Reducing 2-Methylisoborneol (MIB) and Geosmin in the Metropolitan-Phoenix Area Water Supply

A Cooperative Research and Implementation Program among

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City of Tempe
City of Peoria

For calendar year 2004

EXECUTIVE SUMMARY

The goal of this project is to continue advancing the state-of-knowledge and implementation activities regarding algae-related water quality issues in the metro-Phoenix water supply systems. ASU wants to build upon the results and momentum of the previous T&O projects, which have been ongoing since 1998. The specific tasks proposed and corresponding objectives are as follows:

- Task 1 – Monitoring
  - Collect and analyze samples from Bartlett Lake, Saguaro Lake, and Lake Pleasant
  - Collect and analyze samples from the lower Verde and Salt Rivers
  - Collect and analyze samples from the CAP and SRP canal system
  - Collect and analyze samples from influent and treated WTP waters
- Task 2 – Research and T&O Control Evaluations
  - Evaluate the effectiveness of recently available copper algacides in controlling algae in the canals and water treatment plants.
  - Examine data from previous years to gain a better understanding of when and where to start copper treatments – through development of spatial MIB production model
  - Discover why Deer Valley WTP achieved ~50% MIB and Geosmin removal without PAC addition during routine and intensive monitoring in fall 2003.
  - Conclude monitoring and evaluation for the effects of forest fires on water quality in the Salt River.
  - Organize comparison of SRP and CAP canal brushing/scrapping equipment
- Task 3 – Process Control Recommendations and Communication
  - Produce Regional Water Quality Newsletters centered around sampling and data analysis, with recommendations for utilities treatment scenarios and canal treatment.
  - Organize and lead a workshop on algae-related issues (August 2004)

TASK 1 – MONITORING PROGRAM

MIB and geosmin are the two most common taste and odor (T&O) compounds responsible for earthy-musty-moldy aesthetic problems in drinking waters. During this study, MIB nearly always occurred at higher concentrations than geosmin and was removed within WTPs by powder activated carbon less effectively than geosmin. Granular activated carbon and ozone were very effective at controlling both T&O compounds. In 2004 a third T&O compound (cyclocitral) was monitored and the concentrations were frequently higher than MIB levels. Cyclocitral was removed easier than MIB within the WTPs.

MIB concentrations in the Lake Pleasant caused significant problems for water utilities on the CAP canal and Arizona Canal for approximately 3 weeks in September and October of 2004, until pass-through water directly from the Colorado River (rather than water released from Lake Pleasant) was present in the CAP canal. Saguaro Lake had higher MIB levels than Bartlett Lake in 2004, and caused persistent MIB throughout the SRP system between 5 and 20 ng/L. In July and early August 2004, MIB production in the Arizona canal resulted in MIB levels about 30 ng/L.

Greenway WTP had all finished water samples (100%) below 10 ng/L. South Tempe WTP had 92% of the samples < 10 ng/L, while North Tempe WTP had only 38% less <10 ng/L. However, North Tempe WTP had 69% of the samples < 15 ng/L. Union Hills and Val Vista had ~80% of the treated water samples < 10ng/L. 24th Street WTP had 67% of the treated water samples < 10 ng/L, but Deer Valley only had 34% of the treated water samples < 10 ng/L. Therefore, Deer Valley had the most frequent number of samples above 10 ng/L. Ozone and GAC treatment at Greenway WTP was the most effective treatment for MIB. During selected sampling across the treatment train, most of the MIB removal at Greenway WTP occurred during ozonation and it appeared the GAC had reach near saturation of MIB.

Monitoring water temperatures and stratification within the reservoirs allowed prediction of MIB levels likely to be encountered by WTPs weeks in advance. Frequent monitoring of MIB in the canals allowed recommendation of locations to treat the canals. In 2004 it was only necessary to treat the Arizona canal once with brushing, in response to MIB production. Canal brushing effectively reduced MIB production in the canals. Thus this project aided in optimizing the timing, location, and therefore, costs of MIB treatment. In previous years it was necessary to apply more frequent canal maintenance. Monitoring MIB levels of raw and treated water within WTPs aided utilities in adjusting powder activated carbon dosages.

MIB was the dominant T&O compound. Geosmin occurred at significantly lower concentrations than MIB, and was removed better than MIB within the WTPs when PAC was added. Standards for several sulfur-based compounds (hexanal, dimethyl trisulfide, and 2,4 heptadienal) were purchased and prepared. However, the detection limit by SPME GC-MS was > 100 ppt for hexanal, and ~50 ppt for the other two compounds.

Starting in 2003 and then throughout 2004 the earthy-musty compound cyclocitral was also monitored. The maximum cyclocitral concentration in the reservoirs was 20 ng/L, and lower in the canals due to blending with CAP water. Slight increases in cyclocitral concentrations were observed along the length of the Arizona Canal during June and July (2004), corresponding with periods and locations for MIB production in the canals. MIB concentrations were generally higher than cyclocitral concentrations, when both co-occurred. Within the reservoirs, cyclocitral was greater than MIB approximately 60% of the time. However, within the canals and WTPs cyclocitral was greater than MIB concentrations only one-third of the time.

Due to the persistent drought elevated arsenic levels (13 to 21 ppb) were observed in Bartlett Lake and lower levels in Saguaro Lake (4 to 9 ppb). The new arsenic MCL is 10 ppb. Arsenic was well removed at the Phoenix WTPs, but < 40% of the influent arsenic was removed at the Tempe or Peoria WTPs.

DOC concentrations remained fairly constant throughout 2004, primarily due to minimal spring snowmelt or monsoon rainfalls. Table E.1 and E.2 summarize DOC and SUVA values for 2004 and into 2005, respectively. Heavy rainfall and runoff in early 2005 has significantly increased DOC, SUVA, and nutrient values in the lakes. This will significantly change the water quality for 2005. Table 2.7 summarizes recent data for February 2005. The DOC increase in Bartlett Lake is greater than Saguaro Lake because of less upstream storage on the Verde River, based

upon other sampling in 2005 the levels in Saguaro Lake will increase by March 2005 as runoff is passed downstream through the Salt River Reservoirs. The increase in SUVA represents a significant shift in the characteristics of the DOC to a more humified material. This material should be slightly easier to remove by coagulation, but at the same time is much more reactive with chlorine in forming DBPs.

Table E.1 – Average DOC and SUVA for 2004 measurements

Reservoir	DOC (mg/L)	SUVA (L/mg-cm)
Lake Pleasant	3.1	0.013
Saguaro Lake	4.6	0.017
Bartlett Lake	3.1	0.022

Table E.2 – Average DOC and SUVA for February 2005

Reservoir	DOC (mg/L)	SUVA (L/mg-cm)
Lake Pleasant	4.0	0.022
Saguaro Lake	5.0	0.024
Bartlett Lake	6.3	0.050

All data for this project is electronically maintained in an Excel ACCESS database system. Appendices to this report contain hardcopy output from this system. Hopefully both electronic and hardcopy data will be useful to the utilities in long-term planning.

TASK 2 – RESEARCH AND T&O CONTROL EVALUATIONS

Several research activities conducted in 2004 were conducted to provide both practical and fundamental improvements in understanding and controlling algae and T&O compounds. They are briefly summarized as follows:

- A comparison of four commercial copper products for algae control were evaluated. No statistical differences were observed between the copper products for experiments with *Pseudanabeana sp.*
- A model that estimates MIB production per mile of canal was developed. The model accounts for dilution (surface water or groundwater pumping) and aids in identifying specific canal stretches with high MIB production. During periods with MIB production within the canals, production rates of 1 to 5 ng MIB per mile of canal per day were observed. These are fairly low production rates, but over several miles contribute significantly to MIB levels entering WTPs. Some parts of the canals had consistent negative production rates, indicating biodegradation or volatilization of MIB but not dilution – since dilution was accounted for in the model. This type of modeling allows improved understanding for MIB sources and fate within the canals, and to optimize the treatment of canals in order to reduce MIB production.

- A comparison of the SRP mechanical brushing and CAP squeegee device for removing algae from canal walls were evaluated. Both removed >50% of the biomass. Because of the geometry and materials, CAP and SRP staff did not think the devices would function as well on the other entities systems as on their own canals.
- Algaecide coatings that could be applied to the concrete canal walls were evaluated for the potential in controlling algae growth and subsequent MIB production. Products containing Zinc Omadine were very effective over 6 months in nearly preventing algae growth. The long-term use of these products in potable water supply systems need to be considered by SRP and local cities. Coatings using titanium dioxide were not effective in controlling algae growth, although further studies are probably still warranted.
- Detailed analysis for the effects of forest fires in the Salt River, Arizona and South Platte River, Colorado are detailed in a MS thesis recently completed. A synthesis of this thesis is included. In Arizona a comparison between the Salt River and Verde River over the same time periods indicated substantially higher loadings and different trends in loadings for the two watersheds, which could be directly associated to the 2002 forest fires in the Salt River watershed. Table E.3 summarizes the observed trends.

Table E.3 Mass loading comparison of the Salt River and Verde River

	% Change 1 year post-fire		% Change 2 years post-fire	
Constituent	**Salt River**	**Verde River**	**Salt River**	**Verde River**
Total Organic Carbon	↑↑↑	-	-	-
Dissolved Organic Carbon	↑↑	↑	↓	↓
Total Phosphorus	↑↑↑	↓	↓	↓
Dissolved Phosphorus	↑↑	↓	↓	↓
Total Nitrogen	↑↑↑	↓	↓	↓
Ammonia	↑↑↑	↑	↓	↓
Nitrate-Nitrite	↑↑		↓	-
Suspended Sediment	↑↑	↓	↓	-
Stream Discharge	↓	↓	↓	↓

Legend:

↓ or ↑ < 100%	100%< ↑↑ <1000%	1000% < ↑↑↑

TASK 3 – PROCESS CONTROL RECOMMENDATIONS AND COMMUNICATION

Twenty six Regional Water Quality Newsletters were produced and distributed in 2004. One workshop was held in August 2004 to discuss the T&O situation and potential innovative control strategies.

RECOMMENDATIONS

Continuous and ongoing process control monitoring can avoid undesirable T&O events which would cause consumers to be dissatisfied with the taste and odor quality of their water. This dissatisfaction may lead consumers to perceive their drinking water as being unsafe. Therefore it is imperative that local agencies continue T&O monitoring to prevent serious T&O episodes. As a continuing goal of reducing T&O levels to below the threshold levels, it is important that water providers (CAP & SRP) work together with cities and WTP operators to provide raw water at the WTPs with the lowest T&O levels possible. This can occur through blending of source waters, managing groundwater pumping, and treating periphytic algae growth in the canals. WTPs must consider optimization of PAC selection and dosing, and plan to upgrade treatment processes (e.g., GAC adsorption systems).

Between 1998 and late 2004 the Valley has been in a prolonged drought. Heavy rains in December 2004 and through February 2005 have filled the SRP reservoirs and delivered runoff into the CAP system. This runoff has drastically changed the nutrient and DOC levels in the reservoirs, and will likely affect algae activity this summer. Our best guess in respect to algae activity is increased chlorophyll-a content, but a shift away from T&O producing cyanobacteria toward green algae and diatoms. Cyanobacteria tend to prefer warmer water and higher conductivity water than green algae. The runoff has decreased conductance. Reservoir surface temperatures will likely reach similar levels as in past years however, and the higher reservoir levels means increased reservoir volume in the upper 10 m of the lake where algae activity will be greatest. The runoff has increased DOC concentrations in the reservoirs. In the past we have seen that DOC degrades in the hypolimnion of the reservoirs fairly rapidly (months), while algae productivity in the summer results in DOC formation. Therefore we expect a gradual shift this summer in the characteristics of the DOC from high SUVA to lower SUVA. Upon chlorination, the DOC in 2005 may be more reactive in forming DBPs than in 2004.

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CHAPTER 1 - BACKGROUND

ASU has been working with regional water providers (SRP, CAP) and metropolitan Phoenix cities since 1998 on algae-related issues affecting drinking water supplies, treatment, and distribution. The results have improved the understanding of taste and odor (T&O) occurrence, control, and treatment, improved the understanding of dissolved organic and algae dynamics, and initiated a forum to discuss and address regional water quality issues. We continued this program through 2004, which continued to be a drought year until December 2004 when significant rainfall events started filling the reservoirs. Continuing the project through 2005 will complete a study over multiple years of drought and heavy rainfall and provide the context for longer range planning around algae, T&O, and organic issues.

The 2004 project was designed to support WTPs in reducing T&O in drinking water at regional WTP and improve the quality of water being delivered to residents of the Phoenix Metropolitan area through continuing a program of monitoring, research, and process control evaluations on the water supply reservoirs, canals, and finished drinking water. A map of the water supply system and locations of routine sampling is presented in Figure 1.1. The goal of this project is to continue advancing the state-of-knowledge and implementation activities regarding algae-related water quality issues in the metro-Phoenix water supply systems. ASU wants to build upon the results and momentum of the previous T&O project. The specific tasks proposed and corresponding objectives are as follows:

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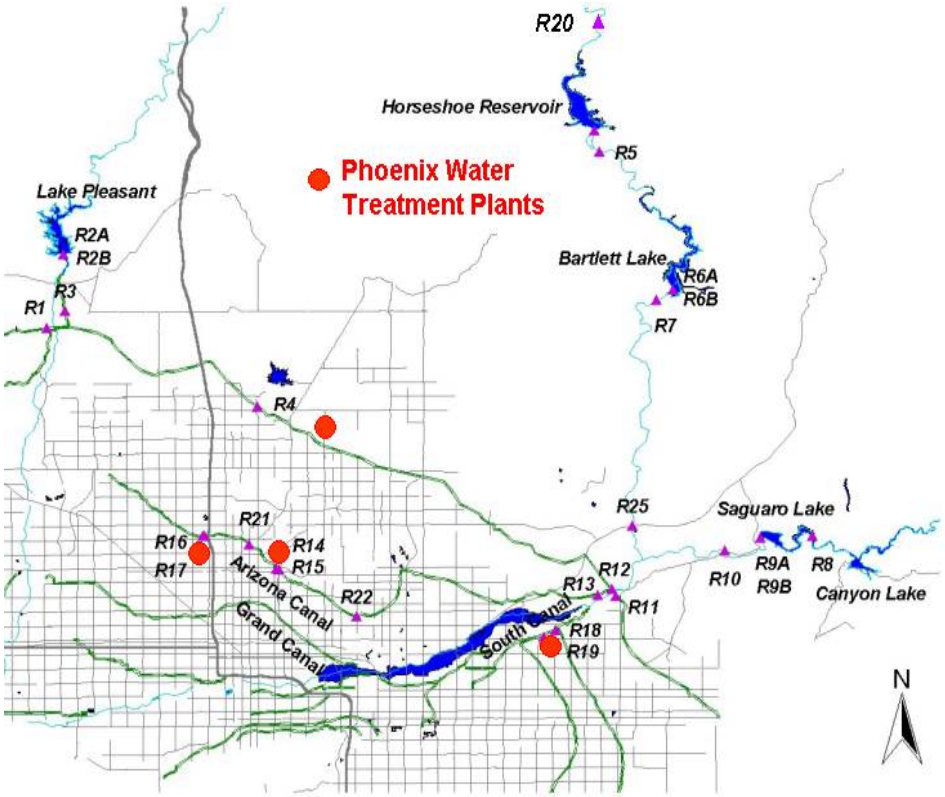


Figure 1.1 Overview map of water supply system and locations of routine sampling (R# designations)

CHAPTER 2 - RESULTS

TASK 1 - MONITORING PROGRAM

Sampling locations and justification for the sites is described in Table 2.1. Parameters analyzed at each site varied based upon frequency and analytical significance. Table 2.2 summarizes the general analytical approach. The appendix to this report provides data on all analyses, and is available in an electronic format (ACCESS). The T&O Newsletters were used as a tool to disseminate much of the collected data in an immediate fashion. The schedule for the T&O Newsletter was monthly (January through June) and then approximately weekly (July through December). This section will graphically summarizes key trends in selected parameters.

Drought conditions persisted throughout 2004, until rains in December 2004. Due to the drought, SRP relied upon blending CAP water into the head of the Arizona and South canals and significant groundwater pumpage.

MIB and Geosmin

Lakes

Trends of MIB in the three lakes are presented in Figure 2.1. Saguaro Lake experienced MIB production in 2004, and every year prior. Lake Pleasant and Bartlett Lake tend to have MIB production in the same years, but not every year. In 2004, MIB production in Lake Pleasant occurred in mid-September and lead to elevated levels being released into the CAP canal for 3 to 4 weeks which lead to significant problems for WTPs on the CAP canal, as well as those on SRP canals. Drought conditions in 2004 lead to high CAP water use in the SRP canals, so even WTPs on the SRP canals were affected by the high MIB levels discharged from Lake Pleasant.

MIB was present throughout the water column in Lake Pleasant during September and early October of 2004. The reservoir exhibited a weak thermal stratification in September and by the end of October was destratified. Bartlett Lake had MIB (max 30 ng/L) in the epilimnion, but levels were < 10 ng/L throughout the year in the hypolimnion. Saguaro Lake had high MIB in August and September 2004 throughout the water column, but was < 10 ng/L after October. MIB was probably produced in upstream Salt River reservoirs and transported into Saguaro Lake in 2004.

Geosmin levels were < 8 ng/L throughout the entire year in all the reservoirs. Therefore geosmin was not an issue in 2004 within the reservoirs.

Table 2.1 – Location and Justification of monitoring sites. Sampling will be conducted by CAP, SRP, and ASU

Monitoring Site	Justification	Sampling Team
Terminal Lakes Havasu Pleasant (R2A, R2B) Bartlett (R6A, R6B) Saguaro (R9A, R9B)	Algae growth in the lakes is a primary source of T&O entering WTPs; monitoring reservoirs and predicting the duration of T&O occurrence will allow COP to order PAC supplies, etc.	CAP SRP& ASU
Rivers Verde River at Beeline Hwy (R25) Salt River at Bluepoint Bridge (R10)	These sites are downstream of terminal lakes and represent influent water to the SRP canal system; storm runoff affects T&O in rivers	 ASU ASU
CAP Canal Wadell Canal (R3) Above SRP cross-connect (R11)	CAP canal provides water to Union Hills WTP and to the head of the SRP canals; historically T&O levels are lower in CAP water than SRP water and offer opportunities to blend sources to control T&O	 ASU ASU ASU
Arizona Canal Above & Below CAP cross-connect (R12& R13) At Beeline Highway (Hwy87) Pima Road (Pima) 56th Street (R22) Central Street (R21)	For the past three years three different "hot spots" for T&O production have been identified. Frequent monitoring has localized "hot spots" and allowed for copper treatment or canal brushing by SRP to reduce in-canal T&O production	All by ASU
South Canal Below CAP cross-connect (SOCA) South Canal at head of Consolidated and Tempe Canal (HTC)	Different blends of SRP and CAP surface water enter the Arizona and South canals, and downstream of Val Vista WTP groundwater is pumped into the canal	ASU
WTPs (Influent and Effluent samples) <u>City of Phoenix</u> Union Hills WTP (UH In/UH Out) 24th Street WTP (R15/R16) Deer Valley WTP (R16/R17) Val Vista WTP (R18/R19) <u>City of Tempe</u> Martinez WTP (NP In/NP Out) South WTP (SPT In/ SPT out) <u>City of Peoria</u> Greenway WTP (Green In/Green Out)	Influent T&O concentrations allow optimization of treatment conditions (e.g., PAC type and doses); finished water is quality perceived by customers	All by ASU

Table 2.2 – Sampling frequency and water quality parameters

Monitoring Site	Sampling Frequency	Water Quality Parameters
Terminal Lakes	1x per month	Field: Depth profiles (Temperature, DO), secchi disk depth; Lab (Epi- and hypo-limnion samples): MIB, Geosmin, Cyclocitral, TP, TDN, UVA254, DOC, conductance
Rivers	Monthly from Jan-June and more frequently June through December	Field: temperature Lab: MIB, Geosmin, Cyclocitral, TP, TDN, conductance, DOC, UVA254
CAP Canal		
Arizona Canal		
South Canal		
Water Treatment Plants		

Note: arsenic and perchlorate were measured on select parameters during the first half of 2004.

Canals

MIB production in the canals was significantly less prevalent in 2004 compared with previous years. In fact, it was only during June and July 2004 that in-canal production of MIB appeared in the Arizona Canal. Figure 2.2 illustrates MIB concentrations in the Arizona Canal on a monthly basis. In June 2004 MIB concentrations increased from < 5 ng/L below the CAP cross connect on the Arizona Canal to 15 ng/L near Deer Valley WTP. In July 2004 production also occurred and exceeded 20 ng/L (Figure 2.3); in response ASU recommended canal brushing of the lower canal section. This canal brushing lead to a reduction in MIB production (Figure 2.4), and for the rest of 2004 MIB production in the Arizona Canal was minimal (Figure 2.2). The longer history of canal treatments is presented in Figure 2.5.

Geosmin production was not a significant issue within the canal system. The only exception was production in the Arizona Canal between 24th street WTP and Deer Valley in July 2004 when geosmin concentrations at Deer Valley reached 14 ng/L. Canal brushing effectively controlled this in-canal geosmin production.

Blending of CAP water near the head of the Arizona Canal generally decreased the MIB concentration coming from the Salt River (mostly when Saguaro Lake water was used between June and September 2004; Figure 2.2). This blending of CAP water was beneficial for reducing T&O levels in the canals. The exception of this CAP blending "benefit" was during October 2004, when CAP water contained high MIB levels from Lake Pleasant. MIB levels in the canals exceeded 30 ng/L and were only slightly diluted along the length of the Arizona Canal by groundwater.

The South Canal did not experience significant changes in MIB after "conservative" mixing of CAP and SRP water. Groundwater pumped into the Tempe Canal diluted MIB throughout most

of the year, resulting in < 10 ng/L MIB for the South Tempe WTP raw water. The only exception was an inlet value of 18 ng/L in August 2004, which resulted in 11 ng/L of MIB in the WTP effluent.

Water Treatment Plants

Most of the MIB entering the WTPs came from the reservoirs, and was not produced within the canals. The WTPs removed MIB only when powder activated carbon (PAC) was added. Specific attention was placed on Deer Valley WTP, where in 2003 MIB removal in the presedimentation basins occurred without PAC addition. This removal with PAC was odd, and did not occur again in 2004. Plots for changes in MIB concentration are presented in Figure 2.6; these are percentage changes and in some cases slight differences in MIB concentrations (e.g., 2 ng/L to 4 ng/L) could result in a negative (apparent increase) in MIB concentration.

A more detailed breakdown of MIB concentrations in raw and finished waters is presented in Tables 2.3 and 2.4. Greenway WTP had all finished water samples (100%) below 10 ng/L. South Tempe WTP had 92% of the samples < 10 ng/L, while North Tempe WTP had only 38% less <10 ng/L. However, North Tempe WTP had 69% of the samples < 15 ng/L. Union Hills and Val Vista had ~80% of the treated water samples < 10ng/L. 24th Street WTP had 67% of the treated water samples < 10 ng/L, but Deer Valley only had 34% of the treated water samples < 10 ng/L. Therefore, Deer Valley had the most frequent number of samples above 10 ng/L. Ozone and GAC treatment at Greenway WTP was the most effective treatment for MIB. During selected sampling across the treatment train, most of the MIB removal at Greenway WTP occurred during ozonation and it appeared the GAC had reach near saturation of MIB. Finished water contain < 10 ng/L of geosmin and cyclocitral.

Other T&O Compounds (non-MIB or Geosmin)

MIB was the dominant T&O compound. Geosmin occurred at significantly lower concentrations than MIB, and was removed better than MIB within the WTPs when PAC was added. Standards for several sulfur-based compounds (hexanal, dimethyl trisulfide, and 2,4 heptadienal) were purchased and prepared. However, the detection limit by SPME GC-MS was > 100 ppt for hexanal, and ~50 ppt for the other two compounds.

Starting in 2003 and then throughout 2004 the earthy-musty compound cyclocitral was also monitored. Seasonal trends in the lakes and canals for cyclocitral concentrations are presented in Figures 2.7 and 2.8, respectively. The maximum cyclocitral concentration in the reservoirs was 20 ng/L, and lower in the canals due to blending with CAP water. Slight increases in cyclocitral concentrations were observed along the length of the Arizona Canal during June and July (2004), corresponding with periods and locations for MIB production in the canals. MIB concentrations were generally higher than cyclocitral concentrations, when both co-occurred (Figure 2.9). Within the reservoirs, cyclocitral was greater than MIB approximately 60% of the time. However, within the canals and WTPs cyclocitral was greater than MIB concentrations only one-third of the time.

Table 2.3– Percentage samples in different MIB concentration ranges (Phoenix WTPs) for 2004

MIB Range (ng/L)	24th Street		Deer Valley		Val Vista		Union Hills	
	Raw	Fin.	Raw	Fin.	Raw	Fin.	Raw	Fin.
<50	100%	100%	100%	100%	100%	100%	100%	100%
<30	69%	96%	69%	93%	100%	100%	90%	90%
<20	59%	93%	41%	79%	100%	100%	85%	85%
<15	41%	78%	28%	52%	100%	100%	85%	80%
<10	21%	67%	17%	34%	62%	82%	85%	80%
<5	17%	19%	10%	24%	62%	55%	85%	80%
<2	0%	0%	0%	3%	31%	45%	75%	55%
# 2004 Samples	27	25	27	24	27	23	28	28

Table 2.4 –Percentage samples in different MIB concentration ranges (Tempe & Peoria WTPs) for 2004

MIB Range (ng/L)	N. Tempe		S. Tempe		Greenway	
	Raw	Fin.	Raw	Fin.	Raw	Fin.
<50	100%	100%	100%	100%	100%	100%
<30	83%	88%	100%	100%	94%	100%
<20	67%	81%	100%	100%	88%	100%
<15	56%	69%	94%	100%	69%	100%
<10	33%	38%	94%	92%	38%	100%
<5	11%	19%	81%	77%	19%	80%
<2	0%	6%	50%	15%	6%	67%
# 2004 Samples	24	24	25	25	25	25

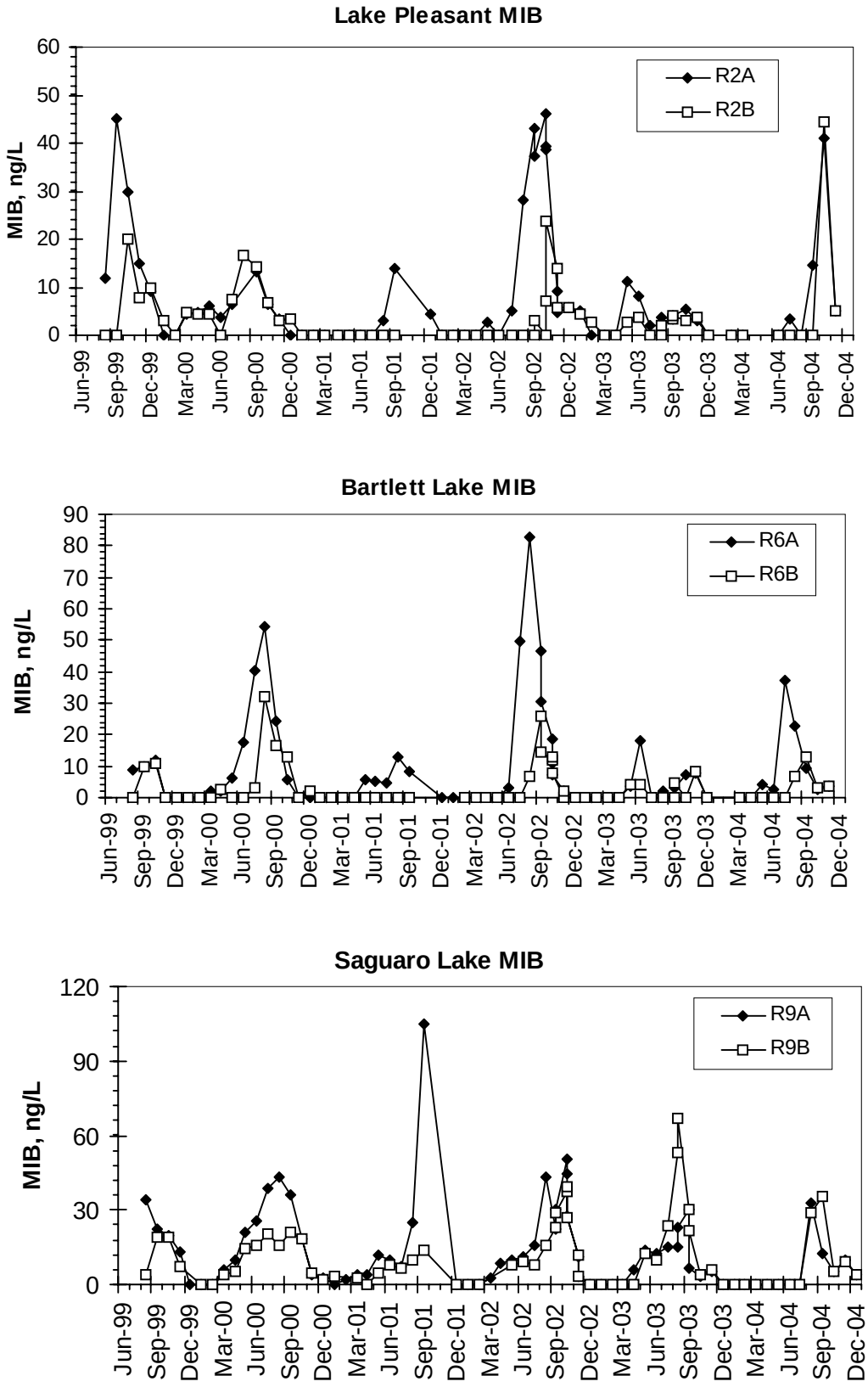


Figure 2.1 Trends in MIB concentration in epilimnion (R2A, R6A, R9A) and hypolimnion (R2B, R6B, R9B) of terminal reservoirs for the metro Phoenix region

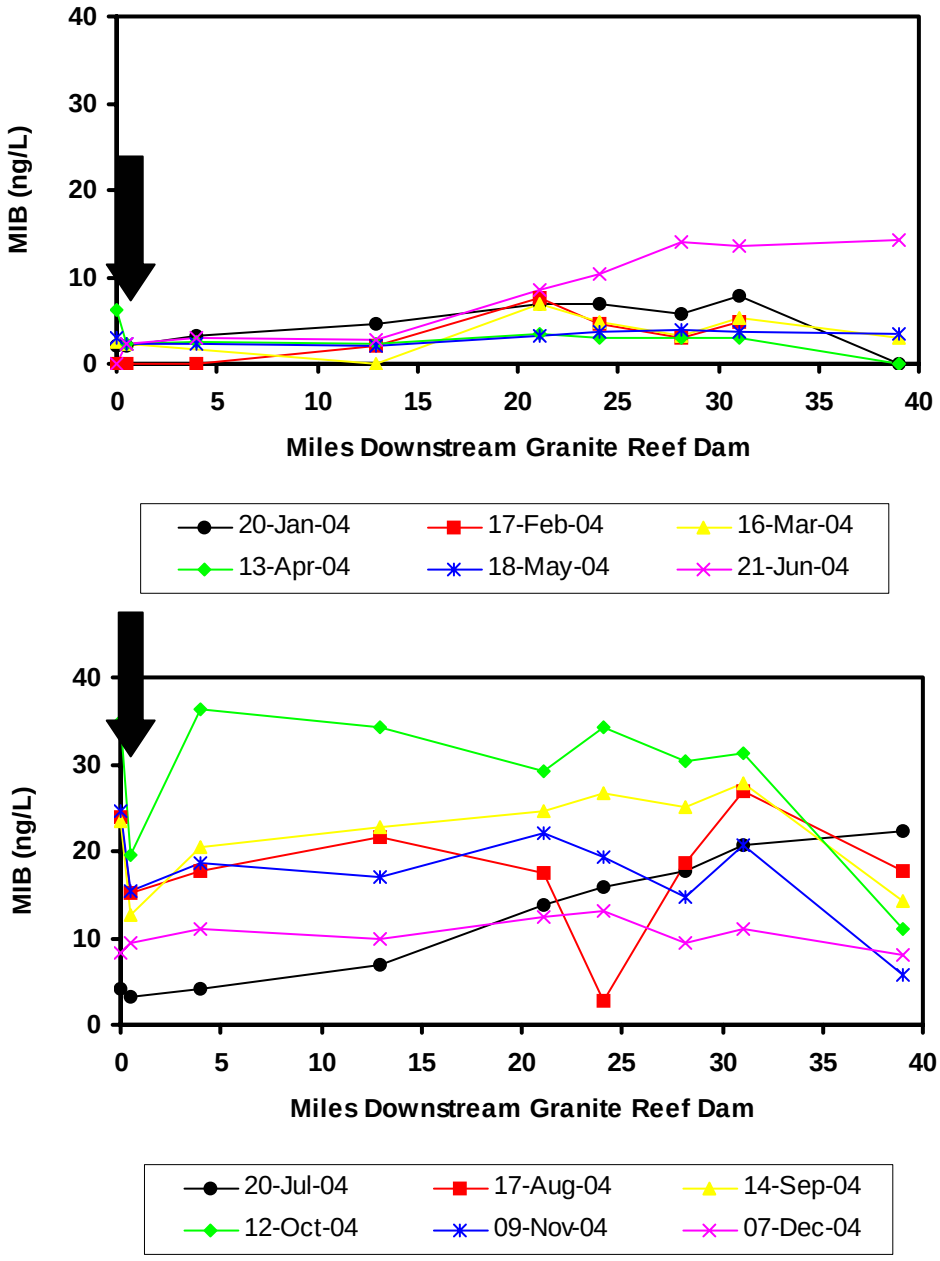


Figure 2.2 MIB concentrations along the length of the Arizona canal during cooler water months (upper) and warmer water months (lower). Black arrow indicates location of CAP water entering the Arizona Canal.

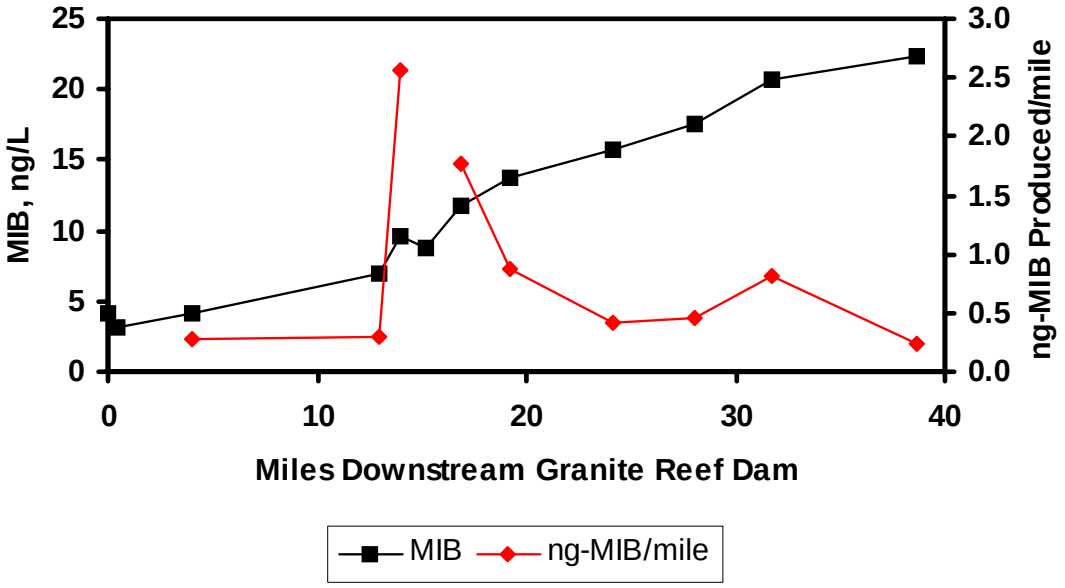


Figure 2.3 Increasing MIB concentrations and production (ngMIB/mile) in the Arizona Canal for July 2004.

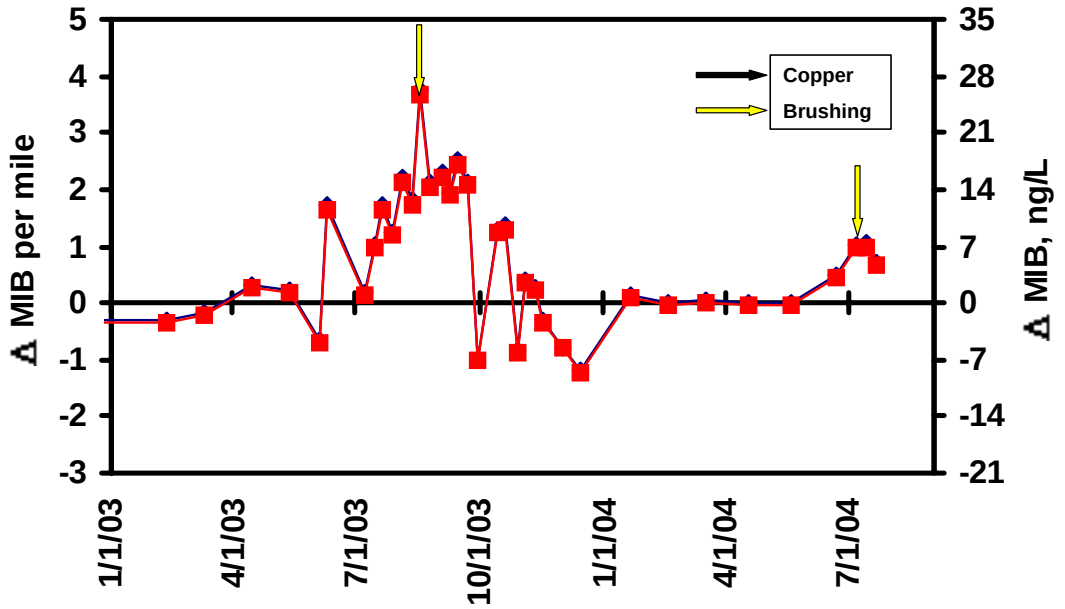


Figure 2.4 MIB production in the lower part of the Arizona Canal and periods when SRP brushed the canal.

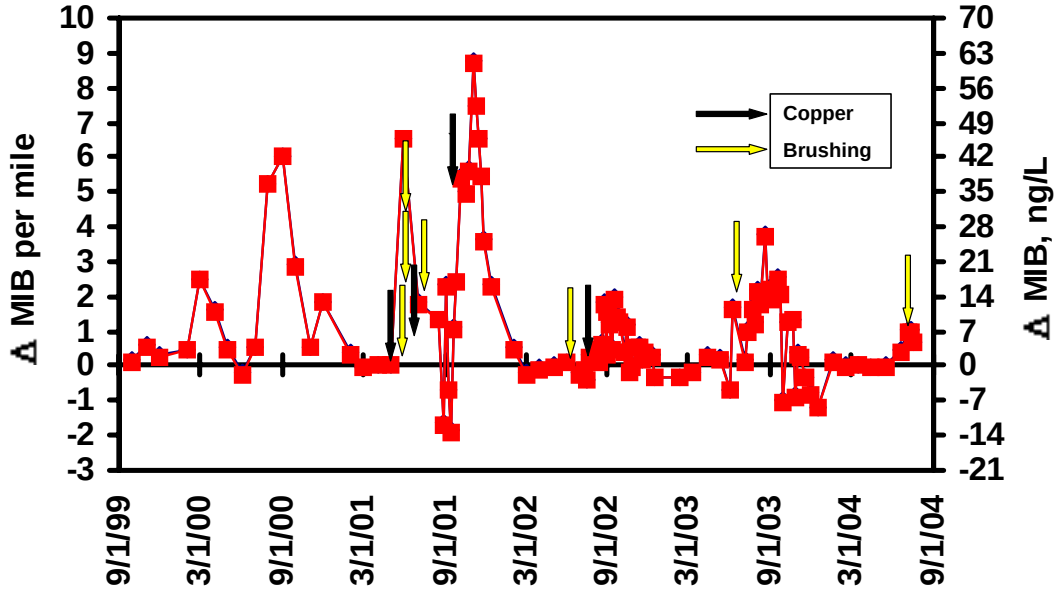


Figure 2.5 MIB production in the lower part of the Arizona Canal and periods when SRP brushed or added copper in the canal over the past 5 years.

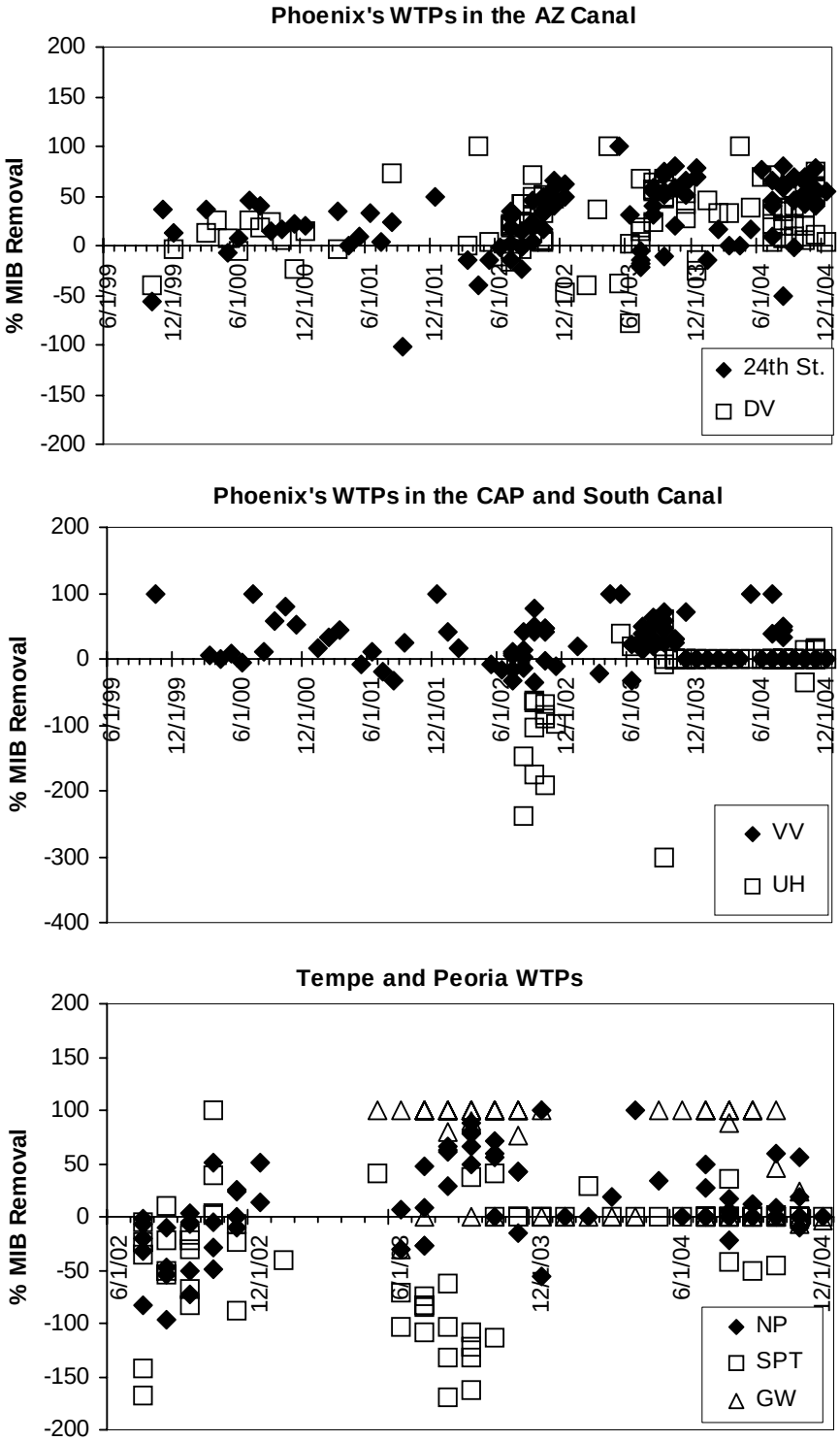


Figure 2.6 Changes in MIB concentration within the monitored WTPs

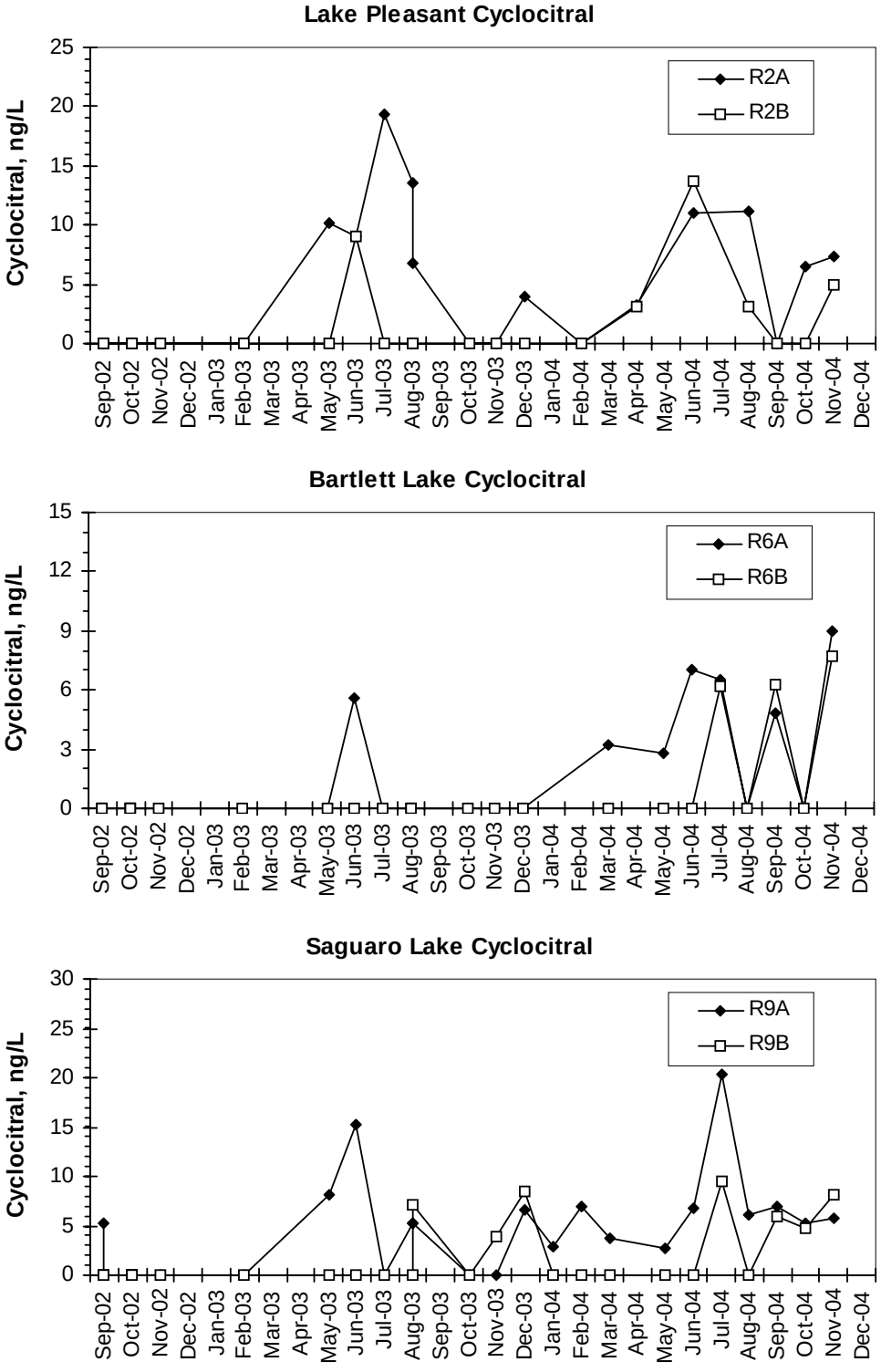


Figure 2.7 Cyclocitral concentrations in the reservoirs

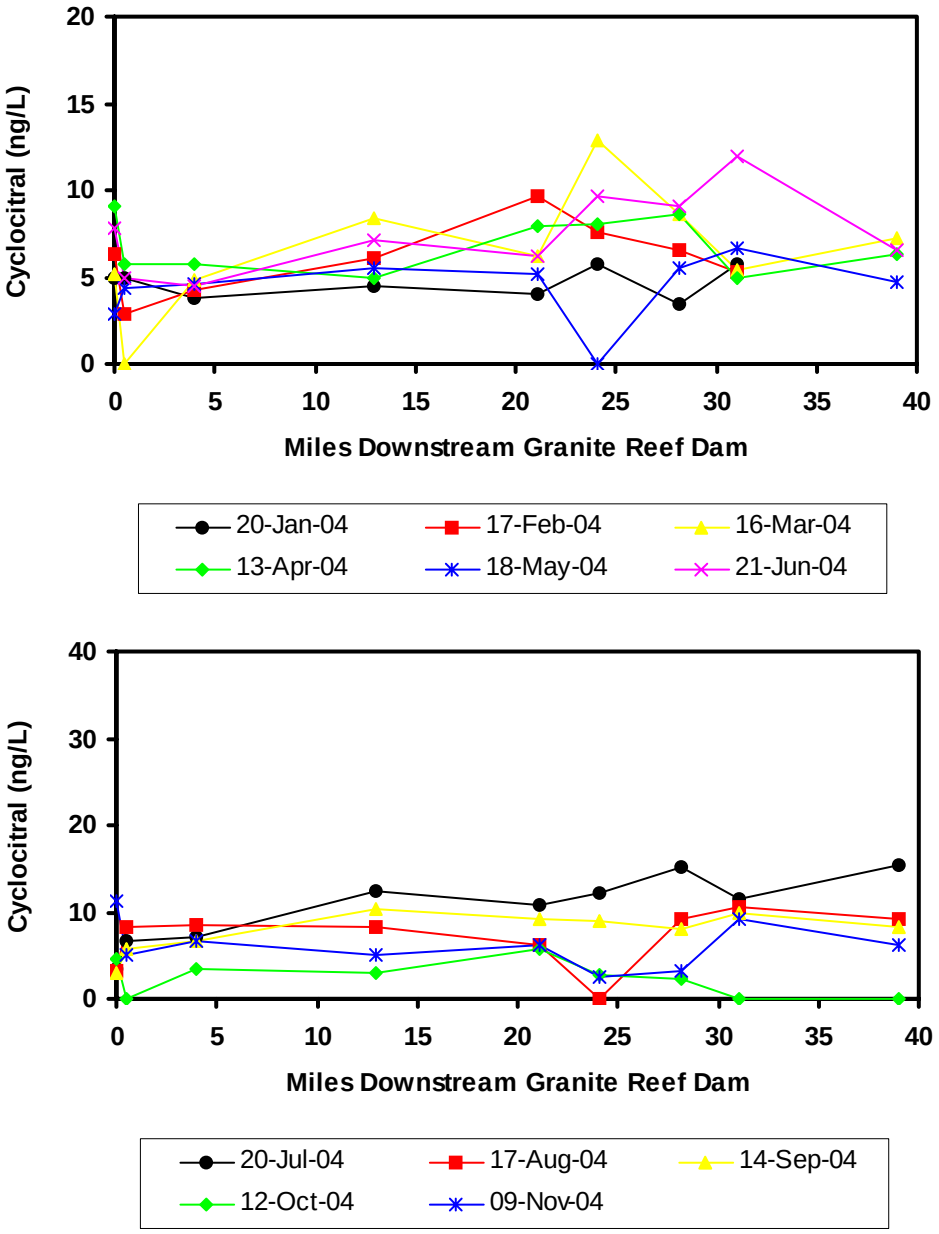


Figure 2.8 Cyclocitral concentrations in the canals

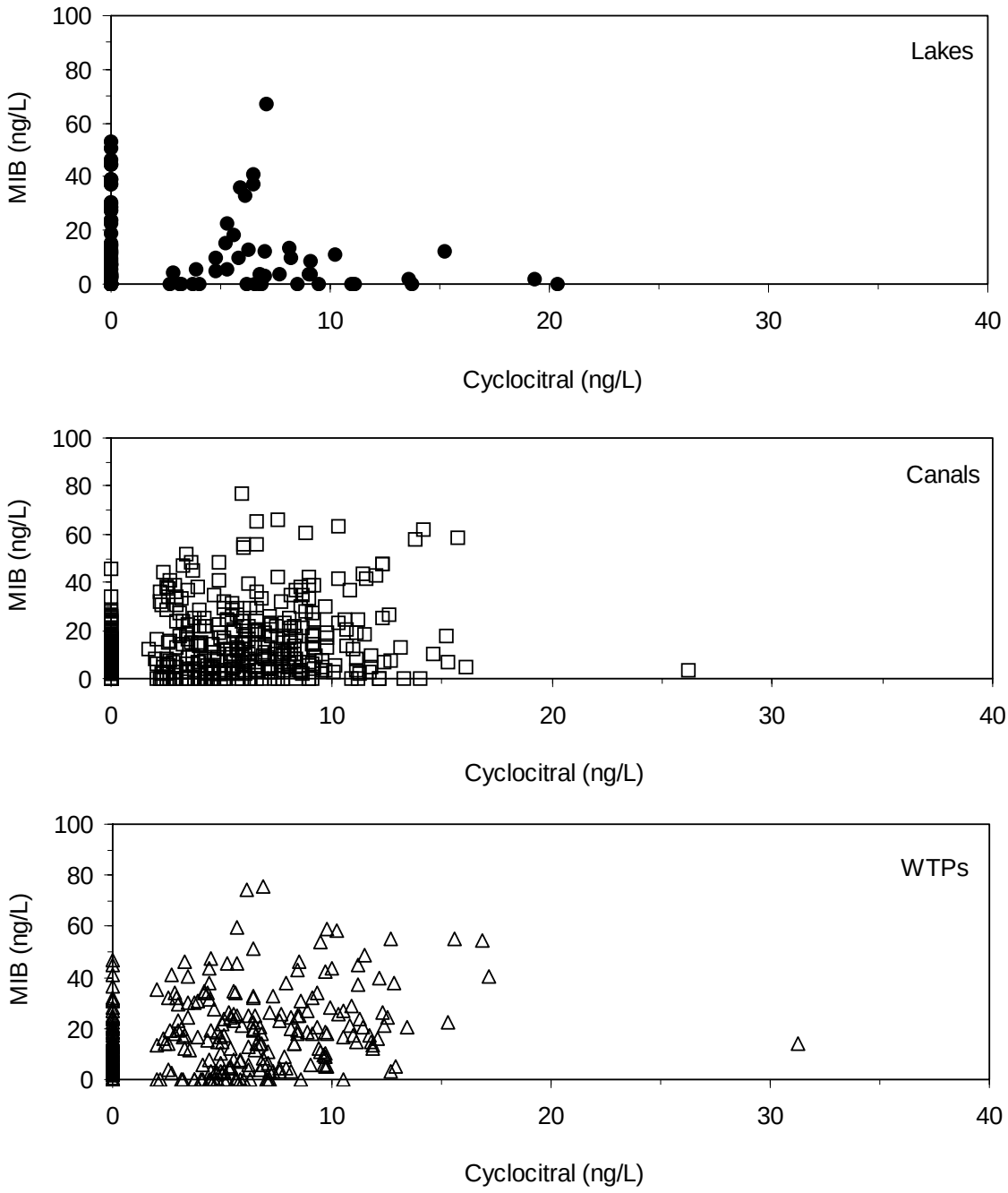


Figure 2.9 Cyclocitral concentrations correlated with MIB concentrations

Arsenic and Perchlorate Occurrence

For the first few months of 2004 ASU measured arsenic at all the sites. Because of the drought conditions arsenic levels were high and would have exceeded the new MCL of 10 μg/L. Table 2.5 summarizes the arsenic data. Bartlett Lake contained high levels of arsenic. The Phoenix WTPs which use moderate dosages of metal coagulants to control DOC, also removed most of the influent arsenic. Peoria's Greenway WTP did not remove much arsenic and in some cases would have been above the new MCL. Tempe's WTPs only removed 20% to 40% of the influent arsenic.

Perchlorate (ClO_4^-) was measured for three months in early 2004. Data is summarized in Table 2.5. The detection limit was 1 ppb, and only samples from Lake Havasu had detectable levels of perchlorate. The MCL for perchlorate has not been set, but may be between 1 and 30 ppb.

Table 2.5 Summary of arsenic and perchlorate samples for early 2004

Location	Arsenic (μg/L)	Perchlorate (μg/L)
Lakes		
Lake Havasu	Up to 3	2.6
Lake Pleasant	~3	<1
Bartlett Lake	13 to 21	<1
Saguaro Lake	4 to 9	<1
WTP Treated Water		
Union Hills	<2	<1
Val Vista	<2	<1
24th Street	2 to 3	<1
Deer Valley	<2	<1
Greenway	10% to 30% removal	<1
N. Tempe	20% to 40% removal	<1
S. Tempe	~20% removal	<1
MCL	10	TBD

Organic Carbon

DOC concentrations remained fairly constant throughout 2004, primarily due to minimal spring snowmelt or monsoon rainfalls (Figure 2.10). It was not until December 2004 that DOC concentrations increased in Bartlett Lake due to upstream runoff. Specific ultraviolet absorption at 254nm (SUVA) is an indicator of organic matter aromatic carbon content, and is calculated as UV254 divided by DOC. Trends in SUVA are presented in Figure 2.11. Tables 2.6 and 2.7 summarize DOC and SUVA values for the reservoirs in 2003 and 2004, respectively. No major changes occurred. Other nutrient data also remained relatively constant (Figure 2.12).

The WTPs effectively removed DOC during 2004 (Figure 2.13). Heavy rainfall and runoff in early 2005 has significantly increased DOC, SUVA, and nutrient values in the lakes. This will significantly change the water quality for 2005. Table 2.8 summarizes recent data for February

2005. The DOC increase in Bartlett Lake is greater than Saguaro Lake because of less upstream storage on the Verde River, based upon other sampling in 2005 the levels in Saguaro Lake will increase by March 2005 as runoff is passed downstream through the Salt River Reservoirs. The increase in SUVA represents a significant shift in the characteristics of the DOC to a more humified material. This material should be slightly easier to remove by coagulation, but at the same time is much more reactive with chlorine in forming DBPs.

Table 2.6 – Average DOC and SUVA for 2003 measurements

Reservoir	DOC (mg/L)	SUVA (L/mg-cm)
Lake Pleasant	4.0	0.012
Saguaro Lake	4.4	0.015
Bartlett Lake	4.7	0.023

Table 2.7 – Average DOC and SUVA for 2004 measurements

Reservoir	DOC (mg/L)	SUVA (L/mg-cm)
Lake Pleasant	3.1	0.013
Saguaro Lake	4.6	0.017
Bartlett Lake	3.1	0.022

Table 2.8– Average DOC and SUVA for February 2005

Reservoir	DOC (mg/L)	SUVA (L/mg-cm)
Lake Pleasant	4.0	0.022
Saguaro Lake	5.0	0.024
Bartlett Lake	6.3	0.050

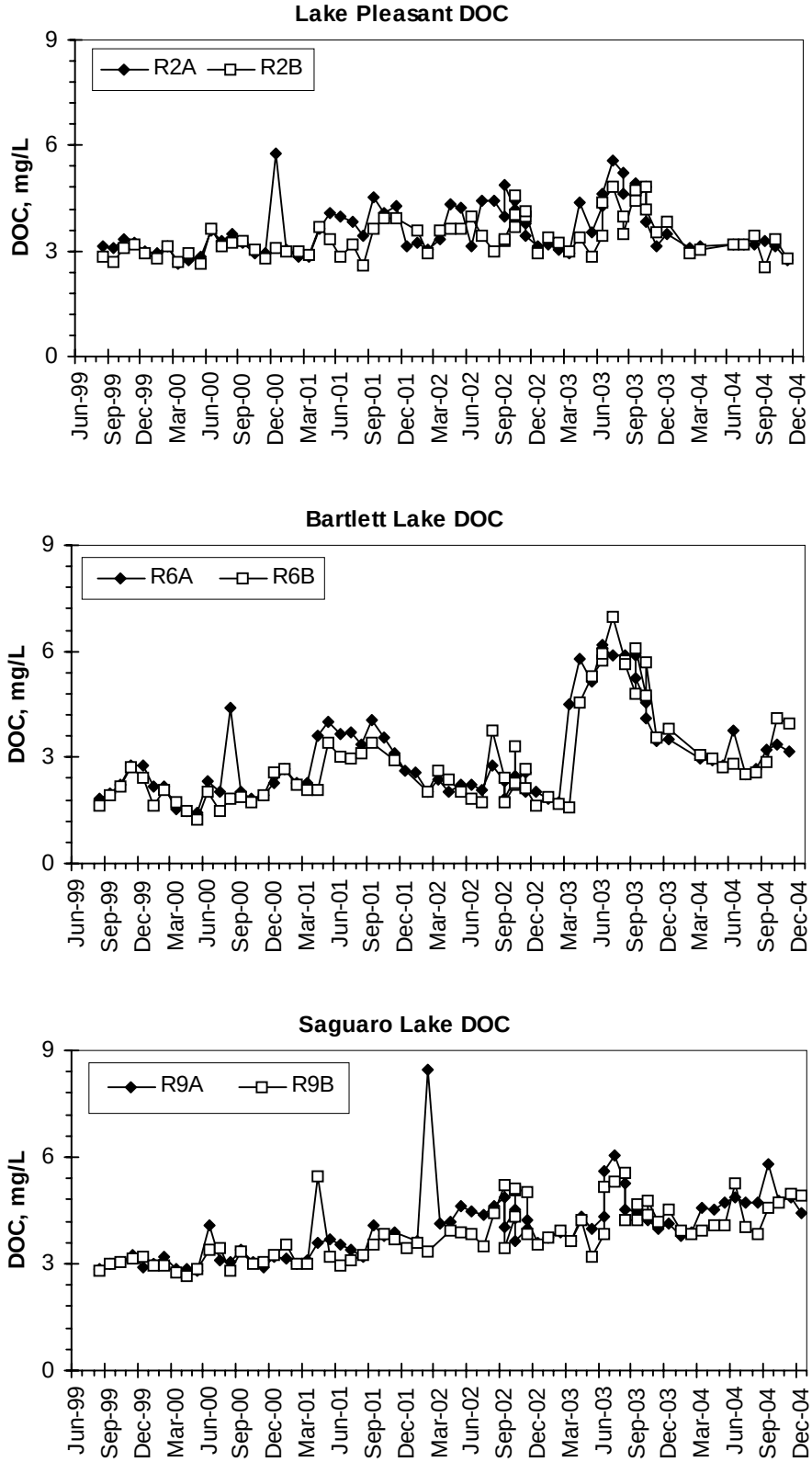


Figure 2.10 DOC in the upper 10-m (epilimnion: R2A, 6A, 9A) and deeper (hypolimnion: R2B, 6B, 9B) parts of the lakes

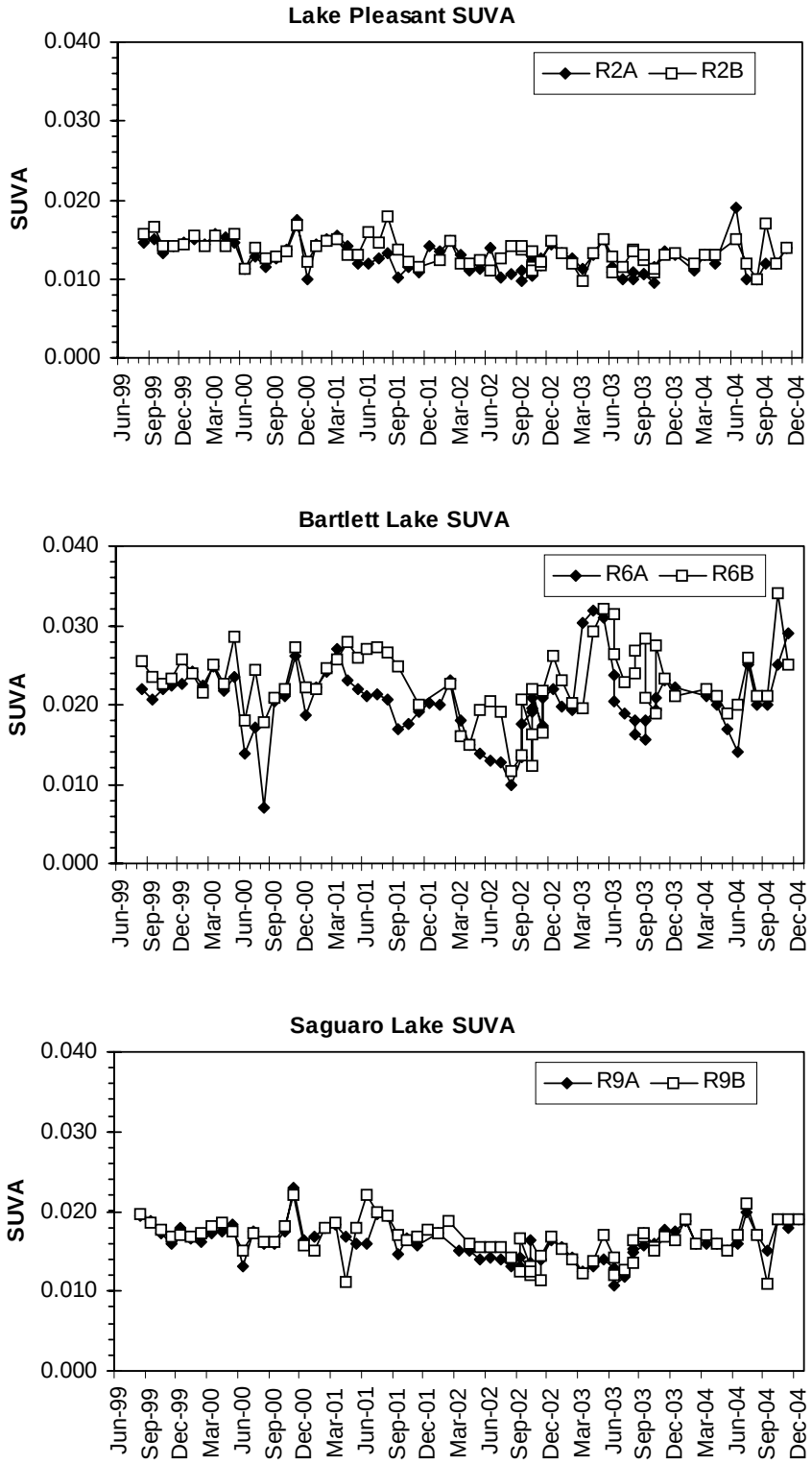


Figure 2.11 Trends in SUVA in epilimnion (R2A, R6A, R9A) and hypolimnion (R2B, R6B, R9B) of terminal reservoirs for the metro Phoenix region

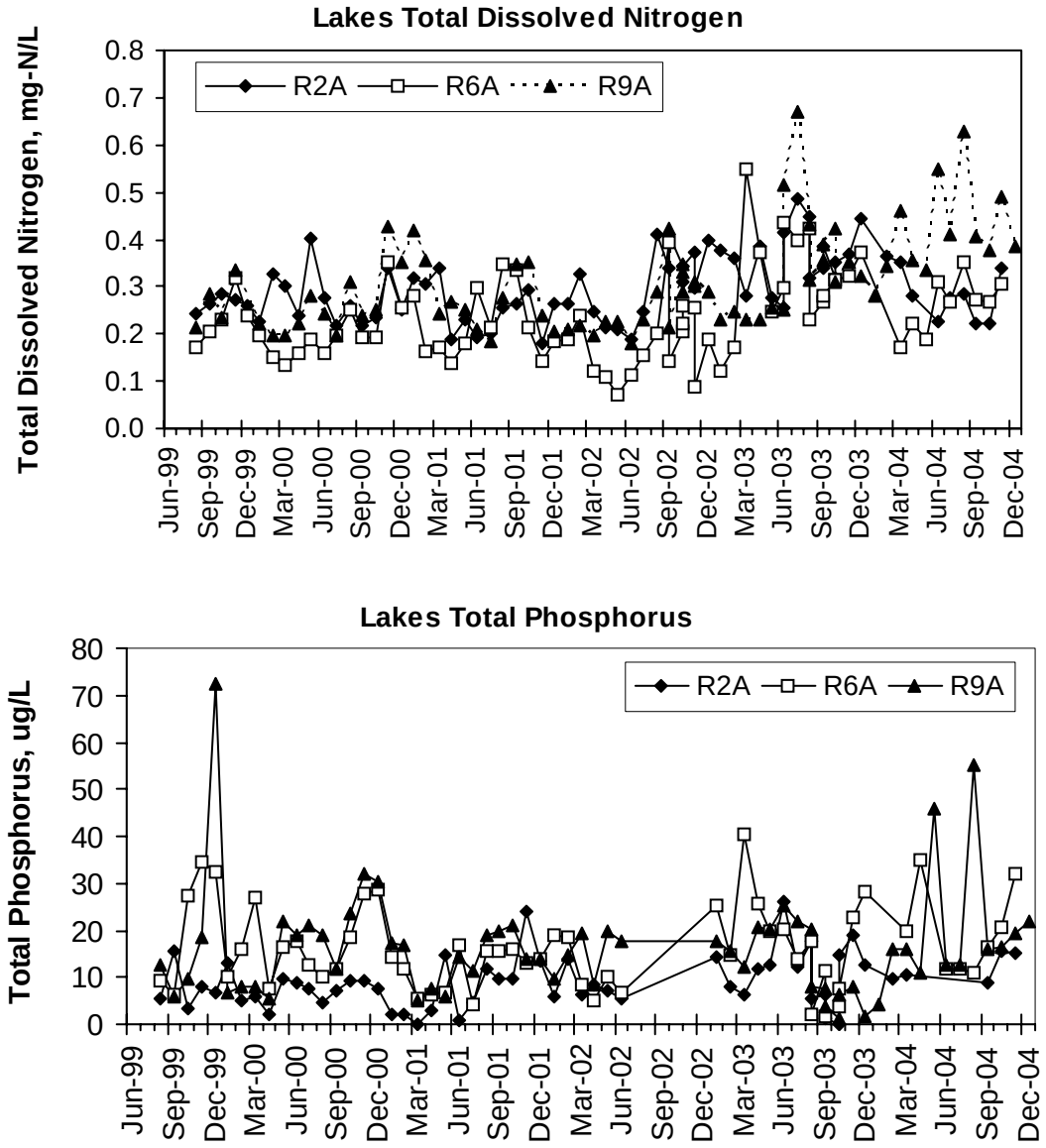


Figure 2.12 Trends in Nitrogen and Phosphorous concentration in epilimnion (R2A, R6A, R9A) of terminal reservoirs for the metro Phoenix region

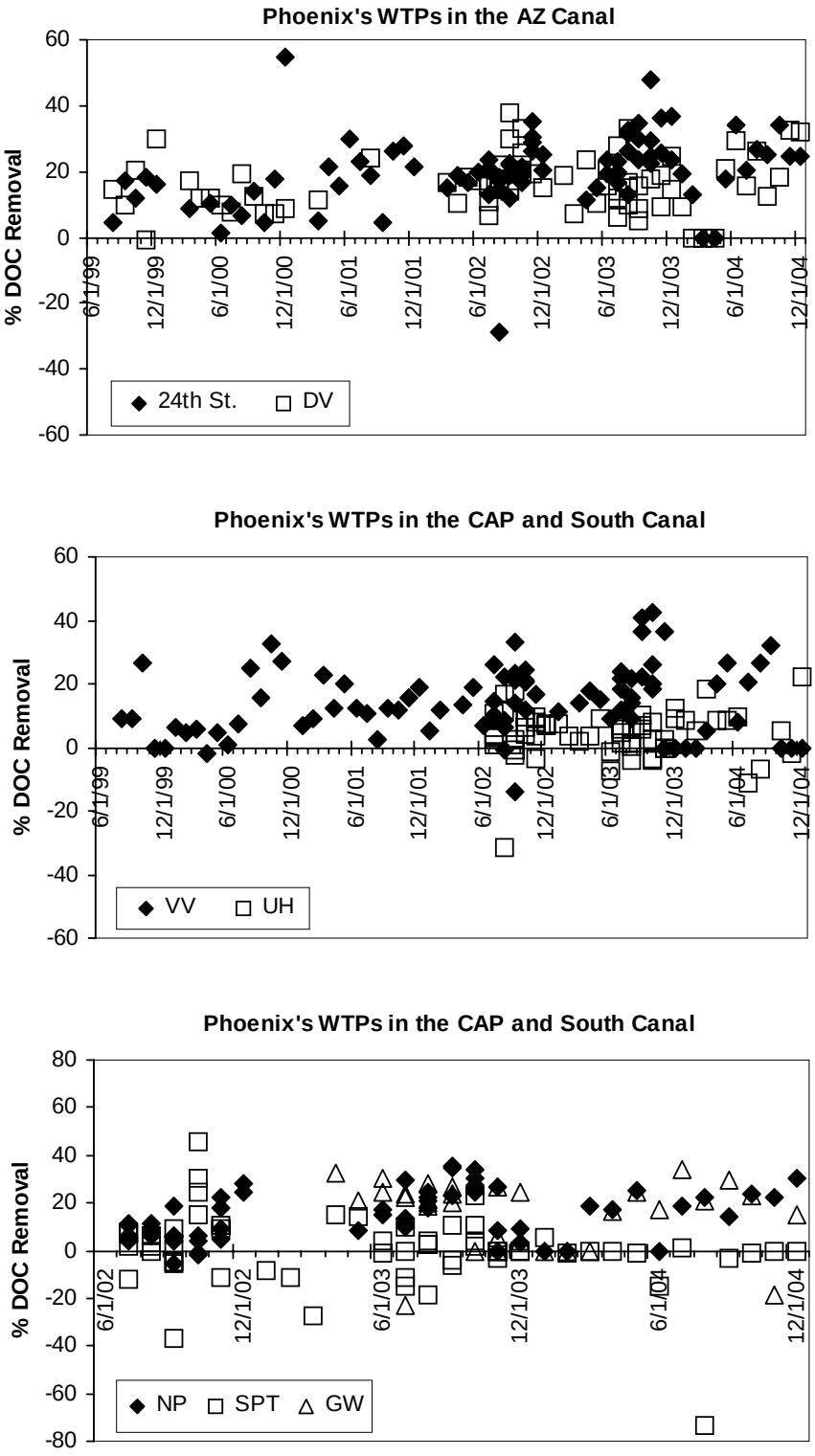


Figure 2.13 – Percentage DOC change across each WTP

TASK 2 – RESEARCH AND T&O CONTROL EVALUATIONS

Comparison of Copper Products

In batch laboratory experiments was undertaken using Arizona Canal water a study to evaluate the relative effectiveness of four different commercial copper-based algacides (Earthtec, Algaymicin PWF, SCI-62, and Cutrine-Plus). A native *Pseudanabeana sp.* was used for the tests. Copper dosages of 0.5 to 5 mg/L were evaluated, with contact times of 2 to 6 hours between the copper products and algae. After the specified contact time, water containing the copper product was removed and replaced with canal water without copper. Chlorophyll-a was measured 7 days later. There were some losses of biomass during water exchange, and as a result there was not a single copper product that consistently outperformed the other products. In all cases, increasing copper dosage to 5 ppm lead to less chlorophyll-a at the end of the experiments. Figure 2.14 represents the type of data that has been collected. Error bars are not shown for this preliminary data as the experiments were only conducted in duplicate. On average the difference between the duplicate samples was 31%, but ranged from <10% to 70% variability. As such it is difficult to make a strong recommendation on any copper product at this time. Additional experimentation remains ongoing to develop a more accurate technique for evaluating copper products. These are using larger numbers of replicates and alternative means of assessing algae activity.

