



**REPORT OF BIOLOGICAL OXYGEN DEMAND ANALYSES PERFORMED
ON VARIOUS AGRICULTURAL WASTE STREAMS**

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I. METHODOLOGY

1. General Procedure

The procedure used for determination of Biological Oxygen Demand followed the general methodology for the unseeded dilution procedure described in the Analytical Methods Manual prepared by Environment Canada (Anon. 1980) and the Standard Methods Manual for the Examination of Water and Wastewater prepared by the American Public Health Association, Inc (Anon., 1966). Samples were diluted to varying degrees depending on their BOD potential with a specially prepared dilution water. The dissolved oxygen content of this mixture was then determined 15 min after dilution and again after five days. The difference in these values, corrected for dilution, is reported as the five day BOD (BOD_5).

2. Preparation of Dilution Water

Dilution water was prepared using distilled water from a Barnstead Sybron Glass Still. Prior to making the dilution water the distilled water was saturated with oxygen by bubbling compressed air into the water until the dissolved oxygen content of the water was >8.0 mg/l. The purpose for this was to insure that an adequate supply of oxygen was present in the dilution water and to minimize changes in dissolved oxygen content that might occur during the dilution process if the water was not oxygen saturated. One ml of each of the following solutions was added to each liter of dilution water (these solutions contain all the trace elements in sufficient quantity to ensure that bacterial metabolism is not limited by inorganic nutrient availability):

i) Phosphate Buffer Solution: 8.50 g potassium dihydrogen phosphate (KH_2PO_4), 21.75 g dipotassium hydrogen phosphate (K_2HPO_4), 33.40 disodium hydrogen phosphate heptahydrate ($Na_2HPO_4 \cdot 7H_2O$), and 1.70 g ammonium chloride (NH_4Cl) was dissolved in 500 ml of distilled water and then diluted to 1 liter.

ii) Magnesium sulphate solution: 22.50 g magnesium sulphate ($MgSO_4 \cdot 7H_2O$) was dissolved in distilled water and diluted to 1 liter.

iii) Calcium chloride solution: 27.5 g anhydrous calcium chloride ($CaCl_2$) was dissolved in distilled water and diluted to 1 liter.

iv) Ferric chloride solution: 0.25 g ferric chloride ($FeCl_3 \cdot 6H_2O$) was dissolved in distilled water and diluted to 1 liter.

3. Pretreatment of Samples

Samples arrived at the laboratory in 1 liter high density polyethylene bottles and were stored at room temperature until they were processed (usually within 1 hr and never more than 2 hrs after arriving at the lab). The first two times (three times for the H-series samples) samples from a particular site were processed, they were tested for chlorine residuals which could potentially interfere with biodegradation. The test consisted of adding 10 ml of 1+50 H_2SO_4 followed by 10 ml of a potassium iodide solution (10 g in 100 ml distilled H_2O) to a 100ml portion of the sample, and titrating with a sodium sulfite solution (1.575g Na_2SO_3 in 1 l distilled H_2O). No chlorine residuals were found in any of the samples and this test was not conducted on further samples.

4. BOD Incubations and Measurement

An appropriate volume of sample (determined by trial and error - see below) was diluted to 2 l with dilution water. The dilution took place in a 5 l plastic bucket, and mixing was accomplished by stirring with a steel spoon. The diluted sample was siphoned into 6 BOD bottles which were then stoppered. The dissolved oxygen content of three of the bottles was determined after 15 min (measured from the time the sample and the dilution water were mixed) and the results recorded as the initial oxygen value. (The 15 min waiting period is required to discount the immediate chemical oxygen demand, caused by the presence of reduced inorganic substances such as sulfite and ferrous compounds.) The remaining three BOD bottles were incubated for 5 days at 20 °C after which the dissolved oxygen content was determined and recorded. This value was used as the final oxygen value. The above procedure was repeated three times for each sample and at three different dilutions. Three different dilutions were required to ensure that at least one dilution was in the range suitable for calculating BOD.

5. Determination of Dissolved Oxygen Concentration

The concentration of dissolved oxygen in the samples was determined using the modified Winkler method. Two ml of manganous sulfate reagent followed by 2 ml of alkaline iodide was added to each bottle. The stopper was replaced in the bottle, the bottle vigorously shaken, allowed to stand until the resulting precipitate had settled at least one third the way down the bottle, shaken again, and again allowed to stand until the precipitate had again settled at least one third the way down the bottle. Then 2 ml of concentrated sulfuric acid was added to each bottle, the stopper replaced and the bottle vigorously shaken until the precipitate completely dissolved. One hundred ml of sample was then transferred from the BOD bottle to a 250 ml Erlenmeyer flask and a few drops of starch indicator solution was added to the flask. The solution was titrated to a colorless endpoint using 0.025N phenylarsine oxide (PAO).

