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Hydraulic characterization of the kinsere geology, Democratic Republic of the Congo

Moswathupa, Hamilton Thabang Segana

2019

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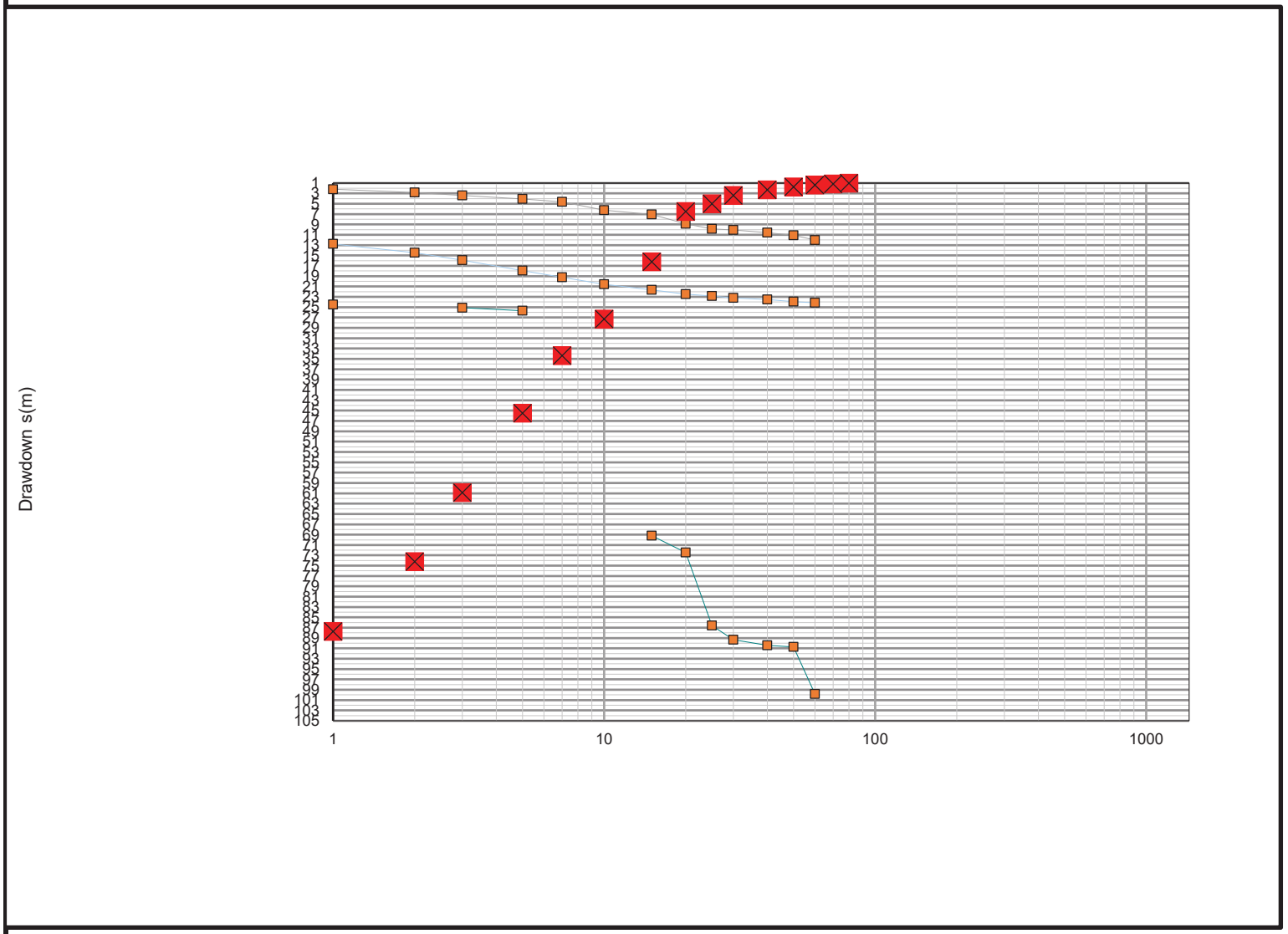
Appendices

Appendix A: Hydrocensus Water Level Data

BH I.D	Use	General Area Description	Easting	Northing	Collar Elevation (mamsl)	Collar Height (magl)	Borehole Depth (mbgl)	Water Level	
								mbgl	mamsl
DEW04	Dewatering Borehole	Kinsevere Hill	563506	8743210	1 220	0.52	121	47	1 172
DEW07	Dewatering Borehole	Kinsevere Hill open pit area	563304	8743432	1 222	0.49	121	52	1 170
DEW08	Dewatering Borehole	Northeast side Mashi Pit	561921	8745031	1 191	0.65	139	12	1 178
DEW25	Dewatering Borehole	In Central Pit	562104	8744452	1 204	0.40	250	8	1 196
DEW26	Dewatering Borehole	West side of Central Pit	561947	8743956	1 208	0.40	250	7	1 201
DEW33	Dewatering Borehole	North side of Mashi	561897	8744830	1 161	0.50	140	19	1 142
GWT07	Groundwater Supply Borehole	West side of dirty pond (Junction roads)	561129	8743746	1 218	0.68	68	33	1 184
GWT09	Groundwater Supply Borehole	Wash bay area	560880	8744292	1 213	0.42	70	28	1 185
GWT10B	Groundwater Supply Borehole	NB mining area	560869	8744622	1 208	0.50	100	27	1 181
GWT12	Groundwater Supply Borehole	Kinsevere Hill open pit area	562674	8743784	1 219	0.42	120	49	1 170
MON03	Monitoring Borehole	Kinsevere Hill open pit area	563812	8744477	1 211	0.59	81	36	1 174
MON04	Monitoring Borehole	East side of TSF 2	564095	8742098	1 238	0.43	81	53	1 185
MON09	Monitoring Borehole	Water Borehole at Kalilanda Village	561439	8746527	1 185	0.51	50	1	1 183
MON10	Monitoring Borehole	Water Borehole at Mpundu Village	562378	8746861	1 187	0.29	51	86	1 101
MON11	Monitoring Borehole	Water Borehole at Ernest Village	563669	8747317	1 189	0.30	50	3	1 186
MON24	Monitoring Borehole	South side of Central Pit	562315	8743790	1 213	0.45		27	1 185
MON41	Monitoring Borehole	Northeast of Kinsevere concession	563628	8745484	1 203	0.50	103	26	1 177
MON42	Monitoring Borehole	Southeast of Kinsevere concession	564094	8742970	1 214	0.57	88	37	1 176
MON43	Monitoring Borehole	South of TSF	562223	8741740	1 237	0.91	120	58	1 178
MON44	Monitoring Borehole	North of TSF	562837	8742978	1 224	0.75	103	49	1 174
MON45	Monitoring Borehole	Northeast of Mashi Pit	562060	8745095	1 204	0.70	99	25	1 178
MON46	Monitoring Borehole	Northwest of Mashi Pit	561663	8744839	1 203	0.55	101	42	1 160
MON47	Monitoring Borehole	Southeast of Central Pit	562559	8743777	1 218	0.61	101	48	1 169
MON52	Monitoring Borehole	South of TSF01 Area	563581	8744115	1 215			32	1 183
TSFMON01	Monitoring Borehole	South of TSF01 Area	563038	8741614	1 236	0.91	80	56	1 179
TSFMON02	Monitoring Borehole	South of Kinsevere Hill Towards EAF and New SX/EW TSF	563396	8743096	1 221	1.00	81	17	1 203
TSFMON03	Monitoring Borehole	Near Magazine Explosive Storage Yard	562391	8743224	1 217	0.95	80	23	1 193
TSFMON04	Monitoring Borehole	Kinsevere Hill	564082	8742010	1 243	0.49	80	63	1 180
TSFMON05	Monitoring Borehole	Tailings Storage Facility	563113	8741617	1 259	0.95	80	83	1 175
TSFMON07	Monitoring Borehole	Pundu Village	563150	8746101	1 195	0.95	86	4	1 190
TSFMON08	Monitoring Borehole	Kinsevere Hill	563734	8743879	1 214	0.71	80	37	1 176
HTH1	Multi-level Pressure Piezometer	North side of the Central Pit	562635	8744539	1 214	Pore Pressure Measurements			
HTH2	Multi-level Pressure Piezometer	East side of the Central Pit	562709	8744123	1 219	Pore Pressure Measurements			
HTH3	Multi-level Pressure Piezometer	West side of the Central Pit	562061	8831347	1 206	Pore Pressure Measurements			
HTH4	Multi-level Pressure Piezometer	North west side of the Central Pit	561976	8744653	1 205	Pore Pressure Measurements			
HTH5	Multi-level Pressure Piezometer	North side of the Mashi Pit	561938	8745022	1 203	Pore Pressure Measurements			
HTH6	Multi-level Pressure Piezometer	South side of the Central Pit	562030	8743850	1 203	Pore Pressure Measurements			

Appendix B: Pumping Test Data

STEP DRAWDOWN TEST DATA PLOT



= Drawdown data.

X = Recovery data.

BH DEW08

DATE TESTED

From 21/08/2017

To 21/08/2017

DISCHARGE RATES (Q)

Q1 =	**5.06**	l/s
Q2 =	**10.15**	l/s
Q3 =	**20.19**	l/s
Q4 =	**0.00**	l/s
Q5 =	**0.00**	l/s
Q6 =	**0.00**	

STEPPED DISCHARGE TEST & RECOVERY

CONSULTANT :				**CONSULTANT ONSITE :**	MOSH
PUMP TESTING CONTRACTOR :				**PUMP TESTING SUPERVISOR :**	SAKHI
PROJECT NUMBER :				**PROJECT NAME :**	KINSEVERE GW
COORDINATES :	S-11.35209		E27.56749	**BOREHOLE I.D**	DEW08
AQUIFER TESTING DATES :	FROM : 21/08/2017	TO :	21/08/2017	**PROVINCE :**	KATANGA

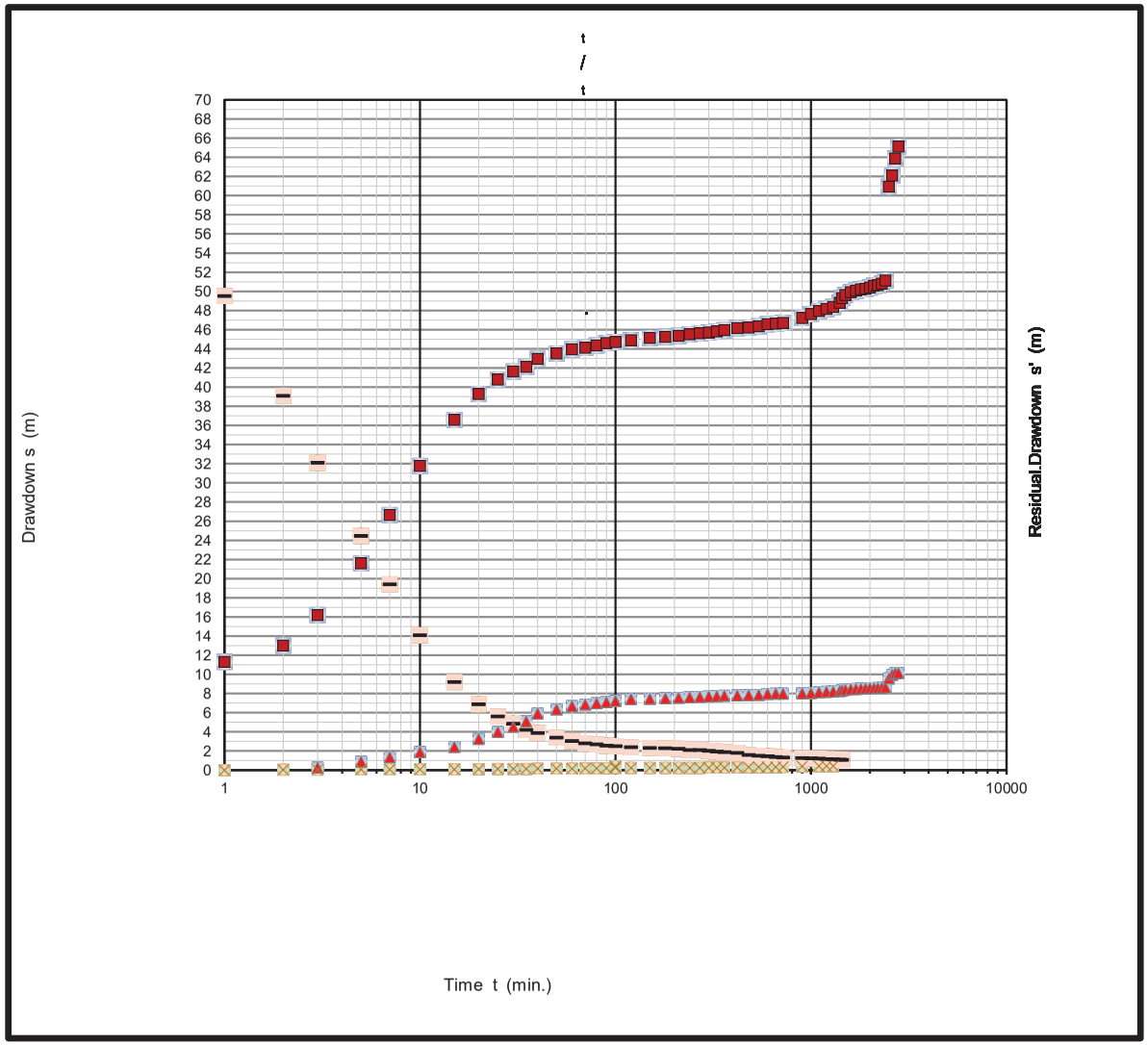
BOREHOLE DETAILS	
CASING HEIGHT (magl) :	0.6
BOREHOLE DEPTH (mbgl) :	125
STATIC WATER LEVEL (mbgl)	12.75
PUMP INSTALLATION DEPTH (mbgl)	120
AVAILABLE DRAWDOWN (m)	107.25

STEPPED DISCHARGE TEST & RECOVERY

STEP 1						STEP 2					STEP 3				
TIME	**DRAW**		**YIELD**	**TIME**	**RECOVERY**	**TIME**	**DRAW**	**YIELD**	**TIME**	**RECOVERY**	**TIME**	**DRAW**	**YIELD**	**TIME**	**RECOVERY**
(MIN)	**DOWN (M)**		**(L/S)**	**(MIN)**	**(M)**	**(MIN)**	**DOWN (M)**	**(L/S)**	**(MIN)**	**(M)**	**(MIN)**	**DOWN (M)**	**(L/S)**	**(MIN)**	**(M)**
1	2.18		5.06	**1**		**1**	12.78	10.15	**1**		**1**	24.50	20.19	**1**	
2	2.85			**2**		**2**	14.49		**2**		**2**			**2**	Issue with dip meter
3	3.40			**3**		**3**	15.90	10.40	**3**		**3**	25.10		**3**	
5	4.06		5.01	**5**		**5**	17.95		**5**		**5**	25.70		**5**	
7	4.62		5.05	**7**		**7**	19.24		**7**		**7**			**7**	Issue with dip meter
10	6.24			**10**		**10**	20.58		**10**		**10**			**10**	Issue with dip meter
15	7.05			**15**		**15**	21.66	10.13	**15**		**15**	69.18	20.11	**15**	
20	8.88			**20**		**20**	22.47		**20**		**20**	72.47	20.21	**20**	
25	9.84		5.11	**25**		**25**	22.87		**25**		**25**	86.60		**30**	
30	10.06			**30**		**30**	23.19	10.09	**30**		**30**	89.30	20.28	**40**	
40	10.61		5.04	**40**		**40**	23.51		**40**		**40**	90.43	20.15	**50**	
50	11.12			**50**		**50**	23.93	9.98	**50**		**50**	90.70		**60**	
60	12.01			**60**		**60**	24.15		**60**		**60**	99.84		**70**	
Average (l/s)			5.06					10.15					20.19		
Average (m3/d)			436.88					877.13					1744.20		
pH						**pH**					**pH**				
TEMP			°C			**TEMP**		°C			**TEMP**		°C		
EC			µS/cm			**EC**		µS/cm			**EC**		µS/cm		

STEP 4						STEP 5					STEP 6				
TIME	**DRAW**		**YIELD**	**TIME**	**RECOVERY**	**TIME**	**DRAW**	**YIELD**	**TIME**	**RECOVERY**	**TIME**	**DRAW**	**YIELD**	**TIME**	**RECOVERY**
(MIN)	**DOWN (M)**		**(L/S)**	**(MIN)**	**(M)**	**(MIN)**	**DOWN (M)**	**(L/S)**	**(MIN)**	**(M)**	**(MIN)**	**DOWN (M)**	**(L/S)**	**(MIN)**	**(M)**
1				**1**	87.71	**1**			**1**		**1**			**1**	
2				**2**	74.20	**2**			**2**		**2**			**2**	
3				**3**	60.88	**3**			**3**		**3**			**3**	
5				**5**	45.52	**5**			**5**		**5**			**5**	
7				**7**	34.36	**7**			**7**		**7**			**7**	
10				**10**	27.30	**10**			**10**		**10**			**10**	
15				**15**	16.24	**15**			**15**		**15**			**15**	
20				**20**	6.50	**20**			**20**		**20**			**20**	
25				**25**	5.00	**25**			**25**		**25**			**25**	
30				**30**	3.40	**30**			**30**		**30**			**30**	
40				**40**	2.30	**40**			**40**		**40**			**40**	
50				**50**	1.74	**50**			**50**		**50**			**50**	
60				**60**	1.38	**60**			**60**		**60**			**60**	
				70	1.17										
				80	1.02										
				90	0.92										
				100	0.84										
				120											
				150											
				180											
				210											
				240											
TEMP			°C		0.07	**TEMP**		°C			**TEMP**		°C		
EC			µS/cm		0.06	**EC**		µS/cm			**EC**		µS/cm		

CONSTANT DISCHARGE TEST DATA PLOT



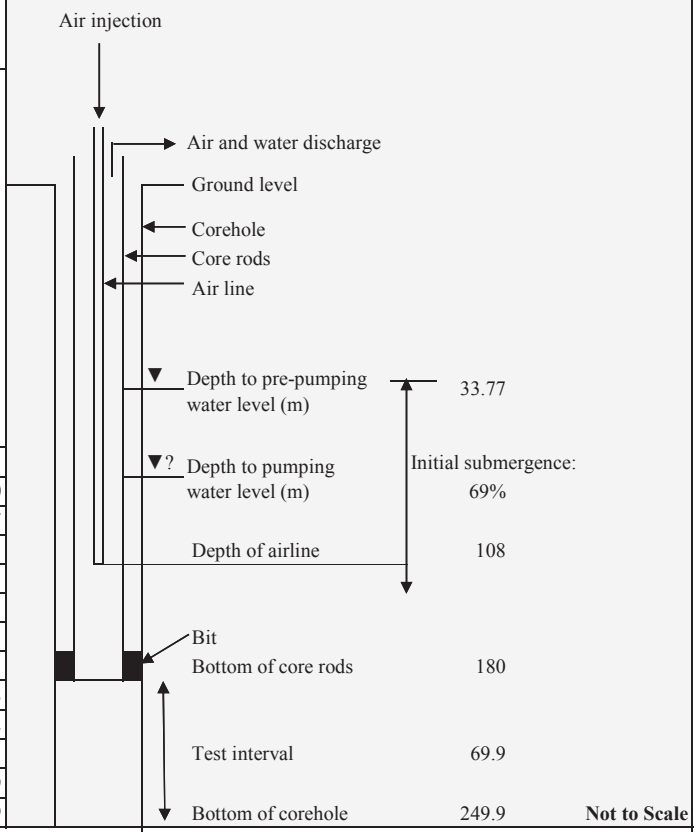
CONSULTANT :									**CONSULTANT ONSITE :**						MOSH		
PUMP TESTING CONTRACTOR :									**PUMP TESTING SUPERVISOR :**						SAKHI		
PROJECT NUMBER :									**PROJECT NAME :**						KINSEVERE GW		
COORDINATES :			S-11.35209		E27.56749				**BOREHOLE I.D**						DEW08		
AQUIFER TESTING DATES :			FROM :	22/08/2017	TO :				**PROVINCE :**						KATANGA		
BOREHOLE DETAILS			**CASING HEIGHT (magl) :**						0.6								
			BOREHOLE DEPTH (mbgl) :						125								
			STATIC WATER LEVEL (mbgl)						15.55								
			PUMP INSTALLATION DEPTH (mbgl)						120								
			AVAILABLE DRAWDOWN (m)						104.45								
						OBSERVATION HOLE 1		DEW17	OBSERVATION HOLE SRK06			OBSERVATION HOLE 3			OBSERVATION HOLE 4		
DISCHARGE BOREHOLE						Distance(m);	15		Distance(m);			Distance(m);			Distance(m);		
TIME	CDT DRAWDOWN		YIELD	TIME	CDT RECOVE	TIME:	Drawdown	Recovery	TIME:	Drawdown	Recovery	TIME:	Drawdown		TIME:		Drawdown
(MIN)	(M)		(L/S)	MIN	(M)	(min)	m	(m)	(min)	(m)		(min)	(m)		(min)		(m)
0.5	10.1	109.9			56.29	0.5		10.15									
1	11.31			**1**	49.50	**1**		10.13	**1**	0.00		**1**			**1**		
2	13.00			**2**	39.07	**2**		9.94	**2**	0.05		**2**			**2**		
3	16.20			**3**	32.10	**3**	0.26	9.52	**3**	0.05		**3**			**3**		
5	21.58			**5**	24.46	**5**	0.87	9.07	**5**	0.06		**5**			**5**		
7	26.64			**7**	19.40	**7**	1.34	8.19	**7**	0.06		**7**			**7**		
10	31.76			**10**	14.07	**10**	1.89	7.60	**10**	0.08		**10**			**10**		
15	36.58			**15**	9.20	**15**	2.41	5.02	**15**	0.08		**15**			**15**		
20	39.26			**20**	6.87	**20**	3.25	3.82	**20**	0.10		**20**			**20**		
25	40.78			**25**	5.60	**25**	3.97	2.83	**25**	0.11		**25**			**25**		
30	41.61			**30**	4.85	**30**	4.53	1.97	**30**	0.12		**30**			**30**		
35	42.10			**35**	4.21	**35**	5.08	0.80	**35**	0.13		**35**			**35**		
40	42.94			**40**	3.87	**40**	5.90	0.44	**40**	0.14		**40**			**40**		
50	43.50			**50**	3.40	**50**	6.33		**50**	0.15		**50**			**50**		
60	43.93			**60**	3.03	**60**	6.67		**60**	0.16		**60**			**60**		
70	44.10			**70**	2.80	**70**	6.85		**70**	0.17		**70**			**70**		
80	44.35			**80**	2.68	**80**	6.98		**80**	0.18		**80**			**80**		
90	44.58			**90**	2.56	**90**	7.10		**90**	0.21		**90**			**90**		
100	44.70			**100**	2.50	**100**	7.22		**100**	0.22		**100**			**100**		
120	44.90			**120**	2.38	**120**	7.40		**120**	0.22		**120**			**120**		
150	45.12			**150**	2.32	**150**	7.45		**150**	0.22		**150**			**150**		
180	45.23			**180**	2.27	**180**	7.50		**180**	0.22		**180**			**180**		
210	45.35			**210**	2.24	**210**	7.55		**210**	0.22		**210**			**210**		
240	45.50			**240**	2.10	**240**	7.59		**240**	0.23		**240**			**240**		
270	45.62			**270**	2.08	**270**	7.62		**270**	0.24		**270**			**270**		
300	45.71			**300**	2.02	**300**	7.67		**300**	0.25		**300**			**300**		
330	45.82			**330**	1.94	**330**	7.70		**330**	0.26		**330**			**330**		
360	45.94			**360**	1.88	**360**	7.75		**360**	0.27		**360**			**360**		
420	46.15			**420**	1.80	**420**	7.79		**420**	0.29		**420**			**420**		
480	46.20			**480**	1.58	**480**	7.82		**480**	0.30		**480**			**480**		
540	46.35			**540**	1.49	**540**	7.85		**540**	0.31		**540**			**540**		
600	46.57			**600**	1.44	**600**	7.95		**600**	0.31		**600**			**600**		
660	46.62			**660**	1.37	**660**	7.97		**660**	0.32		**660**			**660**		
720	46.70			**720**	1.30	**720**	7.99		**720**	0.33		**720**			**720**		
900	47.21			**900**	1.26	**900**	8.01		**900**	0.39		**900**			**900**		
1000	47.62			**1000**	1.24	**1000**	8.02		**100**	0.40		**100**			**100**		
1100	47.93			**1100**	1.19	**1100**	8.11		**1100**	0.41		**1100**			**1100**		
1200	48.15			**1200**	1.15	**1200**	8.16		**1200**	0.42		**1200**			**1200**		
1300	48.36			**1300**	1.11	**1300**	8.19		**1300**	0.42		**1300**			**1300**		
1400	48.81			**1400**	1.09	**1400**	8.25		**1400**			**1400**			**1400**		
1440	49.29			**1440**	1.08	**1440**	8.31		**1440**			**1440**			**1440**		
1500	49.61			**1500**		**1500**	8.38		**1500**			**1500**			**1500**		
1600	49.90			**1600**		**1600**	8.43		**1600**			**1600**			**1600**		
1700	50.07			**1700**		**1700**	8.47		**1700**			**1700**			**1700**		
1800	50.20			**1800**		**1800**	8.50		**1800**			**1800**			**1800**		
1900	50.27			**1900**		**1900**	8.52		**1900**			**1900**			**1900**		
2000	50.40			**2000**		**2000**	8.54		**2000**			**2000**			**2000**		
2100	50.58			**2100**		**2100**	8.55		**2100**			**2100**			**2100**		
2200	50.64			**2200**		**2200**	8.56		**2200**			**2200**			**2200**		
2300	50.81			**2300**		**2300**	8.58		**2300**			**2300**			**2300**		
2400	51.13			**2400**		**2400**	8.62		**2400**			**2400**			**2400**		
2500	60.92			**2500**		**2500**	9.56		**2500**			**2500**			**2500**		
2600	62.10			**2600**		**2600**	9.94		**2600**			**2600**			**2600**		
2700	63.88			**2700**		**2700**	10.11		**2700**			**2700**			**2700**		
2800	65.11			**2800**		**2800**	10.14		**2800**			**2800**			**2800**		
2900				**2900**		**2900**			**2900**			**2900**			**2900**		
3000				**3000**		**3000**			**3000**			**3000**			**3000**		

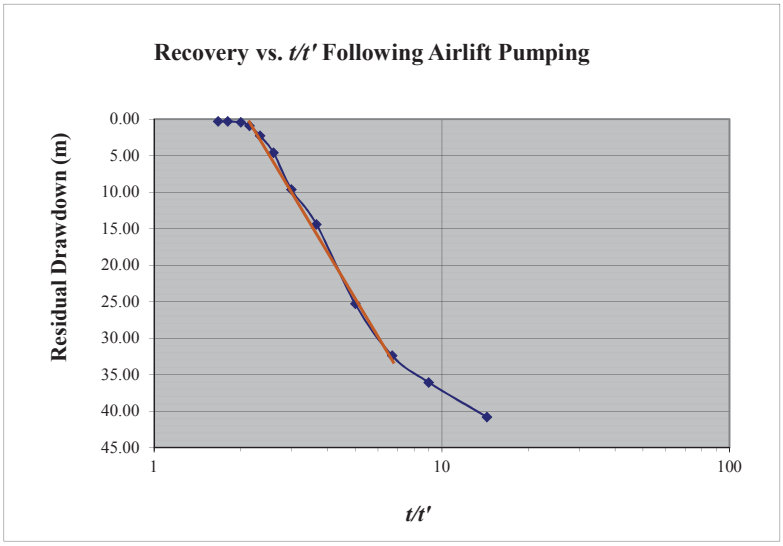
Appendix C: Airlift Testing Data

Analysis of DEW31 Airlift Pumping and Recovery Data

Corehole Depth (m):	249.9			Pre-Pumping WL (m):	33.8	
Core Rod Depth (m):	180.0			Depth of Airline (m):	107.6	
Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	35			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	43	3	14.3		74.57	40.80
	45	5	9.0		69.84	36.07
	47	7	6.7		66.18	32.41
	50	10	5.0		59.08	25.31
	55	15	3.7		48.18	14.41
	60	20	3.0		43.42	9.65
	65	25	2.6		38.38	4.61
	70	30	2.3		36.05	2.28
	75	35	2.1		34.69	0.92
	80	40	2.0		34.20	0.43
	90	50	1.8		34.06	0.29
	100	60	1.7		34.06	0.29

