# 2.0 Data Summary

This chapter outlines the types and sources of data developed by ADEQ in support of the Queen Creek TMDL modeling (**Table 2-1**). Detailed summaries of dissolved copper and total lead instream observations are also presented along with the spatial distribution of the hardness instream concentrations. ADEQ's sampling and analysis plan for the Queen Creek TMDL project was specifically designed with the purpose to develop and implement a dynamic watershed model. ADEQ installed automated instrumentation to generate sufficient data for populating model input. ADEQ has also collected numerous grab samples across the watershed to characterize water quality from various sources, landuse types and bedrock lithologies. All these data sources were analyzed and used in the initial model setup, parameterization, and calibration of the Queen Creek TMDL model (Arizona DEQ, 2010).

**Table 2-1: Summary of Data**

| Data Types | Sources |
|---|---|
| Topography | USGS - 7.5' Quadrangle and 30 m DEM (Digital Elevation Model) |
| Waterbodies | USGS - NHD (National Hydrography Dataset) |
| Soils | USEPA BASINS – SATSGO |
| Vegetation | USEPA BASINS |
| Land use | USEPA BASINS |
| Surficial Geology | 1988 Arizona Geologic Survey |
| Meteorologic (15-minute data) Air Temperature, Relative Humidity, Wind Speed, and Solar Radiation) | ADEQ – Pinto/Mineral Creek Weather Station |
| Precipitation (15-minute data) | ADEQ – Two Electronic Recording Rain Gages (Omya Mine/Pump Spring and at Boyce Thompson Arboretum). |
| Stream Discharge (15-minute data) | ADEQ – Eight Electronic Stream Stage Recorders On Queen Creek and Tributaries |
| In-stream water Quality Data | ADEQ – Automatic and Manual Collection in Queen Creek and Tributaries |
| Point Source (NPDES) Discharge and Pollutant Concentrations (15-minute data) | ADEQ - Facility Discharge Monitoring Reports (DMR) data for Resolution Copper Co (previously BHP and Magma) and Town of Superior WWTP |
| Hard Rock Data and Non-Point Source Pollutant Concentrations (geology, abandon/inactive mines, etc.) | ADEQ – Hard Rock and Surface Water Samples from Select Sub-watersheds |
| Design/Synthetic Storms Precipitation Frequency | NOAA Atlas 14 |
| Channel Geometry | USEPA BASINS, ADEQ Surveys and USGS Topographic Maps |

## 2.1. Water Quality Data

ADEQ collected water quality samples using automatic samplers deployed at numerous locations in the watershed. These automated samplers collected samples through several storm events and were supplemented with manually collected samples throughout the data collection period. Field data collection began in the fall of 2003 until late February 2008. Numerous samples were taken during the winter of 2007-2008 where several runoff-producing precipitation events were recorded. In fact, a total of 22.2 inches of rainfall was recorded from late November 2007 to late February 2008 at the headwaters



ED_013248_00000768-00001

(Omya) rain gage. Water quality data were also collected at numerous other sites across the watershed and were used to assign pollutant concentrations for sub-watersheds and other individual sources.
In 2010, ADEQ initiated an additional monitoring program and collected water quality and lithologic data in the Queen Creek watershed. The intent was to fill a few spatial water quality data gaps identified during the initial modeling phase. This additional data will allow a fine-tuning of the watershed model spatial representation and distribution of dissolved copper and total lead loadings. The following sections present a summary of the dissolved copper, total lead, hardness, and hard rock data.

### 2.1.1 Dissolved Copper Instream Data

**Figure 2-1** presents the average observed dissolved copper concentrations for each segment with water quality station(s) in the Queen Creek watershed. **Table 2-2** presents similar results in a tabular format. These summaries clearly indicate that all the sub-basins in the Queen Creek watershed have been covered through an extensive collection of water quality measurements totaling 700 data points. **Figure 2-1** indicates that the highest observed concentrations were observed in the Oak Flat sub-basin (segments 22, 23, and 24), the Apex Wash sub-basin (segment 50), and the RCC Superior Wash (segment 90).

### 2.1.2 Hardness Instream Data

Since the dissolved copper criteria are hardness-dependent, knowledge of the hardness (mg/L as CaCO3) instream levels are important for assessing compliance with water quality standards. **Figure 2-2** depicts the spatial distribution of observed hardness instream concentrations and reveals that the lowest hardness levels were recorded in the Oak Flat sub-basin.

### 2.1.3 Total Lead Instream Data

**Figure 2-3** presents the average observed total copper concentrations for each segment with water quality station(s) in the Queen Creek watershed. **Table 2-3** presents similar results in a tabular format. These summaries clearly indicate that all the sub-basins in the Queen Creek watershed have been covered through an extensive collection of water quality measurements totaling 700 data points. **Figure 2-3** and **Table 2-3** indicates that the highest observed total lead concentrations were observed in the Reymert Wash sub-basin (segment 28) where the average total concentration was recorded at 1.63 mg/L. Even though just two observations were made at this segment, the excessively high instream copper concentration is confirmed and consistent with the hard rock data collected in Reymert Wash (**Section 2.1.4**)

### 2.1.4 Hard Rock Data

In 2010 ADEQ collected additional copper and lead samples at specific locations in the Queen Creek watershed. This sampling focused on specific locations in the watershed such as waste piles in abandoned mines, mineralized rocks, and single lithology areas. Dissolved copper and lead data as well as soil data copper and lead (hard rock) were collected at these locations. The soil copper and lead data are depicted in **Figures 2-4** and **2-5**, respectively. The highest soil copper concentration of 14,000 mg/kg was recorded at segment 16 (Potts Canyon). The highest soil lead concentration was recorded a segment 55 (Reymert Wash) at a concentration of 40,000 m/kg exceeding by one order of magnitude all the other soil lead data in the watershed.



