06		

Comments:

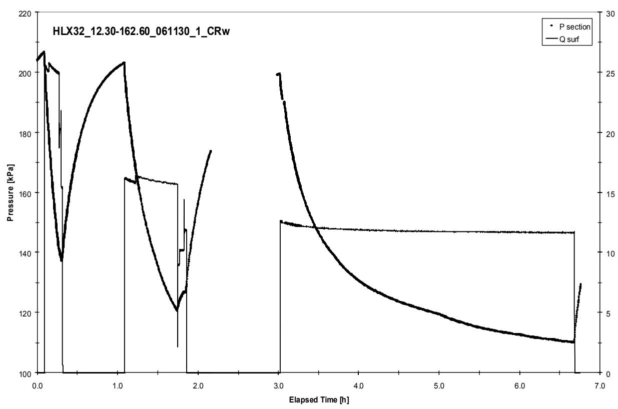
The inner zone transmissivity of 3.6E-4 m2/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be 9E-5 to 7E-4 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 32

Test Summary Sheet

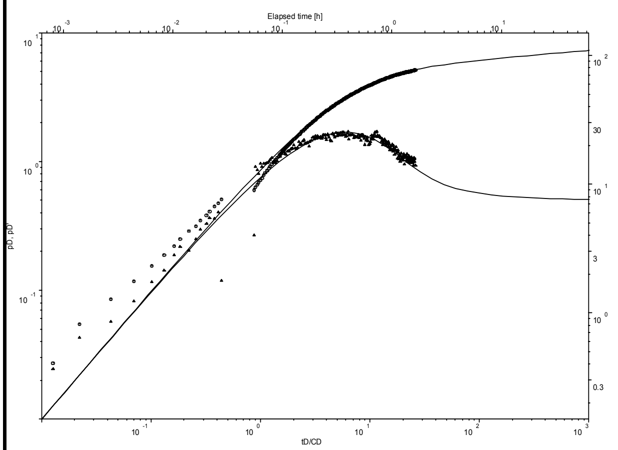
Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX32	Test start:	061130 09:16
Test section from - to (m):	12.30-162.60	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	204		
p_p(kPa) =	111	p_F (kPa) =	-
Q_p (m^3/s)=	2.0E-04		
tp (s) =	13202	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	55.6		
$Temp_w$(gr C)=	8.5		
Derivative fact.=	0.02	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	2.1E-05		
T_M (m^2/s)=	2.6E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	#NV	dt_1 (min) =	-
dt_2 (min) =	#NV	dt_2 (min) =	-
T (m^2/s) =	2.0E-05	T (m^2/s) =	
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	1.4E-07	K_s (m/s) =	-
S_s (1/m) =	6.7E-06	S_s (1/m) =	-
C (m^3/Pa) =	3.0E-06	C (m^3/Pa) =	-
C_D (-) =	9.6E-02	C_D (-) =	-
ξ (-) =	0.0	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Selected representative parameters.			
dt_1 (min) =	#NV	C (m^3/Pa) =	3.0E-06
dt_2 (min) =	#NV	C_D (-) =	9.6E-02
T_T (m^2/s) =	2.0E-05	ξ (-) =	0.0
S (-) =	1.0E-03		
K_s (m/s) =	1.3E-07		
S_s (1/m) =	6.7E-06		

Comments:

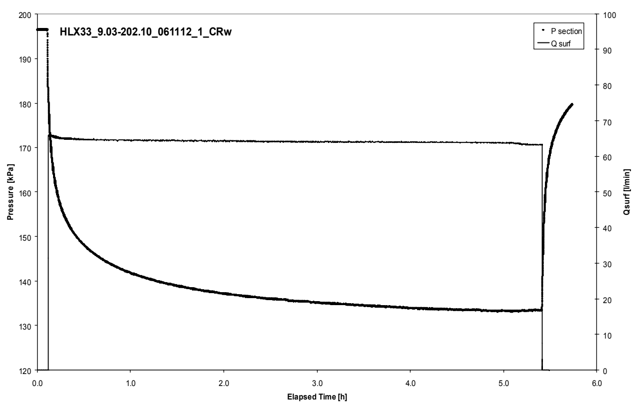
The recommended transmissivity of 2.0E-5 m2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be 9E-6 to 7E-5 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 33

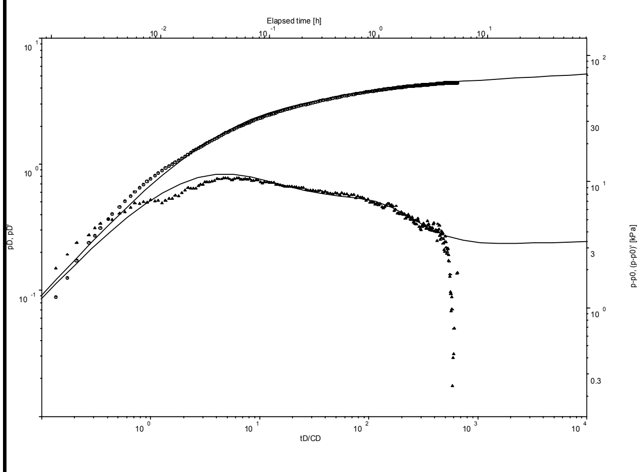
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX33	Test start:	061112 09:05
Test section from - to (m):	9.03-202.10	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	196		
p_p(kPa) =	133	p_F (kPa) =	-
Q_p (m^3/s)=	1.07E-03		
tp (s) =	19037	t_F (s) =	-
S el S^* (-)=	1.00E-03	S el S^* (-)=	-
EC_w (mS/m)=	37.1		
$Temp_w$(gr C)=	8.5		
Derivative fact.=	0.05	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	1.7E-04		
T_M (m^2/s)=	2.2E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	12.07	dt_1 (min) =	-
dt_2 (min) =	40.29	dt_2 (min) =	-
T (m^2/s) =	1.2E-04	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	6.3E-07	K_s (m/s) =	-
S_s (1/m) =	5.2E-06	S_s (1/m) =	-
C (m^3/Pa) =	2.3E-06	C (m^3/Pa) =	-
C_D (-) =	7.4E-02	C_D (-) =	-
ξ (-) =	-2.14	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.			
dt_1 (min) =	12.07	C (m^3/Pa) =	2.3E-06
dt_2 (min) =	40.29	C_D (-) =	7.4E-02
T_T (m^2/s) =	1.2E-04	ξ (-) =	-2.14
S (-) =	1.0E-03		
K_s (m/s) =	6.2E-07		
S_s (1/m) =	5.2E-06		

Comments:

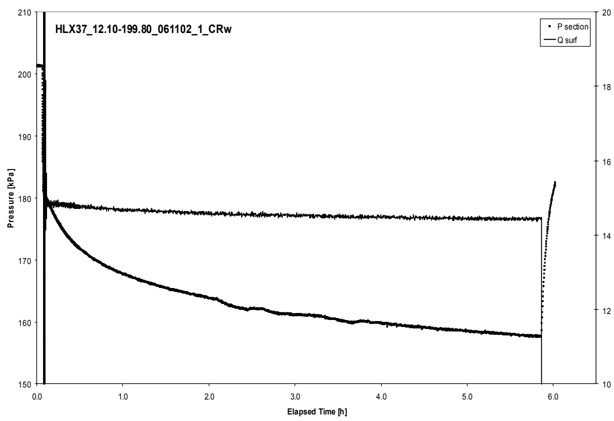
The inner zone transmissivity of 1.2E-4 m2/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be 7E-5 to 5E-4 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 37

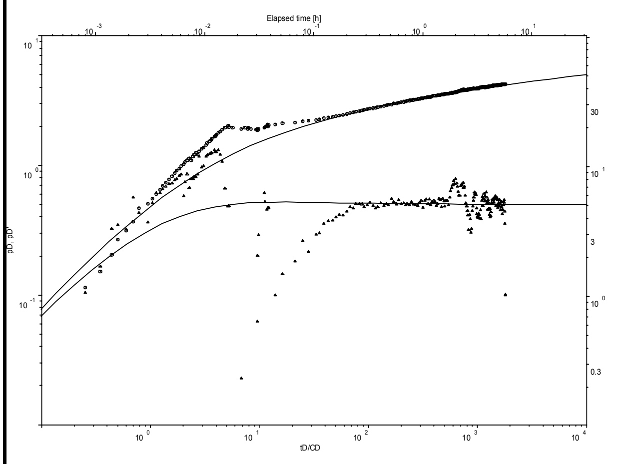
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX37	Test start:	061102 08:47
Test section from - to (m):	12.10-199.80	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	201		
p_p(kPa) =	158	p_F (kPa) =	-
Q_p (m^3/s)=	2.4E-04		
tp (s) =	20899	t_F (s) =	-
S el S^* (-)=	1.0E-03	S el S^* (-)=	-
EC_w (mS/m)=	29.3		
$Temp_w$(gr C)=	9.1		
Derivative fact.=	0.06	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	5.5E-05		
T_M (m^2/s)=	7.2E-05		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	13.72	dt_1 (min) =	-
dt_2 (min) =	312.09	dt_2 (min) =	-
T (m^2/s) =	3.7E-05	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	2.0E-07	K_s (m/s) =	-
S_s (1/m) =	5.3E-06	S_s (1/m) =	-
C (m^3/Pa) =	2.7E-07	C (m^3/Pa) =	-
C_D (-) =	8.7E-03	C_D (-) =	-
ξ (-) =	-2.8	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.			
dt_1 (min) =	13.72	C (m^3/Pa) =	2.7E-07
dt_2 (min) =	312.09	C_D (-) =	8.7E-03
T_T (m^2/s) =	3.7E-05	ξ (-) =	-2.8
S (-) =	1.0E-03		
K_s (m/s) =	2.0E-07		
S_s (1/m) =	5.3E-06		

Comments:

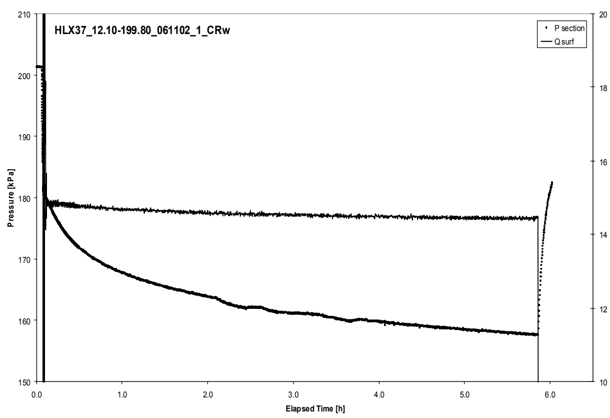
The recommended transmissivity of 3.7E-5 m2/s is derived from the analysis of the CRw phase. The confidence range for the transmissivity is estimated to be 8E-6 to 8E-5 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 39

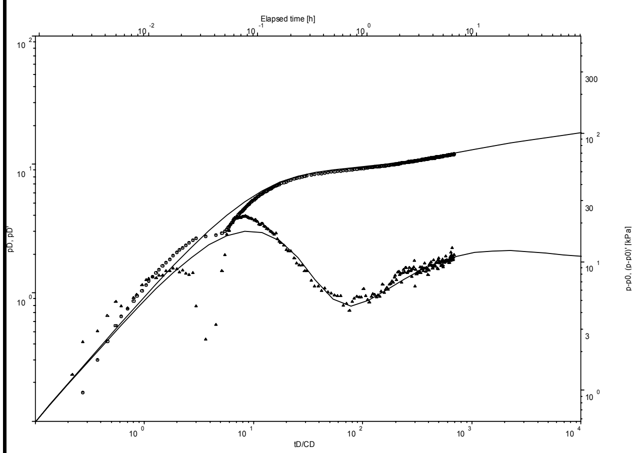
Test Summary Sheet

Project:	Oskarshamn site investigation	Test type:[1]	CRw
Area:	Laxemar	Test no:	1
Borehole ID:	HLX39	Test start:	061106 08:55
Test section from - to (m):	6.10-199.30	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p



Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period

not conducted

Flow period		**Recovery period**	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	228		
p_p(kPa) =	155	p_F (kPa) =	-
Q_p (m^3/s)=	5.42E-04		
tp (s) =	22705	t_F (s) =	-
S el S^* (-)=	1.00E-03	S el S^* (-)=	-
EC_w (mS/m)=	41.7		
$Temp_w$(gr C)=	9.2		
Derivative fact.=	0.05	Derivative fact.=	-
Results		**Results**	
Q/s (m^2/s)=	7.3E-05		
T_M (m^2/s)=	9.6E-05		
Flow regime:	IARF	Flow regime:	-
dt_1 (min) =	30.89	dt_1 (min) =	-
dt_2 (min) =	60.34	dt_2 (min) =	-
T (m^2/s) =	1.5E-04	T (m^2/s) =	-
S (-) =	1.0E-03	S (-) =	-
K_s (m/s) =	7.7E-07	K_s (m/s) =	-
S_s (1/m) =	5.2E-06	S_s (1/m) =	-
C (m^3/Pa) =	3.1E-06	C (m^3/Pa) =	-
C_D (-) =	1.0E-01	C_D (-) =	-
ξ (-) =	2.85	ξ (-) =	-
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Selected representative parameters.			
dt_1 (min) =	30.89	C (m^3/Pa) =	3.1E-06
dt_2 (min) =	60.34	C_D (-) =	1.0E-01
T_T (m^2/s) =	1.5E-04	ξ (-) =	2.85
S (-) =	1.0E-03		
K_s (m/s) =	7.8E-07		
S_s (1/m) =	5.2E-06		

Comments:

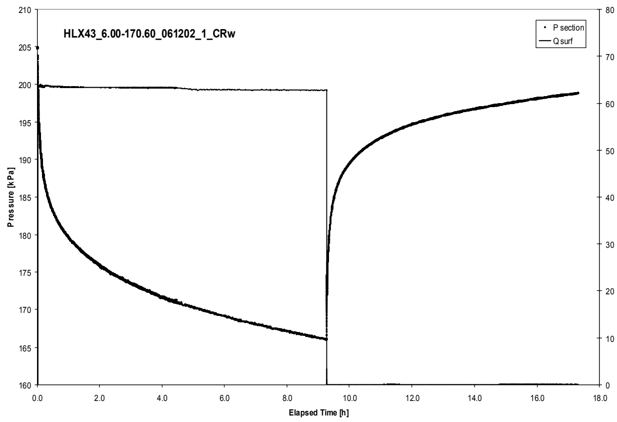
The inner zone transmissivity of 1.5E-4 m2/s is deemed to be the recommended transmissivity. The confidence range for the transmissivity is estimated to be 4E-5 to 5E-4 m²/s. The flow dimension displayed during the test is 2.

Borehole: HLX 43

Test Summary Sheet

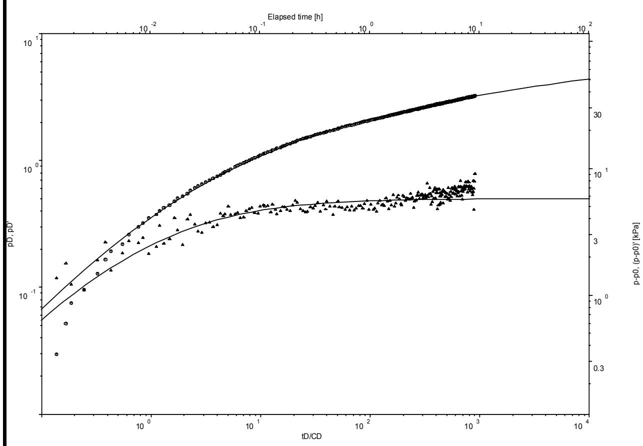
Project:	Oskarshamn site investigation	Test type:[1]	CRwr
Area:	Laxemar	Test no:	1
Borehole ID:	HLX43	Test start:	061202 09:26
Test section from - to (m):	6.00-170.60	Responsible for test execution:	Philipp Wolf
Section diameter, $2 \cdot r_w$ (m):	0.14	Responsible for test evaluation:	Cristian Enachescu

Linear plot Q and p

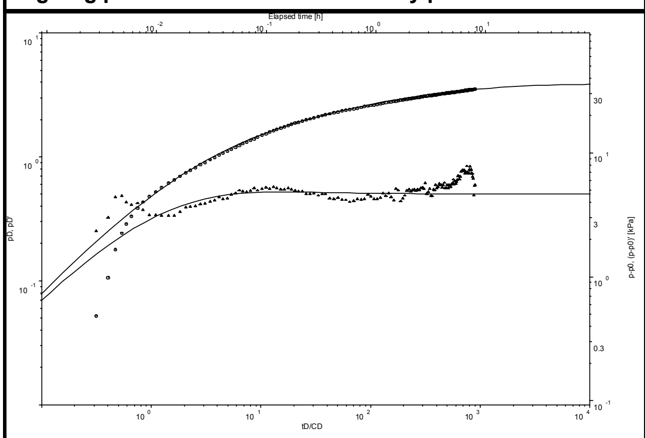


Flow period		Recovery period	
Indata		**Indata**	
p_0 (kPa) =	-		
p_i (kPa) =	205		
p_p(kPa) =	166	p_F (kPa) =	201
Q_p (m^3/s)=	1.05E-03		
tp (s) =	33273	t_F (s) =	53913
S el S^* (-)=	1.00E-03	S el S^* (-)=	1.00E-03
EC_w (mS/m)=	54.5		
$Temp_w$(gr C)=	7.8		
Derivative fact.=	0.03	Derivative fact.=	0.02
Results		**Results**	
Q/s (m^2/s)=	2.7E-04		
T_M (m^2/s)=	3.4E-04		
Flow regime:	transient	Flow regime:	transient
dt_1 (min) =	11.96	dt_1 (min) =	3.80
dt_2 (min) =	421.03	dt_2 (min) =	294.82
T (m^2/s) =	1.4E-04	T (m^2/s) =	1.8E-04
S (-) =	1.0E-03	S (-) =	1.0E-03
K_s (m/s) =	8.7E-07	K_s (m/s) =	1.1E-06
S_s (1/m) =	6.1E-06	S_s (1/m) =	6.1E-06
C (m^3/Pa) =	3.4E-06	C (m^3/Pa) =	3.7E-06
C_D (-) =	1.1E-01	C_D (-) =	1.2E-01
ξ (-) =	-4.09	ξ (-) =	-3.53
T_{GRF}(m^2/s) =	-	T_{GRF}(m^2/s) =	-
S_{GRF}(-) =	-	S_{GRF}(-) =	-
D_{GRF} (-) =	-	D_{GRF} (-) =	-

Log-Log plot incl. derivates- flow period



Log-Log plot incl. derivatives- recovery period



Selected representative parameters.			
dt_1 (min) =	11.96	C (m^3/Pa) =	3.4E-06
dt_2 (min) =	421.03	C_D (-) =	1.1E-01
T_T (m^2/s) =	1.4E-04	ξ (-) =	-4.09
S (-) =	1.0E-03		
K_s (m/s) =	8.5E-07		
S_s (1/m) =	6.1E-06		

Comments:

The recommended transmissivity of 1.4E-4 m2/s was derived from the analysis of the CRw phase, which shows a slight better data and derivative quality. The confidence range for the transmissivity is estimated to be 7E-5 to 5E-4 m²/s. The flow dimension displayed during the test is 2. The static pressure measured at transducer depth was derived from the CRwr phase using straight line extrapolation in the Horner plot to a value of 202.3 kPa.

