



The Water Quality of the Salt and Verde River Watersheds Fiscal Year 2008
















ADEQ
Arizona Department of Environmental Quality

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Fiscal Year 2008

By The Monitoring and Assessments Units
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Arizona Department of Environmental Quality
Open File Report OFR11-01
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Field Assistance: Anel Avila, Justin Bern, Aiko Condon, Kurt Ehrenburg, Karyn Hanson, Lee Johnson, Jason Jones, Lin Lawson, Max Power, Sam Rector, Meghan Smart, Patti Spindler, and John Woods.

Report Review: Jason Jones, John Woods, Patti Spindler, Lin Lawson, Meghan Smart, Debra Daniel, Linda Taunt.

Report Cover: Selected streams of the Salt and Verde Watersheds.

ABBREVIATIONS

Abbreviation	Name	Abbreviation	Name
ALKCACO3	Total Alkalinity	P-T	Phosphorous Total
ALKPHEN	Phenolphthalein Alkalinity	QA	Quality Assurance
ADEQ	Arizona Department of Environmental Quality	RBS	Relative Bed Stability
AS-D	Arsenic Dissolved	SO4-T	Sulfate Total
AS-T	Arsenic Total	SPCOND	Specific Conductivity
AZGF	Arizona Game and Fish Department	SSC	Suspended Sediment Concentration
AZPDES	Arizona Pollutant Discharge Elimination System	su	Standard pH Units
B-T	Boron Total	TDS	Total Dissolved Solids
CA-T	Calcium Total	TEMP-AIR	Air Temperature
CALCARB-T	Calcium Carbonate Total	TEMP-WATER	Water Temperature
CAL-D/T	Calcium Dissolved/Total	TKN	Total Kjeldahl Nitrogen
CFS	Cubic Feet per Second	TMDL	Total Maximum Daily Load
CHL-T	Chloride Total	USGS	U.S. Geological Survey
CO3	Carbonate	%IH	Percent Ideal Habitat
CU-D	Copper Dissolved		
CWA	Clean Water Act		
DO-MG/L	Dissolved Oxygen in mg/l		
DO%	Dissolved Oxygen in Percent		
E. COLI	Escherichia coli		
FL-T	Fluoride Total		
Ft	Feet		
Ft/s	Feet per second		
HARDCACO3	Total Hardness		
HCO3	Bicarbonate		
HG-D	Mercury Dissolved		
HUC	Hydrologic unit Code		
IBI	Index of Biological integrity		
K-T/D	Potassium Total/Dissolved		
MG-T/D	Magnesium Total/Dissolved		
ml	Milliliters		
mm	Millimeters		
MN-T	Manganese Total		
MRL	Minimum Reporting Level		
MU	Monitoring Unit		
NA-T/D	Sodium Total/Dissolved		
NH3	Ammonia		
N03 + N02	Nitrate plus Nitrite		
ntu	Nephelometric Turbidity Unit		
PB-D	Lead Dissolved		
PFC	Proper Functioning Condition		

TABLE OF CONTENTS

TABLES

FIGURES

CHAPTER 1 – OVERVIEW

Water is one of Arizona's most important commodities. The importance of water will only grow as Arizona's population increases. The United States Census Bureau has ranked Arizona the 2nd fastest growing state after Nevada. Arizona's population as of the 2000 census was 5,130,632. Arizona's population is expected to double by 2030 to 10,712,397. This increase will unquestionably place further demands on Arizona's water supply.

Groundwater is the primary source for Arizona's water (ADWR, 2006). Surface water, Central Arizona Project water and effluent from wastewater treatment plants, make up the remaining 45 percent of the water that Arizona uses. The majority of Arizona's water is used for agriculture with smaller allotments being used for municipal and industrial uses (Figure 1).

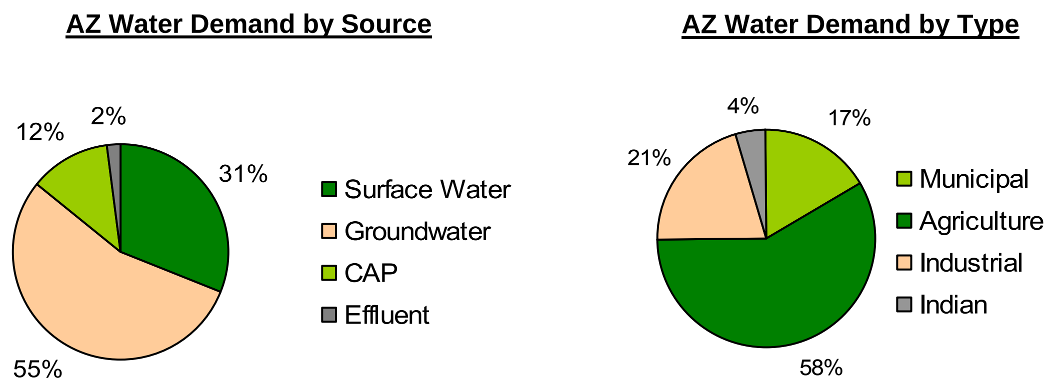


Figure 1. AZ Water Demand by Source and Type (ADWR, 2006)

WHY MONITOR?

ADEQ monitors lakes, streams and groundwater throughout the state to assess whether the water is safe to drink, safe to swim in, suitable for irrigation, and adequate to support aquatic life. Monitoring is used to meet state and federal goals of protecting human health and aquatic life. The Clean Water Act (CWA) and Arizona Revised Statutes (ARS) 49-225 gives ADEQ the authority to conduct ambient water monitoring.

The information that the Monitoring Unit in the Water Quality Division at ADEQ gathers is used by other government agencies such as the U.S. Environmental Protection Agency, Arizona Game and Fish, and the Arizona Department of Water Resources. The data is also used by land owners, universities, operators of drinking water systems and the public to make informed management decisions.

Figure 2 illustrates the relationship between water quality monitoring, assessments, Total Maximum Daily Load (TMDL) development, and the implementation of water quality improvement strategies. Water quality is monitored and the results are compared against the surface water quality standards. The results of the assessment are included in the CWA Section 305(b) report, while impaired waters are placed on the 303(d) list. TMDLs are developed for impaired surface waters on the CWA Section 303(d) list. The National Pollutant Discharge Elimination System (NPDES) is a permitting program which addresses point source discharges to surface waters. These permits are written to ensure discharges meet water quality standards. Arizona received delegation for the NPDES program, known as the AZPDES program, from EPA in December, 2002. The CWA 319 program addresses nonpoint source pollution and provides grants for projects to improve water quality.

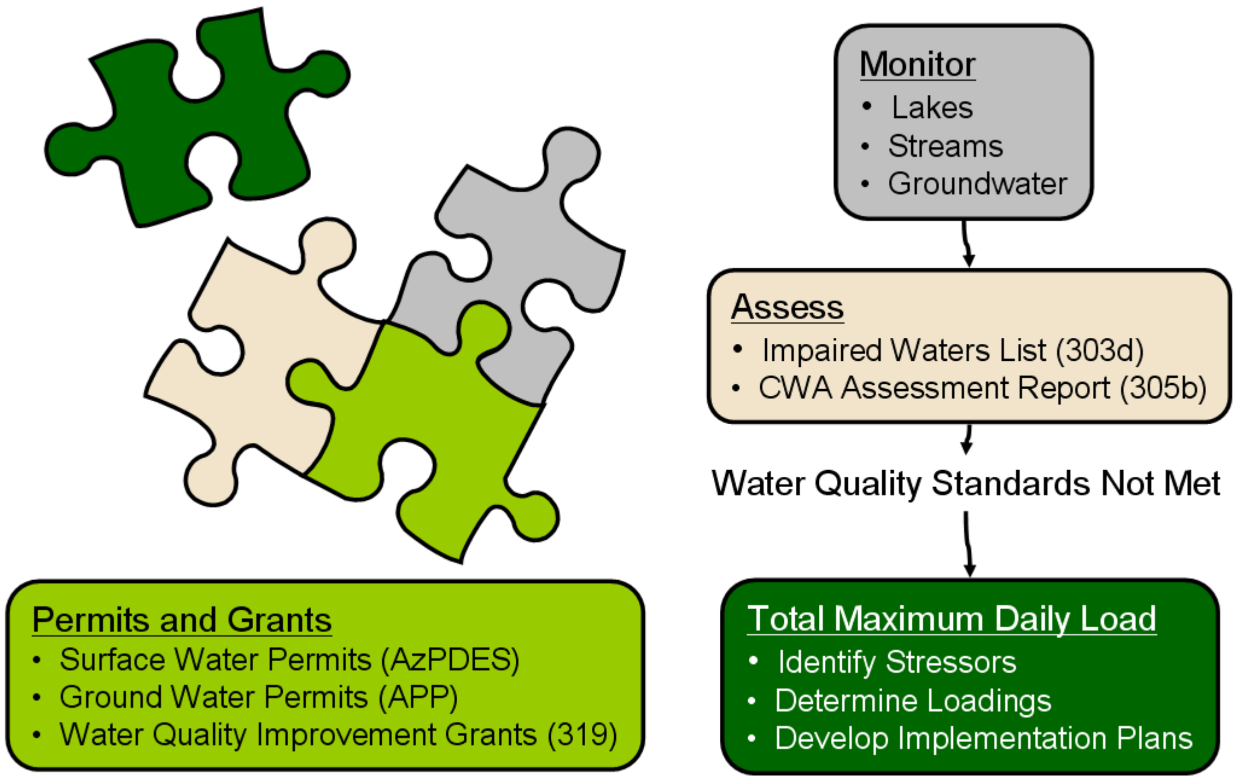


Figure 2. Relationships between Clean Water Act Programs.

This report is not associated with the 305(b) assessment report or the 303(d) impaired waters list. Please consult the most recent Integrated Assessment and Listing Report to determine if a stream reach is impaired or is attaining. The most recent version of the Integrated report can be found on ADEQ's Web site at: http://www.azdeq.gov/environ/water/assessment/assess.html .

ADEQ'S MONITORING UNIT

The Arizona Department of Environmental Quality's (ADEQ) Monitoring Unit is responsible for monitoring the water quality of all of Arizona's groundwater and surface waters, not on tribal lands.

Monitoring Unit staff collects water quality data to assess the biological, chemical, and physical integrity of Arizona's rivers and streams. The objectives of the Monitoring Unit are:

- Conduct ongoing monitoring of the waters of the state as required by Arizona Revised Statutes (A.R.S.) §49-225;
- Characterize the baseline water quality of wadeable, perennial streams;
- Provide credible data for surface water quality assessments, identify impaired waters, and determine compliance with water quality standards as required by §305(b) of the Clean Water Act;
- Collect bioassessment data on the regional biocriteria reference site network to determine trends in reference conditions over time and to test indexes of biological integrity; and
- Monitor the State's outstanding waters to determine whether water quality is being maintained and protected in accordance with Arizona Administrative Code (A.A.C. R18-11-112);
- Monitor the State's groundwater and reservoirs/lakes.

SURFACE WATER MONITORING IN THE SALT AND VERDE WATERSHEDS

This report focuses on wadeable perennial streams within the Salt River and Verde River Watersheds. Forty-seven stream sites in the Salt and Verde Watersheds were sampled from July 2007 to June 2008 (fiscal year 2008). Four quarters of water quality monitoring data were collected for most of the sites. Benthic macroinvertebrate and habitat data were collected at 36 sites during the spring with a follow-up sampling event for 18 of the sites during the fall. Geomorphology data was also collected on Arizona streams to determine stream stability and sediment issues (see chapter 3; Stream Stability and Sediment Pollution).

The purpose of this report is to summarize the water quality data collected during fiscal year 2008. Chemical results are presented in Appendix A. Appendix B includes summary statistics for water quality data. Photos of each site are presented in Appendix C. Macroinvertebrate metric values, IBI scores, and bioassessment results for warm and cold water streams are included in Appendix D.

AZPDES AND TMDL ISSUES IN THE SALT AND VERDE WATERSHEDS

At the time of the study there were 39 Arizona Pollutant Discharge Elimination System (AZPDES) point source discharge locations within the Salt and Verde watersheds. The 39 outfalls are covered by the 23 permits. These permits are located in Table 1 and the outfalls are shown in Figure 3 (some permits have multiple outfalls).

Table 1. List of AZPDES Permits

Permit #	Facility Name
AZ0020508	INSPIRATION MINE
AZ0025097	COBRE VALLEY PLAZA SHOPPING CENTER - CLAYPOOL WWTS
AZ0020401	BHP COPPER - PINTO VALLEY UNIT
AZ0020249	GLOBE, CITY OF - PINAL CREEK WWTP
AZ0024350	PHELPS DODGE MIAMI, INC - LOWER PINAL CREEK WTP
AZ0025640	CANYON LAKE MARINA
AZ0022381	CHAPARRAL CITY WATER CO - SHEA WTP
AZ0024562	VERDE RIVER WELLFIELD SAND TRAP
AZ0023787	LAKE ROOSEVELT WATER/WASTEWATER PLANT, L.L.C.
AZ0022837	WHITE MOUNTAIN APACHE TRIBE - SUNRISE HOTEL
AZ0020117	NORTHERN GILA COUNTY SANITARY DISTRICT - AMERICAN GULCH
AZ0025305	HOUSTON CREEK LANDING - WWTP
AZ0021229	AG&F - CANYON CREEK FISH HATCHERY
AZ0024783	PINE MEADOWS UTIL, LLC - PINE MEADOWS WWTP
AZ0021211	AG&F - TONTO CREEK FISH HATCHERY
AZ0024546	IRON KING/COPPER CHIEF MINE
AZ0024716	COTTONWOOD, CITY OF - WWTF
AZ0021804	JEROME, TOWN OF - WWTP
AZ0021245	AG&F - PAGE SPRINGS FISH HATCHERY
AZ0024082	BIG PARK WATER IMPROVEMENT DISTRICT - WILD HORSE MESA DR
AZ0021807	SEDONA VENTURE
AZ0023116	PINEWOOD SANITARY DISTRICT - KAY S BLACKMAN WWTP
AZ0024708	FLAGSTAFF MEADOWS WWTP

There are a total of 15 impaired streams (Table 2 and Figure 3) within the Salt and Verde watersheds; 14 streams are impaired based on ADEQ's 2006/2008 303(d) list and one stream is impaired based on EPA's 2006/2008 303(d) list. In Table 2, the abbreviation HUC refers to the hydrologic unit code, which identifies specific basins within the watershed and the stream reach refers to a particular section of the stream.

Table 2. Impaired Streams in the Salt and Verde Watersheds

Stream Name	Impaired for	HUC	Reach	Watershed
Christopher Creek - From Headwaters to Tonto Creek	Phosphorus	15060105	353	Salt
Five Point Mountain Tributary - From Headwaters to Pinto Creek	Copper	15060103	885	Salt
Pinto Creek - From West Fork Pinto Creek to Roosevelt Lake	Selenium	15060103	018C	Salt
Salt River - From Pinal Creek to Roosevelt Lake	Sediment	15060103	004	Salt
Salt River - From Stewart Mountain Dam to Verde River	Low Dissolved Oxygen	15060106	003	Salt
Tonto Creek - From headwaters to 341510/1110414**	Phosphorus	15060105	013A	Salt
Grant Creek - From Headwaters to Willow Creek*	Low Dissolved Oxygen	15060202	059A	Verde
East Verde River - From American Gulch to Verde River	Arsenic, Boron	15060203	022C	Verde
East Verde River - From Ellison Creek to American Gulch	Selenium	15060203	022B	Verde
Oak Creek - From Headwaters to West Fork Oak Creek	E. coli	15060202	019	Verde
Oak Creek - From West Fork Oak Creek to Tributary at 345709/1114513	E. coli	15060202	018A	Verde
Oak Creek - From Tributary at 345709/1114513 Downstream Boundary of Slide Rock State Park	E. coli	15060202	018B	Verde
Oak Creek - From Slide Rock State Park to Dry Rock	E. coli	15060202	018C	Verde
Oak Creek - From Dry Creek to Spring Creek	E. coli	15060202	017	Verde
Spring Creek - From Coffee Creek to Oak Creek	E. coli	15060202	022	Verde

* = Listed on EPA's 303 (d) Impaired Waters List
**=Listed on EPA's 303 (d) Impaired Waters List and ADEQ's 303 (d) Impaired Waters List

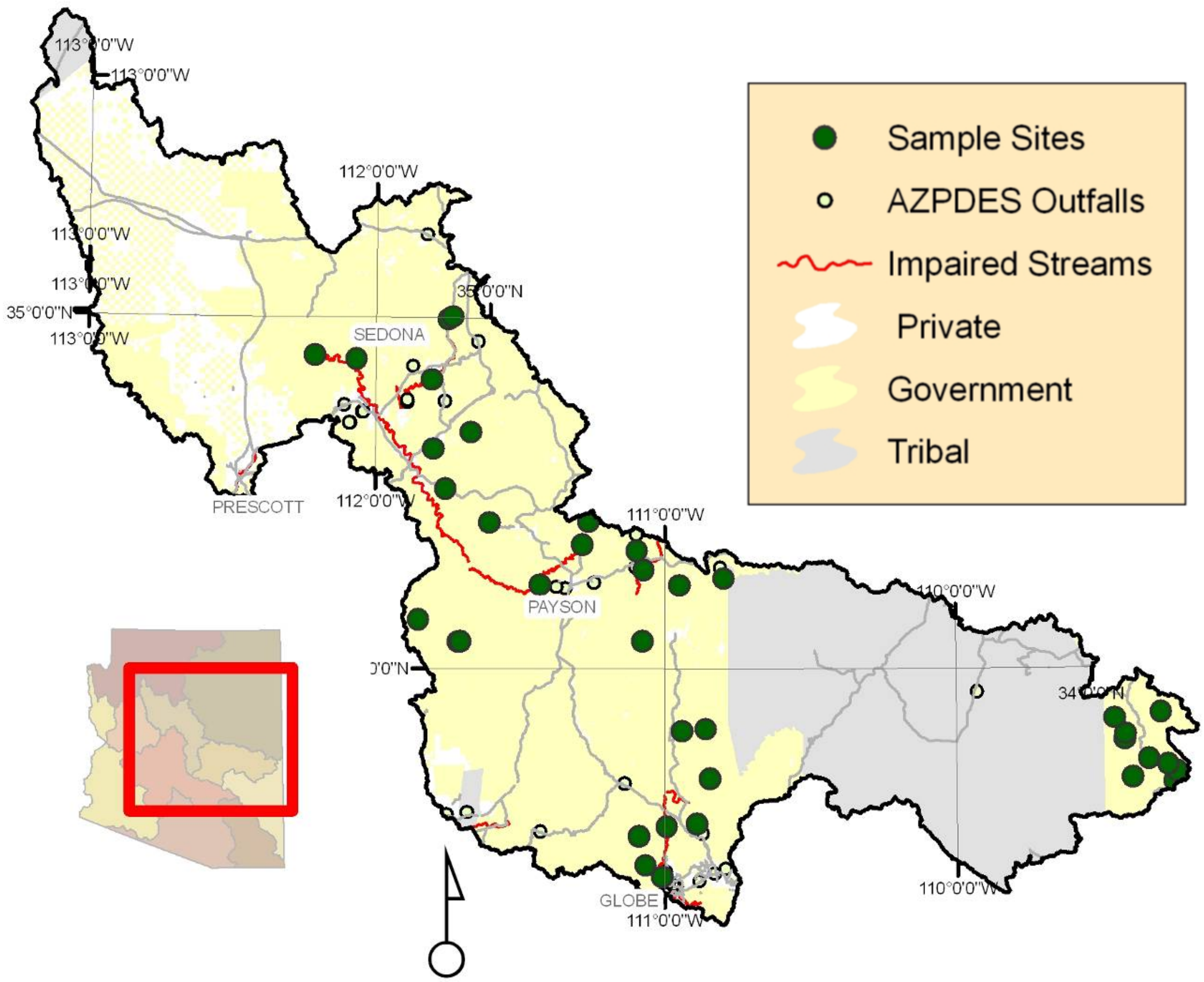


Figure 3. Impaired Streams, AZPDES Outfalls and Salt and Verde Monitoring Sites

ADDITIONAL INFORMATION FOR THE SALT AND VERDE WATERSHEDS

For a basic description of the Salt and Verde River watersheds including information regarding climate, geology and topography visit the University of Arizona's NEMO watershed-based plans at http://www.srnr.arizona.edu/nemo .

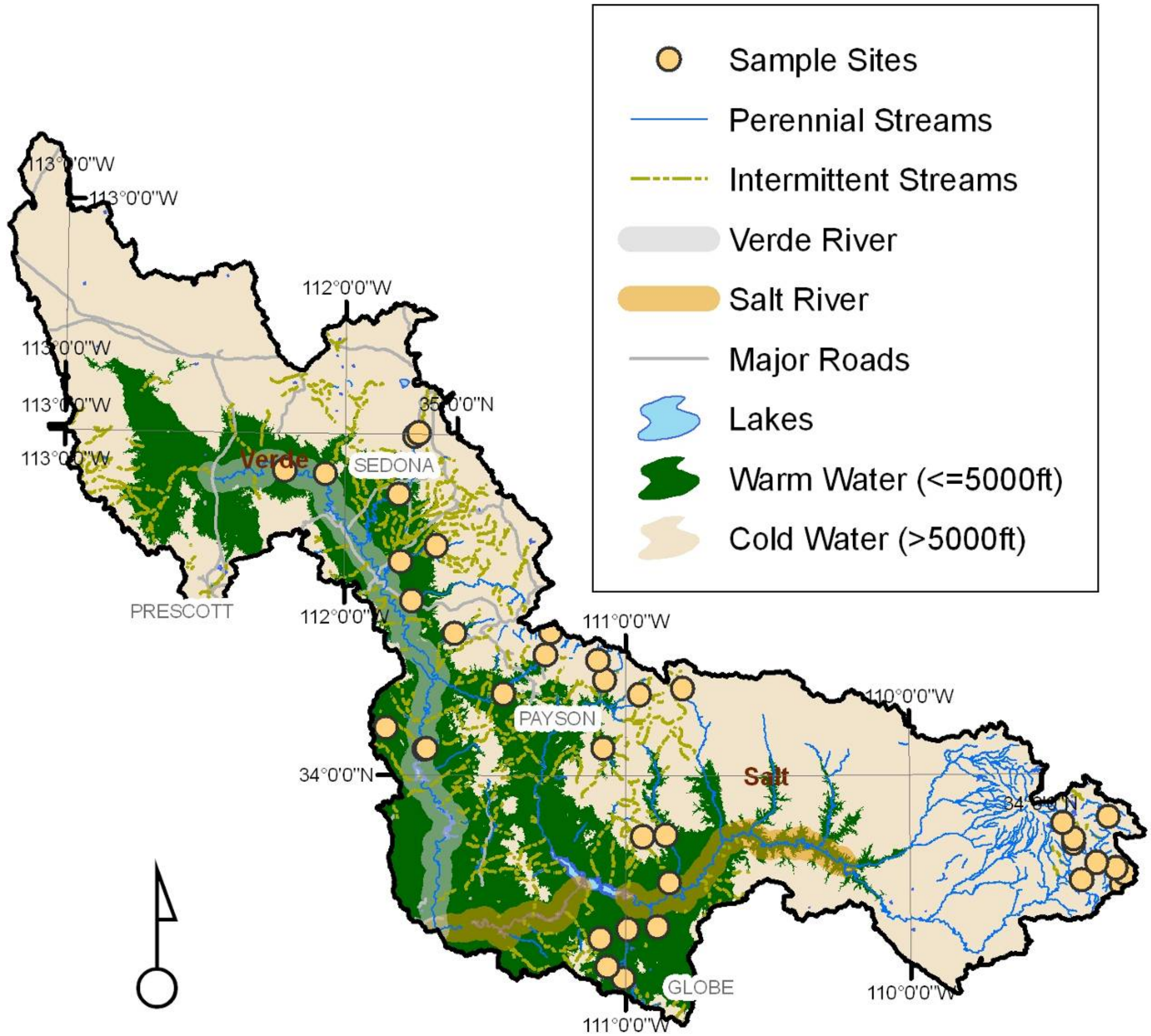


Figure 4. Perennial and Intermittent Reaches in the Salt and Verde Watersheds

The Salt River drains an area of approximately 5,980 square miles and is the largest tributary of the Gila River (Figure 4). The Salt River headwaters originate in the White Mountains from the confluence of the White and Black Rivers at 11,400 feet in elevation and flows approximately 140 miles to its confluence with the Gila River at an elevation of about 900 feet above mean sea level. A series of major reservoirs make up the dammed portions of the Salt River (Roosevelt, Apache, Canyon, and Saguaro Lakes). Perennial flows are found at the higher elevations due to winter snow, monsoon storms, and springs and most intermittent streams are found in the western portion of the watershed (ADWR, 2006).

The Verde River drains an area of approximately 6,188 square miles and traverses a distance of about 140 miles (Figure 4). The Verde River headwaters originate just south of Paulden and flows southeast into Horseshoe and Bartlett Lakes before joining the Salt River. Many large tributaries contribute to the Verde River including Sycamore Creek, Oak Creek, Wet Beaver Creek, West Clear Creek, Fossil Creek, and the East Verde River (ADWR, 2006). The Verde watershed includes the highest peak in Arizona, Humphrey's Peak at 3,840 meters (12,600 ft). The lowest elevation in the Verde watershed is at the confluence of the Verde and the Salt Rivers at 396 meters (1,300 ft). Figure 4 shows the perennial and intermittent reaches in the Salt and Verde watersheds.

The main sources of perennial flows sampled for the Salt and Verde watersheds were snow melt at 52% and springs at 35% (Figure 5). The streams in these watersheds flow through a variety of landforms such as mountain meadows, coarse colluvial deposits, bedrock canyons, and alluvial deposits.

Streams were classified according to Rosgen Level 1 stream classification (Rosgen, 1996). B type streams were by far the dominant stream type for the selected sample sites (Figure 6). These types of streams are dominated by riffles, have moderate gradients and are located in narrow valleys (Table 3).

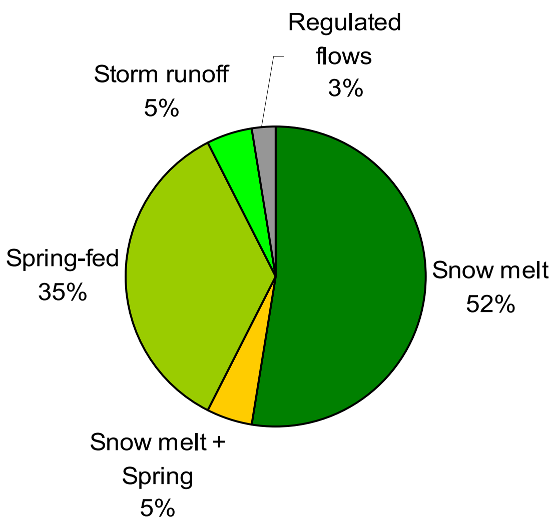


Figure 5. Main Water Sources

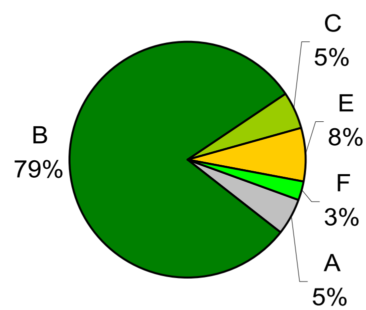


Figure 6. Rosgen Level 1 Stream Types

Table 3. Rosgen Level 1 Stream Type General Descriptions

Stream Type	General Description
A	Steep, entrenched, and cascading step/pool channel
B	Riffle-dominated channel on moderate gradient in narrow valley
C	Meandering riffle/pool channel with point bars and well defined floodplains
E	Highly sinuous riffle/pool channel in broad valley/meadows
F	Entrenched and meandering riffle/pool channel on low gradient
G	Entrenched “gully” step/pool channel on moderate gradient

Omernik (1987) divided the continental United States into 104 Level III ecoregions. Three of the Omernik Level III ecoregions occur in the Salt and Verde study areas: Arizona/New Mexico Mountains, Arizona/New Mexico Plateau, and Sonoran Basin and Range (Figure 7). The Mountains region, which lies across almost all of the Salt and Verde watersheds, accounts for the majority of the ecoregion. The region is characterized by mountainous terrain with pinyon-juniper and oak woodlands at low to mid-elevations and ponderosa pine forests at high elevations. All perennial streams identified in this study occur in the Mountains region which ranges in elevation from 1,780 to 2,920 meters (5,840 to 9,580 feet). The Plateau ecoregion, located in the western portion of our study area, is characterized by desert vegetations at low elevations, grass and shrublands at mid-elevations, and pinyon-juniper woodlands at high elevations. The Sonoran Basin and Range ecoregion occurs in a small area of the Salt watershed and is characterized by scattered low mountains with Palo Verde, cactus shrub, and Saguaro Cactus.

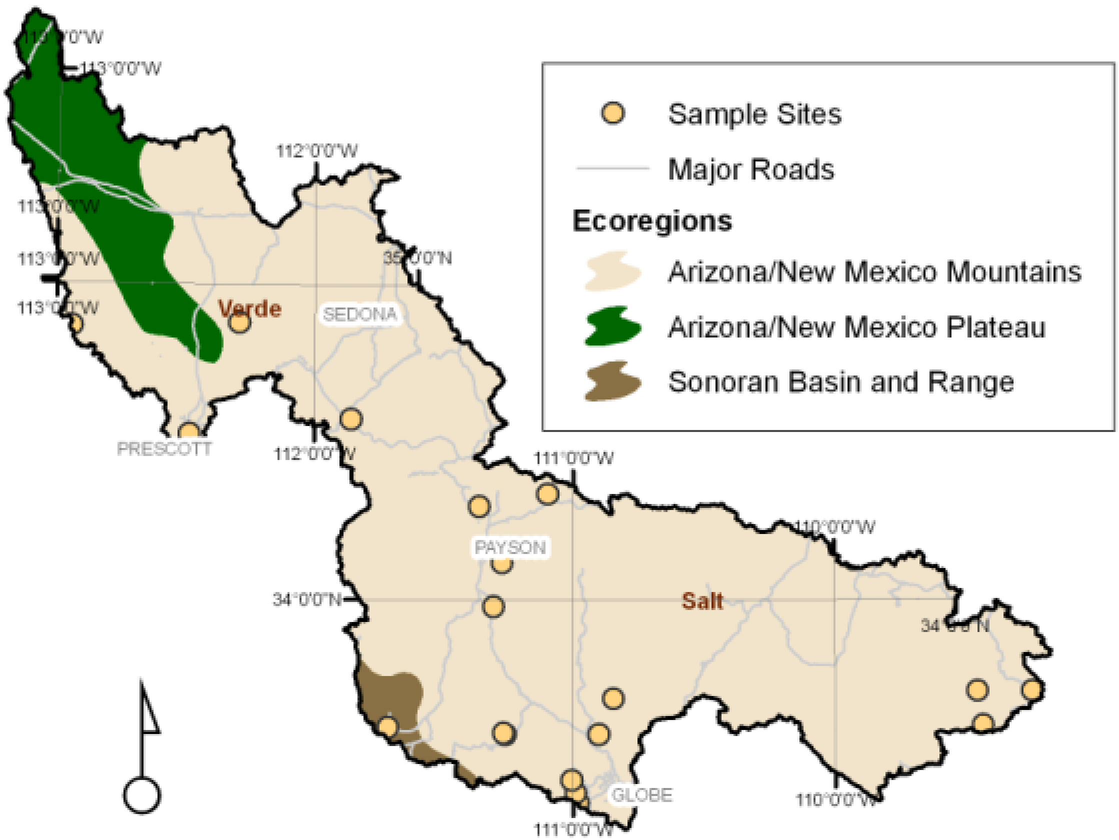


Figure 7. Ecoregions in the Study Area

Precipitation in the Salt and Verde watersheds generally increases with altitude and varies widely from season to season. Precipitation is usually highest during summer months of July and August and peaks again during winter months with the driest period from April through June.

