Canyon Fuel Company, LLC
A Subsidiary of Bowie Resource Holdings, LLC

Skyline Mine
Gregg A. Galecki, Environmental Engineer
HC35, Box 380
Helper, Utah 84526
(435) 448-2636
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March 19, 2015

Mr. Daron R. Haddock
Division of Oil, Gas, and Mining
1594 West North Temple
Salt Lake City, Utah 84114-5801

RE: Application to Reduce Macroinvertebrate and Fish Monitoring requirements, Canyon Fuel Company, LLC, Skyline Mine, C/007/0005,

Dear Daron:

Please find enclosed with this letter Skyline Mine's application to reduce macroinvertebrate and fish monitoring commitments on Woods, Winter Quarters, and Eccles Creeks within the Mine's adjacent area. The submittal includes completed C1 and C2 forms, a memo outlining the basis for the monitoring reduction, redline/strikeout modified text to the M&RP.

Information has been submitted electronically and includes the following files:
-C1 and C2 forms with associated cover letter
-Memo demonstrating the basis for the modification (to be to Appendix A-3)
-redline-strikeout versions of M&RP modifications in Section 2.8.1.

Two (2) hard copies of the information will be submitted at final approval.

If you have any questions regarding this information, please give me a call at (435) 448-2636.

Sincerely:

Gregg A. Galecki
Canyon Fuel Company, LLC.
Environmental Engineer – Skyline Mines

Enclosures

APPLICATION FOR COAL PERMIT PROCESSING

Permit Change ☒ New Permit ☐ Renewal ☐ Exploration ☐ Bond Release ☐ Transfer ☐

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Aquatic Monitoring Reduction
Description, Include reason for application and timing required to implement:
Elimination of macroinvertebrate and fish monitoring.

Instructions: If you answer yes to any of the first eight (gray) questions, this application may require Public Notice publication.

☐ Yes ☒ No 1. Change in the size of the Permit Area? Acres: _____ Disturbed Area: _____ ☐ increase ☐ decrease.
☐ Yes ☒ No 2. Is the application submitted as a result of a Division Order? DO# _____
☐ Yes ☒ No 3. Does the application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes ☒ No 4. Does the application include operations in hydrologic basins other than as currently approved?
☐ Yes ☒ No 5. Does the application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes ☒ No 6. Does the application require or include public notice publication?
☐ Yes ☒ No 7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes ☒ No 8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes ☒ No 9. Is the application submitted as a result of a Violation? NOV # _____
☐ Yes ☒ No 10. Is the application submitted as a result of other laws or regulations or policies?
Explain: _____
☐ Yes ☒ No 11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes ☒ No 12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2)
☐ Yes ☒ No 13. Does the application require or include collection and reporting of any baseline information?
☒ Yes ☐ No 14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes ☒ No 15. Does the application require or include soil removal, storage or placement?
☐ Yes ☒ No 16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes ☒ No 17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes ☒ No 18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes ☒ No 19. Does the application require or include certified designs, maps or calculation?
☐ Yes ☒ No 20. Does the application require or include subsidence control or monitoring?
☐ Yes ☒ No 21. Have reclamation costs for bonding been provided?
☒ Yes ☐ No 22. Does the application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes ☒ No 23. Does the application affect permits issued by other agencies or permits issued to other entities?

Please attach four (4) review copies of the application. If the mine is on or adjacent to Forest Service land please submit five (5) copies, thank you. (These numbers include a copy for the Price Field Office)

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations herein.

Carl W. Winters
Print Name

Carl W. Winters 3/19/15
Sign Name, Position, Date

General Manager

Subscribed and sworn to before me this 19th day of MARCH, 2015

Kathleen Atwood
Notary Public

My commission Expires: 12-02, 2015

Attest: State of Utah } } ss:
County of Carbon

KATHLEEN ATWOOD
NOTARY PUBLIC-STATE OF UTAH
COMMISSION# 650015
COMM. EXP. 12-02-2015

For Office Use Only:	Assigned Tracking Number:	Received by Oil, Gas & Mining

Form DOGM- C1 (Revised March 12, 2002)

APPLICATION FOR COAL PERMIT PROCESSING
Detailed Schedule Of Changes to the Mining And Reclamation Plan

Permittee: Canyon Fuel Company, LLC
Mine: Skyline Mine **Permit Number:** C/007/005
Title: Aquatic Monitoring Reduction

Provide a detailed listing of all changes to the Mining and Reclamation Plan, which is required as a result of this proposed permit application. Individually list all maps and drawings that are added, replaced, or removed from the plan. Include changes to the table of contents, section of the plan, or other information as needed to specifically locate, identify and revise the existing Mining and Reclamation Plan. Include page, section and drawing number as part of the description.

			DESCRIPTION OF MAP, TEXT, OR MATERIAL TO BE CHANGED
☐ Add	☒ Replace	☐ Remove	Section 2.8 Aquatic Wildlife Resources, pages 2-70, 2-71a through 2-71d, Table 2.8-1a (page 2-72a)
☒ Add	☐ Replace	☐ Remove	Appendix A-3, Skyline memo - Basis for Macroinvertebrate and Fish Monitoring Reduction
☐ Add	☐ Replace	☐ Remove	
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Any other specific or special instruction required for insertion of this proposal into the Mining and Reclamation Plan.	**Received by Oil, Gas & Mining**
Five (5) redline and Five (5) clean copies of the application are included in the submittal.	

Date: **March 19, 2015**

To: **File**

From: **Gregg Galecki**

Subject: **Basis for Macroinvertebrate and Fish Monitoring Reduction**

The following is intended to serve as a demonstration for the reduction of macroinvertebrate (benthic) monitoring in streams surrounding the Skyline Mine. Specifics of the current benthic monitoring are outlined in Section 2.8 Aquatic Wildlife Resources, of the Skyline Mining and Reclamation Plan (M&RP). For all the streams to be addressed herewith, a commitment in the M&RP states studies will continue, "for a period determined by Canyon Fuel Company, LLC, DOGM, USFS, and the DWR, to be long enough to provide data to establish population trends."

The following will show 1) sufficient data has been collected to determine the benthic community is predominantly affected by climatic influences; 2) streams not potentially impacted by mine-water discharge do not need benthic monitoring; and 3) other monitoring methods adequately address the potential impacts to the streams. Each stream monitored will be discussed separately. Attached to this memo (Appendix A) is a more comprehensive summary of the benthic and fish surveys within said creeks titled, "Skyline Mine Macroinvertebrate Review for Eccles, Winter Quarters, and Woods Canyon Creeks". This summary document was compiled by Ms. Lisa Reinhart – Biologist, DOGM and will be referenced often. The specific macroinvertebrate studies that detail each year that was assessed are located in Appendix A-3 or the Annual Reports. Studies conducted from 2000 through 2011 were completed by Dr. Dennis Shiozawa working with Mt. Nebo Scientific.

Woods Canyon Creek

Benthic monitoring in Woods Canyon Creek has been collected in five (5) separate surveys in years 1995, 2002, 2003, 2007, and 2011 respectively. In the benthic surveys Woods Canyon and Winter Quarters Canyon creeks have often been compared in the surveys. As no undermining of the Woods Canyon had been conducted until 2014, all five (5) surveys have been considered baseline information. Observations from the surveys include physical conditions that would be expected with increased flow as the stream advances downstream, and lower hardness and alkalinity in the Spring as a response to increased flow from runoff. With the 2002 survey serving as a second baseline assessment, 2003 showed no clear relationship existed with the number of taxa between upstream and downstream reaches, and both the Biotic Condition Index (BCI) and Community Tolerance Quotient (CTQa) indicated all reaches were in very good condition. The 2007 survey indicated the fall taxa were lower compared to the 2003 survey, while the Spring counts were higher than compared to the 2003 survey. On a comparative note, Winter Quarters showed the exact opposite trend during this timeframe with no clear explanation why the different trends would occur. The total invertebrate densities increased while the biomass at most sample stations decreased, and the BCI and CTQa did not detect any differences between stations. The 2011 survey was strongly influenced by spring runoff/flooding which correspondingly showed the invertebrate densities were significantly down from 2007. Changes noted to the BCI and shift in the CTQa reflected changes in water chemistry due to the increase flow at runoff.