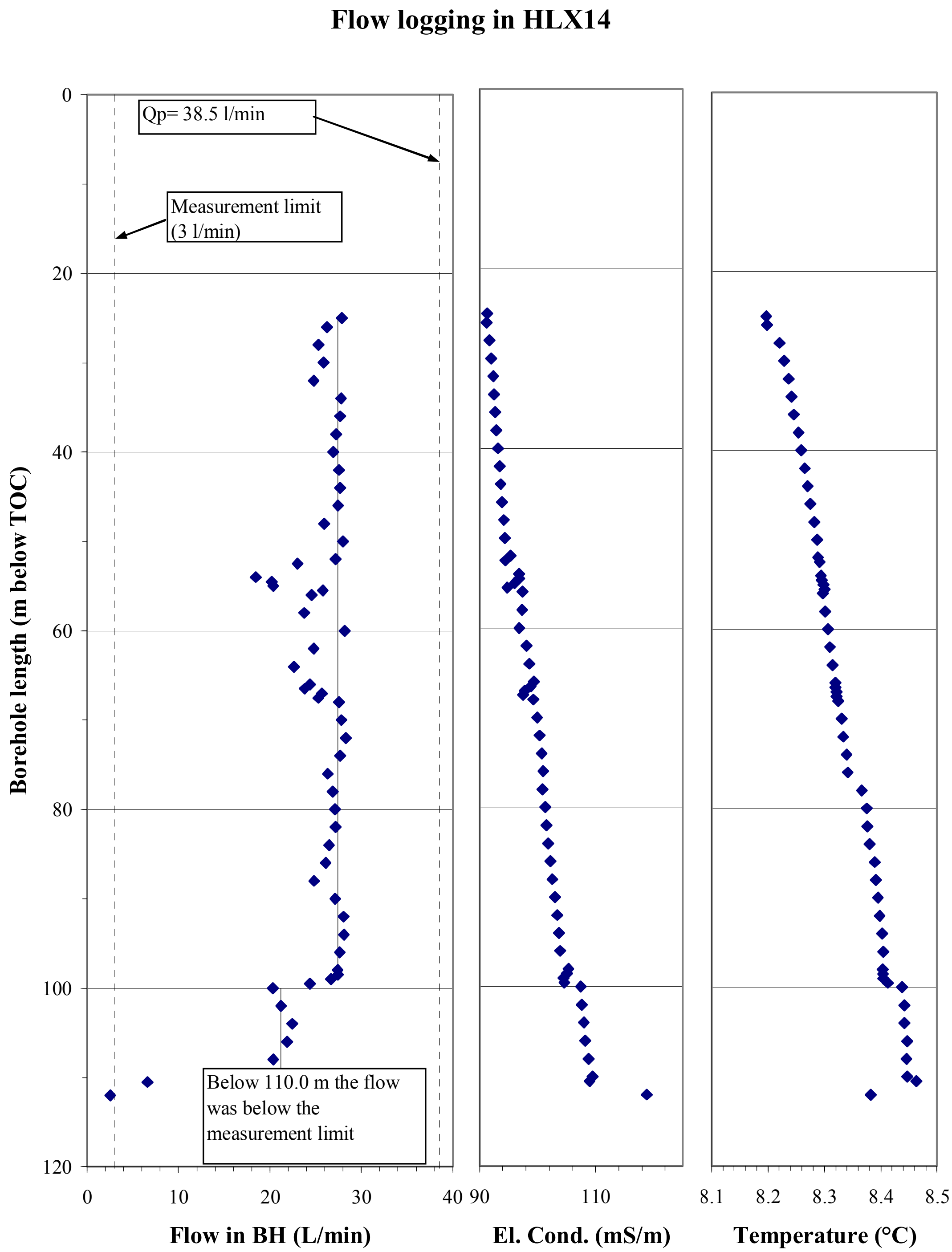
APPENDIX 4

Flow Logging Analysis Diagrams

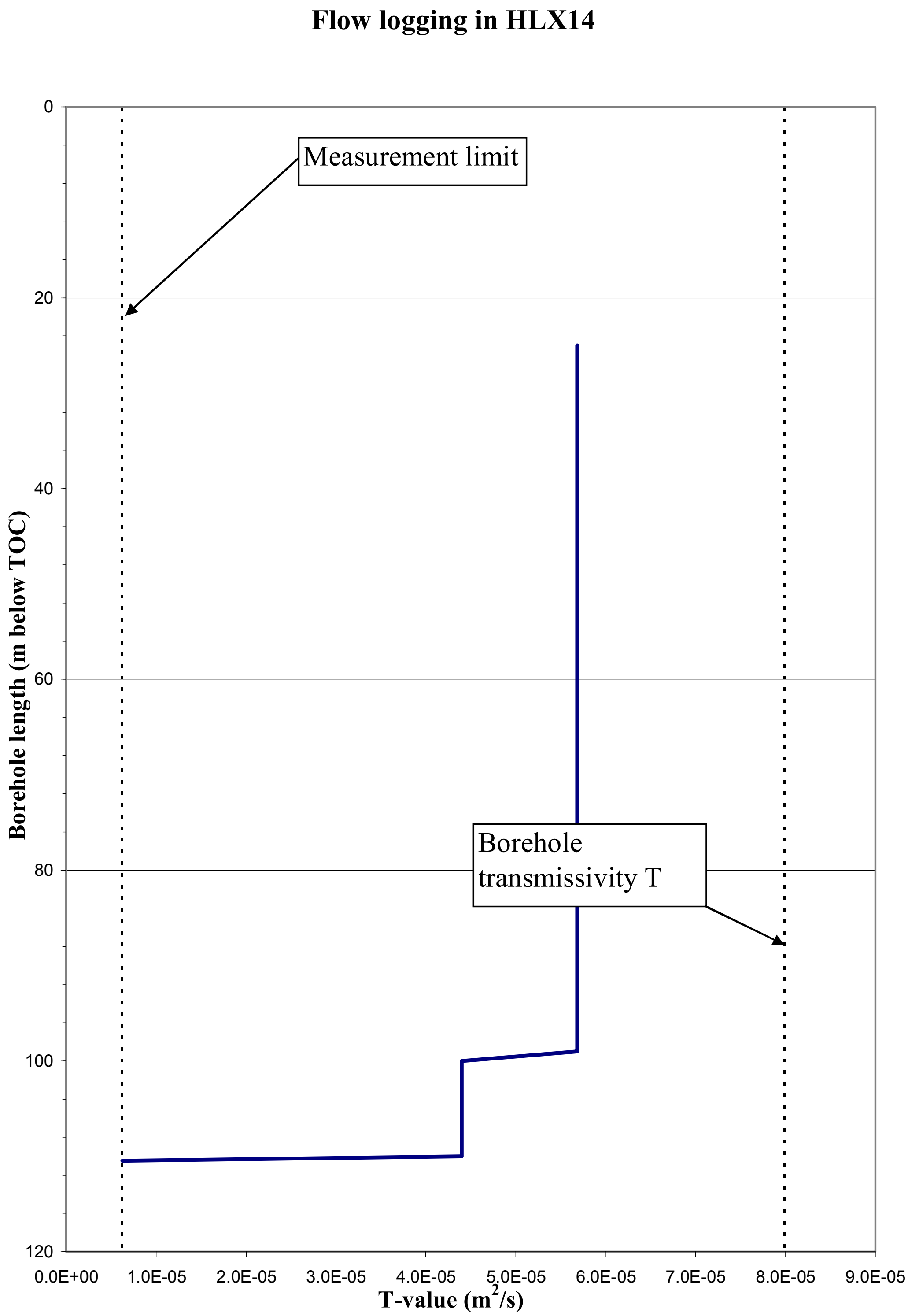
APPENDIX 4-1

HLX 14

Flow Logging Results diagrams



HLX 14: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

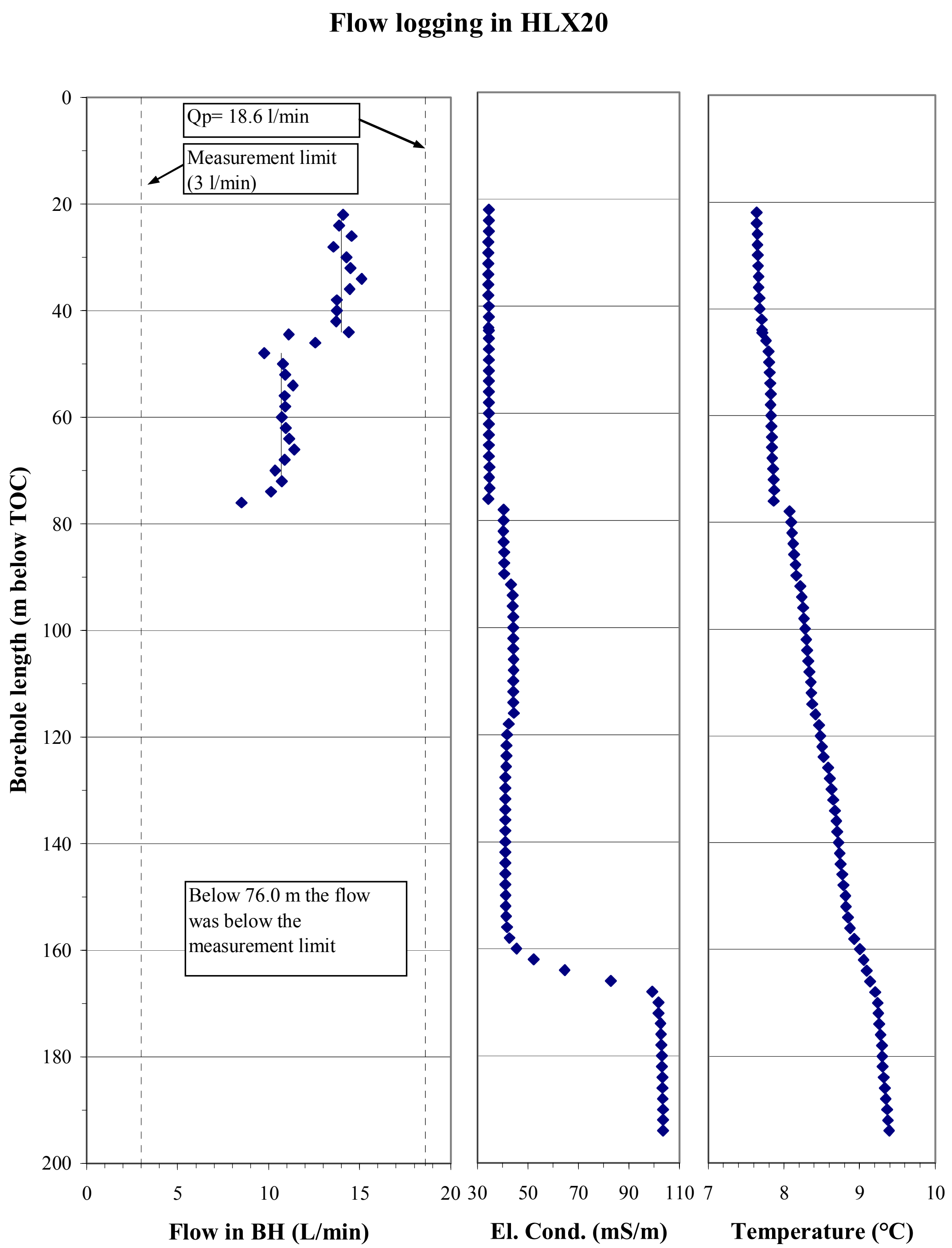


HLX 14: Calculated cumulative transmissivity (T_i) along the borehole

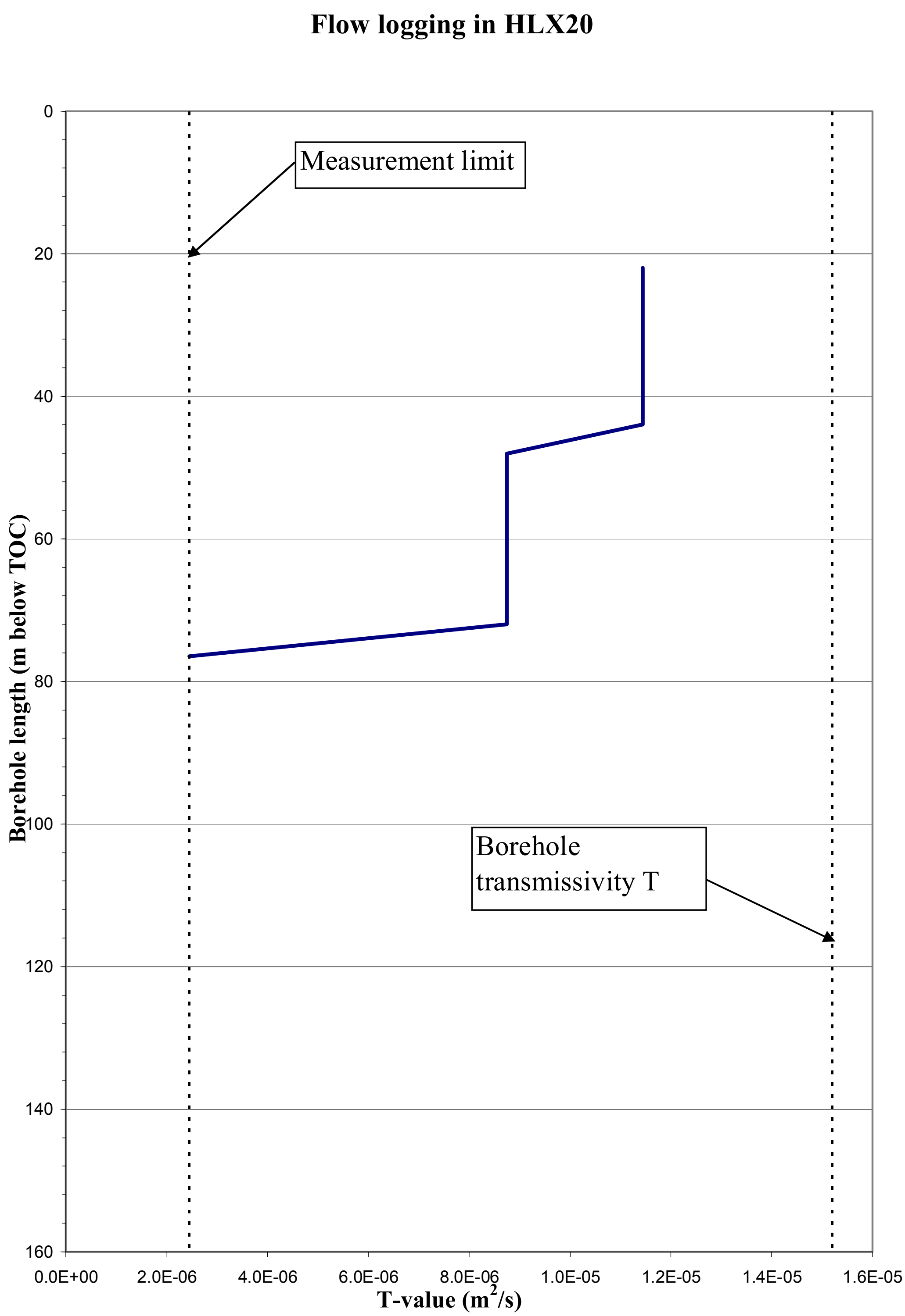
APPENDIX 4-2

HLX 20

Flow Logging Results diagrams



HLX 20: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

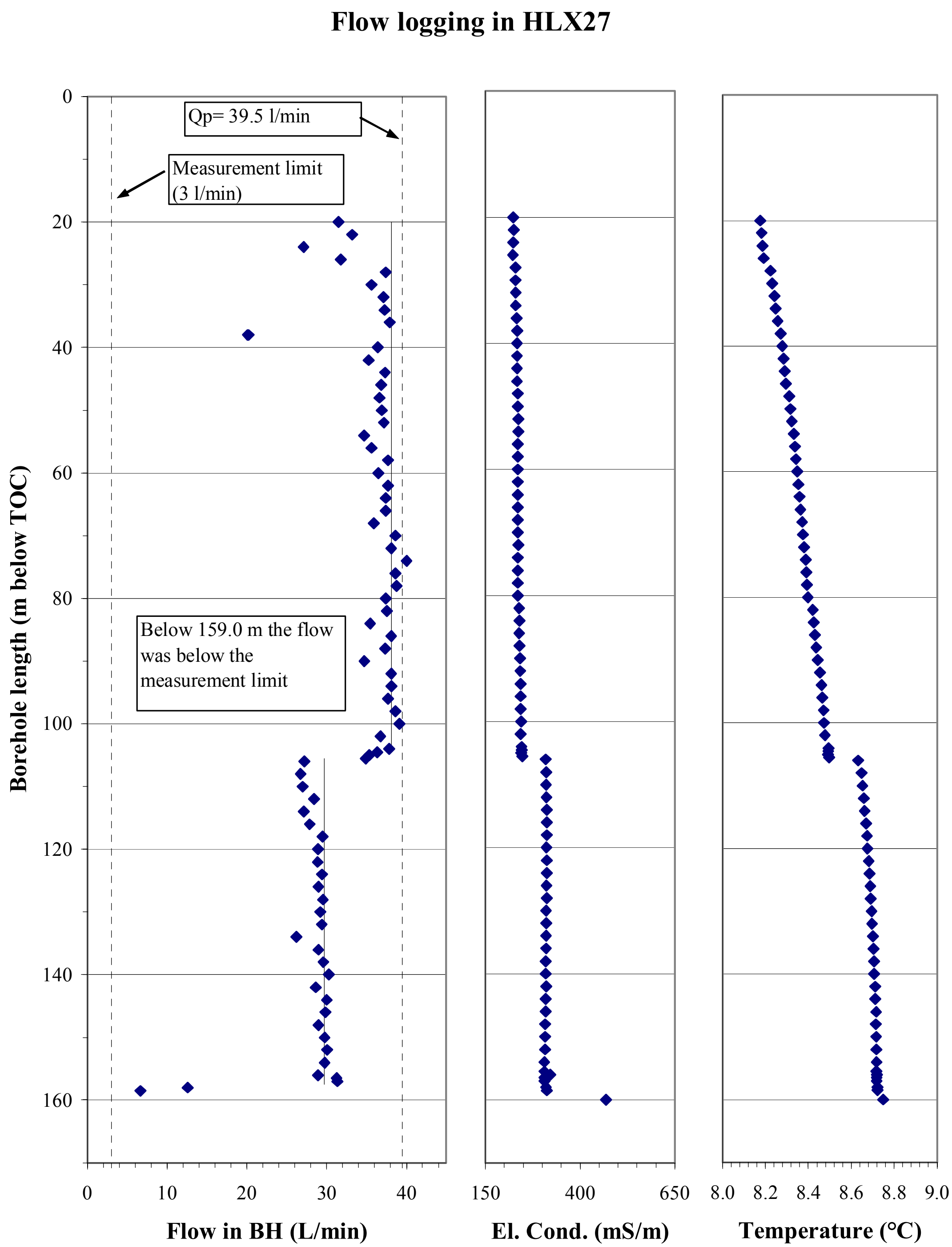


HLX 20: Calculated cumulative transmissivity (T_i) along the borehole

APPENDIX 4-3

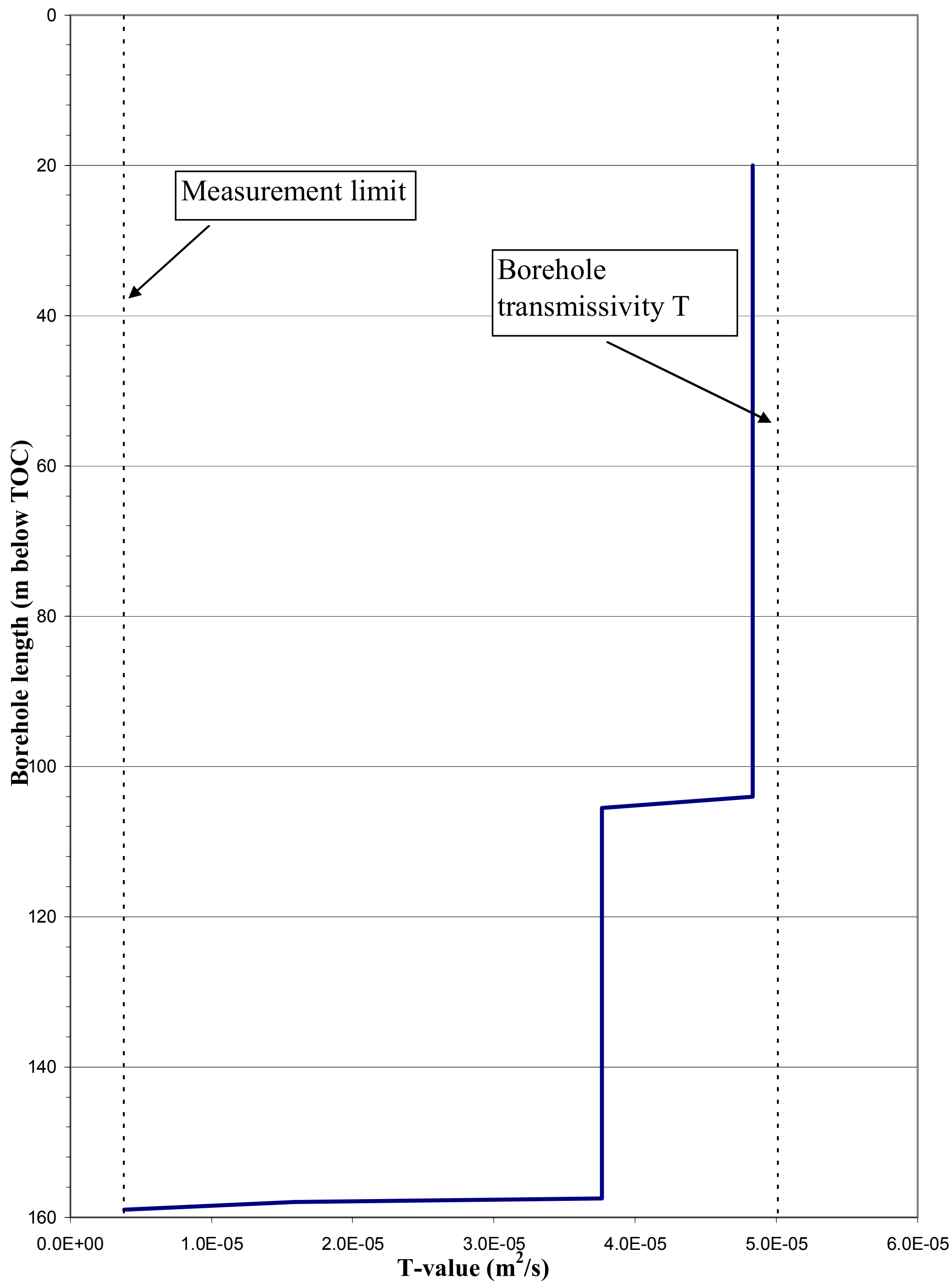
HLX 27

Flow Logging Results diagrams



HLX 27: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

Flow logging in HLX27

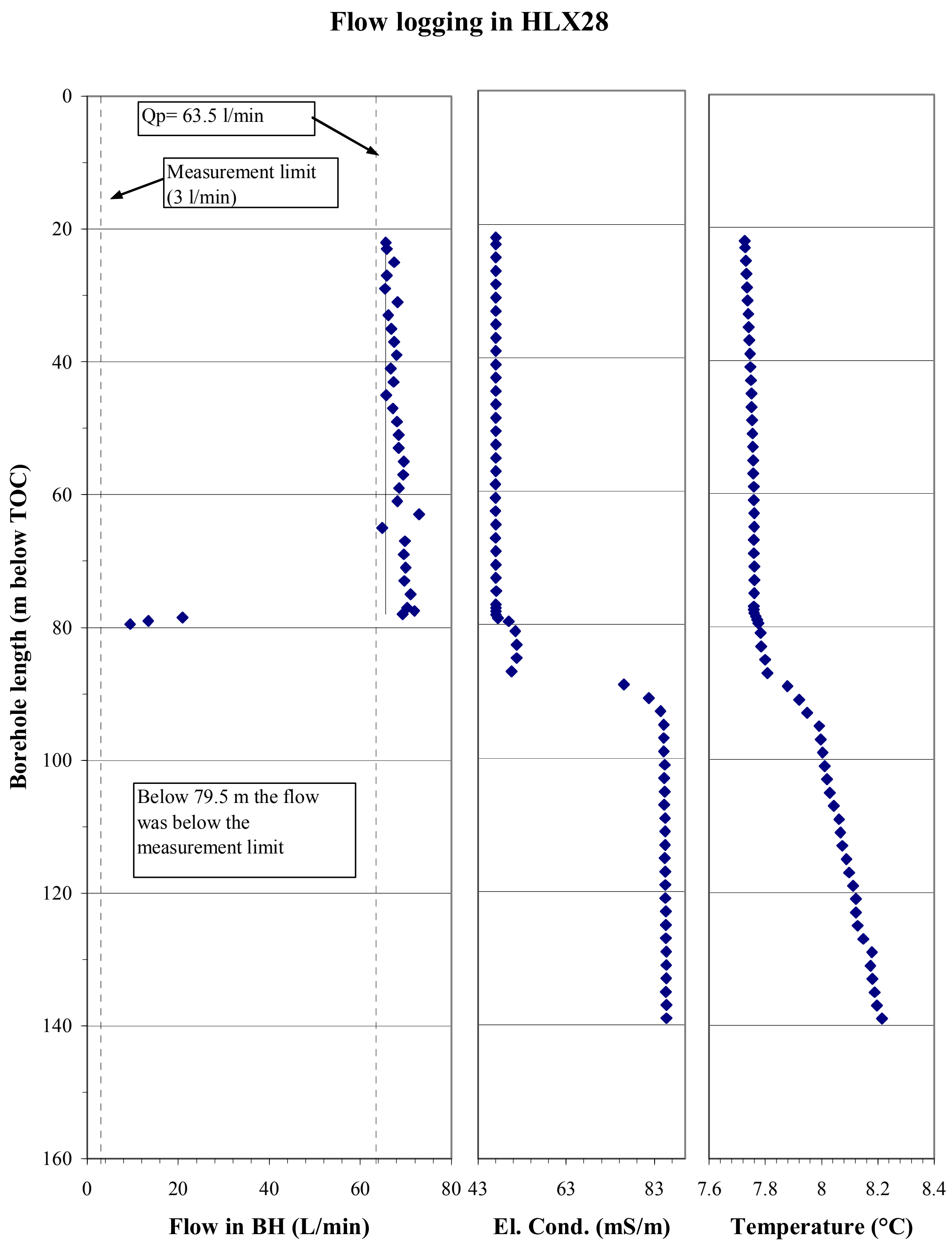


HLX 27: Calculated cumulative transmissivity (T_i) along the borehole

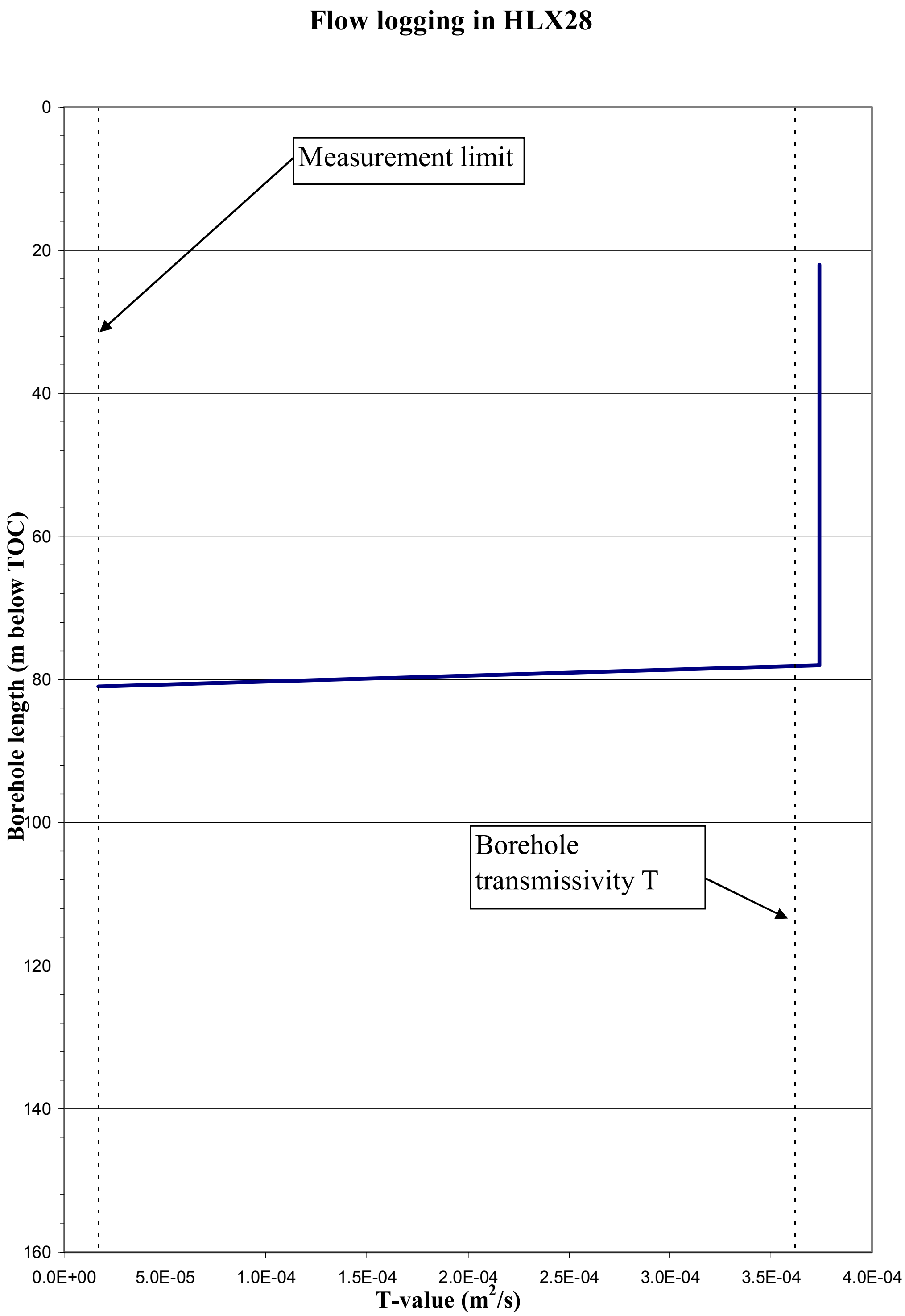
APPENDIX 4-4

HLX 28

Flow Logging Results diagrams



HLX 28: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

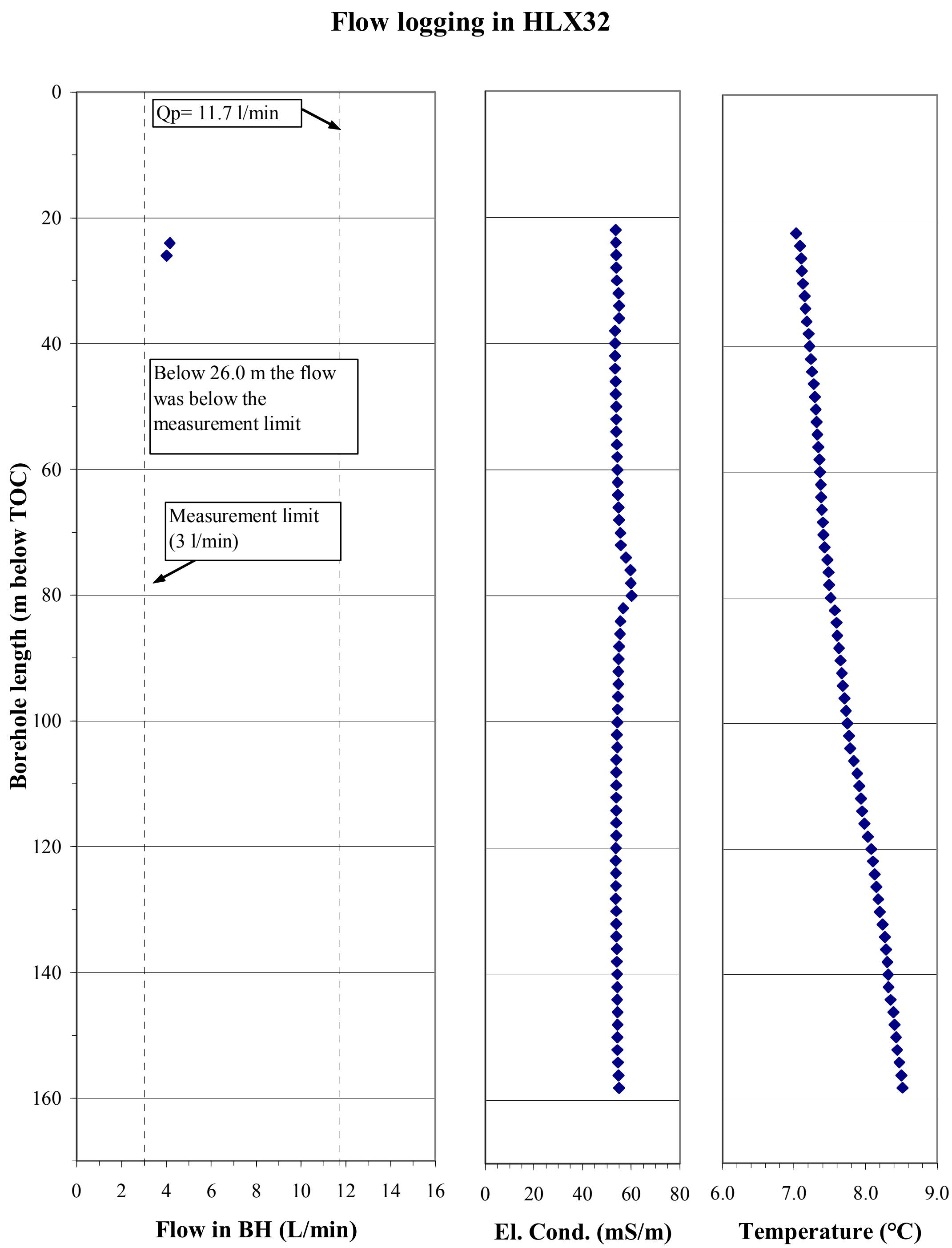


HLX 28: Calculated cumulative transmissivity (T_i) along the borehole

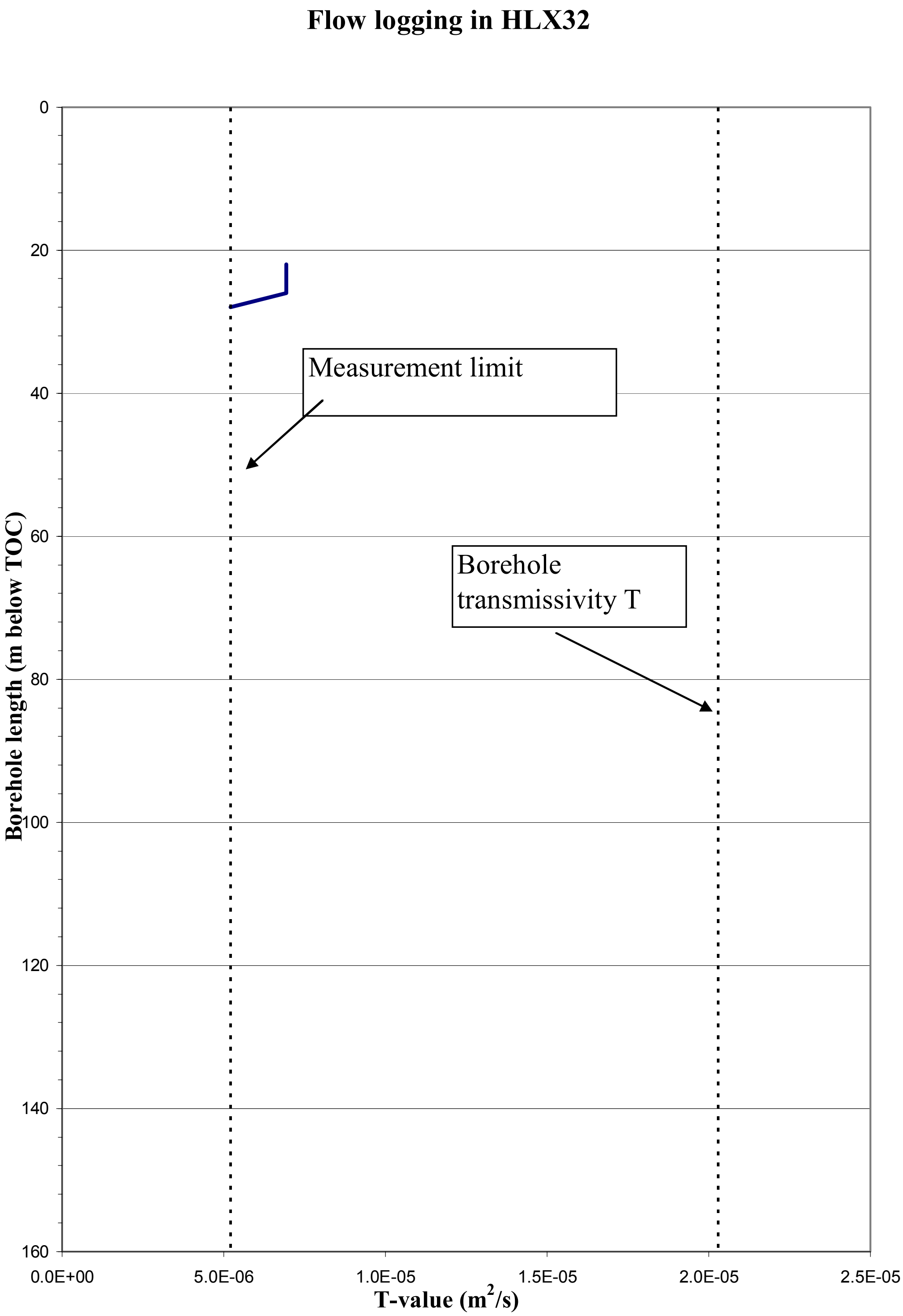
APPENDIX 4-5

HLX 32

Flow Logging Results diagrams



HLX 32: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

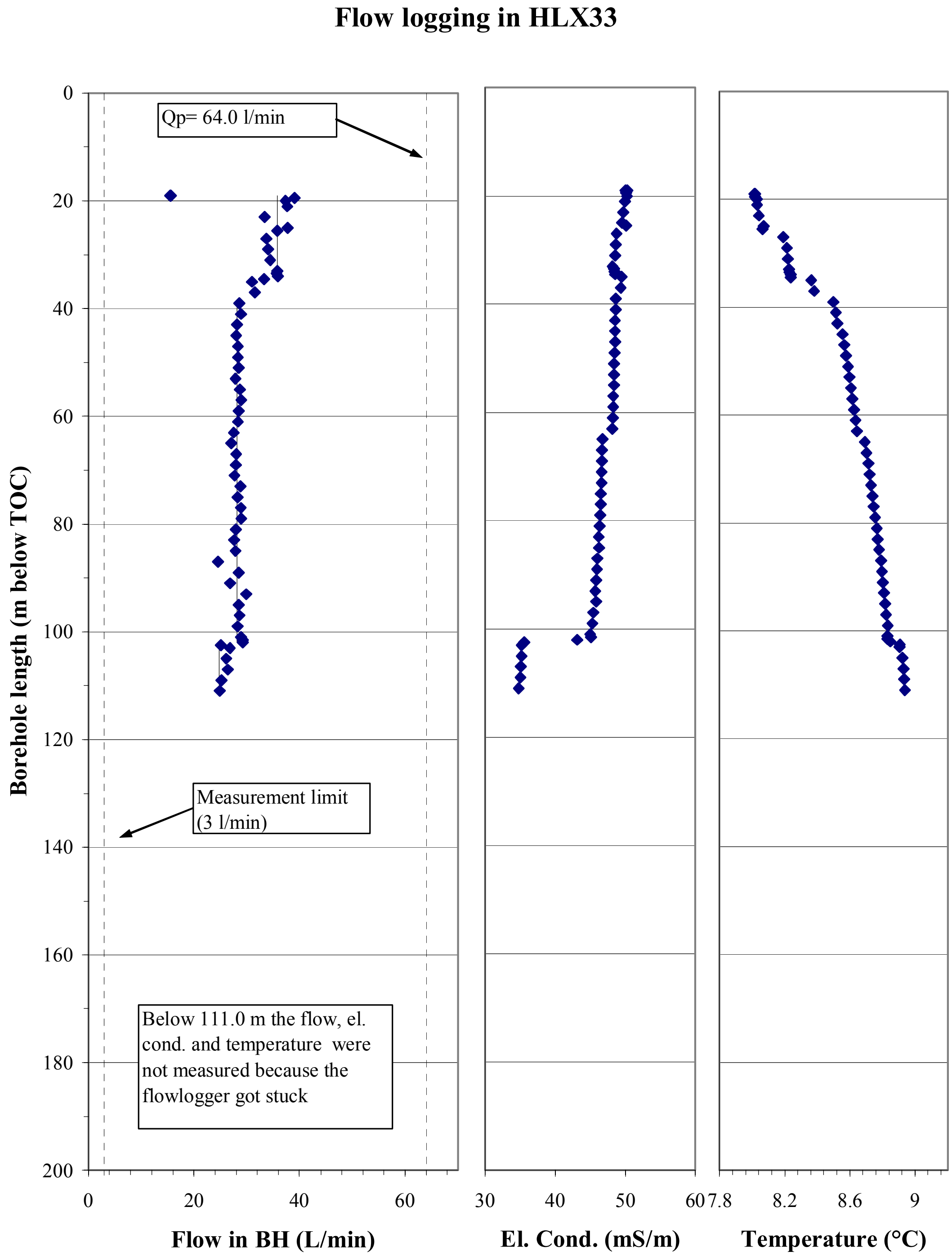


HLX 32: Calculated cumulative transmissivity (T_i) along the borehole

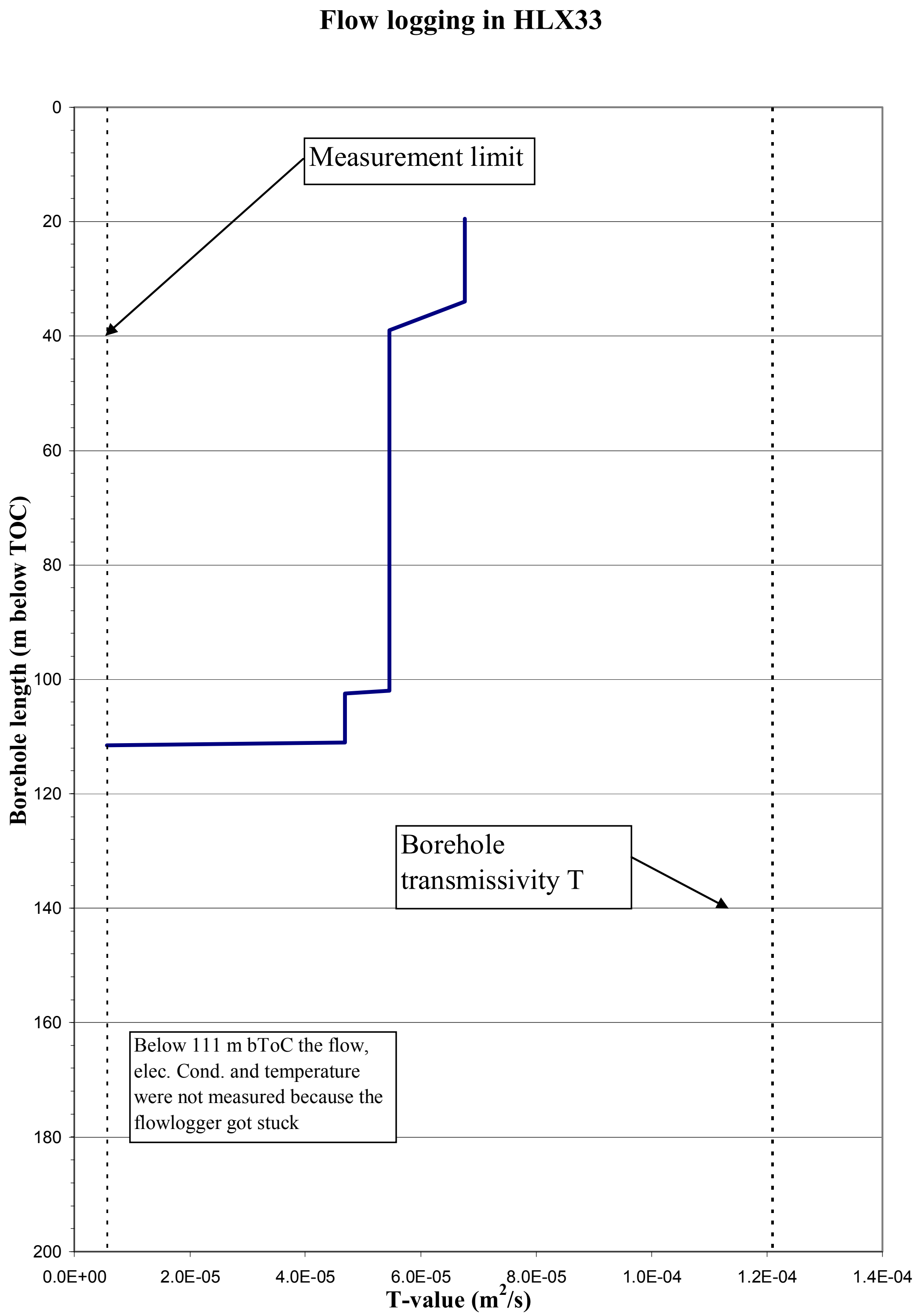
APPENDIX 4-6

HLX 33

Flow Logging Results diagrams



HLX 33: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

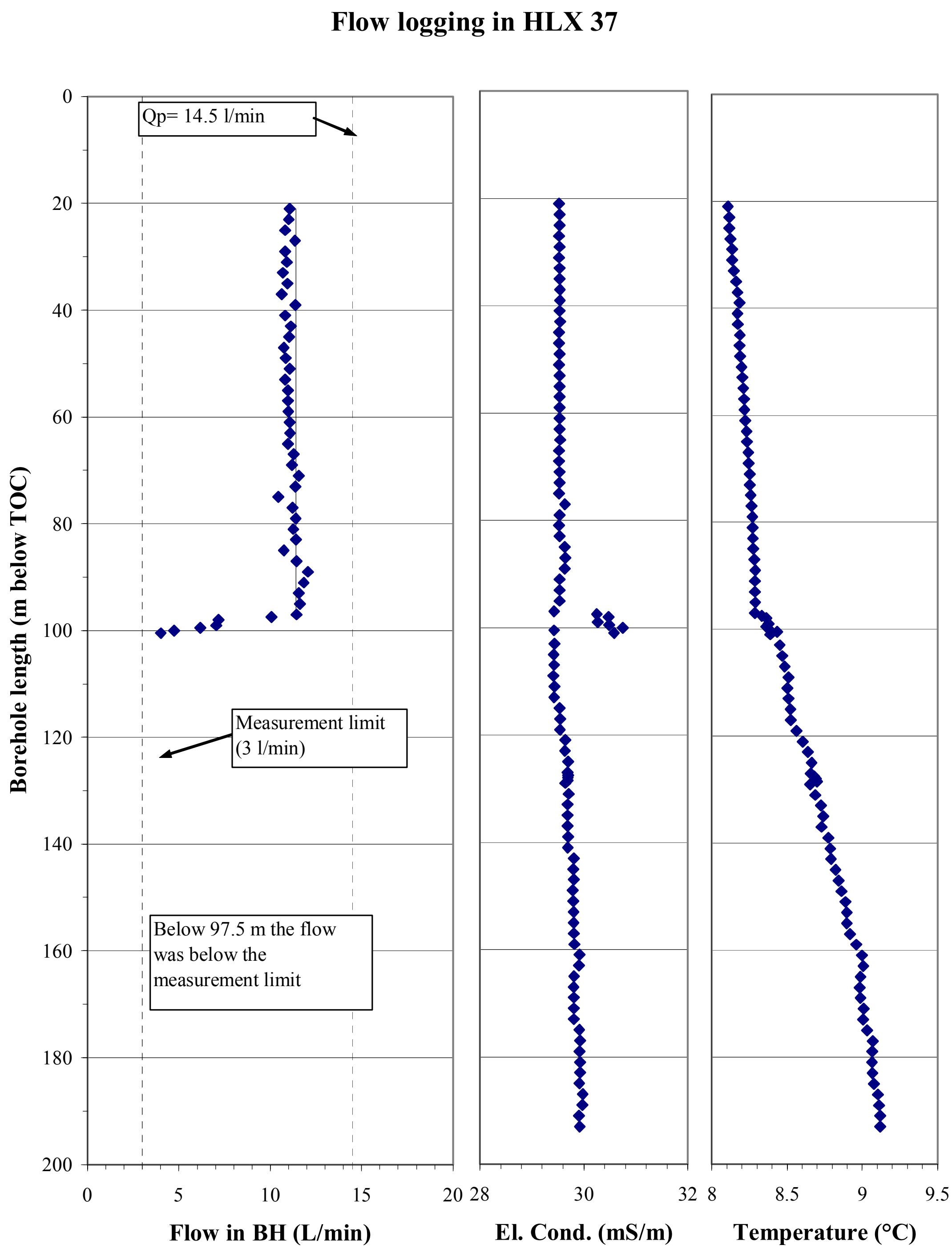


HLX 33: Calculated cumulative transmissivity (T_i) along the borehole

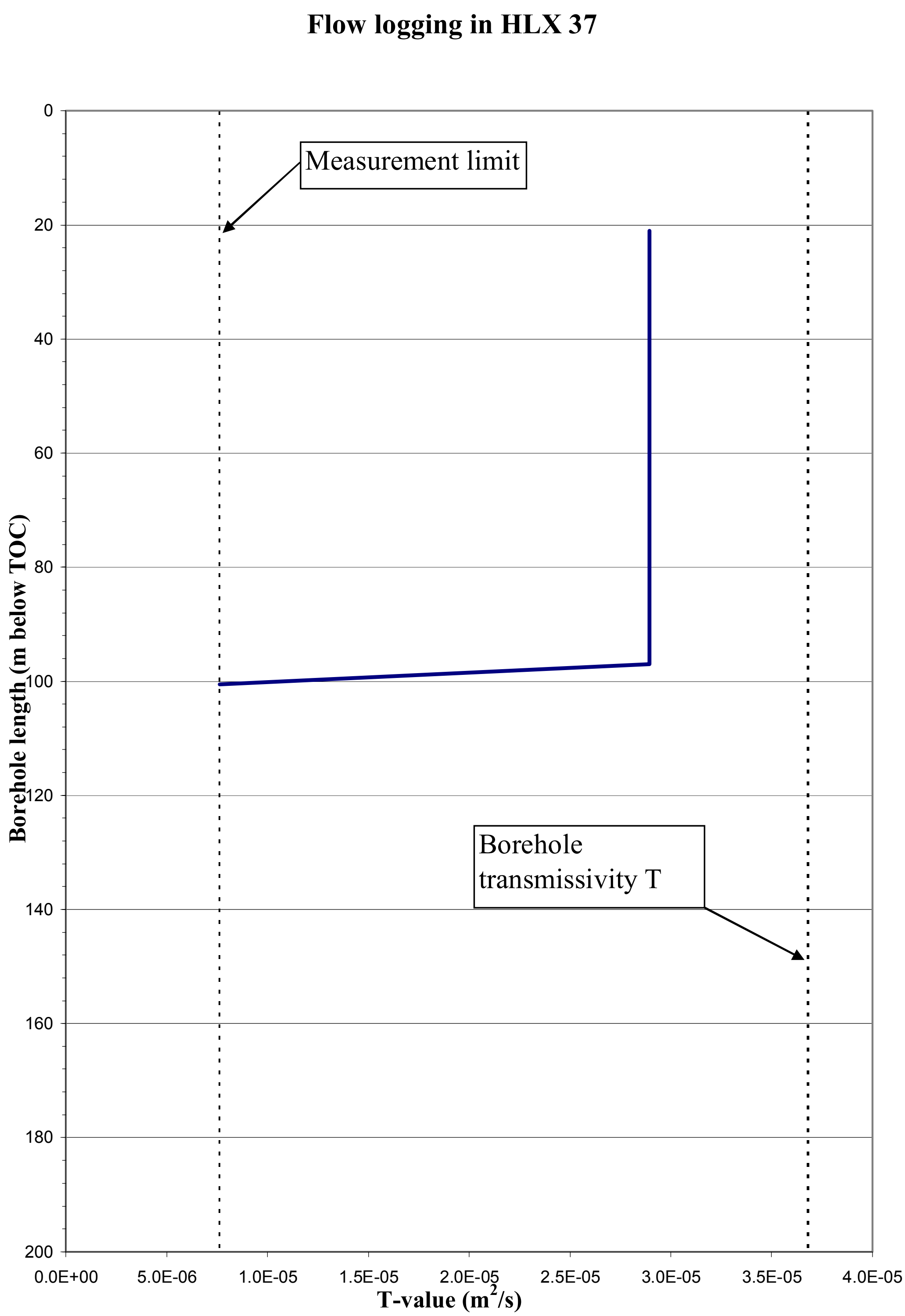
APPENDIX 4-7

HLX 37

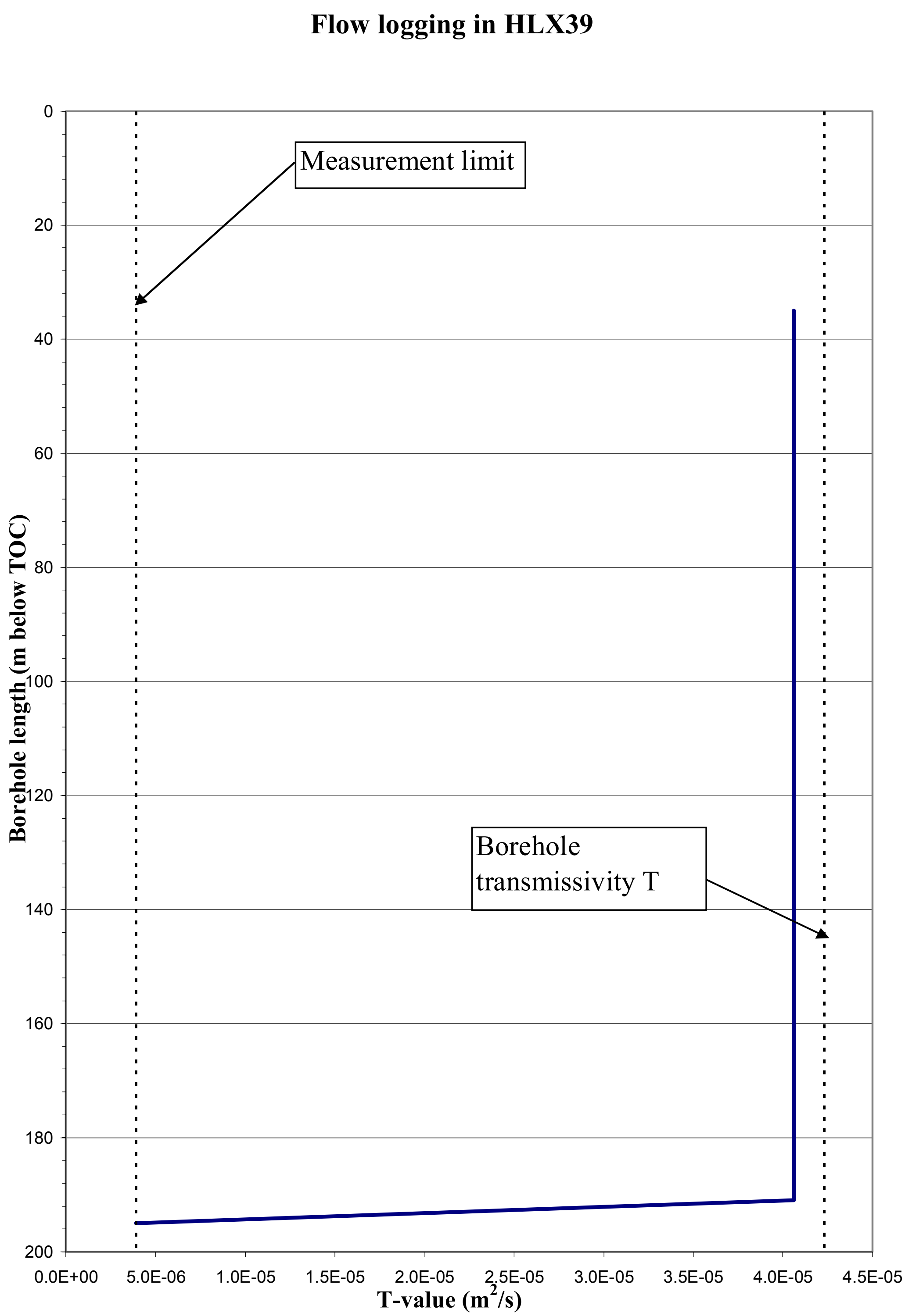
Flow Logging Results diagrams



HLX 37: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole



HLX 37: Calculated cumulative transmissivity (T_i) along the borehole

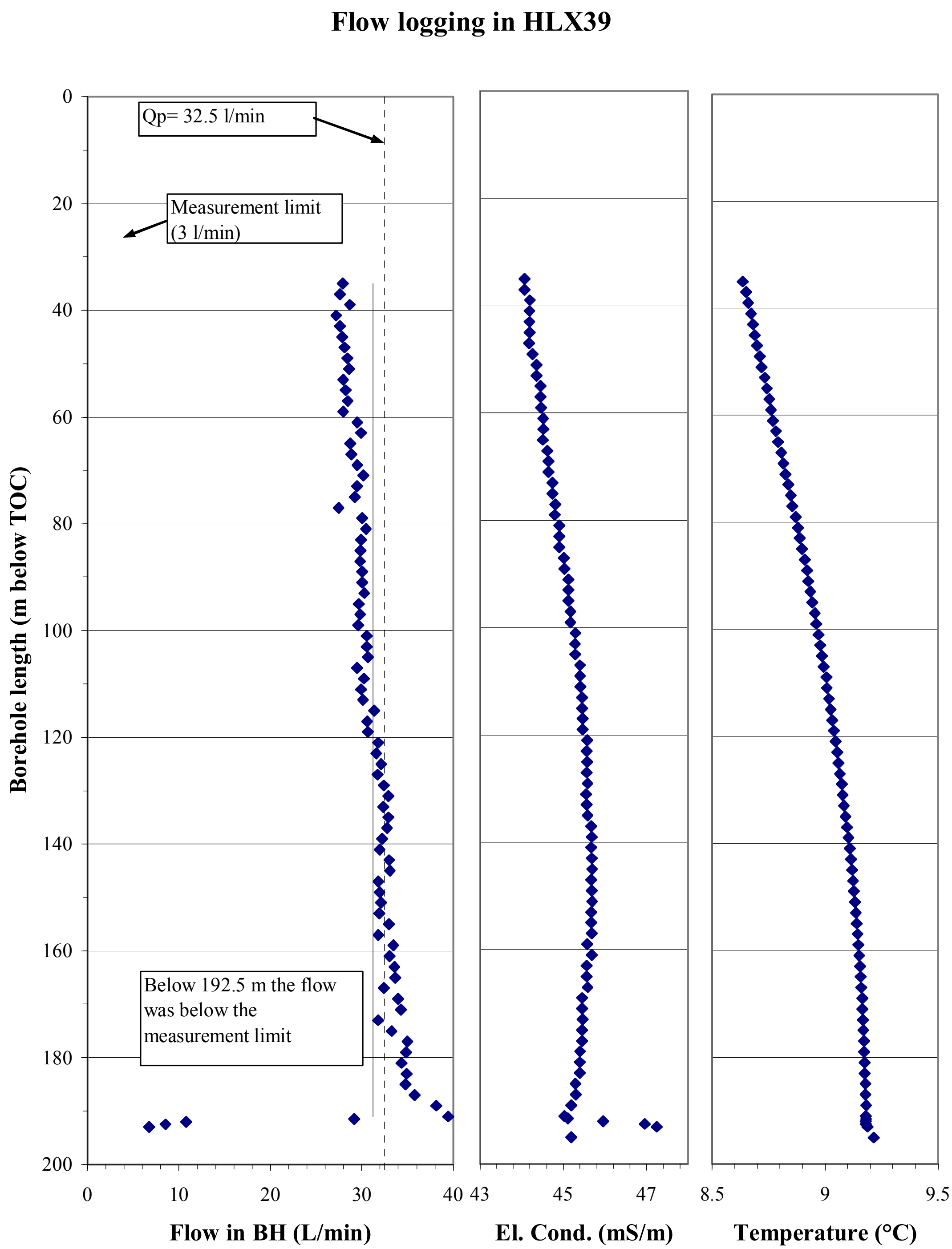


HLX 39: Calculated cumulative transmissivity (T_i) along the borehole

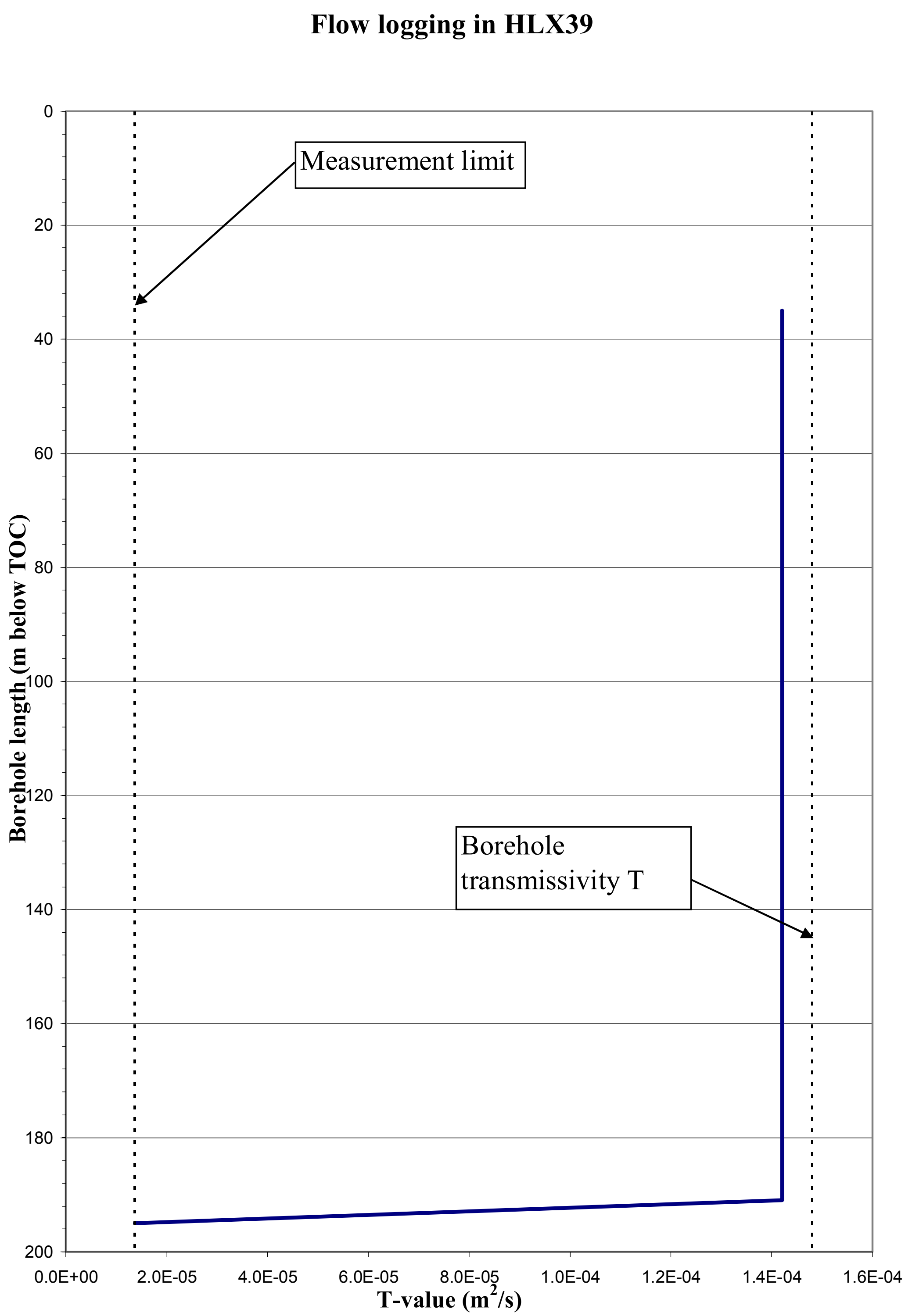
APPENDIX 4-8

HLX 39

Flow Logging Results diagrams



HLX 39: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

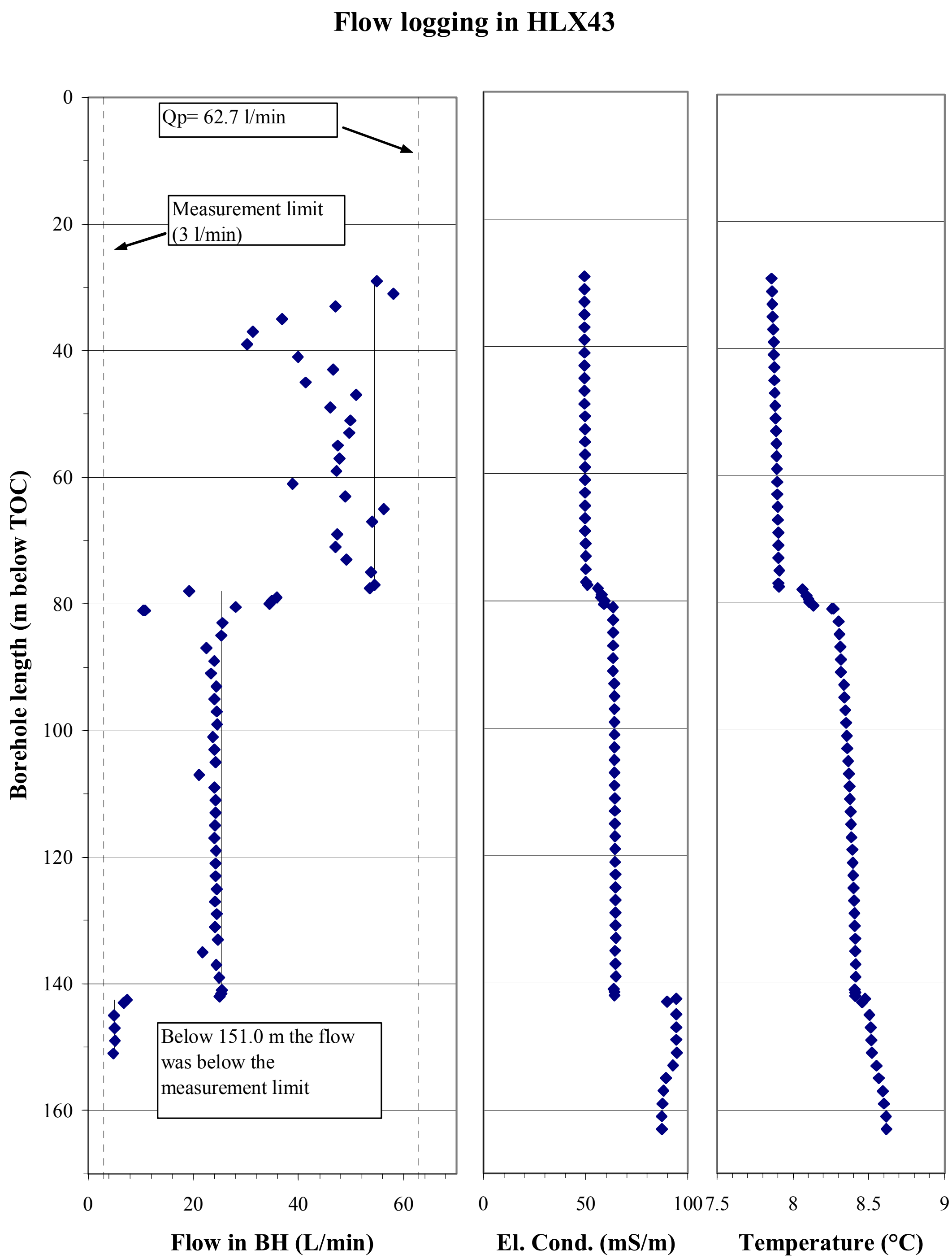


HLX 39: Calculated cumulative transmissivity (T_i) along the borehole

APPENDIX 4-9

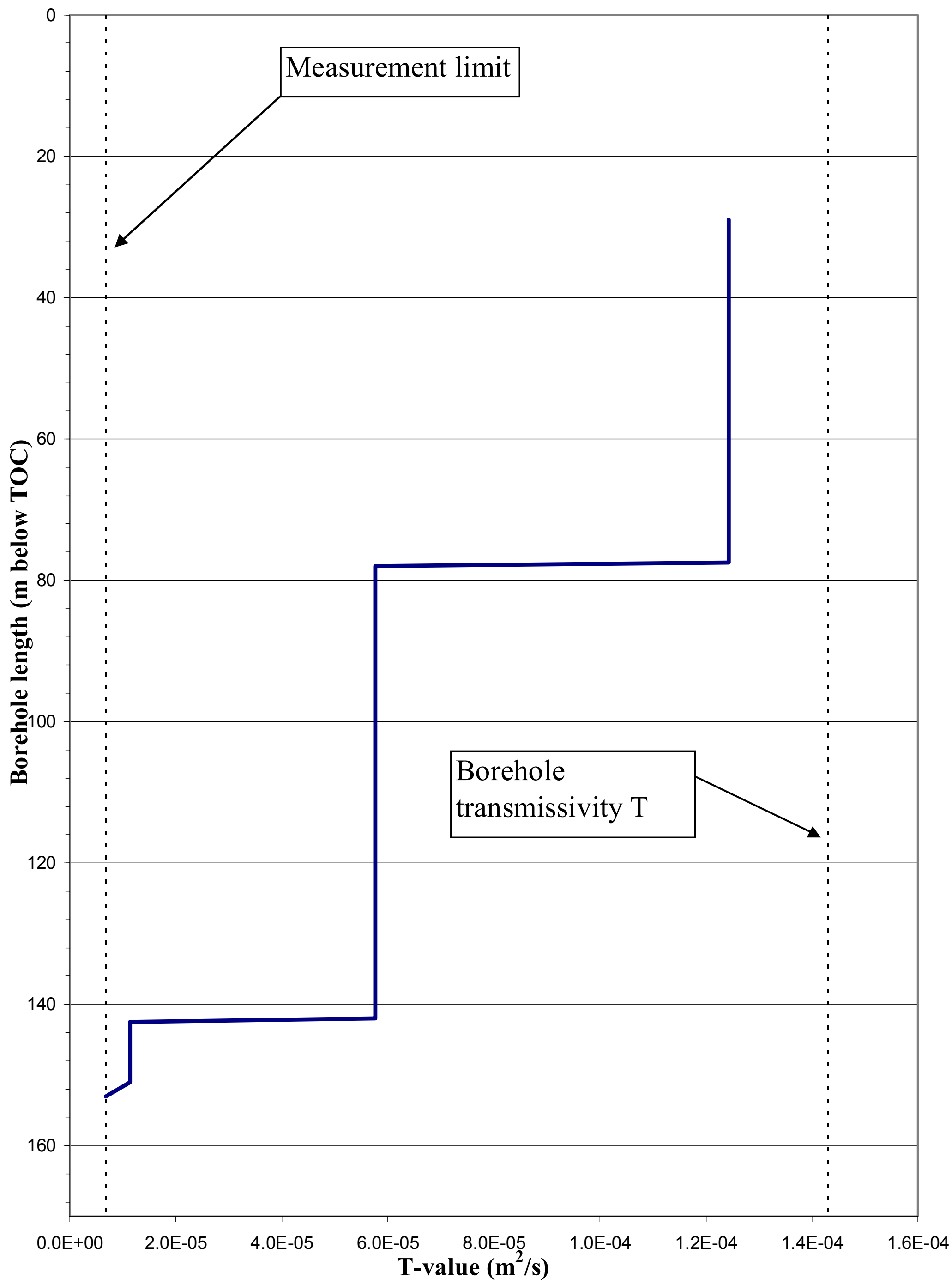
HLX 43

Flow Logging Results diagrams



HLX 43: Distribution of flow (Q_i), electric conductivity (EC) and temperature (Te) along the borehole

Flow logging in HLX43



HLX 43: Calculated cumulative transmissivity (T_i) along the borehole

APPENDIX 5

Nomenclature

Character	SICADA designation	Explanation	Dimension	Unit
Variables, constants				
A_w		Horizontal area of water surface in open borehole, not including area of signal cables, etc.	$[L^2]$	m^2
b		Aquifer thickness (Thickness of 2D formation)	[L]	m
B		Width of channel	[L]	m
L		Corrected borehole length	[L]	m
L_0		Uncorrected borehole length	[L]	m
L_p		Point of application for a measuring section based on its centre point or centre of gravity for distribution of transmissivity in the measuring section.	[L]	m
L_w		Test section length.	[L]	m
dL		Step length, Positive Flow Log - overlapping flow logging. (step length, PFL)	[L]	m
r		Radius	[L]	m
r_w		Borehole, well or soil pipe radius in test section.	[L]	m
r_{we}		Effective borehole, well or soil pipe radius in test section. (Consideration taken to skin factor)	[L]	m
r_s		Distance from test section to observation section, the shortest distance.	[L]	m
r_t		Distance from test section to observation section, the **interpreted** shortest distance via conductive structures.	[L]	m
r_D		Dimensionless radius, $r_D=r/r_w$	-	-
z		Level above reference point	[L]	m
z_r		Level for reference point on borehole	[L]	m
z_{wu}		Level for test section (section that is being flowed), upper limitation	[L]	m
z_{wl}		Level for test section (section that is being flowed), lower limitation	[L]	m
z_{ws}		Level for sensor that measures response in test section (section that is flowed)	[L]	m
z_{ou}		Level for observation section, upper limitation	[L]	m
z_{ol}		Level for observation section, lower limitation	[L]	m
z_{os}		Level for sensor that measures response in observation section	[L]	m
E		Evaporation: hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
ET		Evapotranspiration hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
P		Precipitation hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
R		Groundwater recharge hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
D		Groundwater discharge hydrological budget:	$[L^3/(T\ L^2)]$ $[L^3/T]$	mm/y, mm/d, m^3/s
Q_R		Run-off rate	$[L^3/T]$	m^3/s
