ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Total Maximum Daily Load For:
Tonto Creek (Headwaters to Haigler Creek)
and
Christopher Creek
Salt River Watershed
Tonto National Forest near Payson, Gila County, Arizona
HUC-Reach: 15060105-013A
HUC-Reach: 15060105-013B
HUC-Reach: 15060105-353

Parameter: **Bacteria (Escherichia Coliform)**

June 29, 2004

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ACRONYMS

ADEQ	Arizona Department of Environmental Quality
AZPDES	Arizona Pollutant Discharge Elimination Systems (Arizona's NPDES program)
CWA	Clean Water Act
HUC	Hydrologic Unit Code
LA	Load Allocation (Non-Point Sources)
MOS	Margin of Safety
NPDES	National Pollutant Discharge Elimination Systems (CWA point source permits program)
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency (also EPA)
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WLA	Waste Load Allocation (Point Source)
WQS	Water Quality Standards

cfs	cubic feet per second (commonly used discharge measurement unit)
ft	feet
cfu/100 ml	Colony Forming Units per 100 milliliters (bacteria measurement unit)

DEFINITIONS OF TERMS USED IN THIS REPORT

Baseflow (discharge)	The perennial portion of the stream discharge; the flow not directly dependent on precipitation events. In the case of an ephemeral stream, baseflow equals zero.
Ephemeral	A stream that has a channel that is at all times above the water table and that flows only in direct response to precipitation.
Intermittent	A stream or reach of a stream that flows continuously only at certain times of the year, as when it receives water from a spring or from another surface source, such as melting snow. (AAC R18-11-101(30))
Perennial	A surface water which flows continuously throughout the year. (A.A.C. R18-11-101(38))
Point source	Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fixture, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft from which pollutants are or may be discharged. (40 CFR 122.2)

NOTE: The Arizona Department of Environmental Quality (ADEQ) uses United States Geological Survey (USGS) maps as the source of names for streams, mines, and other features. Where local usage varies, such differences are noted.

PREFACE

The Clean Water Act (CWA) §303[d] and Its Significance

The CWA §303[d][1][A] requires that "each State shall identify those waters within its boundaries for which the effluent limitations...are not stringent enough to implement any water quality standard applicable to such waters." This act also requires states to establish Total Maximum Daily Loads (TMDLs) for such waters.

The CWA §303[d] requires states to submit to the United States Environmental Protection Agency (USEPA) a list of the surface waterbodies for which the designated use (e.g. irrigation, partial body contact, etc.) of that waterbody is impaired or "water quality limited". Surface water quality data are compared with water quality standards and other criteria to determine whether the waterbody is meeting its designated uses. ADEQ publishes a report on the status of surface water and groundwater quality in Arizona every two years (in accordance with the CWA §305(b)) and from this report derives the "Impaired Waters" or "303[d] List".

The TMDL process provides a flexible assessment and planning framework for identifying load reductions or other actions needed to attain surface water quality standards; i.e. water quality goals to protect aquatic life, drinking water, and other water uses. The CWA established the TMDL process to guide application of state surface water quality standards to individual waterbodies and their watersheds.

TMDL Defined

The requirements of a TMDL analysis are described in 40 CFR §130.2 & §130.7, based upon CWA §303[d]. A TMDL is described as "the sum of the individual wasteload allocations for point sources and load allocations for non-point sources and natural background" and a margin of safety such that the capacity of the waterbody to assimilate pollutant loadings is not exceeded. Represented as a mathematical equation:

$$TMDL = WLA + LA + MOS,$$

where WLA is the wasteload allocation consisting of loads from point sources, LA is the load allocation consisting of non-point source loads, and MOS is a Margin of Safety which serves to address uncertainties in the analysis and the natural system.

The TMDL Process

A TMDL analysis is a tool for implementing state surface water quality standards and is based on the relationship between pollution sources and in-stream water quality conditions. The TMDL process is a method used in balancing the pollution concerns for a waterbody and allocating the acceptable pollutant loads among the different point and non-point sources allowing the selection and implementation of suitable control measures to attain water quality standards.

In implementing TMDLs, certain criteria must be taken into account. These criteria include loading capacity, load allocation, wasteload allocation, natural background, and the margin of safety. The loading capacity is the greatest amount of loading that a waterbody can receive without violating water quality standards. Load allocation is the portion of a receiving water's loading capacity that is attributed either to one of its existing non-point sources of pollution or to natural background sources. The portion of the receiving waters' loading capacity that is attributed to existing point sources of pollution is known as the wasteload allocation. Finally, the margin of safety is the factor that accounts for any uncertainty in the relationship between the pollutant loads and the quality of the receiving waterbody (40 CFR §130.2[f-g]). Total pollutant loads are determined by combining the point, non-point and background sources of pollution.

ADEQ has adopted a stakeholder process for many of its programs, including TMDLs. ADEQ works closely with affected stakeholders in developing the TMDL by holding meetings to solicit input on a variety of topics including background information; potential modeling scenarios; identifying possible pollutant sources for allocation; and discussing potential implementation strategies. Once TMDLs are developed for all the water quality problems, they are submitted to the EPA for review and approval.

The TMDL process is not complete once waste load allocations and load allocations have been determined. Assessment of the TMDL effectiveness must be made. Ideally, this would begin within two years after implementation and continue for the period necessary to measure effectiveness of any implementation actions to ensure Surface Water Quality standards are attained.

Project History

In 1994, the Arizona Department of Game and Fish (ADGF) requested review of the nutrient water quality standards for Tonto Creek. ADEQ performed the review, however, the agency did not find reason to change the standards. As a result, the ADGF requested a variance for its National Pollution Discharge Elimination System (NPDES) discharge permit for the Tonto Creek hatchery. From 1994 through 1996, as a part of an investigation triggered by the ADGF requests, ADEQ measured *E.coli* levels in upper Tonto Creek and Christopher Creek. This data was sufficient to determine impairment which resulted in the 303[d]-listing, but was insufficient by itself to isolate sources or calculate loads; therefore, ADEQ supplemented the historic data by collecting additional data specific to the goals of source quantification and TMDL calculation.

Analysis of historic sampling indicates that high bacteria levels appeared to correlate with high recreation times; i.e., summer holiday weekends. Based on this, ADEQ conducted source identification sampling during the summers of 2000, 2002, 2003 and the fall of 2003. ADEQ also conducted intensive bacteria sampling of recreation areas during the Memorial Day, 2000 and Labor Day, 2000 weekends. Sites were established at the beginning and end of the reach; upstream and downstream of potential point and nonpoint sources; and at several other accessible monitoring locations. Samples were collected to discern pollutant sources, the extent of impairment, and allow for the calculation of pollutant loads and allocations.

303[d] Listing History

Tonto Creek (headwaters - Haigler Creek)

- The 1996 303(d) list added impairments due to nitrogen and phosphorus.
- The 1998 303(d) list identified impairments due to nitrogen and phosphorus and added *E. coli.*
- The 2002 303(d) list added impairment due to turbidity and delisted phosphorous and nitrogen and moved *E. coli* to the planning list.

Christopher Creek

- The 1998 303(d) list added impairment due to nitrogen.
- The 2002 303(d) list added impairment due to turbidity and delisted nitrogen.

PURPOSE

This study focused on the uppermost, approximately, ten miles of Tonto Creek from its headwaters to Haigler Creek and the input of its major tributary, Christopher Creek.

The purpose of this study was to collect sufficient data that would permit the identification of load sources and calculation of a TMDL and necessary reductions for each source of *E. coli* when combined with the historic data. Meeting proposed load reductions will ensure that these waterbodies meet the *E. coli* standard for Full Body Contact.

Concurrent with this study, samples were collected to support source identification, and load allocation, and TMDL calculation for nitrogen in Tonto Creek. The Tonto Creek nitrogen TMDL are covered in a separate report.

PHYSICAL SETTING (from Upper Tonto Creek Intensive Survey, ADEQ, 1995)

The project area (Figure 1) is located within the northeastern portion of the Tonto National Forest, Gila County, Arizona. The closest town is Payson, Arizona. The approximate center of the basin is: latitude: 34° 20'N, longitude: 111° 05' W.

Two major perennial streams, Tonto and Christopher Creeks, and three minor streams, Hunter, Horton, and Dick Williams Creeks, are located in the project area. Hunter Creek is tributary to Christopher Creek and Christopher, Horton, and Dick Williams Creeks are tributary to Tonto Creek. The upper Tonto Creek basin and the Christopher Creek Basin cover approximately 30 square miles each.

Project area elevation ranges from approximately 6,500 feet (ft) at the upper end of the perennial reaches to just below 5,000 ft near Bear Flats, for a relief of approximately 1,500 ft.

