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Forsmark site investigation

Single-hole injection tests in borehole KFM07A

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May 2005

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Abstract

Borehole KFM07A is the seventh deep core-drilled borehole within the site investigations in the Forsmark area. It is designed as a so called telescopic borehole, with an enlarged diameter in the upper approximately 100 m, which makes it possible to install certain borehole equipment. The borehole is inclined c 60° from the horizontal plane, about 1,000 m long and cased to about 100 m borehole length. The borehole diameter is about 77 mm in the interval c 102–1,002 m.

This report presents injection tests performed using the pipe string system PSS3 in borehole KFM07A and the test results.

The main aim of the injection tests in KFM07A was to characterize the hydraulic conditions of the rock adjacent to the borehole on different measurement scales (100 m, 20 m and 5 m). Hydraulic parameters such as transmissivity and hydraulic conductivity were determined using analysis methods for transient as well as stationary conditions together with the dominating flow regime and possible outer hydraulic boundaries. In addition, a comparison with the results of the previously performed difference flow logging campaign was made.

The injection tests gave consistent results on the different measurement scales regarding transmissivity. During c 50% of the tests, a certain period with pseudo-radial flow could be identified from the injection period, making a relatively straight-forward transient evaluation possible. However, the recovery periods were often strongly affected by wellbore storage, making a transient evaluation of this period more difficult.

The injection test results were generally consistent with the results from the previous difference flow logging in KFM07A. In some cases however, differences of the position of the test sections for the injection tests and the difference flow logging respectively, made comparisons uncertain. Furthermore, the latter measurements suffered from a high noise level of flow rate, making measured low flow rates uncertain or, alternatively, below the measurement limit.

The injection tests provide a database for statistical analysis of the hydraulic conductivity distribution along the borehole on the different measurement scales. Basic statistical parameters are presented in this report.

Sammanfattning

Borrhål KFM07A är det sjunde kärnborrhålet i platsundersökningarna i Forsmarksområdet. Det är utfört som ett så kallat teleskopborrhål för att göra det möjligt att installera viss borrhålsutrustning i de övre, ca 100 m med större diameter än resten av borrhålet. Borrhålet är ansatt med en lutning av ca 60° från horisontalplanet, är drygt 1 000 m långt och försett med foderrör till ca 100 m. Borrhålsdiametern är ca 77 mm i intervallet ca 102–1 002 m.

Föreliggande rapport beskriver genomförda injektionstester med rörgångssystemet PSS3 i borrhål KFM07A samt resultaten från desamma.

Huvudsyftet med injektionstesterna var att karaktärisera de hydrauliska förhållandena av berget i anslutning till borrhålet i olika mätskalor (100 m, 20 m och 5 m). Hydrauliska parametrar såsom transmissivitet och hydraulisk konduktivitet bestämdes med hjälp av analysmetoder för såväl transienta som stationära förhållanden tillsammans med dominerande flödesregim och eventuella yttre hydrauliska randvillkor.

En jämförelse med resultaten av den tidigare utförda differensflödesloggningen i KFM07A gjordes också.

Injektionstesterna gav samstämmiga resultat för de olika mätskalorna beträffande transmissivitet. Under ca 50 % av testerna kunde en viss period med pseudo-radiellt flöde identifieras från flödesperioden, vilket möjliggjorde en standardmässig transient utvärdering. Återhämtningsperioden var däremot ofta starkt påverkad av brunnsmagasinseffekter, vilket gjorde en unik transient utvärdering av denna period svårare.

Injektionstesterna gav även över lag samstämmiga resultat med den tidigare utförda differensflödesloggningen i KFM07A. I några fall gjorde dock skillnader mellan sektionernas positioner för injektionstesterna respektive mätningarna från differensflödesloggningen att resultatet från jämförelsen blev osäker. Dessutom led differensflödesloggningen av höga brusnivåer från flödesmätningen. Mätningarna av låga flöden blev på grund av detta osäkra, alternativt hamnade de under mätgränsen.

Resultaten från injektionstesterna utgör en databas för statistisk analys av den hydrauliska konduktivitetens fördelning längs borrhålet i de olika mätskalorna. Viss statistisk analys har utförts inom ramen för denna aktivitet och grundläggande statistiska parametrar presenteras i rapporten.

Contents

1 Introduction

The injection tests in borehole KFM07A at Forsmark, Sweden, were carried out during February and March of 2005 by Geosigma AB. The borehole KFM07A was the seventh deep cored borehole within the on-going site investigation in the Forsmark area. The borehole is a so called telescopic borehole. This makes it possible to install certain borehole equipment in the upper c 100 m where the diameter is larger than in the rest of the borehole. The borehole is inclined c 60° from the horizontal plane, about 1,000 m long and cased to about 100 m borehole length. The borehole diameter is c 77 mm in the interval 101.95–1,001.55 m. The location of the borehole is shown in Figure 1-1.

In KFM07A, difference flow logging was previously performed during January of 2005. Flow logging during pumping was only possibly only down to 891 m, due to cavities in the borehole and technical problems with the flow sensor. According to the results of this investigation, 26 conductive fractures were detected and the most high-conductive ones were found at 112.4, 120.2, 133.7 and 178.5 m depth. The deepest identified fracture in the borehole was detected at 970 m from measurement without pumping, see Sokolnicki and Rouhiainen (2005) /1/.

This document reports the results obtained from the injection tests in borehole KFM07A. The activity is performed within the Forsmark site investigation. The work was carried out in compliance with the SKB internal controlling documents presented in Table 1-1. Data and results were delivered to the SKB site characterization database.

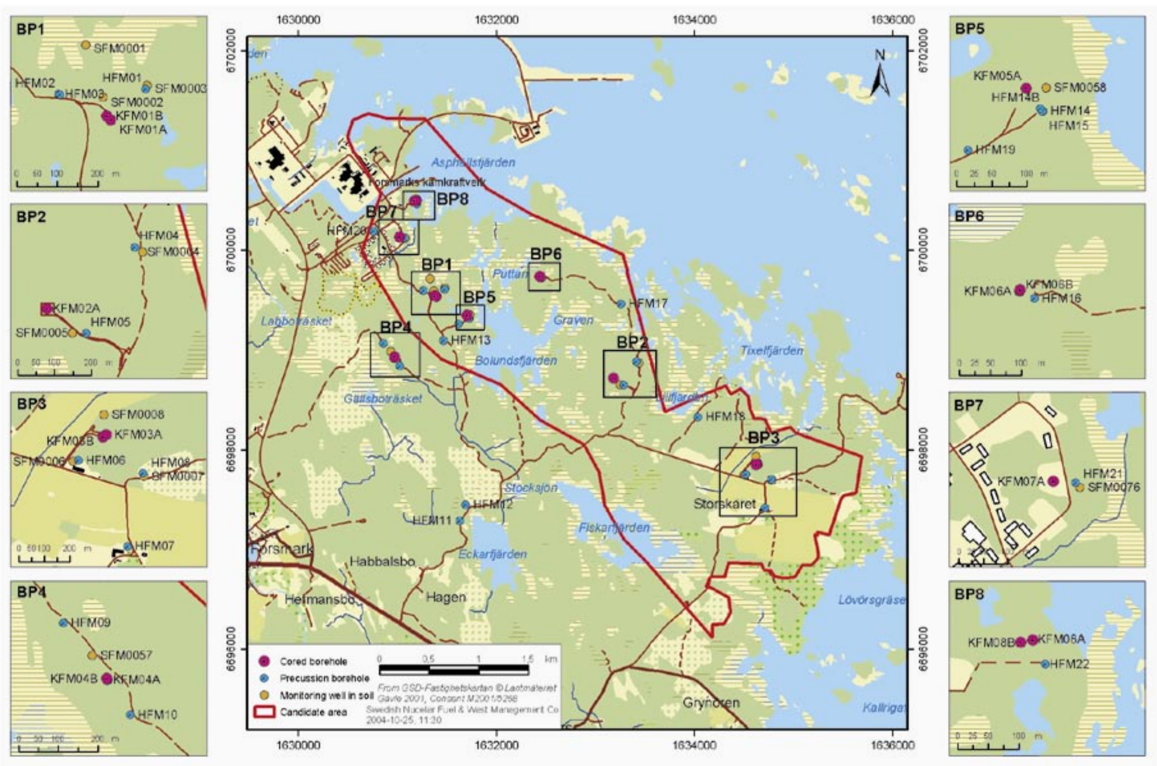

Figure 1-1. The investigation area at Forsmark including the candidate area selected for more detailed investigations. Borehole KFM07A is situated at drilling site DS7.

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

Activity Plan	Number	Version
Hydraulic injection tests in borehole KFM07A with PSS3	AP PF 400-05-006	1.0
Method descriptions	**Number**	**Version**
Mätsystembeskrivning (MSB) – Allmän del. Pipe String System (PSS3).	SKB MD 345.100	1.0
Mätsystembeskrivning för: Kalibrering, PSS3.	SKB MD 345.122	1.0
Mätsystembeskrivning för: Skötsel, service, serviceprotokoll, PSS3.	SKB MD 345.124	1.0
Metodbeskrivning för hydrauliska injektionstester	SKB MD 323.001	1.0
Instruktion för analys av injektions- och enhålspumptester	SKB MD 320.004	1.0
Instruktion för rengöring av borrhålsutrustning och viss markbaserad utrustning	SKB MD 600.004	1.0

2 Objectives

The main aim of the injection tests in borehole KFM07A was to characterize the hydraulic properties of the rock adjacent to the borehole on different measurement scales (100 m, 20 m and 5 m). The primary parameter to be determined was hydraulic transmissivity from which hydraulic conductivity can be derived. The results of the injection tests provide a database which can be used for statistical analyses of the hydraulic conductivity distribution along the borehole on different measurement scales. Basic statistical analyses are presented in this report.

Other hydraulic information of interest was flow regimes and outer hydraulic boundaries. This information was evaluated using transient analysis on the test responses during the flow- and recovery periods.

A comparison with the results of the previously performed difference flow logging in KFM07A was also included in the activity, as a check of the plausibility of the test results. Further, the combined analysis of the injection tests and the difference flow logging provides a more comprehensive understanding of the hydraulic conditions of borehole KFM07A.

3 Scope

3.1 Borehole data

Technical data of the tested borehole are shown in Table 3-1 and in Appendix 4. The reference point of the boreholes is defined as the centre of top of casing (ToC), given as "Elevation" in the table below. The Swedish National coordinate system (RT90) is used for the horizontal coordinates together with RHB70 for the elevation. "Northing" and "Easting" refer to the top of the boreholes.

Table 3-1. Technical data of borehole KFM07A (printout from SKB database, SICADA).

Borehole length(m):	1,001.550				
Drilling Period(s):	**From Date**	**To Date**	**Secup(m)**	**Seclow(m)**	**Drilling Type**
	2004-06-07	2004-06-16	0.000	100.400	Percussion drilling
	2004-06-07	2004-12-09	100.400	1,001.550	Core drilling
Starting point coordinate:	**Length(m)**	**Northing(m)**	**Easting(m)**	**Elevation**	**Coord System**
	0.000	6700127.080	1631031.570	3.330	RT90-RHB70
Angles:	**Length(m)**	**Bearing**	**Inclination (– = down)**		**Coord System**
	0.000	261.470	–59.220		RT90-RHB70
Borehole diameter:	**Secup(m)**	**Seclow(m)**	**Hole Diam(m)**		
	0.000	9.140	0.346		
	0.000	9.140	0.346		
	9.140	100.350	0.251		
	9.140	100.400	0.252		
	100.350	100.400	0.164		
	100.400	101.950	0.086		
	101.950	1,001.550	0.077		
Core diameter:	**Secup(m)**	**Seclow(m)**	**Core Diam(m)**		
	100.400	1,001.550	0.051		
Casing diameter:	**Secup(m)**	**Seclow(m)**	**Case In(m)**	**Case Out(m)**	
	0.000	100.050	0.200	0.208	
	0.000	100.050	0.200	0.208	
	0.000	8.940	0.311	0.323	
	0.200	8.940	0.310	0.324	
	100.050	100.100	0.170	0.208	
	100.050	100.100	0.170	0.208	
Cone dimensions:	**Secup(m)**	**Seclow(m)**	**Cone In(m)**	**Cone Out(m)**	
	96.940	101.700	0.080	0.197	

3.2 Tests performed

The injection tests in borehole KFM07A, performed according to Activity Plan AP PF 400-05-006 see Table 1-1, are listed in Table 3-2. The injection tests were carried out with the Pipe String System (PSS3). The test procedure and the equipment is described in the measurement system description for PSS (SKB MD 345.100) and in the corresponding method descriptions for hydraulic injection tests (SKB MD 323.001, Table 1-1). In addition to the standard injection tests a single packer injection test was executed. The packer isolated a test section between 850 m and the bottom of the borehole. The single packer test was performed because a cavity at approximately 860 m made it impossible to get the pipe string equipment past that point. Furthermore, a few pressure pulse tests were conducted in KFM07A, cf Table 3-2. These tests were performed mainly to evaluate the test strategy and feasibility of pressure pulse tests. However, in two test sections; 224–244 m and 189–194 m, pressure pulse tests were the only tests executed.

In some of the tests the time required for achieving a constant head in the test section was considered to be too long. In other cases, equipment malfunctions caused pressure and/or flow rate disturbances. If either of these cases was expected to affect the data evaluation, the test was repeated. Test number (Test no in Table 3-2) refers to the number of tests performed in the actual section. For evaluation, only data from the last test in each section were generally used.

The selection of the position of the uppermost test section for injection tests was not optimal regarding the comparison between difference flow logging and injection tests. In difference flow logging, the measurement sections in the borehole are slightly longer than 5 m after the length calibration of the measurements. In addition, some of the injection test sections were shifted intentionally in order to avoid cavities in the borehole. The combined effects result in a deviation of the upper and lower limits of the test sections used for the injection tests and the previous difference flow logging in KFM07A /1/. The shift in test section position ranges from 0.04 m to 2.01 m.

Table 3-2. Single-hole injection tests performed in borehole KFM07A.

Borehole	Test section		Section length	Test type[1]	Test no	Test start date, time	Test stop date, time
Bh ID	secup	seclow		(1–7)		YYYYMMDD hh:mm	YYYYMMDD hh:mm
KFM07A	104	204	100	3	2	20050216 06:40	20050216 08:38
KFM07A	204	304	100	3	1	20050216 10:52	20050216 13:41
KFM07A	304	404	100	3, 4B	1	20050216 15:27	20050216 16:35
KFM07A	404	504	100	3, 4B	1	20050216 17:44	20050216 19:33
KFM07A	504	604	100	3, 4B	1	20050216 20:53	20050216 21:54
KFM07A	604	704	100	3	1	20050216 23:04	20050217 00:03
KFM07A	704	804	100	3	1	20050217 08:14	20050217 09:23
KFM07A	750	850	100	3	1	20050217 14:13	20050217 15:25
KFM07A	104	124	20	3	2	20050222 06:58	20050222 08:13
KFM07A	124	144	20	3	1	20050221 06:10	20050221 07:25
KFM07A	144	164	20	3	1	20050221 07:47	20050221 09:01
KFM07A	164	184	20	3	1	20050221 09:21	20050221 10:40
KFM07A	184	204	20	3	1	20050221 10:56	20050221 12:53
KFM07A	204	224	20	3	1	20050221 13:11	20050221 14:28
KFM07A	224	244	20	4B	1	20050221 14:50	20050221 16:45
KFM07A	244	264	20	3	2	20050221 21:34	20050221 23:31
KFM07A	264	284	20	3	1	20050221 18:52	20050221 19:41
KFM07A	284	304	20	3	1	20050221 20:02	20050221 21:05
KFM07A	104	109	5	3	1	20050222 17:33	20050222 18:54
KFM07A	109	114	5	3	1	20050222 19:10	20050222 20:27
KFM07A	114	119	5	3	1	20050222 21:05	20050222 22:24
KFM07A	119	124	5	3	1	20050222 22:40	20050222 23:58
KFM07A	124	129	5	3	1	20050223 06:32	20050223 07:47
KFM07A	127	132	5	3	1	20050223 08:02	20050223 10:05
KFM07A	132	137	5	3	1	20050223 10:22	20050223 11:51
KFM07A	137	142	5	3	1	20050223 12:44	20050223 13:58
KFM07A	139	144	5	3	1	20050223 14:04	20050223 15:21
KFM07A	144	149	5	3	1	20050223 15:55	20050223 17:20
KFM07A	149	154	5	3	1	20050223 17:37	20050223 18:54
KFM07A	154	159	5	3, 4B	1	20050223 19:10	20050223 20:29
KFM07A	159	164	5	3	1	20050223 21:01	20050223 22:07
KFM07A	164	169	5	3	1	20050223 22:28	20050223 23:11
KFM07A	169	174	5	3	1	20050224 06:15	20050224 06:57
KFM07A	171.5	176.5	5	3	1	20050224 07:42	20050224 08:29
KFM07A	176.5	181.5	5	3	1	20050224 08:41	20050224 10:09
KFM07A	181.5	186.5	5	3	1	20050224 10:23	20050224 11:44
KFM07A	184	189	5	3	1	20050224 12:24	20050224 13:09
KFM07A	189	194	5	4B	1	20050224 13:23	20050224 14:34
KFM07A	194	199	5	3	1	20050224 14:49	20050224 16:40
KFM07A	199	204	5	3	1	20050224 16:58	20050224 18:14
KFM07A	204	209	5	3, 4B	1	20050224 18:35	20050224 19:31
KFM07A	209	214	5	3	1	20050224 19:54	20050224 20:45
KFM07A	214	219	5	3	1	20050224 21:01	20050224 21:43
KFM07A	219	224	5	3	1	20050224 21:57	20050224 22:38
KFM07A	244	249	5	3	1	20050224 23:11	20050224 23:57
KFM07A	249	254	5	3	1	20050225 06:27	20050225 07:09
KFM07A	254	259	5	3	1	20050225 07:27	20050225 08:12
KFM07A	259	264	5	3	1	20050225 08:28	20050225 09:43
KFM07A	850	1,001.55	151.55	3	1	20050301 15:58	20050301 17:47

[1] 3: Injection test, 4B: Pulse test.

3.3 Equipment checks

The PSS3 equipment was fully serviced, according to SKB internal controlling documents (SKB MD 345.124, service, and SKB MD 345.122, calibration), in December 2004.

Functioning checks of the equipment were performed during the installation of the PSS equipment at the test site. In order to check the function of the pressure sensors, the air pressure was recorded and found to be as expected. While lowering, the sensors showed good agreement with the total head of water ($p/\rho g$). The temperature sensor displayed expected values in both air and water. Simple functioning checks of down-hole sensors were done at every change of test section interval. Checks were also made continuously while lowering the pipe string along the borehole.

4 Description of equipment

4.1 Overview

4.1.1 Measurement container

All of the equipment needed to perform the injection tests is located in a steel container (Figure 4-1). The container is divided into two compartments; a data-room and a workshop. The container is placed on pallets in order to obtain a suitable working level in relation to the borehole casing.

The hoisting rig is of a hydraulic chain-feed type. The jaws, holding the pipe string, are opened hydraulically and closed mechanically by springs. The rig is equipped with a load transmitter and the load limit may be adjusted. The maximum load is 22 kN.

The packers and the test valve are operated hydraulically by water filled pressure vessels. Expansion and release of packers, as well as opening and closing of the test valve, is done using magnetic valves controlled by the software in the data acquisition system.

The injection system consists of a tank, a pump and a flow metre. The injection flow rate may be manually or automatically controlled. At small flow rates, a water filled pressure vessel connected to a nitrogen gas regulator is used instead of the pump.

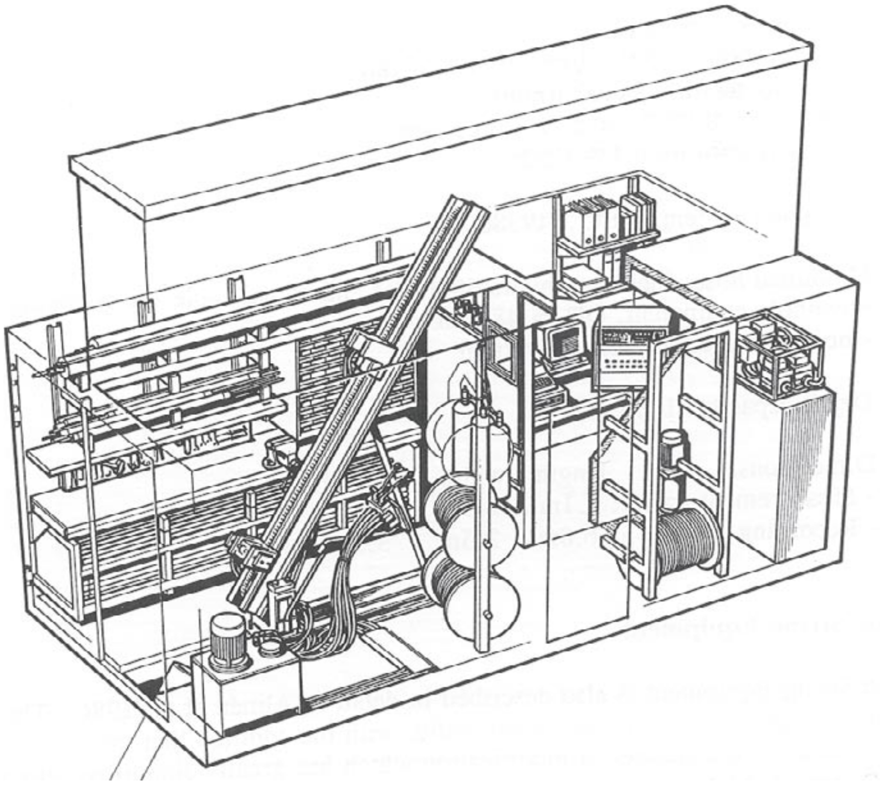

Figure 4-1. *Outline of the PSS3 container with equipment.*

4.1.2 Down-hole equipment

A schematic drawing of the down-hole equipment is shown in Figure 4-2. The pipe string consists of aluminium pipes of 3 m length, connected by stainless steel taps sealed with double o-rings. Pressure is measured above (P_a), within (P) and below (P_b) the test section, which is isolated by two packers. The groundwater temperature in the test section is also measured. The hydraulic connection between the pipe string and the test section can be closed or opened by a test valve operated by the measurement system.

At the lower end of the borehole equipment, a level indicator (calliper type) gives a signal as the reference depth marks along the borehole are passed.

The length of the test section may be varied (5, 20 or 100 metres).

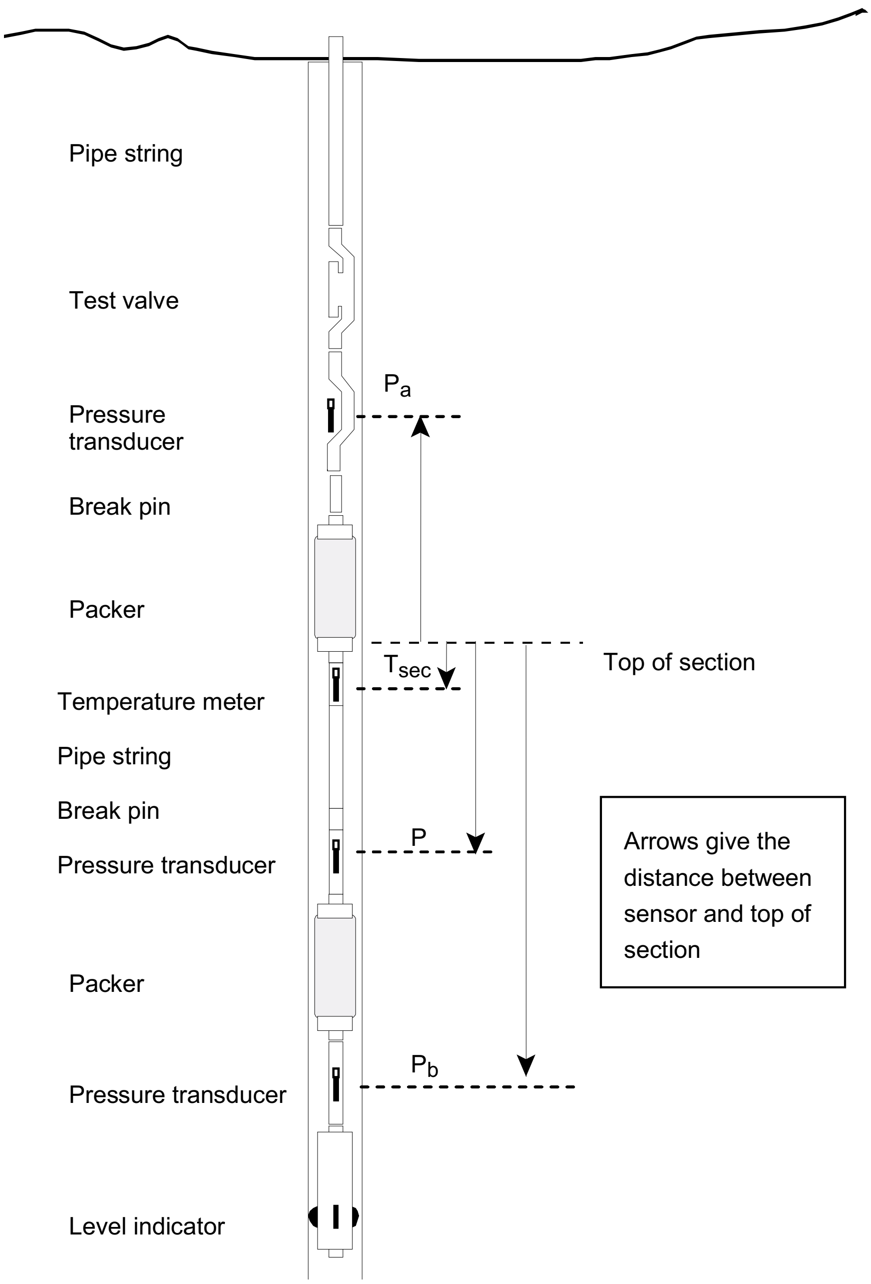

Figure 4-2. *Schematic drawing of the down-hole equipment in the PSS3 system.*

4.2 Measurement sensors

Technical data for the measurement sensors in the PSS system together with corresponding data of the system are shown in Table 4-1. The sensors are components of the PSS system. The accuracy of the PSS system may also be affected by the I/O-unit, cf Figure 4-3, and the calibration of the system.

The sensor positions are fixed relative to the top of the test section. In Table 4-2, the position of the sensors is given with top of test section as reference (Figure 4-2).

Table 4-1. Technical data for sensors together with estimated data for the PSS system (based on current experience).

Technical specification Parameter		Unit	Sensor	PSS	Comments
Absolute pressure	Output signal	mA	4–20		
	Meas. range	MPa	0–13.5		
	Resolution	kPa	< 1.0		
	Accuracy[1)]	% F.S	0.1		
Differential pressure, 200 kPa	Accuracy	kPa		< ± 5	Estimated value
Temperature	Output signal	mA	4–20		
	Meas. range	°C	0–32		
	Resolution	°C	< 0.01		
	Accuracy	°C	±0.1		
Flow Qbig	Output signal	mA	4–20		
	Meas. range	m^3/s	$1.67·10^{-5}$–$1.67·10^{-3}$		
	Resolution	m^3/s	$6.7·10^{-8}$		
	Accuracy[2)]	% O.R	0.15–3	0.2–1	The specific accuracy is depending on actual flow
Flow Qsmall	Output signal	mA	4–20		
	Meas. range	m^3/s	$1.67·10^{-8}$–$1.67·10^{-5}$		
	Resolution	m^3/s	$6.7·10^{-10}$		
	Accuracy[2)]	% O.R	0.4–10	0.4–20	The specific accuracy is depending on actual flow

[1)] 0.1% of Full Scale. Includes hysteresis, linearity and repeatability.

[2)] Maximum error in % of actual reading (% o.r.). The higher numbers correspond to the lower flow.

Table 4-2. Position of sensors in the borehole and displacement volume of equipment in the test section.

Parameter	Length of test section (m) 5	20	100
Equipment displacement volume in test section [1)]	3.6	13	61
Total volume of test section [2)]	23	93	466
Position for sensor P_a, pressure above test section, (m above secup) [3)]	1.87	1.87	1.86
Position for sensor P, pressure in test section, (m above secup) [3)]	–4.13	–19.13	–99.12
Position for sensor T_{sec}, Temperature in test section, (m above secup) [3)]	–0.98	–0.99	–0.99
Position for sensor P_b, pressure below test section, (m above secup) [3)]	–7.00	–22.00	–102.00

[1)] Displacement volume in test section due to pipe string, signal cable, sensors and packer ends (in litre).

[2)] Total volume of test section ($V = \text{section length}*\pi*d^2/4$).

[3)] Position of sensor relative top of test section. A negative value indicates a position below top of test section, (secup).

4.3 Data acquisition system

The data acquisition system in the PSS equipment contains a standard office PC connected to an I/O-unit (Datascan 7320). Using the Orchestrator software, pumping and injection tests are monitored and borehole sensor data are collected. In addition to the borehole parameters, packer and atmospheric pressure, container air temperature and water temperature are logged. Test evaluation may be performed on-site after a conducted test. An external display enables monitoring of test parameters.

The data acquisition system may be used to start and stop the automatic control system (computer and servo motors). These are connected as shown in Figure 4-3. The control system monitors the flow regulator and uses differential pressure across the regulating valve together with pressure in test section as input signals.

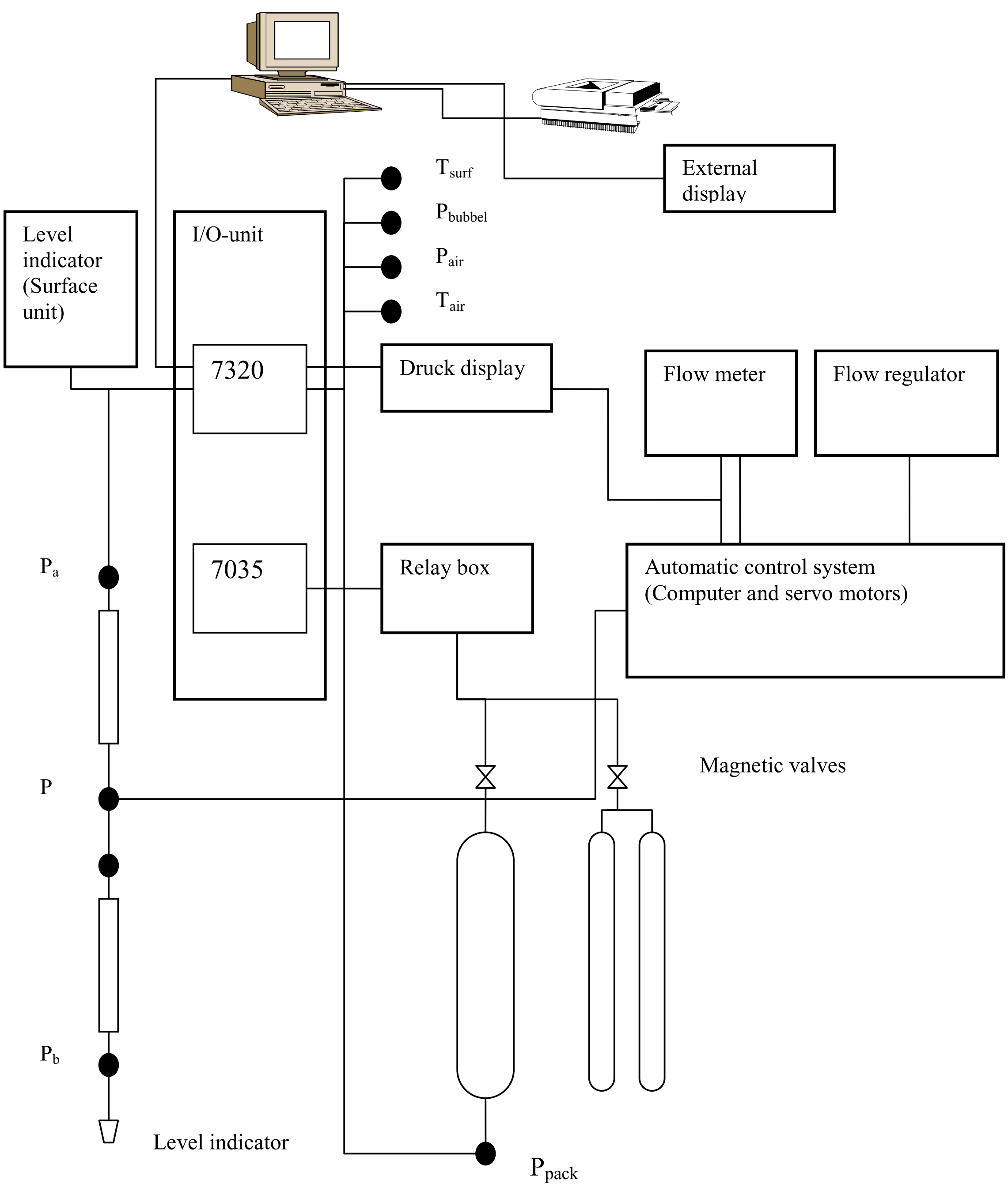

__Figure 4-3.__ Schematic drawing of the data acquisition system and the automatic control system in PSS.

5 Execution

5.1 Preparation

5.1.1 Calibration

All sensors included in PSS are calibrated at the Geosigma engineering service station in Uppsala. Calibration is generally performed prior to each measurement campaign. Results from calibration, e.g. calibration constants, of sensors are kept in a document folder in PSS. If a sensor is replaced at the test site, calibration constants are altered as well. If a new, un-calibrated, sensor is to be used, calibration may be performed afterwards and data re-calculated.

5.1.2 Functioning checks

Equipment functioning checks were performed during the establishment of PSS at the test site. Simple function checks of down-hole sensors were done at every change of test section length, as well as while lowering the pipe string along the borehole.

5.1.3 Cleaning of equipment

Cleaning of the borehole equipment was performed, with minor approved modifications, according to the cleaning instruction (SKB MD 600.004, see Table 1-1), level 2.

5.2 Test performance

5.2.1 Test principle

The injection tests in KFM07A were carried out while maintaining a constant head of generally 200 kPa (20 m) in the test section. Before start of the injection period, approximately steady-state pressure conditions prevailed in the test section. After the injection period, the pressure recovery was measured.

The pressure pulse tests in KFM07A were performed by introducing a pressure pulse to the isolated test section. The test was performed by applying a pressure pulse of c 200 kPa to the pipe string above the test section and then opening the test valve. After 2 minutes the valve was closed and the pressure recovery in the test section was measured.

5.2.2 Test procedure

Generally, the tests were performed according to the Activity Plan AP PF 400-05-006. Exceptions to this plan are presented in section 5.5.

A test cycle includes the following phases: 1) Transfer of the down-hole equipment to the next section, 2) Packer inflation, 3) Pressure stabilisation, 4) Injection, 5) Pressure recovery and 6) Packer deflation.

Table 5-1a. Packer inflation times, pressure stabilisation times and test times used for the injection tests in KFM07A.

Test section length (m)	Packer inflation time (min)	Time for pressure stabilisation (min)	Injection period (min)	Recovery period (min)	Total time/test (min)[1)]
100	30	15	30	30	105
20	25	5	20	20	70
5	25	5	20	20	70

[1)] Exclusive of trip times in the borehole

Table 5-1b. Packer inflation times, pressure stabilisation times and test times used for the pressure pulse tests in KFM07A.

Packer inflation time (min)	Time for pressure stabilisation (min)	Pulse injection (min)	Recovery period (min)	Total time/test (min)[1)]
40	20	2	40	102

[1)] Exclusive of trip times in the borehole

The estimated times for the various phases are presented in Table 5-1a. Regarding the packer inflation times and actual injection and recovery times, slightly different procedures were used for the tests in 100 m sections compared to the tests in 20 m and 5 m sections in accordance with the Activity Plan. Furthermore, slightly longer test times were used for the tests in 100 m sections, cf Table 5-1a.

For injection tests with 20 m and 5 m section length, the injection phase was interrupted if the injection flow was clearly below the measurement limit. Thereafter, the recovery was measured for at least 5 minutes to verify the low conductivity of the section.

As mentioned, beside the standard injection tests, a few pressure pulse tests were performed in KFM07A, cf Table 3-2.

For a pressure pulse test, the test cycle is basically the same as for an injection test. However, the times used are slightly different and are given in Table 5-1b. It should be noted that the times are the same, regardless of section length.

5.2.3 Test strategy

Firstly, injection tests in 100 m sections were performed in the interval 104.0–850.0 m. The intention was to carry out successive tests using a 100 m test section to the bottom of the borehole. This strategy, however, had to be changed due to the impassable cavity at c 860 m.

Secondly, injection tests, or in one case a pressure pulse test, in 20 m sections were carried out in the interval 104.0–304.0 m. The measured 100 m sections within this interval were re-measured in five successive injection tests using a 20 m section length.

Finally, injection tests, or in one case a pressure pulse test, with 5 m section length were conducted in all 20 m sections with a definable final flow rate in the interval 104.0–264.0 m. Four successive tests using a 5 m section length were performed within the 20 m intervals. The total number of injection tests was, thus, dependent on the results of the previous tests.

Since the results of the tests in 100 m sections would have a strong effect on the continued test program, it was particularly important to ensure reliable results of these tests, including sections close to the lower measurement limit.

5.3 Data handling

With the PSS system, primary data are handled using the Orchestrator software (Version 2.3.8). During a test, data are continuously logged in *.odl-files. After the test is finished, a report file (*.ht2) with space separated data is generated. The *.ht2-file (mio-format) contains logged parameters as well as test-specific information, such as calibration constants and background data. The parameters are presented as percentage of sensor measurement range and not in engineering units. The report file in ASCII-format is the raw data file delivered to the data base SICADA.

The *.ht2-files are automatically named with borehole id, top of test section and date and time of test start (as for example __KFM07A_0154.00_200502231910.ht2). The name differs slightly from the convention stated in Instructions for analysis of injection and single-borehole pump test, SKB MD 320.004.

Using the IPPLOT software (Version 3.0), the *.ht2-files are converted to parameter files suitable for plotting using the code SKB-plot and analysis with the AQTESOLV software.

A backup of data files was created on a regular basis by CD-storage and by sending the files to the Geosigma office in Uppsala by a file transfer protocol. A file description table is presented in Appendix 1.

5.4 Analysis and interpretation

5.4.1 General

As described in section 5.2.1, the injection tests in KFM07A were performed as transient constant head tests followed by a pressure recovery period. From the injection period, the (reciprocal) flow rate versus time was plotted in log-log and lin-log diagrams together with the corresponding derivative. From the recovery period, the pressure was plotted versus Agarwal equivalent time in lin-log and log-log diagrams, respectively, together with the corresponding derivative. The routine data processing of the measured data was done according to the Instruction for analysis of injection and single-hole pumping tests (SKB MD 320.004).

For evaluation of the test data, no corrections of the measured flow rate and absolute pressure data (e.g. due to barometric pressure variations or tidal fluctuations) have been made. For short-time single-hole tests, such corrections are generally not needed, unless very small pressure changes are applied. No subtraction of the barometric pressure from the measured absolute pressure has been made, since the length of the test periods are short relative to the time scale for barometric pressure changes. In addition, pressure differences rather than the pressure magnitudes are used by the evaluation.

For pressure pulse tests the evaluation is performed in a lin-log diagram showing the normalized recovery H/H_0 versus elapsed time together with the corresponding derivative.

5.4.2 Measurement limit for flow rate and specific flow rate

The estimated standard lower measurement limit for flow rate for injection tests with PSS is c 1 mL/min ($1.7 \cdot 10^{-8}$ m^3/s). However, if the flow rate for a test was close to, or below, the standard lower measurement limit, a test-specific estimate of the lower measurement limit of flow rate was made. The test-specific lower limit was based on the measurement noise level of the flow rate before and after the injection period. The decisive factor for the varying lower measurement limit is not identified, but it might be of both technical and hydraulic character. For approximately 45 per cent of the injection tests in KFM07A, the actual lower measurement limit of the flow rate was estimated, ranging from $2 \cdot 10^{-9}$ m^3/s to $8 \cdot 10^{-9}$ m^3/s.

The lower measurement limit for transmissivity is defined in terms of the specific flow rate (Q/s). The minimum specific flow rate corresponds to the estimated lower measurement limit of flow rate together with the actual injection pressure during the test, see Table 5-2. The intention during this test campaign was to use a standard injection pressure of 200 kPa (20 m water column). However, for some test sections in KFM07A, the actual injection pressure was considerably different. For one of the tests, the injection pressure exceeded 250 kPa and for four of the tests the apparent injection pressure was below 100 kPa. A low (apparent) injection pressure is often the result of a test section of low conductivity due to a pressure increase, caused by packer expansion, before the injection start. On the other hand, a highly conductive section may also result in a low injection pressure due to limited flow capacity of the PSS. The estimated test-specific lower measurement limit for the specific flow rate in KFM07A ranged from $1.0 \cdot 10^{-10}$ m^2/s to $2.7 \cdot 10^{-8}$ m^2/s. The high value corresponds to a very conductive test section where the limited capacity of the PSS led to a low injection pressure.

Whenever the final flow rate (Q_p) was not defined (i.e. not clearly above the measurement noise before and after the injection period), the estimated lower measurement limit for specific flow rate was based on the estimated lower measurement limit for flow rate for the specific test and a standard injection pressure of 200 kPa. This is done in order to avoid excessively high, apparent estimates of the specific flow rate for these low conductivity sections, which would have been the result if the actual pressure difference at start of injection had been used as injection pressure (since the actual pressure difference often was significantly less than 200 kPa, see above).

The lower measurement limits for the flow rate correspond to different values of steady-state transmissivity, T_M, depending on the section lengths used in the factor C_M in Moye's formula, as described in the Instruction for analysis of injection and single-hole pumping tests (SKB MD 320.004), see Table 5-2.

The practical upper measurement limit of hydraulic transmissivity for the PSS system is estimated at a flow rate of c 30 L/min ($5 \cdot 10^{-4}$ m^3/s) and an injection pressure of c 1 m. Thus, the upper measurement limit for the specific flow rate is $5 \cdot 10^{-4}$ m^2/s. However, the practical upper measurement limit may vary, depending on e.g. depth of the test section (friction losses in the pipe string).

The lower measurement limit for transmissivity for pressure pulse tests with the PSS is not yet defined.

Table 5-2. Estimated lower measurement limit for specific flow rate and steady-state transmissivity for different injection pressures, measurement scales and estimated lower measurement limits for flow rate for the injection tests in borehole KFM07A.

r_w (m)	L_w (m)	Q-measl-L(m^3/s)	Injection pressure (kPa)	Q/s-measl-L (m^2/s)	Factor C_M in Moye's formula	T_M-measl-L (m^2/s)
0.0385	100	1.7E–08	100	1.6E–09	1.30	2.1E–09
0.0385	100	1.7E–08	200	8.2E–10	1.30	1.1E–09
0.0385	100	1.7E–08	300	5.5E–10	1.30	7.1E–10
0.0385	100	1.2E–08	100	1.1E–09	1.30	1.5E–09
0.0385	100	1.2E–08	200	5.7E–10	1.30	7.4E–10
0.0385	100	1.2E–08	300	3.8E–10	1.30	5.0E–10
0.0385	100	5.0E–09	100	4.9E–10	1.30	6.4E–10
0.0385	100	5.0E–09	200	2.5E–10	1.30	3.2E–10
0.0385	100	5.0E–09	300	1.6E–10	1.30	2.1E–10
0.0385	20	1.7E–08	100	1.6E–09	1.04	1.7E–09
0.0385	20	1.7E–08	200	8.2E–10	1.04	8.5E–10
0.0385	20	1.7E–08	300	5.5E–10	1.04	5.7E–10
0.0385	20	1.2E–08	100	1.1E–09	1.04	1.2E–09
0.0385	20	1.2E–08	200	5.7E–10	1.04	6.0E–10
0.0385	20	1.2E–08	300	3.8E–10	1.04	4.0E–10
0.0385	20	5.0E–09	100	4.9E–10	1.04	5.1E–10
0.0385	20	5.0E–09	200	2.5E–10	1.04	2.6E–10
0.0385	20	5.0E–09	300	1.6E–10	1.04	1.7E–10
0.0385	5	1.7E–08	100	1.6E–09	0.82	1.3E–09
0.0385	5	1.7E–08	200	8.2E–10	0.82	6.7E–10
0.0385	5	1.7E–08	300	5.5E–10	0.82	4.5E–10
0.0385	5	1.2E–08	100	1.1E–09	0.82	9.4E–10
0.0385	5	1.2E–08	200	5.7E–10	0.82	4.7E–10
0.0385	5	1.2E–08	300	3.8E–10	0.82	3.1E–10
0.0385	5	5.0E–09	100	4.9E–10	0.82	4.0E–10
0.0385	5	5.0E–09	200	2.5E–10	0.82	2.0E–10
0.0385	5	5.0E–09	300	1.6E–10	0.82	1.3E–10

5.4.3 Qualitative analysis

Initially, a qualitative evaluation of actual flow regimes, e.g. wellbore storage (WBS), pseudo-radial flow regime (PRF), pseudo-spherical flow regime (PSF) and pseudo-stationary flow regime (PSS), respectively, was performed. In addition, indications of outer boundary conditions during the tests were identified. The qualitative evaluation was mainly interpreted from the log-log plots of flow rate and pressure together with the corresponding derivatives.

In particular, time intervals with pseudo-radial flow, reflected by a constant (horizontal) derivative in the test diagrams, were identified. Pseudo-linear flow may, at the beginning of the test, be reflected by a straight line of slope 0.5 or less in log-log diagrams, both for the measured variable (flow rate or pressure) and the derivative. A true spherical flow regime is reflected by a straight line with a slope of –0.5 for the derivative. However, other slopes may indicate transitions to pseudo-spherical (leaky) or pseudo-stationary flow. The latter flow regime corresponds to almost stationary conditions with a derivative approaching zero.

Due to the limited resolution of the flow metre and pressure sensor, the derivative may some times erroneously indicate a false horizontal line by the end of periods with pseudo-stationary flow. Apparent no-flow (NFB) and constant head boundaries (CHB), or equivalent boundary conditions of fractures, are reflected by an increase/decrease of the derivative, respectively. In addition, a preliminary steady-state analysis of transmissivity according to Moye's formula (denoted T_M) was made for the injection period for all tests in conjunction with the qualitative analysis according to the following Equation:

$$T_M = \frac{Q_p \cdot \rho_w \cdot g}{dp_p} \cdot C_M \qquad (5\text{-}1)$$

$$C_M = \frac{1 + \ln\left(\frac{L_w}{2r_w}\right)}{2\pi} \qquad (5\text{-}2)$$

Q_p = flow rate by the end of the flow period (m^3/s)

ρ_w = density of water (kg/m^3)

g = acceleration of gravity (m/s^2)

C_M = geometrical shape factor (–)

dp_p = $p_p - p_i$ (Pa)

r_w = borehole radius (m)

L_w = section length (m)

5.4.4 Quantitative analysis

Injection tests

From the results of the qualitative evaluation, appropriate interpretation models for the quantitative evaluation of the injection tests were selected. When possible, transient analysis was made on both the injection and recovery periods of the tests.

The transient analysis was performed using a special version of the test analysis software AQTESOLV, which enables both visual and automatic type curve matching. The quantitative transient evaluation is generally carried out as an iterative process of manual type curve matching and automatic matching. For the injection period, a model based on the Jacob and Lohman (1952) solution /2/ was applied for estimating the transmissivity and skin factor when a certain period with pseudo-radial flow could be identified. The model is based on the effective wellbore radius concept to account for non-zero (negative) skin factors according to Hurst, Clark and Brauer (1969) /3/.

In borehole KFM07A, the storativity was calculated using an empirical regression relationship between storativity and transmissivity, see Equation (5-3), Rhén et al. (1997) /4/. Firstly, the transmissivity and skin factor were obtained by type curve matching on the data curve using a fixed storativity value of 10^{-6}, according to the instruction SKB MD 320.004. From the transmissivity value obtained, the storativity was then calculated according to Equation (5-3) and the type curve matching was repeated. In most cases the change of storativity did not significantly alter the calculated transmissivity by the new type curve matching. Instead, the estimated skin factor, which is strongly correlated to the storativity using the effective borehole radius concept, was altered correspondingly. This procedure of calculating the storativity from a regression equation has not been used for the injection tests in previous boreholes.

$$S = 0.0007 \cdot T^{0.5} \qquad (5\text{-}3)$$

S = storativity (–)

T = transmissivity (m^2/s)

For transient analysis of the recovery period, a model presented by Dougherty and Babu (1984) /5/ was used when a certain period with pseudo-radial flow could be identified. In this model, a variety of transient solutions for flow in fractured porous media is available, accounting for e.g. wellbore storage and skin effects, double porosity etc. The solution for wellbore storage and skin effects is analogous to the corresponding solution presented in Earlougher (1977) /6/ based on the effective wellbore radius concept to account for non-zero (negative) skin factors. However, for tests in isolated test sections, wellbore storage is represented by a radius of a fictive standpipe (denoted fictive casing radius, r(c)) connected to the test section, cf Equation (5-6). This concept is equivalent to calculating the wellbore storage coefficient C from the compressibility in an isolated test section according to Equation (5-5).

The model by Dougherty-Babu (1984) was used to estimate the transmissivity and skin factor from the recovery period. The storativity was calculated using Equation (5-3) in the same way as described above for the transient analysis of the injection period. In addition, the wellbore storage coefficient was estimated, both from the simulated value on the fictive casing radius r(c) and from the slope of 1:1 in the log-log recovery plots.

For tests showing pseudo-spherical (leaky) flow, eventually transitioning to pseudo-stationary flow, during the injection period, a model by Hantush (1959) /7/ for constant head tests was used for the evaluation. In this model, the skin factor is not separated explicitly but can be calculated from the simulated (effective) borehole radius according to Equation (5-4). In addition, the apparent leakage coefficient K'/b' can be calculated from the simulated value on the leakage factor r/B. The corresponding model for constant flow rate tests, (Hantush 1955) /8/, was used by the evaluation of the recovery period for tests showing pseudo-spherical-, possibly transitioning to pseudo-stationary flow, during this period. The Hantush' model allows calculation of the skin factor from Equation (5-4) together with the wellbore storage coefficient according to Equation (5-6).

$$\zeta = \ln(r_w/r_{wf}) \qquad (5\text{-}4)$$

ζ = skin factor

r_w = borehole radius (m)

r_{wf} = effective borehole radius

Some tests showed fracture responses (a slope of 0.5 or less in a log-log plot). Models for single fractures were then used for the transient analysis as a complement to the standard models described above. Both the models by Ozkan-Raghavan (1991a) /9/ and (1991b) /10/ for a vertical fracture and the model by Gringarten-Ramey (1974) /11/ for a horizontal fracture were employed. In these cases, the test section length was used to convert K and S_s to T and S, respectively, after analysis by fracture models. The quotient K_x/K_y of the hydraulic conductivity in the x and the y-direction, respectively, was assumed to be 1.0 (one). Type curve matching provided values of K_x and L_f, where L_f is the theoretical fracture length.

The different transient estimates of transmissivity from the injection and recovery period, respectively, were then compared and examined. One of these was chosen as the best representative value of the transient transmissivity of the formation adjacent to the test section. This value is denoted T_T. In cases with more than one pseudo-radial flow regime during the injection- or recovery period, the first one is assumed as the most representative for the hydraulic conditions in the rock close to the tested section. In most cases, the transient estimates of transmissivity from the injection period were considered more representative than those from the recovery period. The recovery responses were often strongly affected by wellbore storage and, in general, no pseudo-radial flow regime was reached. Instead, a pseudo-spherical flow regime was often indicated during this period. In addition, pseudo-stationary flow sometimes occurred during the recovery period.

Finally, a representative value of transmissivity of the test section, T_R, was chosen from T_T and T_M. In general, the transient evaluation was considered as giving the best estimate. In only 3 out of 31 tests with a definable flow rate at the end of the flow period, the steady-state transmissivity was chosen as the most representative value of transmissivity. Whenever the flow rate by the end of the injection period (Q_p) was too low to be defined, and thus neither T_T nor T_M could be estimated, the representative transmissivity for the test section was considered to be less than T_M based on the estimated lower measurement limit for Q/s (i.e. $T_R < T_M$ = Q/s-measl-L · C_M according to Equation (5-1).

Estimated values of the borehole storage coefficient, C, based on actual borehole geometrical data and assumed fluid properties are shown in Table 5-3. The net water volume in the test section, V_w, has in Table 5-3 been calculated by subtracting the volume of equipment in the test section (pipes and thin hoses) from the total volume of the test section. For an isolated test section, the net wellbore storage coefficient, C, may be calculated as Almén et al. (1986) /12/:

$$C = V_w \cdot c_w = L_w \cdot \pi \cdot r_w^2 \cdot c_w \quad (5\text{-}5)$$

V_w = water volume in test section (m^3)

r_w = nominal borehole radius (m)

L_w = section length (m)

c_w = compressibility of water (Pa^{-1})

When appropriate, estimation of the actual borehole storage coefficient C in the test sections was made from the recovery period, based on the early borehole response with 1:1 slope in the log-log diagrams. The coefficient C was calculated only for tests with a well-defined line of slope 1:1 in the beginning of the recovery period. In the most conductive sections, this period occurred during very short periods at early test times. The latter values may be compared with the net values of C based on geometry (Table 5-3).

Table 5-3. Calculated net values of the wellbore storage coefficient C for injection tests with different section length, based on the actual geometrical properties of the borehole and equipment configuration in the test section.

Borehole	r_w (m)	L_w (m)	Volume of test section (m^3)	Volume of equipment in section (m^3)	V_w (m^3)	C_{net} (m^3/Pa)
KFM07A	0.03865	100	0.469	0.061	0.408	$1.9 \cdot 10^{-10}$
KFM07A	0.03865	20	0.094	0.013	0.081	$3.7 \cdot 10^{-11}$
KFM07A	0.03865	5	0.023	0.004	0.020	$9.2 \cdot 10^{-12}$

Furthermore, when using the model by Dougherty-Babu (1984), a fictive casing radius, r(c), is obtained from the parameter estimation of the recovery period. This value can then be used for calculating C as Almén et al. (1986) /12/:

$$C = \frac{\pi \cdot r(c)^2}{\rho \cdot g} \qquad (5\text{-}6)$$

Although this calculation was not done regularly and the results are not presented in this report, the calculations corresponded in most cases well to the value of C obtained from the line of slope 1:1 in the beginning of the recovery period.

The estimated values of C from the tests may differ from the net values in Table 5-3 based on geometry. For example, the effective compressibility for an isolated test section may sometimes be higher than the water compressibility due to e.g. packer- or other equipment compliance, resulting in increased C-values.

Pressure pulse tests

A model described by Dougherty and Babu (1984) /5/ was used for evaluation of the pressure pulse tests performed. The normalized recovery H/H_0 is plotted versus elapsed time in a lin-log diagram. As for the injection tests, the effective borehole radius concept, Equation (5-4), was used for calculating the skin factor as well as the concept of a fictive standpipe connected to the test section representing wellbore storage according to Equation (5-6). The transmissivity and skin factor can be estimated for a certain value of storativity and wellbore storage coefficient (represented by the radius of the fictive standpipe) from type curve matching. The storativity was calculated from Equation (5-3) as for the injection tests.

5.5 Nonconformities

The test program in KFM07A was carried out according to the Activity Plan AP PF 400-05-006 with the following exceptions:

- According to the Activity Plan a pressure pulse test was to be conducted whenever the injection flow rate was clearly below the measurement limit. These instructions were subsequently changed by the Activity Leader. Instead, a limited number of pulse tests were performed for evaluation purposes.
- The temperature sensor in the injection water at the ground surface was out of order during the injection tests in KFM07A.

- A cavity in the borehole walls at c 859 m made it impossible to pass this level with the borehole equipment. Therefore the usual testing procedure could not be followed below 850 m. Instead, a single packer test was conducted to acquire hydraulic parameters valid for the borehole section between 850 m and the bottom of the borehole.
- The storativity was calculated using a regression relationship, see section 5.4.4. This procedure of calculating the storativity has not been used for evaluation in previous boreholes and it deviates from the instruction in SKB MD 320.004.
- The selection of the top test section position for the injection tests was not optimal regarding comparison of evaluated transmissivity values from difference flow logging and injection tests, respectively.

6 Results

6.1 Nomenclature and symbols

The nomenclature and symbols used for the results of the injection tests in KFM07A are in accordance with the Instruction for analysis of injection and single-hole pumping tests (SKB MD 320.004). Additional symbols used are explained in the text and in Appendix 5. Symbols used by the AQTESOLV software are explained in Appendix 3.

6.2 Routine evaluation of the single-hole injection tests

6.2.1 General test data

General test data and selected pressure and flow data from all tests are listed in Appendix 2.1 and 2.2, respectively.

Records of other activities in the investigation area during the test period were checked in order to identify possible interference with test data. These records showed that drilling in KFM08A, see Figure 1-1, was in progress, between c 500–800 m borehole length, during the time of testing in KFM07A. No evidence that these activities have interfered with the injection tests in KFM07A has been found. The distance between KFM07A and KFM08A is about 400 m, but since no evidence of interference can be found in test data, the injection tests in KFM07A are assumed to be unaffected by the activities in KFM08A.

6.2.2 Length corrections

The down-hole equipment is supplied with a level indicator located c 3 m below the lower packer in the test section, see Figure 4-2. The level indicator transmits a signal each time a reference mark in the borehole is passed. In KFM07A, reference marks were milled into the borehole wall at every 50 m (with a few exceptions).

During the injection tests in KFM07A with the PSS, length reference marks were detected as presented in Table 6-1. In addition, all length reference marks were detected when lowering to the position for the single packer injection test. At each mark, the length scale for the injection tests was adjusted according to the reported length to the reference mark.

The largest difference between the reported and measured lengths at the reference marks during the injection tests was 0.23 m, at the 849 m reference mark. The difference between two consecutive measurements over a 100 m borehole interval was 0.05 m or less in all cases. A comparison of the measurements performed with different section lengths results in a maximum difference of 0.01 m.

Since the length scale was adjusted in the field every time a reference mark was passed, and because the difference between consecutive marks was small, it was not found worthwhile to make any further adjustments after the measurements, e.g. by linear interpolation between reference marks.

Table 6-1. Detected reference marks during the injection tests in KFM07A.

Borehole length (m)	Detected during the injection tests in 100 m sections	Detected during the injection tests in 20 m sections	Detected during the injection tests in 5 m sections
150	yes	yes	yes
203	yes	yes	yes
250	yes	yes	yes
300	yes	yes	–
350	yes	–	–
400	yes	–	–
450	yes	–	–
500	yes	–	–
550	yes	–	–
600	yes	–	–
650	yes	–	–
700	yes	–	–
750	yes	–	–
800	yes	–	–
849	yes	–	–
900	–	–	–
950	–	–	–
980	–	–	–

6.2.3 General results

For the injection tests, transient evaluation was conducted, whenever possible, both on the injection and recovery periods (T_f and T_s, respectively) according to the methods described in section 5.4.4. The steady-state transmissivity (T_M) was calculated by Moye's formula according to Equation (5-1). Transient evaluation was performed for all tests for which a significant flow rate, Q_p, could be identified, see section 5.4.2. The quantitative analysis was carried out using the AQTESOLV software.

A summary of the results of the routine evaluation of the injection tests in different scales in KFM07A is presented in Table 6-2. The results of the pressure pulse tests in sections 224–244 m and 189–194 m are also included. Selected test diagrams are presented in Appendix 3. In general, one linear diagram showing the entire test sequence together with lin-log and log-log diagrams from the injection and recovery periods, respectively, are presented for the injection tests. For the pressure pulse tests a lin-log diagram of the normalized recovery versus time is presented. For injection tests with a final flow rate below the estimated lower measurement limit for the specific test, only the linear overview diagram is shown in Appendix 3. The results of the routine evaluation of the single-hole tests in borehole KFM07A are also compiled in appropriate tables in Appendix 5 to be stored in the SICADA database.

The dominating transient flow regimes during the injection and recovery periods of the injection tests, respectively, as interpreted from the qualitative test evaluation, are listed in Table 6-2 and further commented on in section 6.2.4. During the injection period, a certain time interval with pseudo-radial flow (PRF) could be identified in c 50% of the tests, cf section 6.2.5. The second most common flow regime was pseudo-spherical (leaky) flow. Several of the responses during the recovery period were strongly influenced by wellbore storage effects. Thus, for most tests, pseudo-radial flow was not reached during this period. Standard methods for single-hole tests with wellbore storage and skin effects were generally used by the routine evaluation of the tests.

Table 6-2. Summary of the routine evaluation of the single-hole injection tests in borehole KFM07A.

Secup (m)	Seclow (m)	Test start YYYYMMDD hh:mm	b (m)	Flow regime[1] injection	recovery	T_M (m^2/s)	T_f (m^2/s)	T_s (m^2/s)	T_T (m^2/s)	T_R [2] (m^2/s)	ξ (–)	t_1 (s)	t_2 (s)	dte_1 (s)	dte_2 (m^3/Pa)	C
104.00	204.00	2005-02-16 06:40	100	PSS	PSS	1.39E–03	9.94E–04	1.11E–03		1.39E–03						
204.00	304.00	2005-02-16 10:52	100	PRF	WBS->	8.39E–09	2.83E–09	3.91E–09	2.83E–09	2.83E–09	–3.49	400	1,800			1.96E–10
304.00	404.00	2005-02-16 15:27	100	–	–	<3.25E–10				<3.25E–10						
404.00	504.00	2005-02-16 17:44	100	PLF	WBS	3.60E–10	3.87E–11	3.45E–11		3.60E–10						
504.00	604.00	2005-02-16 20:53	100	–	–	<3.25E–10				<3.25E–10						
604.00	704.00	2005-02-16 23:04	100	–	–	<4.55E–10				<4.55E–10						
704.00	804.00	2005-02-17 08:14	100	–	–	<3.25E–10				<3.25E–10						
750.00	850.00	2005-02-17 14:13	100	–	–	<4.87E–10				<4.87E–10						
104.00	124.00	2005-02-22 06:58	20	PSS	PSS	9.10E–04		1.00E–03		9.10E–04						
124.00	144.00	2005-02-21 06:10	20	PSS->PRF	PSS	3.40E–06	3.16E–06	4.41E–07	3.16E–06	3.16E–06	–1.60	650	950			5.00E–09
144.00	164.00	2005-02-21 07:47	20	PRF->PSF	PRF->NFB->PSF	8.47E–08	2.51E–08	4.83E–08	4.83E–08	4.83E–08	–3.31	80	200	10	60	
164.00	184.00	2005-02-21 09:21	20	PSF	PSF	2.56E–05	2.37E–05	2.50E–05	2.37E–05	2.37E–05	–1.72					
184.00	204.00	2005-02-21 10:56	20	PRF	WBS->	1.14E–08	7.32E–09	7.80E–09	7.32E–09	7.32E–09	–2.02	400	1,200			6.74E–11
204.00	224.00	2005-02-21 13:11	20	PRF->NFB	WBS->PRF->NFB	1.30E–09	1.22E–09	1.53E–09	1.22E–09	1.22E–09	–3.24	20	90	150	300	4.89E–11
224.00 [3]	244.00	2005-02-21 14:50	20	–	–	<4.17E–10		1.82E–11		<4.17E–10						
244.00	264.00	2005-02-21 21:34	20	PRF	PSF	1.17E–08	9.67E–09	5.22E–09	9.67E–09	9.67E–09	–0.87	300	1,218			5.83E–11
264.00	284.00	2005-02-21 18:52	20	–	–	<4.17E–10				<4.17E–10						
284.00	304.00	2005-02-21 20:02	20	–	–	<4.17E–10				<4.17E–10						
104.00	109.00	2005-02-22 17:33	5	PSF	PSF	2.04E–08	7.14E–09	6.18E–09	7.14E–09	7.14E–09	–4.18					
109.00	114.00	2005-02-22 19:10	5	PRF	PSS	2.08E–06	1.83E–06		1.83E–06	1.83E–06	–3.11	40	1,219			
114.00	119.00	2005-02-22 21:05	5	PSF	PSS	3.86E–07	4.11E–07	3.25E–07	4.11E–07	4.11E–07	–0.91					
119.00	124.00	2005-02-22 22:40	5	PSS->NFB	PSS	6.86E–04	1.02E–03	1.01E–03	1.01E–03	1.01E–03	–1.19					
124.00	129.00	2005-02-23 06:32	5	PSF	WBS->	7.46E–08	8.81E–08	6.78E–08	8.81E–08	8.81E–08	0.00					1.01E–09
127.00	132.00	2005-02-23 08:02	5	PSF->NFB	WBS->PSS	4.91E–09	4.12E–09	1.22E–09	4.12E–09	4.12E–09	0.01					3.07E–11
132.00	137.00	2005-02-23 10:22	5	PSF	PSS	2.70E–06	2.69E–06	2.69E–06	2.69E–06	2.69E–06	–1.49					
137.00	142.00	2005-02-23 12:44	5	PRF	PSF	1.26E–08	1.27E–08	1.36E–08	1.27E–08	1.27E–08	–1.05	100	1,000			
139.00	144.00	2005-02-23 14:04	5	PRF	WBS	1.90E–07	1.91E–07	1.67E–07	1.91E–07	1.91E–07	–1.84	600	1,000			
144.00	149.00	2005-02-23 15:55	5	PRF	PRF	5.76E–08	3.30E–08	2.73E–08	3.30E–08	3.30E–08	–3.67	100	1,200	10	500	9.15E–11

Secup (m)	Seclow (m)	Test start YYYYMMDD hh:mm	b (m)	Flow regime[1)] injection	recovery	T_M (m^2/s)	T_f (m^2/s)	T_s (m^2/s)	T_T (m^2/s)	T_R [2)] (m^2/s)	ξ (–)	t_1 (s)	t_2 (s)	dte_1 (s)	dte_2 (m^3/Pa)	C
149.00	154.00	2005-02-23 17:37	5	PRF	PLF->	9.39E–10	3.40E–10	1.55E–10	3.40E–10	3.40E–10	–3.84	200	1,000			1.89E–11
154.00	159.00	2005-02-23 19:10	5	PRF	WBS->	7.91E–10	7.03E–10	7.53E–10	7.03E–10	7.03E–10	–0.84	10	1,200			1.69E–11
159.00	164.00	2005-02-23 21:01	5	–	–	<8.23E–11				<8.23E–11						
164.00	169.00	2005-02-23 22:28	5	–	–	<1.03E–10				<1.03E–10						
169.00	174.00	2005-02-24 06:15	5	–	–	<1.23E–10				<1.23E–10						
171.50	176.50	2005-02-24 07:42	5	–	–	<2.06E–10				<2.06E–10						
176.50	181.50	2005-02-24 08:41	5	PSF	PSF	1.66E–05	2.48E–05	1.95E–05	2.48E–05	2.48E–05	–0.25					
181.50	186.50	2005-02-24 10:23	5	PSF	WBS->	7.72E–09	2.87E–09	3.83E–09	2.87E–09	2.87E–09	–3.72					1.44E–10
184.00	189.00	2005-02-24 12:24	5	–	–	<2.47E–10				<2.47E–10						
189.00 [3)]	194.00	2005-02-24 13:23	5	–	–	<2.06E–10				<2.06E–10						
194.00	199.00	2005-02-24 14:49	5	PSF->PRF	PRF->PSF	5.94E–09	6.17E–09	3.24E–09	3.24E–09	3.24E–09	–2.76	300	1,000	20	110	
199.00	204.00	2005-02-24 16:58	5	PRF	WBS->PSF	3.44E–09	3.51E–09	3.47E–09	3.51E–09	3.51E–09	–0.97	30	1,000			2.04E–11
204.00	209.00	2005-02-24 18:35	5	–	–	<9.26E–11				<9.26E–11						
209.00	214.00	2005-02-24 19:54	5	–	–	<2.06E–10				<2.06E–10						
214.00	219.00	2005-02-24 21:01	5	–	–	<2.06E–10				<2.06E–10						
219.00	224.00	2005-02-24 21:57	5	–	–	<2.06E–10				<2.06E–10						
244.00	249.00	2005-02-24 23:11	5	–	–	<2.06E–10				<2.06E–10						
249.00	254.00	2005-02-25 06:27	5	–	–	<2.06E–10				<2.06E–10						
254.00	259.00	2005-02-25 07:27	5	–	–	<1.23E–10				<1.23E–10						
259.00	264.00	2005-02-25 08:28	5	PRF	PSF	1.46E–08	1.50E–08	1.07E–08	1.50E–08	1.50E–08	–1.20	40	1,000			
850.00 [4)]	1001.55	2005-03-01 15:58	152	PLF->PRF	PLF	5.73E–07	9.66E–08	4.55E–08	9.66E–08	9.66E–08	–6.02	500	1,800			

[1)] The acronyms in the column "Flow regime" are as follow: wellbore storage (WBS), pseudo-linear flow (PLF), pseudo-radial flow (PRF), pseudo-spherical flow (PSF), pseudo-stationary flow (PSS) and apparent no-flow boundary (NFB). The flow regime definitions are further discussed in section 5.4.3.

[2)] For the tests where Q_p was not detected, T_R was assumed to be less than T_M based on the estimated lower measurement limit for Q/s (i.e. $T_R < T_M$ = Q/s-measl-L·C_M).

[3)] Pressure pulse test.

[4)] Single packer injection test.

For a few tests, particularly from the recovery period, a type curve fit is yet displayed in the diagrams in Appendix 3, despite the estimated parameters from the fit are judged as non-representative and are thus not included in the result tables in SICADA. For these tests, the type curve fit is presented, for example, to illustrate that an assumption of pseudo-radial flow regime is not justified for the test. Instead, some other flow regime is likely to dominate. Alternatively, the type curve is included to display the simulated response for a certain set of parameters in cases where a unique evaluation is considered impossible. For example, for test responses showing only wellbore storage and tests approaching a pseudo-stationary flow, no unique transient evaluation is possible. These tests are discussed in the test comments in section 6.2.4.

The value judged as the most reliable from the transient evaluation of the tests was selected as T_T. The associated value of the skin factor is listed in Table 6-2. As discussed above, a fairly well-defined time interval with pseudo-radial flow could be identified from the injection period in c 50% of the tests. The transmissivity values calculated from the injection period are in most cases considered as the most reliable values from the transient analysis of the test section. In addition, these transmissivity values were generally alsoconsidered as the most representative estimate of transmissivity, $T_{R,}$ from the injection tests in KFM07A. In about 25% of the tests the transmissivity values, calculated from a pseudo-spherical flow regime during the injection period, were considered the most reliable estimate of transmissivity.

The approximate start and stop times used for the transient evaluation on the period with pseudo-radial flow are also listed in Table 6-2. For those tests where transient evaluation was not possible or not considered representative, T_M was chosen as the representative transmissivity value, T_R. If Q_p was below the actual estimated measurement limit, the representative transmissivity value was assumed to be less than the estimated T_M, based on Q/s-measl-L, see section 5.4.2 and 5.4.3.

In Figure 6-1, a comparison of calculated transmissivities in 5 m sections from steady-state evaluation (T_M) and transmissivity values from the transient evaluation (T_T) is presented. There is a good agreement between the two populations. The standard lower measurement limit of transmissivity in 5 m sections for a flow rate of 1 mL/min and an injection pressure of 200 kPa is indicated in the figure.

The wellbore storage coefficient, C, was calculated from the straight line with a unit slope in the log-log diagrams from the recovery period, see Table 6-2. The coefficient C was only calculated for tests with a well-defined line of unit slope in the beginning of the recovery period. In the most conductive sections, this period occurred during very short intervals at very early times and is not visible in the diagrams. In sections with a very low transmissivity, the estimates of C may be uncertain due to difficulties in defining an accurate time for the start of the recovery period. Furthermore, the resolution of the pressure sensors causes the recovery derivative to be quite scattered in sections of low transmissivity. The values of C presented in Table 6-2 may be compared with the net values of C in Table 5-3 (based on geometry).

The number of tests with a well-defined line of unit slope for which it was possible to calculate C was as follows. One out of 10 tests with the 100 m test section resulted in a well-defined 1:1 straight line. Corresponding figures for 20 m tests were 4 out of 10, and for 5 m tests 7 out of 30. Table 6-2 shows that there is, in general, a good agreement between the calculated C values from the tests and the net values on C listed in Table 5-3, although the values from the tests tend to be slightly higher.

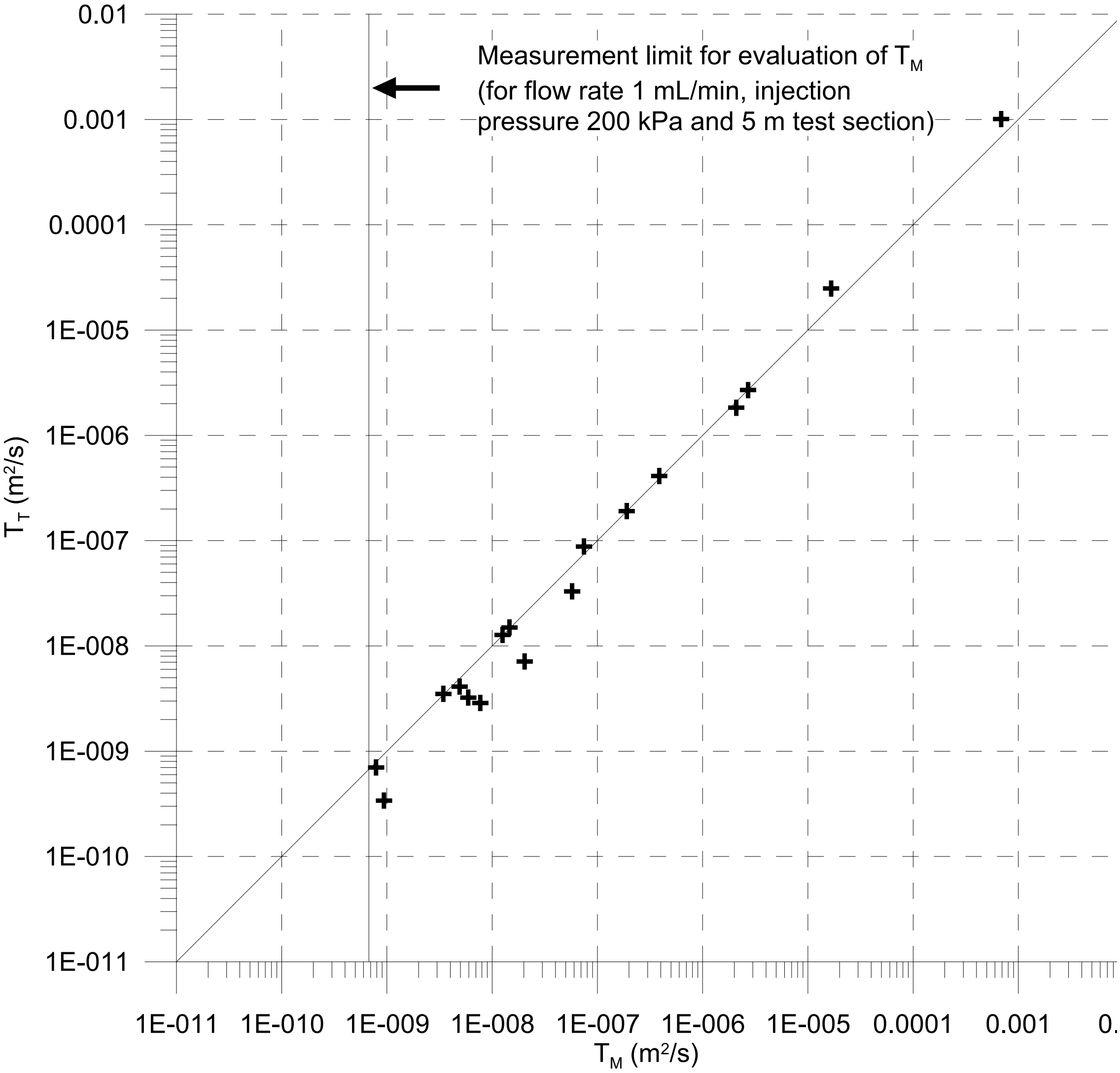

Figure 6-1. *Estimated transmissivities from steady-state- (T_M) and transient (T_T) evaluation from injection tests in 5 m sections in borehole KFM07A.*

The test in section 124–129 m resulted in a significantly higher estimate of C than tests in the other 5 m intervals. The 20 m test that straddles the interval 124–129 m also shows higher C-values than the other 20 m test intervals. No reasonable explanation has been found for this. When constructing 95% confidence intervals (using a t-distribution) from calculated values of C from the tests, the values of C listed in Table 5-3 are within these confidence intervals. No confidence interval could be calculated for the 100 m test section, since there was only one test with a well defined line of unit slope. When constructing 95% confidence intervals (using a t-distribution) from calculated values of C from the tests, but omitting the tests covering the interval of 124–129 m, the values of C listed in Table 5-3 are still within these confidence intervals for the 20 m and 5 m sections.

6.2.4 Comments on the tests

Short comments on each test follow below. Flow regimes and hydraulic boundaries, as discussed in section 5.4.3, are in the text referred to as:

WBS = Wellbore storage

PRF = Pseudo-radial flow regime

PLF = Pseudo-linear flow regime

PSF = Pseudo-spherical flow regime

PSS = Pseudo-stationary flow regime

NFB = Apparent no-flow boundary

CHB = Apparent constant-head boundary

104.0–204.0 m

The transmissivity in the test section is above the measurement limit for the PSS measurement system, hence only c 6 kPa injection pressure is achieved. PSS is indicated for injection and recovery period. Only an approximate transient evaluation with a model assuming pseudo-spherical flow regime is possible on both the flow- and recovery period.

204.0–304.0 m

The injection period shows a PRF from c 400 s to the end of the injection period. The recovery is dominated by WBS and a transition period to a possible PRF.

304.0–404.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

404.0–504.0 m

The final flow during the injection period was not unambiguously distinguished from zero flow noise.

504.0–604.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

604.0–704.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

704.0–804.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

750.0–850.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

104.0–124.0 m

A PSS is dominating both the injection- and the recovery period. Despite an apparent PSS during the injection period, a slight decrease in flow rate is observed during the last c 300 s. A low injection pressure of c 8 kPa, due to the high transmissivity of the section, makes pressure regulation insensitive to change of flow rate. This is a possible explanation to the observed steady flow. Steady-state evaluation of transmissivity is considered to be the most representative value.

124.0–144.0 m

The interpreted PSS during the injection period is uncertain because of the possible transient effects from flow/pressure regulation during the first 60 s. A short period of PRF is indicated from 650 to 950 s. A PSS is dominating the recovery period, hence only an approximate transient evaluation is possible. Interpreted transmissivity from transient evaluation of the injection period is regarded the most representative value of transmissivity.

144.0–164.0 m

There is a weak indication of a PRF from c 80 to c 200 s during the injection period. After c 200 s a PSF is observed. From 10 to 60 s of the recovery period a PRF is indicated. This is followed by an apparent NFB up to c 300 s, transitioning to a PSF by the end of the period. The transient evaluation of parameters from the recovery period is considered to be the most representative.

164.0–184.0 m

Insufficient pressure regulation and constant pressure was achieved after only c 80 s, which complicates flow regime interpretation for the first part of the injection period. However, a PSF is indicated during the flow period. The recovery period is dominated by a PSF. Transient parameter evaluation of the flow period is considered to be the most representative.

184.0–204.0 m

A drift in the gas pressure regulator, primarily during the first c 500 s of the injection period, made the indicated transition less pronounced. After c 400 s a PRF is indicated. Since the pressure stabilized during the second half of the injection period, the indicated PRF (400–1,200 s) is considered as most representative for the tested rock formation. The recovery period is dominated by WBS and a transition to a possible PRF.

204.0–224.0 m

A PRF is indicated from c 20 to 90 s during the injection period. From c 90 s throughout the injection period an apparent NFB is observed. The recovery period showed very similar characteristics, with an indication of a PRF between c 150 and 300 s followed by an apparent NFB for the rest of the period. Transient evaluation of the injection period is considered the most representative.

224.0–244.0 m

No injection test was carried out in this section due to no measurable flow rate. Instead a pressure pulse test was conducted. The transient evaluation is shown in Appendix 3.

244.0–264.0 m

Although the derivative oscillates pretty much, the injection period indicates a PRF lasting from c 300 to 1,200 s. The recovery period indicates a PSF lasting until c 300 s, then transitioning into some other flow regime.

264.0–284.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

284.0–304.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section. The period of measured recovery only showed a pressure increase, showing that the section is of such low transmissivity that the packer expansion affects the pressure throughout the period.

104.0–109.0 m

A PSF is indicated during both the injection- and recovery period. The interpretation is uncertain.

109.0–114.0 m

A well-defined PRF is observed during the injection period. A very fast recovery occurred, inconsistent with the response during the injection period.

114.0–119.0 m

A PSF is indicated during both the injection- and recovery period. The recovery period transitions to a PSS from c 200 s to the end of the period.

119.0–124.0 m

The borehole section has a very high transmissivity. Because of the limited flow capacity of the pump, the head change during the injection period is only c 7 kPa. The evaluation of flow regimes from this period is therefore uncertain, but a PSS transitioning into an apparent NFB is indicated during the injection period. The pressure is almost completely recovered after only 10 s during the recovery period. After this time, a PSS is indicated.

124.0–129.0 m

Although the derivative is very scattered, the injection period indicates a PSF. The recovery period is dominated by WBS and a transition period. It is difficult to make a unique transient evaluation from the recovery period.

127.0–132.0 m

Although the flow rate data is scattered, a PSF transitioning to an apparent NFB after c 300 s is indicated during the injection period. The scattered inverse flow derivative is a consequence of the very noisy flow data. WBS appears during the first 20 s of the recovery period, followed by a transition to a PSS at c 300 s. It is difficult to make a unique transient evaluation from the recovery period.

132.0–137.0 m

A PSF is dominating the injection period. A very rapid recovery into a PSS is making a unique transient evaluation of the recovery phase impossible.

137.0–142.0 m

Although the derivative is very scattered, the injection period indicates a PRF lasting from c 100 to 1,000 s. The recovery period is dominated by a PSF.

139.0–144.0 m

The derivative is very scattered and an unknown event c 350 s into the injection period introduces a disturbance in the flow rate. However, a possible PRF is indicated between 600 and 1,000 s during the injection period. The recovery period is dominated by WBS and a transition period. It is difficult to make a unique transient evaluation from the recovery period.

144.0–149.0 m

During the injection period there are indications of two different periods of PRF. However, it may also be interpreted as variations in flow rate and only one PRF. During the recovery period a PRF is indicated, possibly transitioning to a PSF.

