Total Maximum Daily Load Assessment

Boggs Creek –COARMA18a, Pueblo County, CO

December 2015

Table of Contents

Executive Summary

Information fundamental to Boggs Creek TMDL development is summarized in Table 1. The results of TMDL development are provided in Tables 2-4.

Table 1. TMDL Development Summary

Waterbody ID	COARMA18a		
Segment Description	Mainstem of Boggs Creek from the source to Pueblo Reservoir		
Pollutants Addressed	Se (dissolved), U (total),		
Designated Uses and Impairment Status	Agriculture Aquatic Life Warm1 Recreation E Water Supply	**Impaired** **Impaired** Not Impaired **Impaired**	
Size of Watershed	Approximately 26.5 sq. mi (area delineated using USGS StreamStats), drains to Pueblo Reservoir		
Land use	Mixture of Ranch/rural and open space/river corridor		
Source Identification	**Parameter**	**Nonpoint Sources**	**Point Sources**
	Selenium	Irrigation ditch	None
	Uranium	Irrigation ditch	None
Water Quality Goal	Attainment of water quality standards and all designated uses.		
Water Quality Target	**Parameter**	**Water Quality Standards (ug/L)**	
		acute	**chronic**
	Selenium	18.4	4.6
	Uranium	--	30 (Trec)
Analysis/ Methodology	Load Duration Curves were used to determine loading. Flow estimates were determined based on nearby streamgaging stations and watershed area using USGS Colorado StreamStats.		
Margin of Safety (MOS)	A 10% explicit margin of safety was included in this TMDL for all parameters.		

Table 2. Selenium TMDL: **Monthly nonpoint source (load allocation) allowable loading and pollutant reductions necessary to meet the aquatic life-based selenium standard in Boggs Creek.**

Month	Se Target, WQ Standard (ug/L)	Se TMDL (lbs/day)	10% MOS (lbs/day)	Load Allocation (lbs/day)	Reserve Capacity (lbs/day)	Percent Reduction
Jan	4.6	0.088	0.009	0.077	0.002	99%
Feb	4.6	0.089	0.009	0.079	0.002	99%
Mar	4.6	0.085	0.009	0.075	0.002	97%
Apr	4.6	0.066	0.007	0.058	0.001	97%
May	4.6	0.126	0.013	0.111	0.002	97%
Jun	4.6	0.353	0.035	0.311	0.006	99%
Jul	4.6	0.151	0.015	0.133	0.003	97%
Aug	4.6	0.113	0.011	0.100	0.002	97%
Sep	4.6	0.055	0.005	0.048	0.001	97%
Oct	4.6	0.057	0.006	0.050	0.001	97%
Nov	4.6	0.080	0.008	0.071	0.001	99%
Dec	4.6	0.091	0.009	0.080	0.002	99%

Table 3. Uranium TMDL: **Monthly nonpoint source (load allocation) allowable loading and pollutant reductions necessary to meet the water supply based uranium standard in Boggs Creek.**

Month	U Target, WQ Standard (ug/L)	U TMDL (lbs/day)	10% MOS (lbs/day)	Load Allocation (lbs/day)	Reserve Capacity (lbs/day)	Percent Reduction
Jan	30	0.562	0.056	0.496	0.0101	60%
Feb	30	0.572	0.057	0.505	0.0103	60%
Mar	30	0.545	0.055	0.481	0.0098	62%
Apr	30	0.420	0.042	0.370	0.0076	56%
May	30	0.804	0.080	0.709	0.0145	16%
Jun	30	2.258	0.226	1.992	0.0406	34%
Jul	30	0.966	0.097	0.852	0.0174	37%
Aug	30	0.724	0.072	0.639	0.0130	40%
Sep	30	0.349	0.035	0.308	0.0063	49%
Oct	30	0.364	0.036	0.321	0.0065	55%
Nov	30	0.513	0.051	0.452	0.0092	58%
Dec	30	0.581	0.058	0.513	0.0105	60%

1.0 Introduction

Section 303(d) of the federal Clean Water Act requires states to identify water bodies that are water quality impaired. Water quality impaired segments are those water bodies or stream segments that are not fully attaining one or more assigned use classifications or standards. This segment is currently identified on the Colorado 2012 303(d) List for not meeting selenium, zinc and uranium water quality standards. Boggs Creek was initially on the Colorado 303(d) list in 2002 for selenium and zinc, and was later listed for uranium in 2008. Once listed, unless standards are attained through other mechanisms such as implementation activities, the original listing is shown to be in error or the standards have been changed, the State is required to quantify the amount of a specific pollutant that a listed water body can assimilate without exceeding applicable water quality standards. This maximum allowable pollutant quantity is referred to as the Total Maximum Daily Load ("TMDL").

The TMDL is comprised of the Load Allocation ("LA"), which is that portion of the pollutant load attributed to natural background or the nonpoint sources, the Waste Load Allocation ("WLA"), which is that portion of the pollutant load associated with point source discharges, and a Margin of Safety ("MOS"). The TMDL may also include an allocation reserved to accommodate future growth. The TMDL may be expressed as the sum of the LA, WLA, and MOS.

There are no point source discharges to the Boggs Creek drainage. Future point source discharges are also not anticipated. Therefore, the TMDLs include only allocations to address LA and MOS components.

1.1 Segment Description

Boggs Creek is tributary to Pueblo Reservoir, an on-channel reservoir sited on the Arkansas River mainstem. The Boggs Creek watershed lies to the south and west of Pueblo, Colorado, flowing in a northerly direction to the reservoir. The geographic extent of the watershed includes the surrounding area that drains to Boggs Creek, from its source to the confluence with Pueblo Reservoir (Figure 1).
Boggs Creek is an ephemeral stream, flowing in direct response to precipitation events and, during dry weather, when there is sufficient groundwater to recharge the stream channel.

The Boggs Creek watershed is underlain by cretaceous marine shale. The majority of the watershed is underlain by calcareous limestone and shale composing the Niobrara formation. The uppermost portion of the watershed is composed of Carlile shale, Greenhorn limestone and Graneros shale (Scott et all, 1978). These, and similar cretaceous shales are significant sources of selenium loading throughout the west. Both selenium and uranium are introduced into surface waters in areas underlain by these marine shales as a result of weathering of the shale layers. (Gates, et al, 2009)

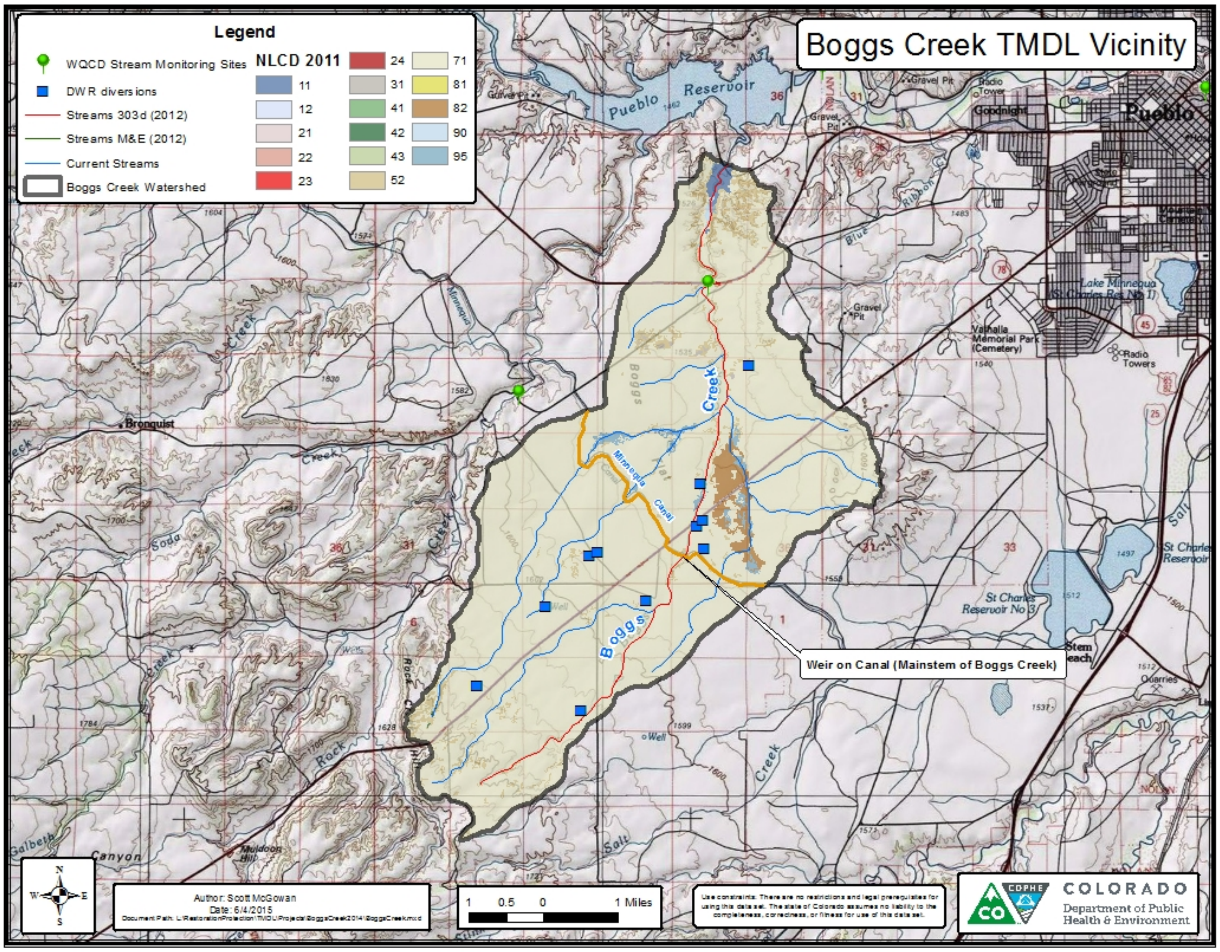

Figure 1-1. Boggs Creek and vicinity

1.2 Land Use

Land use may significantly impact surface water quality. Seepage associated with unlined irrigation ditches, ponds and septic tanks, as well as irrigation of agricultural and residential development increases the amount of water mobilizing selenium and uranium from shale derived soils and the underlying shale strata. The Boggs Creek drainage is largely undeveloped and hosts a few widely scattered residential properties. There is an unlined man-made irrigation ditch that runs through the entire Boggs Creek watershed. There are not currently, nor have there been, any

Colorado Discharge Permit System (CDPS) or National Permit Discharge Elimination System (NPDES) permits that discharge to Boggs Creek. Below is a future land use map of the area (Pueblo Comprehensive Plan, 2008) which includes rural/ranch land south of Highway 96 and open space/river corridor north of the highway. The land use in the area is not projected to change in the next 15years.