In summary, the surveys document benthic health of the stream can change considerably from year to year based on either climatic or other unknown factors unrelated to mining, and that the surveys

have adequately characterized the benthic community. Woods Canyon Creek is one of four (4) streams to be surveyed (Burnout, James, Winter Quarters) without being able to identify any impacts related to mining. No mine water is discharged into the creek, therefore there is no mining effect on water quality, and seasonal water quality monitoring continuing assess water quality. Any losses of water quantity due to mining are adequately monitored with monthly flow measurements collected from spring through fall at regular intervals along the stream.

Fish surveys indicated no fish were present in 1994, with similar conditions noted in 2002. An additional survey was conducted in 2010 when the mine plan was modified to extend approximately ½-mile downstream. Although a total of eight (8) fish were counted in 2010, no fish were counted in 2013. The biological assessment determined that it was not ideal habitat due to shallow pools, relatively low flow, and harsh winter conditions. Populations of fish in Woods Canyon may require active connections with Mud Creek and may serve as a nursery for fluvial populations. It does not appear suitable for maintaining a closed fish population over long time periods. Based on these observations and previously stated monitoring, fish surveys are no longer needed on Woods Canyon Creek.

Winter Quarters Canyon

Benthic monitoring in Winter Quarters has been collected in 1995, 2002, 2003, 2007, and 2011, respectively. As stated with Woods Canyon Creek, the creeks were compared to one another because of their similar nature with no surface disturbance or mine discharge potentially affecting the benthic community. Although the dynamics of the benthic community changes slightly between survey years, no specific reasons were identified, yet it has consistently maintained a moderate population of macroinvertebrates. Contributors include water chemistry associated with high, low, and normal water years that effects water hardness and alkalinity; forage and livestock management in the drainage, and physical restructuring of the streambed during higher spring runoff. The 2003 survey indicated the physical profiles of the stream channels were typical of what would be expected. The Fall 2003 flows were down likely due to prevailing drought conditions. Taxa densities increased from 2002 through 2004, but due likely to improved lab sorting procedures. Winter Quarters dominant taxa were chrinomids, baetid mayflies, and ostracods which all tended to increase in numbers from spring to fall, with the exception of Baetis which increased in Spring samples. Although species tended to 'cluster' per stream, no obvious patterns existed. When comparing spring to fall taxa numbers from subsequent seasons, variations in the densities were observed but could not be attributed to a particular cause. The same held true when conducting cluster analysis' of spring-spring and fall-fall numbers of various year. As with Woods Canyon, the 2011 sampling was strongly influenced by spring runoff with invertebrate densities being significantly down from previous sampling periods. Changes to water chemistry and the benthic community were all attributed to the flow. In May through July 2011 total snowpack was approximately 190 percent of normal with monthly precipitation totals for April, May and July being 312%, 195%, and 240% of normal, respectively.

In summary, similar to Woods Canyon creek, the surveys documented that the benthic community various from year-to-year based on numerous undetermined influences. However the benthic community still followed a reasonably predictable pattern. Winter Quarters Canyon creek can be eliminated from benthic monitoring for the following reasons: 1) longwall mining in the Winter Quarters drainage was completed in 2011 and any impacts associated with subsidence are complete; 2) Water chemistry analysis has been collected on spring through fall basis since 2002 without any adverse impacts; 3) Water quantity monitoring was conducted on a monthly basis while longwall mining was being conducted beneath the various stream sections without any adverse impacts; 4) no surface facilities or mine discharge is added to the creek above any on the benthic

monitoring sites; and 5) similar to James and Burnout creeks, once mining has been completed macroinvertebrate monitoring has been traditionally eliminated.

A fish study conducted 1994 east of the US Forest Service boundary located cutthroat trout in the creek suggesting more were likely present upstream in perennial sections of the creek. Additional fish-count studies were conducted in 2010 and 2013. Although an established fish population exists in Winter Quarters creek, the morphology is similar to Woods Canyon and does not provide ideal habitat. The fish populations of the surveys varied widely and are likely due to climatic conditions. The studies were initially conducted to monitor effects associated with the Winter Quarters Ventilation Facility (WQVF). Since 2011 the sediment pond has never discharged, which would provide only a potential impact. Due to the wide variability of the population between surveys, the elimination of mining within the canyon, and the minimal impact from the WQVF it is proposed that the electro-fishing study be eliminated. In the event the WQVF pond (UPDES 004) started discharging on a regular basis, whole effluent toxicity (WET) testing could be added to the monitoring program. WET testing would be consistent with the sampling conducted at the Mine facility and would adequately evaluate the impacts of any discharge water.

Eccles Creek

Significant benthic monitoring has been conducted on Eccles Creek. Initially conducted annually from 1979 through 1985, then again beginning in 2001 through 2004, subsequently in 2007, 2011, and now scheduled again in 2015. It is apparent that the benthic community has gone through some progressive changes in that time. Going from a relatively undisturbed canyon to building SR-264 with the associated increase in sedimentation from building the road. Since 2001, the creek has experienced another change with a significant increase in flow due to discharge from the mine. The mine discharge is a consistent source of drinking-water quality water, however the increase in flow has modified the morphology of the stream by adding primarily sediment-free, calcium bicarbonate-rich water which in combination reduces the amount of sediment/detritus in the stream. Sufficient data has been collected over the last decade to determine a reasonably predictable change in the benthic community structure has occurred, and will most likely not return to the pre-1979 status until similar conditions return.

Based on the existing data, Skyline proposes that the health of the stream is adequately monitored through quarterly water quality analysis of established sites located both upstream and downstream of the Mine site (DOGM permit); and under the Utah Division of Water Quality (DWQ) Utah Pollution Discharge Elimination System (UPDES) permit weekly water quality sampling combined with quarterly whole effluent toxicity (WET) testing of the Mine Water discharge entering the creek.

Figures 1 through 5 are provided as a demonstration of the quality of the water that is consistently being discharged from the mine. The data set runs from 2007 through 2014 and represents weekly UPDES-001 Mine discharge. **Figure 1** illustrates a consistent flow that has been trending down from approximately 4,400 gpm to 3,000 gpm. **Figure 2** illustrates the total dissolved solids concentration trending from approximately 600 mg/l down to 400 mg/l. Also included in the graph is the Daily Maximum Limit of 1,200 mg/l; note that the concentration is roughly one-third of the allowable concentration. **Figure 3** illustrates the total suspended solids concentrations for both the Daily Maximum Limit (red) and the concentrations observed. The solid blue line at the bottom represents concentrations below laboratory detection limits. Approximately 93 percent of the samples collected were below detection limit, with the remaining 7 percent of samples having a concentration of approximately 15 percent of the Daily Max concentration. **Figure 4** illustrates the concentrations of Total Iron have not exceeded the daily maximum limit of 1 mg/l in more than eight years, with the vast majority of sample concentrations being below 0.4 mg/l or below the detection limit. Figure **5** illustrates the oil and grease concentrations, with less than 2 percent of the samples

collected being above the detection limit. Skyline also believes the one sample that was above the limit was a laboratory error.

Fish studies conducted in 2001, 2004, 2007, 2010, and 2013 indicate the fish numbers fluctuate from year to year based on both climatic conditions and influences attributed to the Skyline mine water discharge. The fish population has both benefitted and been impacted by the mine water, but has demonstrated the resilience and adaptability to adjust to the dynamic conditions. The fish-counts conducted in 2013 were at historic high densities at all the sample locations. The five (5) years of data adequately represent both the current status, evolution, and seasonal variations of the stream, and suggests the frequency of the fish-count surveys would likely only show minor seasonal modifications. The regular monitoring of the water quality through the UPDES discharge monitoring and quarterly DOGM water monitoring will adequately monitor the dynamic nature of the stream.

Summary

Based on the aforementioned discussion, modifications to Section 2.8.1 Aquatic Monitoring Program of the Skyline M&RP have submitted for approval. **Woods Canyon creek:** macroinvertebrate or fish-count surveys will no longer be conducted due to 1) adequate baseline information has been collected; 2) having no surface disturbance or mine water discharge to impact the stream; and 3) the demonstration from other benthic studies that impacts are unlikely. **Winter Quarters creek:** macroinvertebrate or fish-count surveys will no longer be conducted since longwall mining has been completed without any impacts being observed. Fish monitoring will be discontinued as well since adequate baseline has been collected, but could be re-initiated in the event mine water discharge is added to the creek. **Eccles Creek:** monitoring of both macroinvertebrates and fish will be discontinued based on 1) adequate baseline information being collected; 2) continued monitoring of the creek through weekly water chemistry analysis and quarterly WET testing of the mine discharge through the UPDES permit; and 3) quarterly water chemistry analysis through the DOGM water monitoring program. Should conditions change in Eccles Creek due to mining activities, both studies could be re-initiated.