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

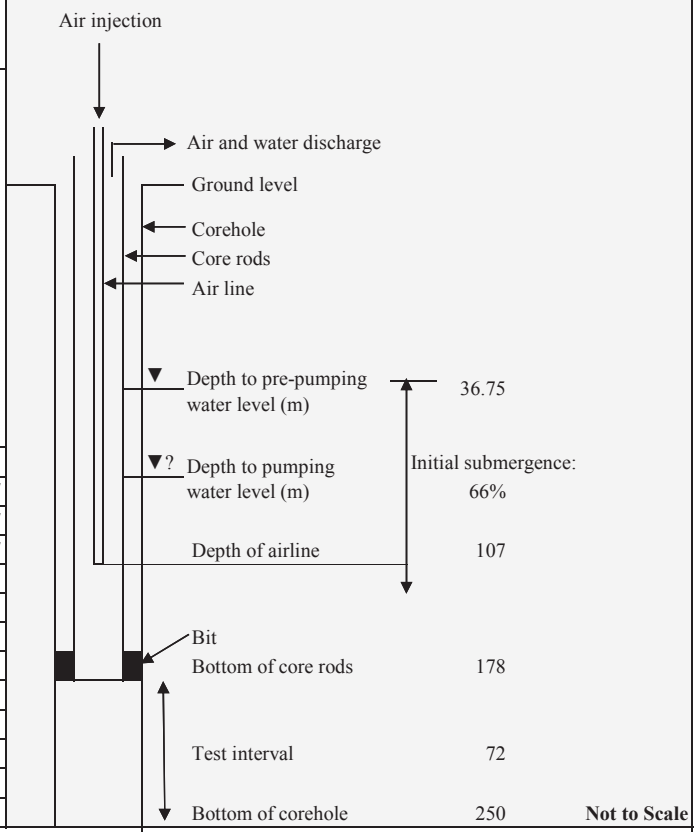
$$T = \frac{0.183Q}{\Delta s}$$

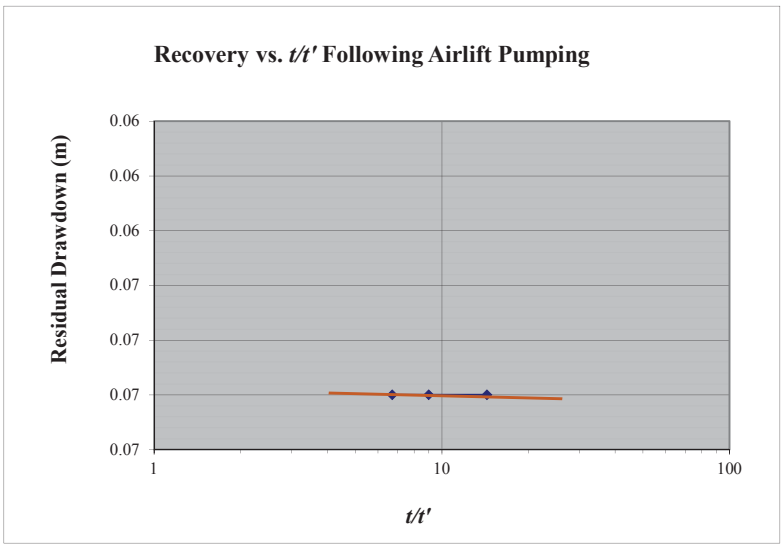
Q_{ave}	50.9	Discharge (m^3/d)
Δs	30.13	Drawdown (m)
T	3.1E-01	m^2/d
b	69.9	Test zone thickness (m)
K	4.4E-03	m/d

Analysis of DEW30 Airlift Pumping and Recovery Data

Corehole Depth (m):	**250.0**		**Pre-Pumping WL (m):**	**36.8**		
Core Rod Depth (m):	**178.0**		**Depth of Airline (m):**	**107.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			23.0		
	5			25.9		
	7			29.1		
	10			25.9		
	15			25.9		
	20			25.9		
	25			25.9		
	30			25.9		
	35			29.1		
	40			29.1		
	50			29.1		
	60			29.1		
			Q_{ave}	27.0		
Recovery	43	3	14.3		36.82	0.07
	45	5	9.0		36.82	0.07
	47	7	6.7		36.82	0.07
	50	10	5.0			
	55	15	3.7			
	60	20	3.0			
	65	25	2.6			
	70	30	2.3			
	75	35	2.1			
	80	40	2.0			
	90	50	1.8			
	100	60	1.7			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

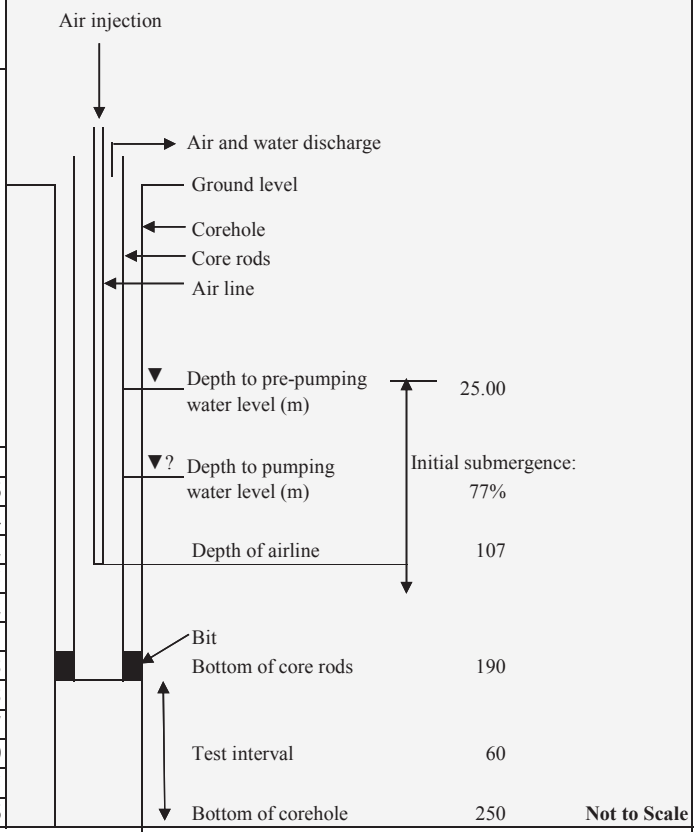
$$T = \frac{0.183Q}{\Delta s}$$

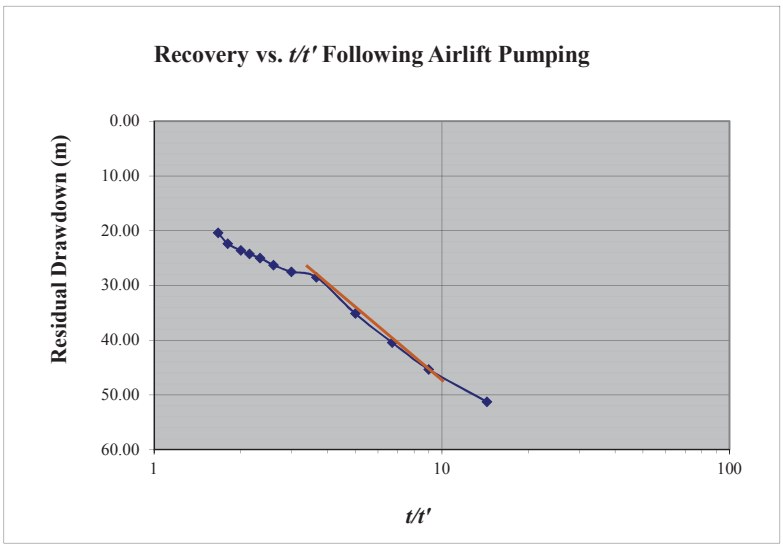
Q_{ave}	647.7	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	1.2E+04	m^2/d
b	72.0	Test zone thickness (m)
K	1.6E+02	m/d

Analysis of DEW29 Airlift Pumping and Recovery Data

Corehole Depth (m):	**250.0**		**Pre-Pumping WL (m):**	**25.0**		
Core Rod Depth (m):	**190.0**		**Depth of Airline (m):**	**107.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			8.5		
	5			8.5		
	7			3.6		
	10			3.1		
	15			2.1		
	20			3.1		
	25			3.1		
	30			3.1		
	35			3.1		
	40			2.1		
	50					
	60					
			Q_{ave}	4.0		
Recovery	43	3	14.3		76.26	51.26
	45	5	9.0		70.34	45.34
	47	7	6.7		65.42	40.42
	50	10	5.0		60.15	35.15
	55	15	3.7		53.52	28.52
	60	20	3.0		52.51	27.51
	65	25	2.6		51.28	26.28
	70	30	2.3		49.98	24.98
	75	35	2.1		49.27	24.27
	80	40	2.0		48.60	23.60
	90	50	1.8		47.35	22.35
	100	60	1.7		45.36	20.36

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

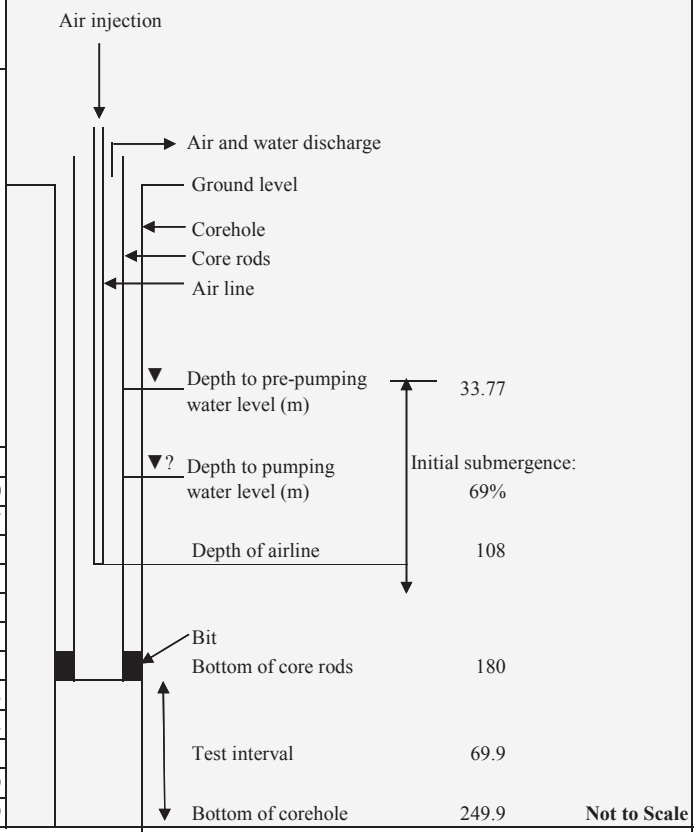
$$T = \frac{0.183Q}{\Delta s}$$

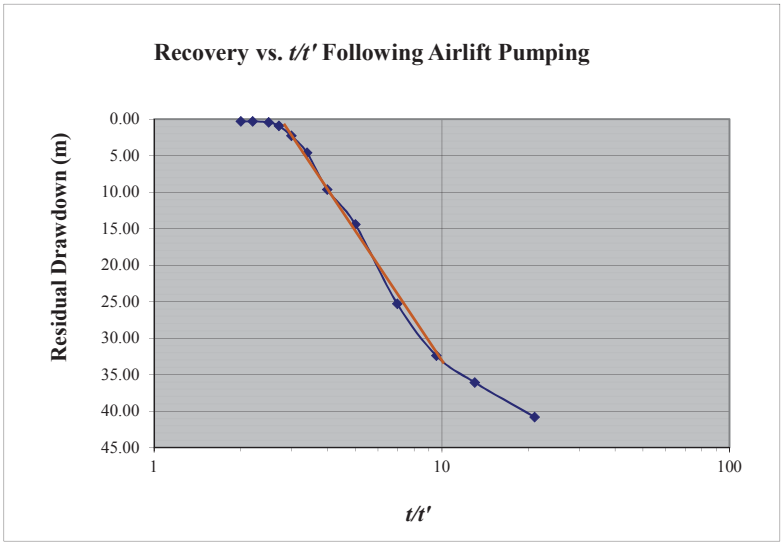
Q_{ave}	96.1	Discharge (m^3/d)
Δs	16.82	Drawdown (m)
T	1.0E+00	m^2/d
b	60.0	Test zone thickness (m)
K	1.7E-02	m/d

Analysis of DEW28 Airlift Pumping and Recovery Data

Corehole Depth (m):			**249.9**	**Pre-Pumping WL (m):**		**33.8**
Core Rod Depth (m):			**180.0**	**Depth of Airline (m):**		**107.6**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	35			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		74.57	40.80
	65	5	13.0		69.84	36.07
	67	7	9.6		66.18	32.41
	70	10	7.0		59.08	25.31
	75	15	5.0		48.18	14.41
	80	20	4.0		43.42	9.65
	85	25	3.4		38.38	4.61
	90	30	3.0		36.05	2.28
	95	35	2.7		34.69	0.92
	100	40	2.5		34.20	0.43
	110	50	2.2		34.06	0.29
	120	60	2.0		34.06	0.29

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

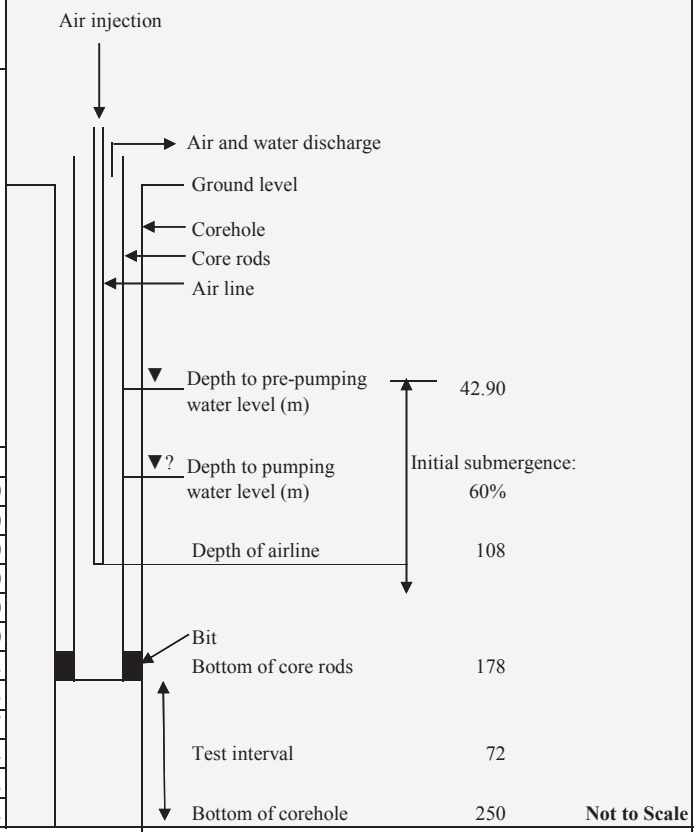
$$T = \frac{0.183Q}{\Delta s}$$

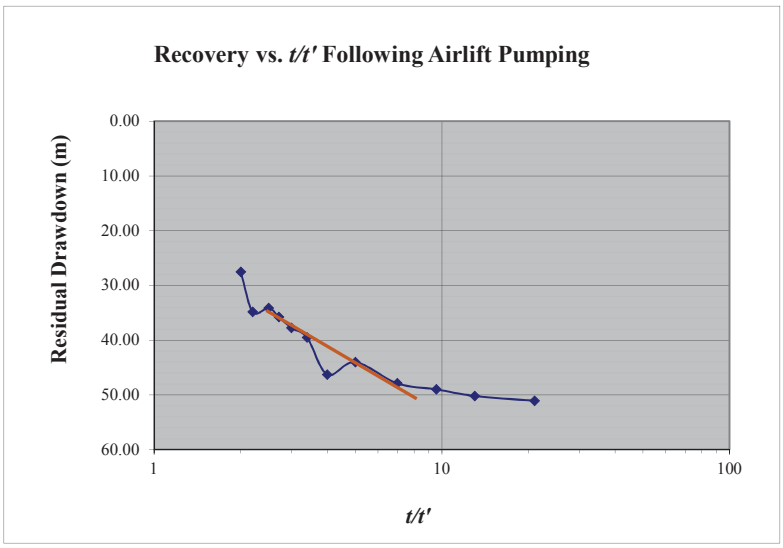
Q_{ave}	50.9	Discharge (m^3/d)
Δs	31.49	Drawdown (m)
T	3.0E-01	m^2/d
b	69.9	Test zone thickness (m)
K	4.2E-03	m/d

Analysis of DEW27 Airlift Pumping and Recovery Data

Corehole Depth (m):	**250.0**		**Pre-Pumping WL (m):**	**42.9**		
Core Rod Depth (m):	**178.0**		**Depth of Airline (m):**	**107.7**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			6.9		
	5			6.1		
	7			9.3		
	10			6.9		
	15			6.1		
	20			6.9		
	25			6.1		
	30			4.8		
	35			3.6		
	40			4.8		
	50					
	60					
			Q_{ave}	6.1		
Recovery	63	3	21.0		94.00	51.10
	65	5	13.0		93.10	50.20
	67	7	9.6		91.90	49.00
	70	10	7.0		90.80	47.90
	75	15	5.0		86.90	44.00
	80	20	4.0		89.20	46.30
	85	25	3.4		82.42	39.52
	90	30	3.0		80.68	37.78
	95	35	2.7		78.67	35.77
	100	40	2.5		77.02	34.12
	110	50	2.2		77.72	34.82
	120	60	2.0		70.42	27.52

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

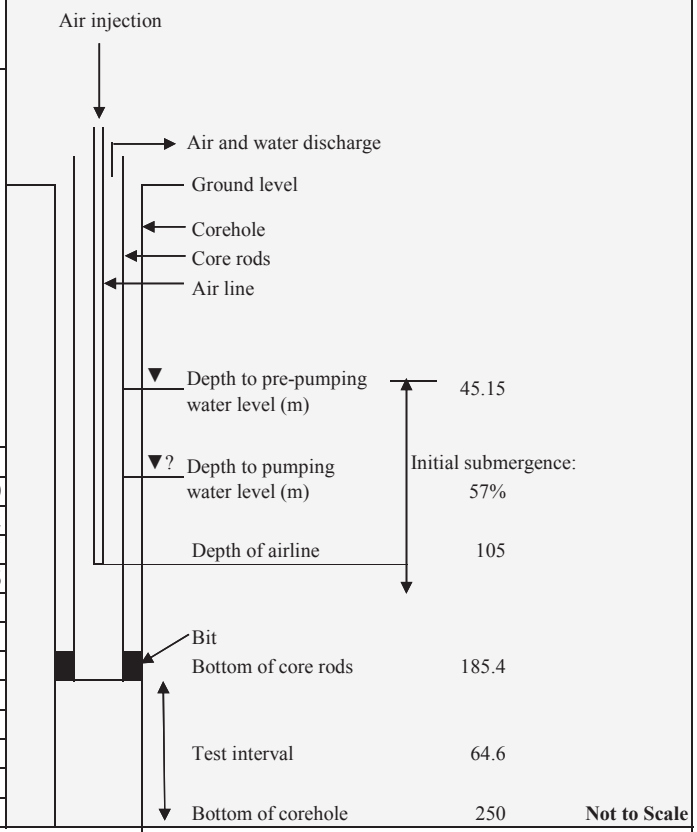
$$T = \frac{0.183Q}{\Delta s}$$

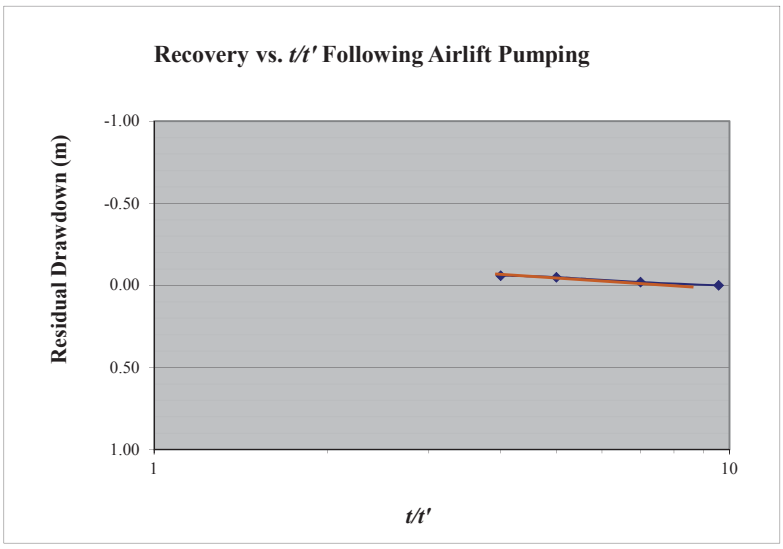
Q_{ave}	147.3	Discharge (m^3/d)
Δs	12.13	Drawdown (m)
T	2.2E+00	m^2/d
b	72.0	Test zone thickness (m)
K	3.1E-02	m/d

Analysis of DEW26 Airlift Pumping and Recovery Data

Corehole Depth (m):	**250.0**			**Pre-Pumping WL (m):**	**45.2**	
Core Rod Depth (m):	**185.4**			**Depth of Airline (m):**	**104.5**	
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			3.6		
	5			3.6		
	7			3.6		
	10			4.8		
	15			4.8		
	20			4.8		
	25			4.2		
	30			4.8		
	35			4.8		
	40			4.8		
	50			3.6		
	60			4.8		
			Q_{ave}	4.3		
Recovery	67	7	9.6		45.15	0.00
	70	10	7.0		45.13	-0.02
	75	15	5.0		45.10	-0.05
	80	20	4.0		45.09	-0.06
	85	25	3.4			
	90	30	3.0			
	95	35	2.7			
	100	40	2.5			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

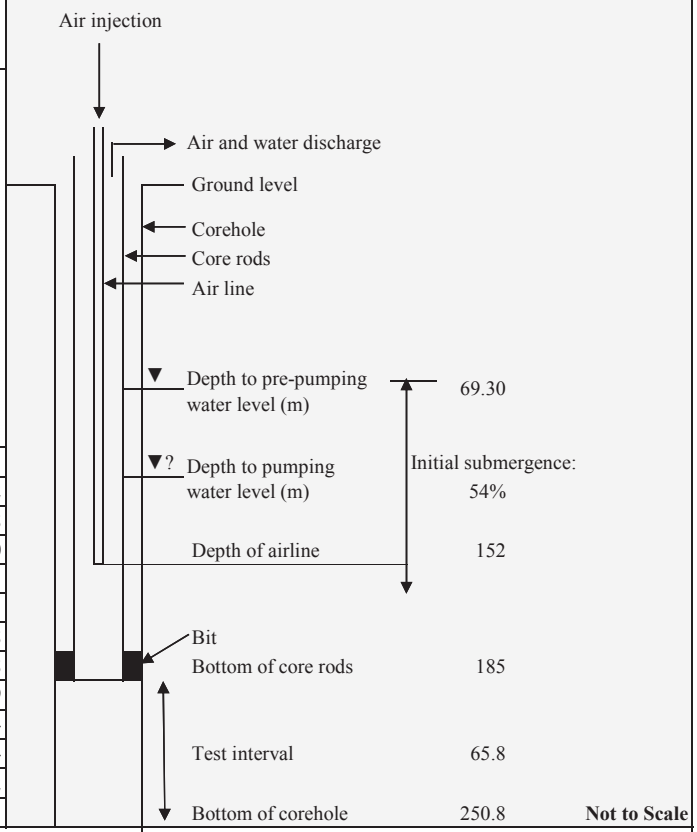
Q_{ave}	103.8	Discharge (m^3/d)
Δs	0.04	Drawdown (m)
T	4.7E+02	m^2/d
b	64.6	Test zone thickness (m)
K	7.4E+00	m/d

Analysis of DEW25 Airlift Pumping and Recovery Data

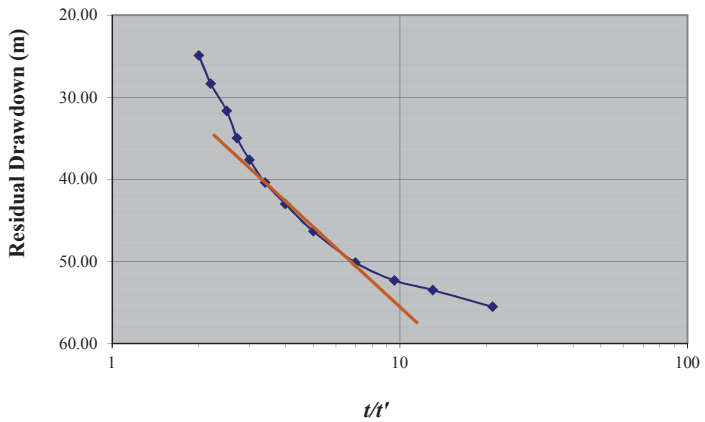
Corehole Depth (m):	250.8			Pre-Pumping WL (m):	69.3	
Core Rod Depth (m):	185.0			Depth of Airline (m):	151.9	

Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	35			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		124.82	55.52
	65	5	13.0		122.78	53.48
	67	7	9.6		121.60	52.30
	70	10	7.0		119.41	50.11
	75	15	5.0		115.61	46.31
	80	20	4.0		112.28	42.98
	85	25	3.4		109.68	40.38
	90	30	3.0		106.89	37.59
	95	35	2.7		104.24	34.94
	100	40	2.5		100.94	31.64
	110	50	2.2		97.62	28.32
	120	60	2.0		94.21	24.91

Schematic Diagram of Airlift Pumping System



Recovery vs. t/t' Following Airlift Pumping



Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

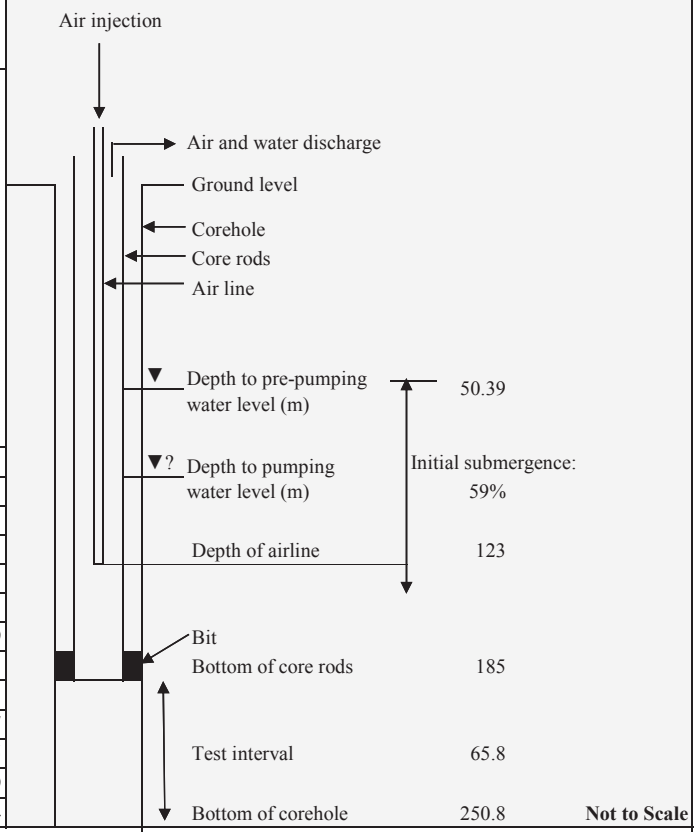
Q_{ave}	50.9	Discharge (m^3/d)
Δs	9.73	Drawdown (m)
T	9.6E-01	m^2/d
b	65.8	Test zone thickness (m)
K	1.5E-02	m/d

