

Nevada's Nutrient Screening Indicators for Wadeable Streams

January 2009



High algae levels in Lower Maggie Creek east of Carlin (July 2008)



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Nevada's Nutrient Screening Indicators for Wadeable Streams

Introduction

Significant efforts are underway throughout the country to develop more appropriate nutrient criteria. Since 1998, Nevada has been participating in our Region IX RTAG (Regional Technical Advisory Group) efforts toward improved nutrient standards. An outgrowth of that process has been the development of Nevada's Nutrient Criteria Strategy (NDEP, January 2009). The foundation of the strategy is the well-recognized conclusion that nitrogen and phosphorus levels alone are poor indicators of nutrient problems. With that in mind, a key component of the strategy is the implementation of a multi-tiered approach to assess waters for nutrient-impairment status. The multi-tiered approach relies on water chemistry, algal levels, dissolved oxygen, and other biological indicators in the use support assessment process.

The first step in the multi-tiered assessment process includes a comparison of the nutrient levels in the subject water to appropriate nutrient screening indicators. This document describes initial nutrient indicators to be used. However, these indicators are subject to change in the future. It is expected that as more information is gathered and more experience is gained, changes may be appropriate.

EPA 304(a) Criteria

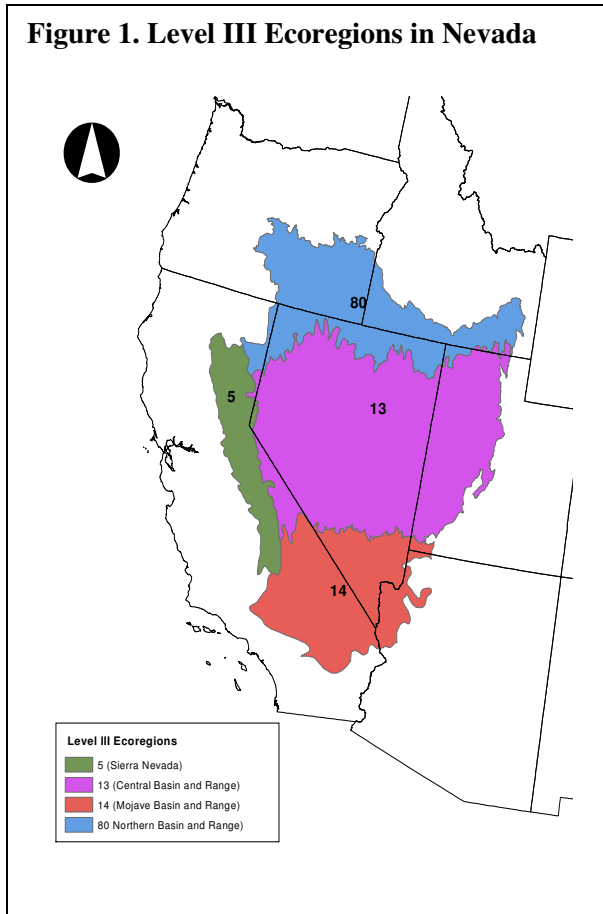
In 2001, EPA published recommended water quality criteria for nutrients under Section 304(a) of the Clean Water Act, with the intention that they serve as a **starting point**. EPA strongly encourages states and tribe to refine these recommendations following key elements in the EPA Technical Guidance Manuals. States and tribes are encourage to address both chemical causal variables (nitrogen, phosphorus) and early indicator response variables (chlorophyll-a, turbidity) in the development of criteria or procedures for translating narrative criteria.

EPA recommends 3 options for developing nutrient criteria (in order of preference)

1. Develop criteria that fully reflect localized conditions and protect specific designated uses, using EPA's Technical Guidance Method. Such criteria may be expressed either as numeric criteria or as procedures to translate a state or tribal narrative criterion into a quantified endpoint
2. Adopt EPA's 304(a) Criteria Recommendations, either as numeric criteria or as procedures to translate narrative criterion into a quantified endpoint.
3. Develop a Unique System using – empirical approaches, loading models, cause and effect based studies/relationships, other analytical tools.

In developing their 304(a) recommendations for rivers and streams, EPA first compiled datasets from Legacy STORET, NASQAN, NAWQA for a 10-year period (1990 to 1999). Using these data, EPA calculated assumed "reference" conditions for various parameters within each ecoregion (Level III, Figure 1).

Figure 1. Level III Ecoregions in Nevada



EPA’s Technical Guidance Manual for Developing Nutrient Criteria for Rivers and Streams describes 2 ways to establish criteria values:

1. Choose the 75th percentile of a population of reference streams (minimally impacted). This is EPA’s preferred way to establish reference conditions for other waters in the same ecoregion. The 75th percentile was selected since it is likely associated with minimally impacted conditions, and should be protective of designated uses.
2. When minimally impacted streams are not identified, use the 25th percentile of the entire population of data to represent a surrogate for an actual minimally-impacted population. According to EPA, case studies have indicated that the 25th percentile from an entire population roughly approximates the 75th percentile of the minimally impacted population (Figure 2). However, recent work by others has disputed this claim by EPA. For Montana, Suplee et al. (2007) found the 75th percentile of the minimal-impacted population corresponded with general population percentiles ranging from 4th to 97th. Based upon data across the U.S., Herlihy and Sifneos (2008) found that

general population 25th percentiles were much lower (by a factor of 2 to 6 in some cases) than the minimally-impacted 75th percentiles.

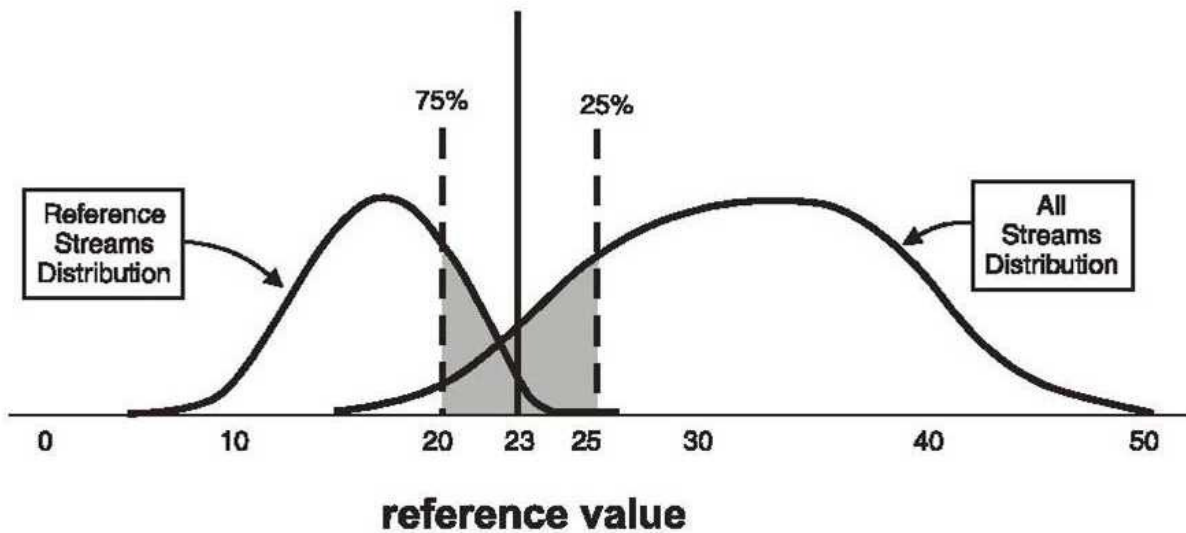


Figure 2. Conceptual Drawing of Distributions of Nutrients in Minimally Impacted Streams vs. All Streams

In the determination of the 304(a) criteria for our region, EPA did not have information on minimally impacted sites available on a national basis, so they relied on the 25th percentile of the entire dataset (within an ecoregion) for the establishing the criteria. One problem with this approach is that it automatically assumes that 75% of the streams are impaired for nutrients.

For each nutrient, EPA calculated the 25th percentile values for each ecoregion using the following steps:

1. Data were compiled by ecoregion (Level III) and grouped by station and season
2. Data were reduced to seasonal median values for each station by season (resulting in 4 medians for each station). This step prevents over-representation of stations with a great deal of data versus those with a small dataset.
3. For each ecoregion, 25th percentiles of the 4 sets of seasonal medians (of all stations within that ecoregion) were calculated (resulting in 4 values for the ecoregion).
4. For each ecoregion, the median of the winter, spring, summer and fall 25th percentiles was calculated. Steps 3 and 4 prevents over-representation of seasons with more data than those seasons with a smaller dataset.

Table 1 summarizes the recommendations for the Nevada ecoregions.

Table 1. EPA’s Surrogate Reference Conditions for Level III Ecoregion Rivers and Streams, mg/l

Parameter	Ecoregion 5 (Sierra Nevada)	Ecoregion 13 (Central Basin and Range)	Ecoregion 14 (Mojave Basin and Range)	Ecoregion 80 (Northern Basin and Range)
TP	0.015	0.0288	0.010	0.055
NO2 + NO3	0.01	0.038	0.353	0.025
TKN	0.10	0.228	0.288	0.23
TN (calculated)	0.11	0.266	0.641	0.255
TN (reported)	0.29	0.425	0.67	0.483

Nutrient Screening Indicators for Nevada

In lieu of using EPA’s 304(a) criteria (as presented in Table 1), States and Tribes are encouraged by EPA to refine these criteria as appropriate (EPA, 2000). NDEP desires to build off of EPA’s effort however intends to use similarly derived values as part of a screening/evaluation process. Given that nutrient levels are a poor indicator of eutrophication, NDEP desires to test these indicators as screening tools and not hard and fast nutrient criteria in the regulations.

This section presents the methodologies used to develop indicators and the resulting indicator levels for different regions of the state. It is the intent that these nutrient indicators be used as part of a multi-tiered approach for assessing beneficial use support of waters (Figure 3), whether currently listed in the NAC or proposed for inclusion in the NAC. For the new waters to be added, NDEP intends to not include hard and fast numeric nutrient criteria into the regulations, but to rely on the multi-tiered approach for assessment purposes. Refer to “Nutrient Assessment Protocols for Wadeable Streams in Nevada” (NDEP, April 2009) for more discussion on the multi-tiered approach.

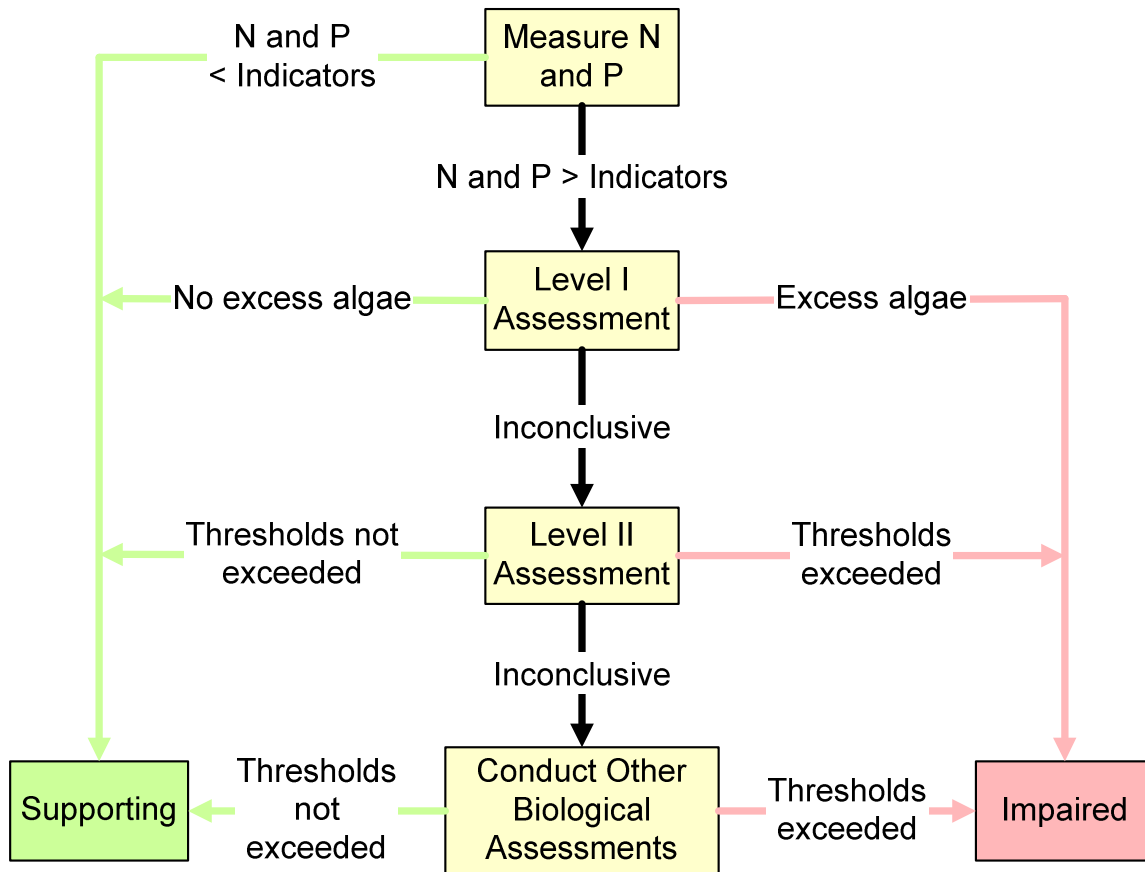


Figure 3. Evaluating New Waters Using Nutrient Screening Indicators in Multi-Tiered Assessment Approach

For those waters already on the 303(d) List based upon exceedances of TP standards, these indicators can not be used as justification for delisting of these waters. Level I/II investigations (NDEP, 2009) and other biological assessments are needed for this purpose. Nevertheless, the nutrient levels in these waters as compared to the screening indicators may be of interest.

Methodology

The basic framework used by EPA has been used in developing potential screening indicators: 1) seasonal medians have been calculated for all of the selected sites; and 2) various percentiles were evaluated for possible use. Some key factors in the development of indicators were as follows:

Waters included in analysis: The analyses were restricted to wadeable stream/river sites, and excluded drains, canals, and other manmade waterbodies. Sites below known nutrient point source discharges (from 1989-2008) were not included, i.e. Truckee River below TMWRF, Carson River below Brunswick Reservoir seeps (in Carson River Canyon), Las Vegas Wash.

A total of 397 water quality monitoring sites were used in analyses presented in the following sections. Table 2 and Figure 4 summarize these sites by hydrographic region, and Table 3 and Figure 5 summarize these sites by ecoregion (Levels III and IV). Appendix A contains a list of these sites.

Table 2. Summary of Sites by Hydrographic Region

Hydrographic Region	Number of Sites
Northwest Region	
Miscellaneous Streams	9
Black Rock Desert Region	
Miscellaneous Streams	25
Snake River Basin	
Bruneau River Basin	1
Goose Creek Basin	5
Jarbidge River Basin	8
SF Owyhee River Basin	7
Owyhee River Basin	7
Salmon Falls River Basin	11
Miscellaneous	4
Subtotal	43
Humboldt River Basin	
Marys River/Tabor Creek	6
SF Humboldt River Basin	11
NF Humboldt River Basin	8
Maggie/Susie Creeks Basin	4
Pine Creek Basin	4
Little Humboldt River	17
Reese River	14
Rock/Boulder Creek	4
Lamoille Creek	6
Humboldt River mainstem	15
Miscellaneous	5
Subtotal	94
West Central Region	
Subtotal	0
Lake Tahoe/Truckee River Basin	
Lake Tahoe Tributaries	30
Truckee River mainstem	9
Steamboat Creek Basin	38
Other Truckee River Tributaries	11
Subtotal	88

Hydrographic Region	Number of Sites
Western Region	
Subtotal	0
Carson River Basin	
East Fork Carson River	9
West Fork Carson River	7
Carson River mainstem	6
Clear Creek	10
Other Carson River tributaries	4
Subtotal	36
Walker River Basin	
East Walker River	10
West Walker River	7
Walker River mainstem	3
Other Walker River tributaries	1
Subtotal	21
Central Region	
Miscellaneous Streams	59
Great Salt Lake Region	
Miscellaneous Streams	4
Escalante Desert Basin	
Subtotal	0
Colorado River Basin	
Virgin River	2
Muddy River	10
White River	5
Miscellaneous	1
Subtotal	18
Death Valley Basin	
Subtotal	0
Entire State	
TOTAL	397

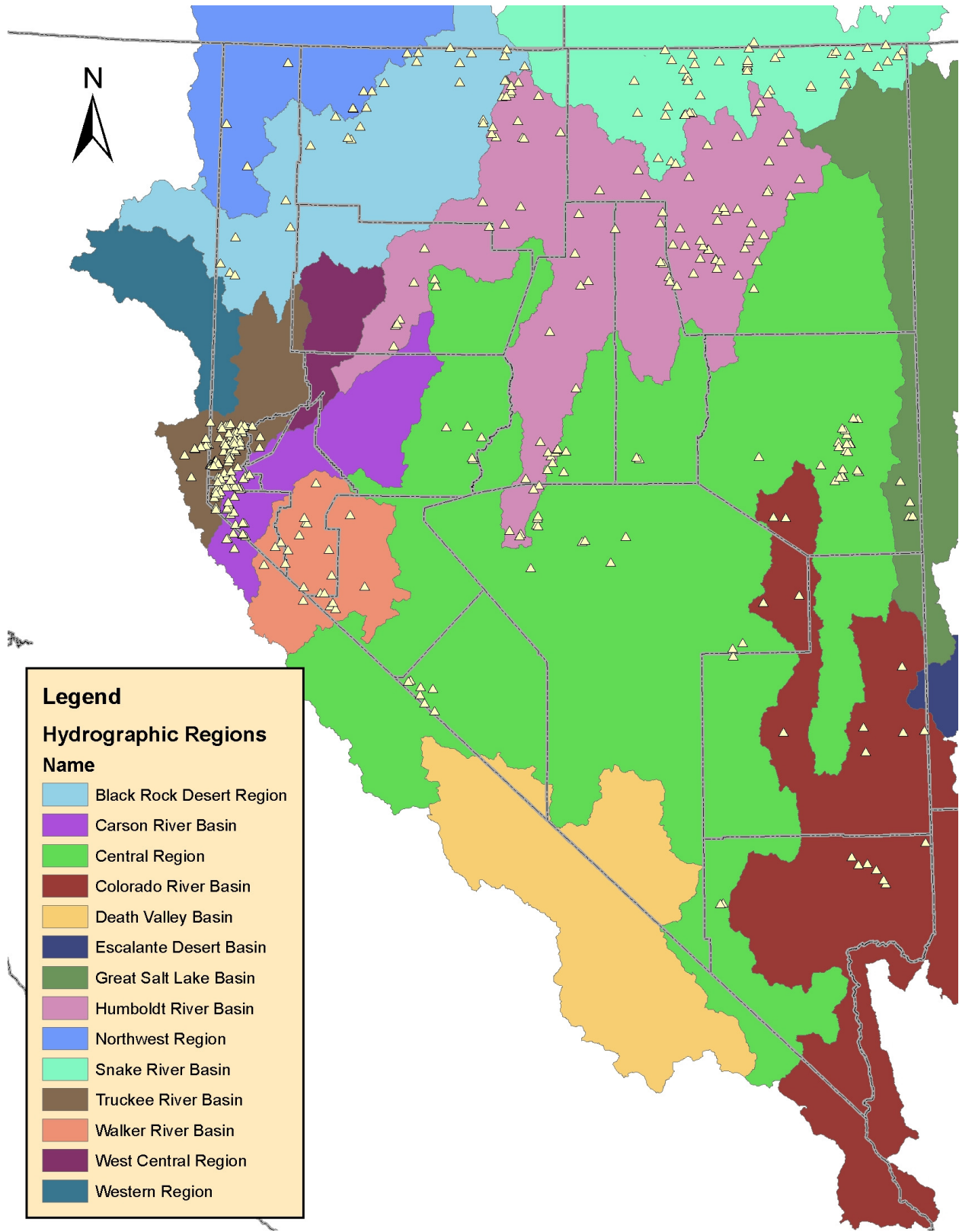


Figure 4. Nutrient Water Quality Monitoring Sites by Hydrographic Region

Table 3. Summary of Sites by Ecoregion

Ecoregion ID and Name		Number of Sites
<i>Ecoregion 05 – Sierra Nevada</i>		
5a	Mid-Elevation Sierra Nevada	55
5b	High Elevation Sierra Nevada	8
	SUBTOTAL	63
<i>Ecoregion 13 – Central Basin and Range</i>		
13a	Salt Deserts	0
13b	Shadscale-Dominated Saline Basins	2
13c	Sagebrush Basins and Slopes	0
13d	Woodland- and Shrub-Covered Low Mountains	3
13e	High Elevation Carbonate Mountains	3
13g	Wetlands	0
13h	Lahontan and Tonopah Playas	0
13j	Lahontan Salt Shrub Basin	22
13k	Lahontan Sagebrush Slopes	6
13l	Lahontan Uplands	0
13m	Upper Humboldt Plains	35
13n	Mid-Elevation Ruby Mountains	5
13o	High Elevation Ruby Mountains	1
13p	Carbonate Sagebrush Valleys	10
13q	Carbonate Woodland Zone	20
13r	Central Nevada High Valleys	13
13s	Central Nevada Mid-Slope Woodland and Brushland	15
13t	Central Nevada Bald Mountains	9
13u	Tonopah Basin	3
13v	Tonopah Sagebrush Foothills	2
13w	Tonopah Uplands	0
13x	Sierra Nevada-Influenced Ranges	10
13y	Sierra Nevada-Influenced High Elevation Mountains	1
13z	Upper Lahontan Basin	6
13aa	Sierra Nevada-Influenced Semiarid Hills and Basins	65
	SUBTOTAL	231

