- WASTEWATER TREATMENT SYSTEM

A. Background

1. History

The original on-site wastewater treatment system installed at the time the facility was first constructed in 1961 began failing in the late 1960's. A replacement system was constructed in 1971. The 1971 system consisted of two septic tanks and dual alternating drainfield cells. In 1990 a third drainfield cell was added along with a new septic tank, grease interceptor, dose tank and valve vault. By the late 1990's the combined 1971 & 1990 system started to exhibit indicators of stress and potential failure such as water ponding in some portions of the active cells.

2. Existing System Description

Wastewater from the facility discharges from two separate points at the building. The flow from the kitchen discharges through a grease interceptor prior to connecting to the main sewer outfall from the building. The function of the grease interceptor is to remove as much of the fats, oil & grease from the kitchen wastes as possible to prevent transportation of these compounds into the downstream portions of the septic system. These compounds are particularly harmful when they are discharged to the drainfield where they will plug up the soil pores and drastically reduce the soil infiltration capabilities.

The combined flow of kitchen wastes and main building flows then discharges to a series of 2 – 6,000 gallon septic tanks. The septic tanks trap the solids and floatable material and the effluent or "gray water" discharges to a dose chamber where duplex pumps alternately transport the water to two of the three available drainfields. The drainfields consist of a north and a south cell which are part of the 1971 installation and a third cell installed in 1990. Routine operation of the system includes a rotation of the cells so that there are always two active cells receiving effluent and one cell resting. Staff rotates the resting/active cells on a regular basis. Records indicate that the normal routine has been to rotate cells 3 to 4 times per year. Cells are rotated by operating valves in the valve vault installed in 1990. The drainfield dosing pump records are included in **Appendix G**.

3. Operational Issues

Observation ports or tubes located in each of the cells are monitored periodically for observation of water ponding within the drainfield. Water levels, if observed, are recorded. The frequency of cell rotation is increased

based on the severity of the water depth observed and the number of ports found with water in them. More frequent water ponding and an increase in the depth of the water indicate soil infiltrative capacities are being exceeded. Ponding of water in a drainfield is generally the result of two possible conditions:

1) a biomat formation at the gravel/soil interface which affects the infiltrative capacity of the soil or;
2) the application of more water than the soil is capable of hydraulically transmitting away from the drainfield.

Condition No. 1, a biomat, is a normally occurring event within any drainfield that has standard strength septic tank effluent discharged to it. The formation of a biomat is going to happen in all drainfields at some time in their life span. The degree of thickness or permeability associated with the biomat is dependent on the wastewater strength, the amount of oxygen available for decomposition, the volume of water applied and the rest cycles built into the operation of the system.

Condition No. 2 results from more water use in the facility served than anticipated during the design stage of the system. The design capacity of this system, when two cells are operating was calculated to be 10,000 gallons per day. Water meter readings and dose pump run time meters indicate that the system is currently being loaded at a rate equivalent to 200% to 250% of original design capacity.

While still a functioning system it is only a matter of time before the drainfield will no longer accept the current flows and start to cause backups into the building or eruptions of untreated effluent on to the ground surface. At that time the only acceptable method of treatment at least for the short term will be to pump and haul the wastewater to the nearest municipal facility for treatment and disposal.

B. Previous Studies

1. A study conducted by Ayres & Associates in 1988 evaluated the wastewater disposal system. The study reviewed water usage, wastewater characteristics, soils and topography, and subsurface drainage. The recommendations from that study included a water reduction plan, maintenance suggestions and the addition of a third drainfield cell at the site. The daily design flow of the system was set at 10,000 gal/day, which included an assumed reduction in flow due to implementation of the recommendations. The third cell was

installed in 1990 and for a short period of time there was some flow reduction from the facility.

