Lower Boise River Subbasin Assessment and Total Maximum Daily Load

2015 Total Phosphorus TMDL Addendum for the Lower Boise River, Mason Creek, and Sand Hollow Creek

Hydrologic Unit Code 17050114

Draft

State of Idaho
Department of Environmental Quality

January 2015

DRAFT

Printed on recycled paper, DEQ January 2015, PID Enter PID #, CA code Enter CA Code #. Costs associated with this publication are available from the State of Idaho Department of Environmental Quality in accordance with Section 60-202, Idaho Code.

Cover Photo: Anglers in the lower Boise River near Star, Idaho (October 30, 2013).

Lower Boise River Subbasin Assessment and Total Maximum Daily Load

2015 Total Phosphorus Addendum to Lower Boise River, Mason Creek, and Sand Hollow Creek TMDLs

January 2015

DRAFT

Prepared by
Troy Smith
The Idaho Department of Environmental Quality
Boise Regional Office
1445 N. Orchard Street
Boise, Idaho 83706

In Consultation with the
Lower Boise Watershed Council

Acknowledgments

- Lower Boise Watershed Council
- Technical Advisory Committee (TAC) participants
- Modeling, Technical, and Policy Workgroup participants
- 319 TAC participants
- Bill Stewart, Ben Cope, and others at EPA
- Alex Etheridge, Dorene MacCoy, Chris Mebane, and others at USGS
- Dick Park (Eco Modeling) and Jonathan Clough (Warren Pinnacle Consulting, Inc.)
- Numerous personnel at DEQ, but particularly Darcy Sharp in the Technical Services Division as lead AQUATOX modeler on the project

DRAFT

Table of Contents

DRAFT

DRAFT

List of Tables

DRAFT

DRAFT

DRAFT

List of Figures

DRAFT

DRAFT

DRAFT

DRAFT

DRAFT

Abbreviations, Acronyms, and Symbols

§303(d) refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

µ micro, one-one thousandth

§ section (usually a section of federal or state rules or statutes)

AU assessment unit

AWS agricultural water supply

BAG basin advisory group

BMP best management practice

BOR United States Bureau of Reclamation

BURP Beneficial Use Reconnaissance Program

CFR Code of Federal Regulations (refers to citations in the federal administrative rules)

cfs cubic feet per second

CWAL cold water aquatic life

DEQ Idaho Department of Environmental Quality

DMA Designated Management Agency

DO dissolved oxygen

DWS domestic water supply

EPA United States Environmental Protection Agency

GIS geographic information system

HUC hydrologic unit code

IDAPA Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL Idaho Department of Lands

IDWR Idaho Department of Water Resources

LA load allocation

LBWC Lower Boise Watershed Council

LC load capacity

m meter

mgd million gallons per day

mg/L milligrams per liter

mL milliliter

MOS margin of safety

MS4 municipal separate storm sewer system

n/a not applicable

NA not assessed

NB natural background

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

DRAFT

NTU	nephelometric turbidity unit
PCR	primary contact recreation
QA	quality assurance
RM	river mile
SBA	subbasin assessment
SCR	secondary contact recreation
SS	salmonid spawning
SSC	suspended sediment concentration
TAC	technical advisory committee
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended sediment
US	United States
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
WAG	watershed advisory group
WBAG	*Water Body Assessment Guidance*
WBID	water body identification number
WLA	wasteload allocation
WWTF	wastewater treatment facility

DRAFT

Executive Summary

The federal Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 water bodies in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses 3 water bodies (5 assessment units) in the lower Boise River subbasin that have been placed in Category 5 of Idaho's most recent federally approved 2012 Integrated Report (DEQ 2014c).

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the lower Boise River subbasin, located in southwest Idaho. For more detailed information about the subbasin and previous TMDLs, see the lower Boise River Subbasin Assessment, TMDLs, Addendums, and Five-Year Review (DEQ 1999, 2008, 2009, 2010b).

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

This addendum addresses total phosphorus (TP) in the lower Boise River and Mason Creek between Diversion Dam and Parma, along with Sand Hollow Creek, a tributary to the Snake River. Nuisance levels of aquatic growth associated with TP in the lower Boise River (also referred to as the "LBR") from Middleton to the mouth were associated with impaired cold water aquatic life and contact recreation in the 2012 Integrated Report. Within the physically-complex network of the lower Boise River watershed, tributaries, irrigation conveyances, ground water, unmeasured flows, and other nonpoint sources, along with Wastewater Treatment Facilities (WWTF), Municipal Separate Storm Sewer Systems (MS4), industrial wastewater and stormwater sources, and other point sources affect TP levels and nuisance algae in the subbasin.

This subbasin assessment and total maximum daily load (TMDL) addendum quantifies TP pollutant sources and allocates responsibility for load and wasteload allocations needed for the lower Boise River, Mason Creek, and Sand Hollow Creek, to achieve water quality objectives. For more detailed information about the subbasin and previous TMDLs and Implementation Plans, see:

- Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL (DEQ 2008a)

Draft

- Lower Boise River TMDL Five-Year Review (DEQ 2009)
- Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008)
- Snake River – Hells Canyon Total Maximum Daily Load (TMDL; DEQ and ODEQ 2004).
- Implementation Plan for the Lower Boise River Total Maximum Daily Load (DEQ 2003)
- Lower Boise River TMDL Subbasin Assessment Total Maximum Daily Loads (DEQ 1999),
- Lower Boise River Nutrient and Tributary Subbasin Assessments (DEQ 2001a)
- Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads (DEQ 2010b)
- Mason Creek Subbasin Assessment (2001c)
- Sand Hollow Creek Subbasin Assessment (2001d) (tributary to the Snake River)

Subbasin at a Glance

The lower Boise River Subbasin is identified in the Idaho water quality standards as water body ID17050114, with 36 AUs and several site-specific standards described under Section 140.12 (IDAPA 58.01.02). As described in the Lower Boise River TMDL (DEQ, 1999), the subbasin drains approximately 1,290 square miles of rangeland, forests, agricultural lands and urban areas into the Snake River at the confluence between the cities of Adrian and Nyssa, Oregon. The lower Boise River is a 64-mile long 7th-order stream, which flows northwest from the Lucky Peak Dam outfall east of Boise, through Ada and Canyon counties, to its mouth on the Snake River near Parma, Idaho. The subbasin also drains portions of Elmore, Gem, Payette, and Boise counties. There are at least seven 3rd order, one 4th order, and one 6th order tributaries to the lower Boise River (Figure 1).

Another 6th order stream, Sand Hollow Creek, is included in the subbasin but drains to the Snake River approximately one mile north of the mouth of the lower Boise River (Figure 1).

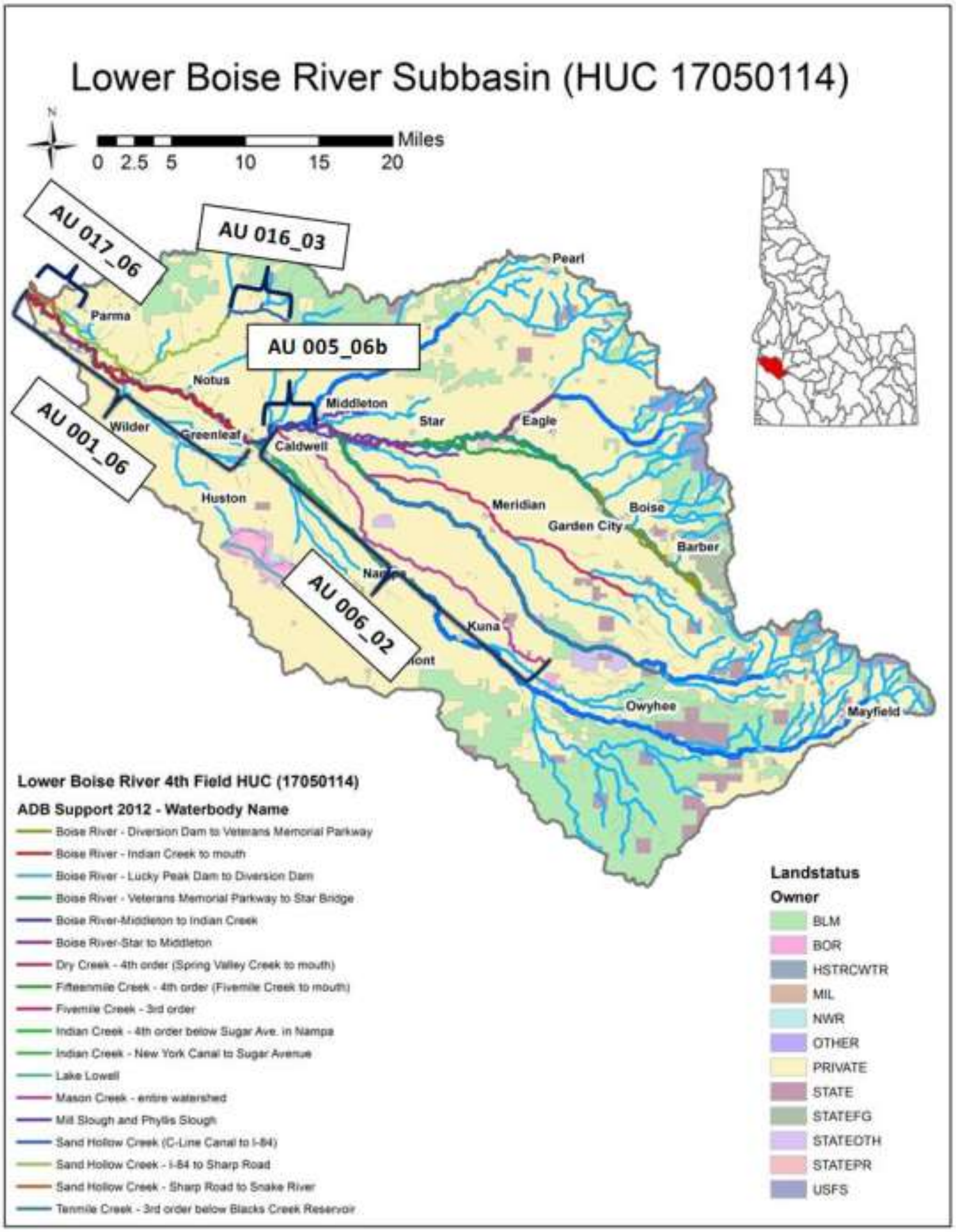
This addendum specifically addresses the following five impaired AUs:

- Boise River–Middleton to Indian Creek (ID17050114SW005_06b)
- Boise River–Indian Creek to Mouth (ID17050114SW001_06)
- Mason Creek–Entire Watershed (ID17050114SW006_02)
- Sand Hollow Creek–C Line Canal to I-84 (ID17050114SW016_03)
- Sand Hollow Creek–Sharp Road to Snake River (ID17050114SW017_06)

Tributary and upstream AUs that are not listed as impaired are addressed as pollutant sources to the downstream impaired AUs, listed above.

The impaired beneficial uses in the subbasin are cold water aquatic life, contact recreation, and salmonid spawning (SS). TP pollutant sources include upstream contributions (background), WWTFs, stormwater, industrial discharges, agricultural and irrigation returns, ground water and unmeasured sources (e.g. drains and septic systems).

The lower Boise River is one of five major tributaries to the Snake River that received a TP allocation of ≤ 70 mg/L from May 1 -September 30 in the Snake River-Hells Canyon (SR-HC) TMDL (DEQ and ODEQ 2004)



. Figure 1. The lower Boise River subbasin. The impaired AUs that are specifically addressed in this TMDL addendum are identified by their AU number on the map (impaired AUs in this TMDL addendum begin with 17050114).

Key Findings

Data analysis for a 5-year review of the Lower Boise River TP TMDL was completed in 2009 (DEQ 2009). This document is available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*.

The lower Boise River from Middleton to the confluence with the Snake River, along with Mason Creek, and two segments of Sand Hollow Creek (a tributary to the Snake River) are listed as impaired (Category 5) from TP or Nutrients Suspected in the 2012 Integrated Report (Table 1). In addition, upstream and tributary AUs that are not listed as impaired on the 2012 Integrated Report are addressed as pollutant sources for the impaired AUs. This TMDL does not address potential impairment in the unlisted AUs of the lower Boise River subbasin. The lower Boise River has designated beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation, while Mason and Sand Hollow Creeks have designated beneficial uses of contact recreation and presumed uses of cold water aquatic life.

These beneficial uses are impaired by TP from point and nonpoint sources. Increasing concentrations of TP in the river can result in elevated benthic (attached) and sestonic (suspended) algae, and negatively impact ecological and recreational conditions such as dissolved oxygen, pH, macroinvertebrate and fish abundances and community composition, swimming, fishing, boating, and aesthetics.

Table 1.Summary of 303(d)-listed assessment units and outcomes in this TMDL.

Water Body	Assessment Unit	Pollutant	TMDL Completed	Recommended Changes to the Next Integrated Report	Justification
Boise River– Middleton to Indian Creek	ID17050114SW005_06b	Total Phosphorus	Yes	Move to Category 4a	TP TMDL Completed
Boise River– Indian Creek to Mouth	ID17050114SW001_06	Total Phosphorus	Yes	Move to Category 4a	TP TMDL Completed
Mason Creek– Entire Watershed	ID17050114SW006_02	Cause Unknown - Nutrients Suspected	Yes	Move to Category 4a	TP TMDL Completed
Sand Hollow Creek– C Line Canal to I-84	ID17050114SW016_03	Cause Unknown - Nutrients Suspected	Yes	Move to Category 4a	TP TMDL Completed
Sand Hollow Creek– Sharp Road to Snake River	ID17050114SW017_06	Cause Unknown - Nutrients Suspected	Yes	Move to Category 4a	TP TMDL Completed

The 2012 Integrated Report also places the lower Boise River, from Diversion Dam to the mouth, as in Category 4c – Waters of the State Not Impaired by a Pollutant. The report further states:

> "‘Many of man's activities in the lower Boise River watershed contribute to degradation of flow and habitat conditions. Flow manipulation for flood control, irrigation, impoundments, flood control activities such as clearing debris and construction of levees, gravel mining, unscreened diversions, angling pressure and barriers in the river all have adverse effects on habitat. It is DEQ's position that habitat modification and flow alteration, which may adversely affect beneficial uses, are not pollutants under Section 303(d) of the Clean Water Act. There are no water quality

DRAFT

> standards for habitat or flow, nor are they suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed to address habitat modification or flow alteration.' (p.48, LBR TMDL, IDEQ, 2000)."

The lower Boise River TP TMDL addendum relies on a staged implementation strategy as referenced in EPA's Phased TMDL Clarification memo (EPA 2006). The staged implementation strategy for the lower Boise River acknowledges that NPDES-permitted point sources will strive to achieve the TMDL target as soon as possible, but can be given up to two permit cycles (10 years from the approval of the TMDL) to achieve their wasteload allocations.

This TMDL addendum, however, does not define an implementation time frame for agricultural and other nonpoint sources; rather, implementation would begin as soon as possible and continue until the load allocation targets are met. This acknowledges that successfully achieving the TMDL targets and nonpoint source allocations will depend on voluntary measures, including but not limited to, available funding, cost-sharing, willing partners, and opportunities for water quality trading.

DEQ, through the lower Boise River TP TMDL addendum, encourages water quality trading to the extent possible and practicable. Water quality trading implementation and details specific to the lower Boise River subbasin will be subsequently developed in an updated water quality trading framework upon completion of the TMDL addendum (see Water Quality Trading, section 5.5.5), which will update the existing water quality trading guidance (DEQ 2012). Additionally, an updated implementation plan will be developed by designated management agencies, including the Idaho Soil and Water Conservation Commission (SWCC), to address load reductions.

Idaho code 39-3611 provides for the review of TMDLs, their allocations, and their assumptions every 5 years. Accordingly, the lower Boise River TP TMDL addendum should include compliance monitoring to assess the 5-year benchmarks, and new data obtained during implementation will help measure the success of reaching water quality goals for both the SR-HC target attainment and beneficial use attainment in the lower Boise River subbasin. During the post-TMDL implementation, monitoring and analyses should be conducted under DEQ, USGS, EPA, or other scientifically-defensible and approved protocols.

Recognizing the many uncertainties in achieving the agricultural and other nonpoint source load allocations over the long-term, an adaptive management-type approach for implementation should address:

- Available funding, cost-sharing, willing partners to help manage agricultural and other nonpoint source TP contributions,
- Effectiveness of agricultural BMPs,
- Ability of ground water phosphorus levels to recover in land conversion and nutrient reduction areas,
- Future drainage and water management policies,
- Rate of land use conversion, and
- Effects of land use conversion on runoff and infiltration,

DRAFT

TMDL Targets

This TMDL addendum focuses on two primary targets:

1. **<u>May 1 – September 30:</u>** TP concentrations (and TP load equivalents[1]) ≤ 0.07 mg/L in the lower Boise River near Parma and in Sand Hollow Creek to achieve the 2004 Snake River-Hells Canyon TMDL TP target; and

2. **<u>Mean Monthly Benthic Chlorophyll a:</u>** TP concentrations (and TP load equivalent) correlated with a mean monthly benthic chlorophyll-a (periphyton) ≤ 150 mg/m^2:
    a. Within the two §303(d)-listed (impaired) AUs on the main stem lower Boise River
        1 ID17050114SW005_06b (Middleton to Indian Creek)
        2 ID17050114SW001_06 (Indian Creek to the mouth)
    b. With different TP allocations to achieve the mean monthly periphyton target for the seasons
        1 May 1 – September 30
        2 October 1 – April 30

<u>Achieve the SR-HC TMDL Target of TP ≤ 0.07 from May 1 – September 30</u>

The final Snake River-Hells Canyon (SR-HC) TMDL was approved by EPA in September 2004 (DEQ and ODEQ 2004). The TMDL addressed point and nonpoint sources within the 2,500 square miles that discharge or drain directly to the Snake River from where it intersects the Oregon/Idaho border near Adrian, Oregon (Snake River Mile 409) to immediately upstream of the inflow of the Salmon River (River Mile 188). Five major tributaries received gross phosphorus allocations at their mouths, including the lower Boise River. The SR-HC TMDL was developed with the assumption that the three major Idaho and two major Oregon tributaries would develop individual nutrient TMDLs or plans for implementation that satisfy final SR-HC nutrient TMDL requirements. Load allocations were developed to achieve target TP concentrations of ≤ 0.07 mg/L in the Snake River and Brownlee Reservoir, particularly during periods when dissolved oxygen levels are low. Compliance with the SR-HC TMDL was determined by applying a TP target of ≤ 0.07 mg/L at the mouth of the lower Boise River (near Parma) from May 1 – September 30.

The lower Boise River TMDL utilizes a flow duration curve with water quality targets to develop a tiered load reduction approach needed to achieve the May 1 – September 30 TP target ≤ 0.07 mg/L identified in the SR-HC TMDL. This analysis utilized the USGS August 2012 mass balance model (Etheridge 2013), along with long-term flow and TP concentration data from the lower Boise River. The final TP allocations were developed to also achieve a mean monthly periphyton target of ≤ 150 mg/m^2 in the lower Boise River. As a result, the TP allocations in this TMDL represent the TP loadings that are assured to achieve both the SR-HC TMDL and lower

DRAFT

[1] TP load equivalent, for purposes of this TMDL, is defined as the mass of TP (e.g. lbs/day, kg/day) that corresponds with an identified TP concentration (mg/L).

Boise River mean monthly periphyton target, and not the maximum potential TP loadings into the lower Boise River that would solely achieve the SR-HC TMDL target.

Achieve the Mean Monthly Benthic Chlorophyll a Target

The TMDL also utilizes the AQUATOX model, USGS 2012 and 2013 synoptic sampling data, historical data, and other available information to develop TP allocations needed to achieve mean monthly benthic (periphyton) chlorophyll a target of ≤ 150 mg/m^2 within the two impaired AUs of the lower Boise River. If it appears that full support of beneficial uses in the lower Boise River are not being attained during the 5-year review or subsequent post-TMDL implementation, other habitat measures may be considered to further reduce periphyton growth.

TMDL Allocation Scenario

The final model scenario (Scenario 3) and TMDL allocation structure that achieves the May 1 – September 30 TP target of 0.07 mg/L near Parma, as well as achieves the 150 mg/m^2 mean monthly periphyton target is as follows:

- Scenario 3 – Final Model Scenario and TMDL Allocation Structure
    - Point sources at 0.1 mg/L TP May – September
    - Point Sources 0.35 mg/L TP October – April (except IDFG Eagle and Nampa Facilities set at 0.1 year-round)
    - Agricultural tributaries and ground water at 0.07 mg/L TP year-round
    - Stormwater (wet weather) TP loads reduced by 42%
    - Non-stormwater (dry weather) TP loads by 84%

May 1 – September 30 TMDL Allocations

The following TP sector allocations represent the gross load and load reductions necessary to achieve:

- The SR-HC TMDL target of ≤ 0.07 mg/L at the mouth of the lower Boise River and Sand Hollow Creek, and
- The mean monthly periphyton target of ≤ 150 mg/m^2 within the impaired AUs of the lower Boise River

DRAFT

Figure 2. TP loads, capacities, and water quality targets for May 1 – September 30, presented as daily averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary, and: 3) Sand Hollow, a Snake River tributary.

Water Body[1]	Flow[2] (cfs)	Flow Rank (%)	Current Load[2]		Load Capacity[3]			Water Quality Targets[3]			
			TP Conc. (mg/L)	TP Load (lbs/day)	Target TP Conc. (mg/L)	Target TP Load (lbs/day)	Target TP Load Reductions (lbs/day [%])	TP Allocations[3] (lbs/day)	TP Load Reductions[3] (lbs/day)	TP Conc. (mg/L)	TP Load Reductions[3] (%)
Lower Boise River near Parma – (AU 001_06)											
	3268	10th	0.21	3747	0.07	1233	-2514 (67%)	601	-3146	0.034	84%
	912	40th	0.31	1531	0.07	344	-1187 (78%)	303	-1228	0.062	80%
	705	60th	0.31	1190	0.07	266	-924 (78%)	237	-953	0.062	80%
USGS August Synoptic Sample[4]	624	69th	0.30	1010	0.07	235	-775 (77%)	224	-786	0.067	78%
	383	90th	0.36	738	0.07	145	-593 (80%)	145	-593	0.070	80%
Mason Creek – (AU 006_02) (Tributary to the lower Boise River)											
	148	Mean	0.41	322	0.07	56	-266 (82%)	56	-266	0.07	82%
Sand Hollow – (AU 017_06) (Tributary to the Snake River)											
	141	Mean	0.4	303	0.07	53	-250 (83%)	53	-250	0.07	83%

[1] All assessment units (AUs) begin with ID17050114.
[2] Lower Boise River – based on a data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.
Sand Hollow – based on USGS and mean data from May 1 – September 30, 1998 through 2012.
[3] Lower Boise River - load capacities and water quality targets are applied near Parma, using duration curves.
Mason Creek and Sand Hollow Creek – mean load capacities and water quality targets calculated and applied as instream conditions.
[4] Lower Boise River flows, TP concentrations, and loads highlighted in green are derived from the USGS August 2012 synoptic sample (Etheridge 2013). These USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

DRAFT

Table 2. Gross load and wasteload allocations by sector for the lower Boise River, May 1 – September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). See Section 5.4.1 for further description of the TP allocation development.

Parma Flow	Background TP Allocations[1]		NPDES WWTF and Industry TP Allocations[2]			Fish Hatchery TP Allocations[3]			Tributary TP Allocations w/o NPDES Flows and TP Loads[4]			Ground Water TP Allocations[5]			Non-Stormwater Dry Weather TP Allocations[6]			Stormwater Wet Weather TP Allocations[7]			TP Input Allocations	TP Inputs Reaching Parma	Parma TP Load w/ Allocations	Parma TP Load Reduction
(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(lbs/day)	(%)	(lbs/day)	(%)
3268	0.018	317	135.6	0.10	73	37	0.10	20	822	0.070	310	-1390	0.070	-524	84% Load Reduction			42% Load Reduction			236	254%	601	84%
912	0.018	88	135.6	0.10	73	37	0.10	20	822	0.070	310	164	0.070	62	84% Load Reduction			42% Load Reduction			594	51%	303	80%
705	0.018	68	135.6	0.10	73	37	0.10	20	822	0.070	310	300	0.070	113	84% Load Reduction			42% Load Reduction			625	38%	237	80%
624	0.015	50	120.0	0.10	65	34	0.10	18	888	0.070	335	485	0.070	183	84% Load Reduction			No Storm Event			651	34%	224	78%
383	0.018	37	135.6	0.10	73	37	0.10	20	822	0.070	310	398	0.070	150	84% Load Reduction			42% Load Reduction			631	23%	145	80%

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2). Long-term median data and the USGS 2012-2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.
[2] WWTF and industrial discharge data are based on facility design flows, represented in Table 25. The USGS August 2012 synoptic sample data represent only WWTF contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).
[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 25.
[4] Tributary data were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).
[5] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).
[6] Non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
[7] Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

* Note: The USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

DRAFT

Table 3. Gross load and wasteload allocations by sector for the lower Boise River, May 1 – September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

	Average Daily Background TP[1]	**Average Daily NPDES WWTF and Industry TP[2]**	**Average Fish Hatchery TP[3]**	**Average Tributary (w/o NPDES Flows and Loads) TP[4]**	**Average Ground Water and Unmeasured TP[5]**	**Average Non-Stormwater Dry Weather TP[6]**	**Average Stormwater Wet Weather TP[7]**
Current TP Conc. (mg/L)	0.018	3.27	0.05	0.25	0.21	n/a	n/a
Current TP Load (lbs/day)	65	1506	9	1144	325	394	71
Target TP Conc. (mg/L)	0.018	0.1	0.1	0.07	0.07	n/a	n/a
TP Allocation (lbs/day)	65	73	20	310	108	n/a	n/a
Percent Reduction (%)	**0%**	**-95%**	**110%**	**-73%**	**-67%**	**-84%**	**-42%**

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2).

[2] Wastewater Treatment Facility (WWTF) and industrial discharge data are based on facility design flows, represented in Table 25.

[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 25 .

[4] Tributary data (Table 27) were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.

[5] The USGS August 2012 mass balance model was used to estimate average ground water flows. The 10th percentile flows were excluded from analyses due to predicted ground water loss (-1315 cfs).

[6] Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 26 and Appendix E) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

[7] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 26 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

DRAFT

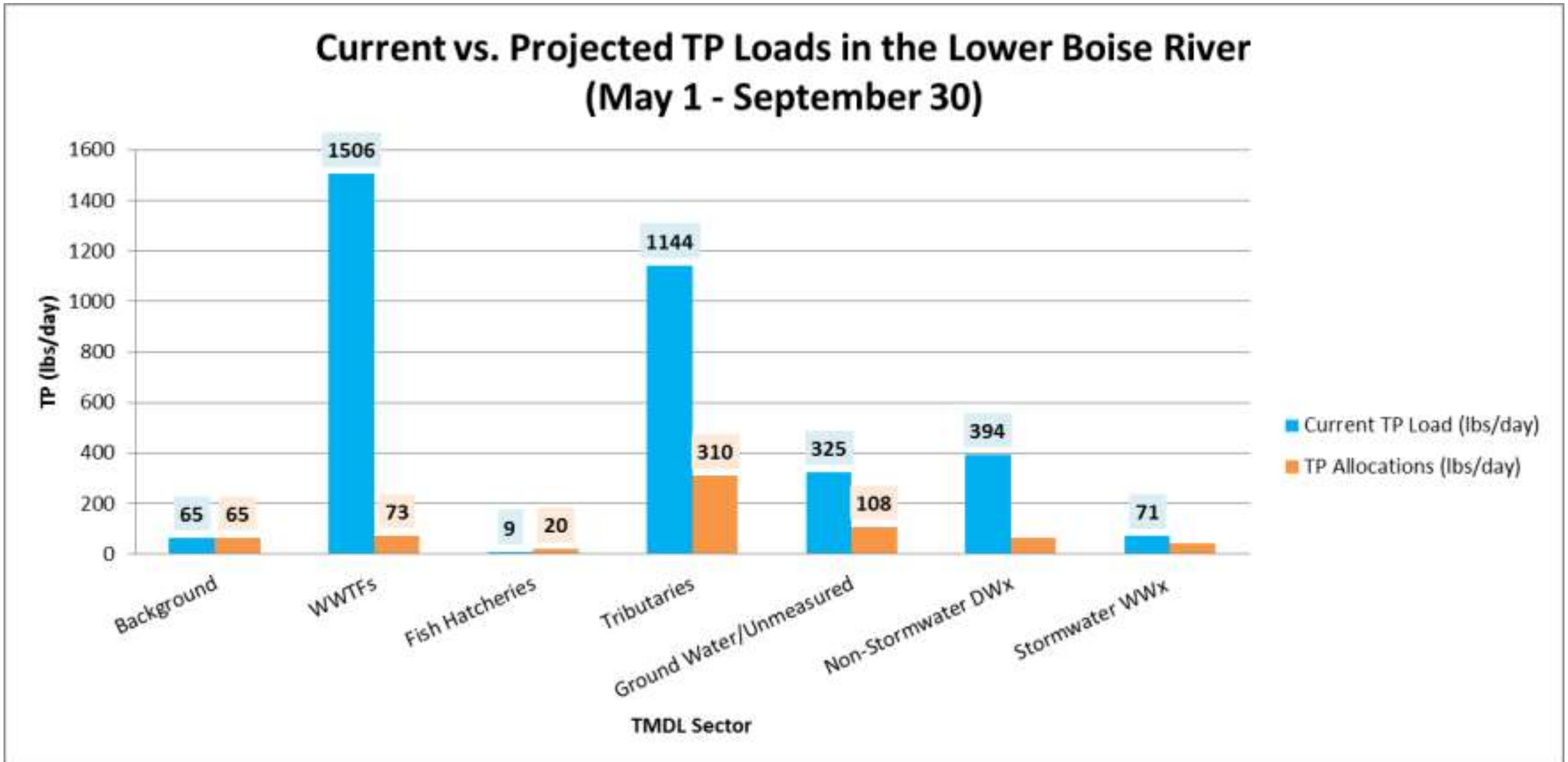


Figure 3. Current vs. projected TP loads for the lower Boise River from May 1 – September 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 42% TP load reduction on average across all MS4s.
* Non-stormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

Table 4. Point source wasteload and nonpoint source load allocations, May 1 – September 30, for Sand Hollow, a Snake River tributary, presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

Sand Hollow Creek	Current Flow (mgd/ cfs)[2]	Design Flow (mgd/ cfs)[2]	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation (lbs/day)	Average TP Load Reduction (%)
Parma WWTF	0.09 mgd 0.14 cfs	0.68 mgd 1.05 cfs	0.21	0.15	0.07	0.4	+157%
Nonpoint, ground water and unmeasured	140.7 cfs	139.7 cfs	0.40	301.2	0.07	52.7	-83%
Total	**140.8 cfs**	**140.8 cfs**	**0.399**	**301.4**	**0.07**	**53.1**	**-82%**

[1] The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow Creek, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

[2] Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the WWTF.

DRAFT

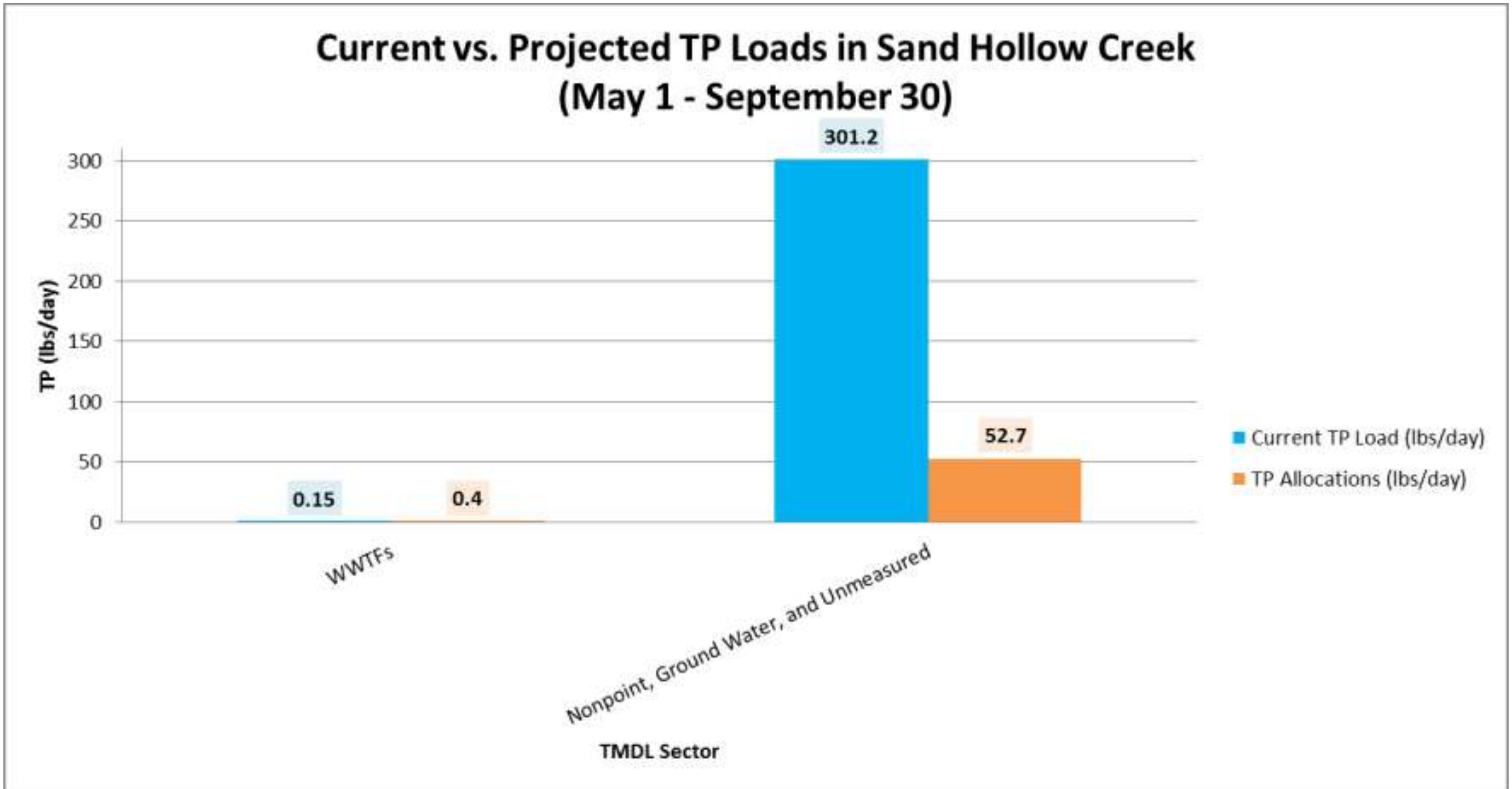


Figure 4. Current vs. projected TP loads for Sand Hollow Creek from May 1 – September 30.

October 1 – April 30 TMDL Allocations

The following TP sector allocations represent the gross load and load reductions necessary to achieve:

- The mean monthly periphyton target of ≤ 150 mg/m^2 within the impaired AUs of the lower Boise River
- Average TP load reductions in the lower Boise River, Mason Creek, and Sand Hollow Creek that are expected to fully support beneficial uses and TP concentrations are at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986)

Table 5. TP loads and water quality targets for October 1 – April 30, expressed per day as monthly averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary, and: 3) Sand Hollow, a Snake River tributary.

Water Body[1]	Flow[2] (cfs)	Flow Rank (%)	Current Load[2]		Water Quality Targets[3]			
			TP Conc. (mg/L)	TP Load (lbs/day)	TP Allocations[3] (lbs/day)	TP Load Reductions[3] (lbs/day)	TP Conc. (mg/L)	TP Load Reductions[3] (%)
Lower Boise River near Parma – (AU 001_06)								
	1293	Mean	0.3	2302	815	-1487	0.11	65%
Mason Creek – (AU 006_02) (Tributary to the lower Boise River)								
	67.7	Mean	0.25	93	29	-64	0.08	69%
Sand Hollow – (AU 017_06) (Tributary to the Snake River)								
	63.6	Mean	0.33	113	26	-87	0.075	77%

[1] All assessment units (AUs) begin with ID17050114.
[2] Lower Boise River – based on a data from October 1 – April 30, 1987 through 2012.
Mason Creek – based on USGS and ISDA mean data from October 1 – April 30, 1995 through 2012.
Sand Hollow – based on USGS and mean data from October 1 – April 30, 1998 through 2012.
[3] Mean load capacities and water quality targets calculated and applied as instream conditions.

DRAFT

Table 6. Gross load and wasteload allocations by sector for the lower Boise River, October 1 – April 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

	Average Daily Background TP[1]	Average NPDES WWTF and Industry TP[2]	Average Fish Hatchery TP[3]	Average Tributary (w/o NPDES Flows and Loads) TP[4]	Average Ground Water and Unmeasured TP[5]	Average Non-Stormwater Dry Weather TP[6]	Average Stormwater Wet Weather TP[7]
Current TP Conc. (mg/L)	0.018	3.32	0.07	0.22	0.15	n/a	n/a
Current TP Load (lbs/day)	125	1394	13	580	127	44	107
Target TP Conc. (mg/L)	0.018	0.35	0.1	0.07	0.07	n/a	n/a
TP Allocation (lbs/day)	125	256	20	178	57	n/a	n/a
Percent Reduction (%)	**0%**	**-82%**	**+50%**	**-69%**	**-55%**	**-84%**	**-43%**

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2).
[2] WWTF and industrial discharge data are based on facility design flows, represented in Table 30.
[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 30.
[4] Tributary data (Table 32) were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
[5] The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.
[6] Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
[7] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

DRAFT

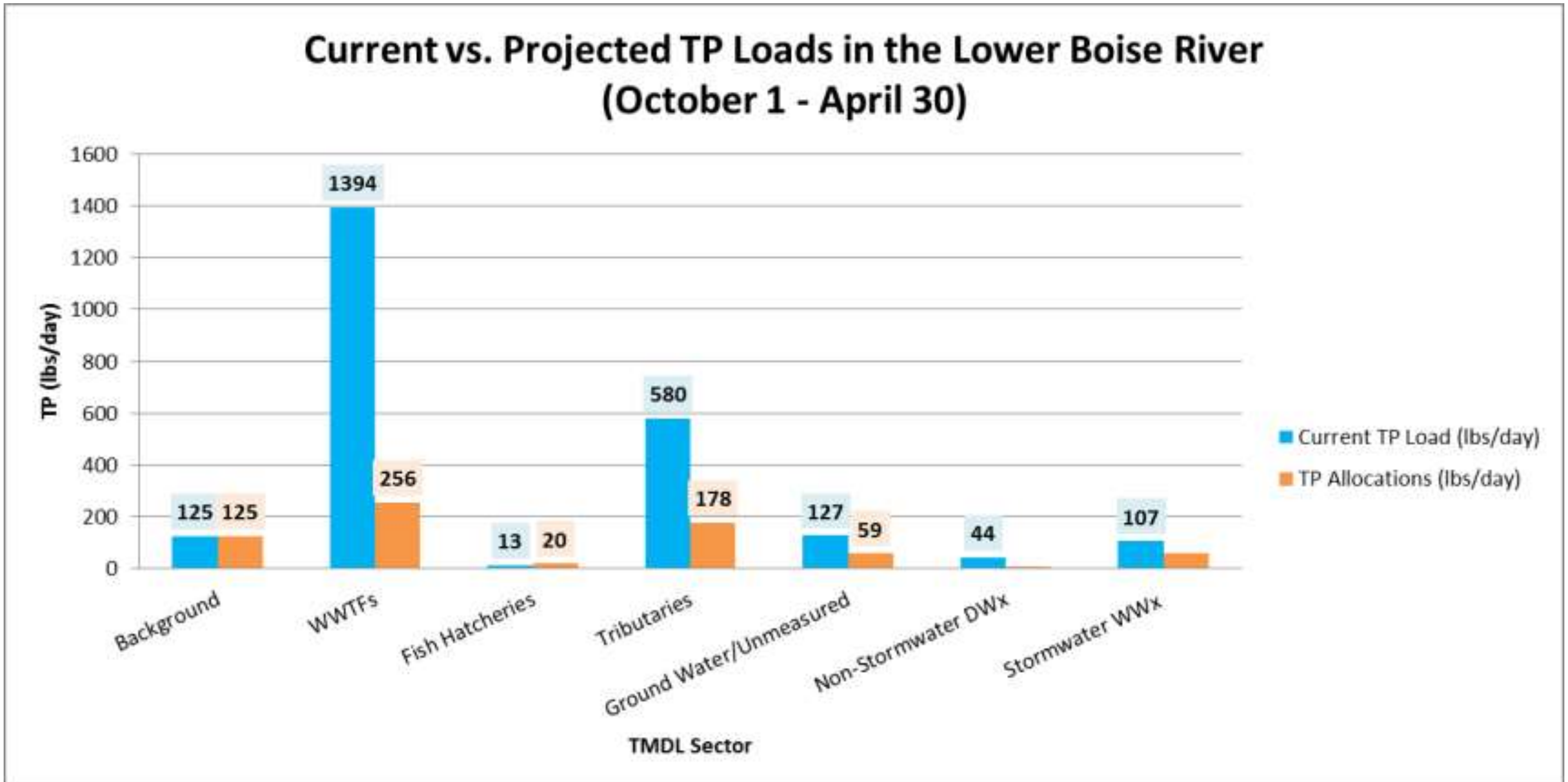


Figure 5. Current projected TP loads for the lower Boise River from October 1 – April 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 43% TP load reduction on average across all MS4s.
* Non-stormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

Table 7. Point source wasteload and nonpoint source load allocations, October 1 – April 30, for Sand Hollow, a Snake River tributary, presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

Sand Hollow Creek	Current Flow (mgd/ cfs)[2]	Design Flow (mgd/ cfs)[2]	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation (lbs/day)	Average TP Load Reduction (%)
Parma WWTF	0.13 mgd 0.20 cfs	0.68 mgd 1.05 cfs	0.12	0.1	0.35	1.99	+1426%
Nonpoint, ground water and unmeasured	63.4 cfs	62.6 cfs	0.33	113.2	0.07	23.6	-79%
Total	**63.6 cfs**	**63.6 cfs**	**0.33**	**113.3**	**0.075**	**25.7**	**-77%**

[1] The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

[2] Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the WWTF.

DRAFT

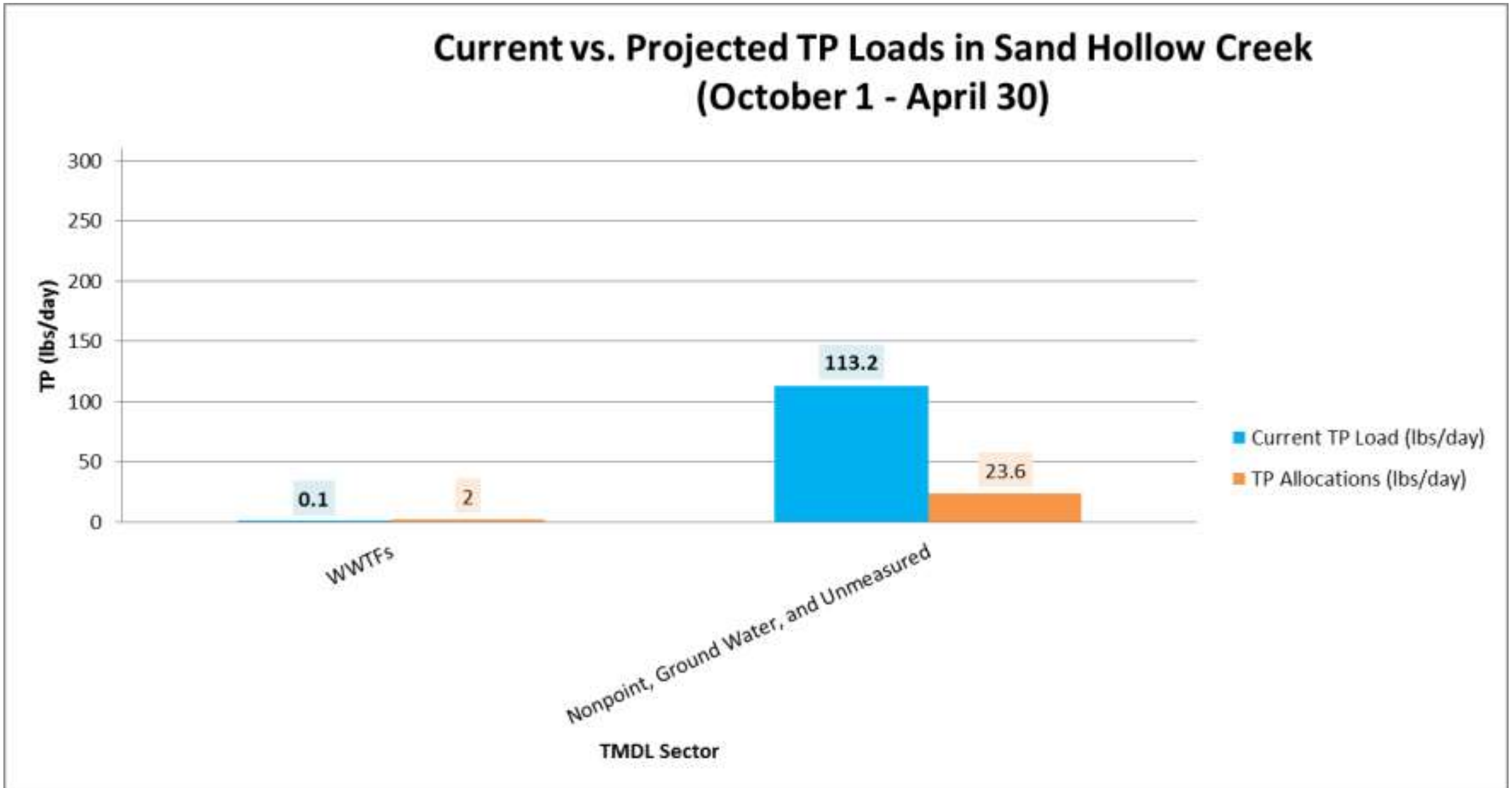


Figure 6. Current vs. projected TP loads for Sand Hollow Creek from October 1 – April 30.

Instream Periphyton and TP Reductions

The final TMDL model scenario (Scenario 3) and TMDL allocation described above reduces the predicted year-round periphyton growth, and TP concentrations and loads in the lower Boise River. Specifically, the final TMDL model scenario (Scenario 3) and TP allocation structure:

- Achieves the mean monthly benthic chlorophyll a target of ≤ 150 mg/m^2 in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient achieve the mean monthly periphyton target on an AU basis, as well as achieve TP concentrations at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986). Although brief periods of elevated periphyton may occur during August in model segment 10 and September in segment 11, these are likely due to growth of low nutrient diatoms which can proliferate under low nutrient and other habitat conditions. These rationales are further discussed in the Model Report (DEQ 2014a).

- Includes the TP allocations necessary to achieve the May 1 – September 30 target of ≤ 0.07 mg/L TP in the lower Boise River near Parma based on long-term load duration data.

DRAFT

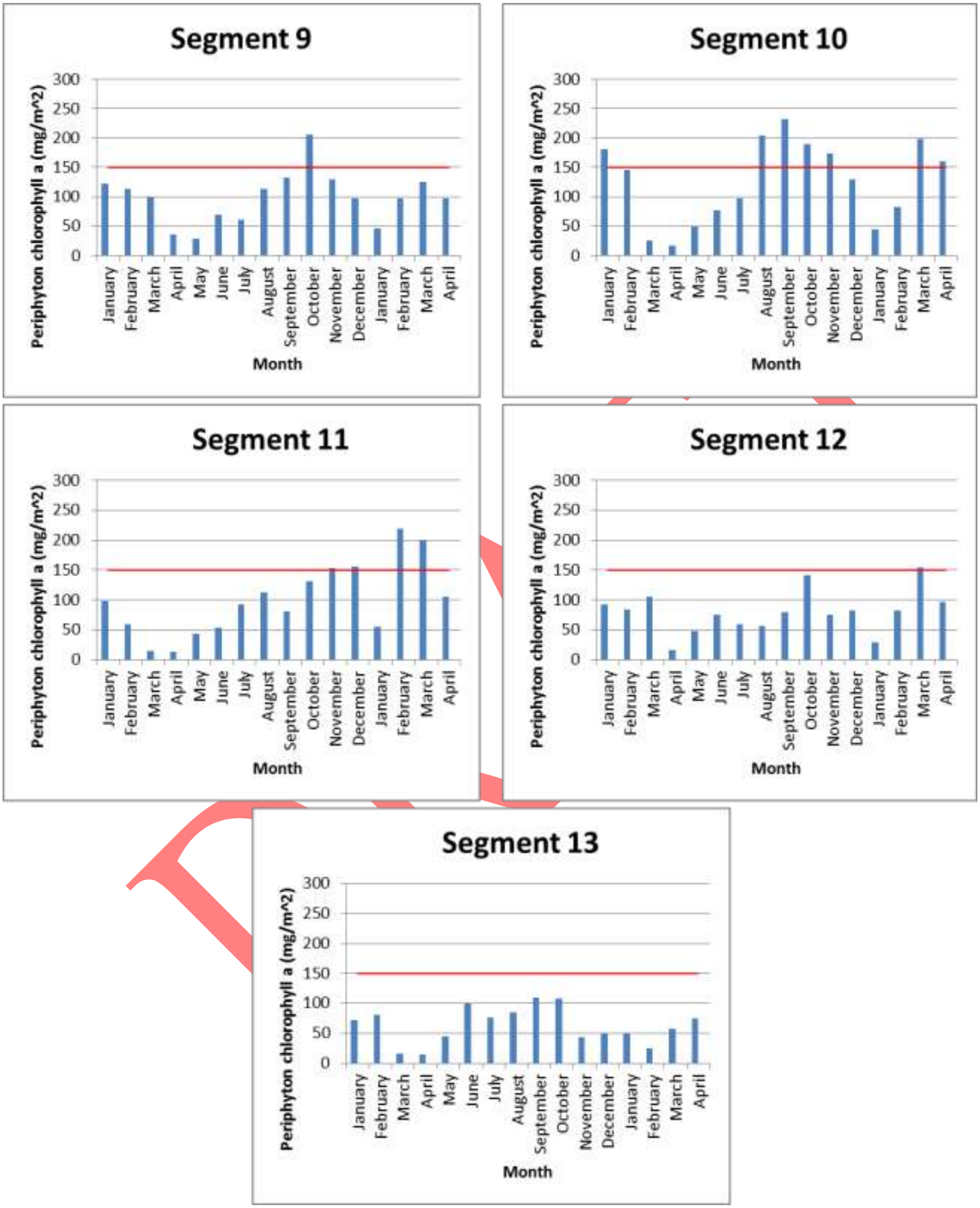


Figure 7. Current modeled mean monthly periphyton from January 1, 2012 through April 22, 2013. Model segments 9-13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

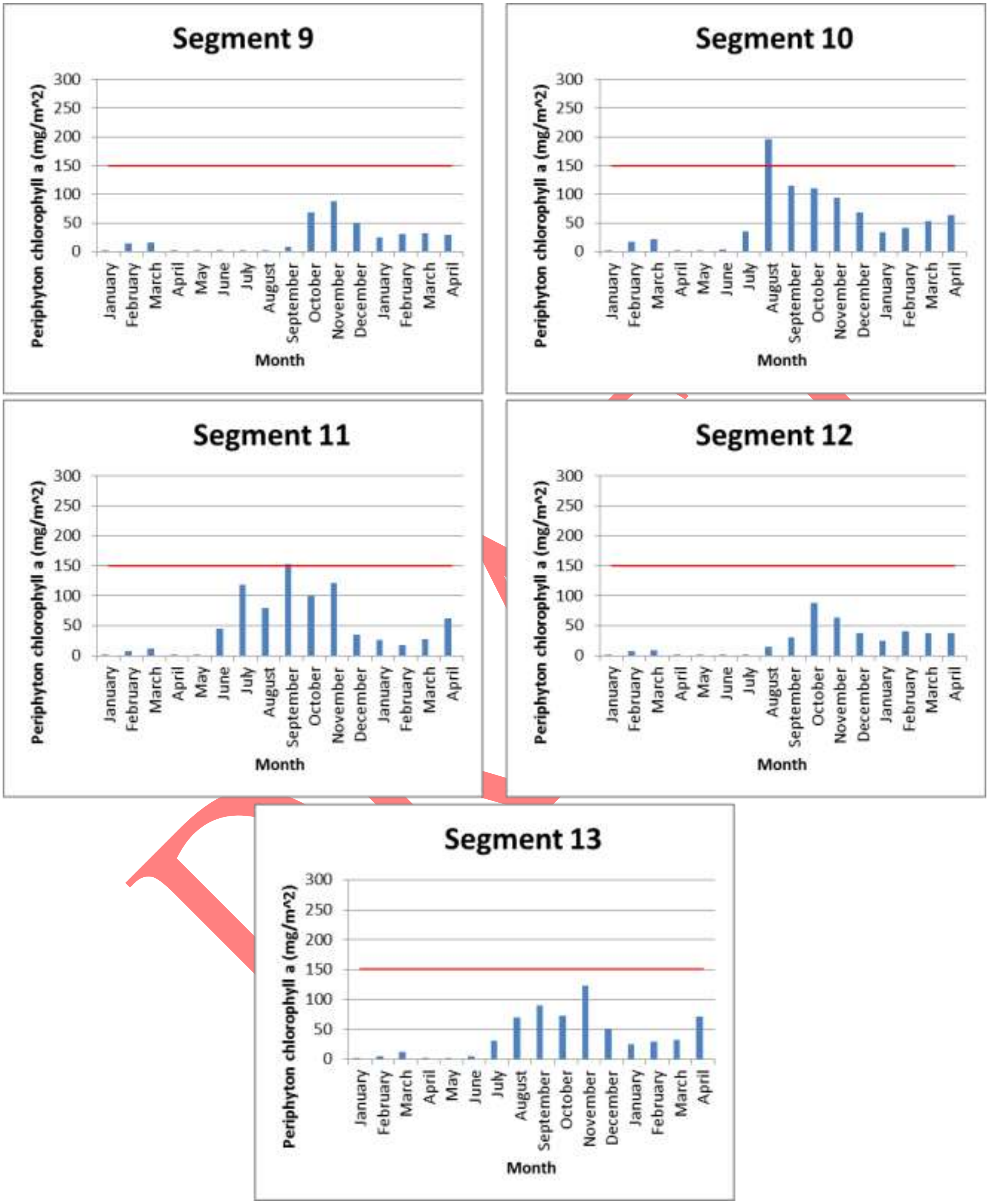
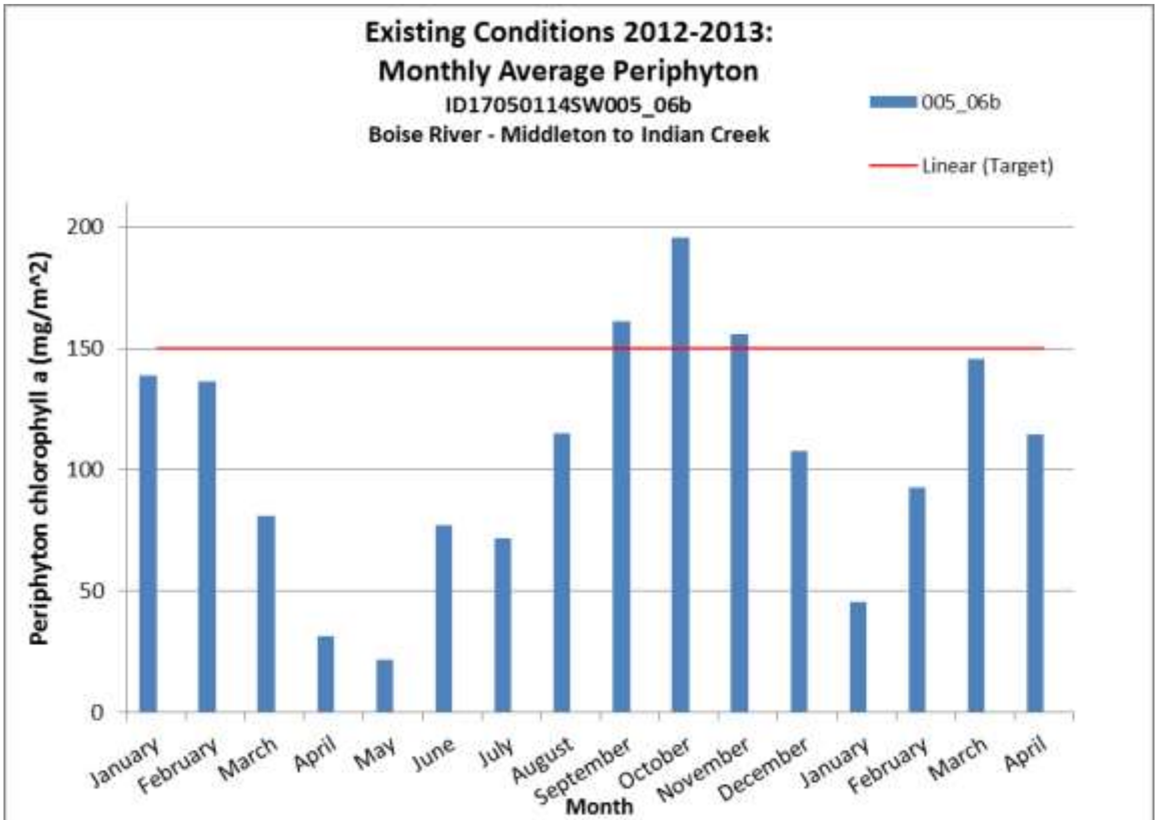


Figure 8. Predicted mean monthly periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure. Model segments 9-13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of 150 mg/m^2.



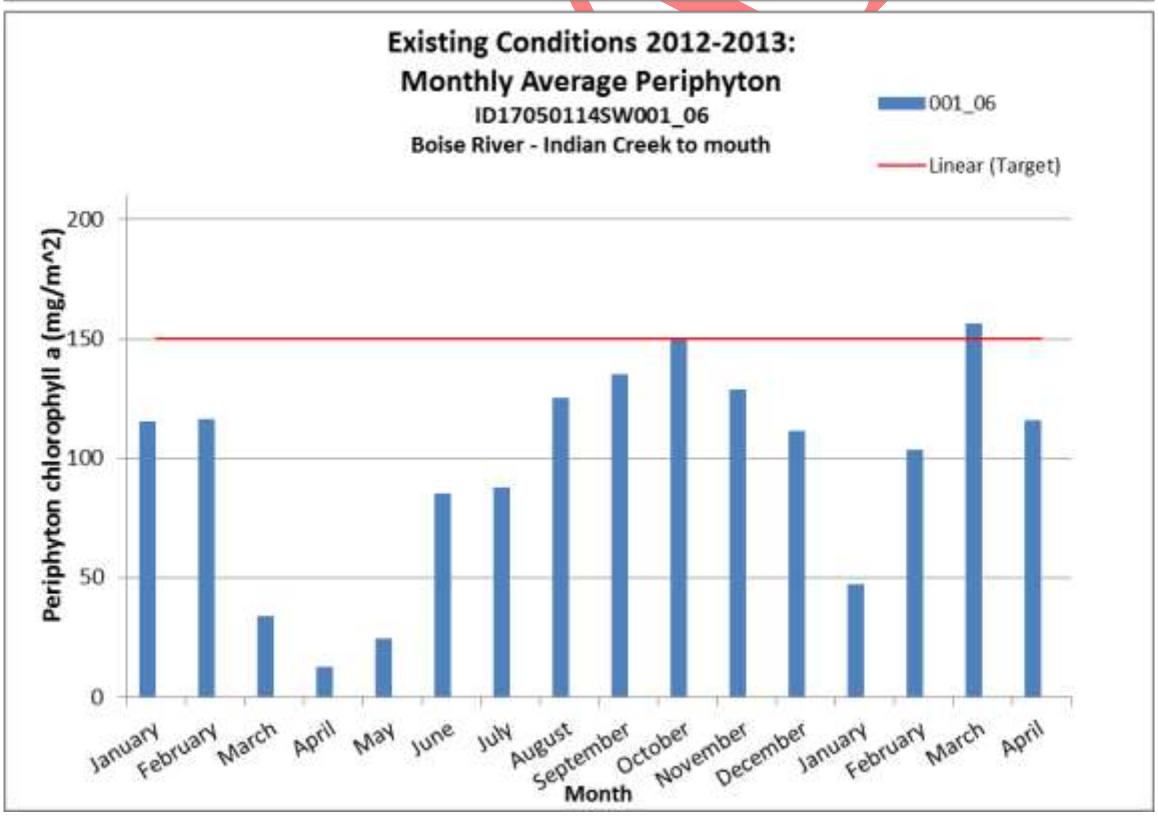


Figure 9. Current modeled mean monthly periphyton from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

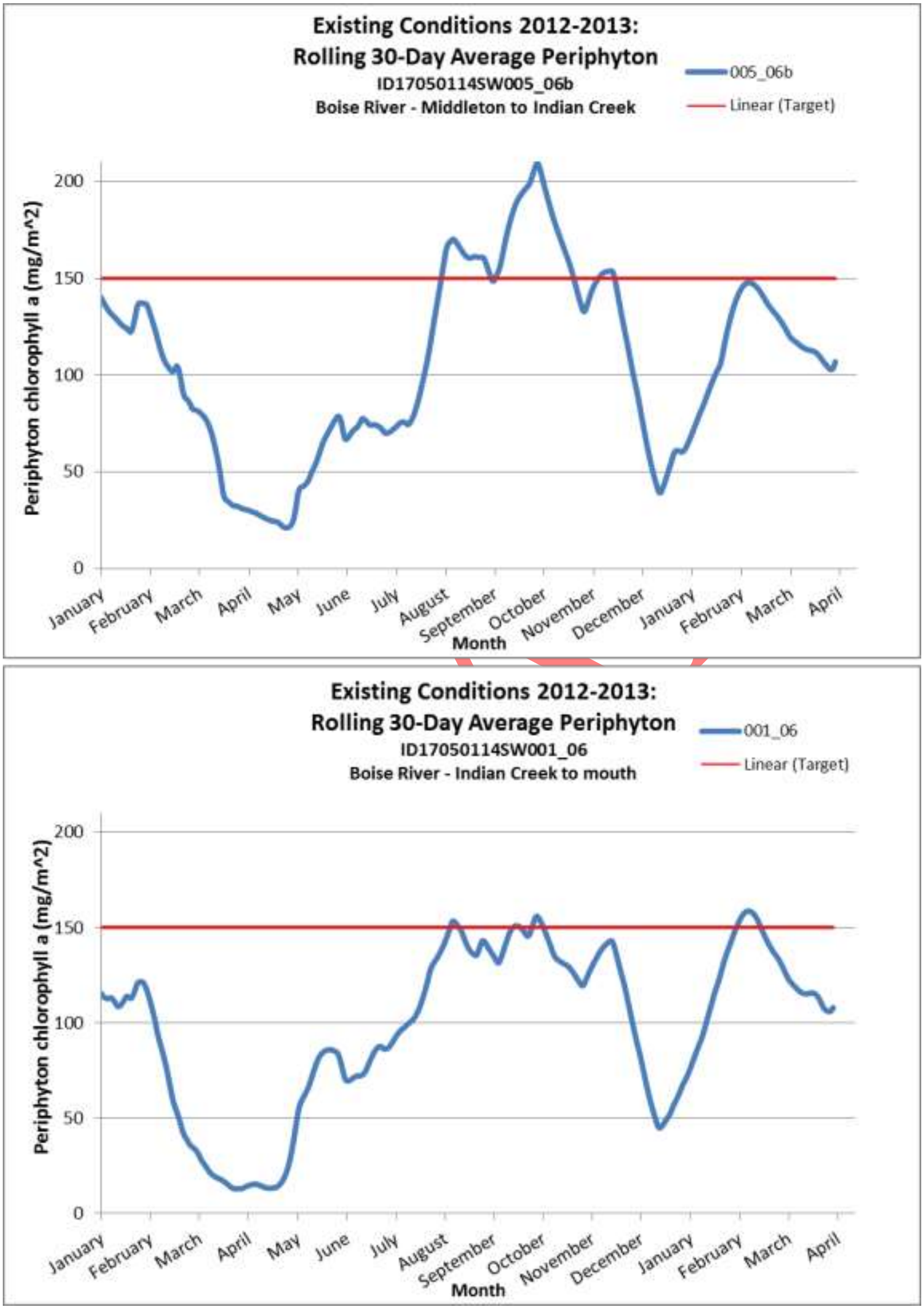


Figure 10. Current modeled 30-day rolling average periphyton from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

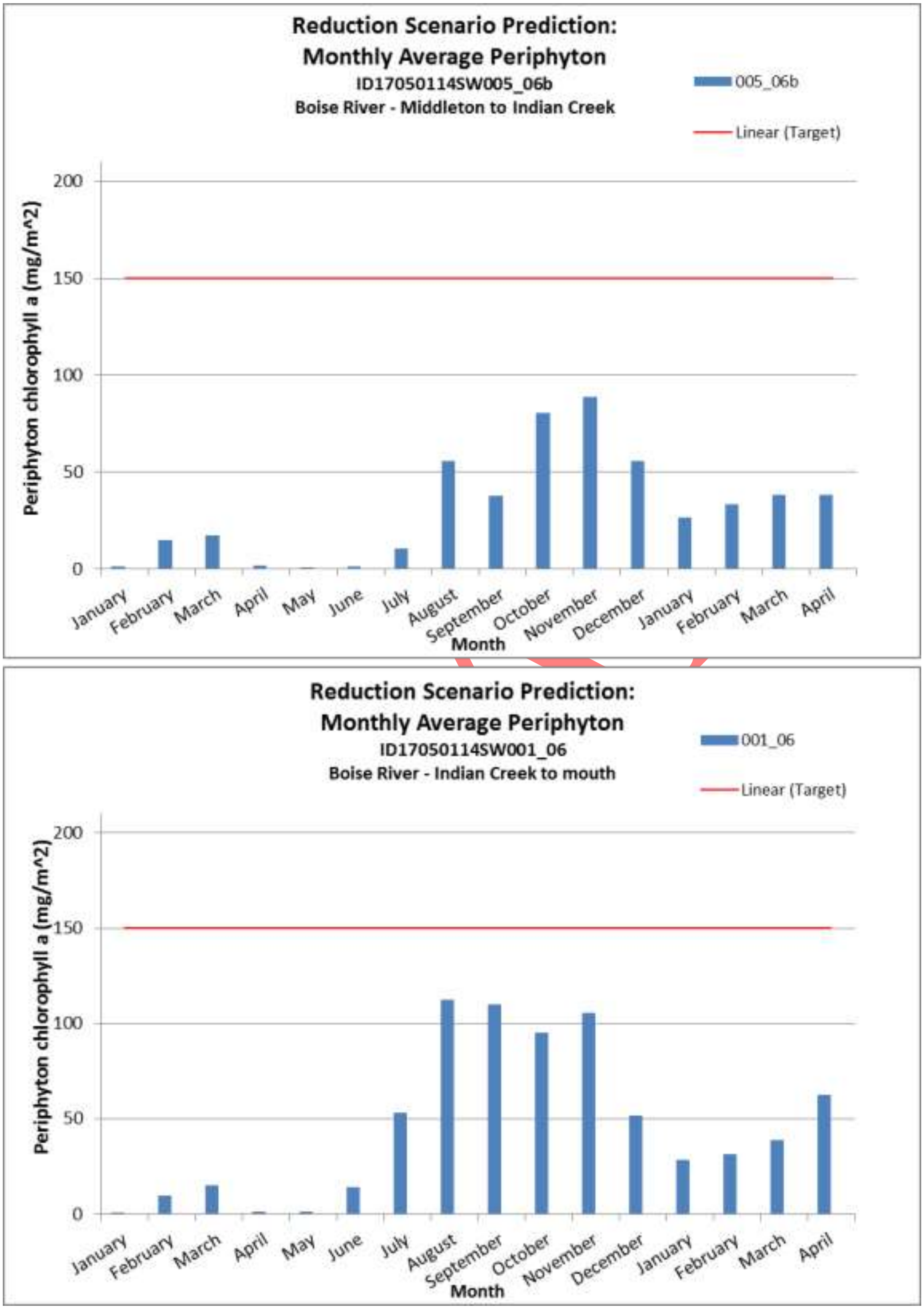


Figure 11. Predicted mean monthly periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

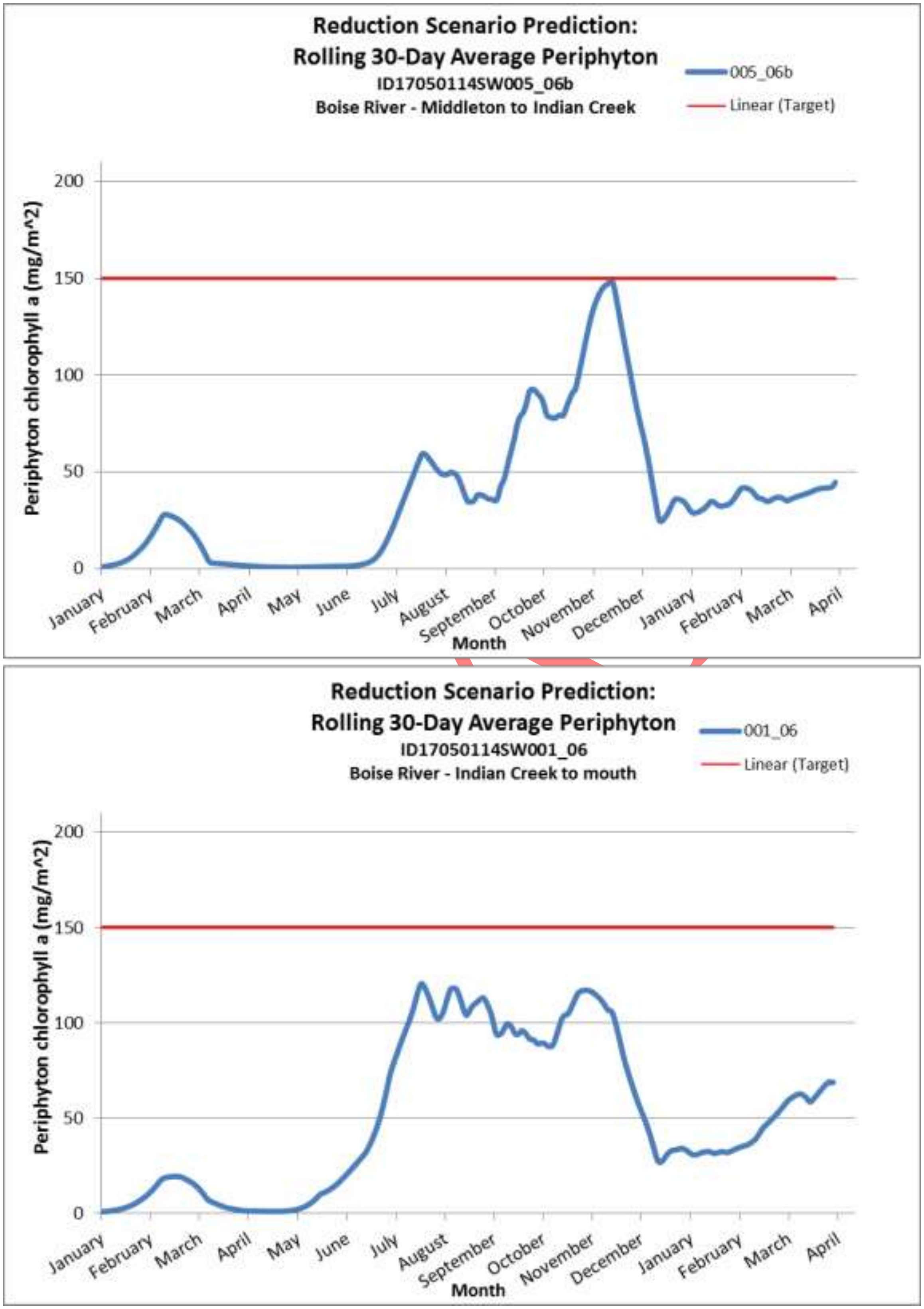
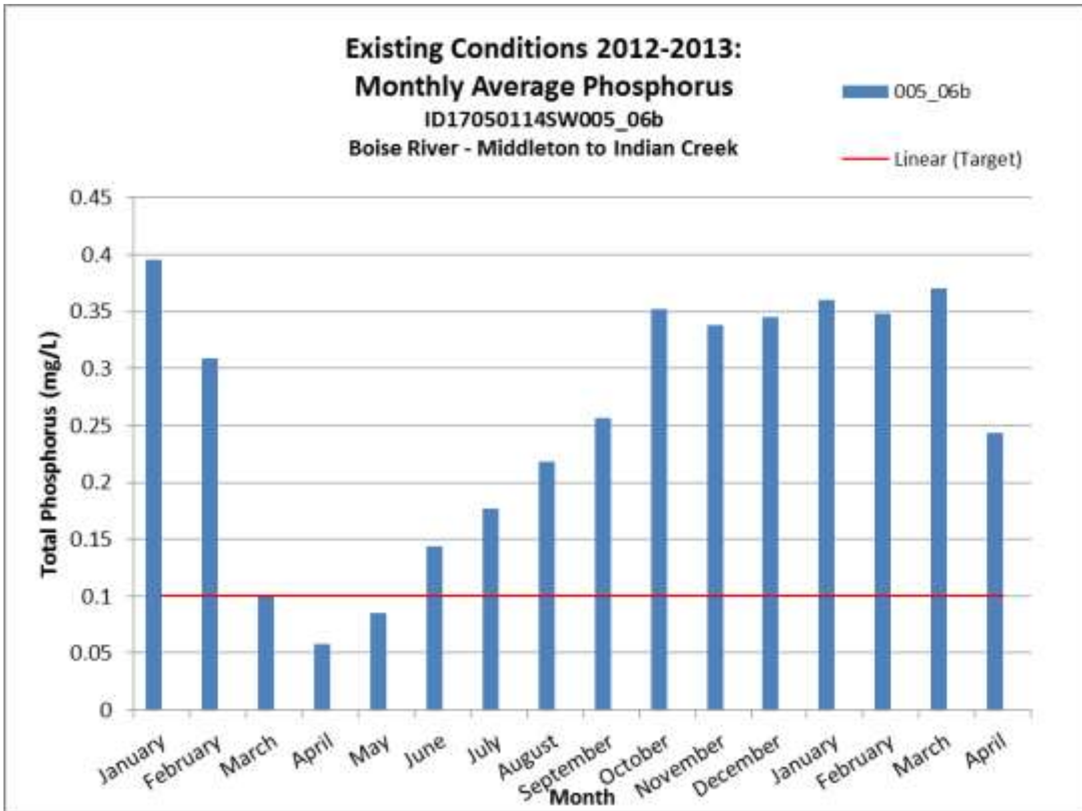


Figure 12. Predicted 30-day rolling average periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.



