

MINING PLAN DECISION DOCUMENT

Bowie Resources, LLC

Bowie No. 2 Mine

Federal Leases COC75916

Delta County, CO



**U.S. Department of the Interior
Office of Surface Mining Reclamation and Enforcement**

Approved March 2015

**Mining Plan Modification Approval
Bowie No. 2 Mine
Federal Coal Lease COC75916
Fact Sheet**

1. This mining plan modification will result in approximately 1,789 acres of Federal Coal Lease COC75916 being added to the mining plan approval area of Bowie Resources LLC's (BRL) Bowie No. 2 Mine, an underground mine near Paonia in Delta County, Colorado.
2. Approval of this mining plan modification will authorize mining of approximately eight million tons of recoverable Federal coal from the federal lease.
3. Approval of this mining plan modification will incorporate approximately 1,431 acres of federal surface land (BLM & USFS managed lands) into the mining plan approval area.
4. The average annual production rate of four million tons and the maximum production rate of six million tons will temporarily change to an average of 3 million tons per year with a maximum of six million tons per year..
5. The permit area for Colorado Permit No. C-1996-083 will increase by approximately 1,790 acres, from approximately 9,197 acres to approximately 10,987 acres.
6. Surface disturbance within the State permit area (403) acres will not increase.
7. The underground mining operations use longwall mining methods.
8. The number of people employed at the mine is 209.
9. The current land uses of rangeland, wildlife habitat, and industrial will not change within the permit and mining plan area.
10. Colorado Division of Reclamation, Mining and Safety determined that a reclamation performance bond of \$11,327,771 made payable to both the State of Colorado and the United States is adequate for the State Permit and this mining plan modification.
11. The life of the mining operations was expected to be extended by three years under Colorado Permit No. C-1996-083 and this mining plan modification. However, due to a recent reduction of workforce the life of mine may extend out to 9 and a half years if market conditions do not recover.
12. Bowie Resources requests approval by March 16, 2015
13. Currently lease COC75916 is facing two separate appeals. The first is IBLA-2014-120 from the Terror Ditch and Reservoir Company alleging that the lease will harm its water rights on Terror Creek through subsidence and that BLM failed to consider comments submitted by the Terror Ditch and Reservoir Company. The second appeal is IBLA 2014-155 from WildEarth Guardians alleging that BLM failed to take a hard look under the National Environmental Policy Act.

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Memoranda



United States Department of the Interior

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Washington, D.C. 20240

JAN 30 2015



Memorandum

To: Janice M. Schneider
Assistant Secretary - Land and Minerals Management

From: *Joseph G. Pizarchik*
Joseph G. Pizarchik
Director

Subject: Recommendation for Approval of the Proposed Mining Plan Modification for Federal Lease COC75916 at Bowie Resources, LLC's Bowie No. 2 Mine located in Delta County, Colorado

I recommend approval, without special conditions, of the mining plan modification for Federal Lease COC75916 at Bowie Resources, LLC's Bowie No. 2 Mine under the Mineral Leasing Act of 1920, as amended. This mining plan approval supplements all previous mining plan approvals for the Bowie No. 2 Mine.

My recommendation to approve the mining plan modification for the Bowie No. 2 Mine is based on:

- (1) Bowie Resources, LLC's complete permit application package;
- (2) Compliance with the National Environmental Policy Act of 1969;
- (3) Documentation assuring compliance with applicable requirements of other federal laws, regulations, and executive orders;
- (4) Comments and recommendations or concurrence of other federal agencies, and the public;
- (5) The findings and recommendations of the Bureau of Land Management regarding the Resource Recovery and Protection Plan, the federal lease requirements, and the Mineral Leasing Act; and,
- (6) The findings and recommendations of the Colorado Division of Reclamation, Mining and Safety regarding the permit application and the Colorado State program.

The Secretary may approve a mining plan for federal leases under 30 U.S.C. 207(c) and 1273(c). In accordance with 30 CFR Chapter VII, Subchapter D, I find that the proposed mining plan modification is in compliance with all applicable laws and regulations. The decision document for the proposed mining plan action is attached.

Attachment



United States Department of the Interior

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050

DEC 3 0 6 330



Memorandum

To: Joseph G. Pizarchick
Director, Office of Surface Mining

Through: Sterling Rideout
Assistant Director, Program Support

From: Ervin Barchenger
Acting Regional Director, Western Region

Subject: Recommendation for Approval, Without Special Conditions, of the Mining Plan Modification for Federal Coal Lease COC75916 at Bowie Resources, LLC's Bowie No. 2 Mine located in Delta County, CO

I. Recommendation

I recommend approval, without special conditions, of a mining plan modification for Federal Coal Lease COC75916 at the Bowie No. 2 Mine. This is a mining plan modification for an underground coal mine being permitted under the Federal Lands program, the approved Colorado State program, and the cooperative agreement. This mining plan approval supplements all previous mining plan approvals for the Bowie No. 2 Mine.

My recommendation to approve this mining plan modification is based on:

- (1) Bowie Resources, LLC's (BRL) complete permit application package (PAP) including the Resource Recovery and Protection Plan (R2P2);
- (2) Compliance with the National Environmental Policy Act of 1969;
- (3) Documentation assuring compliance with applicable requirements of other federal laws, regulations, and executive orders;
- (4) Comments and recommendations or concurrence of other federal agencies, and the public;
- (5) The findings and recommendations of the Bureau of Land Management (BLM) regarding the R2P2, the federal lease requirements, and the Mineral Leasing Act; and,

(6) The findings and recommendations of the Colorado Division of Reclamation, Mining and Safety (CDRMS) regarding the permit application and the Colorado State program.

If you concur with this recommendation, please sign the attached memorandum to the Assistant Secretary, Land and Minerals Management.

II. Background

The Bowie No. 2 Mine is an underground coal mine located five miles northeast of the town of Paonia in Delta County, Colorado. The mine has been in operation since 1997. BRL completed mining of the D-Seam in March 2005, and has since transitioned to the B-Seam portals and workings. The life of the currently approved mining operations within the approved permit area is estimated to be approximately four years at the average production rate of four million tons per year. A maximum production rate of six million tons per year was approved with permit revision six. The mining operations use longwall mining methods. The mine currently employs 352 people.

The mining plan for Federal Lease COC61209 at the Bowie No. 2 Mine was initially approved on October 18, 2000. Since that approval mining plan modifications have been approved on May 11, 2001, November 16, 2001, and December 18, 2013.

Originally the Bowie No. 2 Mine had one lease (COC61209). However, due to difficult mining conditions, portions of coal leases C37210, C27432 and D036955 belonging to Bowie No. 1 Mine, were transferred to the Bowie No. 2 Mine. The lease transfers occurred through permit revision 12 approved by CDRMS on November 16, 2010. The Office of Surface Mining Reclamation and Enforcement (OSMRE) determined that a mining plan modification was not required for the incorporation of the portions of Federal coal leases C37210, C27432 and D036955 into the Bowie No. 2 permit, because the leases were evaluated in the Cyprus Orchard Valley Coal Company's Orchard Valley Mine's October 29, 1993, mining plan modification. Since these leases had been previously evaluated in a mining plan approval, they did not require Secretarial approval as they did not meet the criteria of 30 CFR 746.18(d) for a mining plan modification. It should be noted that on January 25, 1995, CDRMS approved, with conditions, the Succession of Operator and Transfer of Permit No. C-81-038 from the Cyprus Orchard Valley Coal Company to BRL. The mine, formerly known as the Orchard Valley Mine, was renamed the Bowie No. 1 Mine.

The state of Colorado's current permit area for the Bowie No. 2 Mine (C-1996-083) covers approximately 9,197 surface acres, of which approximately 3,832 surface acres are federally owned.

Approximately 403 surface acres are disturbed within C-1996-083.

A total of 7,240 acres of federal coal are permitted within C-1996-083.

A total of approximately 17 million tons of federal coal remains within the current logical mining unit at a mining rate of four million tons a year.

The post-mining land uses within the currently approved permit and mining plan area are rangeland, wildlife habitat, and industrial.

III. The Proposed Action

This mining plan action consists of approval of a mining plan modification for the inclusion of Federal Coal Lease COC75916 to the Bowie No. 2 Mine. Specifically, the mining plan action proposed by BRL would expand coal development and mining operations at the Bowie No. 2 Mine into the following federal coal lands:

Legal Description of COC75916

Township 12 South, Range 91 West, 6th P. M
Section 31: Lots 11 through 26 inclusive
Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.
Section 36: S2

Township 13 South, Range 92 West, 6th P.M.
Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.
Section 5: lots 2, 3, 4, 10, & 11, W/2W/2NENE, NWNE, NESWNE, SESWNE, N/2NWSWNE, N/2NW, N/2N/2SENE, E/2NW/SE, W/2W/2NESE, N/2NENESE, NENWNESE;
Section 6: Lots 1 through 4 inclusive

The addition of lease COC75916 would add approximately eight million tons of recoverable Federal coal within the approximately 1,789 coal acres described in the legal description above, and allow an additional four million tons of Federal coal to be mined from the adjacent existing logical mining units. The total available recoverable coal reserves (including the 17 million tons of federal coal currently remaining in the permit) is approximately 29 million tons, thus increasing the life of mine from four to seven years at the average yearly mining rate of four million tons.

Recently BRL had to reduce its workforce by 150 employees due to declining market conditions. This change in employees will have the following short term effects. The average production rate is temporarily expected to decrease from four million tons per year to three million tons per year. At the production rate of three million tons per year, the life of mine would increase from seven years to nine and a half years. However, BRL is

anticipating that market conditions will improve and that the production rate will go back to 4 million tons per year.

BRL will extend the Bowie No. 2 Mine B-Seam workings beyond the current mine plan. Mains would be developed north from existing west mains and from the north mains gateroads would be developed to facilitate longwall blocks to the east and to the west. Longwall blocks would overlap both COC75916 and existing leases COC37210 & COC61209. Development of the north mains began in mid-2013 and is expected to cross onto COC75916 by late 2015.

The approximate average annual production rate of four million tons and the maximum production rate of six million tons will temporarily change to an average of 3 million tons per year with a maximum of six million tons per year.

The number of people employed at the mine decreased to 209 on October 30, 2014. The decrease is anticipated to be temporary and will return to approximately 350 employees in the future.

The State permit area increased by 1,790 surface acres from its present 9,197 surface acres to a new total of 10,987 surface acres. Federal surface acres added by this action are approximately 1,431.

Approximately 1,789 Federal coal acres will be added to the current 7,240 Federal coal acres currently permitted within C-1996-083 for a total of 9,029 Federal coal acres.

There will be no additional surface disturbance within the approved CDRMS permit area, keeping the surface disturbance at 403 acres for the entire permit.

CDRMS currently has three active stipulations on the permit as described in the *Proposed Decision and Findings of Compliance for the Bowie No. 2 Mine Permit No. C-1996-083 Permit Revision No. 14*, which is located in the State Findings and Decision section of this mining plan decision document.

The post-mining land uses of rangeland, wildlife habitat, and industrial within the permit and mining plan area would not change.

BRL's proposal does not require any additional special conditions to comply with federal laws.

IV. Review Process

CDRMS reviewed the permit application under the Colorado State program, the Federal Lands program (30 CFR Chapter VII, Subchapter D), and the Colorado cooperative agreement (30 CFR 906.30). Pursuant to the Colorado State program and the cooperative agreement, CDRMS approved the permit C-1996-083, permit revision No. 14 on November 15, 2014.

OSMRE has consulted with other federal agencies for compliance with the requirements of applicable federal laws. Their comments and concurrences can be found in the Documentation of Consultation, Concurrence, and Compliance section of this mining plan decision document.

The BLM reviewed the R2P2 for compliance with the Mineral Leasing Act of 1920, as amended, the federal regulations at 43 CFR Part 3480, and the federal leases. The BLM found that maximum economic recovery of the federal coal will be achieved and recommended approval of the mining plan modification in a memorandum dated October 3, 2014.

In a biological assessment dated November 30, 2011, the BLM initiated a section 7 consultation on threatened and endangered species with the United States Fish and Wildlife Service (USFWS) regarding BLM's leasing action. In a biological opinion to BLM dated February 23, 2012, the USFWS identified reporting requirements and any species-specific protective measures necessary for the leasing action. These requirements and protective measures have been incorporated into the PAP. OSMRE reviewed all section 7 consultation documents related to Federal Coal Lease COC75916 for this mining plan modification. OSMRE analyzed BLM's November 2011 biological assessment and found that the determination of effects for threatened and endangered species met OSMRE's section 7 consultation requirements. On October 9, 2014, OSMRE sent an email to USFWS requesting concurrence to ensure that the February 23, 2012, biological opinion is still applicable and can be used for this mining plan modification. In an email dated October 14, 2014, USFWS confirmed that the February 23, 2012, biological opinion is adequate to use for this mining plan modification.

OSMRE has reviewed and concurs with the assessment and recommendations for protection of cultural resources, as stated in the State Historic Preservation Officer's concurrence letters dated April 22, 2013, and March 08, 2013. Colorado's permit for Bowie No. 2 includes a condition pertaining to unanticipated discovery of cultural resources, as does the BLM Lease and the mining plan modification approval.

In a letter dated October 21, 2014, the U.S. Forest Service concurred with the proposed mining plan modification with respect to Federal surface lands within the proposed mining plan area provided that a set of conditions attached to the letter are carried forward in the mining plan modification. The set of conditions provided by the Forest Service are identical to those attached to the BLM lease, which is incorporated into this mining plan modification. This addresses the Forest Service condition for concurrence on the mining plan modification.

The area of this mining plan modification approval has not been designated unsuitable for mining according to section 522(b) of SMCRA.

The mining plan modification is located on approximately 1,333 surface acres of Federal lands within the boundaries of the Grand Mesa, Uncompahgre, and Gunnison National Forests. However, based on OSMRE's analysis and on the concurrence of the USDA Forest

Service, the surface operations and impacts of the Bowie No. 2 Mine are incident to an underground coal mine and will not be incompatible with significant recreational, timber, economic, or other values of the Grand Mesa, Uncompahgre, and Gunnison National Forests

OSMRE has determined that approval of this mining plan modification will not have a significant impact on the quality of the human environment. The environmental analysis prepared by BLM and OSMRE, titled *United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application*, and other environmental documents noted in the Finding of No Significant Impact (FONSI), describe the impacts that may result from approval of this mining plan modification and its alternatives. The FONSI and supporting environmental analyses are included within this mining plan modification decision document.

OSMRE did not identify any issues that required resolution via addition of special conditions to the mining plan approval during its review of the proposed action.

Publication of four consecutive weekly notices in the Delta County Independent newspaper notified the public of the availability of the administratively complete PAP for review. The last publication date was April 16, 2014. Four public comments on the PAP were received from the Terror Ditch and Reservoir Company, U.S. Army Corps of Engineers, Colorado Division of Water Resources, and History Colorado, after the public notices were published. Page 13 of the state of Colorado's *Proposed Decision and Findings of Compliance for the Bowie No. 2 Mine Permit No. C-1996-083 Permit Revision No. 14* summarizes the comments and CDRMS's responses. *Proposed Decision and Findings of Compliance for the Bowie No. 2 Mine Permit No. C-1996-083 Permit Revision No. 14* is located behind the State Permit Findings tab of this mining plan decision document.

There are two pending IBLA appeals of BLM's leasing decision. The first is Terror Ditch and Reservoir Company, IBLA-2014-120. The ditch company appealed the decision alleging that the lease will harm its water rights on Terror Creek through subsidence and that BLM failed to consider comments submitted by the ditch company. The second appeal is WildEarth Guardians, IBLA 2014-155. In this appeal, WildEarth alleges that BLM failed to take a hard look under the National Environmental Policy Act. The main challenges include that the EA failed to adequately analyze the release of nitrogen oxides, methane and volatile organic compounds during mining and that the EA did not analyze the direct, indirect, and cumulative effects of the potential export of the coal that will be mined from the lease. Both appeals are fully briefed and awaiting an IBLA decision.

CDRMS determined that a bond for \$11,327,771 is adequate for Permit No.C-1996-083 associated with this mining plan modification. The bond is payable to both the state of Colorado and the United States.

This mining plan decision document contains- a chronology of events related to the processing of the PAP and this mining plan decision. The information in the PAP, and other information identified in the mining plan decision document, have been reviewed by

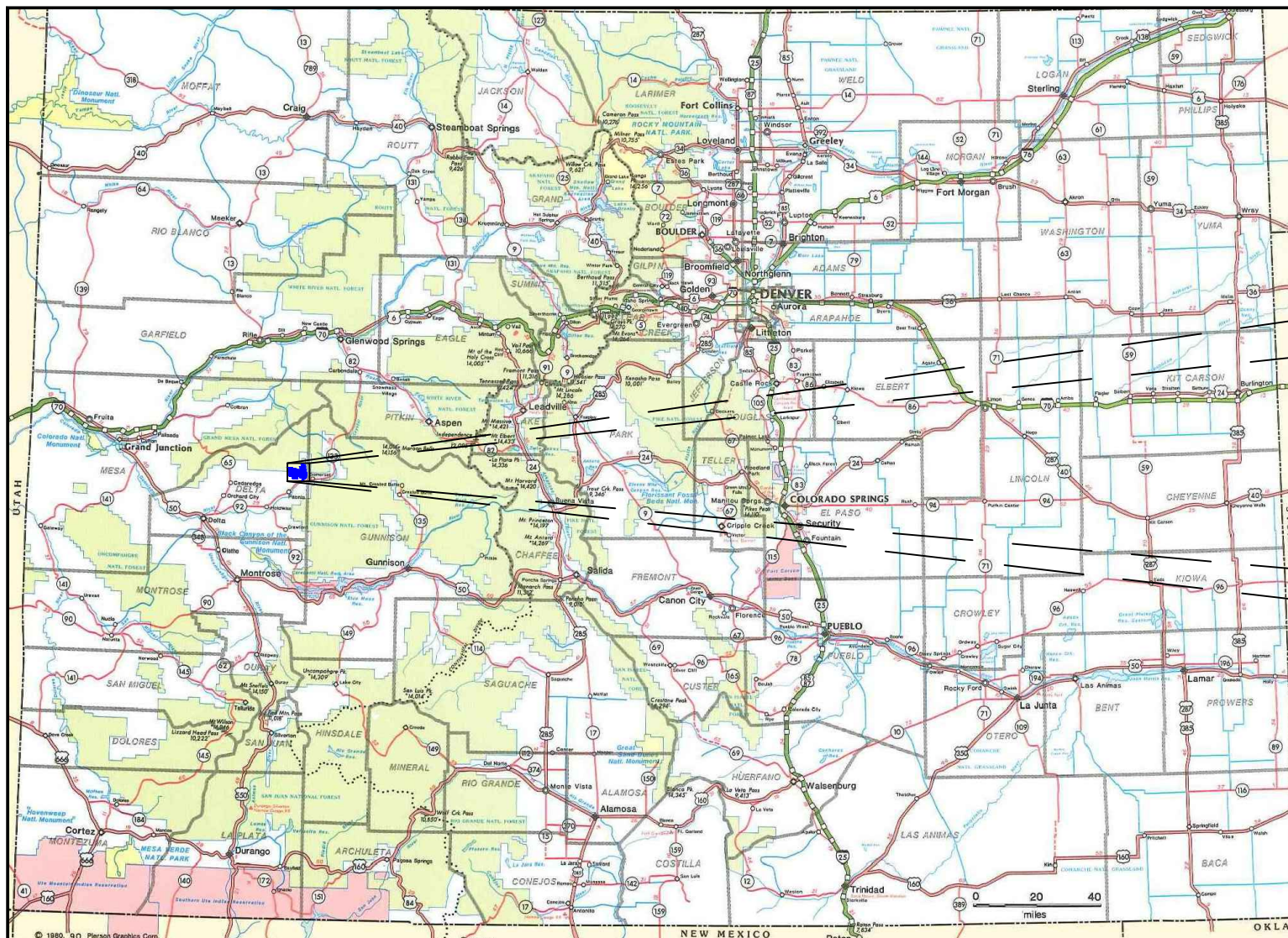
CDRMS staff in coordination with the OSMRE Federal Lands State Coordinator for Colorado.

The content of OSMRE's administrative record consists of the following:

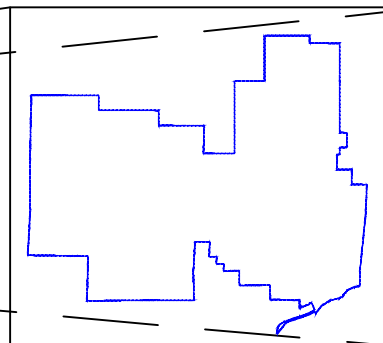
- the complete PAP submitted by BRL;
- CDRMS's *Proposed Decision and Findings of Compliance for the Bowie No. 2 Mine Permit No. C-1996-083, Permit Revision No. 14* provided to OSMRE under the cooperative agreement;
- the Environmental Compliance Document titled *United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application*
- the U.S. Department of the Interior Office of Surface Mining Reclamation and Enforcement statement of National Environmental Policy Act adoption and compliance for the proposed action and alternatives prepared by OSMRE;
- other documents prepared by CDRMS for permit revision No. 14 to the PAP; and,
- correspondence developed during the review and processing of permit revision No. 14 to the PAP.

Attachment

Location Maps



*Bowie No. 2 Mine
Permit Boundary
Through PR-14*



BOWIE RESOURCES, LLC
BOWIE NO. 2 MINE
P.O. BOX 483
PAGLIA, COLORADO 81428



BOWIE NO. 2 MINE

TITLE:
LOCATION MAP

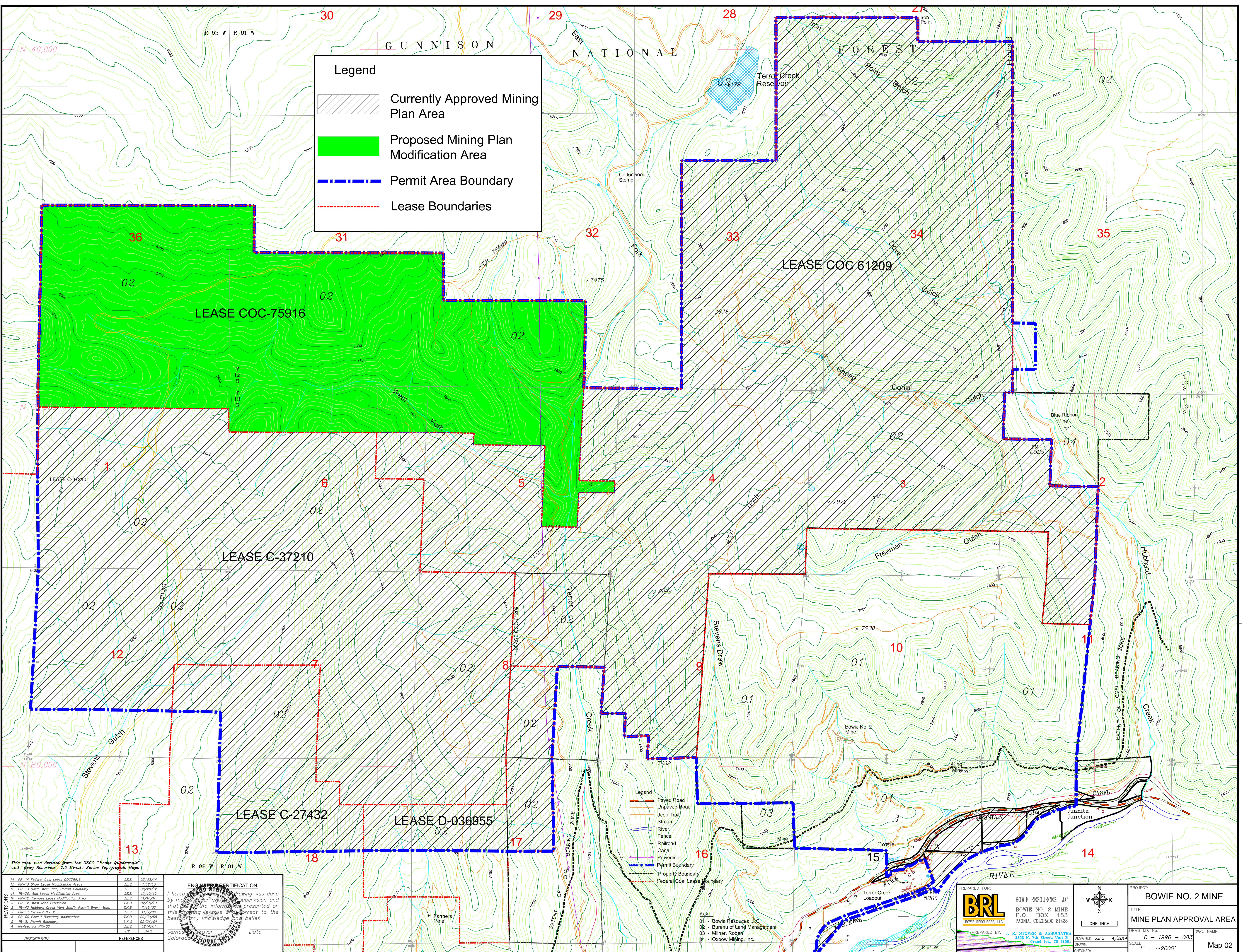
DRMS I.D. No.
C - 1996 - 083

DWG. NAME:
Figure

PREPARED BY: **J. E. STOVER & ASSOCIATES**
2004 N. 7th Street, Unit 9
Grand Jct., CO 81501

DESIGNED: **J.E.S.** 04/2014
DRAWN:

SCALE:
NONE



Legend

- Currently Approved Mining Plan Area
- Proposed Mining Plan Modification Area
- Permit Area Boundary
- Lease Boundaries

Legend

- Paved Road
- Unpaved Road
- Jesp Trail
- Stream
- River
- Fence
- Railroad
- Canal
- Powerline
- Permit Boundary
- Property Boundary
- Federal Coal Lease Boundary

BOWTIE NO. 2 MINE

BRL BOWIE RESOURCES, LLC
BOWIE NO. 2 MINE
P.O. BOX 483
PAONIA, COLORADO 81428

PREPARED BY: J. E. STOVER & ASSOCIATES
2802 N. 7th Street, Unit B
Grand Jct., CO 81501

DESIGNED: J.E.S. 4/2014
DRAWN: [blank]
CHECKED: [blank]

PROJECT: BOWIE NO. 2 MINE
TITLE: MINE PLAN APPROVAL AREA
DRMS I.D. No.: C - 1996 - 083
SCALE: 1" = ~2000'

DWG. NAME: Map 02

ENGINEER'S CERTIFICATION

I hereby certify that this drawing was done by me or under my direct supervision and that the information presented on this drawing is true and correct to the best of my knowledge and belief.

James J. Stover
Colorado State Engineer

Date: [blank]

REVISIONS	DESCRIPTION	DATE
14	PR-14 Federal Coal Lease COC75916	J.E.S. 03/03/14
13	PR-13 Show Lease Modification Area	J.E.S. 07/23/13
12	PR-12 North Mine Prop. Permit Boundary	J.E.S. 09/26/12
11	TR-10 Add Lease Modification Area	J.E.S. 12/10/10
10	PR-10 Renew Lease Modification Area	J.E.S. 11/10/10
9	PR-10 West Mine Expansion	T.K.B. 02/15/10
8	TR-07 Hubbard Creek Vent Shaft; Permit Bndry. Mod.	T.K.B. 7/16/07
7	Permit Renewal No. 2	J.E.S. 11/23/06
6	PR-09 Permit Boundary Modification	T.K.B. 09/20/09
5	TR-01 Permit Boundary	L.K.J. 02/24/04
4	Revised for PR-06	J.E.S. 12/4/03
3		
2		
1		

Chronology Of Events

CHRONOLOGY

Bowie No. 2 Mine
Federal Lease COC75916
Mining Plan Decision Document

<u>DATE</u>	<u>EVENT</u>
February 21, 2012	The U.S. Fish and Wildlife Service provided its final consultation comments to BLM on the lease modification.
March 08, 2013 & April 22, 2013	The State Historic Preservation Office provided its comments to BLM on the lease modification.
March 12, 2014	Bowie Resources, LLC (BRL) submitted permit revision No. 14 to the permit application package (PAP) under the approved Colorado State Program to the Colorado Division of Reclamation, Mining and Safety (CDRMS).
March 20, 2014	CDRMS determined that the permit revision No. 14 to the PAP was administratively complete for public review and comment.
March 21, 2014	The Office of Surface Mining Reclamation and Enforcement (OSMRE) received the permit revision No. 14 to the PAP.
April 16, 2014	BRL published in the Delta County Independent the fourth consecutive weekly notice that its complete permit revision No. 14 to the PAP was filed with CDRMS.
September, 2013	The Environmental Assessment, <i>United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application</i> , was completed.
February 4, 2014	BLM signed its findings of no significant impact statement and decision record.
October 3, 2014	The Bureau of Land Management provided its findings and recommendations on the approval of the mining plan.
October 14, 2014	OSMRE received statement from USFWS stating all section 7 consultation requirements have been met.
October 17, 2014	OSMRE received the CDRMS <i>Proposed Decision and Findings of Compliance for the Bowie No. 2 Mine Permit No. C1996083 Permit Revision No. 14</i> for Bowie Resources, LLC's permit C1996083.
November 15, 2014	CDRMS approved the permit application.
December 19, 2014	The Regional Director, OSMRE Western Region recommended to the Director, OSMRE, that the mining plan action be approved.
March 16, 2015	ASLMM signed the mining plan approval document.

NEPA Compliance Documents

U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT
FINDING OF NO SIGNIFICANT IMPACT AND ADOPTION
OF THE ENVIRONMENTAL ASSESSMENT
FOR

Bowie Resources, LLC
Bowie No. 2 Mine
Federal Coal Lease COC75916
Mining Plan Decision Document

A. Introduction

Bowie Resources, LLC on March 12, 2014, submitted permit revision No. 14 to the permit application package (PAP) for the Bowie No. 2 Mine to the Colorado Division of Reclamation, Mining and Safety (CDRMS). CDRMS approved the permit revision on November 17, 2014. The permit revision proposes extending underground mining operations into 1,789 federal coal acres within the new Federal Lease COC75916. Under the Mineral Leasing Act of 1920, the Assistant Secretary, Land and Minerals Management, as designated by the Secretary of the Interior, must approve, approve with conditions, or disapprove the proposed mining plan modification for Federal Coal Lease COC75916. Pursuant to 30 CFR Part 746, the Office of Surface Mining Reclamation and Enforcement (OSMRE) is recommending approval of the mining plan modification without special conditions.

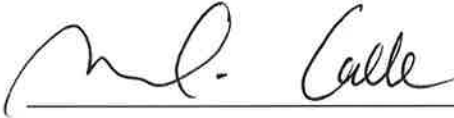
B. Statement of Environmental Significance of the Proposed Action

The undersigned person has determined that the above-named proposed action would not have a significant impact on the quality of the human environment under section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. 4332(2)(C), and therefore, an Environmental Impact Statement is not required.

This Statement of NEPA Adoption and Compliance is based on the attached *United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application*, the associated FONSI, the *Combined Geologic and Engineering Report (GER)* and the *Maximum Economic Recovery Report (MER)* which was prepared by the Uncompahgre Field Office of the Colorado Bureau of Land Management (BLM). OSMRE was a cooperating agency in the development of the Environmental Assessment (EA). In accordance with 43 CFR 46.320, OSMRE has independently reviewed the EA and finds that the EA complies with 43 CFR Part 46, Subpart D, the relevant provisions of the Council on Environmental Quality (CEQ) regulations and other program requirements, including impacts of greenhouse gases and global climate change. Based on this review, OSMRE has adopted the EA prepared by the BLM and referenced above. This finding is also based on consideration of the CEQ criteria for significance (40 CFR 1508.27), both with regard to the context and to the intensity of the impacts described in the EA.

In addition, BLM's review and approval of the Resource Recovery and Protection Plan, the PAP, and CDRMS's Written Findings for the permit revision No. 14 to the PAP have been independently reviewed by OSMRE. These documents reviewed in conjunction with the referenced EA adequately and accurately assess the environmental impacts of the proposed mining plan modification.

The undersigned has also determined that OSMRE's public involvement requirements for EAs have been met. The EA was subject to public review and comment prior to publication of the final EA. Fifteen comments on the EA were received. Those comments were reviewed and analyzed by the BLM and all comments were considered in the development of the final EA. There were four comments on the permit revision No. 14 to the PAP which were analyzed and taken into consideration by CDRMS. In addition, the referenced EA and this FONSI will be made publicly available on the OSMRE Western Region's website.



Marcelo Calle, Manager
Field Operations Branch
Program Support Division
Western Region

12/18/2014

Date

Attachment

**U.S. Department of the Interior
Bureau of Land Management
Uncompahgre Field Office
2505 S. Townsend Ave.
Montrose, CO 81401**

Finding of No Significant Impact (FONSI)

DOI-BLM-CO-S050-2013-0010 EA

CASEFILE/PROJECT NUMBER: COC-75916

LOCATION:

Township 12 South, Range 91 West, 6th P. M.

Section 31: Lots 11 through 26 inclusive

Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.

Section 36: S2

Township 13 South, Range 92 West, 6th P.M.

Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.

Section 5: lots 2, 3, 4, 10, & 11, E/2SWNE, N/2NWSWNE, N/2N/2SENE,
N/2NENESE, NENWNESE, W/2W/2NESE, E/2NWSE;

Section 6: Lots 1 through 4 inclusive

*containing 1,790.2 acres more or less

PROJECT NAME: Spruce Stomp Coal Lease by Application

APPLICANT: Bowie Resources, LLC

BACKGROUND

Currently, Bowie Resources, LLC (Bowie) operates the Bowie No. 2 Mine, which is an underground longwall coal mine northeast of the town of Paonia, Colorado. Coal mining has been conducted in the North Fork Valley for over 100 years. The Bowie No. 2 Mine has been in operation since November 1997 and is capable of producing approximately 5,000,000 tons of coal annually.

Bowie submitted a federal competitive coal lease-by-application (LBA) to the Bureau of Land Management (BLM) on October 12, 2012. The proposed LBA contains lands managed by the BLM Uncompahgre Field Office (UFO) and the U.S. Forest Service (USFS) Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG), as well as private surface lands with

federal minerals. The LBA (COC-75916), called Spruce Stomp, contains approximately 1,790.2 acres and is immediately adjacent to existing coal leases held by Bowie. The proposed lease covers approximately 1,333.6 acres of National Forest System land, 88.4 acres of BLM land and 368.2 acres of private surface with federal minerals. The application area contains an estimated 8.02 million tons of recoverable coal in the B seam. All of the coal mineral estate is administered by the BLM. The BLM is required by law to consider leasing competitively federal coal for economic recovery.

