

Elkhorn Slough (ELK) NERR Nutrient Metadata
(January- December 2004)
Latest Update: July 14, 2025

I). Data Set and Research Descriptors

1) Principal investigator(s) and contact persons

a) Reserve Contact

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b) Laboratory Contact: Same as above

c) Other Contacts and Programs: None

2) Research objectives

Elkhorn Slough (ESNERR) is a unique estuary along the central Californian coast. There are fresh water inputs during the wet season (October through May) causing a brackish environment, while during the dry season (June through September) there is very little freshwater input resulting in a much more saline environment. The surrounding area is mostly farmlands, which causes concern, as they may be a source of significant amounts of nutrients entering the slough. With the base monitoring program we are able to quantify the variability of these nutrients in different areas of the slough as well as through different seasons of the year.

a) Monthly Grab

Monthly grab samples are collected to quantify the spatial variability of important nutrients in the water column at sites representing the estuarine endpoints of the Elkhorn Slough estuary.

b) Diel Sampling Program

Once per month, samples are collected every hour through a 24-hour tidal cycle to quantify the temporal variability of important nutrients in the water column as a function of tidal forcing.

3) Research methods

a) Monthly Grab Sampling Program

Monthly grab samples were taken at the four principle ESNERR data sonde stations (Azevedo Pond, North Marsh, South Marsh and Vierra Mouth) within the Elkhorn Slough estuary. All grab samples were taken on the same day between +3 hrs before slack low-water and low-water. No distinction was made between neap and spring tide conditions. Efforts were made to allow for an antecedent dry period of 72 hours prior to sampling. Replicate (N=2) samples were collected by hand at an approximate depth of 10 cm. At the time of sample collection, water temperature, salinity, and dissolved oxygen was measured with a YSI Model 650 meter. All samples were collected in amber, narrow-mouth, nalgene sample bottles that were previously acid washed (10%), rinsed (3x) with distilled-deionized water, dried, and followed by rinsing (3x) with ambient water prior to collection of the sample. Samples were immediately placed on ice in the dark and returned to the laboratory. Once in the laboratory, samples were shaken and processed for nutrient and Chl-a analysis.

b) Diel Sampling Program

Within the same 24-hour period of grab sample collection, we deploy an ISCO water sampler 30cm above the bottom from the bank of the marsh at South Marsh. This device automatically samples 500 ml of water every 1 hrs 2min. All samples are pumped into polyethylene sample bottles that were previously acid washed (10% HCL), rinsed (3x) with distilled-deionized water and dried. Samples are kept cold with ice until the end of the 24 hr period; the 24 samples are kept in the dark and returned to the laboratory for immediate processing.

4) Site location and character

Elkhorn Slough is located on the West Coast of the United States in Central California. It connects with the Pacific Ocean in central Monterey Bay near Moss Landing, California. There are four sampling sites.

- a. Azevedo Pond (AP) (36° 50' 44.64" N, 121° 45' 13.24" W) receives fertilizer and pesticide runoff from a strawberry field in year-round production. The YSI is located about 10m from a culvert connecting the pond to the slough. Tide ranges from 0 to 1.3 meters while salinity ranges from 8.8 during heavy runoff to 41 ppt during strong evaporation. The sonde is located approximately 30 cm off the bottom, which is composed of silty mud.
- b. North Marsh (NM) (36° 50' 04.75" N, 121° 44' 18.33" W) is located in between South Marsh and Azevedo Pond. This site is impacted by both agricultural and urban runoff. The tidal range is approximately 0.4 meters while salinity ranges between 20 and 40 parts per thousand. There is freshwater runoff from upland and agricultural sites. The sonde is approximately 30 cm off the bottom, which is composed of silty mud.
- c. South Marsh (SM) (36° 49' 05.00" N, 121° 44' 21.83" W), located about 3 km south of NM, is in a side channel of the slough and is relatively free from impact by anthropogenic influences as it is surrounded by mostly reserve land. The YSI is located on the side of a bank in one of the secondary slough channels. This site receives runoff mostly from uplands and some from cattle ranches, receiving the least amount of pollution. Tidal ranges from 0 to 3 meters while the salinity range is from 22 to 36 parts per thousand. The sonde is approximately 30 cm off the bottom, which is composed of compacted silty mud.
- d. The fourth site, Vierra Mouth (VM) (36° 48' 39.95" N, 121° 44' 45.40" W), is located at the mouth of the slough and is used to identify oceanic influence. The tidal range is from 0 to 3.2 meters while salinity ranges from 26 to 34 parts per thousand. The sonde is located approximately 30 cm off the bottom which is composed of compacted mud and sand due to strong tidal currents. This site receives drainage from the