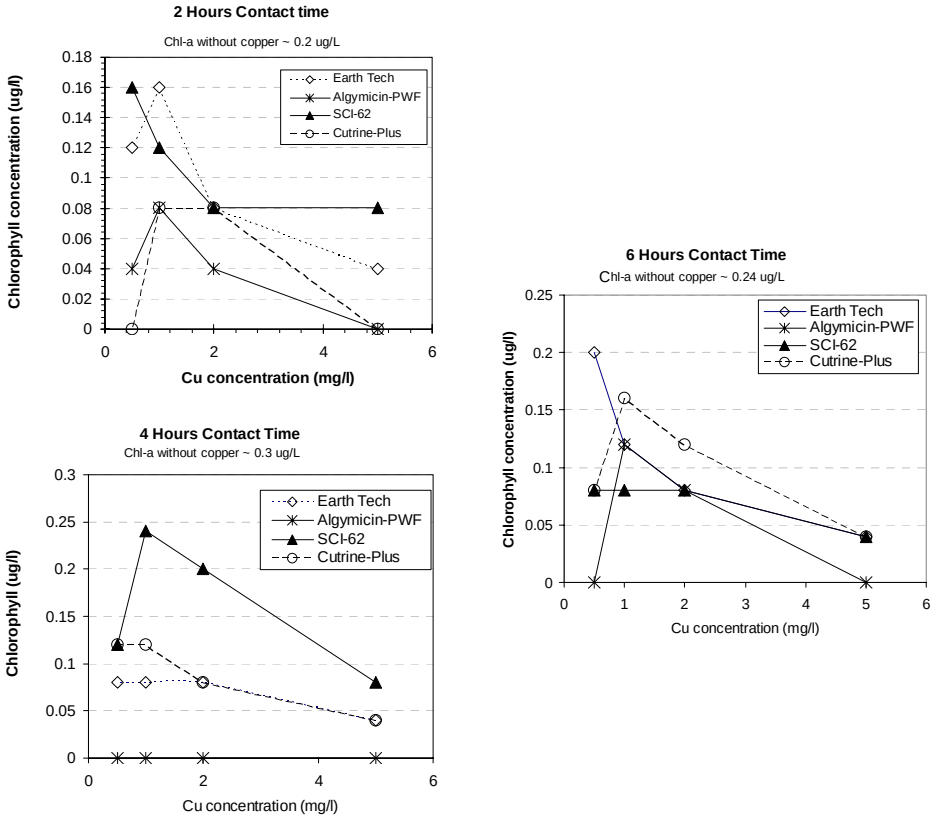


Figure 2.14 Preliminary results from copper product evaluation

Spatial MIB Production Model

The object of this analysis to develop a model that can be used to determine sources of MIB to the Arizona Canal and within-canal production rates in each segment of the canal under various conditions. The model is an Excel spreadsheet that can readily be run at any time in the future. The model computes within-canal production for a given day. Input data are hydrologic data (inflows, well pumping and diversions) and MIB data at four points.

Approach

Data on canal flows, deliveries from the Arizona Canals, and well pumping were obtained from SRP for 2002, 2003 and 2004. The MIB data were collected in the ASU study. Because MIB data were not collected at each diversion, it was necessary to develop a simple model of MIB production between major sampling stations. MIB production (g/mile-day) was assumed to be constant within each section but was allowed to vary among segments. The model is a simple mass balance, in which the mass of MIB leaving a segment is equal to the amount entering the segment, plus MIB production within the segment, minus MIB lost via the diversions and the main canal.

MIB load leaving segment = MIB load entering segment + production within the segment – MIB lost via diversions.

For the simple case of one diversion, the model is:

$$[MIB]_l * Q_l * 10^{-6} = [MIB]_u * Q_u * 10^{-6} + k*L - k*L_d * Q_{d,out}/Qd,AZ$$

Where
$[MIB]_u$ = MIB concentration at upper end of segment
Q_u = flow at upper end of segment, m^3/day
$[MIB]_l$ = MIB concentration at lower end of segment, ng/L
Q_l = flow at lower end of segment
k = MIB production rate (0^{th} order), g/mile
L = length of segment, miles
L_d = length of segment from upper end down to diversion within a segment
$Q_{d,\ out}$ = flow from diversion, m3/day
$Q_{d,AZ}$ = flow in the Arizona Canal at the point of diversion.

Sections were bounded by routine sampling sites. Flow at the lower end of the segment was computed by adding well pumping and subtracting diversions from the inflow at the upper end of the segment. Lengths to each well and diversion were determined from a canal map.

The model was then calibrated for each segment to determine k. Calibration was done by trial-and-error (generally about 4-5 iterations) until the modeled MIB matched the measured MIB.

Modeled segments were:

- Segment 1. From the broad-crested weir (ASU site #12) at the head of the canal to Pima Road (ASU site "Pima Road).

- Segment 2. From Pima Road to the 24th Street Water Treatment Plant (ASU site #14).
- Segment 3. From the 24th Street WTP to the Deer Valley WTP (site #16).
- Segment 4: Deer Valley WTP to the Greenway WTP.

Using the Model

The Excel model can be made available, but will be posted on the project website. The sheet "Generic" can be used at any time in the future, requiring only daily flow data and MIB data at key sites on the Arizona Canal (below CAP inlet, at Pima Road, 24th Street WTP, Deer Valley WTP, and Greenway WTP). The other sheets are examples of model applications for specific dates (discussed below).

The model is run for one day at a time. Two types of data are needed to use the model. Hydrologic data are obtained from SRP. These are entered in columns F and G. There are three types of data: (1) daily flow at two points on the Arizona Canal, (2) pumping data, and (3) diversions. The model uses canal flow data for three points: the broad-crested weir below the CAP inlet, the CAP inlet, and the Arizona Canal at Arizona Falls. Water enters the Arizona Canal from the SRP system and the CAP system. Data from the BCW represents the combination of these flows. Contribution from the SRP side of the system can be computed by subtracting the CAP flow from the BCW flow.

Diversions remove water from the Arizona Canal and should be entered as negative numbers in column F. Well pumping adds water to the Arizona Canal. Pumping values (cfs) are added to column G.

The MIB data (column K) are used for calibration. The model is not very flexible in this regard: it requires MIB data from all of these sites.

After the flow data and MIB data are entered, the model must be calibrated. Calibration points are shown in column M. Calibrate from upstream to downstream. Segment 1 is bounded by Pima Road on the downstream side. Adjust the "k" value for the Pima Road site until the modeled MIB values (column P, row 11) matches the measured MIB value (column K, row 11) (within 0.5 ng/L or so). Start with a "guess" of 0.5 and adjust upward or downward as needed. You should be able to get within 0.5 ng/L of the measured value within 4-5 iterations (trial-and-error method).

Now move to segment 2 (ending at the 24th Street WTP) and repeat the calibration process. K values will likely vary among segments – don't expect them to be the same.

Repeat for segment 3 (ending at the Deer Valley WTP) and segment 4 (ending at the Greenway WTP).

The "k" values are MIB production rates, in g/mile-day. High k values indicate high MIB production rates and can be used to target within-canal treatments. "k" values are a much better indicator than changing MIB concentrations, because MIB concentrations are affected by well pumping and diversions. For example, one could have a high k value (high MIB production) but relatively little increase in MIB within a segment because of high well pumping, which dilutes

the MIB. If one were using MIB gain to guide within-canal treatments, no treatment would be indicated. If the "k" value were used, treatment would be indicated. If well pumping were to cease, the failure to employ canal treatment would result in rapidly elevated MIB values. The "k value" method would indicate canal treatment, so when the wells were turned off, MIB would remain low.

This example shows that within-canal production – represented by the "k" values -- should be used rather than MIB concentrations to guide within-canal treatments.

Modeling for Case Study Dates

Flow Balance. First, a caveat. For each date I did a flow balance: flow at the Arizona Falls site should equal inflows from the head of the canal minus upstream diversions plus upstream pumping. This was never the case, with discrepancies of 50% or more. I discussed this with Dallas Reigle and with Bob Gooch at SRP. Bob did his own calculations independently and confirmed the discrepancy. Dallas and I went through the worksheet and could not find a computational problem. The SRP data management group even re-uploaded the flow data, suspecting a data management problem, but could not find one. SRP is not pursuing this problem further at this time.

The most likely explanation is that the flow data for the Arizona Falls site is inaccurate. The reason for suspecting this site is that it is the only one that is not input or delivery point. Errors at these sites would result in delivery problems, which surely would have been detected.

Modeled MIB Mass Balance. Modeling was done for several dates to represent a range of "high MIB" conditions. Conditions in the Arizona Canal on each date are summarized in Table 2.9.

August 4, 2003. This was during the irrigation season. MIB at the head of the Arizona Canal was low – 9 ng/L at the BCW. MIB concentrations increased to 22 ng/L at Pima Road and 36 ng/L at the Deer Valley WTP.

August 25, 2003. This was also during the irrigation season. MIB at the end of the canal (BCW) was low (12 ng/L) increasing quickly to 42 ng/L at Pima Road, then remaining high (40 ng/L at the 24th Street WTP and 53 ng/L at the Deer Valley WTP)

October 23, 2003. This is near the end of the irrigation season after the switch to Verde River inflows had occurred. MIB was 32 ng/L in the Verde River inflow; this was diluted to 9 ng/L at the BCW site due to dilution with CAP water but then increased quickly to 61 ng/L at Pima Road, 72 ng/L at 24th Street and 81 ng/L at Deer Valley WTPs. This period had very high MIB production segment 1.

July 6, 2004. This was near the middle of the irrigation system, when diversions were high. Nearly all water in the Canal was from the Salt side of the system. MIB at the head of the canal below the CAP inflow as only 3 ng/L. Concentrations remained low at Pima Road (6 ng/L), then increased to 38 ng/L at the 24th Street WTP and remained elevated at downstream sites.

September 28, 2004: This was near the end of the irrigation season. Canal inflows at the upper end were a mix of SRP and Verde River water, with a MIB concentration of 22 ng/L at the BCW. MIB increased gradually: to 33 ng/L at Pima Road, 42 ng/L at the 24th Street Peak WTP and 45 ng/L at the Deer Valley WTP. Both treatment plants were operating.

Table 2.9 Conditions for modeling dates

	8/4/03	8/25/03	10/23/03	7/6/04	9/28/04
% SRP	98	98	100	98	98
% Salt	62	76	2	67	79
% Verde	38	24	98	33	21
Total diversions, cfs	305	362	289	450	315
Total pumping	**9**	**36**	**21**	**63**	**52**

Modeling was done using Excel spreadsheets. Flow and MIB data were entered, and the model was calibrated separately for each segment. Calibration was considered complete when the modeled MIB value at the lower end of the segment was within ~0.1 ng/L of the measured value. Calibrated MIB production rates are summarized in Table 2.10.

MIB production rates varied among segments and within a segment, among dates. On all dates there were segments that produced MIB and segments that consumed MIB.

In general, segments 1 and 3 had the highest k values. The lowermost segment, from the Deer Valley WTP to the Greenway WTP, consistently had negative k values, implying net degradation of MIB. There is no other consistent pattern in k values. The highest k value was observed on the in late fall (in segment 1) when most of the canal water was from the Verde side of the system.

Table 2.10 Model k values (g MIB/mile-day).

Segment	8/4/03	8/25/03	10/23/03	7/6/04	9/28/04
1	2	6.1	9.2	0.5	2.1
2	0.6	-1	1.7	3.7	1.7
3	3.4	2.5	1.5	1	0.33
4	**-1.6**	**-5.5**	**-4.4**	**-0.1**	**-5.1**

Summary

A simple model of MIB production was developed. Using the model requires MIB concentrations at the beginning and end of each segment, plus flow data for the canals on that day. MIB production values (k values) are then obtained by manual calibration. The latter operation takes only a few minutes.

The advantage of this approach over simple inspection of MIB concentrations is that MIB concentrations are influenced by flow conditions. For example, one could have high MIB production rates, but a small increase in concentration, if there is a lot of well pumping to dilute the MIB produced. Knowing that high MIB production is occurring is important, because if the

wells were turned off, MIB concentrations would immediately increase. In this circumstance, treatment of the canals would be indicated prior to well shutdown, to avoid this problem.

Comparison of SRP and CAP Canal Brushing Techniques

In late July 2004 CAP and SRP demonstrated three different techniques for cleaning algae and associated material from the sides of their respective canals. CAP demonstrated two techniques: 1) a large squeegee device and 2) dragging a chain along the side. Images are shown on the next page (Figure 2.16). Biomass samples were collected in cleaned and non-cleaned areas within 30 minutes of each other and the data is summarized in Figure 2.15. The Arizona Canal had less biomass (visually if you attended, but also based upon chlorophyll-a measurements) than the CAP canal (Waddell canal site). All the cleaning techniques reduced biomass from the wall of the canal. The percentage removal of chlorophyll-a was as follows:

- SRP brushing device removed 57% of the biomass
- CAP squeegee device removed 75% of the biomass
- CAP chain-dragging device removed 53% of the biomass

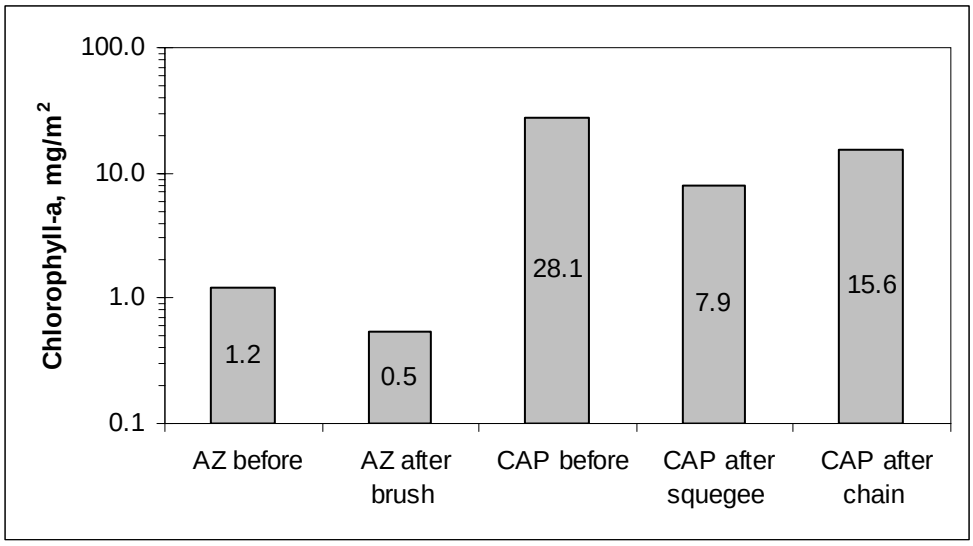


Figure 2.15 – Comparison of cleaning techniques (July 2004)

CAP Squeegee Device shown above

SRP used is brushing device shown below

Figure 2.16 CAP and SRP canal devices for algae removal

Algacide Coating Evaluations

Three types of algaecide coatings have been evaluated:

1. Concrete-cement based algacides were evaluated by CEE faculty (funded by SRP) – different amounts of zinc or copper were added to cement. Results show only a slight reduction in biomass development.
2. Zinc Omadine (C10H8N2O2S2Zn, MW = 317.7) containing coatings from. Zinc omadine is an antimicrobial agent (fungicide and algicide) that is approved for use by the EPA and FDA in Personal care products (antidandruff agent) and Industrial applications (dry film preservative for antifouling coatings, building materials and thermoplastic resins). This was very effective in the Arizona and South Canal systems over extended test durations of 1 to 6 months, after that it may begin flaking off and require replacement.
3. Titanium dioxide (TiO2) coatings were evaluated. TiO2 is photoreactive and has been reported to be able to control microbial growth on surfaces (windows, etc) via sunlight oxidation which generate surface radicals. Tests conducted in 2004 with a commercial product were unsuccessful in controlling algae growth in the Arizona Canal. Additional work is still being considered.

Zinc Omadine Coating

Figure 2.17 is an example of the impact of algaecide coatings on periphytic algae growth. Full details of this study are available in an appendix. Using test tiles, it was demonstrated that two different products containing varying amounts of zinc omadine were effective in reducing attached biomass, measured as chlorophyll. EP2000 contains a higher percentage of the active ingredient Zinc Omadine compared with Sunwave. Leaching studies were conducted in the laboratory (Table 2.11). In the absence of light hydrogen peroxide, an important oxidant, was not present but all experiments with light contained hydrogen peroxide (even AZ canal water without coated test tiles). Therefore, dissolved hydrogen peroxide levels were not affected by the coatings. The coatings did leach zinc, organic carbon, and organic nitrogen. Upon chlorination tests with leached water, the treated tiles and leach organic nitrogen did result in some formation or chloramines, although the chlorine demand was not affected (only the speciation of chlorine residuals).

Table 2.11 Results of leaching studies using pre-rinsed coated tiles in Arizona Canal water. 5x5-cm coated tiles in 1-L of AZ Canal water using Four 40-Watts fluorescent lights (28,400 J/m2)

Sample	H2O2 (mg/L)	Zinc (mg/L)	DOC (mg/L)	TDN (mgN/L)
AZ canal water	0.4	0.01	3.41	0.31
Ep2000	0.2	0.66	4.73	0.80
Duplicate	0.2	0.68	5.18	0.89
EP 2000 without light	0.0	0.53	0.80	0.20
Sunwave	0.6	0.24	6.39	0.61
Duplicate	0.4	0.20	6.25	0.61

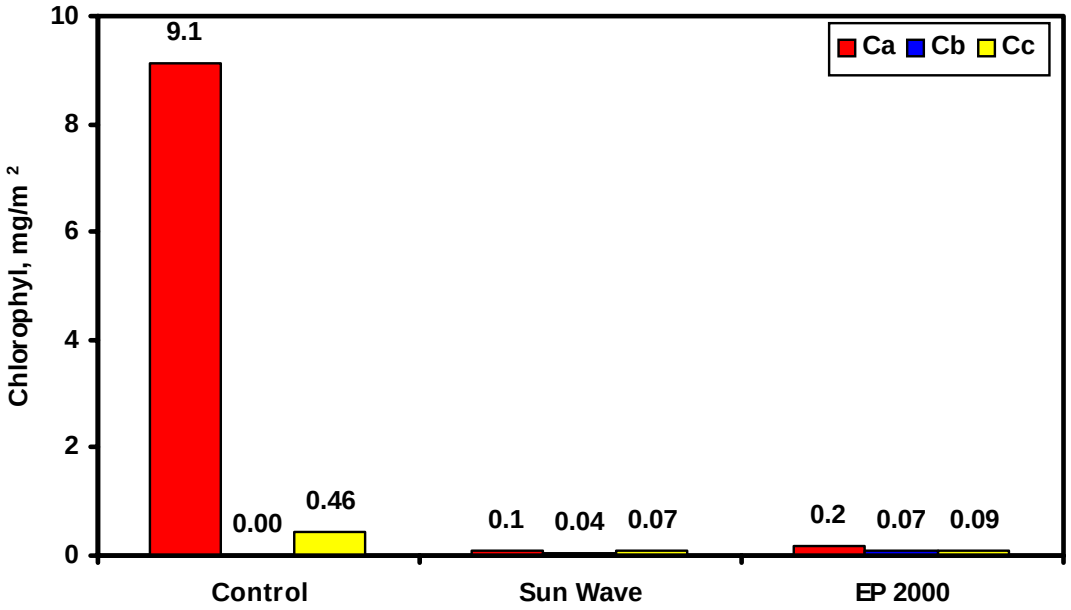


Figure 2.17 Biomass Density after 12 Weeks in the CAP Canal (01/20/04 - 04/13/04)

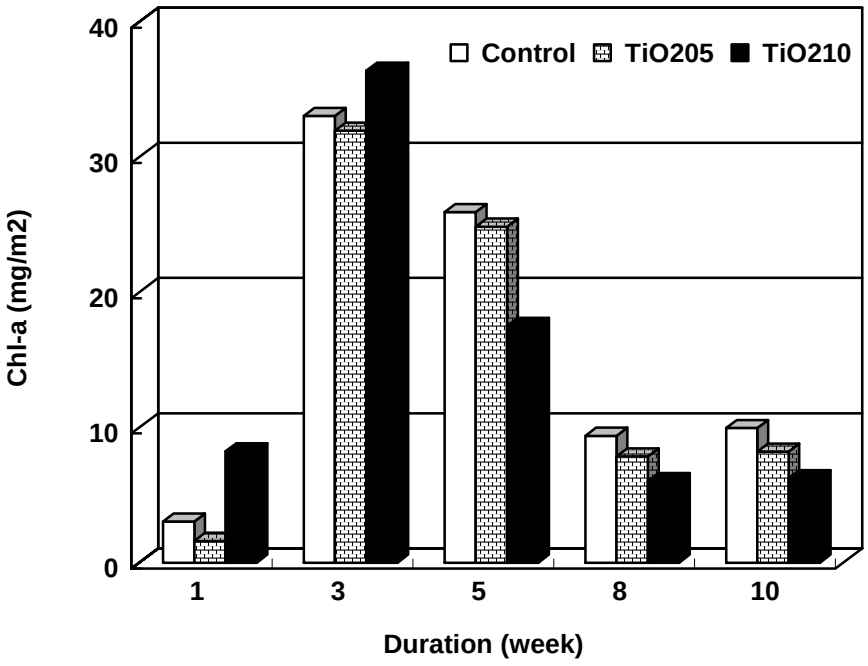


Figure 2.18 Variation in chlorophyll concentration per tile area according to duration and TiO2 coating thickness (Started September 2004)

Field test for algacide coating with TiO2 in the Arizona Canl

The purpose of these tests were to evaluate the performance of the algacide coating with titanium dioxide (TiO2) on the tile in the Arizona Canal. A company in California coated tiles provided to them by ASU:

Contact: David Kwang
Address: Green Millennium Inc.
20539 E. Walnut Dr. Suite B
Walnut, CA 91789
Tel. (909)598-0185
Fax (626)737-6511
Email: dkwang@greenmillennium.com
URL: http://www.greenmillennium.com

The field test will be performed in the upstream Arizona Falls. Three kinds of tiles are used in this test. One is Control (cleaned tile without any biocide coating), another is TD205 (coated tile at 0.5 micron film thickness coated with TiO2), the other is TD210 (coated tile at 1.0 micron film thickness coated with TiO2). These are put in the Arizona Canal in a tile holder. The test tiles will be collected 1, 3, 5, 8, 10 weeks from September to December 2004 after set up the test device. Duplicates of Control, TD205, and TD210 tiles will be taken from the holder, put in a Zip-lock bag, and stored in a cooler at 4 ℃ during transportation to the laboratory. To collect the biomass from the tiles, biomass will be scraped with toothbrush and rinsed with distilled water. Scrapping was completed until all biomass was completely detached from the tile surface. Distilled water containing the scrapped biomass will be filtered with glass fiber filter (GF/C). Filters roll and put in a 50 mL plastic centrifuge tube for Chlorophyll extraction as described in Standard Method 10200 H.

Figure 2.18 shows the variation in chlorophyll concentration per tile area according to duration and TiO2 coating thickness. The concentration of chlorophyll was increased until 3 weeks, after that decreased. The tile with Tio2 coating is better effect for prevent the algae growth than the control, but there is no significant difference between control and TiO2 coating. The decrease in chlorophyll-a content of the biomass on the canal wall decreased over the duration of this study due to declining water temperatures. The study was conducted between September (T~ 25 ^{o}C) and December (T~ 15 ^{o}C).

Effects of 2002 Forest Fires on Water Quality

A MS thesis was completed in 2004 by Darla Gill entitled “The Impacts of Forest Fires on Drinking Water Quality”, and is available upon request. The key results from that thesis will be briefly summarized.

Abstract

The objective of this research was to determine the long-term effects of catastrophic forest fires on drinking water quality. The watersheds burned by the Rodeo-Chediski fire in Arizona and the

Hayman fire in Colorado were the focus of this research. Both fires occurred in watersheds that serve as a drinking water source for a major metropolitan area.

Concentration data and mass loading analyses were conducted utilizing pre- and post-fire water quality data. The results of the Rodeo-Chediski fire and Hayman fire analysis were compared. In addition, an unburned watershed in Arizona was analyzed and served as the reference watershed.

The short- and long-term impacts on stream water that serves as a drinking water source were determined. Short-term effects consisted of elevated nutrient and particulate concentrations in the burned watersheds during subsequent storm events. The post-fire storm events also elevated the metal concentrations in runoff water. However, the maximum contaminant level set by the United States Environmental Protection Agency (EPA) for the metals analyzed was only exceeded by selenium.

Long-term effects will originate from the mobilized particulate fraction settling to the stream or lake bottom. The organic material and metals adsorbed to the particulates will be slowly dissolved, diffusing into the water. The dissolved organics will serve as an energy source for microorganisms that have the ability to cause taste and odor problems in drinking water. While dissolved metals such as arsenic and selenium are regulated by the EPA due to negative human health effects.

Synthesis of Results

Water quality data was analyzed for the Rodeo-Chediski fire (Arizona) and the Hayman fire (Colorado). The concentration data analysis was performed for the burned Arizona and Colorado watersheds and the unburned Verde River watershed. To determine the severity of the impacts of fire on drinking water quality, the burned Arizona watershed was compared to the unburned Verde River watershed and the burned Colorado watershed. Mass loading analysis was completed for the Salt River and Verde River, these results were compared as well. The objective of this chapter is to compile the results of all analyses completed and compare with the literature to determine potential long-term effects of forest fires on drinking water quality.

Streamflow. Forest fires may cause a temporary increase in stream flow, while a drought period will decrease stream flow long-term. The Salt River post-fire peak stream flow, the first flush, occurred one month after containment of the Rodeo-Chediski. The Verde River stream flow was not elevated during the time of the first flush. The post-fire peak stream flow in the Salt River following the fire is consistent with studies conducted by Gottfried et al. (2003) and Elliott and Parker (2001). The effect of the Hayman fire on stream flow is inconclusive. The discrete flow rate data sampling interval at GC, CLI, and NFSP was too large to determine the influence of individual storm events after the fire. However, an overall decreasing trend in the seasonal peak flow is noticeable at NFSP since the fire. This is due to the drought and the upstream dam at CLO. Continuous flow rate data is available for CLO, but the flow rate is controlled by humans. In streams that are controlled by a dam, the influence of storm events is not noticeable. Drought has a prolonged impact on the Salt River stream flow relative to the Rodeo-Chediski fire. The Salt River stream flow remains low two years post-fire relative to pre-1996, which is when the

drought began. Although flow rate data is limited, the streams within the drought-stricken South Platte River watershed are likely to be experiencing low stream flows as well.

Erosion and Suspended Sediment. Post-fire erosion occurred following the Rodeo-Chediski and Hayman fires. The total suspended sediment concentration increased at all of the sampling sites within the burned watersheds. An increase in erosion after a fire was noted in studies conducted by Minshall et al. (2001), Gottfried et al. (2003), and Neary (2004). Due to both fires occurring in mountainous terrain, the steep slopes covered by burned vegetation and litter increased the potential for sediment transport. The grade of a slope having impacts on erosion is consistent with Tiedemann et al. (1979); increased erosion occurring in areas consisting of burned vegetative cover was reported by Wondzell and King (2003).

A mass loading analysis was completed in Arizona for the Salt River and Verde River watersheds. The particulate loading in the Salt River increased by 135% the first year post-fire. The Verde River suspended sediment load decreased by 81%. The fire caused the elevated Salt River load, while drought caused the depletion of the Verde River load.

Nutrients. The dissolved and particulate fractions of nitrogen, phosphorus, and organic carbon were elevated in the Salt River after the first major storm event following the Rodeo-Chediski fire. Increased phosphate and nitrate concentrations in stream water, after a fire, were reported by Earl and Blinn (2003) and Spencer and Hauer (1991). Elevated nitrate concentrations in the runoff of a recently burned watershed were noted by Minshall et al. (2001) and Lewis (1974). Tiedmann et al. (1978) found higher total phosphorus concentrations in stream water after a wildfire. Debano and Conrad (1978) found that erosion caused nitrogen loss after a prescribed fire. The post-fire trends in nutrient concentrations for the Salt River are consistent with all of these studies.

The source of the elevated nutrient concentrations was determined by comparing Salt River concentration data with the adjacent, unburned Verde River watershed. Verde River data was collected and analyzed for ammonia, total nitrogen, dissolved organic carbon, and total phosphorus. The only nutrient to increase in the Verde River during the initial year after the fire was ammonia. The increase occurred in December, 2002 and could be a result of the drought the watershed has been in since the mid-1990s; during a drought nutrients accumulate on the sediment surface. Also, housing developments around Sedona, Arizona could be an ammonia source.

The Salt River watershed has experienced this same drought. Therefore, the increased concentrations of the post-fire nutrients may be magnified since the first flush mobilized newly released nutrients and the drought-induced build up of nutrients. Malmer (2004) reported an increase in post-fire nitrogen and nitrate concentrations in a burned watershed suffering from a drought relative to a burned watershed not in a drought. Although drought does impact nutrient concentrations, the fire is still responsible for further release of more nutrients. The first flush had a greater impact on the mobilization of nutrients due to the drought.

The results of the nutrient mass loading analysis were consistent with the concentration data analysis for the Salt River and Verde River. A comparison of these data is shown in Table 2.12.

The first year after the Rodeo-Chediski fire, all nutrient loadings increased in the Salt River; dissolved organic carbon and ammonia increased on the Verde River. Although the increase in loading of dissolved organic carbon and ammonia in the Verde River is attributed to the drought, the fire had definitive impacts on the Salt River loadings. However, two years post-fire the mass loadings of all the constituents decreased.

Table 2.12 Mass loading comparison of the Salt River and Verde River

	% Change 1 year post-fire		% Change 2 years post-fire	
Constituent	**Salt River**	**Verde River**	**Salt River**	**Verde River**
Total Organic Carbon	↑↑↑	-	-	-
Dissolved Organic Carbon	↑↑	↑	↓	↓
Total Phosphorus	↑↑↑	↓	↓	↓
Dissolved Phosphorus	↑↑	↓	↓	↓
Total Nitrogen	↑↑↑	↓	↓	↓
Ammonia	↑↑↑	↑	↓	↓
Nitrate-Nitrite	↑↑		↓	-
Suspended Sediment	↑↑	↓	↓	-
Stream Discharge	↓	↓	↓	↓

Legend:

↓ or ↑ < 100%	100%< ↑↑ <1000%	1000% < ↑↑↑

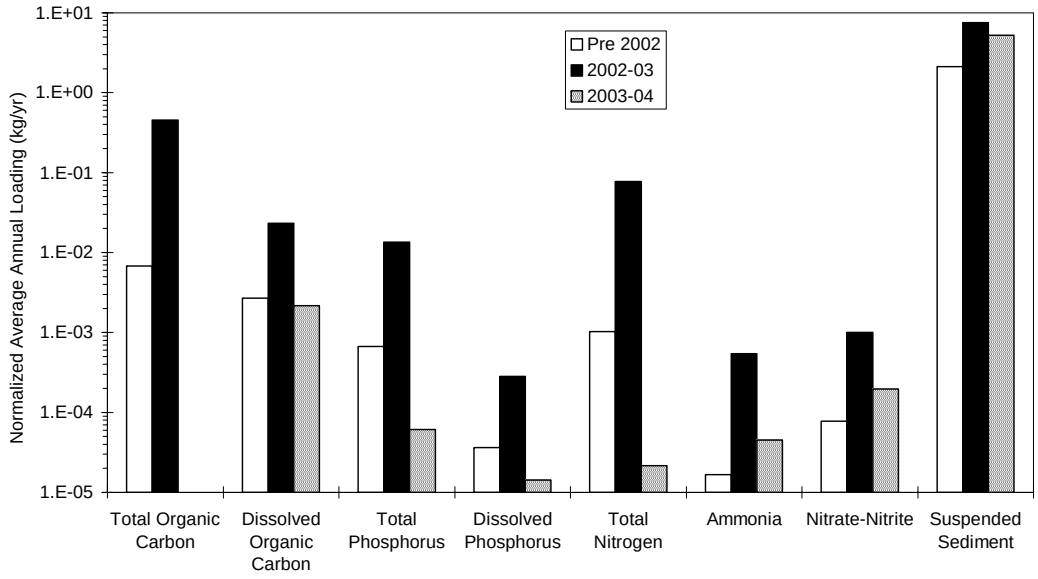


Figure 2.19 Normalized average annual loading of nutrients and suspended sediment for the Salt River at USGS gauging station 09498500

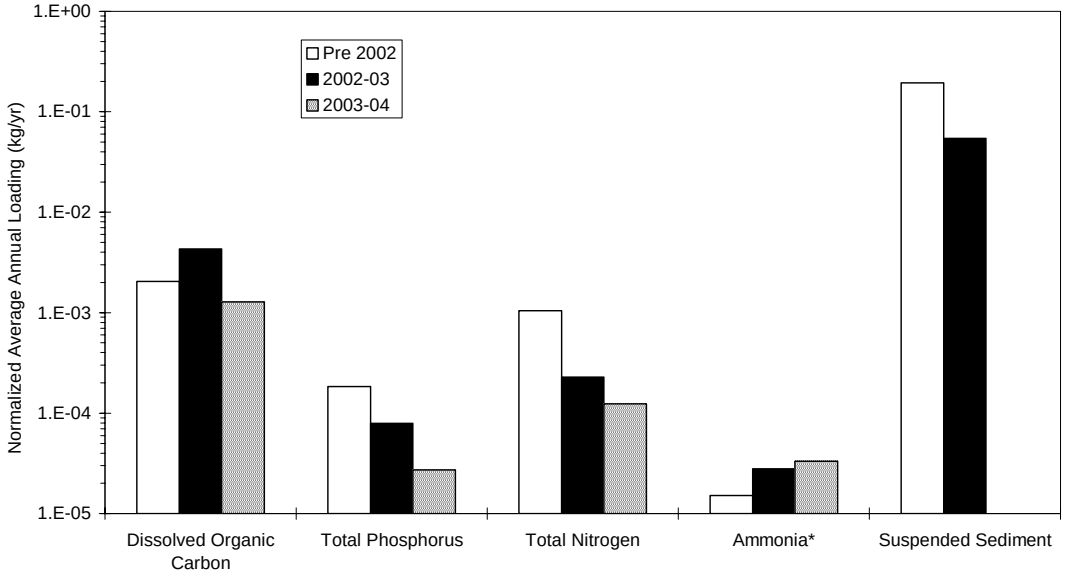


Figure 2.20 Normalized average annual loading of nutrients and suspended sediment for the Verde River at USGS gauging station 09508500

Table 2.13 List of constituents analyzed for the Salt River and South Platte River watershed

Constituents	Pre 2002	2002-2003	2003-2004	Data collected by ASU
Nutrients				
Ammonia	X	X	X	X
Dissolved Organic Carbon	X	X	X	X
Dissolved Phosphorus	X	X	X	X
Nitrate-Nitrite	X	X		X
Total Nitrogen	X	X		
Total Organic Carbon	X	X		
Total Phosphorus	X	X	X	X
Trace Metals				
Total Arsenic	X	X		
Dissolved Arsenic	X	X	X	X
Total Barium	X	X		
Dissolved Barium	X	X		
Total Copper	X	X		
Dissolved Copper	X	X		
Total Iron	X	X		
Dissolved Iron	X	X		
Total Lead	X	X		
Dissolved Lead	X	X		
Total Manganese	X	X		
Dissolved Manganese	X	X		
Total Mercury	X	X		
Dissolved Mercury	X	X		
Dissolved Selenium	X	X		
Total Selenium	X	X		
Total Zinc	X	X		
Dissolved Zinc	X	X		
Ions				
Potassium	X	X		
Manganese	X	X		
Calcium	X	X		
Sodium	X	X		
Chloride	X	X		
Bicarbonate	X	X		
Other				
Suspended Sediment	X	X	X	X
Stream Discharge	Continuous data			

Similar to the concentration data, the drought magnified the increase in mass loading. The total phosphorus, total nitrogen, and suspended sediment loadings decreased in the Verde River, yet these loadings were elevated in the Salt River. The increased loadings in the Salt River during a drought contrast with Cordy et al. (2000). According to this report, nutrient loads increased in the upper Salt River when stream flow exceeded the historical average annual stream flow.

Since the Rodeo-Chediski fire, the average stream flow has remained low, but the mass loading increased. Figures 2.19 and 2.20 illustrate the effect of the decreased stream flow on nutrient and suspended sediment mass loadings. The mass loading of nutrients and suspended sediment was normalized to the volume of water. One year post-fire, the Salt River mass loadings of the nutrients were increased by at least one order of magnitude one year post-fire. Similarly the Verde River mass loading of dissolved organic carbon and ammonia were increased by less than one order of magnitude. In contrast, the Salt River suspended sediment, and Verde River total phosphorus, total nitrogen, and suspended sediment mass loads were decreased by less than one order of magnitude. Two years post-fire, the mass loading of all the constituents decreased in both rivers, with the exception of the mass loading of ammonia in the Verde River. The decrease in the Salt River ranged between one to three orders of magnitude; the decrease in the Verde River was less than one order of magnitude. The normalized the mass loadings provide further support that drought impacts water quality. However, the effects of fire on water quality dominate, at least, the first year following a forest fire. Although not compared to the Verde River, the total organic carbon, dissolved phosphorus, ammonia, and nitrate plus nitrite mass loadings were estimated for the Salt River. These nutrients also displayed an increase in the mass loading the year after the fire. However, all nutrient concentrations, except total organic carbon (data was not available), in both watersheds decreased two years post-fire. The initial mass loading increase is attributed to the fire.

Metals. The post-fire trends of metal concentrations were similar for the Salt River and the Cheesman Lake inlets and outlet. However, not all metals had the same post-fire response between the two wildfire sites. The complete list of metals and other constituents analyzed for the Salt River and the South Platte River watersheds are listed in Table 2.13.

Post-fire metal concentrations were elevated in the receiving water bodies of both burned areas. This is a strong indication the release of the metals was fire-induced. Dissolved arsenic and dissolved manganese concentrations were elevated in the Salt River and South Platte River inlet at Cheesman Lake (CLI). However, the pre-fire dissolved arsenic concentration data at CLI was limited. Total manganese concentrations were higher at all sites in Colorado and Arizona. Although the dissolved manganese concentration in the Salt River was impacted by mining, the post-fire concentration was elevated relative to the concentrations five years prior to the fire; dissolved manganese concentration was elevated at all the Colorado sites. The elevated post-fire concentrations at the burned sampling sites indicate the fire impacted the release of dissolved arsenic and total and dissolved manganese.

Total arsenic, dissolved and total barium, total lead, and total zinc concentrations were elevated post-fire in the Salt River and below the confluence of the North Fork River and South Platte River (NFSP). These elevated concentrations at NFSP were not expected based on the concentrations of these metals at the outlet at Cheesman Lake (CLO). The higher concentrations

are probably a result of the confluence of the South Platte River with the North Fork River. The North Fork River does not drain the area burned by the Hayman fire; however, this watershed was burned by the Hi Meadow fire in June, 2000. Therefore, the Hayman fire cannot be the designated source for the higher concentrations of these metals. In addition, the dissolved aluminum concentration was not impacted by the fire; this is based on available concentration data for CLO, CLI, and NFSP.

Iron was transported from the burned South Platte River watershed. The dissolved iron concentrations increased at CLI, Goose Creek (GC), and CLO after the Hayman fire. The total iron concentration was only elevated at CLI and GC. No concentration increase was observed at CLO due to the settling of the particulate fraction to the bottom of Cheesman Lake. In contrast, the total and dissolved iron concentrations in the Salt River were not altered by the Rodeo-Chediski fire. The contrast between the two fires could be due to geological differences; more iron may naturally exist in the South Platte River watershed than the Salt River watershed.

Other metal concentrations were elevated at one site only. The total copper and total mercury concentrations were higher post-fire relative to background levels in the Salt River. Dissolved zinc and total aluminum concentrations increased at NFSP in Colorado, this could be a result of the Hi Meadow fire that burned the North Fork River watershed in June, 2000. The dissolved cadmium concentration surpassed detection limits only at GC. Since ample pre-fire concentration data exists for the Salt River, the elevated total copper and total mercury concentrations are attributed to the Rodeo-Chediski fire. However, pre-fire concentration data for these metals was insufficient at the Colorado sites. Therefore, the elevated concentrations cannot be directly attributed to the Hayman fire.

Selenium was only analyzed at the Salt River site and was the only EPA regulated metal to exceed the MCL. Selenium impacts human health and aquatic life. In the aquatic environment, bioaccumulation and biomagnification can occur, as well as reproductive impairment in fish (Hamilton and Lemly 1998, Andrews and King 1997). In addition, selenium can cause high sediment concentrations in a lake 11 months after a short-term pulse (Hamilton and Lemly 1998). Therefore, pulse of selenium transported by the first flush may have prolonged effects on the aquatic environment and water quality.

As a result of the increased suspended sediment load in the Salt River, the particulate fraction of the metals analyzed was influenced. Total zinc, total manganese, total barium, total arsenic, total selenium, and total lead mass loadings all increased after the fire. The total mercury loading was minimally depleted, while total iron and total copper loadings remained steady. These trends indicate that some metals are released and mobilized as a result of fire.

In contrast to the increased particulate loadings of metals, the dissolved loading was depleted post-fire, except for barium, arsenic, and selenium. The dissolved manganese, dissolved iron, dissolved copper, dissolved zinc, dissolved lead, and dissolved mercury mass loadings all decreased one year post-fire. The dissolved barium, dissolved arsenic, and dissolved selenium loadings increased; however, the dissolved arsenic load decreased two years post-fire. The results of the loading analysis of these constituents indicate that the fire-induced the release of barium, arsenic, and selenium. If the fire did cause the release of the other metals, then

volatilization is a likely reason for the decreased loadings. In addition, the opportunity for mineral weathering to occur after a fire is depleted. The decrease in infiltration increases overland flow, therefore the particulate fraction is mobilized before the mineral weathering process occurs.

Major Ions. Analysis of the major ionic concentration was completed for the Salt River. The cations, magnesium and potassium, did not increase in concentration after the fire; sodium and calcium concentration increases were minimal. The anionic concentration of bicarbonate and chloride was not impacted by the fire. These results are consistent with the literature. Malmer (2004) concluded the elevated calcium concentrations in a stream draining a burned watershed were due to a long-term drought; therefore the calcium concentration increase is attributed to the drought. In addition, calcium was the only ion to increase in concentration during the first flush. The minimal sodium concentration increase was also noted in a study conducted by Tiedemann et al. (1978); although calcium, magnesium, and potassium concentrations were also elevated in this study, as well. Davis (1989) concluded that the ionic concentration in stream water was not significantly affected by a forest fire. Similarly, Belillas and Roda (1993) found that the anionic concentration in stream water was not responsive to fire. Based on this analysis, sodium is the only ion that was impacted by the fire. The other ionic concentrations remained within background levels.

The ionic loadings for the Salt River were impacted by the fire. As discussed in Chapter 6, the calcium, magnesium, potassium, and bicarbonate loadings were high relative to the flow rate the first year after the fire. The chloride and sodium loadings increased one year post-fire; however no correlation with flow rate was observed. The minimal increase in the ionic mass loading is a result of post-fire concentrations remaining near the upper limits of the background levels.

Factors Affecting Fire Impacts on Drinking Water Utilities

The impact of a forest fire on drinking water utilities depends on two major factors.

- A reservoir located upstream of a WTP.
- The proximity of the forest fire to the surface water source.

A reservoir upstream of a water treatment plant (WTP) can minimize the effects of increased turbidity and ash flows after a forest fire; the particulates would settle to the bottom of the lake. If the WTP pumped water directly from a river within a burned watershed, then the ash and particulates would need to be removed by the WTP. In addition, reservoirs may minimize the effects of post-fire nutrient fluxes. The nutrients stimulate the growth of algae and bacteria, therefore causing potential taste and odor problems. MIB is one taste and odor metabolite produced by algae and bacteria. The MIB profile for Saguaro Lake, which is the final reservoir in the Salt River system, is shown in Figure 2.1. The post-fire MIB concentration remained within background levels.

The proximity of the forest fire to surface water will impact influent water quality at the WTP. A fire that burns the area surrounding the drinking water source will have more pronounced effects than a fire burning the tributaries of the drinking water source. The runoff from a fire that burned tributaries will be intercepted by natural obstacles such as plants and algae within the

stream and be deposited on the stream bed. However, runoff from a fire located at the drinking water source will not be intercepted.

The Rodeo-Chediski fire is an example of a fire that burned the tributaries to a drinking water source. The Hayman fire is an example of a fire that burned the area surrounding the drinking water source. However, at least one reservoir exists upstream of the WTPs utilizing the fire-impacted drinking water source. Therefore, the impacts of the forest fires on WTPs were minimized.

Ecological impacts of forest fires

After a forest fire, re-growth of vegetation begins. The plant succession occurs in stages (Forest and Range 2004).

1. Bare ground
2. Annual plants and grasses
3. Perennial plants and grasses
4. Shrubs
5. Trees

The amount of time for plant succession to occur depends on the severity of the fire. A low intensity fire does not burn all of the vegetation and seeds, whereas a severe fire burns plants, seeds, and organisms. A more severe fire will require more time for plants and trees to re-establish growth (Kormondy 1996).

Similarly, aquatic life is impacted by forest fires as well. Initially, fish kills due to increased stream water temperature and water chemistry changes can occur (Spencer et al. 2003). Spencer et al. (2003) also observed an increase in the density of algae blooms in fire-impacted streams. Long-term impacts result from the post-fire shift in vegetation and land cover. Allan et al. (1997) and Griffith (2001) observed that vegetation can affect stream habitat and water quality. Spencer et al. (2003) noted a shift in consumer food sources following a forest fire. The reliance of consumers on allochthonous food sources decreased while the consumption of autochthonous food sources increased. This is likely due to the increase in autochthonous production that can occur following a forest fire (Spencer et al. 2003).

Significance of findings

The elevated loadings and concentrations of nutrients, metals, and suspended sediment impact drinking water quality. Although the ionic loads increased, the effects on drinking water quality are minimal. The particulates can fill or damage reservoirs and infiltration basins, therefore increasing the level of water treatment necessary (Meixner and Wohlgemuth 2004). The increase in turbidity prevents efficient disinfection; for example, disinfection by ultraviolet radiation is hindered at high turbidity levels (AWWA 1999). Therefore, water treatment plants using turbidity-sensitive disinfection equipment, such as ultraviolet radiation, will need to modify the disinfection process to provide adequate disinfection.

Nutrients and metals impact drinking water quality as well. Metals can be toxic to humans; therefore the EPA has set MCLs. Selenium is one metal regulated by the EPA. The post-fire dissolved concentration of selenium exceeded the MCL. In addition, the particulate concentration was elevated post-fire. The dissolution of particulates into the drinking water

source and the negative human health impacts make selenium the most important constituent. In addition, metals and nutrients promote bacterial and algae growth, causing taste and odor problems.

Long-term drought combined with forest fire impacts water quality. The Salt River and Verde River concentration data comparison lead to this conclusion. Increases in the nutrient concentration data for the Verde River are likely a result of the mobilization of accumulated material due to the drought. The Rodeo-Chediski fire added to this accumulated material in the Salt River watershed. The material was transported into the Salt River during the first flush. Since both watersheds had drought conditions prior to the summer of 2002, the South Platte River watershed probably experienced elevated nutrient concentrations after the Hayman fire.

The long-term effects of forest fires on drinking water quality will be caused by the particulates. The Hayman fire water quality analysis resulted in a definitive trend of particulates settling to the bottom of Cheesman Lake. A similar scenario likely exists for Roosevelt Lake. The particulates will slowly be degraded and enter the dissolved phase. In addition, the suspended sediment organic content after the Rodeo-Chediski fire increased from 2% to 11%. The high organic content is the result of the fire.

TASK 3 – APPLIED RESEARCH PRODUCTS

Regional Water Quality Newsletters

Approximately 26 Regional Water Quality Newsletters were published, distributed via email and internet posting. These were usually produced within 2 days of sample collection, resulting in rapid sample analysis turnaround that would be useful for process modifications. This turnaround time is suitable for dealing with T&O, because rarely do we see more than 5 ng/L change in MIB over the period of even one week in influent water entering the WTPs. An example Newsletter is attached as an appendix. The Newsletters contained MIB, Geosmin and Cyclocitral T&O information for each sampling location, including raw and treated water from WTPs. A summary of process operations at each WTP that responded by email that week was also summarized, and any process change recommendations were made. Informative sections provided a discussion of related activities, results from other sampling, or topical issues.

Workshop

One workshop was organized and presented by ASU. Below is the agenda for the meeting. The presentations are available on the project website.

Regional Water Quality Workshop: Algae Associated Issues
Friday August 20, 2004

Time: 9am to 11am
Location: Historic City Hall - Subcommittee Room (2nd Floor)
17 S. 2nd Avenue (2nd Avenue and Washington)

Purpose: Providing a forum to review and discuss on-going regional water quality issues, in particular algae associated issues.

MEETING SCHEDULE

9:00 Introductions (Nico, Paul)
9:15 Watershed scale: Impacts of forest fires (Darla)
9:30 Reservoir scale (Paul):
- FPA vs GC/MS Correlations
- MIB Production in Reservoirs

9:50 Canal scale (Paul):
- MIB Production in Canals
- Effectiveness of canal treatments
- Algaecide coating evaluations
- DNA-base culprit algae as an Early Warning Indicator (Milt/Hu)

10am Break
10:15 Water Treatment Plant Scale (Paul):
- 2003 MIB Trends
- Dynamic PAC model demonstration
- DOC removal
- Arsenic & perchlorate removal

10:30 Current T&O Levels & Predictions for Fall 2004 (Milt)
10:40 Future Directions & Discussion (Milt)
11:00 Meeting adjourned

Other Related Projects Ongoing at ASU

Culprit Algae Early Warning Detection

ASU continued on-going attempts to genetically fingerprint the culprit T&O producers in the water system so that they can be more readily pinpointed for removal or mitigation efforts. A molecular fingerprinting technique was applied to probe for the presence of cyanobacteria that have the genetic potential to produce MIB and geosmin. This method involved denaturing gradient gel electrophoresis (DGGE) analysis of PCR-amplified 16S rDNA fragments. When analyzed by this method, the phylogenetic composition of periphyton cyanobacterial communities in the Arizona Canal differed substantially, with generally higher richness and diversity of cyanobacterial species at upstream sites compared to downstream sites in the Canal. Direct relationships were observed between specific DNA fingerprints, and episodes and intensity of MIB/geosmin production in specific sections of the Arizona Canal. This suggests that the method, along with GC/MS analysis, could serve as a reliable method for detection and possibly forecasting taste/odor episodes so that mitigation measures may be applied in advance of significant production. ASU plans to continue research along this line with the ultimate goal of implementing this molecular gene probe technology to improve T&O prevention or mitigation practices. This work is funded by Salt River Project, and a final report can be made available separately upon request.

Ozone-Enhanced Biofiltration for MIB and Geosmin Removal

ASU has been successful in obtaining funds for algae-related research, and that effort would be expected to continue. ASU finished its project: AWWARF – Solicited RFP#2775: PIs: P. Westerhoff, Z. Chowdhury, S. Summers. "Ozone-enhanced Biofiltration for MIB and Geosmin Removal" February 2002-2004 ($350,000). A draft final report has been submitted. This work included pilot plant analysis at Chandler and Phoenix. The final report was submitted in early 2005 to AwwaRF.

Other Research Collaborations

ASU continues to collaborate through conducting pipeloop experiments on AWWARF – Tailored Collaboration Project: Cities of Phoenix, Scottsdale, and Tempe plus Arizona State University. "Developing a Customer-Driven Response Strategy for Dealing with Public Perception (taste and odors at the tap) and Potential Health Concerns (algal biotoxins)" April 2002-2004 (PIs: R. Gottler, P. Westerhoff) (>$150,000). Milt Sommerfeld has continued T&O monitoring, recommendations and research with the City of Chandler.

CHAPTER 4 – RECOMMENDATIONS

Continuous and ongoing process control monitoring can avoid undesirable T&O events which would cause consumers to be dissatisfied with the taste and odor quality of their water. This dissatisfaction may lead consumers to perceive their drinking water as being unsafe. Therefore it is imperative that local agencies continue T&O monitoring to prevent serious T&O episodes. As a continuing goal of reducing T&O levels to below the threshold levels, it is important that water providers (CAP & SRP) work together with cities and WTP operators to provide raw water at the WTPs with the lowest T&O levels possible. This can occur through blending of source waters, managing groundwater pumping, and treating periphytic algae growth in the canals. WTPs must consider optimization of PAC selection and dosing, and plan to upgrade treatment processes (e.g., GAC adsorption systems).

Between 1998 and late 2004 the Valley has been in a prolonged drought. Heavy rains in December 2004 and through February 2005 have filled the SRP reservoirs and delivered runoff into the CAP system. This runoff has drastically changed the nutrient and DOC levels in the reservoirs, and will likely affect algae activity this summer. Our best guess in respect to algae activity is increased chlorophyll-a content, but a shift away from T&O producing cyanobacteria toward green algae and diatoms. Cyanobacteria tend to prefer warmer water and higher conductivity water than green algae. The runoff has decreased conductance. Reservoir surface temperatures will likely reach similar levels as in past years however, and the higher reservoir levels means increased reservoir volume in the upper 10 m of the lake where algae activity will be greatest. The runoff has increased DOC concentrations in the reservoirs. In the past we have seen that DOC degrades in the hypolimnion of the reservoirs fairly rapidly (months), while algae productivity in the summer results in DOC formation. Therefore we expect a gradual shift this summer in the characteristics of the DOC from high SUVA to lower SUVA. Upon chlorination, the DOC in 2005 may be more reactive in forming DBPs than in 2004.

APPENDIX – EXAMPLE T&O NEWSLETTER FROM 2004

Regional Water Quality NEWSLETTER

DATE: Report for September 2, 2004
Samples Collected on August 31, 2004
From the Phoenix, Tempe, Peoria, CAP, SRP – ASU Regional Water Quality Partnership

PROJECT WEB PAGE: http://www.public.asu.edu/~westerho/tasteandodor.htm
DISTRIBUTION: **Phoenix:** Walid Alsmadi, Edna Bienz, Frank Blanco, Nicoleta Buliga, Natasha Bernard, Alice.Brawley-Chesworth, Paul Burchfield, Jennifer Calles, Aimee Conroy, Tom Doyle, Ron Jennings, Francisco Gonzales, Randy Gottler, Keith Greenburg, Mike Gritzuk, Yu Chu Hsu, Maureen Hymel, Ron Jennings,Tom Martin, Shan Miller, Richard E. Musil, Paul Mally, Matt Palencia, Chris Rounseville, Mel Schlink, Raymond Schultz, Bonnie Smith, Jeff Van Hoy, Mike Welch, Kevin Williams, Vic Vanderslice; **SRP**: Gregg Elliott, Brian Moorehead, Rick Prigg: **CAWCD**: Doug Crosby, Patrick Dent, Brian Henning,Tim Kacerek; Steve Rottas;**Tempe**: Tom Hartman; Michael Bershad, Grant Osburn, German McCutheon.; **Scottsdale**: Michelle DeHaan,, B. Vernon; Suzanne Grendahl; **Gilbert:** Antonio Trejo; **Glendale**: Lee Hecht, Stephen Rot, Kim Remmel; **Mesa**: Alan Martindale; Charolette Jones; William Hughes; Matt Rexing **Peoria**: John Kerns, Dave Van Fleet, Linda Wahlstrom; **Chandler**: Lori Mccallum, Robert Goff, Victoria Sharp, Jackie Strong, Chris Kincaid, Wendy Chambers; **Tuscon**: Michael Dew. **Consultants**: G. Masseeh, S. Kommineni (Malcom Pirnie); Warren Swanson (Schmueser Gordon Meyer, Inc., Colorado); Troy Day (CZN); Vance Lee, Bob Ardizzone (Carollo Engineering); Paul Westcott, Applied Biochemists, Shugen Pan, Greeley and Hanson, Larry Baker; **ASU Team**: Mario Esparza, Marisa Masles, Darla Gill, Hu Qiang, Milt Sommerfeld, Tom Dempster, Paul Westerhoff, **EPA**: Marvin Young; **DEQ**, Jeff Stuck and Casey Roberts

If you wish to receive the *Newsletter* and are not on our list, send your email address to Dr. Paul Westerhoff (p.westerhoff@asu.edu) get a free "subscription".

SUMMARY: EVALUATION AND RECOMMENDATIONS

1. There is some cyclocitral (no MIB or geosmin) production in the CAP CANAL, an observation reported the first time this year.
2. High MIB (32 ng/L) is being released from Saguaro Lake. This is diluted slightly (22 ng/L MIB) with Verde River water and then diluted further with CAP water (~13 ng/L MIB). Groundwater pumped into the Tempe, Consolidated, and lower Arizona Canal (below 29th Avenue) also dilutes MIB in the canals.
3. In-canal production of MIB is negligible in the Arizona Canal at this time – so no canal treatments are required.
4. PAC was off at Deer Valley, and no MIB removal occurred. This is in contrast to several data points from last year when the presedimentation basins were operating without PAC, yet MIB removal was observed. The presed systems at Deer Valley are still out of service this month. This will make it difficult for Deer Valley to effectively use PAC, but given that the influent MIB is only 20 ng/L PAC treatment will be capable of achieving < 10 ng/L in treated water.

Table 1 - CURRENT OPERATION AND COMMENTS FOR WTPS

WTP	PAC Brand & Dose	Ozone Dose	Pre-chlor. Dose	Copper Dose	Plant Flowrate and HRT for PAC	PROCESS RECOMMENDATIONS
24th Street	Norit 20B 8/24/04 14.4 ppm 8/25/04 10.5 ppm 8/26/04 11.8 ppm 8/27/04 14.5 ppm 8/28/04 13.3 ppm 8/29/04 16.9 ppm 8/30/04 17.8 ppm 8/31/04 17.6 ppm		no	no	60 MGD 2.1 hr HRT 5.28 MG presed volume	Decrease MIB dose to 15 ppm
Deer Valley	Norit 20B 8/25 7.5ppm 8/26 13.1ppm 8/27 14.2ppm 8/28 9.6ppm 8/29 14ppm 8/30 off 8/31 off till noon				Currently by-passing presed basins until end October (construction) 60 MGD Floc HRT = 48 min	As you plan, turn PAC back on at 15 ppm
Val Vista (East)	Norit PAC 20B @ 8-10 mg/l	We are pre-chlorinating in the west plant only. Test to determine if we can oxidize manganese utilizing Cl2 to improve our resv. effluent turb.		Starting to feed for algae control	East = 95 MGD West = 77 mGD East PResed = 15.6 MG (3.9 hours PAC contact time)	East treatment train is achieving better MIB removal than west train. May need to consider increasing PAC on west train by 1-2 ppm.
Union Hills	none		0.5 ppm	0.25 ppm	160 MGD	No change
Tempe North					**Data not reported – Minimal MIB removal is occurring so increase PAC dose**	
Tempe South					**Data not reported –** PAC is not required at this time	
Chandler						
Greenway	--	1.2 mg/L	0.5 ppm		14 MGD	

MONITORING RESULTS

Table 2 - Water Treatment Plants – August 31, 2004

Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
24th Street WTP Inlet**	16.8	5.4	10.5
24th Street WTP Treated	6.6	<2.0	6.5
Deer Valley Inlet	20.4	6.2	13.4
Deer Valley WTP Treated	19.1	5.8	11.7
Val Vista Inlet	12.3	4.1	9.4
Val Vista WTP Treated –East	6.1	<2.0	4.4
Val Vista WTP Treated -West	9.3	3.2	7.2
Union Hills Inlet	<2.0	<2.0	3.1
Union Hills Treated	<2.0	<2.0	2.1
Tempe North Inlet	21.1	7.5	12.4
Tempe North Plant Treated	17.5	5.8	12
Tempe South WTP	<2.0	<2.0	5.6
Tempe South Plant Treated	3.5	<2.0	<2.0
Chandler WTP Inlet	6.9	2.7	5.6
Chandler WTP Treated	<2.0	<2.0	<2.0
Greenway WTP Inlet	14.7	4.7	11.1
Greenway WTP Treated	<2.0	<2.0	5.9

Table 3 - Canal Sampling – August 31, 2004

System	Sample Description	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
CAP	Waddell Canal	<2.0	<2.0	2.2
	Union Hills Inlet	<2.0	<2.0	3.1
	CAP Canal at Cross-connect	<2.0	<2.0	6.6
AZ Canal	Salt River @ Blue Pt Bridge	32.0	2.3	7.7
	AZ Canal above CAP Cross-connect	21.6	2.4	4.0
	AZ Canal below CAP Cross-connect	13.9	2.7	4.0
	AZ Canal at Highway 87	17.8	5.2	9.1
	AZ Canal at Pima Rd.	17.8	4.5	9.2
	AZ Canal at 56th St.	19.0	4.7	11.1
	AZ Canal - Inlet to 24th Street WTP	16.8	5.4	10.5
	AZ Canal - Central Avenue	17.3	6.0	9.8
	AZ Canal - Inlet to Deer Valley WTP	20.4	6.2	13.4
	AZ Canal - Inlet to Greenway WTP	14.7	4.7	11.1
South and Tempe Canals	South Canal below CAP Cross-connect	12.0	<2.0	7.5
	South Canal at Val Vista WTP	12.3	4.1	9.4
	Head of the Tempe Canal	12.2	5.2	8.3
	Tempe Canal - Inlet to Tempe's South Plant	<2.0	<2.0	5.6
	Chandler WTP – Inlet	6.9	2.7	5.6

Table 5 - Reservoir Samples (for August 2004)

Reservoir sampling will be conducted only monthly – next sampling is in mid-August

* CAP is sampling Lake Pleasant on slightly different days than the other reservoirs)

Sample Description	Location	MIB (ng/L)	Geosmin (ng/L)	Cyclocitral (ng/L)
Lake Pleasant (8/10/04)	Eplimnion	2.0	<2.0	11.1
Lake Pleasant (8/10/04)	Hypolimnion	<2.0	<2.0	3.1
Verde River @ Beeline		25.9	8.3	7.2
Bartlett Reservoir	Epilimnion	22.7	<2.0	<2.0
Bartlett Reservoir	Epi-near dock	24.0	<2.0	<2.0
Bartlett Reservoir	Hypolimnion	6.6	2.4	<2.0
Salt River @ BluePt Bridge	8/31/04	32.0	2.3	7.7
Saguaro Lake	Epilimnion	32.9	<2.0	6.1
Saguaro Lake	Epi - Duplicate	32.8	<2.0	5.6
Saguaro Lake	Epi-near doc	28.7	<2.0	9.5
Saguaro Lake	Hypolimnion	28.9	<2.0	<2.0

Table 6 - SRP/CAP OPERATIONS
Values in cfs, for August 31, 2004

System	SRP Diversions	CAP
Arizona Canal	621	330
South Canal	638	354
Pumping	685	0
Total	1259	684

Salt River release from Saguaro Lake: 525 cfs
Verde River release from Bartlett Lake: 100 cfs

Operational Notes

1. Iron and Manganese Issue in Salt River System

Approximately 1 month ago Val Vista WTP on the upper South Canal and Verde WTP which takes water out of the impoundment upstream of Granite Reef Dam both started reporting turbidity levels in filter effluents higher than usual. The Verde WTP had noted black turbidity, and initially thought it may be due to PAC addition. Val Vista noted that when the facility prechlorinated the turbidity issue was not as significant. Over the past week Jerry Russell/ Carollo suggested that it sounded like a reduced Fe/Mn problem. Prechlorination would oxidized the reduced Fe/Mn which then the oxidized form would precipitate and be removed during sedimentation. Chlorination at the filters would result in Fe/Mn precipitates forming in the filter and post-filtration. Fe solids are generally redish-orange and Mn-precipitates are black.

Reduced Fe/Mn oxidation is readily accomplished by free chlorine, chlorine dioxide, or ozone. Oxygen also works, but the speed of oxidation is slower than the other oxidants. As water flows down canals, oxidation by oxygen occurs and reduced Fe/Mn oxidation occurs in-situ. Therefore, it would make sense that only the WTPs near the head of the SRP system experienced this problem.

Reduced Fe/Mn has historically been an issue in Lake Pleasant, but with recent changes in release strategies it had been mitigated. Reduced Fe/Mn has not be common in the SRP system. ASU and UofA both were out sampling on Saguaro Lake in August 2004 and noted very low dissolved oxygen levels (see Figure 1). Low dissolved oxygen levels are an indicator of reducing conditions, which will dissolve particulate Fe and Mn into the water column. This reduced Fe/Mn is then released from Saguaro Lake through the hypolimnion outlet.

One question is why is reduced Fe/Mn present in Saguaro Lake this year, when it had not been an issue in the past. Several hypotheses could explain the observations this year:

1. Forest fires in the Salt River watershed loaded dissolved Fe and Mn into the Salt River system

2. Runoff after 2+ years of drought transported organic matter into the Salt River system which has decomposed and consumed oxygen, resulting in water with low dissolved oxygen.
3. Runoff after the drought and from the forest fires transported nutrients into the Salt River system, which increased algae growth, and upon seasonal algae-die off degradation of the algae biomass consumed oxygen and resulted in water with low dissolved oxygen.

As part of our current study, ASU had evaluated metal loading after the forest fires. Particulate iron loads were about average, but particulate manganese loads were approximately one order of magnitude higher than a long term loading average. Dissolved forms loaded to the reservoir were below average. UofA noted low DO levels in Roosevelt after the forest fires, so this could have transformed particulate Mn to dissolved forms, which then migrated down through the series of Salt River reservoirs to Saguaro Lake.

Runoff after the drought and from the burned areas have clearly lead to nitrogen and DOC levels ~ 40% higher in Saguaro lake this year compared to 3-5 years ago. As a result the productivity of the lake has increased, based upon chlorophyll-a and secchi disk measurements. Thermal destratification of Saguaro Lake was less than 5 ^{0}C in August 2004 so the decomposing algae were a contributing factor to the low dissolved oxygen and maintaining Mn in a reduced and dissolved form. The low ORP measured by UofA is consistent with conditions suitable for Fe/Mn reduction.

Carollo Engineers organized a meeting with City of Phoenix staff on Monday of this week. Phoenix will initiate some Fe/Mn sampling. To deal with the turbidity issue, they have recommended prechlorination to oxidize Fe/Mn and achieve its removal within the WTP.

ASU would be happy to write-up a section on Fe/Mn chemistry and oxidation for a future Newsletter – if you have any interest in this please drop us an email.

2. Arsenic Monitoring

Arsenic data for August 2004 is summarized below, and values are consistent with the general values presented at our workshop:

Location	Arsenic (ug/L)
Lakes	
Lake Havasu	up to 3
Lake Pleasant	~ 3
Bartlett Lake	13 to 21
Saguaro Lake	4 to 9
WTPs Effluents	
UH	<2
VV	<2
24th St	2 to 3
DV	<2
Greenway	10%-30% removal
N. Tempe	20%-40% removal
S. Tempe	~20% removal
MCL (ug/L)	10

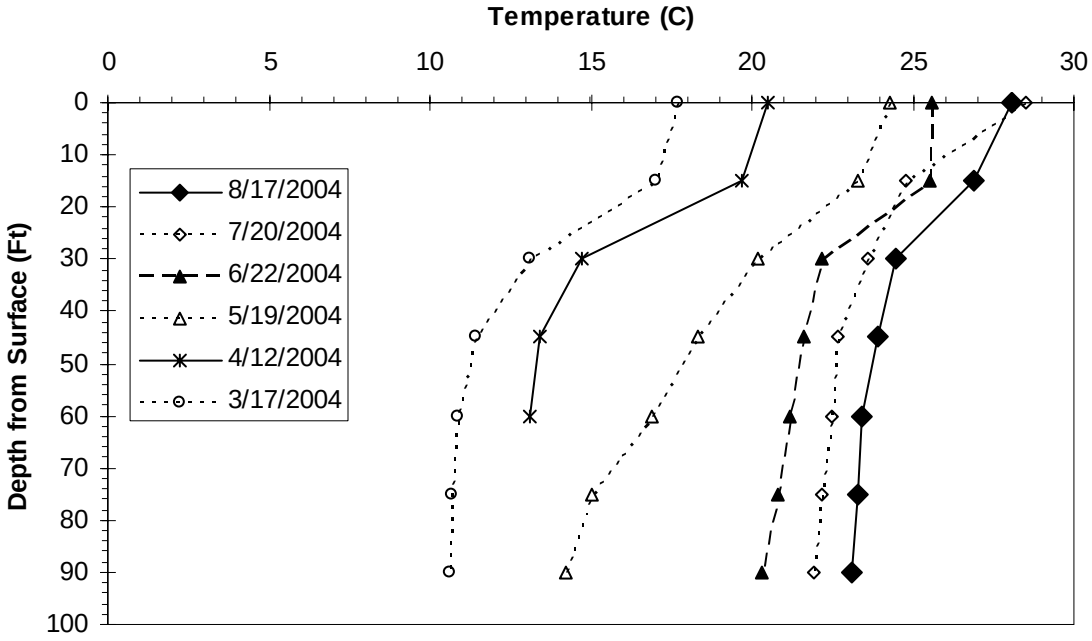
Sampling Date: **August 17, 2004**

Note: Samples in red indicate WTP samples.