FINDING OF NO SIGNIFICANT IMPACT

Based upon analysis and a review of potential environmental impacts contained in the following two NEPA documents, I have determined that the Proposed Action will not have a significant effect on the human environment, individually or cumulatively, with other actions in the general area.

1. 2013, Environmental Assessment (DOI-BLM-CO-S050-2013-0010-EA) (EA), Bowie Coal Lease Modification Application.
2. 2000, USDA FS and BLM Environmental Impact Statement for the Iron Point Exploration License, the Iron Point Coal Lease Tract, and the Elk Creek Coal Lease Tract (a.k.a., "North Fork Coal EIS") and Record of Decision, March 30, 2000.

RATIONALE

This FONSI is based on my consideration of the Council on Environmental Quality's (CEQ) criteria for significance (40 CFR 1508.27), with regard to the context and the intensity of impacts described in the subject EA.

CONTEXT

The Proposed Action is in Delta County, Colorado, on lands managed by BLM and USFS, as well as private lands (with federal coal). The Proposed Action involves leasing federal coal reserves in a LBA tract with approximately 1,790.2 acres immediately adjacent to existing coal leases held by Bowie.

INTENSITY

1) Impacts that may be both beneficial and adverse.

Benefits of the Proposed Action would be continuation of coal production for approximately 1.5 years and contribution to the supply of coal to meet the nation's energy demands. The tract represents about 16 to 18 months of coal reserves based on the rate of mining currently employed at the Bowie No. 2 Mine. Lease stipulations were applied on the LBA to reduce impacts to resources including but not limited to vegetation, riparian, T&E, wildlife habitat and air quality. None of the environmental effects discussed in the EA are considered significant.

2) The degree to which the proposed action affects public health and safety.

Lease stipulations would reduce the potential impacts to public health and safety to a level that is not significant. No public traffic is allowed in the mine surface facilities and traffic near the temporary drill pad locations will be controlled during project surface activities. Precautions for

public health and safety will also be implemented during transport of equipment along public roads to and from the project area.

3) Unique Characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

Inventories have been completed for historic and cultural resources in the project area and no potential impacts have been identified. There are no Wilderness Areas, Lands with Wilderness Characteristics, Prime or Unique Farmlands, Wetlands, Floodplains or Areas of Critical Environmental Concern. The short segment (less than one mile) of stream determined eligible for consideration as a Wild and Scenic River would not have its potential classification degraded by the proposed activities.

4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

This decision for leasing additional coal reserves and its effects are not unique as similar decisions have been made in this area for many years, and leasing is not highly controversial scientifically. There is some uncertainty about the long-term cumulative effects of greenhouse gases and how these effects can be managed but they cannot be quantified or predicted at this time. There may be some public opinion regarding controversy; however, the potential intensity of effects on the quality of the human environment is minimal.

5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

The Proposed Action is not unique or unusual in this area. Coal mining has been ongoing in the area for over a century and both the BLM and the USFS have experience implementing similar actions. Effects from the Proposed Action are not highly uncertain and do not involve unique or unknown risks.

6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

The Proposed Action would not set a precedent for future coal leasing, extraction or mining decisions. Any future proposals would have to be evaluated on their own merits. The Proposed Action does not entail any known issues or elements that would create a precedent for future activities.

7) Consideration of the action in relation to other actions with individually insignificant but cumulatively significant impacts.

Other projects, including future coal mining, are foreseeable. The Proposed Action was considered in the context of past, present and reasonably foreseeable actions, and it is not anticipated that cumulative impacts of any significance would occur.

8) *The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historic resources.*

Inventories have been completed for historic and cultural resources in the project area and no significant impacts to districts, sites, highways, structures, or potential loss or destruction of significant scientific resources, have been identified. Two historic properties are located within the projected subsidence area. Although this could cause minimal effects to the historic properties, it is not expected that they would be adversely affected.

9) *The degree to which the action may adversely affect an endangered or threatened species or its critical habitat.*

All threatened, endangered, candidate and sensitive species known to occur in the project area were considered in the EA. None of these species would be adversely affected by the Proposed Action.

10) *Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.*

The Proposed Action does not violate or threaten violation of any federal, state, local, or tribal law or requirement imposed for the protection of the environment. State, local and tribal interests were given the opportunity to participate in the environmental analysis process.

DETERMINATION

This Finding of No Significant Impact is based on the information contained in the EA and my consideration of criteria for significance (40 CFR 1508.27). It is my determination that:

1) the implementation of the Proposed Action will not have significant environmental impacts; 2) the Proposed Action is in conformance with the Uncompahgre Basin Resource Management Plan; and 3) the Proposed Action does not constitute a major federal action having significant effect on the human environment. Therefore, an Environmental Impact Statement is not required.

Approved:

Barbara Sharrow

Barbara Sharrow
Field Manager
Uncompahgre Field Office

2-4-14

Date

**U.S. Department of the Interior
Bureau of Land Management
Uncompahgre Field Office
2465 South Townsend Avenue
Montrose, CO 81401**

Decision Record

(DOI-BLM-CO-S050-2013-0010 EA)

CASEFILE/PROJECT NUMBERS: COC-75916

LOCATION:

Township 12 South, Range 91 West, 6th P. M.
Section 31: Lots 11 through 26 inclusive
Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.
Section 36: S2

Township 13 South, Range 92 West, 6th P.M.
Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.
Section 5: lots 2, 3, 4, 10, & 11, E/2SWNE, N/2NWSWNE, N/2N/2SENW,
N/2NENESE, NENWNESE, W/2W/2NESE, E/2NWSE;
Section 6: Lots 1 through 4 inclusive

*containing 1,790.2 acres more or less

PROJECT NAME: Spruce Stomp Coal Lease-by-Application

APPLICANT: Bowie Resources, LLC

DECISION:

It is my decision to offer for lease the B seam in the Spruce Stomp LBA tract COC-75916 as described in DOI-BLM-CO-S050-2013-0010 EA. The lease is for underground development and production of federal coal reserves, in accordance with applicable laws and regulations, and subject to the lease stipulations listed below. This decision makes available 8.02 million tons of coal for recovery in the B seam. The Proposed Action is to lease approximately 1,790.2 acres of federal coal in order to avoid bypass of the B seam reserves.

Reasonably foreseeable surface use on the LBA tract includes 35 methane drainage wells (MDW) on 25 MDW pads and four miles of roads resulting in about 45 acres of disturbance. Any or all of the MDW pads and holes will receive site-specific agency review prior to a mine plan approval. Access to the MDWs will be from improved jeep trails or new roads. Surface disturbance will be temporary and will include approximately 25 acres for MDW pads and 20 acres for associated temporary light-use roads. Most effects will be short-term.

RATIONALE:

The decision will make additional federal coal reserves available for leasing, and be consistent with BLM management goals and prescriptions for the area. Any lease issued will also include the stipulations identified in the Coal Unsuitability Criteria, and the standard lease terms (BLM Lease Form 3400-12). All stipulations are consistent with the BLM land use plan. The FS consent letter to BLM dated January 29, 2014, includes conditions to protect surface resources on the NFS lands that are to be included as stipulations on the lease.

This decision balances recovery of the coal resource with protection of other resources and resource uses consistent with the applicable laws, regulations, BLM policy and Resource Management Plan goals and objectives, standards and guidelines, and multiple-use decisions. The LBA was submitted under the Mineral Leasing Act of 1920, Federal Coal Leasing Amendments Act of 1976, and 43 CFR 3400. It was reviewed in accordance with the regulations found at 43 CFR 3425.

The decision does not include the stipulation for no surface developments within the ½ mile wide Wild and Scenic River (WSR) study corridor, i.e., ¼ mile on each side of the stream segment (page 49/50 of the EA and page C1 of Appendix C). Other stipulations in the EA will maintain the free-flowing nature, water quality, and the Outstanding Remarkable Value (ORV) for fish. The analysis in the EA does not demonstrate that the proposed lease or future development would harm the ORV for fish or tentative WSR classification of “scenic.” The WSR classification of “scenic” does allow some development within ¼ mile of the segment as long as the “scenic” classification does not degrade to “recreational.” Surface development, if any in this area, would consist of one or two vent holes and the associated temporary access route and one-acre drill pad. With appropriate siting and screening these developments would not degrade the segment to “recreational.”

The decision to allow the Proposed Action does not result in any undue or unnecessary environmental degradation and is in conformance with the 1989 Uncompahgre Basin Resource Management Plan. It has been made in consideration of the impacts to the affected resources. The lease stipulations applied to the Proposed Action will meet or exceed the Standards for Public Land Health.

The EA addressed the No Action Alternative, the Proposed Action Alternative, and Alternatives Considered but Eliminated from Detailed Analysis.

STIPULATIONS:

AIR QUALITY

- Fugitive emissions from all vehicles traveling on regularly-used non-paved surfaces during all project phases will be controlled utilizing a variety of suppression techniques applied to the non-paved roads.
- Storage piles will be watered or covered as necessary to limit wind erosion potential and reduce fugitive emissions.
- The mine will continue to comply with their APCD-issued air emissions permit provisions, and any other regulatory requirements the facility is subject to now or in the future.

GEOLOGY AND MINERALS

- No surface occupancy will be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.
- The operator/lessee will be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee will be required to establish or amend a monitoring program to be used as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program will provide the procedures and methodologies to adequately assess interrelationships between geology, topography, hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program will incorporate baseline data so as to provide a continuing record over time.

CULTURAL AND PALEONTOLOGICAL RESOURCES

Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the USFS and BLM will:

- Contact the BLM/USFS to determine if a site specific cultural resources inventory is required. If a survey is required, then:
 - Engage the services of a cultural resources specialist acceptable to the BLM/USFS to conduct a cultural resources inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/USFS for review and approval at the time a surface disturbing plan of operation is submitted.

- Implement mitigation measures required by the USFS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.
- The lessee or operator will immediately bring to the attention of the USFS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and will leave such discoveries intact until directed to proceed by USFS and BLM.

INVASIVE, NON-NATIVE SPECIES

Noxious weed control will be required along access routes and at drill sites, in accordance with the Colorado Noxious Weed Act. In addition, the following stipulation will be required:

- An inventory will be completed for noxious weeds within the LBA tract before construction begins in order to determine whether there is a need for pre-treatments (with results of the inventory shared with the USFS and BLM weed specialist).

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) will be used to control subsidence.
- No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) will occur within 200 feet of greenback cutthroat trout (GBCT) occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.
- No surface disturbance, such as road widening or upgrading will occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the GBCT, unless exceptions were approved by the Authorized Officer.
- The operator will not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone will be marked for avoidance by construction equipment and activities.

- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective Best Management Practices (BMPs), will be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.
- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee will, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor will contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures will be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under the subject Biological Assessment (BA), lessee will submit the compiled monthly inspection reports to BLM Uncompahgre Field Office (UFO) by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads will be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure will be placed at the barricades.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period will require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry will be present in the stream, pump intakes will be screened with no larger than 1/16th mesh screen. The screen will not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. The lessee must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping will not take place during the base flow (low flow) periods of the year – October through March.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, will be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed.

- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the project area, regardless of surface ownership.
- Site-specific surveys for sensitive plants will be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There will be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions are approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures will avoid overspray or drift onto desirable species or sensitive plants.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. Prior to commencing mining activities that could cause subsidence, an appropriate augmentation plan for replacement water will be decreed. The augmentation plan will consider drought conditions and the limitations of local water supplies.
- The lessee/operator will design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator will design and implement a stream flow measurement program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on consistent measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to record flow measurements on a minimum monthly schedule, weather permitting, with the ability to obtain measurements more frequently as deemed appropriate. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and U.S. Fish and Wildlife Service (USFWS).
- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) on a biennial schedule during mining activities and twice following mining activities (at 5 and 10 year periods) underneath West Fork Terror Creek prior to bond release. A report will be distributed to the BLM, USFS, and the USFWS documenting if statistically significant declines are observed related to mining activities.

- The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual monitoring report and distributed accordingly.
- The lessee/operator will implement adaptive management to correct observed impacts to the stream. Potential impacts and their subsequent mitigation include:
 - Fishery Impacts: If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the lessee/operator will work with Colorado Parks and Wildlife (CPW) to capture and grow out fish populations from appropriate breeding stock.

Bald and Golden Eagle Nest Sites

- No new permanent surface facilities or disturbance except subsidence will be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.
- No surface activities will be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles. Any proposed surface facilities, disturbance, or activities (as noted above) in or adjacent to these buffer zones will require approval from the surface management agency on a site-specific basis, after consultation with the USFWS.

Bald and Golden Eagle Roost Sites

- No surface activity, except subsidence, will occur within a one-quarter mile radius of winter roosts between November 15 and March 15. Development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity will be restricted to the hours between 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Peregrine Falcon Nest

- No new permanent surface facilities or disturbance will be located within a one-quarter mile radius buffer zone around each peregrine falcon nest site.
- No aboveground activities will be allowed within a one-half mile radius buffer zone around each active peregrine falcon nest site from February 1 to July 15.
- Any proposed surface facilities, disturbance, or activities in, or adjacent to, these buffer zones will require approval from the USFS or BLM on a site-specific basis, after consultation with the USFWS.

MIGRATORY BIRDS

- For any future proposed disturbances on the lease, a qualified biologist will conduct pre-construction breeding bird and raptor surveys during the breeding period within one-half mile of the general disturbance area (drill pads and access roads) if activities occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys will document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to the USFS or BLM biologist, activities may begin within the cleared areas. If active nests are found, development timing will be restricted during the breeding season, as per the USFS or BLM Authorized Officer.
- To minimize or avoid effects to nesting migratory birds, where practicable, the lessee will avoid vegetation removal during the migratory bird nesting period (May 15 to August 1), unless authorized after review by the USFS and/or BLM authorized officer. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM authorized officer will be required.
- If active nests were identified during mine permit related project disturbances, appropriate measures will be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations, and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM authorized officer.
- All unavoidable surface disturbances will require approval of the USFS or BLM Authorized Officer. The USFS or BLM will coordinate with USFWS to determine the type and extent of allowable variances. A site-specific examination will determine if this stipulation will apply.

WILDLIFE, TERRESTRIAL

- Facility construction and major scheduled maintenance will not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times will require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles will be permitted, but no snow plowing may occur.
- Bear-proof containers will be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training will include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation will be utilized on the individual MDW pumps to reduce impacts from their operation and comply with state and federal standards.

ACCESS AND TRANSPORTATION

- No mining related disturbance will occur within 100 feet of the outside line of the right-of-way of Stevens Gulch Road. The angle of draw used to protect the road from

subsidence will be dictated by the approved Colorado Division of Reclamation Mining and Safety (CDRMS) mine plan (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining-related disturbance may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the CDRMS Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of the public road will be protected.

- The lessee/operator will be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the USFS. Monitoring, repair and/or mitigation will be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities will be completed the fall following award of lease. Reports of this survey will be deliverable to the USFS by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) will be submitted to the USFS for review and approval not later than 12 months prior to scheduled undermining. The Plan will detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.
- The lessee/operator will schedule mining activities such that active subsidence of roads occurs during dormant winter months, unless no other practicable alternative exists.

REALTY AUTHORIZATIONS

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the transmission line must be properly grounded. In order to avoid static or induced electrical hazards, no materials may be stored in the 125-foot wide transmission line right-of-way.
- If future longwall mining will come within 100 feet of any transmission line tower foundation, a structural review and acceptance by WAPA will be required.
- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions will be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in the Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- No mining related surface disturbance will occur within 100 feet of the outside line of the transmission line right-of-way without a written finding from the BLM Authorized Officer and consultation with the right-of-way holder.

RANGE MANAGEMENT

- Any construction/operation impacts and man-made barriers to livestock movement will be mitigated by replacing fences, gates, cattle guards, and gates to at least the same condition as they were found before construction, and installation of new fences where needed.

NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by a permit/operation plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Forest Supervisor, Grand Mesa-Uncompahgre-Gunnison NF
2250 Hwy 50, Delta, Colorado 81416
970-874-6600

who is the authorized representative of the Secretary of Agriculture.

NOTICE

CULTURAL AND PALEONTOLOGICAL RESOURCES - The USFS is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the BLM/FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:
2. Engage the services of a cultural resource specialist acceptable to the BLM/FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/FS for review and approval at the time a surface disturbing plan of operation is submitted.
3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation

will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

ENDANGERED OR THREATENED SPECIES - The USFS is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the USFS that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the USFS. An acceptable report must be provided to the USFS identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

MONITORING:

Normal routine compliance inspections will take place periodically throughout the life of the lease. The inspections will be designed to monitor environmental effects of the Proposed Action and to insure that the operator complies with the lease stipulations. In addition, all surface disturbing and mining activities on the lease will be monitored by the Colorado Division of Mining, Reclamation, & Safety, the USFS, and BLM during the mine and reclamation plan permitting process.

COMPLIANCE WITH MAJOR LAWS:

The decision is in compliance with applicable laws, regulations and policy, including the Endangered Species Act, Migratory Bird Treaty Act, Clean Water Act, Clean Air Act, and the National Historic Preservation Act.

PUBLIC INVOLVEMENT:

Public comments were solicited via a letter, dated January 16, 2013, that was mailed to more than 700 interested parties including the appropriate agencies, specific interested parties, and to the general public. The scoping notice was also published in the Delta County Independent and the Grand Junction Daily Sentinel and posted on both the BLM UFO and the USFS websites. Public comments were received through February 22, 2013. A total of 20 comment letters were received during the public comment period. All comment letters were reviewed and considered in the development of the preliminary EA.

Early in July 2013, the preliminary EA was made available for public comment, particularly to parties that commented during scoping. A total of approximately 15 comments were obtained during the entire period until the EA was finalized in late September 2013. Those comments were reviewed and considered in the development of the final EA. There were no substantive comments that necessitated the BLM to revisit the Proposed Action through additional NEPA proceedings.

The USFS issued a consent decision on October 2, 2013, and it was appealed on the last day of their appeal period (November 18, 2013) by Terror Ditch and Reservoir Company (TDRC). On November 26, 2013, the USFS notified the appellant and the BLM that the appellant did not submit substantive comments during their comment period and dismissed the appeal accordingly. The appeal dismissal was contested and USFS renewed their dismissal decision on January 10, 2014. The USFS sent their consent letter to BLM on January 29, 2014.

FINDING OF NO SIGNIFICANT IMPACT:

A Finding of No Significant Impact (FONSI) was prepared, based on the information contained in the EA and my consideration of criteria for significance (40 CFR 1508.27). It is my determination that: 1) the implementation of the Proposed Action will not have significant environmental impacts; 2) the Proposed Action is in conformance with the Uncompahgre Basin Resource Management Plan; and 3) the Proposed Action does not constitute a major federal action having significant effect on the human environment. Therefore, an Environmental Impact Statement is not necessary.

APPEAL PROCEDURES:

The BLM decision to offer the coal LBA is subject to appeal to the Interior Board of Land Appeals (IBLA). Anyone wishing to appeal will have 30 days from this decision to appeal to the Board of Land Appeals, Office of the Secretary, in accordance with regulations at 43 CFR Part 4. Appeal and stay procedures are outlined in Form 1842-1.

ENVIRONMENTAL COORDINATOR: 

Bruce Krickbaum

DATE 1-30-2014

SIGNATURE OF AUTHORIZED OFFICIAL: 

Barbara Sharrow

Field Manager

Uncompahgre Field Office

DATE SIGNED 2-4-14

Attachment: 1) USFS Consent Letter



United States

Department of Agriculture

Forest Service
Rocky Mountain
Region

740 Simms Street
Golden, CO 80401
Voice: 303-275-5350
TDD: 303-275-5367

File Code: **2820**
Date: **January 29, 2014**

State Director, Colorado State Office
Attn: Charlie Beecham
Bureau of Land Management
2850 Youngfield Street
Lakewood, CO 80215

RE: Coal Lease by Application for COC-75916

Dear Mr. Beecham,

This letter conveys USDA - Forest Service consent to BLM leasing the National Forest System (NFS) lands in federal Coal Lease by Application COC- 75916. The LBA contains approximately 1,333 acres of NFS lands managed by the Grand Mesa, Uncompahgre and Gunnison National Forests. **The NFS portions of the coal LBA are described as:**

Township 12 South, Range 91 West, 6th P.M.

Section 31: Lots 11-26;

Section 32: Lots 10-15;

Township 12 South, Range 92 West, 6th P.M.

Section 36: S2;

in Delta County, Colorado. See Map 2 from the EA (enclosed).

The FS consent includes conditions to protect surface resources on the NFS lands that are to be included as stipulations on the lease (enclosed as Appendix C from the EA).

If you have any questions about the LBA, please contact Sharon Deuter (303-275-5098) of the Minerals & Geology Management, Centralized National Operations staff.

Sincerely,

/s/ James S. Bedwell
JAMES S. BEDWELL
Director, Recreation, Lands and Minerals

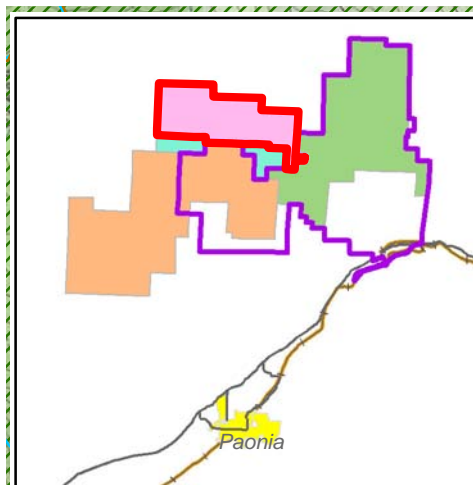
cc: Mailroom R2 Grand Mesa Uncompahgre Gunnison, Barb Sharrow, BLM, Uncompahgre Field Office



It's Cool to Be Safe

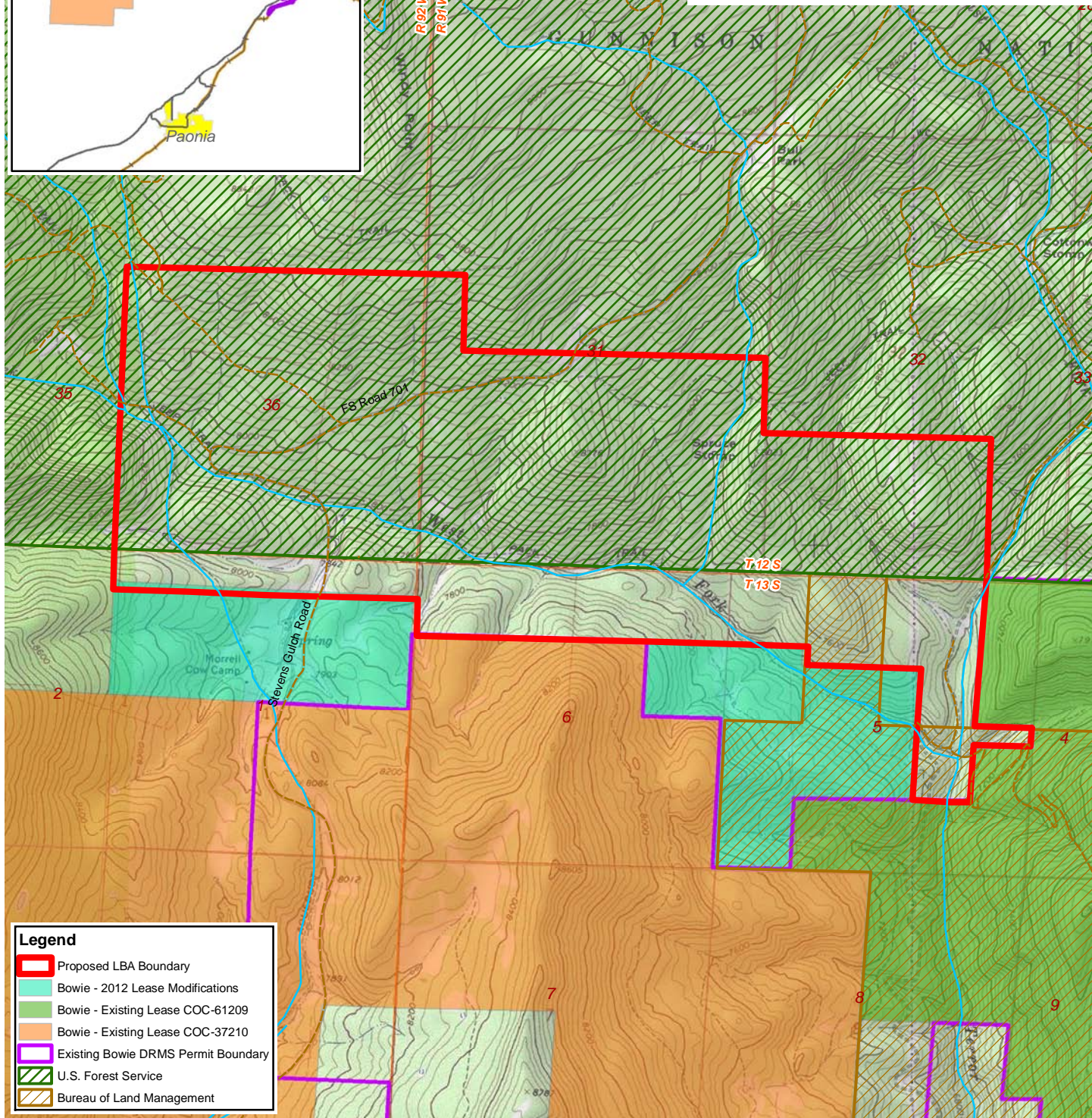
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Map 2

Detailed Location of the
Spruce Stomp Coal Lease by Application
Serial No. COC-75916



No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

3,000 0 3,000
Feet



APPENDIX C

Lease Stipulations

Appendix C

Lease Stipulations

Stipulations Identified in the Unsuitability Criteria

Wild and Scenic River

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw [angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence], etc.) shall be used to control subsidence.
- No surface developments (i.e., MDWs or access roads) shall be allowed within the ½ mile wide river study corridor (i.e., 1/4 mile wide on each side of the West Fork of Terror Creek) on BLM lands/minerals. This stipulation will no longer apply if the eligible segment on West Fork of Terror Creek is found not suitable for inclusion in the National Wild and Scenic River System, or if suitable, if it is dropped from further consideration by Congress.

Rights-of-Way

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the right-of-way must be properly grounded. In order to avoid static or induced electrical hazards no materials may be stored in the transmission line right-of-way.
- If future longwall mining would come within 100 feet of any transmission line tower foundation, a structural review and acceptance by WAPA would be required.
- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions would be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining related surface disturbance would occur within 100 feet of the outside line of the power line right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide

for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.

- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation will be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities will be completed the fall following award of lease. Reports of this survey will be deliverable to the Forest Service by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) will be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan will detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.

Threatened and Endangered Species

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) would occur within 200 feet of greenback cutthroat trout occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer. These techniques would provide for maximum coal removal while protecting the values associated with the threatened greenback cutthroat trout habitat.
- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective BMPs, would be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.
- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee shall, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor shall contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under this BA, lessee shall submit the compiled monthly inspection reports to BLM UFO by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads shall be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure shall be placed at the barricades.

- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year – October through March.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.
- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- No surface disturbance, such as road widening or upgrading would occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the greenback cutthroat trout, unless exceptions were approved by the Authorized Officer.

- Site-specific surveys for sensitive plants would be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There would be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions were approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures would avoid overspray or drift onto desirable species or sensitive plants.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- The lessee/operator would design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator would design and implement a stream flow measurement program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on continuous measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to conduct site visits to ensure continuous flow measurements are recorded on a minimum monthly schedule, weather permitting. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and USFWS.
- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) every two years during and twice following the mining activities (at 5 and 10 years periods) prior to bond release. A report should be distributed to the BLM, USFS and USFWS documenting if statistically significant declines are observed related to mining activities. If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the

lessee/operator will work with CPW to capture and grow out fish populations from appropriate breeding stock. The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual Monitoring Report and distributed accordingly.

Bald and Golden Eagle Nest Sites

- No new permanent surface facilities or disturbance except subsidence would be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.
- No surface activities would be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles. Any proposed surface facilities, disturbance, or activities (as noted above) in or adjacent to these buffer zones would require approval from the surface management agency on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Bald and Golden Eagle Roost Sites

- No surface activity, except subsidence, would occur within a one-quarter mile radius of winter roosts between November 15 and March 15. Development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity would be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Peregrine Falcon Nest

- No new permanent surface facilities or disturbance would be located within a one-quarter mile radius buffer zone around each peregrine falcon nest site.
- No aboveground activities would be allowed within a one-half mile radius buffer zone around each active peregrine falcon nest site from February 1 to July 15.
- Any proposed surface facilities, disturbance, or activities in, or adjacent to, these buffer zones would require approval from the USFS or BLM on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Migratory Birds

- For any future proposed disturbances on the lease, a qualified biologist would conduct pre-construction breeding bird and raptor surveys during the breeding period within 0.5 mile of the general disturbance area (drill pads and access roads) if activities would occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys would document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to and approved by the USFS or BLM Biologist, activities may begin within the cleared areas. If active

nests are found, development timing would be restricted during the breeding season, as per the USFS or BLM authorized officer.

- Where practicable, surface disturbing activities should not occur during the migratory bird nesting period (May 15 through August 1) to prevent potential take of migratory birds and/or eggs, unless vegetation is removed prior to May 15. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM would be required. If active nests were identified during mine permit related project disturbances, appropriate measures would be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations, and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM.
- All unavoidable surface disturbances would require approval of the USFS or BLM Authorized Officer. The USFS or BLM would coordinate with USFWS to determine the type and extent of allowable variances. A site-specific examination would determine if this stipulation would apply.

State Priority Species

- Facility construction and major scheduled maintenance shall not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times would require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles shall be permitted, but no snow plowing may occur.
- Bear-proof containers would be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training would include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation would be utilized on the individual MDW pumps to reduce impacts from their operation.

**NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM
UNDER JURISDICTION OF
DEPARTMENT OF AGRICULTURE**

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by a permit/operation plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Foreset Supervisor, Grand Mesa-Uncompahgre-Gunnison NF
2250 Hwy 50, Delta, Colorado 81416
970-874-6600

who is the authorized representative of the Secretary of Agriculture.

NOTICE

CULTURAL AND PALEONTOLOGICAL RESOURCES - The FS is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the BLM/FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:
2. Engage the services of a cultural resource specialist acceptable to the BLM/FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/FS for review and approval at the time a surface disturbing plan of operation is submitted.
3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

ENDANGERED OR THREATENED SPECIES - The FS is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine

effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the FS that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the FS. An acceptable report must be provided to the FS identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

Stipulations Identified Through Resource Evaluations

Air Quality and Climate

- Fugitive emissions from all vehicles traveling on regularly-used non-paved surfaces during all project phases shall be controlled utilizing a variety of suppression techniques applied to the non-paved roads.
- Storage piles shall be watered or covered as necessary to limit wind erosion potential and reduce fugitive emissions.

Geology and Minerals

- No surface occupancy would be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the lessee, at their expense will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, stock pond, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, livestock and wildlife use, or other land uses as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.
- The operator/lessee would be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee would be required to establish or amend a monitoring program to be used

as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program shall provide the procedures and methodologies to adequately assess interrelationships between geology, topography, hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program shall incorporate baseline data so as to provide a continuing record over time.

Vegetation - Invasive Plant Species

- An inventory shall be completed for noxious weeds within the LBA tract before construction begins in order to determine whether there is a need for pre-treatments (with results of the inventory shared with the USFS and BLM weed specialist).

Access and Transportation

- No mining related disturbance would occur within 100 feet of the outside line of the right-of-way of Stevens Gulch Road. The angle of draw used to protect the road from subsidence would be dictated by the approved Colorado DMG Mining and Reclamation Plan (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining-related disturbance may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of the public road would be protected.
- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation shall be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities shall be completed the fall following award of lease. Reports of this survey shall be deliverable to the Forest Service by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) shall be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan shall detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.
- The lessee/operator shall schedule mining activities such that active subsidence of roads occurs during dormant winter months, unless no other practicable alternative exists.

Range Management

- Any construction/operation impacts man-made barriers to livestock movement shall be mitigated by replacing fences, gates, cattle guards, and gates to at least the same condition as they were found before construction, and installation of new fences where needed.