Figure 1

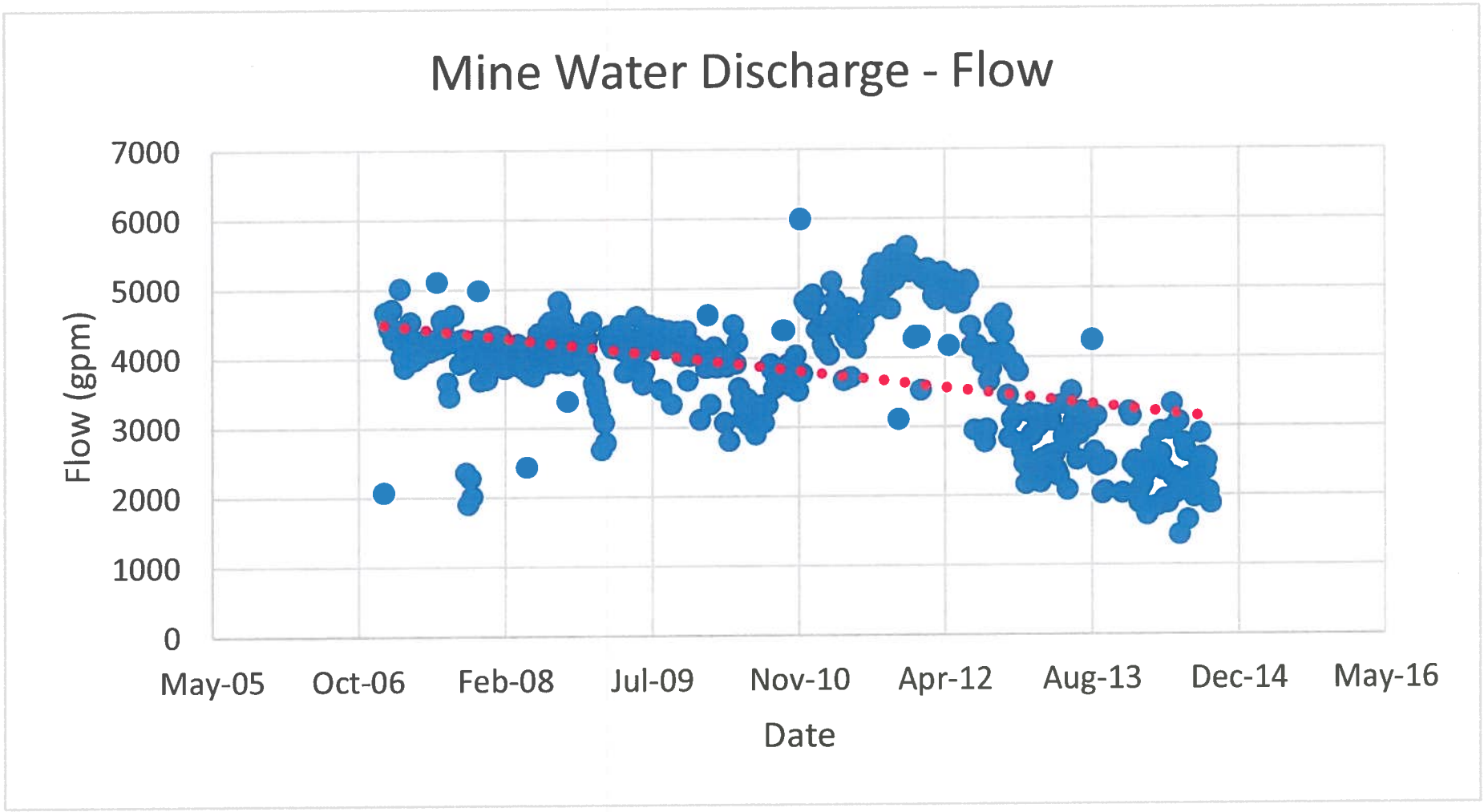

Mine Water Discharge - Flow
Flow (gpm)
7000
6000
5000
4000
3000
2000
1000
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Date

Figure 2

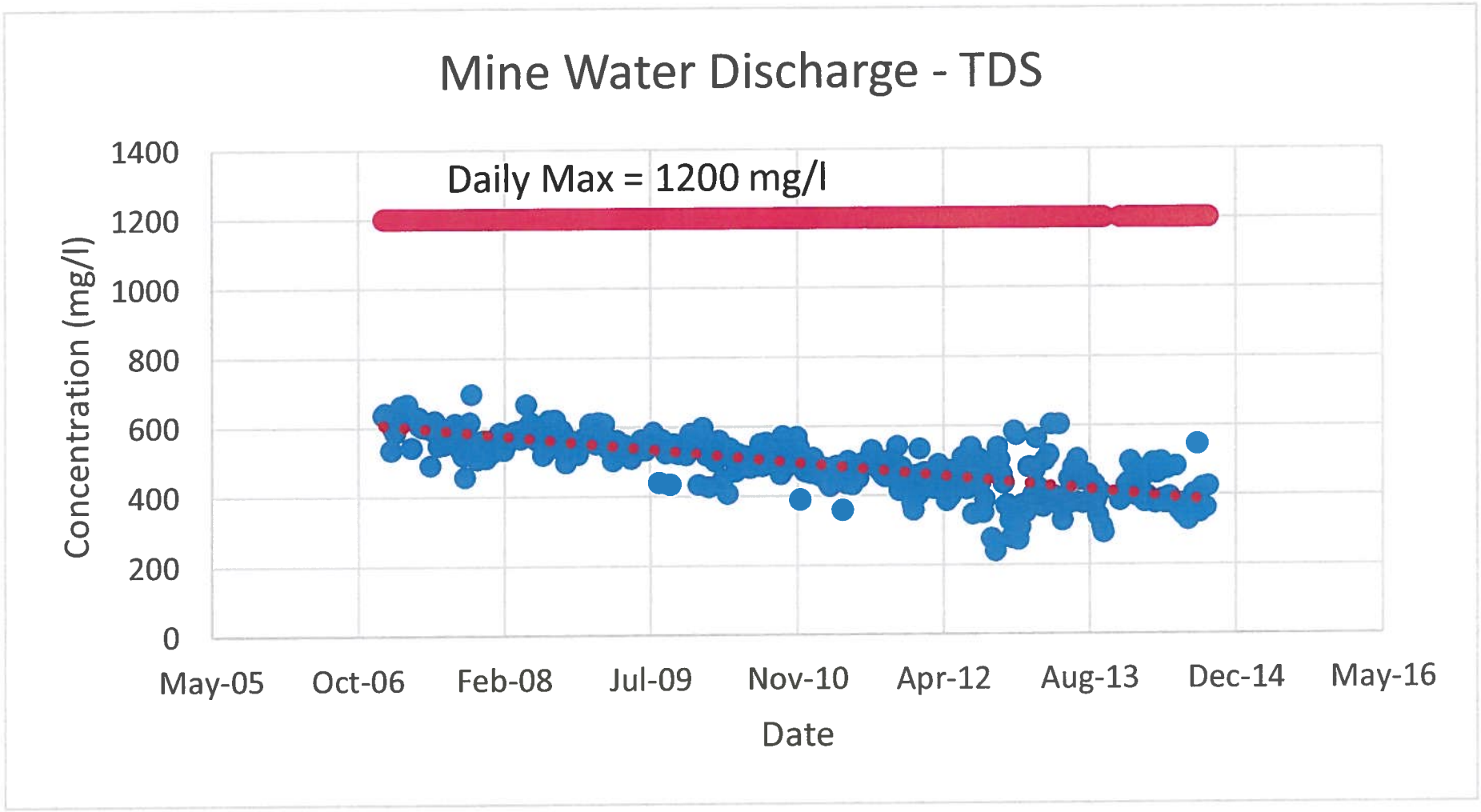

Mine Water Discharge - TDS
Daily Max = 1200 mg/l
Concentration (mg/l)
1400
1200
1000
800
600
400
200
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Date