6. BOD₅ Calculations

The BOD₅ was calculated as the difference between the mean dissolved oxygen concentration of the 15 min bottles and the mean dissolved oxygen concentration in the 5 day bottles divided by the dilution factor (expressed as the percent volume of actual sample in the solution after dilution), all multiplied by 100:

$$\text{BOD}_5 \text{ (mg/l)} = (\text{mean 15 min DO} - \text{mean 5 day DO}) \times 100/\text{dil. fact.}$$

Variances were calculated as:

$$\text{var BOD}_5 \text{ (mg/l)} = (\text{var 15 min DO} + \text{var 5 day DO}) \times 100/\text{dil. fact.}$$

(This variance is to be interpreted as a measure of experimental error and not as sample variance as the replicates are repeated measures on a single sample and not replicate samples.)

As more than one concentration was run on each sample, it was necessary to choose an appropriate dilution for the calculations. A selection criteria of a 5 day DO > 1 mg/l and a five day DO consumption > 1 mg/l was used to eliminate samples with dilutions that were not suitable for calculating BOD₅. If more than one dilution met the criteria the results of the acceptable dilutions were averaged.

7. Calculation of L and K Factors

Theoretical ultimate BODs (L) and the BOD rate constant (K) were estimated for one sample from each series by calculating one day, two day, three day, four day and five day BODs for each sample. L provides information on the maximum oxygen consumption that would occur if the waste material were completely degraded. K provides information about the nature of the material that is being degraded. (Simple sugars and starches are broken down quite rapidly and therefore yield high K values. Less biologically labile substances, such as cellulose and lignins, break down much more slowly and therefore yield lower K values.) The L and K parameters were obtained by fitting the results to the following equation:

$$\text{BOD}_t = L \times (1 - 10^{-Kt}) \quad \text{where,}$$

t = time (days)

BOD_t = BOD at any time t (mg/l)

L = ultimate BOD (mg/l)

K = BOD rate constant (days⁻¹)

L and K were estimated for samples C1, H3, M2 and K1. Graphs of the BOD curve for these samples, together with the corresponding L and K values, are presented in Figure 1.

II. RESULTS

A total of 31 samples arrived at the laboratory between July 1 and Nov. 1, 1993. These samples were collected at four sites: C (6 samples), H (9 samples), K (5 samples) and M (10 samples). BOD₅s were calculated for most of these samples and a summary of the results are presented in Table 1. Note that for samples H1 and M1 (the first day we attempted to measure BODs) the dilution factors chosen were too high causing the samples to go anaerobic before 5 days and we were therefore unable to calculate BODs for these samples. The M5 sample was contaminated in the laboratory so there are no results for this sample. Sample H2 went anaerobic on the 5th day so its result is presented as greater than the 4 day BOD. Samples H4 and M4 were processed in error after only 4 days and those results are also presented as greater than the 4 day BOD. All of the raw data collected during this project is presented in the Appendix.

Table 1. Summary of BOD analyses.

SAMPLE NUMBER	DATE	BOD ₅ (mg/l)	
		Mean	Variance
C1	July 17, 1993	1950.0	38.8
C2	July 29, 1993	3260.0	1.5
C3	Aug. 21, 1993	2376.7	17.5
C4	Sept. 28, 1993	1126.7	97.7 *
C5	Oct. 22, 1993	308.7	9.2
C6	Oct. 28, 1993	1680.0	20.8 *
C7	Nov. 1, 1993	1013.3	34.3 *
H1	July 1, 1993	no reading	
H2	July 7, 1993	>854.7	-
H3	July 21, 1993	345.3	11.8
H4	Aug. 9, 1993	>646.7	-
H5	Aug. 19, 1993	379.3	4.7
H6	Sept. 1, 1993	44.3	0.4
H7	Sept. 15, 1993	2970.0	43.5
H8	Oct. 17, 1993	1533.3	27.4
H9	Oct. 28, 1993	142.7	0.3 *
K1	Aug. 21, 1993	65.7	0.2 *
K2	Sept. 28, 1993	29.5	0.4
K3	Oct. 22, 1993	47.5	0.1
K4	Oct. 28, 1993	166.0	9.9 *
K5	Nov. 1, 1993	281.3	11.4
M1	July 1, 1993	no reading	
M2	July 7, 1993	5413.3	183.0
M3	July 21, 1993	3773.3	182.1
M4	Aug. 9, 1993	>3653.3	-
M5	Aug. 19, 1993	no reading	
M6	Sept. 1, 1993	3746.7	676.1
M7	Sept. 15, 1993	6601.6	243.8
M8	Sept. 28, 1993	2520.0	279.8
M9	Oct. 15, 1993	5493.3	85.9
M10	Oct. 28, 1993	3488.0	15.3