**United States Department of the Interior
Bureau of Land Management**



**United States Department of Agriculture
U.S. Forest Service**



**Environmental Assessment
DOI-BLM-CO-S050-2013-0010 EA**

September 2013

Spruce Stomp Coal Lease by Application

**BLM Uncompahgre Field Office
2465 South Townsend Avenue
Montrose, CO 81401
Phone: (970) 240-5300**

**Grand Mesa, Uncompahgre, and Gunnison National Forests
2250 Highway 50
Delta, CO 81416
Phone (970) 874-6600**

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ENVIRONMENTAL ASSESSMENT

NUMBER: DOI-BLM-CO-SO50-2013-0010

CASEFILE/PROJECT NUMBER: COC-75916

PROJECT NAME: Spruce Stomp LBA

LEGAL DESCRIPTION:

COC-75916

Township 12 South, Range 91 West, 6th P. M
Section 31: Lots 11 through 26 inclusive
Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.
Section 36: S2

Township 13 South, Range 92 West, 6th P.M.
Section 1: Lots 5 through 8 inclusive

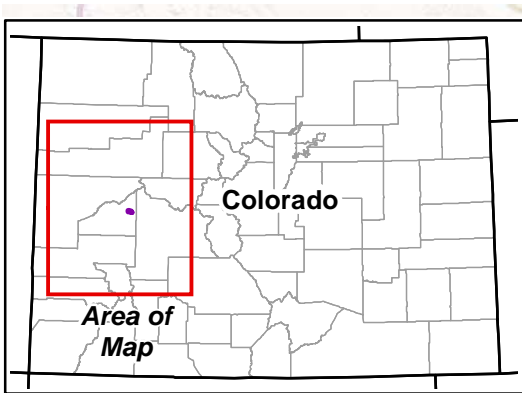
Township 13 South, Range 91 West, 6th P.M.
Section 5: Lots 2, 3, 4, 10, & 11, W/2W/2NENE, NWNE, NESWNE,
SESWNE, N/2NWSWNE, N/2NW, N/2N/2SENE, E/2NW/SE, W/2W/2NESE,
N/2NENESE, NENWNESE;
Section 6: Lots 1 through 4 inclusive

*containing 1,789.2 acres more or less

APPLICANT: Bowie Resources, LLC

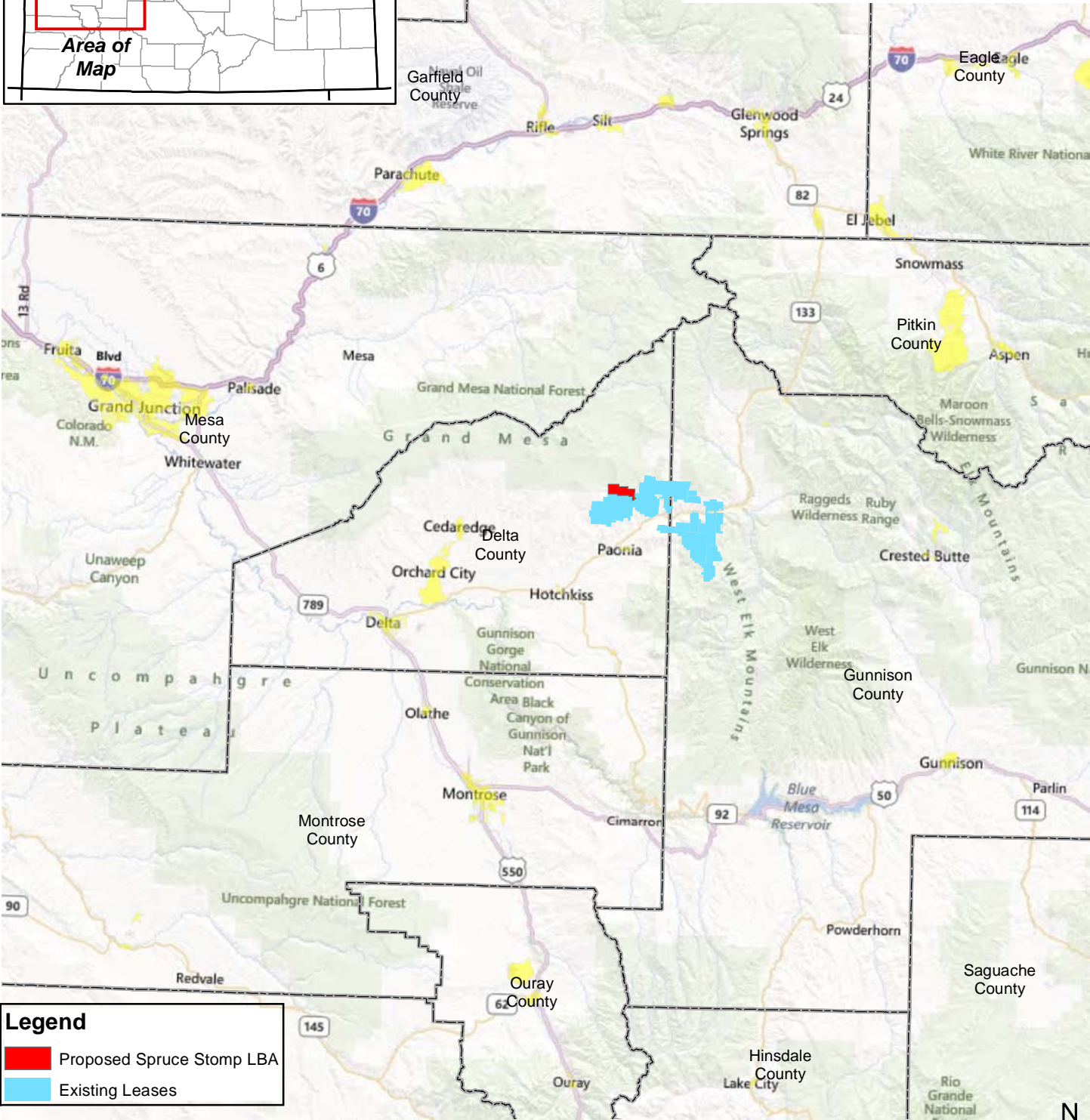
BACKGROUND / INTRODUCTION

Bowie Resources, LLC (Bowie) submitted a federal competitive coal lease-by-application (LBA) to the Bureau of Land Management (BLM) on October 12, 2012. The proposed LBA contains lands managed by the BLM Uncompahgre Field Office (UFO) and the U.S. Forest Service (USFS or Forest Service) Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG), as well as private lands. The LBA (COC-75916), called Spruce Stomp, contains approximately 1,789.2 acres and is immediately adjacent to existing coal leases held by Bowie. The proposed lease covers approximately 1,332.6 acres of National Forest System (NFS) land, 88.4 acres of BLM land and 368.2 acres of private surface with federal minerals (see Maps 1 and 2). The application area contains an estimated 8.02 million tons of recoverable coal. All of the coal mineral estate is administered by the BLM. The BLM is required by law to consider leasing federal coal for economic recovery.



Map 1

General Location of the
Spruce Stomp Coal Lease by Application
Serial No. COC-756916



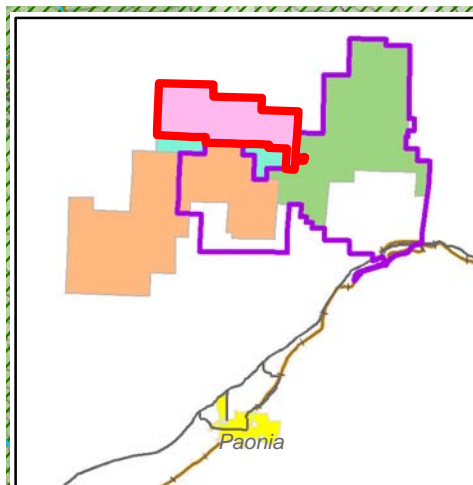
Legend

Proposed Spruce Stomp LBA

Existing Leases

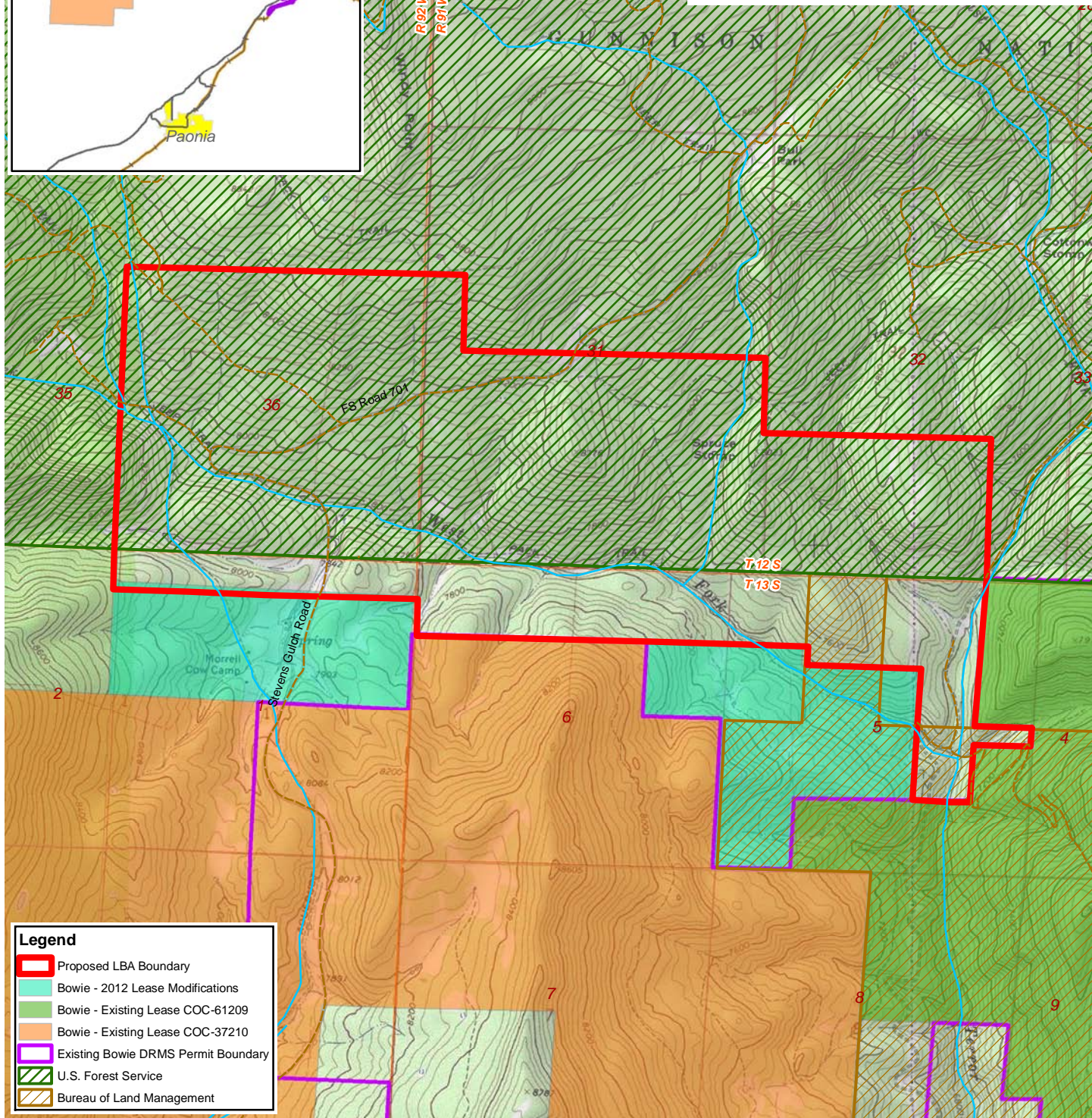
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM





Map 2

Detailed Location of the
Spruce Stomp Coal Lease by Application
Serial No. COC-75916



No warranty is made by the Bureau of Land Management
for use of the data for purposes not intended by the BLM

3,000 0 3,000
Feet



With respect to lands managed by the Forest Service, the agency is considering consenting to the BLM for leasing the portion of COC-75916 under its jurisdiction (1, 332.6 acres) and prescribing conditions (as stipulations) for the protection of non-mineral (surface) resources. If Forest Service consent is given, the BLM, after considering the application and lands under its jurisdiction, will decide whether or not to offer the coal lease by competitive bid and will attach the stipulations necessary to protect non-mineral (surface) resources as prescribed by the surface management agency,

Coal mining has been conducted in the North Fork Valley for more than 100 years. Coal mined in the North Fork Valley, is a high British Thermal Unit (BTU), low sulfur coal. Its use in industry helps meet standards of the Clean Air Act. As such, there is a demand for coal from mines in the North Fork Valley for electric power generation.

Currently, Bowie operates the Bowie No. 2 Mine which is an underground longwall coal mine located about 5 miles northeast of Paonia in Delta County, Colorado (see Map 2). Bowie applied for the coal lease, which is immediately adjacent to their existing federal coal leases at the Bowie No. 2 Mine, with the intention to extend their existing mine and produce additional compliant and super-compliant coal, although they may not be the successful bidder on this LBA. The Bowie No. 2 Mine has been in operation since November 1997 and is capable of producing approximately 5,000,000 tons of coal annually. Bowie holds approximately 11,729.93 federal lease acres and approximately 1,696 acres of fee coal (total 13,425.93 acres). The combined State of Colorado, Division of Reclamation Mining and Safety (DRMS) permits for the Bowie No. 1 and No. 2 mines cover approximately 14,234.4 acres, and the coal is accessed by the Bowie No. 2 Mine.

LEASING PROCESS, AUTHORIZING ACTS AND RELEVANT POLICIES, PLANS AND PROGRAMS

This environmental assessment (EA) is prepared to inform federal agency decision makers; publicly disclose the probable environmental impacts of coal leasing and future development of the coal reserves; and establish protections in the form of lease stipulations for surface resources should the lease be issued.

In order for a mining company to access federal coal reserves, the company must apply to lease the federal lands for development of the coal resource. An application is submitted to the BLM, which administers the federal mineral estate on all federal lands. BLM initiates the lease consideration process, which ensures compliance with the National Environmental Policy Act (NEPA) is completed.

The BLM, charged with administration of the mineral estate on these federal lands, is required by law to consider leasing federally-owned minerals for economic recovery. Federal mineral leasing follows the Mineral Leasing Act of 1920 (MLA), as amended by the Federal Coal Leasing Amendments Act of 1976 (FCLAA), and specific procedures for this project are set forth in 43 CFR 3425. BLM directives indicate the need to offer federal coal in quantities responsive to market conditions and assure maximum economic recovery of mineable federal coal reserves. The BLM has the mineral leasing authority, and the Forest Service is the Surface Managing Agency for lands under their authority within the Spruce Stomp LBA tract. The

leasing and subsequent production of these federally administered coal reserves ensures that they would not be bypassed or rendered inaccessible.

Although the decision to lease these lands is a necessary requisite for mining, that decision is not the enabling action that will allow mining. On-going management of the existing leases, as well as any potential permitting of mining and surface activities associated with this LBA follows the Surface Mining Control and Reclamation Act of 1977 (SMCRA) implementing regulations at 43 CFR 3400 and 30 CFR 700 (respectively) and the State of Colorado Coal regulations. These permitting actions fall within the purview of the DRMS under procedures set forth in 30 CFR 700, et. seq. and the regulations of the Colorado Mined Land Reclamation Board for Coal Mining (CRS 34-33-101).

In order to conduct mine operations on new leases, federal coal lease holders in Colorado must submit a permit revision application to DRMS for proposed expansions of existing mines that covers mining and reclamation on federal lands. DRMS reviews the package to ensure that the permit application complies with the permitting requirements and that the coal mining operation would meet the State's performance standards. The Office of Surface Mining Reclamation and Enforcement (OSM), BLM, and other federal agencies also review the application to ensure it contains the necessary information for compliance with the coal lease, the MLA, NEPA, and other applicable federal laws and regulations. If the application complies, DRMS issues a permit to conduct coal mining operations. When needed, the OSM recommends approval, approval with conditions, or disapproval of the mining plan to the Assistant Secretary of the Interior, Land and Minerals Management. Prior to mining plan approval, OSM obtains input from the BLM (for the mineral estate) and the Forest Service for NFS lands. The OSM and DRMS are cooperating agencies on this EA as they are responsible for the reviewing of mining plans and overseeing the subsequent permitting process.

The Forest Service administers its mineral program (Forest Service Manual 2800 ZERO Code – WO Amendment 2800-91-1 Page 3) to:

1. Encourage and facilitate the orderly exploration, development, and production of mineral and energy resources within the NFS in order to maintain a viable, healthy minerals industry and to promote self-sufficiency in those mineral and energy resources necessary for economic growth and national defense;
2. Ensure that exploration, development and production of mineral resources are conducted in an environmentally sound manner and that these activities are considered fully in the planning and management of other NFS resources; and
3. Ensure that lands disturbed by mineral and energy activities are reclaimed for other productive uses.

The GMUG considers mineral exploration and development to be consistent with its Forest Plan (GMUG Amended Forest Plan, Page II- 61). It cooperates with the U.S. Department of the Interior (USDI), the BLM, in administering lawful development of leasable minerals. Under the federal leasing program, the USDI combined major federal coal management responsibilities into one unified program in order to:

1. Give the nation a greater assurance of being able to meet its national energy objective;
2. Provide a means to promote a more desirable pattern of coal development with ample environmental protection;
3. Assure that state and local governments participate in decisions about where and when federal coal production will take place; and
4. Increase competition in the western coal industry.

Following direction from the Mining and Mineral Policy Act of 1970 and the Federal Land Policy and Management Act (FLPMA) of 1976, the responsible federal agencies must generally ensure the following:

1. Adverse environmental impacts on public land surface resources are minimized to the extent practical;
2. Measures must be included to provide for reclamation, where practicable; and
3. The proposed operation will comply with other federal and state laws and regulations.

DECISION FRAMEWORK

Forest Service. The GMUG Forest Supervisor is the Authorized Officer for this discretionary consent decision on the LBA (FSM 2822.04c, R2 Supplement; 43 CFR 3420.4-2). Given the purpose and need, the Authorized Officer will review the Proposed Action, the other alternatives, and the environmental consequences in order to decide the following:

- Whether or not to consent to the BLM issuing Federal Coal Lease COC-75916 according to the MLA of 1920; as amended by the FCLAA of 1976;
- If the Forest Service consents to issue the lease, it will prescribe stipulations needed for the protection of non-mineral resources on NFS lands.

The Forest Service Authorized Officer will determine if the activity is consistent with the GMUG Forest Plan. The Forest Service decision will be made based on the analysis relative to the No Action and Proposed Action alternatives. In addition, the FS as the Surface Management Agency reviews the land in the application and reviews the Unsuitability Criteria¹ under 43 CFR 3461, and makes a recommendation to the Secretary of Interior who determines whether there are no significant recreational, timber, economic, or other values which may be incompatible with the lease (43 CFR 3461.5(2)(i)).

BLM. The BLM State Director is the Authorized Officer for the BLM and will decide whether or not to conduct a competitive sale for the coal lease under the MLA of 1920, as amended, and the federal regulations under 43 CFR 3400. The UFO Manager/Southwest District Manager is responsible for providing the State Director with briefings and recommendations. Specifically, the BLM will decide whether to:

- Adopt the No-Action Alternative (no leasing);

¹ The Surface Mining Control and Reclamation Act of 1977 (SMCRA) principally regulates coal mine permitting actions (see Section 1.6). To the extent SMCRA applies at the coal leasing stage, it is the basis for the Unsuitability Assessment codified in BLM regulations at 43 CFR 3461 that is applicable at the leasing stage.

- Adopt the coal lease as applied for by the applicant;
- Adopt the coal lease as amended by the BLM.

In addition, for lands administered by the FS, based on recommendation the Secretary of Interior (represented by the BLM State Director) makes the determination on whether there are no significant recreation, timber, economic, or other values which may be incompatible with leasing the lands in question, and whether or not to modify the leases. The BLM cannot issue a coal lease without the consent of the surface managing agency (in this case the Forest Service).

OSM. The OSM is a cooperating agency in preparing this EA. If the lease is issued, they will determine if there is a need for a federal mining plan modification at the time the actual permitting process is underway. If a federal mining plan modification is needed, the OSM will be responsible to recommend that the USDI Assistant Secretary for Lands and Minerals approve, approve with conditions, or not approve the modification under 30 CFR 746.

DRMS. The DRMS is a cooperating agency in preparing this EA. In Colorado, DRMS operates under an OSM-approved program with primary responsibility for administering coal mining operations in the state, as codified by the Colorado Surface Coal Mining Reclamation Act (CRS 34-33-101) and attendant regulations which are consistent with the overarching federal regulations (30 CFR 906). Any applications submitted to the State of Colorado to revise the state mining and reclamation permit, including applications to allow mining and its related surface disturbances, reclamation, and the expansion of the approved mine permit boundary to include the lease area, would be reviewed by the DRMS.

PURPOSE AND NEED FOR THE PROPOSED ACTION

The BLM and the USFS have identified a need to respond to a federal coal lease application in accordance with the MLA of 1920, as amended by the FCLAA of 1976, and the FLPMA of 1976, and implementing regulations at 43 CFR 3400.

The purpose is for the BLM to decide whether or not to offer the Spruce Stomp LBA tract for competitive leasing (with appropriate stipulations) under the MLA, as amended and federal regulations under 43 CFR 3400. The purpose is also for the Forest Service to decide whether to consent to the BLM offering the NFS lands within the tract for lease and what conditions must be prescribed for protection of non-coal resources.

PROPOSED ACTION AND ALTERNATIVES

Proposed Action

The Proposed Action is for the Forest Service to consent to the BLM to lease the NFS lands with conditions for use and protection of non-mineral interests. The Proposed Action is also for the BLM to issue a federal coal lease (COC-75916) for the Spruce Stomp LBA tract (approximately 1,789.2 acres), which would be for underground development and production of federal coal reserves, in accordance with applicable laws and regulations, including terms and conditions for protecting non-mineral resources.

Application of the Unsuitability Criteria for Coal Mining (see Appendix A) described in 43 CFR 3461 did not identify any lands in the tract as being “unsuitable.” Some restrictions were identified for some of the criteria. These restrictions would be carried forward as stipulations on the coal lease. The BLM has prepared a Tract Delineation Report, which is provided as Appendix B.

Reasonably Foreseeable Mine Operations Plan. To analyze potential surface impacts such as underground mine subsidence, this EA assumes a Reasonably Foreseeable Mine Plan (RFMP) for this leasing decision. The Spruce Stomp LBA contains an estimated 8.02 million tons of federal coal reserves in the lower-B seam. While other coal is present in the LBA tract, the BLM Tract Delineation Report (see Appendix B) does not consider the other seams as economically mineable given a variety of reasons. It is assumed that the coal would be recovered using the longwall method of underground coal mining. The tract is bounded on the south by currently leased federal coal and on the east by unmineable (thin) coal (unleased). Therefore, it is assumed that access to the coal reserves in the Spruce Stomp LBA tract would most easily be achieved from the existing underground workings at the Bowie No. 2 Mine with existing surface facilities. Understanding that federal coal is leased through a competitive bid process, the analysis assumes that a company other than Bowie may be the successful bidder at the lease sale. The coal does not outcrop on the Spruce Stomp LBA tract; therefore, no new portals could be located, and there may not be a reasonable shaft location.

It is assumed that the coal would be transported to market using the existing coal handling facilities and existing spur rail line.

The RFMP for the Spruce Stomp tract assumes that coal in the lower-B Seam would be extracted from longwall panels trending northwest southeast. The foreseeable mine operations plan in the Spruce Stomp LBA tract is a northward expansion with new longwall panels planned from the existing lease to the south. Continuous mine development would be used to drive development entries for the longwall panels, with the primary coal production being achieved using the longwall method and equipment.

The tract represents about 16 to 18 months of coal reserves based on the rate of mining currently employed at the Bowie No. 2 Mine. The lower-B Seam coal in the tract would be mined from about 2015 to 2019. Some variations to these timeframes may occur based on permitting, unforeseen mining or geologic circumstances, coal contract variability, etc.

The RFMP assumes a longwall panel configuration that would mine under West Terror Creek. The RFMP was used to develop the coal mine subsidence prediction used to assess potential surface resource impacts.

Reasonably Foreseeable Post-lease Surface Use. In order to effectively analyze potential post-lease activities on the land surface, the analysis assumes a scenario of potential surface use. It must be noted, however, that decisions pertaining to specific surface use and disturbance are not made at the leasing stage rather they are specifically considered at the post-lease permitting stage. In recent years, coal mines operating in the region have experienced build-up of methane gas in the underground workings after the rock strata have subsided due to mining. Under Mine,

Safety, and Health Administration (MSHA) regulations, mines are required to maintain methane levels at or below certain levels to ensure worker safety underground. Typically in this region, the mine ventilation systems alone cannot effectively keep methane levels at or below the established levels; therefore, methane liberation methods are frequently used.

For the purposes of analysis, it is assumed that a system of methane drainage wells (MDWs) would be needed to assist in liberating methane from the underground mine. These MDWs would be drilled from the land surface to a depth located slightly above the mine workings and use the methane vented to power an exhausting pump to pull methane from the mine. Drilling these MDWs requires construction of drill pads and temporary roads on the land surface. Based upon information provided in the application, acres of potential post-lease surface disturbance were estimated and are shown in Table 1. These features are on the landscape for 1 to 3 years, after which they are decommissioned and the land surface is reclaimed and returned to pre-mining land uses. According to DRMS requirements under SMCRA, typical reclamation includes returning land surface to approximate original contours, replacing the topsoil, and revegetation. Experience in the area has shown that reclamation has been generally successful within 2 to 5 years after reclamation work is completed.

Table 1
Reasonably Foreseeable Surface Use Estimated for the Proposed Action

Component	Quantity	Acres
Methane drainage wells	35 ¹	25
Temporary roads for MDWs	4 miles	20
Total	--	45
¹ It is assumed that 10 of the 35 MDWs would be directionally drilled from the 25 estimated pads.		

MDWs are drilled during the construction season before the longwall panel they are located within is to be mined. The set of MDWs within a panel are drilled at approximately the same time over a period of several weeks. A methane pump is installed at each MDW. The methane pump requires weekly inspection and maintenance while in operation. Methane pump operations commence after the longwall has mined past the MDW and cease when the longwall panel has been mined out. Figure 1 provides a photo of a typical methane pump.

For the purposes of the effects analyses in this EA, it is assumed that surface disturbance would occur periodically over the life of the lease. The majority of the lease disturbance is expected to occur within 2 to 4 years of lease issuance; however, it could be about 25 years from lease issuance to lease relinquishment and final bond release. Exact locations of anticipated disturbance cannot be identified at the leasing stage, due to the competitive nature of coal leasing and because a final mine operations plan has not been approved. It is assumed that 35 MDWs would be needed over the life of the lease. It is also assumed that 25 well pads would be needed for the 35 wells; 10 of the MDWs could be completed using directional drilling from pads containing two MDWs. Each pad would require one acre of disturbance. Associated temporary access road acres assume a 30-foot average disturbance width with a 14-foot running surface.

It is highly unlikely that all 35 MDWs would be constructed and/or venting at the same time. Similar to what has been seen in other North Fork mine operations, it is estimated that 6 to 8

MDWs would be in operation at any given time and life of an MDW varies from 1 to 3 years depending on placement in the panel. Typically, in a given summer, the MDWs for the next year's operations are drilled, and the MDWs from the panel mined 2 years previous are reclaimed. However, because the mine plan is not yet known, the exact number of wells that would be operational, constructed, or reclaimed each year is unknown.

It is common practice, and therefore assumed that if any exploration drilling, staging areas, and groundwater monitoring drill pads and access road construction are needed, they would utilize the same locations as those used for MDWs. Therefore, no additional surface use beyond that assumed above for MDWs is analyzed in this document.

Other post-leasing surface disturbance that could be reasonably anticipated includes, but is not limited to, exploration drilling, groundwater monitor well installation, water handling facilities, subsidence and hydrology monitoring facilities, and associated access roads.



Figure 1
Typical Methane Pump

Subsidence and hydrology monitoring may require placement of monitoring devices on the land surface. These may include small subsidence monuments, survey markers, stream gauges, flumes, etc. Access to the facilities would require motorized vehicles that would use the system of existing roads. At the leasing stage, it is not possible to locate site-specific areas where potential post-lease surface uses may occur because the ultimate lease and subsequent mine plan have not yet been approved; therefore, surface use and disturbance cumulative effects are estimations and will be used to aid the impact analysis discussed in each resource section. If

surface uses are proposed during the life of the lease (if it is issued), then the site-specific proposals would be evaluated during subsequent permitting processes through the DRMS and/or the OSM based on surface use stipulations on the lease.

MDW abandonment would follow USFS, BLM, and state guidelines. Holes would be sealed using cement or other approved sealant from the bottom of the hole to within 3 feet of the surface. Drill cuttings may be mixed with the sealant. The surface casing would be cut off below the ground surface. That portion of the hole between the seal and the reclaimed ground surface would be filled with dirt, drill cuttings, or both to minimize hazards to animals or humans. Hole locations would be marked with a 4-foot (minimum) steel roof bolt, brass survey cap, or a T-shaped fence post.

Mining on the existing leases and proposed lease tract would be short term, lasting approximately 3 to 4 years. Due to the economic limitations of this short-term operation, the Proposed Action would include venting methane gas directly into the atmosphere via MDWs and the mine ventilation system (see section below, Alternatives Considered but Eliminated from Detailed Analysis).

Design Features of the Proposed Action

The Proposed Action includes conditions for protection of non-coal resources in the form of lease stipulations derived from restrictions developed from application of the Coal Unsuitability Criteria from 43 CFR 3461 (see Appendix A), the Forest Plan, previous related environmental analyses, policy, and law. These are listed in each respective resource section and are summarized in Appendix C.

In accordance with Forest Service Manual (FSM) 2820, the Standard Notice for Lands under the Jurisdiction of Agriculture would apply to the LBA. This Standard Notice includes requirements for Cultural and Paleontological Resources, and Threatened and Endangered Species. Further, the Standard Notice contains the following language: “The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of an exploration plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by the permit/operation approved by the Secretary of the Interior.”

No Action Alternative

In accordance with NEPA and the Council on Environmental Quality (CEQ) regulations, which require that a No Action Alternative be presented in all environmental analyses in order to serve as a “baseline” or “benchmark” from which to compare all proposed “action” alternatives, this EA analyzes a No Action Alternative.

Under the No Action Alternative, the coal lease would not be approved. As a result, federal coal reserves within the applied for tract would not be recovered and would, therefore, be bypassed.

Alternatives Considered but Eliminated from Detailed Analysis

If an alternative is considered during the environmental analysis process, but the agency decides not to analyze the alternative in detail, the agency must identify those alternatives and briefly explain why they were eliminated from detailed analysis (40 CFR 1502.14). An alternative may be eliminated from detailed analysis if:

- it is ineffective (does not respond to the Purpose and Need for the Proposed Action);
- it is technically or economically infeasible (considering whether implementation of the alternative is likely, given past and current practice and technology);
- it is inconsistent with the basic policy objectives for the management of the area [such as, not in conformance with the Resource Management Plan (RMP)];
- its implementation is remote or speculative;
- it is substantially similar in design to an alternative that is analyzed; and/or
- it would result in substantially similar impacts to an alternative that is analyzed.

Alternatives specific to this EA that were considered, but that will not be analyzed in detail, are discussed below.

Subsidence

Two alternatives were suggested verbally to the agencies by Terror Ditch and Reservoir Company (TDRC) to analyze subsidence for the West Terror Creek drainage by either controlling or preventing subsidence to provide protection for the drainage. Regardless of the protection provided, both alternatives would result in a subsidence protection (or buffer) zone that would be determined using an angle of draw (i.e., angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence). The subsidence buffer zone is depicted in Figure 2.

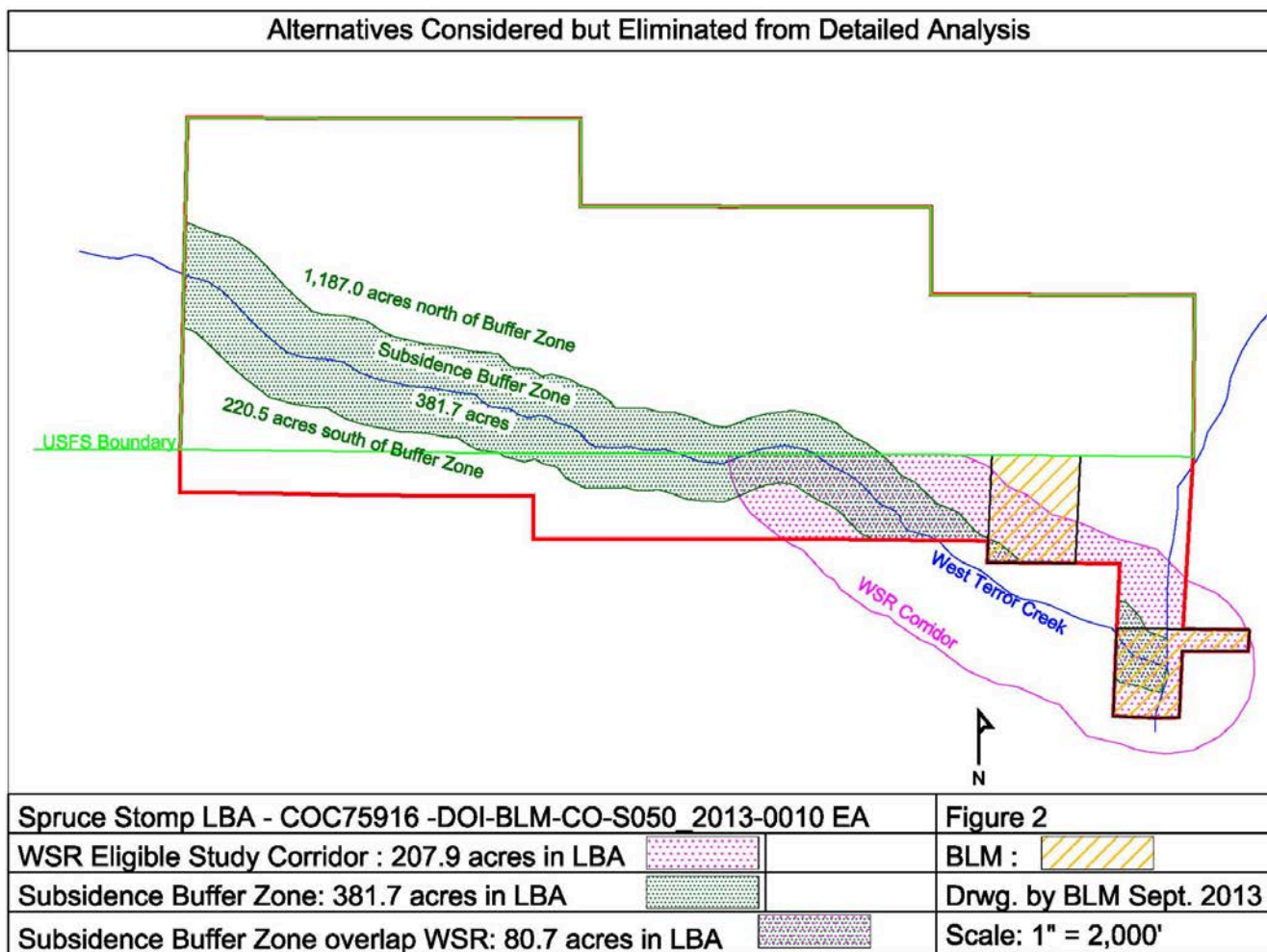


Figure 2 Subsidence Alternatives Considered but Eliminated

The following are common to both alternatives:

1. The buffer zone estimated angle of draw is conservatively estimated to be 25 degrees (North Fork Coal EIS USFS and BLM, 2000).
2. The result would be a winding corridor defining the buffer zone that would get wider in the higher elevations of the drainage and comprise 381.7 acres.
3. The buffer zone would run roughly west-northwest across the tract and break the tract into three portions with the buffer zone in the middle, a 1,187.0-acre northern section, and a 220.5-acre southern section.
4. The buffer zone would overlap the ½ mile wide Wild and Scenic River study corridor established on BLM and private surface/federal minerals on 80.7 acres of the LBA. The buffer zone would not supersede the Wild and Scenic River study corridor.
5. The buffer zone would result in avoiding surface impacts in the drainage.
6. The buffer zone would run counter to the report on surface impacts that concluded that neither adverse impacts to aquatic life nor the wetted perimeter of West Terror Creek would be expected as a result of potential subsidence within the LBA tract (Wright Water Engineers - WWE, 2013a).
7. Neither alternative would be carried forward for detailed analysis because they are ineffective and do not respond to the purpose and need for the Proposed Action.

Control Subsidence in West Terror Creek Alternative. This alternative would allow development mining only (i.e., support pillars left in place) in the buffer zone. There would be reduced coal recovery within the buffer zone and its sinuous shape would interfere with a mine layout that would otherwise be more efficient for the LBA tract. As a result coal recovery in the LBA would be reduced by about 50 percent from an estimated 8.02 to 4.00 million tons.

