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TECHNICAL MEMORANDUM

Utah Coal Regulatory Program

December 21, 2011

TO: Internal File

THRU: Daron Haddock, Coal Program Manager

FROM: April A. Abate, Environmental Scientist III and Team Lead aaa 12-22-2011

RE: South Fork Quitchupah 2R2S, Canyon Fuel Company, SUFCO Mine, Permit # C/041/0002, Task #3950

SUMMARY:

On November 2, 2011, Canyon Fuel Company (CFC), the Permittee submitted an amendment to undermine the South Fork of Quitchupah Creek located within Sections 23, 24, 25 of T21S R4E and Section 30 of T21S R5E. Longwall mining is proposed under the creek in a panel known as the 2R2 South A LW Block, which was granted approval to mine under Bureau of Land Management (BLM) approval on June 8, 2011. This area is located within the SUFCO mine lease area that CFC operates and maintains responsibilities for.

Approval of the amendment is not recommended until the following deficiencies are satisfied:

[R645-301-525]: A similar protocol to that of the East Fork of Box canyon should also be adopted at the South Fork of Quitchupah Creek including filming the channel and the corresponding canyon rims. Documentation of the channel width, stream bed substrate, flow conditions, and subsidence cracks along a series of monitoring locations. Monitoring criteria should include fixed vantage points that can easily be reproducible for subsequent monitoring events, collected width and depth measurements of any pools in the stream and height and depth of any cracks. Additional tools should also be used to observe subsidence crack monitoring such as satellite imagery. In the case of East Fork of Box Canyon, a post-subsidence monitoring report was due 90 days after subsidence was complete. **Past experience has shown that access to the surface is limited to the summer months where access is available to monitor the stream bed surface and observe subsidence cracks. As a result, the mining of the panel will have to be timed such that access to the surface is possible so that the effects from subsidence can be evaluated.**

[R645-301.724.100]: There are no groundwater monitoring wells in the canyon where the South Fork of Quitchupah Creek flows. As a result, baseline data from the nearest perched aquifers (if any) closest to the surface is absent. A groundwater well in the vicinity of the stream channel is essential for characterizing baseline groundwater conditions. The additional well in the stream channel will also be instrumental in measuring any losses of perennial flow from the stream that could migrate from fractures in the surface to any groundwater system below. A rise in the groundwater water table will provide important data to help better mitigate effects from loss of surface flow. Furthermore, based on the orientation of the proposed 2R2 panel and the panel adjacent south, it appears that groundwater monitoring well US-81-4 will be destroyed eventually by longwall mining. Please advise the Division if there is a plan to eliminate this well via mining and provide a proposed location for a replacement well.

[R645-301-724.100]: Geologic resources, baseline and operational data should be included in the Probable Hydrologic Consequences (PHC) report prepared for the South Fork of Quitchupah Creek along with discharge and solute composition of the surface and groundwater properties of all hydrologic resources in the area. Currently, a lack of baseline data from springs, seeps, stock watering ponds and groundwater monitoring wells exists in the area. The locations of the water rights from springs, point to point diversions and stockwatering ponds identified on the adjudication map provided by the Division of Water Rights (DWRi) require field verification with other interested stakeholders such as the US Forest Service, DWRi, the Division and mine personnel. A consensus should be reached among all stakeholders which groundwater resources and ponds should be targeted for an active baseline water monitoring program. An interagency field reconnaissance will need to be scheduled in the summer of 2012 to identify critical groundwater and stockwater resources in the area.

[R645-301-728.100]: A PHC needs to be developed by the operator for the proposed longwall mining below the South Fork of Quitchupah Creek. Similar to the PHC for the 3 Left Modification Panel found in Appendix 7-19 of the SUFCO Mining and Reclamation Plan, full characterization of groundwater and surface water systems for the South Fork of Quitchupah Creek needs to be developed prior to the undermining of the South Fork of Quitchupah Creek via longwall mining. The PHC will outline the risks of significant disruption to the hydrologic balance to the hydrologic resources within the area of the South Fork of Quitchupah as well as any nearby springs, seeps and stockwatering ponds found in the area

[R645-301.731.224.1]: Quarterly laboratory analytical data will be collected on the stream samples SUFCO 006, as defined in the water monitoring protocol of the MRP on page 7-41. However, additional surface and/or groundwater samples should be collected for total iron if a visible iron precipitate is noted within the stream channel or originating from the springs and seeps.

