

ICR TREATMENT STUDY ANALYSIS

Base Analysis and Data Review Comments

Treatment Study ID	1052
Study Protocol	RBSMT
Plant ICR Number	298
PWS Name	City of Hollywood
City, State, Zip	Hollywood, FL 33019

General Comments:

1. During this bench-scale study, two membranes were evaluated: the Koch-Fluid Systems TFC-SR and the Hydranautics NTR7450. Each membrane was evaluated over four quarters (Spring, Summer, Autumn and Winter) as summarized in Table 5 of the Summary Report.
2. The city of Hollywood does operate a nanofiltration softening train in parallel with a chemical softening process train. The flows from each process train are disinfected and then blended together prior to distribution.
3. During data analysis, temperatures of 26°C, 27°C, 26°C, and 24°C for Spring, Summer, Autumn and Winter, were used, respectively. This was necessary to estimate the range of pressures required to maintain a constant production rate over the course of a calendar year. The temperatures were estimated using the range of full-scale influent water temperatures reported in the Summary Report. The temperatures in the Data Collection Spreadsheets are indicative of lab conditions.
4. No cost information was provided in the Summary Report.

Water Quality Comments:

1. 17 water quality outliers were removed from this study.
2. SDS conditions are summarized in Table 10 of the Summary Report. Constant target SDS conditions were used over the four quarters: temperature 24°C, pH 7.9 to 8.2, incubation time 24 hours and free residual ~1 mg/L. Although these are Uniform Formation Conditions (UFC), the Summary Report indicates that they are representative of actual distribution system conditions at the plant.

3. The reported feed alkalinity, total hardness and calcium hardness concentrations for Quarter 1 were very low. Therefore, these data were considered outliers and the average alkalinity, total hardness and calcium hardness concentrations from the remaining three quarters were used in place of the reported Quarter 1 data during data analysis.

Productivity Comments:

1. 7 productivity outliers were removed from this study.
2. The influent to the study was collected directly from the well-field in the Biscayne Aquifer. The only pretreatment used during this study was bench-scale cartridge filtration. No pretreatment to control inorganic scale formation was used. The lack of a scale inhibitor prior to nanofiltration may have resulted in the short cleaning intervals observed during this study. The addition of acid or antiscalant to control inorganic scale formation might have resulted in longer cleaning intervals.
4. The majority of the membrane cleanings were done with a sodium hydroxide solution ($\text{pH} \approx 12$, at 40°C). During one evaluation (NTR7450 membrane, fourth quarter), however, this cleaner was not effective and was followed by a sulfuric acid cleaning ($\text{pH} > 2.5$).

ICR Information

ID / ICR#: FL4060642 / 298
ICR Contact: Robert Boyce
Phone No.: (954) 967-4230
Period: 4/14/98 - 4/23/98 (9 days)

Membrane Information

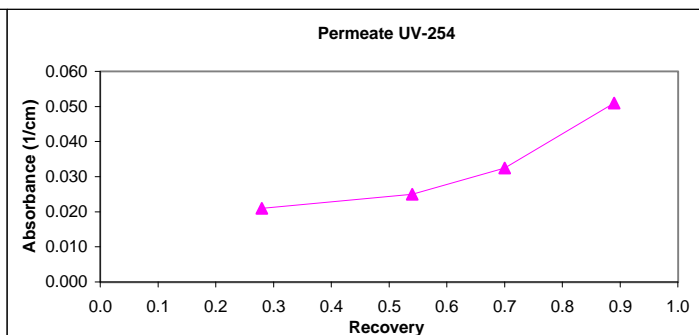
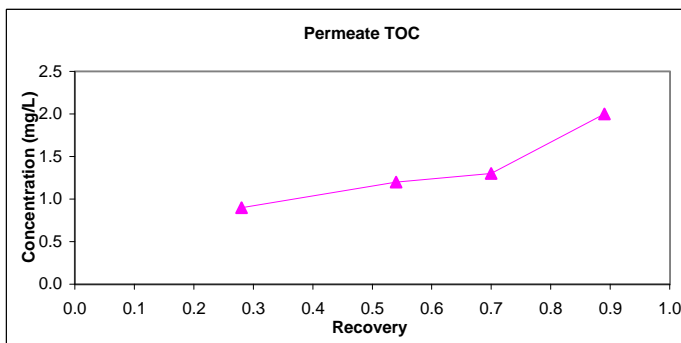
Manufacturer: Hydranautics Corp.
Trade Name: NTR7450
MWCO: 1000 Daltons
Mfr. Flux: 45.0 gfd
Mfr. NDP: 140.0 psi
Mfr. MTCw: 0.320 gfd/psi

Mfr. Temp: 25.0 °C
840 Element Area: 365.0 ft²
840 Purchase Price: \$800
840 Maximum Flow: 75.0 gpm
840 Minimum Flow: 25.0 gpm
840 Total Width: 64.4 ft
840 Feed Spacer Thickness: 0.0023 ft

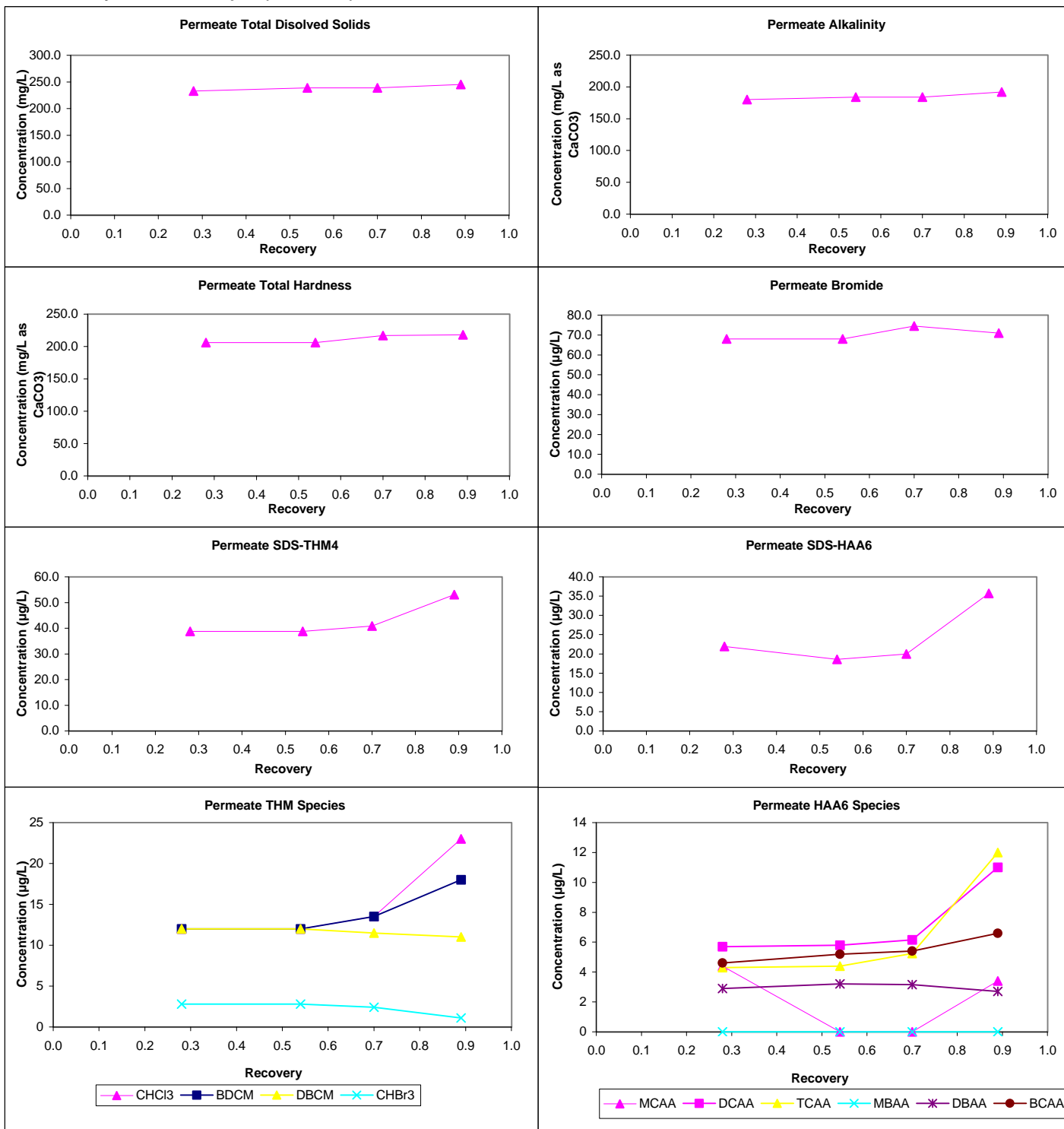
Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)				
Recovery ->	Avg	Diff	0.28	0.54	0.70	0.89	0.28	0.54	0.70	0.89	WQP	Count	Avg	SD	
pH	8.1	0.1	8.1	8.1	8.1	8.1	8.3	8.2	8.1	8.4	TDS	27	-16	65	
Temp	23.5	0.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0					
Alk	140	NA	180	184	184	192	200	204	214	212	Alk	4	102	89	
TDS	259	2	233	239	239	245	261	269	277	278	TDS	4	-12	14	
TotHard	188	NA	206	206	217	218	234	238	259	236	TotHard	4	57	46	
CaHard	158	NA	190	190	206	190	214	232	252	226	CaHard	4	77	50	
Turb	0.33	NA	0.09	0.08	0.09	0.08	0.67	0.40	0.32	0.55	Turb	4	-132	158	
Amm	0.00	NA	0.00	0.00	0.00	0.00	NA	NA	NA	NA	Amm	0	n/a	n/a	
TOC	3.9	0.1	0.9	1.2	1.3	2.0	5.8	7.3	9.9	19.1	TOC	4	5	6	
UV254	0.158	0.003	0.021	0.025	0.033	0.051	0.215	0.276	0.370	0.762	UV254	4	-17	15	
SUVA	4.09	0.04	2.33	2.08	2.50	2.55	3.71	3.78	3.74	3.99					
Bromide	82	NA	68	68	75	71	Pretreatment Information								
TOX	275	NA	82	95	103	160									

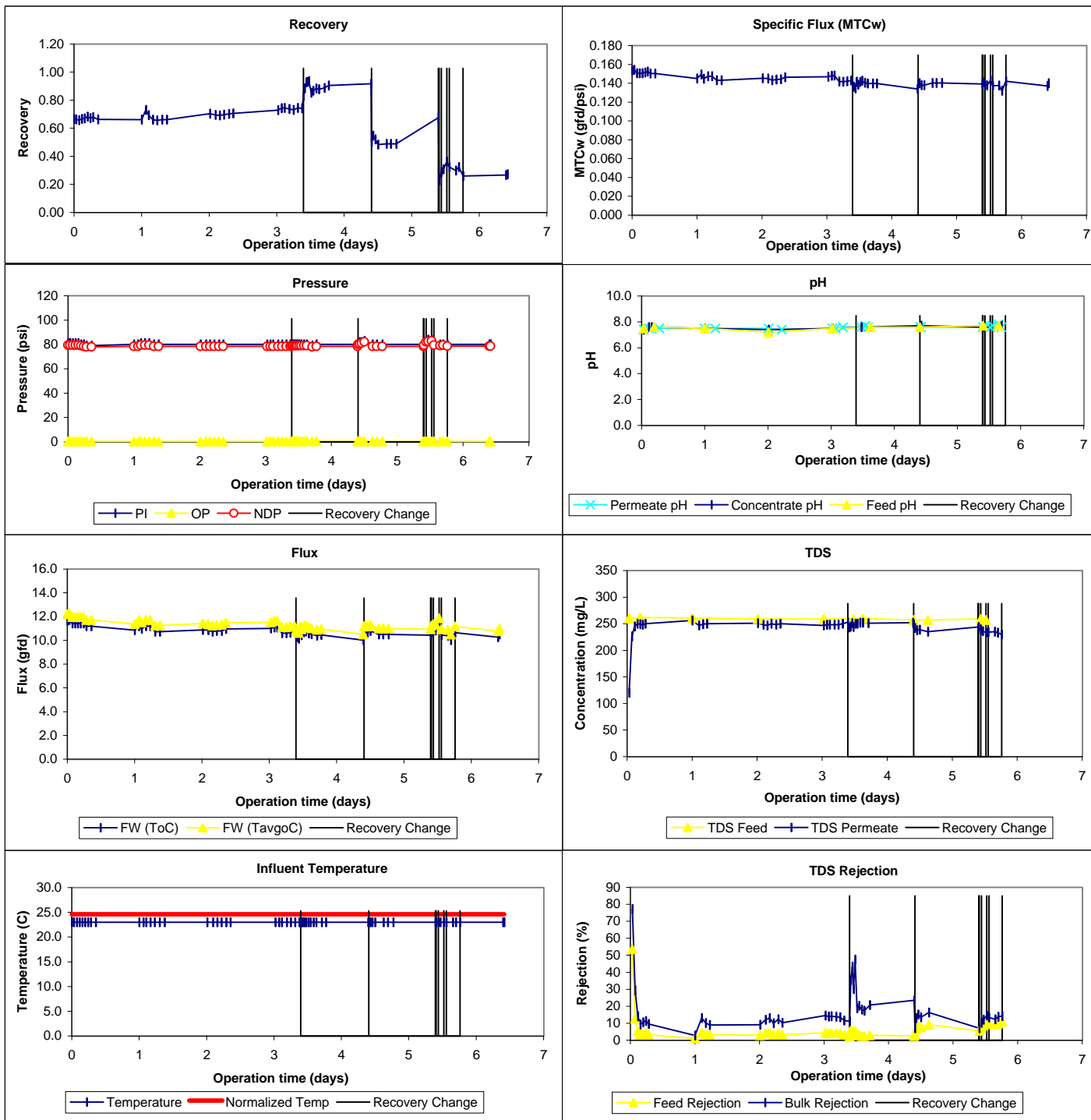
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
ICR Contact: Robert Boyce
Phone No.: (954) 967-4230
Period: 6/27/98 - 7/3/98 (6 days)

