

**UNNAMED TRIBUTARY TO OLEY CREEK
LUZERNE COUNTY**

**WATER QUALITY STANDARDS REVIEW
STREAM REDESIGNATION EVALUATION REPORT**

**Segment: Basin
Stream Code: 28168
Drainage List: K**

**WATER QUALITY MONITORING SECTION (MJL)
WATER QUALITY DIVISION
BUREAU CLEAN WATER
DEPARTMENT OF ENVIRONMENTAL PROTECTION**

2021

INTRODUCTION

The Department of Environmental Protection (DEP) conducted an evaluation of the unnamed tributary (UNT) 28168 to Oley Creek from its source to confluence with Oley Creek due to an error discovered in 25 Pa. Code § 93.9k that affects a portion of the Nescopeck Creek basin including Oley Creek and UNT 28168. The error listed these surface waters with two conflicting use designations. The correction, which occurred through a rulemaking published in 2017, listed the designated use of UNT 28168 as High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF).

GENERAL WATERSHED DESCRIPTION

UNT 28168 is a freestone tributary to Oley Creek in the Nescopeck Creek basin with a drainage area of 0.99 square miles and consists of 1.17 stream miles. The surrounding area is characterized by relatively steep topography. The current land use is approximately 84% forested and 15% barren or nonforested areas as a result of past mining activities.

WATER QUALITY AND USES

Surface Water

There are currently no water supply withdrawals or permitted activities, including active surface coal mining, within the UNT 28168 basin but historical mining activity can be documented back to as early as June 21, 1939 (USDA 1939) (Figure 1).

Biological data was collected by the DEP in 1999, which led to the aquatic life use impairment, and most recently in November 2014, which continues to support impairment.

‘condition of banks’ and ‘bank vegetative protection’, all scoring marginal. All other habitat parameters scored suboptimal or optimal (Table 1).

Aquatic Biota

The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. DEP staff collected habitat and benthic macroinvertebrate data at a single location on UNT 28168 on November 20, 2014 (Figure 2).

Habitat. Instream habitat was assessed at the one station on UNT 28168. The total habitat score of 161 indicates suboptimal habitat conditions overall. The lowest scoring habitat parameter was ‘embeddedness’, followed by

Table 1. UNT 28168, Habitat Assessment Results

PARAMETER	UNT 28168	Rating ¹
1. instream cover	15	SUB
2. epifaunal substrate	20	OPT
3. embeddedness	8	MAR
4. velocity/depth regimes	19	OPT
5. channel alteration	19	OPT
6. sediment deposition	20	OPT
7. frequency of riffles	20	OPT
8. channel flow status	16	OPT
9. condition of banks	10	MAR
10. bank vegetative protection	10	MAR
11. disruptive pressure	20	OPT
12. riparian zone width	20	OPT
Total Score	161	SUB ²

¹ OPT=Optimal; SUB=Suboptimal; MAR=Marginal

² OPT (≥192); SUB(132-192)

