

Hydrologic budgets of the ORW mitigation wetland, 2000

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Introduction

Understanding the hydrologic processes of mitigation wetlands is a fundamental key in effective ecosystem restoration and creation (Mitsch and Gosselink, 2000). One indicator of success for constructed wetlands is the fulfillment of the hydrology criterion (National Research Council, 1995). Hydrologic budgets, therefore, provide valuable information to meet restoration and creation goals.

The 3-ha mitigation wetland (the billabong) at the Olentangy River Wetland Research Park, constructed in the summer of 1996, is a freshwater, oxbow wetland that receives water from the Olentangy River. When the river level is higher than the wetland, water passively flows into the wetland through a check valve and eventually returns to the Olentangy River through a control weir. Previous hydrologic budgets from the beginning were presented in Wang et al. (1997), Johnson et al. (1998) and Zhang and Mitsch (2000). This paper presents monitoring hydrologic budgets for 2000.

Methods

Location of the inflow and outflow of the billabong is shown in Figure 1. A twice-daily reading (staff gauges) was used to measure the surface water level of the Olentangy River and mitigation wetland. The following equation (Mitsch and Gosselink, 1993) was used to determine hydrologic budgets for the mitigation wetland:

$$\Delta V/\Delta t = Q_{in} + Q_{out} + G_{in/out} + P_{reci} - ET \quad (1)$$

Where

$\Delta V/\Delta t$	= Change of water volume in wetland over time,
Q_{in}	= Inflow,
Q_{out}	= Surface outflow,
$G_{in/out}$	= Ground water exchange,
P_{reci}	= Precipitation,
ET	= Evapotranspiration.

All parameters (water inflows, outflows, water volume, precipitation and evapotranspiration, and groundwater) in equation (1) were calculated by the following equations (Wang et al., 1997):

Inflow

$$S_i = 1.8447ah^{1/2} \quad (2)$$

$$a = 0.7372D + 1.387D^2 - 0.39993D^3 \quad (3)$$

= cross sectional area, ft

$$L_r = 723 + L_s \quad (4)$$

where

D = water depth in pipe at weir box (ft)
= min (d, max (0, $L_r - 723.5$))

h = head causing flow (ft)
= max (0, min ($L_r - L_m$, $L_r - 0.6D - 723.5$))

L_r = river water level (ft above MSL)

L_s = staff gauge reading, ft

L_m = mitigation wetland water level (ft above MSL)

Outflow

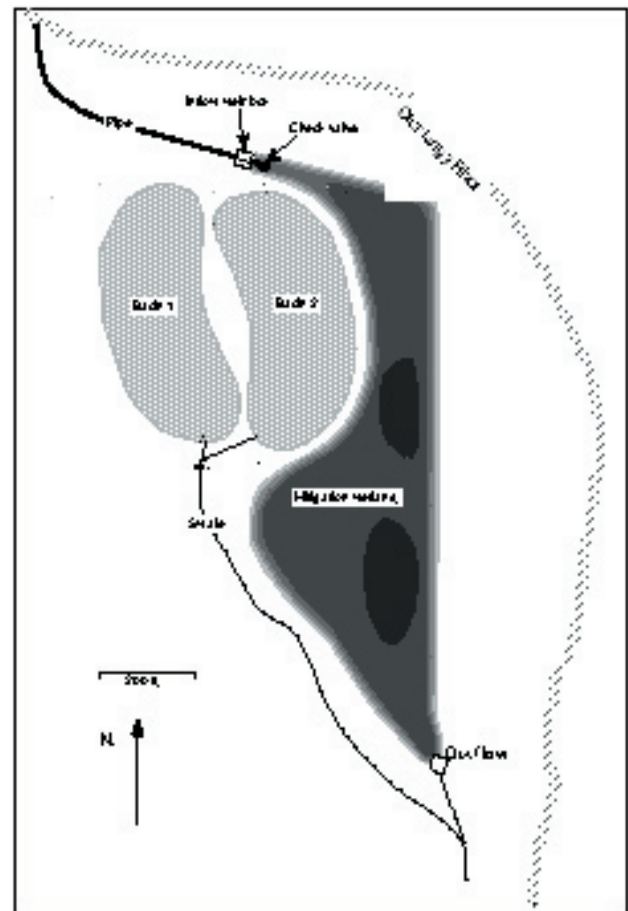


Figure 1. Location of the mitigation wetland at ORWRP.

$$S_0 = 10.16h_0^{1.436} \quad (4)$$

where

$$h_0 = L_m - 724.2 \quad (L_m > 724.2)$$

$$= 0 \quad (L_m \leq 724.2)$$

Surface water volume

Surface water volume was based on relationships between surface area, volume, and elevation. A detailed modeling approach was given by Wang et al. (1997). The following equation was used to calculate water volume (V, ft³) of the mitigation wetland:

$$V = 3.5873 \times 10^4 L_m - 2.5938 \times 10^7 \quad (0 < L_m < 723.5)$$

$$= 6.8425 \times 10^9 - 1.9121 \times 10^7 L_m + 1.336 \times 10^4 L_m^2 \quad (723.5 < L_m < 727.0)$$

(5)

Daily precipitation and ET

Daily precipitation and evapotranspiration data were extracted from the weather station (Mitsch et al., 1995) at ORWRP.