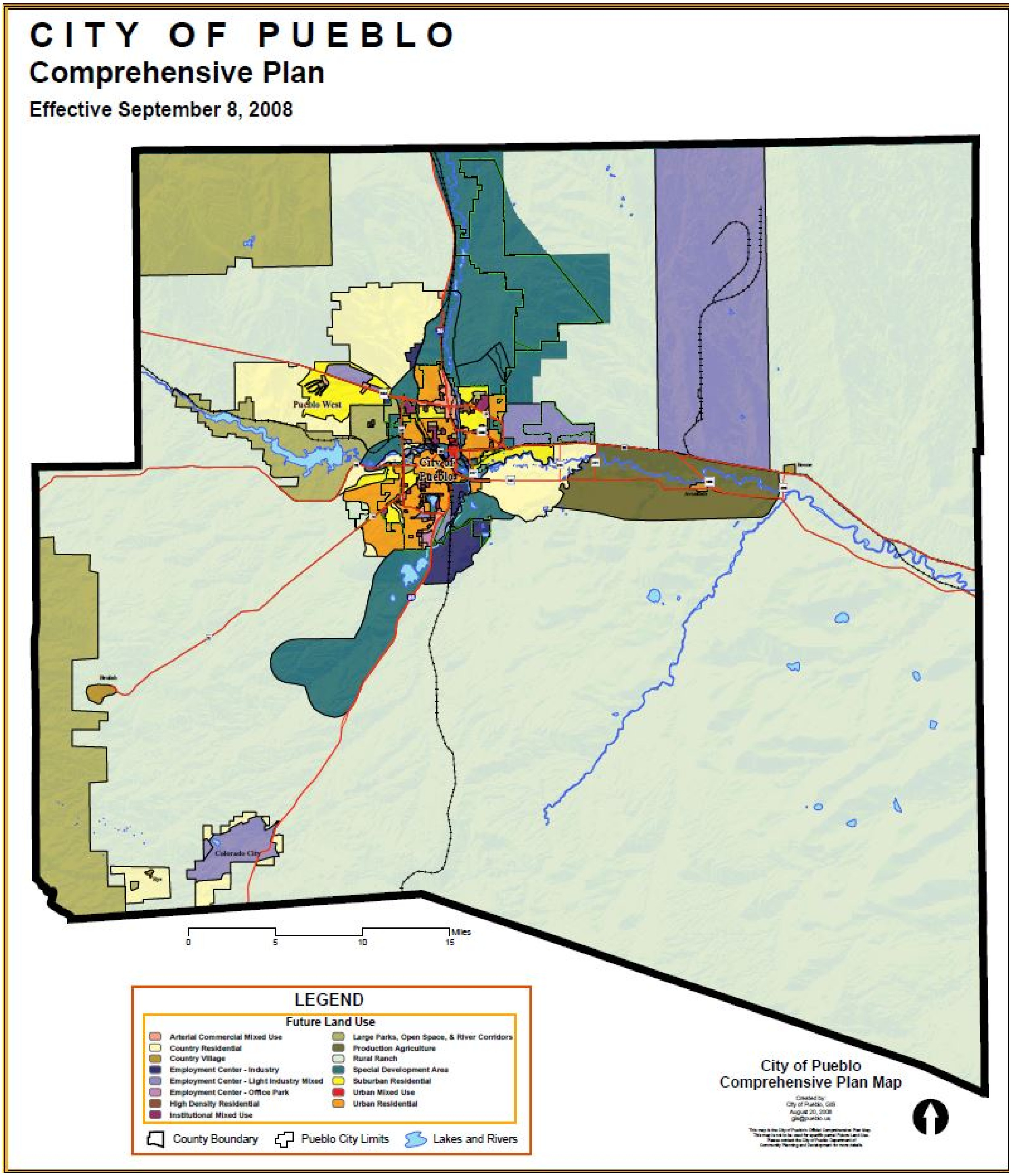

Figure 1.2-1: Future Land Use of Pueblo County from the Pueblo Comprehensive Plan, 2008, details growth expectations and patterns through 2030.

2.0 Water Quality Standards

Waterbodies in Colorado are divided into discrete units or “segments”. The Colorado *Basic Standards and Methodologies for Surface Water*, Regulation 31, (WQCC 2008a) discusses segmentation of waterbodies in terms of several broad considerations:

> *31.6(4)(b)…Segments may constitute a specified stretch of a river mainstem, a specific tributary, a specific lake or reservoir, or a generally defined grouping of waters within the basin (e.g., a specific mainstem segment and all tributaries flowing into that mainstem segment.*
>
> *(c) Segments shall generally be delineated according to the points at which the use, physical characteristics or water quality characteristics of a watercourse are determined to change significantly enough to require a change in use classifications and/or water quality standards*

As noted in paragraph 31.6(4)(c), the use or uses of surface waters are an important consideration with respect to segmentation. In Colorado there are four categories of classified uses: aquatic life use; recreational use; agricultural use; and water supply use. A segment may be designated for any or all of these “use Classifications”:

Each assigned use is associated with a series of pollutant specific numeric standards. These pollutants may vary and are relevant to a given classified use. Numeric pollutant criteria are identified in sections 31.11 and 31.16 of the *Basic Standards and Methodologies for Surface Water.*

2.1 Uses and Standards Addressed in this TMDL

The uses and numeric standards assigned for Boggs Creek, segment COARMA18a, are identified in the *Classifications and Numeric Standards for Arkansas River Basin*, Regulation No. 32 (WQCC 2010).

WBID	Segment Description	Designated Uses
COARMA18a	Mainstem of Boggs Creek from the source to Pueblo Reservoir	Aquatic Life Warm 1 Recreation E Agriculture Water Supply

Table 2.1-1. Designated uses and impairment status for Boggs Creek.

This segment, Middle Arkansas River sub-basin 18a, is included in the current *Section 303(d) List of Impaired Waters* (WQCC 2012) due to non-attainment of aquatic life use-based selenium and zinc standards. Similarly, agricultural use-based standards for selenium and water supply use-based standards for selenium and uranium are not attained. Water quality standards associated with the recreational use designation are attained and that use is fully supported. Table 2.1-2 summarizes the assigned uses and their attainment status. Table 2.1-3 identifies the relevant numeric standards assigned for segment COARMA18a.

Parameter	Aquatic Life warm 1	Recreation E	Water Supply	Agriculture
selenium	impaired	na[1]	impaired	impaired
uranium	not impaired	na	impaired	not impaired
zinc	not impaired	na	not impaired	not impaired

[1] no assigned standard associated with this use

Table 2.1-2. Designated uses and impairment status for Boggs Creek.

Parameter[1]	Classified Use			
	Aquatic Life[2]		Agriculture[3]	Water Supply[3]
	acute	chronic		
selenium	18.4	4.6	20	50
uranium	$=e^{(1.1021\lfloor\ln(hardness)\rfloor+2.7088)}$	$=e^{(1.1021\lfloor\ln(hardness)\rfloor+2.2382)}$	--	30
zinc	$=0.978e^{(0.9094\lfloor\ln(hardness)\rfloor+0.9095)}$	$=0.986e^{(0.9094\lfloor\ln(hardness)\rfloor+0.6235)}$	2000	5000

[1] values in µg/L
[2] expressed as dissolved fraction
[3] expressed as total recoverable fraction

Table 2.1-3. Numeric standards for 303(d) listed parameters for Boggs Creek

Chronic and acute aquatic life use-based standards are designed to protect against different ecological effects of pollutants (long term exposure to relatively lower pollutant concentrations vs. short term exposure to relatively higher pollutant concentrations). Chronic standards represent the level of pollutants that protect 95 percent of the genera from chronic toxic effects of metals. Chronic toxic effects include but are not limited to demonstrable abnormalities and adverse effects on survival, growth, or reproduction (WQCC 2006b).

Per the *Section 303(d) Listing Methodology, 2012 Listing Cycle* (WQCD 2010), attainment of Aquatic Life Use-based metals standards, when expressed as the dissolved fraction, is determined by comparison of the 85^{th} percentile value of the ranked data against the standard.

Agriculture and Water Supply Use-based standards are expressed as a single value and reflect the total or total recoverable metals fraction. Per the *Section 303(d) Listing Methodology, 2010 Listing Cycle* (WQCD 2009), attainment of metals standards, when expressed as the total or total recoverable fraction, is determined by comparison of the 50th percentile value of the ranked data against the standard.