Figure 3

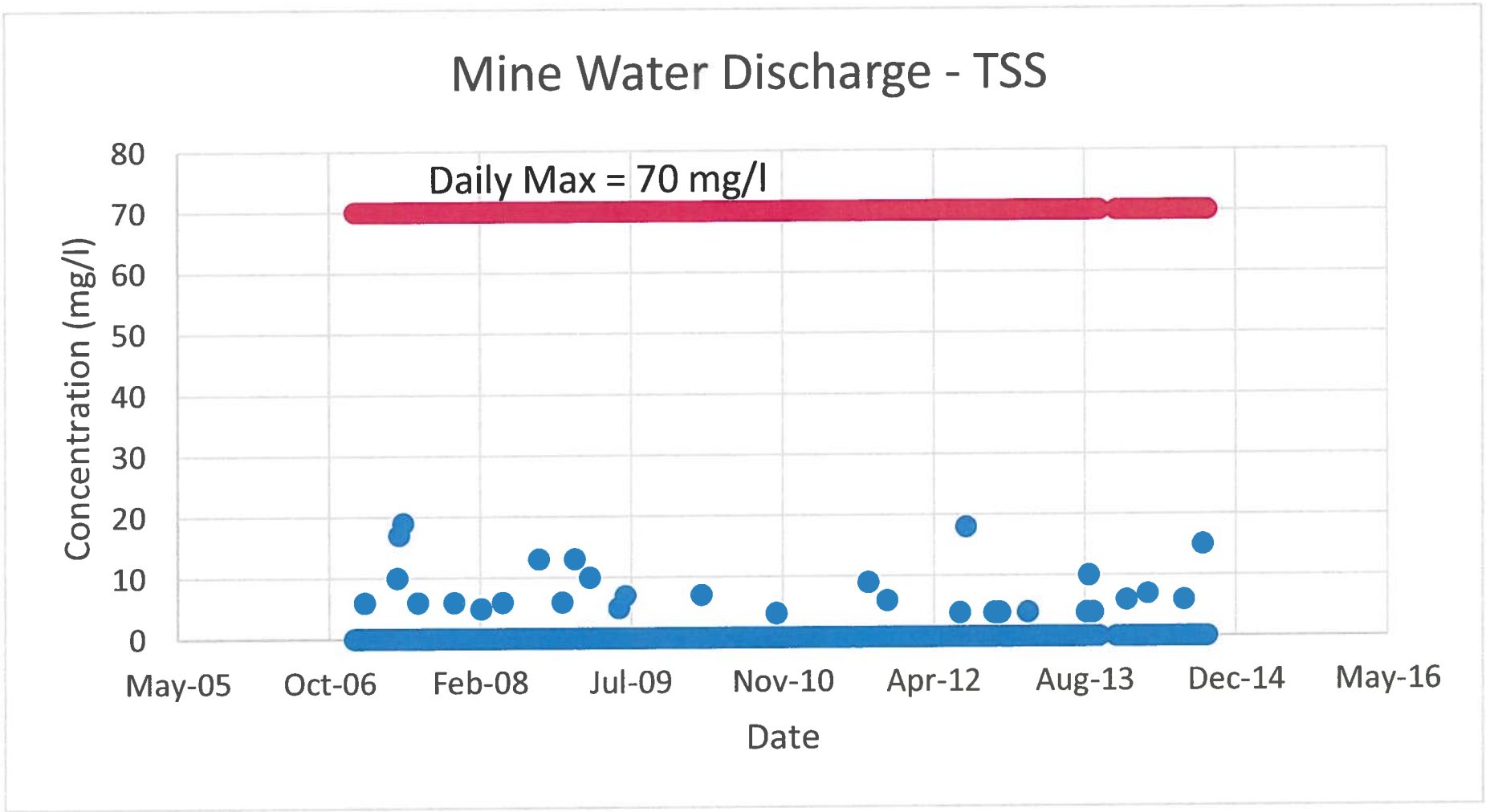

Mine Water Discharge - TSS
Daily Max = 70 mg/l
Concentration (mg/l)
80
70
60
50
40
30
20
10
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Date

Figure 4

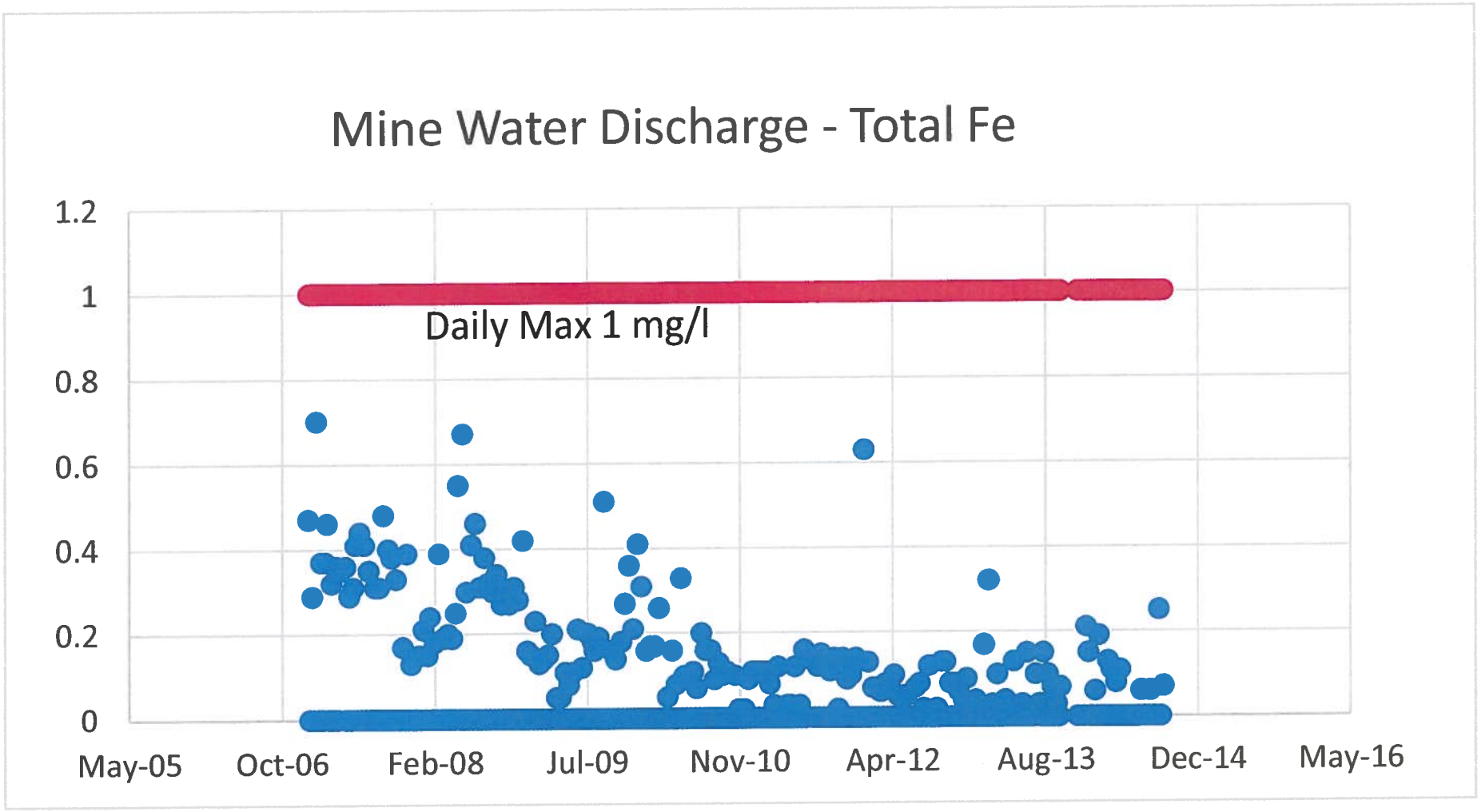
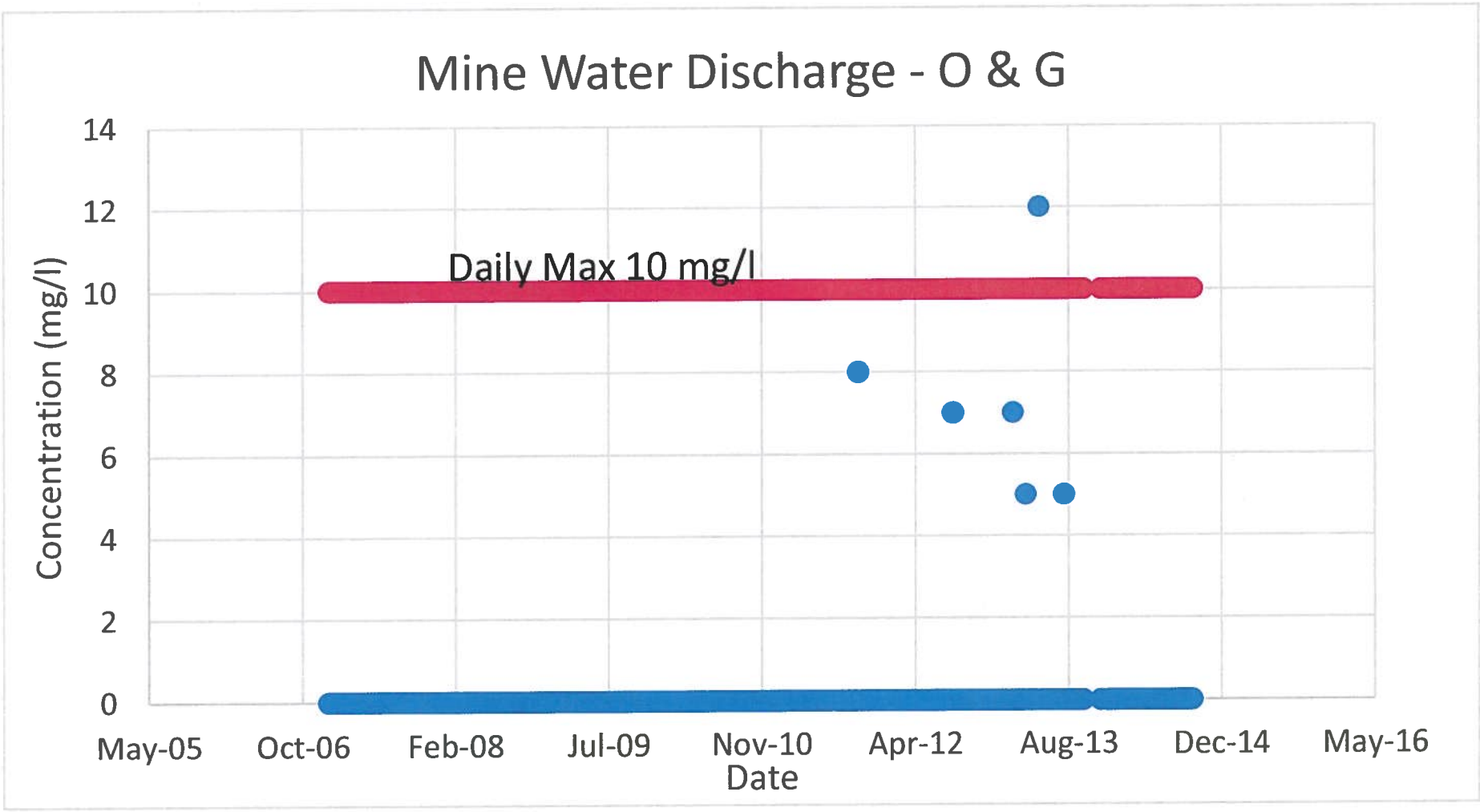