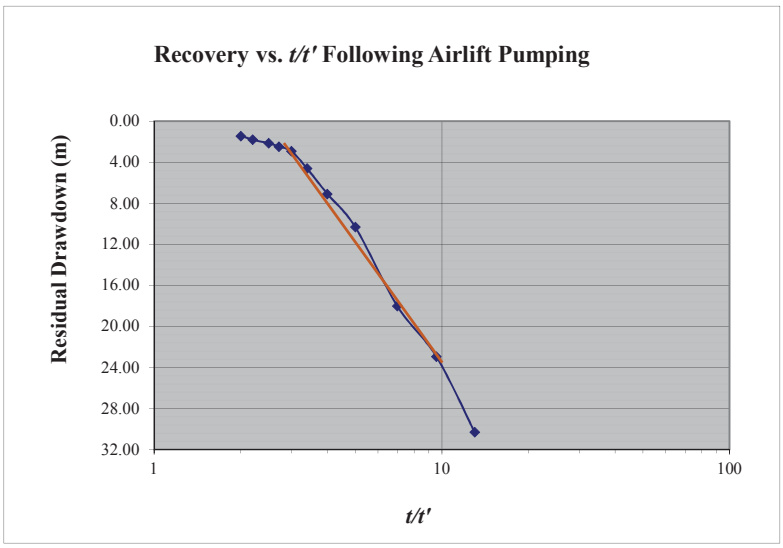
Analysis of DEW24 Airlift Pumping and Recovery Data

Corehole Depth (m):	250.8			Pre-Pumping WL (m):	50.4	
Core Rod Depth (m):	185.0			Depth of Airline (m):	122.8	

Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	35			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0			
	65	5	13.0		80.70	30.31
	67	7	9.6		73.32	22.93
	70	10	7.0		68.40	18.01
	75	15	5.0		60.70	10.31
	80	20	4.0		57.48	7.09
	85	25	3.4		55.00	4.61
	90	30	3.0		53.32	2.93
	95	35	2.7		52.86	2.47
	100	40	2.5		52.54	2.15
	110	50	2.2		52.18	1.79
	120	60	2.0		51.83	1.44

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

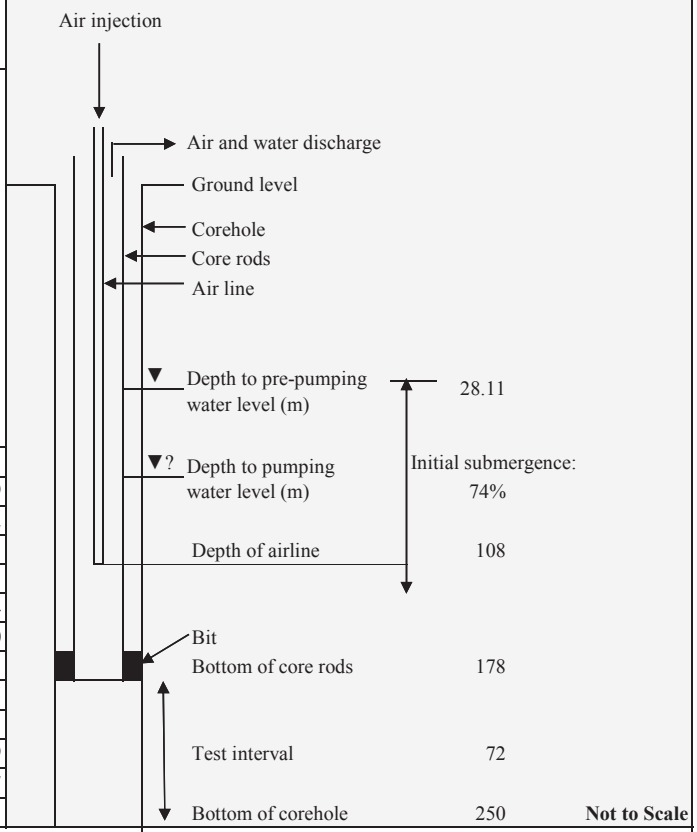
$$T = \frac{0.183Q}{\Delta s}$$

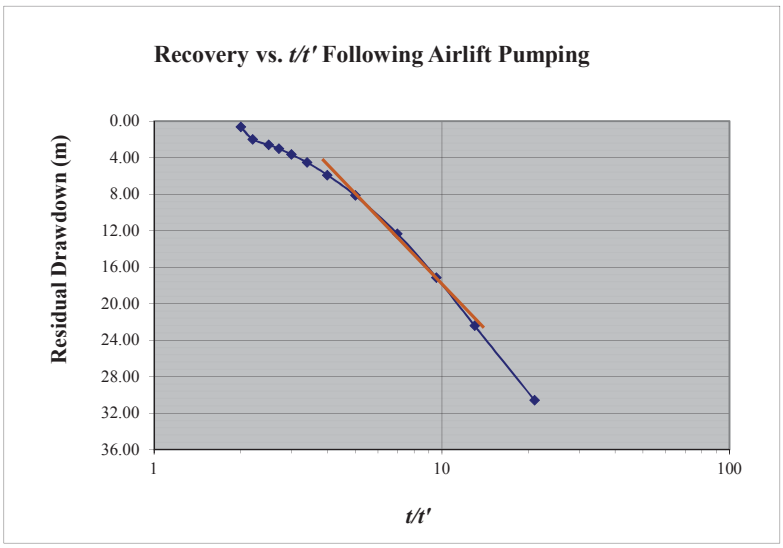
Q_{ave}	50.9	Discharge (m^3/d)
Δs	20.00	Drawdown (m)
T	4.7E-01	m^2/d
b	65.8	Test zone thickness (m)
K	7.1E-03	m/d

Analysis of DEW23 Airlift Pumping and Recovery Data

Corehole Depth (m):			**250.0**	**Pre-Pumping WL (m):**		**28.1**
Core Rod Depth (m):			**178.0**	**Depth of Airline (m):**		**108.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			4.8		
	5			4.8		
	7			4.8		
	10			1.7		
	15			1.3		
	20			1.0		
	25			1.0		
	30			1.0		
	35			1.0		
	40			1.0		
	50			1.0		
	60			1.0		
			Q_{ave}	2.0		
Recovery	63	3	21.0		58.70	30.59
	65	5	13.0		50.53	22.42
	67	7	9.6		45.24	17.13
	70	10	7.0		40.44	12.33
	75	15	5.0		36.25	8.14
	80	20	4.0		34.01	5.90
	85	25	3.4		32.64	4.53
	90	30	3.0		31.76	3.65
	95	35	2.7		31.12	3.01
	100	40	2.5		30.70	2.59
	110	50	2.2		30.08	1.97
	120	60	2.0		28.72	0.61

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

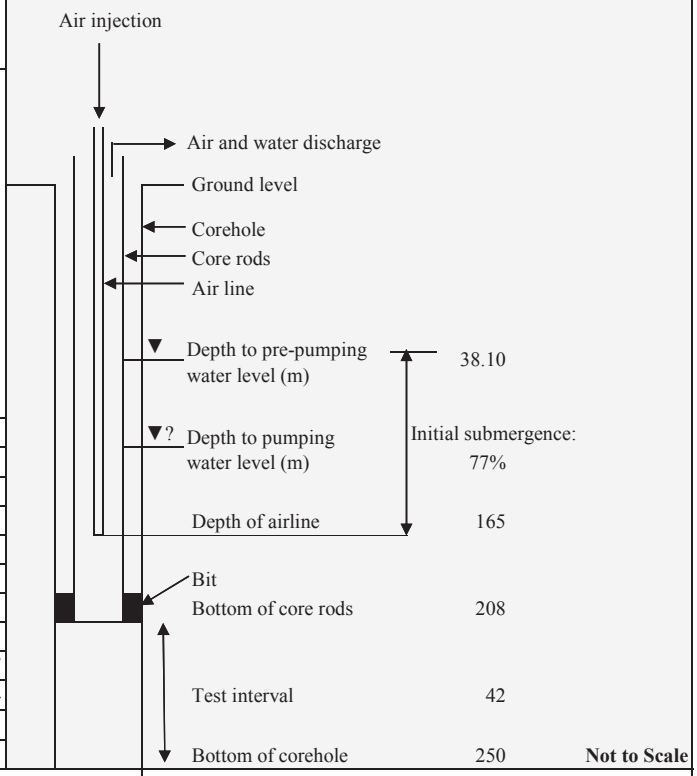
$$T = \frac{0.183Q}{\Delta s}$$

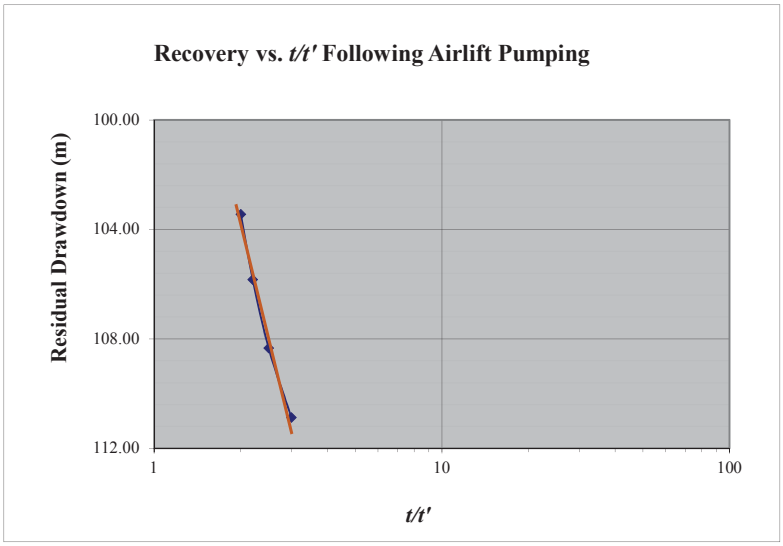
Q_{ave}	48.7	Discharge (m^3/d)
Δs	16.52	Drawdown (m)
T	5.4E-01	m^2/d
b	72.0	Test zone thickness (m)
K	7.5E-03	m/d

Analysis of HTH06 (Test 3) Airlift Pumping and Recovery Data

Corehole Depth (m):			**250.0**	**Pre-Pumping WL (m):**		**38.1**
Core Rod Depth (m):			**208.0**	**Depth of Airline (m):**		**165.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5					
	7					
	10					
	15					
	20					
	25					
	30					
	40					
	50					
	60					
			Q_{ave}	2.1		
Recovery	63	3	21.0			
	65	5	13.0			
	67	7	9.6			
	70	10	7.0			
	75	15	5.0			
	80	20	4.0			
	85	25	3.4			
	90	30	3.0		148.97	110.87
	100	40	2.5		146.44	108.34
	110	50	2.2		143.93	105.83
	120	60	2.0		141.55	103.45

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

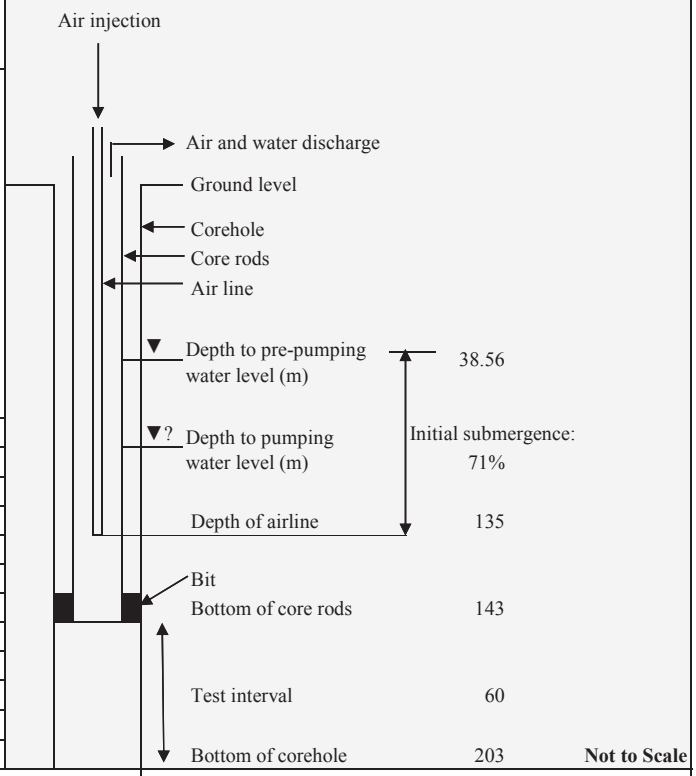
$$T = \frac{0.183Q}{\Delta s}$$

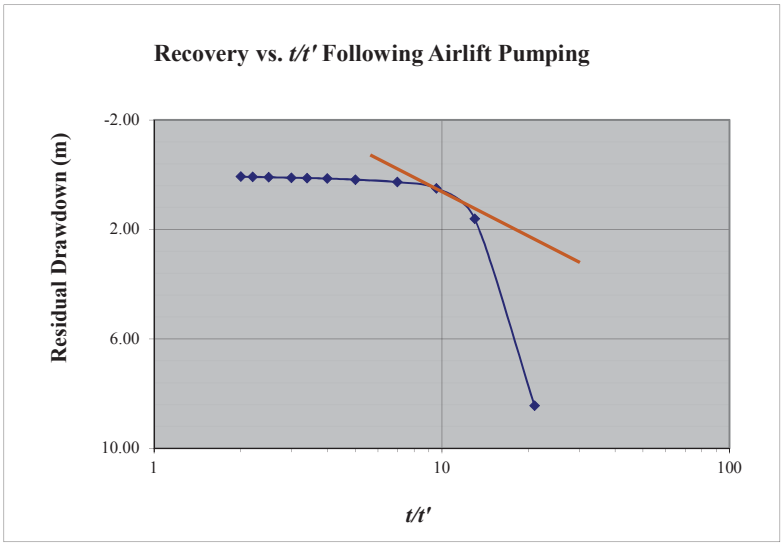
Q_{ave}	50.9	Discharge (m^3/d)
Δs	7.42	Drawdown (m)
T	1.3E+00	m^2/d
b	42.0	Test zone thickness (m)
K	3.0E-02	m/d

Analysis of HTH06 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):	**203.0**		**Pre-Pumping WL (m):**	**38.6**		
Core Rod Depth (m):	**143.0**		**Depth of Airline (m):**	**135.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			10.3		
	5			12.2		
	7			10.3		
	10			10.3		
	15			10.3		
	20			8.5		
	25			8.5		
	30			8.5		
	40			8.5		
	50			8.5		
	60			8.5		
			Q_{ave}	9.5		
Recovery	63	3	21.0		47.00	8.44
	65	5	13.0		40.17	1.61
	67	7	9.6		39.06	0.50
	70	10	7.0		38.83	0.27
	75	15	5.0		38.74	0.18
	80	20	4.0		38.70	0.14
	85	25	3.4		38.68	0.12
	90	30	3.0		38.67	0.11
	100	40	2.5		38.65	0.09
	110	50	2.2		38.64	0.08
	120	60	2.0		38.63	0.07

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

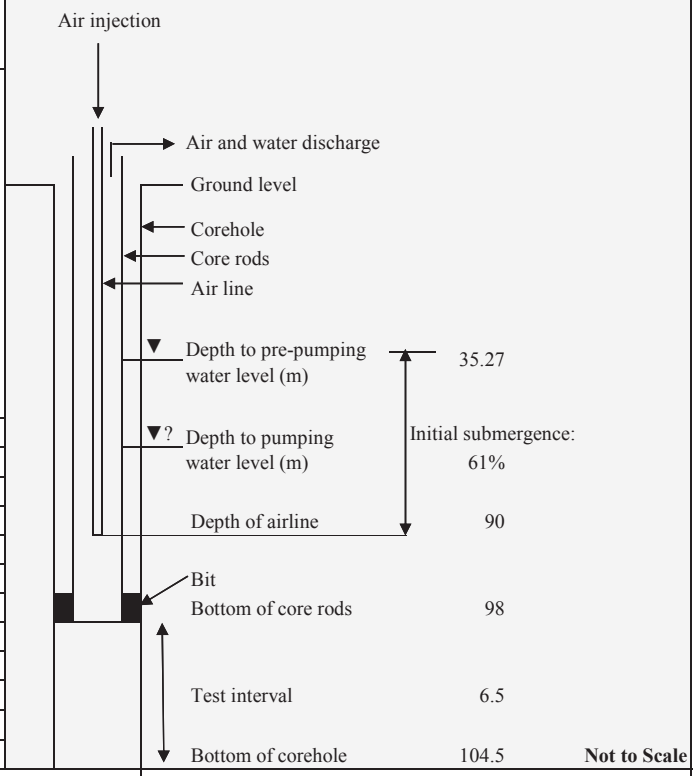
$$T = \frac{0.183Q}{\Delta s}$$

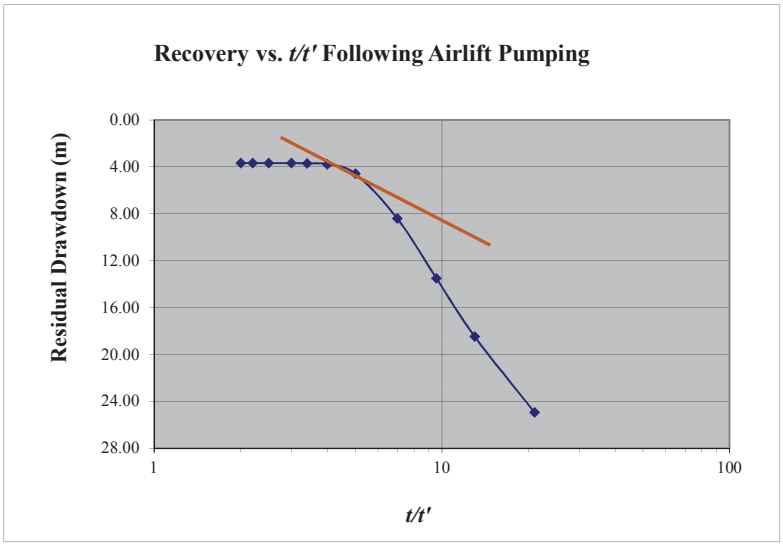
Q_{ave}	227.1	Discharge (m^3/d)
Δs	1.11	Drawdown (m)
T	3.7E+01	m^2/d
b	60.0	Test zone thickness (m)
K	6.2E-01	m/d

Analysis of HTH06 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**104.5**	**Pre-Pumping WL (m):**		**35.3**
Core Rod Depth (m):			**98.0**	**Depth of Airline (m):**		**90.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		60.21	24.94
	65	5	13.0		53.73	18.46
	67	7	9.6		48.76	13.49
	70	10	7.0		43.67	8.40
	75	15	5.0		39.85	4.58
	80	20	4.0		39.05	3.78
	85	25	3.4		38.97	3.70
	90	30	3.0		38.95	3.68
	100	40	2.5		38.95	3.68
	110	50	2.2		38.95	3.68
	120	60	2.0		38.95	3.68

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

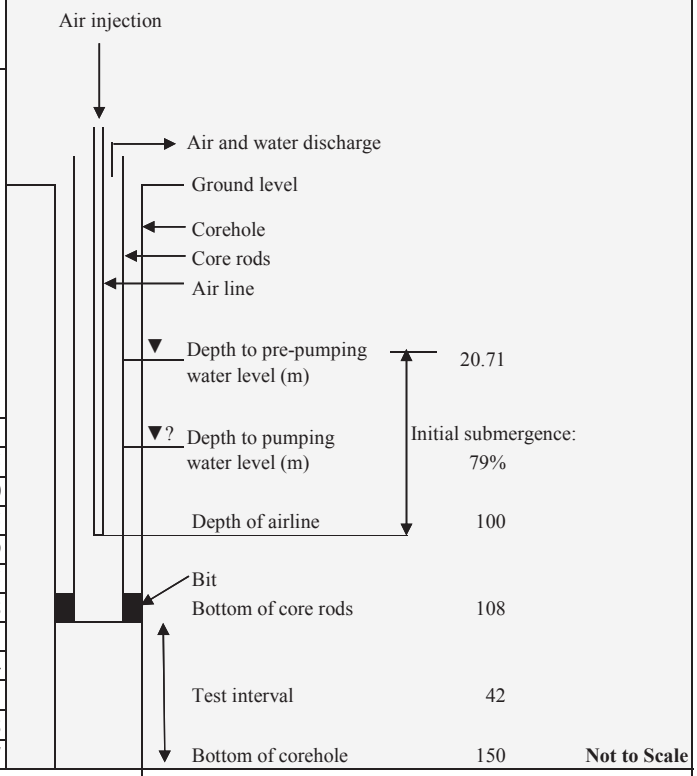
$$T = \frac{0.183Q}{\Delta s}$$

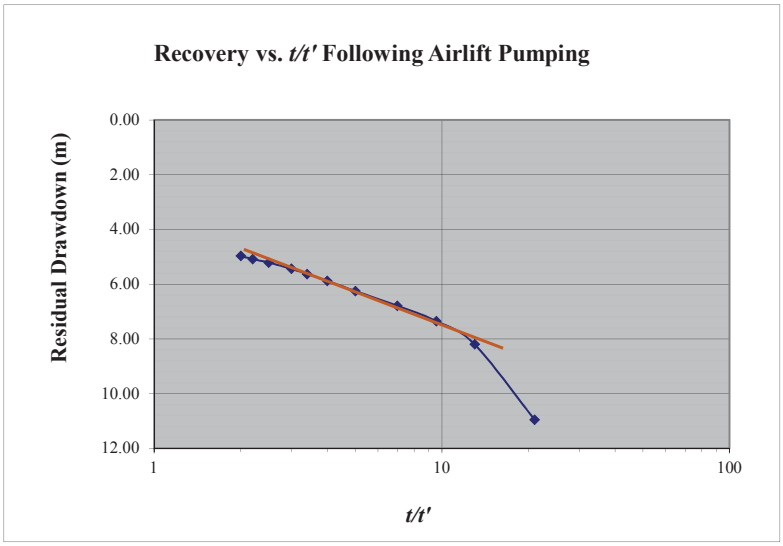
Q_{ave}	50.4	Discharge (m^3/d)
Δs	0.80	Drawdown (m)
T	1.2E+01	m^2/d
b	6.5	Test zone thickness (m)
K	1.8E+00	m/d

Analysis of HTH05 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**150.0**	**Pre-Pumping WL (m):**		**20.7**
Core Rod Depth (m):			**108.0**	**Depth of Airline (m):**		**100.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		31.66	10.95
	65	5	13.0		28.91	8.20
	67	7	9.6		28.06	7.35
	70	10	7.0		27.50	6.79
	75	15	5.0		26.96	6.25
	80	20	4.0		26.59	5.88
	85	25	3.4		26.34	5.63
	90	30	3.0		26.15	5.44
	100	40	2.5		25.92	5.21
	110	50	2.2		25.79	5.08
	120	60	2.0		25.68	4.97

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

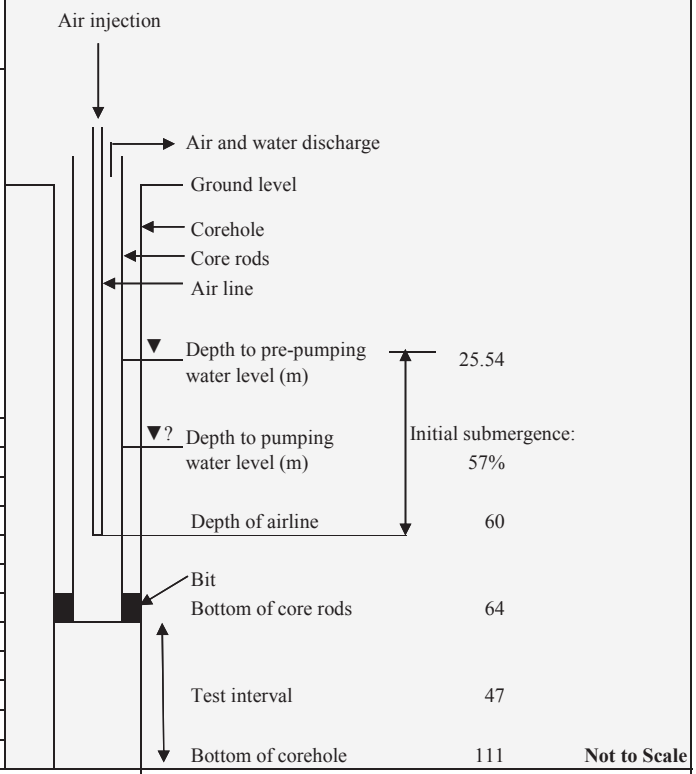
$$T = \frac{0.183Q}{\Delta s}$$

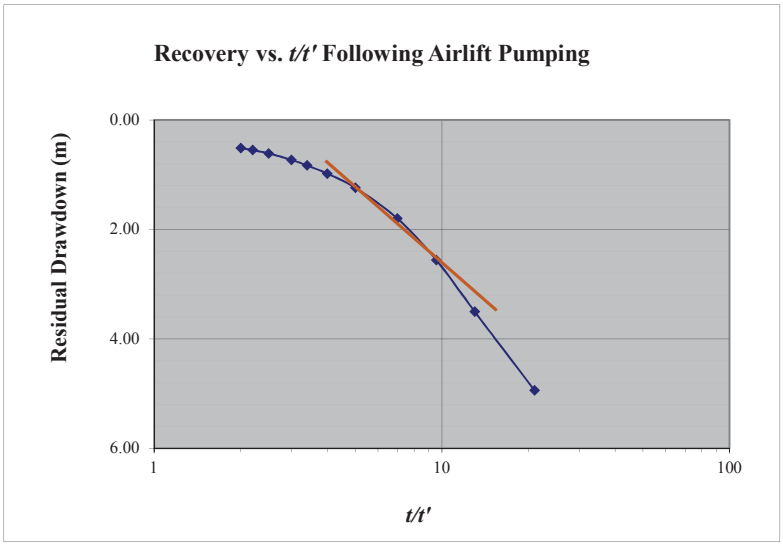
Q_{ave}	50.4	Discharge (m^3/d)
Δs	2.27	Drawdown (m)
T	4.1E+00	m^2/d
b	42.0	Test zone thickness (m)
K	9.7E-02	m/d

Analysis of HTH05 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**111.0**	**Pre-Pumping WL (m):**		**25.5**
Core Rod Depth (m):			**64.0**	**Depth of Airline (m):**		**60.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		30.48	4.94
	65	5	13.0		29.04	3.50
	67	7	9.6		28.10	2.56
	70	10	7.0		27.34	1.80
	75	15	5.0		26.78	1.24
	80	20	4.0		26.52	0.98
	85	25	3.4		26.37	0.83
	90	30	3.0		26.27	0.73
	100	40	2.5		26.15	0.61
	110	50	2.2		26.09	0.55
	120	60	2.0		26.05	0.51