entire watershed due to its location at the mouth. There are several auto wrecking yards located approximately 2 km east of this site.

5) Code variable definitions

Each individual sample is given a 3-part name code in addition to other codes. The 3-part name code "elkapnut" for example, gives the reserve name (elk = Elkhorn Slough Reserve), station name (ap = Azevedo Pond), and SWMP program code (nut = nutrient monitoring program).

elkapnut= Elkhorn Slough Reserve nutrient data for Azevedo Pond

elkmmnut= Elkhorn Slough Reserve nutrient data for North Marsh

elksmnut= Elkhorn Slough Reserve nutrient data for South Marsh

elkvmnut= Elkhorn Slough Reserve nutrient data for Vierra Mouth

The monitoring codes are set as "1" to indicate grab samples and "2" to indicate diel samples. Replicates are also given specific codes. Grab samples in which duplicate samples are taken utilize a "1" for the first samples and a "2" for the second sample. Diel samples are always labeled with a "1" since only one sample is taken at each 1 hr. interval.

6) Data Collection Period

Sampling occurred between January 6 02:34 and December 7 13:21

Diel Sampling (All times in PST)

Site	Start Date	Start Time	End Date	End Time
SM	01/06/04	0234	01/07/04	0220
SM	02/03/04	0145	02/04/04	0131
SM	03/16/04	1345	03/17/04	1331
SM	04/12/04	2355	04/13/04	2341
SM	05/04/04	0500	05/05/04	0446
SM	06/14/04	0348	06/15/04	0334
SM	07/06/04	0842	07/07/04	0828
SM	08/02/04	639	08/03/04	0625
SM	09/08/04	0037	09/09/04	0023
SM	10/04/04	2230	10/05/04	2216
SM	11/02/04	0616	11/03/04	0602
SM	No data	-	-	-

Grab Sampling (All times in PST)

Site	Start Date	Rep 1 Time	Start Date	Rep 2 Time
AP	01/06/04	1440	01/06/04	1441
AP	02/03/04	1340	02/03/04	1341
AP	03/16/04	1215	03/16/04	1216
AP	04/13/04	1135	04/13/04	1136
AP	05/04/04	1605	05/04/04	1606
AP	06/14/04	1324	06/14/04	1325
AP	07/07/04	0925	07/07/04	0926
AP	08/02/04	1620	08/02/04	1621
AP	09/08/04	1215	09/08/04	1216
AP	10/04/04	0830	10/04/04	0831
AP	11/02/04	1753	11/02/04	1754