Groundwater exchange

The difficulties of evaluating groundwater seepage for the mitigation wetland were presented in Wang et al. (1997). The residuals, however, were used to estimate groundwater indirectly after balancing all other components of the hydrologic budgets (eqn. 1).

Results and Discussion

Figure 2 shows the hydroperiod of the wetland and the Olentangy River for 2000. General water level trends of the billabong follow a pattern of high water levels in the early growing season, followed by drier conditions in late summer. This early flooding followed by summer drawdowns is typical of midwest marshes (Mitsch, 1992). These flood events provide nutrients and introduction of seeds and small organisms across a watershed (Mitsch and Gosselink, 2000).

Figure 3 presents the relationships between surface water level (ft above MSL) and wet area (%) of the total mitigation wetland area, and wet periods (days) during two growing seasons (a: from April 20 to Oct. 20 and b: from May 1 to Oct. 31 during the period 1998-99. A summary of the wet days and wet area for the two growing seasons is given in Table 1.

The wet periods are longer than the hydrologic critical days which were given by National Research Council (1995) for wetland delineations and indicate that the design of this wetland was successful in establishing appropriate hydrologic conditions for a Midwest oxbow wetland.

Table 2 shows the annual hydrologic budgets for 2000. Daily values are given in Appendix 1. By comparison, total inflow 11.10 (m/yr) from the river in 2000 was higher than the inflow 10.36 (m/yr) in 1998 and 9.25 (m/yr) in 1999 (Zhang and Mitsch, 2000). Total precipitation (0.91 m/yr) and evapotranspiration (0.91 m/yr) in 2000 were also wetter than total precipitation (0.60 m/yr) evapotranspiration (0.91 m/yr) in 1999, respectively (Zhang and Mitsch, 2000)..

References

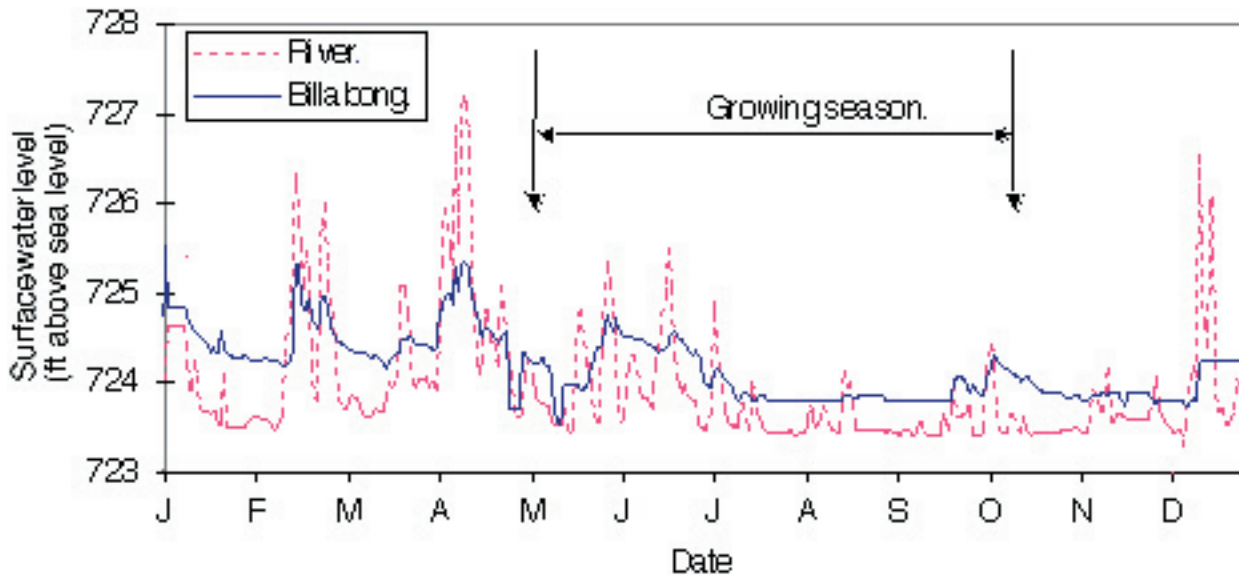


Figure 2. Daily surface water level (ft above sea level) in 2000.