ED_013248_00000768-00002

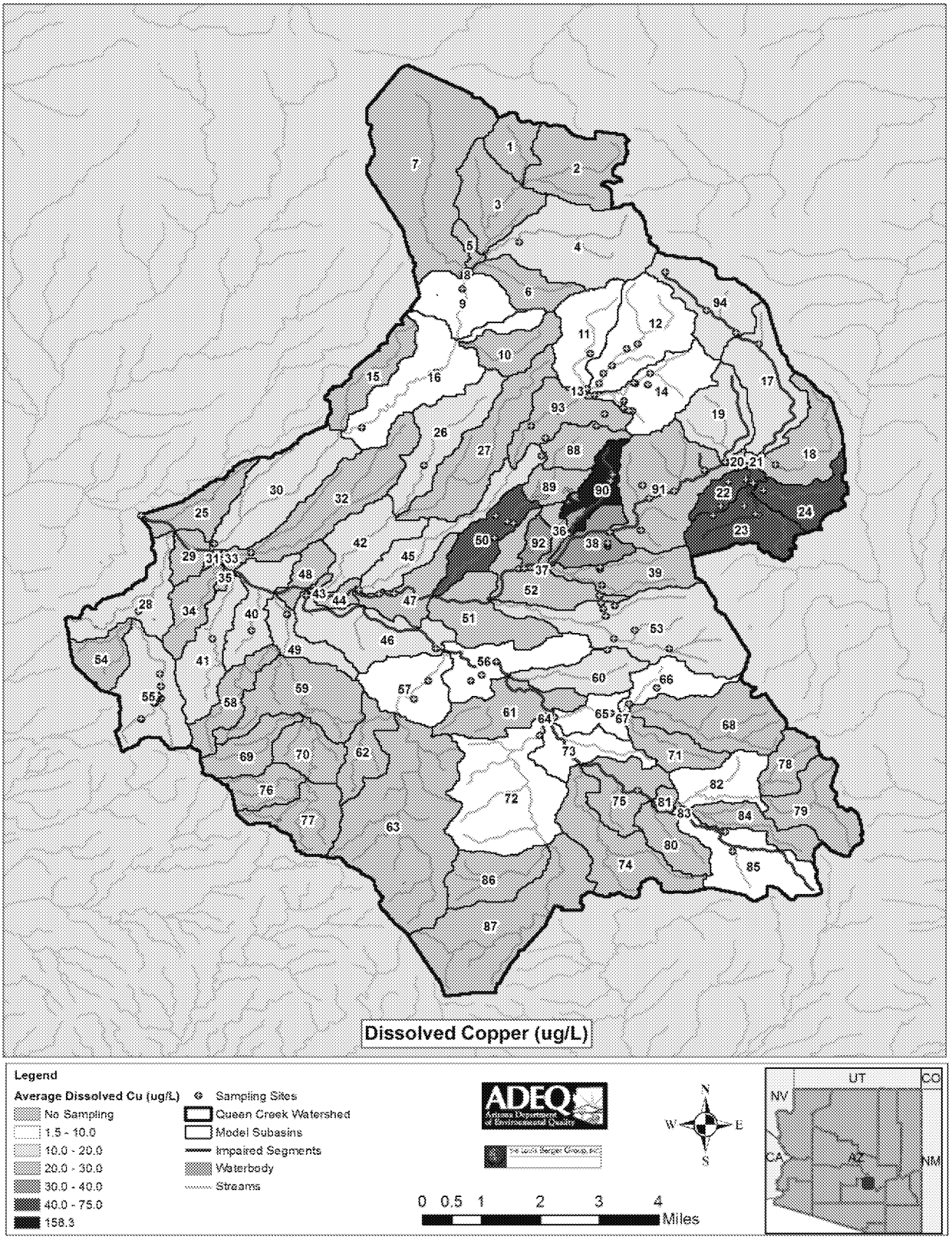


**Figure 2-1: Average Dissolved Copper Concentrations by Segment in the Queen Creek Watershed**

| Table 2-2: Summary of Dissolved Copper Instream Observations by Sub-Basin and Subwatershed | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Subbasin | Model-Segment | # of Stations | # of Samples | Min | Max | Mean | STD | Data Range |
| | | | | µg/L | | | | |
| Potts Canyon | 4 | 1 | 1 | 12.1 | 12.1 | 12.1 | NA | 1/19/2010 |
| | 9 | 1 | 4 | 3.3 | 9.8 | 7.2 | 2.9 | 9/3/2009 - 1/19/2010 |
| | 16 | 2 | 5 | 5.1 | 11.9 | 9.2 | 2.8 | 12/8/2009, 1/22/2010, 1/27/2010 |
| | 25 | 1 | 12 | 8.1 | 44.0 | 21.6 | 12.1 | 8/10/2005 - 2/5/2008 |
| | 30 | 1 | 48 | 2.5 | 49.0 | 11.4 | 6.6 | 8/10/2005 - 2/4/2008, 12/8/2009 |
| Happy Camp Canyon | 26 | 1 | 1 | 18.6 | 18.6 | 18.6 | NA | 1/20/2010 |
| | 32 | 1 | 1 | 24.8 | 24.8 | 24.8 | NA | 1/21/2010 |
| | 42 | 1 | 1 | 18.1 | 18.1 | 18.1 | NA | 12/8/2009 |
| Silver King Wash | 11 | 2 | 4 | 4.7 | 10.0 | 6.9 | 2.2 | 1/28/2008, 2/22/2010, 7/29/2010 |
| | 12 | 5 | 13 | 3.5 | 8.9 | 6.1 | 1.8 | 12/7/2007 - 1/28/2008, 1/27/2010 - 2/22/2010 |
| | 14 | 9 | 9 | 3.2 | 16.0 | 8.8 | 4.7 | 1/28/2008, 2/22/2010 |
| | 45 | 2 | 29 | 6.7 | 62.0 | 14.0 | 10.9 | 3/12/2006 -1/28/2008, 1/22/2010 |
| | 93 | 4 | 9 | 6.4 | 101. | 24.6 | 30.6 | 8/16/2007 - 1/28/2008, 2/22/2010 |
| Apex Wash | 50 | 4 | 32 | 21.9 | 1000 | 74.1 | 171.3 | 12/7/2010, 12/7/2009 - 1/22/2010 |
| | 88 | 2 | 2 | 9.3 | 36.9 | 23.1 | 19.5 | 2/22/2010 |
| RCC Superior Wash | 90 | 2 | 2 | 9.5 | 307. | 158.3 | 210.4 | 3/7/2010 |
| | 92 | 1 | 81 | 11.0 | 92.0 | 31.9 | 14.3 | 7/31/2006 - 3/4/2008 |
| Queen Creek | 17 | 2 | 52 | 1.0 | 70.0 | 15.6 | 11.6 | 4/10/2005 - 3/4/2008 |
| | 18 | 1 | 3 | 24.2 | 32.1 | 27.6 | 4.1 | 1/22/2010, 2/7/2010, 2/22/2010 |
| | 19 | 1 | 6 | 14.0 | 25.0 | 19.2 | 4.1 | 8/7/2007 - 1/6/2008 |
| | 20 | 1 | 2 | 11.0 | 49.0 | 30.0 | 26.9 | 4/19/2005, 8/10/2005 |