Ecoregion ID and Name		Number of Sites
<i>Ecoregion 14 – Mojave Basin and Range</i>		
14a	Creosote Bush-Dominated Basins	0
14b	Arid Foothills	1
14c	Mojave Mountain Woodland and Shrubland	2
14d	Mojave High Elevation Mountains	0
14e	Arid Valleys and Canyonlands	8
14f	Mojave Playas	0
14g	Amargosa Desert	0
	SUBTOTAL	11
<i>Ecoregion 22 – Arizona/New Mexico Plateau</i>		
22d	Middle Elevation Mountains	0
<i>Ecoregion 80 – Northern Basin and Range</i>		
80a	Dissected High Lava Plateau	16
80b	Semiarid Hills and Low Mountains	7
80d	Pluvial Lake Basins	0
80e	High Desert Wetlands	2
80g	High Lava Plains	34
80j	Semiarid Uplands	32
80k	Partly Forested Mountains	0
80l	Salt Shrub Valleys	1
	SUBTOTAL	92
Total		397

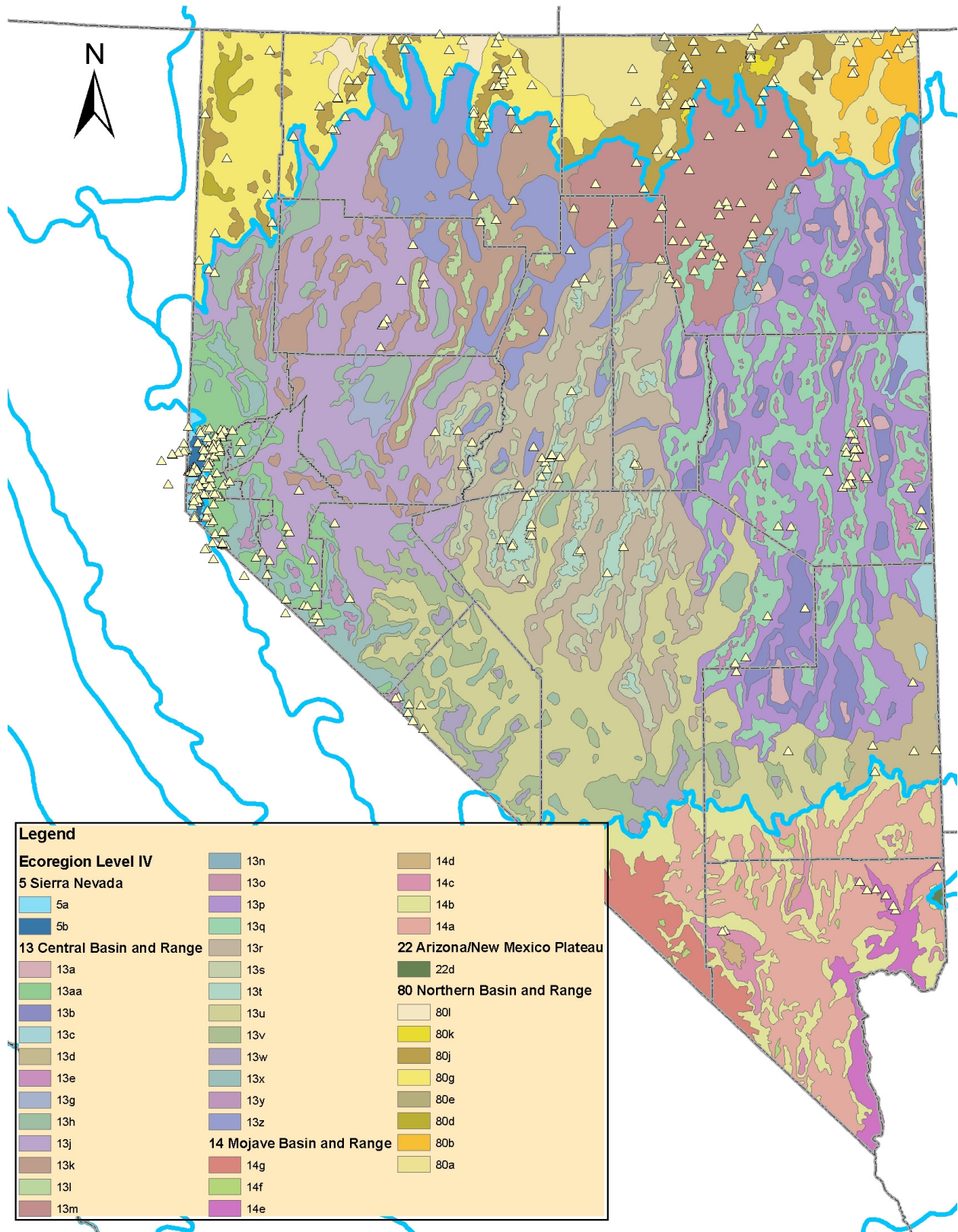


Figure 5. Nutrient Water Quality Monitoring Sites by Ecoregions Level IV

Multiple Sites in proximity to each other: In some instances, multiple monitoring stations have been identified for the same location on a given stream. While most of the data in the NDEP has been based upon NDEP sampling, some of the data are from the sampling activities of other agencies. Though the samples have been collected at the same physical location, different station IDs were assigned. In these instances, data were combined to represent conditions at that physical location.

Some monitoring stations on the same stream may be close to each other. In general, these stations were combined into 1 water quality site if within 1 mile of each other. However, stations were not combined if: 1) a tributary enters between the 2 stations; 2) the stations are in different ecoregions; and 3) the stations are in the headwaters and there is a significant difference in watershed areas.

Data source and range: The 304(a) criteria developed by EPA relied on STORET data for the period 1990-1999. One shortcoming of this approach is that some of the NDEP data were not in STORET for that period. NDEP's internal water quality database contains a more complete set of nutrient data for Nevada waters. For development of the screening indicators, 20 years of data (1989-2008) from the NDEP database were used.

Reference sites: According to EPA (2000), reference reaches should be "...relatively undisturbed stream segments that can serve as examples of the natural biological integrity of a region". Currently, NDEP has yet to identify reference streams as part of its bioassessment program. However, it is believed that most if not all of the reference-eligible streams in Nevada are those higher gradient waters in the upper watersheds. Few if any reference-eligible sites exist for the lower gradient streams.

For some analyses, "Least Disturbed" sites were identified using available satellite imagery and were treated similar to reference sites. Again, these sites were typically in higher gradient stream and it may not be appropriate to use a higher gradient stream as a reference for the lower gradient stream. However, this is likely the only choice available at this time.

Ecoregion levels vs hydrographic regions: Level III Ecoregions span large areas including minimally-impacted high gradient streams and lower gradient streams in the valleys. As a result, analysis of the data on this coarse of levels may not be appropriate for some waters. Level IV Ecoregions provides a much more detailed delineation of area. As data allowed and where deemed appropriate, nutrient indicators were developed by Level IV Ecoregions. In some cases, it was thought to be more useful to break out by hydrographic region. For some streams, it was necessary to set indicators by hydrographic region due to the lack of Level IV delineations. For example, the upper Carson and Walker basins extend into California. Unfortunately, Level IV Ecoregions have not been developed for California making it necessary to examine these data on a watershed and/or Level III Ecoregion basis.

To the extent suggested by the data, indicators were set for combined Level IV ecoregions in order to simplify the implementation of these indicators. Statistical tests, such as Mann-Whitney (test statistical differences in the median of 2 datasets) and Wald-Wolfowitz (tests statistical differences in the population of 2 datasets), were performed to check whether or not it was appropriate to combine datasets from 2 different ecoregions. However, it was necessary to rely mostly on OP and TP datasets for these tests as a significant number of DIN, TKN and TN values were below the detection limits, thereby limiting the usefulness of these tests for the nitrogen species.

Percentiles: As discussed earlier, there is considerable controversy over appropriate percentiles to use when setting nutrient criteria. EPA has suggested using the 75th percentile of reference (minimally-impacted) sites or the 25th percentile of the entire data for a given region. It is recognized that the use of the 25th percentile for the general population results in 75% of the waters in that population exceeding the indicators, thereby prompting a significant number of followup Level I/II evaluations to determine support status. However, the use of a higher percentile (such as the 50th or 75th) increases the probability of assuming an impaired water is not impaired.

Ultimately, the selection of the percentile is dependent upon striking a balance between staff/funding resources available to perform followup Level I/II evaluations and minimizing the risk of misidentifying impaired waters. For this report, a range of “least disturbed” and “all data” percentiles were examined, and indicators were generally set at the 75th percentile of the nutrient levels for the “reference” or “least-disturbed” sites if deemed appropriate. If “least disturbed” sites could not be identified, indicators were typically based upon the 25th percentile for all the sites in that grouping.

High reporting/detection limits: Within the NDEP database, laboratory detection/reporting limits have been handled in various ways for the 20 years of data used in this analysis (Table 4). The handling of the DIN, TKN and TN data has had the greatest impact upon the setting of nutrient indicators. Prior to 2004, many of the DIN, TKN and TN values in the database are below levels thought to be the applicable reporting limit at that time.¹ As a result, the 25th-75th percentiles for DIN, TKN and TN are often uncertain, falling below the detection limit.

Table 4. Summary of Reporting/Detection Limits in NDEP Database

Parameter	Discussion
OP/TP	It appears that up through mid-2004 a detection limit of 0.01 mg/l could have been applied. However, the State Laboratory did not report values as “< detection limit” if the analysis indicated. The Laboratory reported the value as 0.0 and noted it as “estimated”. Since the mid-2004, any OP/TP data that is less than 0.01 is reported as “<0.01”.
DIN	The appropriate detection/reporting limit for DIN data prior to 2004 is uncertain. During this time period, some values that were less than 0.1 mg/l were noted as “estimated”. For a brief period during 2004/05, the Laboratory used a reporting limit of 0.5 mg/l. Since that time, a reporting limit of 0.1 mg/l has been used. Some DRI data for the Truckee River used a detection limit of 0.001 mg/l
TKN	For the period up to mid-2004, there is uncertainty regarding the applicable reporting limit. During this time, no values are listed as “estimated” or as “<detection limit”. However there are a number of values that less than the current detection limit. Since mid-2004, the State Laboratory has used a detection limit of 0.2 mg/l. Some DRI data for the Truckee River used a detection limit of 0.02 or 0.1 mg/l.
TN	TN values in the data base are calculated as the sum of DIN and TKN. Since mid-2004, the lowest TN that could be reported is 0.3 mg/l. For a brief period during 2004/05, the Laboratory used a DIN reporting limit of 0.5 mg/l. As a result, the TN report limit for that period was rather high at 0.7 mg/l.

¹ Little information exists describing the historic reporting limits/detection limits used for the NDEP data.

Use of OP and DIN Indicators: While this report presents OP and DIN indicators for Nevada, it should be recognized that there may be some problems with their use. Daytime grab samples may not be representative of overall OP and DIN levels available for algal use. For example, a number of studies have found significant diel fluctuations in nitrate, with lower levels occurring in the water column during daylight hours due to algal consumption.

Indicators for Level III Ecoregions

For a comparison with EPA’s 304(a) criteria in Table 1, NDEP’s dataset was used to recalculate the 25th percentiles of the data for each of the 4 Ecoregion Level III areas (Table 5). Overall, the recalculated 25th percentile values are similar to EPA’s 304(a) criteria. Note that several of the NDEP values are given as “< detection limit” while some EPA values are given as actual numbers that are less than current detection limits. As discussed earlier, some of the pre-2004 NDEP (and subsequently STORET) data contains “estimated” values that are less than the laboratory’s reporting limit. It appears that EPA did not attempt to screen the dataset for inappropriately estimated levels.

Table 5. EPA and NDEP 25th Percentiles of Nutrient Levels in Level III Ecoregion Rivers and Streams, mg/l

Parameter	Ecoregion 5 (Sierra Nevada)		Ecoregion 13 (Central Basin and Range)		Ecoregion 14 (Mojave Basin and Range)		Ecoregion 80 (Northern Basin and Range)	
	EPA	NDEP	EPA	NDEP	EPA	NDEP	EPA	NDEP
OP	na	<0.01	na	0.01	na	0.02	na	0.02
TP	0.015	0.01	0.0288	0.03	0.010	0.08	0.055	0.04
NO₂ + NO₃	0.01	<0.10	0.038	<0.10	0.353	0.24	0.025	<0.10
TKN	0.10	<0.20	0.228	0.20	0.288	0.31	0.23	0.23
TN (calculated)	0.11	<0.30	0.266	<0.30	0.641	0.49 – 0.55	0.255	<0.30
TN (reported)	0.29		0.425		0.67		0.483	

Indicators for Ecoregion 5 and Tahoe Basin

Ecoregion 5 largely consists of the Sierra Nevada Mountains area, encompassing the Lake Tahoe Basin and the upper Carson and Walker watersheds. Within this region, Level IV Ecoregions 5a and 5b have been delineated (Figure 6). Ecoregions 5a and 5b include the mid- and high-elevation regions of the Sierra Nevada Mountains in the Lake Tahoe Region. Analyses were undertaken to determine the appropriateness of establish separate indicators for 5a and 5b regions, or to develop indicators for the combined ecoregions.

A total of 56 monitoring sites have associated watersheds with >95% of their area in Ecoregion 5a and 5b². The first step in the analysis was to divide the available data for these 56 monitoring sites into 2 categories:

- Watersheds with >50% of their area in Ecoregion 5a (number = 12)
- Watersheds with >50% of their area in Ecoregion 5b (number = 44)

Figure 7 presents a sample boxplot comparison of OP and TP between the 2 categories.

² Sites with watersheds in California could not be included in this analysis as no Ecoregion Level IV delineations have been developed for the state.

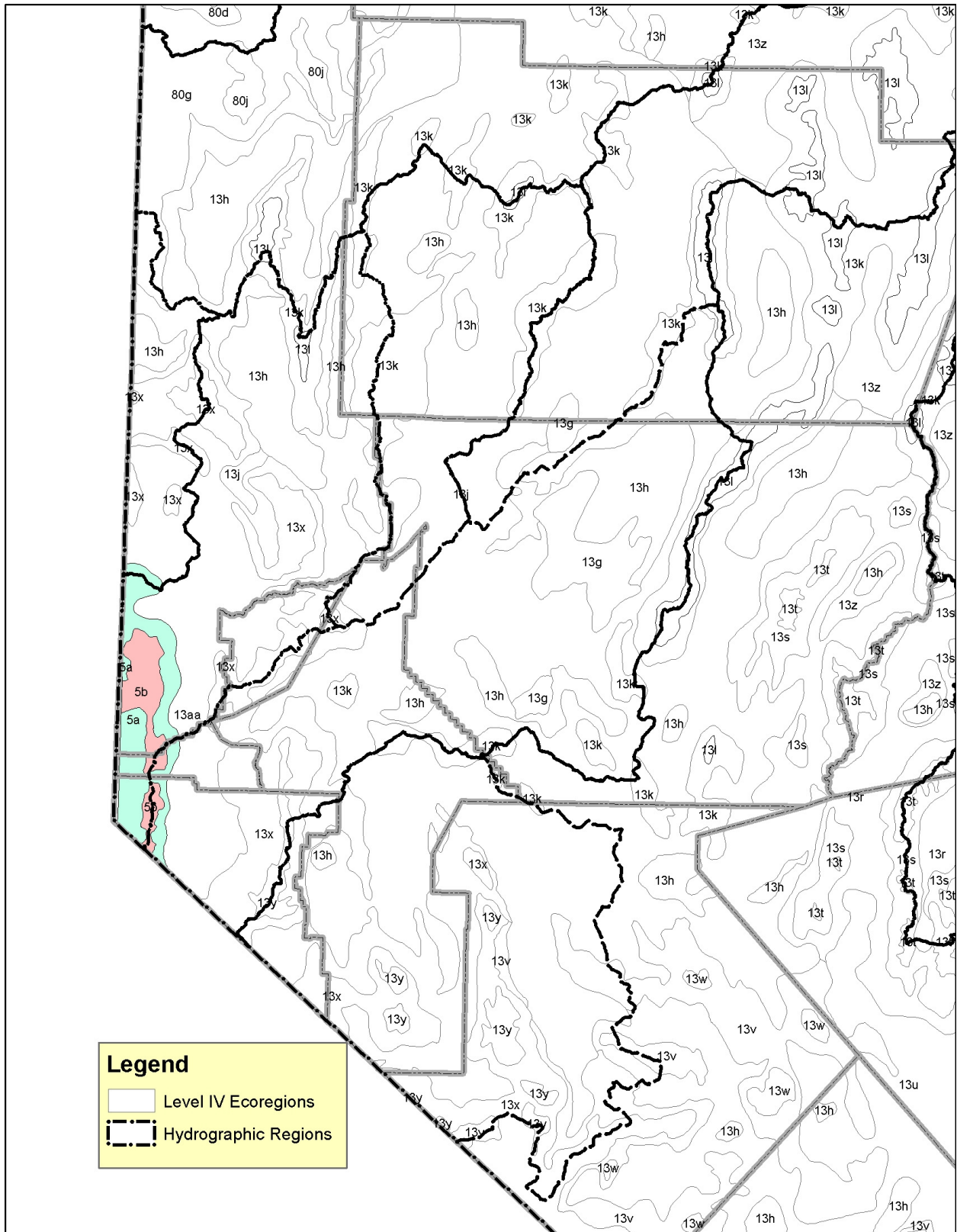


Figure 6. Level IV Ecoregion 5a – Mid-Elevation Sierra Nevada; and 5b – High Elevation Sierra Nevada

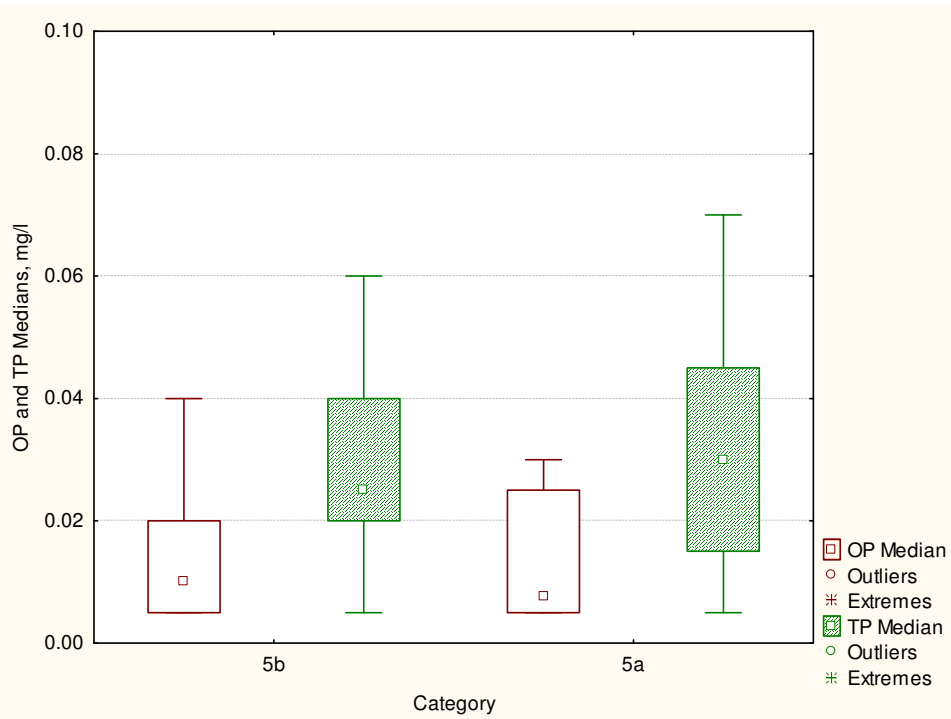


Figure 7. Boxplot of Median OP and TP Values for Sites in Ecoregions 5a and 5b

Next, Mann-Whitney statistical tests were performed to check for any statistical differences in the median of the site medians for the 2 categories. Additionally, Wald-Wolfowitz statistical tests were performed to check for statistical differences in the population of each set of medians. The tests showed there to be no statistically significant differences between the 2 category datasets. Therefore, it was concluded that it would be appropriate to combine the data and develop nutrient indicators for the entire Ecoregion 05 rather than for subregions 5a and 5b.