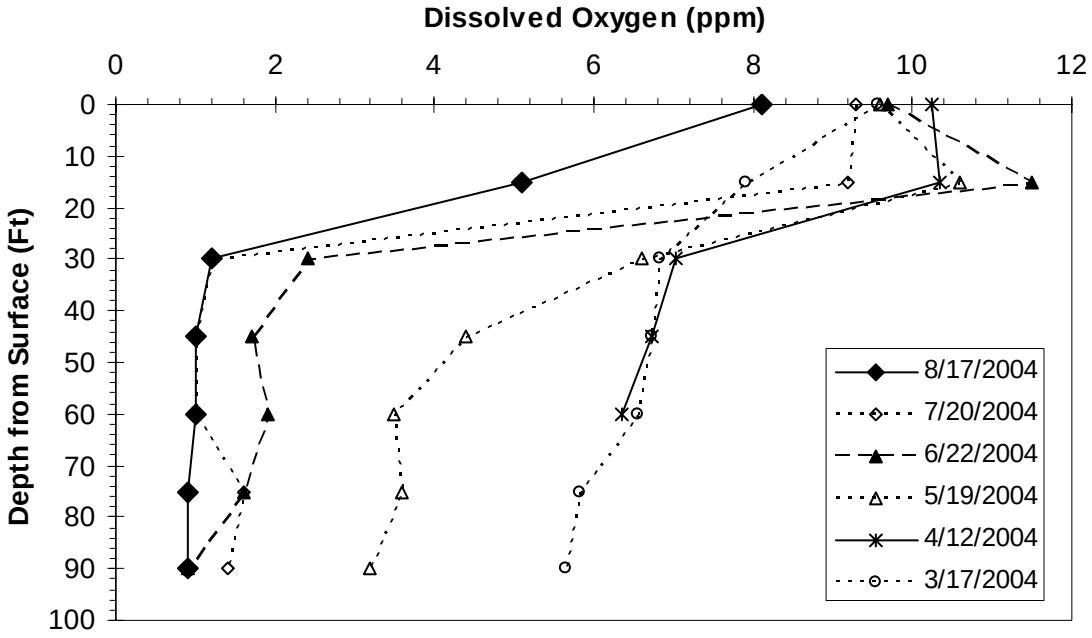
	Sample Description	Acronym	Arsenic (ug/L)
Original sites	Waddell Canal	R3	<2.0
	Salt River below Saguaro (Blue Point Bridge)	R10	5.0
	CAP Canal at Cross-connect	R11	<2.0
	AZ Canal above CAP Cross-connect	R12	6.9
	AZ Canal below CAP Cross-connect	R13	3.8
	AZ Canal - Inlet to 24th Street WTP	**R14**	4.5
	24th Street WTP treated water	**R15**	4.3
	AZ Canal - Inlet to Deer Valley WTP	**R16**	4.0
	Deer Valley WTP treated water	**R17**	<2.0
	South Canal at Val Vista WTP	**R18**	3.9
	Val Vista WTP treated water	**R19**	2.1
	Val Vista West	**VV West**	<2.0
	AZ Canal - Central Ave (N. of Northern)	R21	4.3
	AZ Canal - 56th St. (Alma School Road)	R22	4.1
	verde river at beeline highway	R25	7.5
New Sites 2002	AZ Canal at Highway 87	Hwy 87	4.3
	AZ Canal at Pima Rd.	Pima	4.8
	Union Hills Inlet	**UH In**	2.1
	Union Hills Treated Water	**UH Out**	<2.0
	Cross-Cut Canal - Inlet to Tempe's North Plan	**NP In**	4.2
	Tempe's North Plant treated water	**NP Out**	2.1
	South Canal below CAP Cross-connect	SOCA	3.6
	Head of the Tempe Canal	HTC	5
	Tempe Canal - Inlet to Tempe's South Plant	**SPT In**	3.5
	Tempe's South Plant treated water	**SPT Out**	<2.0
New Sites			
	Chandler WTP - Inlet	**Chan In**	
	Chandler WTP treated water	**Chan Out**	
	Greenway WTP - Inlet	**Green In**	4.6
	Greenway WTP treated water	**Green Out**	3.3
	Lake Pleasant integrated sample	R2A	
	Lake Pleasant integrated sample	R2B	
	Bartlett Reservoir near outlet	R6A	*
	Bartlett Reservoir near outlet	R6B	13.5
	Bartlett Reservoir near dock	R6C	
	Saguaro Lake near inlet	R9A	6.8
	Saguaro Lake near inlet	R9A-Dup	7.3
	Saguaro Lake near inlet	R9B	5.2
	Saguaro Lake near dock	R9C	
	Verde River at Tangle	R20	
	Havasu 1	Havasu 1	2.6
	Havasu 2	Havasu 2	<2.0

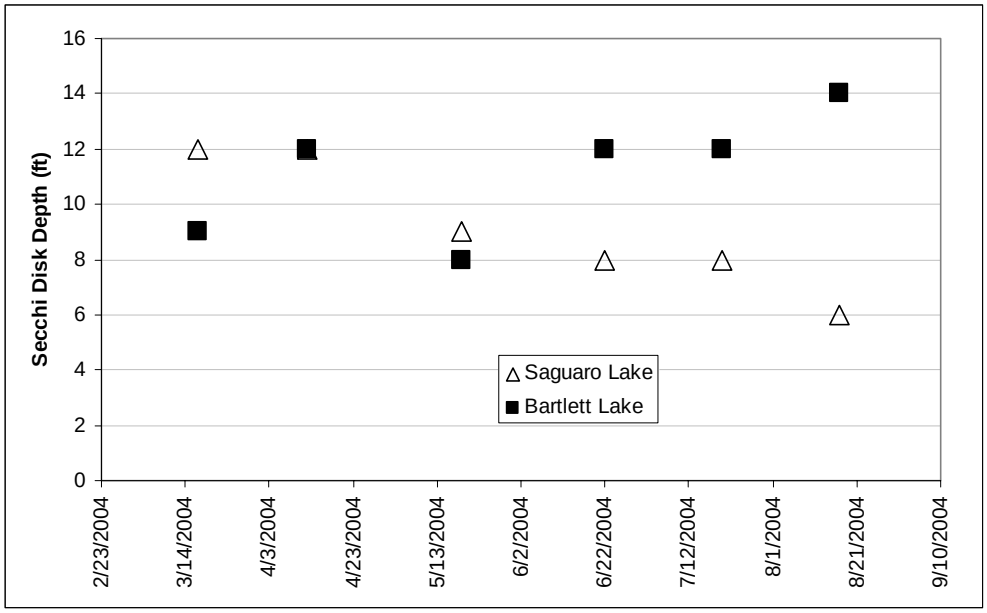
*will test with next month's samples

Saguaro Lake (2004)



Saguaro Lake (2004)





Saguaro Lake data from David Walker (UofA) – August 2004

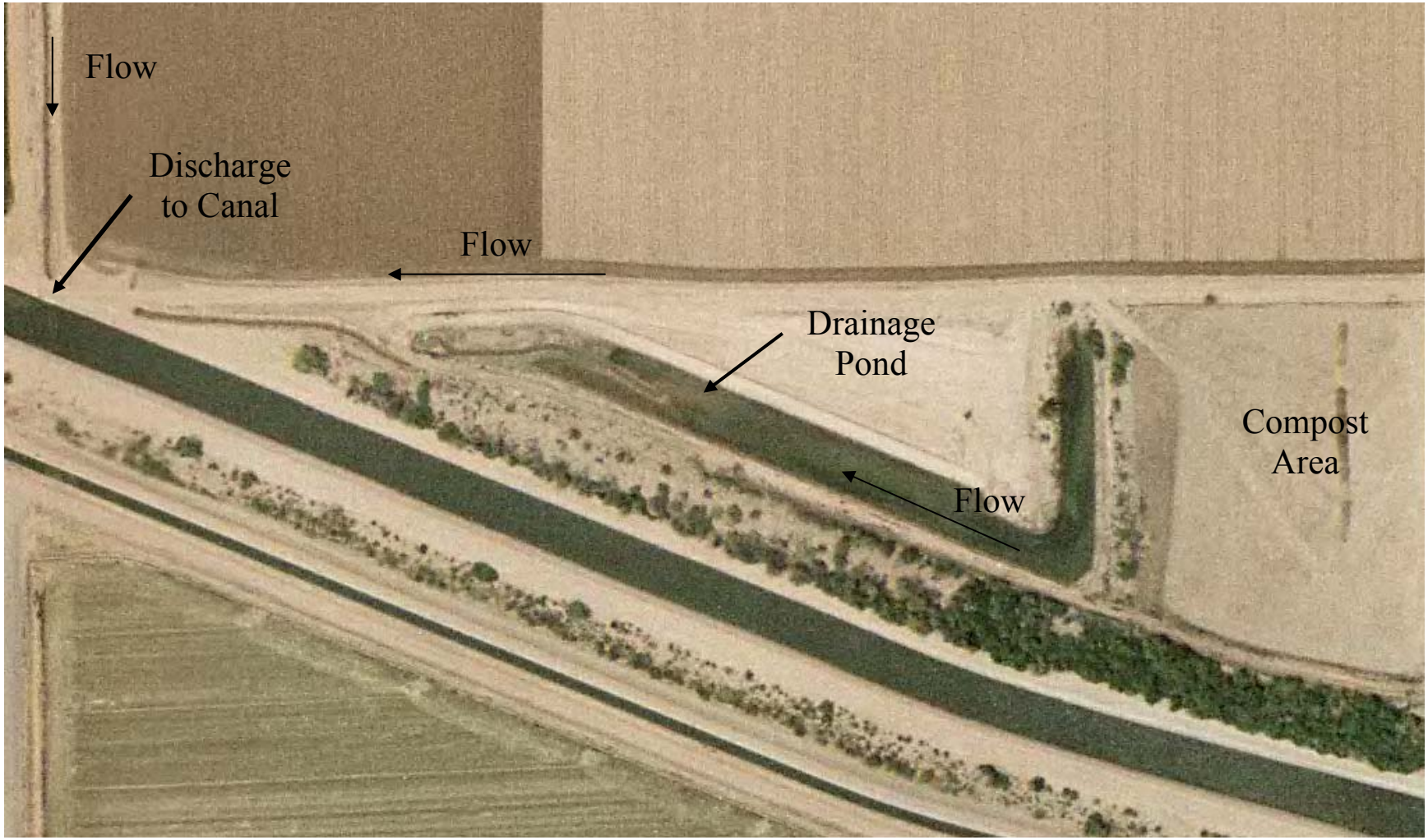
Depth meters	Temp C	DO mg/l	ORP mV
0.1	28.19	6.62	115
0.5	27.91	6.51	118
1	27.82	6.48	120
2	27.73	6.67	124
3	27.55	5.95	129
4	27.46	5.67	132
5	26.86	1.66	147
4.5	27.41	5.94	136
5.5	25.84	0.34	148
6.1	25.6	0.25	119
7	25.08	0.22	-87
8	24.75	0.22	-119
8.9	24.54	0.22	-140
10	24.36	0.21	-185
12	24.04	0.21	-218
14	23.84	0.21	-231
16	23.69	0.22	-216
18	23.61	0.22	-230
20	23.53	0.21	-195
22	23.43	0.22	-183
24	23.35	0.22	-217
26.1	23.25	0.22	-263
28	23.14	0.22	-283
29.9	23.02	0.22	-300

Sampling Date: **August 17, 2004**

Note: Samples in red indicate WTP samples.

	Sample Description	Acronym	Arsenic (ug/L)
Original sites	Waddell Canal	R3	<2.0
	Salt River below Saguaro (Blue Point Bridge)	R10	5.0
	CAP Canal at Cross-connect	R11	<2.0
	AZ Canal above CAP Cross-connect	R12	6.9
	AZ Canal below CAP Cross-connect	R13	3.8
	AZ Canal - Inlet to 24th Street WTP	**R14**	4.5
	24th Street WTP treated water	**R15**	4.3
	AZ Canal - Inlet to Deer Valley WTP	**R16**	4.0
	Deer Valley WTP treated water	**R17**	<2.0
	South Canal at Val Vista WTP	**R18**	3.9
	Val Vista WTP treated water	**R19**	2.1
	Val Vista West	**VV West**	<2.0
	AZ Canal - Central Ave (N. of Northern)	R21	4.3
	AZ Canal - 56th St. (Alma School Road)	R22	4.1
	verde river at beeline highway	R25	7.5
New Sites 2002	AZ Canal at Highway 87	Hwy 87	4.3
	AZ Canal at Pima Rd.	Pima	4.8
	Union Hills Inlet	**UH In**	2.1
	Union Hills Treated Water	**UH Out**	<2.0
	Cross-Cut Canal - Inlet to Tempe's North Plan	**NP In**	4.2
	Tempe's North Plant treated water	**NP Out**	2.1
	South Canal below CAP Cross-connect	SOCA	3.6
	Head of the Tempe Canal	HTC	5
	Tempe Canal - Inlet to Tempe's South Plant	**SPT In**	3.5
	Tempe's South Plant treated water	**SPT Out**	<2.0
New Sites			
	Chandler WTP - Inlet	**Chan In**	
	Chandler WTP treated water	**Chan Out**	
	Greenway WTP - Inlet	**Green In**	4.6
	Greenway WTP treated water	**Green Out**	3.3
	Lake Pleasant integrated sample	R2A	
	Lake Pleasant integrated sample	R2B	
	Bartlett Reservoir near outlet	R6A	*
	Bartlett Reservoir near outlet	R6B	13.5
	Bartlett Reservoir near dock	R6C	
	Saguaro Lake near inlet	R9A	6.8
	Saguaro Lake near inlet	R9A-Dup	7.3
	Saguaro Lake near inlet	R9B	5.2
	Saguaro Lake near dock	R9C	
	Verde River at Tangle	R20	
	Havasu 1	Havasu 1	2.6
	Havasu 2	Havasu 2	<2.0

*will test with next month's samples


Flow
Discharge
to Canal
Flow
Drainage
Pond
Compost
Area
Flow


12. 12. 2003


12. 12. 2003

APPENDIX - COATINGS AND CEMENT-BASED BIOCIDES TO CONTROL ALGAE GROWTH AND TASTE & ODOR RELEASE IN WATER DISTRIBUTION CANALS (AWWA ACE 2004 CONFERENCE PROCEEDING)

Coatings and Cement-based Biocides to Control Algae Growth and Taste & Odor Release in Water Distribution Canals

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Abstract

Characteristic earthy, musty, moldy, and fishy taste and odors (T&O) in drinking water supplies have been attributed to algal sources. Periphytic algal growth on the surface of drinking water conveyance structures (e.g., open channel canals) may induce seasonal T&O episodes. Over the past four years growth of periphytic algae on the walls of a concrete-lined canal conveying surface water has preceded the release of T&O compounds (MIB and Geosmin at rates of 2 to 15 ng/L/mile) into the flowing water during the summer months. Copper applications and/or mechanical brushing techniques have been successful in reducing periphytic biomass and preventing T&O production in the aforementioned canal. However, the use of fixed-surface

biocides to **prevent** periphytic algal growth **before** algae start producing T&O compounds may be more desirable. The main objective of this study was to determine the effectiveness of three antifouling coatings and nine concrete mix formulations to inhibit the periphytic algal growth on concrete structures. The antifouling coating EP2000 was a better inhibitor of periphytic algae than the protective barrier coating Sun Wave. EP2000 and Sun Wave reduced periphytic algal growth by 99 % and 35 % for up to 3 months when compared to control substrates. Algal growth inhibition was found to be directly proportional to the concrete samples zinc concentration. On-going research will be focused on the performance of EP2000 and Sun Wave for longer periods of time in two source waters. A more comprehensive experimental matrix involving 40 mixture designs is currently in progress.

Introduction

Periphytic algae and cyanobacteria, microorganisms growing on the surface of structures, are the most abundant population of microorganisms growing on water conveyance structures if the conditions are optimal for their growth. For optimal growth, periphytic organisms need micronutrients (nitrate and phosphate and other trace metals), sunlight and template temperatures. These conditions make Arizona one of the best-suited regions of the US for periphytic algae growth on water conveyance structures.

Different species of periphytic algae and cyanobacteria can produce volatile metabolites that impart taste and odor (T&O) to the water [1,2]. T&O problems in drinking water sources are a nuisance because the human threshold detection for some T&O compounds is very low for most individuals (Geosmin ~ 10 ng/L) [3]. Different methods have been implemented to control T&O-producing microorganisms growing on structures conveying source water: canal wall brushing, copper sulfate application, and water blending [4]. However these methods may be time consuming, expensive and their effectiveness short, requiring frequent reapplications.

The main objective of this paper was to determine the effectiveness of three antifouling coatings and various concrete mix formulations to inhibit the periphytic algal growth on concrete substrates. Coated tiles were submerged in the Arizona (AZ) Canal for different time periods to quantify periphyton biomass. Concrete samples made out of nine different formulations were submerged several months in an algal growth chamber containing nutrient-rich tap water with a mixture of colonizing plant Diasporas. Chlorophyll, a surrogate of algal biomass, was measured on the tiles and concrete samples to quantify the amount of algae grown on their surface.

Experimental Methods

Ceramic Tiles. Tile substrates were used in laboratory and field tests. Tiles were ordinary ceramic, industrial strength, unglazed quarry tiles 15 cm by 15 cm (Home Depot, Atlanta, GA). This type of tiles was selected because the smooth side of the tile simulated the surface of canal walls and antifouling coatings attached well.

Antifouling Coatings: Three coatings were tested on the tiles. 1) A water-based antifouling coating (EP 2000, E Paint Co., Falmouth, MA), which is recommended for use on all type of watercraft hulls; 2) A water-based protective barrier coating (Sunwave, E Paint Co., Falmouth, MA), a two-part coating recommended as a protective barrier coating for immersion service; 3) A white commercial paint (WCP). Tiles were coated following the manufacturer's instructions:

Briefly, three coats were applied with a theoretical film thickness per coat of 6-8 wet mils (1mil = 1/1000 inch) to obtain 3-4 dry mils. A dry-to-recoat period of 8 hours was followed.

Laboratory Tests with Antifouling Coatings. Recycle reactors were run in the laboratory to determine the inhibitory effect of the EP 2000 antifouling coating under lab conditions. The recycle reactor was a rectangular tank made out of ply propylene plastic (56 cm x 39 cm x 8.5 cm). Holed weirs were put on both ends of the reactor to smooth the flow of liquid medium into the center of the reactor. The reactor hydraulic residence time was set to 3.5 hours using a peristaltic pump with a flowrate of 2.8 ml/sec. Control and coated tiles were put alternatively in the middle of the reactor. Non-coated control tiles were used to compare the effects of antifouling coatings on untreated surfaces. To maximize the alga growth in the reactor, BG-11 medium was used [6]. The reactor was seeded with a mixed algae culture scrapped from the Arizona Canal. The algal culture was comprised of a mixture of Cyanobacteria, Chlorophyta and Chromophyta algal populations. An average light intensity of 50 umol m^{-2} s^{-1} (0.023 Watts m^{-2} s^{-1}) was provided with two 40-watts fluorescent tubes. Duplicates of control and coated tiles were taken from the reactor after one, two and three weeks. To collect the periphyton biomass, the tiles were put in Zip-lock bags to scrape biomass with a toothbrush and periodic rinsing with distilled water (100-200 ml). Scrapping was completed until all biomass was completely detached from the tile surface. Distilled water containing the scrapped biomass was then filtered with glass fiber filter (GF/C, Whatman, Maidstone, UK, ashed at 550 ^{o}C for two hours). Filters were rolled and put in a 50-ml plastic centrifuge tube for chlorophyll extraction as described in Standard Method 10200 H [5].

Leaching Tests. Leaching tests were conducted to determine the amount of H_2O_2 and zinc released by tiles when subjected to different sources of radiant energy (sunlight and fluorescent light). Coated and blank tiles were cut into 5 x 5 cm sections and put in 1-liter beakers with unfiltered AZ Canal water. Water samples were taken from the beakers at different contact times for H_2O_2 and zinc analysis.

Field Tests. Control and coated tiles were put in the AZ Canal in a custom-made tile holder. The capacity of the tile holder is 12 tiles. For details of the AZ Canal, see [4]. Coated and control tiles were left in the water for different periods of time ranging from one to three months. Tiles were taken from the tile holder, put in a Zip-lock bag, and stored in a cooler at 4 C during transportation to the laboratory. Biomass removal from the tiles was performed as previously discussed in the Laboratory Test Section. Biomass was also collected from the canal wall from an area close to the tile holder. Biomass was also collected from other sites along the AZ Canal to compare biomass density between sites. Canal wall biomass was collected to compare the amount of biomass growing on canal walls with that growing on the tiles. Biomass collection from canal walls was done using a custom-made periphyton sampler. For details of sampler and sampling procedure, see [4].

Concrete Samples Preparation. The effects of three cement additives were studied (fly ash (FA), Silica fume (SF), zinc oxide (ZN)). Concrete samples were prepared using different admixtures in ratios described in Table 1. Silica sand was used as the inert component of the mixture. A ratio of sand/cementitious solids of 0.8, water/cementitious solids of 0.5 and various levels of FA, SF, and ZN were used. Concrete constituents were mixed using a DR4000 tabletop

mixer. The materials were weighed on a balance with an accuracy of 0.001 and mixed using the standard mixing method. Briefly, the coarse aggregate (sand) was mixed first with 50% of water for 30 seconds. Then, all the materials were mixed together for 30 seconds. The final step involved the addition of water and mixing for 3 minutes to form a homogeneous mix. Concrete mixes were poured in a steel mold (0.0254 m x 0.0254 m x 0.30 m) and left for hardening. The molds were removed after 2 days of hardening. The samples were cured by completely immersing them in curing solution (10 % $Ca(OH)_2$) for 14 days. The cured concrete casts were cut into 0.0254 m x 0.0254 m x 0.0127 m size coupons with a diamond cone concrete saw. The coupons were classified based on their surface areas, size accuracy and roughness. Control samples were prepared without any chemical additive. Control samples were casted, cured and cut following the procedure described earlier. The control and admixed concrete samples were incubated in the algae growth chamber described in the next paragraph.

Table 1. Experimental matrix of concrete mixtures. W/C = Water/Concrete; S/C = Sand/Concrete

Sample ID	W/C Ratio	S/C Ratio	Admixture1	Amount, %	Admixture2	Amount, %
SF4ZN1	0.5	0.8	SF	5	ZnO	5
SF4ZN2	0.5	0.8	SF	10	ZnO	15
SF1	0.5	0.8	SF	10	N/A	N/A
SF2	0.5	0.8	SF	20	N/A	N/A
C1	0.55	0.8	N/A	N/A	N/A	N/A
C2	0.5	0.8	N/A	N/A	N/A	N/A
FA1	0.5	0.8	FA	20	N/A	N/A
FA2	0.5	0.8	FA	30	N/A	N/A
Plain	0.4	0.8	N/A	N/A	N/A	N/A

Algae Growth Chamber. The algae growth chamber was made in a steel frame with three layers (2.4 m x 2.1 m x 0.9 m). Each layer was 0.60 m high. Within each layer, three open channels were placed at a slope of 3%. The open channels were constructed of PVC pipes that were cut in half lengthwise. Each pipe was connected to plastic containers (0.6 m x 0.6 m). The plastic containers were used to stabilize the flow and transfer the liquid from each layer to the one below. A 75-L plastic container was used as reservoir at the bottom of the chamber. A 19-L plastic container was used overflow chamber at the top of the chamber. A magnetic pump was used to pump water from the main to the reservoir container via a 0.75" PVC pipe. Thereafter water flowed by gravity. Above the open channels on each layer of the frame, four sets of fluorescent lamps were continuously on to provide the illumination for the growth of algae. The study was conducted at ambient room temperature of 24 $\pm$ 3 °C.

Analytical Methods

Chlorophyll Analysis. Chlorophyll *a*, a major photosynthetic pigment present in cyanobacteria and other photosynthetic organisms is routinely used as a surrogate parameter to determine changes in algal biomass [4]. Chlorophyll content of algal biomass was done spectophotometrically following the Standard Method 10200 H [5]. Algal biomass was

concentrated by filtering sample with a glass-fiber filter (GF/C, Whatman, Maidstone, UK, ashed at 550 ^{o}C for two hours). Filter papers with the algal biomass were re-suspended in 30 ml of extraction solution (9:1 acetone:magnesium carbonate solution) to extract chlorophyll pigments. Filters were grounded inside the tube to improve the pigment extraction process. Centrifuge tubes were kept in opaque containers in the dark at 4 C for 24 hours. Samples were centrifuged at 3000 rpm for 5 minutes to separate the solids from suspension. After centrifugation, the samples were ready for spectrometric analysis (MultiSpec 1501, Shimadzu, Corporation, Kyoto, Japan).

MIB and Geosmin Analysis. Analysis of MIB and Geosmin was performed on a Varian Star 3400 CX gas chromatograph and mass spectrometer (GC/MS) using a solid phase microextraction method (SMPE) [4].

Hydrogen Peroxide Analysis. H_2O_2 concentration in solution was measured using the drop count titration method (HYP-1 Method, HACH, Loveland, CO).

Zinc Analysis. Zinc in solution was measured in water samples with a Zincon Method Kit (Method 8009, HACH, Loveland, CO), which is a modification of the Standard Method 3500-Zn B [5].

Radiation Energy. Radiation energy for the recycle reactor and leaching tests was measured with a radiometer/photometer (Model IL 1700, International Light, Newburyport, MA), equipped with a detector (Model SED005#776, Int. Light, MA) and a filter (DVD425#24739, Int. Light, MA). Light filter had a response in the 400-800 nm wavelength range. Radiation energy during the field tests was obtained from the Encanto weather station of the Arizona Meteorological Network of automated weather stations. The Encanto weather station was approximately 9 miles from the tile holder in the AZ Canal.

Results

Algae and Taste and Odor Problems in the AZ Canal

Production of T&O of periphytic algae origin in the AZ Canal have historically occurred [2, 7]. Excessive periphytic algae growth usually proceed T&O problems in summer and autumn months [2]. Figure 1 summarizes weekly MIB concentration measured along the AZ Canal in 2003. MIB is usually around 10 ng/L, the threshold odor detection limit, during winter and spring. However, MIB increases up to 100 ng/L in late summer and autumn. MIB concentration increased as result of higher temperatures and sunlight energy, two of the main energy sources for algae. Total daily solar radiation increases every year in a Gaussian pattern from approximately 12 Million of Joules per m^2 (MJ/m^2) in winter to approximately 30 MJ/m^2 in mid summer (Theoretical equation MJ/m^2 = 20.7 * exp[-(X - 170.21)^2/ 12,095.8] + 8, X = day of the year]. Maximum daily temperature also follows the same Gaussian pattern (Maximum daily ^{o}C = 22.31 * exp[-(X - 204.68)^2/ 9,544.7] + 19.8, X = day of the year].

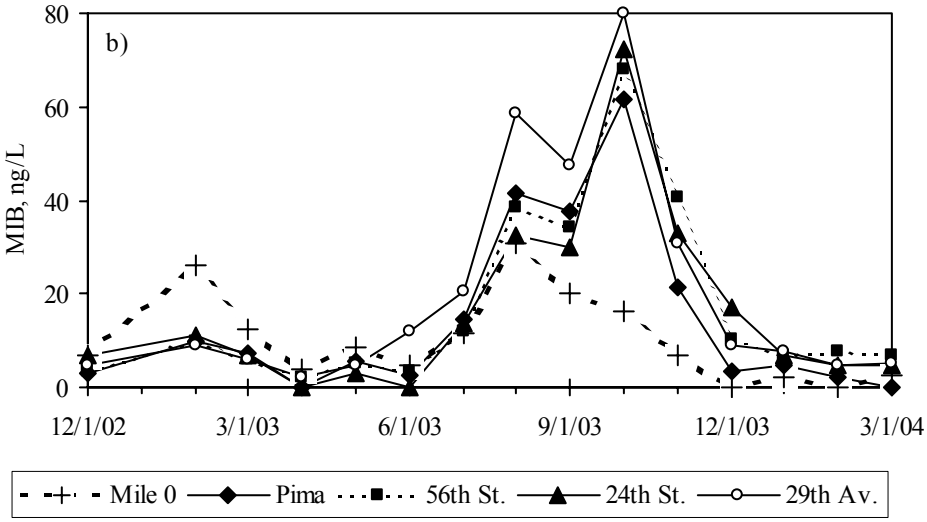

Figure 1. MIB concentration along the Arizona Canal during 2003.

Control of periphytic algae growth, with the subsequent reduction of T&O, has been accomplished in the AZ Canal by chemical [2] and mechanical [4] methods. The chemical method consisted in the application of different copper sulfate-based proprietary chemicals at concentrations less that 1 mg-Cu^{2+}/L to avoid damaging canal fish population [2]. The mechanical method consisted in brushing the canal wall with a tractor-mounted rotating metal brush [4]. However, both methods eliminated the periphytic algae and T&O problems for periods of two to three weeks. Re-application of chemicals and re-brushing of canal walls every three weeks was recommended to keep MIB concentrations close to the threshold detection concentration. Chemical and mechanical treatments of the AZ Canal were effective in reducing T&O problems in the AZ Canal. However, an alternative economic, less labor-intensive method with longer effectiveness periods was sought. Alternatives sought were the use of concrete and antifouling coating linings on canal walls to eliminate periphytic algal growth from canal walls before algae started growing and producing T&O.

Lab Scale Reactors

Lab recycle reactors were run to determine the effectiveness of an antifouling coating in inhibiting algal growth on a representative substrate under optimal growth conditions. Figure 2 shows the periphytic algae concentration that grew on coated and control tiles after one, two and three weeks. Chlorophyll-a was the dominant type of chlorophyll growing on coated and control tiles, indicating that coated tiles were growing the same type of algae as control tiles. Coated tiles had less periphytic algae than control tiles. After one week, coated tiles reduced periphytic algal growth 70 % when compared to control tiles. The percent of periphytic algae in coated tiles, relative to control tiles, decreased to 34 % after three weeks.

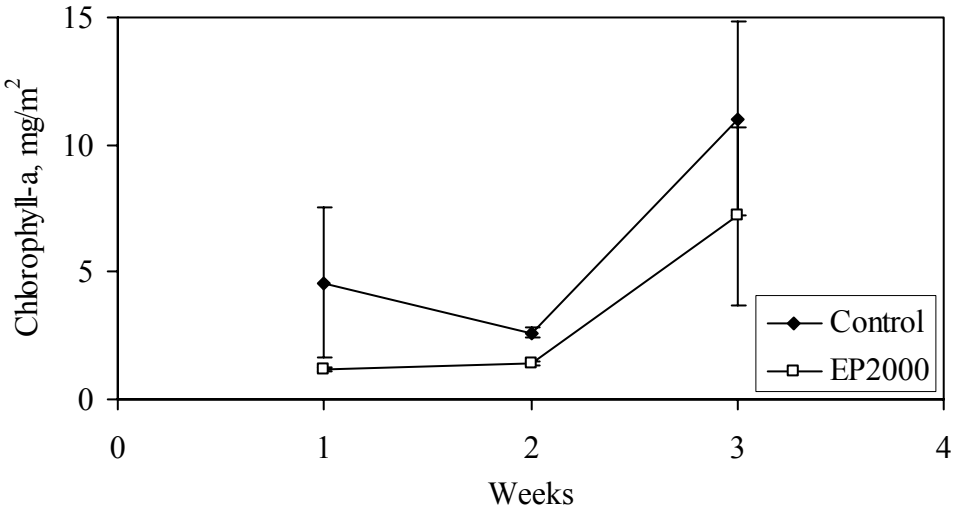

Figure 2. Periphytic algae chlorophyll-a of control and coated tiles (EP 2000) after three weeks in a recycle reactor. Flowrate = 2.8 ml/sec. Growth media = BG-11; Light intensity = 0.023 Watts*m^{-2}*s^{-1} from two 40-Watts fluorescent lights.

Photocatalytic By-products from Antifouling Coatings in Batch Reactors

Coated tiles and control tiles were submerged in beakers with AZ Canal water to quantify photocatalytic by-products released into solution when the coatings are exposed to light under water. Table 2 shows the photocatalytic by-products generated by two antifouling coatings under batch conditions in AZ Canal water. The concentrations measured in the batch reactors were corrected for the presence of each compound in the AZ Canal water. EP2000 generated less H_2O_2 and DOC than Sun Wave. On the other hand, EP2000 generated more Zinc and TDN than Sun Wave. The EP2000 control without light did not generated H_2O_2, indicating that light was photo catalytically generating this by-product. The EP2000 control tile without light generated less zinc, DOC and TDN than the EP2000 tile under the light. Zinc, DOC and TDN may be continuously leaching out of the EP2000 coating, but light and the concurrent photocatalytic process may induce the leaching of more zinc, DOC and TDN. Release of small amounts of H_2O_2 into solution may not be harmful to humans if present in drinking water, as this compound has been extensively used as oxidant to disinfect and purify water [8] and as preservative agent in the food industry [9]. The leaching of zinc from the antifouling coatings may also rise another health issue. However, zinc is regulated by the US EPA as secondary drinking water standard with a MCL of 5 mg/L [5].

Table 2. Photo catalytic by-products from two antifouling coatings under batch conditions (Water = Arizona Canal; Temperature = 25 ^{o}C; Total Radiation Energy = 28,400 J/m^2 from four 40-W fluorescent lights).

Sample	H_2O_2, mg/l	Zinc, mg/l	DOC, mg/l	TDN, mg/l
AZ Canal Water	0.4	0.01	3.41	0.31
EP 2000 I	0.2	0.66	4.73	0.80
EP 2000 II	0.2	0.68	5.18	0.89
EP 2000 w/o light	0.0	0.53	0.80	0.20
Sun Wave I	0.6	0.24	6.39	0.61
Sun Wave II	0.4	0.20	6.25	0.61

Antifouling Coating Performance in the AZ Canal

Table 3 shows the chlorophyll-a measured on canal walls, control and coated tiles after submersion in the AZ Canal for different time periods. The total solar energy for the same time periods is also included in Table 2. Figure 3 shows a detailed chlorophyll analysis of the samples after 12 weeks in the AZ Canal.

Table 3. Chlorophyll-a of control and coated tiles in the Arizona Canal after 3, 4, 6, 9 and 12 weeks submerged in the Arizona Canal. Standard deviations calculated for n = 2. The canal wall samples were collected from a spot approximately 6 feet upstream of the tile holder.

		Chlorophyll -a, mg/m^2				
Sample Name	**Weeks**	**3**	**4**	**6**	**9**	**12**
Canal Wall	**Average**	4.69	4.13	5.69	5.69	50.23
	Std. Dev.					
Control Tiles	**Average**	25.47	35.39	22.07	16.45	134.81
	Std. Dev.	5.16	0.33	21.27	8.28	16.45
EP2000	**Average**	0.09	0.28	0.13	0.06	1.47
	Std. Dev.	0.05	0.10	0.01	0.03	1.12
Sun Wave	**Average**	0.35	0.87		1.55	87.69
	Std. Dev.	0.05	0.42		0.86	16.45
White Commercial Paint	**Average**			22.54		
	Std. Dev.			0.93		
Total Solar Radiation, MJ/m^2		530	810	970	1475	1238

Control tiles had 3 to 8 times more algae than the canal wall adjacent to the tile holder, demonstrating that the selected tiles were good substrates. The amount of algae growing on the canal wall and the control tiles did not significantly varied between 3 and 9 weeks, 4-5 mg-chlor-a/m^2 and 16-35 mg-chlor-a/m^2, respectively (Table 3). However, the amount of algae on the canal wall and the control tiles increased approximately 10 times during the 12-weeks period. Similar growth trends were observed in other sections of the canal during the same time period

(Data not shown). The 10X increase in periphytic algae in control tiles during the 12-week period may be attributed to changes in water quality as canal operators change the source water blend at the head of the canal during late fall and early winter of each the year.

EP 2000 effectively reduced algal growth by 99 % when compared with control tiles for up to 12 weeks. However, Sun Wave was less effective than EP2000 in inhibiting algal growth. During the 3- and 12-weeks period, SW reduced algal growth between 98 and 35 % when compared to control tiles. During the 12-weeks period, the performance of Sun Wave significantly diminished as periphytic algae concentration increased from 1.55 mg-chlor-a/m^2 to 87.7 mg-chlor-a/m^2 (Table 3). The WCP was not a good antifouling option as many algae grew on the WCP tile as the control tile during a 6-week period (~ 22 mg-chlor-a/m^2) (Table 3). Approximately 30 % of the WCP detached from the tile during this 6-week period. No more experiments were performed with the WCP because of its poor performance.

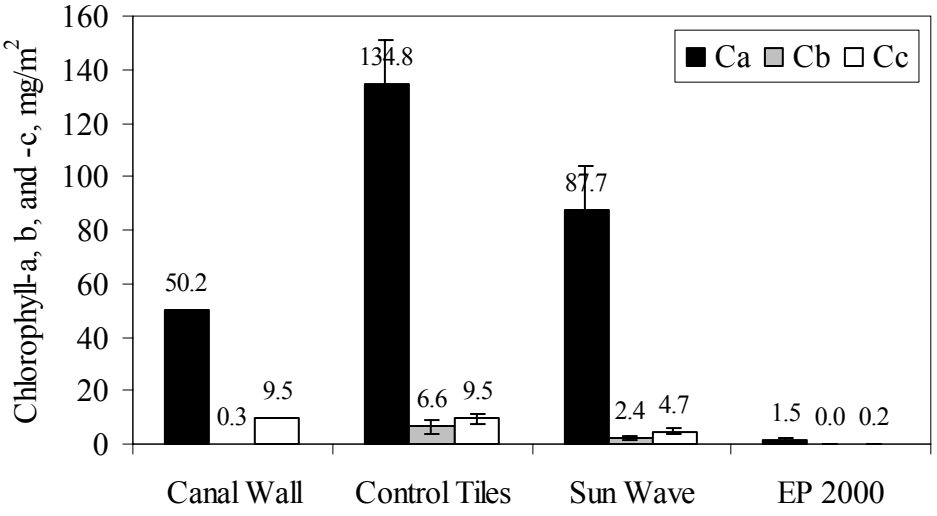

Figure 3. Chlorophyll of canal wall, control and coated tiles after being submerged 12 weeks in the Arizona Canal. Error bars represent one standard deviation for two sample replicates.

Concrete Samples Experiments in the Algae Growth Chamber

The chlorophyll content per unit of surface area (mg/m^2) of nine concrete samples after 4 and 10 months is presented in Figure 4. The data shows a clear difference in the chlorophyll content between the samples with zinc oxide and the samples without zinc oxide. The impact of additives can be seen even after ten months of algal growth (Figure 4b). This trend is seen for chlorophyll B and C concentrations, suggesting that zinc oxide is effective at suppressing the growth of algae belonging to Chromophyta and Chlorophyta species. Moreover, an increased suppression in the growth of groups of algae was observed with the increasing concentration of zinc oxide.

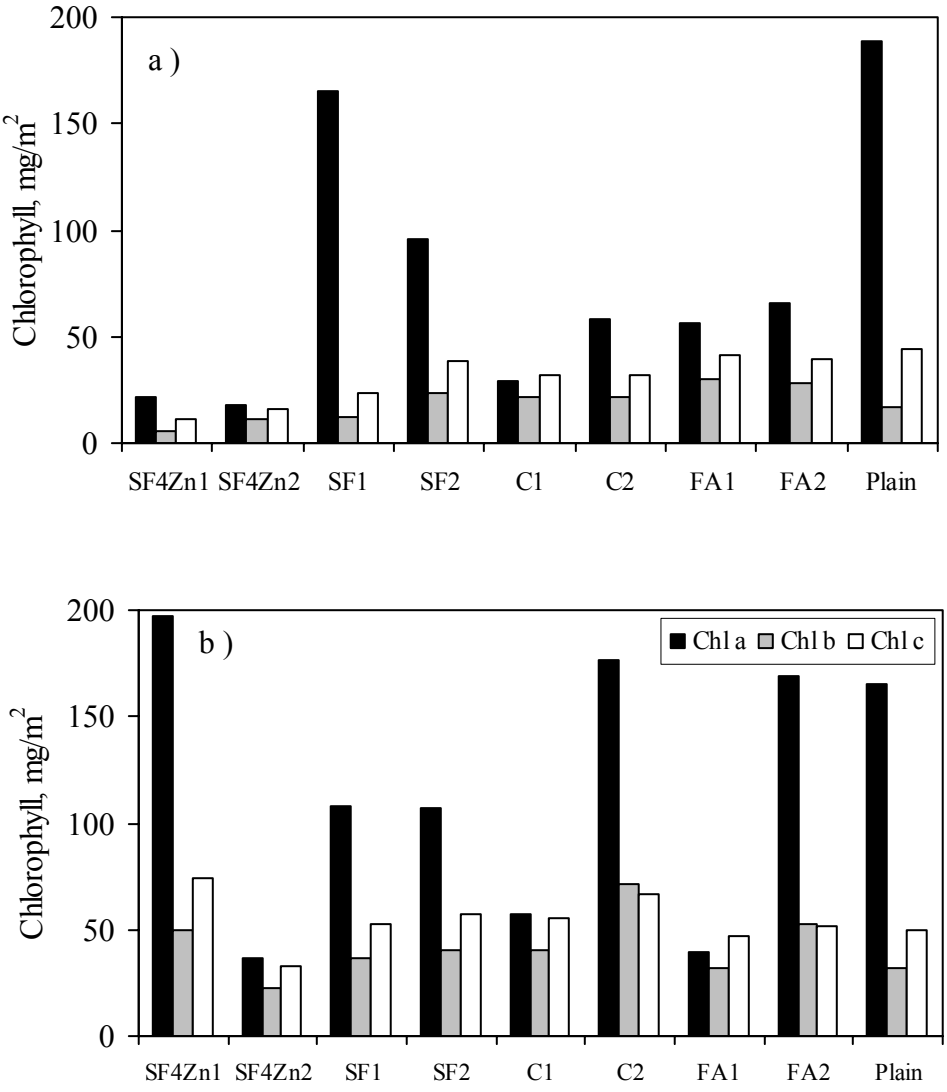

Figure 4. Chlorophyll of different concrete samples after a) four months and b) ten months in the algae growth chamber.

Conclusions

The main findings of this research are:

- EP2000 had better periphytic algae inhibitor than Sun Wave.
- EP2000 and Sun Wave reduced periphytic algae growth by 99 % and 35 % for up to 3 months when compared to control substrates.
- The antifouling Coatings EP 2000 and Sun Wave leached H_2O_2 and zinc as result of the photocatalytic action of sunlight.
- Algal growth was inhibited in cement samples as their zinc oxide concentration increased.

More field-scale experiments are under way to test the inhibition effectiveness of EP2000 and Sun Wave on other source water, the Colorado River water. Coated tiles are being also tested for longer time periods in both source waters. More detailed leaching tests are also being performed. A more comprehensive experimental matrix involving 40 mixture designs is currently in progress. Additional admixtures will include copper slag, copper sulfate, ammonium chloride, sodium bromide, and cetyl-methyl-ammonium bromide.

Acknowledgements

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APPENDIX – EXECUTIVE SUMMARY FROM FINAL REPORT AWWARF #2775:

OZONE-ENHANCED BIOFILTRATION FOR MIB AND GEOMSIN REMOVAL

EXECUTIVE SUMMARY

Tastes and odor (T&O) in water is a common source of customer complaints for water utilities. A survey conducted in more than 800 utilities in the United States and Canada had found that 16% of the utilities experience serious T&O problems, and that utilities spend an average of about 4.5% of their total budget on T&O control. In particular, control of earthy/musty odors is a worldwide concern. Often these earthy/musty odors are caused by the odorants 2-methylisoborneol (MIB) and/or trans-1,10-dimethyl-trans-9-decalol (geosmin). Microorganisms present in surface waters (blue green algae, actinomycetes) produce MIB and geosmin, resulting in part-per-trillion concentrations in water supplies. Ozone-enhanced biofiltration is widely used to achieve multiple water quality benefits (disinfection, trace organic removal, natural organic matter removal) and effectively removes odorants such as MIB and geosmin. However, there is little guidance available for the selection of appropriate ozone dosages or the role of biofiltration for direct oxidation or biodegradation of the odorants.

Although ozonation is very effective in removing MIB and geosmin, the lack of information on oxidation mechanisms (O_3 vs $HO^{\bullet}$ radicals) prevents optimization of ozone for T&O control, DBP control and microbial control. Much of the information on MIB and geosmin oxidation by ozone are dose-response relationships, which are inherently difficult to extrapolate from one pilot study or water to another location. Ozonation byproducts include identifiable low molecular weight oxygenated organic compounds and oxidized NOM, much of which serves as BDOC material for sustaining biological communities in biofilters. While ozonation itself may produce T&O, while oxidizing MIB and geosmin, many of those biodegrade during biofiltration. Most full-scale ozonation facilities apply less than 1 mgO_3/mg TOC to control MIB and geosmin, but there is little information available to determine if this is an optimal dose when ozonation is followed by biofiltration. MIB and geosmin remaining after ozonation should be biodegraded, yet few studies are available that directly quantify the extent of removal in well acclimated and controlled biofilters. In the available studies, biofiltration removes from <10% to >90% of the influent MIB or geosmin. This project aims to better understand ozone-enhanced biofiltration for MIB and geosmin removal by providing information on the above mentioned research gaps.

RESEARCH OBJECTIVES

The project emphasized the optimization of ozone-enhanced biofiltration for MIB and geosmin removal from a practical perspective. Specific objectives of this project were:

- Determine the mechanisms and rate constants for O_3 and $HO^{\bullet}$ oxidation of MIB and geosmin.
- Examine the effects of water source, pH, temperature, initial odorant concentration, hydrogen peroxide dosage and ozone dosage on the kinetics of MIB and geosmin oxidation.
- Conduct long-duration pilot tests with continuous MIB and geosmin feed to evaluate the time required for biofiltration systems to reach pseudo-equilibrium
- Conduct long-duration pilot tests with continuous MIB and geosmin feed to evaluate effects of biofilter media type (sand, anthracite, activated carbon), biofilter backwashing, empty bed contact time, ozone dose, temperature, pH, and influent odorant concentrations.

- Evaluate the status of ozone-enhanced biofiltration for MIB and geosmin control in full-scale treatment systems by measuring odorant concentrations at different locations along the process treatment trains of several systems at participating utilities facilities.
- Develop general relationships for design and operating criteria and costs for ozone-enhanced biofiltration for MIB and geosmin removal.

APPROACH

Considerable research has already been conducted on ozone-enhanced biofiltration processes for NOM and synthetic organic removal, operational optimization, and effects of water quality characteristics on biofilms. Likewise, oxidation mechanisms, byproducts and beneficial effects of ozonation has been well documented. Therefore this report presents overviews of biofiltration and ozonation that support interpretation later in the report (Chapter 2). The experimental approach for laboratory and pilot testing is described in Chapter 3, along with descriptions of analytical methods. Laboratory ozonation experimental results provide a fundamental understanding for the mechanisms of odorant oxidation and include a modeling approach for predicting the beneficial and deleterious effects of ozonation (Chapter 4). Results from combined ozone-biofiltration systems at pilot-scale are presented with the aim at identifying critical control factors for odorant removal (Chapter 5). Building upon research at one pilot site (Boulder,CO), additional mechanistic studies were conducted with media from the pilot study for MIB and geosmin removal during biofiltration provide insight into controlling factors for odorant removal (Chapter 6). A survey of several full-scale utilities employing ozone-biofiltration systems support lab and pilot studies confirm the ability of such systems to effectively remove odorants (Chapter 7). Appendices contain data obtained during the project that support material presented in Chapters 3 through 7. Chapter 8 summarizes key design, operating, and cost factors for ozone-enhanced biofiltration capable of removing MIB and geosmin. The report concludes (Chapter 9) with summary comments and recommendations for utilities currently employing or considering ozone-enhanced biofiltration for MIB and geosmin control.

CONCLUSIONS

Ozone Destruction of MIB and Geosmin (Chapter 4)

Laboratory experiments with nanopure water and various source waters were conducted to investigate the mechanisms and rate constants for MIB and geosmin oxidation during ozonation. It was concluded that hydroxyl radicals ($HO^{\bullet}$) reactions with MIB and geosmin accounted for a larger fraction of odorant oxidation than molecular ozone (O_3). Rate constants between the odorants (MIB or geosmin) and the two important oxidants (O_3 and $HO^{\bullet}$) were fitted from experimental data:

$MIB + O_3 \rightarrow$ Products	$K_{O3,MIB} = 1\ M^{-1}s^{-1}$	(E.1)
$MIB + HO^{\bullet} \rightarrow$ Products	$K_{HO,MIB} = 8.2x10^{9}\ M^{-1}s^{-1}$	(E.2)
$Geosmin + O_3 \rightarrow$ Products	$K_{O3,Geosmin} = 7.5\ M^{-1}s^{-1}$	(E.3)
$Geosmin + HO^{\bullet} \rightarrow$ Products	$K_{HO,Geosmin} = 9.5x10^{9}\ M^{-1}s^{-1}$	(E.4)

Using the fitted rate constants from Nanopure water experiments, the values were used to simulate MIB and geosmin concentrations from natural water ozonation experiments. For most natural water experiments, simulations using Nanopure water rate constants (Equations 4.6 through 4.9) slightly overestimated MIB and geosmin oxidation. Re-fitted rate constants resulted in slightly higher $K_{O3,MIB}$(4 to 9 $M^{-1}s^{-1}$) and $K_{O3,Geosmin}$(5 to 11 $M^{-1}s^{-1}$) values than Nanopure

water experiments, and slightly lower $K_{HO,MIB}$ ($1x10^9$ to $6x10^9$ $M^{-1}s^{-1}$) and $K_{HO,Geosmin}$ ($1x10^9$ to $4x10^9$ $M^{-1}s^{-1}$) values. These slight variations in rate constants may be attributed to the role of secondary oxidants (organic peroxides, carbonate radicals, etc) that were not explicitly accounted for in the model simulations.

$HO^{\bullet}$ contribute significantly to MIB and geosmin oxidation. The ratio (R_{CT}) of the $HO^{\bullet}$ and O_3 concentrations is calculated from via disappearance of an ozone-resistant probe compound (e.g., para-chlorobenzoic acid, PCBA) in the presence of an ozone residual (Elovitz and von Gunten 1999a; Elovitz and von Gunten 1999b; Elovitz et al. 2000; von Gunten 2003a):

$$R_{CT} = \frac{\int HO^{\bullet} dt}{\int O_3 dt} \approx \frac{[HO^{\bullet}]}{[O_3]} \quad \text{(E.5)}$$

The integrated value of ozone residual as a function of time ($\int O_3 dt$), has been termed "ozone exposure". The units on R_{CT} are mole hydroxyl radical per mole molecular ozone. During batch kinetic ozone experiments R_{CT} values ranged from high values of $5x10^{-7}$ during H_2O_2 addition experiments to < $1x10^{-10}$ mol $HO^{\bullet}$ / mol O_3 during T-butanol experiments. R_{CT} variations, as functions of water quality, directly affect MIB and geosmin oxidation kinetics. R_{CT} increased with higher pH, DOC and temperature and R_{CT} decreased with higher alkalinity. R_{CT} decreased with higher ozone dose, but the $HO^{\bullet}$ concentrations were higher (i.e., more MIB and geosmin oxidation) due to higher O_3 concentrations (Equation E.5). The bench-scale batch ozonation experimentation lead to the following conclusions:

- During ozonation the percentage geosmin removal exceeds the percentage MIB removal
- Hydroxyl radical ($HO^{\bullet}$) reactions accounted for a greater percentage of MIB or geosmin oxidation than molecular ozone reactions.
- MIB and geosmin oxidation increases with increase in ozone dose, pH, temperature and H_2O_2.
- The percentage of MIB or geosmin oxidized is independent of the initial odorant concentration.
- Knowledge of R_{CT}, or other approach to quantify $HO^{\bullet}$ concentrations, is critical in predicting odorant removal.
- Combining empirical and mechanistic models can allow investigation for effects of variable water quality or treatment conditions on microbial inactivation, bromate formation, and odorant oxidation as a function of contact time and other parameters.

Pilot-Scale Evaluations (Chapter 5)

Three pilot-scale studies were conducted. The primary objectives of the Chandler, Arizona pilot testing were to identify effective filter designs for T&O removal. The Phoenix, Arizona pilot testing was comprehensive and aimed primarily at TOC control, but the effect of ozone dose, TOC levels, filter media, and backwashing was also studied in terms of T&O control. The goal of the two-phased (Phase I – Acclimation and Phase II – Post-Acclimation) Boulder, Colorado pilot test was to identify how media type, temperature, EBCT, and odorant concentration impact acclimation of biofilters specifically for odorant removal.

A comparison of MIB and geosmin percentage removals for equivalent medias and biofilter EBCTs for the three pilot plant testing programs is presented in Table (E.1). Comparable results were achieved. Acclimated GAC or GAC/sand biofilters achieved higher odorant removals than sand or anthracite sand biofilters. This may be attributed to both residual odorant adsorption

capacity of the GAC (see Chapter 6) and higher biomass densities on GAC. The half-lives for the odorants on GAC biofilters or 2 to 4 minute EBCT are significantly shorter compared against the 15 to 17 minute EBCTs for anthracite/sand biofilters. GAC biofilters also achieved higher TOC removals. Other observed trends include:

- Ozonation removed higher percentages of geosmin than MIB.
- Percentage of MIB and geosmin removals during ozonation were independent of initial odorant concentrations.
- Comparable MIB and geosmin percentage removals occurred during biofiltration, and were nearly independent of influent odorant concentrations.
- Longer EBCTs lead to higher percentage odorant removal during biofiltration.
- Lower temperatures reduced odorant removal during biofiltration.
- Odorant removal during biofiltration was positively correlated with biomass density at the Arizona pilot tests.
- Biofilters require significant time to become acclimated and capable of degrading odorants. This is an especially important consideration during pilot testing.
- GAC acclimated to BDOC and odorants in water from one region of the country may require additional acclimation time when treating water with a different water chemistry.
- Sudden changes in water chemistry may decrease odorant removal during biofiltration.
- Backwashing practices affected biofilter performance for odorant removal; higher odorant removals and higher biomass densities occurred using non-chlorinated backwash water.
- Combined ozonation-GAC biofiltration systems are more likely to remove odorants to below odor thresholds than biofiltration alone or ozonation with anthracite or sand biofilters, achieved acceptable turbidity control, and removed TOC and DBP precursors.

Table E.1

Summary of percentage MIB and geosmin removals achieved with different biofiltration media during the three pilot tests conducted for this study and EBCTs of 2 to 4 minutes (same as Table 5.7)

Pilot Plant Location	Sand or Anthracite/Sand Biofilter		GAC or GAC/sand Biofilter	
	MIB Removal	Geosmin Removal	MIB Removal	Geosmin Removal
Chandler, AZ	19%	-	59%	-
Phoenix, AZ	6%	15%	40%	25%
Boulder, CO	13%	12%	80%	86%

Summary of MIB and Geosmin Biodegradation Mechanisms (Chapter 6)

In the pilot plant phase of this project the biofilters were run for 6 months and at the end the MIB and geosmin utilization rates were higher, i.e., more MIB and geosmin were being removed per filter length or EBCT, in the bottom sections of the filter. After an additional three months of operation the biofilters no longer demonstrated this behavior. The removal was similar in both sections of the biofilter. This behavior was confirmed in experiments in which the segments of the biofilter were spilt and received a common influent. The MIB and geosmin removal was the

same independent of the biomass and the section of the biofilter in which the media was taken. Biofilters in which the temperature was controlled to 6 °C yielded suppressed MIB and geosmin removal compared to those run at ambient temperature (21°C). Biofilters experiments with media that had been acclimated offsite for several years to water with MIB, were very effective (> 80% removal) in removing MIB and geosmin. The attached biomass of this CWW media was 5 to 8 times higher than the media acclimated at CU. The biomass and removal with the CWW media was similar to that of the BAC media in Phase II.

For one of two sets of experiments, low ozone doses yielded lower MIB and geosmin removal. The supports the primary (BDOC) / secondary (MIB and geosmin) substrate approach. In the second experimental set, increasing the ozone dose did not result in an increase in MIB and geosmin removal. Starting with this experiment, and continuing through the velocity, biomass and most of the influent concentration experiments, no significant MIB and geosmin removal by the biofilters was observed. However, in the last of the influent concentration experiments the biofilters re-acclimated and the anticipated MIB and geosmin removal was measured. We have no strong explanation for this behavior.

Data gathered from Phase I, II and III experiments were used to evaluate an overall pseudo first-order rate constant, $k''X$, of 0.039 and 0.079 min^{-1} for MIB and geosmin, respectively. If only Phase III data in which the biofilters did not yield a depth gradient for the utilization rate, were used $k''X$ values were found to be 0.054 and 0.114 min^{-1} for MIB and geosmin, respectively. In both case the rate constant for geosmin was twice that for MIB. Using another media (CWW), similar "impact of influent odorant concentration" tests were conducted to verify these $k''X$ values. Because biomass data was available, these rate constant values no londer include an embedded constant for biomass. Data indicated similar rate constants for MIB and geosmin of approximately 0.003 (min-nmol phosphate/gram of dry media)$^{-1}$ for the top (influent) of the fitler and 0.0013 (min-nmol phosphate/gram of dry media)$^{-1}$ for the bottom part of the filter.

After 9 months of exposure to MIB and geosmin and prior to that 1 year exposure to TOC in a natural water, the BAC media was examined for residual adsorption. Residual adsorption capacity was found under both ambient and high MIB and geosmin concentrations. This indicates that some of the removal found in Phase II was in part adsorption. At the higher concentration geosmin yielded a higher adsorption capacity compared to that of MIB, and both MIB and geosmin were desorbed after three weeks.

Utility Survey (Chapter 7)

Raw water MIB and geosmin concentrations were in the range of < 2 to 20 ng/L during the sampling campaigns of full scale utilities. Ozone-enhanced biofiltration achieves 60-90% removals of MIB, 60-100% of geosmin, and 15-35% of TOC in general. Other observations included:

- Ozonation alone removed 30% to 40% of MIB and 50% to 60% of geosmin, but removals ranged from <10% to 90% of the the initial concentrations.
- Biofiltration alone removed 50% to 70% of the MIB and 60% to >90% of the geosmin applied to the biofilters.
- GAC/sand biofilters had higher biomass densities and on average removed MIB, geosmin, and TOC better than anthracite coal biofilters.

- One utility backwashed filters with non-chlorinated water, and this facility achieved the highest odorant removals.
- TOC removals attributed to ozone-enhanced biofiltration were comparable with TOC removed during coagulation-sedimentation for many utilities.
- The selected utilities clearly demonstrated that ozone-enhanced biofiltration effectively controls odorants.
- Most of the utilities had MIB and geosmin concentrations under 2 ng/L in treated water.

Unit Cost Curves (Chapter 8)

The O&M costs for the four proven technologies were developed for the following four MIB/geosmin occurrence scenarios:

- *Scenario 1* – Seasonal (2 episodes/year) low level (10-200 ng/L) MIB/geosmin occurrence. This was assumed to be 2 episodes/year, 4 weeks/episode, with MIB and geosmin concentrations of 20 ng/L each.
- *Scenario 2* – Seasonal (2 episodes/year) moderate level (20-200 ng/L) MIB/geosmin occurrence. This was assumed to be 2 episodes/year, 4 weeks/episode, with MIB and geosmin concentrations of 70 ng/L each.
- *Scenario 3* – Scenario 1 or 2 with short-term (<2 week) pulses of high MIB/geosmin levels. This was assumed to be 6 episodes/year, 1 week/episode, with MIB/geosmin concentrations of 70 ng/L each.
- *Scenario 4* – Greater than 150 days per year with MIB/geosmin occurrence of greater than 10 ng/L. This was assumed to be 6 months of MIB and geosmin (each) occurring at 20 ng/L concentration.

For seasonal occurrence of low levels of T&O compounds, one of the most economical (in terms of O&M cost) alternatives is adding PAC. The O&M costs for replaceable GAC filter cap are higher than the PAC addition O&M costs. For a treatment plant with annual average flow of 50 mgd, the annual O&M costs for T&O control for Scenario 1 are between $170,000-$500,000.

For seasonal, moderate levels of T&O compounds, the replaceable GAC filter cap is the least O&M cost alternative, followed by PAC addition, ozone biofiltration and GAC post-filter adsorption. For a treatment plant with annual average flow of 50 mgd, the annual O&M costs for T&O control for Scenario 2 are between $310,000-$500,000.

For short-term pulses of high MIB/geosmin scenario, the low cost treatment alternatives were PAC addition and GAC-sorption filter cap. For a treatment plant with annual average flow of 50 mgd, the annual O&M costs for T&O control for Scenario 3 are between $280,000-$500,000.

For prolonged (more than half of the year) MIB/geosmin occurrence, the GAC-sorption filter cap is the least O&M cost alternative. The costs for Scenario 4 for alternatives other than GAC filter cap are similar. For a treatment plant with annual average flow of 50 mgd, the annual O&M costs for T&O control for Scenario 4 are between $310,000-$500,000.

RECOMMENDATIONS FOR UTILITIES

Several tools provided within this report allow utilities to select and operate ozone-enhanced biofiltration systems for MIB and geosmin control. These include the following:

- Models developed for balancing MIB or geosmin removal against CT inactivation credit and bromate formation.

- Data synthesized to recommend GAC and GAC/sand filters are superior to anthracite/sand filters for MIB and geosmin removal or DOC control, and provide at least equivalent turbidity control.
- Models developed to understand the relationship between biomass density measurements and ability of biofilters to degrade MIB and geosmin.
- Data synthesized to recommend design criteria for ozone-enhanced biofiltration systems.
- Models developed for estimating O&M costs associated with four common methods of odorant control.

In part through the above tools, this research leads to the following specific recommendations regarding ozonation and biofiltration systems:

- Ozonation
    - Hydroxyl radicals ($HO^{\bullet}$) are important for most of the MIB and geosmin oxidation that occurs during ozonation. Techniques to increase $HO^{\bullet}$ concentrations include increasing pH during ozonation or adding hydrogen peroxide. The most common approach would be to add hydrogen peroxide into the final contactor, allowing it to react with residual molecular ozone and produce $HO^{\bullet}$. Management of $HO^{\bullet}$ will enhance a utilities ability to oxidize odorants.
    - Molecular ozone (O_3) becomes a more important oxidant than $HO^{\bullet}$ in waters that exhibit low R_{CT} values, such as high alkalinity and low DOC lake waters.
    - Temperature affects the rate of ozone decay, thereby affecting the rate of $HO^{\bullet}$ production and $HO^{\bullet}$ concentrations. For equivalent ozone doses, $HO^{\bullet}$ decrease at lower temperatures.
    - Higher ozone doses increases $HO^{\bullet}$ concentrations and would increase odorant oxidation. In all cases, increasing ozone dosages increases odorant destruction.
    - Higher $HO^{\bullet}$ concentrations form during ozonation of water with higher DOC concentrations, so pre-ozonation may have an enhanced benefit for odorant destruction over intermediate ozonation (i.e., ozonation post sedimentation and before filtration).
    - Volatilization is not a major loss process for odorants during diffused ozone application.
- Biofiltration
    - During pilot-scale testing MIB and geosmin must be spiked continuously for weeks to months to pre-acclimate biofilters, before steady-state conditions can be established.
    - Pilot-testing relying upon MIB and geosmin spiking must use materials that are resistant to gas-permeation for odorant feed tanks, such as Teflon gas sampling bags.
    - Developing an understanding of biomass density variability seasonally, during filter runs, and amongst filters is important. Biomass density may be related to the ability for biofilters to degrade MIB and geosmin. This research used a phospholipids analysis, but other activity-based measurements may be superior.
    - Backwashing practices affect biomass density and performance of biofilters to remove MIB and geosmin. Backwashing with non-chlorinated water provided the best MIB and geosmin control.

- Biologically acclimated activated carbon was superior to anthracite/sand dual media filters for MIB and geosmin control, and always had higher biomass densities than anthracite/sand filters.
- Some MIB and geosmin adsorption capacity remains on biologically acclimated activated carbon after years of operation.
- Changes in influent water quality appears to disrupt or decrease the ability of biofilters to remove MIB or geosmin as efficiently as biofilters without such changes in water quality. Minimizing changes in water quality (rapid changes in feed water or pH) applied to biofilters is recommended.
- Biofiltration efficiency for MIB and geosmin removal tends to decrease at low temperatures.

- Combined Ozone-Biofiltration Systems
  - Combined ozone-biofiltration systems provides multiple water quality benefits (high level of disinfection capability, improved biostability of water entering the water distribution system, reduced final disinfectant demand (e.g., chlorine demand), reduced DBP formation, removal of trace-level organics such as pesticides and synthetic organic compounds).
  - Ozonation does not *remove* TOC, but transforms a fraction of TOC into readily biodegradable DOC.
  - Biofiltration is a required post-treatment step to ozone to assure biologically stable water in distribution system. Biofiltration removes 5% to 25% more of the TOC, more than conventional coagulation achieves in some waters.
  - Ozone and biofiltration systems operate synergistically, providing better water quality than either system if individually applied.
  - Ozone-enhanced biofiltration systems can handle periodic high raw water MIB or geosmin concentrations by increasing ozone dose, increasing pH during ozonation, adding hydrogen peroxide in the final ozone contactor, or scheduling replacement of GAC filter caps to correspond with the onset of an expected season T&O episode.

RECOMMENDATIONS FOR FUTURE RESEARCH

This project was successful in addressing many issues associated with MIB and geosmin oxidation, but identified other related research needs including the following:

- Develop approaches to measure, monitor, and predict $HO^{\bullet}$ concentrations and/or R_{CT} in full-scale and operational ozone contactors on a real-time basis.
- Improve the understanding of biological communities and enzyme pathways in biofilters for degradation of trace-level contaminants. How long does biological acclimation require? How frequent does a contaminant need to be present in the water column for acclimation to occur?
- Develop rapid and accurate biosensors to quantify active biomass density in-situ for biofilters.
- Attempt to separate sorption (onto substrate, into biomass) from biodegradation for odorants and other trace-level contaminants.
- Verify applicability of secondary substrate biofiltration models for emerging trace-level organics.

APPENDIX – DATA COLLECTED FOR PROJECT

TABLE 1.1. MIB (NG/L) FROM AUGUST 1999 TO DECEMBER 2004 - ASU ANALYSES (0 <MDL OF 2 NG/L).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/01/99	0.0						19.5					17.7						0.0			17.5					
09/01/99	0.0						12.2					27.6						8.3			27.1					
10/01/99	0.0	0.0	0.0	0.0	0.0		0.0	0.0	6.0	6.0	0.0	11.0		6.0	8.0	0.0	8.0	9.0	27.0	42.0	28.0	39.0	24.0	0.0	0.0	
11/01/99	0.0	15.0	7.7	0.0	0.0		0.0	0.0	0.0	0.0	7.2	12.8		6.9	9.3	0.0	8.6	5.9	13.7	8.6	17.9					
11/17/99																										
12/01/99	0.0	9.3	9.9	0.0	0.0		0.0	0.0	0.0	0.0	5.8	0.0			5.8	0.0	0.0	0.0	7.0	6.1	9.2	9.5				
01/01/00	0.0	0.0	2.9	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	2.4	0.0	2.5						0.0	0.0	0.0	
02/01/00	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	2.1	0.0	2.2		5.6		0.0	0.0		
03/01/00	0.0	4.4	4.8	3.7	2.1	2.7	2.5	2.1	0.0	2.4	5.7	6.1		4.2	6.6	0.0	21.5	15.1	11.4	7.2	28.9	25.0	6.8	6.4	1.6	
04/01/00	4.0	4.6	4.5	3.4	3.1	2.2	5.2	2.2	2.4	4.6	8.3	10.1	6.9	5.4	4.2	0.0	6.5	4.2	4.9		16.2	12.0	6.5	6.5	4.4	
05/01/00	0.0	6.2	4.4	0.0	0.0	0.0	11.8	6.4	0.0	0.0	20.4	21.1	24.2	14.4	10.2	0.0	12.9	7.5	8.8	9.4	12.6	11.7	9.7	8.8	0.0	9.5
06/01/00	0.0	3.7	0.0	0.0	0.0	0.0	24.1	17.4	0.0	4.8	18.6	25.3	20.9	15.7	12.3	0.0	14.3	10.8	12.5	11.6	11.2	11.9	8.5	9.0	7.5	14.1
07/01/00	6.3	6.4	7.3	3.5	2.5	3.3	37.8	40.1	2.9	5.9	15.3	38.5	26.6	20.1	18.7	2.2	20.0	16.2	15.0	8.3	19.0	14.0	17.6	0.0	87.7	16.7
08/01/00	8.9		16.5	2.6	2.6	0.0	16.8	54.2	32.2	7.1	34.6	43.6	37.2	16.0	14.2	2.6	15.7	10.1	14.8	8.9	51.5	42.6	10.5	9.4	11.5	17.9
09/01/00	10.4	13.2	14.2	10.0	9.7	9.2	4.4	24.5	16.7	13.3	25.6	36.0	32.7	21.0	20.0	7.2	65.0	9.1	21.6	18.5	64.0	48.3	27.4	12.0	9.0	32.0
10/01/00	10.4	6.6	6.8	8.7	4.9	4.7	3.1	5.7	13.1	14.1	23.4	18.4	19.6	18.4	24.4	6.9	38.4	20.4	26.0	21.6	46.5	44.1	16.9	3.3	5.7	23.0
11/01/00	3.6	3.3	3.1	2.8	4.9	4.4	7.6	0.0	0.0	3.2	10.8	3.7	4.0	4.4	11.0	4.7	21.8	11.9	17.6	13.9	21.5	26.4	15.3	7.3	5.5	17.0
12/01/00	0.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	2.0	2.4	4.4	2.5	2.2	2.0	17.9	3.1	9.6	9.3	11.2	9.0	24.3	20.8			0.0	12.4
01/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.0	0.0	3.5	8.6	0.0	15.9						12.4	10.5	0.0	
02/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.0	2.0		20.3		7.7	5.8	8.6		11.3		5.7	3.8	0.0	12.3
03/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	3.7	4.1	2.4	51.6	0.0	24.6	15.0	15.0	9.7	14.9	15.5	4.6	2.6	0.0	12.4
04/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	4.2	4.4	0.0	12.0	0.0	5.2	5.1	5.7	5.7	6.0		0.0	0.0	0.0	5.2
05/01/01		0.0	0.0	0.0	0.0	0.0	4.1	5.8	0.0	0.0	16.5	11.7	10.7	4.3	5.7	0.0	5.9	5.5	5.7	5.2	6.0		4.8	5.2	2.0	7.9
06/01/01	5.2	0.0	0.0	2.0	0.0	0.0	16.5	5.0	0.0	0.0	5.1	9.9	10.0	7.7	5.4	0.0	7.0	5.0	7.6	5.1	53.4		3.6	3.2	2.2	47.5
07/01/01	2.9	0.0	0.0	0.0	0.0	0.0	26.0	4.8	0.0	0.0	8.1	7.3	7.6	6.5	4.9	0.0	6.3	4.8	17.4	16.8	30.1		4.3	5.1	9.0	27.8
08/01/01	7.0	3.2	0.0	0.0	2.2	2.2	4.4	12.9	0.0	0.0	9.8	24.8	23.8	10.0	8.3	0.0	13.5	10.1	20.6	15.9	30.0	8.0	10.1	13.5	3.3	19.0
09/01/01	14.4	14.0	0.0	0.0	3.5	3.6	11.7	8.1	0.0	2.8	20.1	105.1	101.2	13.8	13.8	15.8	3.4	27.5	29.6	59.9	45.9		20.5	15.7		64.7
12/01/01	0.0	4.3		0.0	0.0	0.0	2.9	0.0		0.0	0.0	0.0		0.0	4.8	2.9	7.2	0.0	13.9	7.2	30.2		6.6	0.0	2.1	
01/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	28.5	27.0	2.9		290.0		8.8	5.3		
02/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	3.0	22.9		26.4		5.8	4.8		18.8
03/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	2.3	0.0		0.0	0.0	15.0	4.1	12.5	14.3	11.2	11.3	5.7		2.9	9.8
04/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	8.2	9.0		0.0	0.0	3.8	5.5	3.2	4.5	2.9	0.0	2.3		0.0	2.8
05/01/02	0.0	2.8	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0		10.0	9.8	7.6	6.1	0.0	3.4	4.3	3.5	4.0	3.5	3.4	2.1	2.3	0.0	3.1
06/01/02	0.0	0.0	0.0	0.0	0.0	0.0	11.8	2.9	0.0	0.0		11.3	10.0	9.3	6.7	0.0	6.8	5.7	4.4	4.5	5.3	5.9	5.3	6.1	6.6	6.3
07/01/02																0.0	5.1	5.3	5.3	3.8	3.9	3.2	4.9	4.3		4.5
07/08/02																0.0	6.1	3.8	4.3	4.2	3.6	4.2	2.8	3.7		5.5
07/16/02		5.1	0.0					49.9	0.0			15.5	16.6	7.9		0.0	5.4	4.2	6.3	4.1	3.6	2.9	3.3	3.0		5.7
07/22/02																2.1	5.5	2.8	3.5	4.0	5.7	5.9	3.9	3.7		5.5
07/29/02																0.0	5.9	3.9	4.3	3.5	5.6	4.4	4.5	5.3		4.2
07/30/02																										
08/05/02																3.8	6.4	5.1	6.8	5.8	10.4	8.1	5.9	3.5		6.8
08/12/02		28.2	0.0					82.9	6.7			43.4	51.6	15.7		5.8	10.4	8.3	9.7	8.3	10.6	6.2	5.7	4.9		10.6
08/19/02																7.3	12.5	9.4	12.1	15.0	16.8	17.3	10.9	10.7		15.7
08/26/02																7.7	11.4	9.6	15.5	15.7	28.2	16.3	9.6	10.8		18.5

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/30/02																			15.3		17.8					25.4
08/31/02																			19.0		30.4					49.8
09/03/02		43.1	0.0					46.6	25.7			22.6	27.3	22.8		7.4	18.2	21.1	14.9	12.3	23.6	20.2	11.4	6.8		25.3
09/10/02																	15.1	12.2	12.5	6.8	16.2	11.5	15.3	3.7		22.2
09/16/02		37.2	3.0					30.5	14.5			29.9	31.9	28.8			12.3	7.3	14.7	11.1	28.6	8.4	8.1	11.0		25.2
09/23/02																	17.2	6.2	11.4	8.9	21.4	18.4	10.1	5.1		21.6
09/30/02																	24.2	7.0	11.0	10.7	20.2	10.2	8.3	4.2	3.9	24.0
10/02/02		46.1	0.0					18.6	11.9			50.4	45.6	37.5												
10/07/02																	19.5	6.0	10.8	5.5	13.8	9.4	13.4	7.0		14.4
10/14/02																5.0	25.4	6.1	10.8	9.1	18.8	9.1	14.0	8.4		12.9
10/16/02		38.8	7.1					10.8	12.7			44.6	37.1	39.2												
10/21/02																12.8	24.1	13.3	14.7	9.5	13.7	13.3	21.2	21.9		15.1
10/28/02																17.7	11.8	13.9	18.9	12.7	18.7	17.6	12.6	6.7		17.7
10/30/02		39.3	23.8					7.2	7.9			27.7	24.8	27.2											2.5	
11/04/02																16.8	12.7	16.4	24.2	9.9	28.1		15.6	17.5		20.9
11/12/02																2.1	10.2	7.1	13.0	7.7	17.0		6.7			14.6
11/13/02		9.1	13.9					2.2	0.0			11.3	13.0	11.6												
11/18/02																2.0	6.4	4.5	8.1	4.2	9.4		4.3			9.4
11/25/02		4.9	5.6					0.0	2.1			3.5	3.8	3.5		2.5	10.1	5.6	9.7	3.3	13.0	6.9				11.4
11/30/02																										
12/09/02																2.0	9.2	4.8	8.6	4.4	10.9					9.2
12/16/02																0.0	7.0	6.1	6.8	2.6	4.6	6.8				5.4
12/17/02		5.8	5.6					0.0	0.0			0.0	0.0	0.0												
12/30/02																									0.0	
01/14/03		5.1	4.4					0.0	0.0			0.0	0.0	0.0	5.3	0.0							9.6	7.8		
02/11/03		0.0	2.6					0.0	0.0			0.0	0.0	0.0	7.8		25.9	13.3	11.2		9.1	12.8	8.1			
03/11/03		0.0	0.0					0.0	0.0			0.0	0.0	0.0	5.7		12.4	6.1	6.9		5.8	3.7	6.7	8.2		7.4
04/15/03		0.0	0.0	0.0				0.0	0.0			5.9	6.0	0.0	4.6	0.0	3.8	2.2	0.0	0.0	2.3	0.0	2.1	0.0	0.0	2.3
05/13/03		11.1	2.6	4.1				3.6	4.2			13.5	12.7	12.3	4.5	3.3	8.7	11.6	3.1	0.0	4.8	6.6	5.2	0.0	2.7	5.8
06/03/03		8.3	3.7	5.0				18.3	3.9			12.5	13.3	9.8	10.2	3.1	9.4	7.5	9.8	6.8	5.2	9.3	7.5	9.9		10.5
06/10/03																0.0	4.5	2.1	0.0	0.0	11.8	11.6	17.3	13.6	2.7	3.5
06/24/03																										
07/07/03				0.0											18.7	0.0	10.8	3.8	9.5	10.0	10.7	8.7	7.0	6.1		9.8
07/14/03		2.1	0.0					0.0	0.0			15.1	15.9	23.6		0.0	11.4	5.3	13.5	15.9	20.5	17.7	8.3	5.2		17.9
07/21/03				0.0											24.7	0.0	11.6	6.8	19.1	23.2	31.0	30.0	11.1	8.0		27.2
07/28/03				0.0											39.0	0.0	22.8	16.1	17.8	20.5	26.5	8.5	18.0	9.3		28.0
08/04/03		2.0	0.0	0.0				2.0	0.0			15.2	17.0	53.2	33.4	0.0	28.7	5.6	18.5	8.4	33.8	14.6	23.1	18.5		33.6
08/11/03				0.0											47.1	0.0	26.7	12.5	25.5	15.5	38.0	28.7	24.4	11.7		38.7
08/18/03				0.0											55.6	2.0	31.0	19.5	32.3	22.1	58.4	20.9	22.4	15.6		63.5
08/25/03		3.7	2.2	0.0				0.0	0.0			22.8	21.9	67.2	39.6	3.5	28.4	12.1	40.1	16.5	54.8	25.2	26.3	9.6		62.2
09/02/03																	19.8	12.3	59.9	15.6	75.8	38.9	40.1	21.2		77.2
09/08/03		3.4	3.4	0.0				0.0	0.0			30.1	30.7	29.9	21.5	2.8	21.7	10.7	36.9	16.5	50.4	26.5	34.6	26.5		39.7
09/15/03															16.8	2.0	20.3	8.6	29.8	14.7	47.3	15.4	23.8	13.1		44.7
09/22/03		4.2	4.2					3.0	4.7			6.4	6.1	21.7	12.8	3.2	27.8	7.4	25.7	28.4	40.5	15.5	25.8	7.3	0.0	39.2
09/29/03															5.1	2.8	41.4	9.8	55.3	16.3	48.4	20.9	19.8	8.2		57.5

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
10/06/03																										
10/13/03				5.5											5.5	4.6	16.1	9.3	72.1	30.0	81.0		17.3	13.1	0.0	63.1
10/20/03				4.2											4.7	4.1	7.0	5.8	34.0	27.1	43.4		17.0	12.0		35.9
10/28/03		5.4	2.9	0.0				7.4	0.0			3.0	3.2	3.7		0.0	6.0	5.3	41.2	8.5	35.4		13.7	9.5	0.0	38.3
11/03/03															4.0	0.0	7.1	6.7	24.9	12.3	27.7	15.9	16.5	4.7		42.2
11/10/03				0.0											4.3	0.0	6.9	5.4	32.0	11.7	33.8	24.5	15.0			31.8
11/17/03		3.2	3.7	3.0				7.6	8.5			5.4	5.6	5.6	4.8	0.0	6.8	6.4	32.8	11.6	30.6	14.2	14.6			25.5
12/01/03		0.0	0.0	0.0				0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	2.7	12.0	3.8	6.7	8.4			0.0	13.3
12/15/03															0.0	0.0	0.0	0.0	17.3	3.8	9.0	10.3	3.2		0.0	9.8
01/20/04												0.0	0.0	0.0	0.0	0.0	2.1	2.1	6.8	7.8	7.9	4.3	2.6		0.0	5.8
02/16/04		0.0	0.0	0.0								0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	3.9	4.8	3.2	0.0		0.0	3.1
03/17/04								0.0	0.0			0.0	0.0	0.0	0.0	0.0	2.5	2.2	4.9		5.3	3.6	0.0	0.0	0.0	3.3
04/13/04		0.0	0.0	0.0				0.0	0.0			0.0	2.0	0.0	0.0	0.0	6.3	2.3	3.1		3.0	0.0	0.0	0.0		2.9
05/18/04				0.0				4.3	0.0			0.0	0.0	0.0	0.0	0.0	3.0	2.3	3.7	3.1	3.7	2.3	2.4	0.0	0.0	3.9
06/21/04		0.0	0.0					2.8	0.0			0.0	0.0	0.0	0.0	0.0	0.0	2.2	10.3	2.5	13.6	4.2	0.0	0.0	24.2	14.1
07/06/04				0.0											0.0	0.0	3.1	3.2	38.0	13.1	45.1	13.3	4.5	2.8		47.3
07/13/04																			30.0	16.5	37.3	29.4				
07/20/04		3.4	0.0					37.3	0.0			0.0	0.0	0.0	0.0	0.0	4.2	3.2	15.8	14.4	20.7	20.1	3.6	0.0		17.6
07/27/04																		3.1	12.2	7.3	17.3	11.1				
08/03/04															19.1	0.0	15.8	14.7	17.3	3.4	18.5	14.7	12.8	7.3		14.6
08/10/04																			23.5	8.8	24.8	15.3				
08/17/04		0.0	0.0	0.0				22.7	6.6			32.9	32.8	28.9	38.0	0.0	23.8	15.2	2.8	4.2	26.9	16.5	11.0	7.5	3.5	18.6
08/24/04																			19.0	8.0	24.2	15.8				
08/31/04				0.0											32.0	0.0	21.6	13.9	16.8	6.6	20.4	19.1	12.3	6.1		17.3
09/07/04																			23.2	7.1	20.8	16.5				
09/14/04		14.7	0.0	0.0				9.5	13.1			12.3	12.1	35.7	27.0	0.0	23.5	12.6	26.7	8.5	27.9	16.5	14.4	14.3	3.1	25.0
09/21/04																			31.1	16.8	32.2	29.2				
09/28/04				7.9											21.7	4.8	41.0	22.7	42.3	42.9	43.7	19.4	10.5	10.4		32.1
10/05/04																			45.4	16.2	36.6	13.1				
10/12/04		41.0	44.4	13.0				2.4	3.0			5.2	4.9	5.1	0.0	16.3	35.0	19.6	34.2	10.5	31.3	19.4			0.0	30.3
10/19/04																			38.1	18.3	34.8	27.8				
10/26/04				11.1											2.6	51.7	65.6	44.5	46.2	26.7	41.2	39.3				45.3
11/02/04																			39.8	8.8	34.3	30.4				
11/09/04		5.0	5.0	2.5				3.7	3.6			9.7	8.9	9.5	3.0	2.6	24.7	15.4	19.2	8.9	20.8	8.4				14.6
11/16/04																			14.0	7.8	19.6	9.5				
11/23/04				0.0											0.0	0.0	20.8	9.5	14.6	6.3	19.7	8.2			0.0	12.8
11/30/04																			11.7	7.0	14.7	3.8				
12/07/04				0.0								4.1	3.9	3.9	0.0		8.2	9.5	13.1	6.0	11.1	10.6				9.4

TABLE 1.2. (CONTINUED) MIB (NG/L) FROM AUGUST 1999 TO DECEMBER 2004 - ASU ANALYSES (0 <MDL OF 2 NG/L).