| | 21 | 1 | 4 | 4.5 | 34.0 | 18.1 | 13.8 | 7/23/2007 - 1/27/2008 |
| | 38 | 4 | 24 | 6.2 | 131. | 34.8 | 31.6 | 12/29/2004 - 3/4/2008, 1/21/2010, 2/7/2010 |
| | 39 | 3 | 5 | 11.3 | 35.3 | 22.2 | 9.4 | 1/21/2010 |
| | 47 | 2 | 13 | 10.0 | 51.0 | 26.5 | 13.5 | 11/14/2002 - 5/19/2003, 4/13/2005 - 1/28/2008 |
| | 52 | 2 | 5 | 17.0 | 30.0 | 22.3 | 5.9 | 4/10/2005 - 8/30/2005, 1/21/2010 |
| | 53 | 7 | 15 | 6.0 | 24.4 | 12.9 | 6.7 | 8/21/2009 - 2/7/2010 |
| | 91 | 5 | 16 | 1.5 | 121. | 24.2 | 31.2 | 5/22/2003- 4/19/2005, 8/17/2007-1/8/2008, 1/21/2010 |
| | 94 | 3 | 87 | 0.7 | 55.0 | 12.3 | 12.3 | 4/10/2003 - 3/4/2008 |
| Oak Flat | 22 | 6 | 81 | 10.3 | 65.0 | 44.0 | 12.2 | 7/31/2006 - 3/4/2008, 12/7/2009 - 3/8/2010 |
| | 23 | 4 | 13 | 26.7 | 80.0 | 53.7 | 17.9 | 12/8/2007 - 2/4/2008, 12/7/2009 - 1/22/2010 |
| | 24 | 1 | 1 | 41.0 | 41.0 | 41.0 | N/A | 12/11/2007 |
| Arnett Creek | 46 | 2 | 57 | 5.0 | 25.0 | 10.6 | 3.8 | 12/19/2001 - 8/26/2002, 3/23/2007 - 1/29/2008 |
| | 56 | 3 | 3 | 8.5 | 10.5 | 9.2 | 1.1 | 2/8/2009, 1/21/2010 |
| | 57 | 2 | 4 | 4.5 | 12.8 | 8.5 | 3.5 | 2/8/2009 - 1/27/2010 |
| | 60 | 2 | 2 | 12.1 | 15.3 | 13.7 | 2.3 | 1/21/2010 |
| | 65 | 2 | 3 | 5.3 | 13.0 | 8.2 | 4.2 | 12/7/2007, 1/7/2008, 1/21/2010 |
| | 66 | 2 | 3 | 2.1 | 13.4 | 8.4 | 5.8 | 1/21/2010 |
| | 72 | 1 | 4 | 6.9 | 14.2 | 9.8 | 3.1 | 12/8/2009 - 1/21/2010 |
| | 73 | 1 | 1 | 9.7 | 9.7 | 9.7 | NA | 1/21/2010 |
| | 75 | 1 | 2 | 1.5 | 1.5 | 1.5 | NA | 5/26/2004, 8/3/2004 |
| | 82 | 1 | 2 | 7.2 | 8.9 | 8.1 | 1.2 | 1/7/2008, 1/28/2008 |
| | 83 | 1 | 1 | 9.3 | 9.3 | 9.3 | NA | 1/28/2008 |
| | 85 | 2 | 2 | 6.0 | 8.7 | 7.4 | 1.9 | 1/7/2008, 1/28/2008 |
| Alamo Canyon | 40 | 1 | 2 | 14.1 | 15.3 | 14.7 | 0.8 | 1/21/2010 - 1/22/2010 |
| | 41 | 1 | 1 | 12.2 | 12.2 | 12.2 | NA | 1/22/2010 |
| | 49 | 1 | 3 | 7.5 | 13.4 | 11.1 | 3.2 | 1/21/2010 - 1/22/2010, 3/7/2010 |
| Reymert Wash | 28 | 1 | 2 | 9.2 | 17.3 | 13.3 | 5.7 | 1/21/2010 - 1/22/2010 |
| | 55 | 9 | 27 | 4.5 | 23.6 | 11.2 | 3.9 | 2/8/2009 - 1/22/2010 |