2.2 Listing History

Boggs Creek was initially included on the 2002 Section 303(d) List due to non-attainment of aquatic life use-based selenium and zinc standards, water supply use-based selenium, and agriculture use-based selenium standards. And later identified to be in non-attainment of water supply use-based uranium standard in the 2008 listing cycle. The listing assessment cites water quality data collected from August 2005 through June 2006, although additional sampling has been performed by the WQCD since March, 1998. These earlier samples were not utilized for the 303(d) listing decision assessment because the *Section 303(d) Listing Methodology – 2008 Listing Cycle*, as well as more recent iterations of the Listing Methodology, specifies that the assessment utilized the most recent five years of data for the listing decision analysis. All samples were collected at WQCD station 7285 on Boggs Creek at Highway 96.

Boggs Creek is remains on the 2012 Section 303(d) List due to non-attainment of selenium, uranium and zinc standards. TMDLs have been developed for selenium and uranium. Boggs Creek is in attainment of all assigned zinc standards, and therefore, a TMDL was not warranted at this time.

3.0 Problem Identification

Boggs Creek is an ephemeral stream, flowing in direct response to precipitation events and, during dry weather, when there is sufficient groundwater to recharge the stream channel. The Boggs Creek watershed is underlain by cretaceous marine shale (Figure 2). The majority of the surficial formations are composed of calcareous limestone and shale, the Niobrara formation, identified as *Qg Cretaceous* in Figure 2. The upper reaches of the watershed are characterized by older deposits of Carlile shale, Greenhorn limestone and Graneros shale (*Kn Cretaceous*). Together, with several other geologic strata, these sedimentary deposits comprise the Pierre Shale (Scott, et al, 1978).

Like the Mancos shale of western Colorado, the Pierre shale is classified as a cretaceous marine shale. Such deposits are often referred to as seleniferous shales due to their selenium content and are widely distributed throughout the western United States. Soils derived from underlying seleniferous shales also serve as selenium source material. Selenium is present in several different chemical forms in the soil. In alkaline soils, which are prevalent in much of Colorado and in the Boggs Creek drainage, selenium is predominantly found as selenate (SeO_4^{-2}). This species of selenium is not strongly bound to oxides and other minerals in the soil. As such, it is highly soluble. (Gates, et al, 2009)

Uranium is also present in both the Pierre shale as well as the shale derived soils of the Boggs Creek watershed. Like selenium, the mobility of uranium in soil is influenced by soil properties including pH and redox potential, and soil chemistry within the Boggs Creek drainage tends to facilitate solubility and, consequently, transport of uranium.

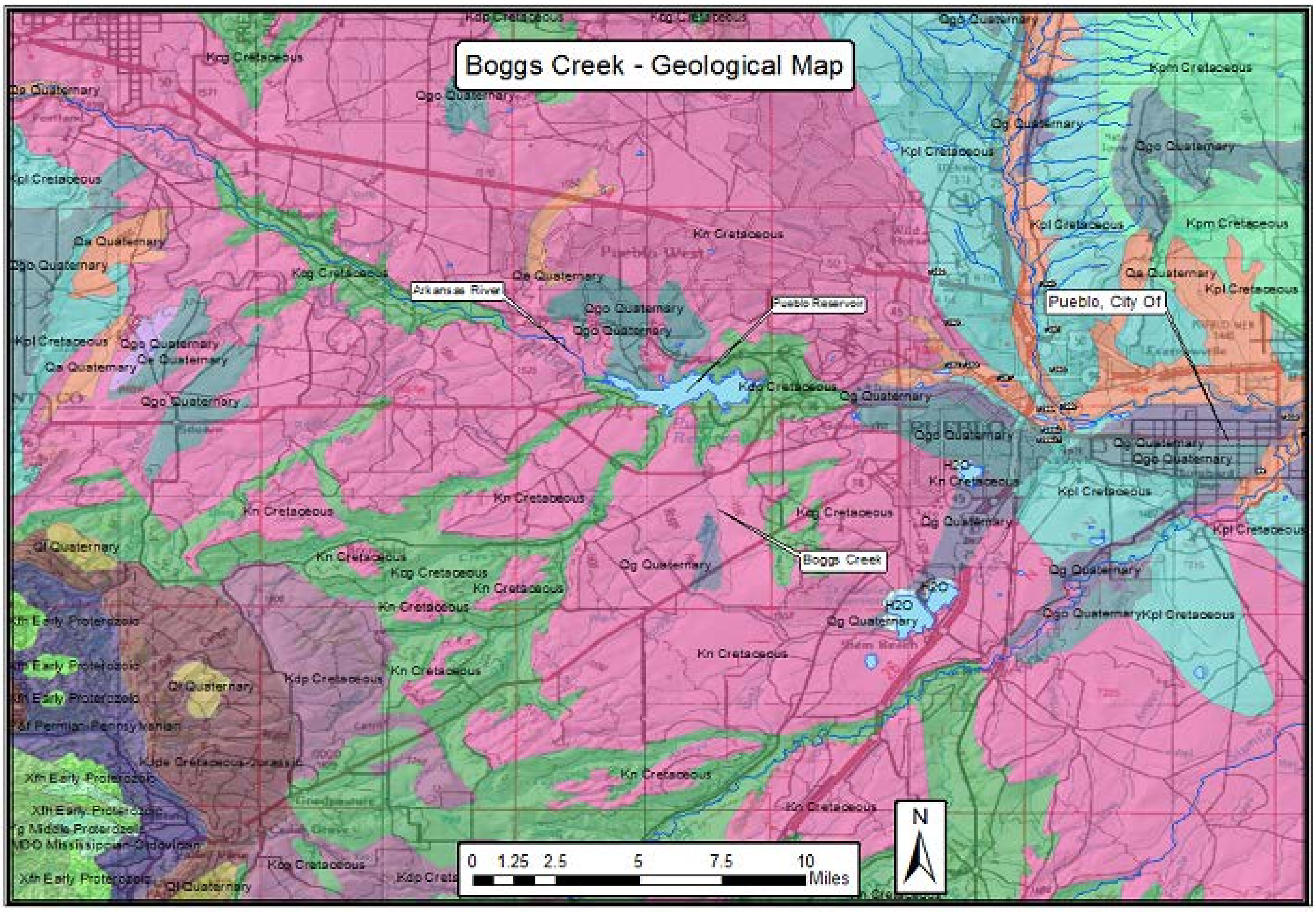

Figure 3-1. Boggs Creek Watershed – Surficial Geology

Soils in the upper watershed, predominantly Manville clay loam, are fairly deep and exhibit a relatively low degree of permeability. The low amount of precipitation in the watershed, in combination with the water storage capacity limits surface water flows in the upper watershed. During recent WQCD sampling in the watershed (2010 – 2012) no surface water was observes in the upper watershed. Lower in the drainage the physiography is characterized by deeply incised gullies, exposing the limestone and shale strata which underlay the entire watershed. The predominant soil type in the lower watershed is the Penrose-Minnequa complex and is shallow and rapidly draining (USDA, 1979). The portion of Boggs Creek from a point immediately above the WQCD sampling location at Highway 96 to the Lake Pueblo State Park has been observed to flow periodically, in response to precipitation or, during dry weather, as a result of groundwater recharge.

Figure 3-2. Boggs Creek above Lake Pueblo State Park

Groundwater which leaches to the relatively impermeable shale deposits tends to dissolve selenium and uranium and, as it flows atop the bedrock strata towards surface drainages, carries elevated levels of dissolved selenium and uranium with it. Various anthropogenic activities accelerate the mobilization and transport of selenium and uranium from shale and shale derived soil to surface water (Gates, et al, 2009). The Minnequa canal transports a significant amount of water, flowing southeast (approximately 5 miles) through the Boggs Creek drainage, upstream from the sampling location. The flow diverted from the Arkansas near Florence, CO travels approximately 11 miles before reaching the Boggs Creek drainage. Canal seepage increases the amount of water mobilizing selenium and uranium from shale derived soils and the underlying shale strata.

4.0 Water Quality Goals and Targets

The water quality target and goal for this TMDL is attainment of the current aquatic life use-based selenium and water supply use-based uranium standards

5.0 Instream Conditions

5.1 Hydrology

The hydrology of the Boggs Creek drainage is driven primarily by recharge of soils overlying shallow cretaceous shales. These shallow, highly permeable soils contribute to a relatively rapid cycle of soil moisture recharge in response to precipitation and subsequent discharge to Boggs Creek. Coupled with the general lack of precipitation which characterizes the region (Table 5-1), flows in Boggs Creek are ephemeral and, when flowing, at an inconsistent flow rate.

Month	Precipitation (inches)
Jan	0.3
Feb	0.3
Mar	0.8
Apr	0.9
May	1.2
Jun	1.2
Jul	2.1
Aug	2
Sep	0.9
Oct	0.6
Nov	0.4
Dec	0.4
Annual	**11.2**

Source http://www.climate-zone.com/climate/united-states/colorado/pueblo/

Table 5-1. Monthly and annual precipitation for Pueblo, CO.

In order to estimate flow for the purposes of using daily flow data over a ten year period, USGS StreamStats was used. This allows one to easily delineate a drainage area with an online map application and use a comparable gaging station in the area. In this case, upstream and downstream USGS gaging stations were evaluated, and the nearest comparable gaged flow is a USGS gage #07096000 (Arkansas River at Canon City, CO), upstream of Pueblo Reservoir. The gage location has similar elevation, climate and geology of the Boggs Creek watershed. The area of the upstream watershed is 3117 square miles, Boggs Creek watershed is 26.5 square miles, and the ratio of watershed areas is 117.6:1. Thus, the flow factor used in calculating estimated flows from the streamgage was 0.0085. USGS StreamStats generates Peak-Flow, Flow-Duration and General Flow statistics using the entire period of record. The tables below summarize information.

Division sampling station 7285, Boggs Creek at Highway 96, was visited at least quarterly between May 2010 and May 2012. Samples were collected on four occasions (5/11/10, 6/21/10, 10/6/10 and 5/18/12). There was no instream flow during the other sampling visits.