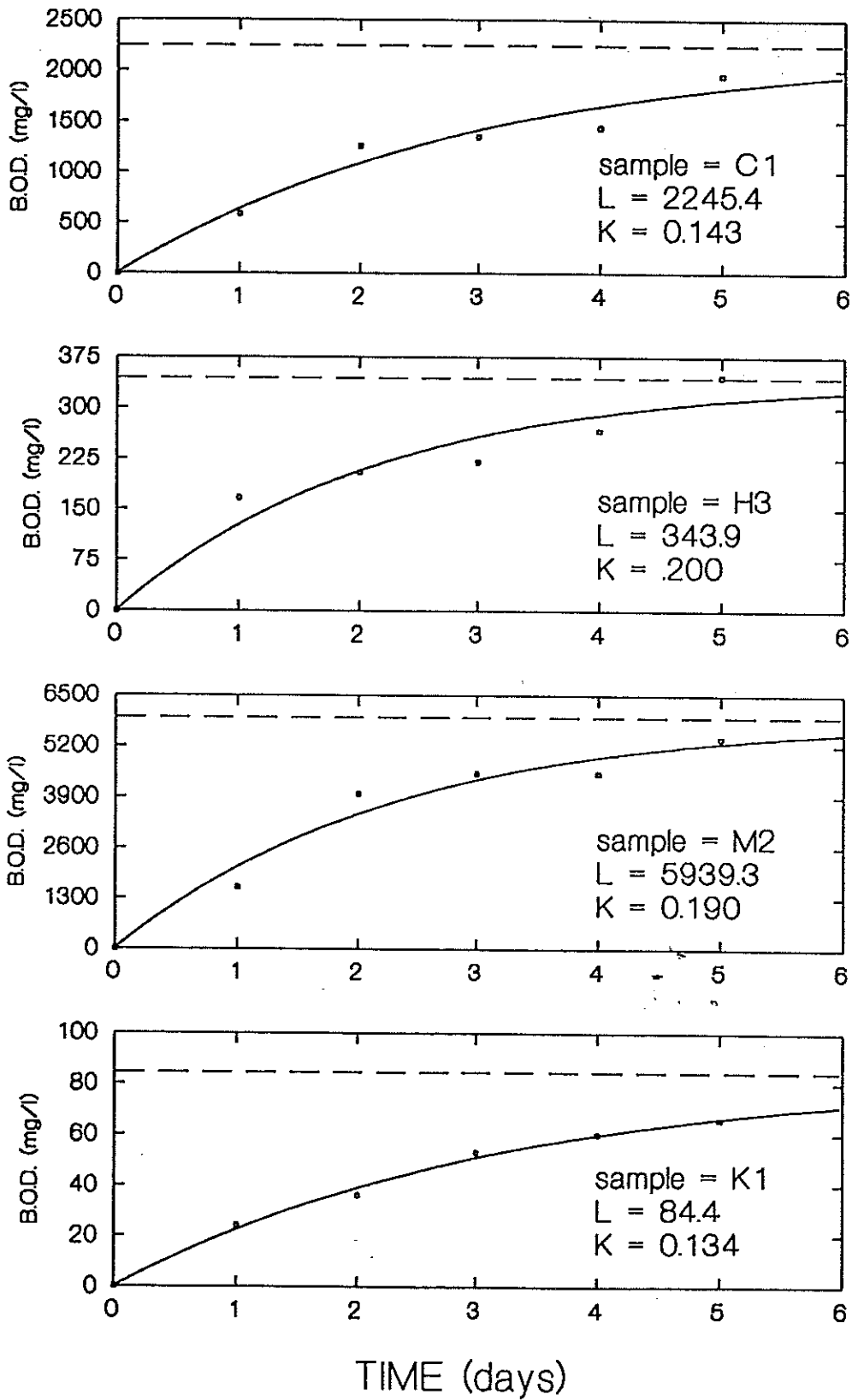


Figure 1

APPENDIX

Raw data collected for the calculation of BODs.

SAMPLE NUMBER	DATE	DILUTION FACTOR	TIME (days)	D0 (mg/l)
cl	930717	0.00	0	7.10
cl	930717	0.00	0	5.88
cl	930717	0.00	0	6.72
cl	930717	0.00	15 min.	7.20
cl	930717	0.00	15 min.	7.18
cl	930717	0.00	15 min.	7.84
cl	930717	0.00	1	6.27
cl	930717	0.00	2	5.74
cl	930717	0.00	3	5.60
cl	930717	0.00	4	5.60
cl	930717	0.00	5	6.38
cl	930717	0.00	5	5.94
cl	930717	0.00	5	5.98
cl	930717	0.05	0	8.04
cl	930717	0.05	0	7.70
cl	930717	0.05	0	7.78
cl	930717	0.05	15 min.	7.62
cl	930717	0.05	15 min.	7.94
cl	930717	0.05	15 min.	7.86
cl	930717	0.05	1	7.60
cl	930717	0.05	2	6.98
cl	930717	0.05	3	6.88
cl	930717	0.05	4	6.88
cl	930717	0.05	5	6.98
cl	930717	0.05	5	6.54
cl	930717	0.05	5	6.88
cl	930717	0.20	0	7.04
cl	930717	0.20	0	7.06
cl	930717	0.20	0	7.52
cl	930717	0.20	15 min.	7.00
cl	930717	0.20	15 min.	7.10
cl	930717	0.20	15 min.	7.38
cl	930717	0.20	1	6.00
cl	930717	0.20	2	4.64
cl	930717	0.20	3	4.48
cl	930717	0.20	4	4.28
cl	930717	0.20	5	3.20
cl	930717	0.20	5	3.10
cl	930717	0.20	5	3.48
cl	930717	1.00	0	5.52
cl	930717	1.00	0	4.88