Membrane Information

Manufacturer: Hydranautics Corp.
Trade Name: NTR7450
MWCO: 1000 Daltons
Mfr. Flux: 45.0 gfd
Mfr. NDP: 140.0 psi
Mfr. MTCw: 0.320 gfd/psi

Mfr. Temp: 25.0 °C
840 Element Area: 365.0 ft²
840 Purchase Price: \$800
840 Maximum Flow: 75.0 gpm
840 Minimum Flow: 25.0 gpm
840 Total Width: 64.4 ft
840 Feed Spacer Thickness: 0.0023 ft

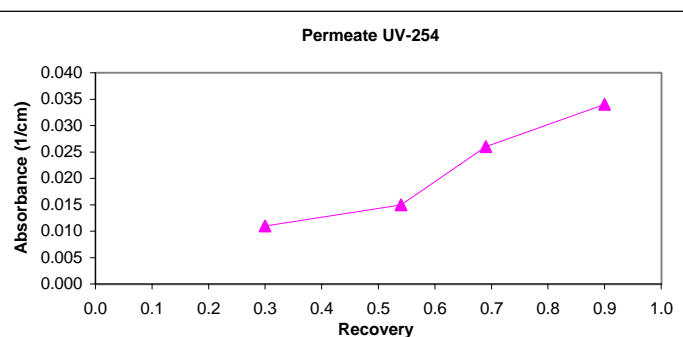
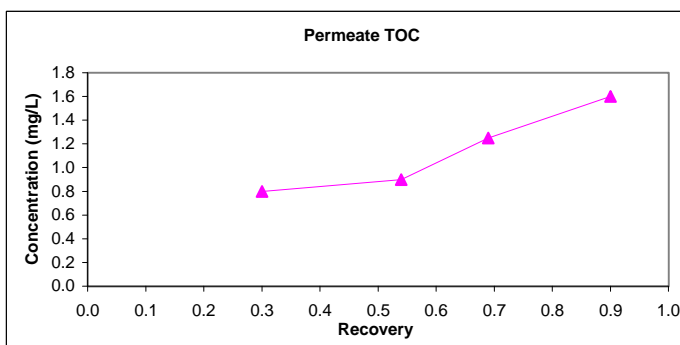
Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)																														
Recovery ->	Avg	Diff	0.30	0.54	0.69	0.90	0.30	0.54	0.69	0.90	WQP	Count	Avg	SD																											
pH	7.9	0.1	7.9	8.4	8.5	8.5	8.2	8.3	8.2	8.2	TDS	50	-4	8																											
Temp	24.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-17	33																											
Alk	262	50	210	206	232	224	284	308	342	362	TDS	4	-17	11																											
TDS	283	7	226	261	258	268	280	275	304	314	TotHard	4	30	56																											
TotHard	274	32	246	252	250	310	308	310	314	386	CaHard	4	-10	8																											
CaHard	261	25	232	228	225	244	264	292	296	354	Turb	4	-129	139																											
Turb	0.15	0.00	0.05	0.04	0.06	0.05	0.15	0.21	0.15	0.25	Amm	0	n/a	n/a																											
Amm	0.07	0.07	0.08	0.00	0.25	0.00	NA	NA	NA	NA	TOC	4	0	7																											
TOC	4.0	0.1	0.8	0.9	1.3	1.6	5.7	7.6	10.4	23.4	UV254	4	-8	7																											
UV254	0.134	0.003	0.011	0.015	0.026	0.034	0.179	0.247	0.365	0.884	<div>Pretreatment Information</div> <table><thead><tr><th>Process</th><th>Description</th><th>Scale</th></tr></thead><tbody><tr><td>Cartridge filtration</td><td>5 micron filter</td><td>bench</td></tr></tbody></table>				Process	Description	Scale	Cartridge filtration	5 micron filter	bench																					
Process	Description	Scale																																							
Cartridge filtration	5 micron filter	bench																																							
SUVA	3.34	0.15	1.38	1.67	2.08	2.13	3.14	3.25	3.51	3.78																															
Bromide	62	0	58	61	60	63	<div>Design Parameters</div> <table><tr><td>Active memb area:</td><td>0.167 ft²</td><td rowspan="2">ID#</td><td rowspan="2">Recov (dec.)</td><td rowspan="2">F_{W-des} (gfd)</td></tr><tr><td>Active width:</td><td>0.330 ft</td></tr><tr><td>Norm Temp:</td><td>24.6 °C</td><td>1</td><td>0.70</td><td>15.0</td></tr><tr><td>Feed TDS:</td><td>300.0 mg/L</td><td>2</td><td>0.90</td><td>15.0</td></tr><tr><td>Manuf rep TDS rej:</td><td>50%</td><td>3</td><td>0.50</td><td>15.0</td></tr><tr><td>Temp Norm MTC-w:</td><td>0.316 gfd/psi</td><td>4</td><td>0.30</td><td>15.0</td></tr></table>								Active memb area:	0.167 ft ²	ID#	Recov (dec.)	F _{W-des} (gfd)	Active width:	0.330 ft	Norm Temp:	24.6 °C	1	0.70	15.0	Feed TDS:	300.0 mg/L	2	0.90	15.0	Manuf rep TDS rej:	50%	3	0.50	15.0	Temp Norm MTC-w:	0.316 gfd/psi	4	0.30	15.0
Active memb area:	0.167 ft ²	ID#	Recov (dec.)	F _{W-des} (gfd)																																					
Active width:	0.330 ft																																								
Norm Temp:	24.6 °C	1	0.70	15.0																																					
Feed TDS:	300.0 mg/L	2	0.90	15.0																																					
Manuf rep TDS rej:	50%	3	0.50	15.0																																					
Temp Norm MTC-w:	0.316 gfd/psi	4	0.30	15.0																																					
TOX	388	3	59	68	91	125																																			

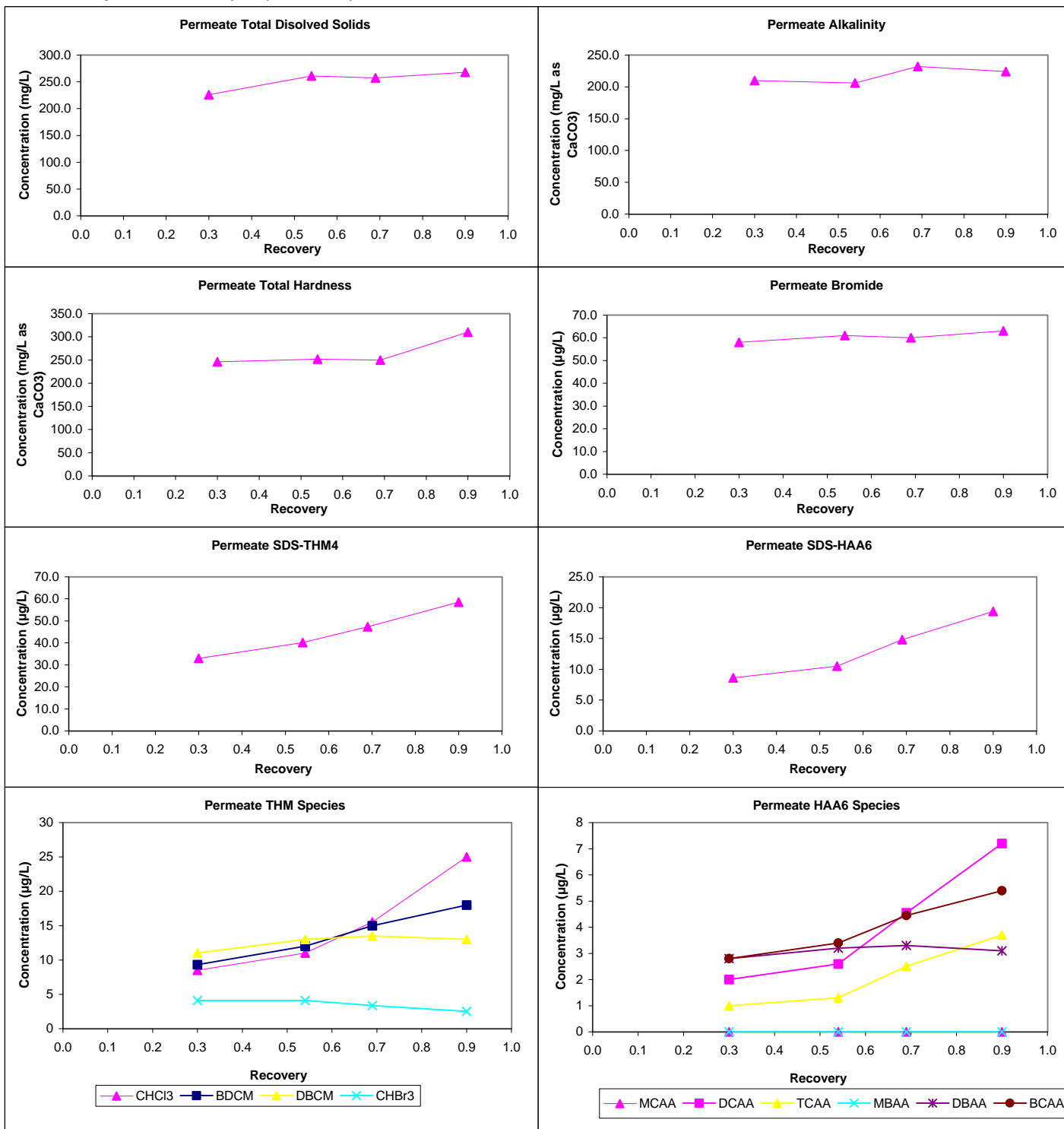
SDS Conditions				
WQP	Avg	SD	Count	Min - Max
Res (mg/L) (0)	1.49	0.18	6	1.31 - 1.76
Temp (°C)	25.0	0.0	6	25.0 - 25.0
pH (unit)	8.2	0.1	6	8.1 - 8.3
Time (hr)	24.0	0.0	6	24.0 - 24.0

Comments:

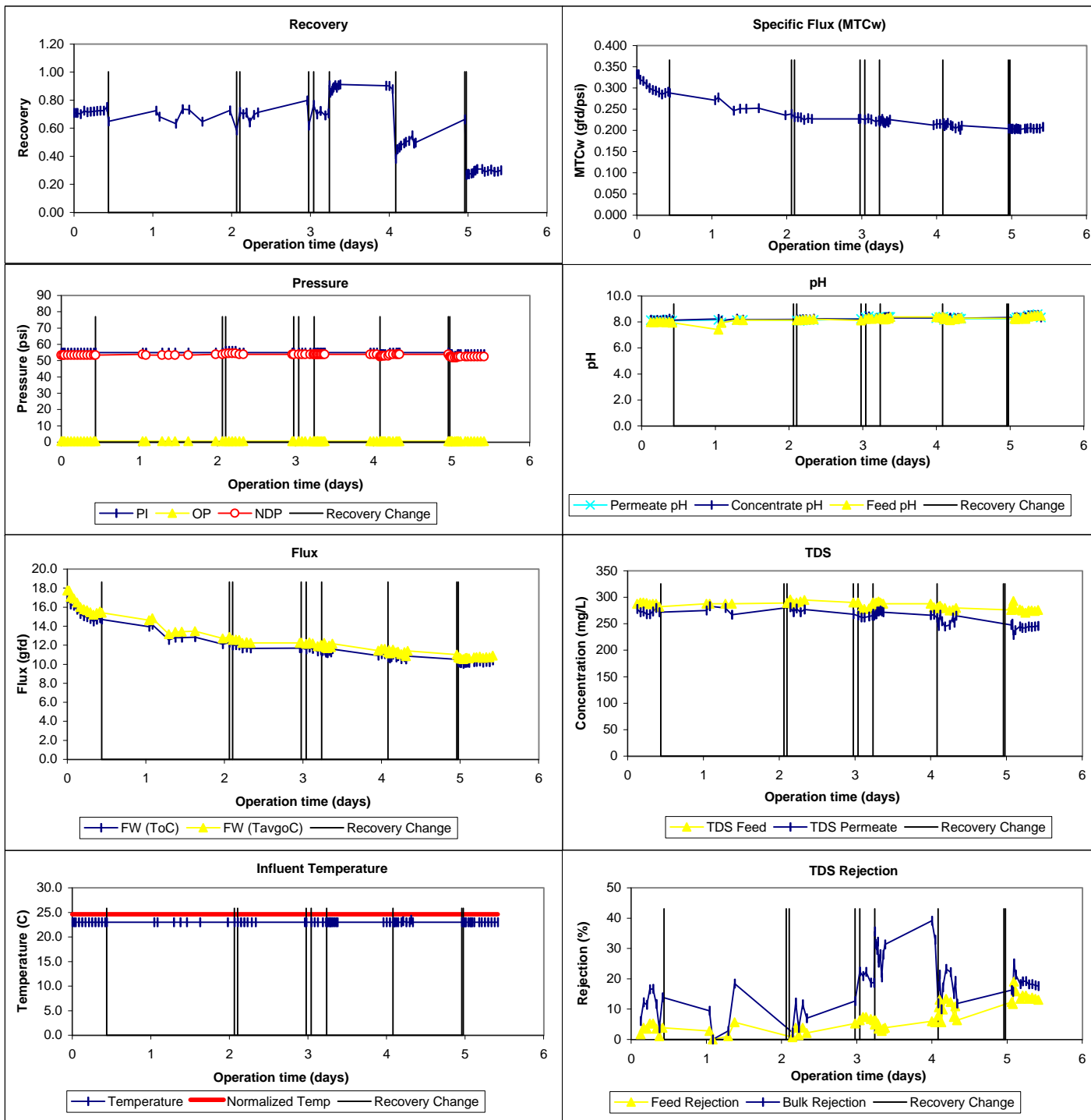
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
ICR Contact: Robert Boyce
Phone No.: (954) 967-4230
Period: 10/27/98 - 11/3/98 (7 days)

