Cumulative Hydrologic Impact Assessment Nos. 136
Cumulative Impact Area No. 10
Subarea No. 1A

<u>Permitting Action</u>

OSMRE No. 3270

Kopper Glo Mining, LLC
Cooper Ridge Surface Mine #1
Claiborne County, Tennessee

I Introduction

This Cumulative Hydrologic Impact Assessment (CHIA), dated September 8, 2015, is written in accordance with the recommended guidelines established in the Office of Surface Mining Reclamation and Enforcement (OSMRE), Knoxville Field Office's (KFO) "***Procedures for the Cumulative Hydrologic Impact Assessment"*** (OSMRE, 2005) and meets the requirements of 30 CFR 942.773.14(e), 780.21(g), and 784.14(f).

II Description of the Cumulative Impact Area (CIA) and Operational Background

The KFO maintains a network of water quality monitoring stations throughout the Tennessee coalfields to document existing conditions and resulting changes caused by surface coal mining operations. These monitoring sites are called trendstations which are located at the outlet to each CIA subarea. The goal of these monitoring stations is to maintain current seasonal water quality data along with measured flow that can be used to assess long-term changes in the cumulative impacts from mining.

OSMRE has designated the entire Clear Fork watershed as CIA 10, which is part of the much larger Upper Cumberland basin and drains an area of approximately 2,575 square miles. The CIA 10 was subsequently subdivided into 20 subareas with associated trendstations. The proposed mine site is located in CIA 10, Subarea 1A on Clear Fork and drains the upper 27.78 square miles (17,781.44 ac) of the Clear Fork watershed. This CHIA evaluated both trendstation and data from active permits (Tables III-1 through III-3) within the Clear Fork and Straight Creek watersheds.

PERMIT (Surface)	Coal Seam	Company Name	Mine Name	Permitted Acres	Disturbed Acres	Shadow Area (Acres)	Mine Status
3290 was 3018	N/A	Middlesboro Mining Operations, LLC	Preparation Plant #2	18.70	18.00		P1
3271 was 3058	Coal Creek /Blue Gem	DRC Coal, LLC	Cooper Ridge Area #2	449.70	267.00		MC
3296 was 3264	Sterling/Stray	Appolo Fuels, Inc.	Sterling & Strays Sur Mine #1	1090.80	804.00		TC
3285 was 3011	Coal Creek	Middlesboro Mining Operations, LLC	Jellico North Deep Mine	74.00	18.00	4414.61	NM
3289 was 3012	Coal Creek	Middlesboro Mining Operations, LLC	Jellico South Deep Mine	24.00	9.00	1526.38	NM
3292 was 3112	Coal Creek /Blue Gem	Middlesboro Mining Operations, LLC	Jellico Strip	2267.20	564.60		MC
3295 was 3192	Rich Mountain	Middlesboro Mining Operations, LLC	KY Line Rich Mtn	99.90	30.00		P1
3270	Mason	Kopper Glo Mining, LLC	Cooper Ridge Surface Mine	1494.3	470.00	260.2	Pending
3294 was 3191	Buckeye Spring	Middlesboro Mining Operations, LLC	Buckeye Springs-2	604.40	158.00	224.73	MC
3229	Rich Mountain	Kopper Glo Mining, LLC	Double Mountain Mine	94.00	68.50	810.17	AP

Table III-1. Active and Anticipated Tennessee Mining Operations Considered in the CIA TS10-1A Watershed (Mine Status definitions can be found in Appendix A)

In addition, OSMRE conducted a one-time stream survey of the Clear Fork watershed during low-flow conditions in October 2010. This data was used to develop a regression model of pollutant loading used to predict water quality changes resulting from additional mining.

A. General Operations Plan

The proposed permit area (Figure III-1 and III-2) is located approximately 1.4 miles northeast of the Clairfield community in Claiborne County, Tennessee. The site is located on the Eagan and Fork Ridge, TN-KY 7.5 minute USGS quadrangle map. The area of surface

disturbance is located along the north slope of Cooper Ridge. Mining is proposed within 100 feet of the outside right-of-way of Valley Creek Road.

Permit (surface)	Coal Seam	Company Name	Permitted Acres	Disturbed Acres	Mine Status
KY8077009	Haul Road	Bell County Coal Corporation	92.87	92.87	A1
KY8075202	Jellico	Bell County Coal Corporation	81.21	0	ND
KY8075025	Poplar Lick /Sterling	Bell County Coal Corporation	4699.57	158.28	AP
KY8075179	Stray	Bell County Coal Corporation	168.28	22.81	O2
KY8075223	Jellico	Bell County Coal Corporation	21.62	21.62	O2
KY8070438	Rich Mountain	Middlesboro Mining Operations, Inc.	258.77		A1
KY8070436	Jellico	Middlesboro Mining Operations, Inc.	180.15		A1
KY9180466	Jellico, Rich Mountain/Rider	Mountainside Coal, Co Inc.	487.27	130	AP
KY8075157	Buckeye Springs	Bell County Coal Corporation	114.39	114.39	O2
KY8070434	Jellico, Rich Mountain	Middlesboro Mining Operations, Inc.	234.76	200	A1
KY8070383	Red Springs, Splint, Hignite, Stays, Sterling, Poplar Lick, Buckeye Springs, Mason	Strata Mining, Inc.	2626.08	200	AP

Table III-2. Active Kentucky Surface Mining Operations Considered in the CIA 10 TS-1A watershed (Mine Status can be found in Appendix A)

Permit (UG)	Coal Seam	Company Name	Permitted Acres		Mine Status
KY8075202	Jellico	Bell County Coal Corporation	1503.52		ND
KY8075025	Poplar Lick Riders 5/6	Bell County Coal Corporation	4218.80		AP
KY8075179	Stray	Bell County Coal Corporation	223.87		O2
KY8070438	Rich Mountain	Middlesboro Mining Operations, Inc.	396.82		A1
KY8070436	Jellico	Middlesboro Mining Operations, Inc.	244.18		A1
KY8075157	Buckeye Springs	Bell County Coal Corporation	3159.72		O2
KY8070434	Jellico, Rich Mountain	Middlesboro Mining Operations, Inc.	403.03	365.00	A1
KY8070433	Hignite Auger Shadow Area	Middlesboro Mining Operations, Inc.	3.56	3.56	A1
KY8075223	Jellico	Bell County Coal Corporation	6500.00	0	O2

Table III-3. Active Kentucky Underground Mining Operations Considered in the CIA 10 TS-1A Watershed (Mine Status can be found in Appendix A)

The proposed operation is a combined surface contour mine involving remining, auger mining, and underground mining activities. The coal seam to be mined is the Mason (Jellico) seam at approximately 1780 feet above mean sea level (AMSL). The proposed permitted acreage is 1496.3 acres with an estimated surface disturbance/remining acreage of 472.5 acres. The affected area for the proposed underground shadow area is 260.2 acres.

The proposed mining operation will mine for approximately 9.2 years, with 360,000 tons of coal mined annually, and 3,329,794 tons over the life of mine. The proposed mining area drains into Nolan Branch, Straight Creek, Clear Fork, Valley Creek, and Hurricane Creek.

This site is divided into two increments. Backfilling and grading will occur in conjunction with active mining. The spoil taken from the initial "A" and "B" cuts will be placed into the orphan Mason (Jellico) mine pit adjacent to these cuts. This spoil will then be used to backfill the second cut highwall. The final cuts will be backfilled with the material that was stacked on each preceding cuts. Backfill underdrains shall be constructed in areas deemed necessary, such as structural lows in the pit floor or where ground water is encountered in the pit. The rock used in the construction of these drains shall be durable shot rock from the site with varying sizes. Drainage control will consist of twenty-eight “on-bench” sediment basins and a network of diversion ditches designed to route the surface water runoff into these sediment basins. Long-term acid drainage is not expected, but there is a small potential for the formation of short-term acid drainage as potentially acid-forming material is removed and handled according to the approved toxic material handling plan. In this case, sediment basins will be used to treat acid drainage if needed. The constructed temporary sediment basins are proposed to be converted into wetlands during the reclamation of this mine site. There were twenty-one surface-water monitoring points and twenty-six ground water monitoring points used to establish baseline conditions for this site.

The applicant intends to leave an underground face-up area at the location shown on the Mining Operations Map (MOP) within cuts 98A and 99A. Conventional auger and/or

highwall mining is proposed following the surface coal mining of the target coal seam and any associated rider seams.

The application states that the anticipated maximum recovery depth is 300 feet for augering and 800 feet for highwall mining. The vertical extent of augering or highwall mining will range from 24 to 49 inches. A variance from the requirement of sealing auger holes within 72 hours is requested due to the proposed augering of multiple seams.
The operator does not intend to surface or auger mine the Mason #1 (Jellico) coal seam in the locations where the underground mining has depleted the reserves.

However, there may be areas where it is feasible to surface or auger mine the remaining pillars of the abandoned underground mine. The applicant also proposes to surface mine rider seams and auger mine in areas behind existing auger holes. During mining near known abandoned underground mines (see Figure III-3), the applicant will test drill the cut(s) prior to overburden removal to determine the actual boundary of any adjacent mine workings. If the surface or auger mining inadvertently breaks into any abandoned underground workings and encounters mine water discharge, an underdrain will be constructed to route that discharge to a drainage ditch constructed at the toe of the backfilled slope, which will route any discharge into the nearest sediment basin.

The applicant does not anticipate any adverse impacts to the receiving stream's water quality due to the overall alkaline nature of the overburden and history of adjacent mining on this particular coal seam.

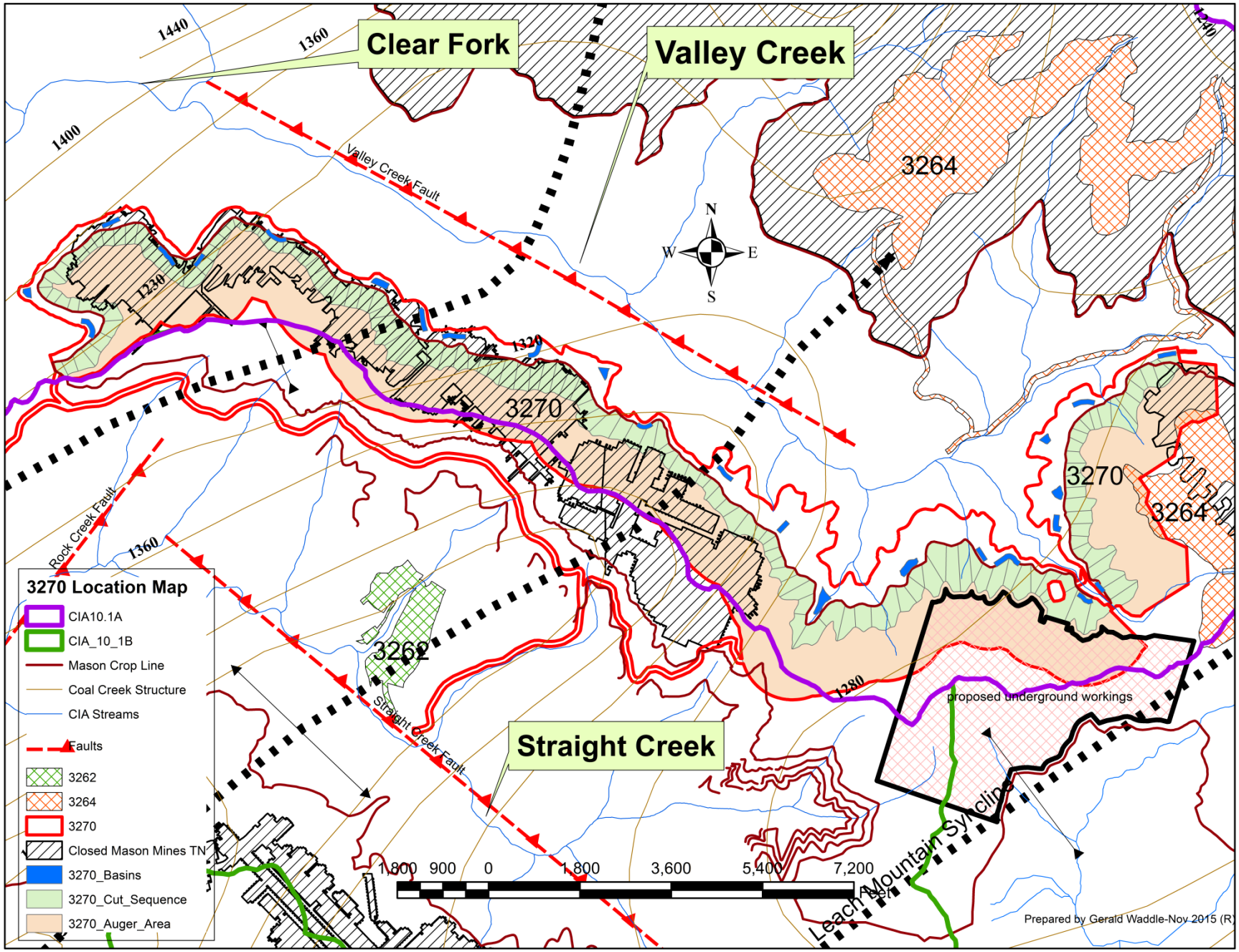

Figure III-1. Kopper Glo Mining, LLC, Cooper Ridge Surface Mine No.1, OSMRE Application 3270 Location Map

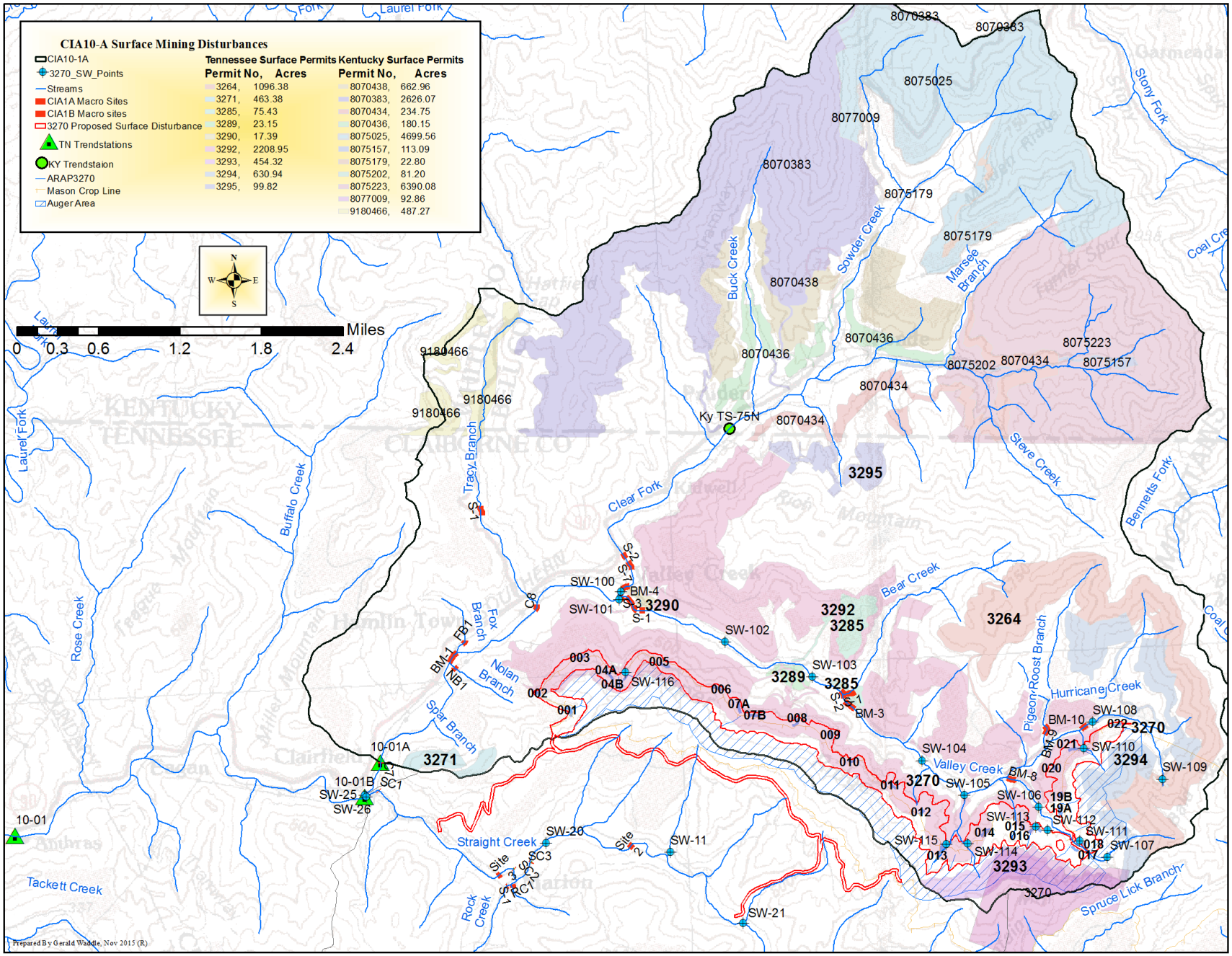

Figure III-2. Existing and Anticipated Surface Mining Disturbances within CIA 10-1A.

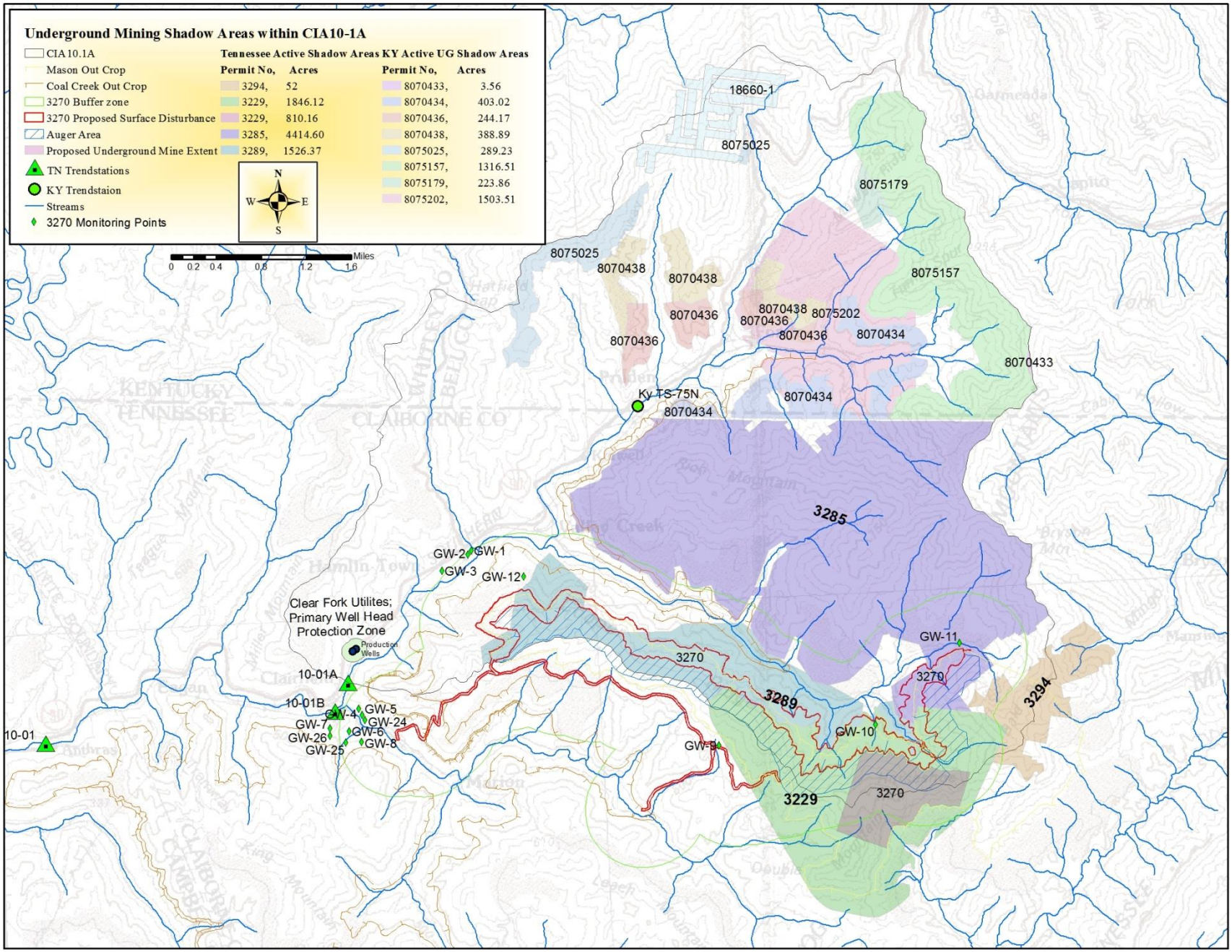

Figure III-3. Existing Underground Mining Shadow Areas Within CIA 10-1A.

B. PHC and HRP Issues

The following section identifies potential issues associated with the proposed permitting action along with an assessment of baseline water quality for the application and adjacent areas.

This operation proposes to mine the Mason (Jellico) coal seam (see Figure III-4) and riders as a part of this application. Each of the four Mason coal seam riders will be exposed in the various highwall cuts at some point during contour mining operations. The application states, "Where the Jellico coal seam or splits are encountered within the mining areas, they will be highwall mined or augured where geologic conditions are favorable for these types of mining". Based on the geologic cross-sections, it appears the proposed surface mining cuts will possibly intersect underground workings at several cross-section locations. The applicant states that the operator does not intend to surface or auger mine the Mason coal seam in the locations where the underground mining has depleted the reserves. There may be areas where it is feasible to surface mine the remaining pillars of abandoned underground mines or to surface mine behind the existing auger holes. As previously stated, "the applicant plans to test drill in cuts near any underground works prior to overburden removal to determine the actual limits of suspected abandon mine voids." If the surface or auger mining inadvertently breaks into the abandoned underground workings and encounters mine water which discharges into the pit or cut area, an underdrain will be constructed. The underdrain will route the discharge to a drainage ditch along the toe of the backfilled slope and will route any drainage to a designated sediment basin.

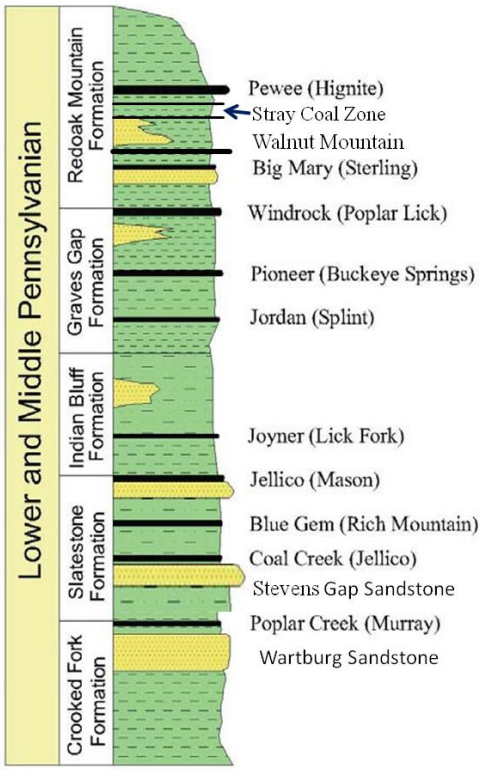

Figure III-4. Target Coal

As with most surface mining permits, the major hydrological concerns relate to potential off-site impacts from sediment contributions from disturbed areas and haulroads, acid/toxic drainage, and alteration to the stream-flow characteristics in the proposed permit and adjacent areas. However, no significant hydrological issues were identified within the application's Probable Hydrologic Consequences (PHC) or the Hydrologic Reclamation Plan (HRP). The PHC does not anticipate any long-term acid toxic drainage from the proposed mining operation. Mitigation of the acid forming materials (AFM) is addressed in the Toxic Material Handling Plan (TMHP) found in Item 58 of this permit application.

No diminution or interruption of any major water resource used for any legitimate purpose is anticipated from the mining activities proposed in the permit application. Neither the applicant nor OSMRE have identified any major ground water users, domestic water supplies, surface water users, or water supply intakes within the proposed permit area or adjacent areas, which could be adversely affected by mining.

Where the applicant encounters ground water flow from mining through any abandoned underground works or anywhere ground water discharge occurs, the flow will be managed within that cut during the mining. Regardless of the origin of any water, all drainage or runoff from the proposed permit area will be routed to a sediment basin and discharged in accordance with applicable National Pollutant Discharge Elimination System (NPDES) water quality effluent standards.

C. Acid or Toxic Drainage Potential

The Mason (Jellico) coal seam and associated riders were previously mined using surface, underground, and auger methods for a number of years within the proposed permit and adjacent areas.

Historically, there is no acid/toxic drainage associated with the mining of these coal seams or riders within this watershed. Eighteen geologic core holes were drilled (Figure III-5) across the proposed permit area for overburden sampling, collection, and analyses. The geology of the application area was defined by data collected at each of the geologic exploration sampling points listed below. The data from application Item 38 was entered into an

overburden analysis worksheet and the overall weighted net acid base (NAB) accounts were calculated. The results from each drill hole's weighted overburden analysis are shown in Table III-4 below.

Core Hole	Elevation (feet)	Net Neutralization Potential (tons/1000 tons)	Total Depth of Core Hole (feet)	Sample Depth(feet)	Starting Elevation (feet)
KG-07-12	EL. 1979	15.62	170.4	170.4	1978.5
KG-08-12	EL. 1990	11.66	160	160	1978.5
KG-09-12	EL. 1972	13.9	195.4	195.4	1919.7
KG-10-12	EL. 2095	20.42	190.8	190.8	1959
KG-11-12	EL. 1971	14.26	146.3	146.3	1970
KG-12-12	EL. 1972	21.12	181.6	83.3	1873.2
KG-22-12	EL. 1995	18.22	161.2	156.2	1980.96
KG-13-12	EL. 2018	28.34	186	186	2012.5
KG-21-12	EL. 1981	19.25	182.5	182.5	1980.96
KG-19-12	EL. 1963	20.42	178	178	1963.01
KG-13-11	EL. 2265		521	197	1935
KG-14-12	EL. 1966	22.36	174.7	174.7	1925.62
KG-18-12	EL. 2078	22.7	182	182	1920.8
KG-16/17-12	EL. 1985	46.76	181.8	180	1973.65
KG-20-12	EL. 1958	30.25	182.5	182.5	1938
KG-15-12	EL. 1998	36.7	175.5	175.5	1941.46
C-2	EL. 1852	Geo-X-Section Only			
R1	EL-1875	Geo-X-Section Only			
CR-1	EL-1920	Geo-X-Section Only			
RDH-1	EL. 1935.5	Geo-X-Section Only			
KG-12-11	El. 1944	Geo X-Section Only			

Table III-4. Overburden NAB Results

The weighted overburden NAB account indicates that the overburden has the potential for producing alkaline water. However, where thin zones of AFM were found, the handling plan states that, "During overburden removal these potentially acid-forming units will be blended with the strata that exhibited excess neutralization potential and placed below the final grade". Adjacent to this proposed mine, there have been 26 permits issued during the last 15 years, which have been successfully reclaimed and bond released. Currently there are nine active permits within the Tennessee portions of the CIA 10, Subarea 1A watershed. Mining has been completed on five of these permits. Out of these active permits, only the DRC's OSMRE Permit 3271 is producing a low volume of AMD from its back fill along the Coal Creek coal seam. This seam is 150-200 feet below the proposed mining. This poor water quality is most likely due to the previous operator's poor handling of the toxic material.

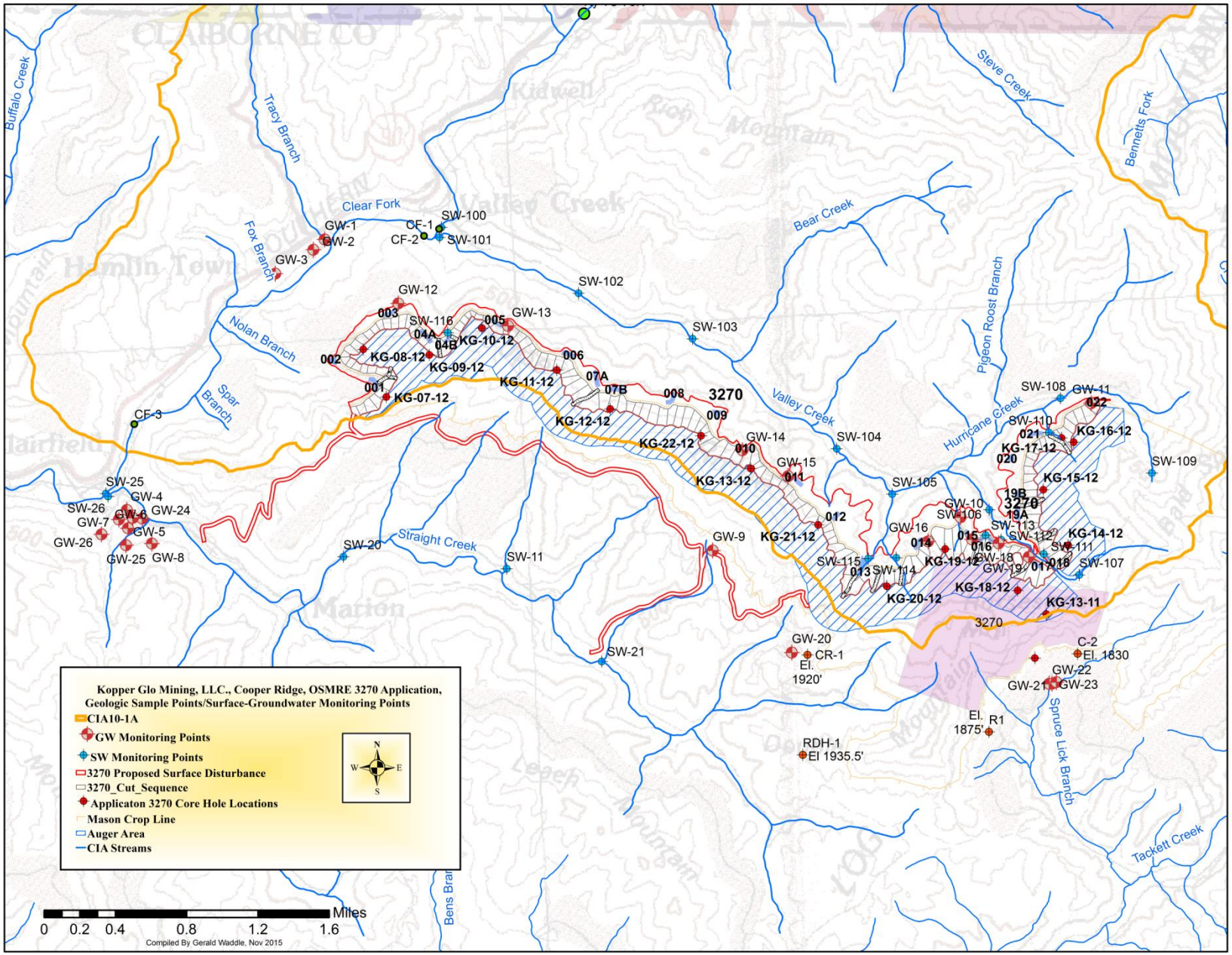

Figure III-5. Geologic and Hydrologic Sample Locations.

D. Siltation Structures

Table III-5 lists the 25-siltation structures (basins) the applicant proposes to construct for this application. These proposed structures locations are shown in Figure III-1.

During mining, all drainage will be directed into the active pit areas. Water will then be pumped to the nearest constructed basin or stored until it can be directed to a conveyance leading to an appropriate structure.

Siltation Structure Number	*Tributary*
001	Nolan Branch of Clear Fork
002, 003	Unnamed tributary to Clear Fork
04A, 04B, 005, 006, 07A, 07B, 008, 009, 010, 011, 012, 013, 014, o15, 016, 017, 018, 19A, 19B	Unnamed tributaries of Valley Creek
020, 021, 022	Unnamed tributaries of Hurricane Creek

Table III-5. Summary of Basin Numbers and Watershed. Basins are Listed in Order From Downstream to Upstream

An OSMRE staff engineer reviewed the appropriate sections of this SMCRA application and determined the overall sediment affects from these potentially uncontrolled sources and the mine site would not cause any issues. The engineer's conclusions are provided below.

Total Maximum Daily Load (TMDL)

The Tennessee Department of Environment and Conservation (TDEC) developed a Total Maximum Daily Load (TMDL) for the Clear Fork of the Cumberland River, which requires implementation in all HUC 12 tributary watersheds that have documented impairment of bio-criteria. TDEC also established 414 pounds/acre/year as the existing sediment load within the Clear Fork watershed. Therefore, to reduce sediment loads within the Valley Creek watershed, TDEC has established a TMDL for Total Suspended Solids (TSS) with a discharge limit of 196.2 pounds/day/outfall for this application.

The TMDL uses the effluent limitation in accordance with 40 CFR Part 434 for TSS as the daily expression and assumes that a permitted mine has a continuous discharge of TSS at a maximum concentration of 35 mg/L. The draft TDEC NPDES permit addresses the Alternate Storm Limitations for discharges that exceed the engineering design criteria for these basins. The effluent limits for all basins that discharge into Valley Creek and Clear

Fork are limited to 70 mg/L TSS, for a daily maximum concentration and monthly average concentration of 35 mg/L TSS. However, if a storm event exceeds a 10 year/24 hour event, TDEC will only require the monitoring of pH for that event.

The sedimentation structures for the proposed permit are not designed to meet the sediment standard (TSS) as used in the TMDL calculation or NPDES permit. The basin design criteria, as required by OSMRE, does not include provisions for monitoring TSS, but are designed for Settleable Solids of (SS) 0.5 ml/L per acre of disturbance. The limitations and monitoring requirements for TSS in the NPDES permit and are enforceable by both TDEC and OSMRE.

TDEC uses the Environmental Protection Agency's (EPA) regulations to set effluent limitations for TSS. TDEC's Water Quality Standards (WQS) uses a narrative standard for siltation in the receiving stream. The in-stream measurement of compliance for this WQS uses biological criteria as compared to Ecoregion reference data sets. In addition, it is important to understand that the narrative standard is not intended to be applied based on a single sample or moment, but on a long-term average compared to the ecoregion reference data set and impacts on the receiving stream's health. This mining operation will utilize sediment control basins with "Best Management Practices" (BMPs) within these watersheds in order to trap the calculated during-mining sediment load.

E. ARAP and Stream Buffer Zones

The OSMRE, TDEC, and the U.S. Army Corps of Engineers (USACE) are required to determine whether any stream or other associated wetlands within the affected area require special protection. Such protection may require establishing stream buffer zones and mitigating any impacts to jurisdictional wetlands. Several site visits were conducted in 2010 to determine the areas in need of protection. A determination of jurisdictional waters of the State of Tennessee and of the United States was made during these site visits. Based on these site visits, it was determined that six streams and seven wet weather conveyances existed within the permit area that had been previously disturbed by mining. TDEC determined that an individual Aquatic Resource Alteration Permits (ARAP) was needed for the mining

operations proposed in these areas. The applicant submitted an ARAP permit to TDEC in order to allow mining and reclamation in these areas that would result in restoration of the natural drainage patterns, stream geomorphology, aquatic habitat, and riparian zones. Likewise, 3.55 acres of wetlands were identified that had formed because of pre-law alteration of the surface hydrology. Kopper Glo proposes to convert approximately 11.47 acres of the proposed sediment treatment structures to wetlands as the site is reclaimed such that there is no net-loss of jurisdictional wetlands.

If approved, all associated impacts will be considered as "de minimus" under the definitions of the TDEC Water Quality Control Board rules under section 1200-4-3-.04(4).
In addition to TDEC's ARAP requirements, Section 404 of the Clean Water Act requires a permit from the USACE for activities associated with placing fill material or dredging activities within waters of the United States. The TDEC ARAP serves as the 401 Certification of the USACE's 404 permit. Upon issuance of the OSMRE permit, TDEC will issue the ARAP permit and the USACE will issue the corresponding 404 permit. The TDEC 401 Certification declares that water quality standards will be maintained by implementing the 404 permit conditions.

Because of these encroachments to restore these streams, the applicant applied for a stream buffer zone waiver. An OSMRE staff engineer was requested to review the appropriate sections of the permit application to determine if the stream buffer zone waiver would cause or contribute to the violation of the applicable State or Federal water quality standards. The ARAP locations are shown in Figure III-5. Based on the findings of TDEC, USACE, and the designs submitted in the application, OSMRE determined there would be no water quality issues associated with the construction of the ARAPs and granted approval of the stream buffer zone waiver.

F. Augering/Highwall Mining

The local dip within the proposed mine site is controlled by a syncline structure in the northern area of the proposed mine site and an anticlinal structure in the southern area of the application. The application's mining plan dictates that for all coal seams, the auger mining will be down dip or along strike. The actual coal seams proposed to be augered have little or

no neutralization potential and therefore have the potential to generate acid/toxic discharge from these openings. If significant discharge is encountered from any auger holes, the discharge will be detained in the pit and pumped to the nearest sediment basin. Once there, the water will be tested for compliance, and treated if necessary, prior to discharge from any sediment basin. The auger holes will then be sealed as soon as possible after the discharge slows down or underdrains will be constructed as described below. All auger holes will be sealed within 30 days from the time of coal removal and will be sealed in accordance with 30 CFR 819.15. Mining will occur within 500 feet of several abandoned underground mines in the Sterling and Poplar Lick coal seams. There are no active underground mine working areas for this mine. The extents of highwall mining related to the abandoned underground works are shown on the MOP map and in Figure III-5, for the seam to be mined.

Auger/highwall mining will be conducted in advance of backfilling operations and will commence following contour mining of the target coal seam. The anticipated maximum depth is 300 feet for augering and 800 feet for highwall mining.

G. Underdrains

The permit application states that, "Backfill underdrains shall be constructed in areas deemed necessary, such as but not limited to structural lows in the pit floor and where ground water is encountered in the pit. The rock to be used in the construction of the drains shall be durable shot rock varying in size from 3 inches to as much as 36 inches in diameter." Furthermore, that application states that, "If during auger mining, discharge from the auger holes is identified, a backfill underdrain shall be constructed to route discharge from the auger holes to the drainage ditch constructed at the toe of the backfilled slope, which will carry the discharge to the sediment basin." OSMRE has reviewed these underdrain plans and finds no adverse water quality or quantity issues will result from their construction.

H. Surface Water Quality and Quantity Characterization

There are 21 premining baseline surface water-monitoring points. 3 points are within Straight Creek, 5 points on Clear Fork, 13 points on Valley Creek, and 3 points on Hurricane Creek. Figures III-6 through III-26 demonstrate the variability of the water quality within

these watersheds. However, the pH remains circumneutral to alkaline within all of the watersheds shown in Figure III-1.

Item 40 (Surface Water Resources Information) of the permit application lists SW-11, SW-20, SW-21, SW-25, SW-26, SW-100, SW-101, SW-102, SW-103, SW-104, SW-105, SW-106, SW-107, SW-108, SW-109, SW-111R, SW-112R, SW113R, SW-114R, SW-115R, and SW-116R as baseline monitoring points.

Item 62 of the permit application lists SW-25/R, SW-100/R, SW-101/R, SW-107/R, and SW-109/R as life of mine monitoring points. Monitoring data from these points are divided into three data ranges. The first data range evaluates the entire data set, the second data range evaluates the full data set except for the last five years of record. The last five-year data set, or the most recent data, comprises the third data set. The data set was divided into ranges because all permit time lines, such as renewals or reclamation bond releases, are based on a five-year sequence. The sequential comparison of these different data ranges should readily identify any trends within the most recent water quality data. The surface water monitoring points are listed from the headwaters to the furthest downstream monitoring point of the proposed application and are shown on Figure III-5.

The SW-109 (SW-13 or HC-9000) monitoring station receives drainage from 0.08 square miles and is located on Hurricane Creek, 5.1 miles upstream from the confluence with Clear Fork. This is a headwater stream. This point is immediately adjacent to Appolo Fuels, Sterling & Strays Surface Mine #1, OSMRE 3296, basins 6 and 7.