c1	930717	1.00	0	4.48
c1	930717	1.00	15 min.	6.10
c1	930717	1.00	15 min.	4.98
c1	930717	1.00	15 min.	6.12
c1	930717	1.00	1	0.00
c1	930717	1.00	2	0.00
c1	930717	1.00	3	0.00
c1	930717	1.00	4	0.00
c1	930717	1.00	5	0.00
c1	930717	1.00	5	0.00
c1	930717	1.00	5	0.00
c2	930729	0.00	15 min.	8.60
c2	930729	0.00	15 min.	8.66
c2	930729	0.00	15 min.	8.52
c2	930729	0.00	5	6.32
c2	930729	0.00	5	6.44
c2	930729	0.00	5	6.52
c2	930729	0.05	15 min.	8.42
c2	930729	0.05	15 min.	8.44
c2	930729	0.05	15 min.	8.46
c2	930729	0.05	5	8.22
c2	930729	0.05	5	8.16
c2	930729	0.05	5	8.28
c2	930729	0.20	15 min.	8.16
c2	930729	0.20	15 min.	8.22
c2	930729	0.20	15 min.	8.20
c2	930729	0.20	5	1.70
c2	930729	0.20	5	1.62
c2	930729	0.20	5	1.70
c2	930729	1.00	15 min.	7.16
c2	930729	1.00	15 min.	7.10
c2	930729	1.00	15 min.	7.02
c2	930729	1.00	5	0.00
c2	930729	1.00	5	0.00
c2	930729	1.00	5	0.00
c3	930821	0.05	15 min.	8.54
c3	930821	0.05	15 min.	8.60
c3	930821	0.05	15 min.	8.58
c3	930821	0.05	5	
c3	930821	0.05	5	7.00
c3	930821	0.05	5	7.14
c3	930821	0.20	15 min.	8.22
c3	930821	0.20	15 min.	8.10
c3	930821	0.20	15 min.	8.32
c3	930821	0.20	5	3.62
c3	930821	0.20	5	3.32
c3	930821	0.20	5	3.44

c3	930821	1.00	15 min.	6.64
c3	930821	1.00	15 min.	6.40
c3	930821	1.00	15 min.	6.50
c3	930821	1.00	5	0.00
c3	930821	1.00	5	0.00
c3	930821	1.00	5	0.00
c4	930928	0.10	15 min.	7.72
c4	930928	0.10	15 min.	7.64
c4	930928	0.10	15 min.	7.68
c4	930928	0.10	5	6.78
c4	930928	0.10	5	6.20
c4	930928	0.10	5	6.68
c4	930928	1.00	15 min.	7.26
c4	930928	1.00	15 min.	7.26
c4	930928	1.00	15 min.	7.36
c4	930928	1.00	5	0.00
c4	930928	1.00	5	0.00
c4	930928	1.00	5	0.00
c4	930928	10.00	15 min.	3.72
c4	930928	10.00	15 min.	3.22
c4	930928	10.00	15 min.	3.26
c4	930928	10.00	5	0.00
c4	930928	10.00	5	0.00
c4	930928	10.00	5	0.00
c5	931022	0.05	15 min.	8.42
c5	931022	0.05	15 min.	8.76
c5	931022	0.05	15 min.	8.52
c5	931022	0.05	5	
c5	931022	0.05	5	
c5	931022	0.05	5	
c5	931022	0.20	15 min.	8.30
c5	931022	0.20	15 min.	8.68
c5	931022	0.20	15 min.	8.28
c5	931022	0.20	5	7.66
c5	931022	0.20	5	7.34
c5	931022	0.20	5	7.30
c5	931022	1.00	15 min.	7.68
c5	931022	1.00	15 min.	7.12
c5	931022	1.00	15 min.	7.40
c5	931022	1.00	5	4.36
c5	931022	1.00	5	4.40
c5	931022	1.00	5	4.18
c6	931028	0.00	15 min.	8.24
c6	931028	0.00	15 min.	8.32
c6	931028	0.00	15 min.	8.30
c6	931028	0.00	5	7.02
c6	931028	0.00	5	7.08

c6	931028	0.00	5	7.24
c6	931028	0.10	15 min.	8.16
c6	931028	0.10	15 min.	8.10
c6	931028	0.10	15 min.	8.16
c6	931028	0.10	5	6.32
c6	931028	0.10	5	6.46
c6	931028	0.10	5	6.60
c6	931028	1.00	15 min.	7.54
c6	931028	1.00	15 min.	7.60
c6	931028	1.00	15 min.	7.64
c6	931028	1.00	5	0.00
c6	931028	1.00	5	0.00
c6	931028	1.00	5	0.00
c6	931028	5.00	15 min.	5.76
c6	931028	5.00	15 min.	5.34
c6	931028	5.00	15 min.	5.32
c6	931028	5.00	5	0.00
c6	931028	5.00	5	0.00
c6	931028	5.00	5	0.00
c7	931101	0.10	15 min.	7.96
c7	931101	0.10	15 min.	8.16
c7	931101	0.10	15 min.	7.84
c7	931101	0.10	5	7.06
c7	931101	0.10	5	6.98
c7	931101	0.10	5	6.88
c7	931101	1.00	15 min.	7.02
c7	931101	1.00	15 min.	7.42
c7	931101	1.00	15 min.	6.64
c7	931101	1.00	5	0.00
c7	931101	1.00	5	0.00
c7	931101	1.00	5	0.00
h2	930707	0.00	0	8.62
h2	930707	0.00	0	8.60
h2	930707	0.00	0	8.42
h2	930707	0.00	15 min.	8.04
h2	930707	0.00	15 min.	8.68
h2	930707	0.00	15 min.	8.62
h2	930707	0.00	1	7.96
h2	930707	0.00	2	8.40
h2	930707	0.00	3	7.44
h2	930707	0.00	4	7.54
h2	930707	0.00	5	7.80
h2	930707	0.00	5	8.38
h2	930707	0.00	5	7.78
h2	930707	1.00	0	8.02
h2	930707	1.00	0	8.48
h2	930707	1.00	0	8.32