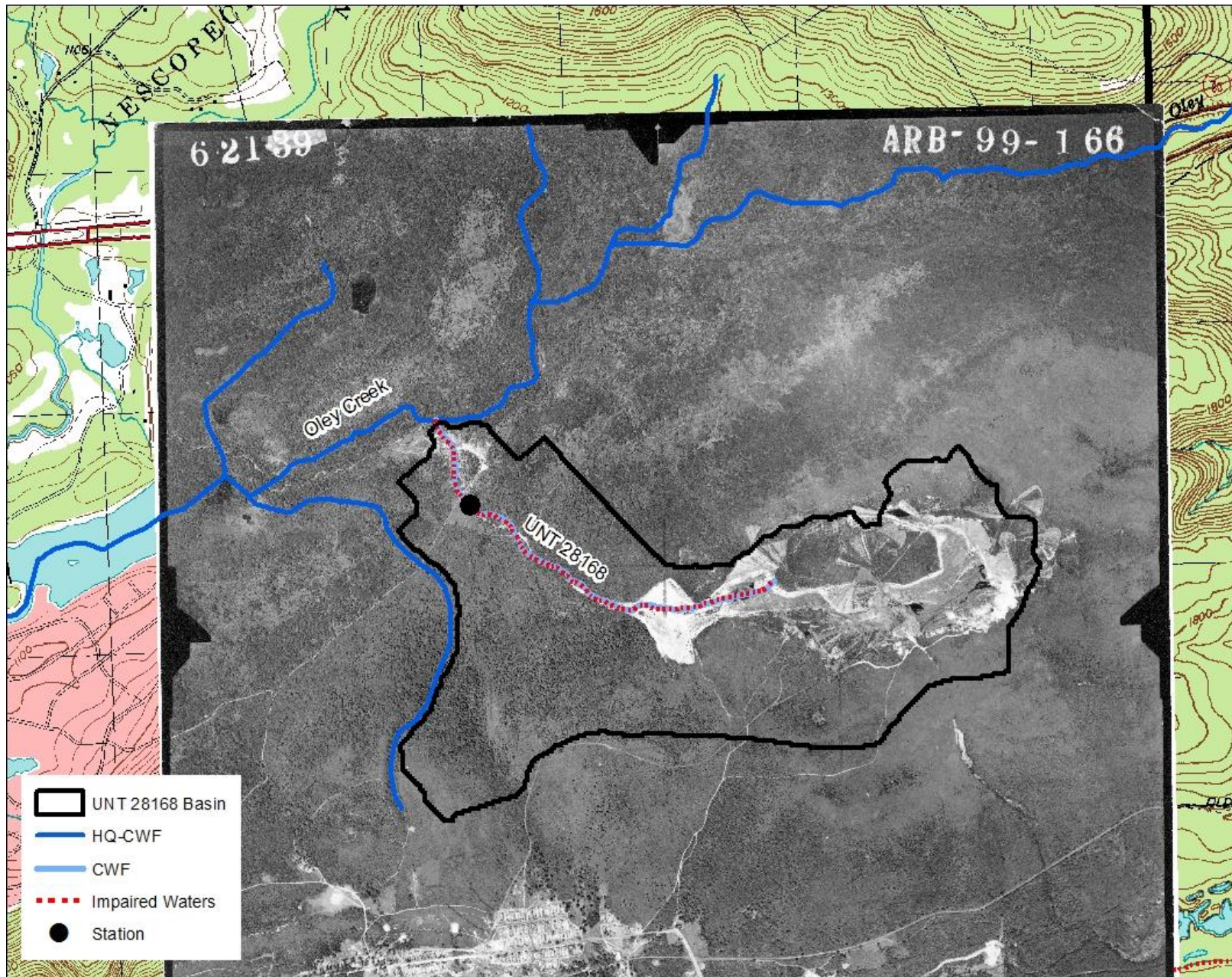


Figure 1. UNT 28168, Aerial Photography - Luzerne County (USDA 1939)