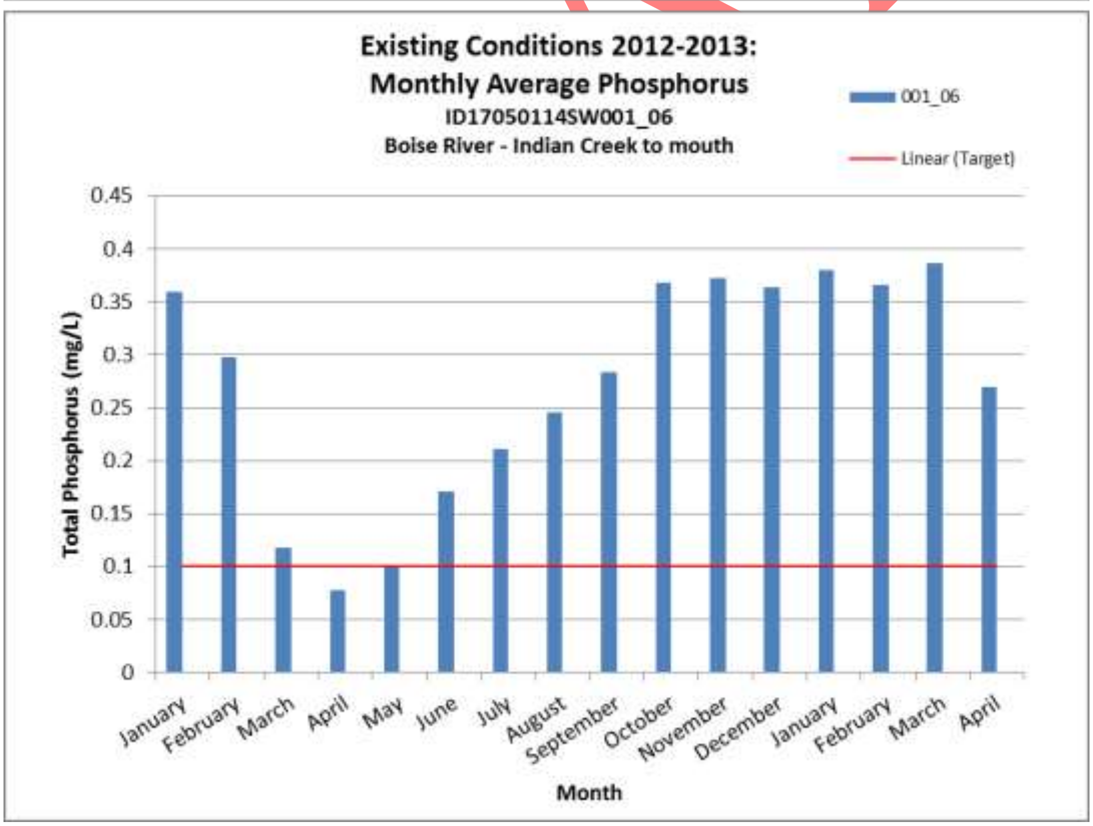
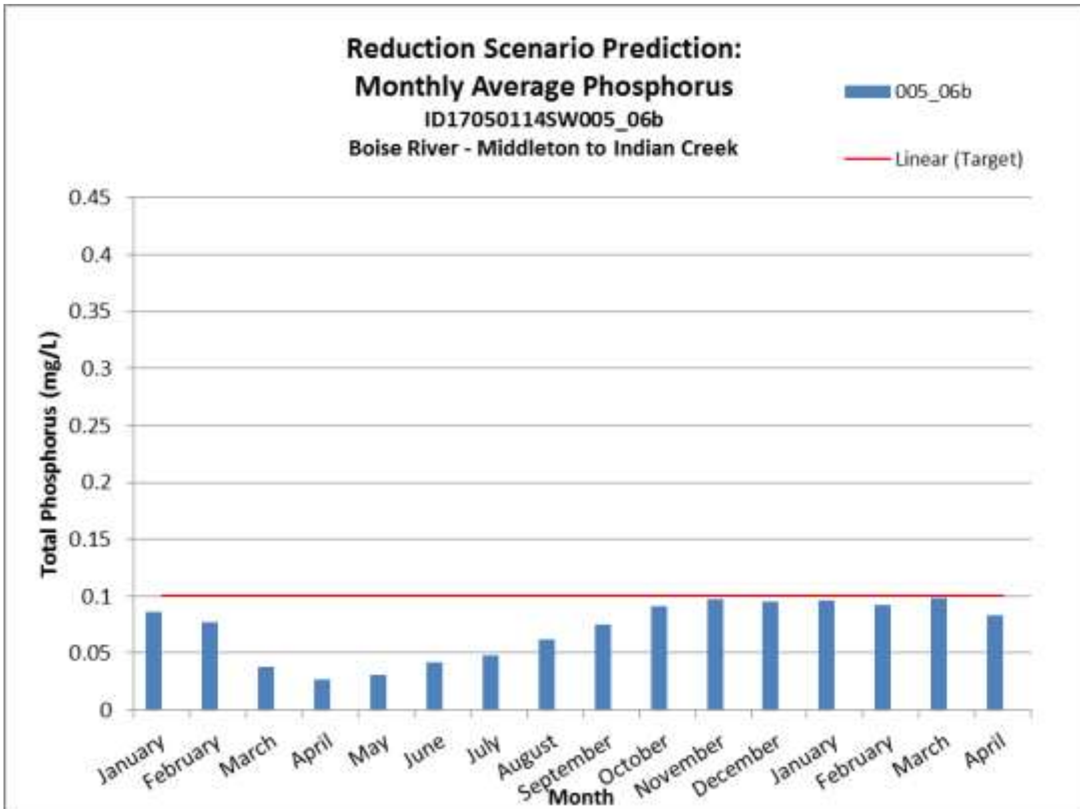


Figure 13. Current modeled monthly TP concentration from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.



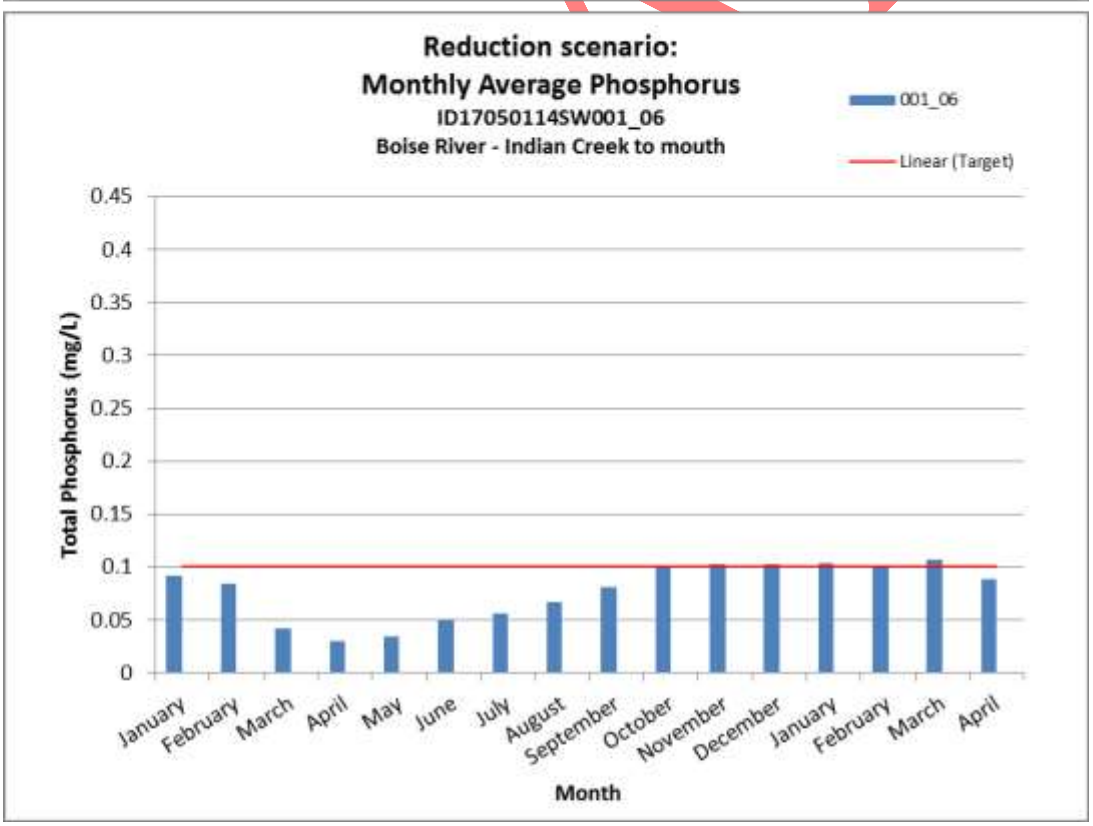


Figure 14. Predicted modeled monthly TP concentration from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.

It is clear that the TMDL analysis illustrates a point of diminishing returns, beyond which further TP reductions do not result in significant reductions in periphyton, likely due to other environmental factors and organic enrichment in the system. That is, TP reductions beyond those modeled the final TMDL model scenario (Scenario 3) do not yield measureable improvements in periphyton reductions. Figure 15 further represents the annual average periphyton in segments 9-13 (the impaired AUs of the lower Boise River) under the various model scenarios. This illustrates, again, that large reductions in periphyton growth are expected to occur under the final model scenario, but additional TP reductions would result in only slight periphyton reductions.

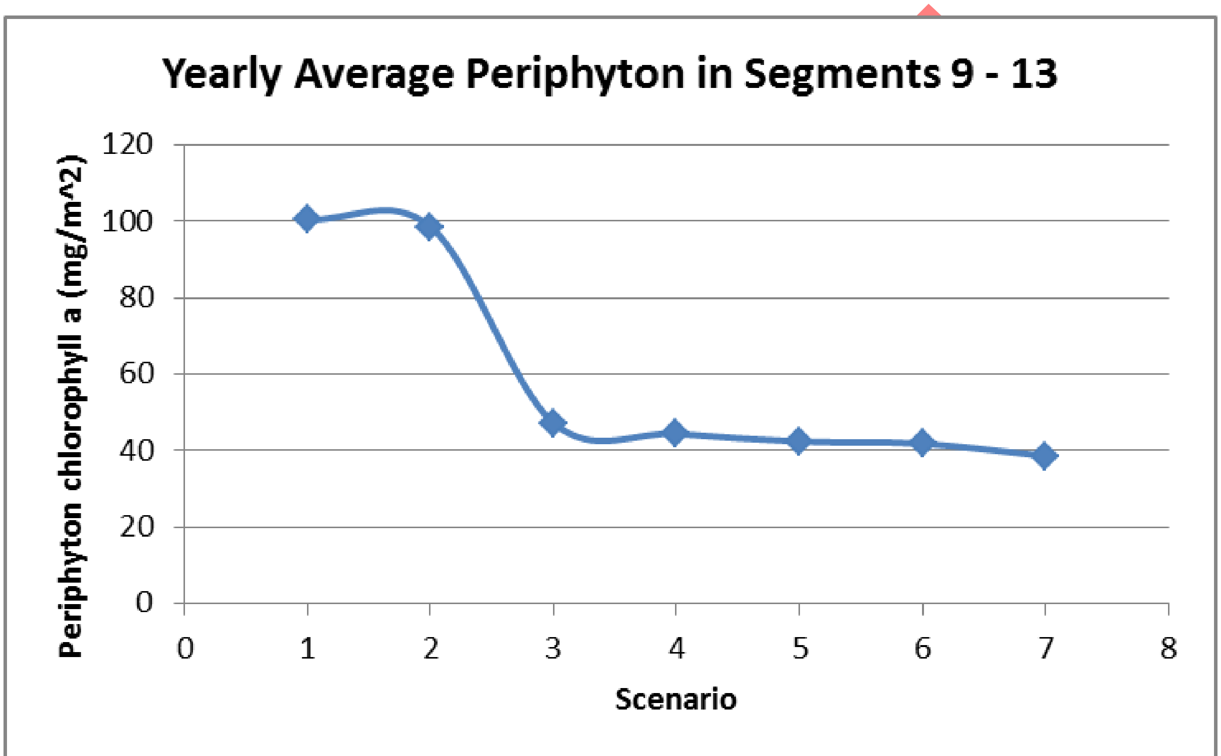


Figure 15. Annual average periphyton in model segments 9-13 (the impaired AUs of the lower Boise River) under seven model scenarios. Further descriptions of each model scenario are available in the preceding paragraphs and Section 5 of this TMDL.

DRAFT

Public Participation

Throughout the TMDL development process, DEQ frequently consulted, coordinated, and met with the southwest Basin Advisory Group (BAG), Lower Boise Watershed Council (LBWC), Technical Advisory Committee (TAC) and other workgroups, EPA, USGS, and other interested stakeholders. Since revitalizing this specific TMDL effort in March 2012, DEQ has consulted with these interested stakeholders in more than 100 meetings, of which, nearly all were open and announced to the public. This continual stakeholder participation was, and will be, critical before, during, and after the public comment period in Month 2014, and in the subsequent TMDL implementation. A distribution list and detailed identification of LBWC and public participation through the TMDL development are available in Appendix C. In addition to these meetings, DEQ also kept the public apprised of progress by posting specific TMDL-related information on the DEQ Lower Boise River Watershed Advisory Group webpage: *http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx*.Posted information includes this draft of the TMDL, the items listed below, and much more:

- November 2013 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v1)
- February 2014 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v2)
- February 2014 – Draft Lower Boise River Phosphorus: AQUATOX Model Report (v1)
- February 2014 – Draft Lower Boise River Phosphorus: AQUATOX Model Report (v2)
- April 2014 – Calibrated AQUATOX model, import files, and data
- February 2014 – Lower Boise River AQUATOX Model Calibration Comments
- November 2014 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v3)
- November 2014 – Draft Lower Boise River Phosphorus: AQUATOX Model Report (v3)
- November 2014 – AQUATOX model TMDL scenario files, import files, and data
- January 2015 – Draft Lower Boise River Subbasin Assessment and Total Phosphorus TMDL Addendum (v4)

DRAFT

Introduction

This document addresses 5 assessment units in the lower Boise River subbasin (two main stem AUs, two Sand Hollow Creek AUs, and one Mason Creek AU) that have been placed in Category 5 of Idaho's most recent federally approved 2012 Integrated Report (DEQ 2014c). The purpose of this total maximum daily load (TMDL) addendum is to characterize and document pollutant loads within the lower Boise River subbasin. The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (section 1), water quality concerns and status (section 2), pollutant source inventory (section 3), and a summary of past and present pollution control efforts (section 4). While the subbasin assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the lower Boise River subbasin. The TMDL (section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Idaho Department of Environmental Quality (DEQ) implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act has been amended 15 times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every 3 years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors and assess waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as "pollution." TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Assessment—Subbasin Characterization

This document presents an addendum to previously completed lower Boise River subbasin assessments, TMDLs and addendums (DEQ 1999, 2003, 2008, 2009, 2010b, 2012). Addendums address waters within a hydrologic unit code (HUC) that did not previously receive a TMDL for a specific pollutant, or they update the TMDL for a specific pollutant with an existing EPA approved TMDL. This TMDL addendum addresses water bodies in the subbasin that are on Idaho's current §303(d) list for Total Phosphorus (TP) and Cause Unknown – Nutrients Suspected.

1.1 Physical, Biological, and Cultural Characteristics

A thorough discussion of the physical, biological, and cultural characteristics of the lower Boise River subbasin are provided in the Lower Boise River TMDL Subbasin Assessment TMDL (DEQ 1999), the Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008), and the Lower Boise River Total Phosphorus Five-Year Review (2009).

1.2 Subwatershed Characteristics

The lower Boise River watershed is one of the more complex watersheds in Idaho (Figure 16; DEQ 2009). Sources of phosphorus are diverse due to the land ownership and management in the watershed (Figure 17) and include: wastewater treatment discharges, stormwater, agriculture, background (from Lucky Peak Reservoir releases), and ground water return flows. Phosphorus from these sources is routed through a physically-complex network of river, tributaries, and irrigation conveyances. Figure 18 shows the subwatershed delineations that are operated, in part, based on this conveyance network (DEQ 2009). Figure 19 provides a simplified schematic of the diversions, drains, and tributaries along the lower Boise River (Etheridge 2013), while Figure 20 displays the daily mean flows at the upper end of the lower Boise River at Diversion Dam, near Middleton, and near the mouth at Parma.

The following description comes from the 1999 Lower Boise River TMDL Subbasin Assessment (DEQ 1999):

> "The presence of upper Boise (Anderson Ranch and Arrowrock) and lower Boise (Lucky Peak, Diversion Dam, and Barber Dam) reservoirs and dams, numerous diversions, and local flood control policies have significantly altered the flow regime and the physical and biological characteristics of the lower Boise River.
>
> Lucky Peak Dam, the structure controlling flow at the upstream end of the watershed, was constructed and began regulating flow in 1957. Water is released from the reservoir to the Boise River just a few miles upstream from Boise. Water releases from the reservoir are managed primarily for flood control and irrigation. Other management considerations include power generation, recreation, maintenance of minimum stream flows during low flow periods and release of water to augment salmon migration flows in the Snake River.
>
> Flow regulation for flood control has replaced natural, short duration (two to three months), flushing peak flows with longer (four to six months), greatly reduced, peak flows. Water management has increased discharge during the summer irrigation season and significantly decreased winter low flows.
>
> The regulated annual hydrograph can be divided into three flow regimes. Low flow conditions generally begin in mid-October when irrigation diversions end. The low flow period extends until flood control releases begin, sometime between the end of January and March. Flood flows generally extend through June, and releases for irrigation control flows from July through mid-October[2].
>
> The U.S. Bureau of Reclamation (USBR) reserves 102,300 acre-feet of storage to maintain instream flows during the winter low flow period. Storage water provides winter instream flows of 80 cfs from Lucky Peak Dam. The Idaho Fish and Game (IDFG) seeks a minimum target release of 150 cfs for fish protection. IDFG has secured 50,000 acre-feet of storage water in Lucky Peak Reservoir to augment winter low flows. With both of these sources it is frequently possible to maintain winter flows of 240 cfs. Flood season flows for the Boise River below Lucky Peak Dam range from about 2000 to 6500 cfs. Irrigation season flows typically range from 2000 to 4000 cfs."

In addition, the Lower Boise River TMDL Subbasin Assessment (DEQ 1999) provides a concise description of the movement and management of water between Diversion Dam and Parma, which DEQ asserts is still largely applicable to the current management:

> "During the irrigation season, numerous diversions carry water to irrigate fields along the north and south sides of the river. Based on location and quantity of diversions and drains the lower Boise River can be divided in two parts at Middleton. The majority of the water that is diverted from the river is removed beginning at Diversion Dam and ending at the Star Road diversion. Over half of the average annual discharge of the river is diverted before it passes the City of Boise. Most drains return to the river below Middleton. Many return flows join the river in the vicinity of Caldwell, while two other large return flows enter between Caldwell and Parma. The reach from Middleton to Caldwell usually has the lowest flows during the irrigation season...During the irrigation season, the monthly average flows at Middleton and Parma are significantly less than at the upstream gaging station. In low water years, diversions have reduced instream flows to as low as 200 cfs at Middleton during the irrigation season.

[2] Flood flow timing can range from none or occur from January to early July, depending on the water year. Irrigation flows begin after flood flows and can begin from April 1 to early July. The end of irrigation season is also a range depending on water supply but generally ends mid-September to mid-October.

DRAFT

> Diversions from the Boise River typically exceed total river discharge in low flow years, because return flows are rediverted for irrigation in a lower stretch of the river. The repeated use and reuse of water is a complicating factor in determining the fate of pollutants discharged to the river and the effects of pollutant reductions at different locations. The sheer number of canals and laterals in the watershed suggest the complexity of interpreting flow conditions and pollutant fate (Figure 7).
>
> In addition to affecting river flows, irrigation practices have also altered drainage patterns in the watershed. Water does not follow natural drainage paths in much of the lower Boise valley. Natural drainages in the lowlands and irrigated areas of the valley have been deepened, lengthened, straightened, and diverted while drains, laterals, and canals have been constructed. The stream alterations and man-made waterways have created new drainage areas that are significantly different from the natural subwatershed areas."

In addition to be listed in Category 5 because of excess nutrients, the 2012 Integrated Report identifies the lower Boise River, from Diversion Dam to the mouth, as Category 4c – Waters of the State Not Impaired by a Pollutant in recognition of the impact of flow and habitat alteration on beneficial use support. The 2012 report states:

> "'Many of man's activities in the lower Boise River watershed contribute to degradation of flow and habitat conditions. Flow manipulation for flood control, irrigation, impoundments, flood control activities such as clearing debris and construction of levees, gravel mining, unscreened diversions, angling pressure and barriers in the river all have adverse effects on habitat. It is DEQ's position that habitat modification and flow alteration, which may adversely affect beneficial uses, are not pollutants under Section 303(d) of the Clean Water Act. There are no water quality standards for habitat or flow, nor are they suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed to address habitat modification or flow alteration.' (p.48, LBR TMDL, IDEQ, 2000)."

DRAFT

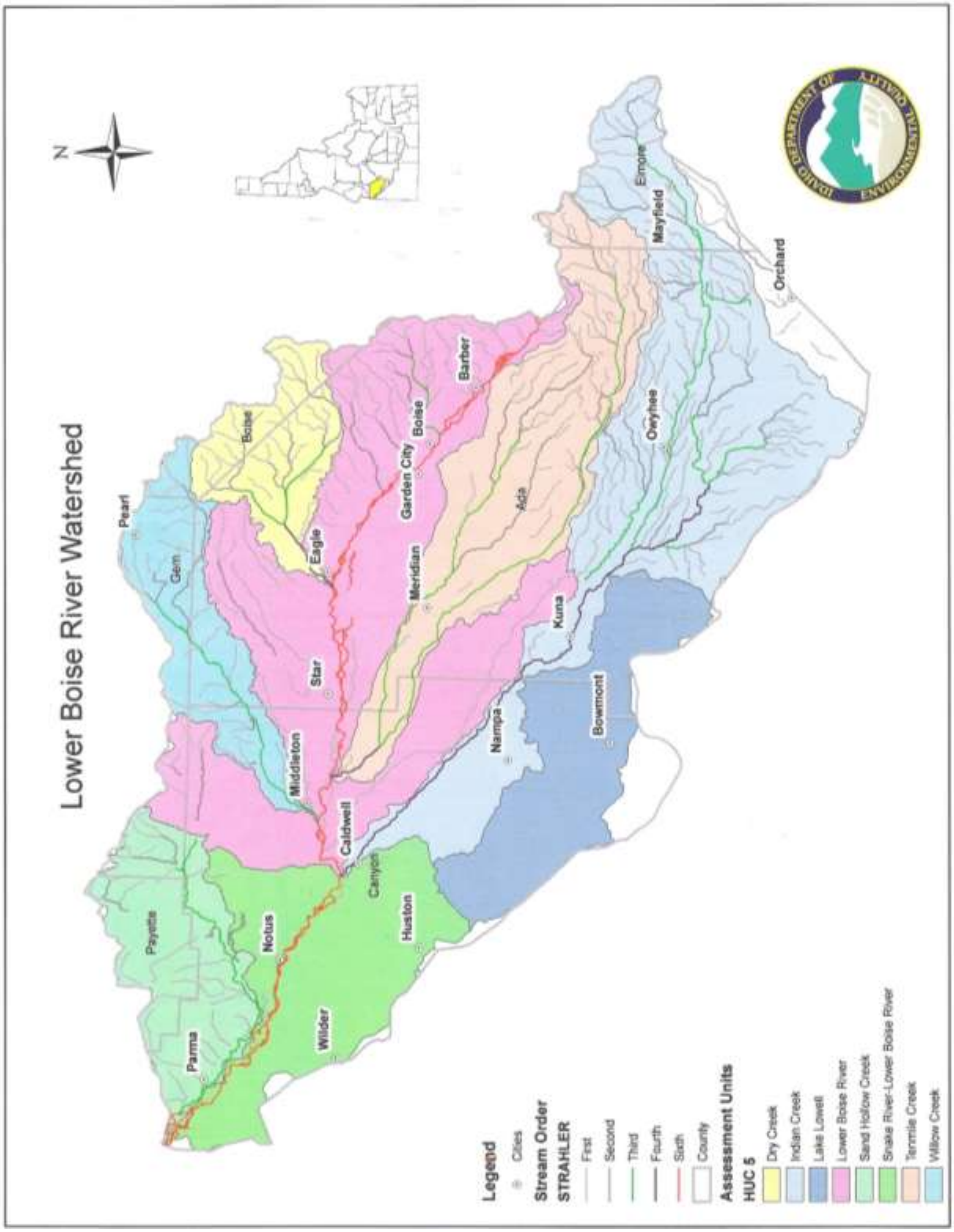


Figure 16. The lower Boise River subbasin and delineation of subwatersheds (DEQ 2009).

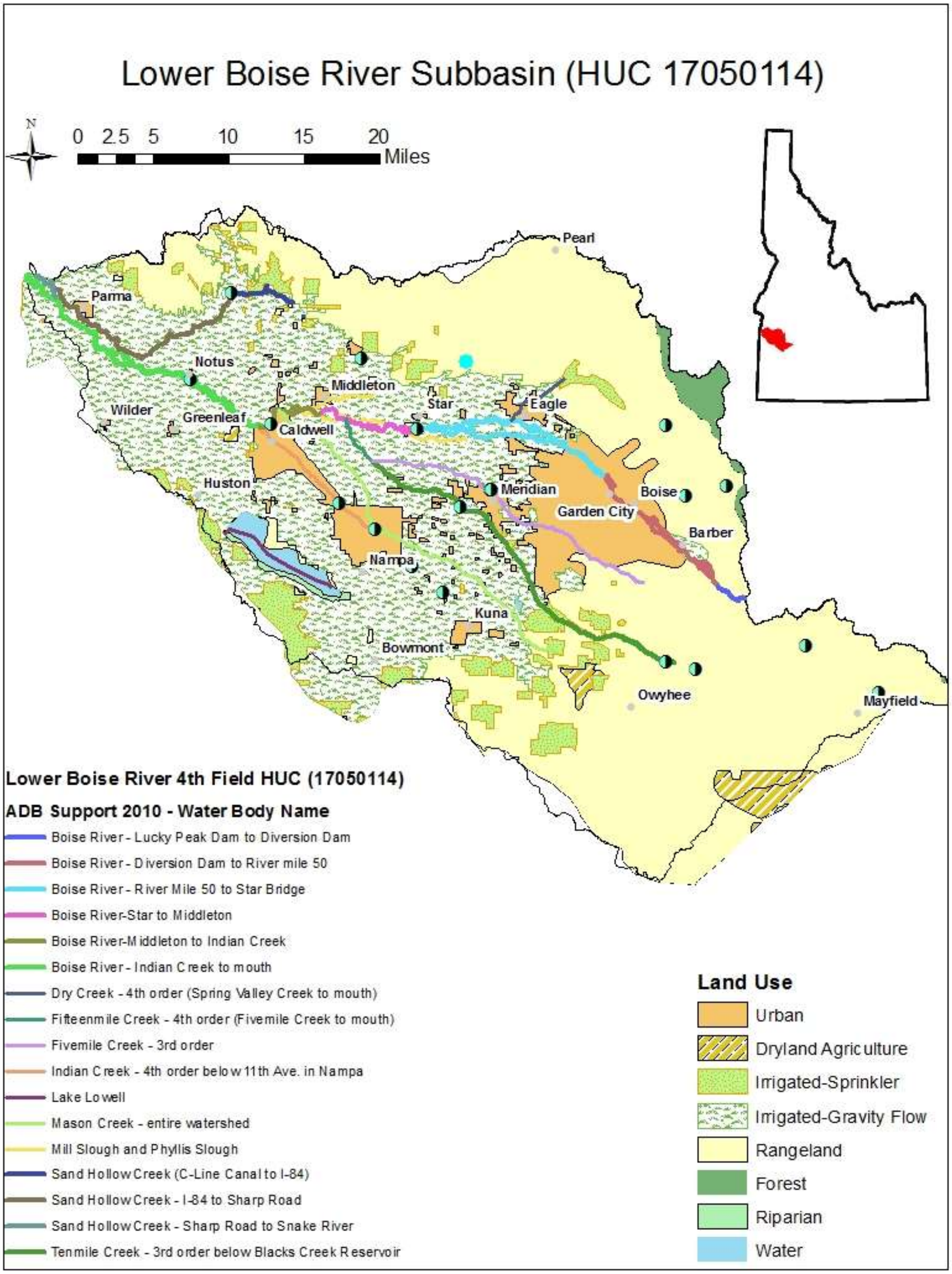


Figure 17. Land use in the lower Boise River Subbasin.

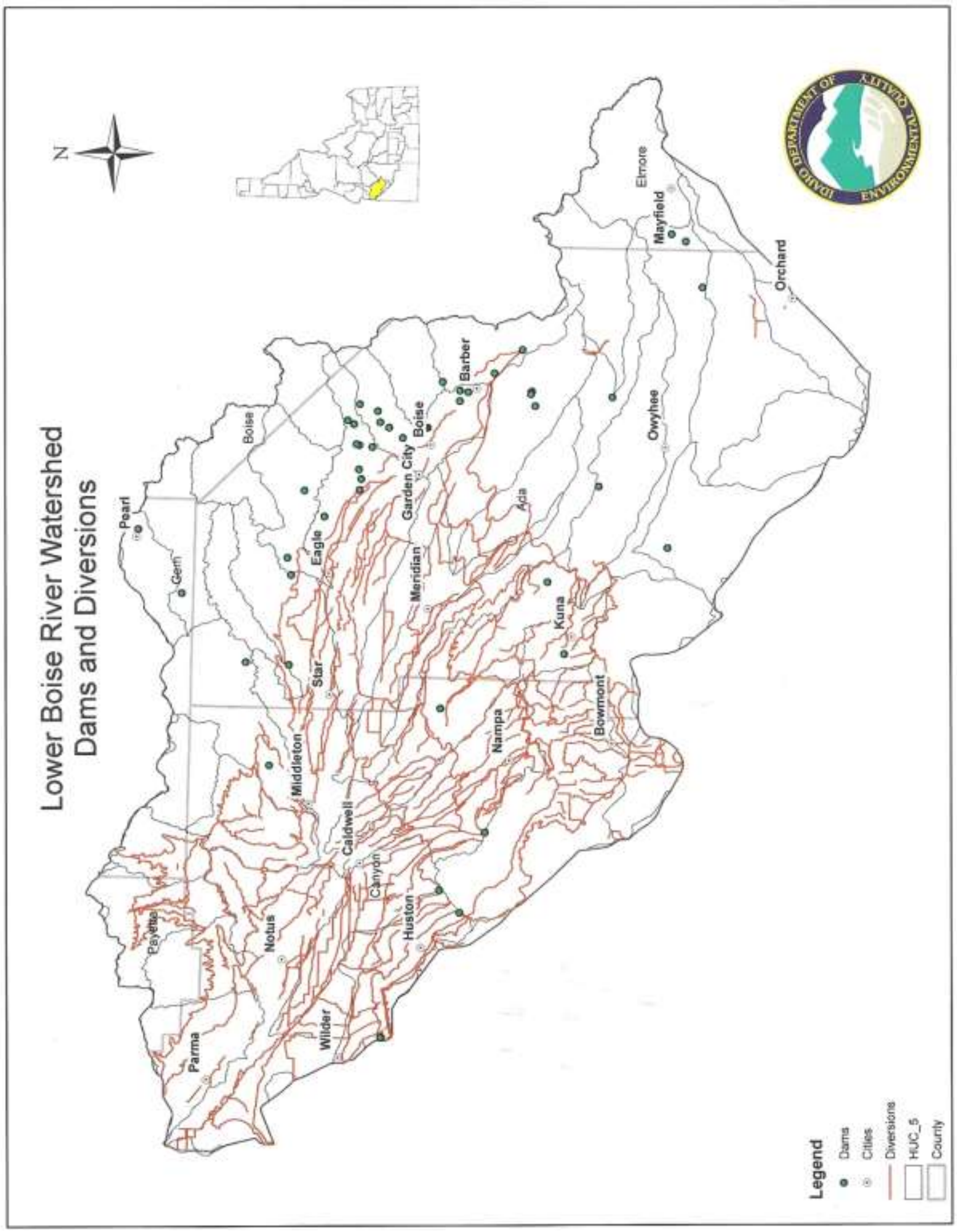


Figure 18. Lower Boise River dams and diversions (canals) permitted through the Idaho Department of Water Resources (IDWR) (DEQ 2009).

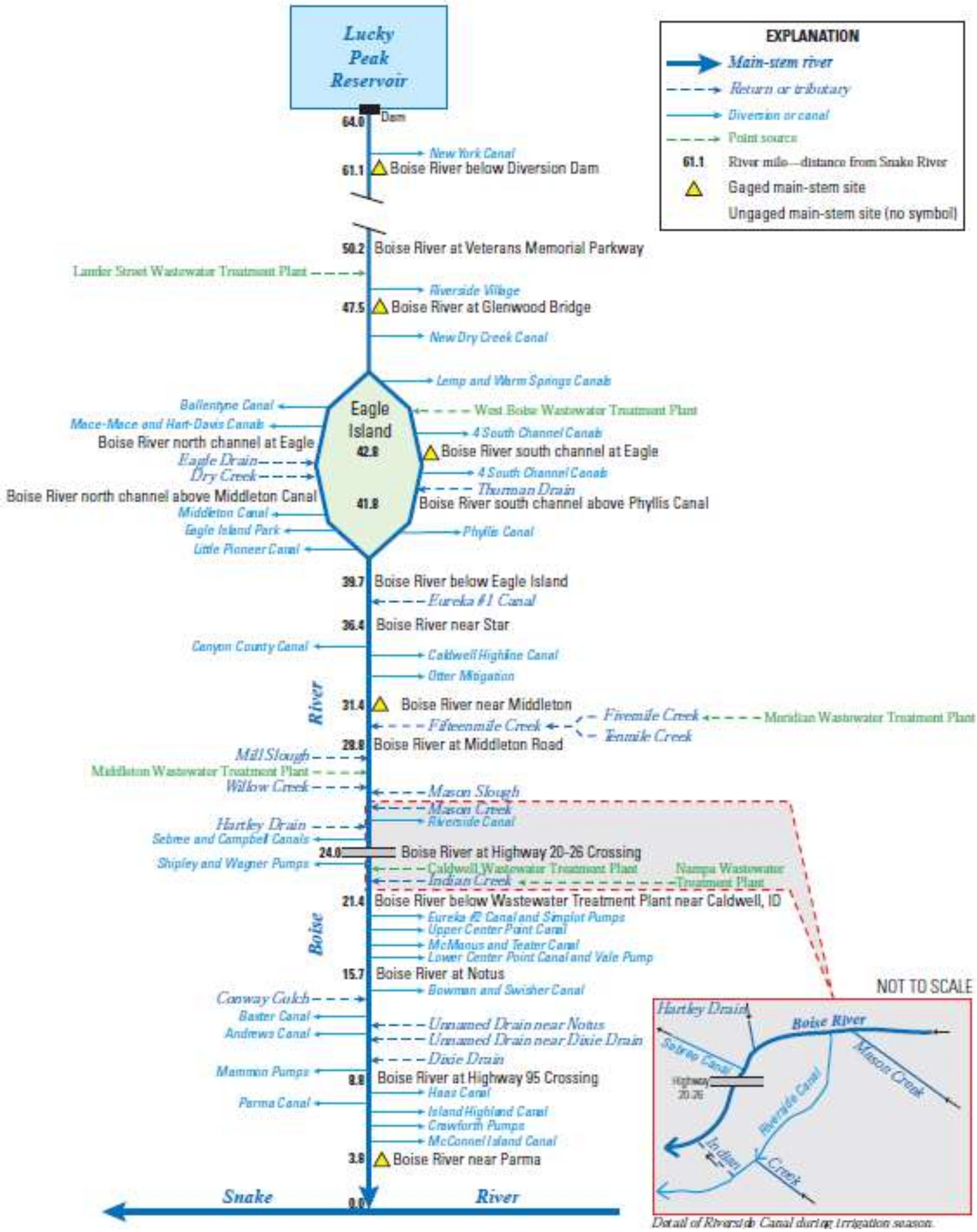


Figure 19. Diversions, drains, and tributaries along the lower Boise River (copied from Etheridge 2013).

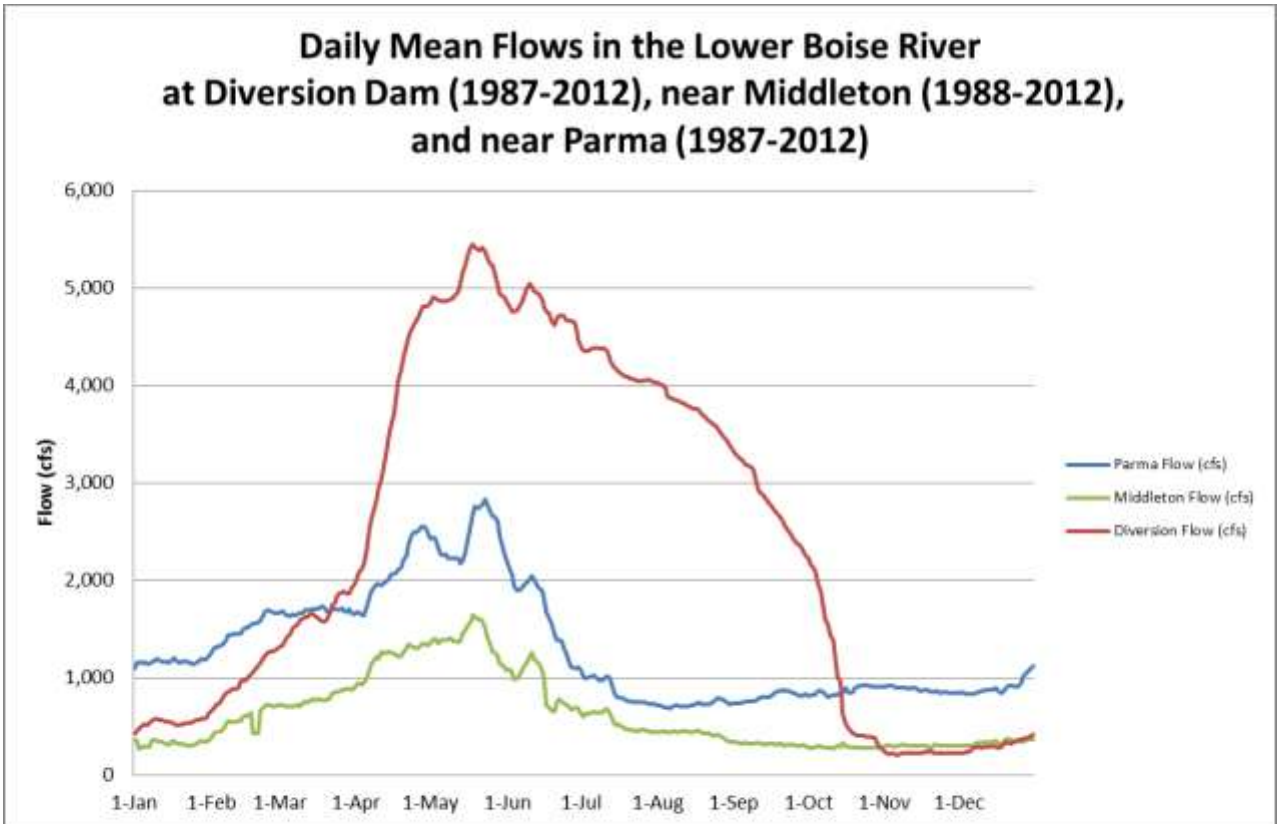


Figure 20. Daily mean flows (cfs) in the lower Boise River at Diversion Dam (USBR), near Middleton (Idaho Power Company), and near Parma (USGS).

Lower Boise River

This addendum addresses two lower Boise River main stem AUs identified as impaired on the 2012 §303(d) list (Figure 21):

- Boise River–Middleton to Indian Creek (ID17050114SW005_06b)
- Boise River–Indian Creek to Mouth (ID17050114SW001_06)

Tributary and upstream AUs that are not listed as impaired for TP are addressed as pollutant sources to the downstream impaired AUs, listed above.

The lower Boise River is a 64-mile stretch of river that flows through Ada County and Canyon County. The river flows in a northwesterly direction from Lucky Peak Dam to its confluence with the Snake River near Parma, Idaho. Major tributaries include Fifteenmile Creek, Mill Slough, Mason Creek, Indian Creek, Conway Gulch, and Dixie Drain. The perennial nature of these tributaries may be the result of agricultural diversion and drain deepening activities in the early 20th century due to elevated ground water levels associated with agricultural irrigation practices (Stevens 2014, unpublished).

Detailed discussions of the lower Boise River subwatershed were provided in the Lower Boise River Subbasin Assessment (DEQ 1999) and Lower Boise River TMDL Five-Year Review (DEQ 2009), which are available at: *http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx*

Mason Creek

This addendum addresses one Mason Creek AU identified as impaired on the 2012 §303(d) list (Figure 21):

- Mason Creek–Entire Watershed (ID17050114SW006_02)

The Mason Creek subwatershed drains 62 square miles of rangeland, agricultural land and urban areas. Mason Creek is located in the southern portion of the lower Boise River watershed and flows through Canyon County, but the headwaters are located in Ada County. The stream flows in a northwesterly direction from its origin at the New York Canal to its confluence with the lower Boise River in the city of Caldwell.

Detailed discussions of the Mason Creek subwatershed were provided in the Mason Creek Subbasin Assessment (DEQ 2001c), which is available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*

Sand Hollow

The addendum addresses two Sand Hollow Creek AUs identified as impaired on the 2012 §303(d) list (Figure 21):

- Sand Hollow Creek–C Line Canal to I-84 (ID17050114SW016_03)
- Sand Hollow Creek–Sharp Road to Snake River (ID17050114SW017_06)

The Sand Hollow Creek subwatershed drains 93 square miles of rangeland, agricultural land and mixed rural farmstead. Sand Hollow Creek is located in the northwest portion of the lower Boise River watershed, although it ultimately drains to the Snake River. Sand Hollow Creek largely flows through Canyon County. However, the headwaters are located in Gem and Payette Counties, north of the town of Notus along the topography separating the lower Boise River and lower Payette River subbasins. The stream flows in a southwesterly direction from its origin to Interstate 84, then in a northwesterly direction from the interstate to its confluence with the Snake River approximately one mile north of the mouth of the Boise River.

Detailed discussions of the Sand Hollow Creek subwatershed were provided in the Sand Hollow Creek Subbasin Assessment (DEQ 2001c), which is available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*

DRAFT

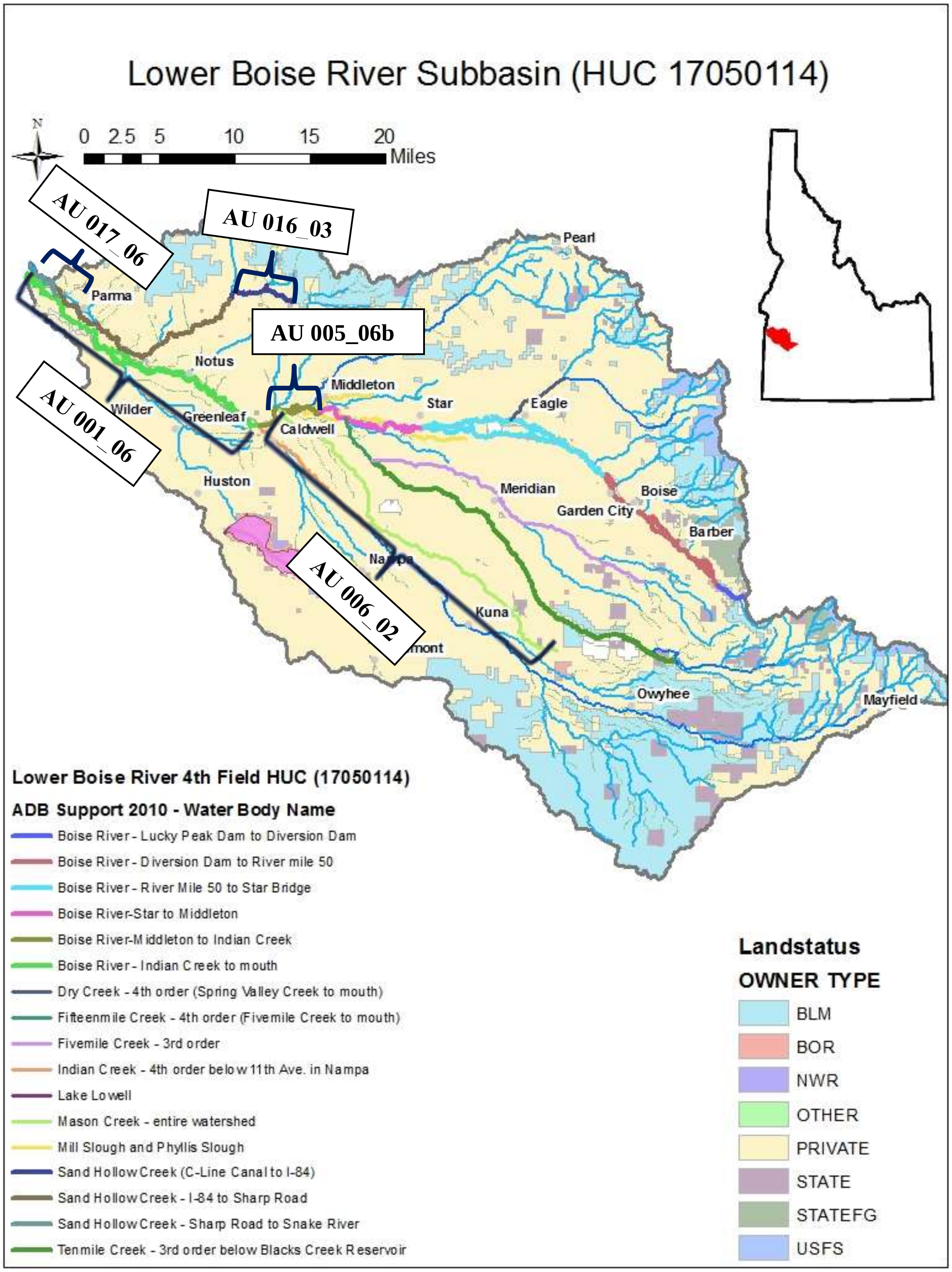


Figure 21. The lower Boise River subbasin. The impaired AUs specifically addressed in this TMDL addendum are identified by their AU number on the map (impaired AUs in this TMDL addendum begin with 17050114).

2 Subbasin Assessment—Water Quality Concerns and Status

A subbasin assessment includes a description of water quality concerns and the status and attainability of designated uses and water quality criteria for the water bodies in the watershed. This section identifies §303(d)-listed waters that are addressed in the TMDL, listing history, and the rationales for listing, the listed pollutants, a description of the designated uses and whether the uses are attainable, the criteria to protect the designated uses and a summary and analyses of existing water quality data in the subbasin.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the Clean Water Act states that waters that are unable to support their beneficial uses and do not meet water quality standards must be listed as water quality limited. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

2.1.1 Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits, primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

Table 8 shows the pollutants listed and the basis for listing for each §303(d)-listed AU and pollutant combination in the lower Boise River subbasin that is addressed in this TMDL. It also shows three AUs that are not on the §303(d) list but are intimately tied to the water quality of the listed AUs.

Two AUs on the main stem lower Boise River are listed as impaired for TP, in part, due to EPA's Partial Approval/Partial Disapproval of Idaho's Final 2008 303(d) list letter dated February 4, 2009, in which EPA disapproved delisting of the lower Boise River for nutrients (total phosphorus) because DEQ did not demonstrate good cause to delist, and that DEQ provided insufficient rationale to justify the exclusion of existing and readily available data. EPA subsequently took public comment on this reversal that ended May 15, 2009. EPA concluded in their final decision letter dated October 13, 2009 that the lower Boise River is water quality-limited and EPA returned the lower Boise River to Idaho’s 303(d) list. EPA's final determination on the lower Boise River (EPA 2009a) is available at *http://www.deq.idaho.gov/media/773615-2008-ir-epa-response-lower-boise-river-hemcreek-101309.pdf*

DRAFT

Table 8. Lower Boise River subbasin §303(d)-listed assessment unit and pollutant combinations that are addressed in this TMDL.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Boise River– Middleton to Indian Creek	ID17050114SW005_06b	Total Phosphorus	1996 §303(d) list - Nutrients
Boise River– Indian Creek to Mouth	ID17050114SW001_06	Total Phosphorus	1996 §303(d) list - Nutrients
Mason Creek– Entire Watershed	ID17050114SW006_02	Cause Unknown - Nutrients Suspected	1996 §303(d) list - Nutrients
Sand Hollow Creek – C-Line Canal to I-84	ID17050114SW016_03	Cause Unknown - Nutrients Suspected	1996 §303(d) list - Nutrients
Sand Hollow Creek – Sharp Road to Snake River	ID17050114SW017_06	Cause Unknown - Nutrients Suspected	1996 §303(d) list - Nutrients

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (swimming) or secondary (boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

2.2.1 Existing Uses

Existing uses under the Clean Water Act are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards" (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

2.2.2 Designated Uses

Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

2.2.3 Undesignated Surface Waters and Presumed Use Protection

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02 §110-160). The WQS have three sections that address nondesignated waters. Section 101.02 and 101.03 specifically address nondesignated man-made waterways and private waters. All other undesignated waters are addressed by section 101.01. Under this section, absent information on existing uses, DEQ presumes that most of Idaho waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the numeric cold water and recreation criteria to undesignated waters. If in addition to *presumed uses*, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

2.2.4 Man-made Waterways and Private Waters

Man-made waterways and private waters have no presumed use protections. Manmade waters are protected for the use for which they were constructed unless otherwise designated in the water quality standards. Private waters are not protected for any beneficial uses unless specifically designated in the water quality standards.

2.2.5 Attainment of Beneficial Uses in the Subbasin

Designated uses must reflect existing uses, but also may include uses that do not currently exist if the uses can be attained in the future. (Idaho Code § 39-3604). The Boise River AUs are designated for cold water aquatic life and recreational uses. Mason Creek and Sand Hollow are designated for recreational uses, but are undesignated for aquatic life. Under section 101.01 (discussed above) Mason Creek and Sand Hollow are presumed to support cold water aquatic life, and so are protected for this use through the application of the applicable cold water aquatic life criteria. Part of the purpose of a Subbasin Assessment is to review whether the uses that are designated are attainable uses. For the Lower Boise Subbasin, this mean looking at whether cold

Draft

water aquatic life and recreational uses are attainable uses in the Boise River, Mason Creek and Sand Hollow AUs.

A designated use is attained if it actually occurs or exists, regardless of whether the use is currently fully supported. (Idaho Code §§39-3602(2) and (13); 39-3604). DEQ's review of relevant information establishes that cold water aquatic life and recreational uses are existing or attained uses in the Boise River, Mason Creek and Sand Hollow Creek AUs. In the impaired AUs of the lower Boise River, contact recreation is documented as an existing use via direct observation, float trips led by Idaho Mountain Recreation (2013) and Idaho Rivers United (2012 – 2014), and guides describing canoeing (Chelstrom 2009) and paddling (1999) of the lower Boise River. Similarly, USGS has documented the presence of cold water aquatic fishes and macroinvertebrates throughout the lower Boise River, including the impaired AUs (MacCoy 2004, 2006).

The DEQ Beneficial Use Reconnaissance Program (BURP) has collected fish and macroinvertebrate data on Mason Creek and Sand Hollow Creek. The data for both streams identify the presence of aquatic macroinvertebrates, and the Mason Creek BURP report identifies the presence of cool water fishes such as redside shiner, smallmouth bass, and northern pikeminnow. Additionally, the USGS found 7 trout in Mason Creek during October 2011 (Etheridge et al. 2014). The Sand Hollow BURP report did not include fisheries data, but the 2001 Sand Hollow Creek Subbasin Assessment identifies game, nongame, and trout fishes that have been collected in the creek (DEQ 2001d). The 2001 Mason Creek and Sand Hollow Creek Subbasin Assessments (DEQ 2001c, 200d) also document that during the summer, contact recreation occurs at several locations in both streams, although the managing irrigation districts discourage such activities (alternatively, canals can be posted as no trespassing).

Based upon the above described information, the AUs addressed by this Subbasin Assessment and TMDL are appropriately designated for cold water aquatic life and recreational uses because these are existing or attained uses. Beneficial uses of the impaired AUs addressed in this TMDL are presented in Table 9.

Table 9. Lower Boise River subbasin beneficial uses of §303(d)-listed streams addressed in this TMDL.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Boise River– Middleton to Indian Creek	ID17050114SW005_06b	COLD, SS, PCR	Designated
Boise River– Indian Creek to Mouth	ID17050114SW001_06	COLD, PCR SS[b]	Designated Existing[b]
Mason Creek– Entire Watershed	ID17050114SW006_02	COLD SCR	Presumed Designated
Sand Hollow Creek– C-Line Canal to I-84	ID17050114SW016_03	COLD SCR	Presumed Designated
Sand Hollow Creek– Sharp Road to Snake River	ID17050114SW017_06	COLD SCR	Presumed Designated

[a] Cold water aquatic life (COLD), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR).
[b] Data collected by the USGS in December 1996 and August 1997 suggest that salmonid spawning is an existing use in the Boise River from Caldwell to the mouth (DEQ 1999).

DRAFT

2.2.6 Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 10).

Table 10. Numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Water Quality Standards: IDAPA 58.01.02.250–251				
Bacteria				
• Geometric mean	<126 *E. coli*/100 mL[b]	<126 *E. coli*/100 mL	—	—
• Single sample[c]	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	—	—
pH	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
Dissolved oxygen (DO)	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	**Water Column DO**: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater **Intergravel DO**: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
Temperature[d]	—	—	22 °C or less daily maximum; 19 °C or less daily average **Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average
Turbidity	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters
[c] A water sample exceeding the E. coli single sample maximums indicates likely exceedance of the geometric mean criterion, but is not alone a violation of water quality standards. If a single sample exceeds the maximums set forth in Subsections 251.01.b.i., 251.01.b.ii., and 251.01.b.iii., then additional samples must be taken as specified in Subsection 251.01.c
[d] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

DRAFT

Narrative criteria for excess nutrients are described in the water quality standards:

> Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. (IDAPA 58.01.02.200.06)

In consultation with the LBWC, DEQ has identified and refined a numeric target to describe nuisance aquatic growth that may impair AUs of the lower Boise River: mean monthly benthic (periphyton) chlorophyll a $\leq$ 150 mg/m^2. The target was based largely on work conducted in Montana, in which 70% of the public identified periphyton of $\leq$ 150 mg/m^2 as acceptable for recreation during the growing season from July 1 – September 30 (Suplee et al. 2008, 2009). In contrast, less than 30% of the public identified periphyton of $\geq$ 200 mg/m^2 as acceptable for recreation. The target is similar to other locations, including Montana, Minnesota, Colorado, and the Clark Fork River, for which the maximum summer periphyton target is 150 mg/m^2 (TSIC 1998, MDEQ 2008, CDPHE 2013, MPAC 2013).

Additional scientific findings support the use of a benthic chlorophyll a target of $\leq$150 mg/m^2 as appropriate for recreation and cold water aquatic life beneficial uses. For example, literature suggests nuisance aquatic algae become apparent between 100 and 200 mg/m^2 and enriched waters often have benthic chlorophyll a concentrations > 150 mg/m^2 (Welch et al. 1988, Dodds and Welch 2000). Biggs (2000) asserted that chlorophyll-a levels > 150-200 mg/m^2 are very conspicuous in streams, are probably unnaturally high, and can compromise the use of rivers for contact recreation and productive sports fisheries (Welch et al. 1988, Dodds et al. 1998). Some of the management problems caused by enrichment, and associated benthic algal proliferations, include aesthetic degradation, alteration of fish and invertebrate communities nutrient enrichment and algae proliferation, and degradation of water quality (particularly dissolved oxygen and pH) (e.g.Miltner and Rankin 1998, Welch et al. 1988, Biggs 2000, Miltner 2010).

Filamentous green algae can have a less desirable appearance than brown-colored diatoms, and can be more problematic for recreation and aquatic life, even when their biomasses are similar (Dodds and Welch 2000). Nevertheless, increased nutrient concentration leads to some detectable changes in higher trophic levels of rivers and streams, especially for grazing invertebrates, in communities dominated by periphytic diatoms (Miltner and Rankin 1998). Above 100 mg/m^2 chlorophyll a, Welch et al. (1988) observed that filamentous species tended to dominate the periphytic composition.

Further, research indicates that total nutrients can provide better overall correlation to eutrophication in streams than do soluble nutrients and that total nitrogen (TN) and TP may be minimum acceptable nutrient criteria in addition to other environmental drivers such light limitation and water velocities (Dodds et al. 1997, Hilton et al. 2006). However, Biggs (2000) identifies advantages and disadvantages of using different nutrient forms in benthic algal biomass-nutrient regression models in streams and rivers.

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily upon biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 22).

DRAFT

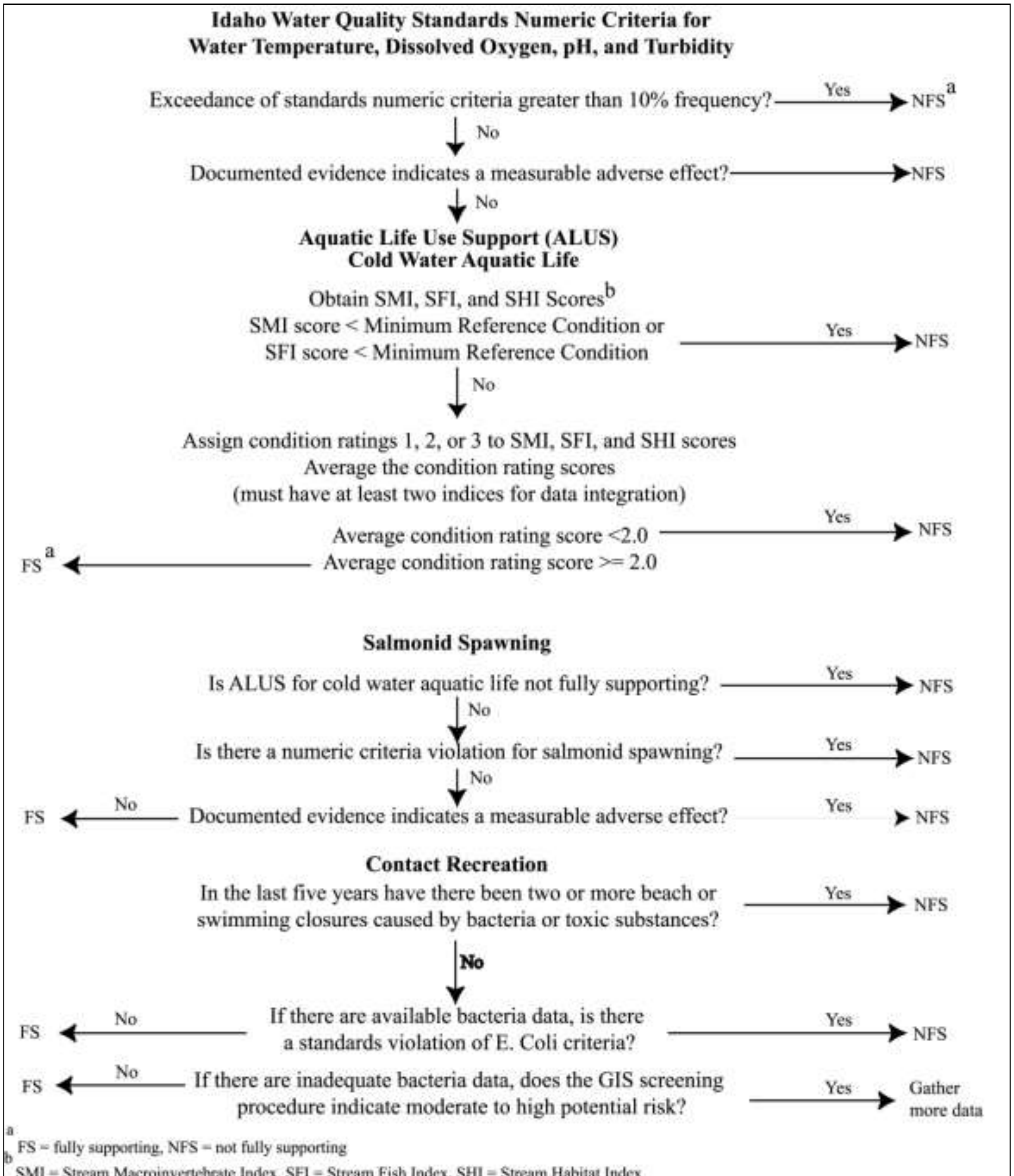


Figure 22. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 Summary and Analysis of Existing Water Quality Data

This section addresses water quality data in the lower Boise River subbasin, focusing on the nutrient-impaired assessment units of the lower Boise River, Mason Creek, and Sand Hollow Creek.

Since the Lower Boise River TMDL Subbasin Assessment TMDL (DEQ 1999) was approved, DEQ has collected data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent water quality data. The results of that effort were compiled in the Lower Boise River Total Phosphorus Five-Year Review (DEQ 2009), available at *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*.

Similarly, DEQ completed the Mason Creek Subbasin Assessment (2001c) and the Sand Hollow Creek Subbasin Assessment (2001d), which identify data collected in the respective subwatersheds. Both of these reports are available at *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx,*

and

http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx.
Since then, water quality and quantity data have continued to be collected in the lower Boise River subbasin by DEQ, LBWC, USGS, ISDA, municipalities, and other agencies and organizations (see Appendix B – Data Sources).

The DEQ BURP has monitored several sites on the lower Boise River and within the subbasin (Figure 23). BURP protocol focuses on biological indicators and typically doesn't capture nutrient impacts. However, the data can identify and measure conditions involving dissolved oxygen, channel substrates, sediment, habitat, and fish and macroinvertebrate populations.

Data Quality and Acceptance

Various current and historical data are analyzed and presented in this TMDL addendum to quantify phosphorus and other environmental conditions in the lower Boise River. These data were collected and provided by various agencies and organizations (See Appendix B. Data Sources) and followed standard and accepted collection and analysis methods as deemed to be of adequate quality for inclusion in the agency water quality programs. Data used to help calibrate the AQUATOX model are documented in DEQ's AQUATOX Model Report (DEQ 2014a) and DEQ's AQUATOX Quality Assurance Project Plan (DEQ 2014b).

USGS data, available through the National Water Information System (NWIS) web interface, along with data from the USGS synoptic sampling and mass balance models (Etheridge 2013) were used to develop the May 1 – September 30 flow and phosphorus load duration analyses in the lower Boise River. Samples collected by the USGS were typically analyzed for orthophosphate as phosphorus following the ammonium molybdate method procedures (Fishman 1993). USGS collected depth- and width-integrated isokinetic samples at locations where streamflow gages are located and/or other common water quality monitoring locations. Municipalities with wastewater discharge typically follow Standards Methods 4500 for the orthophosphate analysis of their wastewater effluent; in this analysis ammonium molybdate and potassium antimonyl tartrate react in acid medium with orthophosphate to form a heteropoly phosphomolybdic acid, which is reduced to intensely colored molybdenum blue by ascorbic acid.

DRAFT

These methods are typically applicable for orthophosphate concentrations in the range of 0.01 to 6 mg/L.

This methodology assumes the orthophosphorus is at a moderate concentration and is completely bioavailable for algal and plant uptake and growth. As orthophosphorus is reduced throughout the watershed, lower level detection methods will be necessary. Additional research shows that the assumption that all orthophosphorus may not be equally bioavailable for algal and plant uptake and growth. There are different rates for labile and refractory decay of the constituents binding phosphorus that influence the bioavailability of the orthophosphorus. More data and analysis would be necessary to further categorize the orthophosphorus sources throughout the watershed. For this TMDL addendum, DEQ maintains the assumption that orthophosphorus from all sources is completely bioavailable and will be analyzed and modeled as such for a conservative approach. However, DEQ recognizes the potential implications of differing orthophosphorus bioavailability. Therefore, for the long term success of the TMDL addendum and implementation of source reductions, DEQ will consider bioavailability data from the sources as new information becomes available now and during the five-year assessments of the TMDL addendum. It is important to note that using this conservative approach provides reasonable assurance that this TMDL will achieve water quality standards to support beneficial uses.

Magnitude, Duration, and Frequency

Analyzing existing water quality data includes spatially and temporally examining data using statistical methods to understand and identify water quality conditions in the river relative to water quality standards. Recognized components of these analyses include magnitude, duration, and frequency. Analyzing the water quality data by magnitude, frequency, and duration is important because a similar analysis is used to determine the actual impairment of designated uses and development of the TMDL. The acceptable conditions for these factors are often based on ecological studies of pollutant effects and recovery periods.

The first component is magnitude, which refers to water quality and pollutant concentrations that are characteristic or representative of conditions. Magnitude of the water quality dataset is often summarized using statistics such as the minimum, median, average and maximum.

The second component is the duration, or the period of time over which concentrations can be averaged and beneficial uses (e.g. aquatic life and contact recreation) can be exposed to elevated levels of pollutants without harm. Since collected data are often from single instantaneous observations, assumptions are made to estimate the day, week, month, or season that such conditions typically occur. The duration is particularly important for certain pollutants whose effects are long term, such as sediment, nutrients and algal biomass. These parameters are frequently addressed in TMDLs as seasonal or annual loads. The analysis of existing water quality data described below included a review by duration based on periods used in previous studies. These periods include: flow conditions, May 1 – September 30 as used in the SR-HC TMDL, and during irrigation season (August 2012), shortly after irrigation ended (October 2012), and shortly before irrigation resumed (March 2013) as used by the USGS (Etheridge 2013).

DRAFT

The third component is the frequency, or how often characteristic water quality conditions may occur in the river without impairing the beneficial uses. While the robustness of the dataset is important for evaluating the frequency, an estimation of the level of various magnitudes of conditions occur once in three seasons and once in ten seasons is described below.

Lower Boise River

Due to higher flows in the lower Boise River than are typically feasible for completing BURP activities, BURP protocol could not be completed at these main stem sites, yielding limited data collection and analyses (specifically stated in the 1995SBOIC029 site data, and presumed for the remaining two main stem sites). The BURP data and summary reports can be obtained through DEQ's 305(b) Integrated Report webpage at *http://mapcase.deq.idaho.gov/wq2010/*.

DRAFT

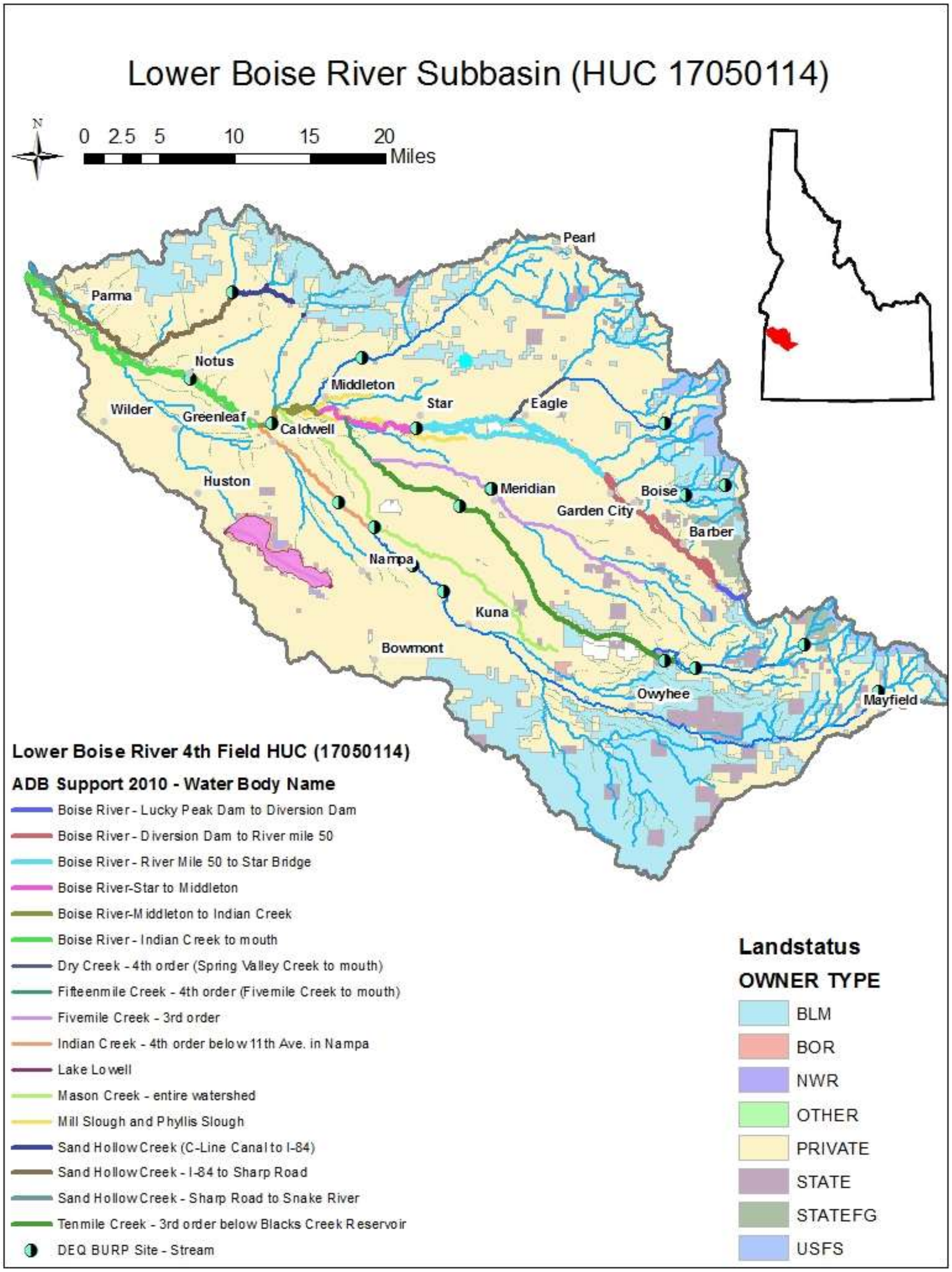
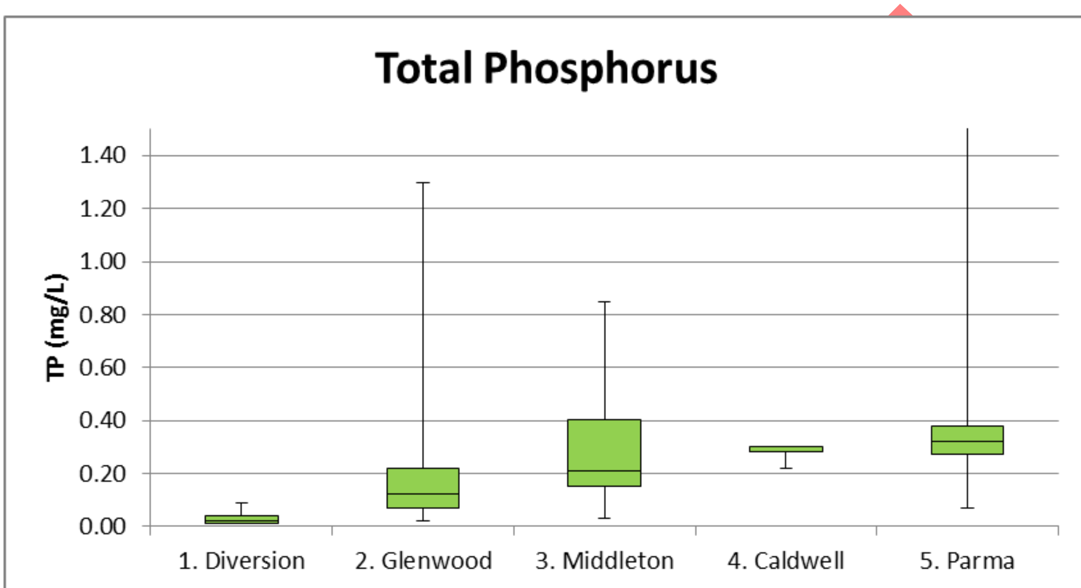


Figure 23. DEQ BURP sites in the lower Boise River Subbasin.