Q_p		Pumping rate	$[L^3/T]$	m^3/s
Q_I		Infiltration rate	$[L^3/T]$	m^3/s
Q		Volumetric flow. Corrected flow in flow logging ($Q_1 – Q_0$) (Flow rate)	$[L^3/T]$	m^3/s
Q_0		Flow in test section during undisturbed conditions (flow logging).	$[L^3/T]$	m^3/s
Q_p		Flow in test section immediately before stop of flow. Stabilised pump flow in flow logging.	$[L^3/T]$	m^3/s

Character	SICADA designation	Explanation	Dimension	Unit
Q_m		Arithmetical mean flow during perturbation phase.	$[L^3/T]$	m^3/s
Q_1		Flow in test section during pumping with pump flow Q_{p1}, (flow logging).	$[L^3/T]$	m^3/s
Q_2		Flow in test section during pumping with pump flow Q_{p1}, (flow logging).	$[L^3/T]$	m^3/s
ΣQ	SumQ	Cumulative volumetric flow along borehole	$[L^3/T]$	m^3/s
ΣQ_0	SumQ0	Cumulative volumetric flow along borehole, undisturbed conditions (ie, not pumped)	$[L^3/T]$	m^3/s
ΣQ_1	SumQ1	Cumulative volumetric flow along borehole, with pump flow Q_{p1}	$[L^3/T]$	m^3/s
ΣQ_2	SumQ2	Cumulative volumetric flow along borehole, with pump flow Q_{p2}	$[L^3/T]$	m^3/s
ΣQ_{C1}	SumQC1	Corrected cumulative volumetric flow along borehole, ΣQ_1-ΣQ_0	$[L^3/T]$	m^3/s
ΣQ_{C2}	SumQC2	Corrected cumulative volumetric flow along borehole, ΣQ_2-ΣQ_0	$[L^3/T]$	m^3/s
q		Volumetric flow per flow passage area (Specific discharge (Darcy velocity, Darcy flux, Filtration velocity)).	$([L^3/T*L^2]$	m/s
V		Volume	$[L^3]$	m^3
V_w		Water volume in test section.	$[L^3]$	m^3
V_p		Total water volume injected/pumped during perturbation phase.	$[L^3]$	m^3
v		Velocity	$([L^3/T*L^2]$	m/s
v_a		Mean transport velocity (Average linear velocity (Average linear groundwater velocity, Mean microscopic velocity));. $v_a=q/n_e$	$([L^3/T*L^2]$	m/s
t		Time	[T]	hour,min,s
t_0		Duration of rest phase before perturbation phase.	[T]	s
t_p		Duration of perturbation phase. (from flow start as far as p_p).	[T]	s
t_F		Duration of recovery phase (from p_p to p_F).	[T]	s
t_1, t_2 etc		Times for various phases during a hydro test.	[T]	hour,min,s
dt		Running time from start of flow phase and recovery phase respectively.	[T]	s
dt_e		$dt_e = (dt \cdot tp) / (dt + tp)$ Agarwal equivalent time with dt as running time for recovery phase.	[T]	s
t_D		$t_D = T{\cdot}t / (S{\cdot} r_w^2)$. Dimensionless time	-	-
p		Static pressure; including non-dynamic pressure which depends on water velocity. Dynamic pressure is normally ignored in estimating the potential in groundwater flow relations.	$[M/(LT)^2]$	kPa
p_a		Atmospheric pressure	$[M/(LT)^2]$	kPa
p_t		Absolute pressure; $p_t=p_a+p_g$	$[M/(LT)^2]$	kPa
p_g		Gauge pressure; Difference between absolute pressure and atmospheric pressure.	$[M/(LT)^2]$	kPa
p_0		Initial pressure before test begins, prior to packer expansion.	$[M/(LT)^2]$	kPa
p_i		Pressure in measuring section before start of flow.	$[M/(LT)^2]$	kPa
p_f		Pressure during perturbation phase.	$[M/(LT)^2]$	kPa
p_s		Pressure during recovery.	$[M/(LT)^2]$	kPa
p_p		Pressure in measuring section before flow stop.	$[M/(LT)^2]$	kPa
p_F		Pressure in measuring section at end of recovery.	$[M/(LT)^2]$	kPa
p_D		$p_D=2\pi{\cdot}T{\cdot}p/(Q{\cdot}\rho_w g)$, Dimensionless pressure	-	-
dp		Pressure difference, drawdown of pressure surface between two points of time.	$[M/(LT)^2]$	kPa

Character	SICADA designation	Explanation	Dimension	Unit
dp_f		$dp_f = p_i - p_f$ or $= p_f – p_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dp_f usually expressed positive.	$[M/(LT)^2]$	kPa
dp_s		$dp_s = p_s – p_p$ or $= p_p – p_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_s usually expressed positive.	$[M/(LT)^2]$	kPa
dp_p		$dp_p = p_i – p_p$ or $= p_p – p_i$, **maximal** pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dp_p expressed positive.	$[M/(LT)^2]$	kPa
dp_F		$dp_F = p_p – p_F$ or $= p_F – p_p$, **maximal** pressure increase/drawdown of pressure surface between two points of time during recovery phase. dp_F expressed positive.	$[M/(LT)^2]$	kPa
H		Total head; (potential relative a reference level) (indication of h for phase as for p). $H=h_e+h_p+h_v$	[L]	m
h		Groundwater pressure level (hydraulic head (piezometric head; possible to use for level observations in boreholes, static head)); (indication of h for phase as for p). $h=h_e+h_p$	[L]	m
h_e		Height of measuring point (Elevation head); Level above reference level for measuring point.	[L]	m
h_p		Pressure head; Level above reference level for height of measuring point of stationary column of water giving corresponding static pressure at measuring point	[L]	m
h_v		Velocity head; height corresponding to the lifting for which the kinetic energy is capable (usually neglected in hydrogeology)	[L]	m
s		Drawdown; Drawdown from undisturbed level (same as dh_p, positive)	[L]	m
s_p		Drawdown in measuring section before flow stop.	[L]	m
			[L]	
