UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1448	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 19		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	150.00	DATUM LEVEL (magl):	0.00	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	22.60	CASING HEIGHT (magl):	0.00	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	58.00	CASING DEPTH (magl):	18.00	PUMP TYPE USED:	BP40

DISCHARGE RATE 1

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		0.07		1		
2		0.81		2		
3		1.17		3		
5		1.59		5		
7		1.99		7		
10		2.47	1.14	10		
15		2.91		15		
20		3.55		20		
30		4.08	1.15	30		
40		5.79		40		
50		6.54	1.16	50		
60		6.97		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 2

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		7.85		1		
2		9.21		2		
3		10.30		3		
5		11.74	2.05	5		
7		13.79		7		
10		14.77		10		
15		15.82		15		
20		16.69		20		
30		18.09	2.09	30		
40		20.13		40		
50		21.01		50		
60		21.97		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 3

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		22.57		1		
2		22.87		2		
3		23.91		3		
5		24.99	3.22	5		
7		29.35		7		
10		31.14		10		
15		33.41		15		
20		34.17		20		
30		36.28	3.23	30		
40		38.91		40		
50		40.61		50		
60		42.60		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 4

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		43.99		1		
2		45.01		2		
3		46.81		3		
5		49.81		5		
7		54.09	4.09	7		
10		56.33		10		
15		57.70		15		
20		57.98		20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 5

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 6

DATE: 01-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		40.400
2				2		29.350
3				3		26.700
5				5		20.550
7				7		15.780
10				10		10.960
15				15		9.570
20				20		5.450
30				30		3.140
40				40		0.870
50				60		0.390
60				90		0.310
70				120		0.270
80				150		0.190
90				180		0.130
100				210		0.110
110				240		0.090
120				300		0.030
				360		0.030
				420		0.00
				480		
				540		
				600		

COMMENTS:

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CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1448	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 19
ALTERNATIVE NO.:		CLIENT:	Research
PUMP INLET DIAMETER (mm):	100		
BOREHOLE DEPTH (mbdl):	150.00	DATUM LEVEL (magl):	0.00
STATIC WATER LEVEL (mbdl):	2.43	CASING HEIGHT (magl):	0.00
DEPTH OF PUMP (mbdl):	58.00	CASING DEPTH (magl):	18.00
EXISTING PUMP:	no		
CONTRACTOR:	AB pumps		
PUMP TYPE USED:	BP40		

TEST STARTED			TEST COMPLETED		DURATION (min):
DATE:	21-Mar-99	TIME:	DATE:	TIME:	TOTAL TIME PUMPED (min):
AVERAGE YIELD (l/s):	2.09	S.W.L.: 22.8			

DISCHARGE BOREHOLE

Time	Drawdown		Yield	Time	Recovery		
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	t/t'
1		1.49		1		12.73	2161
2		2.08		2		10.26	1081
3		2.72		3		9.40	721
5		5.30		5		8.36	433
7		6.78		7		6.31	309.57
10		8.47		10		5.60	217
15		15.00		15		5.16	145
20		17.24		20		4.20	109
30		19.13		30		3.93	73
40		19.95		40		2.49	55
60		20.81		60		1.53	37
90		21.27		90		1.07	25
120		21.67		120		0.87	19
150		21.93		150		0.47	15.4
180		22.26		180		0.36	13
210		22.52		210		0.27	11.286
240		25.22		240		0.21	10
300		23.67		300		0.16	8.2
360		23.99		360		0.09	7
420		24.27		420		0.02	6.1429
480		24.57		480		0.00	5.5
540		24.89		540		0.00	5
600		25.25		600			
720		25.49		720			
840		25.72		840			
960		25.90		960			
1080		26.10		1080			
1200		26.27		1200			
1320		27.47		1320			
1440		28.03		1440			
1560		28.30		1560			
1680		28.68		1680			
1800		28.36		1800			
1920		28.55		1920			
2040		28.7		2040			
2160		29.01		2160			
2280		29.15		2280			
2400		29.24		2400			
2520		29.35		2520			
2640		29.47		2640			
2760		29.56		2760			
2880		24.45		2880			
3000		26.9		3000			
3120		27.2		3120			
3240		27.92		3240			
3360		28.09		3360			
3480		28.23		3480			
3600		28.39		3600			
3720		28.51		3720			
3840		28.77		3840			
3960		28.93		3960			
4080		29.2		4080			
4200		29.39		4200			
4320		29.2		4320			
5040				5040			
5760				5760			
7200				7200			
10080				10080			