Over the past several decades, water quality and habitat data have been collected in the lower Boise River subbasin. Historical USGS water quality data on the lower Boise River illustrate variable upstream to downstream patterns depending on the water quality constituent of interest. For example, median TP concentrations at Glenwood Bridge (0.12 mg/L) are approximately 6 times greater than at Diversion Dam (0.02 mg/L); whereas, subsequent TP concentration near Parma (0.32 mg/L) are 2.7 times greater than at Glenwood Bridge (Figure 24). The TP concentrations in the Boise River near Parma are approximately 16 times greater than at the upstream monitoring location of Diversion Dam.



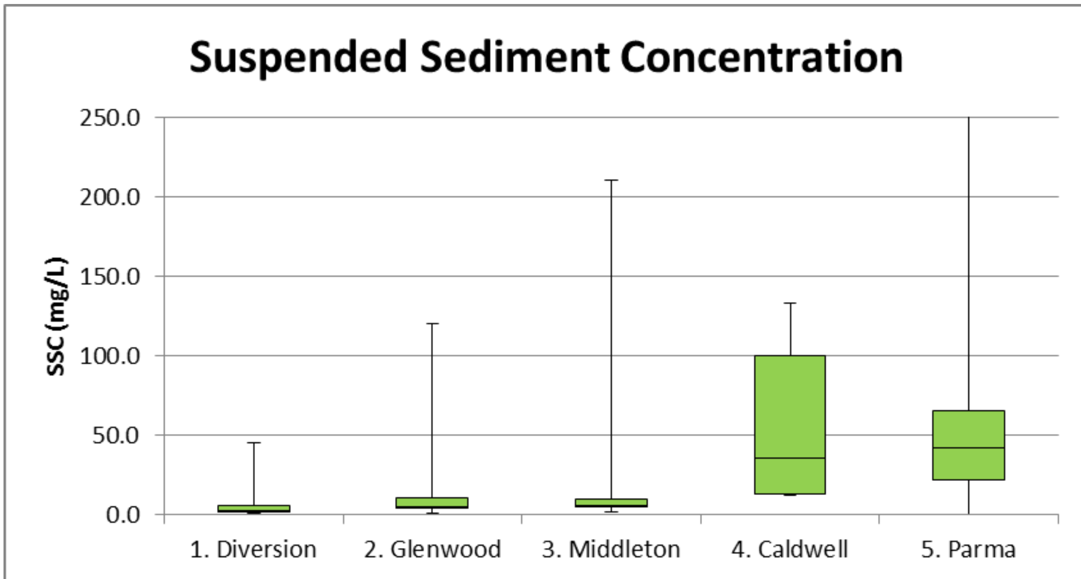
	1. Diversion	2. Glenwood	3. Middleton	4. Caldwell	5. Parma
	n = 123 (1990-2013) (mg/L)	n = 166 (1972-2013) (mg/L)	n = 120 (1976-2013) (mg/L)	n = 5 (1971, 1972, 2013) (mg/L)	n = 830 (1969-2013) (mg/L)
Average	0.03	0.18	0.29	0.28	0.33
Min	0.01	0.02	0.03	0.22	0.07
Q1	0.01	0.07	0.15	0.28	0.27
Median	0.02	0.12	0.21	0.28	0.32
Q3	0.04	0.22	0.40	0.30	0.38
Max	0.09	1.30	0.85	0.30	3.90

Figure 24. TP data collected by USGS on the lower Boise River. The green boxes, indicate the 25th and 75th data percentiles and are parted by the line representing the median value. Measured values below the detection limit at Diversion were given the detection limit as a conservative value. The error bars indicate maximum and minimum observed values. Note, although not fully shown on the figure (for readability), the Parma maximum TP value reaches 3.9 mg/L.

Historical USGS suspended sediment concentration (SSC) data show a similar, but slightly different gradient (Figure 25). Median SSC values increase by approximately 1.2 to 1.7 times from each upstream monitoring station, with the exception of Caldwell. Median SSC values at Caldwell (26.0 mg/L) are approximately 4.3 times greater than those at Middleton (6.0 mg/L).

DRAFT

However, similar to TP, SSC in the Boise River near Parma are approximately 14 times greater than at the upstream monitoring location of Diversion Dam.

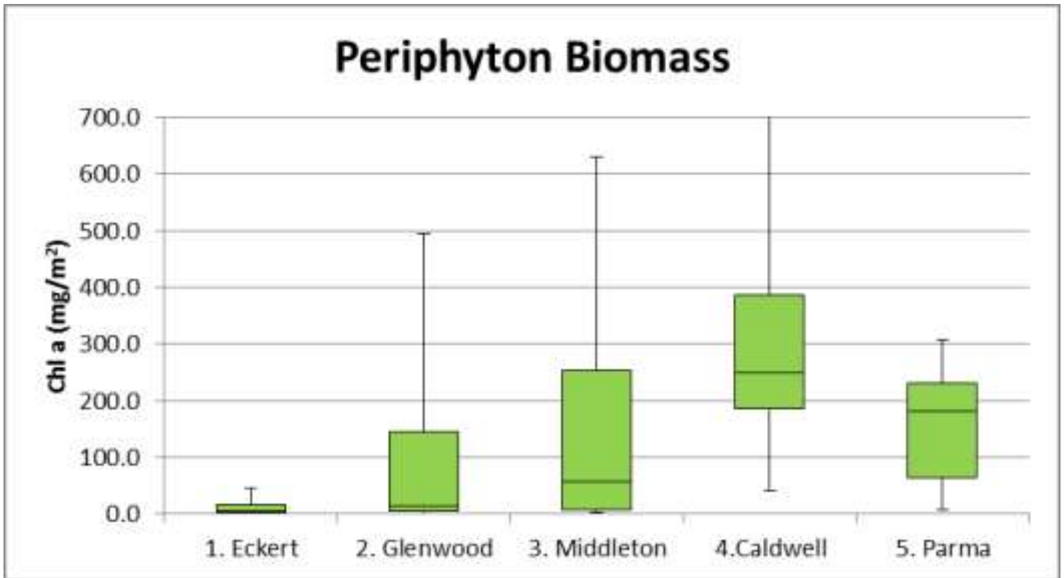


	1. Diversion	2. Glenwood	3. Middleton	4. Caldwell	5. Parma
	n = 113 (1990-2013) (mg/L)	n = 159 (1989-2013) (mg/L)	n = 108 (1991-2013) (mg/L)	n = 5 (1971, 1972, 2013) (mg/L)	n = 303 (1974-2013) (mg/L)
Average	5.8	11.2	11.4	45.8	55.7
Min	1.0	1.0	2.0	12.0	0.0
Q1	2.0	4.0	5.0	14.5	22.0
Median	3.0	5.0	6.0	26.0	42.0
Q3	6.0	10.5	10.3	55.8	65.5
Max	45.0	120.0	211.0	133.0	664.0

Figure 25. Suspended sediment concentration (SSC) data collected by USGS on the lower Boise River. The green boxes, indicate the 25th and 75th data percentiles, and are parted by the line representing the median value. The error bars indicate maximum and minimum observed values. Note, although not fully shown on the figure (for readability), the Parma maximum SSC value reaches 664 mg/L.

USGS periphyton chlorophyll a data show a different upstream to downstream pattern (Figure 26). Median chlorophyll a is approximately 2.7 times greater at Glenwood Bridge (13.9 mg/m^2) than Eckert Road (5.0 mg/m^2). The median chlorophyll a increases by approximately 4.2 times from Glenwood to Middleton (58.2 mg/m^2), and Middleton to Caldwell (249.0 mg/m^2). Conversely, chlorophyll a at Parma (181.0 mg/m^2) decreases by approximately 30% relative to Caldwell. This observed periphyton relationship between Parma and Caldwell may be due to a number of site-specific anthropogenic and environmental factors, including, water velocity, suspended sediment concentrations, available light, phosphorus and other nutrient sources, and water temperatures, to name a few.

DRAFT



	1. Eckert	2. Glenwood	3. Middleton	4.Caldwell	5. Parma
	n = 43 (1995-2013) (mg/m^2)	n = 64 (1995-2013) (mg/m^2)	n = 62 (1995-2013) (mg/m^2)	n = 34 (1995-2013) (mg/m^2)	n = 29 (1995-2013) (mg/m^2)
Average	11.4	90.7	149.5	308.5	157.7
Min	0.0	0.0	2.5	41.7	8.3
Q1	1.9	4.7	8.5	185.8	63.0
Median	5.0	13.9	58.2	249.0	181.0
Q3	17.5	144.8	254.5	387.5	232.0
Max	46.0	496.0	630.0	933.0	307.0

Figure 26. Periphyton chlorophyll a data collected by USGS on the lower Boise River. The green boxes, indicate the 25th and 75th data percentiles, and are parted by the line representing the median value. The error bars indicate maximum and minimum observed values. Note, although not fully shown on the figure (for readability), the Caldwell maximum chlorophyll a value reaches 933 mg/m^2.

DRAFT

Algae Community Composition

The lower Boise River algal community composition analyses conducted by Rushforth (2007) reports organism presence—to genus or species level in most cases—in the Boise River for study dates in October 2005, September 2006, and March 2007. DEQ related the study's periphytic algae presence data with river locations to model periphyton and nutrient relationships (DEQ 2014) (Figure 27):

- Rare—present in <10% of microscope fields
- Common—present in 10-20% of microscope fields
- Abundant—present in >20% of microscope fields

DEQ then created a visual display of the community composition by assigning values to algae presence:

- None = 0
- Rare = 1

- Common = 5
- Abundant = 8

Although the Rushforth study did not provide data that could be used as direct biomass input for modeling, the charts created by DEQ (Figure 28) help to identify relative abundance of the algal groups in various reaches of the river during March, September, and October. From this, it appears that the periphyton community composition in the river can differ both by season and location, including high- and low-nutrient diatoms, green and blue-green algae, and filamentous algae (*Cladophora*).

Periphyton community composition summarized from Rushforth 2007

Model segment	River Mile	Site	Lat	Long	
1	***61.1***	Diversion	43.54531	-116.099469	
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	rare	rare	common	abundant	common
September	none	abundant	common	abundant	none
October	none	none	abundant	common	none
2	***58.3***	Eckert Road	43.56572	-116.132058	USGS Site ID 13203760
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	rare	common	abundant	common
September	abundant	rare	rare	abundant	none
October	common	none	none	common	none
3	***50.17***	Veteran's Parkway	43.63606	-116.2411417	USGS Site ID 13205642
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	none	rare	abundant	rare
September	none	abundant	none	abundant	rare
October	abundant	none	abundant	abundant	none
4	***47.5***	Glenwood	43.66104	-116.2796389	USGS Site ID 13206000
5	***45.51***	Loss to N Channel	43.67043	-116.30753	GIS
6	**45.51**	LOSS TO NORTH CHANNEL	43.67043	-116.30753	GIS
7	**44.16**	Boise WWTP West Boise	43.67271	-116.331657	GIS
8	**40.2**	GAIN FROM NORTH CHANNEL	43.68138	-116.424625	GIS
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	none	common	rare	abundant	common
September	common	none	common	abundant	none
October	common	none	rare	abundant	none
9	***31.43***	Boise River NR Middleton	43.68704	-116.5867694	USGS Site ID 13210815
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	common	rare	rare	abundant	common
September	rare	rare	rare	abundant	abundant
October	common	none	rare	abundant	none
10	***23.98***	Boise River at HWY 20-26	43.68898	-116.6862333	USGS Site ID 13211000
11	***15.66***	Boise River at Notus	43.72088	-116.7980028	USGS Site ID 13212500
12	***10.6***	Above Dixie Drain	43.73225	-116.889004	GIS
13	***8.77***	Boise River at HWY 95 Crossing	43.74721	-116.9124611	USGS Site ID 13212900
	Blue-greens	*Cladophora*	*Greens*	*High-nutrient diatoms*	*Low-nutrient diatoms*
March	rare	abundant	rare	abundant	none
September	none	common	common	abundant	common
October	abundant	none	rare	abundant	none
END	***3.8***	Parma	43.78151	-116.9727944	USGS Site ID 13213000

Figure 27. Summary of periphytic algal community compositions on the lower Boise River (Rushforth 2007, as displayed in DEQ 2014).

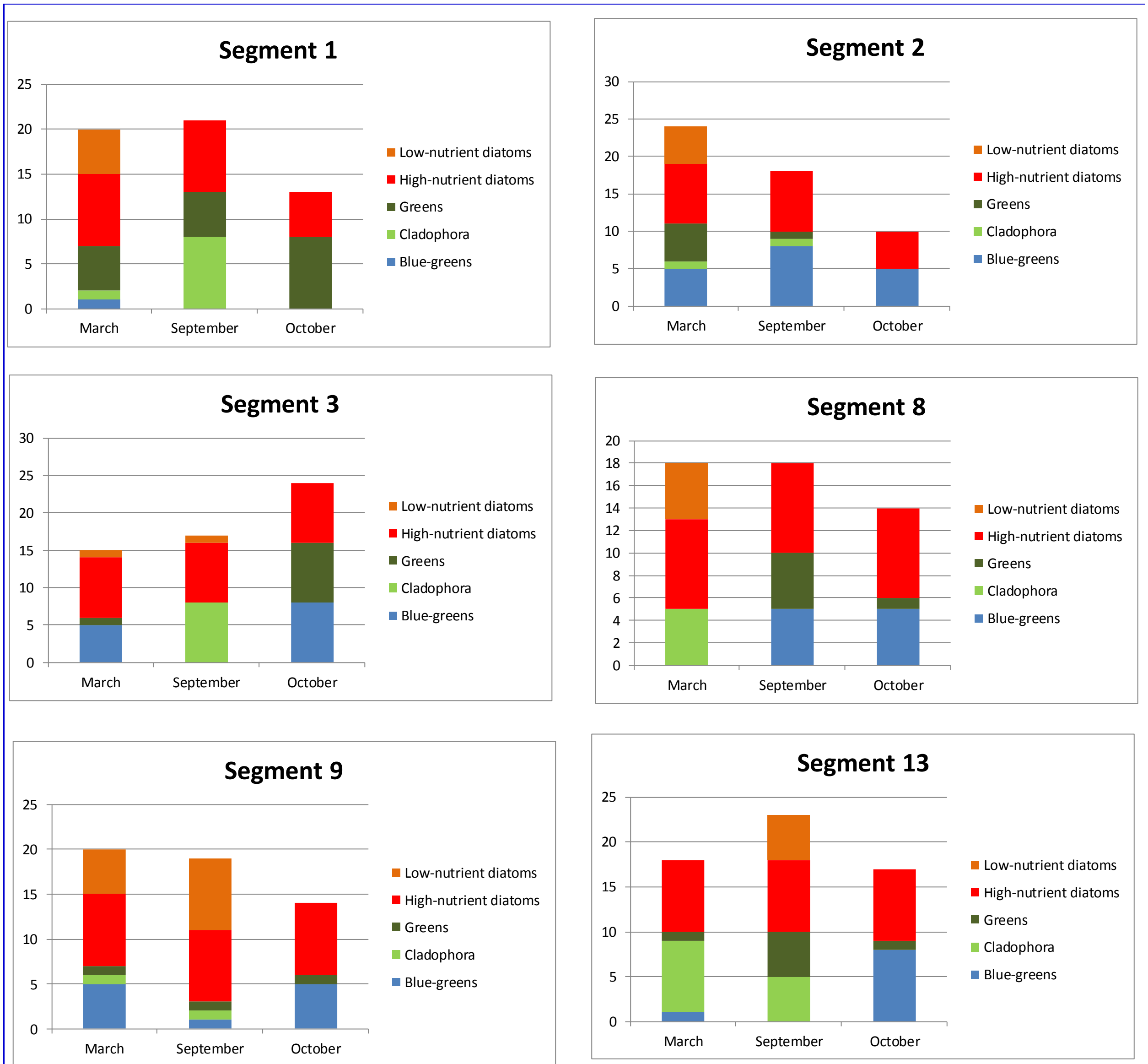


Figure 28. DEQ depiction (DEQ 2014c) of algal community composition in sampled segments, based on previous analyses in the lower Boise River (Rushforth 2007b). Segment 1 = Eckert Road; Segment 2 = Veteran's Parkway; Segment 3 = Glenwood Bridge; Segment 8 = Middleton; Segment 9 = Caldwell; Segment 13 = Parma.

The USGS, in cooperation with DEQ and the LBWC, collected TP and other water quality data during three synoptic sampling events in the lower Boise River watershed during August and October 2012, and March 2013 (a sampling event that takes place over a relatively short timeframe and under relatively stable hydrologic conditions). The resulting mass balance model and report spanned 46.4 river miles along the Boise River from Veteran's Parkway in Boise, ID, river mile (RM) 50.2, to Parma, ID (RM 3.8). The USGS measured streamflow at 14 sites on the main stem of the Boise River, 2 sites on the north channel of the Boise River, 2 sites on the Snake River, one upstream and one downstream of the mouth of the Boise River, and 17 tributary and return flow sites. Additional samples were collected from treated effluent at six wastewater treatment facilities and two fish hatcheries. Idaho Department of Water Resources diversion flow measurements were utilized within the sampled reaches (Etheridge 2013).

A TP mass-balance model was developed by the USGS to evaluate sources of phosphorus to the Boise River during the sampling timeframe (Etheridge 2013). The timing of each synoptic sampling event allowed the USGS to evaluate phosphorus inputs and outputs to the lower Boise River during irrigation season (August 2012), shortly after irrigation ended (October 2012), and shortly before irrigation resumed (March 2013).

According to the USGS mass-balance model and report (Etheridge 2013):

> "…point and nonpoint sources (including ground water) contributed phosphorus loads to the Boise River during irrigation season. Ground water exchange within the Boise River in October 2012 and March 2013 was not as considerable as that measured in August 2012. However, ground water discharge to agricultural tributaries and drains during non-irrigation season was a large source of discharge and phosphorus in the lower Boise River in October 2012 and March 2013. Model results indicate that point sources represent the largest contribution of phosphorus to the Boise River year round, but that reductions in point and nonpoint source phosphorus loads may be necessary to achieve seasonal total phosphorus concentration targets at Parma (RM 3.8) from May 1 through September 30, as set by the 2004 Snake River-Hells Canyon Total Maximum Daily Load document."

The report is consistent with other data collected in the lower Boise River (see Appendix B – Data Sources) indicating that at the upstream sampling location, near Veteran's Parkway (RM 50.2), TP concentrations were between 0.01 and 0.02 mg/L. Conversely, at the downstream sampling location, near Parma, TP concentrations were ≥ 0.29 mg/L during each of the synoptic events (Table 11).

Table 11. Results of USGS synoptic sampling on the lower Boise River in 2012 and 2013[1].

Week of…	Location	Flow (cfs)	TP Concentration (mg/L)	TP Load (lbs/day)
August 20, 2012	Veteran's Parkway (RM 50.2)	759	0.015 (0.02)[2]	61.4
	Parma (RM 3.8)	624	0.30	1,010
October 29, 2012	Veteran's Parkway (RM 50.2)	234	<0.01	5.10
	Parma (RM 3.8)	924	0.29	1,450
March 4, 2013	Veteran's Parkway (RM 50.2)	243	0.01	13.1
	Parma (RM 3.8)	846	0.34	1,550

[1] Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).
[2] The USGS mass balance report text identifies the value as 0.015 and Table 7 of the report identifies the value as 0.02 (Etheridge 2013).

Forms of Phosphorus

TP includes particulate, non-particulate, inorganic, and organic forms of phosphorus. Orthophosphate (OP) is the bioavailable portion of the TP which can be readily utilized by algae. Therefore, higher levels of OP in TP indicate a greater potential for algal growth.

The Lower Boise River Nutrient Subbasin Assessment (DEQ 2001b) identified OP levels as comprising between approximately 75-80% of the TP load, which is similar to previous findings by USGS (MacCoy 2004). The proportion of OP in the lower Boise River increases in downstream stations (e.g. Glenwood to Parma) relative to values measured at Diversion Dam.

OP, TP, and instantaneous discharge measurements collected by the USGS in the lower Boise River near Parma from 1987 to 2012 indicate that across all flows, the OP:TP ratio is approximately 0.78 (Figure 29). At flows greater than the 10th percentile flow rank (≤ 3268 cfs), the mean OP:TP ratio is 0.8, ranging from 0.5 to > 1; whereas, less than the 10th percentile flow rank (≥ 3268 cfs), the mean OP:TP ratio is 0.62, ranging from 0.4 to 0.89.

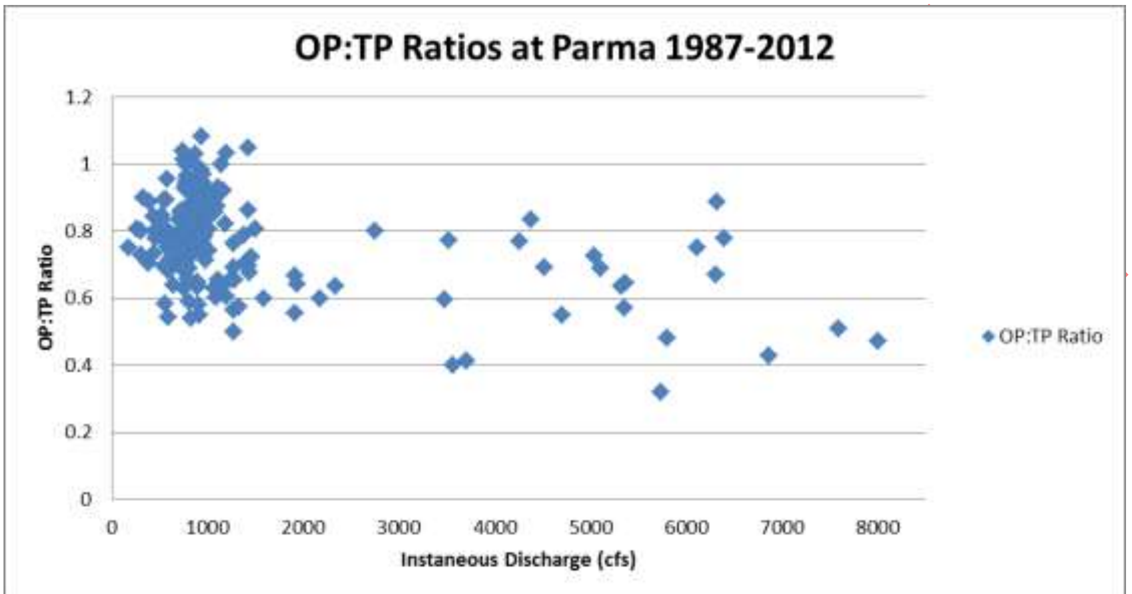
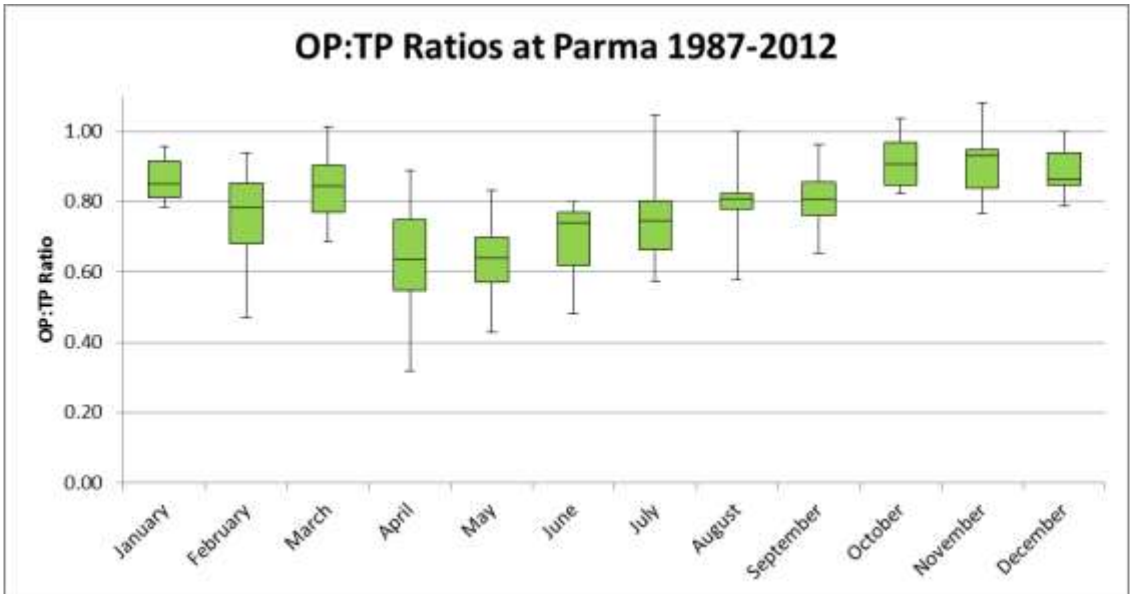


Figure 29. Orthophosphorus to TP ratios relative to instantaneous river discharge as measured by the USGS on the lower Boise River near Parma. The OP:TP ratios are presented relative to the instantaneous measure discharge of the Boise River measured concurrently. Note: DEQ excluded two potential outlier data points due to disproportionate influence on the analysis: 1) OP:TP ratio of 0.053 in August 2009, and 2) OP:TP ratio of 0.125 in September 1988.

Monthly median OP:TP ratios range from a low of 0.64 in April to a high of 0.93 in November (Figure 30). Year-round, the OP:TP ratios in the lower Boise River near Parma average 0.78. Alternatively, OP:TP ratios for the May 1 – September 30 SR-HC TMDL allocation period average 0.73, and ratios for the October 1 – April 30 timeframe average 0.83.



	Jan n=10	Feb n=2	Mar n=12	Apr n=17	May n=22	Jun n=15	Jul n=23	Aug n=46	Sept n=21	Oct n=13	Nov n=14	Dec n=13
Avg	0.86	0.76	0.84	0.63	0.64	0.69	0.74	0.80	0.81	0.92	0.91	0.89
Min	0.79	0.47	0.69	0.32	0.43	0.48	0.58	0.58	0.65	0.82	0.77	0.79
Q1	0.81	0.68	0.77	0.55	0.57	0.62	0.66	0.78	0.76	0.85	0.84	0.85
Med	0.85	0.79	0.84	0.64	0.64	0.74	0.75	0.81	0.81	0.91	0.93	0.87
Q3	0.92	0.85	0.90	0.75	0.70	0.77	0.80	0.82	0.86	0.97	0.95	0.94
Max	0.96	0.94	1.01	0.89	0.83	0.80	1.05	1.00	0.96	1.04	1.08	1.00

Figure 30. Orthophosphorus to TP ratios from USGS data on the lower Boise River near Parma. The green boxes, indicate the 25th and 75th data percentiles, and are parted by the line representing the median value. The error bars indicate the maximum and minimum observed values. Note: DEQ excluded two potential outlier data points due to disproportionate influence on the analysis: 1) a low OP:TP ratio of 0.053 in August 2009, and 2) a low OP:TP ratio of 0.125 in September 1988.

Recent USGS data collected for the lower Boise River mass balance models (Etheridge 2013) identify OP:TP ratios in August 2012 between Diversion Dam and Parma averaged 0.81 (n = 14; range 0.69 to 0.92). During the non-irrigation season, OP:TP ratios averaged 0.89 (n = 15; range 0.6 to 0.98) in October 2012 and 0.81 (n = 15; range 0.3 to 0.95)[3] in March 2013.

Etheridge (2013) provides detailed analyses and discussions of OP and TP in the lower Boise River, as observed during the August 2012, October 2012, and March 2013 synoptic sampling efforts in the subbasin, including the data collection, lab, and statistical methods and analyses. The USGS report (Etheridge 2013) states:

> "Donato and MacCoy (2005) observed the highest orthophosphorus as phosphorus (OP)-to-TP ratios at Parma in November and December and lowest ratios in summer, which was the opposite of patterns observed in the river upstream of agricultural and urban land uses. This suggests that aquatic plants use nutrients in the lower reaches of the river in summer and that dam releases for irrigation supply dilute WWTP effluent…

[3] With the exception of the OP:TP ratio measured below Diversion Dam in March 2013, (0.3), all OP:TP ratios measured in the lower Boise River during the 2012-2013 synoptic sampling were ≥ 0.69.

> The evaluation of OP:TP relative to river mile and suspended sediment concentrations in the Boise River suggests that particulate phosphorus is positively correlated with suspended sediment in the downstream direction during irrigation season and that agricultural sources of particulate phosphorus constitute progressively more of the phosphorus load in a downstream direction.
>
> Agricultural runoff also can contain OP (Sharpley and others, 2002)… A study by Vadas and others (2005) indicated that OP runoff in cropped fields with soil phosphorus concentrations of 14 mg/kg, as analyzed in the 2001 study (Fox and others, 2002), could yield concentrations of 0.11–0.67 mg/L of OP in surface runoff. The OP concentration in Mason Creek was 0.65 mg/L during a runoff period in January 2012, when agricultural fields were fallow (uncropped), suggesting that the low end of estimated OP concentrations in runoff from cropped fields in production is a good estimate for conditions near the mouth of Mason Creek (RM 25.0)…
>
> Despite agricultural phosphorus loading during irrigation season, some of the phosphorus in tributaries, drains, and canals likely originated from point sources that were diverted to supply irrigation water. Phyllis Canal, Indian Creek, and Riverside Canal exemplify water bodies that are used to convey point-source TP loads to irrigated land. The water-quality sample from the south channel of the Boise River immediately upstream of the Phyllis Canal diversion contained 0.18 mg/L OP and 0.21 mg/L TP in August. Phyllis Canal is outside most agricultural areas and downstream of Lander and West Boise WWTPs, indicating that non-agricultural sources of OP probably account for most of the OP in Phyllis Canal."

Differentiating between point and nonpoint source TP loads in the lower Boise River is difficult due to the complex hydrology management and other factors. Etheridge (2013) asserts that environmental tracers may best indicate OP sources in the subbasin because the mass balance models do not account for the fate of any particular TP load. However, they do provide evidence that point source loads may contribute to nonpoint source loads during irrigation season. For example, the August mass balance model results suggest that biogeochemical processes may have had a limited effect on TP concentrations. Conversely, the October and March mass balance models suggest that biogeochemical processes may have occurred in the Boise River, resulting in overall net reductions of main-stem TP concentrations in October 2012 and net gains in March 2013 (Etheridge 2013).

Mason Creek

DEQ BURP data have been collected on Mason Creek. The BURP data and summary reports can be obtained through DEQ's 305(b) Integrated Report webpage at *http://mapcase.deq.idaho.gov/wq2010/*.

The USGS sampled Mason Creek as part of the lower Boise River synoptic sampling efforts in 2012 and 2013 and found that TP concentrations ranged from 0.14 in March to 0.31 mg/L in August (Table 12).

Table 12. Results of USGS synoptic sampling on Mason Creek in 2012 and 2013[1].

Week of…	Flow (cfs)	TP Concentration (mg/L)	TP Load (lbs/day)
August 20, 2012	155	0.31	259
October 29, 2012	66.1	0.18	64.2
March 4, 2013	44.7	0.14	33.8

[1] Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).

DRAFT

Sand Hollow

DEQ BURP data have been collected on Sand Hollow Creek. The BURP data and summary reports can be obtained through DEQ's 2010 305(b) Integrated Report webpage at *http://mapcase.deq.idaho.gov/wq2010/*.

The USGS also sampled Sand Hollow as part of the lower Boise River synoptic sampling efforts in 2012 and 2013 and found that TP concentrations ranged from 0.09 in March to 0.35 mg/L in August (Table 13). These concentrations result in TP loads that directly contribute to the Snake River.

Table 13. Results of USGS synoptic sampling on Sand Hollow Creek in 2012 and 2013[1].

Week of…	Flow (cfs)	TP Concentration (mg/L)	TP Load (lbs/day)
August 20, 2012	169	0.35	319
October 29, 2012	62.0	0.20	66.9
March 4, 2013	38.7	0.09	18.8

[1] Information in this table can be found in Table 7 of the USGS mass balance report (Etheridge 2013).

2.3.1 Data Gaps

This addendum identifies several data gaps that, if eliminated, could help produce a more robust assessment of the effects of TP and periphyton on beneficial uses. The best available data was used to develop the current TMDL addendum. However, DEQ acknowledges there are additional questions to be investigated (Table 14).

Additional monitoring efforts (Sections 4.1 and 5.1.5) are either underway, have been planned, or are the subject of ongoing discussions among DEQ, the USGS, the LBWC, and other stakeholders. Subsequent information developed through these efforts may be used to appropriately revise portions of the TMDL and adjust implementation methods and control measures. Changes in the TMDL will be addressed through supplementary documentation or replacing chapters or appendices as part of the 5-year review process. The goal will be to build upon rather than replace the original work wherever practical. The schedule and criteria for reviewing new data is more appropriately addressed in the implementation plan, due 18 months after approval of this document. The opportunity to revise the TMDL and necessary control measures is consistent with current and developing EPA TMDL guidance which emphasizes an iterative approach to TMDL development and implementation. However, any additional effort on the part of DEQ to revise the TMDL or implementation plan and control measures must be addressed on a case-by-case basis as additional funding becomes available.

Table 14. Data gaps identified during the development of the lower Boise River TMDL addendum.

Pollutant or Factor	Data Gap	Potential Remedy
Phosphorus	Better understanding of the phosphorus concentrations and loads in the Boise River, particularly, near Parma	USGS real time water quality monitoring near Parma – Initiated in 2014
Phosphorus	Better understanding of how phosphorus is diverted, used, and returned to the river (quantities, qualities, types, durations, etc.)	Additional studies utilizing markers to track phosphorus through the subbasin.

DRAFT

Periphyton	Better understanding of spatial and temporal periphyton growth patterns and conditions in the river	More frequent and intensive periphyton sampling in the River
Ground water	Better understanding of ground water behavior (rates of flow and load contributions, timing, etc.)	Additional studies examining water movement in the shallow ground water aquifer relative to lower Boise River flows
Stormwater	Points of input to stormwater system	Drainage system infrastructure and flow mapping
Stormwater	Better understanding of non-stormwater (dry weather) flow magnitude and duration	Non-stormwater (dry weather) survey of flow from outfalls
Stormwater	Better understanding of non-stormwater (dry weather) discharge water quality	Conduct non-stormwater (dry weather) monitoring

2.3.2 Status of Beneficial Uses

Based on an analysis of: 1) the available water quality data collected by DEQ, USGS, ISDA, Idaho Power, municipalities and others, 2) the SR-HC TMDL analysis (DEQ and ODEQ 2004), and 3) written correspondence from EPA (EPA 2009b), cold water aquatic life and contact recreation beneficial uses are impaired by excess nutrients, in the form of TP, within the lower Boise River, Mason Creek, and Sand Hollow Creek. This impairment from excess TP can be expressed as visible slime and other nuisance aquatic growths in these water bodies, impacts to other water quality and aesthetic parameters (see Section 2.2.5), along with contributing nutrient, algal, and other water quality impacts to the Snake River, downstream. A combination of point sources (e.g. WWTFs, stormwater, and industrial discharge) and nonpoint sources (e.g. agricultural return water, ground water, septic, and unmeasured flows) contribute to this TP loading in the lower Boise River.

3 Subbasin Assessment—Pollutant Source Inventory

The pollutant of concern for this TMDL addendum is limited to excess nutrients in the form of TP for which narrative criteria are established in the Idaho water quality standards. TP has been identified as a limiting factor for attaining designated, existing, or presumed beneficial uses in the lower Boise River subbasin (see Section 2.2.5). TP load and wasteload allocations have not previously been established for the lower Boise River subbasin; however, discussions of nonpoint and point sources in the subbasin have been addressed in:

- Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL (DEQ 2008a)
- Lower Boise River TMDL Five-Year Review (DEQ 2009)
- Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008)
- Snake River – Hells Canyon Total Maximum Daily Load (TMDL; DEQ and ODEQ 2004).
- Implementation Plan for the Lower Boise River Total Maximum Daily Load (DEQ 2003)
- Lower Boise River TMDL Subbasin Assessment Total Maximum Daily Loads (DEQ 1999),

DRAFT

- Lower Boise River Nutrient and Tributary Subbasin Assessments (DEQ 2001a)
- Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads (DEQ 2010b)
- Mason Creek Subbasin Assessment (2001c)
- Sand Hollow Creek Subbasin Assessment (2001d) (tributary to the Snake River)

In addition, DEQ asserts that a new implementation plan should be drafted to reflect this current TMDL addendum for the lower Boise River.

3.1 Point Sources

Major point sources within the lower Boise River watershed are mostly WWTFs. These WWTFs treat raw sewage and discharge effluent to meet water quality requirements of their EPA-issued National Pollutant Discharge Elimination System (NPDES) permits. While these WWTFs reduce pollutants from the raw sewage, some amount of phosphorus is discharged in the effluent. EPA-permitted point source facilities discharge phosphorus into the lower Boise River, directly or indirectly, through drains, tributaries, and other hydrological connections, as well as into Sand Hollow Creek (a tributary to the Snake River). The phosphorus loads from these WWTFs and other facilities are calculated based on discharge monitoring data flows and effluent concentrations (Table 15).

Table 15. Current annual point source discharge to the lower Boise River and the Snake River.

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Mean Discharge (MGD)[2]	Mean TP Concentration (mg/L)[2]	Mean TP Load (lbs/day)[2]
Boise River - Main stem					
Lander WWTF	ID-002044-3	RM 50.0	12.39	1.87	193.3
West Boise WWTF	ID-002398-1	RM 44.2	15.11	4.78	602.6
Middleton WWTF	ID-002183-1	RM 27.1	0.46	4.02	15.5
Caldwell WWTF	ID-002150-4	RM 22.6	6.45	2.26	121.6
IDFG-Eagle	Aquaculture General Permit	RM 41.8	2.62	0.02	0.4
Boise River – Tributaries					
Avimor WWTF	In Application	Dry Creek	No Discharge Currently		
Star WWTF	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.53	1.50	6.7
Meridian WWTF	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.40	1.01	45.5
Sorrento Lactalis	ID-002803-7	Mason Creek	0.63	0.02	0.1
Nampa WWTF	ID-002206-3	Indian Creek	10.10	5.03	423.9
Kuna WWTF	ID-002835-5	Indian Creek	0.49	2.45	9.9
IDFG-Nampa	Aquaculture General Permit	Wilson Drain and Pond (Indian Creek)	20.42	0.07	11.8
Darigold	ID-002495-3	RM 22.6 (unmeasured drain)	0.25	0.23	0.5

DRAFT

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Mean Discharge (MGD)[2]	Mean TP Concentration (mg/L)[2]	Mean TP Load (lbs/day)[2]
Notus WWTF[3]	ID-002101-6	Conway Gulch	0.06	4.6	2.2
Wilder WWTF	ID-0020265	Wilder Ditch Drain	0.16	3.37	4.4
Greenleaf WWTF[3]	ID-002830-4	West End Drain (Riverside Canal to Dixie Drain)	0.06	0.06	0.03
ConAgra (XL 4 Star)	ID-000078-7	Indian Creek	No Discharge Currently	No Discharge Currently	No Discharge Currently
Snake River					
Parma WWTF	ID-002177-6	Sand Hollow Creek	0.11	0.15	0.14

[1] River Miles identified by USGS in lower Boise River mass balance report (Etheridge 2013); IDFG-Eagle and Darigold RMs are estimated. IDFG-Eagle discharges at Eagle Island and Darigold discharges to an unmeasured drain that discharges into the lower Boise River.
[2] Mean TP concentrations calculated from January 1, 2012 through April 30, 2013 using data provided by facilities and/or DMR data.
[3] Values for the Notus and Greenleaf facilities are only for October 1 – April 30; the facilities did not discharge from May 1 – September 30. However, the new NPDES permits allow May 1 – September 30 discharge.
Note: These data represent contributions to the Boise River, and they do not account for downstream diversions or uptake (e.g. agriculture, municipal, industrial, or biogeochemical).

Stormwater

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the Multi-Sector General Permit (MSGP), and construction stormwater covered under the Construction General Permit (CGP).

The terms "municipal separate storm sewer" and "municipal separate storm sewer systems" (or MS4) are defined in 40 CFR §122.26(b)(8) and (b)(18), respectively. MS4s include any publicly-owned conveyance or system of conveyances used for collecting and conveying stormwater and which discharges to waters of the United States. MS4s are designed for conveying stormwater only, and are neither part of a combined sewer system, nor part of a publicly owned treatment works. These systems may include roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains (EPA 2008a, 2008b). Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies.

Certain MS4s are regulated under the NPDES permit program based upon meeting certain definitions in federal regulations [see: 40 CFR 122.26(b)(4), (b)(5) and/or (b)(16)]. To prevent harmful pollutants from being discharged through an MS4, operators of a regulated MS4s must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program (SWMP), and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

'True' stormwater is produced by runoff from precipitation-driven storm events. As a result, stormwater ("wet weather") discharges from MS4 systems that result from specific precipitation events will be referred to as stormwater and identified as a point source with a wasteload allocation in this TMDL.

MS4 systems in the Treasure Valley also accept other inputs of water such as agricultural return and ground water. In effect, MS4 systems in the valley often shares "pipes" with non-point source discharges. These non-stormwater ("dry weather") discharges can be authorized in MS4 permits if they satisfy specific conditions (please see individual MS4 permits for more information). As a result, all non-precipitation driven discharges from MS4s will be referred to as non-stormwater and identified as a nonpoint source with a load allocation in this TMDL.

There are several EPA stormwater permittees that discharge phosphorus into the lower Boise River, directly or indirectly, through drains, tributaries, and other hydrological connections (Table 16). Several agencies and organizations share responsibilities for the NPDES MS4 permits. Information and reporting include a five-year report which is available from the partnership internet site: *http://www.partnersforcleanwater.org/default.asp*.
An annual report is published and made available through ACHD's web site: *http://www.achd.ada.id.us/Departments/TechServices/Drainage.aspx*.

Other agencies and stakeholders in the subbasin are in the process of applying for stormwater NPDES permits and have yet to develop or implement the voluntary stormwater activities.

Stormwater within the lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. Permitted stormwater entities are considered point sources and will be assigned "wasteload allocations".

Stormwater management areas for lower Boise River watershed area have been updated based on 2010 census (US Census Bureau) and current GIS mapping information. The MS4s addressed in this TMDL addendum are located within 2010 urbanized areas and city boundaries (incorporated areas) of Ada and Canyon County based on available GIS information (Figure 31 and Figure 32). Cities in urbanized areas include Boise, Eagle, Meridian, Middleton, Nampa, and Caldwell. Within the urbanized areas are also unincorporated areas of Ada County and Canyon County. Additionally, there are areas in each county that are incorporated, but not included in the permitted urbanized areas. These areas include the Ada County cities of Kuna and Star, and Canyon County cities of Greenleaf, Notus, Parma,and Wilder.

Table 17 includes a breakdown of permitted and non-permitted areas based on:

- City limits data from 7/29/14 (Ada County Assessor) and 5/28/14 (Canyon County Assessor);
- Urbanized Area based on 2010 Census;
- Area data from NPDES Permit Factsheets (2000 Census);

DRAFT

Impervious areas for each of the cities are located in Table 18. The impervious data includes roads, buildings, and parking lots and was developed as part of the Treasure Valley Urban Tree Canopy project funded by a grant from the U.S Forest Service (2011 NAIP-UTC Canopy Assessment-PlanItGeo).

DRAFT

Table 16. Annual MS4 stormwater (wet weather) and non-stormwater (dry weather) TP discharge to the lower Boise River[1].

Source	NPDES Permit No.	Area (miles)	Area Ratio[2]	Annual Stormwater Wet Weather Flow[3] (cfs)	Annual Stormwater Wet Weather TP Load[3] (lbs/day)		Annual Non-Stormwater Dry Weather Flow[4] (cfs)	Annual Non-Stormwater Dry Weather TP Load[4] (lbs/day)
Boise/Ada County MS4	IDS-028185 & IDS 027561	149	0.55					
Non-permitted Kuna and Star		44	0.16					
Canyon Hwy Dist #4 MS4	IDS-028134	8	0.03					
ITD District #3 (Eagle & Meridian)	IDS-028177	(112 linear)						
Middleton MS4	IDS-028100	2.3	0.01					
Nampa MS4	IDS-028126	25	0.09					
Nampa Hwy District MS4	IDS-028142	8.5	0.03					
Caldwell MS4	IDS-028118	17.5	0.06					
Non-permitted Notus-Parma (former MS4 IDS-028151)		2	0.01					
Non-permitted Greenleaf, Notus, Parma, Wilder		17	0.06					
	Total	**273.3**	**1.0**	**75.6**	**178.0**		**186.4**	**438.0**

[1] The stormwater (wet weather) and non-stormwater (dry weather) flows and load estimates are derived from data provided by the LBWC stormwater workgroup (Appendix E).
[2] Area ratio = the area contribution of each individual MS4 relative to the total service area for MS4s.
[3] Stormwater (wet weather) flows and loads are primarily the result of immediate precipitation.
[4] Non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin. However, as modeled for this TMDL, non-stormwater (dry weather) flows and loads are an inherent subcomponent of, and not summed separately from, tributary and ground water flows and loads.
* It should be noted that while average loads are used for the TMDL, actual stormwater discharge loads (flow and concentrations) can be much higher due to precipitation events with high intensity and/or duration.

DRAFT

Table 17. 2010 Census Boise Urbanized Area and other areas (prepared by ACHD).

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	Permitted Areas: Urbanized Area[3] Area (mi²)	Permitted Areas: Urbanized Area[3] Acre	Permitted Areas: City Limits [1,2] Area (mi²)	Permitted Areas: City Limits [1,2] Acre	Permitted Urbanized & City Limits Acre	Non-Permitted Areas: City Limits [1,2] Area (mi²)	Non-Permitted Areas: City Limits [1,2] Acre
Ada County									
Boise/Garden City	IDS027561	Phase I			87	55,773			
Boise	IDS027561	Phase I			83	53,053			
Garden City	IDS027561	Phase I			4	2,720			
Ada County Highway District	IDS027561	Phase I			87	55,773			
Boise State University	IDS027561	Phase I			0.24	153			
Ada County Drainage District 3	IDS027561	Phase I			8	4,801			
ITD, District 3	IDS027561	Phase I							
Total Area Boise/Garden City Phase I Permit					**87**	**55,773**			
Ada County Highway District	IDS028185	Phase II	62	39,376	84	54,218			
Meridian		-	24	15,178	28	18,160		4	2,982
Eagle		-	12	7,518	30	19,378		18	11,860
Urbanized Ada County (unincorporated)		-	26	16,680	NA	NA			
Total Area Ada County Phase II Permit			**62**	**39,376**					
Total Area Ada County Phase I and II Permits							**95,149**		
Kuna	NA	-						18	11,619
Star	NA	-						4	3,288
Total Ada County Incorporated Non- Permitted Area								**44**	**29,749**
Canyon County									
Caldwell	IDS028118	Phase II	17.5	11,172				4.6	2,979
Nampa	IDS028126	Phase II	25	16,015				6.5	4,129
Middleton	IDS028100	Phase II	2.3	1,478				2.9	1,851
Urbanized Canyon County (unincorporated)	-	-	24.8	15,890					
ITD, District 3	IDS028177	Phase II							
Canyon Highway District #4[3]	IDS028134	Phase II	8	5,120					
Nampa Highway District #1[3]	IDS028142	Phase II	8.5	5,440					
Notus-Parma Highway District #2[3]	IDS028151	Phase II	2	1,280					
Total Area Canyon County Phase II Permits			**70**	**44,555**					
Greenleaf	NA	-						0.8	493
Notus	NA	-						0.4	246
Parma	NA	-						1.1	706
Wilder	NA	-						0.7	464
Total Canyon County Incorporated Non- Permitted Area								**17**	**10,868**

[1]Ada County Assessor 7/9/14; [2]Canyon County Assessor 5/28/14; [3]Urbanized Area based on 2010 Census; 4Area data from NPDES Permit Factsheets (2000 Census)

*Note: the Notus-Parma Highway District #2 (2 mi²; 1280 acres) is no longer part of a Phase II MS4 Permitted Area and is now a Non-Permitted Area.

DRAFT

Table 18. Impervious areas for Phase I, Phase II, and other areas in the lower Boise River subbasin (prepared by ACHD).

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	City Limits[1, 2]		% Impervious[3] Area City Limits
			Area (mi^2)	Acre	
Ada County					
Boise/Garden City	IDS027561	Phase I	87	55,773	
Boise	IDS027561	Phase I	83	53,053	28
Garden City	IDS027561	Phase I	4	2,720	31
Ada County Highway District	IDS027561	Phase I	87	55,773	
Boise State University	IDS027561	Phase I	0.24	153	
Ada County Drainage District 3	IDS027561	Phase I	8	4,801	
ITD, District 3	IDS027561	Phase I			
Ada County Highway District	IDS028185	Phase II	84	54,218	
Meridian		-	28	18,160	30
Eagle		-	30	19,378	17
Urbanized Ada County (unincorporated)		-	NA	NA	
Kuna	NA	-	18	11,619	25
Star	NA	-	4	3,288	19
Canyon County					
Caldwell	IDS028118	Phase II	22.1	14,151	21
Nampa	IDS028126	Phase II	31.5	16,015	25
Middleton	IDS028100	Phase II	5.2	3,329	13
Urbanized Canyon County (unincorporated)	-	-	NA	NA	
ITD, District 3	IDS028177	Phase II			
Canyon Highway District #4	IDS028134	Phase II	NA	NA	
Nampa Highway District #1	IDS028142	Phase II	NA	NA	
Notus-Parma Highway District #2	IDS028151	Phase II	NA	NA	
Greenleaf	NA	-	0.8	493	
Notus	NA	-	0.4	246	
Parma	NA	-	1.1	706	
Wilder	NA	-	0.7	464	

[1]Ada County Assessor 7/9/14; [2]Canyon County Assessor 5/28/14; [3]Data from 2011 NAIP-UTC Canopy Assessment-PlanItGeo(roads, bldgs, parking lots)

*Note: the Notus-Parma Highway District #2 (2 mi^2; 1280 acres) is no longer part of a Phase II MS4 Permitted Area and is now a Non-Permitted Area.

DRAFT

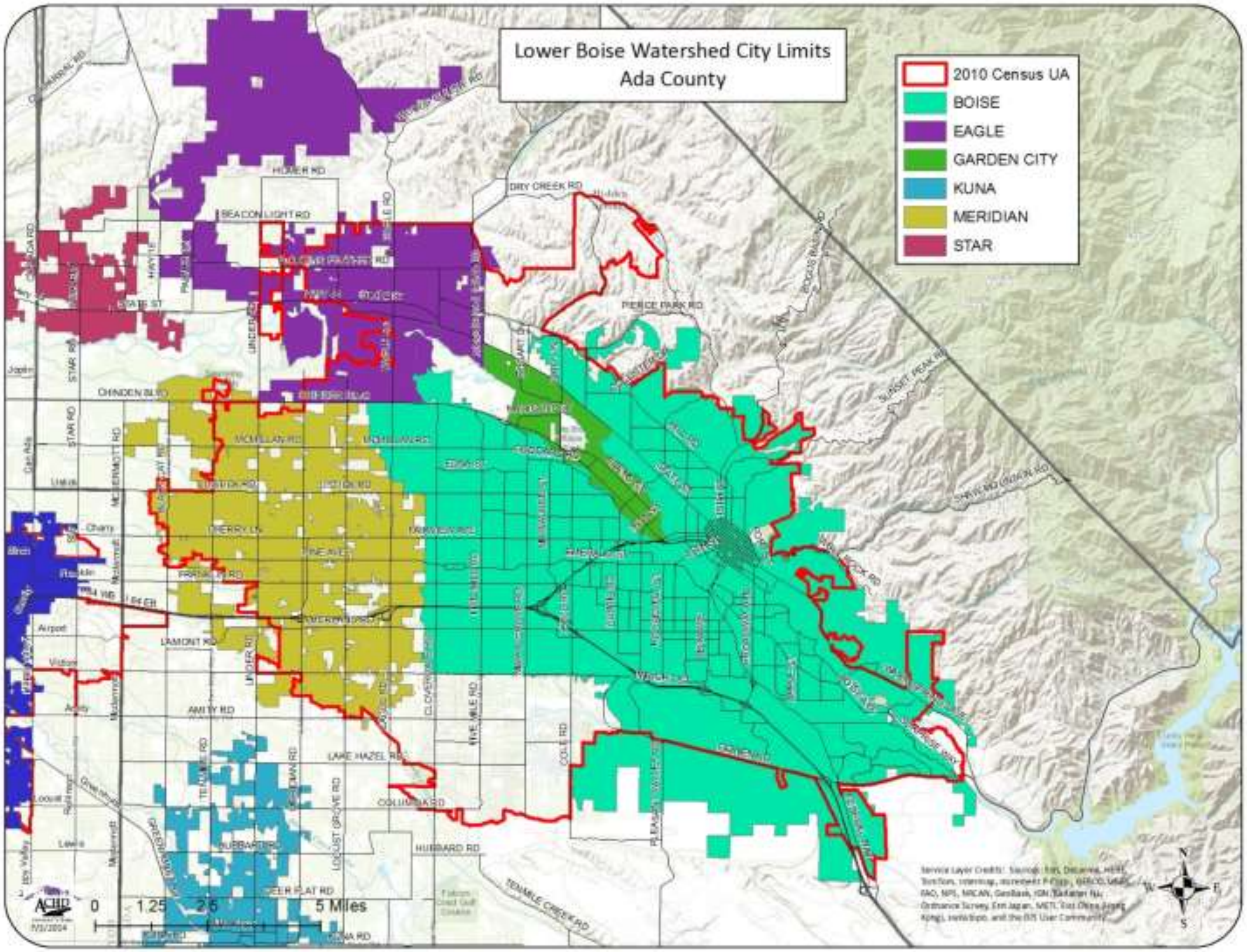


Figure 31. Map of Ada County stormwater management areas (prepared by ACHD).

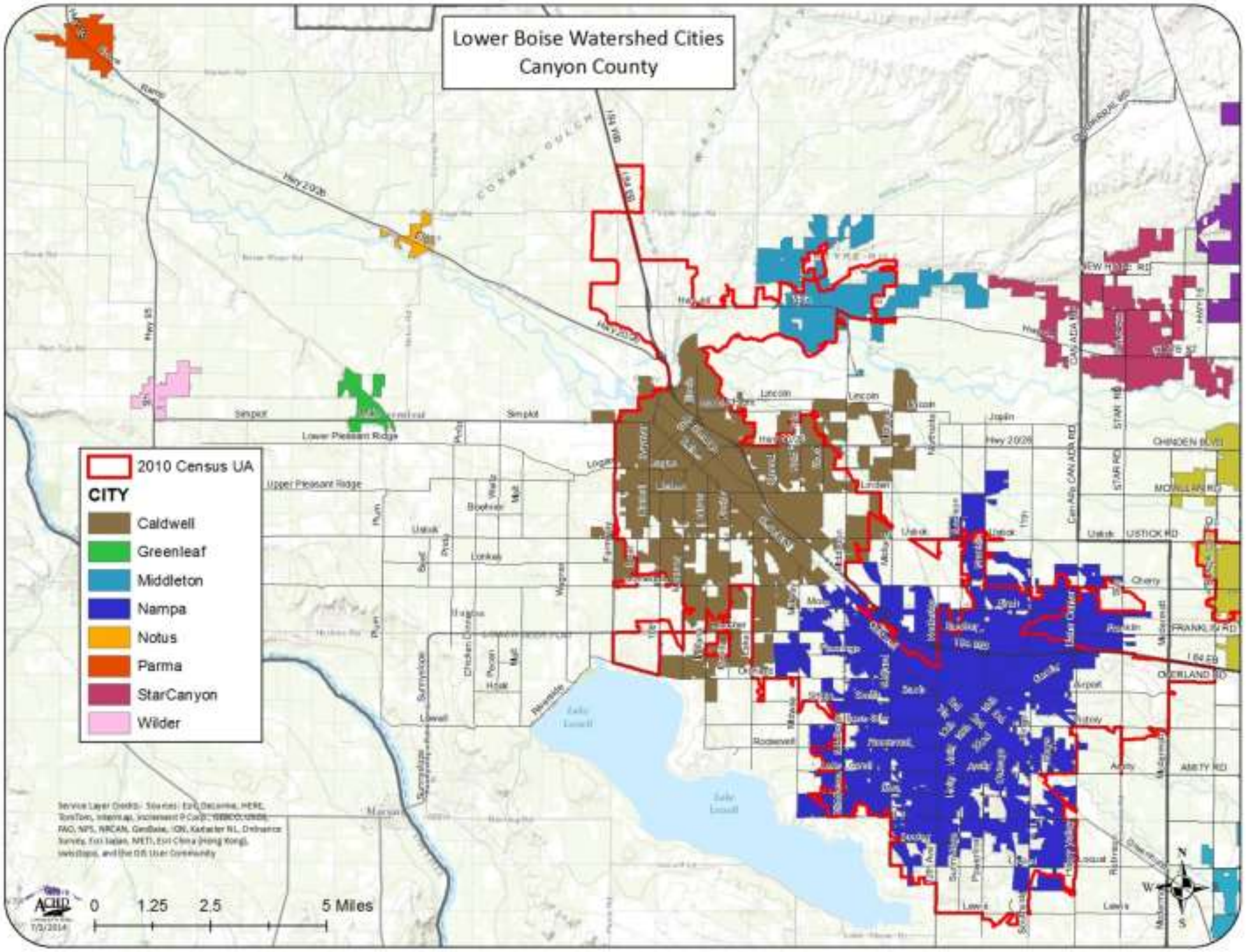


Figure 32. Map of Canyon County stormwater management areas (prepared by ACHD).

Industrial and Construction Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial and construction areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body. Certain types of industrial activities and construction activities must manage their stormwater discharges in accordance with an NPDES permit, as defined in 40 CFR 122.26(b)(14), and (b)(15).

Multi-Sector Industrial and Construction General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an NPDES regulated industrial facility or construction activity discharges industrial stormwater into waters of the U.S., the facility must be permitted under EPA's most recent Multi-Sector General Permit (MSGP) or Construction General Permit (CGP). The facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial or Construction Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

TMDL Industrial and Construction Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial or construction stormwater activities. Industrial and construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP or CGP as applicable under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. Subsequent versions of the MSGP or CGP issued by EPA may have specific monitoring requirements that must be followed.

DEQ expects permittees to conduct any required monitoring under the permit and that BMPs appropriate to the site are applied and maintained to prevent water quality impairment. Table 19 identifies the list active MSGP permits.

Table 19. Active MSGP facilities permitted by the EPA in Ada and Canyon counties (August 2014).

NUMBER	COVERAGE DATE	APPLICATION	ORGANIZATION	PROJECT NAME	COUNTY	CITY	STATUS
IDR05C218	June 18, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Eagle	Ada	Eagle	Active
IDR05CW52	August 22, 2013	Industrial	Delta Global Services	Boise Airport Terminal	Ada	Boise	Active
IDR05C375	June 26, 2009	Industrial	IDAHO NATIONAL GUARD	BOISE AIR TERMINAL (GOWEN FIELD)	Ada	BOISE	Active
IDR05C415	July 02, 2009	Industrial	UNITED PARCEL SERVICE, INC.	UPS - BOISE GATEWAY	Ada	BOISE	Active
IDR05C350	June 25, 2009	Industrial	Cityof Boise	Boise Airport	Ada	Boise	Active
IDR05C239	June 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Sand Gravel Cole Road	Ada	Kuna	Active
IDR05C285	June 18, 2009	Industrial	Southern Foods Group, LLC	Meadow Gold Dairies	Ada	Boise	Active
IDR05C291	June 25, 2009	Industrial	MICRON TECHNOLOGY INC	Micron Technology Inc	Ada	Boise	Active
IDR05C413	July 02, 2009	Industrial	UNITED PARCEL SERVICE, INC.	UPS - BOISE HUB	Ada	BOISE	Active
IDR05C220	July 18, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Sand Gravel Federal Way	Ada	Boise	Active
IDR05C219	June 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete East Boise	Ada	Boise	Active
IDR05C231	July 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Sand Gravel Tenmile	Ada	Kuna	Active
IDR05C051	April 30, 2009	Industrial	Photronics, Inc.	Photronics, Inc. nanoFab	Ada	Boise	Active
IDR05C146	May 23, 2009	Industrial	PACIFIC STEEL AND RECYCLING	PACIFIC STEEL AND RECYCLING	Ada	BOISE	Active
IDR05C234	June 27, 2009	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Joplin	Ada	Boise	Active
IDR05C040	June 26, 2009	Industrial	Clements Concrete Co.	Joplin	Ada	Boise	Active
IDR05C574	September 23, 2009	Industrial	Basalite Concrete Products	Basalite Concrete Products	Ada	Meridian	Active
IDR05C646	October 27, 2009	Industrial	UNITED PARCEL SERVICE, INC.	UPS FREIGHT BOISE TERMINAL	Ada	BOISE	Active
IDR05C622	August 14, 2009	Industrial	PLUM CREEK NORTHWEST LUMBER IN	PLUM CREEK NORTHWEST LUMBER INC	Ada	MERIDIAN	Active

DRAFT

IDR05CA20	May 31, 2010	Industrial	MotivePower	Truck and Engine Annex	Ada	Boise	Active
IDR05C914	December 10, 2009	Industrial	FEDEX EXPRESS CORPORATION	FedEx Express Corp-BOIR	Ada	Boise	Active
IDR05CC01	April 25, 2010	Industrial	GREYHOUND LINES, INC. #770055	GREYHOUND LINES, INC. #770055	Ada	BOISE	Active
IDR05C918	February 05, 2010	Industrial	Alscott Hangar LLC	Boise Airport Alscott Hangar	Ada	Boise	Active
IDR05CI00	November 25, 2010	Industrial	Southwest Airlines Co.	SWA BOI	Ada	Boise	Active
IDR05CI33	January 11, 2011	Industrial	C A PAVING CO	CA PAVING COMPANY BATCH PLANT	Ada	KUNA	Active
IDR05CI85	January 24, 2011	Industrial	MICRON TECHNOLOGY INC	Micron Technology Inc	Ada	Boise	Active
IDR05CJ94	May 02, 2011	Industrial	IDAHO SAND AND GRAVEL CO	Southridge Gravel Source	Ada	Meridian	Active
IDR05CF60	August 26, 2010	Industrial	Idaho National Guard	Gowen Field National Guard base	Ada	Boise	Active
IDR05CG57	October 29, 2010	Industrial	NAMPA PAVING ASPHALT	Plesant valley	Ada	boise	Active
IDR05CK24	May 25, 2011	Industrial	AWS - BOISE TRANFSER STATION	AWS - BOISE TRANSFER STATION	Ada	BOISE	Active
IDR05CM22	August 19, 2011	Industrial	ADA COUNTY HIGHWAY DISTRICT	Schmidt Pit	Ada	Boise	Active
IDR05CK25	May 25, 2011	Industrial	ALLIED WASTE SERVICES OF BOISE	ALLIED WASTE SERVICES OF BOISE	Ada	BOISE	Active
IDR05CT30	July 20, 2012	Industrial	NAMPA PAVING ASPHALT	Look Lane gravel pit	Ada	Caldwell	Active
IDR05CS39	June 10, 2012	Industrial	WF CONSTRUCTION & SALES LLC	BSU ATHLETIC FOOTBALL COMPLEX	Ada	BOISE	Active
IDR05CU22	September 25, 2012	Industrial	PTM of Boise, LLC	Valley Regional Transit/Orchard Street Facility	Ada	Boise	Active
IDR05CS38	June 10, 2012	Industrial	WF CONSTRUCTION & SALES LLC	BSU ATHLETIC FOOTBALL COMPLEX	Ada	BOISE	Active
IDR05CQ94	March 25, 2012	Industrial	Darigold Corp.	Boise	Ada	Boise	Active
IDR05CT84	August 16, 2012	Industrial	Allied Waste Services of North America,LLC	Franklin Road Facility	Ada	Meridian	Active
IDR05CN94	August 26, 2011	Industrial	Masco dba Knife River	Knife River Eagle Pit	Ada	Eagle	Active
IDR05CS54	May 17, 2012	Industrial	Consolidated Properties of Idaho, LLC	STAR PROPERTY	Ada	STAR	Active

DRAFT

IDR05CU26	August 19, 2012	Industrial	NAMPA PAVING ASPHALT	Nampa Paving Asphalt - Altec Property	Ada	Meridian	Active
IDR05CV64	April 14, 2013	Industrial	KNIFE RIVER	Anderson Source	Ada	Eagle	Active
IDR05CV67	April 26, 2013	Industrial	C A PAVING CO	Ten Mile Creek Road - Gravel Pit	Ada	Boise	Active
IDR05CV98	June 05, 2013	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Heron River	Ada	Star	Active
IDR05CV34	January 28, 2013	Industrial	STAKER PARSON COMPANIES	Idaho Concrete Moyle	Ada	Star	Active
IDR05CV57	March 30, 2013	Industrial	Preserve LLC	Preserve Subdivision # 1	Ada	Eagle	Active
IDR05CV62	April 08, 2013	Industrial	Knife River Corporation-Northwest dba Knife River	Johnson Source	Ada	Meridian	Active
IDR05C058	April 29, 2009	Industrial	YRC INC	YRC INC	Ada	BOISE	Active

DRAFT

3.2 Nonpoint Sources

Although the locations of agricultural diversions, dams, drains, and return flows can sometimes be identified as specific points on the landscape, the Clean Water Act designates these as nonpoint sources due to the impact that widespread land use activities have on the water channeled through agricultural irrigation systems. Septic systems, runoff from paved and unpaved road surfaces, and other unquantified sources contribute TP, directly and indirectly, to surface water in the lower Boise River, Mason Creek, and Sand Hollow Creek. Contributions from these nonpoint sources are acknowledged data gaps, and implementation plans could include details regarding future data collection from these sources. Further, non-stormwater (dry weather) discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration.

3.2.1 Agricultural Discharges

Of the approximately 475,000 acres that drain to the lower Boise River below Diversion Dam, approximately 162,000 of those acres are irrigated cropland (as defined by ISDA as encompassing agricultural parcels greater than 20 acres). These acres are located along the water conveyance system and contribute nonpoint loading of phosphorus. Within the watershed, TP is delivered from irrigated cropland and animal-related phosphorus sources (grazing and dairies/feedlots). For example, tributaries, including agricultural drains, and predictive ground water contributed approximately 880 lbs/day and 562 lbs/day of TP, respectively, relative to approximately 1,440 lbs/day attributed to point sources during the USGS August 2012 synoptic sampling (Etheridge 2013). Although less in October 2012, TP contributions from tributaries and ground water were approximately 483 lbs/day relative to point source contributions of approximately 1,050 lbs/day. This was similar to March 2013, when TP contributions from tributaries and ground water were approximately 378 lbs/day relative to point source contributions of approximately 1,220 lbs/day.

Table 20 provides estimated annual discharges and loads to the lower Boise River from major tributaries and drains based on long-term USGS and ISDA data.

DRAFT

Table 20. Annual tributary discharge to the lower Boise River and Snake River.

Source Name	Lower Boise River Receiving River Mile (RM)[1]	Mean Discharge (cfs)[2]	Mean TP Concentration (mg/L)[2]	Mean TP Load (lbs/day)[2]
Boise River				
Eagle Drain	42.7	24.0	0.13	16.8
Dry Creek	42.5	8.7	0.15	7.2
Thurman Drain	41.9	12.0	0.12	7.8
Fifteenmile Creek	30.3	102.4	0.33	179.4
Mill Slough	27.2	92.9	0.21	103.2
Willow Creek	27.0	31.6	0.26	44.3
Mason Slough	25.6	8.2	0.31	13.7
Mason Creek	25.0	111.7	0.34	204.1
Hartley Gulch	24.4	25.3	0.29	39.6
Indian Creek	22.4	130.2	0.53	371.3
Conway Gulch	14.2	36.9	0.33	66.2
Dixie Drain	10.5	185.7	0.35	352.3
Total		**769.7**	**Mean = 0.34**	**1406**
Snake River				
Sand Hollow Creek	Snake River	112.7	0.37	227.7

Note: These data represent contributions to the Boise River, including flows and TP from contributions from agriculture, and municipal and industrial industrial.
[1] As identified by USGS in lower Boise River mass balance report (Etheridge 2013).
[2] Values calculated from USGS and ISDA data available from 1983 – 2013.

3.2.2 Background

Inflows at the upstream boundary of the lower Boise River (Diversion Dam) originate from Lucky Peak Dam releases (operated by the U.S. Army Corps of Engineers). Lucky Peak Reservoir inflows are controlled by two other upstream storage projects: Arrowrock Reservoir and Anderson Ranch Dam (operated by the U.S. Bureau of Reclamation). During the synoptic work on the lower Boise River in 2012 and 2013, USGS identified current background TP concentrations as $\leq$ 0.02 mg/L during all three sample periods. This is consistent with historical data collected near Diversion Dam, and is comparable to background values of 0.02 mg/L used in the SR-HC TMDL (IDEQ/ODEQ 2004). While there are human-caused changes in the upstream watershed (due to 3 reservoirs), DEQ has determined background TP concentration of 0.018 mg/L as appropriate for this TMDL (Table 21). This is based on the 2005 – 2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L. This is similar to long-term data based on the median TP concentration (n=119) in the Boise River below Diversion Dam (RM 61.1), including a statistical analysis of non-detect results using the Kaplan-Mier method (Helsel, 2005) and the USGS 2012-2013 synoptic samples (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L, respectively.

DRAFT

Table 21. Background concentrations for the lower Boise River near Parma.

Sampling Date	Parma Flow (cfs)[1]	Background TP Concentration at Diversion (mg/L)[2]	Potential TP Background Load at Parma (lbs/day)[3]	TP Load at Parma (lbs/day)[1]	Max Potential Background TP Contribution at Parma (%)[4]
August 2012	624	0.018	61	1,010	6.0%
October 2012	924	0.018	90	1,450	6.2%
March 2013	846	0.018	82	1,550	5.3%

Note: These data represent contributions to the Boise River, and they do not account for downstream diversions or uptake (e.g. agriculture, municipal, industrial, or biogeochemical).
[1] As identified by USGS in lower Boise River mass balance model (Etheridge 2013).
[2] Background is calculated as the TP load at Diversion Dam, based on 2005 – 2013 USGS data, indicating concentrations of 0.018 mg/L with detection levels of 0.01 mg/L. Long-term median data and the USGS 2012-2013 synoptic samples (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L, respectively..
[3] Calculated as Parma Flow (cfs) x TP Concentration (mg/L) x 5.39 standard conversion factor (Hammer 1986).
[4] Estimated as the Potential TP Background Load at Parma (lbs/day) / TP Load at Parma (lbs/day). This assumes that 100% of the TP background load reaches Parma.

Conservatively assuming 100% of background TP load reaches Parma, estimates range from approximately 61 to 90 lbs/day at Parma, which represents approximately 5.3 to 6.2%.of the load. Although the actual percentage of background TP loads reaching Parma from Diversion Dam is less due to the diversions and returns, this estimation identifies, in the absence of diversions and returns along the lower Boise River, the maximum potential background TP loads reaching Parma at 0.018 mg/L.

3.2.3 Ground Water and Unmeasured Sources

The gaining and losing reaches of the main stem lower Boise River vary spatially and temporally. In addition to work that has been conducted previously, the USGS synoptic sampling and mass balance model have provided additional information to better understand ground water and other unmeasured sources of water and TP in the lower Boise River.

The questions of ground water and other unmeasured flows contributing to loads observed in the mainstem and tributaries are complex due the numerous water uses and plumbing conveyance in the subbasin. Given the complexity, it is important to note that ground water and unmeasured sources are estimated in the mass balance model as sources not directly attributed to point source, or nonpoint source tributary and drain additions. As a result, it is understood and explicitly assumed that shallow subsurface ground water and unmeasured nonpoint source flows may come from a variety of known and unknown sources that were not measured as surface water, including but not limited to: agricultural irrigation, ground seepage, unidentified small drains, urban, suburban, and rural diffuse returns, non-stormwater (dry weather) returns, septic systems, and bank recharge.

During the USGS August 2012 synoptic sample, ground water and unmeasured flows (485 cfs at 0.22 mg/L TP) accounted for approximately 78% of the 624 cfs discharge measured at the Boise River near Parma, and accounted for approximately 576 lbs/day of TP (Etheridge 2013). Conversely, in October, the Boise River ground water gains of 91.4 cfs accounted for approximately 9.9% of the 924 cfs flow measured at Parma, estimated at 0.16 mg/L, resulting in

DRAFT

79 lbs/day of TP. Finally, the March discharge balance resulted in a 174 cfs gain from ground water, or 21 percent of the 846 cfs discharge observed at the Boise River near Parma, corresponding with TP concentrations of approximately 0.12 mg/L and loads of 113 lbs/day (Etheridge 2013, and Alex Etheridge, pers. comm. 2014).