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	North.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																										
09/01/99																										
10/01/99																										
11/01/99																										
11/17/99																										
12/01/99																										
01/01/00																										
02/01/00																										
03/01/00																										
04/01/00																										
05/01/00	10.5																									
06/01/00	11.7																									
07/01/00	13.0																									
08/01/00	10.7																									
09/01/00	13.2																									
10/01/00	20.2																									
11/01/00	16.5																									
12/01/00	9.7																									
01/01/01																										
02/01/01	9.1	3.0																								
03/01/01	19.9	2.0	16.6																							
04/01/01	4.3	0.0	4.8																							
05/01/01	5.5	18.6	7.0																							
06/01/01	4.1	8.0	8.6																							
07/01/01	6.9	10.3	9.7																							
08/01/01	17.2	9.7	17.2																							
09/01/01	49.5	15.3	47.9																							
12/01/01		0.0	9.6																							
01/01/02	6.7	52.8	0.0																							
02/01/02	13.4	0.0	14.9																							
03/01/02	7.5	0.0	13.0																							
04/01/02	4.8	3.0	5.1																							
05/01/02	3.1	5.4	4.9																							
06/01/02	4.9	5.8	5.2																							
07/01/02	5.2			3.7	5.1								3.3	5.9	5.0		3.5	4.2	5.2		4.5		3.1	7.5	0.0	0.0
07/08/02	4.4			4.2	6.3								3.2	5.8	5.0		3.5	4.6	5.2		4.4		3.8	10.2	0.0	0.0
07/16/02	3.9			4.9	4.7								3.3	3.5	3.8		4.4	4.5	3.7		3.7		5.5	7.5	0.0	0.0
07/22/02	3.5			5.2	5.1								3.6	3.6	3.4		3.0	5.5	2.2		3.4		5.6	6.9	0.0	0.0
07/29/02	3.6			5.0	5.3								4.7	5.3	3.4		4.2	4.5	3.2		2.7		6.7	7.0	0.0	2.1
07/30/02																										
08/05/02	5.1			7.3	10.6								2.9	5.4	5.9		5.5	6.1	5.2		5.4		8.1	9.9	0.0	3.4
08/12/02	7.2			9.4	12.2								5.0	7.2	9.1		5.4	8.0	7.6		6.6		8.7	13.4	0.0	4.0
08/19/02	8.8			14.9	16.4	13.5	10.4						7.8	10.9	11.1	17.3	8.4	12.9	10.6		10.4		17.5	15.8	2.1	7.1

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	North.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/26/02	9.7			16.2	20.9	14.0	10.4						9.5	9.8	10.0	16.2	7.1	14.0	9.1		9.9		10.9	16.4	3.4	8.4
08/30/02	12.3			19.7	19.0	17.3	14.2	22.8								24.4										
08/31/02				25.3	55.6	17.9	11.9	51.1								49.6										
09/03/02	11.5			16.5	24.8	16.0	12.2	21.9					9.5	13.0	16.0	22.3	11.0	11.7	12.5		10.6		9.8	11.9	2.9	8.0
09/10/02	6.2			19.4	22.5	10.3	9.3	19.1					5.9	14.3	13.1	23.9	6.6	6.4	12.6		8.3		4.2	4.9	2.1	4.3
09/16/02	8.3			13.7	28.8								8.4	7.1	9.5		8.0	13.8	8.3		8.9		6.3	10.6	2.5	4.1
09/23/02	7.3			12.3	24.5								9.7	6.9	8.0		8.6	9.1	8.8		7.1		6.2	11.4	0.0	4.1
09/30/02	7.2			11.4	23.6								9.9	6.1	8.0		5.9	8.9	10.3		7.4		10.1	13.2	2.3	3.8
10/02/02																										
10/07/02	5.6			10.0	14.8								14.0	5.6	6.4		5.9	6.2	6.4		8.3		6.0	5.9	5.2	9.9
10/14/02	7.5			11.6	16.5								13.7	6.1	7.6		7.1	9.2	6.5		7.7		9.8	6.0	2.1	6.1
10/16/02																										
10/21/02	11.7			15.7	17.1								17.7	12.8	13.9		10.3	15.4	11.0		10.2		11.4	11.1	8.2	15.1
10/28/02	13.9			15.7	17.3								12.1	11.6	14.2		24.3	11.9	12.1		10.8		7.1	0.0	11.5	19.3
10/30/02																										
11/04/02	17.0			22.2	26.2								14.6	15.4	16.8		25.0	25.1	12.7		17.7		5.2	9.8	9.8	19.5
11/12/02	8.4			14.3	15.4								12.5	7.3	7.7		24.3	26.6	6.4		7.4		5.3	6.6	0.0	2.9
11/13/02																										
11/18/02	4.6			8.0	8.0								9.0	4.9	4.4		16.2	12.3	4.7		4.1		3.2	3.4	0.0	0.0
11/25/02	6.1			14.8	10.2									5.1	6.1		18.8	14.0	5.2		5.5				0.0	2.6
11/30/02																										
12/09/02	6.5			8.2	8.5									6.7	6.4		13.6	6.6	5.1		6.9				0.0	0.0
12/16/02	3.5			5.6	5.4									6.8	3.3		7.7	6.6	3.1		5.1				0.0	0.0
12/17/02																										
12/30/02																										
01/14/03		0.0											4.6									0.0	2.0	2.8	0.0	0.0
02/11/03	10.0	4.1											3.8						9.9			0.0	0.0	2.2	0.0	0.0
03/11/03	5.9	0.0											0.0						7.3			0.0	0.0	0.0	0.0	0.0
04/15/03	2.1	0.0							0.0	0.0	0.0	0.0	0.0	2.1					0.0			4.6	0.0	2.3	0.0	0.0
05/13/03	5.1	6.8							6.6	0.0	2.1	2.1	12.2	5.3			0.0	4.8	5.7	8.7		6.0	7.5	4.4	6.1	3.8
06/03/03	9.9	18.6							7.5	0.0			4.9	8.6			5.9	5.5	8.8			8.5	2.8	5.7	3.6	2.9
06/10/03	3.6								10.4	13.6	7.8		3.1	3.6			6.4	8.3	2.5	8.7		3.0	4.9	8.4	0.0	0.0
06/24/03																										
07/07/03	8.9	5.2							2.9	0.0			8.1	10.9			8.3	10.6	12.4			10.5	2.2	4.6	0.0	0.0
07/14/03	12.1	7.2							3.7	0.0			10.7	11.7			17.8	16.3	14.7			12.5	3.1	5.4	0.0	0.0
07/21/03	20.2	8.4							7.4	0.0			10.6	16.6			19.7	25.0	22.2			15.2	4.0	7.4	0.0	0.0
07/28/03	19.0	14.1							0.0	0.0			16.7	36.7			21.8	11.4	37.8			28.1	4.1	7.5	0.0	0.0
08/04/03	17.8	17.2							24.7	0.0			19.1	7.9			19.2	13.8	15.1			30.8	2.2	5.1	0.0	2.9
08/11/03	24.0	11.9							23.5	0.0			16.3	18.1			25.7	9.8	25.4			28.7	3.9	7.9	0.0	0.0
08/18/03	38.7	13.0							25.2	0.0			29.5	29.0			54.0	21.2	41.4			29.0	4.3	11.6	0.0	0.0
08/25/03	42.8	17.0							14.1	2.8			22.1	26.8			55.3	19.2	47.3			48.5	3.8	6.2	0.0	3.1
09/02/03									51.5					28.8			74.1	37.6	66.2				4.0	10.5	0.9	3.6
09/08/03	37.0	11.1							33.2	0.0			24.8	25.2			41.0	13.9	48.4			22.2	4.9	11.4	0.0	3.4
09/15/03	34.2	6.1							14.4	0.0			4.4	14.7			47.0	10.1	37.5			8.1	10.4	6.5	5.5	2.2
09/22/03	29.7	7.3							32.9	3.1			16.5	14.1			49.4	10.2	34.3			25.2	4.4	9.2	2.5	2.7

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	North.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03	42.5	8.3							21.2	0.0			16.1	18.8			59.1	7.0	43.3			22.9	2.8	6.2	0.0	3.3
10/06/03																										
10/13/03	68.0								53.9	0.0			19.2	30.7			49.6	21.9	61.5			15.6	3.9	8.3	0.0	4.0
10/20/03	48.6	5.5							23.1	0.0			7.3	8.6			34.0	14.0	25.2			7.6	4.2	2.5	0.0	6.0
10/28/03	34.0	2.8							31.0	0.0			8.9	8.4			29.9	8.8	23.3			6.6	0.0	0.0	0.0	0.0
11/03/03	26.3								25.0	0.0			8.8	10.0			19.5	11.4	23.4			7.8	0.0	2.7	0.0	2.0
11/10/03	25.8	5.3							22.4	0.0			13.5	10.9			32.1	18.4	23.8			8.1	0.0	2.2	0.0	0.0
11/17/03	40.6	4.1							16.5	3.8				13.4			27.1	31.4	21.4						0.0	2.8
12/01/03	16.2	0.0							0.0	0.0				5.2			9.5	0.0	10.8						0.0	0.0
12/15/03	10.1	0.0							6.9	0.0	0.0	0.0		6.3			5.6	8.7	3.6						0.0	0.0
01/20/04	6.9	0.0									0.0	0.0	0.0	3.3			5.3		4.6				0.0	0.0	0.0	0.0
02/17/04	7.6	0.0											0.0	0.0					2.1			2.0	3.2	2.3	0.0	2.1
03/16/04	6.8	0.0							3.0		0.0	0.0					5.9	4.8	0.0			0.0			0.0	0.0
04/13/04	3.5								0.0	0.0				2.6			2.6	0.0	2.2			0.0			0.0	0.0
05/18/04	3.3	6.9							3.4	0.0			2.7	2.2			3.2	2.1	2.1			2.0	0.0	0.0	0.0	0.0
06/21/04	8.5	11.1							14.3	0.0	0.0	0.0	4.9	3.0			9.2		2.8			2.7	0.0	2.3	0.0	0.0
07/06/04	25.2	29.6							43.0	0.0			9.9	4.9			24.3	12.5	6.6			4.8	0.0	3.4	0.0	0.0
07/13/04																										
07/20/04	13.8	29.8							22.4	0.0			4.8	4.2			10.9	7.9	6.9		11.7	3.2	3.1	3.1	0.0	0.0
07/27/04	12.0													5.3												
08/03/04	20.7								17.7	0.0			10.9	14.3			14.2	13.4	13.4			14.7	5.2	7.4	0.0	0.0
08/10/04																										
08/17/04	17.4	25.9							17.7	2.0	4.6	4.2	9.2	17.8			16.4	19.9	21.7			11.0	18.2	11.6	0.0	2.0
08/24/04																										
08/31/04	19.0								14.7	0.0			12.2	17.8			21.1	17.5	17.8			12.0	0.0	3.5	0.0	0.0
09/07/04																										
09/14/04	24.7	35.0							14.3	0.0	4.4	5.0	10.9	20.4			25.5	22.5	22.8			14.0	0.0	4.5	0.0	2.0
09/21/04																										
09/28/04	36.2	34.7							18.5	0.0			7.8	36.7			46.4	40.8	33.0			14.7	3.5	5.3	0.0	4.6
10/05/04																										
10/12/04	29.2	21.9							11.0	0.0	3.7	3.5	7.3	36.4			32.3	13.4	34.3			24.2	2.0	2.9	2.1	16.2
10/19/04																									26.2	35.6
10/26/04	54.4	24.8							14.3	7.7			19.8	58.5			45.7	41.7	60.3			55.8	4.0	3.9	45.1	39.3
11/02/04																									32.4	28.4
11/09/04	22.0	9.7							5.8	4.4			5.7	18.7			15.5	12.6	17.0			12.0	5.1		3.3	2.8
11/16/04																										
11/23/04	17.5	7.9							5.8	6.2	0.0	0.0	4.6	12.9			13.9	6.1	13.1				0.0		0.0	0.0
11/30/04																	11.9	13.1								
12/07/04	12.5	5.6							8.1	8.4				11.1			9.5	7.5	10.0			9.1	0.0		0.0	0.0

TABLE 2.1. GEOSMIN (NG/L) FROM AUGUST 1999 TO DECEMBER 2004 - ASU ANALYSES (0 <MDL OF 2 NG/L).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/01/99	0.0						0.0					0.0						0.0			9.1					
09/01/99	0.0						0.0					0.0						5.2			8.0					
10/01/99	0.0	0.0	0.0	43.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	7.0	8.0	0.0	0.0	11.0	18.0	18.0	21.0	8.0	20.0	6.0	
11/01/99	5.1	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	7.9	0.0	0.0	0.0	0.0	0.0	6.4					
11/17/99																										
12/01/99	8.4	0.0	0.0	8.1	6.7		0.0	0.0	0.0	0.0	0.0	0.0			9.9	0.0	0.0	0.0	6.1	0.0	8.7	9.0				
01/01/00	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	3.6	0.0	0.0						0.0	0.0	0.0	
02/01/00	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	2.1	0.0	0.0	0.0	0.0		2.8		0.0	0.0		
03/01/00	5.1	0.0	0.0	6.6	3.4	4.1	2.3	0.0	0.0	0.0	2.2	2.1		0.0	0.0	0.0	3.8	0.0	4.0	0.0	6.2	5.9	0.0	2.4	2.1	
04/01/00	4.1	0.0	0.0	7.1	7.1	6.1	2.0	0.0	2.3	4.9	6.2	0.0	2.4	0.0	0.0	3.1	0.0	2.3	5.4		8.5	9.3	9.7	7.0	3.7	
05/01/00	0.0	5.3	2.9	4.8	6.3	7.2	3.1	7.1	0.0	5.9	2.6	0.0	2.7	2.1	2.4	6.4	3.3	2.4	5.7	5.5	7.5	9.1	5.2	5.6	4.3	4.3
06/01/00	2.2	0.0	0.0	0.0	2.2	0.0	4.9	4.5	3.0	5.1	0.0	3.9	3.7	2.3	3.5	2.7	2.6	2.8	4.6	3.7	4.5	5.3	3.0	2.5	39.2	4.1
07/01/00	0.0	0.0	0.0	0.0	0.0	0.0	109.0	0.0	0.0	5.5	0.0	2.7	0.0	0.0	2.4	0.0	2.1	0.0	3.3	2.2	5.7	3.2	2.5	2.8	6.6	13.6
08/01/00	7.0	4.3	2.4	3.4	3.1	2.7	0.0	2.4	3.0	7.1	5.2	4.5	3.3	2.7	3.5	4.2	4.1	4.1	5.4	3.6	7.1	6.7	6.7	6.9	5.1	8.2
09/01/00	3.8	0.0	0.0	0.0	0.0	2.2	5.1	0.0	0.0	5.0	3.6	3.1	2.8	2.2	2.9	0.0	7.0	0.0	5.4	5.3	14.5	9.7	5.1	2.2	9.5	12.1
10/01/00	2.5	0.0	0.0	0.0	2.5	2.2	2.3	0.0	2.7	4.4	3.4	2.4	2.7	3.3	2.8	2.7	2.8	2.9	6.6	5.1	12.9	15.5	4.2	0.0	0.0	8.8
11/01/00	0.0	0.0	0.0	0.0	3.4	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0	3.5	2.2	4.4	6.8	0.0	0.0	3.3	5.2
12/01/00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.0	0.0	4.1	2.5	11.6	9.2			0.0	6.5
01/01/01	0.0	0.0	0.0	0.0	0.0	0.0	3.1	2.7	0.0	0.0	0.0	0.0	0.0	2.1	0.0	4.7	0.0						0.0	0.0	2.0	
02/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0		2.1		0.0	0.0	0.0	2.5
03/01/01	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	4.2	0.0	4.1	2.7	2.7	0.0	3.0	2.2	6.9	8.0	2.6	0.0	0.0	2.5
04/01/01	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7	3.0	2.7	2.7	3.2		0.0	0.0	0.0	2.9
05/01/01		0.0	0.0	0.0	0.0	0.0	0.0	43.7	8.9	3.1	4.0	9.4	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6		2.5	2.0	2.2	4.1
06/01/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.0	0.0	3.5	5.1	6.0	2.9	3.0	0.0	2.6	2.1	3.0	2.9	19.1		0.0	0.0	8.5	16.5
07/01/01	2.6	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	2.1	4.0	3.8	0.0	2.8	0.0	2.7	2.6	6.7	6.8	10.7		3.3	2.7	9.8	10.4
08/01/01	3.1	0.0	0.0	0.0	2.6	2.6	0.0	0.0	0.0	0.0	0.0	2.7	2.8	0.0	2.8	0.0	2.4	2.7	6.3	2.4	6.6	0.0	3.7	5.9	4.8	4.6
09/01/01	3.2	0.0	0.0	3.4	2.8	3.2	0.0	0.0	0.0	2.8	3.2	4.0	3.8	2.6	2.6	3.0	4.1	4.0	3.6	7.3	5.9		3.1	2.6		6.5
10/01/01	0.0	0.0	0.0	3.2	3.7	3.9	0.0	0.0			2.7	2.5	0.0	0.0	3.3	4.8	3.4	2.9	4.7	0.0	4.7		3.9	0.0	3.4	
11/01/01	10.4	0.0	0.0	13.2	12.5	11.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	4.3	0.0	3.2		2.0	0.0	2.9	3.4
12/01/01	0.0	0.0		0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0		0.0	18.9	21.7	0.0	0.0	3.6	1.5	2.6		3.6	0.0	2.8	
01/01/02	5.0	2.1	3.0	4.8	6.7	7.1	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	9.0	10.4	8.5	8.2		2.1		4.2	2.6		
02/01/02	2.7	0.0	0.0	2.5	3.3	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	0.0	2.2	6.5		3.6		3.7	5.0		4.8
03/01/02	3.7	0.0	0.0	3.4	3.2	3.6	0.0	0.0	0.0	0.0	2.6	2.5	2.6		3.0	3.0	2.0	3.0	3.2	3.0	2.5	2.7	2.5		2.4	3.0
04/01/02	6.0	0.0	0.0	4.5	4.2	4.3	0.0	0.0	0.0	0.0	0.0	3.1	2.8		0.0	4.9	0.0	3.3	2.2	2.0	2.2	0.0	2.6		0.0	2.5
05/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0
06/01/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		3.3	2.5	0.0	0.0	0.0	0.0	0.0	2.2	2.0	2.1	2.6	2.1	2.0	8.7	2.7
07/01/02																0.0	0.0	0.0	2.1	0.0	2.3	0.0	0.0	0.0		0.0
07/08/02																0.0	0.0	0.0	0.0	0.0	2.2	2.2	0.0	0.0		2.1
07/16/02		0.0	0.0					2.0	0.0			0.0	0.0	0.0		0.0	0.0	0.0	3.1	2.5	2.9	2.4	0.0	0.0		2.9
07/22/02																0.0	2.0	0.0	3.7	3.3	4.2	4.0	2.5	2.8		3.9
07/29/02																0.0	2.6	0.0	3.9	4.3	3.9	4.8	3.0	4.0		4.2
07/30/02																										
08/05/02																0.0	2.0	0.0	3.3	3.5	4.1	4.2	0.0	0.0		4.1
08/12/02		0.0	0.0					0.0	0.0			0.0	2.3	0.0		0.0	2.7	0.0	5.2	4.3	5.3	1.7	2.8	2.5		5.4

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/19/02																0.0	2.1	0.0	3.0	5.9	6.7	4.1	3.7	3.4		6.3
08/26/02																0.0	2.4	0.0	5.4	6.4	6.5	4.8	3.1	3.6		5.9
08/30/02																			5.7		6.9					8.4
08/31/02																			6.2		8.9					14.3
09/03/02		0.0	0.0					0.0	0.0			0.0	0.0	0.0		0.0	3.0	18.4	5.2	3.1	18.4	5.2	4.3	0.0		7.0
09/10/02																	3.0	3.1	6.5	2.2	5.6	2.8	8.0	0.0		7.5
09/16/02		0.0	0.0					0.0	0.0			2.8	2.7	0.0			2.2	2.2	6.1	3.1	5.7	0.0	3.3	3.4		7.6
09/23/02																	2.1	0.0	5.2	3.0	6.9	5.7	3.6	0.0		6.8
09/30/02																	2.6	2.7	4.9	3.5	5.8	0.0	5.4	0.0	0.0	7.3
10/02/02		0.0	0.0					0.0	0.0			0.0	0.0	0.0												
10/07/02																	2.7	2.1	4.5	2.9	4.4	0.0	7.2	0.0		5.4
10/14/02																4.3	2.7	4.3	7.9	4.0	7.2	2.1	6.9	0.0		6.9
10/16/02		0.0	0.0					0.0	0.0			2.2	2.2	0.0												
10/21/02																3.8	3.1	3.5	6.6	3.1	5.8	5.2	7.5	6.1		6.7
10/28/02																4.6	0.0	3.2	8.6	3.7	6.6	5.2	6.4	0.0		6.3
10/30/02		0.0	0.0					0.0	0.0			2.5	0.0	0.0											2.1	
11/04/02																5.6	2.1	3.8	10.3	0.0	12.2		9.2	8.6		8.1
11/12/02																6.3	2.8	4.9	18.2	14.2	15.1		8.4			15.3
11/13/02		0.0	0.0					0.0	0.0			0.0	0.0	0.0												
11/18/02																3.4	0.0	2.9	8.5	2.2	10.6		11.2			10.7
11/25/02		0.0	0.0					0.0	0.0			0.0	0.0	0.0		6.1	0.0	4.3	9.4	0.0	10.8	4.3				9.9
11/30/02																										
12/09/02																6.2	0.0	4.2	5.9	0.0	6.7					6.0
12/16/02																2.0	2.3	2.4	4.0	0.0	3.6	3.8				3.2
12/17/02		0.0	0.0					0.0	0.0			0.0	0.0	0.0												
12/30/02																									0.0	
01/14/03		0.0	0.0					0.0	0.0			0.0	0.0	0.0	5.7	4.0							6.3	5.8		
02/11/03		0.0	0.0					0.0	0.0			0.0	0.0	0.0	5.0		3.5	3.6	6.0		5.4	6.5	2.7			
03/11/03		0.0	0.0					0.0	0.0			0.0	0.0	0.0	2.3		2.3	2.6	2.9		2.8	2.2	3.1	2.4		2.8
04/15/03		0.0	0.0	0.0				0.0	0.0			2.9	3.1	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05/13/03		0.0	0.0	0.0				0.0	0.0			2.0	0.0	0.0	0.0	0.0	2.1	0.0	2.0	0.0	2.0	0.0	2.1	0.0	0.0	0.0
06/03/03		0.0	0.0	0.0				17.9	2.0			0.0	0.0	0.0	0.0	0.0	2.0	0.0	3.0	2.5	3.4	3.0	0.0	0.0		4.2
06/10/03																0.0	0.0	0.0	0.0	0.0	2.8	2.4	0.0	0.0	0.0	3.0
06/24/03																										
07/07/03				0.0											0.0	0.0	2.0	0.0	7.9	6.8	9.8	6.2	2.3	0.0		9.6
07/14/03		0.0	0.0					2.5	0.0			0.0	0.0	0.0		0.0	2.3	0.0	9.1	9.1	16.3	12.9	2.7	0.0		14.5
07/21/03				0.0											0.0	0.0	2.9	2.1	12.9	13.8	19.9	19.3	3.7	0.0		19.1
07/28/03				0.0											3.1	10.4	3.6	3.2	10.7	12.1	15.4	2.5	3.6	0.0		16.6
08/04/03		0.0	7.4	0.0				0.0	0.0			0.0	0.0	0.0	2.9	0.0	3.4	2.7	13.6	0.0	20.7	2.0	4.3	3.4		20.0
08/11/03				0.0											2.9	0.0	3.4	2.3	14.5	4.2	18.5	14.2	4.1	0.0		17.4
08/18/03				3.4											4.2	0.0	4.3	3.3	18.5	5.0	25.5	5.4	4.3	0.0		29.9
08/25/03		0.0	5.5	0.0				0.0	0.0			2.3	2.5	3.6	7.0	3.7	5.0	4.2	19.6	3.0	22.6	7.4	3.9	0.0		28.7
09/02/03																	2.6	3.1	19.5	1.4	23.1	9.0	3.1	1.0		24.4
09/08/03		0.0	14.1	3.1				0.0	0.0			0.0	0.0	2.5	3.8	2.2	3.3	2.8	12.0	0.0	14.6	5.4	3.5	2.8		13.4
09/15/03															3.3	3.4	2.7	3.1	9.9	0.0	12.9	3.5	2.6	0.0		12.4

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
09/22/03		0.0	0.0					0.0	0.0			2.0	2.0	2.7	3.7	6.7	2.7	5.9	9.3	6.2	12.2	3.5	4.0	0.0	0.0	13.3
09/29/03															2.8	5.2	2.1	4.8	14.4	0.0	11.6	3.9	4.1	0.0		17.9
10/06/03																										
10/13/03				6.3											0.0	4.7	3.2	4.3	19.9	4.1	16.2		3.6	3.1	2.8	16.0
10/20/03				2.1											0.0	2.4	3.4	2.8	12.1	8.4	10.6		3.0	2.9		12.0
10/28/03		0.0	0.0	0.0				0.0	5.7			0.0	0.0	0.0		0.0	2.7	0.0	13.4	0.0	9.8		2.4	0.0	2.8	13.4
11/03/03															0.0	0.0	3.7	2.7	10.3	5.2	10.1	5.1	3.2	0.0		18.7
11/10/03				0.0											0.0	0.0	3.1	2.3	13.8	0.0	12.8	7.7	3.0			13.5
11/17/03		0.0	0.0	0.0				0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.2	3.3	14.4	2.9	2.4			7.4
12/01/03		0.0	0.0	0.0				0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	0.0	7.1	5.6			0.0	9.5
12/15/03															0.0	0.0	0.0	0.0	7.5	2.6	6.9	4.6	0.0		10.1	6.4
01/20/04												0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.1	7.5	7.3	3.5	0.0		0.0	6.1
02/17/04		0.0	0.0	0.0								0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	2.9	3.9	0.0	0.0			3.4
03/16/04				2.1				0.0	0.0			0.0	0.0	0.0	0.0	2.2	2.0	2.1	4.9		5.6	2.2	0.0	0.0	3.6	4.6
04/13/04		0.0	0.0	0.0				4.3	2.1			0.0	0.0	0.0	0.0	0.0	3.7	2.6	3.4		2.9	0.0	2.0	0.0		3.2
05/18/04				0.0				4.1	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	5.0	8.2	0.0	0.0	5.7	2.2
06/21/04		0.0	0.0					7.8	0.0			3.5	2.4	0.0	0.0	0.0	0.0	0.0	5.0	0.0	8.1	0.0	0.0	0.0	9.5	4.9
07/06/04				0.0											0.0	0.0	3.1	2.2	14.0	5.0	15.6	5.7	3.2	0.0		14.6
07/13/04																			11.4	4.1	14.1	9.2				
07/20/04		0.0	0.0					4.3	0.0			2.5	2.5	0.0	0.0	0.0	2.4	0.0	8.0	7.3	9.1	10.0	2.8	2.9		7.7
07/27/04																		0.0	6.2	2.3	7.9	3.2				
08/03/04															0.0	0.0	2.7	2.2	5.3	0.0	5.5	4.8	3.1	0.0		4.2
08/10/04																			5.4	0.0	5.9	2.6				
08/17/04		0.0	0.0	0.0				0.0	2.4			0.0	0.0	0.0	3.1	0.0	4.0	2.7	0.0	0.0	7.3	3.3	4.0	2.0	0.0	6.0
08/24/04																			5.9	0.0	6.8	2.8				
08/31/04				0.0											2.3	0.0	2.4	2.7	5.4	0.0	6.2	5.8	4.1	0.0		6.0
09/07/04																			8.0	0.0	6.6	5.6				
09/14/04		0.0	0.0	0.0				0.0	2.3			0.0	0.0	0.0	19.3	2.2	37.4	2.7	6.6	0.0	8.1	3.3	5.1	5.1	4.7	14.1
09/21/04																			9.7	3.1	8.4	8.4				
09/28/04				0.0											4.6	2.3	2.8	3.0	11.0	10.5	11.0	3.1	4.1	3.2		9.0
10/05/04																			11.1	0.0	8.1	0.0				
10/12/04		0.0	4.3	0.0				0.0	0.0			0.0	0.0	0.0	0.0	0.0	4.0	0.0	7.1	0.0	7.8	5.0			28.5	7.8
10/19/04																			6.6	0.0	6.7	5.0				
10/26/04				0.0											0.0	0.0	3.5	0.0	8.1	2.7	8.1	8.0				7.4
11/02/04																			7.6	2.1	5.6	6.0				
11/09/04		0.0	0.0	0.0				0.0	0.0			0.0	0.0	0.0	0.0	0.0	2.9	2.1	5.3	0.0	8.8	0.0				4.7
11/16/04																			4.9	0.0	13.1	5.1				
11/23/04				0.0											0.0	0.0	2.0	0.0	3.9	0.0	10.5	0.0			0.0	4.1
11/30/04																			3.1	0.0	6.8	0.0				
12/07/04				0.0								0.0	0.0	0.0	0.0		2.6	3.0	5.1	0.0	8.6	8.1				5.4

TABLE 2.2. (CONTINUED) GEOSMIN (NG/L) FROM AUGUST 1999 TO DECEMBER 2004 - ASU ANALYSES (0 <MDL OF 2 NG/L).

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	Northn.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																										
09/01/99																										
10/01/99																										
11/01/99																										
11/17/99																										
12/01/99																										
01/01/00																										
02/01/00																										
03/01/00																										
04/01/00																										
05/01/00	7.2																									
06/01/00	3.6																									
07/01/00	2.8																									
08/01/00	4.4																									
09/01/00	3.5																									
10/01/00	3.9																									
11/01/00	3.2																									
12/01/00	0.0																									
01/01/01																										
02/01/01	0.0	0.0																								
03/01/01	6.0	2.9	4.3																							
04/01/01	0.0	0.0	2.2																							
05/01/01	2.0	3.0	2.3																							
06/01/01	2.5	3.4	3.8																							
07/01/01	4.1	2.4	5.4																							
08/01/01	4.4	3.3	5.9																							
09/01/01	4.9	4.0	6.2																							
10/01/01	3.1	2.4	4.8																							
11/01/01	2.9	0.0	3.1																							
12/01/01		0.0	3.4																							
01/01/02	2.1	12.1	0.0																							
02/01/02	4.7	0.0	5.2																							
03/01/02	2.8	3.0	2.7																							
04/01/02	0.0	3.0	2.1																							
05/01/02	0.0	2.3	0.0																							
06/01/02	2.3	6.2	2.8																							
07/01/02	0.0			0.0	0.0								0.0	0.0	0.0		0.0	0.0	0.0		0.0		0.0	2.3	0.0	0.0
07/08/02	0.0			0.0	0.0								0.0	0.0	0.0		0.0	2.4	0.0		0.0		0.0	2.8	0.0	0.0
07/16/02	0.0			3.1	3.4								2.1	0.0	0.0		0.0	4.1	0.0		0.0		2.1	2.4	0.0	0.0
07/22/02	0.0			3.1	3.3								2.2	0.0	0.0		0.0	3.2	2.0		0.0		2.4	2.7	0.0	0.0
07/29/02	2.1			3.9	3.8								2.4	0.0	2.1		3.0	3.2	0.0		0.0		2.3	2.9	0.0	0.0
07/30/02																										
08/05/02	0.0			3.8	3.7								0.0	0.0	2.0		2.0	3.2	0.0		2.1		2.3	2.7	0.0	0.0

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	Northn.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/12/02	2.6			5.1	5.5								2.7	2.1	3.0		2.2	5.0	2.7		2.5		2.8	3.0	0.0	0.0
08/19/02	2.7			6.7	5.3	3.9	3.2						2.9	2.3	2.9	6.6	2.1	8.3	2.7		2.9		6.2	5.5	0.0	0.0
08/26/02	2.4			5.6	6.7	3.4	2.6						2.8	2.0	2.7	5.6	2.2	12.2	2.2		2.4		2.3	3.8	0.0	0.0
08/30/02	3.6			7.6	6.5	4.8	3.8	8.5								7.9										
08/31/02				8.0	21.8	3.9	3.3	16.9								10.3										
09/03/02	3.3			5.9	6.2	4.2	3.2	5.8					6.2	2.6	4.0	6.2	2.5	5.8	3.7		3.0		2.0	0.0	0.0	0.0
09/10/02	2.8			6.8	6.6	4.7	3.4	6.8					4.7	3.6	4.4	7.9	2.8	0.0	3.8		2.1		0.0	0.0	0.0	0.0
09/16/02	3.5			6.0	5.9								3.4	2.4	3.2		2.8	4.1	2.7		3.2		4.9	6.3	0.0	0.0
09/23/02	3.3			5.5	7.0								3.4	2.0	2.7		2.7	3.7	2.9		2.6		3.9	7.3	0.0	0.0
09/30/02	3.8			5.8	6.9								5.5	2.8	3.7		2.8	7.3	3.4		3.2		5.5	9.5	0.0	0.0
10/02/02																										
10/07/02	2.7			4.8	4.8								4.1	2.9	3.5		2.6	8.1	3.3		0.0		3.0	0.0	0.0	0.0
10/14/02	4.8			7.2	7.4								6.1	4.4	5.5		2.9	10.4	4.5		5.2		7.3	0.0	0.0	3.2
10/16/02																										
10/21/02	4.4			7.5	6.7								5.1	3.7	4.7		2.6	9.2	4.1		3.9		3.2	0.0	0.0	2.7
10/28/02	3.6			6.8	5.7								6.9	2.8	2.9		4.2	0.0	3.0		2.8		3.5	0.0	0.0	0.0
10/30/02																										
11/04/02	5.2			11.1	12.4								8.1	4.9	4.4		4.1	5.0	3.2		4.8		2.9	4.0	0.0	0.0
11/12/02	5.5			22.7	20.3								7.8	5.4	5.5		8.0	7.5	5.2		4.6		0.0	2.7	0.0	3.2
11/13/02																										
11/18/02	3.3			9.5	8.7								6.6	3.0	2.8		3.7	2.3	3.1		3.1		0.0	0.0	0.0	2.2
11/25/02	4.8			11.0	9.7									4.6	4.3		4.1	0.0	4.5		4.5				0.0	2.1
11/30/02																										
12/09/02	3.7			6.0	6.2									3.7	3.6		3.0	0.0	3.8		3.6				2.2	3.9
12/16/02	2.2			3.9	3.5									2.1	2.0		0.0	0.0	2.0		2.8				0.0	2.1
12/17/02																										
12/30/02																										
01/14/03		2.0											5.2									4.5	0.0	0.0	0.0	0.0
02/11/03	5.8	2.3											0.0						2.9			2.5	0.0	0.0	0.0	0.0
03/11/03	2.4	2.4											0.0						2.2			3.4	0.0	0.0	0.0	0.0
04/15/03	0.0	0.0							0.0	0.0	0.0	0.0	0.0	0.0					0.0			0.0	0.0	0.0	0.0	0.0
05/13/03	0.0	3.1							0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	2.0	3.5		2.4	0.0	0.0	0.0	0.0
06/03/03	0.0	4.1							0.0	0.0			0.0	0.0			0.0	2.1	0.0			0.0	0.0	0.0	0.0	0.0
06/10/03	0.0								0.0	0.0	0.0		0.0	0.0			0.0	0.0	0.0	3.5		0.0	0.0	0.0	0.0	0.0
06/24/03																										
07/07/03	4.1	2.8							0.0	0.0			0.0	2.3			4.5	4.3	4.8			0.0	0.0	2.8	0.0	0.0
07/14/03	2.8	4.1							0.0	0.0			3.2	3.0			7.8	8.1	4.6			2.6	12.7	2.9	0.0	0.0
07/21/03	9.6	4.9							2.0	0.0			3.3	4.4			10.3	11.7	10.4			3.4	0.0	2.0	0.0	0.0
07/28/03	9.6	5.3							0.0	0.0			3.7	14.1			10.8	0.0	14.7			4.5	0.0	3.1	0.0	0.0
08/04/03	10.1	6.4							15.1	0.0			3.9	3.1			11.9	3.2	9.7			3.4	0.0	2.2	0.0	0.0
08/11/03	12.1	4.6							11.9	0.0			3.5	3.9			12.2	0.0	11.3			3.3	0.0	3.6	0.0	0.0
08/18/03	17.8	5.3							5.8	0.0			4.8	6.2			26.0	2.9	17.3			4.0	0.0	3.1	0.0	0.0
08/25/03	21.2	7.3							2.3	0.0			5.5	7.3			25.0	2.6	19.2			5.1	0.0	0.0	0.0	2.9
09/02/03									15.8					4.1			21.1	2.8	17.6				0.6	2.1	1.4	2.1
09/08/03	10.6	3.6							12.0	0.0			3.9	4.9			10.2	0.0	11.7			2.9	0.0	2.3	0.0	2.4

Date	R22	R25	R26	16th St.	19th Av.	32nd St.	44th St.	7th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	Northn.	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/15/03	10.0	2.7							5.0	0.0			0.0	4.0			12.7	0.0	9.4			0.0	6.9	0.0	0.0	3.4
09/22/03	10.7	3.0							9.4	0.0			3.6	7.0			14.2	0.0	10.9			2.9	0.0	0.0	0.0	4.9
09/29/03	11.6	3.1							6.7	0.0			3.6	6.3			13.1	0.0	10.3			4.7	0.0	2.1	0.0	5.1
10/06/03																										
10/13/03	17.3								10.3	0.0			4.5	6.4			12.7	0.0	12.4			3.6	0.0	0.0	0.0	3.5
10/20/03	14.1	4.8							4.2	0.0			2.7	3.3			9.7	0.0	8.5			3.0	2.2	0.0	2.1	0.0
10/28/03	9.4	3.6							8.0	0.0			2.4	2.8			10.0	0.0	7.2			2.4	0.0	0.0	0.0	0.0
11/03/03	9.3								8.7	0.0			3.1	3.9			7.3	0.0	9.8			2.7	0.0	0.0	0.0	0.0
11/10/03	8.6	2.8							9.9	0.0			3.2	3.5			12.3	3.0	9.5			0.0	2.6	0.0	0.0	0.0
11/17/03	12.8	0.0							5.1	0.0				2.3			11.9	9.8	8.2						0.0	0.0
12/01/03	9.1	0.0							0.0	0.0				2.1			7.8	0.0	7.9						0.0	0.0
12/15/03	9.7	5.5							3.5	0.0	0.0	0.0		2.4			7.1	10.1	5.4						0.0	0.0
01/20/04	5.9	0.0									3.4	2.4	3.3	2.1			14.3		3.4				0.0	0.0	0.0	0.0
02/17/04	3.7	0.0											3.5	0.0					2.3			3.5	0.0	0.0	0.0	0.0
03/16/04	6.5	2.2							3.5					0.0			12.7	3.8	2.2			0.0			0.0	0.0
04/13/04	3.3								2.6	0.0				2.2			3.2	0.0	3.2			2.0			0.0	0.0
05/18/04	0.0	3.2							13.8	0.0			0.0	0.0			0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0
06/21/04	3.5	7.7							11.2	0.0	2.5	0.0	2.1	0.0			6.6		2.8			0.0	0.0	0.0	0.0	0.0
07/06/04	11.1	9.4							14.9	0.0			4.2	4.0			12.9	5.3	8.8			2.4	0.0	0.0	0.0	0.0
07/13/04																										
07/20/04	7.6	8.8							10.4	0.0			2.9	2.9			6.9	2.8	6.6		7.9	2.3	2.3	2.4	0.0	0.0
07/27/04	6.4													3.2												
08/03/04	5.6								5.7	0.0			2.6	3.1			4.5	4.6	4.2			2.3	0.0	2.3	0.0	0.0
08/10/04																										
08/17/04	4.8	8.3							4.9	0.0	2.3	2.3	3.8	4.8			6.3	6.6	5.5			0.0	5.2	3.0	0.0	0.0
08/24/04																										
08/31/04	4.7								4.7	0.0			5.2	5.2			7.5	5.8	4.5			0.0	0.0	0.0	0.0	0.0
09/07/04																										
09/14/04	6.2	2.6							4.2	0.0	2.4	2.2	4.5	5.5			8.6	5.4	6.1			2.9	0.0	0.0	5.6	0.0
09/21/04																										
09/28/04	8.2	2.5							5.3	0.0			2.4	7.7			10.4	11.7	7.0			2.8	0.0	0.0	0.0	2.0
10/05/04																										
10/12/04	6.5	3.6							3.8	0.0	3.5	2.7	2.3	5.5			7.0	0.0	6.1			2.6	0.0	0.0	0.0	0.0
10/19/04																									0.0	0.0
10/26/04	6.4	4.6							2.9	0.0			2.7	5.0			6.7	5.2	6.9			2.5	0.0	0.0	0.0	0.0
11/02/04																									0.0	0.0
11/09/04	7.7	2.3							2.0	0.0			2.9	4.4			4.1	0.0	4.1			2.1	0.0		0.0	0.0
11/16/04																										
11/23/04	6.0	0.0							3.0	2.9	0.0	0.0	2.2	3.2			3.7	0.0	3.3				0.0		0.0	0.0
11/30/04																	2.3	0.0								
12/07/04	5.6	2.1							5.3	5.7				4.3			3.8		4.0			2.7	0.0		0.0	0.0

Table 3. MIB (ng/L) from August 1999 to December 2004 - COP analyses (0 <MDL of 2 ng/L).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/01/99	0	12	0	0	0		38	9	0	0	12	34		4	6	0	10	5	0	12	19	22	14	9		
09/01/99	4	45	0	0	0		14	10	10	8	13	22		19	13	0	12	9	29	33	46	33	31	23		
10/01/99	5	30	20	6	3		6	12	11	12	16	20		19	15	4	18	19	42	43	39	44	37	21	0	
11/01/99	0	27	15	2	0		2	0	0	2	13	16		14	12	0	10	7	23	22	19					
11/17/99																										
12/01/99	0	14	14	0			0	0	0	0	7	5			8	0	6	9	15	16	22	13				
01/01/00		10	6									5		5									10	11		
02/01/00																			15		31					
03/01/00												15		0		0	24	21								
04/01/00																			7		18	9	4			
05/01/00																			7	5	5	5	6			
06/01/00																			8	7	8	10	7			
07/01/00																			10	7	12	15	10			
08/01/00																			15	10	51	35	9			
09/01/00																			17	15	52	37	30			
10/01/00																			29	25	37	34	20			
11/01/00																										
12/01/00																										
01/01/01					0											0	17						13	13		
02/01/01																0	11						7	5		
03/01/01																				8	8	11	4	4		
04/01/01																			3	3	5		3	4		
05/01/01																			4	3	4		4			
06/01/01																			8	7			4			
07/01/01																			15	11	22		0			
08/01/01																			44	35	54	20	23			
09/01/01																			50		50		17			
10/01/01																			45	26	92		22			
11/01/01																			46	13			23			
12/01/01																										
01/01/02																					333		7			
02/01/02																										
03/01/02																										
04/01/02																										
05/01/02																										
06/01/02																										
07/01/02																										
07/08/02																										
07/16/02																										
07/22/02																										
07/29/02																										
07/30/02																										

TABLE 4. GEOSMIN (NG/L) FROM AUGUST 1999 TO DECEMBER 2004 - COP ANALYSES (0 <MDL OF 2 NG/L).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/01/99	2	0	0	0	0		0	0	0	7	0	0		0	0	0	2	3	0	7	6	9	4	3		
09/01/99	2	0	0	3	9		0	0	0	8	0	0		0	4	8	3	3	10	10	14	11	4	3		
10/01/99	0	0	0	50	6		0	0	0	2	3	2		2	5	13	4	5	9	7	9	10	8	2	2	
11/01/99	2	0	0	2	0		0	0	0	0	3	2		2	8	2	0	0	5	5	5					
11/17/99																										
12/01/99	4	0	0	4			0	0	0	0	0	2			8	3	2	0	4	5	7	5				
01/01/00		0	0											3									3	3		
02/01/00																			2		6					
03/01/00												8		0		5	3	6								
04/01/00																			4		5	4	3			
05/01/00																			3	2	2	3	2			
06/01/00																			2	2	3	3	2			
07/01/00																			3	2	4	5	2			
08/01/00																			5	4	7	6	6			
09/01/00																			5	4	15	9	5			
10/01/00																			9	6	15	18	3			
11/01/00																										
12/01/00																										
01/01/01					0											4	0						0	0		
02/01/01																2	2						2	2		
03/01/01																				3	3	3	2	0		
04/01/01																			5	5	4		3	3		
05/01/01																			2	2	3		2			
06/01/01																			2	0			0			
07/01/01																			4	3	8		0			
08/01/01																			17	6	24	0	9			
09/01/01																			5		4		2			
10/01/01																			3	0	2		0			
11/01/01																			7	0			0			
12/01/01																										
01/01/02																					0		6			
02/01/02																										
03/01/02																										
04/01/02																										
05/01/02																										
06/01/02																										
07/01/02																										
07/08/02																										
07/16/02																										
07/22/02																										
07/29/02																										
07/30/02																										

TABLE 5.1. TOTAL NITROGEN (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
08/01/99	0.30	0.23	0.32	0.39	0.34		0.55	0.20	0.27	0.28	0.24	0.27		0.35	0.21	0.35	0.20	0.25	0.25		0.27		0.29
09/01/99	0.26	0.32	0.32	0.37	0.34		0.51	0.23	0.37	0.40	0.33	0.31		0.45	0.21	0.34	0.30	0.27	0.29		0.33		0.29
10/01/99	0.32	0.33	0.34	0.32	0.28		0.44	0.32	0.29	0.41	0.27	0.28		0.36	0.28	0.28	0.31	0.33	0.37		0.39		0.27
11/01/99	0.45	0.29	0.35	0.43	0.42		0.36	0.35	0.37	0.37	0.34	0.35		0.32	0.35	0.44	0.29	0.37	0.32		0.47		
12/01/99		0.28	0.28		0.39		0.23	0.31		0.35									0.42		0.31		
01/01/00	0.40	0.27	0.31	0.40	0.37		0.11	0.23	0.21	0.21	0.53	0.24		0.23	0.11	0.37	0.16						0.21
02/01/00	0.41	0.34	0.29	0.41	0.41		0.37	0.18	0.21	0.24	0.24	0.25		0.26	0.17	0.42	0.16	0.34	0.32		0.18		0.41
03/01/00	0.41	0.33	0.31	0.45	0.43	0.39	0.36	0.19	0.30	0.27	0.21	0.25		0.48	0.21	0.46	0.26	0.33	0.50		0.44		0.37
04/01/00	0.44	0.30	0.31	0.37	0.42	0.41	0.33	0.19	0.21	0.23	0.26	0.26	0.25	0.33	0.23	0.41	0.26	0.30	0.49		0.75		0.37
05/01/00	0.50	0.30	0.40	0.41	0.44	0.46	0.69	0.22	0.23	0.27	0.27	0.30	0.31	0.34	0.25	0.43	0.25	0.32	0.41		0.71		0.38
06/01/00	0.47	0.26	0.26	0.34	0.32	0.38	0.31	0.24	0.43	0.20	0.27	0.33	0.29	0.33	0.24	0.36	0.24	0.26	0.27		0.44		0.27
07/01/00	0.37	0.35	0.35	0.36	0.41	0.40	0.36	0.24	0.22	0.30	0.37	0.35	0.28	0.70	0.31	0.36	0.28	0.26	0.24		0.23		0.25
08/01/00	0.32	0.35	0.33	0.28	0.33	0.29	0.31	0.31	0.34	0.24	0.31	0.44	0.33	0.22	0.28	0.29	0.27	0.27	0.29		0.29		0.27
09/01/00	0.30	0.28	0.27	0.27	0.27	0.29	0.48	0.31	0.24	0.37	0.39	0.42	0.32	0.32	0.36	0.34	0.23	0.48	0.33		0.60		0.28
10/01/00	0.23	0.26	0.31	0.32	0.23	0.26	0.26	0.38	0.63	0.51	0.38	0.34	0.31	0.33	0.26	0.25	0.33	0.36	0.37		0.72		0.30
11/01/00	0.38	0.38	0.41	0.39	0.33	0.33	0.47	0.35	0.33	0.37	0.58	0.44	0.41	0.52	0.33	0.38	0.25	0.26	0.31		0.30		0.34
12/01/00	0.26	0.29	0.30	0.27	0.27	0.27	0.23	0.29	0.39	0.30	0.46	0.38	0.39	0.37	0.13	0.27	0.16	0.19	0.47		0.50		
01/01/01	0.36	0.36	0.35	0.40	0.36	0.39	0.19	0.33	0.35	0.26	0.52	0.44	0.43	0.48	0.20	0.34	0.22						0.22
02/01/01	0.43	0.33	0.39	0.42	0.40	0.40	0.17	0.21	0.23	0.23	0.45	0.39	0.40	0.44	0.17	0.39	0.21	0.19	0.28		0.22		0.27
03/01/01	0.50	0.35	0.37	0.44	0.43	0.43	0.37	0.17	0.20	0.20	0.37	0.27	0.25	0.35	0.22	0.43	0.16	0.27	0.50		0.79		0.42
04/01/01	0.38	0.20	0.34	0.40	0.56	0.59	0.13	0.15	0.19	0.16	0.24	0.30	0.24	0.27	0.23	0.38	0.10	0.12	0.19		0.54		0.29
05/01/01		0.26	0.40	0.30	0.32	0.31	0.15	0.23	0.17	0.18	0.26	0.30	0.30	0.31	0.22	0.34	0.23	0.25	0.29		0.66		0.27
06/01/01	0.26	0.27	0.33	0.53	0.45	0.25	0.03	0.35	0.35	0.16	0.22	0.29	0.30	0.29	0.21	0.31	0.30	0.37	0.30		0.50		0.27
07/01/01	0.26	0.29	0.42	0.36	0.37	0.31	0.30	0.19	0.34	0.16	0.24	0.26	0.25	0.23	0.19	0.29	0.35	0.36	0.25		0.67		0.26
08/01/01	0.39	0.26	0.32	0.38	0.29	0.42	0.32	0.36	0.39	0.22	0.31	0.32	0.21	0.29	0.24	0.27	0.20		0.26		0.30		0.24
09/01/01	0.29	0.29	0.29	0.25	0.29	0.24	0.19	0.31	0.26	0.26	1.43	0.72	0.43	0.76	0.63	0.40	0.61	0.37	0.45		0.59		0.35
10/01/01	0.29	0.33	0.35	0.36	0.30	0.29	0.35	0.26		0.32	0.70	0.41	0.41	0.45	0.37	0.37	0.25	0.25	0.36	0.35	0.74		0.34
11/01/01	0.25	0.28	0.22	0.22	0.20	0.19	0.10	0.23	0.21	0.21	0.33	0.26	0.28	0.29	0.22		0.18	0.14	0.58		0.67		0.22
12/01/01	0.34	0.29		0.33	0.32	0.31	0.06	0.22		0.20	0.40	0.28	0.26	0.26	0.13	0.32	0.16	0.12	0.12		1.27		0.13
01/01/02		0.28		0.34	0.32	0.31	0.03	0.21		0.19	0.30	0.28	0.25	0.26	0.20	0.33	0.12	0.15	0.62		0.32		0.19
02/01/02	0.38	0.35	0.29	0.39	0.44	0.43	0.05	0.25	0.22	0.17	0.27	0.26	0.26	0.27	0.19	0.37	0.21	0.24	0.29		0.25		0.24
03/01/02	0.44	0.29	0.36	0.44	0.46	0.46	0.08	0.15	0.34	0.18	0.83	0.34	0.36		0.21	0.49	0.25	0.38	0.49		0.67		0.39
04/01/02	0.42	0.23	0.37	0.41	0.44	0.42	0.18	0.14	0.26	0.21	0.26	0.30	0.32	0.24	0.42	0.47	0.26	0.26	0.39		0.62		0.38
05/01/02	0.34	0.22	0.34	0.33	0.34	0.32	0.08	0.10	0.13	0.15		0.30	0.35	0.23	0.20	0.34	0.19	0.24	0.27		0.28		0.27
06/01/02	0.31	0.21	0.31	0.32	0.32	0.28	0.11	0.15	0.10	0.12		0.31	0.38	0.25	0.20	0.30	0.24	0.22	0.28		0.38		0.24
07/01/02																							
07/08/02																							
07/16/02																							
07/22/02																							
07/29/02																							
07/30/02																							
08/05/02																							
08/12/02																							
08/19/02																							
08/26/02																							

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
08/30/02																							
09/03/02																							
09/10/02																							
09/16/02																							
09/23/02																							
09/30/02																							
10/02/02																							
10/07/02																							
10/14/02																							
10/16/02																							
10/21/02																							
10/28/02																							
10/30/02																							
11/04/02																							
11/12/02																							
11/13/02																							
11/18/02																							
11/25/02																							
11/30/02																							
12/09/02																							
12/16/02																							
12/17/02																							
12/30/02																							
01/14/03																							
02/11/03																							
03/11/03		0.32	0.35					0.55	0.18			0.25	0.25	0.43									
04/15/03		0.37	0.53					0.40	0.98			0.29	0.51	0.29									
05/13/03		0.30	0.39					0.24	0.43			0.27	0.47	0.24									
06/03/03		0.29	0.41					0.39	0.51			0.31	0.30	0.25									
06/10/03																							
06/24/03																							
07/07/03																							
07/14/03		0.46	0.66					0.48	0.71			0.81	0.61	0.78									
07/21/03																							
07/28/03																							
08/04/03		0.49	0.49					0.71	0.54			0.52	0.50	0.76									
08/11/03																							
08/18/03																							
08/25/03		0.38	0.32					0.34	0.41			0.40	0.43	0.40									
09/02/03																							
09/08/03		0.37	0.52					0.32	0.35			0.42	0.37	0.40									
09/15/03																							
09/22/03		0.40	0.41					0.33	0.56			0.40	0.41	0.45									
09/29/03																							
10/06/03		0.40	0.46					0.31	0.36			0.42	0.47	0.52									

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
10/13/03																							
10/20/03																							
10/28/03		0.33	0.55					0.29	0.70			0.36	0.40	0.52									
11/03/03																							
11/10/03																							
11/17/03		0.39	0.49					0.33	0.33			0.36	0.32	0.40									
12/01/03		0.46	0.52					0.48	0.42			0.35	0.36	0.53									
12/15/03																							
01/20/04												0.37	0.33	0.43									
02/17/04		0.32	0.33									0.34	0.33	0.36									
03/16/04		0.40	0.37					0.16	0.29			0.49	0.41	0.33									
04/13/04		0.30	0.41					0.26	0.20			0.35	0.34	0.42									
05/18/04								0.19	0.22			0.32	0.36	0.32									
06/21/04																							
07/20/04																							
08/17/04																							
09/14/04																							
10/12/04																							
11/09/04																							
12/07/04																							

TABLE 5.2. (CONTINUED) TOTAL NITROGEN (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R19	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99		0.17																					
09/01/99		0.63																					
10/01/99		0.20																					
11/01/99		0.08																					
12/01/99																							
01/01/00		0.11																					
02/01/00	0.28																						
03/01/00		0.17																					
04/01/00		0.16																					
05/01/00		0.22																					
06/01/00		0.21																					
07/01/00		0.24																					
08/01/00		0.68																					
09/01/00		0.14																					
10/01/00		0.28																					
11/01/00		0.02																					
12/01/00		0.10																					
01/01/01		0.04																					
02/01/01		0.12	0.20																				
03/01/01		0.07	0.13	0.47																			
04/01/01		0.09	0.08	0.28																			
05/01/01			0.11	0.39																			
06/01/01		0.12	0.11	0.37																			
07/01/01			0.18	0.60																			
08/01/01			0.14	0.37																			
09/01/01		0.77	0.29	0.73																			
10/01/01	0.30	0.22	0.30	0.39																			
11/01/01		0.04	0.23																				
12/01/01		0.00	0.12	0.26																			
01/01/02			0.04																				
02/01/02		0.16	0.12	0.28																			
03/01/02			0.16	0.57																			
04/01/02		0.16	0.20	0.45																			
05/01/02			0.12	0.32																			
06/01/02			0.49	0.31																			
07/01/02																							
07/08/02																							
07/16/02																							
07/22/02																							
07/29/02																							
07/30/02																							
08/05/02																							
08/12/02																							

Date	R19	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02																							
08/26/02																							
08/30/02																							
09/03/02																							
09/10/02																							
09/16/02																							
09/23/02																							
09/30/02																							
10/02/02																							
10/07/02																							
10/14/02																							
10/16/02																							
10/21/02																							
10/28/02																							
10/30/02																							
11/04/02																							
11/12/02																							
11/13/02																							
11/18/02																							
11/25/02																							
11/30/02																							
12/09/02																							
12/16/02																							
12/17/02																							
12/30/02																							
01/14/03																							
02/11/03																							
03/11/03		0.24																					
04/15/03		0.10																					
05/13/03		0.33							0.55	0.49													
06/03/03									0.42	0.42													
06/10/03																							
06/24/03																							
07/07/03																							
07/14/03		0.15																					
07/21/03																							
07/28/03																							
08/04/03																							
08/11/03																							
08/18/03																							
08/25/03		0.29							0.32	0.27													
09/02/03																							
09/08/03																							
09/15/03																							
09/22/03																							

Date	R19	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03																							
10/06/03																							
10/13/03																							
10/20/03																							
10/28/03		0.14																					
11/03/03																							
11/10/03																							
11/17/03																							
12/01/03		0.08																					
12/15/03		0.07																					
01/20/04		0.05																					
02/17/04		0.06							0.45	0.43													
03/16/04									0.49	0.50													
04/13/04									0.47	0.49													
05/18/04																							
06/21/04																							
07/20/04																							
08/17/04																							
09/14/04																							
10/12/04																							
11/09/04																							
12/07/04																							

TABLE 6.1. TOTAL DISSOLVED NITROGEN (MG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	0.266	0.243	0.336	0.379	0.348		0.448	0.173	0.326	0.286	0.237	0.213		0.266	0.203	0.352	0.212	0.225	0.225		0.241		0.234	
09/01/99	0.233	0.262	0.315	0.335	0.322		0.372	0.207	0.343	0.363	0.281	0.283		0.311	0.211	0.334	0.201	0.215	0.250		0.226		0.238	
10/01/99	0.279	0.284	0.255	0.275	0.251		0.318	0.230	0.226	0.331	0.226	0.233		0.284	0.256	0.273	0.253	0.235	0.268		0.343		0.228	
11/01/99	0.364	0.273	0.292	0.372	0.365		0.292	0.318	0.276	0.338	0.362	0.336		0.270	0.287	0.408	0.292	0.280	0.285		0.335			
12/01/99		0.260	0.280		0.380		0.120	0.240		0.260									0.400		0.430			
01/01/00	0.380	0.225	0.288	0.362	0.362		0.053	0.197	0.136	0.149	0.230	0.220		0.222	0.106	0.354	0.109						0.156	
02/01/00	0.352	0.326	0.298	0.392	0.372		0.200	0.152	0.140	0.202	0.206	0.196		0.202	0.142	0.378	0.130	0.270	0.224		0.196		0.292	0.268
03/01/00	0.378	0.300	0.286	0.410	0.398	0.380	0.146	0.132	0.248	0.146	0.196	0.198		0.220	0.184	0.370	0.152	0.258	0.414		0.404		0.368	
04/01/00	0.412	0.238	0.266	0.320	0.380	0.376	0.188	0.158	0.142	0.188	0.226	0.220	0.236	0.254	0.232	0.382	0.224	0.288	0.330		0.560		0.334	
05/01/00	0.446	0.404	0.422	0.466	0.404	0.410	0.528	0.188	0.182	0.234	0.252	0.280	0.304	0.264	0.240	0.420	0.224	0.338	0.378		0.632		0.306	
06/01/00	0.434	0.278	0.228	0.332	0.312	0.358	0.150	0.160	0.168	0.162	0.216	0.244	0.270	0.266	0.188	0.322	0.200	0.246	0.256		0.382		0.228	
07/01/00	0.262	0.216	0.258	0.322	0.316	0.314	0.158	0.196	0.146	0.164	0.288	0.196	0.220	0.322	0.204	0.388	0.232	0.230	0.322		0.296		0.238	
08/01/00	0.296	0.258	0.258	0.252	0.282	0.242	0.178	0.250	0.295	0.248	0.270	0.310	0.248	0.238	0.220	0.258	0.246	0.290	0.262		0.282		0.314	
09/01/00	0.268	0.216	0.244	0.240	0.232	0.252	0.226	0.194	0.180	0.310	0.278	0.238	0.234	0.220	0.246	0.256	0.188	0.230	0.240		0.478		0.228	
10/01/00	0.238	0.234	0.254	0.238	0.216	0.248	0.152	0.194	0.524	0.458	0.350	0.252	0.248	0.288	0.238	0.208	0.270	0.238	0.322		0.680		0.230	
11/01/00	0.362	0.338	0.342	0.348	0.330	0.318	0.452	0.350	0.314	0.344	0.504	0.426	0.394	0.440	0.310	0.292	0.248	0.256	0.266		0.280		0.312	
12/01/00	0.242	0.252	0.266	0.260	0.254	0.256	0.232	0.256	0.282	0.250	0.450	0.352	0.372	0.356	0.090	0.220	0.126	0.146	0.396		0.486			
01/01/01	0.330	0.318	0.338	0.378	0.340	0.358	0.100	0.282	0.272	0.246	0.504	0.418	0.426	0.386	0.178	0.328	0.194						0.224	
02/01/01	0.386	0.306	0.338	0.384	0.386	0.376	0.104	0.162	0.204	0.224	0.456	0.356	0.356	0.424	0.168	0.348	0.190	0.142	0.242		0.212		0.232	
03/01/01	0.490	0.340	0.360	0.424	0.408	0.420	0.278	0.172	0.180	0.166	0.338	0.242	0.246	0.342	0.204	0.406	0.138	0.270	0.486		0.776		0.402	
04/01/01	0.380	0.190	0.316	0.372	0.536	0.536	0.082	0.138	0.140	0.154	0.230	0.270	0.222	0.250	0.190	0.350	0.112	0.114	0.180		0.520		0.258	
05/01/01		0.232	0.400	0.296	0.282	0.292	0.134	0.182	0.158	0.174	0.242	0.250	0.278	0.300	0.204	0.346	0.210	0.202	0.262		0.656		0.224	
06/01/01	0.235	0.193	0.322	0.397	0.281	0.244	0.037	0.297	0.388	0.138	0.227	0.210	0.230	0.283	0.253	0.301	0.312	0.273	0.203		0.469		0.201	
07/01/01	0.235	0.200	0.371	0.324	0.280	0.297	0.112	0.215	0.261	0.140	0.183	0.183	0.199	0.183	0.179	0.282	0.141	0.168	0.201		0.560		0.156	
08/01/01	0.298	0.257	0.281	0.336	0.290	0.281	0.281	0.347	0.346	0.197	0.213	0.276	0.237	0.284	0.216	0.265	0.186		0.261		0.311		0.230	
09/01/01	0.243	0.264	0.253	0.225	0.250	0.233	0.213	0.333	0.275	0.262	0.448	0.349	0.305	0.715	0.278	0.276	0.270	0.349	0.539		0.544		0.248	
10/01/01	0.289	0.295	0.315	0.332	0.271	0.265	0.210	0.213		0.269	0.297	0.351	0.338	0.356		0.265	0.205	0.147	0.346	0.410	0.733		0.310	0.293
11/01/01	0.301	0.179	0.131	0.194	0.179	0.188	0.077	0.141	0.186	0.165	0.234	0.237	0.224	0.226	0.149		0.138	0.142	0.532	0.135	0.681		0.187	0.141
12/01/01	0.340	0.262		0.301	0.327	0.328	0.042	0.184		0.188	0.371	0.206	0.197	0.224	0.127	0.330	0.097	0.123	0.081	0.048	1.199		0.176	0.602
01/01/02		0.265		0.304	0.329	0.290	0.028	0.187		0.146	0.268	0.208	0.233	0.202	0.155	0.251	0.111	0.134	0.525		0.327		0.144	0.132
02/01/02	0.411	0.327	0.280	0.362	0.375	0.408	0.045	0.239	0.203	0.143	0.226	0.216	0.214	0.256	0.173	0.327	0.140	0.214	0.259		0.192		0.238	0.183
03/01/02	0.387	0.248	0.304	0.377	0.387	0.393	0.076	0.120	0.223	0.167	0.230	0.196	0.205		0.192	0.381	0.147	0.299	0.343	0.357	0.522	0.650	0.331	
04/01/02	0.394	0.214	0.296	0.371	0.394	0.391	0.116	0.108	0.141	0.180	0.158	0.227	0.225	0.221	0.208	0.368	0.207	0.215	0.261	0.234	0.569	0.563	0.296	0.295
05/01/02	0.308	0.210	0.286	0.282	0.297	0.269	0.046	0.071	0.156	0.138		0.225	0.218	0.186	0.155	0.301	0.186	0.200	0.173	0.079	0.141	0.112	0.176	0.108
06/01/02	0.270	0.187	0.282	0.325	0.257	0.253	0.062	0.112	0.068	0.096		0.179	0.221	0.164	0.169	0.266	0.135	0.182	0.169	0.103	0.235	0.163	0.143	0.108
07/01/02																0.237	0.169	0.179	0.157	0.129	0.269	0.338	0.155	0.115
07/08/02																0.353	0.198	0.275	0.244	0.241	0.213	0.242	0.314	0.265
07/16/02		0.246	0.280					0.153	0.113			0.231	0.248	0.236		0.339	0.197	0.203	0.177	0.153	0.377	0.498	0.167	0.138
07/22/02																0.266	0.233	0.248	0.214	0.186	0.395	0.256	0.202	0.464
07/29/02																0.270	0.186	0.230	0.254	0.190	0.476	0.592	0.230	0.210
07/30/02																								
08/05/02																0.302	0.222	0.236	0.262	0.204	0.252	0.260	0.258	0.234
08/12/02		0.410	0.412					0.199	0.563			0.290	0.312	0.415		0.326	0.290	0.244	0.232	0.186	0.216	0.216	0.300	0.242