149.0–154.0 m

A PRF is shown during the injection period from c 200 to 1,000 s. Noisy flow data due to low flow makes inverse flow derivative scattered and consequently flow regime interpretation uncertain. Recovery period is dominated by a PLF (not fully developed WBS) and a transition period.

154.0–159.0 m

The injection period is dominated by a well-defined PRF. The flow data is scattered due to flow rate close to the measurement limit. The scattered inverse flow derivative is a consequence of the very noisy flow data. The use of a high filter factor does not change the overall shape of the inverse flow derivative since there is no positive or negative trend in the calculated derivative. WBS and a transition period are dominating the recovery period. Transient evaluation of the injection period is considered to be the most representative.

159.0–164.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

164.0–169.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

169.0–174.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

171.5–176.5 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

176.5–181.5 m

During the injection period a PSF is indicated. Also the recovery period is dominated by a PSF.

181.5–186.5 m

The injection period is dominated by a possible PSF. The injection pressure decreased c 4 kPa during the injection period, which makes the interpretation somewhat uncertain. The recovery period is dominated by WBS and a transition period.

184.0–189.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

189.0–194.0 m

The test section has a very low transmissivity. The test was performed as a pressure pulse test. The period of measured recovery showed a pressure increase indicating that the section is of such low conductivity that the packer expansion still affects the pressure throughout the period. Therefore, the test was interrupted and as a result, T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section. No representative transient evaluation of the test was possible.

194.0–199.0 m

During the injection period a PSF is indicated, lasting until c 300 s. After this time a PRF is indicated. The injection pressure decreased c 4 kPa during the injection period due to a drift in the gas pressure regulator. As a result, reciprocal flow rate was disturbed throughout the injection period which may complicate the interpretation of flow regimes during this period. During the recovery period, a PRF is indicated until c 100 s, transitioning to a PSF by the end of the recovery period.

199.0–204.0 m

Although the derivative is very scattered, the injection period is assumed to be dominated by a PRF. The injection pressure decreased c 2 kPa during the injection period due to a drift in the gas pressure regulator. The recovery period is dominated by WBS and a transition period to a possible PSF.

204.0–209.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

209.0–214.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

214.0–219.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

219.0–224.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

244.0–249.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

249.0–254.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

254.0–259.0 m

The test section has a very low transmissivity. Since the flow rate was not detectable, neither steady-state nor transient evaluation of transmissivity was possible. Hence, in accordance with AP PF 400-05-006, the injection time was shortened. As a result T_M, based on Q/s-measl-L, was considered to be the most representative transmissivity value for this section.

259.0–264.0 m

Although the derivative is very scattered, the injection period is assumed to be dominated by a PRF. The recovery period is dominated by a PSF preceded by some transition period until c 60 s into the recovery period. It is difficult to make a unique transient evaluation from the recovery period.

850.0–1001.6 m

The injection period may indicate a PLF lasting until c 700 s or alternatively, a NFB. Thereafter, a PRF is indicated throughout the injection period. About 350 s into the injection period, a valve change and a change of flow metre induced a sudden drop of flow rate. Because of this, three deviating data points have been removed from the flow rate data. Transient evaluation was made on the first part of the data curve (before the valve change) based on an approximate PRF. The recovery period is also dominated by a PLF or alternatively, an apparent NFB. No representative transient evaluation could be made on the recovery period.

6.2.5 Flow regimes

A summary of the frequency of identified flow regimes for injection tests in different scales in KFM07A is presented in Table 6-3, which shows the identified flow regimes for all tests. For example, if a certain test indicates a pseudo-radial flow regime (PRF) transitioning to a pseudo-spherical flow regime (PSF), this test contributes to one observation of pseudo-radial and one observation of pseudo-spherical flow. The numbers within parenthesis denote the number of tests where the actual flow regime is the only one present.

It should be noted that the interpretation of flow regimes is only tentative and based on visual inspection of the data curves. The number of tests with a pseudo-linear flow regime may be underestimated for the injection period due to the fact that a certain time is required for achieving constant pressure in the beginning of the test, thus masking the initial period.

Table 6-3 shows that a period of pseudo-radial flow could be identified from the injection period in c 50–60% of the tests in 5 m and 20 m test sections with a definable final flow rate in borehole KFM07A. For the recovery period, the corresponding result is only c 10–25%. During the injection period, the PSF flow regime is almost as common as the PRF regime for the 5 m test sections. During the recovery period PSF, eventually transitioning to PSS, is the most common flow regime.

In about 32% of the tests, more than one flow regime could be identified. Transitions from some flow regime to either a pseudo-radial flow regime or an apparent no-flow boundary were most common during the injection period. For the recovery period a change from WBS to some other flow regime was the most common type of transition. However, during both the injection- and recovery period a great diversity of transitions occurred.

Table 6-3. Interpreted flow regimes during the injection tests in KFM07A.

Section length (m)	Number of tests	Number of tests with definable Q_p	Injection period					Recovery period					
			PLF	PRF	PSF	PSS	NFB	WBS	PLF	PRF	PSF	PSS	NFB
5	30	16	0(0)	9(8)	8(6)	1(0)	2(0)	6(4)	1(0)	2(1)	6(4)	5(4)	0(0)
20	10	6	0(0)	5(2)	2(1)	2(1)	1(0)	2(1)	0(0)	2(0)	3(2)	2(2)	2(0)
100	8	2	1(1)	1(1)	0(0)	1(1)	0(0)	2(2)	0(0)	0(0)	0(0)	1(1)	0(0)
151.55 [1)]	1	1	1(0)	1(0)	0(0)	0(0)	0(0)	0(0)	1(1)	0(0)	0(0)	0(0)	0(0)

[1)] Single packer injection test

6.2.6 Transmissivity values on different scales

The transmissivity values considered the most representative, TR, from the injection tests in the tested sections of 151 m (single packer test), 100 m, 20 m and, 5 m length, respectively, are shown in Figure 6-2. This figure generally demonstrates a good agreement between results obtained from tests on different scales. However, the transmissivity value for the 100 m section 204.0–304.0 m is considerably lower than the cumulative transmissivity of the 5 m and 20 m sections respectively, in the corresponding borehole interval. A consistency check of the transmissivity values on the different scales was made by summation of calculated values from smaller scales (20 m and 5 m) and comparing with the estimated values in longer sections (100 m and 20 m).

In Table 6-4, estimated transmissivity values in 100 m and 20 m test sections according to steady-state (T_M) and most representative evaluation (T_R) are listed together with summed transmissivities in 20 m and 5 m sections over the corresponding 100 m and 20 m sections. In addition, the corresponding sum of transmissivities from the difference flow logging in 5 m sections (SUM T_D) is displayed for each section.

When the transmissivity values are below the measurement limit (Q_p could not be defined), the most representative transmissivity value, T_R, was considered to be less than T_M, based on Q/s-measl-L, for the test section. The measurement limit values are included in the summed values in Table 6-4. This leads to overestimated values of the summed transmissivities. This is particularly true for the summed transmissivities from the difference flow logging in 5 m sections, due to the high number of (cumulative) values on the lower measurement limit for these tests, see Sokolnicki and Rouhiainen (2005) /1/.

In Figure 6-3, transmissivity values considered as the most representative for 100 m and 20 m sections (T_R–100 m and T_R–20 m, respectively) are plotted versus the sum of the transmissivity values considered most representative in 5 m sections in the corresponding intervals (SUM T_R–5 m). The lower measurement limit of T_M for the different section lengths (Q_p = 1 mL/min and an assumed pressure difference of 200 kPa) together with the cumulative measurement limit for the sum of 5 m sections are also shown in the figure.

Figure 6-3 indicates a good agreement between measured transmissivity values in longer sections and summed transmissivity values in corresponding 5 m sections for the injection tests. The small deviation towards the lower measurement limit is caused by the fact that values at the measurement limit (Q/s-measl-L) are accumulated in the summation process which most likely results in overestimated values of SUM T_R–5 m.

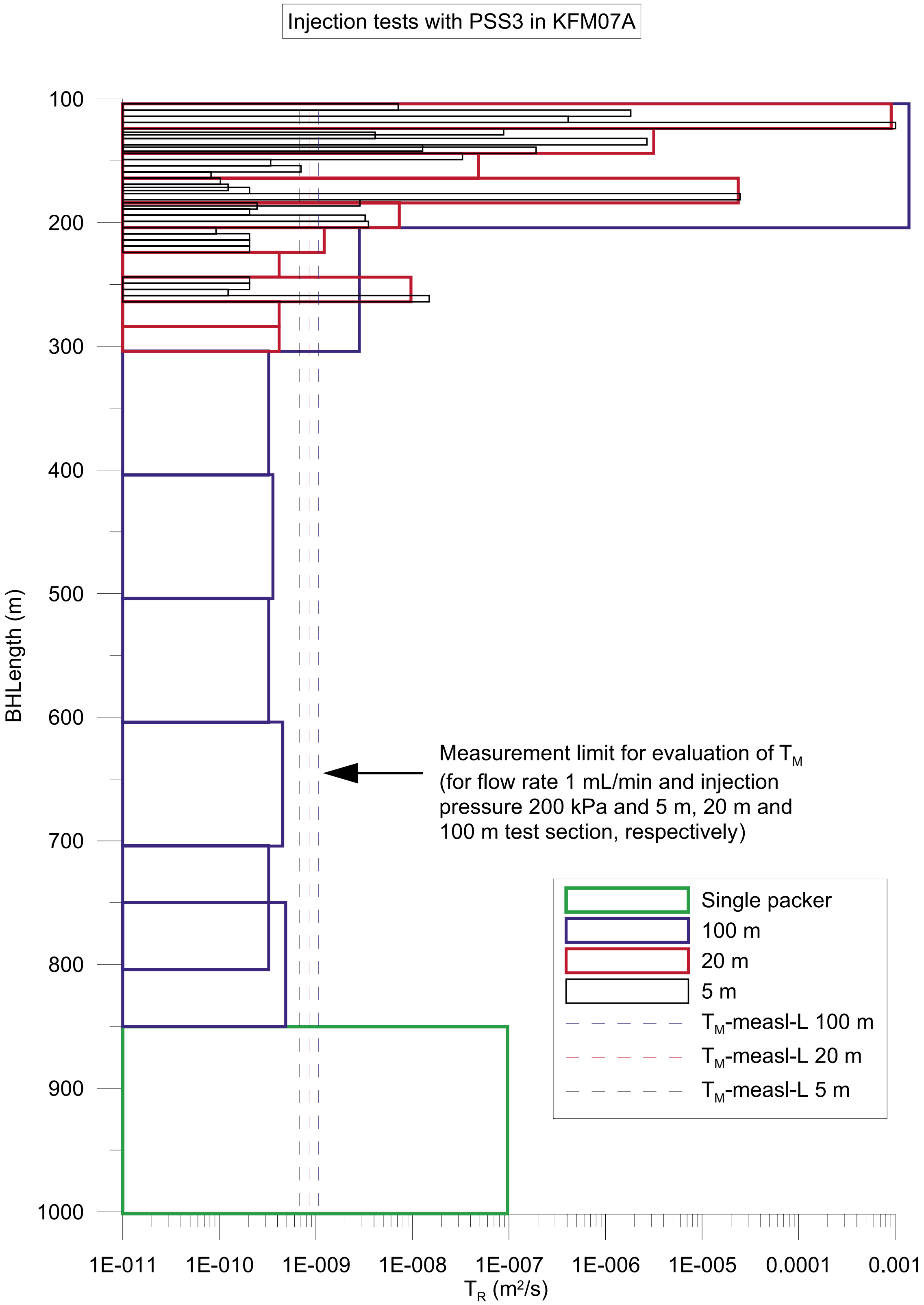

Figure 6-2. *Estimated best representative transmissivity values (T_R) for sections of 100 m, 20 m and 5 m length in borehole KFM07A. The c 150 m long section from the single packer test is also represented in the diagram. Estimated transmissivity values for the lower measurement limit from stationary evaluation (T_M–measl-L) based on a flow rate of $1.7 \cdot 10^{-8}$ m^3/s and an injection pressure of 200 kPa for different test section lengths are also shown.*

Table 6-4. Estimated transmissivity values in 100 m and 20 m test sections together with summed up transmissivity values in 20 m and 5 m sections in the corresponding borehole intervals from the injection tests in KFM07A. In addition, the corresponding sum of transmissivity values from the difference flow logging in 5 m sections is shown.

Borehole Idcode	Secup inj.test (m)	Seclow inj.test (m)	L_w (m)	T_M inj. tests (m^2/ s)	T_R inj. tests (m^2/s)	SUM T_M (20 m) inj. tests (m^2/s)	SUM T_R (20 m) inj. tests (m^2/s)	SUM T_M (5 m) inj. tests (m^2/s)	SUM T_R (5 m) inj. tests (m^2/s)	Secup diff-flow log (m)	Seclow diff-flow log (m)	SUM-T_D (5 m) diff-flow log (m^2/s)
KFM07A	104.00	204.00	100.00	1.39E–03	1.39E–03	9.39E–04	9.37E–04	7.08E–04	1.04E–03	101.99	202.11	1.07E–04
KFM07A	204.00	304.00	100.00	8.39E–09	2.83E–09	1.43E–08	1.21E–08	1.59E–08	1.62E–08	202.11	302.20	3.28E–07
KFM07A	304.00	404.00	100.00	<3.25E–10	<3.25E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	302.21	402.31	3.53E–07
KFM07A	404.00	504.00	100.00	3.60E–10	3.60E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	402.32	502.32	6.90E–07
KFM07A	504.00	604.00	100.00	<3.25E–10	<3.25E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	502.32	602.44	6.98E–07
KFM07A	604.00	704.00	100.00	<4.55E–10	<4.55E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	602.44	702.53	7.47E–07
KFM07A	704.00 [1)]	804.00	100.00	<3.25E–10	<3.25E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	702.54	802.63	6.98E–07
KFM07A	750.00 [1)]	850.00	100.00	<4.87E–10	<4.87E–10	n.m. 20 m	n.m. 20 m	n.m. 5 m	n.m. 5 m	747.58	847.67	6.27E–07
KFM07A	104.00	124.00	20.00	9.10E–04	9.10E–04			6.88E–04	1.01E–03	101.99	122.01	6.72E–05
KFM07A	124.00	144.00	20.00	3.40E–06	3.16E–06			2.98E–06	2.99E–06	122.02	142.05	1.99E–05
KFM07A	144.00	164.00	20.00	8.47E–08	4.83E–08			5.94E–08	3.42E–08	142.06	162.09	3.16E–06
KFM07A	164.00	184.00	20.00	2.56E–05	2.37E–05			1.66E–05	2.48E–05	162.11	182.11	1.63E–05
KFM07A	184.00	204.00	20.00	1.14E–08	7.32E–09			9.84E–09	7.20E–09	182.11	202.11	9.90E–09
KFM07A	204.00	224.00	20.00	1.30E–09	1.22E–09			7.10E–10	7.10E–10	202.11	222.11	3.17E–08
KFM07A	224.00	244.00	20.00	<4.17E–10	<4.17E–10			n.m. 5 m	n.m. 5 m	222.11	242.12	4.76E–08
KFM07A	244.00	264.00	20.00	1.17E–08	9.67E–09			1.52E–08	1.55E–08	242.12	262.13	1.69E–07
KFM07A	264.00	284.00	20.00	<4.17E–10	<4.17E–10			n.m. 5 m	n.m. 5 m	262.13	282.17	3.98E–08
KFM07A	284.00	304.00	20.00	<4.17E–10	<4.17E–10			n.m. 5 m	n.m. 5 m	282.17	302.20	4.00E–08

[1)] Partly overlapping sections

n.m. = not measured

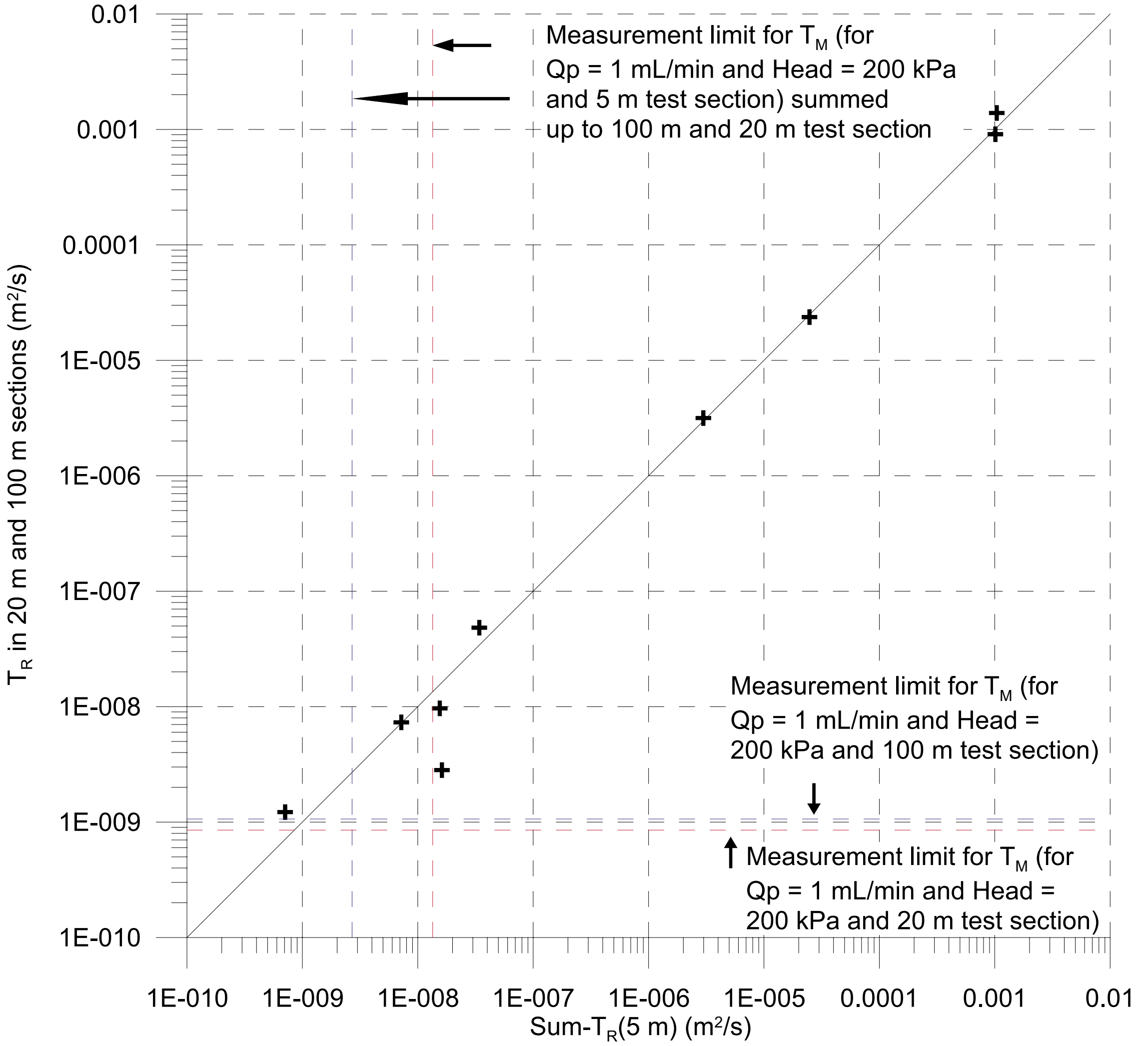

Figure 6-3. *Transmissivity values considered most representative (T_R) for 100 m and 20 m sections versus the sum of corresponding transmissivity values (T_R) in 5 m sections in the corresponding borehole intervals from the injection tests in KFM07A.*

6.3 Comparison with results from the difference flow logging

In Figure 6-4, a comparison is made of calculated steady-state (T_M) and most representative transmissivity values (T_R) from the injection tests in 5 m sections with the calculated transmissivity values in the corresponding 5 m sections from the difference flow logging (T_D) in KFM07A, Sokolnicki and Rouhiainen (2005) /1/. In Figure 6-5, T_R and T_D for the injection tests in 5 m sections are plotted versus borehole length.

The presented measurement limit for the difference flow logging is the estimated, practical lower measurement limit (varying along the borehole) /1/. In the summation of the transmissivities from the 5 m sections, the estimated values for the lower (practical) measurement limits are included. The lower measurement limit from the difference flow logging is varying substantially along the borehole in KFM07A. In Figure 6-5 four separate levels can be clearly identified. The difference flow logging in KFM07A suffered from an unusually high noise level of flow rate, which fact resulted in a significantly increased lower measurement limit in certain borehole intervals.

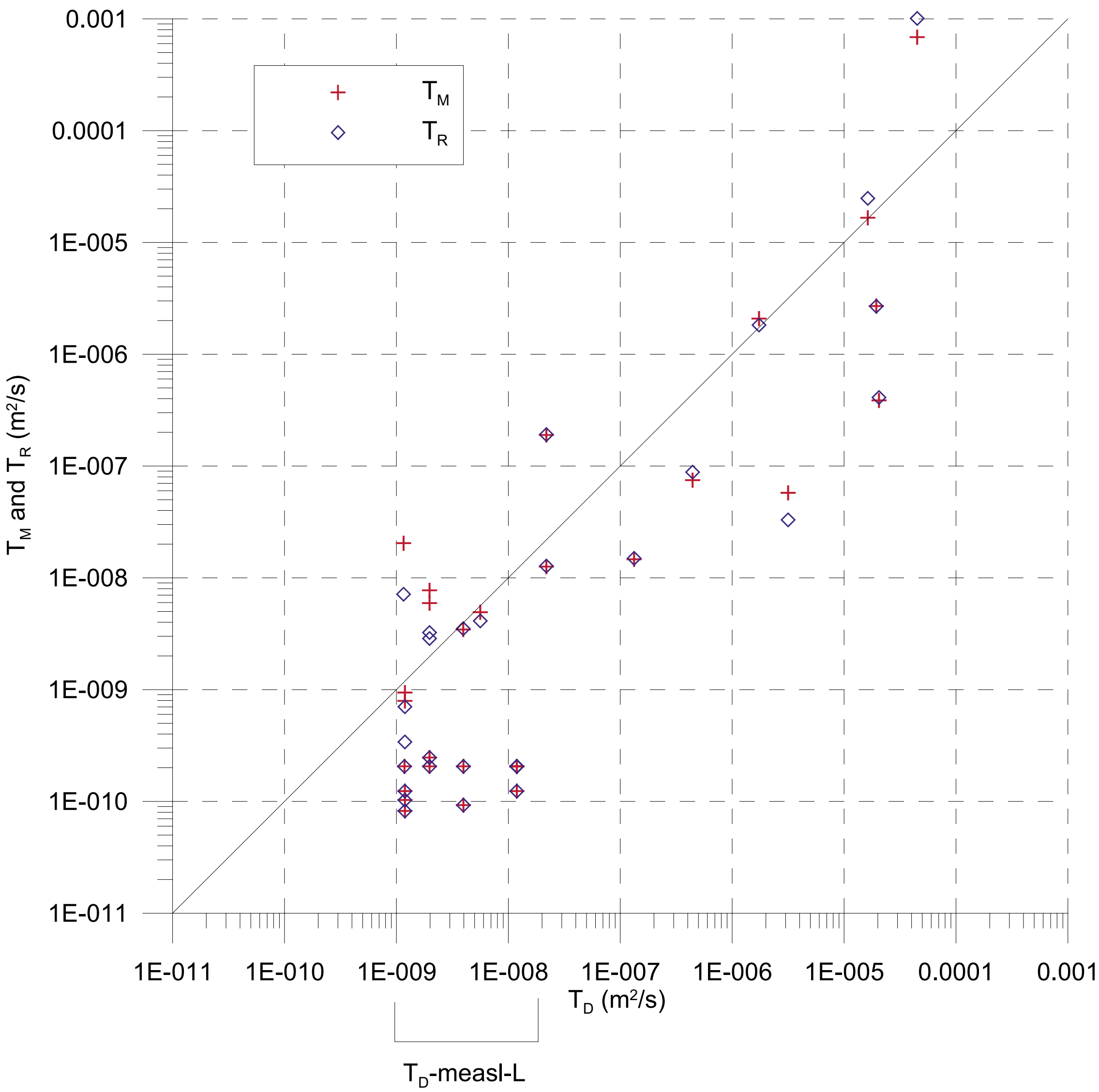

Figure 6-4. *Comparison of estimated steady-state (T_M) and most representative (T_R) transmissivity values from the injection tests in 5 m sections with estimated transmissivity values in the corresponding 5 m sections from the previous difference flow logging (T_D) in KFM07A. The practical measurement limit for T_D lies within the interval marked by brackets.*

Figure 6-4 indicates a decreased agreement between the estimated transmissivity values from the injection tests and the difference flow logging compared to previous boreholes. At least two test sections show a discrepancy of about twice as large as observed in previous boreholes, which probably is an effect of the difference between in the positions of the test sections for the injection tests respectively the difference flow logging which was larger in KFM07A than in previous boreholes tested. Furthermore, for the difference flow logging, the estimated, practical lower measurement limit for transmissivity varied between $1.2 \cdot 10^{-9}$ m²/s and $3.7 \cdot 10^{-8}$ m²/s. This limit is significantly higher than the corresponding limits for the injection tests in KFM07A. This is clearly seen in Figure 6-4 as the difference between T_D, T_M and T_R, respectively, for low transmissivity values. In addition, it should be noted that the two methods differ regarding assumptions and associated uncertainties. Potential uncertainties for difference flow logging results are discussed in Ludvigson et al. (2002) /13/ and for injection tests in Andersson et al. (1993) /14/.

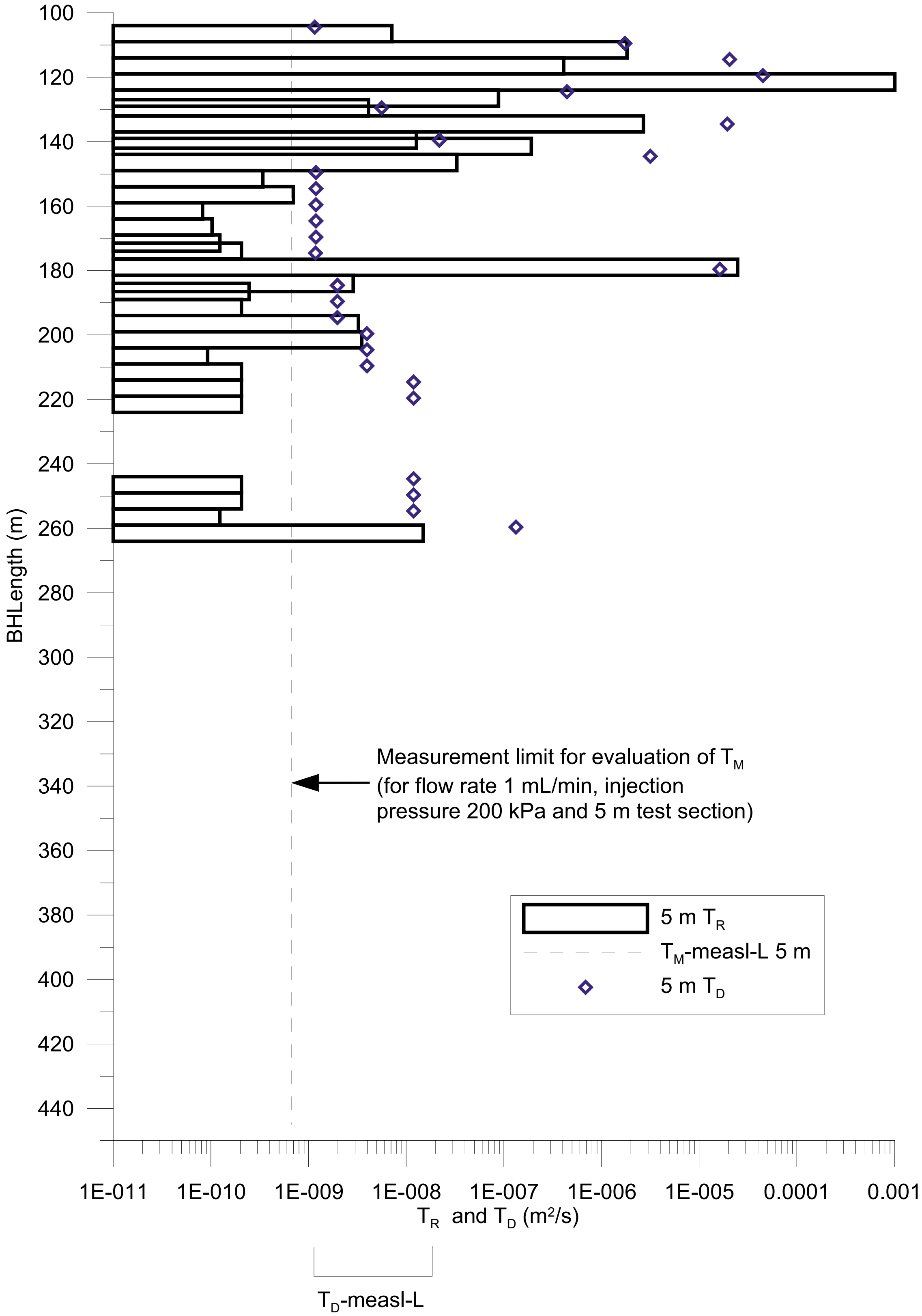

Figure 6-5. *Comparison of most representative (T_R) transmissivity values from the injection tests in 5 m sections with estimated transmissivity values in the corresponding 5 m sections from the previous difference flow logging (T_D) in KFM07A. The practical measurement limit for T_D lies within the interval marked by brackets.*

In Figure 6-6, a comparison is made of the estimated steady-state transmissivity values from the injection tests in 100 m and 20 m test sections with summed transmissivity values for 5 m sections from the difference flow logging (SUM T_D(5 m)) in the corresponding borehole intervals. The latter sums are shown in Table 6-4. Figure 6-6 shows that the estimated transmissivity values from the injection tests in 100 m and 20 m sections are distributed over a much wider range than the sum of transmissivity values from the difference flow logging. This is partly a result of the lower measurement limit values being included in the sum for the difference flow logging. In Figure 6-7, T_R and SUM T_D (5 m) are plotted versus the borehole length for the injection test intervals in 20 m, 100 m and single packer sections.

The results in Figure 6-6 are consistent with the results in Figure 6-4, even though the number of tests exceeding the lower measurement limit for the difference flow logging in Figure 6-6 is relatively low.

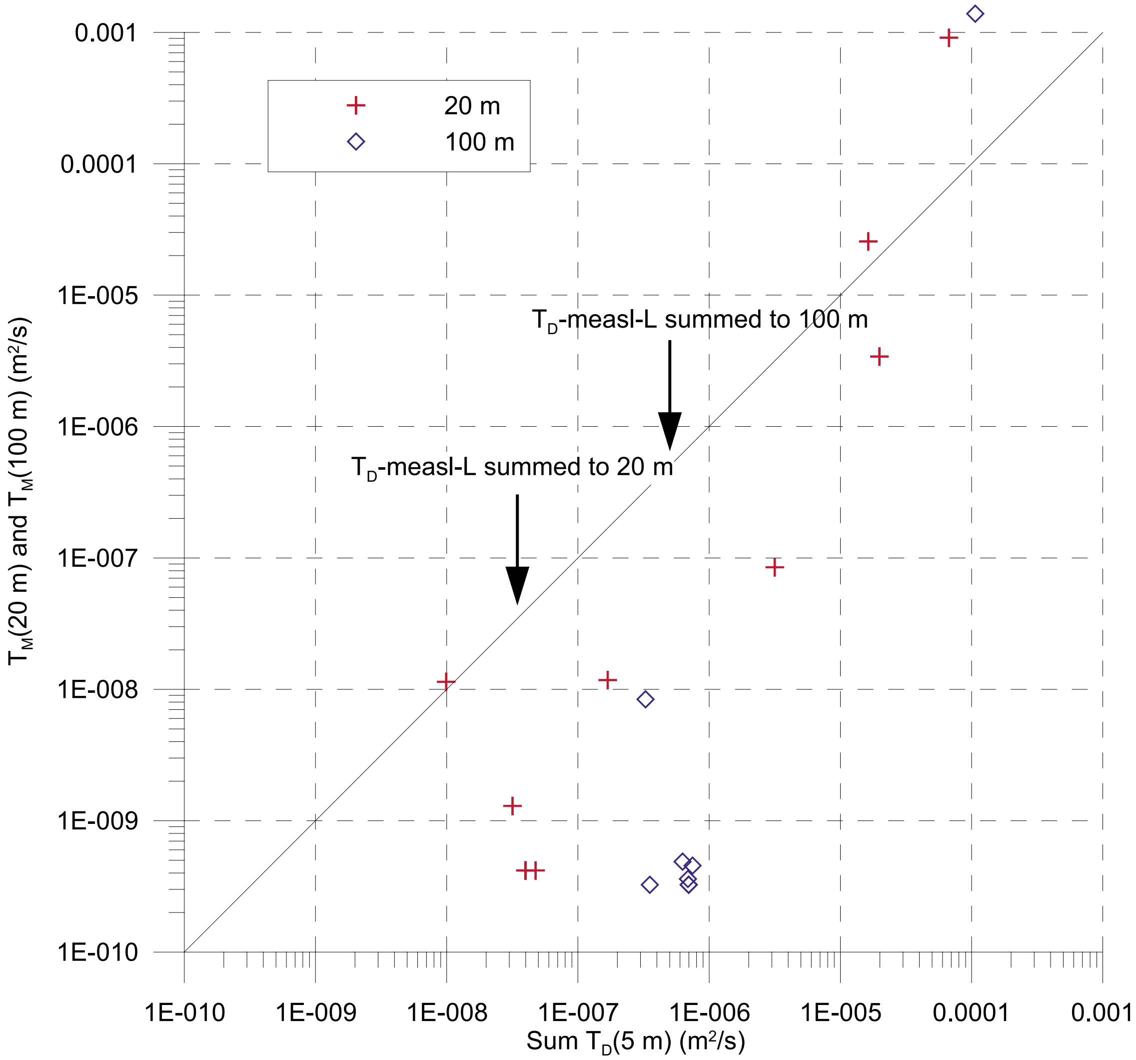

Figure 6-6. *Comparison of estimated steady-state transmissivity values from injection tests in 20 m and 100 m sections with summed transmissivity values in 5 m sections in the corresponding borehole intervals from difference flow logging in KFM07A.*

For the difference flow logging, the flow period of the borehole before the flow measurements was much longer than for the injection tests. Therefore, the difference flow logging mainly measures interconnected, conductive fracture networks reaching further away from the borehole. The injection tests also measures isolated, short fractures. The transmissivity of such isolated fractures is assumed to decrease with increasing flow times. But during short injection tests, such effects may not be seen. These expected differences in results from the injection tests and difference flow logging can however not be supported by the results presented in this section.

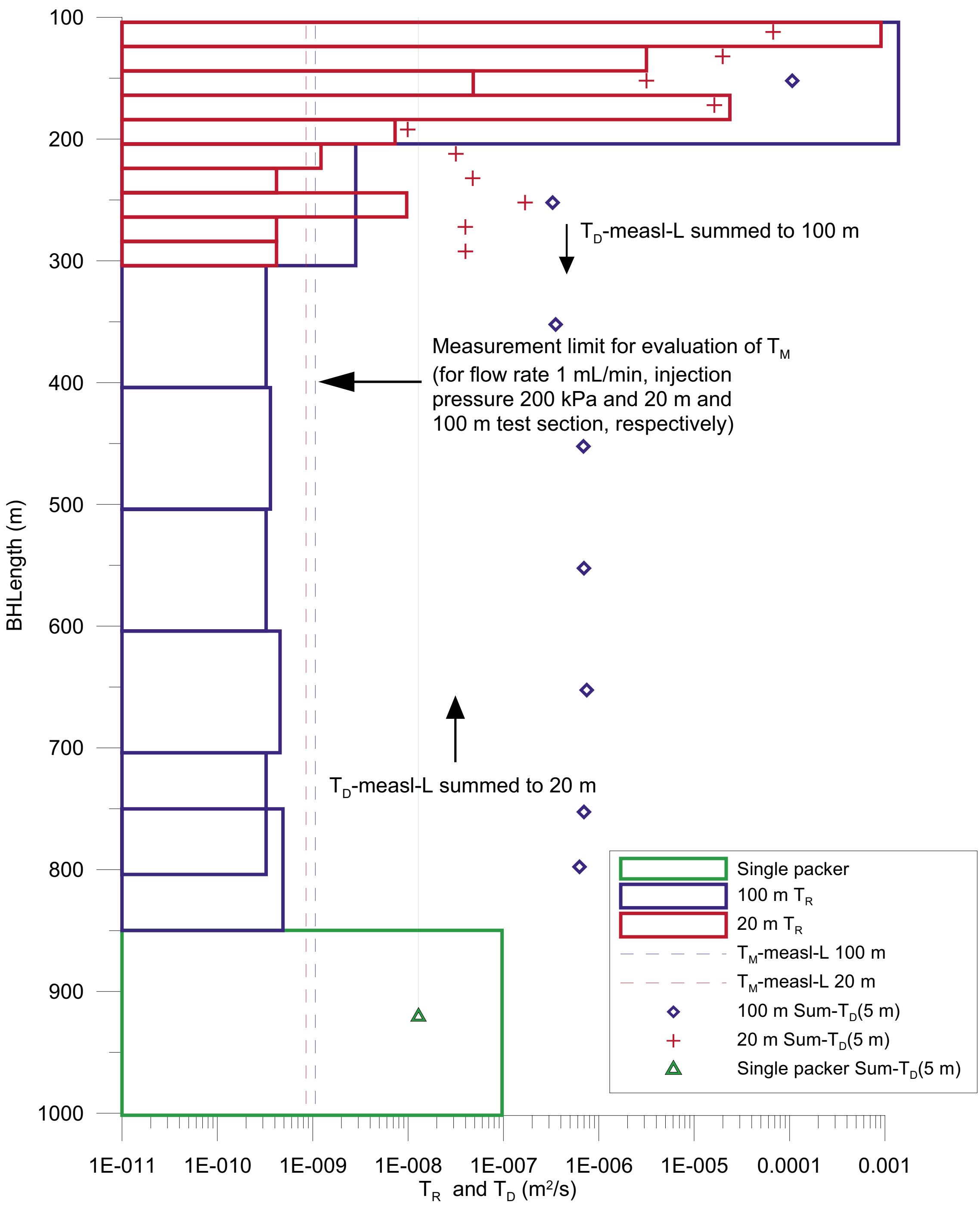

Figure 6-7. *Comparison of most representative (T_R) transmissivity values from injection tests in 20 m, 100 m and single packer sections with summed transmissivity values in 5 m sections in the corresponding borehole intervals from difference flow logging in KFM07A.*

6.4 Basic statistics of hydraulic conductivity distributions

Some basic statistical parameters were calculated for the steady-state hydraulic conductivity (K_M) distributions in different scales (100 m, 20 m and 5 m) from the injection tests in borehole KFM07A. The hydraulic conductivity is obtained by dividing the transmissivity by the section length, in this case T_M/L_w. Results from tests where Q_p was below the estimated measurement limit were not included in the statistical analyses of K_M. Therefore, the same basic statistical parameters were derived for the hydraulic conductivity considered most representative ($K_R = T_R/L_w$), including all tests. In the statistical analysis, the logarithm (base 10) of K_M and K_R was used. Selected results are shown in Table 6-5. It should be noted that the statistics for the different section lengths is based on different borehole intervals.

Table 6-5. Basic statistical parameters for steady-state hydraulic conductivity (K_M) and hydraulic conductivity considered most representative (K_R) in borehole KFM07A. L_w = section length, m = arithmetic mean, s = standard deviation.

Borehole	Parameter	Unit	L_w = 100 m	L_w = 20 m	L_w = 5 m
KFM07A	Measured borehole interval	m	104.00–850.00 [2)]	104.00–304.00	104.00–264.00 [3)]
	Number of tests	–	8	10	30
	N:o of tests below E.L.M.L or above E.U.M.L.[1)]	–	6	4	14
	m ($Log_{10}(K_M)$)	Log_{10}(m/s)	–10.44	–8.61	–8.99
	s ($Log_{10}(K_M)$)	–	2.30	2.24	1.79
	m ($Log_{10}(K_R)$)	Log_{10}(m/s)	–10.50	–8.67	–9.04
	s ($Log_{10}(K_R)$)	–	2.30	2.24	1.82

1) Number of tests where Qp could not be defined (E.L.M.L. = estimated lower measurement limit, E.U.M.L = estimated upper measurement limit).

2) Sections 704.00–804.00 and 750.0–850.00 partly overlapping. The interval between 850.00 m and the bottom of the borehole was measured separately with a single packer injection test.

3) Sections 124.00–129.00 and 127.00–132.00 are partly overlapping. Sections 137.00–142.00 and 139.00–144.00 are partly overlapping. Sections 169.00–174.00 and 171.50–176.50 are partly overlapping. Sections 181.50–186.50 and 184.00–189.00 are partly overlapping. The interval 224.00–244.00 was not measured in 5 m test sections.

6.5 Comparison of results from different hydraulic tests in KFM07A

In Table 6-6, a comparison of estimated transmissivity values from different hydraulic tests in KFM07A is presented. It should be observed that the summed transmissivity values for the injection tests only include the tests actually performed for each section length. However, the most conductive sections are measured.

Table 6-6 shows that the results of the different hydraulic test methods in borehole KFM07A are not entirely consistent. The cumulative borehole transmissivity from the difference flow logging is about one order of magnitude lower compared with the results from the injection tests and c 5 times lower than the transmissivity calculated from the pumping test (4.4E-04 m^2/s) in the open borehole during difference flow logging /1/.

Table 6-6. Comparison of calculated transmissivity values from different hydraulic single-hole tests in borehole KFM07A.

Hydraulic test method	Sum of T (m^2/s)	Borehole interval and length of interval (m)	
		104.00–850.00	850.00–1,001.55
Injection tests	$\sum T_M$(100 m) [1)]	1.39E–03	
	$\sum T_R$(100 m) [1)]	1.39E–03	
	$\sum T_M$(20 m) [2)]	9.39E–04	
	$\sum T_R$(20 m) [2)]	9.37E–04	
	$\sum T_M$(5 m) [3)]	7.08E–04	
	$\sum T_R$(5 m) [3)]	1.04E–03	
	$\sum T_M$(151 m) [4)]		5.73E–07
	$\sum T_R$(151 m) [4)]		9.66E–08
Difference flow logging [5)]	$\sum T_D$(5 m)	1.07E–04	1.42E–08 [6)]

[1)] Sections 704.00–804.00 and 750.00–850.00 partly overlapping for the injection tests.
[2)] The measured interval in 20 m sections was only 104.00 m to 304.00 m.
[3)] The measured intervals were 104.00 m to 224.0 m and 244.00 m to 264.0 m. Sections 124.00–129.00 and 127.00–132.00 partly overlapping. Sections 137.00–142.00 and 139.00–144.00 are partly overlapping. Sections 169.00–174.00 and 171.50–176.50 are partly overlapping. Sections 181.50–186.50 and 184.00–189.00 are partly overlapping.
[4)] Single packer injection test.
[5)] Calculated sums of transmissivity include values on the estimated lower measurement limit.
[6)] Difference flow logging was not performed during pumping in this borehole interval.

However, the transmissivity of one of the measured 5 m sections (120–125 m) and a corresponding fracture at c 120.2 m were close to the upper measurement limit in the difference flow logging, even at a low drawdown in the borehole. This fact may possibly result in an underestimation of the transmissivity of this section and fracture during the difference flow logging. The largest contribution to the total transmissivity of the borehole is supplied by the intervals 119.0–124.0 m and 176.5–181.5 m.

Furthermore, difference flow logging during pumping of the borehole was not performed in the interval c 850–1,000 m due to a cavity which may also have resulted in an underestimation of the transmissivity of this interval.

7 References

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Appendices

Appendix 1	File description table
Appendix 2.1	General test data
Appendix 2.2	Pressure and flow data
Appendix 3	Test diagrams – Injection tests
Appendix 4	Borehole technical data
Appendix 5	Sicada tables

Appendix 1. File description table

Bh id	Test section		Test type	Test no	Test start Date, time	Test stop Date, time	Data files of raw and primary data	Parameters in file	Comments
idcode	(m)	(m)	(1-7)[1)]		YYYYMMDD hh:mm	YYYYMMDD hh:mm	__Borehole id_secup_date and time of test start		
KFM07A	104	204	3	1	20050215 21:09	20050215 23:32	__KFM07A_0104.00_200502152109.ht2	P,Q,Te	
KFM07A	104	204	3	2	20050216 06:40	20050216 08:38	__KFM07A_0104.00_200502160640.ht2	P,Q,Te	
KFM07A	204	304	3	1	20050216 10:52	20050216 13:41	__KFM07A_0204.00_200502161052.ht2	P,Q,Te	
KFM07A	304	404	3	1	20050216 15:27	20050216 16:35	__KFM07A_0304.00_200502161527.ht2	P,Q,Te	
KFM07A	404	504	3	1	20050216 17:44	20050216 19:33	__KFM07A_0404.00_200502161744.ht2	P,Q,Te	
KFM07A	504	604	3	1	20050216 20:53	20050216 21:54	__KFM07A_0504.00_200502162053.ht2	P,Q,Te	
KFM07A	604	704	3	1	20050216 23:04	20050217 00:03	__KFM07A_0604.00_200502162304.ht2	P,Q,Te	
KFM07A	704	804	3	1	20050217 08:14	20050217 09:23	__KFM07A_0704.00_200502170814.ht2	P,Q,Te	
KFM07A	750	850	3	1	20050217 14:13	20050217 15:25	__KFM07A_0750.00_200502171413.ht2	P,Q,Te	
KFM07A	504	604	4B	2	20050217 18:00	20050217 20:05	__KFM07A_0504.00_200502171800.ht2	P,Q,Te	
KFM07A	404	504	4B	2	20050217 20:57	20050217 22:43	__KFM07A_0404.00_200502172057.ht2	P,Q,Te	
KFM07A	304	404	4B	2	20050217 23:42	20050218 07:57	__KFM07A_0304.00_200502172342.ht2	P,Q,Te	
KFM07A	104	124	3	1	20050218 21:29	20050218 22:45	__KFM07A_0104.00_200502182129.ht2	P,Q,Te	
KFM07A	124	144	3	1	20050221 06:10	20050221 07:25	__KFM07A_0124.00_200502210610.ht2	P,Q,Te	
KFM07A	144	164	3	1	20050221 07:47	20050221 09:01	__KFM07A_0144.00_200502210747.ht2	P,Q,Te	
KFM07A	164	184	3	1	20050221 09:21	20050221 10:40	__KFM07A_0164.00_200502210921.ht2	P,Q,Te	
KFM07A	184	204	3	1	20050221 10:56	20050221 12:53	__KFM07A_0184.00_200502211056.ht2	P,Q,Te	
KFM07A	204	224	3	1	20050221 13:11	20050221 14:28	__KFM07A_0204.00_200502211311.ht2	P,Q,Te	
KFM07A	224	244	4B	1	20050221 14:50	20050221 16:45	__KFM07A_0224.00_200502211450.ht2	P,Q,Te	
KFM07A	244	264	3	1	20050221 17:18	20050221 18:00	__KFM07A_0244.00_200502211718.ht2	P,Q,Te	
KFM07A	264	284	3	1	20050221 18:52	20050221 19:41	__KFM07A_0264.00_200502211852.ht2	P,Q,Te	
KFM07A	284	304	3	1	20050221 20:02	20050221 21:05	__KFM07A_0284.00_200502212002.ht2	P,Q,Te	
KFM07A	244	264	3	2	20050221 21:34	20050221 23:31	__KFM07A_0244.00_200502212134.ht2	P,Q,Te	
KFM07A	104	124	3	2	20050222 06:58	20050222 08:13	__KFM07A_0104.00_200502220658.ht2	P,Q,Te	
KFM07A	104	109	3	1	20050222 17:33	20050222 18:54	__KFM07A_0104.00_200502221733.ht2	P,Q,Te	
KFM07A	109	114	3	1	20050222 19:10	20050222 20:27	__KFM07A_0109.00_200502221910.ht2	P,Q,Te	
KFM07A	114	119	3	1	20050222 21:05	20050222 22:24	__KFM07A_0114.00_200502222105.ht2	P,Q,Te	
KFM07A	119	124	3	1	20050222 22:40	20050222 23:58	__KFM07A_0119.00_200502222240.ht2	P,Q,Te	
KFM07A	124	129	3	1	20050223 06:32	20050223 07:47	__KFM07A_0124.00_200502230632.ht2	P,Q,Te	
KFM07A	127	132	3	1	20050223 08:02	20050223 10:05	__KFM07A_0127.00_200502230802.ht2	P,Q,Te	
KFM07A	132	137	3	1	20050223 10:22	20050223 11:51	__KFM07A_0132.00_200502231022.ht2	P,Q,Te	
KFM07A	137	142	3	1	20050223 12:44	20050223 13:58	__KFM07A_0137.00_200502231244.ht2	P,Q,Te	
KFM07A	139	144	3	1	20050223 14:04	20050223 15:21	__KFM07A_0139.00_200502231404.ht2	P,Q,Te	
KFM07A	144	149	3	1	20050223 15:55	20050223 17:20	__KFM07A_0144.00_200502231555.ht2	P,Q,Te	

Bh id	Test section		Test type	Test no	Test start Date, time	Test stop Date, time	Data files of raw and primary data	Parameters in file	Comments
idcode	(m)	(m)	(1-7)[1)]		YYYYMMDD hh:mm	YYYYMMDD hh:mm	__Borehole id_secup_date and time of test start		
KFM07A	149	154	3	1	20050223 17:37	20050223 18:54	__KFM07A_0149.00_200502231737.ht2	P,Q,Te	
KFM07A	154	159	3	1	20050223 19:10	20050223 20:29	__KFM07A_0154.00_200502231910.ht2	P,Q,Te	
KFM07A	159	164	3	1	20050223 21:01	20050223 22:07	__KFM07A_0159.00_200502232101.ht2	P,Q,Te	
KFM07A	164	169	3	1	20050223 22:28	20050223 23:11	__KFM07A_0164.00_200502232228.ht2	P,Q,Te	
KFM07A	169	174	3	1	20050224 06:15	20050224 06:57	__KFM07A_0169.00_200502240615.ht2	P,Q,Te	
KFM07A	171.5	176.5	3	1	20050224 07:42	20050224 08:29	__KFM07A_0171.50_200502240742.ht2	P,Q,Te	
KFM07A	176.5	181.5	3	1	20050224 08:41	20050224 10:09	__KFM07A_0176.50_200502240841.ht2	P,Q,Te	
KFM07A	181.5	186.5	3	1	20050224 10:23	20050224 11:44	__KFM07A_0181.50_200502241023.ht2	P,Q,Te	
KFM07A	184	189	3	1	20050224 12:24	20050224 13:09	__KFM07A_0184.00_200502241224.ht2	P,Q,Te	
KFM07A	189	194	4B	1	20050224 13:23	20050224 14:34	__KFM07A_0189.00_200502241323.ht2	P,Q,Te	
KFM07A	194	199	3	1	20050224 14:49	20050224 16:40	__KFM07A_0194.00_200502241449.ht2	P,Q,Te	
KFM07A	199	204	3	1	20050224 16:58	20050224 18:14	__KFM07A_0199.00_200502241658.ht2	P,Q,Te	
KFM07A	204	209	3	1	20050224 18:35	20050224 19:31	__KFM07A_0204.00_200502241835.ht2	P,Q,Te	
KFM07A	209	214	3	1	20050224 19:54	20050224 20:45	__KFM07A_0209.00_200502241954.ht2	P,Q,Te	
KFM07A	214	219	3	1	20050224 21:01	20050224 21:43	__KFM07A_0214.00_200502242101.ht2	P,Q,Te	
KFM07A	219	224	3	1	20050224 21:57	20050224 22:38	__KFM07A_0219.00_200502242157.ht2	P,Q,Te	
KFM07A	244	249	3	1	20050224 23:11	20050224 23:57	__KFM07A_0244.00_200502242311.ht2	P,Q,Te	
KFM07A	249	254	3	1	20050225 06:27	20050225 07:09	__KFM07A_0249.00_200502250627.ht2	P,Q,Te	
KFM07A	254	259	3	1	20050225 07:27	20050225 08:12	__KFM07A_0254.00_200502250727.ht2	P,Q,Te	
KFM07A	259	264	3	1	20050225 08:28	20050225 09:43	__KFM07A_0259.00_200502250828.ht2	P,Q,Te	
KFM07A	204	209	4B	2	20050225 10:30	20050225 12:50	__KFM07A_0204.00_200502251030.ht2	P,Q,Te	
KFM07A	154	159	4B	2	20050225 13:22	20050225 15:08	__KFM07A_0154.00_200502251322.ht2	P,Q,Te	
KFM07A	850	1001.55	3	1	20050301 15:58	20050301 17:47	__KFM07A_0850.00_200503011558.ht2	P,Q,Te	Injection below single packer.

[1)] 3: Injection test, 4B: Pulse test

Appendix 2.1. General test data

Borehole:	KFM07A
Testtype:	CHir (Constant Head injection and recovery), Pulse test
Field crew:	C. Hjerne, K. Gokall-Norman, P. Thur, T. Svensson, M. Holmqvist, S. Jönsson, P. Fredriksson
General comment:	

Test section secup	**Test section seclow**	**Test start**	**Start of flow period**	**Stop of flow period**	**Test stop**	**Total flow time t_p**	**Total recovery time t_F**
(m)	(m)	YYYYMMDD hh:mm	YYYYMMDD hh:mm:ss	YYYYMMDD hh:mm:ss	YYYYMMDD hh:mm	(min)	(min)
104.00	204.00	20050216 06:40	20050216 07:36:08	20050216 08:05:54	20050216 08:38	30	30
204.00	304.00	20050216 10:52	20050216 12:38:33	20050216 13:08:56	20050216 13:41	30	30
304.00	404.00	20050216 15:27	20050216 16:14:12	20050216 16:26:47	20050216 16:35	13	6
404.00	504.00	20050216 17:44	20050216 18:31:12	20050216 19:01:17	20050216 19:33	30	30
504.00	604.00	20050216 20:53	20050216 21:39:26	20050216 21:44:43	20050216 21:54	5	7
604.00	704.00	20050216 23:04	20050216 23:51:48	20050216 23:56:23	20050217 00:03	5	5
704.00	804.00	20050217 08:14	20050217 09:02:13	20050217 09:10:02	20050217 09:23	8	11
750.00	850.00	20050217 14:13	20050217 15:02:16	20050217 15:12:51	20050217 15:25	11	11
104.00	124.00	20050222 06:58	20050222 07:31:26	20050222 07:51:32	20050222 08:13	20	20
124.00	144.00	20050221 06:10	20050221 06:43:18	20050221 07:03:34	20050221 07:25	20	20
144.00	164.00	20050221 07:47	20050221 08:19:19	20050221 08:39:38	20050221 09:01	20	20
164.00	184.00	20050221 09:21	20050221 09:57:57	20050221 10:18:10	20050221 10:40	20	20
184.00	204.00	20050221 10:56	20050221 12:11:12	20050221 12:31:33	20050221 12:53	20	20
204.00	224.00	20050221 13:11	20050221 13:45:34	20050221 14:05:54	20050221 14:28	20	20
224.00	244.00	20050221 14:50	20050221 16:21:21	20050221 16:23:11	20050221 16:45	2	20
244.00	264.00	20050221 21:34	20050221 22:49:21	20050221 23:09:39	20050221 23:31	20	20
264.00	284.00	20050221 18:52	20050221 19:25:46	20050221 19:33:15	20050221 19:41	7	6
284.00	304.00	20050221 20:02	20050221 20:53:26	20050221 20:56:34	20050221 21:05	3	6
104.00	109.00	20050222 17:33	20050222 18:12:01	20050222 18:32:21	20050222 18:54	20	20
109.00	114.00	20050222 19:10	20050222 19:45:05	20050222 20:05:25	20050222 20:27	20	20
114.00	119.00	20050222 21:05	20050222 21:41:42	20050222 22:01:58	20050222 22:24	20	20
119.00	124.00	20050222 22:40	20050222 23:15:40	20050222 23:35:56	20050222 23:58	20	20
124.00	129.00	20050223 06:32	20050223 07:04:43	20050223 07:25:01	20050223 07:47	20	20
127.00	132.00	20050223 08:02	20050223 09:23:07	20050223 09:43:24	20050223 10:05	20	20
132.00	137.00	20050223 10:22	20050223 11:08:30	20050223 11:28:46	20050223 11:51	20	20
137.00	142.00	20050223 12:44	20050223 13:15:36	20050223 13:35:53	20050223 13:58	20	20
139.00	144.00	20050223 14:04	20050223 14:39:13	20050223 14:59:31	20050223 15:21	20	20
144.00	149.00	20050223 15:55	20050223 16:37:39	20050223 16:57:56	20050223 17:20	20	20
149.00	154.00	20050223 17:37	20050223 18:11:33	20050223 18:31:53	20050223 18:54	20	20
154.00	159.00	20050223 19:10	20050223 19:46:38	20050223 20:06:58	20050223 20:29	20	20
159.00	164.00	20050223 21:01	20050223 21:34:24	20050223 21:54:29	20050223 22:07	20	11
164.00	169.00	20050223 22:28	20050223 23:00:14	20050223 23:03:22	20050223 23:11	3	6
169.00	174.00	20050224 06:15	20050224 06:46:45	20050224 06:48:16	20050224 06:57	2	7
171.50	176.50	20050224 07:42	20050224 08:15:42	20050224 08:17:10	20050224 08:29	1	10
176.50	181.50	20050224 08:41	20050224 09:27:05	20050224 09:47:21	20050224 10:09	20	20
181.50	186.50	20050224 10:23	20050224 11:01:40	20050224 11:21:57	20050224 11:44	20	20
184.00	189.00	20050224 12:24	20050224 12:56:05	20050224 13:00:24	20050224 13:09	4	7
189.00	194.00	20050224 13:23	20050224 14:24:55	20050224 14:26:51	20050224 14:34	2	6
194.00	199.00	20050224 14:49	20050224 15:57:51	20050224 16:18:09	20050224 16:40	20	20
199.00	204.00	20050224 16:58	20050224 17:31:45	20050224 17:52:03	20050224 18:14	20	20
204.00	209.00	20050224 18:35	20050224 19:07:07	20050224 19:18:14	20050224 19:31	11	11
209.00	214.00	20050224 19:54	20050224 20:35:41	20050224 20:37:47	20050224 20:45	2	5
214.00	219.00	20050224 21:01	20050224 21:33:30	20050224 21:36:27	20050224 21:43	3	5
219.00	224.00	20050224 21:57	20050224 22:29:24	20050224 22:31:30	20050224 22:38	2	5
244.00	249.00	20050224 23:11	20050224 23:43:24	20050224 23:49:28	20050224 23:57	6	5
249.00	254.00	20050225 06:27	20050225 06:59:33	20050225 07:01:13	20050225 07:09	2	6
254.00	259.00	20050225 07:27	20050225 08:03:54	20050225 08:04:58	20050225 08:12	1	5
259.00	264.00	20050225 08:28	20050225 09:00:46	20050225 09:21:03	20050225 09:43	20	20
850.00 [1)]	1001.55	20050301 15:58	20050301 16:45:28	20050301 17:15:48	20050301 17:47	30	30

[1)] Single packer injection test

Appendix 2.2. Pressure and flow data

Summary of pressure and flow data for all tests in KFM07A

Test section		Pressure			Flow		
secup	seclow	p_i	p_p	p_F	Q_p 1)	Q_m 2)	V_p 2)
(m)	(m)	(kPa)	(kPa)	(kPa)	(m^3/s)	(m^3/s)	(m^3)
104.00	204.00	969.84	975.9	969.84	6.59E-04	6.65E-04	1.19E+00
204.00	304.00	1814.74	2020.06	1844.99	1.35E-07	1.96E-07	3.58E-04
304.00	404.00	2671.06	2841.72	2838.42			
404.00	504.00	3483.66	3702.03	3670.69	6.16E-09	3.96E-08	7.15E-05
504.00	604.00	4325.81	4529.89	4528.23			
604.00	704.00	5146.38	5348.12	5348.39			
704.00	804.00	5951.82	6154.52	6152.59			
750.00	850.00	6333.02	6522.52	6521.14			
104.00	124.00	960.1	967.76	960.05	6.81E-04	6.83E-04	8.30E-01
124.00	144.00	1135.39	1381.41	1135.53	8.18E-05	8.87E-05	1.08E-01
144.00	164.00	1306.33	1511.78	1313.75	1.70E-06	2.05E-06	2.51E-03
164.00	184.00	1477.12	1667.4	1477.67	4.77E-04	4.92E-04	5.95E-01
184.00	204.00	1648.74	1850.62	1663.04	2.25E-07	2.73E-07	3.33E-04
204.00	224.00	1833.03	2022.79	1953.48	2.40E-08	5.66E-08	6.91E-05
224.00	244.00	2017.7	2219.72	2210.36			
244.00	264.00	2154.67	2354.48	2154.81	2.29E-07	2.60E-07	3.18E-04
264.00	284.00	2345.27	2554.15	2536.56			
284.00	304.00	2546.32	2723.58	2741.18			
104.00	109.00	959.24	1159.24	970.37	5.04E-07	5.98E-07	7.32E-04
109.00	114.00	1000.76	1206.91	1000.62	5.32E-05	6.01E-05	7.33E-02
114.00	119.00	1043.12	1251.46	1042.98	9.97E-06	1.04E-05	1.26E-02
119.00	124.00	1085.9	1093.04	1086.44	6.06E-04	6.32E-04	7.71E-01
124.00	129.00	1129.34	1343.73	1129.90	1.98E-06	2.24E-06	2.73E-03
127.00	132.00	1155.2	1377.98	1155.20	1.36E-07	1.49E-07	1.82E-04
132.00	137.00	1198.1	1399.43	1198.10	6.73E-05	6.81E-05	8.29E-02
137.00	142.00	1242.79	1443.16	1244.86	3.12E-07	3.44E-07	4.19E-04
139.00	144.00	1257.51	1491.29	1257.51	5.49E-06	6.56E-06	7.99E-03
144.00	149.00	1300.42	1502.02	1306.47	1.44E-06	1.71E-06	2.09E-03
149.00	154.00	1352.12	1551.8	1397.78	2.32E-08	4.36E-08	5.34E-05
154.00	159.00	1422.53	1609.28	1420.88	1.83E-08	2.20E-08	2.66E-05
159.00	164.00	1485.1	1654.53	1635.40			
164.00	169.00	1608.04	1691.38	1720.67			
169.00	174.00	1595.25	1738.68	1737.72			
171.50	176.50	1557.71	1762.48	1769.62			
176.50	181.50	1576.25	1799.88	1577.10	4.60E-04	4.77E-04	5.78E-01
181.50	186.50	1623.99	1845.53	1637.06	2.12E-07	2.75E-07	3.36E-04
184.00	189.00	1723.56	1888.44	1838.38			
189.00	194.00	1813.08	1931.35	1934.65			
194.00	199.00	1730.58	1970.3	1742.67	1.76E-07	2.06E-07	2.51E-04
199.00	204.00	1777.32	2011.71	1780.08	1.00E-07	1.15E-07	1.40E-04
204.00	209.00	1891.6	2057.31	2011.11			
209.00	214.00	1950.46	2100.63	2153.57			
214.00	219.00	1978.11	2143.13	2176.67			
219.00	224.00	2014.96	2159.62	2202.53			
244.00	249.00	2225.78	2399.46	2461.07			
249.00	254.00	2325.61	2437.96	2510.58			
254.00	259.00	2370.16	2481.55	2644.23			
259.00	264.00	2279.41	2479.76	2280.65	3.63E-07	4.03E-07	4.91E-04
850.00 3)	1001.55	7148.96	7349.05	7188.43	8.56E-06	1.17E-05	2.13E-02

1) No value indicates a flow below measurement limit (measurement limit is unique for each test but nominally 1.67 E-8 m^3/s).
2) No value indicates that the parameter could not be calculated due to low and uncertain flow rates during a major part of flow period.
3) Single packer injection test.

p_i	Pressure in test section before start of flow period
p_p	Pressure in test section before stop of flow period
p_F	Pressure in test section at the end of recovery period
Q_p	Flow rate just before stop of flow period
Q_m	Mean (arithmetic) flow rate during flow period
V_p	Total volume injected during the flow period

Appendix 3. Test diagrams – Injection Tests

In the following pages diagrams are presented for all test sections. A linear diagram of pressure and flow rate is presented for each test. For most tests lin-log and log-log diagrams are presented, from the injection and recovery period respectively.

Nomenclature for Aqtesolv:

T	=	transmissivity (m^2/s)
S	=	storativity (-)
K_z/K_r	=	ratio of hydraulic conductivities in the vertical and radial direction (set to 1)
Sw	=	skin factor
r(w)	=	borehole radius (m)
r(c)	=	effective casing radius (m)
C	=	well loss constant (set to 0)
r/B	=	leakage factor (-)

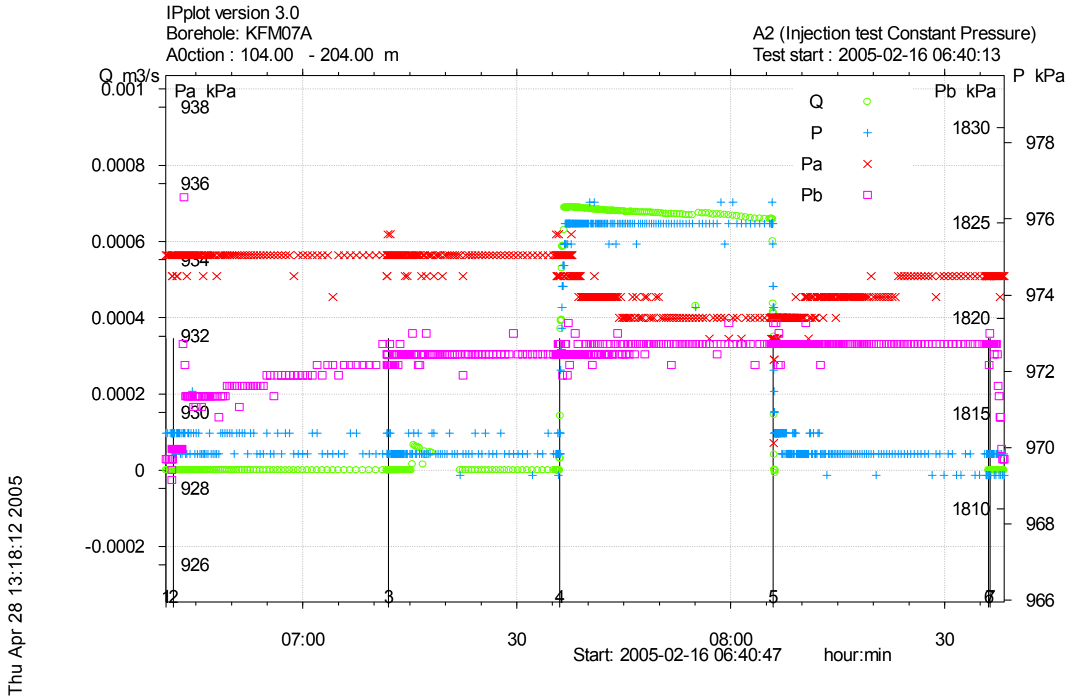


Figure A3-1. Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 104.0-204.0 m in borehole KFM07A.

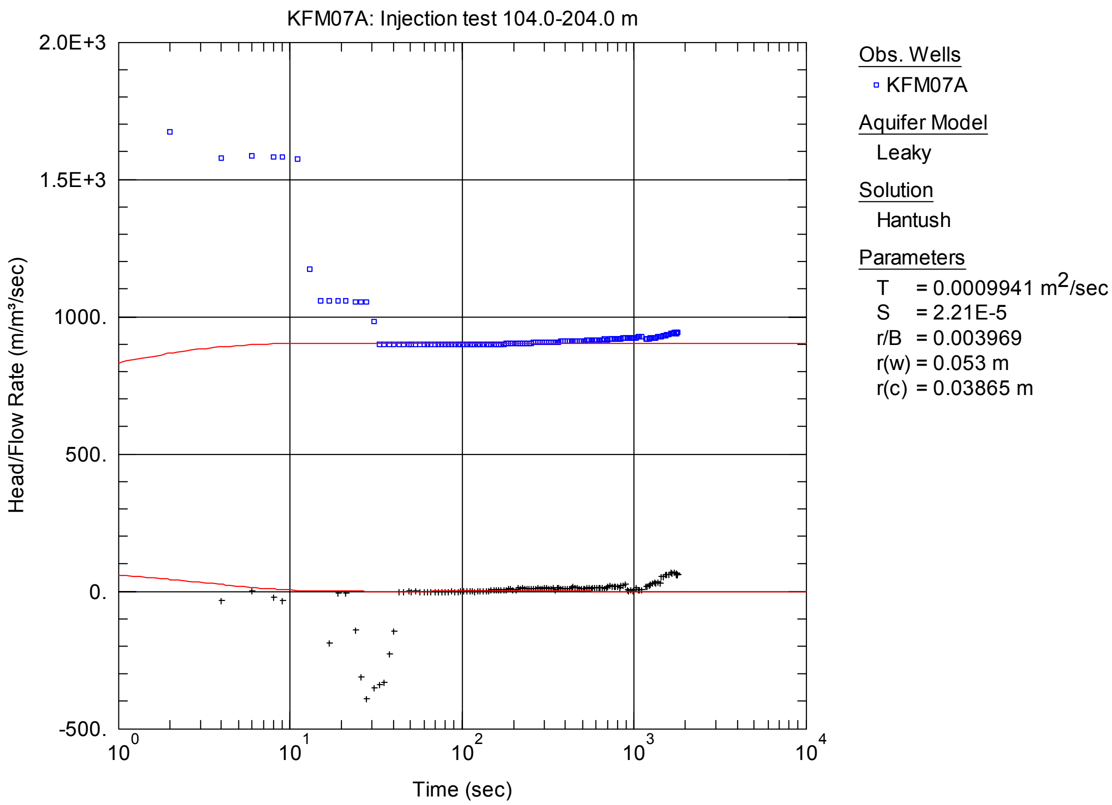


Figure A3-2. Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-204.0 m in KFM07A.