The project area is characterized by mild summers and cold winters. The area receives approximately 28 inches of precipitation annually (Western Regional Climatic Center website). The precipitation pattern is divided into two distinct seasons, winter (December-March) and monsoon (July-September).

The Tonto Creek basin is covered by a predominately Ponderosa Pine forest, but the northwestern portion of the basin was decimated by the Dude Fire in 1992 and is currently dominated by grasses, scrub, snags, and scattered groves of pines.

A telephone conversation (2/5/04) with Glen Knowles, a biologist with the United States Fish and Wildlife Service (USFWS), brought forth the information that while presence of threatened or endangered species in the subject stream segment is not confirmed, potential habitat for the following is present: Spike Dace, Loach Minnow, Headwater Chub, Chiricahua Leopard Frog, and Bald Eagle. It is not believed that these are directly threatened by the presence of the subject stressor, *E. coli*.

The geology of the project basin is predominately sedimentary rocks including limestone, sandstone, and shale. The basin fill is mainly clay and silt with some sand and gravel.

Hydrology

The subject streams and reaches are described in the Arizona surface water quality standards as, "Headwaters to confluence with unnamed tributary at 34° 18' 10"/111° 04' 14"" , "un-named tributary at 34° 18' 10"/111° 04' 14" to Haigler Creek " and "Tributary to Tonto Creek at 34° 18' 36"/111° 04' 23""

Upstream of the springs above the hatchery, flow is either intermittent or ephemeral (undetermined and not relevant to the purposes of this investigation). From the springs to the end of the listed reach, flow is perennial. Based upon measurements at baseflow, groundwater (from the headwaters springs and other un-delineated springs along the reach) is the primary source of flow in the perennial portion of the stream. During the course of this project, measured discharges ranged from 0.04 to 107 cubic feet per second (cfs) at various points along the subject reach. Field observations confirm that all of the tributaries to upper Tonto Creek, except for Christopher Creek, are intermittent or ephemeral.

Land Use/Land Ownership

The upper Tonto Creek basin is wholly contained within the Tonto National Forest, and as such, is available for recreational usage. Various privately-owned properties that are primarily used for recreational purposes (e.g., summer cabins) are located within the basin.

The subject basin is bisected from east to west by Highway 260 which is lined, at both Tonto Creek and Christopher Creek, with various cabins, lodges, stores, and restaurants. Highway 260 is in the process of being widened to four lanes and re-routed to allow gentler curves and slopes. This widening project began in the Christopher Creek area during Summer 2002 and was mostly completed by Summer 2003 and began in the Tonto Creek area during Fall 2003.

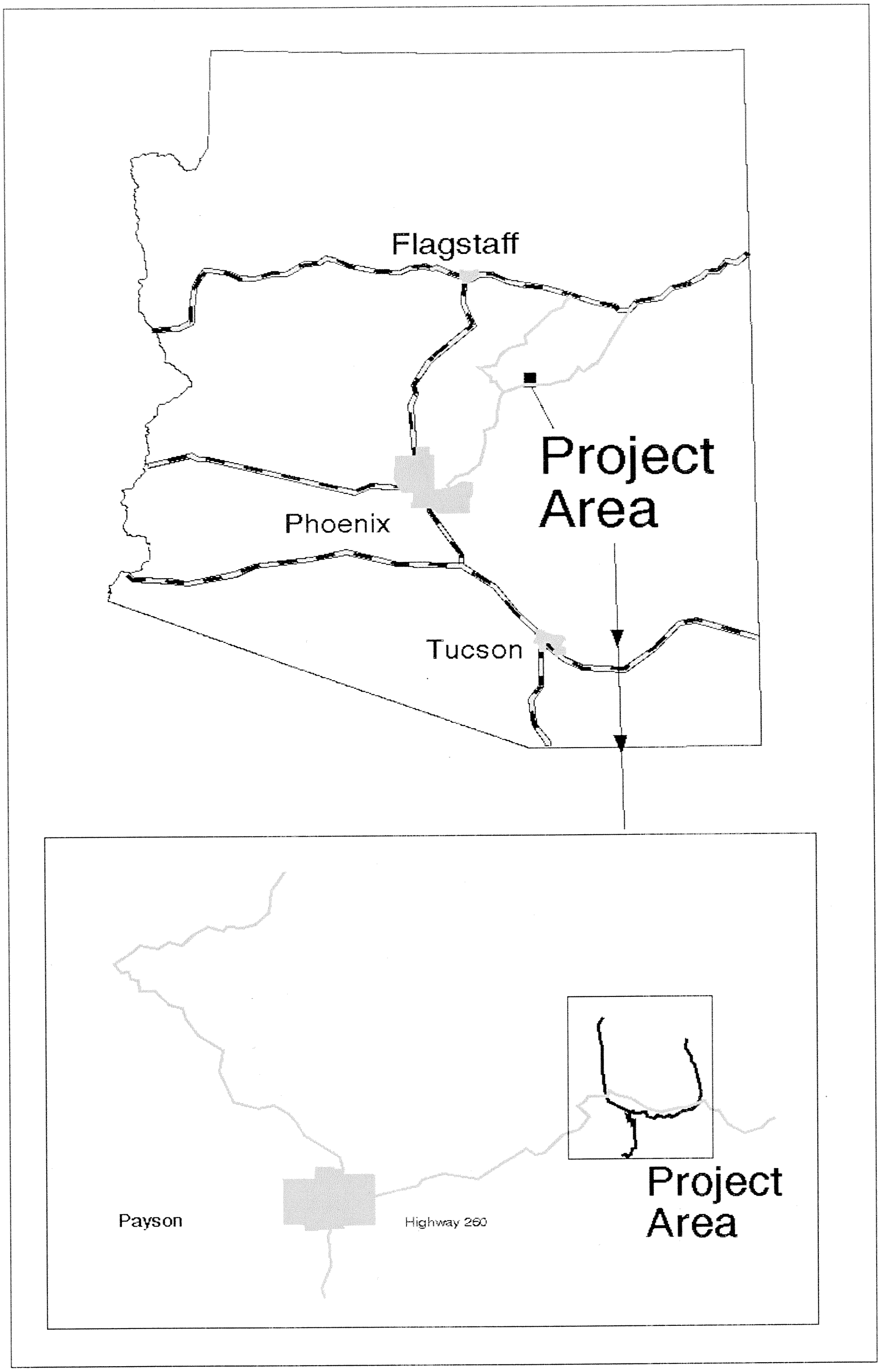

Figure 1
Tonto & Christopher Creeks
TMDL Project

Bob Scalamera
ADEQ/WQD/HSAS/TMDL Unit
03/30/04

NUMERIC TARGETS

The numeric target for the listed pollutant has been set so that the most stringent water quality standard for the assigned designated uses can be met.

Designated Uses

The **2004 303(d) list** identifies the following stream segments as either impaired by *E. coli.* or potentially impaired (planning list)

- Tonto Creek, HUC-Reach: 15060105-013A
  Headwaters to un-named tributary at 34° 18' 10"/111° 04' 14" (approximately equivalent to the 5000' MSL elevation line.)

- Tonto Creek, HUC-Reach: 15060105-013B
  un-named tributary at 34° 18' 10"/111° 04' 14" to Haigler Creek

- Christopher Creek HUC-Reach: 15060105-353
  Headwaters to Tonto Creek

Designated Uses:
A&Wc - Aquatic and Wildlife cold water above 5000 foot elevation.
A&Ww - Aquatic and Wildlife warm water below 5000 foot elevation.
FBC - Full Body Contact (Only use affected and impaired by *E. coli*)
FC - Fish Consumption
AgL - Agricultural Livestock watering
AgI - Agricultural Irrigation

Surface Water Quality Standards (WQS)

(from Arizona Administrative Code, Title 18, Chapter 11)

E. coli are measured in colony-forming units per 100 milliliters (cfu/100ml). The applicable single sample standard is 235 cfu/100ml. There is also a geometric mean standard of 126 cfu/100ml, but in order to apply this standard, 4 samples must be collected from the same point (WQS) within a 30 day period (Impaired Waters Identification Rule - Arizona Administrative Code, Title 18, Chapter 11, Article 6).

Except for one month (May, 2000 - out of several years of data) at only four (out of 25) sites, ADEQ doesn't have enough data from Tonto and Christopher Creeks to calculate a geometric mean in accordance with the rules.

In "Protocol for Developing Pathogen TMDLS", EPA 841-R-00-002, January 2001, page 4-6, EPA states:

> "As many monitoring programs are based on quarterly sampling, there may not be enough historical data to support the use of the geometric mean criteria as the target. In this case the 'not to exceed' value may be used."