ED_013248_00000768-00004

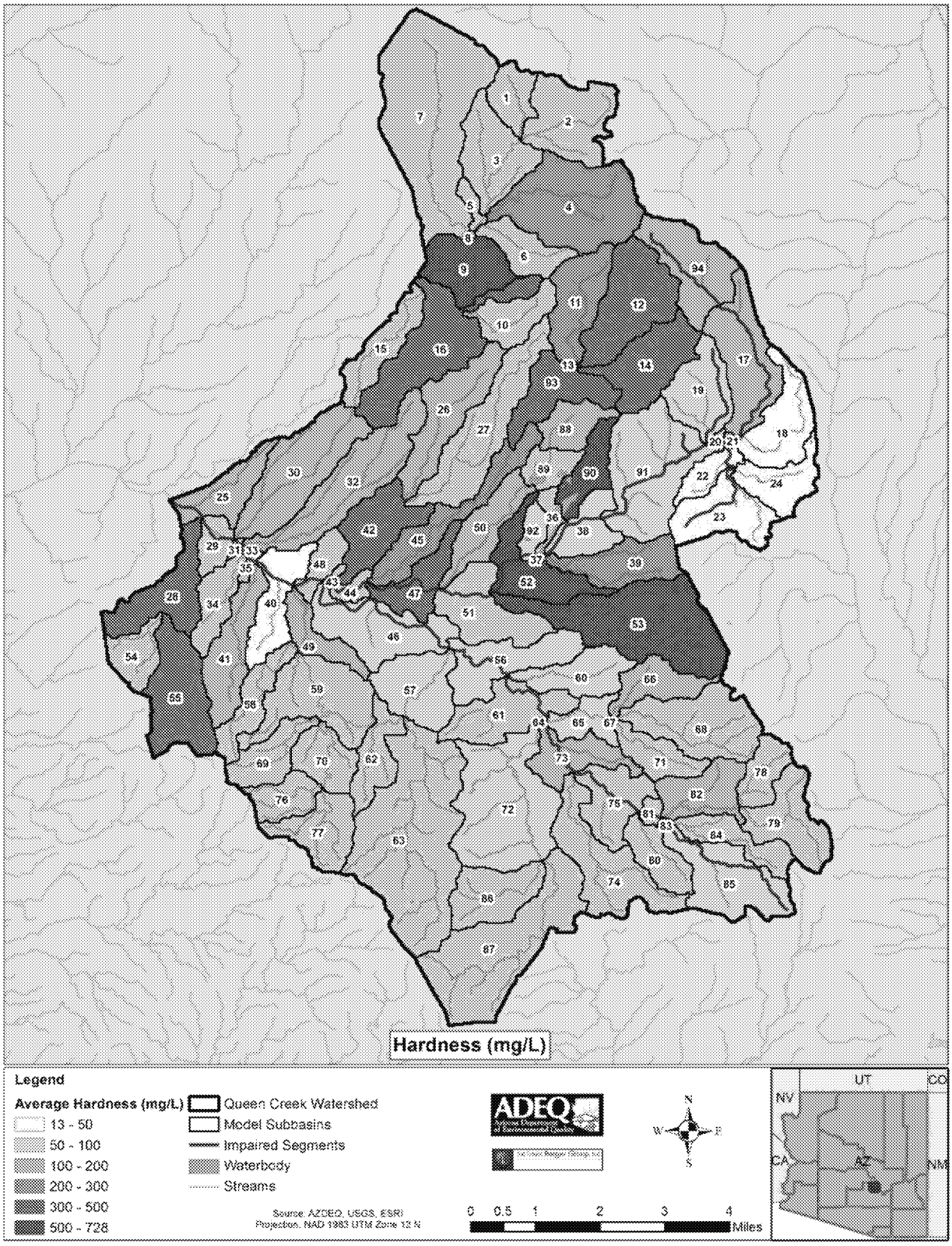


**Figure 2-2: Average Dissolved Hardness Concentrations by Segment in the Queen Creek Watershed**

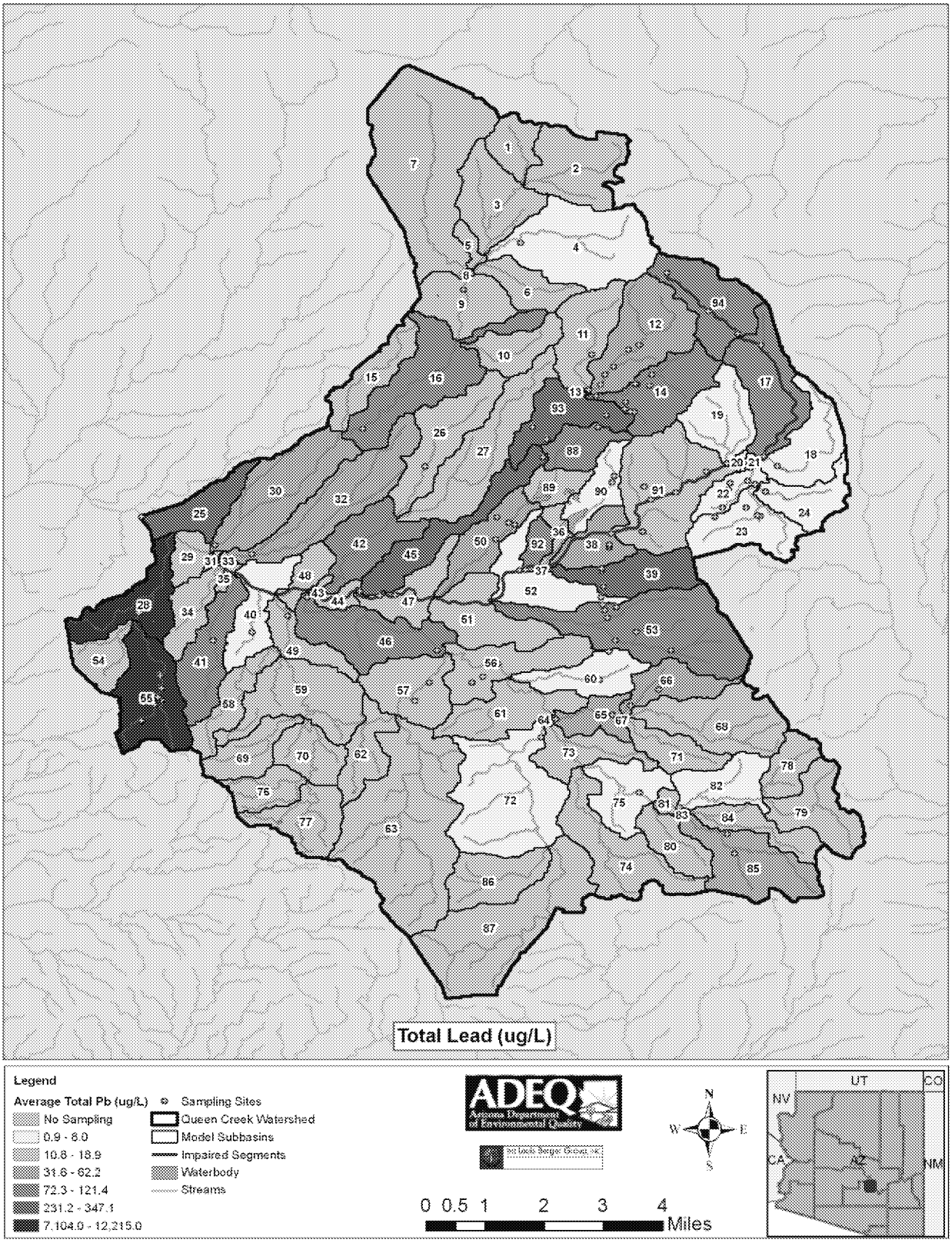


**Figure 2-3: Average Total Lead Concentrations by Segment in the Queen Creek Watershed**

| Table 2-3: Summary of Total Lead Instream Observations by Sub-Basin and Segment | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sub-Basin | Sub-watershed | # of Stations | # of Samples | Min | Max | Mean | STD | Data Range |
| | | | | µg/L | | | | |
| Potts Canyon | 4 | 1 | 1 | 0.9 | 0.9 | 0.9 | NA | 1/19/2010 |
| | 9 | 1 | 4 | 0.2 | 40.2 | 18.9 | 21.7 | 9/3/2009 - 1/19/2010 |
| | 16 | 2 | 5 | 0.3 | 135.0 | 76.2 | 60.5 | 12/8/2009, 1/22/2010, 1/27/2010 |
| | 25 | 1 | 12 | 2.5 | 1200.0 | 288.2 | 424.2 | 8/10/2005 - 2/5/2008 |
| | 30 | 1 | 49 | 2.5 | 300.0 | 62.2 | 70.2 | 8/10/2005 - 2/4/2008, 12/8/2009 |
| Happy Camp Canyon | 26 | 1 | 1 | 14.5 | 14.5 | 14.5 | NA | 1/20/2010 |
| | 32 | 1 | 1 | 32.4 | 32.4 | 32.4 | NA | 1/21/2010 |
| | 42 | 1 | 1 | 96.3 | 96.3 | 96.3 | NA | 12/8/2009 |
| Silver King Wash | 11 | 2 | 4 | 0.2 | 44.0 | 18.5 | 19.0 | 1/28/2008, 2/22/2010, 7/29/2010 |
| | 12 | 5 | 13 | 0.2 | 240.0 | 31.6 | 70.1 | 12/7/2007 - 1/28/2008, 1/27/2010 - 2/22/2010 |
| | 14 | 9 | 9 | 0.2 | 436.0 | 97.2 | 176.6 | 1/28/2008, 2/22/2010 |