3.3 Pollutant Transport

Phosphorus is discharged into the river from both point and nonpoint sources. It is difficult to determine pollutant delivery potential in such a complex watershed with modified surface hydrology system because water is diverted and often reused downstream from its original source. In the lower Boise River watershed, wastewater and agricultural return flow is often subsequently diverted and utilized again for irrigation, industrial, or municipal purposes. Further, even through complex modeling efforts, the accuracy in determining exactly where particular pollutants originate, decreases as distance from original diversion/return increases.

In this TMDL addendum, the potential relative contribution of each source sector is discussed throughout Section 5. In which, the relative contribution from each source sector is calculated as the ratio of total measured TP inputs from the various sources relative to the measured TP loads at Parma. A major assumption in these calculations is that TP from each source sector has a similar potential to reach Parma. A strength of this simplified assumption facilitates using straightforward calculations to quantify potential loading relationships without requiring additional complex assumptions about TP use and reuse throughout the watershed. Conversely, a limitation of this assumption is that the lower Boise River watershed is much more dynamic than potentially represented by simplified ratios. However, trying to further refine calculations to estimate individual TP sources relative to loads measured at Parma would add additional layers of complexity, assumptions, and speculation about how TP moves and is reused through the system. And although measured data are readily available regarding the TP inputs from various point-and nonpoint sources throughout the watershed, as well as the TP loads measured at Parma, the movement of TP through, and the interrelationships among the complex plumbing, water re-use, agricultural drains and tributaries, ground water, and other biogeochemical process are not well-understood.

Additional discussions of pollutant transport in the subbasin are provided in the Lower Boise River Nutrient Subbasin Assessment (DEQ 2001b) and Lower Boise River Implementation Plan: Total Phosphorus (DEQ 2008).

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts

Information concerning pollution control efforts for WWTFs, urban and suburban storm drainage, agricultural and other nonpoint sources (including rural roads, septic systems, leaky and sewer lines) can be found in the Implementation Plan for the Lower Boise River TMDL (DEQ 2003). While the 2003 plan was developed for the sediment and bacteria TMDLs, many of the BMP practices used by nonpoint sources would be similar for TP. Additional information pertaining to point sources is also available in the Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008).

In 2013 and 2014, DEQ solicited information from the LBWC, TAC, and other stakeholders to help describe past and present pollution control efforts in the subbasin. The following descriptions in this section represent the information provided to DEQ.

319 Grants and Projects

In 1987, Congress established the Nonpoint Source Management Program under section 319 of the Clean Water Act to help states address nonpoint source pollution by identifying waters affected by such pollution and adopting and implementing management programs to control this pollution. In the 319 grant selection process, proposals are required to link project benefits to pollutant load reductions identified in an approved TMDL. Preference is given to projects where priority has been identified in a water quality improvement plan. To keep the focus on improving water quality, load reduction estimates must be calculated for each pollutant being addressed by the non-point source project.

These 319 programs recommend where and how to use BMPs to prevent runoff from becoming polluted, and where it is polluted, to reduce the amount that reaches surface waters. For example, Ferguson (1999) estimates that an average range of 40 to 60% of irrigation water applied to cropland in the south-central and south-west areas of Idaho flows off of surface irrigated fields. And Carter (2002) and Ferguson (1999) also identify BMPs that can be implemented to reduce subsequent pollutant delivery from fields.

Since 1997, DEQ has allocated approximately 1.4 million dollars toward 319 grants in the lower Boise River subbasin for the implementation of BMPs to reduce and prevent pollutant runoff (e.g. sediment and nutrients) from reaching surface waters (Table 22). Currently, contract S443 is being implemented by the Lower Boise Watershed Council, which includes the implementation of projects using sprinkler and drip irrigations systems to reduce water use and pollutant delivery relative to traditional surface irrigation practices.

DRAFT

Table 22. 319 project grants in the lower Boise River subbasin.

Subgrant	Grant Year	Year Close	Project Name	Sponsor	Budget[1]
QC037900	1997		LBRWQP TandE		$32,000.00
QC051900	1999		LBRWQP DNA Finger Printing	Lower Boise River WQ Plan	$46,839.00
QC061100	2000		Dixie Surge System	Canyon SWCD	$18,000.00
S104	2004		Boise River Side Channel Reconstruction	Trout Unlimited	$159,525.00
S120	2000	2005	Jerrell Glenn Wetland Restoration	Jerrell Glenn	$22,250.00
S130/Ph1	2002		Indian Creek LID Demonstration Caldwell	City of Caldwell	$28,668.00
S130/Ph2	2002		Indian Creek LID Demonstration Caldwell	City of Caldwell	$73,332.00
S131	2001		Downtown Boise Graywater Recycling	The Christensen group	$50,000.00
S132	2002		Barber Park Living Roof Demonstration	Ada County	$150,703.00
S195	2002		Indian Creek Stormwater Runoff Phase 2	City of Caldwell	$79,383.00
S231	2006	2008	Dry Creek Streambed Protection Patterson Property	Ada SWCD	$58,365.67
S232	2004		Boise River Side Channel Formerly S104	Trout Unlimited	$34,525.00
S323	2009		Canyon Co. BMPs for WQ Improvement	Lower Boise Watershed Council	$250,000.00
S356[2]	2009		Ada County BMPs Four Corners[2]	Ada SWCD[2]	$48,000.00
S443	2011		Canyon County BMPs	Lower Boise Watershed Council	$250,000.00
S521	2014		Canyon County BMP Program	Lower Boise Watershed Council	$250,000.00

[1] Total subgrant amount allocated for each project, but not necessarily the amount spent.
[2] Ada SWCD revised the application to purchase a John Deere 1590 No-Till Drill - 15 ft., (model year 2013) that would be made available, at a reasonable cost, for use by producers within the lower Boise River watershed. The drill has been purchased and sediment and phosphorus losses are expected to be reduced by up to 95%.
*Note: Because 319 granting did not require Load Reduction Estimates until recently, estimates are only available for subgrants S120, S231, and S323.

DRAFT

Soil and Water Conservations Districts

In addition to 319 grants, numerous projects have been completed within the lower Boise River subbasin through federal programs, such as the Conservation Stewardship Program, Environmental Quality Incentives Program, and Wildlife Habitat Incentives Program. The conservation partnership (Ada Soil and Water Conservation District, Canyon Soil Conservation District, Idaho Association of Soil Conservation Districts, Natural Resources Conservation Service, Idaho Soil and Water Conservation Commission, and landowners) addresses agricultural nonpoint source pollution through voluntary BMPs. Table 23 provides a list of BMPs installed in the Lower Boise River subbasin from 2008-2013.

Table 23. Best Management Practices (BMPs) installed in the lower Boise River Subbasin between October 2008 and December 2013).

Practices in the Willow Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	Units
CANYON			
Livestock Pipeline	1,150.4	15,340.0	ft
Watering Facility	1,118.1	3.0	ea
GEM			
Cover Crop	24.5	10.0	ac
Integrated Pest Management (IPM)	32.7	32.7	ac
Nutrient Management	32.7	32.7	ac
Practices in the Tenmile Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	Applied Units
ADA			
Channel Bed Stabilization	2.2	1,400.0	ac
Conservation Cover	2.2	2.2	ac
Riparian Forest Buffer	2.2	2.2	ac
Riparian Herbaceous Cover	2.2	1.0	ac
Stream Habitat Improvement and Management	2.2	2.2	ac
Streambank and Shoreline Protection	2.2	1,400.0	ac
Structure for Water Control	2.2	3.0	no
Tree/Shrub Establishment	2.2	2.2	ac
Upland Wildlife Habitat Management	2.2	2.2	ac
Wetland Enhancement	2.2	1.0	ac
Wetland Wildlife Habitat Management	2.2	2.2	ac
CANYON			
Agricultural Energy Management Plan, Headquarters - Written	5.9	1.0	no
Conservation Crop Rotation	37.0	37.0	ac
Cover Crop	18.2	0.1	ac
Forage Harvest Management	35.6	35.6	ac

Integrated Pest Management (IPM)	36.9	36.9	ac
Irrigation System, Micro-irrigation	37.4	37.4	ac
Irrigation System, Surface and Subsurface	35.6	35.6	ac
Irrigation Water Conveyance, Corrugated Metal Pipeline	30.6	67.0	ft
Irrigation Water Conveyance, Ditch and Canal Lining, Plain Concrete	30.6	755.0	ft
Irrigation Water Management	92.8	92.8	ac
Nutrient Management	91.6	73.5	ac
Nutrient Management Plan - Written	37.4	1.0	no
Prescribed Grazing	7.9	7.9	ac
Seasonal High Tunnel System for Crops	18.2	2,178.0	sq ft
ELMORE			
Conservation Crop Rotation	109.2	109.2	ac
Prescribed Grazing	995.2	770.4	ac
Residue and Tillage Management, Reduced Till	4.2	4.2	ac
Practices in the Sand Hollow Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	Applied Units
CANYON			
Above Ground, Multi-Outlet Pipeline	62.4	760.0	ft
Anionic Polyacrylamide (PAM) Application	58.4	58.4	ac
Comprehensive Nutrient Management Plan	10.0	1.0	no
Conservation Crop Rotation	522.1	516.7	ac
Cover Crop	57.1	57.1	ac
Forage Harvest Management	64.0	47.6	ac
Integrated Pest Management (IPM)	459.0	459.0	ac
Irrigation Pipeline	163.1	12,956.0	ft
Irrigation Reservoir	4.7	0.4	ft
Irrigation System, Microirrigation	329.6	304.1	ac
Irrigation Water Conveyance, Corrugated Metal Pipeline	45.7	20.0	ft
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	162.3	9,025.0	ft
Irrigation Water Conveyance, Pipeline, Steel	112.8	348.0	ft
Irrigation Water Management	588.7	579.6	ac
Nutrient Management	814.3	848.7	ac
Prescribed Grazing	31.3	31.3	ac
Pumping Plant	158.4	7.0	no
Sprinkler System	353.5	295.3	ac
Structure for Water Control	230.4	13.0	no

Subsurface Drain	18.8	720.0	ft
Underground Outlet	93.7	2,206.0	ft
Upland Wildlife Habitat Management	25.0	25.0	ac
GEM			
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	74.5	1,300.0	ft
Irrigation Water Conveyance, Pipeline, Low-Pressure, Underground, Plastic	74.5	780.0	ft
Irrigation Water Management	74.5	74.5	ac
Nutrient Management	74.5	74.5	ac
Pumping Plant	74.5	1.0	no
Sprinkler System	74.5	63.0	ac
Structure for Water Control	74.5	1.0	no
PAYETTE			
Conservation Crop Rotation	40.1	40.6	ac
Integrated Pest Management (IPM)	40.1	40.6	ac
Irrigation Pipeline	112.8	5,135.0	ft
Irrigation Regulating Reservoir	56.3	1.0	fac
Irrigation Water Management	196.6	163.7	ac
Nutrient Management	131.7	110.0	ac
Pumping Plant	31.4	1.0	no
Sprinkler System	140.1	140.1	ac
Structure for Water Control	31.4	1.0	no
Upland Wildlife Habitat Management	40.1	40.6	ac
Practices in the Mason Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	Applied Units
ADA			
Conservation Crop Rotation	63.3	63.3	ac
Surface Roughening	63.3	63.3	ac
CANYON			
Conservation Crop Rotation	0.8	0.8	ac
Cover Crop	0.8	0.2	ac
Fence	80.0	6,193.0	ft
Forage and Biomass Planting	109.2	97.3	ac
Integrated Pest Management (IPM)	5.8	5.8	ac
Irrigation Pipeline	55.0	3,333.0	ft
Irrigation System, Microirrigation	13.8	13.8	ac
Irrigation System, Surface and Subsurface	4.2	4.2	fac
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	5.7	1,030.0	ft

Irrigation Water Management	150.3	149.1	ac
Livestock Pipeline	54.2	1,101.0	ft
Nutrient Management	36.7	36.7	ac
Prescribed Grazing	8.6	8.6	ac
Pumping Plant	51.2	4.0	no
Seasonal High Tunnel System for Crops	1.6	4,674.0	sq ft
Sprinkler System	71.1	52.9	ac
Structure for Water Control	52.7	7.0	no
Upland Wildlife Habitat Management	3.4	2.2	ac
Watering Facility	8.6	1.0	no
Windbreak/Shelterbelt Establishment	14.5	3,860.0	ft
Practices in the Indian Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	Applied Units
CANYON			
Forage and Biomass Planting	6.8	6.8	ac
Irrigation System, Microirrigation	1.6	1.6	ac
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	14.5	930.0	ft
Irrigation Water Management	23.4	23.4	ac
Nutrient Management	70.7	70.7	ac
Pumping Plant	1.1	1.0	no
Seasonal High Tunnel System for Crops	1.6	1.0	sq ft
Sprinkler System	13.4	12.6	ac
Structure for Water Control	1.1	1.0	no
ELMORE			
Conservation Crop Rotation	163.4	163.4	ac
Prescribed Grazing	10,857.8	6,749.7	ac
Range Planting	220.9	98.3	ac
Practices in the Dry Creek watershed	Sum of Land Unit Acres	Sum of Applied Amount	
ADA			
Channel Bank Vegetation	12.8	2.0	ac
Channel Bed Stabilization	12.8	600.0	ft
Conservation Cover	12.8	2.0	ac
Dam, Diversion	12.8	1.0	no
Livestock Pipeline	12.8	1,800.0	ft
Riparian Forest Buffer	12.8	2.0	ac
Structure for Water Control	12.8	1.0	no
Tree/Shrub Establishment	12.8	2.0	ac

Tree/Shrub Site Preparation	12.8	2.0	ac
Wetland Enhancement	12.8	2.0	ac
CANYON			
Field Border	18.1	7.6	ac
Forage and Biomass Planting	14.9	14.9	ac
Forage Harvest Management	14.9	15.2	ac
Integrated Pest Management (IPM)	60.2	60.2	ac
Irrigation System, Microirrigation	18.1	2.3	ac
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	14.9	615.0	ft
Irrigation Water Management	14.9	12.6	ac
Windbreak/Shelterbelt Establishment	18.1	6,160.0	ft
Practices in the Boise River-Snake River watershed	Sum of Land Unit Acres	Sum of Applied Amount	Applied Units
CANYON			
Conservation Cover	34.5	13.0	ac
Conservation Crop Rotation	317.8	317.8	ac
Fence	71.4	2,550.0	ft
Forage and Biomass Planting	5.0	7.6	ac
Irrigation Pipeline	324.4	25,415.0	ft
Irrigation Regulating Reservoir	16.2	1.0	ac
Irrigation System, Microirrigation	274.7	234.0	ac
Irrigation Water Conveyance, Corrugated Metal Pipeline	4.3	85.0	ft
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	96.4	4,255.0	ft
Irrigation Water Management	701.0	693.0	ac
Mulching	1.7	0.5	ac
Non-forested riparian zone enhancement for fish and wildlife	71.4	1,247.7	linear ft/yr
Nutrient Management	435.8	435.8	ac
Prescribed Grazing	18.6	25.6	ac
Pumping Plant	300.0	13.0	no
Retrofit watering facility for wildlife escape	404.7	27.0	no
Seasonal High Tunnel System for Crops	0.3	160.0	sq ft
Sediment Basin	182.1	10.0	no
Solar powered electric fence charging systems	127.4	6.0	no
Sprinkler System	347.4	337.1	ac
Structure for Water Control	323.1	20.0	no
Tree/Shrub Establishment	40.5	0.3	ac

Upland Wildlife Habitat Management	82.0	10.8	ac
Wetland Enhancement	34.5	5.7	ac
Wetland Wildlife Habitat Management	53.8	19.5	ac

* Note: The life expectancy of each practice depends on the individual circumstances and contract periods. Construction specifications guide the installation of practices, along with operation and maintenance guidelines.

Simplot Caldwell Potato Processing Plant

The Simplot potato processing plant and land application site is adjacent to the lower Boise River, west of Caldwell. This plant has been applying industrial wastewater on this site since the late 1960's and early 1970's. Since first obtaining a land application permit at the site in the 1980's, the site has been operating under a zero surface water discharge requirement. In 1998, upgrades at the Simplot site included (H. Haminishi, pers. comm., 2013):

- Flood irrigation fields were converted to sprinkler irrigation, including an extensive pumping system and piping infrastructure, in 2012, this system was upgraded to include more pivot irrigation and to irrigate corners that were previously not farmed.
- The land application system was doubled in land size to its current acreage (approximately 2000 acres).
- The cattle feedlot on site was shut down.
- An anaerobic digester was installed for further digestion of organics and conversion of nutrients to a more "plant available" form.
- A holding pond was built (28 MG) that allowed periods during the winter to hold water (during very severe weather) and to hold water during summer harvest of crops.
- A silt recovery system was installed to remove significantly more silt during the washing of the potato, thus reducing silt discharges to the land application system.
- A centrifuge building and system was installed for dewatering primary clarifier underflow.
- In 2008, the ethanol plant was permanently shut down, thus eliminating a source of flow and nutrients.

Even though Simplot upgraded the site over the years, there was still concern that the canals and drains going through the site, along with the high ground water, were possibly impacting surface water quality, even without direct discharge. As a result, DEQ required a study that was completed in 2008, specifically looking at many source impacts of phosphorus for the site that resulted in several recommendations: 1) reducing phosphorus loadings to the site, 2) evaluating a couple of unnamed drains at the site for reduction or elimination of phosphorus impacts, and 3) eliminating the Simplot domestic drainfield on site as a source of phosphorus. Associated implementation measures have included:

- Wastewater flow has been reduced from 1,474 MGY in 1995, to 637 MGY in 2012, to 551 MGY in 2013.
- In 2009, a double cropping system was installed for the land that has nearly doubled the nutrient uptake (both nitrogen and phosphorus) as well as significantly increase ash (TDS) uptake.
- In 2009, zero discharge evaporation ponds were installed to replace the domestic drainfield, thus eliminating domestic wastewater as a source of phosphorus.

DRAFT

In addition, Simplot is currently completing construction and startup of a new treatment system that will support the new potato processing plant at this site. This treatment system will:

- Reduce overall hydraulic flow to the land application site
- Reduce nitrogen loading to less than half of the current loading rates and reduce phosphorus loading rates by 90-95%
- Return more than half of the treated process water to the new process plant for reuse in the industrial process
- Use mechanical reverse osmosis to evaporate the concentrate from the treatment plant

The plant currently has one MSGP and two CGPs open, with a third requested. With the new potato plant on line and the old plant now shut down, Simplot will be updating the SWPPP for the MSGP, but does not plan to request a new MSGP.

City of Meridian

Meridian operates a WWTF that was constructed in 1978. There have been numerous capacity upgrades and treatment improvements since the original construction. Flow through the plant has increased from about 3.2 to 5.6 mgd (annual averages from 2001 and 2013, respectively), representing nearly a 5-percent annual increase in response to population growth within the city. Discharge is permitted to two outfalls, Fivemile Creek and the Boise River. Upgrades and improvements have included:

- Biological treatment process improvements to provide both biological phosphorus removal and nitrification and denitrification for ammonia and total nitrogen reduction.
- Tertiary filtration.
- Return activated sludge denitrification.
- Primary sludge fermentation is under construction.
- Investment in Class A recycled water program

Additional Water Quality Information

Additional information regarding past, present, and future management actions affecting water quality in the lower Boise River were previously identified and are available in the 2008 Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008), including submissions by:

- City of Boise
- City of Caldwell
- City of Nampa
- City of Star
- City of Wilder
- Darigold

4.1 Water Quality Monitoring

A combination of one time, ongoing, regularly-scheduled, and event-specific water quality monitoring occurs in the lower Boise River (see Appendix B – Data Sources). These monitoring efforts include, but are not limited to DEQ BURP sampling, synoptic sampling events of 2012 and 2013 (Etheridge 2013), other long-term USGS data collection, ongoing City of Boise data

DRAFT

collection throughout the river (unpublished data), Discharge Monitoring Reports (DMRs) and other data collected by municipal, stormwater, and industrial dischargers, 319 grant and other nonpoint source monitoring efforts.

Since 1994 the USGS has monitored water quality and biological communities in the Boise River in cooperation with DEQ and the LBWC. Early efforts were designed to assess ongoing status and trends in water quality and biological communities on the Boise River, and synoptic studies to identify the tributaries contributing the most significant loads of selected constituents to the river. The program evolved over the years to accommodate data needs to formulate TMDLs in the lower Boise River subbasin. Included were several short-term studies to evaluate continuous water temperatures; ground water nutrient loads, nutrient and sediment loads discharged to the Snake River, resident fish communities, cost-effective methods to more-frequently monitor nutrients and sediment, and potential applications of isotopic tracers for understanding nutrient sources and cycling (USGS 2012, 2013a, 2013b).

Additionally, the USGS, in cooperation with the DEQ and the LBWC, has collected and published other biological data throughout the lower Boise River subbasin, including aquatic growth (periphyton and phytoplankton). Some of their published monitoring results are available in the subsequent documents:

- Evaluation of Total Phosphorus Mass Balance in the Lower Boise River, Southwestern Idaho (Etheridge 2013)
- Water-quality Conditions near the Confluence of the Snake and Boise Rivers, Canyon County, Idaho (Wood and Etheridge 2011)
- Water-Quality and Biological Conditions in the Lower Boise River, Ada and Canyon Counties, Idaho, 1994–2002 (MacCoy 2004)
- Water-quality Conditions of the Lower Boise River, Ada and Canyon Counties, Idaho, May 1994 through February 1997 (Mullins 1998)
- Biological Assessment of the Lower Boise River, October 1995 through January 1998, Ada and Canyon Counties, Idaho (Mullins 1999)

5 Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must be based on critical conditions—the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for water quality trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary (40 CFR 130.2). These other measures must still be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads; however, under a federal court decision, daily loads must also be expressed.

5.1 Instream Water Quality Targets

Instream water quality targets are selected for the purpose of restoring "full support of designated beneficial uses" (Idaho Code 39-3611, 39-3615). The state's water quality standards for nutrients and nuisance aquatic growth are narrative rather than numerical. DEQ selected two targets for the lower Boise River in this TMDL addendum: 1) a target to specifically achieve the SR-HC TMDL allocation target for the lower Boise River and 2) a nuisance aquatic growth target specific to the lower Boise River.

The Mason Creek TP allocations were developed to help achieve the lower Boise River targets, which DEQ believes are sufficiently stringent to result in full beneficial use support in the creek.

The Sand Hollow Creek TP allocations were developed to help achieve the SR-HC target, and to be commensurate with other lower Boise River tributaries, which DEQ believes are sufficiently stringent result in full beneficial support in the creek.

5.1.1 Projected Conditions

The TMDL targets are designed to achieve full support of designated or existing beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek. Because identifying the impairment or support of beneficial uses is based on multiple lines of evidence, it is difficult to directly measure or compare to the narrative water quality standards. Water quality targets were selected based on scientific literature for river conditions representing a variety of water quality systems, including levels of phosphorus and benthic chlorophyll a representative of unimpaired and impaired streams and rivers. This information was then used to help determine load capacity, existing pollutant loads, wasteload allocations, and load allocations.

The projected conditions are anticipated to improve water quality by reducing periphyton growth, phytoplankton and sestonic algae delivery, and other potential impacts such as low dissolved oxygen, in order to support beneficial uses of contact recreation and aesthetics, aquatic life, and wildlife habitats. At the same the time targets are structured to support existing beneficial uses of domestic, agricultural, and industrial water supply, which are significant economic and sociopolitical drivers in the watershed.

The water quality targets are structured to recognize multiple factors within the watershed:

1. The lower Boise River, Mason Creek, and Sand Hollow Creek have some finite ability to process and transport TP at concentrations greater than background values without impairing beneficial uses, but will respond positively to TP target concentrations.
2. Watershed hydrology dynamics are not simple (e.g., upstream reservoirs, irrigation diversions, return flows and drains).
    a. Flow is highly managed throughout the watershed.
    b. Water quality conditions vary seasonally.
    c. Water quality conditions vary with spatial extent (e.g., location in the watershed).
3. Phosphorus sources have different locational impacts.
4. Phosphorus is moving through the watershed; it may take years before nonpoint source phosphorus load reductions are observed downstream.
5. Phosphorus and benthic algae are not toxics and should not be managed as such.
6. Limited exceedances (depending on magnitude, duration, and frequency) may be acceptable so long as they do not impair beneficial uses.
7. TP has multiple components, including labile and refractory, and may not be equally bioavailable for algal growth.
8. Algal biomass may be influenced by human and environmental factors other than TP, alone (e.g., flow, water temperature, other nutrients).
9. Algal species composition is variable.
10. Supporting reuse, offsets, trading, and other innovative approaches may further improve water quality over meeting the targets, alone.
11. A balanced approach is necessary. Using simple assumptions about the fate and transport of TP throughout the watershed may be too conservative; whereas, developing a detailed

approach to track phosphorus as it moves through the intricate maze of channels for irrigation may be currently unattainable.

12. The concepts of seasonal conditions and limited exceedances are supported by a number of references including EPA guidance, use in other TMDLs including the SR-HC TMDL, the fact that the phosphorus and periphyton are not toxic, and responses vary with conditions and time.

5.1.2 Target Selection (Lower Boise River)

These targets are intended to protect beneficial uses and are translated into other forms for setting allocations and limits in permits. The TMDL strives to be clear in how allocations were developed and in how NPDES permits should interpret the allocations. However, it is important to be clear that the target selection informs analyses but is a site-specific interpretation of a narrative standard and is not a standard itself that is necessarily applicable to any other watershed.

<u>Snake River-Hells Canyon TMDL Target Compliance</u>

- *<u>May 1 – September 30:</u> TP concentrations (or TP load equivalent) $\leq$ 0.07 mg/L in the lower Boise River near Parma to comply with the 2004 Snake River-Hells Canyon TMDL*

The final SR-HC TMDL was approved by EPA in September 2004 (DEQ 2004). The TMDL addressed point and nonpoint sources that discharge or drain directly to that reach of the Snake River. Five major tributaries received gross phosphorus allocations at their mouths, including the lower Boise River. Load allocations in the SR-HC TMDL were developed to achieve TP concentrations of $\leq$ 0.07 mg/L in the Snake River and Brownlee Reservoir from May 1 – September 30 (IDEQ and ODEQ 2004; p. ii):

> "Site-specific chlorophyll a and total phosphorus targets (less than 14 ug/L and less than or equal to 0.07 mg/L respectively) were identified by the TMDL. These targets are seasonal in nature and apply from May through September. … Inflowing tributaries have been assigned load allocations to meet the 0.07 mg/L total phosphorus target at their inflow to the Snake River."

Therefore, compliance with the SR-HC TMDL requires achieving the seasonal 0.07 mg/L TP target at the mouths of the lower Boise River and Sand Hollow Creek near Parma (although not explicitly stated; Figure 33).

DRAFT

Snake River - Hells Canyon TMDL Load Allocations

June 2004

Table 4.0.9. Calculated total phosphorus load allocations for tributary, point and nonpoint sources to the Snake River - Hells Canyon TMDL reach based on calculated average flows (May through September).

Segment	Load Allocation[a,b] (kg/day)	Percent Reduction
Snake River Inflow	1,379	28
Owyhee River	71	73
Boise River	242	78
Malheur River	58	88
Payette River	469	34
Weiser River	136	65
Drains	91	86
Ungaged flows	137	64
Total Upstream Snake River Load Allocations	2582	54
Total Upstream Snake River Waste Load Allocations	153	
Total Upstream Snake River Segment Load and Waste Load Allocations	2,735[c]	
Burnt River	21	60
Powder River	33	74
Unmeasured Tributaries to Brownlee	40	50
Total Brownlee Reservoir Segment	2,829[d]	
Unmeasured Tributaries to Oxbow	10	50
Total Oxbow Reservoir Segment	2,839	

[a] The SR-HC TMDL target for total phosphorus for each tributary is a concentration of less than or equal to 0.07 mg/L total phosphorus as measured at the mouth of the tributary and applies from May through September. Because the total phosphorus target is concentration-based, actual allowable tributary load allocations under the TMDL are dependant on actual tributary flow and will fluctuate year to year. The total phosphorus load allocations listed in this table are based on averaged tributary flows measured in 1979, 1995 and 2000, which were average Snake River flow years, not necessarily average tributary flow years. Therefore they do not necessarily represent the calculated load allocations for any specific year or different series of years.

Figure 33. Table 4.0.9. and associated text from the 2004 SR-HC TMDL (DEQ and ODEQ 2004). The TP load allocation of 242 kg/day converts to approximately 533.5 lbs/day.

Achieving the target at the mouths of the lower Boise River and Sand Hollow Creek near Parma is expected to be protective of cold water aquatic life and contact recreation in the Snake River. Reducing the phosphorus load is anticipated to reduce the phytoplankton, measured as chlorophyll a, in the Snake River and reservoirs. Therefore, load and wasteload allocations in this TMDL addendum will support the SR-HC TMDL target of less than or equal to 0.07 mg/l TP, which in turn should result in < 14 µg/L chlorophyll a as a mean growing season limit with a nuisance threshold of 30 µg/L with exceedance threshold of no greater than 25 percent for the Snake River.

Also, the loading analysis for this TP TMDL addendum, results in TP concentrations and loading that achieve the mean monthly periphyton (nuisance algae) target in the lower Boise River. The May 1 – September 30 TP concentration and load equivalent targets correspond to the 90th percentile low flows in the lower Boise River near Parma. Achieving the TP target near Parma will help reduce the frequency, magnitude, and duration of algal blooms and their associated aesthetic, ecological, and physical impacts on contact recreation and cold water aquatic life, in the Snake River, the lower Boise River, Sand Mason Creek, and Sand Hollow Creek.

Nuisance Algae Target

Through the TMDL process, DEQ, in consultation with the LBWC, identified a set of metrics that relate nuisance algae growth with the impairment of beneficial uses in the lower Boise River (see Section 2.2.5). The following metrics and rationale were selected as appropriate TP allocation periods for the lower Boise River:

- **Mean Monthly Benthic Chlorophyll a Target**
    - ***Magnitude*** **-** Mean monthly benthic chlorophyll a of ≤ 150 mg/m^2.
    - ***Location*** – Within impaired AUs of the main stem lower Boise River.
    - ***Duration***
        - May 1 – September 30
            - May 1 – September 30 aligns with the SR-HC TMDL target dates and can include primary growing periods for benthic algae within the river given favorable conditions such as light, temperature, and hydrology.
        - October 1 – April 30
            - October 1 – April 30 incorporates the early fall period that historically appears to coincide with elevated periphyton, but also when a majority of the historical periphyton data has been collected in the lower Boise River. It also incorporates the winter and spring conditions during which very little historical periphyton data have been collected in the lower Boise River. Nonetheless, the limited data illustrate that periphyton has exceeded 200 mg/m^2 during this time period at multiple sampling locations.
    - ***Frequency*** – For TMDL implementation, DEQ recommends that an allowable exceedance frequency of 1 in 10 years is sufficient to maintain full support of beneficial uses.
        - The allowable exceedance frequency is set at once in 10 years based on mean monthly values observed over a rolling 10-year period.

These target criteria are similar to those developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013) and Colorado (CDPHE 2013), and corresponds with

DRAFT

scientific literature values that support contact recreation and cold water aquatic life (see Section 2.2.5).

5.1.3 Target Selection (Mason Creek)

The target selection for Mason Creek is developed in the same manner as load allocations for the other major tributaries to the lower Boise River. These load allocations will help the lower Boise River achieve the May 1 – September 30 SR-HC TMDL TP target, while also achieving the nuisance aquatic growth targets (translated into a TP target) in the lower Boise River. These allocations are further expected to fully support beneficial uses in Mason Creek through TP load reductions that are consistent with those of Sand Hollow Creek, the lower Boise River, EPA Gold Book recommended TP value of 0.1 mg/L (EPA 1986), and should translate in nuisance aquatic growth reductions sufficient to fully support beneficial uses. In addition, subsequent monitoring of Mason Creek, along with DEQ's ongoing statewide effort to identify nutrient and nuisance aquatic growth relationships in wadeable streams, should provide further insight into achieving full beneficial use in Mason Creek and other lower Boise River tributaries. An adaptive management approach, as part of the 5-year review, will help to determine if subsequent changes to load allocations will be necessary to fully support beneficial uses in Mason Creek.

5.1.4 Target Selection (Sand Hollow Creek)

The target selection for Sand Hollow Creek, a tributary to the Snake River, is developed to help achieve the May 1 – September 30 target in the Snake River as identified in the SR-HC TMDL (DEQ and ODEQ 2004). These allocations are further expected to fully support beneficial uses in Sand Hollow Creek through TP load reductions that are consistent with those of the Mason Creek, the lower Boise River, EPA Gold Book recommended TP value of 0.1 mg/L (EPA 1986), and should translate in nuisance aquatic growth reductions sufficient to fully support beneficial uses. In addition, subsequent monitoring of Sand Hollow Creek, along with DEQ's ongoing statewide effort to identify nutrient and nuisance aquatic growth relationships in wadeable streams, should provide further insight into achieving full beneficial use in Sand Hollow Creek. An adaptive management approach, as part of the 5-year review, will help to determine if subsequent changes to load allocations will be necessary to fully support beneficial uses in Sand Hollow Creek.

5.1.5 Water Quality Monitoring Points

USGS efforts are now underway to track trends in water quality that might result from management of water resources. These efforts require an emphasis on gathering information within tributary basins in addition to continued monitoring on the Boise River for ongoing trend detection. This includes maintaining and evaluating the long-term water-quality dataset on the lower Boise River near Parma. Monitoring results from the lower Boise River near Parma incorporate contributions and impacts from basin activities and represent the quality of Boise River water discharging to the Snake River. The USGS measures continuous streamflow near Parma as funded by the USGS National Streamflow Information Program (NSIP).

Additionally, monitoring activities beginning in fiscal year 2014 include sample collection and continuous monitoring of water-quality parameters at the gage near Parma. In addition to collecting at least 8 water quality samples during the fiscal year, a continuous water-quality

DRAFT

monitor will be installed and operated at the Parma stream gage. The continuous monitor will collect temperature, specific conductance, dissolved oxygen, and turbidity every 15 minutes and will be updated in real time on the stream gage web page (USGS 2013b).

A previously-published statistical regression model provides the ability to estimate TP and suspended sediment in real time at Parma given continuously monitored turbidity and specific conductance (Wood and Etheridge 2011). Event-based sample collection efforts will be used to verify and/or calibrate model estimates of the TP and suspended sediment. Real-time estimates of TP and suspended sediment will be provided on line and can be used to evaluate TP and suspended sediment loading and concentrations on time scales consistent with storm events, diurnal variation, and anomalous fluctuations in stream pollutants (USGS 2013b). The statistical regression model will provide useful information for scheduling event-based samples, but only event-based samples will be used for water quality evaluations and compliance purposes.

Through development of the subsequent Implementation Plan, DEQ, LBWC, USGS, and other stakeholders will continue to develop and refine the water quality monitoring points and strategies in the lower Boise River subbasin. This effort will help to ascertain the effectiveness and impacts of TP load reductions on both achieving the May – September 0.07 mg/L TP target near Parma, as well as achieving the 150 mg/m^2 mean monthly benthic chlorophyll a target in the impaired AUs.

5.2 Load Capacity

Load capacity is the calculated TP load in the lower Boise River at Parma that complies with the SR-HC TMDL and fully supports beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek. In other words, it is the amount of TP these waterbodies can receive and still meet water quality standards. The amount of this pollutant must achieve a sufficient level to meet "...water quality standards with seasonal variations and a margin of safety which takes into account any lack of knowledge..." (Clean Water Act § 303(d)(C)). The margin of safety accounts for uncertainty about assimilative capacity, the relationship between the selected target and support of beneficial uses, and includes variability in target measurement.

The TP load capacity values for the lower Boise River, Mason Creek, and Sand Hollow Creek §303(d)-listed AUs are based on the following assumptions: DEQ expects the TP allocations in this TMDL addendum will support beneficial uses, while acknowledging that adaptive management adjustments may be necessary as additional information is obtained through monitoring. TP concentrations that support beneficial uses in western watersheds and values identified in scientific literature are assumed to be useful reference points. However, TP concentrations that fully support cold water aquatic life and recreation beneficial uses in the lower Boise River and its tributaries have not been previously established.

5.2.1 TP Load Capacity to Achieve SR-HC TMDL Target of ≤ 0.07 mg/L May 1 – September 30

The TP load capacities developed for the lower Boise River near Parma, Mason Creek, and Sand Hollow Creek are based on the instream loads:

DRAFT

- TP concentration and TP load equivalent of ≤ 0.07 mg/L are maintained at the mouth of the lower Boise River and Sand Hollow Creek throughout the critical season (May 1–September 30), and
- That support beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek.

The TP loading scenario that achieves both conditions in the lower Boise River corresponds to the 90th percentile low flow conditions (Table 24, Figures 31-33) and maintains the same TP concentrations and loads under higher flows for all point and nonpoint sources, except natural background and ground water/unmeasured, which adjusts with river flow. These load capacities comply with the target TP allocations identified in the SR-HC TMDL and with the lower Boise River mean monthly periphyton target (Section 5.1.2).

The allocations for the lower Boise River from May 1 – September 30 are designed to achieve the SR-HC TMDL 0.07 mg/L TP target, by utilizing a combination of the USGS mass balance models and duration curves. The USGS mass balance model and report (Etheridge 2013) are available online: *http://pubs.usgs.gov/sir/2013/5220/*. The duration curves are developed in reference to An Approach for Using Load Duration Curves in the Development of the TMDLs (EPA 2007), which is available online: *http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2007_08_23_tmdl_duration_curve_guide_aug2007.pdf*. According to the duration curve reference document:

> "The duration curve approach is particularly applicable because stream flow is an important factor in the determination of loading capacities…An underlying premise of the duration curve approach is correlation of water quality impairments to flow conditions. The duration curve alone does not consider specific fate and transport mechanisms, which may vary depending on watershed or pollutant characteristics…Practitioners, should consider using a separate analytical tool to develop a TMDL when factors other than flow significantly affect a water body's loading capacity."

The load duration curve approach recognizes that the assimilative capacity of the lower Boise River and the maximum allowable loading varies with flow conditions. Therefore, existing loading, and load reductions required to achieve the SR-HC TMDL TP water quality target, are calculated under different flow conditions. The difference between existing loading and the TP target of 0.07 mg/L is used to calculate the loading reductions required.

Based on the following reasons, DEQ has determined that utilizing the duration approach, along with the USGS mass balance models and other information is appropriate for this TMDL:

1. The May 1 – September 30 SR-HC TMDL TP allocation identified for the lower Boise River is concentration-based. Therefore, flow is directly related to the water quality target and load capacity.
2. The May 1 – September 30 R^2 correlation values between TP loads and concentrations, relative to flows at Parma, were 0.84 and 0.57.
3. The USGS mass balance model results suggest that biogeochemical processes, including uptake by plants, may have had a limited effect on main-stem TP concentrations in August 2012 (Etheridge 2013).

However, it is important to note that under all flow conditions except the 90th percentile low flows, the TP load and waste load allocations are more stringent than necessary to achieve 0.07 mg/L TP near Parma. These extra reductions were required to also achieve the mean monthly benthic chlorophyll a target of 150 mg/m^2 within the TP-impaired AUs of the lower Boise River (see Section 5.1.2 and 5.4.3).

40 CFR §130.7(c)(1) requires TMDLs to take into consideration seasonal variation in watershed conditions and pollutant loading. Seasonal variation is accounted for in this TMDL by using long-term USGS flow records and water quality data to develop flow and load curves, and the reductions and allocations needed to achieve the SR-HC TMDL TP target for the lower Boise River.

Daily mean flows based on the USGS gage 13213000 as recorded at the Boise River near Parma for the period 1987 through 2012 are shown in Figure 20. The period 1987 through 2012 was selected because it incorporates long-term daily mean flows as measured by USGS, while only including river management practices and conditions that are still largely relevant to current conditions, and includes the initiation of long-term TP data collection by the USGS in the lower Boise River near Parma.

Daily flows from 1987 through 2012 were used to develop a May 1 – September 30 flow duration curve for the lower Boise River at Parma (Figure 34). The lowest daily flow was 108 cfs in 1992 and the highest was 8,040 cfs in 2012. The flow duration curve shows the percentage of time that an average flow for May 1 – September 30 occurs at Parma. Four tiers were selected for calculations, the 10th, 40th, 60th, and 90th percentiles.

The flows for the four tiers and the TP target concentration of 0.07 mg/L were used along with a standard conversion factor to calculate the load capacity for phosphorus (load = concentration×flow×5.39; Hammer 1986) in the lower Boise River near Parma (Table 24). Additionally, the load capacity for phosphorus was also calculated for the flow that occurred during the USGS August 2012 synoptic sample (Table 21), which was equivalent to the 69th percentile. The estimation of load capacity for the lower Boise River at Parma relative to the sources upstream in the watershed is described in Section 5.4.

Mean flow conditions were used estimate existing pollutant loads and allocations for Mason and Sand Hollow Creeks.

DRAFT

Table 24. TP loads and capacities for May 1 – September 30 presented as daily averages. They are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a Boise River tributary, and: 3) Sand Hollow Creek, a Snake River tributary.

Water Body[1]	Flow[2] (cfs)	Flow Rank (%)	Current Load[3]		Load Capacity[3]		
			TP Conc. (mg/L)	TP Load (lbs/day)	Target TP Conc. (mg/L)	Target TP Load (lbs/day)	Target TP Load Reductions (lbs/day [%])
Lower Boise River near Parma – (AU 001_06)							
	3268	10th	0.21	3747	0.07	1233	-2514 (67%)
	912	40th	0.31	1531	0.07	344	-1187 (78%)
	705	60th	0.31	1190	0.07	266	-924 (78%)
USGS August Synoptic Sample[4]	624	69th	0.30	1010	0.07	235	-775 (77%)
	383	90th	0.36	738	0.07	145	-593 (80%)
Mason Creek – (AU 006_02) (Tributary to the lower Boise River)							
	148	Mean	0.41	322	0.07	56	-266 (82%)
Sand Hollow – (AU 017_06) (Tributary to the Snake River)							
	141	Mean	0.4	303	0.07	53	-250 (82%)

[1] All assessment units (AUs) begin with ID17050114.
[2] Lower Boise River – based on a data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.
Sand Hollow – based on USGS and mean data from May 1 – September 30, 1998 through 2012.
[3] Lower Boise River - load capacities are calculated and applied near Parma, using duration curves.
Mason Creek and Sand Hollow Creek – mean load capacities are calculated and applied as instream conditions.
[4] Lower Boise River flows, TP concentrations, and loads highlighted in green are derived from the USGS August 2012 synoptic sample (Etheridge 2013). These USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

DRAFT

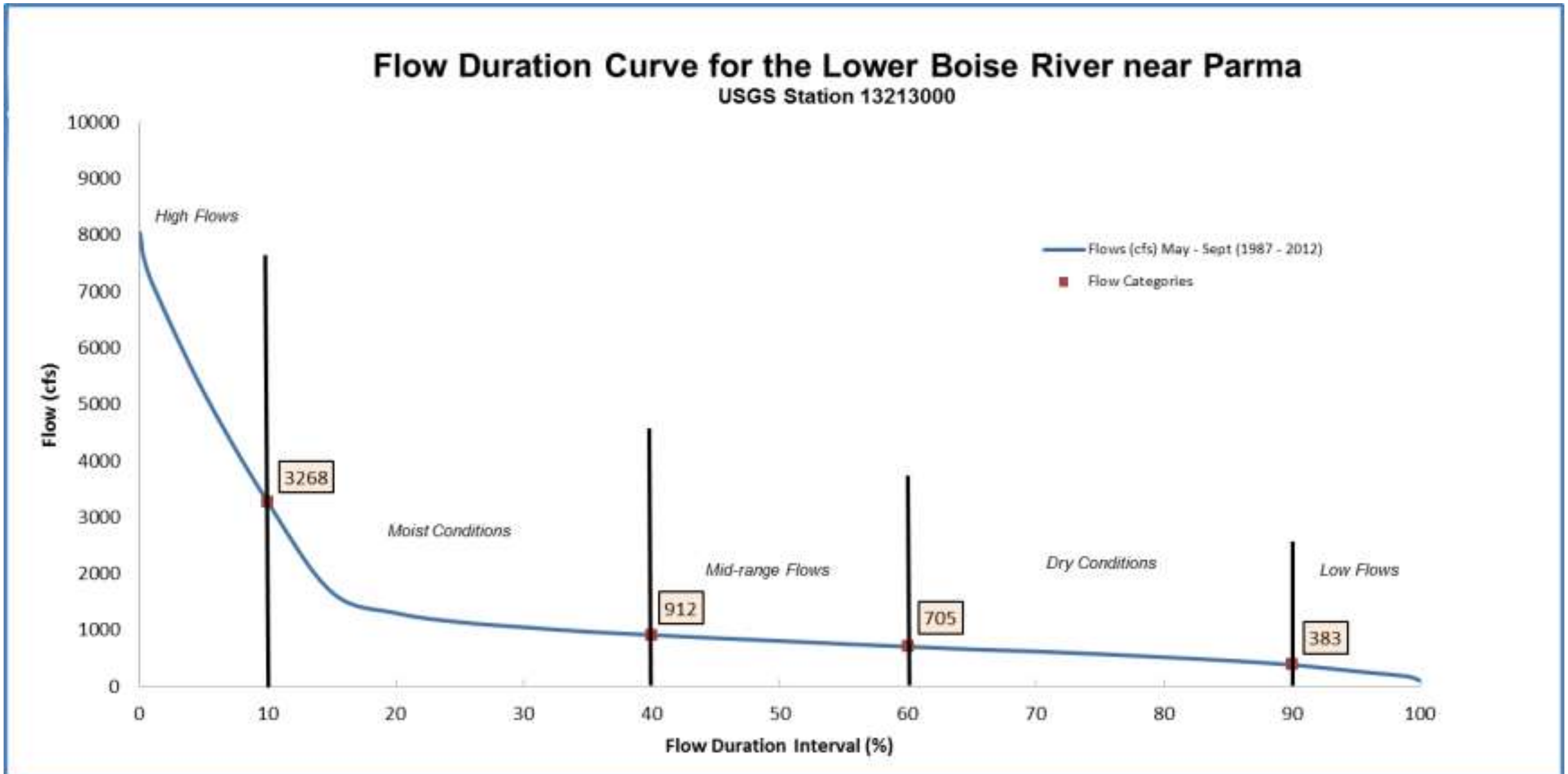


Figure 34. Flow duration curve for the lower Boise River near Parma from May 1 – September 30, 1987-2012.

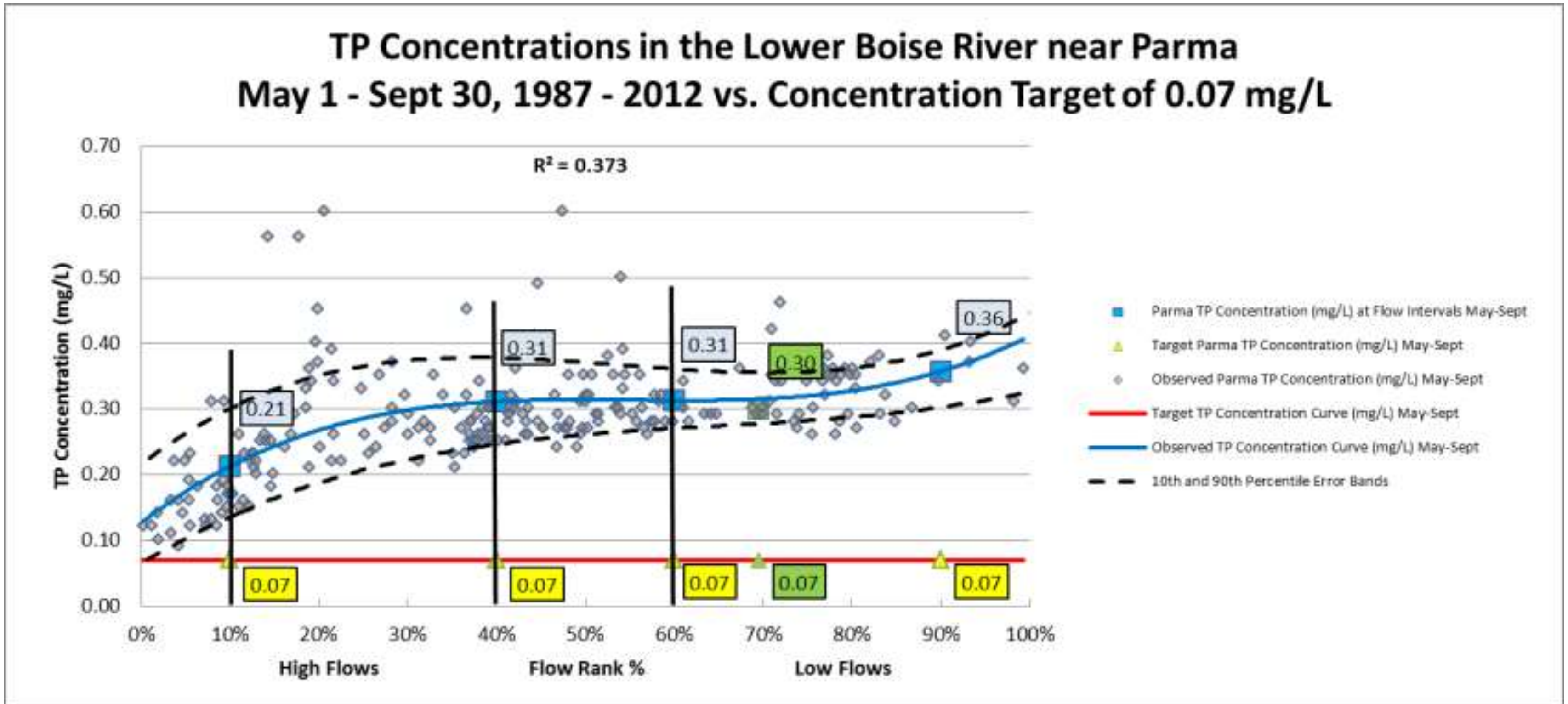


Figure 35. Long-term TP concentrations for the lower Boise River in relation to the concentration target of ≤ 0.07 mg/L May 1 – September 30. Note: DEQ excluded a potential outlier data point from the figure and analyses due to disproportionate influence: a TP concentration of 2 mg/L associated with an 80th percentile flow on September 21, 1988.

DRAFT

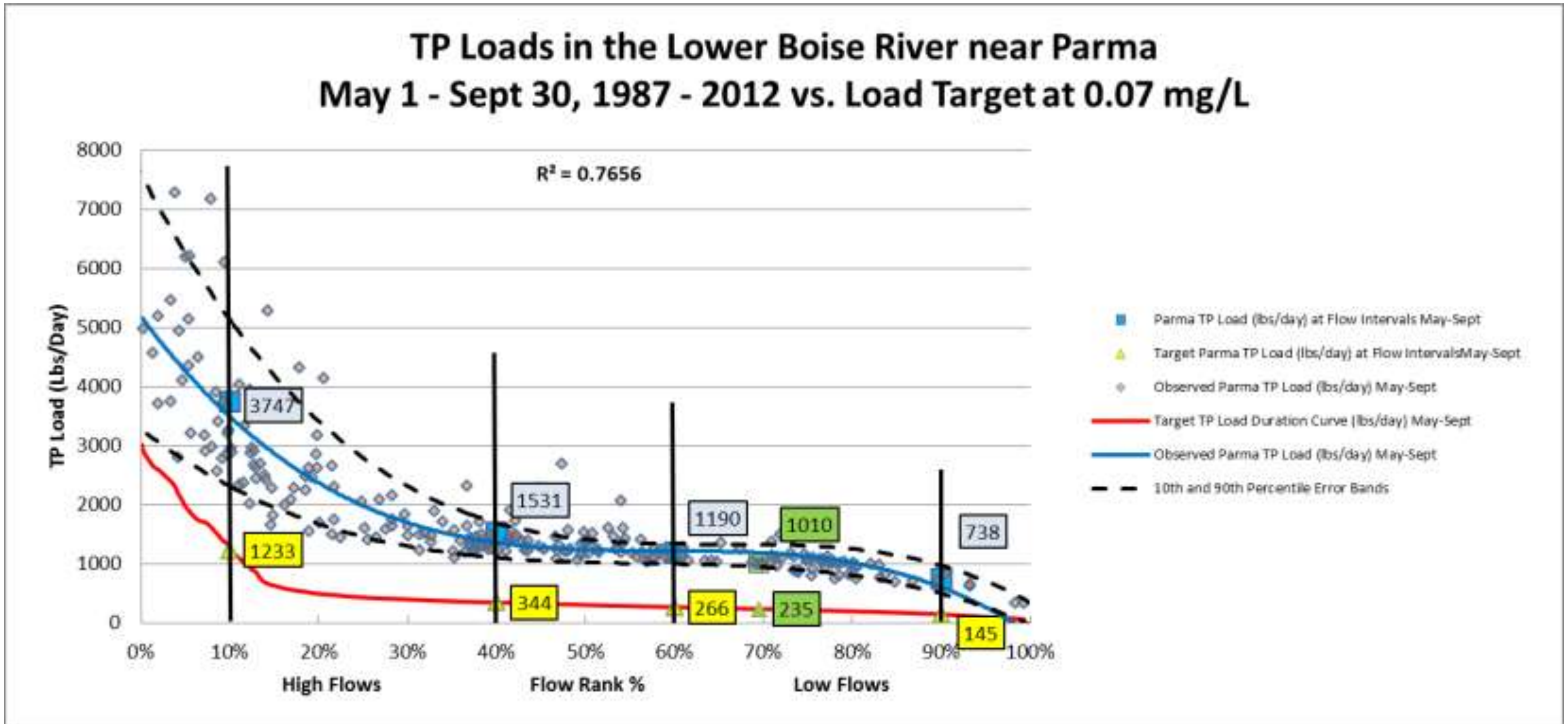


Figure 36. Long-term TP loads for the lower Boise River in relation to the TP load equivalent target of ≤ 0.07 mg/L May 1 – September 30. Note: DEQ excluded a potential outlier data point from the figure and analyses due to disproportionate influence: a TP load of 5544 lbs/day associated with an 80.5th percentile flow on September 21, 1988.

5.2.2 TP Load Capacity to Achieve the Mean Monthly Benthic Chlorophyll-a Target of ≤ 150 mg/m²

The AQUATOX model was used to assess the load capacity for TP and benthic algae for the lower Boise River, as a function of multiple parameters included within the model. Further analyses are described in the Lower Boise River Total Phosphorus AQUATOX Model Report (DEQ 2014a).

The load capacity is the summation of TP inputs to the AQUATOX model under which simulation results achieve the mean monthly periphyton target. There are multiple combinations of TP inputs from sources that may mathematically achieve the selected target. The division of the load capacity to the sources upstream in the watershed is described in Section 5.4. The particular combination of pollutants chosen for the TMDL is based on a number of factors including the characteristics of the watershed, the results of the USGS August 2012, October 2012, and March 2013 mass balance models (Etheridge 2013), and previous studies of the watershed.

Figure 37 shows the results of USGS benthic chlorophyll a sampling between 1995 and 2013. These results reflect a range of elevated periphyton at several locations between October-November and January-March. However, these results also demonstrate that the majority of data have historically been collected during October and November, with relatively fewer data being observed the remainder of the year.

DRAFT

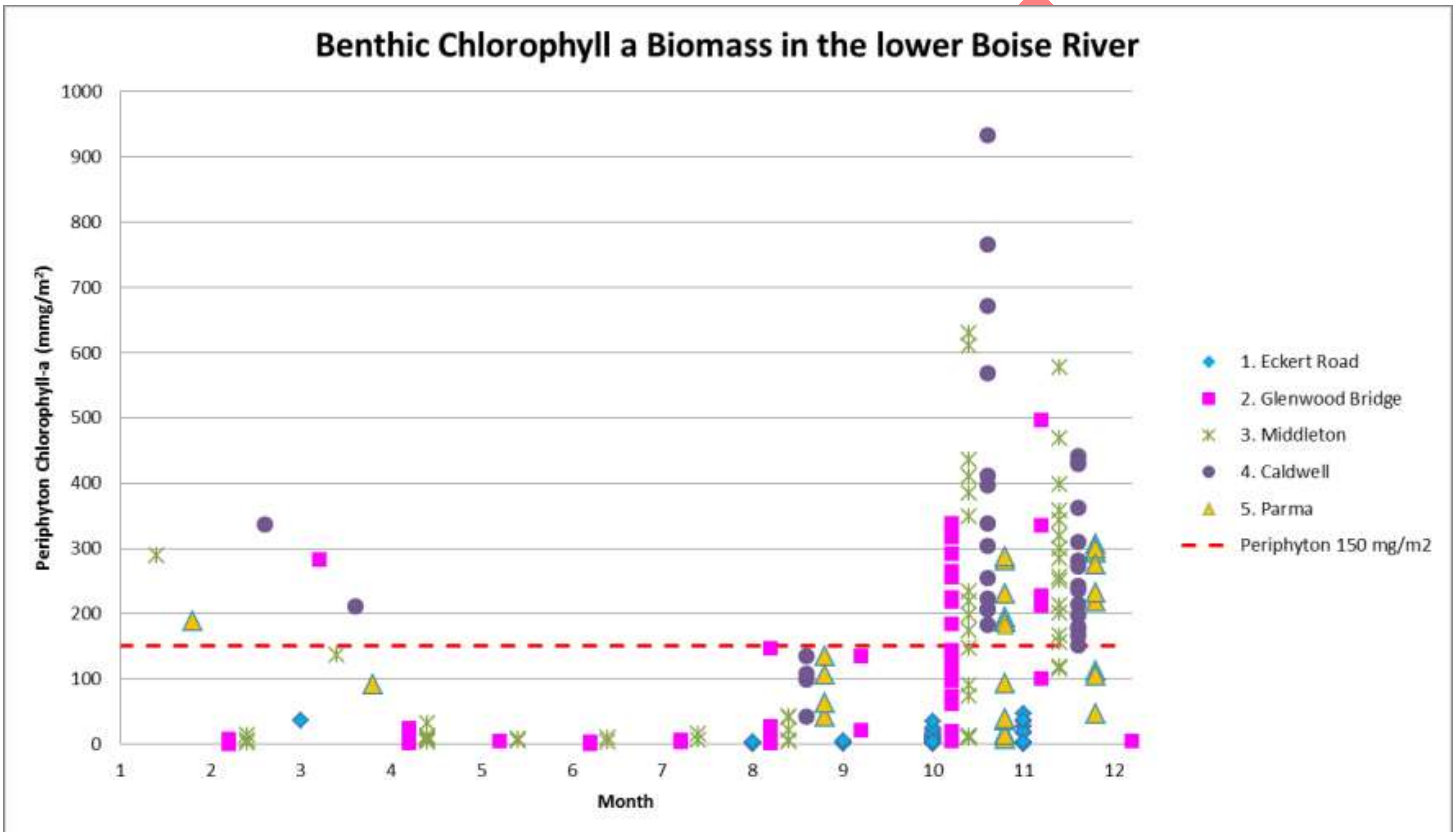


Figure 37. USGS benthic chlorophyll a samples in the lower Boise River between 1995 and 2013. Note, some value differences may reflect different sampling methodologies.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(g)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

5.3.1 Boise River and Mason Creek TP Loads (May 1 – September 30)

Background

A background TP concentration of 0.018 mg/L is based on the 2005 – 2013 USGS TP data at Diversion Dam with detection levels of 0.01 mg/L (see Section 3.2.2).

NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or discharge monitoring reports (DMR) from May 1 – September 30, 2012, as available (Table 25). This time period was chosen to utilize the most recent data available and accurately capture the current conditions. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios, and in turn are more dependent on factors such as population, service area, etc.

NPDES-Permitted Municipal Stormwater and Non-Stormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several workgroup meetings and correspondence (Table 26). These data were developed for May 1 – September 30 for MS4-permitted and non-permitted areas. Stormwater (wet weather) flows represent specific precipitation (storm) events that are not represented as part of the USGS August 2012 synoptic sample, and may be underrepresented in other long-term river monitoring data not specifically focusing on these short-term flows and loads.

Few non-stormwater (dry weather) data have been collected in the subbasin (Appendix E; Table 26). Non-stormwater (dry weather) flows and loads can originate from a variety of sources, including but not limited to agricultural water supply returns, shallow ground water, urban/suburban sources (e.g. lawn watering), and other unmeasured sources. Further, non-stormwater (dry weather) discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration analyses.

For stormwater (wet weather) and non-stormwater (dry weather), it is assumed that loadings remain relatively independent of various Boise River flow conditions, and in turn are more dependent on factors such as population, service area, specific storm events, etc.

Nonpoint Source Tributary, Ground Water, and Unmeasured

Agricultural and other nonpoint source tributary contributions were calculated from available USGS and ISDA data for May 1 – September 30 from 1983 through 2013, as available (Table 27). This long-term data was selected due to temporal and spatial paucity of data and in order to moderate the intra- and inter-annual variation that can result from varying precipitation, runoff, temperature, and water use regimes. Flow, TP concentrations, and loads are also presented by removing the flows and TP loads attributed to NPDES-permitted facilities.

Ground water and unmeasured contributions were calculated from the August 2012 synoptic sampling effort in the lower Boise River subbasin (Etheridge 2013) and further derived from professional judgment to adjust ground water interactions under various flow scenarios (Alex Etheridge, pers. comm. 2014). This data represents the best and most current ground water and unmeasured flow data for the lower Boise River.

Additional Assumptions

Lower Boise River TP inputs do not translate directly into TP loads at Parma. Instead, TP inputs relative to TP loadings at Parma were calculated over various flow scenarios to develop delivery ratios. An assumption of this approach is that TP from each source has similar potential to reach Parma. This simplified assumption facilitates the use of calculations to quantify potential loading without requiring complex assumptions about TP use and reuse throughout the watershed. Conversely, a limitation of this assumption is that the lower Boise River watershed is much more dynamic than potentially represented by simple ratios. However, trying to further refine calculations to estimate individual TP sources relative to loads measured at Parma would add additional layers of complexity, assumptions, and speculation about how TP moves through the system. And although measured data are readily available regarding the TP inputs from various point-and nonpoint sources throughout the watershed, as well as the TP loads measured at Parma, the movement of TP through, and the interrelationships among the complex plumbing, water re-use, agricultural drains and tributaries, ground water, and other biogeochemical processes are not well-understood.

The USGS August 2012 mass balance model (Etheridge 2013) was used to identify contributing source flows and loads for the time period measured (e.g. August 2012 with Boise River flows near Parma at 624 cfs) and to help derive approximate ground water flows associated with the various flow scenarios in the lower Boise River near Parma. However, upon recommendation from the USGS model developer (Alex Etheridge, pers. comm. 2014), the mass balance model was not utilized to estimate lower Boise River TP concentrations or loads near Parma under adjusted flows scenarios. This is because altering river flows in the mass balance model also requires altering ground water, tributary, background, and WWTF flows throughout the system to maintain the balance. The complex relationships among the various sources under changing flow conditions are not well understood and would require utilizing additional speculation. Further, although the mass balance model clearly illustrates the flow and TP relationships throughout the river during one week in August 2012 when flows near Parma were 624 cfs, it does not account for varying flow and TP relationships in the subbasin.

Table 25. Current permitted May 1 – September 30 point source TP discharge to the lower Boise River and its tributaries.

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Mean Discharge (MGD)[2]	Design Flow (MGD)	Mean TP Conc. (mg/L)[2]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[2]	Permitted TP Load (lbs/day)
Boise River - Main stem								
Lander WWTF	ID-002044-3	RM 50.0	12.71	15.0	2.10	0.07/monthly avg 0.0931/weekly avg	222.7	8.7/monthly avg 11.6/weekly avg
West Boise WWTF	ID-002398-1	RM 44.2	16.10	24.0	4.47	0.07/monthly avg 0.084/weekly avg	600.5	14/monthly avg 16.8/weekly avg
Middleton WWTF	ID-002183-1	RM 27.1	0.57	1.83	3.23	No Limit	15.4	No Limit
Caldwell WWTF	ID-002150-4	RM 22.6	7.90	8.50	2.37	No Limit	156.2	No Limit
IDFG-Eagle[3]	NPDES Aquaculture Permit	RM 41.8	2.95	4.25	0.02	No Limit	0.6	No Limit
Boise River –Tributaries								
Avimor WWTF[5]	In Application	Dry Creek	In Application	0.42	No Discharge Currently			
Star WWTF	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.63	1.85	1.85	No Limit	9.7	No Limit
Meridian WWTF[4]	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.87	10.2	1.26	No Limit	61.6	No Limit
Sorrento Lactalis	ID-002803-7	Mason Creek	0.7	1.52	0.03	0.07/monthly avg 0.14/weekly avg	0.02	0.29/monthly avg 0.58/weekly avg
Nampa WWTF	ID-002206-3	Indian Creek	10.51	18.0	4.97	No Limit	435.8	No Limit
Kuna WWTF	ID-002835-5	Indian Creek	0.47	3.5	0.04	0.07/monthly avg 0.105/weekly avg	0.2	1.1/monthly avg 1.65/weekly avg
IDFG-Nampa[3]	IDG-130042 NPDES Aquaculture Permit	Wilson Drain and Pond (Indian Creek)	17.85	19.38	0.06	No Limit	8.8	No Limit
Darigold	ID-002495-3	RM 22.6	0.22	1.70	0.31	No Limit	0.6	No Limit

DRAFT

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Mean Discharge (MGD)[2]	Design Flow (MGD)	Mean TP Conc. (mg/L)[2]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[2]	Permitted TP Load (lbs/day)
		(unmeasured drain)						
Notus WWTF[5]	ID-002101-6	Conway Gulch	No May-Sep Discharge Currently	0.11	No May-Sep Discharge Currently	0.07/monthly avg 0.14/weekly avg	No May-Sep Discharge Currently	0.064/monthly avg 0.128/weekly avg
Wilder WWTF	ID-0020265	Wilder Ditch Drain	0.07	0.25	6.02	No Limit	3.3	No Limit
Greenleaf WWTF[5]	ID-002830-4	West End Drain	No May-Sep Discharge Currently	0.24	No May-Sep Discharge Currently	0.07/monthly avg 0.105/weekly avg	No May-Sep Discharge Currently	0.14/monthly avg 0.21/weekly avg
ConAgra (XL4Star)[5]	ID-000078-7	Indian Creek	No May-Sep Discharge Currently	0.48	No May-Sep Discharge Currently	No Limit	No May-Sep Discharge Currently	No Limit
Total			**76.54**	**111.23**	**2.37**		**1515.48**	

[1] River Miles as identified by USGS in the Lower Boise River Mass Balance Report (Etheridge 2013). Darigold discharges to an unmeasured drain that discharges into the lower Boise River at or near RM 22.6.
[2] Calculated from May 1 – September 30, 2012 using data provided by facilities and/or DMR data.
[3] Eagle and Nampa IDFG facility outputs were calculated using 2011 and 2012 data due a single concentration/load May 1 – September 30 data point in 2012.
[4]Meridian – Permitted flow was 7 mgd when the NPDES permit was issued in 1999. The receiving water was commonly Fivemile Creek; however, the city is permitted to discharge to the south channel of the Boise River. Meridian's current design flow is 10.2 (mgd) and is used for allocations.
[5]The Avimor, Notus, Greenleaf, and ConAgra facilities did not discharge from May 1 – September 30. However, new NPDES permits allow May 1 – September 30 discharge.

DRAFT

Table 26. Current May 1 – September 30 MS4 stormwater (wet weather) and non-stormwater (dry weather) TP discharge to the lower Boise River[1].

Source	NPDES Permit No.	Area (miles)	Area Ratio[2]	May - Sept Stormwater Wet Weather Flow[3] (cfs)	May - Sept Stormwater Wet Weather Load[3] (lbs/day)		May - Sept Non-Stormwater Dry Weather Flow[4] (cfs)	May - Sept Non-Stormwater Dry Weather Load[4] (lbs/day)
Boise/Ada County MS4	IDS-028185 & IDS 027561	149	0.55					
Non-permitted Kuna and Star		44	0.16					
Canyon Hwy Dist #4 MS4	IDS-028134	8	0.03					
ITD District #3 (Eagle & Meridian)	IDS-028177	112 linear						
Middleton MS4	IDS-028100	2.3	0.01					
Nampa MS4	IDS-028126	25	0.09					
Nampa Hwy District MS4	IDS-028142	8.5	0.03					
Caldwell MS4	IDS-028118	17.5	0.06					
Non-permitted Notus-Parma MS4 (former MS4 IDS-028151)		2	0.01					
Non-permitted Greenleaf, Notus, Parma, Wilder		17	0.06					
	Total	**273.3**	**1.0**	**30.3**	**71.0**		**167.7**	**394**

[1] The stormwater (wet weather) and non-stormwater (dry weather) flows and load estimates were derived from data provided by the LBWC stormwater workgroup (Appendix E).
[2] Area ratio = the area contribution of each individual MS4 relative to the total service area for MS4s.
[3] Stormwater (wet weather) loads have an average TP concentration of approximately 0.44 mg/L as estimated by the LBWC stormwater workgroup (Appendix E). Storm water (wet weather) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4 systems.
[4] Non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin. Non-stormwater (dry weather) loads have an average TP concentration of approximately 0.44 mg/L as estimated by the LBWC stormwater workgroup (Appendix E). Current flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

DRAFT

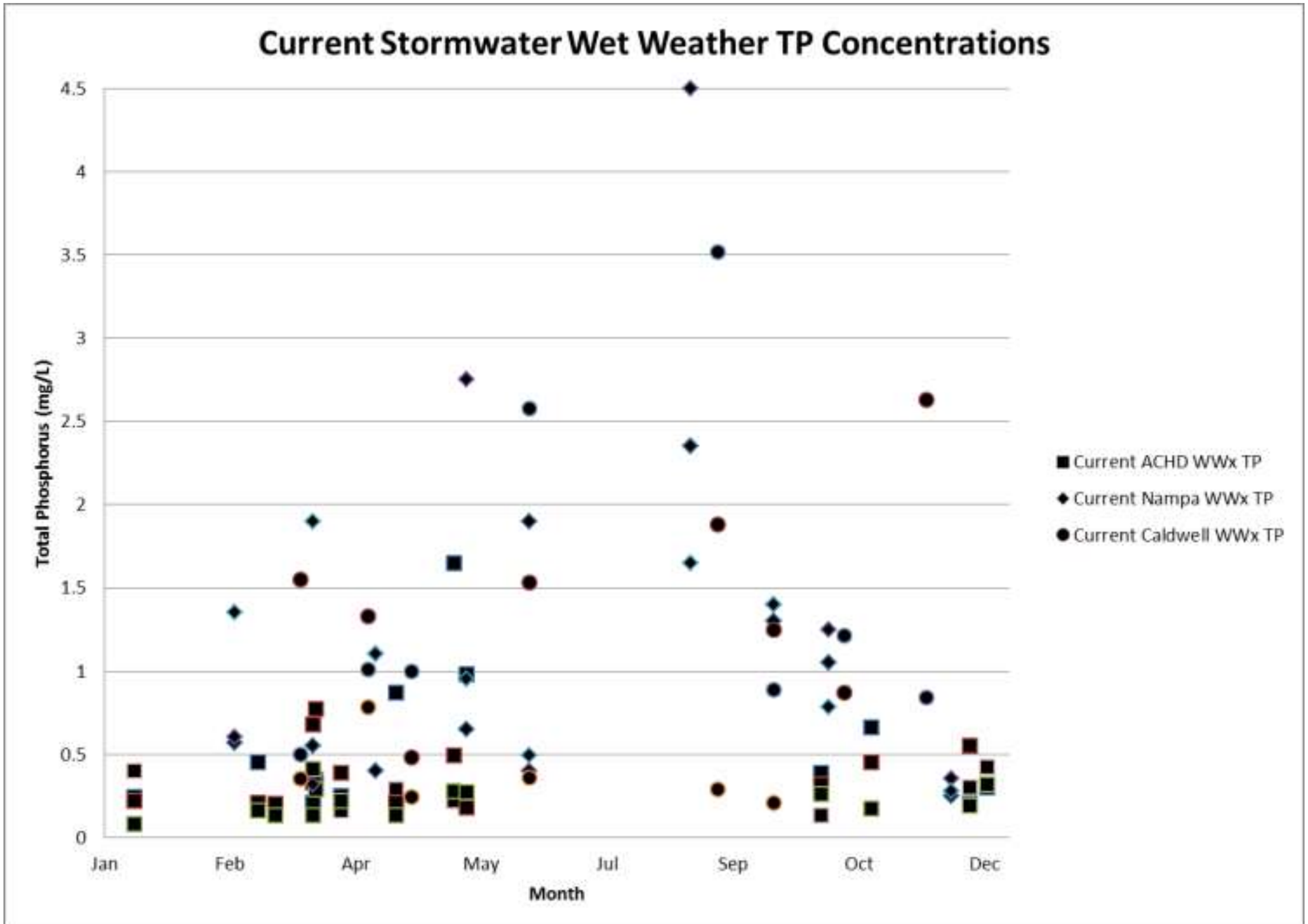


Figure 38. Current stormwater (wet weather) TP concentrations.