Mine Water Discharge - Total Fe
1.2
1
0.8
0.6
0.4
0.2
0
Daily Max 1 mg/l
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16

Figure 5


Mine Water Discharge - O & G
Daily Max 10 mg/l
Concentration (mg/l)
14
12
10
8
6
4
2
0
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Apr-12
Aug-13
Dec-14
May-16
Date

APPENDIX A
Skyline Mine Macroinvertebrate Review for Eccles, Winter Quarters, and Woods Canyon Creeks

Baseline Habitat

Eccles Creek

Eccles Creek is a small mountain stream draining west to east into Pleasant Valley Creek which flows north approximately 3 miles where it empties into Scofield Reservoir. Discharges in Eccles Creek are frequently as low as 2 cfs during late summer, fall and winter months; and high flows seldom exceed 50 cfs, even at the creek mouth. Water temperatures of streams such as Eccles Creek fluctuate because of turbulence from the rough channels. During November to March, water temperatures remain between 0-2°C. In the summer, water temperatures often fluctuate from 12-15° C daily although high temperatures seldom exceed 20° C.

Through natural erosion of mudstone, sandstone and shale deposits, Eccles Creek has periods of high total suspended solids (sedimentation). This occurs, however, during periods of high runoff when the stream waters have sufficient energy (velocity) to carry the fine sediments out of the canyon rather than depositing them on the coarser substrate materials. During normal runoff years, there are numerous clean trout spawning gravel beds in Eccles Creek. During low runoff years, fine sediments may not be flushed from the spawning grounds. Maintenance of this resource is dependent upon a continuation of flow, adequate substrate, food-base and water quality conditions.

The existing aquatic species of Eccles Creek, fish and macroinvertebrates, have adapted to tolerate natural temperature fluctuations and sediment loads. The macroinvertebrate communities of Eccles Creek have a high diversity of specie representing all major trophic groups. There are species found only in high quality water streams indicating the high water quality of Eccles Creek. There are also environmentally resistant taxa present. This high diversity represents a resiliency to environmental change, especially short term changes.

Upper Eccles Creek above the White Oak Mine Road, have numerous taxa of macroinvertebrates found only in high quality waters and stable habitats. Lower Eccles Creek (Stations EC04 and EC05) has a more tolerant macroinvertebrate community with taxa tolerant to sedimentation dominating the community.

Cutthroat trout have historically maintained naturally reproducing populations in Eccles Creek from the National Forest boundary downstream to the creek mouth. Recent migrations, however, have been impeded by obstacles unrelated to mining, such as, irrigation diversions, and numerous beaver dams. There are no fish in the upper forks of Eccles Creek.

Winter Quarters Canyon Creek

As indicated in the 1995 environmental assessment prepared by the Forest Service and the Bureau of Land Management Winters Quarters Canyon Creek has a moderate population of macroinvertebrates , Perennial flow in the canyon has produced Stonefly larvae as far up as Box and Bob's Canyons. Mayfly nymphs were also found present in waters tested. Cutthroat trout were found within the creek east of the Forest Boundary on June 7, 1994 indicating fish are likely within perennial sections of the creek containing significant flows. An additional baseline survey was conducted in Winter Quarters Canyon Creek in October 2002 indicated similar conditions and species. The Winter Quarters Ventilation Facility pad was specifically designed to minimized any potential impacts to the stream. The pad was designed to stay a minimum of two (2) stream widths from the stream, (or approximately 24 feet), thus maintaining a buffer zone and avoiding impacts to both the stream and riparian areas. The macroinvertebrates are monitored on a scheduled basis to insure the health of the stream

Woods Canyon Creek

As indicated in the 1995 Environmental Assessment, Mayfly nymphs *were* found within the upper portions of Woods Canyon Creek in higher quantities than those found within Winter Quarters Canyon. Stonefly larvae were also found as high as the fork in the stream near the center of Section 34 (T 12 S, R 6 E). No fish were seen during the 1994 field survey although some may have been present. A survey conducted in Woods Canyon Creek in October 2002 indicated similar conditions. Another fish survey was conducted in 2010 to serve as baseline information for expanded mining located approximately 1/2 mile east and further downstream than previously conducted. Similar with the earlier surveys the stream is relatively shallow and does not provided ideal fish habitat, however a total of eight (8) fish were identified. An addition of both a macroinvertebrate and a fish monitoring location were set up to insure monitoring stations are established downstream of mining activities to fully evaluate any impacts from mining.

Mining Impacts on Fisheries Resources

The surface facility disturbances in the portal area encroach on sections of all three upper Eccles Creek forks. In order to reduce sedimentation of these stream segments and the main stream, the tributaries and a section of Eccles Creek-=proper, immediately below the tributary confluences, were diverted into closed culverts. This modified approximately a 4,200 feet length of total stream habitat but did not reduce available fish habitat since fish were not found above the U.S. Forest boundary prior to the diversion. Downstream drift of macroivertebrates from the upper reaches of these forks still occurs as before.

At the coal loadout facilities near the mouth of the canyon (Station ECOS), approximately 600 feet of stream was moved to the north into a new channel The new channel is 100 feet shorter but has nearly the same gradient (3 feet additional vertical drop/1,000 feet horizontal channel).

Degradation of Eccles Creek between the National Forest boundary and the coal loadout facilities should continue to be minimal since road and conveyor plans were developed and are being implemented to minimize effects on the stream.

Water being discharged from the mine is augmenting the Eccles Creek stream flow (UPDES discharge point 001). This increased stream flow is especially beneficial during summer months when normal stream flows are low. Water temperatures are also moderated by this increased flow. During the life of the WOVF pad, long term sediment control will be implemented thorough a sediment pond (UPDES discharge point 004).