As of the date of this CHIA document, 33 samples have been collected at this point, representing approximately 8 water years or 33 quarters (Tables III-6 and III-7). During this period, the water maintained a circumneutral pH ranging between 7.1 and 8.4 with a median of 7.7. TDS ranged from 109 to 411 mg/L with a median of 269 mg/L; iron ranged from 0.1 to 2.52 mg/L with a median of 0.35 mg/L; manganese ranged from 0.01 to 0.9 mg/L with a median of 0.15; and sulfate ranged from 23.4 to 250 mg/L with had a median of 111.00 mg/L. Flow ranged from 0.25 cubic feet per second (cfs) to 17.5 cfs with a median of 0.3 cfs and the selenium data ranged from 0.25 to 3.5 µg/L.

SW-109	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/16/2007 - 3/6/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.75	317.25	248.83	124.68	94.08	16.09	0.62	0.25	1.07
Median	7.70	322	269	111	101.85	12.00	0.35	0.15	0.30
Minimum	7.10	176	109	23.40	12	1	0.10	0.01	0.06
Maximum	8.40	473	411.11	250	165	53	2.52	0.90	6.00
Count	33	33	33	33	33	33	33	33	33
SW-109	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/16/2007 - 2/12/2009		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.74	319.85	278.00	145.67	108.05	12.25	0.26	0.25	0.96
Median	7.75	328.48	285.50	204	110.35	12.00	0.30	0.19	0.30
Minimum	7.50	276.13	240	40	100.10	8.00	0.10	0.04	0.06
Maximum	8.00	349.77	304	250	115.36	18.00	0.37	0.55	2.26
Count	12	12	12	12	12	12	12	12	12
SW-109	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/20/2010 - 3/6/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.76	315.76	232.16	112.69	86.10	18.29	0.83	0.25	1.13
Median	7.70	320	206.86	108.30	79	16.00	0.57	0.15	0.40
Minimum	7.10	176	109	23.40	12	1.00	0.16	0.01	0.06
Maximum	8.40	473	411.11	238	165	53.00	2.52	0.90	6
Count	21	21	21	21	21	21	21	21	21

Table III-6. Summary of Surface Water Parameters at SW-109.

.

Range 1: 3/16/2007 to 3/6/2015	
n=33	**7 years, 11 months, 18 days**
Range 2: 3/16/2007 to 12/12/2009	
n=12	**2 years, 8 months, 26 days**
Range 3: 3/20/2010 to 3/6/2015	
n=21	**4 years, 11 months, 14 days**

Table III-7. SW-109 Date Ranges

An analysis of the data from the last 21 quarters compared to the overall data set continues to demonstrate a seasonal fluctuation in the data without any parameters exceeding OSMRE's threshold criteria.

The SW-108 (HC-4000) monitoring station receives drainage from 1.37 square miles and is located on Hurricane Creek, 4.3 miles upstream from the confluence with Valley Creek and Clear Fork. This point is immediately adjacent to Basin 022, but also lies below Appolo Fuels, Sterling & Strays Surface Mine #1, OSMRE permit 3296, and Basins 7, 8, 9, 10, 11, 12, 14, and 15.

SW-108/R	pH	TDS	Specific Conductance	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/16/2007 - 3/6/2015		(mg/L)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	265.4	370.3	146.4	107.3	12.4	0.5	0.3	1.9
Median	7.9	268.0	371.0	147.0	112.6	10.0	0.5	0.2	1.8
Minimum	7.0	126.0	186.0	30.0	14.0	1.0	0.1	0.0	0.2
Maximum	8.6	414.0	513.0	267.0	165.0	50.0	1.7	0.8	4.0
Count	31	31	31	31	31	31	31	31	31
SW-108/R	pH	TDS	Specific Conductance	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/16/2007 - 12/12/2009		(mg/L)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.85	287.42	375.28	154.75	113.62	12.58	0.45	0.40	2.12
Median	7.85	283.00	369.51	206.00	112.58	12.00	0.48	0.28	2.30
Minimum	7.80	207.00	270.28	30.00	105.18	10.00	0.15	0.06	0.50
Maximum	7.90	375.00	489.64	267.00	120.45	17.00	0.57	0.75	3.10
Count	12	12	12	12	12	12	12	12	12
SW-108/R	pH	TDS	Specific Conductance	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/20/2010 - 3/6/2015		(mg/L)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.79	251.50	367.22	141.18	103.23	12.21	0.61	0.20	1.72
Median	7.90	223.00	371.00	135.40	109.20	9.00	0.58	0.15	1.30
Minimum	7.00	126.00	186.00	64.00	14.00	1.00	0.06	0.01	0.19
Maximum	8.60	414.00	513.00	212.00	165.00	50.00	1.68	0.74	4.00
Count	19	19	19	19	19	19	19	19	19

Table III-8. Summary of Surface Water Parameters at SW-108.

To date, 31 samples have been collected at this point (Tables III-8 and III-9). The data was divided into 3 data ranges. The first range consists of the entire data population from 3/16/2007 to 3/6/2015, the second is from 3/16/2007 to 12/12/2009, and the third is from 3/20/2010 to 3/6/2015. Overall, for the 31 quarters, the water has a circumneutral pH water ranging between 7.0 to 8.6 units.

Range 1: 3/16/2007 to 3/6/2015	
n=31	**7 years, 11 months, 18 days**
Range 2: 3/16/2007 to 12/12/2009	
n=12	**2 years, 8 months, 26 days**
Range 3: 3/20/2010 to 3/6/2015	
n=19	**4 years, 11 months, 14 days**

Table III-9. SW-108 Date Ranges

TDS ranged from 126 to 414 mg/L with a median of 268 mg/L; iron ranged from 0.1 to 1.7 mg/L with a median of 0.5 mg/L, and manganese ranged from 0.0 to 0.8 mg/L with a median of 0.20 mg/L. The median alkalinity is 112.6 mg/L with a sulfate median of 147 mg/L. Flow ranged from 0.2 cfs to 4.0 cfs with a median of 1.8 cfs.

An analysis of the data from the last 19 quarters compared to the overall SW-108 data set, demonstrates only a seasonal fluctuation in the data without any parameters exceeding OSMRE's threshold criteria.

SW-110 is an unnamed tributary to Hurricane Creek and is located 4.0 miles upstream from the confluence with Valley Creek and Clear Fork on Hurricane Creek. It receives drainage from a 0.12 square mile watershed. This point is immediately below Basin 021. As if the date of this CHIA document, 6 samples have been collected at this point. The first 2 out of the 6 sampling events, the tributary was dry. This point is a baseline data collection point. The water maintained a circumneutral pH with no parameters exceeding OSMRE's threshold criteria as shown in Table III-10.

SW-110	Field pH	Specific Conductivity	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
(Statistic)	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.53	397.75	263.67	144.38	59.5	15	0.19	0.06	1.46
Median	7.46	391	216	142.5	57.5	14	0.11	0.06	1.55
Minimum	6.82	252	207	79.5	10	6	0.1	0.02	0.06
Maximum	8.4	557	368	213	113	26	0.46	0.1	2.7
Count	4	4	3	4	4	4	4	4	4

Table III-10. Summary of Surface Water Parameters at SW-110.

The SW-107 (SW-10/R or HC 2400) monitoring station receives drainage from 0.21 square miles and is located on Valley Creek, 4.6 miles upstream from the confluence with Clear Fork. This point lays above all discharges from the proposed 3270 mine. However, it lies below the Appolo Fuels, Sterling & Strays Surface Mine #1, OSMRE permit 3296, Basins 1, and 2. As of the date of this CHIA document 69 samples have been collected at this point. The data set was divided into three data ranges as shown in Tables III-11 and III-12.

The first range consisted of the entire data population from 5/26/2004 to 3/6/2015, the second range was from 5/26/2004 to 12/12/2009, and the third range was from 2/20/2010 to 3/6/2015.

SW-107	Flow (cfs)	Field pH	Specific Conductivity	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total
5/26/2004 - 3/6/2015		(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	0.21	7.80	393.91	337.67	128.95	102.50	9.97	0.56	0.31
Median	0.07	7.80	400.00	342.89	129.00	107.00	10.00	0.52	0.24
Minimum	0.00	7.00	185.00	158.58	14.00	14.00	1.00	0.01	0.01
Maximum	2.00	8.50	654.00	560.62	290.00	165.00	49.00	1.60	1.52
Count	69	69	69	69	69	69	69	69	69
SW-107	Flow (cfs)	Field pH	Specific Conductivity	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total
5/26/2004 - 12/12/2009		(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	0.09	7.80	362.87	311.06	113.77	109.82	9.94	0.46	0.24
Median	0.06	7.80	361.64	310.00	42.00	111.12	10.00	0.41	0.24
Minimum	0.00	7.40	234.48	201.00	14.00	84.75	3.00	0.01	0.01
Maximum	0.50	8.30	459.63	394.00	290.00	121.62	16.00	0.95	0.72
Count	35	35	35	35	35	35	35	35	35
SW-107	Flow (cfs)	Field pH	Specific Conductivity	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total
2/20/2010 - 3/6/2015			(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	0.34	7.80	425.87	365.06	144.58	94.95	10.00	0.66	0.38
Median	0.08	7.90	439.50	376.75	138.60	101.18	8.00	0.63	0.28
Minimum	0.00	7.00	185.00	158.58	55.50	14.00	1.00	0.04	0.01
Maximum	2.00	8.50	654.00	560.62	245.50	165.00	49.00	1.60	1.52
Count	34	34	34	34	34	34	34	34	34

Table III-11. Summary of Surface Water Parameters at SW-107.

Overall, for the 69 quarters, the pH was neutral to slightly alkaline, ranging from 7.0 to 8.5 standard units (S.U.). TDS ranged from 158 to 560 mg/L, with a median of 342 mg/L; iron ranged from 0.01 to 1.6 mg/L with a median of 0.5 mg/L; and manganese ranged from 0.0 to 1.5 mg/L with a median of 0.24 mg/L. The median alkalinity is 107 mg/L with a sulfate median of 129 mg/L. Flow ranges from 0 cfs to 2 cfs with a median of 0.07 cfs. Comparing median data values to OSMRE's threshold criteria, no parameters exceeded the OSMRE threshold criteria.

Range 1: 5/26/2004 to 3/6/2015	
n=31	**10 years, 9 months, 8 days**
Range 2: 5/26/2004 to 12/12/2009	
n=12	**5 years, 6 months, 16 days**
Range: 2/20/2010 to 3/6/2015	
n=19	**5 years, 0 months, 14 days**

Table III.-12. SW-107 Date Ranges

The SW-111 baseline monitoring station receives drainage from a 0.013 square mile watershed and is located on small tributary to Valley Creek, 4.3 miles upstream from the confluence Valley Creek and Clear Fork. There are two samples for this point (Table III-13).

SW-111 Date	Field pH	Specific Conductivity (µS/cm)	TDS (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	TSS (mg/L)	Iron Total, (mg/L)	Manganese Total, (mg/L)	Flow (cfs)
10/25/2012	7.26	564	457	168	131	3.9	0.33	0.22	0.16
12/5/2012	7.53	566	458	190	124	9.0	0.24	0.09	0.27

Table III-13. Summary of Surface Water Parameters at SW-111.

The SW-112 station is baseline monitoring point that receives drainage from 0.034 square miles and is located on small-unnamed tributary to Valley Creek, 4.2 miles upstream from the confluence Valley Creek and Clear Fork. There were two attempts at monitoring this point but on both sample dates the stream was dry.

The SW-113 monitoring station is a baseline point that receives drainage from 0.095 square miles and is located on a small-unnamed tributary to Valley Creek 4.2 miles upstream from the confluence Valley Creek and Clear Fork. There were five baseline samples identified at this point, however, only two samples were collected (Table III-14). On the subsequent three dates, the point was dry.

SW-113 Date	Field pH	Specific Conductivity (µS/cm)	TDS (mg/L)	Sulfate (mg/L)	Alkalinity (mg/L)	TSS (mg/L)	Iron Total (mg/L)	Manganese Total (mg/L)	Flow (cfs)
4/8/2013	8.14	263	212	120	14	29	0.405	0.0502	0.113
6/13/2013	7.81	566	199	72.6	46	23	0.77	<0.10	0.002

Table III-14. Summary of Surface Water Parameters at SW-113.

The SW-106 monitoring station (SW-22R or VC20100) receives drainage from a 0.72 square mile watershed and is located on Valley Creek, 3.9 miles upstream from the confluence Valley Creek and Clear Fork. The data was divided into three data ranges as shown in Tables III-15 and III-16. The first range consists of the entire data population that was sampled from 09/22/1999 to 12/22/2014. The second data range was constructed using the first forty samples collected from 09/22/1999 to 12/05/2009 and the third data range was constructed using the last sixteen samples collected from 3/06/2010 to 12/22/2014.

SW-106	Flow (cfs)	Field pH	Sulfate	Alkalinity	TSS	TDS	Specific Conductivity	Iron Total	Manganese Total
9/22/1999 - 12/22/2014		(units)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	0.59	7.8	111.5	112.83	11.14	371.92	399.06	0.44	0.27
Median	0.3	7.8	77	118.33	10	377	401.2	0.43	0.21
Minimum	0	6.9	17	16	2	174.78	186	0.01	0.02
Maximum	5.21	8.5	288	203.9	90	542.19	632	2.6	1.45
Count	55	56	55	56	56	56	56	56	56
SW-106	Flow (cfs)	Field pH	Sulfate	Alkalinity	TSS	TDS	Specific Conductivity	Iron Total	Manganese Total
9/22/1999 -12/5/2009		(units)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	0.3	7.8	79.65	111.68	12.28	370.66	394.46	0.39	0.27
Median	0.22	7.8	50	118.1	11	389	413.97	0.41	0.21
Minimum	0	7.3	17	16	4	189.81	202	0.01	0.02
Maximum	1.26	8.5	255	185	90	510	542.74	2.6	0.9
Count	39	40	39	40	40	40	40	40	40
SW-106	Flow (cfs)	Field pH	Sulfate	Alkalinity	TSS	TDS	Specific Conductivity	Iron Total	Manganese Total
3/6/2010 - 12/22/2014		(units)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	1.3	7.81	189.14	115.69	8.31	375.07	410.58	0.56	0.28
Median	0.735	7.85	174.6	118.8	8.5	349.04	371.45	0.5	0.21
Minimum	0.01	6.9	105	59.66	2	174.78	186	0.07	0.03
Maximum	5.214	8.4	288	203.9	19	542.19	632	1.97	1.45
Count	16	16	16	16	16	16	16	16	16

Table III-15. Summary of Surface Water Parameters at SW-106.

Overall, for the fifty-five quarters sampled, the water maintained a circumneutral pH, which ranged from 6.9 to 8.5 with a median value of 7.8. The TDS ranged from 174 to 542 mg/L with a median of 377 mg/L; iron ranged from 0.01 to 2.6 mg/L with a median of 0.43 mg/L; and manganese ranged from 0.02 to 1.45 mg/L with a median of 0.21 mg/L. The median alkalinity is 118 mg/L with a sulfate median of 77 mg/L while the flow ranged from 0.00 cfs to 5.21 cfs with a median of 0.3 cfs.

Range 1: 9/22/1999 to 12/22/2014	
n=55	**15 years, 3 months, 0 days**
Range 2: 9/22/1999 to 12/5/2009	
n=39	**10 years, 2 months, 13 days**
Range3 : 3/6/2010 to 12/22/2014	
n=16	**4 years, 9 months, 16 days**

Table III-16. SW-106 Date Ranges

During the last 16 quarters, the mean flow at this point has changed significantly and has increased over 100 percent. This change can be attributed to the mining industry changing their methods for determining flow. In 2009, OSMRE/KFO started requiring industry to provide the actual measured flow with all their monitoring data instead of an estimated flow. After comparing the median data values from all three data ranges to OSMRE's threshold criteria, there were no parameters in the data ranges, which exceeded OSMRE's threshold criteria

The SW-114 monitoring station is a baseline point that receives drainage from a 0.105 square mile watershed. It is located on a small-unnamed tributary to Valley Creek, 3.39 miles upstream from the confluence of Valley Creek and Clear Fork. There were eight baseline samples identified for this point; however, only six samples were collected (Table III-17). SW-114 was dry on 10/25/2012 and 12/5/2015.

SW-114	pH	Specific Conductivity	TDS	Sulfate	Alkalinity Total	TSS	Iron Total	Manganese Total	Flow
2/27/2013	10/24/2013	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.72	852	686.17	444.83	138.67	14.83	0.32	0.25	0.1
Median	7.72	846.5	682	418.75	154	14	0.2	0.25	0.01
Minimum	7.41	702	565	320	93	5	0.1	0.01	0.01
Maximum	8.13	1055	848	646	171	28	0.7	0.54	0.4
Count	6	6	6	6	6	6	6	6	6

Table III-17. Summary of Surface Water Parameters at SW-114.

For these six samples the water maintained an alkaline pH ranging from 7.41 to 8.13 with a median of 7.72. The TDS ranged from 565 to 848 mg/L with a median of 846 mg/L; iron ranged from 0.1 to 0.7 mg/L with a median of 0.2 mg/L; and manganese ranged from 0.01 to 054 mg/L with a median of 0.25 mg/L. The median alkalinity is 154 mg/L with a sulfate median of 418 mg/L. Flow ranged from 0.01 cfs to 0.4 cfs with a median of 0.01 cfs.

Once the median data values were compared to OSMRE's threshold criteria, both TDS and sulfate exceeded OSMRE's threshold criteria. This point is located at an elevation of 1785 ft AMSL, approximately 370 feet above Valley Creek.

The SW-115 monitoring station is a baseline point that receives drainage from 0.105 square miles. It is located on a small-unnamed tributary to Valley Creek, 3.39 miles upstream from the confluence of Valley Creek with Clear Fork. Eight baseline samples were identified for this point; however, only six samples (Table III-18) were collected due to the point being dry on 10/25/2012 and 12/5/2015. Additionally, the applicant performed a full suite analysis for this site.

SW-115	pH	TDS	Specific Conductivity	TSS	Iron Total	Manganese Total	Sulfate	Alkalinity	Flow
4/8/2013	10/24/2013	(mg/L)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.76	284.83	352	11.33	0.41	0.42	89.57	88.67	0.13
Median	7.7	290	358	11.5	0.42	0.41	86.25	84.5	0.02
Minimum	7.49	191	236	6	0.1	0.07	57.8	45	0
Maximum	8.01	377	468	16	0.76	1.03	139	140	0.4
Count	6	6	6	6	6	6	6	6	6

Table III-18. Summary of Surface Water Parameters at SW-115.

Overall, for the six samples, the pH was alkaline and ranged from 7.49 to 8.01. TDS ranged from 191 to 377 mg/L with a median of 290 mg/L. Iron ranged from 0.1 to 0.76 mg/L with a median of 0.42 mg/L. Manganese ranged from 0.07 to 1.03 mg/L with a median of 0.41mg/L. The median alkalinity is 84 mg/L with a sulfate median of 86 mg/L. Flow ranged from 0.00 cfs to 0.4 cfs with a median of 0.02 cfs. Lastly, after comparing median data values to OSMRE's threshold criteria, no parameters exceeded OSMRE's threshold criteria. This point is located at an elevation of 1785 ft. AMSL, approximately 370 feet above Valley Creek.

The SW-116 monitoring station is a baseline point that receives drainage from 0.15 square miles. It is located on a small-unnamed tributary to Valley Creek, 0.2 miles upstream from the confluence Valley Creek and Clear Fork. There were eight baseline samples identified for this point, however, only three samples were collected, as shown in Table III-19, with the remainder found dry.

Overall, for these three samples, the water is alkaline with a pH ranging from 8.16 to 8.31 S.U. The TDS ranged from 227 to 357 mg/L. The iron ranged from 0.23 to 0.30 mg/L with manganese measuring less than 0.1 mg/L for all samples. The alkalinity is 99 mg/L with a sulfate median of 65 mg/L. Flow ranges from 0.00 cfs to 0.53 cfs and was dry the majority of the time. Lastly, by comparing the median data values to OSMRE's threshold criteria, no

parameters were found exceeding OSMRE's threshold criteria. This point is located at an elevation of 1800 ft. AMSL and is approximately 650 feet above Valley Creek.

SW-116	pH	TDS	Specific Conductivity	TSS	Iron Total	Manganese Total	Sulfate	Alkalinity	Flow
Date	(units)	(mg/L)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
10/25/2012	Dry								
12/5/2012	Dry								
2/27/2013	Dry								
4/8/2013	8.29	227	280	28	0.306	<0.0500	63.9	62	0.53
6/13/2013	Dry								
8/29/2013	8.31	357	441	22	0.28	<0.10	92.5	145	0.0044
9/26/2013	Dry								
10/24/2013	8.16	238	303	11	0.23	<0.10	65.2	99	0.0017

Table lll-19. Summary of Surface Water Parameters at SW-116

The SW-103 monitoring station is located on Valley Creek, 1.68 miles upstream from the confluence with Clear Fork and receives drainage in a 5.36 square mile watershed. It is 1436 feet downstream of the confluence with Bear Creek. As of the date of this CHIA document 78 samples have been collected at this location (Table III-20). The dataset was divided into three data ranges (Table III-21). The first range consists of the entire data population from 12/15/1999 to 5/13/2015, the second data range was constructed using the first fifty-one samples collected from 12/15/1999 to 11/14/2009, and the third data range was constructed using the last twenty-seven samples collected from 2/13/2010 to 5/13/2015. Overall, for the 78 samples, the water is alkaline and the pH ranged from 7.10 to 8.7. TDS ranged from 135 to 506 mg/L with a median of 320 mg/L. Iron ranged from 0.01 to 2.56 mg/L with a median of 0.39 mg/L. Manganese ranged from 0.01 to 1.86 mg/L with a median of 0.28 mg/L. The median alkalinity is 112 mg/L with a sulfate median of 71 mg/L. Flow ranged from 0.06 cfs to 75 cfs with a median of 0.8 cfs. However, over the last 27 quarters, the mean flow at this point has increased by 900 percent over the first 51 quarters. This change can be attributed to industry changing their methods for determining flow. In 2009, OSMRE/KFO started requiring industry to provide the actual measured flow with all monitoring data instead of an estimated flow. No parameters exceeded the OSMRE's threshold after comparing the median data values to OSMRE's threshold criteria.

SW-103	pH	Specific Conductance	TDS	TSS	Sulfate	Alkalinity	Iron Total	Manganese Total	Flow
12/15/1999	5/13/2015	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.78	453.94	327.26	10.51	109.59	111.05	0.48	0.32	3.34
Median	7.8	440	320.09	10	71	112.11	0.39	0.28	0.8
Minimum	7.1	186	135.31	1	23	18	0.01	0.01	0.06
Maximum	8.7	696	506.32	42	296	176	2.56	1.86	75
Count	78	78	78	78	78	78	78	78	78
SW-103	pH	Specific Conductance	TDS	TSS	Sulfate	Alkalinity	Iron Total	Manganese	Flow
12/15/1999	11/14/2009	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.77	437.9	318.56	10.71	79.68	111.33	0.36	0.34	2.26
Median	7.8	434.38	316	11	52	112.15	0.14	0.36	0.45
Minimum	7.1	202	146.95	4	23	46	0.01	0.01	0.06
Maximum	8.3	685.94	499	20	260	176	0.94	0.75	75
Count	51	51	51	51	51	51	51	51	51
SW-103	pH	Specific Conductance	TDS	TSS	Sulfate	Alkalinity	Iron Total	Manganese	Flow
2/13/2010	5/13/2015	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.8	484.25	343.71	10.15	166.09	110.53	0.71	0.29	5.38
Median	8	485	373.92	8	157	110.97	0.65	0.26	4.3
Minimum	7.1	186	135.31	1	40.1	18	0.15	0.01	0.99
Maximum	8.7	696	506.32	42	296	174	2.56	1.86	11.86
Count	27	27	27	27	27	27	27	27	27

Table III-20. Summary of Surface Water Parameters at SW-103.

Range 1:12/15/1999 to 5/13/2015	
n=78	**15 years, 4 months, 28 days**
Range 2: 12/15/1999 to 11/14/2009	
n=51	**9 years, 10 months, 30 days**
Range 3 : 2/13/2010 to 5/13/2015	
n=27	**5 years, 3 months, 0 days**

Table III-21. SW-103 Date Ranges

SW-4 (CF4)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/25/2003 - 4/2/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.67	486.04	340.95	160.37	112.06	10.38	0.71	0.4	4.49
Median	7.7	466.89	319.98	141.55	111.4	11	0.53	0.29	1.56
Minimum	6.8	246	151	9	26.92	1	0.05	0	0.01
Maximum	8.6	1100	663	1440	297	23	6.95	1.64	22.08
Count	64	64	64	64	64	64	64	64	64
SW-4 (CF4)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/25/2003 - 12/5/2009		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.57	465.98	333.49	105.26	114.56	11	0.54	0.38	1.19
Median	7.6	432.68	308	66	114.86	11	0.47	0.28	1.2
Minimum	6.8	309.05	220	9	90.76	7	0.05	0.01	0.5
Maximum	7.9	709.42	505	290	132	15	0.94	0.87	2.2
Count	35	35	35	35	35	35	35	35	35
SW-4 (CF4)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
2/20/2010 - 4/2/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.78	510.24	349.96	226.89	109.05	9.64	0.91	0.42	8.47
Median	7.8	490	338	178	101.87	10	0.56	0.3	6
Minimum	6.9	246	151	82	26.92	1	0.08	0	0.01
Maximum	8.6	1100	663	1440	297	23	6.95	1.64	22.08
Count	29	29	29	29	29	29	29	29	29

Table III-22. Summary of Surface Water Parameters at SW-4(CF-4).

The SW-4 (CF4) monitoring station is located on Clear Fork Creek, 2.1 miles upstream from the confluence with Valley Creek and receives drainage from a 9.36 square mile watershed within Kentucky. To date, sixty-four samples have been collected at this point (Table III-22). The data was divided into three data ranges (Table III-23). The first range consisted of the entire data population from 3/25/2003 to 4/2/2015, the second data range was constructed using the first thirty-five samples collected from 3/25/2003 to 12/5/2009, and third data range was constructed using the last twenty-nine samples collected from 2/20/2010 to 4/2/2015.

Range 1: 3/25/2003 to 4/2/2015	
n=64	**12 years, 0 months, 8 days**
Range 2: 3/25/2003 to 12/5/2009	
n=35	**6 years, 8 months, 10 days**
Range 3: 2/20/2010 to 4/2/2015	
n=29	**5 years, 1 months, 13 days**

Table III-23. SW-4 Date Ranges

Overall, for the sixty-four quarters, the water maintained a circumneutral pH to slightly alkaline that ranged from 6.8 to 8.6 S.U. TDS ranged from 151 to 663 mg/L with a median of 319 mg/L; iron ranged from 0.05 to 6.95 mg/L with a median of 0.53 mg/L; and manganese ranged from 0 to 1.64 mg/L with a median of 0.29 mg/L. The median alkalinity is 111 mg/L with a sulfate

median of 141 mg/L. Flow ranged from 0.01 cfs to 22.00 cfs with a median of 1.56 cfs. However, over the last twenty-seven quarters the mean flow has change significantly. It has increased by a magnitude of five over the first thirty-five quarters. This change could be attributed to industry changing their methods for when determining flow. In 2009, OSMRE/KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. Lastly, after comparing the median data values with OSMRE's threshold criteria, no parameters exceeded the OSMRE threshold criteria.

The SW-100 (CF1) monitoring station is located on Clear Fork Creek, 0.06 miles upstream from the confluence with Valley Creek and receives drainage from a 13.83 square mile watershed located in both Tennessee and Kentucky. As of the date of this CHIA document sixty-seven samples have been collected at this point (Table III-24). The data was divided into three data ranges. The first range consisted of the entire data population from 12/15/1999 to 6/25/2015, the second data range was constructed using the first thirty-five samples collected from 12/15/1999 to 12/5/2009, and the third data range was constructed using the last twenty-eight samples collected from 3/6/2010 to 6/25/2015 (Figure III-25).

Overall, for the 67 samples, the water maintained a neutral pH to slightly alkaline ranging from 7.0 to 8.6 with a median value of 7.7. The TDS ranged from 160 to 630 mg/L with a median of 359 mg/L; iron ranged from 0.01 to 1.7 mg/L with a median of 0.29 mg/L; and manganese ranged from 0.03 to 1.3 mg/L with a median of 0.29 mg/L. The median alkalinity is 112 mg/L with a sulfate median of 110 mg/L. Flow ranges from 0.01 cfs to 21.6 cfs with a median of 0.9 cfs. However, in the last 28 samples, the median flow at this point has change significantly. The reported flow has increased approximately 18 times the flow reported during the first 39 quarters. This change may be attributed to industry changing their methods for determining flow.

In 2009, OSMRE/KFO started requiring industry to provide the actual measured flow along with all monitoring data instead of an estimated flow. Lastly, by comparing the median data values with OSMRE's threshold criteria, it was found that no parameters exceeded the OSMRE's threshold criteria.

SW-100	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.78	443.75	373.34	117.71	111.25	12.42	0.43	0.39	3.69
Median	7.71	436.25	359	110	112.1	11	0.29	0.29	0.9
Mode	7.7	397.21	346	29	112.1	14	0.05	0.12	0.1
Minimum	7	221	160	22	40	1	0.01	0.03	0.1
Maximum	8.6	723.25	630	360	206	123	1.7	1.3	21.6
Count	67	67	67	67	67	67	67	67	67
SW-100	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 12/5/2009		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.78	438.96	382.36	89.98	105.07	10.64	0.33	0.45	0.54
Median	7.7	412.14	359	64.6	110.77	11	0.29	0.43	0.45
Mode	7.7	470	409.4	29	112.1	12	0.05	0.12	0.45
Minimum	7.1	268	233.45	22	40	4	0.01	0.06	0.1
Maximum	8.4	723.25	630	290	206	20	0.93	1.08	1.8
Count	39	39	39	39	39	39	39	39	39
SW-100	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/6/2010 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.77	450.42	360.77	156.35	119.86	14.89	0.58	0.29	8.08
Median	7.8	490	371.5	151	118.18	10	0.41	0.22	8.12
Mode	8	546	440	115	114	10	0.25	0.4	3
Minimum	7	221	160	25.5	56.3	1	0.03	0.03	0.1
Maximum	8.6	617	530.48	360	191.7	123	1.7	1.3	21.6
Count	28	28	28	28	28	28	28	28	28

Table III-24. Summary of Surface Water Parameters at SW-100(CF1).

The SW-101 monitoring station (VC025) is located on Valley Creek, 0.02 miles upstream from the confluence with Clear Fork and receives drainage from a 8.89 square mile watershed. To date, eighty-four samples have been collected as this point (Table III-26). The data was divided into three data ranges. The first range consists of the entire data population from 12/15/1999 to 6/25/2015, the second data range was constructed using the first fifty-five samples collected from 12/15/1999 to 12/5/2009, and the third data range was constructed using the last twenty-nine samples collected from 2/13/2010 to 6/19/2015 (Table III-27).

Range 1: 12/15/1999 to 6/25/2015	
n=67	**15 years, 6 months, 10 days**
Range 2: 12/15/1999 to 12/5/2009	
n=39	**9 years, 11 months, 20 days**
Range 3: 3/6/2010 to 6/25/2015	
n=28	**5 years, 3 months, 19 days**

Table III-25. SW-100 Date Ranges

SW-101	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 6/19/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.79	432.77	349.46	130.47	114.12	13.81	0.74	0.39	2.51
Median	7.8	436.79	353.29	105.15	115.35	12	0.82	0.31	1.05
Minimum	7	202	166.57	22	5.1	1	0.01	0	0
Maximum	8.6	637	525.27	390	171	160	1.75	1.8	12.12
Count	84	84	84	82	84	84	84	84	84
SW-101	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 11/14/2009		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	101.21	335.79	7.8	112.71	10.84	0.79	0.41		0.88
Median	7.8	417.17	344	60	114.06	12	0.9	0.37	1
Minimum	7.1	202	166.57	22	58	2	0.01	0	0.08
Maximum	8.4	600	494.76	366	162	17	1.75	1.01	2.3
Count	55	55	55	53	55	55	55	55	55
SW-101	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
2/13/2010 - 6/19/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.77	481.24	375.4	183.96	116.78	19.64	0.67	0.35	5.6
Median	7.8	489	377.67	154	117.7	11.5	0.73	0.2	6
Minimum	7	234.05	193	37.1	5.1	1	0.1	0.01	0
Maximum	8.6	637	525.27	390	171	160	1.35	1.8	12.12
Count	29	29	29	29	29	28	29	29	29

Table III-26. Summary of Surface Water Parameters at SW-101(VC025).

Overall, for the eighty-four samples, the pH is neutral to slightly alkaline, ranging between 7.0 to 8.6. The TDS ranged from 166 to 525 mg/L with a median of 353 mg/L. Iron ranged from 0.01 to 1.75 mg/L with a median of 0.82 mg/L. Manganese ranged from 0.0 to 1.80 mg/L with a median of 0.31 mg/L. The median alkalinity is 115 mg/L with a sulfate median of 105 mg/L. Flow ranges from 0 cfs to 12.12 cfs with a median of 1.05 cfs. However, over the last twenty-nine samples, the median flow at this point has change significantly and has increased by a magnitude of six times the baseline condition. This change can be attributed to the industry changing methods for determining flow.

Range 1; 12/15/1999 to 6/25/2015	
n=84	**15 years, 6 months, 10 days**
Range 2: 12/15/1999 to 11/14/2009	
n=55	**9 years, 10 months, 30 days**
Range 3: 2/13/2010 to 6/19/2015	
n=29	**5 years, 4 months, 6 days**

Table III-27. SW-101 Date Ranges

In 2009, OSMRE/KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. Lastly, in comparing the median data values for SW-101 to OSMRE's threshold criteria, no parameters exceeded the OSMRE thresholds.

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The SW-102 (VC6000) monitoring station is located on Valley Creek, 0.5 miles upstream from the confluence with Clear Fork and receives drainage from an 8.25 square mile watershed. To the date of this CHIA document, 46 samples have been collected at this point (Table III-28). The data is divided into three data ranges. The first range consists of the entire data population from 4/17/1997 to 6/25/2015, the second data range is constructed using the first fifty-five samples collected from 4/17/1999 to 10/30/2007, and the third data range is constructed using the last twenty-nine samples collected from 2/15/2010 to 6/25/2015 (Table III-29).

SW-102	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
4/17/1997 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.92	507.74	388.68	123.08	121.2	14.15	0.53	0.29	7.59
Median	7.94	486.5	376.74	112.95	115.15	12	0.6	0.24	1
Minimum	7.4	368.83	180	29	65.04	4	0.01	0.01	0.04
Maximum	8.7	791	566	293	263	99	2.5	0.92	125
Count	46	46	46	46	46	46	46	46	46
SW-102	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
4/17/1997 - 10/30/2007		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.96	534.71	399.78	73	123.94	10.17	0.36	0.24	6.59
Median	8	494.3	366	51	119.75	11	0.3	0.14	0.8
Minimum	7.4	395.44	180	29	69	4	0.01	0.01	0.2
Maximum	8.7	791	566	190	218	19	0.99	0.92	32
Count	23	23	23	23	23	23	23	23	23
SW-102	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
2/15/2008 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.88	480.78	377.57	173.17	118.45	18.13	0.71	0.34	8.59
Median	7.9	483	381.08	189	114.1	14	0.69	0.34	1.52
Minimum	7.4	368.83	291	35	65.04	4	0.03	0.02	0.04
Maximum	8.6	620	489.17	293	263	99	2.5	0.68	125
Count	23	23	23	23	23	23	23	23	23

Table III-28. Summary of Surface Water Parameters at SW-102(VC6000)

Overall, for the forty-six samples collected at SW-102, the pH is neutral to slightly alkaline, ranging between 7.4 and 8.7 with a median value of 7.9. The TDS ranged from 180 to 566 mg/L with a median of 376 mg/L. Iron ranged from 0.01 to 2.50 mg/L with a median of 0.6 mg/L. Manganese ranged from 0.01 mg/L to 0.92 mg/L with a median of 0.24 mg/L. The median alkalinity is 115 mg/L with a sulfate median of 112 mg/L. Flow ranged from 0.04 cfs to 125 cfs with a median of 1.00 cfs. Within the last twenty-nine samples, the median flow at this point changed significantly and increased by a magnitude of two times baseline condition. This change may be attributed to industry changing their methods for determining flow. In 2009, OSMRE-KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. After comparing the median data values for SW-102 to OSMRE's threshold criteria, no parameters exceeded OSMRE's threshold.

Range 1: 4/17/1997 to 6/25/2015	
n=46	**18 years, 2 months, 8 days**
Range: 2: 4/17/1997 to 10/30/2007	
n=23	**10 years, 6 months, 13 days**
Range 2: 2/15/2008 to 6/25/2015	
n=23	**7 years, 4 months, 10 days**

Table III-29. SW-102 Date Ranges

The CF-2 monitoring station is located on Clear Fork Creek, 0.07 miles downstream from the confluence with Valley Creek and receives drainage from a 23.02 square mile watershed. To date, sixty-two samples have been collected at this point (Table III-30). The data was divided into three data ranges (Table III-31). The first range consists of the entire data population from 12/15/1999 to 6/25/2015, the second data range was constructed using the first thirty-seven samples collected from 12/15/1999 to 10/24/2008, and the third data range was constructed using the last twenty-five samples collected from 1/17/2009 to 25/2015.

Overall, for the sixty-two samples, the pH was neutral to slightly alkaline and ranged between 7.0 to 8.6. The TDS ranged between 148 to 628 mg/L with a median of 358 mg/L. Iron ranged from 0.02 to 2.76 mg/L with a median of 0.26 mg/L. Manganese ranged from 0.02 to 1.68 mg/L with a median of 0.43 mg/L. The median alkalinity is 112 mg/L with a sulfate median of 77 mg/L. Flow ranged from 0.25 cfs to 26.40 cfs with a median of 1.25 cfs. However, in the last twenty-five samples, the median flow at this point has change significantly; and has increased by a magnitude of six times baseline condition. This change can be due to industry changing their methods for when determining flow. In 2009, OSMRE/KFO started requiring industry to provide the actual measured flow with all monitoring data instead of an estimated flow. After

comparing the median data values against OSMRE's threshold criteria, it was found that no parameters exceeded OSMRE's thresholds.

CF-2	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.84	445.03	357.28	120.04	115.65	10.42	0.38	0.42	3.27
Median	7.8	461.12	358	77.35	112.1	11	0.26	0.43	1.25
Minimum	7	169	148	18.2	44	1	0.02	0.02	0.25
Maximum	8.6	750	628	290	378	24	2.76	1.68	26.4
Count	62	62	62	62	62	62	62	62	62
CF-2	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
12/15/1999 - 10/24/2008		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.93	446.39	342.21	75.73	116.26	11.14	0.24	0.43	1.05
Median	7.9	463.08	355	55.3	110.75	12	0.21	0.49	0.9
Minimum	7.4	241	184.75	20	44	2	0.02	0.06	0.25
Maximum	8.3	750	574.96	266	378	24	0.74	0.9	2.8
Count	37	37	37	37	37	37	37	37	37
CF-2	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
1/17/2009 - 6/25/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.71	380.53	443.02	185.63	114.74	9.36	0.6	0.4	6.55
Median	7.7	372	448.73	198	115.25	10	0.5	0.39	5.4
Minimum	7	148	169	18.2	75.8	1	0.08	0.02	1.2
Maximum	8.6	628	628	290	188.6	22	2.76	1.68	26.4
Count	25	25	25	25	25	25	25	25	25

Table III-30. Summary of Surface Water Parameters at CF-2

Range 1: 12/15/1999 to 6/25/2015	
n=62	**15 years, 6 months, 10 days**
Range 2: 12/15/1999 to 10/24/2008	
n=37	**8 years, 10 months, 9 days**
Range 3: 1/17/2009 to 6/25/2015	
n=25	**6 years, 5 months, 2 days**

Table III-31. CF-2 Date Ranges

The SW-25 monitoring point is located on Clear Fork Creek, 0.87 miles downstream from the confluence with Valley Creek and receives drainage from a 27.9 square mile watershed. To date, seventy-four samples have been collected at this point (Table III-32). The data was divided into three data ranges (Table III-33). The first range consists of the entire data population from 9/14/1999 to 3/19/2015, the second data range was constructed using the first thirty-seven samples collected from 9/14/1999 to 12/2/2009, and the third data range was constructed using the last thirty-one samples collected from 1/15/2010 to 3/19/2015.