CHAPTER 2 – MONITORING DESIGN AND METHODS

PROBABILISTIC MONITORING DESIGN

Arizona uses a probabilistic monitoring design to assess wadeable perennial streams in Arizona. A probabilistic monitoring design allows statistically valid inferences to be made about sites that have not actually been visited. This report is the first of three that will comprise the second statewide probabilistic assessment of Arizona. The first was completed by the Arizona Game and Fish Department and USGS in 2006.

For the statewide assessment, fifty-one sites were selected to be sampled over a three year cycle with 17 sites in each region. The Central Monitoring Region is the first region to be sampled. Splitting the state into three regions enabled ADEQ to keep this rotating approach and minimize travel time. Figure 8 illustrates which watersheds make up each monitoring region and indicates the years each region is scheduled to be sampled.

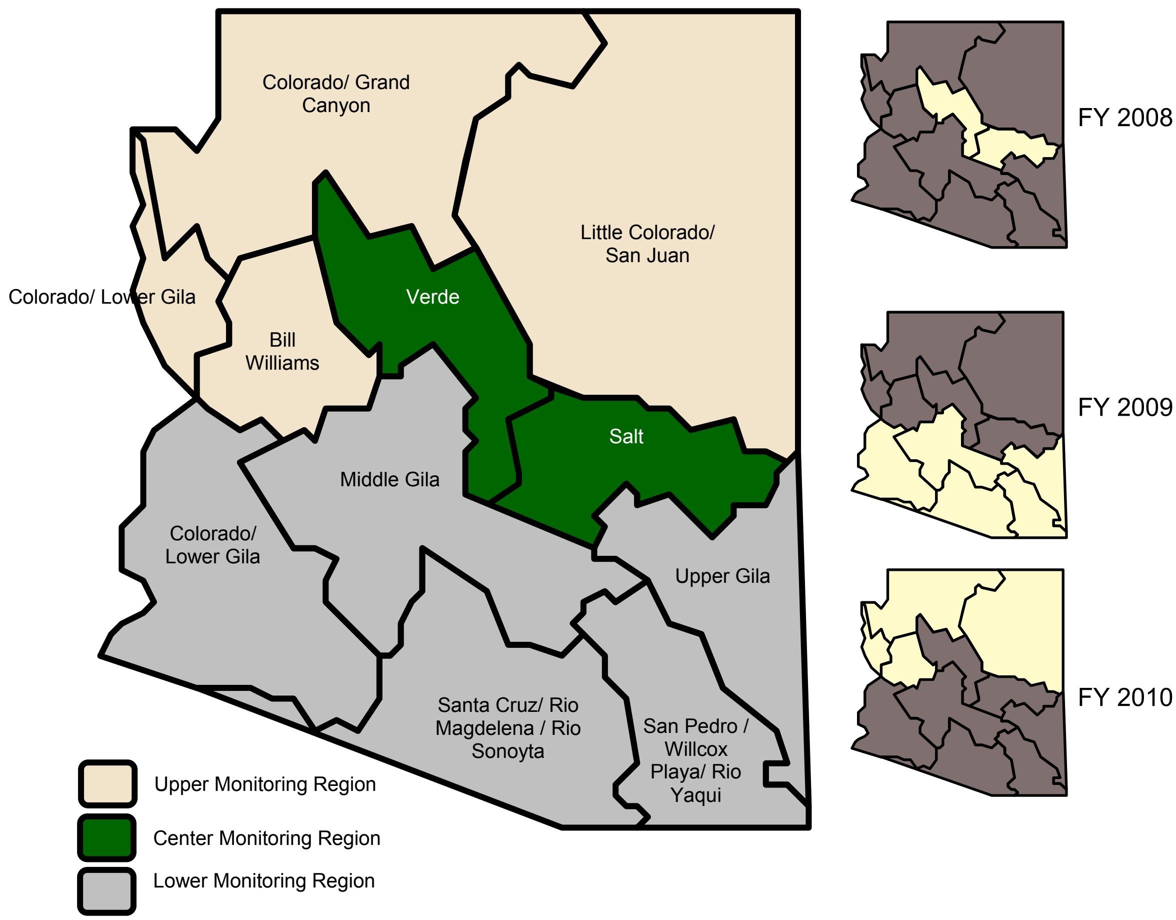


Figure 8. Monitoring Regions

In order to use the probability-based monitoring plan, EPA generated a random sampling site list with specific coordinates using the R-statistical program. The coordinates were then plotted on ADEQ's perennial stream map. The map was modified in 2007 from the original version of an Arizona Game and Fish Department map from 1993. ADEQ updated the map with new "predicted perennial" reaches based on the USGS models, which used existing ADEQ flow records to predict the hydrological regime of ungaged streams in Arizona (Anning, 2009). The map was also modified to exclude stream reaches that were on Native American land, lake shorelines, canals, or ditches.

Next, the random sites were further evaluated by GIS and field reconnaissance, and categorized as "target" or "non-target". GIS and reconnaissance validated the following criteria for the "target" sites:
1) Was the sample site wadeable and perennial?
2) Was the sample site accessible?
3) Was permission granted if the site was on private land?
4) Was sample site on Native American Land?

For the Central Monitoring Region 33 sites were evaluated, of which 20 sites were determined "target" sites. Of the target sites, however, 3 could not be sampled due to landowner denial or the presence of a physical barrier. The remaining 17 sites were determined to be target-sites for probabilistic stream monitoring. The 2008 site evaluation results were added as new attributes to the perennial stream map for future reference and to further improve the accuracy of selecting "target" monitoring sites.

TARGETED MONITORING DESIGN

A targeted monitoring design was used in conjunction with the probabilistic design. Targeted sites are selected to address data gaps for reaches identified on the 2004 §305(b) Planning List, to monitor Arizona's Outstanding Waters and to investigate complaints. Table 4 lists all the targeted sites in this study.

Data Gaps

Section 305(b) of the Clean Water Act requires ADEQ to conduct a water quality assessment of Arizona's surface waters every two years. Current EPA guidance states that each surface water assessed should be placed in one of five assessment categories that describes its level of attainment. The five categories are as follows:

1) Surface waters where all designated uses are attaining;
2) Surface waters that are attaining some designated uses but there is insufficient data to assess the remaining uses;
3) Surface waters with insufficient data to assess any designated use;
4) Surface waters that are not attaining one or more designated uses, but a Total Maximum Daily Load (TMDL) analysis is not required; and
5) Surface waters that are impaired for one or more designated uses and a TMDL is required.

Surface waters with insufficient data to determine whether a surface water is attaining designated uses or is impaired are identified in categories 2 and 3 on the assessment list. Surface waters in these categories are included on a planning list and targeted for water quality monitoring to fill existing data gaps. In some cases, data sets for some sample sites were incomplete and did not include all core parameters required for §305(b) water quality assessment. In other cases, there were an insufficient number of sampling events to make an assessment.

Outstanding Arizona Waters

Monitoring Unit (MU) staff collect surface water data for Arizona's Outstanding Waters (previously identified as unique waters) to characterize existing water quality and to determine whether water quality is being maintained and protected. Currently, there are 22 Outstanding Arizona Waters listed in Arizona's Administrative Code R18-11-112. The primary purpose of monitoring outstanding waters is to collect data to characterize baseline water quality. A long-term goal of this program is to acquire enough water quality data over time to determine water quality trends in Arizona's outstanding waters and to determine whether state antidegradation requirements are being met (i.e., water quality is improving, being maintained, or degrading). Antidegradation rules require that the water quality in Arizona's Outstanding Waters not be degraded. MU staff conducted quarterly chemical monitoring and spring macroinvertebrates collection at sites located on the outstanding waters.

The following outstanding waters were monitored in the Central Monitoring Region:

- Bear Wallow Creek
- Hay Creek
- North Fork of Bear Wallow Creek
- Snake Creek
- Stinky Creek
- Oak Creek
- West Fork Oak Creek

Biocriteria

MU staff conducts bioassessments and habitat assessments at biocriteria reference sites, random sites, and outstanding water sites to develop Arizona's regional reference site network statewide and to monitor trends in reference conditions over time. Another purpose of the biocriteria monitoring effort is to test existing indices of biological integrity for warm and cold water streams over a range of impairment conditions and sources of stressors. A minimum of 10 biocriteria reference sites are selected in each watershed each fiscal year (FY). Benthic macroinvertebrate samples are collected in wadeable, perennial streams with suitable riffle habitats during the spring index period (April, May, or June). Some of the random sites were also used as reference sites for the FY 08 macroinvertebrate collection. A subset of the spring sites was also collected during the fall of FY08 for a spring/fall comparison (Appendix D).

Geomorphology

MU staff collect data on stream channel characteristics to determine channel stability and the fate of sediment transport. Geomorphology sampling is a separate activity from other sampling activities and sites were selected that had been previously sampled for macroinvertebrates and Stream Ecosystem Monitoring. The geomorphology analysis was not limited to the Salt and Verde River watersheds but includes sites sampled over a three year period from 2007 to 2009; twelve sites from the Little Colorado watershed, eight from the Verde River watershed, and six from the Salt River watershed for a total of twenty-six sites (see Table 9). The inclusion of non-Salt/Verde sites provides a larger data set that diminishes the influence of outliers in the data and provides a more accurate trend analysis. Sixteen of the twenty-six sites are classified as cold water and the remainder as warm water sites. Two of the Verde watershed sites are classified as intermittent and the remaining sites are perennial.

SITE LOCATION

Table 4 summarizes where the sites were sampled and indicates which monitoring objective was addressed. Figure 4 shows the aerial location of all the Salt and Verde River monitoring sites.

ADEQ gives each sample site a unique identification code. The first two letters correspond to the watershed code. For example, SRBON001.69, SR corresponds to the Salt River Watershed. Using certain rules, the next three letters are chosen to correspond to the stream name. Using our example SRBON001.69, BON represents Boneyard Creek. Lastly, the values at the end of the identification code relate to the river miles that pinpoint the sample site on the stream (measured in river miles from the mouth of the stream to the site location). The site ID SRBON001.69 represents the specific sampling point 1.69 river miles from the mouth of Boneyard Creek located in the Salt River watershed.

Table 4. Site List

Site ID	Stream Name	Designated Uses	UTM (mN)[1]	UTM (mE)	Type
SRBON001.69	Boneyard Creek	A&Wc, FBC, FC, AgI, AgL	3748981	657377	Random
SRCHE013.65	Cherry Creek	A&Ww, FBC, FC, AgI, AgL	3743142	513223	Random
SRCYN045.73	Canyon Creek	A&Wc, FBC, DWS, FC, AgI, AgL	3790831	518811	Random

Site ID	Stream Name	Designated Uses	UTM (mN)[1]	UTM (mE)	Type
SRFIS004.49	Fish Creek	A&Wc, FBC, FC, AgI, AgL	3728081	648962	Random
SRHAG013.09	Haigler Creek	A&Wc, FBC, FC, AgI, AgL	3788656	504691	Random
SRTON053.87	Tonto Creek	A&Ww, FBC, FC, AgI, AgL	3793899	493707	Random
SRTON059.43	Tonto Creek	A&Wc, FBC, FC, AgI, AgL	3799674	491093	Random
SRWRK007.97	Workman Creek	A&Wc, FBC, FC, AgI, AgL	3742629	505625	Random
VRVER107.53	Verde River	A&Ww, FBC, FC, AgI, AgL	3818409	423723	Random
VREVR023.59	East Verde Creek	A&Ww, FBC, DWS, FC, AgI, AgL	3788950	460501	Random
VROAK002.96	Oak Creek	A&Ww, FBC, DWS, FC, AgI, AgL	3838943	416717	Random
VRSPN000.78	Spring Creek	A&Ww, FBC, FC, AgI, AgL	3845679	416592	Random
VRVER053.70	Verde River	A&Ww, FBC, FC, AgI, AgL	3770650	434497	Random
VRVER139.99	Verde River	A&Ww, FBC, FC, AgI, AgL	3847469	405432	Random
VRWBV002.97	Wet Beaver Creek	A&Ww, FBC, FC, AgI, AgL	3831907	426762	Random
VRWCL005.10	West Clear Creek	A&Ww, FBC, FC, AgI, AgL	3819494	430624	Random
VRROU002.93	Round Tree Canyon Creek	A&Ww, FBC, FC, AgL	3777965	421892	Random & Targeted – Assessments
VRFOS011.88	Fossil Creek	A&Ww, FBC, FC, AgL	3808305	444367	Random & Targeted – Outstanding
SRBEV001.40	Beaver Creek @ USGS Gage	A&Wc, FBC, FC, AgI, AgL	3734354	653689	Targeted – Assessments
SRBEV007.28	Beaver Creek above Forest Road 26 Bridge	A&Wc, FBC, FC, AgI, AgL	3732458	659817	Targeted – Assessments
SRBEV009.56	Beaver Creek below Hannagan Creek	A&Wc, FBC, FC, AgI, AgL	3730541	662438	Targeted – Assessments
SRERT000.10	Ellis Ranch Tributary	A&Ww, FBC, FC	3687299	507900	Targeted – Assessments
SRHAN000.06	Hannagan Creek	A&Wc, FBC, FC, AgL	3730387	662507	Targeted – Assessments
SRHAN002.27	Hannagan Creek	A&Wc, FBC, FC, AgL	3727060	661654	Targeted – Assessments
SRHNC000.14	Haunted Canyon	A&Ww, FBC, FC	3697378	499327	Targeted – Assessments
SRPNL005.12	Pinal Creek	A&Ww, FBC, FC, AgL	3713259	510380	Targeted – Assessments

Site ID	Stream Name	Designated Uses	UTM (mN)[1]	UTM (mE)	Type
SRPNT008.48	Pinto Creek	A&Ww, FBC, FC, AgI, AgL	3712330	500865	Targeted – Assessments
SRWPN004.47	West Fork Pinto Creek	A&Ww, FBC, FC	3700025	494050	Targeted – Assessments
VREVR045.50	East Verde River	A&Wc, FBC, DWS, FC, AgI, AgL	3801644	473967	Targeted – Assessments
SRBWL005.79	Bear Wallow Creek	A&Wc, FBC, FC, AgL	3718824	643806	Targeted – Outstanding Water
SRHAY000.04	Hay Creek	A&Wc, FBC, FC, AgL	3742084	646041	Targeted – Outstanding Water
SRNBE000.10	North Fork of Bear Wallow Creek	A&Wc, FBC, FC, AgL	3718703	644179	Targeted – Outstanding Water
SRSNK001.33	Snake Creek	A&Wc, FBC, FC, AgL	3727497	642643	Targeted – Outstanding Water
SRST1000.38	Stinky Creek	A&Wc, FBC, FC, AgL	3747110	642599	Targeted – Outstanding Water
VROAK031.38	Oak Creek	A&Ww, FBC, DWS, FC, AgI, AgL	3853873	426269	Targeted – Outstanding Water
VROAK048.36	Oak Creek	A&Wc, FBC, DWS, FC, AgI, AgL	3873108	432548	Targeted – Outstanding Water
VROAK048.92	Oak Creek	A&Wc, FBC, DWS, FC, AgL	3874291	432832	Targeted – Outstanding Water
VRWOK000.82	West Fork of Oak Creek	A&Wc, FBC, FC, AgL	3872913	431586	Targeted – Outstanding Water
SRCGN009.78	Campaign Creek	A&Ww, FBC, FC, AgL	3709403	491896	Targeted – Reference
SRSPI011.63	Spring Creek	A&Ww, FBC, FC, AgL	3771110	492953	Targeted – Reference
SRTON046.90	Tonto Creek @ Hellsgate	A&Ww, FBC, FC, AgI, AgL	3786019	490814	Targeted – Reference
SRWFB005.34	West Fork Black River	A&Wc, FBC, DWS, FC, AgI, AgL	3740450	645953	Targeted – Reference
VREVR051.15	East Verde River Below Washington Park	A&Wc, FBC, DWS, FC, AgI, AgL	3808881	475806	Targeted – Reference
VRPIE000.29	Pine Creek	A&Ww, FBC, DWS FC, AgI, AgL	3787137	455005	Targeted – Reference
VRSYH000.25	Sycamore Creek @ Sheeps Bridge	A&Ww, FBC, FC, AgL	3771206	435248	Targeted – Reference

Site ID	Stream Name	Designated Uses	UTM (mN)[1]	UTM (mE)	Type
VRSYW001.72	Sycamore Creek @ Wilderness Area	A&Ww, FBC, FC, AgI, AgL	3860506	402484	Targeted – Reference
VRVER165.07	Verde River @ Perkinsville	A&Ww, FBC, FC, AgI, AgL	3861926	389240	Targeted – Reference
VRWBV012.56	Wet Beaver Creek	A&Ww, FBC, FC, AgI, AgL	3837087	438604	Targeted – Reference
VRWCL036.37	West Clear Creek	A&Wc, FBC, FC, AgL	3823564	462611	Targeted – Reference
SRCOO001.92	Coon Creek @ Forest Road # 203	A&Ww, FBC, FC, AgL	3727570	514459	Targeted – Assessment

[1]Coordinates in North American Datum 1983

A&Wc = Aquatic and wildlife cold
A&Ww = Aquatic and wildlife warm
DWS = Domestic water source
FBC = Full body contact
FC = Fish consumption
AgI = Agriculture irrigation
AgL = Agriculture livestock

Study Area/Watershed Conditions

During the winter months a large precipitation and flood event occurred in the eastern Verde River watershed and majority of the Salt River watershed. The flood event ranged in magnitude from an estimated 3.5 to 30 year return interval in the Salt River watershed and from 2 to 8 year flood event in the Verde River watershed (Figure 9). Flood return intervals were estimated from statistical summaries for USGS stream gages in the Salt and Verde watersheds (Appendix D; Pope et al., 1998). The largest flood events among stream sites were those with a 25 to 30 year return interval in the Salt River watershed (Campaign Creek, Cherry Creek, Coon Creek, Pinto Creek, West Fork Pinto Creek, and Workman Creek). The largest flood events in the Verde River watershed were estimated as those with an 8 year return interval which occurred in the East Verde River, Fossil Creek, Roundtree Creek, Sycamore Creek and West Clear Creek.

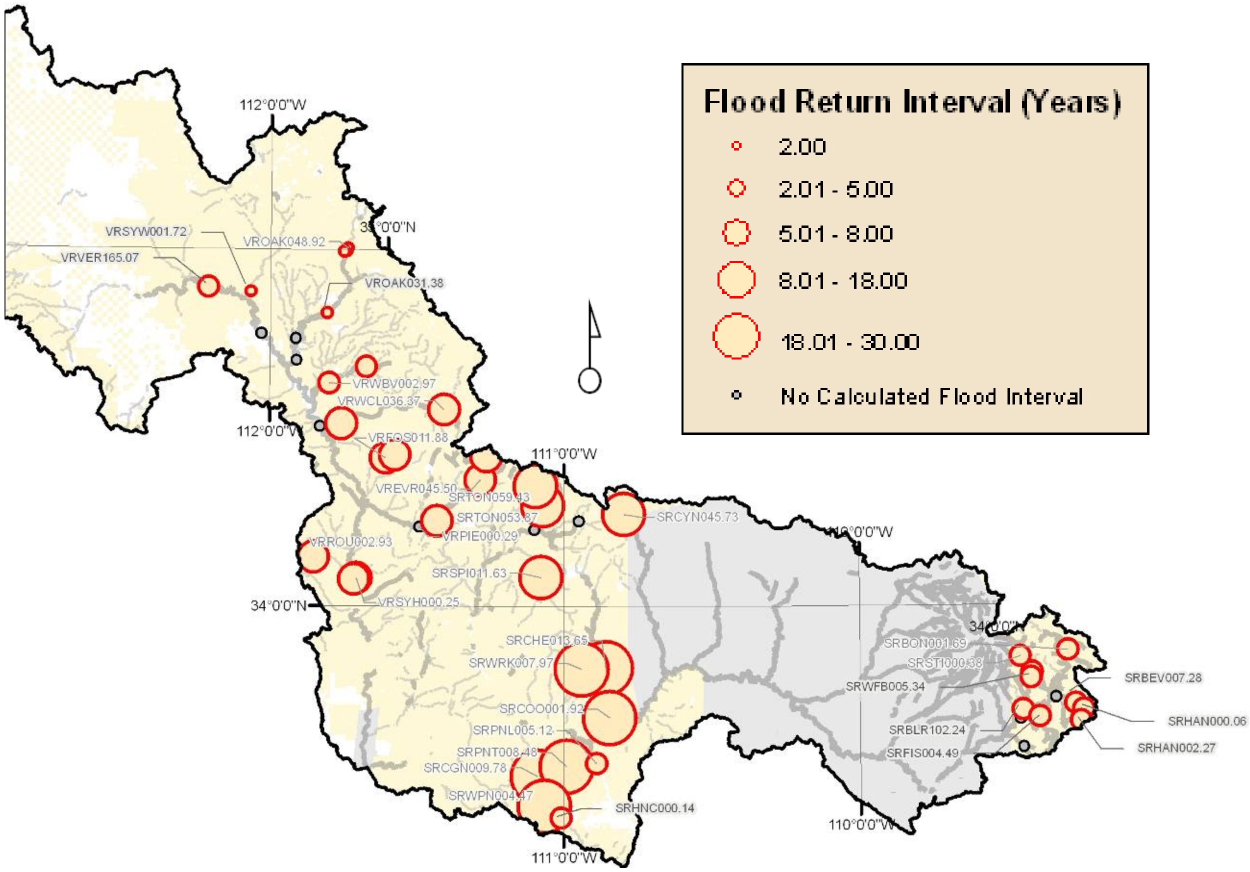


Figure 9. Flood Return Intervals in Years

SAMPLE METHODS

The ADEQ Standard Operating Procedures for Water Quality Sampling (Jones, 2010) describes the sample collection methods used for water chemistry, macroinvertebrate and habitat data.

CHAPTER 3 – SUMMARY OF DATA / ANALYSIS

REGIONAL VARIATIONS IN WATER QUALITY PARAMETERS

Water quality parameters can vary significantly by location due to a number of factors such as human disturbance, geology, ecology and climate. Figures 10 to 17 indicate how parameters, such as discharge, vary from one site to another. These figures summarize the range and aerial distribution of a particular parameter. They are not intended to provide pinpoint measurements for each site. Use Appendix A for specific results.

In figures 10-17, each site is represented as an average of all four quarters. Averaging the data allows the comparison of many sites and parameters at the same time.

Ranges for each parameter (i.e., the size of each circle and the corresponding range) were chosen based on criteria such as water quality standards and the distribution of the results. Each parameter is discussed briefly below.

Discharge. Oak Creek (VROAK048.92) and Wet Beaver Creek (VRWBV012.56) had the highest discharges in the Central Monitoring Region with values of 179 and 127 cfs respectively. Discharge was typically lower in the Salt River Watershed (0 to 31 cfs) (Figure 10).

Specific Conductivity (SpCond). Conductivity was markedly lower in the eastern part of the Salt River watershed near Mount Baldy. All conductivity values in this region were below 133 uS/cm. Pinal Creek (SRPNL005.12) and Pinto Creek (SRPNT008.48) had the highest average conductivities with values of 1,834 and 1,246 uS/cm, respectively (Figure 11).

Dissolved Oxygen (DO). Stinky Creek (SRSTI000.38) had the lowest average DO for all sites (5.69 mg/L). West Clear Creek (VRWCL036.37) had the highest average DO concentration of 11.08 mg/L. Most sites had DO concentrations between 8 and 10 mg/L (Figure 12).

E. Coli. The highest average E. coli count was at Wet Beaver Creek VRWBV002.97. The E. Coli values varied considerably at this site (non-detect - 480 cfu/100 mL). Oak Creek (VROAK002.96), East Verde River (VREVR045.50), and Spring Creek VRSPN000.78 all had E. coli concentrations over 100 cfu/100 mL. The remainder of the sites had average concentrations below 55 cfu/100mL (Figure 13).

Suspended Sediment Concentration (SSC) and Turbidity. In 2002, ADEQ replaced the water quality standard for turbidity with suspended sediment concentration (SSC). The SSC standard for the Aquatic and Wildlife Warm designated use is 80 mg/L, while the Aquatic and Wildlife Cold is 25 mg/L. The highest SSC and turbidity concentrations were found in the middle of the Verde watershed. The Verde River (VRVER165.07, VRVER139.99), Oak Creek (VROAK002.96) and Wet Beaver Creek (VRWBV002.97) all had average turbidity and SSC concentrations greater than 50 NTUs and 28 mg/L, respectively (Figure 14).

Habitat and Proper Functioning Condition (PFC) Score. Habitat scores provide a qualitative way to assess riffle habitat quality, riffle extent, riffle embeddedness, sediment deposition and bank stability. Habitat scores are also used in conjunction with macroinvertebrate sampling to describe the riffle habitat condition in which the macroinvertebrates were sampled. A score of 0-7 indicates the habitat is very distressed; 8-14 means distressed, and above 15 is good condition. Proper Functioning Condition (PFC) is a qualitative method for assessing the condition of riparian-wetland areas (Prichard et al, 1993). The term PFC is used to describe both the assessment process, and a defined, on-the-ground condition of a riparian-wetland area. PFC is represented as a percent of the ideal score, which is calculated at the percent of "yes" responses on the Stream Ecosystem Monitoring field form. A higher percentage indicates a higher quality riparian area.

None of the sites sampled had habitat scores below 8. Beaver Creek had the worst habitat and PFC scores (9 and 12% respectively). Oak Creek (VROAK031.38), Sycamore Creek (VRSYW001.72) and Tonto Creek (SRTON059.43) had excellent habitat and PFC scores equaling 20 and greater than 84% respectively. Seventy-four percent of the sites had habitat scores in the "good" range (Figure 15).

Percent Fines. Percent fines is the amount of sediment less than 2 mm in size on the streambed. For cold water streams, percent fines is measured within riffle habitats by measuring a minimum of 100 particles. A result above 30 percent fines is considered to be detrimental to aquatic life in cold water streams.

For warm water streams, percent fines is determined within reach habitats by measuring a minimum of 100 particles. A result above 50 percent fines is considered to be detrimental to aquatic life in warm water streams. None of the warm or cold water sites had average percent fines over the narrative standards. The maximum reach/warm water value was 44 % while the maximum riffle/coldwater value was 22 %, which are below the 50 % and 30 % limits, respectively (Figure 16).

Index of Biological Integrity (IBI). Seven metrics were used to calculate a macroinvertebrate IBI for cold water streams: total taxa, Diptera taxa, intolerant taxa, Hilsenhoff Biotic Index, percent Plecoptera, percent scrapers, and scraper taxa. Table 5 describes the thresholds for IBI scores in warm and cold water streams.

Sites with inconclusive IBI scores require a verification sample to re-assess the condition of the site. If the verification sample results are in the 'poor' or 'inconclusive' ranges, the site is considered to be exceeding the aquatic and wildlife standard. During the spring index period, 42 percent of the 36 sites were violating the biocriteria standards (Figure 17). A subset of these sites (n=18) were sampled again in the fall and only 6 percent continued to violate the standard. More information regarding biocriteria monitoring and results, see the Bioassessment Results section in Chapter 3.