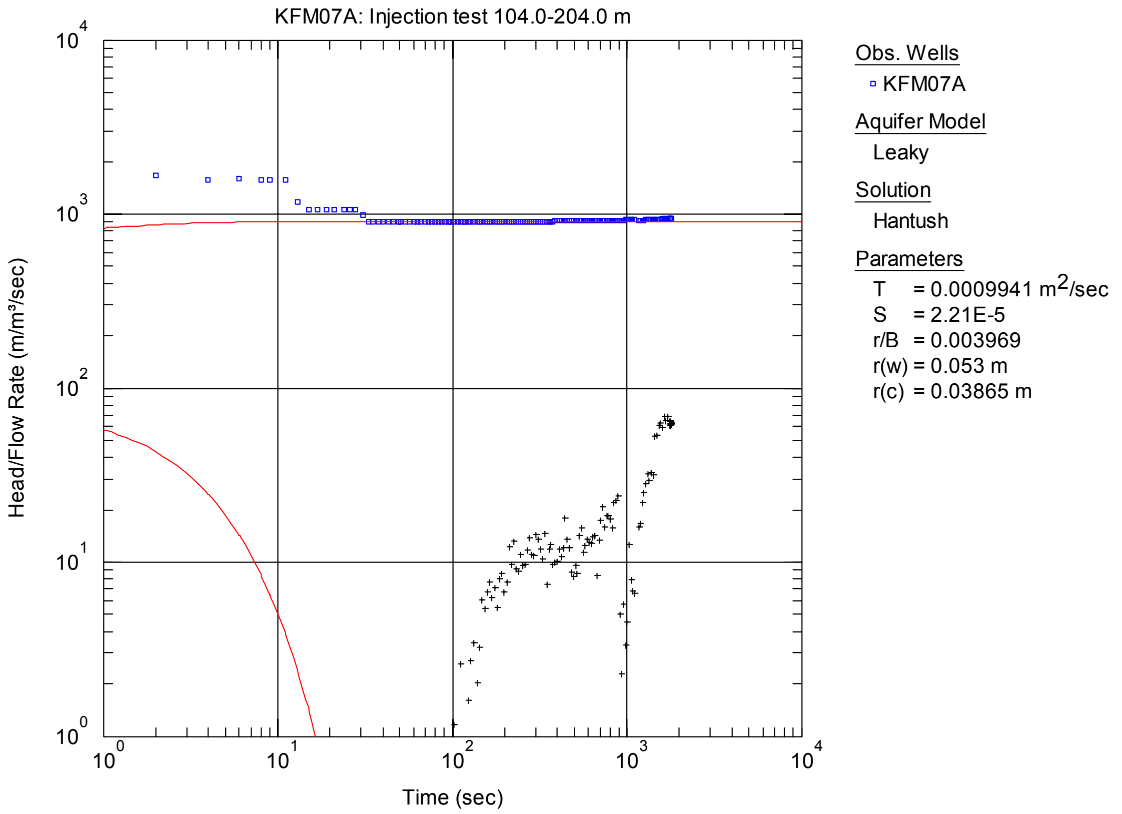


Figure A3-3. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-204.0 m in KFM07A.*

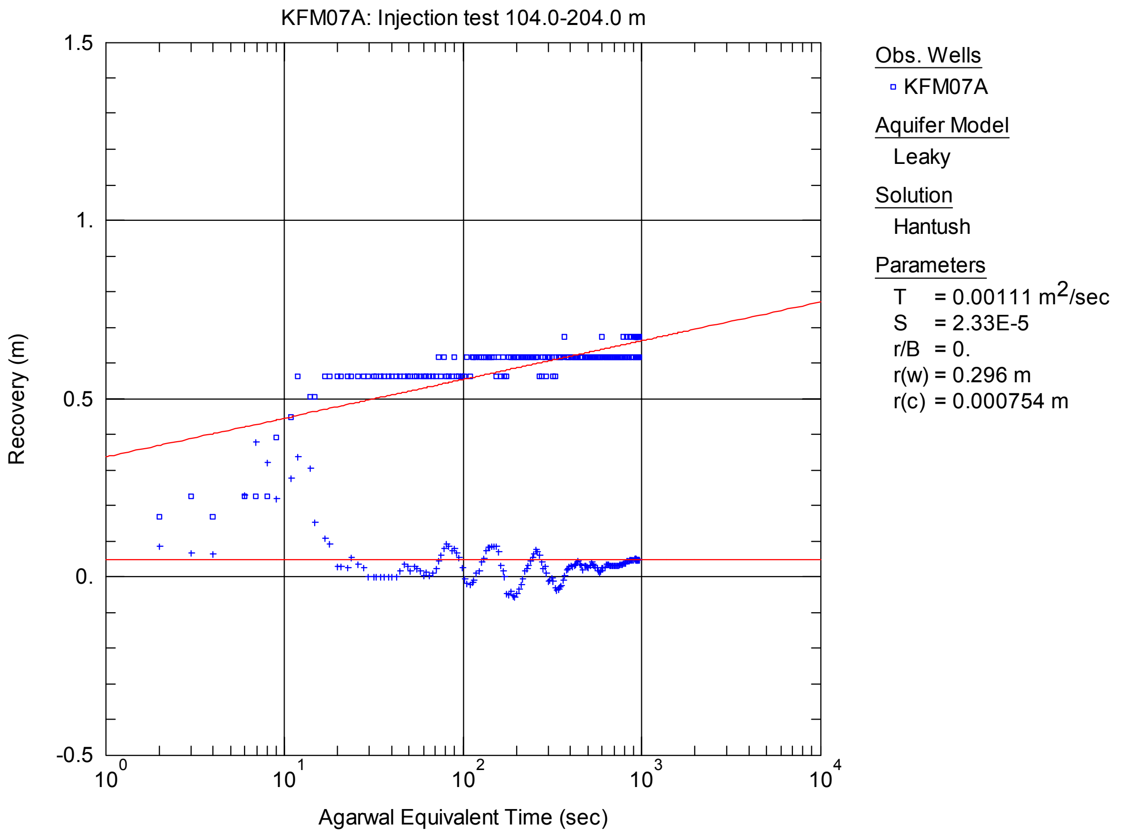


Figure A3-4. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-204.0 m in KFM07A.*

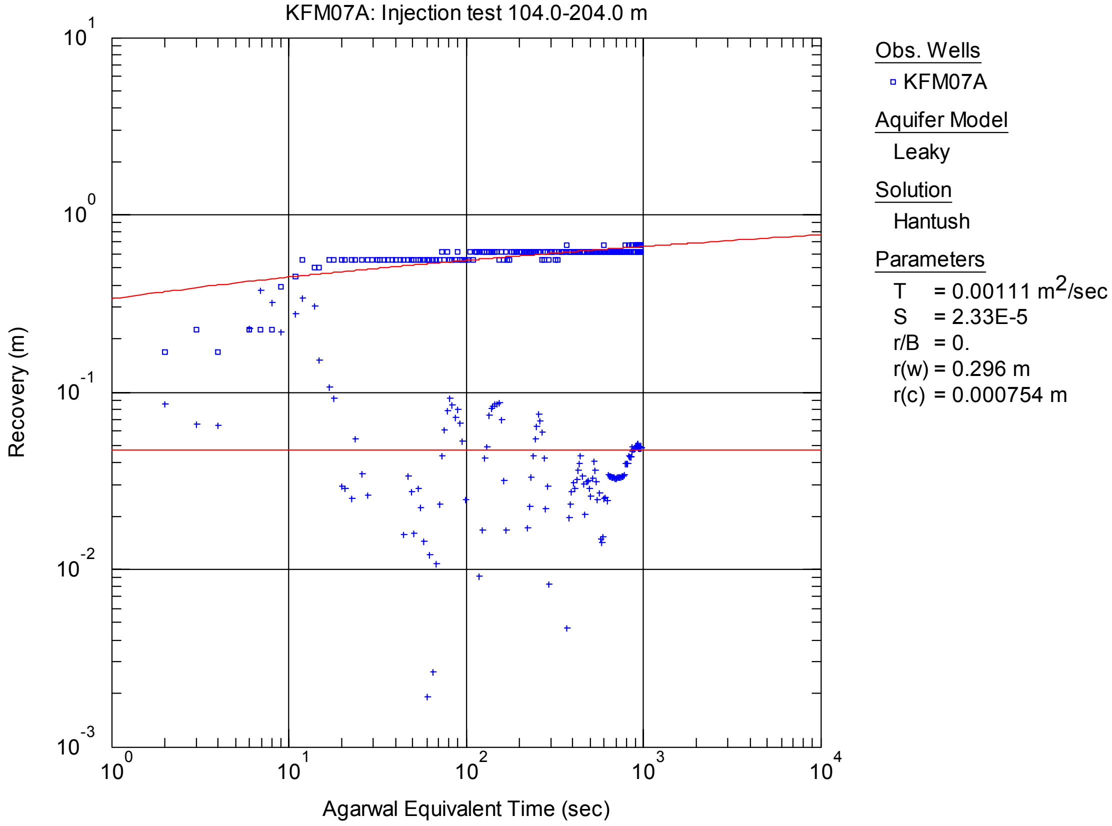


Figure A3-5. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-204.0 m in KFM07A.*

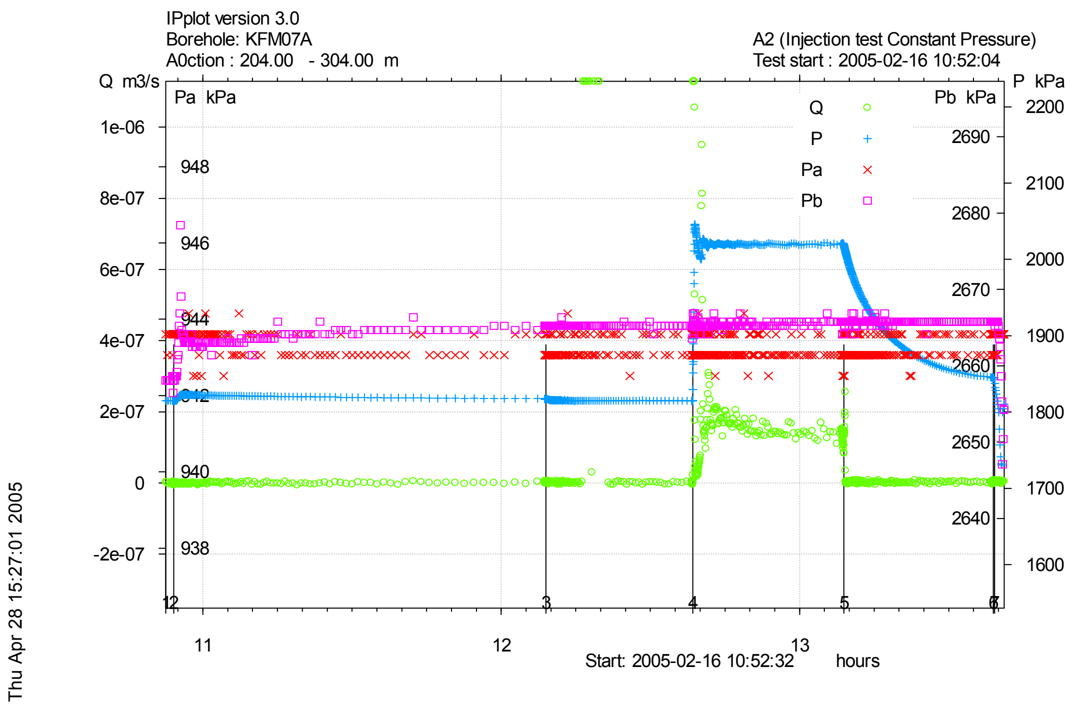


Figure A3-6. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 204.0-304.0 m in borehole KFM07A.*

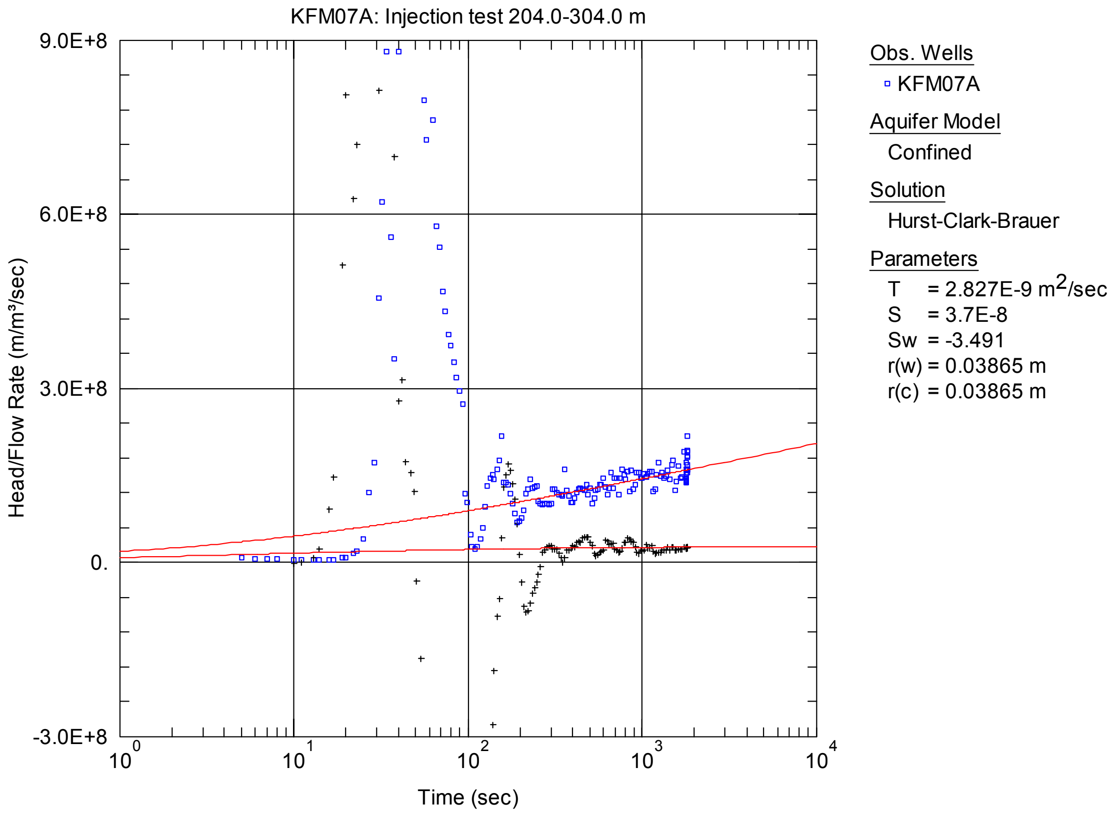


Figure A3-7. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 204.0-304.0 m in KFM07A.*

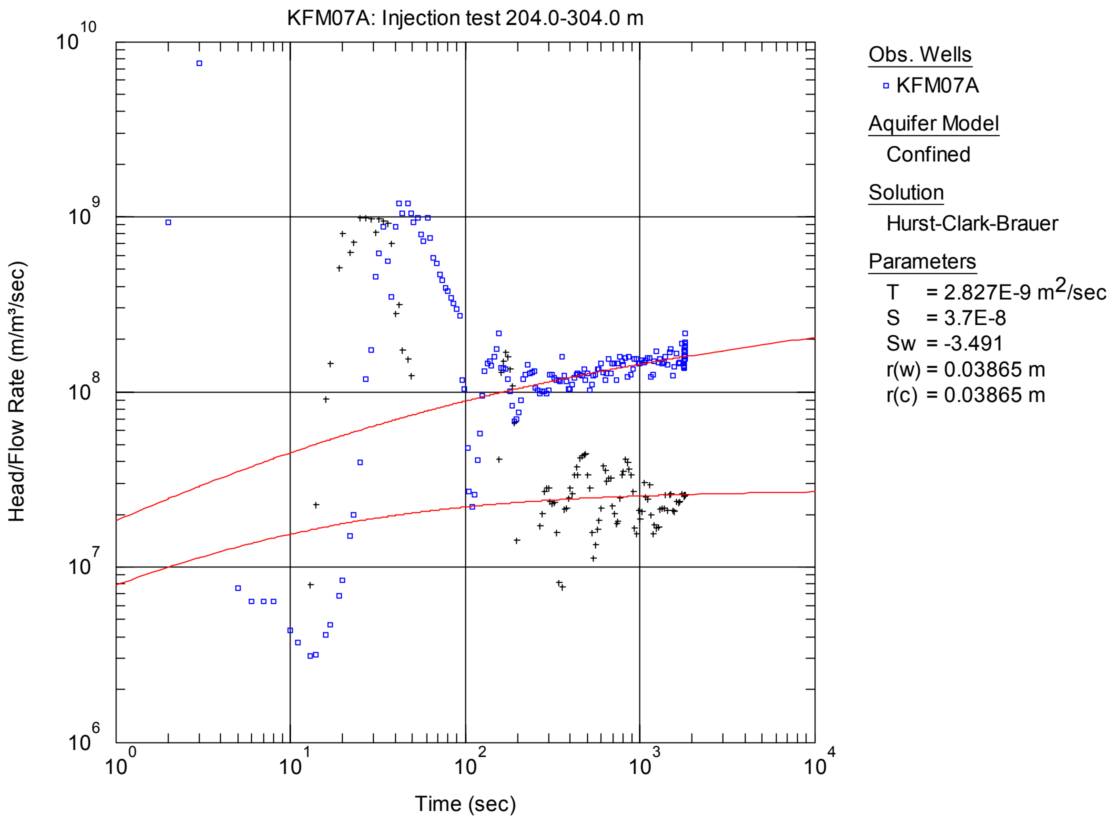


Figure A3-8. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 204.0-304.0 m in KFM07A.*

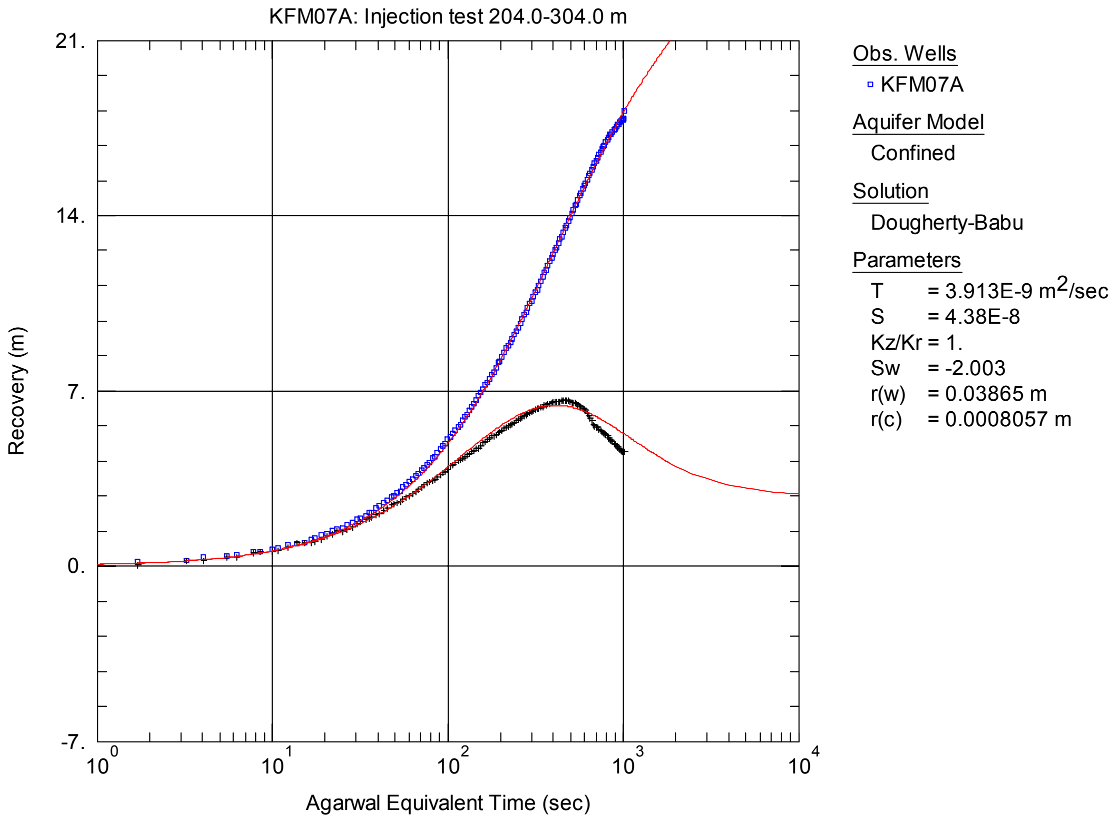


Figure A3-9. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 204.0-304.0 m in KFM07A.*

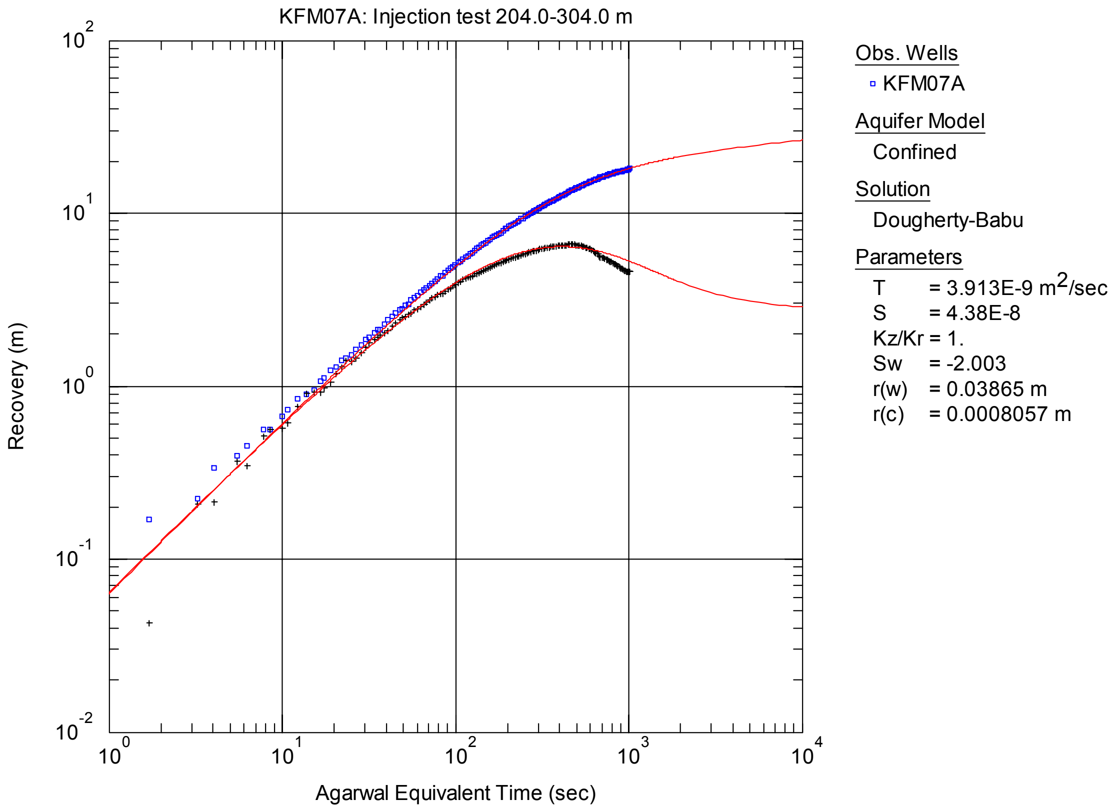


Figure A3-10. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 204.0-304.0 m in KFM07A.*

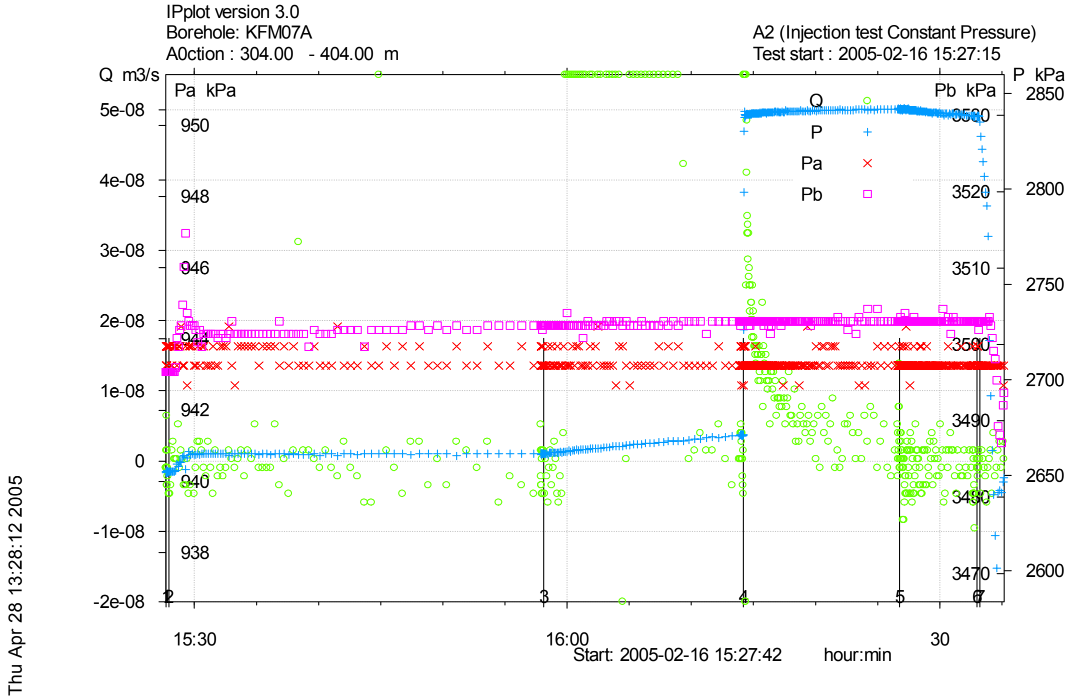


Figure A3-11. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 304.0-404.0 m in borehole KFM07A.*

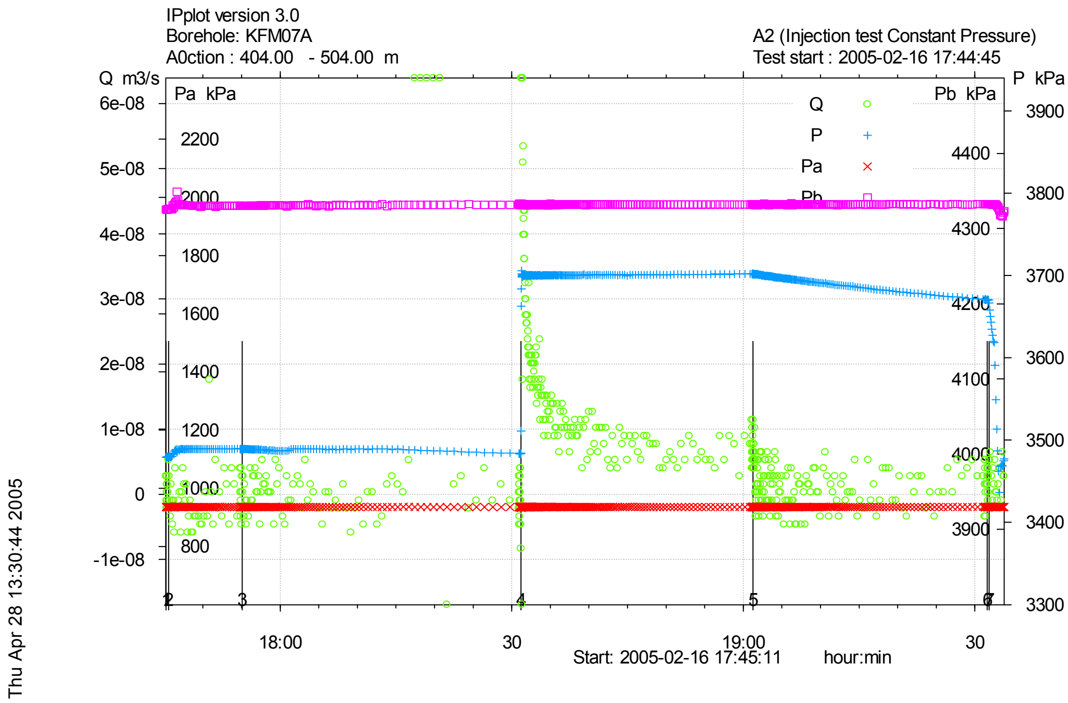


Figure A3-12. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 404.0-504.0 m in borehole KFM07A.*

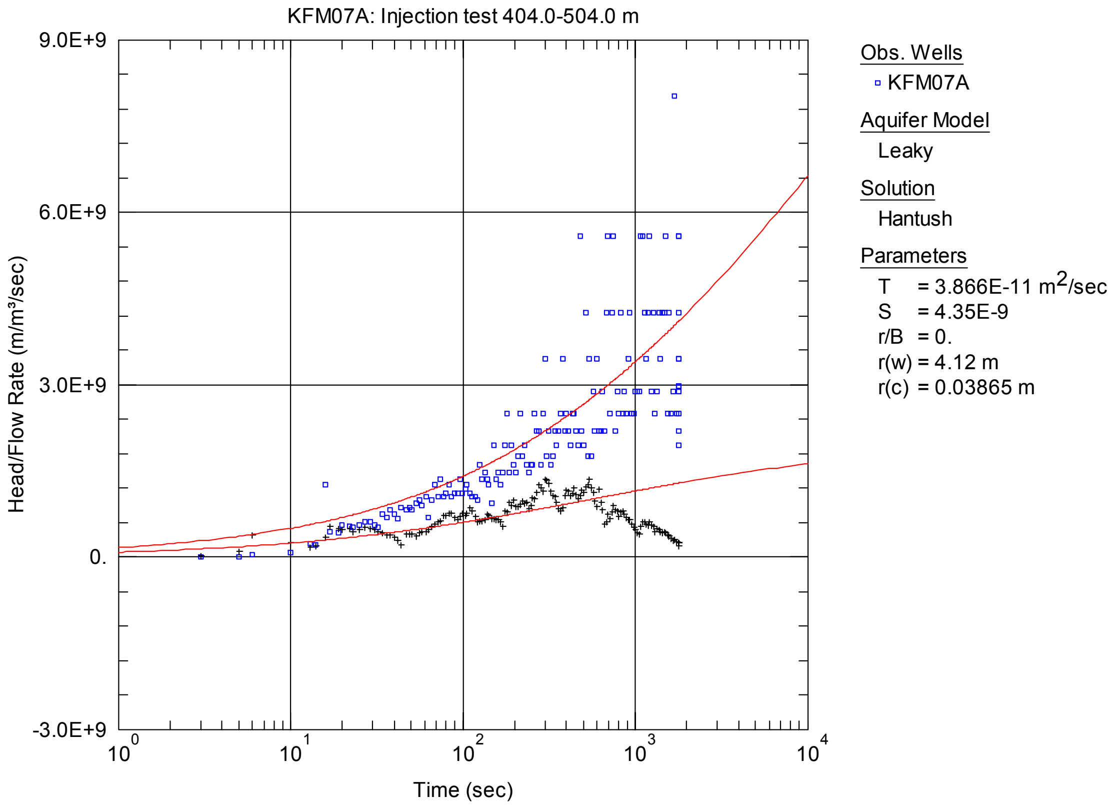


Figure A3-13. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 404.0-504.0 m in KFM07A.*

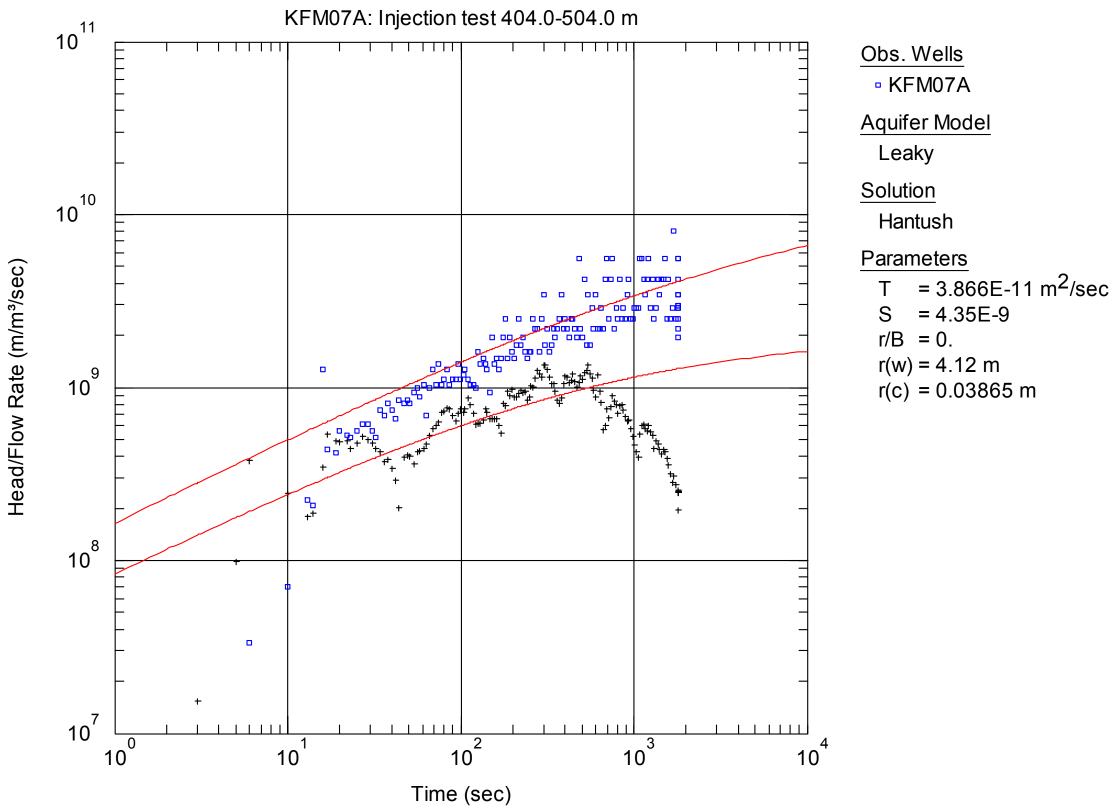


Figure A3-14. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 404.0-504.0 m in KFM07A.*

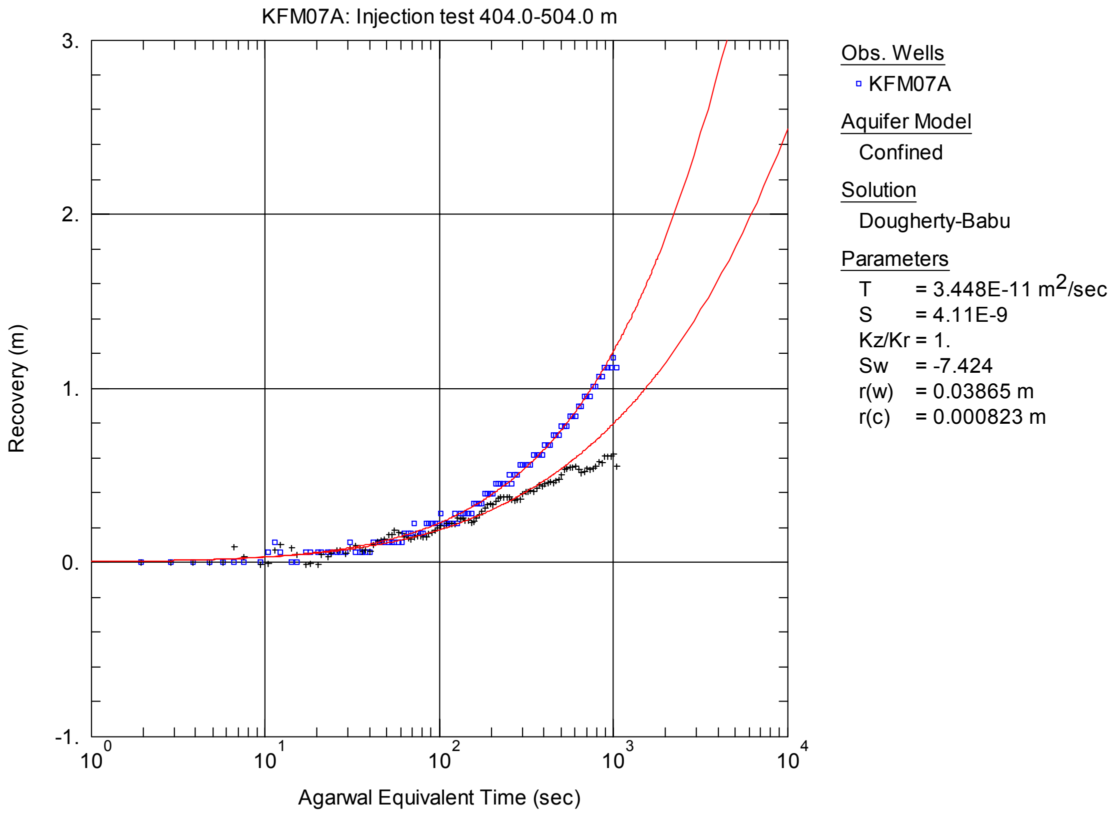


Figure A3-15. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 404.0-504.0 m in KFM07A.*

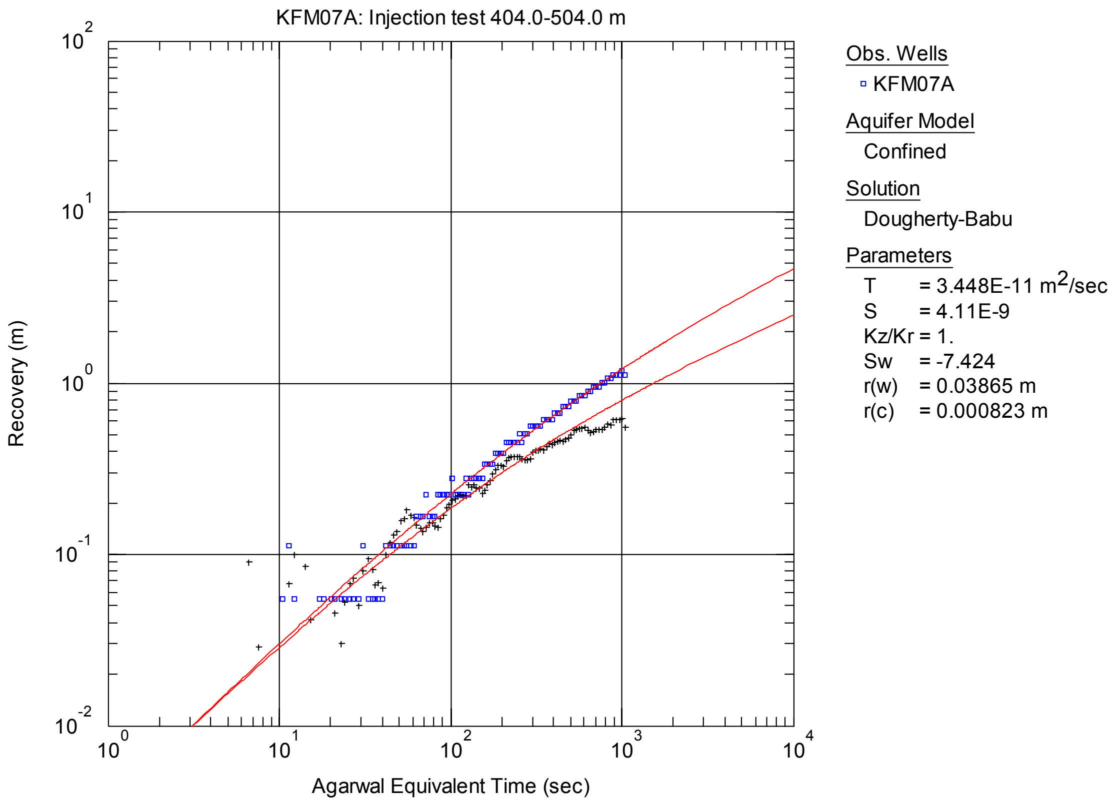


Figure A3-16. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 404.0-504.0 m in KFM07A.*

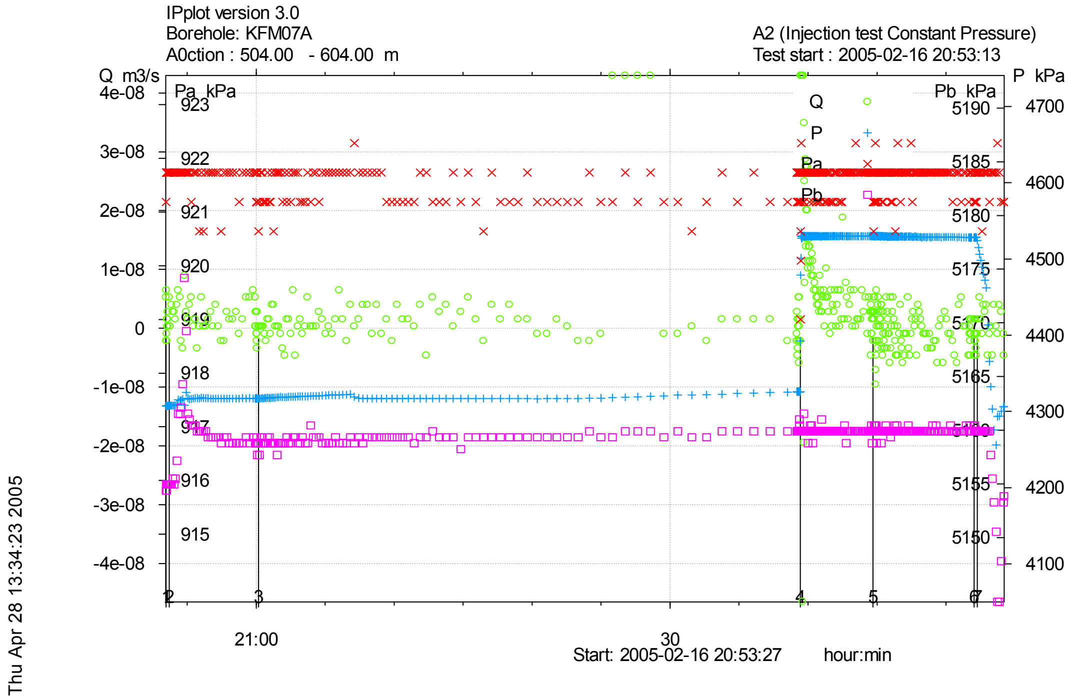


Figure A3-17. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 504.0-604.0 m in borehole KFM07A.*

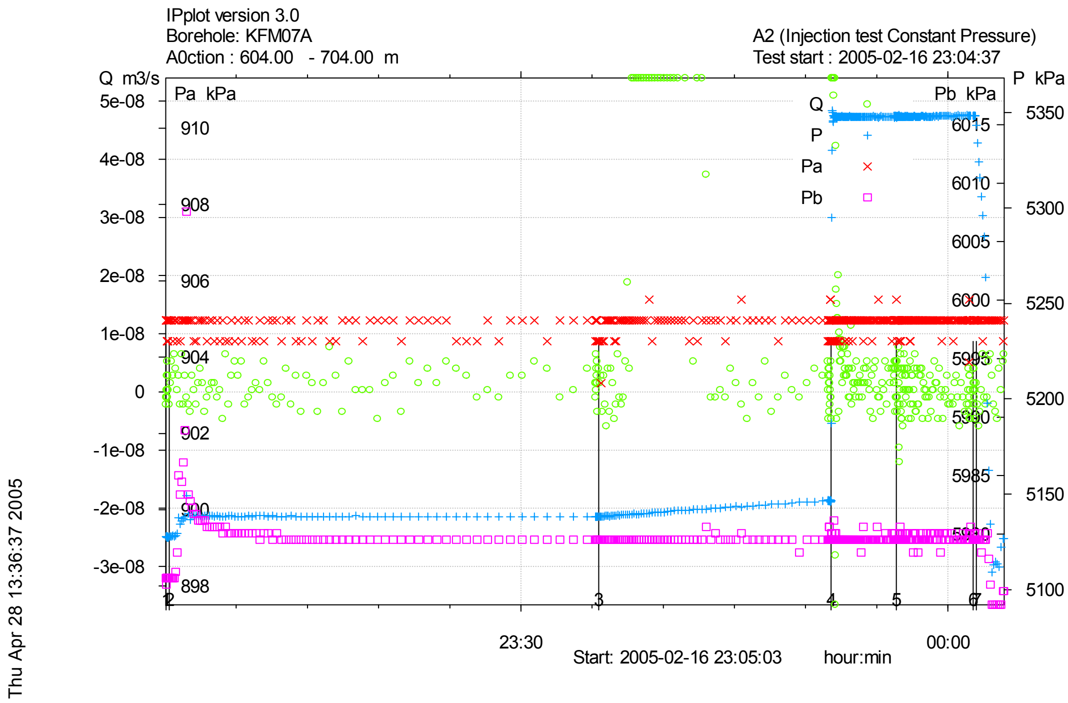


Figure A3-18. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 604.0-704.0 m in borehole KFM07A.*

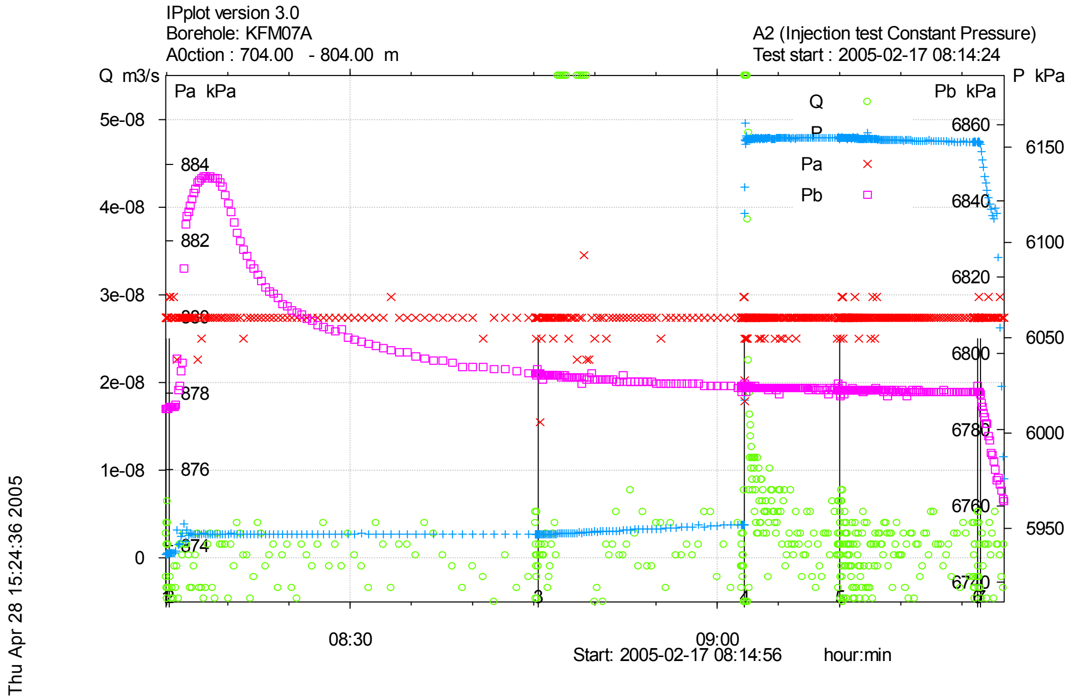


Figure A3-19. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 704.0-804.0 m in borehole KFM07A.*

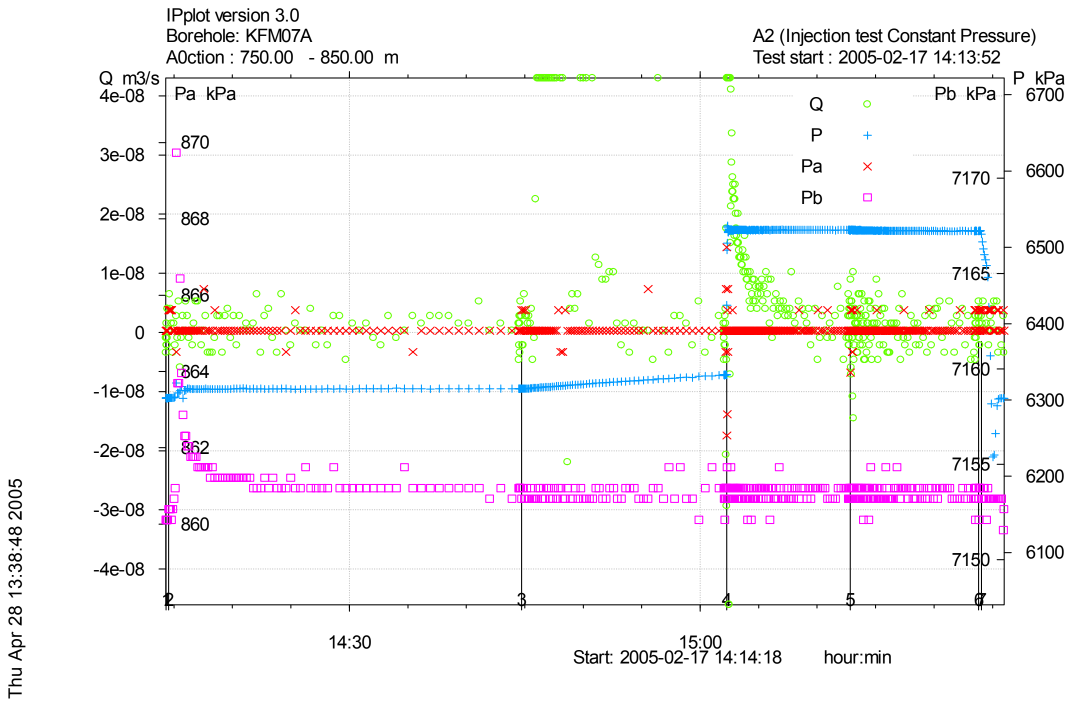


Figure A3-20. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 750.0-850.0 m in borehole KFM07A.*

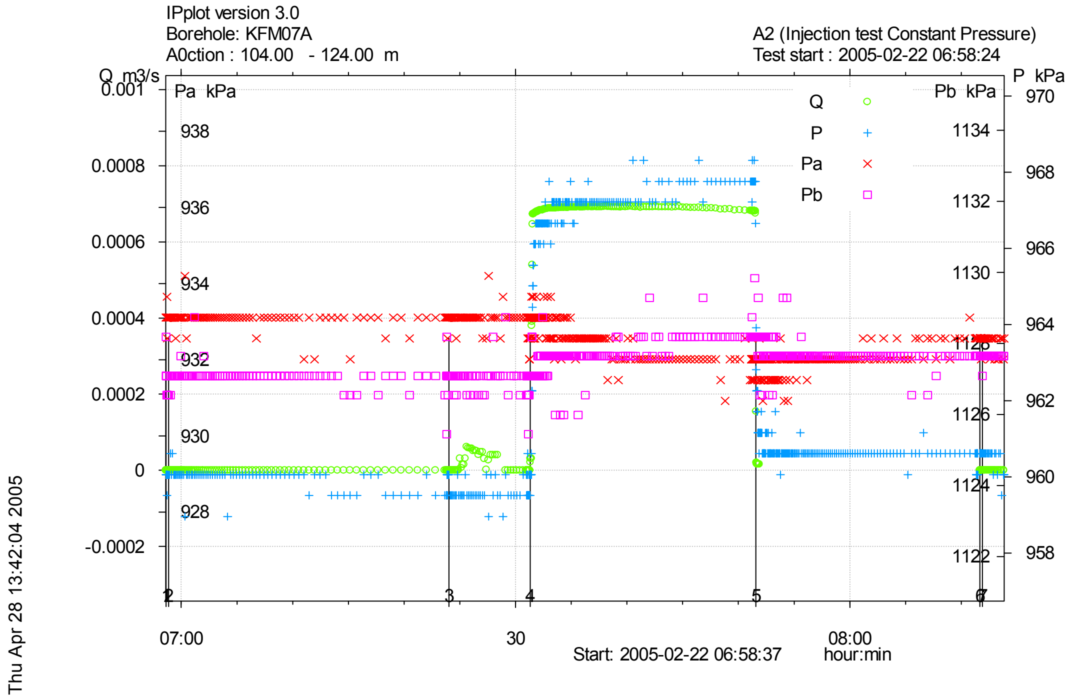


Figure A3-21. Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 104.0-124.0 m in borehole KFM07A.

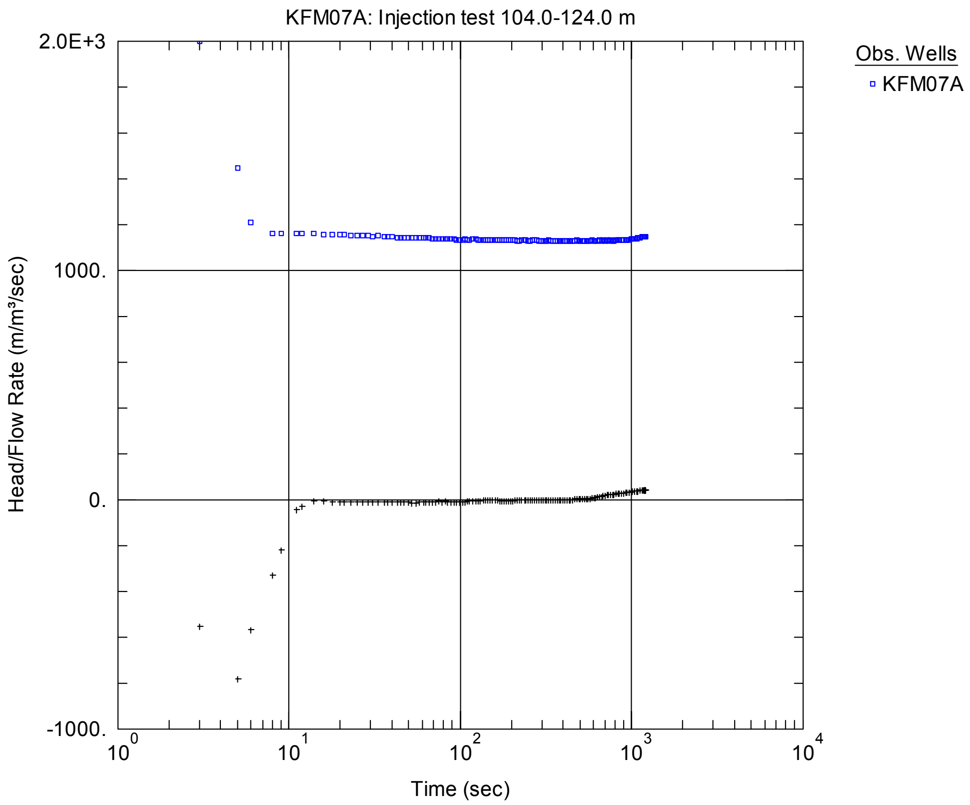


Figure A3-22. Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-124.0 m in KFM07A.

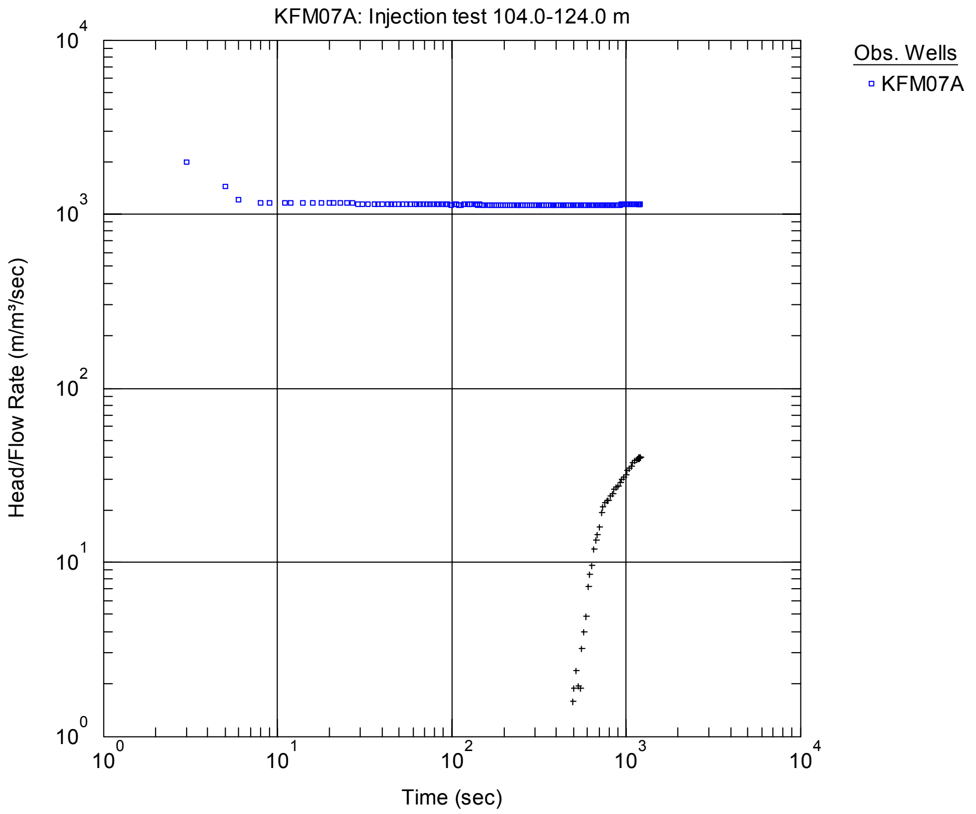


Figure A3-23. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-124.0 m in KFM07A.*

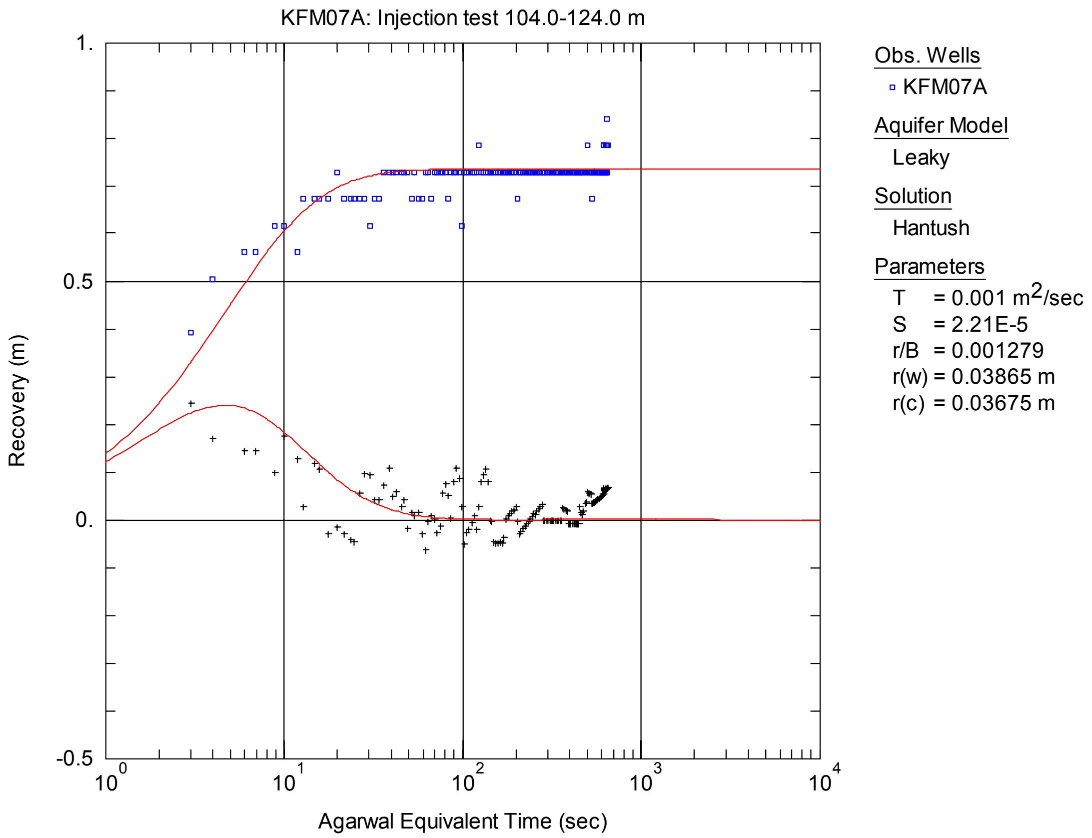


Figure A3-24. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-124.0 m in KFM07A.*

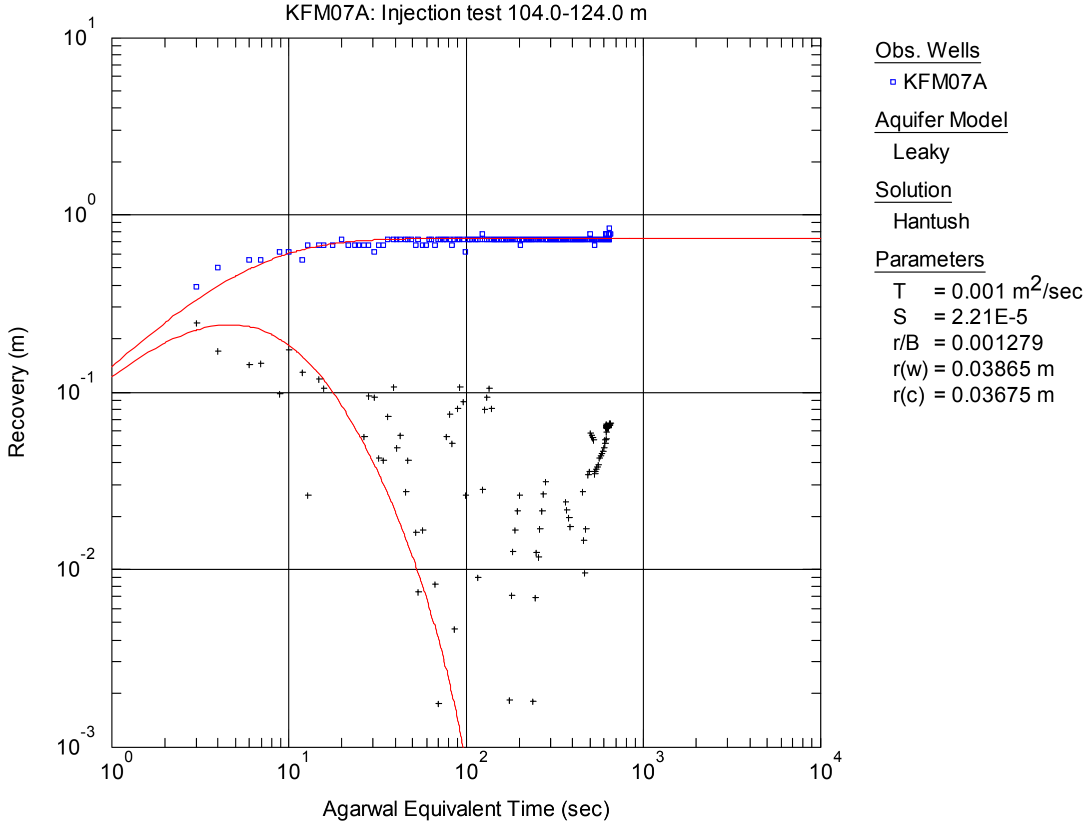


Figure A3-25. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-124.0 m in KFM07A.*

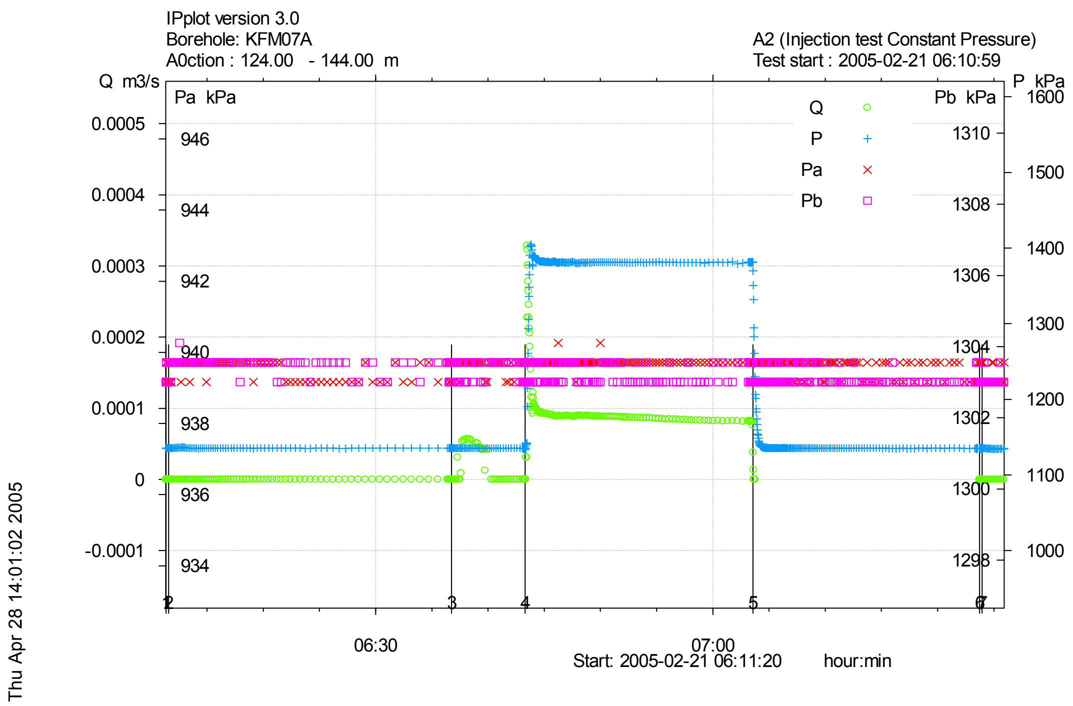


Figure A3-26. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 124.0-144.0 m in borehole KFM07A.*

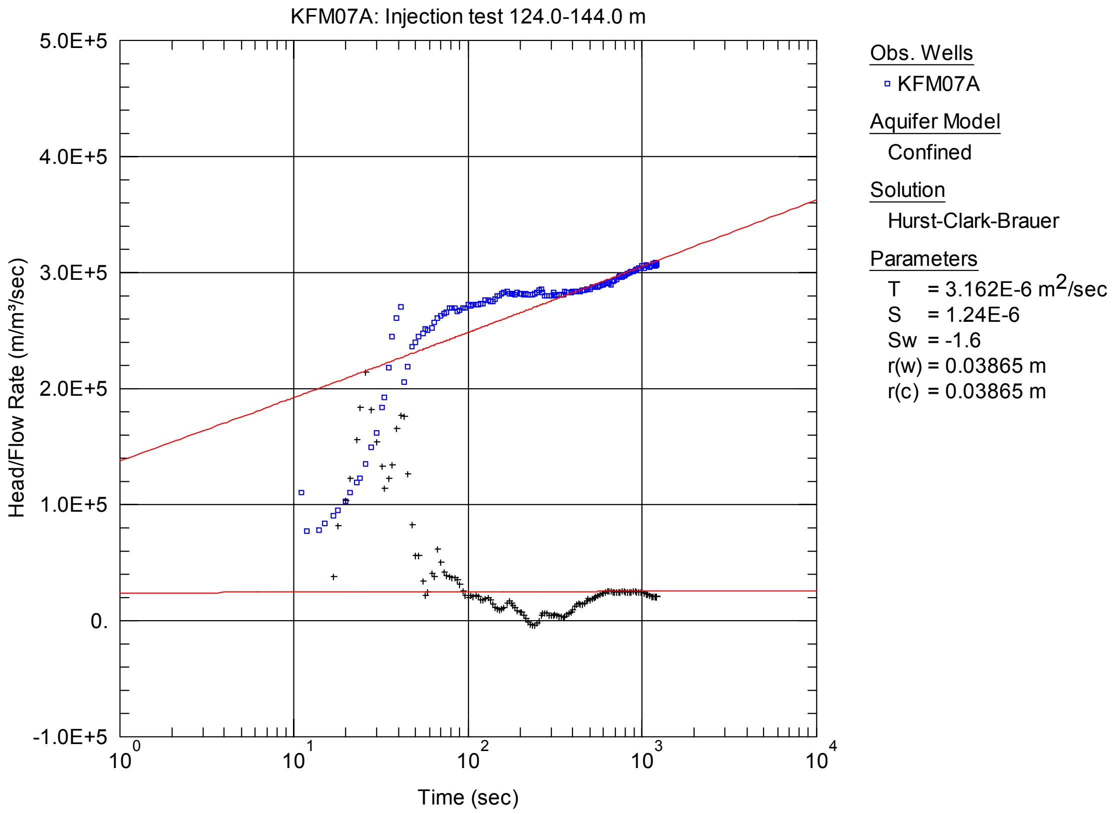


Figure A3-27. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 124.0-144.0 m in KFM07A.*

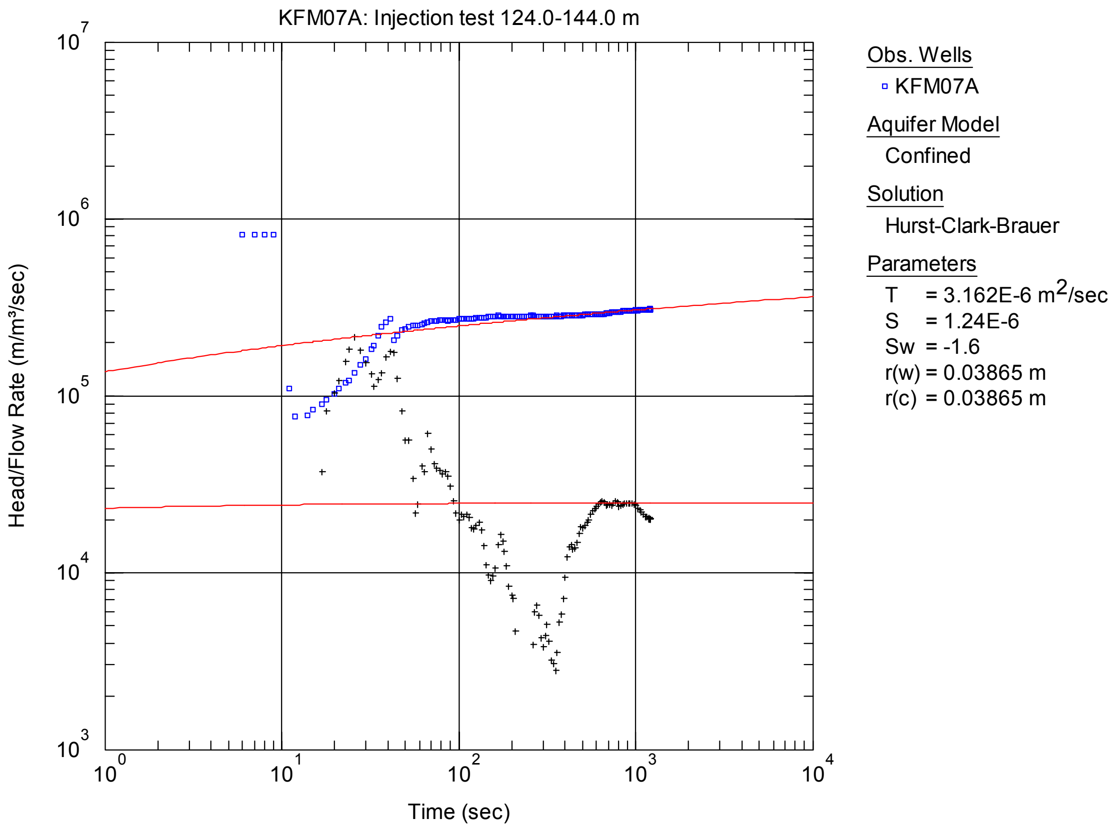


Figure A3-28. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 124.0-144.0 m in KFM07A.*

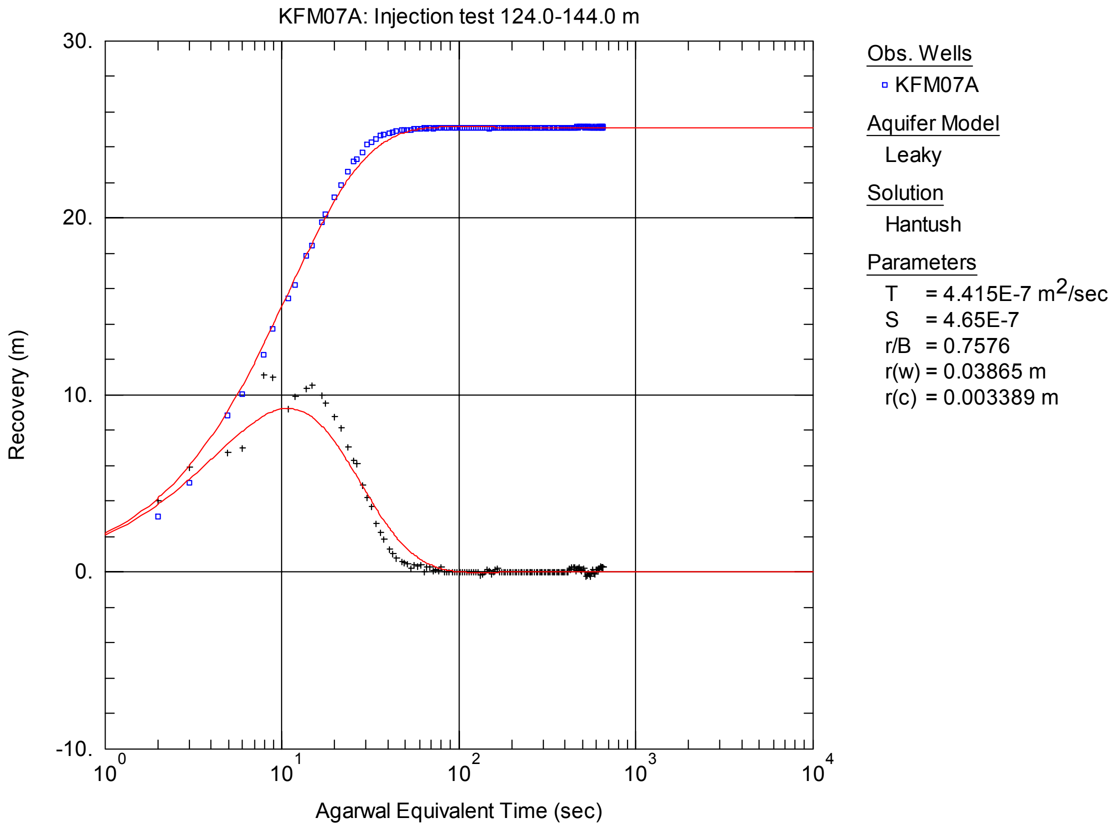


Figure A3-29. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 124.0-144.0 m in KFM07A.*

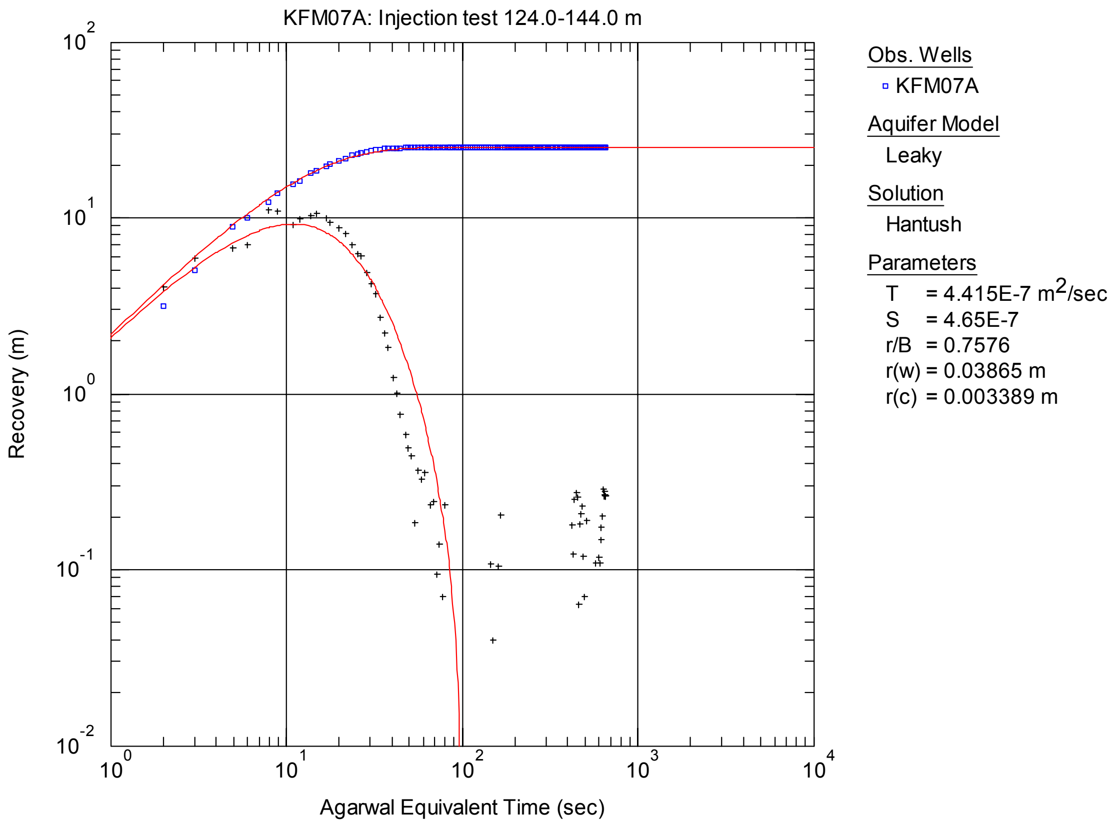


Figure A3-30. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 124.0-144.0 m in KFM07A.*

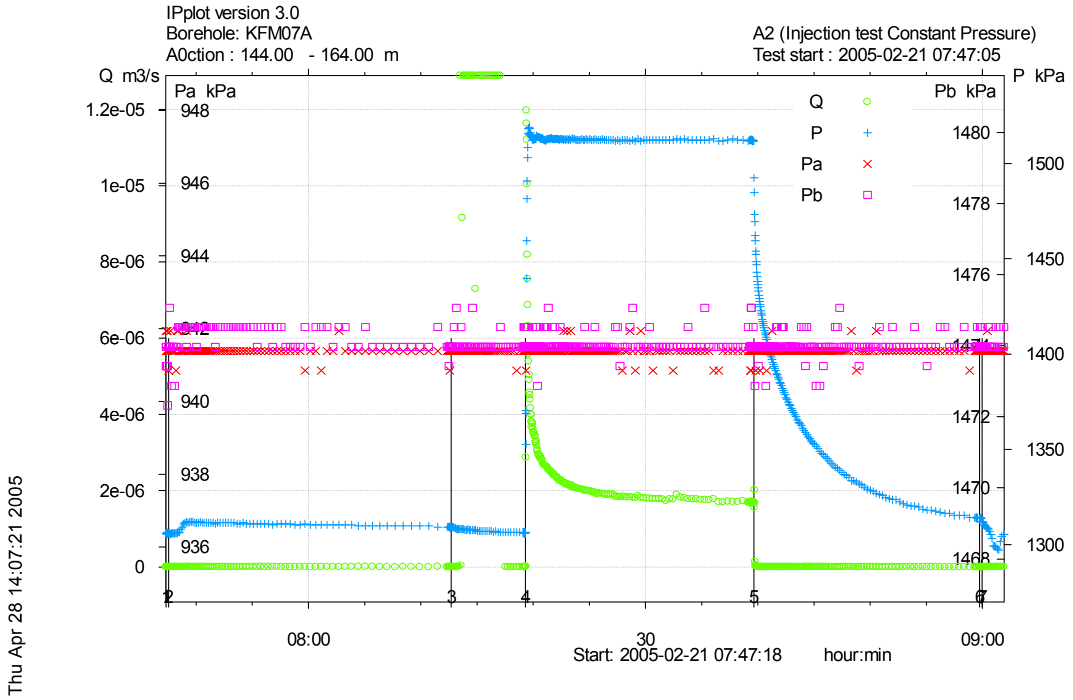


Figure A3-31. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 144.0-164.0 m in borehole KFM07A.*

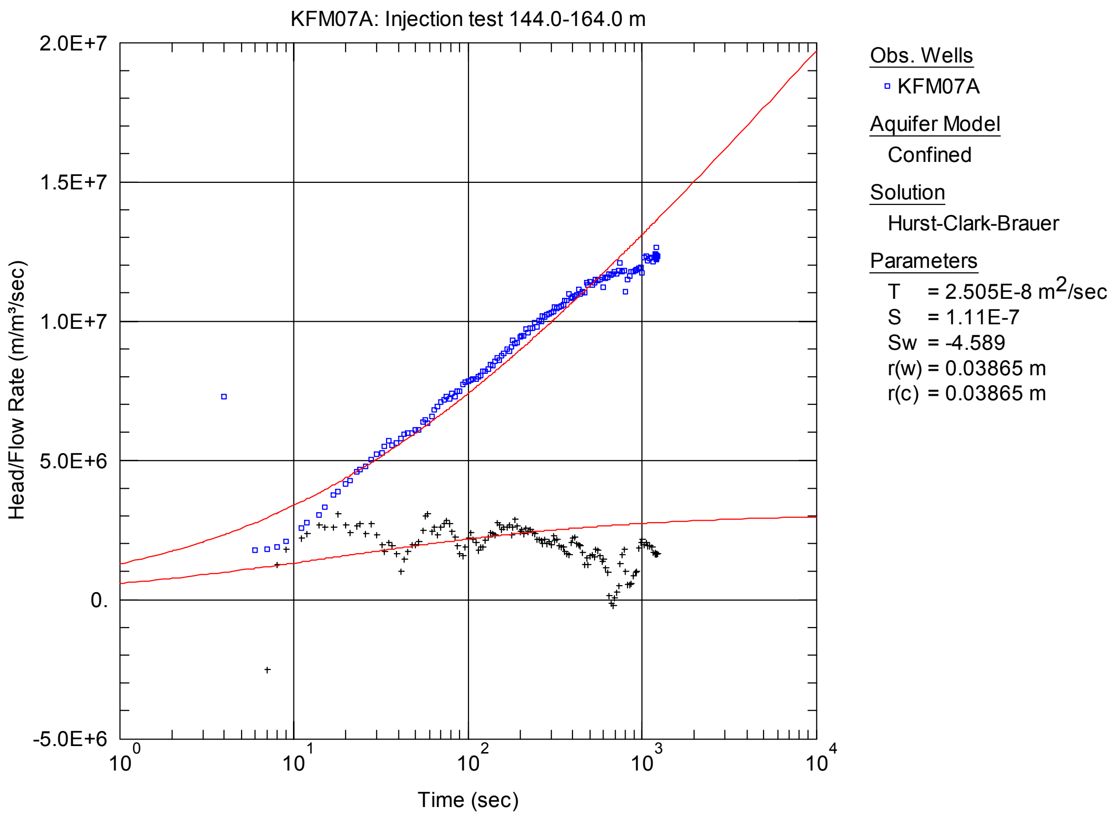


Figure A3-32. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 144.0-164.0 m in KFM07A.*

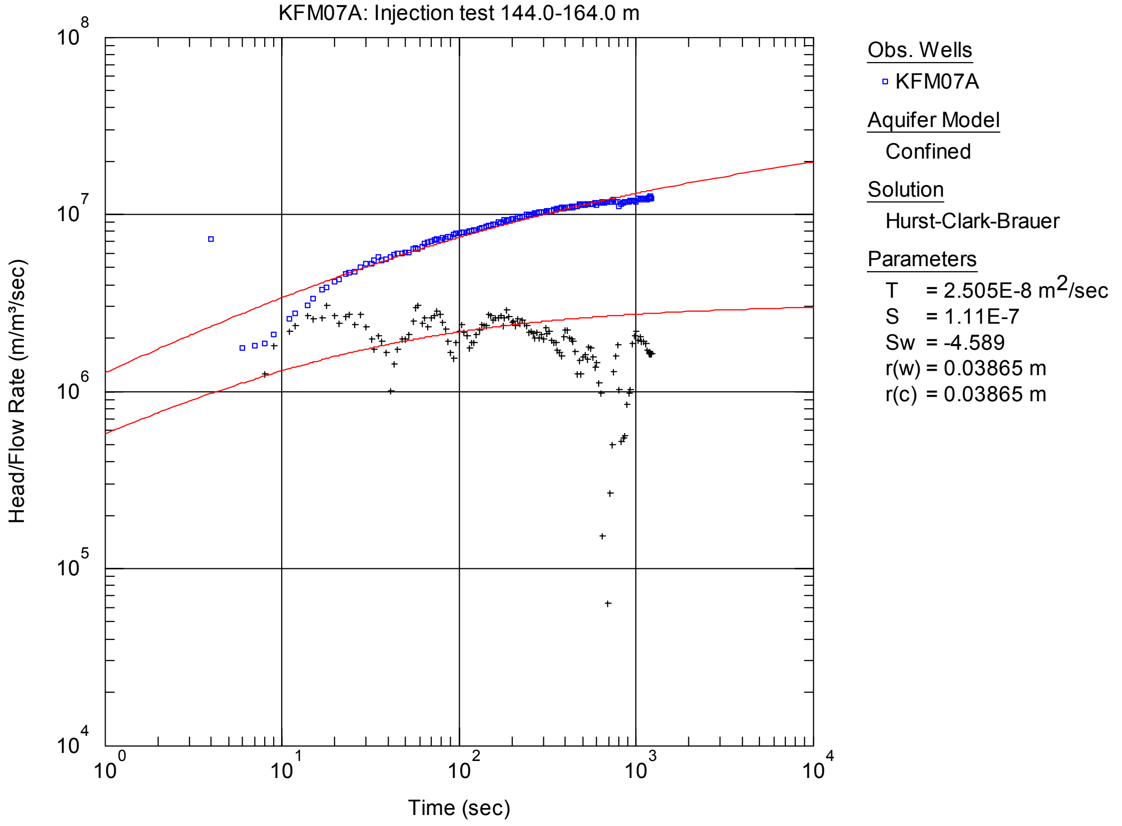


Figure A3-33. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 144.0-164.0 m in KFM07A.*

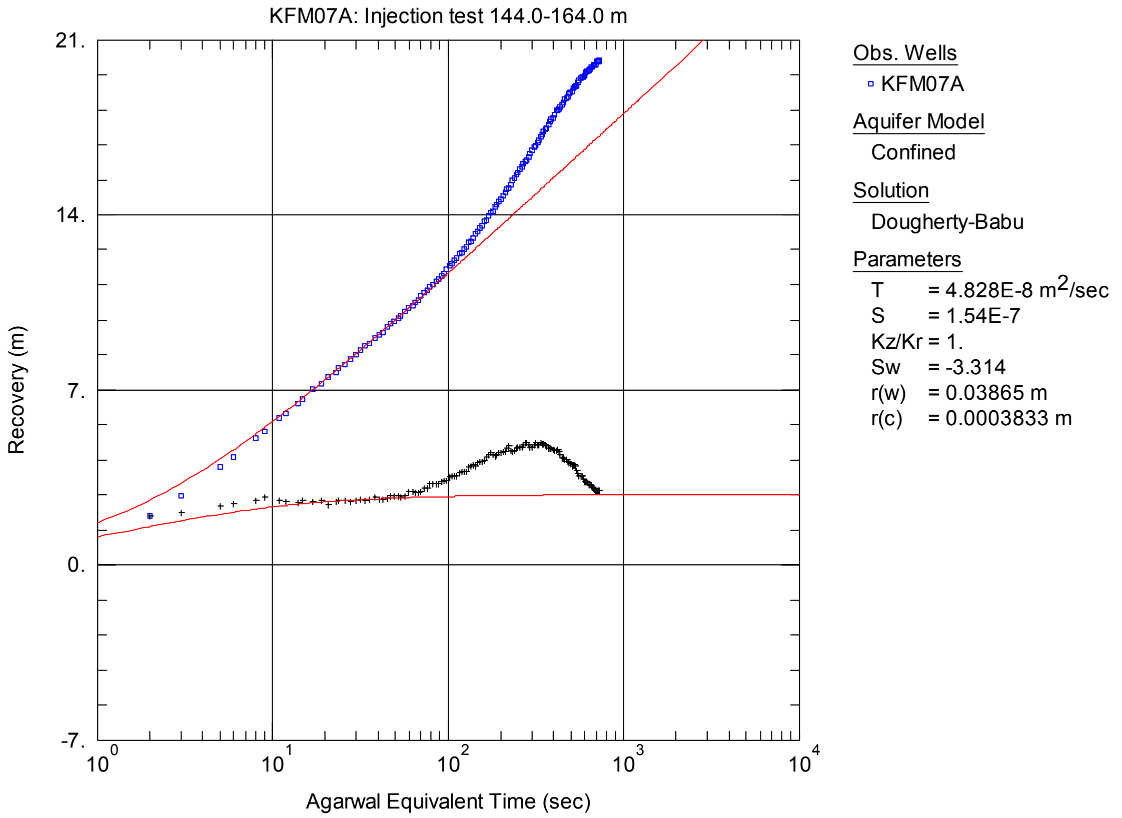


Figure A3-34. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 144.0-164.0 m in KFM07A.*

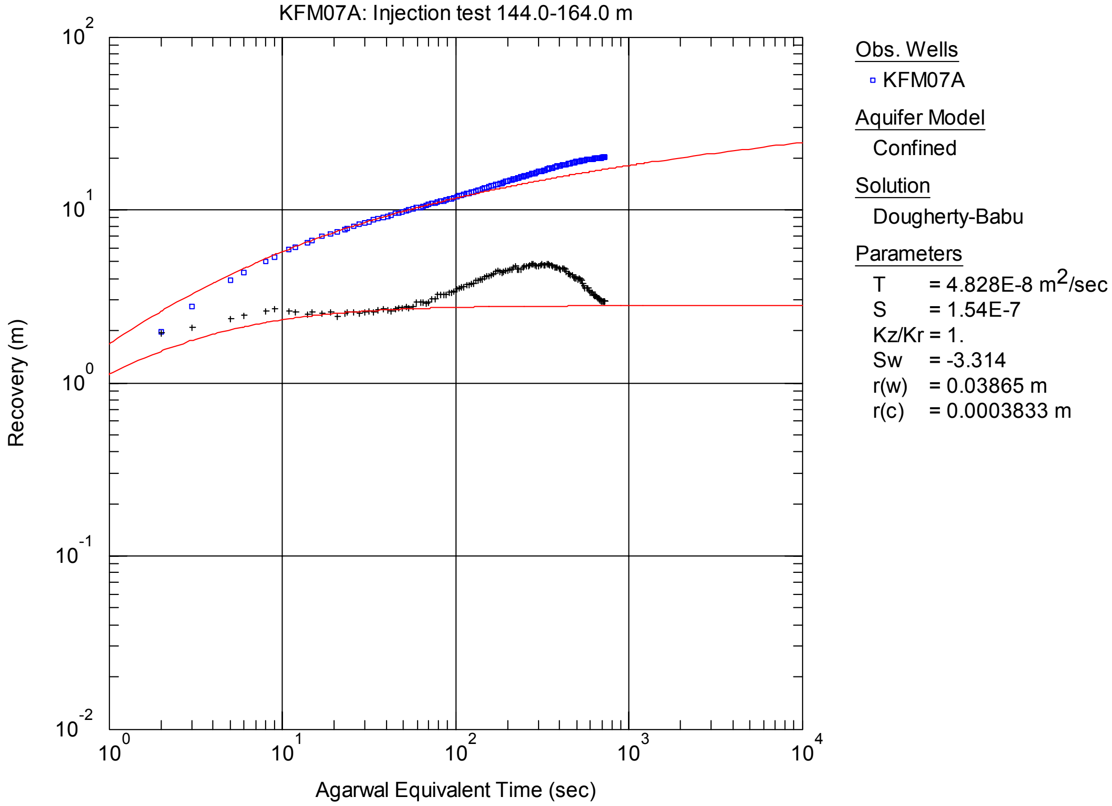


Figure A3-35. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 144.0-164.0 m in KFM07A.*

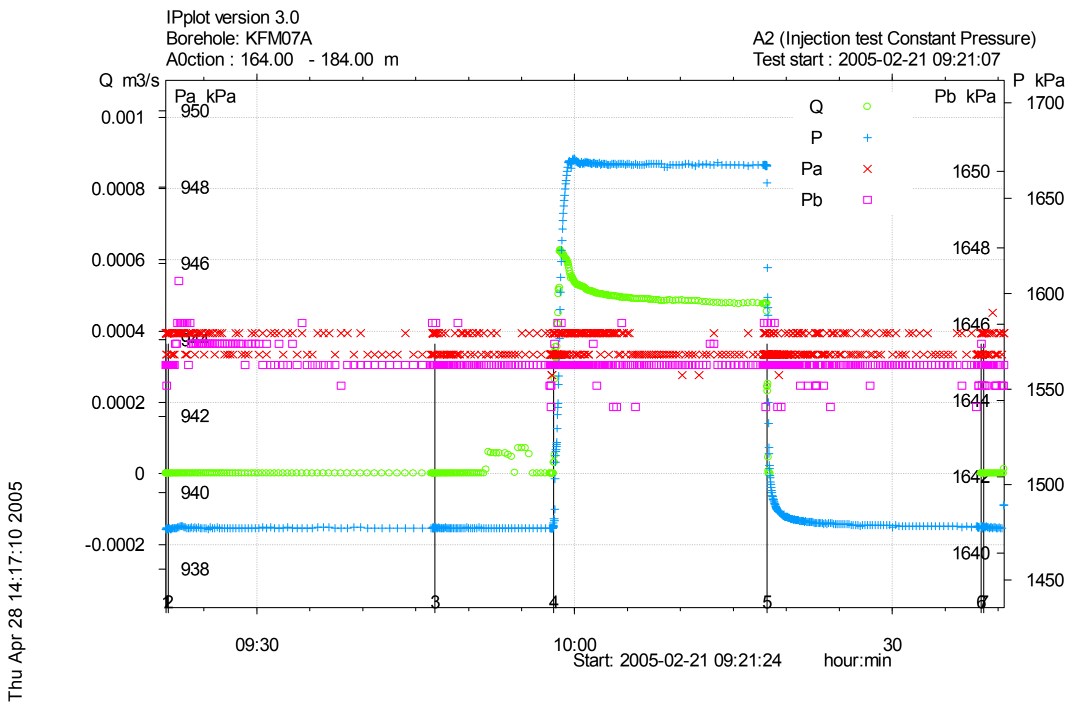


Figure A3-36. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 164.0-184.0 m in borehole KFM07A.*