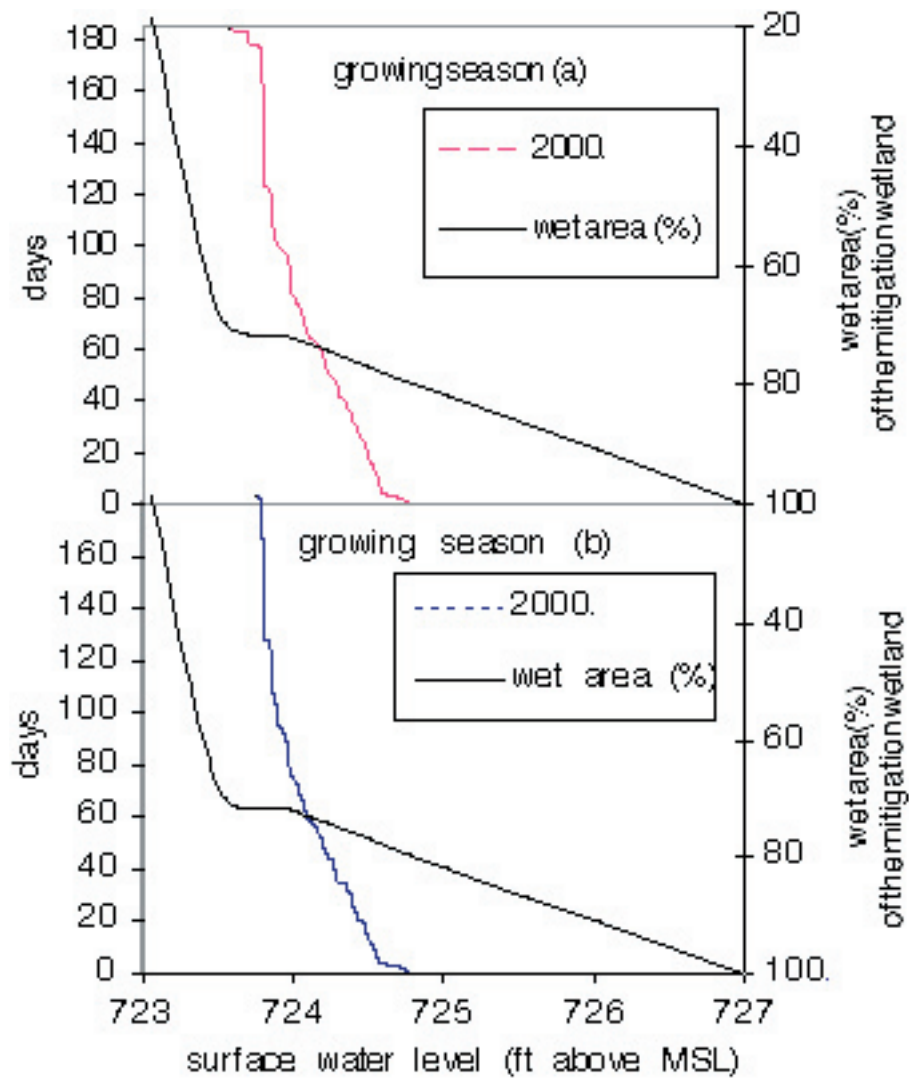


Figure 3. Relationship of surface water level to wet days and wet area (%) of the billabong during the growing seasons (a and b), 2000.

Table 1. A summary of the wet days and wet area for the two growing seasons in 2000.

growing seasons	wet days		
April 20 - October 19 2000	140	81	0
May 1 - October 31 2000	140	75	0

Table 2. Estimated annual hydrologic budgets, 2000.

hydrologic parameters	2000 (m/yr)	
Surface inflow from river	11.10	
Surface outflow		8.67
Precipitation		0.91
Evapotranspiration	0.91	

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Appendix A. Estimated daily hydrologic budgets for the billabong at ORWRP, 2000.

Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation (ft ³)	ET (ft ³)
01/01/00	724.41	724.20	142147	57575	0	0	0
01/02/00	724.03	725.50	457309	0	0	701	740
01/03/00	724.65	724.85	294085	0	0	42895	508
01/04/00	724.65	724.85	294085	0	0	5316	584
01/05/00	724.65	724.85	294085	0	0	701	1166
01/06/00	724.65	724.85	294085	0	0	701	1502
01/07/00	724.65	724.85	294085	0	0	701	1773
01/08/00	724.65	724.85	294085	0	0	3338	5482
01/09/00	724.44	724.81	284051	0	0	701	3895
01/10/00	723.99	724.71	260471	0	0	2019	455
01/11/00	723.92	724.64	242864	0	0	701	2265
01/12/00	724.24	724.57	228257	0	0	701	2661
01/13/00	724.06	724.55	221885	0	0	22457	5617
01/14/00	723.75	724.52	214718	0	0	15205	5349
01/15/00	723.70	724.49	208426	0	0	701	5530
01/16/00	723.68	724.44	196474	0	0	701	1821
01/17/00	723.67	724.34	173918	0	0	27732	2265
01/18/00	723.69	724.40	186610	0	0	15205	6023
01/19/00	723.68	724.33	172478	0	0	1360	5646
01/20/00	723.56	724.34	173534	0	0	701	3471
01/21/00	723.52	724.58	229831	0	0	1360	5045
01/22/00	724.09	724.39	185705	0	0	25754	5312
01/23/00	723.51	724.34	174232	0	0	701	903
01/24/00	723.51	724.30	165568	0	0	701	1837
01/25/00	723.51	724.28	160631	0	0	701	283
01/26/00	723.51	724.28	160238	0	0	701	2187
01/27/00	723.51	724.28	160238	0	0	701	1830

Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation (ft ³)	ET (ft ³)
01/28/00	723.51	724.28	160376	0	0	701	470
01/29/00	723.51	724.30	163977	0	0	701	3900
01/30/00	723.57	724.29	162063	0	0	701	6435
01/31/00	723.60	724.26	156434	0	0	701	4147
02/01/00	723.61	724.26	155699	0	0	701	1465
02/02/00	723.63	724.26	155699	0	0	13887	10143
02/03/00	723.61	724.26	155988	0	0	7294	6372
02/04/00	723.61	724.29	162417	0	0	701	1263
02/05/00	723.59	724.27	157909	0	0	2019	2385
02/06/00	723.56	724.26	155699	0	0	701	11197
02/07/00	723.53	724.26	155699	0	0	2019	15110
02/08/00	723.48	724.25	153785	0	0	62015	11948
02/09/00	723.51	724.24	151171	0	0	701	13284
02/10/00	723.56	724.22	147635	0	0	701	9616
02/11/00	723.66	724.20	142147	0	0	701	1800
02/12/00	724.32	724.20	142147	37905	0	701	2267
02/13/00	724.85	724.25	152774	155260	5499	9931	8118
02/14/00	725.59	724.57	226947	298504	105618	701	13470
02/15/00	726.34	725.28	400852	355424	494419	701	13102
02/16/00	725.81	725.32	411378	241434	521832	701	2454
02/17/00	725.54	725.02	335938	230101	333425	4657	1678
02/18/00	725.06	724.84	292653	116717	235305	3997	908
02/19/00	725.46	724.81	283661	250649	216043	701	2130
02/20/00	725.19	724.93	312664	140687	279614	701	3815
02/21/00	724.20	724.76	272296	0	0	701	5936
02/22/00	723.84	724.61	236940	0	0	701	10489
02/23/00	725.46	724.76	272013	261415	191735	701	2275
02/24/00	725.76	724.96	321733	304589	300306	701	4726
02/25/00	725.98	724.95	319209	349849	294511	2019	15012
02/26/00	725.33	724.87	299294	197175	249795	12568	10947
02/27/00	724.94	724.71	261175	108128	169818	701	12410
02/28/00	724.78	724.58	230125	88545	111223	36962	8949
02/29/00	724.53	724.52	214935	16494	85180	5316	8100
03/01/00	723.83	724.45	200284	0	0	701	8387
03/02/00	723.72	724.44	195792	0	0	5975	3541
03/03/00	723.72	724.39	185489	0	0	14546	4161
03/04/00	723.82	724.37	181493	0	0	701	7217
03/05/00	723.85	724.36	177448	0	0	701	10202
03/06/00	723.84	724.35	176251	0	0	44214	9464
03/07/00	723.83	724.33	171693	0	0	701	2626
03/08/00	723.76	724.35	175699	0	0	701	2840
03/09/00	723.67	724.33	170666	0	0	11249	7957
03/10/00	723.62	724.33	171276	0	0	701	9980
03/11/00	723.62	724.28	161137	0	0	701	9020
03/12/00	723.65	724.29	162864	0	0	701	9891
03/13/00	723.70	724.32	168294	0	0	701	11859
03/14/00	723.69	724.29	162803	0	0	701	11860
03/15/00	723.68	724.25	154169	0	0	701	12039
03/16/00	723.69	724.23	149181	0	0	701	2516