AP	12/07/04	1200	12/07/04	1201
Site	Start Date	Rep 1 Time	Start Date	Rep 2 Time
NM	01/06/04	1430	01/06/04	1431
NM	02/03/04	1300	02/03/04	1301
NM	03/16/04	1200	03/16/04	1201
NM	04/13/04	1110	04/13/04	1111
NM	05/04/04	1630	05/04/04	1631
NM	06/14/04	1240	06/14/04	1241
NM	07/07/04	0940	07/07/04	0941
NM	08/02/04	1620	08/02/04	1621
NM	09/08/04	1150	09/08/04	1151
NM	10/04/04	0810	10/04/04	0811
NM	11/02/04	1823	11/02/04	1824
NM	12/07/04	1249	12/07/04	1250
Site	Start Date	Rep 1 Time	Start Date	Rep 2 Time
SM	01/06/04	1410	01/06/04	1411
SM	02/03/04	1240	02/03/04	1241
SM	03/16/04	1135	03/16/04	1136
SM	04/13/04	1100	04/13/04	1101
SM	05/04/04	1454	05/04/04	1455
SM	06/14/04	1222	06/14/04	1223
SM	07/07/04	0830	07/07/04	0831
SM	08/02/04	1545	08/02/04	1546
SM	09/08/04	1102	09/08/04	1103
SM	10/04/04	0745	10/04/04	0746
SM	No data	-	-	-
SM	12/07/04	1320	12/07/04	1321
Site	Start Date	Rep 1 Time	Start Date	Rep 2 Time
VM	01/06/04	1530	01/06/04	1531
VM	02/03/04	1415	02/03/04	1416
VM	03/16/04	1300	03/16/04	1301
VM	04/13/04	1200	04/13/04	1202
VM	05/04/04	1535	05/04/04	1536
VM	06/14/04	1414	06/14/04	1415
VM	07/07/04	0955	07/07/04	0956
VM	08/02/04	1645	08/02/04	1646
VM	09/08/04	1245	09/08/04	1246
VM	10/04/04	0905	10/04/04	0906
VM	11/02/04	1745	11/02/04	1746
VM	No data	-	-	-

7) Associated researchers and projects

Ken Johnson et al. are looking at nutrient budgets in the slough with real time nitrate loggers in the main channel of the slough. Adina Paytan, Scott Wankle et al are looking at nitrogen isotopes to assess the contributions of nitrogen through ground water. Nicholas Welschmeyer et al are looking at nutrients and

phytoplankton populations in the main channel of the slough on a weekly basis. Marc Los Huertos et al are investigating nutrient budgets in the Elkhorn

Slough watershed and identifying "hot spots" of nutrients in the slough while working with local farmers to attempt to decrease high nutrient loads. Robert Burton from Moss Landing Marine Laboratories is investigating the functionality of wetlands as nitrate source reduction.

8) Distribution

NOAA/ERD retains the right to analyze, synthesize and publish summaries of the NERRS System-wide Monitoring Program data. The PI retains the right to be fully credited for having collected and processed the data. Following academic courtesy standards, the PI and NERR site where the data were collected will be contacted and fully acknowledged in any subsequent publications in which any part of the data are used. Manuscripts resulting from this NOAA/OCRM supported research that are produced for publication in open literature, including refereed scientific journals, will acknowledge that the research was conducted under an award from the Estuarine Reserves Division, Office of Ocean and Coastal Resource Management, National Ocean Service, National Oceanic and Atmospheric Administration. The data set enclosed within this package/transmission is only as good as the quality assurance and quality control procedures outlined by the enclosed metadata reporting statement. The user bears all responsibility for its subsequent use/misuse in any further analyses or comparisons. The Federal government does not assume liability to the Recipient or third persons, nor will the Federal government reimburse or indemnify the Recipient for its liability due to any losses resulting in any way from the use of this data.

NERR water quality data and metadata can be obtained from the Research Coordinator at the individual NERR site (please see Section 1. Principal investigators and contact persons), from the Data Manager at the Centralized Data Management Office (please see personnel directory under the general information link on the CDMO home page) and online at the CDMO home page <http://cdmo.baruch.sc.edu/>. Data are available in text tab-delimited format, Microsoft Excel spreadsheet format and comma-delimited format.