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

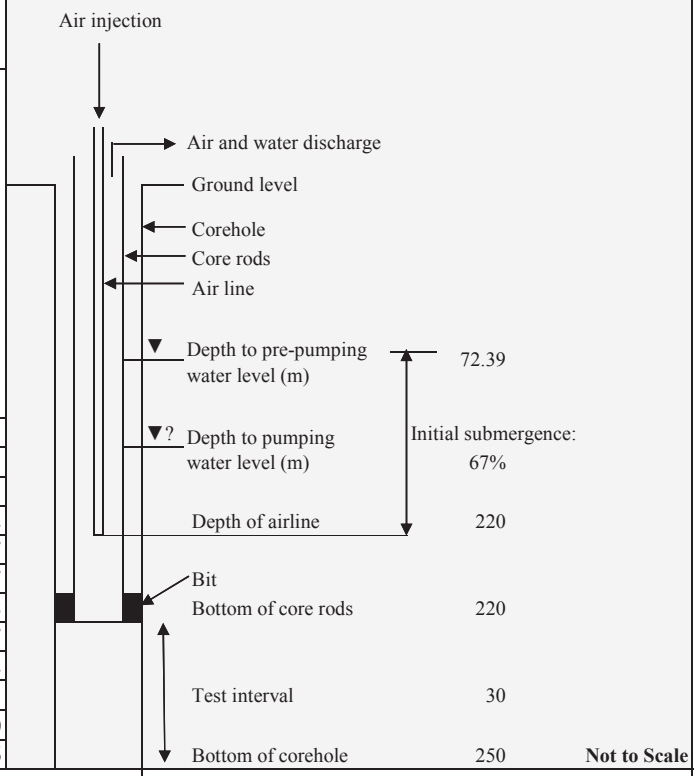
$$T = \frac{0.183Q}{\Delta s}$$

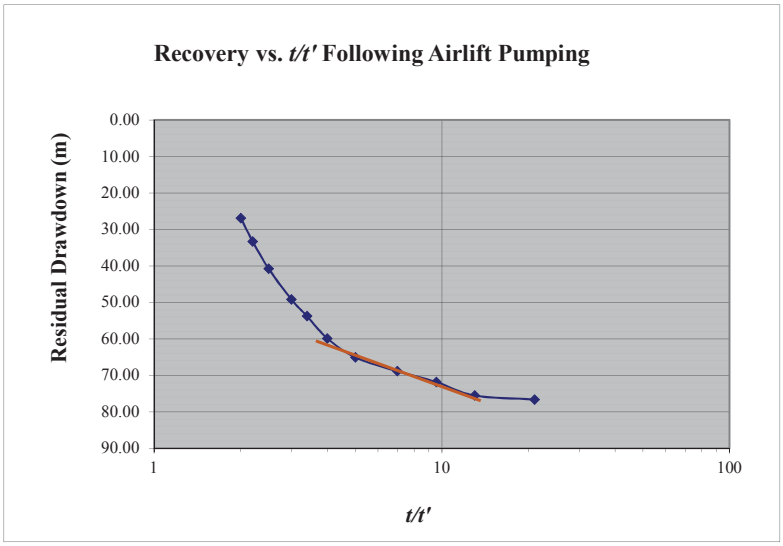
Q_{ave}	50.4	Discharge (m^3/d)
Δs	1.32	Drawdown (m)
T	7.0E+00	m^2/d
b	47.0	Test zone thickness (m)
K	1.5E-01	m/d

Analysis of HTH04 (Test 3) Airlift Pumping and Recovery Data

Corehole Depth (m):			**250.0**	**Pre-Pumping WL (m):**		**72.4**
Core Rod Depth (m):			**220.0**	**Depth of Airline (m):**		**220.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			1.1		
	5			1.1		
	7			1.1		
	10			1.1		
	15			1.1		
	20			1.1		
	25			1.1		
	30			1.1		
	40			1.1		
	50			1.1		
	60			1.1		
			Q_{ave}	1.1		
Recovery	63	3	21.0		149.00	76.61
	65	5	13.0		147.92	75.53
	67	7	9.6		144.21	71.82
	70	10	7.0		141.26	68.87
	75	15	5.0		137.46	65.07
	80	20	4.0		132.27	59.88
	85	25	3.4		126.16	53.77
	90	30	3.0		121.61	49.22
	100	40	2.5		113.12	40.73
	110	50	2.2		105.69	33.30
	120	60	2.0		99.25	26.86

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

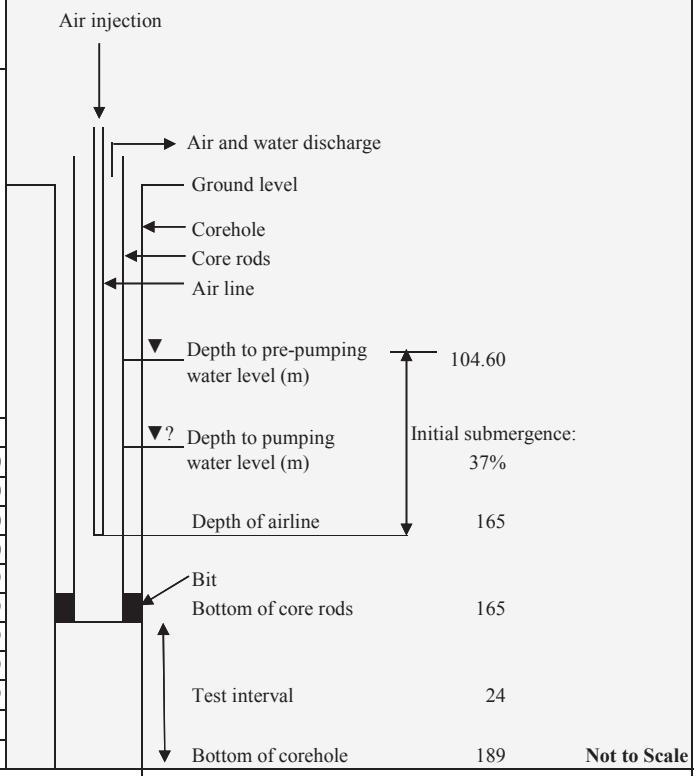
$$T = \frac{0.183Q}{\Delta s}$$

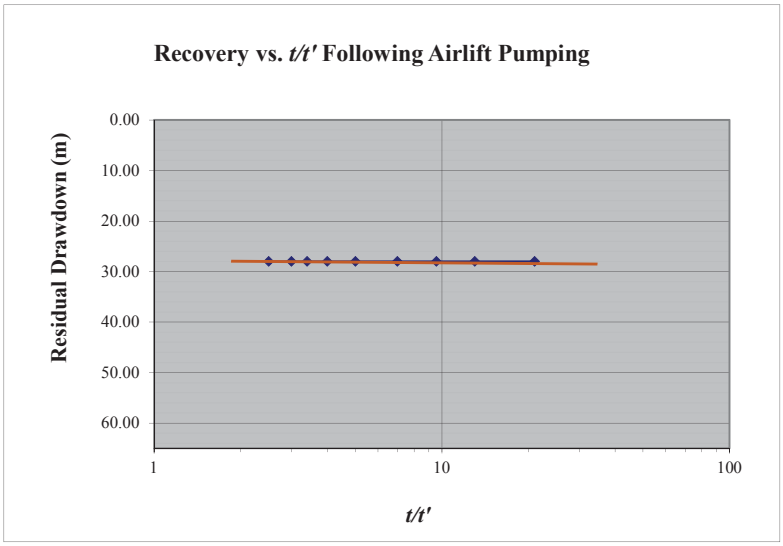
Q_{ave}	26.4	Discharge (m^3/d)
Δs	19.65	Drawdown (m)
T	2.5E-01	m^2/d
b	30.0	Test zone thickness (m)
K	8.2E-03	m/d

Analysis of HTH04 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**189.0**	**Pre-Pumping WL (m):**		**104.6**
Core Rod Depth (m):			**165.0**	**Depth of Airline (m):**		**165.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			1.1		
	5			1.1		
	7			1.1		
	10			1.1		
	15			1.1		
	20			1.1		
	25			1.1		
	30			1.1		
	40					
	50					
	60					
			Q_{ave}	1.1		
Recovery	63	3	21.0		132.60	28.00
	65	5	13.0		132.60	28.00
	67	7	9.6		132.60	28.00
	70	10	7.0		132.60	28.00
	75	15	5.0		132.59	27.99
	80	20	4.0		132.59	27.99
	85	25	3.4		132.59	27.99
	90	30	3.0		132.59	27.99
	100	40	2.5		132.59	27.99
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

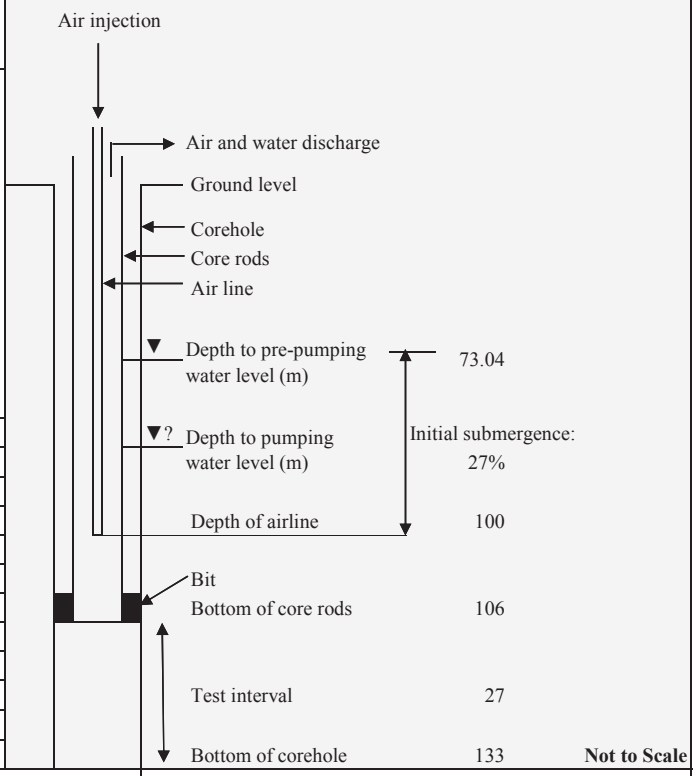
$$T = \frac{0.183Q}{\Delta s}$$

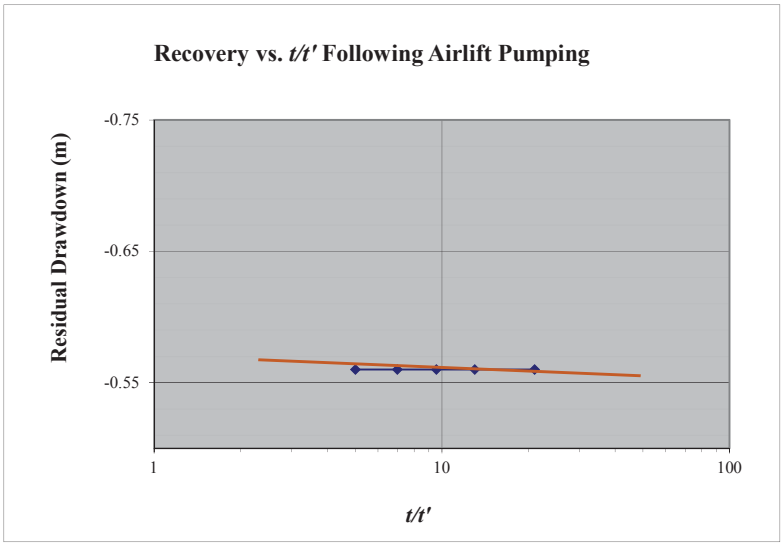
Q_{ave}	26.4	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	4.8E+02	m^2/d
b	24.0	Test zone thickness (m)
K	2.0E+01	m/d

Analysis of HTH04 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**133.0**	**Pre-Pumping WL (m):**		**73.0**
Core Rod Depth (m):			**106.0**	**Depth of Airline (m):**		**100.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			3.1		
	5			3.1		
	7			3.1		
	10			3.1		
	15			3.1		
	20			3.1		
	25			3.1		
	30			3.1		
	40			3.1		
	50			3.1		
	60			3.1		
			Q_{ave}	3.1		
Recovery	63	3	21.0		72.48	-0.56
	65	5	13.0		72.48	-0.56
	67	7	9.6		72.48	-0.56
	70	10	7.0		72.48	-0.56
	75	15	5.0		72.48	-0.56
	80	20	4.0			
	85	25	3.4			
	90	30	3.0			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

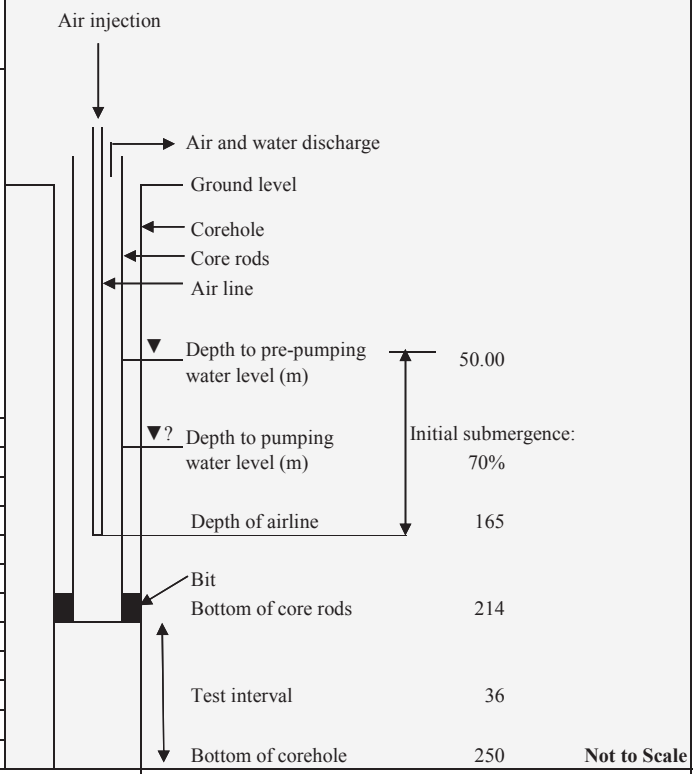
$$T = \frac{0.183Q}{\Delta s}$$

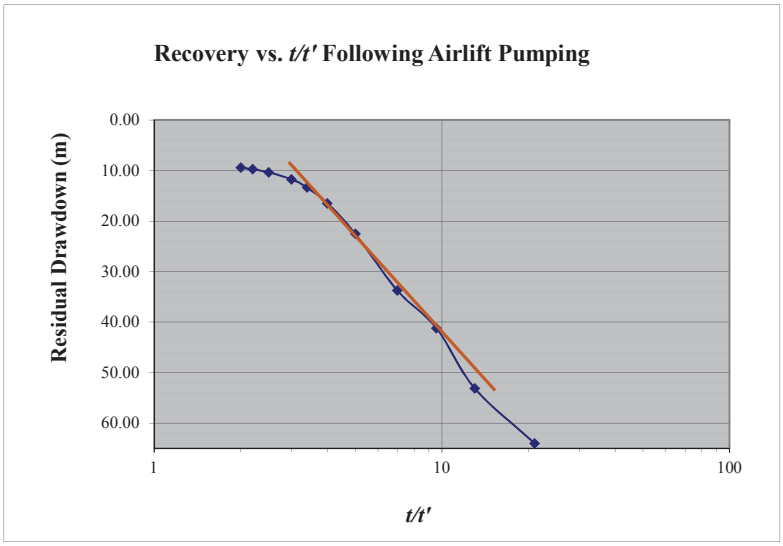
Q_{ave}	74.9	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	1.4E+03	m^2/d
b	27.0	Test zone thickness (m)
K	5.1E+01	m/d

Analysis of HTH03 (Test 4) Airlift Pumping and Recovery Data

Corehole Depth (m):			**250.0**	**Pre-Pumping WL (m):**		**50.0**
Core Rod Depth (m):			**214.0**	**Depth of Airline (m):**		**165.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			1.3		
	10			0.8		
	15			0.8		
	20			0.8		
	25			0.8		
	30			0.8		
	40			0.8		
	50			0.8		
	60			0.8		
			Q_{ave}	1.1		
Recovery	63	3	21.0		114.00	64.00
	65	5	13.0		103.11	53.11
	67	7	9.6		91.19	41.19
	70	10	7.0		83.75	33.75
	75	15	5.0		72.54	22.54
	80	20	4.0		66.50	16.50
	85	25	3.4		63.37	13.37
	90	30	3.0		61.73	11.73
	100	40	2.5		60.36	10.36
	110	50	2.2		59.76	9.76
	120	60	2.0		59.41	9.41

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

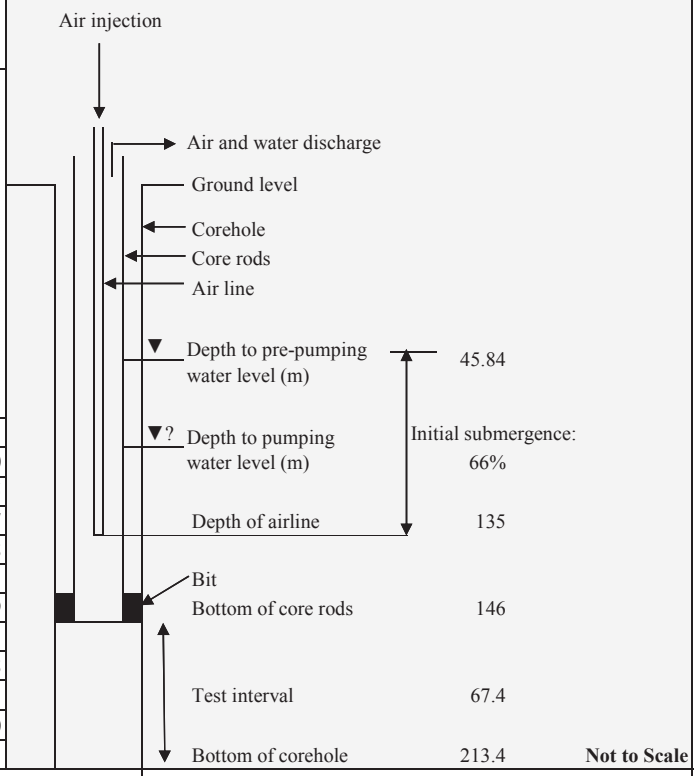
$$T = \frac{0.183Q}{\Delta s}$$

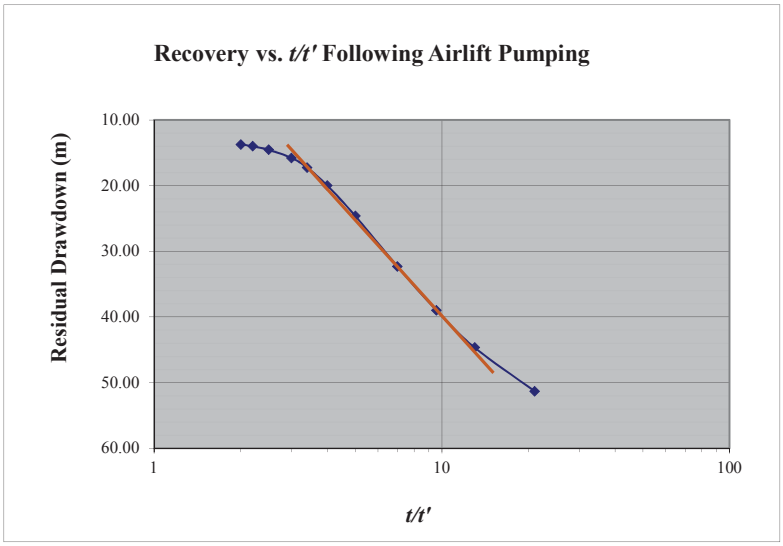
Q_{ave}	25.4	Discharge (m^3/d)
Δs	24.69	Drawdown (m)
T	1.9E-01	m^2/d
b	36.0	Test zone thickness (m)
K	5.2E-03	m/d

Analysis of HTH03 (Test 3) Airlift Pumping and Recovery Data

Corehole Depth (m):			**213.4**	**Pre-Pumping WL (m):**		**45.8**
Core Rod Depth (m):			**146.0**	**Depth of Airline (m):**		**135.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	40			2.1		
	50			2.1		
	60			2.1		
			Q_{ave}	2.1		
Recovery	63	3	21.0		97.14	51.30
	65	5	13.0		90.49	44.65
	67	7	9.6		84.81	38.97
	70	10	7.0		78.12	32.28
	75	15	5.0		70.45	24.61
	80	20	4.0		65.83	19.99
	85	25	3.4		63.07	17.23
	90	30	3.0		61.62	15.78
	100	40	2.5		60.37	14.53
	110	50	2.2		59.84	14.00
	120	60	2.0		59.55	13.71

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

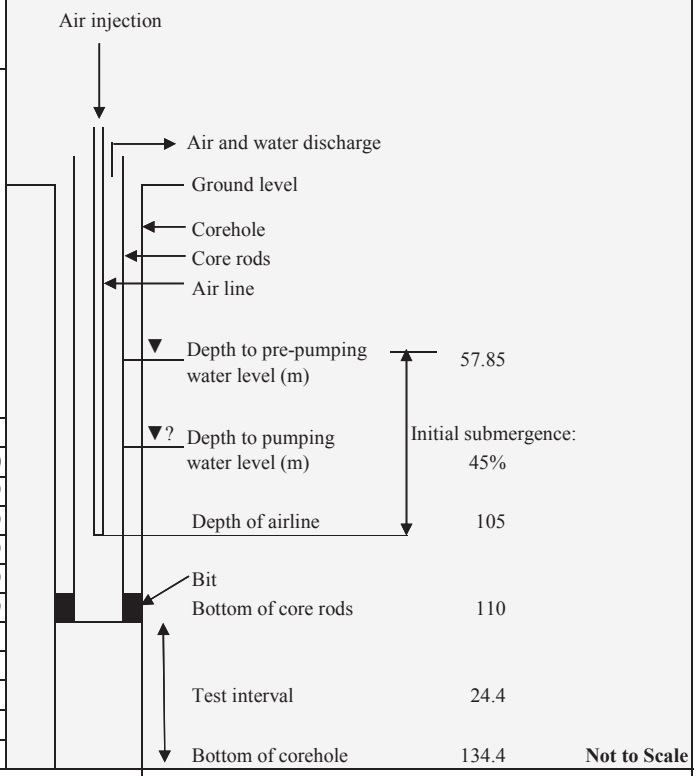
$$T = \frac{0.183Q}{\Delta s}$$

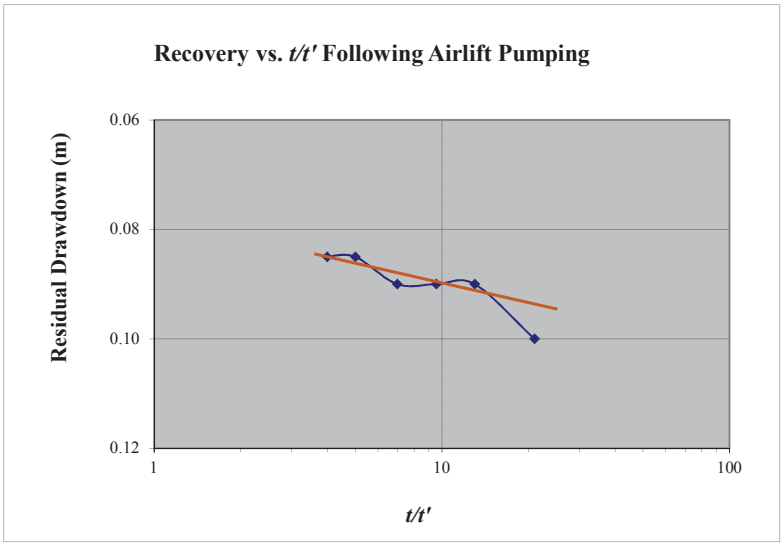
Q_{ave}	50.4	Discharge (m^3/d)
Δs	21.74	Drawdown (m)
T	4.2E-01	m^2/d
b	67.4	Test zone thickness (m)
K	6.3E-03	m/d

Analysis of HTH03 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**134.4**	**Pre-Pumping WL (m):**		**57.9**
Core Rod Depth (m):			**110.0**	**Depth of Airline (m):**		**105.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			8.5		
	5			10.3		
	7			10.3		
	10			10.3		
	15			10.3		
	20			10.3		
	25			10.3		
	30			10.3		
	40			10.3		
	50			10.3		
	60			10.3		
			Q_{ave}	10.1		
Recovery	63	3	21.0		57.95	0.10
	65	5	13.0		57.94	0.09
	67	7	9.6		57.94	0.09
	70	10	7.0		57.94	0.09
	75	15	5.0		57.94	0.09
	80	20	4.0		57.94	0.09
	85	25	3.4			
	90	30	3.0			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

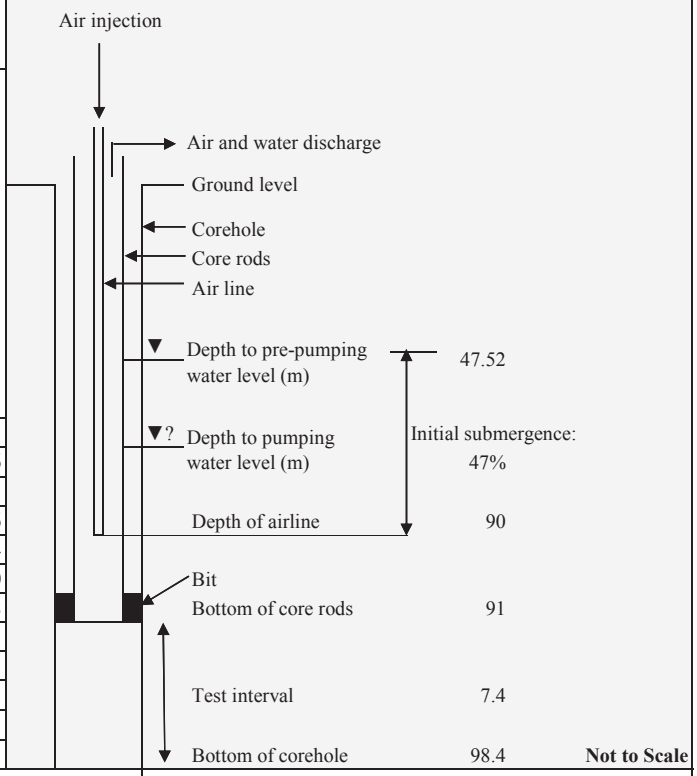
Q_{ave}	242.1	Discharge (m^3/d)
Δs	0.02	Drawdown (m)
T	3.0E+03	m^2/d
b	24.4	Test zone thickness (m)
K	1.2E+02	m/d

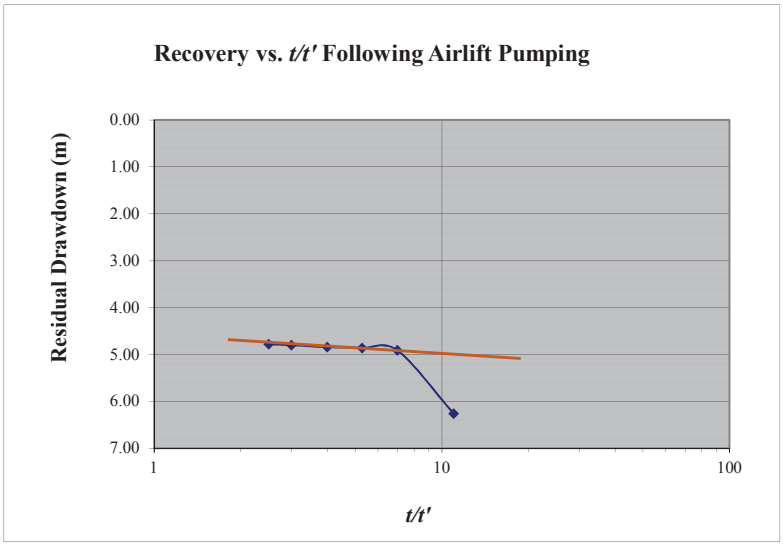
Analysis of HTH03 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):		**98.4**		**Pre-Pumping WL (m):**		**47.5**
Core Rod Depth (m):		**91.0**		**Depth of Airline (m):**		**90.0**

Data	*t* (mins)	*t′* (mins)	*t/t′*	*Q* (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			5.4		
	5			6.9		
	7			6.9		
	10			6.9		
	15			6.9		
	20			6.9		
	25			6.9		
	30			6.9		
			Q_{ave}	6.7		
Recovery	33	3	11.0		53.78	6.26
	35	5	7.0		52.43	4.91
	37	7	5.3		52.38	4.86
	40	10	4.0		52.36	4.84
	45	15	3.0		52.32	4.80
	50	20	2.5		52.30	4.78
	55	25	2.2			
	60	30	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