Table 27. Current May 1 – September 30 tributary TP discharge to the Lower Boise River.

Source Name	Lower Boise River Receiving River Mile (RM)[1]	Mean Discharge (cfs)[2]	Mean TP Concentration (mg/L)[2]	Mean TP Load (lbs/day)[2]
Boise River				
Eagle Drain	42.7	36.3	0.11	22.3
Dry Creek	42.5	6.5	0.16	5.6
Thurman Drain	41.9	15.0	0.11	8.6
Fifteenmile Creek	30.3	131.7	0.31	222.2
Mill Slough	27.2	104.9	0.21	118.2
Willow Creek	27.0	36.1	0.23	44.0
Mason Slough	25.6	13.0	0.22	15.4
Mason Creek	25.0	147.6	0.41	322.1
Hartley Gulch	24.4	39.2	0.27	57.4
Indian Creek	22.4	100.6	0.50	271.6
Conway Gulch	14.2	44.8	0.41	99.7
Dixie Drain	10.5	232.6	0.38	477.2
Total		**908.4**	**Mean = 0.34**	**1664.4**
Tributary Loads excluding WWTF TP Loads[3]	**May 1 – Sept 30**	**853.5**	**Mean = 0.25**	**1144.3**

[1] River Miles as identified by USGS in the lower Boise River Mass Balance Report (Etheridge 2013).
[2] Values calculated from USGS and ISDA data available from 1983 – 2013.
[3] Tributary flows and loads calculated by subtracting WWTF flows and loads.

Table 28. Current May 1 – September 30 ground water/unmeasured and background TP discharge to the Lower Boise River.

	Mean Flow (cfs)[2]	Mean TP Conc. (mg/L)	Mean TP Load (lbs/day)
Ground water & unmeasured[1]	-1390 to 485	0.21	-1573 to 562
Background[2]	37 to 317	0.018	68 to 317

[1] Ground water and unmeasured flows are estimated from the August 2012 USGS synoptic sampling and mass balance and professional judgment (Alex Etheridge, pers. comm. 2014). These flows and loads are estimated as negative under 10th percentile high flow conditions, as the flows and loads are absorbed into near-river terrestrial zones.
[2] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2).

Based on available information for each source, current loads by sector are presented in Table 29 and Figure 39.

DRAFT

Table 29. Current sector TP loads for the lower Boise River, May 1 – September 30, presented per day as monthly averages. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013).

Parma Flow	Current Background TP Inputs[1]		Current NPDES WWTF and Industry TP Inputs[2]			Current Fish Hatchery TP Inputs[3]			Current Tributary TP Inputs w/o NPDES Flows and Loads[4]			Current Ground Water TP Inputs[5]			Current Non-Stormwater Dry Weather TP Inputs[6]			Current Stormwater Wet Weather TP Inputs[7]			Current Total TP Inputs	TP Inputs Reaching Parma	Current Parma TP Load	Parma TP Load Reduction Needed
(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(lbs/day)	(%)	(lbs/day)	(%)
3268	0.018	317	85.3	3.27	1506	32	0.05	9	853	0.25	1144	-1390	0.21	-1573	168	0.44	394	30	0.44	71	1474	254%	3747	67%
912	0.018	88	85.3	3.27	1506	32	0.05	9	853	0.25	1144	164	0.21	186	168	0.44	394	30	0.44	71	3005	51%	1531	78%
705	0.018	68	85.3	3.27	1506	32	0.05	9	853	0.25	1144	300	0.21	340	168	0.44	394	30	0.44	71	3139	38%	1190	78%
624	0.015	50	84.0	3.18	1440	NA	0.06	9	888	0.18	880	485	0.21	562	168	0.44	394	No Storm Event			2942	34%	1010	77%
383	0.018	37	85.3	3.27	1506	32	0.05	9	853	0.25	1144	398	0.21	450	168	0.44	394	30	0.44	71	3218	23%	738	80%

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L. Long-term median data and the USGS 2012-2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.

[2] WWTF and industrial discharge data are calculated for May 1 – September 30, 2012, represented in Table 25. The USGS August 2012 synoptic sample data represent only WWTF contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).

[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 25.

[4] Tributary data were calculated by removing WWTF, industrial, and aquaculture flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).

[5] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).

[6] Non-stormwater (dry weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E). Current non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

[7] Stormwater (wet weather) contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E). These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).

*Note: The USGS-derived values highlighted in green are only for comparing the USGS mass balance data with long-term flow and load duration data and not for allocation purposes. The USGS August 2012 mass balance model estimated the total diversions as -1,590 cfs at 0.22 mg/L TP, resulting in 1,890 lbs/day.

DRAFT

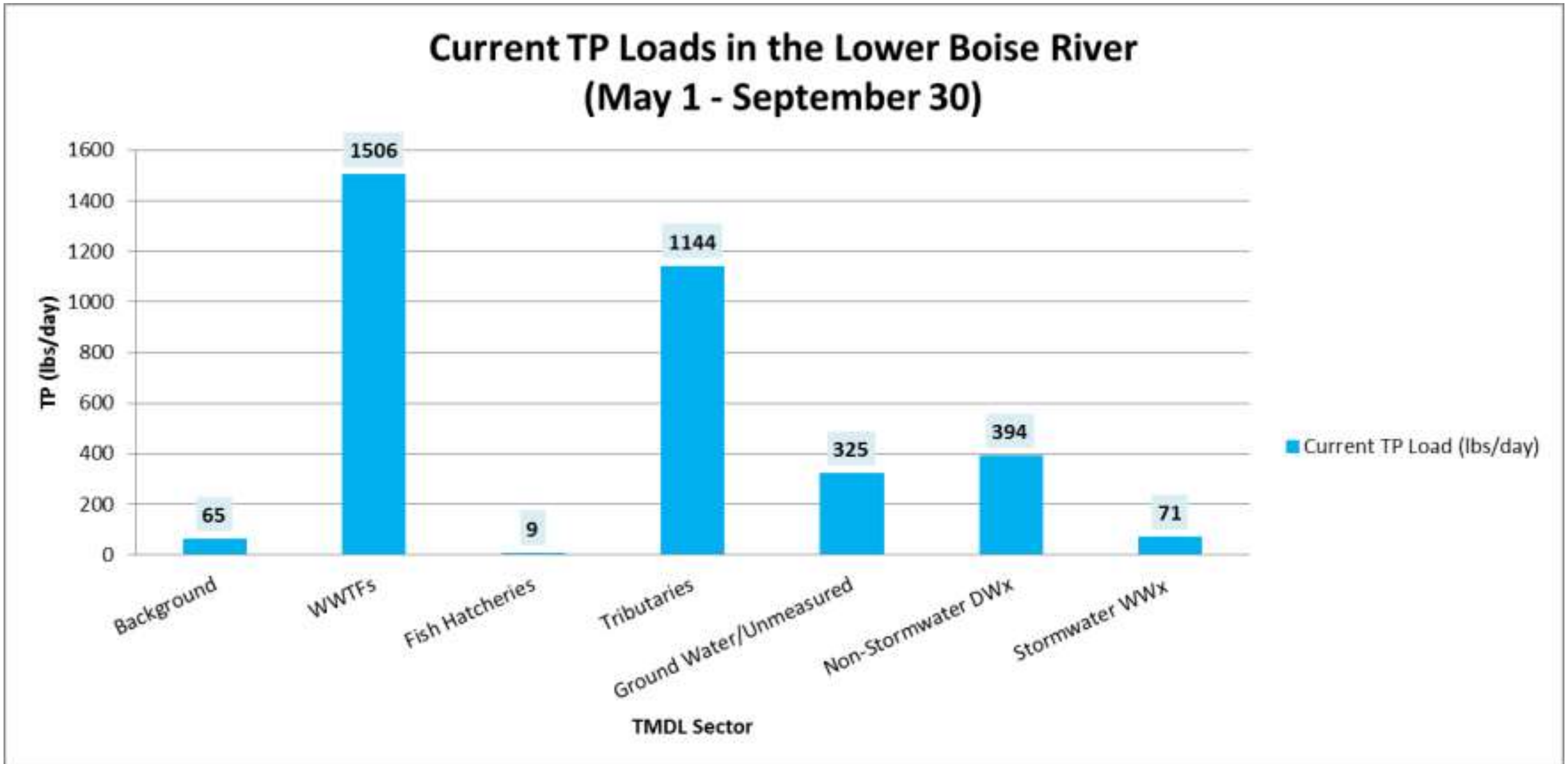


Figure 39. Current TP loads in the lower Boise River from May 1 – September 30, based on average daily total TP inputs of approximately 3121 lbs/day for the 90th, 60th, and 40th percentile flow conditions (the 10th flow conditions were omitted due to negative ground water flow and loading estimates).

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s.
* Non-stormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.3.2 Boise River and Mason Creek TP Loads (October 1 – April 30)

Background

A background TP concentration of 0.018 mg/L is based on the 2005 – 2013 USGS TP data (see Section 3.2.2).

NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities

Point source contributions were calculated from facility-supplied data and/or DMRs from October 1 –April 30, 2012-2013 (Table 30). This time period was chosen to utilize the most recent data available and accurately capture the current conditions. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios, and in turn are more dependent on factors such as population, service area, etc.

NPDES-Permitted Municipal Stormwater and Non-Stormwater

Existing stormwater (wet weather) TP contributions were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several workgroup meetings and correspondence (Table 31). These data were developed for October 1 – April 30 for MS4-permitted and non-permitted areas. Stormwater (wet weather) flows represent specific precipitation (storm) events that are not represented as part of the USGS October 2012 or March 2013 synoptic samples, and may be underrepresented in other long-term river monitoring data not specifically focusing on these short-term flows and loads.

Few non-stormwater (dry weather) data have been collected in the subbasin (Appendix E and Table 31). Non-stormwater (dry weather) flows and loads can come from a variety of sources, including but not limited to agricultural returns, shallow ground water, urban/suburban sources (e.g. lawn watering), and other unmeasured sources. Further, non-stormwater (dry weather) discharge is an inherent component of the tributary and ground water/unmeasured flows and loads within the USGS synoptic samples and mass balance models, as well as the long-term flow and load duration analyses.

For stormwater (wet weather) and non-stormwater (dry weather), it is assumed that loadings remain relatively independent of various Boise River flow conditions, and in turn are more dependent on factors such as population, service area, specific storm events, etc.

Nonpoint Source Tributary, Ground Water, and Unmeasured

Agricultural and other nonpoint source tributary contributions were calculated from available USGS and ISDA data for October 1 – April 30 from 1983 through 2013 (Table 32). This long-term data was selected due to temporal and spatial paucity of data and in order to moderate the intra- and inter-annual variation that can result from varying precipitation, runoff, temperature, and water use regimes. Flow, TP concentrations, and loads are also presented by removing the flows and TP loads attributed to NPDES-permitted facilities.

Ground water, unmeasured, and background contributions were calculated using data from the October 2012 and March 2013 synoptic sampling effort in the lower Boise River subbasin (Etheridge 2013) and professional judgment using the October 2012 and March 2013 lower

DRAFT

Boise River mass balance model to adjust ground water interactions in the lower Boise River under various flow scenarios (Alex Etheridge, pers. comm. 2014). This data represents the best and most current ground water and unmeasured flow data for the lower Boise River.

DRAFT

Table 30. Current permitted October 1 – April 30 point source TP discharge to the lower Boise River.

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Current Flow (MGD)[2]	Design Flow (MGD)	Mean TP Conc. (mg/L)[2]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[2]	Permitted TP Load (lbs/day)
Boise River - Main stem								
Lander WWTF	ID-002044-3	RM 50.0	12.24	15.0	1.77	No Limit	180.8	No Limit
West Boise WWTF	ID-002398-1	RM 44.2	14.65	24.0	4.94	No Limit	603.3	No Limit
Middleton WWTF	ID-002183-1	RM 27.1	0.41	1.83	4.37	No Limit	14.9	No Limit
Caldwell WWTF	ID-002150-4	RM 22.6	5.78	8.5	2.21	No Limit	106.6	No Limit
IDFG-Eagle	NPDES General Aquaculture Permit	RM 41.8	2.20	4.25	0.02	No Limit	0.4	No Limit
Boise River -Tributaries								
Avimor WWTF[4]	In Application	Dry Creek	In Application	0.42	No Discharge Currently			
Star WWTF	ID-002359-1	Lawrence Kennedy Canal (Mill Slough/Boise River)	0.49	1.85	1.34	No Limit	5.5	No Limit
Meridian WWTF[3]	ID-002019-2	Fivemile Creek (Fifteenmile Creek)	5.18	10.2	0.90	No Limit	38.7	No Limit
Sorrento Lactalis	ID-002803-7	Mason Creek	0.60	1.52	0.02	0.07/monthly avg 0.14/weekly avg	0.1	0.29/monthly avg 0.58/weekly avg
Nampa WWTF	ID-002206-3	Indian Creek	9.91	18.0	5.13	No Limit	424.1	No Limit
Kuna WWTF	ID-002835-5	Indian Creek	0.49	3.5	3.34	No Limit	13.8	No Limit
IDFG-Nampa[3]	IDG-130042 NPDES General Aquaculture Permit	Wilson Drain and Pond (Indian Creek)	21.52	19.38	0.07	No Limit	12.7	No Limit
Darigold	ID-002495-3	RM 22.6 (unmeasured	0.27	1.7	0.20	No Limit	0.4	No Limit

Source	NPDES Permit No.	Main stem RM[1] or Receiving Water	Current Flow (MGD)[2]	Design Flow (MGD)	Mean TP Conc. (mg/L)[2]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[2]	Permitted TP Load (lbs/day)
		drain)						
Notus WWTF	ID-002101-6	Conway Gulch	0.06	0.11	4.60	No Limit	2.2	No Limit
Wilder WWTF	ID-0020265	Wilder Ditch Drain	0.19	0.25	2.23	No Limit	3.6	No Limit
Greenleaf WWTF	ID-002830-4	West End Drain	0.06	0.24	0.06	No Limit	0.03	No Limit
ConAgra (XL4Star)[4]	ID-000078-7	Indian Creek	No Oct-Apr Discharge Currently	0.48	No Oct-Apr Discharge Currently	No Limit	No Oct-Apr Discharge Currently	No Limit
Total			**74.04**	**111.23**	**2.28**		**1407.14**	

[1] River Miles as identified by USGS in the Lower Boise River Mass Balance Report (Etheridge 2013). Darigold discharges to an unmeasured drain that discharges into the lower Boise River at or near RM 22.6.

[2] Calculated from October 1 – April 30, 2012 using data provided by facilities and/or DMR data.

[3] Meridian – Permitted flow was 7 when the NPDES permit was issued in 1999. The receiving water was commonly Fivemile Creek; however, the city is permitted to discharge to the south channel of the Boise River. Meridian's current design flows is 10.2 (mgd) and is used for allocations.

[4] The Avimor and ConAgra facilities did not discharge from October 1 – April 30. However, new NPDES permits allow October 1 – April 30 discharge.

DRAFT

Table 31. Current October 1 – April 30 MS4 stormwater (wet weather) and non-stormwater (dry weather) TP discharge to the lower Boise River[1].

Source	NPDES Permit No.	Area (miles)	Area Ratio[2]	Oct - Apr Stormwater Wet Weather Flow[3] (cfs)	Oct - Apr Stormwater Wet Weather Load[3] (lbs/day)		Oct – Apr Non-Stormwater Dry Weather Flow[4] (cfs)	Oct - Apr Non-Stormwater Dry Weather Load[4] (lbs/day)
Boise/Ada County MS4	IDS-028185 & IDS 027561	149	0.55					
Non-permitted Kuna and Star		44	0.16					
Canyon Hwy Dist #4 MS4	IDS-028134	8	0.03					
ITD District #3 (Eagle & Meridian)	IDS-028177	112 linear						
Middleton MS4	IDS-028100	2.3	0.01					
Nampa MS4	IDS-028126	25	0.09					
Nampa Hwy District MS4	IDS-028142	8.5	0.03					
Caldwell MS4	IDS-028118	17.5	0.06					
Non-permitted Notus-Parma MS4 (former MS4 IDS-028151)		2	0.01					
Non-permitted Greenleaf, Notus, Parma, Wilder		17	0.06					
	Total	**273.3**	**1.0**	**45.3**	**107.0**		**18.7**	**44.0**

[1] The stormwater (wet weather) and non-stormwater (dry weather) flow and load estimates were derived from data provided by the LBWC stormwater workgroup (Appendix E).
[2] Area ratio = the area contribution of each individual MS4 relative to the total service area for MS4s.
[3] Stormwater (wet weather) loads have an average TP concentration of approximately 0.44 mg/L as estimated by the LBWC stormwater workgroup (Appendix E). Storm water (wet weather) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4 systems.
[4] Non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin. Non-stormwater (dry weather) loads have an average TP concentration of approximately 0.44 mg/L as estimated by the LBWC stormwater workgroup (Appendix E). Current flows and loads are a subcomponent of, and not summed separately from, tributary and ground water/unmeasured discharge.

DRAFT

Table 32. Current October 1 – April 30 tributary TP discharge to the Lower Boise River.

Source Name	Lower Boise River Receiving River Mile (RM)[1]	Mean Discharge (cfs)[2]	Mean TP Conc. (mg/L)[2]	Mean TP Load (lbs/day)[2]
Boise River				
Eagle Drain	42.7	11.7	0.16	9.8
Dry Creek	42.5	14.6	0.13	9.9
Thurman Drain	41.9	8.2	0.14	6.1
Fifteenmile Creek	30.3	58.0	0.34	104.9
Mill Slough	27.2	56.0	0.20	60.3
Willow Creek	27.0	21.4	0.33	37.5
Mason Slough	25.6	5.8	0.36	11.1
Mason Creek	25.0	67.7	0.25	92.6
Hartley Gulch	24.4	10.7	0.31	17.9
Indian Creek	22.4	167.7	0.57	516.9
Conway Gulch	14.2	22.1	0.19	22.6
Dixie Drain	10.5	114.5	0.31	191.3
Total		**558.2**	**Mean = 0.36**	**1081.0**
Tributary Loads excluding WWTF TP Loads[3]		**498.6**	**Mean = 0.22**	**579.9**

[1] River Miles as identified by USGS in lower Boise River Mass Balance Report (Etheridge 2013).
[2] Values calculated from USGS and ISDA data available from 1983 – 2013.
[3] Tributary flows and loads calculated by subtracting WWTF flows and loads.

Table 33. Current October 1 – April 30 ground water/unmeasured and background TP discharge to the lower Boise River.

	Mean Flow (cfs)	Mean TP Conc. (mg/L)	Mean TP Load (lbs/day)
Ground water & unmeasured[1]	133 to 180	0.15	108 to 146
Background[2]	1,293	0.018	125

[1] Ground water and unmeasured mean flows are estimated from the October and March 2012-2013 USGS synoptic sampling and mass balance (Etheridge 2013), and the water balance used for the AQUATOX model.
[2] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2).

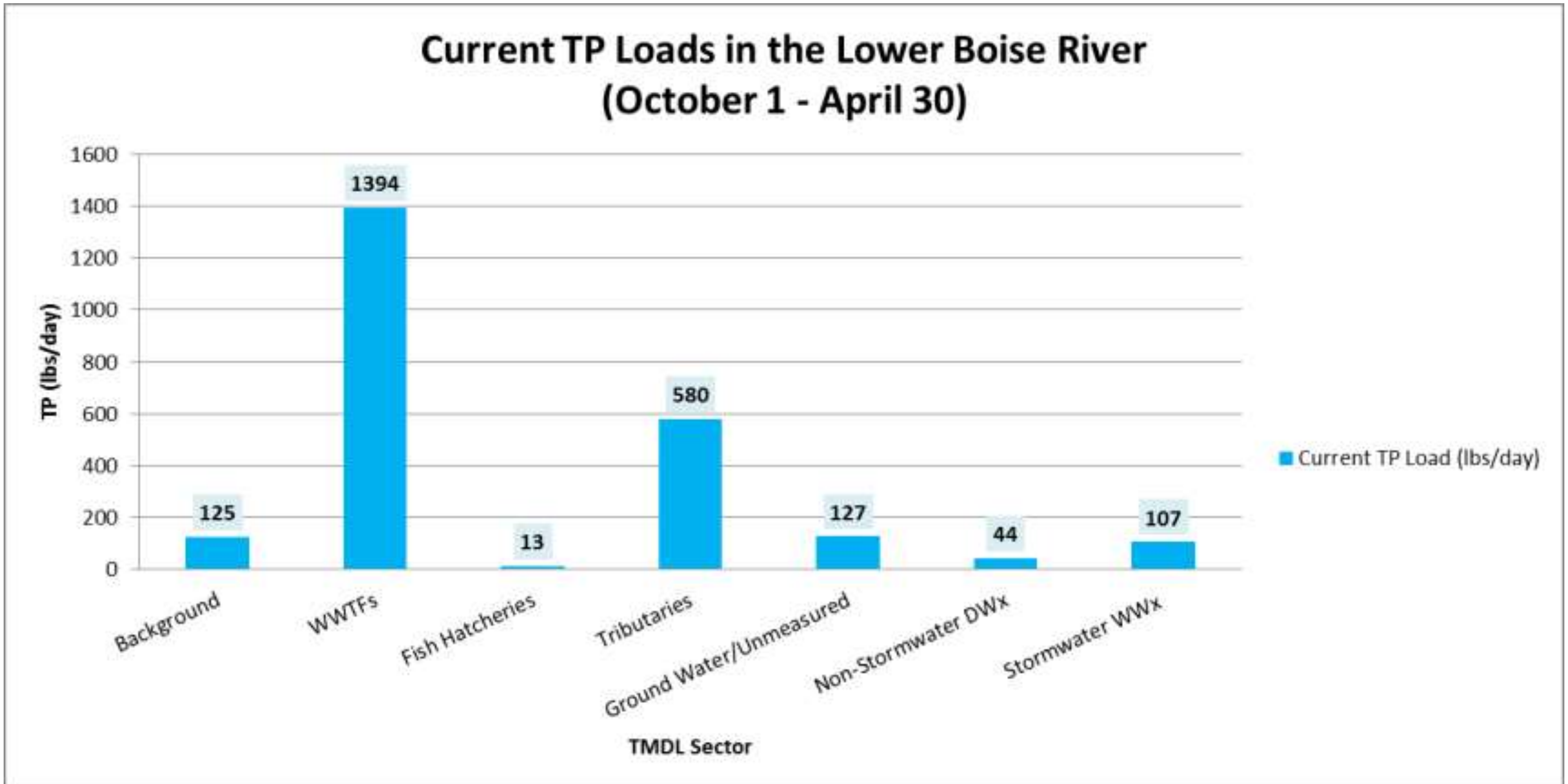


Figure 40. Current TP loads in the lower Boise River from October 1 – April 30, based on average daily total TP inputs of approximately 2302 lbs/day.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s.
* Non-stormwater (dry weather; DWx) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

5.3.3 Sand Hollow TP Loads (May 1 – September 30)

Table 34 and Table 35 present May 1 – September 30 point source and nonpoint source discharge, TP concentrations, and TP loadings into Sand Hollow Creek, a tributary to the Snake River.

Table 34. Current permitted May 1 – September 30 point source TP discharge to Sand Hollow (a tributary to the Snake River).

Source	NPDES Permit No.	Receiving Water	Mean Discharge (MGD)[1]	Design Flow (MGD)	Mean TP Conc. (mg/L)[1]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[1]	Permitted TP Load (lbs/day)
Parma WWTF	ID-002177-6	Sand Hollow (Snake River)	0.09	0.68	0.21	No Limit	0.15	No Limit

[1] Calculated from May 1 – September 30, 2012-2013 using data provided by facilities and/or DMR data.

Table 35. Current May 1 – September 30 nonpoint source TP discharge to Sand Hollow (a tributary to the Snake River).

Source Name	Receiving Water	Mean Discharge (cfs)[1]	Mean TP Conc. (mg/L)[1]	Mean TP Load (lbs/day)[1]
Nonpoint, ground water, background, and other unmeasured	Sand Hollow (Snake River)	140.8	0.4	302.6

[1] From ISDA and USGS for data available data from 1998 – 2013. This includes TP loading from the Parma WWTF.

DRAFT

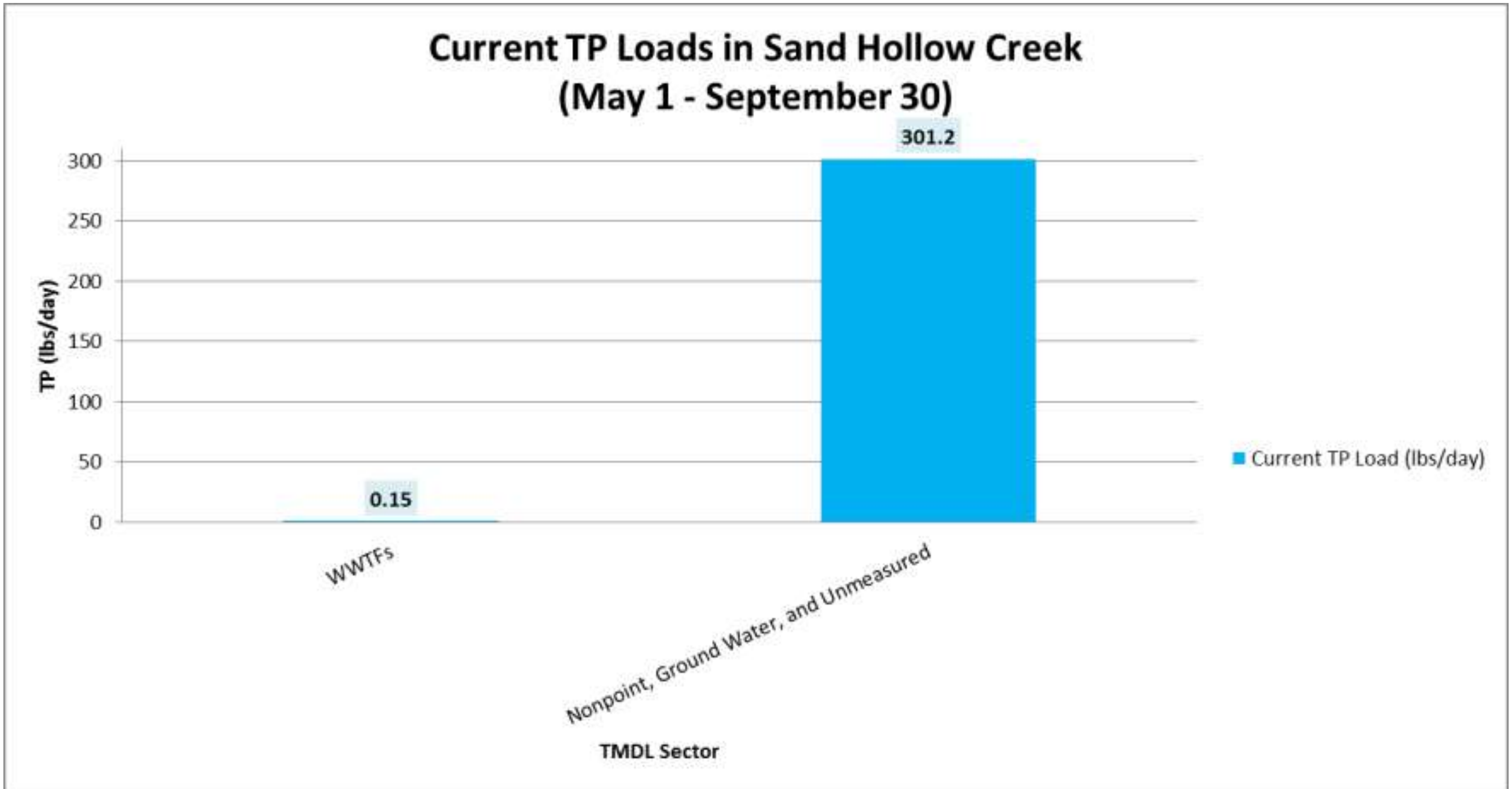


Figure 41. Current TP loads in Sand Hollow Creek May 1 – September 30, based on average daily total TP inputs of approximately 301 lbs/day.

5.3.4 Sand Hollow TP Loads (October 1 – April 30)

Table 36 and Table 37 present October 1 – April 30 point source and nonpoint source discharge, TP concentrations, and TP loadings into Sand Hollow Creek, a tributary to the Snake River.

Table 36. Permitted October 1 – April 30 point source TP discharge to Sand Hollow (a tributary to the Snake River).

Source	NPDES Permit No.	Receiving Water	Mean Discharge (MGD)[1]	Design Flow (MGD)	Mean TP Conc. (mg/L)[1]	Permitted TP Conc. (mg/L)	Mean TP Load (lbs/day)[1]	Permitted TP Load (lbs/day)
Parma WWTF	ID-002177-6	Sand Hollow (Snake River)	0.13	0.68	0.12	No Limit	0.1	No Limit

[1] Calculated from October 1 – April 30, 2012-2013 using data provided by facilities and/or DMR data.

Table 37. October 1 – April 30 nonpoint source TP discharge to Sand Hollow (a tributary to the Snake River).

Source Name	Receiving Water	Mean Discharge (cfs)[1]	Mean TP Conc. (mg/L)[1]	Mean TP Load (lbs/day)[1]
Nonpoint, ground water, background, and other unmeasured	Sand Hollow (Snake River)	63.6	0.33	113.3

[1] From ISDA and USGS for data available data from 1998 – 2013. This includes TP loading from the Parma WWTF.

DRAFT

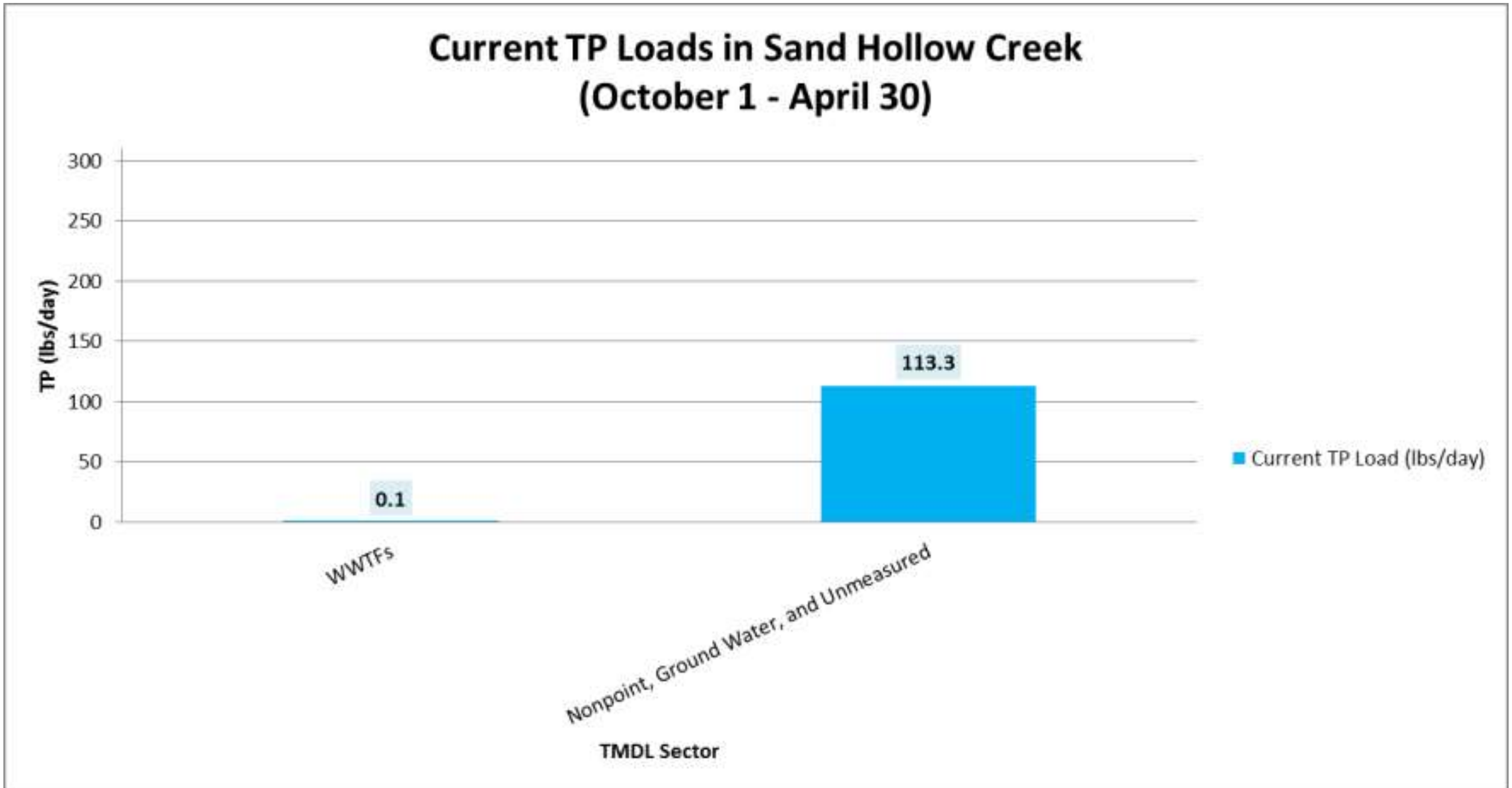


Figure 42. Current TP loads in Sand Hollow Creek from October 1 – April 30, based on average daily total TP inputs of approximately 113 lbs/day.

5.4 Load and Wasteload Allocations

The load and wasteload allocations include a margin of safety to take into account seasonal variability and uncertainty. Uncertainty arises in selection of water quality targets, load capacity, and estimates of existing loads, and may be attributed to incomplete knowledge or understanding of the lower Boise River managed system, such as assimilation, data gaps, or variability.

A detailed approach was used for the analysis and selection of the allocations, which include implicit and explicit margins of safety and take into account seasonal variability and uncertainty with the conservative assumptions built into the methodology (Section 5.4.4).[4] Considerations included equitable cost, cost effectiveness, and credit for prior efforts, but all within the ceiling of remaining available load to fully support existing beneficial uses. Each point source receives a wasteload allocation, whereas nonpoint source load allocation responsibilities are often varied (e.g. tributaries vs. ground water and unmeasured). The projected implementation timeframes are identified in section 5.5.1, and will be further evaluated in the subsequent implementation plan.

5.4.1 Boise River and Mason Creek TP Allocations to Achieve the SR-HC TMDL Target of $\leq$ 0.07 mg/L May 1 – September 30

- *May 1 – September 30: TP concentrations and TP load equivalent $\leq$ 0.07 mg/L in the lower Boise River near Parma to comply with the 2004 Snake River-Hells Canyon TMDL (and achieve the mean monthly periphyton target in the lower Boise River).*

The following analysis and allocations indicate that lower Boise River TP loadings near Parma must be reduced between approximately 81% to 83% from May 1 – September 30 in order to achieve the TP load equivalent target of $\leq$ 0.07 mg/L and comply with the mean monthly benthic chlorophyll a (periphyton) target of $\leq$ 150 mg/m^2 in the impaired AUs lower Boise River. Tables 38-44, Figure 43, and Figure 44 outline sector-wide and specific allocations that achieve both targets. As with the current loading estimates, there are several assumptions identified in the load and wasteload analyses to help achieve the May 1 – September TP and periphyton targets.

Background

Background TP concentration of 0.018 mg/L is based on the 2005 – 2013 USGS TP data at Diversion Dam, with detection levels of 0.01 mg/L (see Section 3.2.2).

To achieve the May 1 – September 30, 0.07 mg/L TP target near Parma and the 150 mg/m^2 mean monthly periphyton target, this sector received load allocations of 37 to 317 lbs/day (0.018 mg/L) TP for various flow conditions (0% reduction).

DRAFT

---

[4] Note: Given the complexity of the LBR managed watershed, through the implementation process and the TMDL 5-year review, WLAs and LAs established in this TMDL may be reevaluated as additional data become available.

NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities

Point source allocations are calculated for facility design flows from May 1 – September 30. It is assumed that point source loadings remain relatively independent of various Boise River flow scenarios, and in turn are more dependent on factors such as population, service area, etc.

To achieve the May 1 – September 30, 0.07 mg/L TP target near Parma and the 150 mg/m^2 mean monthly periphyton target, this sector received wasteload allocations of 73 lbs/day (0.1 mg/L) TP for all flow conditions (95% reduction).

NPDES Permitted Municipal Stormwater and Non-Stormwater

Stormwater (wet weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E) through several meetings and correspondence. Non-stormwater (dry weather) allocations are derived as a subcomponent of the tributary and ground water/unmeasured discharge, which must achieve a 0.07mg/L TP load equivalent in order help achieve the May 1 – September 30 TP target of 0.07 mg/L near Parma. Stormwater (wet weather) and non-stormwater (dry weather) allocations are for MS4-permitted and non-permitted areas. And it is assumed that these loadings remain relatively independent of various Boise River flow scenarios, and in turn are more dependent on factors such as population, service area, storm events, etc.

To achieve the May 1 – September 30 TP target of 0.07 mg/L near Parma and the 150 mg/m^2 mean monthly periphyton target, stormwater (wet weather) load and wasteload allocations represent a 42% load reduction from current conditions. Non-stormwater (dry weather) allocations represent an 84% load reduction, which is the percent load reduction needed to achieve a TP load equivalent of 0.07 mg/L under current flow conditions for each MS4. These allocations are further broken down into the following subcategories:

- Stormwater (wet weather) in MS4-permitted areas:
  - Average daily *wasteload allocations* as a 42% TP load reduction

- Stormwater (wet weather) in non-MS4 permitted areas:
  - Average daily *load allocations* as a 42% TP load reduction

- Non-stormwater (dry weather) in MS4-permitted areas:
  - Average daily *wasteload allocations*[5] as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions

- Non-stormwater (dry weather) in non-MS4 permitted areas:
  - Average daily *load allocations* as an 84% TP load reduction equivalent to 0.07 mg/L under current flow conditions

[5] To the extent that non-stormwater (dry weather) discharges are the result of non-point source activities (i.e., groundwater infiltration, irrigation pass-through and other non-storm water flows that are not part of the allowed discharge under the MS4 NPDES permit), they are assigned a load allocation.

DRAFT

Stormwater (wet weather) and non-stormwater (dry weather) estimates and allocations are based on limited data and conservative assumptions. Further, these TP allocations and/or their use in NPDES permits may need to be adjusted as MS4/urban/agriculture boundaries and land uses change in the lower Boise River subbasin.

The plumbing of MS4 systems is intricate, and the exact quantity of the non-stormwater inputs is presently unknown. However, MS4 permittees have provided initial estimates for the percentage of their non-stormwater discharge that originates from nonpoint-sources (Table 38). These estimates should be refined through monitoring and mapping in future permit cycles and as part of the TMDL implementation.

Table 38. Estimates for the percentage of non-stormwater (dry weather) MS4 discharge attributable to non-point sources. These estimates are very approximate, and are based on professional judgment, rather than hard data.

Facility	NPDES Permit No.	Non-Stormwater (dry-weather) Discharge Attributable to Nonpoint-Sources (%)
Boise/Ada County MS4	IDS-028185 & IDS 027561	?[2]
Non-permitted[1] Kuna and Star		100%
Canyon Hwy Dist #4 MS4	IDS-028134	100%
ITD District #3 (Eagle & Meridian)	IDS-028177	?[2]
Middleton MS4	IDS-028100	?[2]
Nampa MS4	IDS-028126	99%
Nampa Hwy District MS4	IDS-028142	0%
Caldwell MS4	IDS-028118	98%
Non-permitted[1] Notus-Parma MS4 (former MS4 IDS-028151)		100%
Non-permitted[1] Greenleaf, Notus, Parma, Wilder		100%
Industrial Facilities	Multi-Sector General Permit	0%
Construction Activities	Construction General Permit	0%
Confined Animal Feeding Operations	IDG010000	0%

[1] The “Non-permitted” areas receive 100% load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.
[2] Estimates have not been received for these MS4 systems at the time of release for this draft TMDL.

The following issues and concerns are identified and discussed to provide a better understanding of how loads are represented and allocations are applied within the TMDL:

- Concentration vs Load

DRAFT

  - It is generally understood that attempting to achieve a concentration target at point of discharge for stormwater is difficult and costly. For this reason, most stormwater management BMPs are designed and implemented to reduce loads for each MS4. To facilitate implementation, allocations are expressed as a percent reduction from the baseline that can then be translated into management practices.
  - Many BMPs remove only 10 to 45 percent of influent phosphorus loads, and therefore it may be technically or economically difficult to treat all stormwater runoff from a locality or achieve large loading reductions through the use of BMPs alone. For these reasons, the stormwater (wet weather) load reductions should be interpreted as an appropriate goal on an MS4 basis, based on a reasonable level of effort in individual permit terms.
  - The stormwater (wet weather) wasteload allocations are based on existing loads, recognizing that retrofitting the existing infrastructure may require considerable time and resources. Runoff from new urban development will need to be managed carefully, using appropriate BMPs and consistent with the overall TP reduction goals.
- Low Frequency of Storms
  - Because stormwater (wet weather) loads are precipitation-driven and can vary by orders of magnitude depending on the location and/or event, one number will often not represent an adequate daily load value. To better account for allowable differences in loading due to flow-related conditions, stormwater (wet weather) wasteload allocations in this TMDL represent average daily TP load reductions, but acknowledge that higher maximum daily loads can occur and still achieve the per day monthly average target discharge.
    i. There is a relatively low frequency occurrence of storms with only about 40 annual events causing runoff producing volumes. And, while the lowest occurrence is during the summer, precipitation and runoff rates can exceed average.
  - Stormwater (wet weather) flows result from specific precipitation (storm) events, that are not represented as part of the USGS August 2012 synoptic sample, and may be underrepresented in other long-term data not specifically focusing on these flows and loads.
- Permittees and Non-Permittees
  - In situations where a stormwater (wet weather) or non-stormwater (dry weather) source is not currently regulated by a permit but may become part of a permitted area in the future, the allocation is currently expressed load allocation. The load allocation could later be deemed a wasteload allocation if the stormwater (wet weather) or non-stormwater (dry weather) discharge for the source were required to obtain NPDES permit coverage or become annexed into an existing MS4.
  - Therefore, current non-permittees within regulated areas (e.g. Meridian, Eagle, unincorporated urbanized Ada County, and Southwest Boise) and unregulated areas are included as load allocations in the TMDL because these jurisdictions have regulatory authority over private and municipal properties that are potential sources of stormwater runoff.
- Non-Stormwater (Dry Weather)

DRAFT

- In this TMDL analysis, the non-stormwater (dry weather) flows and loads are implicitly measured as a subcomponent of the tributary and ground water/unmeasured discharge.
- Non-stormwater (dry weather)can originate from a variety of sources, including but not limited to agricultural returns, shallow ground water, urban/suburban sources (e.g. lawn watering), and other unmeasured sources.
- Due to non-stormwater (dry weather) being estimated as an inherent component of tributaries and ground water/unmeasured in this TMDL analysis, the sector received an allocation equivalent of 0.07 mg/L TP for current flow conditions, which is the same allocation for the tributaries and ground water/unmeasured.
- The non-stormwater (dry weather) TP reductions could be achieved through load reductions, offsets/trading, reuse, and other BMPs targeting phosphorus reductions, increased attention to on-site stormwater inspection, maintenance, and public education.

Nonpoint Source Tributary, Ground Water, and Unmeasured

Agricultural and other nonpoint source tributary allocations were calculated from available USGS and ISDA data for May 1 – September 30 from 1983 through 2013, and removing the design flows and TP loads attributed to NPDES-permitted facilities. To achieve the May 1 – September 30 TP target of 0.07 mg/L near Parma and the 150 mg/m^2 mean monthly periphyton target, this sector received allocations of 310 lbs/day (0.07 mg/L) TP for all flow conditions (73% reduction).

Ground water and unmeasured flows were calculated from the 2012 August synoptic sampling effort in the lower Boise River subbasin (Etheridge 2013) and professional judgment using the August 2012 lower Boise River mass balance model to adjust ground water interactions in the lower Boise River under various flow scenarios (Alex Etheridge, pers. comm. 2014). To achieve the May 1 – September 30, 0.07 mg/L TP target near Parma and the 150 mg/m^2 mean monthly periphyton target, this sector received allocations of -524 to 183 lbs/day (0.07 mg/L) TP for various flow conditions (67% reduction).

Additional Assumptions

Because the USGS mass balance model does not account for varying flow and TP relationships in the subbasin, upon recommendation from the USGS model developer (Alex Etheridge, pers. comm. 2014), the USGS mass balance model was not utilized to set TP allocations near Parma under adjusted flows scenarios. The USGS mass balance model was used, however, for initial sensitivity analysis of TP concentration inputs under twelve scenarios. The analysis was insightful for narrowing the range of potential load and wasteload allocations under current conditions (Etheridge 2014), indicating that nonpoint and unmeasured discharges may need to be reduced to concentrations of 0.07 mg/L due to the magnitude of the loadings, whereas point sources may need to be reduced to concentrations of 0.30 mg/L. These findings are useful starting points for the subsequent load duration and AQUATOX modeling, and demonstrate the significance of reducing nonpoint and unmeasured discharges to achieve the targets during the May 1 – September 30 timeframe.

DRAFT

DRAFT

Table 39. TP loads, capacities, and water quality targets for May 1 – September 30, presented as daily averages. These are calculated for: 1) the Boise River near Parma; 2) Mason Creek, a lower Boise River tributary, and: 3) Sand Hollow, a Snake River tributary.

Water Body[1]	Flow[2] (cfs)	Flow Rank (%)	Current Load[2]		Load Capacity[3]			Water Quality Targets[3]			
			TP Conc. (mg/L)	TP Load (lbs/day)	Target TP Conc. (mg/L)	Target TP Load (lbs/day)	Target TP Load Reductions (lbs/day [%])	TP Allocations[3] (lbs/day)	TP Load Reductions[3] (lbs/day)	TP Conc. (mg/L)	TP Load Reductions[3] (%)
Lower Boise River near Parma – (AU 001_06)											
	3268	10th	0.21	3747	0.07	1233	-2514 (67%)	601	-3146	0.034	84%
	912	40th	0.31	1531	0.07	344	-1187 (78%)	303	-1228	0.062	80%
	705	60th	0.31	1190	0.07	266	-924 (78%)	237	-953	0.062	80%
USGS August Synoptic Sample[4]	624	69th	0.30	1010	0.07	235	-775 (77%)	224	-786	0.067	78%
	383	90th	0.36	738	0.07	145	-593 (80%)	145	-593	0.070	80%
Mason Creek – (AU 006_02) (Tributary to the lower Boise River)											
	148	Mean	0.41	322	0.07	56	-266 (82%)	56	-266	0.07	82%
Sand Hollow – (AU 017_06) (Tributary to the Snake River)											
	141	Mean	0.4	303	0.07	53	-250 (83%)	53	-250	0.07	83%

[1] All assessment units (AUs) begin with ID17050114.
[2] Lower Boise River – based on a data from May 1 – September 30, 1987 through 2012 and duration curves with water quality targets.
Mason Creek – based on USGS and ISDA mean data from May 1 – September 30, 1995 through 2012.
Sand Hollow – based on USGS and mean data from May 1 – September 30, 1998 through 2012.
[3] Lower Boise River - load capacities and water quality targets are applied near Parma, using duration curves.
Mason Creek and Sand Hollow Creek – mean load capacities and water quality targets calculated and applied as instream conditions.
[4] Lower Boise River flows, TP concentrations, and loads highlighted in green are derived from the USGS August 2012 synoptic sample (Etheridge 2013). These USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

DRAFT

Table 40. Gross load and wasteload allocations by sector for the lower Boise River, May 1 – September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits. The green highlight represents data derived from the USGS August 2012 mass balance model for the lower Boise River (Etheridge 2013). See Section 5.4.1 for further description of the TP allocation development.

Parma Flow	Background TP Allocations[1]		NPDES WWTF and Industry TP Allocations[2]			Fish Hatchery TP Allocations[3]			Tributary TP Allocations w/o NPDES Flows and TP Loads[4]			Ground Water TP Allocations[5]			Non-Stormwater Dry Weather TP Allocations[6]			Stormwater Wet Weather TP Allocations[7]			TP Input Allocations	TP Inputs Reaching Parma	Parma TP Load w/ Allocations	Parma TP Load Reduction
(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(cfs)	(mg/L)	(lbs/day)	(lbs/day)	(%)	(lbs/day)	(%)
3268	0.018	317	135.6	0.10	73	37	0.10	20	822	0.070	310	-1390	0.070	-524	84% Load Reduction			42% Load Reduction			236	254%	601	84%
912	0.018	88	135.6	0.10	73	37	0.10	20	822	0.070	310	164	0.070	62	84% Load Reduction			42% Load Reduction			594	51%	303	80%
705	0.018	68	135.6	0.10	73	37	0.10	20	822	0.070	310	300	0.070	113	84% Load Reduction			42% Load Reduction			625	38%	237	80%
624	0.015	50	120.0	0.10	65	34	0.10	18	888	0.070	335	485	0.070	183	84% Load Reduction			No Storm Event			651	34%	224	78%
383	0.018	37	135.6	0.10	73	37	0.10	20	822	0.070	310	398	0.070	150	84% Load Reduction			42% Load Reduction			631	23%	145	80%

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2). Long-term median data and the USGS 2012-2013 synoptic data (Etheridge 2013) indicate background concentrations of 0.02 and 0.015 mg/L.
[2] WWTF and industrial discharge data are based on facility design flows, represented in Table 25. The USGS August 2012 synoptic sample data represent only WWTF contributions from Lander, West Boise, Meridian, Middleton, Nampa, and Caldwell facilities (Etheridge 2013).
[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 25.
[4] Tributary data were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries. The USGS August 2012 synoptic sample calculated tributaries by removing the contributions from only the Meridian and Nampa facilities (Etheridge 2013).
[5] The USGS August 2012 mass balance model was used to adjust ground water flows, including ground water loss (-1315) under various river flow scenarios (Alex Etheridge, pers. comm. 2014). The USGS August 2012 synoptic identified ground water flows as 485 cfs with 0.21 mg/L concentration (Etheridge 2013).
[6] Non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E), and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
[7] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Appendix E), and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events and were not captured as part of the USGS August 2012 synoptic sample (Etheridge 2013).
* Note: The USGS-derived values are only for comparing the USGS mass balance data with long-term flow and load duration data and not for TP allocation purposes.

DRAFT

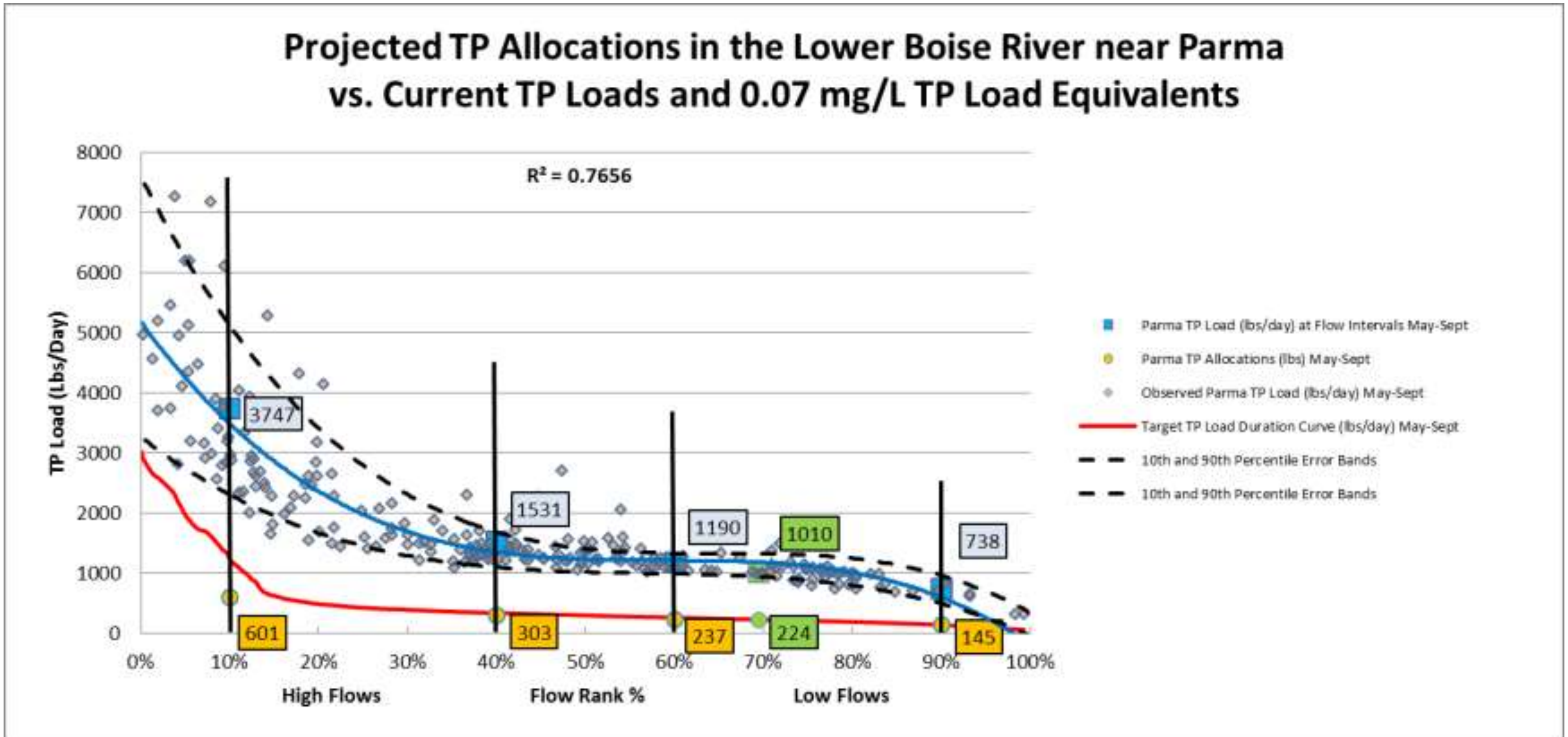


Figure 43. TP allocation targets (orange markers and labels) for the lower Boise River near Parma, relative to current TP loads (blue markers and labels) and the TP target load equivalent of ≤ 0.07 mg/L (red line). The green markers and labels represent the loads derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).

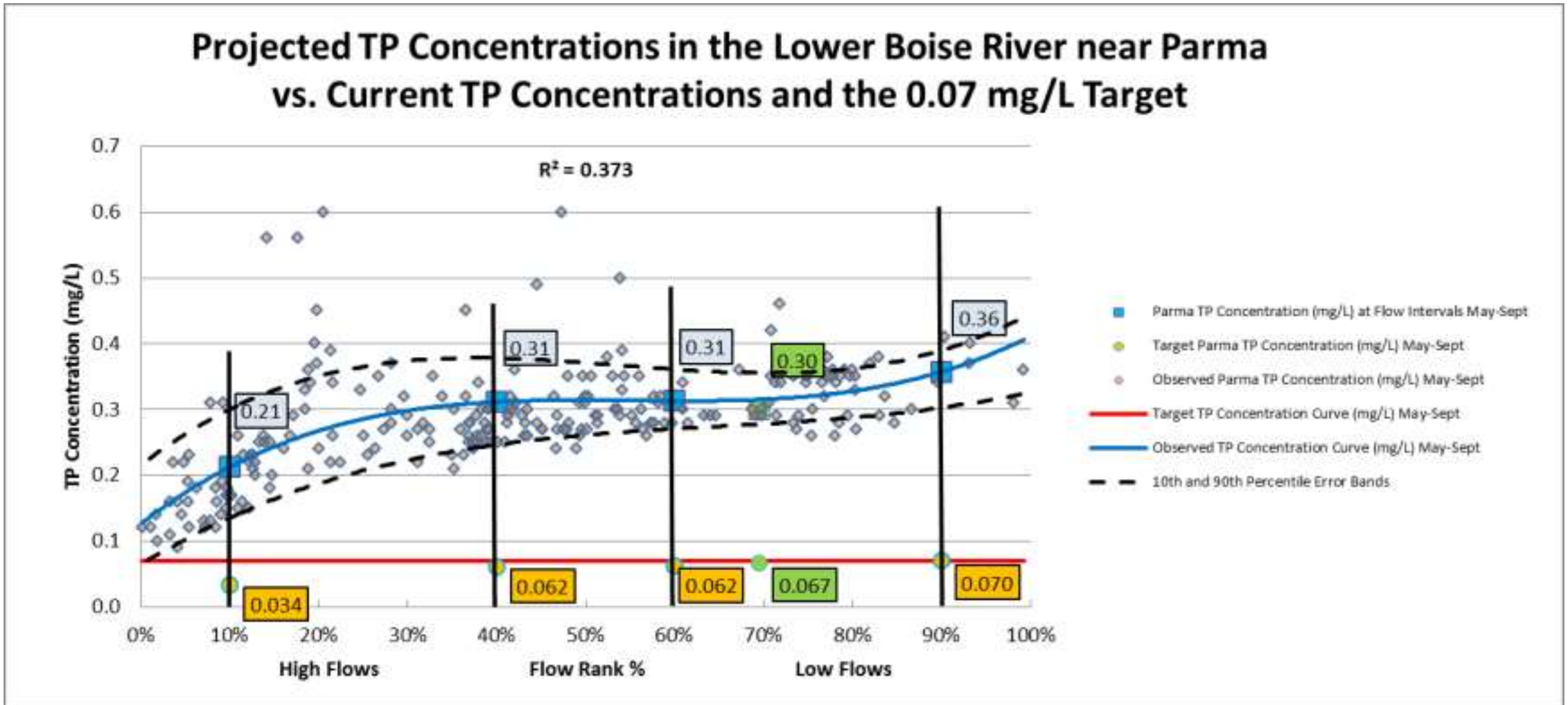


Figure 44. TP concentration targets (orange markers and labels) for the lower Boise River near Parma, relative to Current TP concentrations (blue markers and labels) and TP target concentration of $\leq$ 0.07 mg/L (red line). The green markers and labels represent the current load derived from the USGS August 2012 synoptic sampling event (Etheridge 2013).

Table 41. Gross load and wasteload allocations by sector for the lower Boise River, May 1 – September 30, presented per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

	Average Daily Background TP[1]	Average Daily NPDES WWTF and Industry TP[2]	Average Fish Hatchery TP[3]	Average Tributary (w/o NPDES Flows and Loads) TP[4]	Average Ground Water and Unmeasured TP[5]	Average Non-Stormwater Dry Weather TP[6]	Average Stormwater Wet Weather TP[7]
Current TP Conc. (mg/L)	0.018	3.27	0.05	0.25	0.21	n/a	n/a
Current TP Load (lbs/day)	65	1506	9	1144	325	394	71
Target TP Conc. (mg/L)	0.018	0.1	0.1	0.07	0.07	n/a	n/a
TP Allocation (lbs/day)	65	73	20	310	108	n/a	n/a
Percent Reduction (%)	**0%**	**-95%**	**110%**	**-73%**	**-67%**	**-84%**	**-42%**

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2).
[2] WWTF and industrial discharge data are based on facility design flows, represented in Table 25.
[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 25 .
[4] Tributary data (Table 27) were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
[5] The USGS August 2012 mass balance model was used to estimate average ground water flows. The 10th percentile flows were excluded from analyses due to predicted ground water loss (-1315 cfs).
[6] Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 26 and Appendix E) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
[7] Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 26 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

DRAFT

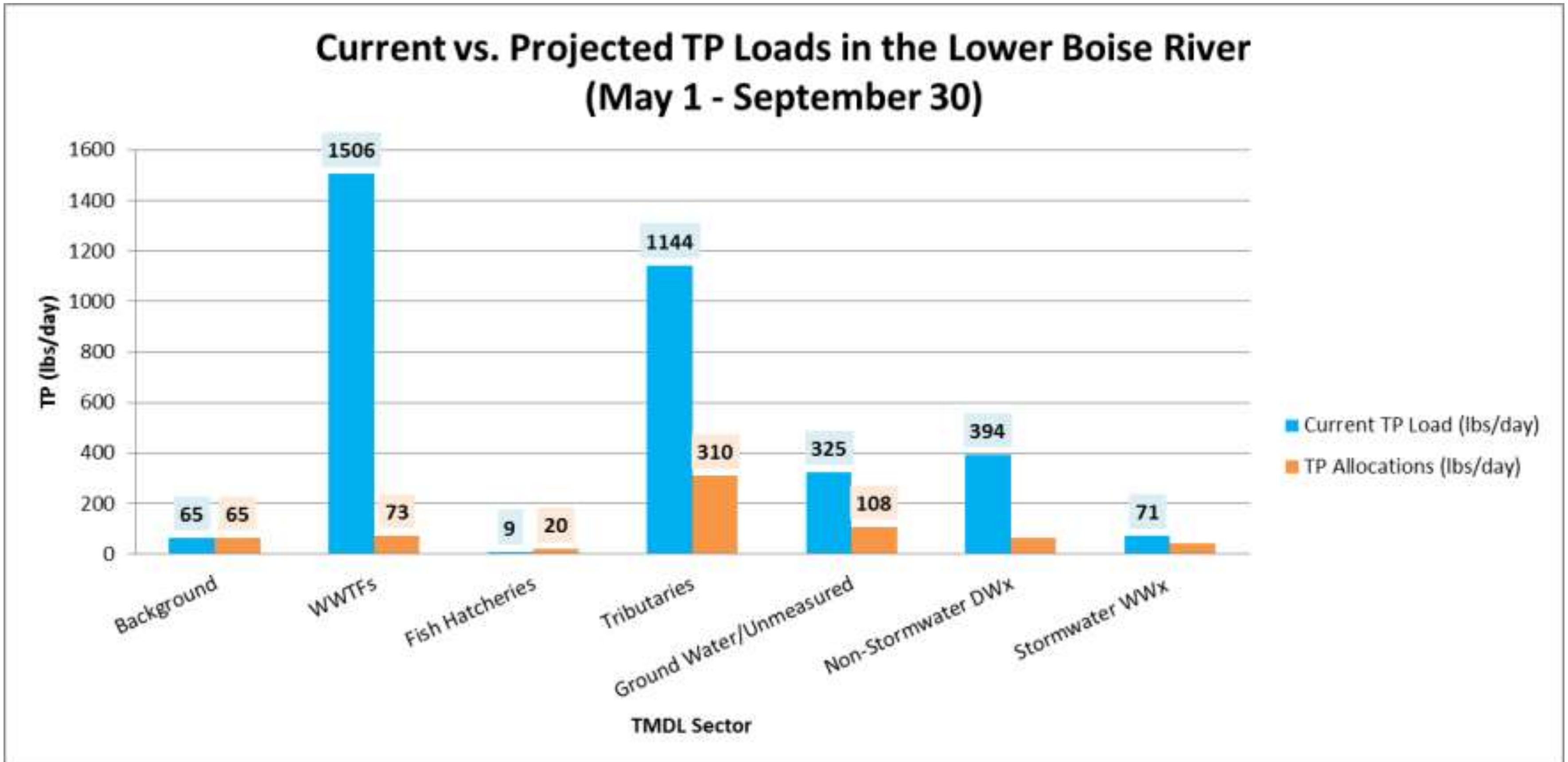


Figure 45. Current vs. projected TP loads for the lower Boise River from May 1 – September 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 42% TP load reduction on average across all MS4s.
* Non-stormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

Table 42 identifies facility-specific point source TP wasteload allocations, Table 43 identifies stormwater load and wasteload allocations, Table 44 and Table 45 identify the nonpoint source load allocations for the lower Boise River tributaries, natural background, ground water and unmeasured.

DRAFT

Table 42. Point source wasteload allocations for the lower Boise River, May 1 – September 30. Wasteload **allocations at TP concentrations of 0.1 mg/L are presented per day as monthly averages[1,2] DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.**

Point Source	Current Flow (MGD)	Design Flow (MGD)	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Average TP Allocation[1] (lbs/day)	Average TP Load Reduction[1] (%)
Boise River - Main stem						
Lander Street WWTF	12.71	15	2.10	222.7	12.5	-94%
West Boise WWTF	16.10	24	4.47	600.5	20.0	-97%
Middleton WWTF	0.57	1.83	3.23	15.4	1.5	-90%
Caldwell WWTF	7.90	8.5	2.37	156.2	7.1	-96%
IDFG Eagle	2.95	4.25	0.02	0.6	3.6	+500%
Boise River – Tributary						
Avimor WWTF – Dry Creek	No Discharge Currently	0.42	No Discharge Currently	No Discharge Currently	0.35	No Discharge Currently
Star WWTF – Lawrence-Kennedy Canal	0.63	1.85	1.85	9.7	1.5	-84%
Meridian WWTF – Fivemile Creek	5.87	10.2	1.26	61.6	8.5	-86%
Meridian WWTF – Boise River						
Sorrento Lactalis – Purdham Drain	0.7	1.52	0.03	0.2	1.3	+738%
Nampa WWTF – Indian Creek	10.51	18.0	4.97	435.8	15.0	-97%
Kuna WWTF – Indian Creek	0.47	3.5	0.04	0.2	2.9	+1766%
IDFG Nampa – Indian Creek	17.85	19.38	0.06	8.8	16.2	+84%
Darigold – unmeasured drain	0.22	1.7	0.31	0.6	1.4	+149%
Notus WWTF – Conway Gulch	No Discharge Currently	0.11	No Discharge Currently	No Discharge Currently	0.09	No Discharge Currently
Wilder WWTF – Wilder Ditch Drain	0.07	0.25	6.02	3.3	0.21	-94%
Greenleaf WWTF – West End Drain	No Discharge Currently	0.24	No Discharge Currently	No Discharge Currently	0.20	No Discharge Currently
ConAgra (XL 4 Star) –Indian Creek	No Discharge Currently	0.48	No Discharge Currently	No Discharge Currently	0.40	No Discharge Currently
Total	**76.5**	**111.2**	**2.37**	**1515.5**	**92.8**	**-94%**

[1] The WLAs and load reductions are estimates that achieve the ≤ 0.07 TP target in the lower Boise River for the 90th percentile low flow conditions for May 1 – September 30, 1987 through 2012 near Parma, and are applied to all flows in order to also achieve the lower Boise River mean monthly periphyton target (see Section 5.4.3).

DRAFT

[2] It is expected that all NPDES point source facilities will achieve the wasteload allocation targets within compliance schedules granted by DEQ and approved by EPA. Achieving the wasteload allocation targets are expected to occur through enhanced technology and/or water quality trading. This TMDL addendum provides opportunity for potentially re-opening NPDES permits, by providing new water quality information.

DRAFT

Table 43. Point source stormwater (wet weather) and non-stormwater (dry weather) TP allocations for MS4-permitted and non-permitted areas of the lower Boise River, May 1 – September 30. Wasteload and load allocations are presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as percent load reductions for average monthly limits in NPDES permits[1].

Source	NPDES Permit No.	Area (miles)	Area Ratio[2]	Current Stormwater Wet Weather Avg TP Load[4] (lbs/day)	Stormwater Wet Weather Avg TP Wasteload Allocation[4,5] (% Reduction)		Current Non-Stormwater Dry Weather Avg TP Load[6] (lbs/day)	Non-Stormwater Dry Weather Avg TP Allocation[6,7] (% Reduction)
Boise/Ada County MS4	IDS-028185 & IDS 027561	149	0.55	Current Load = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39	42% Load Reduction = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39 x 0.42		Current Load = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39	84% Load Reduction = $Q_{current}$ (cfs) x 0.07 (mg/L) x 5.39
Non-permitted[3] Kuna and Star		44	0.16					
Canyon Hwy Dist #4 MS4	IDS-028134	8	0.03					
ITD District #3 (Eagle & Meridian)	IDS-028177	112 linear						
Middleton MS4	IDS-028100	2.3	0.01					
Nampa MS4	IDS-028126	25	0.09					
Nampa Hwy District MS4	IDS-028142	8.5	0.03					
Caldwell MS4	IDS-028118	17.5	0.06					
Non-permitted[3] Notus-Parma MS4 (former MS4 IDS-028151)		2	0.01					
Non-permitted[3] Greenleaf, Notus, Parma, Wilder		17	0.06					
	Total	**273.3**	**1.0**		**-42%**			**-84%**

[1] Stormwater (wet weather) and non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E). DEQ intends that wasteload allocations are to be expressed as monthly average limits in NPDES permits.
[2] Area ratio = the area contribution of each individual MS4 relative to the total service area for MS4s.
[3] The "Non-permitted" areas receive load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.
[4] Stormwater (wet weather) allocations represent a 42% average TP load reduction on average across all permitted and non-permitted MS4 areas. The gross current TP load estimate is 71 lbs/day, with a reduction to 41 lbs/day. In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is standard conversion factor (Hammer 1986).
[5] Higher maximum daily stormwater (wet weather) target loads may exceed average daily loads and still allow MS4s to comply with the load and wasteload reductions.

DRAFT

[6] Non-stormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and non-permitted MS4 areas in order to achieve a 0.07 mg/L TP load equivalent under current flows. The gross current TP load estimate is 394 lbs/day, with a reduction to 63 lbs/day (non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations). In the wasteload allocation equation, Qcurrent (cfs) is current baseline discharge, Ccurrent (mg/L) is current baseline TP concentration, and 5.39 is a standard conversion factor (Hammer 1986).

[7] It is DEQ's intent to include in the MS4 wasteload allocation, only that non-storm water that is categorized as allowable under the MS4 NPDES permit, and to treat other non-storm water flow as a nonpoint source. If the other non-storm water flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 38). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.

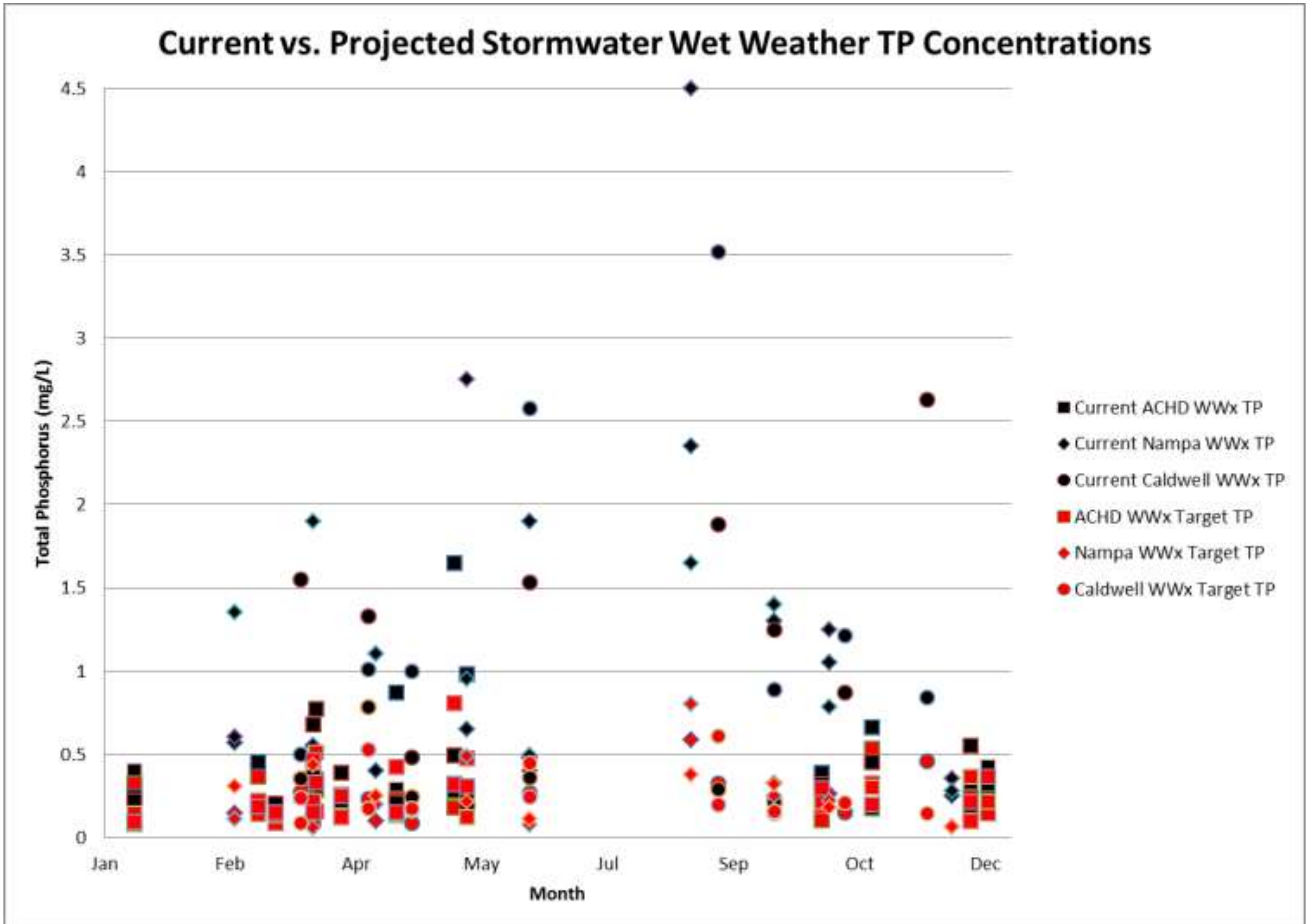


Figure 46. Current vs. projected stormwater (wet weather) TP concentrations (year-round).