II. Physical Structure Descriptors

9) Entry verification

Monthly nutrient data is measured and entered into an excel file consisting of sampling station ID, date and time, and parameter values expressed in unit concentrations. John Haskins and Allison Myers verify all parameter values in the excel file by cross comparison with laboratory data sheets and by graphing the data and identifying anomalous data points or other problems. Monthly excel files were compiled into a yearly excel file. Missing data are verified through inspection of field logs and flagged by an "M" in the compiled excel file. Values flagged with a "K" are further explained in the metadata. Calculated values are flagged by a "C" in the compiled excel file.

10) Parameter Titles and Variable Names by Data Category

Required NOAA/NERRS System-wide Monitoring Program water quality parameters are denoted by an asterisks "**".

Data Category	Parameter	Variable Name	Units of Measure
a)	Phosphorus and Nitrogen:		
	*Orthophosphate	PO4F	mg/L as P
	*Nitrite + Nitrate, Filtered	NO23F	mg/L as N

*Nitrite, Filtered	NO2F	mg/L as N
*Nitrate, Filtered	NO3F	mg/L as N
*Ammonium, Filtered	NH4F	mg/L as N
*Dissolved Inorganic Nitrogen	DIN	mg/L as N

b) Plant pigments:

*Chlorophyll a, Fluorometric	CHLA_N	µg/L
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Notes:

1. Time is coded based on a 2400 hour clock and is referenced to Pacific Standard Time (PST).
2. Reserves have the option of measuring either NO23 or NO2 or NO3.

11) Measured and Calculated Laboratory Parameters

a) Variables Measured Directly

Nitrogen species:	NO2F, NO23F, NH4F
Phosphorus species:	PO4F
Other:	CHLA

b) Computed Variables

NO3:	NO23F-NO2F
DIN:	NO23F+NH4F

12) Limits of Detection

Method Detection Limits (MDL), the lowest concentration of a parameter that an analytical procedure can reliably detect, has been established by the Moss Landing Marine Lab (MLML) Nutrient Analytical Laboratory. The MDL is determined as 3 times the standard deviation of a minimum of 7 replicates of a single low concentration sample. The following chart presents the current MDL's; these values are periodically reviewed and revised.

MDL TABLE

2004	Jan	0.0011	0.0014	0.0013	0.0024	0.045
2004	Feb	0.0008	0.0014	0.0013	0.0063	0.045
2004	Mar	0.0001	0.001	0.0018	0.0032	0.045
2004	Apr	0.0003	0.0016	0.0011	0.0047	0.045
2004	May	0.0007	0.0021	0.0017	0.0036	0.045
2004	Jun	0.0008	0.0011	0.0012	0.0029	0.045
2004	Jul	0.0006	0.0007	0.0018	0.005	0.045
2004	Aug	0.0025	0.0007	0.0018	0.0029	0.045
2004	Sep	0.0007	0.001	0.001	0.0041	0.045
2004	Oct	0.0001	0.001	0.0022	0.0023	0.045
2004	Nov	0.0014	0.0026	0.0009	0.0021	0.045
2004	Dec	0.0004	0.0029	0.0012	0.0032	0.045

Upper Detection Limit
Ammonia (NH₄F) 0.1680 mg/L

13) Laboratory Methods

a) Parameter: NH₄F

- i) Method Reference: Stricklin and Parsons Determination of Ammonia.
- ii) Method Descriptor: Samples collected and stored on ice in amber bottles prior to being filtered with a 0.45 µm GFF filter and subsequently subjected to hypochlorite-phenol in the presence of NH₃. Sodium nitroprusside is then used as a catalyst in the reaction. A oxidizing solution is then added (a mixture of sodium hypochlorite and alkaline reagent). The sample is then allowed to stand at a temperature between 20 and 27 °C for at least 1 hour and then placed in a 10 cm cuvette and absorbance is measured at 640 nm.
- iii) Preservation Method: Samples filtered and stored at 4 °C up to 24 hours.