h2	930707	1.00	15 min.	8.56
h2	930707	1.00	15 min.	8.62
h2	930707	1.00	15 min.	8.52
h2	930707	1.00	1	6.06
h2	930707	1.00	2	1.42
h2	930707	1.00	3	0.64
h2	930707	1.00	4	0.00
h2	930707	1.00	5	0.00
h2	930707	1.00	5	0.06
h2	930707	1.00	5	0.00
h2	930707	3.00	0	8.28
h2	930707	3.00	0	8.14
h2	930707	3.00	0	8.26
h2	930707	3.00	15 min.	8.20
h2	930707	3.00	15 min.	7.98
h2	930707	3.00	15 min.	8.24
h2	930707	3.00	1	0.82
h2	930707	3.00	2	0.00
h2	930707	3.00	3	0.00
h2	930707	3.00	4	0.00
h2	930707	3.00	5	0.00
h2	930707	3.00	5	0.00
h2	930707	3.00	5	0.00
h2	930707	10.00	0	7.22
h2	930707	10.00	0	7.56
h2	930707	10.00	0	7.34
h2	930707	10.00	15 min.	7.04
h2	930707	10.00	15 min.	
h2	930707	10.00	15 min.	7.20
h2	930707	10.00	1	0.00
h2	930707	10.00	2	0.00
h2	930707	10.00	3	
h2	930707	10.00	4	
h2	930707	10.00	5	
h2	930707	10.00	5	
h2	930707	10.00	5	
h3	930721	0.00	0	
h3	930721	0.00	0	8.00
h3	930721	0.00	0	7.88
h3	930721	0.00	15 min.	8.52
h3	930721	0.00	15 min.	8.48
h3	930721	0.00	15 min.	8.54
h3	930721	0.00	1	8.46
h3	930721	0.00	2	8.34
h3	930721	0.00	3	8.46
h3	930721	0.00	4	8.40
h3	930721	0.00	5	8.34

h3	930721	0.00	5	8.44
h3	930721	0.00	5	8.44
h3	930721	0.10	0	8.42
h3	930721	0.10	0	8.40
h3	930721	0.10	0	8.48
h3	930721	0.10	15 min.	8.00
h3	930721	0.10	15 min.	7.62
h3	930721	0.10	15 min.	7.76
h3	930721	0.10	1	8.14
h3	930721	0.10	2	8.16
h3	930721	0.10	3	8.22
h3	930721	0.10	4	7.06
h3	930721	0.10	5	7.78
h3	930721	0.10	5	6.84
h3	930721	0.10	5	7.90
h3	930721	0.30	0	8.48
h3	930721	0.30	0	8.38
h3	930721	0.30	0	8.42
h3	930721	0.30	15 min.	8.36
h3	930721	0.30	15 min.	8.32
h3	930721	0.30	15 min.	8.42
h3	930721	0.30	1	8.16
h3	930721	0.30	2	7.86
h3	930721	0.30	3	7.98
h3	930721	0.30	4	7.74
h3	930721	0.30	5	7.40
h3	930721	0.30	5	6.48
h3	930721	0.30	5	7.26
h3	930721	1.00	0	8.58
h3	930721	1.00	0	8.54
h3	930721	1.00	0	8.48
h3	930721	1.00	15 min.	8.42
h3	930721	1.00	15 min.	8.46
h3	930721	1.00	15 min.	8.52
h3	930721	1.00	1	6.80
h3	930721	1.00	2	6.42
h3	930721	1.00	3	6.26
h3	930721	1.00	4	5.80
h3	930721	1.00	5	5.40
h3	930721	1.00	5	4.76
h3	930721	1.00	5	4.88
h4	930809	0.10	15 min.	7.98
h4	930809	0.10	15 min.	7.98
h4	930809	0.10	15 min.	8.86
h4	930809	0.10	4	7.28
h4	930809	0.10	4	7.36
h4	930809	0.10	4	7.74