OBSERVATION BOREHOLES

	BOREHOLE 1			S.W.L.	BOREHOLE 2			S.W.L.	BOREHOLE 3			S.W.L
	No.: H06 1424			21.78	No.: H06 1452			20.63	No.: H06 1075			
	Distance (m): 39.2				Distance (m): 39.75				Distance: 103.35			
Time	Drawdown		Rec		Time	Drawdown		Rec	Time	Drawdown		Rec
(min)	mbdl	(m)	(m)		(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
1		0.00	0.02		1				1		0.00	0
2		0.00	0.02		2				2		0.00	
3		0.00	0.02		3				3		0.00	
5		0.00	0.01		5				5		0.00	
7		0.00	0.01		7				7		0.00	
10		0.00	0.01		10				10		0.00	
15		0.00	0.01		15				15		0.00	
20		0.00	0.01		20				20		0.00	
30		0.00	0.01		30				30		0.00	
40		0.00	0		40				40		0.00	
60		0.00			60				60		0.00	
90		0.00			90				90		0.00	
120		0.00			120				120		0.00	
150		0.00			150				150		0.00	
180		0.00			180				180		0.00	
210		0.00			210				210		0.00	
240		0.00			240				240		0.00	
300		0.00			300				300		0.00	
360		0.00			360				360		0.00	
420		0.00			420				420		0.00	
480		0.00			480				480		0.00	
540		0.00			540				540		0.00	
600		0.00			600				600		0.00	
720		0.00			720				720		0.00	
840		0.00			840				840		0.00	
960		0.00			960				960		0.00	
1080		0.00			1080				1080		0.00	
1200		0.00			1200				1200		0.00	
1320		0.01			1320				1320		0.00	
1440		0.01			1440				1440		0.00	
1560		0.01			1560				1560		0.00	
1680		0.01			1680				1680		0.00	
1800		0.01			1800				1800		0.00	
1920		0.01			1920				1920		0.00	
2040		0.01			2040				2040		0.00	
2160		0.01			2160				2160		0.00	
2280		0.01			2280				2280		0.00	
2400		0.01			2400				2400		0.00	
2520		0.01			2520				2520		0.00	
2640		0.01			2640				2640		0.00	
2760		0.01			2760				2760		0.00	
2880		0.01			2880				2880		0.00	
3000		0.01			3000				3000		0.00	
3120		0.01			3120				3120		0.00	
3240		0.02			3240				3240		0.00	
3360		0.02			3360				3360		0.00	
3480		0.02			3480				3480		0.00	
3600		0.02			3600				3600		0.00	
3720		0.02			3720				3720		0.00	
3840		0.02			3840				3840		0.00	
3960		0.02			3960				3960		0.00	
4080		0.02			4080				4080		0.00	
4200		0.02			4200				4200		0.00	
4320		0.02			4320				4320		0.00	
5040					5040				5040			
5760					5760				5760			
7200					7200				7200			
10080					10080				10080			

ERVATION BOREHOLES FOR CD (4,5,6,7& 8)

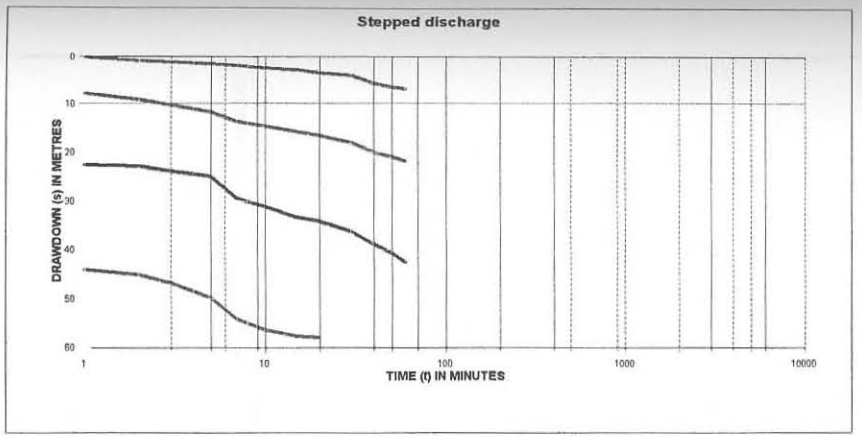
BOREHOLE NO.:	H06 1448	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 19
ALTERNATIVE NO.:		CLIENT: Research	PUMP INLET DIAMETER (mm): 100
BOREHOLE DEPTH (mbdl):	150.00	DATUM LEVEL (magl):	0.00
STATIC WATER LEVEL (mbdl):	2.43	CASING HEIGHT (magl):	0.00
DEPTH OF PUMP (mbdl):	58.00	CASING DEPTH (magl):	18.00

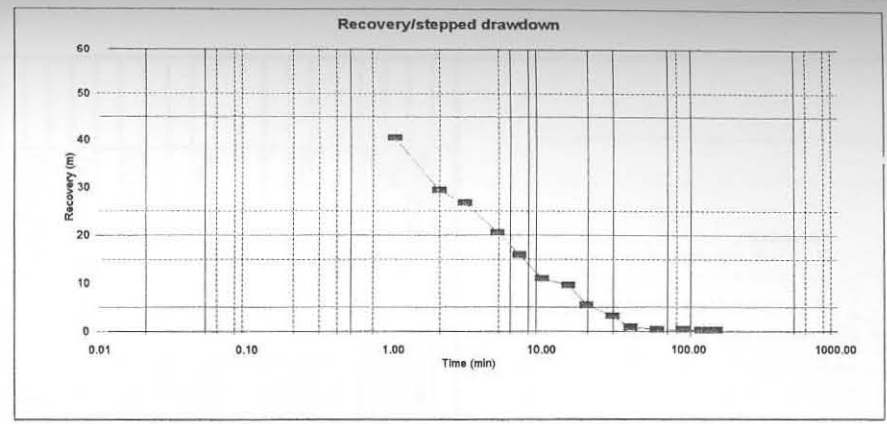
EXISTING PUMP:	no		
CONTRACTOR:	AB pumps		
PUMP TYPE USED:	BP40		

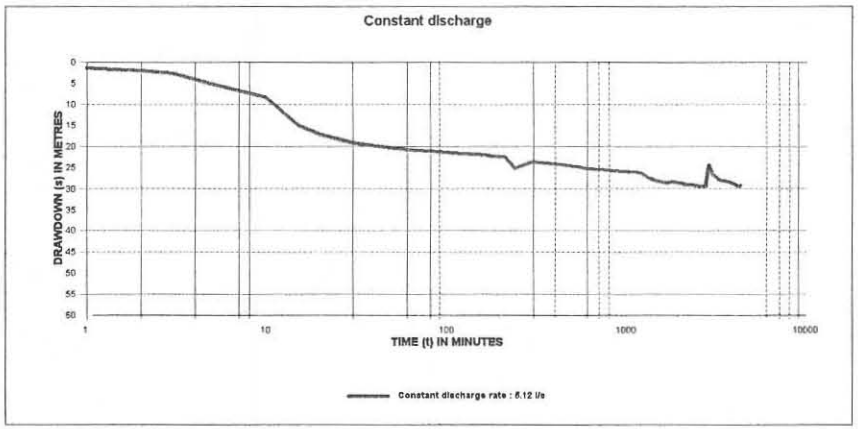
TEST STARTED		TEST COMPLETED		DURATION (min):	
DATE:	TIME:	DATE:	TIME:	TOTAL TIME PUMPED (min):	