h_0		Initial above reference level before test begins, prior to packer expansion.	[L]	m
h_i		Level above reference level in measuring section before start of flow.	[L]	m
h_f		Level above reference level during perturbation phase.	[L]	m
h_s		Level above reference level during recovery phase.	[L]	m
h_p		Level above reference level in measuring section before flow stop.	[L]	m
h_F		Level above reference level in measuring section at end of recovery.	[L]	m
dh		Level difference, drawdown of water level between two points of time.	[L]	m
dh_f		$dh_f = h_i - h_f$ or $= h_f – h_i$, drawdown/pressure increase of pressure surface between two points of time during perturbation phase. dh_f usually expressed positive.	[L]	m
dh_s		$dh_s = h_s – h_p$ or $= h_p – h_s$, pressure increase/drawdown of pressure surface between two points of time during recovery phase. dh_s usually expressed positive.	[L]	m
dh_p		$dh_p = h_i – h_p$ or $= h_p –h_i$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_p expressed positive.	[L]	m
dh_F		$dh_F = h_p – h_F$ or $= h_F – h_p$, maximal pressure increase/drawdown of pressure surface between two points of time during perturbation phase. dh_F expressed positive.	[L]	m
Te_w		Temperature in the test section (taken from temperature logging). Temperature		^oC
Te_{w0}		Temperature in the test section during undisturbed conditions (taken from temperature logging).		^oC

Character	SICADA designation	Explanation	Dimension	Unit
Te_o		Temperature in the observation section (taken from temperature logging). Temperature		^oC
EC_w		Electrical conductivity of water in test section.		mS/m
EC_{w0}		Electrical conductivity of water in test section during undisturbed conditions.		mS/m
EC_o		Electrical conductivity of water in observation section		mS/m
TDS_w		Total salinity of water in the test section.	$[M/L^3]$	mg/L
TDS_{w0}		Total salinity of water in the test section during undisturbed conditions.	$[M/L^3]$	mg/L
TDS_o		Total salinity of water in the observation section.	$[M/L^3]$	mg/L
g		Constant of gravitation (9.81 $m*s^{-2}$) (Acceleration due to gravity)	$[L/T^2]$	m/s^2
π	pi	Constant (approx 3.1416).	[-]	
r		Residual. r= p_c-p_m , r= h_c-h_m, etc. Difference between measured data (p_m, h_m, etc) and estimated data (p_c, h_c, etc)		
ME		Mean error in residuals. $ME = \frac{1}{n}\sum_{i=1}^{n} r_i$		
NME		Normalized ME. NME=ME/(x_{MAX}-x_{MIN}), x: measured variable considered.		
MAE		Mean absolute error. $MAE = \frac{1}{n}\sum_{i=1}^{n} \lvert r_i \rvert$		
NMAE		Normalized MAE. NMAE=MAE/(x_{MAX}-x_{MIN}), x: measured variable considered.		
RMS		Root mean squared error. $RMS = \left(\frac{1}{n}\sum_{i=1}^{n} r_i^2\right)^{0.5}$		
NRMS		Normalized RMR. NRMR=RMR/(x_{MAX}-x_{MIN}), x: measured variable considered.		
SDR		Standard deviation of residual. $SDR = \left(\frac{1}{n-1}\sum_{i=1}^{n} (r_i - ME)^2\right)^{0.5}$		
SEMR		Standard error of mean residual. $SEMR = \left(\frac{1}{n(n-1)}\sum_{i=1}^{n} (r_i - ME)^2\right)^{0.5}$		
Parameters				
Q/s		Specific capacity s=dp_p or s=s_p=h_0-h_p (open borehole)	$[L^2/T]$	m^2/s
D		Interpreted flow dimension according to Barker, 1988.	[-]	-
dt_1		Time of starting for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
dt_2		End of time for semi-log or log-log evaluated characteristic counted from start of flow phase and recovery phase respectively.	[T]	s
dt_L		Response time to obtain 0.1 m (or 1 kPa) drawdown in observation section counted from start of recovery phase.	[T]	s
TB		Flow capacity in a one-dimensional structure of width B and transmissivity T. Transient evaluation of one-dimensional structure	$[L^3/T]$	m^3/s
T		Transmissivity	$[L^2/T]$	m^2/s
T_M		Transmissivity according to Moye (1967)	$[L^2/T]$	m^2/s
T_Q		Evaluation based on Q/s and regression curve between Q/s and T, as example see Rhén et al (1997) p. 190.	$[L^2/T]$	m^2/s
T_S		Transmissivity evaluated from slug test	$[L^2/T]$	m^2/s

Character	SICADA designation	Explanation	Dimension	Unit
T_D		Transmissivity evaluated from PFL-Difference Flow Meter	$[L^2/T]$	m^2/s
T_I		Transmissivity evaluated from Impeller flow log	$[L^2/T]$	m^2/s
T_{Sf}, T_{Lf}		Transient evaluation based on semi-log or log-log diagram for perturbation phase in injection or pumping.	$[L^2/T]$	m^2/s
T_{Ss}, T_{Ls}		Transient evaluation based on semi-log or log-log diagram for recovery phase in injection or pumping.	$[L^2/T]$	m^2/s
T_T		Transient evaluation (log-log or lin-log). Judged best evaluation of T_{Sf}, T_{Lf}, T_{Ss}, T_{Ls}	$[L^2/T]$	m^2/s
T_{NLR}		Evaluation based on non-linear regression.	$[L^2/T]$	m^2/s
T_{Tot}		Judged most representative transmissivity for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).	$[L^2/T]$	m^2/s
K		Hydraulic conductivity	[L/T]	m/s
K_s		Hydraulic conductivity based on spherical flow model	[L/T]	m/s