SW-25	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
9/14/1999 - 3/19/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.65	521.46	412.46	13.49	156.67	103.27	0.54	0.19	9.96
Median	7.75	517.5	406.21	7	176.5	97.5	0.28	0.14	1.5
Minimum	6.71	194	153.14	2	10	23	0.04	0.01	0.02
Maximum	8.62	1040	820.95	206	476	437	4.52	1.04	92
Count	74	74	74	74	73	74	74	74	73
SW-25	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
9/14/1999 - 12/2/2009		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.53	502.91	397.02	9.65	142.78	94.02	0.44	0.22	8.65
Median	7.53	466	373	7	132	91	0.3	0.15	0.99
Minimum	6.71	194	153.14	2	10	23	0.04	0.01	0.02
Maximum	8.46	1040	820.95	35	476	242	1.96	1.04	90.66
Count	43	43	43	43	42	43	43	43	42
SW-25	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
1/15/2010 - 3/19/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.81	547.19	433.87	18.81	175.49	116.1	0.68	0.15	11.75
Median	7.83	552	436	7	188	108	0.26	0.13	3.75
Minimum	6.79	277	218.66	3	52	40	0.1	0.04	0.12
Maximum	8.62	989	780.69	206	322	437	4.52	0.36	92
Count	31	31	31	31	31	31	31	31	31

Table III-32. Summary of Surface Water Parameters at SW-25

Overall, for the seventy-four samples, the pH is circumneutral to slightly alkaline, ranging from 6.71 to 8.62 with a median value of 7.75. The TDS ranged from 153 to 820 mg/L with a median of 406 mg/L. Iron ranged from 0.04 to 4.52 mg/L with a median of 0.28 mg/L. Manganese ranged from 0.02 to 1.68 mg/L with a median of 1.04 mg/L. The median alkalinity is 97 mg/L with a sulfate median of 176 mg/L. Flow ranges from 6.71 cfs to 8.62 cfs with a median of 7.53 cfs. However, over the last thirty-one samples, the median flow at

this point has not change significantly based on the historic data. Lastly, in comparing the median data values to OSMRE's threshold criteria, no parameters exceeded OSMRE's threshold criteria.

Range 1: 9/14/1999 to 3/19/2015	
N=74	**15 years, 6 months, 5 days**
Range 2: 9/14/1999 to 12/2/2009	
N=43	**10 years, 2 months, 18 days**
Range 3: 1/15/2010 to 3/19/2015	
N=31	**5 years, 2 months, 4 days**

Table III-33. SW-25 Date Ranges

The SW-21 monitoring station is located on Straight Creek just below the confluence of an unnamed tributary 3.7 miles upstream from the confluences of Straight Creek and Clear Fork. This point receives the drainage from the headwaters of Straight Creek, which is a 3.8 square mile watershed. This site is also immediately below the confluence of Straight Creek and GW-SC2, a high TDS contributor within Straight Creek.

SW-21	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
8/2/1989 - 3/18/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	561.25	333.32	143.29	122.07	10.7	0.75	0.25	4.49
Median	7.75	558.71	327.58	81	114.35	8	0.31	0.17	1.08
Minimum	6.81	70	41	10	14.1	1	0.01	0.01	0.01
Maximum	8.7	1130	850	557.5	319.2	160	55.1	2.5	75
Count	160	160	160	160	160	160	160	160	160
SW-21	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
8/2/1989 - 12/8/2008		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.65	489.18	286.13	95.34	106.16	9.48	0.86	0.26	5.07
Median	7.7	511.83	297.5	60.5	110.17	7.5	0.31	0.18	0.9
Minimum	6.81	70	41	10	22	1	0.01	0.01	0.01
Maximum	8.51	1130	662.55	557.5	319.2	54	55.1	1.59	75
Count	108	108	108	108	108	108	108	108	108
SW-21	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
1/26/2009 - 3/18/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.82	710.92	431.32	242.88	155.12	13.23	0.51	0.21	3.26
Median	7.92	766	449.12	256.5	168	9	0.31	0.14	1.32
Minimum	6.85	152	145	60.5	14.1	1	0.08	0.02	0.2
Maximum	8.7	1122	850	450	245	160	4.28	2.5	61.88
Count	52	52	52	52	52	52	52	52	52

Table III-34. Summary of Surface Water Parameters at SW-21.

This monitoring location has been in use since August 1989 and is only a baseline point for this application. As of the date of this CHIA document, 160 samples have been collected at

this point (Table III-34). The data was divided into three data ranges (Table III-35). The first range consisted of the entire data population from 8/2/1989 to 3/18/2015, the second data range was constructed using the first one hundred and eight samples collected from 8/2/1989 to 12/8/2008, and the third data range was constructed using the last fifty-two samples collected from 1/26/2009 to 3/18/2015. Overall, for the one hundred and sixty quarters, the pH was circumneutral to alkaline, ranging from 6.8 to 8.7 with a median value of 7.7. The TDS ranged from 41 to 850 mg/L with a median of 327 mg/L. The iron and manganese concentrations are consistently below 0.5 mg/L. The median alkalinity is 114 mg/L with a sulfate median of 81 mg/L. Flow ranged from 0.01 cfs to 75 cfs with a median of 1.08 cfs. The overall water quality data at this point indicates a moderately buffered stream with only slight impacts from mining. The major impact at this point is occurring from the discharges from GS-SC2 (an underground mine) which causes elevated TDS while sulfate values remain low within the stream. However, by splitting the data into parts provides a clearer picture of the hydrologic reclamation success over the previous four to five years. The first one hundred and eight data points were compared to the last fifty-two points sampled and it appears that the TDS, specific conductance, and alkalinity have increased approximately 34 percent over the last twenty-four years. However, sulfate has increased by 76.4 percent during the same period to over 250 mg/L. Nevertheless, while comparing the remaining median data values to OSMRE's threshold criteria, no other parameters exceeded the OSMRE's thresholds. There is no mining planned in this watershed.

Range 1: 8/2/1989 to 3/18/2015	
N=160	**25 years, 7 months, 16 days**
Range 1: 8/2/1989 to 12/8/2008	
N=108	**19 years, 4 months, 6 days**
Range 1: 1/26/2009 to 3/18/2015	
N=52	**6 years, 1 months, 20 days**

Date Ranges

The SW-11 monitoring station receives drainage from a 0.34 square mile watershed and is located on a tributary to Straight Creek, 2.8 miles upstream from the confluence with Clear Fork.

This site serves only as a baseline surface water monitoring point for this permit application. As of the date of this CHIA document, fifty-one samples have been collected at this site (Table III-36). The data was divided into three data ranges for the analysis (Table III-37). The first data range consists of the total data population collected from 4/26/1985 to 9/13/2013, the second data range was constructed using the first twenty-eight samples collected from 4/26/1996 to 6/12/2003, and the third data range was constructed using the last twenty-three samples collected from 3/5/2008 to 9/13/2013.

SW-11	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
4/26/1985 - 9/13/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	458.49	245.16	151.32	44.69	14.7	0.76	0.48	0.75
Median	7.36	408.07	174.25	76.3	37	7	0.35	0.31	0.18
Minimum	4.5	30.96	11	20	0	1	0.08	0.02	0.01
Maximum	8.4	1160	625.61	600	118	191	8.95	3	5
Count	51	51	51	51	51	50	51	51	51
SW-11	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
4/26/1985 - 6/12/2003		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	402.46	146.17	96.65	46.78	7.15	0.34	0.48	1.14
Median	6.8	331.82	117.91	62.6	30.5	6	0.29	0.27	0.58
Minimum	4.5	30.96	11	20	0	1	0.1	0.02	0.01
Maximum	8.1	1160	412.18	600	118	18	1	3	5
Count	28	28	28	28	28	27	28	28	28
SW-11	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/5/2008 - 9/13/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	526.7	365.67	217.87	42.13	23.57	1.27	0.48	0.27
Median	7.8	525	367.39	225	43	7	0.51	0.43	0.09
Minimum	6.64	194	68.93	36.7	21	3	0.08	0.06	0.01
Maximum	8.4	894	625.61	375	63	191	8.95	1.18	2.19
Count	23	23	23	23	23	23	23	23	23

Table III-36. Summary of Surface Water Parameters at SW-11.

Overall, for these fifty-one data points, the surface water pH ranged from 4.5 to 8.4 with a median value of 7.36. The TDS ranged from 11 to 625 mg/L with a median of 174 mg/L. Iron ranged from 0.08 to 8.95 mg/L with a median of 0.35 mg/L. Manganese ranged from

0.02 to 3.00 mg/L with a median of 0.31 mg/L. The median alkalinity is 37 mg/L 9 with a sulfate median of 76 mg/L. Flow ranges from 0.01 cfs to 5.0 cfs with a median of 0.18 cfs. However, the first five data points of the second data range (early 1985) indicated the stream was acidic, where the acidity was greater than the alkalinity. The water quality improved over the next twenty-three data points once remining operations started. When comparing the first twenty-eight data points to the last twenty-three data points, it is seen that TDS increased by 69 percent, specific conductance increased by 37 percent, and alkalinity increased by 31 percent, iron increased by 32 percent, and manganese increased by 37 percent during those twenty-four years. Sulfate, however, increased by 76.4 percent during the same period to over 250 mg/L.

Range 1: 4/26/1985 to 9/13/2013	
n=51	**28 years, 4 months, 18 days**
Range 1: 4/26/1985 to 6/12/2003	
n=28	**18 years, 1 months, 17 days**
Range1: 3/5/2008 to 9/13/2013	
n=23	**5 years, 6 months, 8 days**

Table III-37. SW-11 Date Ranges

The last twenty-three data points indicated that the median flow at this site has decreased by 97 percent. More than likely, the flow reduction was caused by an increase in water retention on the previously reclaimed mines, recently reclaimed mines, and the creation of new wetlands within the watershed. The flow reduction may be the primary cause of the increasing concentrations found in the third data set. In 2009, OSMRE/ KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. By comparing the median data values to OSMRE's threshold criteria, it was found that only sulfate exceeded the OSMRE's threshold criteria of 250 mg/L and no other parameters exceeded their thresholds.

The SW-20 monitoring point lies on Straight Creek 1.5 miles upstream from Clear Fork and immediately above the confluence of Rock Creek. The station receives drainage from 6.49 square miles. This site serves as a baseline surface water monitoring point for this permit application. To date, 50 samples have been collected at this site (Table III-38). The data was divided into three data ranges for this analysis (Table III-39). The first data range consists of the total data population collected from 7/26/1999 to 3/18/2015, the second data range was constructed using the first twenty-eight samples collected from 4/26/1996 to 6/12/2003, and the third data range was constructed using the last twenty-three samples collected from 3/5/2008 to 9/13/2013.

Overall, for these fifty data points, the pH was circumneutral and ranged from 6.56 to 8.50 with a median value of 7.8. TDS ranged from 125 to 998 mg/L with a median of 524 mg/L. Iron ranged from 0.03 to 5.62 mg/L with a median of 0.26 mg/L. Manganese ranged from 0.01 to 0.94 mg/L with a median of 0.16 mg/L.

SW-20	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
7/26/1999 - 3/18/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.81	568.95	515.98	178.03	113.35	21.86	0.66	0.18	3.13
Median	7.89	578	524.19	192	120	10	0.26	0.16	1.08
Minimum	6.56	138	125.15	11	20	3	0.03	0.01	0.01
Maximum	8.5	1090	988.52	450	213	184	5.62	0.94	21.33
Count	50	50	50	50	50	50	50	50	50
SW-20	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
7/26/1999 - 9/15/2008		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.73	462.21	419.18	121.39	93.5	15.56	0.46	0.17	2.73
Median	7.78	400	362.76	70.25	100	10	0.28	0.14	0.56
Minimum	6.56	138	125.15	11	22	3	0.03	0.01	0.01
Maximum	8.5	938	850.67	303	175	60	3.25	0.94	21.33
Count	25	25	25	25	25	25	25	25	25
SW-20	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
2/24/2009 - 3/18/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.89	675.68	612.77	234.66	133.2	28.16	0.86	0.19	3.54
Median	8.08	693	628.48	245	141	10	0.19	0.18	2.8
Minimum	6.88	323	292.93	61.2	20	3	0.1	0.05	0.39
Maximum	8.43	1090	988.52	450	213	184	5.62	0.38	10.83
Count	25	25	25	25	25	25	25	25	25

Table III-38. Summary of Surface Water Parameters at SW-20.

The median alkalinity is 120 mg/L with a sulfate median of 192 mg/L. Flow ranged from 0.01 cfs to 21.33 cfs with a median of 1.08 cfs. But, by comparing the first twenty-five data points to the last twenty-five data points, it is seen that both TDS and specific conductance increased by 42 percent, alkalinity increased by 29 percent, iron decreased by 47 percent. However, both manganese and sulfate increased by 22 percent and 71 percent over the last 15.5 years.

Range 1: 7/26/1999 to 3/18/2015	
n=50	**15 years, 7 months, 20 days**
Range 2: 7/26/1999 to 9/15/2008	
n=25	**9 years, 1 months, 20 days**
Range 3: 2/24/2009 to 3/18/2015	
n=25	**6 years, 0 months, 22 days**

Table III-39. SW-20 Date Ranges

The last twenty-five data points indicate the median flow at this site has decreased by 80 percent. More than likely the flow increase is caused by additional logging, added mine acreage, constant basin discharges, new underground mine discharges, and the creation of new wetlands within the watershed.

The new mining combined with the reclamation may be the primary cause of the increasing concentrations of sulfate and alkalinity found in the third data set. Also, in 2009, OSMRE KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. Lastly, by comparing the median data values to OSMRE's threshold criteria, it was found that only TDS exceeded OSMRE's threshold criteria of 500 mg/L with no other parameters exceeding these thresholds.

The SW-26 monitoring station is 0.1 mile upstream on Straight Creek from the confluence of Clear Fork on Straight Creek and adjacent to the proposed operation. The baseline monitoring for this point started at this location in March 1999 and monitoring is ongoing. This station receives drainage from 10.9 square miles. As of the date of this CHIA document sixty-three samples have been collected at this site (Table III-40). The data was divided into three data ranges for the analysis (Figure III-41). The first data range consists of the total data population collected from 3/11/1999 to 6/2/2015, the second data range was constructed using the first twenty-eight samples collected from 4/26/1996 to 6/12/2003, and the third data range was constructed using the last thirty-five samples collected from 3/5/2008 to 6/2/2015.

Overall, for these sixty-three data points, the pH is circumneutral to slightly alkaline and ranged from 6.88 to 8.42 with a median value of 7.7. The TDS **r**anged from 72 to 900 mg/L with a median of 487 mg/L. The iron and manganese median concentrations are consistently below 0.5 mg/L. The median alkalinity is 126 mg/L with a sulfate median of 180 mg/L. The median selenium value is 0.29 ug/L. Flow ranged from 0.05 cfs to 37.35 cfs with a median of 1 cfs. Also, in 2009, OSMRE KFO started requiring industry to provide measured flow with all monitoring data instead of an estimated flow. Lastly, by comparing the median data values to OSMRE's threshold criteria, it was found that only TDS exceeded OSMRE's threshold criteria of 500 mg/L with no other parameters exceeding any thresholds.

SW-26	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/11/1999 - 6/2/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.72	572.73	459.63	180.92	122.3	30.83	0.69	0.18	3.72
Median	7.73	607	487.11	180	126	8	0.3	0.16	1
Minimum	6.88	90	72.22	11	10	0.01	0.05	0	0.05
Maximum	8.42	1122	900.4	422	575	930	9.7	0.55	37.35
Count	63	63	63	63	63	63	63	63	63
SW-26	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/11/1999 - 12/13/2007		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.49	535.89	430.05	150.51	99.29	14.89	0.5	0.24	2.37
Median	7.44	389.5	312.57	119.63	90	7.5	0.3	0.24	0.79
Minimum	6.88	119	95.5	11	24	3	0.05	0.01	0.31
Maximum	8.14	1122	900.4	386	214	116	4.15	0.51	29.57
Count	28	28	28	28	28	28	28	28	28
SW-26	pH	Specific Conductance	TDS	Sulfate	Alkalinity	TSS	Iron Total	Manganese Total	Flow
3/5/2008 - 6/2/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.89	602.2	483.3	205.25	140.71	43.57	0.84	0.14	4.79
Median	7.93	650	525	244	144	8	0.32	0.1	1.43
Minimum	6.91	90	72.22	25.9	10	0.01	0.1	0	0.05
Maximum	8.42	1052	844.22	422	575	930	9.7	0.55	37.35
Count	35	35	35	35	35	35	35	35	35

Table III-40. Summary of Surface Water Parameters at SW-26

The following seven box plot charts provide data comparison between the surface water monitoring points along the main stem of Valley Creek to the last monitoring point on Clear Fork. These plots are arranged from the headwater monitor point SW-109 on the far right of the chart to SW-25 to the far left of the chart. The variations between each point's median data are shown on each chart by using a red line moving from the upstream median data point, to the downstream median data point, from box to box plot.

Range 1: 3/11/1999 to 6/2/2015	
n=63	**16 years, 2 months, 22 days**
Range 2: 3/11/1999 to 12/13/2007	
n=28	**8 years, 9 months, 2 days**
Range 3: 3/5/2008 to 6/2/2015	
n=35	**7 years, 2 months, 28 days**

Table III-41. SW-26
Date Ranges

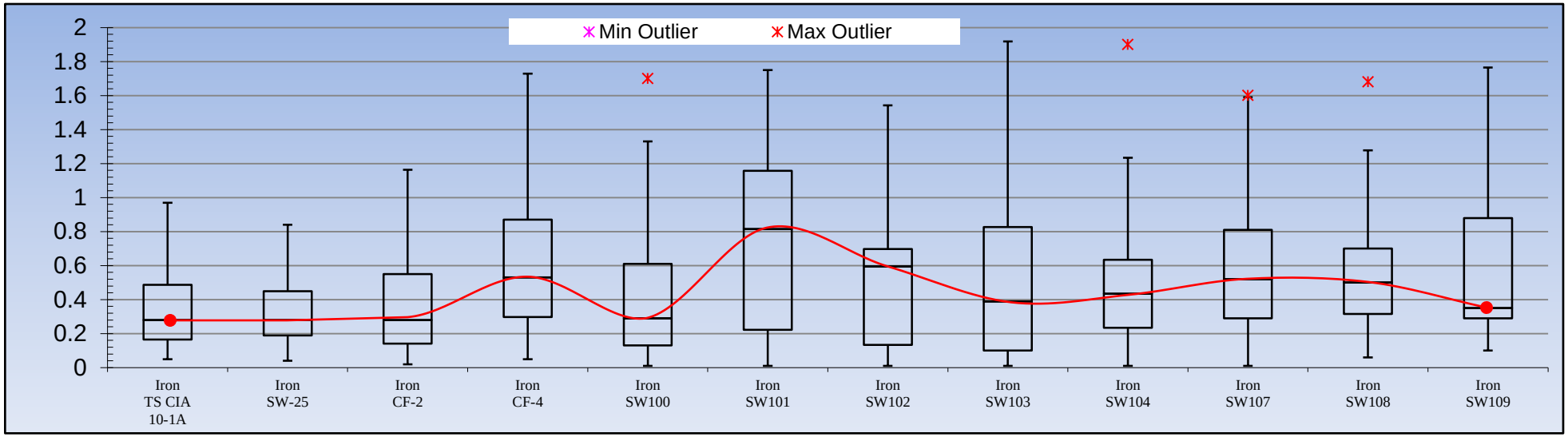


Figure III-6. Iron (mg/L) Baseline Data at Surface Monitoring Points

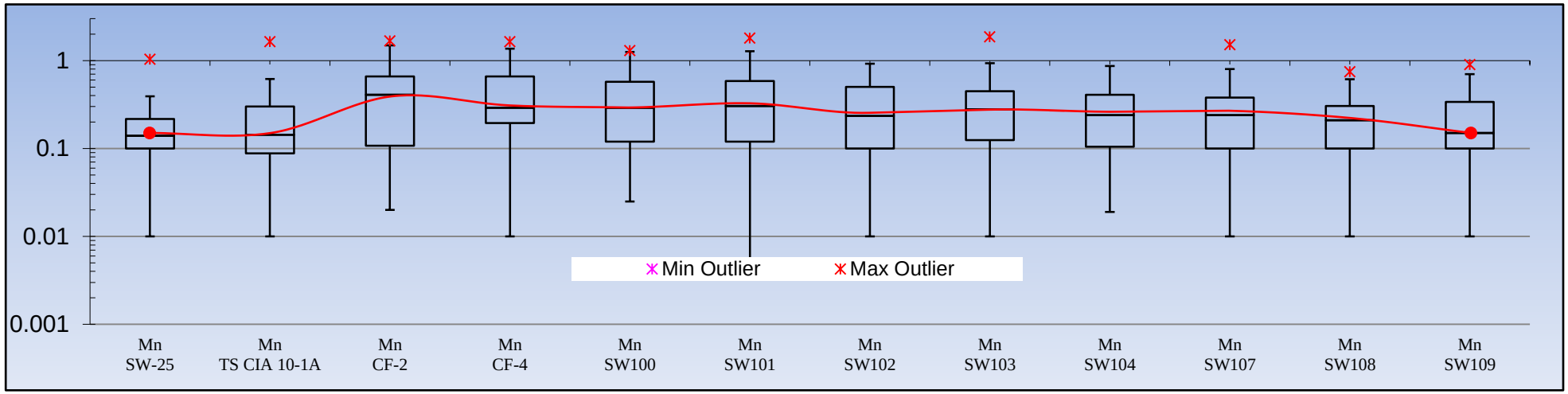


Figure III-7. Manganese (mg/L) Baseline Data for Surface Monitoring Points

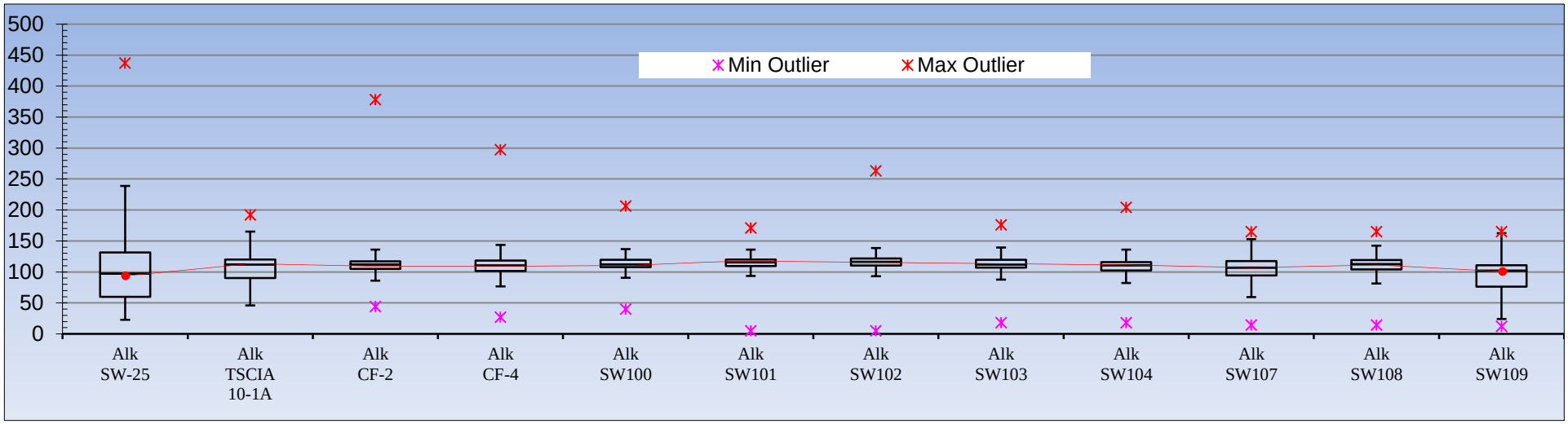


Figure III-8. Alkalinity (mg/L) Baseline Data for Surface Monitoring Points

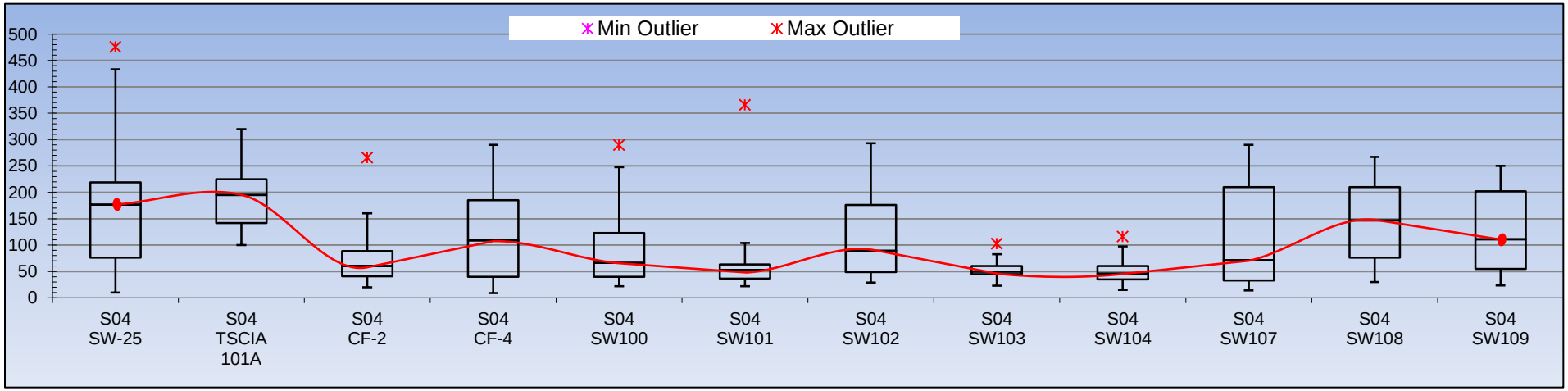


Figure III-9. Sulfate (mg/L) Baseline Data for Surface Monitoring Points

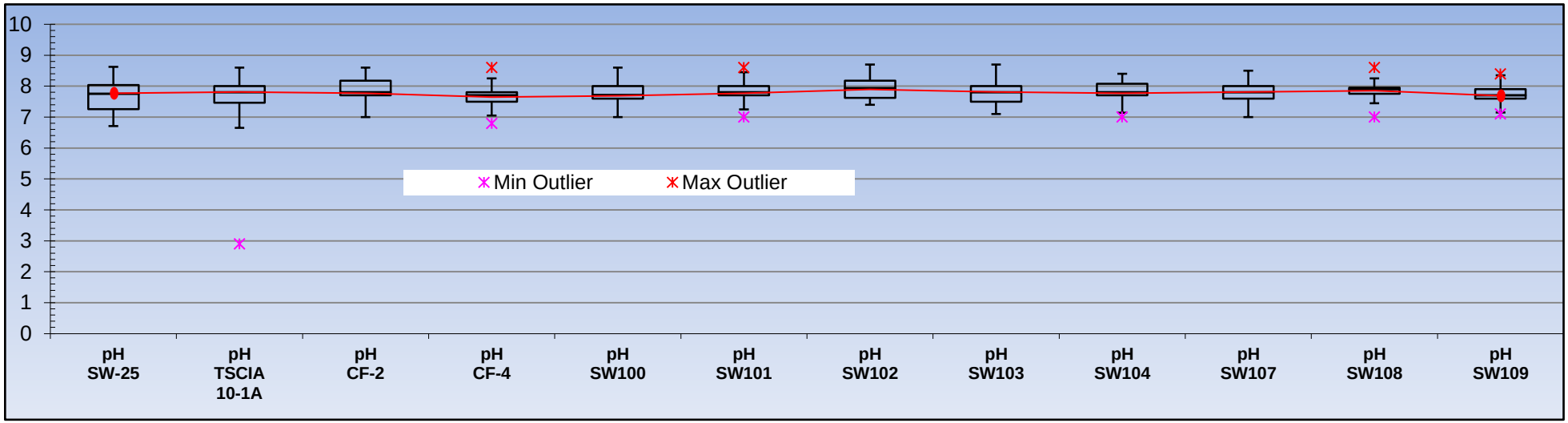


Figure III-10. pH Baseline Data for Surface Monitoring Points

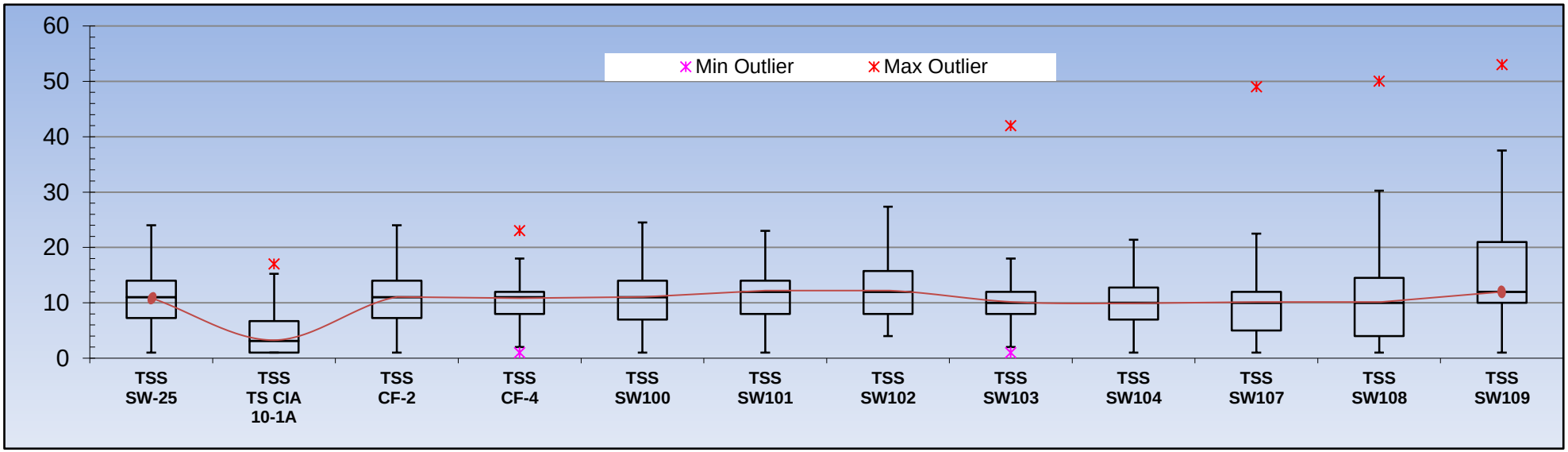


Figure III-11. TSS (mg/L) Baseline Data for Surface Monitoring Points

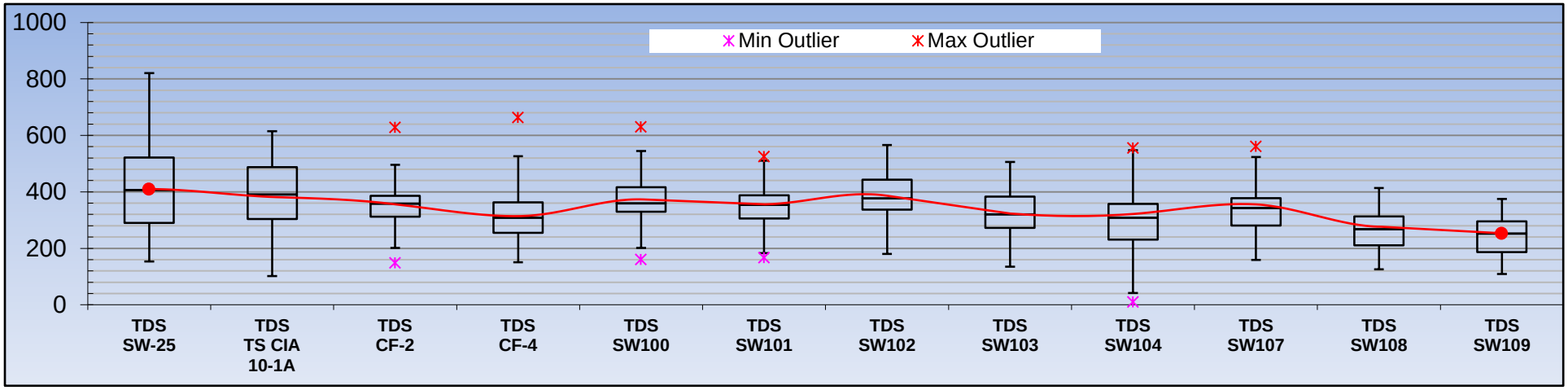


Figure III-12. TDS (mg/L) Baseline Data for Surface Monitoring Points

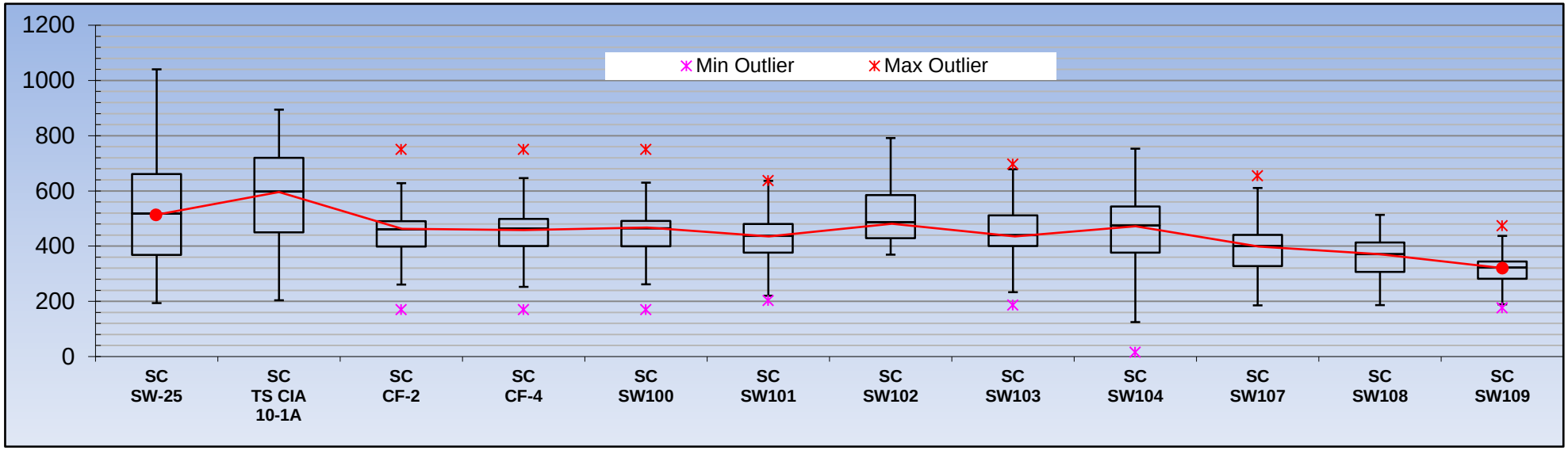


Figure III-13. Specific Conductance, Baseline Data for Surface Monitoring Points

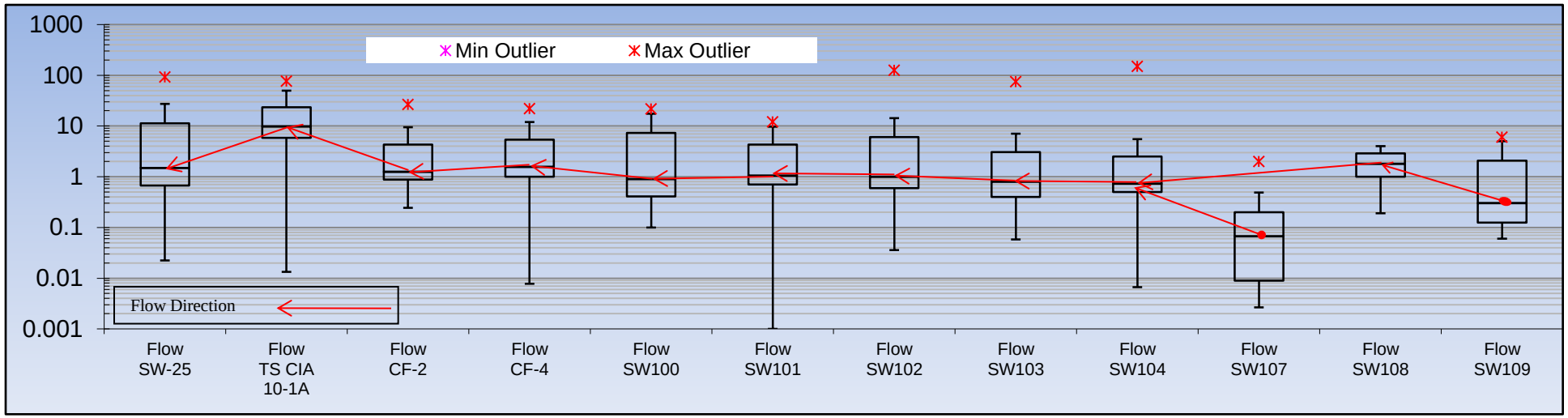


Figure III-14. Flow in Cubic Feet Per Second (CFS), Baseline Data for Surface Monitoring Points

I. Surface Water Use Classification

The TDEC surface water uses classifications for Clear Fork from its mouth to its origin, which includes Valley Creek and Straight Creek, are fish and aquatic life, recreation, irrigation, livestock watering, and wildlife. There are no surface water users that have been identified within or adjacent to the proposed mine site.

J. Ground Water Quantity and Quality Characterization

The ground water system in the proposed permit and adjacent areas is relatively simple and typical for the Cumberland Block of the Tennessee coalfield. Ground water essentially moves from topographic highs (ridge tops) to topographic lows (valley bottoms), following a stair-stepping course along geologic fractures. Stress-relief fracture systems occur parallel to the slope of the topography. Some ground water may emerge as seeps and springs along exposed highwalls or along sandstone bluffs on its way to the valley bottom. Sandstones are largely discontinuous in this portion of the coalfield and afford no large-scale regional flow system. However, they do act as localized perched aquifers.

In the immediate area of the proposed site, the water-bearing formations above the coal and rider seams to be mined, primarily consist of minor perched zones, which most likely have been altered from pre-law mining activities. Within the permit area, the water-bearing formations are the naturally occurring stress relief fraction within the valley wall and coal seam voids within the Mason coal zone.

Within the proposed mine area and adjacent areas, the local ground water movement is being controlled by numerous abandoned underground mine workings adjacent to the surface and auger areas. The potential pooling of water in these voids would depend on the bottom of coal seam structures as shown on the Figure III-1 and Figure III-4. Along Cooper Ridge, the area that would have the greatest hydraulic head, will lie along the down gradient crop line where mine waters might pool within the abandoned underground works. However, there is a great potential for these works within the Mason coal seam to drain into other abandoned works at lower elevations within Cooper Ridge.

This scenario indicates the Mason abandoned works may be relatively dry wherever the applicant proposes to breach into any old works. Water quality and quantity data from twenty-six ground water sample points were collected to help characterize seasonal ground water conditions within the proposed permit area. The ground water monitoring points are shown on Figure III-5. Some of these points were only sampled once due to their location and the limited possibility for them to be impacted by the proposed mining. While other points within the influence of the proposed mining area had, six or more samples collected to provide the permit application's baseline ground water data. The baseline ground water monitoring data indicates the ground water quality in the area is variable as shown in Tables III-42 to III-67 and is representative of the naturally occurring ground water, while other samples indicate direct impacts from mining.

The applicant sampled twenty-six ground water points (GW-1 to GW-26) within and adjacent to the proposed permit area. The application identified above drainage seep zones within the permit area that is representative of ground water discharge from the Mason coal seam. These zones are identified as GW-13 to GW-23. These seeps were used to establish the baseline seasonal water quality of the site. The permit states, "During the life of the proposed operation, ground water will be monitored quarterly (every three months) by collecting water samples every third calendar month at GW-9, GW-10, GW- 11, GW-20, GW-21, GW-22, and GW-23." The locations of these monitoring points are shown on Figure III-5. The existing abandoned underground works in the Mason coal seam have disrupted the natural ground water flow paths within Cooper Ridge. These abandoned underground works tend to pool ground water and allow it to gravity drain from old works into and through existing stress relief fractures, existing boreholes, and fractures induced by previous mining. Based on the mining proposed in this application and the proposed removal of Mason rider seams, it is not anticipated that the mining will have any adverse effects on the quality of the discharge on the either side of Cooper Ridge where the Mason coal seam outcrops.

GW-1 is a privately owned well located on the NW side of Clear Fork immediately beside Tracy Branch at an elevation of 1160 ft. AMSL. Water quality parameters are within normal ranges for this area's ground water as shown in Table III-42. This point was sampled only once.