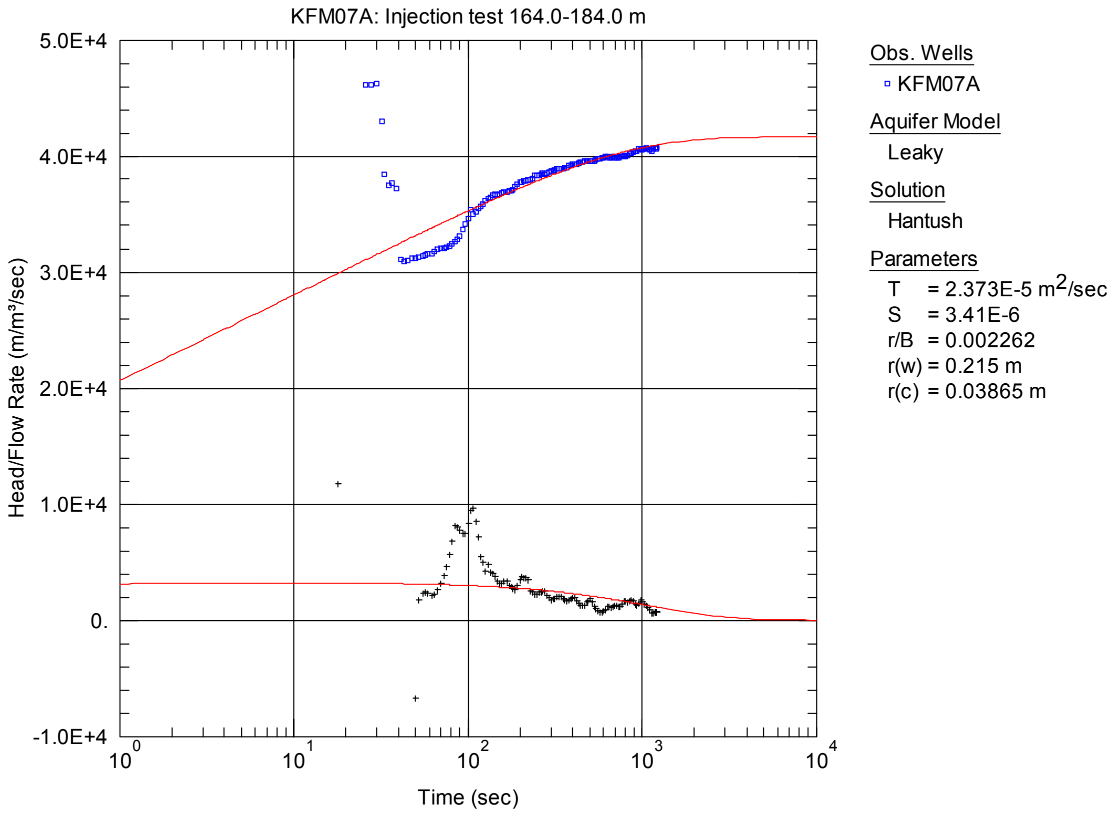


Figure A3-37. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 164.0-184.0 m in KFM07A.*

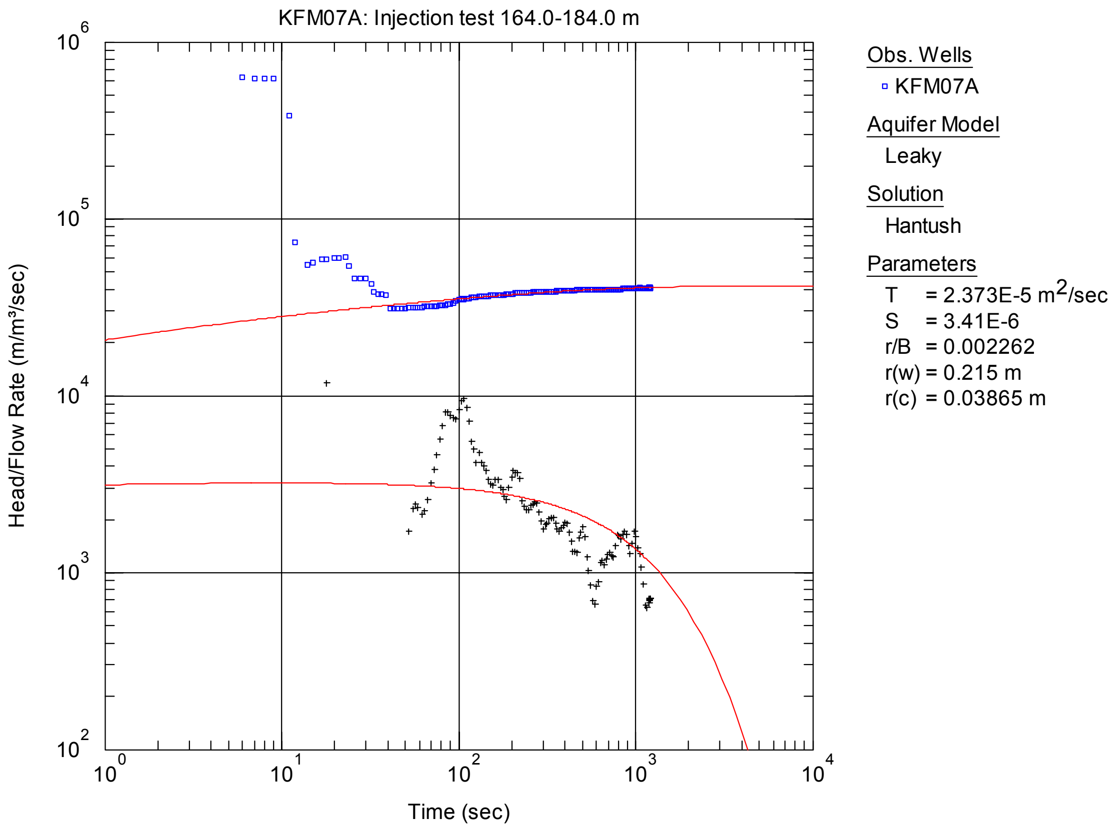


Figure A3-38. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 164.0-184.0 m in KFM07A.*

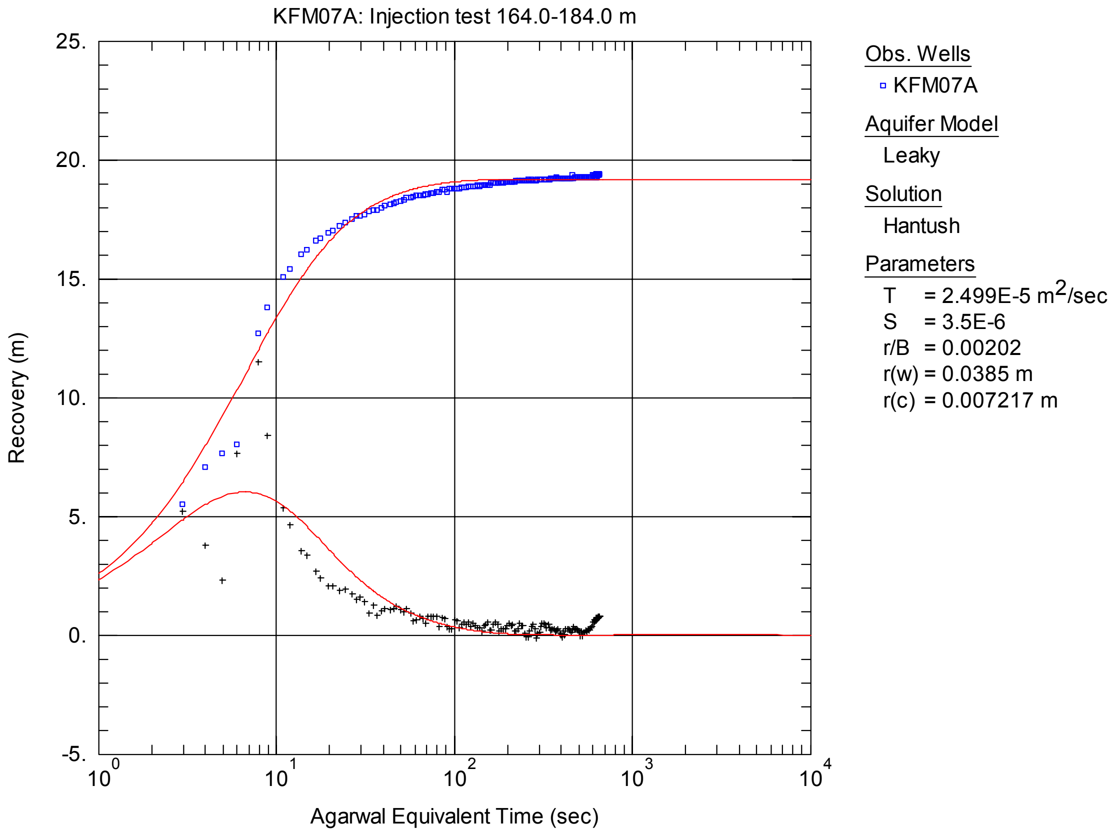


Figure A3-39. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 164.0-184.0 m in KFM07A.*

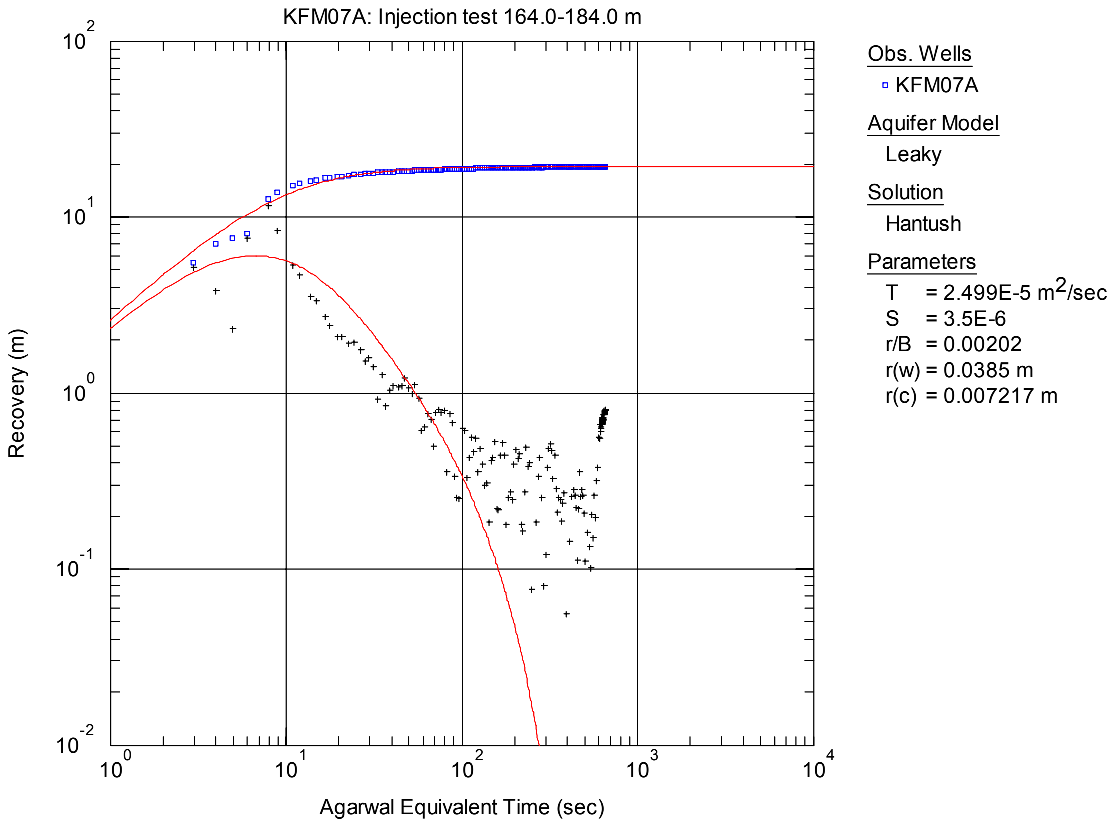


Figure A3-40. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 164.0-184.0 m in KFM07A.*

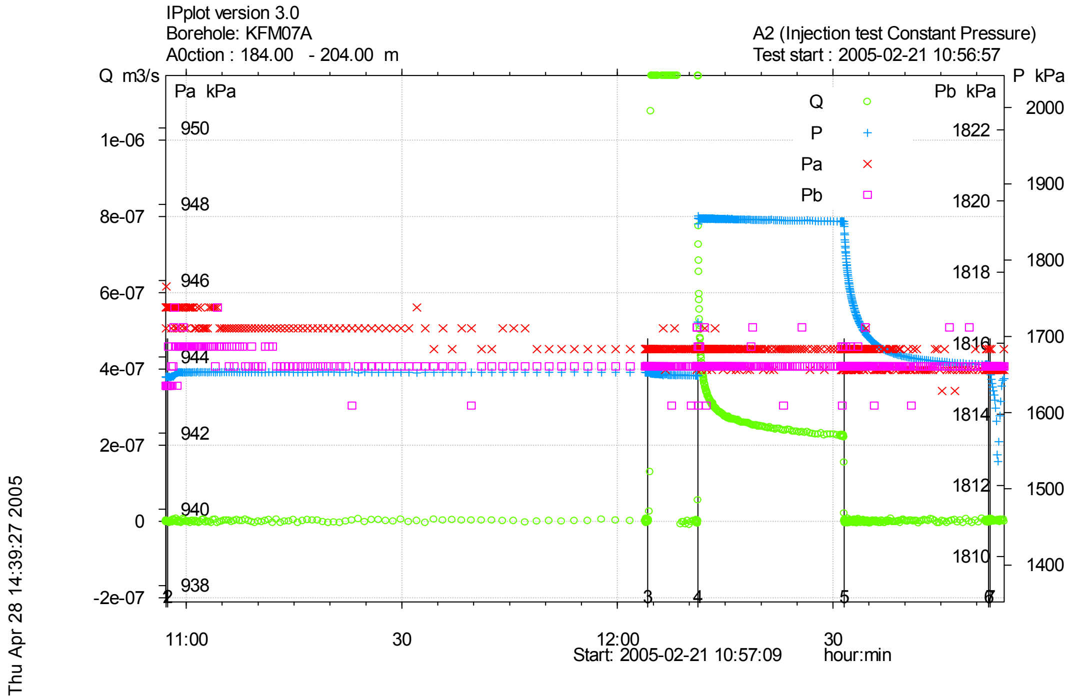


__Figure A3-41.__ Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 184.0-204.0 m in borehole KFM07A.

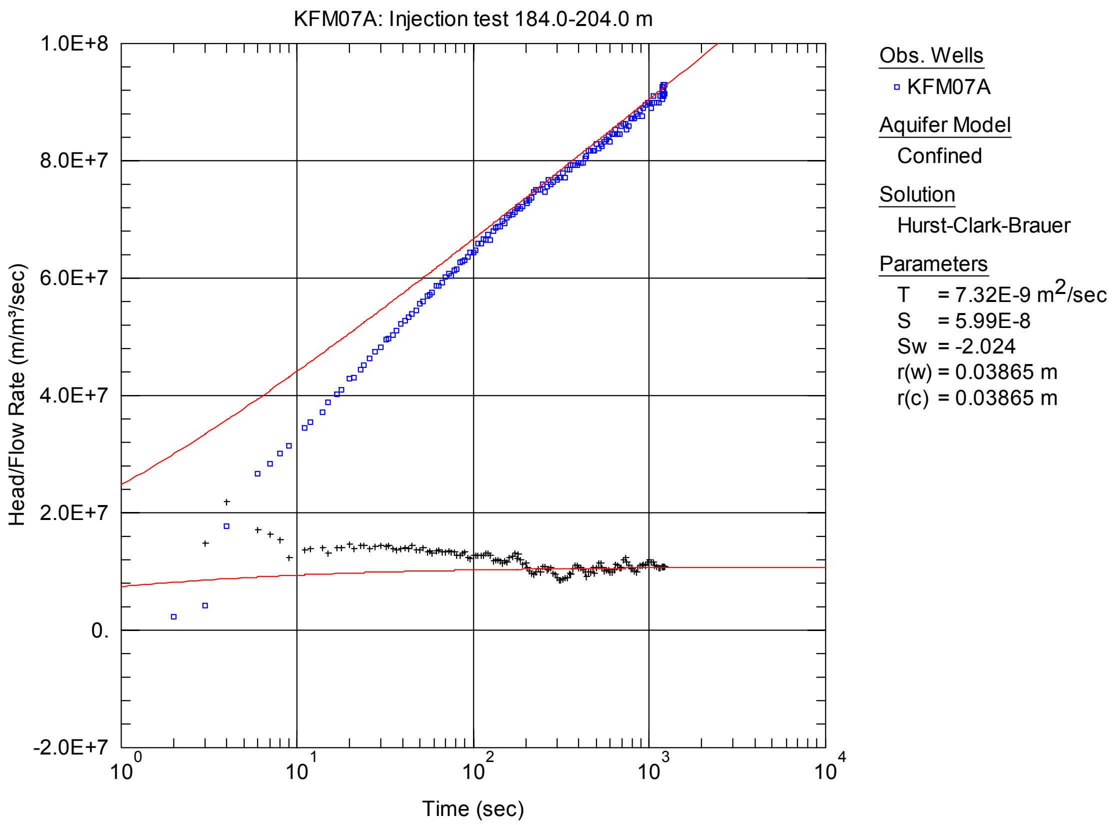


__Figure A3-42.__ Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 184.0-204.0 m in KFM07A.

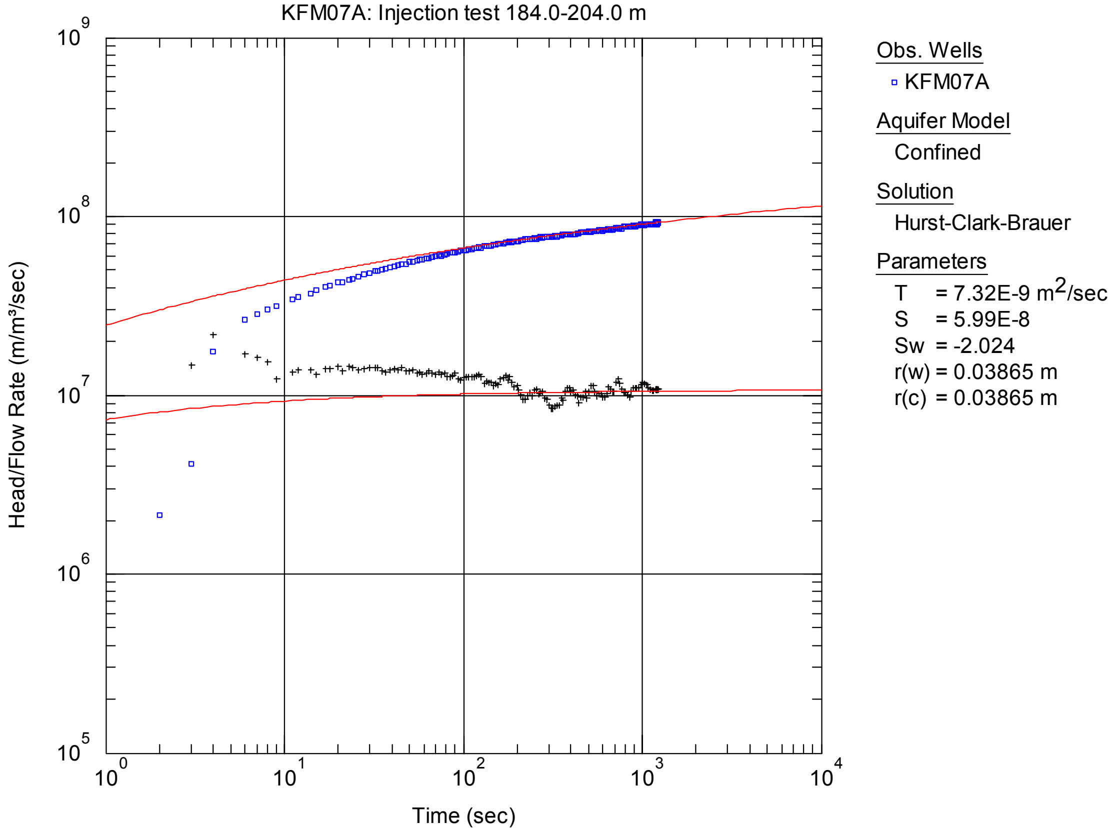


Figure A3-43. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 184.0-204.0 m in KFM07A.*

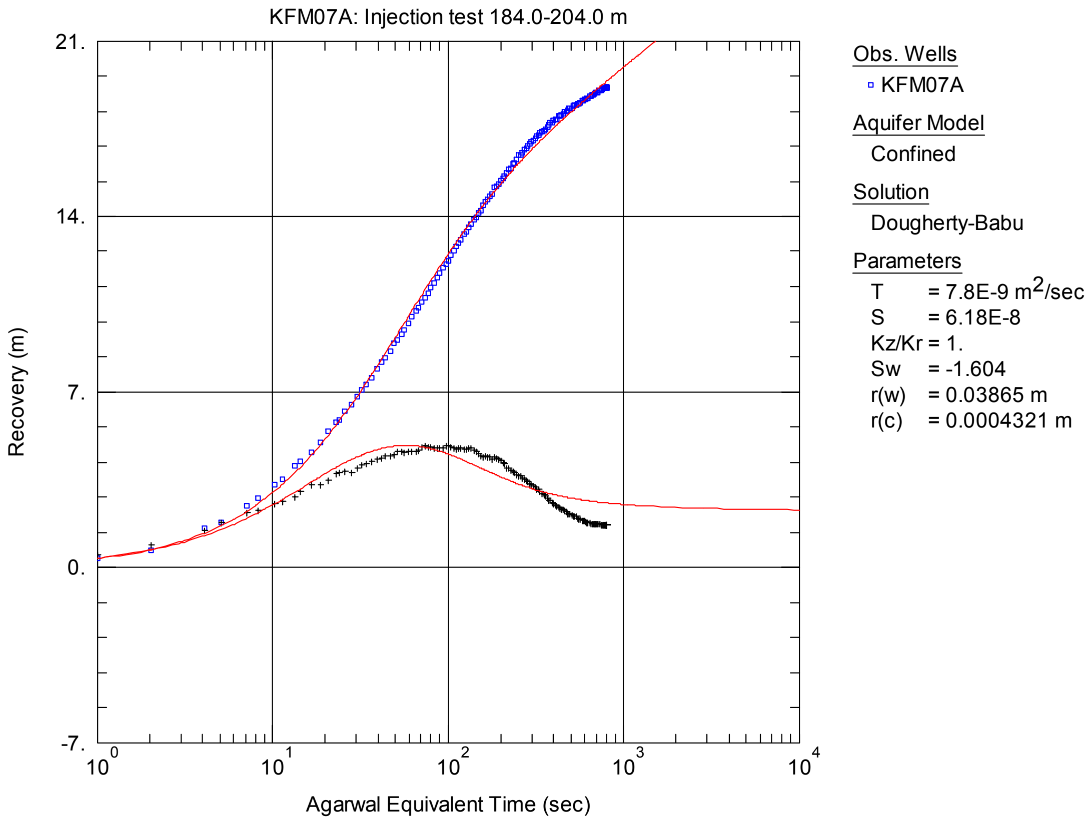


Figure A3-44. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 184.0-204.0 m in KFM07A.*

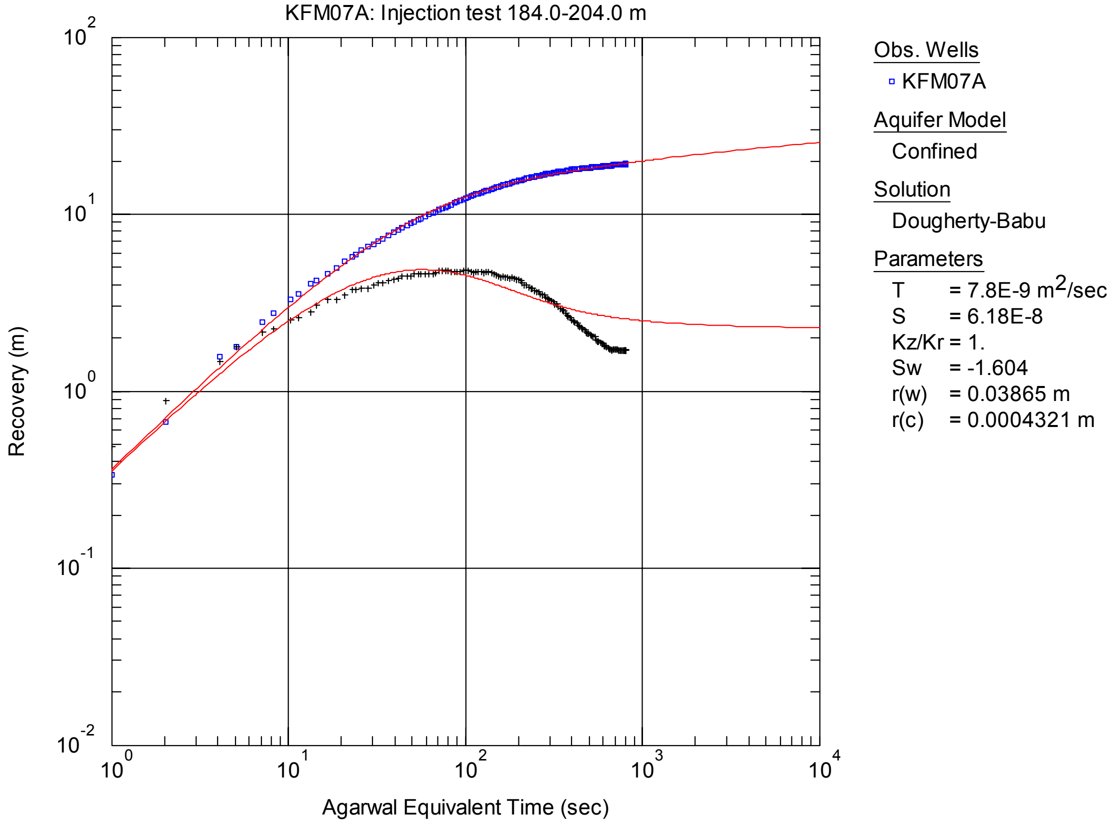


Figure A3-45. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 184.0-204.0 m in KFM07A.*

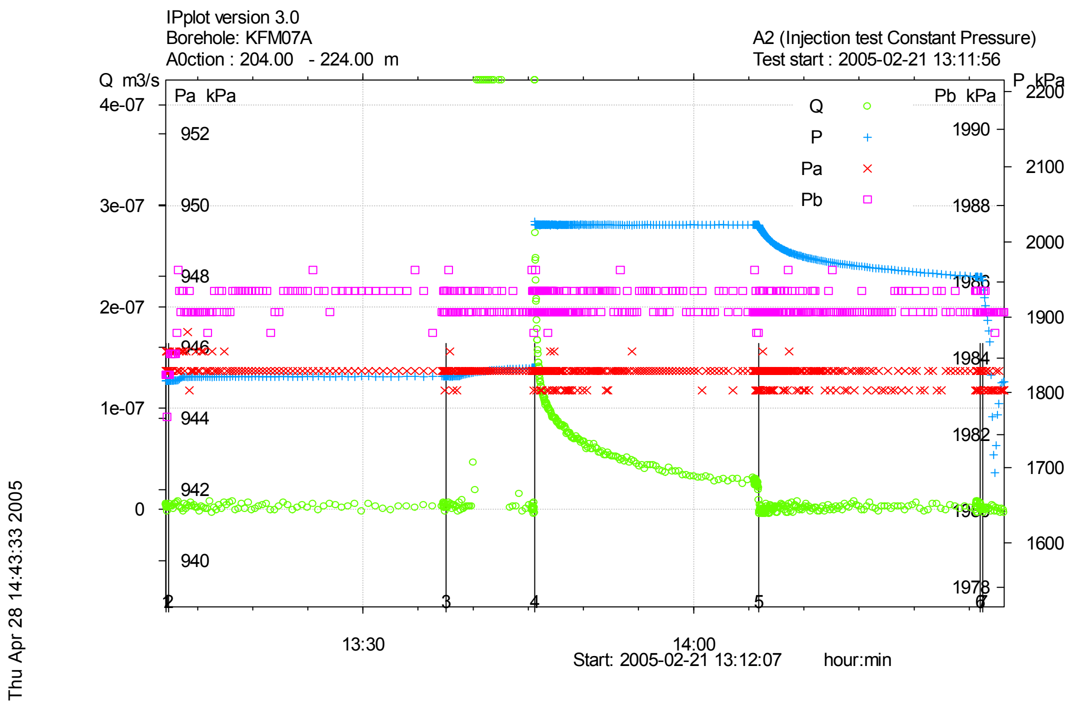


Figure A3-46. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 204.0-224.0 m in borehole KFM07A.*

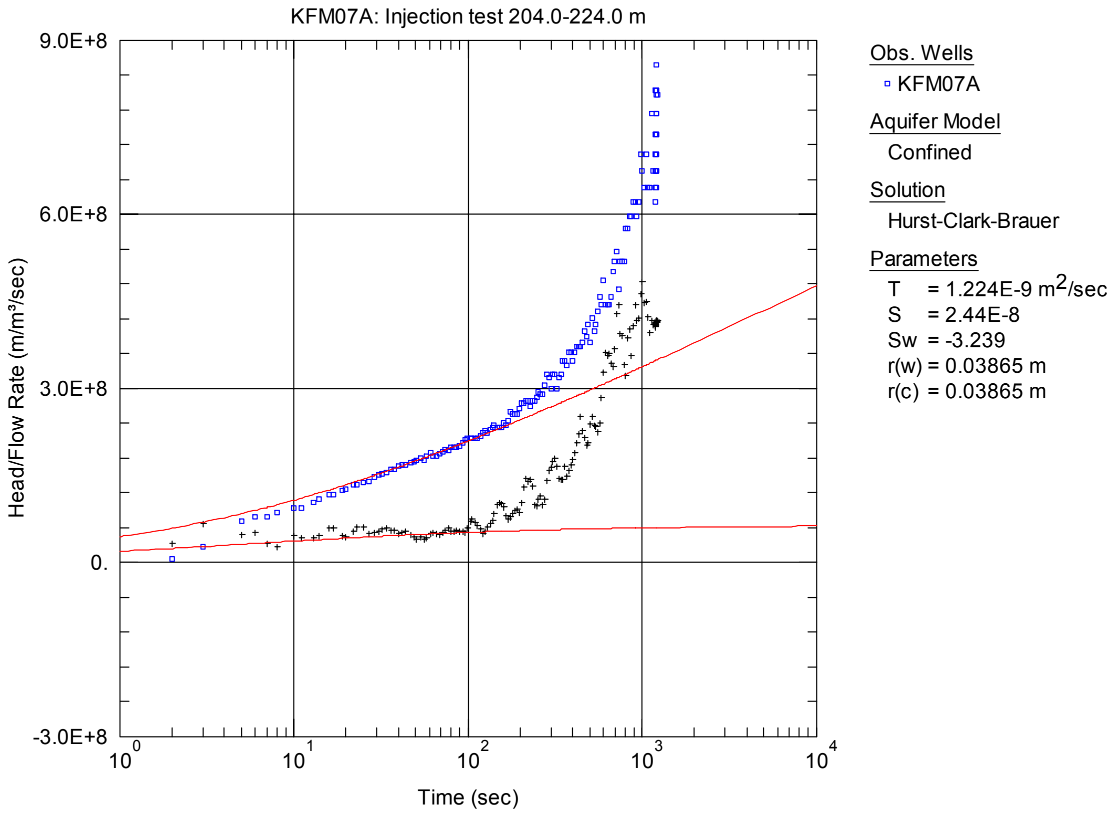


Figure A3-47. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 204.0-224.0 m in KFM07A.*

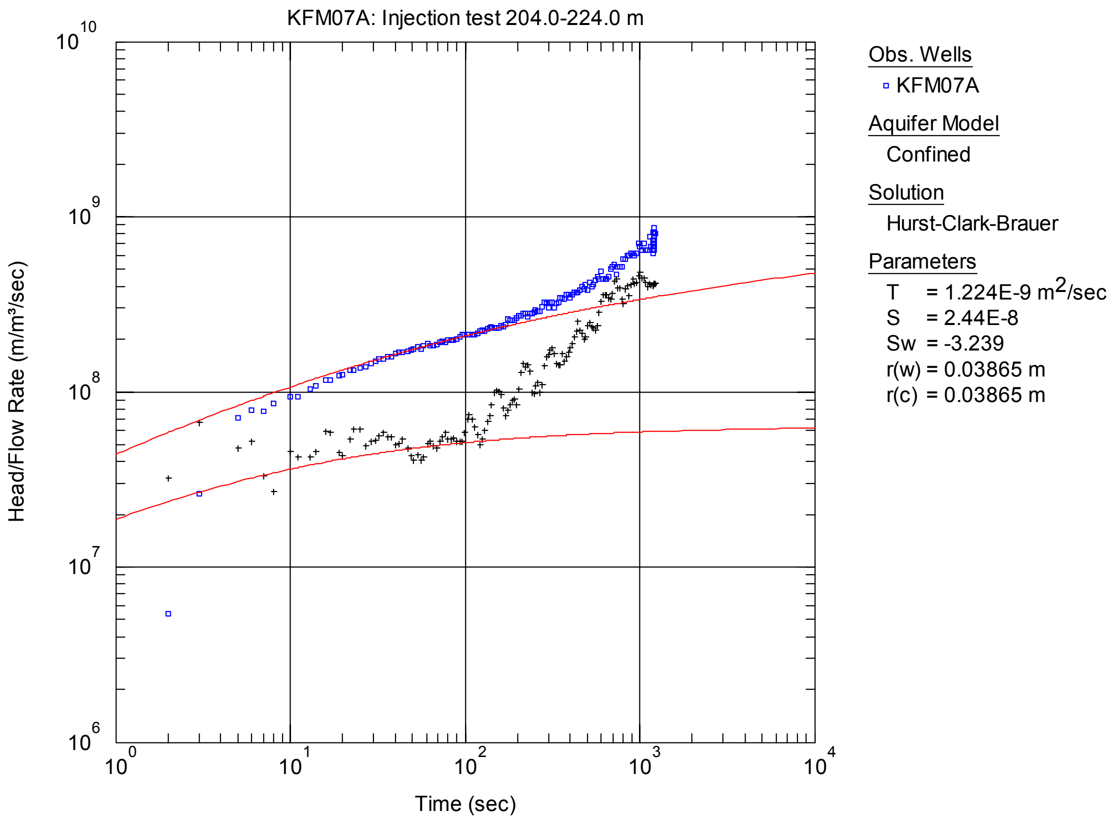


Figure A3-48. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 204.0-224.0 m in KFM07A.*

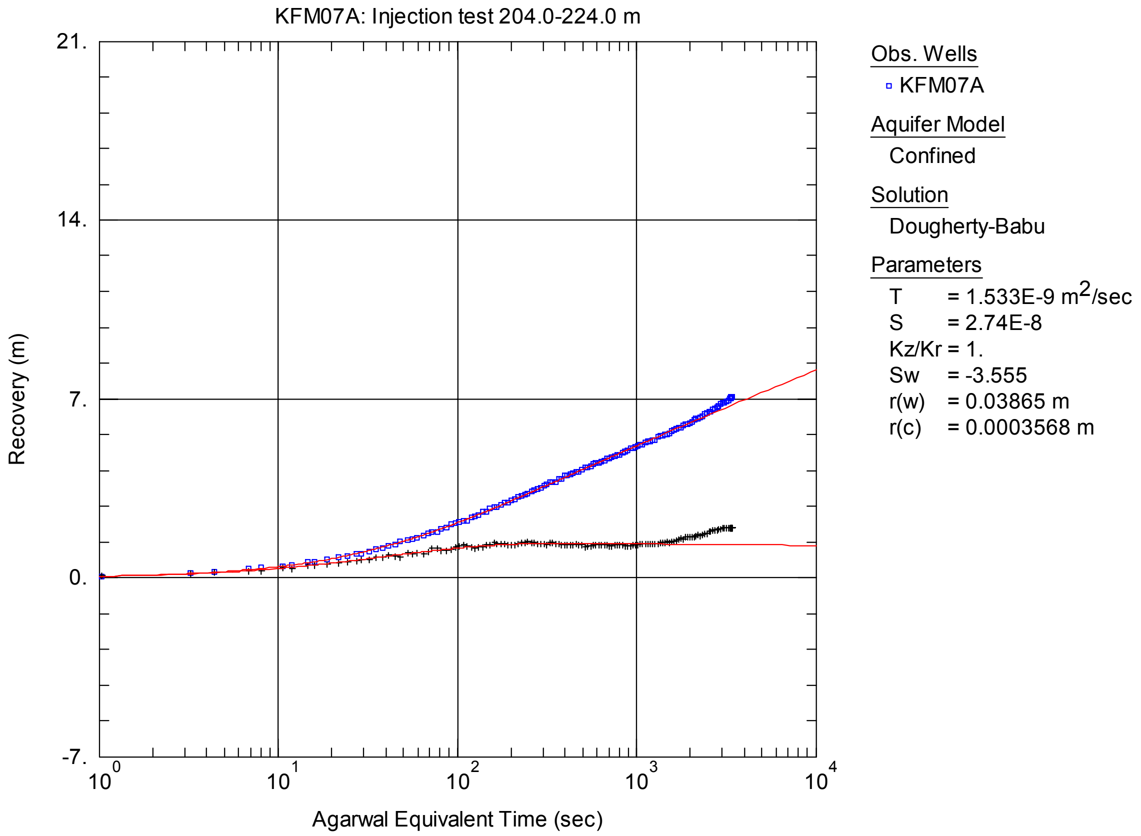


Figure A3-49. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 204.0-224.0 m in KFM07A.*

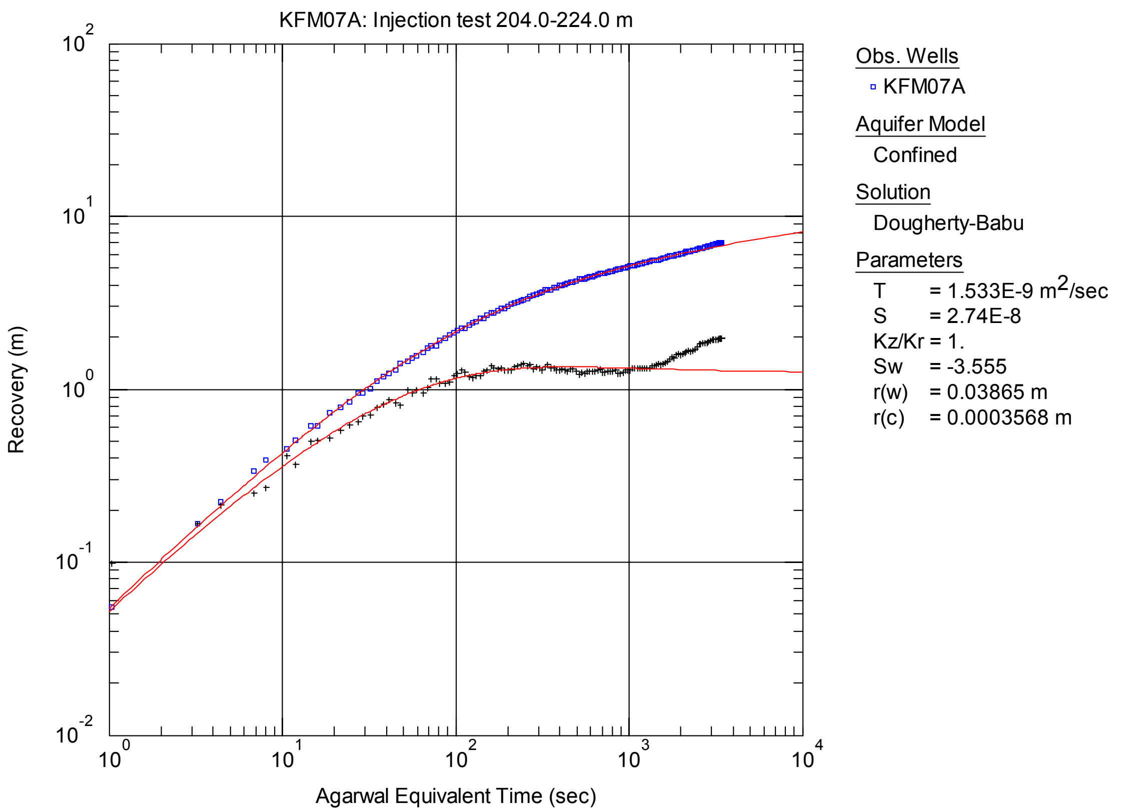


Figure A3-50. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 204.0-224.0 m in KFM07A.*

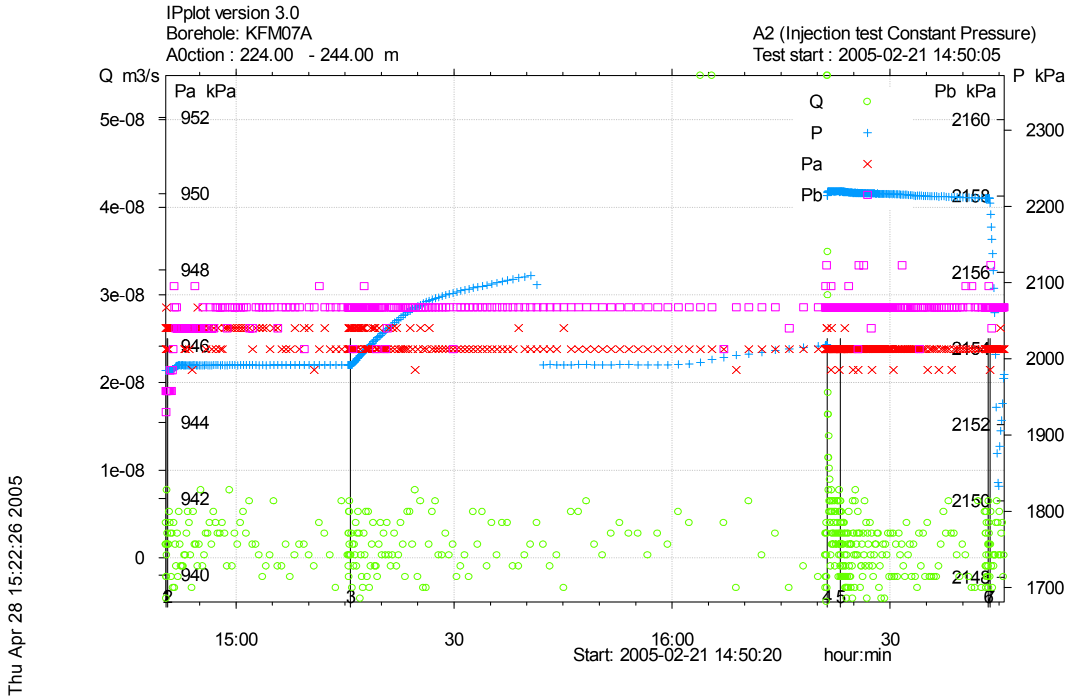


__Figure A3-51.__ Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 224.0-244.0 m in borehole KFM07A. The test was conducted as a pressure pulse test.

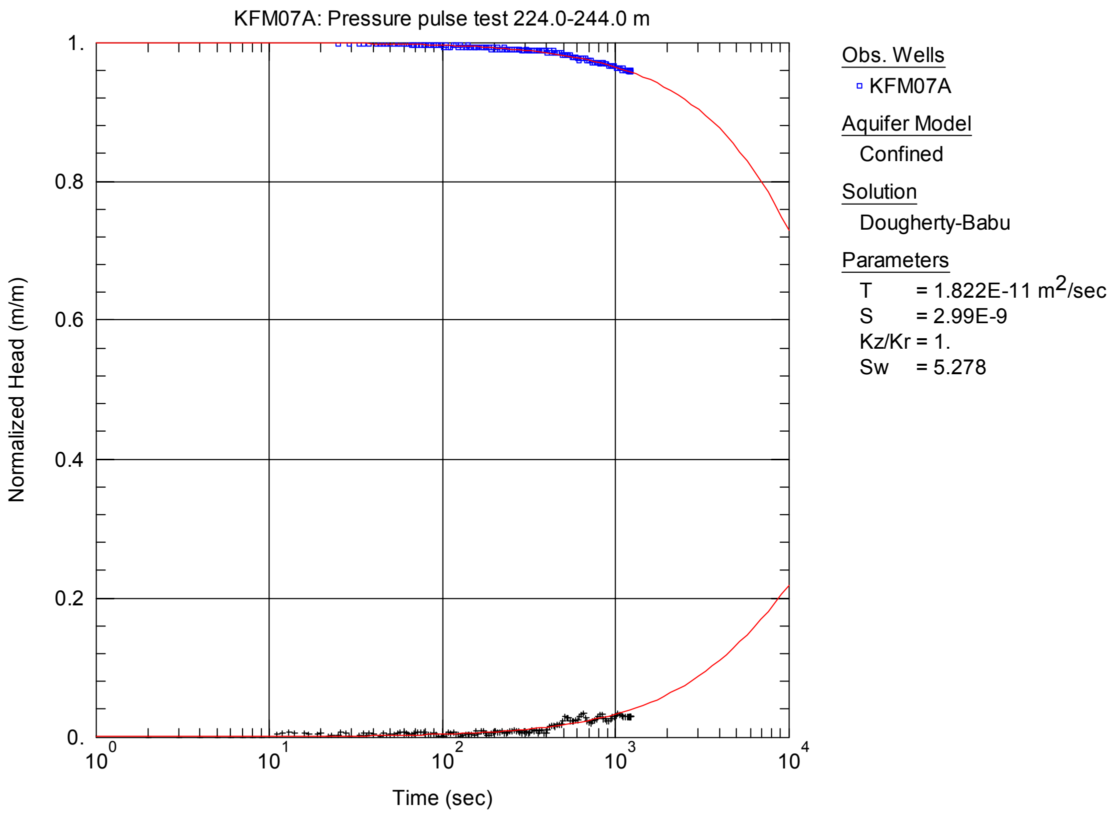


__Figure A3-52.__ Lin-log plot of recovery (□) and derivative (+) versus time, from the pressure pulse test in section 224.0-244.0 m in KFM07A.

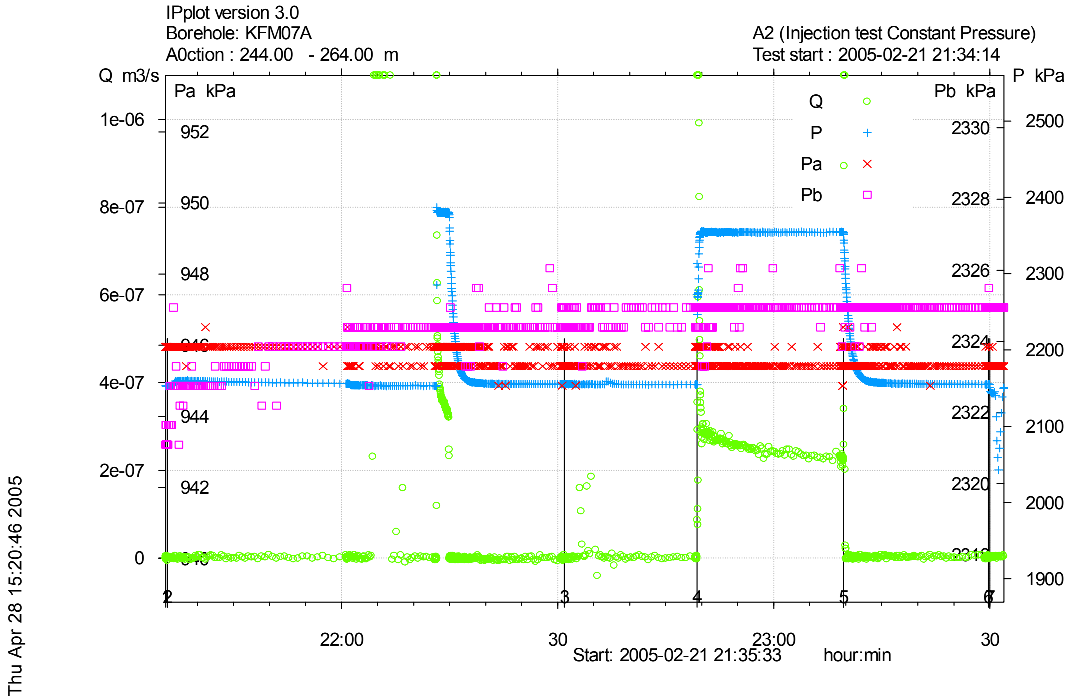


Figure A3-53. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 244.0-264.0 m in borehole KFM07A.*

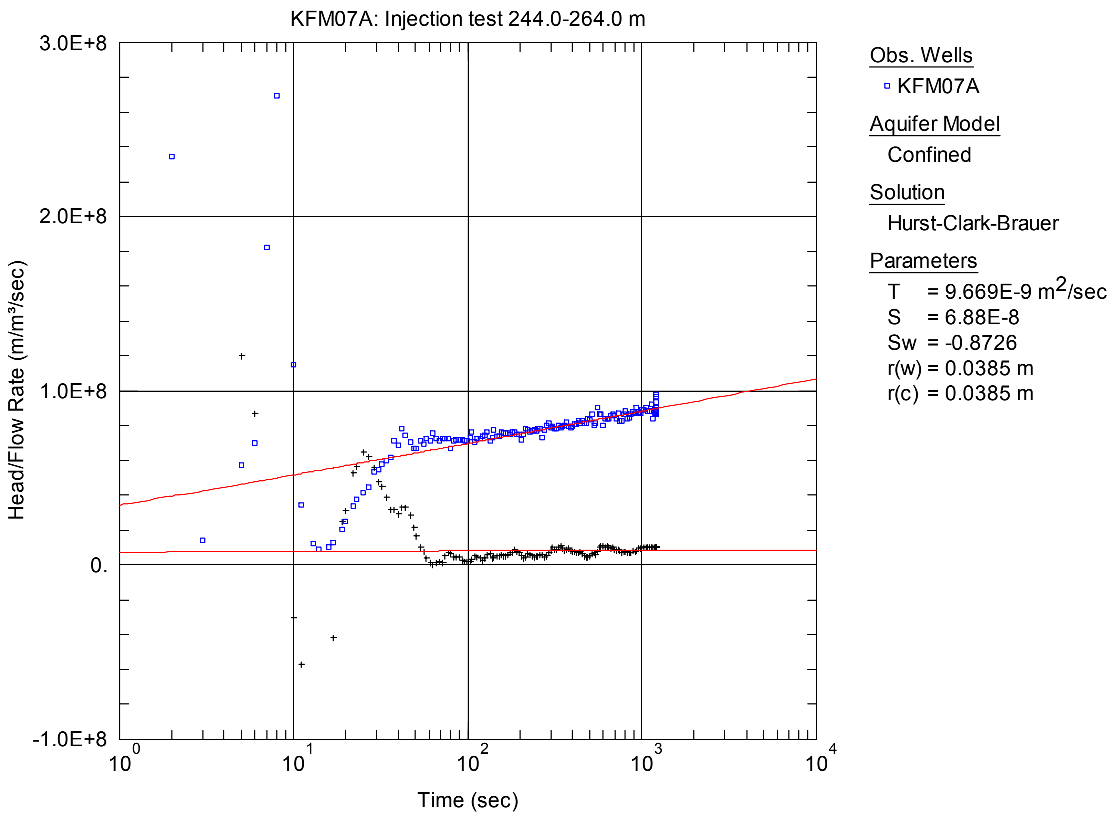


Figure A3-54. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 244.0-264.0 m in KFM07A.*

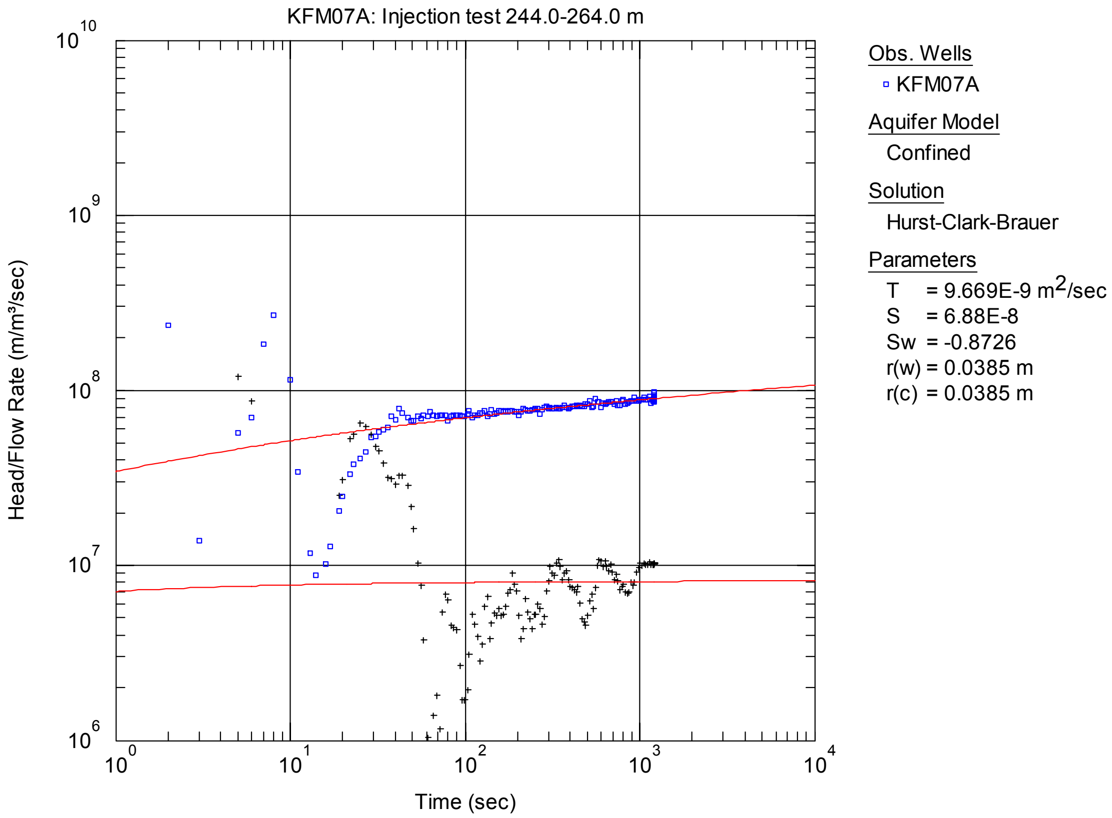


Figure A3-55. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 244.0-264.0 m in KFM07A.*

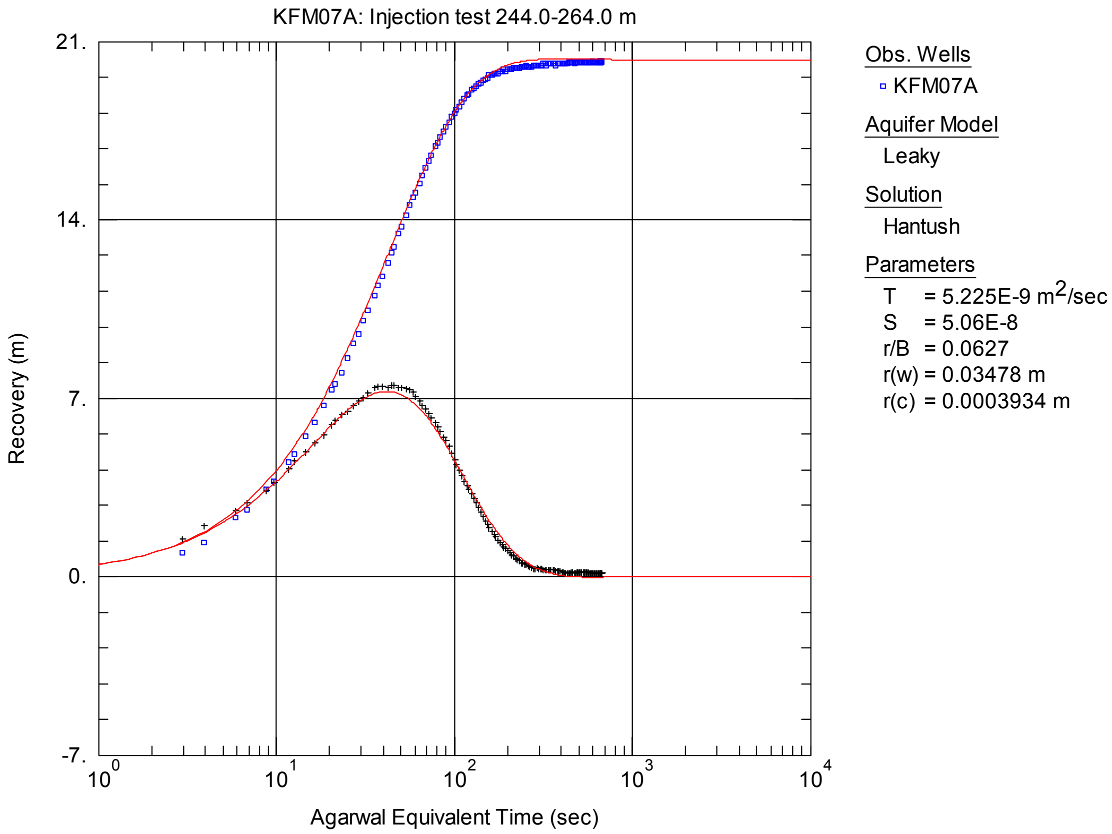


Figure A3-56. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 244.0-264.0 m in KFM07A.*

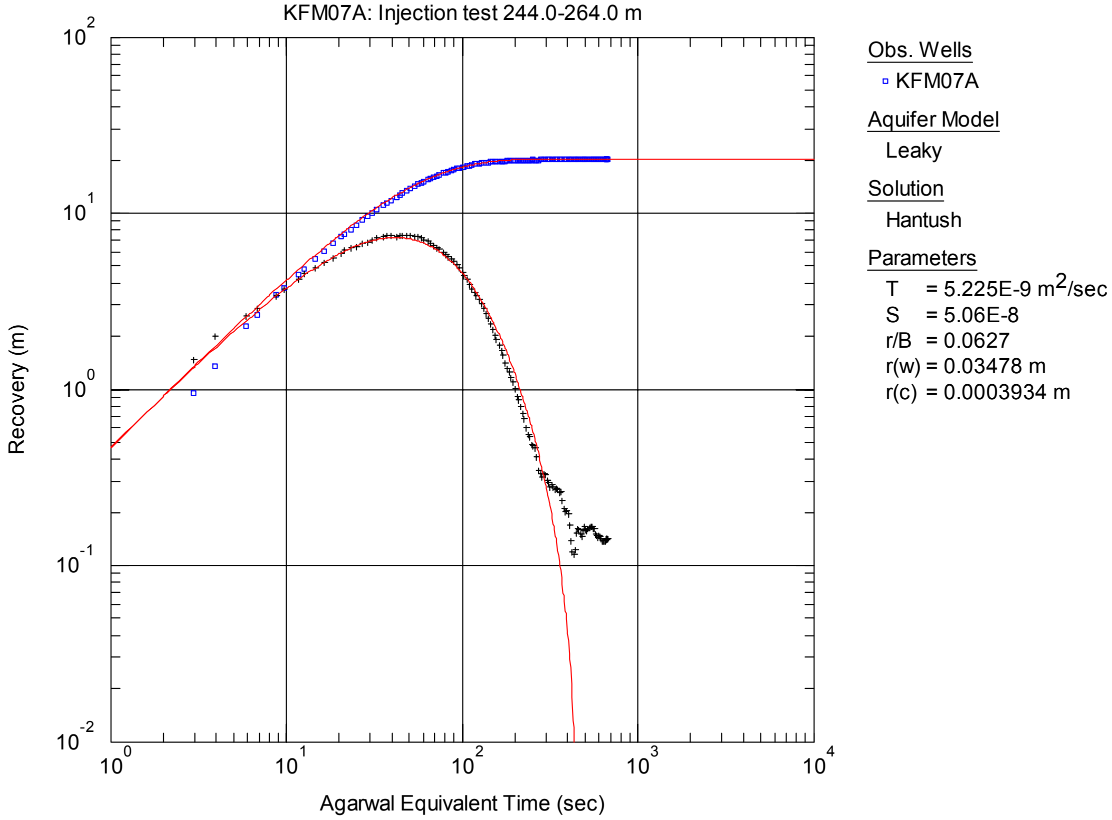


Figure A3-57. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 244.0-264.0 m in KFM07A.*

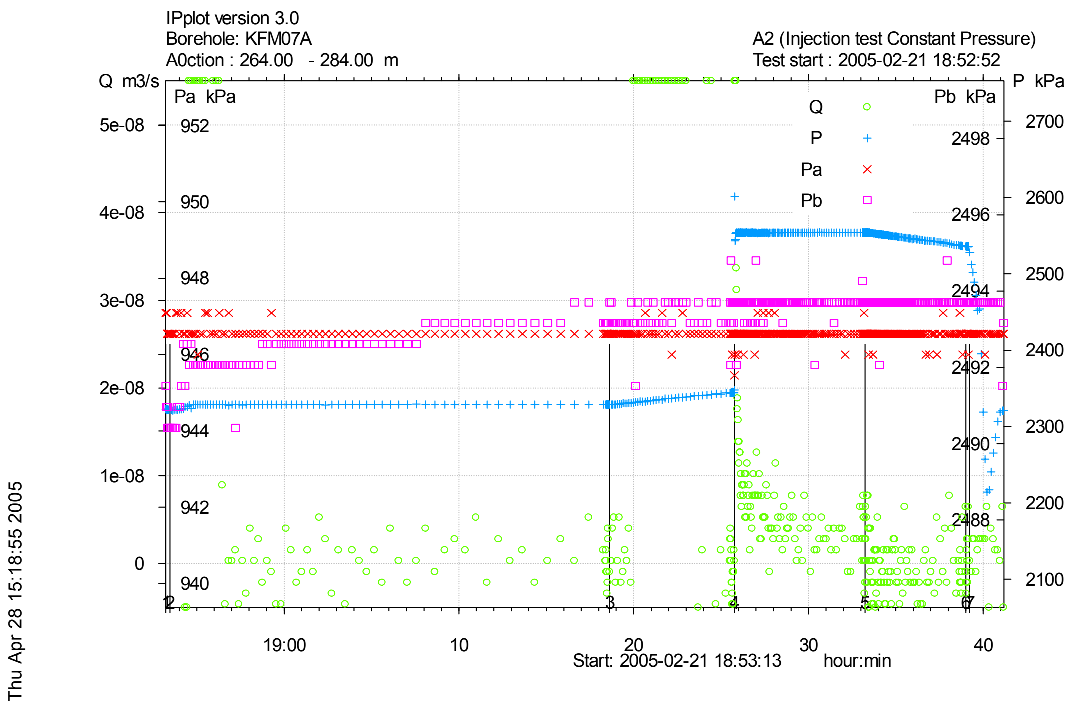


Figure A3-58. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 264.0-284.0 m in borehole KFM07A.*

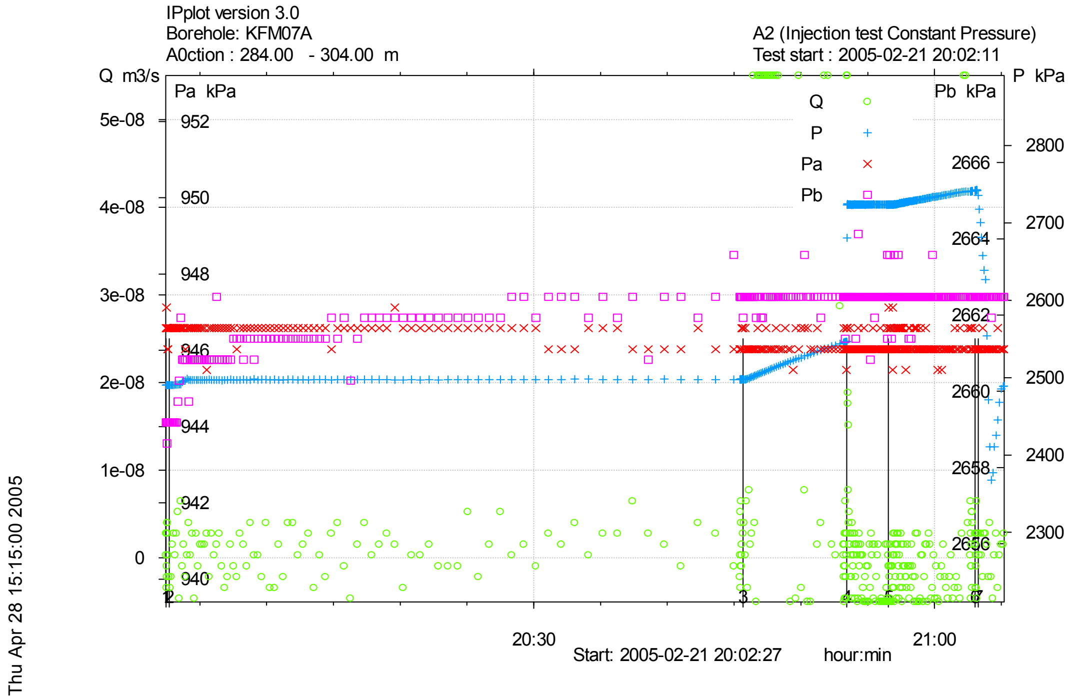


Figure A3-59. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 284.0-304.0 m in borehole KFM07A.*

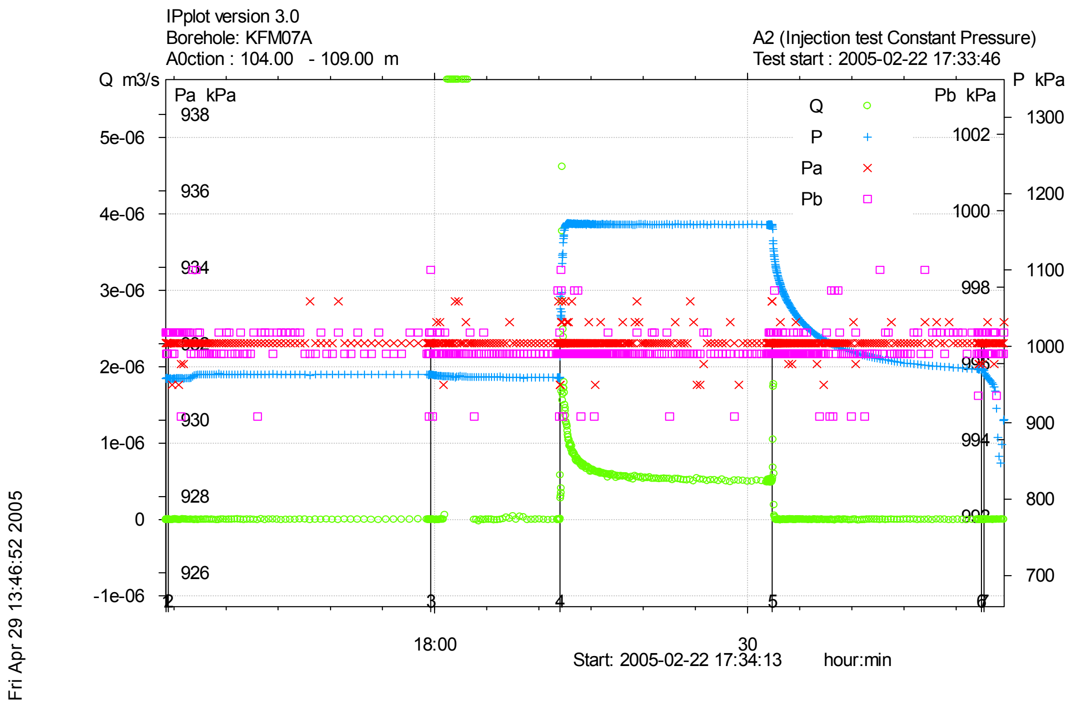


Figure A3-60. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 104.0-109.0 m in borehole KFM07A.*

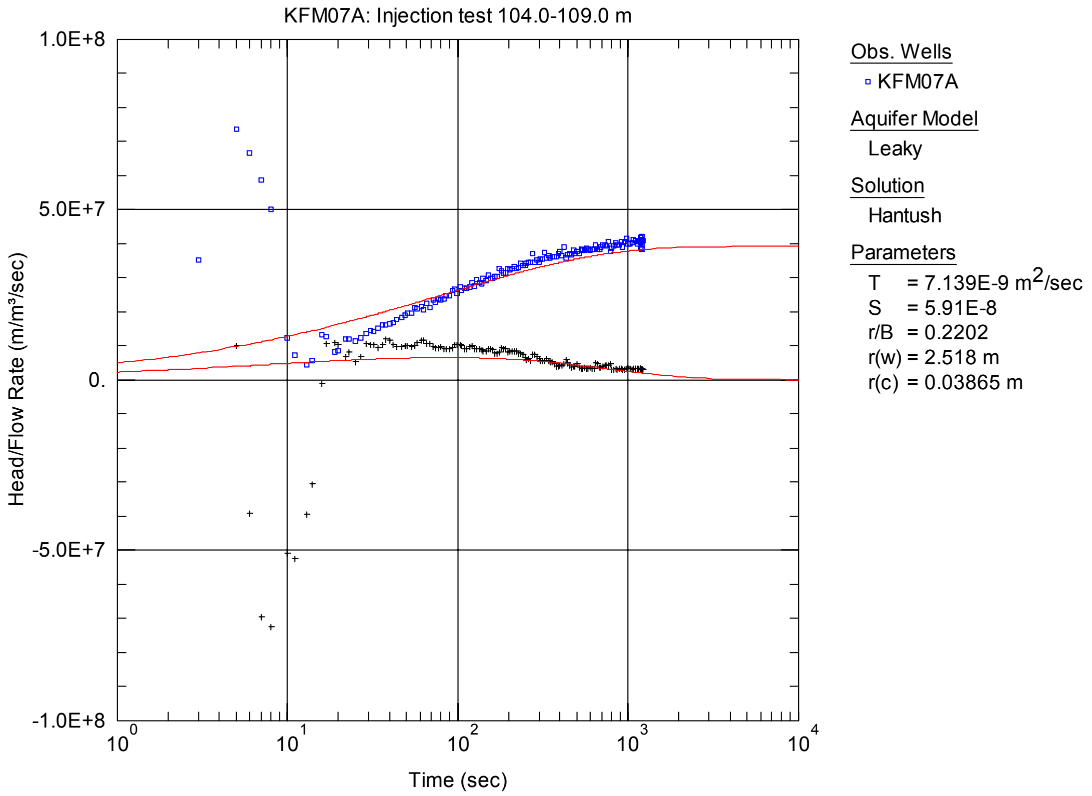


Figure A3-61. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-109.0 m in KFM07A.*

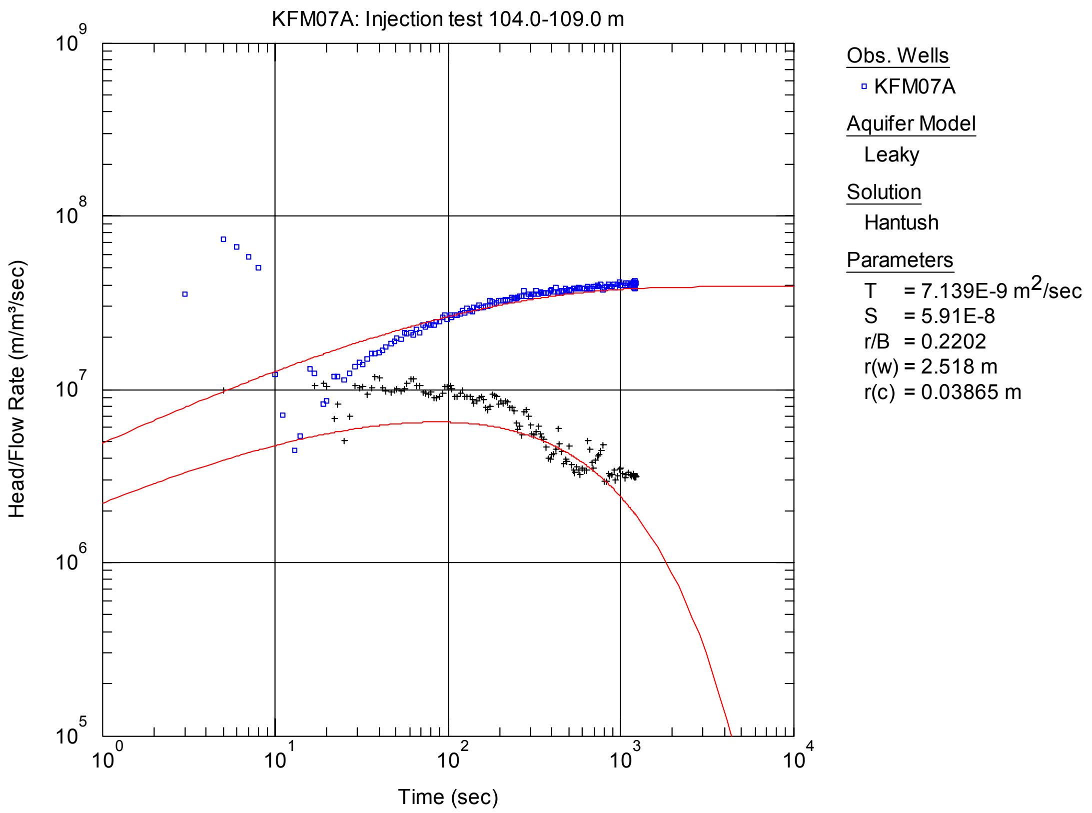


Figure A3-62. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 104.0-109.0 m in KFM07A.*

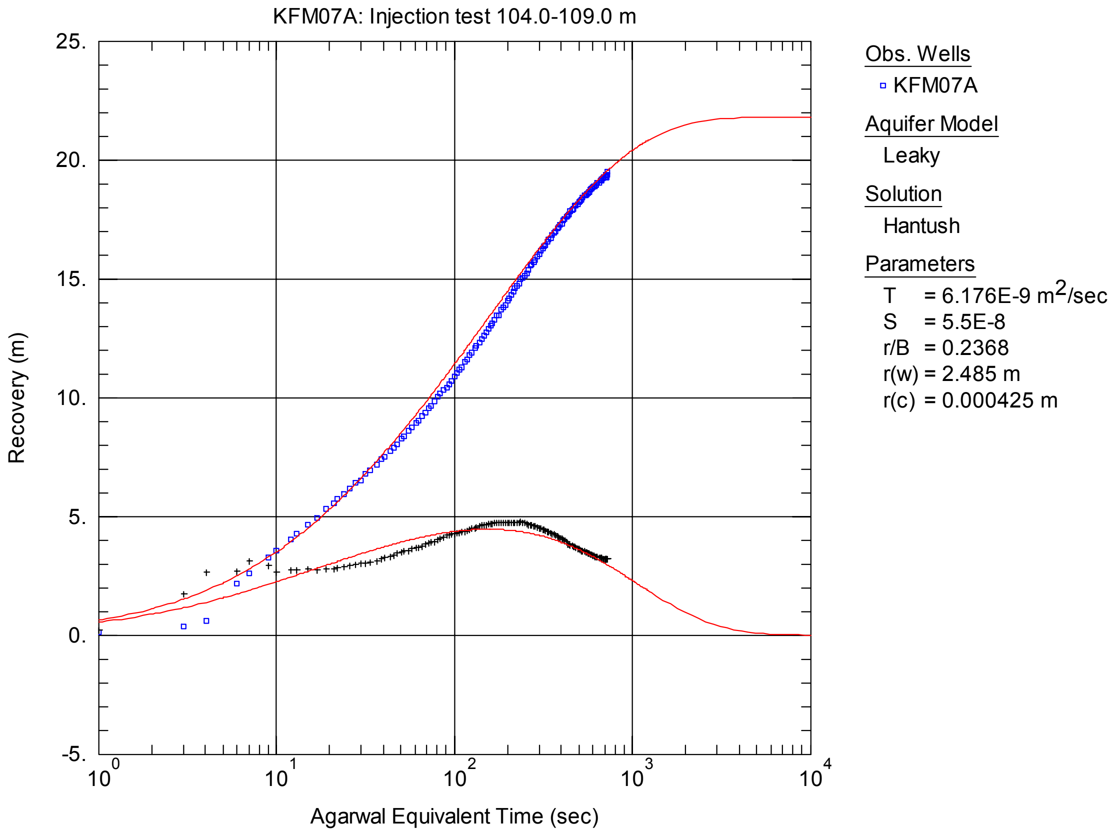


Figure A3-63. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-109.0 m in KFM07A.*

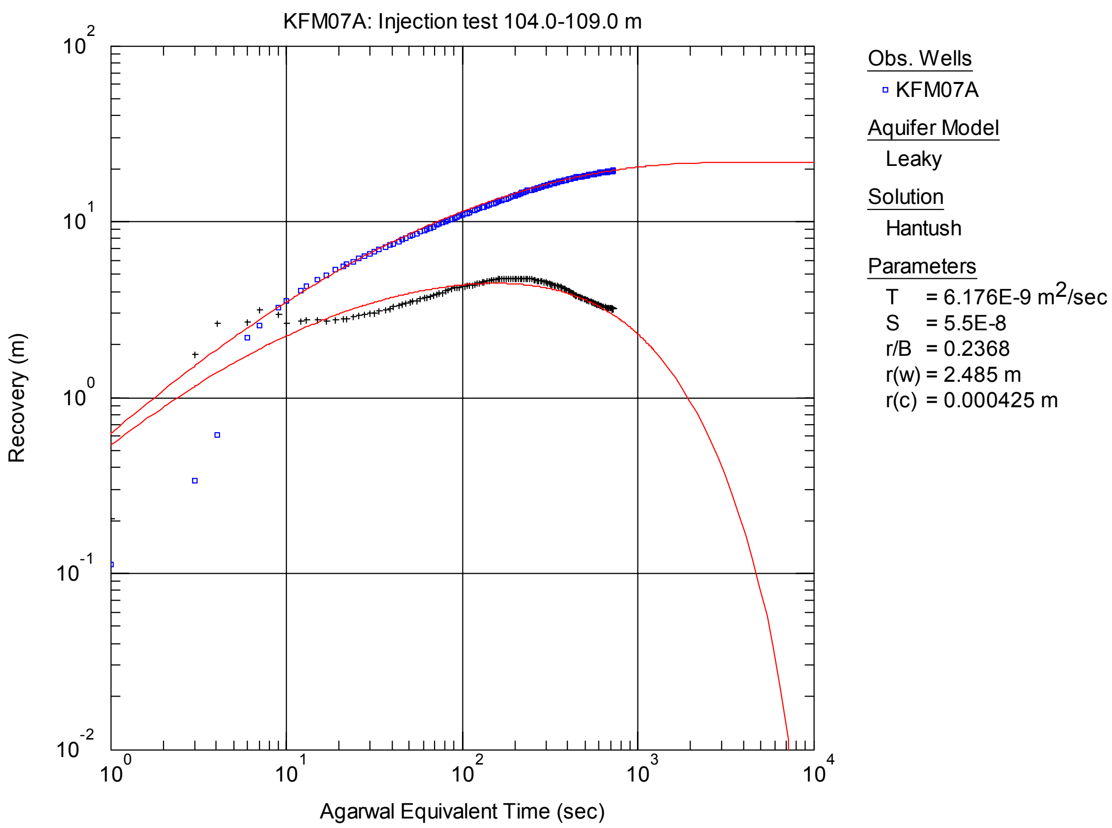


Figure A3-64. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 104.0-109.0 m in KFM07A.*

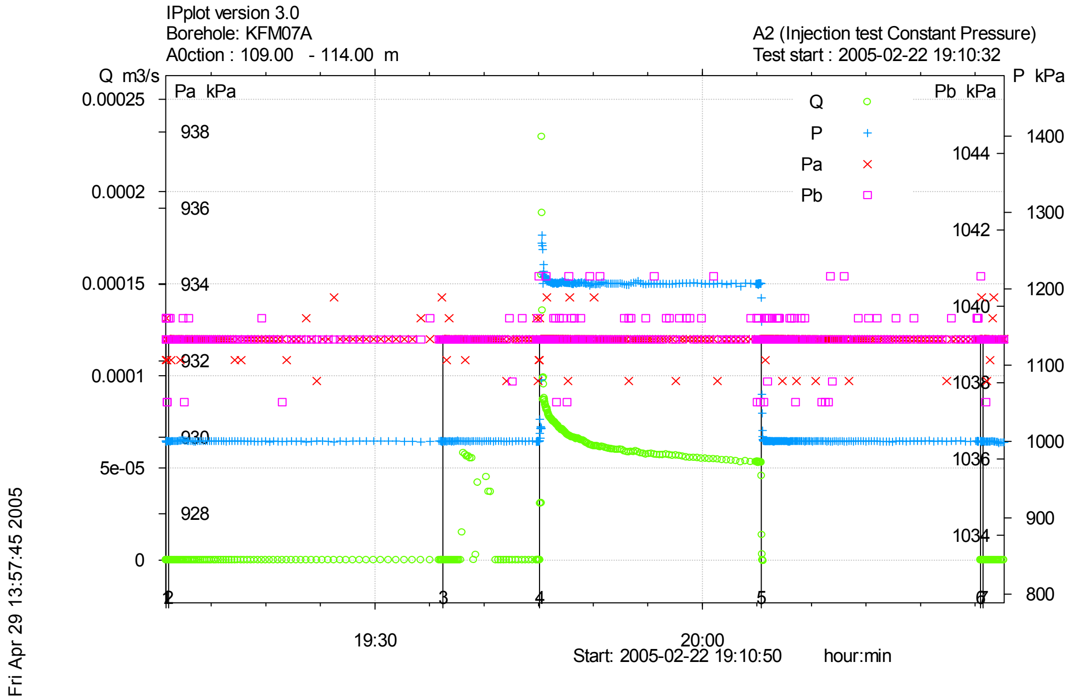


Figure A3-65. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 109.0-114.0 m in borehole KFM07A.*