Membrane Information

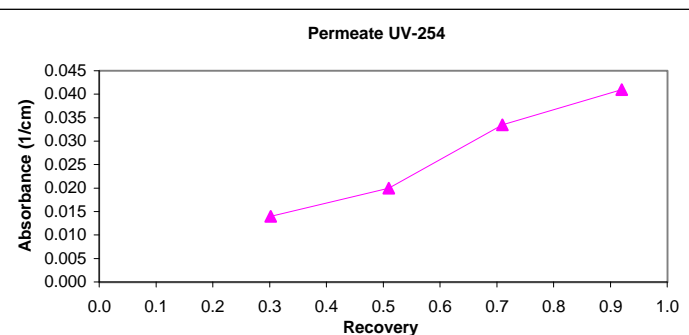
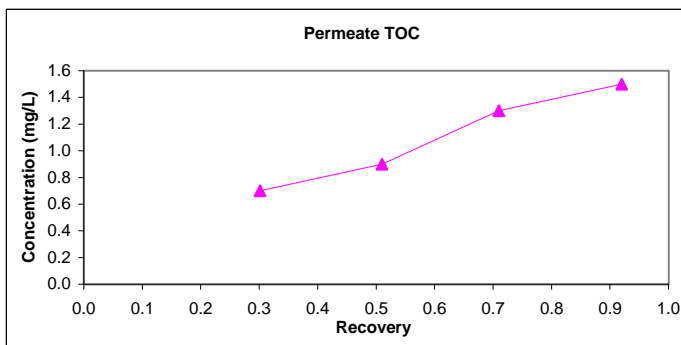
Manufacturer: Hydranautics Corp.
Trade Name: NTR7450
MWCO: 1000 Daltons
Mfr. Flux: 45.0 gfd
Mfr. NDP: 140.0 psi
Mfr. MTCw: 0.320 gfd/psi

Mfr. Temp: 25.0 °C
840 Element Area: 365.0 ft²
840 Purchase Price: \$800
840 Maximum Flow: 75.0 gpm
840 Minimum Flow: 25.0 gpm
840 Total Width: 64.4 ft
840 Feed Spacer Thickness: 0.0023 ft

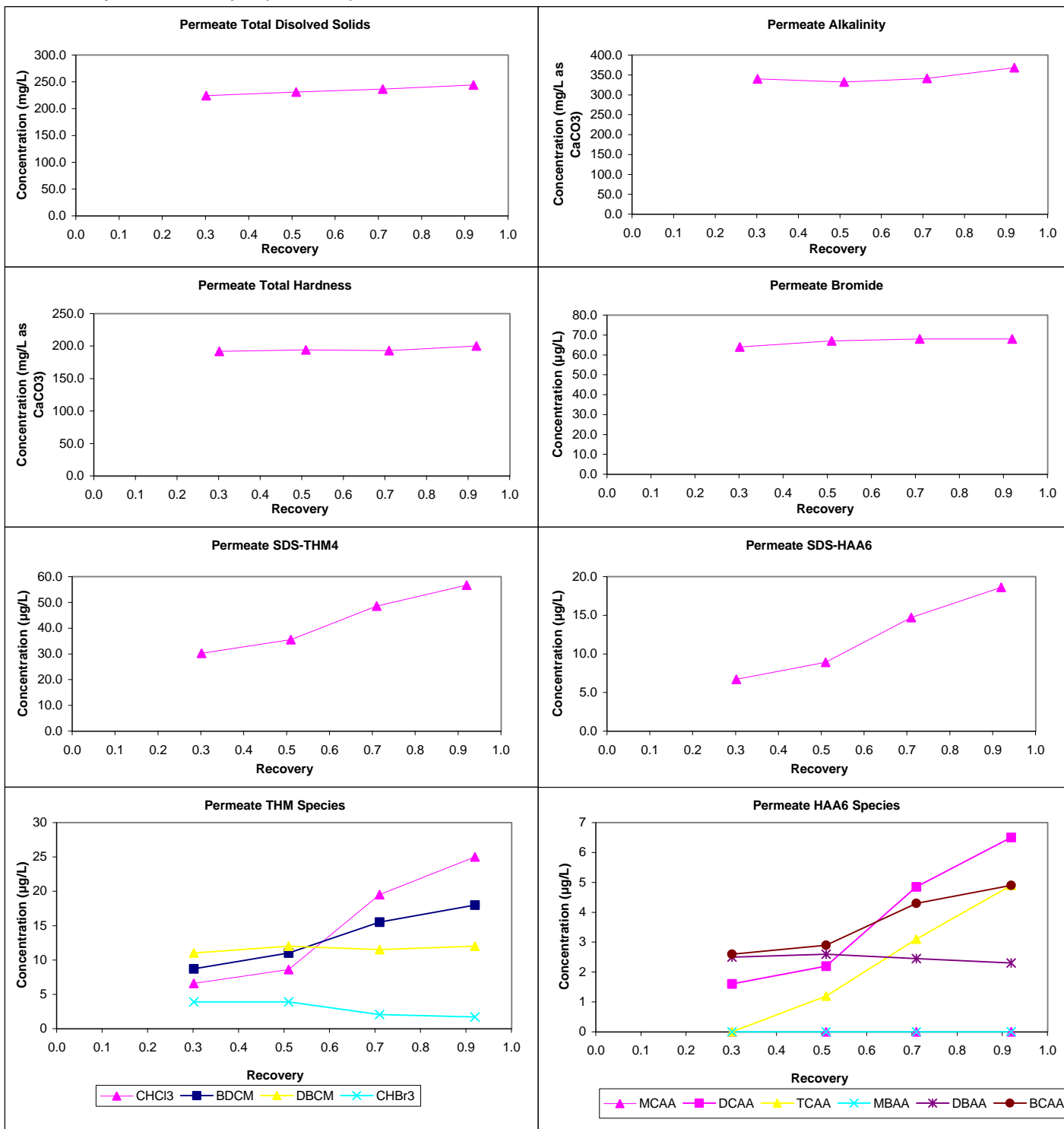
Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)			
Recovery ->	Avg	Diff	0.30	0.51	0.71	0.92	0.30	0.51	0.71	0.92	WQP	Count	Avg	SD
pH	7.6	0.6	8.0	8.0	7.8	7.8	8.2	8.2	8.1	8.3	TDS	43	-12	18
Temp	23.0	1.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	Alk	4	-10	6
Alk	378	2	340	332	341	368	382	402	412	424	TDS	4	-6	6
TDS	250	2	224	231	237	244	255	266	270	278	TotHard	4	-55	72
TotHard	228	6	192	194	193	200	210	228	250	210	CaHard	4	-92	118
CaHard	224	6	184	174	177	178	178	226	240	204	Turb	4	-192	234
Turb	0.35	0.08	0.11	0.18	0.29	0.15	0.19	0.24	0.71	0.43	Amm	0	n/a	n/a
Amm	0.00	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	4	2	13
TOC	3.6	0.1	0.7	0.9	1.3	1.5	5.2	7.4	9.0	23.5	UV254	4	-18	16
UV254	0.144	0.003	0.014	0.020	0.034	0.041	0.184	0.263	0.345	0.951				
SUVA	4.04	0.01	2.00	2.22	2.58	2.73	3.54	3.55	3.83	4.05				
Bromide	70	1	64	67	68	68								
TOX	353	3	50	58	96	120								
CHCl3	113.0	17.0	6.6	8.6	19.5	25.0								
BDCM	24.0	3.0	8.7	11.0	15.5	18.0								
DBCM	5.1	1.0	11.0	12.0	11.5	12.0								
CHBr3	0.0	0.0	3.9	3.9	2.1	1.7								
THM4	142.1	21.0	30.2	35.5	48.6	56.7								
MCAA	2.9	0.1	0.0	0.0	0.0	0.0								
DCAA	28.5	1.5	1.6	2.2	4.9	6.5								
TCAA	25.5	2.5	0.0	1.2	3.1	4.9								
MBAA	0.0	0.0	0.0	0.0	0.0	0.0								
DBAA	1.2	0.1	2.5	2.6	2.5	2.3								
BCAA	6.8	0.3	2.6	2.9	4.3	4.9								
TBAA	0.0	NA	NR	NR	NA	NR								
CDBAA	2.5	0.3	3.2	3.2	3.1	3.3								
DCBAA	6.5	1.4	2.3	2.5	3.3	4.7								
HAA5	58.1	0.9	4.1	6.0	10.4	13.7								
HAA6	64.9	1.2	6.7	8.9	14.7	18.6								
HAA9	70.9	NA	NR	NR	NA	NR								
SDS Conditions														
WQP	Avg	SD	Count	Min - Max										
Res (mg/L) (0)	1.35	0.15	6	1.11 - 1.50										
Temp (°C)	26.0	0.0	6	26.0 - 26.0										
pH (unit)	7.9	0.1	6	7.8 - 8.0										
Time (hr)	24.0	0.0	6	24.0 - 24.0										
Design Parameters														
Active memb area:		0.167 ft ²				ID#		Recov (dec.)		F _{W-des} (gfd)				
Active width:		0.330 ft				1		0.70		15.0				
Norm Temp:		24.6 °C				2		0.90		15.0				
Feed TDS:		300.0 mg/L				3		0.50		15.0				
Manuf rep TDS rej:		50%				4		0.30		15.0				
Temp Norm MTC-w:		0.316 gfd/psi												
Comments:														

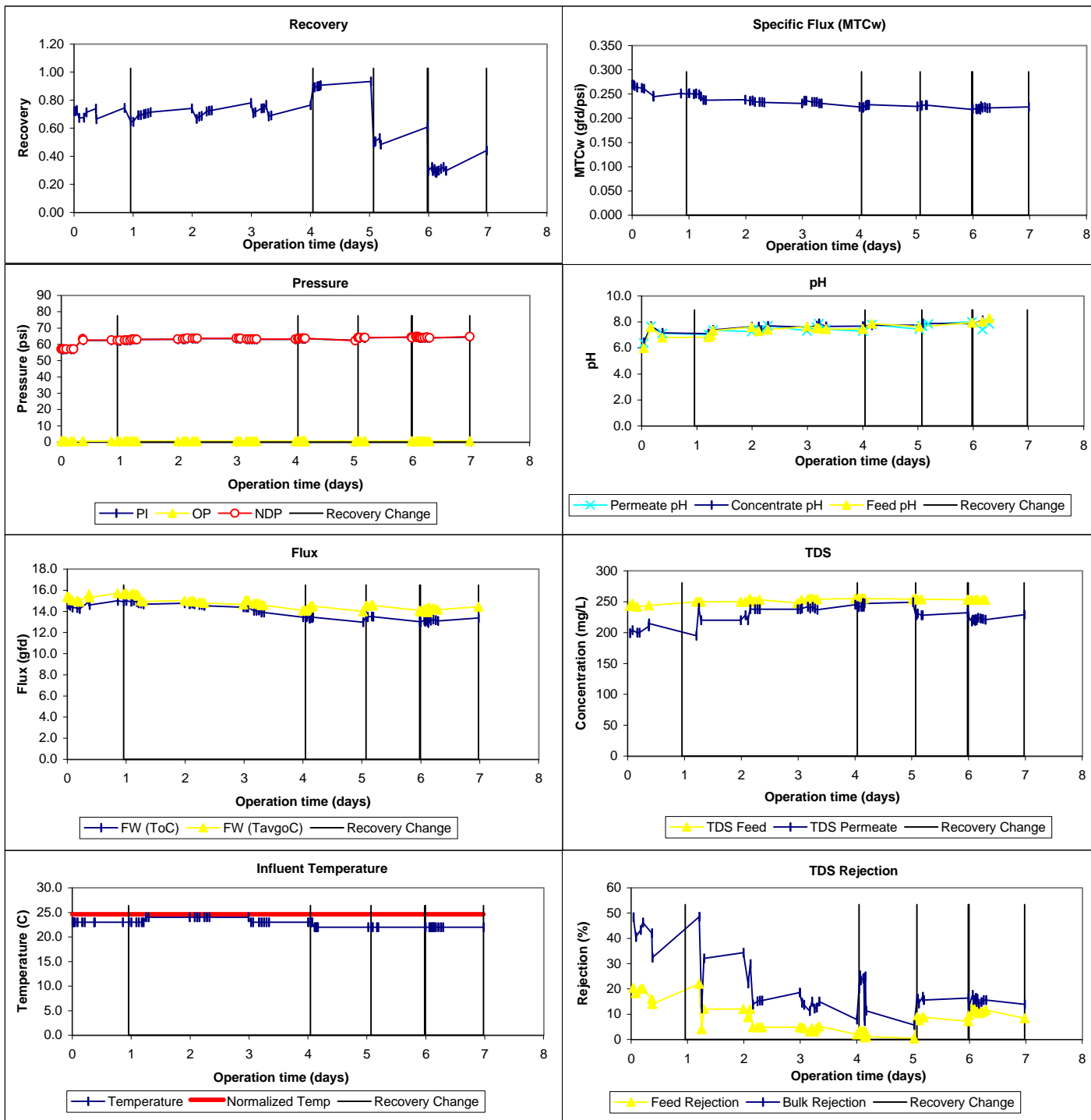
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
 ICR Contact: Robert Boyce
 Phone No.: (954) 967-4230
 Period: 2/20/99 - 2/26/99 (6 days)