The "not to exceed value" is the single sample maximum; therefore, the Tonto/Christopher TMDL is based upon the single sample standard. The numeric target is 235 cfu/100ml.

In-stream Indicators

Reliable in-stream indicators related to bacteria impacts on water quality have not been observed in the subject watershed. The "normal" indicators (i.e., insects, fish, and vegetation) are not adversely affected by *E. coli*.

Sampling Measurements

Tables 1 through 26 display the summary of measured concentrations and discharge. Unless otherwise noted, all displayed data were used to calculate the TMDL and associated loads.

Figures 2 and 3 display the locations of ADEQ sample sites.

Samples were analyzed using the USEPA-approved Colilert® method.

SOURCE IDENTIFICATION, LINKAGE ANALYSIS AND SAMPLE COLLECTION POINTS

The primary objective of this investigation was to collect data sufficient to isolate, geographically and temporally, and quantify the primary pollutant load sources in the project area. All significant sources have been identified and linkages between these significant sources and loads are discussed below.

Other than the Tonto Creek Fish Hatchery (its permit doesn't cover bacteria), there are no known AZPDES-permitted point sources in the subject basin; however, a complete review of all sources may result in the classification of some as point source which would then require AZPDES discharge permits.

In addition to natural background, there are several additional sources including basin-wide recreational uses and unincorporated communities/summer home clusters located in the project area.

Tonto Creek was monitored from its headwaters to the upstream end of the wilderness area just downstream from Bear Flats. The wilderness area between Bear Flats and Haigler Creek has no previous monitoring data or non-natural sources in its approximately six mile reach. Christopher Creek was monitored in its entirety.

ADEQ has developed a system for naming surface water sample point I.D.s, for example: SRTON072.66 or SRCRS000.08. The first two characters are the major basin code ("SR" is the Salt River), the next three characters are the stream code ("TON" for Tonto Creek, "CRS" for Christopher Creek), and the number is the distance in miles from the stream mouth to the sample point. For purposes of this project, the number is the actual stream miles as measured on USGS maps in scales of 1:250,000 and 1:24,000.

Sample sites (Figures 2 and 3) were selected to meet TMDL project goals; i.e., identification and quantification of pollutant sources.

Table 1 SRTON073.00 (nat. bckgrnd)

Date	Flow (cfs)	E.Coli (cfu)
06/29/94	1	3
07/12/94	0.5	16
08/22/94	0.1	23
09/06/00	0.05	11
10/31/00	n/a	10
07/21/03	0.06	70
08/05/03	0.04	6
08/18/03	0.07	7
10/07/03	0.09	1
10/21/03	0.1	1

Table 2 SRTON072.66 (Downstream of hatchery)

Date	Flow (cfs)	E.Coli (cfu)
06/29/94	2.82	4
07/12/94	2.69	40
08/22/94	2.54	33
05/23/00	2.15	2
09/06/00	1.5	29
10/31/00	9.64	10
07/07/03	1.46	179
07/21/03	2.55	**365**
08/05/03	2.29	35
08/18/03	1.6	7
10/07/03	4	4
10/21/03	2.1	10

Table 3 SRTON071.72 (Upstream of Baptist Camp)

Date	Flow (cfs)	E.Coli (cfu)
05/23/00	1.99	91
09/06/00	1.7	11
10/31/00	7.03	6
07/07/03	2.25	28
07/21/03	2.27	54
08/05/03	1.87	26
08/18/03	2.01	20
10/07/03	2.34	91
10/21/03	2.23	50

Table 4 SRTON070.86 (Downstream of Baptist Camp)

Date	Flow (cfs)	E.Coli (cfu)
06/29/94	3.15	54
07/12/94	2.4	44
08/02/94	2.88	29
08/23/94	2.7	40
09/19/94	2.67	24
05/23/00	2.09	7
09/06/00	1.45	37
10/31/00	9.8	20
07/07/03	1.63	56
07/21/03	1.71	214
08/05/03	1.76	115
08/18/03	2.19	219
10/07/03	2.27	128
10/21/03	1.94	43

Table 5 SRTON070.00 (Upstream of Horton Ck.)

Date	Flow (cfs)	E.Coli (cfu)
07/08/03	1.84	16
08/06/03	1.59	**260**
08/19/03	1.53	84
10/07/03	2.06	68
10/21/03	1.46	20

Table 6 SRTON069.87 (Upstream of Horton Ck.)

Date	Flow (cfs)	E.Coli (cfu)
05/23/00	1.7	12
09/03/00	0.9	**659**
09/06/00	0.9	50
10/31/00	14	58

Table 7 SRTON069.83 (Downstream of Horton Ck.)

Date	Flow (cfs)	E.Coli (cfu)
07/08/03	0.93	13
07/23/03	1.27	228
08/06/03	1.57	205
08/19/03	1.23	76
10/07/03	2.16	93
10/21/03	1.35	20

Table 8 SRTON069.80 (Downstream of Horton Ck.)

Date	Flow (cfs)	E.Coli (cfu)
06/29/94	2.94	28
07/12/94	2.47	40
08/02/94	2.46	11
08/23/94	2.47	103
09/19/94	3.02	8
05/23/00	1.43	54
09/03/00	0.8	**436**
09/06/00	0.83	30
10/31/00	18.33	33

Table 9 SRTON069.08 (Upstream of new bridge)

Date	Flow (cfs)	E.Coli (cfu)
05/28/00	1.5	47
05/30/00	1.5	61
10/07/03	n/a	86

Table 10 SRTON068.95 (Center of new bridge)

Date	Flow (cfs)	E.COLI (cfu)
06/30/94	3.76	25
07/13/94	2.94	11
08/02/94	2.2	7
08/23/94	2.82	86
09/19/94	3	4
05/24/00	1.64	102
05/27/00	1.6	99
05/28/00	1.6	56
05/30/00	1.6	59
09/02/00	2.3	168
09/03/00	2.3	98
09/06/00	2.26	68
11/01/00	15.48	28

Table 11 SRTON068.77 (Downstream of new bridge, Upstream of Kohl's Ranch)

Date	Flow (cfs)	E.COLI (cfu)
07/08/03	1.25	6
07/23/03	1.61	**613**
08/06/03	1.02	135
08/19/03	1.08	91
10/07/03	1.56	161
10/21/03	1.55	9

5/2000 Geometric mean for SRTON068.95: 76

Table 12 SRTON068.00 (Downstream of Kohl's, Upstream of Tontozona)

Date	Flow (cfs)	E.COLI (cfu)
06/30/94	4.61	40
07/13/94	3.65	12
08/03/94	4.1	50
08/24/94	3.6	77
09/20/94	4.02	22
05/25/00	2.24	31
05/31/00	2.2	17
09/02/00	2.1	199
09/03/00	2.3	96
09/06/00	2.3	91
10/31/00	20	140
07/08/03	n/a	40
07/22/03	n/a	158
08/06/03	n/a	179
08/19/03	n/a	111
10/08/03	n/a	46
10/22/03	n/a	28

Table 13 SRTON067.95 (Downstream of Tontozona)

Date	Flow (cfs)	E.COLI (cfu)
06/30/94	5.02	28
07/13/94	2.76	9
08/03/94	5.05	13
08/24/94	4.68	64
09/20/94	6.06	14

Table 14 SRTON066.90 (Upstream of Christopher Ck)

Date	Flow (cfs)	E.Coli (cfu)
08/30/96	2.59	20
08/31/96	2.32	20
09/01/96	1.62	220
09/02/96	2	190
05/25/00	2.31	12
05/28/00	2.3	3
05/31/00	2.3	9
09/04/00	2.31	141
11/01/00	22.03	53
07/09/03	2.74	17
07/30/03	2.78	**2419**
08/12/03	1.41	**520**
08/20/03	4.27	**2419**
10/09/03	n/a	55
10/23/03	1.56	12

Table 15 SRTON066.80 (Downstream of Christopher Ck)

Date	Flow (cfs)	E.Coli (cfu)
08/30/96	3.49	**400**
08/31/96	2.61	130
09/01/96	2.88	230
09/02/96	2.71	**240**
12/21/99	5	2
05/02/00	3.96	4
09/06/00	2.7	86
06/06/01	4.72	100
07/18/01	2.7	40
09/07/01	1.6	40
09/26/02	1.03	5
05/07/03	10	7
07/30/03	3.4	**2419**

Table 16 SRTON065.38 (Upstream of Bear Flats)