b) Parameter: NO₃F, NO₃F, and NO₂F

- i) Method Reference: Stricklin and Parsons Determination of Nitrite.
- ii) Method Descriptor: The water sample is first filtered then is passed through a cadmium column where the nitrate is reduced to nitrite. When only analyzing for nitrite the sample is not exposed to cadmium and thus the nitrite in the water is quantified. The nitrite is then exposed to sulfanilamide solution and allowed to react for 2 minutes then is exposed to N-(1-naphthyl)-ethylenediamine dihydrochloride solution and allowed to react for at least 10 minutes. The sample is then placed in a 1 cm cuvette where the absorbance is measured at 543 nm. Nitrate concentration equals the NO₃F (nitrate + nitrite) concentration minus the nitrite concentration. Thus NO₃ is calculated by subtracting NO₂F - NO₂F.
- iii) Preservation Method: Sample is filtered through a 0.45 µm filter and analyzed the same day.

c) Parameter: PO₄F

- i) Method Reference. Same as Nitrite with Alpkem machine.
- ii) Method Descriptor: Ammonium molybdate is added to a water sample to produce phosphomolybdic acid, which is then reduced to phosphomolybdous acid (a blue compound) following the addition of dihydrazine (or hydrazine) sulfate. The sample is passed through a 50 mm flowcell and absorbance is measured at 820 nm.
- iii) Preservation Method: Sample is filtered through a 0.45 µm filter and analyzed the same day.

d) Parameter: ChlA

- i) Method Reference. EPA method 445.0 UNESCO (1994) Protocols for the joint global ocean flux study (JGOFS) core measurements. pp. 97-100.
- ii) Method Descriptor: CHLA is extracted in 10 ml 90% acetone for 24 hrs and then fluorescence is measured and recorded (F_o). Several drops (2-3) of 10% are added to convert the CHLA to phaeopigments (PHAE). The fluorescence is again measured and recorded (F_a). The concentration (µg/L) of CHLA and PHAE are calculated using the F_o/F_a ratio.
- iii) Preservation Method: A known volume of sample is filtered onto a 25 mm GF/F filter, folded in half and placed in a known volume of 90% acetone and then stored at -4 °C until analysis 24 hrs later.

14) Reporting of Missing Data and data with concentrations lower than method detection limits

Nutrient/Chla comment codes and definitions are provided in the following table. Missing data are denoted by a blank cell “ ” and commented coded with an “M”. Laboratories in the NERRS System submit data that

are censored at a lower detection rate limit, called the Method Detection Limit or MDL. MDL's for specific parameters are listed in the Laboratory Methods and Detection Limits Section (Section II, Part 14) of this document. Measured concentrations that are less than this limit are replaced with the minimum detection limit value and comment coded with a "B" in the variable code comment column. For example, the measured concentration of NO23F was 0.0005 mg/L as N (MDL=0.0008), the reported value would be 0.0008 with a "B" placed in the NO23F comment code column. Calculated parameters are comment coded with a "C" and if any of the components used in the calculation are below the MDL, the calculated value is removed and also comment coded with a "B". If a calculated value is negative, the value is removed and comment coded with an "N".

Note: The way below MDL values are handled in the NERRS SWMP dataset was changed in November of 2011. Previously, below MDL data from 2002-2006 were also coded with a B, but replaced with -9999 place holders. Any 2002-2006 nutrient/pigment data downloaded from the CDMO prior to December November of 2011 will contain -9999s representing below MDL concentrations.

Comment Code	Definition
A	Value above upper limit of method detection
B	Value below method detection limit
C	Calculated value
D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
H	Sample held beyond specified holding time
K	Check metadata for further details
M	Data missing, sample never collected or calculated value could not be determined due to missing data
P	Significant precipitation (reserve defined, see metadata for further details)
U	Lab analysis from unpreserved sample
S	Data suspect, see metadata for further details

15) QA/QC Programs

a) Precision

- i) Field Variability –ELKNERR collects two successive grab samples (usually within one minute of each other) for the determination of water mass variability within each site.
- ii) Laboratory Variability – In determining laboratory variability, replicates (10%) are split from a single sample. Laboratory replicates are done for ammonium, nitrite, nitrate and phosphate standards on a semi-regular basis.