Parameter	Value
6-hour, 100-yr precipitation, in inches	3.51
Mean basin slope computed from 10 m DEM, in percent	4.37
Area that drains to a point on a stream, in square miles	26.5
Mean Basin Elevation, in feet	5180
Mean annual precipitation, in inches	13.63
Percentage of basin above 7500 ft elevation	0

Table 5-2 USGS SteamStats Basin Characteristics Report

The flow gage used has a typical hydrograph for the Arkansas basin, with peak flows occurring in the summer months. There is significantly more variation in the flow percentiles during high flow season (May, June, and July), whereas, the shoulder and low flow months (September through April) have low variation consistently below 5 cfs.

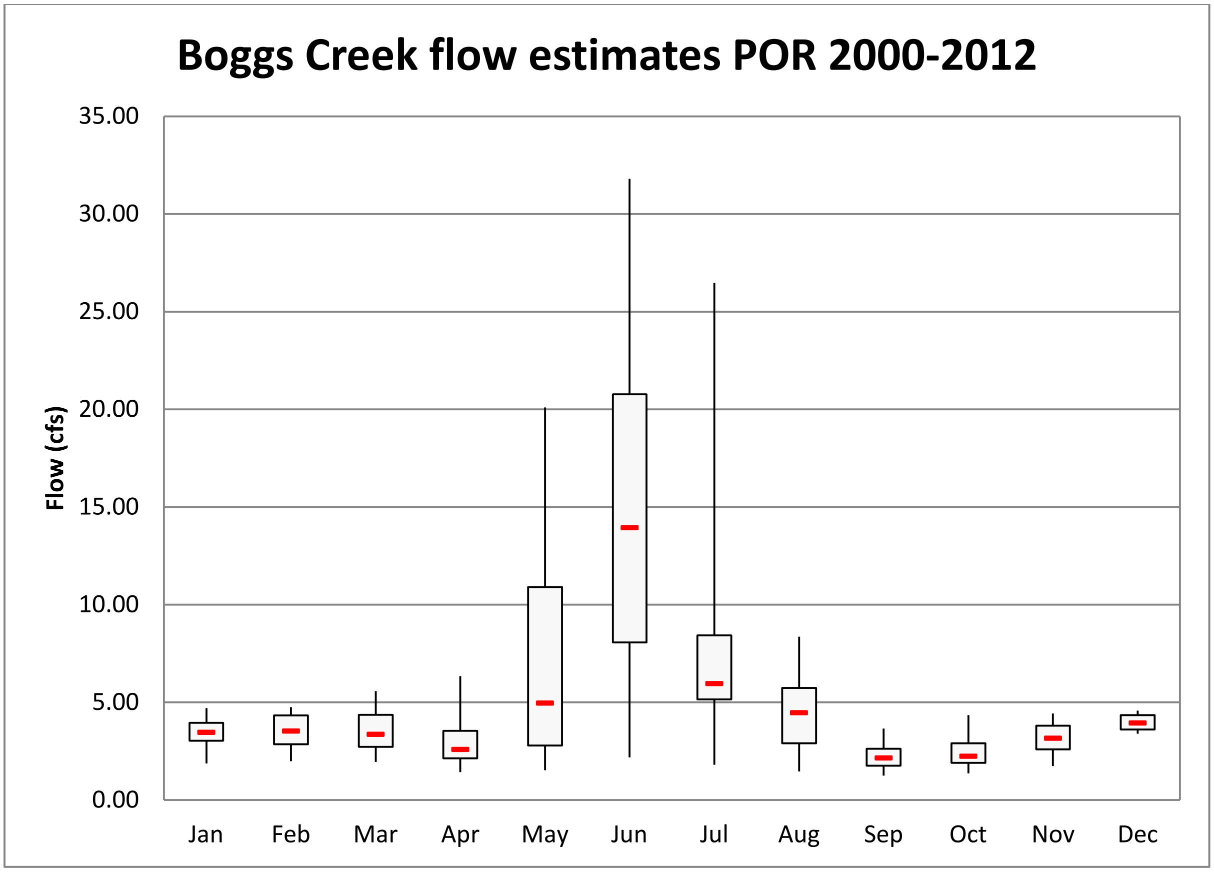

Figure 5-1: Statistical representation of monthly flows from 2000 through 2012. The box and whisker plots include the 5^{th}, 25^{th}, 75^{th}, 95^{th} percentiles of monthly flows over a 12 yr period. The red lines are the median flows for each month.

5.2 Ambient Water Quality

Aquatic life use-based selenium standards are expressed as dissolved concentrations, while the water supply use-based uranium standard is expressed as total recoverable fraction. The aquatic life use-based standards for selenium are expressed as numeric values, 4.6 µg/L (chronic) and 18.4 µg/L (acute)Water quality sample data collected between 2005 and the present, consistently (5 of 7 samples) exceed the acute standard as well as the chronic standard. All data collected can be seen in Appendix A.

Attainment of chronic dissolved metal standards is determined by comparison of the 85^{th} percentile value of the ranked data against the standard (see *Section 303(d) Listing Methodology – 2012 Listing Cycle*, WQCC 2011), while attainment of the total recoverable uranium is determined by comparing the 50^{th} percentile against the standard.

month	chronic Se TVS[1]	ambient Se[1]	U[1] TVS	ambient U[1]
Jan	4.6	**<u>311</u>**[2]	30	**<u>68</u>**
Feb	4.6	**<u>312</u>**[2]	30	**<u>68</u>**
Mar	4.6	**<u>155</u>**	30	**<u>71</u>**
Apr	4.6	**<u>141</u>**	30	**<u>62</u>**
May	4.6	**<u>136</u>**	30	**<u>32</u>**
Jun	4.6	**<u>396</u>**	30	**<u>41</u>**
Jul	4.6	**<u>130</u>**	30	**<u>43</u>**
Aug	4.6	**<u>123</u>**	30	**<u>45</u>**
Sep	4.6	**<u>135</u>**[2]	30	**<u>53</u>**
Oct	4.6	**<u>148</u>**	30	**<u>60</u>**
Nov	4.6	**<u>311</u>**	30	**<u>65</u>**
Dec	4.6	**<u>311</u>**[2]	30	**<u>68</u>**

Table 5.2-1. Attainment/Exceedances of Monthly Chronic Water Quality Standards (exceedances in bold and underlined)

[1] metal values in µg/l

2 Sample data not available for month. Values calculated as averages of data for preceding and following months

6.0 Technical Analysis

6.1 Load Duration Curve

Load duration curves are a graphical tool used to illustrate the relationships between flow and water quality. First a flow duration curve is estimated using daily flows were calculated using the flow factor, and data from 2000-2012 for USGS gage #09096000 (Arkansas River at Canon City, CO). The flow data was then ranked According to the EPA 841-B-07-006 document:

"The use of "percent of time" provides a uniform scale ranging between 0 and 100. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, while floods are exceeded infrequently.

A basic flow duration curve runs from high to low along the x-axis. The x-axis represents the duration amount, or "percent of time", as a cumulative frequency distribution. The y-axis represents the flow value (e.g. cubic feet per second) associated with the "percent of time" (or duration) it is met or exceeded…"

Flow duration curves represent the percent of time a flow is likely to be equaled or exceeded within the stream based on historic flow data. This allows for the grouping of flow conditions, in this case into five general indicator categories. The "high-flow" category represents flows observed during the greatest 10 percent of all flow values; 'moist conditions' represents flow values observed 30 percent of the time (they are equaled or exceeded 10-40 percent of the time); 'mid-ranges' represents 20 percent of all flows (equaled or exceeded 40-60 percent of the time); 'dry-conditions' represents 30 percent of all flows (equaled or exceeded 60 to 90 percent of the time); and 'low-flow' conditions exist about 10 percent of the time, with 90 to 100 percent of all flows equaling or exceeding those in the low flow category.

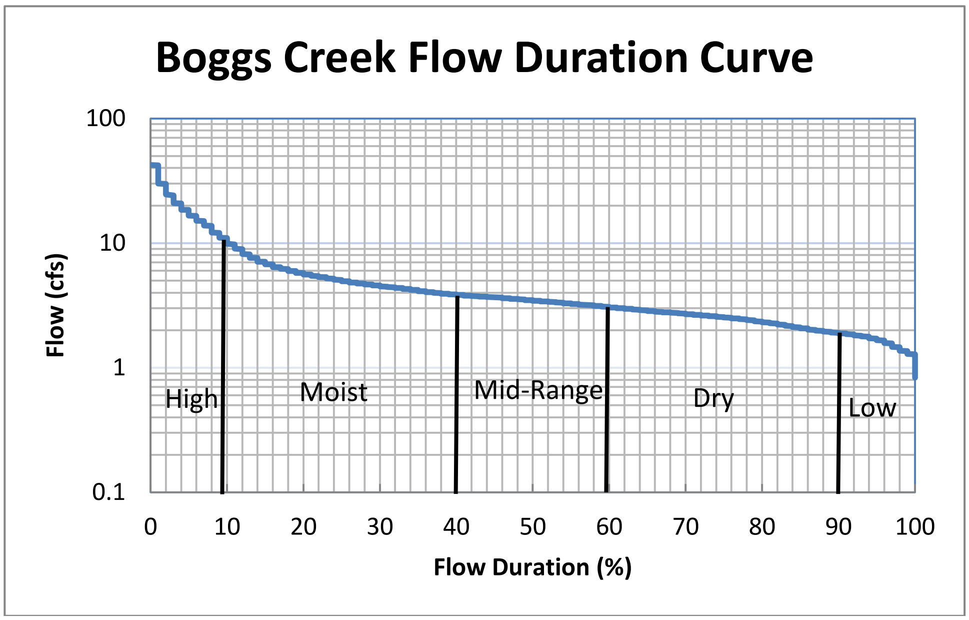

Figure 6.1-1 Boggs Creek Flow Duration Curve, using USGS gage #09096000 (Arkansas River at Canon City, CO)

The load duration curve is then calculated by multiplying stream flow with the numeric water quality standard and a conversion factor resulting a in a curve that represents the water quality standard in lbs per day for a particular pollutant of concern. Ambient water quality data is then plotted, with an associated flow measurement to compute an instantaneous load. The pattern that emerges on a LDC can indicate the source of impairment. For instance, loading that is constant across all flow regimes can indicate a point source problem. Or impairments only observed in the high flow range can indicate a non-point source problem associated with a storm event.