[R645-301.731.530]: It is in the best interest of the mine operator, as well as the regulatory management agencies involved to have a well-defined water replacement contingency

plan in place prior to the onset of mining under the S. Fork of Quitchupah Creek. This mitigation plan can be incorporated into the PHC prepared for the S. Fork of Quitchupah Creek. Comment letters received from DWRi declared that all surface and groundwater within the drainage that supplies Quitchupah Creek is considered State-appropriated and will be required to satisfy downstream water rights. The USFS expressed concern over the statements made regarding if the mine is unsuccessful in restoring flow after two spring runoff periods and that Canyon Fuel Company will initiate "additional planning and analysis with the Forest Service". The USFS' position is that a solid mitigation plan should be hashed out prior to any water loss or riparian habitat loss.

TECHNICAL ANALYSIS:

ENVIRONMENTAL RESOURCE INFORMATION

Regulatory Reference: Pub. L 95-87 Sections 507(b), 508(a), and 516(b); 30 CFR 783., et. al.

PERMIT AREA

Regulatory Requirements: 30 CFR 783.12; R645-301-521.

Analysis:

The location of panel A of the 2R2 reserve coal block was given approval to mine by the BLM on June 8, 2011. The panel is located in Section 24 of T21S R4E on Federal lease UTU-63214. The 2R2 reserve coal block is outside any of the SUFCO permitted disturbance areas. However, the area is located within the hydrologic adjacent area boundary and falls under the jurisdiction of the Quitchupah/Muddy Creek Cumulative Hydrologic Impact Area document prepared by the Division (latest ver. November 2010). The purpose of the document is to prepare findings showing that any proposed coal mining and reclamation activities have been designed to prevent material damage to the hydrologic balance outside the permit area.

GEOLOGIC RESOURCE INFORMATION

Regulatory Reference: 30 CFR 784.22; R645-301-623, -301-724.

Analysis:

Subsidence cracks have been reported and characterized in the Quitchupah tract. According to Section 6.3.2 of the approved SUFCO MRP, cracks are typically surveyed and included in an annual Subsidence Report to the Division. Subsidence in the area of the Quitchupah tract, where the drainage is characterized by a deep canyon capped with Castlegate sandstone has been observed as cracks typically forming parallel to the drainage rim and may or may not be parallel to the axis o the panel. Occasionally, when the larger cracks remain open, SUFCO has repaired several cracks on the rim when it was determined to present a safety hazard. Where the bedrock is exposed at the surface, cracks were described as forming an "en echelon" pattern with a local joint pattern evident. This pattern tends to occur where the Castlegate Sandstone has subsided at or near the rim of the drainages or canyons. In these areas, large blocks of Castlegate Sandstone were reported to rotate toward the drainage during subsidence.

Overburden thickness above the coal seam varies considerably due to canyon and plateau landforms that characterize the lease area. Regional overburden ranges from approximately 600 to 1,800 feet and averages about 900 feet of thickness. According to the Overburden Isopach Map provided in the MRP as Plate 5-11, the Castlegate Sandstone forms the canyon rim area of the South Fork of Quitchupah creek above the 2R2 South A LW Block panel at a thickness of approximately 900 feet. The Price River Formation overlies the Castlegate and gradually thickness toward the western above the panel at a thickness of up to 1,200 feet. By comparison, the East Fork of Box Canyon where Pines 105 was damaged, the entire area was underlain by Castlegate Sandstone at an approximate thickness of 800-900 feet. By further comparison, Box Canyon located in the Pines Tract contains a perennial stream that was undermined in 2004 by approved longwall mining activity. Average overburden thickness of the Castlegate in the area of Box Canyon is reported to be approximately 900 feet.