2. In 1998 Ayres & Associates conducted another study to evaluate potential replacement options for the BRCC system. Presumably this study was conducted because of fears of failure of the combined 1971 & 1990 systems. This study evaluated a number of alternatives for wastewater treatment including land application, both surface and subsurface, and regional treatment options with discharge to nearby Morrison Creek. Regional treatment alternatives included aerated lagoons and stabilization ponds, constructed wetlands and fixed film reactors such as peat filters and sand filters. The recommended replacement system for BRCC was for subsurface drip irrigation. The design flow identified in the report was to be 25,000 gallons per day based on a presumption that inmate population would increase to 175 and the daily flow would remain at 110 gal/person/day plus a peaking factor of 1.3.

C. Regulatory Requirements

1. At the time of the 1998 study the regulatory and jurisdictional issues surrounding high flow facilities, such as BRCC, were in an ever changing environment. In recent years the role of both DNR and the Department of Commerce has become somewhat clearer as far a jurisdictional requirements, design review and treatment options that can be employed in large flow situations. Facilities with a single discharge of greater than 12,000 gallons per day, discharging to the groundwater, must address wastewater strength reduction aimed at meeting NR 140 groundwater standards. DNR has reviewed and approved certain treatment processes and methods that will meet discharge standards. A system design which utilizes one of the approved technologies must be used in the treatment system design.

2. The review process for system designs over 12,000 gal/day includes a review by both agencies. DNR reviews the basic concept of the treatment process for conformation with desired treatment goals and issues either a general or individual discharge permit for the facility on a case by case basis. The Department of Commerce reviews the plans for conformity to COMM 83 and Component Manual requirements.

3. The 1998 Ayres study recommended alternative was to replace the current system with a subsurface drip irrigation system. This alternative is still valid today but a more aggressive pretreatment of the wastewater with one of the DNR approved technologies must be included in the system design.

D. Summary and Recommendations

1. The wastewater system at BRCC is nearing 20 years old in portions of the system and two of the drainfield cells are almost 30 years old. The normal design life for the dispersal component of a septic system is 20 years. When advanced treatment alternatives are used, such as the alternating drainfields used at BRCC, the life expectance of a system can be increased substantially. When allowed to rest, the infiltrative surface of the cell has a chance to dry out and rejuvenate itself through a natural breakdown of the biomat. Assuming that the design flow levels are never or rarely exceeded, this method of designing a septic system has proven benefits and has increased longevity. At BRCC the current discharge flows have increased to twice the original design flow (21,600 gpd vs. 10,000 gpd) resulting in increasing evidence that the infiltrative capacity of the soil has been exceeded.

2. Alternative evaluation, final selection, design and construction of a replacement treatment system should be implemented as soon as possible. Currently the average daily flow at BRCC is 21,600 gal/day. Alternatives evaluated in the Ayres 1998 study could be reviewed and their viability evaluated based on present day conditions and regulatory requirements. If the final treatment system alternative selected is an on-site subsurface discharge system as it was in 1998, the recommended daily design flow should be equal to the current average flow plus a 1.5 peaking factor. Department of Commerce rules for septic system design require the use of either code derived estimated flows or water meter recorded flows times 150% to allow for peaks, surges and potential future growth. If the water usage at BRCC remains stable at 21,600 gal/day average flow then the design flow for a replacement system should be equal to 21,600 gpd x 1.5 or 32,400 gallons per day minimum.

   Other treatment alternatives that utilize surface water discharge or regional treatment options would be evaluated based on standard acceptable peaking factors for the particular process being evaluated.

An estimate for the proposed improvement is included in **Appendix H**.