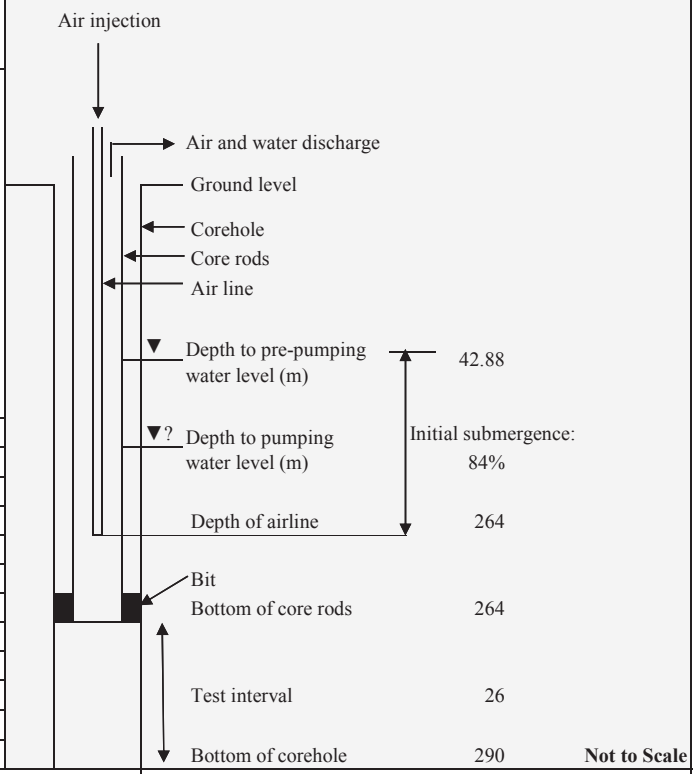
$$T = \frac{0.183Q}{\Delta s}$$

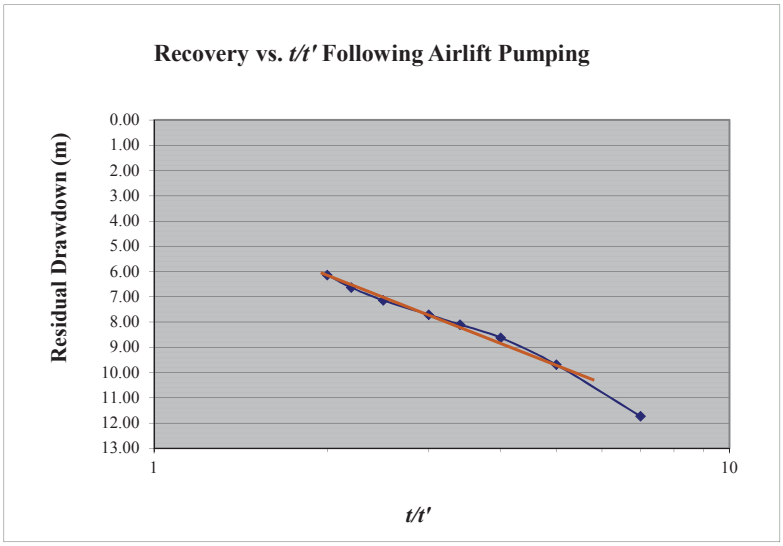
Q_{ave}	160.4	Discharge (m^3/d)
Δs	0.13	Drawdown (m)
T	2.3E+02	m^2/d
b	7.4	Test zone thickness (m)
K	3.1E+01	m/d

Analysis of HTH02 (Test 3) Airlift Pumping and Recovery Data

Corehole Depth (m):			**290.0**	**Pre-Pumping WL (m):**		**42.9**
Core Rod Depth (m):			**264.0**	**Depth of Airline (m):**		**264.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			5.4		
	5			19.1		
	7			19.1		
	10			19.1		
	15			24.6		
	20			24.6		
	25			24.6		
	30			24.6		
	40			21.7		
	50			21.7		
	60			21.7		
			Q_{ave}	20.5		
Recovery	63	3	21.0		62.32	19.44
	65	5	13.0		59.71	16.83
	67	7	9.6		56.89	14.01
	70	10	7.0		54.61	11.73
	75	15	5.0		52.57	9.69
	80	20	4.0		51.50	8.62
	85	25	3.4		50.98	8.10
	90	30	3.0		50.59	7.71
	100	40	2.5		50.02	7.14
	110	50	2.2		49.51	6.63
	120	60	2.0		49.02	6.14

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

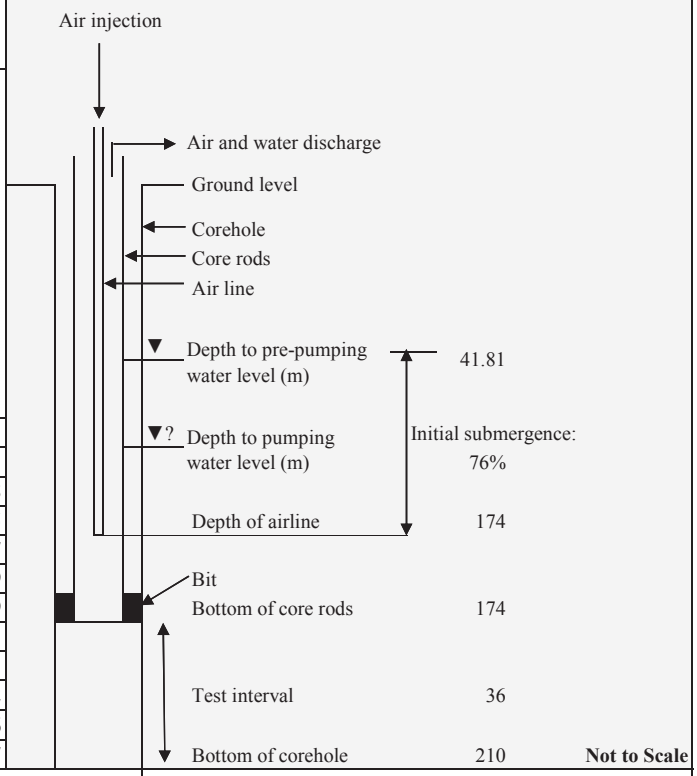
$$T = \frac{0.183Q}{\Delta s}$$

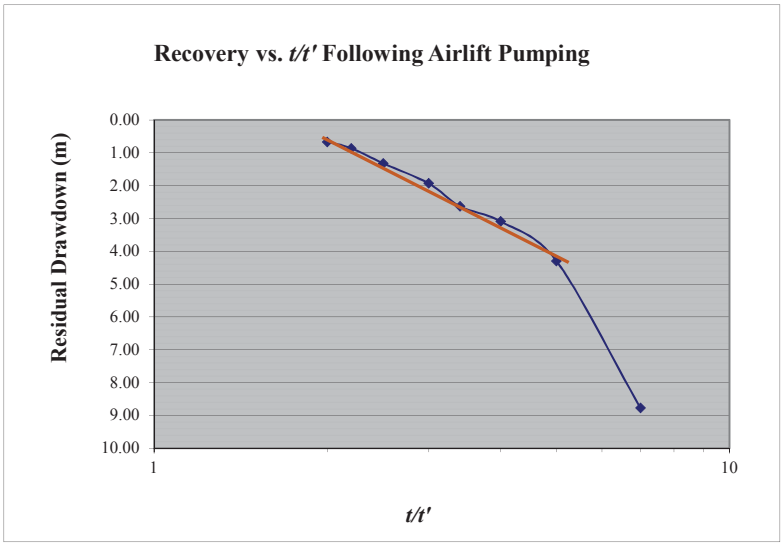
Q_{ave}	492.8	Discharge (m^3/d)
Δs	12.81	Drawdown (m)
T	7.0E+00	m^2/d
b	26.0	Test zone thickness (m)
K	2.7E-01	m/d

Analysis of HTH02 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**210.0**	**Pre-Pumping WL (m):**		**41.8**
Core Rod Depth (m):			**174.0**	**Depth of Airline (m):**		**174.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			4.2		
	5			4.2		
	7			51.0		
	10			19.1		
	15			8.5		
	20			8.5		
	25			6.9		
	30			6.9		
	40			6.9		
	50			6.9		
	60			6.9		
			Q_{ave}	11.8		
Recovery	63	3	21.0			
	65	5	13.0		71.09	29.28
	67	7	9.6		58.06	16.25
	70	10	7.0		50.58	8.77
	75	15	5.0		46.10	4.29
	80	20	4.0		44.90	3.09
	85	25	3.4		44.44	2.63
	90	30	3.0		43.74	1.93
	100	40	2.5		43.13	1.32
	110	50	2.2		42.67	0.86
	120	60	2.0		42.48	0.67

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

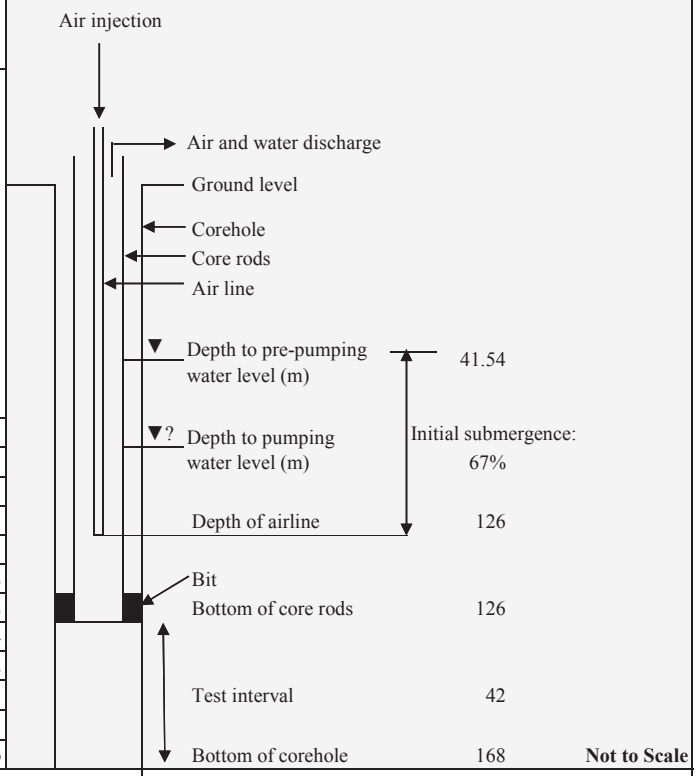
$$T = \frac{0.183Q}{\Delta s}$$

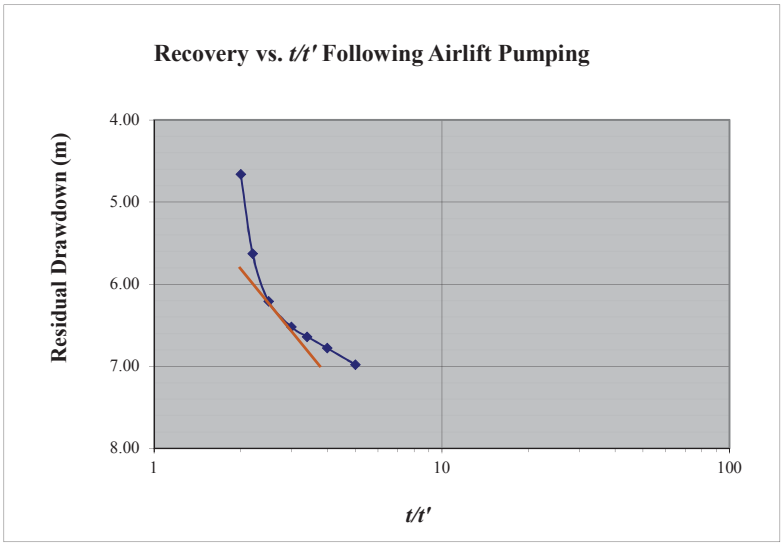
Q_{ave}	282.8	Discharge (m^3/d)
Δs	3.62	Drawdown (m)
T	1.4E+01	m^2/d
b	36.0	Test zone thickness (m)
K	4.0E-01	m/d

Analysis of HTH02 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**168.0**	**Pre-Pumping WL (m):**		**41.5**
Core Rod Depth (m):			**126.0**	**Depth of Airline (m):**		**126.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			1.0		
	5			1.0		
	7			1.0		
	10			1.0		
	15			1.0		
	20			1.0		
	25			1.0		
	30			1.0		
	40			1.0		
	50			1.0		
	60			1.0		
			Q_{ave}	1.0		
Recovery	63	3	21.0			
	65	5	13.0			
	67	7	9.6			
	70	10	7.0			
	75	15	5.0		48.52	6.98
	80	20	4.0		48.32	6.78
	85	25	3.4		48.18	6.64
	90	30	3.0		48.06	6.52
	100	40	2.5		47.75	6.21
	110	50	2.2		47.17	5.63
	120	60	2.0		46.20	4.66

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

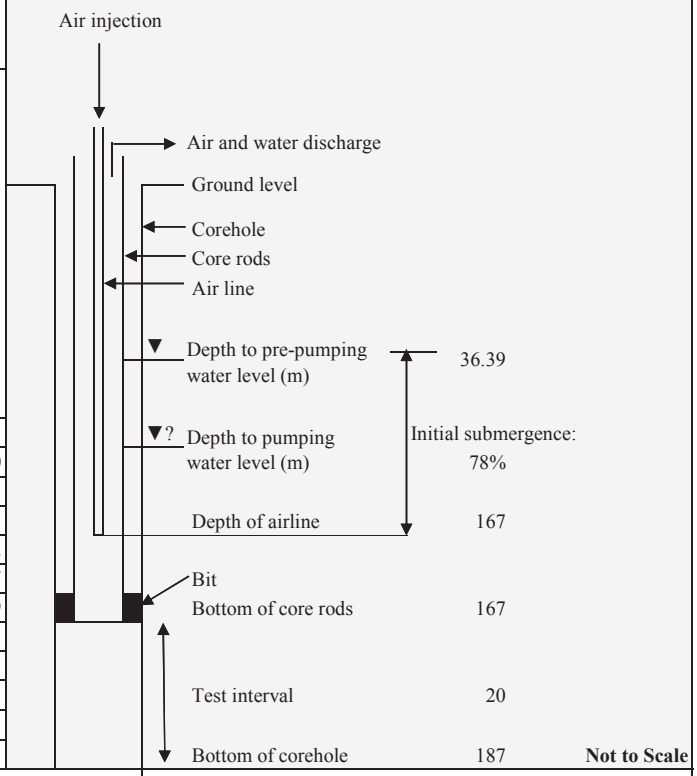
$$T = \frac{0.183Q}{\Delta s}$$

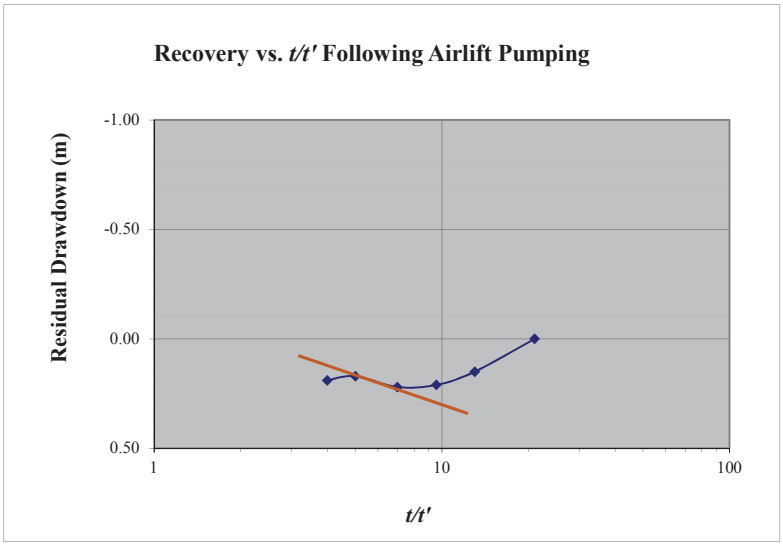
Q_{ave}	25.0	Discharge (m^3/d)
Δs	0.31	Drawdown (m)
T	1.5E+01	m^2/d
b	42.0	Test zone thickness (m)
K	3.5E-01	m/d

Analysis of HTH01 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**187.0**	**Pre-Pumping WL (m):**		**36.4**
Core Rod Depth (m):			**167.0**	**Depth of Airline (m):**		**167.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			6.9		
	5			6.9		
	7			6.9		
	10			8.5		
	15			8.5		
	20			8.5		
	25			8.5		
	30			8.5		
	40			9.3		
	50			9.3		
	60			10.3		
			Q_{ave}	8.4		
Recovery	63	3	21.0		36.39	0.00
	65	5	13.0		36.54	0.15
	67	7	9.6		36.60	0.21
	70	10	7.0		36.61	0.22
	75	15	5.0		36.56	0.17
	80	20	4.0		36.58	0.19
	85	25	3.4			
	90	30	3.0			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

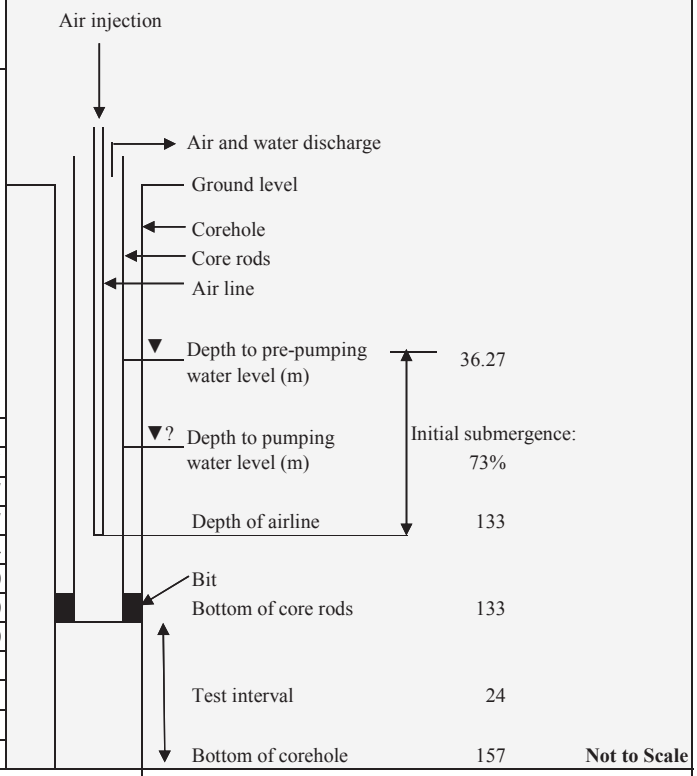
$$T = \frac{0.183Q}{\Delta s}$$

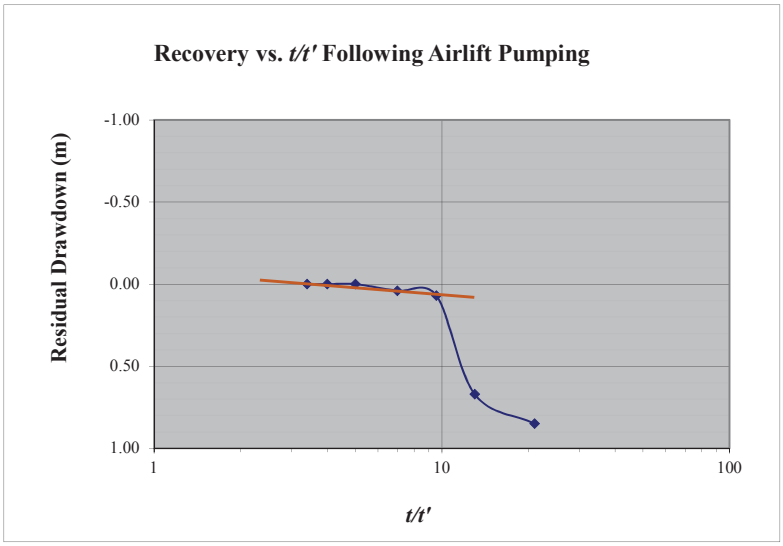
Q_{ave}	200.5	Discharge (m^3/d)
Δs	0.05	Drawdown (m)
T	7.3E+02	m^2/d
b	20.0	Test zone thickness (m)
K	3.7E+01	m/d

Analysis of HTH01 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**157.0**	**Pre-Pumping WL (m):**		**36.3**
Core Rod Depth (m):			**133.0**	**Depth of Airline (m):**		**133.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			21.7		
	5			21.7		
	7			21.7		
	10			21.7		
	15			19.1		
	20			19.1		
	25			20.4		
	30			20.4		
	40			21.7		
	50			20.4		
	60			20.4		
			Q_{ave}	20.7		
Recovery	63	3	21.0		37.12	0.85
	65	5	13.0		36.94	0.67
	67	7	9.6		36.34	0.07
	70	10	7.0		36.31	0.04
	75	15	5.0		36.27	0.00
	80	20	4.0		36.27	0.00
	85	25	3.4		36.27	0.00
	90	30	3.0			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

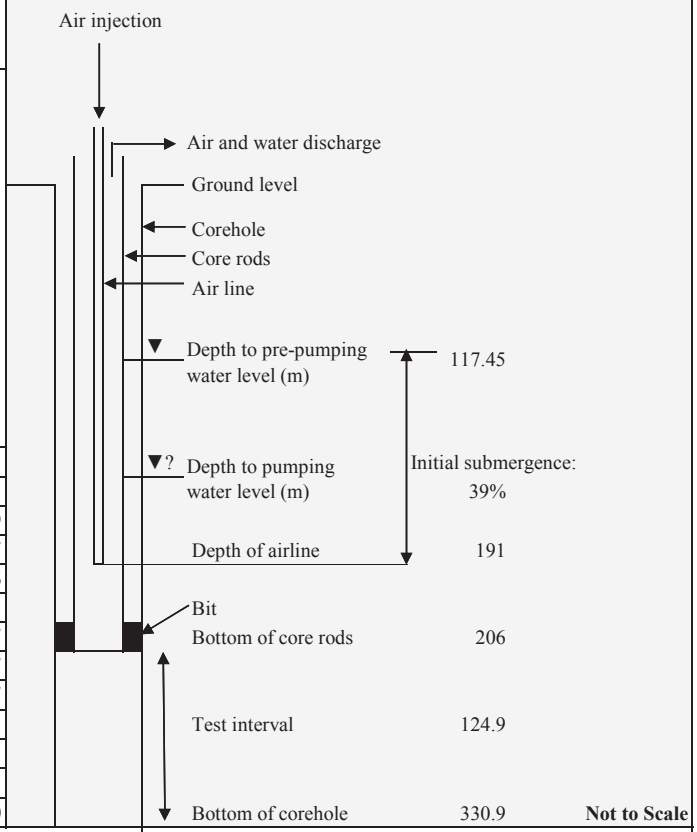
$$T = \frac{0.183Q}{\Delta s}$$

Q_{ave}	497.4	Discharge (m^3/d)
Δs	0.07	Drawdown (m)
T	1.3E+03	m^2/d
b	24.0	Test zone thickness (m)
K	5.4E+01	m/d

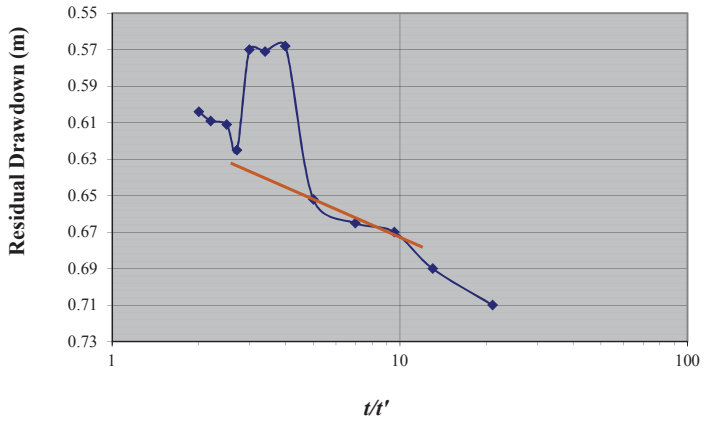
Analysis of KSV17004 Airlift Pumping and Recovery Data

Corehole Depth (m):	330.9			Pre-Pumping WL (m):	117.5	
Core Rod Depth (m):	206.0			Depth of Airline (m):	191.0	
Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			0.5		
	5			0.5		
	7			0.5		
	10			0.5		
	15			0.5		
	20			0.5		
	25			0.5		
	30			0.5		
	35			0.5		
	40			0.5		
	50			0.5		
	60			0.5		
			Q_{ave}	0.5		
Recovery	63	3	21.0		118.16	0.71
	65	5	13.0		118.14	0.69
	67	7	9.6		118.12	0.67
	70	10	7.0		118.12	0.66
	75	15	5.0		118.10	0.65
	80	20	4.0		118.02	0.57
	85	25	3.4		118.02	0.57
	90	30	3.0		118.02	0.57
	95	35	2.7		118.08	0.63
	100	40	2.5		118.06	0.61
	110	50	2.2		118.06	0.61
	120	60	2.0		118.05	0.60

Schematic Diagram of Airlift Pumping System



Recovery vs. t/t' Following Airlift Pumping



Theis (1935) Recovery Method

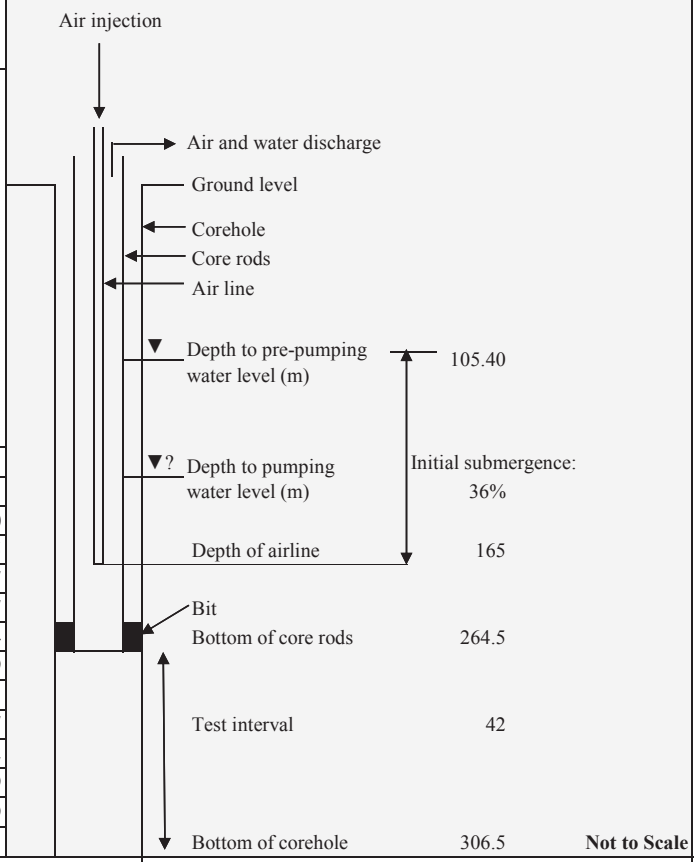
$$T = \frac{0.183Q}{\Delta s}$$

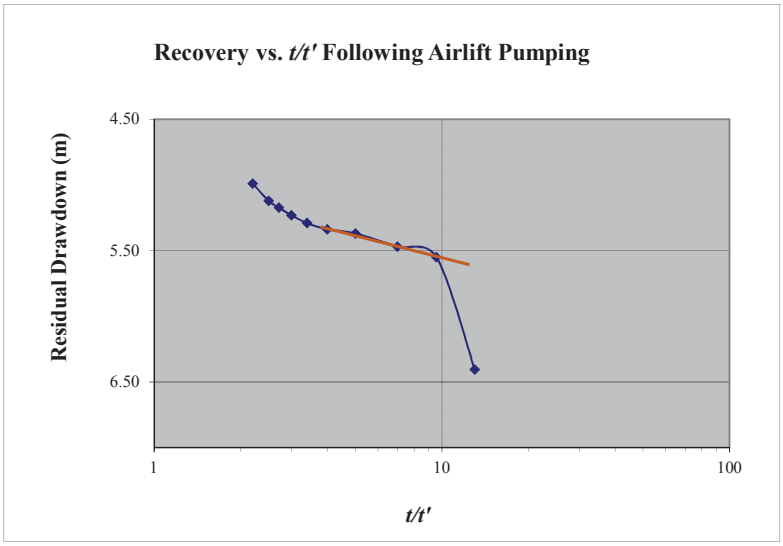
Q_{ave}	12.2	Discharge (m^3/d)
Δs	0.02	Drawdown (m)
T	1.1E+02	m^2/d
b	124.9	Test zone thickness (m)
K	9.0E-01	m/d