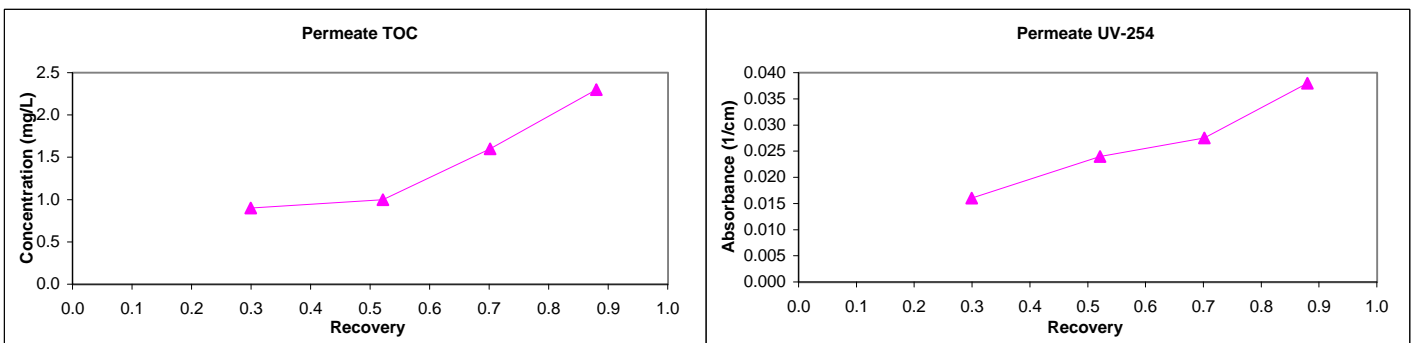
Membrane Information

Manufacturer: Hydranautics Corp.
 Trade Name: NTR7450
 MWCO: 1000 Daltons
 Mfr. Flux: 45.0 gfd
 Mfr. NDP: 140.0 psi
 Mfr. MTCw: 0.320 gfd/psi
 Mfr. Temp: 25.0 °C
 840 Element Area: 365.0 ft²
 840 Purchase Price: \$800
 840 Maximum Flow: 75.0 gpm
 840 Minimum Flow: 25.0 gpm
 840 Total Width: 64.4 ft
 840 Feed Spacer Thickness: 0.0023 ft

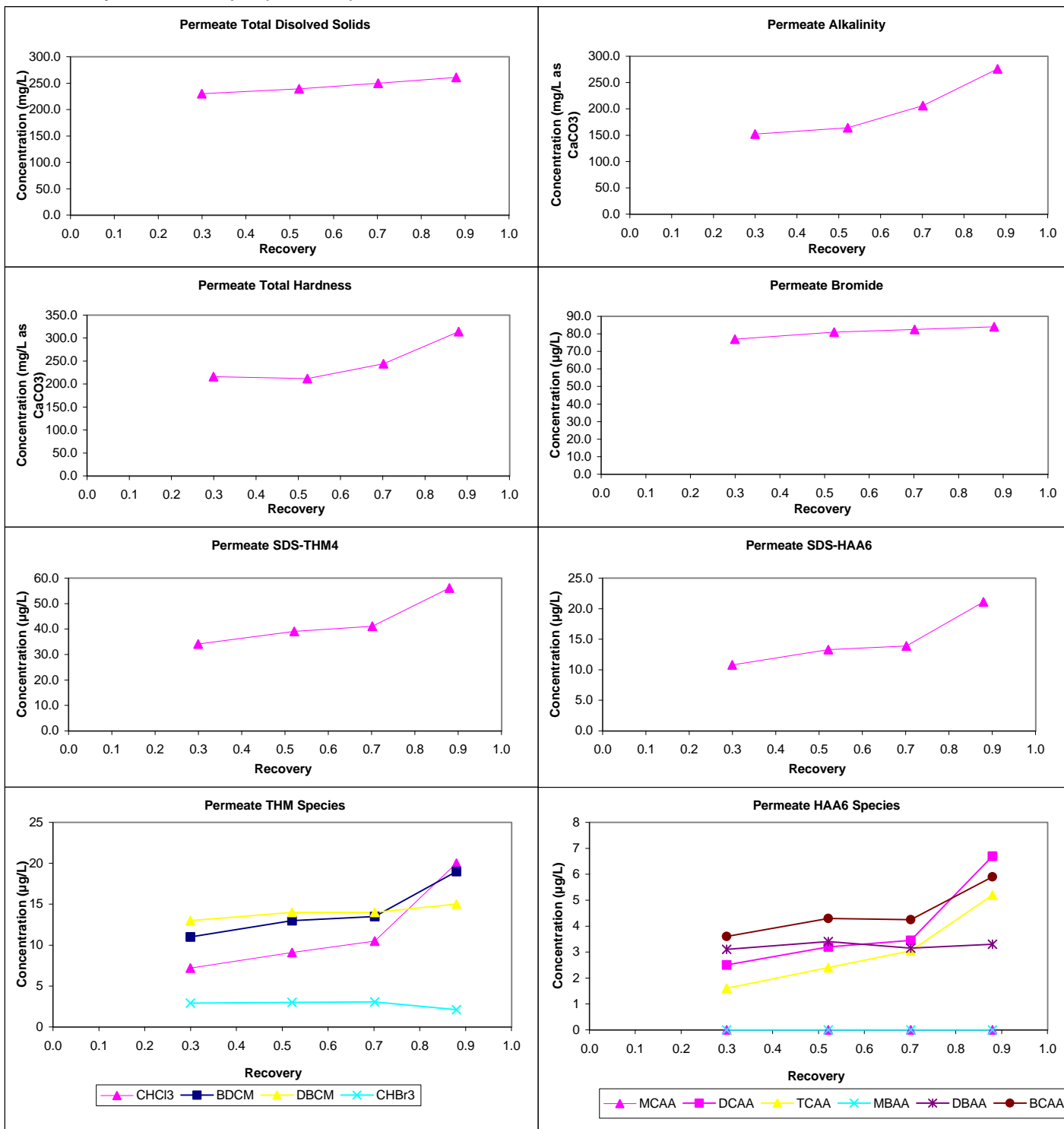
Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)															
Recovery ->	Avg	Diff	0.30	0.52	0.70	0.88	0.30	0.52	0.70	0.88	WQP	Count	Avg	SD												
pH	7.7	0.0	7.7	7.9	7.8	7.8	8.1	8.1	7.9	7.9	TDS	54	-6	5												
Temp	23.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-53	31												
Alk	290	26	152	164	206	276	222	226	325	344	TDS	4	-10	4												
TDS	269	0	230	239	250	261	268	276	272	301	TotHard	4	-19	30												
TotHard	310	22	216	212	244	314	286	290	346	366	CaHard	4	-31	14												
CaHard	263	13	152	158	198	248	258	272	283	316	Turb	4	-266	109												
Turb	0.32	0.18	0.06	0.07	0.08	0.12	0.15	0.19	0.26	0.34	Amm	0	n/a	n/a												
Amm	0.36	0.10	0.11	0.20	0.43	0.36	NA	NA	NA	NA	TOC	4	-10	5												
TOC	4.7	0.4	0.9	1.0	1.6	2.3	5.7	7.8	10.2	21.2	UV254	4	-20	11												
UV254	0.164	0.006	0.016	0.024	0.028	0.038	0.208	0.274	0.400	0.800	Pretreatment Information Process Description Scale Cartridge filtration 5 micron filter bench															
SUVA	3.57	0.47	1.78	2.40	1.72	1.65	3.65	3.51	3.92	3.77																
Bromide	85	0	77	81	83	84	Design Parameters Active memb area: 0.167 ft ² Active width: 0.330 ft Norm Temp: 24.6 °C Feed TDS: 300.0 mg/L Manuf rep TDS rej: 50% Temp Norm MTC-w: 0.316 gfd/psi																			
TOX	390	10	66	76	84	125																				
CHCl3	97.5	2.5	7.2	9.1	10.5	20.0	Comments:																			
BDCM	29.5	0.5	11.0	13.0	13.5	19.0																				
DBCM	7.3	0.7	13.0	14.0	14.0	15.0	Design Parameters Active memb area: 0.167 ft ² Active width: 0.330 ft Norm Temp: 24.6 °C Feed TDS: 300.0 mg/L Manuf rep TDS rej: 50% Temp Norm MTC-w: 0.316 gfd/psi																			
CHBr3	0.0	0.0	2.9	3.0	3.1	2.1																				
THM4	134.3	1.3	34.1	39.1	41.1	56.1	Comments:																			
MCAA	1.0	1.0	0.0	0.0	0.0	0.0																				
DCAA	28.0	0.0	2.5	3.2	3.5	6.7	Comments:																			
TCAA	35.0	1.0	1.6	2.4	3.1	5.2																				
MBAA	0.0	0.0	0.0	0.0	0.0	0.0	Comments:																			
DBAA	1.4	0.1	3.1	3.4	3.2	3.3																				
BCAA	8.6	0.3	3.6	4.3	4.3	5.9	Comments:																			
TBAA	0.0	0.0	0.0	0.0	0.0	0.0																				
CDBAA	1.1	1.1	2.8	3.1	2.9	3.1	Comments:																			
DCBAA	10.4	0.6	3.1	3.7	3.9	4.4																				
HAA5	65.4	0.1	7.2	9.0	9.7	15.2	Comments:																			
HAA6	74.0	0.4	10.8	13.3	13.9	21.1																				
HAA9	85.5	2.1	16.7	20.1	20.6	28.6	Comments:																			
SDS Conditions																										
WQP	Avg	SD	Count	Min - Max																						
Res (mg/L) (0)	1.10	0.10	6	1.00 - 1.22																						
Temp (°C)	24.0	0.0	6	24.0 - 24.0																						
pH (unit)	8.0	0.1	6	8.0 - 8.2																						
Time (hr)	24.0	0.0	6	24.0 - 24.0																						

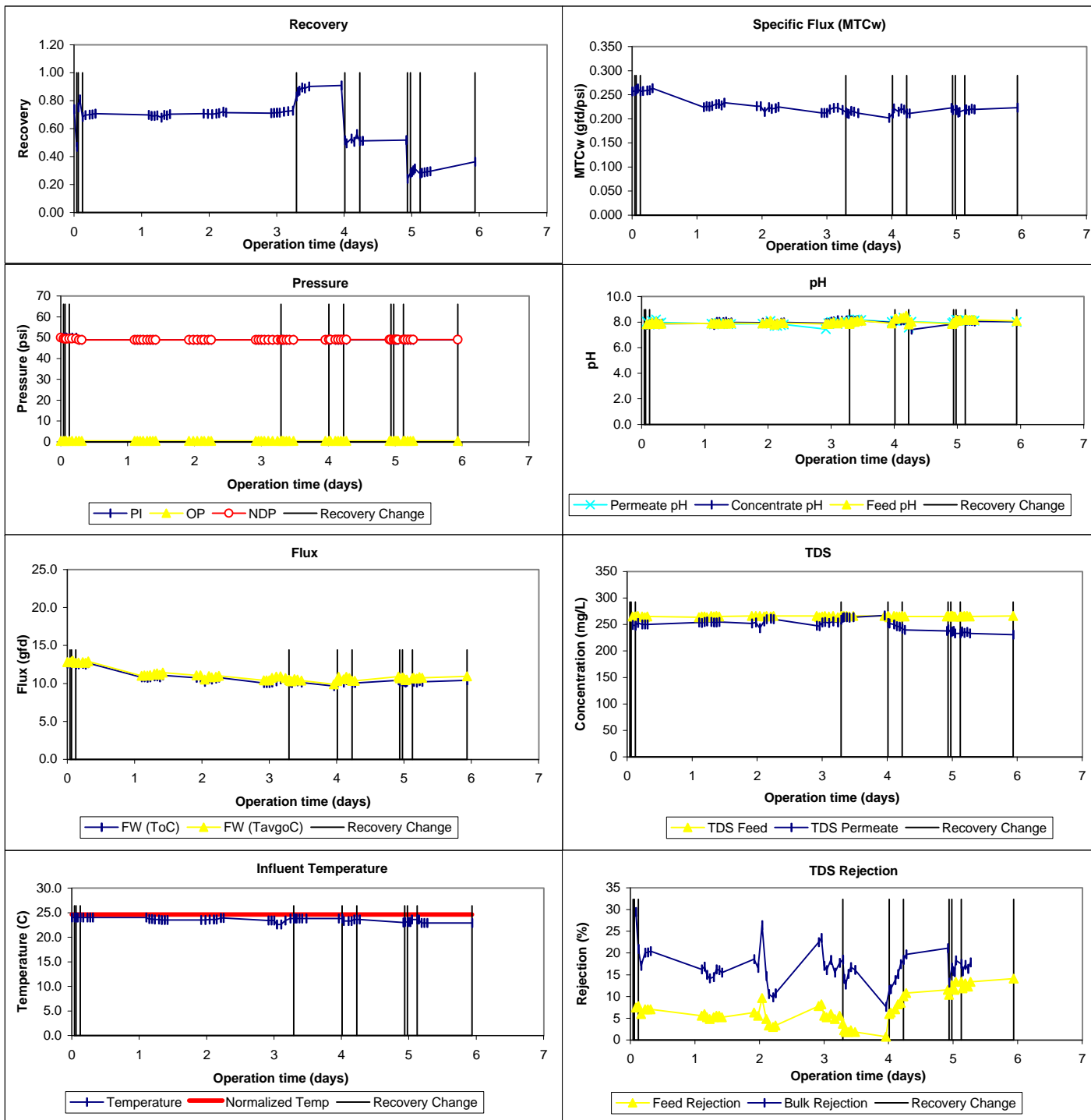
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
 ICR Contact: Robert Boyce
 Phone No.: (954) 967-4230
 Period: 4/7/98 - 4/12/98 (5 days)