The Quitchupah/Muddy Creek Cumulative Hydrologic Impact Area (CHIA) report document reports on page 37 that substantial fracturing has occurred because of subsidence reported at rates of between 5-6 feet. Because of the high risk of aquifer dewatering and spring and surface water diminution, it is critical that a comprehensive monitoring program and mitigation plan as the result of subsidence is put in place. Based on the geology of the region, subsidence cracks have been documented routinely in the Castlegate Sandstone. A lowering of the water table was demonstrated at PINES 105 spring located in the Pines Lease tract as a result of subsidence fracturing. In 2003/2004, SUFCO undermined the perennial stream in the East Fork of Box Canyon when the 3LPE panel was mined. At that time, pre-mining and post-mining subsidence surveys were performed involving video taping the stream channel. The identification of springs sources and which geologic formation they occur in was also planned. After mining panel 3L, mitigation measures to seal subsidence cracks in the East Fork of Box Canyon included bentonite grouting. An appropriate pre-mining subsidence survey protocol was employed before and after the undermining of Box Canyon. A similar protocol to that of the East Fork of Box canyon should also be adopted at the South Fork of Quitchupah Creek including filming the channel and the corresponding canyon rims. Documentation of the channel

width, stream bed substrate, flow conditions, and subsidence cracks along a series of monitoring locations. Monitoring criteria should include fixed vantage points that can easily be reproducible for subsequent monitoring events, collected width and depth measurements of any pools in the stream and height and depth of any cracks. Additional tools should also be used to observe subsidence crack monitoring such as satellite imagery. In the case of East Fork of Box Canyon, a post-subsidence monitoring report was due 90 days after subsidence was complete.

Findings:

[R645-301-525]: A similar protocol to that of the East Fork of Box canyon should also be adopted at the South Fork of Quitchupah Creek including filming the channel and the corresponding canyon rims. Documentation of the channel width, stream bed substrate, flow conditions, and subsidence cracks along a series of monitoring locations. Monitoring criteria should include fixed vantage points that can easily be reproducible for subsequent monitoring events, collected width and depth measurements of any pools in the stream and height and depth of any cracks. Additional tools should also be used to observe subsidence crack monitoring such as satellite imagery. In the case of East Fork of Box Canyon, a post-subsidence monitoring report was due 90 days after subsidence was complete. **Past experience has shown that access to the surface is limited to the summer months where access is available to monitor the stream bed surface and observe subsidence cracks. As a result, the mining of the panel will have to be timed such that access to the surface is possible so that the effects from subsidence can be evaluated.**

HYDROLOGIC RESOURCE INFORMATION

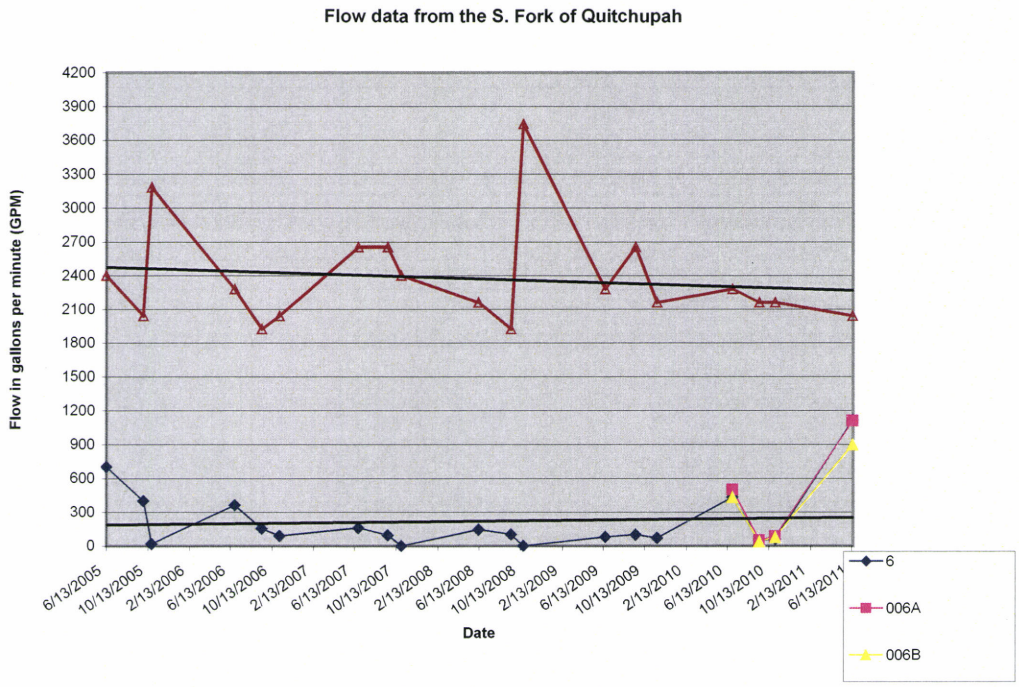
Regulatory Reference: 30 CFR Sec. 701.5, 784.14; R645-100-200, -301-724.