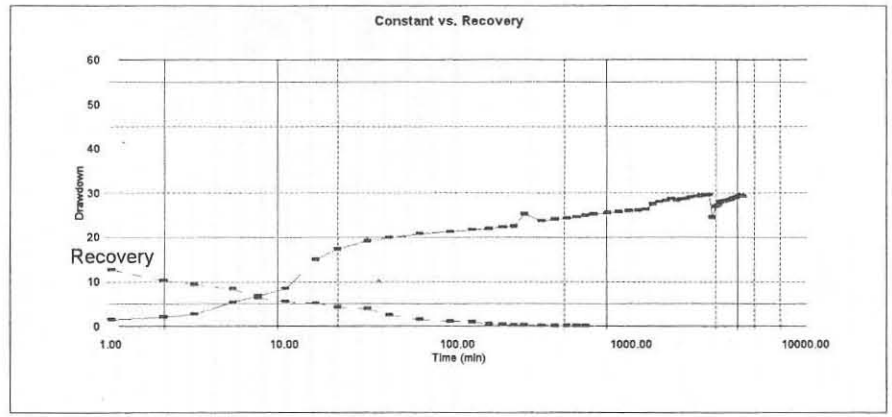
OBSERVATION BOREHOLES	BOREHOLE 4			S.W.L.	BOREHOLE 5			S.W.L.	BOREHOLE 6			S.W.L.	BOREHOLE 7			S.W.L.	BOREHOLE 8			S.W.L.
	No.:				No.: H06 1074			22.36	No.:				No.:				No.:			
	Distance (m):			24.33	Distance (m): 285				Distance (m):				Distance (m):				Distance:			
	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec	Time	Drawdown		Rec
	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
	1				1		0.00	1.49	1				1				1			
	2				2		0.00	1.21	2				2				2			
	3				3		0.00	1.02	3				3				3			
	5				5		0.00	0.41	5				5				5			
	7				7		0.00	0.13	7				7				7			
	10				10		0.00	0.12	10				10				10			
	15				15		0.00	0.11	15				15				15			
	20				20		0.00	0.07	20				20				20			
	30				30		0.00	0.03	30				30				30			
	40				40		0.00	0.02	40				40				40			
	60				60		0.00	0.01	60				60				60			
	90				90		0.00	0	90				90				90			
	120				120		0.00		120				120				120			
	150				150		0.00		150				150				150			
	180				180		0.00		180				180				180			
	210				210		0.00		210				210				210			
	240				240		0.00		240				240				240			
	300				300		0.00		300				300				300			
	360				360		0.00		360				360				360			
	420				420		0.00		420				420				420			
	480				480		0.20		480				480				480			
	540				540		0.34		540				540				540			
	600				600		0.47		600				600				600			
	720				720		0.68		720				720				720			
	840				840		0.92		840				840				840			
	960				960		1.25		960				960				960			
	1080				1080		1.50		1080				1080				1080			
	1200				1200		1.64		1200				1200				1200			
	1320				1320		1.85		1320				1320				1320			
	1440				1440		0.70		1440				1440				1440			
	1560				1560		0.66		1560				1560				1560			
	1680				1680		0.62		1680				1680				1680			
	1800				1800		0.58		1800				1800				1800			
	1920				1920		0.72		1920				1920				1920			
	2040				2040		0.83		2040				2040				2040			
	2160				2160		0.95		2160				2160				2160			
	2280				2280		0.99		2280				2280				2280			
	2400				2400		0.09		2400				2400				2400			
	2520				2520		0.18		2520				2520				2520			
	2640				2640		1.27		2640				2640				2640			
	2760				2760		1.29		2760				2760				2760			
	2880				2880		1.31		2880				2880				2880			
	3000				3000		1.35		3000				3000				3000			
	3120				3120		1.38		3120				3120				3120			
	3240				3240		1.41		3240				3240				3240			
	3360				3360		1.46		3360				3360				3360			
	3480				3480		1.49		3480				3480				3480			
	3600				3600		1.52		3600				3600				3600			
	3720				3720		1.53		3720				3720				3720			
	3840				3840		1.55		3840				3840				3840			
	3960				3960		1.57		3960				3960				3960			
	4080				4080		1.59		4080				4080				4080			
	4200				4200		1.62		4200				4200				4200			
	4320				4320		1.65		4320				4320				4320			
	5040				5040				5040				5040				5040			
	5720				5720				5720				5720				5720			
	7200				7200				7200				7200				7200			
	10080				10080				10080				10080				10080			