K_m		Hydraulic conductivity matrix, intact rock	[L/T]	m/s
k		Intrinsic permeability	$[L^2]$	m^2
kb		Permeability-thickness product: kb=k·b	$[L^3]$	m^3
SB		Storage capacity in a one-dimensional structure of width B and storage coefficient S. Transient evaluation of one-dimensional structure	[L]	m
SB*		Assumed storage capacity in a one-dimensional structure of width B and storage coefficient S. Transient evaluation of one-dimensional structure	[L]	m
S		Storage coefficient, (Storativity)	[-]	-
S*		Assumed storage coefficient	[-]	-
S_y		Theoretical specific yield of water (Specific yield; unconfined storage. Defined as total porosity (n) minus retention capacity (S_r)	[-]	-
S_{ya}		Specific yield of water (Apparent specific yield); unconfined storage, field measuring. Corresponds to volume of water achieved on draining saturated soil or rock in free draining of a volumetric unit. S_{ya}= S_y (often called S_y in literature)	[-]	-
S_r		Specific retention capacity, (specific retention of water, field capacity) (Specific retention); unconfined storage. Corresponds to water volume that the soil or rock has left after free draining of saturated soil or rock.	[-]	-
S_f		Fracture storage coefficient	[-]	-
S_m		Matrix storage coefficient	[-]	-
S_{NLR}		Storage coefficient, evaluation based on non-linear regression	[-]	-
S_{Tot}		Judged most representative storage coefficient for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).	[-]	-
S_s		Specific storage coefficient; confined storage.	[1/L]	1/m
S_s*		Assumed specific storage coefficient; confined storage.	[1/L]	1/m
c_f		Hydraulic resistance: The hydraulic resistance is an aquitard with a flow vertical to a two-dimensional formation. The inverse of c is also called Leakage coefficient. c_f=b´/K´ where b´ is thickness of the aquitard and K´ its hydraulic conductivity across the aquitard.	[T]	s
L_f		Leakage factor: $L_f = (K \cdot b \cdot c_f)^{0.5}$ where K represents characteristics of the aquifer.	[L]	m
ξ	Skin	Skin factor	[-]	-

Character	SICADA designation	Explanation	Dimension	Unit
ξ*	Skin	Assumed skin factor	[-]	-
C		Wellbore storage coefficient	$[(LT^2)\cdot M^2]$	m^3/Pa
C_D		$C_D = C\cdot\rho_w g /(2\pi\cdot S\cdot r_w^2)$, Dimensionless wellbore storage coefficient	[-]	-
ω	Stor-ratio	$\omega = S_f /(S_f + S_m)$, storage ratio (Storativity ratio); the ratio of storage coefficient between that of the fracture and total storage.	[-]	-
λ	Interflow-coeff	$\lambda = \alpha\cdot (K_m / K_f) \cdot r_w^2$ interporosity flow coefficient.	[-]	-
T_{GRF}		Transmissivity interpreted using the GRF method	$[L^2/T]$	m^2/s
S_{GRF}		Storage coefficient interpreted using the GRF method	[1/L]	1/m
D_{GRF}		Flow dimension interpreted using the GRF method	[-]	-
c_w		Water compressibility; corresponding to β in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_r		Pore-volume compressibility, (rock compressibility); Corresponding to α/n in hydrogeological literature.	$[(LT^2)/M]$	1/Pa
c_t		$c_t = c_r + c_w$, total compressibility; compressibility per volumetric unit of rock obtained through multiplying by the total porosity, n. (Presence of gas or other fluids can be included in c_t if the degree of saturation (volume of respective fluid divided by n) of the pore system of respective fluid is also included)	$[(LT^2)/M]$	1/Pa
nc_t		Porosity-compressibility factor: $nc_t = n\cdot c_t$	$[(LT^2)/M]$	1/Pa
nc_tb		Porosity-compressibility-thickness product: $nc_tb = n\cdot c_t\cdot b$	$[(L^2T^2)/M]$	m/Pa
n		Total porosity	-	-
n_e		Kinematic porosity, (Effective porosity)	-	-
e		Transport aperture. $e = n_e\cdot b$	[L]	m
ρ	Density	Density	$[M/L^3]$	$kg/(m^3)$
ρ_w	Density-w	Fluid density in measurement section during pumping/injection	$[M/L^3]$	$kg/(m^3)$
ρ_o	Density-o	Fluid density in observation section	$[M/L^3]$	$kg/(m^3)$
ρ_{sp}	Density-sp	Fluid density in standpipes from measurement section	$[M/L^3]$	$kg/(m^3)$
μ	my	Dynamic viscosity	[M/LT]	Pa s
μ_w	my	Dynamic viscosity (Fluid density in measurement section during pumping/injection)	[M/LT]	Pa s
FC_T		Fluid coefficient for intrinsic permeability, transference of k to K; $K=FC_T\cdot k$; $FC_T=\rho_w \cdot g/ \mu_w$	[1/LT]	1/(ms)
FC_S		Fluid coefficient for porosity-compressibility, transference of c_t to S_s ; $S_s=FC_S\cdot n\cdot c_t$; $FC_S=\rho_w \cdot g$	$[M/T^2L^2]$	Pa/m
Index on K, T and S				
S		S: semi-log		
L		L: log-log		
f		Pump phase or injection phase, designation following S or L (withdrawal)		
s		Recovery phase, designation following S or L (recovery)		
NLR		NLR: Non-linear regression. Performed on the entire test sequence, perturbation and recovery		
M		Moye		
GRF		Generalised Radial Flow according to Barker (1988)		
m		Matrix		
f		Fracture		
T		Judged best evaluation based on transient evaluation.		