| | 45 | 2 | 29 | 2.5 | 840.0 | 231.2 | 222.6 | 3/12/2006 -1/28/2008, 1/22/2010 |
| | 93 | 4 | 9 | 2.1 | 1000.0 | 347.1 | 345.7 | 8/16/2007 - 1/28/2008, 2/22/2010 |
| Apex Wash | 50 | 4 | 31 | 6.1 | 212.0 | 49.4 | 48.8 | 12/7/2010, 12/7/2009 - 1/22/2010 |
| | 88 | 2 | 2 | 2.5 | 224.0 | 113.3 | 156.6 | 2/22/2010 |
| RCC Superior Wash | 90 | 2 | 2 | 0.2 | 2.9 | 1.5 | 1.9 | 3/7/2010 |
| | 92 | 1 | 90 | 2.0 | 810.0 | 121.4 | 164.2 | 7/31/2006 - 3/4/2008 |
| Queen Creek | 17 | 2 | 52 | 2.3 | 960.0 | 72.5 | 169.8 | 4/10/2005 - 3/4/2008 |
| | 18 | 1 | 3 | 1.1 | 6.1 | 4.0 | 2.6 | 1/22/2010, 2/7/2010, 2/22/2010 |
| | 19 | 1 | 6 | 2.5 | 12.0 | 4.6 | 3.8 | 8/7/2007 - 1/6/2008 |
| | 20 | 1 | 2 | 1.0 | 2.5 | 1.8 | 1.1 | 4/19/2005, 8/10/2005 |
| | 21 | 1 | 4 | 2.5 | 2.5 | 2.5 | NA | 7/23/2007 - 1/27/2008 |
| | 38 | 4 | 23 | 0.7 | 460.0 | 46.0 | 108.0 | 12/29/2004 - 3/4/2008, 1/21/2010, 2/7/2010 |
| | 39 | 3 | 5 | 3.7 | 877.0 | 240.6 | 365.7 | 1/21/2010 |
| | 47 | 2 | 14 | 2.5 | 82.0 | 11.9 | 21.1 | 11/14/2002 - 5/19/2003, 4/13/2005 - 1/28/2008 |
| | 52 | 2 | 5 | 1.0 | 12.9 | 4.7 | 4.8 | 4/10/2005 - 8/30/2005, 1/21/2010 |
| | 53 | 7 | 14 | 1.1 | 397.0 | 79.3 | 105.5 | 8/21/2009 - 2/7/2010 |
| | 91 | 5 | 16 | 0.5 | 126.0 | 14.1 | 32.0 | 5/22/2003 - 4/19/2005, 8/17/2007 - 1/8/2008, 1/21/2010 |
| | 94 | 3 | 86 | 1.0 | 810.0 | 83.7 | 160.2 | 4/10/2003 - 3/4/2008 |