Analysis:

Baseline Information

Currently, there are three surface water sampling locations monitored on a quarterly-basis along the south fork of Quitchupah Creek. Surface water sample location SUFCO 006 has been a historical stream monitoring location since June 1983. Two additional water monitoring points SUFCO 006A and 006B were added to the plan in June 2010. A third surface water sampling location is proposed for addition to the plan SUFCO 006C as part of this submittal. This location is intended to represent the downstream conditions. A mine water discharge outfall (UT-0022918-003A) is located approximately 1.5 miles further downstream and discharges water at an average constant rate of 6.75 cubic feet per second (cfs). Maximum flow rates from the South Fork of Quitchupah Creek reported from data point SUFCO 006 have been reported as 2 cfs (Table 7, Quitchupah/Muddy Creek CHIA Nov 2010). By comparison, the groundwater

discharge from the outfall location discharges at rates 12 times greater than the discharges rates measured upstream at SUFCO 006 (see graph below). Locations of these surface water sample locations are shown on Plate 7-3 of the SUFCO MRP.



SUFCO has proposed to conduct a pre-subsidence survey of the stream channel over the portion that will overlie the 2R2 panel block A proposed for mining. The survey will consist of a gain/loss evaluation to be conducted on a single day in late summer or early fall. The plan calls for the study to be conducted in ***late summer/early fall 2011***. No gain/loss survey was submitted to the Division to date, so it is assumed that this date will need to be corrected based on the timing of any approval of this amendment. The survey will then reoccur two weeks prior to mining and then once every two weeks after subsidence begins. Flow observations are to be collected every other week for at least 12 weeks or as conditions allow once mining beneath the stream channel has occurred. SUFCO plans to perform quarterly monitoring for subsidence outside of the 15 degree angle of draw.

There are no spring sites that are actively monitored by SUFCO in the vicinity of the 2R2 panel (Sections 23, 24, 25, and 26 of T21S R4E). Water Rights have been identified on numerous springs and stockwatering ponds within this area (see map provided by the Division of Water Rights attached to this memo). These water rights are listed in Appendix 7-1 of the SUFCO MRP as being registered to the US Forest Service and all ultimately drain to the Muddy Creek Drainage. A total of 5 springs have been identified in Section 23, two springs in the northeast corner of Section 26 and one spring in the northeast corner of Section 24. None of these springs were discussed in the amendment submitted by SUFCO addressing any proposal to monitor these springs for baseline data requirements. These springs would be located outside of

the 15 degree angle of draw for longwall mining in some instances; however, it has been reported that evidence of fracturing has been documented approximately 200 feet outside the 15 degree angle of draw (CHIA Nov. 2010, page 35). These springs may represent an important component to base flow in Quitchupah Creek and will be very important to target for a baseline monitoring program.

Similar to the springs, two stockwatering ponds were identified in Sections 24 and 25 of T21S R4E and Section 30 of T22S R5S. It is unknown whether these stockwatering ponds are fed by springs or if they are just capturing surface water runoff. These ponds will also be required to be actively monitored as part of a baseline water monitoring program prior to mining.

