APPENDIX E

ISOTOPE AND PACKER TEST RESULTS

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A total of two deep borings, one in SMU 1 (OL-STA-10108) and one in SMU 3 (OL-STA-30033), were conducted during the Phase II PDI. The borings were completed to assist with refining the subsurface stratigraphy and to collect porewater samples to further our understanding of groundwater beneath the lake (Figures 1 and 3 of the main report, respectively). These borings extended approximately 10 ft into the bedrock and logs for each location can be found in Appendix C of this report.

Groundwater samples were collected from the bedrock interval by installing a packer assembly at the bottom of the 4-inch casing and purging a minimum of one water volume from the open rock hole. Groundwater was then sampled by passing the water through a copper tube for several minutes to remove any trapped air in the tubes. The discharge end of the tube was then crimped off and capped while the pump was still running. The intake end of the copper tube was then sealed in a similar fashion. A hydrometer reading of the groundwater was also taken for water density measurement and recorded. The copper tubes were sent to the University of Rochester for isotopic dating analysis in accordance with the Focused Remedial Investigation Work Plan for Wastebeds 1 to 8 (O'Brien & Gere, 2005.)

The University of Rochester analyzed the dissolved gases from the copper tubes, but the tritium analysis had to be re-done because of difficulties in getting dissolved helium to degas from the brines. Furthermore, high concentrations of organic solutes complicated the extraction and analysis in unanticipated ways. Standardization procedures used were also difficult because of the high ionic strength of the waters coupled to organic, both of which the laboratory was previously unfamiliar with.

Proper degassing of helium in samples is essential for analysis of tritium as the tritium concentration is determined by the helium ingrowth method. In this method, tritium is not measured directly, rather helium is measured as it can be measured more precisely and accurately that tritium. Tritium decays to helium and the basis of this method is to purge the water sample of all helium, and then let the sealed sample sit for a specified period of time and then analyze for helium. All the helium that is detected is assumed to be the result of tritium decay during the specified period. If the sample is not adequately degassed, the helium from decay is overestimated and thus the tritium concentration is overestimated.

Unfortunately, the University of Rochester was not able to re-run the analyses due to insufficient remaining sample volumes. Due to the issues with dissolved gases from the tubes, tritium analyses are considered to be unusable.

Packer testing was conducted upon completion of the isotope analysis sampling procedures. The packer test was conducted using the same packer assembly described above. Results of the packer testing are included as Attachment 1 of this appendix.

Appendix E
Isotope and Packer Test Results
Attachment 1

Pressure Test Log					
Job Number:	CD2641		Boring Number:	OL-STA-30033	
Date:	10/5/2006		Test Number:	1	
Depth of Boring:	148	ft	Technician:	Mark Childs	
Packer Inflation Pressure:	140	psig	Bore Hole Size:	3	in
Depth to Bottom of Packer:	137.5	ft	Depth to Top of Packer:	135	ft
Length of Test Section:	10.5	ft	PSIG Length of Packer:	1.5	ft
Height of Water Swivel Above Ground:	3.65	ft	Distance of Pressure Gauge Above Ground:	3.65	ft
Meter I.D. Number:	31034987		Material Being Tested:	Bedrock	

Water Meter Reading	Pressure of Test (PSIG)	Time Lapse (Min.)	Water Take (Gallons)	Cumulative Flow Rate (GPM)	Instantaneous Flow Rate (GPM)
146.48	10	1	0.03	0.03	0.0009
146.51	10	2	0.03	0.06	0.03
146.53	10	3	0.02	0.06	0.02
146.55	10	4	0.02	0.08	0.02
146.57	10	5	0.02	0.1	0.02
146.59	10	6	0.02	0.12	0.02
146.605	10	7	0.015	0.105	0.015
146.621	10	8	0.016	0.128	0.016
146.649	10	9	0.028	0.252	0.028
146.656	10	10	0.007	0.07	0.007
146.672	10	11	0.016	0.176	0.016
146.698	10	12	0.005	0.06	0.026
146.703	10	13	0.005	0.065	0.005
146.719	10	14	0.016	0.224	0.016
146.734	10	15	0.015	0.225	0.015
146.75	10	16	0.016	0.256	0.016
146.766	10	17	0.016	0.272	0.016
146.782	10	18	0.016	0.288	0.016
146.799	10	19	0.017	0.323	0.017
146.815	10	20	0.016	0.32	0.016
146.832	10	21	0.017	0.357	0.017
146.848	10	22	0.016	0.352	0.016
146.864	10	23	0.016	0.368	0.016
146.881	10	24	0.017	0.408	0.017
146.9	10	25	0.019	0.475	0.019
146.916	10	26	0.016	0.416	0.016
146.933	10	27	0.017	0.459	0.017
146.95	10	28	0.017	0.476	0.017
146.967	10	29	0.017	0.493	0.017
146.986	10	30	0.019	0.57	0.019