Appendix G

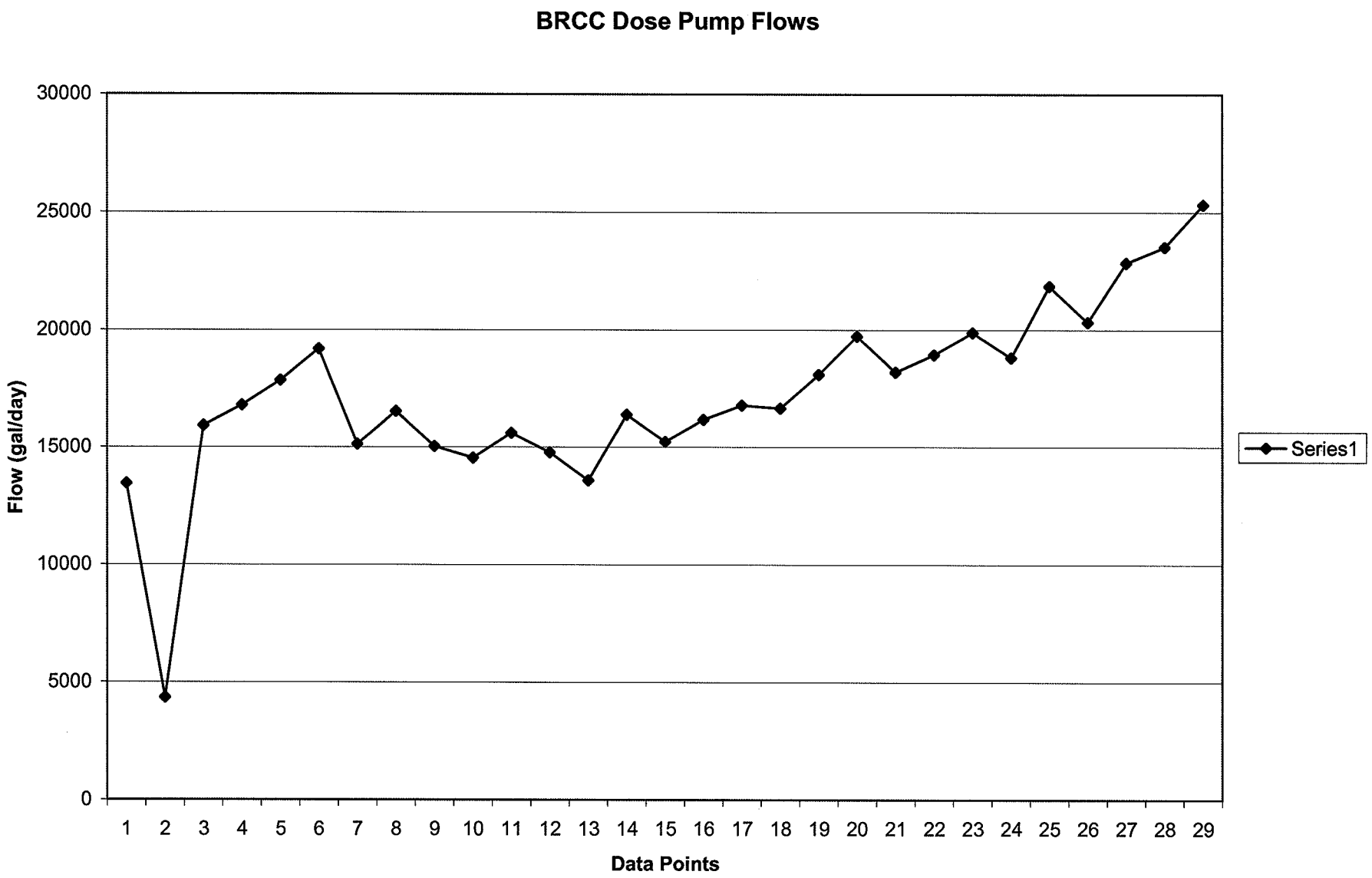
Drainfield Dosing Pump Records