One groundwater monitoring well is located in the vicinity of the 2R2 Panel proposed for mining. Groundwater monitoring well US-81-4 is located in the northwest corner of Section 25 and screened within the Hiawatha coal seam of the Blackhawk formation. A second well US-81-1 was also drilled within the vicinity of US-81-4; however data has never been produced from it. Baseline groundwater data are available from US-81-4 since 1996. The well produces consistent data averaging a depth to water level in the Hiawatha coal seam of 945 feet.

Baseline Cumulative Impact Area Information

Twenty-eight years worth of data are available from SUFCO 006. According to the CHIA document, measurements of low-flow discharge rates of a stream can be estimated within a standard deviation of approximately 20%. Given that a 28 year body of data exists for this reach of the stream, that standard can be reduced to 15%. Data recorded from SUFCO 0006 could be used to evaluate any drop in low-flow rates using that standard below 15% to assess whether or not surface flow of the stream was affected by mining-induced subsidence.

Baseline data from springs, seeps and stockwatering ponds in the vicinity of the South Fork of Quitchupah Creek is absent. Several springs, seeps and stockwatering ponds do exist in the area based on the adjudication maps provided by the Division of Water Rights (DWRi).

Baseline data from groundwater monitoring wells in the stream channel is absent. The closest monitoring well US-81-4 is located 2,000 feet to the south of the stream channel on the canyon plateau. US-81-4 is screened in the coal seam. Currently no characterization of any aquifers below the stream bed has been investigated in this area. An additional monitoring well in the vicinity of the stream channel would be essential in characterizing any aquifer below the stream bed surface and if any water loss from the perennial stream is affecting the aquifer.

Probable Hydrologic Consequences Determination

A Probable Hydrologic Consequences (PHC) was not submitted as part of this amendment. The MRP contains a PHC for the overall lease area beginning with Appendix 7-17 prepared by Mayo and Associates in 1997. Additional lease tract-specific PHC's can be found in subsequent appendices within the SUFCO MRP. For example, a PHC was developed for longwall mining in the 3 Left Panel Modification Area (Appendix 7-19) for the undermining of Box Canyon, but a PHC developed for the Quitchupah tract was not listed in the MRP.

The PHC for the 3 Left Modification Panel area outlined the risks of significant disruption to the hydrologic balance of Box Canyon. Baseline and operational data were presented in the report along with discharge and solute composition of the surface and groundwater properties in the vicinity of Box Canyon. A discussion of the geologic surface of the stream bed in the affected area was presented. A PHC complete with a full characterization of groundwater and surface water systems for the South Fork of Quitchupah Creek needs to be developed prior to the undermining of the South Fork of Quitchupah Creek via longwall mining.

Groundwater Monitoring Plan

The amendment submitted by SUFCO addressed the monitoring of the South Fork of Quitchupah Creek only presented as an update to pages 7-51G through I and JA in the MRP. No discussion of groundwater monitoring wells, springs, or seeps or any type of monitoring plan was submitted.

Surface-Water Monitoring Plan

The plan submitted by SUFCO as part of this amendment proposes a more intensive monitoring and mitigation plan to monitor flows, subsidence cracks and repair of the cracks. The plan calls for frequent inspection of the stream channel as longwall mining progresses and the addition of a new surface water monitoring point along Quitchupah Creek SUFCO 006C. However, past experience has shown that access to the surface is limited to the summer months where access is available to monitor the stream bed surface and observe subsidence cracks. As a result, the mining of the panel will have to be timed such that the effects from subsidence can be observable and that access to the surface is possible.

State-Appropriate Water Supply

On December 8, 2011, the Division received a response to a request for comments pertaining to this amendment from the Utah Division of Water Rights. The letter indicated that DWRi completed a review of the water rights near the proposed mine workings and provided a map of the water rights identified. The letter indicated that Quitchupah Creek and its associated drainage basin upstream from the major irrigation water uses are considered a fully appropriated water body. Point to point stock watering rights have also been identified in the subject area along the reach of stream identified on the map provided by DWRi. This means that water rights

established on the stream generally exceed in flow and volume the available water supply during most of the irrigation season. All surface and groundwater within the drainage that supplies Quitchupah Creek is considered State-appropriated and will be required to satisfy downstream water rights.