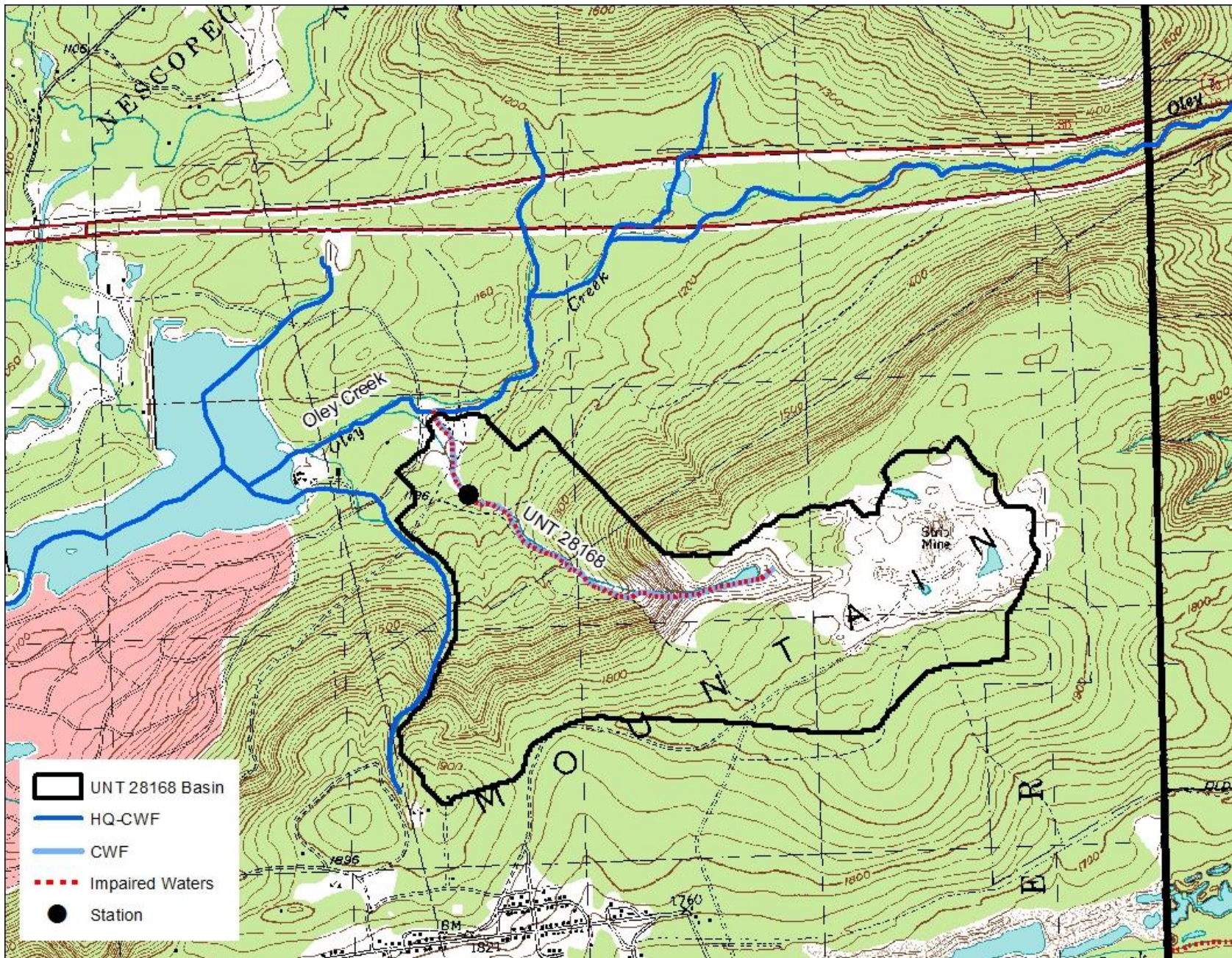


Figure 2. UNT 28168, Luzerne County Lat: 41° 02' 57.348" Long: 75° 54' 36.323"

Table 2. UNT 28168, Benthic Macro. Data

TAXA		UNT 28168
<u>MAYFLIES</u>		
Ephemerellidae	<i>Ephemerella</i>	1
	<i>Eurylophella</i>	1
	<i>Serratella</i>	2
Leptophlebiidae	<i>Paraleptophlebia</i>	1
<u>STONEFLIES</u>		
Leuctridae	<i>Leuctra</i>	1
<u>CADDISFLIES</u>		
Hydropsychidae	<i>Diplectrona</i>	1
	<i>Hydropsyche</i>	1
Limnephilidae	<i>Hydatophylax</i>	3
Philopotamidae	<i>Dolophilodes</i>	1
Ryhacophilidae	<i>Rhyacophila</i>	3
<u>TRUE FLIES</u>		
Chironomidae		194
Tipulidae	<i>Limnophila</i>	1
<u>MISC. INSECT TAXA</u>		
Elmidae	<i>Promoresia</i>	1
<u>NON-INSECT TAXA</u>		
Oligochaeta		2
	<i>Richness</i>	14
	<i>Total Taxa</i>	213

Benthos. Benthic macroinvertebrates were collected at one station on UNT 28168 (Table 2) using the DEP's current macroinvertebrate data collection protocols (Shull and Lookenbill 2018). Sample results indicate poor taxonomic diversity and a high abundance of tolerant taxa. The sample scores 36.1 of a maximum score of 100 (Table 3) on the DEP's Index of Biotic Integrity for Wadeable, Freestone, Riffle-Run Streams (Chalfant 2013); which indicates that UNT 28168 is appropriately listed on the 303(d) list of impaired waters.