BOREHOLE NUMBER: [illegible] 1448

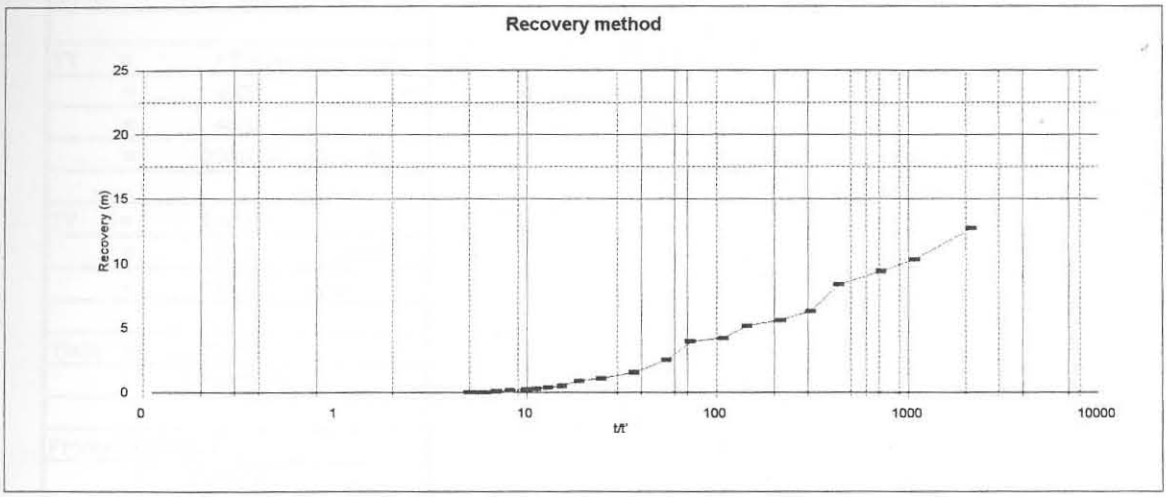








Comments:



	Pump cycle =	1440	min	(24hrs)
	Yield =	2.09	l/s	
	t/t" =	5	(Graph)	
	Recovery period =	1440	/ t/t"	
		1440	/ 5.00	
			288.00	min
	Pumping period =	1440	- 288.00	
			1152.00	min
	Litres pumped =	1.44E+05	L	
	Pump yield @ 24 hrs	1.67	L/s	
	Factor of safety =	0.75		
	Operating yield =	**1.25**	**L/s for 24 hrs**	

Comments:

Comments:

RULE of THUMB

Bh no.		H06 1496	
TT	=	PT + recovery time	
	=	4320	540
	=	4860	
	=	291600	seconds
TV	=	L/s*TP	
	=	2.09	4320
	=	541728	litres
Yield	=	TV/TT	
		1.85777778	l/s
Production yield			
	=	Yield *FS	
	=	1.85777778	75%
	=	1.39333333	l/s @ 24hrs

FC-METHOD : Estimation of the sustainable yield of a borehole

Borehole:

Extrapolation time in years = (enter)	3	1576800	Extrapol.time in minutes
Effective borehole radius (r_e) = (enter)	2.8	2.8	Estimate of effective r_e
Q (l/s) from pumping test =	2.05	0.16	Estimate of t_c of WBS
s_a (available drawdown), sigma_s = (enter)	35.38	10	Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	32.08	s_available working drawdown(m)
t(end) and s(end) of pumping test =	4320	29.56	End time and drawdown of test
Average maximum derivative = (enter)	14.89	25.9	Estimate of average of max deriv
Average second derivative = (enter)	0	0.0	Estimate of average second deriv
Derivative at radial flow period = (enter)	3.44		Read from derivative graph
	T-early[m^2/d] =	9.42	
T and S estimates from derivatives	T-late [m^2/d] =	2.18	T-average = 4.53
(To obtain correct S-value, use program RPTSOLV)	S-late =	2.48E-03	S-estimate could be wrong

BASIC SOLUTION

(Using derivatives + subjective information about boundaries)

(No values of T and S are necessary)

		Maximum influence of boundaries at long time		
	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	67.71	105.87	144.02	258.48
Q_sust (l/s) =	0.97	0.62	0.46	0.25
	Best case	→		Worst case

Average Q_sust (l/s) = 0.51

with standard deviation= 0.30

(If no information exists about boundaries skip advanced solution and go to final recommendation)

STEPPED DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1049	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 19		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	72.00	DATUM LEVEL (magl):	0.23	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	13.20	CASING HEIGHT (magl):	0.30	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	64.00	CASING DEPTH (magl):	18.00	PUMP TYPE USED	BP40

DISCHARGE RATE 1

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		1.54		1		
2		1.73		2		
3		1.96		3		
5		2.25	2.96	5		
7		2.79		7		
10		3.08		10		
15		3.33		15		
20		3.48		20		
30		3.74		30		
40		3.89		40		
50		4.00		50		
60		4.05		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 2

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		6.39		1		
2		6.63		2		
3		6.80		3		
5		6.96	6.00	5		
7		7.26		7		
10		7.57		10		
15		7.80		15		
20		7.94		20		
30		8.14		30		
40		8.30		40		
50		8.46		50		
60		8.58		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 3

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		14.37		1		
2		15.60		2		
3		17.58		3		
5		20.56	12.31	5		
7		21.72		7		
10		22.55		10		
15		23.33		15		
20		23.84		20		
30		24.54		30		
40		24.98		40		
50		25.30		50		
60		25.65		60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 4

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1		33.49		1		
2		43.86		2		
3		44.93		3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 5

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		
2				2		
3				3		
5				5		
7				7		
10				10		
15				15		
20				20		
30				30		
40				40		
50				50		
60				60		
70				70		
80				80		
90				90		
100				100		
110				110		
120				120		
				150		

DISCHARGE RATE 6

DATE: 25-Mar-99 TIME:

Time	Drawdown		Yield	Time	Recovery	
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)
1				1		17.580
2				2		9.830
3				3		7.090
5				5		6.220
7				7		5.150
10				10		4.520
15				15		3.750
20				20		3.350
30				30		2.890
40				40		2.570
50				60		2.190
60				90		1.850
70				120		1.660
80				150		1.330
90				180		1.410
100				210		1.370
110				240		1.300
120				300		1.240
				360		1.170
				420		1.10
				480		1.03
				540		0.94
				600		0.87

COMMENTS:

CONSTANT DISCHARGE TEST AND RECOVERY

BOREHOLE NO.:	H06 1049	PROJECT:	SOUTHERN DISTRICT
ALTERNATIVE NO.:		SITE NAME:	PHYS 19
ALTERNATIVE NO.:		CLIENT:	Research