Character	SICADA designation	Explanation	Dimension	Unit
Tot		Judged most representative parameter for particular test section and (in certain cases) evaluation time with respect to available data (made by SKB at a later stage).		
b		Bloch property in a numerical groundwater flow model		
e		Effective property (constant) within a domain in a numerical groundwater flow model.		
Index on p and Q				
0		Initial condition, undisturbed condition in open holes		
i		Natural, "undisturbed" condition of formation parameter		
f		Pump phase or injection phase (withdrawal, flowing phase)		
s		Recovery, shut-in phase		
p		Pressure or flow in measuring section at end of perturbation period		
F		Pressure in measuring section at end of recovery period.		
m		Arithmetical mean value		
c		Estimated value. The index is placed last if index for “where” and “what” are used. Simulated value		
m		Measured value. The index is placed last if index for “where” and “what” are used. Measured value		
Some miscellaneous indexes on p and h				
w		Test section (final difference pressure during flow phase in test section can be expressed dp_{wp}; First index shows “where” and second index shows “what”)		
o		Observation section (final difference pressure during flow phase in observation section can be expressed dp_{op}; First index shows “where” and second index shows “what”)		
f		Fresh-water head. Water is normally pumped up from section to measuring hoses where pressure and level are observed. Density of the water is therefore approximately the same as that of the measuring section. Measured groundwater level is therefore normally represented by what is defined as point-water head. If pressure at the measuring level is recalculated to a level for a column of water with density of fresh water above the measuring point it is referred to as fresh-water head and h is indicated last by an f. Observation section (final level during flow phase in observation section can be expressed h_{opf}; the first index shows “where” and the second index shows “what” and the last one “recalculation”)		

APPENDIX 6

SICADA Data Tables

APPENDIX 6-1

SICADA Data Tables

Flow Logging

(Simplified version v1.7)

SICADA/Data Import Template

File Identity	
Created By	
Created	

File Time Zone

Compiled By	
Quality Check For Delivery	
Delivery Approval	

Activity Type	HY690 HY690 - PLU Flow logging-Impeller

Project	AP PS 400-06-110

Activity Information						Additional Activity Data						
						C10	I250	P20	P200	P220	R240	R25
Idcode	Start Date	Stop Date	Secup (m)	Seclow (m)	Section No	Company	Test equipment	Field crew manager	Field crew	Person evaluating data	calibration type	Report
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, P. Wolf	R. van der Wall		Stephan Rohs
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, M. Andrassy	R. van der Wall		Stephan Rohs
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		Golder Associates	HTHB2	Philipp Wolf	P. Wolf, S. Rohs	P. Wolf		Stephan Rohs
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, M. Andrassy	R. van der Wall		Stephan Rohs
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		Golder Associates	HTHB2	Philipp Wolf	P. Wolf, S. Rohs	P. Wolf		Stephan Rohs
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, M. Andrassy	R. van der Wall		Stephan Rohs
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, P. Wolf	R. van der Wall		Stephan Rohs
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		Golder Associates	HTHB2	Reinder van der Wall	R. van der Wall, P. Wolf	R. van der Wall		Stephan Rohs
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		Golder Associates	HTHB2	Philipp Wolf	P. Wolf, S. Rohs	P. Wolf		Stephan Rohs

Table	plu_impell_main_res
	Flowlogging with impeller, evaluated data of the entire hole

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
l	FLOAT	m	Corrected borehole length
cum_flow_q0	FLOAT	m**3/s	Undisturbed cumulative flow rate, see table description
cum_flow_q1	FLOAT	m**3/s	Cumulative flow rate at pumping flow Q1/head h1,see descr.
cum_flow_q2	FLOAT	m**3/s	Cumulative flow rate at pumping flow Q2/head h2, see descr.
cum_flow_q1t	FLOAT	m**3/s	Cumulative flow at the top of measured interval,pump flow Q1
cum_flow_q2t	FLOAT	m**3/s	Cumulative flow at the top of measured interval,pump flow Q2
corr_cum_flow_q1c	FLOAT	m**3/s	Corrected cumulative flow q1 at pump flow Q1,see tabledescr.
corr_cum_flow_q2c	FLOAT	m**3/s	Corrected cumulative flow q2 at pump flow Q2,see tabledescr.
corr_cum_flow_q1tc	FLOAT	m**3/s	Corrected cumulative flow q1T at pump flow Q1,see...
corr_cum_flow_q2tc	FLOAT	m**3/s	Corrected cumulative flow q2T at pump flow Q2,see...
corr_com_flow_q1tc	FLOAT	m**3/s	Corrected q1Tc for estimated borehole radius (rwa)
corr_com_flow_q2tc	FLOAT	m**3/s	Corrected q2Tc for estimated borehole radius (rwa)
transmissitivy_hole_	FLOAT	m**2/s	T: Transmissivity of the entire hole, see table description
value_type_t	CHAR		0:true value,-1:T<lower meas.limit,1:T>upper meas.limit
bc_t	CHAR		Best choice code: 1 means T is best transm. choice, else 0
cum_transmissivity_	FLOAT	m**2	T_F: Cumulative transmissivity, see table description
value_type_tf	CHAR		0:true value,-1:TF<lower meas.limit,1:TF>upper meas.limit
bc_tf	CHAR		Best choice code: 1 means TF is best transm. choice, else 0
l_measl_tf	FLOAT	m**2/s	Lower measurement limit of T_F,see table description
cum_transmissivity_	FLOAT	m**2	T_FT: Cumulative transmissivity, see table description
value_type_tft	CHAR		0:true value,-1:TFT<lower meas.limit,1:TFT>upper meas.limit
bc_tft	CHAR		Best choice code: 1 means TFT is best transm. choice,else 0
u_measl_tf	FLOAT	m**2/s	Upper measurement limit of T_F, see table description
reference	CHAR		SKB number for reports describing data and results
comments	CHAR		Short comment to evaluated data (optional)
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Activity QA signature

idcode	start_date	stop_date	(m) secup	(m) seclow	section_no	(m) l	(m**3/s) cum_flow_q0	(m**3/s) cum_flow_q1	(m**3/s) cum_flow_q2	(m**3/s) cum_flow_q1t	(m**3/s) cum_flow_q2t	(m**3/s) corr_cum_flow_q1c	(m**3/s) corr_cum_flow_q2c	(m**3/s) corr_cum_flow_q1tc
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00			4.57E-04	6.42E-04						
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00			2.33E-04	3.10E-04						
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00			6.35E-04	6.58E-04						
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00			1.09E-04	1.06E-03						
HLX 32	2006.11.29 14:17	2006.11.29 14:17	22.00	160.00			6.67E-03	1.95E-04						
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00			5.97E-04	1.07E-03						
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00			1.90E-04	2.42E-04						
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00			5.20E-04	5.42E-04						
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00			9.08E-04	1.05E-03						

idcode	(m**3/s) corr_cum_flow_q2tc	(m**3/s) corr_com_flow_q1tcr	(m**3/s) corr_com_flow_q2tcr	(m**2/s) transmissivy_hole_t	value_type_t	bc_t	(m**2) cum_transmissivity_tf	value_type_tf	bc_tf	(m**2/s) l_measl_tf	(m**2) cum_transmissivity_tft	value_type_tft	bc_tft	(m**2/s) u_measl_tf	reference	comments
HLX 14				7.99E-05	0	1	5.69E-05	0	0	6.23E-06						
HLX 20				1.52E-05	0	1	2.70E-06	0	0	2.45E-06						
HLX 27				5.01E-05	0	1	4.83E-05	0	0	3.81E-06						
HLX 28				3.62E-04	0	1	3.74E-04	0	0	1.71E-05						
HLX 32				2.03E-05	0	1	6.94E-06	0	0	5.21E-06						
HLX 33				1.21E-04	0	1	6.77E-05	0	0	5.67E-06						
HLX 37				3.68E-05	0	1	2.89E-05	0	0	7.61E-06						
HLX 39				1.48E-04	0	1	1.42E-04	0	0	1.37E-05						
HLX 43				1.43E-04	0	1	1.24E-04	0	0	6.84E-06						

Table	plu_impeller_anomaly Evaluated data of interpreted anomalies		
Column	**Datatype**	**Unit**	**Column Description**
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
l_a_upper	FLOAT	m	Borehole length to upper limit of inferred flow anomaly
l_a_lower	FLOAT	m	Borehole length to lower limit of inferred flow anomaly
fluid_temp_tea	FLOAT	oC	Measured borehole fluid temperature at inferred anomaly.
fluid_elcond_eca	FLOAT	mS/m	Measured fluid el conductivity of borehole fluid at anomaly
fluid_salinity_tdsa	FLOAT	mg/l	Calculated total dissolved solids of fluid at anomaly, see.
dq1	FLOAT	m**3/s	Flow rate of inferred flow anomaly at pump flow Q1or head h1
dq2	FLOAT	m**3/s	Flow rate of inferred flow anomaly at pump flowQ2 or head h2
r_wa	FLOAT	m	Estimated borehole radius
dq1_corrected	FLOAT	m**3/s	Corrected flow rate of anomaly at pump flow Q1 or see descr.
dq2_corrected	FLOAT	m**3/s	Corrected flow rate of anomaly at pump flow Q2, or see descr
spec_cap_dq1c_s1	FLOAT	m**2/s	dq1/s1.Spec. capacity of anomaly at pump flow Q1 or ..,see
spec_cap_dq2c_s2	FLOAT	m**2/s	dq2/s2.Spec. capacity of anomaly at pump flow Q2 or.,see des
value_type_dq1_s1	CHAR		0:true value,-1:<lower meas.limit,1:>upper meas.limit.
value_type_dq2_s2	CHAR		0:true value,-1:<lower meas.limit,1:>upper meas.limit.
ba	FLOAT	m	Representative thickness of anomaly for TFa,see description
transmissivity_tfa	FLOAT	m**2/s	Transmissivity of inferred flow anomaly.
value_type_tfa	CHAR		0:true value,-1:TFa<lower meas.limit,1:TFa>upper meas.limit.
bc_tfa	CHAR		Best choice code.1 means TFa is best choice of T, else 0
l_measl_tfa	FLOAT	m**2/s	Lower measurement limit of TFa, see table description
u_measl_tfa	FLOAT	m**2/s	Upper measurement limit of TFa, see table description
comments	CHAR		Short comment on evaluated parameters
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Activity QA signature

			(m)	(m)		(m)	(m)	(oC)	(mS/m)	(mg/l)	(m**3/s)
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**l_a_upper**	**l_a_lower**	**fluid_temp_tea**	**fluid_elcond_eca**	**fluid_salinity_tdsa**	**dq1**
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		110.00	110.50	8.45	109.50		3.53E-04
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		99.00	100.00	8.40	105.30		1.03E-04
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		72.00	76.50	7.86	34.76		1.78E-04
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		44.00	48.00	7.67	34.49		5.50E-05
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		158.00	159.00	8.72	468.10		2.08E-04
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		157.50	158.00	8.72	306.2		2.87E-04
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		104.00	105.50	8.49	245.5		1.40E-04
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		78.00	79.50	7.76	47.07		1.09E-03
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		111.00	111.50	8.93	34.82		4.13E-04
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		102.00	102.50	8.83	45.30		5.67E-05
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		34.00	39.00	8.22	48.17		1.27E-04
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		97.00	100.50	8.28	29.50		1.90E-04
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		191.00	192.50	9.18	45.02		5.20E-04
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		153.00	151.00	8.52	94.6		3.38E-04
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		80.00	80.50	8.09	57.8		8.33E-05
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		77.50	78.00	7.91	50.0		4.87E-04

idcode	dq2 (m**3/s)	r_wa (m)	dq1_corrected (m**3/s)	dq2_corrected (m**3/s)	spec_cap_dq1c_s1 (m**2/s)	spec_cap_dq2c_s2 (m**2/s)	value_type_dq1_s1	value_type_dq2_s2	ba (m)	transmissivity_tfa (m**2/s)	value_type_tfa	bc_tfa	l_measl_tfa (m**2/s)	u_measl_tfa (m**2/s)	comments
HLX 14		0.7			6.55E-05		0		0.5	4.40E-05	0	1	6.23E-06		
HLX 14		0.7			1.92E-05		0		1.0	1.29E-05	0	1	6.23E-06		
HLX 20		0.7			1.79E-05		0		4.5	8.74E-06	0	1	2.45E-06		
HLX 20		0.7			5.51E-06		0		4.0	2.70E-06	0	1	2.45E-06		
HLX 27		0.7			2.53E-05		0		1.0	1.59E-05	0	1	3.81E-06		
HLX 27		0.7			3.48E-05		0		0.5	2.18E-05	0	1	3.81E-06		
HLX 27		0.7			1.70E-05		0		1.5	1.07E-05	0	1	3.81E-06		
HLX 28		0.7			3.15E-04		0		1.5	3.74E-04	0	1	1.71E-05		
HLX 33		0.7			6.44E-05		0		0.5	4.69E-05	0	1	5.67E-06		
HLX 33		0.7			8.82E-06		0		0.5	7.75E-06	0	1	5.67E-06		
HLX 33		0.7			1.97E-05		0		5.0	1.30E-05	0	1	5.67E-06		
HLX 37		0.7			4.28E-05		0		3.5	2.89E-05	0	1	7.61E-06		
HLX 39		0.7			7.02E-05		0		1.5	4.06E-05	0	1	1.37E-05		
HLX 43		0.7			8.55E-05		0		0.5	4.63E-05	0	1	6.84E-06		
HLX 43		0.7			2.11E-05		0		0.5	1.14E-05	0	1	6.84E-06		
HLX 43		0.7			1.23E-04		0		0.5	6.66E-05	0	1	6.84E-06		

Table	plu_impeller_basic_d Flow logging using impeller, basic data

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
sign	CHAR		Activity QA signature
start_flowlogging	DATE	yyyymmdd	Date and time of flowlogging start (YYYY-MM-DD hh:mm:ss)
stop_flowlogging	DATE	yyyymmdd	Date and time of flowlogging stop (YYYY-MM-DD hh:mm:ss)
l	FLOAT	m	Corrected borehole length during logging, see table descr.
test_type	CHAR		Type of test,(1- 7); see table description
formation_type	CHAR		1: Rock, 2: Soil (supeficial deposits)
q_measl_l	FLOAT	m**3/s	Estimated lower measurement limit of borehole flow,see des.
q_measl_u	FLOAT	m**3/s	Estimated upper measurement limit of borehole flow,see desc.
pump_flow_q1	FLOAT	m**3/s	Flow rate at surface during flow logging period 1
pump_flow_q2	FLOAT	m**3/s	Flow rate at surface during flow logging period 2
dur_flow_phase_tp1	FLOAT	s	Duration of flow period 1
dur_flow_phase_tp2	FLOAT	s	Duration of flow period 2
dur_flowlog_tfl_1	FLOAT	s	Duration of the flowlogging survey 1
dur_flowlog_tfl_2	FLOAT	s	Duration of the flowlogging survey 2
drawdown_s1	FLOAT	m	Representative drawdown in borehole during flowlog period 1
drawdown_s2	FLOAT	m	Representative drawdown in borehole during flowlog period 2
initial_head_ho	FLOAT	m.a.s.l.	Initial hydraulic head (open borehole),see table description
hydraulic_head_h1	FLOAT	m.a.s.l.	Represen. hydr.head during flow period 1,see table descr.
hydraulic_head_h2	FLOAT	m.a.s.l.	Represen. hydr.head during flow period 2,see table descr.
reference	CHAR		SKB report number for reports describing data & evaluation
comments	VARCHAR		Short comment to the evaluated parameters (optional))

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	start_flowlogging (yyyymmdd)	stop_flowlogging (yyyymmdd)	l (m)	test_type	formation_type	q_measl_l (m**3/s)	q_measl_u (m**3/s)
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		20061104	20061104		6	1	5.0000E-05	1.6667E-03
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		20061110	20061110		6	1	5.0000E-05	1.6667E-03
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		20061124	20061124		6	1	5.0000E-05	1.6667E-03
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		20061108	20061108		6	1	5.0000E-05	1.6667E-03
HLX 32	2006.11.29 14:17	2006.11.29 14:17	22.00	160.00		20061129	20061129		6	1	5.0000E-05	1.6667E-03
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		20061112	20061112		6	1	5.0000E-05	1.6667E-03
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		20061102	20061102		6	1	5.0000E-05	1.6667E-03
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		20061106	20061106		6	1	5.0000E-05	1.6667E-03
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		20061202	20061202		6	1	5.0000E-05	1.6667E-03

idcode	(m**3/s) pump_flow_q1	(m**3/s) pump_flow_q2	(s) dur_flow_phase_tp1	(s) dur_flow_phase_tp2	(s) dur_flowlog_tfl_1	(s) dur_flowlog_tfl_2	(m) drawdown_s1	(m) drawdown_s2	(m.a.s.l.) initial_head_ho	(m.a.s.l.) hydraulic_head_h1	(m.a.s.l.) hydraulic_head_h2	reference	comments
HLX 14	6.42E-04		17090		9720		5.39		7.66	2.27			
HLX 20	3.10E-04		21498		14220		9.99		5.96	-4.03			
HLX 27	6.58E-04		19960		12780		8.24		4.42	-3.82			
HLX 28	1.06E-03		18516		11160		3.47		7.59	4.12			
HLX 32	1.95E-04		13202		5940		9.56		3.98	-5.58			
HLX 33	1.07E-03		19037		11760		6.42		7.54	1.12			
HLX 37	2.42E-04		20899		13500		4.44		9.01	4.57			
HLX 39	5.42E-04		22705		15420		7.41		10.39	2.98			
HLX 43	1.05E-03		33273		10560		3.96		9.48	5.52			

Table	plu_impeller_ec_temp Measurements of EC and Temp during Impeller Flow logging

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
idcode	CHAR		Object or borehole identification code
sign	CHAR		Activity QA signature
test_type	CHAR		Test type 1-7; see table description
date	DATE	yyyymmdd	Date and time of measurement(YYYY_MM_DD hh:mm:ss)
bhlen	FLOAT	m	Borehole lenght to point of measuring
temperature	FLOAT	degrees	Fluid temperature iat measured depth
elcond	FLOAT	mS/m	Electric conductivity of borehole fluid at measured depth.
reference	CHAR		SKB report No for reports describing data and evaluation
comments	CHAR		Short comment to the measurements