Analysis of KSV17005 (Test2) Airlift Pumping and Recovery Data

Corehole Depth (m):			**306.5**	**Pre-Pumping WL (m):**		**105.4**
Core Rod Depth (m):			**264.5**	**Depth of Airline (m):**		**165.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			0.5		
	5			0.5		
	7			0.5		
	10			0.5		
	15			0.5		
	20			0.5		
	25			0.5		
	30			0.5		
	35			0.5		
	40			0.5		
	50			0.5		
	60			0.5		
			Q_{ave}	0.5		
Recovery	63	3	21.0			
	65	5	13.0		111.81	6.40
	67	7	9.6		110.95	5.55
	70	10	7.0		110.87	5.47
	75	15	5.0		110.77	5.37
	80	20	4.0		110.74	5.34
	85	25	3.4		110.69	5.29
	90	30	3.0		110.63	5.23
	95	35	2.7		110.57	5.17
	100	40	2.5		110.52	5.12
	110	50	2.2		110.39	4.99
	120	60	2.0		110.90	5.49

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

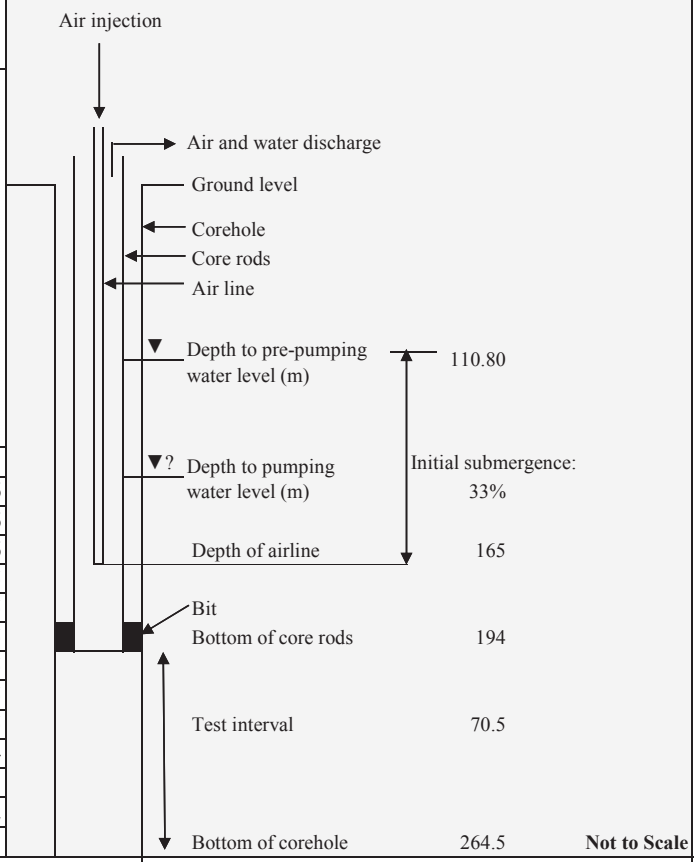
$$T = \frac{0.183Q}{\Delta s}$$

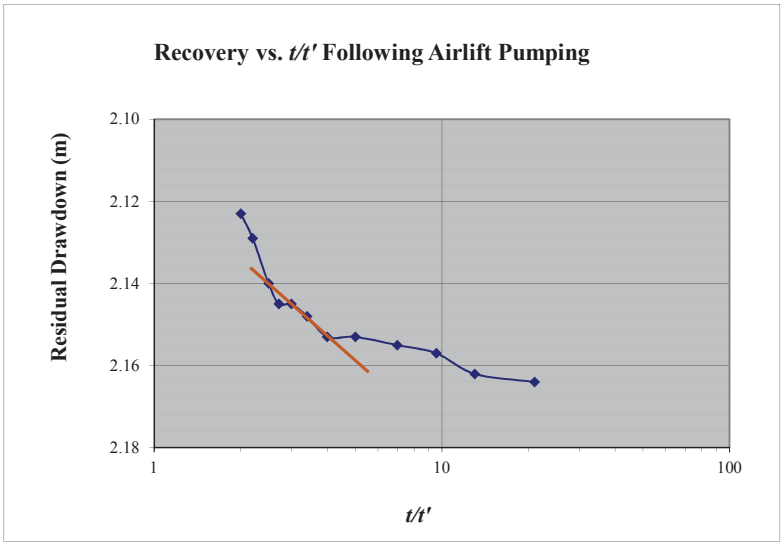
Q_{ave}	12.2	Discharge (m^3/d)
Δs	0.26	Drawdown (m)
T	8.6E+00	m^2/d
b	42.0	Test zone thickness (m)
K	2.1E-01	m/d

Analysis of KSV17005 (Test1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**264.5**	**Pre-Pumping WL (m):**		**110.8**
Core Rod Depth (m):			**194.0**	**Depth of Airline (m):**		**165.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			0.5		
	5			0.5		
	7			0.5		
	10			0.5		
	15			0.5		
	20			0.5		
	25			0.5		
	30			0.5		
	35					
	40					
	50					
	60					
			Q_{ave}	0.5		
Recovery	63	3	21.0		112.97	2.16
	65	5	13.0		112.96	2.16
	67	7	9.6		112.96	2.16
	70	10	7.0		112.96	2.15
	75	15	5.0		112.96	2.15
	80	20	4.0		112.96	2.15
	85	25	3.4		112.95	2.15
	90	30	3.0		112.95	2.15
	95	35	2.7		112.95	2.15
	100	40	2.5		112.94	2.14
	110	50	2.2		112.93	2.13
	120	60	2.0		112.93	2.12

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

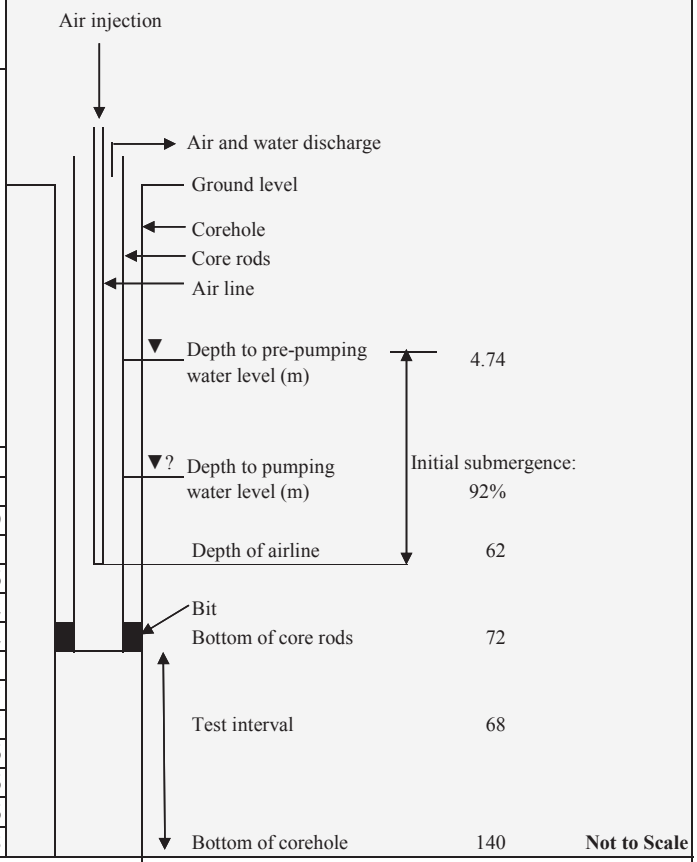
$$T = \frac{0.183Q}{\Delta s}$$

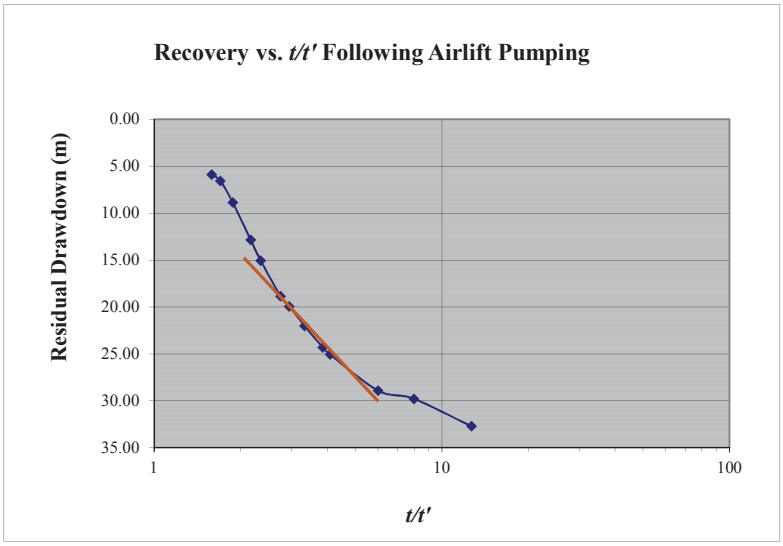
Q_{ave}	12.2	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	1.7E+02	m^2/d
b	70.5	Test zone thickness (m)
K	2.4E+00	m/d

Analysis of KSVSS51 Airlift Pumping and Recovery Data

Corehole Depth (m):	**140.0**		**Pre-Pumping WL (m):**	**4.7**		
Core Rod Depth (m):	**72.0**		**Depth of Airline (m):**	**62.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	5			0.5		
	7			0.5		
	10			0.5		
	15			0.5		
	20			0.5		
	25			0.5		
	30			0.5		
	35			0.5		
			Q_{ave}	0.5		
Recovery	38	3	12.7		37.45	32.71
	40	5	8.0		34.53	29.79
	42	7	6.0		33.65	28.91
	46	11	4.1		29.80	25.06
	47	12	3.9		29.06	24.32
	50	15	3.3		26.76	22.02
	53	18	2.9		24.67	19.93
	55	20	2.7		23.59	18.85
	61	26	2.3		19.79	15.05
	65	30	2.2		17.60	12.86
	75	40	1.9		13.60	8.86
	85	50	1.7		11.30	6.56
	95	60	1.6		10.62	5.88

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

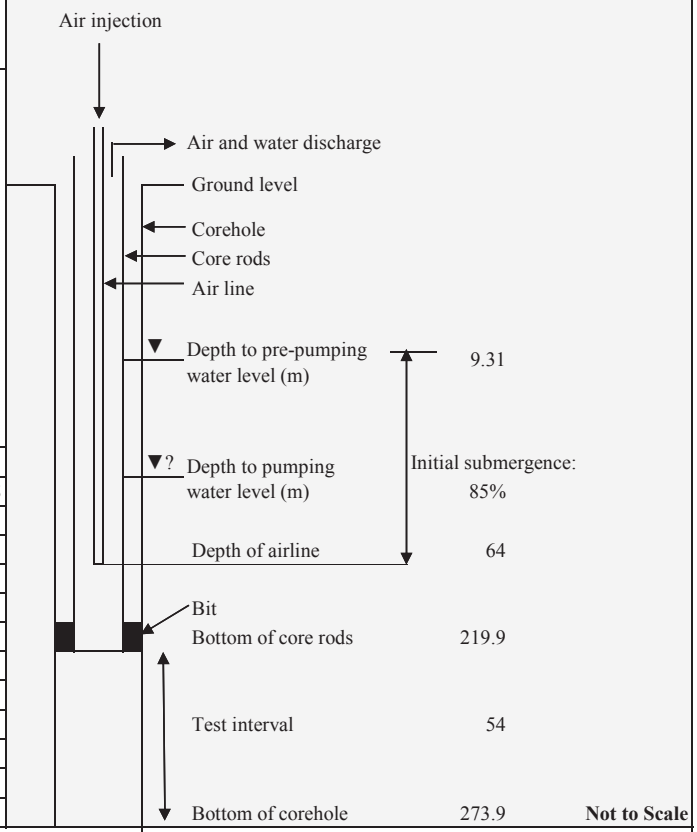
$$T = \frac{0.183Q}{\Delta s}$$

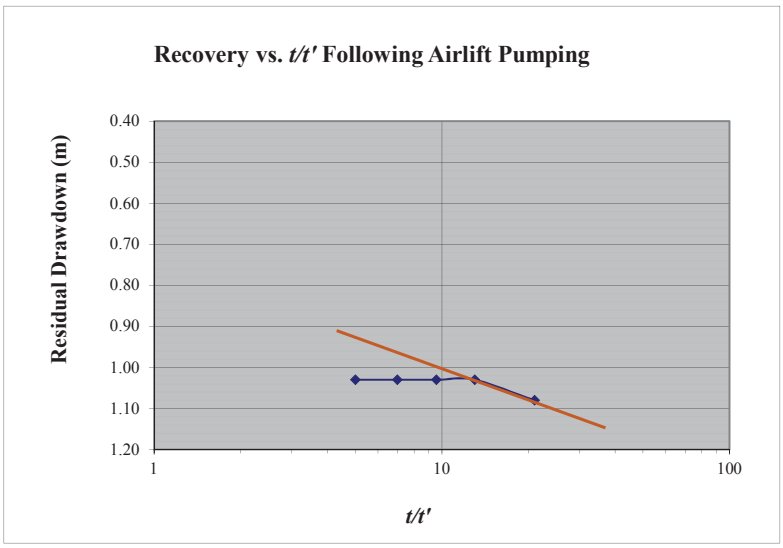
Q_{ave}	12.2	Discharge (m^3/d)
Δs	10.06	Drawdown (m)
T	2.2E-01	m^2/d
b	68.0	Test zone thickness (m)
K	3.3E-03	m/d

Analysis of KTCSS320 (Test 2) Airlift Pumping and Recovery Data

Corehole Depth (m):	**273.9**		**Pre-Pumping WL (m):**	**9.3**		
Core Rod Depth (m):	**219.9**		**Depth of Airline (m):**	**64.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			2.1		
	5			2.1		
	7			2.1		
	10			2.1		
	15			2.1		
	20			2.1		
	25			2.1		
	30			2.1		
	35			2.1		
	40			2.1		
	50			2.1		
	60			3.7		
			Q_{ave}	2.3		
Recovery	63	3	21.0		10.39	1.08
	65	5	13.0		10.34	1.03
	67	7	9.6		10.34	1.03
	70	10	7.0		10.34	1.03
	75	15	5.0		10.34	1.03
	80	20	4.0			
	85	25	3.4			
	90	30	3.0			
	95	35	2.7			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

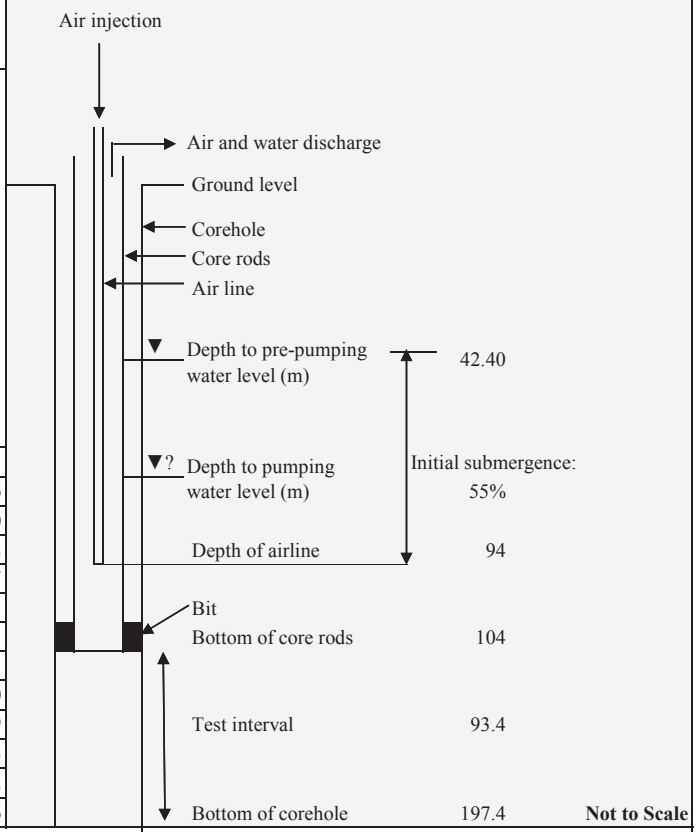
$$T = \frac{0.183Q}{\Delta s}$$

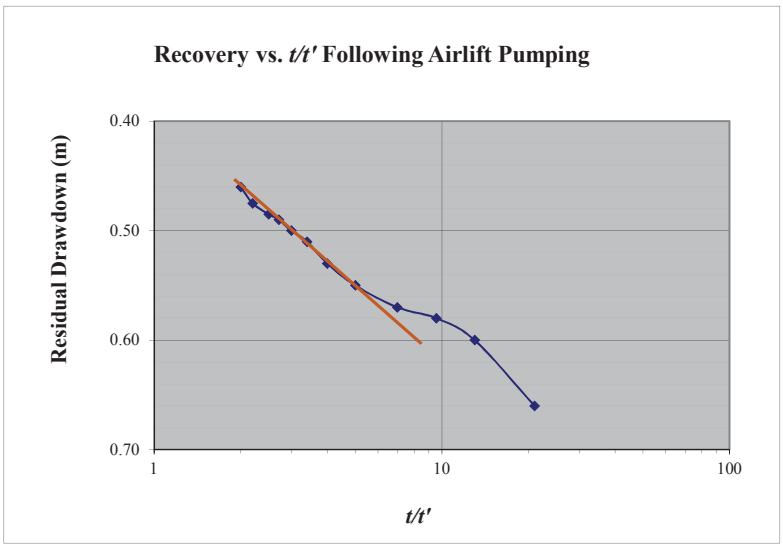
Q_{ave}	54.1	Discharge (m^3/d)
Δs	0.05	Drawdown (m)
T	2.0E+02	m^2/d
b	54.0	Test zone thickness (m)
K	3.7E+00	m/d

Analysis of KTCSS320 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):	**197.4**		**Pre-Pumping WL (m):**	**42.4**		
Core Rod Depth (m):	**104.0**		**Depth of Airline (m):**	**94.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			4.6		
	5			3.7		
	7			3.7		
	10			3.7		
	15			3.7		
	20			3.7		
	25			3.7		
	30			3.7		
	35			3.7		
	40			3.7		
	50			3.7		
	60			3.7		
			Q_{ave}	3.8		
Recovery	63	3	21.0		43.06	0.66
	65	5	13.0		43.00	0.60
	67	7	9.6		42.98	0.58
	70	10	7.0		42.97	0.57
	75	15	5.0		42.95	0.55
	80	20	4.0		42.93	0.53
	85	25	3.4		42.91	0.51
	90	30	3.0		42.90	0.50
	95	35	2.7		42.89	0.49
	100	40	2.5		42.89	0.48
	110	50	2.2		42.88	0.48
	120	60	2.0		42.86	0.46

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

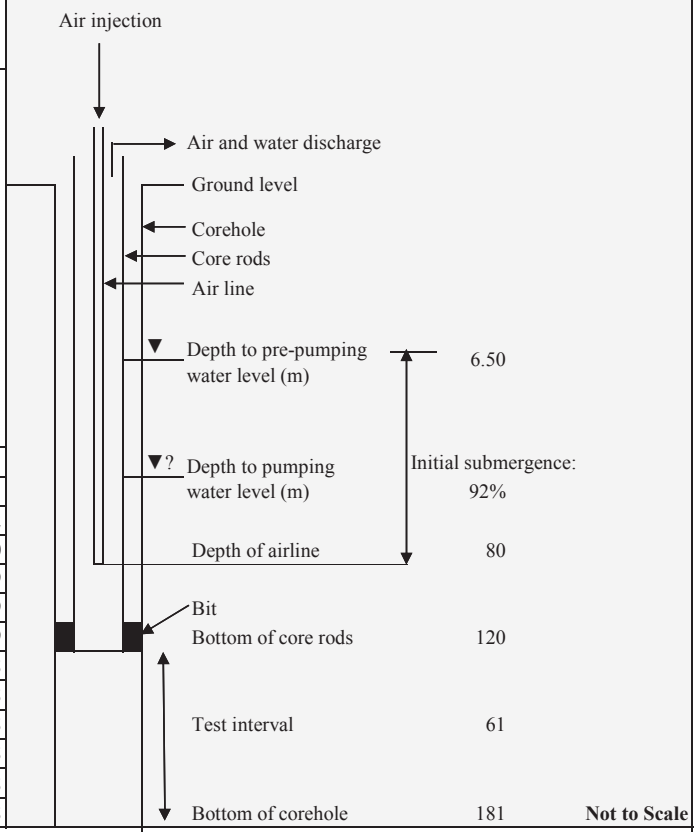
$$T = \frac{0.183Q}{\Delta s}$$

Q_{ave}	91.4	Discharge (m^3/d)
Δs	0.05	Drawdown (m)
T	3.3E+02	m^2/d
b	93.4	Test zone thickness (m)
K	3.6E+00	m/d

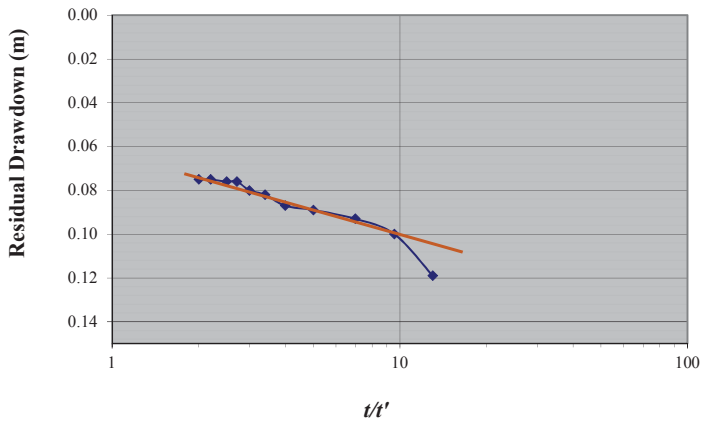
Analysis of KSV17002 (Test 1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**181.0**	**Pre-Pumping WL (m):**		**6.5**
Core Rod Depth (m):			**120.0**	**Depth of Airline (m):**		**80.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			6.6		
	5			6.6		
	7			5.2		
	10			5.2		
	15			5.2		
	20			5.2		
	25			5.2		
	30			4.6		
	35			4.6		
	40			5.2		
	50			4.0		
	60			5.2		
			Q_{ave}	5.3		
Recovery	63	3	21.0			
	65	5	13.0		6.62	0.12
	67	7	9.6		6.60	0.10
	70	10	7.0		6.60	0.09
	75	15	5.0		6.59	0.09
	80	20	4.0		6.59	0.09
	85	25	3.4		6.58	0.08
	90	30	3.0		6.58	0.08
	95	35	2.7		6.58	0.08
	100	40	2.5		6.58	0.08
	110	50	2.2		6.58	0.08
	120	60	2.0		6.58	0.08

Schematic Diagram of Airlift Pumping System



Recovery vs. *t/t′* Following Airlift Pumping



Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

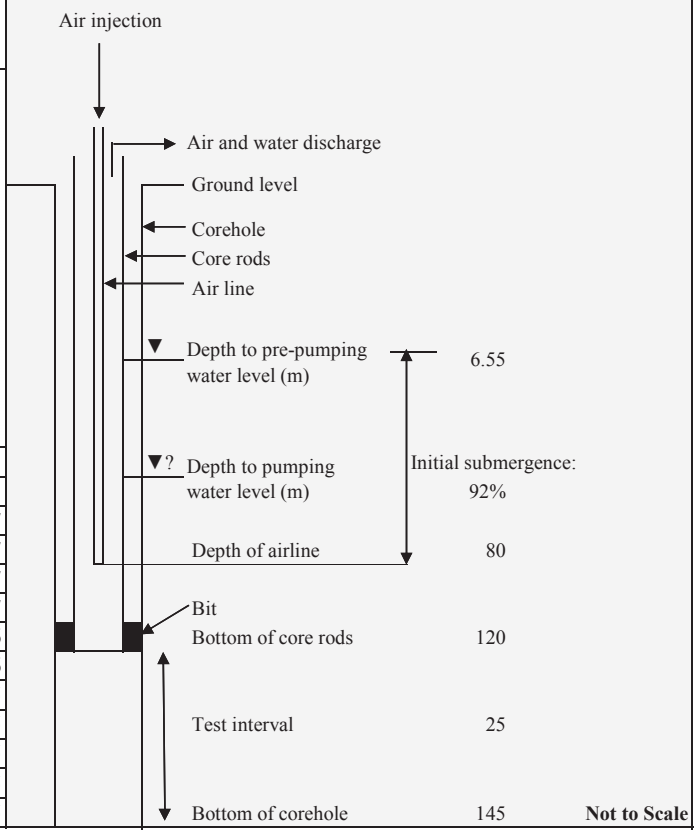
Q_{ave}	126.1	Discharge (m^3/d)
Δs	0.03	Drawdown (m)
T	9.2E+02	m^2/d
b	61.0	Test zone thickness (m)
K	1.5E+01	m/d

Analysis of KSV17003 (Test 1) Airlift Pumping and Recovery Data

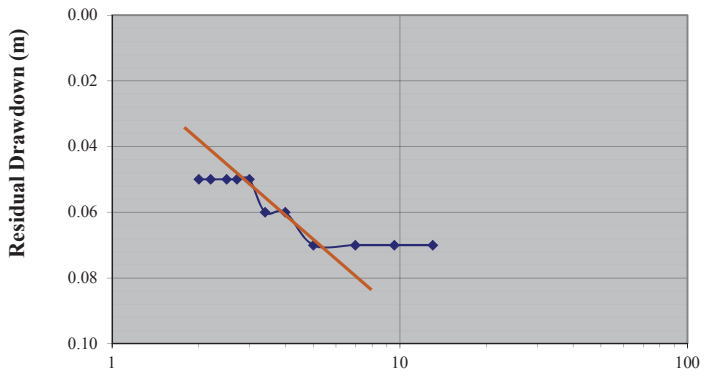
Corehole Depth (m):		**145**		**Pre-Pumping WL (m):**		**6.6**
Core Rod Depth (m):		**120**		**Depth of Airline (m):**		**80.0**

Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			4.6		
	5			6.3		
	7			6.3		
	10			7.4		
	15			6.6		
	20			7.4		
	25			7.4		
	30			8.2		
	35			8.2		
	40			8.2		
	50			7.4		
	60			6.6		
			Q_{ave}	7.0		
Recovery	63	3	21.0			
	65	5	13.0		6.62	0.07
	67	7	9.6		6.62	0.07
	70	10	7.0		6.62	0.07
	75	15	5.0		6.62	0.07
	80	20	4.0		6.61	0.06
	85	25	3.4		6.61	0.06
	90	30	3.0		6.60	0.05
	95	35	2.7		6.60	0.05
	100	40	2.5		6.60	0.05
	110	50	2.2		6.60	0.05
	120	60	2.0		6.60	0.05

Schematic Diagram of Airlift Pumping System



Recovery vs. t/t' Following Airlift Pumping



Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

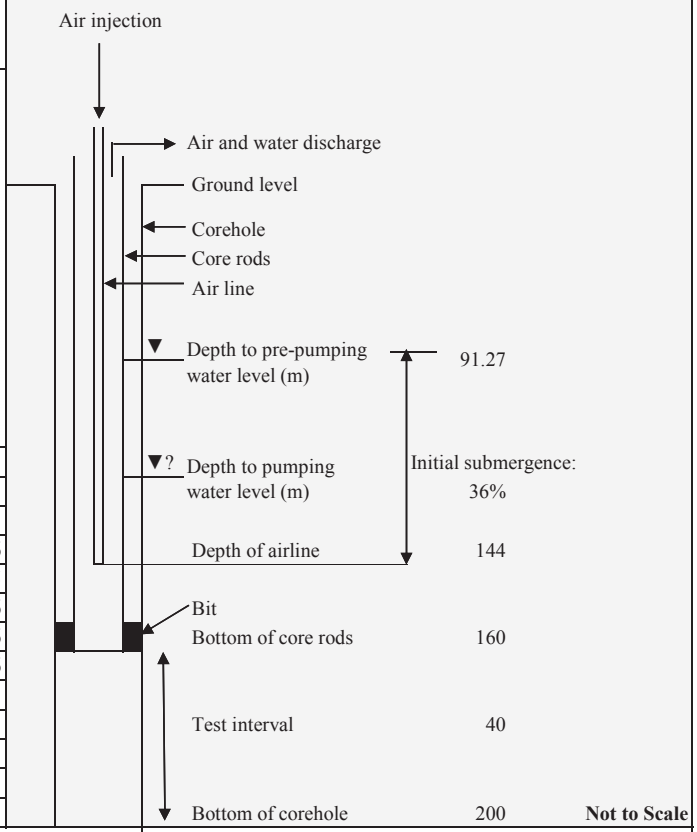
Q_{ave}	168.9	Discharge (m^3/d)
Δs	0.02	Drawdown (m)
T	1.5E+03	m^2/d
b	25.0	Test zone thickness (m)
K	6.2E+01	m/d