h4	930809	1.00	15 min.	8.34
h4	930809	1.00	15 min.	8.54
h4	930809	1.00	15 min.	8.64
h4	930809	1.00	5	2.00
h4	930809	1.00	5	2.08
h4	930809	1.00	5	
h4	930809	1.50	15 min.	8.32
h4	930809	1.50	15 min.	8.30
h4	930809	1.50	15 min.	8.42
h4	930809	1.50	5	0.00
h4	930809	1.50	5	0.00
h4	930809	1.50	5	0.00
h4	930809	5.00	15 min.	8.00
h4	930809	5.00	15 min.	8.10
h4	930809	5.00	15 min.	7.70
h4	930809	5.00	5	0.00
h4	930809	5.00	5	0.00
h4	930809	5.00	5	0.00
h5	930819	0.10	15 min.	8.20
h5	930819	0.10	15 min.	8.12
h5	930819	0.10	15 min.	8.16
h5	930819	0.10	5	7.84
h5	930819	0.10	5	7.52
h5	930819	0.10	5	7.96
h5	930819	1.00	15 min.	8.04
h5	930819	1.00	15 min.	8.02
h5	930819	1.00	15 min.	8.30
h5	930819	1.00	5	4.18
h5	930819	1.00	5	4.32
h5	930819	1.00	5	4.48
h5	930819	2.00	15 min.	7.54
h5	930819	2.00	15 min.	7.62
h5	930819	2.00	15 min.	7.48
h5	930819	2.00	5	0.36
h5	930819	2.00	5	0.48
h5	930819	2.00	5	0.18
h6	930901	0.10	15 min.	9.02
h6	930901	0.10	15 min.	9.14
h6	930901	0.10	15 min.	9.00
h6	930901	0.10	5	8.90
h6	930901	0.10	5	8.70
h6	930901	0.10	5	8.98
h6	930901	1.00	15 min.	8.98
h6	930901	1.00	15 min.	8.96
h6	930901	1.00	15 min.	9.06
h6	930901	1.00	5	7.82
h6	930901	1.00	5	8.36

h6	930901	1.00	5	8.24
h6	930901	5.00	15 min.	8.96
h6	930901	5.00	15 min.	8.84
h6	930901	5.00	15 min.	9.12
h6	930901	5.00	5	6.76
h6	930901	5.00	5	6.80
h6	930901	5.00	5	6.72
h7	930915	0.10	15 min.	7.75
h7	930915	0.10	15 min.	7.72
h7	930915	0.10	15 min.	7.74
h7	930915	0.10	5	5.00
h7	930915	0.10	5	4.60
h7	930915	0.10	5	4.70
h7	930915	1.00	15 min.	7.66
h7	930915	1.00	15 min.	7.55
h7	930915	1.00	15 min.	7.71
h7	930915	1.00	5	0.00
h7	930915	1.00	5	0.00
h7	930915	1.00	5	0.00
h7	930915	2.00	15 min.	7.84
h7	930915	2.00	15 min.	7.81
h7	930915	2.00	15 min.	7.64
h7	930915	2.00	5	0.00
h7	930915	2.00	5	0.00
h7	930915	2.00	5	0.00
h8	931017	0.00	15 min.	8.82
h8	931017	0.00	15 min.	8.72
h8	931017	0.00	15 min.	8.72
h8	931017	0.00	5	7.88
h8	931017	0.00	5	8.08
h8	931017	0.00	5	8.20
h8	931017	0.05	15 min.	8.72
h8	931017	0.05	15 min.	8.76
h8	931017	0.05	15 min.	8.78
h8	931017	0.05	5	7.74
h8	931017	0.05	5	7.48
h8	931017	0.05	5	7.64
h8	931017	0.10	15 min.	8.70
h8	931017	0.10	15 min.	8.76
h8	931017	0.10	15 min.	8.78
h8	931017	0.10	5	7.38
h8	931017	0.10	5	7.20
h8	931017	0.10	5	7.06
h8	931017	1.00	15 min.	8.72
h8	931017	1.00	15 min.	8.72
h8	931017	1.00	15 min.	8.76
h8	931017	1.00	5	6.66

h8	931017	1.00	5	6.72
h8	931017	1.00	5	6.54
h9	931028	0.10	15 min.	8.10
h9	931028	0.10	15 min.	7.94
h9	931028	0.10	15 min.	8.34
h9	931028	0.10	5	7.64
h9	931028	0.10	5	.
h9	931028	1.00	15 min.	7.74
h9	931028	1.00	15 min.	7.76
h9	931028	1.00	15 min.	7.74
h9	931028	1.00	5	6.38
h9	931028	1.00	5	6.28
h9	931028	1.00	5	6.30
h9	931028	5.00	15 min.	7.98
h9	931028	5.00	15 min.	7.48
h9	931028	5.00	15 min.	8.14
h9	931028	5.00	5	0.00
h9	931028	5.00	5	0.00
h9	931028	5.00	5	0.00
k1	930821	0.00	15 min.	8.52
k1	930821	0.00	15 min.	8.72
k1	930821	0.00	15 min.	8.68
k1	930821	0.00	1	8.58
k1	930821	0.00	2	8.60
k1	930821	0.00	3	8.36
k1	930821	0.00	4	8.12
k1	930821	0.00	5	7.06
k1	930821	0.00	5	7.12
k1	930821	0.00	5	7.20
k1	930821	0.05	15 min.	8.46
k1	930821	0.05	15 min.	8.46
k1	930821	0.05	15 min.	8.60
k1	930821	0.05	1	8.48
k1	930821	0.05	2	8.38
k1	930821	0.05	3	8.32
k1	930821	0.05	4	8.38
k1	930821	0.05	5	8.06
k1	930821	0.05	5	8.42
k1	930821	0.05	5	8.44
k1	930821	0.50	15 min.	8.54
k1	930821	0.50	15 min.	8.66
k1	930821	0.50	15 min.	8.64
k1	930821	0.50	1	8.44
k1	930821	0.50	2	8.02
k1	930821	0.50	3	7.84
k1	930821	0.50	4	7.68