However from the standpoint of ease of use, it was thought that indicators set by watershed may be more functional than by ecoregion. Therefore, the following steps were taken to develop indicators for Lake Tahoe tributaries. There are a number of eastern-slope Sierra streams with headwaters in Ecoregion 5 that flow into Ecoregion 13. These streams have been addressed in another section of this report.

While Nevada has yet to establish reference sites, least-disturbed sites (above development) were identified for this analysis using satellite imagery. Figure 8 depicts the lower OP and TP levels in the least-disturbed sites compared to the other sites. The various percentiles for all the Tahoe tributary sites, the 75th percentile of the least-disturbed sites, along with the revised Ecoregion 05 25th percentiles, are shown in Table 6. It is recommended that the 75th percentile of the least-disturbed sites be used as an indicator.

As with most of the sites in Nevada, little is known about the actual eutrophication status of these waters. However given the low levels of phosphorus and nitrogen, it is unlikely that significant algae growth is occurring in these streams.

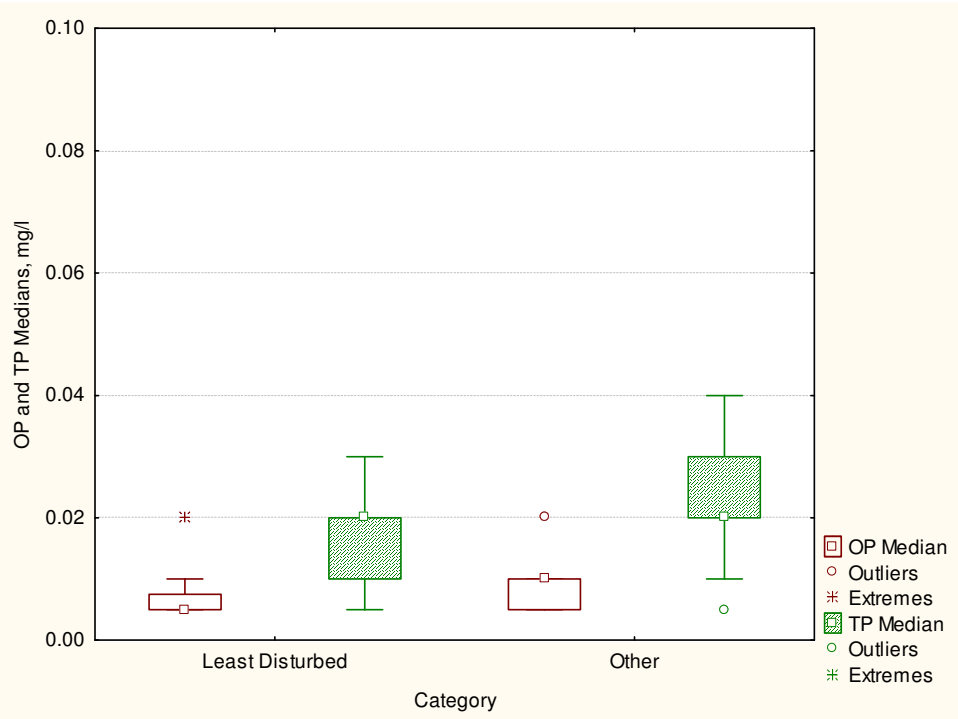


Figure 8. Boxplot of Median OP and TP Values for Tahoe Tribes – Least Disturbed vs. Other

Table 6. Nutrient Percentiles for Lake Tahoe Tributaries and Recommended Indicators

Category	Parameter	OP	TP	DIN	TKN	TN
All Data	25 th	<0.01	0.01	<0.10	<0.20	<0.30
	50 th	<0.01	0.02	<0.10	0.17 – 0.20	0.19 – 0.30
	75 th	0.01	0.03	<0.50	0.2	0.22 - 0.70
Least Disturbed	75 th	<0.01	0.02	<0.50	0.17 – 0.20	0.19 – 0.70
All Ecoregion 05	25 th	<0.01	0.01	<0.10	<0.20	<0.30
RECOMMENDED		<0.01	0.02	<0.10	<0.20	<0.30

Indicators for Ecoregion 13 and Associated Hydrographic Regions

A majority of Nevada falls within Ecoregion 13 – Central Basin and Range (Figure 5) and includes parts of numerous hydrographic regions, such as the Humboldt River Basin, Truckee River Basin, Carson River Basin, Walker River Basin and the Central Region. The following sections present nutrient indicators for various Level IV Ecoregions and hydrographic regions within Ecoregion 13.

Headwaters in 13e and 13q (Carbonate Mountains)

Including in this grouping are those streams with headwaters in Ecoregions 13e and 13q, located in east-central Nevada in the carbonate mountains (Figure 9). Within this grouping, 32 monitoring sites exist with nutrient data. Of these sites, 24 have associated watersheds with 95% of their areas in combined Ecoregion 13e and 13q. Analyses were performed to determine whether or not it was appropriate to develop separate nutrient indicators for these 2 ecoregions. The first step in this analysis was to divide the available data for these 24 sites into 2 categories:

- Watersheds with >50% of their area in Ecoregion 13e (number = 14)
- Watersheds with >50% of their area in Ecoregion 13q (number = 10)

While boxplots showed some differences between the OP and TP medians for these 2 groups, Mann-Whitney and Wald-Wolfowitz statistical tests for significance in these differences yielded conflicting results. Therefore, it seemed appropriate to combine the indicators for those watershed with >95% of their area in 13e and 13q. However, the question remained as to how to address those other waters with <95% of their watershed in 13e/13q.

Another approach was taken which involved the identification of least-disturbed sites. As discussed earlier, reference sites have yet to be established for Nevada. Therefore, available satellite imagery was used to identify a subset of the 32 sites that could be considered “least disturbed”. Based upon EPA’s approach, the 75th percentiles of the Least-Disturbed Sites were calculated and compared to the 25th percentiles of All Sites (Table 7). There is essentially no difference between the 75th percentile of the “least-disturbed” sites and the 25th percentile of all the data.

Little is known about the actual eutrophication status of these waters. Future work could involve more detailed efforts to better identify “Least Disturbed” sites and where excess algae actual occurs. However, given that all of the DIN, TKN and TN statistics are less than detection limits, the additional work may not be warranted.

It could be questioned whether or not it is appropriate to use the higher elevation “least-disturbed” sites as some sort of “reference” for conditions in the lower elevation sites. The lower elevation sites could be expected to naturally have higher nutrient concentrations.

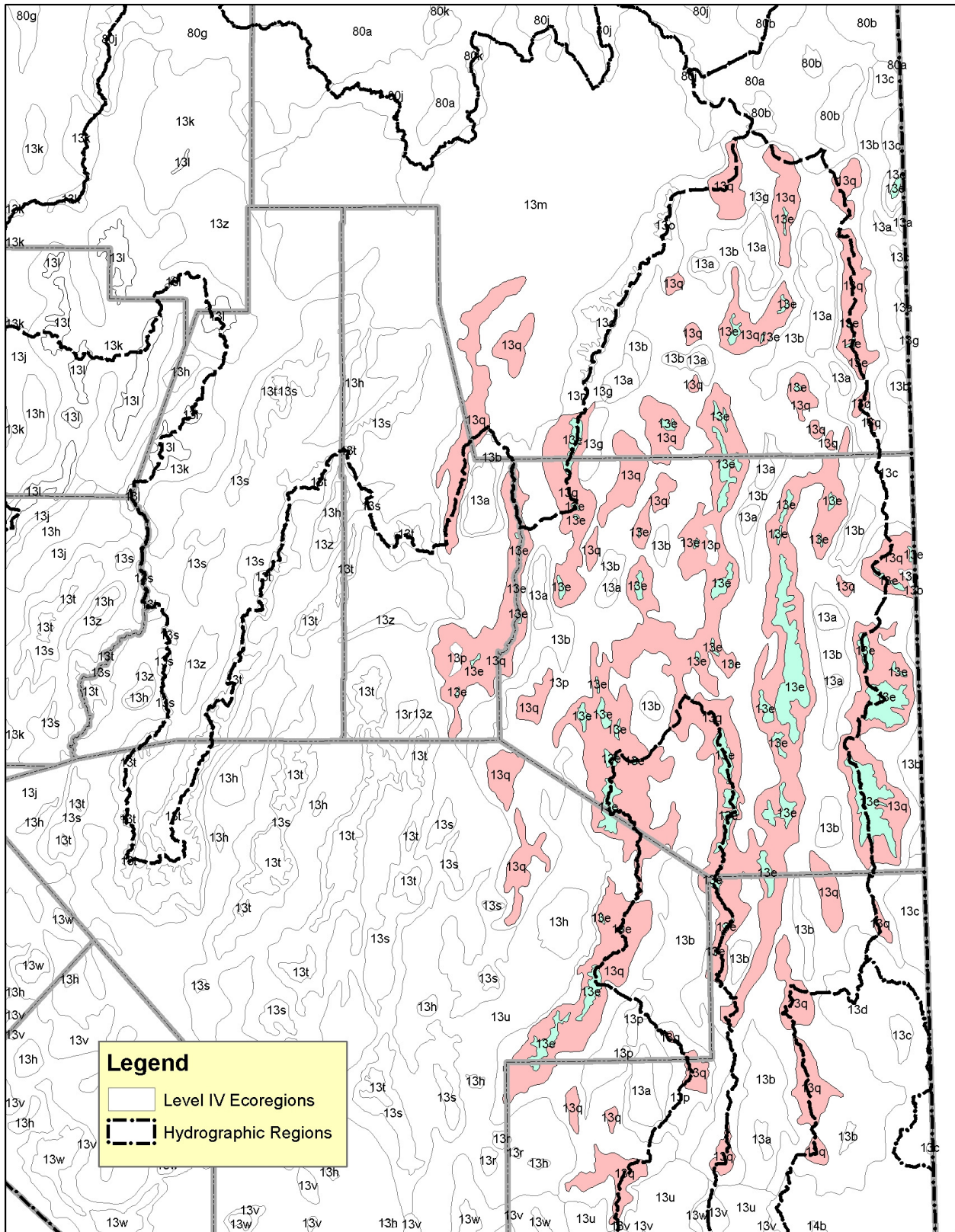


Figure 9. Level IV Ecoregion 13e – High Elevation Carbonate Mountains; and 13q – Carbonate Woodland Zone

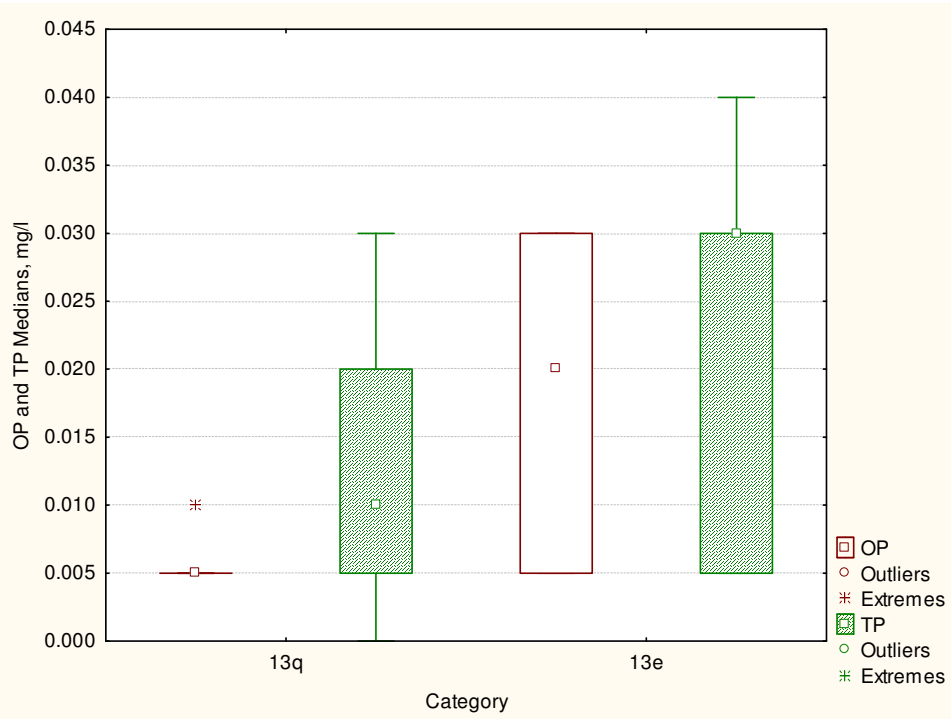


Figure 10. Boxplot of Median OP and TP Values for 13q and 13e Streams

Table 7. Nutrient Percentiles for Streams with Headwaters in Ecoregions 13e and 13q, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
Least-Disturbed Sites	75 th	0.02	0.03	<0.5	<0.2	<0.7
All Data	25 th	<0.01	<0.01	<0.1	<0.2	<0.3
	50 th	<0.01	0.02	<0.18	0.17 – 0.20	<0.4
	75 th	0.02	0.03	0.20 – 0.50	0.20	0.30 – 0.70
Ecoregion 13	25 th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.02	0.03	<0.1	<0.2	<0.3

Headwaters in 13o and 13n (Ruby Mountains)

This grouping includes streams with headwaters in Ecoregions 13o (High Elevation Ruby Mountains) and 13n (Mid-Elevation Ruby Mountains) (Figure 11). NDEP database contains nutrient data for 15 monitoring within this grouping. Of these 15 monitoring sites, only 1 site has its associated watersheds with >95% of its area in Ecoregion 13o. This is not a sufficient number of sites to develop separate 13o indicator criteria. Within the combined Ecoregion 13o and 13n, only 6 of the 15 sites had watersheds with >95% of their area in combined 13o/13n.

Another approach was taken using “least disturbed” sites identified from available satellite imagery. Additionally, 2008 field surveys identified some streams in this grouping as having “limited algae” or “excess algae” (NDEP, 2009). Graphical analyses of the nutrient data indicates that the nutrient levels for the “least-disturbed” sites and the “nonexcessive algae” sites were similar. However, the lower elevation sites tended to have higher phosphorus and nitrogen concentrations (Figure 12).

Table 8 presents the 75th percentiles for the “least disturbed + limited algae” sites; 25th-75th percentiles for all 15 monitoring sites; and the 25th percentiles for all Ecoregion 13 sites.

It could be questioned whether or not it is appropriate to use the higher elevation “least-disturbed” sites as some sort of “reference” for conditions in the lower elevation sites. The lower elevation sites could be expected to naturally have higher nutrient concentrations.

Table 8. Nutrient Percentiles for Streams with Headwaters in Ecoregions 13o and 13n, and Recommended Indicators

Data	Percentile	OP	TP	DIN	TKN	TN
Least-Disturbed Sites & Nonexcessive Algae Sites	75th	<0.01	0.02	<0.30	<0.20	<0.50
All Data	25th	<0.01	<0.01	<0.10	<0.20	<0.30
	50th	<0.01	0.02	<0.10	0.16 – 0.20	0.19 – 0.50
	75th	<0.01	0.04	<0.20	0.43 – 0.47	0.47 – 0.68
Ecoregion 13	25th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		<0.01	0.02	<0.10	<0.20	<0.30

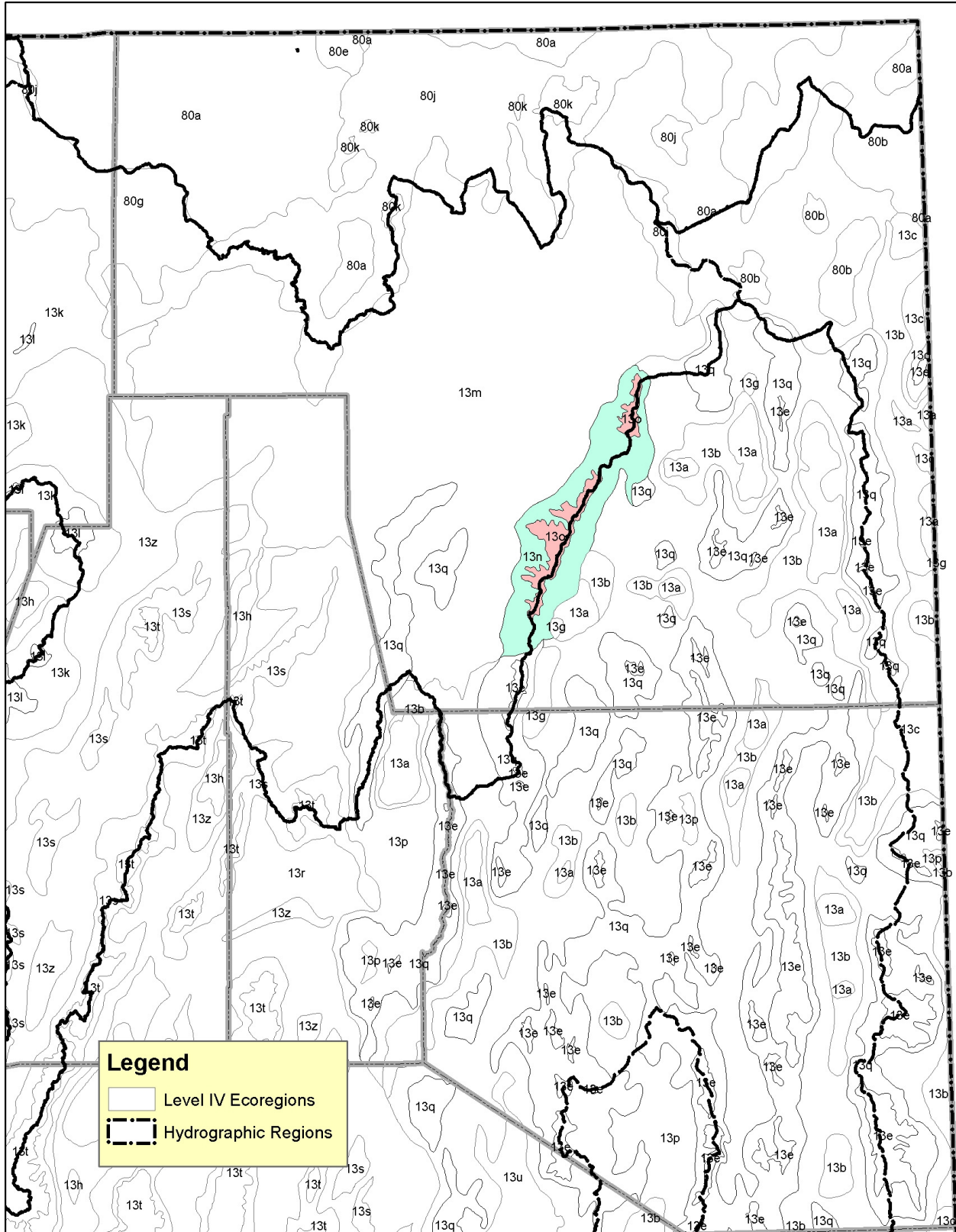


Figure 11. Level IV Ecoregion 13o – High Elevation Ruby Mountains; and 13n – Mid-Elevation Ruby Mountains

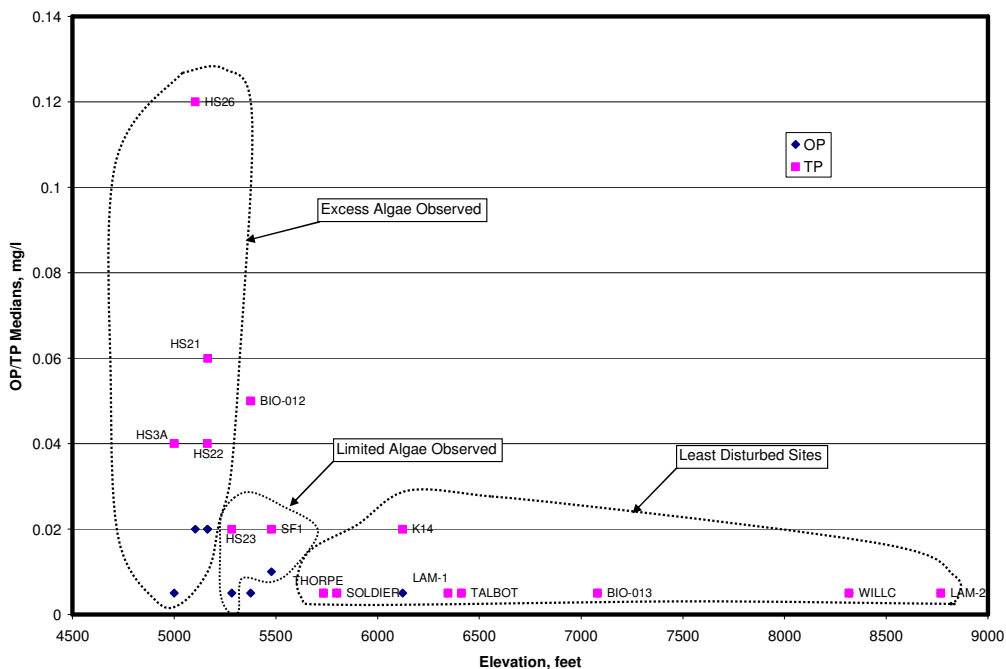


Figure 12. OP and TP Medians for Streams with Headwaters In Ruby Mountains

Headwaters in 13t and 13s

Including in this grouping are the streams with headwaters in Ecoregions 13t (Central Nevada Bald Mountains) and 13s (Central Nevada Mid-Slope Woodland and Brushland) located in central Nevada (Figure 13). A total of 39 monitoring sites exist for this grouping. A variety of streams are included in this grouping ranging from small watersheds such as Willow Creek (WILO-1) to larger watersheds such as Pine Creek and Reese River. For these waters, nutrient concentrations tend to increase with decreases in elevation (Figure 14).