BOREHOLE DEPTH (mbdl):	72.00	DATUM LEVEL (magl):	0.23	PUMP INLET DIAMETER (mm):	100
STATIC WATER LEVEL (mbdl):	2.43	CASING HEIGHT (magl):	0.30	EXISTING PUMP:	no
DEPTH OF PUMP (mbdl):	64.00	CASING DEPTH (magl):	18.00	CONTRACTOR:	AB pumps
				PUMP TYPE USED:	BP40

TEST STARTED				TEST COMPLETED		DURATION (min):	
DATE:	26-Mar-99	TIME:		DATE:		TIME:	TOTAL TIME PUMPED (min):
AVERAGE YIELD (l/s):	10.12	S.W.L.:	14.07				

DISCHARGE BORE

Time	Drawdown		Yield	Time	Recovery		
(min)	mbdl	(m)	(l/s)	(min)	mbdl	(m)	t/t'
1		11.20		1		25.64	4321
2		12.00		2		25.30	2161
3		14.97	10.10	3		25.23	1441
5		16.18		5		24.90	865
7		17.19		7		24.80	618.14
10		17.60		10		24.66	433
15		17.94		15		24.33	289
20		18.17		20		23.95	217
30		18.70		30		23.69	145
40		19.06		40		23.43	109
60		19.59	10.10	60		23.11	73
90		20.28		90		22.86	49
120		20.70		120		22.57	37
150		21.05		150		22.35	29.8
180		21.14		180		22.19	25
210		21.80		210		22.09	21.571
240		21.98		240		21.94	19
300		22.38		300		21.69	15.4
360		22.74	10.16	360		21.48	13
420		23.10		420		21.29	11.286
480		23.37		480		20.95	10
540		23.82		540		20.88	9
600		24.15		600		20.80	8.2
720		24.85		720		20.53	7
840		25.70	10.14	840		20.23	6.1429
960		26.36		960		19.96	5.5
1080		26.85		1080		19.63	5
1200		27.29		1200		19.50	4.6
1320		27.75		1320		19.45	4.2727
1440		28.44	10.14	1440		19.40	4
1560		29.17		1560		19.36	3.7692
1680		29.65		1680		19.27	3.5714
1800		30.00		1800		18.83	3.4
1920		30.32		1920		18.66	3.25
2040		30.68		2040		18.5	3.1176
2160		31.43		2160		18.41	3
2280		31.78		2280		18.32	2.8947
2400		31.99		2400		18.23	2.8
2520		32.55		2520		18.14	2.7143
2640		32.87		2640		18.05	2.6364
2760		33.26		2760		17.96	2.5652
2880		33.8		2880		17.85	2.5
3000		34.35		3000		17.77	2.44
3120		34.5		3120		17.72	2.3846
3240		34.75		3240		17.61	2.3333
3360		35.16		3360		17.48	2.2857
3480		35.56	10.14	3480		17.36	2.2414
3600		36.04		3600		17.28	2.2
3720		36.65		3720		17.2	2.1613
3840		36.85		3840		17.12	2.125
3960		37.08		3960		17.04	2.0909
4080		37.26		4080		16.96	2.0588
4200		37.35		4200		16.87	2.0286
4320		37.49		4320		16.79	2
5040				5040			
5760				5760			
7200				7200			
10080				10080			

OBSERVATION BOREHOLES

	BOREHOLE 1			S.W.L.	BOREHOLE 2			S.W.L.	BOREHOLE 3			S.W.L
	No.:	H06 1060		21.78	No.:	H06 1451		6.24	No.:	H06 1059		
	Distance (m):	13.67			Distance (m):	106.85			Distance:			
Time	Drawdown			Rec	Time	Drawdown		Rec	Time	Drawdown		Rec
(min)	mbdl	(m)		(m)	(min)	mbdl	(m)	(m)	(min)	mbdl	(m)	(m)
1		0.81		25.88	1		0.07	15.21	1		0.00	0
2		1.30		25.48	2		0.11	12.3	2		0.00	0
3		2.10		25.04	3		0.15	9.64	3		0.00	0
5		3.08		24.59	5		0.18	7.14	5		0.00	0
7		4.06		24.37	7		0.20	6.3	7		0.00	0
10		5.00		24.2	10		0.22	5.9	10		0.00	0
15		5.46		23.8	15		0.24	5.09	15		0.00	0
20		5.74		23.35	20		0.27	4.75	20		0.00	0
30		6.19		23.08	30		0.29	4.1	30		0.00	
40		6.50		22.8	40		0.35	3.8	40		0.00	
60		7.77		22.42	60		0.41	3.01	60		0.00	
90		8.25		22.07	90		0.47	2.63	90		0.00	
120		8.45		21.82	120		1.06	2.12	120		0.00	
150		8.62		21.61	150		1.52	18.4	150		0.00	
180		8.98		21.42	180		2.02	1.16	180		0.00	
210		9.38		21.3	210		2.30	0.89	210		0.00	
240		9.61		21.13	240		2.78	0.8	240		0.00	
300		9.96		20.88	300		3.12	0.72	300		0.00	
360		10.52		20.69	360		3.94	0.64	360		0.00	
420		10.88		20.48	420		4.68	0.51	420		0.00	
480		11.26		20.2	480		5.14	0.4	480		0.00	
540		11.62		20.03	540		5.79	0.29	540		0.00	
600		12.04		19.96	600		6.09	0.11	600		0.00	
720		12.80		19.3	720		6.89	0.07	720		0.00	
840		13.56		18.64	840		7.15	0.05	840		0.00	
960		14.32		17.98	960		7.93	0	960		0.00	
1080		15.08		17.32	1080		8.27		1080		0.00	
1200		15.84		16.66	1200		8.80		1200		0.00	
1320		16.20		16	1320		9.57		1320		0.00	
1440		16.61		15.3	1440		10.23		1440		0.00	
1560		17.33		15.16	1560		11.30		1560		0.00	
1680		17.86		15.04	1680		11.71		1680		0.00	
1800		18.28		14.82	1800		12.13		1800		0.00	
1920		18.77		14.67	1920		12.53		1920		0.00	
2040		19.29		14.47	2040		12.94		2040		0.00	
2160		19.95		14.38	2160		13.45		2160		0.00	
2280		20.63		14.29	2280		13.96		2280		0.00	
2400		21.50		14.2	2400		14.42		2400		0.00	
2520		21.97		14.11	2520		14.98		2520		0.00	
2640		22.64		14.02	2640		15.51		2640		0.00	
2760		22.95		13.93	2760		16.09		2760		0.00	
2880		23.34		13.8	2880		16.51		2880		0.00	
3000		23.38		13.72	3000		17.04		3000		0.00	
3120		23.40		13.65	3120		17.57		3120		0.00	
3240		23.59		13.54	3240		17.8		3240		0.00	
3360		23.93		13.4	3360		18.07		3360		0.00	
3480		24.26		13.26	3480		18.36		3480		0.00	
3600		24.56		13.19	3600		18.67		3600		0.00	
3720		24.84		13.12	3720		18.98		3720		0.00	
3840		25.16		13.03	3840		19.29		3840		0.00	
3960		25.49		12.98	3960		19.6		3960		0.00	
4080		25.79		12.91	4080		19.91		4080		0.00	
4200		26.09		12.8	4200		20.22		4200		0.00	
4320		26.36		12.7	4320		20.54		4320		0.00	
5040					5040				5040			
5760					5760				5760			
7200					7200				7200			
10080					10080				10080			