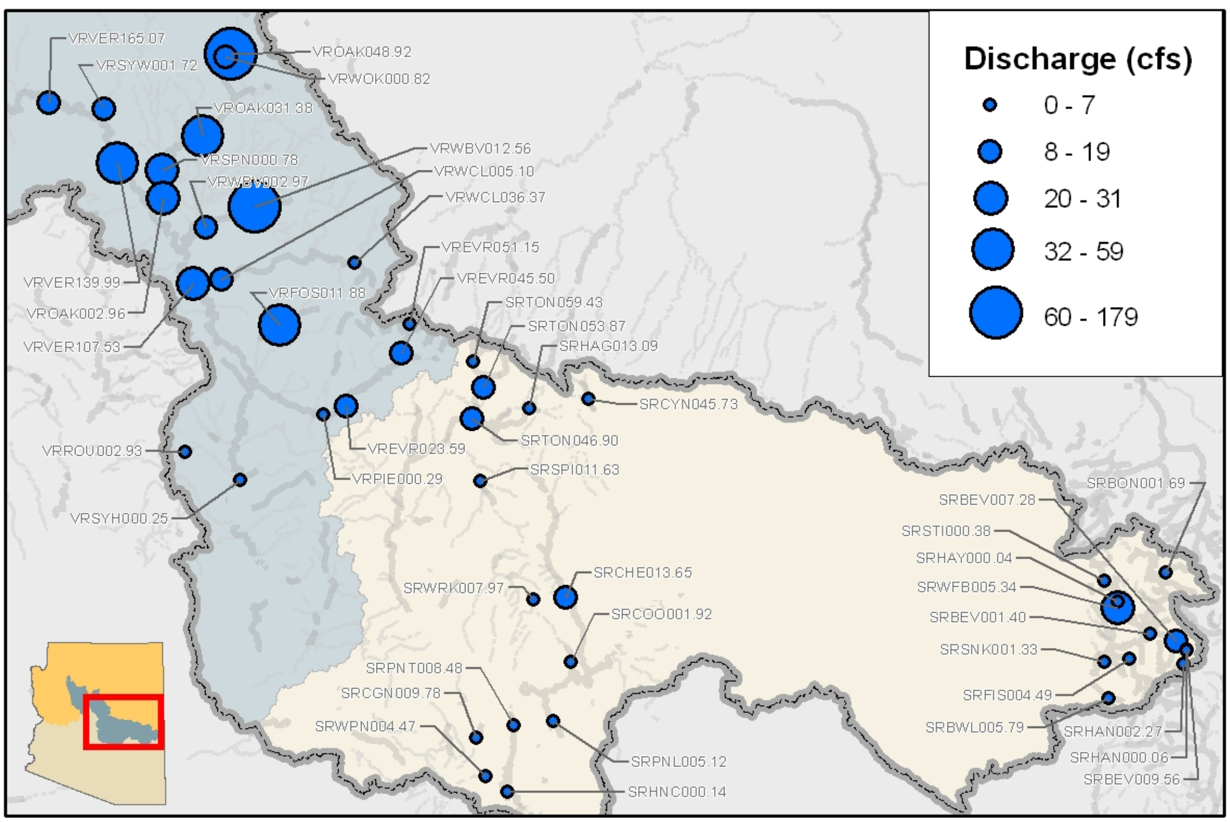


Figure 10. Yearly Average Discharge (cfs)

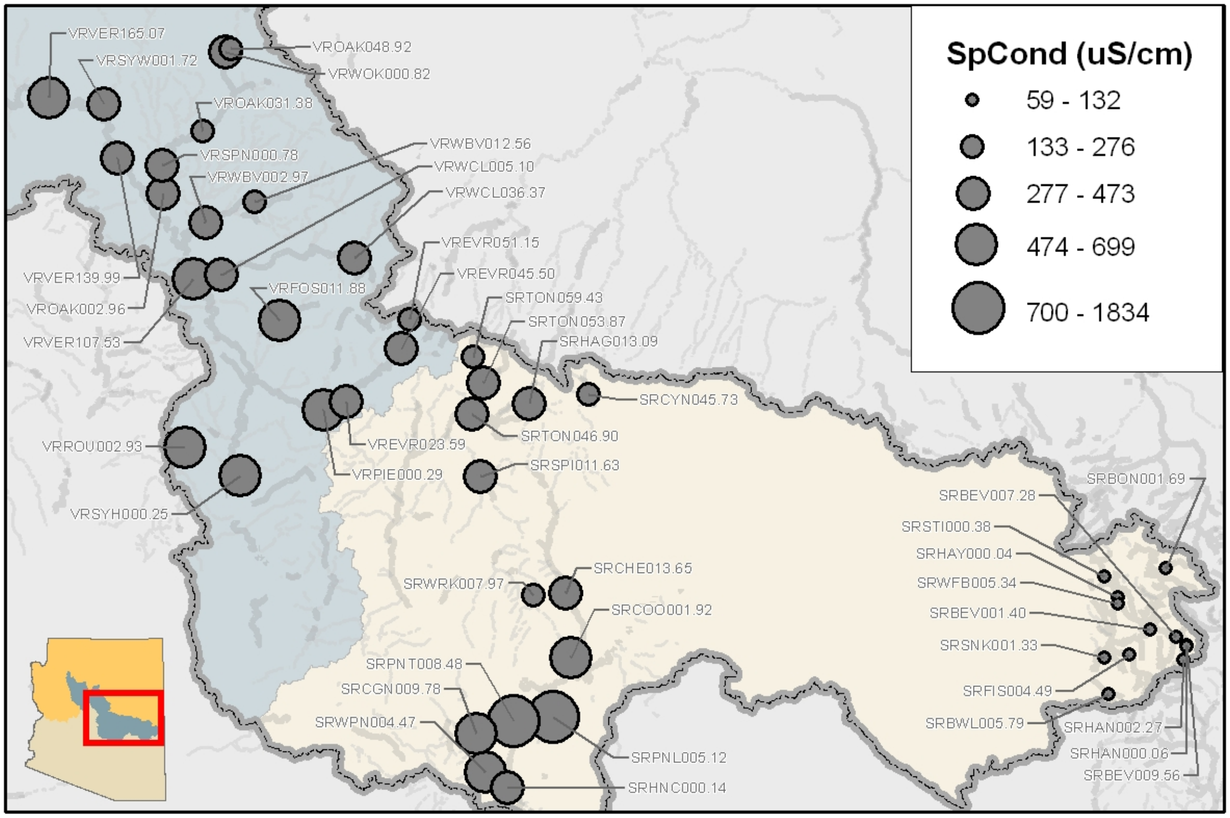


Figure 11. Yearly Average Specific Conductivity Results

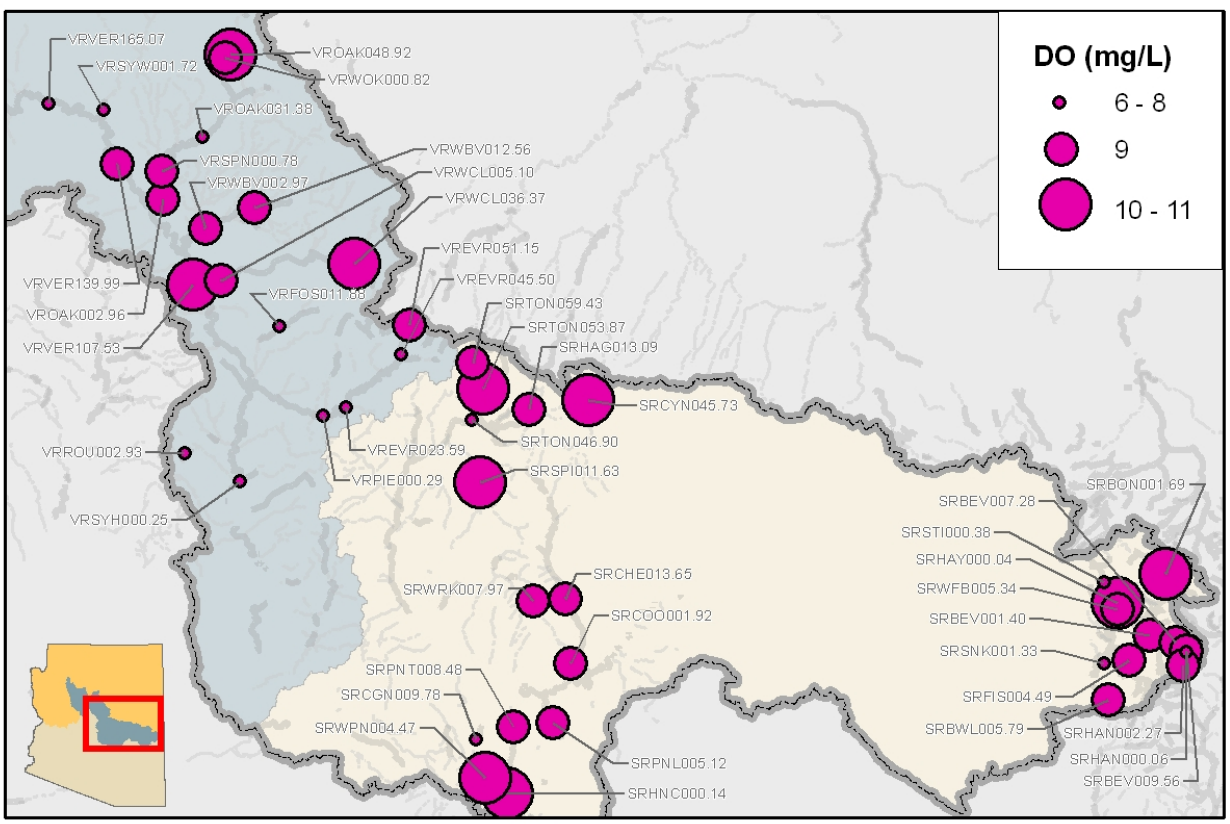


Figure 12. Yearly Average Dissolved Oxygen Level

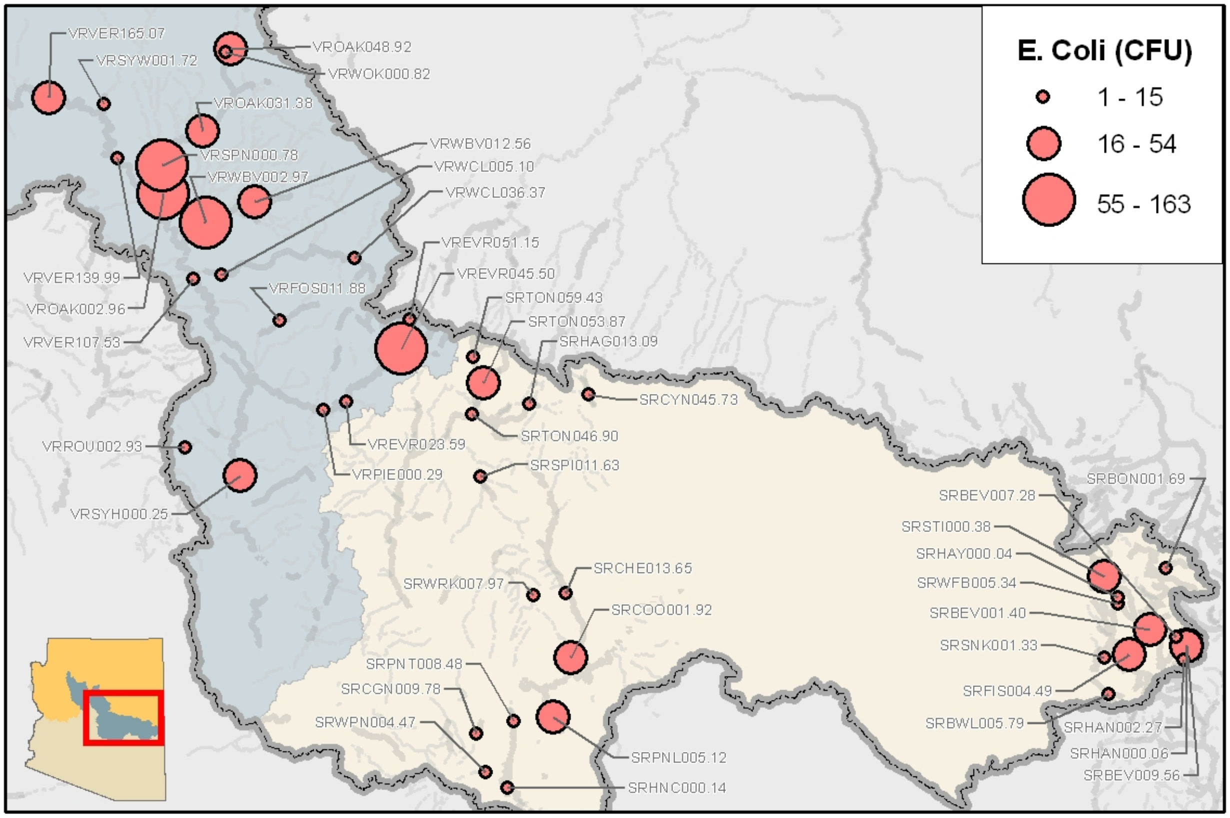


Figure 13. Yearly Average E. Coli Concentrations

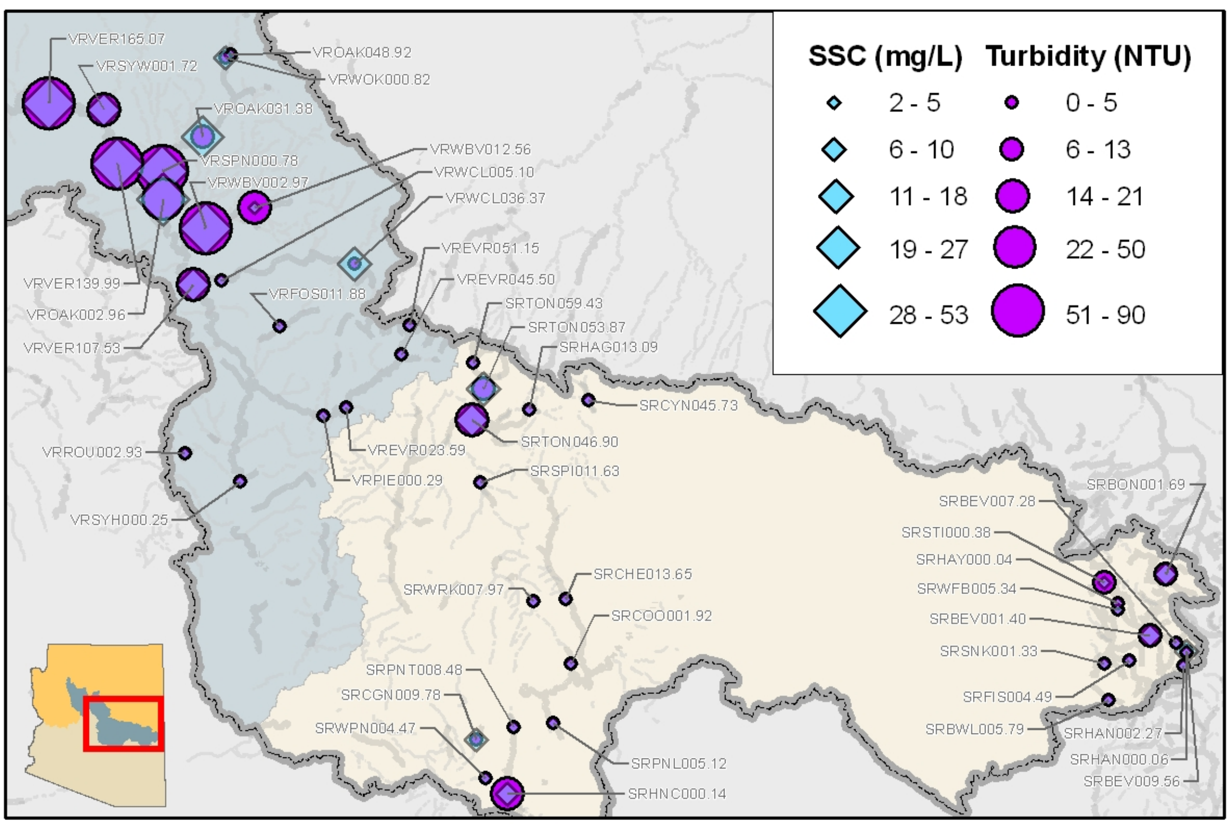


Figure 14. Yearly Average SSC and Turbidity Results

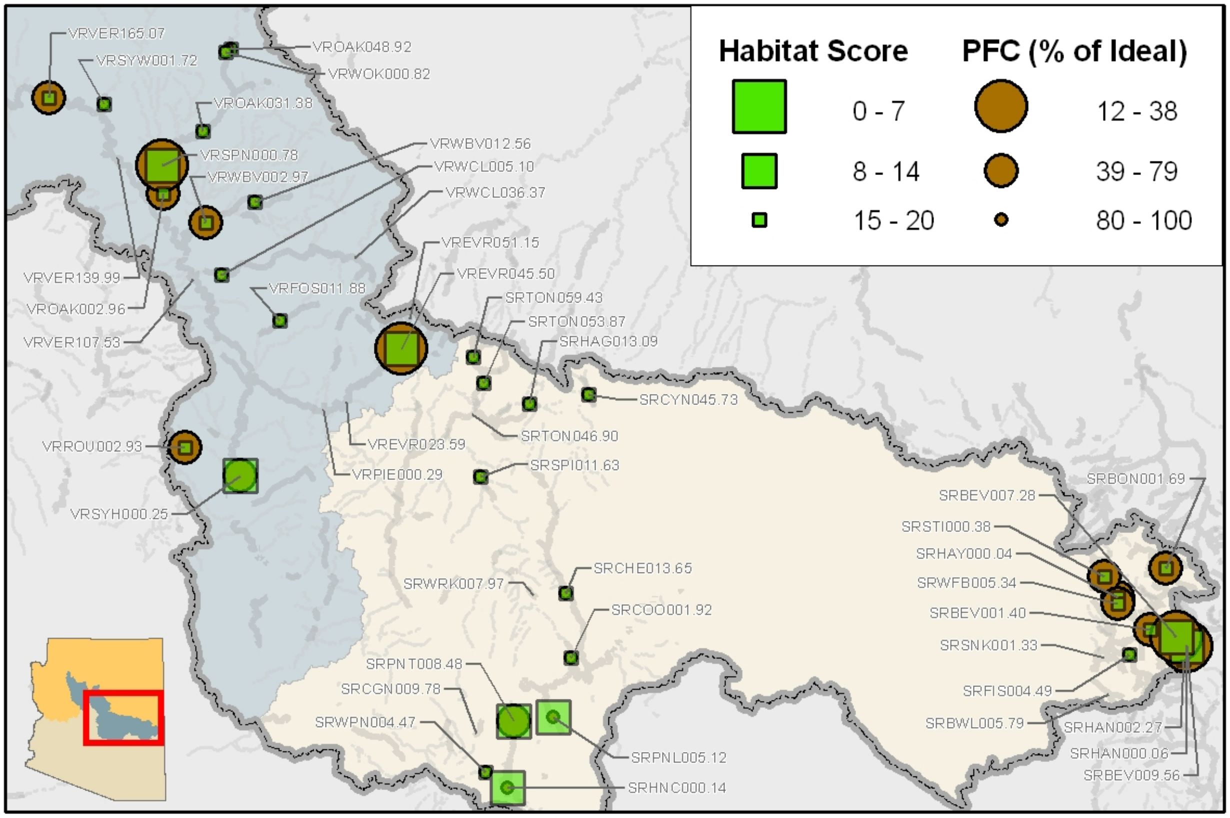


Figure 15. Annual Habitat and PFC Score

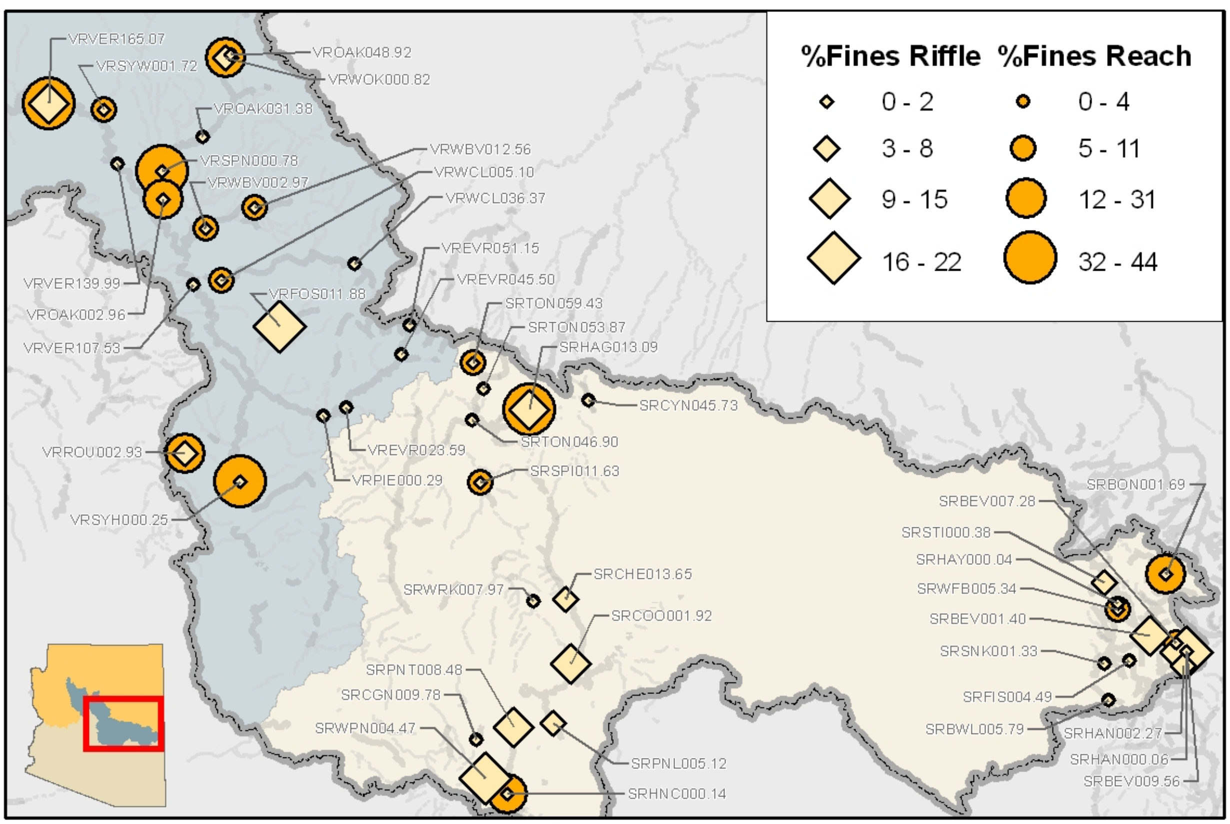


Figure 16. Percent Fines in Riffle and Reach Habitats

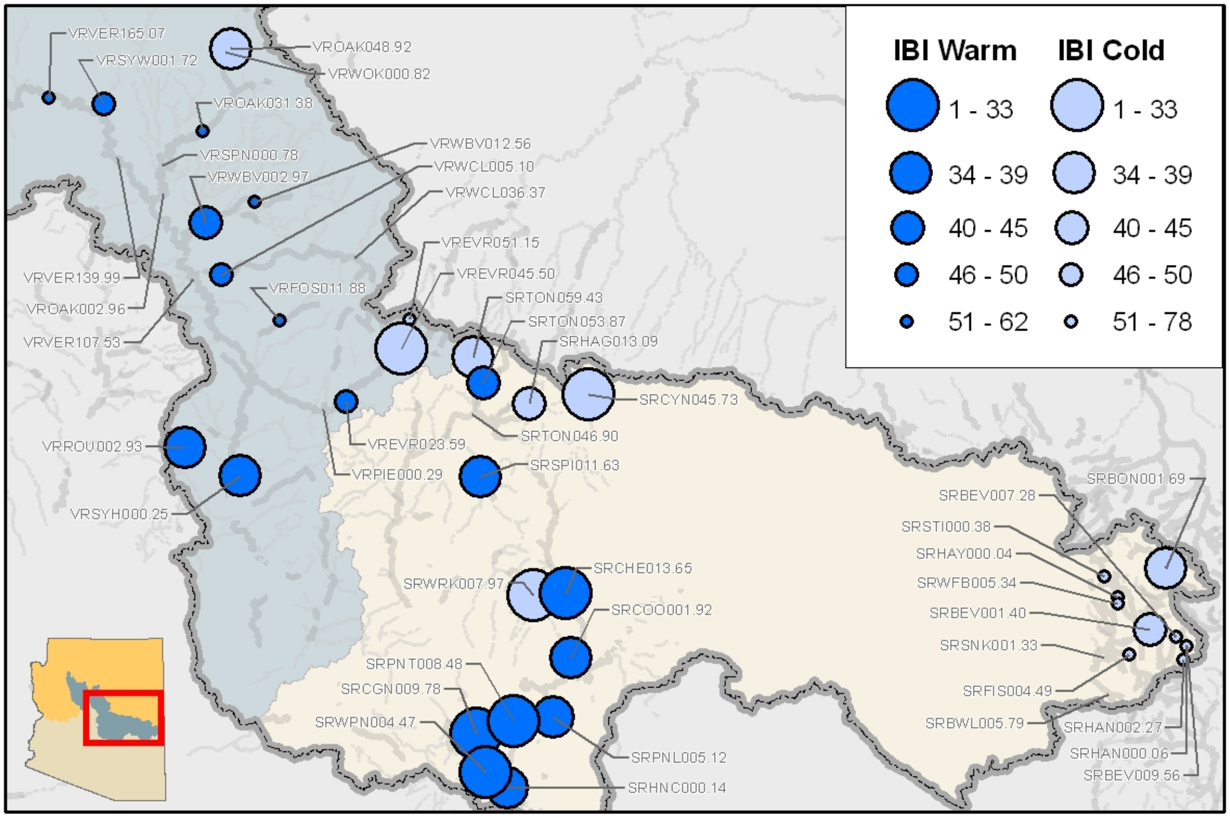


Figure 17. Warm and Cold IBI Scores

BIOLOGICAL AND HABITAT ASSESSMENTS

Background

ADEQ utilizes benthic macroinvertebrate to directly assess the aquatic life designated use in wadeable perennial streams. In 2009, Arizona developed a narrative standard for macroinvertebrates. This standard is for warm and cold water streams throughout the state (Table 5). The cold water Index of Biological Integrity (IBI) is based on seven different metrics (total taxa, Diptera taxa, intolerant taxa, Hilsenhoff Biotic Index, percent Plecoptera, percent scrappers, and scrapper taxa). The warm water IBI is based on nine metrics (total taxa, Hilsenhoff Biotic Index, Ephemeroptera taxa, Tricoptera taxa, Chironomidae taxa, percent Ephemeroptera, percent individuals in the dominant taxon, number of scraper taxa, and percent scrapers). Guidelines for analysis of biological data and use of the biocriteria standard are presented in the "Narrative Biocriteria Standard Implementation Procedures for Wadeable, Perennial Streams" (ADEQ, 2008c).

The ADEQ narrative biocriterion reads as follows: "A wadeable, perennial stream shall support and maintain a community of organisms having a taxa richness, species composition, tolerance and functional organization comparable to that of a stream with reference conditions in Arizona." (A.A.C. R18-11-108.01).

Table 5. Macroinvertebrate IBI Thresholds for Wadeable, Perennial Streams of Arizona

Macroinvertebrate bioassessment result	Index of Biological Integrity Score		Assessment category
	Cold water	Warm water	
Greater than the 25th percentile of reference condition	≥ 52	≥ 50	Meeting biocriterion
Between 10th and 25th percentile of reference	46 – 51	40 – 49	Inconclusive
Less than the 10th percentile of reference condition	≤ 45	≤ 39	Violating biocriterion

Macroinvertebrate Results

The results from water chemistry analysis found few significant ambient water quality issues. The macroinvertebrate data presents a different view. Fifteen of the 36 sites (42%) violated the macroinvertebrate IBI during the spring index period from April to June. A subset of these locations (total of 18 sites) was again sampled in the fall of 2008, for a spring-fall comparison study. Only one of the 18 sites violated the standard in the fall (6%)(Figure 18). The results indicate significantly worse benthic macroinvertebrate conditions in the spring, most likely due to lasting effects of large winter floods. All of the assessment results, IBI scores, and metric values are found in Appendix D.

Reference sites should meet the macroinvertebrate IBI score if upstream conditions remain unchanged. For spring/summer 2008, nearly 43% of reference/outstanding sites were violating the standard or were inconclusive, indicating there were some anthropogenic or natural disturbance(s) in the area. Large floods (10 to 50-year events) have been observed in several areas of the watershed in early 2008. These extreme high flows have undoubtedly scoured the streambeds and banks, impairing in-stream habitat conditions and reducing the abundance and diversity of the benthic macroinvertebrate population. The better conditions assessment of the fall is an indication that the macroinvertebrate population in most of these sites have recovered from the flood impacts well enough to meet the biological standard in as short as six months.

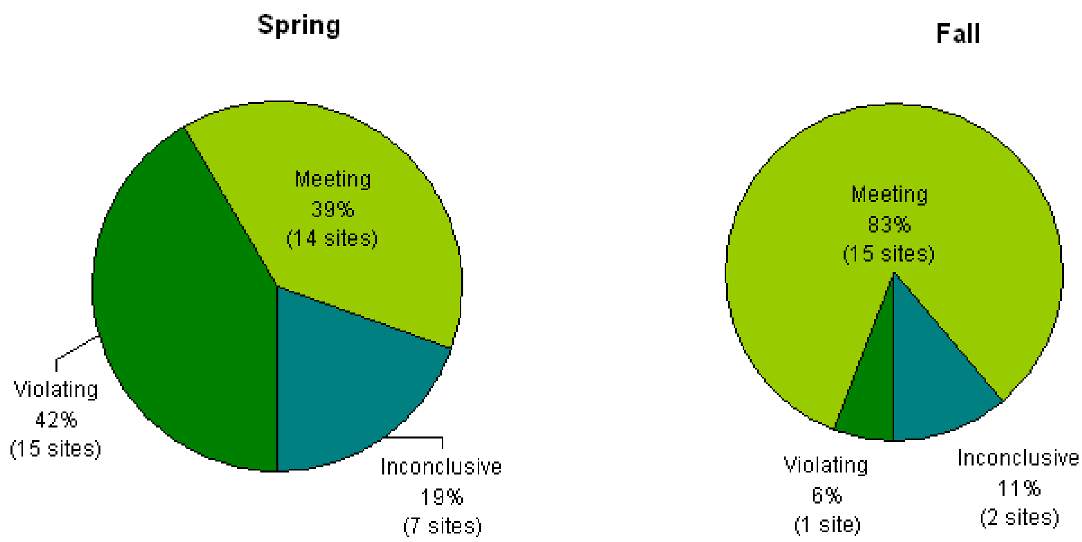
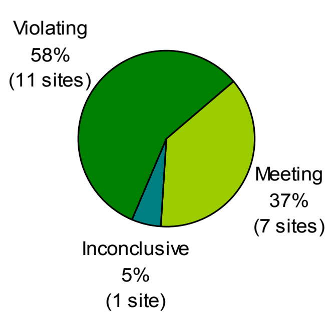
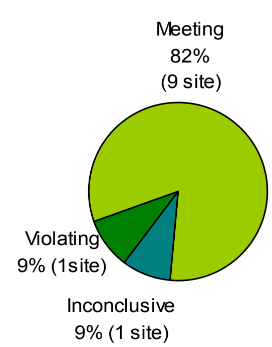


Figure 18. Overall bioassessment results in spring and fall 2008

Figure 19 summarizes the bioassessment results by different watersheds and by cold vs. warm water streams. In spring, significantly more sites were violating the biocriterion in the Salt River watershed than in the Verde River Watershed (although the percentages of both violating and inconclusive categories combined were similar for the two watersheds). The violating proportion was also greater for the warm water streams (47%) as compared to the cold water streams (35%), indicating that warm water sites in the SR watershed were most severely affected by winter floods. In fall, there were no substantial differences in terms of percentages of attaining sites between the two watersheds or between warm and cold water streams (all ranging between 80-87% meeting the biocriterion).