Water Chemistry

A limited amount of water chemistry data was collected from the abandoned mine discharge and from the surface water of UNT 28168. Water chemistry data indicates acidic conditions with pH < 5.0, elevated aluminum, and very little, if any, alkalinity instream. All of which are indicative of abandoned mine drainage (Table 4).

Table 3. UNT 28168, Benthic Macro. Metric Calculations

DATE	IBI	RICHNESS	MOD EPT	HBI	% DOM	% MOD MAY	BECK3	SHANNON DIV
November 20, 2014	36.1	14	9	5.69	91.1	2.3	18	0.52

PUBLIC RESPONSE AND PARTICIPATION SUMMARY

The DEP provided public notice of intent to assess UNT 28168 and requested technical data from the general public through publication in the Pennsylvania Bulletin on May 30, 2015 (45 Pa.B. 2676) and also on the DEP's website. In addition, Dennison and Foster townships, Luzerne County Planning Commission, and Luzerne County Conservation District were notified of this redesignation evaluation in a letter dated May 11, 2015. No comments or information was received in response to the notice.

Final Draft Notice, Comments and Response. Once the final draft report was completed it was made available to affected municipalities, County Planning Commissions, and County Conservation Districts in a letter dated July 14, 2018 with a public comment period ending 30-days later. In addition, the DEP provided public notice of the draft report comment period on the DEP's website and in the Pennsylvania Bulletin on July 14, 2018 (48 Pa.B 4174). No comments were received regarding the draft report.

Table 4. UNT 28168, Chemical Grab Sample Results

PARAMETER	UNITS	ABANDONED DISCHARGE			SURFACE WATER
		4/22/2008	12/8/2010	10/9/2013	11/20/2014
ALKALINITY	mg/L	0	0	0	0
ALUMINUM T	µg/L	4049	4448	5679	1146
BARIUM	µg/L				29
BORON	µg/L				< 19.105
CALCIUM T	mg/L	1.612	1.525	7.226	3.798
COPPER T	µg/L				7.7
FERROUS IRON T	µg/L	380	410	200	
HARDNESS T	mg/L	11	11		15
IRON T	µg/L	450	416	591	51
LEAD	µg/L				0.306
MAGNESIUM T	mg/L	1.733	1.798	3.031	1.356
MANGANESE T	µg/L	182	191.000	321	154
NICKEL T	µg/L			50	< 12
SELENIUM T	µg/L				< 0.763
SODIUM T	µg/L			1.166	0.645
STRONTIUM T	µg/L				30
CHLORIDE T	µg/L				0.901
ZINC	µg/L			236	48
pH	SU	3.6	3.4	3.9	4.8
SP COND	µS/cm			220	65
ACIDITY T	mg/L	43	55.4	62.6	
SULFATE T	mg/L	31.1	55.1	63.5	23.568
OSMOTIC PRESSURE	MOS/KG				2
TDS	mg/L				60
TSS	mg/L	6	< 5		10
NITRATE & NITRITE D	mg/L				< 0.011
ORTHO PHOSPHORUS D	mg/L				0.005
NITROGEN D	mg/L				< 0.058
PHOSPHORUS D	mg/L				0.005
NITROGEN T	mg/L				< 0.058
NITRATE & NITRITE T	mg/L				< 0.011
TOC	mg/L				0.43
ORTHO PHOSPHORUS T	mg/L				0.005
PHOSPHORUS T	mg/L				0.003

Measurements with "<" indicate concentrations below the reporting limit

DESIGNATED USE REVIEW

Oley Creek is a tributary to Nescopeck Creek located upstream of SR 309 in Luzerne County. The upper Nescopeck Creek basin from its source to the SR 309 bridge is currently designated High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF), but as of the 1979 rulemaking, three named tributaries (Creasy Creek, Little Nescopeck Creek, and Oley Creek) that enter the Nescopeck Creek above the SR 309 Bridge were inadvertently included in Chapter 93.9k with a designation of Cold Water Fishes (CWF). This error essentially listed these three tributaries with two conflicting use designations, HQ-CWF and CWF.