Table 44. Agricultural and other nonpoint source tributary load allocations for the lower Boise River, May 1 – September 30. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages.

Tributary	Boise River Receiving River Mile (RM)	Flow (cfs)	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation[1] (lbs/day)	Average TP Load Reduction (%)
Eagle Drain	42.7	36.3	0.11	22.3	0.070	13.7	-39%
Dry Creek[2]	42.5	6.5	0.16	5.6	0.073	2.6	-54%
Thurman Drain	41.9	15.0	0.11	8.6	0.070	5.7	-34%
Fifteenmile Creek[3]	30.3	131.7	0.31	222.2	0.074	52.3	-76%
Mill Slough[4]	27.2	104.9	0.21	118.2	0.071	40.1	-66%
Willow Creek	27.0	36.1	0.23	44.0	0.070	13.6	-69%
Mason Slough	25.6	13.0	0.22	15.4	0.070	4.9	-68%
Mason Creek[5]	25.0	147.6	0.41	322.1	0.070	56.1	-83%
Hartley Gulch	24.4	39.2	0.27	57.4	0.070	14.8	-74%
Indian Creek[6]	22.4	100.6	0.50	271.6	0.089	48.3	-82%
Conway Gulch[7]	14.2	44.8	0.41	99.7	0.070	16.9	-83%
Dixie Drain[8]	10.5	232.6	0.38	477.2	0.070	87.9	-82%
Total		**908.4**	**0.34**	**1664.4**	**0.073**	**356.7**	**-79%**

[1] Because the TP target is concentration-based, actual allowable tributary load allocations under the TMDL are dependent on actual tributary flow and will fluctuate year to year.
[2] Dry Creek TP load allocation includes the design flow and TP contributions from Avimor WWTF: 0.1 mg/L May 1 – September 30.
[3] Fifteenmile Creek TP load allocation includes the design flow and TP contributions from Meridian WWTF: 0.1 mg/L May 1 – September 30.
[4] Mill Slough TP load allocation includes the design flow and TP contributions from Star WWTF: 0.1 mg/L May 1 – September 30.
[5] Mason Creek TP load allocation includes the design flow and TP contributions from Sorrento Lactalis: 0.1 mg/L May 1 – September 30.
[6] Indian Creek TP load allocation includes the design flow and TP contributions from Kuna and Nampa WWTFs, IDFG Nampa facility, and ConAgra: 0.1 mg/L May 1 – September 30.
[7] Conway Gulch TP load allocation includes the design flow and TP contributions from Notus WWTF: 0.1 mg/L May 1 – September 30.
[8] Dixie Drain TP load allocation includes the design flow and TP contributions from Wilder and Greenleaf WWTFs: 0.1 mg/L May 1 – September 30.

DRAFT

Table 45. Agricultural and other nonpoint source ground water, unmeasured, and background load allocations for the lower Boise River, May 1 – September 30. Load allocations are presented per day as monthly averages[1]. DEQ intends that load allocations are to be expressed as monthly averages.

	Mean Flows (cfs)	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation (lbs/day)[1]	Average TP Load Reduction (%)
Ground water & unmeasured[2]	-139 to 485	0.21	-1573 to 562	0.07	-524 to 150	-67%
Background[3]	383 to 3268	0.018	37 to 317	0.018	37 to 317	0%

[1] Because the TP target is concentration-based, actual allowable ground water, unmeasured, and background load allocations under the TMDL are dependent on actual flow and will fluctuate year to year.
[2] Ground water and unmeasured flows are derived from the August 2012 USGS synoptic sampling and mass balance (Alex Etheridge, pers. comm. 2014). Ground water/unmeasured TP concentrations were reduced to 0.07 mg/L for all flows.
[3] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2).

5.4.2 Boise River and Mason Creek TP Allocations to Achieve the Mean Benthic Chlorophyll-a Target

The AQUATOX model of the lower Boise River was used to simulate load and wasteload allocations in comparison to water quality targets, and to help select the appropriate TMDL allocation scenarios (DEQ 2014a).

DEQ reduced the number of TP reduction scenarios through consultation with the Lower Boise Watershed Council, EPA and other interested stakeholders to the following:

1. Existing Conditions (the calibrated model)
2. Scenario 1 + a 0.23 foot depth increase in model segment 10 (Hwy 20-26 Bridge to Notus Bridge)
3. Final Model Scenario – Point sources at 0.1 mg/L TP May – September and 0.35 mg/L TP October – April; agricultural and other nonpoint source tributaries and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; non-stormwater (dry weather) TP loads at 84% reduction.
4. Scenario 2 + a 0.23 foot depth increase in model segment 10
5. Point sources, agricultural and other nonpoint source tributaries, and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; non-stormwater (dry weather) TP loads at 84% reduction
6. Scenario 3 + a 0.23 foot depth increase in model segment 10
7. Point sources at 0.05 mg/L TP year-round (approximate limits of technology); agricultural and other nonpoint source tributaries and ground water at 0.07 mg/L TP year-round; stormwater (wet weather) TP loads at 42% reduction; non-stormwater (dry weather) TP loads at 84% reduction.

DRAFT

The final AQUATOX model scenario (Scenario 3) and TMDL allocation resulted from hundreds of model scenario runs and analyses to identify TP allocations that would help achieve the mean monthly periphyton target and support beneficial uses, while also being technically, socially, and economically viable options.

The final AQUATOX model scenario (Scenario 3) and TMDL allocation is described below with additional descriptions outlined in Table 46, while Table 47, Table 48, and Table 49 summarize the model results for the final TMDL allocation scenario. The TMDL Scenario 3 and TP allocation structure, specifically:

- Achieves the mean monthly benthic chlorophyll a target of < 150 mg/m2 in the impaired AUs of the lower Boise River. Multiple lines of evidence indicate that the TMDL phosphorus reductions are sufficient achieve the mean monthly periphyton target on an AU basis, as well as achieve TP concentrations at or near the EPA Gold Book recommended value of 0.1 mg/L (EPA 1986). Although brief periods of elevated periphyton may occur during August in model segment 10 and September in segment 11, these are likely due to growth of low nutrient diatoms which can proliferate under low nutrient and other habitat conditions. These rationales are further discussed in the Model Report (DEQ 2014a).

- Includes the TP allocations necessary to achieve the May 1 – September 30 target of ≤ 0.07 mg/L TP in the lower Boise River near Parma based on long-term load duration data (see Section 5.4.1).

<u>Final AQUATOX Model Scenario and TMDL Allocation Structure</u>

<u>NPDES-Permitted Wastewater, Industry, and Fish Hatchery Facilities</u>
- 0.1 mg/L TP from May 1 – September 30
- 0.35 mg/L TP from October 1 – April 30
- IDFG Eagle and Nampa fish hatchery facilities: 0.1 mg/L TP year-round

All of the point source targets were modeled to address facility design flows and loads. The IDFG Eagle fish hatchery facility, along with Lander, West, Middleton, and Caldwell WWTFs were direct inputs in the AQUATOX model. Therefore, their design capacity loads were simulated in the final TMDL scenario. The remaining NPDES-permitted facilities in Table 52 were included in the model simulation by externally calculating the additional TP loading contributions to the tributaries or ground water/unmeasured segments to which they discharge under design flow conditions.

<u>NPDES-Permitted Stormwater and Non-Stormwater</u>
- Stormwater (wet weather) = 42% TP reduction year-round

All NPDES-permitted MS4s and non-permitted areas identified in Table 53 were included in the model simulation by externally calculating the (wet weather) TP loading to ground water/unmeasured segments to which they discharge. Stormwater (wet weather) TP concentrations and loads are elevated for short periods and then, due to short residence time, rapidly decrease to dry weather conditions between events. Using average stormwater (wet weather) TP concentrations in the model would result in higher non-storm event TP

DRAFT

concentrations and loads than would actually be seen in the river. Therefore, a 0.5 correction was modeled to more-accurately represent the effect of short-term stormwater (wet weather) TP spikes on monthly periphyton growth.

- Non-stormwater (dry weather) = 84% TP reduction year-round

The non-stormwater (dry weather) flows and loads are implicitly measured as subcomponent of the tributary and ground water/unmeasured discharge. They can originate from a variety of sources, including but not limited to agricultural returns, shallow ground water, urban/suburban sources (e.g. lawn watering), and other unmeasured sources. Due non-stormwater (dry weather) being estimated as an inherent component of tributaries and ground water/unmeasured in the TMDL analyses, this sector received an allocation equivalent of 0.07 mg/L TP for current flow conditions, which is the same allocation for the tributaries and ground water/unmeasured.

The plumbing of MS4 systems is intricate, and the exact quantity of the non-stormwater inputs is presently unknown. However, MS4 permittees have provided initial estimates for the percentage of their non-stormwater discharge that originates from nonpoint-sources (see Table 38). These estimates should be refined through monitoring and mapping in future permit cycles and as part of the TMDL implementation.

<u>Nonpoint Source Tributary, Ground Water, and Unmeasured</u>

- 0.07 mg/L TP year-round

Agricultural and other nonpoint source tributaries, ground water, and unmeasured, including non-stormwater (dry weather), loads were set at the concentration equivalent of 0.07 mg/L TP year-round. However, agricultural tributaries and ground water/unmeasured segment loads were adjusted $\geq$ 0.07 mg/L, as appropriate, to account for TP contributions from NPDES-permitted facilities or stormwater (wet weather) loads (Table 54 and Table 55).

<u>Total Suspended Sediment</u>

As described in more detail in the Model Report (DEQ 2014a) the total suspended sediment (TSS) data was represented as a 37% reduction. This reduction was used to approximate water quality conditions that could result from phosphorus-targeted BMPs, it was identified in the LBR sediment TMDL (DEQ 1999), and DEQ is currently developing a subsequent sediment TMDL for lower Boise River tributaries. Clearing suspended sediment out of the water column increases periphyton growth. Model results show that periphyton growth is limited by light availability and clearer water increases light available to substrate.

<u>Other Forms of Organic Enrichment</u>

As described in more detail in the Model Report (DEQ 2014a) the phosphorus reduction scenarios for the river segments, tributaries, and ground water, applied the same ratio of TP reduction required to achieve the TP target to any existing ammonia, nitrogen, biochemical oxygen demand, or chlorophyll data. That is because, in order to more-accurately model phosphorus reduction scenarios, reductions in nitrogen and carbon must also be simulated. This is reasonable because watershed improvement projects that reduce phosphorus also control nitrogen and other forms of organic enrichment. The steps to build the import spreadsheet for simulating this reduction scenario included:

DRAFT

- Using the monthly average of historic water quality data at the same precision as historical data. This was necessary because of the uneven temporal scale of available water quality data. This allows more general application of the results. Non-detects in the historical data were treated as equal to the detection limit, which is a conservative assumption.

- Replacing total soluble phosphorus data with total phosphorus. This allows the model to calculate stoichiometry on existing data rather than using literature values.

- Reducing monthly averages of ammonia, nitrogen, biochemical oxygen demand, and chlorophyll data according to the same ratio as required by bringing historical monthly average TP data to the TP target.

Mean Dynamic Depth (Water)

Although not included as part of the final TMDL model scenario and allocations, the Model Report (DEQ 2014a) discusses the potential impacts on periphyton growth and accrual that could result from adjustments to the width:depth ratio in segments of the lower Boise River. The potential adjustments were identified through the modeling process, when it was discovered that channel depth is an important limiting factor for algal growth. As such, a modeled increase channel depth, along with the significant TP reductions described above, illustrate a potential approach to further reduce periphyton growth and accrual. This approach could be further investigated if it appears that full support of beneficial uses in the lower Boise River are not being attained during a 5-year review or subsequent post-TMDL implementation monitoring under the significant year-round TP load reductions identified above.

This corresponds to knowledge that artificially a high width-to-depth ratio for freshwater streams is a known sign of impairment (Rosgen and Silvey 1996). Common habitat improvement designs for restoring impaired streams include adding habitat complexity and decreasing the width-to-depth ratio of stream channels.

Model Limitations

The AQUATOX is a robust EPA-approved water quality model that was used to help develop TP load and wasteload allocations to achieve the mean monthly benthic chlorophyll a targets of $\leq$ 150 mg/m^2. Even so, it is important to recognize that all models are mathematical approximations of the true system, with some uncertainty being an inherent component of model results. Through the TMDL implementation and continued monitoring, DEQ, the LBWC, and other stakeholders will continue to improve our knowledge and understanding of the phosphorus and benthic algae relationships in the lower Boise River.

DRAFT

Table 46. Summary of AQUATOX model inputs for the final TMDL allocation scenario.

Input	Flow (mgd)	Total Phosphorus (mg/L; adjusted)[1]
Upstream Background	2012-13 Flow Balance	0.01
Boise River - Main stem		
Lander WWTF	2012-13 flows + loads for 15 mgd	May-Sept. 0.1 (0.12) Oct.-Apr. 0.35 (0.43)
West Boise WWTF	2012-13 flows + loads for 24 mgd	May-Sept. 0.1 (0.15) Oct.-Apr. 0.35 (0.57)
Middleton WWTF	2012-13 flows + loads for 1.83 mgd	May-Sept. 0.1 (0.3) Oct.-Apr. 0.35 (1.44)
Caldwell WWTF	2012-13 flows + loads for 8.5 mgd	May-Sept. 0.1 (0.11) Oct.-Apr. 0.35 (0.52)
IDFG Eagle	2012-13 flows + loads for 4.25 mgd	May-Sept. 0.1 (0.1) Oct.-Apr. 0.1 (0.14)
Tributaries		
Fifteenmile Creek – Meridian WWTF	2012-13 flows + loads for 10.2 mgd	May-Sept. 0.07 (0.074) Oct.-Apr. 0.07 (0.146)
Mill Slough – Star WWTF	2012-13 flows + loads for 1.85 mgd	May-Sept. 0.07 (0.071) Oct.-Apr. 0.07 (0.084)
Mason Creek – Sorrento	2012-13 flows + loads for 1.52 mgd	May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.080)
Indian Creek – Nampa WWTF Kuna WWTF IDFG Nampa ConAgra	2012-13 flows + loads for 18.0 mgd + loads for 3.5mgd + loads for 19.38 mgd + loads for 0.48 mgd	May-Sept. 0.07 (0.089) Oct.-Apr. 0.07 (0.132)
Conway Gulch – Notus WWTF	2012-13 flows +loads for 0.11 mgd	May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.072)
Dixie Drain – Wilder WWTF Greenleaf WWTF	2012-13 flows + loads for 0.25 mgd + loads for 0.24 mgd	May-Sept. 0.07 (0.070) Oct.-Apr. 0.07 (0.072)
All Other Tributaries	2012-13 flows	Year-round 0.070
Ground Water and Unmeasured		
Segment 4 (Dry Creek) – Avimor WWTF	2012-13 flows + loads for 0.42 mgd	May-Sept. 0.03 Oct.-Apr. 0.05
Segment 10 – Darigold	2012-13 flows + loads for 1.7 mgd	May-Sept. 0.07 (0.07) Oct.-Apr. 0.07 (0.09)
All other Ground Water, Unmeasured, Non-Stormwater & Stormwater	2012-13 flows	Year-round $\leq$ 0.07 mg/L TP + stormwater and non-stormwater loads
Sediment (TSS)	37% reduction in all segments	

[1]All NPDES-permitted facilities set to loading equivalent for design flows of 0.1 mg/L TP May 1 – September 30, and 0.35 mg/L TP October 1 – April 30 (except the Eagle and Nampa IDFG facilities set to loading equivalent of 0.1 mg/L TP year-round). Stormwater (wet weather) TP loading to ground water/unmeasured was set to an average 42% reduction. A 0.5 correction was modeled to more-accurately represent the effect of (wet weather) TP concentration and load spikes on monthly periphyton growth. All tributaries, ground water, and stormwater (dry weather) were set to the loading equivalents of 0.07 mg/L TP year-round, except TP loadings are adjusted for those tributaries and segments to account for increased TP loading attributed to WWTF facilities and/or stormwater (wet weather) loads.

DRAFT

Table 47. Summary of final TMDL scenario results for TP targets in model segment 13 (near Parma).

Total Phosphorus	
Criteria	**Results**
May 1 – September 30	
Seasonal average TP ≤ 0.07 mg/L at Parma, May 1 – September 30	Mean TP = 0.06 mg/L Median TP = 0.06 mg/L Max TP = 0.12 mg/L
October1 – April 30	
Seasonal average TP mg/L at Parma, October 1 – April 30	Mean TP = 0.08 mg/L Median TP = 0.09 mg/L Max TP = 0.20 mg/L

Table 48. Summary of TMDL scenario results for mean monthly periphyton chlorophyll a targets.

Periphyton					
Month	**Mean Monthly Periphyton (mg/m^2)**				
	Seg 9	**Seg 10**	**Seg 11**	**Seg 12**	**Seg 13**
January	1.1	1.0	0.7	0.7	0.6
February	14.0	16.8	6.8	6.6	5.0
March	15.8	21.2	12.3	8.7	12.6
April	1.7	2.2	1.0	0.8	1.5
May	0.7	1.1	2.1	0.4	1.3
June	0.7	2.9	44.1	0.7	4.5
July	0.7	35.5	118.8	1.2	30.2
August	0.6	195.8	79.3	14.2	69.4
September	7.9	114.3	153.3	29.9	90.6
October	68.8	110.8	98.8	88.1	73.1
November	87.3	93.2	121.4	62.7	122.7
December	50.4	68.8	34.4	37.8	50.6
Mean Monthly Periphyton ≥ 150 mg/m^2	**0%**	**8%**	**8%**	**0%**	**0%**

DRAFT

Table 49. Summary of TMDL scenario results for mean monthly TP concentrations.

Total Phosphorus					
Month	**Mean Monthly TP Concentration (mg/L)**				
	Seg 9	**Seg 10**	**Seg 11**	**Seg 12**	**Seg 13**
January	0.09	0.10	0.10	0.10	0.10
February	0.08	0.09	0.09	0.09	0.09
March	0.06	0.08	0.07	0.07	0.07
April	0.05	0.06	0.06	0.05	0.05
May	0.03	0.03	0.03	0.04	0.04
June	0.04	0.05	0.05	0.05	0.05
July	0.05	0.05	0.05	0.06	0.06
August	0.06	0.07	0.07	0.07	0.07
September	0.07	0.08	0.08	0.08	0.08
October	0.09	0.10	0.10	0.09	0.09
November	0.09	0.11	0.10	0.10	0.10
December	0.10	0.11	0.11	0.11	0.11
Mean Monthly TP Concentration > 0.1 mg/L	**0%**	**17%**	**8%**	**8%**	**8%**

Figure 47 shows the relationships between mean monthly periphyton exceedances > 150 mg/m^2 and TP reductions under the seven model scenarios. It is clear that the periphyton-TP relationship illustrates a point of diminishing returns, beyond which further TP reductions do not result in further significant reductions in periphyton, likely due to other environmental factors and organic enrichment in the system. That is, TP reductions beyond those modeled the final TMDL model scenario (Scenario 3) do not yield measureable improvements in periphyton reductions.

Lower instream TP concentrations can be realized with further TP load reductions, but these reductions would be expensive to implement and not likely to improve ecological conditions or further support beneficial uses in the river. Additionally, as shown in Table 47, mean and median TP concentrations in the lower Boise River near Parma are less than the May – September 0.07 mg/L target, and less than the EPA Gold Gook recommended value of 0.1 mg/L for the remainder of the year.

DRAFT

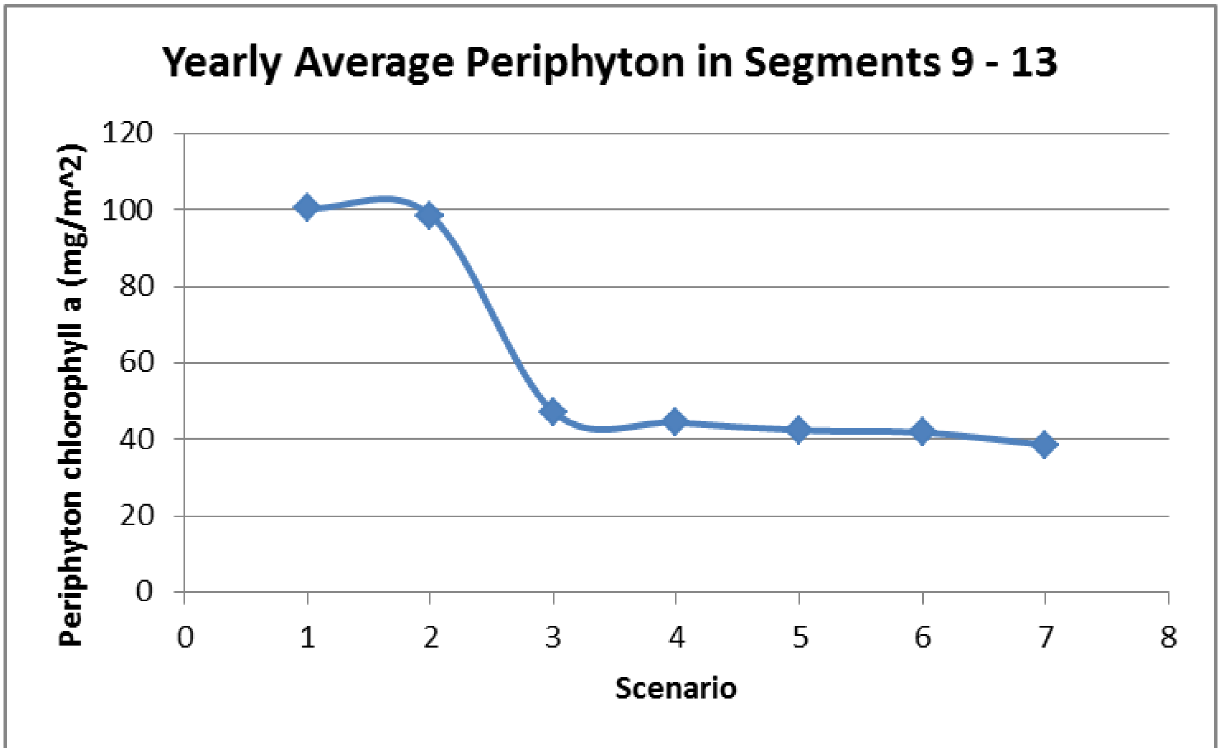


Figure 47. Annual average periphyton in model segments 9-13 (the impaired AUs of the lower Boise River) under seven model scenarios. Further descriptions of each model scenario are available in the preceding paragraphs.

Figure 48 shows the existing modeled conditions and mean monthly periphyton in segments 9-13, with elevated periphyton occurring during multiple months in model segments 9-12. Figure 49 shows mean monthly periphyton in segments 9-13 under the final model scenario (Scenario 3) and TMDL allocations. This results in a significant reduction in overall periphyton growth throughout the year. Although overall periphyton drops throughout these segments, the temporary elevated periphyton in segments 10 and 11 occur because of a shift in periphyton species, becoming dominated by low nutrient diatoms, which proliferate under low nutrient concentrations and other habitat conditions.

DRAFT

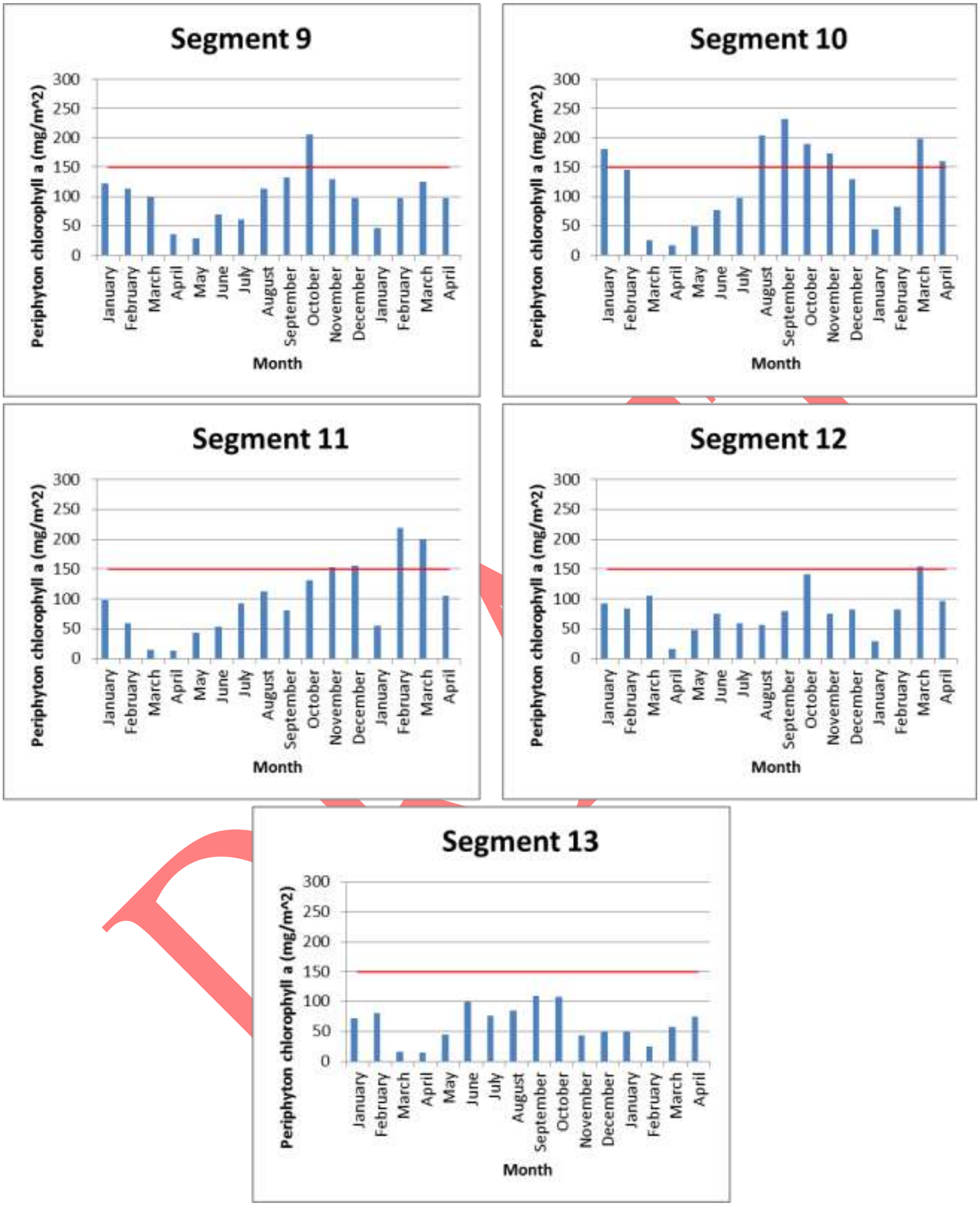


Figure 48. Scenario 1 – Existing Conditions. Current modeled mean monthly periphyton from January 1, 2012 through April 22, 2013. Model segments 9-13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

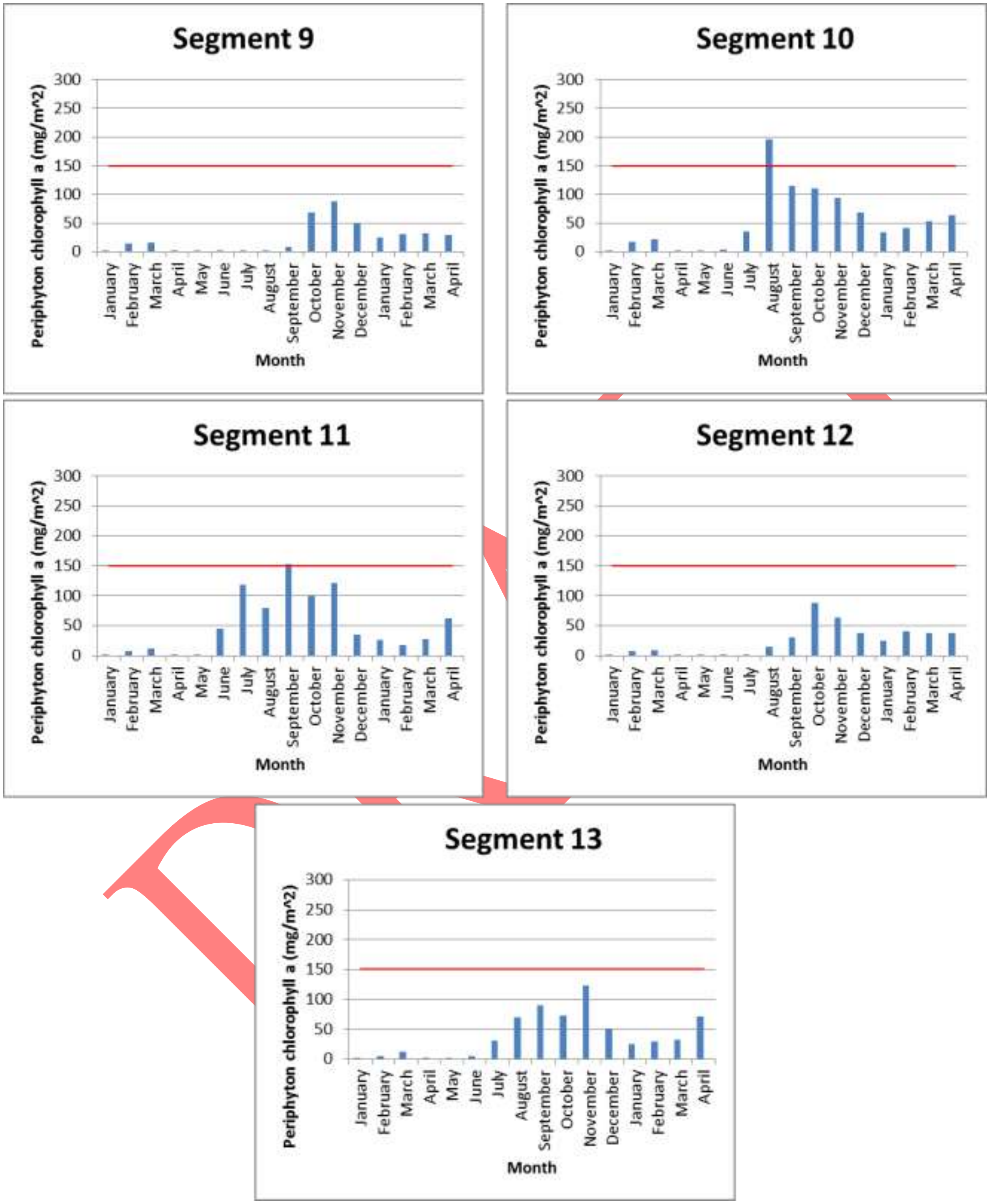


Figure 49. Scenario 3 – Predicted mean monthly periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario and TP allocation structure. Model segments 9-13 correspond with the TP-impaired AUs of the lower Boise River from Middleton to the mouth, near Parma. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

Results for the model scenarios described above are reported on a model segment basis. When the results for the final model scenario and TMDL allocations—Scenario 3—are averaged according to the AUs, there are no exceedances of the mean monthly periphyton target (Figure 50 and Figure 52), a 30-day rolling average of periphyton target (Figure 51and Figure 53), and the EPA Gold Book recommended value for TP[6] are mostly attained (Figure 54, Figure 55).

Because the impaired AUs do not line up exactly with the model segments, a weighted average of the model segments within each AU was utilized to calculated periphyton and TP concentrations on an AU basis:

- ID17050114SW005_06b is 5.49 miles (Middleton to Indian Creek)
    - 3.95 miles of Segment 9 (71.9%)
    - 1.54 miles of Segment 10 (28.1%)

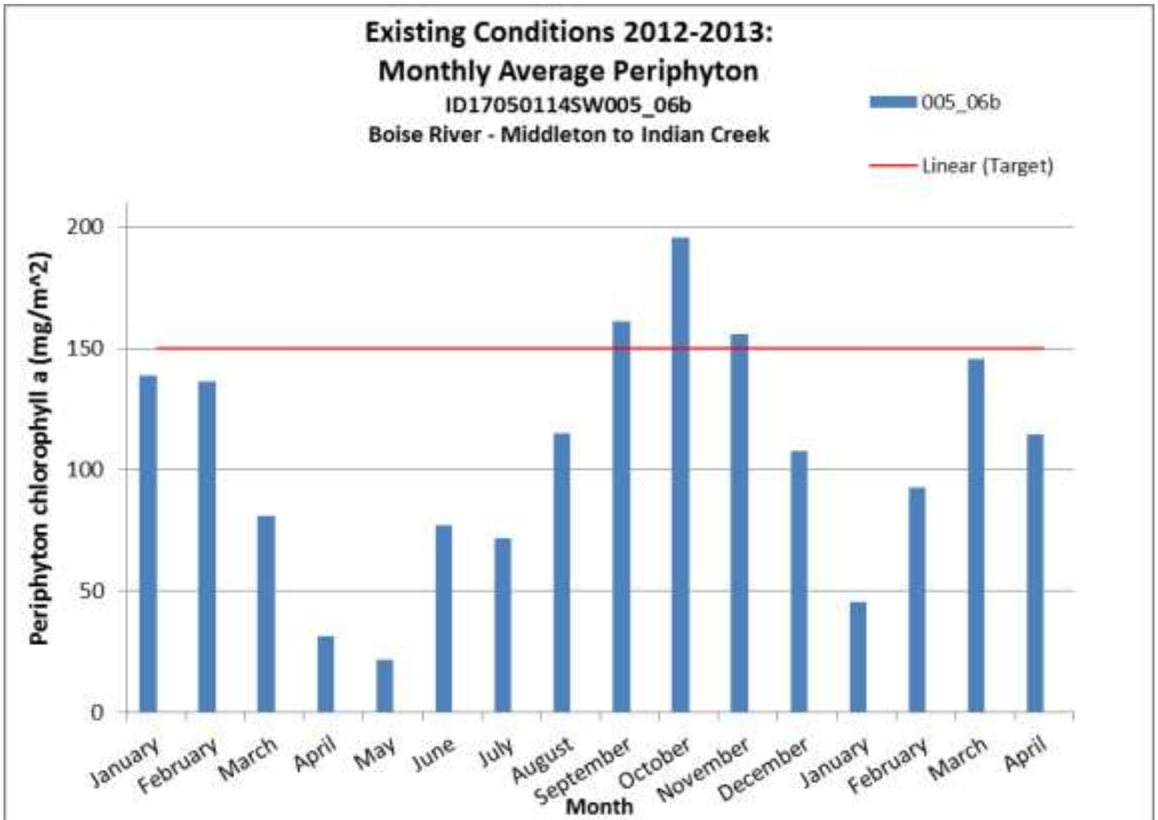
- ID17050114SW001_06 is 18.64 miles (Indian Creek to the Mouth)
    - 6.78 miles of Segment 10 (36.4%)
    - The entire length of Segment 11 (27.1%)
    - The entire length of Segment 12 (9.8%)
    - The entire length of Segment 13 (26.7%)

Examination of the difference between the existing and TP reduction scenarios shows that a relatively large phosphorus reduction is necessary to create a relatively smaller periphyton reduction. Existing TP averages 0.28 mg/L annually for the two listed AUs, whereas the average annual TP for the reduction Scenario 3 is 0.08 mg/L. This represents a 71% annual reduction in phosphorus. Alternatively, existing periphyton averages 101 mg/m^2 annually for the two listed AUs, whereas the annual average is 47 mg/m^2 for the TP reduction Scenario 3, a 53% reduction.

The following figures illustrate that the final AQUATOX model scenario and TMDL allocations result in substantial TP and periphyton reductions within impaired AUs of the lower Boise River, and that further TP reductions alone will not, and are not needed to further improve support for beneficial uses.

DRAFT

[6] Although there is no specific phosphorus target in the lower Boise River outside of the May-September timeframe, a TP target of 0.10 mg/L should help to meet beneficial uses. The target for the lower Boise River from May 1 – September 30 near Parma is $\geq$ 0.07 mg/L TP.



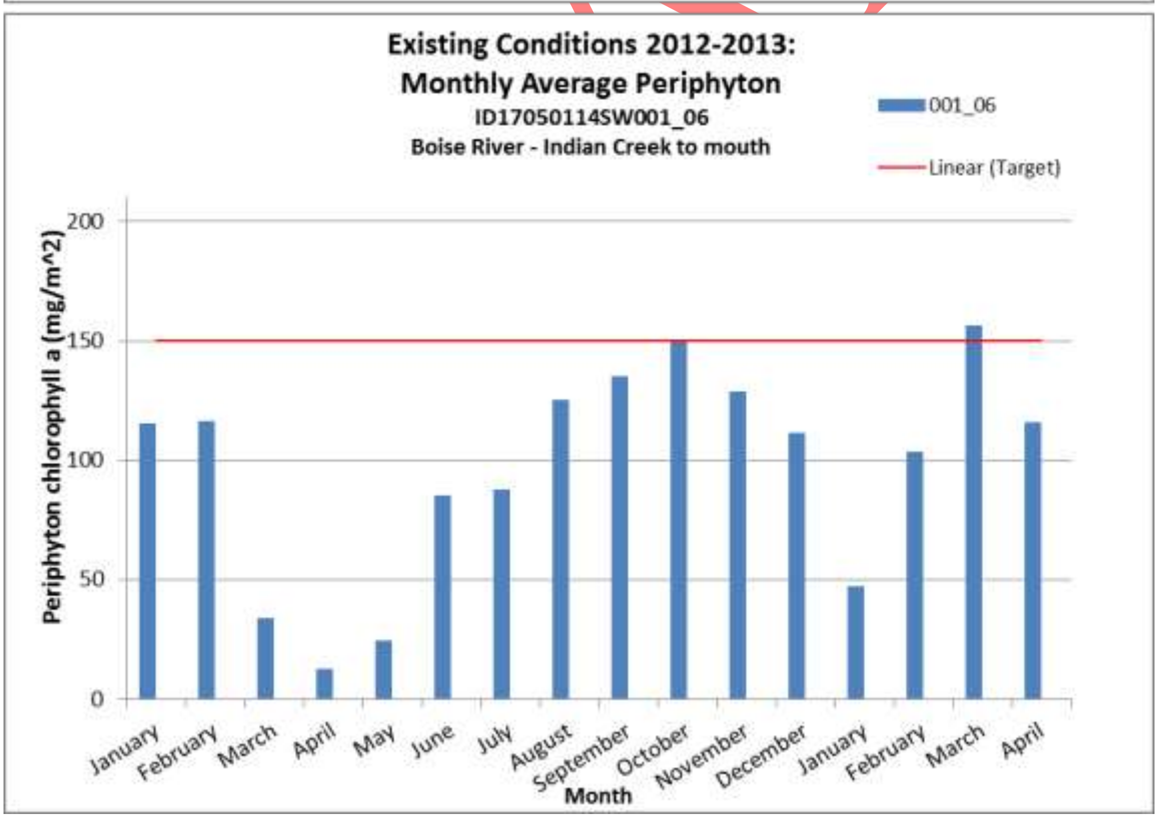


Figure 50. Current modeled mean monthly periphyton from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

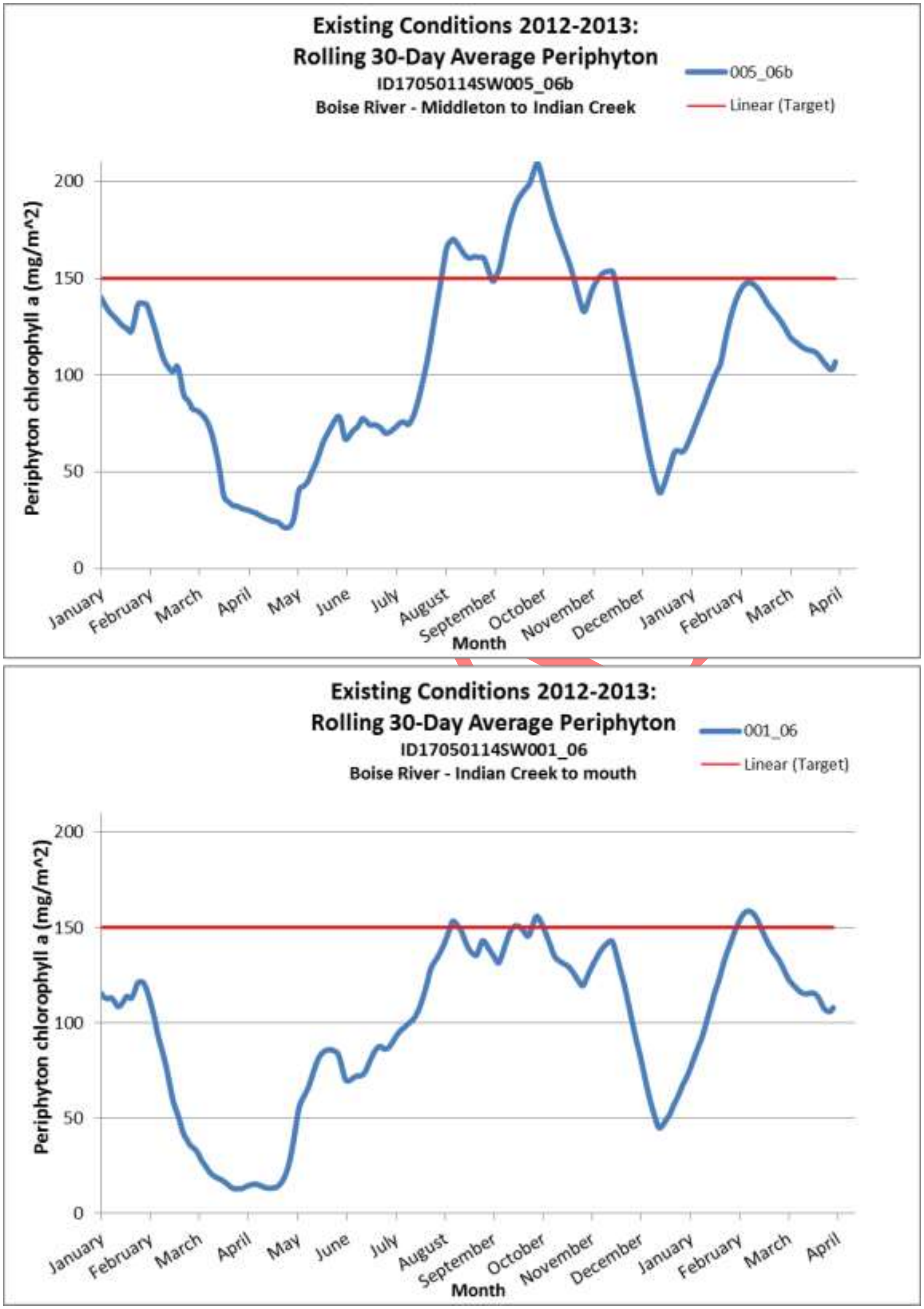
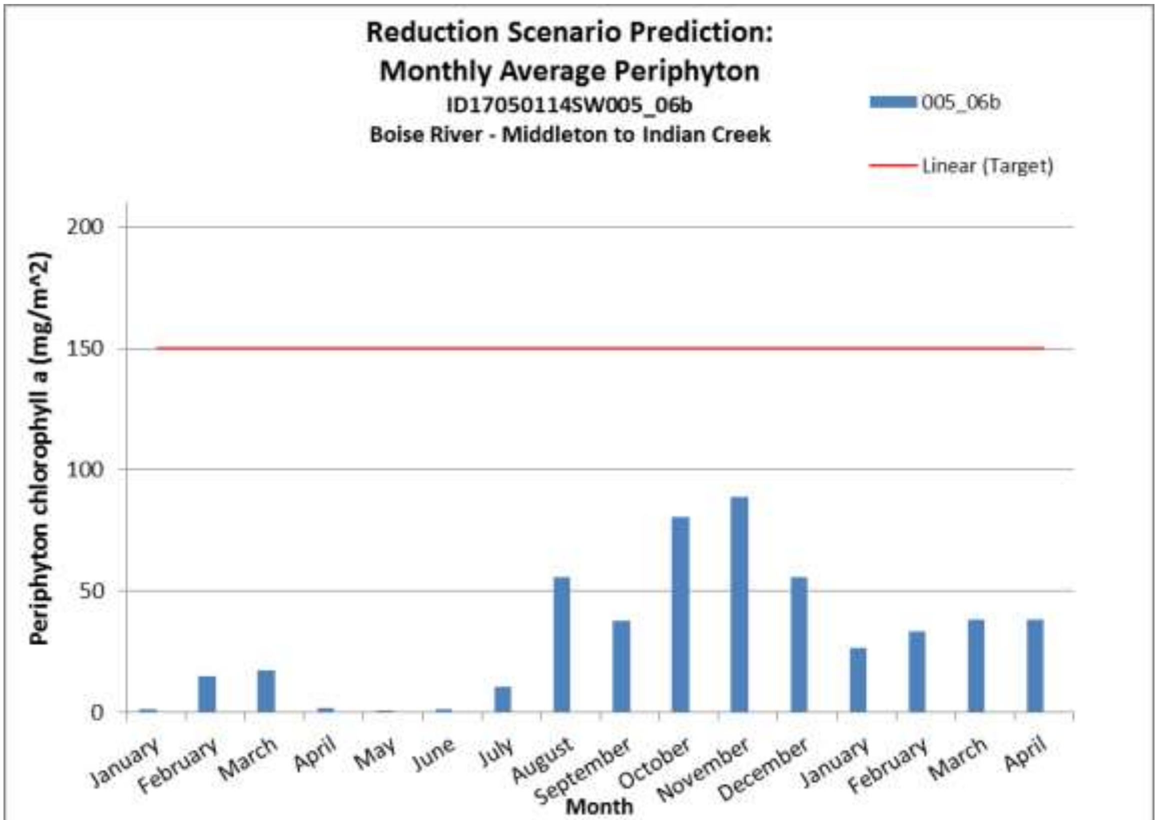


Figure 51. Current modeled 30-day rolling average periphyton from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.



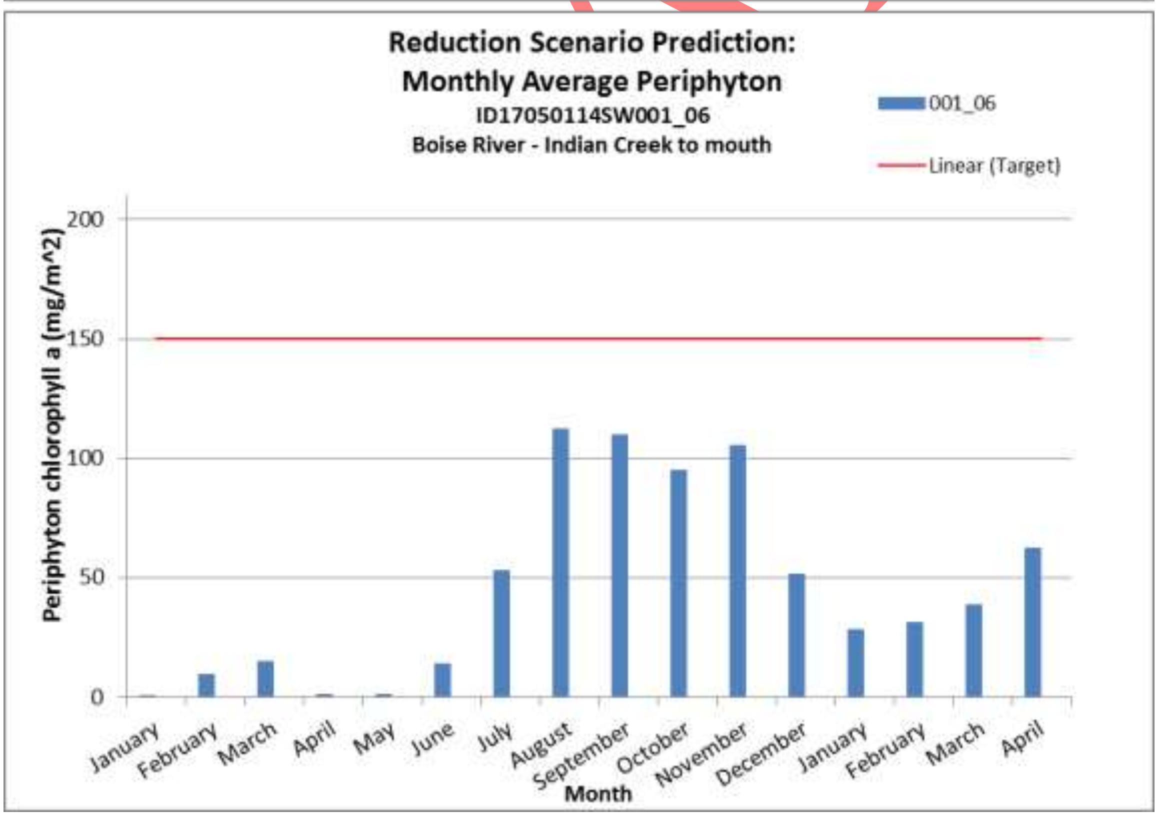


Figure 52. Predicted mean monthly periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.

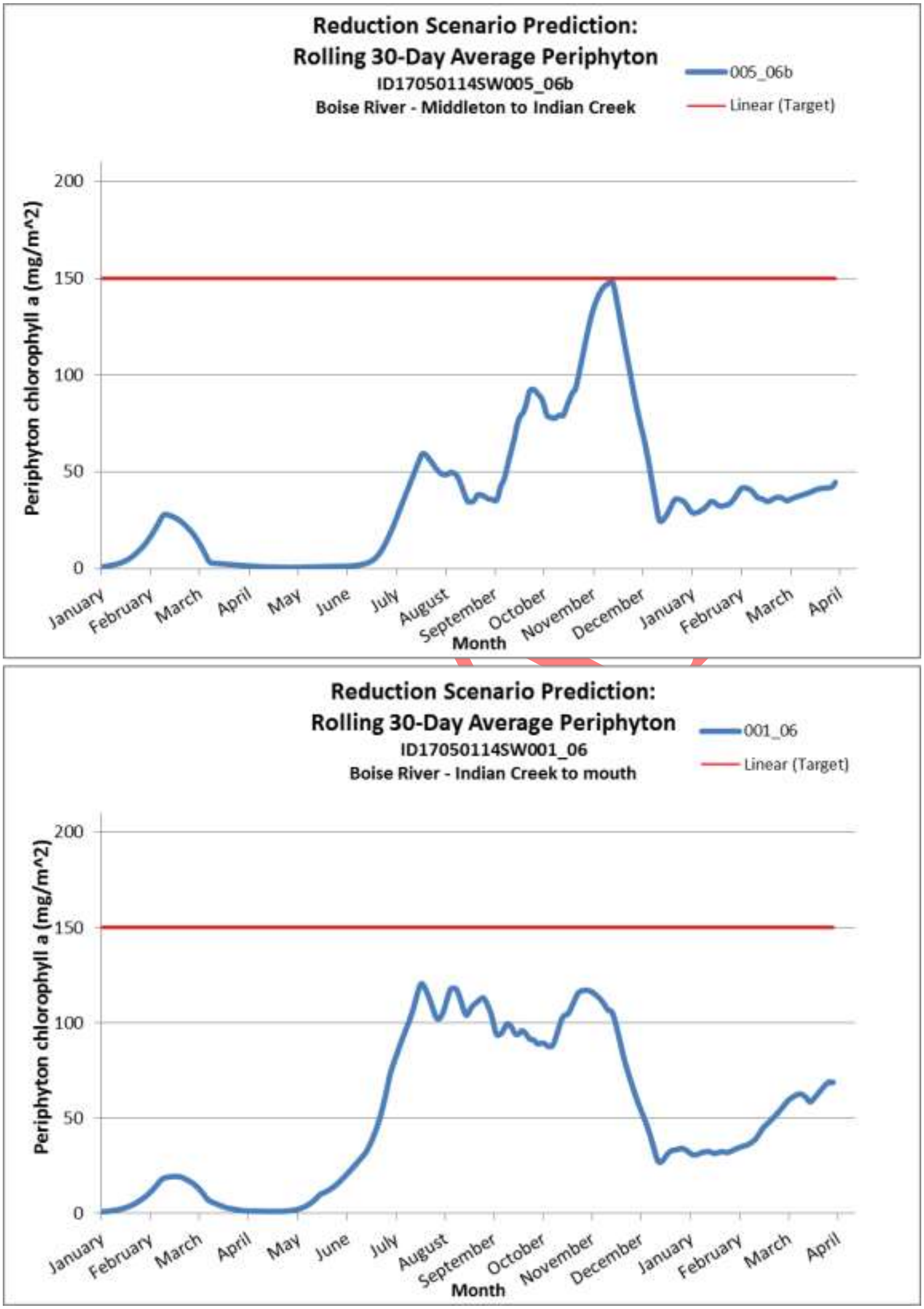
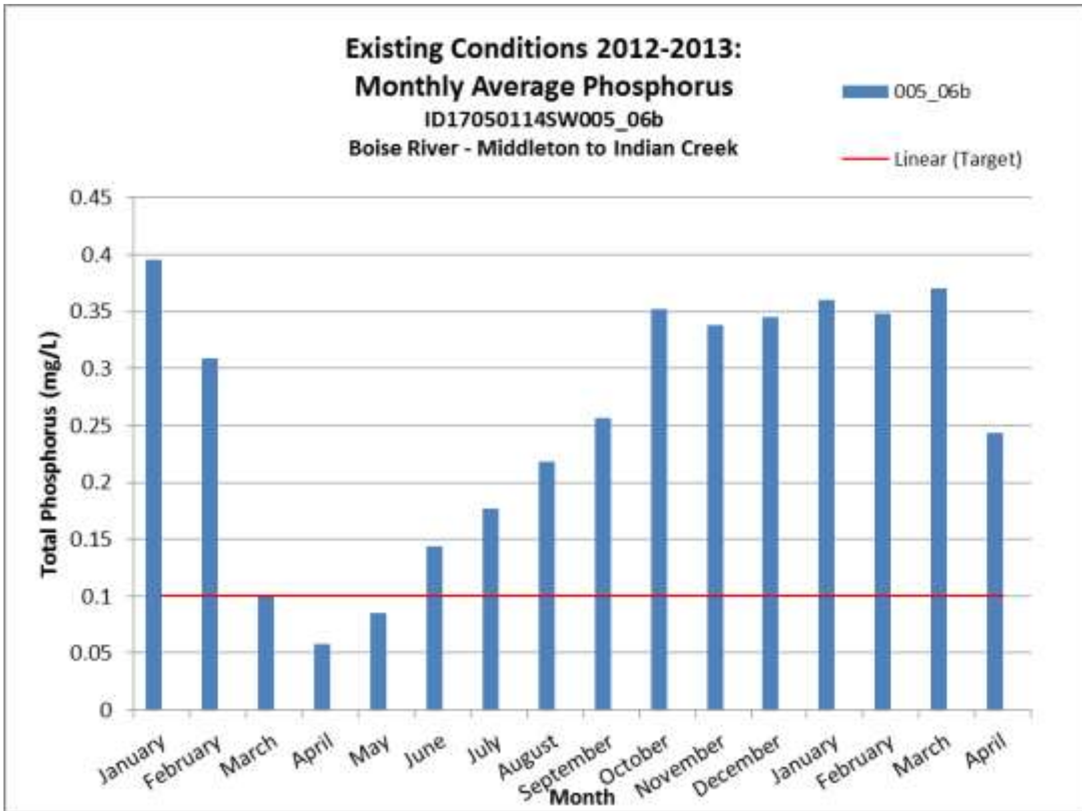


Figure 53. Predicted 30-day rolling average periphyton from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the mean monthly periphyton target of 150 mg/m^2.



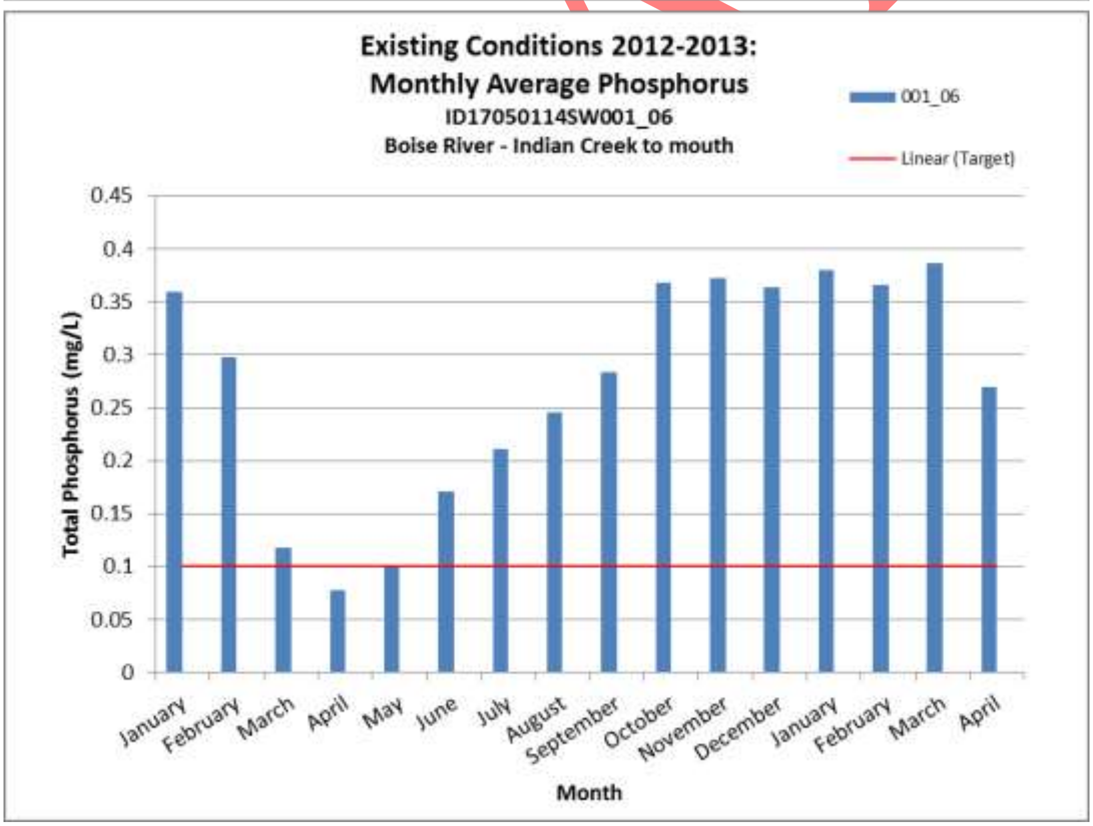
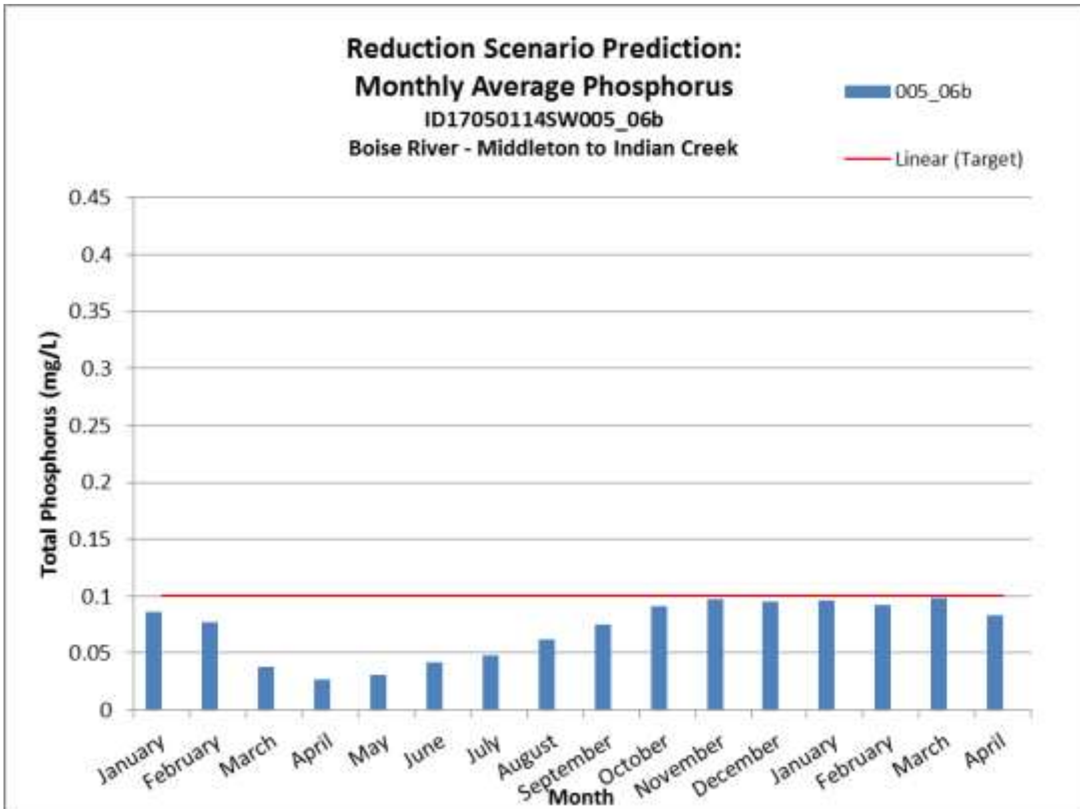


Figure 54. Current modeled monthly TP concentration from January 1, 2012 through April 22, 2013 in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.



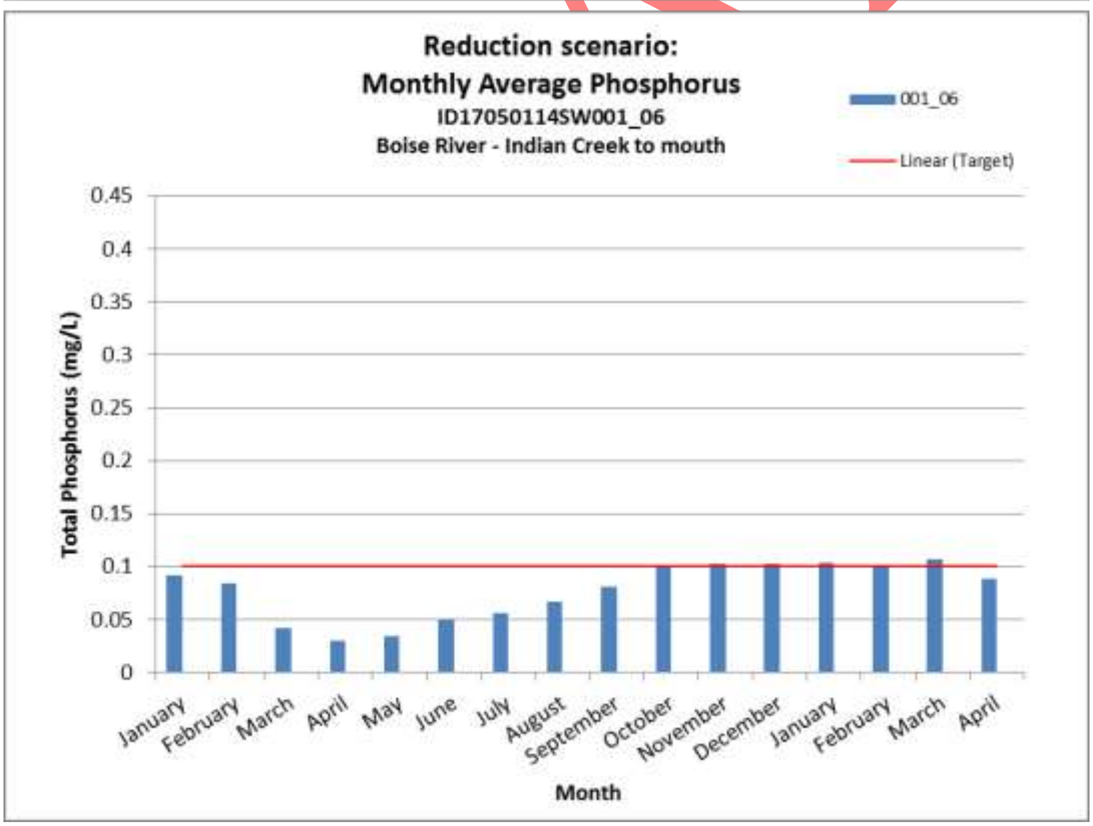


Figure 55. Predicted modeled monthly TP concentration from January 1, 2012 through April 22, 2013 under the final TMDL scenario (Scenario 3) and TP allocation structure in the TP-impaired AUs of the lower Boise River. The red line indicates the EPA Gold Book recommended value of 0.1 mg/L.

The following analyses, tables, and figures identify the sector-wide and specific October 1 – April 30 TP allocations and load reductions that correspond with the final model scenario and are necessary to achieve the mean monthly periphyton target. The May 1 – September 30 TP allocations and load reductions that correspond with the final model scenario and are necessary to achieve the mean monthly periphyton target and the SR-HC TMDL May 1 – September 30 TP target of 0.07 mg/L are presented in Section 5.4.1.

Table 50. Gross load and wasteload allocations by sector for the lower Boise River, October 1 – April 30, presented as per day as monthly averages. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

	Average Daily Background TP[1]	Average NPDES WWTF and Industry TP[2]	Average Fish Hatchery TP[3]	Average Tributary (w/o NPDES Flows and Loads) TP[4]	Average Ground Water and Unmeasured TP[5]	Average Non-Stormwater Dry Weather TP[6]	Average Stormwater Wet Weather TP[7]
Current TP Conc. (mg/L)	0.018	3.32	0.07	0.22	0.15	n/a	n/a
Current TP Load (lbs/day)	125	1394	13	580	127	44	107
Target TP Conc. (mg/L)	0.018	0.35	0.1	0.07	0.07	n/a	n/a
TP Allocation (lbs/day)	125	256	20	178	57	n/a	n/a
Percent Reduction (%)	**0%**	**-82%**	**+50%**	**-69%**	**-55%**	**-84%**	**-43%**

[1] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data, with detection levels of 0.01 mg/L (see Section 3.2.2).
[2] WWTF and industrial discharge data are based on facility design flows, represented in Table 30.
[3] Fish Hatchery data represent the Idaho Fish and Game Eagle and Nampa facilities identified in Table 30.
[4] Tributary data (Table 32) were calculated by removing all WWTF, industrial, and aquaculture design flows, concentrations, and loads that discharge into tributaries.
[5] The USGS October 2012 and March 2013 mass balance models were used to estimate average ground water flows.
[6] Non-stormwater (dry weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) and represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.
7 Stormwater (wet weather) allocations were derived from the data provided by the LBWC stormwater workgroup (Table 31 and Appendix E) and represent a 42% TP load reduction on average across all MS4s. These flows and loads represent specific precipitation (storm) events.

DRAFT

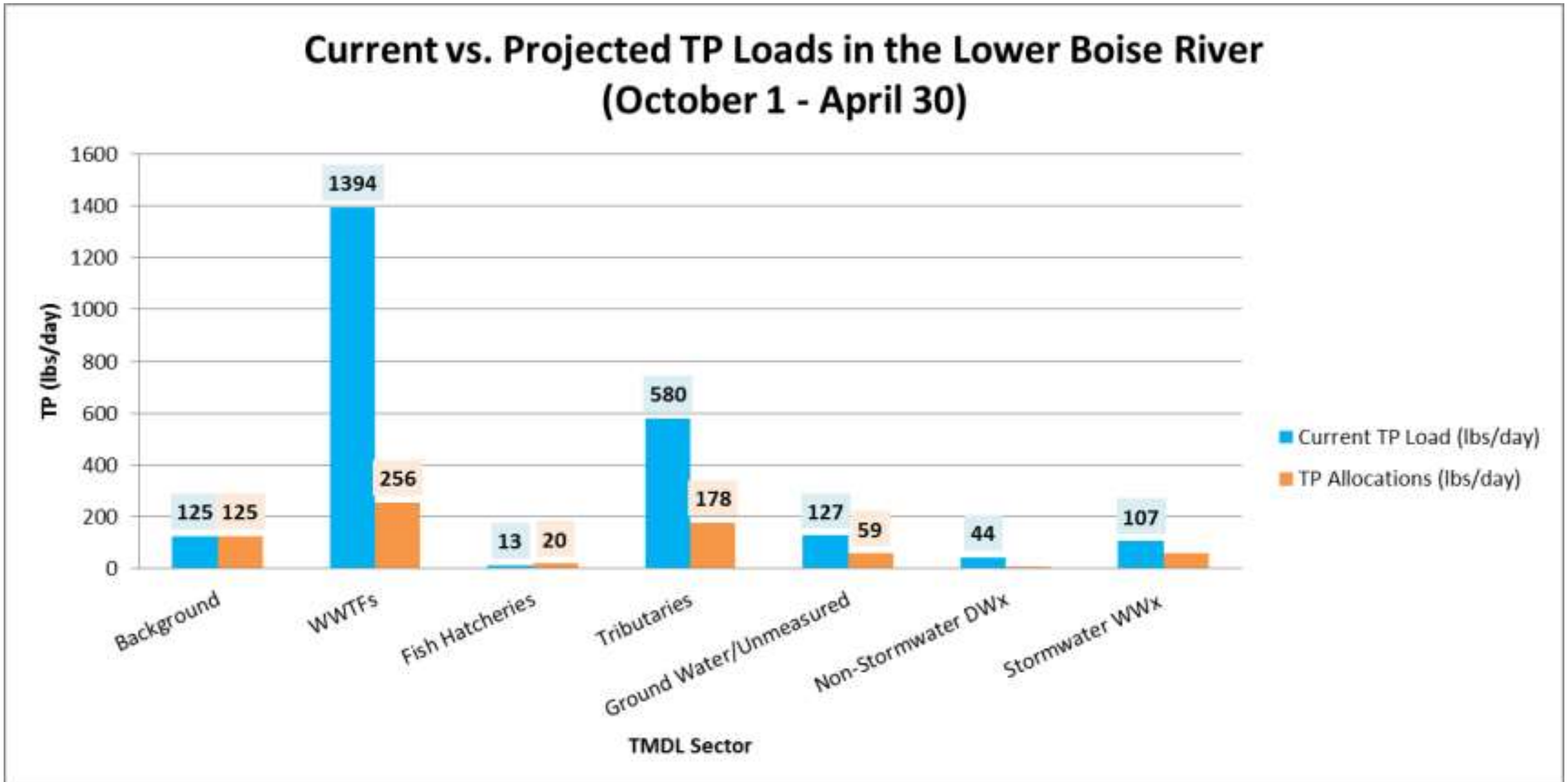


Table 51. Current projected TP loads for the lower Boise River from October 1 – April 30.

* Stormwater (wet weather; WWx) flows and loads are associated with precipitation (storm) events conveyed through permitted and non-permitted MS4s. Stormwater (wet weather) allocations represent a 43% TP load reduction on average across all MS4s.
* Non-stormwater (dry weather; DWx) allocations represent an 84% TP load reduction on average across all MS4s in order to achieve a 0.07 mg/L TP load equivalent under current flows. Non-stormwater (dry weather) flows and loads are a subcomponent of, and not summed separately from, tributary and ground water load allocations.

Table 52. Point source TP wasteload allocations for the lower Boise River subbasin, October 1 – April 30. Wasteload allocations are presented per day as monthly averages[1,2]. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits. See Table 42 in Section 5.4.1 for detailed description of the May – September TP allocations and load reductions.

Facility/ Source	NPDES Permit No.	Current Oct-Apr Average TP Load (lbs/day)	Oct-Apr Average TP Allocation (lbs/day) at TP Conc. = 0.35 mg/L	Oct-Dec Average TP Load Reduction (%)
Boise River - Main stem				
Lander Street WWTF	ID-002044-3	180.8	43.8	-76%
West Boise WWTF	ID-002398-1	603.3	70.1	-88%
Middleton WWTF	ID-002183-1	14.9	5.3	-64%
Caldwell WWTF	ID-002150-4	106.6	24.8	-77%
IDFG Eagle[3]	NPDES Aquaculture Permit	0.4	3.6	+714%
Boise River – Tributaries				
Avimor WWTF – Dry Creek	In Application	No Discharge Currently	1.2	No Discharge Currently
Star WWTF – Lawrence-Kennedy Canal	ID-002359-1	5.5	5.4	-1%
Meridian WWTF – Fivemile Creek and Boise River	ID-002019-2	38.7	29.8	-23%
Sorrento Lactalis – Purdham Drain	ID-002803-7	0.1	4.4	+4333%
Nampa WWTF – Indian Creek	ID-002206-3	424.1	52.6	-88%
Kuna WWTF – Indian Creek	ID-002835-5	13.8	10.2	-26%
IDFG Nampa[3] – Indian Creek	IDG-130042 Aquaculture Permit	12.7	16.2	+27%
Darigold – unmeasured drain	ID-002495-3	0.4	5.0	+1039%
Notus WWTF – Conway Gulch	ID-002101-6	2.2	0.32	-86%
Wilder WWTF – Wilder Ditch Drain	ID-0020265	3.6	0.73	-80%
Greenleaf WWTF – West End Drain	ID-002830-4	0.03	0.70	+2402%
ConAgra (XL 4 Star) –Indian Creek	ID-000078-7	No Discharge Currently	1.39	No Discharge Currently
Total		**1407.1**	**275.5**	**-80%**

[1] The WLAs and load reductions are estimates that achieve the mean monthly periphyton target of $\leq$ 150 mg/m^2 in the lower Boise River and the May – September TP target of $\leq$ 0.07 mg/L near Parma.