3000	0.05
3120	0.11
3240	0.13
3360	0.12
3480	0.08
3600	0.08
3720	0.08
3840	0.08
3960	0.08
4080	0.09
4200	0.08

+24hrs test

S.W.L. : 24.6

Date :	22-Apr-99	
Drawdown	Recovery	t/t'
7.98	12.76	1441.00
8.9	12.5	721.00
10.05	12.39	481.00
12.34	12.32	289.00
13.08	12.22	206.71
13.84	11.92	145.00
14.55	11.54	97.00
15.07	11.09	73.00
15.67	10.86	49.00
15.9	10.57	37.00
16.57	10.17	25.00
17.07	9.8	17.00
17.51	9.5	13.00
17.88	9.32	10.60
18.13	9.2	9.00
18.39	9.04	7.86
18.66	8.95	7.00
19.08	8.71	5.80
19.5	8.55	5.00
19.93	8.41	4.43
20.31	8.29	4.00
20.5	8.15	3.67
20.85	8.05	3.40
21.41	7.91	3.00
21.97	7.77	2.71
22.53	7.63	2.50
23.09	7.49	2.33
23.65	7.35	2.20
24.23	7.19	2.09
24.87	7.06	2.00
	6.92	1.92
	6.77	1.86
	6.6	1.80

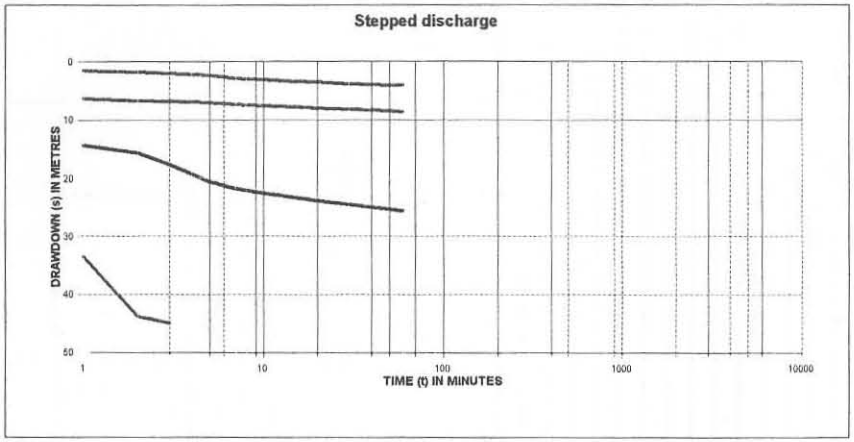
VATION BOREHOLES FOR CD (4,5,6,7& 8)

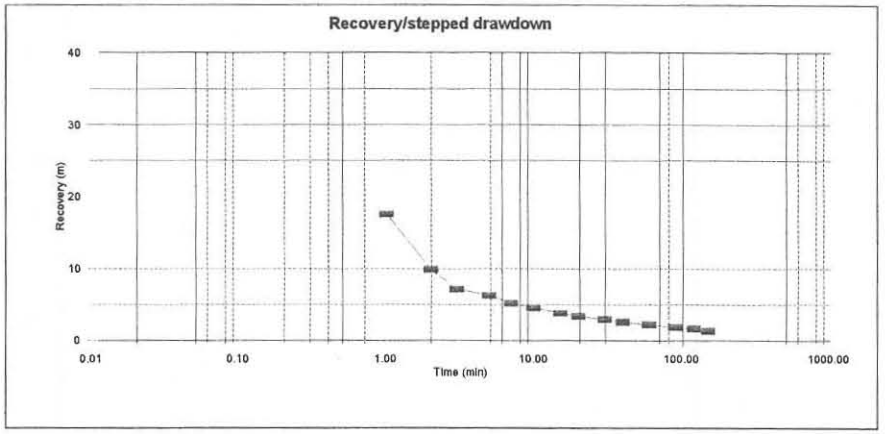
BOREHOLE NO.:	H06 1049	PROJECT:	SOUTHERN DISTRICT		
ALTERNATIVE NO.:		SITE NAME:	PHYS 19		
ALTERNATIVE NO.:		CLIENT:	Research	PUMP INLET DIAMETER (mm):	100
BOREHOLE DEPTH (mbdl):	72.00	DATUM LEVEL (magl):	0.23	EXISTING PUMP:	no
STATIC WATER LEVEL (mbdl):	2.43	CASING HEIGHT (magl):	0.30	CONTRACTOR:	AB pumps
DEPTH OF PUMP (mbdl):	64.00	CASING DEPTH (magl):	18.00	PUMP TYPE USED:	BP40