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 10:45	114.0	8.36	122.62		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 10:49	112.0	8.38	118.84		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 10:55	110.5	8.46	108.97		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 10:52	110.0	8.45	109.46		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 10:59	108.0	8.45	108.80		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:02	106.0	8.45	108.24		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:05	104.0	8.44	107.98		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:08	102.0	8.44	107.59		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:11	100.0	8.44	107.50		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:22	99.5	8.41	104.62		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:19	99.0	8.40	104.49		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:17	98.5	8.40	105.03		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:14	98.0	8.40	105.34		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:25	96.0	8.40	103.95		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:28	94.0	8.40	103.67		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:31	92.0	8.40	103.41		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:34	90.0	8.39	103.03		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:37	88.0	8.39	102.57		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:40	86.0	8.39	102.21		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:43	84.0	8.38	101.83		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:46	82.0	8.38	101.51		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:48	80.0	8.38	101.37		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:51	78.0	8.37	100.87		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:54	76.0	8.34	101.00		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 11:57	74.0	8.34	100.71		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:00	72.0	8.33	100.34		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:03	70.0	8.33	99.92		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:05	68.0	8.32	99.27		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:19	67.5	8.32	97.53		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:16	67.0	8.32	97.80		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:14	66.5	8.32	98.86		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:08	66.0	8.32	99.39		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:11	64.0	8.31	98.58		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:22	62.0	8.31	98.08		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:26	60.0	8.31	96.87		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:28	58.0	8.30	97.36		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:31	56.0	8.30	97.46		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:42	55.5	8.30	94.78		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:39	55.0	8.30	96.08		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:36	54.5	8.30	96.83		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:34	54.0	8.29	96.82		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	start_date	stop_date	secup	seclow	section_no	test_type	date	bhlen	temperature	elcond	reference	comments
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:47	52.5	8.29	94.45		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:45	52.0	8.29	95.34		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:51	50.0	8.29	94.38		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:53	48.0	8.28	94.20		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:56	46.0	8.28	93.85		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 12:59	44.0	8.27	93.63		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:02	42.0	8.27	93.46		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:04	40.0	8.26	93.18		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:07	38.0	8.25	92.89		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:10	36.0	8.25	92.69		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:12	34.0	8.24	92.53		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:15	32.0	8.24	92.34		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:18	30.0	8.23	91.97		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:21	28.0	8.22	91.74		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:23	26.0	8.20	91.21		
HLX 14	2006.11.04 10:46	2006.11.04 13:28	25.00	114.00		6	2006.11.04 13:26	25.0	8.20	91.31		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:07	196.0	9.44	103.80		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:09	194.0	9.39	103.57		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:13	192.0	9.38	103.55		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:16	190.0	9.36	103.54		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:19	188.0	9.35	103.41		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:21	186.0	9.33	103.32		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:23	184.0	9.32	103.26		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:24	182.0	9.30	103.13		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:28	180.0	9.30	103.03		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:31	178.0	9.30	102.91		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:36	176.0	9.28	102.77		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:39	174.0	9.26	102.50		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:42	172.0	9.25	101.70		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:44	170.0	9.24	101.65		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:46	168.0	9.21	99.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:48	166.0	9.14	82.83		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:52	164.0	9.09	64.54		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:53	162.0	9.05	52.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 11:57	160.0	9.00	45.45		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:00	158.0	8.93	42.74		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:01	156.0	8.88	41.76		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:03	154.0	8.84	41.46		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:04	152.0	8.82	41.25		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:07	150.0	8.81	41.25		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**test_type**	**date**	**bhlen**	**temperature**	**elcond**	**reference**	**comments**
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:08	148.0	8.79	41.14		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:10	146.0	8.77	41.14		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:12	144.0	8.75	41.13		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:13	142.0	8.74	41.09		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:15	140.0	8.72	41.08		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:16	138.0	8.71	41.08		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:18	136.0	8.69	41.09		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:20	134.0	8.67	41.09		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:21	132.0	8.65	41.09		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:23	130.0	8.63	41.07		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:24	128.0	8.61	41.15		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:26	126.0	8.58	41.46		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:28	124.0	8.53	41.51		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:29	122.0	8.50	41.52		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:31	120.0	8.48	41.74		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:32	118.0	8.46	42.34		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:33	116.0	8.42	44.47		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:35	114.0	8.37	44.24		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:36	112.0	8.36	44.24		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:38	110.0	8.36	44.25		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:39	108.0	8.34	44.36		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:40	106.0	8.32	44.36		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:42	104.0	8.31	44.25		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:43	102.0	8.30	44.26		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:45	100.0	8.28	44.19		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:47	98.0	8.26	44.20		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:49	96.0	8.25	44.08		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:50	94.0	8.24	44.06		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:51	92.0	8.22	43.43		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:53	90.0	8.16	40.60		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:55	88.0	8.15	40.59		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 12:57	86.0	8.13	40.54		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:00	84.0	8.12	40.43		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:03	82.0	8.11	40.31		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:04	80.0	8.09	40.52		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:07	78.0	8.07	40.41		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:10	76.0	7.86	34.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:17	74.0	7.87	34.94		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:25	72.0	7.86	34.76		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:29	70.0	7.86	34.78		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:33	68.0	7.85	34.65		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:37	66.0	7.84	34.66		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:43	64.0	7.84	34.67		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:46	62.0	7.83	34.55		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:50	60.0	7.83	34.53		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:53	58.0	7.82	34.66		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 13:57	56.0	7.83	34.67		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:00	54.0	7.82	34.64		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:04	52.0	7.81	34.65		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:07	50.0	7.81	34.66		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:10	48.0	7.80	34.65		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:13	46.0	7.76	34.54		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:20	44.5	7.72	34.49		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:17	44.0	7.71	34.48		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:24	42.0	7.71	34.49		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:28	40.0	7.68	34.49		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:31	38.0	7.68	34.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:34	36.0	7.67	34.38		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:38	34.0	7.67	34.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:41	32.0	7.66	34.38		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:44	30.0	7.66	34.37		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:48	28.0	7.65	34.38		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:51	26.0	7.65	34.49		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:55	24.0	7.64	34.50		
HLX 20	2006.11.10 11:06	2006.11.10 15:03	22.00	196.00		6	2006.11.10 14:58	22.0	7.64	34.49		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 09:16	162.0	8.83	643.67		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:10	160.0	8.75	468.08		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:18	158.5	8.72	311.61		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:15	158.0	8.72	310.22		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:31	157.0	8.72	306.31		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:28	156.5	8.72	306.23		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:25	156.0	8.72	320.93		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:33	155.5	8.72	305.42		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:36	154.0	8.72	305.80		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:39	152.0	8.72	307.80		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:41	150.0	8.72	307.66		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:46	148.0	8.72	307.43		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:48	146.0	8.72	309.12		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:51	144.0	8.71	309.32		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:53	142.0	8.71	310.33		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**test_type**	**date**	**bhlen**	**temperature**	**elcond**	**reference**	**comments**
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:56	140.0	8.71	309.11		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 11:59	138.0	8.71	309.08		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:02	136.0	8.70	310.15		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:04	134.0	8.70	310.19		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:07	132.0	8.70	310.37		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:10	130.0	8.69	310.12		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:13	128.0	8.69	311.71		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:15	126.0	8.69	311.35		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:18	124.0	8.69	311.78		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:21	122.0	8.68	312.18		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:23	120.0	8.68	311.50		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:26	118.0	8.67	311.83		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:28	116.0	8.67	312.11		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:31	114.0	8.66	312.22		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:33	112.0	8.66	311.30		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:36	110.0	8.65	310.11		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:38	108.0	8.65	310.50		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:41	106.0	8.63	309.46		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:50	105.5	8.50	247.14		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:48	105.0	8.49	244.31		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:45	104.5	8.49	246.20		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:43	104.0	8.49	245.53		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:53	102.0	8.48	243.17		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:55	100.0	8.47	244.52		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 12:59	98.0	8.47	243.15		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:01	96.0	8.47	243.20		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:04	94.0	8.46	243.08		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:06	92.0	8.45	242.01		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:09	90.0	8.44	241.75		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:12	88.0	8.44	240.43		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:14	86.0	8.43	239.43		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:17	84.0	8.43	239.63		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:19	82.0	8.42	239.29		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:21	80.0	8.40	236.03		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:23	78.0	8.39	235.17		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:26	76.0	8.39	236.06		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:29	74.0	8.39	235.94		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:31	72.0	8.38	236.32		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:33	70.0	8.37	236.14		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:36	68.0	8.37	236.20		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:38	66.0	8.36	236.14		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:40	64.0	8.36	236.01		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:43	62.0	8.35	236.15		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:45	60.0	8.35	236.27		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:48	58.0	8.34	236.27		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:50	56.0	8.34	236.15		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:52	54.0	8.33	236.62		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:55	52.0	8.32	236.42		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 13:57	50.0	8.32	235.89		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:00	48.0	8.31	236.28		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:02	46.0	8.29	233.26		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:04	44.0	8.29	233.43		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:07	42.0	8.28	233.23		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:10	40.0	8.28	233.39		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:12	38.0	8.27	233.87		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:14	38.0	8.27	233.93		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:17	36.0	8.26	232.27		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:19	34.0	8.25	230.04		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:21	32.0	8.24	230.14		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:24	30.0	8.23	229.76		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:26	28.0	8.22	229.54		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:29	26.0	8.19	222.96		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:32	24.0	8.19	224.25		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:35	22.0	8.18	224.29		
HLX 27	2006.11.24 11:07	2006.11.24 14:41	20.00	162.00		6	2006.11.24 14:37	20.0	8.18	223.95		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:53	141.0	8.28	85.83		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:54	139.0	8.22	85.71		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:55	137.0	8.20	85.70		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:56	135.0	8.19	85.64		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:57	133.0	8.18	85.65		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 12:58	131.0	8.17	85.66		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:01	129.0	8.18	85.66		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:04	127.0	8.15	85.56		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:05	125.0	8.13	85.54		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:06	123.0	8.12	85.54		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:07	121.0	8.12	85.44		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:09	119.0	8.11	85.43		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:10	117.0	8.10	85.44		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:12	115.0	8.09	85.37		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:13	113.0	8.07	85.37		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:14	111.0	8.07	85.39		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:15	109.0	8.06	85.39		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:17	107.0	8.04	85.26		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:18	105.0	8.03	85.28		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:19	103.0	8.02	85.25		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:21	101.0	8.01	85.27		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:22	99.0	8.00	85.14		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:24	97.0	8.00	85.15		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:26	95.0	7.99	85.14		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:27	93.0	7.95	84.34		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:36	91.0	7.92	81.72		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:40	89.0	7.88	76.01		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:41	87.0	7.81	50.58		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:44	85.0	7.80	51.72		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:44	83.0	7.78	51.78		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:45	81.0	7.78	51.43		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:53	79.5	7.78	49.97		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:49	79.0	7.77	47.55		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:10	78.5	7.77	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:06	78.0	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:03	77.5	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 13:59	77.0	7.76	47.07		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:14	75.0	7.76	47.16		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:18	73.0	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:21	71.0	7.76	47.07		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:28	69.0	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:31	67.0	7.76	46.95		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:35	65.0	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:39	63.0	7.76	46.94		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:43	61.0	7.76	46.93		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:47	59.0	7.76	46.94		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:50	57.0	7.76	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:53	55.0	7.76	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 14:58	53.0	7.76	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:02	51.0	7.75	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:05	49.0	7.75	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:10	47.0	7.75	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:14	45.0	7.75	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:17	43.0	7.75	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:21	41.0	7.75	47.05		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	start_date	stop_date	secup	seclow	section_no	test_type	date	bhlen	temperature	elcond	reference	comments
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:25	39.0	7.75	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:28	37.0	7.74	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:31	35.0	7.74	47.04		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:35	33.0	7.74	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:40	31.0	7.74	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:44	29.0	7.74	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:47	27.0	7.73	47.05		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:50	25.0	7.73	47.04		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:53	23.0	7.73	47.06		
HLX 28	2006.11.08 12:52	2006.11.08 15:58	22.00	141.00		6	2006.11.08 15:56	22.0	7.73	47.06		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 09:10	160.0	8.57	56.06		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:12	158.0	8.52	55.05		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:14	156.0	8.50	54.81		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:14	154.0	8.47	54.46		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:16	152.0	8.44	54.31		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:17	150.0	8.43	54.31		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:18	148.0	8.41	54.43		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:19	146.0	8.39	54.42		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:21	144.0	8.35	54.19		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:22	142.0	8.32	54.14		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:23	140.0	8.31	54.15		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:24	138.0	8.31	54.13		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:25	136.0	8.29	54.02		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:27	134.0	8.27	53.91		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:28	132.0	8.24	53.87		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:29	130.0	8.20	53.76		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:30	128.0	8.18	53.64		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:31	126.0	8.15	53.65		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:32	124.0	8.13	53.66		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:33	122.0	8.10	53.64		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:34	120.0	8.08	53.65		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:35	118.0	8.04	53.75		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:37	116.0	7.99	53.92		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:38	114.0	7.95	53.86		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:39	112.0	7.94	53.88		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:40	110.0	7.91	53.91		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:41	108.0	7.88	53.92		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:42	106.0	7.84	53.85		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:44	104.0	7.79	54.20		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:45	102.0	7.77	54.12		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	start_date	stop_date	secup	seclow	section_no	test_type	date	bhlen	temperature	elcond	reference	comments
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:46	100.0	7.75	54.30		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:48	98.0	7.73	54.42		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:49	96.0	7.71	54.48		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:50	94.0	7.68	54.68		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:52	92.0	7.67	54.70		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:53	90.0	7.65	54.79		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:54	88.0	7.63	54.96		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:55	86.0	7.61	55.33		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:57	84.0	7.59	55.60		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 14:58	82.0	7.57	56.71		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:00	80.0	7.51	60.08		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:01	78.0	7.49	59.80		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:02	75.9	7.48	59.68		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:04	74.0	7.46	57.82		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:06	72.0	7.43	55.76		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:08	70.0	7.41	55.60		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:10	68.0	7.40	54.94		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:11	66.0	7.39	54.78		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:12	64.0	7.38	54.58		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:14	62.0	7.37	54.42		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:15	60.0	7.36	54.31		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:16	58.0	7.35	54.14		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:18	56.0	7.34	54.03		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:19	54.0	7.33	53.91		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:20	52.0	7.32	53.86		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:22	50.0	7.30	53.77		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:23	48.0	7.29	53.65		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:25	46.0	7.27	53.60		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:27	44.0	7.25	53.38		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:29	42.0	7.24	53.37		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:31	40.0	7.22	53.26		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:34	38.0	7.21	53.25		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:36	36.0	7.18	54.95		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:37	34.0	7.16	55.06		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:38	32.0	7.15	54.80		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:41	30.0	7.13	54.01		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:41	28.0	7.11	53.75		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:45	26.0	7.10	53.76		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:48	24.0	7.09	53.66		
HLX 32	2006.11.29 14:17	2006.11.29 15:56	22.00	160.00		6	2006.11.30 15:55	22.0	7.03	53.64		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:12	111.5	8.94	35.05		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:09	111.0	8.94	34.82		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:17	109.0	8.93	35.05		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:20	107.0	8.93	35.11		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:23	105.0	8.92	35.21		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:26	103.0	8.90	35.21		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:40	102.5	8.91	35.61		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:37	102.0	8.85	43.14		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:33	101.5	8.83	45.14		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:30	101.0	8.83	45.01		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:43	99.0	8.83	45.30		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:47	97.0	8.82	45.45		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:51	95.0	8.82	45.85		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:54	93.0	8.81	45.73		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 11:58	91.0	8.80	45.85		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:01	89.0	8.80	45.95		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:04	87.0	8.79	46.02		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:08	85.0	8.78	46.23		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:11	83.0	8.77	46.21		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:14	81.0	8.76	46.34		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:18	79.0	8.75	46.40		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:22	77.0	8.74	46.50		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:26	75.0	8.74	46.50		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:29	73.0	8.73	46.62		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:33	71.0	8.72	46.62		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:36	69.0	8.71	46.68		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:40	67.0	8.70	46.67		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:43	65.0	8.69	46.78		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:46	63.0	8.64	48.16		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:50	61.0	8.63	48.26		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:53	59.0	8.63	48.29		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 12:57	57.0	8.61	48.28		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:00	55.0	8.61	48.39		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:03	53.0	8.60	48.43		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:07	51.0	8.59	48.43		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:10	49.0	8.58	48.45		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:13	47.0	8.57	48.55		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:16	45.0	8.56	48.54		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:19	43.0	8.52	48.54		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:23	41.0	8.51	48.66		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**test_type**	**date**	**bhlen**	**temperature**	**elcond**	**reference**	**comments**
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:26	39.0	8.50	48.64		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:29	37.0	8.38	49.36		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:32	35.0	8.36	49.47		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:44	34.5	8.24	48.54		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:42	34.0	8.24	48.45		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:39	33.5	8.23	48.37		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:36	33.0	8.23	48.17		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:48	31.0	8.22	48.55		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:50	29.0	8.21	48.65		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:54	27.0	8.19	48.77		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:00	25.5	8.06	50.13		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 13:57	25.0	8.07	49.58		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:03	23.0	8.04	49.74		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:08	21.0	8.03	49.97		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:17	20.0	8.03	50.25		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:14	19.5	8.02	50.11		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:20	19.0	8.02	50.29		
HLX 33	2006.11.12 11:06	2006.11.12 14:22	19.00	111.00		6	2006.11.12 14:11	19.0	8.01	50.03		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:52	195.0	9.20	29.98		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:53	193.0	9.12	29.92		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:54	191.0	9.12	29.91		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:55	189.0	9.11	29.97		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:56	187.0	9.11	29.98		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:58	185.0	9.08	29.91		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:58	183.0	9.07	29.93		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 10:59	181.0	9.06	29.92		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:00	179.0	9.07	29.92		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:01	177.0	9.07	29.93		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:02	175.0	9.03	29.91		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:03	173.0	9.01	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:04	171.0	9.01	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:05	169.0	8.99	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:06	167.0	8.98	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:07	165.0	8.99	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:08	163.0	9.01	29.91		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:09	161.0	9.00	29.92		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:10	159.0	8.96	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:11	157.0	8.92	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:12	155.0	8.90	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:16	153.0	8.90	29.80		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:26	151.0	8.89	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:27	149.0	8.86	29.79		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:28	147.0	8.84	29.81		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:29	145.0	8.82	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:30	143.0	8.79	29.80		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:32	141.0	8.79	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:33	139.0	8.77	29.70		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:34	137.0	8.73	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:38	135.0	8.74	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:41	133.0	8.73	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:43	131.0	8.69	29.71		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:44	129.0	8.65	29.64		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:06	128.5	8.70	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:03	128.0	8.69	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:58	127.5	8.68	29.70		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 11:54	127.0	8.66	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:08	125.0	8.66	29.69		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:10	123.0	8.64	29.63		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:14	121.0	8.60	29.64		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:15	119.0	8.56	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:16	117.0	8.53	29.55		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:17	115.0	8.52	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:19	113.0	8.51	29.43		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:20	111.0	8.50	29.44		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:21	109.0	8.51	29.41		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:22	107.0	8.48	29.43		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:23	105.0	8.47	29.42		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:24	103.0	8.45	29.43		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:26	101.0	8.39	30.58		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:37	100.5	8.44	29.43		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:34	100.0	8.38	30.75		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:31	99.5	8.36	30.49		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:29	99.0	8.38	30.27		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:46	98.0	8.36	30.48		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:43	97.5	8.33	30.25		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:40	97.0	8.29	29.43		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:50	95.0	8.29	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:52	93.0	8.29	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:56	91.0	8.29	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 12:59	89.0	8.29	29.63		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**test_type**	**date**	**bhlen**	**temperature**	**elcond**	**reference**	**comments**
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:02	87.0	8.28	29.64		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:05	85.0	8.28	29.63		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:08	83.0	8.27	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:11	81.0	8.27	29.52		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:14	79.0	8.27	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:17	77.0	8.26	29.64		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:19	75.0	8.26	29.52		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:22	73.0	8.25	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:25	71.0	8.25	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:28	69.0	8.25	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:30	67.0	8.24	29.52		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:33	65.0	8.23	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:36	63.0	8.23	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:39	61.0	8.22	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:41	59.0	8.22	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:44	57.0	8.22	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:47	55.0	8.21	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:50	53.0	8.20	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:53	51.0	8.20	29.52		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:55	49.0	8.19	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 13:58	47.0	8.19	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:01	45.0	8.19	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:04	43.0	8.17	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:07	41.0	8.17	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:10	39.0	8.18	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:13	37.0	8.17	29.54		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:16	35.0	8.16	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:19	33.0	8.15	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:22	31.0	8.14	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:24	29.0	8.13	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:27	27.0	8.12	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:30	25.0	8.12	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:33	23.0	8.11	29.53		
HLX 37	2006.11.02 10:52	2006.11.02 14:37	21.00	195.00		6	2006.11.02 14:36	21.0	8.11	29.52		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:35	197.0	9.24	43.59		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:37	195.0	9.22	45.19		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:41	193.0	9.19	47.24		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:59	192.5	9.18	46.95		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:55	192.0	9.18	45.96		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:52	191.5	9.18	45.12		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 11:48	191.0	9.18	45.02		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:04	189.0	9.18	45.19		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:08	187.0	9.18	45.30		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:11	185.0	9.18	45.30		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:15	183.0	9.18	45.40		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:19	181.0	9.18	45.40		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:23	179.0	9.17	45.40		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:26	177.0	9.17	45.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:30	175.0	9.17	45.46		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:33	173.0	9.17	45.46		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:37	171.0	9.17	45.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:41	169.0	9.16	45.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:45	167.0	9.16	45.58		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:48	165.0	9.16	45.56		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:52	163.0	9.15	45.56		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 12:59	161.0	9.15	45.68		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:03	159.0	9.15	45.57		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:07	157.0	9.14	45.68		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:11	155.0	9.14	45.67		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:14	153.0	9.14	45.67		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:16	151.0	9.13	45.69		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:19	149.0	9.13	45.68		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:21	147.0	9.12	45.67		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:24	145.0	9.12	45.69		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:27	143.0	9.11	45.68		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:29	141.0	9.11	45.67		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:32	139.0	9.10	45.68		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:34	137.0	9.10	45.67		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:37	135.0	9.09	45.58		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:40	133.0	9.08	45.56		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:43	131.0	9.08	45.55		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:45	129.0	9.07	45.58		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:48	127.0	9.07	45.57		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:50	125.0	9.06	45.57		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:53	123.0	9.05	45.56		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:56	121.0	9.05	45.57		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 13:58	119.0	9.04	45.46		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:01	117.0	9.03	45.46		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:04	115.0	9.02	45.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:06	113.0	9.02	45.45		

idcode	start_date	stop_date	secup (m)	seclow (m)	section_no	test_type	date (yyyymmdd)	bhlen (m)	temperature (degrees)	elcond (mS/m)	reference	comments
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:09	111.0	9.01	45.41		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:12	109.0	9.01	45.40		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:14	107.0	8.99	45.40		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:17	105.0	8.99	45.29		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:20	103.0	8.98	45.28		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:23	101.0	8.97	45.29		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:26	99.0	8.96	45.17		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:28	97.0	8.96	45.17		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:31	95.0	8.94	45.12		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:34	93.0	8.93	45.12		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:36	91.0	8.93	45.12		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:39	89.0	8.92	45.02		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:42	87.0	8.91	45.01		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:44	85.0	8.90	44.90		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:47	83.0	8.89	44.90		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:50	81.0	8.88	44.91		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:53	79.0	8.87	44.80		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:56	77.0	8.85	44.80		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 14:59	75.0	8.85	44.74		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:01	73.0	8.84	44.74		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:04	71.0	8.82	44.64		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:07	69.0	8.82	44.65		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:09	67.0	8.81	44.62		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:12	65.0	8.79	44.51		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:15	63.0	8.78	44.52		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:17	61.0	8.77	44.52		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:20	59.0	8.76	44.46		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:23	57.0	8.75	44.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:25	55.0	8.74	44.45		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:28	53.0	8.73	44.36		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:31	51.0	8.72	44.36		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:33	49.0	8.71	44.25		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:36	47.0	8.70	44.17		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:39	45.0	8.69	44.19		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:42	43.0	8.68	44.18		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:44	41.0	8.67	44.19		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:47	39.0	8.66	44.20		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:50	37.0	8.65	44.07		
HLX 39	2006.11.06 11:35	2006.11.06 15:52	35.00	197.00		6	2006.11.06 15:53	35.0	8.64	44.07		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 10:33	165.0	8.70	87.14		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	start_date	stop_date	secup	seclow	section_no	test_type	date	bhlen	temperature	elcond	reference	comments
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:26	163.0	8.62	87.20		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:28	161.0	8.61	87.16		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:29	159.0	8.60	87.54		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:31	157.0	8.59	87.97		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:32	155.0	8.57	89.19		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:33	153.0	8.55	92.66		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:37	151.0	8.52	94.58		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:39	149.0	8.52	94.31		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:42	147.0	8.51	94.30		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:44	145.0	8.50	94.20		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:47	143.0	8.46	89.84		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:56	142.5	8.48	94.21		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:54	142.0	8.41	64.16		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:52	141.5	8.41	64.17		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:49	141.0	8.41	63.71		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 11:59	139.0	8.41	64.64		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:01	137.0	8.41	64.48		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:04	135.0	8.41	64.38		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:06	133.0	8.41	64.66		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:09	131.0	8.41	64.48		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:11	129.0	8.40	64.49		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:14	127.0	8.40	64.49		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:16	125.0	8.40	64.48		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:19	123.0	8.40	64.49		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:21	121.0	8.39	64.37		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:23	119.0	8.39	64.39		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:26	117.0	8.39	64.37		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:28	115.0	8.38	64.26		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:31	113.0	8.38	64.26		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:33	111.0	8.38	64.28		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:36	109.0	8.37	64.17		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:38	107.0	8.37	64.17		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:41	105.0	8.36	64.16		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:43	103.0	8.36	64.14		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:45	101.0	8.36	64.15		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:48	99.0	8.35	64.08		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:50	97.0	8.35	64.10		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:52	95.0	8.34	64.10		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:55	93.0	8.34	63.99		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:57	91.0	8.32	63.26		