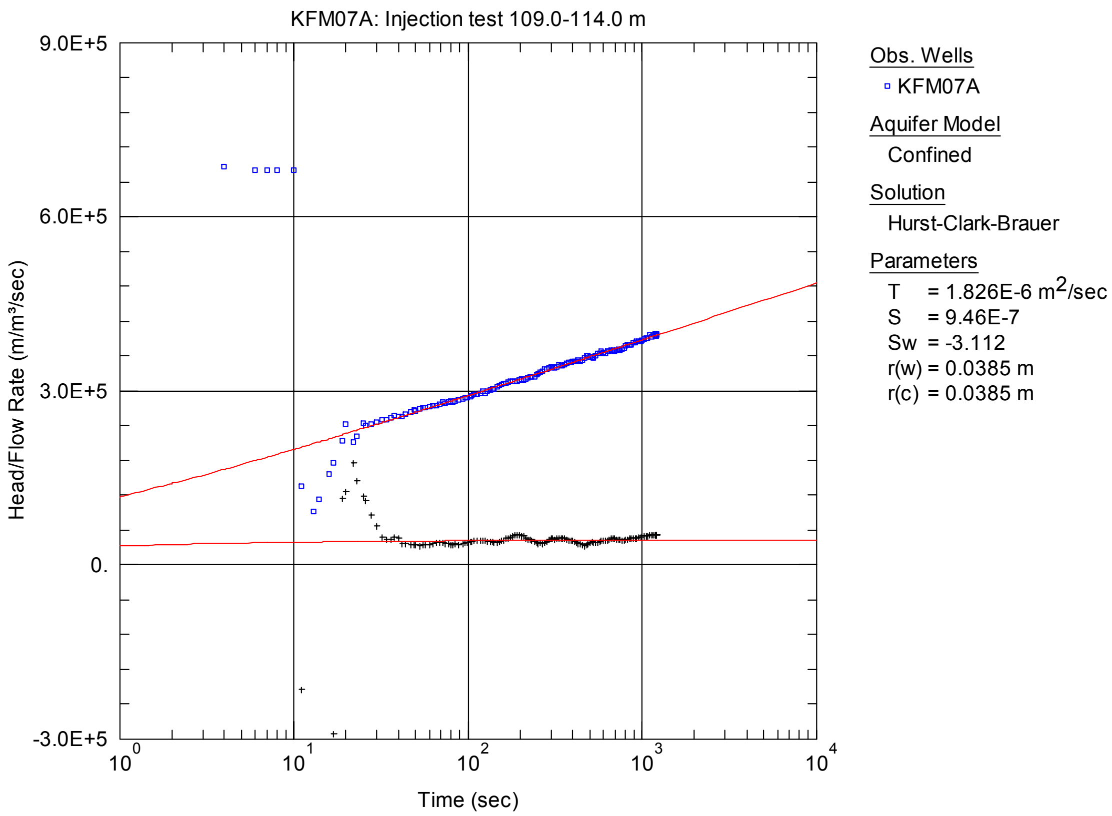


Figure A3-66. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 109.0-114.0 m in KFM07A.*

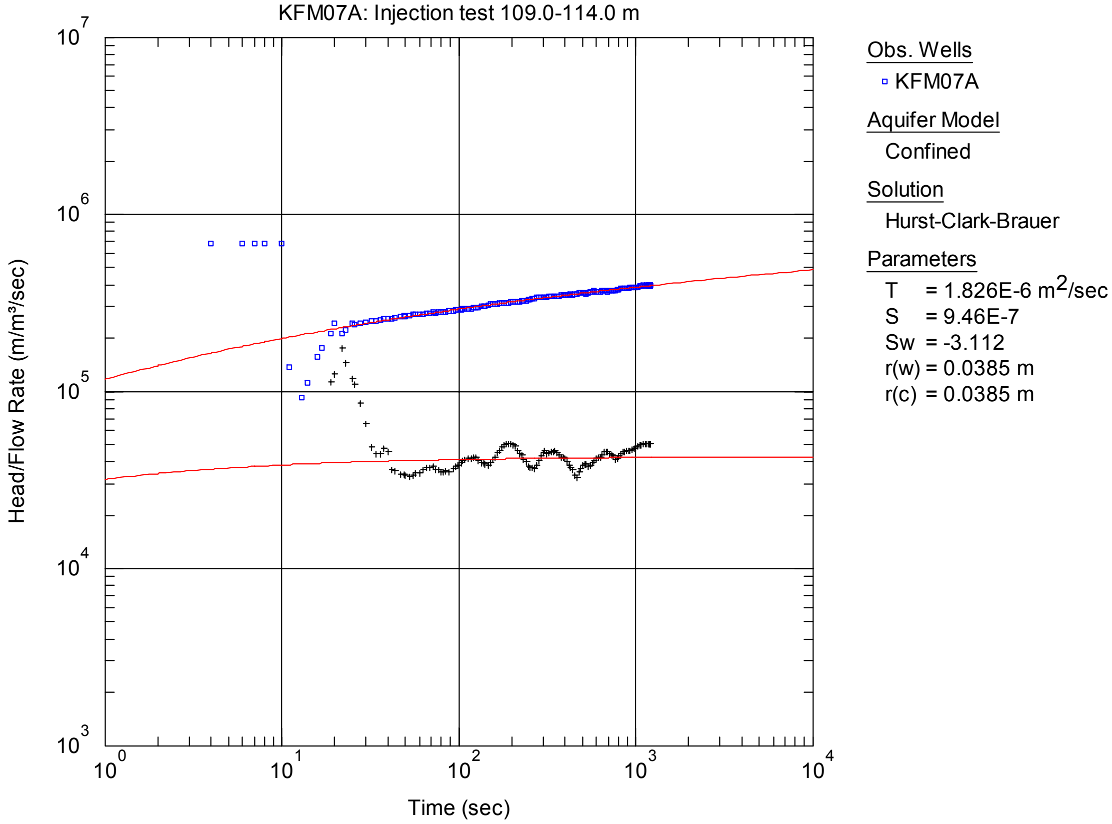


Figure A3-67. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 109.0-114.0 m in KFM07A.*

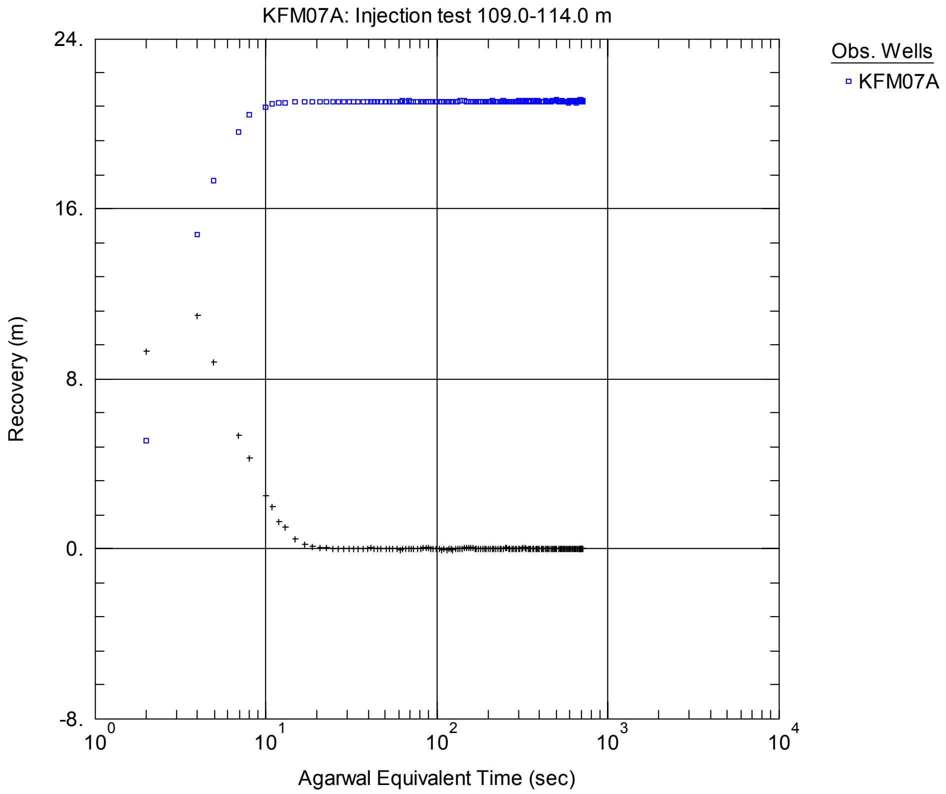


Figure A3-68. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 109.0-114.0 m in KFM07A.*

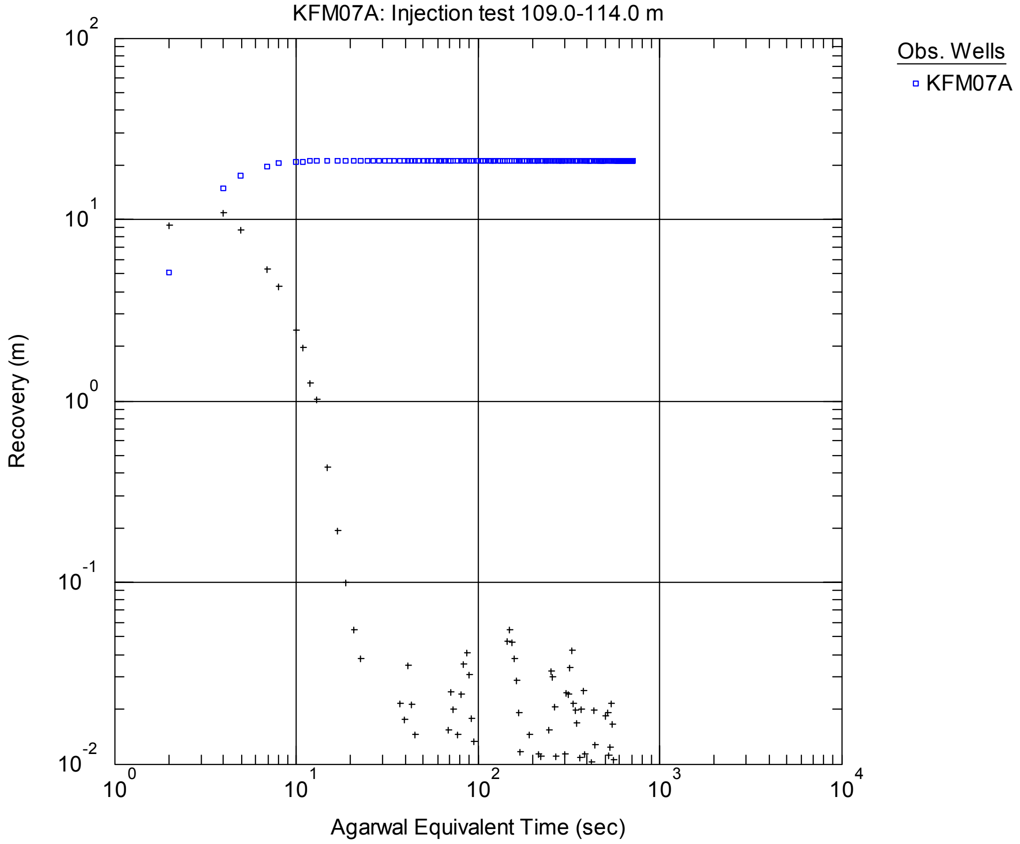


Figure A3-69. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 109.0-114.0 m in KFM07A.*

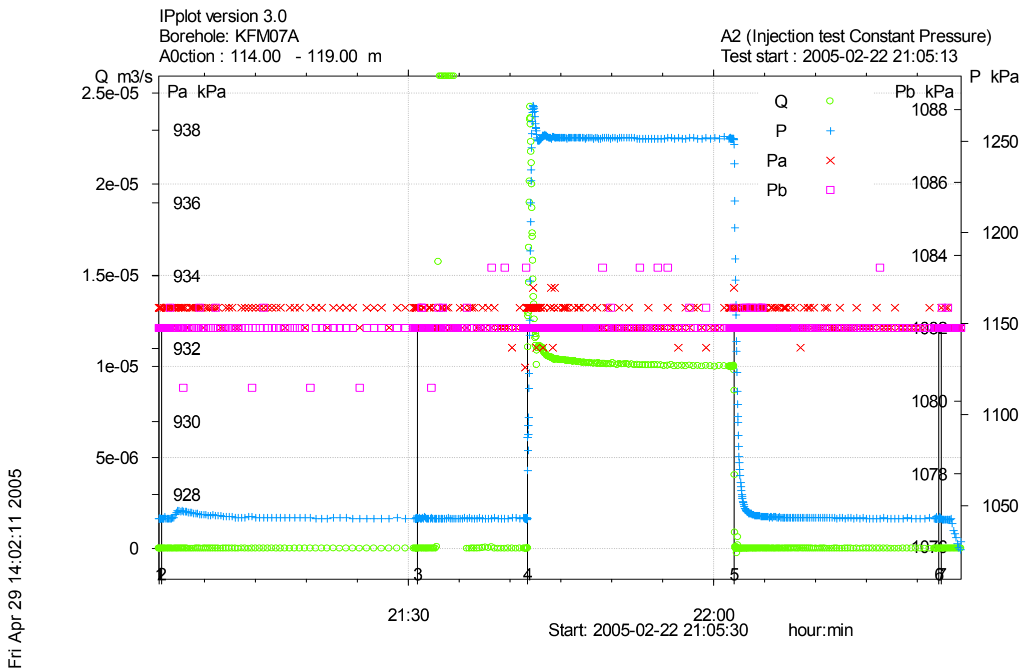


Figure A3-70. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 114.0-119.0 m in borehole KFM07A.*

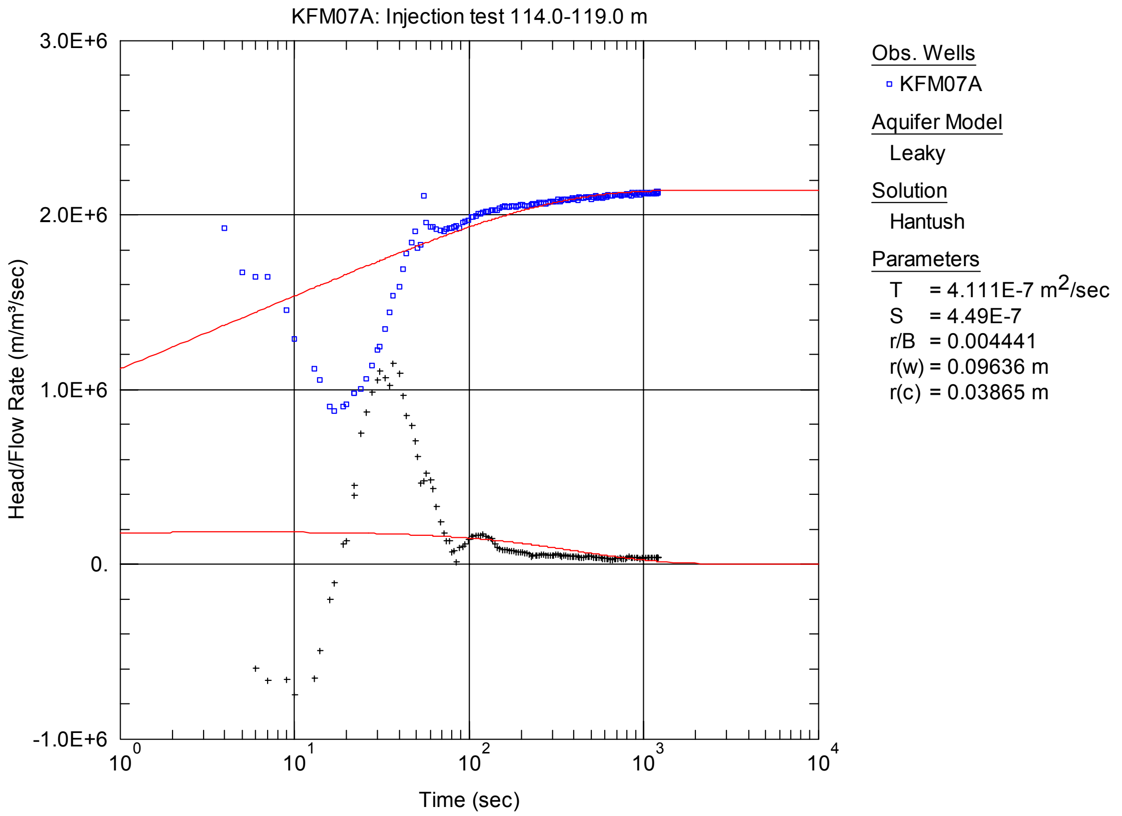


Figure A3-71. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 114.0-119.0 m in KFM07A.*

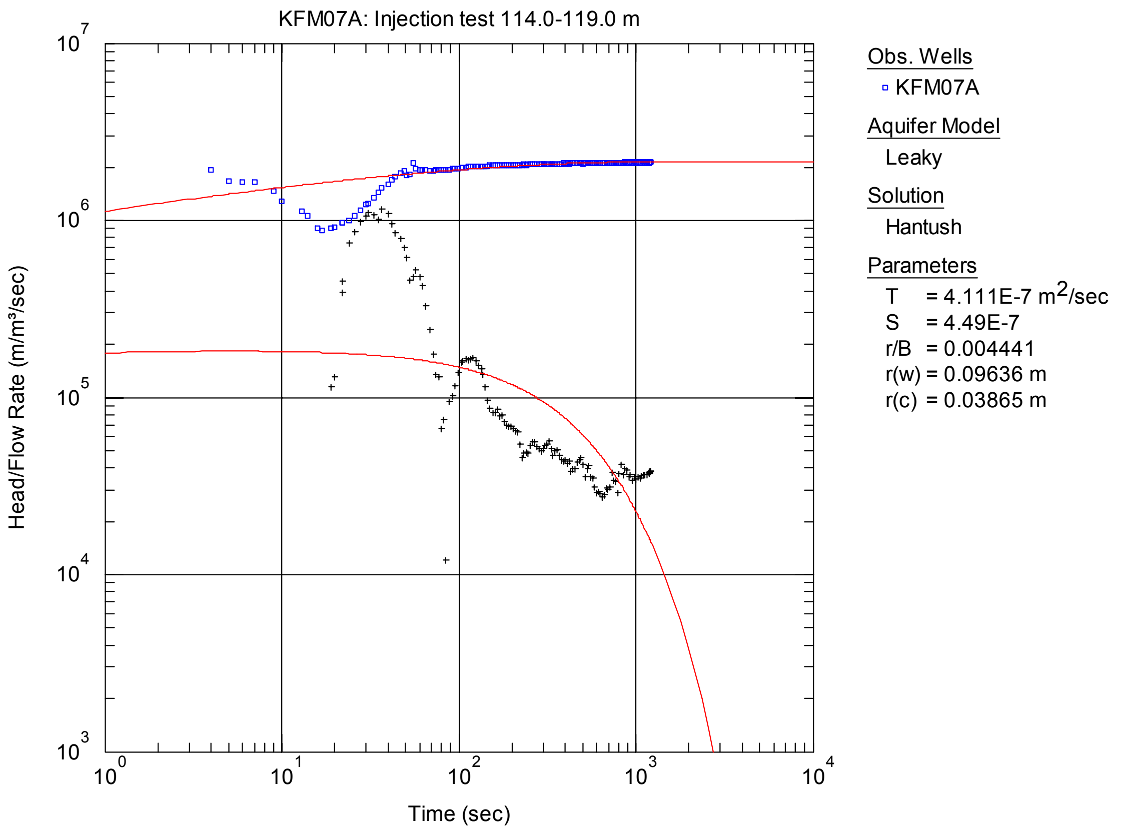


Figure A3-72. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 114.0-119.0 m in KFM07A.*

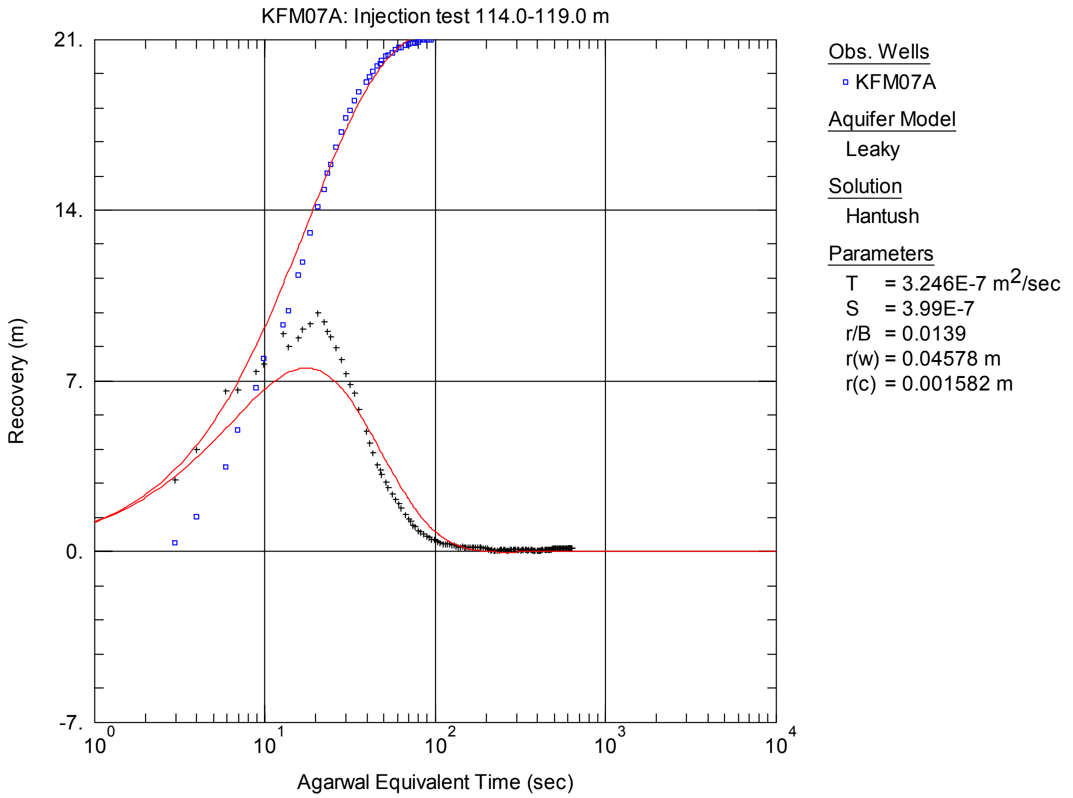


Figure A3-73. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 114.0-119.0 m in KFM07A.*

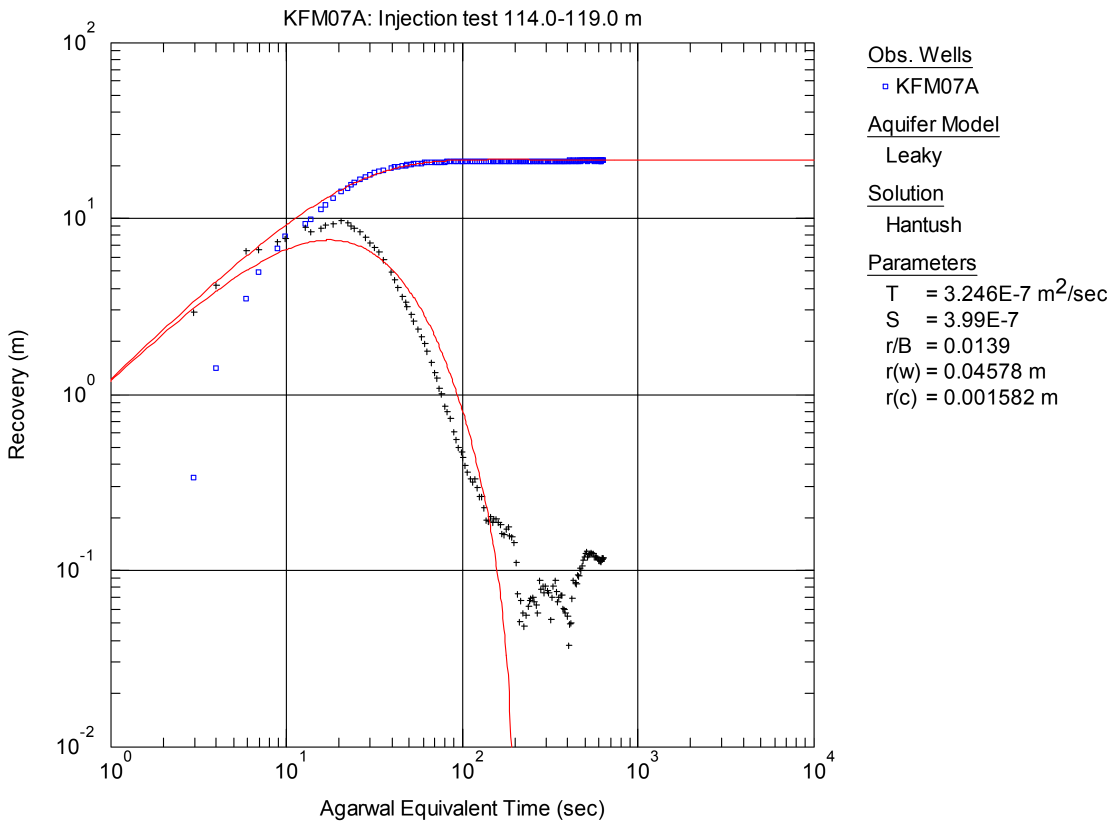


Figure A3-74. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 114.0-119.0 m in KFM07A.*

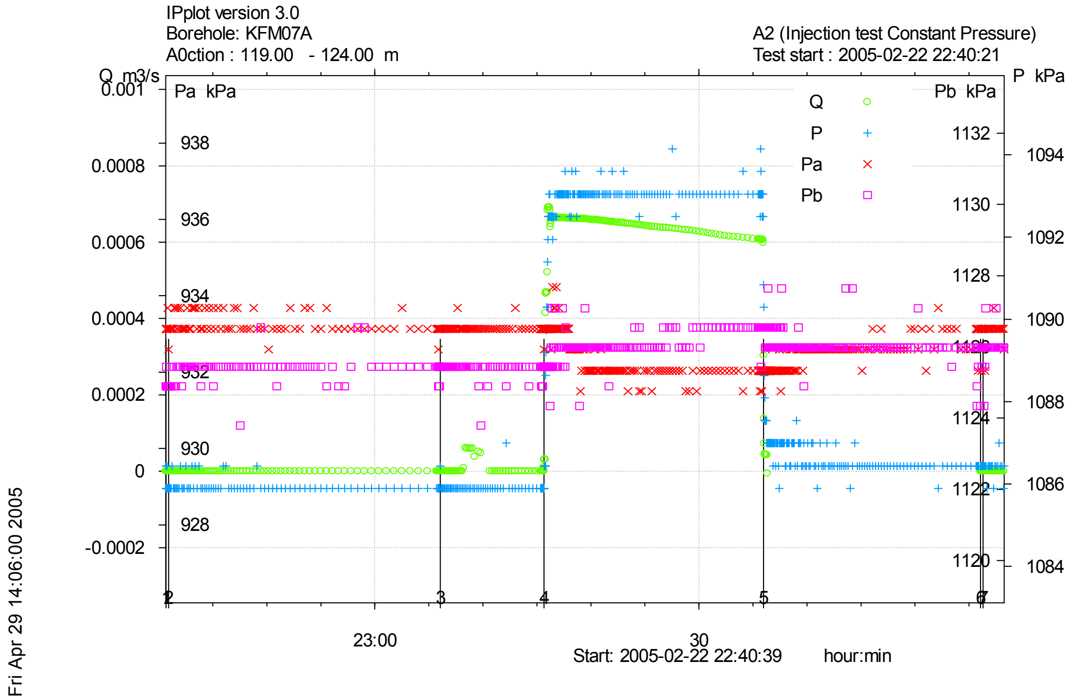


Figure A3-75. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 119.0-124.0 m in borehole KFM07A.*

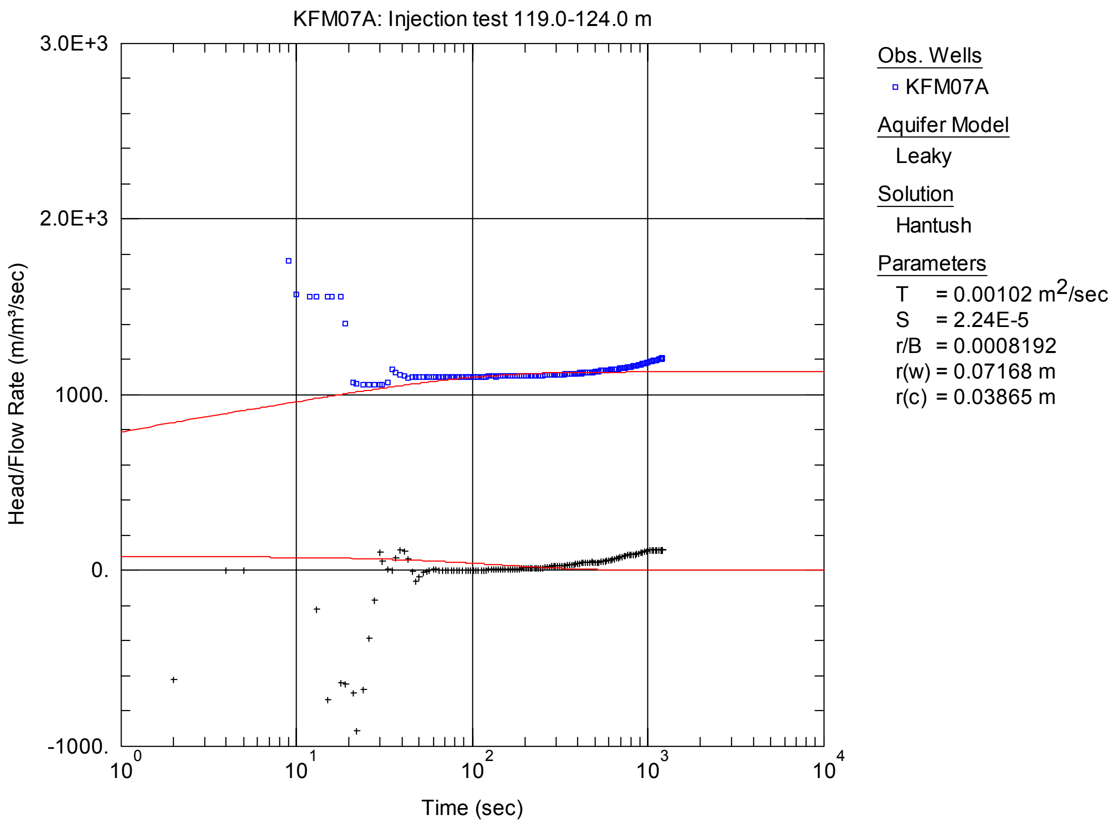


Figure A3-76. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 119.0-124.0 m in KFM07A.*

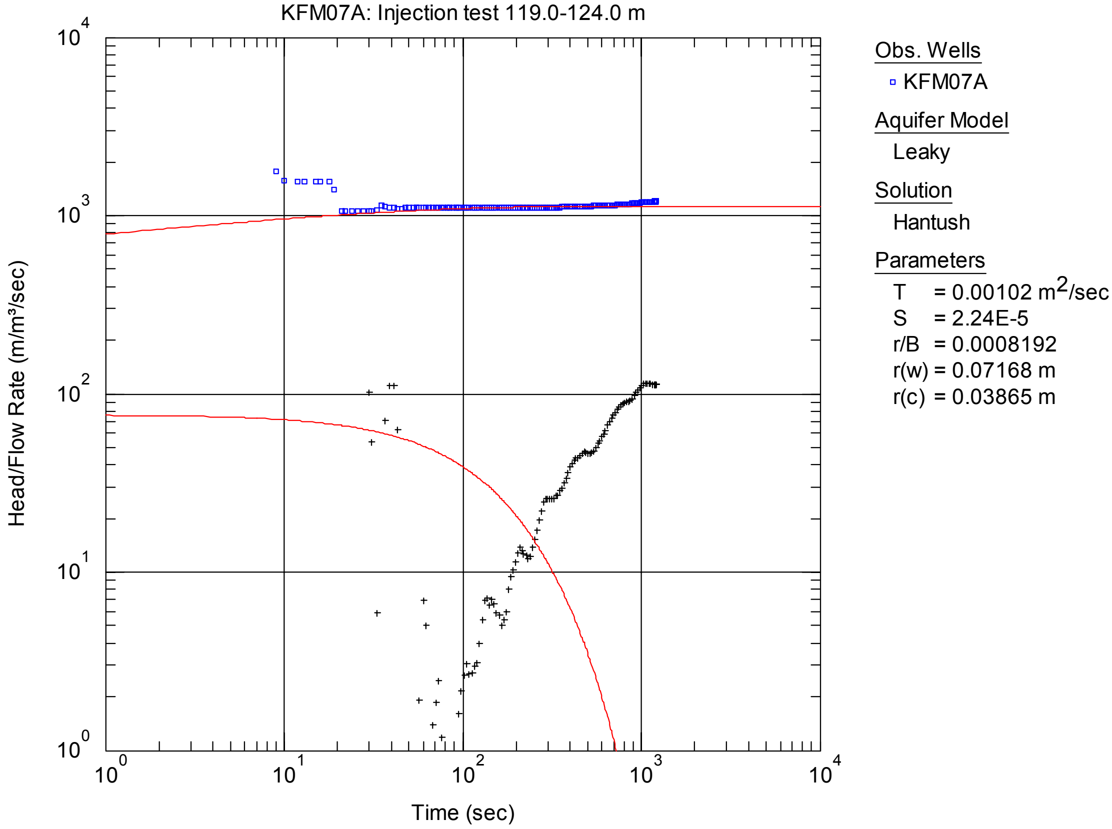


Figure A3-77. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 119.0-124.0 m in KFM07A.*

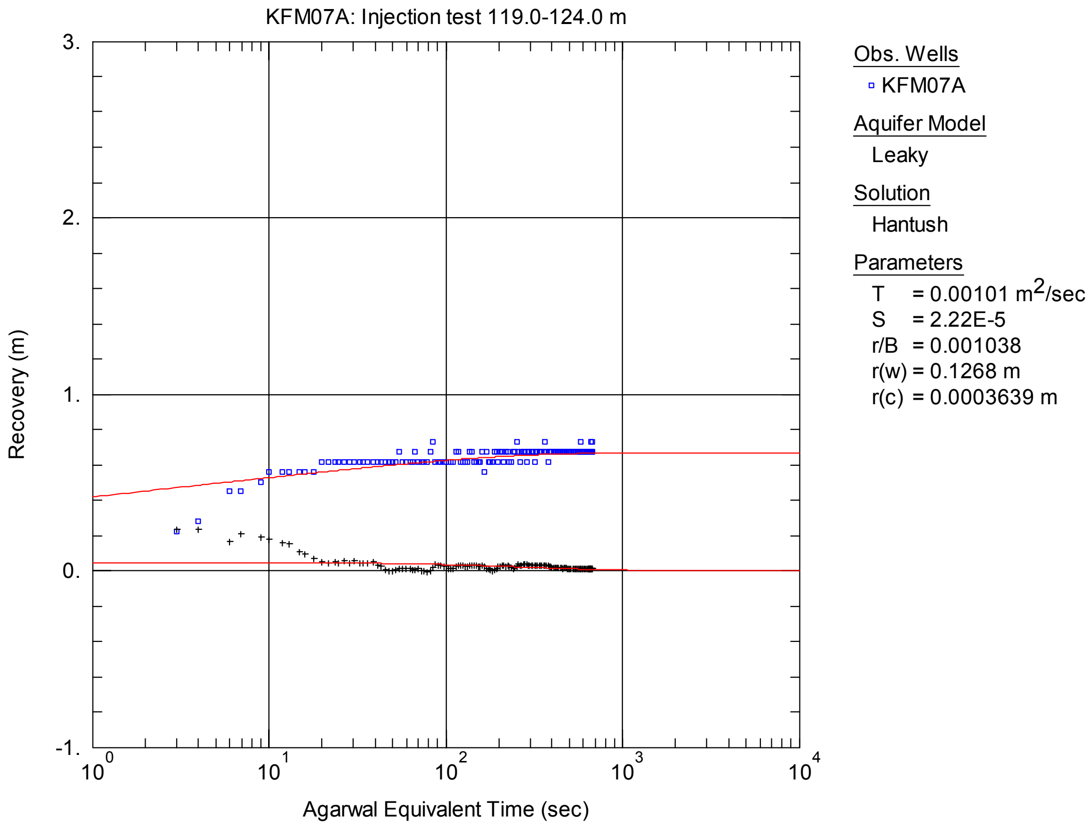


Figure A3-78. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 119.0-124.0 m in KFM07A.*

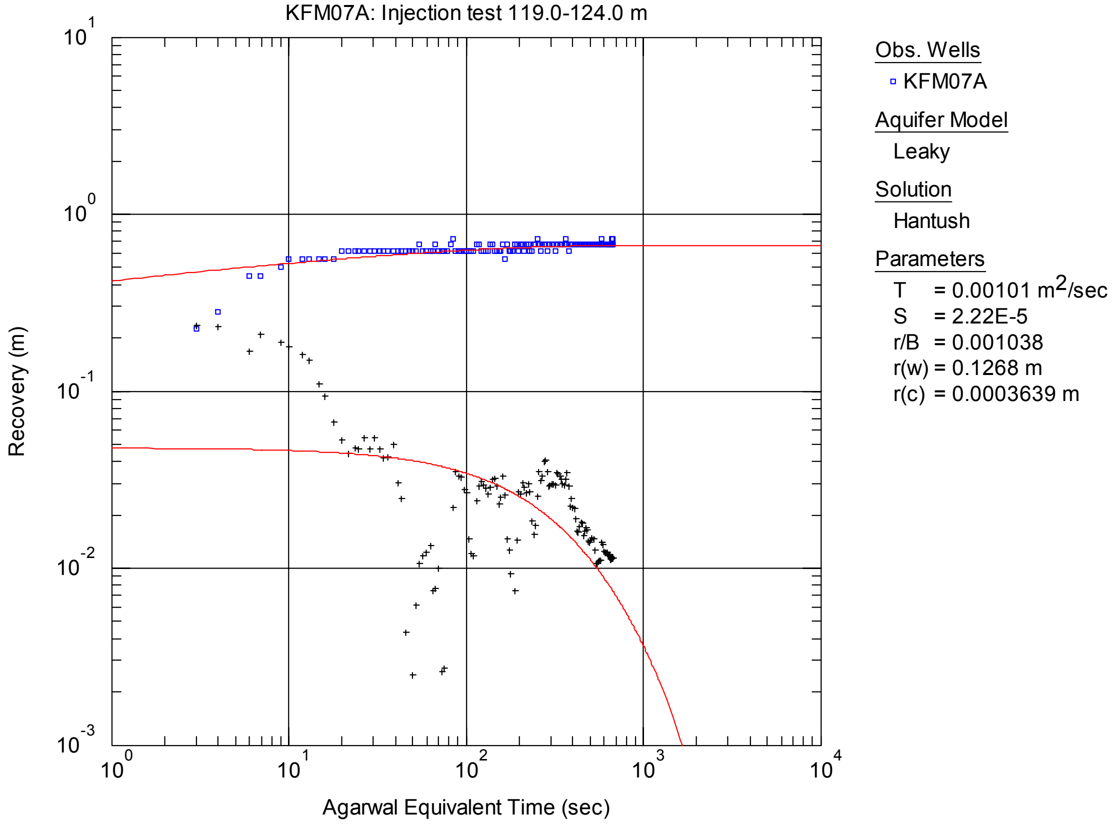


Figure A3-79. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 119.0-124.0 m in KFM07A.*

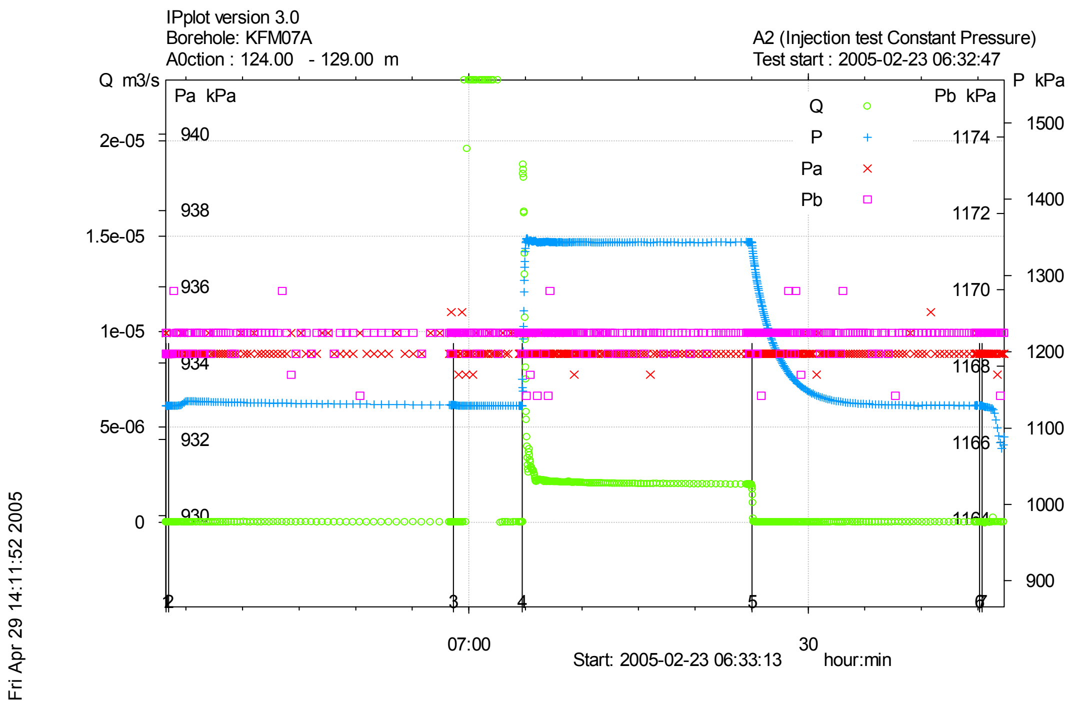


Figure A3-80. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 124.0-129.0 m in borehole KFM07A.*

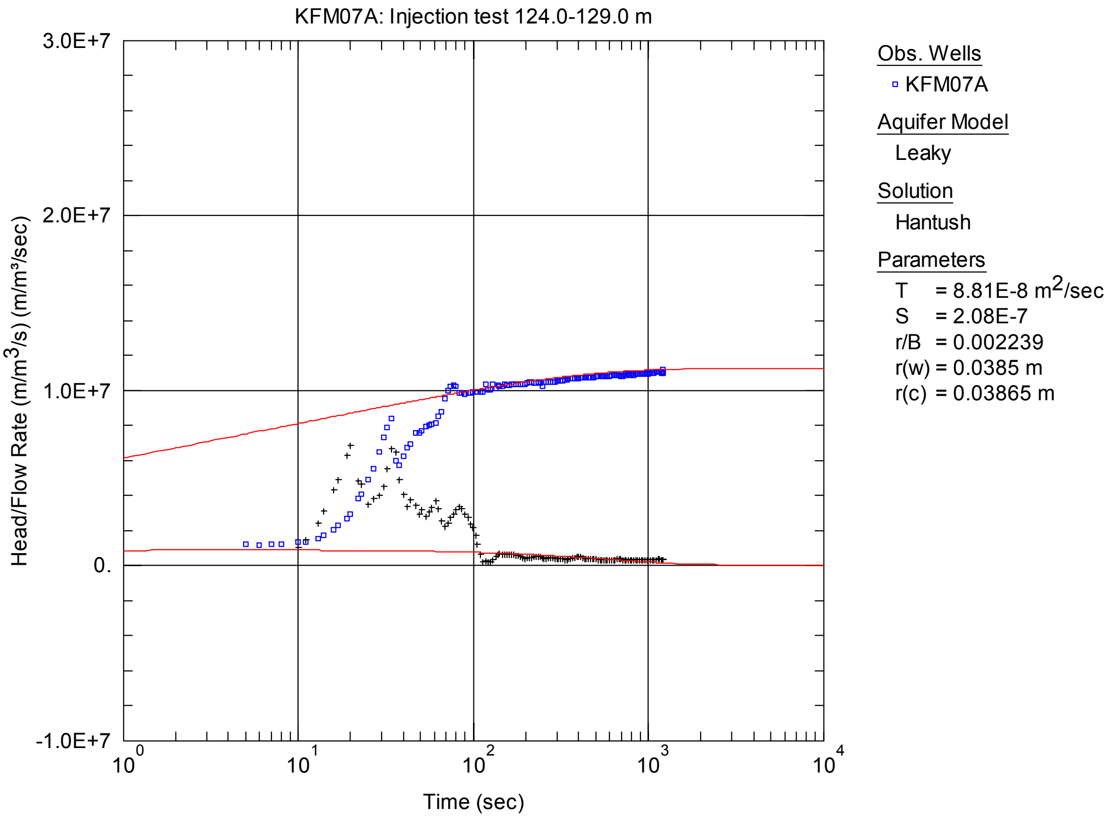


Figure A3-81. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 124.0-129.0 m in KFM07A.*

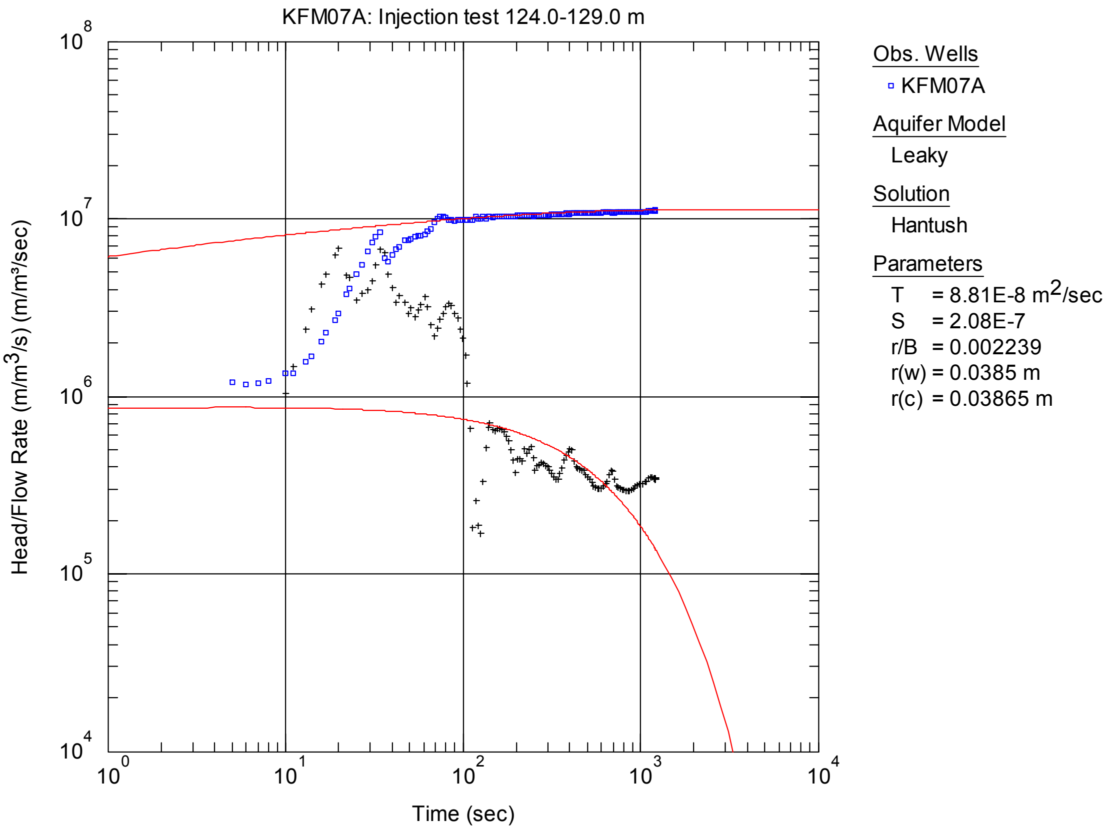


Figure A3-82. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 124.0-129.0 m in KFM07A.*

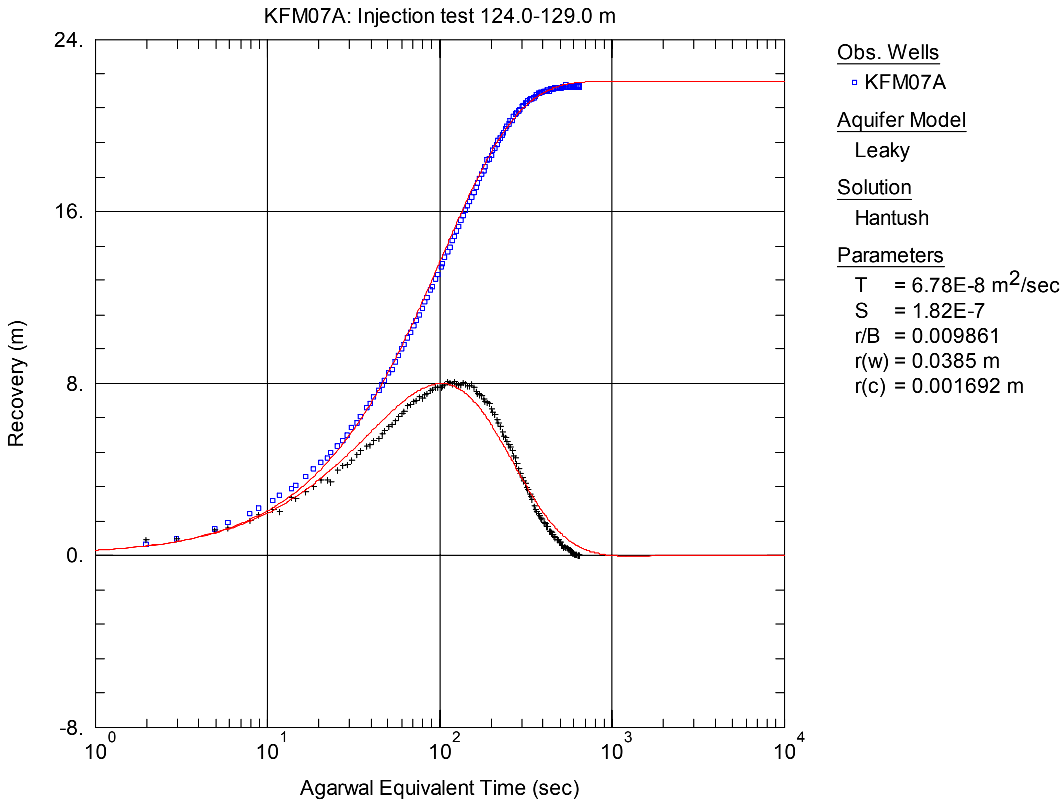


Figure A3-83. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 124.0-129.0 m in KFM07A.*

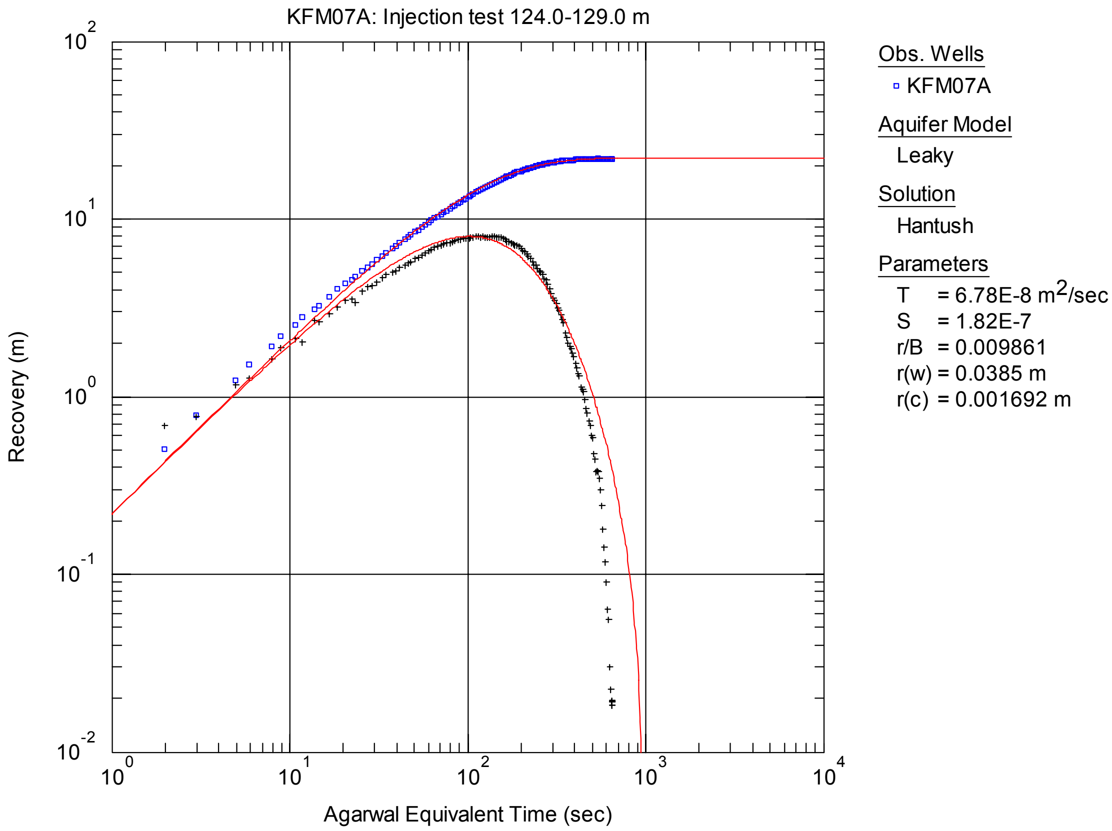


Figure A3-84. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 124.0-129.0 m in KFM07A.*

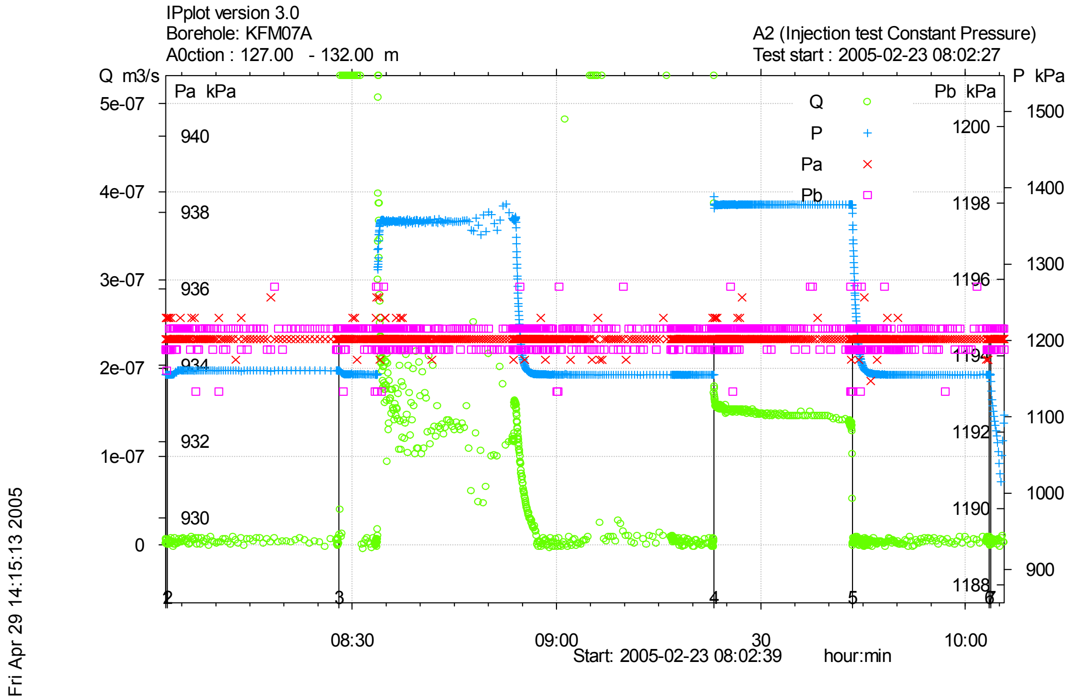


Figure A3-85. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 127.0-132.0 m in borehole KFM07A.*

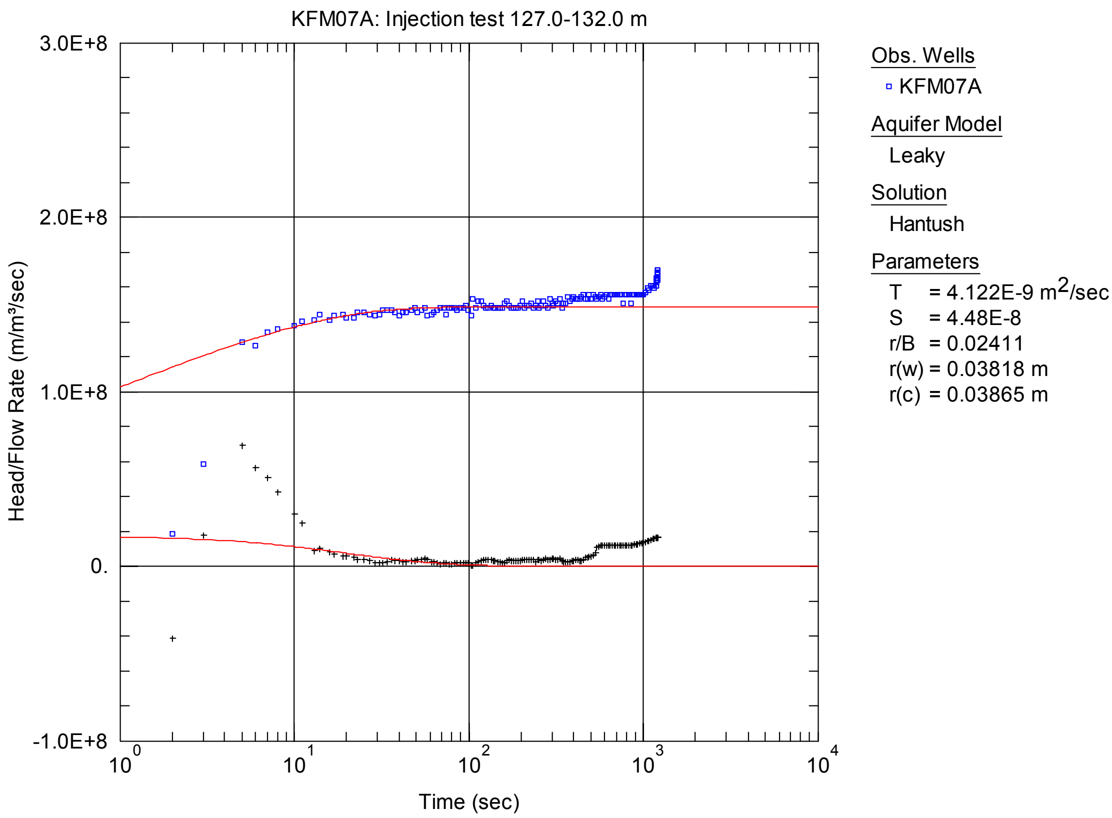


Figure A3-86. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 127.0-132.0 m in KFM07A.*

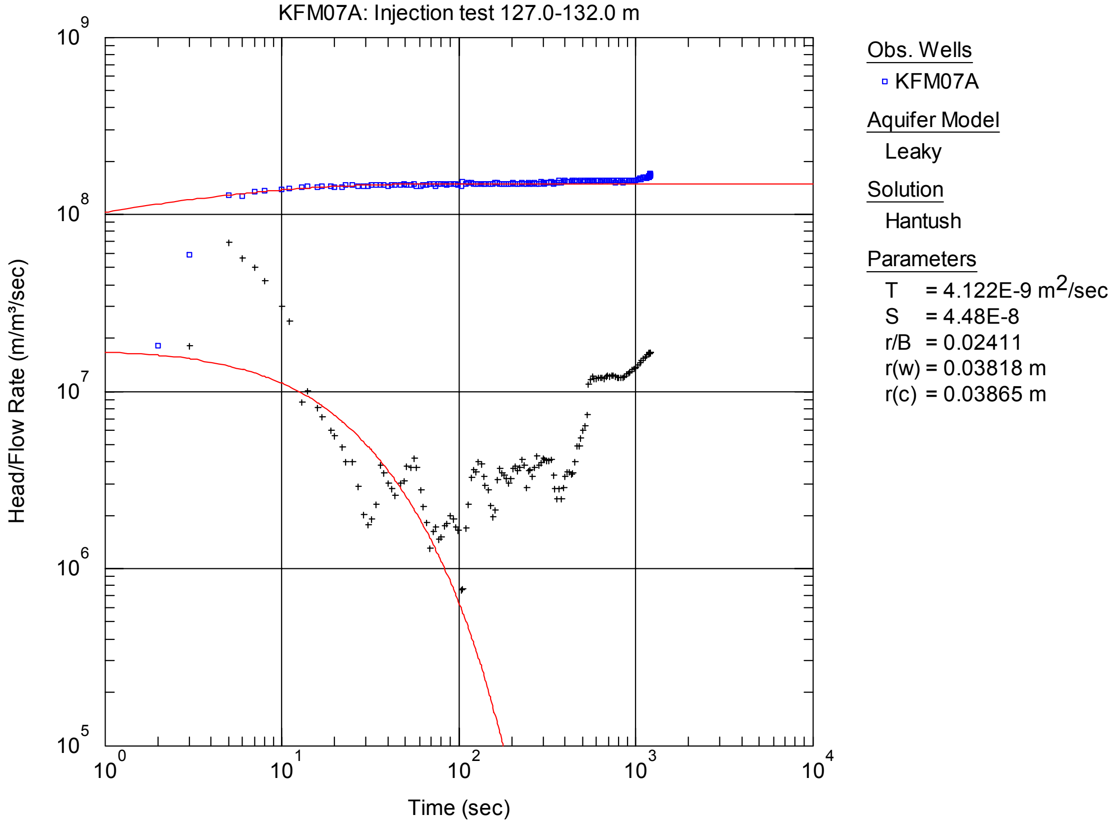


Figure A3-87. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 127.0-132.0 m in KFM07A.*

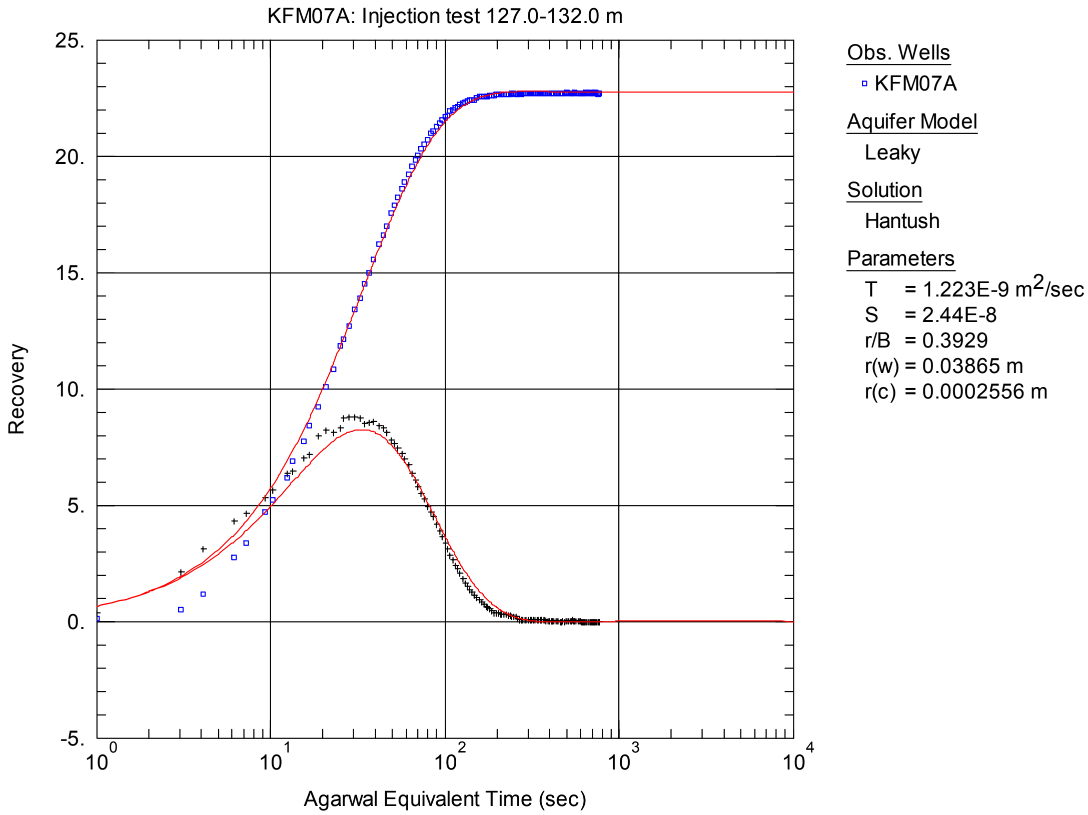


Figure A3-88. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 127.0-132.0 m in KFM07A.*

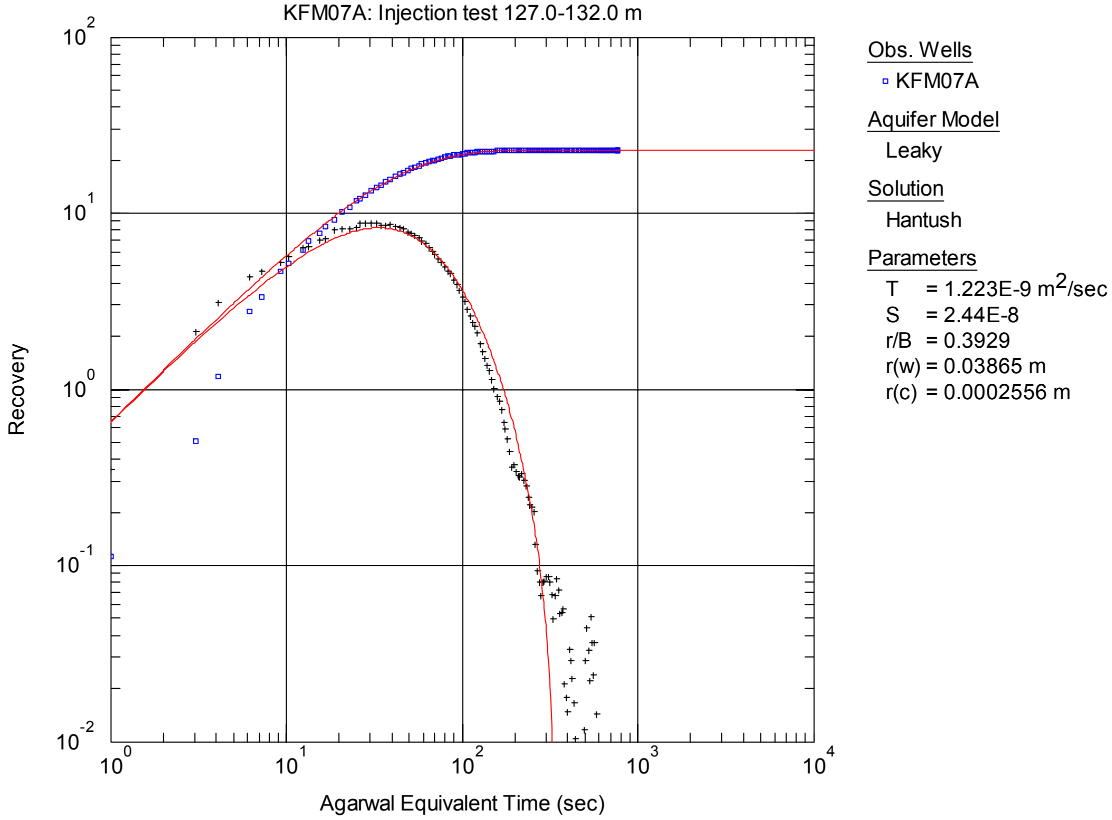


Figure A3-89. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 127.0-132.0 m in KFM07A.*

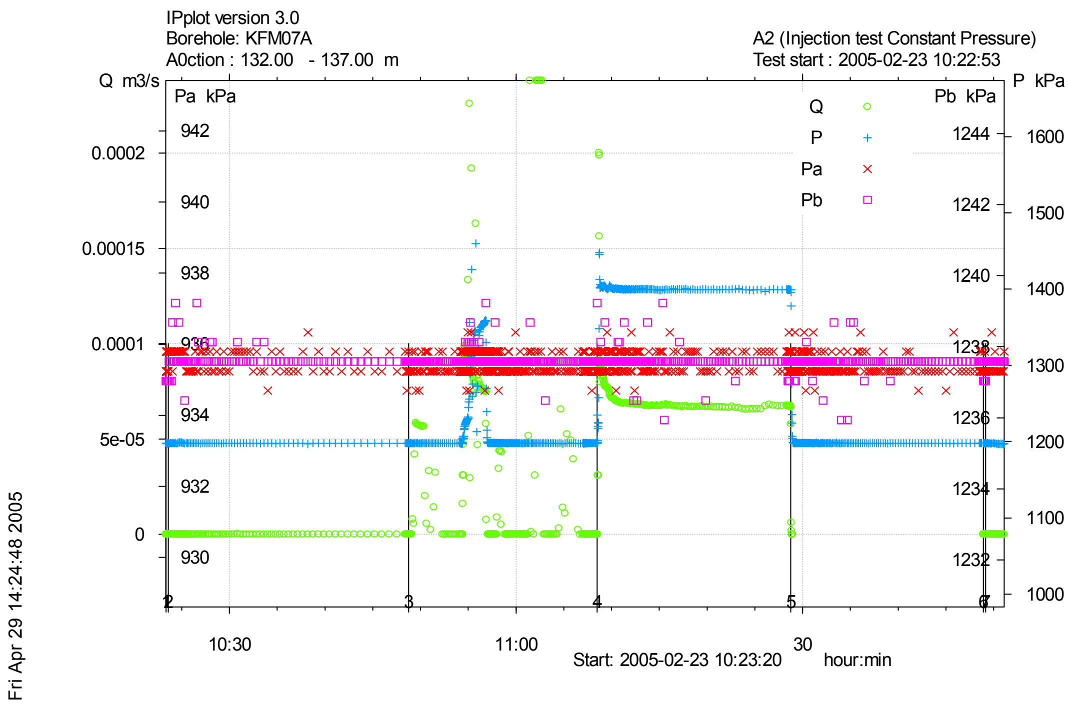


Figure A3-90. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 132.0-137.0 m in borehole KFM07A.*

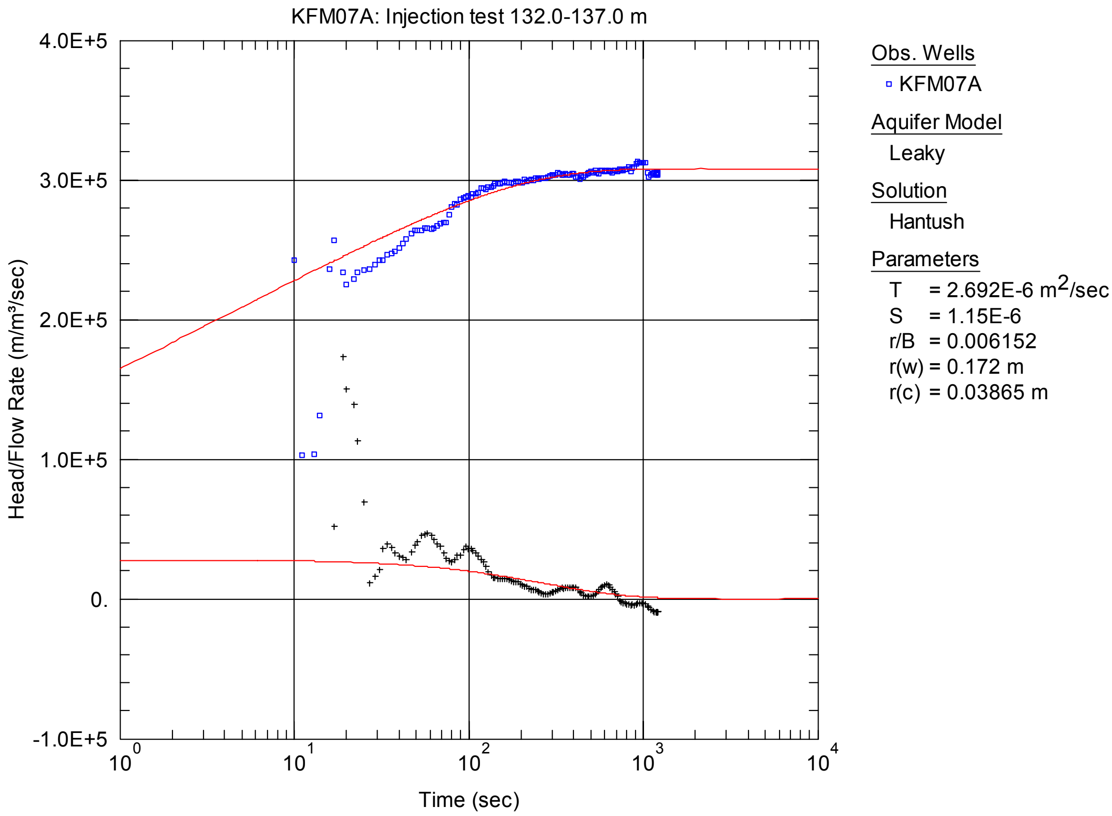


Figure A3-91. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 132.0-137.0 m in KFM07A.*

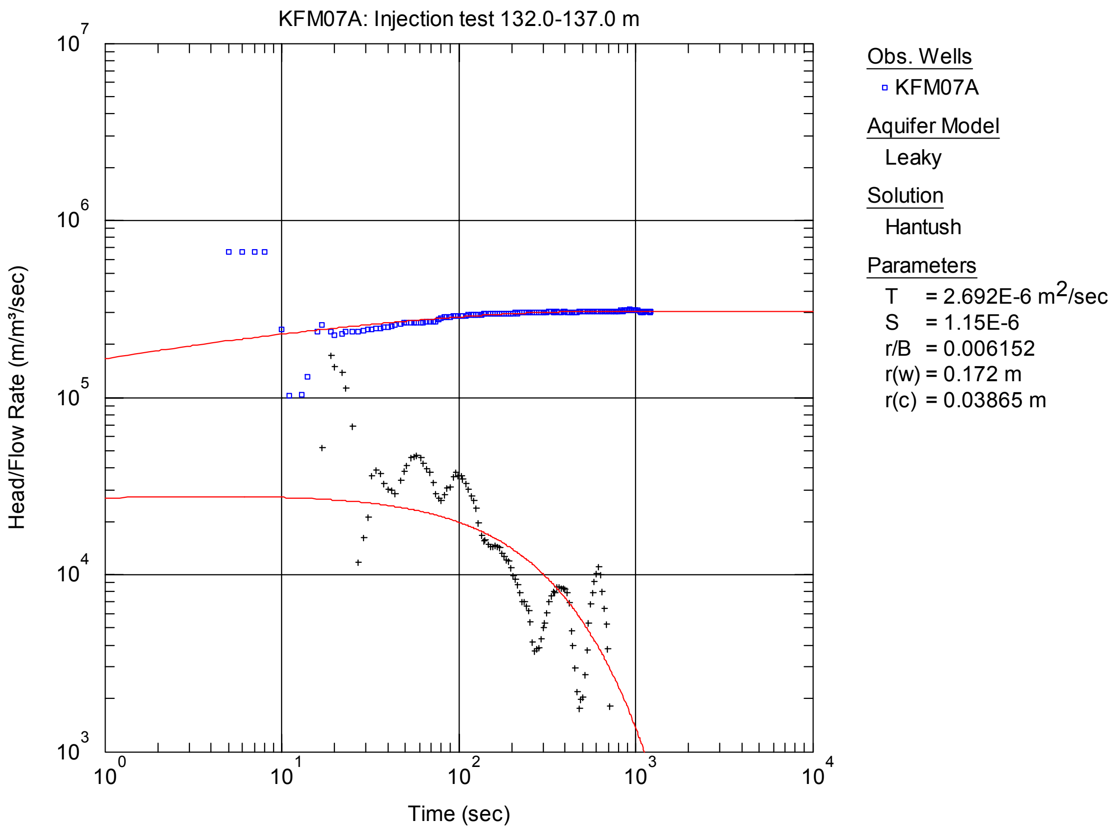


Figure A3-92. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 132.0-137.0 m in KFM07A.*

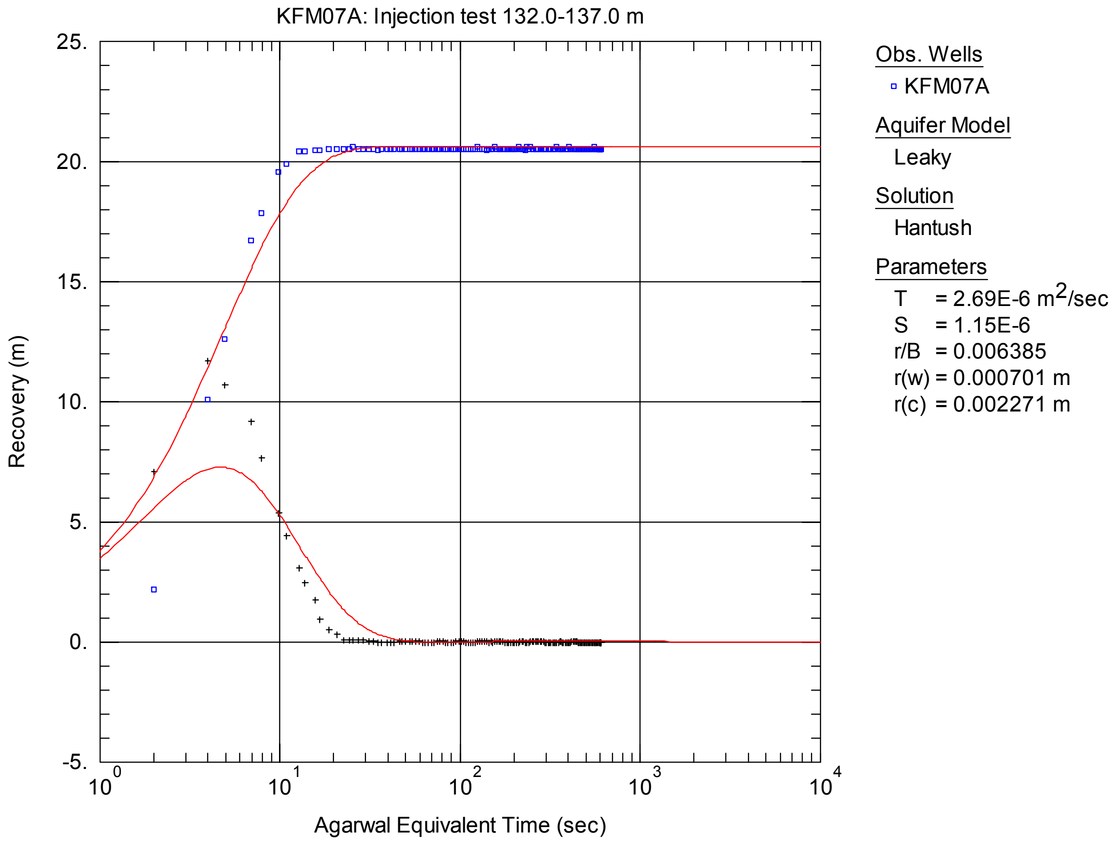


***Figure A3-93.** Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 132.0-137.0 m in KFM07A.*

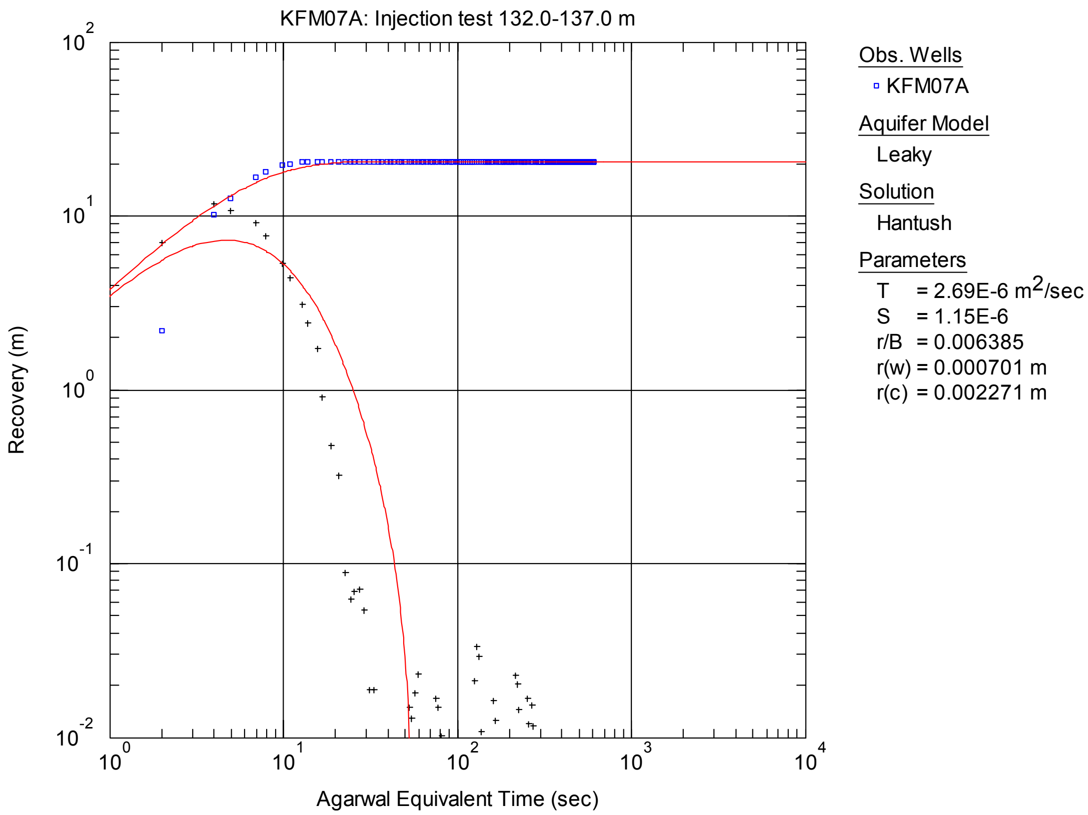


***Figure A3-94.** Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 132.0-137.0 m in KFM07A.*

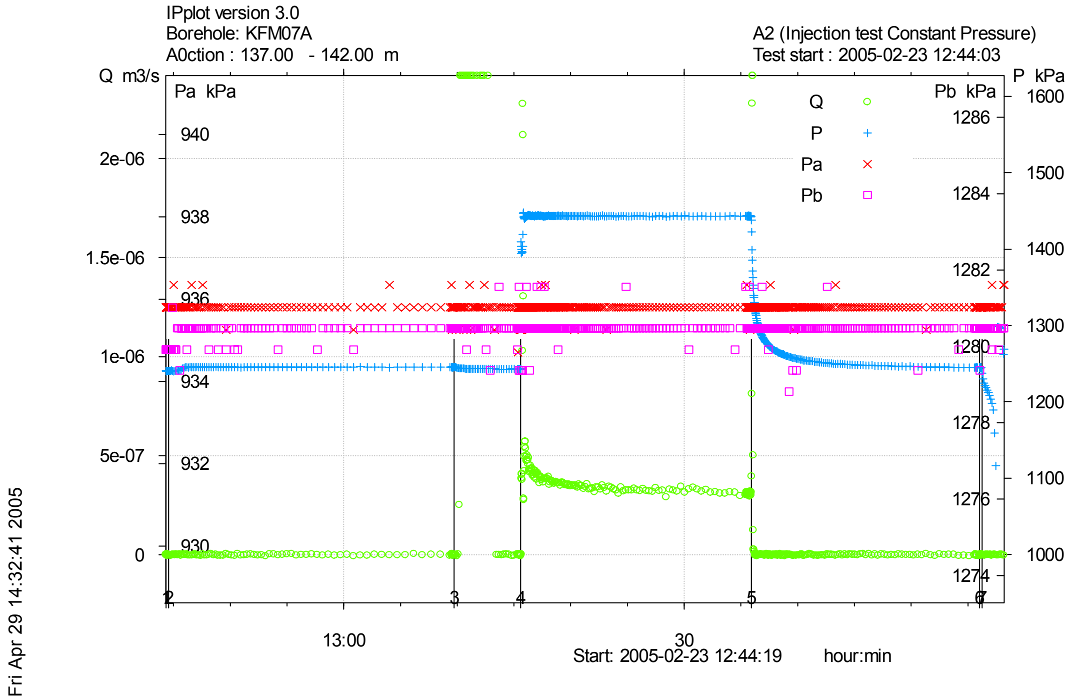


Figure A3-95. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 137.0-142.0 m in borehole KFM07A.*