GW-1	pH	Specific Conductance	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.4	745	167.54	237	2.71/1.16	0.26	N/A	unknown

Table III-42. Summary of Ground Water Parameters at GW-1.

GW-2 is a privately owned well and found on the NW side of Clear Fork immediately beside GW-1. This point was sampled only once. Water quality parameters are within normal ranges for this area's ground water as shown in Table III-43.

GW-2	pH	Specific Conductance	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.5	686	129.5	194	3.31	0.09	N/A	unknown

Table III-43. Summary of Ground Water Parameters at GW-2.

GW-3 is a private well owned by Charles Dupree located at an elevation of approximately 1126 ft AMSL. It is approximately 50 ft. deep and found on the NW side of Clear Fork immediately between Tracy Branch and Fox Branch. This point was sampled once. Water quality parameters are within normal ranges for ground water in this area (Table III-44).

GW-3	pH	Specific Conductance	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.9	552	N/A	272	1.36/0.83	0.09	N/A	unknown

Table III-44. Summary of Ground Water Parameters at GW-3.

GW-4 is a private well owned by Ancel Garrett well on the west side of Straight Creek located at an elevation 1126 AMSL. This point was sampled only once (Table III-45). Water quality parameters are within normal ranges for ground water in this area.

GW-4	pH	Specific Conductance	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.6	560	122.5	130	0.15	0.09	N/A	unknown

Table III-45. Summary of Ground Water Parameters at GW-4

GW-5 is a private well owned by Curtis Hatfield located on the west side of Straight Creek located at an elevation 1170 AMSL. This point was sampled once (Table III-46). Water quality parameter were within normal ranges for ground water in this area.

GW-5	pH	Specific Conductance	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.0	553	122.5	202	0.22	0.61	N/A	unknown

Table III-46. Summary of Ground Water Parameters at GW-5.

GW-6 is a private well owned by Tom Marlow and found on the west side of Straight Creek located at an elevation 1222 ft. AMSL. This point was sampled once (Table III-47). Water quality parameters are within normal ranges for ground water in this area.

GW-6	pH	Specific Conductance	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	7.0	481	63	150	2.24/11.05	0.1	N/A	unknown

Table III-47. Summary of Ground Water Parameters at GW-6.

GW-7 is a spring well owned by Tom Marlow located on the west side of Straight Creek at an elevation of 1222 ft. AMSL. This point was sampled once (Table III-48). Water quality parameters are within normal ranges for ground water in this area.

GW-7	pH	Specific Conductance	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge	Depth to Water
Well	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)	(ft)
	8.5	562	9.9	286	0.11	0.09	N/A	unknown

Table III-48. Summary of Ground Water Parameters at GW-7.

GW-8 is a spring owned by Corrigan TLP, LLC (S) and WPP, LLC (M), and was used by Mr. Gary Garrett. The spring is located on the west side of Straight Creek at an elevation

1222 ft. AMSL. Twelve samples were collected at this spring to establish the quality and quantity of the discharge (Table III-49). Water quality parameters are within normal range for ground water in this area.

GW-8 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge
1/30/2007 - 9/20/2010		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(gpm)
Mean	7.78	247.83	197.5	60.64	25.08	0.49	0.01	7.36
Median	7.83	256.5	205	62.5	25.5	0.43	0.01	5
Minimum	7.23	128	101	36.2	14	0.06	0.01	0
Maximum	8.39	349	277	86.5	34	1.12	0.04	27
Count	12	12	12	12	12	12	12	12

Table III-49. Summary of Ground Water Parameters at GW-8

GW-9 is a discharge from the reclaimed OSMRE 3127, Mountainside Coal Company, Cooper Ridge Area #3 permit. The wet seal is located on the west side of Straight Creek at an elevation 1280 ft. AMSL. Ten samples were collected from the wet seal discharge pipe to establish quality and quantity of the discharge (Table 50). Water quality parameters are within normal ranges for ground water in this area. This point will be used as a life of mine ground water monitoring point.

GW-9 (UG Mine)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total
1/21/2011 - 10/24/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Mean	7.2	640.1	510.23	88.2	283.25	0.94	0.12
Median	7.27	639.5	498.32	88.2	282.63	0.38	0.1
Minimum	6.55	542	437	76.6	261	0.01	0.09
Maximum	7.7	852	655.7	98.5	313	6.12	0.21
Count	10	10	10	10	10	10	10

Table III-50. Summary of Ground Water Parameters at GW-9

GW-10 is an existing spring found on the west side of Valley Creek along an unnamed tributary, just below proposed Basin 015. The spring is located at an elevation 1820 ft. (AMSL). Seven samples were collected from the spring to establish the quality and quantity of the discharge from within the permit area (Table III-51). Water quality parameters are within normal ranges for ground water in this area. This point will be used as a life of mine ground water monitoring point.

GW-10 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge
12/5/2012 - 10/24/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	N/A	394.57	319.14	78.74	145.14	3.62	1.84	0.04
Median	7.12	394	319	81	149	2.12	0.97	0.0022
Minimum	6.91	351	285	62.4	114	0.77	0.18	0.0006
Maximum	7.6	436	355	86	171	8.4	6.28	0.25
Count	7	7	7	7	7	7	7	7

Table III-51. Summary of Ground Water Parameters at GW-10

GW-11 is a ground water monitoring well constructed by the applicant on the west side of Hurricane Creek just above proposed Basin 022. The well is located at an elevation of 1820 ft. (AMSL) with a depth of 84 feet. Seven samples were collected from the spring to establish the quality and quantity of the discharge within the permit area (Table III-52). The water quality demonstrates minor mining related impacts due to the elevated iron and manganese content. This point will be used as a life of mine ground water monitoring point.

GW-11 (Well)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Tot/Dis	Depth to Water
10/31/2012 - 10/24/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(ft)
Mean	N/A	450.57	363.86	38.97	258.29	10.6/3.5	3.26/1.73	33.33
Median	6.84	589	475	26.5	385	8.2/3.6	3.13/1.57	28
Minimum	6.1	128	107	10	23	3.8/0.27	1.26/0.75	23.5
Maximum	7.53	712	574	123	425	27.8/6.8	5.27/3.19	47.5
Count	7	7	7	7	7	7	7	6

Table III-52. Summary of Ground Water Parameters at GW-11

GW-12 is a ground water monitoring well drilled by the applicant. It is found on the west side of Clear Fork at an elevation 1820 ft. (AMSL) and is approximately 59 feet deep. Seven samples were collected from the well to establish the quality and quantity of the discharge from within the permit area (Table III-53). The water quality demonstrates minor mining related impacts due to the elevated iron and manganese content. This point will be used as a life of mine ground water monitoring point.

GW-12 (Well)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Tot/Dis	Depth to Water
12/5/2012 - 10/24/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(ft)
Mean	6.52	277.14	224.71	26.94	143.43	9.7/3.9	2.4/1.2	41.23
Median	6.42	152	125	27	39	8.7/4.1	2.7/1.0	43
Minimum	5.86	112	93	14.8	10	4.69/0.14	1.01/0.21	34
Maximum	7.3	608	481	40.4	425	18.1/6.9	3.82/2.23	43.6
Count	7	7	7	7	7	7	7	7

Table III-53. Summary of Ground Water Parameters at GW-12

GW-13 ground water monitoring point is an existing spring immediately beside basin 005. This point is located on the southwest side of Valley Creek at an elevation 1859 ft. (AMSL). Four samples were collected from the spring to establish the quality and quantity of the discharge from within the permit area (Table III-54). Water quality parameters are within normal ranges for this ground water in this area. This point was used to establish the base line quality and quality of the ground water within the proposed mining area.

GW-13 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
8/30/2013	DRY							
9/26/2013	DRY							
10/24/2013	DRY							
10/15/2014	8.25	260	210	42.8	54	1.33	0.1	0.004456
11/17/2014	8.16	290	235	65.4	59	0.21	0.1	0.004456
12/9/2014	7.98	226	183	76.9	35	0.35	0.1	0.002228
1/27/2015	7.08	240	195	76.9	42	0.16	0.1	0.002228

Table III-54. Summary of Ground Water Parameters at GW-13

GW-14 ground water monitoring point is an existing spring immediately beside Basin 010. This point is found on the southwest side of Valley Creek at an elevation 1852 ft. (AMSL). Seven samples were collected from this spring to establish the quality and quantity of the discharge from within the permit area (Table III-55). Water quality parameters are within normal ranges for ground water in this area. This point was only used to establish the base line quality and quality of the ground water within the proposed mining area and will not be sampled again.

GW-14 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Tot/Dis	Manganese Tot/Dis	Discharge
12/5/2012 - 10/24/2013		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.4	137.43	112.29	25.34	51.29	5.4/4.09	0.96/1.11	0.005398
Median	7.16	142	115	21.7	50	2.89/3.55	0.41/0.78	0.006595
Minimum	6.83	81	66	16.6	21	0.62/1.49	0.15/0.71	0.002228
Maximum	8.2	202	163	43.8	85	17.2/9	3.1/1.85	0.006684
Count	7	7	7	7	7	7/5	7/3	7

Table III-55. Summary of Ground Water Parameters at GW-14

GW-15 ground water monitoring point is an existing spring immediately beside Basin 011. The point is found on the southwest side of Valley Creek at an elevation 1798 ft. (AMSL). Seven samples were collected from the spring to establish quality and quantity of the discharge from within the permit area (Table III-56). Water quality parameters are within normal ranges for ground water in this area. This point was only used to establish the base line quality and quality of the ground water within the proposed mining area.

GW-15 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Iron Dis.	Manganese Total	TSS	Discharge
8/30/2013 - 1/27/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	5.97	431.84	374.29	130.54	139.43	2.14	2.94	22.5	104.39	0.002785
Median	7.63	432	382	59	187	0.64	2.86	0.32	42	0.003342
Minimum	3.08	369	297	31.4	10	0.1	2.76	0.09	0.37	0.000557
Maximum	8.39	482	440	264	258	5.56	3.2	61.5	250	0.004456
Count	7	7	7	7	7	7	3	7	7	5

Table III-56. Summary of Ground Water Parameters at GW-15

GW-16 ground water monitoring point is an existing spring immediately beside Basin 014. The point is found on the southwest side of Valley Creek at an elevation 1837 ft. AMSL. Five samples were collected from the spring to establish quality and quantity of the discharge from within the permit area (Table III-57). Water quality parameters are within normal ranges for ground water in this area. This point was only used to establish the baseline quality and quality of the ground water within the proposed mining area.

GW-16 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
8/30/2013	7.64	389	315	83.5	140	8.87	2.87	187	0.000557
9/26/2013	DRY								
10/24/2013	DRY								
10/15/2014	7.16	138	114	50.6	29	1.53	0.1	12	0.01114
11/17/2014	8.08	250	202	51.6	74	0.85	0.1	12	0.006684
12/9/2014	7.93	282	228	73.3	72	0.53	0.1	53	0.004456
1/27/2015	7.06	292	236	74.1	64	0.1	0.1	26	0.000557

Table III-57. Summary of Ground Water Parameters at GW-16

GW-17 ground water monitoring point is an existing spring immediately between Basins 015 and 016. The point is found on the southwest side of Valley Creek at an elevation 1813 ft. AMSL. Seven samples were collected from the spring to establish quality and quantity of the discharge from within the permit area (Table III-58). Water quality parameters are within normal ranges for ground water in this area. This point was only used to establish the baseline quality and quality of the ground water within the proposed mining area.

GW-17 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Iron Dis.	Manganese Total	Manganese Dis.	TSS	Discharge
8/30/2013 - 1/27/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.32	185.14	150.42	42.01	44.57	1.92	1.48	0.7	0.9	78.14	0.00811
Median	7.32	158	130	40.8	18	1.26	1.03	0.1	0.9	20	0.0066
Minimum	6.56	155	119	30.5	10	0.43	0.64	0.1	0.86	4	0.0005
Maximum	8.09	256	210	57.2	114	6.57	3.25	1.98	0.94	215	0.0178
Count	7	7	7	7	7	7	4	7	2	7	7

Table III-58. Summary of Ground Water Parameters at GW-17

GW-18 ground water monitoring point is an existing spring. This point is located on the southwest side of Valley Creek at an elevation 1813 ft. AMSL and lies to the east of Basin 014. Seven samples were collected from this spring to establish the quality and quantity of the discharge from within the permit area (Table III-59). Water quality parameters are within a normal range for ground water in this area. This point was used to establish the base line quality and quality of the ground water within the proposed mining area.

GW-18 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Iron Dis.	Manganese Total	TSS	Discharge
8/30/2013 - 1/27/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.27	186	150.71	43.53	32	2.3	3.02	0.36	48.43	0.02
Median	7.24	156	130	38.4	11	0.34	1.29	0.1	20	0.0067
Minimum	6.27	142	117	31.5	10	0.1	1.12	0.1	5	0.0022
Maximum	8.26	328	260	59.2	148	10.53	6.66	1.59	195	0.1
Count	7	7	7	7	7	7	3	7	7	7

Table III-59. Summary of Ground Water Parameters at GW-18

GW-19 ground water monitoring point is an existing spring. This point is found on the southwest side of Valley Creek at an elevation 1790 ft. AMSL and lies to the northwest of Basin 017. Seven samples were collected from this spring to establish quality and quantity of the ground water from within the permit area (Table III-60). Water quality parameters demonstrate minor mining related impacts due to the elevated iron and manganese content. However, in this particular case, the excessive total suspended solids might be artificially elevating the iron and manganese concentrations. This point was used to establish the baseline quality and quality of the ground water within the proposed mining area.

GW-19 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Iron Dis.	Manganese Total	TSS	Discharge
8/29/2013 - 1/27/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.66	460.17	353.71	153.94	53.74	4.63	2.83	0.86	71	0.007
Median	7.8	425	305	122	47	0.96	2.72	0.14	23	0.007
Minimum	7	328	254	0.1	31	0.1	0.86	0.1	10	0.002
Maximum	8.26	740	586	427.5	109	20	5	4.48	314	0.022
Count	7	6	7	7	7	7	4	7	7	7

Table III-60. Summary of Ground Water Parameters at GW-19

GW-20 ground water monitoring point is an existing spring. This point is found on the east side of Straight Creek on the Mason Crop line at an elevation 1810 ft. AMSL. Five samples were collected from this spring to establish the quality and quantity of the ground water from the Mason coal seam out crop off the permit area (Table III-61). The ground water at this point demonstrates mining related impacts due to the elevated concentrations for total dissolved solids and sulfate. This point will be used as a life of mine ground water monitoring point.

GW-20 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Discharge
2/8/2007 - 1/27/2015		(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
Mean	7.48	1203.2	966.88	315	517.6	0.132	0.088	8.2	0.188
Median	7.44	1038	833	332	502	0.1	0.1	8	0.16
Minimum	6.99	967	778	128	439	0.09	0.04	4	0.04
Maximum	7.99	1841	1479.4	460	633	0.27	0.1	11	0.4
Count	5	5	5	5	5	5	5	5	5

Table III-61. Summary of Ground Water Parameters at GW-20

GW-21 ground water monitoring point is an existing spring adjacent to GW-23 and GW-22. This point is located in the headwaters of Spruce Lick Branch on the Mason coal seam outcrop line at an elevation of 1700 ft. AMSL. Four samples were collected from the spring to establish the quality and quantity of the discharge from the Mason coal seam outside the permit area (Table III-62). The ground water at this point demonstrates mining related impacts due to the elevated concentrations for total dissolved solids and sulfate. This point will be used as a life of mine ground water monitoring point.

GW-21 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
10/15/2014	7.62	600	484	65.5	262	1.24	0.32	0.0088
11/17/2014	7.79	572	459	146.5	221	0.2	0.12	0.02
12/9/2014	7.81	558	451	172.5	256	0.15	0.11	0.02
1/27/2015	7.39	656	528	216.5	240	0.41	0.29	0.02

Table III-62. Summary of Ground Water Parameters at GW-21

GW-22 ground water monitoring point is an existing spring adjacent to GW 23 and GW-21. This point is found within the headwaters of Spruce Lick Branch on the Mason coal seam out cropline at an elevation 1700 ft. AMSL. Four samples were collected from the spring to establish quality and quantity of the discharge from the Mason coal seam outside the permit area (Table III-63). The ground water at this point demonstrates mining related impacts due to the elevated concentrations for total dissolved solids and sulfate. This point will be used as a life of mine ground water monitoring point.

GW-22 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
10/15/2014	7.38	744	598	218	321	2.81	0.84	0.0132
11/17/2014	8.03	585	472	149.5	236	0.11	<0.10	0.02
12/9/2014	7.62	633	509	172	290	0.68	0.56	0.01
1/27/2015	7.05	744	597	228	267	1.07	0.71	0.013

Table III-63. Summary of Ground Water Parameters at GW-22

GW-23 ground water monitoring point is an existing spring adjacent to GW-21 and GW-22. The point is found in the headwaters of Spruce Lick Branch on the Mason outcrop line at an elevation 1700 ft. AMSL. Four samples were collected from the spring to establish quality and quantity of the discharge from the Mason coal seam outside the permit area (Table III-64). The ground water at this point demonstrates mining related impacts due to the elevated total dissolved solids and sulfate content. This point will be used as a life of mine ground water monitoring point.

GW-23 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
10/15/2014	7.34	646	521	70.5	261	4.21	0.65	210	0.0176
11/17/2014	7.58	603	488	163.5	231	1.45	0.16	95	0.02
12/9/2014	7.75	570	461	169	257	0.97	0.11	130	0.01
1/27/2015	7.19	660	531	202.5	256	0.57	<0.10	30	0.009

Table III-64. Summary of Ground Water Parameters at GW-23

GW-24 is a private well owned by Gary Garrett and located on the west side of Straight Creek at an elevation 1120 ft. AMSL and has a depth of 140 ft. At this time, only one sample has been collected from this well (Table III-65). Water quality parameters are within normal ranges for ground water in this area.

GW-24 (Well)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Depth to Water/Total Depth
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(ft)
1/27/2015	6.45	455	365	142.5	100	<0.10	1.13	5	70/140

Table III-65. Summary of Ground Water Parameters at GW-24

GW-25 is a spring owned by Corrigan TLP, LLC (S) and WPP, LLC (M) and was used by Mr. Gary Garrett. The spring is located on the west side of Straight Creek at an elevation

1249 ft. AMSL. Two samples were collected from this spring to establish the quality and quantity of the discharge (Table III-66). Water quality parameters are within normal ranges for ground water in this area.

GW-25 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
12/11/2014	7.64	388	312	45.3	206	2.31	0.55	13	0.008912
1/23/2015	8.18	947	760	280	184	0.18	<0.10	19	0.006684

Table III-66. Summary of Ground Water Parameters at GW-25

GW-26 (GW-Sulfur) is a spring owned by Corrigan TLP, LLC (S) and WPP, LLC (M). The landowner considers this an undeveloped water resource. This spring is located on the west side of Straight Creek located at an elevation 1240 ft. AMSL. Two samples were collected from this spring in order to establish the quality and quantity of the discharge (Table III-67). Water quality parameters are within normal ranges for ground water in this area

GW-26 (Spring)	pH	Specific Conductance	TDS	Sulfate	Alkalinity	Iron Total	Manganese Total	TSS	Discharge
	(units)	(µS/cm)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(cfs)
12/11/2014	7.21	309	249	88.5	63	0.5	<0.10	25	0.002228
1/23/2015	7.96	503	406	84.5	220	1.24	0.37	9	0.002228

Table III-67. Summary of Ground Water Parameters at GW-25

Mean Ground Water Data Comparison

GW-1 through GW-8 and GW-24 through GW-26 are located in areas accepting drainage from 300 feet to 600 feet below the proposed mining. The median values for each of these points are graphed to provide a visual comparison of data (Figures III-15 through III-25). GW-9 through GW-23 are springs located on or immediately below the Mason coal seam outcrop. However, GW-10 and GW-12 are monitoring wells, which are located at each end of the proposed permit area. These points are used to establish the quality of the ground water discharges from the proposed permit area. The median water quality values for each of these points were graphed to compare each of these baseline water quality sampling points.

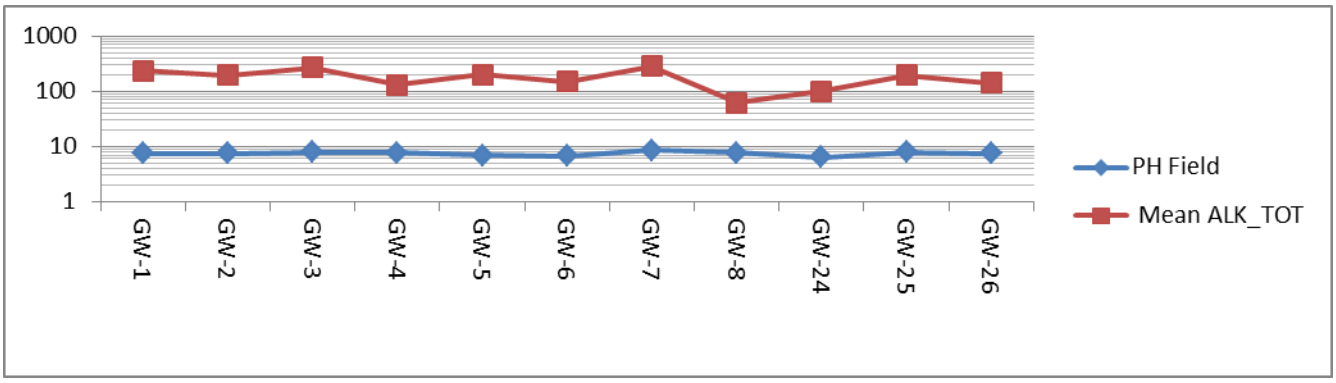


Figure III-15. pH vs Alkalinity (mg/L) Mean Data Comparison for Ground Monitoring Points

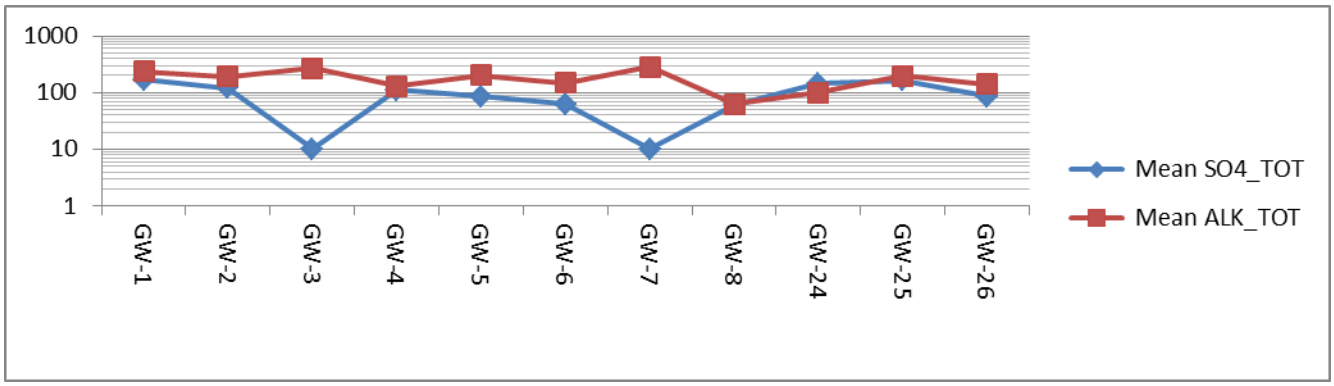


Figure III-16. Sulfate (mg/L) vs Alkalinity (mg/L) Mean Data Comparison for Ground Monitoring Points

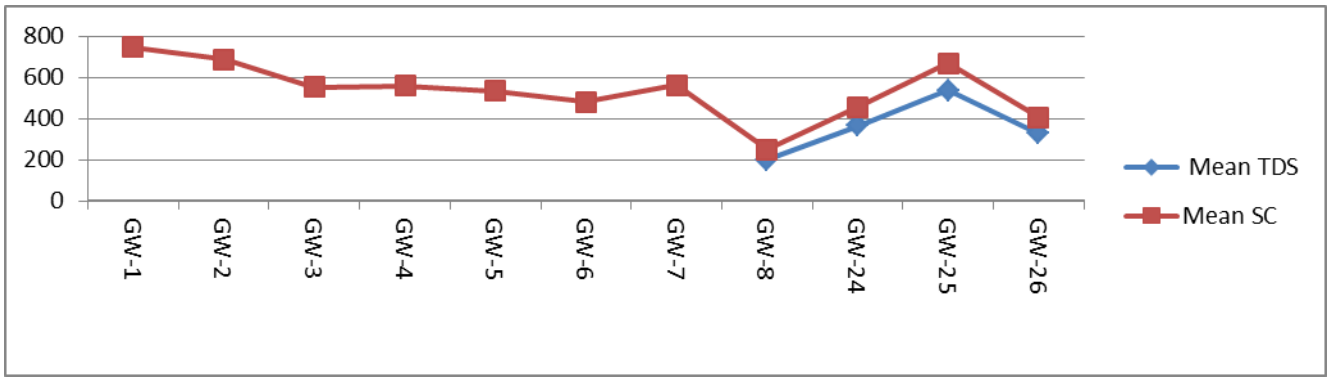


Figure III-17. TDS (mg/L) vs Specific Conductance (SC) Mean Data Comparison for Ground Monitoring Points

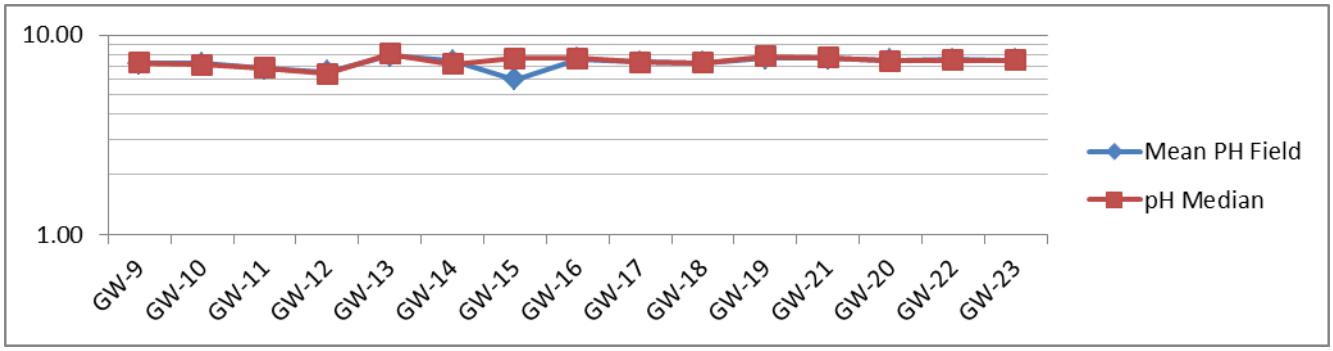


Figure III-18. pH mean vs pH Median Data Comparison for Ground Monitoring Points

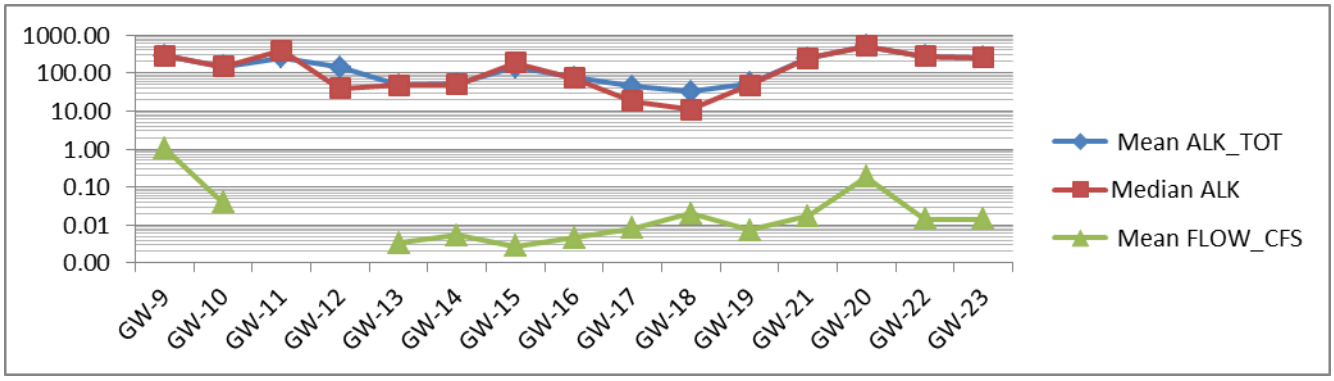


Figure III-19. Alkalinity Mean vs Alkalinity Median Data Comparison for Ground Monitoring Points

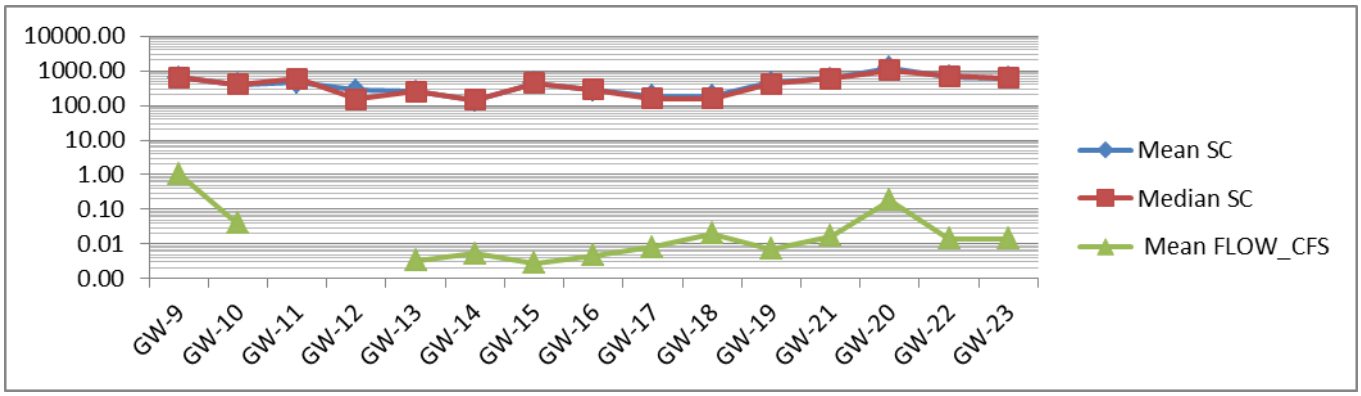


Figure III-20. Specific Conductance Mean vs Median Data Comparison for Ground Monitoring Points

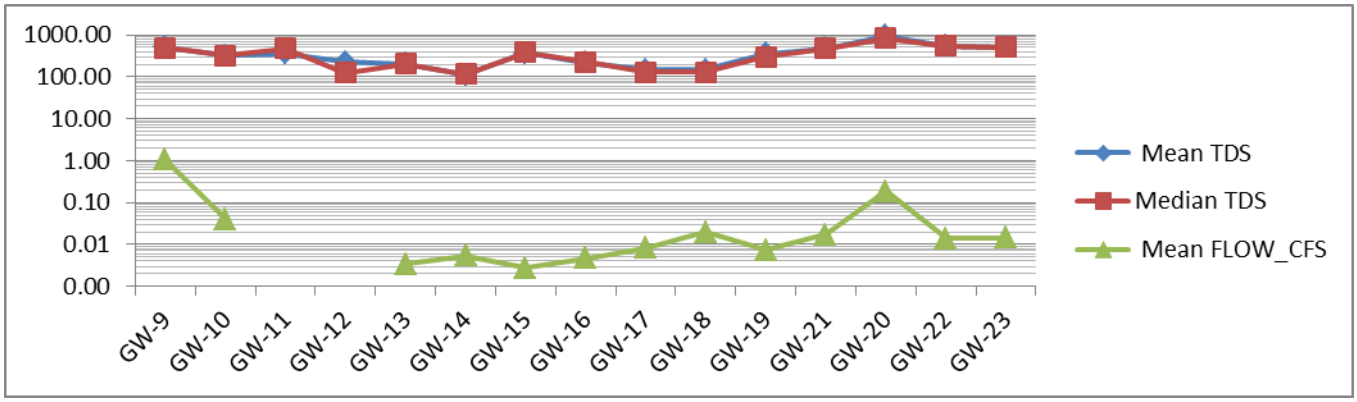


Figure III-21. Total Dissolved Solids Mean vs Median Data Comparison for Ground Monitoring Points

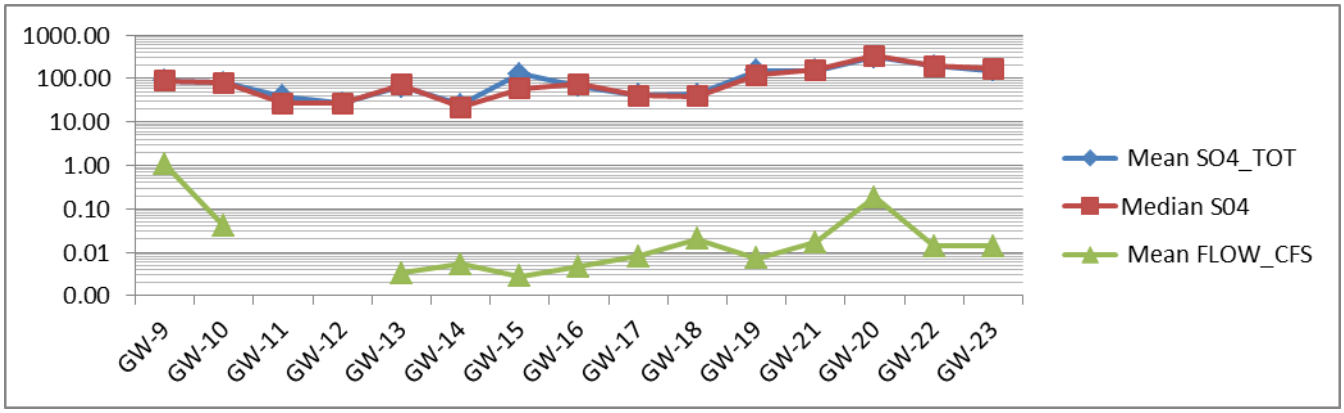


Figure III-22. Mean Sulfate vs Median Sulfate Data Comparison for Ground Monitoring Points

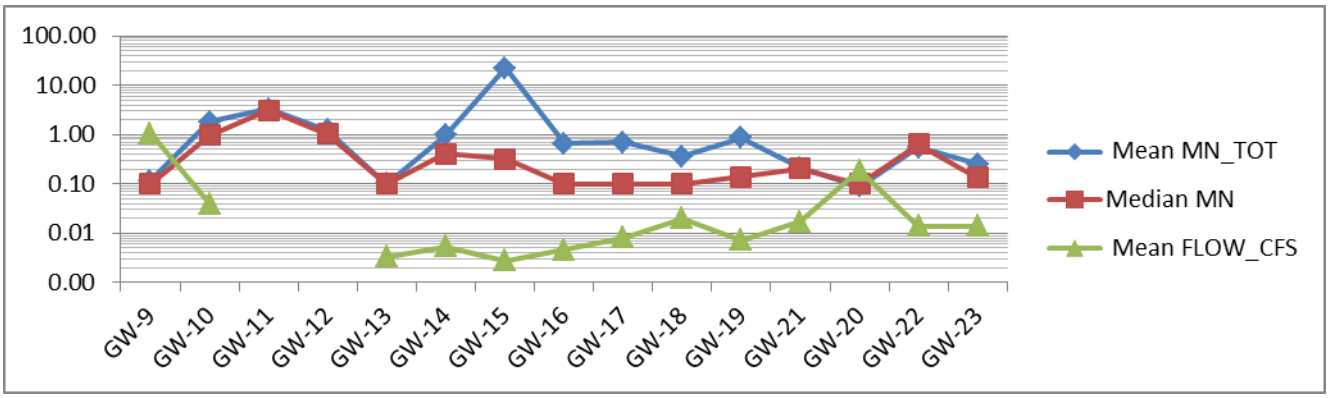


Figure III-23. Mean Manganese vs Median Data Comparison for Ground Monitoring Points

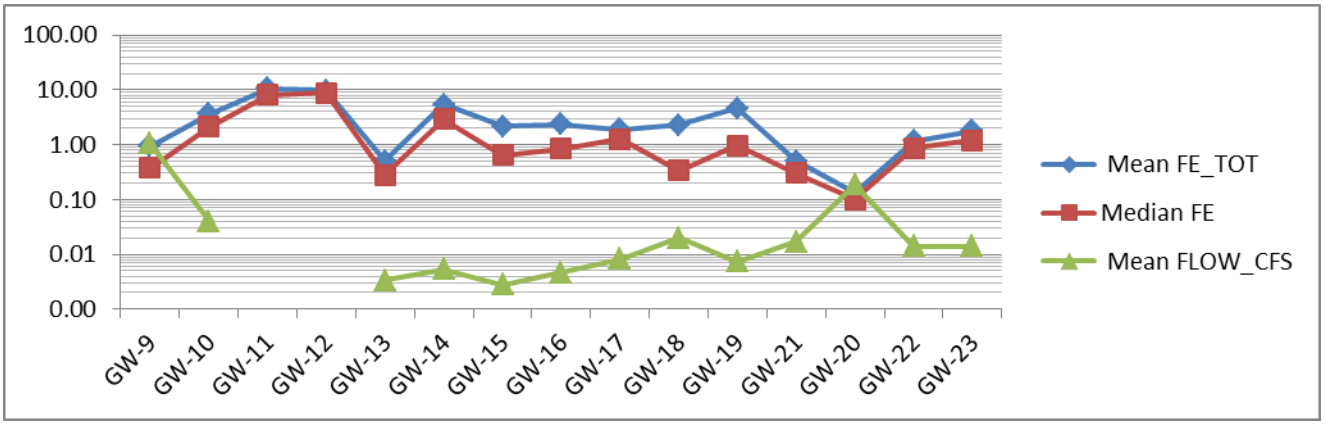


Figure III-24. Mean Iron vs Median Iron Data Comparison for Ground Monitoring Points

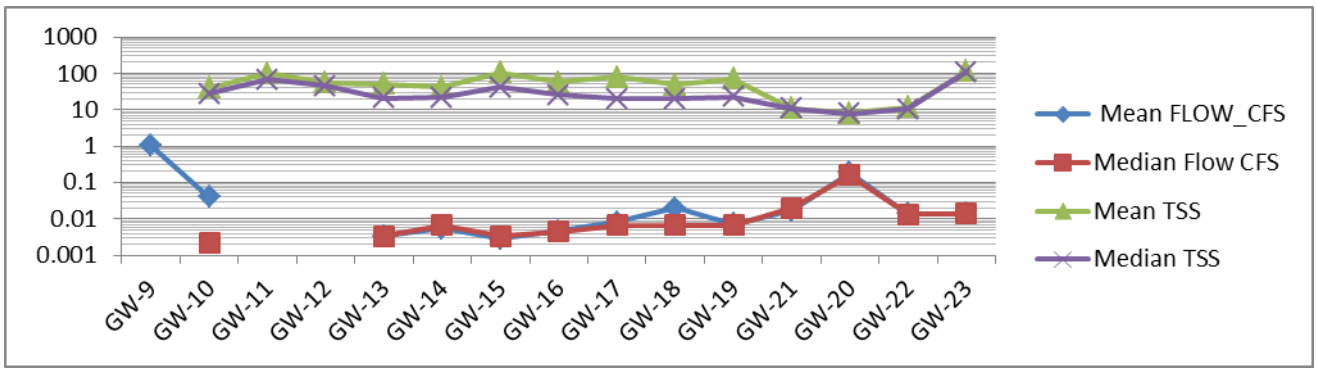


Figure III-25. Mean Flow vs Mean Total Suspended Solids Data Comparison for Ground Monitoring Points

K. 3270 PHC Water Quality Assessments

The applicant provided the following water quality predictions using values within the existing baseline conditions found during low-flow and high-flow months. A range of values for low and high-flow conditions are shown with the average shown in parenthesis in Tables III-68 through III-70.