Membrane Information

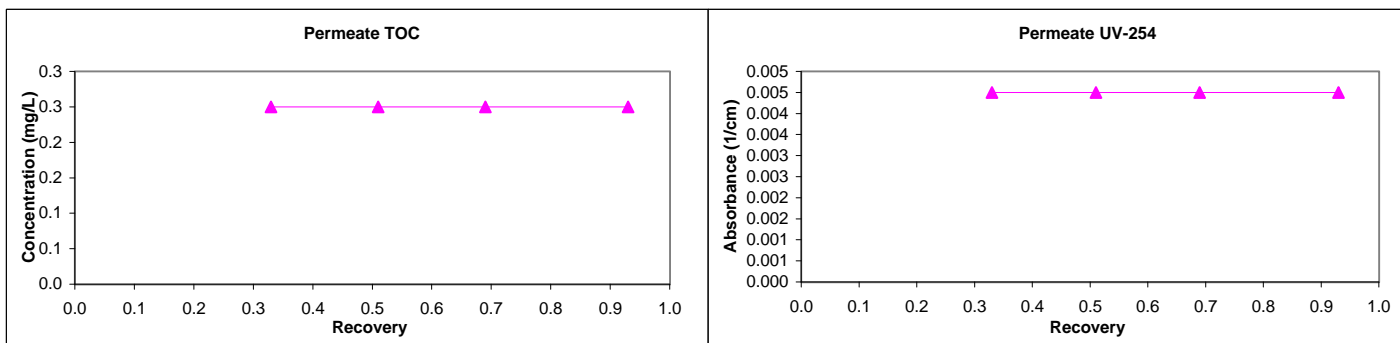
Manufacturer: Fluid Systems
 Trade Name: TFC-SR
 MWCO: 300 Daltons
 Mfr. Flux: 24.0 gfd
 Mfr. NDP: 100.0 psi
 Mfr. MTCw: 0.240 gfd/psi

Mfr. Temp: 25.0 °C
 840 Element Area: 330.0 ft²
 840 Purchase Price: N.A.
 840 Maximum Flow: 80.0 gpm
 840 Minimum Flow: 20.0 gpm
 840 Total Width: 58.2 ft
 840 Feed Spacer Thickness: 0.0026 ft

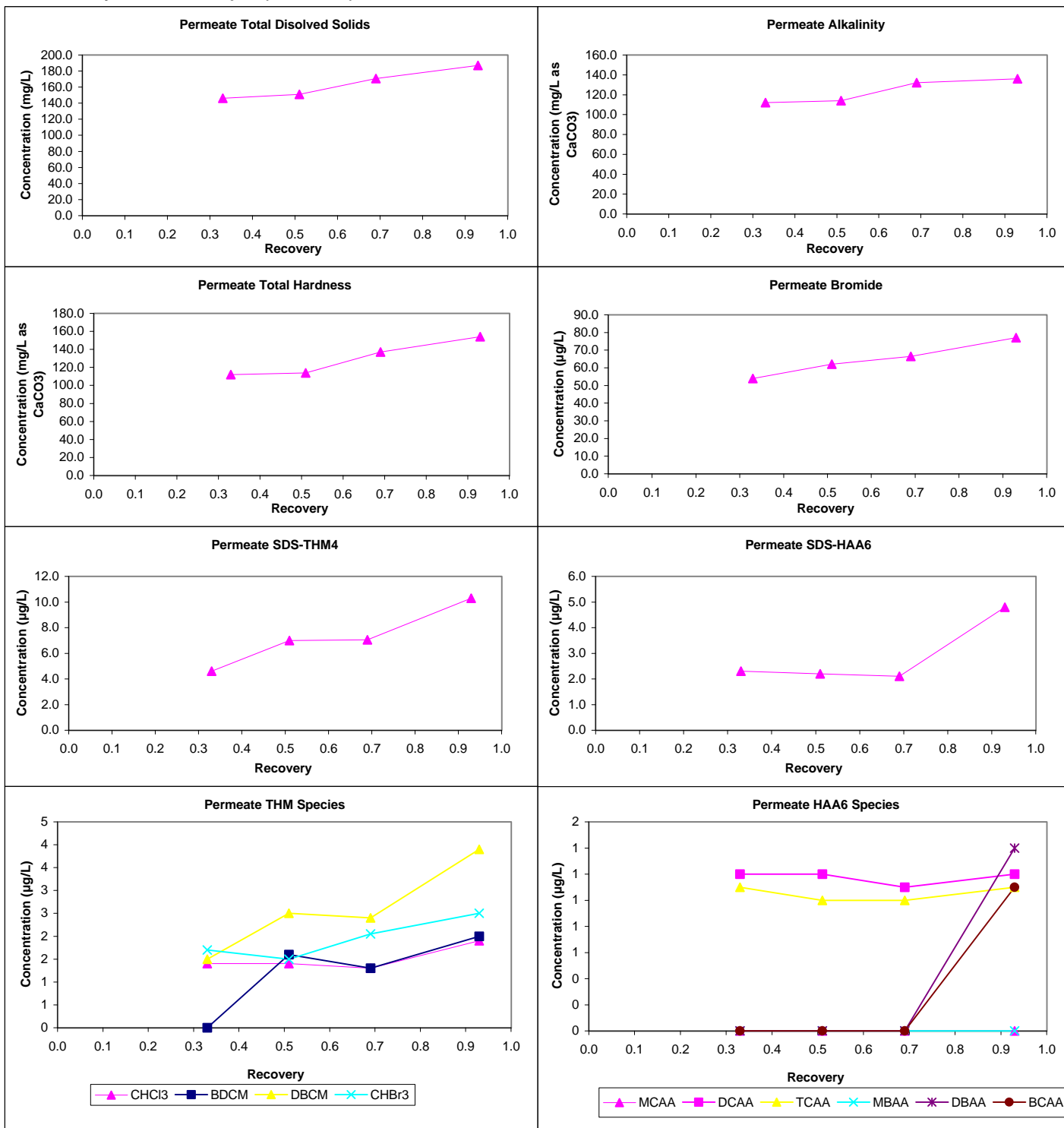
Water Quality Summary

Source ->		Feed		Permeate				Concentrate				Mass Balance Closure Err (%)					
Recovery ->	Avg	Diff	0.33	0.51	0.69	0.93	0.33	0.51	0.69	0.93	WQP	Count	Avg	SD			
pH	8.1	0.1	8.3	8.3	8.3	8.1	8.3	8.1	8.1	8.2	TDS	30	1	18			
Temp	23.5	0.5	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-4	41			
Alk	140	NA	112	114	132	136	130	228	226	124	TDS	4	-43	41			
TDS	259	2	146	151	171	187	232	333	373	595	TotHard	4	-5	30			
TotHard	188	NA	112	114	137	154	202	310	386	442	CaHard	4	1	46			
CaHard	158	NA	112	106	133	118	174	302	362	426	Turb	4	-513	606			
Turb	0.33	NA	0.06	0.11	0.30	0.07	0.14	0.14	0.19	0.25	Amm	0	n/a	n/a			
Amm	0.00	NA	0.00	0.00	0.00	0.00	NA	NA	NA	NA	TOC	0	n/a	n/a			
TOC	3.9	0.1	0.3	0.3	0.3	0.3	6.1	8.1	12.2	34.0	UV254	0	n/a	n/a			
UV254	0.158	0.003	0.005	0.005	0.005	0.005	0.180	0.267	0.409	1.092	Pretreatment Information						
SUVA	4.09	0.04	1.80	1.80	1.80	1.80	2.95	3.30	3.36	3.21					Process		Description
Bromide	82	NA	54	62	67	77	Cartridge filtration								5 micron filter		bench
TOX	275	NA	13	13	13	13											
CHCl3	80.0	NA	1.4	1.4	1.3	1.9											
BDCM	24.0	NA	0.0	1.6	1.3	2.0											
DBCM	5.6	NA	1.5	2.5	2.4	3.9											
CHBr3	0.0	NA	1.7	1.5	2.1	2.5											
THM4	109.6	NA	4.6	7.0	7.1	10.3											
MCAA	2.9	NA	0.0	0.0	0.0	0.0											
DCAA	29.0	NA	1.2	1.2	1.1	1.2											
TCAA	41.0	NA	1.1	1.0	1.0	1.1											
MBAA	1.0	NA	0.0	0.0	0.0	0.0											
DBAA	1.6	NA	0.0	0.0	0.0	1.4											
BCAA	8.5	NA	0.0	0.0	0.0	1.1											
TBAA	NA	NA	0.0	0.0	0.0	0.0											
CDBAA	2.5	NA	0.0	0.0	0.0	0.0											
DCBAA	15.0	NA	0.0	0.0	0.0	1.0											
HAA5	75.5	NA	2.3	2.2	2.1	3.7											
HAA6	84.0	NA	2.3	2.2	2.1	4.8											
HAA9	NA	NA	2.3	2.2	2.1	5.8											
SDS Conditions																	
WQP	Avg	SD	Count	Min - Max			Active memb area:		0.167 ft ²	ID#		Recov	F _{w-des}				
Res (mg/L) (0)	0.84	0.13	5	0.65 - 0.95			Active width:		0.330 ft			(dec.)	(gfd)				
Temp (°C)	26.0	0.0	5	26.0 - 26.0			Norm Temp:		24.6 °C	1		0.70	15.0				
pH (unit)	8.2	0.0	5	8.2 - 8.2			Feed TDS:		300.0 mg/L	2		0.90	15.0				
Time (hr)	24.0	0.0	5	24.0 - 24.0			Manuf rep TDS rej:		50%	3		0.50	15.0				
							Temp Norm MTC-w:		0.237 gfd/psi	4		0.30	15.0				
Comments:																	

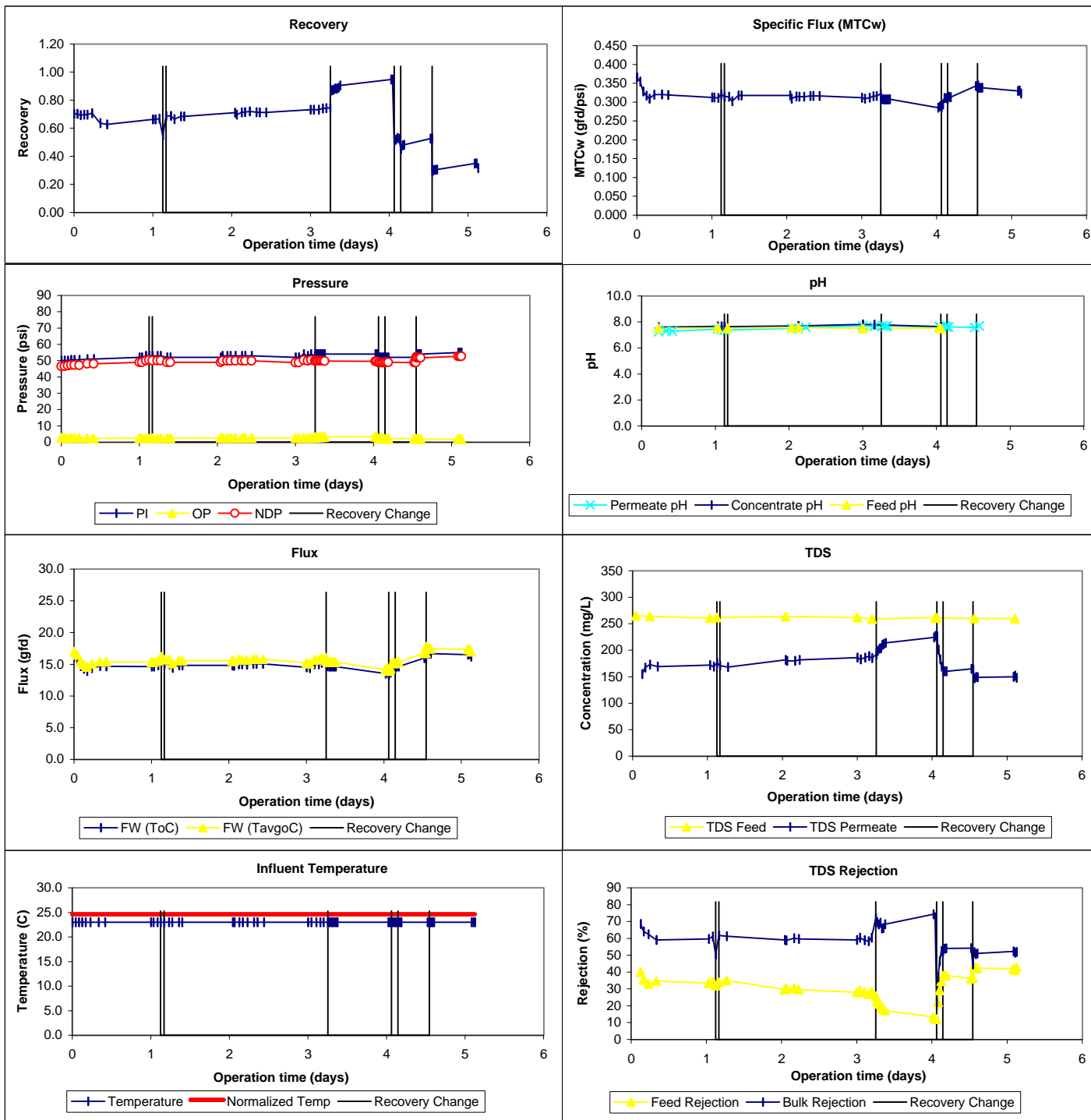
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
ICR Contact: Robert Boyce
Phone No.: (954) 967-4230
Period: 6/17/98 - 6/25/98 (8 days)