The error in the upper Nescopeck Creek basin was corrected through a rulemaking published on November 18, 2017 (47 Pa.B. 7029). In the process of correcting the error in § 93.9k, UNT 28168 to Oley Creek was designated HQ-CWF. UNT 28168 is currently on the 303(d) list of impaired waters for source 'Abandoned Mine Drainage'. Due to the geographically concurrent impairment listing and special protection designation of UNT 28168 it is necessary to determine if the conditions that created the impairment occurred before the special protection designation and if UNT 28168 should be redesignated to a less restrictive use. In order to redesignate a stream to a less restrictive use, the DEP must conduct a use attainability analysis that satisfies the demonstrations required by 25 Pa. Code § 93.4(b) *Less restrictive uses* and §93.4(c) *Redesignation of water*.

Use Attainability Analysis Requirements. Section § 93.4(b) states that “less restrictive uses than those currently designated for particular waters listed in § § 93.9a—93.9z may be adopted when it is demonstrated that:

- the designated use is more restrictive than the existing use,
- the use cannot be attained by implementing effluent limits required under sections 301(b) and 306 of the Federal Clean Water Act (33 U.S.C.A. § § 1311(b) and 1316) [*pertains to point source discharges*] or implementing cost-effective and reasonable best management practices (BMPs) for nonpoint source control,
- and one or more of the following conditions exist:
 - (1) Naturally occurring pollutant concentrations (natural quality) prevent the attainment of the use.
 - (2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met.
 - (3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
 - (4) Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the waterbody to its original condition or to operate the modification in a way that would result in the attainment of the use.
 - (5) Physical conditions related to the natural features of the waterbody, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life uses.
 - (6) Controls more stringent than those required by sections 301(b) and 306 of the Federal Clean Water Act would result in substantial and widespread economic and social impact.”

Use Attainability Analysis Summary. In order to properly evaluate less restrictive uses than those designated for UNT 28168, the DEP has conducted the following use attainability analysis to determine the appropriate designated use as required by § 93.4(b):

- An evaluation of uses actually attained on or after November 28, 1975,

- An evaluation of point sources and nonpoint sources to determine if effluent limits and BMPs will result in attainment of the designated use,
- A determination of whether any of the six conditions (§ 93.4(b)1-6) is applicable.

Uses Actually Attained. As part of this redesignation evaluation, information known to the DEP was reviewed to determine, to the best extent practical, whether the HQ-CWF designated use is supported by “existing use” conditions that may have been present at the time of the original designation. “Existing uses”, as defined in 25 Pa. Code § 93.1, are “*Those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards.*”

This portion of the upper Nescopeck Creek basin was initially designated a Conservation Area (3.5) and cold water fishes (1.1) in the the final rulemaking at 3 Pa.B. 787, 791 published on April 28, 1973. The Conservation Area designation was converted to HQ-CWF in the 1979 final rulemaking (9 Pa.B. 3051). Creasy Creek, Little Nescopeck Creek, and Oley Creek had not changed from HQ-CWF. Documentation from the 1979 rulemaking supports that the entire Upper Nescopeck Creek basin, including the three tributaries in question, was intended to be designated HQ-CWF because they were all included in the Conservation Area delineation. The manner in which the Pennsylvania Code was written during the 1979 rulemaking provides further evidence that the authors did not realize that these three tributaries actually enter Nescopeck Creek above the SR 309 Bridge.

A basin-wide Migratory Fishes (MF) designation was added to the Atlantic Slope basin (Drainage Lists A through O and Z) as part of the 2008 Triennial Review of Water Quality Standards (published as final on May 16, 2009, at 39 Pa.B. 2523).

Recent survey results indicate that UNT 28168 is appropriately listed on the 303(d) list of impaired waters, and historical aerial photography (Figure 1) confirms that significant mining activity as early 1939 would have been such to cause conditions that did not meet Water Quality Standards.