Station	pH	Fe Total (mg/L)	Mn Total (mg/L)	TDS (mg/L)	SO4 (mg/L)	Acidity (mg/L)	Alkalinity (mg/L)
Valley Creek VC-9250 SWIM-12	7.2-8.2	0.29-1.42	0.10-0.26	892-401	46.0-168.3	0.0-1.	56.58-150.3

Table III-68. Summary Baseline Conditions

Parameter	Premining (mg/L)	During Mining (mg/L)	Anticipated Postmining
TDS-Low	466.81	535.98	8-10% Increase over Premine
TDS-High	258.65	293.27	10-14% Increase over Premine
Sulfate-Low	259.46	295.34	8-10% Increase over Premine
Sulfate-High	141.97	161.60	10-14% Increase over Premine
Alkalinity-Low	121.12	138.34	8-10% Increase over Premine
Alkalinity-High	66.27	75.7	10-14% Increase over Premine

Table III-69. Valley Creek Summary Water Quality Predictions: SWIM-12 (VC-9250) 4353-Acre Watershed; Mining Acreage: Premining1250.9, Postmining 1448.9

Sediment Yield WITH BMP's (Tons/Year)				
Stream	Premining	During-Mining	Postmining	Difference
Valley Creek	2758.3	2762.4	2790.00	+1%/+1%
Hurricane Creek	178.80	195.30	185.8	+8.5%/+3.8%

Table III-70. Summary of Sediment Yield with BMP's (Tons/Year)

The applicant does not predict any significant off-site impacts or exceedances to the surface or ground water quality or quantity in Valley or Hurricane Creeks as seen in the previous tables. The applicant predicts the annual sediment yield will slightly increase during postmining reclamation, but Table III-70 demonstrates the site will be compliant with the TDEC sediment TMDL requirement.

III Cumulative Impact Area(s): Assessment of Impacts

The following section identifies potential issues associated with the addition of the proposed permitting action within CIA Subarea 10-1A. These assessments of current and long-term water quality trends in the sub-watershed are described herein. All of the monitoring data from active OSMRE's surface water and ground water sites were considered in this assessment. This included all of TDEC's current Water Pollution Control discharge monitoring reports. All active monitoring locations are shown on Figure III-5.

A. Geology of the Cumulative Impact Areas

The proposed permit area and CIA 10, Subarea 1A, watersheds are located within the Upper to Middle Pennsylvanian stratigraphy of the Tennessee Cumberland Fault Block (Luther, 1959). This feature is part of a large overthrust sheet, which has followed a northwestern displacement of approximately 10 miles with a 500-foot vertical displacement above its relative position with other areas of the Cumberland Plateau. This fault extends from near Jacksboro, Tennessee to Elkhorn City, Kentucky.

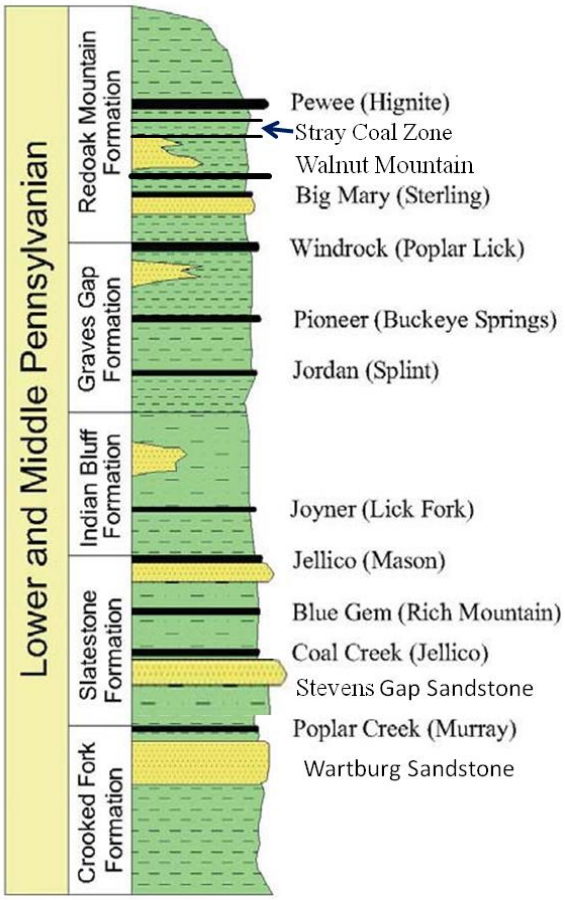


Figure III-26. General stratigraphy and coal geology of the CIA 10, Subarea 1, 2A, and 2B watersheds

The overall geologic form within the Cumberland Fault Block is a relatively flat-bottomed synclinal basin with the axis of the basin being close to the Cumberland Mountain edge of the fault block. The proposed mining is located in the Fonde Basin, which is a subset of this much larger Middlesboro basin within the fault block.

Steep slope topography and narrow valley bottoms characterize the upper portion of the CIA watershed. The mean elevation was calculated to be 1937 ft. AMSL with the highest elevation being 3032 ft.

AMSL and the lowest elevation being 1492 ft. AMSL. The maximum topographic relief of this area exceeds 1500 ft. AMSL with an average of approximately 1000 ft. AMSL. The average stream slope for the main channel of Clear Fork was approximately 25 feet/mile.

Figure III-26 shows the general Pennsylvanian rock formations for these subareas. The surface strata of these watersheds represent portions of the lower and middle Pennsylvanian stratigraphy for the Slatestone, Indian Bluff, Graves Gap, and Redoak Mountain Formations.

Structural data provided by the applicant(s) and others show several features that control the ground water movement within this CIA. The geologic structure is shown in Figure III-1. There are four dominant folds in these watersheds. The first fold is the Sandlick Anticline, a northeast plunging anticline that crosses Straight Creek into Valley Creek and coalesces with the second major fold (Figure III-1). The second fold is the southward plunging Rich Mountain Anticline. However, the Rich Mountain Anticline terminates as it intersects with Hurricane Creek. The third is a sub-parallel, southward plunging syncline. This syncline is on the immediate right flank of the Rich Mountain Anticline. This syncline crosses Cooper Ridge near OSMRE Permit 3058. This structural orientation explains the duel directional dips found within Cooper Ridge on the proposed mine site. This syncline plunges toward Tackett Creek and disappears where it intersects with Tackett Creek. The fourth fold is the, "Leach Mountain Syncline". The axis of the syncline is approximately 2,000 feet southwest of the crest of Leach Mountain. The axis of the fold curves slightly as with each of the other three folds, but has an apparent plunge angle that varies from zero to 2 degrees eastward.

B. Hydrology of the Cumulative Impact Areas

Local ground water systems can be divided into two components, an above drainage component and a below drainage component. Fundamentally, the above drainage ground water consists of water-bearing formations above the local surface drainage pattern. Below drainage ground water consists of water-bearing formation below the first or second order streams in the watershed.

In tilted strata, the ground water flow directions tend to parallel the dip. Fold axes of synclines should represent zones of concentrated ground water flow where an anticline axes represent ground water divides. Ground water flow that intersects a fault may be transmitted across the fault, have restricted flow, or may be redirected along the fault or drag folds associated with faulting. All of these possible scenarios may be occurring within these watersheds.

Base flow Alteration

OSMRE/KFO reviewed the potential for alterations in the base flow characteristics of the area streams because of this proposed action and the two anticipated operations.

No cumulative impacts on base flow were anticipated due to the proposed mining activities in the Clear Fork or Valley Creek watersheds. All perennial and intermittent streams within the application area are protected with the appropriate buffer zones in order to minimize the potential for dewatering. The buffer zones for proposed permit 3270 are shown on Figure III-5.

Generally, surface coal mining activities result in an increase to stream base flow caused by a reduction in evapotranspiration from tree removal and increased flow from backfill storage of ground water. Likewise, underground mine pools store water, which may ultimately discharge to the surface water system. The applicant(s) intends to mine through the peripheral underground workings where coal can be recovered. Given the orientation of the structure of this coal seam and riders, there is a potential for increased ground water flows resulting from the day lighting of these underground workings. The surface disturbances are generally located in an up-dip orientation based on the structure of the coal seams within this CIA. This proposed operation predicts no significant diminution of ground water quality and no significant increase /decrease in ground water quantity with either the proposed surface or underground mining operation. There are known water supplies that can be impacted from the proposed Kopper Glo Mining, LLC, Cooper Ridge 3270 OSMRE permit application.

Flooding Analysis

An OSMRE staff engineer was requested to review the appropriate sections of the permit application to determine the flooding potential from the proposed mining operations. The following narrative is the OSMRE Engineers conclusions.

The applicant performed a detailed flooding analysis of all mining activities within the CIA 10, Subarea 1A watershed. The SEDCAD computer model was used to predict peak flow for the 25-year and 100-year storm events. Peak flow generated by SEDCAD was input into the irregular channel routine of the Bentley Systems, Inc., Flow Master to develop water surface elevations at various locations along Clear Fork. The reports of the SEDCAD and Flow Master modeling and cross sections are included in the permit application.

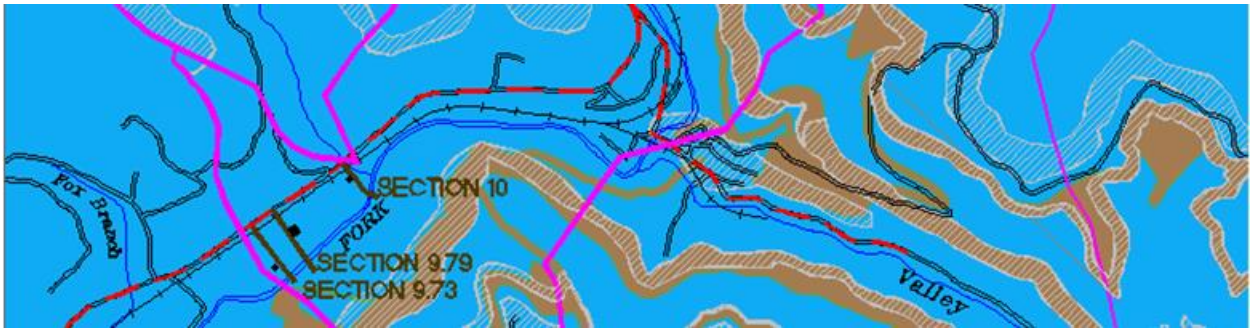


Figure III-27. Location Map of Cross-Sections used for Flooding Analysis

The three critical areas that were evaluated are the Clairfield Elementary school (cross section 9.79), residence # 25 (cross section 9.73), and the Baptist Church (cross section 10.0) as shown in Figure III-27. The results of these evaluations were reviewed by OSMRE/KFO engineering staff to determine if mining would result in an increased risk in the flooding potential or result in new damage to those structures. The flooding analyses were based on 25- and 100-year recurrent storm events under existing, during mining, and postmining conditions. The location of the channel cross sections are shown below and the results of the analysis are summarized in the Flooding Analysis Table III-71 below.

Condition	25-Year Discharge (cfs)	Surface Water Elevation (in feet)			100-Year Discharge (cfs)	Surface Water Elevation (in feet)		
		Section - 10	Section - 9.79	Section - 9.73		Section - 10	Section 9.79	Section- 9.73
Existing	9,522.20	1139.81	1133.85	1131.99	13,88.268	1140.86	1134.79	1132.60
During Mining	9,731.27	1139.98	1133.92	1132.07	14,207.34	1141.02	1134.89	1132.69
Postmining	9,576.58	1139.93	1133.87	1132.04	13,929.99	1140.95	1134.84	1132.64
Maximum Flood Depth Increase (feet)		0.17	0.07	0.08		0.16	0.10	0.09

Table III-71. Flooding Analyses Summary

Clear Fork, Residence # 25, Cross Section 9.73: As indicated in Table III-71 and shown in Figure III-28, a slight increase in the peak discharge is predicted for during and postmining conditions. The increase in peak discharge during the 100 year event would increase the surface water elevation by 0.09 feet or 1.08 inches. The predicted surface water elevation is modeled to be 3.72 inches below the finished floor elevation of residence number 25.

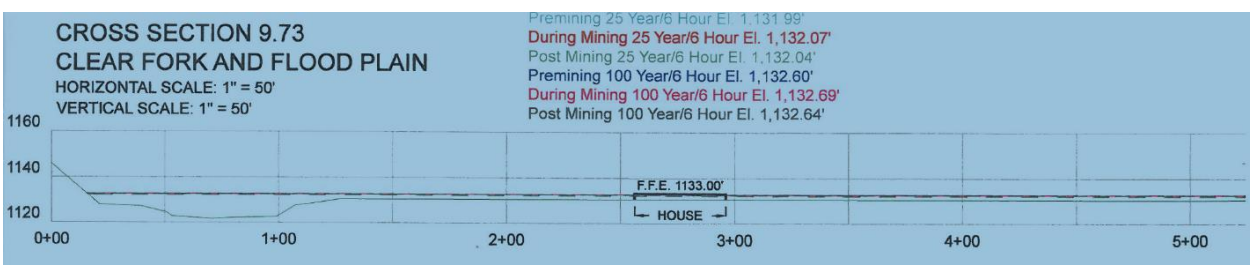


Figure III-28. Flooding Cross-section 9.73

Clear Fork, Clairfield Elementary School, Cross Section 9.79: As indicated in Table III-71 and shown in Figure III-29, a slight increase in the peak discharge is predicted for during and postmining conditions. The increase in peak discharge during the 100- year event would increase the surface water elevation by 0.10 feet or 1.20 inches. The predicted surface water elevation is modeled to be 6.12 inches below the finished floor elevation of Clairfield Elementary School.

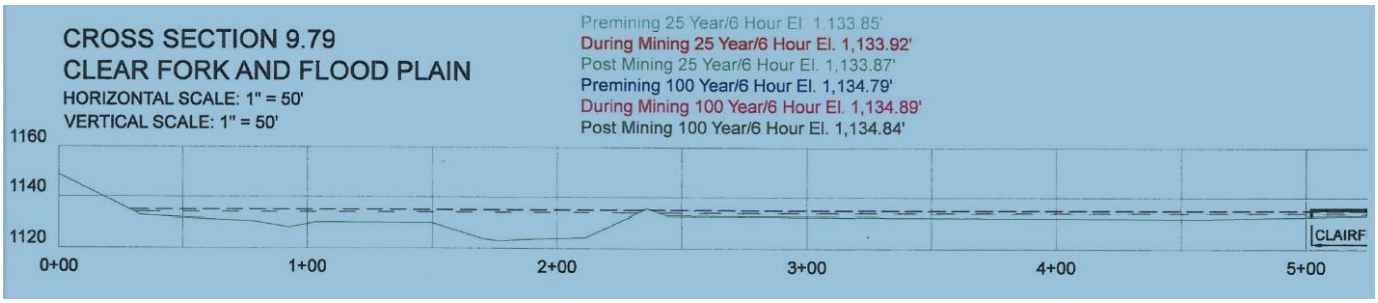


Figure III-29. Flooding Cross section 9.79

<u>Clear Fork, Baptist Church, Cross Section 10.0:</u> As indicated in the Table III-71 and shown in Figure III-30, a slight increase in the peak discharge is predicted for during and postmining conditions. The increase in peak discharge during the 100 year event would increase the surface water elevation by 0.16 feet or 1.92 inches. The predicted surface water elevation is modeled to be 24.72 inches below the finished floor elevation of the Baptist Church.

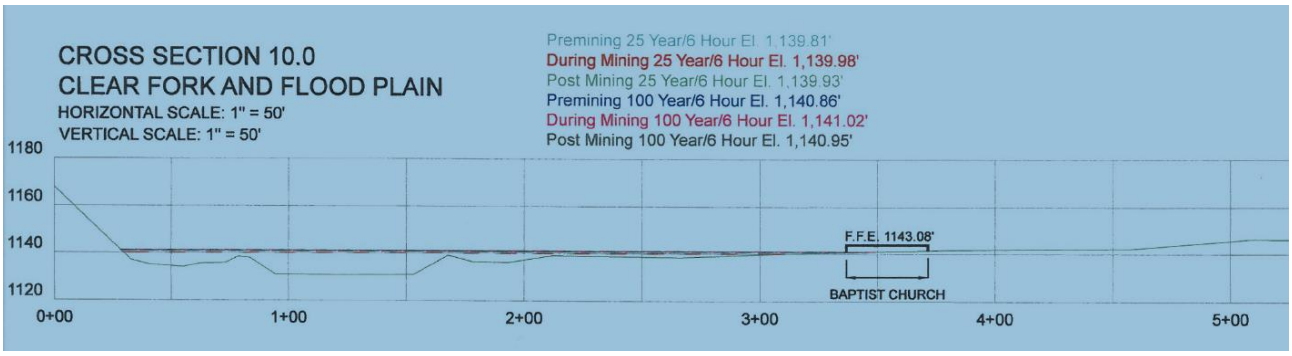


Figure III-30. Cross Section 9.73

These predicted flood elevations were compared to the existing floor elevations of the school, church, and the residential structure and determined that the increase in the water levels were minor and would not exceed any elevations that would cause additional flooding of those structures. Therefore, the expected increase in the depth of flow would not result in any material damage that would be attributable to surface coal mining activities within the watershed. In addition, it should be noted that residence #25, the Clairfield Elementary School, and the Baptist Church are located within the Flood Zone as identified on the National Flood Insurance Program Rate Map 47025C0035D, dated 9/25/2009.

Sediment Yields at TS10-1A

CIA 10, Subarea1A trendstation is located on Clear Fork, approximately 3.7 miles upstream from TS10-1 and drains into the upper 29.8 square miles of the Clear Fork watershed (Figure III-31).The receiving streams in this watershed have historically been and are currently being impacted by sedimentation from the active and abandoned mines, landslides, logging activities, oil and gas exploration/recovery, and unimproved roadways. The severity of this impact has generally improved through time because of the natural revegetation of the barren spoil piles and the remining of the majority of the abandoned mine benches over the past 20 years. However, logging and other land use disturbances are anticipated to continue throughout the Clear Fork watershed. TDEC stated that the upcoming stabilization of existing roads in the mine area, in combination with the reclamation activities that will result from the proposed mining would reduce sediment loading in the Valley Creek. TDEC concluded that the reclamation of this site will be instrumental in restoring the Valley Creek and Tackett Creek watersheds to a fully supporting use status and meeting the Cumberland River TMDL document requirements. These views are codified by the issuance of the State NPDES permit for this mine site and Kopper Glo, LLC., OSMRE Permit 3296 within this watershed.

Proper implementation of drainage/sediment control including the construction of the proposed sediment structures and ARAP channels will reduce the potential for erosion of the steep slope terrain, the associated risk of creating or reactivating landslides, and reduce the sediment load within this CIA. The existing roadways, which access the proposed mine sites, are also a source of sediment loading to the area streams. Upgrading and maintenance plans for these roadways are part of the mining plans and should help to minimize, but not eliminate, the sediment loading to the receiving streams in each CIA.

Sediment yields from existing operations, anticipated operations, and other land use activities within each CIA watershed were estimated using the EPA Spreadsheet Tool for Estimating Pollution Loading (STEPL) version 4.1. STEPL uses a combination of the Universal Soil Loss Equation (USLE) and storm runoff calculated by methods outlined in the United States Department of Agriculture, Urban Hydrology for Small Watersheds, also known as TR-55

(USDA, 1986). The TR-55 method uses a set of curve numbers based on land use classifications and soil properties such as erosivity and hydrologic soil group. Estimates of existing and predicted changes in sediment yield were performed at OSMRE/KFO for CIA 10, Subarea 10-1A trendstation.

These estimates are provided in Tables III-72, which is based on the approximate acreage of each watershed found in Figure III-31. The land use map (Figure III-31) and estimated land use disturbance are based on the 2006 National Land Cover Data (NLCD) set which consists of 16 land use classifications. OSMRE correlated these NLCD land uses with the STEPL modeling requirements to develop the inputs for STEPL. Areas of new mining, which have been permitted since the 2006 NLCD, were added to ensure that sediment yield for these areas were included. All TR-55 runoff calculations were based on a hydrologic soil group C soil, which is the dominant soil type in the watershed.

This CHIA takes into account the previous permitting actions for the Appolo Fuels, Inc., OSMRE Permit 3296 and the Kopper Glo Mining, LLC, OSMRE permit application 3270. These actions added 1276 acres of new mining disturbance to the STEPL model. This mining was added as a user-defined category to ensure that sediment yield for these areas were included.

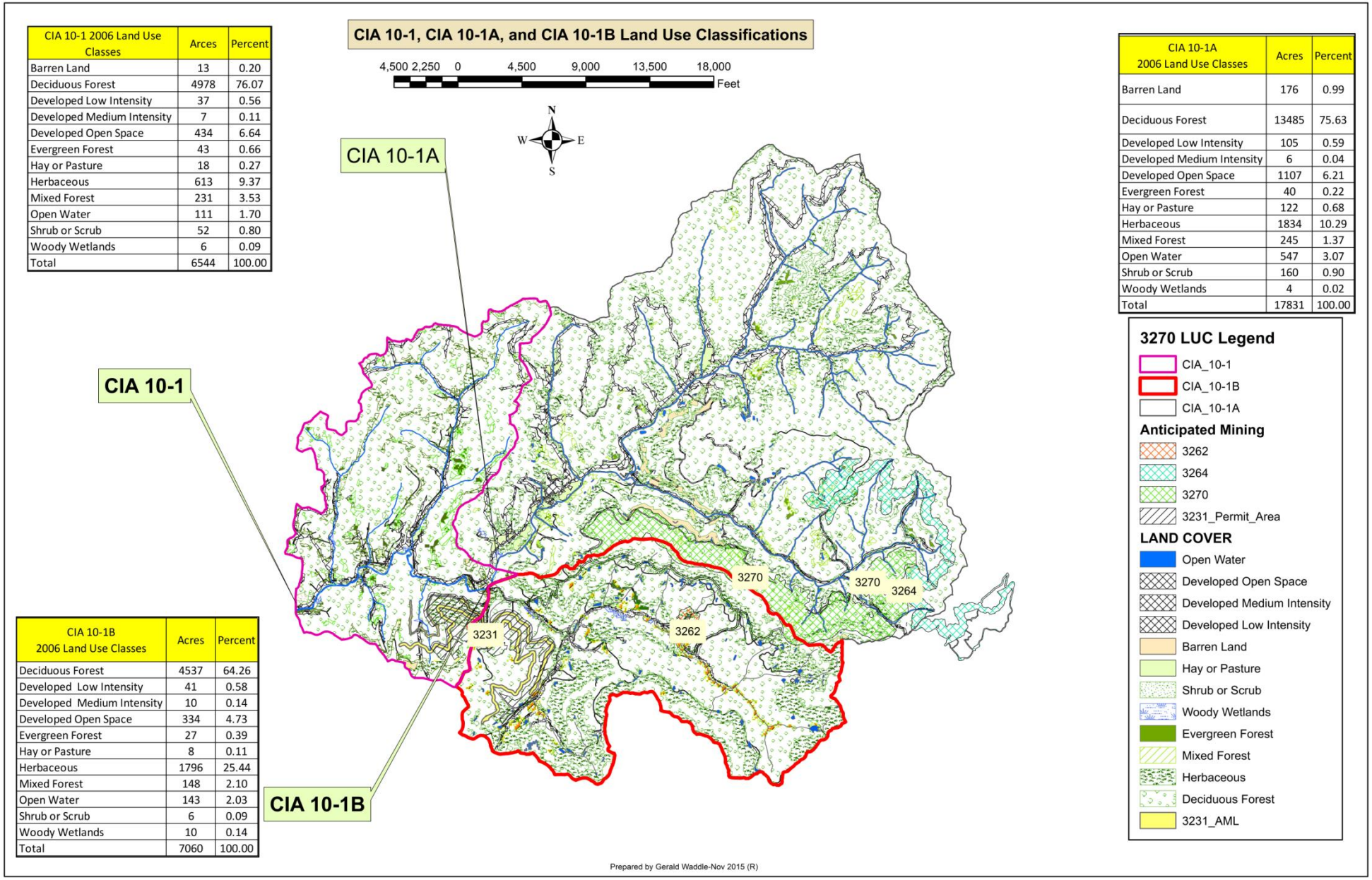
The CHIA for the CIA 10-1A estimates an initial decrease of approximately 41% in the annual sediment yield due to the implementation of BMPs during the active mining. These estimates are due in part to the stabilizing existing haul roads upgraded for use for the proposed mining that have been an ongoing source of sediment prior to active mining. Additionally, as part of any mining permit's reclamation plan it is expected sediment yield will be minimized as result of contemporaneous reclamation. This type of reclamation consists of backfilling and grading of mining/remined areas and abandon mine lands simultaneously establishing sediment control and ground cover to erosion on the newly graded backfilled mine areas. TDEC's Clear Fork TMDL lists the annual sediment yield/load of 414 lbs./ac/yr. within the Clear Fork Watershed an impairment to the watershed due to siltation. The estimated sediment yield for the Clear Fork watershed translates into an annual

yield at TS10-1A of 3680.66 tons/year as compared to the OSMRE premining estimated annual yield (Table III-72) of 4985 tons/ac/yr. at TS10-1A. By converting from tons/year and comparing the projected OSMRE premining yield in lbs./acre/year, it can be compared to the TDEC's TMDL existing load of 414 lbs./acre/year. This sediment load (414 lbs./acre/year) is the target by which TDEC wants to reduce by at least 33.3% for all mining within this watershed. Table 72 presents the prevailing conditions of 560 lbs./acre/year. With the implementations of BMPs, it is predicted the sediment yield reduction will be approximately 41% when these BMPs are fully implemented during mining. At the end of postmining reclamation phase where all active BMPs have been removed, the predicted sediment yield will increase slightly to an estimated 36% reduction staying under TDEC's targeted sediment reduction of 33.3 %.

Once mature forests are established and replace the initial grassland areas, the overall sediment production levels are anticipated to decline significantly over prevailing and post-mining reclamation levels. BMPs were considered for all categories of land use in both watersheds, since there are over 200 acres of existing basins scattered throughout these watersheds. OSMRE is assuming that all of the proposed mining lands will be successfully reclaimed to a grassland, then forest.

Condition	Yield in Tons/Year*	Yield in lbs. / Acre/Year*	BMP Sediment Reduction
Prevailing	4985	560	0
During Mining	2977	334	41%
Postmining	3194	359	36%

Table III-72. Sediment potential based on Land Use changes in the CIA 10-1A. Subarea Watershed. with BMPs



CIA 10-1 2006 Land Use Classes	Arces	Percent
Barren Land	13	0.20
Deciduous Forest	4978	76.07
Developed Low Intensity	37	0.56
Developed Medium Intensity	7	0.11
Developed Open Space	434	6.64
Evergreen Forest	43	0.66
Hay or Pasture	18	0.27
Herbaceous	613	9.37
Mixed Forest	231	3.53
Open Water	111	1.70
Shrub or Scrub	52	0.80
Woody Wetlands	6	0.09
Total	6544	100.00

CIA 10-1A 2006 Land Use Classes	Acres	Percent
Barren Land	176	0.99
Deciduous Forest	13485	75.63
Developed Low Intensity	105	0.59
Developed Medium Intensity	6	0.04
Developed Open Space	1107	6.21
Evergreen Forest	40	0.22
Hay or Pasture	122	0.68
Herbaceous	1834	10.29
Mixed Forest	245	1.37
Open Water	547	3.07
Shrub or Scrub	160	0.90
Woody Wetlands	4	0.02
Total	17831	100.00

CIA 10-1B 2006 Land Use Classes	Acres	Percent
Deciduous Forest	4537	64.26
Developed Low Intensity	41	0.58
Developed Medium Intensity	10	0.14
Developed Open Space	334	4.73
Evergreen Forest	27	0.39
Hay or Pasture	8	0.11
Herbaceous	1796	25.44
Mixed Forest	148	2.10
Open Water	143	2.03
Shrub or Scrub	6	0.09
Woody Wetlands	10	0.14
Total	7060	100.00

Figure III-31. Land Use Classifications for Estimating Soil Erosion and Runoff in the CIA 10-1 Watershed.

C. CIA 10, Subarea 10-1A-Surface Water

This section discusses the prevailing water quantity and chemistry of the CIA 10 Subarea 10-1A watershed. This discussion is based on trendstation data, OSMRE stream monitoring data, and Discharge Monitoring Baseline Report data (DMR). This includes supplemental information collected within each watershed to help characterize and make predictions of change resulting from the proposed mining identified in Table III-1 of this CHIA.

The TDEC has under the *Rules of the Water Quality Board, Chapter 1200-4-4, Use Classifications for Surface Waters* (TDEC, 2007), classified all streams with the exception of wet-weather conveyances, into surface water use categories. Clear Fork and Valley Creek, are designated for recreation, irrigation, fish and aquatic life, and livestock watering.

All water quantity and quality criteria evaluated, as part of this CHIA evaluation, will be based on these designated uses of the surface water systems. Since there were no potentially impacted surface water users identified within or adjacent to the proposed mine site or within the CIA 10, Subarea 1A watershed, the highest TDEC use, classification is considered to be criteria associated with the protection of fish and aquatic life.

Surface Water Quantity

To estimate the surface water flow regime within these watersheds, the U.S. Geological Survey (USGS) StreamStats program (http://water.usgs.gov/osw/streamstats/tennessee.html) and the TDEC Low Flow and Flow Duration model were utilized to calculate mean monthly discharges, flow duration, and critical discharges for high and low events. The StreamStats program was developed based on USGS procedures outlined in Ladd and Law (2007); Law and Tasker (2003); and Bingham (1986).

The TDEC model was developed from the procedures found in Law, G.S., Tasker, G.D., and Ladd, D.E, (2009), "Streamflow-Characteristic Estimation Methods for Unregulated Streams of Tennessee". As described in the "Procedures for the Cumulative Hydrologic Impact Assessment" (2005), OSMRE conducts data exploration and evaluation by these methods. The Handbook recommends using the mean monthly flows from the closest USGS gauging station to estimate the mean monthly flows at the prescribed trendstation. The USGS gauging station at Saxton, Kentucky was used in the case of this CHIA.

Mean Flow	Discharge (cfs)
Annual	48.7
January	76.1
February	86.2
March	102.3
April	78.66
May	49.8
June	26.8
July	19.4
August	15.66
September	12.1
October	14.5
November	31.5
December	62.1

Table III-73. Mean Annual and Monthly Flows for the CIA 10 1A. Subarea watershed (19071.92ac)

Table III-73 lists estimated mean annual and monthly mean flows at the CIA 10, Subarea 1A trendstation, which includes both baseflow and all storm water runoff. These estimates can then be used to calculate the expected stream discharge within any given watershed size. For example, the annual mean stream flow in CIA 10, Subarea 1A was estimated to be approximately 48.7 cfs. The subarea has a drainage area of approximately 28.9 square miles, which equates to an average discharge of 1.68 cfs/mile^2 or 0.000088 cfs/acre annually.

Table III-74 provides peak storm flows that were calculated using the StreamStats program for these watersheds. For example, in Table III-74, the results show that the average two year, recurrent interval storm should generate a peak discharge of approximately 2920 cfs at the trendstation. Depending on the State or Federal agency, a two-year recurrent interval storm is considered an approximation of the effective discharge for this watershed, which is often considered for channel geomorphology and bank erosion.

Year	Peak Flow
2-year	2920 cfs
5-year	4720 cfs
10-year	6040 cfs
25-year	7790 cfs
50-year	9160 cfs
100-year	13800 cfs

Table III-74. Peak Storm Discharge for Straight Creek at the CIA 10-1A Subarea Trendstation

Most of OSMRE's CHIA water quality and quantity samples were collected during low-flow conditions. Flow duration is

another method for comparing stream discharge. Flow duration is a comparative estimate of the percentage of time that a stream flow can be anticipated to equal or exceed a measured stream flow event. Thus, using Table III-75, a measured discharge of 3.04 cfs would be anticipating that 90% of the yearly stream discharge would be expected to equal or exceed this flow rate.

Flow Duration	Discharge (cfs)
D95%	1.92
D90%	3.04
D80%	5.38
D70%	8.85
D60%	14.22
D50%	22.23
D25%	52.14
D10%	105.33

Table III-75. Flow durations for the CIA 10, Subarea 1A Watershed

For example, the CIA Subarea 10-1A trendstation measured median flow is 7.83 cfs, which is between the the D70% and D80% flow duration. That means the majority of OSMRE's water quality and quantity data from this CIA trendstation was collected during near the lowest 25 percentile of flow when dilution of mineralized mine water is at its minimal.

The USGS (1982) concluded that most streams in this area that drain less than 100 square miles occasionally go dry. This is a result of the steep slopes, which generate rapid runoff and the semi-impervious nature of the soil, which limits infiltration. As a result, stream flow is poorly sustained in periods of low precipitation. Therefore, it is often necessary to estimate critical low-flow stream discharges to determine if adequate dilution or assimilative capacity is available for mine or other wastewater discharges. It is especially important in areas where non-storm water discharges result from either ground water pumpage or gravity drainage from underground mines during periods when seasonal near zero-flow conditions are occurring.

An estimate of annual and winter critical low-flow discharge and their anticipated recurrence intervals are provided in Table III-76 (Law et al., 2009). Summer low flow is generally considered as the period between May 1 and November 30, while winter low flow is considered from December 1 through April 30.

Low Flow Event	**Annual Low Flow (cfs)**	**Winter Low Flow (cfs)**
7Q2	0.74	5.54
7Q10	0.23	2.95
7Q20	0.15	1.4
3Q2	0.64	4.32
3Q10	0.27	1.1
3Q20	0.14	0.69

Table III-76.-Critical low flow (cfs) Estimates for CIA 10 TS-1A.

Surface Water Quality

The proposed permit area is located within the CIA 10, Subarea 1A watershed. Water quality data was obtained from the OSMRE Envirodata database and used in a statistical evaluation to assess conditions in the CIA10, Subareas1A watershed while also comparing to the adjacent CIA 10, Subareas 1 (lower Clear Fork) and 1B (Straight Creek) These analyses were undertaken to evaluate water quality trends in the larger CIA 10, Subarea 1 watershed. The water quality of the CIA 10, Subareas 1, 1A, and 1B watersheds is typically a calcium-magnesium-sulfate water for all flow conditions and years of record collected by OSMRE. Figure III-32 provides a Piper diagram for this trendstation data during specific periods of record. The median base flow (with some outliers) and high base flow data, plot more strongly in the magnesium-calcium-sulfate quadrants. Historically, the U.S. Forest Service data indicated that the water type in these watersheds, circa 1950-1965, was strongly magnesium-calcium-sulfate type water. The water type is generally consistent, throughout these watersheds, but some migration within the water type can be seen between the different years and the different flow conditions.

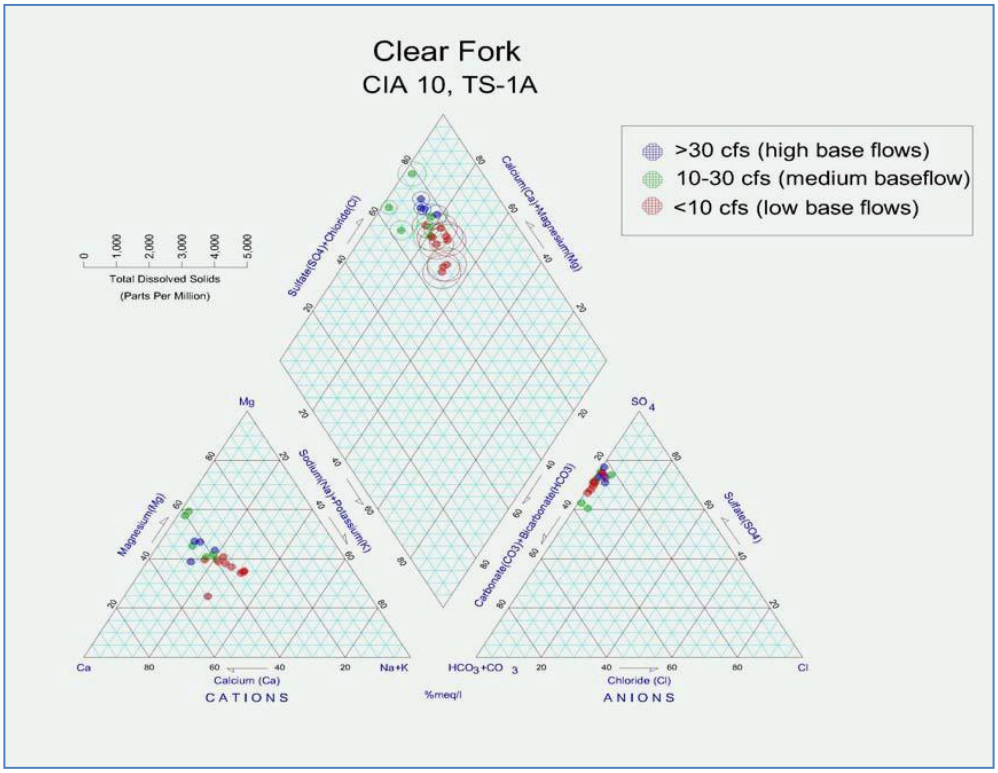


Figure III-32. Piper diagram showing water type based on OSMRE collection year for the CIA 10, TS-1A Trendstation (5/1986-8/2006)

TS 10-1A Data Evaluation

Water quality data was evaluated using parametric methods, but where data did not follow a normal distribution, non-paramedic statistics were used to evaluate the data for discernable trends. Tested data was then classified as normal or non normal. Table III-77 summarizes data classifications with the statistical test used with the data.

Many SMCRA pollutants do not have numerical water quality criteria which can be directly applied to effects on stream-use classification. As a result, OSMRE uses a series of threshold concentrations for parameters such as TDS, sulfate, and manganese, which can be monitored for gross changes in the watershed. These thresholds are currently listed as 500, 250, and 1.0 mg/L, respectively, for each of these pollutants. Once these thresholds are either measured in the field or predicted to be exceeded, OSMRE will request TDEC to verify that these levels of mineralization are not affecting the designated uses of the surface water systems. OSMRE may also require biological surveys of streams with documented exceedances to help determine biological support.

Due to documented TDS exceedances above OSMRE thresholds and several exceedances of the EPA's Criterion Maximum Concentration (CMC) or Criterion Continuous Concentration (CCC) values for aluminum, OSMRE has in the past, contacted TDEC to perform a review and analysis for Valley Creek, Clear Fork, and Straight Creek watersheds to determine use support. TDEC requires all NPDES applicants to conduct biological surveys within these watersheds on an annual basis to monitor the use support.

Parameter	CIA 10-1A
pH	Data Appears Normal at 5% Significance Level No Trend
Iron	Data Approximate Normal at 5% Statistically significant evidence of an increasing Trend at the specified level of significance.
Manganese	Date not Normally Distributed at 5% Significance Level No Trend
Sulfate	Data Normal at 5% Significance Level No Trend Mann Kendal Trend Test
Alkalinity	Data Appear Normal at 5% Significance Level No Trend Mann Kendal Trend Test
TSS	Data not Normal at 5% Significance Level
TDS	Data appear Normal at 5% Significance Level No Trend Mann Kendal Trend Test
Al	Data appear Normal at 5% Significance Level No Trend Mann Kendal
Specific Conductance	Data appear Normal at 5% Significance Level Upward Trend Mann Kendal

Table III-77. Summarized Data Classification.

Since the highest use classification for watersheds and their tributaries is the protection of fish and aquatic life, this water quality criteria will be used to determine exceedances. These watersheds are not classified for use as a domestic water supply. Hence, Drinking Water Act standards were not applied to any measured water quality data collected in these watersheds, but in some instances are identical to TDEC's fish and aquatic life criteria.

An assessment for each SMRCA pollutant is provided below to help interpret the current water quality trends within this watershed. These parameters are shown with the other downstream and adjacent trendstation(s) data within the watershed for reference.

The use of "Box -Whisker" (Figure III-33) is used to simplify the data review. The chart is based on five summary statistics: (1) Minimum value – the smallest value in the data set; (2) Second quartile – the value below which the lower 25% of the data are contained; (3) Median value – the middle number in a range of numbers; (4) Third quartile – the value above which the upper 25% of the data are contained; and (5) Maximum value – the largest value in the data set. The ends of the whisker are set at 1.5*IQR (interquartile range) above the third quartile (Q3-maximum value) and 1.5*IQR below the first quartile (Q1- minimum value). If the minimum or maximum sampled values are outside this range, then they are considered as outliers. The normal convention for box plots is to show all the outliers and to simplify this template, only the Min and Max outliers are shown. Figures III-34 through III-42 show the long-term distribution of SMCRA parameters measured (Table III-78) in this CIA10, Subarea 1A watershed along with the immediate adjacent subareas CIA 10, Subarea 1 located downstream in the Clear Fork watershed and CIA 10, Subarea 1B located in the Straight Creek watershed.