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Date	River (ft)	Bill.(ft)	Volume (ft³)	Inflow (ft³)	Outflow (ft³)	Precipitation(ft³)	ET (ft³)
03/17/00	723.84	724.16	132836	0	0	701	3920
03/18/00	724.02	724.23	148003	0	0	701	7262
03/19/00	723.94	724.28	160858	0	0	701	2415
03/20/00	724.06	724.34	174778	0	0	701	3025
03/21/00	725.07	724.36	179162	197862	32679	701	7672
03/22/00	725.10	724.50	210302	197771	77634	701	10124
03/23/00	725.07	724.49	209523	190200	76384	701	12375
03/24/00	724.76	724.48	206619	102515	71776	701	7947
03/25/00	724.41	724.51	213855	0	0	701	16651
03/26/00	724.04	724.49	208245	0	0	701	14588
03/27/00	723.96	724.42	191739	0	0	701	9065
03/28/00	724.04	724.43	194372	0	0	701	9949
03/29/00	724.05	724.43	194584	0	0	701	10834
03/30/00	724.07	724.43	193544	0	0	701	11719
03/31/00	723.96	724.41	189744	0	0	701	2519
04/01/00	724.01	724.40	186578	0	0	5316	3157
04/02/00	724.02	724.37	180201	0	0	701	2350
04/03/00	723.93	724.41	188988	0	0	7953	2355
04/04/00	724.65	724.81	285049	0	0	2019	4907
04/05/00	725.55	724.81	285049	276849	218989	701	4451
04/06/00	725.95	724.95	319651	344019	295523	701	2502
04/07/00	725.50	724.99	327077	227586	312666	701	3079
04/08/00	725.07	724.87	298605	113645	248282	5316	1810
04/09/00	726.88	725.28	400324	436498	493054	29709	4850
04/10/00	725.56	725.02	336343	237592	334383	701	5019
04/11/00	726.89	725.30	405980	434492	507732	701	4866
04/12/00	727.20	725.34	415215	471090	531905	1360	3726
04/13/00	727.09	725.32	410021	459931	518278	701	1683
04/14/00	726.81	725.29	403583	425684	501499	701	2238
04/15/00	725.52	724.99	328049	233206	314928	17842	2802
04/16/00	724.23	724.78	277222	0	0	4657	4003
04/17/00	724.10	724.60	234428	0	0	2679	2722
04/18/00	724.25	724.53	218405	0	0	13887	1052
04/19/00	724.79	724.60	233438	88783	117148	2679	4108
04/20/00	724.81	724.60	234311	94064	118724	701	2871
04/21/00	724.48	724.57	227976	0	0	58059	3013
04/22/00	724.44	724.54	220394	0	0	701	4258
04/23/00	724.41	724.49	208872	0	0	46851	4205
04/24/00	724.18	724.46	200611	0	0	701	3038
04/25/00	725.08	724.49	208183	194654	74248	701	1430
04/26/00	724.40	724.58	229755	0	0	701	4984
04/27/00	724.30	723.70	33006	60042	0	2019	4738
04/28/00	724.10	723.70	32952	34318	0	701	4146
04/29/00	723.76	723.70	32952	5321	0	701	3553
04/30/00	723.63	723.70	32952	0	0	0	809
05/01/00	723.61	723.70	32952	0	0	0	4043
05/02/00	723.65	724.30	165281	0	0	0	3234
05/03/00	724.07	724.35	176315	0	0	0	809

Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation(ft ³)	ET (ft ³)
05/04/00	724.27	724.29	163564	0	0	0	0
05/05/00	724.02	724.22	145883	0	0	4717	0
05/06/00	723.89	724.22	147393	0	0	0	1617
05/07/00	723.79	724.23	149862	0	0	4717	809
05/08/00	723.78	724.24	151213	0	0	0	1617
05/09/00	723.78	724.27	158343	0	0	674	0
05/10/00	723.75	724.19	139354	0	0	0	1617
05/11/00	723.74	724.19	139938	0	0	0	4043
05/12/00	723.64	724.11	121815	0	0	0	38005
05/13/00	723.55	723.70	33561	0	0	0	0
05/14/00	723.54	723.54	-593	138	0	2695	0
05/15/00	723.53	723.80	54416	0	0	0	3234
05/16/00	723.71	723.98	94071	0	0	0	8895
05/17/00	723.50	723.98	93278	0	0	0	0
05/18/00	723.45	723.98	93278	0	0	0	0
05/19/00	723.49	723.98	93278	0	0	4043	0
05/20/00	724.25	723.98	93278	49705	0	0	809
05/21/00	724.59	723.97	90677	104863	0	0	0
05/22/00	724.81	723.93	82089	147541	0	0	61454
05/23/00	724.19	723.97	90039	40989	0	33692	0
05/24/00	724.21	724.08	114432	33355	0	6738	1617
05/25/00	723.97	724.20	142310	0	0	22237	6469
05/26/00	723.66	724.27	157450	0	0	674	1617
05/27/00	723.60	724.35	177234	0	0	0	7278
05/28/00	723.57	724.39	185170	0	0	0	1617
05/29/00	724.55	724.42	193352	53646	51806	0	3234
05/30/00	724.88	724.56	223930	122811	100371	0	13746
05/31/00	725.34	724.76	271694	224305	191080	1348	0
06/01/00	724.80	724.57	227361	95085	106344	4043	1617
06/02/00	724.49	724.71	260915	0	0	0	0
06/03/00	723.76	724.63	242477	0	0	0	4852
06/04/00	723.58	724.58	229113	0	0	0	3234
06/05/00	723.59	724.53	217439	0	0	0	4043
06/06/00	723.88	724.52	216242	0	0	0	3234
06/07/00	724.15	724.53	217375	0	0	0	6469
06/08/00	724.32	724.51	214320	0	0	0	4852
06/09/00	724.32	724.50	211476	0	0	0	5660
06/10/00	723.93	724.50	210012	0	0	0	5660
06/11/00	723.84	724.48	205136	0	0	0	5660
06/12/00	723.82	724.45	198482	0	0	0	8086
06/13/00	723.83	724.42	191809	0	0	29649	0
06/14/00	723.79	724.43	194980	0	0	0	809
06/15/00	723.72	724.38	184142	0	0	0	2426
06/16/00	724.23	724.39	184243	0	0	674	809
06/17/00	724.38	724.34	173968	22286	26350	0	3234
06/18/00	724.58	724.36	177947	75017	31163	0	3234
06/19/00	725.10	724.39	186232	204908	41893	0	6469
06/20/00	725.51	724.48	207030	285522	72422	0	12129
06/21/00	725.04	724.54	221128	173352	95566	0	16981