Load duration curves were developed for selenium and uranium.
The selenium load duration curve (Figure 6.1-2) shows consistent loading across all flow regimes. There are no emerging patterns that point to high or low flow issues,

runoff or seasonal irrigation return flow. Because a portion of the flow during all flow regimes is dependent on the groundwater table, selenium loading most likely comes from groundwater recharge and release of selenium through the soil.

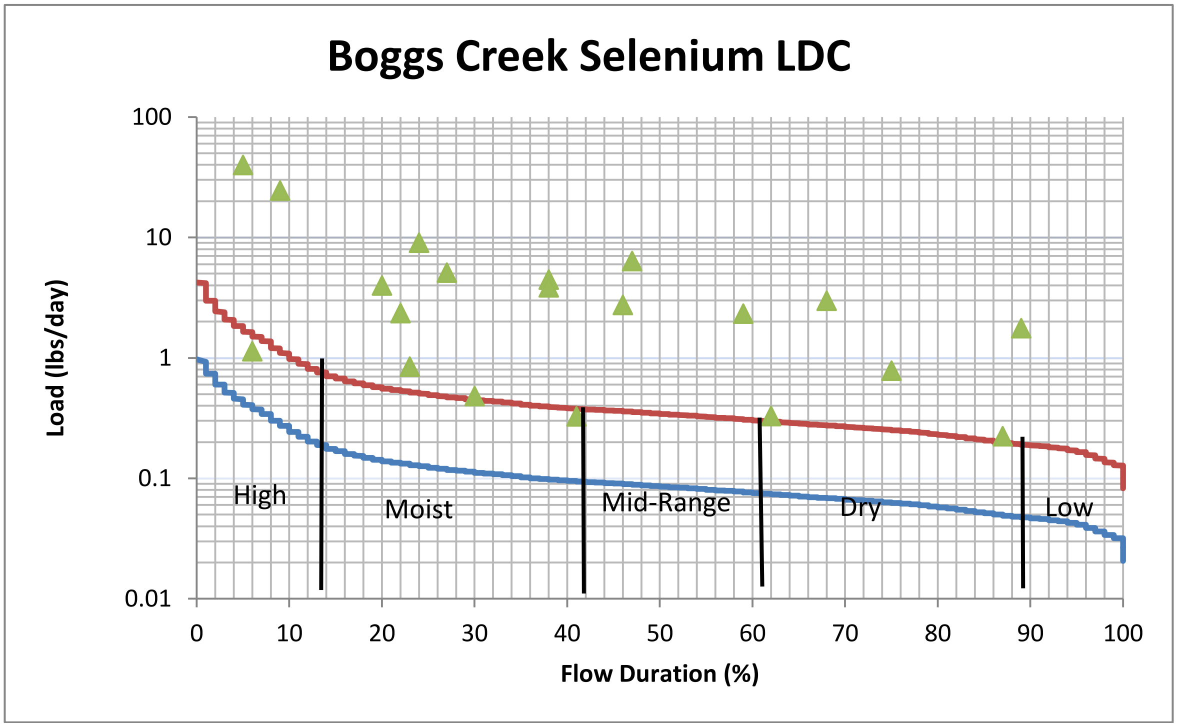

Figure 6.1-2- Selenium exceedances shown in all flow regimes (green triangles). Red line represents the acute standard, and the blue line represents the chronic standard.

Uranium reductions are needed in all flow regimes. The load duration curve does not show any possible high or low flow issues, or illustrate consistent loading from a possible point source.

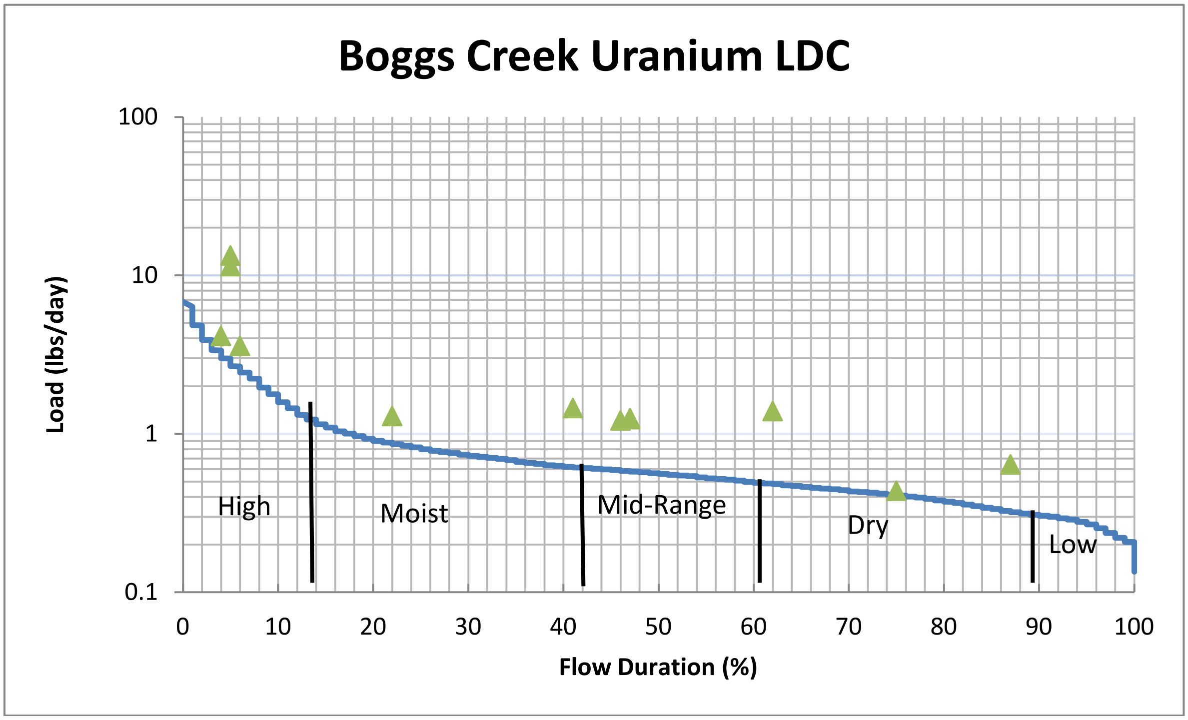

Figure 6.1-3- Uranium exceedances shown in all flow regimes (green triangles). The blue line represents the chronic uranium standard

6.2 Point Sources

There are no NPDES or CDPS permitted point source discharges in the Boggs Creek drainage. The Pueblo Area Council of Governments Comprehensive Plan indicates the entire Boggs Creek drainage watershed is zoned as rural/ranching. Anticipated growth for Pueblo over the next 15 years is less than 2% (Pueblo Comprehensive Plan, 2008). Given the land use, and growth projections, no reserve capacity has been assigned in this TMDL for future dischargers, as this would be unlikely.

6.3 Non-Point and Natural Sources

The Boggs Creek drainage is predominantly underlain by cretaceous marine shale which is source material for both selenium and uranium found in Boggs Creek. Seepage from the Minnequa canal has been identified as a potential source affecting the fate and transport of selenium and uranium to surface water. As previously stated, there is no identifiable source for the (former) zinc impairment.

7.0 TMDL Allocation

7.1 Total Maximum Daily Loads

TMDLs are required in instances where waterbodies fail to support classified uses and/or attain assigned numeric water quality standards. The TMDL calculates the pollutant load reductions required to attain water quality standards. The load reductions are apportioned among MOS, WLA and LA. The WLA represents pollutant contributions from permitted and non-permitted point source discharges. The LA is comprised of nonpoint source and/or background contributions. The TMDL may be expressed as the sum of the LA, WLA and MOS.

$$TMDL = WLA + LA + MOS$$

TMDL = Sum of Waste Load Allocations + Sum of Load Allocations + Margin of Safety

7.1.1 WLA

There are no permitted point source discharges in the Boggs Creek drainage. Therefore there are no waste load allocations calculated for this TMDL. As mentioned earlier, there is no anticipated future permitted discharge(s) to Boggs Creek; therefore, no reserve capacity was included in this TMDL.

7.1.2 LA

All sources that were examined (i.e. natural geology of the area and hydrology of Boggs Creek) are considered nonpoint sources and are therefore accountable to load allocations. Similarly, all load reductions are required from nonpoint sources.

7.1.3 MOS

According to the Federal Clean Water Act, TMDLs require a MOS component that accounts for the uncertainty about the relationship between the pollutant loads and the receiving waterbody. The MOS can be implicit or explicit. A 10% explicit margin of safety was included in this TMDL. This MOS is included to account for the uncertainty between the TMDL load allocations and the desired water quality target. The MOS used in the TMDL analysis is explicit (10%) and also resides in the comparison of chronic load reductions applied to acute standard exceedances. Conservative assumptions used in the analysis include the use of the 85th percentile of the data in establishing ambient conditions, per the 303(d) Assessment Methodology.