Membrane Information

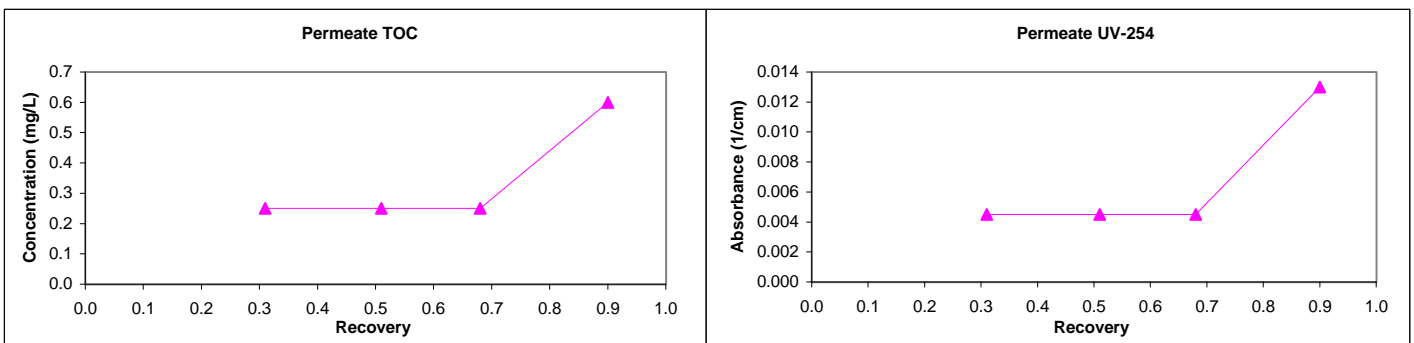
Manufacturer: Fluid Systems
Trade Name: TFC-SR
MWCO: 300 Daltons
Mfr. Flux: 24.0 gfd
Mfr. NDP: 100.0 psi
Mfr. MTCw: 0.240 gfd/psi

Mfr. Temp: 25.0 °C
840 Element Area: 330.0 ft²
840 Purchase Price: N.A.
840 Maximum Flow: 80.0 gpm
840 Minimum Flow: 20.0 gpm
840 Total Width: 58.2 ft
840 Feed Spacer Thickness: 0.0026 ft

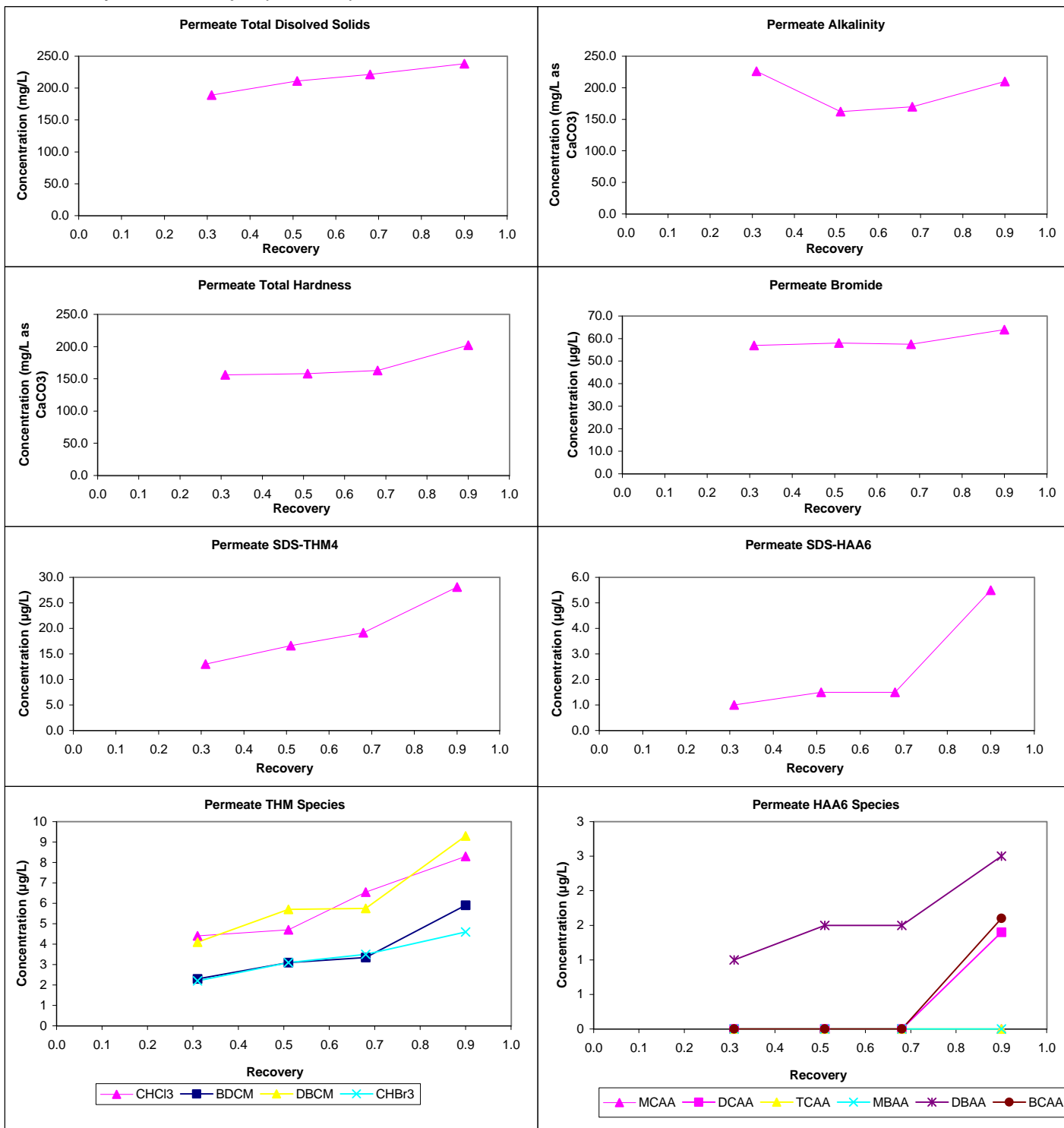
Water Quality Summary

Source ->	Feed		Permeate				Concentrate				Mass Balance Closure Err (%)																														
Recovery ->	Avg	Diff	0.31	0.51	0.68	0.90	0.31	0.51	0.68	0.90	WQP	Count	Avg	SD																											
pH	7.9	0.1	8.1	8.2	7.9	8.1	8.4	8.5	8.1	8.5	TDS	51	-61	222																											
Temp	24.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-32	34																											
Alk	262	50	226	162	170	210	250	382	304	430	TDS	4	-10	14																											
TDS	283	7	189	211	222	238	314	340	412	530	TotHard	4	-24	24																											
TotHard	274	32	156	158	163	202	316	350	422	584	CaHard	4	-28	24																											
CaHard	261	25	124	132	157	186	294	334	406	572	Turb	4	13	65																											
Turb	0.15	0.00	0.04	0.05	0.04	0.05	0.75	0.66	0.24	0.80	Amm	0	n/a	n/a																											
Amm	0.07	0.07	0.00	0.00	0.21	0.11	NA	NA	NA	NA	TOC	1	-7	n/a																											
TOC	4.0	0.1	0.3	0.3	0.3	0.6	5.9	7.9	11.7	32.4	UV254	1	-11	n/a																											
UV254	0.134	0.003	0.005	0.005	0.005	0.013	0.195	0.262	0.390	1.102	<div>Pretreatment Information</div> <table><thead><tr><th>Process</th><th>Description</th><th>Scale</th></tr></thead><tbody><tr><td>Cartridge filtration</td><td>5 micron filter</td><td>bench</td></tr></tbody></table>				Process	Description	Scale	Cartridge filtration	5 micron filter	bench																					
Process	Description	Scale																																							
Cartridge filtration	5 micron filter	bench																																							
SUVA	3.34	0.15	1.80	1.80	1.80	2.17	3.31	3.32	3.33	3.40																															
Bromide	62	0	57	58	58	64	<div>Design Parameters</div> <table><tr><td>Active memb area:</td><td>0.167 ft²</td><td rowspan="2">ID#</td><td rowspan="2">Recov (dec.)</td><td rowspan="2">F_{W-des} (gfd)</td></tr><tr><td>Active width:</td><td>0.330 ft</td></tr><tr><td>Norm Temp:</td><td>24.6 °C</td><td>1</td><td>0.70</td><td>15.0</td></tr><tr><td>Feed TDS:</td><td>300.0 mg/L</td><td>2</td><td>0.90</td><td>15.0</td></tr><tr><td>Manuf rep TDS rej:</td><td>50%</td><td>3</td><td>0.50</td><td>15.0</td></tr><tr><td>Temp Norm MTC-w:</td><td>0.237 gfd/psi</td><td>4</td><td>0.30</td><td>15.0</td></tr></table>								Active memb area:	0.167 ft ²	ID#	Recov (dec.)	F _{W-des} (gfd)	Active width:	0.330 ft	Norm Temp:	24.6 °C	1	0.70	15.0	Feed TDS:	300.0 mg/L	2	0.90	15.0	Manuf rep TDS rej:	50%	3	0.50	15.0	Temp Norm MTC-w:	0.237 gfd/psi	4	0.30	15.0
Active memb area:	0.167 ft ²	ID#	Recov (dec.)	F _{W-des} (gfd)																																					
Active width:	0.330 ft																																								
Norm Temp:	24.6 °C	1	0.70	15.0																																					
Feed TDS:	300.0 mg/L	2	0.90	15.0																																					
Manuf rep TDS rej:	50%	3	0.50	15.0																																					
Temp Norm MTC-w:	0.237 gfd/psi	4	0.30	15.0																																					
TOX	388	3	13	13	13	38	<div>Comments:</div>																																		
CHCl3	120.0	0.0	4.4	4.7	6.6	8.3																																			
BDCM	27.5	0.5	2.3	3.1	3.4	5.9																																			
DBCM	6.6	0.1	4.1	5.7	5.8	9.3																																			
CHBr3	0.0	0.0	2.2	3.1	3.5	4.6																																			
THM4	154.1	0.6	13.0	16.6	19.2	28.1																																			
MCAA	3.2	0.4	0.0	0.0	0.0	0.0																																			
DCAA	31.5	1.5	0.0	0.0	0.0	1.4	<div>SDS Conditions</div> <table><thead><tr><th>WQP</th><th>Avg</th><th>SD</th><th>Count</th><th>Min - Max</th></tr></thead><tbody><tr><td>Res (mg/L) (0)</td><td>1.35</td><td>0.25</td><td>6</td><td>1.04 - 1.65</td></tr><tr><td>Temp (°C)</td><td>25.0</td><td>0.0</td><td>6</td><td>25.0 - 25.0</td></tr><tr><td>pH (unit)</td><td>8.2</td><td>0.1</td><td>6</td><td>8.0 - 8.3</td></tr><tr><td>Time (hr)</td><td>24.0</td><td>0.0</td><td>6</td><td>24.0 - 24.0</td></tr></tbody></table>								WQP	Avg	SD	Count	Min - Max	Res (mg/L) (0)	1.35	0.25	6	1.04 - 1.65	Temp (°C)	25.0	0.0	6	25.0 - 25.0	pH (unit)	8.2	0.1	6	8.0 - 8.3	Time (hr)	24.0	0.0	6	24.0 - 24.0		
WQP	Avg	SD	Count	Min - Max																																					
Res (mg/L) (0)	1.35	0.25	6	1.04 - 1.65																																					
Temp (°C)	25.0	0.0	6	25.0 - 25.0																																					
pH (unit)	8.2	0.1	6	8.0 - 8.3																																					
Time (hr)	24.0	0.0	6	24.0 - 24.0																																					
TCAA	25.0	0.0	0.0	0.0	0.0	0.0																																			
MBAA	0.0	0.0	0.0	0.0	0.0	0.0																																			
DBAA	1.4	0.0	1.0	1.5	1.5	2.5																																			
BCAA	8.0	0.0	0.0	0.0	0.0	1.6																																			
TBAA	0.0	NA	NR	NR	NA	NR																																			
CDBAA	0.0	0.0	0.0	0.0	0.0	2.0																																			
DCBAA	6.8	0.7	0.0	1.0	1.0	1.5																																			
HAA5	61.0	1.1	1.0	1.5	1.5	3.9																																			
HAA6	69.0	1.0	1.0	1.5	1.5	5.5																																			
HAA9	76.1	NA	NR	NR	NA	NR																																			