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/19/02																0.232	0.184	0.210	0.210	0.170	0.180	0.182	0.250	0.234
08/26/02																0.296	0.210	0.290	0.202	0.158	0.374	0.416	0.212	0.204
08/30/02																								
09/03/02		0.340	0.440					0.392	0.402			0.422	0.442	0.732		0.238	0.200	0.284	0.202	0.144	0.382	0.460	0.280	0.258
09/10/02																	0.270	0.246	0.208	0.176	0.230	0.204	0.278	0.174
09/16/02		0.410	0.384					0.142	0.130			0.214	0.218	0.316			0.214	0.214	0.280	0.232	0.402	0.318	0.160	0.132
09/23/02																	0.170	0.166	0.452	0.190	0.408	0.352	0.222	0.182
09/30/02																	0.190	0.196	0.222	0.162	0.192	0.136	0.184	0.162
10/02/02		0.342	0.380					0.204	0.326			0.330	0.358	0.360										
10/07/02																	0.182	0.190	0.186	0.134	0.556	0.504	0.236	0.178
10/14/02																0.210	0.214	0.202	0.252	0.200	0.484	0.464	0.228	0.164
10/16/02		0.308	0.536					0.222	0.594			0.346	0.366	0.756										
10/21/02																0.204	0.162	0.204	0.246	0.186	0.488	0.214	0.174	0.134
10/28/02																0.230	0.162	0.182	0.244	0.188	0.212	0.414	0.210	0.142
10/30/02		0.342	0.526					0.260	0.262			0.290	0.412	0.590										
11/04/02																0.228	0.174	0.240	0.268	0.220	0.228		0.234	0.192
11/12/02																0.316	0.170	0.238	0.274	0.216	1.032		0.224	
11/13/02		0.374	0.534					0.254	0.224			0.300	0.356	0.394										
11/18/02																0.238	0.064	0.180	0.196	0.198	0.710		0.306	
11/25/02		0.298	0.406					0.090	0.128			0.312	0.256	0.218		0.294	0.106	0.192	0.168	0.154	0.218	0.302	0.458	
11/30/02																								
12/09/02																0.342	0.132	0.250	0.272	0.244	0.264			
12/16/02																0.358	0.108	0.174	0.312	0.328	0.312	0.274		
12/17/02		0.398	0.388					0.188	0.192			0.288	0.298	0.350										
12/30/02																								
01/14/03		0.378	0.357					0.121	0.165			0.229	0.225	0.204	0.193	0.343							0.281	0.258
02/11/03		0.361	0.390					0.171	0.174			0.246	0.351	0.259	0.248		0.163	0.300	0.197		0.345	0.384	0.345	
03/11/03		0.280	0.319					0.550	0.166			0.231	0.274	0.352	0.242		0.146	0.328	0.450		0.492	0.452	0.303	0.261
04/15/03		0.384	0.368	0.404				0.373	0.562			0.230	0.237	0.258	0.242	0.403	0.129	0.313	0.431	1.183	0.808	0.790	0.335	0.271
05/13/03		0.277	0.380	0.519				0.247	0.441			0.254	0.317	0.243	0.279	0.413	0.203	0.343	0.367	0.381	0.398	0.387	0.288	0.283
06/03/03		0.254	0.404	0.342				0.297	0.511			0.252	0.253	0.232	0.225	0.354	0.218	0.326	0.361	0.347	0.625	0.450	0.265	0.288
06/10/03																0.361	0.195	0.288	0.323	0.341	0.563	0.508	0.287	0.278
06/24/03		0.414	0.661	0.411				0.434	0.532			0.515	0.379	0.576	0.236	0.356	0.196	0.300	0.327	0.318	0.562	0.320	0.270	0.267
07/07/03				0.458											0.290	0.382	0.223	0.319	0.344	0.311	0.517	0.316	0.308	0.272
07/14/03		0.485	0.680					0.399	0.657			0.672	0.489	0.797		0.343	0.240	0.342	0.354	0.353	0.415	0.298	0.270	0.257
07/21/03				0.448											0.249	0.362	0.262	0.314	0.338	0.280	0.288	0.250	0.300	0.276
07/28/03				0.405											0.294	0.367	0.270	0.305	0.362	0.320	0.598	0.379	0.314	0.266
08/04/03		0.449	0.464	0.418				0.425	0.509			0.432	0.402	0.652	0.283	0.348	0.277	0.330	0.292	0.277	0.349	0.253	0.272	0.273
08/11/03				0.391											0.328	0.259	0.263	0.239	0.370	0.261	0.364	0.333	0.268	0.296
08/18/03				0.246											0.268	0.230	0.246	0.234	0.232	0.264	0.588	0.418	0.232	0.216
08/25/03		0.318	0.291	0.240				0.231	0.417			0.313	0.367	0.377	0.271	0.227	0.264	0.235	0.272	0.192	0.638	0.563	0.312	0.243
09/02/03																								
09/08/03		0.341	0.465	0.284				0.268	0.317			0.358	0.342	0.380	0.283	0.270	0.253	0.259	0.314	0.281	0.647	0.364	0.304	0.266
09/15/03																								
09/22/03		0.387	0.392	0.296				0.281	0.540			0.388	0.359	0.466	0.341	0.310	0.277	0.282	0.280	0.315	0.640	0.530	0.280	0.210

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
09/29/03															0.547	0.356	0.265	0.322	0.340	0.291	0.444	0.389	0.367	0.261
10/06/03		0.320	0.495	0.333				0.316	0.378			0.425	0.399	0.456	0.647	0.279	0.259	0.290	0.343	0.311	0.420	0.348	0.301	0.189
10/13/03				0.325											0.477	0.327	0.233	0.289	0.334	0.319	0.493		0.255	0.258
10/20/03				0.387											0.265	0.321	0.231	0.292	0.297	0.340	0.465		0.281	0.252
10/28/03		0.353	0.562	0.349				0.313	0.764			0.312	0.379	0.478		0.359	0.246	0.318	0.268	0.213	0.381		0.309	0.267
11/03/03															0.253	0.421	0.331	0.374	0.392	0.315	0.832	0.713	0.459	0.339
11/10/03																								
11/17/03		0.369	0.503	0.365				0.321	0.335			0.352	0.339	0.399	0.224	0.383	0.205	0.301	0.377	0.315	0.932	1.076		
12/01/03		0.443	0.523	0.382				0.374	0.468			0.321	0.345	0.419	0.192	0.373	0.187	0.224	0.257	0.480	0.581	0.575		
12/15/03															0.187	0.340	0.151	0.259	0.248	0.246	0.373	0.364		
01/20/04												0.282	0.272	0.411	0.199	0.366	0.233	0.336	0.509	0.456	1.297	1.150		
02/17/04		0.364	0.327	0.415								0.342	0.325	0.320	0.181	0.364	0.170	0.248	0.322	0.295	0.675	0.705	0.271	
03/16/04		0.352	0.386	0.450				0.173	0.263			0.462	0.375	0.333	0.219	0.464	0.231	0.360	0.390		0.625	0.656	0.398	0.378
04/13/04		0.279	0.374					0.220	0.261			0.356	0.302	0.388	0.260	0.559	0.157	0.405	0.334		0.675	0.647	0.420	0.410
05/18/04				0.390				0.189	0.217			0.334	0.317	0.274	0.241	0.386	0.227	0.316	0.396	0.360	0.531	0.550	0.296	0.308
06/21/04		0.228	0.245					0.310	0.261			0.548	0.552	0.778	0.406	0.330	0.314	0.317	0.356	0.241	0.359	0.314	0.390	0.327
07/20/04		0.275	0.380					0.267	0.364			0.411		0.383	0.381	0.381	0.373	0.384	0.366	0.310	0.342	0.316	0.356	0.295
08/17/04		0.286	0.565	0.411				0.351	0.409			0.627	0.507	0.450	0.401	0.338	0.387	0.330	0.408	0.359	0.780	0.688	0.377	0.309
09/14/04		0.223	0.341	0.282				0.274	0.395			0.406	0.430	0.450	0.314	0.290	0.295	0.244	0.316	0.301	0.689	0.547	0.310	0.273
10/12/04		0.224	0.244	0.239				0.268	0.532			0.378	0.307	0.358	0.536	0.198	0.237	0.207	0.332	0.256	0.592	0.523		
11/09/04		0.339	0.340	0.399				0.307	0.519			0.489	0.458	0.497	0.357	0.383	0.317	0.377	0.249	0.242	0.278	0.209		
12/07/04				0.477					0.379			0.385	0.508		0.246		0.344	0.312	0.538	0.493	0.291	0.280		

TABLE 6.2. (CONTINUED) TOTAL DISSOLVED NITROGEN (MG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	0.110																							
09/01/99	0.380																							
10/01/99	0.188																							
11/01/99	0.080																							
12/01/99																								
01/01/00	0.042																							
02/01/00																								
03/01/00	0.146																							
04/01/00	0.104																							
05/01/00	0.260																							
06/01/00	0.128																							
07/01/00	0.188																							
08/01/00	0.402																							
09/01/00	0.076																							
10/01/00	0.280																							
11/01/00	0.014																							
12/01/00	0.062																							
01/01/01	0.020																							
02/01/01	0.108			0.160																				
03/01/01	0.070			0.126	0.498																			
04/01/01	0.066			0.080	0.280																			
05/01/01				0.116	0.370																			
06/01/01	0.164			0.122	0.345																			
07/01/01	1.246			0.081	0.330																			
08/01/01				0.118	0.373																			
09/01/01	0.301			0.235	0.396																			
10/01/01	0.158			0.246	0.376																			
11/01/01	0.044			0.083																				
12/01/01	0.000			0.108	0.237																			
01/01/02				0.027																				
02/01/02	0.101			0.079	0.238																			
03/01/02				0.138	0.444																			
04/01/02	0.090			0.150	0.369																			
05/01/02				0.115	0.263																			
06/01/02	0.083			0.225	0.233																			
07/01/02		0.183	0.140				0.275					0.217	0.184	0.161	0.131	0.171	0.152		0.169		1.062	1.042	0.309	0.223
07/08/02		0.252	0.245			0.306	0.212					0.643	0.257	0.263	0.271	0.197	0.258		0.272		1.273	1.259	0.439	0.352
07/16/02		0.157	0.191			0.206	0.159					0.525	0.161	0.158	0.174	0.135	0.175		0.181		1.426	1.092	0.450	0.303
07/22/02		0.218	0.226			0.238	0.236					0.493	0.196	0.203	0.187	0.114	0.223		0.225		1.432	1.489	0.394	0.240
07/29/02		0.242	0.224			0.240	0.226					0.602	0.204	0.202	0.226	0.182	0.212		0.246		1.680	1.096	0.308	0.224
07/30/02																								
08/05/02		0.254	0.228			0.236	0.224					0.550	0.256	0.222	0.222	0.164	0.208		0.212		1.680	1.430	0.362	0.248

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/12/02		0.224	0.246			0.229	0.216					0.313	0.260	0.240	0.226	0.178	0.250		0.228		1.709	1.666	0.380	0.248
08/19/02		0.230	0.180			0.236	0.220					0.480	0.260	0.210	0.226	0.154	0.200		0.204		1.930	1.796	0.260	0.188
08/26/02		0.188	0.196			0.182	0.188					0.554	0.188	0.190	0.268	0.126	0.180		0.206		1.556	1.578	0.254	0.276
08/30/02																								
09/03/02		0.200	0.222			0.254	0.196					0.528	0.184	0.204	0.244	0.192	0.190		0.258		1.914	1.794	0.218	0.190
09/10/02		0.238	0.244			0.246	0.298					0.996	0.228	0.204	0.206	0.242	0.194		0.226		2.536	2.422	0.264	0.172
09/16/02		0.202	0.270			0.188	0.220					0.538	0.216	0.220	0.234	0.174	0.200		0.274		2.242	2.262	0.210	0.172
09/23/02		0.248	0.216			0.236	0.238					0.734	0.170	0.172	0.298	0.208	0.180		0.242		2.422	2.368	0.206	0.166
09/30/02	0.158	0.238	0.260			0.228	0.200					0.512	0.202	0.222	0.250	0.176	0.234		0.294		1.796	1.682	0.192	0.140
10/02/02																								
10/07/02		0.206	0.176			3.790	0.620					0.810	0.148	0.168	0.200	0.160	0.168		0.200		2.216	2.210	0.222	0.142
10/14/02		0.262	0.218			0.250	0.238					0.676	0.202	0.208	0.306	0.236	0.170		0.216		1.318	1.362	0.218	0.146
10/16/02																								
10/21/02		0.220	0.226			0.338	0.218					0.168	0.200	0.198	0.240	0.214	0.242		0.212		1.250	1.330	0.276	0.160
10/28/02		0.560	0.262			0.246	0.210					0.716	0.184	0.180	0.226	0.302	0.194		0.232		2.540	2.506	0.322	0.154
10/30/02	0.184																							
11/04/02		0.250	0.312			0.270	0.234					1.064	0.208	0.190	0.286	0.244	0.244		0.256		1.872	1.748	0.278	0.182
11/12/02		0.242	0.236			0.248	0.442					0.546	0.230	0.172	0.304	0.266	0.174		0.222		2.034	2.120	0.368	0.286
11/13/02																								
11/18/02		0.162	0.166			0.518	0.236					0.160	0.110	0.102	0.186	0.164	0.138		0.162		1.918	2.208	0.298	0.178
11/25/02		0.248	0.170			0.194	0.174						0.136	0.142	0.238	0.214	0.176		0.174				0.348	0.246
11/30/02																								
12/09/02		0.298	0.272			0.252	0.278						0.150	0.166	0.358	0.314	0.162		0.262				0.390	0.290
12/16/02		0.330	0.330			0.304	0.314						0.148	0.256	0.418	0.306	0.258		0.338				0.428	0.292
12/17/02																								
12/30/02	0.038																							
01/14/03	0.116			0.146								1.513								0.327	2.643	2.382	0.375	0.294
02/11/03	0.372		0.215	0.201								1.018					0.304			0.410	2.735	2.704	0.405	0.359
03/11/03	0.194		0.442	0.143								1.436					0.196			0.391	2.826	2.656	0.436	0.368
04/15/03	0.125	0.941	0.339	0.126				2.005	2.160			0.601	0.268				0.425			0.189	1.860	1.697	0.410	0.338
05/13/03	0.130	0.421	0.388	0.225				1.407	0.688	0.532	0.511	0.669	0.362		0.392	0.359	0.339			0.240	2.011	1.878	0.496	0.372
06/03/03		0.339	0.354	0.199				0.386	0.462	0.414	0.437	0.584	0.295		0.377	0.307	0.337	2.480		0.212	1.331	1.320	0.410	0.347
06/10/03		0.369	0.335					1.298	1.414			0.549	0.260		0.357	0.241	0.255			0.225	2.041	1.919	0.358	0.325
06/24/03	0.113	0.341	0.317	0.188				0.444	0.472	0.417	0.368	0.483	0.263		0.347	0.272	0.438			0.230	1.789	1.631	0.359	0.324
07/07/03		0.339	0.318	0.236				1.120	0.944			0.552	0.316		0.325	0.282	0.282			0.227	1.807	1.451	0.371	0.320
07/14/03	0.115	0.325	0.298	0.232								0.428	0.305		0.296	0.274	0.288			0.227	1.591	1.609	0.357	0.310
07/21/03		0.354	0.351	0.241				1.471	0.562			0.361	0.324		0.291	0.224	0.299			0.640	1.157	1.118	0.412	0.326
07/28/03		0.346	0.364	0.253				0.614	1.375			0.739	0.307		0.418	0.355	0.283			0.253	2.103	1.928	0.396	0.333
08/04/03		0.320	0.340	0.244				0.332	0.322			0.795	0.308		0.341	0.295	0.311	2.195		0.299	2.487	2.313	0.391	0.321
08/11/03		0.268	0.279	0.225				0.649	0.559			0.939	0.280		0.306	0.243	0.281			0.300	2.060	2.045	0.318	0.283
08/18/03				0.208				0.400	0.491			0.298			0.264	0.228				0.235	1.466	1.469	0.257	0.196
08/25/03	0.309			0.186				2.040	0.688	0.273	0.259	0.926			0.268	0.221				0.252	2.214	2.117	0.241	0.184
09/02/03																								
09/08/03				0.181				0.872	0.527			0.599			0.357	0.290				0.294	1.831	1.554	0.247	0.227
09/15/03																								

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/22/03	0.186			0.152				1.158	0.548			0.602			0.692	0.200				0.302	2.064	2.056	0.297	0.242
09/29/03				0.219				1.872	1.988			0.772			0.436	0.368				0.294	2.078	1.795	0.332	0.271
10/06/03				0.207				0.342	0.306			0.338			0.466	0.355				0.267	1.896	2.470	0.342	0.215
10/13/03								0.871	0.808	0.298	0.333	0.713			0.435	0.314				0.227	1.262	1.680	0.373	0.271
10/20/03				0.376				2.421	1.431			0.970			0.457	0.386				0.228	2.698	2.795	0.401	0.300
10/28/03	0.123			0.293				1.331	3.577			0.917			0.273	0.264				0.248	1.788	2.007	0.356	0.330
11/03/03								1.287	1.561			1.136			0.363	0.309				0.389	3.350	3.245	0.369	
11/10/03																								
11/17/03				0.191				0.715	0.419						0.489	0.443							0.355	0.308
12/01/03	0.072			0.178				2.846	3.201						0.402	0.494							0.387	0.335
12/15/03	0.087			0.175				2.589	3.032	0.370	0.353				0.378	0.323							0.340	0.312
01/20/04	0.035			0.259						0.361	0.396	1.074									2.401	2.163	0.381	0.317
02/17/04	0.068			0.192						0.395	0.385	0.656								0.146	2.676	2.515	0.378	0.336
03/16/04	0.123			0.177				2.825		0.460	0.469				0.484	0.439				0.374			0.446	0.415
04/13/04								2.178	1.983	0.491	0.456				0.505	0.505				0.418			0.479	0.410
05/18/04	0.185			0.141				0.736	0.520	0.425	0.429	0.615			0.432	0.403				0.291	2.442	2.381	0.404	0.325
06/21/04	0.146			0.144				0.329	0.406	0.463	0.442	0.492			0.429					0.361	1.436	1.231	0.442	0.331
07/20/04	0.448			0.166				0.334	0.300	0.433		0.375			0.342	0.374				0.366	0.411	0.304	0.396	0.366
08/17/04	0.349			0.511				1.572	0.449	0.438	0.566	0.710			0.561	0.465				0.351	2.310	2.138	0.418	0.427
09/14/04	2.445			0.207				2.817	1.718	0.315	0.514	0.774			0.445	0.426				0.255	2.667	2.428	0.263	0.272
10/12/04	0.131			0.191				2.986	2.384	0.369	0.368	0.844			0.422	0.368				0.207	2.138	2.251	0.242	0.198
11/09/04	0.255			0.274				4.143	3.376	0.387	0.379	0.393			0.234	0.272				0.374	1.379		0.366	0.384
12/07/04				0.309				0.534	0.694						0.624	0.458				0.307	1.945		0.505	0.418

TABLE 7.1. TOTAL PHOSPHOROUS (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	4.1	5.5	2.1	9.5	5.6		39.2	9.5	31.6	34.3	28.5	12.8		42.4	24.3	1.5	28.0	19.5	9.5		22.7		16.6	
09/01/99	0.0	15.4	39.7	9.6	0.0		43.0	6.4	30.3	40.2	17.9	6.0		13.9	25.6	0.0	28.0	15.8	32.3		29.5		14.4	
10/01/99	0.0	3.2	9.4	6.5	0.0		53.7	27.5	15.4	40.1	23.1	9.7		17.6	20.1	0.0	44.0	28.9	48.6		28.8		16.8	
11/01/99	15.1	8.1	12.8	6.4	7.1		34.5	34.6	62.6	32.1	25.9	18.4		19.8	13.5	40.3	31.8	44.2	33.1		50.6			
12/01/99	5.3	6.6	8.8	5.2	5.5		31.3	32.6	160.6	36.0	24.2	72.6		0.0	6.6	20.0	31.1	27.8	21.0		14.0			
01/01/00	12.2	13.0	10.0	12.6	3.3		14.2	10.1	22.9	12.4	15.3	6.5		5.8	0.0	0.0	12.3						8.4	
02/01/00	7.4	5.2	1.2	3.0	7.2		91.4	15.8	20.0	26.6	23.4	8.0		17.8	6.4	3.2	15.8	13.0	29.2		7.2		22.0	0.2
03/01/00	1.4	6.0	2.8	1.8	4.0	3.2	101.0	27.0	43.8	34.8	19.6	8.2		85.6	10.2	7.2	40.0	27.0	30.8		11.8		4.2	
04/01/00	2.8	2.0	0.6	2.8	1.0	0.6	54.2	7.4	8.6	18.2	13.0	5.6	5.0	12.8	8.0	0.0	11.0	10.0	45.4		38.0		6.2	
05/01/00	11.0	9.6	11.2	11.0	10.4	10.6	113.8	16.4	29.0	26.6	23.2	22.0	21.4	46.0	22.6	11.4	17.4	15.6	19.2		38.2		21.8	
06/01/00	9.6	9.0	8.2	8.8	8.8	10.0	85.2	17.6	266.8	28.2	22.2	18.8	18.6	29.4	19.2	11.0	21.6	14.6	14.8		18.2		17.0	
07/01/00	10.2	7.6	15.2	10.6	10.2	8.8	52.2	12.6	25.8	27.2	29.2	21.2	18.0	139.8	28.2	9.8	30.8	25.4	15.0		12.8		15.6	
08/01/00	4.6	4.8	7.4	4.6	6.2	7.2	35.6	10.2	35.4	26.8	22.0	18.8	10.0	15.8	17.0	8.4	17.4	11.4	12.0		11.6		11.4	
09/01/00	4.4	7.2	11.2	11.0	11.2	11.4	43.0	12.0	18.6	42.0	28.0	11.8	7.2	7.6	20.0	11.4	19.8	11.8	12.0		7.6		9.8	
10/01/00	5.6	9.4	10.4	13.6	7.0	7.2	67.6	18.6	93.2	84.4	38.4	23.6	22.2	27.6	18.2	9.4	44.4	30.8	20.2		14.8		17.4	
11/01/00	7.8	9.2	16.0	8.2	7.2	8.0	25.4	28.0	34.8	36.6	43.6	32.0	32.2	32.8	18.0	5.0	28.0	21.0	31.4		26.2		17.0	
12/01/00	7.4	7.6	13.2	9.2	9.4	9.4	34.4	28.8	47.6	39.6	39.8	30.2	31.4	30.0	12.8	9.6	33.2	31.8	28.2		20.0			
01/01/01	2.0	2.0	3.0	0.0	0.0	0.0	27.4	14.2	24.8	12.2	24.8	17.4	13.4	15.6	0.0	0.0	12.8						6.8	
02/01/01	10.6	2.0	8.0	3.4	8.2	2.2	16.0	11.6	13.8	14.0	26.8	17.0	17.0	19.0	7.8	3.8	29.4	24.8	30.0		14.6		14.2	
03/01/01	6.2	0.0	5.0	1.8	2.0	1.6	59.6	5.6	10.8	6.6	17.4	5.0	7.0	15.0	9.8	1.6	9.8	3.6	8.2		7.0		4.8	
04/01/01	2.6	2.8	3.4	3.6	2.8	3.0	12.6	6.4	25.8	15.4	14.6	7.6	7.8	13.8	12.0	3.0	12.4	13.8	22.4		8.4		10.8	
05/01/01		14.8	0.0	4.2	0.0	0.0	26.6	6.8	2.4	12.0	12.4	5.8	5.8	21.4	8.4	0.0	6.0	3.4	1.8		1.8		2.6	
06/01/01	3.4	0.8	0.9	3.7	7.8	4.6	24.0	16.9	2.1	26.4	19.1	14.2	15.6	15.4	16.4	2.8	18.6	17.0	30.9		19.4		14.5	
07/01/01	0.0	4.7	8.7	4.9	5.6	2.0	30.9	4.4	6.5	20.5	16.2	11.2	3.8	9.9	12.6	0.4	9.2	10.4	16.7		5.7		5.0	
08/01/01	13.1	11.6	14.1	15.0	14.3	13.7	84.6	15.4	19.4	35.9	25.4	19.0	20.2	31.9	30.5	13.2	33.0		26.5		19.8		22.7	
09/01/01	3.4	9.6	11.4	13.4	14.2	10.2	73.4	15.6	15.0	40.8	36.2	20.0	17.8	29.0	31.0	14.6	37.8	36.4	35.2		23.4		11.4	
10/01/01	6.1	9.7	12.4	31.0	16.7	16.0	65.9	15.9		87.0	19.7	21.2	23.4	23.7	14.2	28.9	25.0	24.7	8.0	15.2	28.9		7.4	37.8
11/01/01	6.4	24.2	7.3	5.2	7.5	4.4	27.4	13.0	18.8	15.9	29.0	13.7	18.2	16.3	11.3		18.5	21.0	16.9		15.9		22.4	
12/01/01	8.0	13.3		46.1	7.3	6.4	15.6	14.0		24.3	37.3	13.7	12.4	12.6	6.8	9.8	14.2	14.6	11.5		9.5		12.5	
01/01/02		6.1		7.3	8.3	7.0	16.1	19.1		23.7	25.6	9.7	12.4	12.1	11.3	4.9	9.4	12.1			9.1		13.9	
02/01/02	5.1	14.0	9.7	8.5	12.9	6.0	13.4	18.4	17.9	15.6	20.3	14.8	11.1	12.8	9.4	24.0	15.1	9.7	11.1		13.2		11.8	
03/01/02	5.5	6.4	6.6	8.9	7.6	7.4	15.2	8.6	20.2	14.9		19.3	21.1		11.0	51.9	19.9	9.5	34.6		30.6		17.7	
04/01/02	7.6	8.6	5.7	6.2	4.4	4.1	37.5	4.9	7.6	13.3	15.7	8.4	9.8	3.5	21.2	8.9	20.3	14.2	21.0		31.4		20.9	
05/01/02	7.6	7.3	7.3	7.4	7.0	7.5	32.9	10.1	15.6	14.1		19.7	22.3	18.9	29.3	8.9	18.9	15.7	21.0		23.4		12.2	
06/01/02	5.4	5.3	5.4	5.9	6.4	6.3	32.3	6.9	12.6	20.2		17.6	17.5	10.9	18.9	3.5	20.9	19.4	19.4		18.9		18.2	
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02																								
08/19/02																								

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/26/02																								
08/30/02																								
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12/17/02																								
12/30/02																								
01/14/03		14.4	13.8					25.1	24.2			17.8	15.9	18.8	11.8	8.3							11.9	
02/11/03		7.9	5.4					14.7	54.0			15.6	18.5	18.9	18.0		28.8	20.3			33.4		22.4	
03/11/03		6.3	8.5					40.6	19.0			12.2	21.7	15.0	14.1		29.4	21.3			16.0		9.4	
04/15/03		11.8	9.8	6.0				25.8	29.9			20.7	22.9	20.4	20.5	6.6	38.1	16.1			46.1		11.5	
05/13/03		12.8	12.4	6.0				19.8	20.2			20.2	20.6	10.8	17.2	5.6	16.8	6.4			32.8		30.0	
06/03/03																								
06/10/03																								
06/24/03		26.3	13.6	12.2				20.4	20.6			25.2	22.8	25.7	37.0	13.2	28.6	17.8			21.6		30.2	
07/07/03																								
07/14/03		12.1	7.8					14.1	11.3			22.1	20.1	36.9		5.3	14.6	8.7			10.3		11.6	
07/21/03																								
07/28/03																								
08/04/03		17.5	17.2					17.7	23.8			20.1	19.0	23.1										
08/11/03				22.2											28.2	20.4	35.4	26.2			24.6		31.8	
08/18/03																								
08/25/03		5.6	5.8					2.3	8.8			8.2	8.0	6.2										
09/02/03																								
09/08/03		6.2	7.6					11.2	13.2			7.6	9.0	14.0										
09/15/03															24.8	11.2	32.9	19.2			16.2			28.8
09/22/03		1.1	2.3					1.6	2.8			3.9	1.6	3.1										
09/29/03																								

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
10/06/03		0.0	2.6					3.8	3.5			1.3	0.0	1.2										
10/13/03				6.0											32.8	7.0	10.6	6.4			4.1			
10/20/03																								
10/28/03		14.8	25.1					7.7	30.2			6.5	5.7	5.2										
11/03/03																								
11/10/03																								
11/17/03		18.8	14.7	7.7				22.7	32.5			7.9	6.0	9.8	11.9	9.9	23.2	10.6			14.6			
12/01/03		12.8	10.8					28.3	25.8			1.8	6.3	2.3										
12/15/03															10.0	7.4	20.5	10.6			11.8			
01/20/04												4.4	9.0	6.0	4.7	0.0	17.0	11.4			2.7			
02/17/04		9.8	9.4	9.3								16.1	16.8	17.0	12.6	11.6	28.2	18.8			24.7		13.1	
03/16/04		10.7	9.5	7.5				19.7	22.9			15.9	14.3	16.8	15.9	12.1	31.5	15.4			24.1		24.7	
04/13/04				8.3				35.0	23.1			10.8	11.6	7.6		10.4	36.3	22.0			43.3		18.2	
05/18/04				0.0					19.9			46.1	12.7	14.3	5.3	0.0	5.7	0.0	12.7		33.0		4.8	
06/21/04								11.9	12.3			12.8	14.5	25.5	26.4	4.5	19.2	16.9			12.3		13.6	
07/20/04								11.9	12.3			12.8	14.5	25.5	26.4	4.5	19.2	16.9			12.3		13.6	
08/17/04				8.2				11.0	21.4			55.0	23.5	26.8	40.6	6.3	33.8	14.2			39.0		7.9	
09/14/04		8.8	29.8	6.5				16.4	16.3			16.0	23.2	22.2	25.5	6.2	24.9	11.1	19.5		12.3		12.3	
10/12/04		15.4	28.8	19.1				20.7	51.9			16.4	15.3	17.3	64.3	75.4	35.1	12.2	17.7		24.0			
11/09/04		15.0	17.1	9.9				32.2	37.0			19.2	23.2	22.8	36.4	8.9	28.1	17.6	11.8		19.5			
12/07/04				44.2								21.7	25.1	22.1	22.2		38.8		103.5		18.5			

TABLE 7.2. (CONTINUED) TOTAL PHOSPHOROUS (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	15.6																							
09/01/99	154.0																							
10/01/99	29.3																							
11/01/99	5.8																							
12/01/99																								
01/01/00	3.2																							
02/01/00																								
03/01/00	27.2																							
04/01/00	11.6																							
05/01/00	35.0																							
06/01/00	50.2																							
07/01/00	46.4																							
08/01/00	80.2																							
09/01/00	20.4																							
10/01/00	15.4																							
11/01/00	10.6																							
12/01/00	0.0																							
01/01/01	7.6																							
02/01/01	5.4			15.8																				
03/01/01	8.6			5.4																				
04/01/01	11.0			10.2	13.6																			
05/01/01				9.6	4.6																			
06/01/01	163.5			6.8	34.4																			
07/01/01				0.4	15.0																			
08/01/01				14.8	23.8																			
09/01/01	149.8			14.6	27.2																			
10/01/01	32.6			20.1																				
11/01/01	7.3			24.0																				
12/01/01	5.9			11.8	13.9																			
01/01/02				10.1																				
02/01/02	9.9			9.9	11.6																			
03/01/02				8.4	32.3																			
04/01/02				13.2	18.4																			
05/01/02				12.8	18.3																			
06/01/02				78.5	20.5																			
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02																								

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02																								
08/26/02																								
08/30/02																								
09/03/02																								
09/10/02																								
09/16/02																								
09/23/02																								
09/30/02																								
10/02/02																								
10/07/02																								
10/14/02																								
10/16/02																								
10/21/02																								
10/28/02																								
10/30/02																								
11/04/02																								
11/12/02																								
11/13/02																								
11/18/02																								
11/25/02																								
11/30/02																								
12/09/02																								
12/16/02																								
12/17/02																								
12/30/02																								
01/14/03				25.0								22.2								10.8	7.5		10.6	
02/11/03	138.4			28.4								18.3					31.5			12.4	13.3		10.4	
03/11/03	68.5			25.1								12.1					23.5				2.2		7.2	
04/15/03												16.3								38.5	8.0		7.0	
05/13/03	10.0			29.5								19.6								39.3	8.8		19.6	
06/03/03																								
06/10/03																								
06/24/03	34.6			32.6				19.1				23.2			19.4					33.4	16.0		13.2	
07/07/03																								
07/14/03				11.2								13.4			9.2					14.3	6.6		4.3	
07/21/03																								
07/28/03																								
08/04/03																								
08/11/03				56.5								27.6			32.6		18.8				18.8		19.8	
08/18/03																								
08/25/03	43.8																							
09/02/03																								
09/08/03																								
09/15/03				20.4								29.8			32.8								11.2	
09/22/03	24.1																							

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03																								
10/06/03																								
10/13/03												7.4			5.5		3.7				1.2			
10/20/03																								
10/28/03																								
11/03/03																								
11/10/03																								
11/17/03				22.1				21.8							7.7		6.1						4.8	
12/01/03																								
12/15/03				20.6				12.3							18.3		8.9						6.6	
01/20/04	10.6			28.7								7.3					8.8				6.8		0.0	
02/17/04	13.9			38.6								17.1					21.4				12.2		7.6	
03/16/04	37.0			26.2				10.3							22.4		28.9						8.4	
04/13/04								18.0							50.5		26.0						8.0	
05/18/04	13.9							21.7				7.2			19.6		8.0				0.0		8.4	
06/21/04	25.5			10.1				18.0				17.8			17.0		10.2				20.7		4.4	
07/20/04	25.5			10.1				18.0				17.8			17.0		10.2				20.7		4.4	
08/17/04	162.9			200.0						6.8	2.7	14.4			32.4		47.6			47.5	95.4		60.0	
09/14/04	482.9			25.2				11.7				15.4			19.8		16.3			19.2	6.8		4.9	
10/12/04	23.5			41.8				10.7		31.5		16.1			19.4		20.7				9.7		7.6	
11/09/04	109.1			43.9				10.2		28.9	22.3	11.7			20.0		17.0				10.4		28.5	
12/07/04				45.4				11.8							291.0		30.8				27.7		35.8	

TABLE 8.1. TOTAL DISSOLVED PHOSPHOROUS (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	7.0	1.8	0.0	3.1	0.0		15.9	2.6	22.9	22.2	15.8	0.0		25.6	17.3	0.0	33.6	18.9	11.5		7.8		33.3	
09/01/99	10.0	10.6	0.0	9.0	3.5		26.9	1.9	42.1	30.2	16.8	0.0		2.4	12.9	0.0	9.9	19.4	15.2		4.8		5.6	
10/01/99	0.0	0.0	0.0	0.0	0.0		20.6	4.7	2.5	23.0	13.5	6.2		10.3	13.7	0.0	22.2	9.0	10.2		5.7		5.2	
11/01/99	3.4	5.1	8.2	3.0	2.7		10.5	19.7	16.0	12.8	19.6	9.9		9.6	10.8	32.4	14.9	14.5	15.8		18.0			
12/01/99	3.6	5.7	5.8	4.1	3.3		7.1	19.2	17.0	15.0	22.6	13.4		10.7		12.4	13.3	11.8	10.2		9.0			
01/01/00	0.0	0.0	0.0	0.0	0.0		0.0	5.5	4.1	3.9	14.8	3.8		3.1	0.0	0.0	1.4						0.0	
02/01/00	2.4	2.8	0.0	0.0	0.0		16.6	4.0	5.6	10.6	16.1	4.2		6.4	4.0	0.0	9.4	0.0	5.2		5.2		0.8	0.2
03/01/00	1.0	3.8	1.4	0.6	0.4	0.0	9.8	5.2	16.2	8.4	16.0	4.0		14.6	5.6	0.0	7.4	3.2	4.2		4.6		0.2	
04/01/00	0.0	0.0	0.0	0.0	0.0	0.0	7.4	0.0	0.0	5.8	2.4	0.0	0.0	6.8	3.6	0.0	1.4	0.0	1.2		2.0		0.2	
05/01/00	9.6	8.8	7.8	8.0	8.0	8.2	30.4	14.4	12.2	19.4	18.4	14.4	15.6	25.0	16.6	9.4	15.2	10.2	13.8		14.8		11.6	
06/01/00	7.8	7.2	6.4	7.2	7.2	7.4	18.6	10.6	13.4	18.8	15.6	10.2	14.0	16.0	13.4	8.8		4.2	12.2		12.8		10.0	
07/01/00	7.2	6.4	6.6	8.0	9.0	7.4	18.0	10.2	25.0	24.0	16.6	10.0	9.8	55.6	24.2	7.8	19.4	19.2	9.4		11.2		14.8	
08/01/00	2.2		4.8	4.6	2.4	1.8	11.6	5.6	27.6	22.2	11.8	7.6	5.8	14.0	13.2	4.4	12.0	9.4	7.8		6.0		6.6	
09/01/00	18.0	15.4	15.2	19.4	17.4	16.8	29.2	16.2	19.4	49.4	28.0	14.8	18.6	14.0	30.0	17.4	21.2	16.4	20.8		15.6		6.4	
10/01/00	5.6	5.2	6.2	5.6	8.4	4.4	18.6	10.8	62.8	57.4	27.8	14.4	19.8	21.8	15.0	17.6	34.4	21.0	23.6		21.6		21.4	
11/01/00	4.8	5.6	6.0	5.4	5.2	7.4	12.6	19.6	19.0	19.4	35.8	26.2	23.0	25.2	12.4	3.6	10.2	9.4	8.8		19.8		10.6	
12/01/00	4.4	4.2	6.8	7.0	6.2	7.2	25.6	21.4	25.6	24.4	35.2	25.6	26.2	26.4	9.4	5.8	12.8	14.6	14.4		13.8			
01/01/01	1.6	0.0	0.0	0.0	0.0	0.0	2.0	6.0	12.0	5.2	21.6	15.6	9.6	9.0	0.0	0.0	1.0						0.0	
02/01/01	5.2	2.0	1.8	1.4	0.0	1.0	5.2	4.6	9.2	7.2	22.8	11.4	11.0	16.8	5.4	2.0	7.2	8.0	13.2		8.4		4.8	
03/01/01	3.2	0.0	1.0	0.0	0.0	0.0	21.4	4.6	7.0	5.6	14.6	4.2	3.8	9.4	3.8	1.6	8.0	2.6	6.0		3.4		1.2	
04/01/01	1.4	2.0	2.4	1.6	2.8	1.6	10.8	6.2	16.2	14.4	13.8	6.4	5.4	13.2	10.4	2.2	8.6	8.0	8.8		5.8		4.4	
05/01/01		8.4	0.0	2.4	0.0	0.0	13.6	3.2	0.0	12.0	10.4	5.4	4.6	20.0	7.4	0.0	5.4	2.2	1.0		1.0		0.0	
06/01/01	0.0	0.0	0.0	0.0	0.0	0.0	5.7	0.0	0.0	6.4	5.5	0.0	0.0	6.5	10.4	0.0	5.4	3.6	0.0		0.0		0.0	
07/01/01	5.4	3.8	6.5	6.5	4.7	2.2	23.8	18.1	5.7	15.6	2.2	0.0	4.6	10.1	12.0	0.0	7.7	7.7	3.6		49.7		2.4	
08/01/01	11.1	12.9	12.1	13.5	12.6	36.1	40.9	12.8	19.5	36.1	22.7	19.2	15.7	30.4	28.4	11.0	28.1		17.9		13.8		19.1	
09/01/01	3.0	7.8	9.0	8.0	9.4	7.4	20.4	3.8	14.2	27.6	17.0	18.6	8.0	22.0	18.0	7.4	16.8	18.4	13.6		17.2		19.8	
10/01/01	5.0	6.5	5.0	20.6	14.5	11.4	23.5	6.2		8.7	12.3	12.0	14.7	21.6	9.7	13.1	16.5	14.2	7.6	8.1	12.7		7.3	9.9
11/01/01	5.0	4.2	3.2	1.5	5.3	3.5	11.1	5.9	11.1	8.5	15.8	6.3	8.6	9.6	6.5		11.7	11.8	11.4	8.7	9.1		13.1	20.9
12/01/01	4.8	9.1		2.4	6.7	5.7	9.8	11.3		13.3	25.1	8.3	7.1	8.3	6.1	6.0	10.8	14.5	7.1	3.2	5.2		10.2	3.7
01/01/02		5.1		2.3	5.0	5.8	8.9	9.3		11.8	22.3	7.7	7.0	8.5	5.6	2.6	9.1	7.4			5.1		5.3	4.0
02/01/02	4.5	3.3	6.1	7.4	2.2	3.6	7.2	12.1	11.4	8.7	16.4	6.3	6.7	11.3	8.3	7.9	8.0	5.6	6.3		6.5		8.3	4.1
03/01/02	3.3	5.2	5.4	3.8	4.7	4.8	9.9	5.9	11.4	8.9	9.0	7.4	7.6		7.1	9.4	6.7	5.1	6.8	6.9	8.3	5.8	9.2	
04/01/02	5.7	5.8	4.8	2.9	1.8	1.4	10.9	2.6	4.0	5.5	3.1	1.4	1.9	1.4	9.9	5.6	11.5	7.2	7.2		7.5		8.1	
05/01/02	5.3	4.8	6.2	4.5	5.5	7.2	12.4	9.1	10.2	9.7		9.1	10.9	13.3	24.0	5.8	14.6	9.6	14.0		9.2		4.2	
06/01/02	3.9	1.7	5.6	6.0	2.6	8.0	7.1	2.8	5.1	5.1		4.5	5.1	3.6	10.2	2.8	6.6	7.2	6.2		6.6		6.7	
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02																								
08/19/02																								

TABLE 8.2. (CONTINUED)TOTAL DISSOLVED PHOSPHOROUS (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 <MDL).

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	6.3																							
09/01/99	28.2																							
10/01/99	4.7																							
11/01/99	4.4																							
12/01/99																								
01/01/00	3.0																							
02/01/00																								
03/01/00	3.6																							
04/01/00	0.0																							
05/01/00	10.0																							
06/01/00	10.2																							
07/01/00	4.0																							
08/01/00	7.4																							
09/01/00	18.8																							
10/01/00	9.6																							
11/01/00	8.8																							
12/01/00	0.0																							
01/01/01	2.0																							
02/01/01	4.6			6.6																				
03/01/01	7.2			3.8																				
04/01/01	4.0			7.4	7.4																			
05/01/01				4.8	1.6																			
06/01/01	5.6			5.9	7.3																			
07/01/01				2.6	19.5																			
08/01/01				14.5	20.5																			
09/01/01	16.0			12.4	19.4																			
10/01/01	20.6			23.2																				
11/01/01	5.4			12.4																				
12/01/01	4.2			9.7	8.7																			
01/01/02				7.6																				
02/01/02	6.6			8.4	8.0																			
03/01/02				9.9	23.2																			
04/01/02				8.2	8.1																			
05/01/02				9.9	9.5																			
06/01/02				10.7	6.6																			
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02																								

TABLE 9.1. CHLOROPHYLLA (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 < MDL).

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	0.3	0.3	0.6	0.8	1.1		7.6	3.8	2.1	3.6	1.7	9.0		5.1	4.2	1.7	5.4	5.1	0.6		3.1		2.8	
09/01/99	1.9	2.6	0.0	0.3	0.0		7.5	3.7	2.8	2.4	2.0	7.7		5.1	7.1	0.0	5.1	4.0	3.1		2.8		2.6	
10/01/99	1.2	2.3	2.2	1.7	1.1		6.0	5.7	5.9	5.1	7.4	4.8		4.2	4.0	2.8	4.8	4.8	5.9		2.2		2.8	
11/01/99	2.6	4.3	2.1	1.4	0.8		8.6	2.0	1.7	1.8	1.7	10.0		4.5	1.5	1.2	4.6	4.9	4.8		1.1			
12/01/99	0.3	0.0	0.4	0.0	2.0		15.2	2.1	4.9	0.2	1.1	7.2			1.1	1.4	4.0	5.5	6.0		2.8			
01/01/00	2.8	4.8	3.4	1.9	1.7		7.7	2.8	3.4	4.3	1.4	2.8		2.8	4.8	1.6	4.2						6.8	
02/01/00	0.9	0.1	0.1	0.9	2.6		5.5	2.3	3.4	2.0	1.8	3.5		2.9	2.1	11.2	2.7	5.8	3.8		1.5		10.4	
03/01/00	0.8	0.5	0.0	0.3	1.1	0.6	9.0	2.0	1.4	2.2	0.5	2.5		5.5	2.2	3.7	6.2	4.2	9.2		1.4		2.0	
04/01/00	0.9	2.9	2.6	0.9	0.9	1.2	8.6	4.3	2.3	1.4	2.6	1.2	0.9	1.1	4.3	0.6	1.7	1.7	5.4		5.2		2.0	
05/01/00	0.6	0.9	0.3	0.0	0.3	0.3	12.9	3.1	3.1	1.1	1.4	4.3	4.0	2.5	2.0	1.2	2.0	1.7	3.8		4.9		1.4	
06/01/00	2.0	0.3	0.0	0.1	0.6		9.5	4.3	7.0	1.2	0.6	4.6	4.3	2.9	2.0	1.5	2.0	2.3	6.6		3.4		5.2	
07/01/00	2.1	2.0	0.9	0.9	0.6	0.6	9.7	2.6	1.4	2.8	4.9	9.9	10.2	15.6	4.3	0.9	3.8	3.8	4.3		0.8		4.8	
08/01/00	0.9	3.2	2.0	1.2	2.3	2.0	6.7	2.3	2.2	3.2	2.5	14.5	5.2	1.1	3.1	5.4	3.1	4.2	6.3		1.7		2.5	
09/01/00	0.3	3.4	3.1	2.8	1.7	1.1	21.0	4.3	3.7	3.8	7.7	7.7	7.4	8.0	2.8	2.5	2.8	1.7	3.1		1.4		2.0	
10/01/00	2.6	4.0	2.9	4.9	4.3	4.0	2.4	6.0	2.5	4.8	2.3	9.0	7.6	2.8	4.3	4.8	4.2	4.2	2.8		1.1		3.5	
11/01/00	3.4	3.7	3.5	3.4	0.9	1.2	3.8	3.7	4.8	5.4	2.0	4.0	4.9	4.3	3.5	4.0	3.5	3.5	1.5		1.5		1.7	
12/01/00	4.5	4.5	4.0	4.2	2.9	3.4	6.9	2.9	3.1	3.4	0.3	1.7	1.7	2.0	2.8	6.0	2.6	3.7	4.3		12.6			
01/01/01	2.6	3.7	4.5	4.8	2.8	3.7	4.9	4.3	4.3	3.2	0.6	7.4	6.6	5.7	0.6	5.7	2.4						2.3	
02/01/01	4.8	6.4	7.1	6.5	4.5	3.6	2.2	2.8	2.5	5.1	2.0	4.0	4.0	1.1	0.8	4.5	2.8	2.3	4.3		1.7		6.3	
03/01/01	1.8	2.5	2.0	1.2	1.8	1.7	2.0	3.1	0.9	1.1	1.4	3.4	4.1	0.9	0.9	5.5	2.3	2.6	3.7		0.6		2.3	
04/01/01	0.6	3.1	0.0	0.9	0.6	0.6	3.5	0.9	10.0	1.1	2.3	3.7	3.2	0.6	2.3	0.9	4.1	3.8	12.5		2.9		2.6	
05/01/01		2.6	0.3	2.9	1.1	1.1	4.9	13.8	2.8	2.0	1.8	3.7	4.6	0.9	14.6	1.2	3.5	3.5	5.1		0.9		2.9	
06/01/01	1.7	1.4	1.4	0.5	0.9	0.9	5.9	9.2	0.6	2.0	2.3	9.7	10.3	4.5	6.6	1.4	3.4	3.4	5.4		2.3		5.4	
07/01/01	1.2	4.7	0.0	0.8	1.7	1.7	5.2	10.8	0.3	1.5	5.2	12.5	10.5	0.6	1.5	1.2	1.8	1.8	2.0		1.4		2.0	
08/01/01	0.3	1.4	0.3	0.9	2.0	1.7	4.3	0.9	0.0	1.2	1.7	1.9	3.9	0.3	4.5	1.1	4.6	3.4	2.0		1.5		3.1	
09/01/01	0.6	1.2	0.0	1.7	1.2	0.9	4.6	0.3	0.0	0.6	0.9	1.1	0.9	0.9	8.9	0.4	2.9	2.6	2.4		2.0		1.2	
10/01/01	0.9	1.7	0.8	1.5	1.7	1.6	1.8			1.1	66.9	4.9	4.6	2.6	1.1	8.2	2.8	2.5	1.1		1.1		2.3	
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	1.5	2.3	2.3	1.7	1.2	1.4	0.0	2.0	1.4	2.3	6.0	9.1	10.2	2.3	2.3	1.4	5.6	1.1	1.4		2.6		2.8	
03/01/02																								
04/01/02																								
05/01/02																								
06/01/02																								
07/01/02																								
07/08/02																								
07/16/02		0.3	0.0					7.1	0.0			10.7	10.7	2.2										
07/22/02																								
07/29/02																								
08/05/02																								

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/12/02		0.5	0.3					0.7	2.3			1.3	2.6	1.4										
08/19/02																								
08/26/02																								
09/03/02		0.7	0.2					1.5	2.1			2.5	2.7	3.0										
09/10/02																								
09/16/02		0.9	0.2					1.5	3.4			3.5	3.1	1.5										
09/23/02																								
09/30/02																								
10/02/02		0.8	0.2					1.7	1.8			2.1	2.0	2.6										
10/07/02																								
10/14/02																								
10/16/02		1.5	0.4					4.8	3.4			3.1	1.2	2.9										
10/21/02																								
10/28/02																								
10/30/02		1.5	0.7					5.0	3.6			3.6	4.1	3.2										
11/04/02																								
11/12/02																								
11/13/02		2.6	0.7					5.3	4.4			4.8	4.9	5.3										
11/18/02																								
11/25/02																								
12/09/02																								
12/16/02																								
12/17/02		0.4	0.5					2.0	0.7			4.8	3.9	5.3										
01/14/03		1.6	4.7					3.1	1.9			3.6	4.0	3.9										
02/11/03		2.0	2.1					0.5	2.5			2.4	2.9	3.6										
03/11/03		9.7	4.5					11.2	5.6			7.6	8.3	4.5										
04/15/03		6.7	1.5					7.2	3.4			8.5	8.3	5.1										
05/13/03		4.8	1.5					7.4	4.2			11.2	10.9	5.5										
06/03/03		5.7	2.8					10.7	5.4			11.7	11.0	5.4										
06/10/03																								
06/24/03																								
07/07/03																								
07/14/03																								
07/21/03																								
07/28/03																								
08/04/03																								
08/11/03																								
08/18/03																								
08/25/03																								
09/02/03																								
09/08/03																								
09/15/03																								
09/22/03																								
09/29/03																								
10/06/03																								

TABLE 9.2. (CONTINUED) CHLOROPHYLLA (UG/L) FROM AUGUST 1999 TO DECEMBER 2004 (0 < MDL).

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00	0.8																							
04/01/00	0.3																							
05/01/00																								
06/01/00	1.7																							
07/01/00	1.4																							
08/01/00	6.7																							
09/01/00	2.4																							
10/01/00	2.3																							
11/01/00																								
12/01/00	0.0																							
01/01/01																								
02/01/01	0.0			7.1																				
03/01/01	0.9			1.7	6.1																			
04/01/01	0.9			5.2																				
05/01/01				1.1	7.1																			
06/01/01				1.1	4.5																			
07/01/01				0.3	1.4																			
08/01/01				0.6	2.6																			
09/01/01	0.0			0.0	1.7																			
10/01/01				3.4	0.2																			
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	0.0			0.3	1.4																			
03/01/02																								
04/01/02																								
05/01/02																								
06/01/02																								
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
08/05/02																								
08/12/02																								
08/19/02																								

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/26/02																								
09/03/02																								
09/10/02																								
09/16/02																								
09/23/02																								
09/30/02																								
10/02/02																								
10/07/02																								
10/14/02																								
10/16/02																								
10/21/02																								
10/28/02																								
10/30/02																								
11/04/02																								
11/12/02																								
11/13/02																								
11/18/02																								
11/25/02																								
12/09/02																								
12/16/02																								
12/17/02																								
01/14/03																								
02/11/03	0.2																							
03/11/03																								
04/15/03																								
05/13/03																								
06/03/03																								
06/10/03																								
06/24/03																								
07/07/03																								
07/14/03																								
07/21/03																								
07/28/03																								
08/04/03																								
08/11/03																								
08/18/03																								
08/25/03																								
09/02/03																								
09/08/03																								
09/15/03																								
09/22/03																								
09/29/03																								
10/06/03																								
10/13/03																								
10/20/03																								

TABLE 10.1. SPECIFIC CONDUCTANCE (US/CM) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	800	890	850	870	830		500	490	490	500	1200	1220		1210	1200	850	1120	1120	1130		1060		1030	
09/01/99	750	800	785	790	780		480	480	460	450	1060	1080		1085	1055	770	1025	1015	1020		1010		1020	
10/01/99	760	850	810	770	760		425	495	490	480	1120	1150		1180	1180	780	1010	1000	995		995		995	
11/01/99	705	745	775	690	705		439	432	439	435	1185	1120		1125	1190	730	495	495	500		495			
12/01/99	715	755	745	703	655		504	417	420	427	1230	1225			1233	795	503	520	415		420			
01/01/00	762	790	775	728	742		520	486	499	494	1141	1104		1102	1145	719	496						593	
02/01/00	704	715	732	700	690		488	483	466	473	1077	1081		1079	1094	698	495	612	619		490		627	
03/01/00	740	760	770	715	703	702	443	497	501	495	1120	1103		1104	1127	712	511	652	660		655		709	
04/01/00	810	857	835	790	818	811	495	503	500	506	1203	1212	1205	1211	1199	785	1047	931	984		972		930	
05/01/00	737	790	795	728	748	749	592	475	500	502	1298	1253	1252	1253	1262	798	1190	1000	923		951		1000	
06/01/00	799	900	897	841	897	899	605	485	502	515	1255	1190	1170	1154	1162	760	1145	1009	1252		1290		1182	
07/01/00	830	898	912	846	875	860	670	503	500	502	1453	1399	1400	1400	1435	890	1405	1348	1143		1189		1247	
08/01/00	758	805	810	792	712	711	587	480	480	490	1510	1500	1500	1500	1455	804	1370	1221	990		995		875	
09/01/00	837	945	920	918	916	914	640	535	530	517	1485	1435	1436	1420	1451	892	1195	890	939		980		998	
10/01/00	745	837	840	866	810	800	590	530	495	491	1422	1365	1367	1372	1394	802	1210	980	995		1000		912	
11/01/00	740	762	760	750	770	765	548	600	503	510	1397	1369	1370	1390	1380	723	985	908	900		999		885	
12/01/00	721	712	710	699	700	700	479	498	453	491	1345	1315	1310	1301	1300	700	499	503	545		570			
01/01/01	702	705	702	695	721	717	448	448	650	427	1285	1306	1305	1330	1290	702	501						585	
02/01/01	645	623	622	627	725	720	319	399	396	385	1383	1376	1370	1360	1402	757	501	500	495		481		567	
03/01/01	830	805	800	790	780	780	220	455	510	503	1315	1399	1400	1403	1415	807	590	685	695		730		745	
04/01/01	775	722	720	691	700	700	298	345	445	435	1207	1233	1233	1227	1298	700	475	495	500		510		600	
05/01/01		615	600	575	725	720	422	237	265	345	1470	1407	1400	1402	1375	738	1299	1170	1045		1050		1070	
06/01/01	670	633	648	687	660	658	501	258	292	412	1435	1380	1347	1385	1398	719	1322	1324	1208		1160		1089	
07/01/01	662	670	660	682	595	590	528	265	298	330	1376	1278	1290	1330	1342	695	1280	1125	998		1000		1036	
08/01/01	640	625	605	615	607	605	412	292	285	325	1305	1320	1318	1335	1345	695	1350	1195	1155		1180		1125	
09/01/01	605	600	598	587	600	599	433	275	245	269	1201	1198	1201	1196	1210	615	1187	1169	1183		1198		1070	
10/01/01	601	611	608	600	622	620	425			266	1201	1298	1296	1293	1236	602	362	394	500		624		500	
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	717	703	701	692	706	702	429	397	399	421	1334	1327	1324	1342	1400	698	1149	970	999		1022		1020	
03/01/02	710	730	728	711	710	711	495	448	458	440	1387	1400	1375		1381	701	895	777	792		805		880	
04/01/02	750	727	718	699	728	703	500	415	430	435	1444	1390	1387	1399	1430	778	1298	1170	1118		1140		1142	
05/01/02	612	599	599	583	580	580	430	352	348	345		1177	1180	1173	1155	580	1103	1000	936		945		889	
06/01/02	638	642	633	640	648	650	498	399	397	410		1435	1480	1478	1499	751	1403	1345	1031		1028		1026	
07/01/02																970	1763	1736	1518	1529		1571	1580	1580
07/08/02																975	1748	1420	1520	1544	1546	1543	1431	1434
07/16/02		1008	982					631	644			1850	1860	1867		962		1431	1434	1436	1443	1439		1291
07/22/02																965	1736	1234	1154	1173	1161	1232	1407	1378
07/29/02																965	1642	1160	1129	1151	1139	1178	1293	1286
08/05/02																971	1738	1385	1387	1424	1419	1425	1194	1195
08/12/02		1015	949					640	649			1894	1922	1875		953	1730	1367	1362	1387	1361	1379	1151	1091
08/19/02																972	1768	1472	1540	1538	1466	1498	1264	1247
08/26/02																984	1184	1152	1138	1176	1152	1191	1223	1235

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
09/03/02		1032	988					665	654			1943	1940	1936		962	1767	1301	1246	1274	1270	1219	1157	
09/10/02																	1781	1507	1038	991		1123	1459	1172
09/16/02		1046	986					665	660			1974	1937	1947			1619	1143	1096	1100	1119	1119	1314	1290
09/23/02																	1540	1050	1028	1038	1029	1026		1196
09/30/02																	1498	1026	1013	1002	983	999	1090	1081
10/02/02		1023	986					672	647			1977	1976	1988										
10/07/02																	1521	1010	999	1008	1020	1062	1351	1375
10/14/02																950	1589	991	988	1000	1014	1020	1243	1265
10/16/02		1031	983					680	660			1970	1972	1959										
10/21/02																981	1223	992	984	1000	1009	1015	1171	1185
10/28/02																809	904	927	923	987	1024		890	913
10/30/02		1028	998					687	690			1974	1985	1983										
11/04/02																1020	1050	1045	1067	1112	1130		1035	1070
11/12/02																958	733	852	829	856	885		847	
11/13/02		1055	988					691	689			1975	1979	1985										
11/18/02																959	738	829	730	862	890		874	
11/25/02																								
12/09/02																								
12/16/02																963	748	810	855	908	871	866		
12/17/02		1015	990					693	701			1986	2004	1986										
01/14/03		992	1002					724	696			2004	1998	1997	1974	968							897	
02/11/03		990	1008					677	689			2018	2001	2042	1982		773	870	839		809		916	
03/11/03		983	1009					494	653			2013	2023	2006	2006		735	869	889		834		860	
04/15/03		973	966	960				347	474			1978	1986	1990	2035	966	659	822	852		868		823	
05/13/03		957	1005	990				342	345			2047	2015	1950	2056	992	527	873	865		862		734	
06/03/03		958	995	981				346	330			2014	2019	1996	1995	988	1719	1293	1250		1266		1507	
06/10/03																970	1495	1263	1176		1167		1346	
06/24/03		1010	1006	999				400	357			2155	2124	2090	2070	995	1345	1110	1104		1114		1272	
07/07/03				1011											2125	980	1310	1122	1223		1143		1235	
07/14/03		979	995	1005				396	366			2159	2167	2109	2153	995	1362	1154	1087		1142			
07/21/03																								
07/28/03				993											2185	980	1725	1413	1135		1113		1518	
08/25/03																								
09/02/03																								
09/08/03																								
09/15/03																								
09/22/03																								
09/29/03																								
10/06/03		1008	993	993				490	489			2253	2254	2240	2286	1000	702	950	942		948		904	
10/13/03																								
10/20/03				983											2277	993	471	731	721		748		791	
10/28/03		1004	1002	993				497	409			2255	2253	2247		995	480	734	728		735		751	
11/03/03																								
11/10/03				1000											2285	993	574	784	740		744		924	
11/17/03				993											2264	996	637	889	875		933			

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
01/20/04												2231	2259	2256	2275	996	693	764	992		1053			
02/17/04		1006	1007	1002								2256	2267	2250	2250	1001	614	783	763		815		845	
03/17/04				1005				571	564			2224	2220	2238	2253	1003	1256	1071			1096		1070	
04/13/04		994	997	995				576	572			2190	2210	2220	2040	998	644	941	883		937		967	
05/18/04				1008				554	582			2260	2260	2220	2230	1012	2020	1483	1439		1432		1474	
06/22/04								520	564			2140	2150	2100	2090	966	2010	1715	1570		1584		1589	
07/20/04								547	573			2180	2190	2180	2140	992	2040	1491	1376		1280		1612	
08/17/04		1022	986	994				567	574			2130	2150	2100	2080	994	1774	1289	1264		1312		1271	
09/14/04		1039	991	991				592	576			2140	2080	2060	2070	998	1896	1318	1236		1238		1334	
10/12/04		1047	1046	1043				588	532			2090	2100	2100	2130	1039	1139	1075	1232		1213			
11/09/04		1030	1027	1001				588	586			2090	2090	2090	2200	1011	672	841	803		816			
12/07/04				870											2120		599	597	576		575			

TABLE 10.2. (CONTINUED) SPECIFIC CONDUCTANCE (uS/CM) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00	402																							
04/01/00	499																							
05/01/00																								
06/01/00	749																							
07/01/00	587																							
08/01/00	470																							
09/01/00	552																							
10/01/00	412																							
11/01/00																								
12/01/00	500																							
01/01/01																								
02/01/01	485			403																				
03/01/01	420			508	702																			
04/01/01	380			480																				
05/01/01				480	1065																			
06/01/01				423	1200																			
07/01/01				355	1009																			
08/01/01				325	1175																			
09/01/01	400			288	1185																			
10/01/01				297	531																			
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02				423	1022																			
03/01/02	499			426	782																			
04/01/02	440			455	1178																			
05/01/02	460			348	970																			
06/01/02				519	1045																			
07/01/02		1511	1606			1512	1514					1470	1627	1650	1616	1627	1633		1599		1460	1453	974	980
07/08/02		1537	1538			1534	1532					1360	1481	1491	1530	1540	1540		1543		1315	1352	981	980
07/16/02		1434	1444			1434	1417					1269	1447			1436	1467		1444		1288	1309		
07/22/02		1148	1185			1165	1154					1309	1239	1235	1160	1174	1226		1161		1304	1331	967	977
07/29/02		1131	1125			1126	1130					1242	1170	1175	1123	1151	1159		1145		1284	1301	965	975
08/05/02		1407	1400			1381	1425					1159	1437	1398	1406	1443	1437		1430		1210	1222	970	986
08/12/02		1362	1360			1335	1362					1126	1353	1372	1359	1379	1366		1346		1198	1196		
08/19/02		1514	1508			1517	1463					1249	1526	1521	1483	1500	1522		1492		1281	1256	970	985

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/26/02		1145	1134			1137	1147					1232	1158	1139	1146	1215	1143		1145		1275	1281	969	980
09/03/02		1253	1254			1241	1248					1168	1300	1273	1262	1240	1264		1224		1216	1257	973	974
09/10/02			982			984	1026					1093	1575	1415	1006		1309		1162		1262	1263	955	956
09/16/02		1098	1120			1092	1085					1166	1121	1115	1089	1085	1107		1096		1195	1246	987	953
09/23/02		890	1016			1020	1011					1187	1043	1026	1008	990	1008		1020		1233	1236	956	968
09/30/02		982	999			993	998					1096	988	977	995	1005	1012		999		1193	1215	954	962
10/02/02																								
10/07/02		997	998			1003	1056					1228	1006	1011	1021	1004	996		999		1284	1288	971	971
10/14/02		978	981			985	977					1203	996	985	991	995	997		986		1175	1174	954	964
10/16/02																								
10/21/02		982	984			984	982					1192	991	963	992	1005	979		991		1260	1240	978	992
10/28/02		1010	897			940	1030					1003	873	865	1024	1026	865		874		1049		1011	1002
10/30/02																								
11/04/02		1107	1061			1104	1127					1142	1038	1050		1123	1054		1063		1103	1122	1023	1038
11/12/02		853	837			835	875					952	833	834		862	836		832		1086	1119	956	964
11/13/02																								
11/18/02		853	844			808	853					859	830	835	836	848	855		830		1113	1189	962	971
11/25/02																								
12/09/02																								
12/16/02		878	873				873							879	879	890	881		882				961	978
12/17/02																								
01/14/03	661			681								1087								946	1221		967	
02/11/03	451		832	677								927			1233		872			973			977	
03/11/03	302		838	652								1080					812			853	1270		963	
04/15/03	691		840	610								965					825			719	1095		973	
05/13/03	717		897	476								852			831		864	1668		564	1130		961	
06/03/03			1262	480				1171				1407			1243		1272			1670	1361		975	
06/10/03			1190	476								1294			1170		1239			1465	1255		983	
06/24/03			1132	395				1120				1233			1124		1134			1363	1281		990	
07/07/03			1118	386				1079				1215			1115		1130			1313	1235		985	
07/14/03	779		1078	395				1180				1095			1140		1105			1385	1190		994	
07/21/03																								
07/28/03			1141	403				1063				1328			1138		1385			1622	1317		991	
09/29/03																								
10/06/03			940	435				1014				890			936		949			890	1150		978	
10/13/03																								
10/20/03			744	407				699				940			741		724			603	1227		992	
10/28/03			758	438				708				905			734		756			566	1064		992	
11/03/03																								
11/10/03			757	508				825				915			754		756			850			996	
11/17/03			883	540				695							880								992	
01/20/04	622		974	561								1019					877				1206		1001	
02/17/04	625		775	560								978					766			633	1250		1006	
03/17/04	621		1025	571				1011							1090		1054			1100	1058		1004	
04/13/04			895					919							894		940			940			999	

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
05/18/04	693		1440	566				1432				1365			1436		1458			1564	1299		1014	
06/22/04	717		1567	539				1567				1532			1577		1826				1384		963	
07/20/04		1497	1587	548				1343				1565			1307		1502			1730	1560		993	
08/17/04	718		1301	523						1010		1222			1287		1479			1262	1305		987	
09/14/04	540		1261	568				1267		1001	1001	1245			1232		1300			1471	1244		993	
10/12/04	720		1284	587				966		1014	1091	1184			1207		1211			1086	1215		1045	
11/09/04	583		829	578						1010	1010	1008			812		842			888	1086		1003	
12/07/04			576	536				809									588			596	1187		865	

TABLE 11. TEMPERATURE (°C) FOR LAKE PLEASANT FROM AUGUST 1999 TO DECEMBER 2004.

Date	0	5	10	15	20	25	30	35	40	45	50	4.6	9.1	13.7	18.3	22.9	27.4	32	36.6	41.1	45.7	50.3
08/01/99	28.6	27.9	27.8	20.2	17.5	15.9	15.3	14.6	14.4	14.6	14.6											
09/01/99	26.6	26.5	26.5	26.5	19.4	17.4	16.6	15.4	15.4	15.4												
10/01/99	23.8	23.6	23.5	23.5	23.4	18.3	17.9	18.2	18.3	18.2												
11/01/99	19.9	18.7	18.5	18.5	18.5	18.4	18.0	17.8	16.9	15.7												
12/01/99	14.0	14.0	14.0	14.0	13.9	13.9	13.9	13.9	13.9	13.9												
01/01/00	12.3	11.7	11.6	11.6	11.6	11.6	11.6	10.9	10.7	10.7												
02/01/00	12.1	12.1	12.1	12.1	12.1	12.0	11.8	11.6	11.6	11.5												
03/01/00	14.8	13.8	13.7	13.5	13.3	12.5	12.3	12.2	12.2	12.1												
04/01/00	19.0	18.3	17.1	15.4	15.0	14.7	14.5	12.5	12.5	12.4												
05/01/00	21.3	21.1	19.0	15.2	13.8	13.1	12.8	12.6	12.6	12.8												
06/01/00	26.5	25.8	24.1	19.6	15.5	14.8	14.5	12.9	12.8	12.7												
07/01/00	29.6	28.4	28.0	21.3	16.9	15.0	14.6	14.1	14.0	14.0												
08/01/00	29.8	29.3	29.1	26.7	22.7	22.2	22.2	22.4	22.2	22.1												
09/01/00	28.5	27.7	27.4	27.1	27.1																	
10/01/00	24.1	23.6	23.6	23.6																		
11/01/00	16.4	16.0	15.9	15.6	15.6	15.6	15.5	15.5	15.5													
12/01/00	13.5	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3												
01/01/01	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2												
02/01/01	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8													
03/01/01	13.0	12.5	12.4	12.2	12.2	11.5	11.2	11.1	11.0	10.9	10.9											
04/01/01	19.9	17.0	16.8	13.1	12.8	12.1	11.6	11.5	11.4	11.3	11.3											
05/01/01	24.4	22.4	17.0	14.1	12.9	12.2	11.8	11.7	11.7	11.6	11.6											
06/01/01	25.9	25.3	19.1	14.1	12.8	12.2	11.9	12.0	12.0	12.0	12.0											
07/01/01	28.0	27.5	24.6	15.3	13.6	12.9	12.5	12.3	12.1	12.0	12.0											
08/01/01																						
09/01/01	27.5	27.1	27.0	26.8	19.5	16.8	15.1	14.0														
10/01/01	22.6	22.9	22.7	22.6	22.5	22.4	19.3	15.4	15.0	15.1												
11/01/01	20.4	20.9	20.9	20.1																		
12/01/01	14.6	14.6	14.4	14.2	13.8	13.8	13.8															
01/01/02	11.8	11.7	11.6	11.6	11.6	11.6	11.5	11.3	11.3													
02/01/02	11.7	10.7	10.6	8.0	8.1	7.9	7.8															
03/01/02	13.0	12.3	12.2	12.1	12.1	11.8	11.4	18.8	19.9	20.2												
04/01/02	18.7	16.8	14.2	12.9	12.1	11.7	11.4	11.4	11.6	11.6												
05/01/02	21.8	20.5	19.8	12.9	12.1	11.7	11.5	11.4	11.4	11.4												
06/01/02	26.2	25.0	20.8	13.9	12.4	11.8	11.6	11.6	11.5													
07/16/02	28.4											28.4	26.5	17.7	13.7	12.8	12.4		12.0	11.7	11.6	11.6
08/12/02	28.0											27.9	27.8	20.6	16.4	14.4	13.5	13.0	12.4	12.0	12.0	11.9
09/03/02	27.5											27.5	27.4	25.3	18.1	15.8	14.8	13.6	12.7	12.4	12.4	12.3
09/16/02	26.4											26.3	26.3	24.6	19.5	16.5	14.4	13.6	12.8	12.6	12.5	
10/02/02	24.1											24.1	24.2	24.1	22.8	18.4	16.6	14.7	13.4	13.2	13.2	
10/16/02	22.4											22.5	22.5	22.5	22.4	22.2	19.6	15.6	13.9	13.6	13.4	
10/30/02	20.4											20.5	20.5	20.5	20.5	20.5	20.5	17.1	14.1	13.9	13.7	
11/13/02	18.2											18.2	18.3	18.2	18.2	18.2	17.7	17.4	16.7	14.3	13.7	
11/25/02	16.0											16.2	16.2	16.1	16.1	16.2	16.1	16.1	16.1	16.1	16.1	

Date	0	5	10	15	20	25	30	35	40	45	50	4.6	9.1	13.7	18.3	22.9	27.4	32	36.6	41.1	45.7	50.3
12/17/02	13.1											13.2	13.2	13.2	13.1	13.0	12.9	12.9	12.9	12.9	12.9	12.9
02/11/03	13.5											13.3	12.7	12.6	12.4	12.3	12.2	12.2	12.2	12.1	12.1	12.1
03/11/03	15.8											14.6	14.0	13.7	13.2	12.9	12.6	12.6	12.5	12.5	12.4	12.3
04/15/03	17.9											16.7	16.3	15.1	14.4	14.0	13.2	13.1	12.9	12.9	12.8	12.7
05/13/03	19.7											19.6	19.3	15.5	14.9	14.5	13.9	13.5	13.3	13.2	13.1	13.0
06/03/03	25.0											24.8	19.1	16.6	15.4	14.7	14.0	13.6	13.5	13.4	13.3	13.2
06/10/03																						
06/24/03	24.7											24.7	20.6	16.9	15.3	14.7	14.2	13.8	13.7	13.6	13.4	13.3
07/07/03																						
07/14/03	29.1											28.7	23.2	17.9	16.2	15.5	14.9	14.5	14.3	13.8	13.6	13.5
07/21/03																						
07/28/03																						
08/04/03	29.0											29.0	28.4	19.2	16.8	16.1	15.7	15.3	14.8	14.2	14.0	13.9
08/11/03																						
08/18/03																						
08/25/03	29.3											29.3	29.0	22.8	18.6	17.1	16.3	15.9	15.1	14.7	14.6	14.5
09/02/03																						
09/08/03	28.4											28.4	28.2	25.3	20.0	18.3	17.3	16.1	15.7	15.1	15.0	14.9
09/15/03																						
09/22/03	26.0											25.9	25.9	25.7	21.9	19.6	18.2	16.9	16.1	15.3		
09/29/03																						
10/06/03	24.5											24.6	24.6	24.6	23.2	20.1	18.7	17.4	16.5	15.8		
10/13/03																						
10/20/03																						
10/28/03	21.9											22.0	22.0	22.0	22.0	21.7	21.6	21.4	20.6	17.1	15.8	
11/03/03																						
11/10/03																						
11/17/03	18.2											18.2	18.2	18.2	18.2	18.1	18.0	17.9	17.8	17.7	17.8	
12/01/03																						
12/15/03																						
01/20/04																						
02/17/04																						
03/16/04																						
04/13/04																						
05/18/04																						
06/21/04																						
07/20/04																						
08/17/04																						
09/14/04																						
10/12/04																						
11/09/04																						
12/07/04																						

TABLE 12. DISSOLVED OXYGEN (MG/L) FOR LAKE PLEASANT FROM AUGUST 1999 TO DECEMBER 2004.