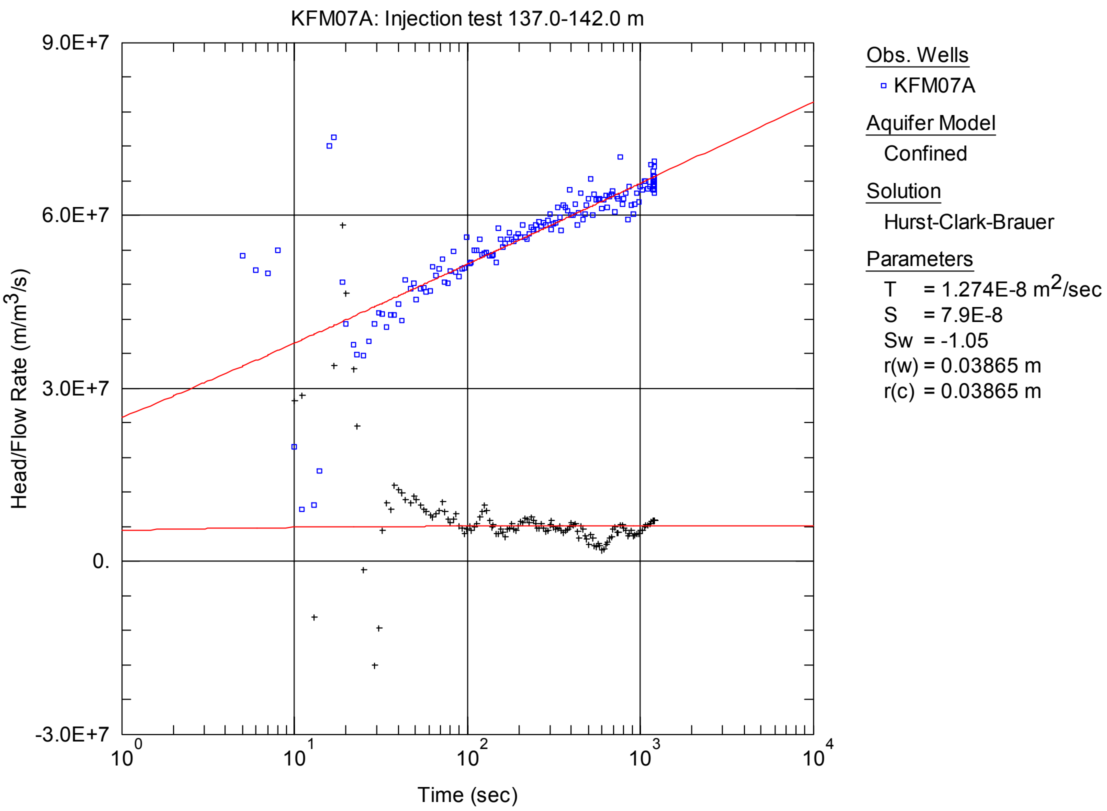


Figure A3-96. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 137.0-142.0 m in KFM07A.*

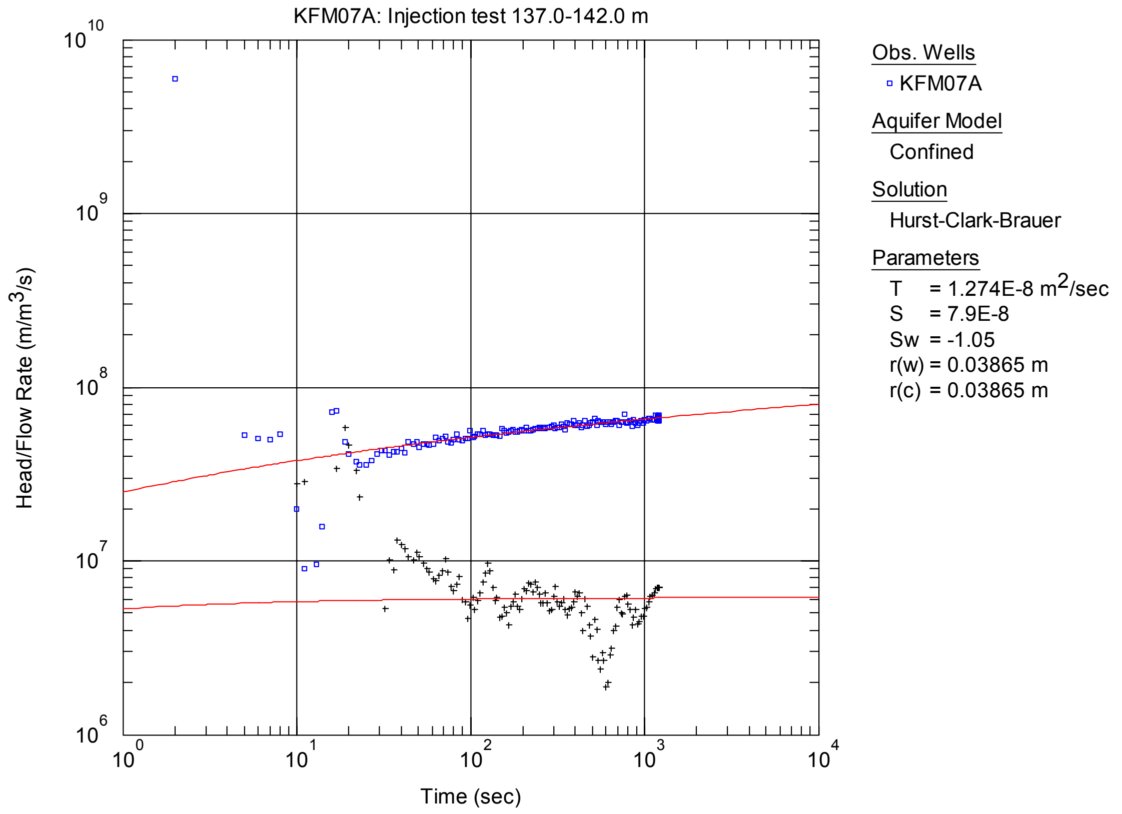


Figure A3-97. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 137.0-142.0 m in KFM07A.*

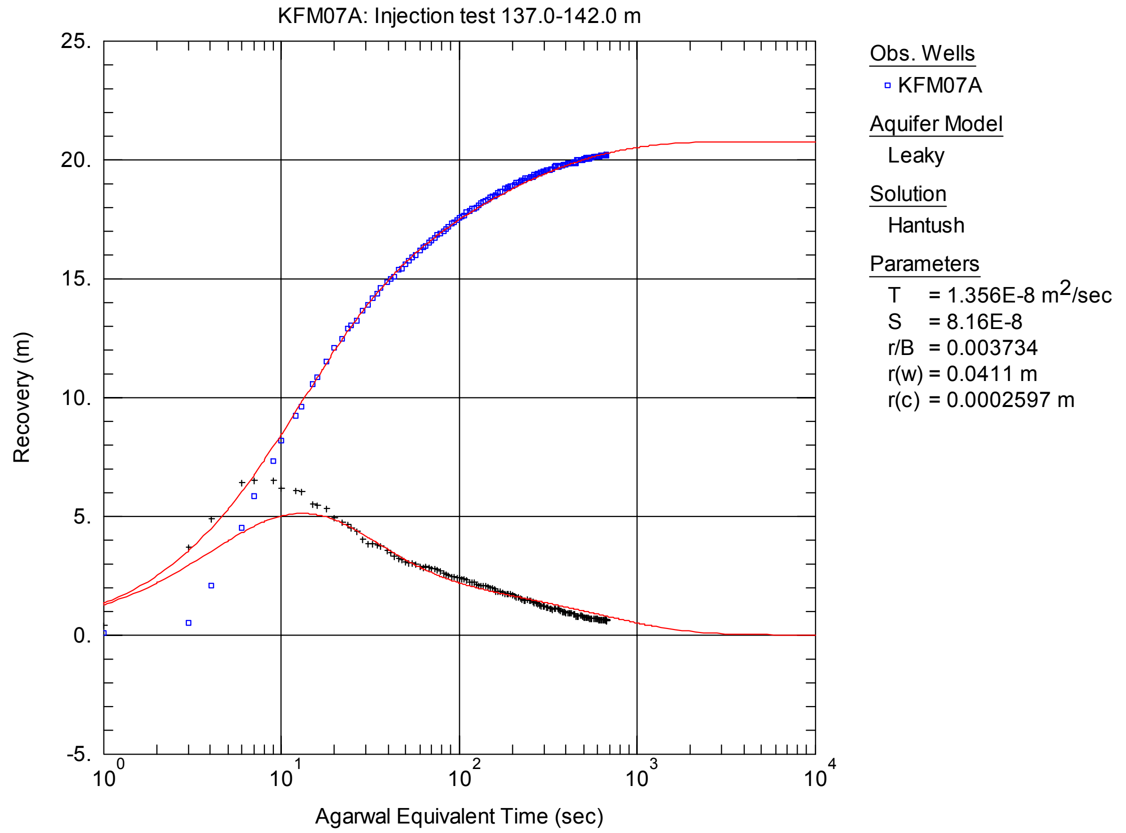


Figure A3-98. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 137.0-142.0 m in KFM07A.*

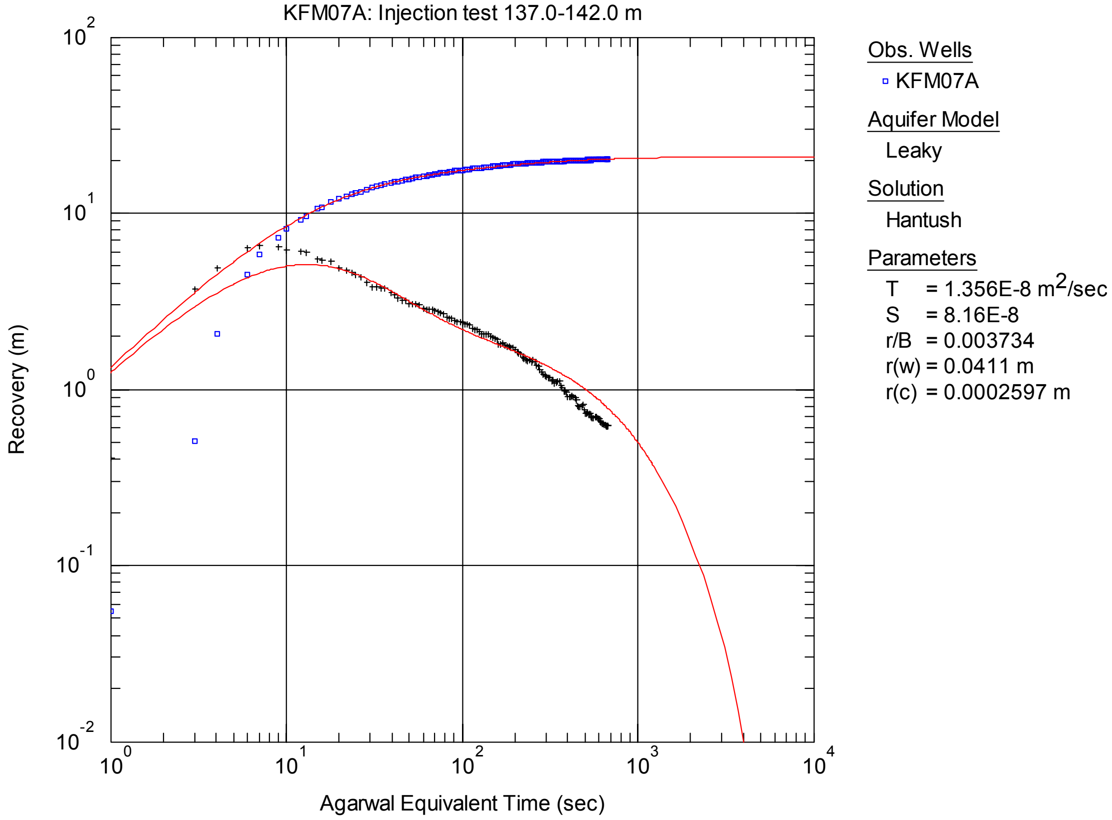


Figure A3-99. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 137.0-142.0 m in KFM07A.*

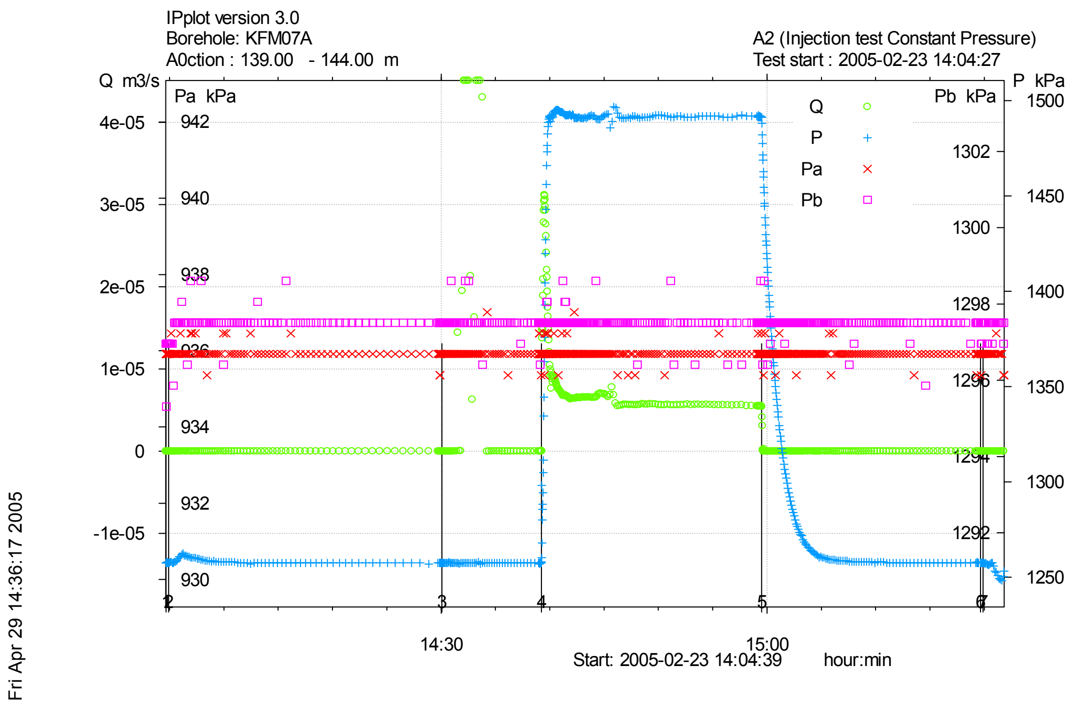


Figure A3-100. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 139.0-144.0 m in borehole KFM07A.*

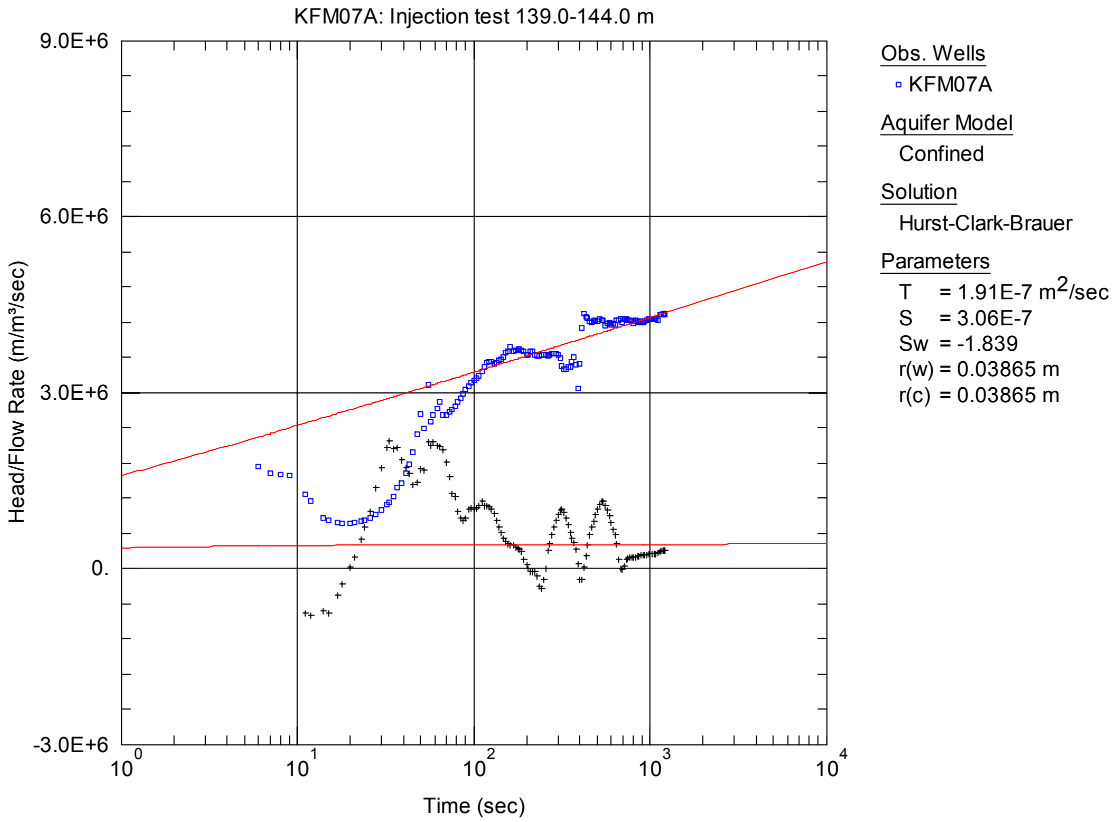


***Figure A3-101.** Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 139.0-144.0 m in KFM07A.*

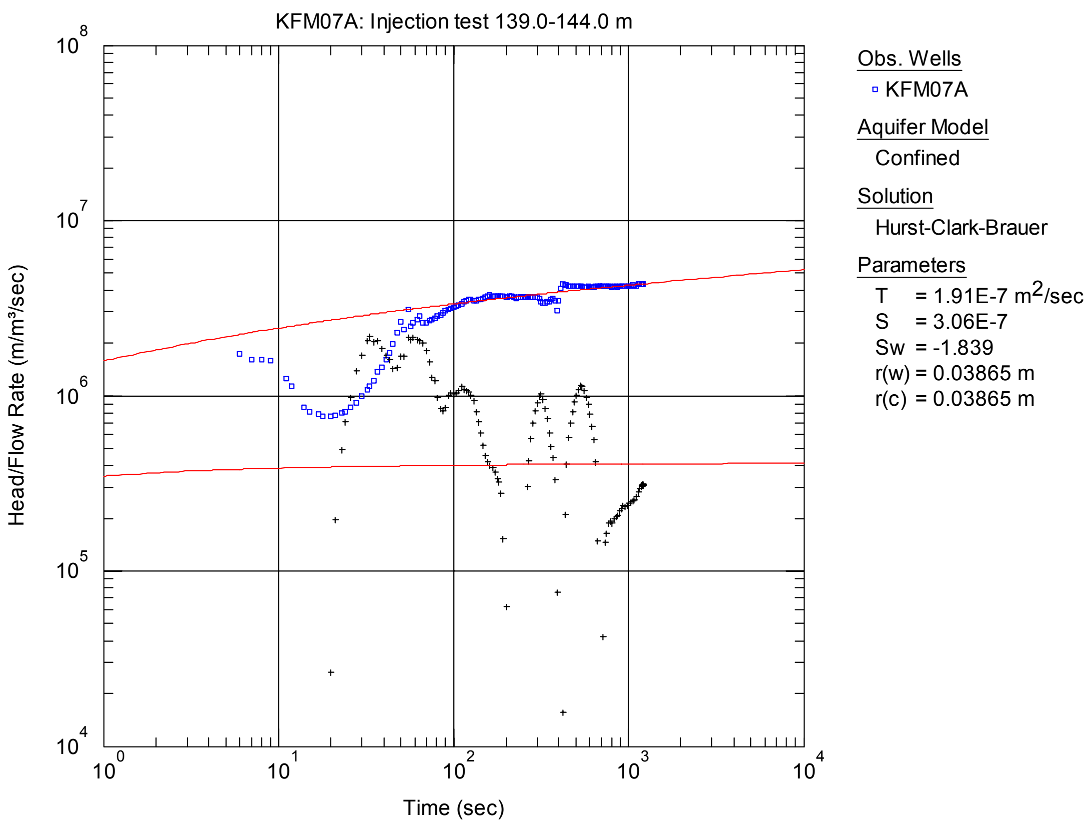


***Figure A3-102.** Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 139.0-144.0 m in KFM07A.*

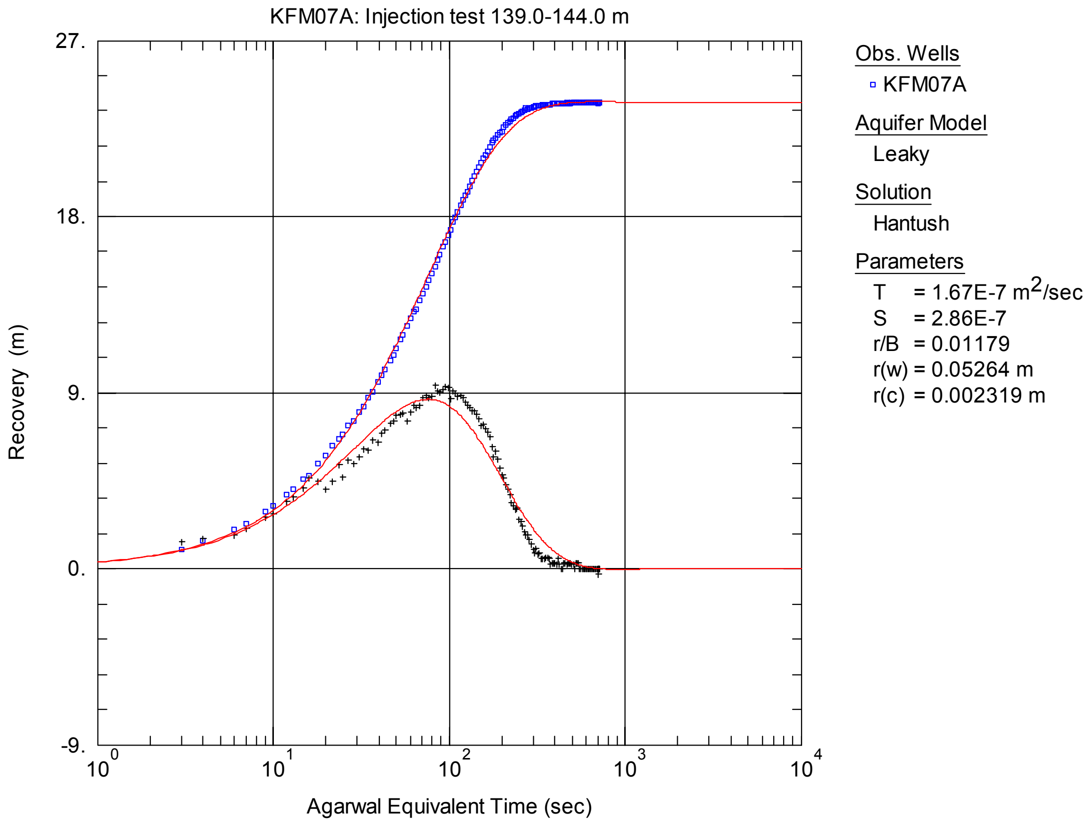


Figure A3-103. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 139.0-144.0 m in KFM07A.*

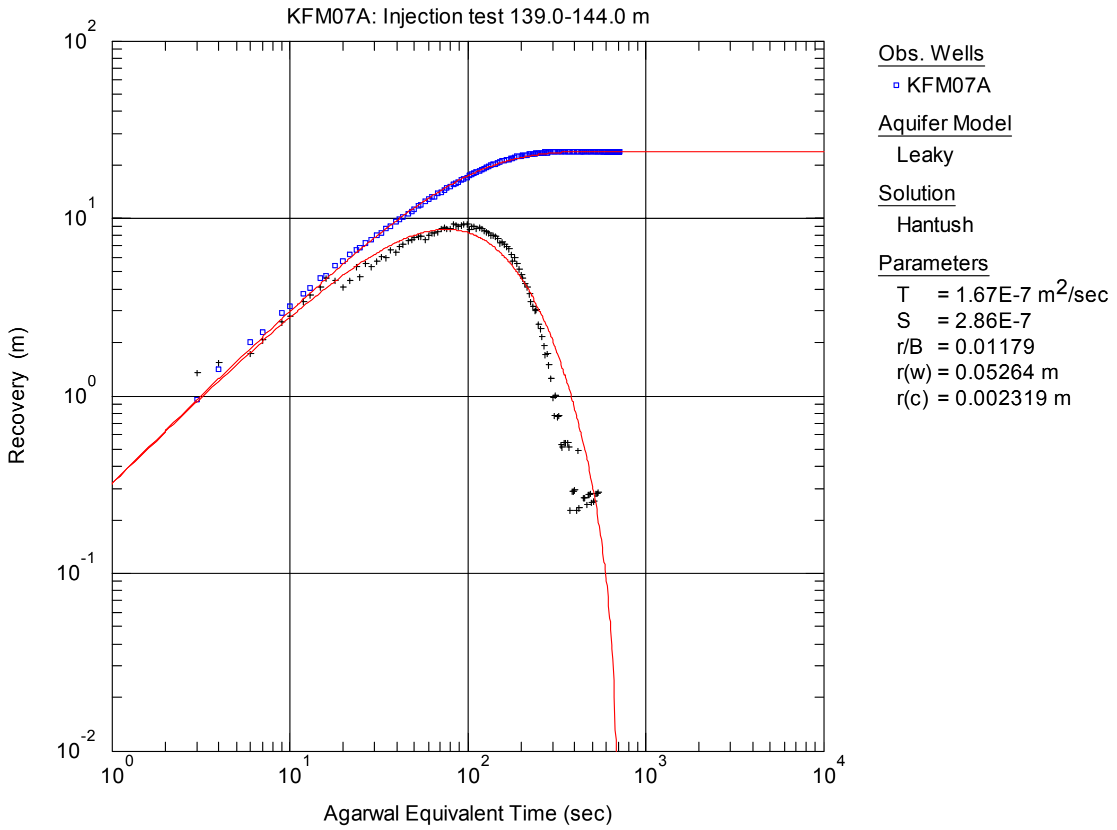


Figure A3-104. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 139.0-144.0 m in KFM07A.*

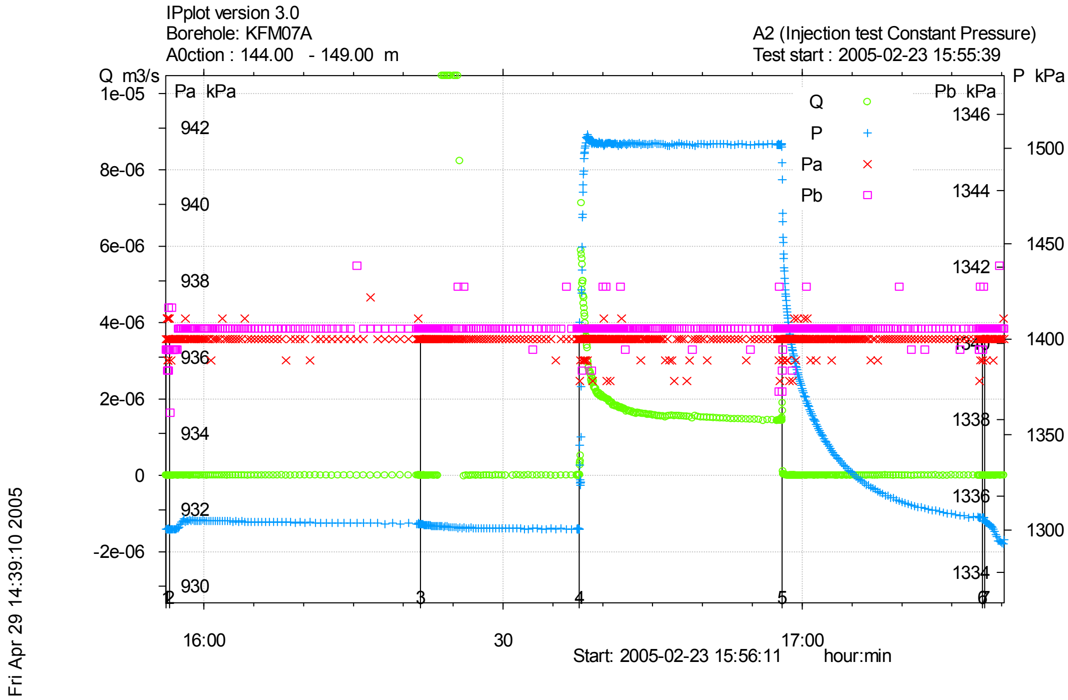


Figure A3-105. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 144.0-149.0 m in borehole KFM07A.*

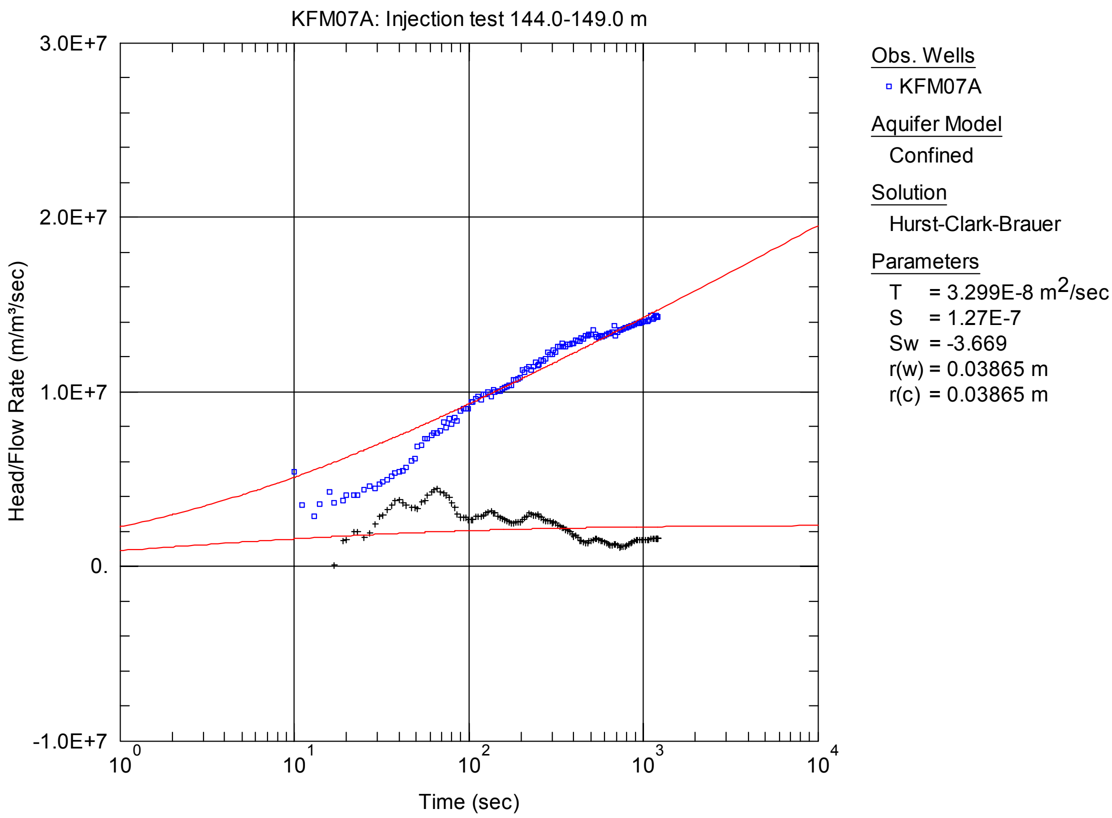


Figure A3-106. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 144.0-149.0 m in KFM07A.*

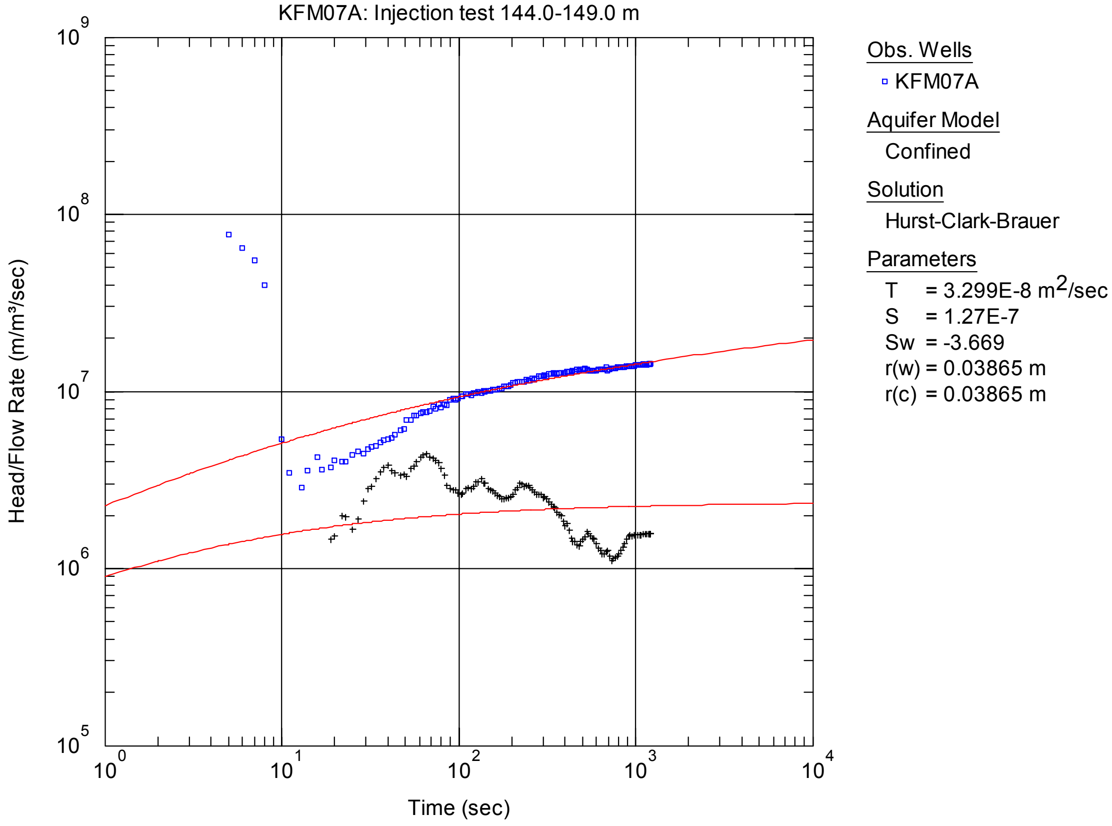


Figure A3-107. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 144.0-149.0 m in KFM07A.*

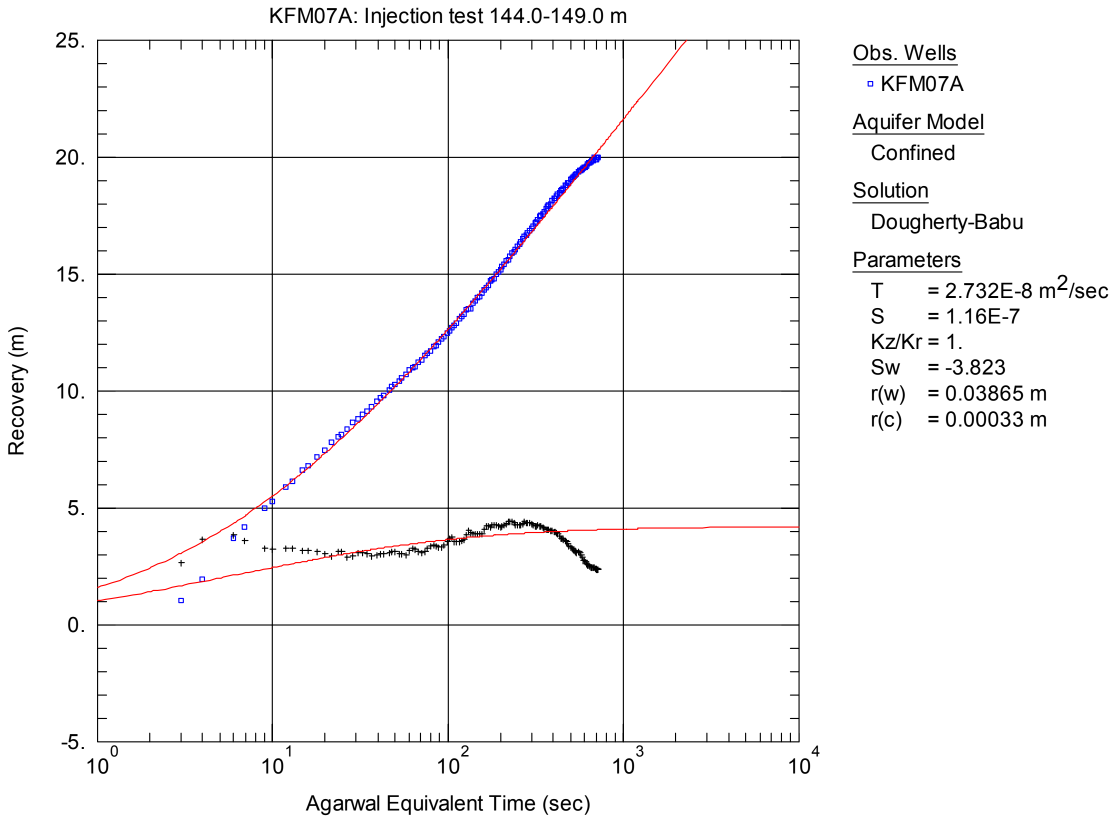


Figure A3-108. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 144.0-149.0 m in KFM07A.*

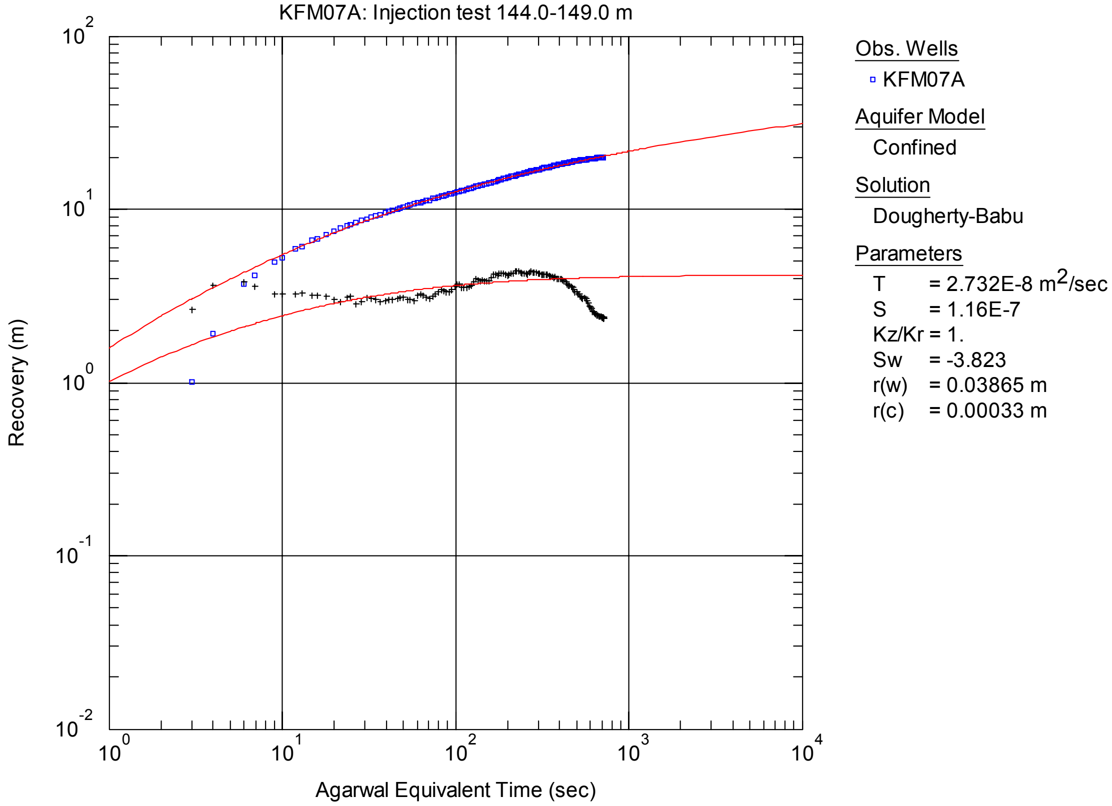


Figure A3-109. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 144.0-149.0 m in KFM07A.*

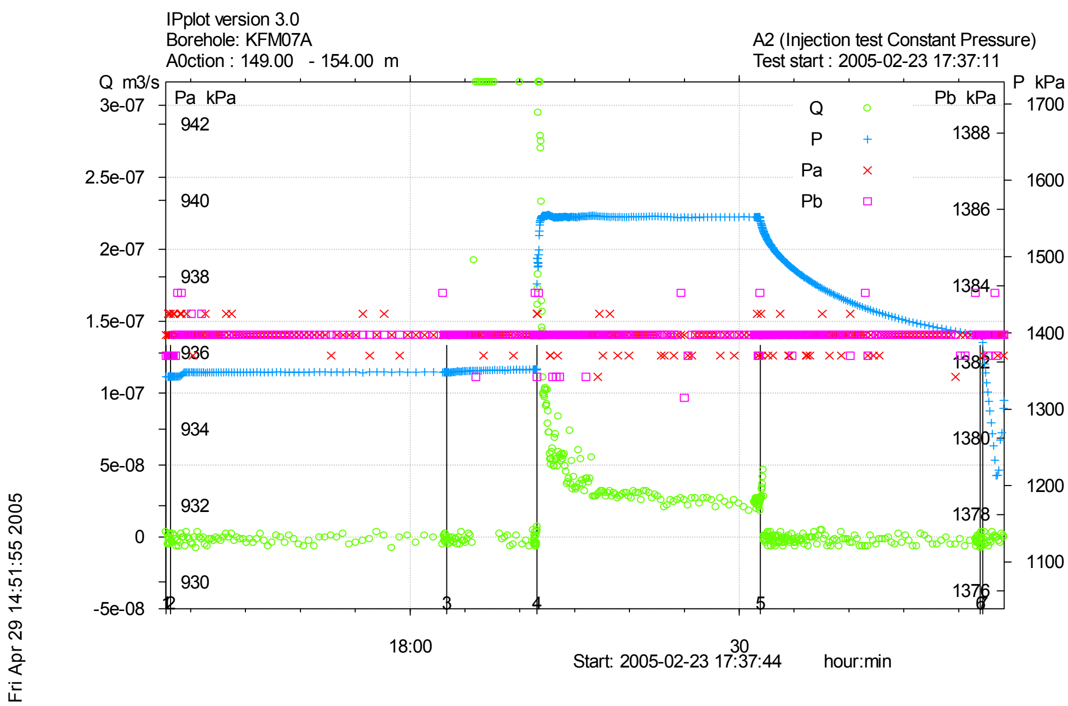


Figure A3-110. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 149.0-154.0 m in borehole KFM07A.*

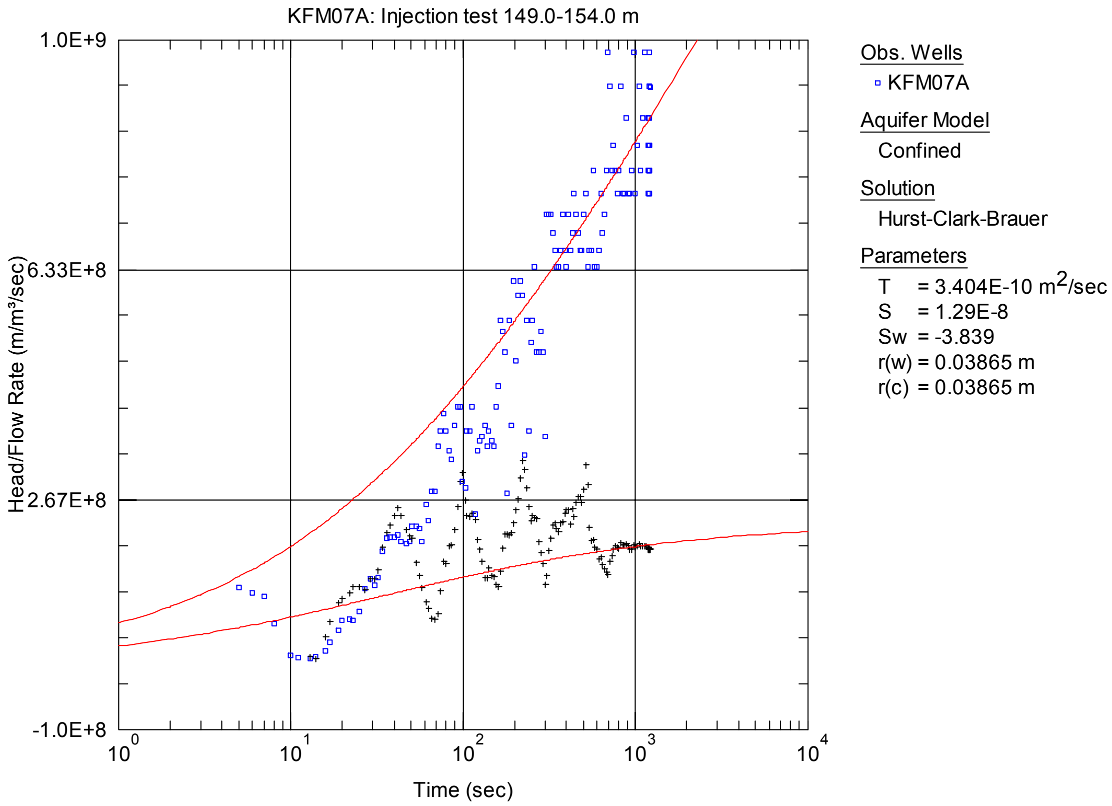


Figure A3-111. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 149.0-154.0 m in KFM07A.*

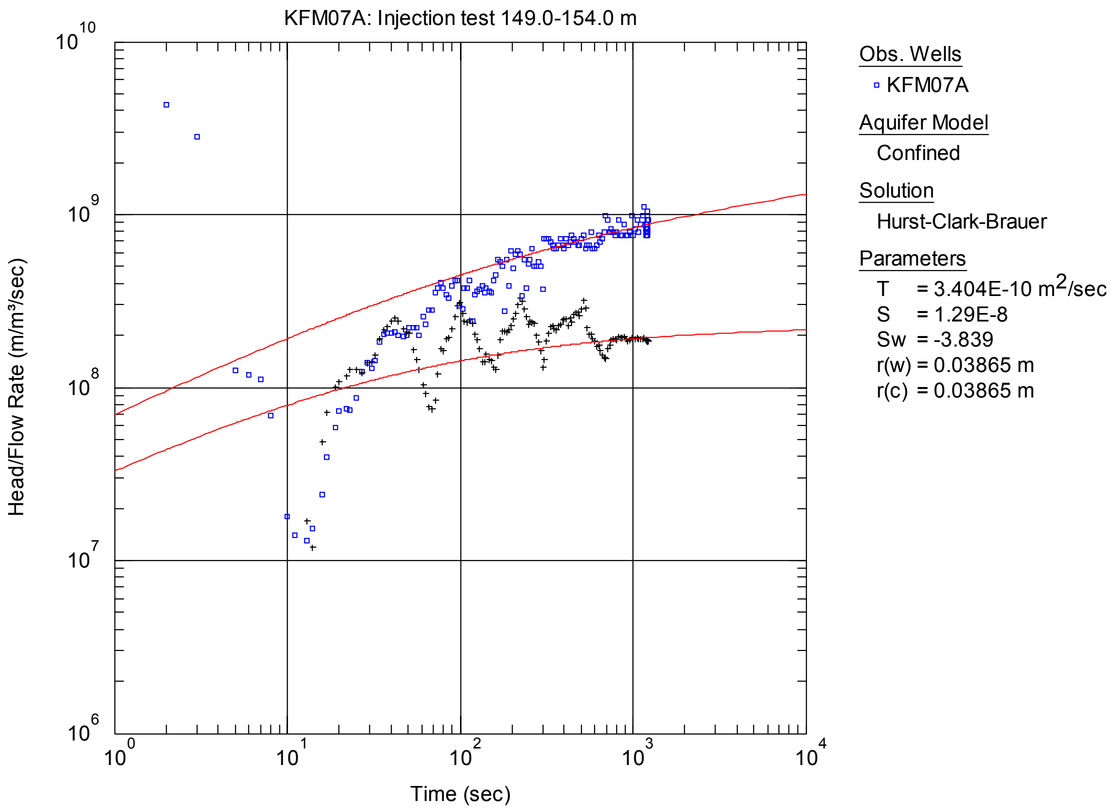


Figure A3-112. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 149.0-154.0 m in KFM07A.*

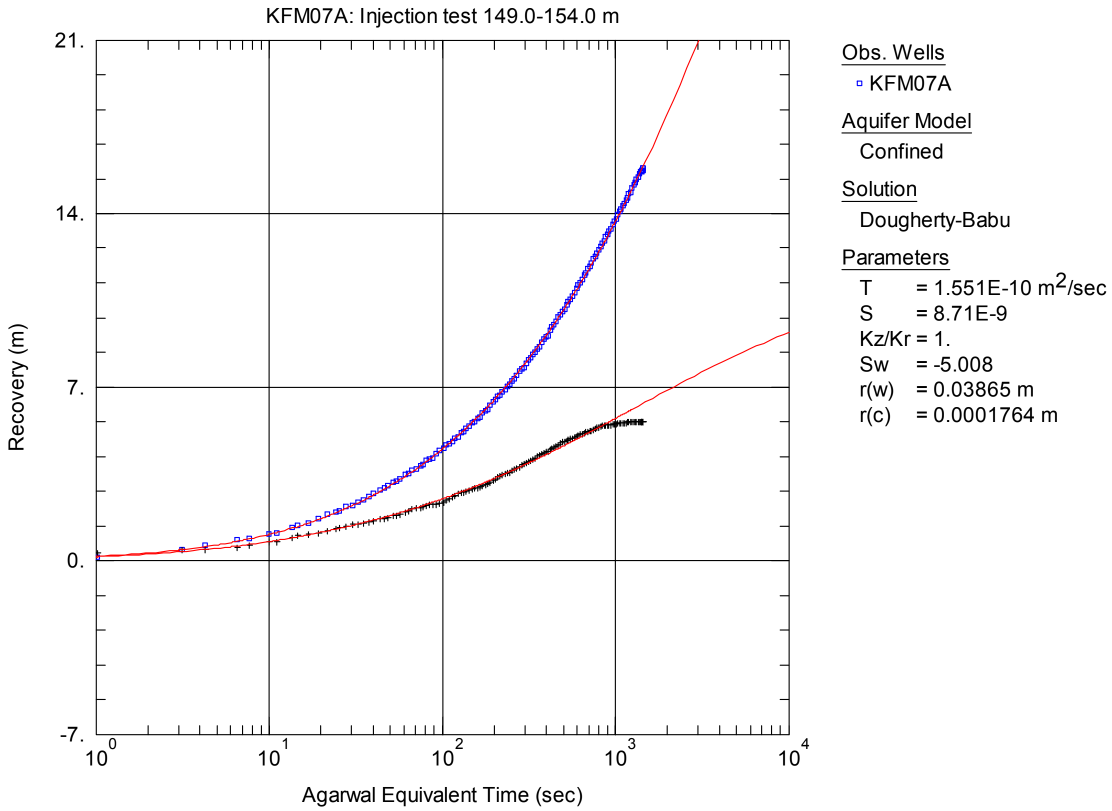


Figure A3-113. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 149.0-154.0 m in KFM07A.*

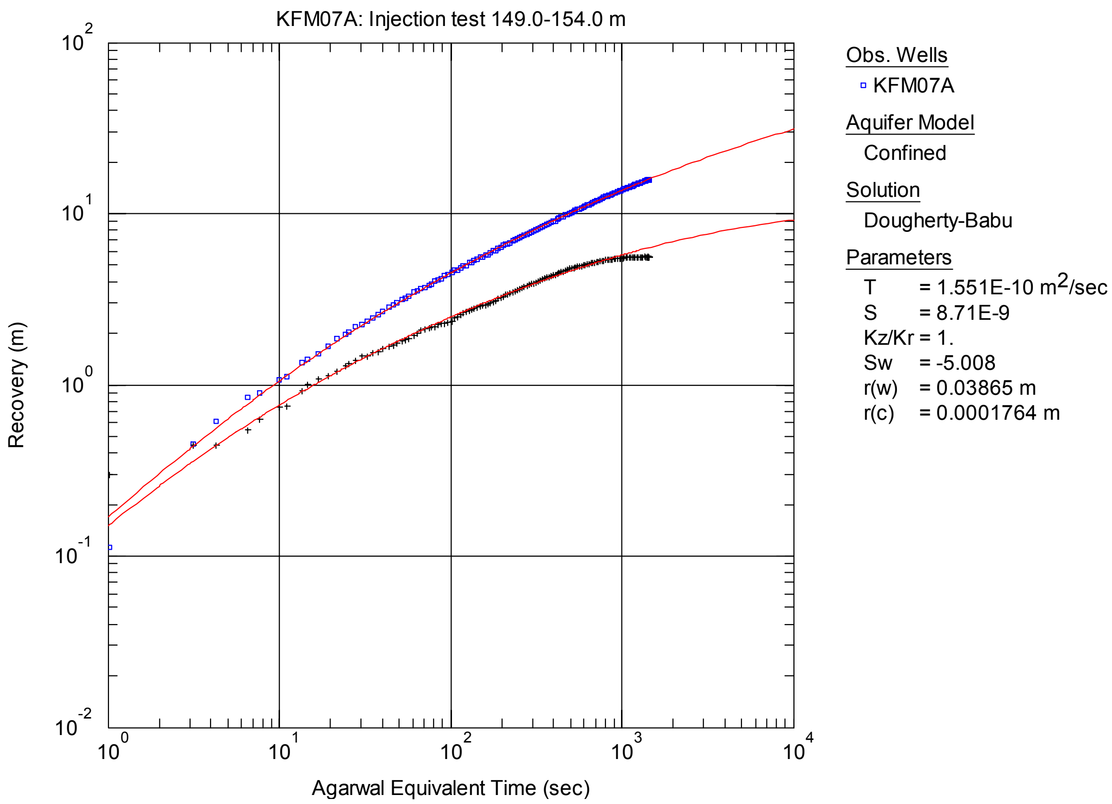


Figure A3-114. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 149.0-154.0 m in KFM07A.*

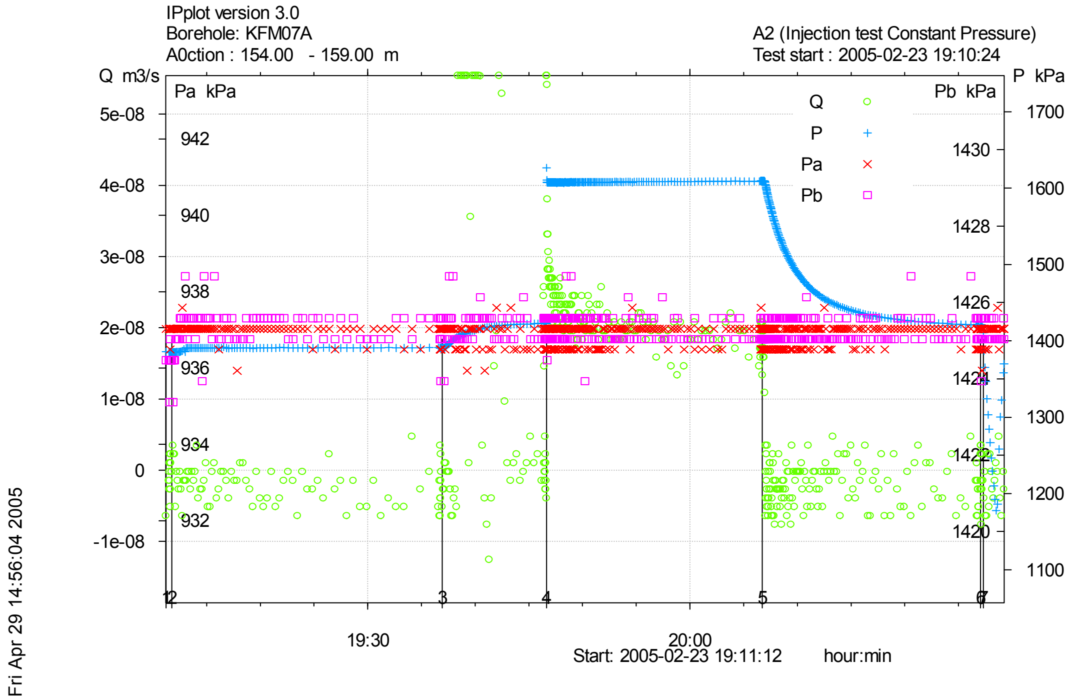


Figure A3-115. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 154.0-159.0 m in borehole KFM07A.*

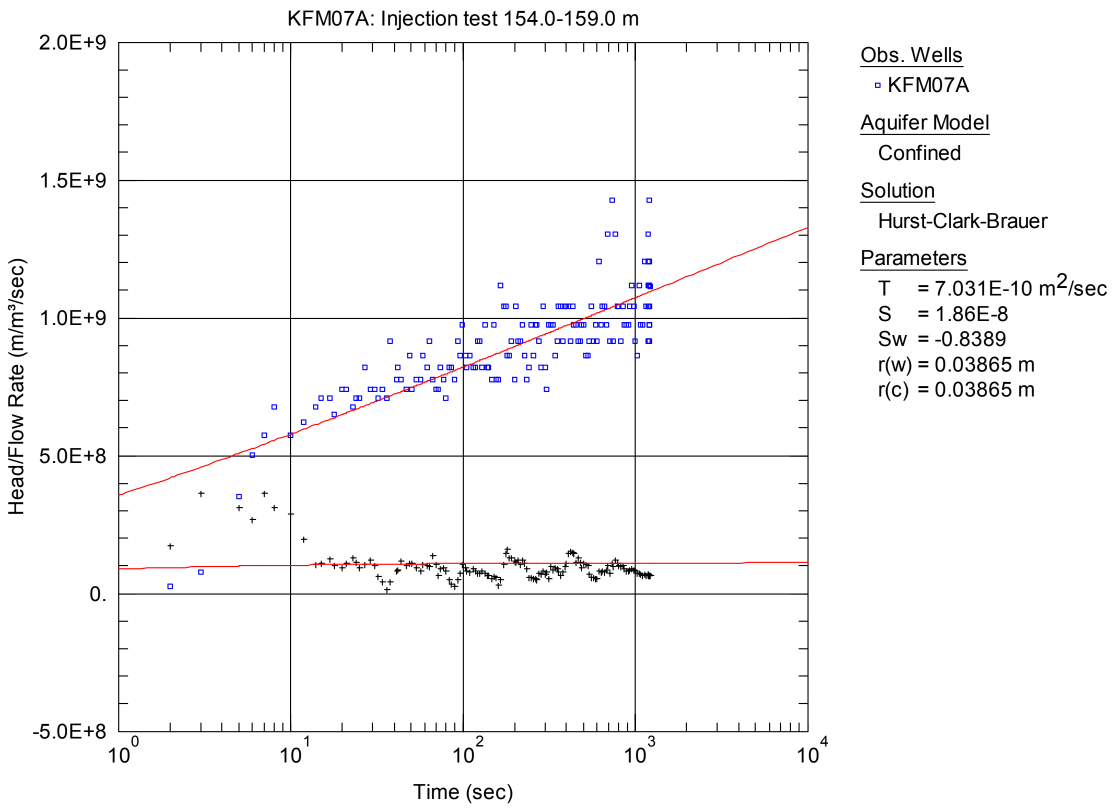


Figure A3-116. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 154.0-159.0 m in KFM07A.*

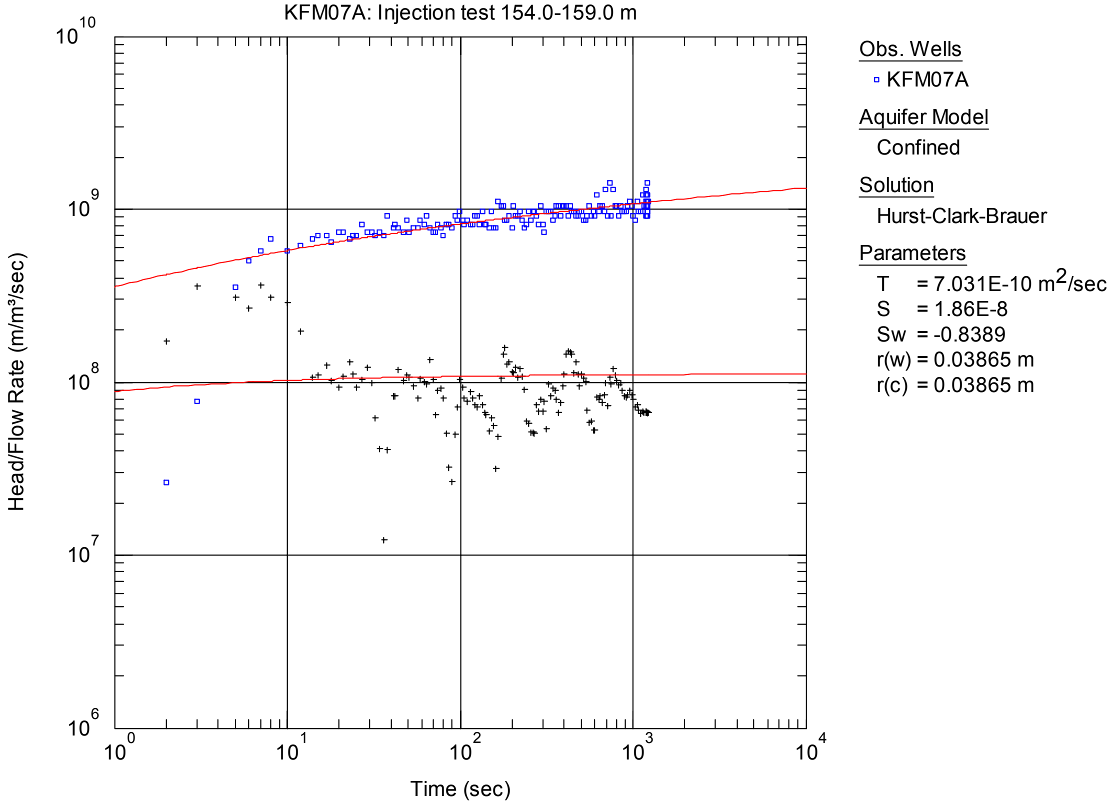


Figure A3-117. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 154.0-159.0 m in KFM07A.*

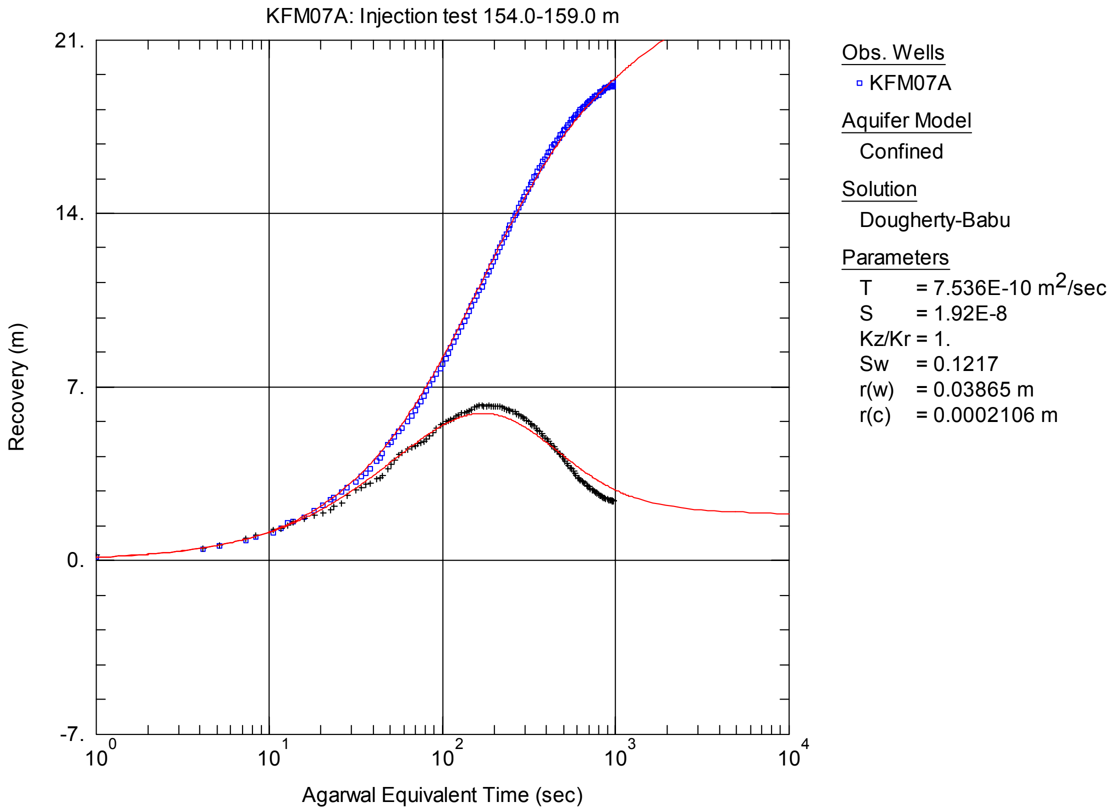


Figure A3-118. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 154.0-159.0 m in KFM07A.*

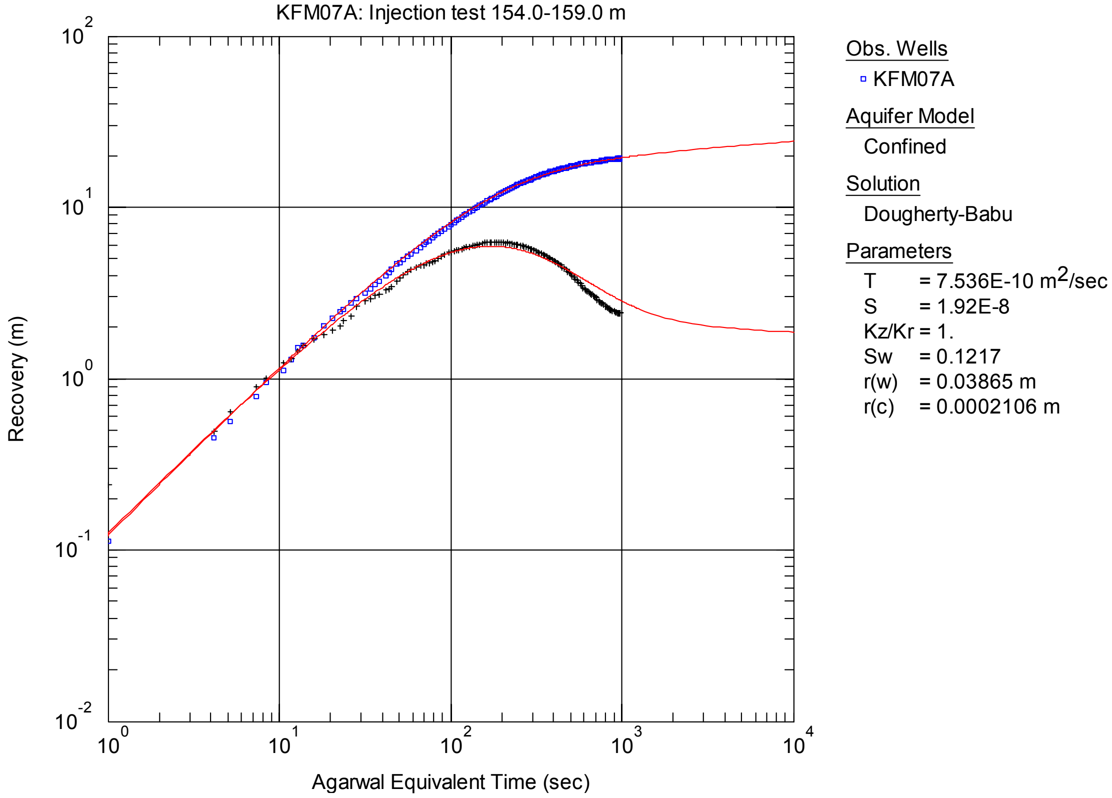


Figure A3-119. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 154.0-159.0 m in KFM07A.*

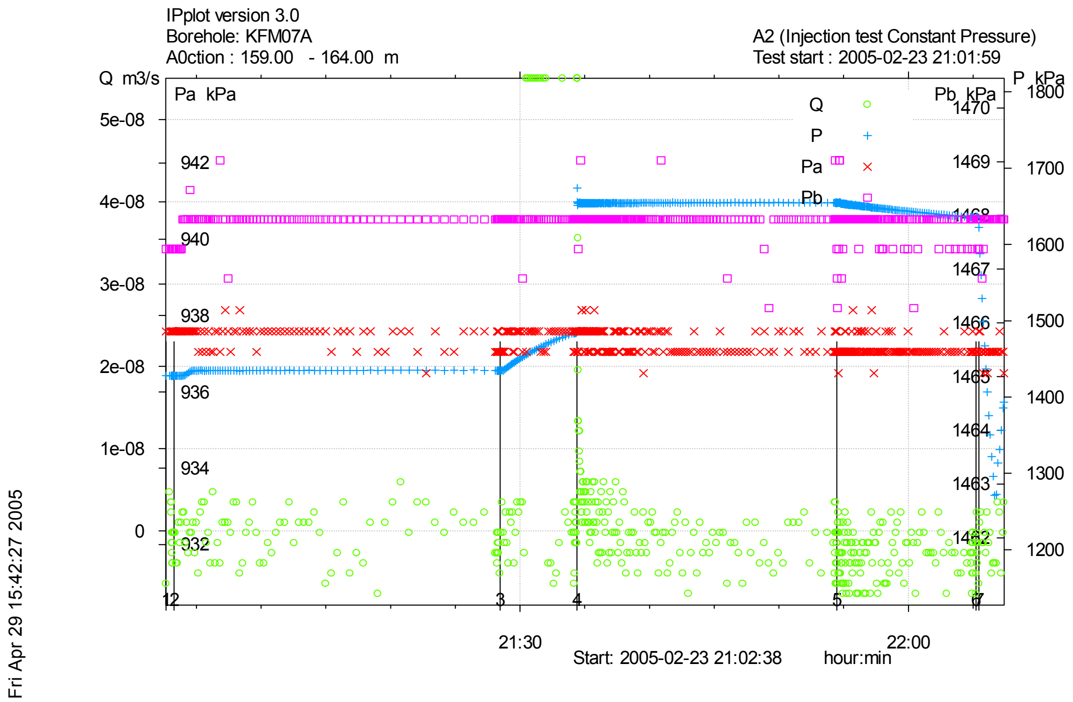


Figure A3-120. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 159.0-164.0 m in borehole KFM07A.*

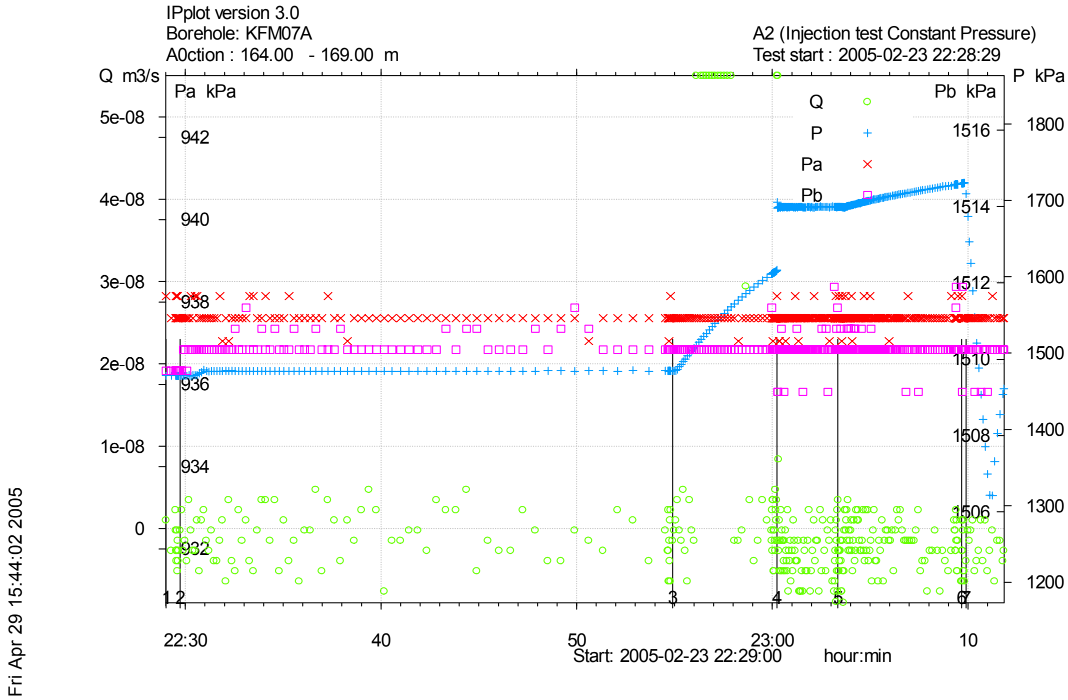


Figure A3-121. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 164.0-169.0 m in borehole KFM07A.*

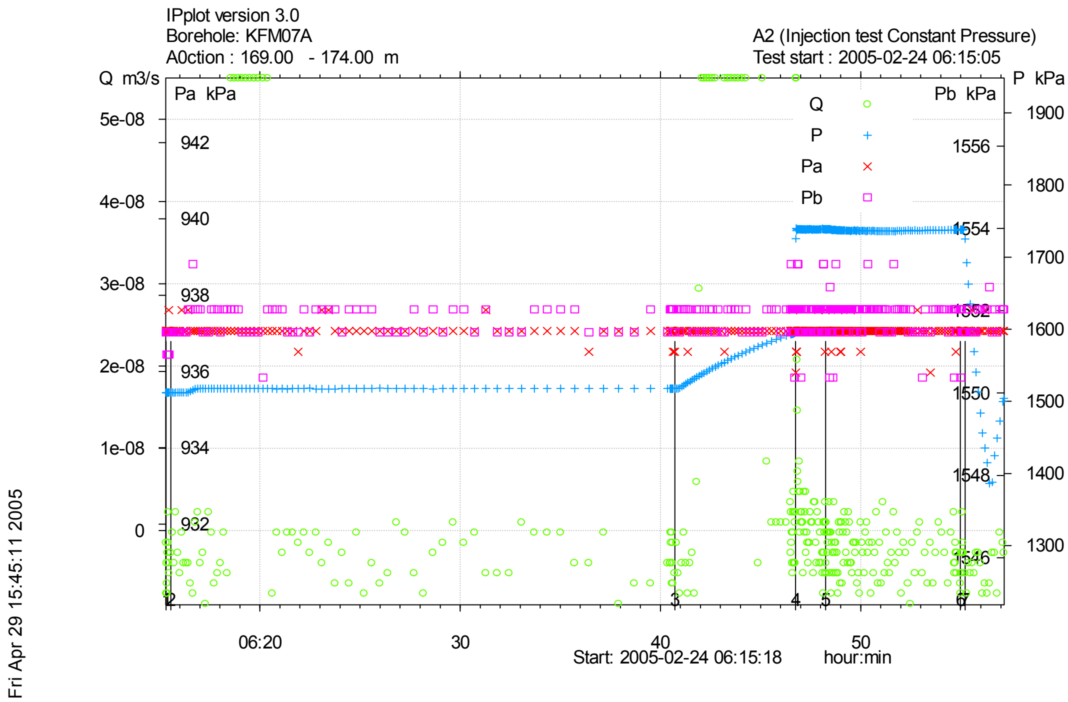


Figure A3-122. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 169.0-174.0 m in borehole KFM07A.*

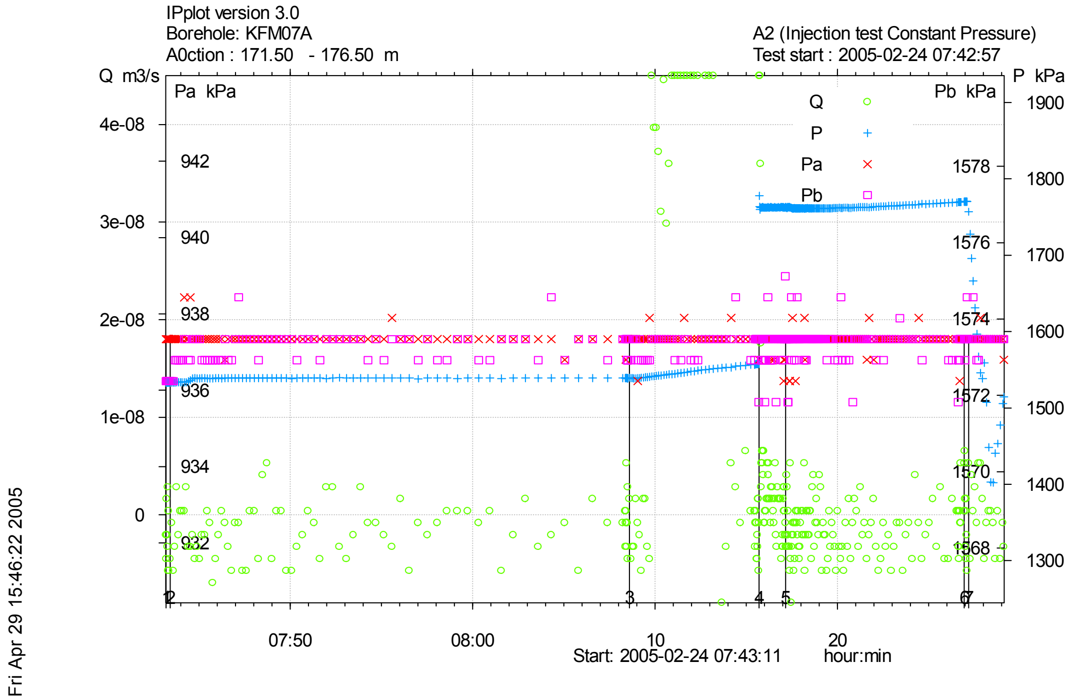


Figure A3-123. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 171.5-176.5 m in borehole KFM07A.*

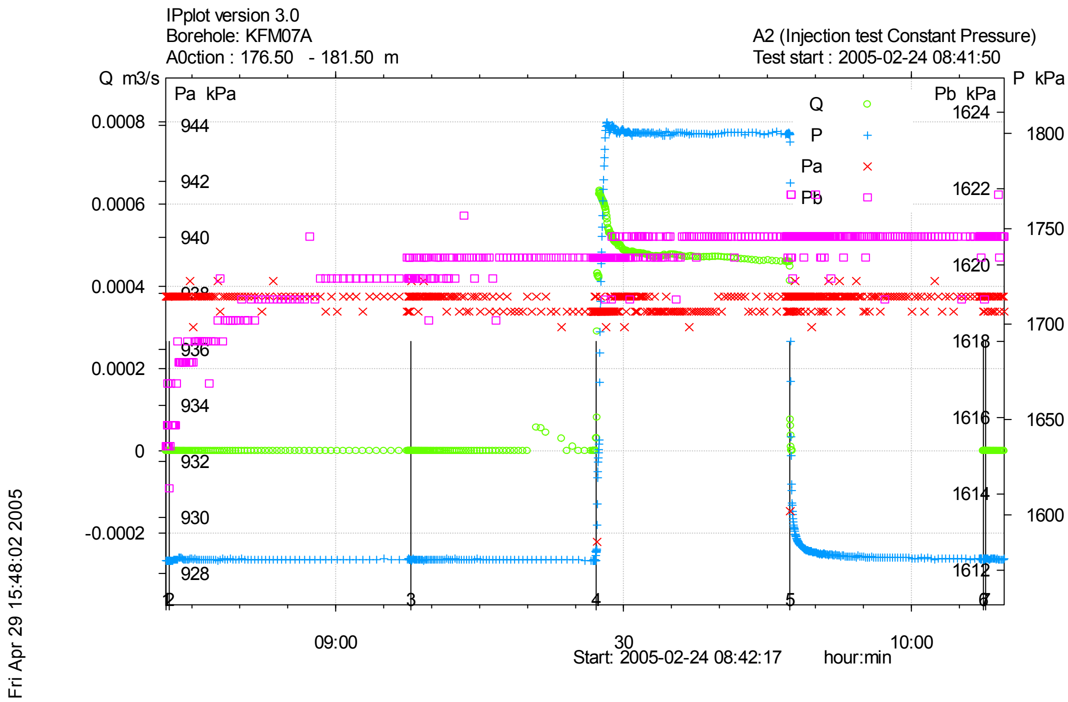


Figure A3-124. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 176.5-181.5 m in borehole KFM07A.*