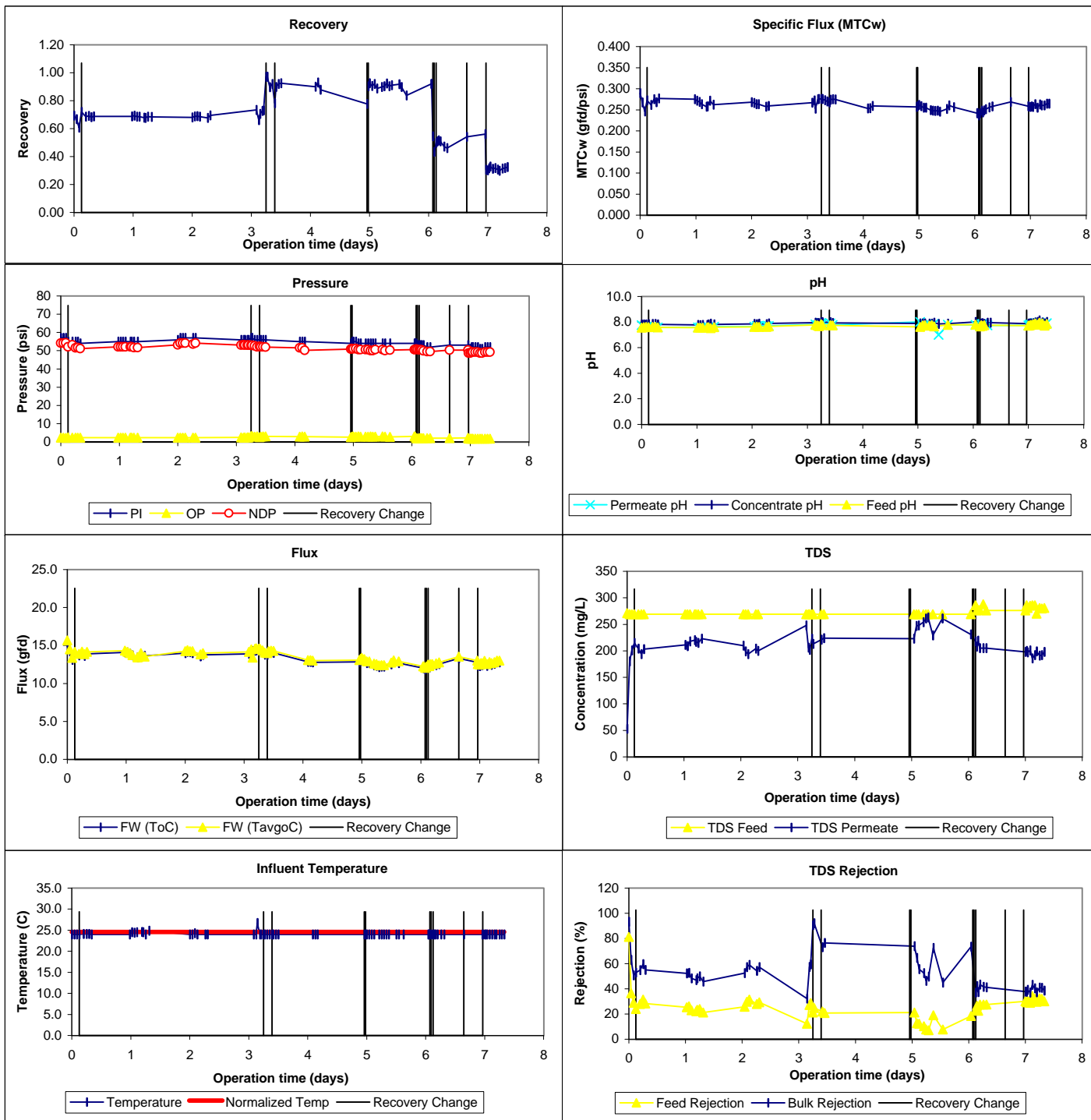
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
 ICR Contact: Robert Boyce
 Phone No.: (954) 967-4230
 Period: 10/13/98 - 10/19 (6 days)

Membrane Information

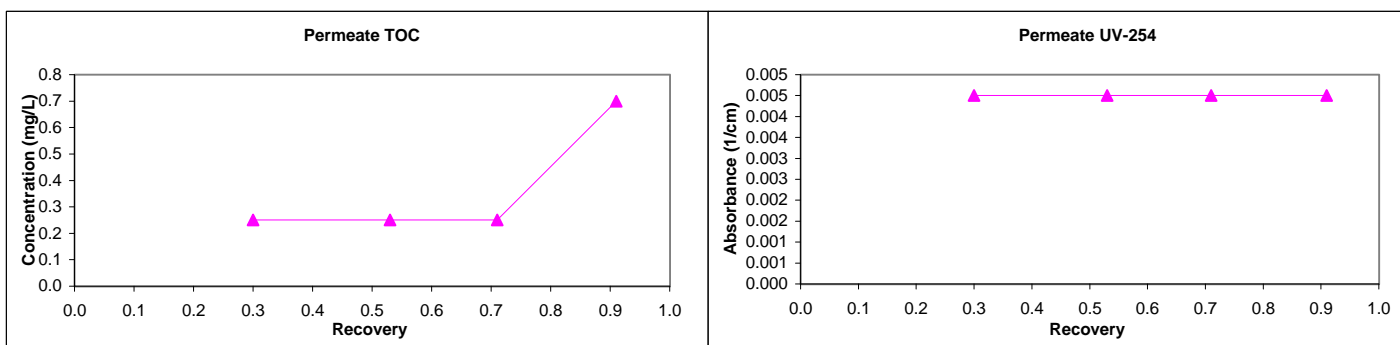
Manufacturer: Fluid Systems
 Trade Name: TFC-SR
 MWCO: 300 Daltons
 Mfr. Flux: 24.0 gfd
 Mfr. NDP: 100.0 psi
 Mfr. MTCw: 0.240 gfd/psi

Mfr. Temp: 25.0 °C
 840 Element Area: 330.0 ft²
 840 Purchase Price: N.A.
 840 Maximum Flow: 80.0 gpm
 840 Minimum Flow: 20.0 gpm
 840 Total Width: 58.2 ft
 840 Feed Spacer Thickness: 0.0026 ft

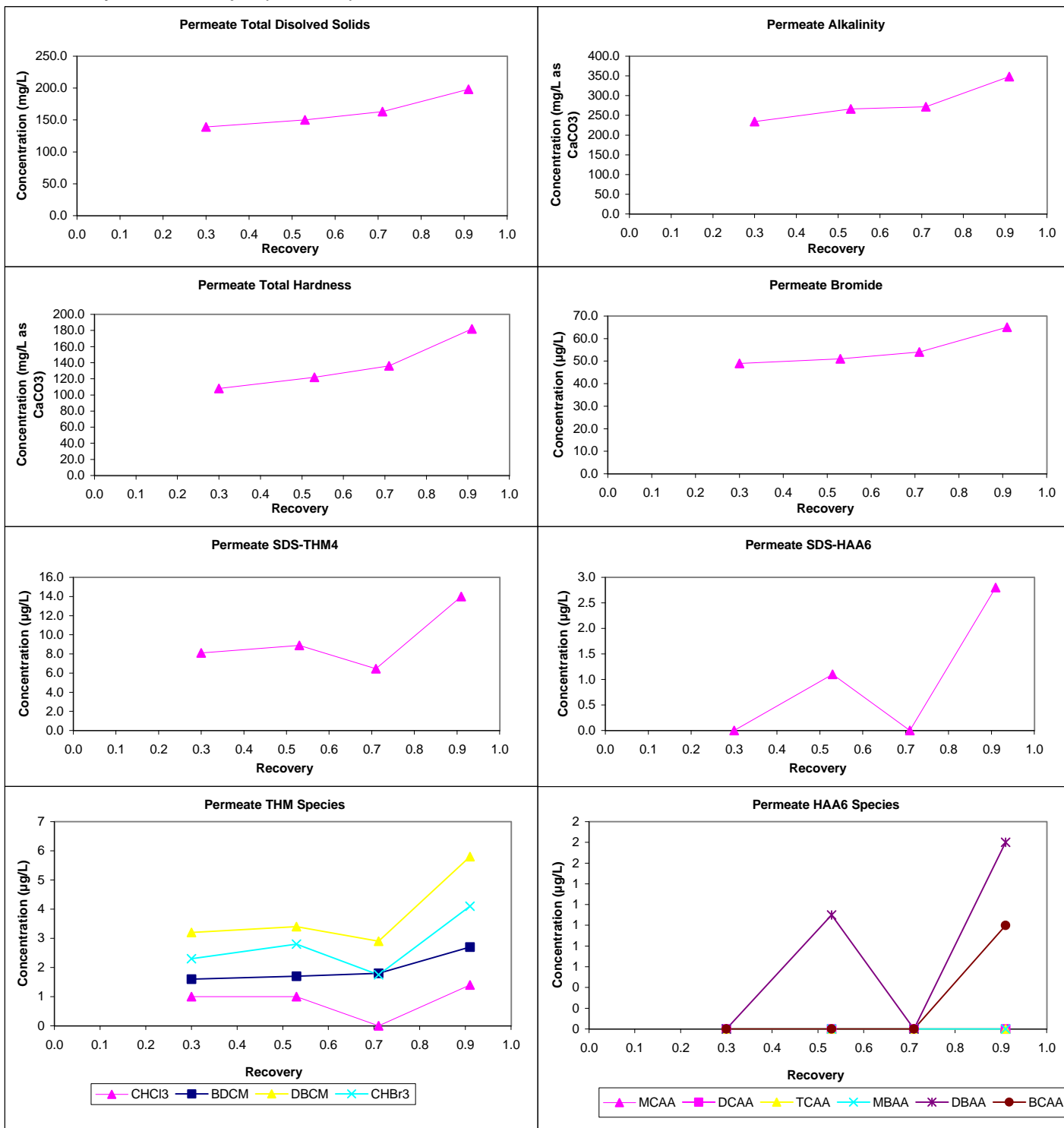
Water Quality Summary

Water Quality Summary															Mass Balance Closure Err (%)			
Source ->	Feed		Permeate				Concentrate											
Recovery ->	Avg	Diff	0.30	0.53	0.71	0.91	0.30	0.53	0.71	0.91	WQP	Count	Avg	SD				
pH	7.6	0.6	7.4	8.1	7.7	7.7	7.0	6.9	6.6	6.8	TDS	55	-33	36				
Temp	23.0	1.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	Alk	4	-3	9				
Alk	378	2	234	266	272	348	464	526	605	594	TDS	4	-21	26				
TDS	250	2	139	150	163	198	288	332	409	486	TotHard	4	-31	11				
TotHard	228	6	108	122	136	182	240	244	330	544	CaHard	4	-23	24				
CaHard	224	6	104	118	118	158	236	322	442	560	Turb	4	-102	114				
Turb	0.35	0.08	0.09	0.08	0.15	0.10	0.54	0.40	0.43	0.81	Amm	0	n/a	n/a				
Amm	0.00	0.00	0.00	0.00	0.17	0.00	NA	NA	NA	NA	TOC	1	-11	n/a				
TOC	3.6	0.1	0.3	0.3	0.3	0.7	5.4	8.0	11.6	29.2	UV254	0	n/a	n/a				
UV254	0.144	0.003	0.005	0.005	0.005	0.005	0.204	0.287	0.449	1.048								
SUVA	4.04	0.01	1.80	1.80	1.80	0.64	3.78	3.59	3.87	3.59								
Bromide	70	1	49	51	54	65												
TOX	353	3	13	13	13	13												
CHCl3	113.0	17.0	1.0	1.0	0.0	1.4												
BDCM	24.0	3.0	1.6	1.7	1.8	2.7												
DBCM	5.1	1.0	3.2	3.4	2.9	5.8												
CHBr3	0.0	0.0	2.3	2.8	1.8	4.1												
THM4	142.1	21.0	8.1	8.9	6.5	14.0												
MCAA	2.9	0.1	0.0	0.0	0.0	0.0												
DCAA	28.5	1.5	0.0	0.0	0.0	0.0												
TCAA	25.5	2.5	0.0	0.0	0.0	0.0												
MBAA	0.0	0.0	0.0	0.0	0.0	0.0												
DBAA	1.2	0.1	0.0	1.1	0.0	1.8												
BCAA	6.8	0.3	0.0	0.0	0.0	1.0												
TBAA	0.0	NA	0.0	0.0	0.0	0.0												
CDBAA	2.5	0.3	0.0	0.0	0.0	2.2												
DCBAA	6.5	1.4	0.0	0.0	0.0	1.1												
HAA5	58.1	0.9	0.0	1.1	0.0	1.8												
HAA6	64.9	1.2	0.0	1.1	0.0	2.8												
HAA9	70.9	NA	0.0	1.1	0.0	6.1												
SDS Conditions																		
WQP	Avg	SD	Count	Min - Max														
Res (mg/L) (0)	1.14	0.20	6	0.82 - 1.44														
Temp (°C)	26.0	0.0	6	26.0 - 26.0														
pH (unit)	7.9	0.3	6	7.4 - 8.1														
Time (hr)	24.0	0.0	6	24.0 - 24.0														
Pretreatment Information																		
Process					Description					Scale								
Cartridge filtration					5 micron filter					bench								
Design Parameters																		
Active memb area:										0.167 ft ²								
Active width:										0.330 ft		ID#		Recov (dec.)	F _{W-des} (gfd)			
Norm Temp:										24.6 °C		1		0.70	15.0			
Feed TDS:										300.0 mg/L		2		0.90	15.0			
Manuf rep TDS rej:										50%		3		0.50	15.0			
Temp Norm MTC-w:										0.237 gfd/psi		4		0.30	15.0			
Comments:																		