Though there are 39 monitoring sites in this grouping, there are insufficient sites to support developing separate nutrient indicators for Ecoregions 13t and 13s. Therefore, it was deemed appropriate to evaluate the use of least-disturbed sites for setting combined indicators for all streams with headwaters in 13t/13s. For this grouping, least-disturbed sites were basically those watersheds with limited roads in the watershed. As expected, nutrient levels were lower in the “Least-Disturbed sites than in the “Other” sites (Figure 15). Building off of EPA’s approach, the 75th percentiles of the Least-Disturbed Sites were calculated and compared to the 25th percentiles of All Sites (Table 9). There is essentially no difference between the 75th percentile of the “least-disturbed” sites and the 25th percentile of all the data.

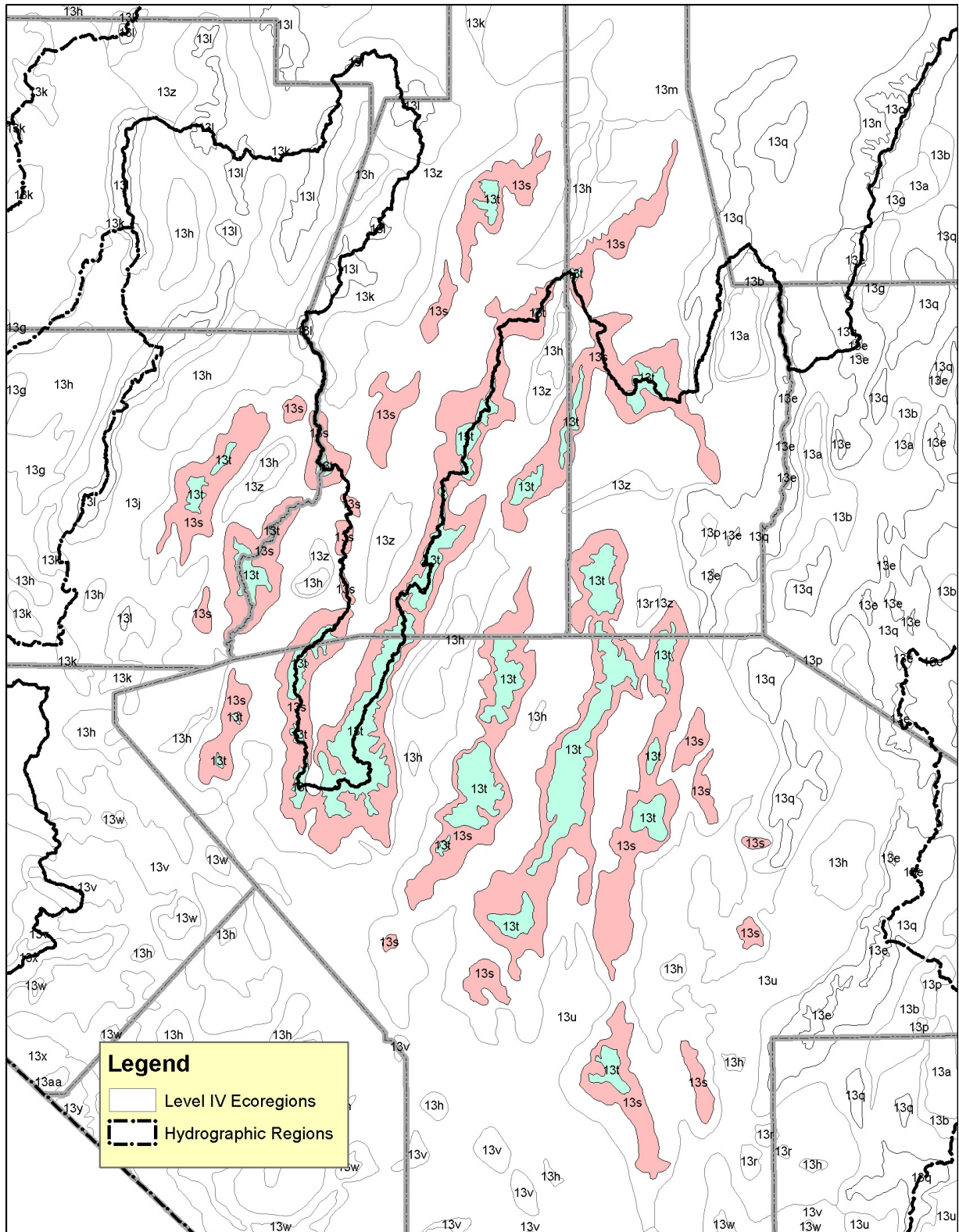


Figure 13. Level IV Ecoregion 13t – Central Nevada Bald Mountains; and 13s – Central Nevada Mid-Slope Woodland and Brushland

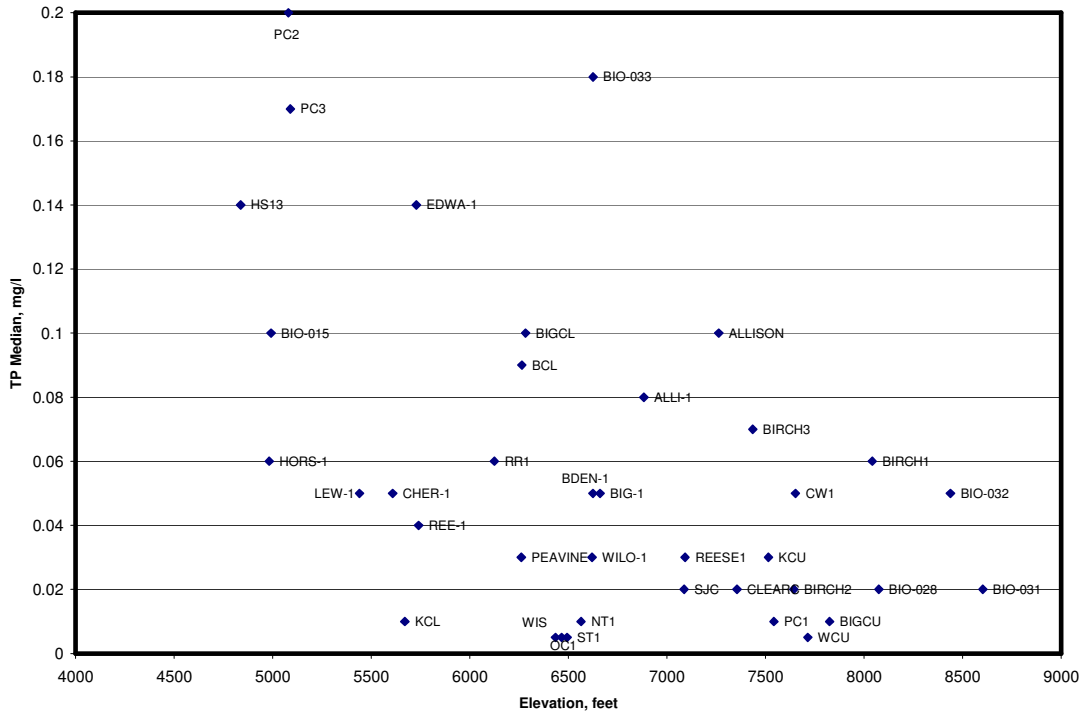


Figure 14. OP and TP Medians by Elevation for Streams with Headwaters in Ecoregions 13t and 13s

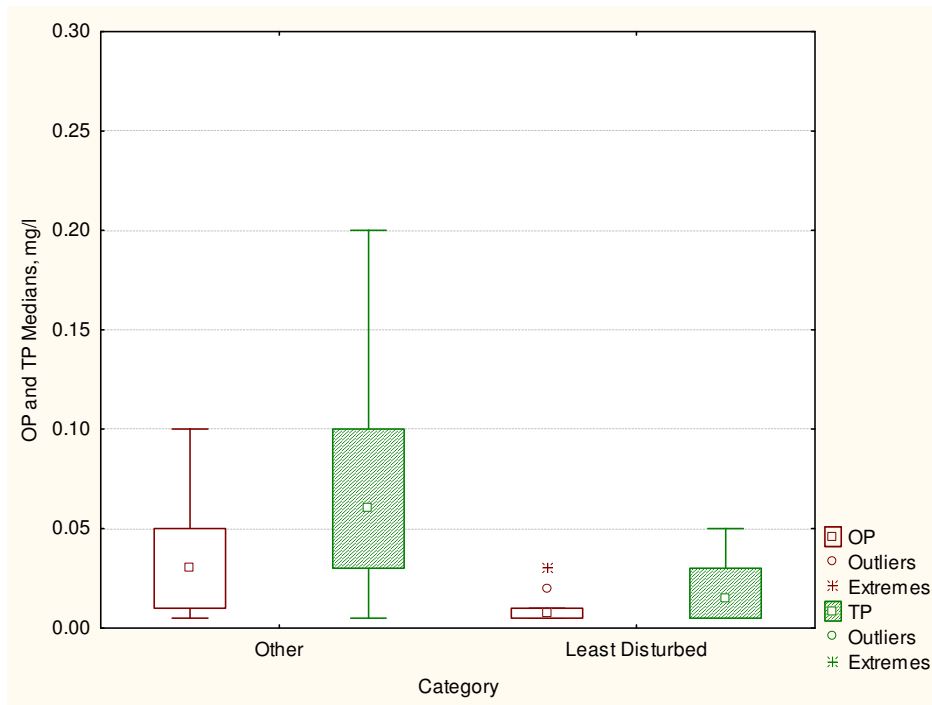


Figure 15. Boxplot of Median OP and TP Values for Least-Disturbed and Other Streams with Headwaters in Ecoregion 13t and 13s

Table 9. Percentiles of Streams with Headwaters in Ecoregions 13s and 13t, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
Least-Disturbed Sites	Median of 4 Seasonal 75 th Percentiles	0.01	0.03	<0.29	<0.24	<0.46
All Data	Median of 4 Seasonal 25 th Percentiles	<0.01	0.02	<0.10	<0.20	<0.30
	50 th Percentile	0.03	0.05	<0.15	0.18 – 0.20	0.21 – 0.46
	75 th Percentile	0.04	0.09	<0.30	0.29	0.32 – 0.56
Ecoregion 13	25th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.01	0.03	<0.10	<0.20	<0.30

It could be questioned whether or not it is appropriate to use the higher elevation “least-disturbed” sites as some sort of “reference” for conditions in the lower elevation sites. The lower elevation sites could be expected to naturally have higher nutrient concentrations.

Little is known about the actual eutrophication status of these waters, with the exception of Pine Creek (Humboldt River tributary). Visual surveys during the summer of 2008 indicated that excessive algal levels exist in the lower stream. Future work could involve more detailed efforts to better identify “Least Disturbed” sites and where excess algae actual occurs. However, given that all of the DIN, TKN and TN statistics are less than detection limits, the additional work may not be warranted.

Table 10. Nutrient Medians for Pine Creek

ID	Stream	OP	TP	DIN	TKN	TN
HS13	Pine Creek	0.07	0.14	<0.1	0.59	0.72

Headwaters in 13l

Ecoregion 13l (Lahontan Uplands) encompasses a series of mountain ranges located in Pershing County and the surrounding area (Figure 16). However, NDEP has collected data at only 4 streams in region. With just a small sample set, it is probable that the calculated percentiles are not that representative of the population of streams flowing out of Ecoregion 13l. Nevertheless, the resulting calculations are presented in Table 11 and compared with the Level III Ecoregion 13 25th percentiles. Interestingly, there is little difference between the 25th percentile of the Ecoregion 13l sites and the 25th percentile of the Level III Ecoregion 13 sites.

Table 11. Percentiles of Streams with Headwaters in Ecoregion 13l, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
All Data	25th	<0.01	0.03	<0.10	0.26	0.32 – 0.35
	50th	0.02	0.03	<0.18	0.29	0.34 – 0.51
	75th	0.03	0.04	0.07 – 0.32	0.3	0.44 – 0.70
Ecoregion 13	25th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.01	0.03	<0.10	0.20	<0.30

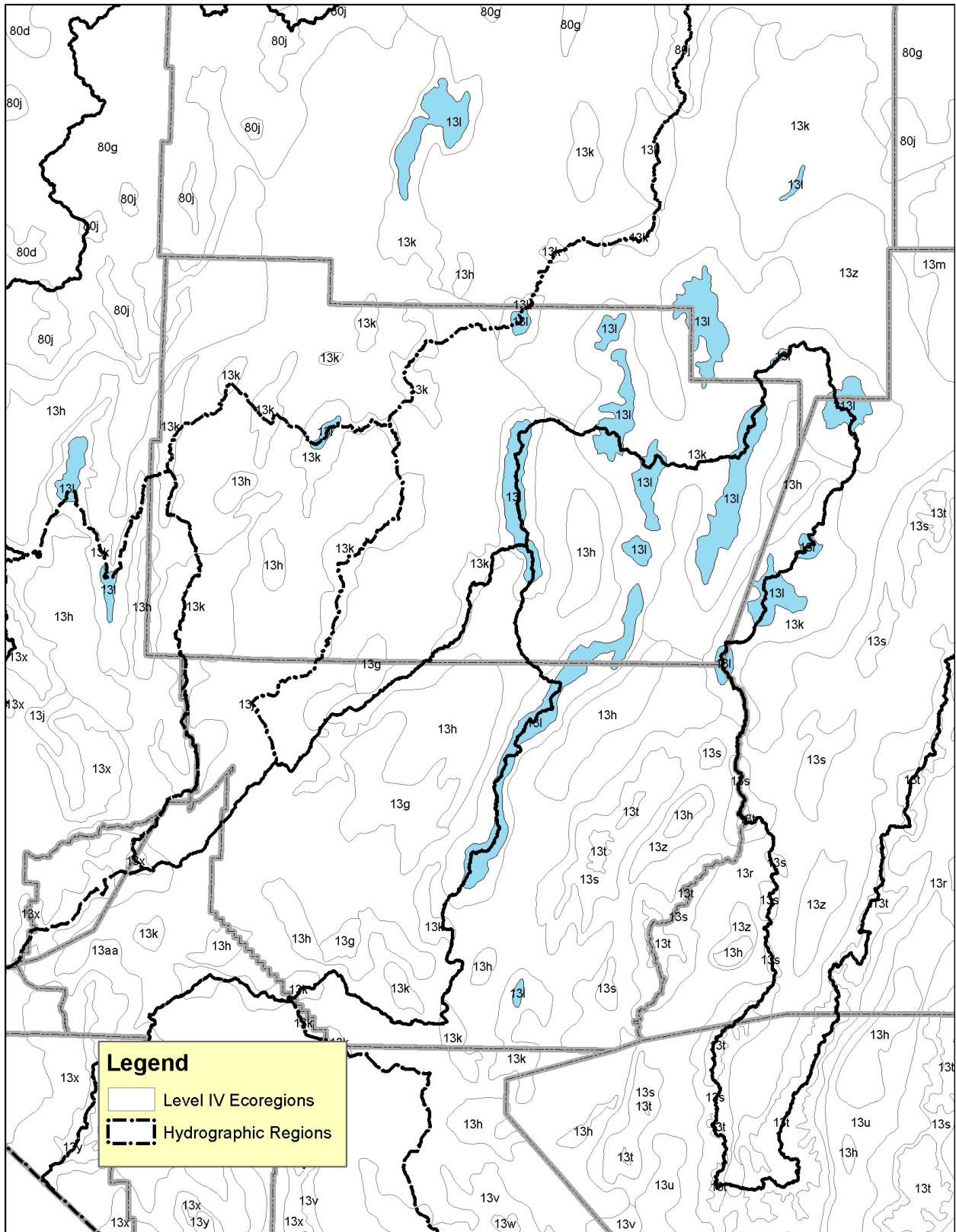


Figure 16. Level IV Ecoregion 13l – Lahontan Uplands

Streams with Headwaters in White Mountains in the Esmeralda County Area

This grouping includes those streams that originate in the White Mountains near the Nevada-California stateline in Esmeralda County. However within this group, NDEP has data for only 6 different sites. This small sample may not be representative of all streams in this region. Nevertheless, percentile calculations have been performed for possible use as indicators. Interestingly, there is little difference between the 25th percentile of these sites and the 25th percentile of the Level III Ecoregion 13 sites.

Table 12. Nutrient Percentiles for Streams with Headwaters in the White Mountains, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
All Data	25th	<0.01	0.02	<0.10	<0.20	0.15 – 0.38
	50th	<0.01	0.02	<0.14	0.22 – 0.26	0.27 – 0.42
	75th	<0.01	0.03	<0.19	0.30	0.31 – 0.44
Ecoregion 13	25th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.01	0.03	<0.10	0.20	<0.30

Steamboat Creek, Tributaries and Eastern Sierra Streams

The focus of the following analysis is the Steamboat Creek drainage and its tributaries, and the other eastern-slope Sierras tributaries to the Carson system (Carson Valley). Within this grouping, the NDEP database contains 52 monitoring sites. In general, these sites have watersheds with areas in Level IV Ecoregions 5a, 5b and 13aa.

Preliminary investigations showed a general increase in nutrient levels with decreases in elevation (and increases in watershed area) (Figure 17). To further evaluate relationships, the 52 sites were divided into 2 categories (Above Development; Below Development) and the associated data were evaluated to examine relationships. As expected, the phosphorus levels in the “Above Development Fringe” category were significantly lower than those in the “Below Development Fringe” (Figure 18).