Date	Flow (cfs)	E.Coli (cfu)
06/15/95	9.6	2
07/08/95	7.44	8
07/19/95	7.31	6
08/02/95	5.11	8
08/16/95	6.68	68
09/20/95	4.98	43
11/15/95	5.27	8
08/30/96	5.14	**900**
08/31/96	2.85	**1400**
09/02/96	3.29	200
09/03/96	3.02	150
05/24/00	2.87	3
05/27/00	2.9	1
05/28/00	2.9	3
05/30/00	2.9	173
09/02/00	2	**344**
09/03/00	2	**285**
09/05/00	1.93	127
10/31/00	74.86	**249**
07/08/03	1.9	1
07/23/03	2.54	**2419**
08/07/03	1.51	36
08/20/03	5.04	**2419**
10/09/03	n/a	53
10/22/03	1.8	10

5/2000 Geometric mean for SRTON065.38: 6

Table 17 SRTON064.22 (Downstream of Bear Flats)

Date	Flow (cfs)	E.Coli (cfu)
06/15/95	9.75	2
07/08/95	7.64	2
07/19/95	7.32	9
08/02/95	5.41	19
08/16/95	6.75	60
09/20/95	4.37	9
11/15/95	5.9	15
05/24/00	2.56	12
05/30/00	2.6	5
09/02/00	3	**525**
09/03/00	3	**272**
09/05/00	3.44	201
10/31/00	80	**272**
07/08/03	1.46	51
07/23/03	n/a	**2419**
08/07/03	1.97	**299**
08/20/03	6.6	**2419**
10/09/03	2.39	76
10/22/03	1.8	41

Table 18 SRCRS006.04 (Natural Background)

Date	Flow (cfs)	E.COLI (cfu)
06/13/95	2.95	2
07/17/95	1.88	5
07/31/95	1.78	7
08/15/95	1.52	10
09/05/95	1.38	4
09/18/95	1.33	4
11/13/95	1.64	2
05/24/00	0.77	1
09/03/00	1.1	5
09/05/00	1.12	1
10/30/00	11.2	16

Table 19 SRCRS005.70 (Downstream of Headwaters)

Date	Flow (cfs)	E.COLI (cfu)
05/24/00	0.69	2
09/02/00	0.5	4
09/03/00	0.5	7
09/05/00	0.41	5
10/30/00	15.39	11

Table 20 SRCRS004.47 (Upstream of old 260)

Date	Flow (cfs)	E.Coli (cfu)
06/13/95	2.69	9
07/17/95	1.68	17
08/01/95	1.08	58
08/14/95	0.86	64
09/05/95	1.15	62
09/19/95	1.17	20
11/13/95	0.97	25
05/24/00	0.58	2
05/30/00	0.6	1
09/05/00	0.47	117
10/30/00	12	77
07/09/03	1.23	58
07/22/03	n/a	28
08/06/03	n/a	20
08/19/03	n/a	21
10/08/03	n/a	10
10/22/03	n/a	6

Table 21 SRCRS003.56 (Downstream of Chris. Ck., Upstream of new 260)

Date	Flow (cfs)	E.Coli (cfu)
06/13/95	2.57	8
07/18/95	1.57	25
08/01/95	1.09	93
08/15/95	1.05	93
09/06/95	1.07	135
09/19/95	1.04	50
11/13/95	1.13	4
05/24/00	1.27	7
05/30/00	0.4	17
09/05/00	2.02	**260**
10/30/00	10.82	127
07/09/03	0.29	49
07/22/03	0.52	91
08/06/03	0.31	214
08/19/03	0.54	199
10/08/03	0.69	**345**
10/22/03	0.32	27

Table 22 SRCRS002.85 (Downstream of Hunter Ck, Upstream of Chris. Ck. Cmpgrnd)

Date	Flow (cfs)	E.Coli (cfu)
06/14/95	3.12	2
07/07/95	1.46	9
07/18/95	1.38	4
08/01/95	0.99	20
08/15/95	1.22	52
09/06/95	1.19	84
09/18/95	0.91	18
11/14/95	1.43	15
05/25/00	0.47	10
05/27/00	0.5	1
05/28/00	0.5	4
05/30/00	0.5	12
09/02/00	0.25	96
09/03/00	0.2	96
09/06/00	0.23	93
10/30/00	14.46	192
07/09/03	0.28	6
07/22/03	0.51	80
08/06/03	0.28	37
08/19/03	0.76	122
10/08/03	0.46	44
10/22/03	n/a	61

Table 23 SRCRS002.26 (Downstream of Chris. Ck. Cmpgrnd, Upstream of R_C)

Date	Flow (cfs)	E.Coli (cfu)
06/14/95	2.94	1
07/07/95	1.51	54
07/18/95	2.18	3
08/01/95	1.06	19
08/16/95	1.39	72
09/06/95	0.99	106
09/19/95	1.16	18
11/14/95	1.38	84
05/27/00	0.6	4
05/28/00	0.6	5
05/30/00	0.6	16
09/02/00	0.3	76
09/03/00	0.3	54
09/06/00	0.3	93
10/30/00	18	137
07/09/03	n/a	41
07/22/03	n/a	**1120**
08/06/03	n/a	20
08/19/03	n/a	**2419**
10/08/03	n/a	28
10/22/03	n/a	28

5/2000 Geometric mean for SRCRS002.85: 5

Table 24 SRCRS001.24 (Downstream of R_C, Upstream of Box Canyon)

Date	Flow (cfs)	E.Coli (cfu)
06/14/95	3.17	2
07/07/95	1.16	16
07/19/95	1.34	8
08/02/95	0.64	7
08/16/95	1.17	34
09/06/95	0.85	26
09/20/95	0.81	72
11/14/95	1.12	68
08/30/96	1.13	**3800**
08/31/96	0.98	**1100**
09/01/96	0.48	**900**
09/02/96	0.62	**990**
09/03/96	0.55	**240**
05/25/00	0.5	4
05/27/00	0.5	1
05/28/00	0.5	5
05/31/00	0.5	1
09/02/00	0.3	**689**
09/03/00	0.3	115
09/06/00	0.3	70
10/31/00	20	**479**
07/09/03	0.18	46
07/23/03	0.36	80
08/07/03	0.14	98
08/20/03	1.82	**2419**
10/08/03	0.33	133
10/22/03	0.18	66

Table 25 SRCRS000.08 (Mouth of Chris. Ck.)

Date	Flow (cfs)	E.Coli (cfu)
05/25/00	0.75	1
05/28/00	0.75	1
05/31/00	0.75	2
09/04/00	0.46	47
11/01/00	30	76
07/30/03	0.63	3
08/12/03	2.54	42
08/20/03	5.56	**2419**
10/09/03	n/a	11
10/23/03	0.37	4

5/2000 Geometric mean for SRCRS001.24: 2

Table 26 lists measurements made through the Labor Day 2000 weekend at several sites in Box Canyon, a popular recreation area. Box Canyon is characterized by a step-pool arrangement with the pools separated by falls, riffles, and runs in various combinations. Due to the extremely rugged terrain with very difficult access, only the three uppermost pools are used by most swimmers and waders.

The sample points are at the top of the canyon and in the run segments below each of the six uppermost pools. The total stream segment length represented by these six pools is approximately 200 meters. Flow at all sites at the time of sampling was estimated at 0.3 cfs.

Table 26 E.coli Measurements in Box Canyon, Labor Day 2000

Date	Site	E.COLI (cfu)
9/03/00	400 meters upstream from top of canyon	**238**
9/03/00	200 meters upstream from top of canyon	138
9/02/00	top of canyon (SRCRS001.24)	**689**
9/03/00	top of canyon (SRCRS001.24)	115
9/02/00	1st pool	**501**
9/03/00	1st pool	133
9/02/00	2nd pool	**299**
9/03/00	2nd pool	185
9/02/00	3rd pool	194
9/03/00	3rd pool	214
9/02/00	4th pool	179
9/03/00	4th pool	184
9/02/00	5th pool	129
9/03/00	5th pool	192
9/02/00	6th pool	115
9/03/00	6th pool	162