| Oak Flat | 22 | 6 | 73 | 1.0 | 62.0 | 8.0 | 12.6 | 7/31/2006 - 3/4/2008, 12/7/2009 - 3/8/2010 |
| | 23 | 4 | 13 | 0.5 | 6.8 | 2.2 | 1.6 | 12/8/2007 - 2/4/2008, 12/7/2009 - 1/22/2010 |
| | 24 | 1 | 1 | 2.5 | 2.5 | 2.5 | NA | 12/11/2007 |
| Arnett Creek | 46 | 2 | 54 | 2.5 | 350.0 | 72.3 | 78.1 | 12/19/2001 - 8/26/2002, 3/23/2007 - 1/29/2008 |
| | 56 | 3 | 3 | 1.4 | 28.8 | 10.8 | 15.6 | 2/8/2009, 1/21/2010 |
| | 57 | 2 | 4 | 0.4 | 45.2 | 12.3 | 22.0 | 2/8/2009 - 1/27/2010 |
| | 60 | 2 | 2 | 2.6 | 5.0 | 3.8 | 1.7 | 1/21/2010 |
| | 65 | 2 | 3 | 10.7 | 85.0 | 36.9 | 41.7 | 12/7/2007, 1/7/2008, 1/21/2010 |
| | 66 | 2 | 3 | 3.0 | 92.4 | 37.7 | 47.9 | 1/21/2010 |
| | 72 | 1 | 4 | 0.5 | 2.7 | 1.6 | 0.9 | 12/8/2009 - 1/21/2010 |
| | 73 | 1 | 1 | 16.5 | 16.5 | 16.5 | NA | 1/21/2010 |
| | 75 | 1 | 2 | 1.5 | 1.5 | 1.5 | *0.0* | 5/26/2004, 8/3/2004 |
| | 82 | 1 | 2 | 2.5 | 11.0 | 6.8 | 6.0 | 1/7/2008, 1/28/2008 |
| | 83 | 1 | 1 | 13.0 | 13.0 | 13.0 | NA | 1/28/2008 |
| | 85 | 2 | 2 | 32.0 | 70.0 | 51.0 | 26.9 | 1/7/2008, 1/28/2008 |
| Alamo Canyon | 40 | 1 | 2 | 3.2 | 6.6 | 4.9 | 2.4 | 1/21/2010 - 1/22/2010 |
| | 41 | 1 | 1 | 95.5 | 95.5 | 95.5 | NA | 1/22/2010 |
| | 49 | 1 | 3 | 0.2 | 29.9 | 10.9 | 16.5 | 1/21/2010 - 1/22/2010, 3/7/2010 |
| Reymert Wash | 28 | 1 | 2 | 1630. | 22,800 | 12,215 | 14,969 | 1/21/2010 - 1/22/2010 |
| | 55 | 9 | 27 | 0.7 | 35500.0 | 7104.4 | 9746.2 | 2/8/2009 - 1/22/2010 |