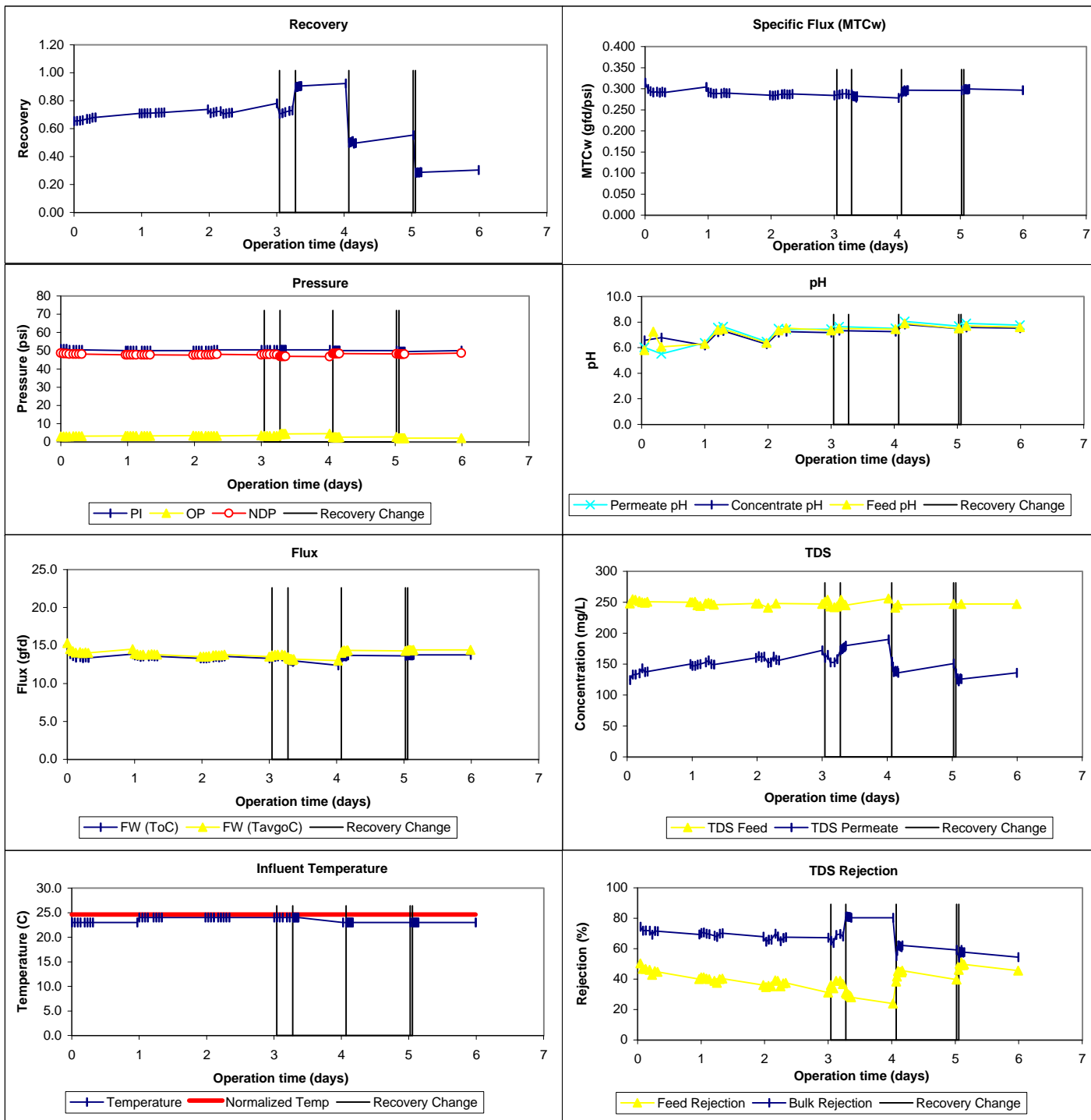
Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs



ICR Information

ID / ICR#: FL4060642 / 298
 ICR Contact: Robert Boyce
 Phone No.: (954) 967-4230
 Period: 2/11/99 - 2/17/99 (6 days)

Membrane Information

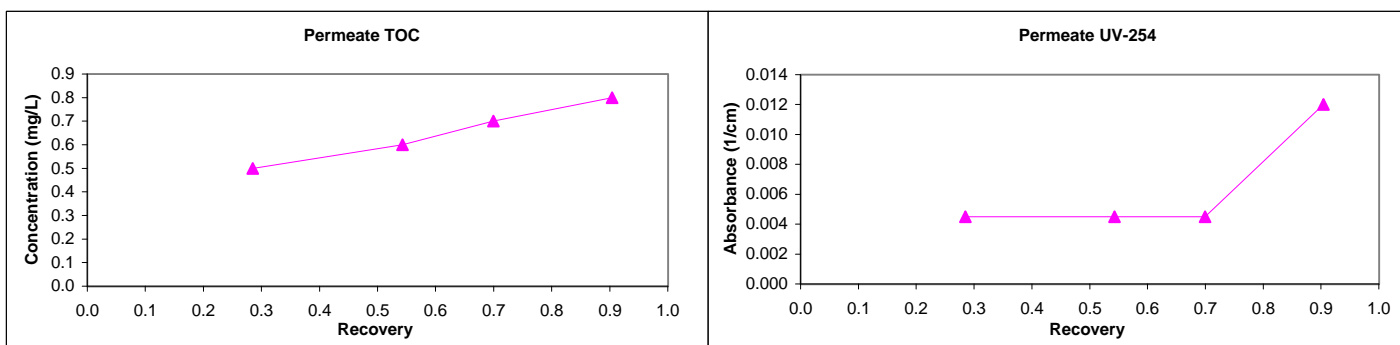
Manufacturer: Fluid Systems
 Trade Name: TFC-SR
 MWCO: 300 Daltons
 Mfr. Flux: 24.0 gfd
 Mfr. NDP: 100.0 psi
 Mfr. MTCw: 0.240 gfd/psi

Mfr. Temp: 25.0 °C
 840 Element Area: 330.0 ft²
 840 Purchase Price: N.A.
 840 Maximum Flow: 80.0 gpm
 840 Minimum Flow: 20.0 gpm
 840 Total Width: 58.2 ft
 840 Feed Spacer Thickness: 0.0026 ft

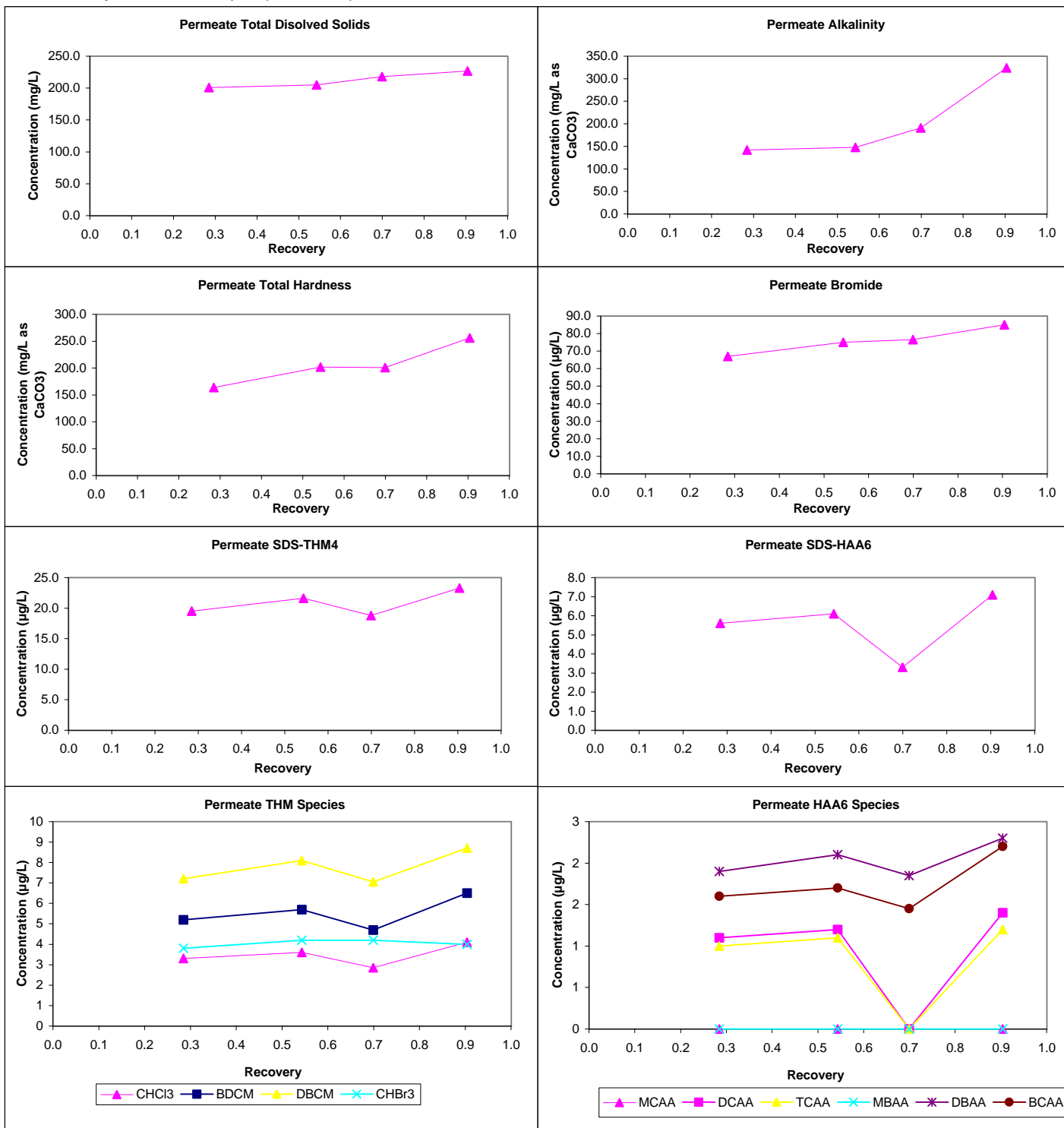
Water Quality Summary

Source ->		Feed		Permeate				Concentrate				Mass Balance Closure Err (%)			
Recovery ->	Avg	Diff	0.28	0.54	0.70	0.90	0.28	0.54	0.70	0.90	WQP	Count	Avg	SD	
pH	7.7	0.0	8.0	8.0	7.8	7.8	7.9	7.8	7.9	8.0	TDS	41	3	22	
Temp	23.0	0.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	Alk	4	-2	74	
Alk	290	26	142	148	191	324	286	312	355	410	TDS	4	1	8	
TDS	269	0	201	205	218	227	331	356	391	612	TotHard	4	-12	8	
TotHard	310	22	164	202	201	256	322	412	465	786	CaHard	4	-11	7	
CaHard	263	13	142	156	164	208	274	366	417	750	Turb	4	-85	98	
Turb	0.32	0.18	0.06	0.09	0.07	0.10	0.50	0.51	0.35	0.85	Amm	0	n/a	n/a	
Amm	0.36	0.10	0.50	0.49	0.47	0.44	NA	NA	NA	NA	TOC	4	2	9	
TOC	4.7	0.4	0.5	0.6	0.7	0.8	6.3	8.8	14.0	47.8	UV254	1	5	n/a	
UV254	0.164	0.006	0.005	0.005	0.005	0.012	0.220	0.344	0.520	1.672					
SUVA	3.57	0.47	0.90	0.75	0.64	1.50	3.49	3.91	3.71	3.50					
Bromide	85	0	67	75	77	85	Pretreatment Information								
TOX	390	10	32	33	32	36	Process Description Scale								
CHCl3	97.5	2.5	3.3	3.6	2.9	4.1	Cartridge filtration		5 micron filter		bench				
BDCM	29.5	0.5	5.2	5.7	4.7	6.5									
DBCM	7.3	0.7	7.2	8.1	7.1	8.7									
CHBr3	0.0	0.0	3.8	4.2	4.2	4.0									
THM4	134.3	1.3	19.5	21.6	18.8	23.3									
MCAA	1.0	1.0	0.0	0.0	0.0	0.0									
DCAA	28.0	0.0	1.1	1.2	0.0	1.4									
TCAA	35.0	1.0	1.0	1.1	0.0	1.2									
MBAA	0.0	0.0	0.0	0.0	0.0	0.0									
DBAA	1.4	0.1	1.9	2.1	1.9	2.3									
BCAA	8.6	0.3	1.6	1.7	1.5	2.2									
TBAA	0.0	0.0	0.0	0.0	0.0	0.0									
CDBAA	1.1	1.1	0.0	0.0	0.0	0.0									
DCBAA	10.4	0.6	1.4	1.6	1.3	1.9	Design Parameters								
HAA5	65.4	0.1	4.0	4.4	1.9	4.9	Active memb area:		0.167 ft ²		ID#	Recov	F _{w-des}		
HAA6	74.0	0.4	5.6	6.1	3.3	7.1	Active width:		0.330 ft			(dec.)	(gfd)		
HAA9	85.5	2.1	7.0	7.7	4.6	9.0	Norm Temp:		24.6 °C		1	0.70	15.0		
							Feed TDS:		300.0 mg/L		2	0.90	15.0		
							Manuf rep TDS rej:		50%		3	0.50	15.0		
							Temp Norm MTC-w:		0.237 gfd/psi		4	0.30	15.0		
SDS Conditions															
WQP	Avg	SD	Count	Min - Max											
Res (mg/L) (0)	1.00	0.17	6	0.80 - 1.22											
Temp (°C)	24.0	0.0	6	24.0 - 24.0											
pH (unit)	8.1	0.1	6	8.0 - 8.2											
Time (hr)	24.0	0.0	6	24.0 - 24.0			Comments:								

Water Quality Parameter Graphs



Water Quality Parameter Graphs (Continued)



Productivity Graphs