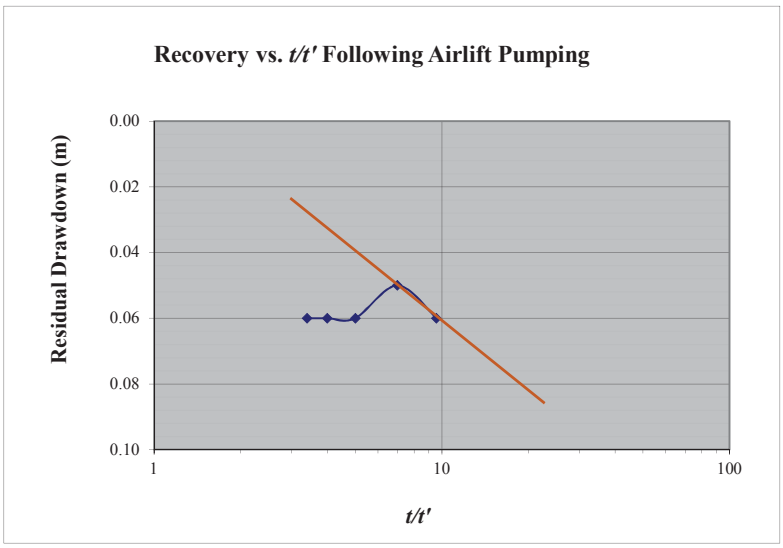
Analysis of DEW18-1 Airlift Pumping and Recovery Data

Corehole Depth (m):	200.0			Pre-Pumping WL (m):	91.3	
Core Rod Depth (m):	160.0			Depth of Airline (m):	143.7	

Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			1.0		
	5			1.8		
	7			1.8		
	10			1.8		
	15			1.0		
	20			1.0		
	25			1.5		
	30			1.0		
	35			1.0		
	40			1.5		
	50			1.0		
	60			1.5		
			Q_{ave}	1.3		
Recovery	63	3	21.0			
	65	5	13.0			
	67	7	9.6		91.33	0.06
	70	10	7.0		91.32	0.05
	75	15	5.0		91.33	0.06
	80	20	4.0		91.33	0.06
	85	25	3.4		91.33	0.06
	90	30	3.0			
	95	35	2.7			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

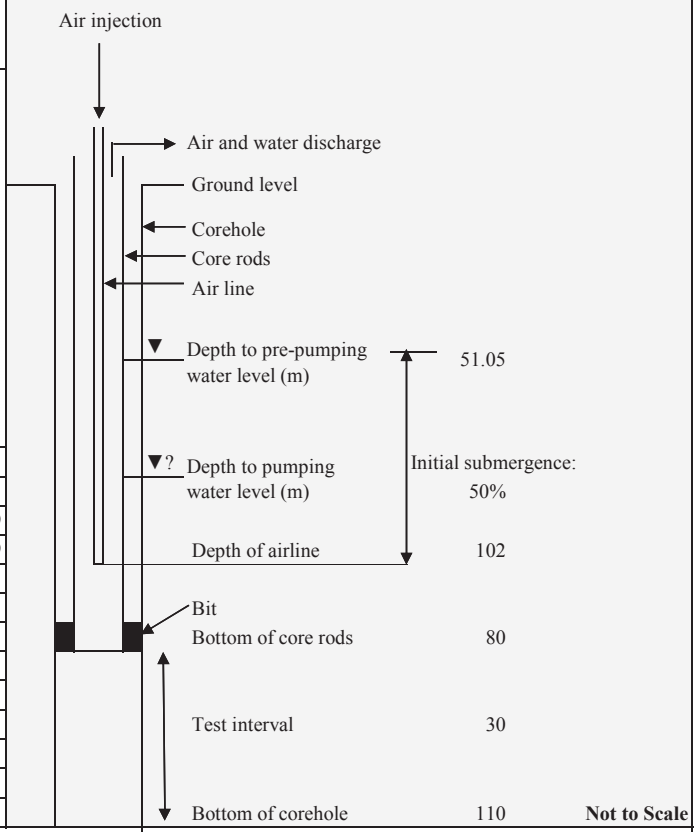
$$T = \frac{0.183Q}{\Delta s}$$

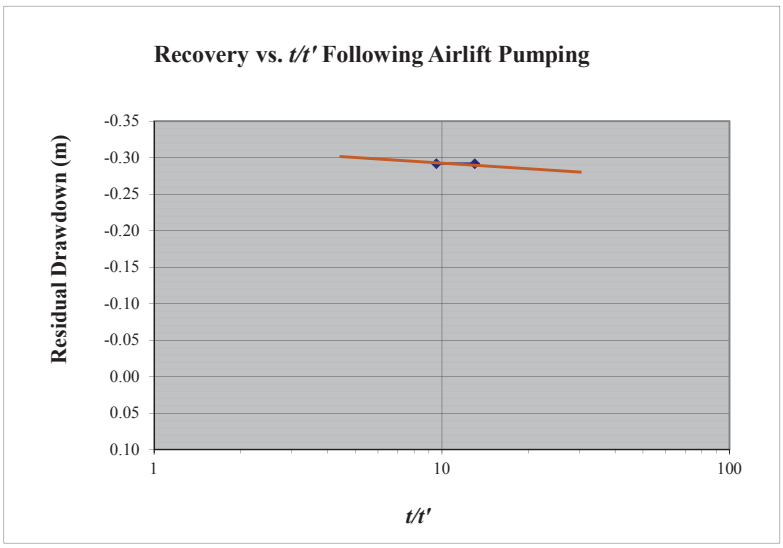
Q_{ave}	32.0	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	5.9E+02	m^2/d
b	40.0	Test zone thickness (m)
K	1.5E+01	m/d

Analysis of KH01 (Test1) Airlift Pumping and Recovery Data

Corehole Depth (m):			**110.0**	**Pre-Pumping WL (m):**		**51.0**
Core Rod Depth (m):			**80.0**	**Depth of Airline (m):**		**102.0**
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			3.0		
	5			3.4		
	7			3.0		
	10			4.2		
	15			4.2		
	20			4.2		
	25			4.2		
	30			4.2		
	35			2.3		
	40					
	50					
	60					
			Q_{ave}	3.6		
Recovery	63	3	21.0			
	65	5	13.0		50.76	-0.29
	67	7	9.6		50.76	-0.29
	70	10	7.0			
	75	15	5.0			
	80	20	4.0			
	85	25	3.4			
	90	30	3.0			
	95	35	2.7			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

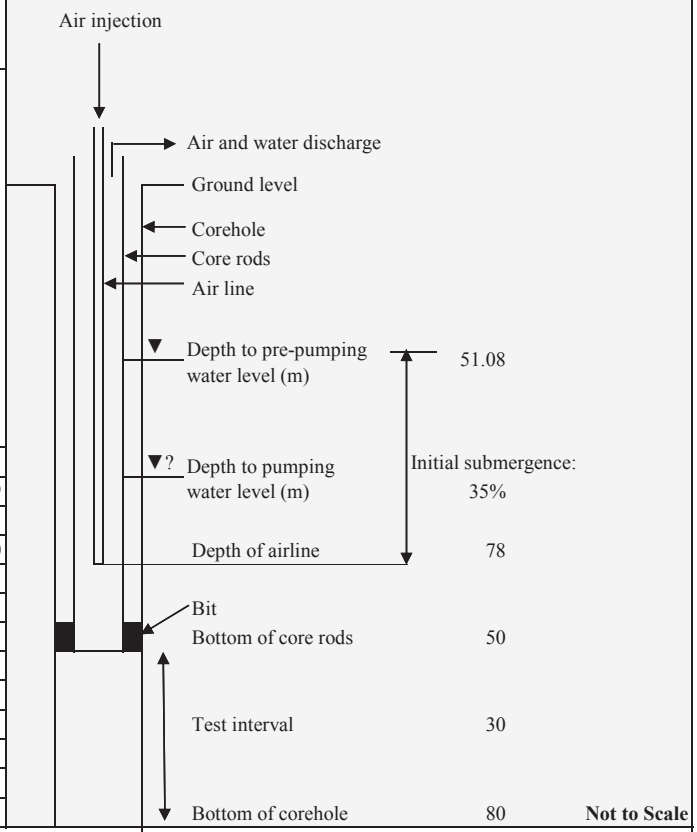
$$T = \frac{0.183Q}{\Delta s}$$

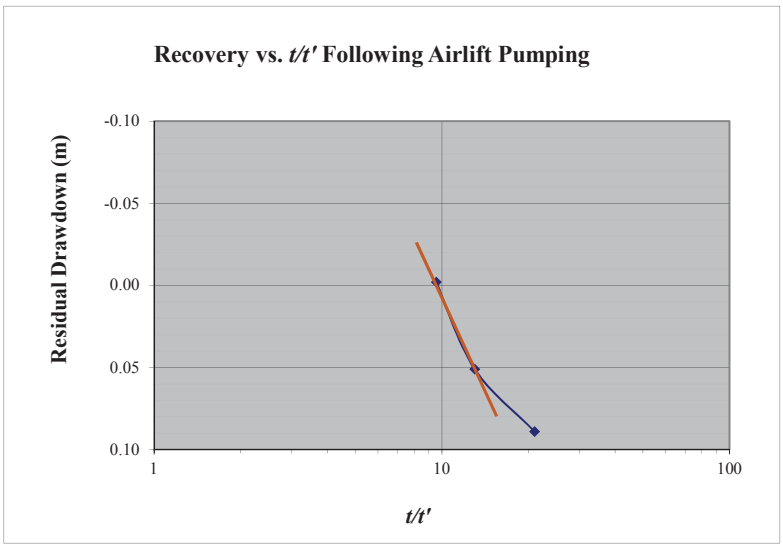
Q_{ave}	86.7	Discharge (m^3/d)
Δs	0.01	Drawdown (m)
T	1.6E+03	m^2/d
b	30.0	Test zone thickness (m)
K	5.3E+01	m/d

Analysis of KH01 (Test2) Airlift Pumping and Recovery Data

Corehole Depth (m):	**80.0**		**Pre-Pumping WL (m):**	**51.1**		
Core Rod Depth (m):	**50.0**		**Depth of Airline (m):**	**78.0**		
Data	***t*** **(mins)**	***t′*** **(mins)**	***t/t′***	***Q*** **(m^3/hr)**	**Depth to Water (m)**	**Residual Drawdown (m)**
Pumping	--			--		
	3			1.8		
	5			2.3		
	7			2.3		
	10			2.3		
	15			2.3		
	20			2.3		
	25			2.3		
	30			2.3		
	35			2.3		
	40			2.3		
	50			2.3		
	60			2.3		
			Q_{ave}	2.3		
Recovery	63	3	21.0		51.17	0.09
	65	5	13.0		51.13	0.05
	67	7	9.6		51.08	0.00
	70	10	7.0			
	75	15	5.0			
	80	20	4.0			
	85	25	3.4			
	90	30	3.0			
	95	35	2.7			
	100	40	2.5			
	110	50	2.2			
	120	60	2.0			

Schematic Diagram of Airlift Pumping System





Theis (1935) Recovery Method

$$T = \frac{0.183Q}{\Delta s}$$

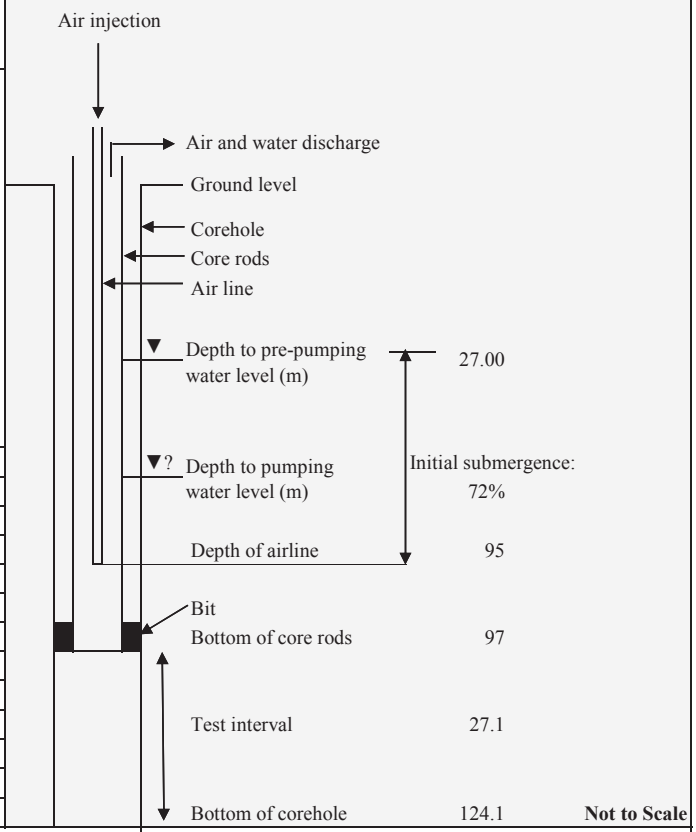
Q_{ave}	54.9	Discharge (m^3/d)
Δs	0.05	Drawdown (m)
T	1.9E+02	m^2/d
b	30.0	Test zone thickness (m)
K	6.3E+00	m/d

Analysis of DEW33 Airlift Pumping and Recovery Data

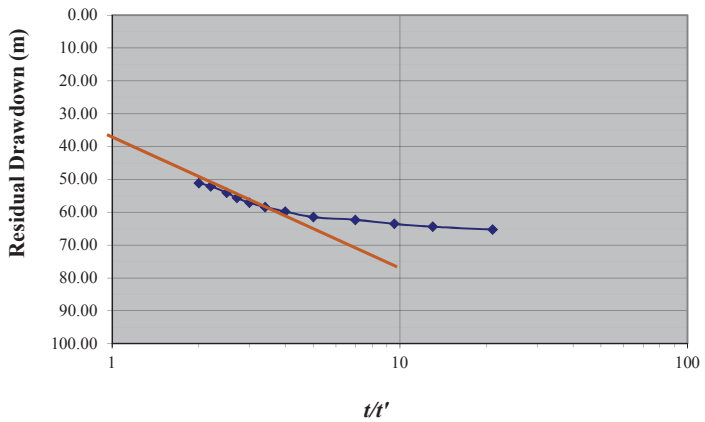
Corehole Depth (m):	124.1		Pre-Pumping WL (m):	27		
Core Rod Depth (m):	97.0		Depth of Airline (m):	95		

Data	t (mins)	t' (mins)	t/t'	Q (m^3/hr)	Depth to Water (m)	Residual Drawdown (m)
Pumping	--			--		
	3			1.0		
	5			1.0		
	7			1.0		
	10			1.0		
	15			1.0		
	20			1.0		
	25			1.0		
	30			1.0		
	35			1.0		
	40					
	50					
	60					
			Q_{ave}	1.0		
Recovery	63	3	21.0		92.30	65.30
	65	5	13.0		91.40	64.40
	67	7	9.6		90.54	63.54
	70	10	7.0		89.30	62.30
	75	15	5.0		88.48	61.48
	80	20	4.0		86.78	59.78
	85	25	3.4		85.42	58.42
	90	30	3.0		84.05	57.05
	95	35	2.7		82.65	55.65
	100	40	2.5		81.02	54.02
	110	50	2.2		79.11	52.11
	120	60	2.0		78.11	51.11

Schematic Diagram of Airlift Pumping System



Recovery vs. t/t' Following Airlift Pumping



Theis (1935) Recovery Method

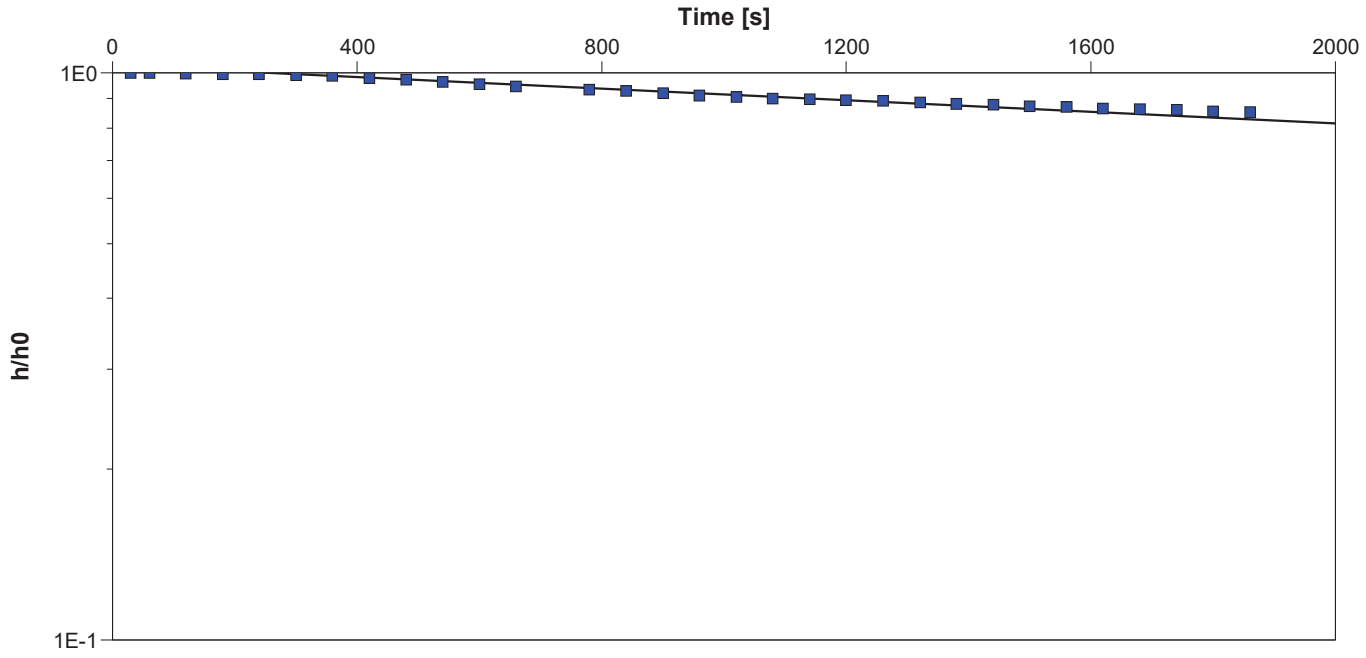
$$T = \frac{0.183Q}{\Delta s}$$

Q_{ave}	25.0	Discharge (m^3/d)
Δs	7.67	Drawdown (m)
T	6.0E-01	m^2/d
b	27.1	Test zone thickness (m)
K	2.2E-02	m/d

Appendix D: Slug Test Data

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC0670	Test Well: SRC070
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC070	Analysis Date: 08/01/2019
Aquifer Thickness: 8.80 m		

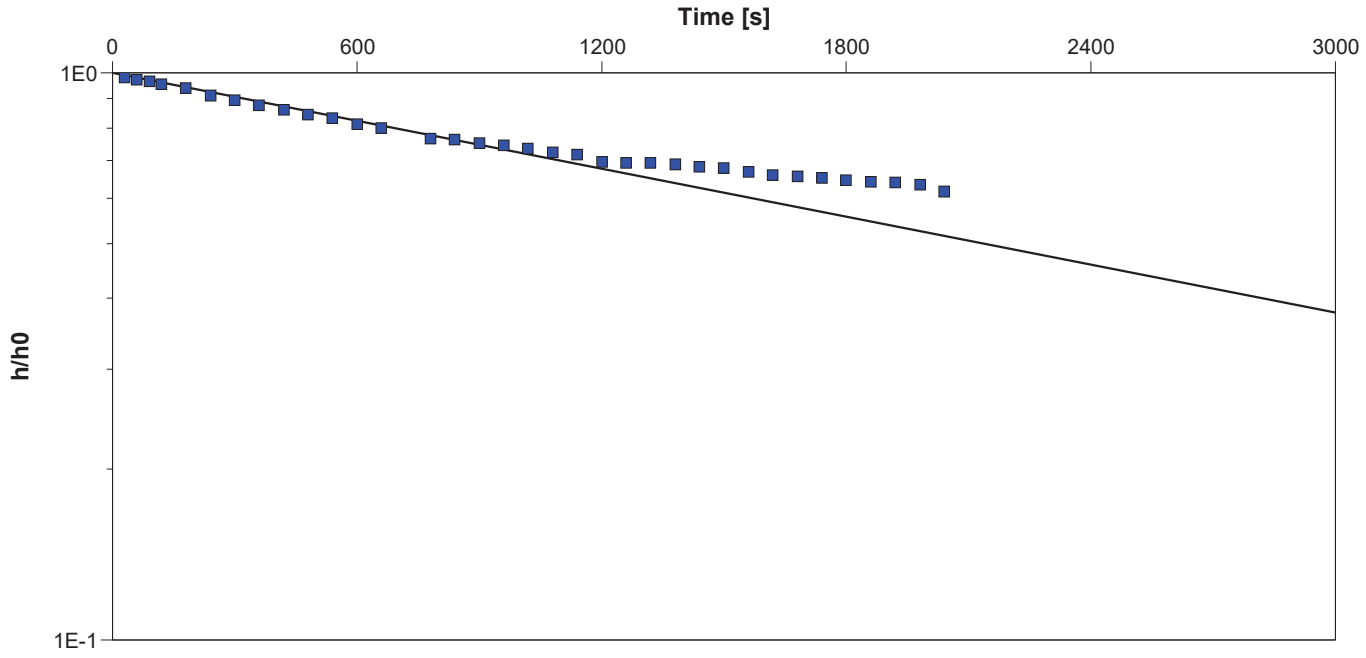


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC070	8.04×10^{-3}	

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC069	Test Well: SRC069
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC069	Analysis Date: 08/01/2019
Aquifer Thickness: 20.70 m		

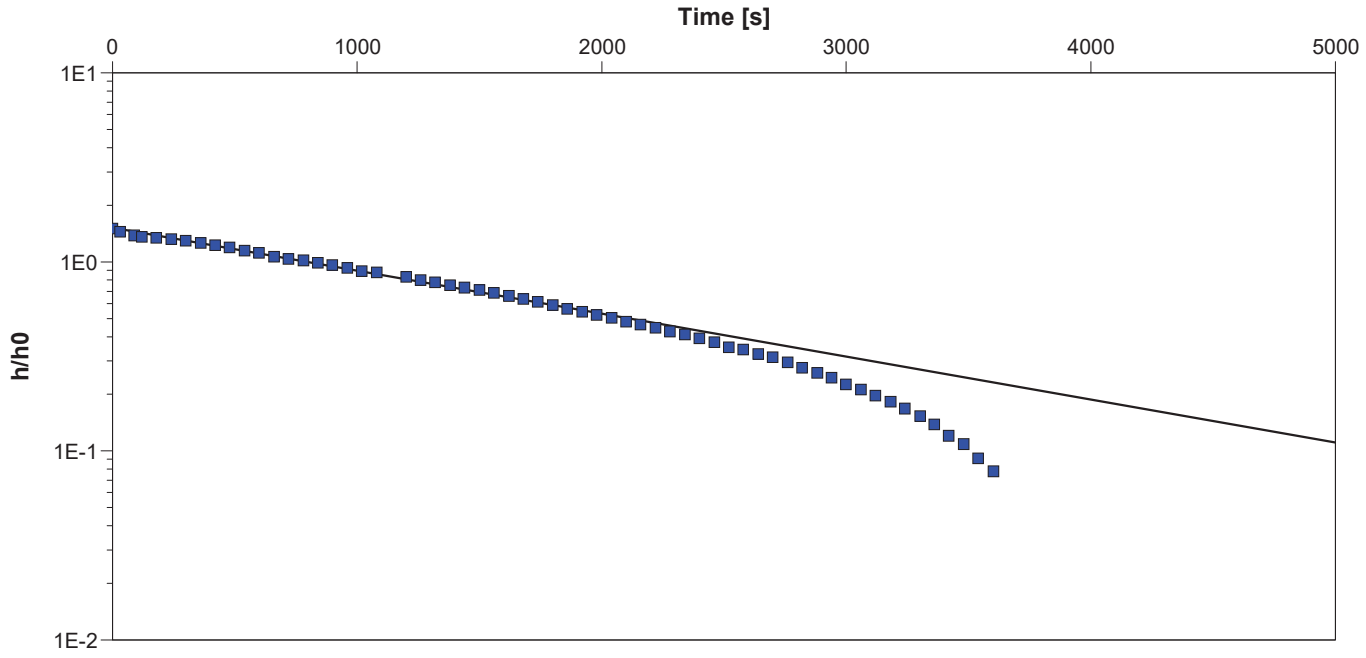


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC069	1.14×10^{-2}	

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC066	Test Well: SRC066
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC066	Analysis Date: 08/01/2019
Aquifer Thickness: 13.60 m		

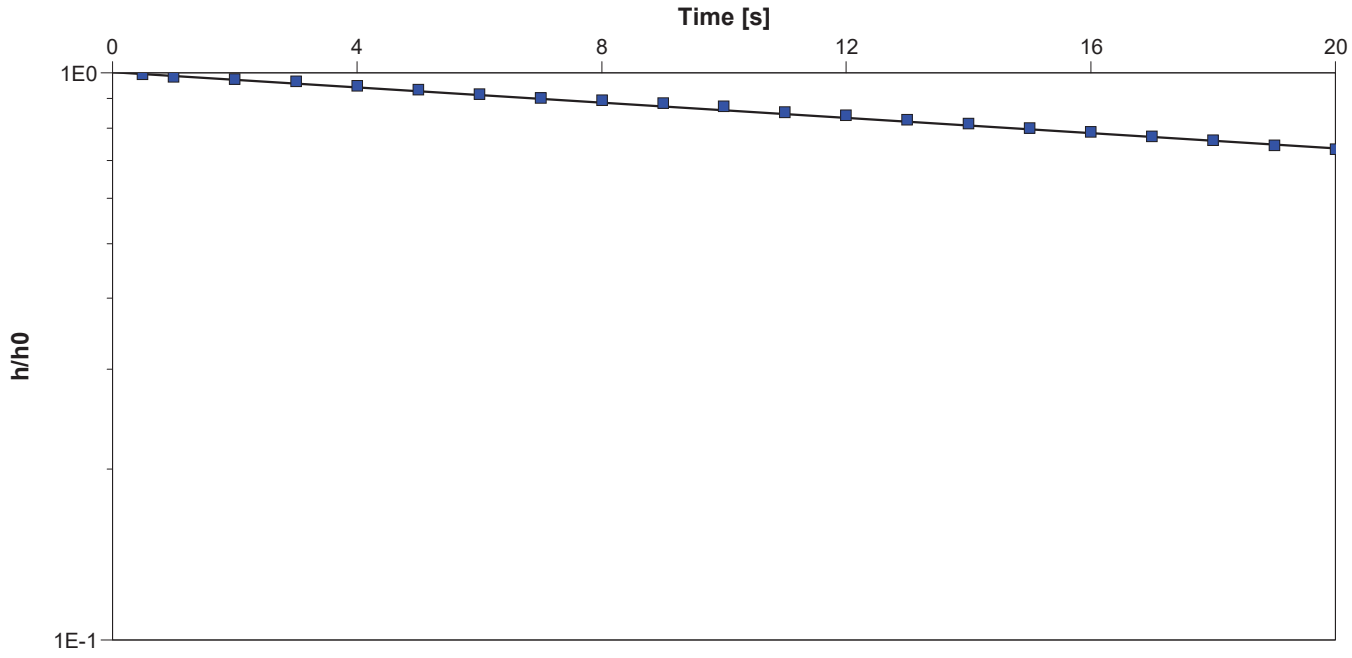


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC066	2.55×10^{-2}	

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC059	Test Well: SRC059
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC051	Analysis Date: 08/01/2019
Aquifer Thickness: 22.35 m		