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Isotope and Packer Test Results
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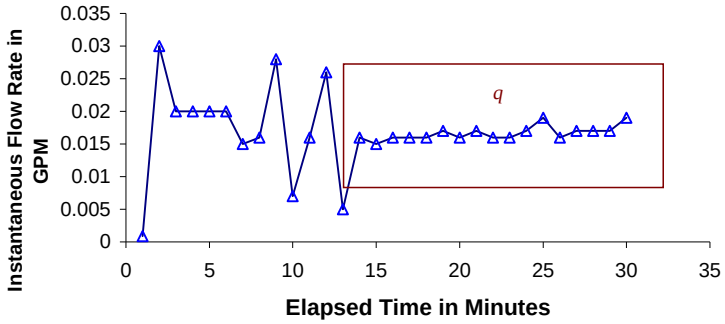
PACKER TEST ANALYSIS	
Job Number:	CD2641
Date:	10/5/2006
Boring Number:	OL-STA-30033
Test Number:	1
Technician:	Mark Childs



$$k = \frac{q}{2\pi L h} \log_e \frac{L}{r} \quad for\ L \geq 10r$$

$$k = \frac{q}{2\pi L h} \sinh -1 \frac{L}{2r} \quad for\ L \geq r$$

L =	10.5	ft
h =	167	ft H_2O
q =	3.20478138	ft^3/day
r =	0.125	ft
L/r =	84	

k = 0.0018937 ft/day = 6.6805E-07 cm/sec

Appendix E
Isotope and Packer Test Results
Attachment 1

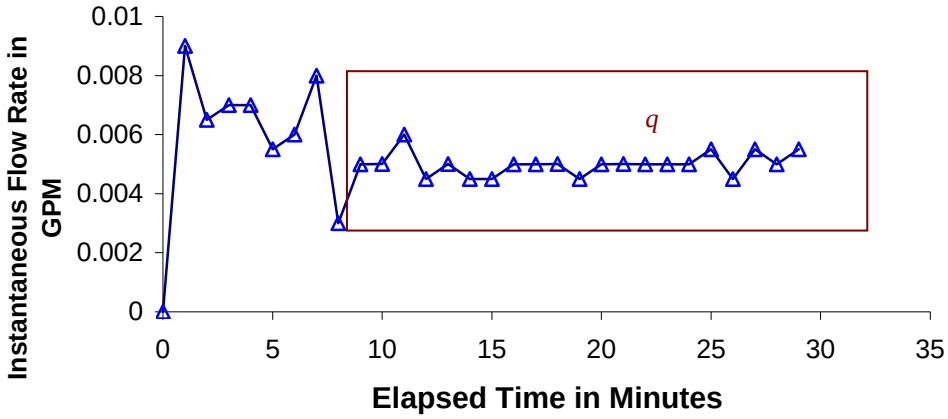
Pressure Test Log					
Job Number:	CD2641		Boring Number:	OL-STA-10108	
Date:	11/2/2006		Test Number:	1	
Depth of Boring:	201	ft	Technician:	Mark Childs	
Packer Inflation Pressure:	120 PSIG	psig	Bore Hole Size:	3	in
Depth to Bottom of Packer:	190.5	ft	Depth to Top of Packer:	188.5	ft
Length of Test Section:	10.5	ft	PSIG Length of Packer:	2	ft
Height of Water Swivel Above Ground:	5.58	ft	Distance of Pressure Gauge Above Ground:	5.75	ft
Meter I.D. Number:	31034987		Material Being Tested:	Bedrock	

Water Meter Reading	Pressure of Test (PSIG)	Time Lapse (Min.)	Water Take (Gallons)	Cumulative Flow Rate (GPM)	Instantaneous Flow Rate (GPM)
151.821	10	0	0.009	0	0
151.83	10	1	0.0065	0.0065	0.009
151.8365	10	2	0.007	0.014	0.0065
151.8435	10	3	0.007	0.021	0.007
151.8505	10	4	0.0055	0.022	0.007
151.856	10	5	0.006	0.03	0.0055
151.862	10	6	0.008	0.048	0.006
151.87	10	7	0.003	0.021	0.008
151.873	10	8	0.005	0.04	0.003
151.878	10	9	0.005	0.045	0.005
151.883	10	10	0.006	0.06	0.005
151.889	10	11	0.0045	0.0495	0.006
151.8935	10	12	0.005	0.06	0.0045
151.8985	10	13	0.0045	0.0585	0.005
151.903	10	14	0.0045	0.063	0.0045
151.9075	10	15	0.005	0.075	0.0045
151.9125	10	16	0.005	0.08	0.005
151.9175	10	17	0.005	0.085	0.005
151.9225	10	18	0.0045	0.081	0.005
151.927	10	19	0.005	0.095	0.0045
151.932	10	20	0.005	0.1	0.005
151.937	10	21	0.005	0.105	0.005
151.942	10	22	0.005	0.11	0.005
151.947	10	23	0.005	0.115	0.005
151.952	10	24	0.0055	0.132	0.005
151.9575	10	25	0.0045	0.1125	0.0055
151.962	10	26	0.0055	0.143	0.0045
151.9675	10	27	0.005	0.135	0.0055
151.9725	10	28	0.0055	0.154	0.005
151.978	10	29	0.005	0.145	0.0055

Appendix E
Isotope and Packer Test Results
Attachment 1

PACKER TEST ANALYSIS

Job Number:	CD2641
Date:	11/2/2006
Boring Number:	OL-STA-10108
Test Number:	1
Technician:	Mark Childs



$$k = \frac{q}{2\pi Lh}\log_e \frac{L}{r} \quad for\ L \geq 10r$$

$$k = \frac{q}{2\pi Lh}\sinh -1\frac{L}{2r} \quad for\ L \geq r$$

L =	10.5	ft
h =	222.6	ft H_2O
q =	0.96256684	ft^3/day
r =	0.125	ft
L/r =	84	

k = 0.00042671 ft/day = 1.5053E-07 cm/sec