Date	R2-5	R2-10	R2-15	R2-20	R2-25	R2-30	R2-35	R2-40	R2-45	R2-4.6	R2-9.1	R2-13.7	R2-18.3	R2-22.9	R2-27.4	R2-32.0	R2-36.6	R2-41.1	R2-45.7	R2-50.0	R2-50.3
08/01/99																					
09/01/99	10.5	9.4	9.2	5.6	5.5	5.2	3.5	2.8	2.6												
10/01/99	9.7	8.3	7.4	7.1	5.2	3.6	2.8	2.3	2.1												
11/01/99	10.7	9.4	8.9	8.7	8.5	8.2	7.1	3.9	1.3												
12/01/99	8.6	7.8	7.5	7.2	6.9	6.5	6.4	6.5	5.2												
01/01/00	9.3	9.1	8.9	9.0	9.3	8.8	8.8	8.8	8.5												
02/01/00	10.0	8.5	8.5	8.1	7.9	7.4	6.7	6.4													
03/01/00	10.2	10.1	9.2	8.8	8.5	8.1	7.9	7.7	7.4												
04/01/00	10.7	9.8	9.0	7.6	7.1	7.0	6.7	6.6	6.4												
05/01/00	9.5	9.9	9.3	8.5	7.7	7.1	7.0	3.5	3.4												
06/01/00	7.2	8.0	8.4	7.8	6.5	5.2	4.7	4.7	1.7												
07/01/00	6.9	6.2	7.0	6.4	5.4	4.9	2.4	2.5	2.5												
08/01/00	6.9	6.1	3.4	3.8	2.5	2.6	2.5	2.4	2.5												
09/01/00	6.2	5.9	3.0	3.0																	
10/01/00	6.0	5.8	5.6	5.8																	
11/01/00	7.2	7.0	7.4	7.5	7.4	7.3	7.1	7.1													
12/01/00	7.8	7.6	7.5	7.1	4.9	4.9	4.6	4.3	4.2												
01/01/01	9.4	9.3	9.3	9.1	9.0	8.9	8.5	7.7	8.6												
02/01/01	9.5	9.3	8.9	9.3	8.6	8.6	8.3	8.4													
03/01/01	10.1	9.6	9.6	9.7	9.3	8.9	8.8	8.4	8.4											8.3	
04/01/01	10.2	9.7	8.7	8.5	8.3	7.8	7.8	7.5	7.3											7.4	
05/01/01	10.2	9.8	8.7	8.6	8.6	8.4	8.1	7.8	7.5											7.3	
06/01/01	8.5	7.4	5.8	6.0	5.9	5.8	2.7	2.7	2.7											2.9	
07/01/01	6.1	5.4	3.0	3.7	3.8	3.5	3.3	3.3	3.3											3.3	
08/01/01																					
09/01/01	6.2	6.1	5.8	0.3	0.3	0.3	0.3														
10/01/01	6.3	6.6	6.3	6.5	6.4	1.3	1.4	1.2	1.3												
11/01/01	8.2	7.9	7.8																		
12/01/01	7.4	7.4	7.4	7.4	7.7	7.7															
01/01/02	4.8	4.6	4.5	4.4	4.3	4.2	4.2	4.2													
02/01/02	10.5	10.5																			
03/01/02	9.8	9.7	9.6	9.4	9.3	9.1	4.8	4.8	4.7												
04/01/02	10.3	10.6	10.1	9.5	9.2	9.0	8.6	8.5	8.0												
05/01/02	7.5	7.4	7.5	7.2	6.8	6.7	6.8	6.7	6.7												
06/01/02	7.0	7.1	6.7	5.8	5.4	5.2	5.0	4.9													
07/16/02										8.3	8.2	9.3	7.3	6.4	5.8		5.4	5.2	5.1		5.1
08/12/02										7.3	7.3	5.8	5.2	4.5	3.8	3.1	2.7	2.6	2.5		2.5
09/03/02										7.8	8.0	4.6	4.1	4.2	3.7	2.1	1.1	1.2	1.2		1.1
09/16/02										7.8	7.9	1.5	2.6	3.0	1.5	0.8	0.5	0.3	0.2		
10/02/02										6.4	6.2	5.9	1.3	1.4	0.9	0.2	0.1	0.1	0.1		
10/16/02										7.4	7.4	7.3	7.4	6.3	0.3	0.2	0.1	0.1	0.1		
10/30/02										6.9	7.0	6.9	6.9	6.9	6.8	0.3	0.2	0.2	0.1		
11/13/02										7.8	7.7	7.7	7.7	7.8	8.1	8.0	5.6	0.4	0.2		
11/25/02										9.0	9.1	9.1	9.0	9.0	9.0	9.0	9.0	9.0	9.0		

Date	R2-5	R2-10	R2-15	R2-20	R2-25	R2-30	R2-35	R2-40	R2-45	R2-4.6	R2-9.1	R2-13.7	R2-18.3	R2-22.9	R2-27.4	R2-32.0	R2-36.6	R2-41.1	R2-45.7	R2-50.0	R2-50.3
12/17/02										9.2	9.2	9.1	9.2	9.3	9.2	9.3	9.4	9.1	8.9		8.8
02/11/03										10.9	10.8	10.5	10.3	10.2	10.3	10.3	10.3	9.9	9.7		9.5
03/11/03										11.2	11.4	11.2	11.0	10.5	10.1	10.0	10.0	9.9	9.7		9.4
04/15/03										9.5	9.8	9.0	8.5	8.4	7.9	8.0	8.0	7.8	7.6		7.4
05/13/03										9.9	10.0	7.4	6.8	6.9	6.5	6.5	6.3	6.4	6.1		6.0
06/03/03										9.4	9.2	5.6	4.8	4.6	4.9	4.8	4.8	4.9	4.9		4.9
06/10/03																					
06/24/03										9.2	6.6	2.2	2.1	2.4	3.0	3.2	3.4	3.5	3.4		3.3
07/07/03																					
07/14/03										7.5	4.8	0.4	0.7	0.9	1.4	1.6	1.7	1.8	1.9		1.9
07/21/03																					
07/28/03																					
08/04/03										7.5	7.2	0.5	0.3	0.3	0.2	0.2	0.2	0.2	0.2		0.2
08/11/03																					
08/18/03																					
08/25/03										7.3	6.5	0.5	0.2	0.2	0.1	0.1	0.1	0.1	0.1		0.1
09/02/03																					
09/08/03										6.8	6.0	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1		0.1
09/15/03																					
09/22/03										6.7	6.2	5.2	0.3	0.2	0.1	0.1	0.1	0.1			
09/29/03																					
10/06/03										5.3	5.2	5.2	1.1	0.6	0.4	0.3	0.3	0.3			
10/13/03																					
10/20/03																					
10/28/03										6.8	6.7	6.7	6.4	6.4	6.3	5.9	4.4	0.9	0.4		
11/03/03																					
11/10/03																					
11/17/03										7.8	7.8	7.6	7.4	7.4	7.3	7.4	7.3	7.6	7.4		
12/01/03																					
12/15/03																					
01/20/04																					
02/17/04																					
03/16/04																					
04/13/04																					
05/18/04																					
06/21/04																					
07/20/04																					
08/17/04																					
09/14/04																					
10/12/04																					
11/09/04																					
12/07/04																					

TABLE 13. pH FOR LAKE PLEASANT FROM AUGUST 1999 TO DECEMBER 2004.

Date	R2-5	R2-10	R2-15	R2-20	R2-25	R2-30	R2-35	R2-40	R2-45	R2-4.6	R2-9.1	R2-13.7	R2-18.3	R2-22.9	R2-27.4	R2-32.0	R2-36.6	R2-41.1	R2-45.7	R2-50	R2-50.3
08/01/99																					
09/01/99																					
10/01/99																					
11/01/99	8.4	8.4	8.4	8.4	8.3	8.2															
12/01/99	8.3	8.3	8.3	8.3	8.2	8.2															
01/01/00	8.3	8.3	8.3	8.3	8.3	8.3															
02/01/00	8.1	8.1	8.1	8.0	8.0	8.0															
03/01/00	8.2	8.1	8.0	7.9	7.8	7.7															
04/01/00	8.1	7.7	7.6	7.0	4.4	3.7															
05/01/00	8.4	8.3	8.0	7.0	6.4	5.9															
06/01/00	8.0	7.9	7.6	7.0	6.7	3.9															
07/01/00	7.9	7.6	7.1	6.2	6.2	5.7															
08/01/00	8.7	7.8	6.9	6.4	5.8	2.4															
09/01/00	8.2	8.1	7.7	7.5																	
10/01/00	7.9	7.8	7.7																		
11/01/00	8.1	8.0	7.9	7.9	7.7	7.6															
12/01/00	8.0	7.9	7.7	7.6	7.4	6.7															
01/01/01																					
02/01/01	8.5	8.5	8.4	8.3	8.2	8.1															
03/01/01	8.7	8.6	8.3	8.0	7.7	7.4															
04/01/01	8.4	8.2	7.8	7.6	7.3	7.0															
05/01/01	8.4	8.0	7.3	6.9	6.6	6.3															
06/01/01	8.4	8.3	7.9	7.8	7.7	7.6															
07/01/01	8.3	8.2	7.8	7.2	7.0	6.8															
08/01/01																					
09/01/01	6.5	4.1	1.9	6.9	4.7	2.7															
10/01/01	8.0	7.8	7.3	6.3	5.4																
11/01/01	8.2	8.1	8.0																		
12/01/01	7.7	7.8	7.9	7.9	7.9	7.8															
01/01/02	8.6	8.6	8.5	8.4	8.3	8.2															
02/01/02	8.2	8.7	8.1	8.1	8.1	8.0															
03/01/02	8.3	8.6	8.5	8.4	8.3																
04/01/02	8.6	8.6	8.4	8.2	8.0	7.9															
05/01/02	8.2	8.3	7.9	7.6	7.4	7.2															
06/01/02	8.6	8.6	8.2	8.0	7.8	7.6															
07/16/02																					
08/12/02																					
09/03/02																					
09/16/02																					
10/02/02																					
10/16/02																					
10/30/02																					
11/13/02																					
11/25/02																					

Date	R2-5	R2-10	R2-15	R2-20	R2-25	R2-30	R2-35	R2-40	R2-45	R2-4.6	R2-9.1	R2-13.7	R2-18.3	R2-22.9	R2-27.4	R2-32.0	R2-36.6	R2-41.1	R2-45.7	R2-50	R2-50.3
12/17/02																					
02/11/03																					
03/11/03																					
04/15/03																					
05/13/03																					
06/03/03																					
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08/17/04																					
09/14/04																					
10/12/04																					
11/09/04																					
12/07/04																					

TABLE 14. TEMPERATURE (°C) FOR BARTLETT LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R6A	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32.0	R6-36.6	R6-41.1	R6-45.7	R6-50.3
08/01/99	28.7	28.1	27.6	21.5	18.5	16.8	15.9	15.8	15.9	16.0											
09/01/99	27.5	27.1	26.8	26.5	22.0	19.5	17.9	17.0	17.4	17.5											
10/01/99	23.0	23.1	23.1	23.0	23.0	22.9	22.8	21.3	21.4	21.4											
11/01/99	18.0	18.0	18.0	18.0	17.9	17.9	17.9	17.9	17.9	17.9											
12/01/99	12.7	12.8	12.8	12.8	12.8	12.7	12.6	12.5	12.5	12.5											
01/01/00	9.9	9.9	9.9	9.9	9.6	9.2	9.0	8.8	8.8	8.8											
02/01/00	12.4	12.3	11.2	10.9	10.6	10.3	10.0	10.1	10.1	10.1											
03/01/00	14.8	14.8	13.5	12.7	12.5	11.9	11.8	11.1	11.1	11.1											
04/01/00	19.9	19.6	16.9	14.9	13.5	13.3	13.3	13.3	13.3	13.3											
05/01/00	22.3	22.0	18.2	16.1	15.4	15.3	15.4	15.3	15.2	15.2											
06/01/00	26.3	25.5	21.1	18.0	15.7	14.6	14.6	14.6	14.6	14.6											
07/01/00	28.2	28.1	23.5	18.5	16.2	15.0	14.5	14.4	14.4	14.4											
08/01/00	29.0	29.2	27.3	21.1	19.0	18.2	15.3	15.5	15.6	15.7											
09/01/00	26.7	26.7	26.5	26.0	22.8	19.0	17.9	17.7													
10/01/00	22.3	22.3	22.3	22.3	22.3	22.2	19.7	17.9	18.1												
11/01/00	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1												
12/01/00	13.2	13.3	13.3	13.3	12.9	12.6	12.5	12.5													
01/01/01	10.3	10.2	10.2		10.2	10.2	10.2	10.2													
02/01/01	10.0	10.0	10.0	10.0	10.0	9.9	9.9														
03/01/01	13.3	13.2	12.6	11.9	11.0	10.6	10.4	10.4													
04/01/01	18.7	18.6	16.8	14.8	13.1	12.2	11.8	11.2	11.2	11.2											
05/01/01	23.6	23.4	18.7	16.5	15.2	13.7	13.7														
06/01/01	26.6	25.3	20.0	16.8	15.2	14.2	13.6	13.0	12.3												
07/01/01	27.7	27.6	21.5	17.7	15.8	14.9	14.2	13.3	12.9	12.7											
08/01/01																					
09/01/01	27.2	27.1	27.0	21.6	17.5	16.4	15.6	14.8	14.3	13.8											
10/01/01	22.6																				
11/01/01	20.0	19.9	19.9	19.9	19.8	19.8	19.7	19.6	19.6												
12/01/01	14.3	14.3	14.3	14.3	14.2	14.1	13.7														
01/01/02	10.7	10.6	10.6	10.5	10.3	10.0	10.0														
02/01/02	9.6	9.5	9.5	4.9	4.7	4.6	4.4														
03/01/02	12.5	12.4	12.4	11.0	10.5	10.2	10.1	10.1	12.8												
04/01/02	19.4	18.6	14.0	12.0	11.0	10.8	10.6	10.6													
05/01/02	22.4	21.4	19.0	12.9	11.9	11.3	11.0	11.1	11.0	11.0											
06/01/02	26.2	25.5	20.8	15.2	13.1	12.1	11.4	11.3	16.2												
07/16/02	28.1										27.9		20.3		13.5		12.6				
08/12/02	28.8										28.3	27.5	22.5	17.9	15.9	14.7	13.6				
09/03/02	28.1										27.6	27.0	24.0	19.9	17.3	15.8	14.8				
09/16/02	25.9										25.8	25.6	25.3	22.9	19.1	17.5	15.8				
10/02/02	24.0										24.0	24.0	24.0	23.9	20.6	18.1	16.8				
10/16/02	22.9										22.0	22.0	22.0	22.0	21.8	19.7	18.0				
10/30/02	20.4										20.3	20.3	20.2	20.2	20.2	19.9	19.7				
11/13/02	15.0										14.9	14.8	14.7	14.5	14.3	14.1	17.5				
11/25/02	15.8										15.8	15.9	15.9	15.8	15.4	15.2					

Date	R6A	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32.0	R6-36.6	R6-41.1	R6-45.7	R6-50.3
12/17/02	13.5										13.4	13.3	13.3	13.1	12.8	12.6					
02/11/03	13.2										12.8	11.6	11.4	11.2	11.2	11.0	10.7				
03/11/03	14.7										14.3	12.7	12.3	11.7	11.3	11.2	11.2	11.2			
04/15/03	16.5										16.1	16.0	14.4	12.8	12.7	12.5	12.3	12.0	11.8	11.7	
05/13/03	21.1										20.8	17.0	15.0	13.7	12.9	12.4	12.3	12.1	12.0		
06/03/03	26.6										24.8	18.7	16.4	14.7	13.8	13.0	12.8	12.5	12.3		
06/10/03																					
06/24/03	25.5										25.2	23.2	18.3	16.2	14.9	14.2	13.4	13.0	12.6		
07/07/03																					
07/14/03	29.3										28.6	24.9	20.3	17.5	16.0	15.3	14.5	13.8	13.2		
07/21/03																					
07/28/03																					
08/04/03	29.1										29.0	26.6	22.1	18.7	17.2	15.9	15.1	14.5	14.0		
08/11/03																					
08/18/03																					
08/25/03	29.9										29.2	27.9	23.7	20.5	18.5	17.4	16.5	15.5	14.9		
09/02/03																					
09/08/03	28.0										28.0	27.6	24.5	21.3	19.0	17.8	16.6	15.8	15.4		
09/15/03																					
09/22/03	27.2										27.0	26.8	26.5	26.3	26.1	25.9					
09/29/03																					
10/06/03	25.8										25.8	25.8	25.8	25.8	25.7	25.4					
10/13/03																					
10/20/03																					
10/28/03	22.2										22.2	22.3	22.3	22.3	22.3	21.9	19.5	18.1			
11/03/03																					
11/10/03																					
11/17/03	18.6										18.6	18.6	18.6	18.6	18.6	18.6	18.3	18.2			
12/01/03																					
12/15/03																					
01/20/04																					
02/17/04																					
03/16/04	17.7	17	13.1	11.4	10.9	10.7	10.6	10.6													
04/13/04	19.5	18.3	16.5																		
05/18/04	22.7										22.6	19.4	17.5	14.9	12.8	11.9	11.5	11.2			
06/21/04	25.9										25.5	22.4	18.7	16.9	14.7	13.2	12.2	11.8			
07/20/04	28.6										28.2	26.3	22.7	19.2	17.5	15.6	14.3	13.2			
08/17/04	27.9										27.9	27.6	24.2	20.8	18.7	17.5	15.7	14.5	13.8		
09/14/04	27.2										26.8	26.3	26.1	22.8	19.8	18.2	16.8	15.7			
10/12/04	23.1										23.1	23.1	23.1	23.0	22.1	20.6	18.7	17.7	15.9		
11/09/04	18.9										18.6	18.6	18.6	18.3	18.1	17.8	17.5	17.2	17.1		
12/07/04																					

TABLE 15. DISSOLVED OXYGEN (MG/L) FOR BARTLETT LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32	R6-36.6	R6-41.1	R6-45.7	R6-50.3
08/01/99	8.8	6.2	0.3			0.3			0.1											
09/01/99	5.6	5.2	3.3	0.0	0.1	0.1	0.1	0.1	0.1											
10/01/99	6.0	5.6	5.5	5.5	4.5	3.4	0.7	0.6	0.6											
11/01/99	7.5	7.5	7.4	7.2	7.1	7.0	0.6	0.4	0.3											
12/01/99	8.3	8.0	7.1	6.8	6.4	1.2	1.0	1.0	0.9											
01/01/00	9.1	8.5	8.2	8.0	7.7	7.6	7.4	4.4	4.0											
02/01/00	10.4	8.6	8.0	7.5	6.7	4.9	4.9	4.6	4.5											
03/01/00	10.0	9.4	7.9	7.0	5.0	4.2	0.4	0.4	0.4											
04/01/00	9.6	9.1	6.4	5.4	0.8	0.5	0.4	0.4	0.4											
05/01/00	8.3	4.3	4.0	3.2	2.3	2.2	2.5	2.6	2.4											
06/01/00	12.9	4.3	3.0	4.3	1.8	1.8	1.7	1.6	1.6											
07/01/00	6.6	0.9	0.8	0.7	0.5	0.4	0.3	0.2	0.2											
08/01/00	5.9	1.2	0.9	0.9	0.8	0.6	0.4	0.3	0.3											
09/01/00	7.0	5.0	1.7	0.6	0.6	0.5	0.4													
10/01/00	5.5	5.5	5.6	4.9	1.3	1.3	1.2													
11/01/00	6.5	5.9	5.7	5.8	5.5	5.1	5.2	4.5												
12/01/00	6.6	6.8	7.0	6.7	6.1	5.0	5.3													
01/01/01	8.5	8.6	8.3	8.3	8.2	8.2	7.0													
02/01/01	9.2	8.6	9.0	8.7	6.8	6.4														
03/01/01	12.0	11.9	11.3	10.3	9.9	9.9	9.8													
04/01/01	9.4	8.3	7.3	8.7	9.0	8.7	8.0	6.1	6.3											
05/01/01	9.1	6.1	6.7	8.3	8.8															
06/01/01	7.0	3.2	3.2	5.1	5.5	5.5	6.6	5.5												
07/01/01	5.7	2.4	2.8	2.9	3.3	3.4	3.6	3.2	2.1											
08/01/01																				
09/01/01	6.7	6.5	1.5	1.6	1.4	1.3	1.2	1.2	1.2											
10/01/01																				
11/01/01	8.2	8.9	8.7	8.4	8.3	8.4	8.2													
12/01/01	8.8	8.6	8.5	8.4	8.4	8.2														
01/01/02	11.6	12.0	12.1	12.4	11.9	12.0														
02/01/02	9.8	9.8																		
03/01/02	9.8	10.0	9.3	9.0	8.4	8.6	11.3	2.4												
04/01/02	8.5	8.3	7.2	7.6	7.3	7.1	6.3													
05/01/02	14.8	13.1	14.8	14.4	14.3	14.0	10.8	8.8	8.5											
06/01/02	3.2	2.5	2.2	2.3	2.4	2.8	2.2													
07/16/02										9.2		1.0		0.6		0.3				
08/12/02										8.0	4.4	0.2	0.2	0.1	0.2	0.1				
09/03/02										7.5	5.2	0.6	0.3	0.3	0.3	0.3				
09/16/02										6.6	5.5	2.9	0.4	0.3	0.3	0.3				
10/02/02										5.7	5.7	5.7	5.2	0.2	0.1	0.1				
10/16/02										7.1	7.1	7.1	7.0	4.1	0.3	0.2				
10/30/02										6.7	6.6	6.6	6.6	6.7	6.4	6.2				
11/13/02										9.0	9.1	9.0	8.4	7.9	7.3	5.7				
11/25/02										8.3	8.1	8.0	7.8	7.3	6.6					

Date	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32	R6-36.6	R6-41.1	R6-45.7	R6-50.3
12/17/02										8.8	8.9	8.8	8.6	8.4	8.4					
02/11/03										11.4	9.7	9.9	10.0	9.4	8.6	8.0				
03/11/03										12.6	11.0	10.5	9.6	9.1	9.0	8.8	7.9			
04/15/03										8.7	8.6	7.3	7.0	6.9	7.2	7.5	7.0	5.7	4.4	
05/13/03										8.7	4.8	5.1	5.4	5.7	5.8	5.7	5.8	4.7		
06/03/03										7.5	3.1	3.7	5.1	5.2	5.4	5.3	5.1	4.2		
06/10/03																				
06/24/03										6.4	0.3	0.2	1.9	3.0	3.5	3.6	3.7	2.9		
07/07/03																				
07/14/03										6.7	0.4	0.3	0.2	0.7	1.3	1.6	1.3	0.7		
07/21/03																				
07/28/03																				
08/04/03										7.8	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
08/11/03																				
08/18/03																				
08/25/03										8.6	1.0	0.2	0.1	0.1	0.1	0.1	0.1	0.1		
09/02/03																				
09/08/03										6.2	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
09/15/03																				
09/22/03										5.6	3.8	0.5	0.3	0.2	0.2					
09/29/03																				
10/06/03										4.3	4.2	4.0	4.0	1.5	0.4					
10/13/03																				
10/20/03																				
10/28/03										5.3	5.3	5.0	4.8	4.7	2.0	0.3	0.3			
11/03/03																				
11/10/03																				
11/17/03										5.8	5.6	5.2	4.7	4.5	4.0	3.7	3.2			
12/01/03																				
12/15/03																				
01/20/04																				
02/17/04																				
03/16/04	7.1	5.7	5.3	5.3	5.1	5.1	4.2													
04/13/04	10.4	9.1																		
05/18/04										10.4	6.2	5.2	5.0	4.8	5.2	4.6	3.3			
06/21/04										10.9	4.9	3.0	3.2	4.3	5.1	4.5	3.7			
07/20/04										9.4	4.9	1.1	1.1	1.0	1.0	1.0	1.0			
08/17/04										7.0	6.1	1.3	1.2	1.3	1.2	1.3	1.3	1.3		
09/14/04										7.8	4.6	3.1	0.9	0.6	0.6	0.5	0.5			
10/12/04										6.4	5.4	4.6	4.0	1.1	0.6	0.6	0.6	0.5		
11/09/04										5.3	4.5	4.1	3.7	3.5	3.2	3.1	3.1	3.1		
12/07/04																				

TABLE 16. pH FOR BARTLETT LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32	R6-36.6	R6-41.1	R6-45.7	R6-50.3
08/01/99																				
09/01/99																				
10/01/99	8.5	8.5	8.5		8.5	8.5	8.5													
11/01/99	8.5	8.5	8.5	8.4	8.4	8.4														
12/01/99	8.4	8.4	8.4	8.4	8.4	7.6														
01/01/00	8.4	8.4	8.4	8.3	8.3	8.3														
02/01/00	8.6	8.5	8.4	8.4	8.2	7.7														
03/01/00	8.6	8.4	8.2	8.0	7.7	7.5														
04/01/00	8.2	7.9	7.5	7.2	6.5															
05/01/00	8.4	8.2	8.1	8.0	8.0	7.9														
06/01/00	8.3	7.7	7.3	7.0	7.0	6.8														
07/01/00	8.2	7.2	6.7	6.3	6.0	5.6														
08/01/00	8.3	7.4	6.7	6.3	5.8															
09/01/00	8.2	7.7	7.0	7.3	7.2	7.1														
10/01/00	8.0	8.0	7.9	7.9	7.8	7.7														
11/01/00	8.3	8.0	8.1	8.1	7.9	7.8														
12/01/00	8.0	7.8	7.5	7.2	6.9	4.6														
01/01/01																				
02/01/01	8.7	8.6	8.5	8.4	8.2	8.2														
03/01/01	8.7	8.4	8.1	7.6	7.2	6.4														
04/01/01	8.1	7.8	7.6	7.5	7.1	6.8														
05/01/01	8.6	8.2	7.7	7.5	7.3	7.2														
06/01/01	8.9	8.1	7.9	7.8	7.8	7.7														
07/01/01	8.8	8.3	8.0	7.9	7.7	7.6														
08/01/01																				
09/01/01	8.4	8.2	7.0	5.8	4.0	1.9														
10/01/01																				
11/01/01	8.0	7.9	7.5	6.8	5.4	6.2														
12/01/01	7.5	7.7	7.2	6.7	6.0	5.2														
01/01/02	7.8	6.9	5.0	3.7	2.3	1.0														
02/01/02	8.4	8.5	8.4	8.3	8.3	8.2														
03/01/02	8.6	8.6	8.4	8.3	8.1	7.9														
04/01/02	8.3	8.3	8.1	7.5	6.5	5.1														
05/01/02	8.5	8.4	8.2	8.0	7.8	7.6														
06/01/02	8.7	8.6	8.2	7.9	7.8	7.6		7.1												
07/16/02																				
08/12/02																				
09/03/02																				
09/16/02																				
10/02/02																				
10/16/02																				
10/30/02																				
11/13/02																				
11/25/02																				

Date	R6-5	R6-10	R6-15	R6-20	R6-25	R6-30	R6-35	R6-40	R6-45	R6-4.6	R6-9.1	R6-13.7	R6-18.3	R6-22.9	R6-27.4	R6-32	R6-36.6	R6-41.1	R6-45.7	R6-50.3
12/17/02																				
02/11/03																				
03/11/03																				
04/15/03																				
05/13/03																				
06/03/03																				
06/10/03																				
06/24/03																				
07/07/03																				
07/14/03																				
07/21/03																				
07/28/03																				
08/04/03																				
08/11/03																				
08/18/03																				
08/25/03																				
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05/18/04																				
06/21/04																				
07/20/04																				
08/17/04																				
09/14/04																				
10/12/04																				
11/09/04																				
12/07/04																				

TABLE 17. TEMPERATURE (°C) FOR SAGUARO LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R9A	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13.7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
08/01/99	30.0	27.4	24.5	23.9	23.7	23.6	23.6	23.6	23.6	23.6											
09/01/99	27.5	26.9	25.2	24.6	24.2		23.7		23.5												
10/01/99	25.4	24.0	23.9	23.6	23.2	23.1	22.9	22.9	22.9	22.9											
11/01/99	20.4	20.1	20.0	20.0	19.9	19.9	19.9	19.9	19.9	19.9											
12/01/99	15.5	15.5	15.5	15.5	15.5	15.5	15.5														
01/01/00	12.8	12.5	12.4	12.4	12.4	12.4	12.3	12.2	12.2	12.2											
02/01/00	14.5	13.6	13.1	12.9	12.8	12.8	12.8	12.5	12.5	12.5											
03/01/00	16.7	16.1	13.9	13.4	13.1	13.0	12.9	12.9	13.0	12.9											
04/01/00	20.6	20.1	15.4	13.7	13.4	13.3	13.2	13.2	13.2	13.2											
05/01/00	23.8	22.8	18.9	18.2	17.7	17.0	16.1	15.6	15.8	15.8											
06/01/00	26.9	25.3	20.9	20.6	20.0	20.0	19.3	18.9	18.9	18.9											
07/01/00	29.1	25.5	23.8	23.0	22.6	22.2	21.7	21.6	21.7	21.7											
08/01/00	30.0	27.1	24.9	24.4	24.2	24.0	23.5	23.4	23.4	23.4											
09/01/00	28.1	27.3	25.9	25.1	24.7	24.5	23.9	23.8													
10/01/00	23.9	24.0	24.1	24.3	24.4	24.6	24.8														
11/01/00	18.6	18.7	18.7	18.7	18.7	18.7	18.6	18.6													
12/01/00	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4													
01/01/01	13.4	12.8	12.7	12.7	12.6	12.6	12.6														
02/01/01	13.0	12.5	12.3	12.2	12.1	12.1	12.1														
03/01/01	14.8	14.1	13.5	12.6	12.5	12.6	12.5														
04/01/01	20.8	18.6	15.3	13.7	13.1	12.9	12.8														
05/01/01	25.0	22.4	19.7	18.8	18.3	17.2	15.6														
06/01/01	25.8	23.3	21.7	20.7	20.5	20.2	19.7	19.7	19.8												
07/01/01	27.5	27.1	22.7	22.0	21.7	21.5	21.3														
08/01/01	29.6	26.4	23.7	23.2	23.0	22.8	22.5	22.3													
09/01/01	27.9	27.5	25.5	24.7	24.2	24.2	24.1														
10/01/01	23.0	22.4	22.4	22.3	22.3	22.1	22.0	22.0													
11/01/01	20.7	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6											
12/01/01	15.5	15.9	16.0	16.0	16.0	16.0	16.0														
01/01/02	12.8	12.8	12.8	12.8	12.8	12.8	12.8														
02/01/02	12.2	12.0	12.0	9.3	9.3	9.5	9.6														
03/01/02	14.9	14.1	12.7	12.4	12.3	12.3	12.3														
04/01/02	20.8	19.5	15.2	13.5	13.3	12.9	12.8	13.0													
05/01/02	22.6	17.9	17.2																		
06/01/02	21.5	19.2	18.7	18.4	18.2	17.9	17.7	17.8	17.9												
07/16/02	27.8										22.0	19.7	19.2	18.6	18.0	17.9	17.7				
08/12/02	28.6										24.6	21.9	20.7	20.2	19.9	19.5					
09/03/02	30.8										25.3	23.0	22.0	21.6	21.3	21.0	20.4				
09/16/02	26.3										25.4	23.7	22.5	22.1	21.8	21.5					
10/02/02	24.1										23.9	23.9	23.0	22.4	22.0	21.7					
10/16/02	24.4										22.8	22.6	22.5	22.5	22.5	22.2	21.9				
10/30/02	21.9										21.5	21.4	21.4	21.4	21.4	21.3	21.3				
11/13/02	17.6										17.0	16.8	16.7	16.6	16.6	16.5	19.6				
11/25/02	18.2										18.2	18.2	18.1	18.1	18.1	18.0					

Date	R9A	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13.7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
12/17/02	15.9										15.7	15.6	15.6	15.5	15.5	15.5					
02/11/03	14.6										14.1	13.6	13.4	13.3	13.3	13.3	13.2				
03/11/03	15.5										15.2	14.2	13.8	13.6	13.5	13.5					
04/15/03	17.8										17.7	16.3	14.9	14.3	14.1	13.9					
05/13/03	23.7										21.0	18.4	16.0	15.5	14.6	14.3					
06/03/03	27.0										23.4	21.6	19.9	17.9	16.8	16.1					
06/10/03																					
06/24/03	26.2										25.4	23.1	22.4	21.6	20.9	19.8					
07/07/03																					
07/14/03	30.1										26.2	24.9	24.0	23.1	22.6	22.2					
07/21/03																					
07/28/03																					
08/04/03	30.9										28.4	26.1	25.2	24.6	24.2	23.6	22.6				
08/11/03																					
08/18/03																					
08/25/03	30.1										28.9	26.9	25.9	25.6	25.4	25.0					
09/02/03																					
09/08/03	28.4										28.3	28.1	26.4	26.2	26.0	25.8					
09/15/03																					
09/22/03	25.9										25.9	25.9	25.9	25.7	20.7	18.4	16.6	15.9	15.6	15.6	
09/29/03																					
10/06/03	25.0										25.0	25.1	25.1	25.1	25.0	20.6	17.4	16.5	16.2		
10/13/03																					
10/20/03																					
10/28/03	24.6										24.2	2.2	24.1	24.1	24.1	24.0					
11/03/03																					
11/10/03																					
11/17/03	21.0										20.6	20.5	20.5	20.4	20.4	20.4					
12/01/03																					
12/15/03																					
01/20/04	13.2										13.1	13.1	13.1	13.1	13.1	13.1					
02/17/04	13.3	12.9	12.4	12.3	12.4	12.4	12.4														
03/16/04	18.1	16.6	13.6	13.2	13.0	12.8	12.7														
04/13/04	20.5	19.7	14.7	13.4	13.1																
05/18/04	24.3										23.3	20.2	18.3	16.9	15.0	14.2					
06/21/04	25.6										25.5	22.2	21.6	21.2	20.8	20.3					
07/20/04	28.5										24.8	23.6	22.7	22.5	22.2	21.9					
08/17/04	28.1										26.9	24.5	23.9	23.4	23.3	23.1					
09/14/04	27.0										26.9	25.0	24.6	24.2	24.0	23.7					
10/12/04	24.3										24.1	24.1	24.0	24.0	23.9	23.9					
11/09/04	20.1										20.2	20.2	20.2	20.2	20.0	20.0					
12/07/04																					

TABLE 18. DISSOLVED OXYGEN (MG/L) FOR SAGUARO LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13.7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
08/01/99	4.4	0.6	0.7	1.2	1.5	1.7	1.6	1.7	1.4											
09/01/99	7.2	0.3	0.3	1.9		2.4		0.4												
10/01/99	6.6	4.9	2.7	4.2	4.5	3.9	3.4	3.2	3.2											
11/01/99	7.4	7.3	6.9	6.6	6.4	5.7	0.7	0.5	0.5											
12/01/99	5.9	5.1	5.4	5.3	5.2	5.2	4.0	4.0	4.2											
01/01/00	9.9	9.5	9.3	8.9	8.4	8.3	7.6	7.4	7.2											
02/01/00	8.9	7.4	7.1	7.0	5.9	5.6	4.0	3.7	3.7											
03/01/00	9.6	7.3	5.9	5.2	4.7	4.5	3.8	3.6	3.5											
04/01/00	8.0	6.8	4.8	4.3	3.7	3.0	3.2	2.6	2.6											
05/01/00	8.5	5.9	5.0	4.9	4.1	3.1	0.7	0.5	0.4											
06/01/00	7.9	4.3	4.0	3.5	4.6	3.3	0.4	0.4	0.3											
07/01/00	4.2	0.9	0.9	0.8	0.7	0.3	0.3	0.3	0.4											
08/01/00	3.6	0.7	0.6	1.1	1.4	0.4	0.5	0.4	0.4											
09/01/00	6.0	0.4	0.4	0.3	0.3	0.3	0.3													
10/01/00	5.3	4.7	4.5	4.0	3.5	3.5	2.3													
11/01/00	5.1	4.7	5.0	4.9	5.0	4.7	1.4													
12/01/00	6.2	5.7	5.7	5.7	5.7	5.6	4.9													
01/01/01	7.2	6.9	6.7	7.0	6.8	6.7														
02/01/01	9.2	8.5	7.6	7.1	7.0	7.1														
03/01/01	10.2	8.6	6.7	6.7	6.7	6.1														
04/01/01	9.8	6.0	6.2	6.4	6.1	5.7														
05/01/01	9.3	6.0	5.7	5.8	5.2	3.6														
06/01/01	7.2	2.9	4.1	4.7	4.8	3.0	2.3	2.1												
07/01/01		1.3	1.4	2.1	1.9	1.2														
08/01/01	3.7	2.2	2.0	2.0	2.4	1.9	1.7													
09/01/01																				
10/01/01	4.4	4.1	4.0	2.8	2.5	1.7	0.5													
11/01/01	7.3	7.3	7.3	7.3	7.4	7.4	6.7	6.6	6.6											
12/01/01	9.5	9.6	9.8	9.8	9.8	9.7														
01/01/02	0.3	0.3	0.3	0.3	0.3	0.3														
02/01/02	9.4	9.2																		
03/01/02	10.3	6.5	5.7	5.7	5.5	3.5														
04/01/02	9.9	3.7	2.2	2.9	2.4	1.4	1.3													
05/01/02																				
06/01/02																				
07/16/02										1.2	1.0	1.0	1.0	1.7	1.0	0.8				
08/12/02										1.5	0.3	0.2	0.2	0.2	0.2					
09/03/02										3.0	0.5	0.3	0.3	0.2	0.2	0.2				
09/16/02										1.7	0.4	0.3	0.3	0.3	0.3					
10/02/02										3.6	3.9	0.2	0.2	0.2	0.1					
10/16/02										5.4	5.0	4.8	4.5	3.9	0.3	0.2				
10/30/02										5.4	5.0	4.8	4.5	3.9	0.3	0.2				
11/13/02										8.5	8.2	8.1	8.0	7.7	7.3	5.9				
11/25/02										6.4	6.4	6.4	6.5	6.4	6.2					

Date	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13.7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
12/17/02										7.8	7.3	7.4	7.7	7.4	7.3					
02/11/03										10.3	8.7	8.6	8.4	8.3	8.0	7.5				
03/11/03										10.7	10.0	8.3	6.3	5.9	5.5					
04/15/03										9.8	7.2	4.3	3.6	3.3	3.2					
05/13/03										9.9	6.5	1.3	0.8	0.8	0.5					
06/03/03										9.8	5.8	3.2	0.5	0.2	0.2					
06/10/03																				
06/24/03										9.0	2.0	0.9	0.2	0.2	0.2					
07/07/03																				
07/14/03										6.1	1.5	0.2	0.1	0.1	0.1					
07/21/03																				
07/28/03																				
08/04/03										7.2	0.4	0.2	0.2	0.2	0.1	0.1				
08/11/03																				
08/18/03																				
08/25/03										5.0	0.2	0.1	0.1	0.1	0.1					
09/02/03																				
09/08/03										4.2	0.4	0.2	0.1	0.2	0.1					
09/15/03																				
09/22/03										7.6	7.4	7.3	6.7	0.5	0.2	0.2	0.1	0.1	0.1	
09/29/03																				
10/06/03										7.1	7.1	7.2	7.0	6.9	0.3	0.2	0.2	0.2		
10/13/03																				
10/20/03																				
10/28/03										6.0	5.6	5.3	5.3	5.2	5.0					
11/03/03																				
11/10/03																				
11/17/03										6.0	5.7	5.8	5.6	5.4	5.4					
12/01/03																				
12/15/03																				
01/20/04																				
02/17/04	8.2	7.8	7.5	6.7	7.1	7.1														
03/16/04	7.9	6.8	6.7	6.6	5.8	5.7														
04/13/04	10.4	7.0	6.7	6.4																
05/18/04										10.6	6.6	4.4	3.5	3.6	3.2					
06/21/04										11.5	2.4	1.7	1.9	1.6	0.9					
07/20/04										9.2	12.0	1.0	1.0	1.6	1.4					
08/17/04										5.1	1.2	1.0	1.0	0.9	0.9					
09/14/04										7.7	1.2	1.0	0.8	0.7	0.6					
10/12/04										5.7	5.4	5.0	4.7	4.3	3.8					
11/09/04										5.8	5.7	5.3	5.0	4.9	5.0					
12/07/04																				

TABLE 19. pH FOR SAGUARO LAKE FROM AUGUST 1999 TO DECEMBER 2004.

Date	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13_7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
08/01/99																				
09/01/99																				
10/01/99	7.8	7.8	7.8			7.7	7.7	7.7												
11/01/99	7.8	7.9	7.8	7.8	7.8	7.7														
12/01/99	8.0	7.9	7.9	7.9	7.9	7.8														
01/01/00	7.9	8.0	8.3	8.8	8.0	8.0														
02/01/00	8.3	8.2	8.1	8.0	7.9	7.8														
03/01/00	8.3	8.1	7.8	7.6	7.5	7.3			6.7											
04/01/00	8.0	7.9	7.5	7.3	7.1	5.2														
05/01/00	8.3	7.9	7.7	7.6	7.6	7.5														
06/01/00	8.4	8.0	7.6	7.3	7.0	6.7														
07/01/00	7.9	7.6	7.4	7.2	7.1	6.9														
08/01/00	7.3	6.9	6.6	6.4	3.7															
09/01/00	8.2	7.3	7.1	6.9	6.7	6.5														
10/01/00	7.6	7.4	7.3	7.1	6.9	6.8														
11/01/00	7.8	7.6	7.5	7.4	7.3	7.1														
12/01/00	7.6	7.5	7.4	7.3	7.2	7.0														
01/01/01																				
02/01/01	8.3	8.0	7.7	7.5	7.2	7.0														
03/01/01	8.9	8.5	8.0	7.7	7.4	7.1														
04/01/01	8.9	7.7	7.0	6.7	6.5	6.4														
05/01/01	8.3	7.7	7.4	7.2	6.9	6.5														
06/01/01	8.2	7.8	7.6	7.6	7.6	7.5														
07/01/01	7.7	7.3	7.0	6.8	6.6	6.0														
08/01/01	8.3	8.0	7.6	7.2	6.8	5.2														
09/01/01	7.3	6.6	5.9	5.4	5.6	5.9														
10/01/01	7.8	7.8	7.7	7.5	7.3	7.3	7.1													
11/01/01	7.6	7.6	7.7	7.6	7.6	7.5														
12/01/01	8.2	8.2	8.2	8.1	8.0	8.0														
01/01/02																				
02/01/02	8.1	8.1	7.9	7.8	7.7	7.6														
03/01/02	9.2	8.3	8.8	8.8	8.8	8.5														
04/01/02	9.1	8.3	8.0	7.6	7.2	6.9														
05/01/02	8.2	7.8	7.5	7.4	7.2															
06/01/02																				
07/16/02																				
08/12/02																				
09/03/02																				
09/16/02																				
10/02/02																				
10/16/02																				
10/30/02																				
11/13/02																				
11/25/02																				

Date	R9-5	R9-10	R9-15	R9-20	R9-25	R9-30	R9-35	R9-40	R9-45	R9-4.6	R9-9.1	R9-13_7	R9-18.3	R9-22.9	R9-27.4	R9-32.0	R9-36.6	R9-41.1	R9-45.7	R9-50.3
12/17/02																				
02/11/03																				
03/11/03																				
04/15/03																				
05/13/03																				
06/03/03																				
06/10/03																				
06/24/03																				
07/07/03																				
07/14/03																				
07/21/03																				
07/28/03																				
08/04/03																				
08/11/03																				
08/18/03																				
08/25/03																				
09/02/03																				
09/08/03																				
09/15/03																				
09/22/03																				
09/29/03																				
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05/18/04																				
06/21/04																				
07/20/04																				
08/17/04																				
09/14/04																				
10/12/04																				
11/09/04																				
12/07/04																				

TABLE 20.1. TEMPERATURE (^{O}C) FOR STREAMS AND CANALS FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
08/01/99	31.1	28.6	15.9	18.1			28.7			30.0							30.0					
09/01/99		26.6	18.0	17.0			27.5	27.1	24.7	27.5		26.6			27.0	28.0		28.0				
10/01/99	24.1	23.8	23.5	23.6		21.5	23.0			25.4		22.5	21.0	21.2	25.0		24.3		21.8			
11/01/99		19.9		18.6			18.0		20.3	20.4	18.3	19.0	17.3	17.2	18.7		19.0					
12/01/99	12.5	14.0	12.8	10.1		8.5	12.7	13.0	14.6	15.5	9.1	1.7	10.2	10.3	4.2		9.6					
01/01/00	11.0	12.3	11.0	12.0		8.0	9.9	11.0	12.5	12.8	9.3	9.5	9.3						10.2	12.4		
02/01/00	12.2	12.1	15.1	14.3		14.0	12.4	12.5	14.6	14.5	14.5	13.7	13.1	13.7	14.4		15.2		13.9			
03/01/00	17.5	14.8	17.5	17.3		16.4	14.8	12.6	13.3	16.7	18.0	16.8	17.9	17.5	19.1		20.3		17.1			
04/01/00	21.8	19.0	30.1	21.2		20.7	19.9	14.9	18.7	20.6	16.0	21.1	17.9	19.4	18.3		21.8		18.6			
05/01/00	23.0	21.3	23.8	22.0		21.5	22.3	15.6	17.8	23.8	18.0	22.2	18.5	20.7	20.0	21.5	21.8	21.6	18.9	20.0		
06/01/00	27.3	26.5	14.0	17.8		25.6	26.3	18.1	19.2	26.9	21.6	17.0	20.0	19.3	24.0		24.9		19.4			
07/01/00	29.3	29.6	14.6	15.4		28.6	28.2	18.0	25.9	29.1	23.6	15.8	22.5	22.8	22.9		23.6		21.3			
08/01/00	31.2	29.8	17.9	19.7		30.0	29.0	19.2	28.7	30.0	24.8	20.0	25.2	23.0	25.6		26.6		22.3			
09/01/00	28.2	28.5	25.8	25.3		26.4	26.7	18.0	27.9	28.1	23.8	25.3	26.8	25.4	24.9		27.7		25.2			
10/01/00	21.5	24.1	23.9	21.7		18.7	22.3	18.4	23.1	23.9	21.9	21.8	20.7	21.3	22.0		21.9		22.0			22.3
11/01/00	15.0	16.4	15.3	15.0		11.3	17.1	16.6	18.2	18.6	16.2	13.6	14.4	14.4	10.7	14.2	14.1		15.6			
12/01/00	13.1	13.5	13.0	12.2		11.0	13.2	13.0	14.7	15.4	10.8	12.3	11.2	11.4	11.5	11.4	11.1	11.9				11.3
01/01/01	11.0	11.2	11.0	10.1		9.9	10.3	10.2	12.4	13.4	12.8	13.1	16.3	10.0								
02/01/01	8.4	10.8	11.0	11.4		10.6	10.0	10.4	11.9	13.0	12.7	11.3	10.6		11.0		12.2		11.9	10.9		12.0
03/01/01	14.9	13.0	14.9	15.6		11.9	13.3	12.1	15.3	14.8	16.1	14.2	16.1	15.3	16.8		17.9	17.8	15.3	15.5		
04/01/01	20.0	19.9	22.2	19.7		17.0	18.7	13.5	18.3	20.8	22.4	19.9	16.6	16.7	19.7	24.4	20.9		19.0	22.0		20.0
05/01/01		24.4	23.6	23.5		24.2	23.6	14.7	23.1	25.0	18.5	23.0	17.6	17.0	21.6		23.9		18.9			22.7
06/01/01	26.2	25.9	13.4	21.1		24.8	26.6	15.8	20.8	25.8	21.8	20.8	20.4	20.6	22.4	25.5	22.7		20.1	23.0		22.2
07/01/01	29.3	28.0	13.2	17.3		26.8	27.7	16.7		27.5	23.3	18.7	22.8	21.3	25.3		27.2		22.1			26.0
08/01/01	30.8		14.4	18.6		28.0		16.9	22.5	29.6	24.4	18.5	23.7	22.4	26.4	25.8	27.8	21.0	23.6	25.1	26.8	27.1
09/01/01	28.0	27.5	15.2	17.8		24.8	27.2	16.3	22.4	27.9	24.6	19.2	23.7	24.1	27.7	28.3	26.7		22.6	26.0		26.4
10/01/01	18.2	22.6	21.0	18.8		18.9	22.6	16.2	24.0	23.0	20.4	18.8	17.3	17.5	22.0		20.0		18.2			20.9
11/01/01		20.4					20.0			20.7												
12/01/01	12.6	14.6	12.6	12.8		8.4	14.3	13.9		15.5	9.4	8.6	11.5	11.9	11.3		13.3		10.9			11.1
01/01/02	11.1	11.8	11.2	10.9		9.1	10.7	9.4	12.2	12.8	12.3	11.1	10.0	10.4					12.8			
02/01/02	11.2	11.7	11.4	11.1		9.5	9.6	9.8		12.2	10.9	10.6	11.9	11.6	12.8		13.1		12.5	15.0		13.9
03/01/02	14.5	13.0	13.8	14.1		13.8	12.5	10.6	16.7	14.9	13.9	13.7	15.0	14.2	15.5		16.5	17.5	21.0			16.4
04/01/02	20.5	18.7	19.7	20.1		19.6	19.4	13.0	16.8	20.8	14.0	20.1	16.4	17.3	19.4	23.3	22.1		18.5	22.0		20.6
05/01/02		21.8	22.0	23.1		23.5	22.4	14.0	23.4	22.6	16.9	22.5	17.4	18.7	22.0	24.0	22.2	24.2	20.3	23.0		21.6
06/01/02		26.2	17.5	22.0		26.7	26.2	27.8		21.5	19.6	22.5	18.7	19.0	23.6		24.3		19.8			24.0
07/01/02												19.0	20.0		24.2		24.6					24.8
07/08/02												16.4	20.7		24.9		25.5					25.0
07/16/02		28.4					28.1			27.8		19.5	22.0		25.5		26.8					26.1
07/22/02												18.9	22.7		22.8		25.1					23.6
07/29/02												19.7	23.8		23.7		26.8					25.0
08/05/02												17.6	22.1		22.8		23.8					23.0
08/12/02		28.0					28.8			28.6		19.6	24.1		25.0		26.0					25.4
08/19/02												21.7	22.5		25.2		25.6					25.8
08/26/02												20.7	23.8		23.0		25.0					23.4

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
09/03/02		27.5					28.1			30.8		22.7	24.7		26.2		27.4					26.8
09/10/02													22.6		23.3		26.0					23.5
09/16/02		26.4					25.9			26.3			24.3		26.1		28.0					27.5
09/23/02													24.1		23.1		25.6					24.2
09/30/02													23.8		21.7		23.0					22.5
10/02/02		24.1					24.0			24.1												
10/07/02													21.7		20.2		22.3					21.3
10/14/02												20.3	21.0		21.1		23.0					22.2
10/16/02		22.4					22.9			24.4												
10/21/02												19.1	20.9		20.3		21.9					21.0
10/28/02												18.7	17.7		19.8		19.6					19.7
10/30/02		20.4					20.4			21.9												
11/04/02												18.9	18.0		19.2		19.3					18.8
11/12/02												17.1	16.4		18.2		19.0					17.5
11/13/02		18.2					15.0			17.6												
11/18/02												15.8	14.9		16.0		15.9					16.3
11/25/02		16.0					15.8			18.2		14.0	13.5		14.8		15.4					14.2
12/09/02												14.0	13.5		14.8		15.4					14.2
12/16/02												13.0	13.1		13.8		13.4					13.5
12/17/02		13.1					13.5			15.9												
01/14/03											13.8	13.6										
02/11/03		13.5					13.2			14.6	16.4		16.5		17.8		15.6					
03/11/03		15.8					14.7			15.5	18.1		18.1		21.0		21.5					
04/15/03		17.9					16.5			17.8	21.6		16.4	17.8	19.0		20.0					19.6
05/13/03		19.7	23.4				21.1			23.7	23.7	21.6	19.7		22.8		24.6					
06/03/03		25.0	28.0				26.6			27.0	17.8	26.0	21.3		26.9		27.2					27.0
06/10/03												24.3	20.2		25.0		25.3					25.0
06/24/03		24.7	15.0				25.5			26.2	24.1	23.2	23.2		23.1		24.6					23.6
07/07/03			14.8								23.4	18.8	24.2		25.2		25.9					25.4
07/14/03		29.1					29.3			30.1		19.1	25.5		26.1		26.9					26.5
07/21/03			16.3								24.0	20.1	25.2		26.5		27.5					26.8
07/28/03			15.0								24.0	19.7	26.0		24.8		25.0					24.8
08/04/03		29.0	15.7				29.1			30.9	24.2	20.1	27.2		26.1		28.6					27.0
08/11/03			15.9								25.3	16.7	26.1		24.8		26.5					25.5
08/18/03			16.3								25.2	16.6	25.9		25.6		28.3					27.9
08/25/03		29.3	18.6				29.9			30.1	26.4	23.1	28.5		27.6		29.2					28.7
09/02/03																						
09/08/03		28.4	17.4				28.0			28.4	26.2	24.4	27.3		27.0		27.9					27.0
09/15/03												20.5	25.3		24.2		26.2					25.2
09/22/03		26.0	18.6				27.2			25.9	25.1	19.1	24.6		22.1		24.4					23.3
09/29/03											25.3	20.7	26.5		25.1		25.4					25.5
10/06/03		24.5					25.8			25.0		22.8	22.5		24.2							25.0
10/13/03			23.7								25.0	24.3	24.2		27.0		27.5					26.2
10/20/03			24.8								22.0	24.2	20.4		23.9		24.8					24.0
10/28/03		21.9	21.6				22.2			24.6		20.8	17.6		20.1		20.2					20.6

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20	R21
11/03/03											17.9	19.8	18.9		18.6		19.3					19.6
11/10/03			18.3								15.1	18.0	17.1		17.2		18.1					18.2
11/17/03		18.2	17.8				18.6			21.0	15.4	17.5	16.1		18.0		18.2					17.8
12/01/03			14.3										12.0		14.0							14.2
12/15/03											10.5		12.4		13.4		12.6					
01/20/04										13.2		12.2	13.3		14.2		15.3					
02/17/04			11.8							13.3		11.0	12.0		14.5		14.0					
03/16/04			17.6				17.7			18.1		17.6	19.3		22.0		21.0					21.5
04/13/04			21.8				19.5			20.5		19.5	20.2		22.7		21.3					
05/18/04			14.8				22.7			24.3	15.7	21.7	18.5		23.3		24.5					
06/21/04							25.9			25.6	22.1	21.5	21.2		25.5		26.1		21.7			25.2
07/06/04			13.6								22.3	22.5	22.0		25.4		25.8		23.0			
07/20/04							28.6			28.5	23.1	19.6	24.2		25.8		26.4		22.7			
08/03/04											23.7	16.8	23.8		26.5		26.8		22.1			26.6
08/17/04			14.9				27.9			28.1	24.3	17.3	26.5		25.6		27.8		22.3			26.0
08/31/04			17.4								23.8	21.5	20.8		23.0		25.3		21.7			24.4
09/14/04			19.2				27.2			27.0	24.2	23.3	25.3		26.2		27.6		24.1			26.8
09/28/04			22.2								23.4	23.0	23.9		25.5		25.7		23.0			25.6
10/12/04			23.2				23.1			24.3	24.4	23.3	22.2		22.9		22.9					23.5
10/26/04			21.3								25.4	21.7	21.5		22.2		20.4					20.4
11/09/04			18.2				18.9			20.1	18.6	18.2	18.0		17.9		17.1					17.1
11/23/04			15.6								14.7	16.1	15.0		14.7		15.0					14.7
12/07/04			12.2								12.0		12.5		12.2		11.2					10.5

TABLE 20.2. (CONTINUED) TEMPERATURE (^{O}C) FOR STREAMS AND CANALS FROM AUGUST 1999 TO DECEMBER 2004.

Date	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																						
09/01/99																						
10/01/99																						
11/01/99																						
12/01/99																						
01/01/00																						
02/01/00																						
03/01/00																						
04/01/00																						
05/01/00																						
06/01/00																						
07/01/00																						
08/01/00																						
09/01/00																						
10/01/00	21.8																					
11/01/00																						
12/01/00																						
01/01/01																						
02/01/01	12.2	12.4																				
03/01/01	17.9	19.3	24.7																			
04/01/01	19.8		21.3																			
05/01/01		29.6																				
06/01/01	22.0	30.4	23.3																			
07/01/01	24.8	34.0	26.4																			
08/01/01		34.2	28.3																			
09/01/01	26.1	30.3	26.8																			
10/01/01	19.7	20.4																				
11/01/01																						
12/01/01	11.7	13.8																				
01/01/02		13.8																				
02/01/02	12.5	15.8	13.8																			
03/01/02	14.5	22.5	16.7																			
04/01/02	19.1	25.8																				
05/01/02	21.6	26.1	24.2																			
06/01/02	22.6	28.0	24.3																			
07/01/02	23.5			24.4	24.9						20.2				21.6		23.2					
07/08/02	23.7			25.0	25.3					22.7	19.9				22.7		23.3					
07/16/02	24.7			26.2	26.2					22.8	22.2				24.1		24.5					
07/22/02	22.3			23.0	24.8					22.6	21.5				22.4		2.3					
07/29/02	22.7			24.4	26.0					22.7	21.8				22.7		22.8					
08/05/02	22.1			22.8	23.7					20.5	20.9				21.7		22.1					
08/12/02	24.5			25.6	25.7					22.2	23.0				24.3		24.4					
08/19/02	24.8			25.5	25.3					23.4	22.8				24.0		24.5					

Date	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/26/02	22.1			23.3	24.2					21.4	22.3				22.4		22.0					
09/03/02	25.5			26.7	27.2					23.7	24.4				25.4		25.3					
09/10/02	22.7			23.4	24.1					22.0	23.1				24.0		22.9					
09/16/02	24.8			26.5	27.9					24.2	24.3				24.5		24.5					
09/23/02	21.8			23.5	25.0					22.5	21.4				21.6		22.5					
09/30/02	20.8			22.0	22.8						20.8				21.0		20.5					
10/02/02																						
10/07/02	19.3			20.5	21.7						20.0				20.4		19.4					
10/14/02	20.3			21.6	22.3						20.6				19.8		19.9					
10/16/02																						
10/21/02	19.5			20.7	21.4					19.8	19.9				19.7		19.1					
10/28/02	18.2			19.9	19.1						19.0				19.3		18.5					
10/30/02																						
11/04/02	18.7			19.3	19.2					18.3	18.6				17.9		17.7					
11/12/02	16.8			18.4	17.3					17.1	16.9				16.2		16.2					
11/13/02																						
11/18/02	15.0			16.5	15.7					14.2	15.4				15.3		14.6					
11/25/02	14.3			15.2	13.9						13.5				13.2		13.5					
12/09/02	14.3			15.2	13.9						13.5				13.2		13.5					
12/16/02	13.5			13.8	13.8						12.9				12.2		12.8					
12/17/02																						
01/14/03		14.6								16.9												
02/11/03	17.1	17.8								18.4	17.9											
03/11/03	20.6	17.7								20.6					19.1							
04/15/03	17.9	16.8								17.8	18.5				18.4			16.7				
05/13/03	21.8									21.2	21.5				22.6			20.2				
06/03/03	25.9	25.7								23.5	26.0				24.7							
06/10/03	24.5									23.5	23.2				24.3							
06/24/03	22.7									22.8	23.7				25.6			23.0				
07/07/03	24.1	24.3								24.4	22.3				23.9			24.1				
07/14/03	24.8	25.3								25.3	22.7				24.6			25.2				
07/21/03	25.7	25.4								25.5	23.3				24.7			25.0				
07/28/03	23.9	26.5								25.2	24.2				25.6			25.7				
08/04/03	24.6	26.0								25.1	22.2				23.7			26.8				
08/11/03	23.9	25.3				30.4				24.9	22.8				23.9			25.6				
08/18/03	24.4									25.0	23.4				25.0			25.6				
08/25/03	26.0	29.5				31.4				25.7	25.8				26.3			27.9				
09/02/03																						
09/08/03	26.2	26.9				29.8				24.9	26.1				26.5			26.3				
09/15/03	22.9					29.4				23.2	23.2				23.0			24.4				
09/22/03	20.8					26.7				21.3	22.8				20.8			23.4				
09/29/03	23.2	25.3				30.3												22.7				
10/06/03	23.1					26.1				22.9	22.9				22.7			22.5				
10/13/03	24.9					27.4				23.9	25.3				24.8			24.2				
10/20/03	22.5					29.2				21.4	22.9				23.1			21.2				

Date	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
10/28/03	18.6					22.3				19.4	19.4				19.0			17.9				
11/03/03	17.9					19.3				19.9	19.1				18.5			19.2				
11/10/03	16.4					19.2				17.7	17.6				17.1			17.7				
11/17/03	18.0					22.2									16.4							
12/01/03	12.7					22.1									12.8							
12/15/03	13.2					16.7									11.5							
01/20/04	13.3									16.5					13.2							
02/17/04	13.9									14.9					11.1			12.0				
03/16/04	21.1					25.5									18.1							
04/13/04	21.1					24.4									19.6							
05/18/04	22.2					25.6				21.1					22.4			19.7				
06/21/04	24.3					27.5				23.3	22.0				23.8			21.1				
07/06/04	24.8					28.9				22.9			23.3		24.7			22.2				
07/20/04	25.0					29.4				24.3			22.8		24.4			22.6				
08/03/04						29.3				23.5	22.7		24.4		24.1			23.5	25.1		26.1	
08/17/04	24.1									22.3	23.4		23.7		25.8			21.9				
08/31/04	22.7					28.0				22.8	21.9		23.5		23.1			20.8				
09/14/04	25.3					28.5				23.7	24.9		25.6		25.3			24.2				
09/28/04	24.0					28.9				23.6	24.0		24.2		24.1			23.3				
10/12/04	22.0	25.0				27.0				22.7	23.5		23.5		22.7			22.9			24.4	
10/26/04	21.3	24.2				23.2				22.2	22.1		21.8		23.1			21.4			21.0	
11/09/04	17.6	20.0				22.2				21.0	18.5		18.1		16.7			18.1	21.1		18.1	
11/23/04	14.9	16.3				18.2				14.6	15.9		15.2		14.4				19.8		16.4	
12/07/04	12.3	17.0				12.8					13.2		11.1		13.3			12.9	18.2		11.2	

TABLE 21. DISSOLVED OXYGEN (MG/L) FOR STREAMS AND CANALS FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R4	R4-Dup	R6A	R8	R9A	R10	R11	R12	R13	R14	R16	R18	R19	R21	R22	R25	R26
08/01/99		6.8			7.8		7.6												
09/01/99		9.8			6.5		7.9												
10/01/99	7.9	8.6	7.7		7.0		6.8			7.7	6.8	10.4	24.3	7.2					
11/01/99		9.0	10.0		7.6	9.2	8.5		11.5	9.8	9.9	10.4	10.6						
12/01/99		9.2	10.2		8.6	7.5	6.5	9.3	10.8	9.3	9.0	10.4	11.6						
01/01/00		9.0			10.4	10.7	10.3	11.9	10.6	10.2				10.9	11.5				
02/01/00	10.0	11.5	11.2		11.3	9.4	10.2	8.1	10.5	9.0	9.2	8.9	10.2	8.8					
03/01/00		10.6	11.0		11.5	7.8	10.4	8.1	10.1	7.9	9.3	9.5	9.4	9.4					
04/01/00		11.1			9.9	9.3	9.4	8.2	7.6	8.1	8.4	11.3	9.6	9.7					
05/01/00		9.9			9.7	7.2	9.0	8.8	9.4	9.0	9.1	11.6	10.5	10.0					
06/01/00		7.2			15.3	6.4	7.8	7.3	10.4	8.2	9.4	9.3	8.2	9.0					
07/01/00		7.0	7.1		7.5	7.0	8.4	6.1	10.4	6.6	6.6	10.4	8.4	9.1					
08/01/00		7.6			7.7	8.2	9.2	7.2	11.7	7.2	9.7	8.1	7.9	7.7					
09/01/00		7.5	7.7		8.0	5.7	6.8	7.5	8.4	7.5	9.3	8.0	7.4	7.2					
10/01/00		6.7	8.1		5.7	5.5	5.9	6.9	8.8	7.3	8.3	7.2	7.7	8.0		7.6	8.8		
11/01/00		8.0	10.1		7.7	6.2	5.8	8.5	8.6	8.5	9.0	13.6	10.0	9.1			12.8		
12/01/00		9.1	9.8		8.1	7.7	6.8	8.0	9.7	9.0	8.8	10.1	10.3						
01/01/01		9.7	10.0		9.3	8.1	8.0	9.6	7.9	9.4	8.6								
02/01/01		10.4	10.1		10.3	10.6	10.0	10.1	13.5	12.4		10.6	10.3	9.5				10.8	
03/01/01		10.5	9.5		11.7	8.8	10.6	8.1	10.6	8.6	9.5	8.9	8.2	8.8	7.9		8.1	8.4	5.7
04/01/01		9.9	9.5		9.3		9.0	6.3	10.2	9.4	9.8	8.6	8.1	7.9		6.5	9.0		
05/01/01		10.1			9.8	9.7	8.6	9.8	8.9	8.8	8.7	8.6	8.9	9.0				9.0	
06/01/01		8.3	6.6		9.0	6.9	8.5		9.5	8.1	8.0	7.1	7.2	6.6		7.3	6.9	8.4	7.5
07/01/01		6.3	8.0		6.1		5.0	4.5	5.2	4.3	5.2	8.9	7.9	8.8		8.3	8.7		8.7
08/01/01			5.8			5.4	7.2	9.1	9.7	7.0	8.4	7.6	7.5	7.6		7.5		10.5	
09/01/01		6.2	4.5		6.8				10.9			6.4	6.5	6.3					
10/01/01			6.3			8.2	4.3	6.1	8.6	7.2	7.4	8.8	9.5	8.2		7.7	8.5	8.5	
11/01/01		8.3			8.2		7.4												
12/01/01		7.5			9.0		9.2	9.7	10.2	9.8	9.9			1.4					
01/01/02		5.2	11.7		11.4	0.4	0.3	0.3	0.3	0.3	0.3			10.4				0.2	
02/01/02		10.5	11.1		9.9		9.9	9.8	10.9	9.6	10.5	10.3	10.2	9.7		9.9	10.9	11.1	10.3
03/01/02		9.7	9.6		10.2	12.0	11.1	8.8	10.5	9.6	11.7	9.0	7.9	7.3		8.1	9.4	9.8	8.4
04/01/02		10.6	9.9		8.4	9.7	11.2	7.8	9.3	7.2	8.7	10.2	8.6	9.8		9.6	9.0	10.6	
05/01/02		7.7	8.6		14.9			6.9	9.2	7.8	9.0	8.5	8.5	8.6		8.9	8.7	10.0	
06/01/02		7.8	8.3		7.6			8.2		8.4	9.6	10.8	10.0	10.0		10.0	10.8		7.3
07/01/02																			
07/08/02																			
07/16/02		7.5			8.9		7.8												
07/22/02																			
07/29/02																			
08/05/02																			
08/12/02		7.2			8.2		8.1												
08/19/02																			
08/26/02																			

Date	R1	R2A	R4	R4-Dup	R6A	R8	R9A	R10	R11	R12	R13	R14	R16	R18	R19	R21	R22	R25	R26
09/03/02		7.5			7.3		7.3												
09/10/02																			
09/16/02		7.7			6.2		6.3												
09/23/02																			
09/30/02																			
10/02/02		6.4			5.9		4.0												
10/07/02																			
10/14/02																			
10/16/02		7.5			6.8		5.7												
10/21/02																			
10/28/02																			
10/30/02		7.0			6.6		5.7												
11/04/02																			
11/12/02																			
11/13/02		8.0			9.0		8.5												
11/18/02																			
11/25/02		8.8			8.2		7.1												
12/09/02																			
12/16/02										9.1		9.2	9.1			9.2	9.2		
12/17/02		9.2			9.0		8.3												
01/14/03																			
02/11/03		10.5			11.2		10.2												
03/11/03		10.8			13.0		10.7												
04/15/03		9.3			8.4		9.7												
05/13/03		9.7			8.7		9.4												
06/03/03		9.3			9.0		10.2												
06/10/03																			
06/24/03		9.0			6.9		9.2												
07/07/03																			
07/14/03		7.3			7.6		9.6												
07/21/03																			
07/28/03																			
08/04/03		7.3			7.6		8.1												
08/11/03																			
08/18/03																			
08/25/03		7.1			8.8		7.6												
09/02/03																			
09/08/03		6.7			6.2		5.5												
09/15/03																			
09/22/03		6.2			5.7		7.2												
09/29/03																			
10/06/03		4.9			3.8		7.0												
10/13/03																			
10/20/03																			
10/28/03		6.7			5.3		6.5												

Date	R1	R2A	R4	R4-Dup	R6A	R8	R9A	R10	R11	R12	R13	R14	R16	R18	R19	R21	R22	R25	R26
11/03/03																			
11/10/03																			
11/17/03		7.7			5.6		6.5												
12/01/03																			
12/15/03																			
01/20/04																			
02/17/04							8.3												
03/16/04					8.6		9.6												
04/13/04					14.0		10.3												
05/18/04					9.8		9.6												
06/21/04					9.7		9.7												
07/20/04					7.6		9.3												
08/17/04					6.9		8.1												
09/14/04					7.9		8.9												
10/12/04					6.4		5.7												
11/09/04					6.9		5.8												
12/07/04																			

TABLE 22.1. pH FOR STREAMS AND CANALS FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R21	R22
08/01/99																						
09/01/99																						
10/01/99	8.3		8.4	8.4		8.0						9.0	8.1	8.1	8.6		8.4		8.3			
11/01/99		8.2		8.4			8.5		8.1	7.7	7.4	8.3	8.4	8.5	8.7		8.7					
12/01/99		8.2		8.3			8.3		7.7	7.9	8.0	8.6	8.6	8.6	8.7	7.8	8.7	7.8				
01/01/00		8.2		7.8			8.3		8.0	7.7	8.1	8.3	8.4						8.3			
02/01/00		8.0		8.2			8.5		7.8	8.2	8.0	8.2		8.4	8.1		8.2		8.0			
03/01/00	8.6	8.2	8.6	8.7		8.7	8.7	8.7	8.4	8.3	8.1	8.5	8.4	8.5	8.6		8.7		8.5			
04/01/00	8.3	8.3	8.3	8.4		8.2	8.5	8.3	7.9	7.6	7.7	8.4	8.0	8.2	8.3		8.2		8.3			
05/01/00	8.5	8.4	8.4			8.3	8.4	8.4	7.8	8.4	8.1	8.7	8.2	8.5	8.5	7.6	8.4	7.6	8.3	7.8		
06/01/00	8.3	8.1	7.8	8.1		8.1	8.4	7.8	7.4	8.7	7.9	8.2	7.7	8.0	8.4		8.4		8.1			
07/01/00	8.4	8.8	7.6	7.9		8.2	8.5	7.8	7.5	8.6	7.9	8.3	8.0	8.0	8.4		8.5		8.1			
08/01/00	8.3	8.2	7.5	7.9		8.5	8.6	8.0	7.7	8.4	7.7	8.1	7.7	7.9	8.4		8.3		8.1			
09/01/00	7.8	8.4	7.8	8.2		8.3	8.5	7.9	7.6	8.3	8.0	8.2	8.6	8.4	8.3		8.4		8.4			
10/01/00	8.6	7.9	8.5	8.5		8.6	8.4	8.2	7.4	7.7	8.1	8.6	8.4	8.5	8.5		8.3		8.4		8.6	8.3
11/01/00	8.6	8.1	8.6	8.6		8.3	8.6	8.6	7.8	7.9	8.2	8.6	8.6	8.7	8.6	7.4	8.7	7.6	8.4			8.5
12/01/00	8.6	8.2	8.6	8.6		8.3	8.3	8.6	7.6	7.7	8.3	8.6	8.5	8.6	8.9	6.7	8.7	8.2			8.3	
01/01/01			8.5	8.5		8.9		8.5						8.6								
02/01/01	11.1	8.5	8.4	8.5		8.4	8.7	8.5	8.2	8.4	8.3	8.3	8.4		8.5		8.7		8.5	8.0	8.6	8.6
03/01/01	8.4	8.8	8.4	8.4		8.2	8.8	8.4	8.3	9.0	8.1	8.4	8.6	8.5	9.4		8.4	7.8	8.2	8.2		8.5
04/01/01	8.5	8.4	8.5	8.5		9.4	8.4	8.3	7.9	8.5	8.0	8.6	8.6	8.6	8.0	7.2	8.5		8.5	7.8	8.5	8.5
05/01/01		8.4	8.3	8.5		8.2	8.8	8.4	7.4	8.3	8.1	8.3	7.9	8.1	8.4		8.5		8.2		8.2	
06/01/01	8.4	8.4	7.9	8.3		8.4	8.8	8.4	7.2	8.6	8.2	8.3	7.9	8.1	8.4	7.7	8.2		8.2	7.7	8.3	8.4
07/01/01	8.0	8.2	7.6			7.9	9.0	7.8		8.3	7.3	7.4	6.8	7.1								
08/01/01	8.2		7.4	7.7		8.2		8.1	7.9	8.8	8.0	8.0	7.8	7.9	8.2	7.0	8.1	7.6	7.9	7.7	8.0	
09/01/01	8.2	7.6	7.3	7.5		8.3	8.4	8.0	7.5	8.0	8.0	8.1	7.8	7.8	8.1	7.7	7.3		7.8	7.6	7.6	8.2
10/01/01		8.0		7.6		6.8	8.0		8.1	7.9	7.8	8.1	805.0	8.1	7.7		8.2		7.9	7.9	8.0	8.1
11/01/01		8.2					8.3			7.5												
12/01/01	8.5	7.3	8.5	8.1		8.4	7.6	8.3		8.1	7.9	8.6	8.4	8.4	8.8		8.4		8.5		8.5	8.7
01/01/02	8.5	8.6	8.5	8.1		8.5	8.5	8.4			7.9	8.4	8.3	8.3					8.1			
02/01/02	7.4	8.2	6.7	8.2		7.8	8.4	7.1		8.2	7.8	8.3	8.3	8.3	8.3		8.5		8.0	8.3	8.4	8.2
03/01/02	8.4	8.1	8.4	8.3		8.2	8.5	7.3	9.2	8.9	8.0	8.4	8.3	8.4	8.3		8.1	7.6	7.9		8.3	8.2
04/01/02	8.4	8.4	7.9	8.6		8.4	8.0	7.2	8.3	8.9	7.3	8.4	7.3	7.3	8.6	7.8	8.6		8.1	7.8	8.5	8.5
05/01/02		8.1	8.2	8.6		8.4	8.4	7.3	8.8	8.9	8.0	8.6	8.2	18.7	8.5	7.7	8.5	7.6	8.3		8.4	8.4
06/01/02		8.6	7.4	8.4		8.0	8.7				8.2	8.5	7.8	8.0	8.4		8.4		8.1		8.3	8.3
07/01/02												7.2	7.6		8.5		8.6				8.5	8.5
07/08/02												8.4	8.3		8.6						8.6	8.5
07/16/02												8.3	8.4		8.5		8.7				8.6	8.5
07/22/02												7.3	8.4		8.3		8.8				8.6	8.3
07/29/02													8.4		8.4		8.7				8.7	8.4
08/05/02												8.3	8.1		8.5		8.6				8.5	8.5
08/12/02												8.4	8.2		8.6		8.6				8.5	8.6
08/19/02												8.5	8.0		8.6		8.6				8.5	8.6
08/26/02												8.5	8.5		8.6		8.6				8.6	8.6

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R21	R22
09/03/02												8.6	8.2		8.6		8.6				8.6	8.6
09/10/02													8.0		8.8		8.5				8.7	8.5
09/16/02													8.5		8.6		8.6				8.7	8.5
09/23/02													8.7		8.6		8.7				8.7	8.4
09/30/02													8.6		8.5		8.7				8.8	8.4
10/02/02																						
10/07/02													8.7		8.6		8.6				8.8	8.5
10/14/02												8.5	8.5		8.6		8.8				8.8	8.5
10/16/02																						
10/21/02												8.4	8.7		8.8		8.6				9.0	8.6
10/28/02												8.4	8.5		8.9		8.7				8.7	8.6
10/30/02																						
11/04/02												8.6	8.7		9.1		9.0				8.8	8.7
11/12/02												8.6	8.6		9.1		8.9				8.8	8.8
11/13/02																						
11/18/02												6.6	6.6		6.5		6.5				6.5	6.4
11/25/02												9.1	9.1		9.2		9.1				9.1	9.2
12/09/02												9.1	9.1		9.2		9.1				9.1	9.2
12/16/02												9.1										
12/17/02																						
01/14/03											8.8	9.3										
02/11/03											8.6		9.5		9.2		9.2					9.2
03/11/03											8.7		9.3		9.1		9.1					9.2
04/15/03											8.6		9.2	9.2	9.3		9.2				9.3	9.2
05/13/03			9.1								8.6	9.1	9.3		9.1		9.1					9.1
06/03/03			9.1								8.8	9.0	8.8		8.9		8.9				9.0	9.0
06/10/03												9.0										
06/24/03			7.9								8.3	8.0	8.4		8.5		8.5				8.5	8.4
07/07/03			7.5								7.7	8.1	7.9		8.4		8.4				8.4	8.4
07/14/03												8.0	8.0		8.4	8.3					8.4	8.4
07/21/03			7.9								7.5	8.1	8.0		8.5		8.5				8.4	8.5
07/28/03			7.7								7.5	8.0	7.9		8.3		8.3				8.3	8.3
08/04/03			7.7								7.6	8.1	8.3		8.4		8.4				8.3	8.3
08/11/03			7.8								7.7	8.0	8.0		8.4		7.8				8.4	8.4
08/18/03			8.0								7.9	8.2	8.0		8.3		8.3				8.4	8.2
08/25/03			8.0								7.9	8.2	8.2		8.3		8.4				8.4	8.2
09/02/03																						
09/08/03			7.7								7.8	8.0	8.0		8.2		8.3				8.2	8.2
09/15/03												8.0	8.1		8.3		8.3				8.3	8.1
09/22/03			7.9								7.2	8.0	8.3		8.3		8.4				8.4	8.1
09/29/03											7.7	8.0	8.4		8.5		8.2				8.5	8.2
10/06/03												8.1	8.3		8.4						8.4	8.1
10/13/03			8.7								7.9	8.3	8.4		8.6		8.5				8.3	8.4
10/20/03			8.2								7.5	8.1	8.4		8.5		8.5				8.5	8.3
10/28/03			8.5									8.2	8.4		8.6		8.5				8.7	8.4

Date	R1	R2A	R3	R4	R4-Dup	R5	R6A	R7	R8	R9A	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R21	R22
11/03/03											7.7	8.3	8.7		8.5		8.6				8.6	8.4
11/10/03			8.6								8.4	8.6	8.8		8.7		8.9				8.8	8.6
11/17/03			8.6								8.9	8.7	8.8		8.9		8.8				8.7	8.7
12/01/03			8.5										8.3		8.9						8.8	8.6
12/15/03											7.4		8.5		8.9		8.7					8.8
01/20/04												8.5	8.3		8.4		8.3					8.4
02/17/04			8.4									7.4	8.3		8.4		8.3					8.5
03/16/04			8.5									8.9	8.5		8.8		8.3				8.6	8.6
04/13/04			8.2									8.3	8.1		8.5		8.1					8.2
05/18/04			8.1								7.0	8.2	8.1		8.2		8.3					8.2
06/21/04											7.4	8.1	8.0		8.3		8.3		7.2		8.3	8.3
07/06/04			8.2								7.9	8.2	8.1		8.5		8.5		7.8			8.5
07/20/04											7.6	7.8	7.9		8.3		8.2		7.4			8.2
08/03/04											7.9	8.1	7.9		8.5		8.4		7.9		8.5	
08/17/04			7.8								7.7	7.9	8.2		8.4		8.5		7.9		8.4	8.4
08/31/04			7.9								7.7	8.0	7.9		8.3		7.5		8.0		8.4	8.1
09/14/04			7.9								7.7	8.1	8.0		8.2		7.2		7.9		8.3	8.2
09/28/04			7.6								7.6	7.8	8.0		8.0		7.2		7.8		8.1	7.8
10/12/04			8.0								8.2	8.3	8.2		8.2		7.2				8.2	8.1
10/26/04			7.9								8.4	8.3	8.5		8.3		7.7				7.7	8.1
11/09/04			8.4								8.0	8.3	8.3		8.6		8.4				8.3	8.3
11/23/04			8.1								8.0	8.2	8.2		8.3		8.3				8.1	8.3
12/07/04			8.2								8.3		8.3		8.4		8.2				8.2	8.5

TABLE 22.2. (CONTINUED) pH FOR STREAMS AND CANALS FROM AUGUST 1999 TO DECEMBER 2004.