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Date	River (ft)	Bill. (ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation(ft ³)	ET (ft ³)
06/22/00	724.52	724.58	229325	0	0	0	0
06/23/00	724.11	724.56	223948	0	0	0	0
06/24/00	724.02	724.49	207410	0	0	0	809
06/25/00	723.90	724.48	206010	0	0	0	1617
06/26/00	723.97	724.42	192852	0	0	32344	1617
06/27/00	723.86	724.40	187769	0	0	38409	0
06/28/00	723.81	724.30	164361	0	0	2022	0
06/29/00	723.80	724.38	181977	0	0	0	1617
06/30/00	723.59	724.30	164109	0	0	82487	13353
07/01/00	723.51	724.28	159703	0	0	499	18101
07/02/00	723.51	724.03	104001	0	0	499	18160
07/03/00	723.49	723.98	94155	0	0	499	17229
07/04/00	723.62	723.98	93334	0	0	499	27722
07/05/00	723.65	723.96	89402	0	0	499	15351
07/06/00	724.87	724.09	117246	158763	0	499	10526
07/07/00	724.40	724.16	133445	59816	0	499	21472
07/08/00	723.95	724.10	119884	0	0	40539	23882
07/09/00	723.72	724.05	109219	0	0	499	20487
07/10/00	723.61	724.00	97223	0	0	499	19836
07/11/00	723.54	723.97	91613	0	0	499	19389
07/12/00	723.52	723.94	84165	0	0	499	16688
07/13/00	723.52	723.86	66646	0	0	499	7229
07/14/00	723.51	723.80	55164	0	0	499	19703
07/15/00	723.76	723.84	62001	0	0	499	37340
07/16/00	723.77	723.90	75121	0	0	499	33795
07/17/00	723.46	723.85	65338	0	0	499	26875
07/18/00	724.01	723.80	54256	25257	0	9397	26109
07/19/00	723.86	723.80	54256	8215	0	29735	19418
07/20/00	723.71	723.80	54256	0	0	29735	17661
07/21/00	723.62	723.87	69852	0	0	499	18559
07/22/00	723.52	723.85	65408	0	0	499	13146
07/23/00	723.46	723.85	65009	0	0	499	23169
07/24/00	723.46	723.80	54256	0	0	499	15560
07/25/00	723.46	723.80	54256	0	0	499	14148
07/26/00	723.46	723.80	54256	0	0	499	15928
07/27/00	723.46	723.80	54256	0	0	499	14678
07/28/00	723.46	723.80	54256	0	0	499	14345
07/29/00	723.46	723.80	54256	0	0	499	14012
07/30/00	723.46	723.80	54256	0	0	499	13679
07/31/00	723.46	723.80	54256	0	0	499	9505
08/01/00	723.47	723.80	54256	0	0	499	8482
08/02/00	723.43	723.80	54256	0	0	499	6351
08/03/00	723.43	723.80	54256	0	0	499	4168
08/04/00	723.44	723.80	54256	0	0	499	4428
08/05/00	723.45	723.80	54256	0	0	499	11065
08/06/00	723.51	723.80	54256	0	0	499	10625
08/07/00	723.75	723.80	54256	0	0	499	6703
08/08/00	723.72	723.80	54256	0	0	499	6640

Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation (ft ³)	ET (ft ³)
08/09/00	723.51	723.80	54256	0	0	499	11849
08/10/00	723.53	723.80	54256	0	0	499	11212
08/11/00	723.60	723.80	54256	0	0	499	17549
08/12/00	723.76	723.80	54256	0	0	1770	12066
08/13/00	723.57	723.80	54256	0	0	499	16095
08/14/00	723.47	723.80	54256	0	0	499	9074
08/15/00	723.47	723.80	54256	0	0	499	14087
08/16/00	723.46	723.80	54256	0	0	499	21065
08/17/00	723.46	723.80	54256	0	0	499	30991
08/18/00	723.83	723.80	54256	4911	0	499	20562
08/19/00	724.13	723.87	69358	37628	0	499	18039
08/20/00	723.94	723.86	67990	13106	0	499	15198
08/21/00	724.01	723.86	67167	21902	0	499	7281
08/22/00	723.51	723.84	62975	0	0	499	6544
08/23/00	723.47	723.86	67167	0	0	499	5935
08/24/00	723.47	723.86	67393	0	0	499	6067
08/25/00	723.47	723.85	65804	0	0	499	8069
08/26/00	723.47	723.86	67167	0	0	499	8253
08/27/00	723.47	723.86	67167	0	0	499	7451
08/28/00	723.47	723.86	67167	0	0	499	7358
08/29/00	723.47	723.86	67167	0	0	499	7264
08/30/00	723.47	723.86	67167	0	0	499	7171
08/31/00	723.47	723.86	67167	0	0	0	3234
09/01/00	723.46	723.80	54256	0	0	0	10512
09/02/00	723.45	723.79	52114	0	0	0	1617
09/03/00	723.46	723.79	52114	0	0	0	3234
09/04/00	723.46	723.79	52114	0	0	0	8895
09/05/00	723.46	723.79	52114	0	0	46495	20215
09/06/00	723.46	723.79	52114	0	0	0	809
09/07/00	723.41	723.79	52114	0	0	0	0
09/08/00	723.49	723.79	52114	0	0	0	1617
09/09/00	723.49	723.79	52114	0	0	0	0
09/10/00	723.41	723.79	52114	0	0	0	35579
09/11/00	723.42	723.79	52114	0	0	0	0
09/12/00	723.43	723.79	52114	0	0	0	0
09/13/00	723.52	723.79	52114	0	0	0	12129
09/14/00	723.57	723.79	52114	0	0	0	5660
09/15/00	723.44	723.79	52114	0	0	0	5660
09/16/00	723.43	723.79	52114	0	0	0	2426
09/17/00	723.41	723.80	54256	0	0	0	5660
09/18/00	723.41	723.80	54256	0	0	6065	25876
09/19/00	723.41	723.80	54256	0	0	1348	4852
09/20/00	723.41	723.80	54256	0	0	0	4043
09/21/00	723.67	723.80	54256	0	0	0	26684
09/22/00	723.60	723.80	54256	0	0	0	2426
09/23/00	723.48	723.80	54256	0	0	0	1617
09/24/00	723.71	723.80	54256	0	0	0	5660
09/25/00	723.97	724.02	101536	0	0	2695	809
09/26/00	723.63	724.03	105025	0	0	0	7278

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Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation (ft ³)	ET (ft ³)
09/25/00	723.97	724.02	101536	0	0	2695	809
09/26/00	723.63	724.03	105025	0	0	0	7278
09/27/00	723.62	724.06	110521	0	0	50538	0
09/28/00	723.65	724.05	108140	0	0	2695	0
09/29/00	723.69	723.97	91283	0	0	0	0
09/30/00	723.74	723.89	72650	0	0	0	1617
10/01/00	723.42	723.98	93962	0	0	0	809
10/02/00	723.41	723.96	88038	0	0	3369	0
10/03/00	723.41	723.90	75715	0	0	2695	809
10/04/00	723.41	723.87	68665	0	0	0	0
10/05/00	723.44	723.86	67980	0	0	0	1617
10/06/00	724.14	723.97	91571	31683	0	0	50134
10/07/00	724.42	724.21	144303	58949	559	8086	57411
10/08/00	724.20	724.30	164457	0	0	20889	0
10/09/00	723.68	724.27	158321	0	0	5391	6469
10/10/00	723.49	724.21	143815	0	0	0	35579
10/11/00	723.46	724.18	138421	0	0	0	1617
10/12/00	723.44	724.17	135293	0	0	24258	0
10/13/00	723.45	724.17	134343	0	0	0	52560
10/14/00	723.65	724.13	127138	0	0	0	5660
10/15/00	723.66	724.09	117017	0	0	0	2426
10/16/00	723.47	724.06	111254	0	0	8086	809
10/17/00	723.45	724.02	101442	0	0	674	0
10/18/00	723.61	724.06	110124	0	0	0	1617
10/19/00	723.50	724.07	114199	0	0	0	28301
10/20/00	723.44	724.06	111772	0	0	0	1617
10/21/00	723.42	724.02	102612	0	0	0	0
10/22/00	723.43	723.99	95841	0	0	2022	0
10/23/00	723.43	723.95	86933	0	0	0	0
10/24/00	723.45	723.92	79252	0	0	0	0
10/25/00	723.45	723.90	76119	0	0	0	1617
10/26/00	723.45	723.90	75828	0	0	0	809
10/27/00	723.45	723.90	75828	0	0	0	809
10/28/00	723.45	723.90	75828	0	0	0	2426
10/29/00	723.45	723.90	75828	0	0	0	1617
10/30/00	723.45	723.90	75828	0	0	0	12938
10/31/00	723.45	723.90	75105	0	0	0	0
11/01/00	723.48	723.86	66692	0	0	81535	809
11/02/00	723.49	723.84	62798	0	0	5391	0
11/03/00	723.49	723.83	60378	0	0	0	0
11/04/00	723.51	723.86	66789	0	0	0	0
11/05/00	723.51	723.85	65009	0	0	0	1617
11/06/00	723.46	723.85	65009	0	0	0	0
11/07/00	723.46	723.80	54256	0	0	0	1617
11/08/00	723.46	723.80	54256	0	0	0	2426
11/09/00	723.45	723.80	54256	0	0	0	0
11/10/00	723.58	723.84	62403	0	0	0	0
11/11/00	723.91	723.88	70426	8036	0	0	0
11/12/00	723.80	723.88	70606	0	0	0	0