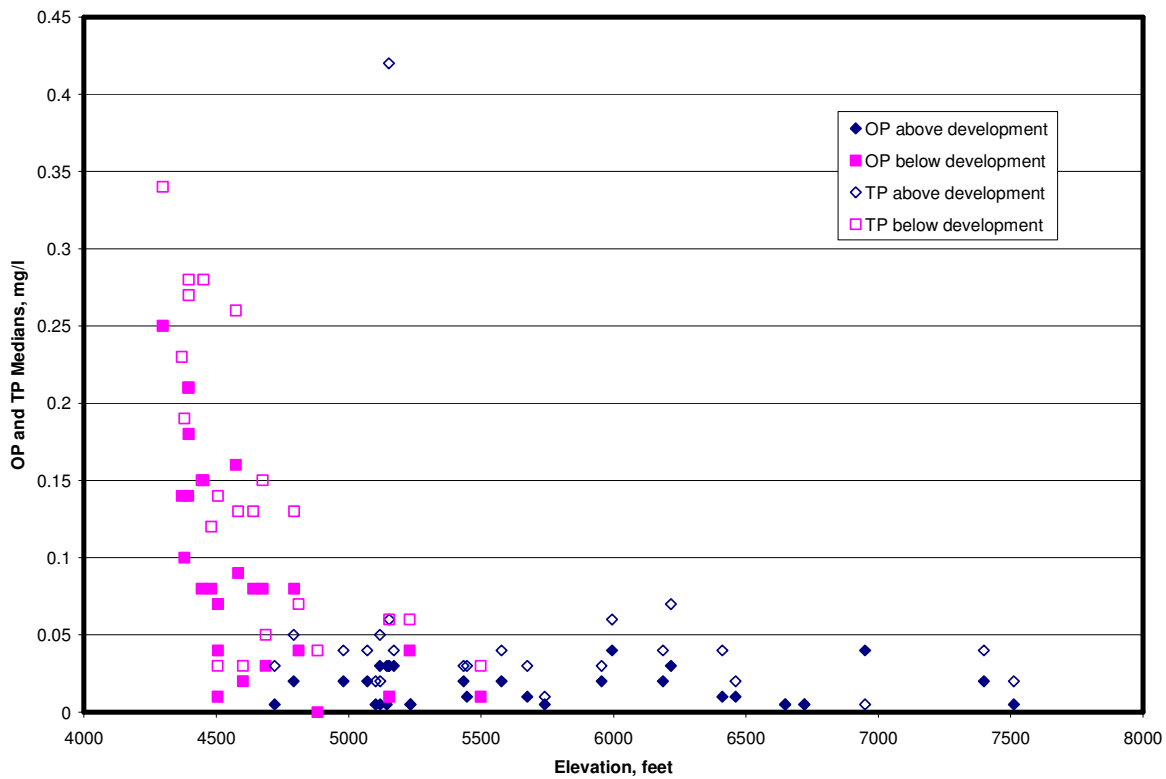


Figure 17. OP and TP Medians versus Elevation for Steamboat Creek, Tributaries and Eastern Sierra Streams

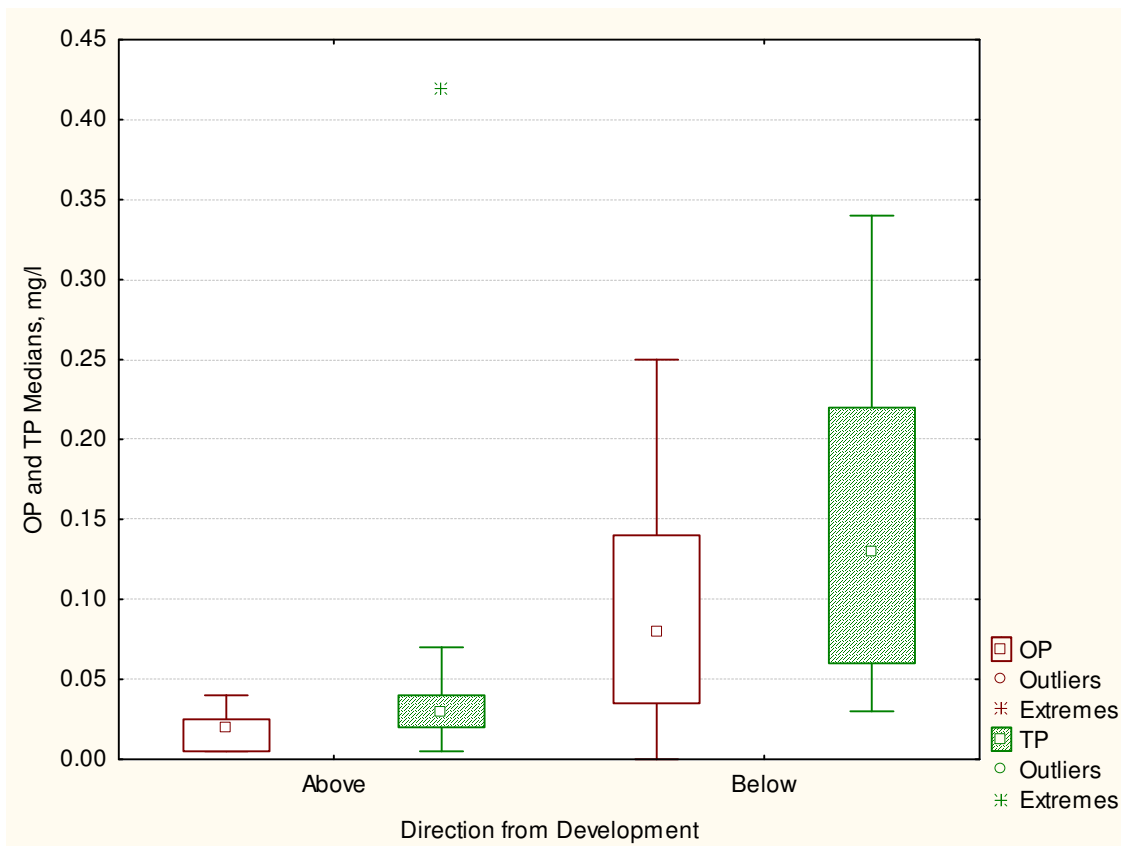


Figure 18. OP and TP Medians for Steamboat and Eastern Sierra Streams as Related to Direction from Development

Table 13 summarizes the 25th and 75th percentiles for the all the data, for the sites above the development fringe and for the sites below the development fringe. It is recommended that the 75th percentile of the “Above Development” sites be used as the indicators, with the exception of the TKN where the detection limit is recommended.

Table 13. Percentiles Steamboat Creek, Tributaries and Eastern Sierra Streams, and Recommended Indicators

Data	Percentile	OP	TP	DIN	TKN	TN
All Data	25 th	0.01	0.03	<0.10	0.20	<0.3
	50 th	0.03	0.05	<0.10	0.21	0.29 – 0.51
	75 th	0.08	0.13	0.07 – 0.37	0.46	0.53 – 0.71
Above Development Fringe	75 th	0.02	0.04	<0.5	0.22	0.29 - 0.70
Ecoregion 13	25 th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.02	0.04	<0.10	0.20	<0.30

Humboldt River and Tributaries

This grouping includes all streams within the Humboldt basin. Other sections of this report present indicators for some Humboldt streams: 1) streams with headwaters in 13o/13n, 2) streams with headwaters in 13t/13s, and 3) streams with headwaters in Ecoregions 80j and 80g in Northwest Nevada. It is recommended that these other 3 sets of indicators be the default as appropriate. For those streams not covered by one of the 3 sets, it is recommended that the following Humboldt Basin indicators be used.

Since no functional groupings by Level IV Ecoregion could be found for these waters, it was decided to look for possible watershed groupings. While there is rather significant variation in nutrient levels across the subbasins (Figure 19), there are insufficient data to calculate subbasin-level indicators. Instead, percentiles were calculated based upon 2 larger categories – 1) Humboldt basin above Palisade; and 2) Humboldt basin below Palisade, and compared to the overall Level III Ecoregion 25th percentile (Table 14).

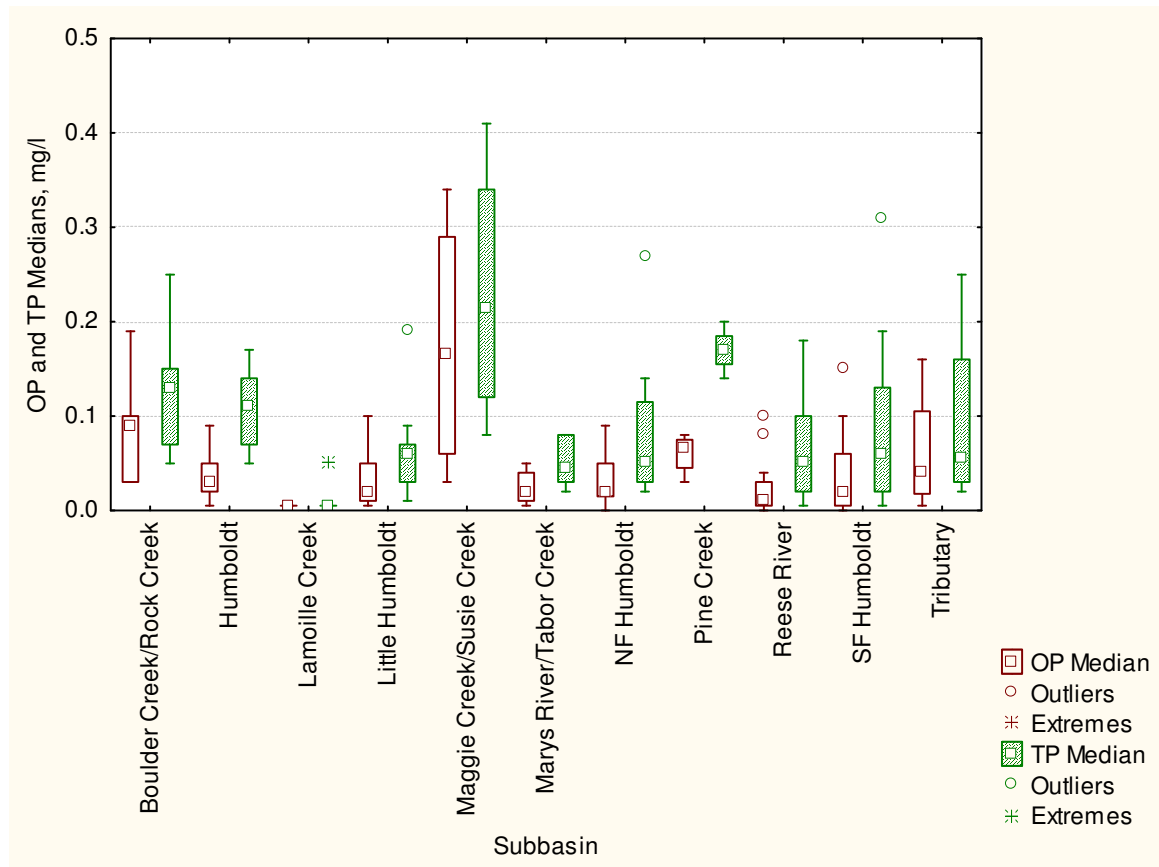


Figure 19. OP and TP Medians for Humboldt Basin Streams Grouped by Watershed

Table 14. Percentiles for Humboldt River Basin, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
Above Palisade	25 th	<0.01	0.03	<0.10	0.20	0.21 – 0.37
	50 th	0.02	0.06	<0.10	0.36	0.43 – 0.51
	75 th	0.05	0.12	<0.20	0.54	0.66 – 0.74
Below Palisade	25 th	0.01	0.04	<0.10	0.20	0.22 – 0.45
	50 th	0.03	0.07	<0.10	0.30	0.44 – 0.56
	75 th	0.05	0.13	<0.30	0.50	0.69 – 0.75
Ecoregion 13	25 th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED – Above Palisade		<0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED – Below Palisade		0.01	0.04	<0.10	0.20	<0.30

Walker and Tributaries

A majority of the Walker basin monitoring sites have associated watershed areas extending into California. As stated earlier, Level IV Ecoregion delineations have yet to be established for California. Therefore, it was not possible to examine the Walker sites based upon Level IV Ecoregions. Instead, percentiles were calculated based upon all Walker basin sites and compared to the overall Level III Ecoregion 25th percentile (Table 15). The 25th percentiles of the Walker data were higher than the Level III 25th percentiles for OP, TP, TKN and TN. It is notable that the percentiles for the Walker data are some of the highest within Level III Ecoregion 13.

Table 15. Percentiles for Walker River Basin and Tributaries, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
All Data	25 th	0.03	0.07	<0.10	0.37	0.41 – 0.44
	50 th	0.04	0.09	<0.10	0.42	0.48 – 0.53
	75 th	0.07	0.12	<0.10	0.48	0.53 – 0.57
Ecoregion 13	25 th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.03	0.07	<0.10	0.37	0.40

Carson River and Tributaries

As with the Walker basin, a majority of the Carson basin monitoring sites have associated watershed areas extending into California. Therefore, it was not possible to examine the data for possible Level IV Ecoregion indicators. Instead, percentiles were calculated based upon all Carson basin sites and compared to the overall Level III Ecoregion 25th percentile (Table 16). Another section of this report presents indicators for eastern-slope Sierra Nevada streams and it is recommended that these indicators be the default for these streams. For those other streams in the Carson basin, it is recommended that the indicators in Table 16 be used.

Table 16. Percentiles for Carson River Basin and Tributaries, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
All Data	25 th	0.01	0.03	<0.10	0.19 – 0.20	0.22 – 0.31
	50 th	0.02	0.04	<0.10	0.29	0.35 – 0.45
	75 th	0.04	0.10	<0.10	0.47	0.50 – 0.59
Ecoregion 13	25 th	0.01	0.03	<0.10	0.20	<0.30
RECOMMENDED		0.01	0.03	<0.10	0.20	<0.30

Indicators for Ecoregion 14

No functional groupings by Level IV Ecoregion could be found for these waters, so it was decided to default to the use of the Ecoregion 14 values from Table 5 and as summarized in Table 17.

Table 17. Percentiles for Level III Ecoregion 14, and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
Ecoregion 14	25 th	0.02	0.08	0.24	0.31	0.49 – 0.55
RECOMMENDED		0.02	0.08	0.24	0.31	0.50

Indicators for Ecoregion 80

Analyses were undertaken to investigate the appropriateness of combining Level IV Ecoregions for the development of indicators.

Headwaters in Ecoregions 80j and 80g in Northwest Nevada

This grouping includes those streams in Northwest Nevada with headwaters in Ecoregions 80j and 80g (Figure 20). A majority of these streams are located within Hydrographic Basins – Northwest Region, Black Rock Desert – with some in the upper portion of the Little Humboldt River Basin. The monitored watersheds within Ecoregion 80j are typically at higher elevations than 80g and includes Santa Rosa Range and Pine Forest Range in Humboldt County; Granite Range in Washoe County. Some watersheds flow from 80j to 80g, while others are solely within 80g. The data were examined to determine if it was appropriate to combine data for these 2 ecoregions. Given that many of these streams have their headwaters in 80j with 80g in the lower portions of the streams, one could expect that nutrient medians could increase with decreases in the % of watershed in 80j (increases in watershed in 80g). However, none of the data indicated any obvious relationships between the nutrient medians and % area in 80j.

Another approach was taken to further evaluate the appropriateness of combining 80g and 80j sites. The first step was to divide the available data (medians for each station) into 2 categories:

- watersheds with >50% of their area in Ecoregion 80g (no. = 21)
- watersheds with >50% of their area in Ecoregion 80j (no. = 23)

In all cases, 95% or more of a watershed had to fall in Ecoregion 80g and 80j (combined) for it to be included in this portion of the analyses. Boxplot graphs of the data show little difference between the OP and TP medians of the 80g and 80j streams (Figure 21). This suggests that separate indicators for 80j and 80g watersheds may be appropriate. Statistical test (Mann-Whitney and Wald-Wolfowitz) confirmed that there is no statistically significant difference between the 2 datasets and that it would be appropriate to combine the datasets and develop nutrient indicators for 80g and 80j combined.

The 25th-75th percentiles for the combined dataset are compared to the Level III Ecoregion 80 Indicators (Table 18). The 25th percentiles of combined 80g/80j data are very similar to the 25th percentiles for Level III Ecoregion 80.

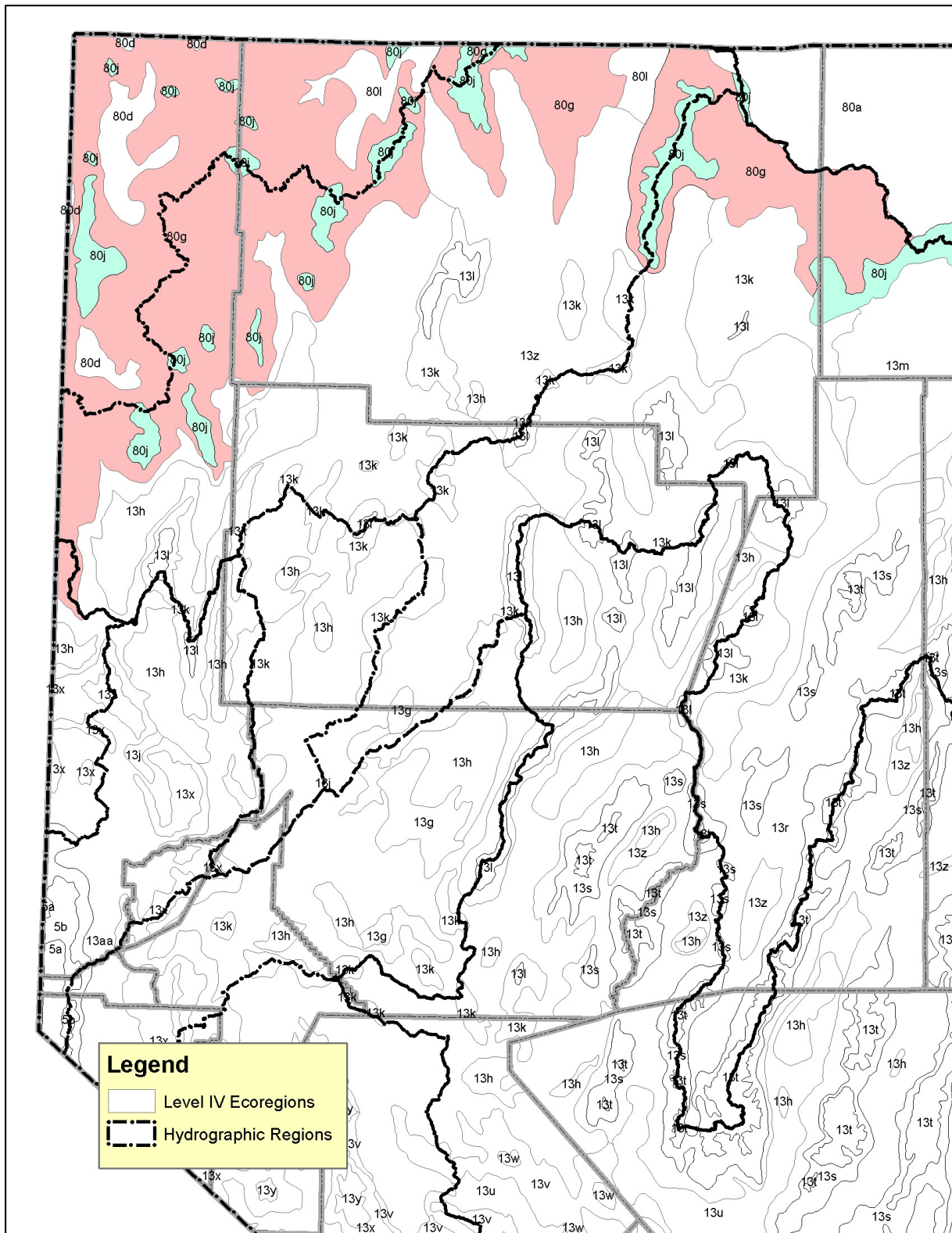


Figure 20. Level IV Ecoregion 80j – Semi-arid Uplands; and 80g – High Lava Plains in Northwestern Nevada