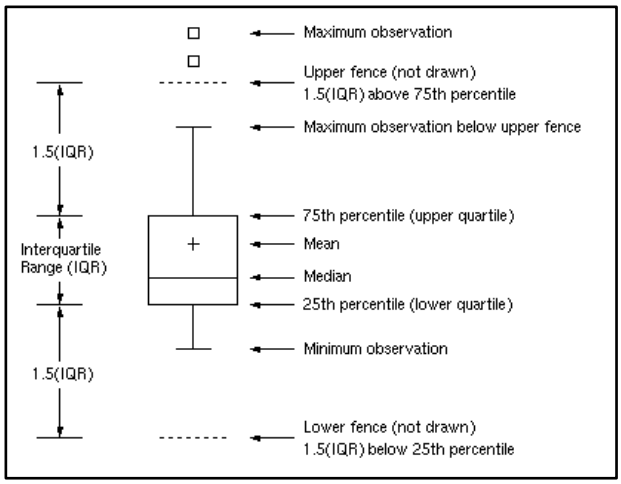


Figure III-33. Box-Whisker Data Classification

pH: The measured pH values in this watershed ranges between 6.5 and 8.3 and is indicative of increased alkalinity and hardness resulting from previous mining activities. The pH data

is not normally distributed. Using the Theil-Sen Trend Analysis Test, no evidence was found of any trend at the specified level of significance (95%), nor does it demonstrate any evidence of either any increasing or decreasing trend. Figure III-34 shows the long-term distribution of pH values measured (Table III-78) at the OSMRE's CIA 10-1A trendstation.

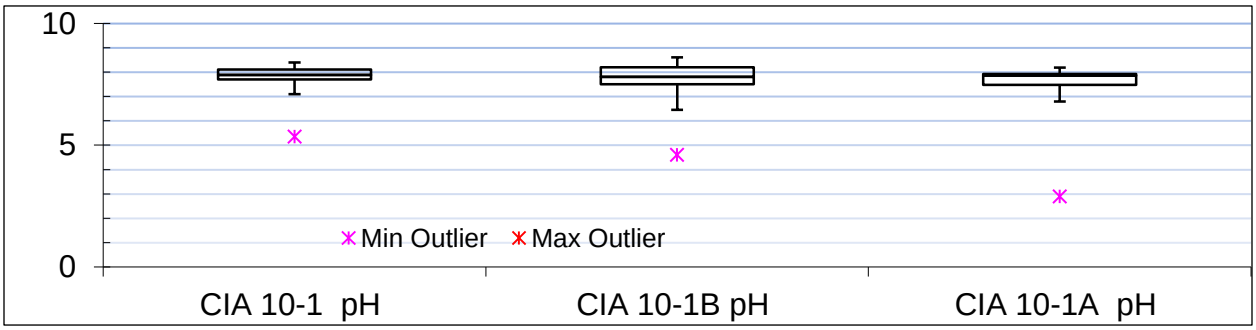


Figure III-34. pH for CIA 10-1A Trendstation

The pH box plot shows that the long term distribution of the data for three CIA 10-1 trendstations have nearly the same median. Also, the box sizes only change slightly indicating little dispersion among the data; which implies there is not much difference between the pH values between CIA subareas. Historically, the pH values for this station have been within acceptable ranges during the past 23 years, based on the OSMRE record. The median pH value of the trendstation is 7.87. Trendstations 10-1 and 10-1A have nearly the same median with less than 1 percent difference between these values as indicated on Figure III-10 that compares the trendstation data to the application baseline monitoring station data.

Iron: The measured iron concentrations generally range between 0.05 and 0.94 mg/L with a median of 0.24 mg/L. The mean iron value has not changed significantly in the last five years. TDEC does not have in stream "numeric" water quality criteria for iron. Since the concentrations are continuously below 1 mg/L, this is an acceptable threshold limit for the stream usage criteria. The iron data is not normally distributed for all three trendstations. Using the Theil-Sen Trend Analysis Test, "no evidence was found for any trend at the specified level of significance (95%)." There were no exceedances noted over the course of 33 sample periods. The iron box plot (Figure III-35) compares the distribution of the data for

the three trendstations in this watershed while Figure III-6 compares the trendstation to baseline monitoring station data.

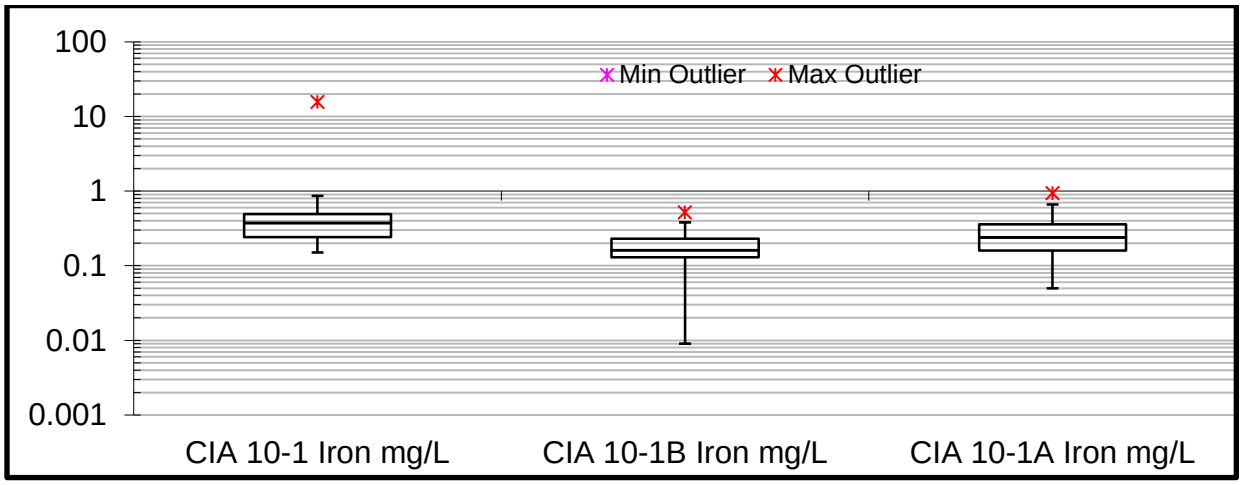


Figure III-35. Measured values for Iron (Fe) Concentrations at the CIA 10-1A Trendstations

The data analysis indicates there is no significant evidence for either increasing or decreasing iron trends in these watersheds. The median concentrations for total iron are 0.28 mg/L. The median ranges for CIA10-1 and CIA10-1A trendstations lie between these two charts 2nd and 3rd Quartile which indicates the iron dissolution rates are virtually the same between each these two trendstations. Collectively, the iron concentrations within these watersheds are within compliant ranges and should remain complaint based on the proposed mining and reclamation plans under the Kopper Glo Mining, LLC Cooper Ridge Surface Mine #1 permit application.

Manganese: The manganese box plot (Figure III-36) shows the distribution of the data for the three trendstations. The data analysis indicates no significant evidence was found for either an increasing or decreasing trend in the CIA10-1A or CIA10-1B watersheds. The manganese data generally ranges between 0.01and 0.5 mg/L with a median of 0.097 mg/L, which is well below the OSMRE threshold value of 0.35 mg/L. The data appears Gamma distributed. Using the Mann Kendal Trend Test, no statistically significant evidence was found for any trend at the specified level of significance (95%). Figure III-36 and Table III-78 show the long-term distribution of manganese values measured at the OSMRE CIA 10, Subarea 1A trendstation. The mean concentration for total manganese is 0.13 mg/L. The

median ranges for CIA10-1 and CIA10-1A trendstations lie between these two charts, 2nd and 3rd quartile, which indicate that the manganese dissolution rates are virtually the same between each these two trendstations.

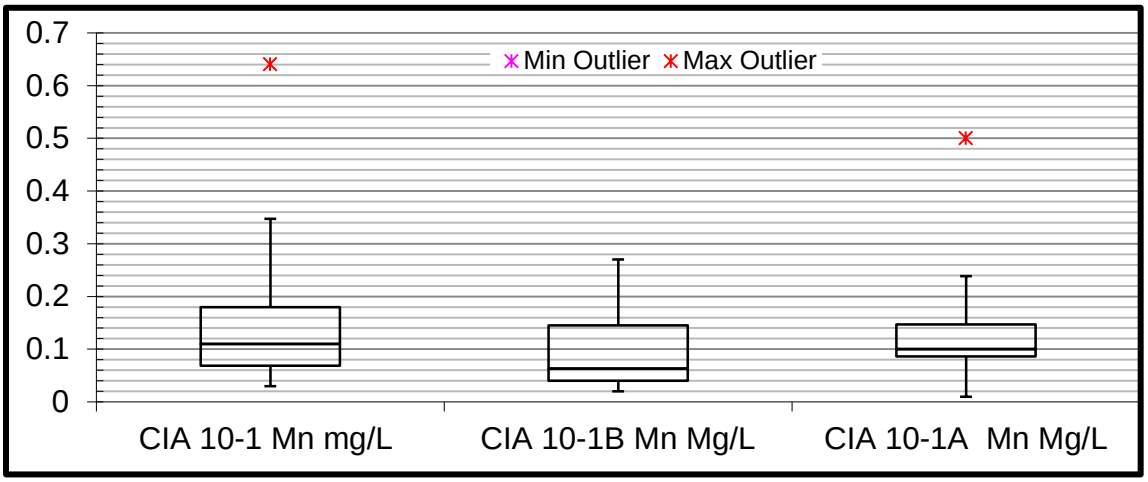


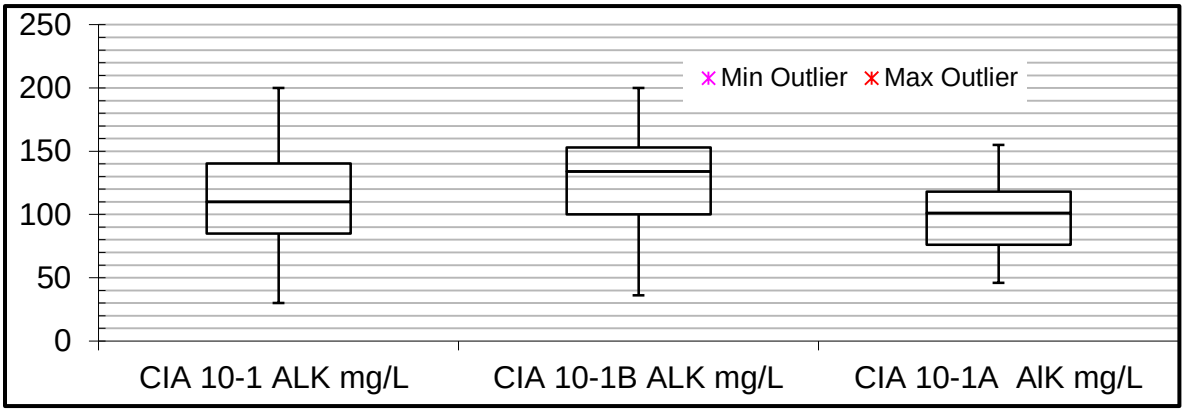
Figure III-36. Measured values for Manganese (Mn) Concentration at the CIA 10-1A trendstation

The CIA 10-1 tests indicated a downward trend in this watershed. Since both CIA10-1A and 1B discharges water through this point, it can be assumed that these combined discharges influence this downward trend for manganese at CIA 10-1. The median concentrations for total manganese are 0.11 mg/L, 0.11 mg/L, and 0.097 mg/L respectively, which is well below OSMRE' s threshold value of 0.35 mg/L. The median values lie within the 2nd and 3rd Quartile for all trendstations, which indicates manganese dissolution rates are virtually the same between each of the watersheds. There is insufficient statistical evidence to identify a significant manganese trend at any trendstation included in this analysis. Collectively, manganese concentrations within these watersheds are within compliant ranges and should remain complaint based on the proposed the mining and reclamation plan for the Kopper Glo Mining, LLC's Cooper Ridge Surface Mine #1.

Alkalinity: The measured alkalinity ranged between 46 and 155 mg/L, making this moderately hard water. The data appears normally distributed. Using the Mann Kendal Trend Test, statistically significant evidence was found for an increasing trend at the specified level of significance (95%). Figure III-37 shows the long-term distribution of alkalinity values measured (Table III-78) at the OSMRE trendstation. The alkalinity box plot

(Figure III-37) compares the distribution of the data for all three trendstations while Figure III-8 compares the trendstation to the baseline data stations.

Figure III-37. Measured values for Alkalinity (ALK) at CIA 10-1A Trendstation.



The alkalinity data sets are normally distributed for all three watersheds. The data indicated that significant evidence was found for an increasing trend within two of the watersheds, but no trend was identified for TS10-1. The median concentration for total alkalinity is 109 mg/L, 101 mg/L and 101.5 mg/L respectively.

The median ranges are within the 2nd and 3rd Quartile for all of the trendstations, which indicates that dissolution rates are virtually the same between each of the watersheds. The most logical explanation for this increase in alkalinity is the extensive reclamation of abandoned mine lands within these watersheds. There is no TDEC water quality criterion for alkalinity.

Sulfate: The measured sulfate concentration generally ranged between 102 and 320 mg/L, with a median of 197.5 mg/L, which is below the OSMRE threshold value of 250 mg/L. The data appears normally distributed. Using the Mann Kendal Trend Test, statistically significant evidence was found for an increasing trend at the specified level of significance (95%) for all three watersheds. The sulfate box plot (Figure III-38) shows the distribution of the data for all three CIA-10-1 trendstations while Figure III-9 compares the date to the baseline monitoring stations. The median concentration for total sulfate is 187.5 mg/L, 209 mg/L, and 197.5 mg/L respectively. The median ranges lies within the 2nd and 3rd Quartile

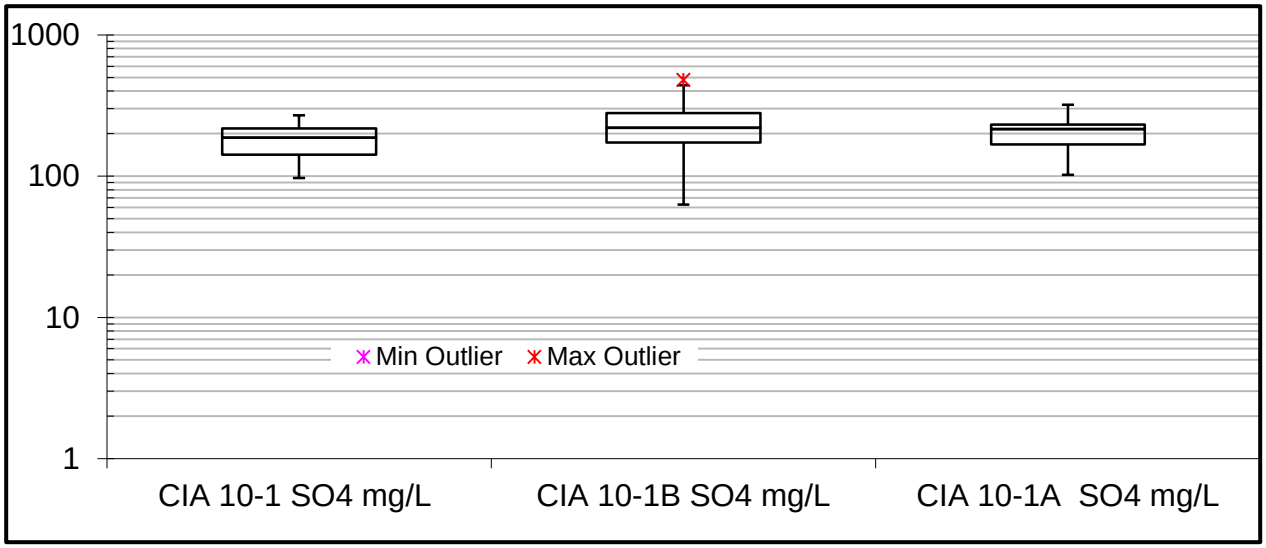


Figure III-38. Measured values for Sulfate (SO_4) at CIA 10-1A Trendstation.

for all of the trendstations, which indicates sulfate dissolution rates are virtually the same between each of the watersheds.

The most logical explanation of this increase in sulfate is the extensive reclamation of abandoned mine lands within these watersheds. Mine owners are required to handle and/or neutralize acid-forming materials. The byproduct of neutralizing acid material is sulfate. There is no TDEC water quality criterion for sulfate, but OSMRE uses a threshold limit of 250 mg/L as a trigger to evaluate in stream impacts

Collectively, as shown in Figure III-38, sulfate concentrations within these watersheds are within OSMRE threshold ranges and should remain compliant based on the proposed mining and reclamation plans for the Kopper Glo Mining, LLC, OSMRE 3270 permit application and the anticipated mining plans.

Total Dissolved Solids: The measured TDS concentrations ranged between 102 and 615 mg/L with a median of 392.5 mg/L, which is below the OSMRE threshold value of 500 mg/L. Using the Mann Kendal Trend Test, statistically significant evidence was found for an increasing trend at the specified level of significance (95%) within all three watersheds. There are seven exceedances out of the 33 sample periods. Figure III-39 and Figure III-12

compares the long-term distribution of TDS values measured (Table III-78) at OSMRE's trendstations and the baseline monitoring stations.

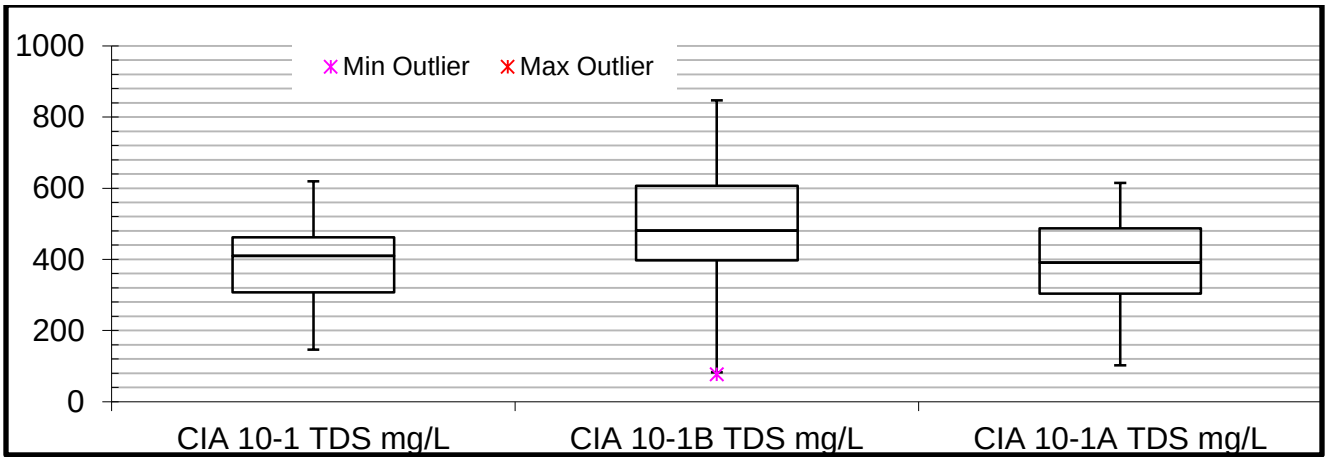


Figure III-39. Measured values for TDS at CIA 10 -1A Trendstation.

The TDS data is normally distributed for all three watersheds. The median concentration for TDS is 417 mg/L, 481 mg/L, and 392.5 mg/L respectively. The median range of the data lie within the 2nd and 3rd Quartile for two trendstations, which indicates that the dissolution rates are virtually the same between each of the watersheds, however, CIA10-1B had the largest dispersion of data. The most logical explanation for this upward data trend could be the elevated TDS within the discharges from underground works found in this watershed. Since the Straight Creek (10-1B) watershed has numerous, direct ground water discharges into the stream from abandoned underground mines should result in larger data dispersions. Previous CHIAs indicate the predicted 3Q10 discharge for Straight Creek is 0.48 ft^3/s. But these ground water discharges provide 0.45 ft^3/s to 166 ft^3/s of flow into Straight Creek with a significant TDS load. There is no water quality criterion for TDS, except for the OSMRE 500 mg/L threshold.

Aluminum: The data appears normally distributed. Using the Mann Kendal Trend Test, statistically significant evidence was found for an increasing trend at the specified level of significance (95%). Total aluminum exceeded the CCC value of 0.087 mg/L thirteen times out of the thirty-three samples.

However, as stated in the EPA National Recommended Water Quality Criteria Correction (U. S. EPA, 1999), the toxicity of aluminum is lower at higher pH and hardness values and is not quantified at this time. Likewise, the EPA recognizes the potential for aluminum associated with clay particles being less toxic than other forms. Figure III-40 shows the long-term distribution of aluminum values measured (Table III-78) at the OSMRE TS10-1A trendstation. Figure III-40 also shows a comparison of TSS and aluminum.

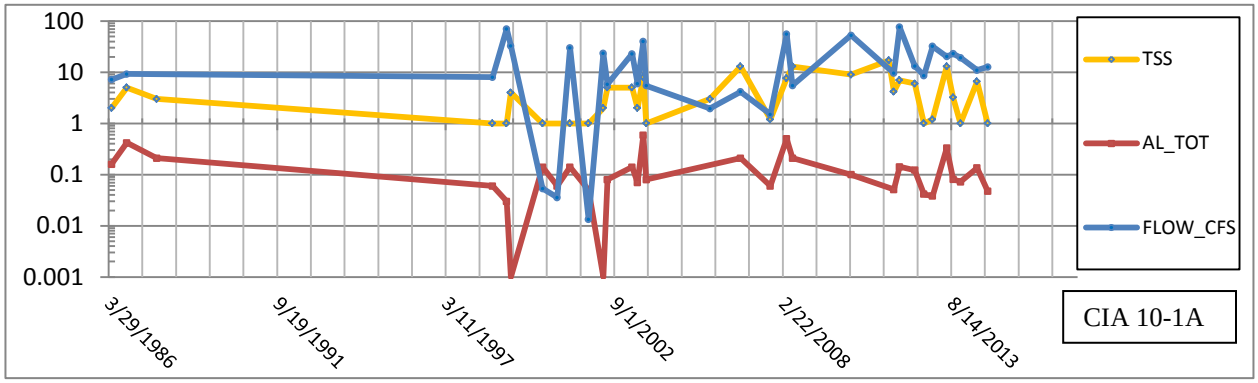


Figure III-40. Comparison of TSS and AL Concentrations at TS-1A Trendstation.

The trend demonstrates that as TSS increases with flow, that total aluminum also increases. Suspended clay particles are usually a form of an aluminum-silicate mineral that comprises the majority of TSS.

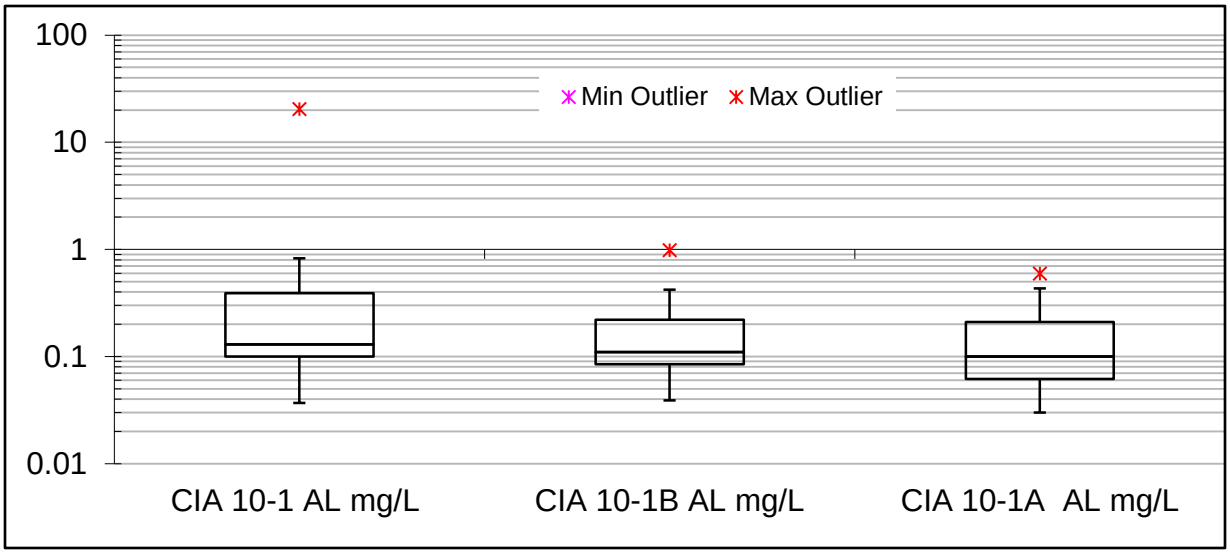


Figure III-41. Measured values for Aluminum (AL) concentrations at the CIA 10-1A Trend Station.

The aluminum box plot (Figure III-41) indicates the distribution of the data for all three trendstations within the CIA 10-1 watershed. The data appears normally distributed.

Using the Mann Kendal Trend Test, statistically significant evidence was found of an increasing aluminum trend at the specified level of significance (95%) for all three watersheds. The medians are 0.14, 0.09, and 0.09 mg/L respectively with very little dispersion within each data set. This suggests very little difference exists between pollutant sources or it has the same parent rock and dissolution rate.

Total aluminum exceeded the CMC value of 0.75 mg/L at CIA 10-1 four times, and one time at CIA 10-1B, since sampling started in 1986. The total aluminum concentrations have seen a cyclic rise and fall sequence since 2003. These sequences develop a steady upward trend for aluminum in all watersheds

EPA recognized that the total aluminum values might be reflective of suspended clay particulates, which would be considered less toxic than dissolved forms of the metal (EPA, 2009). This is especially true in waters with higher pH values and hardness, which is the existing condition in Clear Fork watershed.

Specific Conductance: The SC box plot (Figure III-42) shows the distribution of the data for all three trendstations. The SC data is normally distributed for all three watersheds. Using the Mann Kendal Trend Test, statistically significant evidence was found for an increasing trend at the specified level of significance (95%) within all three watersheds. The median concentrations for SC are 579 µS/cm, 668 µS/cm, and 591 µS/cm respectively.

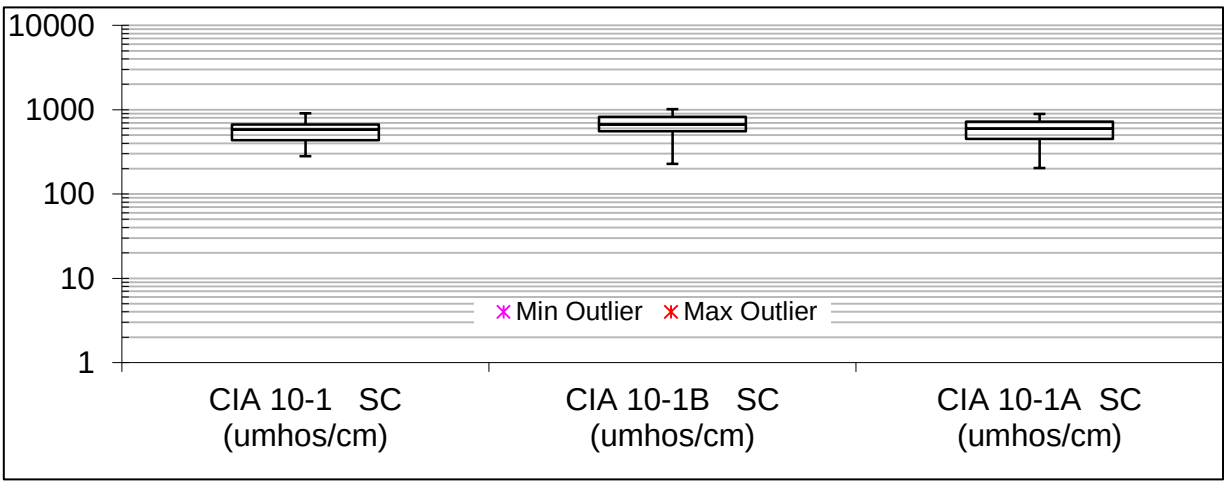


Figure III-42. Measured Values for Specific Conductance (SC) at the CIA 10-1A Trendstation

Table III-78. Summary of SMCRA-related pollutants and applicable criteria measured at the CIA 10, Subarea 1A Trendstation

CIA10 – 1A Parameter	Units	Range	Mean Value	Median Value	Number of Exceedances	Number of Samples	CMC/CCC	OSMRE Thresholds
pH		6.5 - 8.3	N/A	7.87	0	33	6.0 - 9.0[1]	6.5 - 8.5[3]
Alkalinity	(mg/L)	46 - 155	97.44	101.5	---	33	---/>20[1.]	---
Acidity	(mg/L)	0 - 19.2	0.4	0.6	---	33	---	---
Iron (T)	(mg/L)	0.05 - 0.94	0.28	0.24	0	33	---	1.0[3]
Iron (D)	(mg/L)	UD - 0.50	0.23	0.05	0	33	---	---
Manganese(T)	(mg/L)	0.01 - 0.5	0.13	0.09	0	33	---	1.0[3.]
Manganese(D)	(mg/L)	UD - 0.49	0.1	0.09	---	33	---	0.35[3]
Aluminum(T)	(mg/L)	UD - 0.59	0.27	0.09	13	33	0.75/0.087[2]	---
Aluminum(D)	(mg/L)	UD - 0.50	0.22	0.05	2	33	---	---
TDS	(mg/L)	102 - 615	380	392	7	33	---	500
Specific Conductance	(µS/cm)	154 - 894	577	591	---	33	---	---
Sulfate	(mg/L)	102 - 320	194	197	5	33	---	250
TSS	(mg/L)	1 - 17	4.58	3	---	33	---	----
Hardness	(mg/L)	127 - 334	249.39	257.5	---	---	---	---

Note: (T)=total recoverable, (D)=dissolved: Notes: [1.]TDEC Criteria, [2.]EPA Criteria, [3.] OSMRE material damage assessment threshold criteria

Specific Conductance Modeling

Specific conductance was modeled in the CIA 10, Subarea 1A watershed using two approaches developed by OSMRE and a mass balance procedure described by Johnson, Haas, and Fritz (2010) which has been recommended by the U.S. Fish and Wildlife Service (USFWS). These models were designed to estimate specific conductance within the Clear Fork watershed and Valley Creek sub-watersheds. The first method utilized the linear regression model described in Section F of this document to estimate TDS increases caused by additional mining disturbances during low stream flow conditions. Specific conductivity increases is then estimated from the TDS/specific conductance ratios that exist between these two constituents. This ratio varies with flow conditions but typically TDS is between 0.65 and 0.8 of the specific conductance value. The Johnson method was first attempted using all available data from the OSMRE GIS database to develop a low-flow median event for the 23 monitoring stations shown on Figure III-43. A second Johnson model was developed using a one-day sample set collected by Biological System Consultants, Inc. Watersheds and estimated conductivity values are shown in Figure A-1 and Table A-1 of the Appendix.

The results of the low-flow regression model and the first Johnson method were compared to existing data for the CIA 10, Subarea 1A trendstation (see Table III-78) and are shown in

Figure III-43. The Johnson method results were compiled from the 23 evaluation points (E points) within the CIA10-1A watershed. Nine other maps show the E points and surface water monitoring point locations at greater resolution, but are not included in this CHIA. These large scales maps include the acreage of both the watersheds and mining disturbances needed for the equation shown in Figure III-43.

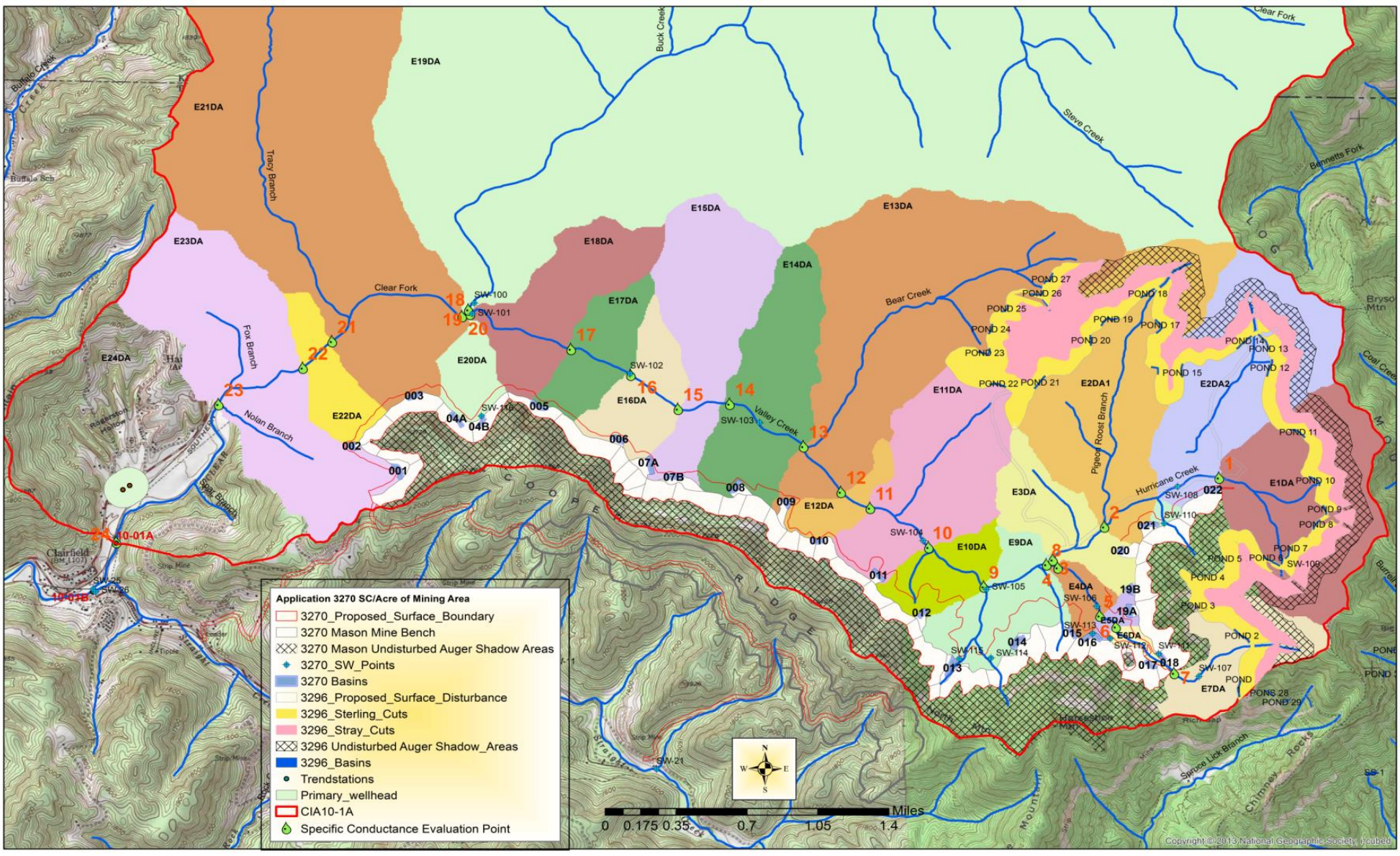
The E points are shown on Figure III-43 with the predicted changes in specific conductance of the proposed permit boundary and cumulative impact area. The predictions were based on cumulative totals of TDS and/or specific conductance versus watershed size. The model starts at Basin 22 (E-1) in the headwaters of Hurricane Creek. The equation cascades each specific conductance and acreage value downstream from E-1 to E-24 to produce a projected cumulative impact for TDS from the proposed mine site. The results of both models are shown in Subtable-1 of Figure III-43. While the linear regression method estimates that conductivity will increase by approximately 27% during low-flow conditions, the mean data Johnson method actually showed a 25% decrease.

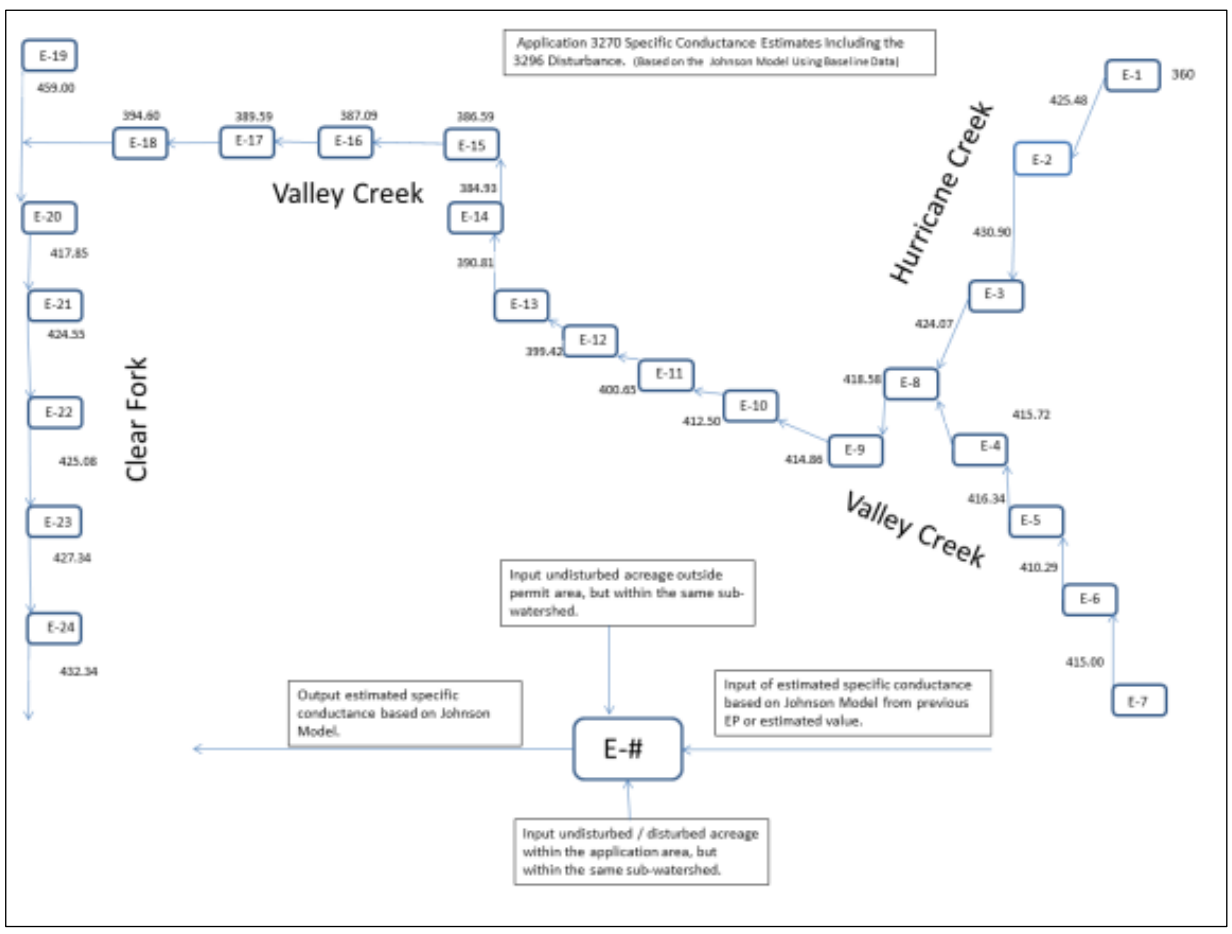
The second Johnson model method utilizing a set of specific conductivity data that were collected on a single day throughout the Clear Fork watershed. This model extended from the headwaters of Clear Fork and Steve Creek in Kentucky to Clear Fork downstream of the confluence with Nolan Branch near Hamlin Town, Tennessee. It included mining associated with the Sterling and Strays seams (OSMRE Permit No. 3164), the Mason Seam (OSMRE Permit No. 3270), and the Hignite seam associated with a proposed permit 3304 by Middlesboro Mining (recently submitted). The specific conductance predicted to discharge from each of these mine sites needed for the Johnson Model was estimated from seep, spring, and mine discharges collected on the same coal seams in this area. These resulted in the following assumptions: 1) it was assumed that the Hignite and Sterling/Stray mines would discharge specific conductance of 800 µS/cm; 2) the Mason mine would discharge at 900 µS/cm; and 3) in watersheds with more than one seam involved, an average of 850 µS/cm was used. The data was verified and recalculated by OSMRE which resulted in higher specific conductivity values than those estimated by Biological Systems Consultants, Inc.