	Average percent difference	Standard deviation
Nitrite	3.4	1.3
Ammonia	3.9	2.4
Nitrate	3.2	1.9
Phosphate	1.5	2.3

- iii) Inter-organizational splits – None

b) Accuracy

i) Sample Spikes – Sample spikes were split from a single diel sample or grab sample. Sample spikes are done for nitrite and ammonium on a semi-regular basis. Average percent recovery was found to be 98.3% and 99.1%.

ii) Standard Reference Material Analysis – These samples are run when samples are supplied to the lab. Last sample received Feb 2005.

iii) Cross Calibration Exercises - None

16) Other Remarks

On 7/14/2025 this dataset was updated to include embedded QAQC flags and codes for anomalous/suspect, rejected, missing, and below detection limit data. System-wide monitoring data beginning in 2007 were processed to allow for QAQC flags and codes to be embedded in the data files rather than using the original single letter codes used for the nutrient and pigment dataset along with the detailed sections in the metadata document for suspect, missing, and rejected data. Please note that prior to 2007, rejected data were deleted from the dataset so they are unavailable to be used at all. Suspect, missing, rejected and below minimum detection flags and appropriate three letter codes were embedded retroactively for dataset consistency. The QAQC flag/codes corresponding to the original letter codes are detailed below.

Flag/code	If also C	Historic Letter Code	Historic Code Definition
<1> [SUL]		A	Value above upper limit of method detection
<-4> [SBL]	<-4> [SCB]	B	Value below method detection limit
no need to flag/code unless combined		C	Calculated value
<-3> [GQD]	<-3> [GCR]	D	Data deleted or calculated value could not be determined due to deleted data, see metadata for details
<1> (CHB)		H	Sample held beyond specified holding time
<0> (CSM) unless other flag		K	Check metadata for further details
<-2> [GDM]	<-2> [GCM]	M	Data missing, sample never collected or calculated value could not be determined due to missing data
<-3> [SNV] and <1> [SCC] for components (CRE) or F_Record (CRE)		N	Negative calculated value
<0> (CJS)		P	Significant precipitation (reserve defined, see metadata for further details)
<1> (CSM)		U	Lab analysis from unpreserved sample
		S	Data suspect, see metadata for further details

a. The following nitrate data were deleted due to negative values, indicating an error in measurement:

Date	Site	Monitoring Program	Time
05/04/04	Azevedo Pond	Grab Sample (Rep 1 and 2)	16:05- 16:06
06/14/04	Azevedo Pond	Grab Sample (Rep 2)	13:25
09/08/04	Azevedo Pond	Grab Sample (Rep 1 and 2)	12:15- 12:16
09/09/04	South Marsh	Diel Sample	00:23

b. Due to ISCO malfunction, the following data points are missing:

03/17/04 ISCO collected samples from only the first 17 hours. The last 7 hours of data are therefore missing. These data points would have corresponded to the times 07:19-13:31

08/02/04 ISCO failed to collect samples from the first four hours and only sampled the last 20 hours. Missing data would have corresponded to the times 06:39 –09:45

09/08/04 ISCO failed to collect samples from the first 9 hours and also from hours 21-22. Missing data would have corresponded to the times 00:37- 08:53 and 21:17- 22:19

10/05/04 ISCO collected samples from only the first 15 hours. The last 9 hours of data are therefore missing. These data points would have corresponded to times 14:00- 22:16

11/02/04 ISCO failed to collect samples from hour 4, 10, and 11. Missing data would have corresponded to times 09:22, 15:34- 16:36

12/07/04 All samples are missing from December 07 due to ISCO failure

c. The following grab samples are missing due to collection errors:

11/02/04 South Marsh
12/07/04 Vierra Mouth

d. The following samples are below the MDL and replaced with a -9999 and comment coded with a "B" in the data section. If a sample is used in a calculation, the calculated value is also replaced with a -9999 and comment coded with a "B".