On December 6, 2011, in a response to a request from the Division to comment on the proposed amendment to undermine the South Fork of Quitchupah Creek, the Forest Service (USFS) submitted a comment letter expressing concern over the statements made regarding if the mine is unsuccessful in restoring flow after two spring runoff periods and that Canyon Fuel Company will initiate "additional planning and analysis with the Forest Service". The USFS' position is that a solid mitigation plan should be hashed out prior to any water loss or riparian habitat loss. For example, the mitigation plan for North Water Spring in the Pines tract took approximately 6 years to resolve.

As expressed in the USFS letter, if any mitigation measures that prove unsuccessful in restoring flows to springs, seeps, or the stream, than a mitigation plan needs to be outlined in the PHC that will be prepared for the area. The plan will outline how the mine intends to provide an alternative water source to replace State-appropriated water needed to satisfy downstream users.

Water-Quality Standards and Effluent Limitations

The monitoring plan proposed by SUFCO included flow only measurements of the stream two weeks before and every two weeks after subsidence begins. During the undermining of Box Canyon in 2004, some water quality concerns arose from the surface water and rock interactions in areas of subsidence cracks where newly exposed fresh rock was making contact with the water and causing some elevated concentrations of iron.

Stream Buffer Zones

The exception to the stream buffer zone rule will be applied in this case. The rule does not allow any land disturbance within 100 feet of a perennial stream to be disturbed by coal mining activities unless the Division specifically authorizes mining and reclamation through a stream. The Division has issued a prior approval to undermine the East Fork of Box Canyon on September 30, 2003 allowing for undermining on the condition that the monitoring and mitigation plan submitted by the mine was adhered to. Any mitigation such as the sealing of any subsidence-related cracks will require a Stream Alteration permit issued by the Army Corps of Engineers. SUFCO has committed to applying for this permit in the amendment submitted.

Findings:

[R645-301.724.100]: There are no groundwater monitoring wells in the canyon where the South Fork of Quitchupah Creek flows. As a result, baseline data from the nearest perched aquifers (if any) closest to the surface is absent. A groundwater well in the vicinity of the stream channel is essential for characterizing baseline groundwater conditions. The additional well in the stream channel will also be instrumental in measuring any losses of perennial flow from the stream that could migrate from fractures in the surface to any groundwater system below. A rise in the groundwater water table will provide important data to help better mitigate effects from loss of surface flow. Furthermore, based on the orientation of the proposed 2R2 panel and the panel adjacent south, it appears that groundwater monitoring well US-81-4 will be destroyed eventually by longwall mining. Please advise the Division if there is a plan to eliminate this well via mining and provide a proposed location for a replacement well.

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[R645-301.731.530]: It is in the best interest of the mine operator, as well as the regulatory management agencies involved to have a well-defined water replacement contingency plan in place prior to the onset of mining under the S. Fork of Quitchupah Creek. This

mitigation plan can be incorporated into the PHC prepared for the S. Fork of Quitchupah Creek. Comment letters received from DWRi declared that all surface and groundwater within the drainage that supplies Quitchupah Creek is considered State-appropriated and will be required to satisfy downstream water rights. A comment letter response from the USFS expressed concern over the statements made regarding if the mine is unsuccessful in restoring flow after two spring runoff periods and that Canyon Fuel Company will initiate "additional planning and analysis with the Forest Service". The USFS' position is that a solid mitigation plan should be hashed out prior to any water loss or riparian habitat loss.

RECOMMENDATIONS:

Approval of the amendment is not recommended until the above deficiencies are satisfied.