Prevent Subsidence in West Terror Creek Alternative. This alternative would deny any type of mining in the buffer zone. The buffer zone itself and the portion of the proposed tract north of the buffer zone would be completely inaccessible, thereby making them both unmineable. The proposed tract would be rejected and the BLM would delineate a tract to contain only mineable coal south of the buffer zone which would be approximately 220.5 acres or 12.3 percent of the proposed tract and represent about 87 percent less recoverable coal reserves. That tract would not likely support any competitive bonus bid.

Coal Mine Methane (CMM) and Gob Vent Gas (GVG) Capture

An alternative analyzing the capture of CMM from the mine ventilation system and GVG released from the MDW was considered; however, the alternative was not carried through the entire analysis process. The alternative was eliminated from detailed analysis due to the anticipated environmental impacts associated with methane capture [i.e., new pipelines to each well site, improved roads to service the MDWs, power lines to a variety of facilities (wells, compressors, etc.)] as well as the cost associated with the infrastructure required.

In December 2012, Bowie provided the BLM with a report (Vessels Coal Gas Inc., 2012) evaluating the technical and economic feasibility to capture CMM and GVG within the lease area. Vessels Coal Gas, Inc. (VCG) evaluated the technical capability and potential for uses of methane recovered from the Bowie No. 2 Mine. VCG is a Denver based company, developing

and operating coal mine methane producing properties in the Rocky Mountain and Appalachian coal basins.

Separately, VCG has performed numerous evaluations for gathering methane from various coal mine sources in the Paonia to Somerset corridor along the North Fork of the Gunnison River. In general, those evaluations have indicated a need for volumes on the order of 10,000,000 cubic feet per day of methane to justify the costs for gas treating and pipeline facilities that would be required to access commercial natural gas markets. The volumes of gas available from the GVG at the Bowie No. 2 Mine are less than 1,000,000 cubic feet per day of methane. VCG has recently completed construction of an electric generation and enclosed flare project, utilizing methane emissions from the nearby Elk Creek Coal Mine operated by Oxbow Mining. The economics of this project were supported by a successful negotiation of a favorable electric power purchase agreement with Holy Cross Energy and a carbon offset contract for enclosed flare destruction with Xcel Energy, each of which was negotiated before the recent fall in carbon offset prices. Carbon offset prices from an enclosed flare project are not likely to improve as readily as carbon offsets from a beneficial use project such as electricity generation might.

The report notes that the Climate Action Reserve has placed a higher ranking within its development of carbon reduction protocols on beneficial use as opposed to methane destruction projects. VCG concluded that the current conditions at the Bowie No. 2 Mine make current methane capture technologies economically unfeasible. Methane released to the atmosphere from the Bowie No. 2 Mine activity has two principal avenues:

- High volume circulation of ventilation air through the underground mining access corridors that is subsequently exhausted to atmosphere; and
- MDWs drilled from the surface to locations immediately above the longwall panels that are used to remove methane released during the mining of longwall panels for the safety of the mine workers.

As indicated in the VCG report, the geographic location of the proposed new longwall panels would be too far from the existing Bowie surface facilities to provide ready access to facilities for GVG to be made available for either electric or natural gas markets or to utilize process heat loads.

While the BLM does not analyze methane capture in the alternatives carried forward in this EA, nothing in this document would prevent any lessee, if the lease is issued, from voluntarily implementing a methane capture project in the future if it is determined to be feasible and all needed permits and authorizations are acquired.

Reduce Potential Greenhouse Gas Emissions through Methane Flaring

An alternative analyzing the flaring of CMM was also considered and eliminated from detailed analysis. Any proposed flaring system intended for use at a coal mine in the United States would need to be approved by MSHA. MSHA has a process in place to analyze the safety aspects of a proposed design and would conduct a thorough review of the proposed flaring system in order to establish the requirements for the system. It is not likely that a thorough review and approval

would occur prior to the development and operation of the mine expansion. To date, MSHA has not approved a flaring system for a coal mine in the Western U.S. MSHA has authorized a flaring system for Solvay's underground trona mine near Green River, Wyoming. This degasification system was commissioned in August 2010 and is currently in operation. Trona mines have similar characteristics to underground coal mines in terms of their methane gas production and mining techniques. However, trona is a non-combustible ore, while coal is highly combustible. Because of the combustibility of coal, and associated concerns for miner safety, the flaring system in use at Solvay cannot be considered for an underground coal mine.

Additionally, flaring of methane can result in the release of other air pollutants, including NO₂ and carbon monoxide (CO), which are criteria pollutants. The following was considered in relation to methane flaring:

- As indicated in the VCG report, to reduce methane emissions from the GVG, conventional flaring technology could be used to destroy the methane.
 - Production of methane for flaring would occur approximately 80 percent of the time for 5 to 6 months. Exhibit C to the VCG report provides a summary of MDW flow and methane concentration data.
 - Absent a significant increase in both a) market valuations of carbon offsets from capture of methane associated with coal mining and b) the levels of methane emissions from the Bowie No. 2 Mine, economic returns are far below that necessary to provide any reasonable incentive to a carbon project developer to consider investing in facilities to capture the methane emissions associated with the currently proposed Bowie No. 2 Mine operating plan.

While the USFS and BLM did not analyze methane flaring in the alternatives carried forward in this EA, nothing in this document prevents any lessee, if the lease is issued, from voluntarily implementing a methane flaring project in the future if it is determined to be feasible and all needed permits are acquired.

Public Involvement

SCOPING AND IDENTIFIED ISSUES

As part of the public involvement process, letters were mailed to more than 700 interested parties (i.e., private landowners, government agencies, businesses, and advocacy groups) and a public notice/legal ad outlining the Proposed Action as well as the BLM's and the USFS' intent to prepare an EA analyzing the application was published. The legal ad was published in the Delta County Independent and the Grand Junction Daily Sentinel, newspapers of record for the agencies. The proposal and a map were posted to the BLM UFO website at <http://www.blm.gov/co/st/en/fo/ufo.html> and the USFS website at <http://www.fs.usda.gov/goto/sprucestomp>. The BLM and the USFS invited the public to provide comments on the proposal for 30 days beginning January 16, 2013 and ending 30 days following the date of publication of the legal notice (ended February 22, 2013).

During the comment period, 20 comment letters were received, including 1 from Colorado Parks and Wildlife (CPW), 2 from Delta County, 1 from Western Area Power Administration

(WAPA), and 1 from a recreation advocacy group. Additionally, 11 letters from business and industry interests and 4 letters from individuals were received in support of the project. All comment letters were reviewed and considered in the development of the EA. The following is a summary of those comments and responses by resource:

Air Quality. One comment expressed support for the proposed MDWs.

Fish and Wildlife. CPW noted the entire area is within deer and elk winter range. Recommendations include implementing seasonal timing restrictions to address impacts to wintering big game; avoiding stream disturbances during June and July to avoid impacts to spawning cutthroat trout; and fencing and netting the reserve pits to exclude wildlife access. Additionally, CPW recommends that bear proof waste containers be used to avoid conflicts with bears.

General. Several comments in support of the project were received, citing past business practices of Bowie, enhanced coal recovery, and the positive socioeconomic impacts to the region.

Land Use. WAPA asked that the BLM require a stipulation requiring the lessee to avoid negatively impacting the authorized rights-of-way; if impacts are unavoidable, then the BLM will consult with the right-of-way holder. WAPA specifically requested that the stipulations include a 100-foot clearance from any underground mining activities around the transmission line structure foundations

Migratory Birds. CPW recommended preconstruction raptor surveys and requested CPW's raptor nest buffer guidelines be followed.

Noxious and Invasive Species. One comment recommended controlling weeds on newly disturbed areas.

Reclamation. A comment stated that the GVB drill pads and associated roads are temporary features that will be fully restored upon completion of the mining activities. CPW recommended reseeding with wildlife friendly seed mix.

Recreation. Thunder Mountain Wheelers stated that public recreational use, specifically big game hunting, would not be negatively impacted.

Socioeconomics. Numerous comments were in support of the project, citing the positive socioeconomic benefits from coal mining in the area.

Transportation and Access. CPW recommended keeping the drill roads closed to public use and reclaiming all new roads and pads as drilling is accomplished. WAPA asked that the BLM include a stipulation in the lease to ensure protection of WAPA's transmission line and access and maintain a minimum 100-foot clearance from any underground mining activities around the transmission line structure foundations. Additionally, no access or spur road should be blocked, damaged or otherwise occupied such that WAPA linemen and others responsible for the

maintenance and operation of WAPA's transmission lines are prevented from completing their work.

Threatened and Endangered/Special Status Species. CPW raised special concern regarding impacts to greenback cutthroat trout in the Terror Creek drainage, recommending no surface disturbance within 300 feet of any water within the Terror Creek Watershed and minimizing stream disturbances during June and July to avoid impacts to spawning cutthroat trout. Additionally, a recommendation was made to minimize impacts to migratory birds, including nesting raptors.

Wetland and Water Resources. CPW recommended using the best methods possible to control runoff to reduce silt buildup in area waterways; no surface disturbance within 300 feet of any water within the Terror Creek Watershed; locating staging and refueling, or chemical storage areas, outside riparian zones and floodplains; and disinfecting equipment and tools previously used in a river, stream, lake, pond or wetland prior to moving to another waterbody to avoid spreading aquatic nuisance species or other undesirable biota.

Public Review of Preliminary EA

Approximately 15 letters or other forms of comment were received on the preliminary EA during the 30-day public review period. They include: one from the National Park Service, one from Western Area Power Administration, two from environmental groups, and one from Bowie Resources LLC. Five sets of comments from business/industry interests expressed concerns about the Proposed Action and five comments from individuals supported the Proposed Action. All comments were reviewed and considered in the development of the final EA. These comments are on file with the BLM. The following is a general summary of the comments and agency responses by resource:

Air Quality. Comments questioned the analysis completed in the preliminary EA. Requests were made for a greater level of analysis of coal combustion at power plants utilizing the coal produced at the mine. Additional detail was also requested related to volatile organic compound (VOC) emissions associated with methane venting activities. Other comments were related to dust from vehicle travel associated with mine development in the future.

Agency Response. The EA Air Quality section provides emission calculations using average emissions for combustion at U.S. facilities. The EA notes that the current Bowie No. 2 Mine is not a significant source of NO_x and VOC emissions (the photochemical reactivity potential of methane in the troposphere is considered negligible [40 CFR 51.100(s)]) and therefore operations at the mine are not expected to contribute significantly to any regional ozone formation potential. The Air Quality section includes stipulations to prevent or minimize fugitive dust. The EA is tiered to the 2000 North Fork Coal EIS and has described and analyzed the air resources based upon the most current information and standards available.

Fish, Migratory Birds and Wildlife. Concern was expressed about proposed mitigation for the greenback cutthroat trout, migratory birds, and habitat for species which occupy the West Fork of Terror Creek and the LBA tract.

Agency Response. Several changes to the text have been made in the proposed stipulations protecting wildlife.

General. Several comments in support of the project were received, citing past business practices of Bowie, enhanced coal recovery, and the positive socioeconomic impacts to the region.

Agency Response. No changes to text required.

Watershed, Water Systems/Storage and Land Use. Concern was expressed about the impacts of mining and exploration activity on the integrity of water collection, storage and distribution systems, and the watershed.

Agency Response. The stipulations in the Geology and Minerals section, as well as the Threatened and Endangered Species section, would protect all surface resources, including any water collection, and storage and distribution systems. Additional language has been added to the stipulations requiring an augmentation plan and additional post mining water quality, quantity, and habitat monitoring. Additional review of the mine plan will occur, as noted in the introduction to the EA, and new or additional stipulations could be added at that time.

Soils and Reclamation. Comments expressed concern that much of the area is characterized by steep, unstable, highly erodible slopes and requested that a no surface occupancy stipulation be placed on slopes in excess of 40 percent.

Agency Response. The stipulations in the Geology and Minerals section ensure adequate overview of surface disturbance on steep slopes. The stipulations include:

- No surface occupancy would be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.

Mitigation and Monitoring. Comments requested that prior to commencement of mining operations beneath West Terror Creek, in-stream flow monitoring, both above and below the surface areas affected by mining influence be in place and operational. The purpose of such monitoring is to determine whether water is being lost in transit over the affected area.

Agency Response. The stipulations in the Geology and Minerals and the Threatened and Endangered Species sections would protect all surface resources. Stipulations include:

- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the lessee, at their expense will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace

any surface water and/or developed groundwater source, stock pond, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, livestock and wildlife use, or other land uses as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.

- The operator/lessee would be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee would be required to establish or amend a monitoring program to be used as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program shall provide the procedures and methodologies to adequately assess interrelationships between geology, topography, hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program shall incorporate baseline data so as to provide a continuing record over time.

Environmental Policy. Commenters requested that the BLM and FS prepare an Environmental Impact Statement to analyze and assess the impacts of the proposed lease. They did not support the BLM/FS Finding of No Significant Impact on the Spruce Stomp Lease Application.

Agency Response. Both agencies have taken a comprehensive and thoughtful review of the proposed impacts to the possible issuance of a coal lease in the future. The agencies have extensive experience in assessing and monitoring all of the mines in the North Fork Valley. The subsidence report prepared and reviewed by the agencies presents a professional analysis that supports the conclusions in the EA. In addition, as described in the EA, the Proposed Action is not anticipated to result in effects to water quality or quantity. The stipulations in the Geology and Minerals section, as well as the Threatened and Endangered Species section, would protect all surface resources, including any water collection and storage and distribution systems. This EA is tiered to the North Fork Coal EIS completed in 2000. Based on the analyzed effects, an EA is appropriate under NEPA.

Wetland and Water Resource. The proposed expansion of coal extraction would be in the West Terror Creek watershed and beneath West Terror Creek. Comments expressed preference that no subsidence be allowed directly beneath West Terror Creek. Concerns included runoff damaging irrigation structures and delivering silt into the ditch system and damage to county roads, etc.

Agency Response. As described in the EA, the Proposed Action is not anticipated to result in effects to water quality or quantity. After the lease is awarded, the mine plan review process, described in the introduction section of the EA, would require no loss of water. The stipulations in the Geology and Minerals section, as well as the Threatened and Endangered Species section, would protect all surface resources, including any water collection and storage and distribution systems. The EA has been modified to add language requiring an augmentation plan and additional post mining water quality, quantity, and habitat monitoring.

PLAN CONFORMANCE REVIEW

The Proposed Action is subject to, and has been reviewed for, conformance with the BLM Unsuitability Criteria for coal leasing (see Appendix A), the BLM Resource Management Plan (RMP), and the USFS Land and Resource Management Plan (LRMP or Forest Plan).

Bureau of Land Management

The Proposed Action is in conformance with the following BLM RMP (BLM, 1989) (43 CFR 1610.5-3, 1617.3):

Name of Plan: Uncompahgre Basin RMP

Date Approved: July 26, 1989, as amended

Decision Number/Page: Management Unit 7, pg. 21, and Management Unit 9, pg. 22.

Decision Language: Management Unit 7: “The management unit will be managed for both existing and potential coal development. Development of existing coal leases will continue and non-leased federal coal will be identified as acceptable for further coal leasing consideration with a minimum of multiple-use restrictions. Activities and land uses that are consistent with maintaining existing coal operations and the potential for coal development will be permitted.”

Management Unit 9: “The management unit will be managed to restore and enhance riparian vegetation along 48 miles of streams.” “Coal development will be considered on a site-specific basis after consultation with affected entities and formulation of mitigating measures.”

USDA Forest Service

The Proposed Action is in conformance with the following Forest Service Plan:

Name of Plan: 1991 Amendment of the GMUG Land and Resource Management Plan

Date Approved: September 1991

Decision: The GMUG National Forests made provisions for coal leasing subject to the application of the coal unsuitability criteria established in 43 CFR 3461 (see Appendix E to the LRMP). In addition, as allowed in 43 CFR 3461.2-1(b)(1) and 3461.3-1(b)(1), the specific lands in this proposal was reviewed for unsuitability by the Forest Service and a recommendation to the Secretary of the Interior will be made who will determine whether there are no significant recreational, timber, economic, or other values which may be incompatible with the lease (43 CFR 3461.5(2)(i), see Appendix A-Unsuitability Analysis Report). None of the lands were found to be unsuitable based on the criteria; see Appendix A-Unsuitability Analysis Report). The LRMP also provided for criteria to consider for the applicable protection of specific surface resources as addressed in Section III, General Direction, pages 63-69 of the LRMP.

Multiple use management area prescriptions as designated in the Forest Plan for the lands bounded by the LBA tract are summarized below:

- 4B-Wildlife habitat management for one or more management indicator species. Livestock grazing will be compatible with wildlife habitat management.
- 4C-Wildlife habitat improvement. Vegetation treatment in hardwood and shrub dominated land. Livestock grazing will be compatible with wildlife habitat management.
- 9A-Riparian/Aquatic Ecosystems. Emphasis is on the management of all the components of aquatic/riparian ecosystems to provide healthy, self-perpetuating plant communities, acceptable water quality standards, and habitats for viable populations of fish and wildlife, and stable stream channels and still water body shorelines. Mineral activities may occur but must minimize disturbance to riparian areas and initiate timely and effective rehabilitation of disturbed areas and restore them to a state of productivity comparable to that before disturbance.

The Proposed Action conforms to the overall guidance given in the LRMP, as amended (1991), which encourages environmentally sound energy and mineral development. No additional restrictions or need for stipulations were identified as a result of applying the criteria (see Appendix A).

Other Related NEPA Documents:

This EA tiers to the 2000 USFS and BLM Environmental Impact Statement (EIS) for the Iron Point Exploration License, the Iron Point Coal Lease Tract and the Elk Creek Coal Lease Tract (North Fork Coal EIS - USFS and BLM, 2000). The air quality modeling and analysis included in the 2000 North Fork Coal EIS (pages 3-3 to 3-17 and Appendix M) has been used and updated for the air quality analysis in this EA (additional air quality data was used in this analysis, see the Air Quality and Climate section below). The transportation and geology sections of the North Fork Coal EIS have also been used in this EA analysis.

In August 2012, the BLM completed EA-DOI-BLM-CO-SO50-2012-0001, which was related to modifications of Bowie coal leases COC-37210 and COC-61209 of approximately 502.43 acres. The lease modifications have been approved and issued by the BLM.

Standards for Public Land Health

In January of 1997, the Colorado BLM approved the Standards for Public Land Health (see Table 2). These standards describe conditions needed in order to sustain public land health in relation to all uses of public lands. A finding for each Standard has been made in the Affected Environment and Environmental Consequences/Stipulations section of this EA. These findings only apply to the BLM land and mineral resources within the LBA tract.

Table 2
Standards for Public Land Health

Standard	Definition/Statement
Standard 1 Upland Soils	Upland soils exhibit infiltration and permeability rates that are appropriate to soil type, climate, land form, and geologic processes. Adequate soil infiltration and permeability allows for the accumulation of soil moisture necessary for optimal plant growth and vigor, and minimizes surface run-off.
Standard 2 Riparian Systems	Riparian systems associated with both running and standing water function properly and have the ability to recover from major surface disturbance, such as fire, severe grazing, or 100-year floods. Riparian vegetation captures sediment, and provides forage, habitat, and bio-diversity. Water quality is improved or maintained. Stable soils store and release water slowly.
Standard 3 Plant and Animal Communities	Healthy, productive plant and animal communities of native and other desirable species are maintained at viable population levels commensurate with the species and habitat's potential. Plants and animals at both the community and population level are productive, resilient, diverse, vigorous, and able to reproduce and sustain natural fluctuations, and ecological processes.
Standard 4 Threatened and Endangered Species	Special status, threatened and endangered species (federal and state), and other plants and animals, and their habitats, officially designated by the BLM, are maintained or enhanced by sustaining healthy, native plant and animal communities.
Standard 5 Water Quality	The water quality of all waterbodies, including groundwater where applicable, located on or influenced by BLM-managed public lands will achieve or exceed the Water Quality Standards established by the State of Colorado. Water Quality Standards for surface and ground waters include the designated beneficial uses, numeric criteria, narrative criteria, and anti-degradation requirements set forth under state law as found in (5 CCR 1002-8), as required by Section 3031 of the Clean Water Act.

AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND STIPULATIONS

This section describes the human and natural environmental resources that could be affected by the Proposed Action and presents comparative analyses of the direct and indirect effects on the environment. A description of the past, present, and reasonably foreseeable actions is included at the end of this section.

Within each resource area, evaluation of impacts is intended to provide an impartial assessment to help inform the decision-maker and the public. The impact analysis does not imply or assign a value or numerical ranking to impacts. Actions resulting in adverse impacts to one resource may impart a beneficial impact to other resources. In general, adverse impacts described in this section are considered important if they result from, or relate to, the implementation of any of the alternatives. These impacts are defined as follows:

- Direct impacts – Impacts that are caused by the action and that occur at the same time and in the same general location as the action. For purpose of impact assessment, impacts caused by mine subsidence are not considered to be surface disturbance in the EA due to the depth of overburden within the tract and the unlikely occurrence of observable surface disturbance.
- Indirect impacts – Impacts that occur at a different time or in a different location than the action to which the impacts are related.
- Short or long-term impacts – When applicable, the short-term or long-term aspects of impacts are described. For the purposes of this EA, short-term impacts occur during or after the activity or action and may continue for up to 2 years. Long-term impacts occur beyond the first 2 years.
- Cumulative impacts - Cumulative impacts are impacts on the environment that result from incremental impact of the action when added to other past, present, and reasonably foreseeable future action. For each resource, an analysis area was defined to adequately measure cumulative effects of each alternative. Reasonably foreseeable surface use described in **Cumulative Impacts Section** is considered in the direct and indirect effects analysis and in the cumulative effects section.

Elements specified by statute, regulation, executive order, other resources, or the Standards for Public Land Health are described and analyzed in this section. Table 3 lists the elements considered in this section; those that could be impacted are brought forward for analysis. Any element not affected by the Proposed Action or No Action alternatives will not be analyzed in this document, and the reasons for no impact will be stated. Environmental impact analysis was based upon available data and literature from state and federal agencies, peer-reviewed scientific literature, and resource studies conducted in the proposed lease application area.

There are no Areas of Critical Environmental Concern (ACECs), Wilderness Areas, Lands with Wilderness Characteristics, Colorado Roadless Areas, Prime or Unique Farmlands, or Floodplains within the LBA tract. In addition, Timber Management is not brought forward for analysis, because while the area contains NFS lands, the predominant land use is not timber production.

Table 3
Environmental Assessment Resource Areas

Element	Not Applicable or Not Present	Present, but No Impact	Applicable and Present; Brought Forward for Analysis
Air Quality and Climate			X
ACEC	X		
Wilderness	X		
Lands with Wilderness Characteristics	X		
Wild and Scenic Rivers			X
Cultural Resources			X
Native American Religious Concerns	X		
Farmlands, Prime/Unique	X		
Soils			X
Vegetation			X
Invasive, Non-native Species			X
Threatened and Endangered Species			X
Migratory Birds			X
Wildlife, Terrestrial			X
Wildlife, Aquatic			X
Wetlands and Riparian Zones			X
Floodplains	X		
Water Quality, Surface and Ground			X
Wastes, Hazardous or Solid			X
Environmental Justice		X	
Access			X
Transportation			X
Cadastral Survey	X		
Realty Authorizations			X
Range Management			X
Timber Management		X	
Wildfire			X
Hydrology/Water Rights			X
Noise			X
Recreation			X
Visual Resources			X
Geology and Minerals			X
Paleontology			X
Law Enforcement	X		
Socio-Economics			X

AIR QUALITY and CLIMATE

Affected Environment

The project effects and cumulative analysis area for air quality is the upper portion of the regional airshed, which generally corresponds to the watershed for the North Fork of the Gunnison River upstream from Paonia.

Paonia, Colorado is located in the North Fork Gunnison River Valley at an elevation of approximately 5,682 feet. The area is rural with mountainous terrain. The normal temperatures (min and max) for the area range from 14.4 to 38.6 °F in January to 53.4 to 88.9 °F in July. The

average annual precipitation amounts to approximately 14.02 inches, which according to historical records is relatively evenly distributed throughout the year. Average annual wind resultants are generally from the southeast at a speed of approximately 7.1 miles per hour (mph). The area enjoys sunshine for approximately 70 percent of the time and has an annual average sky cover of around 52 percent (Western Regional Climate Center, 2012).

Air quality in the region, which is generally made up of smaller towns, usually located in fairly broad river valleys, is affected by multiple activities currently conducted within the area. The lease tract is located near the boundaries of Delta and Gunnison counties, and so it is reasonable to conclude that indirect and cumulative effects for the area would be influenced in the near field by sources of emissions within each county's respective emissions inventory. Activities occurring within the region that affect air quality include stationary facilities such as coal mining and subsequent coal mining operations (e.g., loading), concrete mix plants, gravel pits, lime storage facilities, natural gas-fired electrical generating plants, natural gas dehydration facilities, landfills, etc. Portable source examples include facilities such as gravel crushers, associated processing equipment, and asphalt plants. Mobile sources of emissions within the region include highway or on-road vehicles, and off-road vehicles such as construction-related equipment (dozers, loaders, backhoes, etc.) and recreational vehicles (snowmobiles, all terrain vehicles - ATVs, and dirt bikes). Smoke from grass and forest fires represent area source emissions that can have an impact on air quality.

Regulatory Framework

The Clean Air Act (CAA), which was last amended in 1990, requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) (40 CFR 50) for criteria pollutants. Criteria pollutants are air contaminants that are commonly emitted from the majority of emissions sources and include carbon monoxide (CO), lead (Pb), sulfur dioxide (SO₂), particulate matter (including PM₁₀, which refers to particles smaller than 10 microns in effective diameter, and PM_{2.5}, which refers to particles smaller than 2.5 microns in effective size), ozone (O₃), and nitrogen dioxide (NO₂).

The CAA established two types of NAAQS:

Primary standards: – Primary standards set limits in order to protect public health, including the health of "sensitive" populations (such as asthmatics, children, and the elderly).

Secondary standards: – Secondary standards set limits in order to protect public welfare, including protection against decreased visibility, and damage to animals, crops, vegetation, and buildings.

The EPA regularly reviews the NAAQS (every 5 years) to ensure that the latest science on health effects, risk assessment, and observable data such as incidence rates are evaluated in order to re-propose any NAAQS to a lower limit if the data supports the finding.

The Colorado Air Pollution Control Commission, by means of an approved State Implementation Plan (SIP) and/or delegation by the EPA, can establish state ambient air quality

standards for any criteria pollutant that is at least as stringent as, or more so, than the federal standards. Ambient air quality standards must not be exceeded in areas where the general public has access. Table 4 lists the federal (NAAQS) and the Colorado Ambient Air Quality Standards (CAAQS) ambient air quality standards.

Table 4
Ambient Air Quality Standards ¹

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		Primary and Secondary	Rolling 3-month average	0.15 µg/m ³ ⁽²⁾	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		Primary	1-hour	100 ppb	98 th percentile, averaged over 3 years
		Primary and Secondary	Annual	53 ppb ⁽³⁾	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		Primary and Secondary	8-hour	0.075 ppm ⁽⁴⁾	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution [Dec. 14, 2012]	PM _{2.5}	Primary and Secondary	Annual	12 µg/m ³	Annual mean, averaged over 3 years
			24-hour	35 µg/m ³	98 th percentile, averaged over 3 years
	PM ₁₀	Primary and Secondary	24-hour	150 µg/m ³	Not to be exceeded more than once per year on average over years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sep 14, 1973]		Primary	1-hour	75 ppb ⁽⁶⁾	99 th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Primary	Annual	0.0267 ppm ⁽⁷⁾	Arithmetic Average
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) National Ambient Air Quality Standards (<http://www.epa.gov/air/criteria.html>).

(2) Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m³ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated non-attainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

(3) The official level of the annual NO₂ standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard (“anti-backsliding”). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

(5) The PM_{2.5} Secondary Standard (Annual) --15 µg/m³--annual mean, averaged over 3 years

(6) Final rule signed June 2, 2010. The 1971 annual and 24-hour SO₂ standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated non-attainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved. (b) The 1997 standard—and the implementation rules for that standard—will remain in place for implementation purposes as EPA undertakes rulemaking to address the transition from the 1997 ozone standard to the 2008 ozone standard. (c) EPA is in the process of reconsidering these standards (set in March 2008).

(7) Colorado Primary Standard

NOTE: Air quality in the Delta and Gunnison County Air Sheds currently meets all NAAQS and CAAQS.

Emissions Source Classifications and Regulatory Authority

Emissions sources are generally regulated according to their type and classification. Essentially all emissions sources fall into two broad categories, stationary and mobile. Stationary sources are generally non-moving, fixed-site producers of pollution such as power plants, chemical plants, oil refineries, manufacturing facilities, and other industrial facilities. This source class can also cover certain types of portable sources. Stationary facilities emit air pollutants via process vents or stacks (point sources) or by fugitive releases (emissions that do not pass through a process vent or stack). Stationary sources are also classified as major and minor. A major source is one that emits, or has the potential to emit, a regulated air pollutant in quantities above a defined threshold (100 or 250 tons per year, depending on the source classification). Stationary sources that are not major are considered minor or area sources. A stationary source that takes federally-enforceable limits on production, consumption rates, or emissions to avoid major source status is considered a synthetic minor source. The Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division (APCD) has authority under their approved SIP, or by EPA delegation, to regulate and issue air permits for stationary sources of pollution in Colorado.

Mobile sources include any air pollution that is emitted by motor vehicles, engines, and equipment that can be moved from one location to another (typically under their own power). Due to the large number of sources, which includes cars, trucks, buses, construction equipment, lawn and garden equipment, aircraft, watercraft, motorcycles, etc., and their ability to move from one location to another, mobile sources are regulated differently than stationary sources. In general, the EPA and other federal entities retain authority to set emissions standards for these sources depending on their type (on-road or off-road) and class (light duty, heavy duty, horsepower rating, weight, fuel types, etc.). Mobile sources are not regulated by the state (the State of California is the exception) unless they are covered under an applicable SIP specific to a non-attainment or maintenance area.

Criteria Pollutants. Of all the criteria pollutants, only ground level ozone and secondary formation particulate matter (PM_{2.5}), also known as condensable particulate matter, are not directly emitted by emissions sources. Ozone is chemically formed in the atmosphere via interactions of oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight and under certain meteorological conditions (NO_x and VOCs are ozone precursors). Ozone formation and prediction is complex, generally results from a combination of significant quantities of VOCs and NO_x emissions from various sources within a region, and has the potential to be transported across long ranges. Therefore, it is typically not appropriate to assess potential ozone impacts of a single project on potential regional ozone formation and transport. Further, the relative amounts of ozone precursor emissions, NO_x and VOCs, that would be emitted from the mine are quite small. Because the area is not currently experiencing any issues with ozone, and there is no anticipated change in the annual emissions of ozone precursors as a result of the tract being mined, photochemical modeling would be quite unlikely to show any measurable impacts from the mine's emissions. For these reasons, ozone will not be further addressed in this document beyond the related precursor discussions. The relative differences in project and regional precursor emissions are available for review in Tables 5 and 6.

The EPA defines PM_{2.5} as particulate matter with an aerodynamic diameter less than or equal to 2.5 microns in size. According to the EPA, the chemical composition of PM_{2.5} is characterized in terms of five major components that comprise the mass of pollutant. In the West, organic carbon (OC) is generally the largest estimated component of PM_{2.5} by mass. Primary emissions of PM_{2.5} are generally from combustion processes with fireplaces, woodstoves, and wildfire being important contributors to OC. A minority component of PM_{2.5} is made up of crustal elements (i.e., fugitive dust). Some types of fine particles are formed in the atmosphere from emissions of nitrogen oxide and sulfur dioxide gases and are referred to as secondary or condensable particulates. The mine does not emit large quantities of these gases when compared with regional emissions. Therefore, secondary PM_{2.5} will not be addressed in more detail than a general discussion of particulates. Further, full photochemical grid modeling (which would be required to quantitatively estimate secondary PM_{2.5} formation) is not appropriate nor warranted at this scale (i.e. individual project level analysis).

Hazardous Air Pollutants (HAPs). Toxic air pollutants, also known as hazardous air pollutants (HAPs), are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. The majority of HAPs originate from stationary sources (factories, refineries, power plants) and mobile sources (e.g., cars, trucks, buses), as well as indoor sources (building materials and cleaning solvents). No ambient air quality standards exist for HAPs, instead emissions of these pollutants are regulated by a variety of laws that target the specific source class and industrial sectors for stationary, mobile, and product use/formulations. The majority of HAPs emitted from Bowie's operations are the result of the on-road and non-road vehicle use.

Greenhouse Gases (GHGs). Gases that trap heat in the atmosphere are often called greenhouse gases, and include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and several fluorinated species of gases such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Carbon dioxide is emitted from the combustion of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Methane is emitted during the production and transport of coal, natural gas, and oil. Methane also results from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills. Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Fluorinated gases are powerful greenhouse gases that are emitted from a variety of industrial processes and are often used as substitutes for ozone-depleting substances (i.e., CFCs, HCFCs, and halons). All of the different gases have various capacities to trap heat in the atmosphere, which are commonly referred to as the gases' global warming potential (GWP). Carbon dioxide has a GWP of 1, and so for the purposes of analysis the global warming potential of a greenhouse gas is generally expressed in terms of carbon dioxide equivalents (CO₂e), or the amount of CO₂ that would possess an equivalent amount of warming potential.

As with the HAPs, ambient air quality standards do not exist for GHGs. In its Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the CAA, the EPA determined that GHGs are air pollutants subject to regulation under the CAA. The most recent rules promulgated to regulate the emissions and the industries responsible are the Mandatory Reporting Rule (74 FR 56260) and the Tailoring Rule (70 FR 31514). Under the

EPA's GHG Mandatory Reporting Rule, underground coal mines subject to the rule are required to report emissions in accordance with the requirements of Subpart FF. Under the provisions of the Tailoring Rule (step 2 – July 2011) a new facility would be subject to Prevention of Significant Deterioration (PSD) permitting if it has the potential to emit GHGs in excess of 100,000 tons per year (tpy) of CO₂e equivalent and 100/250 tpy of GHGs on a mass basis. For existing facilities this review would take place during any subsequent modifications to the facility (CDPHE's anticipated implementation strategy).

The EPA is also planning to develop stationary source GHG emissions reduction rules (New Source Performance Standards - NSPS) that could mandate substantial reductions in U.S. greenhouse gas emissions. Alternatively, Congress may develop cap-and-trade legislation as another means to reduce GHG emissions. Consequently, GHG emissions from coal burned at power plants may be regulated in the near future. The first EPA regulation to limit emissions of GHGs imposed carbon dioxide emission standards on light-duty vehicles, including passenger cars and light trucks. As of April 2013, the EPA had not set GHG emission standards for stationary sources (such as compressor stations); however, the EPA is gathering detailed GHG emission data from thousands of facilities throughout the U.S., and will use the data in order to develop an improved national GHG inventory, as well as to establish future GHG emission control regulations.