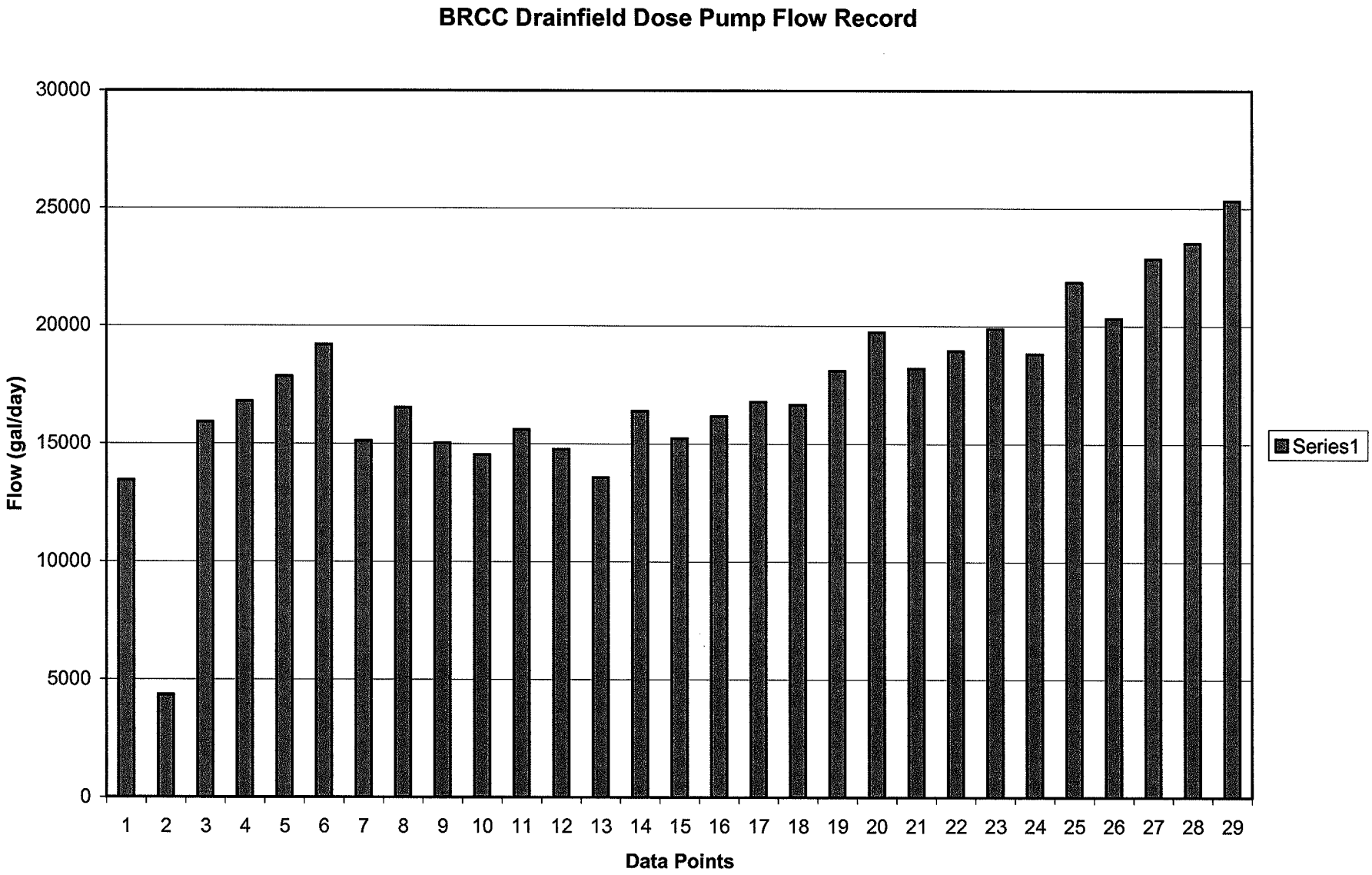
Black River Correctional Center
Drainfield Dose Pump Record