			(m)	(m)			(yyyymmdd)	(m)	(degrees)	(mS/m)		
idcode	**start_date**	**stop_date**	**secup**	**seclow**	**section_no**	**test_type**	**date**	**bhlen**	**temperature**	**elcond**	**reference**	**comments**
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 12:59	89.0	8.32	63.31		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:02	87.0	8.31	63.44		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:04	85.0	8.31	63.43		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:06	83.0	8.30	63.43		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:09	81.0	8.26	63.27		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:11	81.0	8.27	63.27		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:20	80.5	8.13	58.97		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:18	80.0	8.11	59.13		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:16	79.5	8.10	57.49		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:13	79.0	8.09	57.78		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:27	78.0	8.06	56.00		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:25	77.5	7.91	50.94		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:23	77.0	7.90	50.02		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:30	75.0	7.91	50.03		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:32	73.0	7.90	50.04		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:34	71.0	7.91	49.97		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:36	69.0	7.90	49.76		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:39	67.0	7.90	49.76		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:41	65.0	7.90	49.75		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:44	63.0	7.90	49.75		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:46	61.0	7.90	49.64		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:49	59.0	7.89	49.65		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:51	57.0	7.89	49.64		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:53	55.0	7.89	49.58		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:55	53.0	7.89	49.59		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 13:58	51.0	7.89	49.59		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:00	49.0	7.88	49.47		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:03	47.0	7.88	49.48		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:05	45.0	7.88	49.50		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:07	43.0	7.88	49.37		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:10	41.0	7.87	49.38		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:12	39.0	7.87	49.37		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:14	37.0	7.87	49.32		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:17	35.0	7.87	49.31		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:19	33.0	7.86	49.32		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:21	31.0	7.86	49.31		
HLX 43	2006.12.02 11:27	2006.12.02 14:23	29.00	165.00		6	02.12.2006 14:24	29.0	7.86	49.32		

APPENDIX 6-2

SICADA Data Tables

Pump Tests

SICADA/Data Import Template

File Identity	
Created By	
Created	

Compiled By	
Quality Check For Delivery	
Delivery Approval	

Activity Type	HY 690 Pump tests
Project	AP PS 400-06-1

Activity Information						**Additional Activity Data**		
						C10	P20	P200
Idcode	**Start Date**	**Stop Date**	**Secup (m)**	**Seclow (m)**	**Section No**	**Company**	**Field crew manager**	**Field crew**
HLX 14	2006.11.04 08:43	2006.11.04 13:43	11.90	115.90		Golder Associates	Reinder van der Wall	R. van der Wall, P. Wolf
HLX 20	2006.11.10 09:04	2006.11.10 15:30	9.03	202.20		Golder Associates	Reinder van der Wall	R. van der Wall, M. Andrassy
HLX 27	2006.11.24 09:06	2006.11.24 14:45	6.03	164.70		Golder Associates	Philipp Wolf	P. Wolf, S. Rohs
HLX 28	2006.11.08 10:45	2006.11.08 16:20	6.03	154.20		Golder Associates	Reinder van der Wall	R. van der Wall, M. Andrassy
HLX 32	2006.11.30 09:16	2006.11.30 16:05	12.30	162.60		Golder Associates	Philipp Wolf	P. Wolf, S. Rohs
HLX 33	2006.11.12 09:03	2006.11.12 14:43	9.03	202.10		Golder Associates	Reinder van der Wall	R. van der Wall, M. Andrassy
HLX 37	2006.11.02 08:47	2006.11.02 14:52	12.10	199.80		Golder Associates	Reinder van der Wall	R. van der Wall, P. Wolf
HLX 39	2006.11.06 08:55	2006.11.06 16:03	6.10	199.30		Golder Associates	Reinder van der Wall	R. van der Wall, P. Wolf
HLX 43	2006.12.02 09:26	2006.12.03 09:40	6.00	170.60		Golder Associates	Philipp Wolf	P. Wolf, S. Rohs

Table	plu_s_hole_test_d PLU Injection and pumping, General information

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
test_type	CHAR		Test type code (1-7), see table description
formation_type	CHAR		1: Rock, 2: Soil (superficial deposits)
start_flow_period	DATE	yyyymmdd	Date & time of pumping/injection start (YYYY-MM-DD hh:mm:ss)
stop_flow_period	DATE	yyyymmdd	Date & time of pumping/injection stop (YYYY-MM-DD hh:mm:ss)
flow_rate_end_qp	FLOAT	m**3/s	Flow rate at the end of the flowing period
value_type_qp	CHAR		0:true value,-1<lower meas.limit1:>upper meas.limit
mean_flow_rate_qm	FLOAT	m**3/s	Arithmetic mean flow rate during flow period
q_measl__l	FLOAT	m**3/s	Estimated lower measurement limit of flow rate
q_measl__u	FLOAT	m**3/s	Estimated upper measurement limit of flow rate
tot_volume_vp	FLOAT	m**3	Total volume of pumped or injected water
dur_flow_phase_tp	FLOAT	s	Duration of the flowing period of the test
dur_rec_phase_tf	FLOAT	s	Duration of the recovery period of the test
initial_head_hi	FLOAT	m	Hydraulic head in test section at start of the flow period
head_at_flow_end_h	FLOAT	m	Hydraulic head in test section at stop of the flow period.
final_head_hf	FLOAT	m	Hydraulic head in test section at stop of recovery period.
initial_press_pi	FLOAT	kPa	Groundwater pressure in test section at start of flow period
press_at_flow_end_p	FLOAT	kPa	Groundwater pressure in test section at stop of flow period.
final_press_pf	FLOAT	kPa	Ground water pressure at the end of the recovery period.
fluid_temp_tew	FLOAT	oC	Measured section fluid temperature, see table description
fluid_elcond_ecw	FLOAT	mS/m	Measured section fluid el. conductivity,see table descr.
fluid_salinity_tdsw	FLOAT	mg/l	Total salinity of section fluid based on EC,see table descr.
fluid_salinity_tdswm	FLOAT	mg/l	Tot. section fluid salinity based on water sampling,see...
reference	CHAR		SKB report No for reports describing data and evaluation
comments	VARCHAR		Short comment to data
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Signature for QA data accknowledge (QA - OK)
lp	FLOAT	m	Hydraulic point of application

idcode	start_date	stop_date	secup	seclow	section_ no	test_type	formation_ type	start_flow_period	stop_flow_period	flow_rate_end_ qp	value_type_ qp	mean_flow_ rate_qm	q_measl__l	q_measl__u
HLX 14	20061104 08:43	20061104 13:43	11.90	115.90		1B	1	2006-11-04 08:45:28	2006-11-04 13:29:18	6.42E-04	0	6.55E-04	1.67E-05	2.50E-03
HLX 20	20061110 09:04	20061110 15:30	9.03	202.20		1B	1	2006-11-10 09:08:02	2006-11-10 15:06:20	3.10E-04	0	3.23E-04	1.67E-05	2.50E-03
HLX 27	20061124 09:06	20061124 14:45	6.03	164.70		1B	1	2006-11-24 09:07:55	2006-11-24 14:40:35	6.58E-04	0	6.72E-04	1.67E-05	2.50E-03
HLX 28	20061108 10:45	20061108 16:20	6.03	154.20		1B	1	2006-11-08 10:51:02	2006-11-08 15:59:38	1.06E-03	0	1.06E-03	1.67E-05	2.50E-03
HLX 32	20061130 09:16	20061130 16:05	12.30	162.60		1B	1	2006-11-30 12:11:33	2006-11-30 15:51:35	1.95E-04	0	1.98E-04	1.67E-05	2.50E-03
HLX 33	20061112 09:03	20061112 14:43	9.03	202.10		1B	1	2006-11-12 09:06:06	2006-11-12 14:24:23	1.07E-03	0	1.08E-03	1.67E-05	2.50E-03
HLX 37	20061102 08:47	20061102 14:52	12.10	199.80		1B	1	2006-11-02 08:49:45	2006-11-02 14:38:04	2.42E-04	0	2.43E-04	1.67E-05	2.50E-03
HLX 39	20061106 08:55	20061106 16:03	6.10	199.30		1B	1	2006-11-06 09:35:32	2006-11-06 15:53:57	5.42E-04	0	5.52E-04	1.67E-05	2.50E-03
HLX 43	20061202 09:26	20061203 09:40	6.00	170.60		1B	1	2006-12-02 09:27:38	2006-12-02 18:42:11	1.05E-03	0	1.05E-03	1.67E-05	2.50E-03

idcode	tot_volume_vp	dur_flow_phase_tp	dur_rec_phase_tf	initial_head_hi	head_at_flow_end_hp	final_head_hf	initial_press_pi	press_at_flow_end_pp	final_press_pf	fluid_temp_tew	fluid_elcond_ecw	fluid_salinity_tdsw	fluid_salinity_tdswm	reference	comments	lp
HLX 14	1.12E+01	17090	#NV			#NV	210	157	#NV	8.3						
HLX 20	6.95E+00	21498	#NV			#NV	211	113	#NV	8.6						
HLX 27	1.34E+01	19960	#NV			#NV	210	129	#NV	8.6						
HLX 28	1.97E+01	18516	#NV			#NV	205	171	#NV	8.0						
HLX 32	2.62E+00	13202	#NV			#NV	204	111	#NV	8.5						
HLX 33	2.05E+01	19037	#NV			#NV	196	133	#NV	8.5						
HLX 37	5.09E+00	20899	#NV			#NV	201	158	#NV	8.9						
HLX 39	1.25E+01	22705	#NV			#NV	228	155	#NV	9.2						
HLX 43	3.50E+01	33273	53913			20.49	205	166	201	7.8						

Table	plu_s_hole_test_ed1
	PLU Single hole tests, pumping/injection. Basic evaluation

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
start_date	DATE		Date (yymmdd hh:mm:ss)
stop_date	DATE		Date (yymmdd hh:mm:ss)
project	CHAR		project code
idcode	CHAR		Object or borehole identification code
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
section_no	INTEGER	number	Section number
test_type	CHAR		Test type code (1-7), see table description!
formation_type	CHAR		Formation type code. 1: Rock, 2: Soil (superficial deposits)
lp	FLOAT	m	Hydraulic point of application for test section, see descr.
seclen_class	FLOAT	m	Planned ordinary test interval during test campaign.
spec_capacity_q_s	FLOAT	m**2/s	Specific capacity (Q/s) of test section, see table descript.
value_type_q_s	CHAR		0:true value,-1:Q/s<lower meas.limit,1:Q/s>upper meas.limit
transmissivity_tq	FLOAT	m**2/s	Tranmissivity based on Q/s, see table description
value_type_tq	CHAR		0:true value,-1:TQ<lower meas.limit,1:TQ>upper meas.limit.
bc_tq	CHAR		Best choice code. 1 means TQ is best choice of T, else 0
transmissivity_moye	FLOAT	m**2/s	Transmissivity,TM, based on Moye (1967)
bc_tm	CHAR		Best choice code. 1 means Tmoye is best choice of T, else 0
value_type_tm	CHAR		0:true value,-1:TM<lower meas.limit,1:TM>upper meas.limit.
hydr_cond_moye	FLOAT	m/s	K_M: Hydraulic conductivity based on Moye (1967)
formation_width_b	FLOAT	m	b:Aquifer thickness repr. for T(generally b=Lw) ,see descr.
width_of_channel_b	FLOAT	m	B:Inferred width of formation for evaluated TB
tb	FLOAT	m**3/s	TB:Flow capacity in 1D formation of T & width B, see descr.
l_measl_tb	FLOAT	m**3/s	Estimated lower meas. limit for evaluated TB,see description
u_measl_tb	FLOAT	m**3/s	Estimated upper meas. limit of evaluated TB,see description
sb	FLOAT	m	SB:S=storativity,B=width of formation,1D model,see descript.
assumed_sb	FLOAT	m	SB* : Assumed SB,S=storativity,B=width of formation,see...
leakage_factor_lf	FLOAT	m	Lf:1D model for evaluation of Leakage factor
transmissivity_tt	FLOAT	m**2/s	TT:Transmissivity of formation, 2D radial flow model,see...
value_type_tt	CHAR		0:true value,-1:TT<lower meas.limit,1:TT>upper meas.limit,
bc_tt	CHAR		Best choice code. 1 means TT is best choice of T, else 0
l_measl_q_s	FLOAT	m**2/s	Estimated lower meas. limit for evaluated TT,see table descr
u_measl_q_s	FLOAT	m**2/s	Estimated upper meas. limit for evaluated TT,see description
storativity_s	FLOAT		S:Storativity of formation based on 2D rad flow,see descr.
assumed_s	FLOAT		Assumed Storativity,2D model evaluation,see table descr.
bc_s	FLOAT		Best choice of S (Storativity) ,see descr.
ri	FLOAT	m	Radius of influence
ri_index	CHAR		ri index=index of radius of influence :-1,0 or 1, see descr.
leakage_coeff	FLOAT	1/s	K'/b':2D rad flow model evaluation of leakage coeff,see desc
hydr_cond_ksf	FLOAT	m/s	Ksf:3D model evaluation of hydraulic conductivity,see desc.
value_type_ksf	CHAR		0:true value,-1:Ksf<lower meas.limit,1:Ksf>upper meas.limit,
l_measl_ksf	FLOAT	m/s	Estimated lower meas.limit for evaluated Ksf,see table desc.
u_measl_ksf	FLOAT	m/s	Estimated upper meas.limit for evaluated Ksf,see table descr
spec_storage_ssf	FLOAT	1/m	Ssf:Specific storage,3D model evaluation,see table descr.
assumed_ssf	FLOAT	1/m	Ssf*:Assumed Spec.storage,3D model evaluation,see table des.
c	FLOAT	m**3/pa	C: Wellbore storage coefficient; flow or recovery period
cd	FLOAT		CD: Dimensionless wellbore storage coefficient
skin	FLOAT		Skin factor;best estimate of flow/recovery period,see descr.
dt1	FLOAT	s	Estimated start time of evaluation, see table description
dt2	FLOAT	s	Estimated stop time of evaluation. see table description
t1	FLOAT	s	Start time for evaluated parameter from start flow period
t2	FLOAT	s	Stop time for evaluated parameter from start of flow period
dte1	FLOAT	s	Start time for evaluated parameter from start of recovery
dte2	FLOAT	s	Stop time for evaluated parameter from start of recovery
p_horner	FLOAT	kPa	p*:Horner extrapolated pressure, see table description
transmissivity_t_nlr	FLOAT	m**2/s	T_NLR Transmissivity based on None Linear Regression...
storativity_s_nlr	FLOAT		S_NLR=storativity based on None Linear Regression,see..
value_type_t_nlr	CHAR		0:true value,-1:T_NLR<lower meas.limit,1:>upper meas.limit
bc_t_nlr	CHAR		Best choice code. 1 means T_NLR is best choice of T, else 0
c_nlr	FLOAT	m**3/pa	Wellbore storage coefficient, based on NLR, see descr.
cd_nlr	FLOAT		Dimensionless wellbore storage constant, see table descrip.
skin_nlr	FLOAT		Skin factor based on Non Linear Regression,see desc.
transmissivity_t_grf	FLOAT	m**2/s	T_GRF:Transmissivity based on Genelized Radial Flow,see...
value_type_t_grf	CHAR		0:true value,-1:T_GRF<lower meas.limit,1:>upper meas.limit
bc_t_grf	CHAR		Best choice code. 1 means T_GRF is best choice of T, else 0
storativity_s_grf	FLOAT		S_GRF:Storativity based on Generalized Radial Flow, see des.
flow_dim_grf	FLOAT		Inferred flow dimesion based on Generalized Rad. Flow model
comment	VARCHAR	no_unit	Short comment to the evaluated parameters
error_flag	CHAR		If error_flag = "*" then an error occured and an error
in_use	CHAR		If in_use = "*" then the activity has been selected as
sign	CHAR		Signature for QA data accknowledge (QA - OK)

idcode	start_date	stop_date	secup	seclow	section_no	test_type	formation_ type	lp	seclen_class	spec_capacity_ q_s	value_type_ q_s	transmissivity _tq	value_type_ tq	bc_tq	transmissivity_ moye	bc_tm	value_type_t m	hydr_cond_ moye	formation_ width_b
HLX 14	20061104 08:43	20061104 13:43	11.90	115.90		1B	1		104	1.19E-04	0				1.44E-04	0	0	1.38E-06	
HLX 20	20061110 09:04	20061110 15:30	9.03	202.20		1B	1		193	3.10E-05	0				4.06E-05	0	0	2.10E-07	
HLX 27	20061124 09:06	20061124 14:45	6.03	164.70		1B	1		159	7.99E-05	0				1.02E-04	0	0	6.43E-07	
HLX 28	20061108 10:45	20061108 16:20	6.03	154.20		1B	1		148	3.05E-04	0				3.87E-04	0	0	2.61E-06	
HLX 32	20061130 09:16	20061130 16:05	12.30	162.60		1B	1		150	2.04E-05	0				2.59E-05	0	0	1.72E-07	
HLX 33	20061112 09:03	20061112 14:43	9.03	202.10		1B	1		193	1.66E-04	0				2.18E-04	0	0	1.13E-06	
HLX 37	20061102 08:47	20061102 14:52	12.10	199.80		1B	1		188	5.44E-05	0				7.10E-05	0	0	3.78E-07	
HLX 39	20061106 08:55	20061106 16:03	6.10	199.30		1B	1		193	7.31E-05	0				9.57E-05	0	0	4.95E-07	
HLX 43	20061202 09:26	20061203 09:40	6.00	170.60		1B	1		165	2.66E-04	0				3.41E-04	0	0	2.07E-06	

idcode	width_of_channel_b	tb	l_measl_tb	u_measl_tb	sb	assumed_sb	leakage_factor_lf	transmissivity_tt	value_type_tt	bc_tt	l_measl_q_s	u_measl_q_s	storativity_s	assumed_s	bc_s	ri	ri_index	leakage_coeff	hydr_cond_ksf	value_type_ksf	l_measl_ksf	u_measl_ksf
HLX 14								7.99E-05	0	1	5.00E-05	1.00E-04	1.00E-03	1.00E-03		882.92	0					
HLX 20								1.52E-05	0	1	6.00E-06	5.00E-05	1.00E-03	1.00E-03		653.99	0					
HLX 27								5.01E-05	0	1	1.00E-05	9.00E-05	1.00E-03	1.00E-03		849.09	0					
HLX 28								3.62E-04	0	1	9.00E-05	7.00E-04	1.00E-03	1.00E-03		348.66	1					
HLX 32								2.03E-05	0	1	9.00E-06	7.00E-05	1.00E-03	1.00E-03		550.94	-1					
HLX 33								1.21E-04	0	1	7.00E-05	5.00E-04	1.00E-03	1.00E-03		368.37	-1					
HLX 37								3.68E-05	0	1	8.00E-06	8.00E-05	1.00E-03	1.00E-03		804.34	0					
HLX 39								1.48E-04	0	1	4.00E-05	5.00E-04	1.00E-03	1.00E-03		474.07	1					
HLX 43								1.43E-04	0	1	7.00E-05	5.00E-04	1.00E-03	1.00E-03		1424.93	0					

idcode	spec_storage_ssf	assumed_ssf	c	cd	skin	dt1	dt2	t1	t2	dte1	dte2	p_horner	transmissivity_t_nlr	storativity_s_nlr	value_type_t_nlr	bc_t_nlr	c_nlr	cd_nlr	skin_nlr	transmissivity_t_grf	value_type_t_grf	bc_t_grf	storativity_s_grf	flow_dim_grf	comment
HLX 14			2.01E-05	6.53E-01	-3.5	8464	15120					#NV													
HLX 20			2.79E-07	9.06E-03	-2.9	1765	10905					#NV													
HLX 27			7.37E-07	2.39E-02	-3.3	228	13829					#NV													
HLX 28			1.47E-06	4.77E-02	-2.5	352	1252					#NV													
HLX 32			2.95E-06	9.58E-02	0.0	#NV	#NV					#NV													
HLX 33			2.27E-06	7.37E-02	-2.1	724	2417					#NV													
HLX 37			2.69E-07	8.74E-03	-2.8	823	18725					#NV													
HLX 39			3.10E-06	1.01E-01	2.9	1853	3620					#NV													
HLX 43			3.37E-06	1.09E-01	-4.1	718	25262					202.3													