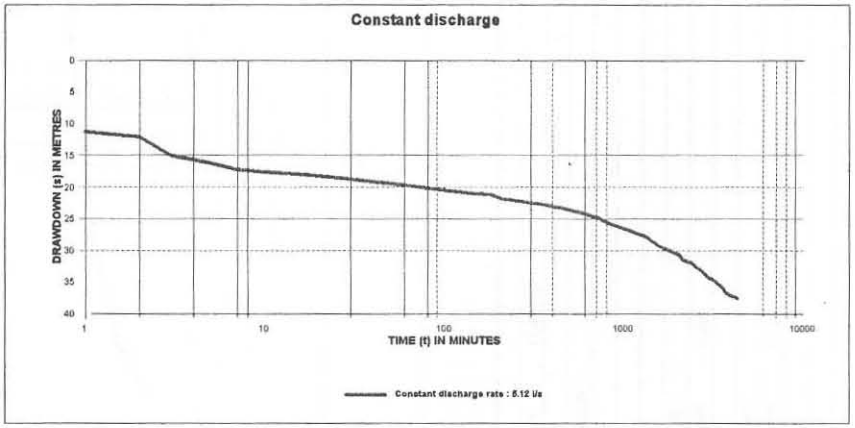
TEST STARTED		TEST COMPLETED		DURATION (min):	
DATE:	TIME:	DATE:	TIME:	TOTAL TIME PUMPED (min):	

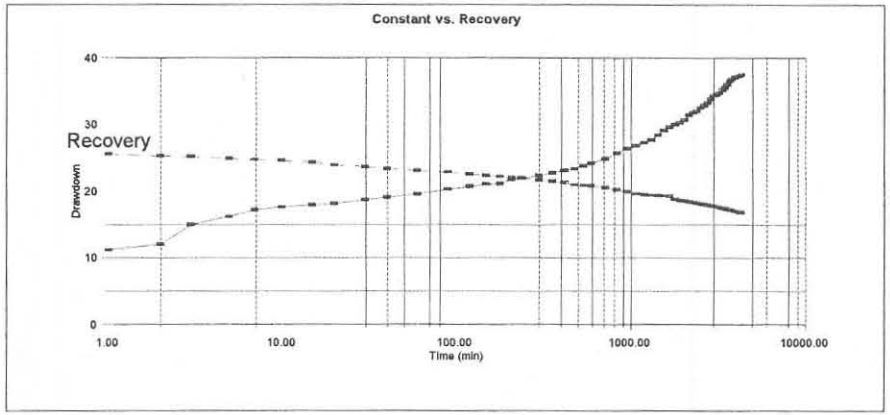
OBSERVATION BOREHOLES	BOREHOLE 4			S.W.L.	BOREHOLE 5			S.W.L.	BOREHOLE 6				BOREHOLE 7				BOREHOLE 8			
	No.:				No.: H06 1450			3.72	No.:				No.:				No.:			
	Distance (m):				Distance (m): 101.86				Distance (m):				Distance (m):				Distance:			
	Time (min)	Drawdown mbdl	Drawdown (m)	Rec (m)	Time (min)	Drawdown mbdl	Drawdown (m)	Rec (m)	Time (min)	Drawdown mbdl	Drawdown (m)	Rec (m)	Time (min)	Drawdown mbdl	Drawdown (m)	Rec (m)	Time (min)	Drawdown mbdl	Drawdown (m)	Rec (m)
	1				1		0.00	0.53	1				1				1			
	2				2		0.00	0.52	2				2				2			
	3				3		0.00	0.51	3				3				3			
	5				5		0.00	0.5	5				5				5			
	7				7		0.00	0.49	7				7				7			
	10				10		0.00	0.48	10				10				10			
	15				15		0.00	0.48	15				15				15			
	20				20		0.00	0.47	20				20				20			
	30				30		0.00	0.47	30				30				30			
	40				40		0.01	0.47	40				40				40			
	60				60		0.04	0.46	60				60				60			
	90				90		0.07	0.45	90				90				90			
	120				120		0.09	0.45	120				120				120			
	150				150		0.10	0.45	150				150				150			
	180				180		0.11	0.44	180				180				180			
	210				210		0.13	0.43	210				210				210			
	240				240		0.14	0.43	240				240				240			
	300				300		0.14	0.42	300				300				300			
	360				360		0.15	0.42	360				360				360			
	420				420		0.16	0.42	420				420				420			
	480				480		0.16	0.4	480				480				480			
	540				540		0.17	0.39	540				540				540			
	600				600		0.18	0.38	600				600				600			
	720				720		0.19	0.38	720				720				720			
	840				840		0.20	0.37	840				840				840			
	960				960		0.21	0.34	960				960				960			
	1080				1080		0.22	0.31	1080				1080				1080			
	1200				1200		0.24	0.28	1200				1200				1200			
	1320				1320		0.27	0.25	1320				1320				1320			
	1440				1440		0.30	0.19	1440				1440				1440			
	1560				1560		0.30	0.09	1560				1560				1560			
	1680				1680		0.30	0.05	1680				1680				1680			
	1800				1800		0.31	0	1800				1800				1800			
	1920				1920		0.32		1920				1920				1920			
	2040				2040		0.34		2040				2040				2040			
	2160				2160		0.36		2160				2160				2160			
	2280				2280		0.38		2280				2280				2280			
	2400				2400		0.4		2400				2400				2400			
	2520				2520		0.42		2520				2520				2520			
	2640				2640		0.44		2640				2640				2640			
	2760				2760		0.46		2760				2760				2760			
	2880				2880		0.47		2880				2880				2880			
	3000				3000		0.47		3000				3000				3000			
	3120				3120		0.47		3120				3120				3120			
	3240				3240		0.47		3240				3240				3240			
	3360				3360		0.48		3360				3360				3360			
	3480				3480		0.48		3480				3480				3480			
	3600				3600		0.49		3600				3600				3600			
	3720				3720		0.5		3720				3720				3720			
	3840				3840		0.5		3840				3840				3840			
	3960				3960		0.51		3960				3960				3960			
	4080				4080		0.52		4080				4080				4080			
	4200				4200		0.53		4200				4200				4200			
	4320				4320		0.53		4320				4320				4320			
	5040				5040				5040				5040				5040			
	5720				5720				5720				5720				5720			
	7200				7200				7200				7200				7200			
	10080				10080				10080				10080				10080			