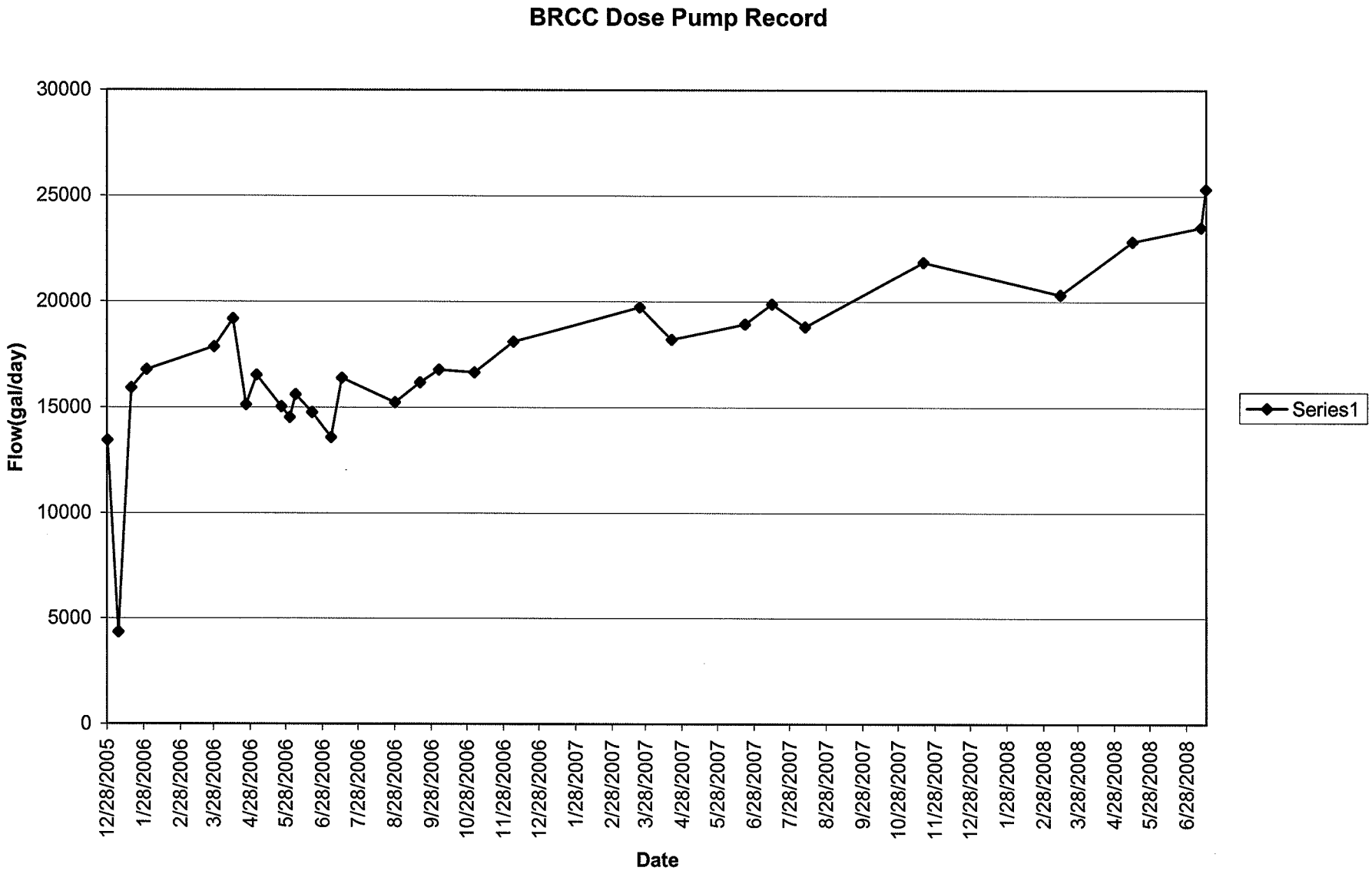
		Pump 1				Pump 2					
Date	RTM reading (hrs.)	Elapsed Time (min.)	no. of days	minutes (/day)	RTM reading	Elapsed Time (hrs.)	no. of days (min.)	minutes (/day)	Combined run time (min.)	Pump Flow Rate*	Flow/day
12/28/2005	2009.43				2059.65						
1/6/2006			9	0	2065.41	345.6	9	38.4	38.4	350	13440
1/17/2006			42	0	2074.10	521.4	42	12.4	12.4	350	4345
1/30/2006			13	0	2083.95	591.0	13	45.5	45.5	350	15912
3/28/2006			57	0	2129.50	2733.0	57	47.9	47.9	350	16782
4/13/2006			16	0	2143.10	816.0	16	51.0	51.0	350	17850
4/24/2006			9	0	2151.32	493.2	9	54.8	54.8	350	19180
5/3/2006			9	0	2157.80	388.8	9	43.2	43.2	350	15120
5/24/2006			21	0	2174.32	991.2	21	47.2	47.2	350	16520
5/31/2006	2009.99		7	0	2179.33	300.6	7	42.9	42.9	350	15030
6/5/2006	2011.56	94.2	5	18.8	2181.22	113.4	5	22.7	41.5	350	14532
6/19/2006	2016.60	302.4	14	21.6	2186.58	321.6	14	23.0	44.6	350	15600
7/5/2006	2021.72	307.2	16	19.2	2192.71	367.8	16	23.0	42.2	350	14766
7/14/2006	2024.50	166.8	9	18.5	2195.75	182.4	9	20.3	38.8	350	13580
8/28/2006	2041.50	1020.0	45	22.7	2213.85	1086.0	45	24.1	46.8	350	16380