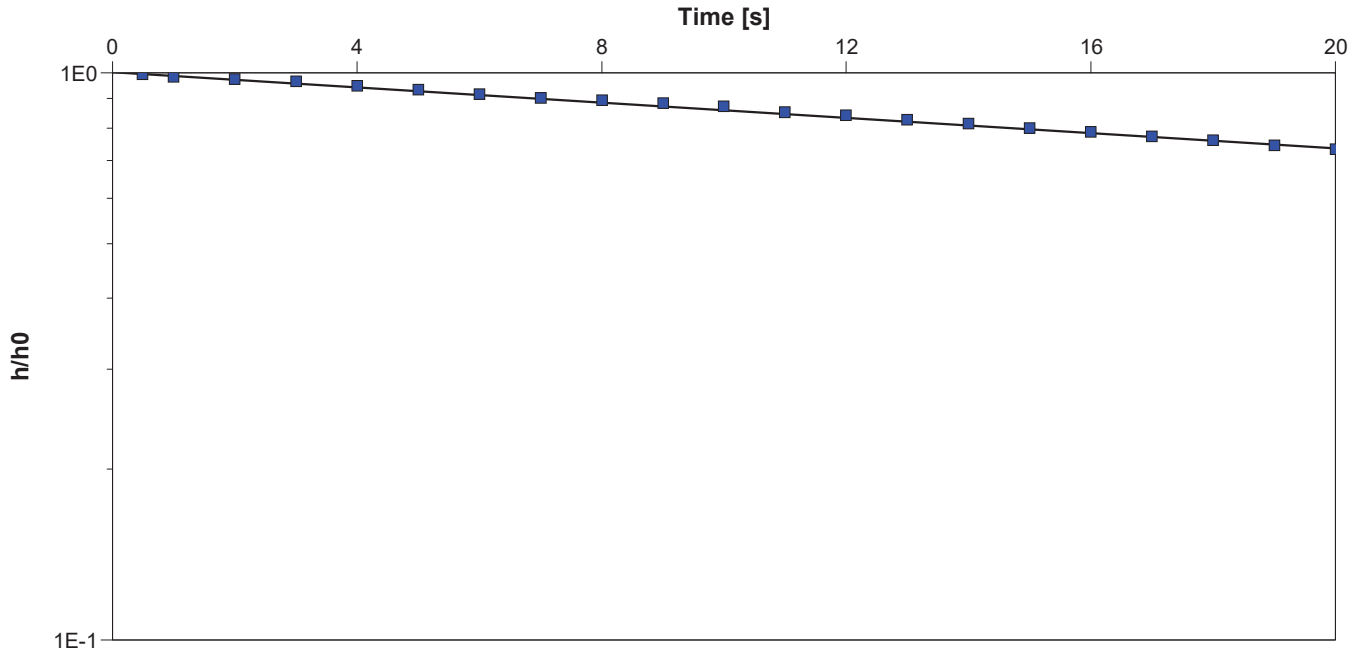


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC059	5.10×10^{-1}	

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC059	Test Well: SRC059
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC051	Analysis Date: 08/01/2019
Aquifer Thickness: 22.35 m		

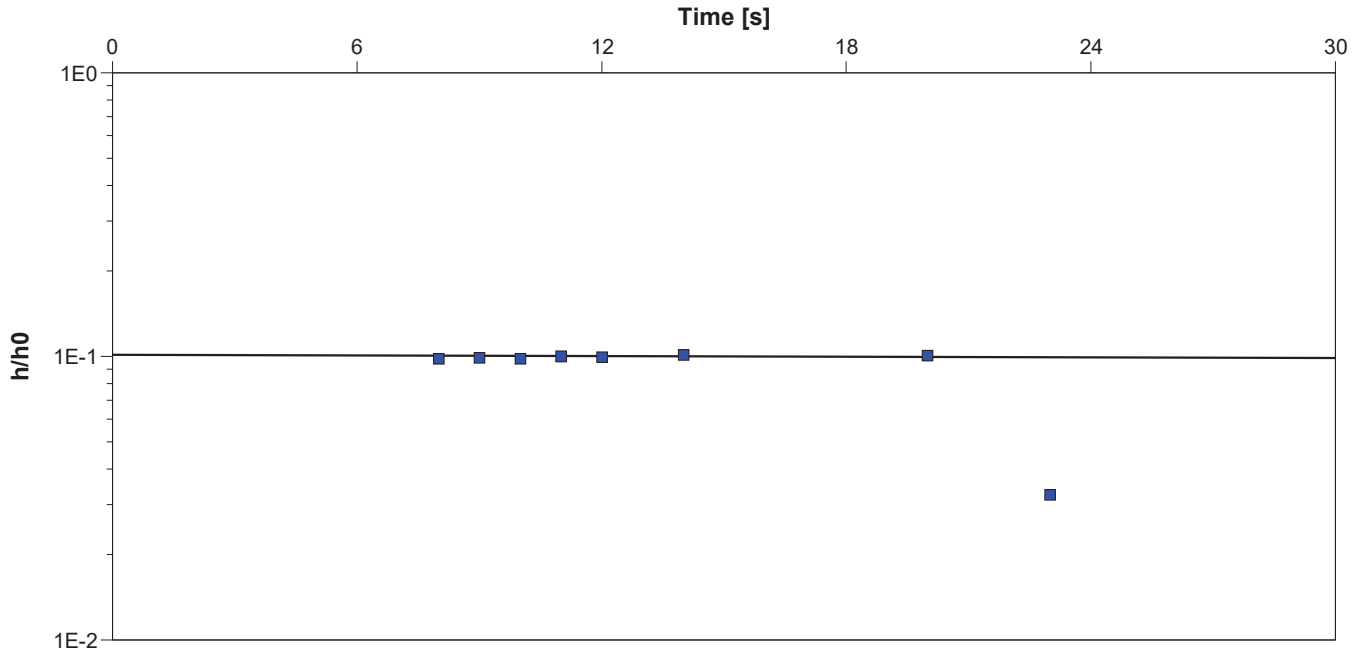


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC059	5.10×10^{-1}	

Schlumberger Water Services	Contact Info Address Company Name City, State/Province	**Slug Test Analysis Report**
		Project: Hydraulic Charcterisation of KNS Geology
		Number: 1099612
		Client: MMG

Location: Kinsevere	Slug Test: SRC048	Test Well: SRC048
Test Conducted by: Hamilton		Test Date: 04/12/2018
Analysis Performed by: Hamilton	SRC048	Analysis Date: 08/01/2019
Aquifer Thickness: 2.79 m		

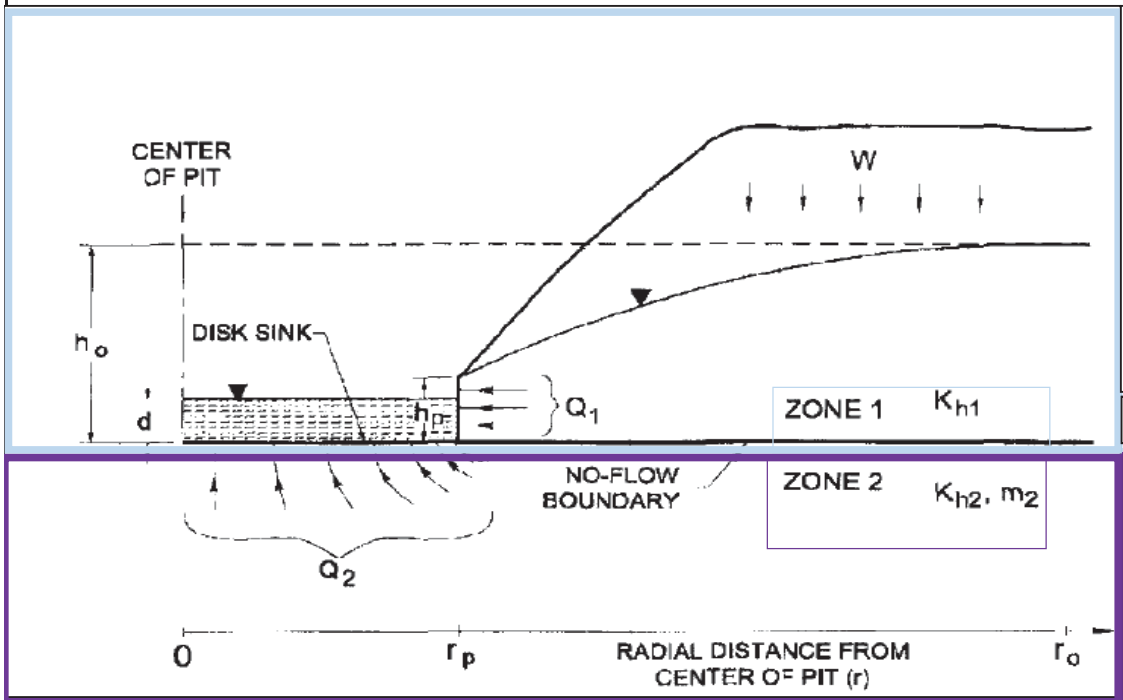


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/d]	
SRC048	1.60×10^{-1}	

Appendix E: Groundwater Inflow Calculations

Projected Gundwater Inflow Determination for Mashi Pit



Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W\,\pi\,(r_o^2 - r_p^2)$$

ho	=	105	Initial Saturated Thickness (m)
hp	=	85	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	2100	Radius of Influence **(use for reiteration) (m)**
rp	=	335	Effective Pit Radius (m)

Input

Reiteration

ho	=	105

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow

Q1	=	11227	m3/d
		130	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\,r_p\left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

rp	=	335	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	105	Initial Saturated Thickness
d	=	85	Depth of the Pit Lake

Input

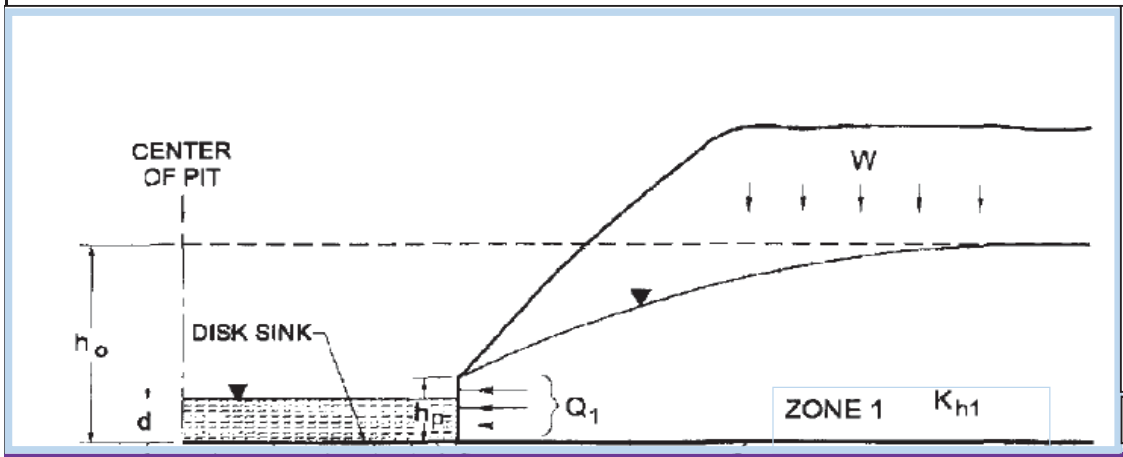
Zone 2 Inflow

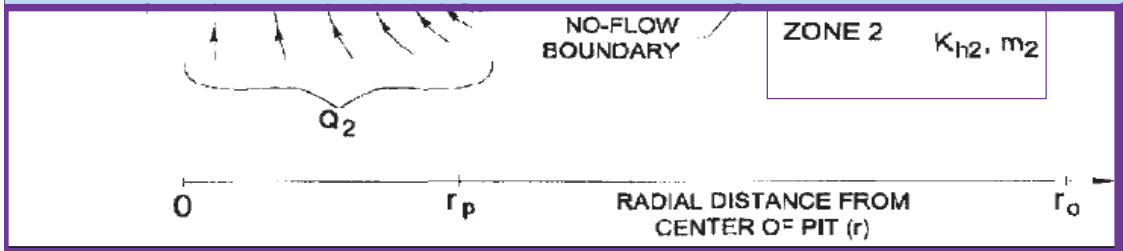
Q2	=	3538	m3/d
		41	L/s

Q1=	130	L/s
Q2=	41	L/s
Q1+Q2=	171	L/s

Dupuit-Forchheimer

Gundwater Inflow Determination for Mashi Pit





Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W \pi (r_o^2 - r_p^2)$$

ho	=	30	Initial Saturated Thickness (m)
hp	=	10	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	1225	Radius of Influence **(use for reiteration) (m)**
rp	=	335	Effective Pit Radius (m)
		Input	

Reiteration

ho	=	30

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow

Q1	=	3627	m3/d
		42	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\, r_p \left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

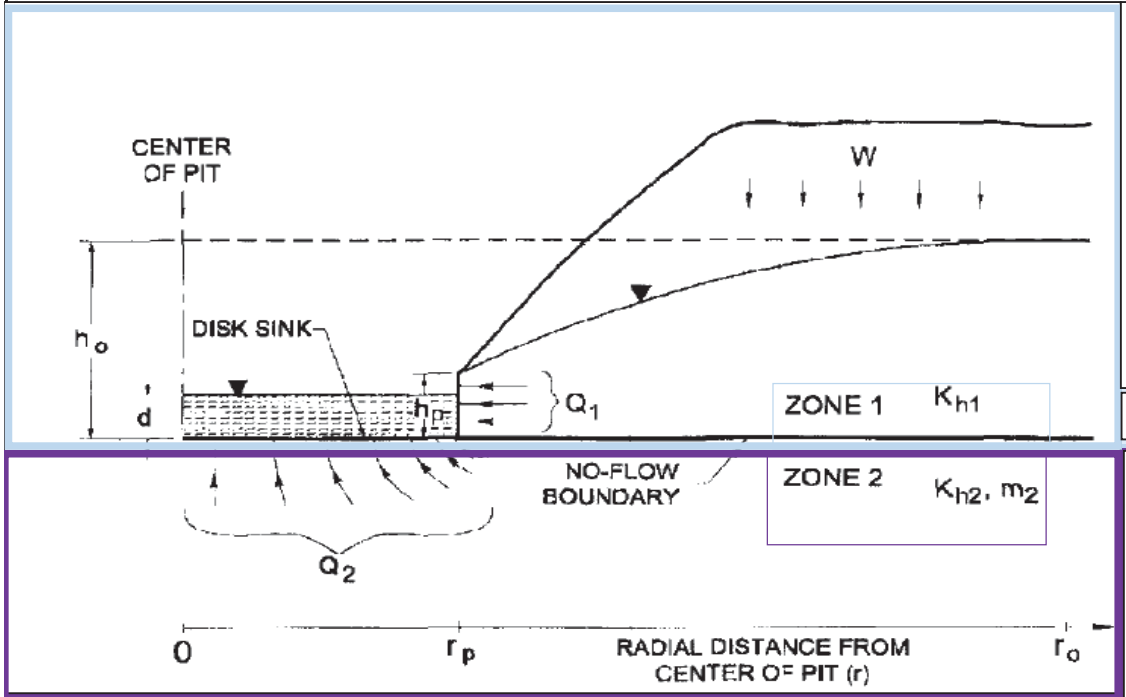
rp	=	335	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	30	Initial Saturated Thickness
d	=	10	Depth of the Pit Lake
		Input	

Zone 2 Inflow

Q2	=	3538	m3/d
		41	L/s

Q1=	42	L/s
Q2=	41	L/s
Q1+Q2=	83	L/s

Projected Gundwater Inflow Determination for Kinsevere Hill South Pit



Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W \pi (r_o^2 - r_p^2)$$

ho	=	55	Initial Saturated Thickness (m)
hp	=	0	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	1625	Radius of Influence **(use for reiteration) (m)**
rp	=	166	Effective Pit Radius (m)
		Input	

Reiteration

ho	=	55

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow			
Q1	=	6826	m3/d
		79	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\, r_p \left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

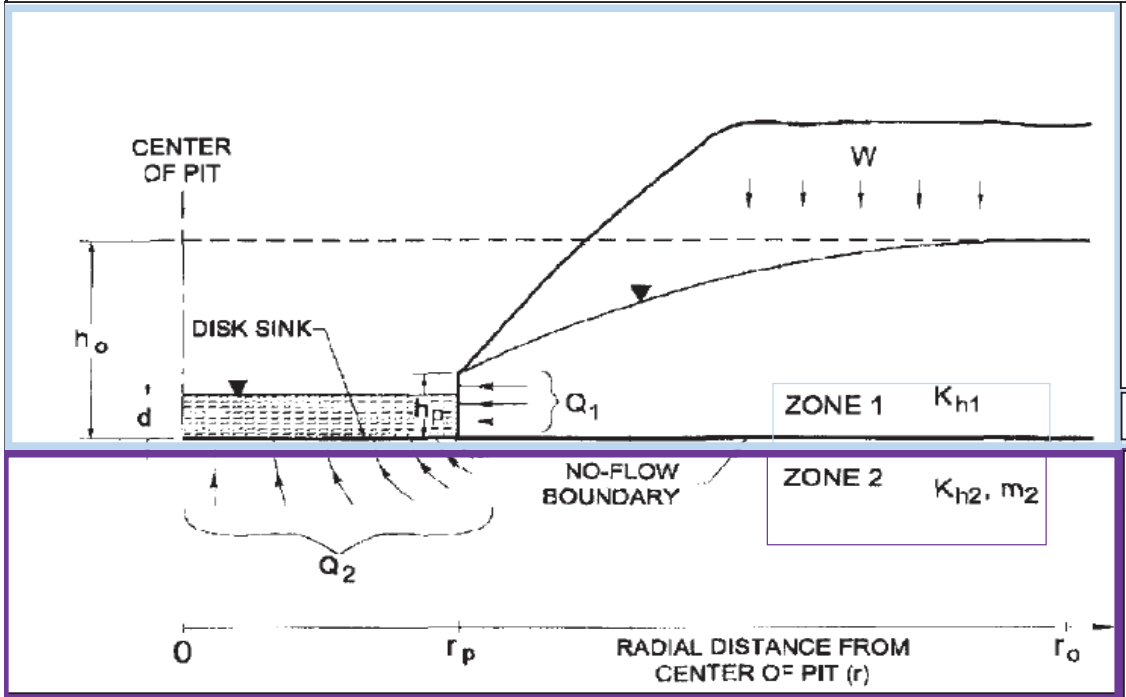
rp	=	166	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	55	Initial Saturated Thickness
d	=	0	Depth of the Pit Lake
		Input	

Zone 2 Inflow			
Q2	=	4821	m3/d
		56	L/s

Q1=	79	L/s
Q2=	56	L/s
Q1+Q2=	135	L/s

Dupuit-Forchheimer

Projected Gundwater Inflow Determination for Kinsevere Hill North Pit



Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W\,\pi\,(r_o^2 - r_p^2)$$

ho	=	10	Initial Saturated Thickness (m)
hp	=	0	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	625	Radius of Influence **(use for reiteration) (m)**
rp	=	271	Effective Pit Radius (m)
		Input	

Reiteration

ho	=	10

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow			
Q1	=	829	m3/d
		10	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\,r_p\left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

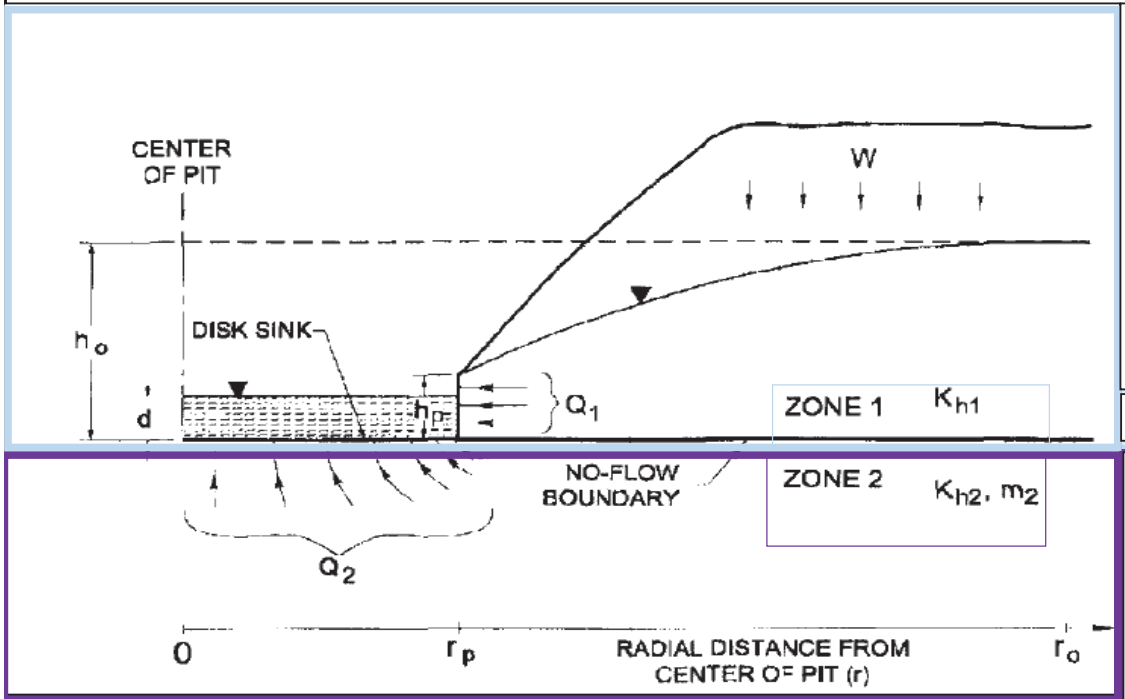
rp	=	271	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	10	Initial Saturated Thickness
d	=	0	Depth of the Pit Lake
		Input	

Zone 2 Inflow			
Q2	=	1431	m3/d
		17	L/s

Q1=	10	L/s
Q2=	17	L/s
Q1+Q2=	26	L/s

Dupuit-Forchheimer

Gundwater Inflow Determination for Central Pit



Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W \pi (r_o^2 - r_p^2)$$

ho	=	110	Initial Saturated Thickness (m)
hp	=	25	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	3350	Radius of Influence **(use for reiteration) (m)**
rp	=	405	Effective Pit Radius (m)
		Input	

Reiteration

ho	=	110

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow			
Q1	=	28887	m3/d
		334	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\, r_p \left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

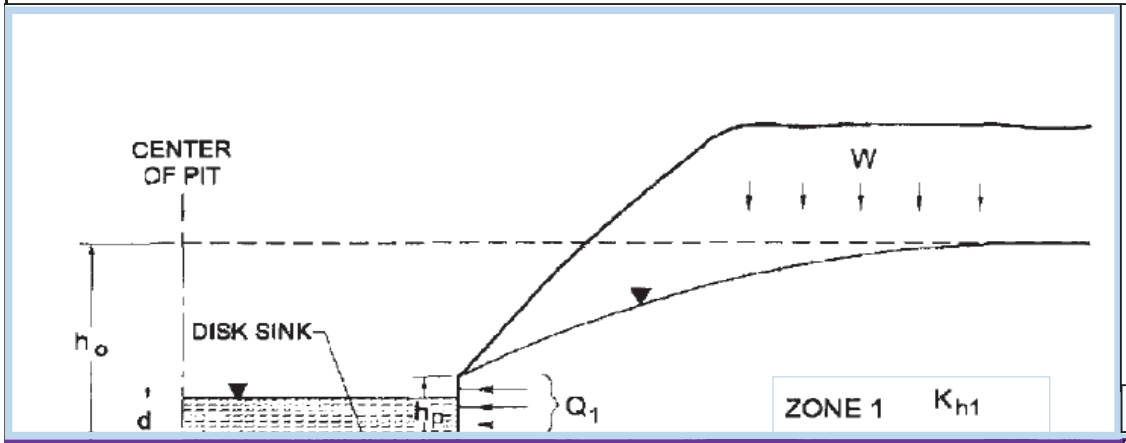
rp	=	405	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	110	Initial Saturated Thickness
d	=	25	Depth of the Pit Lake
		Input	

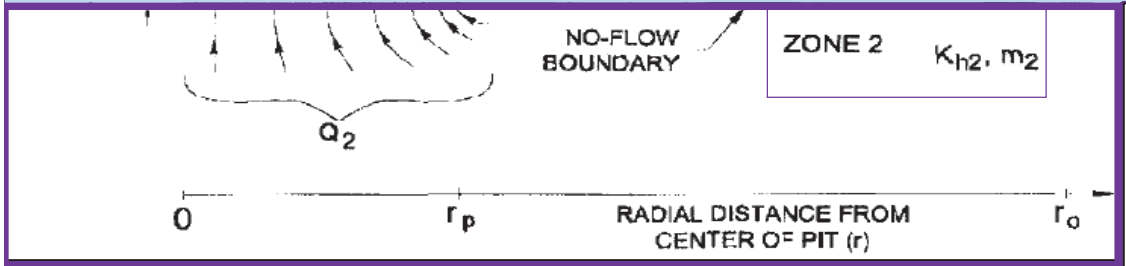
Zone 2 Inflow			
Q2	=	18176	m3/d
		210	L/s

Q1=	334	L/s
Q2=	210	L/s
Q1+Q2=	545	L/s

Dupuit-Forchheimer

Projected Gundwater Inflow Determination for Central Pit





Zone 1 Analytical Solution

The analytical solution for Zone 1 considers steady-state, unconfined, horizontal radial flow, with uniformly distributed recharge at the water table. Additional assumptions of this solution are as follows:

- The pit walls are approximated as a right circular cylinder.
- Ground water flow is horizontal. The Dupuit-Forchheimer approximation (McWhorter and Sunada 1977) is used to account for changes in saturated thickness due to depression of the water table.
- The static (premining) water table is approximately horizontal.
- Uniform distributed recharge occurs across the site as a result of surface infiltration. All recharge within the radius of influence (cone of depression) of the pit is assumed to be captured by the pit.
- Ground water flow toward the pit is axially symmetric.

As derived in the Appendix, the following equation applies for these conditions:

$$(1)\ h_o = \sqrt{h_p^2 + \frac{W}{K_{h1}}\left[r_o^2 \ln\left(\frac{r_o}{r_p}\right) - \frac{(r_o^2 - r_p^2)}{2}\right]}$$

$$(2)\ Q_1 = W\,\pi\,(r_o^2 - r_p^2)$$

ho	=	275	Initial Saturated Thickness (m)
hp	=	190	Saturated Thickness (m)
W	=	8.32E-04	Distributed Recharge Flux (m/d)
Kh1	=	1.32E+00	Horizontal Hydraulic Conductivity (m/d)
r0	=	5450	Radius of Influence **(use for reiteration) (m)**
rp	=	405	Effective Pit Radius (m)
		Input	

Reiteration

ho	=	275

Values have to match

Change r0 so the ho values can match

Zone 1 Inflow			
Q1	=	77161	m3/d
		893	L/s

Zone 2 Analytical Solution

The analytical solution for Zone 2 is based on steady-state flow to one side of a circular disk sink of constant and uniform drawdown. The sink represents the bottom of the pit. This solution is based on the following assumptions:

- Hydraulic head is initially uniform (hydrostatic) throughout Zone 2. Initial head is equal to the elevation of the initial water table in Zone 1.
- The disk sink has a constant hydraulic head equal to the elevation of the pit lake water surface. If the pit is completely dewatered, the disk sink head is equal to elevation of the pit bottom.
- Flow to the disk sink is three-dimensional and axially symmetric.
- Materials within Zone 2 are anisotropic, and the principal coordinate directions for hydraulic conductivity are horizontal and vertical.

The steady-state inflow rate to one side of the disk sink is given by the following equations:

$$Q_2 = 4\,r_p \left(\frac{K_{h2}}{m_2}\right)(h_o - d)$$

$$m_2 = \sqrt{\frac{K_{h2}}{K_{v2}}}$$

rp	=	405	Effective Pit Radius (same as above)
Kh2	=	1.32E+00	Horizontal Hydraulic Conductivity
Kv2	=	1.32E-02	Vertical Hydraulic Conductivity
m2	=	10	Anisotropy Parameter **(Do not edit)**
ho	=	275	Initial Saturated Thickness
d	=	190	Depth of the Pit Lake
		Input	

Zone 2 Inflow			
Q2	=	18176	m3/d
		210	L/s

Q1=	893	L/s
Q2=	210	L/s
Q1+Q2=	1103	L/s

Dupuit-Forchheimer