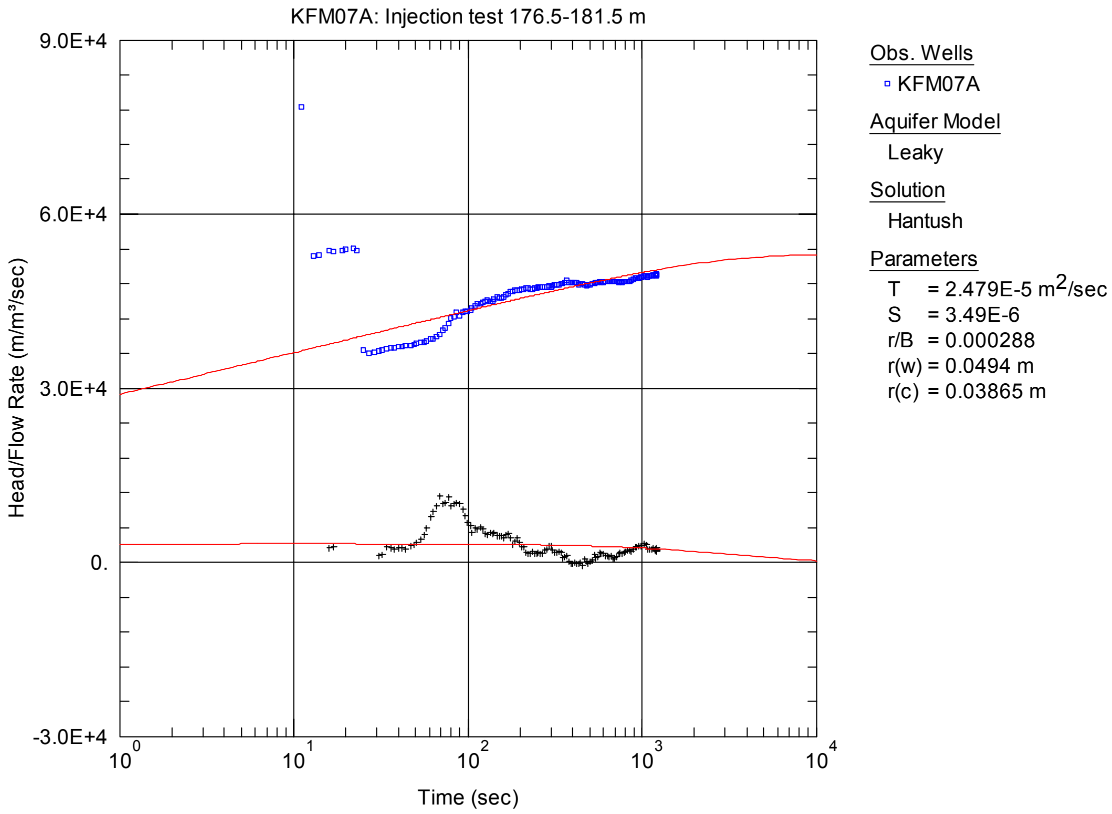


Figure A3-125. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 176.5-181.5 m in KFM07A.*

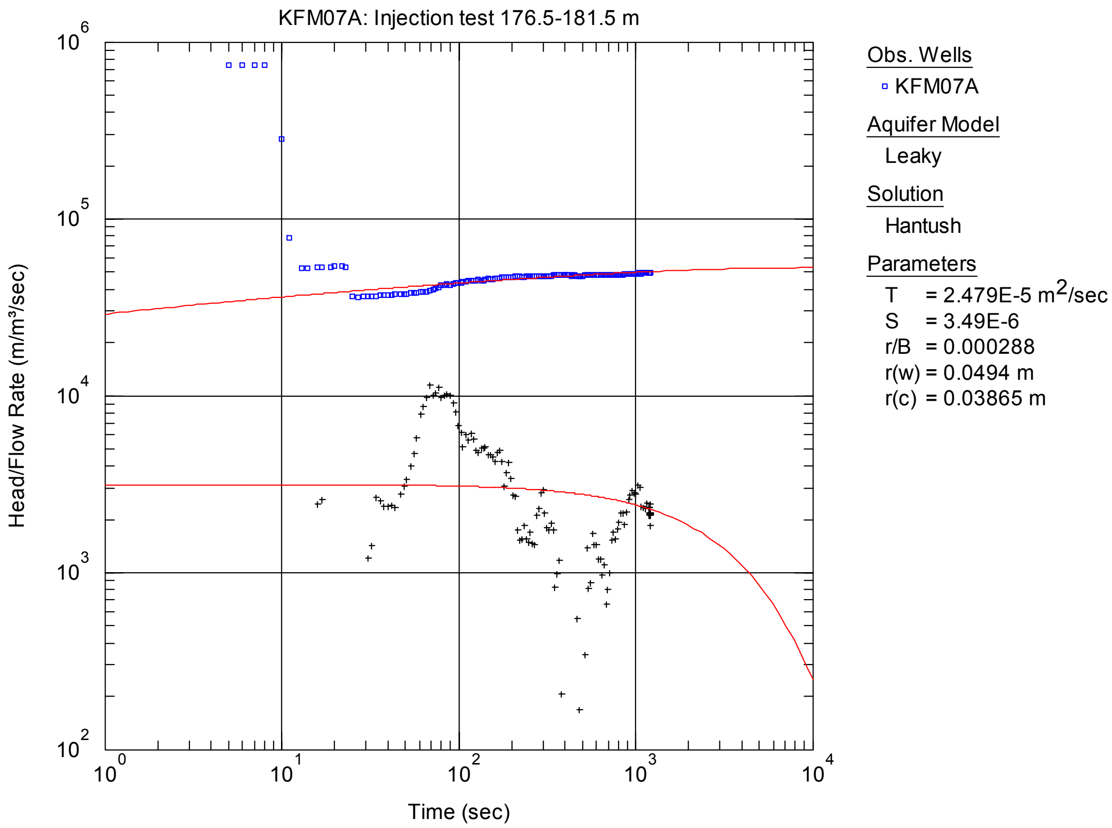


Figure A3-126. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 176.5-181.5 m in KFM07A.*

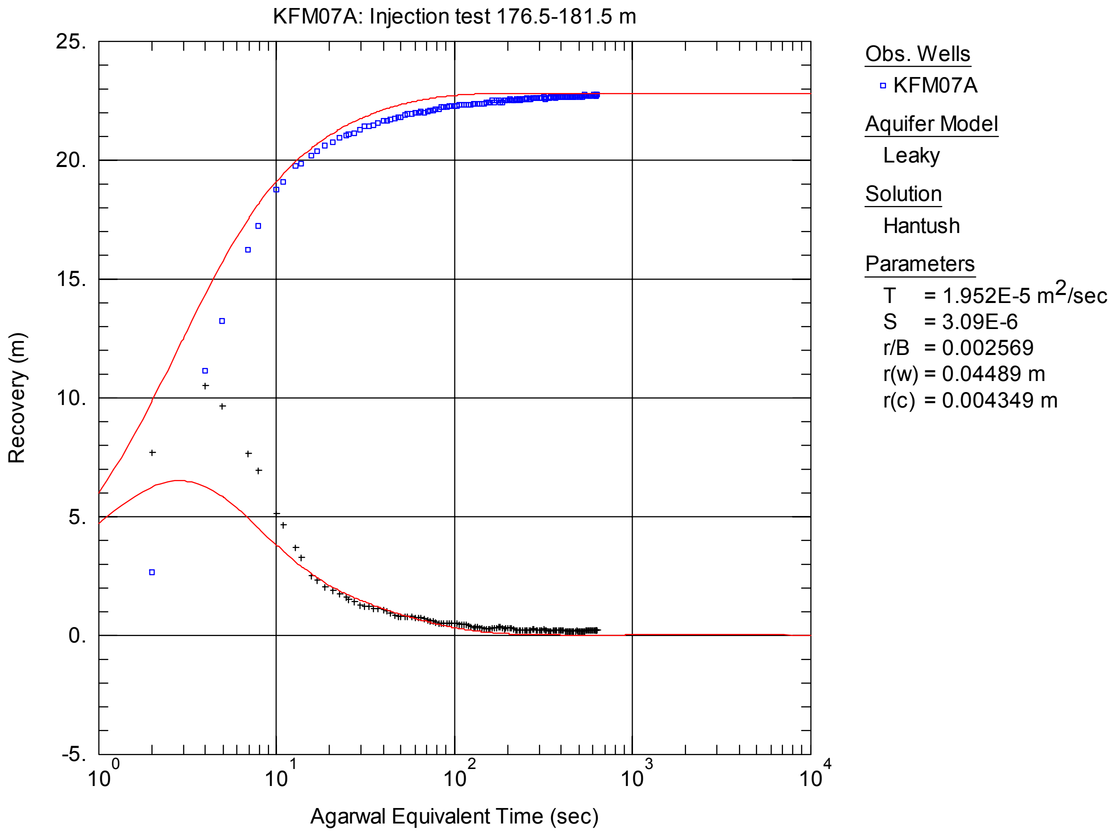


Figure A3-127. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 176.5-181.5 m in KFM07A.*

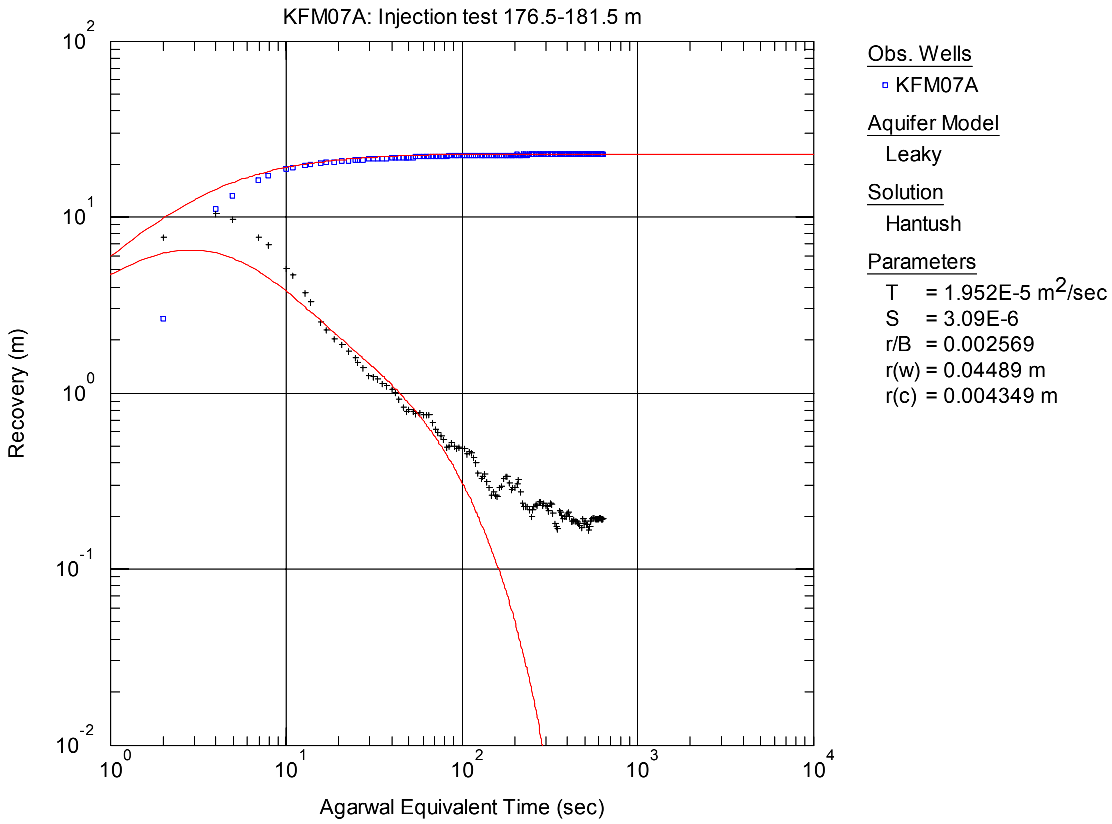


Figure A3-128. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 176.5-181.5 m in KFM07A.*

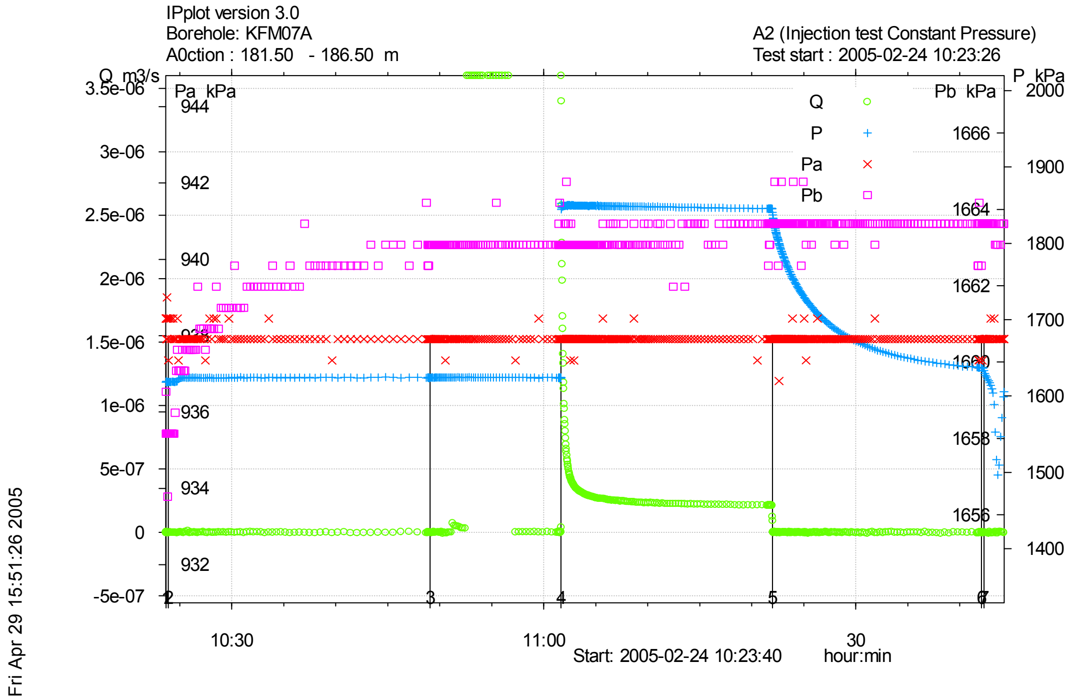


Figure A3-129. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 181.5-186.5 m in borehole KFM07A.*

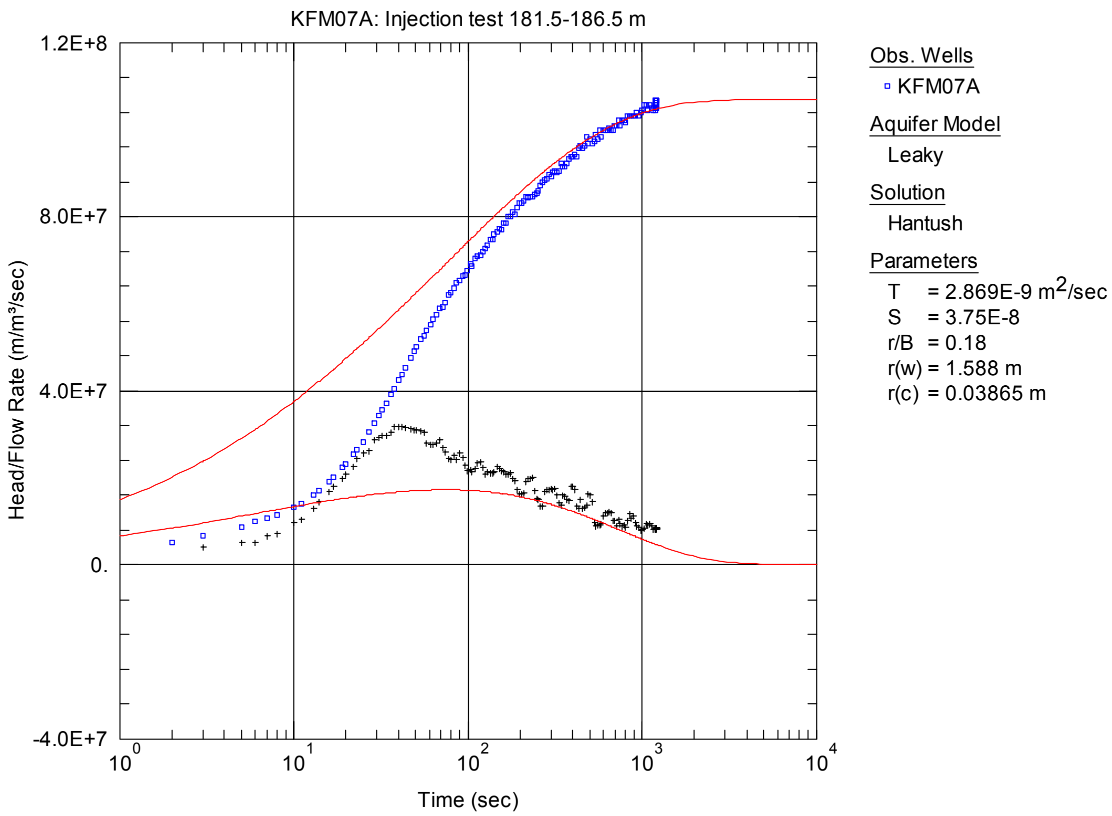


Figure A3-130. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 181.5-186.5 m in KFM07A.*

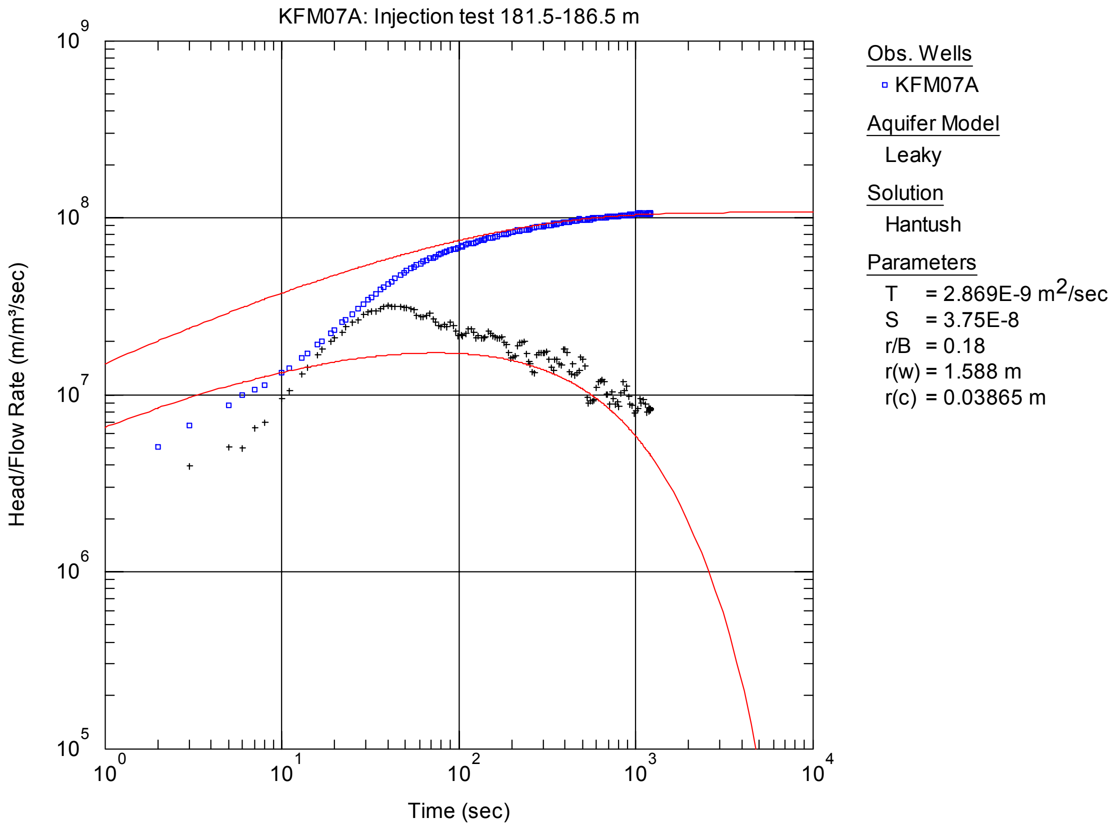


Figure A3-131. Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 181.5-186.5 m in KFM07A.

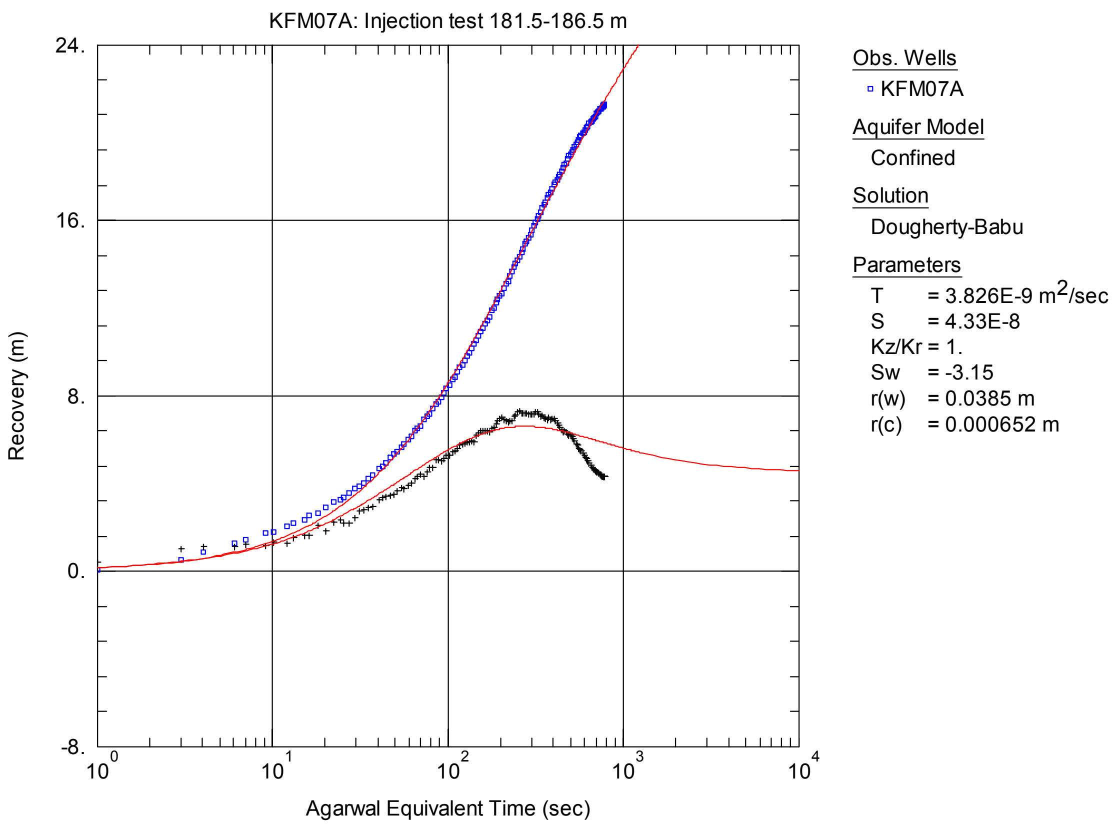


Figure A3-132. Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 181.5-186.5 m in KFM07A.

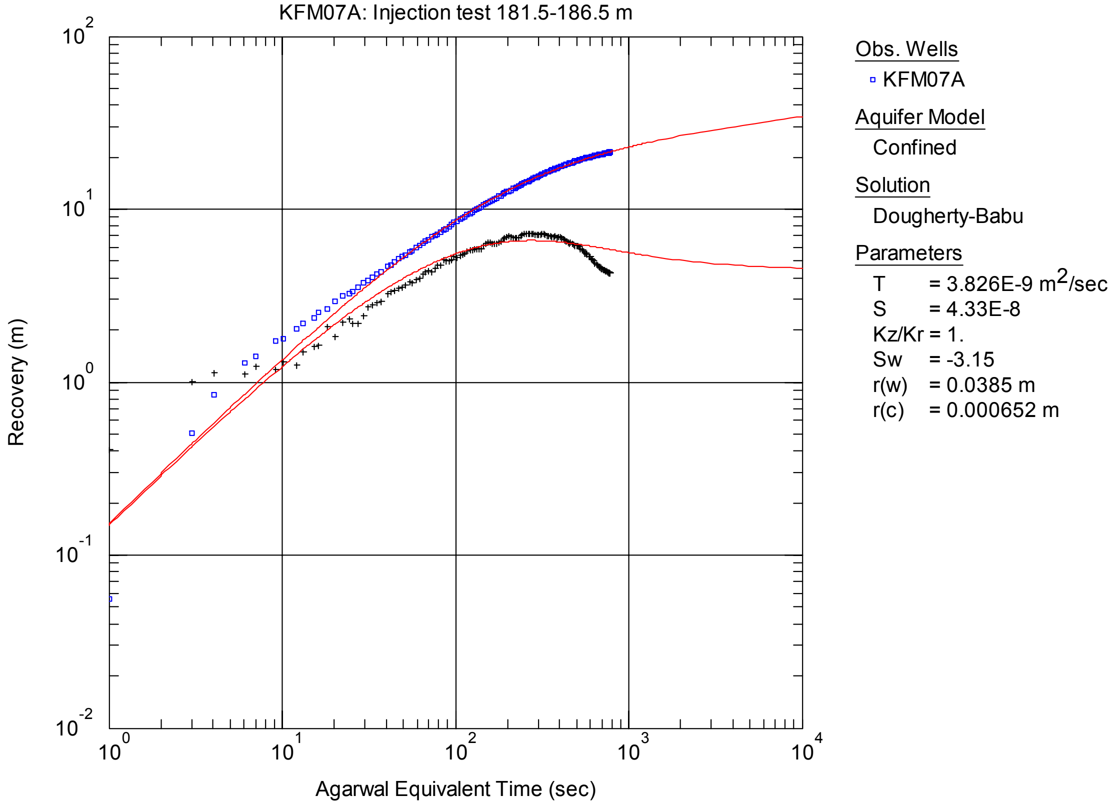


Figure A3-133. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 181.5-186.5 m in KFM07A*

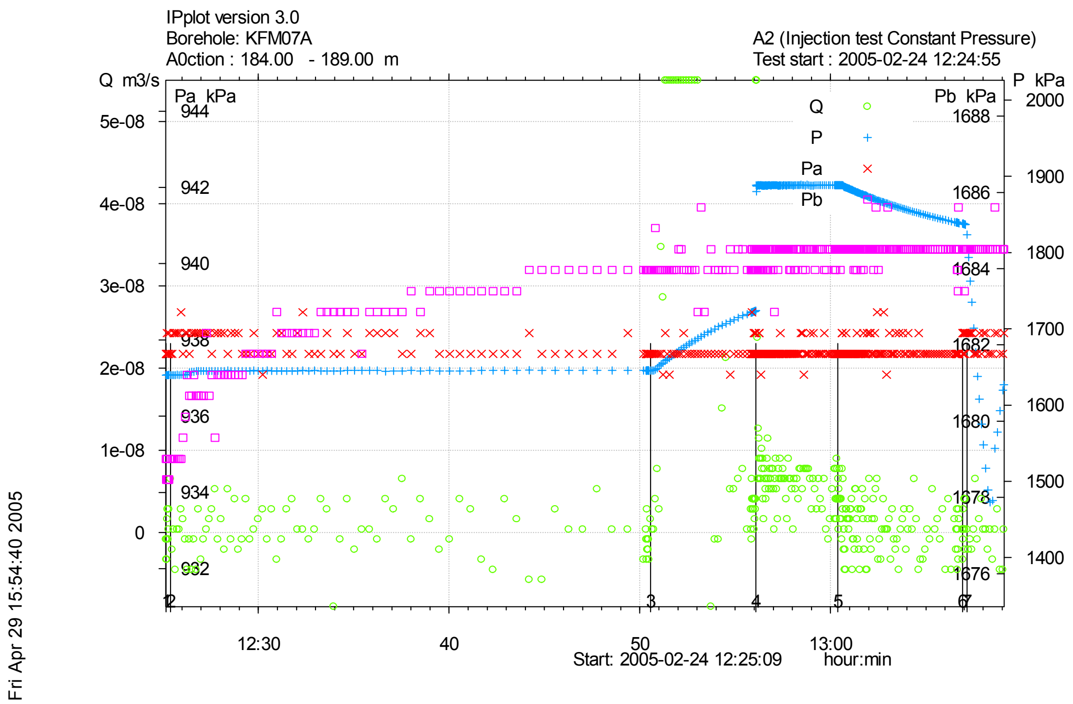


Figure A3-134. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 184.0-189.0 m in borehole KFM07A.*

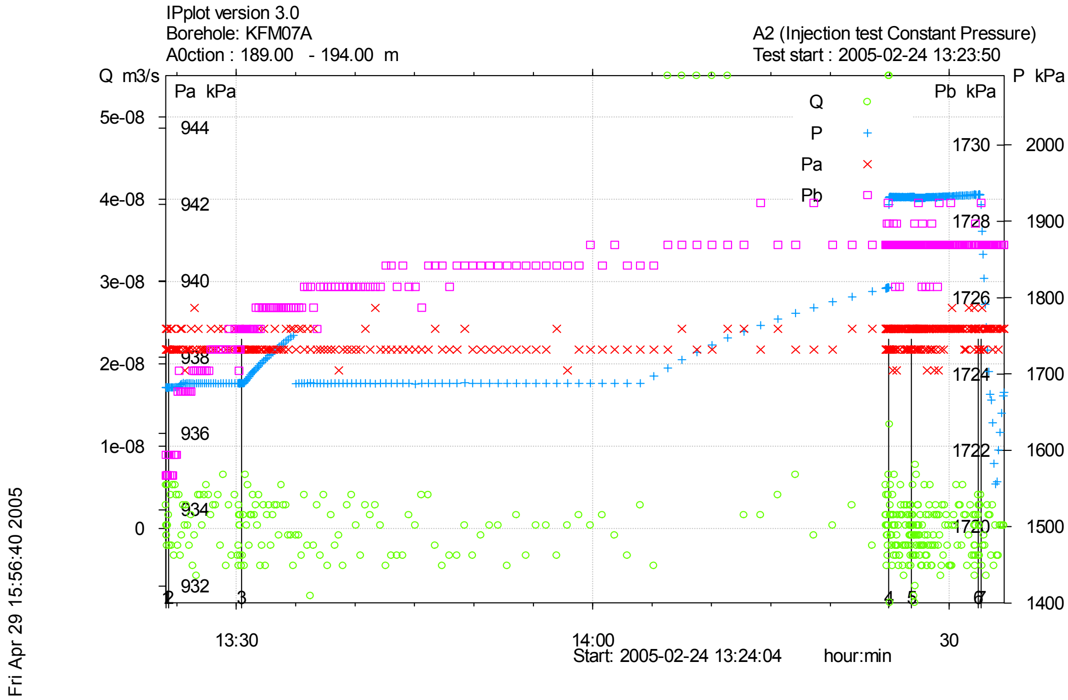


Figure A3-135. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 189.0-194.0 m in borehole KFM07A. The test was conducted as a pressure pulse test.*

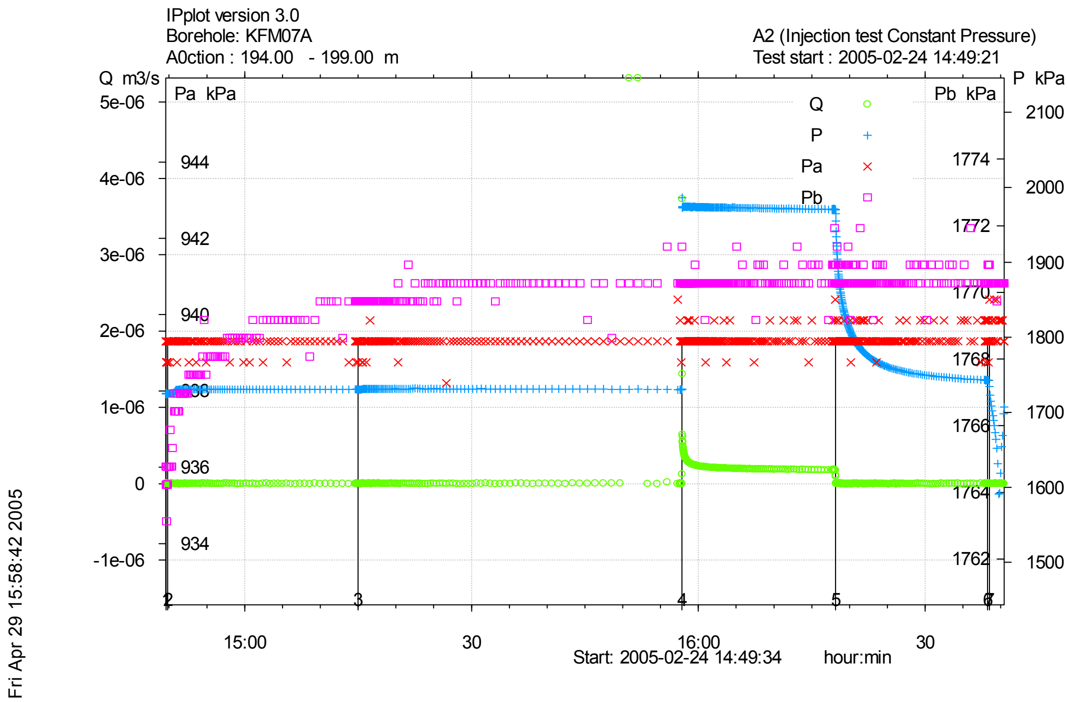


Figure A3-136. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 194.0-199.0 m in borehole KFM07A.*

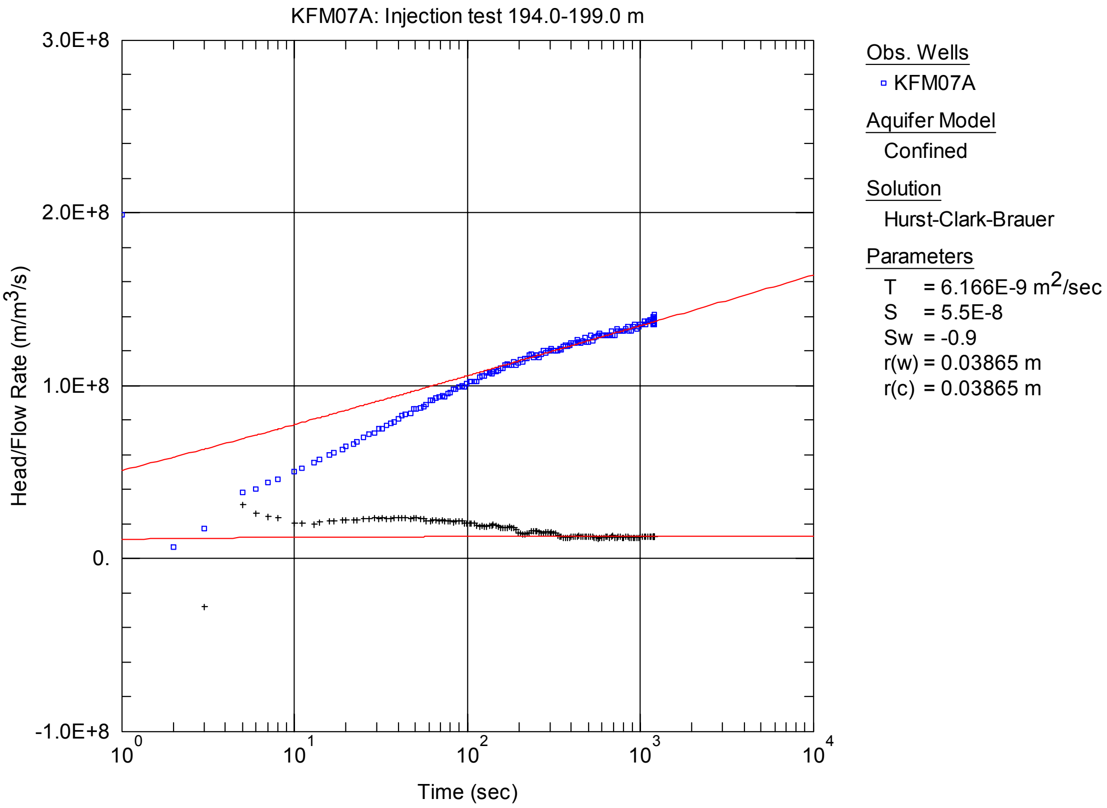


Figure A3-137. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 194.0-199.0 m in KFM07A.*

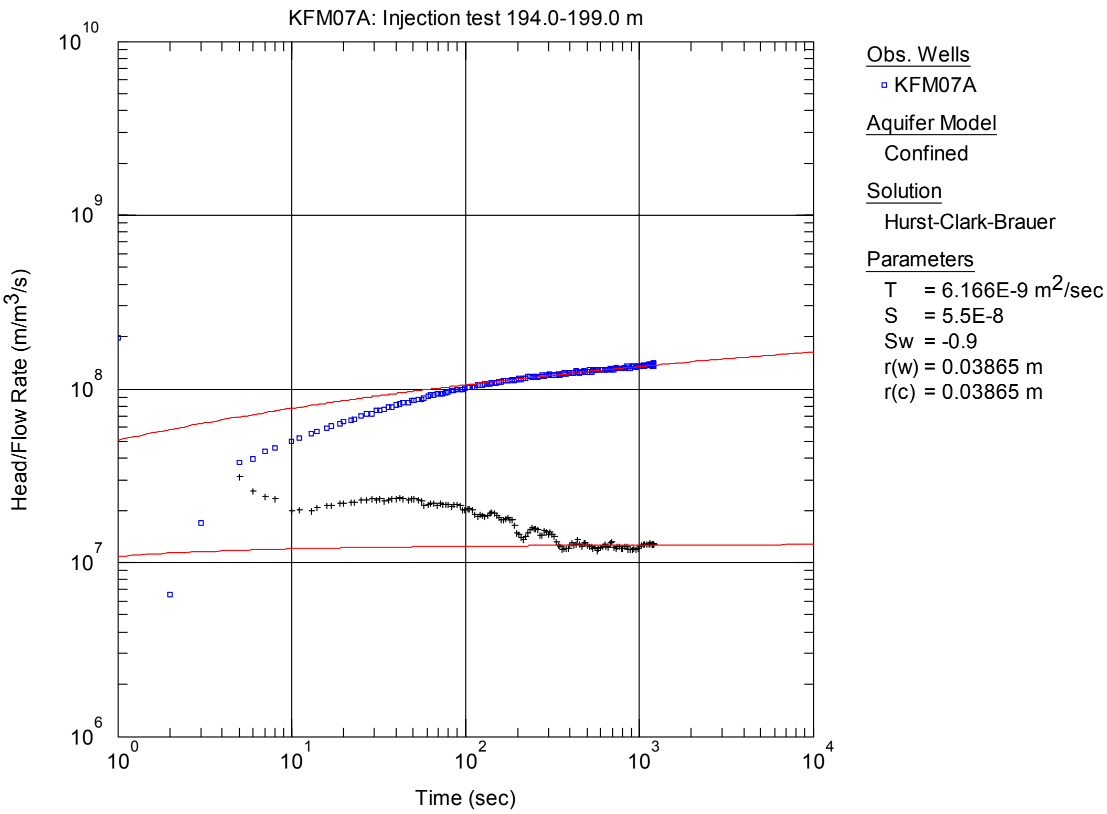


Figure A3-138. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 194.0-199.0 m in KFM07A.*

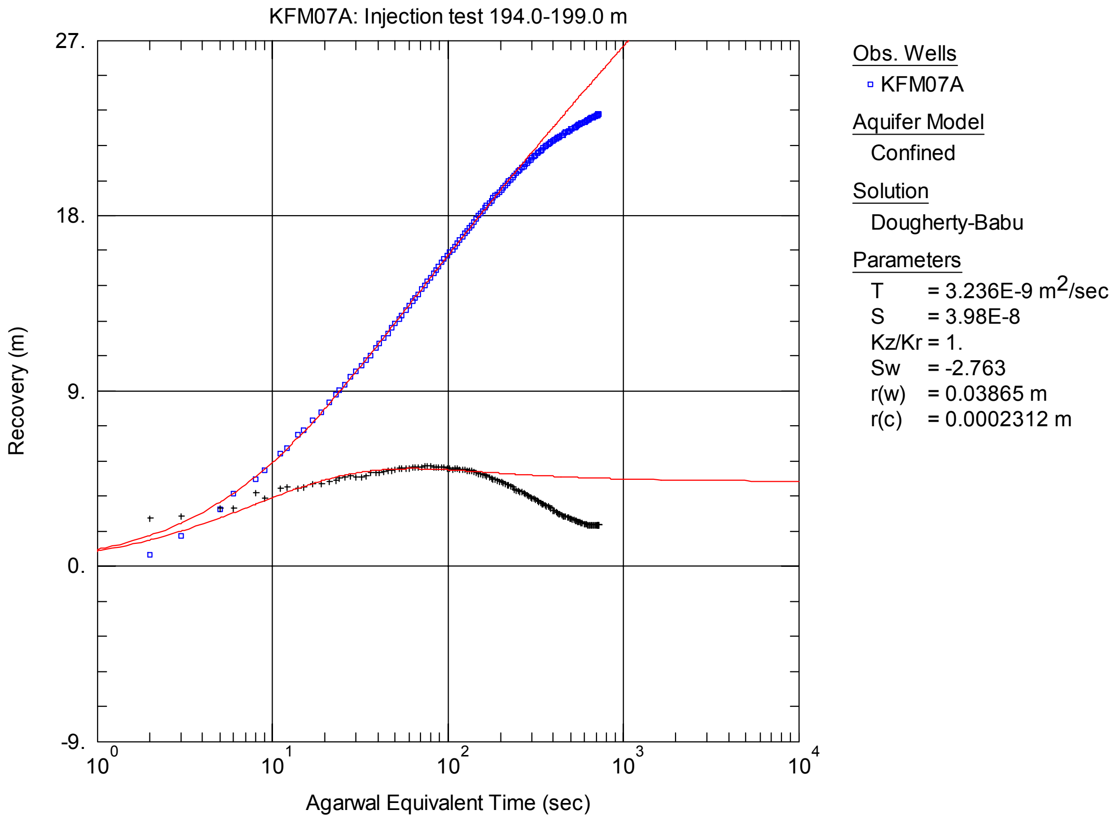


Figure A3-139. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 194.0-199.0 m in KFM07A.*

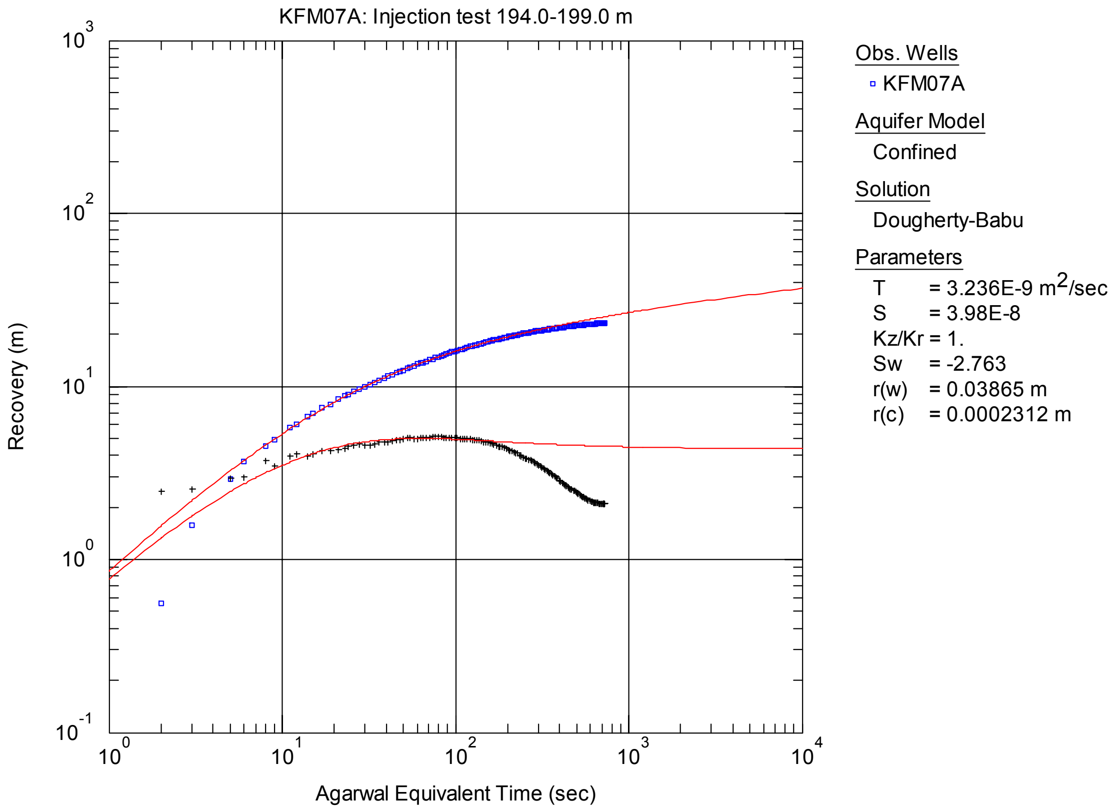


Figure A3-140. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 194.0-199.0 m in KFM07A.*

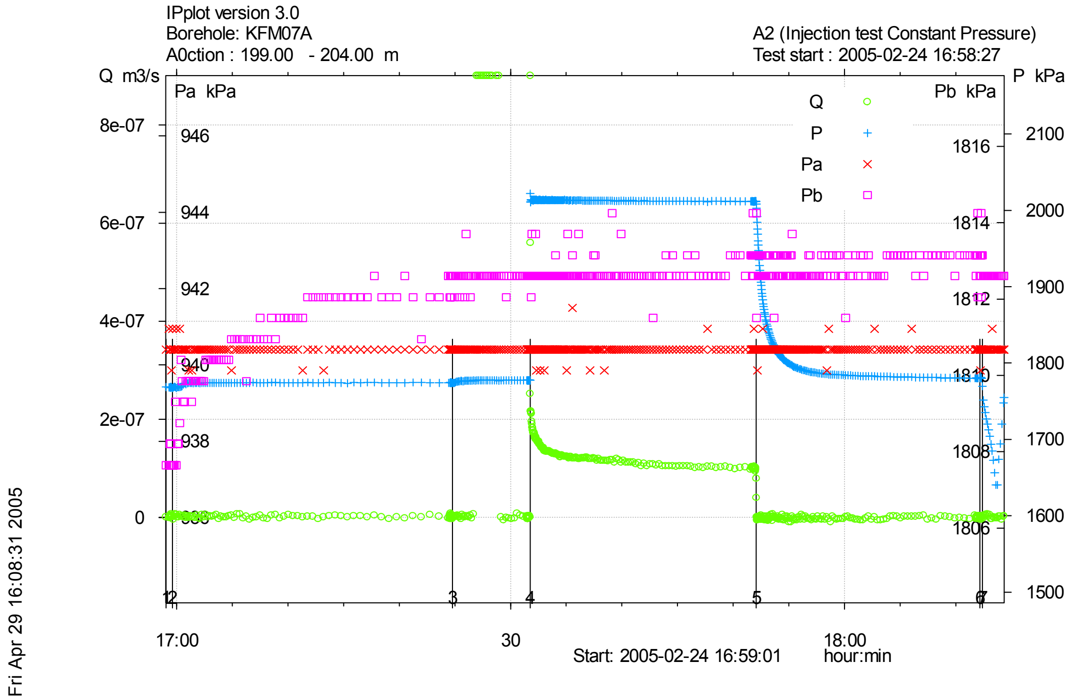


Figure A3-141. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 199.0-204.0 m in borehole KFM07A.*

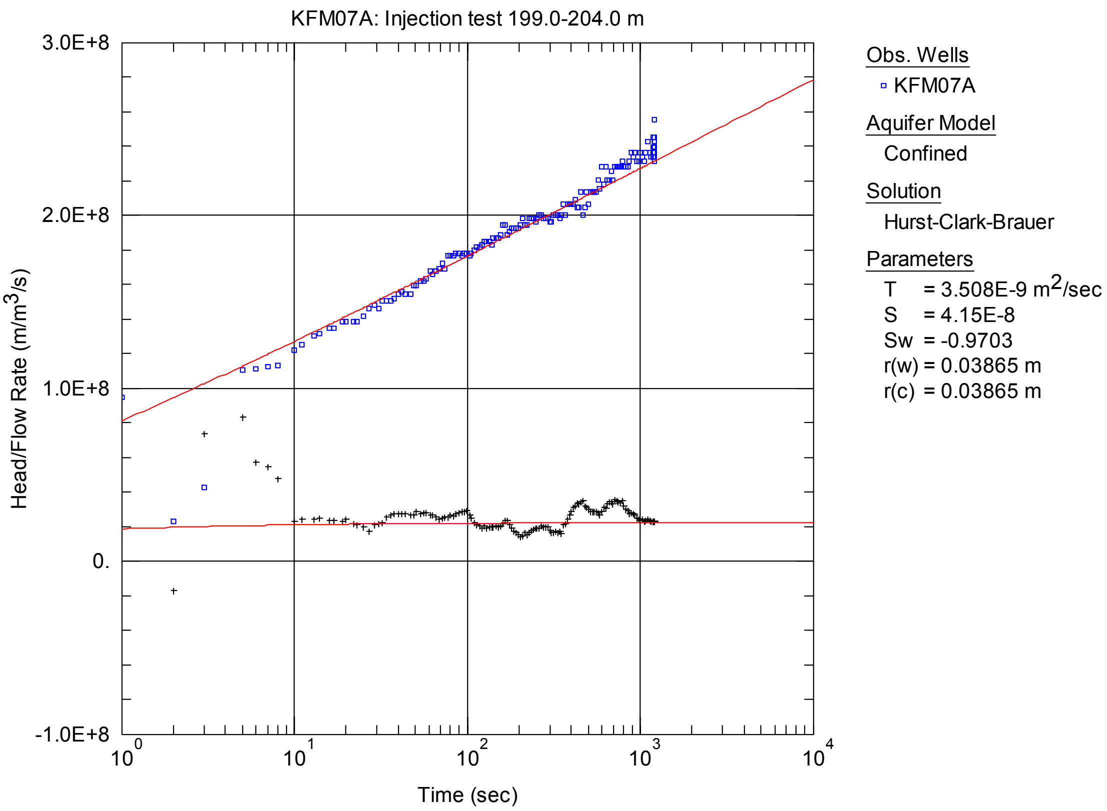


Figure A3-142. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 199.0-204.0 m in KFM07A.*

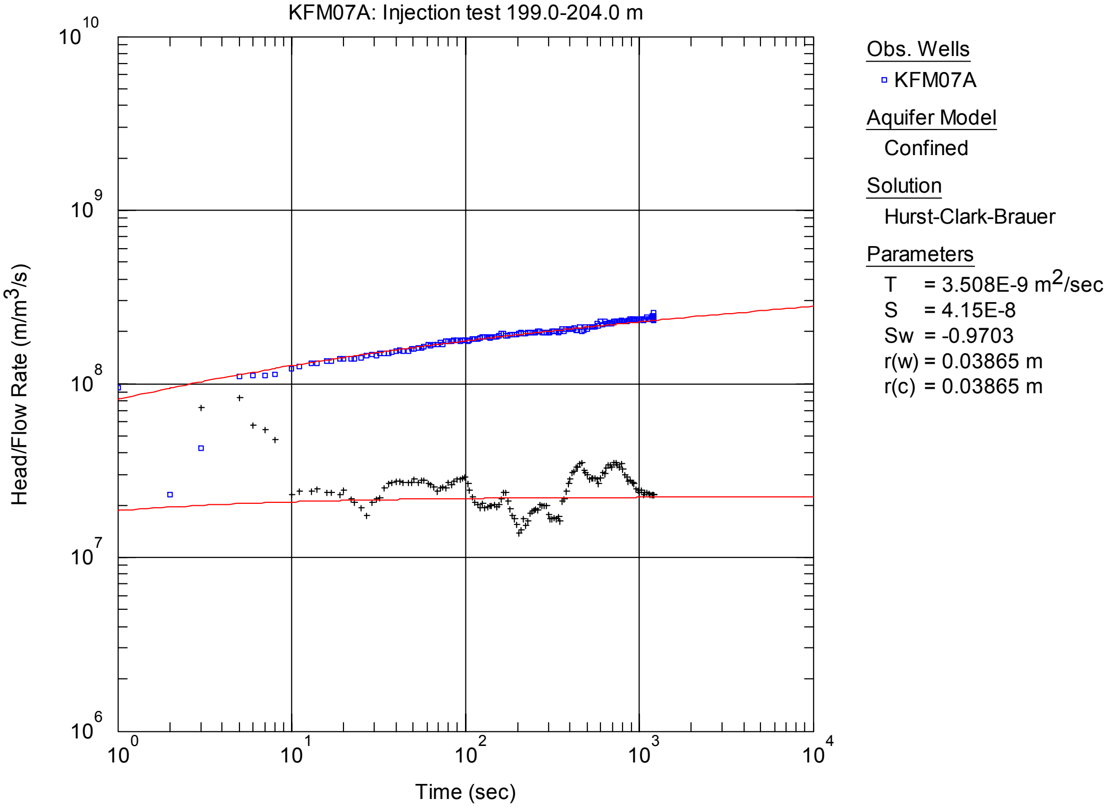


***Figure A3-143.** Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 199.0-204.0 m in KFM07A.*

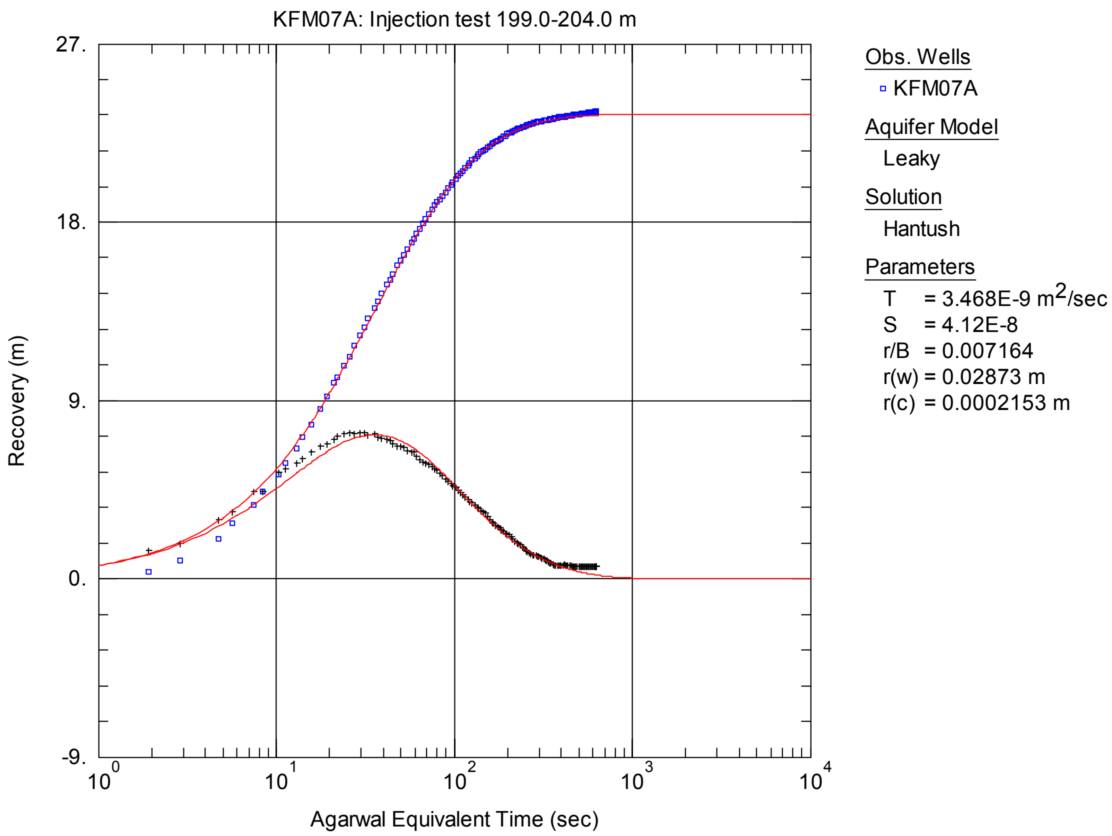


***Figure A3-144.** Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 199.0-204.0 m in KFM07A.*

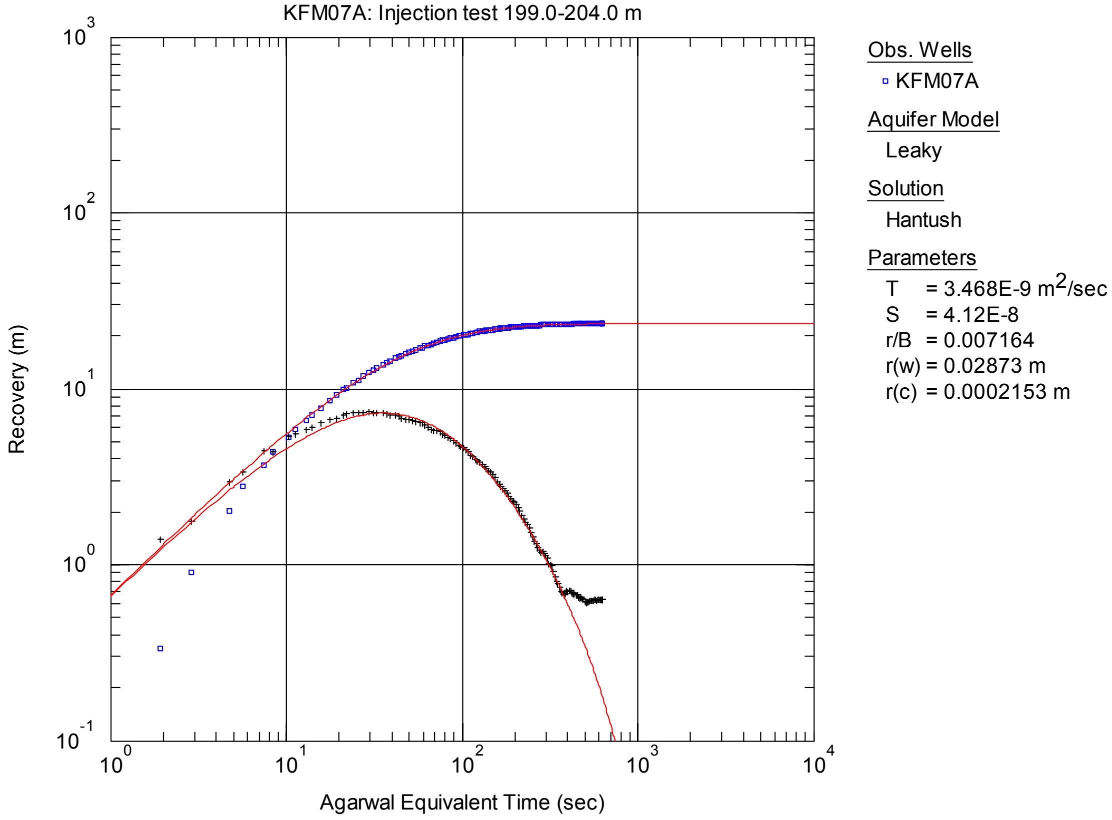


Figure A3-145. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 199.0-204.0 m in KFM07A.*

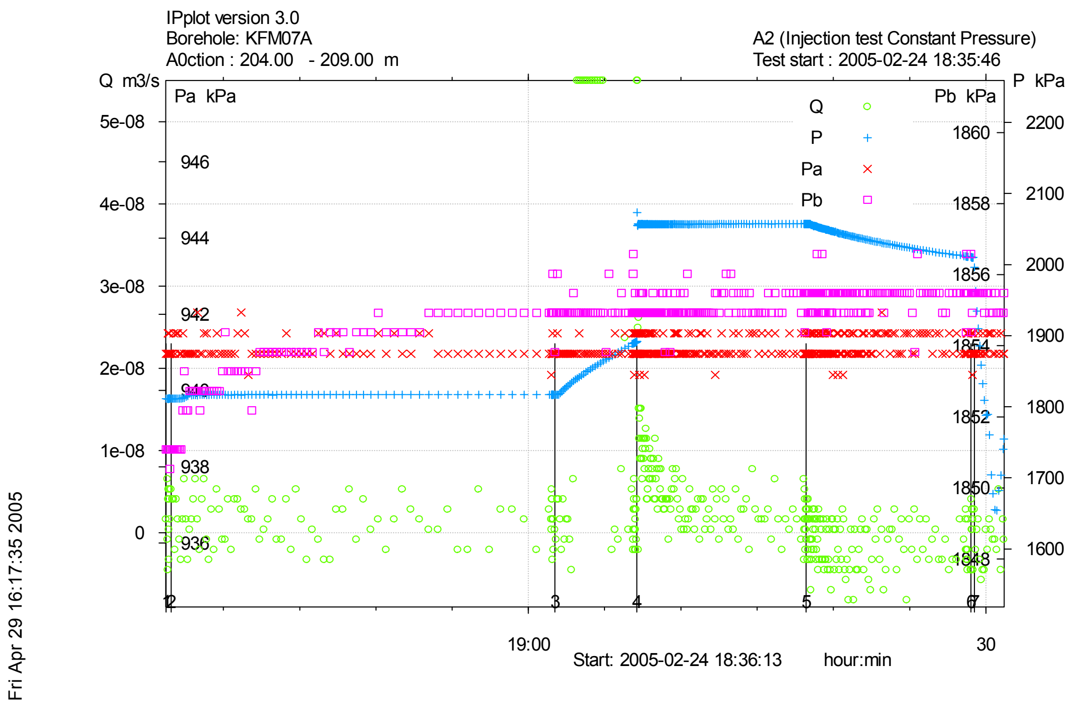


Figure A3-146. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 204.0-209.0 m in borehole KFM07A.*

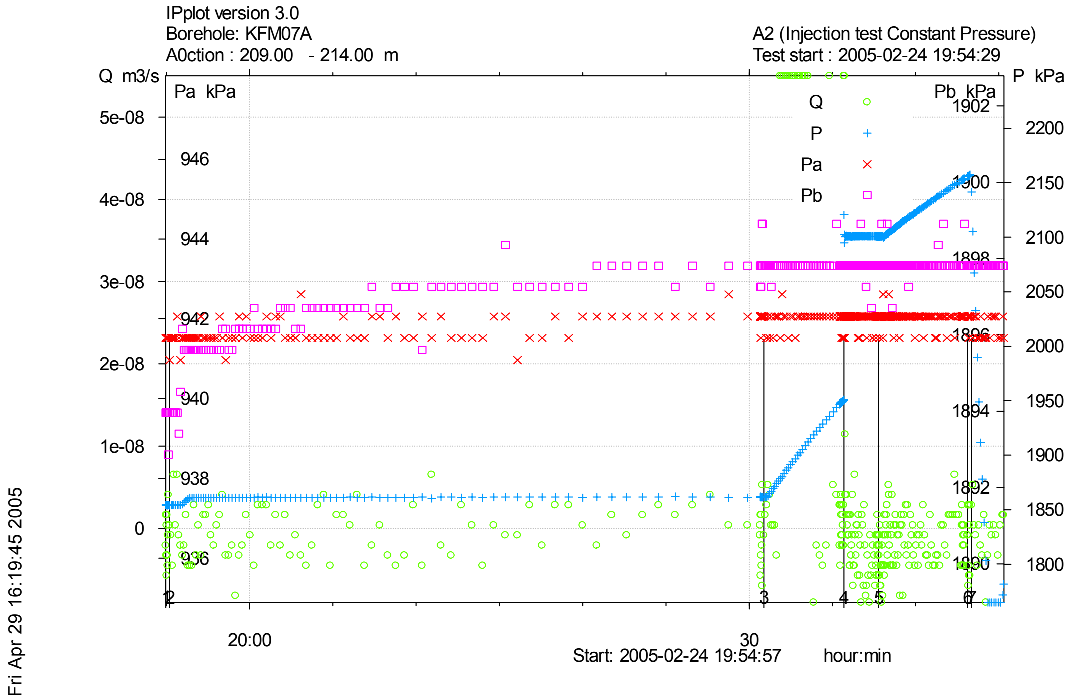


Figure A3-147. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 209.0-214.0 m in borehole KFM07A.*

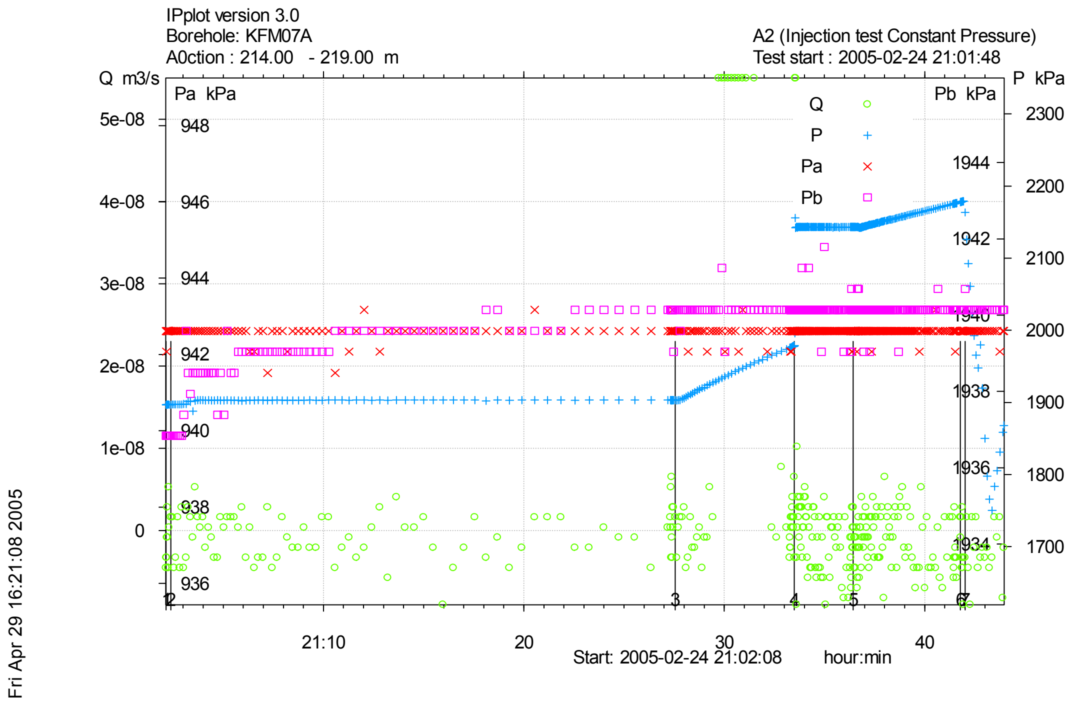


Figure A3-148. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 214.0-219.0 m in borehole KFM07A.*

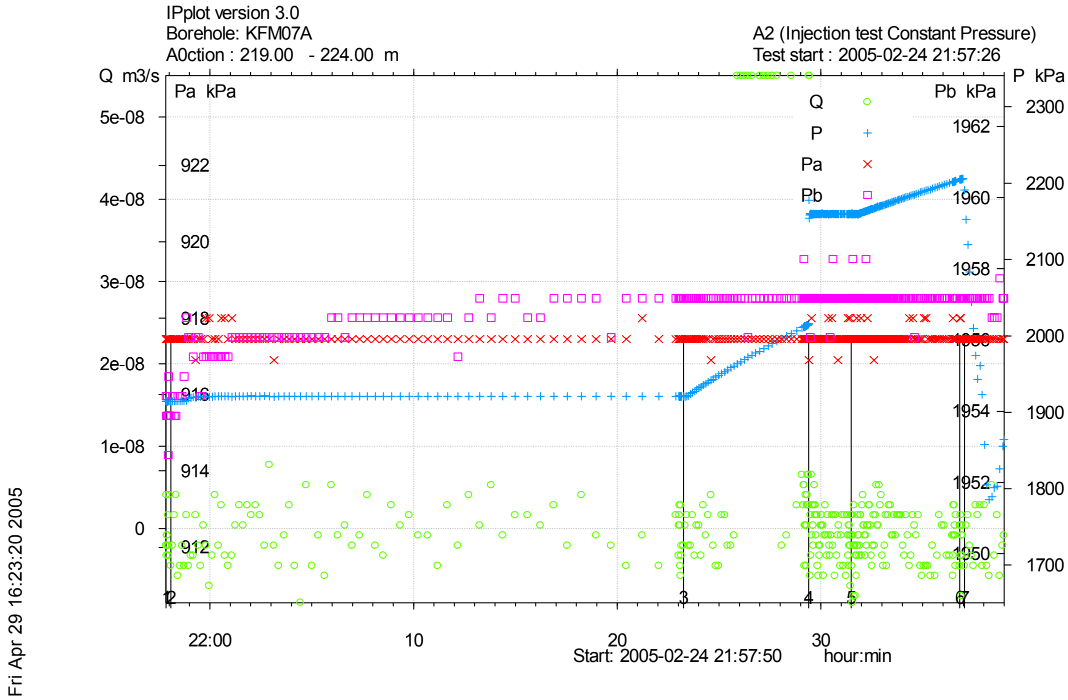


Figure A3-149. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 219.0-224.0 m in borehole KFM07A.*

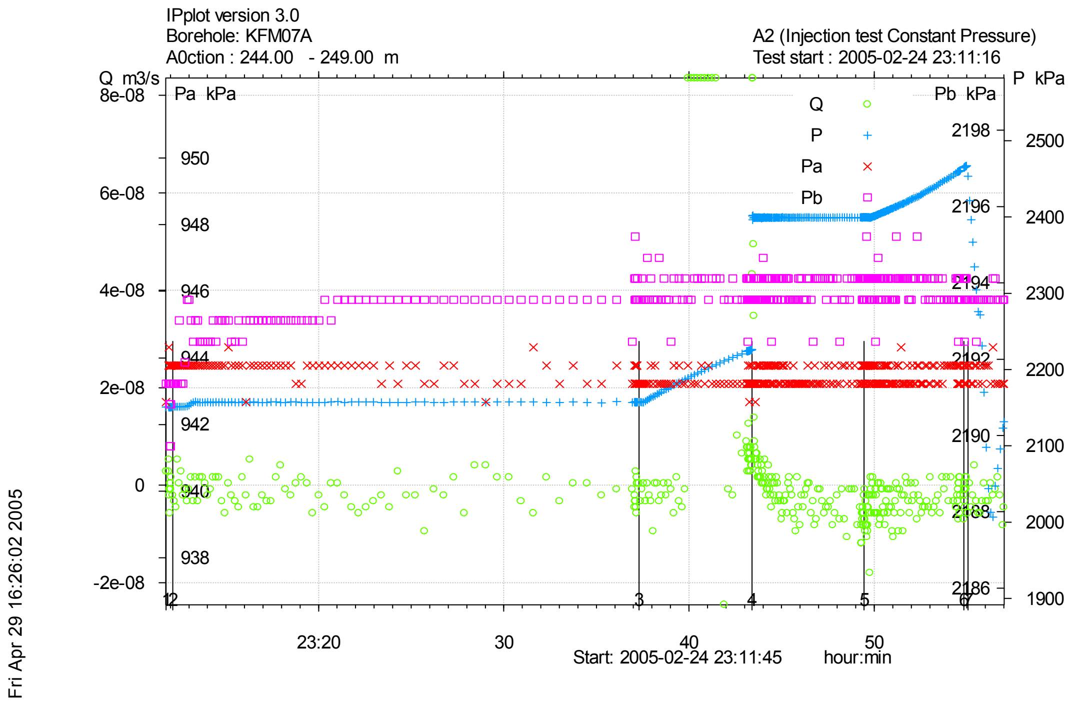


Figure A3-150. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 244.0-249.0 m in borehole KFM07A.*

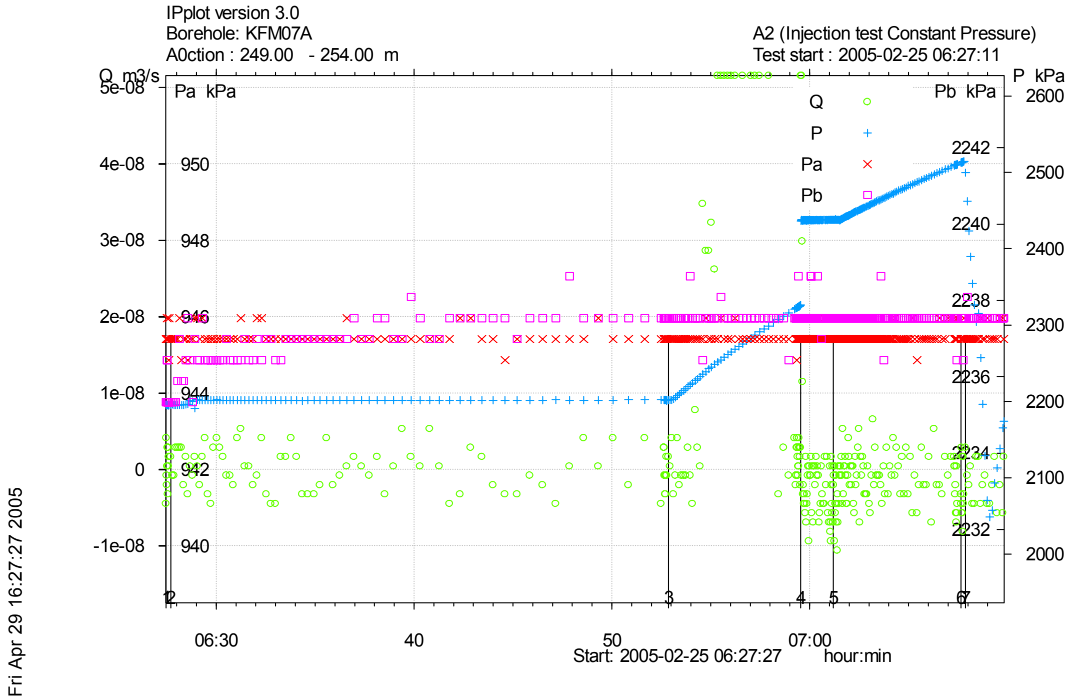


Figure A3-151. Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 249.0-254.0 m in borehole KFM07A.

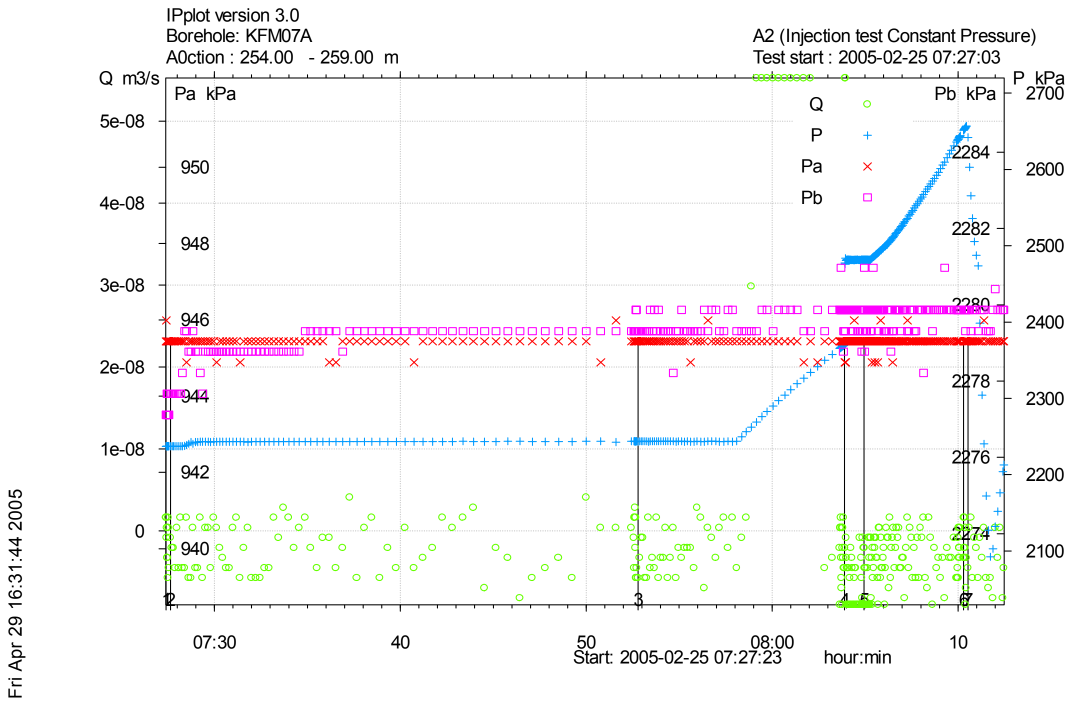


Figure A3-152. Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 254.0-259.0 m in borehole KFM07A.