ED_013248_00000768-00007

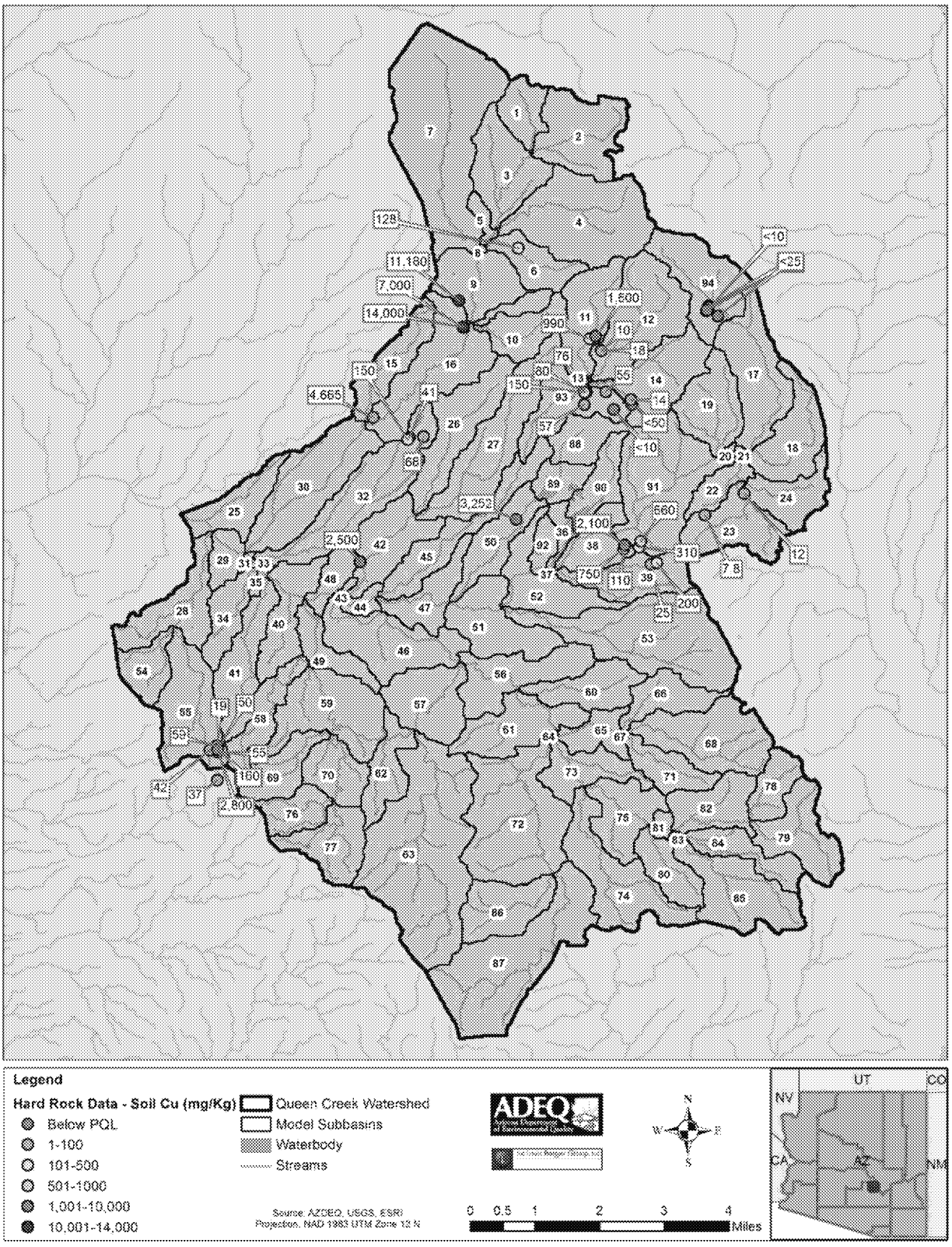


**Figure 2-4: Soil Copper Data in the Queen Creek Watershed**

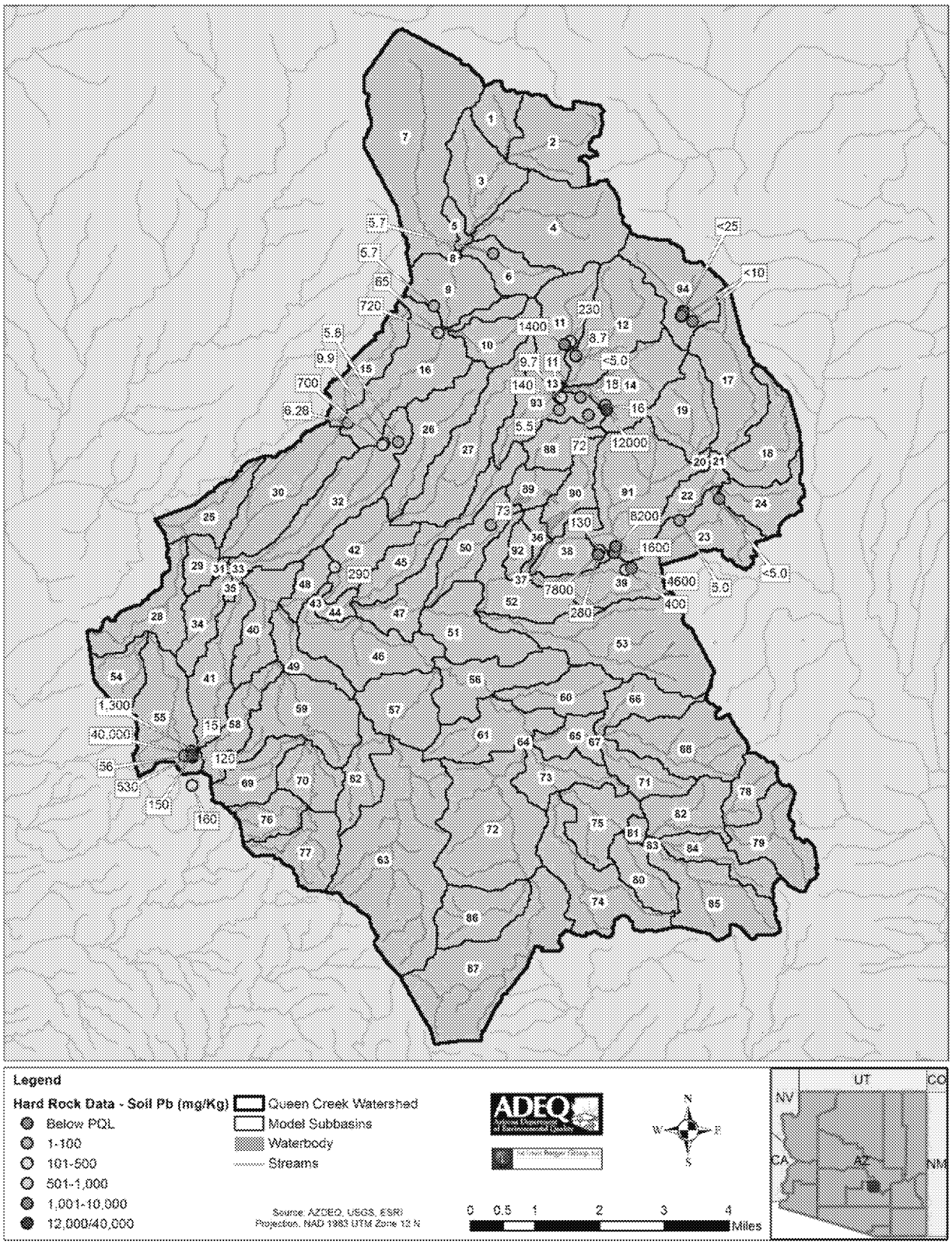


**Figure 2-5: Soil Lead Data in the Queen Creek Watershed**

# Table of Contents

[ TOC \o "1-3" \h \z \u ]

## List of Figures

**[ TOC \t "Style for Figure" \c ]**

## List of Tables

**[ TOC \t "Style for Table" \c ]**



ED_013248_00000768-00010