Date	Site	Monitoring Program	Parameter	Time
03/16/04		NM Grab Sample (Rep 1)	Nitrite	12:00
09/08/04	SM	Grab Sample (Rep 1 and 2)	Ammonia	11:02- 11:03
09/08/04	SM	Diel Sample	Nitrite	09:55
09/08/04	VM	Diel Sample	Ammonia	12:46
11/02/04	AP	Grab Sample (Rep 1 and 2)	Nitrite	17:53- 1754

e. The following diel data are missing due to lab error:
09/08/2004 0955 NO2 for 09/08 0955 was analyzed but due to an error in the lab there was no value for this sample. Due to this error NO3 also could not be calculated.

f. Daily, Monthly, and Annual Precipitation Totals Jan-Dec 2004

elkcwmet Caspian Weather Station

Date	Daily Precip Totals (mm)
01/01/2004	23.4
01/02/2004	0.8
01/03/2004	0.3
01/06/2004	1.0
01/07/2004	0.3
01/11/2004	0.3
01/13/2004	0.3
01/14/2004	0.8
01/23/2004	0.3
01/24/2004	13.0
01/27/2004	2.5
01/28/2004	0.5
01/30/2004	0.3
01/31/2004	0.3

January Monthly Total (mm) 44.1

02/05/2004	0.3
02/06/2004	0.5
02/07/2004	0.3
02/08/2004	0.3
02/09/2004	0.3
02/12/2004	0.3
02/16/2004	13.7
02/17/2004	18.5
02/18/2004	9.4
02/19/2004	1.5
02/20/2004	1.5
02/21/2004	1.3
02/22/2004	0.8
02/23/2004	0.3
02/24/2004	4.6
02/25/2004	30.0
02/26/2004	9.1
02/27/2004	1.8
02/28/2004	0.3

February Monthly Total (mm) 94.8

03/01/2004	5.8
03/03/2004	0.3
03/04/2004	0.3
03/06/2004	0.3
03/07/2004	0.3
03/10/2004	0.3
03/11/2004	0.3
03/13/2004	0.3
03/14/2004	0.3
03/16/2004	0.3
03/18/2004	0.3
03/20/2004	0.3
03/25/2004	9.1
03/27/2004	0.3

March Monthly Total (mm) 18.5

04/01/2004	0.3
04/10/2004	0.3
04/14/2004	0.3
04/20/2004	2.3

April Monthly Total (mm) 3.2

05/28/2004	2.5
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May Monthly Total (mm) 2.5

07/04/2004 0.3

July Monthly Total (mm) 0.3

09/17/2004 0.3

09/19/2004 0.5

September Monthly Total (mm) 0.8

10/16/2004 5.6

10/17/2004 10.9

10/18/2004 0.3

10/19/2004 23.6

10/29/2004 0.3

October Monthly Total (mm) 40.7

11/03/2004 13.0

11/04/2004 5.6

11/06/2004 0.3

11/09/2004 0.5

11/10/2004 1.8

11/11/2004 10.2

11/12/2004 0.3

11/14/2004 0.3

11/16/2004 0.3

11/17/2004 0.3

11/18/2004 0.3

11/19/2004 0.3

11/24/2004 0.3

11/25/2004 0.3

11/27/2004 4.6

November Monthly Total (mm) 38.4

12/07/2004 28.4

12/08/2004 21.6

12/09/2004 1.8

12/10/2004 0.3

12/12/2004 0.3

12/22/2004 0.3

12/28/2004 33.5

12/30/2004 7.1

12/31/2004 34.3

December Monthly Total (mm) 127.6

Annual Total (mm) 370.9