k1	930821	0.50	5	7.78
k1	930821	0.50	5	7.78
k1	930821	0.50	5	7.48
k1	930821	2.00	15 min.	8.32
k1	930821	2.00	15 min.	8.34
k1	930821	2.00	15 min.	8.36
k1	930821	2.00	1	7.86
k1	930821	2.00	2	7.62
k1	930821	2.00	3	7.28
k1	930821	2.00	4	7.16
k1	930821	2.00	5	7.10
k1	930821	2.00	5	7.00
k1	930821	2.00	5	6.98
k2	930928	0.00	15 min.	7.20
k2	930928	0.00	15 min.	7.12
k2	930928	0.00	15 min.	7.12
k2	930928	0.00	5	4.00
k2	930928	0.00	5	4.38
k2	930928	0.00	5	4.20
k2	930928	0.10	15 min.	8.04
k2	930928	0.10	15 min.	7.96
k2	930928	0.10	15 min.	7.92
k2	930928	0.10	5	
k2	930928	0.10	5	
k2	930928	0.10	5	
k2	930928	1.00	15 min.	7.10
k2	930928	1.00	15 min.	7.28
k2	930928	1.00	15 min.	7.40
k2	930928	1.00	5	6.88
k2	930928	1.00	5	6.42
k2	930928	1.00	5	6.78
k2	930928	10.00	15 min.	7.20
k2	930928	10.00	15 min.	7.12
k2	930928	10.00	15 min.	7.12
k2	930928	10.00	5	4.00
k2	930928	10.00	5	4.38
k2	930928	10.00	5	4.20
k3	931022	0.00	15 min.	8.64
k3	931022	0.00	15 min.	8.28
k3	931022	0.00	15 min.	8.04
k3	931022	0.00	5	8.32
k3	931022	0.00	5	8.32
k3	931022	0.00	5	8.30
k3	931022	1.00	15 min.	8.44
k3	931022	1.00	15 min.	8.36
k3	931022	1.00	15 min.	8.42
k3	931022	1.00	5	7.96

m2	930707	0.05	4	5.76
m2	930707	0.05	5	5.14
m2	930707	0.05	5	5.16
m2	930707	0.05	5	5.62
m2	930707	0.20	0	8.20
m2	930707	0.20	0	7.64
m2	930707	0.20	0	7.96
m2	930707	0.20	15 min.	7.70
m2	930707	0.20	15 min.	7.98
m2	930707	0.20	15 min.	8.24
m2	930707	0.20	1	5.56
m2	930707	0.20	2	2.94
m2	930707	0.20	3	2.00
m2	930707	0.20	4	1.10
m2	930707	0.20	5	0.00
m2	930707	0.20	5	0.00
m2	930707	0.20	5	0.00
m2	930707	0.50	0	8.14
m2	930707	0.50	0	8.36
m2	930707	0.50	0	8.24
m2	930707	0.50	15 min.	7.76
m2	930707	0.50	15 min.	7.98
m2	930707	0.50	15 min.	7.00
m2	930707	0.50	1	2.98
m2	930707	0.50	2	0.00
m2	930707	0.50	3	0.00
m2	930707	0.50	4	.
m2	930707	0.50	5	.
m2	930707	0.50	5	.
m2	930707	0.50	5	.
m3	930721	0.05	0	7.72
m3	930721	0.05	0	7.80
m3	930721	0.05	0	7.74
m3	930721	0.05	15 min.	7.90
m3	930721	0.05	15 min.	7.84
m3	930721	0.05	15 min.	7.84
m3	930721	0.05	1	7.46
m3	930721	0.05	2	6.90
m3	930721	0.05	3	6.80
m3	930721	0.05	4	6.30
m3	930721	0.05	5	6.48
m3	930721	0.05	5	6.54
m3	930721	0.05	5	6.66
m3	930721	0.10	0	8.08
m3	930721	0.10	0	8.32
m3	930721	0.10	0	8.04
m3	930721	0.10	15 min.	8.08