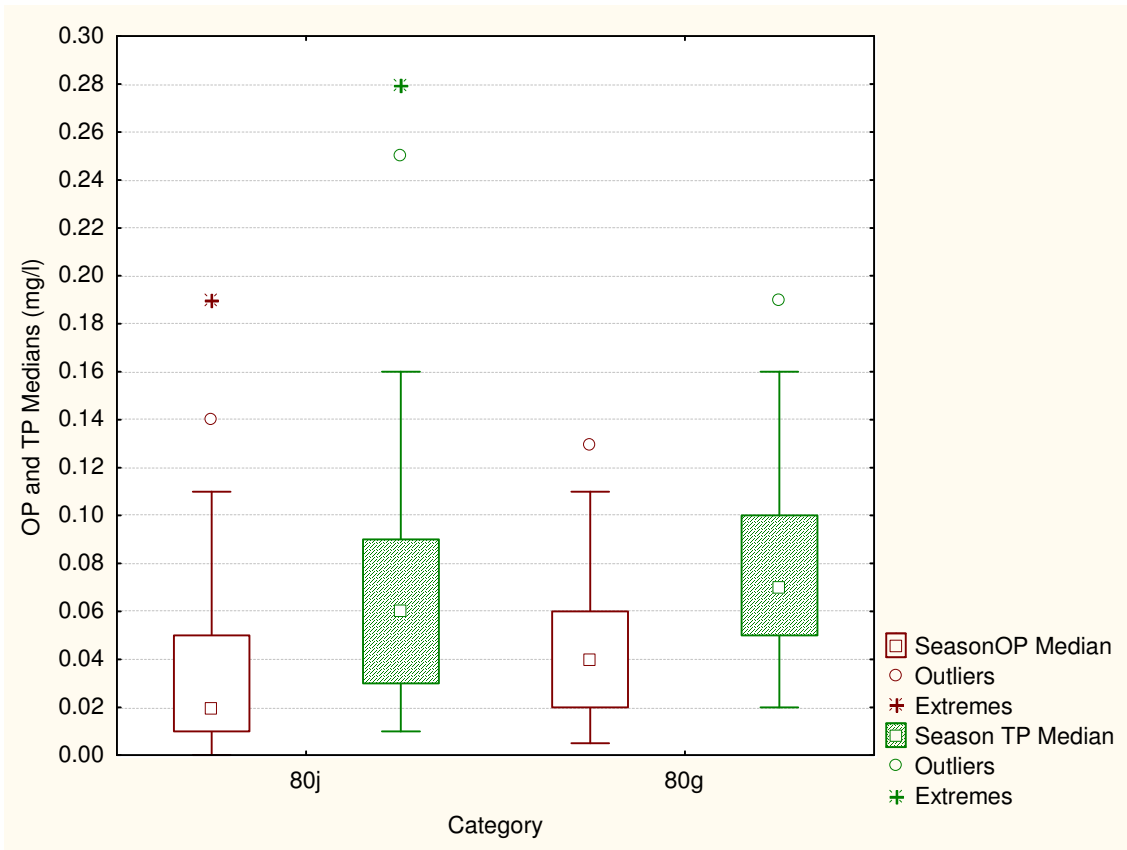


Figure 21. Boxplot of OP and TP Medians for Streams in Ecoregion 80j and 80g

Table 18. Percentiles for Streams with Headwaters in Ecoregion 80j and 80g in Northwest Nevada

Category	Statistic	OP	TP	DIN	TKN	TN
All Data	25 th	0.02	0.05	<0.10	0.20	0.20 – 0.30
	50 th	0.03	0.07	<0.10	0.30	0.30 – 0.50
	75 th	0.06	0.11	0.10 – 0.24	0.39	0.51 – 0.70
All Ecoregion 80	25th	0.02	0.04	<0.10	0.23	<0.30
RECOMMENDED		0.02	0.05	<0.10	0.20	<0.30

Ecoregion 80 Streams in Northeastern Nevada

This grouping includes streams in Ecoregion 80 in Northeastern Nevada (Figure 22). Waters in this grouping are located in the Snake River basin along with some streams along the northern fringe of the Humboldt River basin. No functional groupings by Level IV Ecoregion could be found for these waters, so it was decided to examine them by watershed. Nutrient levels varied widely from one subbasin to another. In general, the median nutrient levels in the Jarbidge Subbasin (includes East Jarbidge) were the lowest (Figure 23). Salmon Falls Creek appears to have some of the greatest variability in total phosphorus, followed by Goose Creek.

Table 19 summarizes the calculated percentiles and the recommended threshold. Separate Jarbidge basin indicators were recommended and were based upon 75th percentile of all Jarbidge sites, with the exception of TKN, which was set at the detection limit.

Table 19. Nutrient Percentiles for NE Nevada Streams in Ecoregion 80 and Recommended Indicators

Category	Percentile	OP	TP	DIN	TKN	TN
Jarbidge Only (EF and Main Jarbidge)	75 th	<0.01	0.01	<0.10	0.25	0.29 – 0.34
All Data	25 th	<0.01	0.03	<0.10	0.20	0.22 – 0.33
	50 th	0.02	0.06	<0.10	0.30	0.34 – 0.47
	75 th	0.05	0.09	<0.11	0.40	0.50 – 0.63
All Ecoregion 80	25 th	0.02	0.04	<0.10	0.23	<0.30
RECOMMENDED – Jarbidge Basin		<0.01	0.01	<0.10	0.20	<0.30
RECOMMENDED – Other		<0.01	0.03	<0.10	0.20	<0.30

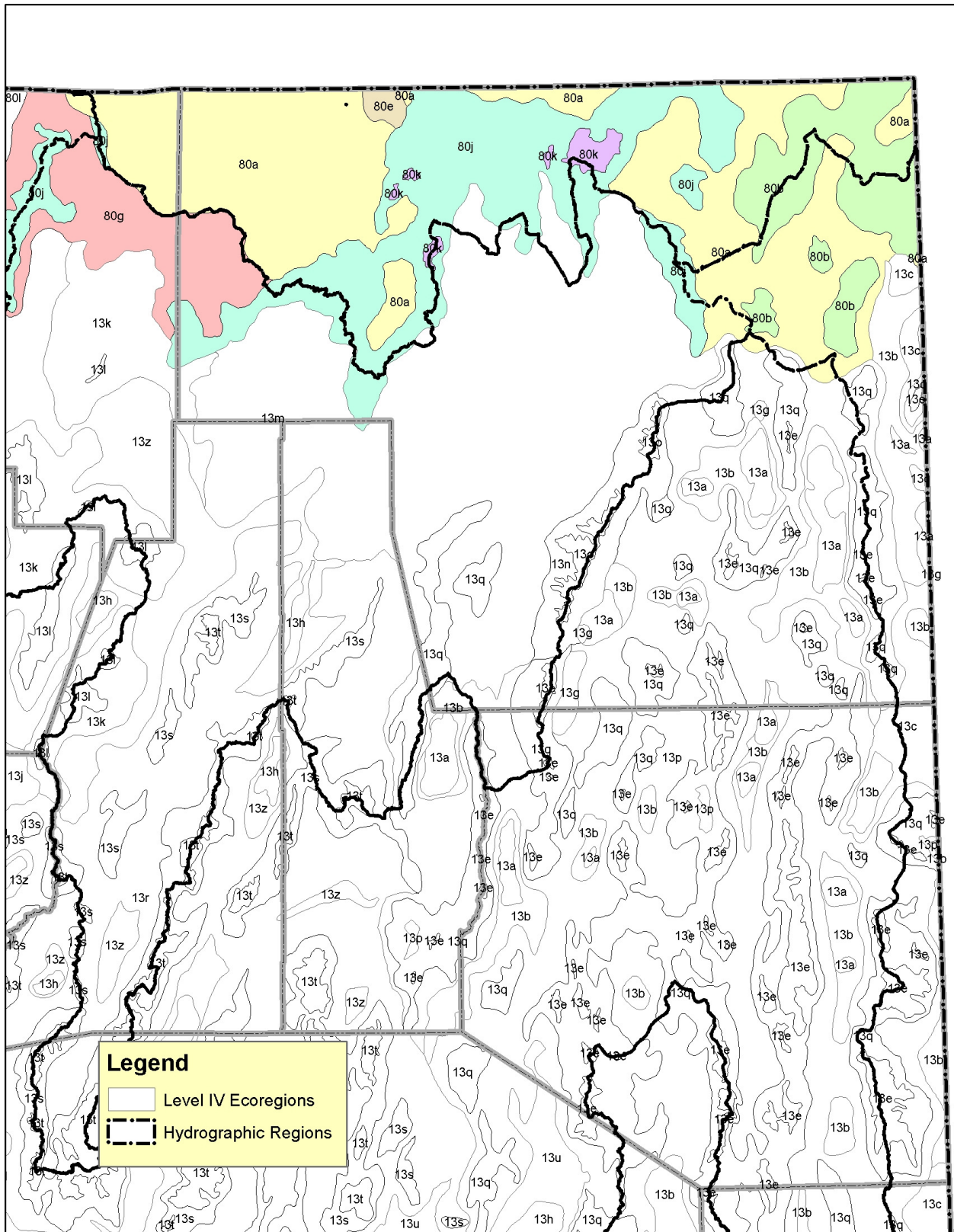


Figure 22. Level IV Ecoregion 80 in Northeastern Nevada

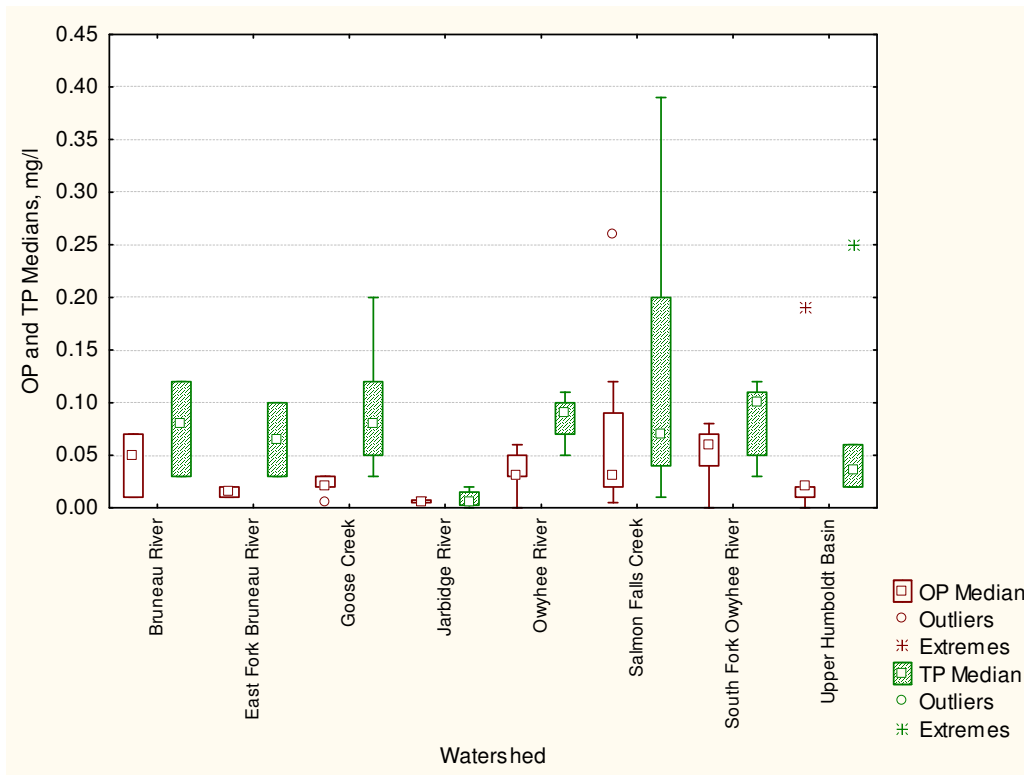


Figure 23. OP and TP Medians for Streams in Northeastern Nevada Grouped by Watershed

Comparison of Sites with Known Algae Levels with Recommended Indicators

During the summer of 2008, NDEP staff performed a number of visual surveys of Humboldt basin waters that are on the 2006 303(d) List for total phosphorus (NDEP, 2009). In Table 20, the sites have been grouped into “Excess Algae” and “Limited Algae” based upon the percentage of streambottom covered by filamentous algae. The OP, TP, TKN and TN levels for the “Excess Algae” sites were found to generally be higher than those for the “Limited Algae” sites (Figures 24 and 25). When median levels were compared to the recommended indicators, 72% exceeded the indicators for the “Excess Algae” waters and only 33% exceeded the indicators for the “Limited Algae” sites.

Table 20. Upper Humboldt Basin Sites with Known Algal Levels during 2008 Surveys

Site ID	Site Name	OP Median	TP Median	DIN Median	TKN Median	TN Median
2008 Surveys Indicated Excess Algae (50%-100% cover)						
HS21	Ten Mile Ck at SF Humboldt	0.02	0.06	<0.10	0.70	0.80
HS22	SF Humboldt R bel Dam at Gage	0.02	0.04	<0.10	0.50	0.50-0.60
HS26	SF Humboldt R bel Dixie Ck at Bridge	0.02	0.12	<0.10	0.55	0.55-0.65
HS3A	SF Humboldt R bel Dixie Ck	<0.01	0.04	<0.10	0.36	0.44-0.48
HS24	Huntington Ck at Bridge	0.05	0.09	<0.10	0.55	0.55-0.65
HC	Huntington Ck 4.2 miles upstream of Bridge	0.1	0.13	<0.10	0.40	0.42-0.50
HS17	Maggie Ck ab Jacks Ck	0.24	0.27	<0.10	0.24	0.26
BIO-007	Maggie Ck bel Cottonwood Ck	0.34	0.41	<0.10	0.20	0.20-0.30
HS14	Maggie Creek at Hwy 221	0.03	0.08	<0.10	0.37	0.39-0.43
HS13	Pine Creek	0.07	0.14	<0.10	0.59	0.72
2008 Surveys Indicated Limited Algae (<25% cover)						
SF1	SF Humboldt R at Hwy 228	0.01	0.02	<0.10	0.20	0.20-0.30
HS23	SF Humboldt R at Twin Bridges	<0.01	0.02	<0.10	0.25	0.25-0.35
HS1	Marys River	0.04	0.06	<0.10	0.29	0.29-0.35
Recommended Indicators						
Range of Recommended Indicators for these waters		<0.01 – 0.01	0.02 – 0.03	<0.10	<0.20 – 0.20	<0.30

Note: Shaded cells indicate that the median exceeds the recommended indicator for the water. For the TN median with a range, the minimum of the range was used for comparison to the indicators.

In another effort, TetraTech (2009) and NDEP monitored nutrient and algae levels in Dry Creek (a tributary to Steamboat Creek in the Reno area) in 2008. While limited algae was observed at the 3 study sites, the median nutrient levels exceed all 5 indicators for Steamboat and its tributaries (Table 21).

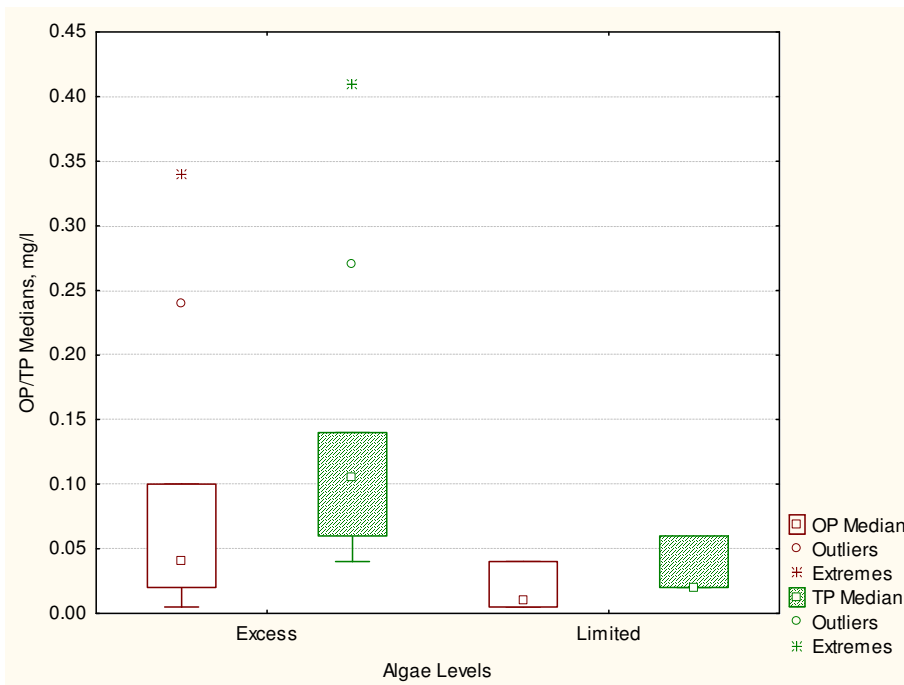


Figure 24. OP and TP Medians for “Excess Algae” Sites vs. “Limited Algae” Sites – Humboldt Basin Surveys, 2008

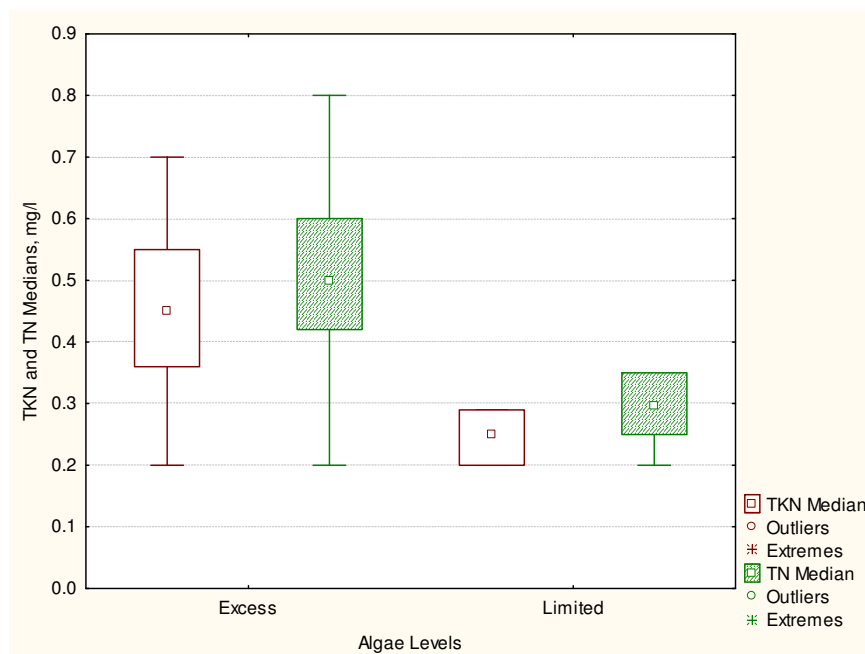


Figure 25. TKN and TN Medians for “Excess Algae” Sites vs. “Limited Algae” Sites – Humboldt Basin Surveys, 2008

Table 21. Dry Creek Sites with Known Algal Level during 2008 Study

Site ID	Site Name	OP Median	TP Median	DIN Median	TKN Median	TN Median
<i>2008 Surveys Indicated Limited Algae (<25% cover)</i>						
	Upper Dry Creek Site	0.20	0.20	0.22	1.8	2.00
	Middle Dry Creek Site	0.10	0.20	0.23	1.1	1.30
	Lower Dry Creek Site	0.10	0.20	0.20	1.5	1.70
<i>Recommended Indicators</i>						
	Steamboat Creek and Tributaries	0.02	0.04	<0.10	0.20	<0.30

Summary

A summary of the recommended nutrient indicators are presented in Table 22. For those waters not covered in a subgrouping, the Level III Ecoregion indicators should be used. It is interesting that most of the variability from one group of indicators to another is with the OP and TP indicators. Due to rather high reporting limits used by the laboratory, many of the DIN, TKN and TN indicators are at or near the detection limit. Significant levels of additional DIN, TKN and TN data at much lower detection would be needed to better identify these indicators.