Black Carbon. Black carbon is a by-product of incomplete combustion of fossil fuels, biofuels, and biomass. It can be emitted when coal is burned, as well as through tailpipe emissions from engines that use diesel fuel (such as diesel trucks and locomotives). Black carbon, therefore, is a likely by-product that would be emitted from haul trucks used during coal mining operations. Black carbon emissions from diesel tailpipe emissions are largely dependent upon the composition of the diesel fuel, and not upon the type of engine used. Black carbon is an unregulated pollutant; however, the EPA does regulate diesel fuel quality, such that, in recent years diesel fuel quality has been improved.

Black carbon is not emitted from the coal when it is being mined, but is likely to occur when the coal is combusted. Black carbon emissions associated with coal combustion occur at the facility where the coal is being burned, not where it is being mined. It is a component of the anthropogenic global warming phenomenon, and acts to warm the earth's atmosphere by reducing the ability to reflect sunlight (albedo). It is the second highest contributor to global warming; however it is very short-lived, staying in the atmosphere only a few days to a few weeks. This analysis does not quantify or analyze indirect emissions of black carbon associated with the coal's combustion because the BLM cannot determine which facilities will burn the coal (in order to produce electricity). Since power plant facilities differ considerably in their use of emissions controls (which would, in turn, greatly affect the emissions associated with burning the coal), it is not feasible to estimate the black carbon emissions that would result.

Air Quality Designations

Air quality (any geographical area that defines the class boundary) is categorized as either attainment (an area where the air does not exceed NAAQS specified concentrations of a criteria pollutant) or non-attainment (an area where the air does exceed NAAQS specified concentrations

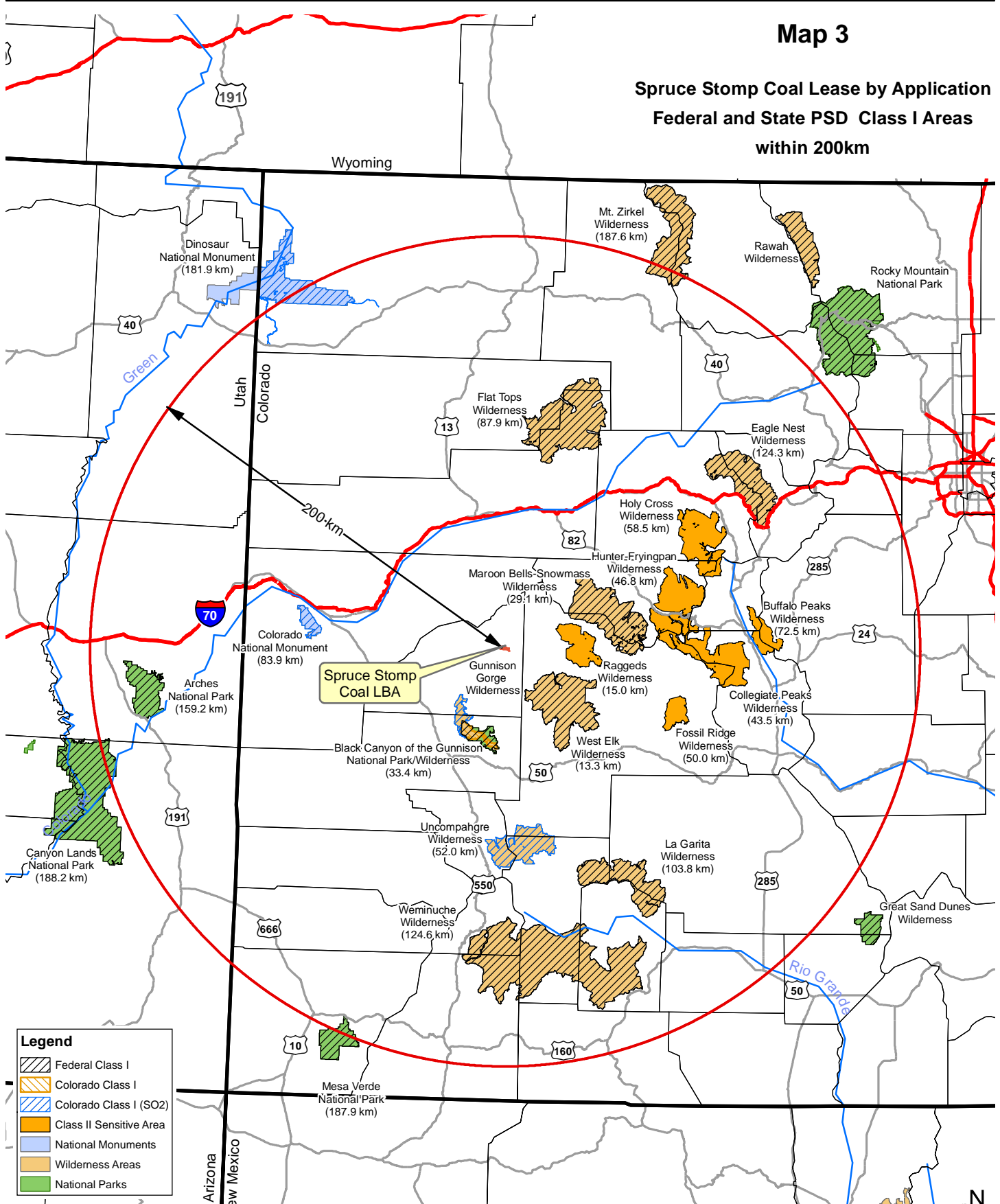
of a criteria pollutant). Two additional subset categories of attainment exist for those areas where a formal designation has not been made, i.e., Attainment/Unclassifiable (generally rural, or natural areas), and for areas where previous violations of the NAAQS have been documented, but pollution concentrations no longer exceed NAAQS concentrations, i.e., Attainment/Maintenance areas. Further, all geographical regions are assigned a priority Class (I, II, or III) which describes how much degradation to the existing air quality is allowed to occur within the area under the PSD permitting rules. Class I areas are areas of special national or regional natural, scenic, recreational, or historic value, and essentially allow very little degradation in air quality, while Class II areas allow for reasonable industrial/economic expansion. There are currently no Class III areas defined in Colorado. The closest federal mandatory Class I areas located near the LBA tract are the West Elk Wilderness Area (approximately 8 miles southeast), Maroon Bells-Snowmass Wilderness Area (approximately 18 miles northeast), and the Black Canyon of the Gunnison National Park and Wilderness Area (approximately 21 miles south-southwest). Map 3 illustrates the location of these and other regional PSD Class I areas relative to the LBA tract.

For an area that is in attainment for the NAAQS and CAAQS, the CAA provides specific criteria for stationary sources to allow for economic growth under the PSD permitting rules (40 CFR 52.21 or 40 CFR 51.166 for SIP approved Rules). Major PSD sources are required to provide an analysis to ensure their emissions in conjunction with other applicable emissions increases and decreases will not cause or contribute to a violation of any applicable NAAQS or PSD increment. A PSD increment is the amount of pollution an area is allowed to increase while preventing air quality in the airshed from deteriorating to the level set by the NAAQS. The NAAQS is a maximum allowable concentration "ceiling," while a PSD increment is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is defined as the ambient concentration existing at the time that the first complete PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment. Under no circumstance can the air quality of the airshed deteriorate beyond the concentration allowed by the applicable NAAQS. In addition, the analysis required for permitting must include impacts to surface waters, soils, vegetation, and visibility (also known as air quality related values - AQRVs) caused by any increase in emissions, and from associated growth. Associated growth is industrial, commercial, and residential growth that will occur in the area due to the source. Where a PSD source (with significant emissions) is located near a Class I airshed, the AQRV thresholds set by the applicable Class I controlling agency (Federal Land Manager) must be assessed to determine if an adverse impact on the area is likely to occur.

If a non-attainment designation takes effect for any criteria pollutant, the state will have three years to develop implementation plans outlining how areas will attain and maintain the NAAQS by reducing air pollutant emissions contributing to the violation. Further, any new major stationary source or major modification to a stationary source that emits a non-attainment pollutant in the designated area would be required to offset new or modified emissions sources in a ratio of greater than 1:1. Offset emission or emissions credits would be required to be obtained from within the designated non-attainment area.

Map 3

Spruce Stomp Coal Lease by Application Federal and State PSD Class I Areas within 200km



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

Environmental Consequences/Stipulations

Proposed Action

It is assumed that implementation of the Proposed Action would result in emissions of criteria pollutants, HAPs, and GHGs. Fugitive particulate matter would be emitted when drill rigs and other vehicles associated with the mining activities travel on existing dirt roads or overland access routes to MDW drilling locations. Emissions of particulate matter would be generated from processing equipment, material handling transfer points, storage piles, rail load-out locations, and mine ventilation shafts. Air quality would also continue to be impacted by fuel combustion sources, such as the engine exhaust emissions from locomotives, mobile material handling equipment, personnel transport equipment, and stationary internal combustion engines.

Emissions Inventory

It is assumed that the Proposed Action would produce direct and indirect emissions of the above-identified pollutants from both stationary and mobile sources during mining operations. Production rates would not increase under the Proposed Action and therefore production emissions can reasonably be expected to be the same. No reasonably foreseeable increases in permitted emissions authorizations are anticipated by the implementation of the Proposed Action. As described above, however, there is anticipated to be approximately 35 additional MDWs drilled if the lease is issued. These are construction activities and are not permitted by CDPHE, but their development would be a source of air emissions, and those emissions are quantified herein.

Direct Emissions. With the exception of particulate matter, all of the directly emitted criteria pollutants originating from the mine's operations are from fuel combustion sources, such as mobile mining equipment and stationary emergency generators. HAPs and GHGs are also emitted from fuel combustion sources, albeit in de minimis (or minimal) amounts. The overwhelming majority of the site's GHG emissions are the result of methane drainage systems that are installed to reduce the combustion potential of the mine's underground atmosphere. The systems at the Bowie No. 2 Mine consist of Ventilation Air Methane (VAM), and MDW methane.

The majority of PM₁₀ emissions from the mining area are from miscellaneous sources, which are mainly fugitive dust sources rather than stack emissions or internal engine combustion sources. Fugitive emissions are those not caught by a capture system and are often due to equipment leaks, earth moving/quarrying, equipment and vehicles traveling on paved and unpaved roads, and windblown disturbances.

Stationary sources (including fugitive emissions) at the Bowie No. 2 Mine are regulated by CDPHE and are authorized by multiple APCD permits. The permits establish limits for stationary and other regulated emissions sources which maintain emission rates below certain applicability thresholds, allowing the mine to be classified as a synthetic minor source under New Source Review and the Title V Operating Permit program (for major sources), as well as a PSD minor source not subject to PSD permit requirements. Some stationary equipment at the site is covered by NSPS - Subpart Y, which specifies emissions standards for coal preparation

plants. Under the SIP PSD rules, the site is covered under one of the 28 named source categories (see CDPHE AQCR 3, Part D, Section II.A.24.e) which requires inclusion of any fugitive emissions related to the coal process operations in the site's potential to emit calculations for major source determination. The latest revisions made to the permit were issued prior to the implementation of the SIP rules for GHG permitting, and therefore the permit does not cover GHG emissions (including methane) from the mine. Stationary sources of direct emissions at the Bowie No. 2 Mine and within the lease area include the following:

- Material Processing Screens
- Material Processing Crushers
- Material Handling Conveyors
- Mine Ventilation
- Fugitive Dust from Surface Operations (material handling, stockpiles, MDW drilling)
- Coal Preparation
- Train Loading
- MDW Releases

Criteria pollutant emission rates, as permitted in CDPHE-APCD air quality permits 96DL103-1, 96DL103-6, 96DL103-7F, 98DL0726, 01DL0685, 03DL0099F, 03DL0596, 03DL0923F, 04DL0560, and 06DL1082F to which the Bowie No. 2 Mine is currently subject, are provided in Table 5.

HAP emissions from stationary sources are considered minimal, and there are no permitted sources of HAPs. HAP emissions are primarily emitted from on-road and nonroad mobile sources.

Mobile sources at the facility include underground mining equipment, listed under source classification code (SCC) 2270009010, and aboveground construction equipment identified under SCC 2270002000, as well as light duty gasoline trucks. The underground mining mobile sources are specialized, industry specific equipment designed to function in the unique environment of an underground mine, while the aboveground sources would be heavy construction equipment used for material handling, stockpile management, and drilling.

Emissions from mobile sources at the mine come from various types of equipment. As noted in the purpose and need section of the EA, this is a competitive lease and the BLM does not have specific data on the mine's mobile source equipment in order to produce a detailed emissions inventory for these sources. To produce this type of estimate, it would be necessary to know the exact number and types of equipment in use, as well as other information such as the age, horsepower, and hours of use for each piece of equipment.

Table 5
Estimated Direct Criteria and GHG Emissions from Stationary and Mobile Sources (tpy)

Stationary Sources	CDPHE-APDC Permit	Stationary PM₁₀	Fugitive PM₁₀	PM_{2.5}	VOC	CO	NO_x	SO₂	CO₂	CH₄	N₂O
Screen	96DL103-1	6.3	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crusher	96DL103-6	6.0	NA	NA	NA	NA	NA	NA	NA	NA	NA
Conveyor Transfer, Haul, Stockpiles	96DL103-7F	4.2	161.2	NA	NA	NA	NA	NA	NA	NA	NA
Ventilation Shaft	98DL0726	14	NA	NA	NA	NA	NA	NA	NA	NA	NA
Train Loading	01DL0685	8.76	NA	NA	NA	NA	NA	NA	NA	NA	NA
Portal Development	03DL0099F	NA	39.7	NA	NA	NA	NA	NA	NA	NA	NA
Coal Prep/Wash Plant	03DL0596	8.8	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOB Handling	03DL0923F	NA	40	NA	NA	NA	NA	NA	NA	NA	NA
Underground Conveyor	04DL0560	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA
GOB Pile Operations	06DL1082F	2.1	55	NA	NA	NA	NA	NA	NA	NA	NA
Methane Sources	None	NA	NA	NA	NA	NA	NA	NA	ND	24,905	NA
Mobile Sources²	SCC	Mobile PM₁₀	Fugitive PM₁₀	PM_{2.5}	NMOG	CO	NO_x	SO₂	CO₂	CH₄	N₂O
Underground Mining Equipment	2270009000	6.82	Accounted for in permits above	6.62	10.46	40.38	47.97	0.65	3,031.54	0.16	0.02
Surface Mining Equipment	2270002036 2270002051 2270002060 2270002069 2270002033	1.79	Accounted for in permits above	1.73	2.18	11.55	24.68	0.39	1,795.79	0.03	0.02
MDW Drilling	NA	0.68	19.9	2.9	0.89	5.0	8.1	0.18	660.2	0.04	0.01
Gasoline Trucks	LDGT		0.03	0.03	0.05	0.73	0.08	0.02	107.64	NA	NA
Total Direct Emissions (tons)		59.49	315.83	11.28	13.58	57.66	80.83	1.24	5,595	24,905	0.05
¹ Mobile sources emissions are for exhaust only. ² All emissions reported in short tons.											

However, there are data on the total amount of diesel fuel used by all of the mobile sources at the mine on an annual basis. By making some reasonable assumptions about the mobile equipment in use, the BLM was able to use an EPA emissions model known as nonroad (2008a) to estimate potential mobile source emissions. The model was run for Delta and Gunnison counties using available mobile source inventories for the year 2000 and emissions factors for typical mobile sources were obtained from the model. This year was chosen to be reasonably conservative, as mobile equipment from the year 2000 would be likely to have been replaced in the last thirteen years by newer equipment with lower emissions. The BLM also made reasonable assumptions of the types of equipment likely to be used and the typical thermal efficiencies associated with these types of sources. With these assumptions, it was possible to estimate potential criteria pollutant and greenhouse gas emissions from the data on total diesel fuel use. Appendix D provides more detail on how these calculations were made. The resulting mobile source emissions estimates are shown in Table 5.

For the light duty gasoline trucks (LDGT), the analysis used the corporate average fuel efficiency (CAFE) mileage standards for the model year (MY) 2004 to estimate total vehicle miles travelled (VMT) from the fuel use data that was provided by the mine. The VMT data was then multiplied by the pollutant specific emissions factors for MY 2004 LDGT to derive emissions. The 2004 factor was chosen to be conservative and to reflect the fact that gasoline engines do not last as long as typical diesel powered equipment used at similar rates.

Indirect Emissions. Electrical energy consumed at the site can reasonably be expected to produce emissions from the supplying source, unless that source is some form of renewable energy. It is possible to provide rough estimates of emissions from mine electricity consumption if the annual energy consumption and supplier data is known, however the consumption information is not available to the BLM at this time.

Train emissions from hauling the mined and processed coal were accurately quantified in the original 2000 North Fork Coal EIS prepared for the mine and are discussed further below. The analysis tiers to the referenced EIS in support of the rail emissions discussion. Rail hauling emissions would continue under the Proposed Action.

Combustion of the mined and processed coal will produce all of the emissions outlined above. According to the U.S. Energy Information Administration (2009), nearly 94 percent of all coal consumed in the U.S. during 2009 was used in the generation of electric power. Bowie ships 95 to 98 percent of their coal to electric utilities with the remainder going to various manufacturing plants such as coke and cement. It would be possible to provide a quantification of criteria, GHG, and HAP emissions associated with the burning of the mined coal at a specific facility; however, the types and location of the facilities the coal might be processed and consumed in is speculative and not foreseeable. The contractual agreements between the coal fired power plant and the coal supply company are outside the scope of this analysis, and the BLM does not determine at which facilities the coal is used. Different emissions control devices on a power plant could greatly affect the amount of criteria, HAP and GHG emissions that are released into the atmosphere. For example, a power plant that is equipped with selective catalytic reduction or practices CO₂ capture would ultimately release much smaller quantities of NO_x and CO₂ than a power plant lacking such controls.

Even though the BLM cannot reasonably say where the coal is ultimately going to be burned, it is still possible to do emissions calculations to estimate the associated CO₂ emissions from the combustion of the coal. The specific information required, i.e., the number of tons of coal produced per year from the mine, and the heat content or carbon content of that coal in BTUs or percent weight per ton, is known for the proposed lease area. However, because the type of facility the coal might be processed in (i.e., the control efficiency of the facility) is speculative, calculations were made using average numbers for U.S. facilities. Therefore, the emissions calculation does not represent actual GHG emissions from this specific project. Assuming the Proposed Action would generate 5.0 million tons of high-quality low-sulfur super compliant bituminous coal per year, with an average heat content of 24.2 million BTUs per ton, nearly 12.12 million metric tons of CO₂e would be emitted. This amount represents 10.14 percent of all CO₂e emissions in Colorado during 2007, 0.18 percent of all CO₂e emissions in the U.S. during 2007, and 0.05 percent of global CO₂ emissions during 2007 (Climate Analysis Indicator Tool - CAIT-US, 2011). These calculations are based upon default emission factors for stationary combustion in the energy industries (Intergovernmental Panel on Climate Change - IPCC, 2006), assuming no other use of the coal and complete total combustion, and therefore represent a highly conservative overestimate of potential GHG emissions.

Air Quality Impacts

The airshed in the Proposed Action area (western counties) is currently designated as attainment for all criteria pollutants. The attainment status for pollutants in the project area is determined by monitoring levels of criteria pollutants for which NAAQS and CAAQS apply. The attainment designation means that no violations of any ambient air quality standard have been documented in the area. The airshed around the Proposed Action area is also identified as a Class II airshed, which allows for reasonable economic growth. Table 6 provides a listing of the most recently available air pollutant emissions inventory compiled by CDPHE for the Delta and Gunnison county emissions sources. Table 7 below provides air pollutant emissions totals from the region for comparison.

As previously stated, the mine is regulated by the CDPHE, which analyzed the mine's operations prior to issuing a permit to emit air pollutants. The APCD determined the standards and emissions limits the mine would need to adhere to so that its activities would not adversely impact air quality. The BLM has no regulatory authority for air quality within the state, and thus to meet the mandate to protect air quality under the FLPMA, the BLM relies upon the APCD's analysis and expertise for such matters in justifying the appropriateness of the EA for this action.

Table 6
Delta and Gunnison County Emissions Inventory (CDPHE, 2008)

Source Type	Inventory Pollutants									
	CO		NO ₂		SO ₂		PM ₁₀		VOC	
	Gunnison	Delta	Gunnison	Delta	Gunnison	Delta	Gunnison	Delta	Gunnison	Delta
Vehicles:	3,830.83	5,027.39	537.35	745.32	3.95	5.80	21.50	30.95	365.69	461.62
Road Dust:	ND	ND	ND	ND	ND	ND	1,229.75	961.00	ND	ND
Non-Road:	2,097.71	1,206.47	275.42	248.62	0.84	0.77	39.32	27.57	664.81	270.94
Wood burning:	1,115.69	2,254.55	15.09	30.50	2.34	4.73	154.58	312.36	215.74	435.96
Point Source:	38.06	0.86	36.05	6.09	0.92	0.19	215.46	378.17	60.71	17.27
Railroad:	8.22	22.14	83.43	224.75	4.75	12.80	2.07	5.58	3.11	8.37
Aircraft:	121.58	288.03	4.17	1.56	0.48	0.24	2.33	5.67	9.39	27.07
Forest/Ag. Fires:	3,389.85	1,051.06	89.51	34.90	28.64	7.88	469.02	130.29	218.40	61.39
Solvents:	ND	ND	ND	ND	ND	ND	ND	ND	57.25	116.38
Agricultural Tilling:	ND	ND	ND	ND	ND	ND	0.79	270.88	ND	ND
Structure Fires:	0.93	1.91	0.02	0.04	ND	ND	0.17	0.34	0.17	0.35
Surface Coating:	ND	ND	ND	ND	ND	ND	ND	ND	52.22	89.46
Restaurants:	1.44	2.94	0.01	0.02	0.01	0.02	3.88	7.93	3.59	7.33
Biogenic:	2,681.08	2,040.81	192.99	232.53	ND	ND	ND	ND	20,474.30	16,546.90
Oil Gas Point:	131.56	ND	147.24	ND	0.07	ND	0.97	ND	84.79	ND
Oil Gas Area:	23.23	4.97	20.36	0.11	0.44	ND	2.21	367.98	54.92	0.57
Combustion:	29.73	231.14	19.55	47.37	1.82	15.18	0.62	0.00	1.81	9.91
Tank Trucks:	ND	ND	ND	ND	ND	ND	ND	ND	0.29	0.33
Refueling:	ND	ND	ND	ND	ND	ND	ND	ND	10.77	14.55
Portables:	ND	ND	ND	ND	ND	ND	ND	ND	15.03	10.49
Construction:	ND	ND	ND	ND	ND	ND	400.97	ND	ND	ND
Pesticides:	ND	ND	ND	ND	ND	ND	ND	ND	13.48	27.52
Totals (tons):	13,469.91	12,132.27	1,421.20	1,571.84	44.28	47.61	2,543.65	2,498.73	22,306.46	18,106.41
ND = No Data										

Table 7
Mesa County Emissions Inventory (tons), Total Emissions (CDPHE, 2008)¹

CO	NO ₂	SO ₂	PM ₁₀	VOC
40,688	9,048	2,879	8,050	39,828
¹ Provided for illustration purposes only.				

Pollutant Monitoring. Grand Junction is the only large city in the area, and the only location that monitors for CO and air toxics on the western slope. In 2008, Rifle, Palisade, and Cortez began monitoring for ozone. The other western county locations monitor only for particulates. They are located in Delta, Durango, Parachute, and Telluride. Currently, there are four gaseous pollutant monitors and 11 particulate monitors in the western counties area (see Tables 8 and 9). There are one CO, three O₃, eight PM₁₀, and three PM_{2.5} monitoring sites. PM₁₀ data have been collected in Colorado since 1985; however, the samplers were modified in 1987 to conform to the requirements of the new standard. Therefore, available trend data is only valid back to 1987. Since 1988, the state has had at least one monitor exceed the level of the 24-hour PM₁₀ standard (150µg/m³) every year except 2004. Monitoring for PM_{2.5} in Colorado began with the establishment of sites in Denver, Grand Junction, Steamboat Springs, Colorado Springs, Greeley, Fort Collins, Platteville, Boulder, Longmont, and Elbert County in 1999. Additional sites were established nearly every month until full implementation of the base network was achieved in July of 1999. In 2004, there were 20 PM_{2.5} monitoring sites in Colorado. Thirteen of the 20 sites were selected based on the population of the metropolitan statistical areas. This is a federal selection criterion that was developed to protect the public health in the highest population centers. In addition, there were seven special-purpose monitoring (SPM) sites. These sites were selected due to historically elevated concentrations of PM₁₀ or because citizens or local governments had concerns of possible high PM_{2.5} concentrations in their communities. All SPM sites were removed as of December 31, 2006 due to the low concentrations of PM_{2.5} measured and a lack of funding.

Table 8
Western County Gaseous, Particulate, and Meteorological Monitors in Operation for 2010

County	Location	CO	SO ₂	NO _x	O ₃	PM ₁₀	PM _{2.5}	Met
Delta	Delta - Health Dept 560 Dodge St.					X3		
Garfield	Rifle - Health Dept 195 W. 14th Ave.				X			
	Rifle - Henry Building 144 E. 3					X3 / H	H	
	Parachute - Elem. School 100 E. 2					X3		
La Plata	Durango - River City Hall 1235 Camino del Rio					X3		
Mesa	Grand Junction - Pitkin 645½ Pitkin Ave.	X				H		X
	Grand Junction - Powell 650 South Ave.					X3	X3 / H	
	Palisade Water Treatment 865 Rapid Creek Rd.				X			X
	Clifton - Hwy. 141 & D Rd.					X3		
Montezuma	Cortez - Health Dept 106 W. North Ave.				X		X6	
San Miguel	Telluride - 333 W. Colorado Ave.					X3		
(Xn) – Filter Sample Continued; n=frequency in days, (H) – Hourly particulate								

Because the Bowie No. 2 Mine is primarily a source of PM₁₀ emissions, only the recent monitoring data for particulate matter is shown in Table 9. The regional monitoring data for both ozone and carbon monoxide suggests the air quality at the monitored locations is attaining the national standards. More so than other pollutants, PM₁₀ is a localized pollutant where concentrations vary considerably. Thus, local averages and maximum concentrations of PM₁₀ are more meaningful than averages covering large regions or the entire state. The data is presented for qualitative purposes only.

**Table 9 ($\mu\text{g}/\text{m}^3$)
Western County Monitored Particulate Matter Values for NAAQS (2010)**

County	Location	PM ₁₀			PM _{2.5}	
		Annual ¹	24 Hour	3 Yr. Ave. Ex.	Annual	24 Hour
Delta	Delta - Health Dept 560 Dodge St.	21.4	51	0	ND	ND
Garfield	Rifle - Henry Building 144 E. 3	20.5	54	0	ND	ND
	Parachute - Elem. School 100 E. 2	21.3	96	0	ND	ND
La Plata	Durango - River City Hall 1235 Camino del Rio	18.1	51	1.3	ND	ND
Mesa	Grand Junction - Pitkin 645¼ Pitkin Ave.	23.0	90	0	ND	ND
	Grand Junction - Powell 650 South Ave.	18.6	41	0	8.6	33.5
	Clifton - Hwy. 141 & D Rd.	19.9	60	0	ND	ND
Montezuma	Cortez - Health Dept 106 W. North Ave.	ND	ND	ND	6.3	14.4
San Miguel	Telluride - 333 W. Colorado Ave.	19.9	354	3.1	ND	ND

¹ Annual standard rescinded, ND = No Data

Although the data shown above were not collected in the immediate vicinity of the mine, they indicate that PM₁₀ standards are presently being met in the region. Table 10 shows available monitoring data from surrounding counties for other criteria pollutants. These also data show that ambient air quality standards are being met.

**Table 10
County Monitoring Data (2012)**

County	NO ₂ 98th Percentile 1-hr (ppb)	Ozone 2nd Max 1-hr (ppm)	Ozone 4th Max 8-hr (ppm)	PM _{2.5} 98th Percentile 24-hr ($\mu\text{g}/\text{m}^3$)	PM _{2.5} Weighted Mean 24- hr ($\mu\text{g}/\text{m}^3$)	PM ₁₀ 2nd Max 24-hr ($\mu\text{g}/\text{m}^3$)	PM ₁₀ Mean 24- hr ($\mu\text{g}/\text{m}^3$)
Delta	.	.	.	.	.	58	24
Garfield	.	0.08	0.068	.	.	46	19
Gunnison	.	0.08	0.066	.	.	72	20
La Plata	29	0.08	0.069	10	4.3	59	19
Mesa	.	0.08	0.071	24	7.3	143	23
Montezuma	.	0.08	0.068	12	5.6	.	.
Rio Blanco	19	0.08	0.069	25	9.9	.	.
San Miguel	.	.	.	.	.	68	17

source: http://www.epa.gov/airdata/ad_rep_con.html

The available PM_{2.5} monitoring data indicate that the region is in attainment with the standards. Most of the mine's direct particulate matter emissions result from coal handling operations, including moving and loading of coal, coal washing and preparation, and so on. Particulate matter emissions from these types of activities are generally not in the fine fraction (that is, they are larger than 2.5 microns in size). The mine also does not emit large quantities of nitrogen oxide or sulfur dioxide gases, which can be converted in the atmosphere into fine particulate matter. The mine is thus not a large source of PM_{2.5} and is not required by the state to obtain a PM_{2.5} emissions permit. Particulate emissions are not expected to increase under the Proposed Action because the rate of mining will not increase. The mine is thus not expected to cause or contribute to a violation of the PM_{2.5} standards.

Potential Impacts Analysis for Criteria Pollutants. A detailed air quality assessment, including modeling, of the Bowie No. 2 Mine was conducted as part of the environmental analysis in the North Fork Coal EIS (USFS and BLM, 2000). In this Final EIS (FEIS), an air quality assessment was completed for the Bowie No. 2 Mine, which is permitted by the state to produce up to 5.0 million tons of coal and coal-refuse annually. The Proposed Action analyzed in this EA assumes an expansion of the Bowie No. 2 Mine and that mining operations would continue in the lease tract. That is, the action would not constitute adding additional production to previously authorized limits or increasing mining intensity.

The air quality analysis conducted for the North Fork Coal EIS included an emissions inventory and modeling analysis that covered all three active coal mines in the North Fork Valley (Bowie No. 2, Elk Creek, and West Elk) and other related emission sources. That emissions inventory quantified PM₁₀, NO_x, and SO₂ emissions. The modeling analysis also included a visibility impacts assessment in the West Elk Wilderness Area as well as an atmospheric deposition impacts assessment. Emissions that were calculated and modeled included tailpipe emissions from mining equipment, haul trucks, and locomotives (railway emissions). The results of that detailed impact assessment predicted no significant impacts to air quality as a result of authorizing the mines. Further, the CDPHE in authorizing the mines permits evaluates the pollutants with significant impact levels (SIL) above their modeling criteria to ensure the mines operations will not violate the states air quality standards. It is therefore reasonable to conclude that the mines operations are within tolerable impacts to air quality based on the CDPHE's analysis and subsequent approval of the mine's permits.

It is assumed that the equipment that would be used for mining operations within the LBA tract would be the same equipment that is being used in the current mining operations. Therefore, the air quality impacts associated with the LBA tract can be presumed to be equal to, or less than, impacts predicted in the original air quality impact assessment. The air quality assessment for this EA tiers to that original assessment. Additionally, given the age of the original assessment, and the useful life of most of the equipment, it can be reasonably expected that some of the equipment has been replaced by newer models, which would have the effect of reducing equipment emissions based on the regulatory requirements placed on newer non-road engines.

As related to railway emissions, due to more stringent regulations since the North Fork Coal EIS was written, the EPA predicted that, on a nationwide average, NO_x emissions from locomotives in the year 2010 would be about 40 percent less than emissions compared to 1999 levels (USFS and BLM, 2000 page 3-7). The North Fork Coal EIS air quality impact analysis, which relied on emissions factors for 1999, determined NO_x emissions to be insignificant and thus current NO_x emissions resulting from trains hauling coal are expected to be no higher than the previously modeled levels.

With respect to potential ozone formation, the county level analysis of the emissions inventory suggests the region is potentially NO_x limited. Therefore, to effectively limit any potential for ozone formation due to area emissions, controls should focus on controlling NO_x emissions. The Bowie No. 2 Mine is not a significant source of NO_x and VOC emissions (the photochemical reactivity potential of methane in the troposphere is considered negligible [40

CFR 51.100(s)) and therefore operations at the mine are not expected to contribute significantly to any regional ozone formation potential.

With respect to the facility's emissions in the regional context, emissions of criteria pollutants from the Bowie No. 2 Mine are not presently causing or contributing to any violations of national ambient air quality standards, should not increase above current levels, and therefore should not result in any additional impacts on existing ambient air quality in the area.

Potential Impacts Analysis for Greenhouse Gas Pollutants. According to the U.S. Global Change Research Program (2009), global warming is unequivocal, and the global warming that has occurred over the past 50 years is primarily human-caused. Standardized protocols designed to measure factors that may contribute to climate change, and to quantify climatic impacts, are presently unavailable. As a consequence, site or regional specific impact assessment of projects related anthropogenic activities on global climate change cannot be accurately estimated. Moreover, specific levels of significance have not yet been established by regulatory agencies. Therefore, climate change analysis for the purpose of this environmental assessment within this air quality section is limited to accounting for GHG emissions changes that would contribute incrementally to climate change and to disclose the anticipated changes forecasted for the region based on the global models.

Methane associated with coal seams and the surrounding rock would be liberated during the mining process, as well as during the subsequent fracturing of the overburden, which occurs as the gob area (the portion of coal panels that have already been mined) is allowed to collapse. In order to protect the health and safety of miners working underground, explosive gases would be removed from the mine via a ventilation system as well as through MDWs drilled into the gob area. MDWs would be drilled to about 10 to 50 feet above the target coal seam about 1 year before mining operations begin. As the longwall mining passes under the MDW, the strata around the MDW would fracture and liberate methane. MDWs would actively pump mine atmosphere (including methane) to the surface. The MDW pumps are fueled by methane from the gob. The process of fracturing and liberation of methane would continue as the mined area collapses behind the mining operation, and the MDWs continue to pump methane from the gob. Both the ventilation system and the MDWs would release methane directly into the atmosphere. This would result in varying levels of methane release, based upon the relative concentration of methane in the mine air and overburden. Because methane emission rates are roughly correlated with coal production rates, and because coal production from the Bowie No. 2 Mine is expected to be consistent with current production rates, the rate of methane emission is not expected to differ greatly from current emission rates.