9/18/2006	2048.35	411.0	21	19.6	2222.23	502.8	21	23.9	43.5	350	15230
10/4/2006	2053.85	330.0	16	20.6	2229.05	409.2	16	25.6	46.2	350	16170
11/3/2006	2064.20	621.0	30	20.7	2242.67	817.2	30	27.2	47.9	350	16779
12/6/2006	2076.05	711.0	32	22.2	2256.19	811.2	32	25.4	47.6	350	16649
3/23/2007	2116.90	2451.0	107	22.9	2307.52	3079.8	107	28.8	51.7	350	18091
4/19/2007	2128.02	667.2	27	24.7	2321.76	854.4	27	31.6	56.4	350	19724
6/20/2007	2153.00	1498.8	62	24.2	2350.50	1724.4	62	27.8	52.0	350	18195
7/13/2007	2162.89	593.4	23	25.8	2361.35	651.0	23	28.3	54.1	350	18937
8/10/2007	2174.90	720.6	28	25.7	2375.85	870.0	28	31.1	56.8	350	19883
11/18/2007	2218.90	2640.0	100	26.4	2421.40	2733.0	100	27.3	53.7	350	18806
3/13/2008	2271.25	3141.0	116	27.1	2489.78	4102.8	116	35.4	62.4	350	21856
5/13/2008	2297.31	1563.6	61	25.6	2522.76	1978.8	61	32.4	58.1	350	20325
7/10/2008	2325.02	1662.6	58	28.7	2558.15	2123.4	58	36.6	65.3	350	22847
7/14/2008	2327.00	118.8	4	29.7	2560.65	150.0	4	37.5	67.2	350	23520
11/11/2008	2389.72	3763.2	119	31.6	2641.41	4845.6	119	40.7	72.3	350	25320