The TMDL equation becomes the following:

$$\text{TMDL} = \sum \text{LA} + \text{MOS}$$

Where,
LA (lbs/day) = Water Quality Standard (µg/l) x Flow (cfs) x Conversion Factor - MOS

Conversion factor (CF):

$$\left(\frac{\text{ft}^3}{\text{sec}}\right)\left(\frac{\mu\text{g}}{\text{L}}\right) \rightarrow \frac{\text{lbs}}{\text{day}}$$

CF =

$$\left(\frac{ft^3}{sec}\right)\left(\frac{60\ sec}{1\ min}\right)\left(\frac{60\ min}{1\ hr}\right)\left(\frac{24\ hr}{1\ day}\right)\left(\frac{28.32\ L}{ft^3}\right)\left(\frac{\mu g}{L}\right)\left(\frac{g}{10^6 \mu g}\right)\left(\frac{0.002205\ lbs}{g}\right)$$

$$=0.0054$$

7.2 TMDL for Dissolved Selenium

The entire TMDL is expressed as a Load Allocation, meaning that all pollutant reduction necessary to attain standards are from nonpoint sources.

In order to attain chronic selenium standards, Boggs Creek would require high reductions in selenium loading (97-99%) for all months. Because there are limited data for the winter low flow months, ambient water quality concentrations were set at the same value for each month (Nov-Feb).

Comparison of individual sample values, when adjusted by the appropriate monthly loading reductions against the corresponding acute selenium standards, indicates that acute selenium standards would be achieved with the exception of a single sample result. State assessment protocol, as defined in the *Section 303(d) Listing Methodology – 2012 Listing Cycle,* requires individual sample results not exceed the corresponding acute standard at a frequency greater than one exceedance within a three year period. A single exceedance within the period of record assessed would be considered to demonstrate attainment of the acute standard. The calculated load reductions are therefore protective of both acute and chronic selenium standards.

Month	Median (cfs)	Se Standard (ug/L)	Se TMDL (lbs/day)	10% MOS	TMDL w/ MOS (allowable load)	Current Conditions (ambient WQ, ug/L)	Current Load (lbs/day)	Load Reduction (lbs/day)	Percent Reduction
Jan	3.5	4.6	0.088	0.009	0.079	311	5.829	5.75	99%
Feb	3.5	4.6	0.089	0.009	0.080	312	5.950	5.87	99%
Mar	3.4	4.6	0.085	0.009	0.077	155	2.825	2.75	97%
Apr	2.6	4.6	0.066	0.007	0.059	141	1.974	1.91	97%
May	5.0	4.6	0.126	0.013	0.113	136	3.642	3.53	97%
Jun	13.9	4.6	0.353	0.035	0.317	396	29.809	29.49	99%
Jul	6.0	4.6	0.151	0.015	0.136	130	4.186	4.05	97%
Aug	4.5	4.6	0.113	0.011	0.102	123	2.960	2.86	97%
Sep	2.2	4.6	0.055	0.005	0.049	135	1.572	1.52	97%
Oct	2.2	4.6	0.057	0.006	0.051	148	1.789	1.74	97%
Nov	3.2	4.6	0.080	0.008	0.072	311	5.309	5.24	99%
Dec	3.6	4.6	0.091	0.009	0.082	311	6.029	5.95	99%

Table 7.2-1: Monthly selenium current conditions and load reductions necessary to meet the applicable water quality standard.

7.3 TMDL for Total Uranium

For the total uranium TMDL, a 10 percent Margin of Safety was included in the TMDL. The TMDL is expressed as a Load Allocation, meaning that all pollutant reduction necessary to attain standards would have to be accomplished through reductions of non-point source pollution.

Month	Median (cfs)	U Standard (ug/L)	U TMDL (lbs/day)	10% MOS (lbs/day)	TMDL w/ MOS (allowable load, lbs/day)	Current Conditions (ambient WQ, ug/L)	Current Load (lbs/day)	Load Reduction (lbs/day)	Percent Reduction
Jan	3.5	30	0.562	0.056	0.506	68	1.273	0.768	60%
Feb	3.5	30	0.572	0.057	0.515	68	1.297	0.782	60%
Mar	3.4	30	0.545	0.055	0.491	71	1.291	0.800	62%
Apr	2.6	30	0.420	0.042	0.378	62	0.868	0.490	56%
May	5.0	30	0.804	0.080	0.724	32	0.858	0.134	16%
Jun	13.9	30	2.258	0.226	2.032	41	3.086	1.054	34%
Jul	6.0	30	0.966	0.097	0.869	43	1.385	0.515	37%
Aug	4.5	30	0.724	0.072	0.652	45	1.086	0.435	40%
Sep	2.2	30	0.349	0.035	0.314	53	0.611	0.297	49%
Oct	2.2	30	0.364	0.036	0.327	60	0.727	0.400	55%
Nov	3.2	30	0.513	0.051	0.462	65	1.111	0.650	58%
Dec	3.6	30	0.581	0.058	0.523	68	1.317	0.794	60%

Table 7.3-1: Monthly uranium current conditions and load reductions necessary to meet the applicable water quality standard

8.0 Restoration Planning and Implementation Process

There is no known restoration planning for the Boggs Creek watershed. Because there are no known discharges associated with selenium and uranium impairments, regulatory mechanisms (NPDES or CDPS permits) are not an appropriate tool. The most recent (December 2012) water quality management plan for the area points out the source(s) are unknown and further monitoring data is needed.

A rather robust selenium study has been conducted in the lower Arkansas watershed, *Assessing and Modeling Irrigation-Induced Selenium in the Strem-Aquifer System of the Lower Arkansas River Valley, Colorado* (Gates, T.K., et. al, 2009) While data collection for the Gates study did not include Boggs Creek specifically, the selenium transport attributed to groundwater influence and geology of the area is the same. The study demonstrates a strong correlation between selenium and uranium in groundwater, and powerful relationships with nitrate in groundwater. The relationship to nitrate from fertilizers, and degree to which selenium depends on oxidation, suggests selenium in surface water can be reduced through nitrate control using best management practices (BMPs) in irrigated agriculture.

9.0 Public Involvement

Boggs Creek was initially included on the 2002 303(d) list of impaired waters in Colorado based upon water quality data, and remained subsequent lists, including the 2012 303(d) list. The development of the 303(d) list is a public process involving solicitation from the public of candidate waterbodies, formation of a technical review committee comprised of representatives of both the public and private sector, and a public hearing before the Colorado Water Quality Control Commission. In an effort to engage local interest, the Division presented information to local groups including Pueblo Area Council of Governments (PACOG) and Arkansas and Fountain Coalition for Urban River Evaluation (AF CURE). The presentation(s) took place in the spring of 2015 and included general information on the TMDL development process, as well as identify specific TMDLs the Division is currently in process of completing.

The TMDL report was also public noticed. The TMDL was made available for public review and comment during a 30 day public notice period in September, 2015. Notice was provided in the Colorado Water Quality Information Bulletin and the draft TMDL was posted on the Division TMDL webpage.

The division received one comment letter from the public notice period, on behalf of Pueblo West Metropolitan District (PWMD). None of the information resulted in revisions to the TMDL report. Appendix B is a summary of the comments received during public notice period and the division's responses to those comments.

The final TMDL report was published in the Water Quality Information Bulletin for public review during a 30-day public notice period mid-December through mid-January 2016, as required by Regulation 21 (WQCC, 2015). Following this public notice period, the report was submitted to EPA.

10.0 References

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Scott, G.R., R.B. Taylor, R.C. Epis and R.A. Wobus, 1978. Geologic map of Pueblo 1 degree x 2 degree quadrangle, south-central Colorado. Map I-1022 (Scale 1:250,000).

Pueblo Area Council of Governments, Comprehensive Plan, Future Land Use Map, 2008, online at http://county.pueblo.org/government/county/department/planning-and-development/land-use-administration

U.S. Geological Survey, 2012, The StreamStats program for Colorado, online at http://water.usgu.gov/osw/streamstats/colorado.html.

U.S. Department of Agriculture Soil Conservation Service, 1979. Soil Survey of Pueblo Area,Colorado. http://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/colorado/CO626/0/Pueblo.pdf

WQCC 2012. Colorado Department of Public Health and Environment, Water Quality Control Commission, 2012, 303(d) List of Impaired Waters, Regulation No. 93.

WQCC 2013. Colorado Department of Public Health and Environment, Water Quality Control Commission, The Basic Standards and Methodologies for Surface Water, Regulation No. 31. Amended 9/11/12, Effective January 31, 2013.

WQCC 2014. Colorado Department of Public Health and Environment, Water Quality Control Commission, Classifications and Numeric Standards Arkansas River Basin Regulation No. 32. Amended 1/12/15, Effective 6/30/15.

WQCC 2015. Colorado Department of Public Health and Environment, Water Quality Control Commission, Procedural Rules Regulation No. 21. Amended 3/10/15, Effective 4/30/15.

WQCD 2011. Section 303(d) Listing Methodology – 2012 Listing Cycle. June 2011.

Appendix A. Data collected by the Water Quality Control Division

Sample Collection Date	Selenium (μg/L)	Sample Collection Date	Uranium (μg/L)
3/17/1998	16	3/17/1998	71
3/21/1998	180	6/2/1998	120
6/2/1998	420	**6/2/1998**	**140**
11/19/1998	330	11/19/1998	64
5/4/2000	200	**11/19/1998**	**65**
6/27/2000	380	8/10/2005	45
7/25/2000	130	4/4/2006	62
8/23/2000	140	6/6/2006	40
10/3/2000	170	5/11/2010	32
11/6/2000	200	6/21/2010	41
8/10/2005	82	10/6/2010	60
2/13/2006	210	5/18/2012	86.5
4/4/2006	141		
6/6/2006	0		
5/11/2010	57.5		
6/21/2010	13		
8/18/2010	20		
10/6/2010	21		
2/15/2011	330		
5/25/2011	30		
5/18/2012	20.5		

Appendix B. Summary of Comments received at Public Notice and Water Quality Control Division Response

The Boggs Creek TMDL report was made available for public review and comment during a 30 day public notice period in September 2015, ending October 12, 2015. The division received one comment letter (attached) prepared on behalf of Pueblo West Metropolitan District (PWMD).