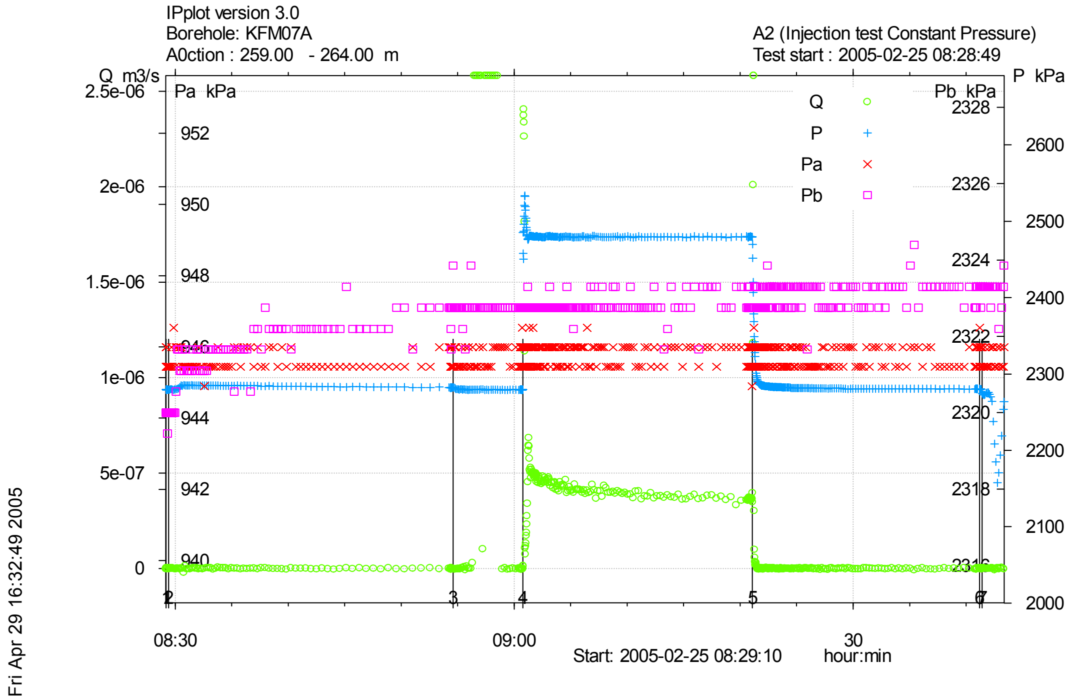


__Figure A3-153.__ Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 259.0-264.0 m in borehole KFM07A.

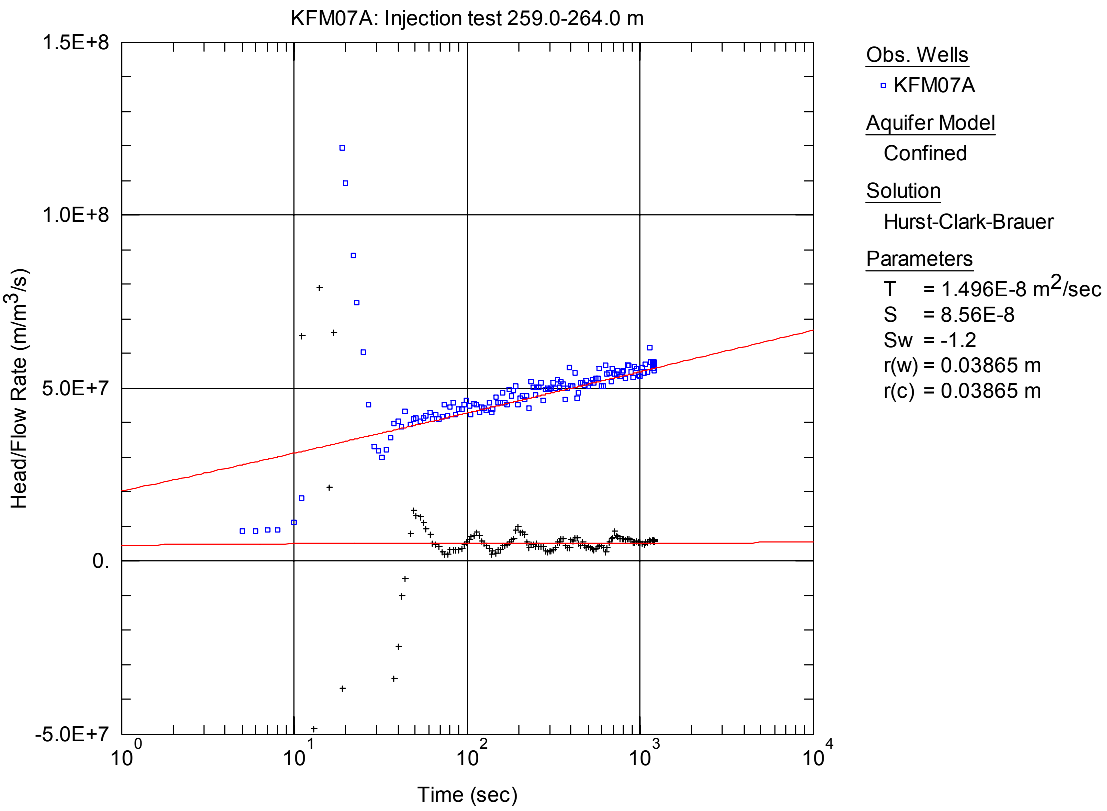


__Figure A3-154.__ Lin-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 259.0-264.0 m in KFM07A.

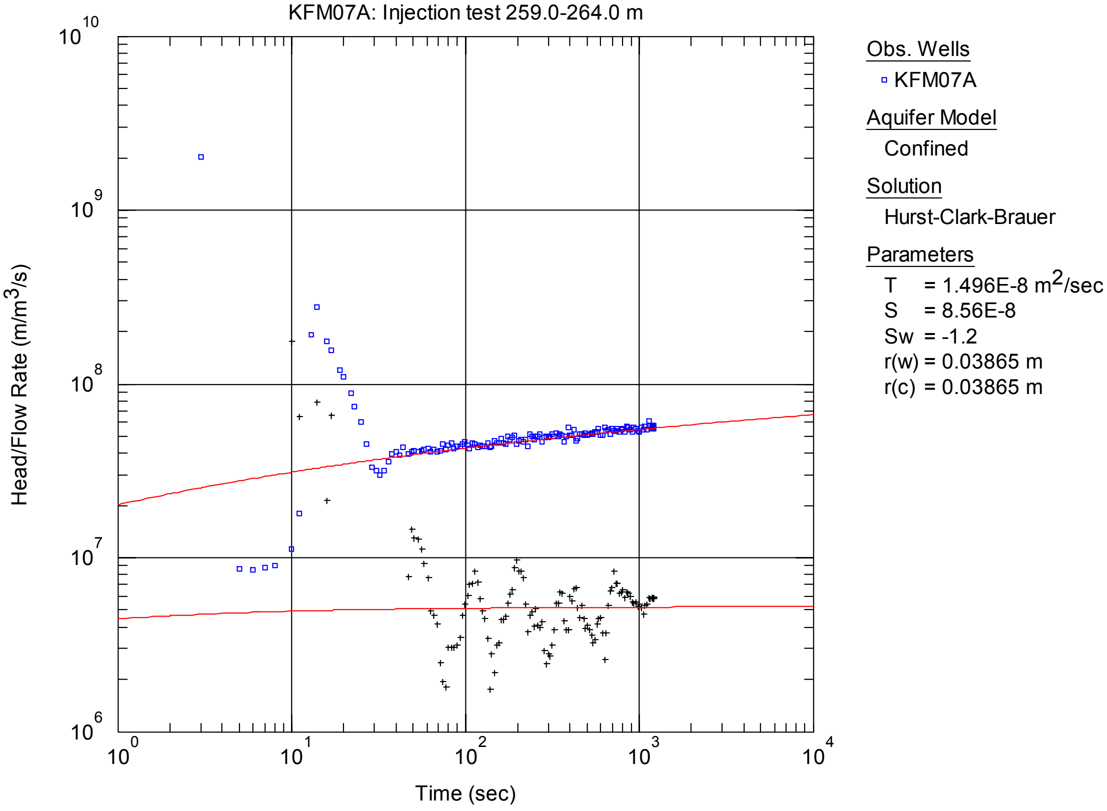


Figure A3-155. *Log-log plot of head/flow rate (□) and derivative (+) versus time, from the injection test in section 259.0-264.0 m in KFM07A.*

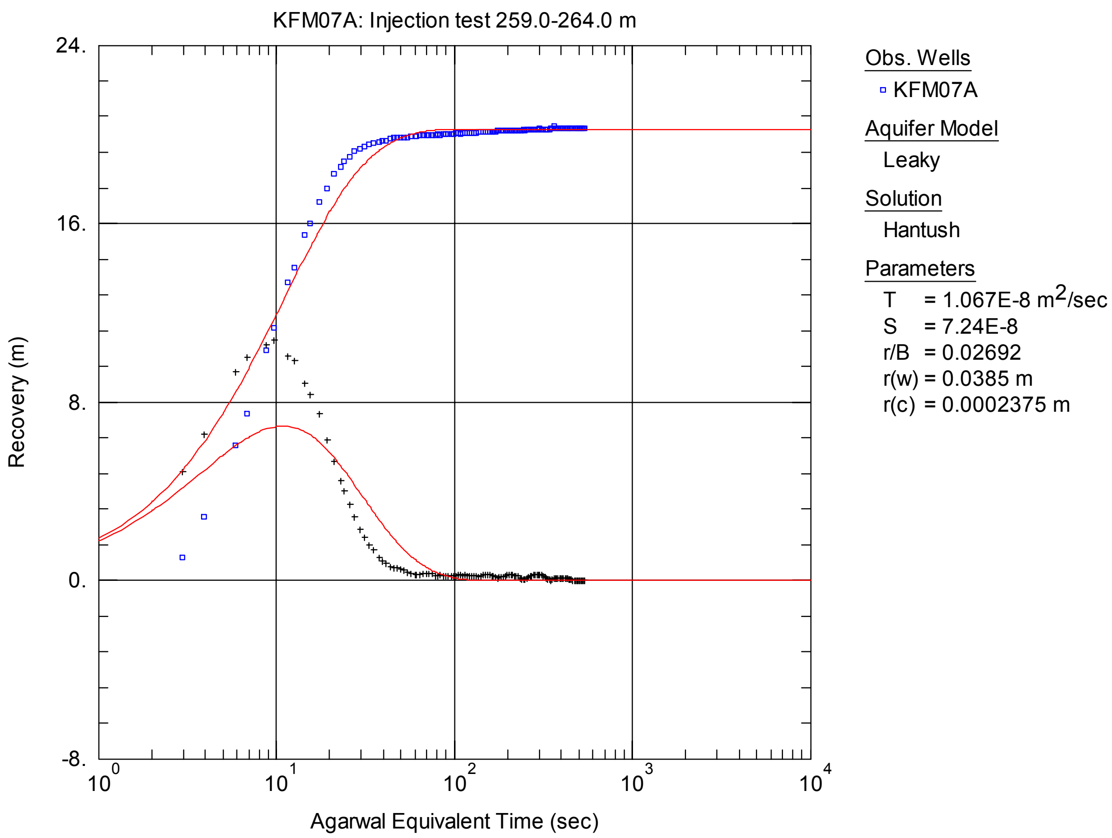


Figure A3-156. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 259.0-264.0 m in KFM07A.*

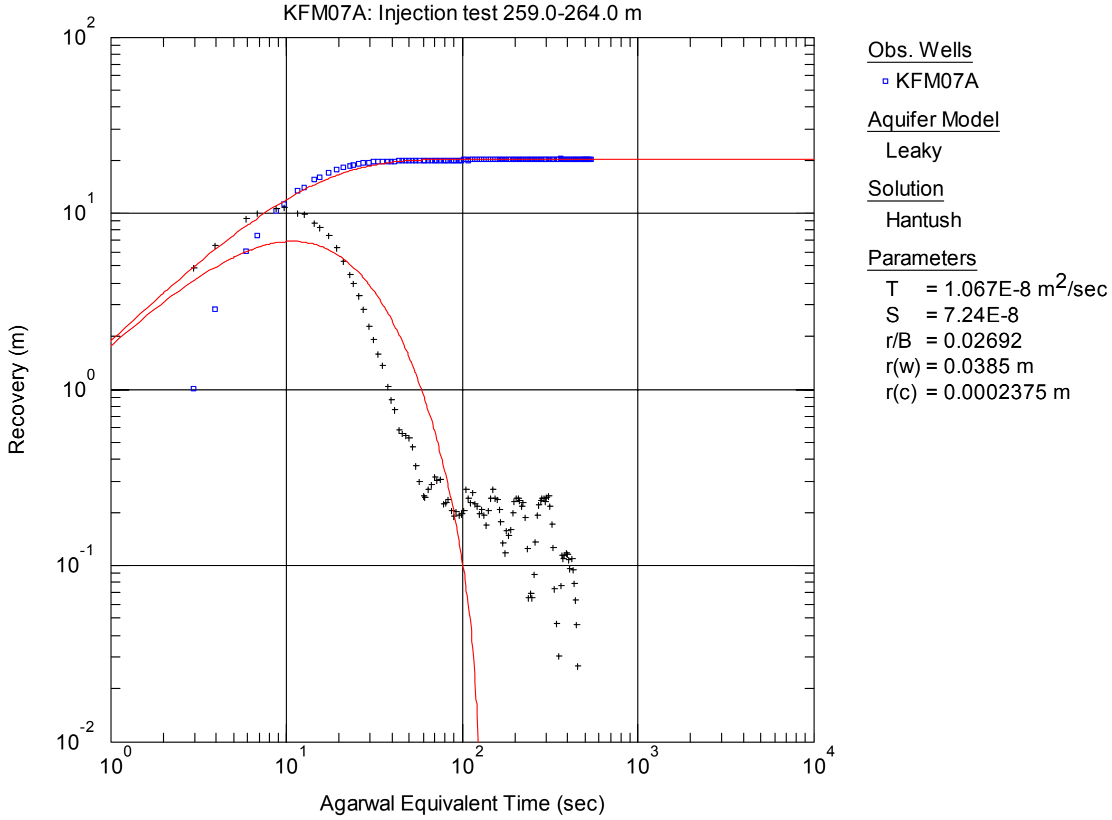


Figure A3-157. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 259.0-264.0 m in KFM07A.*

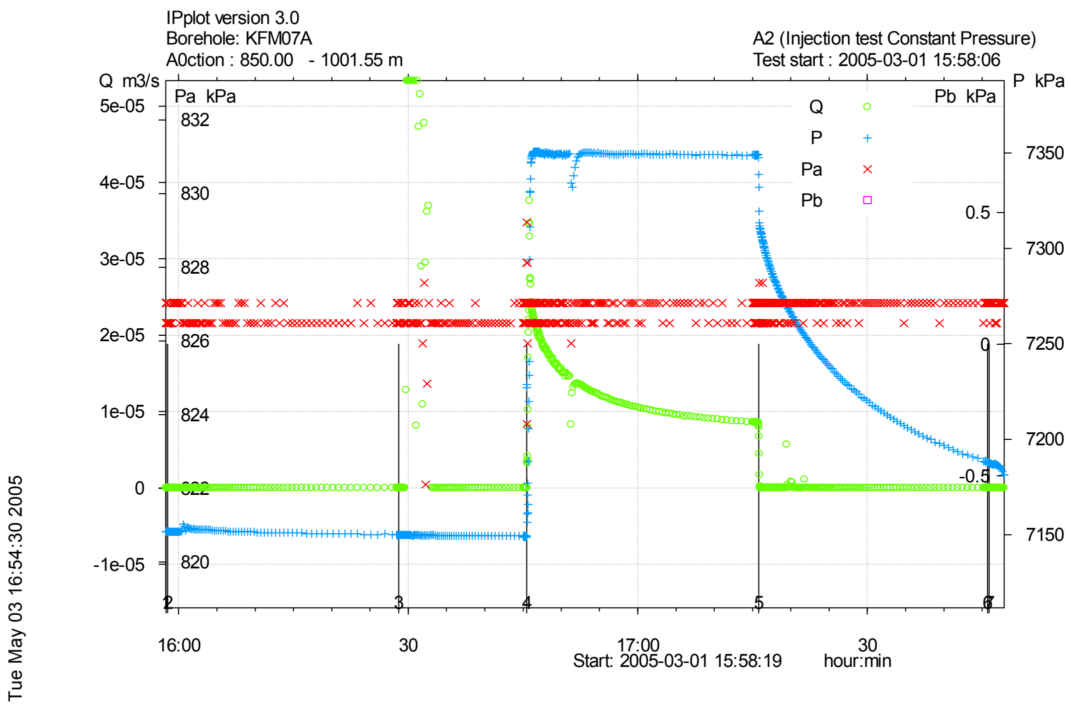


Figure A3-158. *Linear plot of flow rate (Q), pressure (P), pressure above section (Pa) and pressure below section (Pb) versus time from the injection test in section 850.0-1001.5 m in borehole KFM07A.*

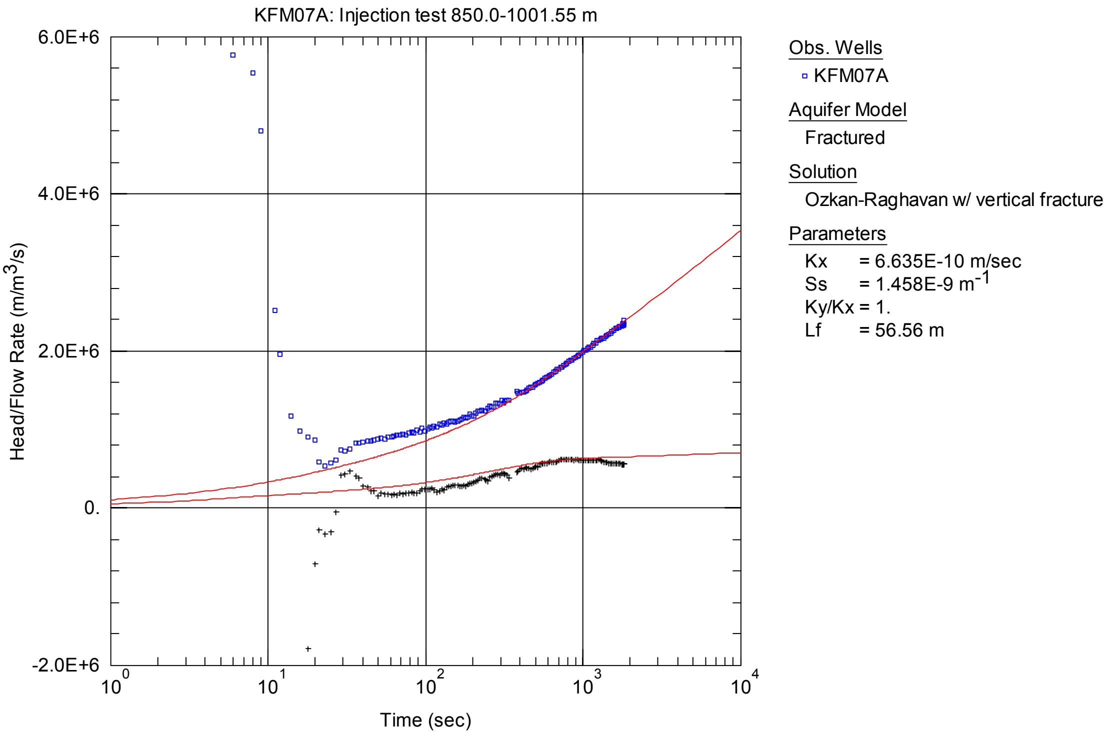


Figure A3-159. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, showing fit to the Ozkan-Raghavan solution from the injection test in section 850.0-1001.5 m in KFM07A.*

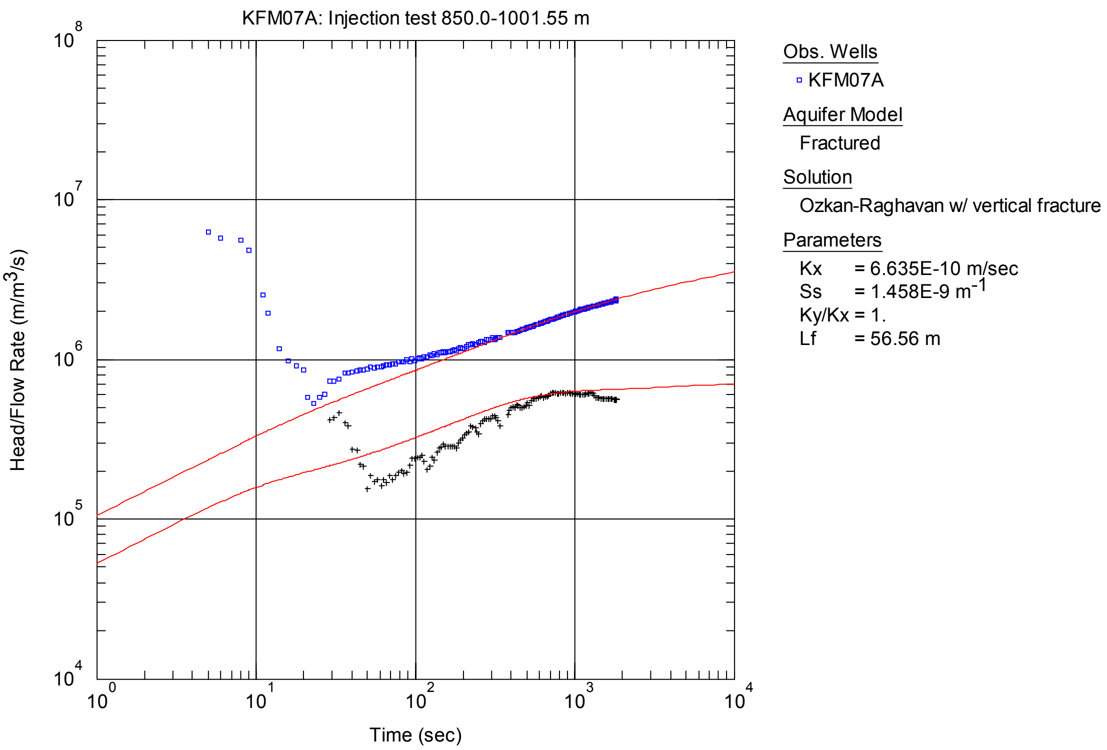


Figure A3-160. *Log-log plot of head/flow rate (□) and derivative (+) versus time, showing fit to the Ozkan-Raghavan solution from the injection test in section 850.0-1001.5 m in KFM07A.*

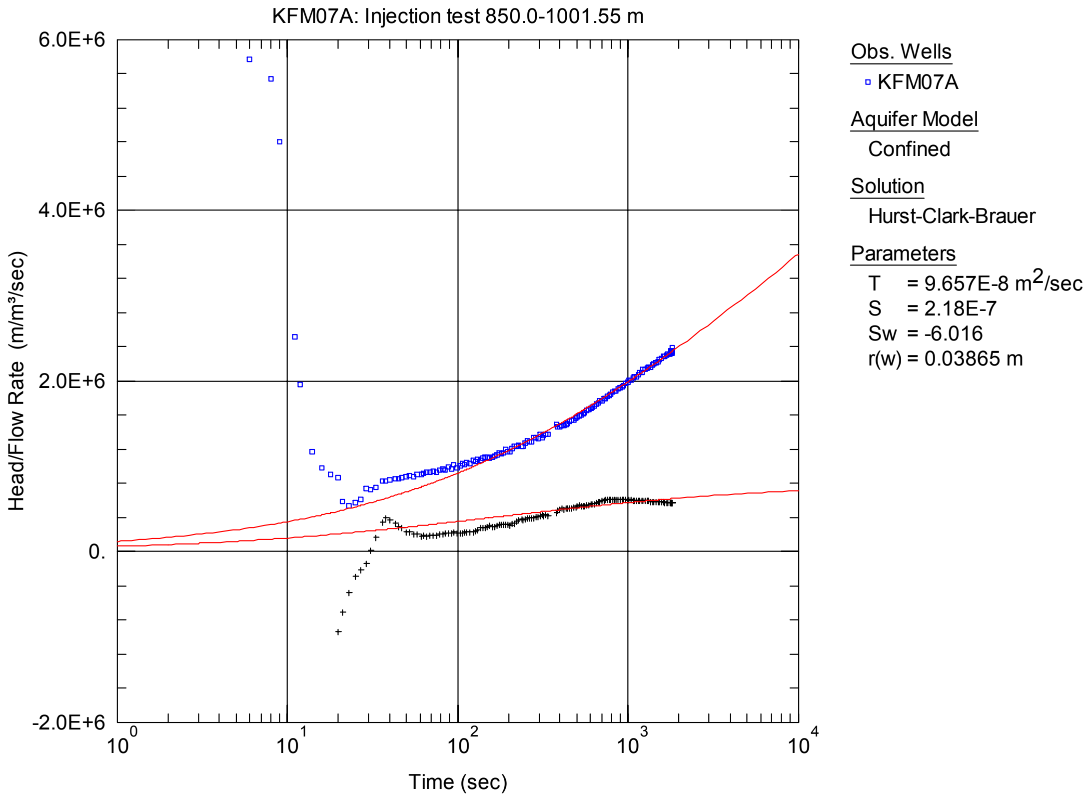


Figure A3-161. *Lin-log plot of head/flow rate (□) and derivative (+) versus time, showing fit to the Hurst-Clark-Brauer solution from the injection test in section 850.0-1001.5 m in KFM07A.*

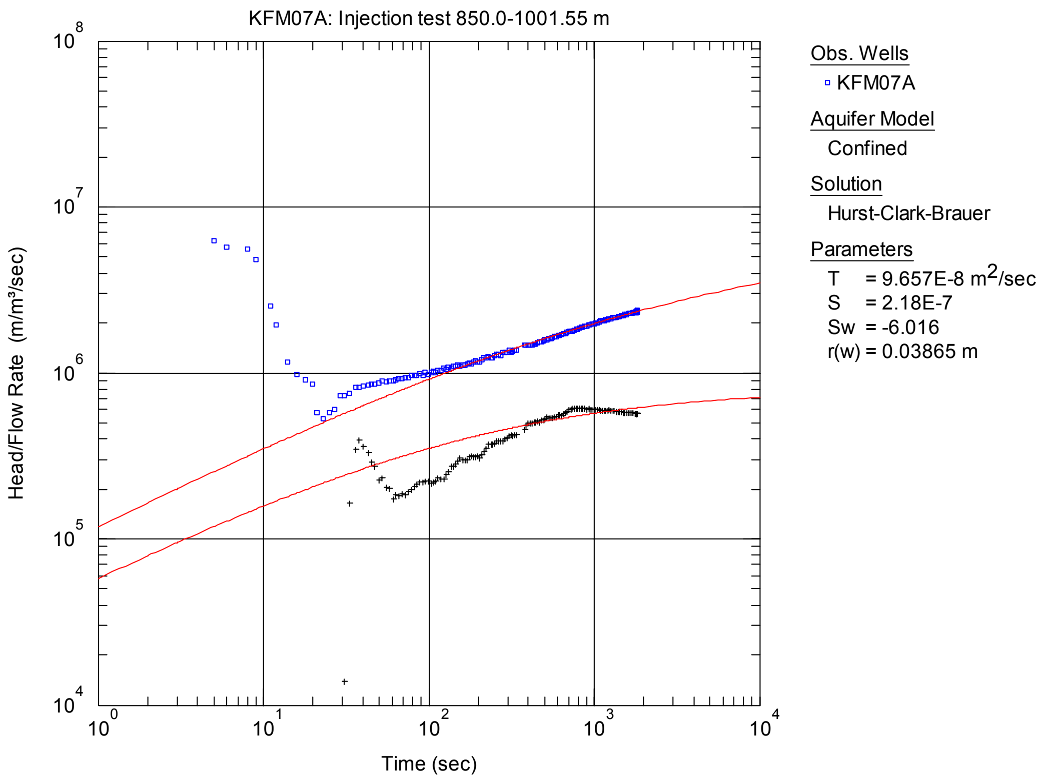


Figure A3-162. *Log-log plot of head/flow rate (□) and derivative (+) versus time, showing fit to the Hurst-Clark-Brauer solution from the injection test in section 850.0-1001.5 m in KFM07A.*

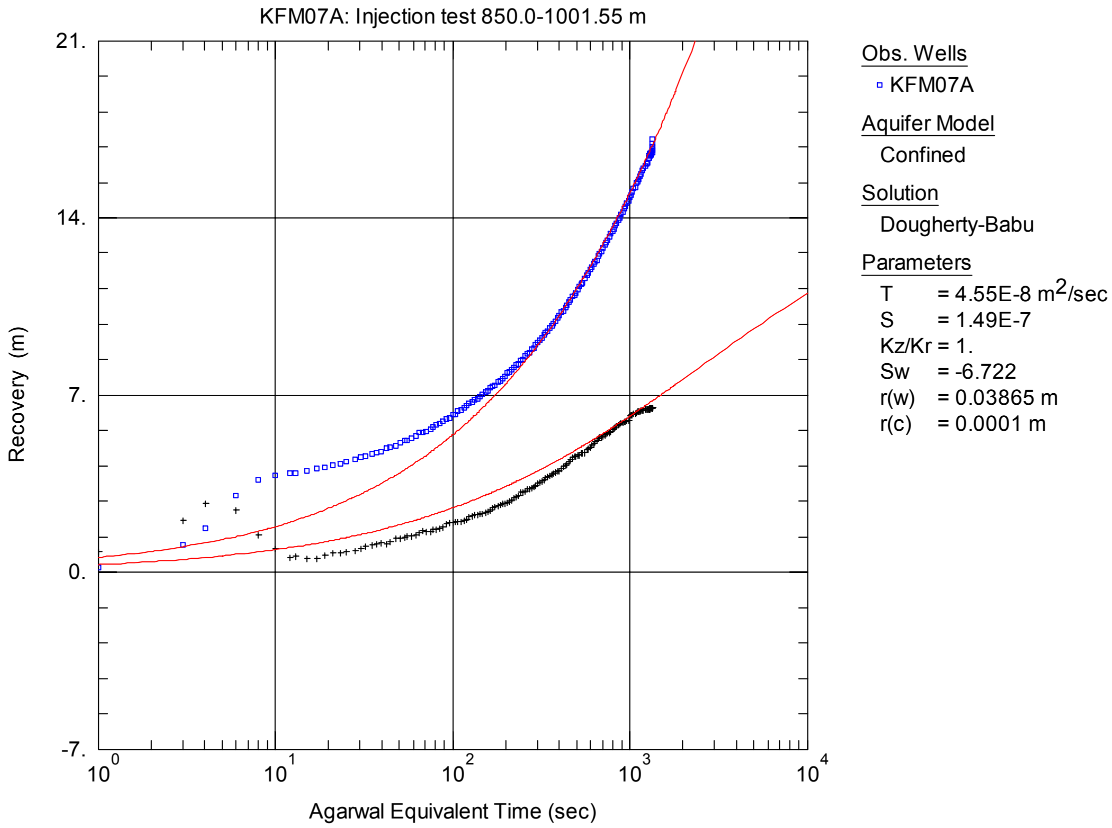


Figure A3-163. *Lin-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 850.0-1001.5 m in KFM07A.*

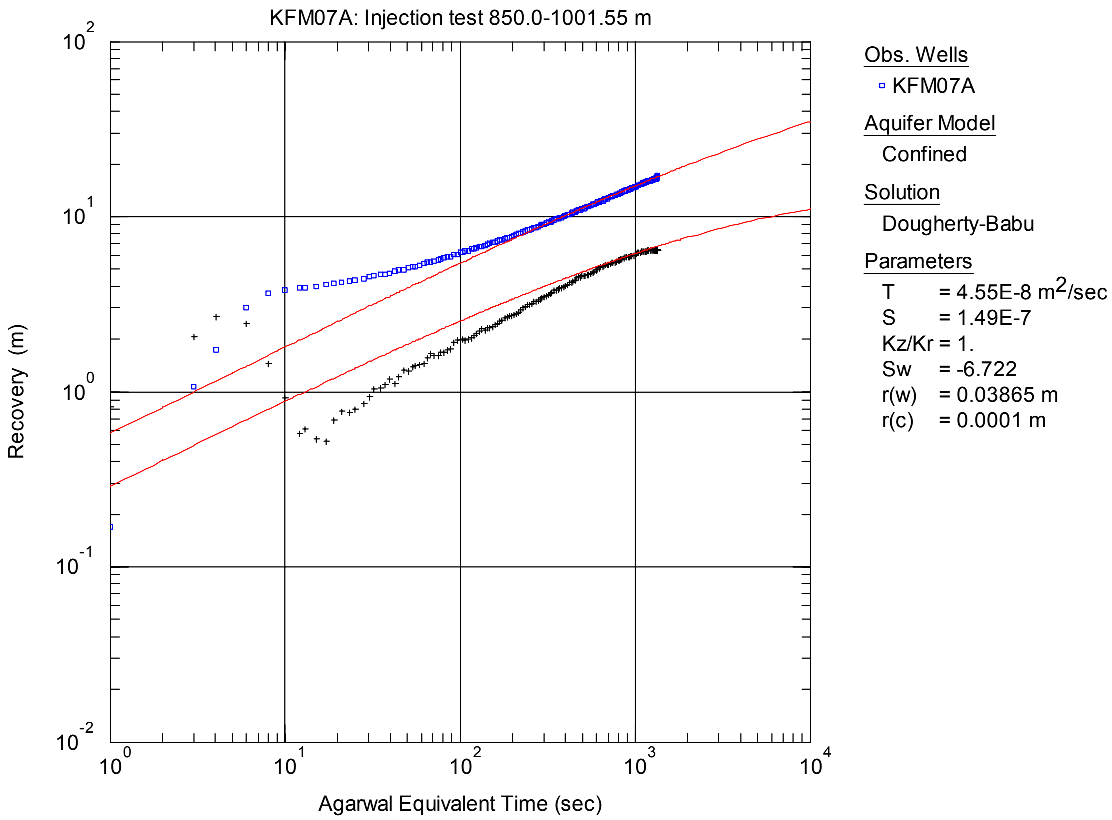
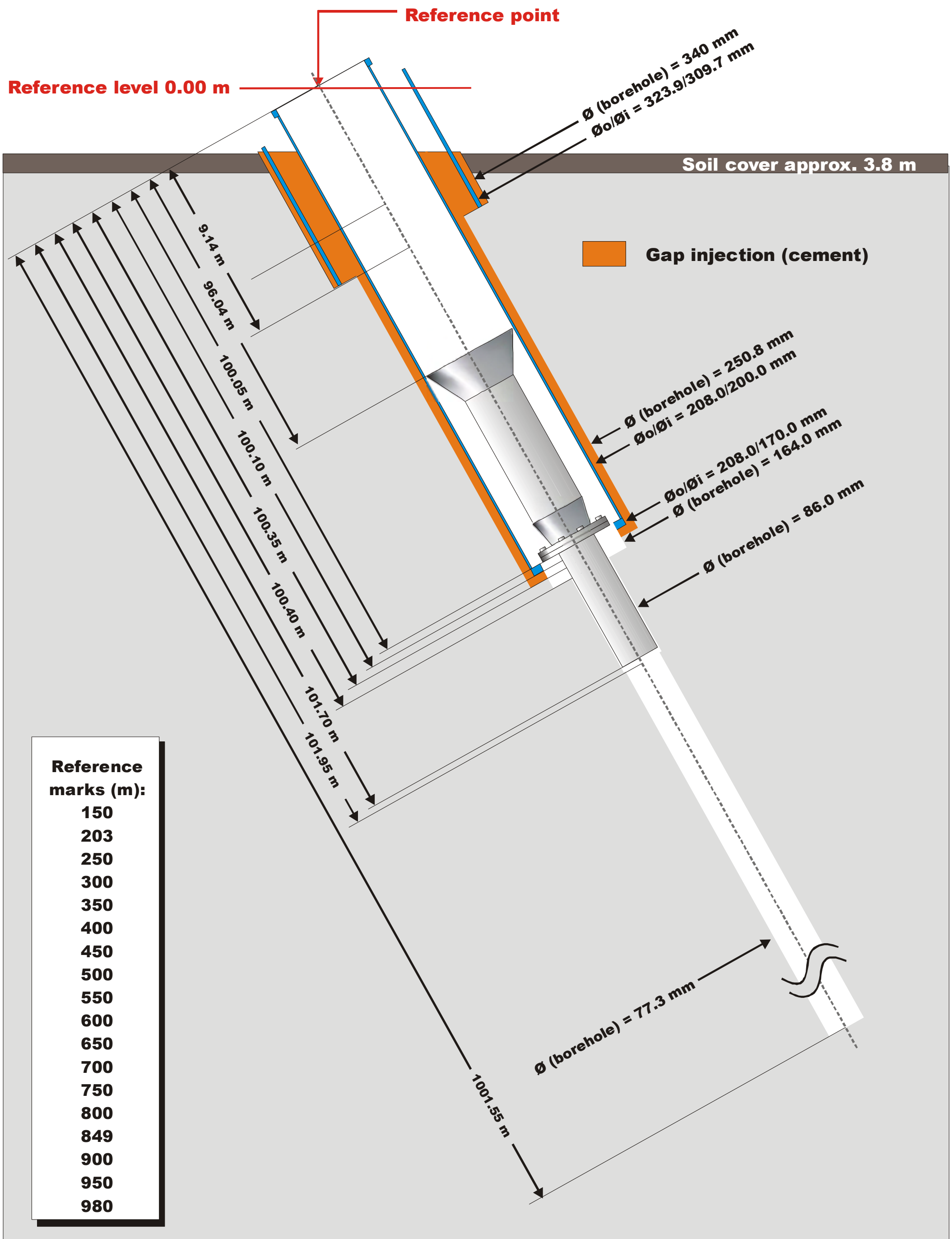


Figure A3-164. *Log-log plot of recovery (□) and derivative (+) versus equivalent time, from the injection test in section 850.0-1001.5 m in KFM07A.*

Appendix 4. Borehole technical data

Technical data
Borehole KFM07A



Drilling reference point

Northing: 6700127.08 (m), RT90 2,5 gon V 0:-15

Easting: 1631031.57 (m), RT90 2,5 gon V 0:-15

Elevation: 3.32 (m), RHB 70

Orientation

Bearing (degrees): 261.47°

Inclination (degrees): -59.22°

Borehole

Length: 1001.55 m

Percussion drilling period

Drilling start date:

Drilling stop date:

Core drilling period

Drilling start date: 2004-10-18

Drilling stop date: 2004-12-09

Appendix 5. Sicada tables

Nomenclature plu_s_hole_test_d

Column	Datatype	Unit	Column Description	Alt. Symbol
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-L**
q_measl__u	FLOAT	m**3/s	Estimated upper measurement limit of flow rate	Q-measl-U
tot_volume_vp	FLOAT	m**3	Total volume of pumped(positive) or injected(negative) 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_hp	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_pp	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.	

Column	Datatype	Unit	Column Description	Alt. Symbol
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	

Nomenclature plu_s_hole_test_ed1

Column	Datatype	Unit	Column Description	Alt. Symbol
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.	Q/s
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)	T_M
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)	K_M

Column	Datatype	Unit	Column Description	Alt. Symbol
formation_width_b	FLOAT	m	b:Aquifer thickness repr. for T(generally b=Lw) ,see descr.	b
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...	T_T
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	Q/s-measl-L
u_measl_q_s	FLOAT	m**2/s	Estimated upper meas. limit for evaluated TT,see description	Q/s-measl-U
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.	
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	C
cd	FLOAT		CD: Dimensionless wellbore storage coefficient	
skin	FLOAT		Skin factor;best estimate of flow/recovery period,see descr.	ξ
dt1	FLOAT	s	Estimated start time of evaluation, see table description	dt_1
dt2	FLOAT	s	Estimated stop time of evaluation. see table description	dt_2
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..	

Column	Datatype	Unit	Column Description	Alt. Symbol
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)	

Nomenclature plu_s_hole_test_obs

Column	Datatype	Unit	Column Description
site	CHAR		Investigation site name
activity_type	CHAR		Activity type code
idcode	CHAR		Object or borehole identification code
start_date	DATE		Date (yymmdd hh:mm:ss)
secup	FLOAT	m	Upper section limit (m)
seclow	FLOAT	m	Lower section limit (m)
obs_secup	FLOAT	m	Upper limit of observation section
obs_seclow	FLOAT	m	Lower limit of observation section
pi_above	FLOAT	kPa	Groundwater pressure above test section,start of flow period
pp_above	FLOAT	kPa	Groundwater pressure above test section,at stop flow period
pf_above	FLOAT	kPa	Groundwater pressure above test section at stop recovery per
pi_below	FLOAT	kPa	Groundwater pressure below test section at start flow period
pp_below	FLOAT	kPa	Groundwater pressure below test section at stop flow period
pf_below	FLOAT	kPa	Groundwater pressure below test section at stop recovery per
comments	VARCHAR		Comment text row (unformatted text)

Nomenclature plu_slug_test_ed

Column	Datatype	Unit	Column Description	Alt. Symbol
site	CHAR		Investigation site name	
idcode	CHAR		Object or borehole identification code	
secup	FLOAT	m		
seclow	FLOAT	m	Lower section limit (m)	
start_date	DATE		Date (yymmdd hh:mm:ss)	
stop_date	DATE		Date (yymmdd hh:mm:ss)	
activity_type	CHAR		Activity type code	
test_type	CHAR		Type of test, one of 7, see table description	
formation_type	CHAR		1: Rock, 2: Soil (superficial deposits)	
start_flow_period	DATE		Date and time of flow phase start (YYYYMMDD hhmmss)	
dur_flow_phase_tp	FLOAT	s	Time for the flowing phase of the test (tp)	
dur_rec_phase_tf	FLOAT	s	Time for the recovery phase of the test (tF)	
initial_head_h0	FLOAT	m	Initial formation hydraulic head, see table description	
initial_displacem_dh0	FLOAT	m	Initial displacement of hydraulic head,see table description	
displacem_dh0_p	FLOAT	m	Initial displacement of slugtest,see table description	
displacem_dh0_f	FLOAT	m	Initial displacement of bailtest,see table description	
head_at_flow_end_hp	FLOAT	m	Hydraulic head at end of flow phase,see table description	
final_head_hf	FLOAT	m	Hydraulic head at the end of the recovery,see table descr.	
initial_press_pi	FLOAT	kPa	Initial formation pressure	
initial_press_diff_dp0	FLOAT	kPa	Initial pressure change from pi at time dt=0,pulse test	
press_change_dp0_p	FLOAT	kPa	Initial pressure change;pulse test-measured	
press_at_flow_end_pp	FLOAT	kPa	Final pressure at the end of the flowing period	
final_press_pf	FLOAT	kPa	Final pressure at the end of the recovery period	
formation_width_b	FLOAT	m	b:Interpreted formation thickness repr. for evaluated T,see	
transmissivity_ts	FLOAT	m**2/s	Ts: Transmissivity based on slugtest, see table description	
value_type_ts	CHAR		0:true value,-1:Ts<lower meas.limit,1:Ts>upper meas.limit	
bc_ts	CHAR		Best choice code.1 means Ts is best choice of transm.,else 0	
transmissivity_tp	FLOAT	m**2/s	TP: Transmissivity based on pulse test, see table descript.	
value_type_tp	CHAR		0:true value,-1:Tp<lower meas.limit,1:Tp>upper meas.limit	
bc_tp	CHAR		Best choice code.1 means Tp is best choice of transm.,else 0	

Column	Datatype	Unit	Column Description	Alt. Symbol
l_meas_limit_t	FLOAT	m**2	Estimated lower measurement limit for Ts orTp,see descript.	
u_meas_limit_t	FLOAT	m**2	Estimated upper measurement limit for Ts & Tp, see descript.	
storativity_s	FLOAT		S= Storativity, see table description	
assumed_s	FLOAT		S*=assumed storativity, see table description	
skin	FLOAT		Skin factor	
assumed_skin	FLOAT		Asumed skin factor	
c	FLOAT	m**3/pa	Well bore storage coefficient	
fluid_temp_tew	FLOAT	oC	Fluid temperature in the test section, see table description	
fluid_elcond_ecw	FLOAT	mS/m	Fluid electric conductivity in test section,see table descri	
fluid_salinity_tdsw	FLOAT	mg/l	Total salinity of the test section fluid (EC), see descr.	
fluid_salinity_tdswm	FLOAT	mg/l	Total salinity of the test section fluid (samples),see descr	
dt1	FLOAT	s	Estimated start time of evaluation, see table description	
dt2	FLOAT	s	Estimated stop time of evaluation, see table description	
reference	CHAR		SKB report No for reports describing data and evaluation	
comments	CHAR		Short comment to evaluated parameters	

KFM07A plu_s_hole_test_d. Left (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	start_flow_period	stop_flow_period	flow_rate_end_qp	value_type_qp	mean_flow_rate_qm
KFM07A	2005-02-16 06:40	2005-02-16 08:38	104.00	204.00	3	1	2005-02-16 07:36:08	2005-02-16 08:05:54	6.5900E-04	0	6.6470E-04
KFM07A	2005-02-16 10:52	2005-02-16 13:41	204.00	304.00	3	1	2005-02-16 12:38:33	2005-02-16 13:08:56	1.3500E-07	0	1.9610E-07
KFM07A	2005-02-16 15:27	2005-02-16 16:35	304.00	404.00	3	1	2005-02-16 16:14:12	2005-02-16 16:26:47		-1	
KFM07A	2005-02-16 17:44	2005-02-16 19:33	404.00	504.00	3	1	2005-02-16 18:31:12	2005-02-16 19:01:17	6.1590E-09	0	3.9630E-08
KFM07A	2005-02-16 20:53	2005-02-16 21:54	504.00	604.00	3	1	2005-02-16 21:39:26	2005-02-16 21:44:43		-1	
KFM07A	2005-02-16 23:04	2005-02-17 00:03	604.00	704.00	3	1	2005-02-16 23:51:48	2005-02-16 23:56:23		-1	
KFM07A	2005-02-17 08:14	2005-02-17 09:23	704.00	804.00	3	1	2005-02-17 09:02:13	2005-02-17 09:10:02		-1	
KFM07A	2005-02-17 14:13	2005-02-17 15:25	750.00	850.00	3	1	2005-02-17 15:02:16	2005-02-17 15:12:51		-1	
KFM07A	2005-02-22 06:58	2005-02-22 08:13	104.00	124.00	3	1	2005-02-22 07:31:26	2005-02-22 07:51:32	6.8070E-04	0	6.8250E-04

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	start_flow_period	stop_flow_period	flow_rate_end_qp	value_type_qp	mean_flow_rate_qm
KFM07A	2005-02-21 06:10	2005-02-21 07:25	124.00	144.00	3	1	2005-02-21 06:43:18	2005-02-21 07:03:34	8.1790E-05	0	8.8660E-05
KFM07A	2005-02-21 07:47	2005-02-21 09:01	144.00	164.00	3	1	2005-02-21 08:19:19	2005-02-21 08:39:38	1.7000E-06	0	2.0540E-06
KFM07A	2005-02-21 09:21	2005-02-21 10:40	164.00	184.00	3	1	2005-02-21 09:57:57	2005-02-21 10:18:10	4.7660E-04	0	4.9170E-04
KFM07A	2005-02-21 10:56	2005-02-21 12:53	184.00	204.00	3	1	2005-02-21 12:11:12	2005-02-21 12:31:33	2.2480E-07	0	2.7280E-07
KFM07A	2005-02-21 13:11	2005-02-21 14:28	204.00	224.00	3	1	2005-02-21 13:45:34	2005-02-21 14:05:54	2.4000E-08	0	5.6630E-08
KFM07A	2005-02-21 21:34	2005-02-21 23:31	244.00	264.00	3	1	2005-02-21 22:49:21	2005-02-21 23:09:39	2.2900E-07	0	2.6000E-07
KFM07A	2005-02-21 18:52	2005-02-21 19:41	264.00	284.00	3	1	2005-02-21 19:25:46	2005-02-21 19:33:15		-1	
KFM07A	2005-02-21 20:02	2005-02-21 21:05	284.00	304.00	3	1	2005-02-21 20:53:26	2005-02-21 20:56:34		-1	
KFM07A	2005-02-22 17:33	2005-02-22 18:54	104.00	109.00	3	1	2005-02-22 18:12:01	2005-02-22 18:32:21	5.0430E-07	0	5.9840E-07
KFM07A	2005-02-22 19:10	2005-02-22 20:27	109.00	114.00	3	1	2005-02-22 19:45:05	2005-02-22 20:05:25	5.3200E-05	0	6.0070E-05
KFM07A	2005-02-22 21:05	2005-02-22 22:24	114.00	119.00	3	1	2005-02-22 21:41:42	2005-02-22 22:01:58	9.9700E-06	0	1.0370E-05
KFM07A	2005-02-22 22:40	2005-02-22 23:58	119.00	124.00	3	1	2005-02-22 23:15:40	2005-02-22 23:35:56	6.0630E-04	0	6.3240E-04
KFM07A	2005-02-23 06:32	2005-02-23 07:47	124.00	129.00	3	1	2005-02-23 07:04:43	2005-02-23 07:25:01	1.9810E-06	0	2.2350E-06
KFM07A	2005-02-23 08:02	2005-02-23 10:05	127.00	132.00	3	1	2005-02-23 09:23:07	2005-02-23 09:43:24	1.3560E-07	0	1.4880E-07
KFM07A	2005-02-23 10:22	2005-02-23 11:51	132.00	137.00	3	1	2005-02-23 11:08:30	2005-02-23 11:28:46	6.7280E-05	0	6.8120E-05
KFM07A	2005-02-23 12:44	2005-02-23 13:58	137.00	142.00	3	1	2005-02-23 13:15:36	2005-02-23 13:35:53	3.1220E-07	0	3.4380E-07
KFM07A	2005-02-23 14:04	2005-02-23 15:21	139.00	144.00	3	1	2005-02-23 14:39:13	2005-02-23 14:59:31	5.4880E-06	0	6.5620E-06
KFM07A	2005-02-23 15:55	2005-02-23 17:20	144.00	149.00	3	1	2005-02-23 16:37:39	2005-02-23 16:57:56	1.4370E-06	0	1.7130E-06
KFM07A	2005-02-23 17:37	2005-02-23 18:54	149.00	154.00	3	1	2005-02-23 18:11:33	2005-02-23 18:31:53	2.3230E-08	0	4.3630E-08
KFM07A	2005-02-23 19:10	2005-02-23 20:29	154.00	159.00	3	1	2005-02-23 19:46:38	2005-02-23 20:06:58	1.8290E-08	0	2.2000E-08
KFM07A	2005-02-23 21:01	2005-02-23 22:07	159.00	164.00	3	1	2005-02-23 21:34:24	2005-02-23 21:54:29		-1	
KFM07A	2005-02-23 22:28	2005-02-23 23:11	164.00	169.00	3	1	2005-02-23 23:00:14	2005-02-23 23:03:22		-1	
KFM07A	2005-02-24 06:15	2005-02-24 06:57	169.00	174.00	3	1	2005-02-24 06:46:45	2005-02-24 06:48:16		-1	
KFM07A	2005-02-24 07:42	2005-02-24 08:29	171.50	176.50	3	1	2005-02-24 08:15:42	2005-02-24 08:17:10		-1	
KFM07A	2005-02-24 08:41	2005-02-24 10:09	176.50	181.50	3	1	2005-02-24 09:27:05	2005-02-24 09:47:21	4.5990E-04	0	4.7670E-04
KFM07A	2005-02-24 10:23	2005-02-24 11:44	181.50	186.50	3	1	2005-02-24 11:01:40	2005-02-24 11:21:57	2.1170E-07	0	2.7500E-07
KFM07A	2005-02-24 12:24	2005-02-24 13:09	184.00	189.00	3	1	2005-02-24 12:56:05	2005-02-24 13:00:24		-1	
KFM07A	2005-02-24 14:49	2005-02-24 16:40	194.00	199.00	3	1	2005-02-24 15:57:51	2005-02-24 16:18:09	1.7640E-07	0	2.0610E-07
KFM07A	2005-02-24 16:58	2005-02-24 18:14	199.00	204.00	3	1	2005-02-24 17:31:45	2005-02-24 17:52:03	1.0000E-07	0	1.1480E-07
KFM07A	2005-02-24 18:35	2005-02-24 19:31	204.00	209.00	3	1	2005-02-24 19:07:07	2005-02-24 19:18:14		-1	
KFM07A	2005-02-24 19:54	2005-02-24 20:45	209.00	214.00	3	1	2005-02-24 20:35:41	2005-02-24 20:37:47		-1	

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	start_flow_period	stop_flow_period	flow_rate_end_qp	value_type_qp	mean_flow_rate_qm
KFM07A	2005-02-24 21:01	2005-02-24 21:43	214.00	219.00	3	1	2005-02-24 21:33:30	2005-02-24 21:36:27		-1	
KFM07A	2005-02-24 21:57	2005-02-24 22:38	219.00	224.00	3	1	2005-02-24 22:29:24	2005-02-24 22:31:30		-1	
KFM07A	2005-02-24 23:11	2005-02-24 23:57	244.00	249.00	3	1	2005-02-24 23:43:24	2005-02-24 23:49:28		-1	
KFM07A	2005-02-25 06:27	2005-02-25 07:09	249.00	254.00	3	1	2005-02-25 06:59:33	2005-02-25 07:01:13		-1	
KFM07A	2005-02-25 07:27	2005-02-25 08:12	254.00	259.00	3	1	2005-02-25 08:03:54	2005-02-25 08:04:58		-1	
KFM07A	2005-02-25 08:28	2005-02-25 09:43	259.00	264.00	3	1	2005-02-25 09:00:46	2005-02-25 09:21:03	3.6290E-07	0	4.0270E-07
KFM07A	2005-03-01 15:58	2005-03-01 17:47	850.00	1001.55	3	1	2005-03-01 16:45:28	2005-03-01 17:15:48	8.5610E-06	0	1.1680E-05

KFM07A plu_s_hole_test_d. Right (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	secup	seclow	q_measl__l	q_measl__u	tot_volume_vp	dur_flow_phase_tp	dur_rec_phase_tf	initial_press_pi	press_at_flow_end_pp	final_press_pf	fluid_temp_tew	reference	comments
KFM07A	104.00	204.00	1.67E-08	1.00E-03	1.19E+00	1786.00	1814.00	969.84	975.90	969.84	11.56		
KFM07A	204.00	304.00	1.67E-08	1.00E-03	3.58E-04	1823.00	1803.00	1814.74	2020.06	1844.99	7.89		
KFM07A	304.00	404.00	5.00E-09	1.00E-03		755.00	374.00	2671.06	2841.72	2838.42	8.81		
KFM07A	404.00	504.00	5.00E-09	1.00E-03	7.15E-05	1805.00	1821.00	3483.66	3702.03	3670.69	9.74		
KFM07A	504.00	604.00	5.00E-09	1.00E-03		317.00	440.00	4325.81	4529.89	4528.23	10.68		
KFM07A	604.00	704.00	7.00E-09	1.00E-03		275.00	324.00	5146.38	5348.12	5348.39	11.66		
KFM07A	704.00	804.00	5.00E-09	1.00E-03		469.00	675.00	5951.82	6154.52	6152.59	12.69		
KFM07A	750.00	850.00	7.50E-09	1.00E-03		635.00	659.00	6333.02	6522.52	6521.14	13.18		
KFM07A	104.00	124.00	1.67E-08	1.00E-03	8.30E-01	1206.00	1206.00	960.10	967.76	960.05	10.20		
KFM07A	124.00	144.00	1.67E-08	1.00E-03	1.08E-01	1216.00	1210.00	1135.39	1381.41	1135.53	7.21		
KFM07A	144.00	164.00	1.67E-08	1.00E-03	2.51E-03	1219.00	1206.00	1306.33	1511.78	1313.75	7.45		
KFM07A	164.00	184.00	1.67E-08	1.00E-03	5.95E-01	1213.00	1213.00	1477.12	1667.40	1477.67	9.67		
KFM07A	184.00	204.00	1.67E-08	1.00E-03	3.33E-04	1221.00	1206.00	1648.74	1850.62	1663.04	7.88		
KFM07A	204.00	224.00	1.67E-08	1.00E-03	6.91E-05	1220.00	1205.00	1833.03	2022.79	1953.48	7.92		
KFM07A	244.00	264.00	1.67E-08	1.00E-03	3.18E-04	1218.00	1205.00	2154.67	2354.48	2154.81	8.27		
KFM07A	264.00	284.00	8.00E-09	1.00E-03		449.00	346.00	2345.27	2554.15	2536.56	8.46		
KFM07A	284.00	304.00	8.00E-09	1.00E-03		188.00	389.00	2546.32	2723.58	2741.18	8.65		
KFM07A	104.00	109.00	1.67E-08	1.00E-03	7.32E-04	1220.00	1203.00	959.24	1159.24	970.37	7.14		
KFM07A	109.00	114.00	1.67E-08	1.00E-03	7.33E-02	1220.00	1205.00	1000.76	1206.91	1000.62	7.10		
KFM07A	114.00	119.00	1.67E-08	1.00E-03	1.26E-02	1216.00	1206.00	1043.12	1251.46	1042.98	7.12		
KFM07A	119.00	124.00	1.67E-08	1.00E-03	7.71E-01	1216.00	1206.00	1085.90	1093.04	1086.44	11.58		
KFM07A	124.00	129.00	1.67E-08	1.00E-03	2.73E-03	1218.00	1206.00	1129.34	1343.73	1129.90	7.25		
KFM07A	127.00	132.00	1.67E-08	1.00E-03	1.82E-04	1217.00	1206.00	1155.20	1377.98	1155.20	7.27		
KFM07A	132.00	137.00	1.67E-08	1.00E-03	8.29E-02	1216.00	1209.00	1198.10	1399.43	1198.10	7.18		
KFM07A	137.00	142.00	1.67E-08	1.00E-03	4.19E-04	1217.00	1206.00	1242.79	1443.16	1244.86	7.36		
KFM07A	139.00	144.00	1.67E-08	1.00E-03	7.99E-03	1218.00	1208.00	1257.51	1491.29	1257.51	7.34		

idcode	secup	seclow	q_measl__l	q_measl__u	tot_volume_vp	dur_flow_phase_tp	dur_rec_phase_tf	initial_press_pi	press_at_flow_end_pp	final_press_pf	fluid_temp_tew	reference	comments
KFM07A	144.00	149.00	1.67E-08	1.00E-03	2.09E-03	1217.00	1206.00	1300.42	1502.02	1306.47	7.43		
KFM07A	149.00	154.00	1.67E-08	1.00E-03	5.34E-05	1220.00	1203.00	1352.12	1551.80	1397.78	7.44		
KFM07A	154.00	159.00	1.67E-08	1.00E-03	2.66E-05	1220.00	1219.00	1422.53	1609.28	1420.88	7.48		
KFM07A	159.00	164.00	2.00E-09	1.00E-03		1205.00	645.00	1485.10	1654.53	1635.40	7.54		
KFM07A	164.00	169.00	2.50E-09	1.00E-03		188.00	379.00	1608.04	1691.38	1720.67	7.60		
KFM07A	169.00	174.00	3.00E-09	1.00E-03		91.00	404.00	1595.25	1738.68	1737.72	7.72		
KFM07A	171.50	176.50	5.00E-09	1.00E-03		88.00	588.00	1557.71	1762.48	1769.62	7.76		
KFM07A	176.50	181.50	1.67E-08	1.00E-03	5.78E-01	1216.00	1209.00	1576.25	1799.88	1577.10	8.83		
KFM07A	181.50	186.50	1.67E-08	1.00E-03	3.36E-04	1217.00	1206.00	1623.99	1845.53	1637.06	7.80		
KFM07A	184.00	189.00	6.00E-09	1.00E-03		259.00	392.00	1723.56	1888.44	1838.38	7.80		
KFM07A	194.00	199.00	1.67E-08	1.00E-03	2.51E-04	1218.00	1206.00	1730.58	1970.30	1742.67	7.83		
KFM07A	199.00	204.00	1.67E-08	1.00E-03	1.40E-04	1218.00	1206.00	1777.32	2011.71	1780.08	7.86		
KFM07A	204.00	209.00	2.25E-09	1.00E-03		667.00	648.00	1891.60	2057.31	2011.11	7.90		
KFM07A	209.00	214.00	5.00E-09	1.00E-03		126.00	321.00	1950.46	2100.63	2153.57	7.95		
KFM07A	214.00	219.00	5.00E-09	1.00E-03		177.00	321.00	1978.11	2143.13	2176.67	7.99		
KFM07A	219.00	224.00	5.00E-09	1.00E-03		126.00	320.00	2014.96	2159.62	2202.53	8.01		
KFM07A	244.00	249.00	5.00E-09	1.00E-03		364.00	323.00	2225.78	2399.46	2461.07	8.28		
KFM07A	249.00	254.00	5.00E-09	1.00E-03		100.00	387.00	2325.61	2437.96	2510.58	8.33		
KFM07A	254.00	259.00	3.00E-09	1.00E-03		64.00	321.00	2370.16	2481.55	2644.23	8.37		
KFM07A	259.00	264.00	1.67E-08	1.00E-03	4.91E-04	1217.00	1206.00	2279.41	2479.76	2280.65	8.41		
KFM07A	850.00	1001.55	1.67E-08	1.00E-03	2.13E-02	1820.00	1794.00	7148.96	7349.05	7188.43			Single packer test, no Pb or Tew transducers

KFM07A plu_s_hole_test_ed1. Left (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	spec_capacity_q_s	value_type_q_s	transmissivity_moye	bc_tm	value_type_tm	hydr_cond_moye	formation_width_b
KFM07A	20050216 06:40	20050216 08:38	104.00	204.00	3	1	1.07E-03	1	1.39E-03	1	1	1.39E-05	100.00
KFM07A	20050216 10:52	20050216 13:41	204.00	304.00	3	1	6.45E-09	0	8.39E-09	0	0	8.39E-11	100.00
KFM07A	20050216 15:27	20050216 16:35	304.00	404.00	3	1	2.50E-10	-1	3.25E-10	0	-1	3.25E-12	100.00
KFM07A	20050216 17:44	20050216 19:33	404.00	504.00	3	1	2.77E-10	0	3.60E-10	1	0	3.60E-12	100.00
KFM07A	20050216 20:53	20050216 21:54	504.00	604.00	3	1	2.50E-10	-1	3.25E-10	1	-1	3.25E-12	100.00
KFM07A	20050216 23:04	20050217 00:03	604.00	704.00	3	1	3.50E-10	-1	4.55E-10	0	-1	4.55E-12	100.00
KFM07A	20050217 08:14	20050217 09:23	704.00	804.00	3	1	2.50E-10	-1	3.25E-10	0	-1	3.25E-12	100.00
KFM07A	20050217 14:13	20050217 15:25	750.00	850.00	3	1	3.75E-10	-1	4.87E-10	0	-1	4.87E-12	100.00
KFM07A	20050222 06:58	20050222 08:13	104.00	124.00	3	1	8.72E-04	1	9.10E-04	1	1	4.55E-05	20.00
KFM07A	20050221 06:10	20050221 07:25	124.00	144.00	3	1	3.26E-06	0	3.40E-06	0	0	1.70E-07	20.00
KFM07A	20050221 07:47	20050221 09:01	144.00	164.00	3	1	8.12E-08	0	8.47E-08	0	0	4.24E-09	20.00
KFM07A	20050221 09:21	20050221 10:40	164.00	184.00	3	1	2.46E-05	0	2.56E-05	0	0	1.28E-06	20.00
KFM07A	20050221 10:56	20050221 12:53	184.00	204.00	3	1	1.09E-08	0	1.14E-08	0	0	5.70E-10	20.00
KFM07A	20050221 13:11	20050221 14:28	204.00	224.00	3	1	1.24E-09	0	1.30E-09	0	0	6.48E-11	20.00
KFM07A	20050221 21:34	20050221 23:31	244.00	264.00	3	1	1.12E-08	0	1.17E-08	0	0	5.87E-10	20.00
KFM07A	20050221 18:52	20050221 19:41	264.00	284.00	3	1	4.00E-10	-1	4.17E-10	0	-1	2.09E-11	20.00
KFM07A	20050221 20:02	20050221 21:05	284.00	304.00	3	1	4.00E-10	-1	4.17E-10	0	-1	2.09E-11	20.00
KFM07A	20050222 17:33	20050222 18:54	104.00	109.00	3	1	2.47E-08	0	2.04E-08	0	0	4.07E-09	5.00
KFM07A	20050222 19:10	20050222 20:27	109.00	114.00	3	1	2.53E-06	0	2.08E-06	0	0	4.17E-07	5.00
KFM07A	20050222 21:05	20050222 22:24	114.00	119.00	3	1	4.70E-07	0	3.86E-07	0	0	7.73E-08	5.00
KFM07A	20050222 22:40	20050222 23:58	119.00	124.00	3	1	8.33E-04	1	6.86E-04	0	1	1.37E-04	5.00
KFM07A	20050223 06:32	20050223 07:47	124.00	129.00	3	1	9.07E-08	0	7.46E-08	0	0	1.49E-08	5.00
KFM07A	20050223 08:02	20050223 10:05	127.00	132.00	3	1	5.97E-09	0	4.91E-09	0	0	9.83E-10	5.00
KFM07A	20050223 10:22	20050223 11:51	132.00	137.00	3	1	3.28E-06	0	2.70E-06	0	0	5.40E-07	5.00
KFM07A	20050223 12:44	20050223 13:58	137.00	142.00	3	1	1.53E-08	0	1.26E-08	0	0	2.52E-09	5.00
KFM07A	20050223 14:04	20050223 15:21	139.00	144.00	3	1	2.30E-07	0	1.90E-07	0	0	3.79E-08	5.00

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	spec_capacity_q_s	value_type_q_s	transmissivity_moye	bc_tm	value_type_tm	hydr_cond_moye	formation_width_b
KFM07A	20050223 15:55	20050223 17:20	144.00	149.00	3	1	7.00E-08	0	5.76E-08	0	0	1.15E-08	5.00
KFM07A	20050223 17:37	20050223 18:54	149.00	154.00	3	1	1.14E-09	0	9.39E-10	0	0	1.88E-10	5.00
KFM07A	20050223 19:10	20050223 20:29	154.00	159.00	3	1	9.61E-10	0	7.91E-10	0	0	1.58E-10	5.00
KFM07A	20050223 21:01	20050223 22:07	159.00	164.00	3	1	1.00E-10	-1	8.23E-11	0	-1	1.65E-11	5.00
KFM07A	20050223 22:28	20050223 23:11	164.00	169.00	3	1	1.25E-10	-1	1.03E-10	0	-1	2.06E-11	5.00
KFM07A	20050224 06:15	20050224 06:57	169.00	174.00	3	1	1.50E-10	-1	1.23E-10	0	-1	2.47E-11	5.00
KFM07A	20050224 07:42	20050224 08:29	171.50	176.50	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050224 08:41	20050224 10:09	176.50	181.50	3	1	2.02E-05	0	1.66E-05	0	0	3.32E-06	5.00
KFM07A	20050224 10:23	20050224 11:44	181.50	186.50	3	1	9.38E-09	0	7.72E-09	0	0	1.54E-09	5.00
KFM07A	20050224 12:24	20050224 13:09	184.00	189.00	3	1	3.00E-10	-1	2.47E-10	0	-1	4.94E-11	5.00
KFM07A	20050224 14:49	20050224 16:40	194.00	199.00	3	1	7.22E-09	0	5.94E-09	0	0	1.19E-09	5.00
KFM07A	20050224 16:58	20050224 18:14	199.00	204.00	3	1	4.19E-09	0	3.44E-09	0	0	6.89E-10	5.00
KFM07A	20050224 18:35	20050224 19:31	204.00	209.00	3	1	1.13E-10	-1	9.26E-11	0	-1	1.85E-11	5.00
KFM07A	20050224 19:54	20050224 20:45	209.00	214.00	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050224 21:01	20050224 21:43	214.00	219.00	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050224 21:57	20050224 22:38	219.00	224.00	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050224 23:11	20050224 23:57	244.00	249.00	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050225 06:27	20050225 07:09	249.00	254.00	3	1	2.50E-10	-1	2.06E-10	0	-1	4.11E-11	5.00
KFM07A	20050225 07:27	20050225 08:12	254.00	259.00	3	1	1.50E-10	-1	1.23E-10	0	-1	2.47E-11	5.00
KFM07A	20050225 08:28	20050225 09:43	259.00	264.00	3	1	1.78E-08	0	1.46E-08	0	0	2.92E-09	5.00
KFM07A	20050301 15:58	20050301 17:47	850.00	1001.55	3	1	4.20E-07	0	5.73E-07	0	0	3.78E-09	151.55

KFM07A plu_s_hole_test_ed1. Right (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	secup	seclow	transmissivity_tt	value_type_tt	bc_tt	l_measl_q_s	u_measl_q_s	assumed_s	c	cd	skin	t1	t2	dte1	dte2	comment
KFM07A	104.00	204.00		1	0	2.7E-08	5.0E-04	1.00E-06								
KFM07A	204.00	304.00	2.83E-09	0	1	8.0E-10	5.0E-04	3.72E-08	1.96E-10		-3.49	400	1800			
KFM07A	304.00	404.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	404.00	504.00		0	0	2.2E-10	5.0E-04	1.00E-06								
KFM07A	504.00	604.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	604.00	704.00		-1	0	3.5E-10	5.0E-04	1.00E-06								
KFM07A	704.00	804.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	750.00	850.00		-1	0	3.8E-10	5.0E-04	1.00E-06								
KFM07A	104.00	124.00		1	0	2.1E-08	5.0E-04	1.00E-06								
KFM07A	124.00	144.00	3.16E-06	0	1	6.6E-10	5.0E-04	1.24E-06	5.00E-09		-1.60	650	950			
KFM07A	144.00	164.00	4.83E-08	0	1	8.0E-10	5.0E-04	1.54E-07			-3.31			10	60	
KFM07A	164.00	184.00	2.37E-05	0	1	8.6E-10	5.0E-04	3.41E-06			-1.72					
KFM07A	184.00	204.00	7.32E-09	0	1	8.1E-10	5.0E-04	5.99E-08	6.74E-11		-2.02	400	1200			
KFM07A	204.00	224.00	1.22E-09	0	1	8.6E-10	5.0E-04	2.44E-08	4.89E-11		-3.24	20	90			
KFM07A	244.00	264.00	9.67E-09	0	1	8.2E-10	5.0E-04	6.88E-08	5.83E-11		-0.87	300	1218			
KFM07A	264.00	284.00		-1	0	4.0E-10	5.0E-04	1.00E-06								
KFM07A	284.00	304.00		-1	0	4.0E-10	5.0E-04	1.00E-06								
KFM07A	104.00	109.00	7.14E-09	0	1	8.2E-10	5.0E-04	5.91E-08			-4.18					
KFM07A	109.00	114.00	1.83E-06	0	1	7.9E-10	5.0E-04	9.46E-07			-3.11	40	1219			
KFM07A	114.00	119.00	4.11E-07	0	1	7.9E-10	5.0E-04	4.49E-07			-0.91					
KFM07A	119.00	124.00	1.01E-03	1	1	2.3E-08	5.0E-04	2.22E-05			-1.19					
KFM07A	124.00	129.00	8.81E-08	0	1	7.6E-10	5.0E-04	2.08E-07	1.01E-09		0.00					
KFM07A	127.00	132.00	4.12E-09	0	1	7.3E-10	5.0E-04	4.49E-08	3.07E-11		0.01					
KFM07A	132.00	137.00	2.69E-06	0	1	8.1E-10	5.0E-04	1.15E-06			-1.49					
KFM07A	137.00	142.00	1.27E-08	0	1	8.2E-10	5.0E-04	7.90E-08			-1.05	100	1000			
KFM07A	139.00	144.00	1.91E-07	0	1	7.0E-10	5.0E-04	3.06E-07			-1.84	600	1000			

idcode	secup	seclow	transmissivity_tt	value_type_tt	bc_tt	l_measl_q_s	u_measl_q_s	assumed_s	c	cd	skin	t1	t2	dte1	dte2	comment
KFM07A	144.00	149.00	3.30E-08	0	1	8.1E-10	5.0E-04	1.27E-07	9.15E-11		-3.67	100	1200			
KFM07A	149.00	154.00	3.40E-10	0	1	8.2E-10	5.0E-04	1.29E-08	1.89E-11		-3.84	200	1000			
KFM07A	154.00	159.00	7.03E-10	0	1	8.8E-10	5.0E-04	1.86E-08	1.69E-11		-0.84	10	1200			
KFM07A	159.00	164.00		-1	0	1.0E-10	5.0E-04	1.00E-06								
KFM07A	164.00	169.00		-1	0	1.3E-10	5.0E-04	1.00E-06								
KFM07A	169.00	174.00		-1	0	1.5E-10	5.0E-04	1.00E-06								
KFM07A	171.50	176.50		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	176.50	181.50	2.48E-05	0	1	7.3E-10	5.0E-04	3.49E-06			-0.25					
KFM07A	181.50	186.50	2.87E-09	0	1	7.4E-10	5.0E-04	3.75E-08	1.44E-10		-3.72					
KFM07A	184.00	189.00		-1	0	3.0E-10	5.0E-04	1.00E-06								
KFM07A	194.00	199.00	3.24E-09	0	1	6.8E-10	5.0E-04	3.98E-08			-2.76			20	110	
KFM07A	199.00	204.00	3.51E-09	0	1	7.0E-10	5.0E-04	4.15E-08	2.04E-11		-0.97	30	1000			
KFM07A	204.00	209.00		-1	0	1.1E-10	5.0E-04	1.00E-06								
KFM07A	209.00	214.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	214.00	219.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	219.00	224.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	244.00	249.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	249.00	254.00		-1	0	2.5E-10	5.0E-04	1.00E-06								
KFM07A	254.00	259.00		-1	0	1.5E-10	5.0E-04	1.00E-06								
KFM07A	259.00	264.00	1.50E-08	0	1	8.2E-10	5.0E-04	8.56E-08			-1.20	40	1000			
KFM07A	850.00	1001.55	9.66E-08	0	1	8.2E-10	5.0E-04	2.18E-07			-6.02	500	1800			

KFM07A plu_s_hole_test_obs (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	start_date	stop_date	secup	seclow	obs_secup	obs_seclow	pi_above	pp_above	pf_above	pi_below	pp_below	pf_below	comments
KFM07A	2005-02-16 06:40	2005-02-16 08:38	104.00	204.00	100.35	103.00	934.12	932.48	933.57				
KFM07A	2005-02-16 06:40	2005-02-16 08:38	104.00	204.00	205.00	1001.55				1818.24	1818.64	1818.64	
KFM07A	2005-02-16 10:52	2005-02-16 13:41	204.00	304.00	100.35	203.00	943.33	943.20	943.61				
KFM07A	2005-02-16 10:52	2005-02-16 13:41	204.00	304.00	305.00	1001.55				2665.23	2665.78	2665.78	
KFM07A	2005-02-16 15:27	2005-02-16 16:35	304.00	404.00	100.35	303.00	943.39	943.39	943.25				
KFM07A	2005-02-16 15:27	2005-02-16 16:35	304.00	404.00	405.00	1001.55				3503.01	3503.01	3503.01	
KFM07A	2005-02-16 17:44	2005-02-16 19:33	404.00	504.00	100.35	403.00	935.92	935.78	936.32				
KFM07A	2005-02-16 17:44	2005-02-16 19:33	404.00	504.00	505.00	1001.55				4331.73	4332.00	4332.56	
KFM07A	2005-02-16 20:53	2005-02-16 21:54	504.00	604.00	100.35	503.00	921.60	921.74	921.74				
KFM07A	2005-02-16 20:53	2005-02-16 21:54	504.00	604.00	605.00	1001.55				5160.30	5159.61	5159.89	
KFM07A	2005-02-16 23:04	2005-02-17 00:03	604.00	704.00	100.35	603.00	904.96	904.96	904.96				
KFM07A	2005-02-16 23:04	2005-02-17 00:03	604.00	704.00	705.00	1001.55				5979.53	5979.53	5980.63	
KFM07A	2005-02-17 08:14	2005-02-17 09:23	704.00	804.00	100.35	703.00	880.39	879.98	879.98				
KFM07A	2005-02-17 08:14	2005-02-17 09:23	704.00	804.00	805.00	1001.55				6791.33	6790.37	6789.83	
KFM07A	2005-02-17 14:13	2005-02-17 15:25	750.00	850.00	100.35	749.00	865.89	865.07	865.07				
KFM07A	2005-02-17 14:13	2005-02-17 15:25	750.00	850.00	851.00	1001.55				7153.75	7153.47	7153.20	
KFM07A	2005-02-22 06:58	2005-02-22 08:13	104.00	124.00	100.35	103.00	932.70	931.88	932.56				
KFM07A	2005-02-22 06:58	2005-02-22 08:13	104.00	124.00	125.00	1001.55				1127.08	1128.60	1127.64	
KFM07A	2005-02-21 06:10	2005-02-21 07:25	124.00	144.00	100.35	123.00	939.44	939.72	939.72				
KFM07A	2005-02-21 06:10	2005-02-21 07:25	124.00	144.00	145.00	1001.55				1303.01	1303.28	1303.56	
KFM07A	2005-02-21 07:47	2005-02-21 09:01	144.00	164.00	100.35	143.00	941.39	941.39	941.39				
KFM07A	2005-02-21 07:47	2005-02-21 09:01	144.00	164.00	165.00	1001.55				1473.97	1474.11	1473.97	
KFM07A	2005-02-21 09:21	2005-02-21 10:40	164.00	184.00	100.35	163.00	944.03	943.75	943.62				
KFM07A	2005-02-21 09:21	2005-02-21 10:40	164.00	184.00	185.00	1001.55				1644.93	1644.93	1644.93	
KFM07A	2005-02-21 10:56	2005-02-21 12:53	184.00	204.00	100.35	183.00	944.20	944.06	944.20				
KFM07A	2005-02-21 10:56	2005-02-21 12:53	184.00	204.00	205.00	1001.55				1815.35	1815.49	1815.35	

idcode	start_date	stop_date	secup	seclow	obs_secup	obs_seclow	pi_above	pp_above	pf_above	pi_below	pp_below	pf_below	comments
KFM07A	2005-02-21 13:11	2005-02-21 14:28	204.00	224.00	100.35	203.00	945.33	945.20	944.79				
KFM07A	2005-02-21 13:11	2005-02-21 14:28	204.00	224.00	225.00	1001.55				1985.49	1985.07	1985.21	
KFM07A	2005-02-21 21:34	2005-02-21 23:31	244.00	264.00	100.35	243.00	945.55	945.82	945.41				
KFM07A	2005-02-21 21:34	2005-02-21 23:31	244.00	264.00	265.00	1001.55				2324.67	2324.95	2324.95	
KFM07A	2005-02-21 18:52	2005-02-21 19:41	264.00	284.00	100.35	263.00	946.27	946.68	946.00				
KFM07A	2005-02-21 18:52	2005-02-21 19:41	264.00	284.00	285.00	1001.55				2493.57	2493.70	2493.70	
KFM07A	2005-02-21 20:02	2005-02-21 21:05	284.00	304.00	100.35	283.00	946.17	946.03	946.03				
KFM07A	2005-02-21 20:02	2005-02-21 21:05	284.00	304.00	305.00	1001.55				2662.48	2662.76	2662.48	
KFM07A	2005-02-22 17:33	2005-02-22 18:54	104.00	109.00	100.35	103.00	932.01	932.29	932.01				
KFM07A	2005-02-22 17:33	2005-02-22 18:54	104.00	109.00	110.00	1001.55				995.98	996.39	996.25	
KFM07A	2005-02-22 19:10	2005-02-22 20:27	109.00	114.00	100.35	108.00	932.43	932.57	932.57				
KFM07A	2005-02-22 19:10	2005-02-22 20:27	109.00	114.00	115.00	1001.55				1039.13	1038.72	1039.13	
KFM07A	2005-02-22 21:05	2005-02-22 22:24	114.00	119.00	100.35	113.00	932.85	932.71	932.58				
KFM07A	2005-02-22 21:05	2005-02-22 22:24	114.00	119.00	120.00	1001.55				1082.01	1082.15	1082.01	
KFM07A	2005-02-22 22:40	2005-02-22 23:58	119.00	124.00	100.35	118.00	933.00	932.04	933.13				
KFM07A	2005-02-22 22:40	2005-02-22 23:58	119.00	124.00	125.00	1001.55				1125.44	1126.54	1125.98	
KFM07A	2005-02-23 06:32	2005-02-23 07:47	124.00	129.00	100.35	123.00	934.24	934.38	934.24				
KFM07A	2005-02-23 06:32	2005-02-23 07:47	124.00	129.00	130.00	1001.55				1168.59	1168.87	1168.87	
KFM07A	2005-02-23 08:02	2005-02-23 10:05	127.00	132.00	100.35	126.00	934.68	934.68	934.14				
KFM07A	2005-02-23 08:02	2005-02-23 10:05	127.00	132.00	133.00	1001.55				1194.71	1194.30	1194.16	
KFM07A	2005-02-23 10:22	2005-02-23 11:51	132.00	137.00	100.35	131.00	935.24	935.51	935.24				
KFM07A	2005-02-23 10:22	2005-02-23 11:51	132.00	137.00	138.00	1001.55				1238.00	1237.59	1237.59	
KFM07A	2005-02-23 12:44	2005-02-23 13:58	137.00	142.00	100.35	136.00	935.66	935.66	935.80				
KFM07A	2005-02-23 12:44	2005-02-23 13:58	137.00	142.00	143.00	1001.55				1280.20	1280.47	1280.47	
KFM07A	2005-02-23 14:04	2005-02-23 15:21	139.00	144.00	100.35	138.00	935.78	936.05	935.91				
KFM07A	2005-02-23 14:04	2005-02-23 15:21	139.00	144.00	145.00	1001.55				1297.51	1297.51	1297.51	
KFM07A	2005-02-23 15:55	2005-02-23 17:20	144.00	149.00	100.35	143.00	936.47	936.47	936.47				
KFM07A	2005-02-23 15:55	2005-02-23 17:20	144.00	149.00	150.00	1001.55				1340.38	1340.38	1340.38	
KFM07A	2005-02-23 17:37	2005-02-23 18:54	149.00	154.00	100.35	148.00	936.61	936.47	936.47				
KFM07A	2005-02-23 17:37	2005-02-23 18:54	149.00	154.00	155.00	1001.55				1382.44	1382.99	1382.71	

idcode	start_date	stop_date	secup	seclow	obs_secup	obs_seclow	pi_above	pp_above	pf_above	pi_below	pp_below	pf_below	comments
KFM07A	2005-02-23 19:10	2005-02-23 20:29	154.00	159.00	100.35	153.00	936.62	937.02	936.49				
KFM07A	2005-02-23 19:10	2005-02-23 20:29	154.00	159.00	160.00	1001.55				1425.31	1425.04	1425.04	
KFM07A	2005-02-23 21:01	2005-02-23 22:07	159.00	164.00	100.35	158.00	937.59	937.45	937.05				
KFM07A	2005-02-23 21:01	2005-02-23 22:07	159.00	164.00	165.00	1001.55				1467.92	1467.92	1467.92	
KFM07A	2005-02-23 22:28	2005-02-23 23:11	164.00	169.00	100.35	163.00	937.74	937.60	938.14				
KFM07A	2005-02-23 22:28	2005-02-23 23:11	164.00	169.00	170.00	1001.55				1510.25	1510.66	1510.25	
KFM07A	2005-02-24 06:15	2005-02-24 06:57	169.00	174.00	100.35	168.00	937.06	937.06	937.06				
KFM07A	2005-02-24 06:15	2005-02-24 06:57	169.00	174.00	175.00	1001.55				1551.62	1551.62	1551.48	
KFM07A	2005-02-24 07:42	2005-02-24 08:29	171.50	176.50	100.35	170.50	937.34	937.07	937.34				
KFM07A	2005-02-24 07:42	2005-02-24 08:29	171.50	176.50	177.50	1001.55				1573.06	1573.88	1573.47	
KFM07A	2005-02-24 08:41	2005-02-24 10:09	176.50	181.50	100.35	175.50	937.49	937.49	937.89				
KFM07A	2005-02-24 08:41	2005-02-24 10:09	176.50	181.50	182.50	1001.55				1620.20	1620.75	1620.75	
KFM07A	2005-02-24 10:23	2005-02-24 11:44	181.50	186.50	100.35	180.50	937.91	937.91	937.91				
KFM07A	2005-02-24 10:23	2005-02-24 11:44	181.50	186.50	187.50	1001.55				1663.07	1663.62	1663.62	
KFM07A	2005-02-24 12:24	2005-02-24 13:09	184.00	189.00	100.35	183.00	937.91	937.63	937.63				
KFM07A	2005-02-24 12:24	2005-02-24 13:09	184.00	189.00	190.00	1001.55				1684.10	1684.51	1684.51	
KFM07A	2005-02-24 14:49	2005-02-24 16:40	194.00	199.00	100.35	193.00	939.30	939.71	939.30				
KFM07A	2005-02-24 14:49	2005-02-24 16:40	194.00	199.00	200.00	1001.55				1770.54	1770.55	1770.27	
KFM07A	2005-02-24 16:58	2005-02-24 18:14	199.00	204.00	100.35	198.00	940.40	940.40	940.40				
KFM07A	2005-02-24 16:58	2005-02-24 18:14	199.00	204.00	205.00	1001.55				1812.61	1813.15	1812.05	
KFM07A	2005-02-24 18:35	2005-02-24 19:31	204.00	209.00	100.35	203.00	941.23	940.96	941.50				
KFM07A	2005-02-24 18:35	2005-02-24 19:31	204.00	209.00	210.00	1001.55				1854.92	1855.48	1855.48	
KFM07A	2005-02-24 19:54	2005-02-24 20:45	209.00	214.00	100.35	208.00	941.79	942.06	942.06				
KFM07A	2005-02-24 19:54	2005-02-24 20:45	209.00	214.00	215.00	1001.55				1897.81	1897.81	1898.91	
KFM07A	2005-02-24 21:01	2005-02-24 21:43	214.00	219.00	100.35	213.00	942.61	942.34	942.61				
KFM07A	2005-02-24 21:01	2005-02-24 21:43	214.00	219.00	220.00	1001.55				1940.14	1940.14	1940.14	
KFM07A	2005-02-24 21:57	2005-02-24 22:38	219.00	224.00	100.35	218.00	917.45	917.59	917.45				
KFM07A	2005-02-24 21:57	2005-02-24 22:38	219.00	224.00	225.00	1001.55				1957.17	1957.17	1957.17	
KFM07A	2005-02-24 23:11	2005-02-24 23:57	244.00	249.00	100.35	243.00	943.22	943.63	943.22				
KFM07A	2005-02-24 23:11	2005-02-24 23:57	244.00	249.00	250.00	1001.55				2193.70	2193.84	2193.56	
KFM07A	2005-02-25 06:27	2005-02-25 07:09	249.00	254.00	100.35	248.00	945.56	945.42	945.97				
KFM07A	2005-02-25 06:27	2005-02-25 07:09	249.00	254.00	255.00	1001.55				2237.53	2237.53	2237.53	

idcode	start_date	stop_date	secup	seclow	obs_secup	obs_seclow	pi_above	pp_above	pf_above	pi_below	pp_below	pf_below	comments
KFM07A	2005-02-25 07:27	2005-02-25 08:12	254.00	259.00	100.35	253.00	945.43	945.43	945.43				
KFM07A	2005-02-25 07:27	2005-02-25 08:12	254.00	259.00	260.00	1001.55				2279.59	2279.59	2279.87	
KFM07A	2005-02-25 08:28	2005-02-25 09:43	259.00	264.00	100.35	258.00	946.13	945.58	945.99				
KFM07A	2005-02-25 08:28	2005-02-25 09:43	259.00	264.00	265.00	1001.55				2322.75	2322.75	2323.30	
KFM07A	2005-03-01 15:58	2005-03-01 17:47	850.00	1001.55	100.35	849.00	827.03	826.76	827.03				Single packer injection test
KFM07A	2005-03-01 15:58	2005-03-01 17:47	850.00	1001.55									Single packer injection test

KFM07A plu_pulse_test_ed. Left (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	start_date	stop_date	secup	seclow	test_type	formation_type	start_flow_period	dur_flow_phase_tp	dur_rec_phase_tf	initial_press_pi	press_change_dp0_p
KFM07A	2005-02-24 13:23	2005-02-24 14:34	189.00	194.00	4B	1	2005-02-24 14:24	116.00	337.00	1813.08	118.27
KFM07A	2005-02-21 14:50	2005-02-21 16:45	224.00	244.00	4B	1	2005-02-21 16:21	110.00	1221.00	2017.70	202.02

KFM07A plu_pulse_test_ed. Right (This result table to SICADA includes more columns which are empty, these columns are not presented here.)

idcode	secup	seclow	press_at_flow_end_pp	final_press_pf	formation_width_b	transmissivity_tp	value_type_tp	bc_tp	storativity_s	skin	fluid_temp_tew	comments
KFM07A	189.00	194.00	1931.35	1934.65	5.00		-1	0			7.80	below m.l.
KFM07A	224.00	244.00	2219.72	2210.36	20.00	1.82E-11	-1	0	2.99E-09	5.28	8.09	