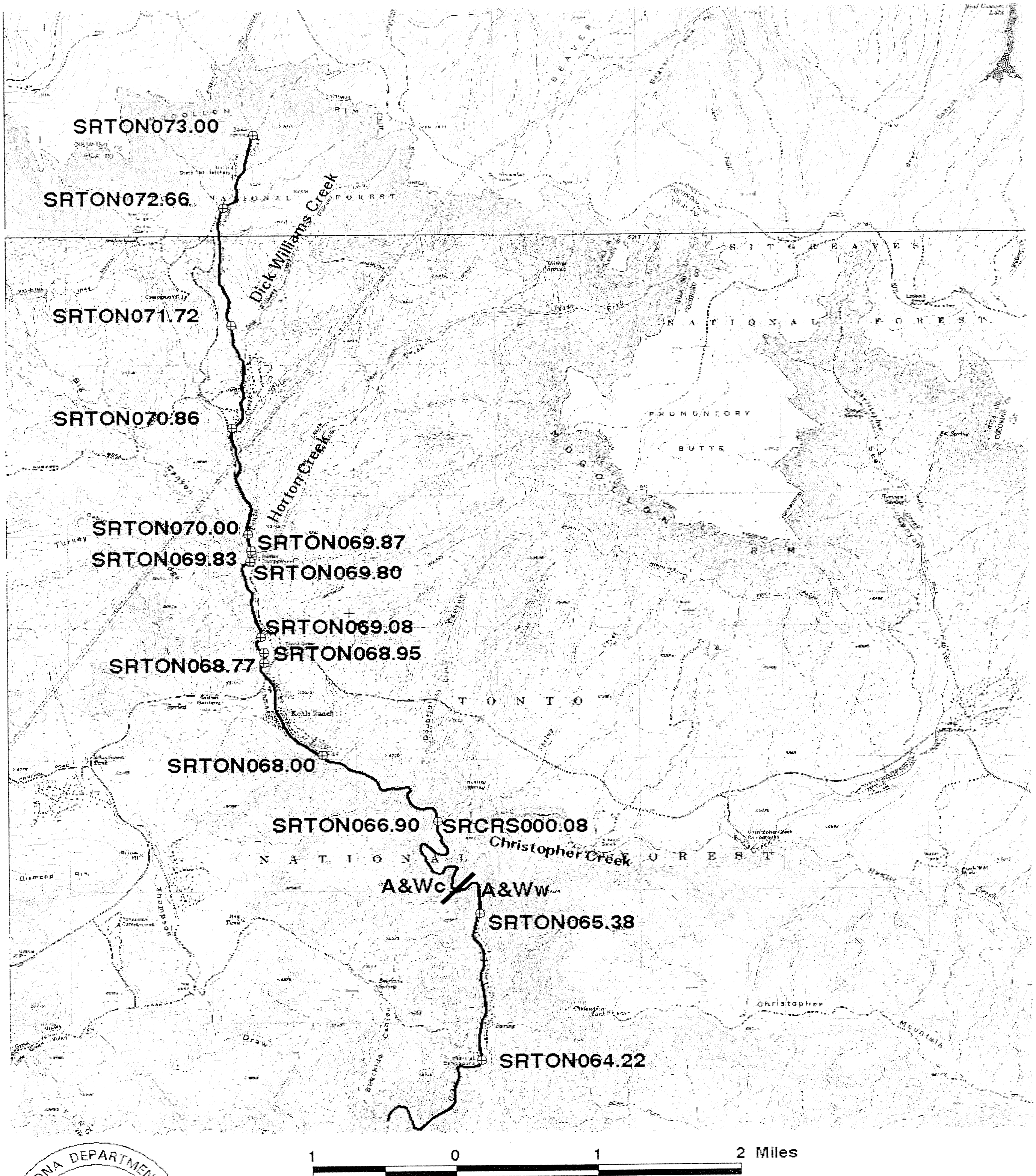

Figure 2 - Sample Points Tonto Creek TMDL Project

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ADEQ/WQD/HSAS/TMDL Unit
03/15/04

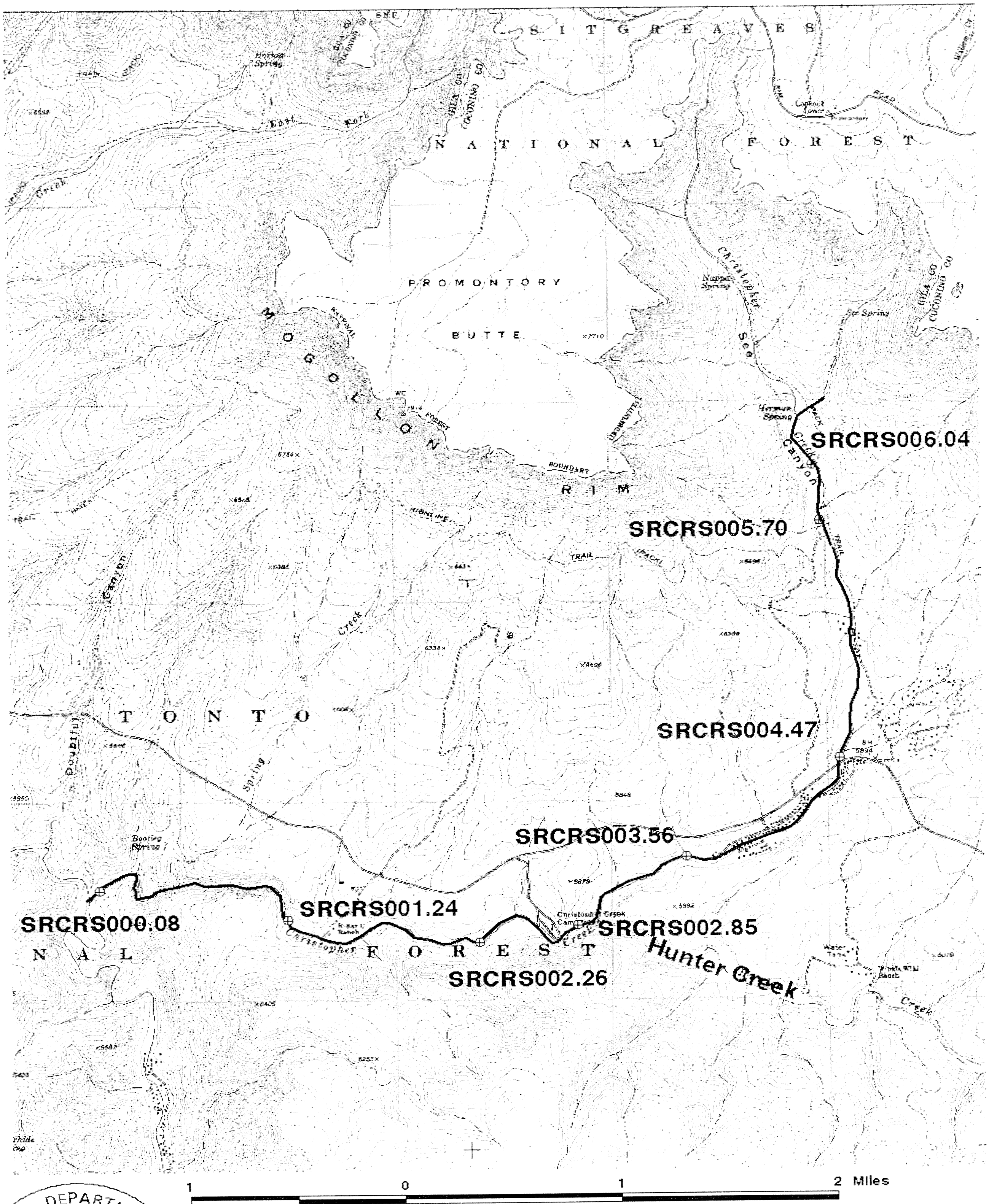

Figure 3 - Sample Points
Christopher Creek TMDL Project

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Segments and Sources Linkage

It is known that under the proper environmental conditions, *E. coli* can live, and even grow, outside of its normal mammal hosts in media such as sediment. The exact set of conditions permitting this are not fully known or understood, but this means that non-point source loads may or may not originate in the segment in which they are measured. For purposes of this TMDL, ADEQ assigns loads to the segment upstream of the measurement points.

Tonto Creek (starting at the headwaters)

Tonto Springs is the perennial source of Tonto Creek and is thus considered **natural background**. Sample point SRTON073.00 is used to measure the natural background loading. Tonto Creek Fish Hatchery diverts the first 700 gallons per minute from Tonto Springs into its operation - this is nearly all the spring discharge.

Discharge from the **Tonto Creek Fish Hatchery** passes through a pond system designed to reduce nutrient loading. The hatchery is the only AZPDES-permitted point source in the project area (AZPDES Permit No. AZ0021211) and the permit does not assign specific bacteria limits as fish are not considered a source of *E. coli.* On the hatchery grounds are several homes (with septic systems) for hatchery employees. Additionally, the area immediately downstream from the hatchery is used for recreation purposes. Sample points SRTON072.66 and SRTON071.72 are used to quantify the impact due to the hatchery and the other uses in this segment.

Baptist Camp is a cluster of mostly summer homes approximately 1½ mile downstream from the hatchery. All these homes are on septic systems and are located within 1/4 mile of Tonto Creek. Dick Williams Creek (intermittent or ephemeral) is tributary to Tonto Creek between the hatchery and Baptist Camp. Sample points SRTON070.86,SRTON070.00 and SRTON069.87 are used to quantify the impact due to the Baptist Camp cottage cluster.