The model results show that small tributaries and headwater streams that receive the majority of the mine drainage would be more significantly impacted than the larger watersheds where dilution from unaffected areas tends to reduce these affects. The most significant increases are in Hurricane and Valley Creeks upstream of the Bear Creek confluence. Increases in specific conductance are estimated to increase between 39 and 57 percent in these subwatersheds with the heaviest concentration of mining as shown in Table A-1 which is included in the Appendix. However, in Valley Creek downstream of Bear Creek, specific conductance increases are diluted over a relatively short distance, so that at the confluence with Clear Fork, the projected increase in conductance drops to 10 percent over existing conditions. This would raise the measured specific conductance from 679 to 749 µS/cm.

The specific conductance in Clear Fork downstream of the confluence with Valley Creek is anticipated to increase by 1.9 percent from approximately 754 to 768 µS/cm, which would be undistinguishable from the existing daily fluctuation in specific conductance that already exists in the watershed. The farthest downstream reach of Clear Fork below the confluence with Nolan Branch shows a slight increase from mining associated with the Mason seam (proposed OSMRE Permit No. 3270). This operation results in raising the specific conductance from approximately 742 to 770 µS/cm or 3.7 percent.

In conclusion, it must be remembered that specific conductance is highly variable throughout the year and subject to many influences. The predictions in the Johnson Model are based on an averaged effluent specific conductance value for each coal seam and mine drainage area mixed with a measured specific conductance on a particular collection day measured by Biological Systems Consultants, Inc. Results could change significantly based on the day and stream flow conditions that a specific conductance measurement is taken. As a result, the use of percentage increase is probably more meaningful than an absolute specific conductance values for projecting change.





$$y_{ij} = d_i x_i (d_i + d_j) + d_j x_j / (d_i + d_j)$$

>where y = downstream water chemistry value,
>i and j =contributing tributaries (watershed name),
>x_i = water chemistry measurement on tributary i,
>d_i = drainage area of tributary i,
>x_j = water chemistry measurement on tributary j,
>d_j = drainage area of tributary j.

CIA 10, Subarea 1A Trendstation (Subtable -1)							
Existing Conditions		OSM Predicted Values (Regression Method)				Johnson Model (Mean Data Method)	
TDS	Specific Conductance	TDS	Specific Conductance	TDS	Specific Conductance	Specific Conductance	
(mg/L)	(µS/cm)	(mg/L)	(µS/cm)	(% Increase)	(% Increase)	(µS/cm)	(% Increase)
Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
380	577	533	734	40.3%	27.2%	432	-25.1%

Figure III-43. Measured Values and Predicted Values for Specific Conductance (SC) at the CIA 10-1A Trendstation

Specific Conductance Trend Monitoring

For the past eight months, OSMRE has been monitoring the pH and specific conductance at the mouth of Valley Creek. Table III-79 provides an almost real time summary of the specific conductance at this point. Figure III-44 provides a time series view of the data comparted to temperature. Figure III-45 provides a Mann-Kendal Trend analysis, which indicates there is a decreasing trend within the data.

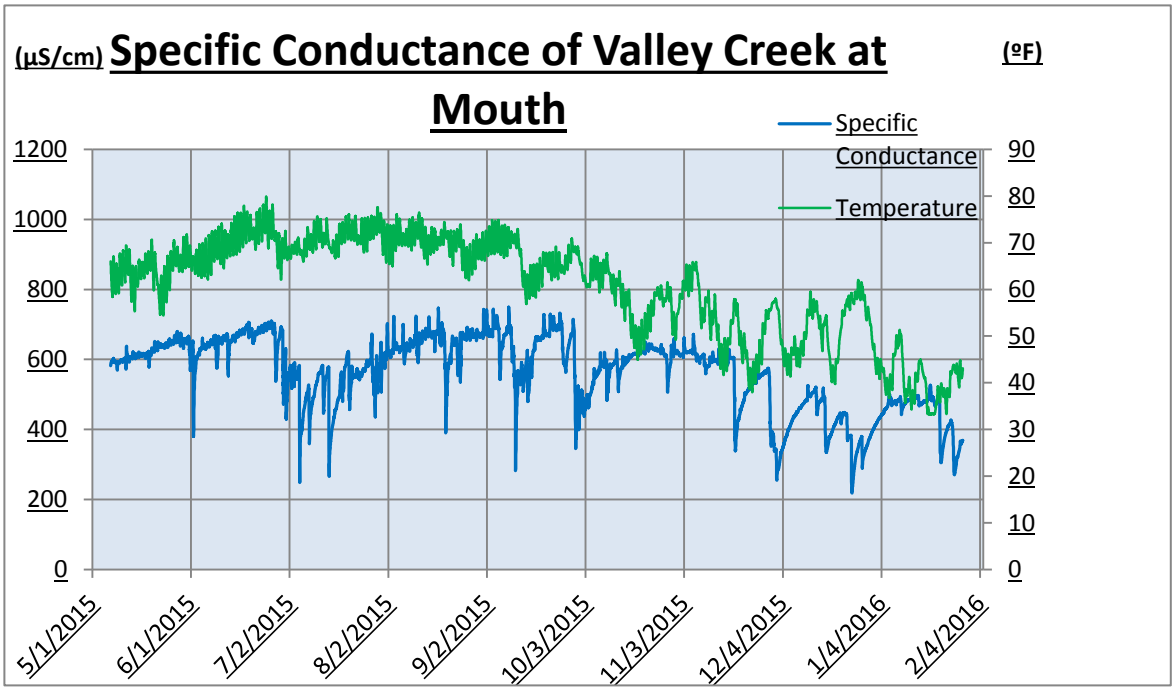


Figure III-44. Graph for of Specific Conductance data at the Valley Creek Mouth (Vicinity of SW-101(VC025).

The analysis was performed using the EPA ProUCL 5.0 statistical software. A complete review of specific conductance for this watershed is included in the discussion of the Johnson Model in the previous section.

Once reclamation has been completed, a slow but gradual decline in the concentrations or levels of these constituents is expected to occur. Studies by Evans, Zipper, Donovan, and Daniels (Evans 2014) on long-term trends of specific conductance resulting from mining disturbances and valley fills showed that declines to near background conditions could be expected to occur on average within 19.6 (±6.6) years of reclamation. However, they acknowledged that actual time frames are variable based on the handling and exposure times of spoil material before reclamation and the occurrence of problematic reactive spoils.

Specific Conductance (µS/cm)	
Mouth of Valley Creek 5/6/15 6:00 PM to 1/29/16 12:30 PM	
Mean	563.52
Median	594.3
Minimum	218.8
Maximum	749.4
Sample Count	12851

Table III-79. Summary of Specific Conductance.

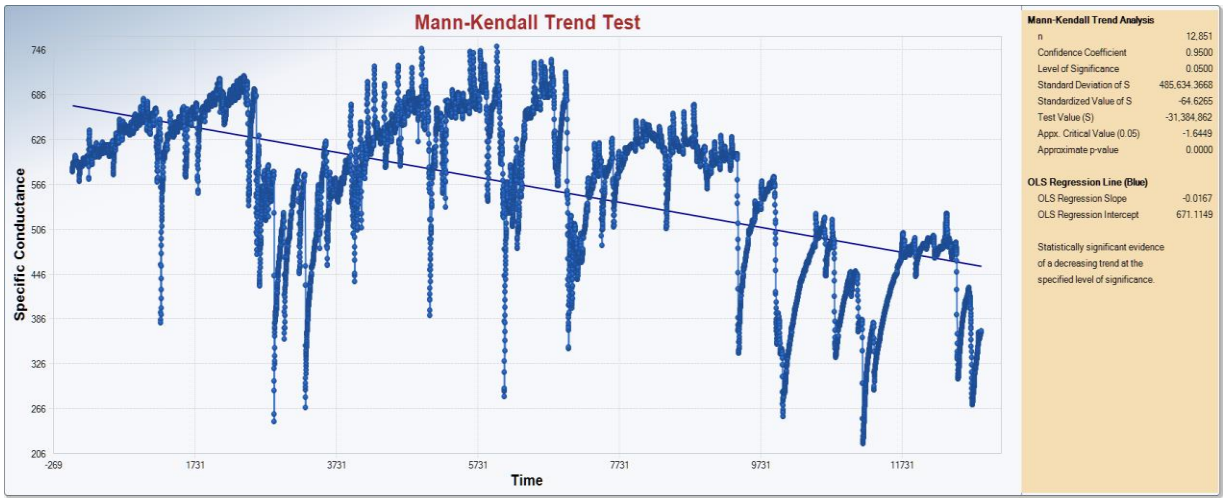


Figure III-45. Mann Kendall Trend Test for Specific Conductance Data in the Vicinity of SW-101(VC025.

EPA Priority/Non-priority Pollutants

Typically, OSMRE only analyzes those water quality parameters, which have been commonly associated with mine drainage. As a result, data on many of the EPA priority/non-priority pollutants is not available and is restricted to only a few of the inorganic chemicals. Likewise, some sampling periods were not analyzed for priority pollutants or have been subsequently dropped completely from routine analysis. Where available, OSMRE has reviewed these pollutants for compliance with TDEC and EPA water quality criteria. These data are summarized in Tables III-80 and III-81.

Hardness Based Pollutants: In reviewing the water quality data at the OSMRE trendstation, several of these criteria are based on dissolved fractions and are hardness dependent. Other criteria are based on total recoverable or on the dissolved fraction but are not hardness dependent. Table III-80 and III-81 contains the summary of the available trendstation data along with the CMC and CCC ranges.

For all hardness dependent metals, OSMRE utilized appropriate TDEC and EPA conversion factors to calculate the actual criteria, which would be applicable to the stream, based on the hardness for that set of conditions on the sample date. Where total recoverable concentrations were collected rather than dissolved concentrations, EPA has developed translator tables, which can calculate the water quality criteria based on these total values.

Since most OSMRE water quality data for these parameters is based on the total recoverable fraction of the sample, these translation factors were applied to determine if water quality criteria were met.

Table III-80.Concentrations of hardness dependent, dissolved metals and applicable criteria measured in the CIA 10 1A watershed

CIA 10-1A Pollutant	Concentration Ranges (ug/L)	Hardness (mg/L as $CaCO_3$)	CMC (ug/L)	CCC (ug/L)
Cadmium	0.02-0.7	127.00-334.00	1.64-3.68	0.65-1.14
Copper	0.6- 3.3	127.00-334.00	21.3- 53.0	13.9-31.8
Lead	0.1-2.0	127.00-334.00	84-233	3.3-9.1
Nickel	1.0-20.0	127.00-334.00	573-1299	64-144
Silver	0.2-1.56	127.00-334.00	5.2-27.5	
Zinc	2.0-180.0	127.00-334.00	143-326	146-328

The effect of hardness on freshwater fish and other aquatic life appear to be related to those ions causing the hardness rather than hardness (EPA, 1986) itself.
However, water quality data with lower method detection limits do not show any exceedances in any of these metals.

CIA10-1A Pollutant	Sampling Period	Concentration (mg/L)	CMC (mg/L)	CCC (mg/L)	MCL/SDWS (mg/L)
Arsenic*	9/21/2010 – 10/22/2014	0.00028-0.00178	0.34	0.15	0.01
Barium	9/21/2010 – 10/22/2014	0.025 - 0.0777	- - -	- - -	2.0
Beryllium	9/21/2010 – 10/22/2014	0.001-0.00222	- - -	- - -	0.004
Chromium	9/21/2010 – 10/22/2014	0.0005-0.00578	- - -	0.1	0.1
Mercury*	9/21/2010 – 10/22/2014	0.0002-0.0005	0.0014	0.00077	0.002
Antimony	9/21/2010 – 10/22/20114	0.00003-0.0029	- - -	- - -	0.006
Selenium	9/21/2010 – 10/22/2014	0.0001-0.00387	0.020	0.005	0.05
Thallium	9/21/2010 – 10/22/2014	0.000007-0.000889	- - -	- - -	0.002

Table III-81. Concentrations of non-hardness dependent constituents and applicable criteria measured in the CIA 10 1A watershed. Based on the dissolved fraction/non-hardness dependent*

Non-Hardness Dependent Pollutants: Selenium, arsenic, and six heavy metal parameters were also analyzed as part of the CHIA monitoring program. This data has been summarized in Table III-81. Trendstation CIA10-1A has had no exceedances of the CCC water quality criteria for selenium with regards to fish and aquatic life.

OSMRE started data collection from this trendstation in 1998. Some of the very earliest water quality data had laboratory detection limits that were actually higher than the calculated CMC or CCC shown in Tables III-80 and III-81. As a result, there was potential for exceedances associated with copper, silver, and cadmium, which cannot be verified through available information.

E. Ground water

The ground water system within the proposed permit and adjacent areas is relatively simple and typical for this section of the Tennessee coalfield. Ground water essentially moves from topographic highs (such as ridge tops) to topographic lows (valley bottoms), following a stair step-like course along geologic fractures. Sandstones are largely discontinuous in this portion of the coalfield and afford no large-scale regional flow system. Ground water movement within and adjacent to the proposed permit area is anticipated to be consistent

with the standard stress-relief fracture conceptual model (Wyrick and Borchers, 1981; Davis, 1987; and Harlow and LeCain, 1991).

Based on this model, ground water essentially moves from the higher elevation recharge zones (ridgelines) to areas of topographic lows (stream valleys) which act as the discharge zones. The stress-relief fracture systems generally parallel the surface topography and extend to a depth of approximately 200 feet.

In the immediate area of the proposed mining operation, the water-bearing formations above the coal and rider seams to be mined are primarily perched zones and most likely have been altered by pre-law mining activities. The proposed operation (except for the proposed underground mine) will be intruding into the underground works to mine the barrier pillars. Once mined, each of these coal zones provides a significant recharge to Straight Creek, Clear Fork, and Valley Creek watersheds.

The ground water flow directions within the Valley Creek and Straight Creek watersheds have been significantly altered due to extensive underground mining of regional coal seams mentioned previously. These underground works cross several ground water divides. The majority of the abandoned works at lower elevations are very extensively and flooded. The majority of mining on these seams used conventional underground mining methods followed by surface mining, which included robbing the outcrop barriers and barrier pillars along the up gradient edges of abandoned works. This particular practice allows miners to recover significant resources with very little risk of a gravity discharge during surfacing mining operations.

Potential Mason Coal Seam Discharges

The Mason coal seam outcrop is found within these watersheds between 1815 ft. to 1901 ft. AMSL. All Mason mines are above drainage mines. Both OSMRE active and released permit mining maps indicate the majority of the Mason coal seams within these watersheds have been mined by both surface and conventional underground mining methods. There are no active underground Mason mines within Straight Creek or Valley Creek. However, Kopper Glo Mining, LLC, OSMRE mining application 3270, proposes to mine the barrier

pillars of several Mason underground mines along the crest of Cooper Ridge. It also proposes to develop an underground Mason mine at the southeastern end of Cooper Ridge.

There are a series of abandoned Mason mines located on the crest of Cooper Ridge (Figure III-46). The first mine is located at the northwest end of Cooper Ridge. The mined area for this abandoned mine was determined to be 318.70 acres with 50 percent coal recovery. While infiltration rates into underground mines will vary significantly based on soils, geology, and topography a regional estimate of the median infiltration rates on the Cumberland Plateau of Tennessee was developed by the USGS. The infiltration rates ranged from 4.3 to 8.9 inches/year with a median of 5.7 inches/year (Hoos, 1990). This infiltration rate can then be converted to an estimated flow rate in gpm/acre. Based on this infiltration rate, an annual flow rate of approximately 0.3 gpm could generate a mine pool discharge of 47.8 gpm based on this acreage.

Immediately southeast of the first mine on Cooper Ridge is a smaller Mason mine (Figure III-46. The mined area for this abandoned mine was determined to be 186 acres with 50 per cent coal recovery. Based on an average annual infiltration rate of 0.3 gallons/minute/acre, this mine pool could discharge 27.9 gallons per minute based on the mined acreage.

There are several abandoned Mason works located on the north east side of Valley Creek in Rich Mountain. These closed mines are interconnected, creating one large Mason mine pool, and are being treated as one mine. The mined area for this abandoned mine was determined to be 3372.09 acres with 50 per cent recovery. Based on an infiltration rate of 0.3 gpm/acre of underground mined area, this mine pool could discharge 505.8 gpm based on the mined acreage.

Three abandoned Mason underground mines were identified within the Kentucky Clear Fork watershed. Based on mapping data from the Kentucky Division of Mining, the combined mining areas were estimated to be 994.51 acres with 50 percent extraction. Based on an infiltration rate of 0.3 gpm/acre of underground mine area, this mine pool could discharge 149.2 gallons per minute based on the mined acreage.

Estimated Underground Mine Discharge to the Surface Water Flow

To help quantify the impacts from underground mine discharges to the seasonal flows within the Clear Fork watershed, OSMRE compared the measured flow at each trendstation to the flows derived from the Saxton gauging station flow data. The same methods used in Section C to determine the flow for each watershed was used in this comparison. The data from the USGS gauging station at Saxton Kentucky was used to determine the mean summer and winter flows for each of the trendstations. The OSMRE CHIA trendstation flow data was then broken down into summer and winter mean flows. The previous Kopper Glo Mining, LLC, 3231 CHIA detailed the underground mining within each of the CIA 10-1 watersheds. Table III-82 provides broad estimated discharges or flows from abandoned and potentially flooded works within each watershed. This is not meant to be an exact determination of seasonal flow changes, but a guide to review the impacts of these flows to the assimilative capacity of these streams based on flow.

In Table III-82, the stream flow variations shown between the Saxton Gage data and the CHIA trendstation data can be attributed to several causes:

1. The Saxton gauging station receives flow from 331 square miles. Within this drainage area, rainfall can vary and influence the surface flow within the sub-watersheds feeding the Saxton gauge. These calculations assume that this drainage area has a uniform discharge, but this is not always the case.
2. Inaccurate flow measurement at the CHIA trendstation along with infrequent and low numbers of actual flow measurements being conducted.
3. Dewatering of these streams by local faults within Valley Creek, Straight Creek, and Rock Creek as described in the P. E. LaMoreaux & Associates ground water assessment prepared for OSMRE in October 1980.

Again, Table III-82 is intended to broadly demonstrate potential changes to flow from underground discharges within each watershed that can affect these streams assimilative capacity.

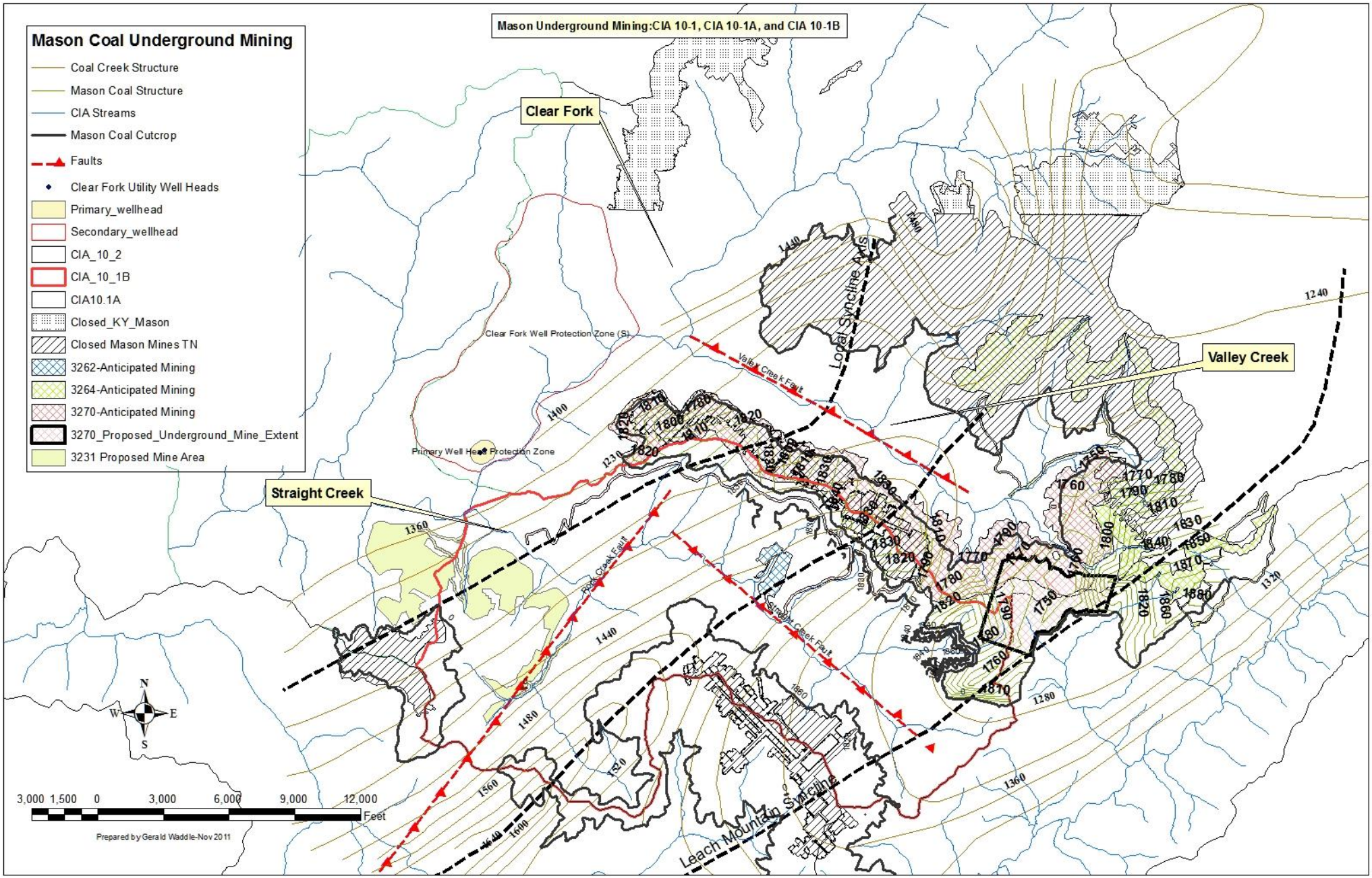


Figure III-46. Mason Coal Underground Mining Map

Trendstation	USGS Predicted Mean Flow (CFS)	CHIA Trendstation Measured Mean Flow (CFS)	Estimated Underground Mines Contributions (CFS)	Inflow/Out Flow from the Watershed (CFS)
CIA10-1 Winter	138	49	8.8	-89
CIA10-1 Summer	35.3	12.45	8.8	-22.85
CIA-1B Winter	29.8	26	3.5	-3
CIA-1B Summer	7.88	13.26	3.5	5.46
CIA-1A Winter	78.66	43.86	5.2	-34.8
CIA-1A Summer	24.24	4.6	5.2	-19.04

Table III-82. Ground water contributions to the surface water flow.

The USGS (1982) concluded that most streams in this area, which drain less than 100 square miles occasionally, go dry. This is caused by the steep slopes, which generate rapid runoff and the semi-impervious nature of the soils, which limit the infiltration. As a result, stream flow is poorly sustained in periods of low precipitation.

As stated previously, OSMRE found that the flows measured at each trendstations were typically less than that of the flows derived from the Saxton gauging station data. Table III-82 suggests, the underground mine discharges provide a larger portion of stream flow during dryer flow seasons of the year and diminish in significance during higher precipitation seasons of the year when more dilution from runoff and increased stream recharge is available from unaffected areas of the watershed. This increased influence of underground mine discharges during the summer mean and low-flow seasons is reflected in the higher concentrations of mine-related constituents such as TDS, sulfates, and alkalinity in the surface water data.

Ground Water Quality

OSMRE routinely collects background hydro-chemical analysis to characterize seasonal discharges of ground water within or adjacent to a proposed mining permit area. In Table III-83, a water quality summary for ground water discharges from the Mason seam is shown. The data represents the ground water discharges from Mason coal seams found in the Straight Creek, Clear Fork, and Valley Creek watersheds. In combination with Figures III-15

to Figure III-25, this data provides a detailed portrait of ambient ground water conditions within the proposed mining area.

These discharges are generally characterized as neutral pH water, that is alkaline rich and has elevated sulfate. The elevated levels of alkalinity and sulfate can be attributed to the effects of mining and the ground water system. The effluent data are alkaline in composition and contribute to the alkaline nature of the receiving stream. The data also indicate that the mined stratum has enough alkalinity to neutralize the net effects of any acid mine drainage.

The analyses in Tables III-42 through III-67 indicate seasonal variation of sampled data that falls within the expected values for ground water in this area. The influence that ground water has on the associated surface water quality can generally be seen by comparing the values in the baseline surface water data in Tables III-6 through III-41 for the baseline surface water quality of this CHIA. The surface water quality is relatively good but has elevated levels of sulfate , alkalinity, and TDS which originates through dispersed ground water recharge and direct discharges from underground mines located throughout the CIA.

Table III-83. Typical water quality for the Mason coal seam.

Site	Well /Seep	pH	TDS (mg/L)**	Total Fe (mg/L)**	Total Mn (mg/L)**	Sulfate (mg/L)**	Flow (gpm)**
GW-18 3110	Seep Discharge Mason Seam	6.23-7.33	675-1110 858/820	0.03-0.42 0.15/0.14	0.52-2.08 1.15/0.95	160.5-725 474/511	8.9-98.7 50/49
GW- 6 3110	Mine Discharge Mason (Wetseal)	6.5-6.8	670-842	0.03-0.21	0.45-0.81	225-390	224-1481
GW-9 #3270	Mine Discharge Mason	6.5-7.7	549-557	0.01-0.3	0.1-0.13	76-97	1.5-10 3.5/2.05

***The table values are listed first as a range from the lowest value to the highest value. The second row of values within the cell is the average value followed by the median value.*

F. Anticipated Water Chemistry Changes

OSMRE has conducted several watershed characterization studies to determine the distribution and concentration of pollutants within the CIA 10, Subarea 1A, watershed. These studies were designed to correlate pollutant loads with watershed size and mining disturbance acreage in each watershed. To develop a loading curve for each parameter, stations were selected in an effort to obtain a good distribution of watershed sizes with varying amounts and percentages of mining-related disturbances.

OSMRE will continue to use these parameter-specific loading curves developed from these studies to make an estimate of changes to base flow water quality resulting from additional permitting actions within these sub watersheds. OSMRE created a series of simple linear regressions (Figures III-47 through III-49) from the data collected during the watershed characterization to determine if a correlation could be established between the mining disturbance to relatively conservative pollutants such as TDS, sulfate, and alkalinity.

These linear regressions showed a statistically significant relationship between mined acres and pollutant loads for these parameters. Loads were calculated by multiplying the stream discharge by the pollutant concentration and a known conversion factor to produce load units in either pounds/day or tons/year. All loads in these equations were based on pounds/day using a standard conversion factor of 5.394 to correct between units. The results of these linear relationships were then used to make predictions concerning the proposed mining disturbances and effects on stream loads in a watershed at similar flow rates.

Because iron and manganese tend to precipitate and absorbed at neutral pH in oxygen rich environments, prediction of change for these metals is difficult with a simple statistical model. Therefore, for these non-conservative pollutants that did not follow a linear relationship with the mining disturbances, the median value at the CIA 10, Subarea 1A trendstation was used to represent existing conditions. Both the iron and manganese data show influences from outliers. As a result, the predicted median and standard deviation (SD) statistic (a robust estimator) was chosen over the simple mean to estimate the increase and decease for the predicted value(s). The mean was used as the predicted value, but to establish each parameters concentration range the predicted value had the SD subtracted or added to establish the high and low ends of the range. Otherwise, the mean values would probably overestimate the existing and anticipated concentrations in the watershed.

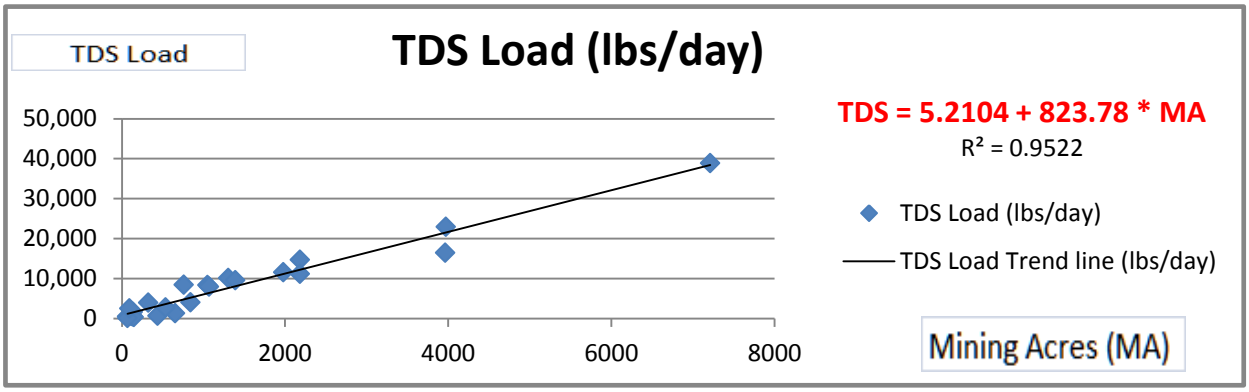


Figure III- 47. Simple statistical regression analysis of TDS concentrations to mining acreage

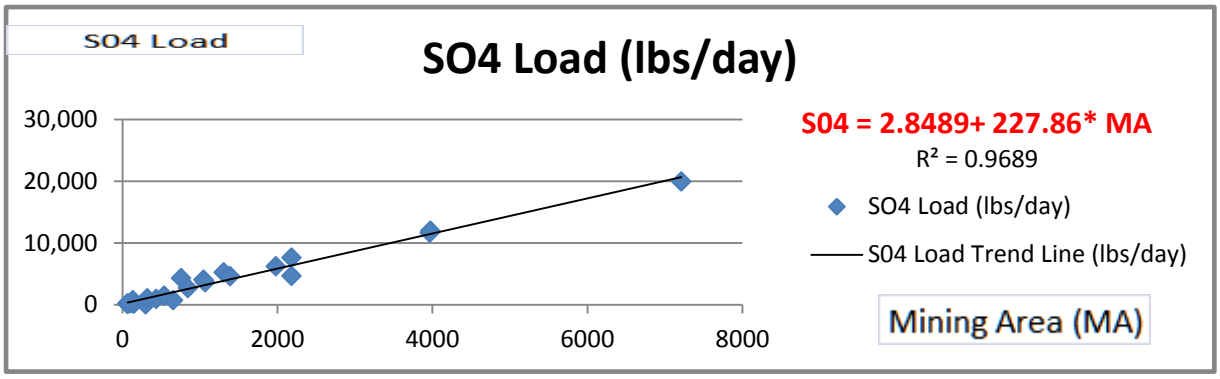


Figure III- 48. Simple statistical regression analysis of sulfate concentrations to mining acreage

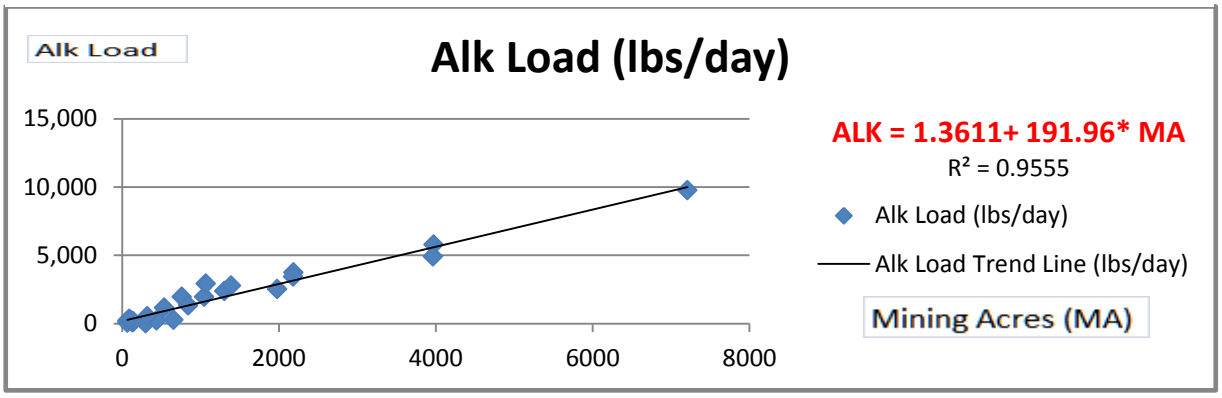


Figure III-49. Simple statistical regression analysis of alkalinity concentrations to mining acreage

Likewise, data from the CIA 10, Subarea 1A trendstation showed a normal distribution for TDS, sulfate, and alkalinity but was influenced by outliers. So, the standard deviation (SD) statistic was chosen to estimate the increase and decease for the predicted value. For each predicted parameters concentration, this value had the SD subtracted or added to establish the range for that parameter. This method correlated well with the existing predictions for the CIA 10, Subarea 1Awatershed. The equations shown in Figures III-47, III-48, and III-49 were used for the predictions that are summarized in Table III-81.

Where actual exceedances are found, these exceedances have been referred to TDEC for evaluation and mitigation recommendations along with any other exceedances of the EPA chronic criteria. Other parameters, such as iron and aluminum, as identified in previous sections, also fall into this group and are referred to TDEC for evaluation and mitigation recommendations.

To estimate changes in a parameter concentration, the new mining disturbances associated with the anticipated mining were added to existing disturbances in the watershed to calculate new pollutant load(s). Mining disturbances were considered as spoil removal or disposal areas, which did not include roadways. Likewise, tree or other vegetative removal areas, which were considered for sediment loading, but are not considered in these calculations unless actual excavation of new rock material is proposed. Based on this constraint, new mining disturbances were estimated to be approximately 1275 acres, which includes the Kopper Glo Mining, LLC proposed permit 3270 and the recently approved Appolo Fuels, Inc. permit 3296 which are shown on Figure III-1 at the beginning of this document. Using each equation in Figures III-47 through III-49, pollutant loads were calculated.

A detailed discussion of the CHIA process for determining pollutant loads is located in the "Cumulative Hydrologic Impact Assessment Handbook, For the Federal Program of Tennessee, October 28, 2005". These predicted increases in the SMCRA pollutant concentrations found in the CIA 10, Subarea 1A watershed trendstation are listed in Table III-84. These estimates are based on the mining area and the mean low flow condition within the modeled watershed. Extrapolation to other flow regimes outside the Clear Fork watershed may not give reasonable results. The anticipated water quality is expected to exceed OSMRE's thresholds for both TDS and sulfate.

Table III-84. Predicted typical low-flow concentrations of SMCRA pollutants as a result of projected mining within the CIA 10, Subarea 1A watershed

Constituent	Specific Conductance (µS/cm)	Total Dissolved Solids (mg/L)	Sulfates (mg/L)	Alkalinity (mg/L)	Total Iron (mg/L)	Total Manganese (mg/L)
Previous CHIA (TS10-1A) OSMRE Permit 3161 Prevailing Conditions (mg/L) **Anticipated Mean mg/L**		**476** **520**	**255** **279**	**130** **152**	**0.24** **0.24**	**0.14** **0.14**
Previous CHIA(TS10-1A) OSMRE Permit 3296 Range Values-mg/L Prevailing Conditions (N=27) **Anticipated Range (mg/L)**	**154[2]-894 (median[1] 629** **154-894**	**102[2]-615 (median[1] 400)** **102-615**	**102[2]-320 (median[1] 209)** **102-320**	**46[2]-155 (median[1] 101)** **46-155**	**0.05[2]-0.94 (median[1] 0.22)** **0.05-0.94**	**0.11[2]-0.5 (median[1] 0.11** **0.01-0.5**
Current CHIA(TS10-1A) Application 3270 Range Values-mg/L Prevailing Conditions (N=33) **Anticipated Range (mg/L)** **Mean Low Flow Prediction**	**154[2]-894** **(Mean577 Median[1] 591)** **154-894 Low Flow 734**	**102[2]-615** **(Mean 380 Median[1] 392)** **102-615 Low Flow 533**	**102[2]-320** **(Mean 194 Median[1] 197)** **102-320 Low Flow 314**	**46[2]-155** **(Mean 97 median[1] 101)** **47-155 Low Flow 144**	**0.05[2]-0.94** **(median[1]0.24)** **0.05-0.94**	**0.11[2]-0.5** **(median[1] 0.10** **0.01-0.50**

Notes: (1) Mean/Median from table III-78 (2) Minimum and maximum values for 1998-2015

Table III-84 offers a comparison of the last three CHIAs prepared within the CIA 10-1A watershed. Historically, the highest TDS measured at this trendstation was 615 mg/L during a very low flow as shown in Table III-78. The OSMRE regression analysis, predicts TDS to reach a mean of 533 mg/L under normal summer low-flow condition, where the OSMRE threshold is 500 mg/L, and will maintain an approximate median concentration of 412 mg/L during other flow conditions. The TDS predicted value is anticipated to increase by a maximum of 28% over the prevailing median value of 392 mg/L.

The historical maximum for specific conductance at this trendstation was 894 µS/cm. Whereas, a predicted corresponding rise of specific conductance relative to TDS will occur during summer low-flow conditions reaching a maximum of 734 µS/cm. Seasonal specific conductance fluctuations will occur between the current minimal value of 154 µS/cm and the predicted maximum of 734 µS/cm. The prevailing median specific conductance of 591 µS/cm is anticipated to increase by a maximum of 28% to approximately 734 µS/cm.

Historically, the highest sulfate measured at this trendstation was 320 mg/L during summer low flow. The OSMRE regression analysis, predicts sulfate will reach a maximum of 313 mg/L under summer low-flow conditions, where OSMRE's threshold is 250 mg/L. However, it will maintain an approximate median concentration of 260 mg/L during other flow conditions. The sulfate predicted median value is anticipated to increase by a maximum of 34% over the prevailing median value of 197 mg/L.

Historically, the highest alkalinity measured at this trendstation was 155 mg/L during a summer low flow. OSMRE's regression analysis predicts alkalinity to reach a maximum of 144 mg/L during summer low-flow conditions. There is no OSMRE threshold value for alkalinity. The predicted alkalinity value is anticipated to increase by 30% over the prevailing median value of 101 mg/L.

Tables III-84 and III-78 along with Figures III-6 and III-35 show a median iron value of 0.24 mg/L, which is well under the EPA CCC concentration of 1.0 mg/L. Tables III-84 and III-78 and Figures III-7 and III-36 show the median manganese value of 0.10 mg/L, which is well below OSMRE's threshold of 0.35 mg/L. Acidity is assumed to stay at zero since the alkalinity is anticipated to increase. There was no previous measured acidity values recorded in the 1986 to 2015 trendstation data. These predictions take into account the discharges from two proposed surface mine operations, which will occur simultaneously

However, the increases in the above identified parameters are anticipated to occur gradually throughout the proposed mining life (five-ten years) for these permits located within this

watershed. Once reclamation is completed, a slow but gradual decline in these concentrations from this site should occur achieving the premining median values shown in Table III-81.

OSMRE previously requested TDEC to evaluate the Valley Creek watershed to determine if Valley Creek is fully supportive of its stream uses. TDEC maintains current biological surveys and water quality data for area receiving streams to monitor Valley Creek supportive use status. TDECs conclusion was that full use support has been maintained in the watershed. Subsequent to this 2015 CHIA evaluation, both water quality and biological health appears to have improved based on the results of TDEC's ongoing annual biological surveys and the multiple SMRCA renewal and midterm hydrologic reviews conducted in this watershed.

G. Antidegradation

Kopper Glo Mining, LLC, OSMRE application 3270 is within the Clear Fork of the Cumberland River watershed and must comply with the Clear Fork of the Cumberland River Total Maximum Daily Load (TMDL) document. The TMDL for each outfall within this OSMRE permit application is 71,615.5 pounds per year or 196 pounds of sediment per day.

TDEC, for streams that have the ability to assimilate pollutant loads, allows some degradation after appropriate alternatives are reviewed. These processes are described fully in the TDEC Water Quality Control Board Rules, Chapter 1200-4-3-06 (TDEC, 2013) which deals with the Tennessee antidegradation policy. According to these rules, existing uses are to be maintained using existing water quality criteria.

TDEC water quality rules do not have water quality criteria for TDS unless the stream is classified for use as a domestic or industrial water supply. However, OSMRE has adopted the use of a TDS threshold criteria for mining-related mineralization. This threshold is established at 500 mg/L, but has no regulatory or jurisdictional authority with regards to the current designated water uses for Valley Creek.