Comments received raised concerns that there are ambient-based site-specific selenium standards that have been established in other stream segments near Pueblo Reservoir with watersheds that have the same geology as Boggs Creek. These established standards are orders of magnitude higher than the chronic selenium standard of 4.6ug/l and PWMD maintains that this standard is not appropriate for Boggs Creek. The letter also points to a supporting memo submitted to the division summarizing the record of ambient-based standards for selenium established during the June 2013 WQCC rulemaking hearing on the Arkansas River Basin. Additionally, it is stated that if site-specific selenium standards were adopted for Boggs Creek, there would be no need for a TMDL and the farmers in the watershed would not be required to comply with BMPs for irrigated agriculture.

Division Response: According to the Clean Water Act, once a waterbody is identified on the 303(d) List as impaired, states are allowed to remove waterbodies from the list after they have developed a TMDL or after other actions to meet water quality standards have been made. It is up to states to set priorities for TMDL development, but ultimately they are required to complete TMDLs 8 to 13 years from a waterbody's original 303(d) listing. The basis for prioritization of TMDLs can be found in the Listing Methodology (WQCC 2014), which includes severity of impairment and age of listing. Because Boggs Creek was initially on the Colorado 303(d) list in 2002 for selenium, it has been a high priority for TMDL development since 2012 (WQCC 2012).

While it is possible that a waterbody can be removed from the 303(d) list as a result of a change in water quality standards, this requires a thorough analysis documenting that the standard cannot be attained, as well as a determination of what the appropriate standard should be. Although a TMDL can be used in support of such an analysis, it does not meet the comprehensive requirements for a standards change. Because of limited resources, the division predominantly relies on an interested party or proponent to advance the development of a site-specific standard; absent that (as is the case for Boggs Creek), the need for a TMDL becomes higher priority the longer the impairment remains on the list. Therefore, the division moved forward with the Boggs Creek TMDL.

Additionally, the division appreciates the comments about implementation implications of the TMDL. However, any effort to implement through non-point *source management is voluntary, which means there is no requirement for farmers to apply BMPs for irrigated agriculture as a result of the TMDL.*

In communication with US EPA Region 8 in regards to review of the draft TMDL, after the public comment period, there was an error found in calculation of the percent reductions.

The division has made appropriate changes to correct the error. These include Tables 2 and 3 of the Executive Summary; and TMDL Tables 7.2-1 and 7.3-2. The correction resulted and in higher percent reduction needed in all months, for selenium and uranium. The loadings and all other data calculations remain unchanged. This correction did not affect the TMDL and no permittees were impacted, therefore, the division feels no need for additional public notice period.

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October 12, 2015

Via email to: Holly.Brown@state.co.us

Holly Brown
TMDL Development
Restoration and Protection Unit
Water Quality Control Division
Colorado Department of Public Health and Environment
WQCD-WSP-B2
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Re: **Pueblo West Metropolitan District - Comments on the Draft September 2015 TMDL Assessment for Boggs Creek – COARMA18a, Pueblo County, CO**

Dear Ms. Brown:

On behalf of the Pueblo West Metropolitan District (PWMD), I am submitting these comments on the Draft September 2015 Total Maximum Daily Load (TMDL) Assessment for Boggs Creek – COARMA18a (Middle Arkansas Segment 18a Boggs Creek), Pueblo County, CO sent to public notice on September 11, 2015 with comments due on October 12, 2015.

On page 6 of the Draft September 2015 TMDL Assessment, Figure 1-1. Boggs Creek and vicinity illustrates that the Boggs Creek watershed is located south of the Pueblo Reservoir. On page 11, Figure 3-1. Boggs Creek Watershed – Surficial Geology illustrates that the geology in the Boggs Creek watershed is the same as the geology in the Pesthouse Gulch, Wildhorse Creek, Golf Course Wash and Turkey Creek watersheds which are located north of the Pueblo Reservoir in the PWMD. On page 15, in 5.2 Ambient Water Quality, first paragraph, the second sentence states "The aquatic life use-based standards for selenium are expressed as numeric values, 4.6 µg/L (chronic) and 18.4 µg/L (acute)." On page 16, Table 5.2-1. Attainment/Exceedances of Monthly Chronic Water Quality Standards shows that in Boggs Creek, all of the monthly ambient selenium concentrations (which range from 123 to 396 µg/L) greatly exceed the chronic standard of 4.6 µg/L. On page 19, in 6.3 Non-Point and Natural Sources, the first sentence states "The Boggs Creek drainage is predominantly underlain by cretaceous marine shale which is source material for … selenium … found in Boggs Creek." On page 26, in Appendix A – Data collected by the Water Quality Control Division, only one data point is less than the chronic standard of 4.6 µg/L selenium.

On page 23 of the Draft September 2015 TMDL Assessment, 8.0 Restoration Planning and Implementation Process states:

> There is no known restoration planning for the Boggs Creek watershed. Because there are no known discharges associated with selenium, zinc and uranium impairments, regulatory mechanisms (NPDES or CDPS permits) are not an appropriate tool. The most recent

(December 2012) water quality management plan for the area points out the source(s) are unknown and further monitoring data is needed.

A rather robust selenium study has been conducted in the lower Arkansas watershed, *Assessing and Modeling Irrigation-Induced Selenium in the Stream-Aquifer System of the Lower Arkansas River Valley, Colorado* (Gates, T.K., et. al, 2009) While data collection for the Gates study did not include Boggs Creek specifically, the selenium transport attributed to groundwater influence and geology of the area is the same. The study demonstrates a strong correlation between selenium and uranium in groundwater, and powerful relationships with nitrate in groundwater. The relationship to nitrate from fertilizers, and degree to which selenium depends on oxidation, suggests selenium in surface water can be reduced through nitrate control using best management practices (BMPs) in irrigated agriculture.

While preparing the TMDL Assessment for Boggs Creek, the Division does not seem to have considered the ambient-based site-specific selenium standards that PWMD and the City of Pueblo have worked so hard to establish for other stream segments near the Pueblo Reservoir with watersheds that have the same geology. All of the ambient-based site-specific chronic selenium standards for nearby stream segments are orders of magnitude higher than the chronic selenium standard of 4.6 µg/L for Boggs Creek; therefore, it is clear that this chronic selenium standard is not appropriate for Boggs Creek. The ambient selenium data collected by the Division could provide the basis for ambient-based site-specific selenium standards for Boggs Creek. If the Division proposed, and the Water Quality Control Commission (WQCC) adopted, ambient-based site-specific selenium standards for Boggs Creek, there would be no need for a TMDL for Boggs Creek and the farmers in the Boggs Creek watershed would not be required to comply with BMPs for irrigated agriculture.

The June 10, 2015 memo (attached) that Jim Egan and I sent to Sarah Johnson of the Division summarizes the record on ambient-based site-specific standards for selenium established during the June 2013 WQCC rulemaking hearing on the Arkansas River Basin, Regulation #32. All of the documents referred to in this memo should be available in the WQCC office.

Please don't hesitate to contact me if you have any questions or comments. Thanks very much for your consideration.

Yours truly,

Connie H. King

Connie H. King

Attachment

cc: Scott Eilert, Director of Utilities, PWMD
Jim Egan, P.E., President, RMI, Inc.

Memorandum

TO: Sarah Johnson, Standards Unit Manager, Water Quality Control Division

FROM: Jim Egan, P.E., President, RMI, Inc.
Connie H. King, Esq., Law Firm of Connie H. King, LLC

DATE: June 10, 2015

SUBJECT: Pueblo West Metropolitan District – Comments on WQCD's February 12, 2015 Draft Site Specific Standards Proposal Completeness Review Checklist

On behalf of the Pueblo West Metropolitan District (PWMD), we have prepared this memorandum in response to the request you made during the February 19, 2015 Basic Standards Workgroup meeting for comments on the Water Quality Control Division's (WQCD's) February 12, 2015 Draft Site Specific Standards Proposal Completeness Review Checklist (February 12, 2015 Draft Checklist) which was referred to in your February 12, 2015 Briefing Memo to the Basic Standards Work Group regarding Site-Specific Standards – What is required?

This response is based upon the ambient-based site-specific selenium standards proposed by PWMD and adopted by the Water Quality Control Commission (WQCC) during the June 2013 Arkansas River Basin, Regulation #32, rulemaking hearing (RMH) process for:

- Middle Arkansas Segment 4a Wildhorse Creek;
- Middle Arkansas Segment 4e Golf Course Wash;
- Middle Arkansas Segment 4g Pesthouse Gulch; and
- Middle Arkansas Segment 18b Turkey Creek.

The format of this response follows the format of the WQCD's February 12, 2015 Draft Checklist.

I. General Information

A. through E.:

This information was provided in the:

- October 23, 2012 letter from Connie King on behalf of PWMD to the WQCC regarding the November 5, 2012 Issues Formulation Hearing (IFH) including Attachments #1 - #4;
- March 19, 2013 PWMD Proponents Prehearing Statement (PPS) including Exhibits #11 - #14;
- April 23, 2013 PWMD Responsive Prehearing Statement (RPS) including Exhibits #18 and #23;
- May 14, 2013 PWMD Rebuttal Statement (RS) including Exhibits #31 - #35; and
- PWMD testimony at the IFH and the June 10 – 11, 2013 RMH.