Horton Creek (intermittent or ephemeral) is tributary to Tonto Creek approximately one mile below Baptist Camp. There is an United States Forest Service (USFS) day recreation site and campground located at the mouth of Horton Creek. Tonto Creek between Horton Creek and Highway 260 is heavily used for camping, picnicking, and fishing. The USFS had a developed campground at the Tonto Creek junction with Highway 260 approximately one mile below Horton Creek. This campground was closed in 2002 and obliterated in 2003 to make way for the new Highway 260 bridge as part of the highway widening project. The impact due to Horton Creek and the downstream recreation area was measured using sample points SRTON069.83, SRTON069.80, SRTON069.08, SRTON068.95 and SRTON068.77.

Starting at Highway 260 and extending for about 3/4 of a mile downstream is the **Kohls Ranch** area, a resort and collection of primarily summer homes. These are all on septic systems and are located within 1/4 mile of Tonto Creek. Butting against the downstream end of Kohls Ranch is **Camp Tontozona**, a retreat center and sports training camp run by Arizona State University. Tontozona has less than 1/4 mile active frontage on Tonto Creek and is also on septic system. Due to their proximity, the impact of a living organism (*E. coli*) due solely to camp Tontozona cannot be differentiated from the Kohl's Ranch impact. The Kohl's Ranch impact is quantified using sample point SRTON068.00 and sample points SRTON067.95 and SRTON066.90 quantify the impacts due to both Kohl's Ranch and Camp Tontozona.

About one mile downstream from Tontozona is the **mouth of Christopher Creek**. Beginning approximately 1½ mile downstream from Christopher Creek is the north end of the Bear Flats community, a cluster of mostly summer homes on septic systems, all within 1/4 mile of Tonto Creek. The reach between Christopher Creek and Bear Flats has a number of pools which can serve as bacteria storage areas. Therefore, measurements made between Christopher Creek and Bear Flats cannot be assigned to a source. This reach is quantified using sample points SRTON066.80 and SRTON065.38.

Bear Flats stretches approximately one mile to the USFS Bear Flat recreation site and it's impact is quantified using sample point SRTON064.22.

Christopher Creek (starting at the headwaters)

For purposes of this project, the perennial headwaters of Christopher Creek are considered to be located at See Spring. The **natural background** load quantification was made using sample point SRCRS006.04 downstream from the springs.

Beginning approximately 1 mile downstream from See Spring is a **recreation area** (fishing, picnicking, wading, etc.) that runs for about ½ of a mile along Christopher Creek. This upper reach area is easily accessed and has a parking lot with vault toilets. The actual recreational area boundaries are difficult to determine, but ADEQ considers the most heavily used portion as a possible pollutant source area. Impact of this recreation area is measured by sample points SRCRS005.70 and SRCRS004.47.

Christopher Creek from about ¼ mile upstream from the old Highway 260 bridge to the top of Box Canyon is bordered by a mix of septic system-equipped resorts, cabins, vault toilet-equipped campgrounds, and is heavily used for camping, picnicking, and fishing.

The **settlement of Christopher Creek** (a name used for the purposes of this project), a mixture of septic system-equipped resort, summer cabins, and campgrounds stretching approximately 1½ miles along Christopher Creek. The new Highway 260 bridge is between this area and Hunter Creek, the mouth of which is about ½ mile downstream from the bottom of the settlement. Sample point SRCRS003.56 is used to quantify the contributions from this settlement.

Approximately 1½ miles up **Hunter Creek** from its mouth on Christopher Creek is the community of Hunter Creek, a cluster of summer and year-round homes on septic systems. Sample point SRCRS002.85 is used to quantify the contributions from Hunter Creek.

Just below the mouth of Hunter Creek is the USFS-developed **Christopher Creek Campground** equipped with vault toilets. Sample point SRCRS002.26 is used to quantify the contributions from Christopher Creek Campground.

Approximately one mile downstream from Christopher Creek Campground is the **R-C Scout Camp**. This facility is equipped with vault toilets, septic systems and a central waste collection and processing system (ponds). The R-C Scout Camp impact is measured by sample points SRCRS001.49, SRCRS001.36 and SRCRS001.24.

A popular undeveloped swimming and wading area on Christopher Creek is known as "**Box Canyon**". Box Canyon begins approximately 1/4 mile downstream from the R-C Boy Scout Camp and twists (a flattened 'S' shape) for about one mile. A series of samples were taken in

Box Canyon over the Labor Day weekend of 2000. The runs between each of the upper-most six pools were sampled. This weekend was chosen because it is at the end of the recreation season. The sample points range from SRCRS001.23 to SRCRS001.18 and are numbered sequentially. Most of these sites were closer than 0.01 mile, the minimum distance possible using the ADEQ site naming system.

Near the bottom of Box Canyon is the mouth of an unnamed tributary draining an area that included a USFS quarry that, during the summer of 2003,was filled with rock spoil from the Highway 260 widening project. Approximately 1/4 mile below the bottom of Box Canyon is the **mouth of Christopher Creek** on Tonto Creek. Sample point SRCRS000.08 is at the mouth of Christopher Creek.

Data Analysis

For purposes of data analysis and trend determination, ADEQ combined the historic 1994 - 1996 data and the source identification data collected in 2000, 2002 and 2003. (Displayed in Tables 1 - 26)

Factors such as weather and varying recreational use levels, have an effect great enough to conceal or blur trends; however, several **general** observations are apparent.

- Bacteria levels increase with downstream distance. This suggests that heavy recreational uses are the most probable human source of bacteria.
- Bacteria levels increase over the summer suggesting an accumulation (probably in sediments), an increase in use, or both.
- Bacteria levels through a holiday weekend (highest recreational user population concentrations) do not exhibit a definite time-based trend. However, levels do roughly correspond to the level of use along a particular reach; i.e., the more popular use areas show a greater impact.
- Bacteria and discharge were not found to be related.
- ADEQ concludes there is no evidence of negative impacts such as fish kills, excessive algae growth, etc. due to excess levels of *E. coli*.

LOAD, ALLOCATION, AND TMDL CALCULATIONS

For purposes related to the widening of Highway 260, the Arizona Department of Transportation (ADOT) installed a stage gage on Tonto Creek just upstream from the old Highway 260 bridge. This gage has been recording stage data since July 2002 and the associated software has been calibrated to provide discharge (in cfs) corresponding to the stage. The highest discharge measured during this period is 107 cfs which is the highest the gage is capable of recording; i.e., the actual discharge may be higher. The range of ADEQ-measured discharge was 0.01 to 75 cfs. Higher discharges have occurred, but could not be safely measured on the subject stream segments.

ADEQ considered using the ADOT gage data, ADEQ discharge measurements and sampling results to construct a "Load-Duration Curve" for use in applying the TMDL to a range of discharges from baseflow to well above flood. Unfortunately, the bacteria data did not exhibit a correlation with discharge and therefore, this approach was discounted. ADEQ has instead chosen to use a simple load reduction concept that will allow easier implementation of the TMDL than using daily loads with cumbersome numbers in the 10^6 range.

TMDL Calculation

The in-stream water quality in the subject waterbodies is such that loads need to be reduced in order to meet standards. The TMDLs and associated percent reductions are set at levels adequate to result in the attainment of applicable water quality standards.

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs can be expressed in terms of mass per time or by other appropriate measures. TMDLs are comprised of the sum of individual wasteload allocations (WLs) for point sources, and load allocations (LAs) for nonpoint sources and natural background levels. In addition, the TMDL contains a MOS to account for variation in the sampling process. Conceptually, this definition is denoted by the equation:

$$TMDL = \Sigma WLA + \Sigma LA + MOS$$

The Load Capacity is the numeric target, 235 cfu/100 ml., which is the standard. Thus, for the segments in this study, the TMDL can be figured:

1) If the sum of the mean of measurements plus the MOS does not exceed the load capacity (235 cfu/100 ml.), then the TMDL = the sum of the mean of measurements plus the MOS.

OR

2) If the sum of the mean of measurements plus the MOS exceeds the load capacity (235 cfu/100 ml.), then the TMDL will be set at the load capacity (235 cfu/100ml.).

The natural background measurements collected at the headwaters of both streams are applied equally to the downstream segments in each stream.

Loads at each sample point include the upstream loads. ADEQ may elect to revisit this TMDL and break out the upstream load from each load when enough data have been collected to allow more accurate accounting for in-stream processes. If this were done, load allocations might be able to be calculated for discrete sources.

The load reduction equals the WLA plus LA minus the mean of all measurements. The percent reduction is the load reduction divided by the mean of all measurements and is included here to display relative change.

Margin of Safety (MOS)

The Colilert® system (produced by IDEXX Laboratories) for measuring *E. coli* uses multi-celled trays and a "most probable number" (MPN) table to determine the bacteria concentration. The MPN table is based on a 95% confidence interval and the range of values possible varies with the individual sample; i.e., the number of large and small cells counted in the sample tray. This range varies from 0.25% to 5.75% for any given MPN.