Table 22. Summary of Recommended Indicators

Grouping	OP	TP	DIN	TKN	TN
Ecoregion 5	<0.01	0.01	<0.10	<0.20	<0.30
Lake Tahoe Tributaries	<0.01	0.02	<0.10	<0.20	<0.30
Ecoregion 13	0.01	0.03	<0.10	0.20	<0.30
Streams with Headwaters in 13e and 13q – Carbonate Mountains	0.02	0.03	<0.10	<0.20	<0.30
Streams with Headwaters in 13o and 13n – Ruby Mountains	<0.01	0.02	<0.10	<0.20	<0.30
Streams with Headwaters in 13t and 13s – Central Nevada	0.01	0.03	<0.10	<0.20	<0.30
Streams with Headwaters in 13l – Pershing County Area	0.01	0.03	<0.10	0.20	<0.30
Streams with Headwaters in White Mountains in the Esmeralda County Area	0.01	0.03	<0.10	0.20	<0.30
Steamboat Creek, Tributaries and Eastern Sierra Streams (Carson Valley, Washoe Valley)	0.02	0.04	<0.10	0.20	<0.30
Humboldt River Basin – Above Palisade	<0.01	0.03	<0.10	0.20	<0.30
Humboldt River Basin – Below Palisade	0.01	0.04	<0.10	0.20	<0.30
Walker River Basin	0.03	0.07	<0.10	0.37	0.40
Carson River Basin	0.01	0.03	<0.10	0.20	<0.30
Ecoregion 14	0.02	0.08	0.24	0.31	0.50
Ecoregion 80	0.02	0.04	<0.10	0.23	<0.30
Headwaters in 80g and 80j in NW Nevada	0.02	0.05	<0.10	0.20	<0.30
Jarbidge River Basin	<0.01	0.01	<0.10	0.20	<0.30
Headwaters in Ecoregion 80 in NE Nevada	<0.01	0.03	<0.10	0.20	<0.30

As described earlier, these values are to be used to indicate whether or not detailed eutrophication studies are needed to determine nutrient impairment status for a given water. These values by themselves should not be used to list waters as impaired. Since these indicators were based upon medians, it would be most appropriate to compare a stream's median nutrient levels against these indicators when determining the need for followup investigations. If the followup needs become too numerous given the staff resources, priorities could be set by focusing on those waters with more than 1 indicator being exceeded.

It is uncertain how much data are needed for a given site to feel confident that an appropriate median can be calculated. Typically the more data the better, however resources often restrict the amount of sampling achievable. It is recommended that a minimum of at least 1 sample during each of the four seasons be collected.

It must be emphasized that these indicators are based on somewhat arbitrary percentiles (25th percentiles for entire populations; 75th percentiles for least-disturbed populations) and should not be used as sole determinants of nutrient impairment. One goal is to select a conservative percentile that errors in favor of the stream health. The higher the percentile used in establishing an indicator, the higher the risk that an impaired stream is identified as NOT needed follow up investigations. On the flip side, lower percentiles increase the burden on staff to perform more follow up investigations. Nevertheless, followup activities can be performed on any streams whether or not it is exceeding the recommended indicators.

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- TetraTech, Inc. 2009. Development of a Standardized Periphyton Sampling Protocol for Streams in Reno Basin, Nevada.
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Appendix A

List of Selected Monitoring Sites Used in Analysis

List of Monitoring Sites by Hydrographic Region

SiteID	Eco region	Station Name	Waterbody Name	Station Subbasin
Hydrographic Basin 01 - Northwest Region				
ALDR	80g	Alder Creek	Alder Creek	Northwest
BIO-001	80g	Cove Creek - Bio Site	Cove Creek	Northwest
BIO-002	80g	Bordwell Creek	Bordwell Creek	Northwest
BIO-003	80g	Butle Creek	Butle Creek	Northwest
BIO-023	80g	Bull Creek	Bull Creek	Northwest
COVE-1	80g	Cove Creek	Cove Creek	Northwest
CRAIN-1	80g	Craine Creek	Craine Creek	Northwest
LAC	80j	Little Adler Creek	Little Adler Creek	Northwest
SCC	80g	South Catnip Creek	South Catnip Creek	Northwest
Hydrographic Basin 02 - Black Rock Desert Region				
ALTA	80g	Alta Creek	Alta Creek	Black Rock Desert
BART-1	13j	Bartlett Creek	Bartlett Creek	Black Rock Desert
BATT-1	13j	Battle Creek	Battle Creek	Black Rock Desert
BIO-024	80g	Snow Creek	Snow Creek	Black Rock Desert
BIO-026	80g	Battle Creek - Bio Site	Battle Creek	Black Rock Desert
BUFF-1	80g	Buffalo Creek	Buffalo Creek	Black Rock Desert
CROW-1	80g	Crowley Creek @ Jordan Meadow	Crowley Creek	Black Rock Desert
CSC	80g	Cold Spring Creek	Cold Spring Creek	Black Rock Desert
EFQRDG	80g	East Fork Quinn River @ Devils Gate	Quinn River, East Fork	Black Rock Desert
EFQRH	80g	East Fork Quinn River @ Headwaters	Quinn River, East Fork	Black Rock Desert
FALLS	80g	Falls Canyon Creek @ Canyon Mouth	Falls Canyon Creek	Black Rock Desert
HC1	80g	Horse Canyon Creek @ Canyon Mouth	Horse Canyon Creek	Black Rock Desert
KINGS-1	13z	Kings River @ Canyon Mouth	Kings River	Black Rock Desert
KINGSU	80g	Kings River (Upper)	Kings River	Black Rock Desert
MAHOGC/BIO-025	80g	Mahogany Creek	Mahogany Creek	Black Rock Desert
MCDT-1	80l	McDermitt Creek @ Gage	McDermitt Creek	Black Rock Desert
NC-1	80g	Negro Creek	Negro Creek	Black Rock Desert
RISE-1	80g	Riser Creek	Riser Creek	Black Rock Desert
ROCKC	80g	Rock Creek	Rock Creek	Black Rock Desert
SFQRL	80g	South Fork Quinn River (Lower)	Quinn River, South Fork	Black Rock Desert
SMC-1/SMK	80g	Smoke Creek - Upper	Smoke Creek	Black Rock Desert
SMC-2	13j	Smoke Creek @ Gage	Smoke Creek	Black Rock Desert
SMC-3	13j	Smoke Creek @ Bridge	Smoke Creek	Black Rock Desert
SOLD	13j	Unnamed Creek from Warm Springs near Soldier Meadow	Unnamed	Black Rock Desert
WASH-1	80g	Washburn Creek	Washburn Creek	Black Rock Desert
Hydrographic Basin 03 - Snake River Basin				
BC1	80j	Bear Creek @ Jarbidge River	Bear Creek	Jarbidge River
BGCL	80a	Goose Creek (Lower)	Goose Creek	Goose Creek
BIO-016	80a	Jarbidge River near State Line	Jarbidge River	Jarbidge River
BIO-017	80j	Deadman's Creek	Deadman's Creek	Miscellaneous
BIO-018	80j	Cavldle Creek	Cavldle Creek	Miscellaneous
BIO-019	80j	Walker Gulch	Walker Gulch	Miscellaneous
BIO-034	80a	Salmon Falls Creek	Salmon Falls Creek	Salmon Falls Creek
BIO-035	80b	Piney Creek	Piney Creek	Goose Creek
BULL-1	80a	Bull Run Creek	Bull Run Creek	South Fork Owyhee River
CAMP	80a	Camp Creek below Humboldt National Forest Boundary	Camp Creek	Salmon Falls Creek
CEDAR-1	80b	Cedar Creek	Cedar Creek	Salmon Falls Creek
DEEP-1	80a	Deep Creek	Deep Creek	South Fork Owyhee River
E1	80a	South Fork Owyhee River @ YP Ranch	Owyhee River, South Fork	South Fork Owyhee River

<i>SiteID</i>	<i>Eco region</i>	<i>Station Name</i>	<i>Waterbody Name</i>	<i>Station Subbasin</i>
E10	80b	Goose Creek	Goose Creek	Goose Creek
E11	80a	East Fork Jarbidge River Below Murphys	Jarbidge River, East Fork	Jarbidge River
E12	80j	Owyhee River Below Wildhorse Reservoir	Owyhee River	Owyhee River
E14	80j	Mill Creek @ Patsville	Mill Creek	Owyhee River
E15	80j	Owyhee River below Mill Creek	Owyhee River	Owyhee River
E16	80j	Owyhee River below Slaughterhouse Creek	Owyhee River	Owyhee River
E1A	80a	South Fork Owyhee River @ IL Ranch	Owyhee River, South Fork	South Fork Owyhee River
E2	80e	Owyhee River @ Boney Lane	Owyhee River	Owyhee River
E3	80e	Owyhee River @ China Dam	Owyhee River	Owyhee River
E4	80j	Owyhee River above Mill Creek	Owyhee River	Owyhee River
E5	80j	Bruneau River @ Mink Ranch	Bruneau River	Bruneau River
E6	80j	Jarbidge River below Jarbidge	Jarbidge River	Jarbidge River
E7	80j	Jarbidge River above Jarbidge	Jarbidge River	Jarbidge River
E8	80a	Salmon Falls Creek	Salmon Falls Creek	Salmon Falls Creek
E9	80a	Shoshone Creek	Shoshone Creek	Salmon Falls Creek
ETRT-1	80b	Trout Creek (Upper)	Trout Creek	Salmon Falls Creek
JAP	80j	Jarbidge River Above Pavlak	Jarbidge River	Jarbidge River
JBL	80j	Jarbidge River below Old Landfill	Jarbidge River	Jarbidge River
JC	80j	Jack Creek	Jack Creek	Jarbidge River
LGOOS-1	80b	Little Goose Creek	Little Goose Creek	Goose Creek
MCCAN-1	80a	McCann Creek	McCann Creek	South Fork Owyhee River
MERR-1	80j	Merritt Creek	Merritt Creek	Miscellaneous
MILLG-1	80a	Milligan Creek	Milligan Creek	Salmon Falls Creek
MTRT-1	80a	Trout Creek @ Rain Gage	Trout Creek	Salmon Falls Creek
SFCU	80a	Salmon Falls Creek (Upper)	Salmon Falls Creek	Salmon Falls Creek
SUNCK	80a	Sun Creek below Humboldt National Forest Boundary	Sun Creek	Salmon Falls Creek
TAYLOR-1	80j	Taylor Canyon Creek	Taylor Canyon Creek	South Fork Owyhee River
TROUT-1	80b	Trout Creek Near Goose Creek	Trout Creek	Goose Creek
WATER-1	80j	Waterpipe Canyon Creek	Waterpipe Canyon Creek	South Fork Owyhee River
WTRT-1	80b	West Fork Trout Creek	Trout Creek, West Fork	Salmon Falls Creek
Hydrographic Basin	04 -	Humboldt River Basin		
BIG-1	13s	Big Creek @ East Edge of Big Creek Campground	Big Creek	Reese River
BIGCL	13r	Big Creek (Lower)	Big Creek	Reese River
BIGCU	13t	Big Creek (Upper)	Big Creek	Reese River
BIO-007	13m	Maggie Creek below Cottonwood	Maggie Creek	Maggie/Susie Creek
BIO-008	80j	Bell Creek	Bell Creek	Rock/Boulder Creek
BIO-009	13k	No Name Creek	No Name Creek	Humboldt Tributary
BIO-010	13m	Rock Creek	Rock Creek	Rock/Boulder Creek
BIO-011	13m	McClellan Creek	McClellan Creek	North Fork Humboldt River
BIO-012	13m	Lamoille Creek upstream of John Day Creek	Lamoille Creek	Lamoille Creek
BIO-013	13n	Rattlesnake Creek	Rattlesnake Creek	South Fork Humboldt River
BIO-014	13m	East Fork Beaver Creek	Beaver Creek, East Fork	North Fork Humboldt River
BIO-015	13r	Rock Creek	Rock Creek	Reese River
BIO-020	80g	Dutch John Creek	Dutch John Creek	Little Humboldt River
BIO-031	13t	Big Sawmill Creek	Big Sawmill Creek	Reese River
BIO-032	13t	Little Sawmill Creek	Little Sawmill Creek	Reese River
BIO-033	13s	Iowa Creek	Iowa Creek	Reese River
BIO-036	13m	Tabor Creek	Tabor Creek	Marys River/Tabor Creek
BIO-037	13m	Humboldt River upstream of Elko	Humboldt River	Humboldt River
BUCK-1	80j	North Fork Little Humboldt - Buckskin	Little Humboldt River, North Fork	Little Humboldt River

<i>SiteID</i>	<i>Eco region</i>	<i>Station Name</i>	<i>Waterbody Name</i>	<i>Station Subbasin</i>
BUCK-2	80j	North Fork Little Humboldt - Buckskin	Little Humboldt River, North Fork	Little Humboldt River
BUCK-3	80j	North Fork Little Humboldt - Buckskin	Little Humboldt River, North Fork	Little Humboldt River
CABINCK	80g	Cabin Creek below FR084 Road	Cabin Creek	Little Humboldt River
DIXIEU	13m	Dixie Creek (Upper)	Dixie Creek	South Fork Humboldt River
H6	13j	Humboldt River Below Rye Patch Reservoir	Humboldt River	Humboldt River
HC	13m	Huntington Creek 4.2 miles Upstream of Bridge	Huntington Creek	South Fork Humboldt River
HS1	13m	Mary's River	Mary's River	Marys River/Tabor Creek
HS12	13j	Humboldt River Above Humboldt Sink	Humboldt River	Humboldt River
HS13	13r	Pine Creek	Pine Creek	Pine Creek
HS14	13m	Maggie Creek @ SR 221	Maggie Creek	Maggie/Susie Creek
HS15	80j	North Fork Humboldt River @ North Fork Ranch	Humboldt River, North Fork	North Fork Humboldt River
HS16	80j	North Fork Humboldt River @ Burrito Tunnel	Humboldt River, North Fork	North Fork Humboldt River
HS17	13m	Maggie Creek above Jacks Creek	Maggie Creek	Maggie/Susie Creek
HS18	13j	Humboldt River above Lovelock	Humboldt River	Humboldt River
HS19	80j	Mary's River Below Wilderness Area @ Orange Bridge	Mary's River	Marys River/Tabor Creek
HS1B	13m	Mary's River near Deeth	Mary's River	Marys River/Tabor Creek
HS21	13m	Ten Mile Creek @ South Fork Humboldt River	Ten Mile Creek	South Fork Humboldt River
HS22	13m	South Fork Humboldt River below Dam @ Gage	Humboldt River, South Fork	South Fork Humboldt River
HS23	13m	South Fork Humboldt River above Reservoir @ Twin Bridges	Humboldt River, South Fork	South Fork Humboldt River
HS24	13q	Huntington Creek @ Bridge	Huntington Creek	South Fork Humboldt River
HS25	13m	Dixie Creek Lower	Dixie Creek	South Fork Humboldt River
HS26	13q	South Fork Humboldt River below Dixie Creek @ Bridge	Humboldt River, South Fork	South Fork Humboldt River
HS27	13m	Trout Creek	Trout Creek	Pine Creek
HS28	13m	Sherman Creek	Sherman Creek	Humboldt Tributary
HS29	13m	North Fork Humboldt River above Haystack Ranch	Humboldt River, North Fork	North Fork Humboldt River
HS2B	13m	North Fork Humboldt River @ I-80	Humboldt River, North Fork	North Fork Humboldt River
HS30	13m	Susie Creek	Susie Creek	Maggie/Susie Creek
HS3A	13m	South Fork Humboldt River below Dixie Creek	Humboldt River, South Fork	South Fork Humboldt River
HS4	13m	Humboldt River @ Osino Cutoff	Humboldt River	Humboldt River
HS5	13m	Humboldt River @ Carlin	Humboldt River	Humboldt River
HS6	13m	Humboldt River @ Palisade	Humboldt River	Humboldt River
HS7	13z	Humboldt River @ Battle Mountain	Humboldt River	Humboldt River
HS8	13z	Humboldt River @ Comus	Humboldt River	Humboldt River
HS9	13j	Humboldt River @ Imlay	Humboldt River	Humboldt River
JACK-1	13m	Jackstone Creek	Jackstone Creek	Humboldt Tributary
LAM-1	13n	Lamoille Creek @ Gage	Lamoille Creek	Lamoille Creek
LAM-2	13o	Lamoille Creek (Upper)	Lamoille Creek	Lamoille Creek
LEW-1	13r	Lewis Creek Before Water Supply	Lewis Creek	Reese River
LH#3	13k	Little Humboldt River above the Hot Springs	Little Humboldt River	Little Humboldt River
LHM-1	13k	Little Humboldt River @ Gage	Little Humboldt River	Little Humboldt River
LYEC	80j	Lye Creek above Campground	Lye Creek	Little Humboldt River
MCL	13k	Martin Creek (Lower) above Paradise Valley	Martin Creek	Little Humboldt River
MCU	80g	Martin Creek (Upper)	Martin Creek	Little Humboldt River

<i>SiteID</i>	<i>Eco region</i>	<i>Station Name</i>	<i>Waterbody Name</i>	<i>Station Subbasin</i>
NFHC	80j	North Fork Humboldt River @ Campground	Humboldt River, North Fork	North Fork Humboldt River
NFLH	80g	North Fork Little Humboldt River near Holloway Meadows	Little Humboldt River, North Fork	Little Humboldt River
NFLH#2	80g	North Fork Little Humboldt River above Greeley Crossing	Little Humboldt River, North Fork	Little Humboldt River
NPH1	13m	Humboldt River downstream of Wells at 754 Bridge	Humboldt River	Humboldt River
NPH2	13m	Humboldt River near Deeth at 203	Humboldt River	Humboldt River
NPH3	13z	Humboldt River Upstream of Winnemucca	Humboldt River	Humboldt River
NPH4	13j	Humboldt River upstream of Lovelock at Airport Road Bridge	Humboldt River	Humboldt River
NPH5	13j	Humboldt River upstream of Lovelock at Rogers Dam Road	Humboldt River	Humboldt River
PC2	13r	Pine Creek @ North Tomera Ranch	Pine Creek	Pine Creek
PC3	13r	Pine Creek @ South Tomera Ranch	Pine Creek	Pine Creek
RATTLE	13m	Rattlesnake Creek	Rattlesnake Creek	Rock/Boulder Creek
REE-1	13z	Reese River Upper @ Old Highway 50	Reese River	Reese River
REE-2	13z	Reese River Lower @ Fish Creek Road	Reese River	Reese River
REESE1	13s	Reese River above Yomba Indian Reservation	Reese River	Reese River
ROAD	80j	Road Creek	Road Creek	Little Humboldt River
ROC-1	13m	Rock Creek @ Gage	Rock Creek	Rock/Boulder Creek
ROCK-1	13k	Rock Creek	Rock Creek	Humboldt Tributary
RR1	13r	Reese River below Yomba Indian Reservation	Reese River	Reese River
SAMMYCK	80j	Sammy Creek above Confluence with NF Humboldt	Sammy Creek	North Fork Humboldt River
SF1	13m	South Fork Humboldt River below Hwy 228	Humboldt River, South Fork	South Fork Humboldt River
SFLH-1	80g	South Fork Little Humboldt River	Little Humboldt River, South Fork	Little Humboldt River
SHL	80g	Stonehouse Creek (Lower) above SR 290	Stonehouse Creek	Little Humboldt River
SHU	80g	Stonehouse Creek (Upper) below Abel Creek Tributary	Stonehouse Creek	Little Humboldt River
SINGAS	80j	Singas Creek (Upper)	Singas Creek	Little Humboldt River
SJC	13s	San Juan Creek	San Juan Creek	Reese River
SOLDIER	13n	Soldier Creek	Soldier Creek	Lamoille Creek
SONA	13k	Sonoma Creek	Sonoma Creek	Humboldt Tributary
TABOR	13m	Tabor Creek above BLM Campground	Tabor Creek	Marys River/Tabor Creek
TALBOT	13m	Talbot Creek	Talbot Creek	Lamoille Creek
TCREEK	80j	T Creek	T Creek	Marys River/Tabor Creek
THORPE	13m	Thorpe Creek	Thorpe Creek	Lamoille Creek
WCU	13t	Washington Creek (Upper)	Washington Creek	Reese River
Hydrographic Basin	06	Truckee River Basin		
1A	5a	1st Creek @ Dell Knotty Pine	1st Creek	Tahoe
1B	5a	1st Creek @ Lakeshore Drive	1st Creek	Tahoe
2A	5a	2nd Creek @ 2nd Creek Drive	2nd Creek	Tahoe
2B	5a	2nd Creek @ Lakeshore Drive	2nd Creek	Tahoe
3B	5a	3rd Creek @ Lakeshore Drive	3rd Creek	Tahoe
BIO-006	5a	Dog Creek	Dog Creek	Truckee River
BRC	5a	Bronco Creek @ Hirschdale Road	Bronco Creek	Truckee River
BRCA	5a	Bronco Creek @ Truckee River	Bronco Creek	Truckee River
CHALK	13aa	Chalk Creek	Chalk Creek	Truckee River
DC-1	13aa	Dry Creek @ Forest Service Boundary	Dry Creek	Steamboat Creek
EF3A	5a	East Fork 3rd Creek @ HWY 431	3rd Creek, East Fork	Tahoe