*1991 system construction manual req'd 285 gpm @ 16.3 ft. TDH

both pumps replaced Oct, 2005, no record of calibration found, pump catalog cut sheet shows a capacity of 350 gpm @ 16' TDH


BRCC Dose Pump Flows
30000
25000
20000
15000
10000
5000
0
Flow (gal/day)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Data Points
Series1


BRCC Drainfield Dose Pump Flow Record
Flow (gal/day)
30000
25000
20000
15000
10000
5000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Data Points
Series1


BRCC Dose Pump Record
Flow(gal/day)
30000
25000
20000
15000
10000
5000
0
12/28/2005
1/28/2006
2/28/2006
3/28/2006
4/28/2006
5/28/2006
6/28/2006
7/28/2006
8/28/2006
9/28/2006
10/28/2006
11/28/2006
12/28/2006
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2/28/2007
3/28/2007
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6/28/2007
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8/28/2007
9/28/2007
10/28/2007
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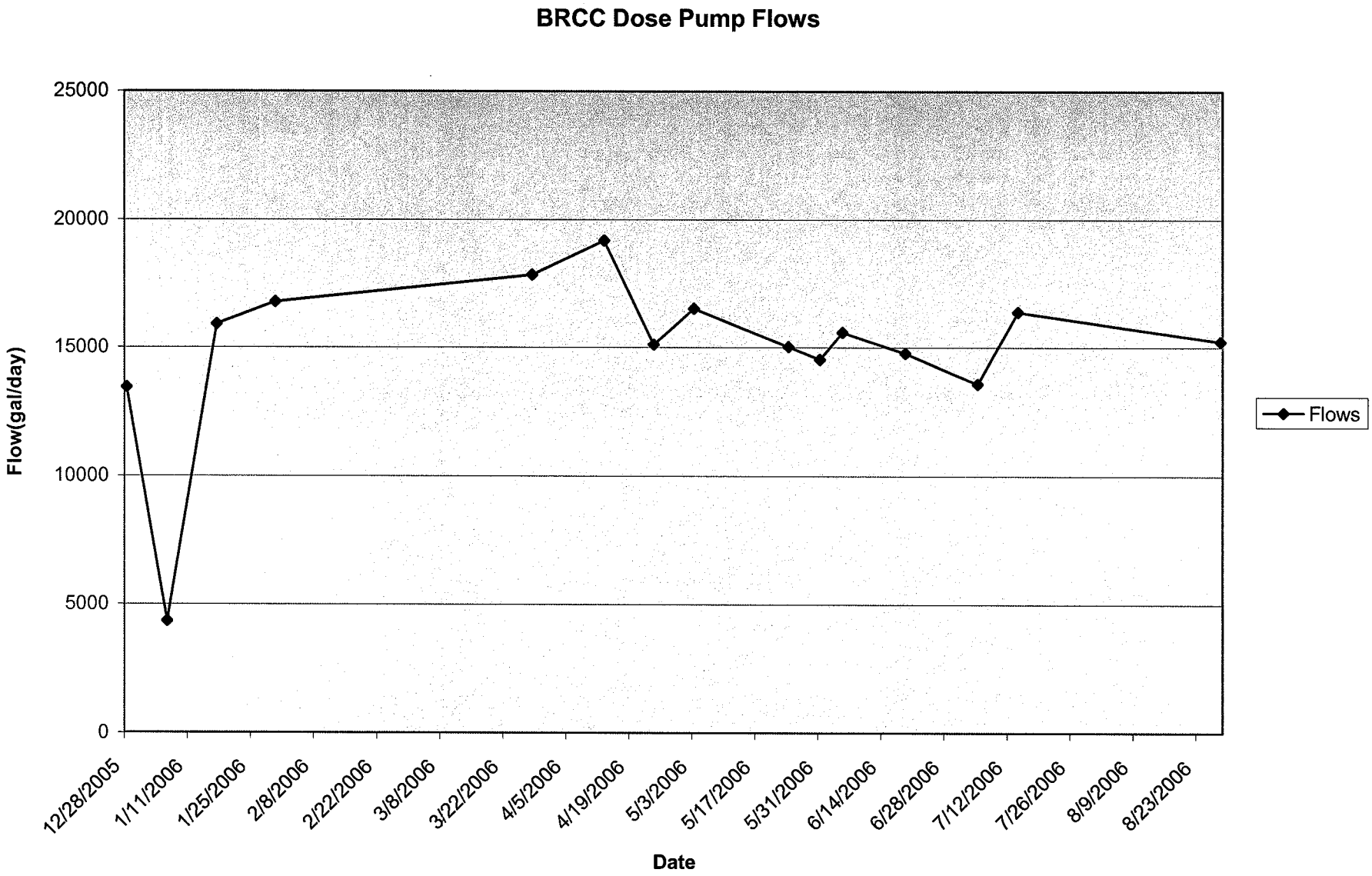
6/28/2008
Date
Series1


BRCC Dose Pump Flows
25000
20000
15000
10000
5000
0
Flow(gal/day)
12/28/2005
1/11/2006
1/25/2006
2/8/2006
2/22/2006
3/8/2006
3/22/2006
4/5/2006
4/19/2006
5/3/2006
5/17/2006
5/31/2006
6/14/2006
6/28/2006
7/12/2006
7/26/2006
8/9/2006
8/23/2006
Date
Flows