ADEQ has chosen to allow 5% for the 95% confidence interval, 6% for the range within the table and another 5% as a standard error to allow for variation in sample collection. The sample collection variation amount is based upon the Arizona State Laboratory allowance of 5% for general variation in process. This variation may include:

- The lack of characterization of many of the minor sources in the subject basin.
- The potential for unidentified sources to contribute pollutant loads or identified sources to provide larger loads than anticipated.
- Precipitation events can occur in portions of the watershed with other portions receiving none and thereby resulting in runoff patterns and stream discharges different from those observed.

Therefore, the total explicit MOS is 16% and, since it is based upon potential errors in measurement, it applies to the measured load. The MOS is applied by one of two methods.

1) If the mean of the measurements plus 16% of the mean of the measurements is less than or equal to the standard, the MOS is 16% of the mean of the measurements.

OR

2) If the mean of the measurements plus 16% of the mean of the measurements is greater than the standard, the MOS is 16% of the maximum allowable load that will not exceed the standard or 32 cfu/100 ml. as calculated thusly:

   For ease of explanation, assume WLA + LA = (W)LA. Then,

   TMDL = (W)LA + MOS leading to

   (W)LA = TMDL - MOS.

   If the TMDL = 235 and MOS = 16% of (W)LA $\therefore$ (W)LA = 235 - 0.16 x (W)LA, so

   (W)LA + 0.16 x (W)LA = 235 which means 1.16 x (W)LA = 235 leading to

   (W)LA = 235 ÷ 1.16 = 203.

   Therefore, the maximum (W)LA that will result in a TMDL $\leq$ 235 is 203, and the corresponding maximum MOS is 235 - 203 = <u>32</u>

A non-quantifiable implicit margin of safety was applied by not allocating additional loading when capacity was available. When the existing load for a stream segment was less than the load capacity, (e.g., standards are not being exceeded) instead of using the difference between load capacity and existing loading as additional allowable load, ADEQ instead chose not to allow any additional loading. This was done for several reasons:

- Even if one or more segments meet standards, the stream reach as a whole does not and therefore additional loading shall not be allocated.

- To allow for non-quantifiable errors in measurement.
- To allow for future sources. This allowance is not required by law, but neither is it prohibited.

ADEQ assumes conservative mixing and does not account for physical and chemical processes occurring in-stream that may reduce concentrations between sample points.

Critical Conditions

Seasonality is apparent as the stream freezes over for at least a portion of each winter and visitation is minimal during the "off-season". Therefore, this TMDL applies from the third week of May through the second week of September (the recreation season) and is not necessary during the rest of the year or at times; e.g., high discharges, when human recreational contact is not possible.

Most ADEQ samples were collected at relatively low discharges, but included precipitation-induced higher flows. Because comparison of the bacteria measurements to discharge does not exhibit a relationship, ADEQ will apply this TMDL to all discharges in the 0 to 100 cfs range. Discharges greater than this would pose an immediate hazard to humans of such magnitude to render the bacteria hazard irrelevant. Thus, a TMDL intended to protect the FBC designated use for discharges greater than 100 cfs is not reasonable or necessary.

TMDL and **Allocations**

The TMDL is either:

- 235 cfu/100 ml. where the mean of all measurements plus 16% exceeds the standard, or
- The sum of the measured load and the MOS where the mean of all measurements does not exceed the standard. This is the application of the non-quantifiable portion of the MOS explained previously.

Table 27 displays the TMDLs, allocations, reductions and supporting data. All loads, reductions and the TMDL are concentrations in units of cfu/100 ml. These TMDLs, allocations, and reductions apply to all flows from the third week of May through the second week of September.

Waste Load Allocations and Load Allocations must be met by all of the identified sources in order for the stream to meet the TMDL. The points of compliance are the sample points used in this study unless or until a means of differentiating between clustered sources is devised.

Please note that the numbers in Table 27 have been updated since the release of the first draft which was made available to the public on March 24, 2004. This update was made to accommodate a different presentation of the MOS.

Table 27 TMDL (units are cfu/100 ml. unless otherwise indicated)

Load Capacity = Standard = 235 cfu/100 ml. Natural background is measured at the natural background site and applied to all other sites.
Tonto Creek natural background = 15 cfu/100 ml. Christopher Creek natural background = 5 cfu/100 ml.

Tonto Segment/sources [1]	Sites (No. of Samples) [2]	Mean of all Measurements	MOS [3]	WLA [4]	LA [4]	TMDL [5]	Load Reduction [6]	Load Reduction (%) [7]
Natural Background - below spring [9]	73.00 (10)	15	2		15	**17**		
Fish Hatchery/hatchery, septic [8, 9]	72.66, 71.72 (21)	37	6	22	15	**43**	0	0%
Baptist Camp/septic	70.86, 70.00, 69.87 (23)	83	13		83	**96**	0	0%
Below Horton Creek	69.83, 69.80, 69.08, 68.95, 68.77 (37)	77	12		77	**89**	0	0%
Kohl's Ranch/septic	68.00 (17)	64	10		64	**74**	0	0%
Kohl's Ranch & Tontozona/septic	67.95, 66.90 (20)	297	32		203	**235**	94	32%
Below Christopher	66.80, 65.38 (38)	317	32		203	**235**	114	36%
Bear Flats/septic	64.22 (19)	338	32		203	**235**	135	40%

Christopher Segment/sources [1]	Sites (No. of Samples) [2]	Mean of all Measurements	MOS [3]	WLA [4]	LA [4]	TMDL [5]	Load Reduction [6]	Load Reduction (%) [7]
Natural Background - below spring	6.04 (11)	5	1		5	**6**		
Upper Reach	5.70, 4.47 (22)	23	4		23	**27**	0	0%
Christopher Creek settlement/septic	3.56 (17)	98	16		98	**114**	0	0%
Hunter Creek/septic	2.85 (22)	43	7		43	**50**	0	0%
Christopher Creek Campground [9]	2.26 (21)	204	32		203	**235**	1	0%
R-C Scout Camp/septic	1.49, 1.36, 1.24 (29)	403	32		203	**235**	200	50%
Box Canyon	1.23, 1.22, 1.21, 1.20, 1.19, 1.18 (12)	202	32		202	**234**	0	0%
Mouth	0.08 (10)	256	32		203	**235**	53	21%

1) All segments include natural background and recreational use. Recreational use includes hiking, biking, camping, picnicking, wading, fishing and hunting.
2) Stream mile portion of sample site name used to delineate segment. (Number of samples collected in segment.)
3) MOS = mean of all measurements from each segment x 16% or 32 cfu/100 ml if mean of measured + 16% is > 235.
4) WLA = mean of all measurements from each segment - natural background - MOS. LA = mean of all measurements from each segment - MOS.
5) TMDL = 235 cfu/100 ml. for segments where mean of all measurements + 16% exceeds standard of 235.
6) Load Reduction (cfu/100 ml) = WLA + LA - mean of all measurements.
7) Load Reduction (%) = Load Reduction divided by mean of all measurements.
8) Hatchery septic inputs cannot be differentiated from hatchery discharge; therefore, the WLA includes both.