Bowie has provided methane emissions estimates for releases through mine ventilation and from the MDWs. Mine ventilation currently liberates 2,710,000 cubic feet of methane per day based on mine exhaust monitoring. MDWs are estimated to release a total of 504,000 cubic feet of methane per day. Based upon the Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008 (EPA Publication 430-R-10-006), April 15, 2010, total coal mining related methane emissions in 2008 were 6.76 tg (teragrams=one million metric tons), and total GHG emissions were 6,956.8 tg CO₂ equivalent. At the Bowie No. 2 Mine, the total release of (2,710,000 + 504,000=) 3,214,000 cubic feet CH₄ per day is the equivalent of 474,464 metric tons per year or

0.0068 percent of the total calculated CO₂ equivalent emissions (6,957) for the U.S. in 2008. Based upon this analysis of mine-vented methane emissions, the calculated GHG emissions associated with the Proposed Action are negligible relative to any potential impacts on the global scale. If the calculated GHG emissions were compared with the global figures (2005 CO₂ equivalent emissions of 26,544 tg, World Development Report 2010: Development and Climate Change, World Bank, 2010), the relative significance of the impact to the global climate would further decrease.

Implementation of the Proposed Action would be estimated to contribute 0.474 mm metric tons of GHG equivalent annually (based on the methane releases), or about 0.0068 percent of total U.S. global contribution. Predicting the degree of impact any single emitter of GHGs may have on global climate change, or on the changes to biotic and abiotic systems that accompany climate change, is not possible at this time. As such, determining to what extent GHG emissions resulting from continued mining may contribute to global climate change, as well as the accompanying changes to natural systems cannot be quantified. The degree to which any observable changes can, or would, be attributable to the Proposed Action cannot be reasonably predicted at this time.

Cumulative Impacts

The cumulative impacts to air quality in the area would primarily result in emissions of particulate matter from current and future mining of coal. Mining activities related to air emissions are permitted by the APCD of the CDPHE. The State imposes permitting limits and control measures in order to limit emissions of NAAQS pollutants. The State develops air quality attainment and maintenance plans in order to keep Colorado in compliance with the federal NAAQS.

A detailed air quality assessment, including modeling, of the original mine was conducted as part of the environmental analysis for the North Fork Coal EIS (USFS and BLM, 2000). The APCD also ensures limits are consistent with the NAAQS by requiring air quality modeling where appropriate.

The air quality analysis conducted for the mine included an emissions inventory and modeling analysis. That emissions inventory quantifies PM₁₀, NO_x, and SO₂ emissions. The modeling analysis also includes a visibility impacts assessment in the West Elk Wilderness Area as well as an atmospheric deposition impacts assessment. Emissions that were calculated and modeled included tailpipe emissions from mining equipment, haul trucks, and locomotives (railway emissions). The results of that detailed impact assessment predicted no significant impacts to air quality as a result of Bowie No. 2 Mine operations.

The proposed lease area would retain the current coal production rate of 5.0 million tons, and the emissions generating equipment used is assumed to be slightly newer than equipment analyzed for the operation in 2000. Therefore, cumulative impacts are not anticipated to exceed NAAQS, or to push the region into non-attainment for any NAAQS, and would result in no net change and the air quality impacts associated with the LBA tract can be presumed to be equal to, or less than, impacts predicted in the original air quality impact assessment.

The BLM estimated the amount of GHG emissions that could be attributed to coal production as a result of the proposed lease, as well as from the forecast coal production from all three coal mines in the North Fork Valley.

Coal production for the operating mines in the North Fork Valley are reported to produce the following emissions of CO₂e:

- Coal production and methane liberation at the Bowie No. 2 Mine 474,464 metric tons of CO₂ equivalent released per year based on on-going mine activities.
- Coal Production and methane liberation at the Elk Creek Mine (Oxbow) 1,200,000 tons of CO₂ equivalent released per year based on on-going mine activities.
- Coal Production and methane liberation from the West Elk Mine 1,230,000 tons of CO₂ equivalent released per year based on on-going mine activities.

The BLM assumed that the majority of the coal was used for coal-fired electric generation as part of the total U.S. use of coal for electric generation. Policies regulating specific levels of significance have not yet been established for GHG emissions. Given the state of the science, it is not possible to associate specific actions with the specific global impacts such as potential climate effects. Because there are no tools available to quantify incremental climate changes associated with these GHG emissions, the analysis cannot reach conclusions as to the extent or significance of the emissions on global climate. The potential impacts of climate change represent the cumulative aggregation of all worldwide GHG emissions.

Climate Change. Coal production rates would not increase under the Proposed Action. Continued mining, operation of mine surface facilities, and associated vehicle traffic, would result in continued minor cumulative contributions to the release of GHGs into the atmosphere. The mining, processing, and shipping of coal from the Bowie No. 2 Mine, and from other mines in the area, would contribute to GHG emissions through carbon fuels used in mining (including fuel consumed by heavy equipment and stationary machinery), electricity used on site, methane released from mined coal, and rail transport of the coal. The use of the coal after it is mined has not been determined at this time; however, almost all of the coal that would be mined from the Bowie No. 2 Mine would be used by coal-fired power plants in order to generate electricity. This also results in the production of GHGs. The proposed lease would make an additional area of the coal seam that is being mined available for mining, and would extend the life of mine by approximately 16 to 18 months. Coal production would be consistent with current production rates. Release of GHGs would remain about the same as current rates.

With respect to GHG emissions, the following projections were identified by the EPA for the Mountain West and Great Plains region:

- The region could experience warmer temperatures with less snowfall.
- Temperatures are expected to increase more in winter than in summer, more at night than in the day, and more in the mountains than at lower elevations.
- Earlier snowmelt means that peak stream flow will be earlier, weeks before the peak needs of ranchers, farmers, recreationalist, and others. In late summer, rivers, lakes, and reservoirs will be drier.

- More frequent, more severe, and possibly longer-lasting droughts will occur.
- Crop and livestock production patterns could shift northward; less soil moisture due to increased evaporation may increase irrigation needs.
- Drier conditions will reduce the range and health of ponderosa and lodge pole pine forests, and increase the susceptibility to fire.
- Grasslands and rangelands could expand into previously forested areas.
- Ecosystems will be stressed and wildlife such as the mountain lion, black bear, long-nose sucker, marten, and bald eagle could be further stressed.

If these projections are realized, there would be impacts to resources within the region. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased windblown dust from drier and more erodible soils. Warmer temperatures with decreased snowfall could have an impact on a particular plants ability to sustain itself within its current range. An increased length of growing season in higher elevations could lead to a corresponding variation in vegetation and change in species composition. These types of changes would be most significant for special status plants and wildlife that typically occupy a very specific ecological niche. Cool season plant species' spatial ranges are predicted to move northward or to higher elevations, and extinction of endemic threatened or endangered plants may be accelerated. Invasive plant species would be more likely to out-compete native species.

Increases in winter temperatures in the mountains could have impacts on traditional big game migration patterns. Due to loss of habitat, or due to competition from other species whose ranges may shift northward or to higher elevations, the population of some animal species may be reduced. Warmer winters with less snow would impact the Canada lynx by removing a competitive advantage they have over other predators. Earlier snowmelt could also have impacts on cold water fish species that occupy streams throughout the planning area. Climate change could affect seasonal frequency of flooding and alteration of floodplains, which could impact riparian conditions. More frequent and severe droughts would have impacts on many wildlife species throughout the region as well as vegetative composition and availability of livestock forage in some areas. Climate change could lengthen the growing season within the region, however, a longer growing season in theory would result in more forage production provided there is sufficient precipitation or it could lead to a change in dominant vegetation type. This could leave these forests and woodlands more susceptible to insect damage and at higher risk of catastrophic wildfires. Increased fire activity and intensity would increase greenhouse gas emissions.

Minimization Measures

Criteria Pollutant Emissions

To reduce particulate matter/fugitive dust emissions during construction and ongoing production activities:

- Most coal transfer points and processing activities during coal production have been enclosed and, therefore, limit dust.

- The mine will continue to comply with their APCD-issued air emissions permit provisions, and any other regulatory requirements the facility is subject to now or in the future.

Greenhouse Gas Emissions

With regard to production activities at the mine, methane liberation from the mine may be reduced through mine planning and sealing previously mined areas.

Stipulations

In addition to adherence to authorized air permits, the BLM and the USFS would require the following stipulations:

- Fugitive emissions from all vehicles traveling on regularly-used non-paved surfaces during all project phases shall be controlled utilizing a variety of suppression techniques applied to the non-paved roads.
- Storage piles shall be watered or covered as necessary to limit wind erosion potential and reduce fugitive emissions.

No Action Alternative

Under the No Action Alternative, mining of the coal lease tract would not be permitted because the lease would not be issued. Current levels of methane liberation and emissions associated with the existing mine plan would continue until mining is completed. The facility would continue to comply with their APCD-issued air emissions permit provisions and any other regulatory requirements the facility is subject to now or in the near future. Methane emissions associated with proposed mining of the LBA tract would not occur.

WILD AND SCENIC RIVERS

Affected Environment

For Wild and Scenic Rivers, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

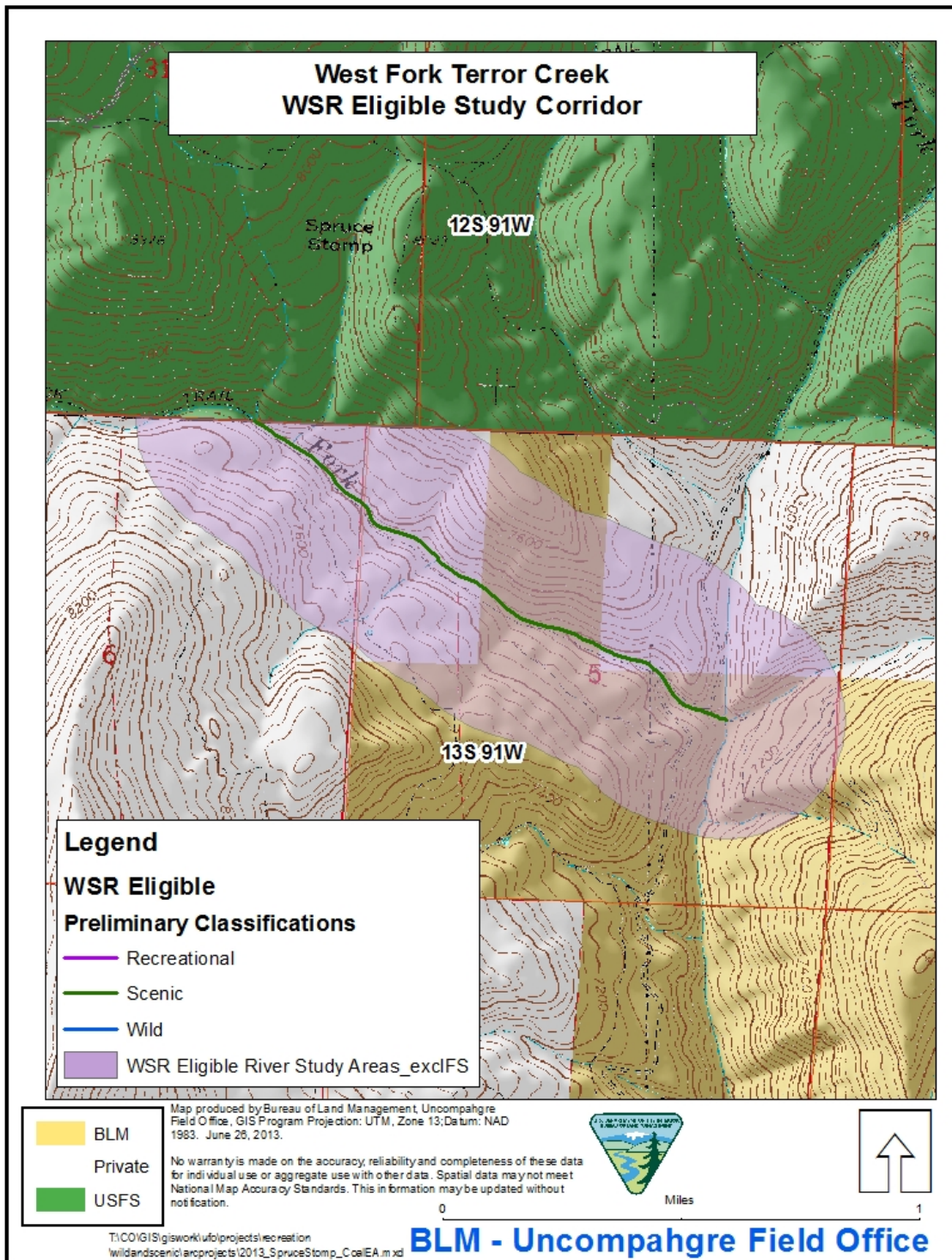
The BLM inventoried area streams and rivers in 2006 as part of the evaluation of Wild and Scenic Rivers (WSR) in the UFO. In June 2010, the Final Wild and Scenic Eligibility Report for the Uncompahgre Planning Area was released (BLM, 2010). A 1.21-mile segment of the West Fork of Terror Creek was determined eligible for inclusion in the National Wild and Scenic River System (NWSRS). Of the 1.21 miles that are eligible, only 0.64 mile is within the LBA tract; 0.76 mile is on private surface and 0.18 mile is on BLM surface (see Figure 3).

The following portions of the proposed lease are within the ½ mile river study corridor of the eligible river segment. There are BLM surface lands and private surface with the subsurface minerals managed by BLM.

Township 13 South, Range 91 West, 6th P.M., Section 5: W/2W/2SENE – approximately 10 acres

Township 13 South, Range 91 West, 6th P.M., Section 6: lots 1 & 2 – approximately 80 acres

Figure 3 West Fork Terror Creek WSR Eligible Study Corridor



Congress enacted the Wild and Scenic Rivers Act (WSRA) (Public Law 90-542; 16 U.S.C. 1271 et seq.) on October 2, 1968 to address the need for a national system of river protection. The legislation was the outgrowth of a nationwide conservation movement that took place during the 1950s and 1960s, as well as a response to the numerous diversion projects and dams constructed along American waterways during the 1930s through 1960s. The WSRA stipulates that the free-flowing condition, water quality, and outstandingly remarkable values (ORVs) of selected waterways should be preserved and protected for the benefit and enjoyment of present and future generations.

As part of the revision of the UFO RMP (ongoing), the BLM was required by WSRA to inventory its rivers and streams to determine their eligibility for inclusion in the NWSRS. The study and designation of watercourses under the WSRA consists of a multi-step process: eligibility → suitability → congressional action. In order to be determined as eligible, they must be free-flowing and possess one or more ORV. The West Fork Terror Creek segment is free-flowing as defined by the WSRA, and possesses a fish ORV (greenback cutthroat trout - see the Threatened, Endangered and Sensitive Species section).

The BLM is currently drafting a suitability report that determines which segments, from among the eligible segments, are suitable for protection under the WSRA. Until that report is finalized, the BLM manages eligible segments under interim protections. Specifically, interim protections include protection of the free-flow of the stream, water quality, and the ORV so as to prevent the segment from losing its eligibility, and to keep the “scenic” classification from degrading to “recreational.”

From the Final Wild and Scenic River Eligibility Report for the Uncompahgre Planning Area (June 2010):

Description: The West Fork of Terror Creek is a perennial headwater stream on the southern flank of Grand Mesa north of Paonia. The creek drains into Terror Creek, which is a tributary of the North Fork of the Gunnison River. The lower terminus of this river segment is its confluence with East Terror Creek, while the upper terminus is the boundary of Grand Mesa National Forest.

Outstandingly Remarkable Values: Fish

Fish - Based upon the best available genetic information, this river segment harbors a population of greenback cutthroat trout (*Oncorhynchus clarki stomias*), a species listed as threatened under the Endangered Species Act. This is one of 37 greenback populations currently identified on the west slope of Colorado.

Preliminary Classification: Scenic

Rationale - An unsurfaced road crosses the West Fork of Terror Creek near its confluence with Terror Creek. The remaining river channel and associated corridor are primitive and undeveloped. There is a small impoundment known as Holy Terror Reservoir, as well as Grand Mesa Canal Head Gate #4, an irrigation diversion upstream of the reach.

The Grand Mesa and Uncompahgre National Forest issued a proposed Forest Plan Revision in conjunction with the Gunnison National Forest in March 2007, which included a WSR eligibility

study. There were no watercourses adjoining the UFO boundary identified as eligible including the West Fork of Terror Creek on NFS lands.

Environmental Consequences/Stipulations

Proposed Action

Current plans for mining include the lands under the West Fork of Terror Creek (see Map 2). WWE conducted an analysis of potential subsidence impacts on the West Fork of Terror Creek aquatic life and water supply due to potential mining of the LBA tract (WWE, 2013a). Mining would be expected to result in a maximum subsidence of about 5.7 feet at the center, near the eastern edge, of the longwall panel with the smallest overburden thickness. This location is approximately 300 feet south of the West Fork of Terror Creek channel. Based on existing topography and geologic modeling, a maximum estimated 5.1 feet of subsidence along the West Fork of Terror Creek channel would be expected to create no more than a 1.5 percent channel slope change. Because the LBA tract generally consists of steep terrain (often in excess of 25 percent slopes), the expected change in slopes is expected to be mostly, if not completely, imperceptible without the aid of survey equipment. A change of 2 percent within the average channel slope of 5.5 percent could lead to an increase in the size of particles transported from 500 mm to 650 mm (WWE, 2013a). However, while some larger material would be mobilized following channel slope increase induced by subsidence, the overall stability of the largest particles should not be significantly compromised as a result of the slope change (WWE, 2013a). Other subsidence related impacts, such as surface cracking or water loss would not be expected to the degree that they would negatively impact the quality of the aquatic habitat of the LBA tract. Based on this analysis, adverse impacts to aquatic life would not be expected as a result of potential subsidence within the LBA tract.

WWE found that the wetted perimeter of the West Fork of Terror Creek is not expected to change noticeably following subsidence, based on the magnitude of slope changes (WWE, 2013a).

Cumulative Impacts

Cumulative impacts to the inventoried segment of the West Fork of Terror Creek should be limited with possible effects from livestock grazing, recreation use, and other mineral related activity such as oil and gas development. Private lands in the area around the inventoried segment could be developed in the future and affect the segment.

Stipulations

The BLM and the USFS would require the following stipulations:

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw [angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence], etc.) shall be used to control subsidence.
- No surface developments (i.e., MDWs or access roads) shall be allowed within the ½ mile wide river study corridor (i.e., 1/4 mile wide on each side of the West Fork of Terror

Creek) on BLM lands/minerals. This stipulation will no longer apply if the eligible segment on West Fork of Terror Creek is found not suitable for inclusion in the National Wild and Scenic River System, or if suitable, if it is dropped from further consideration by Congress.

No Action Alternative

Under the No Action Alternative, there would be no impacts to the West Fork of Terror Creek from leasing of the coal tract as a lease would not be issued.

GEOLOGY AND MINERALS

Affected Environment

For Geology and minerals, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

General Geology. The LBA tract is located on the lower southern slopes of the Grand Mesa, in the Paonia-Somerset coal field, which contains medium to high coal development potential deposits (USFS and BLM, 2000). It resides on Quaternary Alluvium (Holocene Soil-creep deposits and Holocene-Pleistocene colluvial deposits) and the Cretaceous Mesa Verde Formation (Junge, 1978). The Mesa Verde Formation consists of sandstone interbedded with dark gray shales, where coal beds are found in the two major members: Bowie Shale Member and Paonia Shale Member (Stewart et al., 2006).

Table 11 provides a description of the geologic resources within the LBA tract. In addition to the geologic units described below, isolated igneous intrusions, which compromise the quality of adjacent coals, are present in the vicinity (USFS and BLM, 2000). No faults are known within the LBA tract but they could be present.

The surface geology in the area is Mesa Verde on the northern tip, grading to Holocene Soil-creep deposits. The Soil-creep deposits are mixtures of sand, silt, and clay with rock fragments. These deposits are characterized by a series of small swales and ridges and are generally a sign of unstable slopes.

The Cretaceous Mesa Verde Formation is the surface unit in part and lies below the alluvium in part of the LBA tract. The Mesa Verde is the coal bearing formation in the general region and the target of mining. The top of the Mesa Verde is approximately 0 to 400 feet below the surface. Extensive burn zones exist in the Mesa Verde (Stewart et al., 2006). This is evidenced in the region where the Mesa Verde outcrops as red colored shale and can be seen along State Highway 133 (Chronic and Williams, 2002). The Mesa Verde is above the Mancos Shale which is a regionally extensive bed of marine shales ranging up to 4,000 feet in thickness (Tweto, 1979). The regional geology was described in detail in the North Fork Coal EIS (USFS and BLM, 2000).

Table 11
Stratigraphy of the LBA Tract

Geologic Unit		Geologic Period	Description
Alluvium and Colluvium		Quaternary	Unconsolidated soil and rock formed by mass wasting processes or by weathering of intact bedrock.
Wasatch Formation		Tertiary	Red and buff sandstones, and mudstones deposited in alluvial floodplains and stream channels (this formation contains abundant vertebrate fossils and outcrops commonly found throughout the region).
Mesa Verde Group	Ohio Creek Member	Cretaceous	Fluvial conglomerate often used as a local stratigraphic datum.
	Barren Member		Up to 2,300 feet of interbedded sandstones, shales, siltstones, and coals deposited during the final regression of the Western Interior Seaway. Mesa Verde sandstones are common natural gas reservoirs targeted for production to the northwest in Mesa and Garfield Counties. Coal Seams A, B, and C are found near the base of the Lower Coal Member; the D- and E-Seams are found in the base of the Upper Coal Member; the F-Seam is located at the top of the Upper Coal Member. Portions of the Mesa Verde Formation, including coal seams, do not outcrop within the Proposed lease.
	Upper Coal Member		
	Lower Coal Member		
	Rollins Sandstone		
Mancos Formation			Up to 4,000 feet of marine shales (this formation does not outcrop within the Proposed lease, but is exposed west of Somerset along the North Fork of the Gunnison River).

Geologic Hazards. Geologic hazards are defined as potentially unstable and unstable slopes and rockfall areas. The surface geology in the LBA tract consists of primarily unconsolidated deposits of clays and silts of the Wasatch Formation intermixed with basalt boulders derived from extrusive rocks capping Grand Mesa. This material, mapped as debris flows in the area (Dunrud, 1989), is commonly stable and resistant to stream erosion and to mass-gravity movements.

The terminal points of landslide/debris flow deposits are located on the north and south edge of the West Fork of Terror Creek channel where the flow gradient begins to increase eastward (Dunrud, 1989). These deposits are visible on a detailed satellite or aerial image of the area. The northern, more extensive deposit shows no sign of recurring movement. The lower part of the southern slide, however, shows signs of renewed movement since initially deposited (since the mid-1980s during times of very high precipitation). These landslides/debris flows consist of unconsolidated basalt boulders and Wasatch clays that were re-mobilized during periods of very high precipitation.

Other Geologic Resources. The following oil and gas leases are present in the LBA tract:

COC-064766 – Gunnison Energy Corp – T. 13 S., R. 92 W., Section 1, Lot 4, issued on 05/10/2001, expires on 4/19/2013. Oak Mesa OG Unit agreement was terminated on 4/19/2011. According to the Colorado Oil and Gas Conservation Commission (COGCC), the lessee drilled a wildcat well in 2003 and it was shut in until August 2006 when it was plugged and abandoned.

COC-065537 – Gunnison Energy Corp - T. 12 S., R. 91 W., sections 31 and 32, issued on 2/28/2002, lease was committed to the Iron Point OG unit on 7/27/2010. The unit lease in T. 12 S., R. 91 W. is COC-74545X - Iron Point. It expires 7/27/2015. A plan of operation and development was approved on 5/1/2012. The unit is held by producing wells in sections 12 and 25. The COGCC does not show any drilling in either Section 31 or Section 32.

Past oil and gas activity within the region has included coal-bed methane wells, shale wells, and coal mine methane wells. The wells within approximately 20 miles of the lease area include:

- 59 total wells drilled: on private surface (26), split-estate wells (13), Forest Service (20).
- 20 wells are producing and 34 are shut-in and 5 are temporarily abandoned.

Environmental Consequences/Stipulations

Proposed Action

The Proposed Action could result in the production of approximately 8.02 million tons of recoverable tons of coal. There is the possibility of subsidence issues during mining by longwall techniques. Subsidence is the gradual lowering of the surface after the large rectangular blocks of coal are removed from the longwall mining panels. After coal recovery, the overburden is altered due to subsidence. Overburden thicknesses over 800 feet have been classified as having a negligible risk of surface fracturing developing. This is a conservative upper limit under normal conditions.

This analysis of subsidence is tiered to the North Fork Coal EIS (USFS and BLM, 2000) in Appendix K “Subsidence Evaluation” and in Chapter 3.2 under the analysis of Topography/Physiography. The EIS addresses the west tract which is known as the Iron Point Coal Tract and assigned tract serial number COC-61209. The EIS also provides guidance in assessing potential subsidence in the LBA. The longwall panel design, and yield, and gate road pillar design and configuration are likely to be similar to those used in the Iron Point Coal Tract. None of the underlying coal seams has been mined within the LBA tract; therefore, subsidence amounts are reported for mining in undisturbed ground.

Roof rocks primarily consisting of strong, thick sandstones of the Mesa Verde Group would cave into the mine in larger blocks than would shale roof rocks and would reduce the height of caving above the mine workings. These sandstones would generally reduce the amount of subsidence compared to shale. Sandstones at the surface would have larger displacements, and may form cracks up to 1 foot wide and 25 to 50 feet deep on steep slopes. Formation of joints and fractures on steep slopes may contribute to slope instability and susceptibility to landslides and rock falls. At overburden depths greater than 1,000 to 1,500 feet, gate road pillars would yield to the level of recompacted, caved, and broken rock in the longwall panel. This range of depths would be common within the LBA tract.

In the adjacent DRMS permit area, and carried forward into this analysis, there are three zones of expected subsidence impact. The zone of greatest subsidence impact is in areas where the overburden is between 110 and 500 feet. The zone of intermediate subsidence impact is in areas where the overburden is between 500 and 1,000 feet. The zone of minor subsidence impact is in

areas where the overburden is more than 1,000 feet. Under normal conditions, subsidence cracks do not appear likely to propagate through more than 500 feet of overburden.

The values reported in Table 12 are calculated for undisturbed areas within the LBA tract and an average D-Seam mining thickness of 12 feet and a panel width of 800 feet. On average, the maximum amount of subsidence is projected to be approximately 0.6 times the mining thickness.

Table 12
Anticipated Subsidence Values within the LBA Tract

Maximum Subsidence Parameters				
Overburden Depth (feet)	Vertical Displacement (feet)	Maximum Tilt (percent)	Horizontal Tensile Strain (percent)	Horizontal Compressive Strain (percent)
100-250	7.2	21.6 – 8.6	7.2 – 2.9	7.2 – 2.9
250-500	7.2	8.6 – 4.3	2.9 – 1.4	2.6 – 1.3
500-1,000	7.2 – 6.0	4.3 – 1.8	1.4 – 0.6	1.3 – 0.7
1,000-1,500	6.0 – 4.1	1.8 – 0.8	0.6 – 0.3	0.7 – 0.5
1,500-2,000	4.1 – 2.4	0.8 – 0.4	0.3 – 0.15	0.5 – 0.3
2,000-2,500	2.4 – 1.6	0.4 – 0.2	0.15 – 0.1	0.3 – 0.15
Note: Modified from USFS and BLM, 2000.				

Maximum measured vertical displacement (S) values in the Bowie No. 2 Mine range from about 6.0 to 7.5 feet in the upper B-seam above longwall panels B-10, B- 11, and B-12, where the overburden depth ranges from 600 to 1,050 feet. The greatest measured S value (7.5 feet) is located above mined panel B-11 due to yield on adjacent gate road pillars caused by mining of adjacent panels.

Overburden depths in the LBA tract for the B-seam range from about 950 feet in the southeastern portion under Terror Creek but gain overburden rather quickly, climbing out of the drainages to the north and west to 2,300 feet. Based on these data, the S values after mining is complete for the LBA tract vary depending on overburden depths from a maximum projected value of 4.2 feet in the western portion to a maximum projected value of 5.7 feet in the eastern portions. The location of this maximum projected subsidence value is located approximately 300 feet south of the West Fork of Terror Creek. Based on the information contained in the North Fork Coal EIS (USFS and BLM, 2000), and past experiences in valley, the mining is unlikely to result in detectable surface subsidence impacts.

Geologic Hazards. Generally, potential geologic hazards include landslides, frost heaves, and seismic activity related to known or suspected active faults or mining. Landslides and rockfall represent the geologic hazards within the LBA tract. Some landslides have occurred within the area during the past 30 years (mainly as a result of higher-than-average precipitation during the 1980s). Some of these landslides occurred as reactivations of previously disturbed slopes, and some were new movements. Rockfall-prone areas occur in the western portion of the study area, as do less-extensive areas of unstable slopes.

Other Geologic Resources. Other mineral resources in the LBA area include existing oil and gas leasing and perhaps interest in coal bed methane. Impacts to the oil and gas resources are not expected to occur as result of the Proposed Action.

Cumulative Impacts

The cumulative impacts resulting from the continued underground mining in the LBA and adjacent area would primarily be due to the removal of large amounts of coal. Subsidence would be expected to be relatively uniform over large areas. The impacts of subsidence may include lowering elevations over subsided areas. Geologic formations within the subsidence area and above the extracted coal would be fractured. Gas resources could be lost due to the venting of methane through mine operations. However, future gas production in the area could be improved due to fracturing of the rock. There may be small areas that would require stipulations in order to restore surface drainage patterns; however, the overall impacts of subsidence would be minor. Dispersed residential and other development activities would result in only localized impacts to geology, mineral resources, and paleontology. The overall cumulative impacts of these developments would be minor.

Stipulations

As required by DRMS, a subsidence monitoring survey network will be added to the area if the area is mined. The following will be implemented:

- No surface occupancy would be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the lessee, at their expense will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, stock pond, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, livestock and wildlife use, or other land uses as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.
- The operator/lessee would be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee would be required to establish or amend a monitoring program to be used as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program shall provide the procedures and methodologies to adequately assess interrelationships between geology, topography,

hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program shall incorporate baseline data so as to provide a continuing record over time.

No Action Alternative

Under the No Action Alternative, there would be no project-related impacts to the geology of the area from subsidence because the lease would not be issued; however, mining on adjacent leases could have effects but they are expected to be minimal.

CULTURAL RESOURCES

Affected Environment

For Cultural resources the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

A Class III cultural resource inventory was conducted for the entire proposed lease area to identify any cultural resources present (Connor et al., 2012). The inventory resulted in identification and documentation of ten sites within the study area. Of these ten sites, seven had historic materials, two had prehistoric materials, and one site contained both historic and prehistoric materials. Three of the sites within the proposed lease area have been officially deemed eligible for listing on the National Register of Historic Places (NRHP) by the State Historic Preservation Officer (SHPO) so are considered historic properties. These include two historic sites and one prehistoric site. One site with prehistoric and historic materials was determined to be potentially eligible to the NRHP and so is managed as a historic property. The remaining sites were determined Not Eligible to the NRHP by the Colorado SHPO and so are not considered significant cultural resources and do not require additional management consideration.

Environmental Consequences/Stipulations

Proposed Action

Subsidence associated with the Proposed Action is expected to be minimal and would generally affect the area immediately overlying those areas that are mined (see Geology and Minerals). Two historic properties are located within the projected subsidence area; the remaining two significant sites would not be affected by subsidence. It has been determined that, while two historic properties are present within the projected subsidence area, it is not expected that they would be adversely affected by subsidence within the LBA tract (Lane, 2013). These sites would be monitored after project activities commence to ensure the continued integrity of both sites; if changes affecting the site are observed, stabilization or stipulations would be conducted in consultation with Tribes and Colorado SHPO.

Any post-leasing surface use would require avoidance or mitigation of the historic properties or potential historic properties within the lease tract. In addition, if any cultural resources are discovered during construction of the pads or roads, construction would stop and the BLM or USFS would be notified immediately.

Cumulative Impacts

Four historic properties have been documented within the LBA area and only two of these sites are located within the projected subsidence area, which could cause effects from underground mining. None of the sites is located in outcrop areas or on steep slopes, which could harm sites as a result of pronounced effects from subsidence. No significant changes in drainage patterns, which could cause erosion to sites, are expected. Increased surface activity in the vicinity of the historic properties could lead to increased impacts to sites over a short period of time as access into the area increases, but any such impacts are expected to be minor since access roads and pads on the surface would later be reclaimed and access would be restricted during mining activities. Consequently, cumulative impacts to historic properties are expected to be minor.

Stipulations

Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS and BLM shall:

- Contact the BLM/FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:
 - Engage the services of a cultural resource specialist acceptable to the BLM/FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/FS for review and approval at the time a surface disturbing plan of operation is submitted.
 - Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.
- The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

No Action Alternative

Under the No Action Alternative, there would be no impacts from subsidence or mining-related surface activities to cultural resources in the proposed lease tract as leasing would not occur

NATIVE AMERICAN RELIGIOUS CONCERNS

Native American religious concerns are associated with cultural practices or beliefs of a living community rooted in the history or religion of that community and are important in maintaining the continuing cultural or religious identity of the community. Consultations with tribes that historically occupied the proposed lease area did not identify any religious concerns.

SOILS

Affected Environment

For soil resources the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Surface soils in the lease area are mapped in two separate reports: Soil Survey of Grand Mesa – West Elk Area, Parts of Delta, Garfield, Gunnison, Mesa and Montrose Counties and Soil Survey of Paonia Area, Parts of Delta, Gunnison, and Montrose Counties (see Map 4).

There are 15 soil mapping units (MUs) present within the LBA tract. Each of the soils is described below using reports generated from the Natural Resources Conservation Service (NRCS) Soil Data Mart SSURGO data (NRCS, 2013a, b and c). The soil types include clay, loam, clay loam, stony to very stony clay and loam, and gravelly to very gravelly clay and loam. The mapped soil units generally have moderate to severe erosion potential, with K factors ranging from 0.10 to 0.28. None of the soils has saline or sodic characteristics and none meet hydric criteria. The West Fork of Terror Creek channel in the lease area is covered by two mapped soil units: 158 Herm-Fughes-Kolob family complex with 25 to 40 percent slopes, and 39 Fughes loam with 25 to 65 percent slopes (see Map 4).

Table 13 provides the acres of each soil mapping unit within the proposed LBA area. This information is consistent with the discussion in the North Fork Land Health Assessment (LHA) (BLM, 2007). The North Fork LHA evaluated the general area as meeting Standard 1 for soils. Some potential soil protection issues related to high bare ground and low plant basal cover were noted; however, soil loss and runoff damage problems were not identified.