At this point in time there are believed to be no other potential impacts on either Winter Quarters or Woods Canyon Creeks.

Monitoring Summary

Eccles Creek 1979-2011

The data gathered from 1979 through 2002 indicate that the Eccles Creek drainage has undergone a progressive change in benthic community structure. Road widening activities compounded with drought conditions in 1980 produced what appear to be transient decreases in the number of taxa and in densities of benthic invertebrates. Immediately following the opening of the mine in 1981 and the widening of the road, stations downstream from the mine began to show a decline in number of taxa, density, and diversity. This decline was apparent by 1985. In the early 1990's sedimentation significantly impacted the stream, and in 2001 the impact of increased discharge again resulted in finding fewer taxa, lower density, and lower diversity than existed in 1979. One positive factor associated with the increased discharge is that the sands which were impacting the stream bed in the 1990 sampling period are flushed farther downstream, possibly out of the system. By 2002 the benthos was beginning to reestablish itself. While the number of taxa was still very low, at least the densities of the more resilient taxa were increasing.

In June of 2003, data results continued to show significant impacts from the increased inflow of water. In fact, this sample period indicated that the stress may have actually increased over what it was in the previous sample periods. This change could be caused by a number of factors associated with the increased inflow, or it could have been induced by other unknown factors into the stream sometime between October 2002 and June of 2003. It is assumed the change is a chronic response the elevated discharge. The shifts in community structure show an increase in grazers and a decrease in detritivores. Such shifts reflect a decrease in the availability of detritus to run detrital based food chains. The lack of detritus is one expected outcome when habitats capable of retaining detritus are greatly reduced (Shiozawa 1983). In this case, the discharge has increased the stream level to channel full, and at the channel full level of the stream becomes predominantly erosional. This change will increase the flushing rate of detritus from the system, and will also increase the leakage of any coarse particulate matter that is retained on or under rocks. In combination these factors will significantly affect the detrital based food chains in the stream.

June 2004-. As emphasized in previous reports (Shiozawa2002 a,b, c), the benthic community in Eccles Creek is unlikely to return to the structure that existed in 1979 unless the sustained discharge is eliminated. The higher flushing rate relative to the input of allochthonous detritus will tend to prevent the reestablishment of the 1979 community structure, especially in the upper reaches of the stream. It may be possible for the lower reaches, especially E C5 to move closer to the 1979 standard, since the lower reaches should be able to accumulate detritus flushed from upstream.

2007-2008- Total densities and the CTQa measures indicate that some of the sites may have improved considerably. The CTQa measure indicates that 3 of the 25 station samples since 2001 have very good water quality. The BCI indicates that 9 of 25 stations were of good quality. Yet the number of taxa, individual taxa densities,

biomass, diversity indices, cluster analysis, and correspondence analyses all indicate that Eccles Creek has not yet recovered from the increased discharge. The cluster analysis suggests a slight shift of the three stations towards the reference communities of 1979, but they are still highly dissimilar to those communities. Correspondence analyses indicate the communities have changed little since 2001. Given the gradient of the stream channel and the increased discharge, it is unlikely that the stream can return to its pervious state. It originally would have an established a sediment transport rate based on seasonally low flows with occasional flood events. The equilibrium channel for the present higher flows is one with a much greater rate of transport of loose bedload. This situation is enhanced by the input of sediment-free water which generates an armoring processes much like that below reservoirs. Since the water also has a high calcium bicarbonate content, which can be enhanced by anoxic conditions in the discharge waters, significant precipitation of calcium carbonate would be expected as the water degasses. This can further armor the substrate. Thus, it is unlikely that, in the long term, the stream can recover without a reduction in flow or an increased input of loose, coarse material into the stream. As noted previously, the sustained high discharge and lack of interstitial space in the stream bed does not favor retention of detritus (Shiozawa 1983) nor the development of a diverse invertebrate community (Cummins 1974). The armoring will continue to extend downstream as sediments available for transport gradually disappear from the upstream streambed.

The July 2011 samples were strongly influenced by the flooding that took place in the spring of that year. Invertebrate densities in the five established stations were significantly down from previous sampling periods as was the standing crop of invertebrates. These changes were not detected in the stations with the CTQa or with diversity indices. These two measures are standardized either for presence/absence or proportional abundance so that actual density differences are lost. However the BCI did note a change, although it appears that the change reflects the shift in CTQp because of changes in water chemistry, which in turn are likely a transient effect of the high runoff. The most well defined changes in the system were seen in individual taxon densities and in overall biomass estimates. The cluster analysis, based on dissimilarity of taxon densities, placed the July 2011 samples into a single group imbedded in one of two general clusters of stations sampled over the past decade. This indicates that the shifts in community structure over time at the six sites may follow a reasonably predictable pattern, especially once physical data are considered. These samples are still documenting the pre-mining subsidence conditions of the two streams, but as more data are compiled a fuller interpretation of background variation is becoming possible.

Winter Quarters & Woods Canyon Creek

2002/2003- These data are the first of a series of sampling periods where the baseline conditions of the stream systems are established . These data will ultimately give a cumulative picture of the dynamics of the system prior to subsidence . The confounding dynamics of the drought do need to be taken into account since it is possible that fall conditions along the stream riparian areas will differ significantly if more forage is available during normal water years. It is also possible that higher spring runoff during years with more normal snow packs could act to physically restructure the spring invertebrate community.

2003-2004- The physical profiles of the stream channels in Woods and Winter Quarters Canyon are what would be expected. The streams generally increase in discharge downstream, as reflected in channel depth, width, and velocity. During the spring the stream channels tend to be deeper, wider, and to have greater velocities than during the fall. In addition the downstream reaches generally had higher readings in alkalinity, hardness, and conductivity. Both streams had lower hardness and alkalinity in the spring, a typical response to spring runoff as increased flows dilute the ions in transport. Fall 2003 discharge in lower Winter Quarters Canyon was less than that recorded for the middle station, likely a result of the prevailing drought conditions. Alkalinity and conductivity were also lower than in the middle Winter Quarters Canyon reach. This suggests an increased interaction with ground water at this location in the fall of 2003.

The number of taxa collected increased with each sampling period, ending with an average of just over 41 taxa in the spring 2004 sample series. No clear relationships existed with the number of taxa between upstream and downstream reaches in either stream. Densities however showed a substantial increase after the fall 2002 sample series, likely a result of improved sorting procedures. Spring 2003 and spring 2004 density estimates for each reach tended to be more similar to each other. Chironomids, baetid mayflies, ostracods, and copepods were the most abundant taxa in Woods Canyon while in Winter Quarters Canyon the dominant taxa were chironomids, baetid mayflies, and, in the upper reach, ostracods. occurred in different reaches of the streams. The chironomids, ostracods, and copepods tended to be most abundant in the fall samples. *Baetis* increased in density in the spring samples, with the exception of Lower Winter Quarters Canyon where the fall 2003 densities were higher than the spring 2004 values.

The BCI and CTQa values indicated that all five reaches were in very good condition. The diversity index values tended to be higher in the upstream reaches of the streams but no distinct seasonal signal was apparent. Greater differences occurred between season than among stations for a given season. Cluster analysis clearly separates the fall 2002 samples from all other sampling dates. A tendency exists for the fall samples to cluster by stream, but the spring samples do not show any obvious patterns.

2007-2008- Canyon samples differed in the trends with their number of taxa. The Woods taxa counts in the fall were lower than the fall of 2003 while the spring Woods counts were higher than in the spring of 2004. Winter Quarters showed the opposite trend with the number of taxa increasing in the fall of 2001 relative to the fall of 2003 and decreasing in the spring of 2008 relative to the number of taxa in the spring of 2004. It is not clear why such different trends would be occurring between the two streams.

Total invertebrate densities in all five stations for both seasons showed an increase over the 2003-2004 samples. Yet the biomass in most stations decreased. This suggests a shift to smaller taxa, and is reflected in the high increase in the numbers of midges collected. While we did not quantify algae, we did notice a significant increase in algae, especially in the July 2008 sampling period, but also to a lesser extent in fall, 2007. These blooms were notable in the open areas where sunlight was readily reaching the stream bed. This could be one factor shifting the 2007 and 2008 samples into their own subclade in the cluster analysis.