Point and Nonpoint Source Evaluation. There are currently no active National Pollution Discharge Elimination System (NPDES) permitted discharges but there is one abandoned mine discharge within the UNT 28168 basin. Historical mining activity can be documented back to as early as June 21, 1939 (USDA 1939) (Figure 1). Although there are no active permits within the basin and subsequently no opportunity to implement effluent limits required under sections 301(b) and 306 of the Federal Clean Water Act, individuals seeking a NPDES permit to discharge to a special protection water (HQ or Exceptional Value (EV)) must demonstrate that Pennsylvania’s antidegradation requirements and policies have been satisfied before the DEP may issue a permit. Special protection waters require effluent limits that are more stringent than those effluent limits required under sections 301(b) and 306. Water chemistry data for UNT 28168 indicates acidic conditions with elevated metals and reduced alkalinity indicative of abandoned mining operations (Table 4). Preliminary analysis was completed by the DEP to determine the feasibility of treatment to the abandoned discharge. The results indicated that passive treatment options would not be feasible due to the elevated levels of aluminum and net acidic

conditions, and while active treatment options would have a much greater potential of meeting CWF water quality standards, meeting nondegrading, HQ standards would not be achievable.

Human health and aquatic life criteria for toxic substances can be found at 25 Pa. Code § 93.8c, Table 5. The acute aquatic life criterion for total aluminum is 750 ug/L. DEP surveys have documented the elimination of fish and sensitive macroinvertebrates at dissolved aluminum concentrations greater than 500 ug/L (DEP 1998). There are currently no chronic aquatic life or human health criteria for this pollutant in Chapter 93. The acute criterion applies to all non-special protection waters. Special protection waters, including HQ waters, are expected to have water quality that exceeds the minimum criteria outlined in Chapter 93 and require the existing water quality to be maintained and protected (25 Pa. Code § 93.4a). Existing water quality is determined using site-specific data, where available, or from an appropriate reference stream (DEP 2013).

Since there is no opportunity to characterize site-specific data for UNT 28168 because it is currently not attaining any protected aquatic life use and a nondegraded reach of UNT 28168 does not exist, instream water quality objectives were generated from the DEP's reference station on Little Bushkill Creek, an EV stream located in Pike County. The instream objectives based on the upper 95th percent confidence limit of the median values in the data set are: Alkalinity = 7.2 mg/L, Total Aluminum = 69.2 ug/L, Total Iron = 186 ug/L, Total Manganese = 31.3 ug/L, and Total Sulfates = 5.6 mg/L. These objectives would be applied as the criteria that must be met instream. The instream objective for aluminum would require approximately 98% removal efficiency. These instream objectives represent nondegrading, HQ water quality that could not be met with the options or combination of technologies described herein.

Passive treatment options are feasible at relatively low discharge rates with reduced metal concentrations (Demchak et al. 2001, Faulkner and Skousen 1994, Skousen et al. 1998, Skousen et al. 2000, Skousen et al. 2017). The abandoned discharge to UNT 28168 has concentrations of aluminum in excess of 5,000 ug/L (Table 4). Generally, passive treatment through the addition of calcitic limestones or other alkaline material increases pH and alkalinity and decreases dissolved metal concentrations. During this process, aluminum precipitates as aluminum hydroxide, which coats the alkaline material and decreases the effectiveness of the treatment (Saha and Sinha 2016, Skousen et al. 2000). While aluminum concentrations of 5,000 ug/L are relatively moderate when compared to other abandoned discharges (Cravotta and Kirby 2004, Cravotta 2008), passive treatment options are typically considered at aluminum concentrations less than 1,000 ug/L.