DRAFT

[2] It is expected that all NPDES point source facilities will achieve the wasteload allocation targets within compliance schedules granted by DEQ and approved by EPA. Achieving the wasteload allocation targets is expected to occur through enhanced technology and/or water quality trading. This TMDL addendum provides opportunity for potentially re-opening NPDES permits, by providing new water quality information.
[3] Due to their operations it is unlikely that the IDFG Eagle and Nampa fish hatcheries will discharge or need to discharge above a TP concentration of 0.1 mg/L. As a result, their wasteload allocation is set for 0.1 mg/L year-round.

DRAFT

Table 53. Point source MS4 stormwater (wet weather) and non-stormwater (dry weather) TP wasteload allocations for the lower Boise River subbasin, October 1 – April 30. Wasteload allocations are presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as percent load reductions for average monthly limits in NPDES permits. See Table 43 for complete description of the May – September TP allocations and load reductions.

Source	NPDES Permit No.	Area (miles)	Area Ratio[2]	Oct-Apr Current Stormwater Wet Weather Avg TP Load[4] (lbs/day)	Oct-Apr Stormwater Wet Weather Avg TP Wasteload Allocation[4,5] (% Reduction)		Oct-Apr Current Non-Stormwater Dry Weather Avg TP Load[6] (lbs/day)	Oct-Apr Non-Stormwater Dry Weather Avg TP Allocation[6,7] (% Reduction)
Boise/Ada County MS4	IDS-028185 & IDS 027561	149	0.55	Current Load = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39	43% Load Reduction = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39 x 0.43		Current Load = $Q_{current}$ (cfs) x $C_{current}$ (mg/L) x 5.39	84% Load Reduction = $Q_{current}$ (cfs) x 0.07 (mg/L) x 5.39
Non-permitted[3] Kuna and Star		44	0.16					
Canyon Hwy Dist #4 MS4	IDS-028134	8	0.03					
ITD District #3 (Eagle & Meridian)	IDS-028177	112 linear						
Middleton MS4	IDS-028100	2.3	0.01					
Nampa MS4	IDS-028126	25	0.09					
Nampa Hwy District MS4	IDS-028142	8.5	0.03					
Caldwell MS4	IDS-028118	17.5	0.06					
Non-permitted[3] Notus-Parma MS4 (former MS4 IDS-028151)		2	0.01					
Non-permitted[3] Greenleaf, Notus, Parma, Wilder		17	0.06					
	Total	**273.3**	**1.0**		**-43%**			**-84%**

[1] Stormwater (wet weather) and non-stormwater (dry weather) allocations were derived from data provided by the LBWC stormwater workgroup (Appendix E). DEQ intends that wasteload allocations are to be expressed as monthly average limits in NPDES permits.
[2] Area ratio = the area contribution of each individual MS4 relative to the total service area for MS4s.
[3] The "Non-permitted" areas receive load allocations because they are currently not permitted under the NPDES program. As permitting areas change, load and wasteload allocations may be adjusted.
[4] Stormwater (wet weather) allocations represent a 43% average TP load reduction on average across all permitted and non-permitted MS4 areas. The gross current TP load estimate is 107 lbs/day, with a reduction to 61 lbs/day. In the wasteload allocation equation, $Q_{current}$ (cfs) is current baseline discharge, $C_{current}$ (mg/L) is current baseline TP concentration, and 5.39 is standard conversion factor (Hammer 1986).

DRAFT

[5] Higher maximum daily stormwater (wet weather) target loads may exceed average daily loads and still allow MS4s to comply with the load and wasteload reductions.
[6] Non-stormwater (dry weather) allocations represent an 84% TP load reduction on average across all permitted and non-permitted MS4 areas in order to achieve a 0.07 mg/L TP load equivalent under current flows. The gross current TP load estimate is 44 lbs/day, with a reduction to 7 lbs/day (non-stormwater (dry weather) flows and loads are largely unmeasured throughout the subbasin and are a subcomponent of, and not summed separately from, tributary and ground water load allocations). In the wasteload allocation equation, $Q_{current}$ (cfs) is current baseline discharge, $C_{current}$ (mg/L) is current baseline TP concentration, and 5.39 is a standard conversion factor (Hammer 1986).
[7] It is DEQ's intent to include in the MS4 wasteload allocation, only that non-storm water that is categorized as allowable under the MS4 NPDES permit, and to treat other non-storm water flow as a nonpoint source. If the other non-storm water flow can be identified and quantified by the MS4, it will be treated under this TMDL as a nonpoint source (see Table 38). Further, this TMDL does not excuse the responsibility of the MS4 owner or operator to comply with the terms of the applicable NPDES permit.

DRAFT

Table 54. Agricultural and other nonpoint source tributary TP load allocations for the lower Boise River subbasin. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages. See Table 44 in Section 5.4.1 for complete description of the May – September TP allocations and load reductions.

Tributary	Boise River Receiving River Mile (RM)	Current Oct-Apr Average TP Load (lbs/day)	Oct-Apr Average Target TP Conc. (mg/L)	Oct-Apr Average TP Allocation (lbs/day)[1]	Oct-Apr Average TP Load Reduction (%)[1]
Eagle Drain	42.7	9.8	0.070	4.4	-55%
Dry Creek[2]	42.5	9.9	0.083	6.5	-35%
Thurman Drain	41.9	6.1	0.070	3.1	-49%
Fifteenmile Creek[3]	30.3	104.9	0.146	45.7	-56%
Mill Slough[4]	27.2	60.3	0.084	25.4	-58%
Willow Creek	27.0	37.5	0.070	8.1	-78%
Mason Slough	25.6	11.1	0.070	2.2	-80%
Mason Creek[5]	25.0	92.6	0.080	29.1	-69%
Hartley Gulch	24.4	17.9	0.070	4.0	-77%
Indian Creek[6]	22.4	516.9	0.132	119.4	-77%
Conway Gulch[7]	14.2	22.6	0.072	8.6	-62%
Dixie Drain[8]	10.5	191.3	0.072	44.3	-77%
Total		**1081.0**	**0.100**	**300.9**	**-72%**

[1] Because the TP target is concentration-based, actual allowable tributary load allocations under the TMDL are dependent on actual tributary flow and will fluctuate year to year.
[2] Dry Creek TP load allocation includes the design flow and TP contributions from Avimor WWTF: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30.
[3] Fifteenmile Creek TP load allocation includes the design flow and TP contributions from Meridian WWTF: 0.1 mg/L May 1 – September 30 and 0.35 mg/ October 1 – April 30.
[4] Mill Slough TP load allocation includes the design flow and TP contributions from Star WWTF: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30.
[5] Mason Creek TP load allocation includes the design flow and TP contributions from Sorrento Lactalis: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30.
[6] Indian Creek TP load allocation includes the design flow and TP contributions from Kuna and Nampa WWTFs, and ConAgra: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30. It also includes the design flow and TP contributions from the IDFG Nampa facility: 0.1 mg/L year-round.
[7] Conway Gulch TP load allocation includes the design flow and TP contributions from Notus WWTF: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30.
[8] Dixie Drain TP load allocation includes the design flow and TP contributions of 0.3 mg/L from Wilder and Greenleaf WWTFs: 0.1 mg/L May 1 – September 30 and 0.35 mg/L October 1 – April 30.

DRAFT

Table 55. Agricultural and other nonpoint source ground water/unmeasured and natural background source TP load allocations for the lower Boise River. Load allocations are presented per day as monthly averages. DEQ intends that load allocations are to be expressed as monthly averages. See Table 45 in Section 5.4.1 for complete description of the May – September TP allocations and load reductions.

	Oct-Apr Mean Flow (cfs)	Current Oct-Apr Average TP Conc. (mg/L)	Current Oct-Apr Average TP Load (lbs/day)	Oct-Apr Average Target TP Conc. (mg/L)	Oct-Apr Average TP Allocation (lbs/day)	Average TP Load Reduction (%)
Ground water & unmeasured[2]	133 to 180	0.15	108 to 146	0.07	50 to 68	-53%
Background[3]	1,293	0.018	125	0.018	125	0%

[1] Because the TP target is concentration-based, actual allowable ground water, unmeasured, and background load allocations under the TMDL are dependent on actual flow and will fluctuate year to year.
[2] Ground water and unmeasured flows are derived from the October 2012 and March 2013 USGS synoptic sampling and mass balance (Alex Etheridge, pers. comm. 2014). Ground water/unmeasured TP concentrations were reduced to 0.07 mg/L for all flows.
[3] Background TP concentration of 0.018 mg/L was utilized based on 2005 – 2013 USGS Diversion Dam data (see Section 3.2.2).

DRAFT

5.4.3 Sand Hollow TP Allocations to Achieve the SR-HC TMDL Target of ≤ 0.07 mg/L May 1 – September 30

Table 56 identifies point and nonpoint source May 1 – September 30 TP allocations for Sand Hollow Creek, a tributary to the Snake River. These load reductions will ensure that Sand Hollow Creek achieves the SR-HC TMDL target allocations for tributaries of 0.07 mg/L TP from May 1 – September 30.

Table 56. Point source wasteload and nonpoint source load allocations, May 1 – September 30, for Sand Hollow, a Snake River tributary. Load and wasteload allocations are presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

Sand Hollow Creek	Current Flow (mgd/ cfs)[2]	Design Flow (mgd/ cfs)[2]	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation (lbs/day)	Average TP Load Reduction (%)
Parma WWTF	0.09 mgd 0.14 cfs	0.68 mgd 1.05 cfs	0.21	0.15	0.07	0.4	+157%
Nonpoint, ground water and unmeasured	140.7 cfs	139.7 cfs	0.40	301.2	0.07	52.7	-83%
Total	**140.8 cfs**	**140.8 cfs**	**0.399**	**301.4**	**0.07**	**53.1**	**-82%**

[1] The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

[2] Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the WWTF.

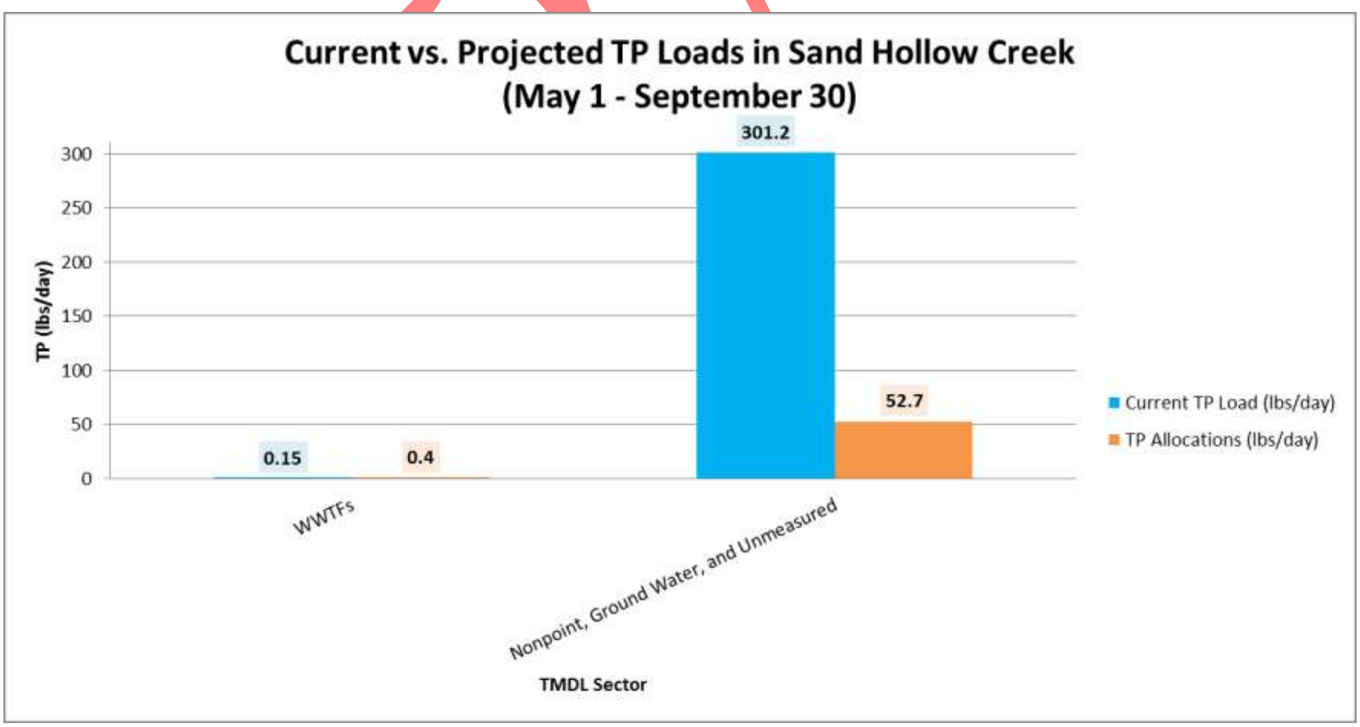


Figure 56. Current vs. projected TP loads for Sand Hollow Creek from May 1 – September 30.

5.4.4 Sand Hollow TP Allocations October 1 – April 30

Table 57 identifies point and nonpoint source October 1 – April 30 TP allocations for Sand Hollow Creek, a tributary to the Snake River. These allocations will result in daily average instream TP concentrations of 0.075 mg/L within Sand Hollow Creek. The load reductions will ensure help ensure that beneficial uses are fully supported in Sand Hollow Creek. Further, these allocations are consistent with those for tributaries of the lower Boise River and will go beyond the irrigation-season (May 1 – September 30) targets to further benefit water quality conditions the SR-HC TMDL.

Table 57. Point source wasteload and agricultural and other nonpoint source load allocations, October 1 – April 30, for Sand Hollow, a Snake River tributary. Load and wasteload allocations are presented per day as monthly averages[1]. DEQ intends that wasteload allocations are to be expressed as average monthly limits, with higher weekly average limits based on the coefficient of variation, in NPDES permits.

Sand Hollow Creek	Current Flow (mgd/ cfs)[2]	Design Flow (mgd/ cfs)[2]	Current TP Conc. (mg/L)	Current TP Load (lbs/day)	Target TP Conc. (mg/L)	Average TP Allocation (lbs/day)	Average TP Load Reduction (%)
Parma WWTF	0.13 mgd 0.20 cfs	0.68 mgd 1.05 cfs	0.12	0.1	0.35	1.99	+1426%
Nonpoint, ground water and unmeasured	63.4 cfs	62.6 cfs	0.33	113.2	0.07	23.6	-79%
Total	**63.6 cfs**	**63.6 cfs**	**0.33**	**113.3**	**0.075**	**25.7**	**-77%**

[1] The TP effluent limits identified in NPDES permits will depend on actual flows in Sand Hollow, and will fluctuate from year to year. It is expected that the point source facility will achieve the wasteload allocation targets with 2 permit cycles.

[2] Nonpoint, ground water, and unmeasured are flows and loads from May 1 – September 30 (1983 – 2012), minus flows and loads from the WWTF.

DRAFT

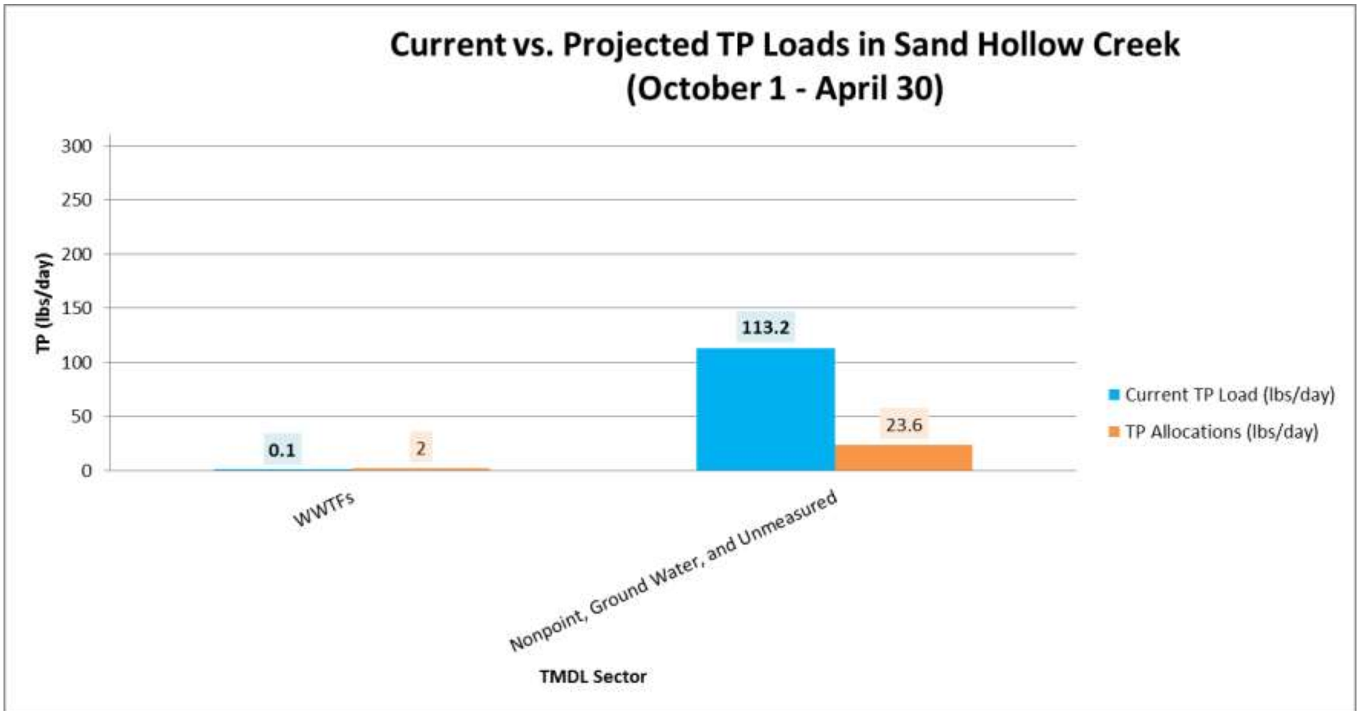


Figure 57. Current vs. projected TP loads for Sand Hollow Creek from October 1 – April 30.

5.4.5 Margin of Safety

This TMDL addendum and the SR-HC TMDL include several conservative implicit and explicit margins of safety (MOS). Therefore, this TMDL addendum does not require additional modification:

1. An explicit 13% MOS was applied to the SR-HC TMDL 0.07 mg/L TP target, and was incorporated into the TP load capacity and allocations. The MOS was determined by the accuracy, representativeness of sampling techniques, and analytical methods. Applying this MOS to the initial 16 µg/L threshold value yielded a target of 14 µg/L chlorophyll a.
2. This TMDL addendum, complies with the target TP allocations identified in the SR-HC TMDL and sets load and wasteload allocations that achieve 0.07 mg/L TP for 90th percentile low flow conditions, and maintains those same concentrations and loads under higher flows in order to comply with the lower Boise River mean monthly periphyton target (Section 5.2.2). Essentially, this TMDL TP allocation structure provides an explicit margin of safety for all flows greater than the 90th percentile.
3. The USGS mass balance model and long-term flow, load, and concentration data sets (1987-2012) were used to help develop the load and wasteload allocations in a conservative mass balance approach to account for nutrients.
4. This TMDL assumes that orthophosphorus from all sources is completely bioavailable and was modeled as such for a conservative approach. Additional research shows that the assumption that all orthophosphorus may not be equally bioavailable for algal and plant uptake and growth. However, more data and analysis would be necessary to further categorize the orthophosphorus sources throughout the watershed.

5. The AQUATOX model was used to simulate long-term TP loads, concentrations, and periphyton biomass relationships to help develop the load and wasteload allocations that achieve the mean monthly periphyton target in a conservative manner.
6. The margin of safety accounts for uncertainty about assimilative capacity, the relationship between the selected target and support of beneficial uses, and includes variability in target measurement.

5.4.6 Seasonal Variation

Achieving the SR-HC TMDL May 1 – September 30 Target

DEQ believes the May 1 – September 30 seasonal TP target $\leq$ 0.07 mg/L is protective of cold water aquatic life and contact recreation by achieving the SR-HC TMDL target of phytoplankton in the Snake River and reservoirs < 14 µg/L. Achieving this seasonal TP target in the lower Boise River will help reduce the frequency, magnitude, and duration of algal blooms and other aesthetic, ecological, and physical nuisance for contact recreation, as well as ecological impacts for cold water aquatic life, in the Snake River, the lower Boise River, Mason Creek, and Sand Hollow Creek. TP is neither a toxic nor results in immediate water quality impairment conditions. TP, along with many other water quality characteristics of the lower Boise River, exhibit seasonal variations in conditions as observed from May 1 – September 30. Incorporating seasonal variation within this TMDL provides for flexibility in managing sources and the river.

Achieving the Mean Monthly Benthic Chlorophyll a (Periphyton) Target

Through the TMDL process, DEQ, in consultation with the LBWC, developed a target that relates nuisance algae growth to the impairment of beneficial uses in the lower Boise River. Specifically, the target strives to limit mean monthly benthic chlorophyll a to $\leq$ 150 mg/m^2 (indicator of nuisance algae) within impaired AUs of the lower Boise River (see Section 2.2.5).

DEQ asserts this target protects contact recreation and cold water aquatic life beneficial uses. The target also corresponds well with values established in the academic literature (see Section 2.2.5) and is similar to targets developed and implemented for waters in Montana (MDEQ 2008), Minnesota (MPCA 2013) and Colorado (CDPHE 2013).

5.4.7 Reasonable Assurance

The point source WLAs and nonpoint source LAs are complementary toward effectively achieving the TP load capacity for the lower Boise River. However, because point source contributions are regulated by the EPA through NPDES permits, the reasonable assurances for this TMDL apply almost exclusively toward nonpoint source load reductions.

TP loading from agricultural and other nonpoint sources that are measured through tributaries and ground water are anticipated to decline due to a combination of ripple effects from point source TP reductions, BMPs, nutrient management, and land conversion. Such loading reductions will require time and resources beyond point source regulation to achieve. However, based on the USGS mass balance model and other data and reports (e.g. Etheridge 2013; Fox et al. 2002; Ferguson 1999), DEQ believes that TP concentrations and loads from nonpoint tributary and ground water sources can be effectively reduced to achieve the TMDL targets in the lower Boise River. The necessary reductions will result from the combination of regulated point source reductions (which inherently influence the amount of TP moving through the system and are subsequently used by nonpoint sources), along with concerted voluntary nonpoint source reductions, which will depend on funding, cost-sharing, willing partners, and effective BMP implementation to achieve the target.

For example, the DEQ's 2008 Lower Boise River Implementation Plan Total Phosphorus (DEQ 2008) asserts:

> "2.<u>BMP Effectiveness</u>. The Rock Creek watershed drains to the Snake River upstream from the SR-HC reach. With very little existing infrastructure, a 68% reduction in the discharge of TP from the watershed was achieved. Despite this improvement, TP concentrations from the watershed remained above 0.1 mg/l. (After project funding declined, the range of improvement also declined to approximately 40% due to the inability to fund the recurring annual BMP costs.)
>
> 3. <u>Prioritizing Lands for Treatment</u>. It is not necessary to treat all agricultural lands to substantially reduce the discharge of pollutants. BMP implementation should focus on priority lands where treatment will be most effective. Lands can be prioritized in three tiers as described earlier. To the maximum extent possible, treatment should focus on Tier 1 and Tier 2 lands with little or no existing BMPs. Prioritizing lands for treatment will increase BMP effectiveness and the probability of meeting allocation objectives within predictable timeframes…
>
> 7. <u>Existing Implementation Levels</u>. …The greatest water quality benefits from BMP implementation will be realized where there has been little or no BMP implementation, on "high priority" lands. Experience in the Rock Creek watershed has demonstrated that, in such areas, implementation of lower per-acre cost BMPs can result in substantial load reductions from irrigated lands. Implementation efforts should therefore be focused in these areas…"

Further examination of data from an Idaho surface-irrigated system directly addresses important Reasonable Assurance questions for future nonpoint source ground water and tributary concentrations. The Northside Canal Company (NSCC) case study is a reasonable application to consider in the LBR TP TMDL as the climate and soils and trend for irrigation efficiency/yield using sprinkler and drip are similar. NSCC TP data (Table 58) show an average of 54 ug/l TP over the last 12 years with a decreasing trend (last 8 year average TP = 49 and OP=20 ug/l).

The NSCC was 100% furrow irrigation in the early 1950's (similar to the lower Boise River) and today is 95% sprinkler, which has resulted in the elimination of 100's of return drains to the Snake River. NSCC has also constructed wetlands and detention basins within the system to provide water quality treatment. NSCC's goal is to have zero returns to the Snake River. This suggests that widespread conversion of sprinkler could result in similar significant reductions in tributary/drain flows and TP loads to the lower Boise River.

DRAFT

Table 58. Summary of North Side Canal Company TP and OP discharge data.

NSCC Drains to the Snake River		
Year	TP	OP
2002	0.07	0.05
2003	0.06	0.04
2004	0.05	0.03
2005	0.08	0.05
2006	0.06	0.02
2007	0.05	0.02
2008	0.05	0.02
2009	0.05	0.02
2010	0.03	0.01
2011	0.03	0.01
2012	0.06	0.03
2013	0.06	0.03
Average	**0.054**	**0.028**
Max	**0.08**	**0.05**
Min	**0.03**	**0.01**

Idaho water quality standards assign specific agencies responsibility for implementing, evaluating, and modifying BMPs to restore and protect impaired water bodies. The State of Idaho is committed to developing implementation plans within 18 months of EPA TMDL approval. DEQ, and the LBWC, will assist designated management agencies (e.g. SWCC) to develop an implementation plan, and DEQ will periodically reassess the beneficial use support status. BMP implementation and revision will continue until full beneficial use support status is documented and the TMDL target is achieved.

Nonpoint sources (e.g. agricultural) achieve their water quality obligations under the Clean Water Act through voluntary implementation of BMPs typically identified by the SWCC Conservation Commission. Idaho water quality standards, IDAPA 58.01.02.055, identify that water bodies not fully supporting beneficial uses:

> "…*shall require the development of TMDLs or other equivalent processes, as described under Section 303(d)(1) of the Clean Water Act*."

Whereas Idaho Statute 39-3610(1) states:

> "…*nothing in this section shall be interpreted as requiring best management practices for agricultural operations which are not adopted on a voluntary basis*."

Whereas Idaho Statute 39-3611(10) states:

> "*Nothing in this section shall be interpreted as requiring best management practices for agricultural nonpoint source activities which are not adopted on a voluntary basis*…"

5.4.8 Reserve for Growth

Where applicable, states must include an allowance for future loading in their TMDL that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of

DRAFT

the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established.

In the case of the lower Boise River TP TMDL addendum, the May-September TP allocations are based on achieving a TP concentration of 0.07 mg/L near Parma, which also contributes to achieving the mean monthly periphyton target of 150 mg/m^2 in the two impaired AUs. Alternatively, the October-April TP allocations correspond only with achieving the mean monthly periphyton target.

Because these allocations are necessary to achieve the May-September TP concentration target and the mean monthly periphyton target, an allowance for future growth is not recommended at this time, unless new point sources discharging directly or indirectly to the lower Boise River, Mason Creek, or Sand Hollow Creek: (1) receive a mean monthly NPDES permit limit for TP of ≤ 0.07 mg/L, (2) a DEQ 5-year review identifies a growth reserve calculated as the difference between current TP loads and TP allocations, where the difference is divided among new/existing point sources, (3) implement approved water quality offsets or trading, or (4) no discharge.

Alternatively, if a DEQ 5-year review of this TMDL addendum and subbasin assessment indicates that TP reductions have led to (A) beneficial uses being fully supported, and (B) state water quality standards being met, additional growth could be allowed. Under those conditions the allowance of new or expanded TP effluent concentrations and loads would need to be developed in a manner consistent with the two objectives presented in this TMDL addendum: 1) achieving a TP concentration of 0.07 mg/L in the lower Boise River near Parma from May-September, and 2) achieving the mean monthly periphyton target of 150 mg/m^2 in the two impaired AUS of the lower Boise River.

5.5 Implementation Strategies

The implementation strategy outlines a pathway by which the SWCC and Ada and Canyon Soil and Water Conservation Districts can develop a comprehensive implementation plan within 18 months after TMDL approval. The implementation plan will provide details of the actions needed to achieve load reductions set forth in this TMDL, a schedule of those actions, and the monitoring needed to document actions and progress toward meeting state water quality standards.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (addressed in section 5.4.7) for the TMDL to meet water quality standards is based on the implementation strategy.

A TP implementation plan for the lower Boise River, previously created by DEQ and the LBWC (DEQ 2008), presented strategies to achieve the May 1 – September 30 SR-HC TP allocation target on the lower Boise River. DEQ asserts that a new implementation plan should be developed to reflect this current TMDL addendum for the lower Boise River. Activities addressed in a new implementation plan should include:

- TP reductions from point source facilities

DRAFT

    - Effluent load and concentration targets
    - Projected flows
    - Projected loads on a seasonal basis
- TP reductions from stormwater dischargers through BMPs, increased attention to on-site stormwater inspection, and public education
- MS4 permittees to map their system inputs and outfalls and identify any non-stormwater (dry weather) discharges nonpoint-source origin, and identify steps to mitigate/eliminate these flows within the implementation timeframe.
- Voluntary BMP implementation on agricultural lands, contingent on available funding, cost-sharing, willing partners, and opportunities for water quality trading
- Conversion of agricultural land to other land uses
- Water quality trading framework
- Monitoring strategy

Some of the original implementation measures from the previous Lower Boise River Implementation Plan (DEQ 2008) could be appropriate for the current TMDL addendum, while acknowledging the need to expand and revise the focus to appropriately address the specific needs of the AUs in this document given current conditions and knowledge.

5.5.1 Time Frame

The lower Boise River TP TMDL addendum relies on a staged implementation strategy as referenced in EPA's Phased TMDL Clarification memo (EPA 2006). The staged implementation strategy for the lower Boise River acknowledges that NPDES-permitted point sources will strive to achieve the TMDL target as soon as possible. DEQ anticipates that 2 permit cycles (10 years from the approval of the TMDL) will be provided via 401 certification and justification to achieve their wasteload allocations. However, in consultation with DEQ, appropriate compliance schedules may be considered on a case-by-case basis for point source permits.

This TMDL addendum, however, does not define an implementation time frame for nonpoint sources; rather, implementation would begin as soon as possible and continue until the load allocation targets are met. This acknowledges that successfully achieving the TMDL target and allocations will depend on voluntary measures, including but not limited to available funding, cost-sharing, willing partners, and opportunities for water quality trading.

5.5.2 Approach

Point source contributions will be determined and regulated by EPA and NPDES permitting, whereas, funding provided under section 319, and other funds, will be used to encourage voluntary projects to reduce nonpoint source pollution. Additionally, upon the development of the TMDL, it is expected that a lower Boise River trading framework will be updated/developed and that trading may be utilized to achieve the pollutant targets in the subbasin (see Section 5.5.5).

Load allocations will be met over a reasonable period of time based on current pollution conditions in the watershed, current land management practices, and other relevant factors, as appropriate. DEQ may provide further guidance on the phased implementation of load allocations and will provide oversight to ensure that appropriate water quality milestones and targets are being achieved. If trading exists in the area covered by this TMDL, any phased implementation of load allocations may be used to derive trading baseline requirements.

5.5.3 Responsible Parties

The final implementation plan for this TMDL addendum will be developed under the existing practice established for the state of Idaho. The plan will be cooperatively developed by DEQ, the LBWC, affected private landowners, and designated management agencies with input through the established public process. Other individuals may also be identified to assist in developing site-specific implementation plans as their areas of expertise are identified as beneficial to the process.

Stakeholders in the lower Boise River subbasin have a responsibility for implementing the TMDL addendum. DEQ and the designated management agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers.

Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those resources for which they have regulatory authority or programmatic responsibilities:

- **Idaho Department of Lands (IDL)** for timber harvest, oil and gas exploration and development, and mining—IDL will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **Idaho Soil and Water Conservation Commission (SWCC)** for grazing and agriculture—working in cooperation with local soil and water conservation districts, the Idaho State Department of Agriculture (ISDA), and the NRCS, the SWCC will provide technical assistance to agricultural landowners. These agencies will help landowners design BMPs appropriate for their property and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **Idaho Transportation Department** for public roads—The Idaho Transportation Department will ensure appropriate BMPs are used for construction and maintenance of public roads.
- **Idaho State Department of Agriculture (ISDA)** for aquaculture, animal feeding operations, and concentrated animal feeding operations—ISDA will work with aquaculture facilities to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, ISDA also inspects animal feeding operations, concentrated animal feeding operations, and dairies to ensure compliance with NPDES requirements.
- **WAG** and other agencies for other activities—Idaho Statute 39-3616 states: *"…recommending those specific actions needed to control point and nonpoint sources of pollution within the watershed so that, within reasonable periods of time, designated beneficial uses are fully supported and other state water quality plans are achieved..consult with the director and participate in the development of each TMDL and any supporting subbasin assessment for water bodies within the watershed, and shall develop and recommend actions needed to effectively control sources of pollution..."*

DRAFT

- **DEQ** for other activities—DEQ will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.

In Idaho, these agencies, and their federal and state partners, are charged by the Clean Water Act to lend available technical assistance and other appropriate support to local efforts for water quality improvements.

The designated management agencies, LBWC, and other appropriate public process participants are expected to:

- Develop BMPs to achieve load allocations.
- Provide reasonable assurance that management measures will achieve load allocations through both quantitative and qualitative analysis of management measures.
- Adhere to measurable milestones for progress.
- Develop a timeline for implementation, with reference to costs and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, load allocations and wasteload allocations are being met, and water quality standards are being met.

In addition to the designated management agencies, the public, through the LBWC and other processes, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (i.e., landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those developed with substantial public cooperation and involvement.

5.5.4 Implementation Monitoring Strategy

The objectives of a monitoring strategy should be to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and track the TMDL implementation effectiveness. This monitoring and feedback mechanism is a major component of the "reasonable assurance" component of the TMDL and implementation plan.

Monitoring will provide information on progress being made toward achieving TMDL allocations and achieving water quality standards, and will help in the interim evaluation of progress, including in the development of 5-year reviews and future addendums.

The implementation monitoring strategy should specifically focus on several aspects:

1. **<u>May 1 – September 30</u>**
    a. Measure TP concentration trends (mg/L) and loadings (lbs/day) in the lower Boise River near Parma relative to the SR-HC May 1 – September 30 TP allocation target of $\leq$ 0.07 mg/L.
        i. Focus monitoring efforts on the various sources identified in this TMDL (e.g. WWTFs, stormwater, tributaries and drains, and ground water/unmeasured).

DRAFT

b. Identify TP concentration trends (mg/L) and TP load equivalents (lbs/day) in Mason Creek near the mouth relative to the its allocation target identified in this TMDL for the May 1 – September 30 time period.
c. Identify TP concentration trends (mg/L) and TP load equivalents (lbs/day) in Sand Hollow Creek near the mouth relative to the SR-HC May 1 – September 30 TP allocation target of ≤ 0.07 mg/L.

2. Mean Monthly Benthic Chlorophyll a < 150 mg/m^2

a. Identify TP concentration trends (mg/L) and loadings (lbs/day) in the lower Boise River relative TP allocation targets designed to help achieve the mean monthly benthic chlorophyll a (periphyton) target of ≤ 150 mg/m^2.
    i. Focus monitoring efforts on the various sources identified in this TMDL (e.g. WWTFs, stormwater, tributaries and drains, and ground water/unmeasured).
b. Measure mean monthly benthic chlorophyll a (periphyton) in the two lower Boise River AUs that are currently listed as impaired for TP in the 2012 Integrated Report (DEQ 2014c) in order to help determine the extent in which changes in TP concentrations and TP load equivalents are helping to achieve the algae growth target.

The Implementation Monitoring Strategy should be designed by DEQ, USGS, designated management agencies, the LBWC, and other affected agencies/organizations/individuals to help ensure scientifically-defensible and meaningful methodologies are utilized to help to track progress toward meeting the TMDL objectives. All sampling and analyses would be conducted under DEQ, USGS, SWCC, or other scientifically-defensible and approved protocols.

5.5.5 Water Quality Trading

Water quality trading (also known as pollutant trading) is a contractual agreement to exchange pollution reductions between two parties. Water quality trading is a business-like way of helping to solve water quality problems by focusing on cost-effective, local solutions to problems caused by pollutant discharges to surface waters. Water quality trading is one of the tools available to meet reductions called for in a TMDL where point and nonpoint sources both exist in a watershed.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Water quality trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Water quality trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. DEQ allows for water quality trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. DEQ's *Water Quality Pollutant Trading Guidance* sets forth the procedures to be followed for water quality trading (DEQ 2010).

DRAFT

5.5.5.1 Trading Components

The major components of water quality trading are trading parties (buyers and sellers) and credits (the commodity being bought and sold). Ratios are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database by DEQ or its designated party.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant beyond a level set by a TMDL:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the wasteload allocation.
- Nonpoint sources create credits by implementing approved BMPs that reduce the amount of pollutant runoff. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP; apply discounts to credits generated, if required; and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit) is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

5.5.5.2 Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL is protected. To do this, hydrologically-based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

5.5.5.3 Trading Framework

For water quality trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA-approved TMDL, DEQ, in concert with the WAG, must develop a water quality trading framework document. The Lower Boise has an existing Trading Framework that DEQ is currently evaluating to revise ratios and policies consistent with this Lower Boise TP TMDL assumptions, and Joint Regional Recommendations (JRR) for water quality trading. The JRR are the outcome pursuant of a three-state effort of Region 10 and the states facilitated through a USDA-NRCS Conservation Innovation Grant awarded to the Willamette Partnership. The framework would mesh with the implementation plan for the watershed that is the subject of the TMDL. The elements of a trading document are described in DEQ’s water quality trading guidance (DEQ 2010).

DRAFT

6 Conclusions

The identified TP pollutant sources in this TMDL are both point and nonpoint in nature. Point sources include WWTF, industrial, fish hatchery, and stormwater contributions. Nonpoint sources include tributaries and drains that are generally agriculturally-fed or supplemented streams, ground water and other unmeasured sources, and background. Allocations in the TMDL addendum are designed to achieve two targets: 1) the May 1 – September 30 SR-HC TP target of $\leq$ 0.07 mg/L in the Snake River (e.g. in the lower Boise River near Parma and at the mouth of Sand Hollow Creek near the Snake River), and 2) TP targets designed to help achieve the mean monthly benthic chlorophyll a (periphyton) target of $\leq$ 150 mg/m^2 in the lower Boise River from May 1 – September 30 and October 1 – April 30. Achieving these targets is expected to result in full support cold water aquatic life and contact recreation beneficial uses in the lower Boise River, Mason Creek, and Sand Hollow Creek.

Table 59 provides a summary of assessment outcomes and recommended changes to the next Integrated Report.

Table 59. Summary of assessment outcomes.

Assessment Unit Name	Assessment Unit Number	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
Boise River – Middleton to Indian Creek	ID17050114SW005_06b	Total Phosphorus	Yes	List in Category 4a for Total Phosphorus	EPA-approved Total Phosphorus TMDL completed
Boise River – Indian Creek to Mouth	ID17050114SW001_06	Total Phosphorus	Yes	List in Category 4a for Total Phosphorus	EPA-approved Total Phosphorus TMDL completed
Mason Creek – Entire Watershed	ID17050114SW006_02	Cause Unknown - Nutrients Suspected Impairment	Yes	List in Category 4a for Total Phosphorus	EPA-approved Total Phosphorus TMDL completed
Sand Hollow Creek – C-Line Canal to I-84	ID17050114SW016_03	Cause Unknown - Nutrients Suspected Impairment	Yes	List in Category 4a for Total Phosphorus	EPA-approved Total Phosphorus TMDL completed
Sand Hollow Creek – Sharp Road to Snake River	ID17050114SW017_06	Cause Unknown- Nutrients Suspected Impairment	Yes	List in Category 4a for Total Phosphorus	EPA-approved Total Phosphorus TMDL completed

In addition, data analysis for a 5-year review of the lower Boise River subbasin was completed in 2009 (DEQ 2009), and a TP implementation plan for the lower Boise River subbasin was completed in 2008 (DEQ 2008). These documents are available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*.

This document was prepared with input from the public, as described in Appendix C, including comments and DEQ responses. A distribution list is included in Appendix D.

References Cited

Biggs, B.J.F. 2000. Eutrophication of streams and rivers: dissolved nutrient-chlorophyll relationships for benthic algae. Journal of North American Benthological Society 19:17-31.

Carter, D.L. 2002. Proposed Best Management Practices (BMP's) to be Applied in the Lower Boise River Effluent Trading Demonstration Project. Report

CDPHE (Colorado Department of Public Health and Environment). 2013. Regulation No. 31. The Basic Standards and Methodologies for Surface Water (5 CCR 1002-31).

CFR (Code of Federal Regulation). 1977. "Guidelines Establishing Test Procedures for the Analysis of Pollutants." 40 CFR 136.

CFR (Code of Federal Regulation). 1983. "EPA Administered Permit Programs: The National Pollutant Discharge Elimination System." 40 CFR 122.

CFR (Code of Federal Regulation). 1983. "Water Quality Standards." 40 CFR 131.

CFR (Code of Federal Regulation). 1995. "Water Quality Planning and Management." 40 CFR 130.

Chelstrom, T. 2009. Canoeing the Boise River. Fourth Edition, Revised August 2009. REI.

Daly, K. and R. Watters. 1999. Kath and Ron's Guide to Idaho Paddling: Flatwater and Easy Whitewater Trips. Great Rift Press.

DEQ (Idaho Department of Environmental Quality). 1999. Lower Boise River TMDL Subbasin Assessment, Total Maximum Daily Loads. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx.*

DEQ (Idaho Department of Environmental Quality). 2001a. Lower Boise River Nutrient and Tributary Subbasin Assessments. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*.

DEQ (Idaho Department of Environmental Quality). 2001b. Lower Boise River Nutrient Subbasin Assessment. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*.

DEQ (Idaho Department of Environmental Quality). 2001c. Mason Creek Subbasin Assessment. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*

DEQ (Idaho Department of Environmental Quality). 2001d. Sand Hollow Creek Subbasin Assessment. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-nutrient-tributary-subbasin.aspx*

DEQ (Idaho Department of Environmental Quality). 2003. Implementation Plan for the Lower Boise River Total Maximum Daily Load. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*

DEQ (Idaho Department of Environmental Quality) and ODEQ (Oregon Department of Environmental Quality). 2004. Idaho Department of Environmental Quality and Oregon Department of Environmental Quality. Snake River–Hells Canyon Total Maximum Daily Load (TMDL). Idaho Department of Environmental Quality/Oregon Department of Environmental Quality, approved by EPA in September 2004.

DEQ (Idaho Department of Environmental Quality). 2005. Catalog of Stormwater Best Management Practices for Idaho Cities and Counties. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/wastewater/stormwater.aspx*.

DEQ (Idaho Department of Environmental Quality). 2008. Lower Boise River Implementation Plan Total Phosphorus. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*

DEQ (Idaho Department of Environmental Quality) and the Lower Boise Watershed Council. 2008a (revised 2012). Sediment and Bacteria Allocations Addendum to the Lower Boise River TMDL. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx.*

DEQ (Idaho Department of Environmental Quality). 2009. Lower Boise River TMDL Five-Year Review. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx.*

DEQ (Idaho Department of Environmental Quality). 2010. Water Quality Pollutant Trading Guidance. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/pollutant-trading.aspx*.

DEQ (Idaho Department of Environmental Quality). 2010b. Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total Maximum Daily Loads. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx.*

DEQ (Idaho Department of Environmental Quality). 2010. Lake Lowell TMDL: Addendum to the Lower Boise River Subbasin Assessment and Total maximum Daily Loads. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/boise-river-lower-subbasin.aspx*.

DRAFT

DEQ (Idaho Department of Environmental Quality). 2011. Idaho's 2010 Integrated Report. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx*.

DEQ (Idaho Department of Environmental Quality). 2014a. Lower Boise River Phosphorus AQUATOX Model Report. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx*.

DEQ (Idaho Department of Environmental Quality). 2014b. Quality Assurance Project Plan: AQUATOX Modeling for the Lower Boise River Total Phosphorus TMDL. Boise, ID: DEQ.

DEQ (Idaho Department of Environmental Quality). 2014c. Idaho's 2012 Integrated Report. Boise, ID: DEQ. Available at: *http://www.deq.idaho.gov/water-quality/surface-water/monitoring-assessment/integrated-report.aspx*.

Dodds, W.K., V.H. Smith, and B. Zander. 1997. Developing nutrient targets to control benthic chlorophyll levels in streams: a case study of the Clark Fork River. Water Resources 31:1738-1750.

Dodds, W.K., J.R. Jones, and E.B. Welch. 1998. Suggested classification of stream trophic state: distributions of temperate stream types by chlorophyll, total nitrogen, and phosphorus. *Water Resources* 32:1455-1462.

Dodds, K. W. and E.B. Welch. 2000. Establishing nutrient criteria in streams. *Journal of North American Benthological Society* 19:186-196.

EPA (U.S. Environmental Protection Agency). 1986. Quality Criteria for Water 1986. EPA Office of Water Regulations and Standards 440/5-86-001. May 1, 1986. *http://water.epa.gov/scitech/swguidance/standards/criteria/aqlife/upload/2009_01_13_criteria_goldbook.pdf*

EPA (U.S. Environmental Protection Agency). 2006. Benita Best-Wong memorandum to Water Division Directors re: Clarification regarding "Phased" Total Maximum Daily Loads, August 2, 2006. *http://www.epa.gov/owow/tmdl/tmdl_clarification_letter.html*.

EPA (U.S. Environmental Protection Agency). 2007. An Approach for Using Load Duration Curves in the Development of TMDLs. EPA Office of Wetlands, Oceans, and Watersheds 841-B-07-2006. August 2007. 68 p. *http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/upload/2007_08_23_tmdl_duration_curve_guide_aug2007.pdf*

EPA (U.S. Environmental Protection Agency). 2008a. The U.S. Environmental Protection Agency (EPA) Proposes to Issue a National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water Discharges to: Notus-Parma Highway District. U.S. EPA Fact Sheet for NPDES Permit # IDS-028151.

DRAFT

EPA (U.S. Environmental Protection Agency). 2008b. The U.S. Environmental Protection Agency (EPA) Proposes to Issue a National Pollutant Discharge Elimination System (NPDES) Permit for Storm Water Discharges to: Ada County Highway District. U.S. EPA Fact Sheet for NPDES Permit # IDS-028185.

EPA (U.S. Environmental Protection Agency). 2009a. Final Decision on the Lower Boise River and Hem Creek. Letter and enclosures from Michael A Bussell, Director, Office of Water and Watersheds (EPA) to Barry N. Burnell, Administrator, Water Quality Program (DEQ). October 13, 2009.

EPA (U.S. Environmental Protection Agency). 2009b. Partial approval/partial disapproval of Idaho's Final 2008 303(d) list. Letter and report from Michael A Bussell, Director, Office of Water and Watersheds (EPA) to Barry N. Burnell, Administrator, Water Quality Program (DEQ). February 4, 2009 (OWW-134).

Etheridge, A.B. 2013. Evaluation of Total Phosphorus Mass Balance in the Lower Boise River, Southwestern Idaho. U.S. Geological Survey Scientific Investigations Report 2013-5220, 70 p.

Etheridge, A.B., MacCoy, D.E., and Weakland, R.J., 2014, Water-quality and biological conditions in selected tributaries of the Lower Boise River, southwestern Idaho, water years 2009–12: U.S. Geological Survey Scientific Investigations Report 2014-5132, 58 p., *http://dx.doi.org/10.3133/sir20145132*.

Fishman, M.J., ed., 1993, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125, 217 p.

Ferguson, D.F. 1999. Best Management Practice Effectiveness on Phosphorus Removal from Field Surface Irrigation Return Flows. Idaho Soil Conservation Commission Technical Report. Boise, ID 19 p.

Fox, J. R.Carlson, K. Campbell, and G. Bahr. 2002. Ground and surface water interaction related to nutrients within Mason Creek agricultural drain Canyon County, Idaho. Ground Water Monitoring Technical Completion Report.

Grafe, C.S., C.A. Mebane, M.J. McIntyre, D.A. Essig, D.H. Brandt, and D.T. Mosier. 2002. Water Body Assessment Guidance. 2nd ed. Final. Boise, ID: Department of Environmental Quality. 114 p.

Hammer, M.J. 1986. *Water and Wastewater Technology*, 2nd ed. Englewood Cliffs, NJ: Prentice Hall, Inc.

Hilton, J., M. O'Hare, M.J. Bowes, J.I. Jones. 2006. How green is my river? A new paradigm of eutrophication in rivers. *Elsevier* 365:66-83.

Idaho Code. 2012. "Creation of Watershed Advisory Groups." Idaho Code 39-3615.

Idaho Code. 2012. "Development and Implementation of Total Maximum Daily Load or Equivalent Processes." Idaho Code 39-3611.

DRAFT

MacCoy, D.E. 2004. Water-quality and biological conditions in the lower Boise River, Ada and Canyon Counties, Idaho, 1994–2002: U.S. Geological Survey Scientific Investigations Report 2004–5128, 80 p.

MDEQ (Montana Department of Environmental). 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. November 2008.

MPCA (Minnesota Pollution Control Agency). 2013. Minnesota Nutrient Criteria Development for Rivers (DRAFT). January 2013.

IDAPA. 2012. "Idaho Water Quality Standards. Idaho Administrative Code." IDAPA 58.01.02.

ISDA (Idaho State Department of Agriculture). 2008. Water Quality Monitoring Report: Lower Boise River and Snake River Tributaries April 24 through October 9, 2008. ISDA Technical Report Summary W-29.

MacCoy, D.E., 2004, Water-Quality and Biological conditions in the lower Boise River, Ada and Canyon Counties, Idaho, 1994–2002: U.S. Geological Survey Scientific Investigations Report 2004–5128, 80 p.

MacCoy, D.E., 2006, Fish communities and related environmental conditions of the lower Boise River, southwestern Idaho, 1974–2004: U.S. Geological Survey Scientific Investigations Report 2006-5111, 36 p.

Idaho, 1974–2004: U.S. Geological Survey Scientific Investigations Report 2006-5111, 36 p.

Miltner, R.J. and E.T. Rankin. 1998. Primary nutrients and the biotic integrity of rivers and streams. *Freshwater Biology* 45:145-158.

Miltner, R.J. 2010. A Method and Rationale for Deriving Nutrient Criteria for Small Rivers and Streams in Ohio. *Environmental Management* 45:842-855.

Mullins, W.H. 1998. Water-quality conditions of the lower Boise River, Ada and Canyon Counties, Idaho, May 1994 through February 1997: U.S. Geological Survey Water-Resources Investigations Report 98-4111, 32 p.

Mullins, W.H. 1999. Biological assessment of the lower Boise River, October 1995 through January 1998, Ada and Canyon Counties, Idaho: U.S. Geological Survey Water-Resources Investigations Report 99-4178, 37 p.

Rosgen, D. 1996. *Applied River Morphology*. Pagosa Springs, CO: Wildland Hydrology.

Rushforth Phycology. 2007. *Periphyton Community Analysis Summary: Boise River Study*. Orem, UT: Rushforth Phycology, LLC.

Strahler, A.N. 1957. Quantitative Analysis of Watershed Geomorphology. *Transactions American Geophysical Union* 38:913–920.

Suplee, M.W., V. Watson, M. Teply, and H. McKee. 2009. How green is too green? Public opinion of what constitutes undesirable algae levels in streams. *Journal of the American Water Resources Association* 45:123-140.

DRAFT

TSIC (Tri-State Implementation Council). 1998. Clark Fork River Voluntary Nutrient Reduction Program. 33 p. + Appendices.

US Congress. 1972. Clean Water Act (Federal Water Pollution Control Act). 33 USC §1251–1387.

USGS (U.S. Geological Survey). 2012. Work plan for the assessment of water quality and biological communities in the lower Boise River and selected tributaries, Ada and Canyon Counties, Idaho 2012 through 2016. 6 p.

USGS (U.S. Geological Survey). 2013a. Work plan for the assessment of water quality and biological communities in the lower Boise River and selected tributaries, Ada and Canyon Counties, Idaho 2013 through 2016. 5 p.

USGS (U.S. Geological Survey). 2013b. Work plan for the assessment of water quality and biological communities in the lower Boise River and selected tributaries, Ada and Canyon Counties, Idaho Federal Fiscal Year 2014. 4 p.

Welch, E.G., J.M. Jacoby, R.R. Horner, and M.R. Seeley. 1988. Nuisance biomass levels of periphytic algae in streams. *Hydrobiologia* 157:161-168.

Western Regional Climate Center. 2010. NCDC 1981-2012 Monthly Normals: Boise WSFO Airport, Idaho 101022. Web July 15, 2014. *http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id1022*

Wood, M.S., and A.B. Etheridge. 2011. Water-quality conditions near the confluence of the Snake and Boise Rivers, Canyon County, Idaho: U.S. Geological Survey Scientific Investigations Report 2011–5217, 70 p.

GIS Coverages

Restriction of liability: Neither the State of Idaho, nor the Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information or data provided. Metadata are provided for data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice.

DRAFT

Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

Any of the various uses of water that are recognized in water quality standards, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics.

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and existing beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

DRAFT

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The margin of safety is not allocated to any sources of pollution.

Nonpoint Source

A dispersed source of pollutants generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater plants.

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment that alter the functioning of natural processes and

DRAFT

produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

Synoptic

A sampling event that takes place over a relatively short timeframe and under relatively stable hydrologic conditions.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual basis. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Wasteload Allocation (WLA)

The portion of receiving water's load capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.

Water Quality Standards

State-adopted and United States Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

DRAFT

This page intentionally left blank for correct double-sided printing.

DRAFT

Appendix A. Site-Specific Water Quality Standards and Criteria

Idaho Water Quality Standards IDAPA 58.01.02.140.12 for the lower Boise River subbasin.

12. **Lower Boise Subbasin**. The Lower Boise Subbasin, HUC 17050114, is comprised of seventeen (17) water body units

Unit	Waters	Aquatic Life	Recreation	Other
SW-1	Boise River- Indian Creek to mouth	COLD	PCR	
SW-2	Indian Creek - Sugar Ave. (T03N, R02W, Sec. 15) to mouth	COLD	SCR	
SW-3a	Split between New York Canal and historic creek bed to Sugar Ave. (T03N, R02W, Sec. 15)	COLD SS	SCR	
SW-3b	Indian Creek Reservoir to split between New York Canal and historic creek bed	COLD	SCR	
SW-3c	Indian Creek Reservoir	COLD	PCR	
SW-3d	Indian Creek - source to Indian Creek Reservoir	COLD	SCR	

Section 140 Page 102

IDAHO ADMINISTRATIVE CODE *IDAPA 58.01.02*
Department of Environmental Quality *Water Quality Standards*

Unit	Waters	Aquatic Life	Recreation	Other
SW-4	Lake Lowell	WARM	PCR	
SW-5	Boise River - river mile 50 (T04N, R02W, Sec. 32) to Indian Creek	COLD SS	PCR	
SW-6	Mason Creek - New York Canal to mouth		SCR	
SW-7	Fifteenmile Creek - Miller Canal to mouth		SCR	
SW-8	Tenmile Creek - Blacks Creek Reservoir Dam to Miller Canal	COLD	SCR	
SW-9	Blacks Creek - source to and including Blacks Creek Reservoir			
SW-10	Fivemile Creek - source to Miller Canal	COLD	SCR	
SW-11a	Boise River - Diversion Dam to river mile 50 (T04N, R02W, Sec. 32)	COLD SS	PCR	DWS
SW-11b	Boise River - Lucky Peak Dam to Diversion Dam	COLD	PCR	DWS
SW-12	Stewart Gulch, Cottonwood and Crane Creeks -source to mouth			
SW-13	Dry Creek - source to mouth			
SW-14	Big/Little Gulch Creek complex			
SW-15	Willow Creek - source to mouth			
SW-16	Langley/Graveyard Gulch complex			
SW-17	Sand Hollow Creek - source to mouth		SCR	

Idaho Water Quality Standards IDAPA 58.01.02.278.01-05 for the lower Boise River subbasin.

278. LOWER BOISE RIVER SUBBASIN, HUC 17050114 SUBSECTION 140.12.

01. Boise River, SW-1 and SW-5 -- Salmonid Spawning and Dissolved Oxygen. The waters of the Boise River from Veterans State Park to its mouth will have dissolved oxygen concentrations of six (6) mg/l or seventy-five percent (75%) of saturation, whichever is greater, during the spawning period of salmonid fishes inhabiting those waters. (3-15-02)

02. Boise River, SW-5 and SW-11a -- Copper and Lead Aquatic Life Criteria. The water-effect ratio (WER) values used in the equations in Subsection 210.02 for calculating copper and lead CMC and CCC values shall be two and five hundred seventy-eight thousandths (2.578) for dissolved copper and two and forty-nine thousandths (2.049) for lead. These site-specific criteria shall apply to the Boise River from the Lander St. wastewater outfall to where the channels of the Boise River become fully mixed downstream of Eagle Island.

Section 278 Page 162

IDAHO ADMINISTRATIVE CODE *IDAPA 58.01.02*
Department of Environmental Quality *Water Quality Standards*

(5-3-03)

03. Indian Creek, SW-3a -- Site-Specific Criteria for Water Temperature. A maximum weekly maximum temperature of thirteen degrees C (13°C) to protect brown trout and rainbow trout spawning and incubation applies from October 15 through June 30. (3-29-12)

04. Boise River, SW-5 and SW-11a -- Site-Specific Criteria for Water Temperature. A maximum weekly maximum temperature of thirteen degrees C (13°C) to protect brown trout, mountain whitefish, and rainbow trout spawning and incubation applies from November 1 through May 30. (3-29-12)

05. Point Source Thermal Treatment Requirement. With regard to the limitations set forth in Section 401 relating to point source wastewater discharges, only the limitations of Subsections 401.01.a. and 401.01.b. and the temperature limitation relating to natural background conditions shall apply to discharges to any water body within the Lower Boise River Subbasin. (3-29-12)

This page intentionally left blank for correct double-sided printing.

DRAFT

Appendix B. Data Sources

Table B1. Data sources for lower Boise River subbasin assessment.

Water Body	Type of Data	Data Source	Collection Date
Lander Street WWTF	Effluent Parameters	Kate Harris, City of Boise	2006 – 2013
West Boise WWTF	Effluent Parameters	Kate Harris, City of Boise	2006 – 2013
Middleton WWTF	Effluent Parameters	Brad Green, City of Middleton Michael Moore, Analytical Laboratories	2011 – 2013
Caldwell WWTF	Effluent Parameters	Lee Van DeBogart, City of Caldwell	2012 – 2013
IDFG Eagle Hatchery	Flow	Jeff Heindel, IDFG	2003 – 2013
IDFG Eagle Hatchery	Effluent Parameters	Kate Harris, City of Boise	2007 – 2013
Darigold, Inc.	Effluent Parameters	Scott Algate, Darigold, Inc.	2012 – 2013
Avimor WWTF	Effluent Parameters	Jeremy Aulbach, Pharmer Engineering LLC	2012-2013
Star WWTF	Effluent Parameters	Ken Vose, Star Sewer and Water	2006 – 2013
Meridian WWTF	Effluent Parameters	Michael Kasch, HDR	2012 – 2013
Sorrento Lactalis	Effluent Parameters	Wendy York, Sorrento Lactalis	2012 – 2013
Nampa WWTF	Effluent Parameters	Matt Gregg, Brown and Caldwell	2012 – 2013
Kuna WWTF	Effluent Parameters	Tom Shaffer, City of Kuna	2012 – 2013
IDFG Nampa Hatchery	Effluent Parameters	DMR Data Kate Harris, City of Boise	2012 – 2013
IDFG Eagle Hatchery	Effluent Parameters	Kate Harris, City of Boise	2007 – 2013
Notus WWTF	Effluent Parameters	Mike Black, City of Notus	2007 – 2013
Wilder WWTF	Effluent Parameters	Wendy Burrows, City of Wilder	2012 – 2013
Greanleaf WWTF	Effluent Parameters	DMR Data	2012 – 2013
Parma WWTF	Effluent Parameters	Ken Steinhaus, City of Parma	2012 – 2013

DRAFT

Lower Boise River, Mason Creek, Sand Hollow Creek, and Lower Boise River Tributaries	Water Quality, Periphyton, Habitat, and Flow Parameters	Alex Etheridge, USGS	1983 – 2013
Lower Boise River Tributaries	Water Quality Parameters	Kirk Campbell, ISDA	1998 - 2008
Lower Boise River and Tributaries	BURP	DEQ	1995, 1996, 2003
Lower Boise River, Dixie Drain, and Point Sources	Water Quality, Periphyton, Habitat, and Flow Parameters	Kate Harris, City of Boise	1993 – 2013
Stormwater	LBWC Stormwater Workgroup	Lee Van de Bogart, City of Caldwell Erica Anderson-Maguire, ACHD Jack Harrison, HyQual Cheryl Jenkins, City of Nampa Ted Douglas, Brown and Caldwell	2007 - 2013

DRAFT

This page intentionally left blank for correct double-sided printing.

DRAFT

Appendix C. Public Participation and Public Comments

DEQ consulted and coordinated with the LBWC during regular and frequent intervals toward developing a nutrient TMDL since the river was listed as impaired by nutrients in the 1998 §303(d) list from Star to the mouth, and again after the final SR-HC TMDL was approved by EPA in September 2004.

Since revitalizing this specific TMDL effort in March 2012, DEQ has consulted, coordinated, and met with the southwest Basin Advisory Group (BAG), Lower Boise Watershed Council (LBWC), Technical Advisory Committee (TAC) and other workgroups, EPA, USGS, and other interested stakeholders in more than 100 meetings, of which, nearly all were open and announced to the public. This continual stakeholder participation was, and will be, critical before, during, and after the public comment period in Month 2014, and in the subsequent TMDL implementation. In addition to these meetings, DEQ also kept the public apprised of progress by posting specific TMDL-related information on the DEQ Lower Boise River Watershed Advisory Group webpage: *http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx*.The meetings and presentations include but are not limited to:

1. April 6, 2012 LBWC TAC
2. April 12, 2012 LBWC
3. May 10, 2012 LBWC
4. June 14, 2012 LBWC
5. June 19, 2012 LBWC TAC
6. July 12, 2012 LBWC
7. July 26, 2012 LBWC TAC
8. August 23, 2012 LBWC TAC
9. September 13, 2012 LBWC
10. September 27, 2012 LBWC TAC
11. October 11, 2012 LBWC
12. October 25, 2012 LBWC TAC
13. November 8, 2012 LBWC
14. November 28, 2012 Modeling Workgroup
15. November 29, 2012 LBWC TAC
16. January 3, 2013 LBWC TAC
17. January 10, 2013 LBWC
18. January 16, 2013 BAG
19. January 17, 2013 Modeling Workgroup
20. January 24, 2013 LBWC & TAC Combined
21. February 14, 2013 LBWC
22. February 21, 2013 Modeling Workgroup
23. February 28, 2013 LBWC TAC
24. March 14, 2013 LBWC
25. March 21, 2013 Modeling Workgroup
26. April 2, 2013 Modeling Work Session
27. April 4, 2013 LBWC TAC
28. April 9, 2013 Modeling Work Session
29. April 11, 2013 LBWC
30. April 16, 2013 Modeling Work Session
31. April 23, 2013 Modeling Work Session
32. April 25, 2013 LBWC TAC
33. April 30, 2013 Modeling Work Session
34. May 2, 2013 LBWC TAC
35. May 9, 2013 LBWC
36. May 14, 2013 Modeling Work Session
37. May 23, 2013 LBWC TAC
38. May 28, 2013 Modeling Work Session
39. June 3, 2013 Ada Soil Conservation District
40. June 11, 2013 Modeling Work Session
41. June 11, 2013 Canyon Soil Conservation District

DRAFT

42. June 13, 2013 LBWC
43. June 18, 2013 Model Work Session
44. June 25, 2013 Model Work Session
45. June 27, 2013 LBWC TAC
46. July 2, 2013 Model Work Session
47. July 9, 2013 Model Work Session
48. July 11, 2013 LBWC
49. July 16, 2013 Model Work Session
50. July 18, 2013 LBWC Monitoring TAC
51. July 23, 2013 Model Work Session
52. July 25, 2013 LBWC TAC
53. August 6, 2013 Model Work Session
54. August 13, 2013 Model Work Session
55. August 22, 2013 LBWC TAC
56. August 22, 2013 DEQ WQ Trading Open House
57. August 27, 2013 Model Work Session
58. September 3, 2013 Model Work Session
59. September 10, 2013 Model Work Session
60. September 12, 2013 LBWC
61. September 24, 2013 Model Work Session
62. September 26, 2013 LBWC TAC
63. October 10, 2013 LBWC
64. October 15, 2013 Model Work Session
65. October 22, 2013 Model Work Session
66. October 24, 2013 LBWC TAC
67. November 5, 2013 Model Work Session
68. November 14, 2013 LBWC
69. November 26, 2013 Model Work Session
70. December 3, 2013 Model Work Session
71. December 19, 2013 Model Work Session
72. January 9, 2014, LBWC
73. January 21, 2014 Model Work Session
74. January 23, 2014 LBWC TAC
75. February 13, 2014 LBWC
76. February 18, 2014 Model Work Session
77. February 26, 2014 LBWC TAC
78. February 27, 2014 Idaho Association of Commerce and Industry
79. March 12, 2014 Ada County Highway District
80. March 13, 2014 LBWC
81. March 17, Treasure Valley Partnership
82. April 3, 2014 LBWC TAC
83. April 10, 2014 Small Municipalities of the Treasure Valley
84. April 10, 2014 LBWC
85. April 15, 2014 Model-Techno-Policy Workgroup
86. April 16, 2014 BAG
87. April 24, 2014 LBWC TAC
88. April 25, 2014 LBWC Stormwater
89. April 30, 2014 Model-Techno-Policy Workgroup
90. May 8, 2014 LBWC
91. May 14, 2014 Model-Techno-Policy Workgroup
92. May 28, 2014 Model-Techno-Policy Workgroup
93. May 29, 2014 LBWC TAC
94. June 11, 2014 Model-Techno-Policy Workgroup
95. June 12, 2014 LBWC
96. July 9, 2014 Model-Techno-Policy Workgroup
97. July 10, 2014 LBWC
98. July 23, 2014, Model-Techno-Policy Workgroup
99. July 30, 2014 LBWC TAC
100. August 11, 2014 LBWC Stormwater
101. August 19, 2014 LBWC Stormwater
102. August 22, 2014 Amalgamate Sugar
103. September 11, 2014 Treasure Valley Partnership
104. September 12, 2014 LBWC Stormwater
105. September 24, 2014 LBWC TAC

DRAFT

106. October 9, 2014 LBWC
107. December 4, 2014 LBWC TAC
108. December 11, 2014 LBWC
109. December 12, 2014 LBWC Stormwater
110. January 8, 2015 LBWC
111. January 21, 2015 LBWC TAC

[Public comments and DEQ responses to be inserted following public comment period.]

DRAFT

This page intentionally left blank for correct double-sided printing.

Appendix D. Distribution List

Ben Cope and Bill Stewart, EPA

BOR Pacific Northwest Region and Snake River Office

Lower Boise Watershed Council, TAC, 319 TAC, and Workgroup Participants

This page intentionally left blank for correct double-sided printing.

Appendix E. Stormwater Information Provided to DEQ by the LBWC Stormwater Workgroup

Lower Boise River

Stormwater Phosphorus Loads

Prepare for: LBR Stormwater Workgroup

Prepared by: Jack Harrison, PhD, PE

Date: November 20, 2014

Purpose and Acknowledgements

Stormwater discharge total phosphorus loading analyses and example wasteload and load allocations were prepared to support Boise River TP TMDL development by Idaho DEQ. Stormwater discharges met on August 11, 19, 27, September 12 and October 14, 2014, to discuss loads and potential allocation scenarios. During these meetings workgroup attendees reviewed and discussed draft information, stormwater data, methodologies for calculations of loads, and allocation options. The analyses and example allocations summarized below were developed with significant input from stormwater representatives for local NPDES permittees, including:

- Erica Anderson-Maguire/ACHD
- Lee Van De Bogart/Caldwell
- Cheryl Jenkins/Nampa
- Michael Mieyr/Nampa
- Jack Harrison/ACHD and Middleton
- Ted Douglass/Nampa

Contents

Summary of Stormwater Loads

To support Lower Boise River total phosphorus TMDL development, stormwater data collected and reported to EPA were used to estimate total phosphorus (TP) loads in pounds per day (lb/d) discharged to the Lower Boise River (Table 1). The areas used in the load estimates are based on the 2010 U.S. Census Bureau census (U.S Census Bureau, 2010) and Ada and Canyon County assessors data (Ada and Canyon Assessor's Offices, 2014). As requested by DEQ, the loads were divided by periods established in the Snake River – Hells Canyon TMDL (IODEQ 2004).

Table 1 - Estimated total phosphorus (TP) loads in pounds per day (lb/d) for urban areas based on 2010 Census and other available data (Ada and Canyon County Assessors Offices, 2014). Also shown are example allocations based on 60% reductions.

Stormwater	Permitted	Non-Permitted	Totals
Areas (ac)	139,704	40,617	180,321
Loads and Example Allocations (lb/d)			
May-Sep Total Load	361	105	465
May-Sep Example Allocations	144	42	186
Oct-Apr Total Load	117	34	151
Oct-Apr Example Allocations	47	14	60

The loads are also divided into permitted and non-permitted urban areas. The loads for the permitted areas are covered by NPDES stormwater permits, are considered point sources and should receive wasteload allocations. The non-permitted loads are for urban areas without permits and should receive load allocations.

Average daily stormwater flows were also estimated based on the calculated average loads and average measured concentrations estimated using the average of the average wet and dry weather concentrations. These flows (Table 2) are assumed to occur throughout the watershed and contribute discharge to the Boise River and tributaries. And, while the October through April flows would generally occur during wet weather periods, the May through September flows could occur throughout the period during wet or dry weather.

Table 2 - Measured average runoff total phosphorus (TP) concentrations, estimated TP loads, and calculated daily average flows

Stormwater	Permitted	Non-Permitted	Totals	Units
Measured Avg. Concentration	0.44	0.44	0.44	mg/L
May-Sep Load (estimated)	361	105	465	lb/d
Average Flow (May-Sep)	154	45	198	cfs
Oct-Apr Load (estimated)	117	34	151	lb/d
Average Flow (Oct-Apr)	50	14	64	cfs

It should be noted that while average flows, concentrations and loads will be used for the TMDL allocations, actual stormwater discharge flows, concentrations and loads can be much higher due to precipitation events with high intensity and/or duration. These and other concerns and issues are discussed below and should be acknowledged in the TMDL.

- ## Stormwater Load Calculations and Methods

The stormwater loads provided in Tables 1 and 2 are based on calculations and information shown in Table 3. To estimate these loads, first the baseline loads were calculated on a per acre basis using the available stormwater runoff data for both wet and dry weather periods (i.e., precipitation and no precipitation periods, respectively). This is similar to the procedure used to estimate loads for Lower Boise River Implementation Plan (DEQ 2008) and Lake Lowell TMDL (DEQ 2010). One difference used to avoid potential double counting is that wet and dry weather loads were added after reducing loads by the estimated fraction of area where dry weather flows dominate. The calculated baseline loads were then partitioned into "seasonal average daily load" estimates as requested by DEQ. Finally, example allocations were calculated assuming 60% load reductions consistent with anticipated reduction targets. Actual allocations will be proposed by DEQ.

The basis for the assumptions is discussed below and additional supporting information is provided in Appendices A through E (provided in separate document).

Table 3 - Wet and dry weather loads for the anticipated TMDL periods (i.e., May-Sep and Oct-Apr) basis and references to more detailed information to support the load estimates

Stormwater	Permitted	Non-Permitted	Totals	Units	Note
Area	218	63		mi^2	Appendix A
	139,704	40,617	180,321	ac	
Baseline Loads					
Wet Weather (WWx)	0.64	0.64		g/ac/d	Appendix B
Full Yr Load	90	26	116	kg/d	
	197	57	254	lb/d	
Percent of area	70%	70%	70%		
	138	**40**	**178**		
Dry Weather (DWx)	3.68	3.68		g/ac/d	Appendix C
Full Yr Load	514	149		kg/d	
	1131	329	1460		
Percent of area	30%	30%			
	339	**99**	**438**	lb/d	
Seasonal Periods					
WWx season fraction	**0.4**	**0.4**			Appendix D
May-Sep Wet Wx	55	16	71	lb/d	
DWx season fraction	**0.9**	**0.9**			
May-Sep Dry Wx	305	89	394	lb/d	
May-Sep Total	361	105	465	lb/d	(SR-HC Critical Period)
WWx season fraction	**0.6**	**0.6**			Appendix D
Oct-Apr Wet Wx	83	24	107	lb/d	
DWx season fraction	**0.1**	**0.1**			
Oct-Apr Dry Wx	34	10	44	lb/d	
Oct-Apr Total	117	34	151	lb/d	(NON Critical Period)
Example Allocations					
% reduction	60%	60%			Example for discussion
May-Sep Allocations	144	42	186	lb/d	(SR-HC Critical Period)
% reduction	60%	60%			Example for discussion
Oct-Apr Allocations	47	14	60	lb/d	(NON Critical Period)

Basis for Load

The basis for the assumptions is discussed below and additional supporting information is provided in Appendices A through D. Additionally, a summary of previous dry weather TMDL data and load allocations are provided in Appendix E.