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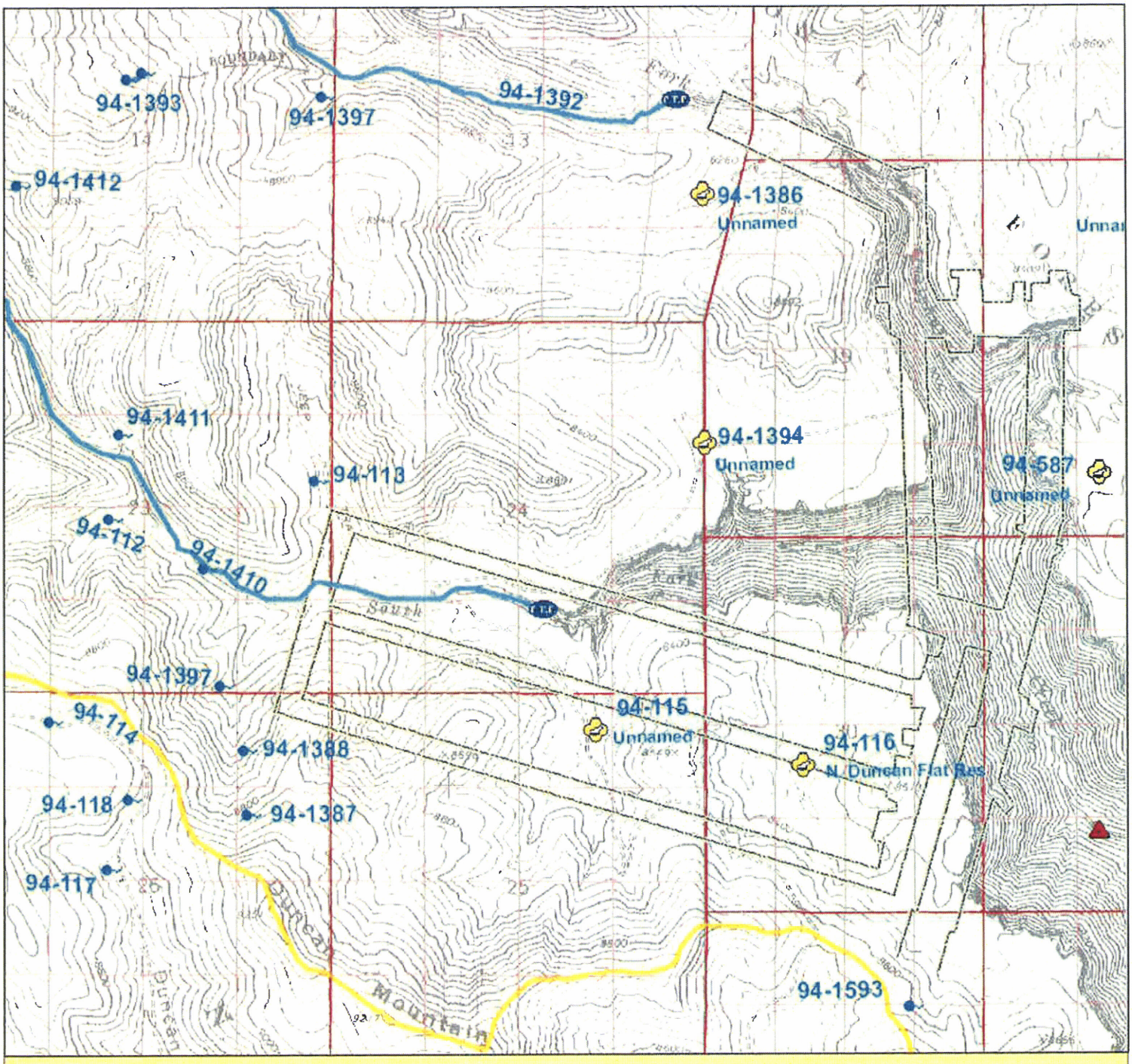

State of Utah Appropriated Water Rights

- Spring
- Underground Water Well
- Seep, Stream, Creek
- Lake, Pond, Res.
- Stock Point to Point
- Sufco_mine_working
- Water Shed Boundaries (AGRC)
- Section Line
- 40 Acre Parcel (Approx)
- Downstream Surface Rights- 94-1183, 1184, 1178, 1190, 1179, 1191, 1883, 1887, 1888, 1895, 1896, 189

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