F. Describe how proposal protects downstream uses:

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

1. Currently there are no point source discharges to Golf Course Wash and Turkey Creek. PWMD monitored the selenium concentrations in Golf Course Wash and Turkey Creek to demonstrate that the regional high selenium concentrations are due to natural sources in the underlying ancient Pierre Shale geology. Since three years of data collection was conducted and effort was expended, PWMD developed and proposed ambient-based site-specific selenium water quality standards for these two segments so as to correctly reflect natural conditions. The data collected and the water quality standard calculations and proposals were submitted to the WQCC and the formal public record of the RMH process.

2. Golf Course Wash and Turkey Creek flow into Pueblo Reservoir. Ongoing long term monitoring data from the Pueblo Reservoir, as collected by the U.S. Geological Survey (USGS) and published in public reports, indicate that the selenium concentration in the Pueblo Reservoir does not exceed the selenium water quality standard assigned to protect the existing and potential uses of water from the Pueblo Reservoir. Calculations made by Jim Egan demonstrating this were transmitted to Trisha Oeth by email from Connie King on October 9, 2014. PWMD representatives provided this information to the WQCC in a handout during the October 14, 2014 WQCC meeting regarding the August 19, 2014 letter from the EPA to the WQCC regarding ambient-based selenium standards for Golf Course Wash and Turkey Creek.

3. Pesthouse Gulch flows into Wildhorse Creek which flows into the Arkansas River. The source of selenium is natural and ancient in nature. The PWMD wastewater treatment plant effluent discharge's selenium concentration is two orders of magnitude less than the upstream flows impacted by natural geologic selenium sources. The WQCD developed and proposed ambient-based site-specific selenium water quality standards for Wildhorse Creek during the June 2007 Arkansas River Basin RMH process. These data, calculations, and rationale are in the public record of that hearing and were summarized in the PWMD submittals during the June 2013 RMH process. Data used by the WQCD Permits Section, as noted in the Water Quality Assessment and Fact Sheet of the PWMD Discharge Permit effective October 1, 2014, indicate no issues with selenium that warranted discharge permit limitations to protect the Arkansas River at the confluence with Wildhorse Creek.

G. Describe stakeholder outreach:

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

1. The PWMD Discharge Permit, CDPS Permit CO-0040789, effective October 1, 2009, contained a compliance schedule for the collection of selenium data necessary to develop appropriate ambient-based site-specific selenium water quality standards for Pesthouse Gulch

and Wildhorse Creek. A discharge permit is a public document, and the issuance of such is subject to public review and comments pursuant to Colorado and federal law.

2. PWMD's letters to and meetings with the WQCD, on September 14, 2011, September 26, 2011, September 28, 2011 and June 6, 2012 addressed the issue of natural background selenium concentrations in Pesthouse Gulch and Wildhorse Creek.

3. The October 8, 2012 letter from Jim Egan to Blake Beyea, WQCD, included selenium data collected to date in Pesthouse Gulch and Wildhorse Creek and preliminary proposals regarding Pesthouse Gulch and Wildhorse Creek. The October 15, 2012 email from Black Beyea to Jim Egan, regarding PWMD's preliminary proposals, stated it does not seem necessary for PWMD to meet with the WQCD prior to the November 5, 2012 IFH.

4. Full participation in the June 2013 Arkansas River Basin RMH process, and submittal of selenium data, including extensive supporting documentation, as well as testimony by PWMD and its consultants at every public WQCC meeting and hearing that was part of the June 2013 RMH process.

5. On April 4, 2013 PWMD representatives met with the Environmental Policy Advisory Committee (EPAC) to the Pueblo Area Council of Governments (PACOG) regarding the ambient-based site-specific selenium water quality standards proposals for all four stream segments (i.e., Pesthouse Gulch, Wildhorse Creek, Golf Course Wash and Turkey Creek), which resulted in the April 22, 2013 letter from EPAC to PACOG in which the EPAC recommended that PACOG support adoption of PWMD's proposed selenium standards for the four stream segments.

6. On April 24, 2013 PWMD and its consultants made a presentation to PACOG regarding the ambient-based site-specific selenium water quality standard proposals for all four stream segments. In the May 14, 2013 letter from PACOG to the WQCC, PACOG accepted PWMD's proposed changes to the selenium standards for the four stream segments.

H. Provide all water quality information used to develop the proposal

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

1. PWMD submitted to the WQCC all of the water quality data and sampling point information during the June 2013 RMH process. Additionally, selenium data collected to date were submitted to WQCD at a meeting on September 14, 2011. The sampling plan for this water quality data collection project was submitted to Dave Akers of the WQCD on September 22, 2010.

2. No modeling was required or utilized for the development of the proposed ambient-based site-specific selenium water quality standards adopted at the June 2013 RMH.

II. Ambient Quality-based Site-specific Standards Proposals

A. Sources of the parameter of concern:

1. Information regarding the natural geologic formation source of the selenium affecting the four stream segments subject to this checklist was submitted to the WQCD and WQCC as summarized above, including the:

a. August 19, 2011 email from Connie King to Annette Quill of AGO, and Dave Akers, Sarah Johnson and Jennifer Miller of WQCD, regarding selenium standards for Pesthouse Gulch and Wildhorse Creek.

b. October 23, 2012 letter from Connie King on behalf of PWMD to the WQCC regarding the November 5, 2012 IFH including Attachments #1 - #4 and PWMD testimony at the November 5, 2012 IFH.

c. March 19, 2013 PWMD PPS including Exhibits #11 - #14.

d. PWMD PPS Exhibit #13 is the PWMD report entitled "Wildhorse Creek, Pesthouse Gulch, Golf Course Wash and Turkey Creek Ambient Quality-Based Site-Specific Selenium Water Quality Standards Report," WRI Engineering, March 2013, which includes all referenced documents provided on a compact disc (CD) located in Appendix C of this report.

e. April 23, 2013 PWMD RPS including Exhibits #18 and #23.

f. May 3, 2013 email from Connie King to Sarah Johnson, WQCD, regarding the 1:30 pm May 6, 2013 conference call agenda.

g. May 14, 2013 PWMD RS including Exhibits #30 - #35.

h. May 23, 2013 teleconference that Connie King, attorney representing PWMD, and Steve Canton, Lee Bergstedt, Stephanie Baker of GEI Consultants, Inc., had with Sarah Johnson and Blake Beyea of WQCD.

i. PWMD testimony at the June 10 – 11, 2013 Arkansas River Basin RMH.

B. Reversibility of Anthropogenic Sources:

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

Not Applicable. The source of selenium for the four stream segments of concern is not anthropogenic. The source of selenium in these segments, as well as others in this region of the State of Colorado, is geologic – the ancient Pierre Shale that underlies much of Southern Colorado.

C. If no improvement is feasible, characterize the Existing Quality - Calculate the appropriate statistic to characterize "Existing Quality" (e.g., 85th %ile for chronic metals, 95th %tile for acute metals, etc.)

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

Twenty (20) years of effort at a substantial cost of precious public resources has been expended by several local dischargers including PWMD and the City of Pueblo to demonstrate the natural ancient geological source of the selenium that enters water bodies in the Arkansas River Valley.

The calculated 85th %ile and 95th %ile for selenium are provided in the:

- October 23, 2012 letter from Connie King on behalf of PWMD to the WQCC regarding the November 5, 2012 IFH including Attachments #1 - #4;
- March 19, 2013 PWMD PPS including Exhibits #11 - #14;
- May 14, 2013 PWMD RS including Exhibits #30 - #35; and
- PWMD testimony at the November 5, 2012 IFH and the June 10 – 11, 2013 RMH.

D. Based on the seasonal and spatial variability and geographic extent of the elevated levels of the parameter, characterize the scope of the proposal:

Unless otherwise indicated, these comments are based upon information in the documents listed in response to Section I.A. through I.E. above.

1. See Section II.A. and II.B., above. Section II.A.1.d., in particular, in PWMD PPS Exhibit #13, includes a geologic map of the region in question, including all four segments of concern, that graphically summarizes the extent of the geologic formation that bears the high natural concentrations of selenium. At this point, and for the foreseeable future, there is no way to control or arrest the mobilization and transportation of the selenium into local water bodies, nor is there any water treatment technologies extant that will remove selenium by three orders of magnitude. Wetlands treatment systems are not viable – they would, in fact, create ecological disasters such as Kesterson Slough and Belews Lake – with respect to water fowl and other wildlife drawn to a manmade wetland that becomes a sink for local selenium-bearing runoff and discharges.

2. Assessment locations have been established by Regulation #32, as recommended by PWMD, and as adopted by WQCC at the June 2013 RMH.

3. Data submitted, as cited above, indicate that seasonal water quality standards are not applicable due to the extensive regional natural geologic selenium source.

III. Site-Specific Criteria-based Standards Proposals

Not Applicable. The source of the selenium is ancient natural geologic formation underlying the region.

IV. Plan for Future Reviews

Not Applicable, see Section III. However, PWMD will continue to monitor Pesthouse Gulch and Wildhorse Creek on a scaled back frequency basis as the watershed into which it discharges reclaimed water. The PWMD wastewater treatment plant discharge, in which the selenium concentration is two orders of magnitude less than the upstream background flows, mitigates the selenium concentration in these two segments by dilution.

V. Implementation

1. As discussed in Section II.2., above, Assessment Locations are specified in Regulation #32, and are being monitored quarterly, at the present time.

2. The WQCD issued a renewed PWMD Discharge Permit, effective October 1, 2014, which does not have any effluent limitations for selenium, based upon the selenium ambient-based site-specific selenium water quality standards for Pesthouse Gulch and Wildhorse Creek that were adopted by the WQCC on June 11, 2013.

Please don't hesitate to contact Jim Egan at (719) 510-9505 or Connie King at (719) 650-2783 if you have any questions or comments. Thanks very much for your consideration.