BOREHOLE NUMBER: H06 1049

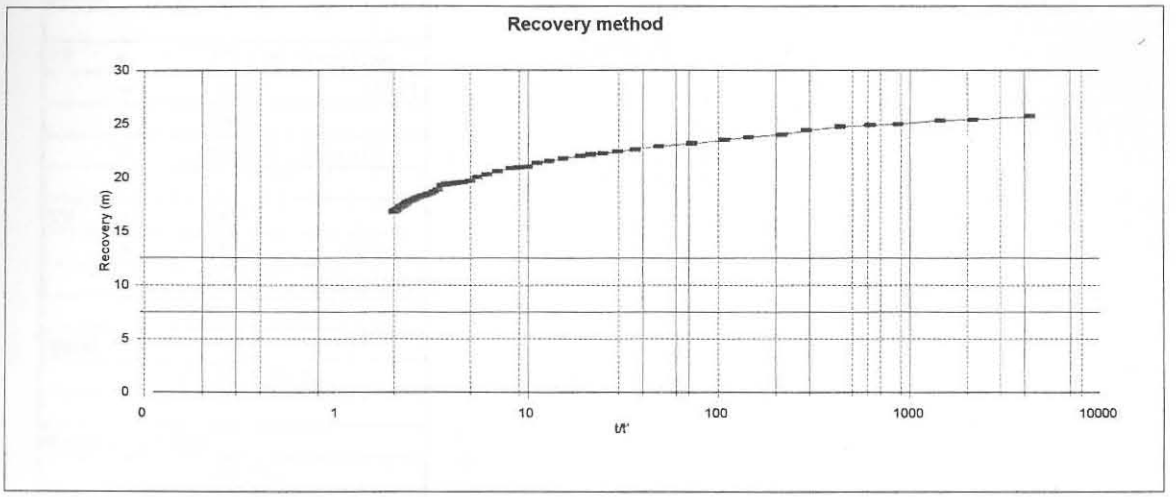








Comments:



	Pump cycle	=	1440	min (24hrs)	
	Yield	=	10.12	l/s	
	t/t"	=	0	(Graph)	
	Recovery period	=	1440 /	t/t"	
			1440 /	0.00	
				ERR min	
	Pumping period	=	1440 -	ERR	
				ERR min	
	Litres pumped	=	ERR	L	
	Pump yield @ 24 hrs		ERR	L/s	
	Factor of safety	=	0.75		
	Operating yield	=	ERR	L/s for 24 hrs	

Comments:

Comments:

RULE of THUMB

H06 1049

TT	=	PT + recovery time	
	=	4320	25171
	=	29491	
	=	1769460	seconds
TV	=	L/s*TP	
	=	10.14	4320
	=	2628288	litres
Yield	=	TV/TT	
		1.48536164	l/s
Production yield			
	=	Yield *FS	
	=	1.48536164	75%
	=	1.11402123	l/s @ 24hrs

FC-METHOD : Estimation of the sustainable yield of a borehole

Borehole:

Extrapolation time in years = (enter)	3	1576800	Extrapol.time in minutes
Effective borehole radius (r_e) = (enter)	5 ←	5.0	Estimate of effective r_e
Q (l/s) from pumping test =	10.14	0.11	Estimate of t_c of WBS
s_a (available drawdown), sigma_s = (enter)	32	10 ←	Sigma_s from risk analysis
Annual effective recharge (m) =	0.0067	28.70	s_available working drawdown(m)
t(end) and s(end) of pumping test =	4320	37.49	End time and drawdown of test
Average maximum derivative = (enter)	30.1 ←	30.1	Estimate of average of max deriv
Average second derivative = (enter)	0.1 ←	0.1	Estimate of average second deriv
Derivative at radial flow period = (enter)	3.4 ←		Read from derivative graph
	T-early[m^2/d] =	47.15	
T and S estimates from derivatives	T-late [m^2/d] =	5.33	T-average = 15.85
(To obtain correct S-value, use program RPTSOLV)	S-late =	4.76E-03	S-estimate could be wrong

BASIC SOLUTION

(Using derivatives + subjective information about boundaries)

(No values of T and S are necessary)

		Maximum influence of boundaries at long time		
	No boundaries	1 no-flow	2 no-flow	Closed no-flow
sWell (Extrapol.time) =	114.94	192.07	269.19	500.57
Q_sust (l/s) =	2.53	1.52	1.08	0.58
	Best case	→		Worst case

Average Q_sust (l/s) = 1.25

with standard deviation= 0.83

(If no information exists about boundaries skip advanced solution and go to final recommendation)