Active treatment options would be more effective at treating the abandoned mine discharge to UNT 28168. Active treatment options are more costly when compared to passive treatment and require regular maintenance (Saha and Sinha 2016, Skousen et al. 1998, Skousen et al. 2000). The effluent water quality from active treatment is affected by a combination of water quality prior to treatment and the specific technologies implemented (DEP 1998, Skousen et al. 2000). Multiple reviews of treatment techniques indicate that properly designed and maintained systems will remove significant concentrations of metals and reduce acidity to the point of meeting some protected uses (Skousen et

al. 2000). Some active treatment options include aeration/oxidation, the addition of neutralizers and the addition of flocculants/coagulants (Skousen et al. 2000). The metals removal efficiencies of these options or a combination of them is lower than more efficient technologies like reverse osmosis. Reverse osmosis has been reported to result in 95-99% metals removal efficiency (Saha and Sinha 2016, Lakherwal 2014, Liu et al. 2008). Other emerging technologies like nanofiltration also have very high reported metals removal efficiencies (Chang-Ming 2007). However, these technologies are subject to membrane fouling, require extensive pretreatment and produce elevated quantities of contaminated sludge directly proportional to the concentration of contaminants (Chang-Ming 2007, Saha and Sinha 2016, Lakherwal 2014, Liu et al. 2008). There are also studies and reviews available that suggest the utility of multiple treatment technologies implemented in succession (Chang-Ming 2007, Skousen et al. 2000). No documentation has been found to demonstrate water quality improvements that would be protective of HQ waters in UNT 28168.

Additionally, both active and passive treatment options would also require dedicated space on which to construct treatment technologies (Skousen et al. 1998, Skousen et al. 2000). However, the DEP has been unable to secure landowner consent to construct a treatment facility in the vicinity of the abandoned discharge to UNT 28168.

According to 'Oley Creek Watershed Assessment and Environmental Management Plan' (Skelly and Loy 2005), a portion of the UNT 28168 headwaters labeled "The Wash" consisted of a 2.7-acre impounded area, surrounded by spoil piles and scree, that was created by past surface mining activities. The impoundment has since been drained and breeched to eliminate safety concerns and to reduce the potential for sediment transport off the site because of any uncontrolled breeching. Areas downstream of the impoundment are high gradient and had significant deposits of unstable sand and gravel evident of past mining activities and associated mining waste. Steep slopes within the basin were at best partially vegetated with pioneer plant species. Approximately 1,030,000 cubic yards of on-site material were regraded, and a stable channel was constructed to halt erosion between January 2013 and January 2015. The two-year regrading project cost \$2,086,825.

Less Restrictive Use Conditions. The less restrictive use conditions found at 25 Pa. Code § 93.4(b) were reviewed. Historical and recent data presented in this report clearly document that the impairment of UNT 28168 to Oley Creek was caused by human activity in the basin (that is, coal mining) prior to November 28, 1975. In addition, one or more of the six conditions outlined in § 93.4(b) must exist in order to redesignate a stream to a less restrictive use. Of the six listed, § 93.4(b)(3) is applicable to UNT 28168, which states "*Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place*".

RECOMMENDATION

Based on applicable regulatory definitions and requirements of The Clean Water Act Section 40 CFR 131.12(a)(l), 25 Pa. Code § 93.4b, the 1973 rulemaking, the 1978-1979 rulemaking, recent field surveys, and historical and present-day land use reviews the DEP makes the following recommendation:

UNT 28168 basin from its source to mouth should have a use designation of CWF, MF. Reasons for this recommendation are listed below:

- 1) In 1973, the upper Nescopeck Creek basin, including UNT 28168, was originally designated as a Conservation Area, which by definition protected waters that were and are in a relatively primitive condition. Since much of UNT 28168 was not in a “relatively primitive condition” anytime between 1939 and the present, the Conservation Area designation was in error for UNT 28168;
- 2) Recent survey results indicate that UNT 28168 is appropriately listed on the 303(d) list of impaired waters;
- 3) Historical aerial photography confirms that significant mining activity as early 1939 would have been such to cause conditions that do not meet Water Quality Standards; and
- 4) Due to historical mining activity and limitations in available metals removal technologies, UNT 28168 will not be able to achieve the water quality levels necessary to meet the protected use of HQ through the implementation of effluent limits required under Sections 301(b) and 306 of the Federal Clean Water Act, partially because there are currently no active NPDES permitted discharges in the basin. In addition, the HQ use also cannot be attained through the implementation of cost-effective and reasonable best management practices (BMPs) for nonpoint source control due to the limitations in available treatment options

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