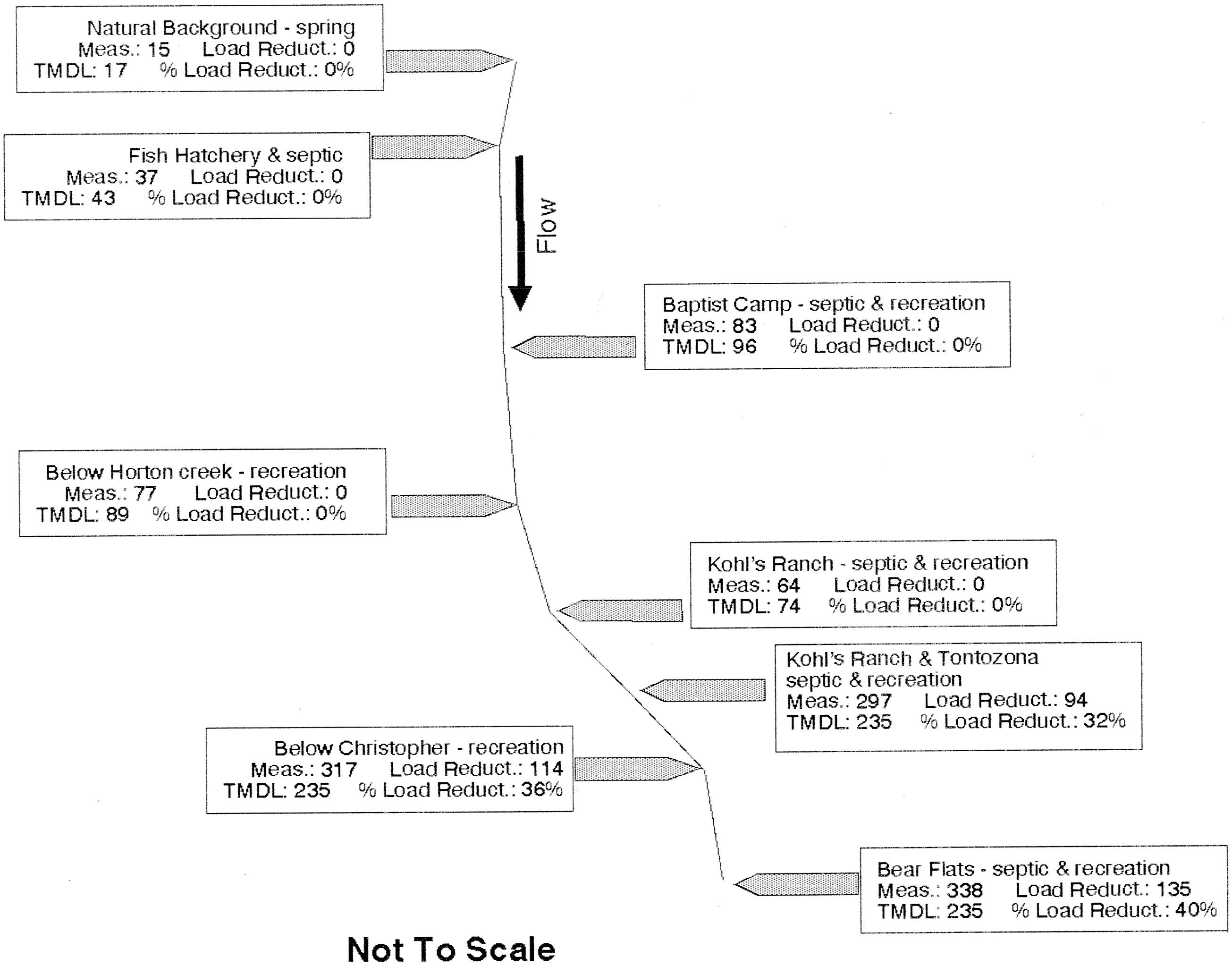

Figure 4 - Segment Load Schematic
Tonto Creek E. coli TMDL Project

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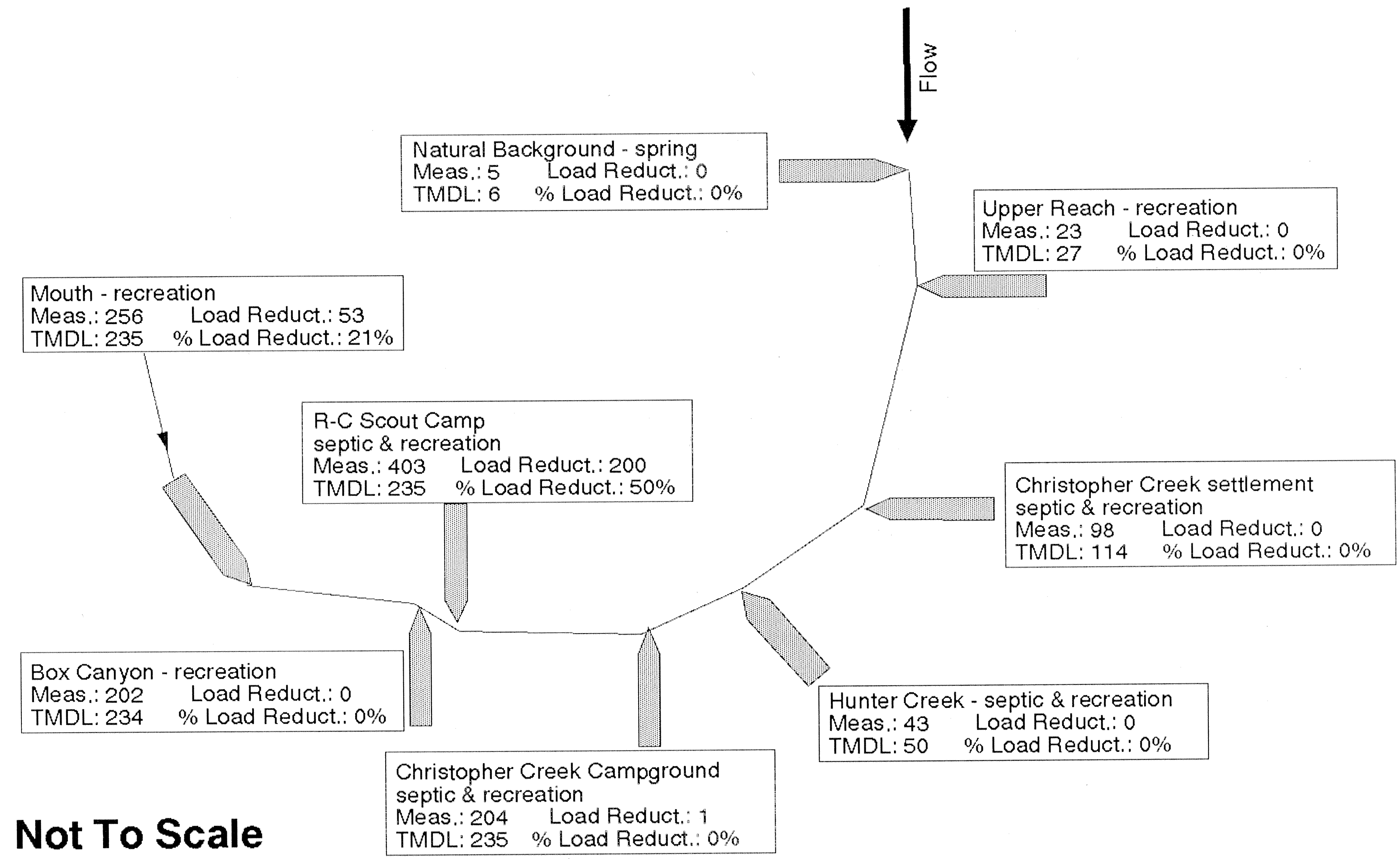

Figure 5 - Segment Load Schematic
Christopher Creek E. coli TMDL Project

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04/27/04

IMPLEMENTATION

This investigation shows that water quality standards will be met when the load reductions are achieved. Identification of major sources of pollutant loading and quantification of contributions will allow management decisions to be made.

Targets for Tonto and Christopher Creeks should include the inspection and repair or upgrade as necessary of all septic and waste systems in the basin. The USFS has, in the last few years, added or upgraded toilets with vault units. The USFS may wish to determine usage statistics for the various recreation areas and design a system for controlling human impacts; e.g., installing more vault toilets, establishing hours of use, daily monitoring of bacteria levels, restrictions based upon discharge, etc.

The USFS (Tonto National Forest) and the Gila County Health Department may wish to establish regular monitoring of *E. coli* levels for the reaches most likely to show a problem in the future.

Monitoring should be planned to allow collection of sufficient samples to determine compliance with both the single sample maximum and geometric mean standards. The use of tracers; e.g., flourescent dyes, may be useful if a means of differentiating between tightly clustered sources such as septic systems can be devised. Future studies may also include collection of the data necessary to permit the use of fate and transport modeling.

To delist these segments, a minimum of five years of sampling with no exceedances <u>or</u> samples which show the load allocations are being met are required.

PUBLIC PARTICIPATION AND RESPONSIVENESS SUMMARY

Development of the Tonto and Christopher Creeks TMDLs included public participation in accordance with 40 CFR Parts 25 & 130.7. Public participation included review and input from stakeholder groups. A notice regarding availability of this draft TMDL report was placed in the *Payson Roundup & Advisor* on March 24, 2004 and a 30-day public comment period followed the notice. A project presentation meeting was held by ADEQ on April 14, 2004. Property owners; environmental groups; representatives of local, state, and federal agencies; and other interested members of the public were notified and invited to attend this meeting. Seventeen stakeholders were in attendance. No written comments were received during the 30-day comment period.

A notice regarding this TMDL will be made in the AAR on May 14, 2004 and after a 45-day review period, the report will be sent to USEPA for final approval.

Written documentation of public participation will be on file with ADEQ's Hydrologic Support and Assessment Section, located at 1110 W. Washington Street, 5th Floor, Phoenix, Arizona 85007.

This report is also posted on the ADEQ TMDL Website at:
http://www.adeq.state.az.us/environ/water/assessment/status.html

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