<i>SiteID</i>	<i>Eco region</i>	<i>Station Name</i>	<i>Waterbody Name</i>	<i>Station Subbasin</i>
EFINCA	5a	Incline Creek Below Diamond Peak	Incline Creek	Tahoe
FC-1	13aa	Franktown Creek	Franktown Creek	Steamboat Creek
FCU	5b	Franktown Creek (Upper) below Hobart Reservoir	Franktown Creek	Steamboat Creek
GC-1	5b	Galena Creek near Sky Tavern	Galena Creek	Steamboat Creek
GRAA/GRA	5a	Gray Creek @ Truckee River	Gray Creek	Truckee River
HCU	5b	Hunter Creek (Upper) below Hunter Creek Pond	Hunter Creek	Truckee River
INCL	5a	Incline Creek @ Lakeshore Drive	Incline Creek	Tahoe
LAGO1	13x	Lagomarsino Creek @ Corral	Lagomarsino Creek	Truckee River
LAGO2	13aa	Lagomarsino Creek Lower	Lagomarsino Creek	Truckee River
LAGO3	13aa	Lagomarsino Creek @ Ave de la Couleurs Drive	Lagomarsino Creek	Truckee River
MCEW1	5a	McEwen Creek above Spring	McEwen Creek	Steamboat Creek
MCEW2	5a	McEwen Creek below Spring	McEwen Creek	Steamboat Creek
PEMB	13aa	Steamboat @ Rosewood Lake Golf Course	Steamboat Creek	Steamboat Creek
SB10	5a	Thomas Creek @ North Timberline	Thomas Creek	Steamboat Creek
SB11	13aa	Steamboat Creek @ Short Lane	Steamboat Creek	Steamboat Creek
SB17	13aa	Steamboat Creek @ Pembroke	Steamboat Creek	Steamboat Creek
SB19/T8	13aa	Steamboat Creek @ Cleanwater Way	Steamboat Creek	Steamboat Creek
SB20	13aa	Whites Creek @ West Zolezzi Lane	Whites Creek	Steamboat Creek
SB21A	13aa	Thomas Creek @ Hwy 395	Thomas Creek	Steamboat Creek
SB21B	13aa	Thomas Creek near Thomas Creek Business Park	Thomas Creek	Steamboat Creek
SB22	13aa	Dry Creek @ Sierra Pacific	Dry Creek	Steamboat Creek
SB23	13aa	Evans Creek (Lower)	Evans Creek	Steamboat Creek
SB24	13aa	Evans Creek @ Sierra Pacific	Evans Creek	Steamboat Creek
SB25	5a	Evans Creek	Evans Creek	Steamboat Creek
SB26	13aa	Alum Creek @ Truckee River	Alum Creek	Truckee River
SB27	5a	Hunter Creek @ Gage	Hunter Creek	Truckee River
SB28	13aa	Whites Creek @ Hwy 395	Whites Creek	Steamboat Creek
SB3	13aa	Steamboat Creek @ Pleasant Valley	Steamboat Creek	Steamboat Creek
SB30	5a	Galena Creek @ Callahan Bridge	Galena Creek	Steamboat Creek
SB31	5a	Browns Creek @ Joy Lake Road	Browns Creek	Steamboat Creek
SB32	13aa	Winters Creek	Winters Creek	Steamboat Creek
SB35	5a	Davis Creek @ Gage	Davis Creek	Steamboat Creek
SB36	13aa	Ophir Creek @ Old 395	Ophir Creek	Steamboat Creek
SB38	13aa	Musgrove Creek	Musgrove Creek	Steamboat Creek
SB4	13aa	Galena Creek	Galena Creek	Steamboat Creek
SB40	13aa	Steamboat Creek @ Old Post Office	Steamboat Creek	Steamboat Creek
SB41	13aa	Steamboat Creek @ Mira Loma	Steamboat Creek	Steamboat Creek
SB42	13aa	Whites Creek @ Arrow Creek Parkway	Whites Creek	Steamboat Creek
SB43	13aa	Thomas Creek @ Ventana Parkway	Thomas Creek	Steamboat Creek
SB5	13aa	Steamboat Creek @ Rhodes Road	Steamboat Creek	Steamboat Creek
SB7	13aa	Steamboat Creek @ Geiger Grade	Steamboat Creek	Steamboat Creek
SB8	5a	Whites Creek @ North Timberline Drive	Whites Creek	Steamboat Creek
T1	5a	Truckee River @ Farad	Truckee River	Truckee River
T2	13aa	Truckee River @ Idlewild Park	Truckee River	Truckee River
T3/TRM	13aa	Truckee River @ East McCarran Bridge	Truckee River	Truckee River
T7	13aa	Truckee River @ Circle C Ranch	Truckee River	Truckee River
TAH1	5a	Burke Creek above Highway 28	Burke Creek	Tahoe
TAH10	5b	Logan House Creek (Upper)	Logan House Creek	Tahoe
TAH11	5a	Marlette Creek (Lower) above Highway 28	Marlette Creek	Tahoe
TAH12	5b	Marlette Creek (Upper) below Dam	Marlette Creek	Tahoe

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TAH13	5b	Unnamed Tributary @ South End of Marlette Lake Fish Spawning Area	Unnamed	Tahoe
TAH14	5a	North Fork Logan House Creek (Lower) above Highway 50	Logan House Creek, North Fork	Tahoe
TAH15	5a	North Fork Logan House Creek (Upper)	Logan House Creek, North Fork	Tahoe
TAH16	5a	North Canyon Creek below Meadow Area above Highway 28	North Canyon Creek	Tahoe
TAH17	5a	Secret Harbor Creek above Highway 28	Secret Harbor Creek	Tahoe
TAH18	5a	Rosewook Creek (Upper)	Rosewook Creek	Tahoe
TAH19	5b	3rd Creek (Upper) above USGS Gage	3rd Creek	Tahoe
TAH2	5a	Edgewood Creek near Pony Express Marker	Edgewood Creek	Tahoe
TAH20	5a	West Fork Incline Creek (Upper) @ Saturn Court	Incline Creek, West Fork	Tahoe
TAH3	5a	Glenbrook Creek (Lower) near Prey Meadows Road	Glenbrook Creek	Tahoe
TAH4	5a	Glenbrook Creek (Mid) above Highway 50	Glenbrook Creek	Tahoe
TAH5	5b	Glenbrook Creek (Upper)/Montreal Canyon	Glenbrook Creek	Tahoe
TAH6	5a	Incline Creek (Upper) above Tyrol	Incline Creek	Tahoe
TAH7	5a	Unnamed Tributary to Incline Creek @ Tyrol Village	Incline Creek, Unnamed Tributary	Tahoe
TAH8	5a	Unnamed Creek above Whittel High School	Unnamed	Tahoe
TAH9	5a	Logan House Creek (Lower) above Highway 50 @ USGS Gage	Logan House Creek	Tahoe
TC-1	5a	Thomas Creek near Trailhead	Thomas Creek	Steamboat Creek
TC111	13aa	Thomas Creek above Arrowhead Parkway	Thomas Creek	Steamboat Creek
TRAJC	5a	Truckee River above Juniper Creek	Truckee River	Truckee River
TRAMC	5a	Truckee River above Martis Creek	Truckee River	Truckee River
TRDC	5a	Truckee River above Donner Creek	Truckee River	Truckee River
TRMC	5a	Truckee River below Martis Creek	Truckee River	Truckee River
TRTC	5a	Truckee River @ Tahoe City	Truckee River	Truckee River
WC-1	5a	Whites Creek above Whites Creek Trailhead	Whites Creek	Steamboat Creek
WC-11	13aa	Whites Creek above Thomas Creek Road	Whites Creek	Steamboat Creek
WFINCA	5a	West Fork Incline Creek @ Hwy 431	Incline Creek, West Fork	Tahoe
WO	5a	Wood Creek @ Lakeshore Drive	Wood Creek	Tahoe
Hydrographic Basin	08 - Carson River Basin			
ACII	13aa	Ash Canyon Creek (Lower) above USGS Gage	Ash Canyon Creek	Carson River Tributary
BCU	13x	Bryant Creek @ Doud Springs	Bryant Creek	East Fork Carson River
BIO-021	5a	Ash Canyon Tributary	Ash Canyon Creek, tributary	Carson River Tributary
BSW/CVBS	13aa	Brockliss Slough @ Waterloo Lane/Mottsville Lane	Brockliss Slough	West Fork Carson River
C1/CVDR	13aa	Carson River @ New Empire Bridge	Carson River	Carson River mainstem
C13/CVMG	13aa	Carson River @ Mexican Gage	Carson River	Carson River mainstem
C15	13aa	East Fork Carson River @ Williams Slough	Carson River, East Fork	East Fork Carson River
C16/CV88	13aa	East Fork Carson River @ Hwy 88	Carson River, East Fork	East Fork Carson River
C17/EFAB	13x	East Fork Carson River Just Above Bryant Creek	Carson River, East Fork	East Fork Carson River
C2	13aa	Carson River @ Cradlebaugh Bridge	Carson River	Carson River mainstem
C20	13x	Bryant Creek Above confluence of East Fork Carson River	Bryant Creek	East Fork Carson River

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C21	13x	East Fork Carson River Below Bryant Creek	Carson River, East Fork	East Fork Carson River
C23	13aa	Daggett Creek @ Foothill Road	Daggett Creek	West Fork Carson River
C3	13aa	Carson River @ Genoa Lane	Carson River	Carson River mainstem
C5	13aa	Brockliss Slough @ Muller Lane	Brockliss Slough	West Fork Carson River
C8	13aa	West Fork Carson River @ Paynesville	Carson River, West Fork	West Fork Carson River
C9/CVWB	13aa	East Fork Carson River @ Riverview	Carson River, East Fork	East Fork Carson River
CC	13aa	Clear Creek Above Confluence Carson River	Clear Creek	Clear Creek
CC1	5a	Clear Creek @ Hwy 50	Clear Creek	Clear Creek
CC2	5a	Clear Creek below Confluence with South Fork	Clear Creek	Clear Creek
CLE-2	13aa	Clear Creek @ Gage	Clear Creek	Clear Creek
CLE-3/CVCC	13aa	Clear Creek Lower	Clear Creek	Clear Creek
CLE-F	13aa	Clear Creek @ Fuji Park	Clear Creek	Clear Creek
CLE-NB	13aa	Clear Creek below New Bridge	Clear Creek	Clear Creek
CLE-TA	5a	Clear Creek Tributary A	Clear Creek, Tributary A	Clear Creek
CLE-TB	5a	Clear Creek Tributary B	Clear Creek, Tributary B	Clear Creek
CLE-UP	5a	Clear Creek @ JA Pasture	Clear Creek	Clear Creek
CRGL/CVGL	13aa	Carson River @ Genoa Lakes Golf Course	Carson River	Carson River mainstem
CVIC	13aa	Indian Creek @ Dresslerville Lane	Indian Creek	East Fork Carson River
CVLD	13aa	Linear Ditch @ SW Corner of Empire Golf Course	Linear Ditch	Carson River Tributary
CVM	5a	East Fork @ Markleeville Below Confluence of Markleeville Creek	Carson River, East Fork	East Fork Carson River
CVW	5a	West Fork @ Woodfords Gage	Carson River, West Fork	West Fork Carson River
DVB	13aa	Brunswick Canyon	Carson River	Carson River mainstem
KINGS1	13aa	Kings Canyon Creek @ Falls	Kings Canyon Creek	Carson River Tributary
WFCW	5a	West Fork Carson River @ Woodfords	Carson River, West Fork	West Fork Carson River
WFDL/CVDL	13aa	West Fork Carson River @ Dressler Lane	Carson River, West Fork	West Fork Carson River
Hydrographic Basin	09 - Walker River Basin			
BIO-022	13aa	Rough Creek (Upper)	Rough Creek	East Walker River
BIO-027	13x	Desert Creek (Upper)	Desert Creek	West Walker River
BOD-1	13aa	Bodie Creek	Bodie Creek	East Walker River
COR-1	13v	Corey Creek @ Gate	Corey Creek	Walker Lake
DC	13j	Desert Creek	Desert Creek	West Walker River
EF4/EF6	13aa	East Fork Walker River @ Morgan Unit	Walker River, East Fork	East Walker River
EF5	13j	East Fork Walker River @ Ivy Ranch	Walker River, East Fork	East Walker River
EFE	13aa	East Fork Walker River @ Elbow	Walker River, East Fork	East Walker River
EFS	13x	East Fork Walker River @ Stateline	Walker River, East Fork	East Walker River
RFC-1	13aa	Rough Creek above Nine Mile Ranch	Rough Creek	East Walker River
RFC-2	13aa	Rough Creek above East Walker River	Rough Creek	East Walker River
SWC	13aa	Sweet Water Creek	Sweet Water Creek	East Walker River
W10	13j	West Fork Walker River @ Wellington	Walker River, West Fork	West Walker River
W2	13j	West Fork Walker River @ Nordyke West	Walker River, West Fork	West Walker River
W3	13j	East Fork Walker River @ Nordyke East	Walker River, East Fork	East Walker River
W4	13j	Walker River @ Wabuska	Walker River	Walker River mainstem
W5	13aa	West Fork Walker River @ Topaz Lane	Walker River, West Fork	West Walker River
W7	13j	West Fork Walker River @ Hudson	Walker River, West Fork	West Walker River
W8	13aa	West Fork Walker River @ Hoye Bridge Gage	Walker River, West Fork	West Walker River
W9	13j	Walker River @ Mason Gage @ Snyder Lane	Walker River	Walker River mainstem

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WSB	13j	Walker River @ Schurz Bridge	Walker River	Walker River mainstem
<i>Hydrographic Basin</i>	10 - Central Region			
ALLI-1	13r	Allison Creek	Allison Creek	Central
ALLISON	13s	North Fork of Allison Creek	Allison Creek, North Fork	Central
BCL	13s	Birch Creek (Lower) 3 miles up Birch Creek Road	Birch Creek	Central
BDEN-1	13s	Big Den Creek	Big Den Creek	Central
BERR-1	13q	Berry Creek	Berry Creek	Central
BERRYCL	13q	Berry Creek (Lower) above confluence with Duck Creek	Berry Creek	Central
BIO-028	13t	Pine Creek (Upper)	Pine Creek	Central
BIO-030	13e	Timber Creek	Timber Creek	Central
BIRCH1	13t	Birch Creek Above Mine	Birch Creek	Central
BIRCH2	13t	Birch Creek Dump Gulch	Birch Creek	Central
BIRCH3	13t	Birch Creek Below Mine	Birch Creek	Central
BIRD	13q	Bird Creek @ Trailhead	Bird Creek	Central
CAVE	13q	Cave Creek above Campground	Cave Creek	Central
CHER-1	13r	Cherry Creek	Cherry Creek	Central
CHRR-1	13q	Cherry Creek	Cherry Creek	Central
CHV	13u	Chiatovich Creek @ Hwy Maintenance Station	Chiatovich Creek	Central
CHVC	13v	Chiatovich Creek @ USGS Gage	Chiatovich Creek	Central
CLEARC	13s	Clear Creek near Clear Creek Ranch	Clear Creek	Central
CLEVE-1	13q	Cleve Creek	Cleve Creek	Central
CLEVEU	13q	Cleve Creek (Upper)	Cleve Creek	Central
COLD1	14c	Cold Creek @ Cold Creek Campground	Cold Creek	Central
COYO-1	13j	Coyote Creek	Coyote Creek	Central
CW1	13t	Cottonwood Creek	Cottonwood Creek	Central
DUCK-1	13p	Duck Creek	Duck Creek	Central
EAST-1	13q	East Creek	East Creek	Central
EDWA-1	13r	Edwards Creek	Edwards Creek	Central
HORS-1	13r	Horse Creek	Horse Creek	Central
ILC	13p	Illipah Creek near Inlet to Illipah Reservoir	Illipah Creek	Central
IND	13x	Indian Creek	Indian Creek	Central
K14	13n	Mayhew Creek above Ruby Valley Road	Mayhew Creek	Central
KALA-1	13q	Kalamazoo Creek	Kalamazoo Creek	Central
KALZOO	13q	Kalamazoo Creek	Kalamazoo Creek	Central
KCL	13r	Kingston Creek (Lower)	Kingston Creek	Central
KCU	13s	Kingston Creek (Upper) @ Guard Station	Kingston Creek	Central
LDY	13x	Leidy Creek above Hydroelectric Plant	Leidy Creek	Central
MURR-1	13p	Murry Creek near Treatment Plant	Murry Creek	Central
NCOTT-1	13p	North Cottonwood Creek	North Cottonwood Creek	Central
NFBCU	13e	North Fork Berry Creek (Upper)	Berry Creek, North Fork	Central
NORTH-1	13p	North Creek	North Creek	Central
NT1	13s	North Fork Twin River at Trailhead	Twin River, North Fork	Central
OC1	13s	Ophir Creek	Ophir Creek	Central
PC1	13s	Pine Creek above Campground	Pine Creek	Central
PEAVINE	13r	Peavine Creek below Campground	Peavine Creek	Central
PERRYA	13u	Perry Aiken Creek above SR 264	Perry Aiken Creek	Central
PINE-1	13p	Pine Creek	Pine Creek	Central
ST1	13s	South Fork Twin River at Trailhead	Twin River, South Fork	Central
STEP-2	13p	Steptoe Creek @ Hwy 486	Steptoe Creek	Central
STEP-3	13q	Steptoe Creek above Cave Creek	Steptoe Creek	Central
STEPL	13q	Steptoe Creek (Lower)	Steptoe Creek	Central

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STEPU	13q	Steptoe Creek (Upper)	Steptoe Creek	Central
TCC	13x	Trail Canyon Creek above Pond	Trail Canyon Creek	Central
TIMBER	13e	Timber Creek above Campground	Timber Creek	Central
TMBR-1	13q	Timber Creek	Timber Creek	Central
TRAIL	13y	Trail Canyon Creek @ Trailhead	Trail Canyon Creek	Central
UNION-1	13j	Union Creek	Union Creek	Central
WC1	14c	Willow Creek @ Willow Creek Campground	Willow Creek	Central
WILLC	13n	Willow Creek below Angle Lake	Willow Creek	Central
WILO-1	13s	Willow Creek	Willow Creek	Central
WIS	13s	Wisconsin Creek	Wisconsin Creek	Central
Hydrographic Basin	11	Great Salt Lake Basin		
BIO-029	13q	Snake Creek (Upper)	Snake Creek	Great Salt Lake
LC	13b	Lehman Creek	Lehman Creek	Great Salt Lake
SCH1	13q	Snake Creek Above Hatchery @ Forest Service Boundary	Snake Creek	Great Salt Lake
SIL-1	13p	Silver Creek South of National Forest Boundary	Silver Creek	Great Salt Lake
Hydrographic Basin	13	Colorado River Basin		
CL11	14e	Muddy River @ Overton	Muddy River	Muddy River
CL12	14e	Muddy River @ Wells Siding	Muddy River	Muddy River
CL13	14e	Muddy River @ Overton National Wildlife Refuge	Muddy River	Muddy River
CL4	14e	Muddy River @ Glendale	Muddy River	Muddy River
CL6	14e	Virgin River @ Mesquite	Virgin River	Virgin River
CL6A	14e	Virgin River @ Riverside	Virgin River	Colorado River
CL8/BD1	13d	Beaver Dam Wash @ State Park above Reservoir	Beaver Creek Wash	Miscellaneous
CLOV-1	13d	Clover Creek @ Barclay	Clover Creek	Muddy River
CS1	13u	Crystal Springs Creek below Hiko Junction	Crystal Springs Creek	White River
FORE-1	13q	Forest Home Creek	Forest Home Creek	White River
MARG	14e	Muddy River Above Reid Gardner	Muddy River	Muddy River
MR1	14e	Muddy River @ Warm Springs Road	Muddy River	Muddy River
MV1	14b	Meadow Valley Wash above Elgin	Meadow Valley Wash	Muddy River
MV2	13p	Meadow Valley Wash above Echo Canyon Reservoir	Meadow Valley Wash	Muddy River
MVW1	13d	Meadow Valley Wash @ USGS Gage (above Elgin)	Meadow Valley Wash	Muddy River
SUN-1	13b	Sunnyside Creek	Sunnyside Creek	White River
WHT-1	13q	White River Upper @ Picnic Area West of Forest Service Boundary	White River	White River
WHT-2	13p	White River Lower @ Hwy 6	White River	White River