Date	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																					
09/01/99																					
10/01/99																					
11/01/99																					
12/01/99																					
01/01/00																					
02/01/00																					
03/01/00																					
04/01/00																					
05/01/00																					
06/01/00																					
07/01/00																					
08/01/00																					
09/01/00																					
10/01/00																					
11/01/00																					
12/01/00																					
01/01/01																					
02/01/01	8.5																				
03/01/01	8.5	8.4																			
04/01/01		8.6																			
05/01/01	8.5																				
06/01/01		8.4																			
07/01/01	8.5																				
08/01/01	8.6	8.4																			
09/01/01	8.6	8.0																			
10/01/01	8.5																				
11/01/01																					
12/01/01	8.6																				
01/01/02	7.3																				
02/01/02	8.4	8.3																			
03/01/02	8.4	8.3																			
04/01/02	9.4																				
05/01/02	9.4	8.6																			
06/01/02	8.1	8.3																			
07/01/02			8.5	8.6						8.5				5.6		8.5					
07/08/02			8.6	8.7					8.3	8.6				8.6		8.5					
07/16/02			8.5	8.6					8.2	8.6				8.6		8.5					
07/22/02			8.5	8.8					7.8	8.6				8.5		8.4					
07/29/02			8.5	8.8					8.2	8.7				8.5		8.4					
08/05/02			8.5	8.5					8.1	8.4				8.6		8.5					
08/12/02			8.6	8.6					8.2	8.5				8.6		8.5					
08/19/02			8.6	8.5					8.2	8.3				8.4		8.5					
08/26/02			8.6	8.6					8.3	8.8				8.7		8.5					

Date	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/03/02			8.6	8.6					8.2	8.6				8.6		8.6					
09/10/02			8.8	8.6					8.2	8.4				8.3		8.4					
09/16/02			8.6	8.7					8.2	8.6				8.6		8.4					
09/23/02			8.7	8.7					8.4	8.5				8.5		8.6					
09/30/02			8.6	8.8						8.6				8.4		8.3					
10/02/02																					
10/07/02			8.7	8.6						8.6				8.4		8.4					
10/14/02			8.6	8.9						8.6				8.4		8.6					
10/16/02																					
10/21/02			8.9	8.7					8.4	8.8				8.5		8.5					
10/28/02			8.9	8.7						8.4				8.7		8.6					
10/30/02																					
11/04/02			9.0	8.8					8.4	8.5				8.7		8.6					
11/12/02			8.1	8.7					8.5	8.9				8.8		8.6					
11/13/02																					
11/18/02			6.5	6.5					9.1	6.6				6.5		6.5					
11/25/02			9.1	9.1						9.2				9.1		9.1					
12/09/02			9.1	9.1						9.2				9.1		9.1					
12/16/02																					
12/17/02																					
01/14/03	9.4								9.0												
02/11/03	9.5								8.9	9.0											
03/11/03	9.1								8.8					9.2							
04/15/03	9.1								9.2	9.2				9.2			9.2				
05/13/03									9.0	9.1				9.2			9.2				
06/03/03	9.2								8.8	9.0				9.0							
06/10/03																					
06/24/03									8.4	8.6				8.6			8.4				
07/07/03	8.4								8.2	8.1				8.5			8.0				
07/14/03	8.0								8.0	8.3				8.4			8.0				
07/21/03	7.1								8.4	8.0				8.4			8.0				
07/28/03	6.7								8.0	8.0				8.3			7.9				
08/04/03	8.0								8.0	8.3				8.3			8.1				
08/11/03	8.3				8.4				8.1	8.2				8.4			8.0				
08/18/03									8.2	8.3				8.3			8.0				
08/25/03	8.2				8.3				8.1	8.4				8.4			7.9				
09/02/03																					
09/08/03	8.3				8.2				7.8	8.2				8.3			8.0				
09/15/03					8.3				8.0	7.8							8.1				
09/22/03					8.4				7.9	8.2				8.3			8.2				
09/29/03	7.9				8.3												8.3				
10/06/03					8.4				8.1	7.5				8.4			8.2				
10/13/03					8.4				8.0	8.3				8.5			8.4				
10/20/03					8.3				7.9	7.8				9.6			8.2				
10/28/03					8.6				8.0	8.3				8.5			8.2				

Date	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
11/03/03					8.7				8.1	8.6				8.7			8.5				
11/10/03					8.8				8.5	8.7				8.8			8.7				
11/17/03					8.7									8.7							
12/01/03					8.4									8.9							
12/15/03					8.7									8.6							
01/20/04									7.7					8.4							
02/17/04									7.8					8.3			8.1				
03/16/04					8.6									8.4							
04/13/04					8.2									8.1							
05/18/04					8.3				7.6					8.2			8.1				
06/21/04					8.3				8.3	8.0				8.3			8.0				
07/06/04					8.5				7.7			7.9		8.5			8.2				
07/20/04					8.4				7.2			6.7		8.7			7.8				
08/03/04					8.4				8.1	8.0		8.1		8.2			7.9	8.2			
08/17/04									7.6	8.4		7.9		8.6			8.2				
08/31/04					8.2				8.0	8.3		8.2		8.2			8.0				
09/14/04					7.3				7.7	8.1		7.9		8.2			8.0				
09/28/04					7.5				7.8	8.0		7.9		8.0			8.0				
10/12/04	8.4				7.7				7.9	8.3		8.4		8.3			8.3				
10/26/04	8.4				7.7				8.0	8.4		8.3		8.6			8.4			8.0	
11/09/04	8.7				8.4				8.7	8.5		8.5		7.8			8.3	8.4		8.3	
11/23/04	8.5				7.4				8.9	8.4		8.1		8.2				7.8		8.1	
12/07/04	8.4				8.2					8.5		8.4		8.4			8.3	7.8		8.2	

TABLE 23.1. TOTAL ORGANIC CARBON (MG/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	2.87	3.09	2.88	2.72	2.76		2.75	1.93	1.74	1.78	2.75	2.94		2.91	2.94	2.73	3.02	2.60	2.49	2.36	2.73	2.45	2.58	2.38
09/01/99	2.78	3.19	2.83	2.59	2.62		2.47	2.06	1.93	1.69	2.75	3.45		3.10	2.83	2.76	2.60	2.57	2.91	2.37	2.92	2.49	2.65	2.45
10/01/99	3.80	3.42	3.10	3.19	2.78		3.23	2.28	2.19	2.30	2.77	2.95		2.96	2.79	2.81	2.60	2.70	2.67	2.22	2.55	2.41	2.49	2.03
11/01/99	2.90	3.33	3.18	2.94	2.98		3.09	2.81	2.86	3.01	3.30	3.32		3.45	2.43	3.07	2.24	2.29	2.72	2.18	2.56	2.43	2.87	
12/01/99	2.63	6.65	2.90	2.61	2.75		1.34	2.48	2.45	2.58	3.40	3.21		3.10	2.17	2.68	2.06	2.11	2.07	1.79	2.09	1.88		
01/01/00	2.73	2.88	2.88	2.69	2.62		1.00	2.31	1.74	1.85	2.77	2.97		2.91	2.05	2.70	1.68						2.04	1.67
02/01/00	2.83	3.04	3.12	2.76	2.65		1.14	2.16	2.12	2.13	2.59	3.08		3.00	2.15	2.70	1.84	2.43	2.64		1.89		2.37	2.23
03/01/00	2.50	2.68	2.78	2.48	2.50	2.51	1.75	1.48	1.74	1.70	2.66	3.30		3.27	2.06	2.55	1.29	1.92	2.06	1.67	1.99	1.87	2.06	1.96
04/01/00	2.54	2.96	3.35	2.82	2.61	2.61	2.63	1.62	1.69	1.59	2.88	3.32	3.00	2.99	2.40	2.40	2.04	2.27	2.32		2.17	1.92	2.23	2.14
05/01/00	2.50	2.87	2.56	2.57	2.53	2.53	1.04	1.49	1.33	1.34	2.61	2.62	2.73	2.75	2.75	2.61	2.60	2.49	2.50	2.30	2.73	2.52	3.01	2.42
06/01/00	3.34	3.55	3.62	3.19	3.22	3.19	1.81	2.31	2.03	1.83	3.42	4.02	3.49	3.49	3.15	3.20	3.06	3.24	3.10	2.99	3.47	3.01	2.99	3.06
07/01/00	3.43	3.46	3.37	2.92	2.93	3.03	1.47	1.97	1.67	1.56	3.29	3.25	3.10	3.66	2.91	3.02	2.96	3.07	3.09	2.75	3.04	2.75	2.68	2.58
08/01/00	3.10	3.56	3.28	2.91	2.90	2.97	1.32	4.50	1.95	1.53	3.12	3.21	3.36	2.93	2.93	3.11	2.78	2.78	3.37	2.79	2.97	2.75	2.74	2.74
09/01/00	3.24	3.25	3.30	3.12	3.22	3.44	2.53	2.30	2.08	1.66	3.66	3.62	3.50	3.54	2.96	3.10	2.29	2.91	2.97	2.78	3.05	2.80	2.90	2.39
10/01/00	2.91	3.06	3.04	3.07	2.84	2.90	1.16	3.66	1.74	1.66	2.92	3.00	3.05	3.10	3.00	2.97	2.82	2.87	3.08	2.70	2.82	2.65	2.77	1.86
11/01/00	2.67	2.81	2.83	2.66	2.64	2.62	1.28	2.04	1.98	1.93	2.75	3.02	2.95	3.00	2.91	2.88	2.25	2.34	2.35	2.09	2.42	2.35	1.45	1.13
12/01/00	2.81	2.97	4.06	3.61	2.97	2.95	3.32	2.20	3.15	2.52	3.08	5.97	3.18	3.03	2.78	2.95	2.07	8.23	2.84	1.83	2.41	2.22		
01/01/01	2.88	3.11	3.08	2.89	2.74	2.77	1.74	2.67	2.65	2.51	2.99	3.11	3.15	3.25	2.42	3.02	1.79						1.71	1.58
02/01/01	2.72	3.07	3.15	2.70	2.64	2.79	2.30	2.25	2.26	2.27	2.86	3.00	2.97	3.00	2.19	2.86	2.19	2.01	2.01		2.03		2.13	1.91
03/01/01	2.78	2.92	2.97	2.66	2.68	2.62	5.16	2.54	2.05	2.11	3.05	3.17	3.23	3.08	2.11	2.64	1.54	1.98	1.96	1.90	2.13	1.81	2.07	1.59
04/01/01	2.83	3.45	2.86	3.08	3.09	3.58	3.04	3.05	2.11	2.03	3.10	3.48	3.21	3.07	2.22	2.68	1.87	2.25	2.18	2.08	2.15		2.30	2.11
05/01/01		4.32	4.00	3.75	3.10	2.98	1.57	3.82	3.26	2.42	3.25	3.84	3.76	3.33	3.38		3.26	3.12	3.18	3.12	3.51		3.75	2.93
06/01/01	2.58	3.53	2.73	2.70	2.93	2.85	0.81	4.35	2.92	2.03	2.91	3.21	3.16	2.93	2.86	2.71	2.61	2.62	3.03	2.20	3.15		2.60	2.43
07/01/01	3.07	3.90	3.31	3.15	3.09	3.05	1.77	3.82	3.24	2.62	3.31	3.46	4.87	3.44	3.13	3.11	3.12	3.04	2.99	2.54	3.14		2.90	3.24
08/01/01	2.52	3.54	2.63	2.64	2.64	2.60	2.17	3.71	3.54	2.31	3.07	3.50	3.14	3.49	2.81	2.74	2.73	2.63	2.69	2.15	2.79	1.95	2.59	2.35
09/01/01	3.75	4.79	3.59	3.34	3.27	3.32	1.53	3.79	3.49	3.28	3.66	3.73	3.92	3.67	3.72	3.30	3.42	3.61	3.84	2.93	5.26		3.39	2.96
10/01/01	3.18	4.19	3.97	3.34	3.37	3.53	1.95	3.70		3.46	4.53	3.77	3.66	3.88	3.47	3.43	3.11	3.48	3.11	2.43	3.25		3.30	2.69
11/01/01	3.31	3.90	3.84	3.21	3.40	3.49	1.12	2.99	2.96	3.28	3.67	3.64	3.64	3.87	0.50		2.61	2.62	2.88	2.06	2.67		2.78	2.28
12/01/01	2.95	3.55		3.21	3.13	2.99	1.11	20.59			4.49		4.23	4.09	2.36	5.29	2.26	2.29	2.16	1.52	2.27		2.25	12.31
01/01/02	2.85	3.82	10.29	2.96	15.64	9.95	1.28	24.78		2.33		3.91	3.93	3.65	18.09	3.08	26.17	11.81	5.46		3.00		8.43	2.79
02/01/02	2.72	4.73	3.00	4.71	2.72	2.66	42.99	2.81	2.28	8.54	3.53	21.82	3.76	3.53	1.40	2.77		2.88	2.83		2.78		2.66	2.43
03/01/02	3.24	3.29	3.58	2.84	2.88	3.10	1.13	2.12	2.17	2.17	10.99	4.31	4.31		3.34	3.01	2.26	2.67	2.81	2.33	2.72	2.41	2.39	
04/01/02	3.21	3.79	3.55	4.11	3.48	3.16	2.20	2.16	1.93	2.23	3.72	4.62	4.66	6.33	5.31	3.19	4.12	3.36	3.45	2.90	3.34	2.98	3.32	2.99
05/01/02	3.07	4.12	3.38	3.30	3.12	3.36	1.20	1.95	1.97	2.02		4.84	4.98	4.03	3.79	3.26	3.76	3.49	3.51	2.97	4.66	3.52	3.45	3.53
06/01/02	3.67	3.57	4.84	3.68	3.52	3.53	1.50	2.64	2.14	2.40		5.91	5.37	4.63	4.59	3.44	4.04	4.04	4.91	3.24	3.85	3.38	3.59	3.63
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02		4.53	3.31					2.13	3.71			5.09	5.06	4.64										
08/19/02																								

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/26/02																								
08/30/02																								
09/03/02		4.34	3.39					2.63	2.57			5.20	5.00	5.98										
09/10/02																								
09/16/02		5.36	3.28					1.85	1.81			4.08	3.72	4.35										
09/23/02																								
09/30/02																								
10/02/02		4.21	3.58					2.63	2.19			4.52	4.75	4.24										
10/07/02																								
10/14/02																								
10/16/02		4.27	4.56					2.73	3.35			3.96	5.53	5.57										
10/21/02																								
10/28/02																								
10/30/02		4.02	3.88					2.44	2.59			3.74	4.24	5.90										
11/04/02																								
11/12/02																								
11/13/02		3.63	3.45					2.53	2.40			3.79	4.02	4.43										
11/18/02																								
11/25/02		3.38	3.82					2.20	2.12			3.89	3.87	3.77										
11/30/02																								
12/09/02																								
12/16/02																								
12/17/02		3.25	3.02					2.18	1.86			3.61	3.64	3.72										
12/30/02																								
01/14/03		3.37	3.38					1.98	2.35			4.29	4.27	4.01										
02/11/03		2.45	3.24					1.56	1.51			3.82	3.96	3.99										
03/11/03		3.00	3.06					4.27	1.67			3.98	3.80	4.34										
04/15/03		4.59	3.67					5.99	4.72			4.69	5.11	4.19										
05/13/03		4.15	3.27					5.98	4.73			4.78	3.88	1.42										
06/03/03		4.57	3.45					7.00	6.10			4.83	4.73	4.05										
06/10/03																								
06/24/03																								
07/07/03																								
07/14/03		5.96	5.00					6.78	7.66			7.29	6.52	5.68										
07/21/03																								
07/28/03																								
08/04/03																								
08/11/03																								
08/18/03																								
08/25/03		5.13	3.68					6.70	5.32			5.02	5.06	4.04										
09/02/03																								
09/08/03		4.96	5.13					6.44	5.22			5.09	4.98	4.45										
09/15/03																								
09/22/03		5.17	4.26					5.48	5.80			4.50	4.56	4.08										
09/29/03																								

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
10/06/03		4.86	4.55					4.52	4.68			4.18	4.31	4.27										
10/13/03																								
10/20/03																								
10/28/03		3.77	3.62					4.07	5.62			4.34	4.50	5.08										
11/03/03																								
11/10/03																								
11/17/03		3.16	3.28					3.51	3.54			4.01	3.95	4.06										
12/01/03		3.60	3.99					3.69	3.79			4.26	4.40	4.77										
12/15/03																								
01/20/04												3.72	3.75	3.64										
02/17/04		3.03	3.03									4.08	4.16	4.20										
03/16/04		3.03	2.97					3.00	3.03			4.77	4.34	4.06										
04/13/04		3.41	3.09					2.85	2.84			4.43	4.50	4.07										
05/18/04								2.99	2.86			5.05	5.19	4.33										
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 23.2. (CONTINUED) TOTAL ORGANIC CARBON (MG/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	1.01																							
09/01/99	3.53																							
10/01/99	0.89																							
11/01/99	1.37																							
12/01/99																								
01/01/00	1.02																							
02/01/00																								
03/01/00	2.26																							
04/01/00	0.86																							
05/01/00	1.92																							
06/01/00	1.49																							
07/01/00	1.39																							
08/01/00	2.06																							
09/01/00	0.96																							
10/01/00	2.77																							
11/01/00	1.03																							
12/01/00	0.79																							
01/01/01	0.79																							
02/01/01	2.82			1.93																				
03/01/01	1.51			1.56	1.99																			
04/01/01	1.54			2.15																				
05/01/01				1.59																				
06/01/01	0.72			1.35																				
07/01/01	21.00			2.11																				
08/01/01				1.80																				
09/01/01	1.20			2.32																				
10/01/01	1.66			4.09																				
11/01/01				2.77																				
12/01/01				1.36																				
01/01/02	1.50			1.35																				
02/01/02				3.32																				
03/01/02	1.29			1.49																				
04/01/02				1.77																				
05/01/02	1.14			1.78																				
06/01/02				5.89																				
07/01/02																								
07/08/02																								
07/16/02																								
07/22/02																								
07/29/02																								
07/30/02																								
08/05/02																								
08/12/02																								

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02																								
08/26/02																								
08/30/02																								
09/03/02																								
09/10/02																								
09/16/02																								
09/23/02																								
09/30/02	1.99																							
10/02/02																								
10/07/02																								
10/14/02																								
10/16/02																								
10/21/02																								
10/28/02																								
10/30/02	2.14																							
11/04/02																								
11/12/02																								
11/13/02																								
11/18/02																								
11/25/02																								
11/30/02																								
12/09/02																								
12/16/02																								
12/17/02																								
12/30/02	0.71																							
01/14/03	0.48																							
02/11/03	6.64																							
03/11/03	5.31																							
04/15/03	1.42																							
05/13/03	1.35									3.63	3.85													
06/03/03										2.81	2.86													
06/10/03																								
06/24/03																								
07/07/03																								
07/14/03	1.31																							
07/21/03																								
07/28/03																								
08/04/03																								
08/11/03																								
08/18/03																								
08/25/03	2.34									2.85	2.88													
09/02/03																								
09/08/03																								
09/15/03																								
09/22/03																								

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03																								
10/06/03																								
10/13/03																								
10/20/03																								
10/28/03	1.39																							
11/03/03																								
11/10/03																								
11/17/03																								
12/01/03	0.93																							
12/15/03	0.51																							
01/20/04	0.74																							
02/17/04	0.84									2.83	2.66													
03/16/04	1.53									2.77	2.77													
04/13/04										2.76	2.70													
05/18/04																								
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 24.1. DISSOLVED ORGANIC CARBON FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99	2.94	3.11	2.84	2.71	2.71		2.78	1.85	1.61	1.63	2.67	2.85		2.82	2.71	2.61	2.63	2.53	2.41	2.31	2.67	2.28	2.53	2.31
09/01/99	2.72	3.07	2.70	2.64	2.71		2.43	1.99	1.92	1.69	2.69	3.00		3.00	2.60	2.62	2.54	2.55	2.67	2.21	2.57	2.31	2.51	2.28
10/01/99	2.80	3.33	3.10	3.20	2.82		3.28	2.23	2.17	2.20	2.71	3.03		3.07	2.84	3.09	2.40	2.40	2.58	2.28	2.82	2.25	2.81	2.07
11/01/99	2.78	3.24	3.17	2.96	2.94		3.07	2.78	2.72	3.08	3.23	3.25		3.13	2.45	3.02	2.17	2.18	2.57	2.11	2.35	2.36	2.48	
12/01/99	2.61	2.99	2.95	2.59	2.74		1.56	2.78	2.42	2.46	2.71	2.90		3.19	1.86	2.81	2.87	2.38	2.13	1.78	2.74	1.92		
01/01/00	2.63	2.92	2.77	2.69	2.61		1.03	2.20	1.64	1.82	2.71	2.98		2.94	2.01	2.63	1.73						1.84	1.72
02/01/00	2.80	3.12	3.11	2.74	2.72		1.28	2.16	2.08	2.14	2.69	3.20		2.95	2.35	2.78	1.77	2.52	2.52		1.97		2.33	2.22
03/01/00	2.48	2.64	2.67	2.44	2.51	2.43	1.83	1.51	1.73	1.71	2.64	2.88		2.73	1.97	2.55	1.18	1.91	2.04	1.86	2.02	1.67	2.09	1.97
04/01/00	2.69	2.74	2.92	2.55	2.45	2.38	2.46	1.51	1.47	1.47	2.67	2.86	2.70	2.64	2.42	2.33	2.08	2.44	2.24		2.11	1.86	2.16	2.21
05/01/00	2.65	2.83	2.62	2.70	2.57	2.82	1.12	1.45	1.22	1.29	2.66	2.81	2.89	2.84	2.67	2.57	2.44	2.54	2.75	2.48	2.56	2.26	2.38	2.27
06/01/00	3.29	3.59	3.61	3.22	3.15	3.31	1.73	2.31	2.01	1.85	3.07	4.10	3.39	3.37	3.11	3.20	3.30	3.08	3.01	2.97	3.16	2.85	3.08	3.04
07/01/00	3.21	3.29	3.13	2.94	4.08	3.37	1.41	2.02	1.48	1.59	3.00	3.09	3.06	3.43	2.81	2.96	2.75	2.80	2.81	2.54	2.84	2.62	2.74	2.54
08/01/00	3.01	3.48	3.25	2.89	2.88	2.88	1.28	4.39	1.84	1.58	3.12	3.05	3.07	2.80	2.77	3.01	2.64	2.72	2.77	2.59	3.52	2.85	3.42	2.56
09/01/00	3.11	3.22	3.29	3.15	3.13	3.09	2.39	2.02	1.90	1.56	3.21	3.40	4.00	3.35	3.03	3.38	2.32	2.97	3.25	2.79	3.18	2.79	2.84	2.39
10/01/00	2.92	2.91	3.02	2.97	2.81	2.82	0.77	1.84	1.72	1.58	2.87	3.05	2.92	3.02	2.93	3.05	2.58	2.77	2.82	2.69	2.70	2.52	2.76	1.86
11/01/00	2.50	2.92	2.81	2.66	2.69	2.97	1.27	1.95	1.92	1.97	2.91	2.88	2.90	3.03	2.85	2.67	2.14	2.23	2.49	2.05	2.49	2.31	1.43	1.04
12/01/00	4.17	5.77	3.08	2.81	3.79	2.81	4.17	2.26	2.56	2.47	4.25	3.21	3.15	3.24	2.13	3.48	2.07	2.12	3.90	1.78	2.31	2.12		
01/01/01	2.75	3.05	3.01	2.91	2.85	2.84	1.69	2.65	2.65	2.62	2.94	3.17	3.13	3.56	2.19	2.91	2.03						1.88	1.76
02/01/01	2.63	2.82	2.99	2.66	2.61	2.68	1.99	2.29	2.22	2.19	2.89	2.99	3.01	3.01	2.09	2.68	2.02	1.93	1.98		2.02		2.14	1.94
03/01/01	2.58	2.82	2.89	2.49	2.62	2.61	4.71	2.28	2.07	2.02	3.00	3.10	3.02	2.99	2.01	2.57	1.38	1.89	1.89	1.80	2.04	1.81	2.08	1.61
04/01/01	2.85	3.63	3.70	3.30	2.93	3.88	3.40	3.60	2.08	2.06	3.22	3.59	3.15	5.44	2.34	2.74	1.84	1.95	2.17	1.71	2.10		2.27	2.00
05/01/01		4.06	3.33	3.31	3.15	3.21	1.91	4.00	3.39	3.19	3.44	3.68	3.71	3.18	3.51	2.99	3.03	3.14	3.12	2.64	3.43		3.85	3.09
06/01/01	2.78	3.99	2.85	2.70	2.78	2.77	0.88	3.64	3.03	1.88	2.88	3.54	3.22	2.97	2.74	2.64	2.71	2.54	3.06	2.15	3.07		2.58	2.26
07/01/01	3.10	3.83	3.18	3.00	3.06	3.04	1.55	3.72	2.94	2.60	3.36	3.41	3.25	3.11	3.18	3.18	3.01	3.00	3.19	2.46	3.09		2.92	2.61
08/01/01	3.46	3.44	2.59	2.41	2.61	2.49	1.97	3.37	3.13	2.26	3.00	3.21	2.88	3.27	2.76	2.67	2.65	2.76	2.63	2.13	2.65	2.01	2.39	2.33
09/01/01	3.62	4.52	3.64	3.53	3.35	3.63	1.52	4.06	3.43	3.16	3.52	4.08	3.80	3.55	3.41	3.31	3.79	3.66	3.50	3.34	5.13		3.24	2.84
10/01/01	3.28	4.07	3.94	3.36	3.31	3.70	1.65	3.58		3.85	4.08	3.79	3.71	3.86	3.49	3.34	3.33	3.65	3.12	2.31	3.06		3.34	2.95
11/01/01	3.42	4.27	3.94	3.20	3.36	3.57	1.09	3.10	2.91	2.91	4.35	3.90	3.61	3.69	2.62		2.82	2.71	2.87	2.07	2.64		2.62	2.22
12/01/01	2.77	3.15		2.85	2.84	2.94	1.26	2.64			3.45		3.77	3.46	5.08	4.99	2.17	2.29	2.26	1.78	2.03		1.93	1.56
01/01/02	2.79	3.22	3.56	2.82	2.78	2.69	0.96	2.58		1.85	3.91	3.63	3.60	3.58	3.49	2.82	3.11	3.05	4.99		2.75		2.72	2.57
02/01/02	2.71	3.02	2.96	2.68	2.89	2.58	0.89	2.05	2.01	1.97	3.16	8.47	3.46	3.32	1.40	2.87	3.06	2.85	2.79		2.82		2.61	2.30
03/01/02	3.25	3.33	3.57	2.91	2.92	2.86	1.35	2.38	2.61	1.99	4.09	4.13	4.14		3.36	2.85	2.24	2.82	2.72	2.31	2.77	2.31	1.61	
04/01/02	3.36	4.33	3.61	4.35	3.23	3.31	1.98	2.05	2.39	2.19	3.83	4.19	4.45	3.94	3.90	3.02	3.90	3.79	3.47	2.81	3.29	2.96	3.39	2.93
05/01/02	3.43	4.23	3.62	3.48	3.48	3.36	1.47	2.23	2.03	2.13		4.63	4.97	3.89	4.32	3.31	3.62	3.78	3.67	3.06	3.89	3.18	3.74	3.04
06/01/02	2.94	3.11	3.98	3.10	3.24	3.02	1.11	2.22	1.81	1.85		4.50	4.74	3.85	3.66	3.16	3.58	3.52	3.71	2.97	3.58	2.97	3.33	3.09
07/01/02																3.02	3.40	3.21	3.61	2.76	3.20	2.99	3.90	2.88
07/08/02																3.44	3.39	3.31	3.41	2.72	3.37	2.85	3.78	3.24
07/16/02		4.44	3.41					2.10	1.73			4.37	4.03	3.50		3.18	3.52	3.29	3.27		3.11		3.21	2.95
07/22/02																3.11	3.32	3.23	3.06	2.66	3.30	2.94	3.26	
07/29/02																2.99	3.40	3.13	3.03	2.40	3.05	2.57	2.79	2.52
07/30/02																								
08/05/02																3.00	3.01		3.26	4.19	3.12	2.57	2.85	2.68
08/12/02		4.42	3.01					2.79	3.76			4.63	4.76	4.43		3.09	3.13	3.16	3.13	2.57	3.07	2.40	3.42	2.67
08/19/02																3.06	3.16	3.19	3.27	2.70	3.28	2.74	2.96	2.99

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/26/02																3.06	2.93	2.92	2.99	2.55	2.90	2.48	2.83	2.59
08/30/02																								
09/03/02		3.97	3.29					2.35	2.44			4.85	4.70	5.20		2.94	3.80	2.94	3.01	2.34	2.92	2.50	2.82	3.21
09/10/02																	3.23	2.95	2.90	2.26	2.92	2.42	2.67	1.79
09/16/02		4.89	3.33					1.82	1.73			4.02	4.33	3.44			2.90	2.99	2.99	2.43	3.00	1.86	2.73	2.35
09/23/02																	2.67	2.98	3.04	2.46	2.94	2.52	2.66	2.10
09/30/02																	2.55	3.21	3.08	2.72	3.07	2.15	2.84	2.18
10/02/02		4.17	4.03					2.44	2.22			4.54	4.64	4.35										
10/07/02																	2.62	3.14	3.29	2.63	3.13	2.33	2.55	2.04
10/14/02																3.32	2.62	3.04	3.01	2.51	2.90	2.26	2.58	2.03
10/16/02		4.44	4.57					2.46	3.33			4.27	4.40	5.06										
10/21/02																3.15	2.32	3.07	3.04	2.48	3.54	2.36	2.45	2.16
10/28/02																3.30	1.88	2.35	2.44	1.92	2.42	1.94	2.25	1.71
10/30/02		3.83	3.70					2.32	2.27			3.66	4.18	5.10										
11/04/02																3.40	1.87	2.72	2.74	1.77	2.51		3.03	2.53
11/12/02																2.82	1.67	2.23	2.57	1.83	2.31		2.11	
11/13/02		3.77	3.96					2.60	2.68			4.00	4.26	5.03										
11/18/02																2.85	1.60	2.26	2.21	1.63	2.11		2.42	
11/25/02		3.44	4.11					2.04	2.12			4.22	4.11	3.84		2.80	1.57	2.20	2.25	1.56	2.18	1.76	1.94	
11/30/02																								
12/09/02																2.89	1.38	2.17	1.88	1.50	1.88			
12/16/02																2.59	1.19	1.56	2.06	1.55	2.06	1.75		
12/17/02		3.12	2.93					2.01	1.64			3.59	3.53	3.56										
12/30/02																								
01/14/03		3.20	3.40					1.84	1.87			3.74	3.81	3.72	2.59	2.79							1.82	1.62
02/11/03		3.03	3.25					1.71	1.69			3.88	3.94	3.92	2.92		1.63	2.37	2.14		2.13	1.73	1.92	
03/11/03		2.94	2.97					4.50	1.60			3.64	3.74	3.66	2.74		1.40	2.07	2.01		1.86	1.73	1.48	1.27
04/15/03		4.39	3.39	3.08				5.77	4.54			4.34	4.28	4.21	3.11	3.04	2.40	2.75	2.99	2.65	2.90	2.22	2.73	2.24
05/13/03		3.51	2.84	2.99				5.14	5.31			3.97	4.14	3.21	2.78	2.79	3.24	2.74	2.62	2.23	2.58	2.32	2.88	2.44
06/03/03		4.30	3.42	3.05				6.18	5.72			4.35	4.37	3.86	3.85	2.96	3.70	3.28	3.25	2.62	3.09	2.60	3.21	
06/10/03																								
06/24/03		4.63	4.40					6.06	5.94			5.63	5.22	5.17			4.58	4.03	3.65	2.80	3.61	2.88	3.55	3.22
07/07/03				3.11											3.74	3.12	4.02	3.43	3.44	2.77	3.34	2.88	3.59	2.81
07/14/03		5.55	4.80					5.89	6.99			6.05	5.43	5.30		3.18	4.28	3.68	3.71	2.98	3.69	3.25	3.93	3.00
07/21/03				3.25											3.78	3.15	4.14	3.62	3.90	3.25	3.74	3.51	3.90	3.44
07/28/03				3.10											3.81	3.23	3.78	3.63	3.38	2.61	3.29	2.38	3.48	2.85
08/04/03		5.22	3.97	3.18				5.86	5.74			5.28	5.18	5.54	3.89	3.45	3.93	3.27	3.57	2.40	3.79	2.53	3.67	3.34
08/11/03				3.39											4.40	3.29	4.18	3.75	3.99	2.73	3.75	3.13	3.87	3.32
08/18/03				3.27											4.23	3.85	4.60	4.17	4.39	3.81	4.19	3.79	4.32	3.64
08/25/03		4.62	3.49	4.18				5.82	5.63			4.52	4.71	4.25	4.53	4.15	4.51	4.02	4.16	3.07	4.36	3.71	4.02	3.14
09/02/03																								
09/08/03		4.57	4.71	4.02				5.86	4.81			4.49	4.45	4.23	4.61	3.98	4.41	3.99	3.95	2.78	3.96	3.76	4.18	3.25
09/15/03																								
09/22/03		4.92	4.41	3.30				5.25	6.07			4.43	4.48	4.65	3.88	3.34	3.63	3.44	3.45	2.63	3.40	2.87	3.29	2.09
09/29/03															4.02	3.63	3.16	3.56	3.44	2.24	3.37	3.07	3.51	2.07

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
10/06/03		4.84	4.80	3.79				4.53	4.75			4.33	4.48	4.39	3.88	3.34	3.56	3.45	3.41	2.57	3.41	2.81	3.40	1.96
10/13/03				3.90											3.38	3.37	3.91	3.54	3.66	2.58	3.47		3.53	2.82
10/20/03				2.92											4.22	3.02	3.99	3.56	3.54	2.74	3.61		3.22	2.63
10/28/03		3.81	4.17	2.77				4.09	5.69			4.21	4.53	4.78		2.80	3.90	3.45	3.93	2.05	3.33		3.12	2.31
11/03/03															2.93	2.85	3.72	3.27	3.44	2.20	3.24	2.94	2.99	1.90
11/10/03																								
11/17/03		3.12	3.54	2.54				3.45	3.55			3.99	3.79	4.19	3.03	2.55	2.51	2.61	2.50	1.86	2.50	2.03		
12/01/03		3.49	3.85	2.66				3.52	3.82			4.13	4.12	4.51	2.70	2.72	2.72	2.67	2.58	1.63	2.48	2.12		
12/15/03															2.61	2.61	2.54	2.46	2.36	1.80	2.66	2.01		
01/20/04												3.79	3.63	3.92	2.44	2.66	1.70	2.02	2.49	2.01	2.32	2.11		
02/17/04		3.09	2.94	2.76								3.89	3.82	3.86	2.80	2.68	2.47	2.49	2.50	2.17	2.66	2.08	2.34	
03/16/04		3.14	3.02	2.75				2.98	3.08			4.59	4.29	3.95	3.68	2.66	2.45	2.62	2.63		2.56	2.07	2.51	1.95
04/13/04		3.27	2.91					2.93	2.96			4.51	4.22	4.08	3.10	3.13	2.25	2.68	2.53		2.57	2.19	2.50	1.99
05/18/04				2.87				2.78	2.73			4.73	4.78	4.06	3.71	2.65	3.56	3.08	3.00	2.47	2.99	2.36	3.02	2.21
06/21/04		3.17	3.19					3.78	2.83			4.85	5.19	5.26	3.88	2.67	3.86	3.50	3.53	2.33	3.39	2.39	3.57	3.29
07/20/04		3.17	3.19					2.53	2.51			4.72	4.74	4.02	3.90	2.44	3.74	2.95	2.87	2.28	3.00	2.54	3.12	2.48
08/17/04		31.60	34.50	2.41				2.67	2.56			4.72	4.88	3.86	4.02	2.21	3.83	2.75	2.74	2.01	2.65	1.95	2.52	1.85
09/14/04		3.30	2.53	2.92				3.22	2.86			5.78	8.03	4.59	4.98	3.08	3.89	3.30	3.17	2.37	3.17	2.78	3.20	2.17
10/12/04		3.15	3.35	3.28				3.36	4.09			4.75	4.50	4.71	4.45	3.21	3.46	3.07	3.18	2.10	3.05	2.50		
11/09/04		2.71	2.77	2.53				3.17	3.94			4.88	4.65	4.97	3.34	2.68	2.38	2.57	2.74	2.06	2.74	1.85		
12/07/04				3.78								4.41	4.42	4.94	3.07		3.06	3.15	3.59	2.70	3.42	2.33		

TABLE 24.2. (CONTINUED) DISSOLVED ORGANIC CARBON FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	0.95																							
09/01/99	3.74																							
10/01/99	0.88																							
11/01/99	1.15																							
12/01/99																								
01/01/00	1.15																							
02/01/00																								
03/01/00	1.56																							
04/01/00	0.56																							
05/01/00	1.70																							
06/01/00	1.48																							
07/01/00	1.13																							
08/01/00	1.98																							
09/01/00	0.95																							
10/01/00	2.61																							
11/01/00	1.88																							
12/01/00	0.88																							
01/01/01	0.77																							
02/01/01	2.57			1.83																				
03/01/01	1.72			1.59	1.99																			
04/01/01	1.56			1.88																				
05/01/01				2.01																				
06/01/01	0.77			1.20																				
07/01/01	19.61			1.72																				
08/01/01				2.14																				
09/01/01	1.06			1.94																				
10/01/01	1.25			3.24																				
11/01/01	0.87			2.85																				
12/01/01				2.38																				
01/01/02	1.01			2.15																				
02/01/02				4.16																				
03/01/02	1.28			1.51																				
04/01/02				1.70																				
05/01/02	1.02			1.63																				
06/01/02	1.45			3.86																				
07/01/02		3.28	3.61			3.59	3.70					3.78	3.77	3.37	3.38	3.01	4.27		3.42		2.23	2.08	3.00	2.69
07/08/02		3.40	3.52			3.43	3.30					3.47	3.20	3.35	3.21	3.08	3.30		3.30		2.92	19.99	3.03	3.01
07/16/02		3.23	4.21			3.43	3.50					2.51	3.24	3.23	3.38		3.13		3.13		1.98	2.21	3.00	2.90
07/22/02		3.32	3.41			3.07	3.21					2.69	3.18	3.51	3.22	2.86	3.27		3.13		1.67	1.63	2.96	2.83
07/29/02		2.94	3.15			3.26	3.21					2.13	3.12	3.03	2.94	2.77	2.91		3.34		2.04	1.87	2.81	2.73
07/30/02																								
08/05/02		3.05	3.15			3.03	3.01					2.40	3.51	3.25	2.98	2.79	3.32				1.42	1.43	3.00	2.63
08/12/02		3.07	3.12			3.23	3.08					2.33	3.25	3.23	3.14	2.88	3.29		3.06		1.48	1.39	3.38	2.81

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02		3.25	3.31			3.29	3.24					2.64	3.40	3.19	3.27	2.98	3.33		4.21		1.42	1.39	2.90	3.81
08/26/02		2.91	2.98			2.99	3.04					2.67	3.01	2.94	2.87	2.56	2.97		2.94		1.34	1.30	3.05	
08/30/02																								
09/03/02		2.89	2.86			2.99	2.97					2.31	2.84	2.94	2.80	2.62	2.97		2.84		1.06	0.96	2.79	2.82
09/10/02		2.94	2.94			3.00	3.03					2.01	2.92	2.57	2.95	2.40	2.47		2.90		0.77	0.81	2.68	2.75
09/16/02		3.03	2.92			3.02	3.06					2.11	3.04	2.94	2.87	2.75	3.02		2.86		0.63	0.66	2.82	2.80
09/23/02		2.99	2.95			3.06	3.01					1.83	3.06	3.02	2.94	2.81	3.00		2.96		0.66	0.64	2.87	2.79
09/30/02	1.51	3.10	3.08			3.06	3.09					2.22	3.08	3.17	2.87	3.03	3.13		2.98		0.69	0.95	3.39	2.78
10/02/02																								
10/07/02		3.27	3.36			3.36	3.13					1.81	3.07	3.18	3.15	3.20	3.17		3.20		0.74	0.64	3.00	2.71
10/14/02		3.06	3.04			3.05	2.95					1.84	3.07	3.11	2.88	2.90	3.14		3.01		1.16	0.81	3.06	2.93
10/16/02																								
10/21/02		3.38	3.15			3.11	3.06					2.51	3.64	3.10	3.08	2.88	3.11		3.08		1.63	1.23	3.09	2.90
10/28/02		2.84	2.24			2.45	2.50					2.00	2.23	2.22	2.42	2.32	2.27		2.17		0.85	0.46	3.40	3.08
10/30/02	1.54																							
11/04/02		2.42	2.80			2.47	2.47					1.57	2.74	2.72	2.38	2.16	2.89		2.71		0.73	0.65	3.35	3.03
11/12/02		2.32	2.11			2.25	2.47					1.56	2.19	2.21	2.36	2.25	2.17		2.22		0.67	0.75	2.69	2.60
11/13/02																								
11/18/02		2.24	2.10			2.22	2.29					2.43	2.24	2.11	2.27	1.86	2.18		2.15		0.77	0.70	2.77	2.56
11/25/02		2.17	2.18			2.17	2.32						2.18	2.12	2.25	1.75	2.22		2.15				2.73	2.82
11/30/02																								
12/09/02		1.88	1.92			1.88	1.93						1.95	1.99	1.89	1.36	1.96		1.89				2.83	2.63
12/16/02		2.05	2.01			2.00	2.10						1.57	2.10	1.97	1.48	2.13		2.02				2.63	2.43
12/17/02																								
12/30/02	0.71																							
01/14/03	0.86			1.13								0.99								2.58	0.67	0.72	2.78	2.58
02/11/03	6.50		2.38	1.57								0.83					2.06			2.69	0.61	0.68	2.67	2.57
03/11/03	5.28		1.94	1.30								0.76					2.29			2.52	0.43	0.55	2.55	2.51
04/15/03	1.07	3.74	2.85	2.66				2.08	1.40			2.92	2.78				3.17			2.46	1.29	1.10	2.98	2.87
05/13/03	1.11	2.63	2.57	3.49				2.14	1.70	3.02	3.40	2.24	2.76		2.58	2.37	2.73			3.10	1.08	0.93	2.72	2.48
06/03/03		3.19	3.25	3.56				2.86	2.00	2.78	2.81	2.60	3.31		3.24	2.75	3.50	16.68		3.57	1.89	1.91	2.71	2.91
06/10/03																								
06/24/03	0.97							3.83	2.88	2.91	2.87	3.96			4.57	3.79				4.62	2.49	2.39	3.22	3.27
07/07/03		3.50	3.40	4.54				2.88	2.19			3.11	3.56		3.39	2.92	3.52			3.96	1.55	1.72	2.95	2.78
07/14/03	1.25	3.73	3.70	4.69								3.28	3.73		3.74	3.31	3.75			4.23	2.04	1.84	3.09	2.87
07/21/03		3.82	3.88	4.33				3.26	2.54			3.68	3.68		3.88	3.50	3.75			4.41	2.33	2.33	3.01	2.87
07/28/03		3.47	3.39	4.35				2.42	2.98			2.69	3.64		3.50	2.47	3.67			3.82	1.53	1.76	3.04	3.00
08/04/03		3.54	3.68	3.80				3.29	2.36			2.64	3.28		3.45	2.84	3.39			3.92	0.91	1.08	3.14	3.13
08/11/03		3.68	3.76	4.53				3.32	2.65			2.68	4.40		3.79	2.88	3.89			4.30	1.37	1.33	3.25	3.05
08/18/03				4.76				4.17	3.26			4.17			4.26	3.37				4.79	1.87	1.79	3.18	3.31
08/25/03	2.26			4.05				3.34	2.72	2.69	2.76	3.00			4.48	3.49				4.86	1.87	1.82	3.92	3.87
09/02/03																								
09/08/03				3.92				3.92	2.99			3.37			4.13	3.17				4.45	2.38	2.47	3.81	3.60
09/15/03																								
09/22/03	1.42			2.83				3.08	2.26			2.63			3.69	2.38				3.65	1.53	1.37	3.13	2.92

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03				2.99				2.30	1.84			2.42			3.44	2.25				3.40	1.14	1.21	3.32	2.98
10/06/03				3.59				3.51	2.48			3.56			3.45	2.29				3.41	1.20	1.07	3.14	2.89
10/13/03								3.36	2.44	2.91	2.88	3.02			3.59	2.70				3.78	2.15	1.65	3.12	3.04
10/20/03				3.27				2.38	2.38			2.23			3.79	2.74				3.65	1.11	1.09	2.60	2.71
10/28/03	1.12			3.90				3.25	20.52			2.22			3.74	2.60				3.59	1.09	1.05	2.55	2.64
11/03/03								3.29	2.42			1.89			3.51	2.58				3.31	0.84	0.87	2.72	
11/10/03																								
11/17/03				2.39				2.08	1.96						2.51	2.29							2.46	2.40
12/01/03	0.95			2.84				1.50	1.44						2.46	2.23							2.60	2.36
12/15/03	0.61			2.60				1.96	1.48	2.30	2.39				2.41	2.33							2.82	2.47
01/20/04	0.79			2.13						2.41	2.37	1.06									0.56	0.53	2.52	2.31
02/17/04	0.91			2.61						2.62	2.59	2.05								2.43	0.78	0.79	2.58	2.45
03/16/04	1.72			2.02				2.07		2.61	2.66				2.58	2.10				2.58			2.59	2.12
04/13/04								2.09	1.74	2.70	2.64				2.58	2.13				2.69			2.55	2.33
05/18/04	0.99			2.06				2.93	2.22	2.28	2.25	2.28			3.03	2.27				3.24	0.83	0.84	2.65	2.42
06/21/04	0.47			1.67				3.29	2.73	2.62	2.65	3.19			3.27					3.99	1.82	2.09	2.66	2.41
07/20/04	2.74			1.28				3.27	2.17	2.14		3.08			2.73	2.23				3.47	3.04	3.00	2.36	2.63
08/17/04	1.68	2.76	2.77	2.56				2.49	1.97	2.10	2.32	1.87	2.87		2.75	2.14	2.89			2.69	0.71	1.23	2.22	2.37
09/14/04	13.13	3.24	3.29	2.35				3.53	2.49	3.20	3.07	2.11	7.58		3.16	2.71	3.28			3.41	0.96	0.99	2.78	5.51
10/12/04	1.27	3.26	3.12	2.59				2.07	1.60	2.89	2.83	1.78	3.20		3.06	2.33	3.99			3.03	0.83	0.84	2.98	2.83
11/09/04	2.89	2.74	2.70	1.92				1.19	1.41	2.56	2.60	1.68	2.64		2.66	2.06	2.66			2.52	1.31		2.48	2.53
12/07/04		3.33	3.47	2.82				2.33	1.98				3.25		3.43	2.39	3.16			3.13	0.90		3.77	2.93

TABLE 25.1. SUVA ($CM^{-1}*(MG/L)^{-1}$) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
08/01/99	0.015	0.014	0.016	0.016	0.016		0.029	0.022	0.026	0.023	0.019	0.019		0.020	0.020	0.017	0.021	0.020	0.020	0.019	0.019	0.019	0.020
09/01/99	0.016	0.015	0.017	0.017	0.016		0.031	0.021	0.023	0.025	0.021	0.019		0.019	0.020	0.016	0.020	0.020	0.022	0.018	0.020	0.017	0.020
10/01/99	0.015	0.013	0.014	0.013	0.014		0.029	0.022	0.023	0.024	0.019	0.017		0.018	0.019	0.014	0.020	0.020	0.020	0.015	0.017	0.016	0.017
11/01/99	0.015	0.014	0.014	0.014	0.014		0.024	0.022	0.023	0.020	0.016	0.016		0.017	0.015	0.014	0.021	0.022	0.021	0.012	0.021	0.016	0.020
12/01/99	0.016	0.015	0.014	0.016	0.015		0.021	0.023	0.026	0.025	0.018	0.018		0.017	0.017	0.015	0.018	0.022	0.025	0.014	0.017	0.018	
01/01/00	0.016	0.015	0.015	0.016	0.016		0.020	0.024	0.024	0.023	0.017	0.017		0.017	0.015	0.016	0.023						0.021
02/01/00	0.016	0.014	0.014	0.016	0.016		0.020	0.022	0.022	0.021	0.016	0.016		0.017	0.016	0.016	0.023	0.017	0.018		0.022		0.019
03/01/00	0.017	0.016	0.016	0.017	0.017	0.017	0.024	0.025	0.025	0.025	0.018	0.017		0.018	0.018	0.016	0.023	0.018	0.019	0.010	0.019	0.015	0.017
04/01/00	0.015	0.015	0.014	0.016	0.017	0.017	0.019	0.022	0.023	0.024	0.019	0.017	0.019	0.019	0.019	0.017	0.019	0.017	0.019		0.019	0.017	0.018
05/01/00	0.016	0.015	0.016	0.016	0.017	0.016	0.031	0.024	0.029	0.029	0.018	0.018	0.018	0.018	0.018	0.017	0.019	0.018	0.017	0.010	0.020	0.015	0.018
06/01/00	0.013	0.011	0.011	0.013	0.013	0.013	0.017	0.014	0.018	0.019	0.015	0.013	0.015	0.015	0.016	0.014	0.015	0.015	0.016	0.009	0.015	0.014	0.015
07/01/00	0.014	0.013	0.014	0.014	0.011	0.013	0.023	0.017	0.024	0.022	0.018	0.018	0.018	0.017	0.019	0.015	0.019	0.018	0.017	0.011	0.017	0.016	0.017
08/01/00	0.013	0.012	0.013	0.014	0.015	0.014	0.017	0.007	0.018	0.020	0.017	0.016	0.015	0.016	0.016	0.013	0.018	0.017	0.017	0.010	0.014	0.015	0.013
09/01/00	0.014	0.013	0.013	0.014	0.014	0.014	0.026	0.020	0.021	0.022	0.018	0.016	0.014	0.016	0.017	0.013	0.018	0.014	0.013	0.010	0.014	0.013	0.016
10/01/00	0.014	0.014	0.013	0.014	0.015	0.014	0.027	0.021	0.022	0.022	0.019	0.018	0.018	0.018	0.018	0.013	0.019	0.017	0.017	0.010	0.017	0.015	0.016
11/01/00	0.018	0.017	0.017	0.016	0.016	0.015	0.025	0.026	0.027	0.028	0.023	0.023	0.023	0.022	0.022	0.018	0.025	0.025	0.022	0.016	0.024	0.020	0.027
12/01/00	0.011	0.010	0.012	0.013	0.011	0.013	0.022	0.019	0.022	0.021	0.013	0.016	0.016	0.016	0.014	0.011	0.020	0.019	0.012	0.014	0.018	0.015	
01/01/01	0.015	0.014	0.014	0.014	0.014	0.014	0.023	0.022	0.022	0.023	0.017	0.017	0.017	0.015	0.015	0.013	0.018						0.017
02/01/01	0.016	0.015	0.015	0.015	0.016	0.015	0.025	0.024	0.025	0.025	0.018	0.018	0.018	0.018	0.016	0.015	0.023	0.025	0.025		0.026		0.019
03/01/01	0.016	0.016	0.015	0.016	0.016	0.016	0.037	0.027	0.026	0.026	0.021	0.018	0.019	0.019	0.019	0.016	0.026	0.020	0.024	0.010	0.021	0.010	0.018
04/01/01	0.015	0.014	0.013	0.013	0.015	0.012	0.026	0.023	0.028	0.026	0.019	0.017	0.019	0.011	0.020	0.016	0.027	0.026	0.025	0.014	0.026		0.021
05/01/01		0.012	0.013	0.013	0.014	0.013	0.021	0.022	0.026	0.018	0.016	0.016	0.016	0.018	0.016	0.014	0.018	0.017	0.018	0.008	0.016		0.014
06/01/01	0.015	0.012	0.016	0.016	0.016	0.016	0.034	0.021	0.027	0.030	0.018	0.016	0.017	0.022	0.019	0.016	0.020	0.019	0.022	0.008	0.019		0.018
07/01/01	0.014	0.013	0.015	0.015	0.015	0.015	0.028	0.021	0.027	0.026	0.018	0.020	0.020	0.020	0.019	0.016	0.019	0.018	0.017	0.012	0.018		0.018
08/01/01	0.013	0.013	0.018	0.019	0.018	0.018	0.039	0.021	0.027	0.031	0.020	0.019	0.022	0.020	0.025	0.017	0.022	0.020	0.021	0.013	0.021		0.021
09/01/01	0.012	0.010	0.014	0.014	0.014	0.013	0.025	0.017	0.025	0.024	0.017	0.015	0.016	0.017	0.018	0.014	0.015	0.016	0.018	0.010	0.013		0.016
10/01/01	0.013	0.012	0.012	0.015	0.014	0.013	0.032	0.018		0.023	0.017	0.017	0.017	0.016	0.017	0.014	0.025	0.021	0.023	0.016	0.021		0.020
11/01/01	0.012	0.011	0.012	0.013	0.013	0.013	0.024	0.019	0.020	0.020	0.015	0.016	0.017	0.017	0.017		0.019	0.020	0.020	0.013	0.020		0.020
12/01/01	0.015	0.014		0.015	0.014	0.014	0.021	0.020			0.018		0.016	0.018	0.008	0.012	0.019	0.018	0.018	0.012	0.019		0.021
01/01/02	0.015	0.014	0.012	0.016	0.015	0.017	0.028	0.020		0.023	0.015	0.017	0.018	0.017	0.018	0.015	0.017	0.018	0.018		0.016		0.018
02/01/02	0.016	0.015	0.015	0.016	0.015	0.016	0.022	0.023	0.023	0.022	0.018		0.018	0.019	0.019	0.015	0.016	0.016	0.018		0.017		0.018
03/01/02	0.013	0.013	0.012	0.015	0.015	0.015	0.021	0.018	0.016	0.024	0.016	0.015	0.015		0.017	0.015	0.018	0.016	0.016	0.012	0.016	0.012	0.015
04/01/02	0.013	0.011	0.012	0.010	0.014	0.013	0.022	0.015	0.015	0.019	0.015	0.015	0.014	0.016	0.016	0.014	0.014	0.014	0.015	0.012	0.015	0.012	0.149
05/01/02	0.013	0.011	0.012	0.012	0.013	0.013	0.022	0.014	0.019	0.018		0.014	0.013	0.016	0.015	0.013	0.016	0.016	0.015	0.012	0.014	0.014	0.014
06/01/02	0.015	0.014	0.011	0.014	0.013	0.015	0.029	0.013	0.020	0.021		0.014	0.013	0.016	0.016	0.014	0.016	0.016	0.018	0.014	0.017	0.014	0.016
07/01/02																0.013	0.015	0.016	0.014	0.013	0.015	0.013	0.012
07/08/02																0.013	0.016	0.015	0.015	0.014	0.016	0.014	0.013
07/16/02		0.010	0.013					0.013	0.019			0.014	0.015	0.015		0.014	0.016	0.015	0.015		0.016		0.014
07/22/02																0.014	0.016	0.014	0.015	0.013		0.011	0.014
07/29/02																0.014	0.015	0.014	0.016	0.013	0.015	0.013	0.016
07/30/02																							
08/05/02																0.014	0.017		0.015	0.008	0.015	0.014	0.015
08/12/02		0.011	0.014					0.010	0.012			0.013	0.013	0.014		0.015	0.019	0.016	0.016	0.015	0.016	0.014	0.013
08/19/02																0.013	0.017	0.015	0.015	0.014	0.015	0.014	0.015

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
08/26/02																0.013	0.016	0.014	0.014	0.013	0.014	0.013	0.014
08/30/02																							
09/03/02		0.011	0.014					0.013	0.014			0.013	0.013	0.012		0.014	0.013	0.015	0.015	0.014	0.015	0.014	0.015
09/10/02																	0.019	0.018	0.017	0.013	0.017	0.014	0.018
09/16/02		0.010	0.014					0.018	0.021			0.014	0.014	0.017			0.016	0.014	0.014	0.012	0.013	0.011	0.015
09/23/02																	0.017	0.014	0.013	0.011	0.014	0.013	0.015
09/30/02																	0.018	0.015	0.014	0.012	0.015	0.011	0.014
10/02/02		0.011	0.012					0.019	0.016			0.013	0.013	0.013									
10/07/02																	0.017	0.013	0.013	0.012	0.013	0.011	0.015
10/14/02																0.013	0.018	0.014	0.015	0.013	0.015	0.012	0.016
10/16/02		0.010	0.011					0.020	0.012			0.014	0.014	0.012									
10/21/02																0.014	0.020	0.015	0.015	0.013	0.012	0.012	0.019
10/28/02																0.014	0.025	0.020	0.021	0.017	0.020	0.016	0.020
10/30/02		0.012	0.014					0.021	0.022			0.016	0.015	0.012									
11/04/02																0.013	0.022	0.016	0.016	0.013	0.017		0.014
11/12/02																0.014	0.022	0.017	0.016	0.013	0.016		0.018
11/13/02		0.012	0.012					0.017	0.016			0.014	0.013	0.011									
11/18/02																0.014	0.021	0.016	0.015	0.012	0.016		0.014
11/25/02		0.013	0.012					0.021	0.022			0.014	0.014	0.015		0.014	0.024	0.017	0.018	0.013	0.018	0.014	0.017
11/30/02																							
12/09/02																0.014	0.022	0.018	0.018	0.013	0.018		
12/16/02																0.015	0.025	0.022	0.017	0.012	0.017	0.015	
12/17/02		0.014	0.015					0.022	0.026			0.016	0.017	0.017									
12/30/02																							
01/14/03		0.013	0.013					0.020	0.023			0.016	0.016	0.015	0.016	0.014							0.015
02/11/03		0.013	0.012					0.019	0.020			0.014	0.021	0.014	0.014		0.018	0.015	0.019		0.020	0.015	0.015
03/11/03		0.011	0.010					0.030	0.020			0.013	0.012	0.012	0.016		0.024	0.017	0.019		0.019	0.009	0.018
04/15/03		0.013	0.013	0.013				0.032	0.029			0.013	0.013	0.014	0.015	0.013	0.023	0.017	0.018	0.013	0.018	0.013	0.017
05/13/03		0.015	0.015	0.013				0.031	0.032			0.014	0.013	0.017	0.016	0.014	0.032	0.020	0.021	0.016	0.020	0.016	0.025
06/03/03		0.012	0.013	0.013				0.024	0.032			0.013	0.013	0.014	0.014	0.013	0.017	0.015	0.015	0.014	0.015	0.014	0.016
06/10/03																							
06/24/03		0.011	0.011					0.021	0.026			0.011	0.012	0.012			0.018	0.013	0.014	0.013	0.014	0.014	0.019
07/07/03				0.014											0.015	0.013	0.022	0.017	0.017	0.014	0.016	0.014	0.019
07/14/03		0.010	0.012					0.019	0.023			0.012	0.013	0.013		0.013	0.021	0.017	0.017	0.015	0.017	0.015	0.020
07/21/03				0.014											0.016	0.013	0.022	0.018	0.020	0.017	0.020	0.019	0.023
07/28/03				0.015											0.017	0.014	0.020	0.018	0.016	0.013	0.016	0.013	0.018
08/04/03		0.011	0.014	0.014				0.018	0.024			0.015	0.013	0.014	0.016	0.011	0.020	0.014	0.015	0.011	0.014	0.012	0.018
08/11/03				0.016											0.015	0.014	0.022	0.018	0.017	0.014	0.018	0.015	0.019
08/18/03				0.014											0.015	0.011	0.019	0.016	0.015	0.009	0.015	0.013	0.018
08/25/03		0.010	0.013	0.011				0.016	0.027			0.015	0.014	0.016	0.013	0.010	0.015	0.012	0.012	0.008	0.011	0.005	0.013
09/02/03																							
09/08/03		0.011	0.012	0.011				0.016	0.028			0.016	0.015	0.017	0.014	0.010	0.016	0.013	0.013	0.008	0.012	0.005	0.013
09/15/03																							
09/22/03		0.011	0.013	0.017				0.018	0.021			0.017	0.016	0.017	0.019	0.016	0.020	0.016	0.016	0.013	0.016	0.008	0.018
09/29/03															0.017	0.013	0.020	0.014	0.014	0.009	0.014	0.006	0.014

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18
10/06/03		0.009	0.011	0.014				0.019	0.019			0.016	0.015	0.016	0.018	0.013	0.025	0.014	0.015	0.011	0.015	0.006	0.016
10/13/03				0.012											0.017	0.012	0.025	0.014	0.015	0.011	0.015		0.019
10/20/03				0.012											0.025	0.011	0.025	0.019	0.019	0.014	0.019		0.018
10/28/03		0.011	0.011	0.013				0.021	0.027			0.016	0.015	0.015		0.013	0.025	0.019	0.016	0.012	0.020		0.021
11/03/03															0.019	0.015	0.026	0.021	0.020	0.014	0.020	0.010	0.017
11/10/03																							
11/17/03		0.013	0.013	0.015				0.023	0.023			0.018	0.019	0.017	0.019	0.015	0.024	0.017	0.018	0.014	0.017	0.008	
12/01/03		0.013	0.013	0.013				0.022	0.021			0.017	0.018	0.016	0.018	0.014	0.022	0.021	0.020	0.015	0.020	0.010	
12/15/03															0.018	0.014	0.020	0.017	0.025	0.013	0.017	0.008	
01/20/04												0.019	0.019	0.018	0.022	0.015	0.027	0.022	0.016	0.014	0.016	0.008	
02/17/04		0.011	0.012	0.011								0.016	0.016	0.016	0.016	0.012	0.020	0.017	0.016	0.007	0.016	0.006	0.016
03/16/04		0.013	0.013	0.012				0.021	0.022			0.016	0.017	0.017	0.017	0.013	0.019	0.015	0.016		0.016	0.005	0.014
04/13/04		0.012	0.013					0.020	0.021			0.016	0.016	0.016	0.018	0.011	0.022	0.014	0.017		0.016	0.006	0.014
05/18/04				0.013				0.017	0.019			0.015	0.015	0.017	0.017	0.014	0.018	0.015	0.016	0.014	0.015	0.008	0.015
06/21/04		0.019	0.015					0.014	0.020			0.016	0.017	0.016	0.019	0.015	0.019	0.018	0.017	0.014	0.017	0.008	0.019
07/20/04		0.010	0.012					0.025	0.026			0.020	0.021	0.021	0.023	0.019	0.023	0.024	0.023	0.021	0.019	0.015	0.025
08/17/04		0.001	0.001	0.015				0.020	0.021			0.017	0.017	0.020	0.202	0.016	0.022	0.019	0.005	0.003	0.020	0.014	0.018
09/14/04		0.012	0.017	0.013				0.020	0.021			0.015	0.011	0.019	0.017	0.011	0.020	0.015	0.015	0.012	0.014	0.008	0.015
10/12/04		0.012	0.012	0.012				0.025	0.034			0.019	0.019	0.018	0.020	0.012	0.023	0.016	0.016	0.011	0.015	0.008	
11/09/04		0.014	0.014	0.015				0.029	0.025			0.018	0.019	0.018	0.020	0.015	0.031	0.022	0.023	0.016	0.022	0.014	
12/07/04				0.031								0.019	0.019	0.018	0.020		0.037	0.035	0.032	0.023	0.033	0.017	

TABLE 25.2. (CONTINUED) SUVA ($CM^{-1}*(MG/L)^{-1}$) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R19	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99	0.016	0.034																							
09/01/99	0.019	0.032																							
10/01/99	0.014	0.023																							
11/01/99		0.014																							
12/01/99																									
01/01/00	0.010	0.014																							
02/01/00	0.015																								
03/01/00	0.015	0.028																							
04/01/00	0.018	0.037																							
05/01/00	0.017	0.014																							
06/01/00	0.013	0.022																							
07/01/00	0.016	0.028																							
08/01/00	0.015	0.033																							
09/01/00	0.012	0.021																							
10/01/00	0.011	0.033																							
11/01/00	0.009	0.015																							
12/01/00		0.019																							
01/01/01	0.013	0.024																							
02/01/01	0.011	0.026			0.024																				
03/01/01	0.009	0.023			0.024	0.023																			
04/01/01	0.019	0.022			0.026																				
05/01/01	0.013				0.017																				
06/01/01	0.017	0.029			0.028																				
07/01/01	0.016				0.023																				
08/01/01	0.020				0.018																				
09/01/01	0.015	0.028			0.021																				
10/01/01	0.016	0.019			0.026																				
11/01/01	0.016	0.019			0.020																				
12/01/01	0.013				0.018																				
01/01/02	0.016	0.023			0.012																				
02/01/02	0.016				0.014																				
03/01/02		0.016			0.018																				
04/01/02	0.012				0.016																				
05/01/02	0.013	0.027			0.018																				
06/01/02	0.015	0.017			0.026																				
07/01/02	0.014		0.014	0.014			0.012	0.014					0.011	0.013	0.015	0.015	0.009	0.011		0.014		0.014	0.008	0.011	0.007
07/08/02	0.012		0.016	0.015			0.015	0.016					0.012	0.016	0.015	0.016	0.009	0.016		0.016		0.011	0.003	0.014	0.007
07/16/02	0.012		0.016	0.012			0.015	0.015					0.015	0.015	0.016	0.015		0.017		0.017		0.014	0.008	0.016	0.007
07/22/02			0.014	0.014			0.015	0.015					0.014	0.015	0.014	0.014	0.009	0.014		0.015		0.015	0.010	0.013	0.009
07/29/02	0.014		0.016	0.014			0.014	0.014					0.016	0.014	0.015	0.016	0.009	0.016		0.013		0.011	0.009	0.015	0.008
07/30/02																									
08/05/02	0.013		0.015	0.015			0.016	0.016					0.015	0.014	0.015	0.016	0.008	0.015				0.014	0.008	0.013	0.008
08/12/02	0.014		0.017	0.017			0.016	0.016					0.016	0.016	0.016	0.016	0.010	0.017		0.017		0.015	0.012	0.013	0.010