- **Stormwater Management Areas**

Stormwater in the selected areas within Lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. In the lower Boise River (LBR) TP TMDL, the Permitted (i.e., regulated) stormwater entities are considered point sources and will be assigned “wasteload allocations”. Additionally, “load allocations” should be assigned to the non-point source (un-regulated) urban stormwater entities and areas.

The Table 4 shows permitted and non-permitted areas and includes a breakdown of permitted and non-permitted areas based on:

- City limits data from 7/29/14 (Ada County Assessor’s Office, 2014) and 5/28/14 (Canyon County Assessor’s Office, 2014);
- Urbanized Areas based on 2010 Census (U.S. Census Bureau, 2010);
- Area data from NPDES Permit Factsheets (2000 Census);

Table 4 - Permitted and non-permitted areas

	Permitted Area (ac)	Non-Permitted Area (ac)
Ada	95,149	29,749
Canyon	44,555	10,868
Total	139,704	40,617

Appendix A provides more details on the areas for individual permittees or jurisdictions. Non-permittees in regulated areas (e.g. Meridian, Eagle, unincorporated urbanized Ada County, e.g., Southwest Boise) and unregulated areas need to be identified in the TMDL to ensure they are given allocations and understand their responsibilities. Many of these jurisdictions have regulatory authority over private and municipal properties that are potential sources of wet weather stormwater and dry weather runoff.

- **Wet Weather Data Summary**

Stormwater data collected during storm events under provisions specified in NPDES permits and reported annually to EPA was compiled and summarized by the stormwater workgroup participants.

The average concentrations shown in Table 5 represent the average measured concentrations of the samples collected by each entity. Data collected by Caldwell, Nampa, and ACHD (Phase II) were collected via grab sampling. ACHD Phase I data was collected as composite samples. See Appendix B for complete data sets.

Table 5 – Averages of wet weather data reported to EPA by permittees

Source	TP Conc. (mg/L)	TP Load Annual (g/ac/d)
ACHD Phase I (Composite)	0.36	0.36
ACHD Phase II (Grab)	0.42	0.22
Nampa (Grab)	1.17	0.61
Caldwell (Grab)*	1.09	1.33
Average	**0.75**	**0.64**

* Note- Caldwell loads estimated using precipitation data and C-Factor

- **Dry Weather Data Summary**

Agricultural runoff, over-irrigation runoff, irrigation water, groundwater discharges, and urban related discharges (e.g. wash water, process/condensate water, etc.) occur during dry weather and can also occur in wet weather. The flows are defined as non-stormwater discharges or dry weather flows. For the purposes of this discussion these types of discharges will be referred to as dry weather discharges. In the Treasure Valley dry weather discharges commonly mix with stormwater discharges. These discharges are authorized if they are "uncontaminated" and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. Due to the large volumes of water associated with dry weather discharges and their potential to contain pollutants, the stormwater workgroup has identified them as an issue of concern and that the issue needs to be identified and addressed within the TMDL.

Stormwater data collected during dry weather periods was compiled by the stormwater workgroup and summarized in Table 6. The average used in Table 6 is an average of the averages of the data sets available (Appendix C). It is important to note that the 2013 EPA issued NPDES Phase I permit requires dry weather discharges to sampled and analyzed beginning in 2015. Data collected by Phase I permittees will help to better understand and evaluate the pollutant loads associated with dry weather discharges. At this time, EPA issue NPDES Phase II permits do not require permittees to collect and analyze dry weather discharges.

Table 6 – Averages of dry weather data collected by ACHD and Nampa

Dry Weather Data Summary	TP Conc.	TP Load Annual

	(mg/L)	(g/ac/d)
ACHD	0.095	2.4
Caldwell	0.146	5.0
Average of Average	**0.12**	**3.68**

Dry weather data used for the previous TMDLs indicated dry weather flows were about 0.37 g/ac/d (Appendix E). However, these were primarily associated with groundwater and background flows. The earlier loading rate was about 10% of the rate observed in more current data of 3.68 g/ac/d (Table 6). While the current load estimate (based on the more recent data) is substantially higher, as discussed below it is applied to a smaller area.

- **Dry Weather Percent of Area**

For the purpose of the TMDL the Dry Weather Percent of Area is estimated to be 30% based on rough mapping of Ada County areas that have irrigation and groundwater in the stormwater system. This map (Figure 1), which was developed by ACHD, shows approximately 46% of area contributes dry weather flows from groundwater and/or irrigation flows. The 30% estimate for the TMDL incorporates a margin of error.

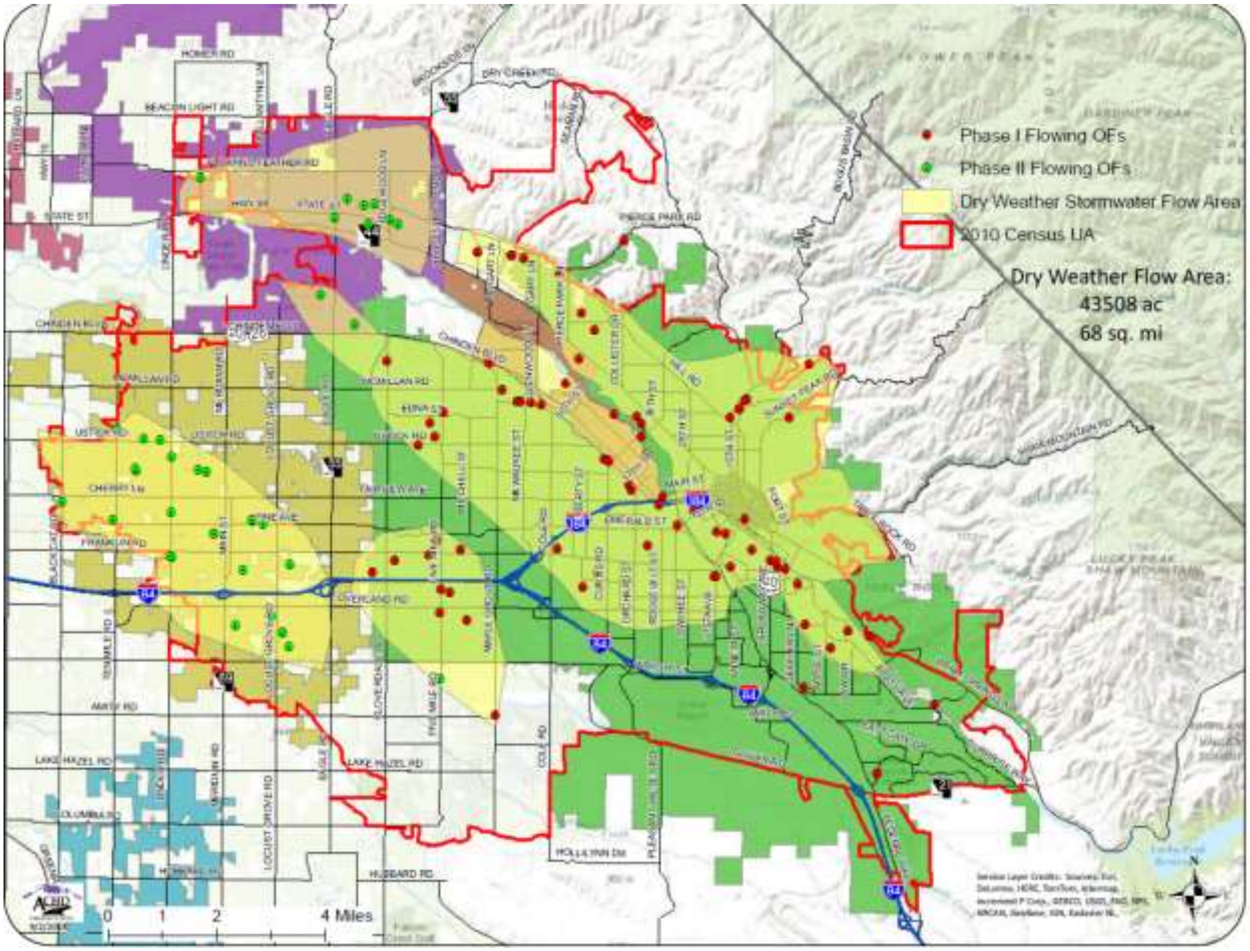


Figure 1 Map of Ada County showing areas with irrigation and shallow groundwater flow into the stormwater system

- **Wet Weather Fractions**

The Wet Weather (WetWx), May- September fraction of 0.4 is the fraction of the wet weather load that is estimated to occur during the May through September period. The fraction was estimated based on precipitation frequency and magnitude as reported at the Boise Airport (Table 7 and Appendix D). The rainfall events during May through September divided by the total number of events suggest a fraction of 0.26 (i.e., 11/42). This also indicates that that the October-April period is the when approximately 74% of the storms that produce greater than 0.1 inches of precipitation occur in the area.

However, keep in mind that loads shown reflect how loads are used and represent a "daily annual average for the period". For example, the data show that the maximum precipitation rates for the May-September period tend to be higher compared to the October-April period (i.e., 1.6 and 1.1 inches, respectively). Also, on any day the actual rate tends to be 0.5 inches higher, and therefore the runoff during the May-September period can exceed the average.

This suggests on a daily basis for the period, the loads can be higher, and therefore, the fraction of 0.4 was used in calculations for the May-September periods and a fraction of 0.6 was used for the October-April period.

Table 7 - Summary of precipitation data collected at the Boise Airport from 1940 to 2012 (WRCC, 2014)

Statistic	May-Sep Period	Oct-Apr Period
# of Days with Precipitation >= 0.1in	11	31
Average Maximum 1-Day Precipitation	1.6	1.1
Maximum 1-Day Precipitation	1.9	1.6

- ### Dry Weather Fractions

The Dry Weather (DryWx) May-September fraction is the fraction of dry weather load that is estimated to occur during the May through September period. The primary sources of the runoff during this period include agriculture and urban irrigation runoff, and groundwater. A fraction of 0.9 is assumed for the DryWx May-September period because the largest portion of these flows is associated with summer-season irrigation runoff. A DryWx fraction of 0.1 during the October-April period represents the generally smaller groundwater flows that occur throughout this period.

- ## General Issues and Concerns

Loads and allocations are based on limited data and many assumptions that often may be considered overly conservative. To provide a better understanding of how loads are represented within the TMDL and how the allocations should be applied, the following issues and concerns should be identified and discussed. Additional issues and concerns may be identified in final documentation.

- ### Concentration vs. Load

It is generally understood that attempting to meet a concentration target at point of discharge for stormwater would be difficult and costly. For this reason, most stormwater management BMPs are designed and implemented to reduce loads. To facilitate implementation, we request that load allocations be express as a percent reduction from the baseline that can then be translated into management practices.

- ### Low frequency occurrence of storm

There is a relatively low frequency occurrence of storms with only about 40 annual events causing runoff producing volumes. And, while the lowest occurrence is during the summer, precipitation and runoff rates can exceed average.

- ### Permittees and Non-permittees

Non-permittees in regulated areas (e.g. Meridian, Eagle, unincorporated urbanized Ada County, e.g, Southwest Boise) and unregulated areas need to be included and listed in the TMDL. These jurisdictions have regulatory authority over private and municipal properties that are potential sources of stormwater/dry weather runoff.

- ### Ag/Over-irrigation/Groundwater

Agricultural runoff, over-irrigation runoff, irrigation water, and groundwater discharges can mix with stormwater discharges. These discharges are authorized if they are "uncontaminated" and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. This needs to be identified and addressed within the TMDL.

- ### MS4 Allocations

Total phosphorus concentration and some flow data are available for the individual MS4s that could be included in the LBR TMDL. This would allow for more localized baseline estimates and possibly specific WLAs for each MS4. If this approach is used, then percent reductions may need to be adjusted such that the resulting allocations are equal.

- ## References

Internet links to data stormwater data include:

http://www.achdidaho.org/Departments/TechServices/Drainage.aspx
http://city.cityofcaldwell.com/StormWater
http://www.cityofnampa.us/stormwater/
http://canyonhd4.org/stormwater.php
http://www.nampahighway1.com/Stormwater.php

U.S. Census Bureau, 2010. https://www.census.gov/cgi-bin/geo/shapefiles2010/main

Ada County Assessor's Office, 2014. 7/9/14 data update sent to ACHD server via FTP data transfer.

Canyon County Assessor's Office, 2014. 5/28/14 data update sent to ACHD server via FTP data transfer.

WWRC. Western Regional Climate Center. http://www.wrcc.dri.edu/
http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?id1022

DEQ, 2008. Lower Boise River Implementation Plan

DEQ, 2010. Lake Lowell TMDL

Appendices

- ## Appendix A – Stormwater Areas

- Appendix B – Wet Weather Data and Analyses
- Appendix C – Dry Weather Data and Analyses
- Appendix D – Wet Weather May -Sep Fraction
- Appendix E – Previous TMDL Dry Weather Loads

Appendices

For

Lower Boise River

Stormwater Phosphorus Loads and Example Allocations

November 20, 2014

Contents

• Appendix A – Permitted and Non-Permitted Stormwater Management Areas

Stormwater in the selected areas within Lower Boise River watershed is regulated under either a Phase I or a Phase II NPDES Permit issued by EPA. In the lower Boise River (LBR) TP TMDL, the permitted (i.e., regulated) stormwater entities are considered point sources and will be assigned "wasteload allocations". Additionally, "load allocations" should be assigned to the non-point source (un-regulated) urban stormwater entities and areas.

Stormwater management areas for LBR TP TMDL area have been updated based on 2010 census (US Census Bureau) and current GIS mapping information. Figures 1a and 1b are maps based on available GIS information for Ada and Canyon County. These show the 2010 urbanized areas and city boundaries (i.e., incorporated areas). Cities included in urbanized areas include Boise, Meridian, Eagle, Caldwell, Nampa, and Middleton. Within the urbanized areas are also areas that are unincorporated – urbanized unincorporated Ada County, and urbanized unincorporated Canyon County. Additionally, there are areas in each county that are incorporated, but not included in the permitted urbanized areas. These areas included the Ada County cities of Kuna and Star, and small Canyon County cities of Greenleaf, Notus, Parma, and Wilder.

The Table A includes a breakdown of permitted and non-permitted areas based on:

- City limits data from 7/29/14 (Ada County Assessor) and 5/28/14 (Canyon County Assessor);
- Urbanized Area based on 2010 Census;
- Area data from NPDES Permit Factsheets (2000 Census);

The basis for area calculations and areas for individual permittees or jurisdictions are discussed in the text that follows.

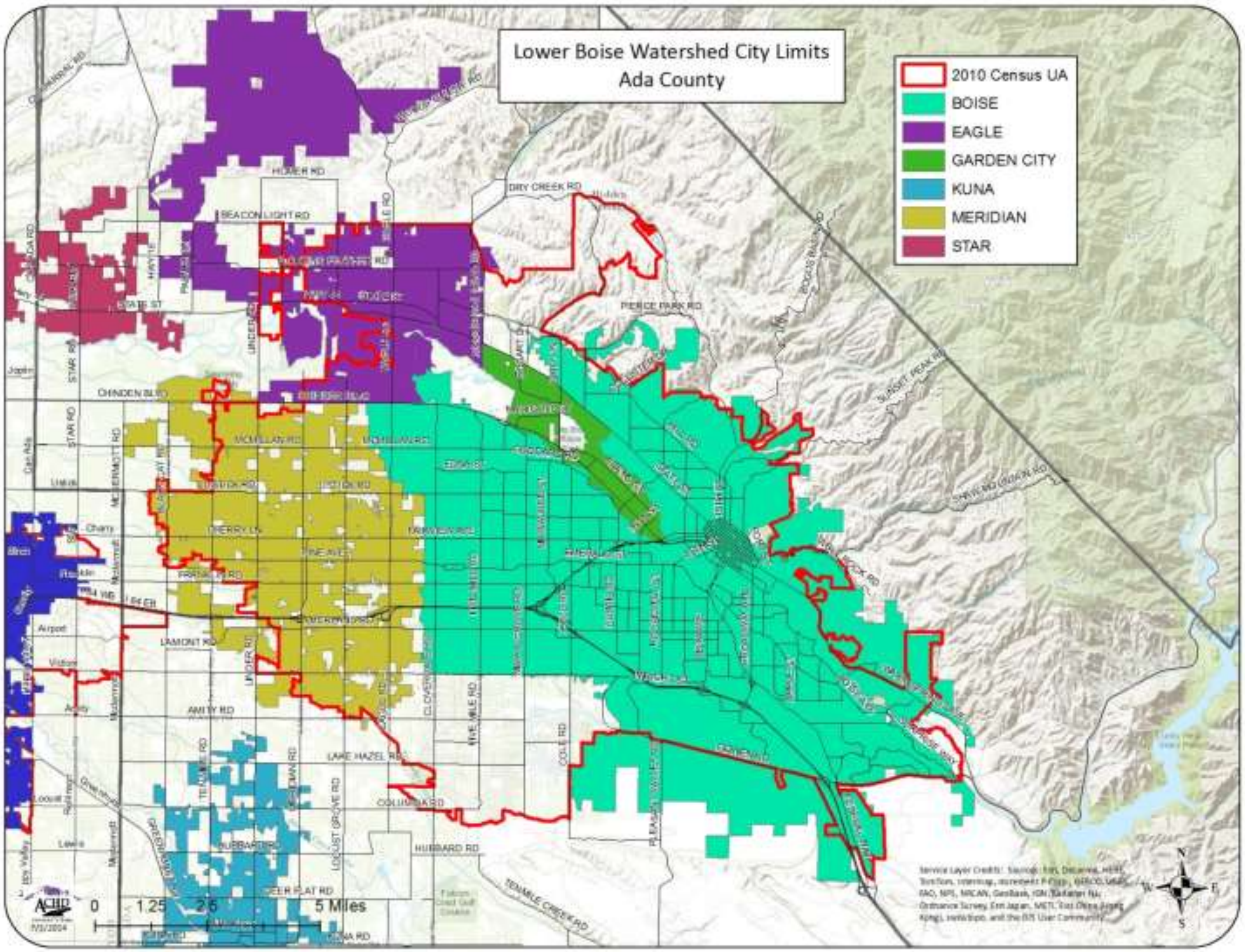


Figure 1a Map of Ada County stormwater management areas (prepared by ACHD, 7/3/2014)

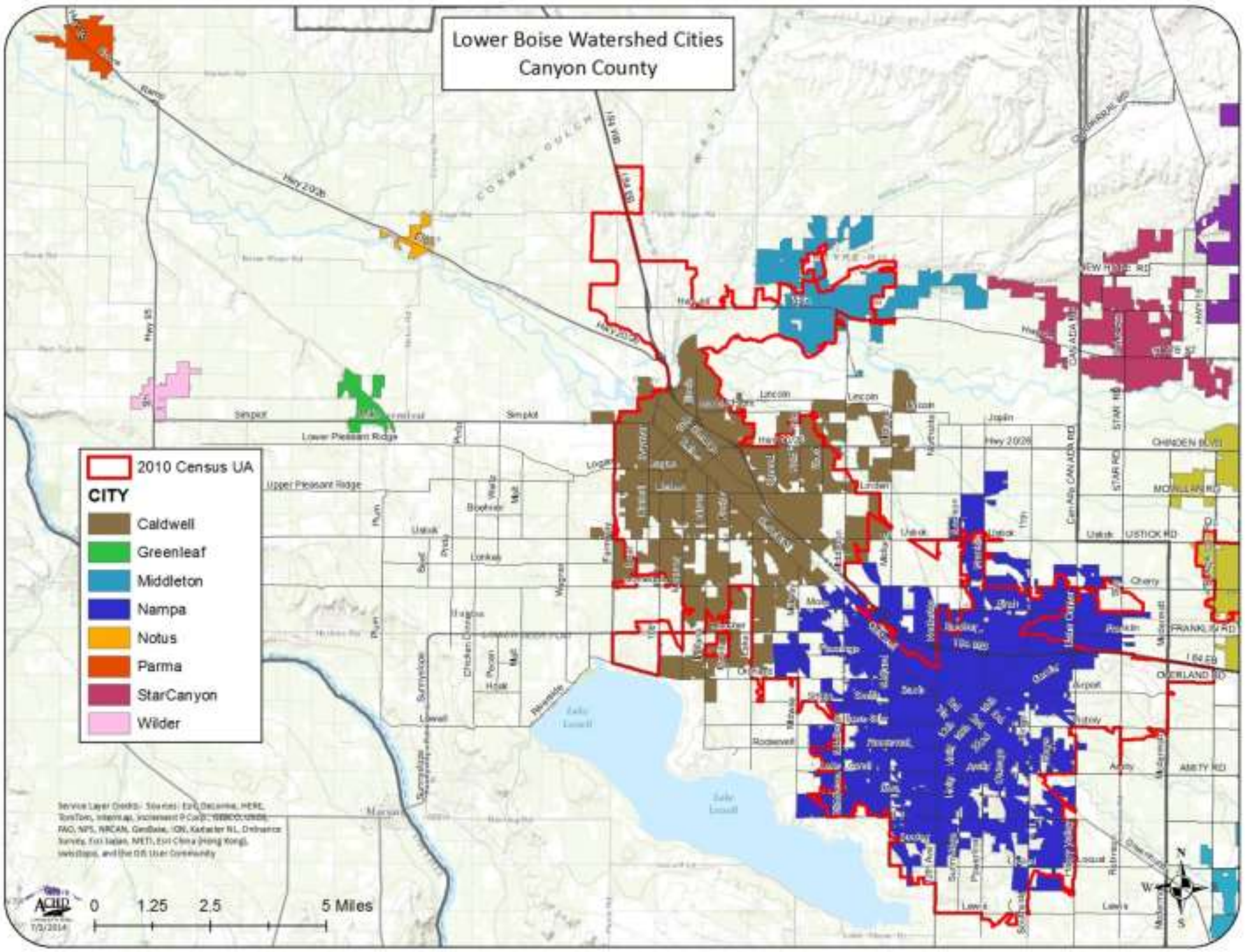


Figure1b Map of Canyon County stormwater management areas (prepared by ACHD, 7/3/2014)

Table A 2010 Census Boise Urbanized Area and other areas (prepared by ACHD)

Permit Holder/Jurisdiction	NPDES Permit Number	MS4 Permit Type	Permitted Areas: Urbanized Area[3] Area (mi²)	Permitted Areas: Urbanized Area[3] Acre	Permitted Areas: City Limits [1,2] Area (mi²)	Permitted Areas: City Limits [1,2] Acre	Permitted Urbanized & City Limits Acre	Non-Permitted Areas: City Limits [1,2] Area (mi²)	Non-Permitted Areas: City Limits [1,2] Acre
Ada County									
Boise/Garden City	IDS027561	Phase I			87	55,773			
Boise	IDS027561	Phase I			83	53,053			
Garden City	IDS027561	Phase I			4	2,720			
Ada County Highway District	IDS027561	Phase I			87	55,773			
Boise State University	IDS027561	Phase I			0.24	153			
Ada County Drainage District 3	IDS027561	Phase I			8	4,801			
ITD, District 3	IDS027561	Phase I							
Total Area Boise/Garden City Phase I Permit					**87**	**55,773**			
Ada County Highway District	IDS028185	Phase II	62	39,376	84	54,218			
Meridian		-	24	15,178	28	18,160		4	2,982
Eagle		-	12	7,518	30	19,378		18	11,860
Urbanized Ada County (unincorporated)		-	26	16,680	NA	NA			
Total Area Ada County Phase II Permit			**62**	**39,376**					
Total Area Ada County Phase I and II Permits							**95,149**		
Kuna	NA	-						18	11,619
Star	NA	-						4	3,288
Total Ada County Incorporated Non- Permitted Area								**44**	**29,749**
Canyon County									
Caldwell	IDS028118	Phase II	17.5	11,172				4.6	2,979
Nampa	IDS028126	Phase II	25	16,015				6.5	4,129
Middleton	IDS028100	Phase II	2.3	1,478				2.9	1,851
Urbanized Canyon County (unincorporated)	-	-	24.8	15,890					
ITD, District 3	IDS028177	Phase II							
Canyon Highway District #4[3]	IDS028134	Phase II	8	5,120					
Nampa Highway District #1[3]	IDS028142	Phase II	8.5	5,440					
Notus-Parma Highway District #2[3]	IDS028151	Phase II	2	1,280					
Total Area Canyon County Phase II Permits			**70**	**44,555**					
Greenleaf	NA	-						0.8	493
Notus	NA	-						0.4	246
Parma	NA	-						1.1	706
Wilder	NA	-						0.7	464
Total Canyon County Incorporated Non- Permitted Area								**17**	**10,868**

[1]Ada County Assessor 7/9/14; [2]Canyon County Assessor 5/28/14; [3]Urbanized Area based on 2010 Census; 4Area data from NPDES Permit Factsheets (2000 Census)

- **Permitted (Regulated) Stormwater**

As stated above, point source "waste load allocations" will be assigned to regulated stormwater entities in the LBR TP TMDL. The areas total 139,704 acres for the Ada and Canyon Counties (Table A).

Both Phase I and Phase II NPDES permits have been issued in LBR watershed.

Areas permitted under the Phase I permit are defined as the corporate boundaries of Boise and Garden City.
Areas permitted under the Phase II permits are based on city/highway district/state transportation department jurisdiction boundaries within the U.S Census-based urbanized areas.

Notes:

- "Urbanized Area" is defined as an area with a population of more than 50,000. The U.S. Census Bureau urbanized area criteria for the 2010 census is described in the Federal Register, Vol. 76, No. 164 , Wednesday, August 24, 2011 .
  The urbanized areas for current Phase II permits are based on 2000 Census. To more accurately reflect current conditions, the areas have been updated using the 2010 Census Boise Urbanized Area (see Maps and Tables).
- To determine the Phase II Areas for ACHD's Phase II permit on the map, the most recent corporate boundaries (aka city limits) for Boise and Garden City were subtracted from the Boise Urbanized Area. .

- **Non-Permitted (Unregulated) Stormwater**

In the LBR TP TMDL, nonpoint source "load allocations" should be assigned to un-regulated urban stormwater entities and areas. The areas total 40,617 acres for Ada and Canyon Counties (Table A). These areas are also in the corporate boundary areas but are not in the corporate boundary within the 2010 Nampa Urbanized Area or the 2010 Boise Urbanized Area. For example, Eagle has an area of 30 mi^2, but only 12 mi^2 is in the Boise Urbanized Area. The difference is that Eagle's city limits include all the land annexed for Avimor.

Appendix B - Wet Weather TP Loads

Previous TMDL Stormwater Baseline TP Loads

Critical period (May through September) loads in previous TMDL (Lake Lowell) and Implementation Plan for Lower Boise River were as follows:

- wet weather TP load is 0.15 g/ac/day.
- dry weather TP load is 0.37g/ac/day.
- **total TP load of 0.52 g/ac/day**.

The previous wet weather TP loads were based on a more limited data set collected in Ada County by ACHD.

Based on:

- ACHD data collected from 3 locations – Americana, Lucky, and Walnut
- Runoff volume was estimated as a percent of annual runoff (i.e., C-Factor)
- The load estimated also included the Walnut site….Walnut was excluded from average the current average because:
  - it has extensive treatment ponds that disconnect most of the wet weather flow;
  - it has continuous dry weather (and groundwater?) flow occurring during much of the year;
  - dry weather flow is from the Boise Canal that conveys low phosphorus (0.03 mg/L) discharged from Lucky Peak

- ## Current Wet Weather Loads

Data from ACHD, Nampa and Caldwell were reviewed, compiled, and analyzed to assess variability in wet weather loads throughout the valley. The tables that follow show the average total phosphorus (TP) runoff loads for each sampling location calculated using similar assumptions:

- ACHD and Nampa runoff volumes are based on measured runoff; Caldwell runoff volume is based on measured precipitation and C-Factor
- Day (or 24-hr) loads (g/ac/d) are event loads assuming the load is produced over a 24-hr period
  Average annual loads (g/ac/d) are calculated using Average Annual load and assuming 40 events per year; these are similar to baseline loads calculated for previous TMDLs as previously discussed.

Data from ACHD, Nampa and Caldwell are provided in this Appendix (B) and Appendix C and include precipitation, runoff, reported concentrations. Load analyses for each location and event are calculated, and can include the “Event Load” (lb/ac/ev), which is the average load produced during the measured precipitation period.

- ***ACHD***

The following tables summarize site information for ACHD monitoring locations.

Table ACHD-1a Phase I monitoring sites

Boise/Garden City Phase I Monitoring Sites				
Site	**Location**	**Drainage Area (ac)**	**Land Use**	**Receiving Water**
Walnut	Boise, Id	567	58% low-density residential 15% high-density residential 26% open space 0.4% commercial/industrial	Boise River
Koppels	Boise, Id	12	66% commercial/industrial 34% transportation	Boise River
Lucky	Boise, Id	105	100% low-density residential	Eagle Drain
Production	Boise, Id	25	100% commercial/industrial	Fivemile Creek
Franklin	Boise, Id	16	44% low-density residential 56% transportation	Ridenbaugh Canal

Table ACHD-1b Phase II monitoring sites

ACHD Phase II Monitoring Sites				
Site:	**Location:**	**Drainage Area (ac):**	**Land Use**	**Receiving Water:**
Edgewood	Eagle, Id	25	30% low-density residential 42% residential rural 13% recreation 15% residential farmland	Eagle Drain
Chrisfield	Meridian, Id	12	100% low-density residential	Fivemile Creek

Notes:

- All sites have limited BMPs except for Walnut, which has extensive wet and dry pond system in upper reaches of watershed. Walnut system is heavily influenced by irrigation water from Boise City Canal.

Table ACHD-2 Average wet weather runoff volumes and loads

Monitoring Site	Area (ac)	Precip. (in)	Runoff Volume (in)	Runoff Fraction (Calc.)		TP Conc. (mg/L)	TP Load 24-hr (g/ac/d)	TP Load Annual (g/ac/d)
Phase 1 (Comp.)								
Koppels	12	0.21	0.13	0.80		0.31	4.73	0.52
Lucky	105	0.25	0.03	0.16		0.51	1.43	0.16
Franklin	16	0.23	0.11	0.60		0.38	3.89	0.43
Production	25	0.25	0.13	0.57		0.21	2.97	0.33
Average								**0.36**
Walnut	567	0.20	0.01	0.04		0.36	0.27	0.03
Phase 2 (grab)								
Chrisfield	12	0.22	0.04	0.20		0.56	2.47	0.27
Edgewood	25	0.25	0.06	0.21		0.28	1.57	0.17
Average								**0.22**

Notes:

- Phase I water quality samples are based on composite water quality samples for period 2007 to 2012
- Phase II are grab samples from 2011 to 2013 sampling periods
- Walnut was excluded from average due to extensive treatment ponds that disconnect most of the wet weather flow; also, this site has continuous dry weather (and groundwater?) flow occurring during much of the year

ACHD wet weather data for each site are provided in the following tables:

Site: Walnut **Location: Boise, Idaho**		**Receiving Water: Boise River** **Drainage Area: 567 acres**								
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	17024	0.068	0.47	0.008	2%	0.00088	0.40	0.04
Wet Comp	12/18/2007	0.14	23983	0.068	0.35	0.012	8%	0.00092	0.42	0.05
Wet Comp	3/1/2008	0.25	21502	0.068	0.48	0.010	4%	0.00113	0.52	0.06
Wet Comp	11/2/2008	0.31	14016	0.072	0.66	0.007	2%	0.00102	0.46	0.05
Wet Comp	3/3/2009	0.13	11556	0.072	0.45	0.006	4%	0.00057	0.26	0.03
Wet Comp	3/25/2009	0.13	23112	0.072	0.21	0.011	9%	0.00053	0.24	0.03
Wet Comp	12/21/2009	0.18	13664	0.069	0.22	0.007	4%	0.00033	0.15	0.02
Wet Comp	2/24/2010	0.33	15616	0.069	0.32	0.008	2%	0.00055	0.25	0.03
Wet Comp	5/10/2010	0.13	13664	0.069	0.37	0.007	5%	0.00056	0.25	0.03
Wet Comp	12/11/2010	0.18	15616	0.069	0.2	0.008	4%	0.00034	0.16	0.02
Wet Comp	4/5/2011	0.13	9080	0.069	0.23	0.004	3%	0.00023	0.10	0.01
Wet Comp	5/8/2011	0.16	6258	0.069	0.2	0.003	2%	0.00014	0.06	0.01
Wet Comp	11/17/2011	0.08	15392	0.07	0.42	0.007	9%	0.00071	0.32	0.04
Wet Comp	12/28/2011	0.21	15392	0.07	0.61	0.007	4%	0.00103	0.47	0.05
Wet Comp	3/25/2012	0.13	5432	0.07	0.19	0.003	2%	0.00011	0.05	0.01
MEAN	n=15				**0.36**					

Table ACHD 3 – Walnut (Phase I site) runoff and load data.

Site: Koppels			Receiving Water: Boise River								
Location: Boise, Idaho			Drainage Area: 12 acres								
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2017	0.46	2624	0.528	0.42	0.060	13%	0.00572	2.60	0.28
Wet Comp	12/18/2007	0.14	3260	0.528	0.35	0.075	53%	0.00592	2.69	0.29
Wet Comp	3/26/2007	0.17	1450	0.528	0.22	0.033	20%	0.00166	0.75	0.08
Wet Comp	11/2/2008	0.31	14016	0.513	0.66	0.322	104%	0.04801	21.82	2.39
Wet Comp	3/3/2009	0.13	11556	0.513	0.45	0.265	204%	0.02699	12.27	1.34
Wet Comp	3/25/2009	0.13	23112	0.513	0.21	0.531	408%	0.02519	11.45	1.25
Wet Comp	12/21/2009	0.18	3344	0.589	0.13	0.077	43%	0.00226	1.03	0.11
Wet Comp	2/24/2010	0.33	2816	0.589	0.14	0.065	20%	0.00205	0.93	0.10
Wet Comp	5/10/2010	0.13	1584	0.589	0.29	0.036	28%	0.00238	1.08	0.12
Wet Comp	10/24/2010	0.39	6368	0.589	0.3	0.146	37%	0.00991	4.51	0.49
Wet Comp	1/13/2011	0.24	4394	0.589	0.4	0.101	42%	0.00912	4.15	0.45
Wet Comp	4/5/2011	0.13	4394	0.589	0.16	0.101	78%	0.00365	1.66	0.18
Wet Comp	11/17/2011	0.08	2640	0.588	0.35	0.061	76%	0.00480	2.18	0.24
Wet Comp	12/28/2011	0.21	2816	0.588	0.4	0.065	31%	0.00585	2.66	0.29
Wet Comp	3/25/2012	0.13	2640	0.588	0.18	0.061	47%	0.00247	1.12	0.12
MEAN	n=15				**0.31**					

Table ACHD 4 – Koppels (Phase I site) runoff and load data.

Site: Lucky			Receiving Water: Eagle Drain							
Location: Boise, Idaho			Drainage Area: 105 acres							
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	12/18/2007	0.14	6080	0.159	0.3	0.016	11%	0.00108	0.49	0.05
Wet Comp	3/26/2007	0.17	3803	0.159	0.32	0.010	6%	0.00072	0.33	0.04
Wet Comp	5/20/2007	0.29	13902	0.159	1.65	0.036	13%	0.01360	6.18	0.68
Wet Comp	11/2/2008	0.31	14016	0.156	0.66	0.037	12%	0.00549	2.49	0.27
Wet Comp	3/3/2009	0.13	11556	0.156	0.45	0.030	23%	0.00308	1.40	0.15
Wet Comp	3/25/2009	0.13	23112	0.156	0.21	0.061	47%	0.00288	1.31	0.14
Wet Comp	10/13/2009	0.13	6324	0.156	0.39	0.017	13%	0.00146	0.66	0.07
Wet Comp	3/10/2010	0.46	21735	0.156	0.17	0.057	12%	0.00219	1.00	0.11
Wet Comp	4/27/2010	0.07	7736	0.156	0.87	0.020	29%	0.00399	1.81	0.20
Wet Comp	12/11/2010	0.18	6736	0.156	0.2	0.018	10%	0.00080	0.36	0.04
Wet Comp	1/13/2011	0.24	12630	0.156	0.24	0.033	14%	0.00180	0.82	0.09
Wet Comp	4/5/2011	0.13	13854	0.156	0.25	0.036	28%	0.00205	0.93	0.10
Wet Comp	12/28/2011	0.21	6912	0.164	0.67	0.018	9%	0.00275	1.25	0.14
Wet Comp	3/25/2012	0.13	6912	0.164	0.34	0.018	14%	0.00139	0.63	0.07
Wet Comp	5/25/2012	0.98	6912	0.164	0.98	0.018	2%	0.00402	1.83	0.20
MEAN	n=15				**0.51**					

Table ACHD 5 – Lucky (Phase I site) runoff and load data.

Site: Franklin		Receiving Water: Ridenbaugh Canal								TP Load	TP Load	TP Load
Location: Boise, Idaho			Drainage Area: 16 acres									
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)		Runoff (in)	Runoff %		(lb/ac/d)	(g/ac/d)	Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	7260	0.45	0.32		0.125	27%		0.00904	4.11	0.45
Wet Comp	12/18/2007	0.14	5408	0.45	0.77		0.093	67%		0.01621	7.37	0.81
Wet Comp	3/1/2008	0.25	5577	0.45	0.49		0.096	38%		0.01064	4.83	0.53
Wet Comp	3/3/2009	0.13	11556	0.507	0.45		0.199	153%		0.02024	9.20	1.01
Wet Comp	3/25/2009	0.13	23112	0.507	0.21		0.398	306%		0.01889	8.59	0.94
Wet Comp	4/29/2009	0.36	4830	0.507	0.68		0.083	23%		0.01278	5.81	0.64
Wet Comp	10/13/2009	0.13	3933	0.507	0.32		0.068	52%		0.00490	2.23	0.24
Wet Comp	12/21/2009	0.18	6464	0.507	0.2		0.111	62%		0.00503	2.29	0.25
Wet Comp	3/10/2010	0.46	7648	0.507	0.21		0.132	29%		0.00625	2.84	0.31
Wet Comp	10/24/2010	0.39	3936	0.507	0.55		0.068	17%		0.00843	3.83	0.42
Wet Comp	12/11/2010	0.18	3328	0.507	0.22		0.057	32%		0.00285	1.30	0.14
Wet Comp	1/13/2011	0.24	5616	0.507	0.39		0.097	40%		0.00852	3.87	0.42
Wet Comp	11/17/2011	0.08	2070	0.502	0.32		0.036	45%		0.00258	1.17	0.13
Wet Comp	12/28/2011	0.21	2277	0.502	0.33		0.039	19%		0.00292	1.33	0.15
Wet Comp	3/25/2012	0.13	3312	0.502	0.18		0.057	44%		0.00232	1.05	0.12
Wet Comp	4/25/2012	0.38	3105	0.502	0.45		0.053	14%		0.00544	2.47	0.27
MEAN	n=16				**0.38**							

Table ACHD 6 – Franklin (Phase I site) runoff and load data.

Site: Production			Receiving Water: Fivemile Creek							
Location: Boise, Idaho			Drainage Area: 25 acres							
Type of Sample	Date	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus(TP) (mg/l)	Runoff (in)	Runoff %	TP Load (lb/ac/d)	TP Load Day (g/ac/d)	TP Load Annual (g/ac/d)
Wet Comp	10/19/2007	0.46	14528	0.994	0.32	0.160	35%	0.01158	5.26	0.58
Wet Comp	12/18/2007	0.14	17696	0.994	0.29	0.195	139%	0.01278	5.81	0.64
Wet Comp	3/1/2008	0.25	13702	0.994	0.28	0.151	60%	0.00956	4.34	0.48
Wet Comp	3/25/2009	0.13	17344	0.855	0.17	0.191	147%	0.00734	3.34	0.37
Wet Comp	5/2/2009	0.53	26016	0.855	0.16	0.287	54%	0.01037	4.71	0.52
Wet Comp	6/2/2009	0.23	8130	0.855	0.41	0.090	39%	0.00830	3.77	0.41
Wet Comp	10/13/2009	0.13	11880	0.562	0.26	0.131	101%	0.00769	3.50	0.38
Wet Comp	12/21/2009	0.18	9477	0.562	0.13	0.104	58%	0.00307	1.39	0.15
Wet Comp	2/24/2010	0.33	11232	0.562	0.13	0.124	38%	0.00364	1.65	0.18
Wet Comp	10/24/2010	0.39	7856	0.562	0.19	0.087	22%	0.00372	1.69	0.19
Wet Comp	12/11/2010	0.18	5152	0.562	0.08	0.057	32%	0.00103	0.47	0.05
Wet Comp	3/15/2011	0.27	6640	0.562	0.22	0.073	27%	0.00364	1.65	0.18
Wet Comp	12/28/2011	0.21	5408	0.544	0.26	0.060	28%	0.00350	1.59	0.17
Wet Comp	3/25/2012	0.13	3408	0.544	0.13	0.038	29%	0.00110	0.50	0.05
Wet Comp	4/25/2012	0.38	15886	0.544	0.27	0.175	46%	0.01068	4.86	0.53
MEAN	n=15				**0.22**					

Table ACHD 7 – Production (Phase I site) runoff and load data.

Site: Chrisfield				Receiving Water: Fivemile Creek			
Location: Meridian, Idaho				Drainage Area: 12 acres			
Type of Sample	Date/Time	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Total Suspended Solids (TSS) (mg/l)	E. Coli (MPN/100 mL)
Wet Grab	3/10/2011 18:51	0.10	1198.00	0.275	0.1286	23.2	5.1
Wet Grab	4/5/2011 5:23	0.24	2875	0.275	0.336	28.3	117.8
Wet Grab	5/8/2011 7:35	0.09	1078	0.275	0.263	46	>2419.6
Wet Grab	10/4/2011 15:30	0.51	6109	0.275	0.783	17.2	816.4
Wet Grab	12/28/2011 3:24	0.18	2,561	0.275	0.455	25.3	8.6
Wet Grab	3/25/2012 22:14	0.29	2,192	0.275	0.153	17.2	6.2
Wet Grab	5/3/2012 11:52	0.10	637	0.275	0.706	28.2	1229.7
Wet Grab	5/25/2012 8:37	0.13	518	0.275	0.281	16.8	866.4
Wet Grab	10/16/2012 1:27	0.36	2,880	0.275	0.422	23	151.5
Wet Grab	11/17/2012 19:21			0.275	1.56	24.9	20.5
Wet Grab	2/22/2013 20:00	0.30	803	0.275	0.224	75.5	42.4
Wet Grab	3/20/2013 4:10	0.13	594	0.275	0.448	133	178.5
Wet Grab	6/19/2013 14:28	0.17	1,796	0.275	0.446	227	1119.9
Wet Grab	9/3/2013 10:13	0.10	774	0.275	1.205	97	980
Wet Grab	11/16/2013 0:41	0.35	3,125	0.49	0.553	18.4	1100
Wet Grab	4/22/2014 8:33	0.23	1,861	0.49	0.748	14	313
Wet Grab	5/8/2014 22:05	0.20	2,290	0.49	0.867	22.1	633.1
WET MEAN	n=17				0.563		

Table ACHD 8 – Chrisfield (Phase II site) runoff and concentration data.

Site: Edgewood					Receiving Water: Eagle Drain		
Location: Eagle, Idaho					Drainage Area: 25 acres		
Type of Sample	Date/Time	Precipitation (in)	runoff volume(cf)	runoff coefficient	Total Phosphorus (TP) (mg/l)	Total Suspended Solids (TSS) (mg/l)	E. Coli (MPN/100mL)
Wet Grab	3/10/2011 18:15	0.10	2516.00	0.275	0.192	68.2	10.9
Wet Grab	4/5/2011 6:10	0.26	6541	0.275	0.1034	25.7	45.9
Wet Grab	5/8/2011 6:43	0.35	8805	0.275	0.0774	13.7	95.5
Wet Grab	10/5/2011 5:37	0.61	15345	0.275	0.0743	4.6	410.6
Wet Grab	12/28/2011 2:27	0.23	931	0.275	0.379	30.8 J	3.1
Wet Grab	3/25/2012 23:07	0.36	4,064	0.275	0.2293	18.3	9.7
Wet Grab	5/3/2012 12:35	0.09	464	0.275	0.158	12.2	461.1
Wet Grab	5/25/2012 7:51	0.09	965	0.275	0.345	128	2590
Wet Grab	10/16/2012 0:53	0.53	15,936	0.275	0.333	24.2	347.6
Wet Grab	2/22/2013 19:22	0.32	9,371	0.275	0.898	765	4.1
Wet Grab	3/20/2013 4:10	0.10	558	0.275	0.482	82.7	8.4
Wet Grab	6/24/2013 18:45	0.09	6,424	0.275	0.104	10.3	579.4
Wet Grab	9/3/2013 11:00	0.13	1,621	0.275	0.142	12.3	1986.3
Wet Grab	11/16/2013 1:42	0.40	3,212	0.29	0.329	75.2	58.8
Wet Grab	3/9/14 11:29	0.10	554	0.29	0.154	18.5	101
Wet Grab	4/22/2014 9:31	0.23	3,647	0.29	0.209	52.4	816.4
Wet Grab	5/8/2014 22:56	0.31	4,470	0.29	0.477	156	3230
WET MEAN	n=17				0.263		

Table ACHD 9 – Edgewood (Phase II site) runoff and concentration data.

- ***Nampa***

Nampa monitoring sites (Table Nampa -1) were selected to represent baseline conditions and have no or very limited existing BMPs within the monitored runoff contributing areas.

Table Nampa 1 - Phase II monitoring sites

Site	Drainage Area (ac)
Indian Creek	31.1
Mason Creek	7.8
Wilson Creek	3.6

The Nampa data were collected as grab samples during the precipitation event. Average annual TP loads based on Nampa data (Table Nampa-2) have a somewhat higher range compared to ACHD. Also note that average concentrations are about twice as high.

Table Nampa 2 - Day and Average Annual TP load (g/ac/d) for 2012 and 2013 monitoring sites

Monitoring Site	Area (ac)	Precip. (in)	Runoff Volume (in)	Runoff Fraction (Calc.)		TP Conc. (mg/L)	TP Load 24-hr (g/ac/d)	TP Load Annual (g/ac/d)
Indian Ck	31.1	0.37	0.12	0.32		1.0	4.5	0.49
Mason Ck	7.8	0.37	0.07	0.19		1.4	2.3	0.25
Wilson Ck	3.6	0.37	0.13	0.35		1.1	9.8	1.08
Average								**0.61**

Table Nampa 3 - Precipitation and Measured Runoff

Date	Precipitation Amount (in)	Measured Runoff (cf)	Measured Runoff (in)	Calculated C-Factor
Indian Creek				
25-Mar-12	0.98	49850	0.44	0.45
25-May-12	0.01	133	0.00	0.12
16-Oct-12	0.51	9984	0.09	0.17
4-Dec-12	0.21	3026	0.03	0.13
22-Feb-13	0.31	15769	0.14	0.45
19-Apr-13	0.27	288	0.00	0.01
19-Jun-13	0.39	26051	0.23	0.59
22-Aug-13		2892	0.03	
24-Sep-13	0.25	12717	0.11	0.45
Avg	0.37	13412	0.12	0.32
Mason Creek				
25-Mar-12	0.98	7621	0.27	0.27
25-May-12	0.01	78	0.00	0.27
16-Oct-12	0.51	1318	0.05	0.09
4-Dec-12	0.21	192	0.01	0.03
22-Feb-13	0.31	2411	0.09	0.27
19-Apr-13	0.29	813	0.03	0.10
19-Jun-13	0.39	1896	0.07	0.17
22-Aug-13		1919	0.07	
24-Sep-13	0.25	1313	0.05	0.19
Avg	0.37	1951	0.07	0.19
Wilson Creek				
25-Mar-12	0.98	2783	0.21	0.22
25-May-12	0.01	618	0.05	4.73
16-Oct-12	0.51	3413	0.26	0.51
4-Dec-12	0.21	384	0.03	0.14
22-Feb-13	0.31	2867	0.22	0.71
19-Apr-13	0.34	1072	0.08	0.24
19-Jun-13	0.39	1085	0.08	0.21
22-Aug-13		662	0.05	
24-Sep-13	0.25	2312	0.18	0.71
Avg	0.38	1688	0.13	0.34

Table Nampa 4 - Nampa Loads

Date	Meas. Runoff (cf)	TP (mg/L)	P Load/ event	P Load/ day	P Load/ yr
Indian Ck					
25-Mar-12	49,850	0.55	22.4	15.85	1.74
25-May-12	133	0.65	0.2	0.40	0.04
16-Oct-12	9,984	1.05	10.1	8.39	0.92
4-Dec-12	3,026	0.25	0.3	0.10	0.01
22-Feb-13	15,769	0.57	2.6	0.65	0.07
19-Apr-13	288	0.4	0.1	0.02	0.00
19-Jun-13	26,051	1.9	23.8	9.90	1.08
22-Aug-13	2,892	2.35	0.0		
24-Sep-13	12,717	1.3	4.0	0.83	0.09
		Avg			0.5
Mason Ck					
25-Mar-12	7,621	0.32	7.9	5.63	0.62
25-May-12	78	2.75	2.0	3.93	0.43
16-Oct-12	1,318	1.25	6.3	5.26	0.58
4-Dec-12	192	0.35	0.1	0.03	0.00
22-Feb-13	2,411	0.6	1.7	0.42	0.05
19-Apr-13	813	1.1	2.6	1.61	0.18
19-Jun-13	1,896	0.4	1.7	0.87	0.10
22-Aug-13	1,919	4.5	0.0		
24-Sep-13	1,313	1.4	2.1	0.53	0.06
		Avg			0.3
Wilson Ck					
25-Mar-12	2,783	1.9	37.3	26.43	2.90
25-May-12	618	0.95	11.7	23.41	2.57
16-Oct-12	3,413	0.78	22.1	18.42	2.02
4-Dec-12	384	0.28	0.3	0.07	0.01
22-Feb-13	2,867	1.35	9.6	2.41	0.26
19-Apr-13	1,072	1.1	8.3	5.89	0.65
19-Jun-13	1,085	0.49	2.0	0.74	0.08
22-Aug-13	662	1.65	0.0		
24-Sep-13	2,312	1.4	6.7	1.40	0.15
		Avg			1.1

- ***Caldwell***

The following table summarizes the monitoring location information for each Caldwell monitoring site. It should be noted that existing BMPs for the runoff areas vary widely, from none to ponds that almost eliminate surface discharge.

Table Caldwell 1 - Monitoring site information

Caldwell Monitoring Sites				
Site	Receiving Water	Drainage Area	C factor	Land Use Description
10th Ave-	Boise River	14.2 acres	.9	mainly freeway roadway
Skyway Drive	Mason creek	27.4 acres	.5 to pond and 0.2 at outfall	2006 Copper creek
12th AVE	Indian Creek	60.0 acres	0.5 with 1,000 gal S&G only	old part of town
	Mason creek	16.3 acres	0.5 to pond and 0.0 out of pond	Delaware park no 6

Caldwell total phosphorus (TP) stormwater loads (Table Caldwell-2) are calculated using measured precipitation and an estimated "C-Factor" as shown in the table. Thus, these loads are not directly comparable to loads calculated using ACHD and Nampa data. Note that concentrations are in the same range as Nampa data, while loads vary more widely and somewhat in proportion to the C-Factor.

Table Caldwell 2- Average Annual TP load (g/ac/d) for 2012 and 2013 monitoring sites

Monitoring Site	Area (ac)	Precip. Volume (in)	Runoff Volume (Est.) (in)	C-Factor (Est.)		TP Conc. (mg/L)	TP Load 24-hr (g/ac/d)	TP Load Annual (g/ac/d)
10th Ave	14.2	0.17	0.16	0.90		1.4	24.50	2.69
Skyway Dr	27.2	0.17	0.02	0.10		0.4	0.45	0.05
12th Avg	60	0.17	0.09	0.50		1.4	11.48	1.26
Average						**1.1**		**1.33**

Table Caldwell 3 - Caldwell Stormwater Monitoring Site Data and Loads:

Date	Total P	Est. Runoff cf	TP Load Event	TP Load Day	TP Load Annual
10th Ave	mg/L	cf	g/ac/ev	g/ac/24-hr	g/ac/d
4/16/2012	1.33	6,038	36.6	16.0	1.8
5/3/2012	0.48	8,825	20.8	8.4	0.9
10/22/2012	0.87	6,502	45.1	11.3	1.2
11/24/2012	2.63	13,934	134.9	73.1	8.0
3/20/2013	1.55	9,754	38.6	30.1	3.3
6/19/2013	1.53	12,076	126.3	36.8	4.0
9/2/2013	1.88	2,322	46.4	8.7	1.0
9/24/2013	1.25	4,645	39.7	11.6	1.3
	C- Factor =	0.90		**Avg**	**2.7**
Skyway Dr					
4/16/2012	0.78	1,293	2.4	1.0	0.12
5/3/2012	0.24	1,890	1.2	0.5	0.05
10/22/2012		1,392	0.0	0.0	0.00
11/24/2012		2,984	0.0	0.0	0.00
3/20/2013	0.35	2,089	1.0	0.8	0.08
6/19/2013	0.36	2,586	3.3	1.0	0.11
9/2/2013	0.29	497	0.8	0.2	0.02
9/24/2013	0.21	995	0.7	0.2	0.02
	C- Factor =	0.20		**Avg**	**0.05**
12th Avg					
4/16/2012	1.01	14,194	15.5	6.8	0.7
5/3/2012	1.00	20,746	24.1	9.8	1.1
10/22/2012	1.21	15,286	34.9	8.7	1.0
11/24/2012	0.84	32,756	24.0	13.0	1.4
3/20/2013	0.50	22,929	6.9	5.4	0.6
6/19/2013	2.58	28,389	118.5	34.6	3.8
9/2/2013	3.52	5,459	48.4	9.1	1.0
9/24/2013	0.89	10,919	15.7	4.6	0.5
	C- Factor =	0.50		**Avg**	**1.3**
	Average	**0.5**		**Average**	**1.3**

Appendix C – Dry Weather Loads Discharged from MS4s

Agricultural runoff, over-irrigation runoff, irrigation water, and groundwater discharges can discharge into the urban stormwater drainage systems and then discharge with stormwater during periods of rainfall runoff or without stormwater during dry weather periods.

These discharges are authorized if they are "uncontaminated" and/or they do not cause, or have the reasonable potential to cause or contribute to, an excursion above the Idaho water quality standards. Because these discharges are included under the NPDES permit they need to be identified and addressed within the TMDL.

Current data available for dry weather flows include sampling results from ACHD and Caldwell:

- ACHD Phase II data (available for years 2011 through 2014)
- Caldwell data for residential area developed in 1960s

Data from ACHD and the City of Caldwell were used to estimate dry weather loads (Table C1).

Table C1 – Average of dry weather data reported to EPA by permittees

Dry Weather Data Summary	TP Conc. (mg/L)	TP Load Annual (g/ac/d)
ACHD	0.095	2.4
Caldwell	0.146	5.0
Average of Average	**0.12**	**3.7**

Comparing the more recent data with the earlier data (Appendix E) indicates that groundwater can represent about 10 percent of the dry weather flows.

- **Permitted Dry Weather Flows**

MS4 Permitted stormwater discharges can include "**Non-Storm Water Discharges"** if the water meets permit conditions. For example, the following is an excerpt from Middleton's NPDES Permit. The same language is found in all the Treasure Valley Phase II NPDES permits.

The permittee is not authorized to discharge non-storm water from the MS4, except where such discharges satisfy one of the following three conditions:

a) The non-storm water discharges are in compliance with a separate NPDES permit;

b) The non-storm water **discharges result from a spill and**:

> (i) **are the result of an unusual and severe weather event** where reasonable and prudent measures have been taken to minimize the impact of such discharge; or
>
> (ii) **consist of emergency discharges** required to prevent imminent threat to human health or severe property damage, provided that reasonable and prudent measures have been taken to minimize the impact of such discharges;

or

c) The non-storm water discharges satisfy each of the following two conditions:

> (i) The discharges consist of uncontaminated water line flushing; potable water sources; landscape irrigation (provided all pesticides, herbicides and fertilizer have been applied in accordance with manufacturer's instructions); lawn watering; irrigation water; flows from riparian habitats and wetlands; diverted stream flows; springs; rising ground waters; uncontaminated ground water infiltration (as defined at 40 CFR § 35.2005(20)) to separate storm sewers; uncontaminated pumped ground water or spring water; foundation

and footing drains (where flows are not contaminated with process materials such as solvents); uncontaminated air conditioning or compressor condensate; water from crawlspace pumps; individual residential car washing; dechlorinated swimming pool discharges; routine external building wash down which does not use detergents; street and pavement wash waters, where no detergents are used and no spills or leaks of toxic or hazardous materials have occurred (unless all spilled material has been removed); fire hydrant flushing; or flows from emergency firefighting activities;

and

(ii) The discharges are not sources of pollution to waters of the United States. A discharge is considered a source of pollution to waters of the United States for the purposes of this permit if it:

(a) Contains hazardous materials in concentrations found to be of public health significance or to impair beneficial uses in receiving waters. (Hazardous materials are those that are harmful to humans and animals from exposure, but not necessarily ingestion);

(b) Contains toxic substances in concentrations that impair designated beneficial uses in receiving waters. (Toxic substances are those that can cause disease, malignancy, genetic mutation, death, or similar consequences);

(c) Contains deleterious materials in concentrations that impair designated beneficial uses in receiving waters. (Deleterious materials are generally substances that taint edible species of fish, cause taste in drinking waters, or cause harm to fish or other aquatic life);

(d)Contains radioactive materials or radioactivity at levels exceeding the values listed in 10 CFR Part 20 in receiving waters;

(e) Contains floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or in concentrations that may impair designated beneficial uses in receiving waters;

(f) Contains excessive nutrients that can cause visible slime growths or other nuisance aquatic growths that impair designated beneficial uses in receiving waters;

(g) Contains oxygen-demanding materials in concentrations that would result in anaerobic water conditions in receiving waters; or

(h) Contains sediment above quantities specified in IDAPA 58.01.02.250.02.e or in the absence of specific sediment criteria, above quantities that impair beneficial uses in receiving waters, or

(i) Contains material in concentrations that exceed applicable natural background conditions in receiving waters (IDAPA 58.01.02.200. 09). Temperature levels may be increased above natural background conditions when allowed under IDAPA 58.01.02.401.

- ### ACHD Phase II Data

Dry weather data collected from the Edgewood subdivision during 2012- May 2014 (Table C2) was used to calculate phosphorus loads for this comparatively small suburban catchment. Flows are relatively continuous with lowest reported flows generally occurring in winter.

Table C2 - Dry weather data collected from the Edgewood subdivision during 2011-May 2014

Site: Edgewood Eagle, Idaho	Receiving Water: Eagle Drain Drainage Area: 25 acres		
Date	**Discharge (cfs)**	**TP conc. (mg/L)**	**TP Load (g/ac/d)**
3/10/2011	0.28	0.095	2.59
4/4/2011	tricle, 0	0.097	0.00
5/7/2011	0.55	0.050	2.68
10/4/2011	0.77	0.082	6.18
12/27/2011		0.105	0.00
3/25/2012	0.064	0.097	0.60
5/2/2012	0.08	0.071	0.55
5/24/2012	1.05	0.082	8.38
10/15/2012	0.06	0.106	0.62
11/29/2012	0.121	0.118	1.40
2/21/2013	0.01	0.123	0.12
6/24/2013	0.55	0.075	4.04
11/15/2013	0.57	0.131	7.30
3/7/2014	trickle, 0	0.138	0.00
4/21/2014	0.17	0.076	1.27
5/8/2014	0.29	0.072	2.04
Average	0.35	0.095	2.36

The loads vary widely but average almost an order-of-magnitude higher than previously reported dry weather loads for the much larger catchments in Phase I permit area (see Tables E2 and E3 in Appendix E).

Graphs of the ACHD Phase II dry weather data (Figures C1 and C2) show how loads and concentrations change by month for three years. Note that lower loads generally occurred in non-growing season months and are associated with lower flows, while somewhat higher concentrations occurred in these winter months.

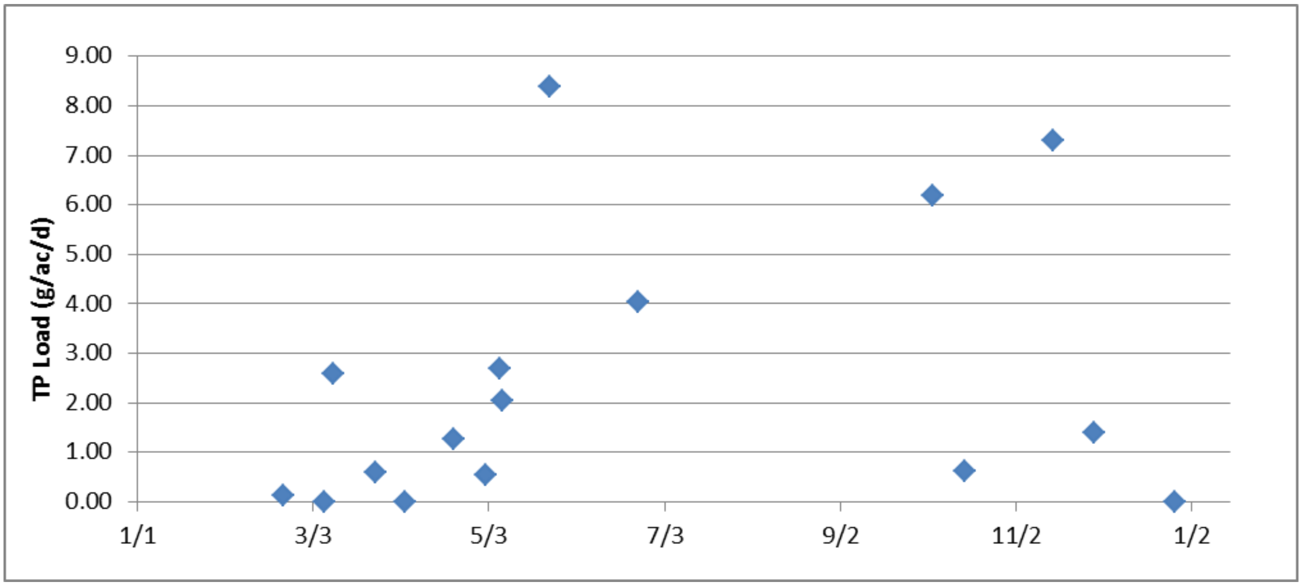


Figure C1 - Dry weather data loads by month for three years sampling.

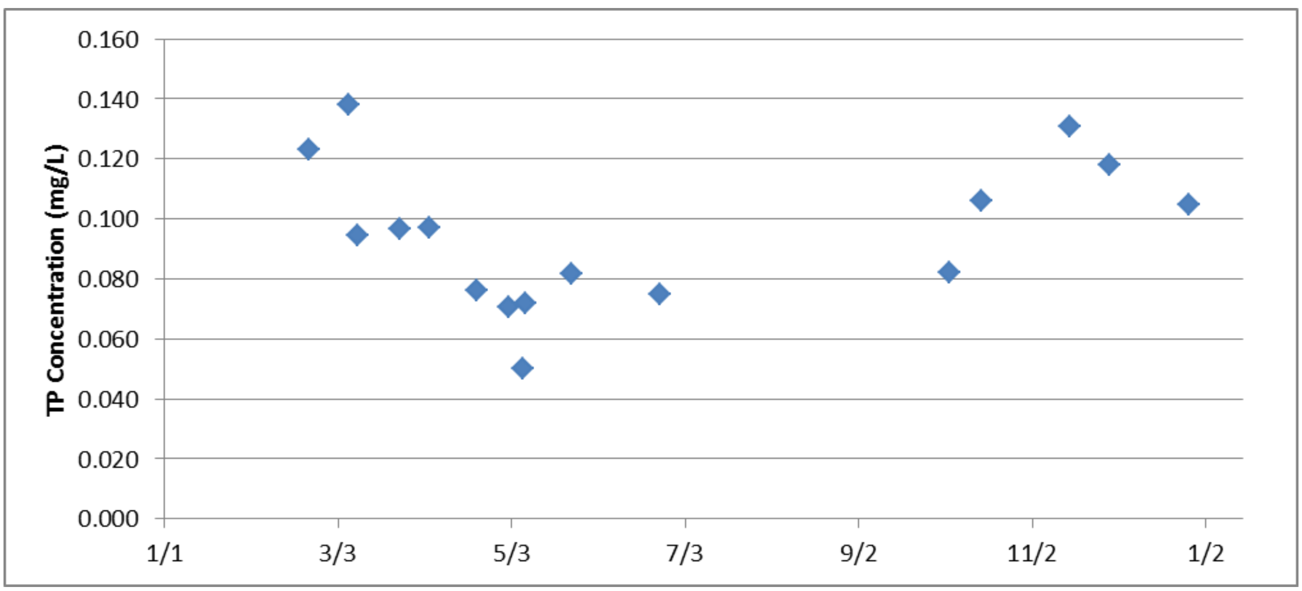


Figure C2 - Dry weather data concentrations by month for three years sampling.

- **Caldwell Data**

Dry weather data was collected from a subdivision developed in the ~1960s. The drainage area is estimated to be 200 acres (rough est.).

Table C3 – Dry weather data collected from Caldwell subdivision

Date	Discharge (cfs)	TP	
		(mg/L)	g/ac/d
6/28/2013	2.9	0.163	5.9
7/15/2013	2.8	0.150	5.1
7/26/2013	2.3	0.126	3.5
8/13/2013	3.1	0.144	5.4
Avg	2.8	0.146	5.0

Appendix D – Wet Weather May – Sep Fraction

Precipitation data collected at the Boise Airport from 1940 to 2012 is summarized in Table D.

Table D Precipitation data collected at the Boise Airport from 1940 to 2012 (NOAA 2014)

Station:(101022) BOISE WSFO AIRPORT

From Year=1940 To Year=2012

	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.		>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	dd/yyyy or yyyymmdd	# Days	# Days	# Days	# Days	in.	in.	-
January	1.40	3.87	1970	0.12	1949	1.13	18/1953	12	5	0	0	6.2	21.4	1964
February	1.07	3.70	1986	0.18	1997	0.92	04/1951	10	4	0	0	3.3	25.2	1949
March	1.25	3.46	1989	0.17	1992	1.60	20/1981	10	5	0	0	1.6	11.9	1951
April	1.20	3.04	1955	0.09	1949	1.27	06/1969	9	4	0	0	0.5	8.0	1967
May	1.29	4.40	1998	0.00	1992	1.77	29/1990	8	4	0	0	0.1	4.0	1964
June	0.84	3.41	1941	0.01	1960	1.91	12/1958	6	3	0	0	0.0	0.0	1940
July	0.25	1.62	1982	0.00	1942	0.94	30/1960	2	1	0	0	0.0	0.0	1940
August	0.28	2.37	1968	0.00	1943	1.61	13/1979	2	1	0	0	0.0	0.0	1940
September	0.55	2.93	1986	0.00	1943	1.73	11/1976	4	2	0	0	0.0	0.0	1940
October	0.81	2.59	2000	0.00	1952	0.90	12/2000	6	3	0	0	0.1	2.7	1971
November	1.32	3.36	1988	0.14	1976	0.78	26/1971	10	5	0	0	2.0	18.6	1985
December	1.42	4.23	1983	0.09	1976	1.03	23/1955	11	5	0	0	5.8	26.2	1983
Annual	11.70	18.77	1983	6.64	1966	1.91	19580612	90	39	3	0	19.6	46.5	1964
Winter	3.90	6.45	1969	1.31	1977	1.13	19530118	33	13	1	0	15.3	43.3	1949
Spring	3.75	7.11	1980	0.83	1992	1.77	19900529	26	12	1	0	2.2	11.9	1951
Summer	1.38	4.13	1941	0.08	1966	1.91	19580612	11	4	1	0	0.0	0.0	1940
Fall	2.68	4.99	1940	0.40	1952	1.73	19760911	20	9	1	0	2.1	18.6	1985

Table updated on Oct 31, 2012

Appendix E – Previous TMDL Dry Weather Loads

Data used for the Lake Lowell TMDLs and the Boise River Implementation Plan (IDEQ 2008) were collected during ACHD Phase I monitoring in 2006 (Table E1). The original analyses (Table E2 and E3), which were dated June 26, 2007, were prepared by Jack Harrison during stormwater work group meetings.

These dry weather loads are based on samples collected bi-weekly for the period July 20, 2006 through September 27, 2006 (Table E4). These were relatively continuous flows and appear to be primarily associated with groundwater discharging from these urban/suburban areas.

Table E1 – summary of stormwater sampling locations with Dry Weather Flows

Station	Type	Land Use	Catchment Area (acres)	Receiving Water
Walnut	Dry	74% low-density residential 13% high-density residential 8% open space 5% commercial/industrial	369	Boise River
Lucky	Dry	100% low-density residential	233	Eagle Drain
Americana	Dry	34% Commercial/Industrial 66% High density residential	615	Boise River

Noted:

- The Americana storm drain system collects drainage from approximately 615 acres. Groundwater, surface flows from the foothills drainage Hulls Gulch, and overflows from the Boise City Canal are known sources of water in the Americana system.
- The Walnut storm drain system conveys drainage from approximately 369 acres in the dry season. Groundwater is also a significant source of flow in this system. The Walnut system is also influenced by water from the Boise City Canal.
- The Lucky Dry site collects drainage from approximately 233 acres. Flows appear to be composed primarily of groundwater while some contributions from the Farmers Union Canal and Boise Valley Canal are suspected

Table E2- Dry weather flows, concentrations and loads for three ACHD sampling locations. Groundwater discharges are the primary source of the dry weather flows.

Americana		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.15	0.37	0.16
Area ac)		615
Load (g/ac/day)		0.26

Walnut		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.03	0.87	0.06
Area ac)		369
Load (g/ac/day)		0.16

Lucky		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.16	0.44	0.16
Area ac)		233
Load (g/ac/day)		0.70

Table E3 - Average dry weather flows, concentrations and loads primarily associated with groundwater discharges.

Average		
TP (mg/L)	Flow (cfs)	Load (kg/d)
0.11	0.56	0.13
Area (ac)		406
Load (g/ac/day)		0.37

Table E4- DryWx:2 – ACHD Phase I data collected in 2006

Americana				Walnut				Lucky		
Date	TP (mg/L)	Flow (cfs)	Load (kg/d)	Date	TP (mg/L)	Flow (cfs)	Load (kg/d)	Date	TP (mg/L)	Flow (cfs)
Median	0.15	0.37	0.16		0.03	0.92	0.06		0.08	0.84
7/20/2006	0.05	1.66	0.19	7/20/2006	0.06	0.24	0.03	7/20/2006	0.09	0.42
7/26/2006	0.07	1.15	0.18	7/26/2006	0.05	0.37	0.04	7/26/2006	0.17	0.40
7/27/2006	0.05	1.20	0.15	7/27/2006	0.04	0.42	0.04	7/27/2006	0.15	0.45
7/31/2006	0.06	1.00	0.14	7/31/2006	0.04	0.96	0.10	7/31/2006	0.18	0.31
8/3/2006	0.11	0.93	0.25	8/3/2006	0.03	0.60	0.05	8/3/2006	0.08	1.49
8/9/2006	0.20	0.47	0.22	8/9/2006	0.03	0.90	0.07	8/9/2006	0.16	0.38
8/10/2006	0.09	0.88	0.18	8/10/2006	0.04	0.88	0.08	8/10/2006	0.08	1.26
8/14/2006	0.27	0.39	0.26	8/14/2006	0.03	1.07	0.07	8/14/2006	0.16	0.43
8/17/2006	0.40	0.31	0.30	8/17/2006	0.02	1.59	0.10	8/17/2006	0.16	0.92
8/21/2006	0.17	0.48	0.20	8/21/2006	0.03	0.85	0.06	8/21/2006	0.16	0.52
8/23/2006	0.29	0.29	0.21	8/23/2006	0.03	0.86	0.06	8/23/2006	0.17	0.43
8/28/2006	0.14	0.32	0.11	8/28/2006	0.03	0.77	0.05	8/28/2006	0.16	0.38
8/30/2006	0.11	0.34	0.09	8/30/2006	0.03	0.98	0.07	8/30/2006	0.18	0.33
9/6/2006	0.29	0.23	0.16	9/6/2006	0.03	0.77	0.06	9/6/2006	0.16	0.24
9/11/2006	0.16	0.24	0.09	9/11/2006	0.03	0.85	0.07	9/11/2006	0.08	1.30
9/13/2006	0.16	0.32	0.13	9/13/2006	0.03	1.01	0.07	9/13/2006	0.16	0.31
9/18/2006	0.12	0.45	0.13	9/18/2006	0.03	0.76	0.05	9/18/2006	0.07	0.86
9/20/2006	0.12	0.33	0.10	9/20/2006	0.05	1.14	0.14	9/20/2006	0.08	0.82
9/25/2006	0.15	0.24	0.09	9/25/2006	0.05	0.99	0.11	9/25/2006	0.07	1.01
9/27/2006	0.18	0.24	0.10	9/27/2006	0.02	1.00	0.06	9/27/2006	0.06	1.78
MEAN	**0.16**	**0.57**	0.22		**0.03**	**0.85**	0.07		**0.13**	**0.70**