	Spring	Fall
Salt River Watershed		

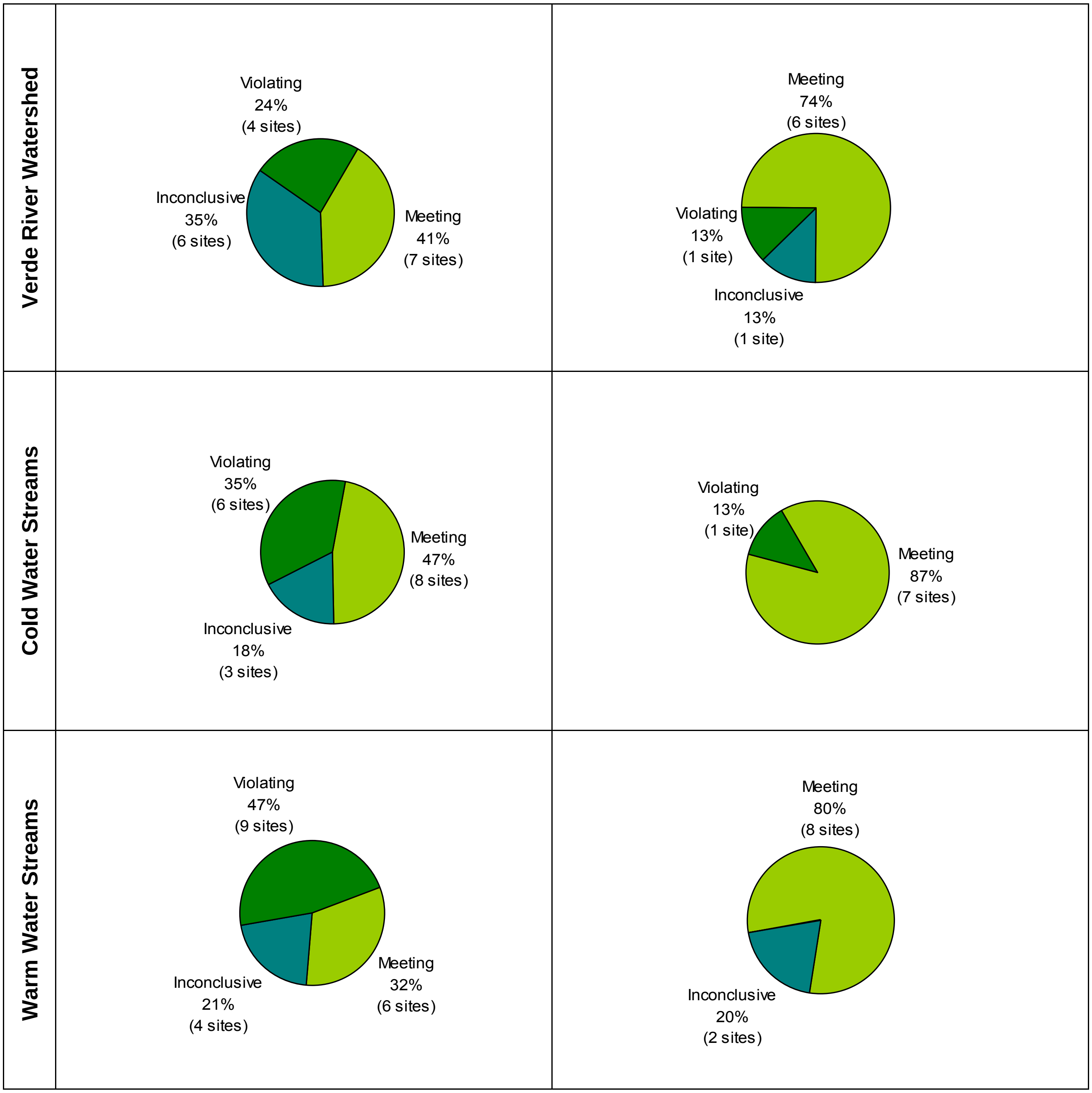


Figure 19. Bioassessment results by watersheds and by assessment regions

Spring IBI scores were highly correlated with flood magnitude in the Salt River sites (Figure 20), but not so in the Verde River sites. While some IBI scores fall below the 25th percentile for meeting the biocriteria at sites with flood sizes greater than the 2-year flood event, they are more pronounced at floods of ≥ 8-year return interval (Figure 20). When floods of high magnitude occur during the winter months, the biological communities do not always recover during the following season. Although ADEQ has a sampling criterion of waiting until 4 weeks after a bankfull flood event, it does not currently have a criterion for sampling post high flood events. Flood events typically scour substrates and eliminate 80-100% of the benthic fauna (Gray, 1981). A longer time frame is needed for the channel to return to stable conditions before macroinvertebrate samples can be considered representative of "normal" conditions. Further research should be conducted to determine a critical flood return interval to use as a biocriteria sampling criterion.

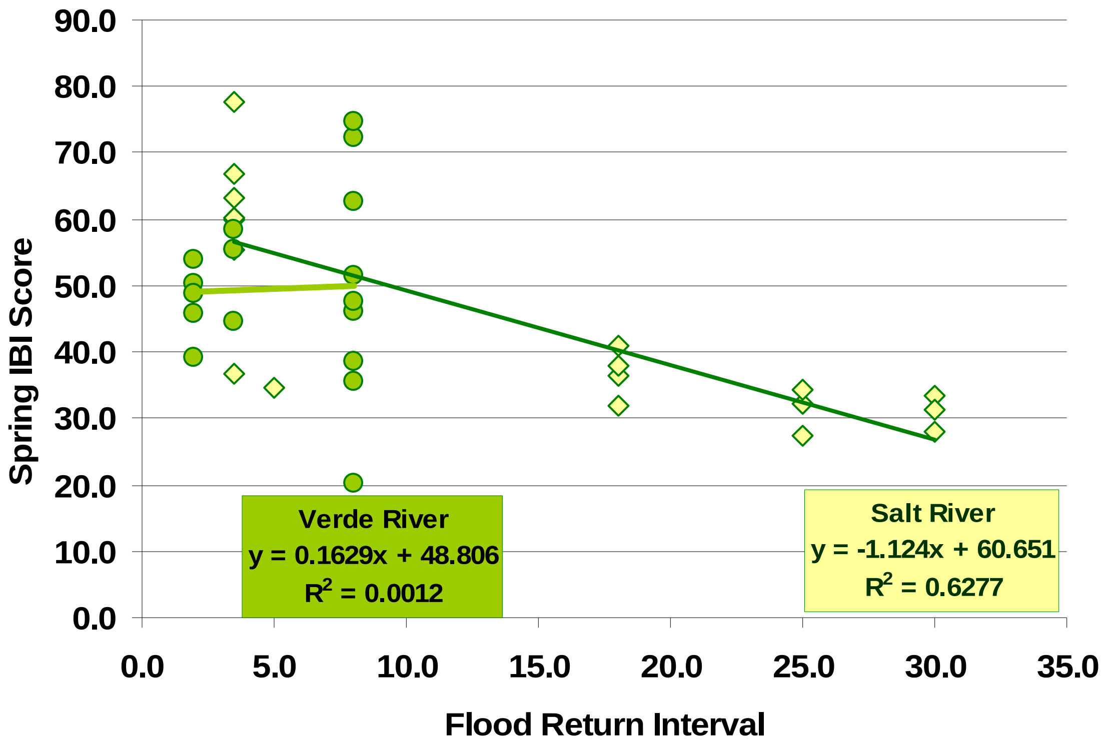


Figure 20. Macroinvertebrate spring IBI scores vary with flood magnitude

ADEQ examined whether spring IBI scores at different elevations and watershed sizes were affected differently by the floods. Regression analyses indicated that IBI scores were generally greater at higher elevations in the Salt River watershed (R^2=0.57), but there was no effect of elevation in the Verde (R^2=0.01; Figure 21). This effect was likely due to the fact that precipitation falls as snow at higher elevations, especially in the Salt River watershed, and is released more gradually into the drainage network, thereby attenuating flood effects. Watershed size did not have any effect on IBI scores in either watershed (Salt R, R^2=0.006; Verde R, R^2=0.29).

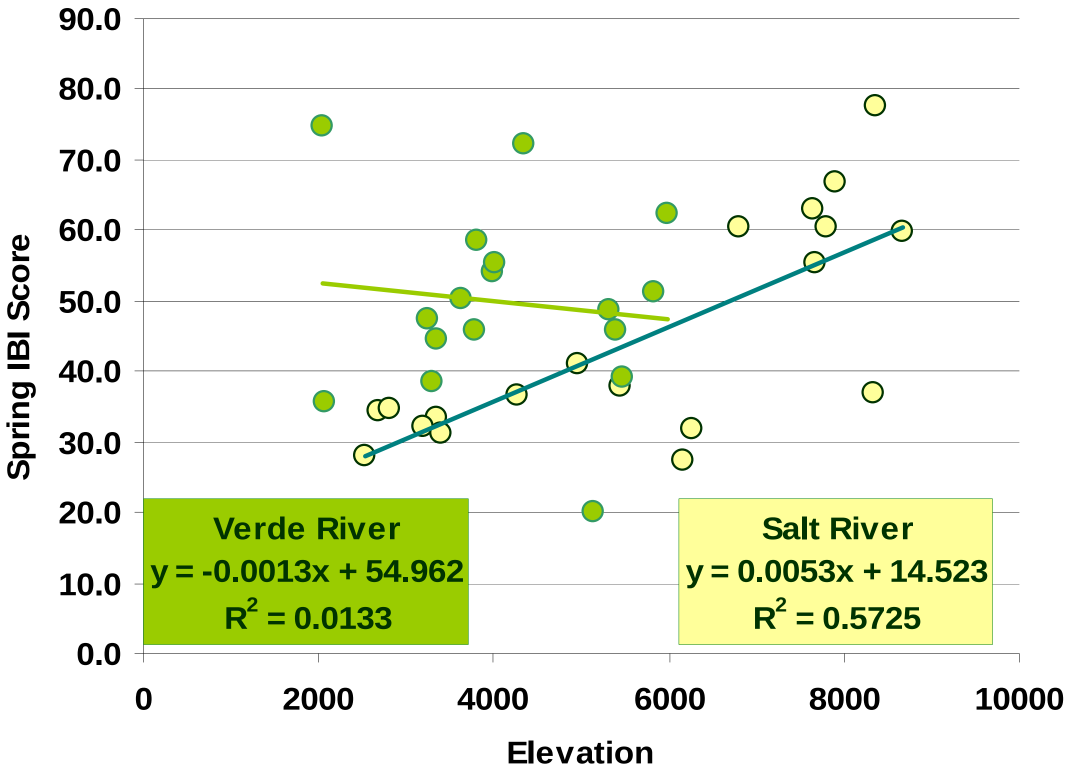


Figure 21. Macroinvertebrate spring IBI scores vary with elevation

A site by site comparison of spring and fall IBI scores between seasons was conducted to examine differences in biological integrity due to flood conditions. In the spring season, five samples were meeting, four inconclusive and nine samples were violating biocriteria. In the fall season, 15 samples were meeting, two were inconclusive, and only one sample was violating the biocriteria. All IBI scores improved from spring to fall season, except for two sites, Boneyard Creek and Sycamore Creek (Table 6). Seven of the nine samples in this dataset were not meeting the biocriteria standard in the spring and were likely affected/stressed by high flood conditions (floods ≥ 5 year return interval) occurring during the winter season. There were another six samples, in the spring only dataset, which were likely affected by flooding as well. These flood affected samples should be exempted from formal 305b/303d assessment and listing due to natural flood conditions. Samples predicted to have been flood affected are flagged in Appendix D.

Table 6. A site by site comparison of IBI scores between spring and fall seasons

Site ID	Spring Sample Date	Spring IBI Score	Fall IBI Score	Fall Sample Date
SRBEV007.28	6/18/2008	55.47	60.47	10/22/2008
SRBON001.69	6/16/2008	36.81	31.24	10/22/2008
SRCYN045.73	5/13/2008	31.94	60.76	10/21/2008
SRPNL005.12	4/23/2008	34.58	63.12	9/30/2008

Site ID	Spring Sample Date	Spring IBI Score	Fall IBI Score	Fall Sample Date
SRPNT008.48	4/16/2008	28.11	68.63	10/20/2008
SRSPI011.63	5/12/2008	36.48	75.95	11/5/2008
SRTON053.87	5/15/2008	41.02	70.74	11/4/2008
SRWFB005.34	6/17/2008	60.29	72.33	10/22/2008
SRWPN004.47	4/15/2008	31.17	51.95	9/30/2008
SRWRK007.97	6/16/2008	27.38	64.85	11/18/2008
VREVR023.59	6/25/2008	45.9	63.03	11/6/2008
VREVR051.15	6/24/2008	51.33	65.35	10/20/2008
VROAK048.92	6/9/2008	39.25	61.67	11/5/2008
VRSYW001.72	6/11/2008	50.23	43.72	11/4/2008
VRVER165.07	6/5/2008	58.53	62.01	11/3/2008
VRWBV012.56	4/30/2008	55.3	60.43	11/6/2008
VRWOK000.82	6/10/2008	48.67	55.84	11/5/2008
SRCGN009.78	5/2/2008	33.47	40.9	11/18/2008

A Mann-Whitney significance test indicated that there was a significant difference between the 18 sites that were sampled in the spring and fall of 2008 (Table 7 and Figure 22). The analysis was re-run without sites having a flood return interval of greater than 5 years (9 sites). The differences between spring and fall IBI scores were less pronounced, but still significant, which suggests that there are some seasonal differences in the macroinvertebrate community, beyond the spring flood effects. Further research is needed to develop a fall IBI score.

Table 7. Seasonal differences in 2008 macroinvertebrate IBI scores

Macroinvertebrate metric	Spring mean value	Fall mean value	Mann-Whitney significance test (p-value)	Significant Difference?
Index of biological integrity score	42.6	59.6	<0.001	Yes

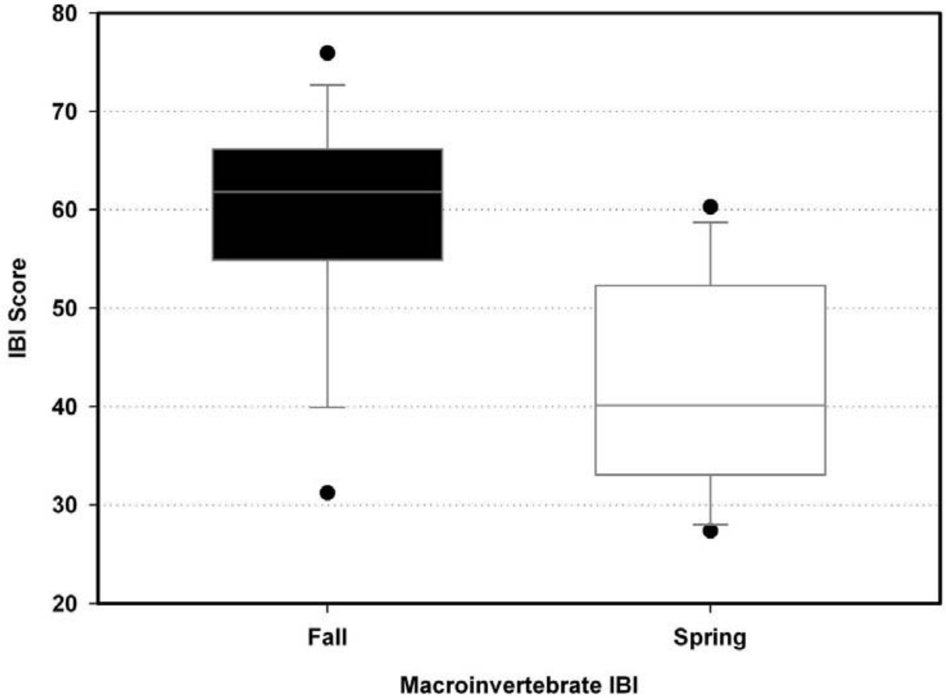


Figure 22. Macroinvertebrate metric values for spring and fall paired samples

Habitat Results

ADEQ investigated whether spring and fall habitat measurements were different by collecting samples during fall 2008 after several months of base flow conditions. Seven habitat measurements among the 18 paired samples were compared using a Mann-Whitney significance test and box and whisker plots (Table 8 and Figure 23). None of the seven habitat variables were significantly different between seasons (Table 8). According to these results, there were no major channel or substrate or riparian cover changes between the spring and fall of 2008. Major channel changes likely occurred during winter and early spring of 2007-08 and conditions stabilized between spring and fall 2008 when there were no large flood events.

Table 8. Seasonal differences in 2008 habitat parameters in the Salt and Verde River watersheds

Habitat parameter	Spring mean habitat value	Fall mean habitat value	Mann-Whitney significance test (p-value)	Significant?
Pfankuch Channel stability Scoring category (1=Good; 2=Fair; 3=Poor)	1.2	1.5	0.152	No
Percent Fines	15%	21%	0.296	No
Habitat Score as percent of ideal	81%	80%	0.505	No
Riffle, percent of habitat	33.5%	35%	0.516	No
Proper functioning condition score, percent of ideal	85%	80%	0.300	No
Percent filamentous algae cover (10m reach)	29%	23%	0.568	No
Reach-wide embeddedness	40%	44%	0.384	No

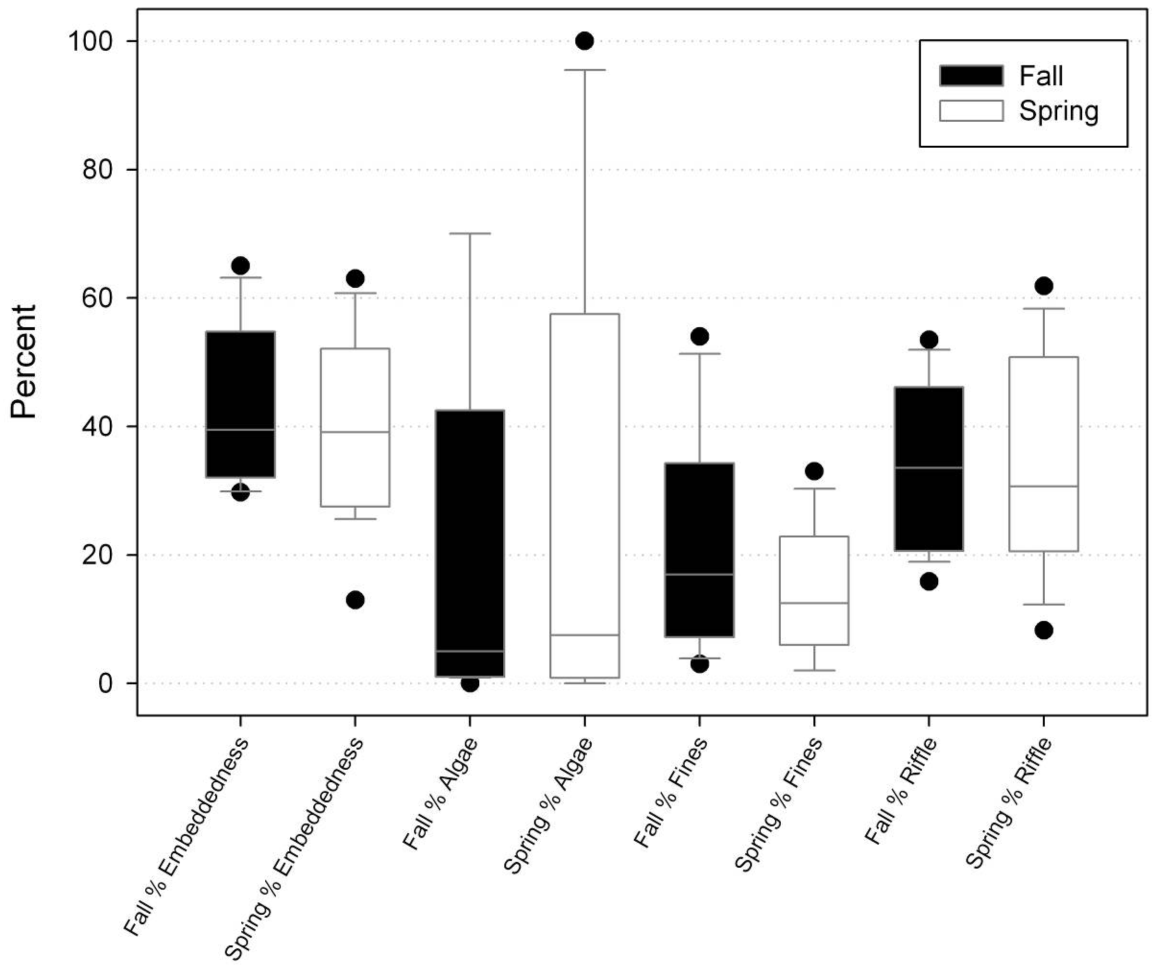


Figure 23. Habitat parameters for spring and fall paired samples

Stressors Affecting the Macroinvertebrate Community

Multivariate analyses were conducted to determine which habitat parameters most contributed to violations of IBI scores in fall and spring datasets. A discriminate function analysis (DFA) was conducted to determine which flow and habitat parameters most contributed to the 15 failing IBI scores in the Salt and Verde River watersheds during spring 2008 sample event. Several DFA analyses were run and the best model DFA test found that flooding, high percent fines in the substrates, embeddedness of the substrate and abundance of crayfish had the greatest effect on spring macroinvertebrate samples. In the fall dataset, there was only one site not meeting the biocriteria standard. No floods occurred during the monsoon period following the high winter floods, so flood magnitude was not used in the fall DFA analysis. The best DFA model for the fall dataset found that percent canopy cover, Pfankuch channel stability class, percent riffle habitat, crayfish abundance, PFC score and habitat score contributed most to the IBI score distribution in the fall. Crayfish are a stressor because all species are exotic/non-native in Arizona and are destructive to the benthic community. The fall results are weak however, due to the small sample size (n=18) and the small number of sites failing or inconclusive with regard to the biocriteria thresholds. There were differences in habitat parameters responsible for the difference of IBI scores in the fall versus spring. The flood effect (from January 2008 flood) far outweighed the other substrate condition factors and biological effect due to crayfish abundance, in the spring dataset. The Salt and Verde stream ecosystems in this study appear to have recovered from floods by the fall of 2008, in which other factors such as canopy cover, substrate and stream channel stability and crayfish had more effect on the macroinvertebrate IBI scores. These factors are what one would expect to influence the macroinvertebrate community at base flow.

STREAM STABILITY AND SEDIMENT POLLUTION

Point source pollution has been the primary focus of pollution abatement to the nation's waters and has achieved substantial success in improving chemical water quality and to a lesser extent the biological quality of the nation's surface water resources. Emphasis has now shifted to non-point source pollution and the physical integrity of waterbodies. Across Arizona, streams and rivers have been particularly susceptible to this non-point source pollutant due to Arizona's arid and fragile landscapes.

In the 1998 305(b) Water Quality Assessment Report, the Arizona Department of Environmental Quality reported that nearly 70% of all water quality limited waterbodies were either directly impaired by turbidity or experienced turbidity violations during the assessed period from October 1992 through September 1997 (ADEQ, 1998). In ADEQ's 2006/2008 Water Quality 305(b) Assessment Report, suspended sediment is identified as a major contributor to stream and lake pollution (ADEQ, 2008a). Turbidity is indirectly related to sediment deposition and the process that generates both conditions is similar; thus, high turbidity and suspended sediment readings usually indicate the erosional status in the watershed or stream channel itself.

Sediment Impacts on Habitat Quality

Field observations for habitat measures related to sediment include ADEQ's Habitat Assessment, Proper Functioning Condition (PFC) (Prichard et al, 1993), and Pfankuch Channel Stability Rating (Pfankuch, 1975; ADEQ, 2010). The three habitat measures are strongly auto-correlated and therefore only Habitat Assessment was used in the following analyses. Direct quantitative measurements used in this analysis include reachwide pebble counts, percent morphological features (riffles, runs, pools), macroinvertebrate taxa, Arizona Index of Biological Integrity (IBI) (ADEQ, 2008c), and Relative Bed Stability (RBS) (Kaufmann et al, 1999).

A positive relationship exists between habitat quality and the total number of macroinvertebrates present (Figure 24). Habitat Assessment site scores were converted to percent of the ideal (perfect) score. Percent Ideal Habitat (%IH) is the raw assessed score expressed as a percentage of the maximum score that could possibly be attained if the channel was in ideal condition. A study reach that is in ideal equilibrium (reference condition) with its watershed would have a 100% rating for each and would be expected to have a large number of macroinvertebrate taxa, a balance of riffles, runs, and pools, healthy riparian, and a sediment regime in balance with the systems hydrology. Linear regression indicates that 46% of the variation in taxa present is due to habitat complexity. Grey squares are Salt/Verde Watershed sites and green diamonds are Little Colorado River Watershed sites.

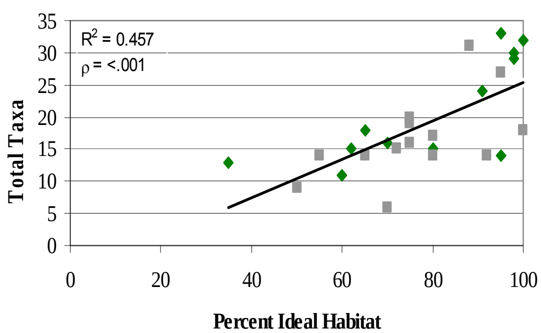


Figure 24. Total number of taxa as a function of Percent Ideal Habitat

In streams where sediment is accumulating, fine particles fill the interstitial spaces between cobbles in riffles, pools become shallow, runs tend to predominate and macroinvertebrate habitat is reduced. Figure 25 shows a strong positive relationship between the percentage of riffles present in the assessed reach to total taxa. Linear regression indicates that 60% of the variability in total taxa is due to the increased presence of riffles in the reach (p = <0.001). This is not surprising since macroinvertebrates were collected only in riffles; however, the presence of riffles is usually a good indicator of a balanced ecosystem. Grey squares are Salt/Verde Watershed sites and green diamonds are Little Colorado River Watershed sites.

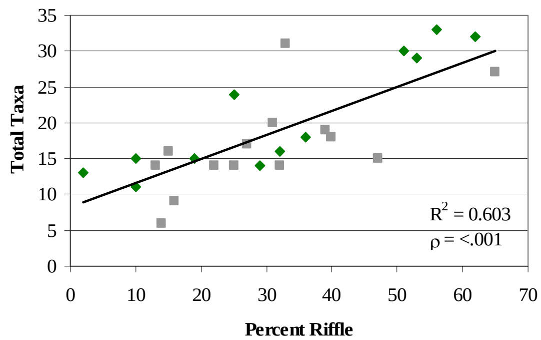


Figure 25. Taxa richness as a function of the percentage of the riffles in the assessed reach

The percentage of cobbles decrease and the percentage of runs increase when pools and riffles fill with sand, so it is not surprising that there is a strong negative relationship between percent runs and total taxa (Figure 26, R^2 = 0.45).

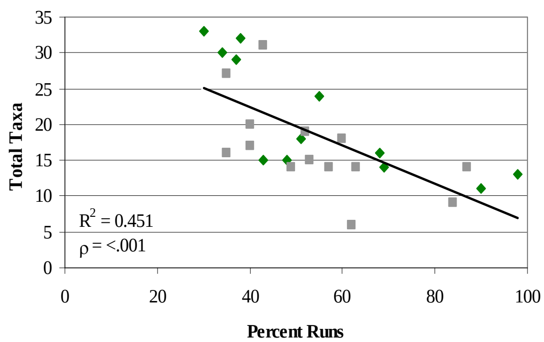


Figure 26. Taxa richness as a function of the percent composition of runs in the reach

The insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddis flies) are sensitive to pollution and are collectively referred to as the EPT group. Figure 27 shows a strong positive relationship between the percent of cobble present in a reach and EPT taxa (R^2 = 0.44). Higher proportions of cobble provide better habitat for the EPT group and as a consequence increase the number of EPT taxa.

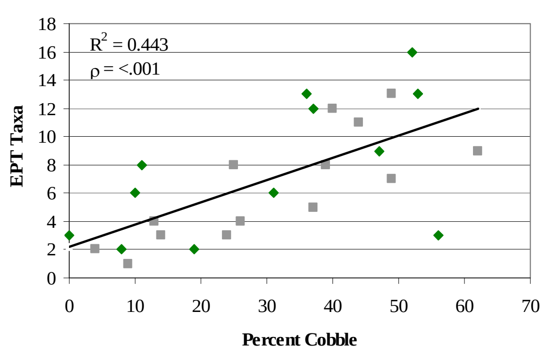


Figure 27. The number of EPT taxa as a function of the percentage of cobble present in the reach

The IBI is a multi-metric scoring of the warm and coldwater macroinvertebrate communities of Arizona (ADEQ, 2008b). Figures 28, 29, and 30 show positive relationships between IBI and %IH, Percent Cobble and Percent Riffles in the reach while Figure 31 reveals a strong negative relationship with Percent Runs. Grey squares are Salt/Verde Watershed sites and green diamonds are Little Colorado River Watershed sites.

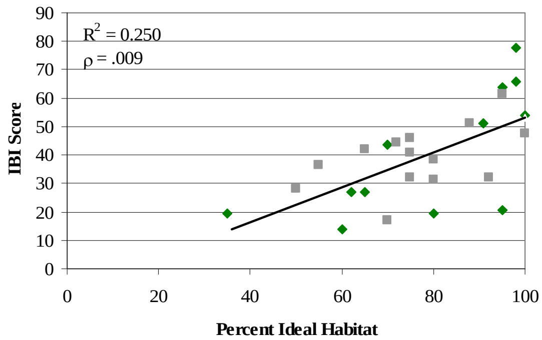


Figure 28. Arizona IBI as a function of the percentage of ideal habitat available in the reach

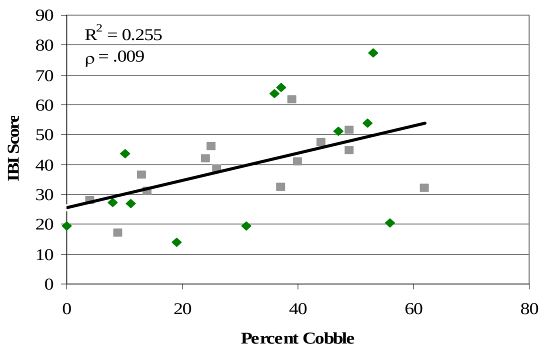


Figure 29. IBI as a function of the percentage of cobble available for colonization

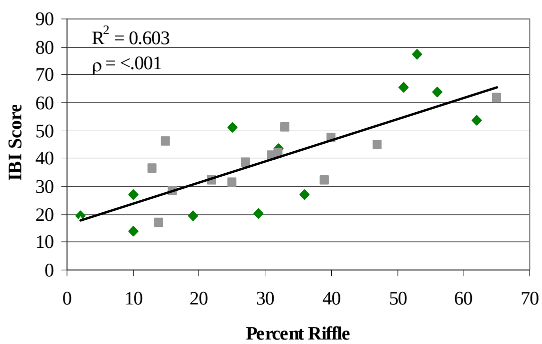


Figure 30. IBI as a function of the percentage of riffles available for colonization

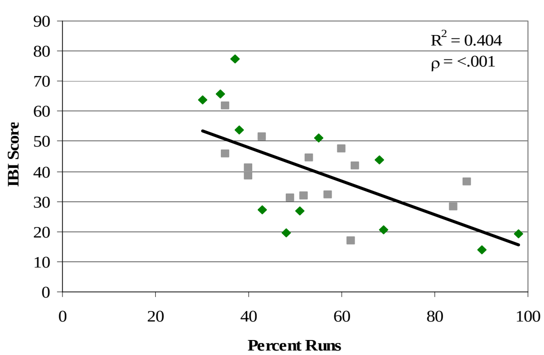


Figure 31. IBI as a function of the percentage of runs in the study reach

Sediment Imbalance Effects

An abundance of fines in the stream has a cascading downward effect on stream integrity. Fines are defined as particles less than two millimeters. Figure 32 reveals that as the percent of fines increase in the reach, the stream moves away from the ideal condition. An ideal habitat has a low percentage of fines and a stream substrate comprised of a variety of particle sizes with colonization space for macroinvertebrates. Regression analysis indicates that fines less than 2 mm account for 52 percent of the variation in habitat quality. A negative relationship exists between percent fines and percent riffles (Figure 33, R^2 = 0.37); a positive relationship between percent fines and percent runs (Figure 34, R^2 = 0.24); a negative relationship between percent fines and total taxa (Figure 35, R^2 = 0.34); and a negative relationship between percent fines and number of EPT taxa (Figure 36, R^2 = 0.44). Grey squares are Salt/Verde Watershed sites and green diamonds are Little Colorado River Watershed sites.