The Biotic Condition Index and Community Tolerance Quotient did not detect any differences between stations. Diversity indices generally showed a decline in stream quality at the majority of stations and this decrease was likely a reflection of the increase in the number of midges in the samples since high numbers of a few taxa will increase the uneveness of the proportions used in the computation of the index.

Only the spring 2008 Upper Winter Quarters station had a large shift in hardness as compared to previous samples. Yet this site was similar to the other Winter Quarters stations in the decreased number of taxa and increased total density. It also had the same taxa dominating abundance as in the other spring 2008 Winter Quarters samples and both biomass and diversity were similar to the other Winter Quarters stations. Interestingly the only other measure that identified a significant difference in the Upper Winter Quarters was in the cluster analysis. Cluster analysis is based on comparisons of individual taxa across sites so the net effect of community differences in the less abundant taxa can have in influence. This suggests that the species composition in the Upper Winter Quarters spring 2008 samples more closely resembled that in the spring 2004 Lower Winter Quarters station. This station, while still having elevated numbers of midges, also is in a heavily shaded reach with conifers on both sides of the stream channel. The invertebrate community may not have been as strongly impacted by algal growth as other sections and thus remained more closely associated with the spring 2004 samples.

While these samples are still documenting the pre-mining subsidence conditions of the two streams, interesting variation is being detected. This could be associated with things such as stream-side grazing, increased surface runoff, and other environmental

factors. What is developing now is a picture of the background variation in the watersheds upon which the post subsidence communities can be appraised.

2011-Samples were strongly influenced by the flooding that took place in the spring of that year. Invertebrate densities in the five established stations were significantly down from previous sampling periods as was the standing crop of invertebrates. These changes were not detected in the stations with the CTQa or with diversity indices. These two measures are standardized either for presence/absence or proportional abundance so that actual density differences are lost. However the BCI did note a change, although it appears that the change reflects the shift in CTQp because of changes in water chemistry, which in turn are likely a transient effect of the high runoff. The most well defined changes in the system were seen in individual taxon densities and in overall biomass estimates. The cluster analysis, based on dissimilarity of taxon densities, placed the July 2011 samples into a single group imbedded in one of two general clusters of stations sampled over the past decade. This indicates that the shifts in community structure over time at the six sites (an additional site was added downstream when the mining was extended further east) may follow a reasonably predictable pattern, especially once physical data are considered. These samples are still documenting the pre-mining subsidence conditions of the two streams, but as more data are compiled a fuller interpretation of background variation is becoming possible.

2.8.1 Aquatic Monitoring Program

An aquatic monitoring program has been conducted to meet the intent of the requirements of R614-301-311. The main purpose of the monitoring program is to gain sufficient knowledge to prevent and/or minimize impacts through wise project planning. Monitoring has: (1) described existing resources; (2) detected existing perturbations; and (3) provided the basis for wise project planning, operation and resource restoration.

The biological (macroinvertebrate and fish) and habitat (sediment and channel surveys) monitoring stations on Eccles Creek are shown in Figure 2.8-A. Sampling dates are limited by weather, but June and late October samplings are usually possible. Two seasonal sampling dates per year are required to differentiate natural seasonal intrastand variance from impact induced changes. Samples were taken annually through the project planning and early development. The biological sampling has been performed in conjunction with normal stream water monitoring so that comparative analysis is possible.

Seven stations on Eccles Creek were selected in relation to impact areas, UDWR fish sampling stations, existing macroinvertebrate and sediment stations, and water quality monitoring stations. At each station on the scheduled sample date (Table 2.8-1), four macroinvertebrate samples were taken from selected optimal substrates with a modified Surber Sampler. Three sediment samples were taken from potential spawning grounds. Replicate samples were taken to enable an analysis of variance between samples.

Habitat surveys, following methodologies used by USBLM and USDFS fisheries habitat specialists, were made annually throughout construction at critical Eccles Creek stations (Table 2.8.1). Measurements included: stream bank stability, channel substrate composition; stream gradient; riparian vegetation (type, relative cover); water width, depth and velocity at various discharges (Q) and channel width and tortuosity.

Fish surveys are conducted by UDWR personnel out of the Price office. Fish surveys are usually made in August so year class I fish will be large enough to sample and young-of-year fish are large enough to observe. Fish are measured as to total length and weight, counted and then released. These data are compared with earlier UDWR collection records, thus illustrating present fish population conditions compared with years past.

Table 2.8-2 summarizes the stream monitoring data. A summary of the sediment composition data, taken in accordance with the schedule on Table 2.8-1, is shown on Table 2.8-3. The UDWR reports have been added to the Aquatic Wildlife section of Volume A-3.

Macroinvertebrate and fish monitoring was conducted by independent contractors from 2000 through 2013. Based on adequate information being collected, and discussed in detail later in this section for each creek, sampling of both studies was discontinued in 2015.

magnification. The mean, standard deviation, density per square meter, and standing crop will be calculated and estimated using the same methods as in previous analysis.

Calculations of the USFS Biotic Condition Index (Winget and Mangum 1979) will be completed using the abundances of the benthic taxa to generate the dominance weighted community tolerant quotient (CTQd). The predicted community tolerant quotient (CTQp) will be calculated using water chemistry data provided in Winget (1972) for the Huntington Creek drainage.

Cluster analysis will be run using the Bray-Curtis dissimilarity index with the UPGM clustering algorithm.

Winter Quarters Canyon and Woods Canyon Creeks

From Fall of 2002 through early Summer of 2004 fish and baseline macroinvertebrate data for the perennial reaches within Winter Quarters Canyon and Woods Canyon Creeks in the North Lease area were gathered. Copies of the reports are included in Appendix Volume A-3, Volume 2.

A macroinvertebrate survey of portions of Winter Quarters Canyon and Woods Canyon Creeks will be performed twice a year for two consecutive years and then every third year thereafter or for a period determined by Canyon Fuel Company, LLC, DOGM, USFS, and the DWR, to be long enough to provide data to establish population trends. This survey will be performed in the fall and spring of each year on or about the same date.

Based on sufficient data being collected, and the completion of longwall mining in Winter Quarters Canyon, macroinvertebrate surveys were terminated in both Winter Quarters and Woods Canyon creeks in concurrence with the various regulatory agencies in 2015. No impacts to the macroinvertebrate community based on mining were observed. Information supporting the ending of the surveys is available in Appendix A-3 (Skyline memo) and the individual macroivertebrate reports located in the Annual Reports.

In 2010 the Winter Quarters Ventilation Facility (WQVF) was added to the permit area approximately 2 mile downstream of the existing macroinvertebrate monitoring stations. Consultation with Dr. Shiozawa who directs the Skyline marcoinvertebrate monitoring program, indicated the portion of stream in the vicinity of the WQVF pad is not conducive to a macroinvertebrate study due to low gradient and inundation of fine sediment. He recommended a electro-fishing monitoring program which is outlined later in this section.

As mining progressed north of Winter Quarters Canyon, the longwall panel orientation was rotated 90 degrees to maximize coal recovery. The rotation expanded mining approximately ½ mile to the east. To accommodate the modification, an additional macroinvertebrate station and fish monitoring station were set up in Woods Canyon to insure monitoring stations are extablished downstream of mining activities to fully evaluate any impacts from mining. The additional electro-fishing monitoring station was added to Woods Canyon creek in 2010 although the stream is marginal fish habitat due to the shallow nature. Sampling frequency will continue every 3rd year unless future sampling confirms the habitat is unsuitable to sustain a viable fish population. See Appendix Volume A-3, Volume 2 for 2010 fish density report.

The following methods have been and will be used for macroinvertebrate sampling. Slight variations to the methods may occur during the field work or based on comments from regulatory agencies.

Three benthic sites will be sampled in each creek. Following the first survey a map with these stations will be prepared and submitted with the next sample report (included in the following year=s annual report). Quantitative samples will be taken with a modified box sampler. The samples taken will be field preserved in 70% ethyl alcohol and returned to the laboratory for processing. The samples will be sorted and invertebrates identified to the lowest possible taxonomic level using the keys of Merritt and Cummins (1996). Those of questionable identity will be further examined and identified under magnification. The mean, standard deviation, density per square meter, and

standing crop will be calculated and estimated.

Calculations of the USFS Biotic Condition Index (Winget and Mangum 1979) will be completed using the abundances of the benthic taxa to generate the dominance weighted community tolerant quotient (CTQd). The predicted community tolerant quotient (CTQp) will be calculated using water chemistry data provided in Winget (1972) for the Huntington Creek drainage.