Date	R19	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02	0.012		0.016	0.015			0.015	0.015					0.015	0.015	0.016	0.015	0.009	0.015		0.012		0.014	0.012	0.013	0.007
08/26/02	0.013		0.014	0.014			0.014	0.014					0.013	0.014	0.014	0.014	0.009	0.015		0.015		0.013	0.008	0.013	
08/30/02																									
09/03/02	0.010		0.016	0.015			0.015	0.015					0.015	0.017	0.016	0.016	0.009	0.015		0.015		0.014	0.008	0.014	0.010
09/10/02	0.013		0.016	0.016			0.016	0.017					0.017	0.019	0.020	0.016	0.010	0.021		0.019		0.016	0.015	0.015	0.009
09/16/02	0.013		0.014	0.014			0.014	0.014					0.014	0.014	0.014	0.014	0.009	0.014		0.014		0.014	0.007	0.014	0.007
09/23/02	0.012		0.014	0.014			0.014	0.014					0.015	0.014	0.014	0.014	0.009	0.014		0.014		0.014	0.010	0.014	0.007
09/30/02	0.012	0.029	0.014	0.014			0.015	0.015					0.014	0.014	0.014	0.015	0.011	0.014		0.014		0.015	0.009	0.012	0.009
10/02/02																									
10/07/02	0.012		0.013	0.013			0.013	0.014					0.014	0.014	0.013	0.014	0.009	0.013		0.013		0.015	0.011	0.014	0.008
10/14/02	0.013		0.014	0.014			0.015	0.015					0.016	0.014	0.014	0.015	0.010	0.014		0.014		0.015	0.010	0.013	0.008
10/16/02																									
10/21/02	0.015		0.014	0.015			0.014	0.015					0.018	0.012	0.015	0.014	0.009	0.015		0.015		0.017	0.009	0.014	0.008
10/28/02	0.014		0.019	0.022			0.022	0.020					0.019	0.022	0.021	0.021	0.015	0.021		0.023		0.021	0.015	0.013	0.008
10/30/02		0.046																							
11/04/02	0.012		0.017	0.016			0.017	0.018					0.016	0.016	0.016	0.019	0.016	0.016		0.016		0.016	0.010	0.013	0.007
11/12/02			0.017	0.018			0.017	0.017					0.019	0.017	0.018	0.016	0.014	0.018		0.018		0.015	0.008	0.014	0.008
11/13/02																									
11/18/02			0.016	0.017			0.016	0.015					0.016	0.016	0.017	0.016	0.014	0.017		0.016		0.013	0.007	0.013	0.008
11/25/02			0.018	0.018			0.018	0.017						0.018	0.018	0.018	0.009	0.018		0.018				0.014	0.009
11/30/02																									
12/09/02			0.017	0.017			0.018	0.017						0.017	0.017	0.020	0.014	0.017		0.017				0.013	0.009
12/16/02			0.017	0.018			0.018	0.017						0.021	0.017	0.018	0.009	0.017		0.017				0.015	0.010
12/17/02																									
12/30/02		0.028																							
01/14/03	0.013	0.021			0.023								0.017								0.014	0.015	0.010	0.013	0.008
02/11/03		0.042		0.019	0.018								0.014					0.018			0.014	0.010	0.007	0.013	0.008
03/11/03	0.014	0.028		0.021	0.023								0.015					0.019			0.014	0.015	0.016	0.014	0.008
04/15/03	0.016	0.025	0.018	0.017	0.021				0.017	0.008			0.016	0.020				0.016			0.022	0.160	0.010	0.012	0.008
05/13/03	0.022	0.021	0.020	0.021	0.035				0.020	0.009	0.013	0.011	0.024	0.020		0.021	0.017	0.020			0.032	0.020	0.011	0.013	0.009
06/03/03			0.015	0.015	0.025				0.015	0.022	0.014	0.014	0.016	0.015		0.016	0.014	0.015	0.045		0.017	0.016	0.010	0.014	0.008
06/10/03																									
06/24/03	0.015	0.023							0.013	0.005	0.013	0.013	0.014			0.012	0.007				0.017	0.011	0.006	0.011	0.006
07/07/03	0.014		0.016	0.017	0.029				0.016	0.007			0.019	0.017		0.017	0.010	0.017			0.022	0.017	0.008	0.013	0.008
07/14/03	0.015	0.026	0.017	0.017	0.028								0.019	0.017		0.017	0.010	0.017			0.021	0.017	0.010	0.013	0.008
07/21/03	0.021		0.019	0.020	0.028				0.020	0.011			0.023	0.019		0.021	0.014	0.020			0.022	0.021	0.011	0.014	0.009
07/28/03	0.016		0.015	0.015	0.029				0.007	0.015			0.018	0.017		0.015	0.012	0.017			0.020	0.017	0.010	0.015	0.009
08/04/03	0.014		0.015	0.015	0.028				0.015	0.007			0.016	0.014		0.015	0.012	0.015			0.020	0.014	0.009	0.014	0.008
08/11/03	0.017		0.018	0.018	0.028				0.017	0.015			0.020	0.016		0.017	0.013	0.018			0.022	0.019	0.011	0.014	0.009
08/18/03	0.012				0.025				0.016	0.007			0.018			0.015	0.011				0.019	0.015	0.007	0.013	0.007
08/25/03	0.008	0.040			0.019				0.011	0.004	0.015	0.014	0.012			0.011	0.008				0.014	0.007	0.003	0.010	0.005
09/02/03																									
09/08/03	0.009				0.021				0.012	0.004			0.013			0.012	0.008				0.014	0.010	0.006	0.010	0.006
09/15/03																									
09/22/03	0.011	0.022			0.027				0.016	0.007			0.018			0.016	0.011				0.019	0.016	0.011	0.016	0.011

Date	R19	R20	R21	R22	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03	0.010				0.025				0.013	0.005			0.015			0.013	0.010				0.016	0.012	0.007	0.013	0.008
10/06/03	0.010				0.026				0.015	0.006			0.017			0.015	0.010				0.017	0.012	0.005	0.013	0.007
10/13/03	0.014								0.016	0.007	0.012	0.012	0.018			0.015	0.012				0.022	0.017	0.008	0.013	0.007
10/20/03	0.015				0.017				0.016	0.008			0.017			0.019	0.014				0.023	0.007	0.013	0.012	0.006
10/28/03	0.014	0.023			0.026				0.020	0.006			0.018			0.018	0.014				0.025	0.014	0.011	0.013	0.007
11/03/03	0.010								0.019	0.009			0.016			0.020	0.015				0.020	0.014	0.008	0.013	
11/10/03																									
11/17/03					0.023				0.019	0.012						0.020	0.013							0.016	0.010
12/01/03		0.026			0.022				0.018	0.012						0.021	0.017							0.014	0.009
12/15/03		0.031			0.022				0.016	0.010	0.015	0.014				0.018	0.014							0.012	0.008
01/20/04		0.015			0.025						0.015	0.016	0.020									0.024	0.017	0.015	0.010
02/17/04		0.021			0.019						0.012	0.012	0.014								0.021	0.008	0.003	0.012	0.007
03/16/04	0.010	0.025			0.021				0.015		0.014	0.014				0.016	0.012				0.015			0.013	0.007
04/13/04	0.011								0.014	0.007	0.013	0.013				0.016	0.011				0.014			0.013	0.008
05/18/04	0.013	0.031			0.019				0.015	0.009	0.016	0.016	0.015			0.015	0.013				0.016	0.014	0.011	0.013	0.009
06/21/04	0.019	0.014			0.023				0.018	0.009	0.015	0.016	0.019			0.019					0.017	0.018	0.010	0.015	0.009
07/20/04	0.020	0.049			0.046				0.023	0.012	0.017		0.023			0.024	0.021				0.025	0.023	0.015	0.019	0.011
08/17/04	0.011	0.045	0.019	0.018	0.038				0.018	0.008	0.015	0.014	0.017	0.018		0.019	0.017	0.019			0.019	0.071	0.020	0.015	0.007
09/14/04	0.011	0.046	0.014	0.016	0.021				0.011	0.006	0.013	0.014	0.020	0.007		0.014	0.013	0.016			0.017	0.011	0.006	0.012	0.004
10/12/04		0.028	0.015	0.017	0.028				0.013	0.009	0.017	0.017	0.017	0.016		0.016	0.012	0.015			0.020	0.050	0.011	0.013	0.009
11/09/04		0.044	0.022	0.023	0.029				0.026	0.011	0.017	0.017	0.017	0.022		0.023	0.017	0.022			0.021	0.014		0.015	0.010
12/07/04			0.034	0.033	0.034				0.020	0.015				0.034		0.035	0.022	0.037			0.037	0.021		0.029	0.013

TABLE 26. PLANKTONIC ALGAE (TOTAL ORGANISMS/mL) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R5	R6A	R6B	R7	R8	R9A	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
08/01/99	147	76	18	18	61	302	522	127	204	44	849	420	208	337	464	258	86		366		171		
09/01/99	41	65	22	15	25	141	352	136	272	42	274	0	135	28	388	252	192		194		186		
10/01/99	75	136	201	150	121	100	128	142	266	72	135	137	122	187	531	359	156		127		366		
11/01/99	115	87	452	1022	612	476	244	425	581	112	1043	474	49	525	503	490	395		539				
12/01/99	350	152	158	332	51	525	95	266	171	73	322		94	157	358	302	712		524				
01/01/00	712	230	157	827	1252	310	316	424	273	143	76	136	495	229	265						272		
02/01/00	87	56	22	130	331	286	46	51	102	7	11	30	19	711	237	394	273		309		877		
03/01/00	382	51	81	236	236	221	26	19	287	8	0	251	115	271	461	194	273		193		216		157
04/01/00	55	56	26	22	40	87	44	29	62	4	4	23	381	38	164	243	394		531		73		26
05/01/00	92	22	35	75	87	59	7	22	171	18	34	91	238	150	288	227	460		330		237		
06/01/00	257	44	40	51	164	619	243	93	215	18	108	229	317	80	307	330	763		446		440		92
07/01/00	167	337	48	22	178	391	323	42	329	313	1518	5201	237	237	503	482	358		266		301		49
08/01/00	141	488	252	113	143	251	81	65	308	45	148	55	191	218	229	159	992		920		274		179
09/01/00	164	532	337	273	229	365	115	98	193	66	171	178	136	108	193	136	271		431		193		130
10/01/00	1267	288	202	295	274	468	432	806	734	346	706	1246	151	166	497	497	108		223		158		684
11/01/00	612	122	295	418	151	562	1303	799	648	670	403	583	323	252	432	814	648		346		310		0
12/01/00	418	1123	382	302	425	619	1678	245	302	475	878	1267	65	547	446	367	259		2938				
01/01/01	317	972	475	526	281	446	482	396	331	526	482	533	115	202	626						252		14
02/01/01	490	482	324	562	828	216	446	187	389	144	29	101	158	576	389	245	490		418		864		144
03/01/01	173	43	29	180	101	36	65	72	115	14	22	7	137	1080	108	418	180		72		367		144
04/01/01	288	58	22	144	202	317	36	655	130	58	58	36	202	425	295	317	598		130		425		166
05/01/01		86	43	605	137	268	283	137	165	129	770	57	454	331	274	274	324		36		404		201
06/01/01	129	14	7	29	144	187	734	14	173	57	1137	72	360	173	547	648	533		677		663		
07/01/01	201	21	35	35	100	375	474	86	144	331	1731	118	100	122	360	259	274		244		476		
08/01/01																							
09/01/01	116	50	86	72	57	245	35	22	230	43	166	14	259	50	533	749	417		792		360		
10/01/01	115	144	129	36	201	187			172	5919	100	57	159	446	533	403	259		302		360		
11/01/01	137	7	43	122	7	65	36	7	58	115	173	187	144		252	58	58		403		151		14
12/01/01	115	50		151	43	65	50		94	43	281	274	22	36	655	482	130		562		302		14
01/01/02	338	58	72	115	130	65	288		288	72	137	158	446	43	461	324	137		1080		1087		
02/01/02	346	310	130	295	310	101	43	58	130	806	115	58	209	425	742	158	94		518		223		
03/01/02																							
04/01/02																							
05/01/02																							
06/01/02																							
07/01/02																							
07/08/02																							
07/16/02																							
07/22/02																							
07/29/02																							
08/05/02																							
08/12/02																							
08/19/02																							
08/26/02																							

TABLE 27. PLANKTONIC DIATOMS (ORGANISMS/ML) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R5	R6A	R6B	R7	R8	R9A	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
08/01/99	135	76	0	18	54	195	493	91	189	19	777	297	165	302	402	229	0		366		164		
09/01/99	22	61	15	7	7	63	317	115	222	28	137		128	28	352	245	178		158		172		
10/01/99	68	94	136	78	100	86	93	107	180	7	57	86	108	158	481	345	142		120		338		
11/01/99	79	57	309	1022	569	368	186	360	503	36	1000	438	41	504	489	483	395		474				
12/01/99	346	148	137	328	51	511	91	266	171	62	301		90	153	337	295	648		517				
01/01/00	705	223	143	820	1245	303	295	417	266	122	72	108	474	229	265						258		
02/01/00	87	48	22	130	331	257	34	37	102	0	4	22	19	711	230	387	273		309		870		
03/01/00	382	47	62	215	208	164	15	11	266	8	0	251	108	271	403	166	273		186		188		143
04/01/00	44	44	26	11	25	55	0	11	58	4	4	23	374	30	157	236	387		517		69		26
05/01/00	81	18	27	75	87	41	7	8	171	18	26	91	231	136	281	227	460		330		237		
06/01/00	78	18	0	44	129	166	201	57	201	14	101	201	259	62	300	330	735		432		440		78
07/01/00	22	273	44	18	152	355	129	28	301	247	1094	5030	230	237	503	482	337		259		301		49
08/01/00	51	424	223	63	129	179	40	39	128	33	65	19	187	199	229	138	985		906		245		136
09/01/00	100	475	302	216	222	344	58	72	193	55	71	93	136	65	193	129	192		388		100		94
10/01/00	1152	274	180	166	216	425	346	720	677	216	590	1238	137	108	338	418	94		173		115		648
11/01/00	324	115	274	223	50	562	1296	792	468	468	158	482	223	216	79	706	641		338		266		0
12/01/00	389	1116	317	288	425	619	1656	245	302	446	871	1267	65	533	446	353	238		2938				
01/01/01	144	432	389	281	101	439	324	259	317	526	475	526	108	101	626						216		14
02/01/01	310	101	86	497	511	202	439	187	374	65	0	29	130	274	374	238	490		418		482		130
03/01/01	151	21	22	151	101	29	36	72	108	7	7	0	115	1080	108	396	180		65		367		144
04/01/01	259	7	22	144	202	317	36	648	130	50	0	36	202	410	295	317	598		130		425		166
05/01/01		79	43	605	137	216	158	108	158	115	727	50	432	302	274	274	317		36		382		158
06/01/01	86	7	0	29	43	173	720	0	144	43	1123	72	360	130	518	634	490		619		634		
07/01/01	158	14	21	21	93	317	446	72	130	288	1397	101	72	108	331	259	245		230		418		
08/01/01																							
09/01/01	58	36	72	58	43	245	14	22	187	22	101	14	245	50	504	720	374		749		331		
10/01/01	58	86	115	29	187	187			158	101	72	43	130	432	504	389	245		288		302		
11/01/01	122	0	14	122	0	58	14	0	50	94	173	187	122		238	50	58		403		151		14
12/01/01	94	43		151	36	65	43		86	14	259	259	14	14	655	482	115		562		302		14
01/01/02	338	36	65	115	130	58	274		281	72	101	122	439	43	461	324	137		1080		1080		
02/01/02	331	310	130	295	302	101	29	58	130	792	36	22	180	425	742	108	72		511		223		
03/01/02																							
04/01/02																							
05/01/02																							
06/01/02																							
07/01/02																							
07/08/02																							
07/16/02																							
07/22/02																							
07/29/02																							
08/05/02																							
08/12/02																							
08/19/02																							
08/26/02																							

TABLE 28. PLANKTONIC GREEN ALGAE (ORGANISMS/ML) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R5dup	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
08/01/99	0	0	18	0	0		21		4	4	4	0	29		29	0	14	7	0	0		0		0		
09/01/99	0	0	0	0	7		14		14	0	14	0	65			0	0	0	0	0		7		0		
10/01/99	0	14	7	0	14		0		14	14	43	36	35		0	7	0	0	0	0		0		0		
11/01/99	0	4	14	0	29		36		0	14	28	0	7		14	4	0	7	7	0		0				
12/01/99	0	0	21	4	0		0		4	0	0	0	7			0	0	7	0	7		0				
01/01/00	0	7	7	0	7		7		14	7	0	14	4		21	14	0	0						0		
02/01/00	0	8	0	0	0		0		12	7	0	0	7		4	0	0	7	7	0		0		0		
03/01/00	0	0	11	0	0		7		0	8	7	0	0		0	0	0	0	7	0		0		14		0
04/01/00	0	8	0	0	4		0		40	7	0	0	0		0	7	0	0	7	0		0		0		0
05/01/00	11	4	8	0	0		0		0	0	0	0	0		0	0	0	0	0	0		0		0		
06/01/00	93	0	0	0	7		0		21	7	0	0	0		7	0	0	0	0	7		0		0		0
07/01/00	36	7	4	0	11		0		14	0	7	4	122		0	0	0	0	0	0		0		0		0
08/01/00	29	14	7	0	0		7		19	8	0	4	36		0	0	4	0	0	0		0		0		7
09/01/00	14	21	14	14	0		7		36	11	0	0	50		57	0	0	0	7	0		7		7		0
10/01/00	115	14	0	29	50		0		0	0	0	0	22		0	0	22	0	0	7		0		0		0
11/01/00	22	0	22	22	14		0		0	7	22	7	0		22	7	0	0	0	0		0		7		0
12/01/00	7	7	0	14	0		0		14	0	0	7	7		0	0	0	0	0	0		0				
01/01/01	7	7	7	0	0		7		43	36	14	0	7		7	7	94	0						0		0
02/01/01	0	7	7	29	0		0		7	0	14	22	29		72	7	7	14	0	0		0		0		0
03/01/01	14	7	0	0	0		0		14	0	0	0	14		7	7	0	0	0	0		0		0		0
04/01/01	7	29	0	0	0		0		0	0	0	0	50		0	0	0	0	0	0		0		0		0
05/01/01		0	0	0	0		0		79	7	7	7	14		0	22	0	0	0	0		0		0		0
06/01/01	0	7	7	0	0		0		14	7	0	0	14		0	0	0	0	0	0		0		0		
07/01/01	29	0	0	0	0		0		14	0	14	0	158		0	0	0	0	0	0		0		0		
08/01/01																										
09/01/01	29	7	0	0	0		0		7	0	0	7	22		0	0	0	0	0	0		0		0		
10/01/01	43	58	0	0	14		0				0	5818	14		0	22	14	0	0	0		0		0		
11/01/01	14	0	7	0	0		7		14	0	7	0	0		0	22		14	0	0		0		0		0
12/01/01	7	7		0	0		0		7		7	22	22		14	7	0	0	0	0		0		0		0
01/01/02	0	22	7	0	0		7		14		7	0	14		22	0	0	0	0	0		0		7		
02/01/02	7	0	0	0	7		0		14	0	0	0	79		36	22	0	0	43	22		7		0		
03/01/02																										
04/01/02																										
05/01/02																										
06/01/02																										
07/01/02																										
07/08/02																										
07/16/02																										
07/22/02																										
07/29/02																										
08/05/02																										
08/12/02																										
08/19/02																										
08/26/02																										

TABLE 29. PLANKTONIC BLUE-GREEN ALGAE (ORGANISMS/ML) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R5	R6A	R6B	R7	R8	R9A	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
08/01/99	8	0	0	0	7	79	25	92	7	25	36	87	43	21	58	29	86		0		7		
09/01/99	19	4	7	8	11	64	14	21	36	14	72		7	0	36	7	14		29		14		
10/01/99	7	28	58	72	7	14	21	21	43	29	43	51	7	29	50	14	14		7		28		
11/01/99	36	26	129	0	14	72	58	51	50	76	36	22	4	21	7	0	0		65				
12/01/99	4	4	0	0	0	14	0	0	0	11	14		4	4	14	7	58		7				
01/01/00	0	0	7	7	0	0	7	0	7	7	0	7	7	0	0						14		
02/01/00	0	0	0	0	0	0	0	7	0	0	0	4	0	0	0	0	0		0		7		
03/01/00	0	4	8	21	28	43	11	0	14	0	0	0	7	0	58	21	0		7		14		14
04/01/00	11	4	0	11	11	32	4	11	4	0	0	0	0	8	7	0	7		14		4		0
05/01/00	0	0	0	0	0	18	0	14	0	0	4	0	0	14	7	0	0		0		0		
06/01/00	86	18	36	7	14	439	14	29	14	4	7	21	58	18	7	0	21		14		0		14
07/01/00	26	50	0	4	15	29	144	14	21	8	252	157	7	0	0	0	14		7		0		0
08/01/00	50	50	22	50	14	65	22	18	180	8	47	36	4	15	0	21	7		14		29		36
09/01/00	36	36	21	43	7	14	21	15	0	11	50	28	0	43	0	0	79		36		79		36
10/01/00	0	0	14	101	7	43	86	86	58	130	50	7	14	36	22	79	7		50		43		36
11/01/00	58	7	0	36	0	0	7	0	158	194	245	79	94	29	353	108	7		7		36		0
12/01/00	22	0	65	0	0	0	0	0	0	7	0	0	0	14	0	14	22		0				
01/01/01	0	14	79	14	0	0	65	86	0	0	0	0	0	7	0	0	0		0		36		0
02/01/01	7	0	0	0	0	0	0	0	0	0	0	0	22	7	7	7	0		0		0		14
03/01/01	7	7	7	22	0	7	14	0	7	7	0	0	14	0	0	22	0		7		0		0
04/01/01	22	22	0	0	0	0	0	7	0	7	7	0	0	14	0	0	0		0		0		0
05/01/01		0	0	7	0	22	36	22	0	7	29	7	0	29	0	0	7		0		22		43
06/01/01	43	0	0	14	101	14	14	7	29	14	0	0	0	43	29	14	43		58		29		
07/01/01	14	7	14	14	7	58	14	0	0	43	158	7	14	14	29	0	29		14		58		
08/01/01																							
09/01/01	29	0	14	14	14	0	14	0	29	14	43	0	14	0	29	29	43		43		29		
10/01/01	14	0	0	7	0	0			14	0	14	14	7	0	29	14	14		14		58		
11/01/01	0	0	0	0	0	0	0	0	7	0	0	0	22		14	7	0		0		14		0
12/01/01	14	0		0	7	0	0		0	7	0	0	0	22	0	0	14		0		0		
01/01/02	0	0	0	0	0	0	0		0	0	14	14	7	0	0	0	0		0		0		
02/01/02	7	0	0	0	0	0	0	0	0	14	0	0	7	0	0	7	0		0		0		
03/01/02																							
04/01/02																							
05/01/02																							
06/01/02																							
07/01/02																							
07/08/02																							
07/16/02																							
07/22/02																							
07/29/02																							
08/05/02																							
08/12/02																							

TABLE 30.1. DISSOLVED ORGANIC NITROGEN (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00																								
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05/01/00																								
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08/01/01																								
09/01/01																								
10/01/01																								
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02																								
03/01/02	0.08	0.14	0.2	0.11	0.09	0.091	0.08	0.1	0.12	0.11	0.22	0.2	0.155		0.18	0.12	0.15	0.05	0.13	0.16	0.1	0.15	0.06	
04/01/02	0.08		0.12	0.12	0.1	0.101	0.09	0.08	0.04	0.08	0.14	0.21	0.205	0.19	0.11	0.1	0.18	0.14	0.15	0.11	0.16	0.15	0.18	0.1
05/01/02	0.04	0.18	0.13	0.09	0.06	0.029	0.02	0.06	0.07	0.06		0.22	0.162	0.15	0.13	0.07	0.16	0.12	0.13	0.02	0.09	0.05	0.07	0
06/01/02	0.12	0.06	0.27	0.18	0.11	0.125	0.03	0.06	0.04	0.06		0.17	0.201	0.14	0.16	0.13	0.12	0.15	0.17	0.09	0.14	0.04	0.14	0.09
07/01/02																0.15	0.16	0.15	0.12	0.12	0.08	0.15	0.14	0.11
07/08/02																0.18	0.17	0.2	0.22	0.2	0.19	0.19	0.23	0.19
07/16/02		0.22	0.1					0.15	0.11			0.23	0.248	0.2		0.13	0.14	0.13	0.17	0.1	0.13	0.06	0.11	0.07
07/22/02																0.17	0.21	0.2	0.19	0.17	0.27	0.14	0.16	0.16
07/29/02																0.2	0.17	0.18	0.22	0.17	0.21	0.17	0.19	0.17
07/30/02																								
08/05/02																0.15	0.16	0.15	0.18	0.14	0.19	0.12	0.15	0.13
08/12/02		0.35	0.38					0.17	0.5			0.24	0.286	0.36		0.14	0.19	0.14	0.16	0.12	0.15	0.09	0.17	0.13
08/19/02																0.18	0.18	0.21	0.21	0.17	0.18	0.15	0.22	0.22

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/26/02																0.12	0.1	0.22	0.16	0.11	0.12	0.04	0.15	0.08
08/30/02																								
09/03/02		0.28	0.28					0.32	0.31			0.34	0.361	0.55		0.13	0.14	0.24	0.17	0.11	0.15	0.14	0.21	0.16
09/10/02																	0.23	0.22	0.2	0.13	0.2	0.16	0.15	0.11
09/16/02		0.34	0.21					0.09	0.12			0.2	0.212	0.26			0.13	0.17	0.2	0.13	0.08	0	0.08	0.05
09/23/02																	0.14	0.14	0.38	0.11	0.2	0.1	0.16	0.13
09/30/02																	0.11	0.11	0.13	0.08	0.13	0.08	0.11	0.1
10/02/02		0.21	0.23					0.15	0.14			0.28	0.303	0.26										
10/07/02																	0.11	0.12	0.13	0.06	0.21	0.18	0.13	0.09
10/14/02																0.12	0.11	0.13	0.14	0.09	0.16	0.11	0.09	0.04
10/16/02		0.27	0.38					0.2	0.35			0.31	0.326	0.49										
10/21/02																0.17	0.15	0.17	0.2	0.15	0.17	0.13	0.15	0.12
10/28/02																0.18	0.13	0.16	0.17	0.13	0.18	0.11	0.15	0.08
10/30/02		0.29	0.34					0.24	0.23			0.26	0.375	0.53										
11/04/02																0.21	0.13	0.22	0.17	0.11	0.17		0.19	0.14
11/12/02																0.17	0.13	0.15	0.18	0.1	0.15		0.16	
11/13/02		0.26	0.31					0.24	0.19			0.24	0.302	0.33										
11/18/02																0.1	0.05	0.08	0.08	0.04	0.02		0.09	
11/25/02		0.21	0.27					0.08	0.1			0.25	0.206	0.15		0.15	0.08	0.1	0.11	0.05	0.11	0.04	0.12	
11/30/02																								
12/09/02																0.16	0.09	0.14	0.12	0.08	0.12			
12/16/02																0.16	0.09	0.11	0.14	0.08	0.14	0.1		
12/17/02		0.23	0.21					0.17	0.14			0.24	0.25	0.29										
12/30/02																								
01/14/03		0.19	0.2					0.12	0.15			0.22	0.216	0.18	0.17	0.16							0.11	0.09
02/11/03		0.16	0.15					0.09	0.02			0.19	0.19	0.2	0.13		0.03	0.1	0.06		0.1	0.06	0.07	
03/11/03		0.17	0.18					0.2	0.11			0.22	0.265	0.27	0.21		0.11	0.16	0.14		0.16	0.09	0.08	0.08
04/15/03		0.29	0.18	0.13				0.2	0.12			0.21	0.229	0.21	0.21	0.13	0.12	0.14	0.21	0.56	0.15	0.09	0.16	0.14
05/13/03		0.26	0.18	0.27				0.24	0.24			0.25	0.308	0.24	0.25	0.18	0.19	0.17	0.17	0.14	0.18	0.17	0.18	0.17
06/03/03		0.25	0.2	0.18				0.28	0.2			0.25	0.253	0.23	0.23	0.16	0.22	0.22	0.2	0.19	0.19	0.16	0.19	0.22
06/10/03																0.16	0.16	0.17	0.17	0.2	0.21	0.17	0.2	0.19
06/24/03		0.37	0.43	0.14				0.4	0.3			0.48	0.35	0.5	0.23	0.2	0.19	0.19	0.18	0.18	0.18	0.19	0.19	0.18
07/07/03				0.19											0.24	0.2	0.21	0.21	0.22	0.19	0.2	0.18	0.24	0.2
07/14/03		0.45	0.49					0.37	0.59			0.66	0.477	0.62		0.18	0.2	0.2	0.27	0.23	0.23	0.23	0.23	0.17
07/21/03				0.2											0.24	0.21	0.21	0.16	0.21	0.19	0.23	0.17	0.23	0.17
07/28/03				0.12											0.2	0.19	0.22	0.19	0.17	0.12	0.13	0.11	0.17	0.12
08/04/03		0.42	0.44	0.25				0.35	0.46			0.42	0.371	0.59	0.23	0.19	0.24	0.22	0.21	0.15	0.27	0.17	0.26	0.22
08/11/03				0.26											0.31	0.16	0.22	0.22	0.32	0.19	0.21	0.21	0.23	0.22
08/18/03				0.13											0.26	0.21	0.22	0.22	0.2	0.17	0.15	0.18	0.19	0.18
08/25/03		0.3	0.27	0.2				0.23	0.33			0.31	0.35	0.37	0.26	0.2	0.2	0.21	0.24	0.16	0.16	0.11	0.23	0.19
09/02/03																								
09/08/03		0.33	0.44	0.2				0.26	0.25			0.35	0.313	0.34	0.26	0.22	0.21	0.22	0.21	0.18	0.15	0.19	0.23	0.19
09/15/03																								
09/22/03		0.34	0.37	0.28				0.26	0.48			0.38	0.325	0.38	0.28	0.23	0.23	0.22	0.21	0.23	0.2	0.13	0.2	0.14
09/29/03															0.29	0.21	0.19	0.12	0.19	0.18	0.14	0.11	0.32	0.16

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
10/06/03		0.3	0.4	0.23				0.27	0.31			0.38	0.363	0.37	0.26	0.21	0.18	0.23	0.21	0.18	0.22	0.16	0.22	0.14
10/13/03				0.21											0.23	0.27	0.2	0.22	0.27	0.22	0.26		0.22	0.14
10/20/03				0.25											0.25	0.25	0.21	0.23	0.24	0.22	0.25		0.22	0.2
10/28/03		0.28		0.09				0.28				0.31	0.349	0.46		0.2	0.21	0.17	0.22	0.15	0.19		0.2	0.1
11/03/03															0.11	0.16	0.2	0.22	0.23	0.13	0.21	0.13	0.12	0.13
11/10/03																								
11/17/03		0.22	0.36	0.11				0.22	0.23			0.28	0.272	0.33	0.19	0.19	0.15	0.17	0.21	0.14	0.12	0.09		
12/01/03				0.18											0.15	0.19	0.17	0.17	0.15	0.12	0.16	0.1		
12/15/03															0.15	0.14	0.14	0.14	0.12	0.1	0.14	0.13		
01/20/04												0.21	0.192	0.29	0.15	0.13	0.13	0.03	0.13	0.08	0.04	0.04		
02/17/04																								
03/16/04																								
04/13/04																								
05/18/04																								
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 30.2. (CONTINUED) DISSOLVED ORGANIC NITROGEN (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Hwy 87	Mesa	Pima	Scotts	NP In	NP Out	Green In	Green Out	Hav. 1	Hav. 2	HTC	Roosvelt	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00																								
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09/01/01																								
10/01/01																								
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	0.092																							
03/01/02				0.11																				
04/01/02	0.047			0.1	0.37																			
05/01/02				0.06																				
06/01/02	0.037			0.21																				
07/01/02		0.14	0.11				0.213	0.166	0.15	0.145	0.124	0.123	0.16					0.14			0.088	0.062	0.209	0.124
07/08/02		0.22	0.23			0.253	0.19	0.231	0.241	0.243	0.238	0.218	0.134					0.23			0.236	0.288	0.237	0.196
07/16/02		0.14	0.17			0.176	0.119	0.146	0.143	0.158	0.144	0.138	0.117					0.05			0.038	0.007	0.133	0.081
07/22/02		0.18	0.2			0.21	0.217	0.176	0.189	0.21	0.195	0.158	0.094					0.02			-0.141	-0.05	0.212	0.139
07/29/02		0.22	0.2			0.212	0.208	0.187	0.186	0.197	0.192	0.197	0.155					0.13			0.063	0.054	0.18	0.14
07/30/02																								
08/05/02		0.17	0.17			0.161	0.171	0.18	0.153	0.157	0.165	0.153	0.109					0.1			-0.062	-0.106	0.163	0.1
08/12/02		0.16	0.16			0.163	0.133	0.175	0.18	0.185	0.146	0.15	0.098					-0.26			-0.18	-0.147	0.109	0.094

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Hwy 87	Mesa	Pima	Scotts	NP In	NP Out	Green In	Green Out	Hav. 1	Hav. 2	HTC	Roosvelt	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02		0.23	0.17			0.236	0.22	0.26	0.21	0.2	0.204	0.218	0.154					0.18			0.059	-0.012	0.141	0.151
08/26/02		0.15	0.15			0.134	0.145	0.145	0.142	0.158	0.133	0.184	0.085					0.11			-0.187	-0.189	0.088	0.054
08/30/02																								
09/03/02		0.16	0.15			0.221	0.139	0.153	0.171	0.166	0.143	0.191	0.144					0.11			0.022	-0.046	0.103	0.093
09/10/02		0.21	0.22			0.246	0.271	0.212	0.192	0.178	0.2	0.172	0.193					0.26			0.674	0.444	0.216	0.103
09/16/02		0.08	0.18			0.073	0.12	0.178	0.178	0.163	0.191	0.132	0.112					0.17			0.152	0.146	0.097	0.083
09/23/02		0.16	0.14			0.157	0.142	0.157	0.169	0.155	0.137	0.211	0.161					0.08			0.352	0.335	0.158	0.119
09/30/02	0.101	0.15	0.15			0.147	0.146	0.126	0.182	0.187	0.2	0.128	0.097					0.12			-0.287	-0.194	0.104	0.061
10/02/02																								
10/07/02		0.08	0.12			3.715	0.21	0.085	0.118	0.117	0.123	0.121	0.101					0.07			0.046	0.07	0.119	0.066
10/14/02		0.14	0.09			0.134	0.116	0.151	0.118	0.105	0.086	0.151	0.104					0.1			-0.058	-0.107	0.097	0.044
10/16/02																								
10/21/02		0.19	0.2			0.204	0.185	0.187	0.181	0.206	0.196	0.173	0.137					0.13			0.035	0.002	0.189	0.131
10/28/02		0.19	0.17			0.195	0.174	0.16	0.157	0.167	0.166	0.169	0.203					0.09			-0.063	-0.114	0.202	0.13
10/30/02	0.121																							
11/04/02		0.18	0.18			0.172	0.172	0.175	0.172	0.185	0.186	0.153	0.131					0.07			0.012	-0.045	0.209	0.137
11/12/02		0.15	0.15			0.168	0.178	0.139	0.145	0.154	0.153	0.177	0.155					0.14			-0.005	0.044	0.169	0.13
11/13/02																								
11/18/02		0.11	0.07			0.072	0.084	0.093	0.079	0.082	0.073	0.111	0.059					0.12					0.102	0.049
11/25/02		0.12	0.11			0.083	0.13	0.103	0.12	0.115	0.113	0.124	0.021										0.098	0.082
11/30/02																								
12/09/02		0.13	0.13			0.093	0.134	0.116	0.122	0.126	0.123	0.115	0.072										0.181	0.106
12/16/02		0.14	0.14			0.135	0.144	0.117	0.133	0.145	0.149	0.13	0.039										0.172	0.097
12/17/02																								
12/30/02	0.034																							
01/14/03	0.026			0.09																0.176			0.149	0.098
02/11/03	0.154		0.12	0.03						0.029								0.07		0.14	0.069	0.142	0.086	0.073
03/11/03	0.131		0.13	0.1						0.173								0.07		0.131	0.075	0.076	0.141	0.103
04/15/03	0.116	0.48	0.12	0.11				0.143		0.229								0.14		0.117	0.025		0.118	0.058
05/13/03	0.124	0.19	0.19	0.18				0.178		0.197		0.174	0.14		0.06	0.198	0.199	0.04		0.204			0.241	0.126
06/03/03		0.18	0.2	0.2				0.195		0.237		0.189	0.156	0.182	0.105	0.141	0.17	0.14	0.922	0.197	0.103	0.059	0.168	0.141
06/10/03		0.23	0.18					0.177		0.17		0.213	0.175	0.128	0.146			0.17		0.198	0.178	0.151	0.121	0.116
06/24/03	0.076	0.19	0.17	0.18				0.162		0.331		0.216	0.168	0.176	0.131	0.18	0.151	0.15		0.204	0.141	0.11	0.135	0.149
07/07/03		0.22	0.2	0.22				0.215		0.215		0.191	0.16	0.162	0.112			0.18		0.196	0.122	0.075	0.183	0.14
07/14/03	0.095	0.21	0.18	0.17				0.203		0.206		0.206	0.205					0.18		0.209	0.087	0.069	0.174	0.131
07/21/03		0.18	0.22	0.2				0.231		0.208		0.172	0.155	0.122	0.106			0.18		0.33	0.095	0.102	0.229	0.125
07/28/03		0.16	0.17	0.17				0.192		0.182		0.183	0.122	0.105	0.183			0.1		0.166	0.1	0.172	0.145	0.146
08/04/03		0.23	0.28	0.19				0.228		0.225		0.21	0.183	0.253	0.149			0.15	0.94	0.176	-0.061	0.067	0.224	0.162
08/11/03		0.25	0.21	0.2				0.244		0.26		0.218	0.207	0.222	0.144			0.12		0.265	0.09	0.105	0.235	0.184
08/18/03				0.2								0.217	0.191	0.183	0.084			0.23		0.212	0.076	-0.013	0.215	0.177
08/25/03	0.124			0.16								0.24	0.192	0.061	0.072	0.179	0.182	0.01		0.204	0.047	0.019	0.203	0.169
09/02/03																								
09/08/03				0.16								0.188	0.137	0.145	0.085			0.11		0.262	0.026	0.006	0.193	0.171
09/15/03																								
09/22/03	0.186			0.11								0.544	0.182	0.064	0.093			0.07		0.199	0.019		0.193	0.197

Date	R20	R21	R22	R25	R26	16th St.	19th Av.	Hwy 87	Mesa	Pima	Scotts	NP In	NP Out	Green In	Green Out	Hav. 1	Hav. 2	HTC	Roosvelt	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03				0.16								0.146	0.128	0.053	0.152			0.13		0.195	0.134	0.054	0.141	0.201
10/06/03				0.17								0.236	0.089	0.179	0.112			0.25		0.217	0.122	0.099	0.239	0.177
10/13/03												0.235	0.076	0.233	0.172	0.23	0.253	0.22		0.192	0.24	0.153	0.272	0.242
10/20/03				0.27								0.252	0.177	0.182	0.158			0.16		0.201	0.353	0.503	0.222	0.222
10/28/03	0.102			0.16								0.215	0.165	0.115				0.07		0.19	0.05		0.153	0.194
11/03/03												0.158	0.185	0.164	0.044					0.24	0.136	0.353	0.171	
11/10/03																								
11/17/03				0.17								0.136	0.193	0.111	0.103								0.153	0.147
12/01/03				0.15								0.213	0.182	0.336	0.235								0.207	0.107
12/15/03	0.069			0.16								0.151	0.098	0.068	0.035	0.13	0.103						0.133	0.111
01/20/04				0.14												0.115	0.139	0.03					0.086	0.086
02/17/04																								
03/16/04																								
04/13/04																								
05/18/04																								
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 31.1. NITRATE (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00																								
04/01/00																								
05/01/00																								
06/01/00																								
07/01/00																								
08/01/00																								
09/01/00																								
10/01/00																								
11/01/00																								
12/01/00																								
01/01/01																								
02/01/01																								
03/01/01	0.255	0.145	0.109	0.292	0.280	0.284	0.054	0.000	0.013	0.011	0.110	0.017	0.011	0.095	0.000	0.286	0.000	0.109	0.343		0.699		0.262	
04/01/01	0.229	0.000	0.188	0.205	0.231	0.223	0.000	0.000	0.064	0.073	0.025	0.000	0.000	0.082	0.000	0.207	0.000	0.000	0.069		0.416		0.136	
05/01/01		0.000	0.235	0.133	0.118	0.121	0.034	0.000	0.000	0.053	0.011	0.000	0.000	0.082	0.000	0.130	0.000	0.031	0.052		0.367		0.044	
06/01/01																								
07/01/01																								
08/01/01																								
09/01/01																								
10/01/01																								
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	0.277	0.186	0.100	0.246	0.548	0.301	0.000	0.061	0.084	0.049	0.095	0.011	0.018	0.055	0.000	0.215	0.000	0.100	0.095		0.038		0.059	0.080
03/01/02	0.296	0.095	0.080	0.264	0.286	0.293	0.000	0.000	0.076	0.046	0.000	0.000	0.042		0.000	0.251	0.000	0.242	0.204	0.182	0.411	0.484	0.234	
04/01/02	0.263	0.193	0.108	0.200	0.260	0.256	0.000	0.000	0.077	0.079	0.000	0.000	0.000	0.000	0.000	0.244	0.000	0.050	0.079	0.086	0.359	0.379	0.096	0.141
05/01/02	0.233	0.013	0.146	0.176	0.224	0.222	0.015	0.000	0.082	0.066		0.000	0.024	0.036	0.022	0.227	0.024	0.068	0.040	0.055	0.042	0.053	0.097	0.097
06/01/02	0.122	0.117	0.006	0.130	0.125	0.119	0.028	0.036	0.018	0.029		0.008	0.014	0.011	0.006	0.124	0.013	0.020	0.001	0.010	0.082	0.108	0.000	0.000
07/01/02																0.069	0.000	0.015	0.002	0.000	0.159	0.168	0.000	0.000
07/08/02																0.154	0.024	0.074	0.022	0.034	0.022	0.041	0.079	0.069
07/16/02		0.017	0.155											0.000		0.168	0.043	0.064	0.010	0.024	0.241	0.430	0.054	0.056
07/22/02																0.072	0.001	0.037	0.003	0.001	0.114	0.095	0.025	0.268
07/29/02																0.062	0.000	0.036	0.000	0.001	0.249	0.408	0.023	0.027
07/30/02																								
08/05/02																0.099	0.000	0.036	0.023	0.006	0.012	0.083	0.057	0.055
08/12/02		0.000	0.000					0.000	0.000			0.000	0.000	0.000		0.090	0.002	0.034	0.005	0.002	0.013	0.075	0.054	0.054

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/19/02																0.038	0.000	0.000	0.000	0.000	0.000	0.032	0.011	0.000
08/26/02																0.138	0.047	0.061	0.029	0.031	0.237	0.337	0.061	0.108
08/30/02																								
09/03/02		0.042	0.140					0.049	0.056			0.068	0.063	0.064		0.080	0.036	0.037	0.033	0.033	0.227	0.307	0.060	0.073
09/10/02																	0.030	0.027	0.011	0.045	0.030	0.047	0.075	0.066
09/16/02		0.023	0.109					0.018	0.000			0.000	0.000	0.000			0.026	0.031	0.053	0.062	0.310	0.303	0.058	0.055
09/23/02																	0.000	0.012	0.054	0.052	0.198	0.214	0.048	0.039
09/30/02																	0.029	0.029	0.050	0.049	0.029	0.023	0.034	0.031
10/02/02		0.070	0.082					0.014	0.010			0.002	0.004	0.002										
10/07/02																	0.023	0.033	0.017	0.026	0.293	0.290	0.063	0.055
10/14/02																0.040	0.025	0.035	0.072	0.073	0.280	0.307	0.065	0.060
10/16/02		0.016	0.026					0.014	0.022			0.008	0.006	0.011										
10/21/02																0.010	0.005	0.004	0.016	0.018	0.301	0.068	0.000	0.000
10/28/02																0.011	0.008	0.003	0.053	0.035	0.015	0.273	0.039	0.037
10/30/02		0.018	0.009					0.003	0.000			0.002	0.003	0.005										
11/04/02																0.006	0.008	0.002	0.066	0.090	0.028		0.020	0.028
11/12/02																0.107	0.010	0.056	0.066	0.088	0.861		0.042	
11/13/02		0.085	0.039					0.015	0.007			0.015	0.011	0.007										
11/18/02																0.108	0.000	0.050	0.075	0.123	0.672		0.067	
11/25/02		0.050	0.091					0.000	0.001			0.003	0.001	0.008		0.119	0.000	0.057	0.028	0.073	0.082	0.213	0.164	
11/30/02																								
12/09/02																0.146	0.012	0.086	0.128	0.140	0.111			
12/16/02																0.168	0.001	0.044	0.152	0.228	0.146	0.159		
12/17/02		0.095	0.132					0.004	0.002			0.003	0.004	0.000										
12/30/02																								
01/14/03		0.159	0.126					0.000	0.000			0.000	0.000	0.000	0.000	0.170							0.149	0.157
02/11/03		0.153	0.133					0.017	0.021			0.010	0.085	0.000	0.019		0.026	0.127	0.024		0.163	0.229	0.188	
03/11/03		0.100	0.095					0.319	0.021			0.000	0.000	0.012	0.007		0.005	0.145	0.267		0.306	0.341	0.190	0.159
04/15/03		0.024	0.152	0.266				0.115	0.394			0.008	0.000	0.023	0.010	0.262	0.000	0.159	0.197	0.454	0.613	0.629	0.148	0.119
05/13/03		0.000	0.190	0.233				0.000	0.190			0.000	0.000	0.000	0.000	0.219	0.003	0.163	0.173	0.220	0.188	0.197	0.090	0.102
06/03/03		0.001	0.199	0.131				0.006	0.311			0.001	0.000	0.005	0.000	0.185	0.000	0.100	0.127	0.137	0.407	0.260	0.067	0.064
06/10/03																0.163	0.000	0.084	0.102	0.101	0.310	0.299	0.053	0.054
06/24/03		0.000	0.184	0.243				0.000	0.187			0.000	0.000	0.000	0.000	0.149	0.000	0.098	0.115	0.105	0.344	0.086	0.055	0.053
07/07/03				0.239											0.011	0.163	0.000	0.098	0.095	0.098	0.288	0.091	0.053	0.054
07/14/03		0.016	0.152					0.007	0.011			0.005	0.002	0.010		0.160	0.007	0.104	0.058	0.101	0.158	0.049	0.044	0.061
07/21/03				0.212											0.002	0.144	0.012	0.098	0.092	0.058	0.038	0.042	0.072	0.083
07/28/03				0.254											0.038	0.169	0.041	0.094	0.167	0.162	0.417	0.243	0.108	0.106
08/04/03		0.000	0.000	0.170				0.000	0.000			0.000	0.000	0.000	0.000	0.107	0.000	0.079	0.029	0.063	0.037	0.054	0.011	0.027
08/11/03				0.077											0.000	0.039	0.008	0.010	0.019	0.070	0.098	0.103	0.020	0.033
08/18/03				0.021											0.000	0.000	0.000	0.000	0.000	0.000	0.415	0.205	0.000	0.005
08/25/03		0.000	0.000	0.000				0.000	0.000			0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.463	0.413	0.044	0.029
09/02/03																								
09/08/03		0.000	0.000	0.000				0.000	0.000			0.000	0.000	0.000	0.000	0.025	0.000	0.009	0.059	0.061	0.438	0.152	0.044	0.043
09/15/03																								
09/22/03		0.005	0.000	0.012				0.011	0.000			0.000	0.000	0.000	0.029	0.002	0.013	0.002	0.046	0.037	0.419	0.383	0.047	0.034

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
09/29/03															0.186	0.040	0.000	0.035	0.089	0.081	0.163	0.178	0.011	0.062
10/06/03		0.000	0.000	0.026				0.014	0.000			0.018	0.012	0.015	0.191	0.033	0.000	0.019	0.076	0.103	0.166	0.167	0.041	0.013
10/13/03				0.022											0.119	0.003	0.014	0.033	0.012	0.062	0.159		0.000	0.055
10/20/03				0.071											0.011	0.029	0.000	0.027	0.033	0.081	0.159		0.037	0.027
10/28/03		0.023	0.023	0.140				0.005	0.000			0.000	0.000	0.000		0.125	0.015	0.082	0.037	0.040	0.149		0.089	0.108
11/03/03															0.013	0.164	0.127	0.129	0.146	0.156	0.592	0.552	0.164	0.176
11/10/03																								
11/17/03		0.077	0.076	0.191				0.089	0.070			0.000	0.000	0.000	0.000	0.158	0.018	0.094	0.133	0.150	0.770	0.979		
12/01/03				0.191											0.000	0.153	0.000	0.013	0.079	0.234	0.402	0.453		
12/15/03															0.000	0.194	0.001	0.100	0.113	0.136	0.218	0.234		
01/20/04												0.056	0.062	0.052	0.045	0.225	0.046	0.262	0.342	0.338	1.221	1.105		
02/17/04																								
03/16/04																								
04/13/04																								
05/18/04																								
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 31.2. (CONTINUED) NITRATE (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																						
09/01/99																						
10/01/99																						
11/01/99																						
12/01/99																						
01/01/00																						
02/01/00																						
03/01/00																						
04/01/00																						
05/01/00																						
06/01/00																						
07/01/00																						
08/01/00																						
09/01/00																						
10/01/00																						
11/01/00																						
12/01/00																						
01/01/01																						
02/01/01	0.000																					
03/01/01	0.000	0.000																				
04/01/01	0.000	0.000	142.000																			
05/01/01		0.000	0.173																			
06/01/01																						
07/01/01																						
08/01/01																						
09/01/01																						
10/01/01																						
11/01/01																						
12/01/01																						
01/01/02																						
02/01/02	0.000	0.041																				
03/01/02		0.024																				
04/01/02	0.011	0.022																				
05/01/02		0.055																				
06/01/02	0.034	0.013																				
07/01/02					0.000					0.042	0.000	0.000	0.000	0.000	0.000		0.024		0.962	0.978	0.090	0.099
07/08/02				0.044	0.022					0.402	0.024	0.022	0.045	0.056	0.015		0.030		1.022	0.941	0.176	0.156
07/16/02				0.022	0.034					0.454	0.010	0.013	0.020	0.018	0.017		0.036		1.376	1.085	0.255	0.222
07/22/02				0.002	0.000					0.457	0.000	0.000	0.018	0.007	0.000		0.017		1.540	1.539	0.148	0.101
07/29/02				0.005	0.000					0.442	0.000	0.000	0.008	0.008	0.000		0.034		1.589	1.027	0.106	0.084
07/30/02																						
08/05/02				0.006	0.000					0.389	0.013	0.009	0.007	0.008	0.000		0.000		1.675	1.497	0.138	0.110
08/12/02				0.006	0.019					0.517	0.012	0.000	0.020	0.025	0.000		0.022		1.806	1.774	0.144	0.105

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02				0.000	0.000					0.300	0.000	0.000	0.000	0.000	0.000		0.000		1.855	1.808	0.095	0.037
08/26/02				0.036	0.029					0.441	0.030	0.025	0.053	0.019	0.018		0.053		1.719	1.736	0.135	0.189
08/30/02																						
09/03/02				0.033	0.040					0.393	0.026	0.025	0.053	0.022	0.024		0.100		1.876	1.840	0.113	0.097
09/10/02				0.000	0.027					0.728	0.016	0.012	0.034	0.049	0.016		0.026		1.860	1.978	0.048	0.069
09/16/02				0.068	0.080					0.340	0.028	0.026	0.090	0.062	0.024		0.075		2.090	2.116	0.111	0.089
09/23/02				0.056	0.048					0.623	0.000	0.000	0.070	0.047	0.013		0.076		2.070	2.033	0.047	0.043
09/30/02	0.024			0.038	0.031					0.355	0.022	0.019	0.095	0.059	0.017		0.067		1.742	1.648	0.044	0.065
10/02/02																						
10/07/02				0.020	0.351					0.691	0.026	0.021	0.038	0.024	0.021		0.028		2.096	2.084	0.067	0.056
10/14/02				0.073	0.065					0.529	0.027	0.027	0.131	0.104	0.029		0.082		1.292	1.406	0.089	0.062
10/16/02																						
10/21/02				0.099	0.012					0.003	0.000	0.000	0.054	0.067	0.017		0.004		1.206	1.328	0.074	0.029
10/28/02				0.025	0.016					0.614	0.000	0.001	0.015	0.053	0.010		0.050		2.592	2.580	0.087	0.024
10/30/02	0.033																					
11/04/02				0.067	0.032					0.962	0.008	0.000	0.086	0.076	0.016		0.050		1.840	1.786	0.039	0.030
11/12/02				0.061	0.237					0.353	0.061	0.006	0.095	0.078	0.005		0.049		2.022	2.066	0.174	0.152
11/13/02																						
11/18/02				0.324	0.130					0.008	0.007	0.002	0.056	0.059	0.018		0.070		2.079	2.344	0.171	0.129
11/25/02				0.073	0.026						0.016	0.009	0.104	0.183	0.034		0.036				0.164	0.164
11/30/02																						
12/09/02				0.119	0.120						0.019	0.025	0.227	0.211	0.023		0.121				0.209	0.184
12/16/02				0.147	0.150						0.024	0.094	0.266	0.255	0.097		0.174				0.228	0.195
12/17/02																						
12/30/02	0.000																					
01/14/03	0.000	0.035								1.513								0.144	2.699	2.491	0.218	0.195
02/11/03	0.133	0.075								0.861					0.181			0.214	2.596	2.550	0.289	0.242
03/11/03	0.037	0.026								1.351					0.004			0.247	2.748	2.580	0.287	0.265
04/15/03	0.000	0.003				2.032	2.288			0.436	0.107				0.162			0.054	1.818	1.770	0.288	0.280
05/13/03	0.004	0.027				1.452	0.620	0.285	0.299	0.615	0.162		0.193	0.190	0.126			0.019	2.055	1.930	0.245	0.241
06/03/03		0.004				0.204	0.355	0.269	0.256	0.431	0.082		0.128	0.120	0.085	1.479		0.013	1.228	1.261	0.240	0.205
06/10/03						1.122	1.238			0.358	0.053		0.102	0.051	0.051			0.007	1.858	1.760	0.204	0.182
06/24/03	0.007	0.000				0.237	0.314	0.205	0.182	0.296	0.079		0.078	0.076	0.059			0.000	1.616	1.521	0.201	0.170
07/07/03		0.007				0.944	0.811			0.349	0.076		0.099	0.102	0.051			0.010	1.666	1.365	0.168	0.175
07/14/03	0.000	0.000								0.226	0.080		0.054	0.058	0.059			0.000	1.488	1.540	0.182	0.178
07/21/03		0.013				1.344	0.440			0.147	0.069		0.082	0.054	0.054			0.036	1.047	0.985	0.177	0.167
07/28/03		0.053				0.489	1.174			0.594	0.087		0.198	0.196	0.080			0.058	1.992	1.755	0.226	0.176
08/04/03		0.000				0.037	0.150			0.590	0.059		0.081	0.050	0.059	1.205		0.000	2.488	2.246	0.167	0.130
08/11/03		0.000				0.367	0.374			0.762	0.000		0.037	0.000	0.000			0.000	1.935	1.907	0.076	0.073
08/18/03		0.000				0.191	0.390			0.016			0.001	0.000				0.000	1.387	1.482	0.030	0.002
08/25/03	0.129	0.000				1.930	0.607	0.075	0.045	0.854			0.000	0.000				0.000	2.151	2.098	0.034	0.011
09/02/03																						
09/08/03		0.007				0.669	0.432			0.436			0.101	0.085				0.000	1.796	1.548	0.047	0.030
09/15/03																						
09/22/03	0.000	0.024				1.063	0.443			0.467			0.134	0.004				0.016	2.039	2.085	0.094	0.010

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03		0.035				1.741	1.826			0.558			0.148	0.147				0.025	1.902	1.680	0.112	0.011
10/06/03		0.032				0.087	0.169			0.016			0.166	0.173				0.000	1.767	2.360	0.094	0.026
10/13/03						0.571	0.622	0.042	0.031	0.418			0.095	0.036				0.000	1.010	1.483	0.069	0.015
10/20/03		0.023				2.217	1.260			0.759			0.131	0.134				0.000	2.345	2.272	0.157	0.070
10/28/03	0.000	0.100				1.174	1.435			0.810			0.049	0.051				0.030	1.738	2.009	0.194	0.137
11/03/03						1.100	1.489			1.047			0.119	0.082				0.130	3.214	2.892	0.190	0.202
11/10/03																						
11/17/03		0.000				0.555	0.303						0.288	0.200							0.182	0.160
12/01/03		0.000				2.499	2.960						0.161	0.264							0.179	0.182
12/15/03	0.010	0.015				2.501	2.987	0.206	0.223				0.204	0.210							0.207	0.200
01/20/04		0.098						0.229	0.238	1.029									2.397	2.175	0.284	0.231
02/17/04																						
03/16/04																						
04/13/04																						
05/18/04																						
06/21/04																						
07/20/04																						
08/17/04																						
09/14/04																						
10/12/04																						
11/09/04																						
12/07/04																						

TABLE 32.1. AMMONIA (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/01/99																								
09/01/99																								
10/01/99																								
11/01/99																								
12/01/99																								
01/01/00																								
02/01/00																								
03/01/00																								
04/01/00																								
05/01/00																								
06/01/00																								
07/01/00																								
08/01/00																								
09/01/00																								
10/01/00																								
11/01/00																								
12/01/00																								
01/01/01																								
02/01/01																								
03/01/01																								
04/01/01	0.024	0.022	0.020	0.029	0.045	0.019	0.013	0.015	0.000	0.002	0.056	0.030	0.034	0.014	0.044	0.026	0.000	0.040	0.016		0.030		0.040	
05/01/01																								
06/01/01																								
07/01/01																								
08/01/01																								
09/01/01																								
10/01/01																								
11/01/01																								
12/01/01																								
01/01/02																								
02/01/02	0.023	0.041	0.022	0.027	0.022	0.024	0.011	0.040	0.041	0.015	0.036	0.019	0.021	0.043	0.015	0.027	0.021	0.026	0.031		0.030		0.021	0.028
03/01/02	0.015	0.016	0.029	0.007	0.009	0.009	0.000	0.016	0.023	0.011	0.007	0.000	0.009		0.010	0.012	0.000	0.012	0.011	0.016	0.010	0.017	0.037	
04/01/02	0.049	0.047	0.065	0.050	0.036	0.034	0.029	0.024	0.022	0.023	0.020	0.019	0.020	0.036	0.094	0.021	0.027	0.030	0.028	0.040	0.047	0.035	0.025	0.051
05/01/02	0.035	0.017	0.014	0.018	0.018	0.018	0.010	0.007	0.007	0.014		0.007	0.032	0.000	0.000	0.006	0.000	0.010	0.000	0.006	0.006	0.009	0.006	0.009
06/01/02	0.026	0.015	0.009	0.014	0.021	0.009	0.008	0.013	0.012	0.012		0.007	0.006	0.018	0.000	0.014	0.004	0.012	0.000	0.000	0.015	0.016	0.006	0.019
07/01/02																0.016	0.005	0.013	0.037	0.006	0.032	0.016	0.013	0.009
07/08/02																0.017	0.000	0.001	0.000	0.010	0.004	0.008	0.003	0.005
07/16/02		0.006	0.027					0.000	0.000			0.000	0.000	0.034		0.044	0.014	0.011	0.001	0.025	0.010	0.014	0.007	0.016
07/22/02																0.022	0.025	0.014	0.017	0.020	0.007	0.024	0.015	0.040
07/29/02																0.011	0.017	0.013	0.038	0.021	0.017	0.018	0.018	0.016
07/30/02																								
08/05/02																0.055	0.062	0.051	0.062	0.056	0.055	0.053	0.056	0.048
08/12/02		0.063	0.029					0.031	0.062			0.049	0.026	0.056		0.095	0.098	0.073	0.063	0.061	0.059	0.052	0.081	0.056

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
08/19/02																0.011	0.008	0.000	0.000	0.000	0.000	0.005	0.022	0.015
08/26/02																0.042	0.065	0.005	0.016	0.020	0.019	0.042	0.000	0.021
08/30/02																								
09/03/02		0.016	0.019					0.025	0.034			0.011	0.018	0.120		0.027	0.022	0.012	0.001	0.003	0.010	0.015	0.013	0.029
09/10/02																	0.011	0.000	0.000	0.000	0.000	0.000	0.050	0.003
09/16/02		0.044	0.070					0.031	0.006			0.011	0.006	0.054			0.055	0.013	0.025	0.043	0.013	0.012	0.026	0.024
09/23/02																	0.034	0.011	0.018	0.026	0.010	0.037	0.015	0.016
09/30/02																	0.048	0.053	0.041	0.035	0.037	0.033	0.044	0.028
10/02/02		0.066	0.065					0.042	0.181			0.045	0.051	0.100										
10/07/02																	0.052	0.039	0.040	0.044	0.054	0.030	0.042	0.038
10/14/02																0.048	0.077	0.041	0.036	0.035	0.046	0.050	0.074	0.064
10/16/02		0.023	0.129					0.012	0.227			0.027	0.034	0.260										
10/21/02																0.027	0.008	0.028	0.030	0.018	0.014	0.019	0.024	0.016
10/28/02																0.038	0.022	0.024	0.022	0.023	0.022	0.031	0.024	0.023
10/30/02		0.033	0.182					0.019	0.032			0.026	0.034	0.053										
11/04/02																0.017	0.035	0.020	0.036	0.024	0.028		0.022	0.028
11/12/02																0.040	0.035	0.035	0.031	0.027	0.020		0.028	
11/13/02		0.031	0.187					0.000	0.031			0.049	0.044	0.055										
11/18/02																0.028	0.019	0.046	0.038	0.038	0.019		0.148	
11/25/02		0.038	0.050					0.009	0.027			0.062	0.049	0.058		0.028	0.029	0.031	0.030	0.035	0.027	0.052	0.176	
11/30/02																								
12/09/02																0.039	0.033	0.027	0.021	0.021	0.030			
12/16/02																0.027	0.017	0.023	0.022	0.024	0.023	0.017		
12/17/02		0.071	0.051					0.016	0.048			0.042	0.044	0.060										
12/30/02																								
01/14/03		0.032	0.035					0.006	0.020			0.013	0.009	0.022	0.021	0.014							0.023	0.014
02/11/03		0.046	0.104					0.064	0.129			0.050	0.077	0.062	0.095		0.109	0.072	0.116		0.083	0.094	0.089	
03/11/03		0.014	0.042					0.029	0.034			0.007	0.009	0.068	0.023		0.032	0.024	0.042		0.030	0.022	0.029	0.021
04/15/03		0.076	0.035	0.010				0.054	0.053			0.008	0.008	0.027	0.027	0.012	0.012	0.019	0.027	0.171	0.049	0.073	0.028	0.017
05/13/03		0.013	0.013	0.018				0.004	0.014			0.003	0.009	0.008	0.032	0.013	0.009	0.011	0.021	0.021	0.034	0.024	0.018	0.013
06/03/03		0.000	0.007	0.035				0.011	0.000			0.000	0.000	0.000	0.000	0.010	0.000	0.007	0.034	0.021	0.030	0.028	0.012	0.001
06/10/03																0.043	0.032	0.034	0.049	0.045	0.042	0.043	0.036	0.036
06/24/03		0.047	0.045	0.026				0.035	0.041			0.039	0.029	0.080	0.008	0.012	0.009	0.016	0.037	0.035	0.037	0.043	0.030	0.034
07/07/03				0.029											0.036	0.017	0.015	0.011	0.027	0.026	0.027	0.046	0.018	0.023
07/14/03		0.020	0.039					0.025	0.060			0.011	0.011	0.169		0.008	0.030	0.039	0.023	0.024	0.030	0.019	0.000	0.023
07/21/03				0.033											0.012	0.011	0.040	0.056	0.041	0.036	0.021	0.040	0.000	0.028
07/28/03				0.027											0.058	0.012	0.010	0.024	0.026	0.040	0.048	0.024	0.033	0.043
08/04/03		0.031	0.023	0.000				0.075	0.049			0.018	0.031	0.062	0.055	0.050	0.036	0.032	0.050	0.063	0.040	0.031	0.004	0.030
08/11/03				0.055											0.018	0.056	0.033	0.015	0.034		0.051	0.025	0.021	0.048
08/18/03				0.092											0.012	0.025	0.025	0.014	0.033	0.092	0.024	0.035	0.042	0.031
08/25/03		0.017	0.017	0.041				0.006	0.087			0.005	0.018	0.005	0.013	0.027	0.062	0.023	0.032	0.037	0.019	0.044	0.041	0.024
09/02/03																								
09/08/03		0.013	0.022	0.089				0.006	0.069			0.014	0.029	0.043	0.025	0.030	0.041	0.030	0.046	0.040	0.055	0.020	0.034	0.032
09/15/03																								
09/22/03		0.041	0.024	0.009				0.012	0.063			0.005	0.034	0.087	0.030	0.083	0.038	0.059	0.020	0.049	0.023	0.014	0.031	0.033

Date	R1	R2A	R2B	R3	R4	R4-Dup	R5	R6A	R6B	R7	R8	R9A	R9A-Dup	R9B	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19
09/29/03															0.070	0.108	0.076	0.168	0.057	0.030	0.143	0.100	0.038	0.038
10/06/03		0.022	0.094	0.075				0.030	0.065			0.027	0.024	0.076	0.197	0.040	0.082	0.038	0.060	0.031	0.035	0.019	0.038	0.036
10/13/03				0.097											0.129	0.057	0.018	0.032	0.050	0.037	0.079		0.034	0.068
10/20/03				0.069											0.006	0.044	0.022	0.031	0.028	0.039	0.058		0.029	0.029
10/28/03		0.051		0.125				0.032				0.000	0.030	0.022		0.038	0.020	0.064	0.015	0.027	0.039		0.021	0.061
11/03/03															0.135	0.097	0.006	0.030	0.020	0.031	0.035	0.037	0.177	0.037
11/10/03																								
11/17/03		0.076	0.072	0.064				0.016	0.033			0.073	0.067	0.072	0.031	0.033	0.039	0.035	0.033	0.027	0.038	0.009		
12/01/03				0.008											0.038	0.034	0.023	0.040	0.032	0.128	0.021	0.023		
12/15/03															0.041	0.003	0.011	0.019	0.013	0.011	0.014	0.005		
01/20/04												0.017	0.018	0.072	0.007	0.010	0.054	0.045	0.038	0.034	0.036	0.004		
02/17/04																								
03/16/04																								
04/13/04																								
05/18/04																								
06/21/04																								
07/20/04																								
08/17/04																								
09/14/04																								
10/12/04																								
11/09/04																								
12/07/04																								

TABLE 32.2. (CONTINUED) AMMONIA (MG-N/L) FROM AUGUST 1999 TO DECEMBER 2004.

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/01/99																						
09/01/99																						
10/01/99																						
11/01/99																						
12/01/99																						
01/01/00																						
02/01/00																						
03/01/00																						
04/01/00																						
05/01/00																						
06/01/00																						
07/01/00																						
08/01/00																						
09/01/00																						
10/01/00																						
11/01/00																						
12/01/00																						
01/01/01																						
02/01/01																						
03/01/01	0.010																					
04/01/01		0.000	0.000																			
05/01/01																						
06/01/01																						
07/01/01																						
08/01/01																						
09/01/01																						
10/01/01																						
11/01/01																						
12/01/01																						
01/01/02																						
02/01/02	0.009	0.040																				
03/01/02		0.000																				
04/01/02	0.032	0.028																				
05/01/02		0.000																				
06/01/02	0.012	0.005																				
07/01/02				0.000	0.062					0.036	0.018	0.011	0.008	0.010	0.007		0.021		0.012	0.002	0.010	0.000
07/08/02				0.009	0.000					0.012	0.002	0.000	0.007	0.007	0.000		0.004		0.015	0.030	0.025	0.000
07/16/02				0.008	0.007					0.021	0.005	0.002	0.016	0.001	0.000		0.002		0.012	0.000	0.062	0.000
07/22/02				0.027	0.019					0.017	0.020	0.014	0.012	0.013	0.013		0.013		0.033	0.000	0.034	0.000
07/29/02				0.024	0.018					0.028	0.018	0.016	0.022	0.019	0.015		0.020		0.028	0.015	0.022	0.000
07/30/02																						
08/05/02				0.069	0.053					0.058	0.063	0.061	0.063	0.047	0.051		0.047		0.067	0.039	0.061	0.038
08/12/02				0.060	0.064					0.056	0.074	0.061	0.056	0.055	0.065		0.060		0.083	0.040	0.127	0.049

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
08/19/02				0.000	0.000					0.005	0.000	0.000	0.008	0.000	0.000		0.000		0.016	0.000	0.024	0.000
08/26/02				0.012	0.014					0.002	0.013	0.024	0.031	0.022	0.004		0.020		0.024	0.031	0.031	0.033
08/30/02																						
09/03/02				0.000	0.017					0.025	0.005	0.009	0.000	0.026	0.000		0.015		0.016	0.000	0.002	0.000
09/10/02				0.000	0.000					0.006	0.000	0.000	0.000	0.000	0.000		0.000		0.002	0.000	0.000	0.000
09/16/02				0.047	0.020					0.024	0.010	0.016	0.013	0.000	0.013		0.009		0.000	0.000	0.002	0.000
09/23/02				0.023	0.048					0.030	0.013	0.003	0.017	0.000	0.012		0.029		0.000	0.000	0.001	0.004
09/30/02	0.033			0.043	0.023					0.038	0.054	0.021	0.027	0.020	0.030		0.027		0.341	0.228	0.044	0.014
10/02/02																						
10/07/02				0.055	0.060					0.049	0.037	0.030	0.041	0.035	0.030		0.049		0.074	0.056	0.036	0.020
10/14/02				0.043	0.057					0.044	0.024	0.063	0.024	0.028	0.037		0.048		0.084	0.063	0.033	0.040
10/16/02																						
10/21/02				0.035	0.021					0.032	0.013	0.017	0.013	0.010	0.019		0.012		0.009	0.000	0.013	0.000
10/28/02				0.026	0.020					0.017	0.025	0.022	0.042	0.046	0.017		0.016		0.011	0.040	0.033	0.000
10/30/02	0.029																					
11/04/02				0.031	0.030					0.029	0.025	0.018	0.047	0.037	0.043		0.020		0.020	0.007	0.031	0.015
11/12/02				0.019	0.027					0.052	0.030	0.021	0.032	0.033	0.015		0.020		0.017	0.010	0.025	0.004
11/13/02																						
11/18/02				0.122	0.023					0.029	0.010	0.021	0.019	0.046	0.038		0.019		0.016	0.004	0.025	0.000
11/25/02				0.038	0.018						0.017	0.013	0.010	0.010	0.027		0.025				0.087	0.000
11/30/02																						
12/09/02				0.040	0.024						0.015	0.019	0.017	0.031	0.014		0.018				0.000	0.000
12/16/02				0.022	0.020						0.007	0.029	0.022	0.012	0.016		0.015				0.028	0.000
12/17/02																						
12/30/02	3.900																					
01/14/03	0.091	0.018								0.012								0.007	0.009	0.005	0.009	0.001
02/11/03	0.085	0.100								0.083					0.094			0.056	0.070	0.012	0.030	0.043
03/11/03	0.026	0.023								0.015					0.019			0.013	0.003	0.000	0.008	0.000
04/15/03	0.009	0.011				0.014	0.007			0.023	0.018				0.034			0.018	0.017	0.020	0.004	0.000
05/13/03	0.002	0.019				0.009	0.008	0.049	0.013	0.014	0.022		0.025	0.029	0.016			0.017	0.000	0.000	0.010	0.005
06/03/03		0.000				0.000	0.002	0.004	0.011	0.010	0.018		0.060	0.032	0.015	0.079		0.003	0.000	0.000	0.001	0.000
06/10/03						0.048	0.030			0.025	0.031		0.043	0.015	0.035			0.020	0.006	0.009	0.033	0.028
06/24/03	0.030	0.010				0.031	0.028	0.032	0.036	0.035	0.022		0.053	0.028	0.047			0.026	0.032	0.000	0.023	0.005
07/07/03		0.013				0.014	0.021			0.028	0.024		0.034	0.020	0.017			0.021	0.019	0.010	0.021	0.005
07/14/03	0.021	0.060								0.025	0.022		0.036	0.011	0.023			0.018	0.017	0.000	0.002	0.000
07/21/03		0.033				0.006	0.015			0.031	0.024		0.037	0.015	0.037			0.274	0.015	0.032	0.006	0.034
07/28/03		0.029				0.021	0.018			0.050	0.028		0.038	0.036	0.022			0.029	0.012	0.001	0.025	0.012
08/04/03		0.056				0.042	0.023			0.054	0.022		0.051	0.062	0.028	0.050		0.123	0.060	0.000	0.000	0.029
08/11/03		0.024				0.060	0.042			0.063	0.037		0.051	0.036	0.021			0.035	0.035	0.034	0.007	0.026
08/18/03		0.010				0.026	0.017			0.055			0.046	0.037				0.022	0.004	0.000	0.012	0.017
08/25/03	0.057	0.023				0.050	0.009	0.019	0.032	0.060			0.028	0.029				0.049	0.017	0.000	0.003	0.004
09/02/03																						
09/08/03		0.015				0.059	0.011			0.053			0.068	0.068				0.032	0.009	0.000	0.007	0.026
09/15/03																						
09/22/03	0.000	0.023				0.031	0.012			0.068			0.014	0.014				0.087	0.006	0.000	0.009	0.036

Date	R20	R25	R26	16th St.	19th Av.	Green In	Green Out	Hav. 1	Hav. 2	HTC	Hwy 87	Mesa	NP In	NP Out	Pima	Rosvlt.	Scot.	SOCA	SPT In	SPT Out	UH In	UH Out
09/29/03		0.025				0.078	0.010			0.089			0.142	0.093				0.074	0.042	0.061	0.079	0.059
10/06/03		0.009				0.076	0.025			0.074			0.064	0.094				0.050	0.007	0.011	0.009	0.012
10/13/03						0.067	0.015	0.026	0.049	0.080			0.105	0.203				0.035	0.013	0.045	0.032	0.014
10/20/03		0.086				0.022	0.014			0.053			0.074	0.075				0.027	0.000	0.020	0.023	0.009
10/28/03	0.022	0.032				0.042				0.035			0.008	0.048				0.028	0.000	0.024	0.009	0.000
11/03/03						0.023	0.028			0.101			0.086	0.042				0.020	0.000	0.000	0.008	0.028
11/10/03																						
11/17/03		0.018				0.049	0.014						0.066	0.050							0.020	0.002
12/01/03		0.028				0.011	0.006						0.028	0.047							0.001	0.046
12/15/03	0.008	0.006				0.020	0.010	0.034	0.028				0.023	0.016							0.000	0.001
01/20/04		0.023						0.018	0.019	0.019									0.017	0.000	0.011	0.000
02/17/04																						
03/16/04																						
04/13/04																						
05/18/04																						
06/21/04																						
07/20/04																						
08/17/04																						
09/14/04																						
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12/07/04																						