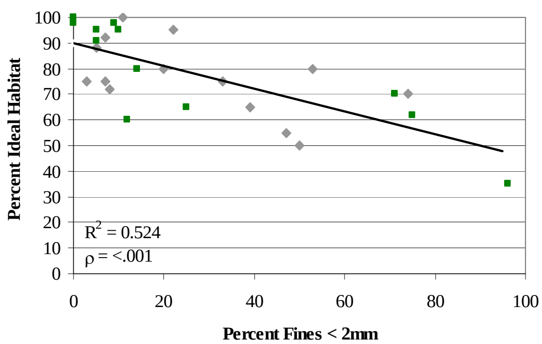


Figure 32. The percentage of Ideal Habitat as a function of percent fines less than 2 mm

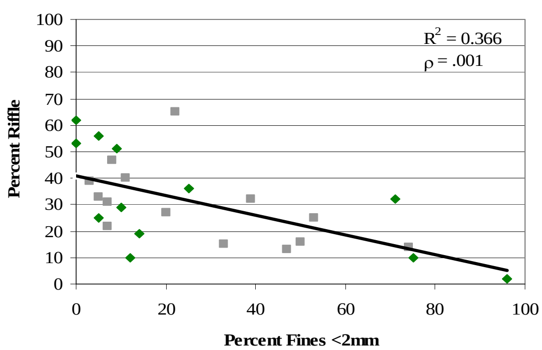


Figure 33. The percentage of riffles present in the reach as a function of fines less than 2 mm

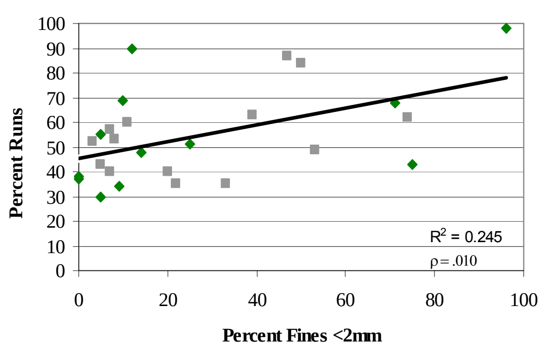


Figure 34. Percent runs in the reach as a function of percent fines less than 2mm

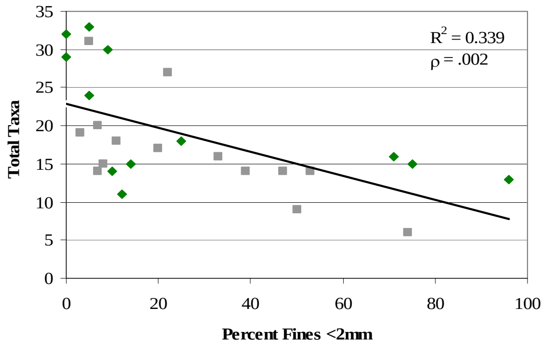


Figure 35. Total number of taxa as a function of percent fines less than 2mm

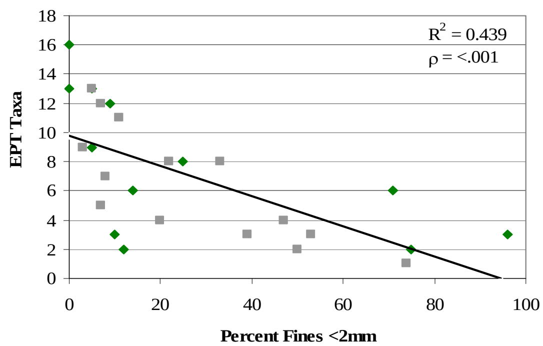


Figure 36. Number of EPT taxa present as a function of percent fines less than 2mm

Channel Stability

Relative Bed Stability (RBS) is an index of substrate mobility with respect to physical characteristics of the waterbody. RBS is the ratio of bed substrate size to the mobile or critical diameter at bankfull flow (USEPA, 2006). Substrates are expected to move a calculable degree for each natural hydrologic and geomorphic condition. When observed substrate mobility is considerably greater or less than the predicted, human-induced suspended and bedded sediment stresses are indicated. By comparing the actual particle sizes observed from a streambed pebble count with the sizes of particles that can be mobilized at bankfull flow, stream stability can be evaluated quite accurately.

The range of RBS values are from zero to infinity. Streams with RBS values approximately less than 1 (Log10 RBS less than zero) indicate that the bed is unstable because the bed particles are mobilized at less than sub-bankfull flows. These channels have a high sediment supply and aggrade. With few exceptions, the occurrence of extremely unstable beds i.e., those with RBS between 0.0001 – 0.01 do not normally occur unless there is a considerable amount of fine sediment input to the stream. If RBS is greater than 1.0 (Log10 RBS = 0), the bed is presumed to be fully mobilized only for events larger than bankfull and the channel is stable. Reference sites generally have RBS values approximately equal to 1.0 to 2.0. RBS values greater than 2 indicate a high transport capacity and incision may be occurring if it has not already done so. RBS values greater than 3 are high energy streams (steep gradient) with limited sediment supply which usually indicate that the channel and banks are greatly armored.

Table 9 lists the sampled streams and their RBS and Log10 RBS (LRBS) values. All but four of the Salt/Verde Watershed sites appear to have unstable channels and two of those four are cold water high elevation sites. This appears to indicate that, when compared to the Little Colorado River Watershed streams, low elevation streams are more unstable than high elevation sites. However; this may be an artifact due to the small sample size.

Table 9. A listing of sampled sites by watershed and ranked by RBS values

Site Name	Site Code	RBS	LRBS
Little Colorado River Watershed Sites			
Rudd Creek at Sipe Wildlife Area (cw)	LCRUD003.45	0.001	-2.870
Morrison Creek .08 mile below confluence with Coyote Creek (cw)	LCMRS043.17	0.088	-1.053
Coyote Creek at Richville Valley (cw)	LCCOY000.71	0.124	-0.905
West Fork Little Colorado River at Government Springs (cw)	LCWLR000.92	0.779	-0.108
Hall Creek east of Geneva Reservoir (cw)	LCHAL004.59	0.899	-0.046
South Fork Little Colorado River above campground (cw)	LCSLR001.42	0.997	-0.001
Little Colorado River above Airport Road (cw)	LCLCR342.03	1.207	0.082
Benton Creek near Pat Knoll Cabin (cw)	LCBEN002.47	1.341	0.128
Show Low Creek above Morgan wash (cw)	LCSHL026.50	1.831	0.263
Silver Creek at end of Queen Creek Place (cw)	LCSIL041.04	2.418	0.383
Show Low Creek below Porter and Billy Creek confluence (cw)	LCSHL031.05	3.322	0.521
Little Colorado River behind Greer Post Office (cw)	LCLCR360.06	4.130	0.616
Salt River Watershed and Verde River Watershed Sites			
Granite Creek at Granite Park (cw)	VRGRA029.97	0.012	-1.933
West Fork Pinto Creek below Kennedy Ranch (ww)	SRWPN004.47	0.014	-1.869
Granite Creek upstream of White Spar Campground (cw)	VRGRA033.51	0.073	-1.138
Fossil Creek – east of Mudd Seep (ww)	VRFOS011.88	0.078	-1.105
Spring Creek above Bryant Canyon confluence(ww)	SRSPI011.63	0.114	-0.943
West Clear Creek at campground (ww)	VRWCL005.10	0.299	-0.524
East Verde River below Cracker Jack (ww)	VREVR023.59	0.322	-0.492
Roundtree Creek 3 miles above Tangle Creek confluence (ww)	VRROU002.93	0.334	-0.476
Pinto Creek at Henderson Ford (ww)	SRPNT008.48	0.499	-0.302
Wet Beaver Creek below Montezuma Road (ww)	VRWBV002.97	0.711	-0.148
E. Verde River below Wash Park (cw)	VREVR051.15	0.840	-0.076
Cherry Creek above Devils Chasm Creek (ww)	SRCHE013.65	1.282	0.108
Tonto Creek below Bear Flats (ww)	SRTON053.87	1.502	0.177
Canyon Creek above Valentine Canyon (cw)	SRCYN045.73	1.743	0.241

Note: cw = cold water designation greater than 5,000 feet in elevation, ww = warm water designation less than 5,000 feet in elevation

Channel stability is greatly influenced by the amount of fines being stored in the channel. Figure 37 shows a strong negative relationship between LRBS and percent fines. Regression analysis indicates that 72% of the variation ($p = <0.001$) in LRBS is explained by the effect of percent fines. The channel increases in instability as the percentage of fines increase from zero. If a LRBS score of near zero is considered the threshold between stability and instability, then channels having fines of approximately twenty percent probably should be classified as having an unstable channel.

Figure 37 also reveals that there is a fairly equal distribution of cold and warm water sites along the regression line potentially indicating no difference in the relationship between stable/unstable channels and elevation.

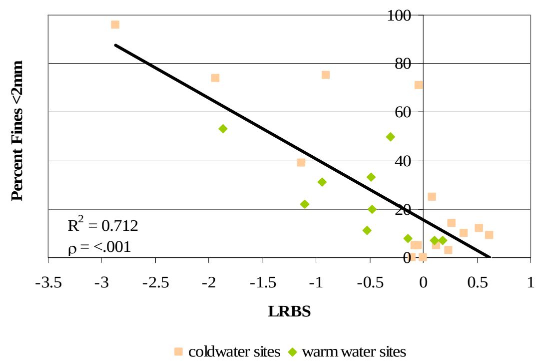


Figure 37. Stream stability expressed as LRBS compared to percent fines less than 2mm

Stepwise multiple regression using seventeen variables identified four as the best predictors of channel instability: percent fines less than 2 mm, water surface slope, bankfull area and percent canopy density. A Spearman rank test indicates that the four variables are not correlated with each other. The formula for the regression line is:

LRBS = 0.897 + (% fines <2mm * -0.025) + (bankfull area * -0.002) + (water surface slope * -10.335) + (% canopy density * -0.008))

The R square for this relationship is 0.881. Percent fines is the most important (F = 117.771) variable while, water surface slope is the least important (F = 7.762) variable in the model. The probability values for percent fines and canopy density are less than 0.001; for bankfull area p = 0.002, and for water surface slope p = 0.011. The residuals plot (not shown) reveals no heteroscedasticity, meaning there is no relation between residuals and LRBS. A residual is the unexplained error in the model; it is the difference between the actual value of LRBS and the predicted value of LRBS. The first order autocorrelation is -0.090. Unrelated variables will have a theoretical autocorrelation value of zero indicating the variables are independent of each other. The model, Figure 38, has a very high R square and low probability values, a lack of heteroscedasticity, and an autocorrelation value near zero indicating a very robust model. Grey squares are Salt/Verde Watershed sites and green diamonds are Little Colorado River Watershed.

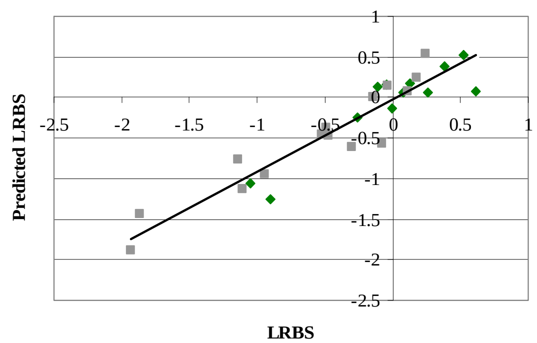


Figure 38. Multiple regression results of LRBS plotted against predicted LRBS

The four variables in the regression equation are all negatively associated with LRBS. Therefore, the major contributing factors of a stream channel moving towards instability follow the evolutionary process of an increasing percentage of fines less than 2 mm, a channel that widens and shallows, a lessening of the water surface slope, and a reduction in percent canopy cover.

Stream Stability and Sediment Pollution Conclusions

Morphological heterogeneity contributes to diverse macroinvertebrate communities. An abundance of fines in a stream channel reduces habitat diversity and impairs biological diversity. Unstable channels, as measured by relative bed stability, have proportionally large amounts of fines less than 2 mm and a percentage of fines of approximately twenty percent may be a stability threshold value for both cold and warm water streams. There is a strong negative correlation between channel stability and percent fines less than 2 mm, wide and shallow stream channels, reduced water surface slopes, and loss of canopy cover.

CHAPTER 4 – EXCEEDANCES

Thirty-two of the 47 sites had at least one exceedance during the FY 2008 sampling season. An exceedance occurs when a variable does not meet it's numeric surface water quality standard by either exceeding a maximum value or by not meeting the variable's adopted range. The most common variable not meeting water quality standards was the IBI score (see Chapter 3 – Macroinvertebrate Results). Some of these violations are likely due to large magnitude floods that occurred in January 2008 (see Appendix A). Dissolved oxygen was exceeded at 10 of the sample sites and was the second most common exceedance (Figure 39, Table 10).

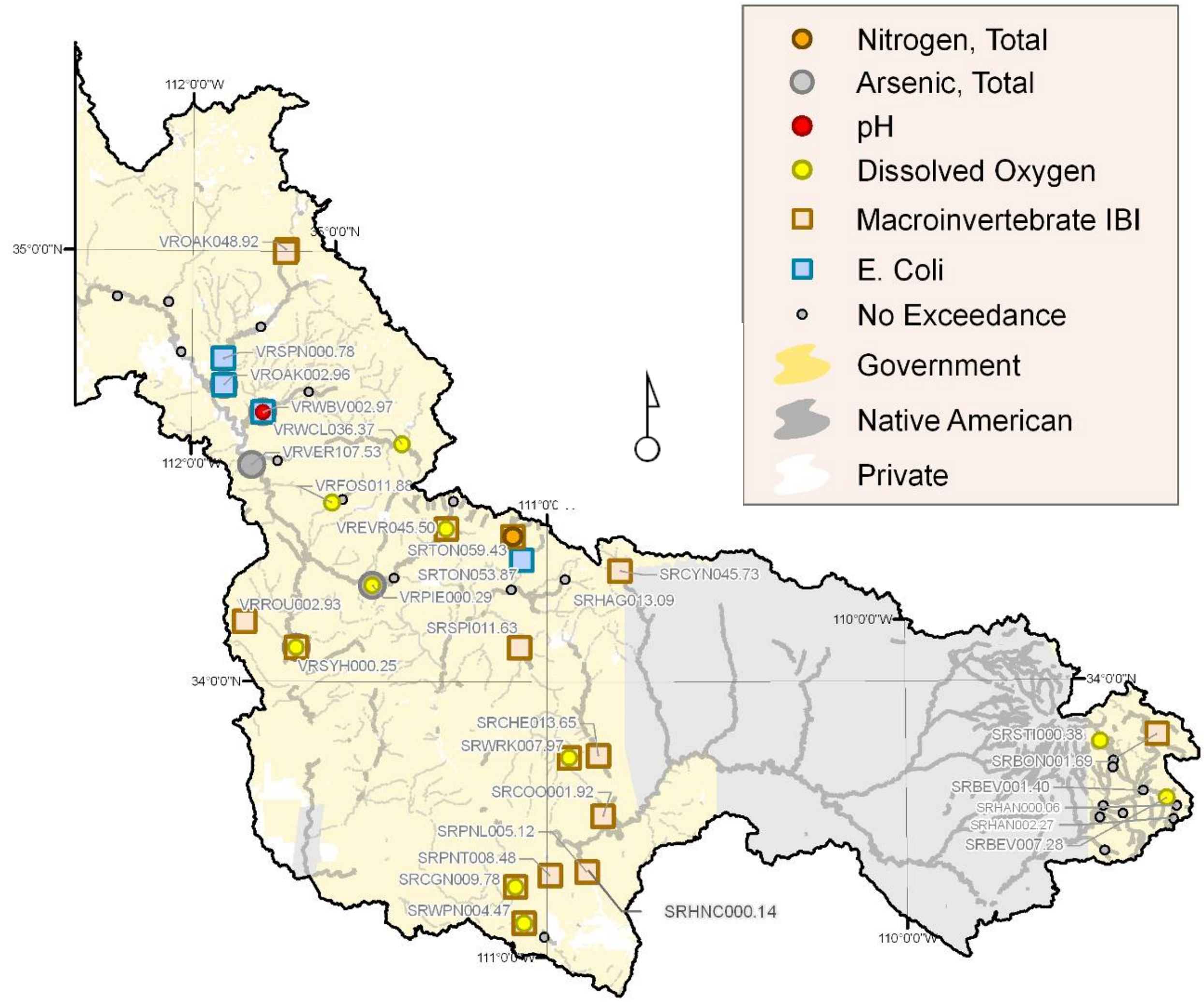


Figure 39. Map of Exceedances

Table 10. Exceedances for Salt and Verde Sites

Site ID	Designated Use[1]	Date	Analyte	Standard	Result
SRBEV007.28	**A&Wc**, FBC, FC, AgI, AgL	6/18/2008	DO	< 7.0 mg/L	6.5 mg/L
SRBON001.69	**A&Wc**, FBC, FC, AgI, AgL	6/16/2008	IBI	< 40	36.81
SRCGN009.78	**A&Ww**, FBC, FC, AgL	8/29/2007	DO	< 6.0 mg/L	5.04 mg/L
SRCGN009.78	**A&Ww**, FBC, FC, AgL	5/2/2008	IBI	< 40	33.47
SRCHE013.65	**A&Ww**, FBC, FC, AgI, AgL	5/1/2008	IBI	< 40	32.26

Site ID	Designated Use[1]	Date	Analyte	Standard	Result
SRCOO001.92	**A&Ww**, FBC, FC, AgL	4/20/2008	IBI	< 40	34.44
SRCYN045.73	**A&Wc**, FBC, DWS, FC, AgI, AgL	5/13/2008	IBI	< 46	31.94
SRPNL005.12	**A&Ww**, FBC, FC, AgL	4/23/2008	IBI	< 40	34.58
SRPNT008.48	**A&Ww**, FBC, FC, AgI, AgL	4/16/2008	IBI	< 40	28.11
SRSPI011.63	**A&Ww**, FBC, FC, AgL	5/12/2008	IBI	< 40	36.48
SRSTI000.38	**A&Wc**, FBC, FC, AgL	6/18/2008	DO	< 7.0 mg/L	4.24 mg/L
SRTON053.87	A&Ww, **FBC**, FC, AgI, AgL	7/7/2008	E. Coli	> 235 cfu	436 cfu
SRTON059.43	**A&Wc**, FBC, FC, AgI, AgL	5/14/2008	IBI Total N[2]	< 46 < 0.5 mg/L	37.85 0.502 mg/L
SRWPN004.47	**A&Ww**, FBC, FC	4/15/2008	IBI	< 40	31.17
SRWPN004.47	**A&Ww**, FBC, FC	6/17/2008	DO	< 6.0 mg/L	5.62 mg/L
SRWRK007.97	**A&Wc**, FBC, FC, AgI, AgL	8/29/2007	DO	< 7.0 mg/L	6.71 mg/L
SRWRK007.97	**A&Wc**, FBC, FC, AgI, AgL	6/16/2008	IBI	< 46	27.38
VREVR045.50	A&Wc, **FBC**, DWS, FC, AgI, AgL	8/14/2007	E. Coli	> 235 cfu	600 cfu
VREVR045.50	**A&Wc**, FBC, DWS, FC, AgI, AgL	5/1/2008	DO IBI	< 7.0 < 46	6.94 20.05
VRFOS011.88	**A&Ww**, FBC, FC, AgL	8/30/2007	DO	< 6.0 mg/L	5.97 mg/L
VROAK002.96	A&Ww, **FBC**, **DWS**, FC, AgI, AgL	8/28/2007	Arsenic	> 0.01 mg/L	0.021 mg/L
VROAK002.96	A&Ww, **FBC**, DWS, FC, AgI, AgL	1/7/2008	E. Coli	> 235 cfu/100mL	408 cfu/100mL
VROAK002.96	A&Ww, **FBC**, **DWS**, FC, AgI, AgL	4/28/2008	Arsenic	> 0.01 mg/L	0.017 mg/L
VROAK048.36	**A&Wc**, FBC, DWS, FC, AgL	7/8/2008	IBI	< 46	45.9
VROAK048.92	**A&Wc**, FBC, DWS, FC, AgL	6/9/2008	IBI	< 46	39.25
VRPIE000.29	**A&Ww**, **FBC**, **DWS** FC, AgI, AgL	8/15/2007	Arsenic DO	> 0.01 mg/L < 6.0 mg/L	0.013 mg/L 4.14 mg/L
VRROU002.93	**A&Ww**, FBC, FC, AgL	4/30/2008	IBI	< 40	38.63
VRSPN000.78	A&Ww, **FBC**, FC, AgI, AgL	8/14/2007	E. Coli	> 235 cfu/100mL	340 cfu/100mL
VRSYH000.25	**A&Ww**, **FBC**, FC, AgL	8/13/2007	Arsenic DO	> 0.030 mg/L < 6.0 mg/L	0.043 mg/L 5.58 mg/L
VRSYH000.25	**A&Ww**, FBC, FC, AgL	5/16/2008	IBI	< 40	35.48
VRVER107.53	A&Ww, **FBC**, FC, AgI, AgL	8/28/2007	Arsenic	> 0.030 mg/L	0.033 mg/L
VRWBV002.97	**A&Ww**, **FBC**, FC, AgI, AgL	8/28/2007	pH E. Coli	< 6.5 > 235	6.05 480 cfu/100mL
VRWBV002.97	A&Ww, **FBC**, FC, AgI, AgL	11/6/2007	Arsenic	> 0.030 mg/L	0.032 mg/L
VRWCL036.37	**A&Wc**, FBC, FC, AgL	7/9/2008	DO	< 7.0 mg/L	6.87 mg/L

1 **Bold** indicates the designated use with the exceedance
2 Total N = Annual average for Total Nitrogen

APPENDIX A – CHEMISTRY RESULTS

In addition to the parameters shown below, Antimony (total and dissolved), Beryllium (total and dissolved), Chromium (total and dissolved), Copper (total), Lead (total), Mercury (total), Zinc (total and dissolved), Cadmium (total and dissolved) and Selenium (total) were sampled but not included in the table because all values were non-detect (ND) for these parameters. The lime colored boxes in the table below represent the exceedances summarized in Chapter 4. All units are reported in milligrams per liter.

Site ID	Sample Date	ALKPHEN	NH3	AS-D	AS-T	B-T	CALCARB-T
SRBEV001.40	6/18/2008	ND	ND	ND	ND	ND	52
SRBEV001.40	4/22/2008	ND	ND	ND	ND	ND	29
SRBEV001.40	10/23/2007	ND	ND	ND	ND	ND	66
SRBEV001.40	7/31/2007	ND	ND	ND	ND	ND	52
SRBEV007.28	6/18/2008	ND	ND	ND	ND	ND	48
SRBEV007.28	4/22/2008	ND	ND	ND	ND	ND	30
SRBEV007.28	10/22/2007	ND	ND	ND	ND	ND	53
SRBEV007.28	7/31/2007	ND	ND	ND	ND	ND	57
SRBEV009.56	5/19/2008	ND	ND	ND	ND	ND	39
SRBEV009.56	3/19/2008	ND	ND	ND	ND	ND	32
SRBEV009.56	8/1/2007	ND	ND	ND	ND	ND	55
SRBON001.69	6/16/2008	4.4	ND	ND	ND	ND	74
SRBON001.69	4/22/2008	ND	ND	ND	ND	ND	50
SRBON001.69	10/23/2007	ND	ND	ND	ND	ND	77
SRBON001.69	8/1/2007	ND	ND	ND	ND	ND	62.3
SRBWL005.79	10/31/2007	ND	ND	ND	ND	ND	56
SRBWL005.79	8/1/2007	ND	ND	ND	ND	ND	49
SRCGN009.78	6/17/2008	ND	0.04	ND	ND	ND	290
SRCGN009.78	5/2/2008	ND	ND	ND	ND	ND	270
SRCGN009.78	12/19/2007	ND	ND	ND	ND	ND	190
SRCGN009.78	8/29/2007	ND	0.036	0.0056	0.0071	ND	300
SRCHE013.65	6/18/2008	4.9	ND	ND	ND	ND	190
SRCHE013.65	5/1/2008	7.4	ND	ND	ND	ND	210
SRCHE013.65	3/21/2008	5.3	ND	ND	ND	ND	180
SRCHE013.65	10/4/2007	5.7	ND	ND	ND	ND	200
SRCOO001.92	6/18/2008	6.2	ND	ND	ND	ND	300
SRCOO001.92	4/20/2008	11	ND	ND	ND	ND	280
SRCOO001.92	3/21/2008	8.8	ND	ND	ND	ND	260
SRCOO001.92	10/4/2007	7.6	ND	ND	ND	ND	310
SRCYN045.73	5/13/2008	ND	ND	0.0058	0.0055	ND	100
SRCYN045.73	5/7/2008	5	ND		0.0055	ND	99
SRCYN045.73	11/27/2007	6.4		0.0091	0.0094	ND	120
SRCYN045.73	9/18/2007	5.3	0.033		0.0084	ND	110
SRFIS004.49	6/24/2008	ND	0.09	ND	ND	ND	36
SRFIS004.49	5/20/2008	ND	ND	ND	ND	ND	27
SRFIS004.49	10/30/2007	ND	ND	ND	ND	ND	37
SRFIS004.49	7/31/2007	ND	ND	ND	ND	ND	34
SRHAG013.09	5/14/2008	6.1	ND	ND	ND	ND	260
SRHAG013.09	3/26/2008	6.05		ND	ND	ND	250
SRHAG013.09	11/27/2007	7.3		ND	ND	ND	260
SRHAG013.09	9/18/2007	6.1	ND		ND	ND	250
SRHAN000.06	5/19/2008	ND	ND	ND	ND	ND	40
SRHAN000.06	3/19/2008	ND	ND	ND	ND	ND	30

Site ID	Sample Date	ALKPHEN	NH3	AS-D	AS-T	B-T	CALCARB-T
SRHAN000.06	7/30/2007	ND	ND	ND	ND	ND	54
SRHAN002.27	6/24/2008	ND	0.06	ND	ND	ND	51
SRHAN002.27	5/21/2008	ND	ND	ND	ND	ND	38
SRHAN002.27	10/31/2007	ND	ND	ND	ND	ND	56
SRHAN002.27	7/31/2007	ND	ND	ND	ND	ND	51
SRHAY000.04	6/17/2008	ND	ND	ND	ND	ND	47
SRHAY000.04	4/23/2008	ND	ND	ND	ND	ND	25
SRHAY000.04	10/23/2007	ND	ND	ND	ND	ND	45
SRHAY000.04	7/31/2007	ND	ND	ND	ND	ND	41
SRHNC000.14	4/30/2008	ND	ND	0.0079	0.0084	ND	200
SRHNC000.14	12/17/2007	ND	0.04	ND	ND	ND	84
SRHNC000.14	8/28/2007	5.6	ND	0.0092	0.012	ND	180
SRPNL005.12	6/17/2008	ND	ND	ND	ND	ND	48
SRPNL005.12	4/23/2008	ND	ND	ND	ND	ND	64
SRPNL005.12	12/18/2007	ND	ND	ND	ND	ND	37
SRPNL005.12	8/27/2007	ND	ND	ND	ND	ND	46
SRPNT008.48	6/17/2008	ND	0.04	ND	ND	ND	250
SRPNT008.48	4/16/2008	ND	ND	ND	ND	ND	220
SRPNT008.48	12/18/2007	ND	ND	ND	ND	ND	200
SRPNT008.48	8/27/2007	ND	ND	ND	ND	ND	270
SRSNK001.33	5/20/2008	ND	ND	ND	ND	ND	33
SRSNK001.33	7/31/2007	ND	ND	ND	ND	ND	56
SRSPI011.63	5/12/2008	6.8	ND	ND	ND	ND	200
SRSPI011.63	3/26/2008	2.1		ND	ND	ND	150
SRSPI011.63	11/27/2007	5.1		ND	ND	ND	230
SRSPI011.63	9/18/2007	ND	0.037		ND	ND	200
SRSTI000.38	6/18/2008	ND	ND	ND	ND	ND	26
SRSTI000.38	10/23/2007	ND	ND	ND	ND	ND	31
SRSTI000.38	7/30/2007	ND	ND	ND	ND	ND	36
SRTON046.90	10/12/2007	5.8	ND	ND	0.0053	ND	190
SRTON053.87	6/24/2008		ND				
SRTON053.87	5/27/2008		ND				
SRTON053.87	5/15/2008	3.2	ND	ND	ND	ND	140
SRTON053.87	5/1/2008		ND				
SRTON053.87	3/25/2008	ND		ND	ND	ND	75
SRTON053.87	11/28/2007	5.1		ND	ND	ND	190
SRTON053.87	9/19/2007	3.9	ND		ND	ND	200
SRTON059.43	5/14/2008	4.3	ND	ND	ND	ND	84
SRTON059.43	3/25/2008	ND		ND	ND	ND	56
SRTON059.43	11/28/2007	ND		ND	ND	ND	99
SRTON059.43	9/19/2007	ND	ND		ND	ND	95
SRWFB005.34	6/17/2008	ND	ND	ND	ND	ND	26
SRWFB005.34	4/23/2008	ND	ND	ND	ND	ND	16
SRWFB005.34	10/22/2007	ND	ND	ND	ND	ND	35
SRWFB005.34	7/31/2007	ND	ND	ND	ND	ND	31
SRWPN004.47	6/17/2008	ND	ND	ND	ND	ND	350
SRWPN004.47	4/15/2008	ND	ND	ND	ND	ND	250
SRWPN004.47	3/20/2008	ND	ND	ND	ND	ND	210
SRWPN004.47	12/17/2007	ND	ND	ND	ND	ND	130
SRWRK007.97	6/16/2008	ND	0.05	ND	ND	ND	170
SRWRK007.97	5/1/2008	ND	ND	ND	ND	ND	140
SRWRK007.97	12/18/2007	ND	ND	ND	ND	ND	83