Cluster analysis will be run using the Bray-Curtis dissimilarity index with the UPGM clustering algorithm.

An electro fishing study ~~-~~was conducted in 2002 to examine 1) the species present in Winter Quarters Canyon; 2) determine if fish were present in Woods Canyon; and 3) determine how far upstream fish extended into either canyon. The one-time survey was conducted on request by the U.S. Forest Service (See Appendix A-3, Volume 2 for report).

Based on the addition of the Winter Quarters Ventilation Facility, beginning in 2010 two (2) electro fishing sites were established Winter Quarters Creek. Two sampling runs (150 meters in length), one upstream and one downstream of the WQVF pad, will be tested on an tri-year basis to monitor the general aquatic health of Winter Quarters Creek. Sampling is minimized to every third year to reduce the stress on the fish population. The fish studies were terminated after the 2013 survey due to adequate baseline information being collected, and the minimal impact from the Winter Quarters site. ~~Emergency~~ Electro fishing surveys ~~sampling~~ could ~~be implemented on an as-needed basis~~resume should conditions change, such as adding mine water discharge to the creek. Information supporting the ending of the surveys is available in Appendix A-3 (Skyline memo) and the individual fish reports located in the Annual Reports..
~~The above described macroinvertebrate studies will continue for two years after active mining and subsidence stops in the applicable drainages unless statistical analysis demonstrates impacts have occurred or may occur to these streams.~~ In the event ~~subsidence~~ mining causes quantifiable damages to fish populations, stream flows, or other negative impacts on fish or wildlife habitat, the mine will identify, research and implement measures sufficient to correct the problems~~. If monitoring data suggests potential adverse impacts have occurred but cannot be conclusively demonstrated by the three years of collected~~

~~data, a new monitoring plan to determine the type and extent of the impact will be developed by DOGM, DWR, USFS and Skyline Mine. The additional monitoring will continue until such impacts are either demonstrated or dismissed by joint consent of DOGM, DWR, USFS, and Skyline Mine.~~ Areas where there is potential for habitat loss from subsidence are shown on Plate 4.17.3-1a. The consumption rate of water from mining activities is provided in Section 2.5.2.

Future aquatic monitoring is planned only on an as needed basis. Need will be established in conjunction with DOGM, USFS,, UDWR, and Skyline personnel and will be required only in case of a major perturbation in fish populations or other anomalous conditions. Monitoring data will be reviewed for mining related impacts, and, if found, a mitigation plan will be developed in conjunction with UDWR and UDOGM personnel. The Permittee will cooperate with UDWR in the investigation of any such conditions. This approach to future monitoring is consistent with the requirements recommended by the UDWR, Price office.

Eccles Creek

To determine the impacts to Eccles Creek , if any, related to discharge of mine water, semi-annual macroinvertebrate studies will be conducted. The studies will start in the spring of 2002 and will continue for three (3) consecutive years or for a period determined by Canyon Fuel Company, LLC, DOGM and the DWR, to be long enough to provide data to establish population trends.

The following methods have been used previously on this creek and will be used for future sampling. Slight variations to the methods may occur during the field work or based on comments from regulatory agencies.

Four samples will be taken at intervals separated by approximately 20 to 30 m. Samples will continue to be taken from three stations on the stream, with five replicates per station. These stations on Eccles Creek are located above South Fork (site 1), Eccles Creek at Whisky Canyon (site 2), and Lower Eccles Creek (site 3). A map with these stations has been added to the Aquatic Wildlife section of Volume A-3.

A box sampler will be used to collect the samples. Samples will be taken in areas with rubble or cobble substrates to insure that similar habitats are examined. When possible, samples will be taken from parts of the stream channel that had been submerged continuously throughout the year. The substrate will be stirred to a depth of approximately 5 cm. Rocks within the area of the sampler will be removed and washed to insure quantitative assessment of the invertebrates. The

box sampler will have a net mesh of approximately 250 microns. The samples will be concentrated on a screen with a mesh of approximately 64 microns and field preserved in ethyl alcohol.

In the laboratory the samples will be sorted in a pan illuminated from below. All invertebrates will be removed and identified to the lowest possible taxonomic level using the keys of Merritt and Cummins (1996). The mean density and standard deviation per sample will be calculated for each taxon and the mean values will be used to determine the density per square meter.

The collected data will be compared to the previous data collected in 1979 through 1983 and included in Appendix A-3, Volume 2. After comparing historical data with data obtained in the three year study starting in 2002, a determination will be made if the macroinvertebrate in Eccles Creek are impacted by the mine water discharge. If impacts are found, the significance of the impacts will be determined and appropriate mitigation is necessary will be performed.

Upon completion of the 2011 data collection, it was determined sufficient data had been collected to determine a habitat evolution had taken place due to an increase in mine water discharge beginning in 2002. Although changes have occurred, they have been predictable due to the consistent, good quality water being added to the system. The consistent nature of the stream has enabled population trends to be establish. Sampling will resume in the event significant changes to either water quality or quantity are observed. See Appendix A-3 for information summarizing the established trends (Skyline memo) and Annual Reports for the specific macroinvertebrate studies.

Fish studies ~~will be~~were conducted on Eccles Creek ~~in 2003~~every third year from 2001 through 2013 (five total studies).The fish study consists of multi-pass electro fishing to estimate fish populations in the stream for one year and then every third year

thereafter. The fish studies will be performed in the fall of each year. Results from sampling will be compared with all available historic studies done on this creek. The studies concluded that a healthy population of fish exist in the stream that sufficient data has been collected to establish population trends. Fish studies will resume again if significant changes to water quality, water quantity or other potential impact associated with mining occurs.

Aquatic Monitoring Summary

Aquatic monitoring data have been accumulated for a period of six years. Summaries of these data are presented in Tables 2.8.2 and 2.8.3. Backup data for these summaries, including the

consultants original report and subsequent summary reports, may be found in Appendix Volume A-3, Aquatic Wildlife.

During a 23 year time span macro-invertebrate data was collect on 24 site visits to Eccles Creek and compiled into a report entitled AA Compilation and Comparison of Eccles Creek Macro-Invertebrate Data for the Period of 1979 - 2002" prepared by Dennis Shiozawa, Ph.D., Professor of Fisheries Biology at Brigham Young University, Provo, Utah. The report documents that Eccles Creek has undergone changes in the benthic community structure through the years of study and demonstrates the resilience and adaptability of the creek to disturbance by multiple sources. Burnout, James, Eccles, Winter Quarters, and Woods canyon creeks have continued Aquatic monitoring reports that are submitted to the Division of Oil, Gas, and Mining in the required Annual Report when the information is compiled. These reports are available for review at the Division of Oil, Gas and Mining public library.

TABLE 2.8-1
STREAM RESOURCE MONITORING SCHEDULE FOR ECCLES CREEK

STATION	
Survey	June
	August

Table 2.8-1a

Fish

Sample Site	End Date	2000 Spring	2000 Fall	2001 Spring	2001 Fall	2002 Spring	2002 Fall	2003 Spring	2003 Fall	2004 Spring	2004 Fall	2005 Spring	2005 Fall	2006 Spring	2006 Fall	2007 Spring	2007 Fall	2008 Spring	2008 Fall	2009 Spring	2009 Fall	2010 Spring	2010 Fall	2011 Spring	2011 Fall
Burnout	F, 2007		C		C						C						C								
Eccles	ND				C						C						C						C		
James	F, 2007		C		C						C						C								
Winter							C																C		
Woods	RC						C																C		

		2012		2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023	
Eccles	ND				RC*																				
Winter					RC																				
Woods	RC				RC																				

Macroinvertebrate

		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010		2011	
Burnout			C	C	C	C	C	C	C	C							RC	RC							
Eccles	ND				C	C	C	C	C	C	C						C	C							RC	RC*
James			C	C	C	C	C	C	C	C							RC	RC							
Winter	2yr ptm						C	C	C	C							C	C							RC	RC
Woods	2yr ptm						C	C	C	C							C	C							RC	RC*

		2012		2013		2014		2015		2016		2017		2018		2019		2020		2021		2022		2023	
Eccles	ND																								
Winter	2yr ptm																								
Woods	2yr ptm																								

Key: C = completed, X = scheduled, ND = no end date, F = Fall, RC = requirements completed * (will re-initiate monitoring if conditions change significantly)

Reports located in the Annual Submitted to the Division of Oil, Gas, and Mining.

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