Date	River (ft)	Bill.(ft)	Volume (ft ³)	Inflow (ft ³)	Outflow (ft ³)	Precipitation(ft ³)	ET (ft ³)
11/13/00	723.71	723.87	69385	0	0	0	14555
11/15/00	723.89	723.88	70860	4873	0	0	4043
11/16/00	724.17	723.85	65199	42923	0	0	0
11/17/00	723.60	723.88	72334	0	0	0	3234
11/18/00	723.57	723.89	72645	0	0	674	0
11/19/00	723.66	723.90	75155	0	0	2695	0
11/20/00	723.64	723.88	71941	0	0	0	0
11/21/00	723.61	723.74	40955	0	0	0	1617
11/22/00	723.61	723.88	71492	0	0	0	7278
11/23/00	723.61	723.88	71492	0	0	2022	0
11/24/00	723.61	723.88	71492	0	0	4043	0
11/25/00	723.61	723.88	71492	0	0	27628	0
11/26/00	723.61	723.88	71492	0	0	0	0
11/27/00	723.61	723.88	71492	0	0	0	3234
11/28/00	723.61	723.88	71492	0	0	0	809
11/29/00	723.61	723.88	71492	0	0	0	3234
11/30/00	723.61	723.88	71492	0	0	0	0
12/01/00	723.92	723.77	48011	16668	0	0	0
12/02/00	724.06	723.80	54654	30821	0	0	0
12/03/00	723.75	723.82	57835	0	0	0	0
12/04/00	723.65	723.79	53014	0	0	18194	0
12/05/00	723.60	723.79	53125	0	0	0	0
12/06/00	723.53	723.81	56062	0	0	0	0
12/07/00	723.51	723.80	54256	0	0	674	0
12/08/00	723.47	723.80	54256	0	0	0	1617
12/09/00	723.44	723.80	54256	0	0	42452	0
12/10/00	723.47	723.80	54256	0	0	0	0
12/11/00	723.31	723.80	53826	0	0	16172	0
12/12/00	723.55	723.76	45445	0	0	10781	0
12/13/00	723.90	723.75	43635	16216	0	74797	0
12/14/00	724.06	723.81	56701	29968	0	674	0
12/15/00	724.19	723.85	64447	45224	0	0	0
12/16/00	724.06	723.82	58018	30922	0	0	0
12/17/00	726.51	724.16	134256	440294	0	0	0
12/18/00	725.26	724.26	155702	236779	7790	0	0
12/19/00	724.40	724.26	155710	47334	7797	5391	0
12/20/00	725.88	724.26	155718	345208	7804	0	0
12/21/00	726.03	724.26	155726	370266	7810	0	6469
12/22/00	724.21	724.26	155734	0	0	0	2426
12/23/00	723.73	724.26	155742	0	0	0	1617
12/24/00	723.70	724.26	155751	0	0	0	2426
12/25/00	723.70	724.26	155759	0	0	0	0
12/26/00	723.57	724.26	155767	0	0	0	0
12/27/00	723.53	724.26	155775	0	0	0	0
12/28/00	723.73	724.26	155783	0	0	6065	1617
12/29/00	724.04	724.26	155791	0	0	0	1617
12/30/00	724.00	724.26	155699	0	0	0	0
12/31/00	724.00	724.26	155699	0	0	0	0