Site ID	Sample Date	ALKPHEN	NH3	AS-D	AS-T	B-T	CALCARB-T
SRWRK007.97	8/29/2007	3.7	ND	ND	ND	ND	190
VREVR023.59	6/25/2008	3.2	ND	ND	ND	ND	200
VREVR023.59	3/26/2008	7.3	ND	ND	ND	ND	200
VREVR023.59	8/14/2007	4.4	ND	ND	ND	ND	180
VREVR045.50	5/1/2008	5.5	ND	ND	ND	ND	290
VREVR045.50	3/27/2008	3.2	ND	ND	ND	ND	220
VREVR045.50	11/13/2007	4.8	ND	ND	ND	ND	300
VREVR045.50	8/14/2007	ND	ND	ND	ND	ND	78
VREVR051.15	6/24/2008	ND	ND	ND	ND	ND	160
VREVR051.15	3/27/2008	ND	0.04	ND	ND	ND	64
VREVR051.15	11/13/2007	3.1	ND	ND	ND	ND	150
VREVR051.15	8/14/2007	ND	ND	ND	ND	ND	140
VRFOS011.88	6/12/2008	ND	ND	ND	ND	ND	280
VRFOS011.88	4/2/2008	ND		ND	ND	ND	280
VRFOS011.88	11/8/2007	ND		ND	ND	ND	290
VRFOS011.88	8/30/2007	ND	ND	ND	ND	ND	290
VROAK002.96	4/28/2008	ND	ND	0.014	0.017	ND	230
VROAK002.96	1/7/2008	ND		ND	ND	ND	61
VROAK002.96	11/6/2007	3.3		0.015	ND	ND	220
VROAK002.96	8/28/2007	4.7	ND	0.019	0.021	ND	230
VROAK031.38	6/4/2008	3.7		ND	ND	ND	160
VROAK031.38	3/19/2008	ND	ND	ND	ND	ND	72
VROAK031.38	10/2/2007	3.7	ND	ND	ND	ND	160
VROAK031.38	8/14/2007	3	ND	0.006	0.0073	ND	170
VROAK048.92	6/9/2008	ND	ND	ND	ND	ND	150
VROAK048.92	4/24/2008		ND				
VROAK048.92	3/19/2008	ND	ND	ND	ND	ND	49
VROAK048.92	11/1/2007		ND				
VROAK048.92	10/2/2007	ND	ND	ND	ND	ND	160
VROAK048.92	8/13/2007	ND	ND	ND	ND	ND	180
VRPIE000.29	3/26/2008	ND	ND	ND	ND	ND	140
VRPIE000.29	11/13/2007	4.2	0.04	ND	ND	ND	310
VRPIE000.29	8/15/2007	ND	ND	0.011	0.013	ND	320
VRROU002.93	4/30/2008	4.8	ND	0.01	0.01	ND	280
VRROU002.93	3/25/2008	9.6	0.08	ND	0.0084	ND	270
VRROU002.93	11/12/2007	13	ND	0.01	0.01	ND	310
VRROU002.93	8/13/2007	3.2	ND	0.016	0.019	ND	320
VRSPN000.78	6/9/2008	5	ND	0.015	ND	ND	200
VRSPN000.78	3/26/2008	ND	ND	0.0053	0.0069	ND	100
VRSPN000.78	10/4/2007	3.5	ND	0.017	0.018	ND	200
VRSPN000.78	8/14/2007	ND	ND	0.013	0.017	ND	190
VRSYH000.25	5/16/2008	ND	0.05	ND	0.022	ND	260
VRSYH000.25	3/25/2008	5.6	0.14	ND	0.019	ND	200
VRSYH000.25	11/12/2007	ND	0.04	0.022	0.022	ND	320
VRSYH000.25	8/13/2007	ND	ND	0.034	0.043	ND	290
VRSYW001.72	6/11/2008	ND	ND	0.0083	ND	ND	290
VRSYW001.72	3/20/2008	ND	ND	ND	ND	ND	110
VRSYW001.72	10/3/2007	ND	ND	0.009	0.01	ND	300
VRSYW001.72	8/15/2007	ND	ND	0.0089	0.011	ND	300
VRVER107.53	4/30/2008	4.65	ND	0.018	0.011511	0.1001	290
VRVER107.53	4/3/2008	ND		0.015	0.016	0.13	210
VRVER107.53	11/6/2007	7.3		0.022	0.023	0.2	270

Site ID	Sample Date	ALKPHEN	NH3	AS-D	AS-T	B-T	CALCARB-T
VRVER107.53	8/28/2007	4.2	ND	0.027	0.033	0.22	300
VRVER139.99	6/11/2008	7.2	ND	0.016	ND	0.08008	240
VRVER139.99	3/20/2008	6.7	ND	0.01	0.013	0.11	200
VRVER139.99	10/3/2007	7.6	ND	0.018	0.019	0.16	240
VRVER139.99	8/14/2007	6	ND	0.018	0.021	0.15	270
VRVER165.07	6/5/2008	3.8		0.026	0.026	0.27	280
VRVER165.07	3/20/2008	16	ND	0.016	0.022	0.22	250
VRVER165.07	10/4/2007	10.5	ND	0.027	0.027	0.25	290
VRVER165.07	8/14/2007	8.85	ND	0.024	0.014014	0.12512	300
VRWBV002.97	4/28/2008	4.3	ND	0.017	0.02	0.23	260
VRWBV002.97	4/3/2008	3		0.013	ND	0.12	160
VRWBV002.97	11/6/2007	ND		0.028	0.032	0.26	220
VRWBV002.97	8/28/2007	4.15	ND	0.0205225	0.0255235	0.110105	270
VRWBV012.56	4/30/2008	ND	ND	0.009	0.011	ND	130
VRWBV012.56	1/8/2008	ND		ND	ND	ND	41
VRWBV012.56	11/7/2007	ND			0.0053	ND	130
VRWBV012.56	8/29/2007	ND	ND	0.013	0.013	ND	130
VRWCL005.10	4/29/2008	3.7	ND	ND	ND	ND	200
VRWCL005.10	4/3/2008	ND		ND	ND	ND	130
VRWCL005.10	11/7/2007	7		ND	ND	ND	200
VRWCL005.10	8/29/2007	7	ND	ND	ND	ND	200
VRWCL036.37	5/8/2008	ND	ND		ND	ND	170
VRWCL036.37	11/8/2007	5.9		ND	ND	ND	220
VRWCL036.37	8/31/2007	5.8	ND	ND	ND	ND	220
VRWOK000.82	6/10/2008	5.8	ND	ND	ND	ND	210
VRWOK000.82	3/21/2008	ND	ND	ND	ND	ND	61
VRWOK000.82	10/2/2007	6.1	ND	ND	ND	ND	210
VRWOK000.82	8/13/2007	4.1	0.21	ND	ND	ND	220

Site ID	Sample Date	CAL-D	CAL-T	CO3	CHL-T	CU-D	DO-MG/L	DO%
SRBEV001.40	6/18/2008	12		ND	ND	ND	8.63	94.8
SRBEV001.40	4/22/2008	7.5		ND	ND	ND	8.95	86.7
SRBEV001.40	10/23/2007		14	ND	ND		10.25	83
SRBEV001.40	7/31/2007		11	ND	ND		7.93	89.6
SRBEV007.28	6/18/2008	11		ND	ND	ND	6.5	62.3
SRBEV007.28	4/22/2008	7.4		ND	ND	ND	9.36	87.4
SRBEV007.28	10/22/2007		12	ND	ND		12.75	115
SRBEV007.28	7/31/2007		13	ND	ND	ND	7.99	86
SRBEV009.56	5/19/2008	10		ND	ND	0.00255	7.67	88.5
SRBEV009.56	3/19/2008	8.7		ND	ND		12.04	115
SRBEV009.56	8/1/2007		13	ND	6.7	ND	6.89	97.7
SRBON001.69	6/16/2008	13		5.2	ND	0.00035	10.16	118.3
SRBON001.69	4/22/2008	10		ND	ND	0.00207	8.23	85.8
SRBON001.69	10/23/2007		13	ND	ND	ND	14.31	104.5
SRBON001.69	8/1/2007		12	ND	ND	ND	7.85	76.3
SRBWL005.79	10/31/2007		11	ND	ND	ND	11.01	86.8
SRBWL005.79	8/1/2007		9.3	ND	ND	ND	7.57	94.2
SRCGN009.78	6/17/2008	68		ND	12	ND	6.43	77.5
SRCGN009.78	5/2/2008	66		ND	11			
SRCGN009.78	12/19/2007	52		ND	14	ND	11.71	93.07
SRCGN009.78	8/29/2007		71	ND	12	ND	5.04	60.1
SRCHE013.65	6/18/2008	41		5.9	20	0.000535	7.54	94.2
SRCHE013.65	5/1/2008	51		8.8	19	0.0004		
SRCHE013.65	3/21/2008	44	45	6.35	12		10.11	95.5
SRCHE013.65	10/4/2007		43	6.8	24	ND	8.17	92.8
SRCOO001.92	6/18/2008	66		7.5	12	ND	8.77	107.7
SRCOO001.92	4/20/2008	66		14	11	ND	9.05	103.7
SRCOO001.92	3/21/2008	63		11	11		8.56	91
SRCOO001.92	10/4/2007		68	9.1	11	ND	8.02	102.8
SRCYN045.73	5/13/2008	34		ND	ND	ND	9.65	102.6
SRCYN045.73	5/7/2008	32		6	ND	ND	9.64	114.1
SRCYN045.73	11/27/2007	37		7.7	ND	ND	13.22	106.6
SRCYN045.73	9/18/2007		35	6.3	ND	ND	8.46	106.1
SRFIS004.49	6/24/2008	7.6		ND	ND	0.00025		
SRFIS004.49	5/20/2008	6.5		ND	ND	0.00034	9	79.3
SRFIS004.49	10/30/2007		7.4	ND	ND	ND	11.96	90.4
SRFIS004.49	7/31/2007		6.8	ND	ND	ND	7.21	90.8
SRHAG013.09	5/14/2008	65		7.3	ND	ND	7.94	86.4
SRHAG013.09	3/26/2008	74	74	7.25	ND	0.00024	8.51	94
SRHAG013.09	11/27/2007		74	8.8	ND	ND	11.34	96.2
SRHAG013.09	9/18/2007		66	7.3	ND	ND	8.36	97.6
SRHAN000.06	5/19/2008	10		ND	ND	ND	7.54	86.6
SRHAN000.06	3/19/2008	8.4		ND	ND		9.04	107
SRHAN000.06	7/30/2007		13	ND	7	ND	7.2	103.4
SRHAN002.27	6/24/2008	12		ND	ND	ND		
SRHAN002.27	5/21/2008	9.5		ND	ND	ND	9.12	78.6
SRHAN002.27	10/31/2007		12	ND	ND	ND	9.87	83.8
SRHAN002.27	7/31/2007		13	ND	14	ND	7.05	92.2
SRHAY000.04	6/17/2008	7.5		ND	ND	ND	8.84	85.3
SRHAY000.04	4/23/2008	5.45		ND	ND	ND	8.36	72.3
SRHAY000.04	10/23/2007		7.2	ND	ND	ND	13.47	114

Site ID	Sample Date	CAL-D	CAL-T	CO3	CHL-T	CU-D	DO-MG/L	DO%
SRHAY000.04	7/31/2007		7	ND	ND		8.52	82.1
SRHNC000.14	4/30/2008	67		ND	9.8			
SRHNC000.14	12/17/2007	36		ND	5.6	ND	13.2	90
SRHNC000.14	8/28/2007		49	6.8	11	ND	6.97	82.6
SRPNL005.12	6/17/2008	350		ND	51	ND	8.17	99.9
SRPNL005.12	4/23/2008	360		ND	55	ND	9.35	94.6
SRPNL005.12	12/18/2007	290		ND	50	ND	12.22	95.7
SRPNL005.12	8/27/2007		300	ND	52	ND	8.15	105.2
SRPNT008.48	6/17/2008	150		ND	32	ND	7.88	97.2
SRPNT008.48	4/16/2008	130		ND	26	ND	10.89	104.3
SRPNT008.48	12/18/2007		190	ND	39	ND	10.47	96.7
SRPNT008.48	8/27/2007		250	2.3	62	ND	8.01	101.1
SRSNK001.33	5/20/2008	7.4		ND	ND	ND	8.85	79.4
SRSNK001.33	7/31/2007		10	ND	ND	ND	7.25	90.9
SRSPI011.63	5/12/2008	51	50	8.1	ND	ND	10.01	106.1
SRSPI011.63	3/26/2008	39		2.5	ND	ND	9.44	97
SRSPI011.63	11/27/2007	55		6.1	6.2		14.56	111.2
SRSPI011.63	9/18/2007		46	ND	6.4	ND	6.75	80.3
SRSTI000.38	6/18/2008	5.4		ND	ND	ND	4.24	45.3
SRSTI000.38	10/23/2007		6	ND	ND			
SRSTI000.38	7/30/2007		6.6	ND	ND		7.13	73.2
SRTON046.90	10/12/2007		48	7	ND		7.54	79.5
SRTON053.87	6/24/2008						6.75	81.6
SRTON053.87	5/27/2008						8.69	93.6
SRTON053.87	5/15/2008	46		3.8	5.5	0.000225	8.84	97
SRTON053.87	5/1/2008						8.77	96.6
SRTON053.87	3/25/2008	24		ND	ND	0.000375	10.92	106.7
SRTON053.87	11/28/2007	60	60	6.1	5.45	0.00038	11.83	89.6
SRTON053.87	9/19/2007		59	4.7	6.7	ND	7.06	81.2
SRTON059.43	5/14/2008	28		5.2	ND	0.00023	8.99	99.9
SRTON059.43	3/25/2008	19		ND	ND	0.00047	9.77	99.5
SRTON059.43	11/28/2007	35		ND	ND	0.0003	12.62	93.6
SRTON059.43	9/19/2007		30.5	ND	ND	ND	9.24	99
SRWFB005.34	6/17/2008	4.2		ND	ND	ND	8.75	92.5
SRWFB005.34	4/23/2008	4.05		ND	ND	ND	7.76	66
SRWFB005.34	10/22/2007		5.9	ND	ND		12.08	103.6
SRWFB005.34	7/31/2007		5.7	ND	ND		8.71	88.4
SRWPN004.47	6/17/2008	85		ND	13	ND	5.62	73.1
SRWPN004.47	4/15/2008	71		ND	9.6	ND	10.68	114.7
SRWPN004.47	3/20/2008	63		ND	8.8		12.75	133
SRWPN004.47	12/17/2007	45		ND	7	ND	11.12	92.7
SRWRK007.97	6/16/2008	36		ND	ND	0.00067	8.24	100.7
SRWRK007.97	5/1/2008	31		ND	ND	0.00044		
SRWRK007.97	12/18/2007	22		ND	ND	ND	11.98	89.8
SRWRK007.97	8/29/2007		38	4.5	ND	ND	6.71	82
VREVR023.59	6/25/2008	38		3.9	ND	0.002685	6.94	91.6
VREVR023.59	3/26/2008	52		8.8	ND	0.00042	7.86	89.9
VREVR023.59	8/14/2007		46	5.3	ND	ND	6.29	86.7
VREVR045.50	5/1/2008	66		6.6	ND	ND	6.94	62.3
VREVR045.50	3/27/2008	59		3.8	ND	ND	8.28	85.3
VREVR045.50	11/13/2007		71	5.7	ND	ND	8.93	94.3
VREVR045.50	8/14/2007		21	ND	ND	ND	8.71	92.4

Site ID	Sample Date	CAL-D	CAL-T	CO3	CHL-T	CU-D	DO-MG/L	DO%
VREVR051.15	6/24/2008	42		2.4	ND	ND	9	102.8
VREVR051.15	3/27/2008	18		ND	ND	ND	8.29	84
VREVR051.15	11/13/2007		38	3.7	ND	ND	11.93	132.3
VREVR051.15	8/14/2007		36	ND	ND	ND	7.74	90.3
VRFOS011.88	6/12/2008	55		ND	7.6	ND	8.96	101.1
VRFOS011.88	4/2/2008	62		ND	7.8	0.000217	8.11	101.7
VRFOS011.88	11/8/2007		71	ND	7.6	ND	9.86	111.8
VRFOS011.88	8/30/2007		74	ND	7.4	ND	5.97	79
VROAK002.96	4/28/2008	57		ND	14	0.00106	9.02	102
VROAK002.96	1/7/2008	17.5		ND	ND	0.0029	11.75	98.9
VROAK002.96	11/6/2007		47	3.9	12	0.00272	9.44	95.9
VROAK002.96	8/28/2007		57	5.6	13	ND	6.69	90.3
VROAK031.38	6/4/2008	36		4.4	ND	ND	9.72	102
VROAK031.38	3/19/2008	17		ND	ND	ND		
VROAK031.38	10/2/2007		28	4.4	ND	ND		
VROAK031.38	8/14/2007		36	3.6	ND		8.35	96.4
VROAK048.92	6/9/2008	35		ND	ND	ND	8.12	89.8
VROAK048.92	4/24/2008						8.36	94.7
VROAK048.92	3/19/2008	12		ND	7.1	ND	16.25	12.45
VROAK048.92	11/1/2007						8.86	87.5
VROAK048.92	10/2/2007		36	ND	ND	ND		
VROAK048.92	8/13/2007		42	ND	ND		7.07	80
VRPIE000.29	3/26/2008	37		ND	ND	ND	8.09	89
VRPIE000.29	11/13/2007		69	5	9.1	ND	10.47	116.2
VRPIE000.29	8/15/2007		73	ND	10	ND	4.14	51.9
VRROU002.93	4/30/2008	62		5.7	10	0.001983	8.1	77.1
VRROU002.93	3/25/2008	64		12	9.4	0.00072	6.9	85.2
VRROU002.93	11/12/2007		58	15	13	0.000745	9.57	103.9
VRROU002.93	8/13/2007		69	3.8	13	ND	6.33	80.9
VRSPN000.78	6/9/2008	47		6	9.2	0.00053	10.32	117
VRSPN000.78	3/26/2008	24		ND	ND	0.0006	10.65	102
VRSPN000.78	10/4/2007		47	4.2	7.9	0.00157		
VRSPN000.78	8/14/2007		47	ND	6.1	ND	7.42	90
VRSYH000.25	5/16/2008	67		ND	9.2	ND	7.51	77.8
VRSYH000.25	3/25/2008	53		6.7	7.3	ND	9.18	101.3
VRSYH000.25	11/12/2007	79		ND	18	ND	6.68	77.9
VRSYH000.25	8/13/2007		76	ND	16	ND	5.58	66.6
VRSYW001.72	6/11/2008	68		ND	ND	ND	7.1	77.6
VRSYW001.72	3/20/2008	31		ND	ND	ND		
VRSYW001.72	10/3/2007		72	ND	ND	ND		
VRSYW001.72	8/15/2007		71	ND	ND		6.78	78.4
VRVER107.53	4/30/2008	69	69	5.6	32.5	0.00128	11.5	135
VRVER107.53	4/3/2008	44		ND	17	0.0010035	8.59	94.3
VRVER107.53	11/6/2007		55	8.8	28	0.000505	11.55	122.7
VRVER107.53	8/28/2007		67	5	36	ND	6.59	93.9
VRVER139.99	6/11/2008	48		8.6	13	0.002253	9.77	118.1
VRVER139.99	3/20/2008	48		8.1	9.2	0.00089		
VRVER139.99	10/3/2007		51	9.2	14	ND		
VRVER139.99	8/14/2007		64	7.2	14	ND	7.48	95.2
VRVER165.07	6/5/2008	36		4.6	23	ND	8.13	83.7
VRVER165.07	3/20/2008	41		19	20	ND		
VRVER165.07	10/4/2007		49.5	12.5	24	ND		

Site ID	Sample Date	CAL-D	CAL-T	CO3	CHL-T	CU-D	DO-MG/L	DO%
VRVER165.07	8/14/2007		52	10.5	23		6.79	87.2
VRWBV002.97	4/28/2008	61		5.1	17	0.00095	8.73	104
VRWBV002.97	4/3/2008	32		3.6	8.3	ND	9.11	101.2
VRWBV002.97	11/6/2007		58	ND	14	0.00096	10.28	107
VRWBV002.97	8/28/2007		75	4.95	14.5	ND	6.47	91.3
VRWBV012.56	4/30/2008	27		ND	ND	ND	8.32	94.7
VRWBV012.56	1/8/2008	9.85		ND	ND		11.63	93
VRWBV012.56	11/7/2007		24	ND	ND	ND	10.06	105.7
VRWBV012.56	8/29/2007		26	ND	ND	ND	7.26	93.7
VRWCL005.10	4/29/2008	44		4.4	ND	0.00028	8.56	93
VRWCL005.10	4/3/2008	27		ND	ND	0.0004025	9.22	92.5
VRWCL005.10	11/7/2007		41	8.4	ND	ND	10.07	103.9
VRWCL005.10	8/29/2007		39	8.4	ND	ND	6.87	85.9
VRWCL036.37	5/8/2008	41		ND	ND		9.74	103.37
VRWCL036.37	11/8/2007		49	7	ND	ND	13.21	111.1
VRWCL036.37	8/31/2007		51	7	ND	ND	10.3	136
VRWOK000.82	6/10/2008	46		7	ND	ND	9.48	107.2
VRWOK000.82	3/21/2008	16		ND	ND	ND		
VRWOK000.82	10/2/2007		48	7.3	ND	ND		
VRWOK000.82	8/13/2007		48	5	ND		8.27	93.9

Site ID	Sample Date	E. COLI	CFS	FL-T	HARDCACO3	HCO3	TKN	PB-D
SRBEV001.40	6/18/2008	11		0.11	55	63	ND	ND
SRBEV001.40	4/22/2008	ND	1.38	ND	35.5	36	0.14	ND
SRBEV001.40	10/23/2007	2		ND	64	81	0.2	
SRBEV001.40	7/31/2007	65	0.49	ND	50	63		
SRBEV007.28	6/18/2008	13		ND	53.5	58	ND	ND
SRBEV007.28	4/22/2008	ND	0.85	ND	35.5	37	0.19	ND
SRBEV007.28	10/22/2007	5		ND	58	65	0.2	
SRBEV007.28	7/31/2007	22	0.51	ND	60	69		
SRBEV009.56	5/19/2008	1	0.958	ND	47	48	0.17	ND
SRBEV009.56	3/19/2008		0.94	ND	41	40	ND	
SRBEV009.56	8/1/2007	35	0.39	ND	59	67	0.11	ND
SRBON001.69	6/16/2008	26	0.35	0.13	55	79	ND	ND
SRBON001.69	4/22/2008	ND		ND	45	61	0.23	ND
SRBON001.69	10/23/2007	1	0.14	0.1	57	94	0.108	ND
SRBON001.69	8/1/2007	ND	0.22	ND	54.3	76	0.188	ND
SRBWL005.79	10/31/2007			ND	52	68	ND	ND
SRBWL005.79	8/1/2007	6	0.18	ND	43	60	0.08	ND
SRCGN009.78	6/17/2008			0.88	270	350	ND	ND
SRCGN009.78	5/2/2008	1.14		0.88	270	330	ND	
SRCGN009.78	12/19/2007	20	0.16	0.63	220	230	ND	ND
SRCGN009.78	8/29/2007			0.87	270	370		ND
SRCHE013.65	6/18/2008			0.19	190	220	ND	ND
SRCHE013.65	5/1/2008	1	0	0.19	230	240	ND	ND
SRCHE013.65	3/21/2008	2		0.16	190	200	ND	
SRCHE013.65	10/4/2007	7	0.47	0.17	190	230		ND
SRCOO001.92	6/18/2008			0.28	320	350	ND	ND
SRCOO001.92	4/20/2008	8.24	0.029	0.27	310	310	0.21	ND
SRCOO001.92	3/21/2008	1	0.06	0.25	290	290		
SRCOO001.92	10/4/2007	73	0.5	0.26	320	360		ND
SRCYN045.73	5/13/2008	7	0.4	ND	120	130	ND	ND
SRCYN045.73	5/7/2008	ND	0.51	ND	110	110	ND	ND
SRCYN045.73	11/27/2007	2	0.24	0.1	130	130	0.2	ND
SRCYN045.73	9/18/2007	ND	0.4	ND	120	130		ND
SRFIS004.49	6/24/2008			ND	35	44	0.3	ND
SRFIS004.49	5/20/2008	1	0.854	ND	30	33	ND	ND
SRFIS004.49	10/30/2007		0.17	ND	35	45	ND	ND
SRFIS004.49	7/31/2007	53	0.82	ND	31	42	0.11	ND
SRHAG013.09	5/14/2008	ND	0.04	0.14	260	310	ND	ND
SRHAG013.09	3/26/2008	4	0.74	0.125	270	290	ND	ND
SRHAG013.09	11/27/2007	6	0.29	0.15	280	300	0.2	ND
SRHAG013.09	9/18/2007	ND	0.16	0.1	250	290		ND
SRHAN000.06	5/19/2008	2	0.513	ND	46	49	0.15	ND
SRHAN000.06	3/19/2008		1.57	ND	40	36	ND	
SRHAN000.06	7/30/2007	33	0.49	ND	60	66	0.12	ND
SRHAN002.27	6/24/2008			ND	55	62	ND	ND
SRHAN002.27	5/21/2008	1	0.553	ND	44	46	0.14	ND
SRHAN002.27	10/31/2007		0.15	ND	57	68	ND	ND
SRHAN002.27	7/31/2007	6	0.34	ND	60	62	0.09	ND
SRHAY000.04	6/17/2008	13		ND	31	57	ND	ND
SRHAY000.04	4/23/2008	ND	1.6	ND	24.5	31	0.12	ND
SRHAY000.04	10/23/2007	1		ND	30	55	ND	

Site ID	Sample Date	E. COLI	CFS	FL-T	HARDCACO3	HCO3	TKN	PB-D
SRHAY000.04	7/31/2007	6	0.26	ND	29	50	0.11	
SRHNC000.14	4/30/2008	ND		0.22	220	240	ND	
SRHNC000.14	12/17/2007	24	0.16	0.12	130	100	ND	ND
SRHNC000.14	8/28/2007	14		0.19	180	210		ND
SRPNL005.12	6/17/2008		1.53	0.88	1200	58	ND	ND
SRPNL005.12	4/23/2008	45	1.109	0.93	1200	78	0.3	ND
SRPNL005.12	12/18/2007	23	1.02	1.1	940	46	ND	ND
SRPNL005.12	8/27/2007	24	0.24	1.1	950	56		ND
SRPNT008.48	6/17/2008		1.868	0.54	560	310	ND	ND
SRPNT008.48	4/16/2008		1.349	0.48	490	270	ND	ND
SRPNT008.48	12/18/2007	3	0.66	0.42	710	240	ND	ND
SRPNT008.48	8/27/2007	27	0.54	0.4	950	320		ND
SRSNK001.33	5/20/2008	1		ND	37	40	0.13	ND
SRSNK001.33	7/31/2007	12	0.19	ND	50	68	0.4	ND
SRSPI011.63	5/12/2008	ND	0.36	0.21	210	230	0.0875	ND
SRSPI011.63	3/26/2008	2	0.15	0.14	160	180	ND	ND
SRSPI011.63	11/27/2007	ND	0.18	0.21	230	270	0.4	
SRSPI011.63	9/18/2007	ND	0.43	0.16	190	240		ND
SRSTI000.38	6/18/2008	77		ND	23	32	ND	ND
SRSTI000.38	10/23/2007	1		ND	26	38	ND	
SRSTI000.38	7/30/2007	21.5	0.02	ND	28	43		
SRTON046.90	10/12/2007	8		0.37	190	220	0.7	
SRTON053.87	5/15/2008	ND	0.33	ND	160	170	0.15	ND
SRTON053.87	3/25/2008	1	1.26	ND	85	92	ND	ND
SRTON053.87	11/28/2007	24	0.18	0.11	220	220	0.2	ND
SRTON053.87	9/19/2007	68	0.13	ND	210	240		ND
SRTON059.43	5/14/2008	ND	0.56	ND	98	91	0.12	ND
SRTON059.43	3/25/2008	1	1.12	ND	67	68	ND	ND
SRTON059.43	11/28/2007	3	0.27	ND	120	120	0.2	ND
SRTON059.43	9/19/2007	16	0.4	ND	105	120		ND
SRTON059.43	10/24/2006						0.84	
SRTON059.43	10/11/2006						0.25	
SRWFB005.34	6/17/2008	29	0.91	ND	16	32	ND	ND
SRWFB005.34	4/23/2008	4	1.64	ND	17	19	0.15	ND
SRWFB005.34	10/22/2007	1	0.35	ND	24	43	ND	
SRWFB005.34	7/31/2007	12	1.02	ND	23	38		
SRWPN004.47	6/17/2008			0.35	430	420	ND	ND
SRWPN004.47	4/15/2008		0.162	0.32	330	310	ND5	ND
SRWPN004.47	3/20/2008	1	0.16	0.31	280	260	ND	
SRWPN004.47	12/17/2007	7	0.17	0.23	200	150	0.2	ND
SRWRK007.97	6/16/2008		0.349	ND	170	200	0.2	ND
SRWRK007.97	5/1/2008	1	0.054	ND	140	170	0.14	ND
SRWRK007.97	12/18/2007	1	0.32	ND	100	100	ND	ND
SRWRK007.97	8/29/2007		0.09	ND	180	220		ND
VREVR023.59	6/25/2008		0.08	0.15	210	240	0.06	ND
VREVR023.59	3/26/2008		0.78	0.11	210	230	ND	ND
VREVR023.59	8/14/2007	4	0.55	ND	180	210		ND
VREVR045.50	5/1/2008	1	0.09	0.1	290	350	ND	ND
VREVR045.50	3/27/2008	1	0.73	ND	230	260	ND	ND
VREVR045.50	11/13/2007	1		ND	290	360	0.6	ND
VREVR045.50	8/14/2007	600	0.96	ND	80	95		ND
VREVR051.15	6/24/2008		0.36	ND	170	190	ND	ND