However, TDEC has identified specific conductance as a threshold parameter for discharges into Valley Creek. In the draft NPDES permit, TDEC, is requiring the applicant to monitor conductance and once the parameter reaches 500 $\mu S/cm^3$ or greater, the applicant must

initiate an approved Adaptive Management Plan (AMP) found in the NPDES permit. The AMP is a site-specific plan that addresses monitoring of effluent that only has a narrative water quality standard. The AMP will place numeric limits on certain water quality parameters and use those limits as triggers to implement the AMP to ensure the effluent water quality meets each narrative standard.

OSMRE is anticipating that occasional exceedances of its 500 mg/L threshold to continue in the CIA 10, Subarea 1A watershed as a result of current and anticipated mining activities. Likewise, specific conductance values will be anticipated to occasionally exceed 500 µS/cm in some of the area streams during periods of low flow. However, both Hurricane Creek and Valley are fully supporting of their use classifications despite these conditions according to the draft NPDES Rationale (TDEC, November 9, 2016) for this permit application. Clear Fork is not supporting use classifications due to biological impairment because of siltation. This resulted in the 303(d) listed for the watershed and the subsequent TMDL for sediment loading that is being applied to this permit.

TDEC does not have an in-stream numeric criteria for iron or aluminum. As a result, OSMRE utilizes the EPA recommended chronic and acute water quality criteria for these parameters as a threshold value for coordinating with TDEC. For total aluminum, an EPA criterion assigns an upper threshold of 0.087 mg/L for the CCC value and 0.75 mg/L for the CMC value. No exceedance of the CMC have been recorded at the CIA 10, Subareas 1A or 1B trendstations, however, multiple exceedances of CCC concentrations have been reported at the TS10-1 trendstation. EPA also has recommended CCC limit for total iron at 1.0 mg/L for protection of fish and aquatic life. Several occurrences of iron at levels above 1.0 mg/L have been reported in area streams either by the applicant or as part of various OSMRE water quality surveys within the watershed.

This information was previously conveyed to TDEC for review in letters dated March 17, 2010 and June 23, 2014, Notification of Water Quality Concerns Associated with the Cumulative Impact Areas (TS10-1 and TS10-1B). Previous notifications for permit applications in CIA-10-1 and CIA-101B did not receive comments from TDEC.

As stated previously, according to the TDEC draft NPDES Rational for the Copper Ridge Surface Mine, Valley Creek is meeting full biological integrity and stream classifications use support. OSMRE had on previous CHIA documents requested recommendations on any additional monitoring requirements and for a use support determination(s). TDEC responded on July 7, 2011 stating that they had evaluated the OSMRE data and stated, "TDS only applies to streams designed as a domestic water supply, and the Division does not have a state numeric Water Quality Standard for aluminum, iron, or sulfate". TDEC's response indicated that they have established long term monitoring points on Clear Fork and its tributaries. That letter went on to state, "these monitoring stations include periodic monitoring of chemistry, biology, and flow to determine compliance with numeric and narrative Water Quality Standards and TDEC will continue to evaluate these parameters narrative Water Quality Standards compliance at these monitoring points". Such monitoring results were included in the draft NPDES Rationale.

H. Biological Integrity

As part of the CHIA, OSMRE evaluated biological survey data on the benthic macroinvertebrate population collected as part of the Kopper Glo Mining, LLC, Mountainside Coal Company, and Appolo Fuels, Inc. previous SMCRA and TDEC permitting requirements. These existing permits have developed a watershed monitoring strategy for assessing changes to the biological integrity of area streams along with identifying blackside dace habitat and occurrences. Kopper Glo Mining, LLC as part of their permitting requirements, will conduct semi-annual (two per year) biological surveys in Straight Creek and Rock Creek. Both Kopper Glo Mining, LLC and Appolo Fuels, Inc. will conduct semi-annual (two per year) biological surveys in Valley Creek and Clear Fork. Mountainside Coal Company has performed biological surveys in Clear Fork and the major tributaries in the Clear Fork watershed including Rose Creek, Buffalo Creek, Nolan Branch, and Fox Branch. Those stations listed in the mandated surveys were located with respect to the currently active OSMRE permits and are shown on Figure III-50.

CIA 10, Subarea 1 Tennessee Macroinvertebrate Scores (TMI)

Within the CIA 10-1 watershed, nine sample sites are identified within the main stem of Clear Fork. Stations C1 to C5 lie immediately above TS10-1 trendstation. The TMI metric scores for C1 to C5 (Table III-85) determined that these stream sections were non-supporting of their biological use classification. These stations receive drainage from large watersheds such as Rose Creek, Buffalo Creek Straight Creek, Valley Creek, and a large drainage area from Kentucky. The surveys include two small tributaries (Table III-86) to Clear Fork immediately below Rose Creek identified as SM-1 and D1. Both of these reaches were non-supporting of their use classification. There is no macroinvertebrate monitoring station within Kings Hollow. However, a review of the current and historical discharge monitoring reports (DMRs), surface water monitoring data and ground water monitoring data for the watershed indicated compliant discharges from the reclaimed basins in the watershed and compliant water quality at SW-54. The low TMI scores are likely directly related to siltation issues identified in the TDEC TMDL for the watershed.

Station No. (Stream)	C1	C2	C3	C4	C5
11/28/2012	24	34	32	Beavers	38
10/17/2012			28	18	
5/24/2012		24			30
5/22/2012	26				
6/ 6/ 2011					24

Table III-85. Tennessee Macroinvertebrate Index (TMI) scores Clear Fork (below confluent with Kings Hollow)

Station No. (Stream)	SM1 Trib to Clear Fork	D1
10/17/2012		28
5/25/2012	18	8

Table III-86. TennesseeMacroinvertebrate Index (TMI) scores. Tributaries to Clear Fork above TS10-1.

Station No. (Stream)	C6	C7	C8
10/17/2012	32	24	26
5/25/2012		24	
5/24/2012	28	26	28

Table III-87. Tennessee Macroinvertebrate Index (TMI) scores Clear Fork (Above confluent with Kings Hollow)

The TMI metric scores for C6 to C8 (Table III-87) determined that these stream sections were non-supporting of their biological use classification. Overall, Clear Fork from TS10-1 to the confluence of Straight Creek is non-supporting of its use classification.

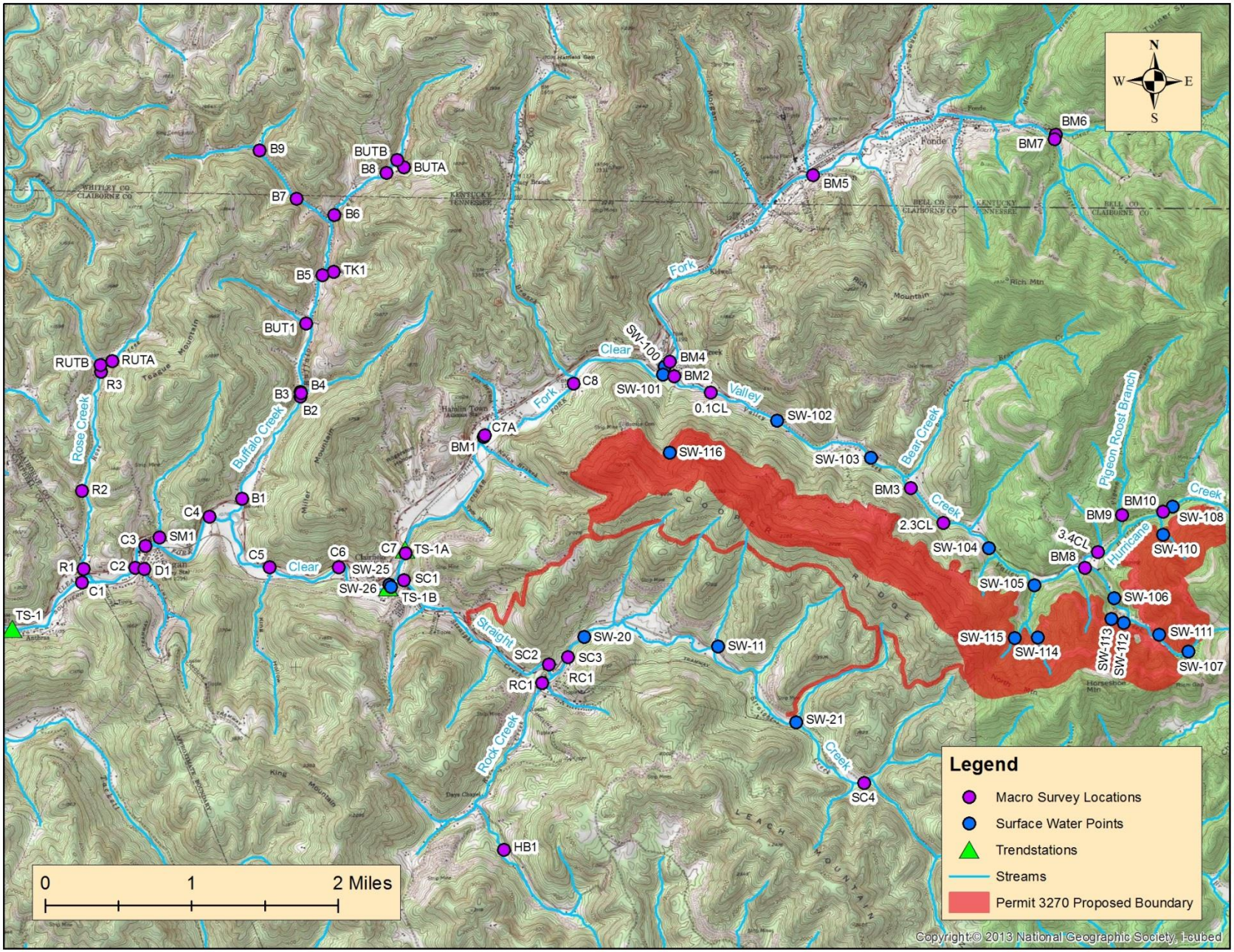


Figure III-50. Active ESA Sampling Locations within TS-1, TS-1A, and TS-1B watersheds

Rose Creek is within the TS10-1 watershed. This drainage is fully supporting (Table III-88) from its confluence with Clear fork to where it splits to form two small tributaries. However, two of the five stations on Rose Creek's smaller tributaries had non-supporting use classifications during the drier months, but rebounded to fully supporting during the higher flow season in 2012. The water quality is very similar to that found in an unmined watershed within the area. The water is lightly buffered (15 mg/L $CaC0_3$) with a semi neutral pH and sulfate less than 50 mg/L at most of the sample points.

Station No. (Stream)	**R1 Rose Creek**	**R2 Rose Creek)**	R3 **Rose Creek**	RUTA **Rose Creek**	RUTB **Rose Creek**
11/27/2012				**36**	**34**
8/8/2012				**30**	**28**
5/21/2012	**32**	**34**	**38**		

Table III- 88. Tennessee Macroinvertebrate Index (TMI) scores on Rose Creek

Buffalo Creek lies within the TS10-1 drainage area. Buffalo Creek also has water quality very similar to that found in unmined watersheds of the area. The water is lightly buffered (15 mg/L $CaCO_3$) with a semi-neutral pH and sulfate is less than 50 mg/L at most of the sample locations.

Station No. (Stream)	**B1 Buffalo Creek**	**B2 Buffalo Creek**	**B3 Buffalo Creek**	**B4 Buffalo Creek**	**8CL (B5)**
11/28/2012			**34**	**34**	**34**
11/27/2012	**30**	**32**			
5/22/2012					**32**
5/21/2012	**26**	**28**	**26**	**30**	

Table III-89. Tennessee Macroinvertebrate Index (TMI) scores for Buffalo Creek.

Station No. (Stream)	**B6 Buffalo Creek**	**B7 Buffalo Creek**	**BUT 1 Buffalo Creek**	**TK1 Buffalo Creek**
11/28/2012	**24**	**38**	**dry**	**40**
5/22/2012	**20**	**22**	**20**	**22**

Table III-90. Tennessee Macroinvertebrate Index (TMI) scores for Buffalo Creek.

During the drier part of the year, all nine stations (Tables III-89 and III-90) on the main channel of Buffalo Creek had non-supporting use classification, but rebounded to fully supporting during the higher flow season in 2012.

TS10-1B Tennessee Macroinvertebrate Scores (TMI)

Within the CIA 10-1B watershed, four stations were identified within the main stem of Straight Creek, one station was located in Rock Creek, and one on Harris Branch.

Station No. (Stream)	SC1 (Straight Creek)	SC2 (Straight Creek)	SC3 (Straight Creek)	SC4 (Straight Creek)	RC1 (Rock Creek)
12/03/2014	32	34	34	36	30
4/23/2014	28	30	34	36	30
12/17/2013	34	34	34	28	36
4/24/2013	28	26	24	30	20
10/25/2012	34	32	28	30	30
5/15/12	32	34	34	36	32
12/ 13/ 2011	36	34	34	36	36
5/ 11/ 2011	26	32	32	32	24
12/28/ 2010	32	36	38	36	30
4/27/ 2009	32	32	32	38	28

Table III-91. Tennessee Macroinvertebrate Index (TMI) Scores, Straight Creek, and Rock Creek.

These stations were located with respect to the currently active and anticipated OSMRE permits in the watershed and their locations are shown in Figure III-50. To date, results of these surveys (see Table III-91) have shown that the TMI scores for the Straight Creek macroinvertebrate monitoring stations (SC1, SC2, SC3 and SC4), were fully supporting with either no change or a slight improvement in TMI scores between the April 2014 and December 2014 surveys. The macroinvertebrate community for the Fall 2014 survey indicated that all macroinvertebrate monitoring stations for Straight Creek were supporting of their stream use classification.

Data from Rock Creek (RC1)and Harris Branch (HB-1) macroinvertebrate monitoring stations, (Tables III-91 and III-92), were found these streams to be non- supporting of their use classification.

The macroinvertebrate survey indices reflect a non-supportive community in Harris Branch (a tributary to the upper section of Rock Creek), but the metrics are designed for streams with greater than two square miles of drainage and Harris Branch falls

Station No. (Stream) HB-1	HB-1
5/25/2011	36
5/15/ 2012	26
10/25/2012	36
4/25/2013	28
10/15/2013	24
4/23/2014	30
4/14/2015	30

Table III-92. Tennessee Macroinvertebrate Index (TMI) scores Harris Branch.

significantly below this criterion with less than one square mile of drainage. The USGS (1982) concluded that most streams in this area, which drain less than 100 square miles, occasionally go dry. This is due to the steep slopes that generate rapid runoff and the semi-impervious nature of the soil which limits infiltration. As a result, stream flow is poorly sustained in periods of low precipitation which can dramatically affect the outcome of these benthic macroinvertebrate surveys.

The overall metric scores determined that all stream sections of Straight Creek are fully supporting (Table III-91) of their stream use classification. However, the historical record indicated that all sections of Straight Creek appeared to have a cyclic impairment due to the time of year and flow conditions at the time of these surveys. A moving average was used to illustrate the seasonal trends at each benthic station. Figure III-51 demonstrates this cyclic impairment or high/low specific conductance at each survey station. In Figure III-52, the downstream flow is from right to left in order of the survey stations (Figure III-50). The graph indicates a reduction of specific conductance at each successive survey point and increase of overall acreage at each survey point. The OSMRE Biologist in previous Environmental Assessments for this watershed, also discussed the results of these surveys. A moving average was used to demonstrate the seasonal changes of the specific conductance.

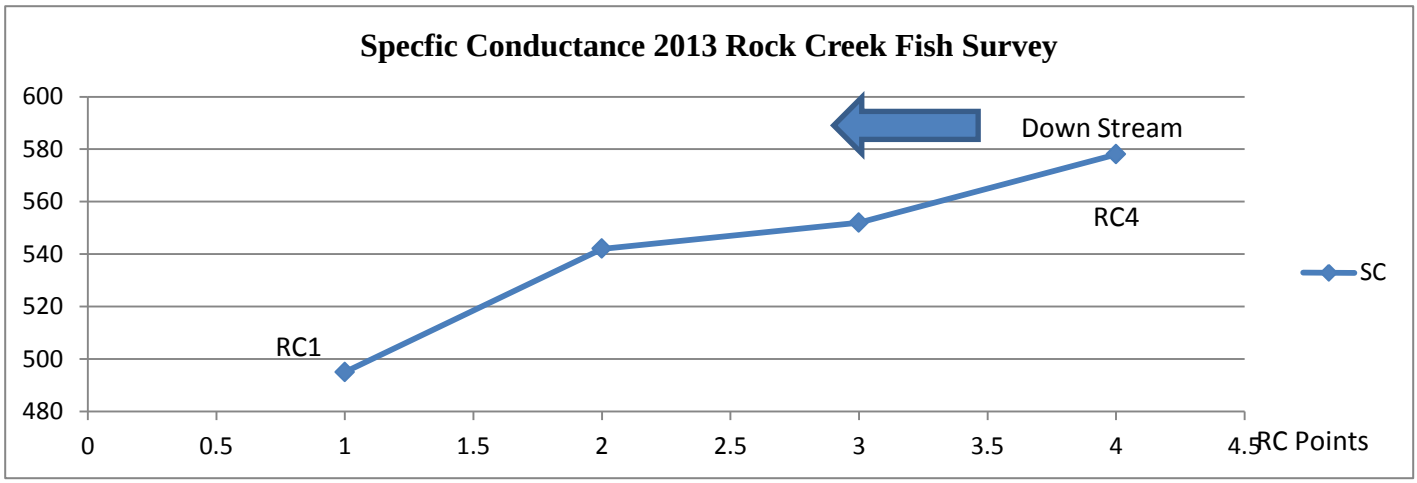


Figure III-51. Specific Conductance (µS/cm) vs monitoring point sample on Straight Creek

This high/low trend for the TMI scores (Table III-91) over the last ten benthic macroinvertebrate surveys for Straight Creek indicated that it is fully supporting the majority

of the time. SC1 was fully supporting 70% of the time, SC2 was fully supporting for 80% of the time, SC3 was fully supporting for 80% of the time, and SC4 was fully supporting for 70% of the time. However, Rock Creek does not follow the same pattern and RC1 was only fully supporting 30% of the time. As with Harris Branch, (Table III-92) it was only fully supporting 28% of the time.

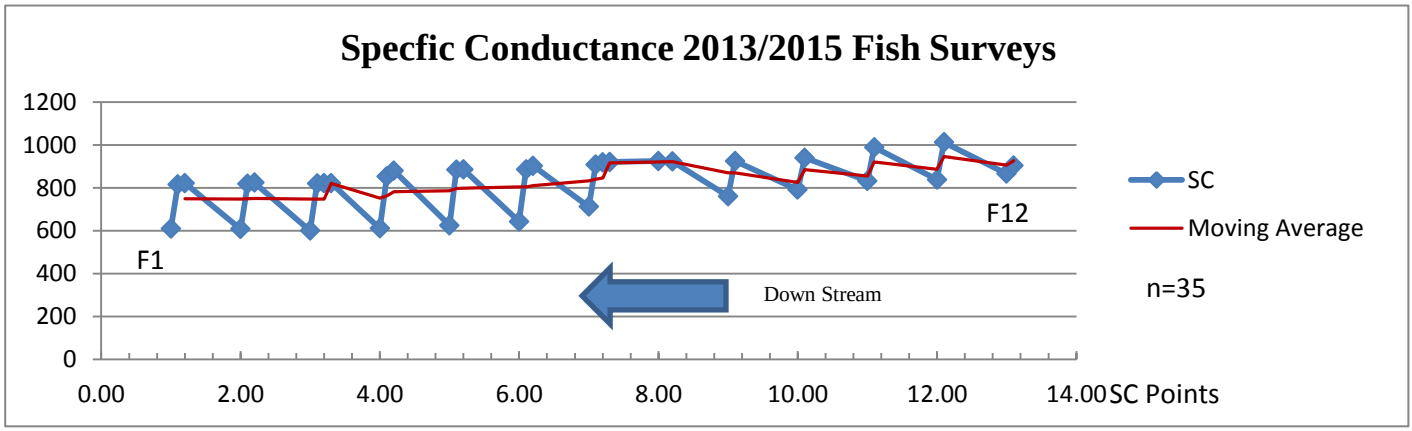


Figure III-52. Specific Conductance (µS/cm) vs monitoring point sample on Rock Creek

The 2014 Straight Creek fish study / inventory was performed on January 21 and 22, 2015 during optimal flow conditions which are shown in the Fish Survey report dated 1/28/2015, no populations of blackside dace *(Chrosomus cumberlandensis)* or silverjaw minnow (*Notropis buccatus*) were identified within the study area. The tributaries of Straight Creek are evaluated on a 5-year basis and not included in the January 2015 report.

TS10-1A Tennessee Macroinvertebrate Scores (TMI)

Table III-93 identifies three stations within the main stem of Valley Creek: 0.1CL, 2.3 CL, and 3.4 CL. The results of these surveys illustrate that the stations were initially partially supporting from 2003 to 2007. There were significant improvements in the TMI scores between the 2007 and 2011 surveys. All stations within the main stem of Valley Creek illustrated fully supporting usage by March 2011.

Station No. (Stream)	0.1 CL (Valley Creek)	2.3 CL (Valley Creek)	3.4 CL (Valley Creek)
Jul 28, 2003	28	30	
Jul 14, 2004	32		
Mar 31, 2007	34	38	36
Mar 31, 2008	30	34	36
Mar 18, 2010	34	40	26
Mar 12, 2011	36	40	38

Table III-93. Tennessee Macroinvertebrate Index (TMI) scores Valley Creek.

Within the CIA 10-1A watershed, three stations (Table III-94 and III-95) were within the main stem of Clear Fork (BM-1, BM-4, BM-5) and two sites are in Kentucky on Steve Creek (BM-6/7). In addition, three sites lie within Valley Creek (BM-2, BM-3, and BM-8). Also, there are two sites in the tributaries to Valley Creek, Pigeon Roost, BM-9 and Hurricane Creek, BM-10.

Station No. (Stream)	BM-1	BM-2	BM-3	BM-4	BM-5	BM-6	BM-7	BM-8
4/ 7/ 2012	36	38	40	38	34	30	20	38

Figure III-94. Tennessee Macroinvertebrate Index (TMI) Scores for Clear Fork and Valley Creek

The three sites in Clear Fork (BM-1, BM-4, and BM-5) had overall metric scores showing that these stream sections of Clear Fork were fully supporting their stream use classification. However, BM-6 and BM-7, located in Steve Creek Kentucky, were found to be non-supporting of its stream use classification. But, due to BM-6 being close to fully support (TMI 32) score it could be classified as slightly impaired. Steve Creek receives drainage from a large abandoned Sterling underground mine. This is the same abandoned mine that was identified in the OSMRE permit 3296 where the permits operation plan is to mine the outcrop barrier pillars within the permit boundary. Remining of this area will likely decrease the pollutant load and help elevate the use-support metric.

Station No. (Stream)	BM-9	BM-10
4/ 7/ 2012	40	40

Table III-95. Tennessee Macroinvertebrate Scores for Pigeon Roost and Hurricane Creek

The overall metric scores for the three sites within Valley Creek, (BM-2, BM-3, and BM-8), indicate that these stream sections of Valley Creek were fully supporting of their stream use classification.

Two of the sites that are located in the tributaries to Valley Creek are Pigeon Roost, BM-9 and Hurricane Creek, BM-10. At these sites, the overall metric scores also determined that these stream sections are fully supporting of their stream use classification.

IV Conclusion

OSMRE has concluded that previous mining operations and other land use activities within the CIA10-1A watershed have resulted in numerous minor exceedances of EPA and OSMRE water quality criteria or thresholds.

To determine use support based on these exceedances, OSMRE requested TDEC to evaluate the data against other information that they have available to determine if Valley Creek is fully supportive of all designated stream uses. OSMRE notified TDEC via correspondence dated March 17, 2010, of the water quality concerns within CIA 10-1A. This correspondence was designed to notify TDEC of measured and predicted exceedances of OSMRE's material damage thresholds for TDS, sulfate, and measured exceedances of EPA's criteria for aluminum. As discussed earlier, TDEC has conducted such reviews since this correspondence, using the annual benthic macroinvertebrate surveys and field investigations. During this assessment, no exceedances of OSMRE thresholds were identified at the trendstations for iron or manganese, although several upstream background samples did identify elevated iron and manganese concentrations. Likewise, based on the TDEC draft NPDES Rationale, the agency concluded that Valley Creek and Hurricane Creek were both fully supporting all stream use classifications including biological integrity.

No legitimate users of surface water resources were identified in the Valley Creek (CIA 10, Subarea 1A) watershed that could or would be adversely affected by surface coal mining. Appropriate surface and ground water monitoring has been utilized to document baseline conditions in combination with a long term monitoring plan that will detect changes in water quantity or quality as a result of the proposed operations.

Stream sedimentation poses a threat to the hydrologic balance within this watershed. However, with proper implementation of drainage control and construction of ARAP

structures within the proposed, mine plan area, an overall improvement should be ultimately recognized. TDEC has stated that the upcoming stabilization of roads in this area in combination with the reclamation activities associated with the proposed re-mining operations and anticipated mining will result in sediment loading reductions in the Valley Creek and Clear Fork watersheds. TDEC has concluded that the reclamation of this site will be instrumental in restoring the Valley Creek watershed to a fully supporting use status and meeting the Cumberland River Total Maximum Daily Load (TMDL) document requirements. This CHIA estimates an initial decrease in the annual sediment yield of approximately 8% during the active mining. These estimates are due to the changes in land use because of the existing and proposed operation, the use of BMPs, and contemporaneous reclamation. Also, the existing haul roads associated with this operation can become a primary source of sediment and with proper maintenance and the use of appropriate BMPs, sediment contribution from the mining areas should be minimized.

TDS is anticipated to increase by a maximum of 27% over the prevailing mean value of value of 386 mg/L. Sulfate values are expected to increase by 15% over the prevailing maximal value of 320 mg/L. Alkalinity is also anticipated to increase by 43% over the prevailing mean of value of 101 mg/L based on the median flow measured at the trendstation. These increases are anticipated to occur gradually throughout the life of this operation and into early reclamation, but in some instances may exceed OSMRE thresholds. Once reclamation is completed, a slow but gradual decline in the constituents from this site should occur. No increases in iron or manganese levels are anticipated from this operation.

On the basis that the proposed mining activity will comply with approved permit conditions and all performance standards, OSMRE has determined that the proposed Kopper Glo Mining, LLC's OSMRE application 3270 mine plan is designed to prevent material damage to the hydrologic balance outside the permit area.

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Table A-1. Johnson Model results based on single date conductivity measurements collected by Biological Systems Consultants, Inc.

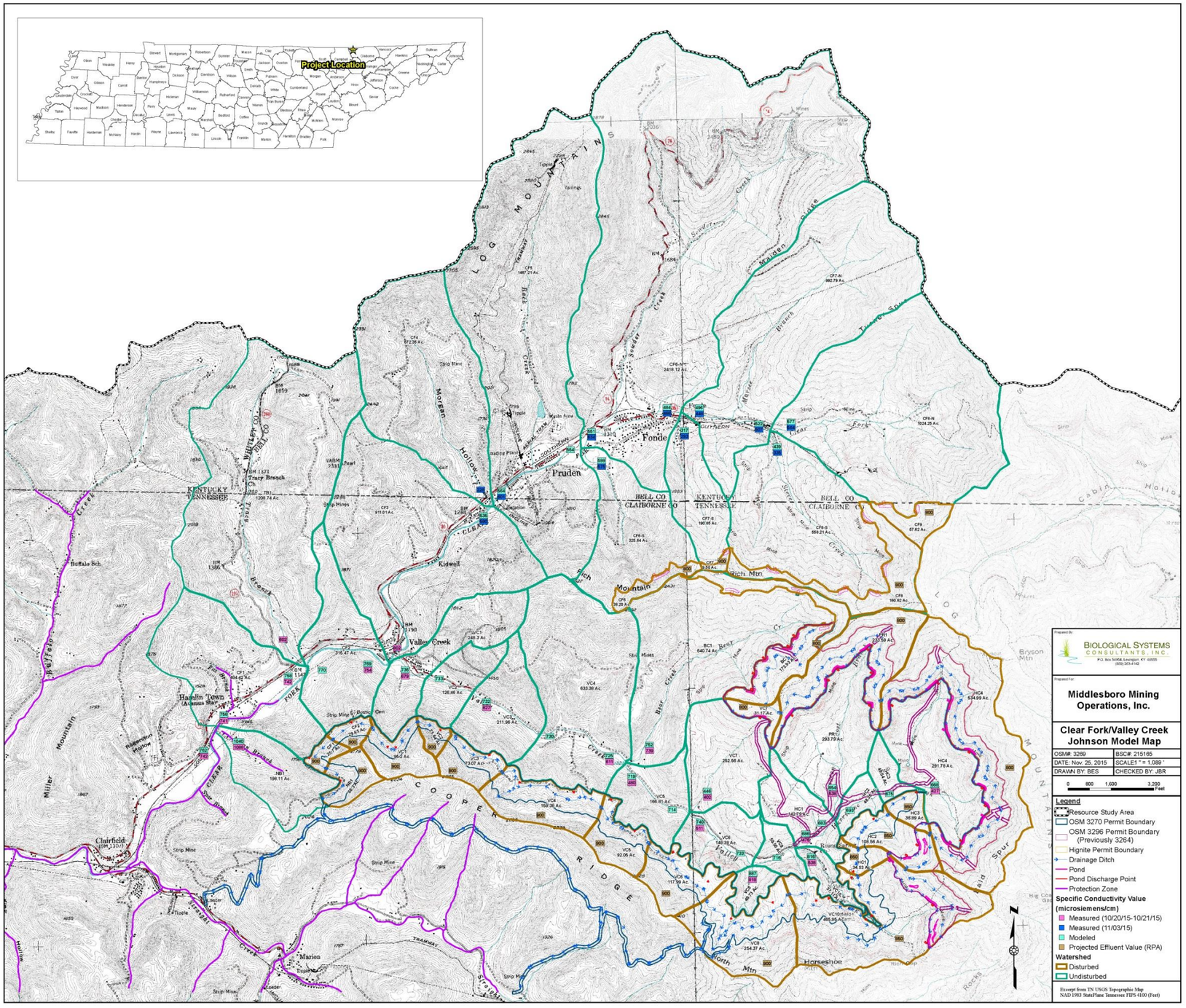

Table A-1. Johnson Model results based on single date conductivity measurements collected by Biological Systems Consultants, Inc.

Johnson Model For Valley/Straight Creek

Seam Conductivity	
Mason	900
Hignite	850
Sterling	800

Watershed	Station	Watershed Acres		Mason Watershed	Hignite Watershed	Sterling Watershed	Mason Cumulative	Hignite Cumulative	Sterling Cumulative	Cumulative Unmined	Cumulative Mined	Cumulative WS Size	Existing Conductivity	Anticipated Conductivity	Percent Change
		Unmined	Mined												
Clear Fork	Outlet	14188.57	2826.843	911.643	645.93	1239.62	1142.94	645.93	1239.62	14188.57	2826.84	17015.41	742	770	3.7%
Nolan Branch	NB-1	198.11	68.3	68.3	0	0.00	68.30	0.00	0.00	198.11	68.30	266.41	1088	1040	-4.4%
Clear Fork	CF-1	484.42	25.7	25.7	0	0.00	843.34	645.93	1239.62	13990.46	2758.54	16749.00	741	756	2.1%
Tracy Branch	TB-1	1208.74	0	0	0	0.00	0.00	0.00	0.00	1208.74	0.00	1208.74	602	602	0.0%
Clear Fork	CF-2	315.47	29.65	0	0	0.00	817.64	645.93	1239.62	12297.30	2732.84	15030.14	754	768	1.9%
Valley at Mouth	VC1	248.3	95.2	95.2	0.0	0.00	817.64	645.93	973.68	3421.65	2437.25	5858.90	679	749	10.3%
Valley Lower	VC2	127.0	25.6	25.6	0.0	0.00	722.44	645.93	973.68	3173.35	2342.05	5515.40			
Valley Lower	VC3	212.0	73.1	73.1	0.0	0.00	696.80	645.93	973.68	3046.39	2316.41	5362.80	627	721	15.0%
Valley Lower	VC4	633.4	159.4	159.4	0.0	0.00	623.73	645.93	973.68	2834.43	2243.34	5077.77			
Bear Creek	BC1	640.7	173.9	0.0	0.0	173.93	0.00	0.00	173.93	640.74	173.93	814.67	639	673	5.4%
Valley Middle	VC5	166.8	92.1	92.1	0.0	0.0	464.4	645.9	799.8	1560.3	1910.0	3470.3	480	679	41.4%
Valley Trib 1	VC7	252.6	31.2	0.0	0.0	31.2	0.0	0.0	31.2	252.6	31.2	283.7	402	446	10.9%
Valley Middle	VC6	148.4	117.9	117.9	0.0	0.0	372.3	645.9	768.6	1140.9	1786.8	2927.8	511	711	39.2%
Valley Trib 2	VC8	49.7	254.4	254.4	0.0	0.0	254.4	0.0	0.0	49.7	254.4	304.1	818	887	8.4%
Valley Upper	VC9	59.6	0.0	0.0	0.0	0.0	0.0	645.9	768.6	942.8	1414.5	2357.3			
Valley Head	VC10	57.1	466.0	0.0	466.0	0.0	0.0	466.0	0.0	57.1	466.0	523.1	538	816	51.7%
Hurricane at Mouth	HC1	142.8	34.5	0.0	34.5	0.0	0.0	180.0	768.6	826.2	948.6	1774.7	475	654	37.6%
Pigeon Roost at Mouth	PR1	293.8	233.6	0.0	0.0	233.6	0.0	0.0	233.6	293.8	233.6	527.4	538	654	21.6%
Hurricane Lower	HR2	48.3	108.6	0.0	108.6	0.0	0.0	145.5	535.0	389.6	680.4	1070.0			
Hurricane Middle	HR3	49.5	36.9	0.0	36.9	0.0	0.0	36.9	535.0	341.3	571.9	913.2			
Hurricane Upper	HR4	291.8	535.0	0.0	0.0	535.0	0.0	0.0	535.0	291.8	535.0	826.8	427	668	56.5%
Clear Fork US Valley	CF-3	911.01	0	0	0	0	0	0	265.94	8560.18	265.94	8826.1	802	802	0.0%
Morgan Hollow	CF-4	672.35	0	0	0	0	0	0	0	672.35	0	672.4	228	228	0.00%
Clear Fork US Morgan	CF-5	1467.21	0	0	0	0	0	0	265.94	6976.82	265.94	7242.8	601	608	1.2%
Clear Fork Trib 1	CF6-S	325.64	38.2	0	0	38.2	0	0	38.2	325.64	38.2	363.8	575	599	4.1%
Sowder Creek	CF6-N	2418.12	0	0	0	0	0	0	227.74	2418.12	227.74	2645.9	634	648	2.3%
Clear Fork Trib 2	CF7-S	190.85	9.5	0	0	9.5	0	0	9.5	190.85	9.5	200.4	293	317	8.2%
Marsee Branch	CF7-N	992.79	0	0	0	0	0	0	218.24	2575	218.24	2793.2	448	476	6.1%
Steve Creek	CF7-S	558.21	160.62	0	0	160.62	0	0	160.62	558.21	160.62	718.8	335	439	31.0%
Clear Fork Head	CF7-N	1024	57.62	0	0	57.62	0	0	57.62	1024	57.62	1081.6	564	577	2.2%

Kentucky code letters to classify mines

Code letters to classify mines are as follows:
URC Underground Rail Coal
URWC Underground Rail Water Coal
UTC Underground Truck Coal
UWC Underground Water Coal
ARC Auger Rail Coal
ASRC Auger Surface Rail Coal
ASTC Auger Surface Truck Coal
ASWC Auger Surface Water Coal
ATC Auger Truck Coal
AWC Auger Water Coal
SRC Surface Rail Coal
STC Surface Truck Coal
SWC Surface Water Coal
GSTC Gob Surface Truck Coal
:*Notations are made as follows:*
A Abandoned
C C Change of Company Name only
C O Change of Operator and Company Name or Operator

SF Surface
UG Under Ground
HWF Head of Hollow Fill
SBK Spoil Bank Fill

MI Minor Revision
MT Mid-Term Review
MTS Mid-Term Review Special
NW New Permit
RP Repermit
RV-Revision
AM amendment
FR Field Revision
MA Major Revision

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A1 - ACTIVE CURRENTLY BEING MINED
A2 - ACTIVE NOT CURRENLY BEING MINED
AP - ACTIVELY PRODUCING COAL
D3 - THIRTY DAYS RECLAMATION DEFERRED
D6 - SIX MONTH RECLAMATION DEFERRED
FF - FINAL FORFEITURE
IA - INACTIVE PERMITS
ND - NO DISTURBANCES
O1 - ACTIVE PERMITS IN FORFEITURE
O2 - ACTIVE TEMPORARY CESSATIONS
P1 - PHASE 1 RELEASE
P2 - PHASE 2 RELEASE
RC - PERMITS COMPLETELY RELEASED
SF - SURETY FAILURE
SP - SUSPENDED PERMIT
XX - MINE STATUS UNKNOWN
YY - CREATED DURING CONVERSION
Z1 - PREPERMIT
Z2 - WILDCAT
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Print Range: 1-6,9-11,13-74,76-79,81-91,93-97,99-119 (8.5x11)
Print Range: 7,12,75,80,92,98 (11x17)

Appendix A: Tennessee Permitting Codes

CODE	DESCRIPTION
A	Surface.
B	Underground.
C	Preparation Plant.
D	Ancillary (Haulroad, Conveyor, and/or Rails).
E	Refuse and/or Impoundment.
F	Loading Facility and/or Tipple.
G	Stockpiles
H	Exploration Permits
I	Notice of Intent to Explore
J	Exempt 16 2/3
K	Government Financed Construction Exemption

PERMIT STATUS

CODE	DESCRIPTION
A	Active: Coal mining and reclamation activities occurring or permitted but not yet disturbed.
IN	Inactive (*Permanent Program Permit*)*:* Phase II completed or Temporary Cessation of Operations. (*Interim Program Permit*): Coal mining completed and reclamation activities initiated.
NA	Not Applicable: When site is unpermitted.
BR	Bond Release: Reclamation completed and State Regulatory Authority (RA) has released all of the bond (Phase III release).
AB	Abandoned: All surface or underground coal mining activities have ceased and operator has left the site without completing reclamation as defined in 30 CFR 840.11(g).
AB1	Bond Forfeiture: Bond forfeiture officially in process or completed, and reclamation in progress or not yet commenced.
AB2	Partially Reclaimed Forfeiture: Forfeited site where all bonds have been used to reclaim site, but site not reclaimed to Program standards.
AB3	Reclaimed Forfeiture: Forfeited site that has been reclaimed to Program standards.

SITE STATUS

CODE	DESCRIPTION
ND	No Disturbance: No coal mining and reclamation operations have been started.
EX	Coal Exploration: Coal exploration operations have started and where coal mining operations have not begun.
AP	Active Coal Producing: Coal surface mining activities are occurring.
AN	Active Non-Producing: Active non-producing facility such as tipple or preparation plant.
NM	No Mining: The Permit Status is active, site is not in Temporary Cessation, no surface coal mining activity, and site not regarded.
MC	Mining Complete: No mining activity on site, site regarded and awaiting phase bond release.
TC	Temporary Cessation: The RA has granted cessation of mining pursuant to 30 CFR 816/817.131(b).
P1	Phase I Release: At lease Phase I bond release granted for entire permitted area. For interim permits, partial bond release.
P2	Phase II Release: At least Phase II bond release for the entire permitted area.
P3	Phase III Release: Reclamation completed and the RA has released all bond.
FP	Forfeiture Pending: The RA is pursuing actions to revoke the permit, collect the performance bond(s), and/ or reclamation of forfeited site is in progress.
FR	Forfeited and Reclaimed: Forfeiture reclamation completed.
WC	Wildcat: Coal mining and reclamation operations have or are taking place and the activity is not covered by the required permits from the RA.

BONDING

CODE	DESCRIPTION
FB	Fully bonded.
NB	Never bonded (NOI's, MWP's and EWN's).
TS	State total release (interim program).
RS	State bond return (interim program).
PS	State partial release (interim program).
FS	State forfeiture.
FO	OSM forfeiture.
RO	Bond returned – Settlement Agreement or Third Party
TO	Total bond release