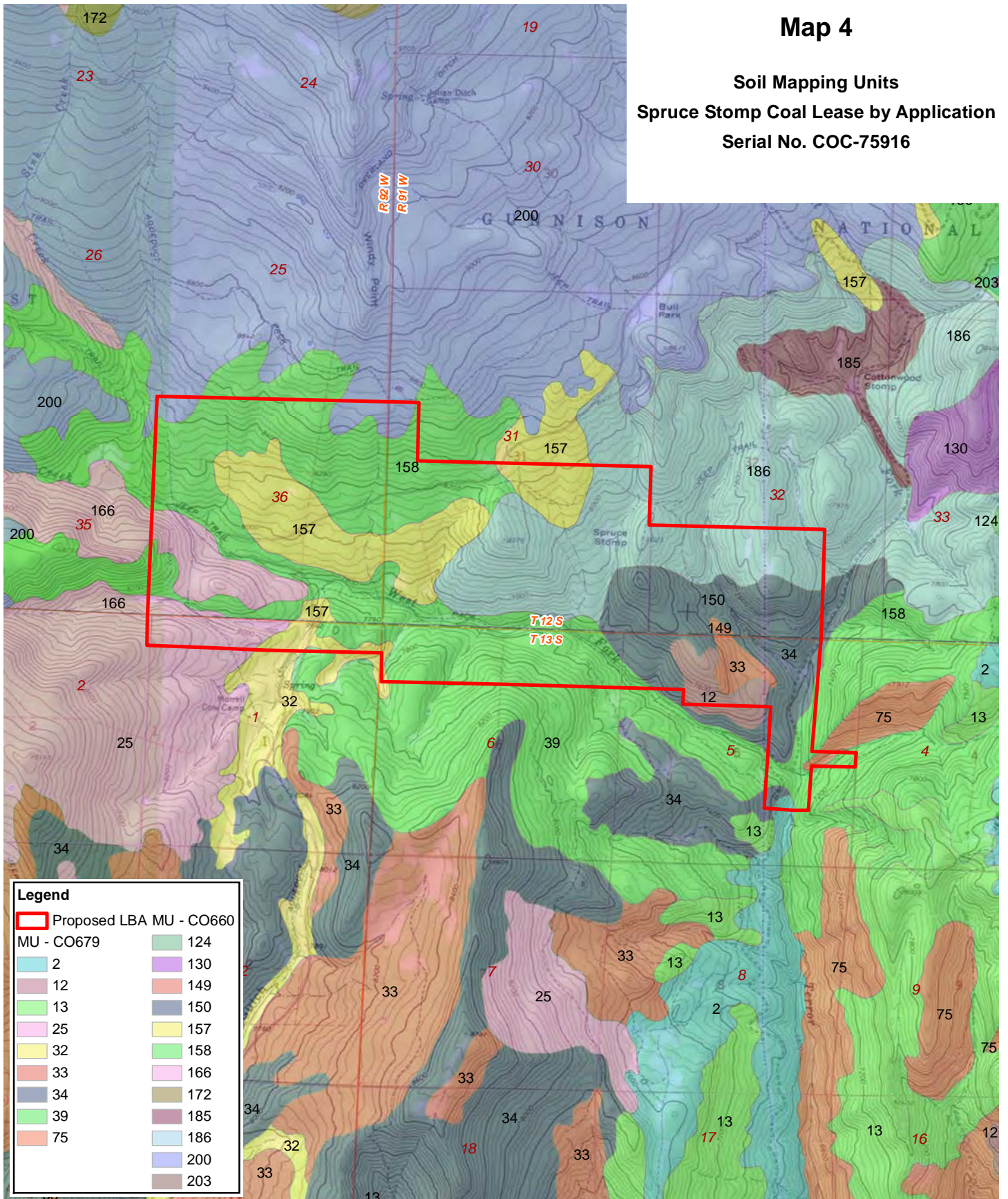
Soil Survey Area CO660 – Grand Mesa – West Elk Area, Colorado, Parts of Delta, Garfield, Gunnison, Mesa, and Montrose Counties

The Godding-Kolob family-Delson complex (MU149 & MU150) are well drained soils found on mesas and benches. They are derived from overburden residuum weathered from basalt and colluvium derived from basalt and/or interbedded colluvium derived from sandstone and shale. The slopes range between 5 to 65 percent. The effective rooting depth is greater than 60 inches. The Godding-Kolob component contains up to 70 percent large stones. The soil is not flooded or ponded. Susceptibility to water erosion is low to moderate.

The Herm-Fughes complex and the Herm-Fughes-Kolob family complex (MU157 and MU158) are well drained soils found on mountains. They are derived from interbedded colluvium derived from sandstone and shale and/or interbedded residuum weathered from sandstone and shale. The slopes range between 5 to 40 percent. The effective rooting depth for the Herm component is greater than 60 inches. The Fughes component has a restrictive layer of paralithic bedrock at 40-60 inches and contains up to 15 percent large stones. The Kolob component is very stony containing up to 70 percent large stones. These soils are not flooded or ponded. Susceptibility to water erosion is low to moderate.

Map 4

Soil Mapping Units
Spruce Stomp Coal Lease by Application
Serial No. COC-75916



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM

3,000 0 3,000
Feet



Table 13
Summary of Soil Resources within the LBA Tract

Soil Mapping Unit	Acres in the Proposed Lease	Percent of the Proposed Lease	Hazard of Erosion	Rutting Hazard
Grand Mesa – West Elk Area, Colorado, Parts of Delta, Garfield, Gunnison, Mesa, and Montrose Counties (CO660)				
Godding-Kolob family-Delson complex (MU149), 5 to 25 percent slopes	2.83	0.16	Moderate to severe – slope erodibility	Slight to Severe– low strength
Godding-Kolob family-Delson complex (MU150), 25 to 65 percent slopes	139.71	7.81	Severe – slope erodibility	Severe – low strength
Herm-Fughes complex (MU157), 5 to 25 percent slopes	252.35	14.10	Moderate to severe – slope erodibility	Severe – low strength
Herm-Fughes-Kolob family complex (MU158), 25 to 40 percent slopes	462.59	25.85	Severe – slope erodibility	Severe – low strength
Leroux-Seitz complex (MU166), 5 to 40 percent slopes	91.78	5.13	Moderate to severe – slope erodibility	Severe – low strength
Shawa-Sandia family-Kolob family complex (MU186), 40 to 65 percent slopes	348.44	19.48	Severe – slope erodibility	Severe – low strength
Wetopa-Wesdy complex (MU200), 5 to 65 percent slopes	37.95	2.12	Severe – slope erodibility	Severe to Moderate– low strength
Paonia Area, Colorado, Parts of Delta, Gunnison, and Montrose Counties (CO679)				
Absarokee-Work Loams (MU2), 6 to 25 percent slope	2.80	0.16	Severe – slope erodibility	Severe – low strength
Beenon-Absarokee loams (MU12) 5 to 20 percent slope	36.15	2.02	Moderate to severe – slope erodibility	Severe – low strength
Cochetopa stony loam (MU 25) 10 to 40 percent slope	45.90	2.57	Moderate – slope erodibility	Moderate – low strength
Delson loam (MU 32) 3 to 12 percent slope	24.30	1.36	Moderate – slope erodibility	Severe – low strength
Delson stony loam (MU33) 3 to 20 percent slope	24.85	1.39	Moderate – slope erodibility	Severe – low strength
Delson very stony loam (MU34) 20 to 60 percent slope	108.49	6.06	Severe – slope erodibility	Moderate – low strength
Fughes loam (MU39) 25 to 65 percent slope	207.17	11.58	Severe – slope erodibility	Severe – low strength
Torriorthents-Rock outcrop, sandstone complex (MU75)	3.89	0.21	Severe – slope erodibility	Slight – strength
Total	1,789.20	100		

The Leroux-Seitz complex (MU166) are moderately to well drained soils found on valleys and mountains. They are derived from residuum weathered from basalt and/or interbedded residuum weathered from sandstone and shale and/or colluvium derived from basalt and/or interbedded colluvium derived from sandstone and shale. Slopes range from 5 to 40 percent. The soil is not flooded or ponded; however, a seasonal zone of water saturation in the Leroux component is at 30 inches during April, May, June, and July.

The Shawa-Sandia family-Kolob family complex (MU186) are well drained soils found on mountain slopes and benches. They are derived from interbedded residuum weathered from sandstone and shale and/or interbedded colluvium derived from sandstone and shale. The slopes range from 40 to 65 percent. The Sandia soil has a restrictive layer of paralithic bedrock at 40 to 60 inches. The Kolob component is very stony containing up to 70 percent large stones. This mapping unit is not flooded or ponded.

The Wetopa-Wesdy complex (MU200) are well drained soils found on mountain slopes ranging from 5 to 65 percent. They are derived from interbedded residuum weathered from sandstone and shale and/or interbedded colluvium derived from sandstone and shale. Depth to a restrictive layer is greater than 60 inches. The Wesdy soil may contain up to 45 percent large stones. These soils are not flooded or ponded.

Soil Survey CO6790 – Paonia Area, Colorado, Parts of Delta, Gunnison, and Montrose Counties

The Abasarokee-Work loams (MU2) are moderately deep, well drained soils found on valley sides and uplands. The slopes range from 6 to 25 percent. The soils are derived from weathered sandstone. The hazard of erosion from wind is slight and from water is moderate to high. The mapping unit is not flooded or ponded. The Absarokee soil has a restrictive layer of lithic bedrock at 20 to 40 inches and the effective rooting depth for the Work loam is greater than 60 inches.

The Beenon-Absarokee loams (MU 12) are well drained soils derived from weathered sandstone and interbedded shale. The mapping unit slopes range between 5 to 20 percent. The Beenon component is shallow and overlies bedrock at a depth of 10 to 20 inches and contains up to 25 percent large stones. The effective rooting depth is approximately 14 inches. The Absarokee loam is moderately deep, overlies bedrock at a depth of 20 to 40 inches and contains up to 15 percent large stones. The effective rooting depth is approximately 30 inches. Water erosion for this complex is moderate to high. Limiting characteristics of the mapping unit include high clay content, depth to bedrock, low organic content, and low available water content.

The Cochetopa stoney loam (MU 25) is a deep, well drained soil derived from alluvium and or complex landslide deposits and has slopes that range between 10 and 40 percent. The hazard from water erosion is moderate to high, and the effective rooting depth is greater than 60 inches. The stone content varies from areas free of stones to small areas with stone contents up to 45 percent. This mapping unit has inclusions in depressions that are considered hydric. The main limitations for construction within this soil unit are the presence of large stones, shrink-swell potential, low strength, and slope.

The Delson loams (MU32, MU33, MU34) are deep, well drained soils formed in stony outwash alluvium from igneous origin. Slopes within these three mapping units range from 0 to 60 percent, and the stone content ranges from 0 to 70 percent. The main limitations for construction within these soil units are stones, low strength, and shrink-swell potential because of the high clay content and the slopes in MU34.

The Fughes loam (MU 39) is a deep, well drained soil formed in old alluvial fan and/or complex landslide deposits. Surface runoff is rapid to very rapid and the hazard from water erosion is high. The main limitations for construction within this soil unit are high clay content, low strength, shrink-swell potential, and slope. The soil limitations within these soil mapping units could be overcome through proper engineering designs and application of appropriate reclamation procedures.

Torriorthents-Rock outcrop, sandstone complex (MU75) is a well drained soil found on moderate to steep mountain slopes ranging from 20 to 50 percent. The Torriorthents soils occur in less sloping area and are derived from stony loamy rockfall deposits. The rock escarpments commonly occur on the upper part of the slopes. Depth to a restrictive layer of lithic bedrock is 10 to 70 inches. Surface runoff is rapid but surface stoniness helps prevent water erosion. The soil is not flooded or ponded.

Environmental Consequences/Stipulations

Proposed Action

Table 13 provides the acres of each soil type within the LBA tract as well as the potential hazard for roads and rutting. If the lease and a subsequent mine plan were approved, MDW pad drilling and partial reclamation would occur over a period of several years. Topsoil from portions of the approximate 1-acre MDW drill pads to be reclaimed would be stockpiled separately from other soil horizons and used to reclaim portions of the drill pads. Topsoil salvage helps to retain microbial communities that can accelerate revegetation of disturbed areas.

The potential direct impacts resulting from MDW drilling would be:

- physical removal, mixing, or burying of surface soils;
- damage including compaction or destruction of soil properties in place;
- mixing of drilling wastes into the pad subsoil materials; and
- localized losses or decreases in vegetation cover and plant litter.

Under the reasonably foreseeable future mine plan, future MDW drill pads and access roads and their associated 45 acres of surface disturbance have the potential to result in short-term indirect impacts to soil through increased water and wind erosion. This could result in a loss of surface soil, potentially impacting the viability of vegetation communities. Soil loss during project activities would be mitigated by seeding the soil stockpiles according to BLM and USFS specifications.

Roads would be reclaimed after mining is complete and ventilation is no longer needed. The period of active use of the roads for drilling would be from a few days to a few weeks, depending

upon the number of drill pads a road would access. Reclamation would include returning disturbed areas to original contours and revegetating the disturbed areas using a USFS or BLM-approved native seed mix. Reclamation of the disturbed areas would be monitored annually until considered successful by the jurisdictional agencies.

Some subsidence is expected to occur as a result of underground activities. Some fracturing or loosening of the soil profile may occur in areas where the surface shows tensile subsidence fractures from the irregular pattern of subsidence and, to a lesser degree, some compression may result in, and near, the areas of maximum subsidence. These modifications to the soil profile could result in increased percolation of water in areas that are fractured and reduced percolation in areas that are compressed. These slight modifications to the soil profile are not expected to result in appreciable changes to the characteristics or properties of the soils.

Cumulative Impacts

The cumulative impacts of continued underground mining to soils in the LBA area would primarily be the disturbance effects of future MDW surface facilities. These additional surface disturbing activities would affect the soil resource by displacing soils at specific locations. The topsoil and subsoil is stockpiled and reserved for reclamation. Contemporaneous reclamation techniques would be used, thus replacing/re-using the soils on the site as soon as the location is no longer needed.

The area around the LBA contains numerous existing natural landslides and other unstable areas. These natural features when combined with surface disturbing activities and subsidence from existing and future coal mining would continue to contribute to localized increased sedimentation. In addition, if landslides and rockfalls are initiated or accelerated due to subsidence, increased sedimentation and erosion is likely to occur in those areas. Previous experience in the North Fork has demonstrated that subsidence triggered mass wasting has not been significant enough to adversely affect terrestrial and aquatic ecology.

There could be local areas of increased erosion; however, the overall impacts to soils would be minor. Oil and gas development, dispersed residential, recreation use, ATV use, and other developments would result in localized impacts to soils; however, the overall cumulative impacts of these developments would be minor.

Stipulations

- None in addition to those in the Geology and Minerals and Threatened and Endangered Species sections.

Finding on the BLM Public Land Health Standard for Upland Soils

The existing soil conditions meet the criteria established in the Public Land Health Standard for upland soils. As appraised in the North Fork LHA (BLM, 2007), the BLM land within the LBA tract meets LHA Standard 1 for soils; however, there are some sites noted with high bare ground and low plant basal cover in the general area. Yet, these sites had adequate litter cover and showed no soil loss or runoff drainage problems.

Currently, there are no identified serious problems with poorly located and maintained roads; however, care needs to be taken in order to monitor this situation in this steep terrain. Based upon the limited disturbance and required site reclamation, the Proposed Action would not change the existing conditions for upland soils in the LBA tract, and natural soil functions would be maintained with the applied stipulations.

No Action Alternative

Under the No Action Alternative, there would be no impacts to soils within the LBA tract because the lease would not be issued. Subsidence from existing lease tracts would occur but the impacts should be minimal on the LBA tract.

VEGETATION

Affected Environment

For vegetation resources the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Habitats in the project area are dominated by mountain shrub communities, primarily Gambel oak, on south-facing slopes, with aspen, spruce-fir, and grasses as the next three dominant cover types by acreage. There are smaller areas of other mountain shrubs and Douglas-fir, with very small areas of sagebrush and juniper within the lease area. Riparian habitat is dominated by blue spruce which typically contains limited populations of narrowleaf cottonwood and willows, including strapleaf, mountain or whiplash willow (USFS, 2013a). While Table 14 shows dominant cover types, there are other species and inclusions of other habitat types within the polygons of the vegetation layer in GIS, and numerous habitat types occur below the resolution of the GIS data. For instance, riparian vegetation along Terror Creek within the analysis area contains substantial strapleaf willow and other riparian vegetation which is not represented by the categorization above. The project area lies at 7,000 to 8,800 feet elevation (see Table 14).

Environmental Consequences/Stipulations

Proposed Action

Under the reasonably foreseeable surface use scenario, it is assumed that approximately 45 acres of vegetation would be disturbed by project activities, of which mountain shrub and aspen forest are expected to be the vegetation types most affected. The road and pad locations have not yet been determined so the impacts of those surface activities are assumed to be proportional to the available surface vegetation proportions in the LBA tract, which would result in most disturbance occurring within mountain shrubland and aspen forest vegetation types (see Table 14).

Table 14
Vegetative Cover-types Present within Proposed LBA Tract

Vegetation Type	Watershed (acres)	Lease Area (acres)	Percent of Lease Area within Watershed
Greasewood	1.4	0	0.0
Mountain grassland	2,130.70	93.63	5.2
Mountain shrub	5,485.30	1260.45	70.4
Bare ground (roads, rock)	287.7	41.83	2.3
Riparian	119.5	11.35	0.6
Sage	463.7	0.30	0.0
Aspen	6,002.30	226.34	12.7
Aspen forest with conifers	609.6	38.48	2.2
Cool moist mixed conifer	58.4	22.69	1.3
Spruce-fir	3,332.60	93.04	5.2
Pinyon-juniper	344.5	1.09	0.1
Water	32.9	0	0.0
Total	18,868.70	1,789.20	100

Localized, short-term disturbance (up to 2 years) to vegetation would result from the construction and use of light-use roads, as well as activities associated with the drilling of 35 MDWs (25 drill pads). During road and well pad construction and route use, vegetation would be disturbed, crushed, or removed. Indirect impacts to vegetation would include increased dust deposition and effects to the native plant community from the introduction of weeds and weedy species. MDW pads and roads would not all be built at one time. It is customary to construct pads and associated access roads in advance of the longwall position, and then restore them once the mining has progressed beyond these locations. Interim reclamation would occur after construction and drilling activities are complete to reduce the amount of bare ground associated with construction of roads.

After mine ventilation is no longer required (approximately 1 to 3 years after construction is completed), drill pads and access roads would be reclaimed, recontoured, and revegetated with native vegetation using BLM and USFS-approved seed mixes. These areas would be recontoured and revegetated with grasses and forbs for erosion control in the short term, and would revegetate to appropriate mid-seral vegetation states for each of the native vegetation types over the long term. Revegetation of areas where trees or shrubs would be disturbed would take longer (10 to 30 years) than areas where only grasses and forbs would be disturbed (2 to 5 years). Although there would be a short-term shift in species composition until native trees and shrubs become reestablished, all areas of disturbance would be reclaimed; and therefore, habitat would not be permanently removed from the landscape but would be removed in the short-term.

Mining may result in subsidence of surface topography as coal is removed from below. This subsidence has resulted in minor landslides. Such disturbance, however, has been limited to steep and unstable ground and has not been widespread in undermined areas. Most surface subsidence has been relatively uniform across the landscape and in most areas does not visibly alter surface

features or vegetation. Impacts to the vegetation community resulting from channel profile changes could occur if water availability along the riparian corridor is significantly altered or if slope instability occurs. WWE found that the wetted perimeter of the West Fork of Terror Creek is not expected to change noticeably following subsidence, based on the magnitude of slope changes (WWE, 2013a). Thus, underground activities would not be expected to impact vegetation within the LBA tract.

Cumulative Impacts

Other than minor subsidence impacts and disturbance from past and future mine location exploration and MDW development, continuing mining operations in the LBA area would not greatly impact vegetation communities. Grazing is anticipated to continue, as practiced, and vegetation communities are not expected to be substantially altered by this practice. However, grazing activity as well as other multiple use programs such as recreation and hunting incrementally increases the establishment of weeds and nonnative species in the region, which will incrementally add to the loss of native plant communities across the landscape, especially for the short term. Sudden Aspen Decline (SAD) is present in the project area and throughout the watershed, though the extent has not been documented. The limited extent of surface mining activities would not be expected to adversely affect overall aspen stand health or survival. There may be local displacement of vegetation communities as a result of continued dispersed residential and timber/vegetation management activities, continued oil and gas development, recreation and ATV use. Overall, cumulative impacts to vegetation are expected to be minor, and mining operations would negligibly contribute to these impacts.

Stipulations

None.

Finding on the BLM Public Land Health Standard for Plant and Animal Communities (partial, see also Wildlife, Aquatic; Wildlife, Terrestrial; and Invasive, Non-native Species)

The North Fork LHA (BLM, 2007) found that the project area was generally in good condition, with a few areas with low ground cover and less plant litter than expected. Cheatgrass (*Bromus tectorum*) is present throughout the LBA tract. The problems were not identified as serious. Vegetation communities on BLM-managed lands in the LBA tract and within the existing lease areas would continue to meet Public Health Standard 3.

No Action Alternative

Under the No Action Alternative, there would be no impacts to vegetation within the LBA tract because the lease would not be issued.

INVASIVE, NON-NATIVE SPECIES

Affected Environment

For invasive, non-native species, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

The State of Colorado maintains a list of plants that are considered to be noxious weeds and are given one of three categories that should be managed according to the Colorado Noxious Weed

Act: Category A species are not known to occur in Colorado or are very limited and should be eradicated; Category B species have varying distributions and densities and weed management plans should be designed to stop the continued spread of these species; and Category C species are widespread and common in Colorado but may be required to be controlled (Colorado Department of Agriculture, 2011). Noxious weed surveys were not conducted for the LBA tract; however, the BLM and USFS have summarized data for known noxious weed occurrences in the general project area. Yellow starthistle, the only Category A species identified, has the largest number of occurrences (see Table 15). Because roads are typically vectors for weed seeds, noxious or invasive weed species would likely be present on or adjacent to the areas that would be disturbed by drilling equipment.

Table 15
Invasive Plant Species Identified in the General Project Area

Scientific Name	Common Name	Category	Number of Distinct Occurrences
<i>Acroptilon repens</i> (L.) DC.	Russian knapweed	B	4
<i>Arctium minus</i> Bernh.	common burdock	C	11
<i>Cardaria draba</i> (L.) Desv.	hoary cress/whitetop	B	1
<i>Carduus nutans</i> L.	musk thistle	B	19
<i>Centaurea diffusa</i> Lam.	diffuse knapweed	B	1
<i>Centaurea solstitialis</i> L.	yellow starthistle	A	47
<i>Cirsium arvense</i> (L.) Scop.	Canada thistle	B	33
<i>Cichorium intybus</i> L.	Chicory	C	8
<i>Cirsium vulgare</i> (Savi) Ten.	bull thistle	B	5
<i>Cynoglossum officinale</i> L.	houndstongue	B	1
<i>Lepidium latifolium</i> L.	perennial pepperweed	B	8
<i>Leucanthemum vulgare</i> Lam.	oxeye daisy	B	2
<i>Verbascum thapsus</i> L.	common mullein	C	1
<i>Lepidium latifolium</i>	tall whitetop	B	Present
<i>Aegilops cylindrica</i>	jointed goatgrass	B	Present

Environmental Consequences/Stipulations

Proposed Action

Under the assumed reasonably foreseeable surface use scenario, light-use roads and drill pads associated with MDW drilling would cause surface disturbance. Access roads would involve scratch-grading or surface preparation that could result in surface disturbance and expose areas to the establishment of noxious weeds. Where soils are disturbed and native vegetation is lost, there is a potential for invasive and non-native plant species to establish. Once established, invasive and exotic species can dominate the sites and prevent effective recovery of native species.

Reclamation of roads, as well as of each drill pad site, would include grading, scarifying, and seeding using BLM- and USFS-approved seed mixtures and application rates. Seeding would occur both as an interim control measure after construction activities are completed and as part of final reclamation, and would occur at a time when opportunities are greatest for establishment (including late summer, fall, or early spring) in order to improve germination rates. As documented with mine operations and reclamation practices in the North Fork, with the proposed stipulations, the risks of long-term noxious weed problems on the roads and MDW pads is expected to be low.

Cumulative Impacts

Other than minor subsidence impacts and disturbance from past and future mine location exploration and MDW development, continuing mining operations in the LBA area would not greatly impact vegetation communities' health and create opportunities for invasive species. There may be local infestations created as a result of continued dispersed residential and forest management activities, continued oil and gas development, grazing, recreation, and ATV use. Stipulations required to control invasive species should limit the impacts from invasive species.

Stipulations

Noxious weed control would be required along access routes and at drill sites, in accordance with the Colorado Noxious Weed Act. Stipulations include:

- An inventory shall be completed for noxious weeds within the LBA tract before construction begins in order to determine whether there is a need for pre-treatments (with results of the inventory shared with the USFS and BLM weed specialist).

The DRMS mining permit requires a noxious weed control plan.

Finding on the BLM Public Land Health Standard for Plant and Animal Communities (partial, see also Wildlife, Aquatic; Wildlife, Terrestrial; and Vegetation)

The LBA tract meets Public Land Health Standard 3 for healthy native communities; however, some exotic invasive plant species are known to exist within the area. Precautions need to be maintained in order to minimize the spread and/or introduction of invasive, non-native species within the project area. With implementation of the stipulations, assumed surface activities would not impact the viability of plant populations or communities. Vegetation communities within the proposed lease area would continue to meet the Standard.

No Action Alternative

Under the No Action Alternative, there would be no increase in the establishment and occurrence of noxious or invasive weeds within the LBA tract because the lease would not be issued.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Affected Environment

The cumulative effects analysis area is defined by the expanded watershed area from east of the town of Delta, north to the Mesa/Delta county line, east to the Pitkin County boundary, then south and west along the watershed for the North Fork of the Gunnison River back towards the town of Delta.

Federally threatened and endangered species are discussed in detail in the Programmatic Biological Assessment (PBA) that was conducted over a large effects area, which included the boundary of the current LBA tract (WestWater Engineering, 2011). In addition, a Biological Assessment (BA), supplementing the determinations of effect in the PBA, was completed to address subsidence impacts associated with longwall mining (WWE, 2013b). The applicable sections of the PBA and BA are summarized in this section. The USFS also prepared a Biological Evaluation (BE) specific to the project area, which included a Management Indicator Species (MIS) Assessment. Results are summarized in the appropriate sections of this document and the BE is included in the Project Record.

Informal Section 7 consultations were completed by the U.S. Fish and Wildlife Service (USFWS), Western Colorado Ecological Services Field Office on February 21, 2012, for Bowie Resources Underground Coal Mining Associated Surface Activities and Facilities and on June 27, 2013 for Longwall Coal Mining Spruce Stomp Lease Area (see Appendix E). The February 2012 informal consultation is programmatic in nature and addresses Bowie's mining-related surface developments and provides information about the potential effects of Bowie's action on federally-listed species included below. The June 2013 informal consultation is specific to subsidence effects associated with longwall mining. Appendix A to the February 2012 consultation document contains the BLM and USFS-required conservation measures that will be used in this and future approvals related to Bowie's developments. These conservation measures, as well as the conservation measures from the June 2013 consultation document, are incorporated into the stipulations in this section.

The USFWS (2012) identified 12 species as endangered, threatened, or candidate under the Endangered Species Act (ESA) that may occur in Delta County (see Table 16). In addition to federally-listed species, the USFS and BLM identified 19 other species as sensitive with the potential to occur within the general area of the LBA tract (see Table 17).

Table 16
Federally Threatened, Endangered, or Candidate Species in Delta County

Common Name/ Scientific Name	Status¹	Potential Occurrence in the Analysis Area²	Discussed in EA	Habitat³
Mammals				
Black-footed ferret <i>Mustela nigripes</i>	E, SE	None	No	Requires large prairie dog colonies in open habitat such as grasslands, steppe, and shrub steppe.
Canada lynx <i>Lynx Canadensis</i>	T, SE	Unlikely	Yes	Coniferous forests interspersed with thickets of trees and shrubs, rocky outcrops, large woody debris; closely associated with snowshoe hares. Present on Grand Mesa.
North American wolverine <i>Gulo gulo lucus</i>	C, SE	None	Yes	High elevation boreal and alpine habitats.
Birds				

Common Name/ Scientific Name	Status¹	Potential Occurrence in the Analysis Area ²	Discussed in EA	Habitat³
Gunnison sage-grouse <i>Centrocercus minimus</i>	C, SC	None	No	Expansive sagebrush with grasses, forbs, and healthy riparian ecosystems; project outside of expected range.
(Western) Yellow-billed cuckoo <i>Coccyzus americanus</i>	C, SC	None	No	Riparian forested habitats dominated by cottonwoods. Observed on North Fork of Gunnison River (Beason, 2009).
Fish				
Colorado pikeminnow <i>Ptychocheilus lucius</i>	E, SE	Unlikely	Yes	Fast, deep, white-water rivers with backwater areas and eddy habitats 2 to 3 feet deep that support aquatic insects, small fish as prey species.
Greenback cutthroat trout <i>Oncorhynchus clarki stomias</i>	T, ST	Present	Yes	Cold, clear, gravely headwater streams and mountain lakes with abundant insects; originally in the Arkansas and South Platte river drainages of Colorado and Wyoming. Recent genetic testing indicates populations exist in the Colorado River drainage.
Razorback sucker <i>Xyrauchen texanus</i>	E, ST	Unlikely	Yes	Slow backwater habitats or large rivers and impoundments, not small tributaries or headwaters, with mud, sand or gravel substrate.
Plants				
Clay-loving wild buckwheat <i>Eriogonum pelinophilum</i>	E, SE	None	No	Restricted to the badlands/Adobe Hills east of Delta and Montrose, CO.
Colorado hookless cactus <i>Sclerocactus glaucus</i>	E, SE	None	No	Rocky hills, alluvial benches, and lower mesa slopes in desert shrub communities from 4,500 to 6,000 feet.
¹ Status: T – Federally Threatened; E – Federally Endangered; C – Federal Candidate; SE – Colorado Endangered; ST – Colorado Threatened; SC – Colorado Candidate. (USFWS, 2013a). ² Potential Occurrence based on habitat associations and known distributions: None: May occur in Delta County but restricted distributions are distant and/or habitat is not present in the project area. Unlikely: May occur in Delta County and marginally suitable habitat present in the project area. Possible: Occurs in Delta County, suitable habitat is present, but not observed in the project area. Present: Observed in the project area and/or occupied habitat includes the project area. ³ Source: CPW, 2012a; CNHP, 2012.				

Table 17
BLM and USFS Sensitive Species that May Be Present in or near the LBA Tract

Common Name/ Scientific Name	USFS Status	BLM Status	CPW Status ¹	Potential Occurrence in the Analysis Area ²	Habitat ³
Mammals					
American marten <i>Martes Americana</i>	Sensitive	N/A	N/A	Likely	Subalpine, spruce-fir and lodgepole pine forests, alpine tundra and occasionally Montane forests. Generally associated with older growth or mixed age stands of spruce fir and lodgepole pine.
Spotted bat <i>Euderma maculatum</i>	Sensitive	Sensitive	N/A	Possible	Ponderosa pine in montane forest, pinyon-juniper woodlands, aspen, semi-desert shrublands.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	Sensitive	Sensitive	SC	Possible	Montane forests, pinyon-juniper woodlands, semi-desert shrublands.
Fringed myotis <i>Myotis thysanodes</i>	Sensitive	Sensitive	N/A	Possible	Ponderosa pine, greasewood, oakbrush, saltbush shrublands.
Hoary bat <i>Lasiurus cinereus</i>	Sensitive	N/A	N/A	Likely	Roosts in deciduous trees, forages over open watercourses and ponds.
Allen's (Mexican) big-eared bat <i>Idionycteris phylotis</i>	N/A	Sensitive	N/A	Unlikely	Ponderosa pine, pinyon-juniper woodland, oak brush, riparian woodland (cottonwood); typically found near rocky outcrops, cliffs, and boulders; often forages near streams and ponds.
Big free-tailed bats <i>Nyctinomops macrotis</i>	N/A	Sensitive	N/A	Possible	Occur in rocky areas and rugged terrain in desert and woodland habitats. Roost in rock crevices in cliffs and caves, and occasionally in tree cavities.
Birds					
American peregrine falcon <i>Falco peregrinus anatum</i>	Sensitive	Sensitive	SC	Possible	Open conifer forests, riparian forests, and cliffs; migrant in western Colorado.
Bald eagle <i>Haliaeetus leucocephalus</i>	Sensitive	Sensitive	SC	Possible	Reservoirs, rivers, wintering in semi-desert and grasslands.
Northern goshawk <i>Accipiter gentilis</i>	Sensitive	Sensitive	N/A	Possible	Forests of aspen, ponderosa pine, lodgepole pine; larger trees for nesting.
Ferruginous hawk <i>Buteo regalis</i>	Sensitive	Sensitive	N/A	Unlikely	Grassland, semi-desert shrublands, rare in pinyon-juniper; nest on isolated structures.
Flammulated owl <i>Otus flammeolus</i>	Sensitive	Sensitive	N/A	Possible	Old growth and mature ponderosa pine, Douglas fir, lodgepole pine, spruce/fir mixed with aspen, pinyon-juniper, hardwood forests from 6,000-10,000 feet.
Purple martin <i>Progne subis</i>	Sensitive	N/A	N/A	Possible	Inhabits old growth aspen, mixed aspen/ponderosa pine or Douglas fir, deciduous riparian woodlands, burns

Common Name/ Scientific Name	USFS Status	BLM Status	CPW Status ¹	Potential Occurrence in the Analysis Area ²	Habitat ³
					with snags. Migratory. Known to nest in watershed.
Olive-sided flycatcher <i>Contopus cooperi</i>	Sensitive	N/A	N/A	Present	Inhabits open mature spruce/fir and Douglas Fir. Forages in woodlands near edges, clearings, bogs, streams, and burned areas. Uses tall exposed perches in tops or high exposed limbs of trees. Migratory.
Lewis's woodpecker <i>Melanerpes lewis</i>	Sensitive	Sensitive	N/A	Possible	Open forest and woodland, often logged or burned, including oak, coniferous forest (often ponderosa), riparian woodland, and orchards, less often in pinyon-juniper.
Fish					
Colorado River cutthroat trout <i>Oncorhynchus clarki pleuriticus</i>	Sensitive	Sensitive	SC	Possible	Clear, headwater streams in the Colorado River drainage, clear mountain streams; no known populations of pure strain cutthroats on public lands managed in the LBA tract.
Amphibians					
Northern leopard frog <i>Rana pipiens</i>	Sensitive	Sensitive	SC	Present	Margins, banks of marshes, ponds, streams, other permanent water.
Reptiles					
Milk snake <i>Lampropeltis triangulum taylori</i>	N/A	Sensitive	N/A	Possible	Grasslands, sandhills, canyons, open woodlands ponderosa, pinyon-juniper; known along the North Fork of the Gunnison River.
Midget faded rattlesnake <i>Crotalus viridis concolor</i>	N/A	Sensitive	SC	Possible	Most terrestrial habitats in west-central Colorado including grasslands, shrublands, pinyon-juniper woodlands, coniferous forests.
¹ Colorado Parks and Wildlife Status Codes: SC = State Special Concern (not a statutory category) (CPW, 2013a). ² Potential Occurrence based on habitat associations and known distributions: Unlikely: May occur in Delta County and marginally suitable habitat present in the project area. Likely: Occurs in Delta County, suitable habitat is present, likely to be present in the project area. Possible: Occurs in Delta County, suitable habitat is present, but not observed in the project area. Present: Observed in the project area and/or occupied habitat includes the project area. ³ Sources: CNHP, 2013; CPW, 2012a; Weber and Wittmann, 1987; Andrews and Richter, 1992; Hammerson, 1986; Woodling, 1985; Fitzgerald et al., 1994.					