Site ID	Sample Date	E. COLI	CFS	FL-T	HARDCACO3	HCO3	TKN	PB-D
VREVR051.15	3/27/2008	4	1.99	ND	70	79	0.2	ND
VREVR051.15	11/13/2007	1	0.35	ND	150	180	0.4	ND
VREVR051.15	8/14/2007	28	0.27	ND	140	160		ND
VRFOS011.88	6/12/2008	ND	1.43	0.15	290	340	ND	ND
VRFOS011.88	4/2/2008	ND	1.77	0.15	290	340	0.2	ND
VRFOS011.88	11/8/2007	30	1.73	0.13	320	350		
VRFOS011.88	8/30/2007	5	1.05	0.12	340	360		ND
VROAK002.96	4/28/2008	13	2.44	0.13	250	270	0.21	ND
VROAK002.96	1/7/2008	408		ND		74	0.3	0.000736
VROAK002.96	11/6/2007		0.57	0.1	200	260	0.4	ND
VROAK002.96	8/28/2007	42	1.15	0.11	240	270		ND
VROAK031.38	6/4/2008		0.88	ND	160	190	0.2	ND
VROAK031.38	3/19/2008	48	1.96	ND	75	88	0.2	ND
VROAK031.38	10/2/2007	6	0.77	ND	130	190		ND
VROAK031.38	8/14/2007	29	0.29	ND	160	200		
VROAK048.92	6/9/2008	8		ND	150	190	ND	ND
VROAK048.92	3/19/2008	ND	1.11	ND	52.5	60	0.15	ND
VROAK048.92	10/2/2007	10	0.1	ND	160	190		ND
VROAK048.92	8/13/2007	15	0.1	ND	180	230		
VRPIE000.29	3/26/2008		0.39	0.1	150	170	ND	ND
VRPIE000.29	11/13/2007	4		0.1	290	370	0.2	ND
VRPIE000.29	8/15/2007	9		0.14	310	390		ND
VRROU002.93	4/30/2008	1	0.38	0.3	270	330	0.1125	ND
VRROU002.93	3/25/2008		0.22	0.31	280	310	0.2	ND
VRROU002.93	11/12/2007	1	0.11	0.36	250	350	0.2	ND
VRROU002.93	8/13/2007	1	0.59	0.32	300	390		ND
VRSPN000.78	6/9/2008	35	0.82	0.13	200	240	0.2	ND
VRSPN000.78	3/26/2008	8		ND	100	120	ND	ND
VRSPN000.78	10/4/2007	34		ND	200	230		0.000064
VRSPN000.78	8/14/2007	340		0.1	200	230		ND
VRSYH000.25	5/16/2008	1	0.02	2.7	220	310	ND	ND
VRSYH000.25	3/25/2008		0.25	2.6	180	230	0.2	ND
VRSYH000.25	11/12/2007	16	0.41	3.4	270	390	0.2	ND
VRSYH000.25	8/13/2007	44	0.12	3.1	260	350		ND
VRSYW001.72	6/11/2008	7		0.12	290	350	ND	ND
VRSYW001.72	3/20/2008	ND	0.39	ND	120	140	0.2	ND
VRSYW001.72	10/3/2007		0.41	0.1	300	360		ND
VRSYW001.72	8/15/2007	17	0.6	0.13	300	360		
VRVER107.53	4/30/2008	6	0.97	0.325	350	340	0.16	ND
VRVER107.53	4/3/2008	ND	71.16	0.2	210	260	0.2	ND
VRVER107.53	11/6/2007			0.27	280	320	0.3	ND
VRVER107.53	8/28/2007	29	3.23	0.33	340	350		ND
VRVER139.99	6/11/2008	4	1.88	0.21	230	280	ND	0.0000685
VRVER139.99	3/20/2008	2	1.07	0.17	200	230	0.2	0.000062
VRVER139.99	10/3/2007		0.92	0.2	230	280		ND
VRVER139.99	8/14/2007	7	0.7	0.23	270	310		ND
VRVER165.07	6/5/2008		0.18	0.52	190	330	ND	ND
VRVER165.07	3/20/2008	5.2	0.29	0.45	200	290	ND	ND
VRVER165.07	10/4/2007	54	1.04	0.495	230	330		ND
VRVER165.07	8/14/2007	20	0.41	0.52	230	340		
VRWBV002.97	4/28/2008	8	0.29	0.12	260	310	0.083	ND
VRWBV002.97	4/3/2008	ND	0.76	0.1	140	180	0.2	ND

Site ID	Sample Date	E. COLI	CFS	FL-T	HARDCACO3	HCO3	TKN	PB-D
VRWBV002.97	11/6/2007		0.55	0.1	260	270	0.3	ND
VRWBV002.97	8/28/2007	480	0.81	0.135	290	320		ND
VRWBV012.56	4/30/2008	ND		ND	130	160	ND	ND
VRWBV012.56	1/8/2008	27		ND		50	0.3	
VRWBV012.56	11/7/2007	2		ND	120	150	0.3	
VRWBV012.56	8/29/2007	54		ND	130	160		ND
VRWCL005.10	4/29/2008	1	0.7	0.1	210	230	ND	ND
VRWCL005.10	4/3/2008	ND	0.77	ND	130	160	0.2	ND
VRWCL005.10	11/7/2007	9	0.59	ND	200	230	0.4	ND
VRWCL005.10	8/29/2007	25	0.3	ND	200	230		ND
VRWCL036.37	5/8/2008	ND	0.05	ND	180	210	ND	
VRWCL036.37	11/8/2007	ND	0.42	ND	220	260	0.3	ND
VRWCL036.37	8/31/2007	4	0.08	ND	230	250		ND
VRWOK000.82	6/10/2008	ND		ND	210	240	ND	ND
VRWOK000.82	3/21/2008	2	0.71	ND	67	74	ND	ND
VRWOK000.82	10/2/2007	ND	5	ND	220	240		ND
VRWOK000.82	8/13/2007	3	0.05	ND	220	260		

Site ID	Sample Date	MG-D	MG-T	MN-T	HG-D	N03+N02	PH	P-T
SRBEV001.40	6/18/2008	6		ND	ND	ND	8.16	0.159
SRBEV001.40	4/22/2008	4.1		ND	ND	0.024	8	0.054
SRBEV001.40	10/23/2007		7	ND		0.045	8.02	0.103
SRBEV001.40	7/31/2007		5.5	ND		ND	8.2	
SRBEV007.28	6/18/2008	6.3		ND	ND	ND	7.98	0.091
SRBEV007.28	4/22/2008	4.15		ND	ND	ND	8.11	0.058
SRBEV007.28	10/22/2007		6.7	ND		ND	7.97	0.049
SRBEV007.28	7/31/2007		6.7	ND		ND	8.19	
SRBEV009.56	5/19/2008	5.3		ND	ND	ND	7.8	0.081
SRBEV009.56	3/19/2008	4.7		ND		0.06	7.63	0.091
SRBEV009.56	8/1/2007		6.5	ND	ND	ND	8.34	0.05
SRBON001.69	6/16/2008	5.5		ND	ND	ND	8.64	0.07
SRBON001.69	4/22/2008	4.85		ND	0.000000576	0.025	8.04	0.047
SRBON001.69	10/23/2007		5.9	ND	ND	0.195	8.12	7.878
SRBON001.69	8/1/2007		5.87	ND	ND	ND	7.79	0.046
SRBWL005.79	10/31/2007		5.9	ND	ND	ND	7.94	0.04
SRBWL005.79	8/1/2007		4.9	ND	ND	ND	8.17	0.03
SRCGN009.78	6/17/2008	25		0.073	ND	0.11	8.08	0.026
SRCGN009.78	5/2/2008	26		ND		0.4	7.93	0.01
SRCGN009.78	12/19/2007	22		ND	ND	0.46	8.03	0.014
SRCGN009.78	8/29/2007		23	0.18	ND	0.11	7.84	
SRCHE013.65	6/18/2008	22		ND	ND	0.02	8.39	0.011
SRCHE013.65	5/1/2008	24		ND	0.000000535	ND	8.46	0.01
SRCHE013.65	3/21/2008	19.5		ND	ND	ND	8.42	0.0085
SRCHE013.65	10/4/2007		21	ND	ND	0.02	8.41	
SRCOO001.92	6/18/2008	38		ND	ND	ND	8.32	0.014
SRCOO001.92	4/20/2008	36		ND	ND	0.084	8.45	0.01
SRCOO001.92	3/21/2008	33		ND		0.05	8.49	0.005
SRCOO001.92	10/4/2007		36	ND	ND	ND	8.27	
SRCYN045.73	5/13/2008	7.9		ND		0.091	8.28	0.036
SRCYN045.73	5/7/2008	7.6		ND	0.000000695	0.077	8.8	0.033
SRCYN045.73	11/27/2007	9.2		ND	ND		8.76	0.053
SRCYN045.73	9/18/2007		8.2	ND	ND	0.064	8.67	
SRFIS004.49	6/24/2008	4		ND	ND	ND	7.25	0.042
SRFIS004.49	5/20/2008	3.4		ND	ND	ND	7.79	0.044
SRFIS004.49	10/30/2007		4	ND	ND	0.38	8.26	0.028
SRFIS004.49	7/31/2007		3.5	ND	ND	ND	8.48	0.03
SRHAG013.09	5/14/2008	23		ND	ND	ND	8.33	0.01
SRHAG013.09	3/26/2008	20	20	ND	ND		8.38	0.0085
SRHAG013.09	11/27/2007		22	ND	ND		8.28	0.018
SRHAG013.09	9/18/2007		21	ND	ND	ND	8.2	
SRHAN000.06	5/19/2008	5.2		ND	ND	ND	8.08	0.083
SRHAN000.06	3/19/2008	4.5		ND		0.08	7.69	0.07
SRHAN000.06	7/30/2007		6.6	ND	ND	0.16	8.24	0.05
SRHAN002.27	6/24/2008	6.1		ND	ND	0.03	7.29	0.083
SRHAN002.27	5/21/2008	5		ND	ND	0.05	7.74	0.061
SRHAN002.27	10/31/2007		6.6	ND	ND	0.093	7.81	0.081
SRHAN002.27	7/31/2007		6.7	ND	ND	ND	7.88	0.05
SRHAY000.04	6/17/2008	3		ND	ND	0.02	8.25	0.032
SRHAY000.04	4/23/2008	2.65		ND	ND	ND	7.89	0.022
SRHAY000.04	10/23/2007		2.8	ND		0.03	8.02	0.036

Site ID	Sample Date	MG-D	MG-T	MN-T	HG-D	N03+N02	PH	P-T
SRHAY000.04	7/31/2007		2.8	ND		ND	8.01	0.026
SRHNC000.14	4/30/2008	14		ND		0.17	8.04	0.01
SRHNC000.14	12/17/2007	9.6		0.081	ND	2.66	7.9	0.071
SRHNC000.14	8/28/2007		14	ND	ND	ND	8.43	
SRPNL005.12	6/17/2008	69		0.43	ND	ND	7.58	0.026
SRPNL005.12	4/23/2008	69		0.0046	ND	ND	7.54	0.01
SRPNL005.12	12/18/2007	53		5.1	ND	0.05	7.33	0.21
SRPNL005.12	8/27/2007		48	ND	ND	ND	8.14	
SRPNT008.48	6/17/2008	46		ND	ND	ND	8.05	0.02
SRPNT008.48	4/16/2008	39		ND	ND	0.25	8.16	0.031
SRPNT008.48	12/18/2007		57	0.093	ND	0.98	7.87	0.038
SRPNT008.48	8/27/2007		79	0.076	ND	ND	8.1	
SRSNK001.33	5/20/2008	4.4		ND	ND	ND	7.8	0.069
SRSNK001.33	7/31/2007		6	ND	ND	ND	7.94	0.04
SRSPI011.63	5/12/2008	20	20	ND	ND	ND	8.24	0.028
SRSPI011.63	3/26/2008	14		ND	ND		8.5	0.028
SRSPI011.63	11/27/2007	23		ND			8.05	0.021
SRSPI011.63	9/18/2007		19	0.11	ND	0.026	7.99	
SRSTI000.38	6/18/2008	2.3		ND	ND	ND	7.93	0.05
SRSTI000.38	10/23/2007		2.7	ND		ND	8.26	0.031
SRSTI000.38	7/30/2007		2.9	0.051		ND	7.76	
SRTON046.90	10/12/2007		17	ND		ND	8.5	0.057
SRTON053.87	5/15/2008	12		ND	ND	ND	8.47	0.043
SRTON053.87	3/25/2008	6		ND	0.00000145		8.08	0.017
SRTON053.87	11/28/2007	17	17	ND	ND		8.37	0.023
SRTON053.87	9/19/2007		16	0.056	ND	0.034	8.42	
SRTON059.43	5/14/2008	6.8		ND	0.0000062	0.11	8.67	0.049
SRTON059.43	3/25/2008	4.7		ND	0.00000213		8.4	0.028
SRTON059.43	11/28/2007	8.7		ND	ND		8.15	0.071
SRTON059.43	9/19/2007		6.8	ND	ND	0.315	8.15	
SRTON059.43	10/24/2006					0.25	7.7	0.025
SRTON059.43	10/11/2006					0.25	8.1	0.025
SRWFB005.34	6/17/2008	1.4		ND	ND	0.15	8.74	0.065
SRWFB005.34	4/23/2008	1.7		ND	ND	0.039	7.94	0.021
SRWFB005.34	10/22/2007		2.1	ND		ND	8.03	0.038
SRWFB005.34	7/31/2007		2.1	ND		0.022	8.63	
SRWPN004.47	6/17/2008	52		0.11	ND	ND	7.46	0.032
SRWPN004.47	4/15/2008	37		ND	ND	0.06	8.04	0.017
SRWPN004.47	3/20/2008	31		ND		0.34	8.03	0.019
SRWPN004.47	12/17/2007	21		ND	ND	2.74	7.94	0.028
SRWRK007.97	6/16/2008	19		ND	0.0000006	0.23	7.99	0.058
SRWRK007.97	5/1/2008	16		ND	0.000000678	0.14	8.32	0.022
SRWRK007.97	12/18/2007	11		ND	ND	0.09	7.97	0.019
SRWRK007.97	8/29/2007		21	ND	ND	0.056	8.23	
VREVR023.59	6/25/2008	28		0.052	0.00000067	ND	8.3	0.014
VREVR023.59	3/26/2008	20		ND	ND	ND	8.35	0.0025
VREVR023.59	8/14/2007		16	ND	ND	ND	8.41	
VREVR045.50	5/1/2008	30		ND	ND	ND	8.11	0.01
VREVR045.50	3/27/2008	20		ND	ND	0.02	8.35	0.0025
VREVR045.50	11/13/2007		28	0.16	ND	ND	8.13	0.019
VREVR045.50	8/14/2007		6.6	ND	ND	0.036	8.11	
VREVR051.15	6/24/2008	15		ND	ND	ND	8.06	0.0365

Site ID	Sample Date	MG-D	MG-T	MN-T	HG-D	N03+N02	PH	P-T
VREVR051.15	3/27/2008	6.1		ND	ND	ND	8.54	0.02
VREVR051.15	11/13/2007		14	ND	ND	ND	6.58	0.041
VREVR051.15	8/14/2007		13	ND	ND	0.039	8.25	
VRFOS011.88	6/12/2008	37		ND	ND	0.04	8.28	0.0025
VRFOS011.88	4/2/2008	33		ND	ND		8.53	0.008
VRFOS011.88	11/8/2007		35	ND			8.34	
VRFOS011.88	8/30/2007		37	ND	ND	0.051	8.53	
VROAK002.96	4/28/2008	25		ND	ND	0.083	8.17	0.026
VROAK002.96	1/7/2008	6.75		0.07	0.0000072		8.47	0.195
VROAK002.96	11/6/2007		21	ND	ND		7.84	0.029
VROAK002.96	8/28/2007		23	0.053	ND	0.23	8.06	
VROAK031.38	6/4/2008	18		ND	ND		8.22	0.026
VROAK031.38	3/19/2008	8		ND	ND	ND	8.08	0.031
VROAK031.38	10/2/2007		14	ND	ND	ND	8.17	
VROAK031.38	8/14/2007		18	ND		ND	8.27	
VROAK048.92	6/9/2008	16		ND	ND	0.13	8.14	0.058
VROAK048.92	3/19/2008	5.45		ND	ND	ND	7.94	0.0685
VROAK048.92	10/2/2007		16	0.1	ND	0.057	8.13	
VROAK048.92	8/13/2007		18	0.17		0.045	7.92	
VRPIE000.29	3/26/2008	13		ND	ND	ND	8.37	0.0025
VRPIE000.29	11/13/2007		29	ND	ND	ND	8.04	0.016
VRPIE000.29	8/15/2007		30	0.21	ND	ND	7.78	
VRROU002.93	4/30/2008	29		ND	ND	ND	8.07	0.015
VRROU002.93	3/25/2008	28		ND	ND	0.4	8.4	0.068
VRROU002.93	11/12/2007		26	ND	ND	0.17	8.28	0.063
VRROU002.93	8/13/2007		30	0.14	ND	0.27	7.94	
VRSPN000.78	6/9/2008	21		ND	ND	0.05	8.14	0.036
VRSPN000.78	3/26/2008	10		ND	0.000000696	0.02	8.1	0.042
VRSPN000.78	10/4/2007		20	0.057	ND	0.18	8.16	
VRSPN000.78	8/14/2007		20	0.13	ND	0.17	8.11	
VRSYH000.25	5/16/2008	14		ND	ND	0.02	7.54	0.012
VRSYH000.25	3/25/2008	11		ND	ND	0.02	8.2	0.0025
VRSYH000.25	11/12/2007	17		ND	ND	ND	8.15	0.021
VRSYH000.25	8/13/2007		16	0.072	ND	0.029	7.44	
VRSYW001.72	6/11/2008	29		ND	ND	0.04	7.78	0.014
VRSYW001.72	3/20/2008	11		ND	ND	0.03	7.88	0.049
VRSYW001.72	10/3/2007		30	ND	ND	0.14	8.14	
VRSYW001.72	8/15/2007		29	0.065		0.16	7.88	
VRVER107.53	4/30/2008	44	44	ND	ND	0.42	8.18	0.027
VRVER107.53	4/3/2008	24		ND	ND		8.09	0.068
VRVER107.53	11/6/2007		35	ND	ND		8.06	0.029
VRVER107.53	8/28/2007		43	ND	ND	0.5	7.91	
VRVER139.99	6/11/2008	27		ND	ND	0.02	8.32	0.044
VRVER139.99	3/20/2008	20		ND	ND	ND	8.34	0.047
VRVER139.99	10/3/2007		26	ND	ND	0.045	8.38	
VRVER139.99	8/14/2007		26	0.089	ND	0.27	8.26	
VRVER165.07	6/5/2008	25		ND	ND		8.11	0.073
VRVER165.07	3/20/2008	23		ND	ND	0.14	8.57	0.026
VRVER165.07	10/4/2007		25.5	0.03003	ND	0.415	8.35	
VRVER165.07	8/14/2007		25	0.041542		0.585	8.32	
VRWBV002.97	4/28/2008	27		ND	0.000000605	ND	8.15	0.01
VRWBV002.97	4/3/2008	14		ND	0.00000157		8.12	0.027

Site ID	Sample Date	MG-D	MG-T	MN-T	HG-D	N03+N02	PH	P-T
VRWBV002.97	11/6/2007		27	ND	ND		8.12	0.056
VRWBV002.97	8/28/2007		24	0.08509	ND	0.096	6.05	
VRWBV012.56	4/30/2008	16		ND	ND	0.13	8.13	0.028
VRWBV012.56	1/8/2008	5.1		ND			8.41	0.124
VRWBV012.56	11/7/2007		15	ND			8.11	0.016
VRWBV012.56	8/29/2007		15	ND	ND	0.12	8.19	
VRWCL005.10	4/29/2008	24		ND	ND	ND	8.53	0.01
VRWCL005.10	4/3/2008	14		ND	0.000000528		8.21	0.029
VRWCL005.10	11/7/2007		25	ND			8.32	0.01
VRWCL005.10	8/29/2007		24	ND	ND	0.021	8.54	
VRWCL036.37	5/8/2008	20		ND		ND	8.32	0.042
VRWCL036.37	11/8/2007		24	ND			7.93	0.008
VRWCL036.37	8/31/2007		24	0.066	ND	ND	8.38	
VRWOK000.82	6/10/2008	24		ND	ND	0.03	8.39	0.028
VRWOK000.82	3/21/2008	6.5		ND	ND	ND	7.81	0.065
VRWOK000.82	10/2/2007		24	ND	ND	ND	8.42	
VRWOK000.82	8/13/2007		24	0.069		0.021	8.23	

Site ID	Sample Date	K-D	K-T	NA-D	NA-T	SPCOND
SRBEV001.40	6/18/2008	0.94		3.7		118
SRBEV001.40	4/22/2008	0.735		3.15		82
SRBEV001.40	10/23/2007		0.96		4.2	141
SRBEV001.40	7/31/2007		1		3.6	122
SRBEV007.28	6/18/2008	0.82		3.65		114
SRBEV007.28	4/22/2008	0.655		2.9		84
SRBEV007.28	10/22/2007		0.68		3.5	126
SRBEV007.28	7/31/2007		0.98		3.8	139
SRBEV009.56	5/19/2008	1.1		3.9		102
SRBEV009.56	3/19/2008	0.73		3.2		86.9
SRBEV009.56	8/1/2007		1.2		4.3	118.8
SRBON001.69	6/16/2008	1.8		9.4		139
SRBON001.69	4/22/2008	0.98		5.35		105
SRBON001.69	10/23/2007		1.7		9	149
SRBON001.69	8/1/2007		1.19		5.6	135
SRBWL005.79	10/31/2007		0.81		3.2	110
SRBWL005.79	8/1/2007		0.82		2.9	80.6
SRCGN009.78	6/17/2008	1.3		31		602
SRCGN009.78	5/2/2008	1.4		29		562
SRCGN009.78	12/19/2007	1.5		25		473
SRCGN009.78	8/29/2007		1.8		29	601.4
SRCHE013.65	6/18/2008	1.9		17		434
SRCHE013.65	5/1/2008	2		16		448
SRCHE013.65	3/21/2008	1.8	1.8	11	11	375.5
SRCHE013.65	10/4/2007		1.7		17	437.8
SRCOO001.92	6/18/2008	1.8		14		610
SRCOO001.92	4/20/2008	1.8		14		549.8
SRCOO001.92	3/21/2008	1.7		12		544.3
SRCOO001.92	10/4/2007		1.9		13	615
SRCYN045.73	5/13/2008	0.88		3		209.7
SRCYN045.73	5/7/2008	0.85		3		200.7
SRCYN045.73	11/27/2007	0.9		2.8		236
SRCYN045.73	9/18/2007		0.76		3	230.5
SRFIS004.49	6/24/2008	0.73		2.8		79
SRFIS004.49	5/20/2008	0.62		2.4		66
SRFIS004.49	10/30/2007		0.55		2.6	79
SRFIS004.49	7/31/2007		0.66		2.3	66.8
SRHAG013.09	5/14/2008	1.1		3.9		453.5
SRHAG013.09	3/26/2008	1.1	1.1	3.9	3.8	467.6
SRHAG013.09	11/27/2007		1.1		3.8	474
SRHAG013.09	9/18/2007		1		3.5	463.9
SRHAN000.06	5/19/2008	1.2		4		109
SRHAN000.06	3/19/2008	0.82		3.6		87.5
SRHAN000.06	7/30/2007		1.3		4.4	62.7
SRHAN002.27	6/24/2008	1.3		5.1		125
SRHAN002.27	5/21/2008	1		4.1		102
SRHAN002.27	10/31/2007		1.1		4.9	136
SRHAN002.27	7/31/2007		1.3		5.1	128.7
SRHAY000.04	6/17/2008	1.5		6.3		87
SRHAY000.04	4/23/2008	0.57		2.9		60
SRHAY000.04	10/23/2007		1.7		6.6	87
SRHAY000.04	7/31/2007		1.3		4.9	83

Site ID	Sample Date	K-D	K-T	NA-D	NA-T	SPCOND
SRHNC000.14	4/30/2008	1.9		17		455
SRHNC000.14	12/17/2007	1.6		10		256
SRHNC000.14	8/28/2007		2.8		19	399.1
SRPNL005.12	6/17/2008	3.8		71		2001
SRPNL005.12	4/23/2008	4		70		1900
SRPNL005.12	12/18/2007	4		60		1680
SRPNL005.12	8/27/2007		4.2		58	1714
SRPNT008.48	6/17/2008	2.7		38		1124
SRPNT008.48	4/16/2008	2.4		33		903
SRPNT008.48	12/18/2007		2.9		40	1276
SRPNT008.48	8/27/2007		4		49	1681
SRSNK001.33	5/20/2008	0.83		2.7		74
SRSNK001.33	7/31/2007		1		3.1	99.8
SRSPI011.63	5/12/2008	2	2	8.4	8.2	374
SRSPI011.63	3/26/2008	1.8		6.1		300.1
SRSPI011.63	11/27/2007	1.6		8.6		429
SRSPI011.63	9/18/2007		1.9		8.3	381.5
SRSTI000.38	6/18/2008	0.9		2.7		57
SRSTI000.38	10/23/2007		1.1		3	81
SRSTI000.38	7/30/2007		1.3		3.2	75
SRTON046.90	10/12/2007		1.3		6.8	359.5
SRTON053.87	6/24/2008					319.8
SRTON053.87	5/27/2008					332.4
SRTON053.87	5/15/2008	0.89		3.8		296
SRTON053.87	5/1/2008					267.3
SRTON053.87	3/25/2008	0.6		2.1		1600
SRTON053.87	11/28/2007	0.995		4	4.1	388
SRTON053.87	9/19/2007		1.2		4.3	393.5
SRTON053.87	10/24/2006					345
SRTON053.87	10/11/2006					315.2
SRTON059.43	5/14/2008	0.8		2.1		176.2
SRTON059.43	3/25/2008	0.58		1.4		77.3
SRTON059.43	11/28/2007	0.96		2.6		231
SRTON059.43	9/19/2007		0.935		2.2	197.8
SRTON059.43	10/24/2006					227
SRTON059.43	10/11/2006					222.4
SRWFB005.34	6/17/2008	1.6		3.2		51
SRWFB005.34	4/23/2008	0.87		2.45		45
SRWFB005.34	10/22/2007		2		4.9	71
SRWFB005.34	7/31/2007		1.7		3.8	68
SRWPN004.47	6/17/2008	3.4		24		853
SRWPN004.47	4/15/2008	2.2		19		603
SRWPN004.47	3/20/2008	1.7		16		558.8
SRWPN004.47	12/17/2007	1.6		12		391
SRWRK007.97	6/16/2008	1.6		6.6		318
SRWRK007.97	5/1/2008	1.5		5.3		259
SRWRK007.97	12/18/2007	1.4		2.8		183
SRWRK007.97	8/29/2007		1.8		7.3	345
VREVR023.59	6/25/2008	1.2		5.8		378.3
VREVR023.59	3/26/2008	0.84		3.9		370.4
VREVR023.59	8/14/2007		1.5		2.7	341.5
VREVR045.50	5/1/2008	0.89		2.8		519
VREVR045.50	3/27/2008	0.79		2.3		393.8

Site ID	Sample Date	K-D	K-T	NA-D	NA-T	SPCOND
VREVR045.50	11/13/2007		0.84		3.5	541.7
VREVR045.50	8/14/2007		0.61		1.2	148.1
VREVR051.15	6/24/2008	0.71		2.1		294.8
VREVR051.15	3/27/2008	0.61		1.4		119.4
VREVR051.15	11/13/2007		0.72		1.7	284
VREVR051.15	8/14/2007		0.77		1.7	263.3
VRFOS011.88	6/12/2008	1.6		12		590
VRFOS011.88	4/2/2008	1.4		9.8		579.4
VRFOS011.88	11/8/2007		1.5		11	604.6
VRFOS011.88	8/30/2007		1.6		11	609.2
VROAK002.96	4/28/2008	1.6		14		441.7
VROAK002.96	1/7/2008	1.35		4.55		130.9
VROAK002.96	11/6/2007		1.3		11	430.4
VROAK002.96	8/28/2007		1.9		13	466.3
VROAK031.38	6/4/2008	0.95		5.3		303
VROAK031.38	3/19/2008	0.8		4.3		158
VROAK031.38	10/2/2007		0.91		4.2	304
VROAK031.38	8/14/2007		1.1		5	319
VROAK048.92	6/9/2008	1.2		4.9		289
VROAK048.92	4/24/2008					259.6
VROAK048.92	3/19/2008	0.98		6.3	6.2	125
VROAK048.92	11/1/2007					275.7
VROAK048.92	10/2/2007		0.83		3.7	291
VROAK048.92	8/13/2007		1.2		4.4	345
VRPIE000.29	3/26/2008	0.79		5.4		274.4
VRPIE000.29	11/13/2007		1		11	580.9
VRPIE000.29	8/15/2007		1.6		12	601.9
VRROU002.93	4/30/2008	1.4		21		533
VRROU002.93	3/25/2008	1.7		20		542.1
VRROU002.93	11/12/2007		1.5		19	547.7
VRROU002.93	8/13/2007		2.7		22	623.6
VRSPN000.78	6/9/2008	1.2		10		400
VRSPN000.78	3/26/2008	0.93		5.1		202
VRSPN000.78	10/4/2007		1.5		8.8	384
VRSPN000.78	8/14/2007		1.9		7.4	381
VRSYH000.25	5/16/2008	1.3		29		502
VRSYH000.25	3/25/2008	1.3		23		405.1
VRSYH000.25	11/12/2007		1.6	36		655.7
VRSYH000.25	8/13/2007		1.8		34	609.2
VRSYW001.72	6/11/2008	1.2		5.1		529
VRSYW001.72	3/20/2008	1		2.7		227
VRSYW001.72	10/3/2007		1.2		5.1	4
VRSYW001.72	8/15/2007		1.4		5	541
VRVER107.53	4/30/2008	3.1	3.1	52	52	765
VRVER107.53	4/3/2008	1.9		24		516.5
VRVER107.53	11/6/2007		2.5		40	675.9
VRVER107.53	8/28/2007		4		57	839.3
VRVER139.99	6/11/2008	2		24		504
VRVER139.99	3/20/2008	1.5		18		417
VRVER139.99	10/3/2007		2.1		25	3
VRVER139.99	8/14/2007		2.7		25	549
VRVER165.07	6/5/2008	3		56		582
VRVER165.07	3/20/2008	2.6		49		535

Site ID	Sample Date	K-D	K-T	NA-D	NA-T	SPCOND
VRVER165.07	10/4/2007		3.3		55	607
VRVER165.07	8/14/2007		3.8		54.5	638
VRWBV002.97	4/28/2008	2.6		22		510.8
VRWBV002.97	4/3/2008	1.6		9.8		309
VRWBV002.97	11/6/2007		2.5		22	531.2
VRWBV002.97	8/28/2007		3.9		21.5	361.4
VRWBV012.56	4/30/2008	1.6		6.4		237.7
VRWBV012.56	1/8/2008	1.5		2.15		82.1
VRWBV012.56	11/7/2007		1.3		6.1	239.1
VRWBV012.56	8/29/2007		1.5		6.2	217.3
VRWCL005.10	4/29/2008	1.5		6.3		347.6
VRWCL005.10	4/3/2008	0.99		3.5		247.3
VRWCL005.10	11/7/2007		1.3		6.4	368.2
VRWCL005.10	8/29/2007		1.6		6.5	361.1
VRWCL036.37	5/8/2008	0.64		2.7		310.9
VRWCL036.37	11/8/2007		0.57		2.6	390
VRWCL036.37	8/31/2007		0.73		2.7	380
VRWOK000.82	6/10/2008	0.89		2.1		373
VRWOK000.82	3/21/2008	0.57		1.5		125
VRWOK000.82	10/2/2007		0.9		1.9	384
VRWOK000.82	8/13/2007		1.2		2	375