m3	930721	0.10	15 min.	8.14
m3	930721	0.10	15 min.	8.12
m3	930721	0.10	1	7.66
m3	930721	0.10	2	6.56
m3	930721	0.10	3	5.94
m3	930721	0.10	4	5.46
m3	930721	0.10	5	4.26
m3	930721	0.10	5	3.96
m3	930721	0.10	5	4.80
m4	930809	0.00	15 min.	.
m4	930809	0.00	15 min.	7.74
m4	930809	0.00	15 min.	7.50
m4	930809	0.00	5	8.50
m4	930809	0.00	5	8.32
m4	930809	0.00	5	8.40
m4	930809	0.05	15 min.	8.74
m4	930809	0.05	15 min.	8.26
m4	930809	0.05	15 min.	8.02
m4	930809	0.05	5	7.56
m4	930809	0.05	5	7.28
m4	930809	0.05	5	7.34
m4	930809	0.10	15 min.	7.82
m4	930809	0.10	15 min.	8.64
m4	930809	0.10	15 min.	8.16
m4	930809	0.10	5	4.58
m4	930809	0.10	5	4.60
m4	930809	0.10	5	4.48
m4	930809	0.50	15 min.	8.20
m4	930809	0.50	15 min.	7.90
m4	930809	0.50	15 min.	8.02
m4	930809	0.50	5	0.00
m4	930809	0.50	5	0.00
m4	930809	0.50	5	0.00
m5	930819	0.00	15 min.	8.40
m5	930819	0.00	15 min.	8.26
m5	930819	0.00	15 min.	8.34
m5	930819	0.00	5	.
m5	930819	0.00	5	.
m5	930819	0.00	5	.
m5	930819	0.05	15 min.	8.38
m5	930819	0.05	15 min.	8.28
m5	930819	0.05	15 min.	8.24
m5	930819	0.05	5	.
m5	930819	0.05	5	.
m5	930819	0.05	5	.
m5	930819	0.10	15 min.	7.78
m5	930819	0.10	15 min.	7.88

m5	930819	0.10	15 min.	7.98
m5	930819	0.10	5	.
m5	930819	0.10	5	.
m5	930819	0.10	5	.
m5	930819	0.50	15 min.	7.70
m5	930819	0.50	15 min.	7.50
m5	930819	0.50	15 min.	7.40
m5	930819	0.50	5	.
m5	930819	0.50	5	.
m5	930819	0.50	5	.
m6	930901	0.00	15 min.	9.02
m6	930901	0.00	15 min.	8.62
m6	930901	0.00	15 min.	8.64
m6	930901	0.00	5	8.32
m6	930901	0.00	5	8.54
m6	930901	0.00	5	8.46
m6	930901	0.05	15 min.	9.00
m6	930901	0.05	15 min.	9.02
m6	930901	0.05	15 min.	8.90
m6	930901	0.05	5	6.92
m6	930901	0.05	5	7.14
m6	930901	0.05	5	7.22
m6	930901	0.10	15 min.	8.66
m6	930901	0.10	15 min.	8.84
m6	930901	0.10	15 min.	8.54
m6	930901	0.10	5	4.20
m6	930901	0.10	5	5.80
m6	930901	0.10	5	4.80
m7	930915	0.00	15 min.	7.81
m7	930915	0.00	15 min.	7.77
m7	930915	0.00	15 min.	7.75
m7	930915	0.00	5	7.04
m7	930915	0.00	5	7.14
m7	930915	0.00	5	7.02
m7	930915	0.05	15 min.	7.50
m7	930915	0.05	15 min.	7.94
m7	930915	0.05	15 min.	8.03
m7	930915	0.05	5	4.28
m7	930915	0.05	5	3.96
m7	930915	0.05	5	3.74
m7	930915	0.10	15 min.	7.63
m7	930915	0.10	15 min.	7.60
m7	930915	0.10	15 min.	7.42
m7	930915	0.10	5	2.36
m7	930915	0.10	5	1.56
m7	930915	0.10	5	2.10
m8	930928	0.10	15 min.	8.04

m8	930928	0.10	15 min.	7.84
m8	930928	0.10	15 min.	7.74
m8	930928	0.10	5	4.78
m8	930928	0.10	5	5.54
m8	930928	0.10	5	5.74
m8	930928	1.00	15 min.	7.58
m8	930928	1.00	15 min.	7.70
m8	930928	1.00	15 min.	7.48
m8	930928	1.00	5	0.00
m8	930928	1.00	5	0.00
m8	930928	1.00	5	0.00
m8	930928	5.00	15 min.	5.30
m8	930928	5.00	15 min.	5.04
m8	930928	5.00	15 min.	5.14
m8	930928	5.00	5	0.00
m8	930928	5.00	5	0.00
m8	930928	5.00	5	0.00
m9	931015	0.00	15 min.	9.55
m9	931015	0.00	15 min.	9.57
m9	931015	0.00	15 min.	9.11
m9	931015	0.00	5	6.18
m9	931015	0.00	5	6.56
m9	931015	0.00	5	6.32
m9	931015	0.05	15 min.	8.89
m9	931015	0.05	15 min.	8.74
m9	931015	0.05	15 min.	8.65
m9	931015	0.05	5	5.12
m9	931015	0.05	5	5.54
m9	931015	0.05	5	5.58
m9	931015	0.10	15 min.	8.80
m9	931015	0.10	15 min.	8.78
m9	931015	0.10	15 min.	8.90
m9	931015	0.10	5	4.60
m9	931015	0.10	5	4.66
m9	931015	0.10	5	4.48
m10	931028	0.15	15 min.	7.94
m10	931028	0.15	15 min.	8.10
m10	931028	0.15	15 min.	7.94
m10	931028	0.15	5	2.88
m10	931028	0.15	5	2.64
m10	931028	0.15	5	2.76
m10	931028	0.50	15 min.	7.38
m10	931028	0.50	15 min.	7.50
m10	931028	0.50	15 min.	7.46
m10	931028	0.50	5	0.00
m10	931028	0.50	5	0.00
m10	931028	0.50	5	0.00