Site ID	Sample Date	SO4-T	SSC	AIR TEMP	H2O TEMP	TDS	TURBIDITY
SRBEV001.40	6/18/2008	7.7	10		20.16	76	12
SRBEV001.40	4/22/2008	8.8	ND	29.2	13.93	54	5.22
SRBEV001.40	10/23/2007	4.7	ND	21.9	6.2	91	8.82
SRBEV001.40	7/31/2007	6.1	25	28.9	21.41	79	14.4
SRBEV007.28	6/18/2008	7.3	NA	20.8	13.4	74	5.93
SRBEV007.28	4/22/2008	8.2	4	21.6	12.37	55	5.78
SRBEV007.28	10/22/2007	6	ND	16.8	10.49	82	1.08
SRBEV007.28	7/31/2007	7	ND	24.1	18.97	91	4.91
SRBEV009.56	5/19/2008	8.4	6	26.7	22.36	66	6.36
SRBEV009.56	3/19/2008	8.7	12	15	8.32	55.4	7.22
SRBEV009.56	8/1/2007	8.6	ND	19.4	19.09	76.1	2.27
SRBON001.69	6/16/2008	NA	14	28.7	22.15	90	16.1
SRBON001.69	4/22/2008	4.8	8	19.6	17.22	68	6.16
SRBON001.69	10/23/2007	NA	ND	13.3	2.88	96	3.5
SRBON001.69	8/1/2007	4	17	22.7	14.06	88	12
SRBWL005.79	10/31/2007	2.1	ND	9.6	5.2	72	0.57
SRBWL005.79	8/1/2007	3.6	ND	18	13.56	51.5	0.42
SRCGN009.78	6/17/2008	29	6	20.7	19.7	385	3.47
SRCGN009.78	5/2/2008	34	ND	17.2	13.88	365	1.07
SRCGN009.78	12/19/2007	54	ND	2.1	6.22	307	0.23
SRCGN009.78	8/29/2007	23	16	22.8	20.97	384.7	15.4
SRCHE013.65	6/18/2008	12	ND	26.8	21.2	278	2.06
SRCHE013.65	5/1/2008	13	ND	22.8	16.37	291	0.93
SRCHE013.65	3/21/2008	13	ND	13.2	9.28	240.3	1.29
SRCHE013.65	10/4/2007	12	9	27	18.38	280.3	2.46
SRCOO001.92	6/18/2008	29	ND	31.8	21.6	390	4.8
SRCOO001.92	4/20/2008	29	ND	25.1	18.06	351.5	1.9
SRCOO001.92	3/21/2008	30	ND	21	14.91	348.3	0.72
SRCOO001.92	10/4/2007	29	4	27.6	20.35	395	1.39
SRCYN045.73	5/13/2008	8.4	ND	6.8	8.55	134.4	2.25
SRCYN045.73	5/7/2008	8.5	ND	19.4	13.71	128.4	2.61
SRCYN045.73	11/27/2007	8.8	4	19.5	5.87	154	1.06
SRCYN045.73	9/18/2007	8.2	ND	25.9	18.68	147.5	2.02
SRFIS004.49	6/24/2008	4.1	ND	16	12.71	51	0.65
SRFIS004.49	5/20/2008	4.4	ND	20.7	9.92	43	1.19
SRFIS004.49	10/30/2007	2.3	ND	10.4	3.59	51	1.5
SRFIS004.49	7/31/2007	2.7	ND	14.5	13.64	42.7	5.68
SRHAG013.09	5/14/2008	11	ND		11.01	290.5	0.62
SRHAG013.09	3/26/2008	14	ND	21.1	13.77	298.8	0.8
SRHAG013.09	11/27/2007	12	4		7.65	307	0.43
SRHAG013.09	9/18/2007	11	ND	21.7	15.96	297.4	1.09
SRHAN000.06	5/19/2008	7.9	ND	26	22.11	71	5.21
SRHAN000.06	3/19/2008	9.2	ND	19	8.93	55.9	6.86
SRHAN000.06	7/30/2007	8.2	ND	16.9	19.7	39	2.9
SRHAN002.27	6/24/2008	7.5	ND	28.1	19.74	81	1.76
SRHAN002.27	5/21/2008	8.2	ND	19	8.85	66	2.47
SRHAN002.27	10/31/2007	6.7	ND	13.2	8.3	88	0.63
SRHAN002.27	7/31/2007	5.6	ND	18.1	14.67	82.3	2.25
SRHAY000.04	6/17/2008	NA	ND	27.1	14.47	57	2.65
SRHAY000.04	4/23/2008	4.4	ND		9.03	39	3.28
SRHAY000.04	10/23/2007	0.5	ND	24.1	8.1	57	0.67
SRHAY000.04	7/31/2007	0.5	ND	26.3	13.56	54	1.77

Site ID	Sample Date	SO4-T	SSC	AIR TEMP	H2O TEMP	TDS	TURBIDITY
SRHNC000.14	4/30/2008	36	ND	27.7	20.2	296	1.27
SRHNC000.14	12/17/2007	43	18	15	5.05	166	55.1
SRHNC000.14	8/28/2007	26	ND	21.7	20.46	255.5	7.29
SRPNL005.12	6/17/2008	1100	ND	33.6	20.7	1283	0.46
SRPNL005.12	4/23/2008	990	ND	17.9	11.68	1219	0.53
SRPNL005.12	12/18/2007	830	ND	3.2	6.49	1092	1.34
SRPNL005.12	8/27/2007	810	ND		25.5	1114	1.63
SRPNT008.48	6/17/2008	320	ND	27.5	22	720	0.59
SRPNT008.48	4/16/2008	260	ND	14.6	12.88	587	0.7
SRPNT008.48	12/18/2007	490	ND	13.5	11.62	829	1.23
SRPNT008.48	8/27/2007	640	8	32.3	24.97	1076	9.05
SRSNK001.33	5/20/2008	5.7	ND	23.8	10.43	48	2.8
SRSNK001.33	7/31/2007	1.1	ND	22.5	14.5	63.8	1.51
SRSPI011.63	5/12/2008	7.7	ND	29.4	16.89	239.4	0.1
SRSPI011.63	3/26/2008	8.9	ND	20.4	10.64	192.1	0.76
SRSPI011.63	11/27/2007	8.6	ND	11.5	4.21	279	0.32
SRSPI011.63	9/18/2007	4.7	ND	24.5	19.29	244.5	1.16
SRSTI000.38	6/18/2008	2.7	8	26.7	20.58	37	5.01
SRSTI000.38	10/23/2007	1.8	ND		7.97	52	3.37
SRSTI000.38	7/30/2007	NA	5	24.4	16.61	48	11.8
SRTON046.90	10/12/2007	8.5	13	11.7	13.51	230	20.2
SRTON053.87	6/24/2008			21.7	17.83		
SRTON053.87	5/27/2008			23.5	12.31		1.87
SRTON053.87	5/15/2008	16	7		11.87	189.5	0.7
SRTON053.87	5/1/2008			19	11.2		1.43
SRTON053.87	3/25/2008	9.5	ND	23.5	8.52	1027	3.8
SRTON053.87	11/28/2007	19	4	2.4	3.5	252	4.2
SRTON053.87	9/19/2007	10	34	20	16.17	251.7	62
SRTON053.87	10/24/2006				11.68		10.5
SRTON053.87	10/11/2006				15.1		22.9
SRTON059.43	5/14/2008	14	9		11.81	113	1.23
SRTON059.43	3/25/2008	9.8	ND	24.9	8.71	8.4	6.74
SRTON059.43	11/28/2007	21	ND	1.2	3.15	150	0.71
SRTON059.43	9/19/2007	8.55	4	14.1	12.53	126.4	3.27
SRTON059.43	10/24/2006				10.92		
SRTON059.43	10/11/2006				12.46		2.84
SRWFB005.34	6/17/2008	NA	ND	32.9	19.62	33	3.41
SRWFB005.34	4/23/2008	3.3	ND	29.2	8.46	29	5.91
SRWFB005.34	10/22/2007	NA	ND	5.5	8.55	46	1.07
SRWFB005.34	7/31/2007	NA	ND	29.3	16.08	44	4.33
SRWPN004.47	6/17/2008	110	5	33.1	22.5	546	1.21
SRWPN004.47	4/15/2008	96	ND	28.4	18.24	392	0.63
SRWPN004.47	3/20/2008	79	ND	21.6	13.91	358.1	0.41
SRWPN004.47	12/17/2007	68	ND	13.9	7.42	254	0.39
SRWRK007.97	6/16/2008	7.5	ND	27.4	15.8	203	0.67
SRWRK007.97	5/1/2008	7.7	ND	18.3	11.7	169	0.76
SRWRK007.97	12/18/2007	12	ND	6	3.34	119	4.26
SRWRK007.97	8/29/2007	NA	ND	23.6	17.54	220	0.58
VREVR023.59	6/25/2008		ND	28.3	23.6	242.1	3.23
VREVR023.59	3/26/2008	7.2	ND	24	13.83	237.1	1.92
VREVR023.59	8/14/2007	0.5	ND	37.3	27.64	218.4	6.6
VREVR045.50	5/1/2008	6.6	ND	14.6	10.5	337	0.67
VREVR045.50	3/27/2008	8.2	ND	11.2	7.33	252.1	2.2

Site ID	Sample Date	SO4-T	SSC	AIR TEMP	H2O TEMP	TDS	TURBIDITY
VREVR045.50	11/13/2007	3.9	ND	19.7	10.67	346.7	1.55
VREVR045.50	8/14/2007	NA	ND	27.4	12.72	94.6	6.52
VREVR051.15	6/24/2008		ND	20.2	13.16	188.7	1.1
VREVR051.15	3/27/2008	6	ND	2.9	5.4	76.3	7.18
VREVR051.15	11/13/2007	7.3	ND	18.2	8.25	181.8	1.34
VREVR051.15	8/14/2007	5.9	ND	18.7	15.59	168.2	3.03
VRFOS011.88	6/12/2008	26	ND	28	20.92	384	1.78
VRFOS011.88	4/2/2008	25	ND	22.8	20.19	371	0.34
VRFOS011.88	11/8/2007	25	ND	28.8	18.68	387.2	0.48
VRFOS011.88	8/30/2007	25	ND	23.4	22.58	389.9	1.21
VROAK002.96	4/28/2008	5	ND	28.3	16.95	283	5.56
VROAK002.96	1/7/2008	1.6	74	10.7	5.05	83.8	64.8
VROAK002.96	11/6/2007	4.4	7	21.8	13.45	275.6	5.73
VROAK002.96	8/28/2007	4.2	77	36.6	24.69	298.3	81.3
VROAK031.38	6/4/2008	NA	ND		17.72	197	1.68
VROAK031.38	3/19/2008	NA	ND	27.7	7.84	103	3.48
VROAK031.38	10/2/2007	NA	19		17.82	197	18.1
VROAK031.38	8/14/2007	NA	10	29.3	22.43	207	15.1
VROAK048.92	6/9/2008	NA	ND	36.3	20.2	188	0.93
VROAK048.92	4/24/2008			21.4	13.14		0.9
VROAK048.92	3/19/2008	NA	ND		4.51	81	4.38
VROAK048.92	11/1/2007				11.29		0.61
VROAK048.92	10/2/2007	NA	5	24.6	17.66	189	1.38
VROAK048.92	8/13/2007	NA	ND	25.5	21.52	224	2.04
VRPIE000.29	3/26/2008	4.8	ND	20.6	12.48	175.6	1.23
VRPIE000.29	11/13/2007	2	ND	27	16.14	372.1	0.79
VRPIE000.29	8/15/2007	4.1	ND	28.3	23.17	385.2	4.23
VRROU002.93	4/30/2008	13	ND	22.6	13.99	346	0.68
VRROU002.93	3/25/2008	15	ND	25.8	17.91	347	1.03
VRROU002.93	11/12/2007	9.3	ND	25.1	14.89	350.6	0.85
VRROU002.93	8/13/2007	5.5	ND	33.9	24.67	399.4	2.97
VRSPN000.78	6/9/2008	3.2	ND	38.9	21.7	260	3.75
VRSPN000.78	3/26/2008	NA	ND	32.2	13.07	132	5.46
VRSPN000.78	10/4/2007	2.9	55	25.9	19.34	249	38.1
VRSPN000.78	8/14/2007	1	150	33	25.01	247	166
VRSYH000.25	5/16/2008	8.4	ND	26.4	16.99	326	0.32
VRSYH000.25	3/25/2008	10	ND	20.5	15.2	259.3	0.42
VRSYH000.25	11/12/2007	11	ND	23.7	18.86	419.7	2.33
VRSYH000.25	8/13/2007	12	6	34	24.27	389	3.07
VRSYW001.72	6/11/2008	4.5	ND	27.1	19.58	344	1.71
VRSYW001.72	3/20/2008	NA	ND		10.77		1.96
VRSYW001.72	10/3/2007	4.5	29	25	20.95	2	22.4
VRSYW001.72	8/15/2007	4.4	34	25	22.43	352	45.8
VRVER107.53	4/30/2008	100	9.5	27.1	19.61	489.1	5.66
VRVER107.53	4/3/2008	47	17	22.2	15.1	330.7	18.8
VRVER107.53	11/6/2007	72	5	32	15.71	432.4	6.85
VRVER107.53	8/28/2007	110	42		26.65	537.2	48
VRVER139.99	6/11/2008	16	6	33.8	25.3	328	16
VRVER139.99	3/20/2008	14	20	27.9	15.36	271	16.7
VRVER139.99	10/3/2007	14	17	44.1	29.3	2	30.8
VRVER139.99	8/14/2007	15	130	37.6	27.83	357	144
VRVER165.07	6/5/2008	16	20	17.4	18.95	378	18.5
VRVER165.07	3/20/2008	16	ND	23.8	14.4	348	17.6

Site ID	Sample Date	SO4-T	SSC	AIR TEMP	H2O TEMP	TDS	TURBIDITY
VRVER165.07	10/4/2007	17	57.5	27	20.06	394	78.8
VRVER165.07	8/14/2007	17	105	27.8	28.16	415	125
VRWBV002.97	4/28/2008	6.8	ND	30.9	19.6	327.1	
VRWBV002.97	4/3/2008	4.4	ND	21.6	15.29	918	1.7
VRWBV002.97	11/6/2007	4.8	44	29.2	14.41	340	16.9
VRWBV002.97	8/28/2007	4.35	165	37	26.99	231.6	250
VRWBV012.56	4/30/2008	NA	ND	21	15.06	152	1.04
VRWBV012.56	1/8/2008	6.2	4	4.1	2.5		53.4
VRWBV012.56	11/7/2007	1.8	ND	13.8	14.08	153.3	2.35
VRWBV012.56	8/29/2007	NA	10	33.5	21.05	139	7.97
VRWCL005.10	4/29/2008	1.6	ND	19.3	14.6	222.5	2.43
VRWCL005.10	4/3/2008	NA	ND	13.5	11.06	158.2	1.63
VRWCL005.10	11/7/2007	2.6	ND	23.8	13.27	235.8	
VRWCL005.10	8/29/2007	NA	ND		22.8	231.3	8.18
VRWCL036.37	5/8/2008	NA	ND	16.9	9.07	198.9	0.81
VRWCL036.37	11/8/2007	1.4	ND		7.65	249.4	0.94
VRWCL036.37	8/31/2007	NA	37	31.9	18.59	243.3	5.26
VRWOK000.82	6/10/2008	NA	ND	30.3	21.31	243	1.4
VRWOK000.82	3/21/2008	NA	ND		2.25	81	2.9
VRWOK000.82	10/2/2007	NA	ND	25.6	15.56	249	2.56
VRWOK000.82	8/13/2007	NA	19	34	21.47	244	2.35

APPENDIX B - RAW STATISTICS

The summary statistics below include all variables where sufficient data was available for analysis. These statistics were compiled from the data presented in Appendix A. Half the mean reporting limit (MRL) was used for all non-detect values (ND). All values were calculated with a 95% confidence interval and an alpha = 0.05.

ALKPHEN	Q1	Q2	Q3	Q4
Mean	2.75	3.63	3.53	2.50
Standard Error	0.32	0.66	0.80	0.29
Median	1.00	3.10	1.00	1.00
Standard Deviation	2.47	3.17	3.90	2.27
Count	61.00	23.00	24.00	62.00

NH3	Q1	Q2	Q3	Q4
Mean	0.0158	0.0235	0.0286	0.0176
Standard Error	0.0033	0.0037	0.0076	0.0019
Median	0.0100	0.0225	0.0150	0.0100
Standard Deviation	0.0262	0.0130	0.0322	0.0148
Count	61.0000	12.0000	18.0000	60.0000

DO mg/l	Q1	Q2	Q3	Q4
Mean	8.04	11.05	10.00	8.55
Standard Error	0.28	0.36	0.51	0.16
Median	7.54	11.23	9.44	8.74
Standard Deviation	2.03	1.76	2.21	1.24
Count	53.00	24.00	19.00	60.00

CO3	Q1	Q2	Q3	Q4
Mean	3.19	4.23	4.15	2.88
Standard Error	0.39	0.79	0.98	0.36
Median	1.00	3.70	1.00	1.00
Standard Deviation	3.04	3.81	4.80	2.86
Count	61.00	23.00	24.00	62.00

HARDNESS	Q1	Q2	Q3	Q4
Mean	179.53	267.13	148.05	204.84
Standard Error	21.80	39.25	18.38	26.12
Median	180.00	220.00	145.00	180.00
Standard Deviation	170.27	188.23	86.21	205.70
Count	61.00	23.00	22.00	62.00

DO%	Q1	Q2	Q3	Q4
Mean	88.72	101.06	93.67	92.99
Standard Error	2.39	2.53	5.25	2.00
Median	90.30	96.45	95.50	94.45
Standard Deviation	17.39	12.39	22.89	15.48
Count	53.00	24.00	19.00	60.00

HCO3	Q1	Q2	Q3	Q4
Mean	189.38	234.61	160.88	189.74
Standard Error	14.94	20.55	19.20	14.91
Median	210.00	240.00	155.00	195.00
Standard Deviation	116.70	98.55	94.06	117.40
Count	61.00	23.00	24.00	62.00

HARDCACO3	Q1	Q2	Q3	Q4
Mean	182.38	266.52	152.61	209.73
Standard Error	22.10	39.70	18.15	27.75
Median	180.00	220.00	155.00	185.00
Standard Deviation	172.59	190.40	85.12	218.47
Count	61.00	23.00	22.00	62.00

E. coli	Q1	Q2	Q3	Q4
Mean	44.06	8.45	45.37	9.42
Standard Error	14.94	2.15	27.01	3.21
Median	13.00	3.00	2.00	1.00
Standard Deviation	109.78	9.87	117.71	22.89
Count	54.00	21.00	19.00	51.00

P-T	Q1	Q2	Q3	Q4
Mean	0.4813	0.0397	0.0425	0.0358
Standard Error	0.4351	0.0091	0.0093	0.0033
Median	0.0430	0.0255	0.0280	0.0280
Standard Deviation	1.8461	0.0427	0.0455	0.0270
Count	18.0000	22.0000	24.0000	66.0000

TKN	Q1	Q2	Q3	Q4
Mean	0.1716	0.2435	0.1457	0.1129
Standard Error	0.0380	0.0273	0.0137	0.0091
Median	0.1100	0.2000	0.1000	0.1000
Standard Deviation	0.1565	0.1308	0.0656	0.0736
Count	17.0000	23.0000	23.0000	66.0000

SO4-T	Q1	Q2	Q3	Q4
Mean	31.43	74.43	11.40	58.67
Standard Error	16.71	40.22	3.24	24.91
Median	4.40	11.00	8.80	8.05
Standard Deviation	130.55	192.87	15.89	192.93
Count	61.00	23.00	24.00	60.00

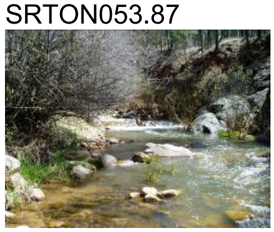
ALKCACO3	Q1	Q2	Q3	Q4
Mean	177.04	198.39	136.71	159.06
Standard Error	13.45	17.22	16.89	12.52
Median	190.00	200.00	125.00	165.00
Standard Deviation	97.00	82.59	82.76	98.60
Count	52.00	23.00	24.00	62.00

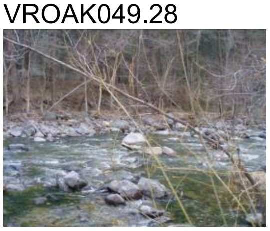
MN-T	Q1	Q2	Q3	Q4
Mean	0.0471	0.2569	0.0269	0.0338
Standard Error	0.0054	0.2202	0.0019	0.0067
Median	0.0250	0.0250	0.0250	0.0250
Standard Deviation	0.0424	1.0562	0.0092	0.0528
Count	61.0000	23.0000	24.0000	62.0000

F-TOTAL	Q1	Q2	Q3	Q4
Mean	0.19	0.34	0.22	0.23
Standard Error	0.05	0.15	0.11	0.05
Median	0.05	0.11	0.05	0.10
Standard Deviation	0.43	0.71	0.52	0.39
Count	61.00	23.00	24.00	62.00

TDS	Q1	Q2	Q3	Q4
Mean	220.83	332.77	4611.53	271.31
Standard Error	26.51	46.11	3734.17	31.92
Median	207.00	279.00	279.00	230.95
Standard Deviation	207.07	221.12	13463.73	251.35
Count	61.00	23.00	13.00	62.00

APPENDIX C - SITE PHOTOS

SRBEV001.40 	SRBEV007.28 	SRBEV009.56 	SRBON001.69 
SRBWL005.79 	SRCGN009.78 	SRCHE0011.0 	SRCOO001.92 
SRCYN045.73 	SRFIS004.49 	SRHAG013.09 	SRHAN000.06 
SRHAN002.27 	SRHAY000.04 	SRHNC000.14 	SRPNL005.12 
SRPNT008.48 	SRSNK001.33 	SRSPI011.63 	SRSTI000.38 
SRTON046.90 	SRTON053.87 	SRTON059.43 	SRWFB005.34 

SRWPN004.47 	SRWRK007.97 	VREVR023.59 	VREVR045.50 
VREVR051.15 	VRFOS011.88 	VROAK002.96 	VROAK031.38 
VROAK049.28 	VRPIE000.29 	VRROU002.93 	VRSPN000.78 
VRSYH000.25 	VRSYW001.72 	VRVER053.70 	VRVER107.53 
VRVER139.99 	VRVER165.07 	VRWBV002.97 	VRWBV012.56 
VRWCL005.10 	VRWCL036.37 	VRWOK000.82 	

APPENDIX D - MACROINVERTEBRATE RESULTS

Warm Water Macroinvertebrate Metrics - Assessment categories: Meeting IBI ≥ 50, Inconclusive IBI = 40-49, Violating IBI < 40 (*highlighted areas indicate samples predicted to be violating the biocriteria standard due to natural flood conditions of winter 2008)

Site ID	Index	Sample Date	Total Taxa	Diptera Taxa	HBI	Percent Scraper	Scraper Taxa	Caddisfly Taxa	Mayfly Taxa	Percent Mayflies	Percent Dominant Taxon	IBI Score	Flood Return Interval (est.)	Assessment Category
SRCGN009.78	Fall	11-18-2008	22	11	5.92	0.00	0	3	2	5.94	47.84	40.9		Inconclusive
SRPNL005.12	Fall	09-30-2008	35	9	6.15	1.90	4	9	2	16.73	21.67	63.1		Meeting
SRPNT008.48	Fall	10-20-2008	34	9	6.59	9.54	4	7	4	44.47	30.53	68.6		Meeting
SRSPI011.63	Fall	11-05-2008	37	5	6.37	4.93	6	8	8	59.67	24.82	76.0		Meeting
SRTON053.87	Fall	11-04-2008	26	4	5.59	7.71	9	6	5	69	29.77	70.7		Meeting
SRWPN004.47	Fall	09-30-2008	31	8	6.63	0.20	1	6	5	8.45	28.49	52.0		Meeting
VREVR023.59	Fall	11-06-2008	26	3	6.59	15.20	4	7	5	40.15	28.52	63.0	8	Meeting
VRSYW000.77	Fall	11-04-2008	24	5	6.27	5.43	3	6	3	2.52	70.74	43.7		Inconclusive
VRVER165.07	Fall	11-03-2008	26	2	6.16	3.52	4	5	7	61.13	18.95	62.0		Meeting
VRWBV012.56	Fall	11-06-2008	27	8	5.94	8.56	6	6	5	13.04	60.51	60.4		Meeting
SRCGN009.78	Spring	05-02-2008	18	8	5.89	0.00	0	2	1	14.29	68.92	33.5*	30	Violating
SRCHE013.65	Spring	05-01-2008	14	2	5.87	0.36	2	1	4	19.78	69.51	32.3*	25	Violating
SRCOO001.92	Spring	04-20-2008	15	4	5.85	1.38	1	3	2	15.22	58.89	34.4*	25	Violating
SRPNL005.12	Spring	04-23-2008	17	6	6.83	0.55	2	2	1	2.37	38.8	34.6*	5	Violating
SRPNT008.48	Spring	04-16-2008	9	4	6.12	1.36	1	0	2	2.14	45.53	28.1*	30	Violating
SRSPI011.63	Spring	05-12-2008	14	5	5.68	0.18	1	1	3	31.91	58.82	36.5*	18	Violating
SRTON053.87	Spring	05-15-2008	20	3	5.96	2.35	4	4	5	6.65	76.13	41.0	18	Inconclusive
SRWPN004.47	Spring	04-15-2008	14	7	6.19	0.71	2	1	0	0	55.12	31.2*	30	Violating
VREVR023.59	Spring	06-25-2008	16	3	5.64	1.80	2	4	4	31.54	31.74	45.9		Inconclusive
VRFOS014.33	Spring	06-13-2008	33	11	6.33	5.37	5	7	6	36.78	20.48	72.3	8	Meeting
VROAK031.38	Spring	06-04-2008	21	6	5.45	1.92	4	2	5	60.58	59.62	53.9	2	Meeting
VRROU002.93	Spring	04-30-2008	17	6	5.88	0.19	1	2	2	17.35	37.87	38.6*	8	Violating
VRSYH000.25	Spring	05-16-2008	21	5	5.90	0.71	2	2	3	9.56	74.51	35.5*	8	Violating
VRSYW001.72	Spring	06-11-2008	20	5	6.32	2.22	2	6	4	25.88	27.17	50.2	2	Meeting
VRVER053.70	Spring	05-16-2008	27	3	5.39	13.77	4	7	9	63.33	22.18	74.8	8	Meeting
VRVER165.07	Spring	06-05-2008	18	3	6.30	29.12	3	6	5	15.52	28.35	58.5	3.5	Meeting
VRWBV002.97	Spring	04-28-2008	15	3	5.59	0.74	2	3	4	42.7	40.11	44.6	3.5	Inconclusive
VRWBV012.56	Spring	04-30-2008	22	7	5.69	3.30	4	2	5	38.1	34.8	55.3	3.5	Meeting
VRWCL005.10	Spring	04-29-2008	18	3	5.71	2.86	2	4	5	33.93	38.39	47.5	8	Inconclusive

Cold Water Macroinvertebrate Metrics - Assessment categories: Meeting IBI ≥ 52, Inconclusive IBI = 46-51, Violating IBI ≤ 45 (*highlighted areas indicate samples predicted to be violating the biocriteria standard due to natural flood conditions of winter 2008).

StationID	Index	Sample Date	Total Taxa	Diptera Taxa	Intolerant Taxa	HBI	Percent Stoneflies	Percent Scraper	Scraper Taxa	IBI Score	Flood Return Interval (est.)	Assessment Category
SRBEV007.28	Fall	10-22-2008	33	10	5	5.75	2.18	6.07	7	60.5		Meeting
SRBON001.69	Fall	10-22-2008	17	3	1	5.36	0.00	6.00	4	31.2	3.5	Violating
SRCYN045.73	Fall	10-21-2008	30	5	2	5.80	0.75	47.38	10	60.8		Meeting
SRWFB005.34	Fall	10-22-2008	42	6	8	4.97	0.58	27.75	11	72.3		Meeting

StationID	Index	Sample Date	Total Taxa	Diptera Taxa	Intolerant Taxa	HBI	Percent Stoneflies	Percent Scraper	Scraper Taxa	IBI Score	Flood Return Interval (est.)	Assessment Category
SRWRK007.97	Fall	11-18-2008	27	7	6	4.97	14.00	14.20	3	64.9		Meeting
VREVR051.15	Fall	10-20-2008	39	6	4	5.54	0.56	29.35	10	65.4		Meeting
VROAK048.92	Fall	11-05-2008	48	11	1	5.82	0.00	19.19	11	61.7		Meeting
VRWOK000.82	Fall	11-05-2008	47	6	1	5.64	5.95	14.05	9	55.8	2	Meeting
SRBEV007.28	Spring	06-18-2008	25	7	2	5.14	6.52	23.73	6	55.5	3.5	Meeting
SRBON001.69	Spring	06-16-2008	24	6	1	5.78	0.39	5.27	4	36.8		Violating
SRCYN045.73	Spring	05-13-2008	19	4	1	5.98	0.00	2.48	5	31.9*	18	Violating
SRFIS004.49	Spring	06-24-2008	27	5	4	5.47	9.11	30.86	7	63.1	3.5	Meeting
SRHAN002.27	Spring	06-24-2008	31	8	6	4.42	8.19	34.29	8	77.5	3.5	Meeting
SRHAY000.04	Spring	06-17-2008	40	8	4	5.61	1.28	20.95	11	66.9	3.5	Meeting
SRSTI000.38	Spring	06-18-2008	34	6	4	5.60	0.57	33.46	6	59.8	3.5	Meeting
SRTON059.43	Spring	05-14-2008	17	5	3	5.83	0.38	2.29	5	37.9*	18	Violating
SRWFB005.34	Spring	06-17-2008	30	6	3	5.41	1.32	27.63	10	60.3	3.5	Meeting
SRWRK007.97	Spring	06-16-2008	16	4	0	5.58	2.46	2.46	2	27.4*	25	Violating
VREVR045.50	Spring	05-01-2008	10	3	0	5.72	0.00	1.57	1	20.1*	8	Violating
VREVR051.15	Spring	06-24-2008	31	10	2	5.48	2.69	11.13	4	51.3	8	Inconclusive
VROAK048.92	Spring	06-09-2008	26	7	1	5.74	0.00	3.05	5	39.3	2	Violating
VRWOK000.82	Spring	06-10-2008	34	7	1	5.75	0.00	7.00	9	48.7		Inconclusive
SRBLR102.24	Summer	07-10-2008	36	6	3	5.44	2.04	19.07	10	60.3	3.5	Meeting
VROAK048.36	Summer	07-08-2008	25	7	2	5.32	0.00	6.11	7	45.9	2	Inconclusive
VRWCL036.37	Summer	07-09-2008	40	7	2	5.24	1.37	22.90	11	62.5	8	Meeting

Macroinvertebrates were not collected or reported for the following sites. The rational for not collecting / reporting is listed after each site.
SRBEV001.40 – intermittent
SRHAG013.09 – travertine
SRHAN000.06 – ephemeral
VRFOS011.88 – travertine
SRHNC000.14 – intermittent

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