Federally-Listed Species

Canada Lynx. Canada lynx (*Lynx canadensis*) are known to be present on Grand Mesa, and at this time, all suitable habitats are considered to be occupied by this species (USFWS, 2010). The Spruce Stomp LBA area contains approximately 75 acres of mapped lynx habitat, all within the Crater Lake lynx analysis unit (LAU) on the Gunnison National Forest. This habitat is all west of the Stevens Gulch road and south of West Terror Creek, and much of it is within the riparian zone of the creek. The lease area also falls outside a USFS and BLM mapped LAU (BLM,

2002). No critical habitat has been designated in Colorado (USFWS, 2009a). There is little to no denning, wintering, or dispersal habitat (spruce/fir) within the proposed lease area.

North American Wolverine. On February 4, 2013, the USFWS published a proposed rule to list the distinct population segment (DPS) of the North American wolverine occurring in the contiguous United States, as a threatened species under the Endangered Species Act - ESA (USFWS, 2013b). The DPS evaluation in the proposed rule concerns the segment of the wolverine species occurring within the contiguous 48 states, including the northern and southern Rocky Mountains, Sierra Nevada Range, and North Cascades Range (USFWS, 2013b). The proposed rule did not propose any critical habitat for the species.

There are numerous historical records of North American wolverines from the Colorado Rocky Mountains; however, the species is believed to have been extirpated from the Southern Rocky Mountains in Colorado, New Mexico, and Wyoming by the early 1900s (Aubrey et al., 2007 cited in USFWS, 2013c).

Colorado River Endangered Fishes. The federally endangered Colorado pikeminnow (*Ptychocheilus lucius*) and razorback sucker (*Xyrauchen texanus*) are not present on the LBA tract but are found 30 miles downstream (USFWS, 1994) of the lease area in portions of the Colorado River system. No suitable habitat for these species is found within the LBA tract.

Greenback Cutthroat Trout. After passage of the Endangered Species Act of 1973 (USFWS 1973), the Greenback Cutthroat Trout (GBCT) (*Oncorhynchus clarki stomias*) was listed as Endangered (USFWS, 1998). In 1978, the species was down-listed to Threatened (USFWS, 1977; USFWS, 1998). No critical habitat has been designated for this species (USFWS, 2009b).

Questions about the taxonomic distinctions between greenback cutthroat trout and Colorado River cutthroat trout remain unresolved (USFWS, 2009b; USFWS, 2012). Based on recent genetic work, cutthroat trout in Colorado have been assigned to different DNA lineages, including the following: GB (greenback), CR (Colorado River), and RG (Rio Grande). It is not known if the DNA lineages represent subspecies.

MEC conducted sampling along the West Fork Terror Creek in 2012 (WWE, 2013a). Fin clips were analyzed for DNA sequence and based on this analysis, the cutthroat trout population in West Fork Terror Creek was identified with approximately 94 percent purity as GB-lineage cutthroat trout. At this time the USFWS considers GB-lineage populations equivalent to greenback cutthroat trout, and they are therefore protected as a threatened species under provisions of the ESA.

CPW considers the mainstem of Terror Creek, from the confluence of the East and West Forks to the confluence with the North Fork, as occupied habitat for GBCT (Kowalski, 2010). Recent surveys documented GBCT in the West Fork of Terror Creek, the East Fork of Terror Creek, and the upstream portion of Terror Creek (WWE, 2013a). There are an estimated 151 to 400 GBCT per mile within the reaches sampled by the Forest Service (Carrillo, 2010; Dare et al., 2011). GBCT are currently confined to mid to high elevation, high gradient streams, and non-native

trout species currently constitute the greatest threat to the long-term health of this species (Young, 2009).

BLM and USFS Sensitive Species

Sensitive species are discussed in detail in the BE and summarized here.

Mammals. The American marten is expected to occur in coniferous forest habitats within the West Terror Creek watershed. Martens show close association with mesic, dense coniferous forests with complex physical structure.

Six species of bats included in Table 17 could occur in the vicinity of the LBA tract:

- Spotted bats (*Euderma maculatum*) occur in ponderosa pine woodlands, pinyon-juniper woodlands, and open semi-desert shrublands (CPW, 2012b). Much of the roosting habitat within the North Fork River LHA area is in cracks and crevices in rock/cliff faces (BLM, 2007).
- Townsend's big eared bats (*Corynorhinus townsendii*) roost in caves, tunnels, mines, and buildings and can be found in lower elevation pinyon-juniper woodlands (Culver et al., 2008).
- Fringed myotis (*Myotis thysanodes*) commonly occupy oak and pinyon woodlands, as well as Douglas-fir and ponderosa pine forests, mines, caves, and buildings (Adams, 2003).
- Hoary bats (*Lasiurus cinereus*) roost in deciduous trees and forage over open watercourses and ponds.
- Allen's (Mexican) big-eared bats (*Idionycteris phyllotis*) occur in Ponderosa pine and pinyon-juniper woodlands, oak brush, riparian woodland (cottonwood). They are typically found near rocky outcrops, cliffs, and boulders and often forage near streams and ponds.
- Big free-tailed bats (*Nyctinomops macrotis*) occur in rocky areas and rugged terrain in desert and woodland habitats. They roost in rock crevices in cliffs and caves, and occasionally in tree cavities.

Birds. There are nine species of birds in Table 17 that are identified as BLM and/or USFS sensitive. Based on habitat present and the range of the species, these species are known to, or could, occur in the LBA tract. No survey information documenting population levels or status within the LBA tract for these species is available. Habitat requirements for these species include:

- Flammulated owls (*Otus flammeolus*) inhabit aspen stands at higher elevations within the drainage, and may use the project area for foraging.
- Brewer's sparrows (*Spizella berweri*) are a sagebrush-obligate species, occupying sagebrush steppe (Knick and Rotenberry, 2001) which may not be extensive enough within the LBA tract to support nesting populations.

- Northern goshawks (*Accipiter gentilis*) may nest within or adjacent to the LBA tract in larger trees.
- Purple martins (*Progne subis*) inhabit old growth aspen, mixed aspen/ponderosa pine or Douglas fir, deciduous riparian woodlands, and burns with snags.
- Olive-sided flycatchers (*Contopus cooperi*) inhabit open mature spruce/fir and Douglas fir woodlands.
- Lewis's woodpecker (*Melanerpes lewis*) inhabit open forests and woodlands, often logged or burned, including oak, coniferous forest (often ponderosa), riparian woodland, and orchards.

There is no suitable nesting habitat for bald eagles (*Haliaeetus leucocephalus*), ferruginous hawks (*Buteo regalis*), or peregrine falcons (*Falco peregrinus anatum*) within the LBA tract, although the lease area may be used for foraging. A Peregrine falcon nest has been located within 2 miles of the LBA tract, and individuals have been observed flying over the project area.

Fish. The LBA tract lies within the range of Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*); however, no individuals have been documented within the LBA tract. Refer to Greenback Cutthroat Trout section for discussion of genetic findings of Colorado River cutthroat trout lineages.

Herpetofauna. Sensitive BLM and/or USFS species of reptiles and amphibians likely or possibly present within the LBA tract, based on known distributions and habitat affinities, include the northern leopard frog (*Rana pipiens*), milk snake (*Lampropeltis triangulum taylori*), and midget faded rattlesnake (*Crotalus viridis concolor*). The northern leopard frog is usually found in permanent water with rooted aquatic vegetation. During the summer it inhabits wet meadows and fields (CPW, 2011). The northern leopard frog is known to be present in the general project area. The midget faded rattlesnake occurs in Delta County and is found in most habitats (CPW, 2011). Milk snakes occur in a variety of habitats including shrubby hillsides, canyons, and open stands of ponderosa pine with Gambel oak, pinyon-juniper woodlands, and river valleys (CPW, 2011). Milk snakes have been documented along the North Fork of the Gunnison River and could be present within the LBA tract.

USFS Management Indicator Species

A complete table of all of the GMUG Management Indicator (MIS) species is presented in the MIS Assessment (available in the Project Record). The Brewer's sparrow is not known or expected to occur in the project area, is unlikely to be impacted, and will not be discussed. The Abert's squirrel is a ponderosa pine obligate, is not known or expected to occur in this area, and will not be discussed. The northern goshawk and American marten are also Sensitive species and are discussed in that section of this document, with additional consideration for management indicator status.

Elk. Populations are abundant (and stable or increasing) on the Forests in R2 and the GMUG. The project area lies in both elk summer range and winter range, although elk use of the immediate area in summer appears to be limited (D. Garrison, personal observation). The proposed activities lie within CPW's Game Management Unit (GMU) 521, which is part of elk

Data Analysis Unit (DAU) E-14. The elk population estimate for this DAU, based on 2011 post-hunting surveys, was 17,610 elk (CPW, 2013b), within the objective population of 15,000 to 19,000. CPW estimated that during the 2011 hunting season (the last for which data is currently available) for GMU 521 there were 3,142 total hunters, who harvested 671 elk, a 21 percent success rate (CPW, 2013c). Population estimates and hunt data for 2012 were not available as of the time of this analysis.

Merriam's wild turkey. Turkey are widespread and locally abundant across the Paonia district, especially in oak and other shrub habitats, but they occur in all areas below approximately 10,000 feet at times. Turkeys are known to occur in and near the project area (D. Garrison, personal observation) and both breeding behavior (strutting) and brood rearing have been observed in the lease area. They are tolerant of human activities, and in winter are commonly found in yards and along roadways in close proximity to humans. Breeding Bird data show a strong upward trend in populations of this species in Colorado (Sauer et al., 2011).

Red-knaped sapsucker. In Colorado, red-naped sapsuckers forage in aspen, willows, and cottonwoods close to their nest sites, which are almost exclusively in mature aspen stands. According to BBS, populations appear to be stable or increasing in the United States, with areas of local declines. From the period 1966 to 2010, the three sapsucker species (combined in the Breeding Bird Survey - BBS analysis) have exhibited a positive trend of +2.6 percent in Colorado (Sauer et al., 2011). Red-naped sapsuckers are seen in aspen stands throughout the district in relatively low numbers (D. Garrison, personal observation). No surveys for this species have occurred in the project area.

Environmental Consequences/Stipulations

Proposed Action

Federally-Listed Species

Canada Lynx. The MDW as assumed under the reasonably foreseeable surface use scenario drilling activities would not adversely affect lynx denning habitat, wintering, or dispersal habitat. In addition, surface-disturbing activities would be limited in extent and would not occur during winter months; would not adversely affect local habitat components or stands in areas of lynx habitat; and would not cause lynx to avoid using the area. The Proposed Action would not notably affect lynx or suitable lynx habitat.

North American Wolverine. The Proposed Action is not likely to jeopardize the continued existence of North American wolverine, as there is currently no wolverine population in the State of Colorado. The available scientific and commercial information does not indicate that other potential stressors such as land management, recreation, infrastructure development, and transportation corridors pose a threat to the DPS (USFWS, 2013b). Section 7 (a)(4) of the ESA requires conferencing with FWS when a proposed action is likely to jeopardize the continued existence of a proposed species or destroy or adversely modify proposed critical habitat. Because the Proposed Action is unlikely to jeopardize the continued existence of North American wolverine, conferencing is not required.

Colorado River Endangered Fishes. No direct effects to endangered Colorado River fish are expected; however, water depletions associated with assumed activities could cause off-site effects to the endangered fish and their critical habitat (Colorado pikeminnow, Bonytail, Humpback chub and razorback sucker) in the lower Gunnison River and Colorado River (USFWS, 1994). Water depletions from the Upper Colorado River Basin would be likely to adversely affect the four federally-listed Colorado River fishes and likely to adversely modify their designated critical habitats. Water depletions were addressed in the USFWS Programmatic Biological Opinion (PBO) (ES/GJ-6-CO-08-F-0010) for water depletions associated with BLM projects authorized by the BLM within the Upper Colorado River Basin in Colorado on February 25, 2009 (USFWS, 2009b). The PBO includes reasonable and prudent alternatives developed by the USFWS, which allow BLM to authorize water depletions while avoiding the likelihood of jeopardy to the endangered fish and avoiding destruction or adverse modification of their critical habitat. The PBO requires the BLM State Office to track all projects that result in water depletions from the Upper Colorado River Basin and provide an annual report to the Service. In addition, the USFS has a PBO with the USFWS (ES/GJ-6-CO-99-F-033-CP062) which has a project limit of 50 acre-feet (yearly total 100 acre-feet). The UFO would include any water depletions associated with the project in the annual report to the BLM State Office.

To comply with the above PBO, the lessee is required to report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from any coal mining-related actions within the project area, regardless of surface or mineral ownership. Depletion fees would be paid by the BLM as required in the above-mentioned PBO.

Greenback Cutthroat Trout. Potential effects to GBCT in Terror Creek and the West Fork of Terror Creek could occur from pumping water for drilling; if sediment entered the creeks as a result of soil disturbance from subsidence; or during construction and/or improvement of access roads. Impacts to water quality and quantity could have negative effects on GBCT populations. Dust, erosion, storm water runoff, chemical spills or fluid releases could be a concern if the roads and MDW pads are located within close proximity to the Terror Creek drainage.

On February 21, 2012, an informal Section 7 consultation for Bowie Resources Underground Coal Mining Associated Surface Activities and Facilities was completed by the USFWS, Western Colorado Ecological Services Field Office, and is contained in Appendix E to this EA. This consultation was done in order to reduce or eliminate potential impacts and a suite of conservation measures was developed by the BLM and Bowie. These conservation measures were concurred upon by the USFWS during the February 2012 informal consultation and would be applied to the LBA tract. Conservation measures include project setbacks from occupied streams; reclamation standards; erosion/sediment control measures and implementation monitoring; and measures to avoid take, entrapment, and entrainment of fish during water pumping activities (see stipulation section for details). Specifically, no new surface disturbance would occur within 200 feet of GBCT occupied habitat as measured from the normal high water mark, and maintenance of roads or other existing features within this zone would be limited to the existing road prism or footprint. The USFWS noted that their understanding of *surface disturbance* to be any project-related disturbance resulting in direct and pronounced alteration, damage, removal, displacement, or mortality of vegetation, soil, or substrates, or similar effects. Also, the BLM and the USFS have committed to ensuring that adequate and proper erosion control measures are implemented and effective, such that adverse effects do not occur to GBCT

and its habitat. Based on this information, the USFWS concurred with BLM's determination that the Proposed Action may affect, but is not likely to adversely affect greenback cutthroat trout, due to discountable and insignificant effects.

WWE conducted an analysis of potential subsidence impacts on the West Fork of Terror Creek aquatic life and water supply due to potential mining of the LBA tract (WWE, 2013a). Mining would be expected to result in a maximum subsidence of about 5.7 feet at the center, near the eastern edge, of the longwall panel with the smallest overburden thickness. This location is approximately 300 feet south of the West Fork of Terror Creek channel. Based on existing topography and geologic modeling, a maximum estimated 5.1 feet of subsidence along the West Fork of Terror Creek channel would be expected to create no more than a 1.5 percent channel slope change. Because the LBA tract generally consists of steep terrain (often in excess of 25 percent slopes), the expected change in slopes is expected to be mostly, if not completely, imperceptible without the aid of survey equipment. A change of 2 percent within the average channel slope of 5.5 percent could lead to an increase in the size of particles transported from 500 mm to 650 mm (WWE, 2013a). However, while some larger material would be mobilized following channel slope increase induced by subsidence, the overall stability of the largest particles should not be significantly compromised as a result of the slope change (WWE, 2013a). Other subsidence related impacts, such as surface cracking or water loss would not be expected to the degree that they would negatively impact the quality of the aquatic habitat of the LBA tract. Based on this analysis, adverse impacts to aquatic life would not be expected as a result of potential subsidence within the LBA tract. Since each of the respective agencies retains some level of discretion in the approval process for the proposed Federal Coal Lease Application, the BLM has been designated as the lead agency to satisfy the respective Endangered Species Act (as amended) Section 7 responsibilities of the cooperating agencies. The Biological Assessment assessed the effects of longwall coal mining and the anticipated subsidence on Greenback cutthroat trout (*Oncorhynchus clarki ssp. Stomias*) in the West Fork of Terror Creek.

The BLM Uncompahgre Field Office determined that the proposed underground coal mining activities in the Spruce Stomp LBA “**may affect, is not likely to adversely affect**” the threatened greenback cutthroat trout and threatened Canada lynx. The Fish and Wildlife Service concurred with BLM's determination on June 21, 2013.

BLM and USFS Sensitive Species

Sensitive species are discussed in detail in the BE and are summarized here.

Mammals. The temporary loss of potential denning or foraging habitat to American marten caused by assumed road or pad construction is estimated at 3.9 total acres, which would be small in comparison to the 4,000 acres of available habitat (USFS, 2013b).

Effects to spotted bats could include short-term disturbance during assumed surface activities, as well as alteration of foraging habitat. However, alteration could be positive if the resulting openings in the vegetation are utilized by the bat. No roosting habitat occurs in the project area.

Effects to Townsend's big-eared bats could include short-term disturbance during project activities, as well as alteration of foraging habitat. Forest structure alteration may result in

changes to foraging behavior of this species if it uses the area. However, this change may be positive if the resulting openings in the vegetation are utilized by the bat. It is unlikely that any action related to the Proposed Action would result in damage or disturbance to roosting habitat, as none occurs in the project area.

Effects to fringed myotis bats could include short-term risk of mortality during removal of habitat, short-term disturbance during assumed surface activities, and long-term alteration of habitat. Roosting habitat is very limited within the lease (1.1 acres or 0.1 percent of the lease area), minimizing the likelihood of a pad or road being placed in the habitat (USFS, 2013b).

Effects to hoary bats could include short-term risk of mortality during removal of habitat, short-term disturbance during assumed surface activities, and long-term alteration of habitat. This species may utilize mature or dead aspen for roosting, especially trees with loose bark, although it is more known for cottonwood roost sites. Only 11.8 acres of riparian habitat are inventoried within the watershed, although cottonwoods are likely to occur along all perennial stream courses and may not be represented in the vegetation data (USFS, 2013b).

Effects to Allen's bats could include short-term risk of mortality during removal of habitat, short-term disturbance during assumed surface activities, and long-term alteration of habitat. Roosting habitat is very limited within the lease area, minimizing the likelihood of a pad or road being placed in the habitat.

Effects to big free-tailed bats could include short-term disturbance during assumed surface activities, as well as alteration of foraging habitat. However, alteration could be positive if the resulting openings in the vegetation are utilized by the bat. No roosting habitat occurs in the project area.

Birds. Potential foraging habitat for peregrine falcons, bald eagles, northern goshawk, and ferruginous hawk is present within the lease area; however, the small amount of potential habitat that would be removed versus available habitat within the lease area would not be expected to affect these species. No nesting substrate would be removed for these four species by assumed surface activities and no nests were observed during surveys.

Effects to purple martin could include: short-term effects during project activities, short-term potential for loss of young during harvest, and long-term changes to habitat. If any birds are nesting in aspen that is removed to create roads or pads, there is a risk of mortality of adults or young. This species is often found nesting immediately adjacent to well-used roads, including Stevens Gulch Road, so nearby construction activities are not expected to disturb this species.

Effects to olive-sided flycatcher could include short-term risk of mortality during removal of habitat, short-term disturbance during assumed surface activities, and long-term alteration of habitat. There could be a temporary loss of potential habitat caused by road or pad construction estimated at 3.9 total acres, which would be small in comparison to the 4,000 acres of available habitat (USFS, 2013b).

Effects to Lewis' woodpecker could include short-term risk of mortality during removal of habitat, short-term disturbance during assumed surface activities, and long-term alteration of habitat. As these birds nest locally primarily in cottonwoods, any loss or alteration of

cottonwood riparian habitat may reduce habitat for this species, and such alteration would be long-term, until large cottonwoods reestablish. It is unlikely that surface activities would occur immediately adjacent to the larger streams in this area (where cottonwoods occur) due to standard BMPs and design criteria for protection of greenback cutthroat trout, which would reduce the likelihood of loss of cottonwoods in the project area.

Flammulated owls utilize aspen habitats for nesting in the LBA tract. Assumed surface activities could result in an estimated temporary loss of up to 7.8 acres of aspen, mixed aspen, or riparian habitats. The watershed contains more than 6,000 acres of aspen habitats and several hundred acres of mixed aspen/conifer (USFS, 2013b).

Herpetofauna. There is no known occurrence of northern leopard frogs in the LBA tract; however, there is habitat along the permanent streams and in some stock ponds. MDW pads and access roads would not be constructed within wetlands, ponds, or reservoir habitats. Drilling should not result in habitat losses for milk snakes. Because midget faded rattlesnakes are found in most habitats within the LBA tract, they would be the most likely affected of the three species. The small amount of potential habitat removed versus available habitat within the lease area would not be expected to affect these species. As would be the case with any terrestrial wildlife species with a small home range, some direct mortality from machinery and human behavior may result in minor short-term effects to local populations.

Fish. Although potentially suitable habitat for roundtail chub and bluehead sucker occurs within the project area in the West Fork of Terror Creek, these species have not been documented. Effects described above for endangered fish would not be expected, and protective measures would also reduce potential effects to BLM sensitive fish species, if present.

USFS Management Indicator Species

Elk. Effects to elk could include:

- short-term direct effects during construction (visual or auditory disturbance or displacement of individuals from machinery, vehicles, and humans);
- long-term direct effects as a result of changes in forage and cover; and/or
- long-term indirect effects through increase of road density within the watershed.

The proposed lease is not within mapped elk production areas (using CPW GIS data as of March 7, 2013). However, elk may calve at any location on and off the Forest, including in the project area. Therefore, if activities occur during calving season, elk may be displaced by project activities. Numerous studies have shown that elk will move back into an area once the disturbance is over and therefore any such displacement would be temporary.

The entire project area, and surrounding landscape, is considered as summer resident habitat, with elk commonly observed in this area during summer and fall. Currently, low levels of summer recreational use are known to occur in the area, other than the Stevens Gulch Road, which is well-used. Legal motorized use is limited to existing roads and trails, which occur throughout the watershed. The roads to be constructed for this project would not be open to public motorized use, and would be open to administrative (including coal traffic) use only, with

anticipated use levels other than during construction and drilling of one trip per day for maintenance and inspection. Pads are likely to include exhausters, with associated noise. Construction activities may occur into the fall hunting seasons. Disturbance to both local elk populations, and to hunters whose camps are no longer accessible or desirable due to project activities and/or traffic, is anticipated. As a result, changes to elk hunting pressure in both the immediate project vicinity and other portions of GMU 521 are expected. Due to the small scale of the disturbance and the size of the GMU, it is not anticipated that harvest will change measurably across the GMU as a result of this project.

Approximately half of the lease area is elk winter range. The remainder of the watershed to the south of the lease area is also winter range. Severe winter range and winter concentration areas occur at the lower end of the watershed, but not within the lease area. Winter range impacts to elk on NFS lands in this area will be mitigated by inclusion of a stipulation prohibiting construction of roads or pads from December 1 to April 15, unless otherwise authorized by the Forest in consultation with CPW.

Because elk are very adaptable, and use a wide variety of habitats, the loss of oak and forested habitat is unlikely to have any measurable effects to elk at the population scale, but will reduce forage availability at small scales over the short period when the pads and roads are in use. After use and reclamation, the road and pad footprint will be in a grass/forb state trending towards shrub and forest over longer terms. Effectively, the conversion will increase grass/forb forage availability in the pad and road footprints but reduce cover. Summer range does not appear to be a limiting factor for elk in the North Fork Gunnison area, and thus alteration of summer habitat is unlikely to cause noticeable population changes.

Project activities may change vulnerability of elk to hunting in this area. The roads created for this project will be closed to public use, but if construction occurs during hunting seasons, elk may be displaced into other areas where there may be more hunting pressure or more effective hunters. Hunters would likely avoid the area where construction is occurring.

Implementation of this project will increase overall road length within the planning area by approximately 4 miles between the period of construction and reclamation. While the roads are in existence, they would receive little use compared to the nearby Stevens Gulch Road. After reclamation, the roads would no longer be in place on the landscape and would not contribute to road density in the watershed.

Summary and Conclusion

The negative effects from this project are of small magnitude and do not result in a Forest-wide decrease in trends or deter from meeting the MIS objectives in the Forest Plan.

Merriam's wild turkey. Effects to turkey could include:

- short-term direct effects during construction (visual or auditory disturbance or displacement of individuals from machinery, vehicles and humans);
- long-term direct effects as a result of changes in forage and cover; and/or
- long-term indirect effects as a result of changes in human use in the area.

Habitat alteration can have both harmful and beneficial impacts to turkeys, and treatments which provide a mosaic of habitat features, allowing for all life stages of turkeys, are desired for this species (USFS, 2005). If temporary construction activities cause nests to fail, turkeys will make

multiple nesting attempts. Individual nests are unlikely to be lost during construction, as the area is not typical of nesting habitat and contains little dense cover. Long-term effects in cover type and abundance are unlikely to cause substantial impacts to turkeys, as they utilize a wide variety of habitats in this area, including roadsides and other disturbed sites. Turkeys appear to be using the area at this time and with the existing disturbance regime.

Summary and Conclusion

The negative effects from this project are of small magnitude and do not result in a Forest-wide decrease in trends or deter from meeting the MIS objectives in the Forest Plan.

Red knaped sapsucker. Effects could include:

- short-term effects of disturbance during construction;
- short-term potential for loss of young during construction; and/or
- long-term changes to habitat.

The nest-building through fledging period runs from about May 20 through August 25 for this species (Kingery, 1998). Project activities during this time may result in abandonment of nests or alteration of territorial boundaries in the project area. Individual nests with eggs or young could be lost during project activities if sapsuckers occur in the project area. This would most likely be either from nest abandonment due to disturbance, or through direct mortality.

Summary and Conclusion

The negative effects from this project are of small magnitude and do not result in a Forest-wide decrease in trends or deter from meeting the MIS objectives in the Forest Plan for all MIS species.

Cumulative Impacts

Prolonged mining would result in negligible impacts to threatened, endangered or special status species or habitat and population dynamics. Dispersed residential development is expected to continue in the area. This development could cause species sensitive to human activity to seek habitat outside the area of development. The increased presence of houses, other buildings, fences, roads, and traffic would also alter the movement of the species and increase losses due to human and other introduced species contact. Residential or other development would also result in minimal surface disturbance on habitats in the area. There would be negligible cumulative impacts to identified threatened, endangered or special status species or habitats from continued mining and other development activities in the LBA area.

Stipulations

The following stipulations for the LBA tract have been compiled from the BLM, USFS, and USFWS:

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) would occur within 200 feet of greenback cutthroat trout occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer. These techniques would provide for maximum

coal removal while protecting the values associated with the threatened greenback cutthroat trout habitat.

- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective BMPs, would be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.
- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee shall, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor shall contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under this BA, lessee shall submit the compiled monthly inspection reports to BLM UFO by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads shall be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure shall be placed at the barricades.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year – October through March.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.

- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- No surface disturbance, such as road widening or upgrading would occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the greenback cutthroat trout, unless exceptions were approved by the Authorized Officer.
- Site-specific surveys for sensitive plants would be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There would be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions were approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures would avoid overspray or drift onto desirable species or sensitive plants.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.

- The lessee/operator would design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator would design and implement a stream flow measurement program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on continuous measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to conduct site visits to ensure continuous flow measurements are recorded on a minimum monthly schedule, weather permitting. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and USFWS.
- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) every two years during and twice following the mining activities (at 5 and 10 years periods) prior to bond release. A report should be distributed to the BLM, USFS and USFWS documenting if statistically significant declines are observed related to mining activities. If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the lessee/operator will work with CPW to capture and grow out fish populations from appropriate breeding stock. The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual Monitoring Report and distributed accordingly.

Finding on the BLM Public Land Health Standard for Threatened and Endangered Species

The LHA (BLM, 2007) identified this area as meeting Public Land Health Standard 4 for special status species, including threatened and endangered species, but with problems, mainly as a result of weed infestations affecting the quality of available habitat. Fish habitat within the project area is in good condition with adequate riparian vegetation and water quality. The assumed surface activities with implementation of BMPs and stipulations should not further degrade the quality of special status species populations and communities within the project area. The Standard with regard to threatened and endangered species, therefore, would be met.

No Action Alternative

The No Action Alternative would have no impacts to threatened, endangered, or sensitive species within the lease area because the lease would not be issued.

MIGRATORY AND OTHER BIRDS OF CONSERVATION CONCERN

Affected Environment

The cumulative effects analysis area is defined by the expanded watershed area from east of the town of Delta, north to the Mesa/Delta County line, east to the Pitkin County boundary, then south and west along the watershed for the North Fork of the Gunnison River back towards the town of Delta.

The Migratory Bird Treaty Act (916 U.S.C. 703-711) identifies numerous bird species of the southwestern U.S. that are assigned a migratory status. USFS and BLM have signed Memorandums of Understanding (MOUs) with the USFWS, which are intended to strengthen migratory bird conservation efforts by identifying and implementing strategies to promote conservation and reduce or eliminate adverse impacts on migratory birds. The focus of the agencies' conservation efforts is on migratory species and some non-migratory game bird species that are listed as Birds of Conservation Concern (BCC). BCC have been identified by the USFWS (2008) for different Bird Conservation Regions (BCR) in the United States to identify those species in the greatest need of conservation action, outside of those species already listed by the USFWS as threatened or endangered. The entire project area is in BCR 16, the Southern Rockies/Colorado Plateau region. The USFWS lists 27 species (see Table 18) that are BCC in BCR 16 (USFWS, 2008). Table 18 also shows the probable status for each species within the LBA tract (Kingery, 1998; CPW, 2011). Several of the species in Table 18 were also included in the Endangered, Threatened, and Sensitive Species section.

Based on species' known distributions and habitat associations in western Colorado, 12 species are known or have potential to occur in the project area (see Table 18). Two of these species were observed on-site during surveys: peregrine falcon and golden eagle. An active peregrine falcon nest is located in the upper end of Dove Gulch. This is the only active peregrine nest known to occur in this general area. The nest is located over a high ridge and more than two miles from any assumed activity associated with road and pad construction and drilling activity.

The bald eagle is present as a winter resident along the North Fork of the Gunnison River. The river and adjacent habitats are designated as Bald Eagle Winter Forage Range by CPW (2011), of which a small portion of the designated range overlaps the southern boundary of the LBA tract and access roads. Biological surveys indicate that bald eagle activity has been observed along the North Fork Valley, but that no bald eagles have been sighted in Bowie's mine area or in areas near the mine for several years.

Table 18
Birds of Conservation Concern within BCR 16

Common Name Scientific Name	Habitat ¹	Potential Occurrence in Project Area
Gunnison sage-grouse <i>Centrocercus minimus</i>	Expansive sagebrush with grasses, forbs, and healthy riparian; project outside of expected range.	No
American bittern <i>Botaurus lentiginosus</i>	Dense freshwater marshes and extensive wet meadows.	No
Bald eagle <i>Haliaeetus leucocephalus</i>	Nests and roosts in large cottonwoods along rivers near prey or carrion during winter.	Yes
Ferruginous hawk <i>Buteo regalis</i>	Nests in isolated trees, rock outcrops, artificial structures, ground near prey base.	No
Golden eagle <i>Aquila chrysaetos</i>	Nest on open cliffs and in canyons or in tall trees (cottonwoods) in open country and riparian zones.	Yes
Peregrine falcon <i>Falco peregrinus</i>	Nests on high cliff faces, often near water; forages in adjacent habitats.	Yes
Prairie falcon <i>Falco mexicanus</i>	Nests in cavities on cliffs, rock outcrops adjacent to open grassland, shrublands.	Yes
Snowy plover <i>Charadrius alexandrinus</i>	Barren or sparsely vegetated alkaline flats and river bars.	No
Mountain plover <i>Charadrius montanus</i>	Short-grass prairie and shrub-steppe landscapes.	No
Long-billed curlew <i>Numenius americanus</i>	Short-grass grasslands, wheat fields, dry land agriculture near water.	No
Yellow-billed cuckoo <i>Coccyzus americanus</i>	Riparian forested habitats dominated by cottonwoods.	No
Flammulated owl <i>Otus flammeolus</i>	Nests in forest of ponderosa pine and Douglas-fir with aspen, and in aspen stands.	Yes
Burrowing owl <i>Athene cunicularia</i>	Nests in burrows, especially prairie dog / badger burrows in grasslands, desert shrub.	No
Lewis's woodpecker <i>Melanerpes lewis</i>	Nests in open stands of cottonwood riparian or urban stands, also in aspen, oak shrub.	Yes
Willow flycatcher <i>Empidonax traillii</i>	Dense riparian habitats along rivers, streams, or other wetlands.	No
Gray vireo <i>Vireo vicinior</i>	Nests in open pinyon-juniper stands with mountain mahogany, deciduous shrub interspersed.	Yes
Pinyon jay <i>Gymnorhinus cyanocephalus</i>	Nest in pinyon and/or juniper woodlands, feed/cache pinyon nuts, juniper berries.	Yes
Juniper titmouse <i>Baeolophus griseus</i>	Nests in pinyon and/or juniper open or dense woodlands, often intermixed with Gambel oak.	Yes
Veery <i>Catharus fuscescens</i>	Damp deciduous/mixed woodlands with dense understory, wood swaps/lowlands, and damp ravines.	No

Common Name Scientific Name	Habitat ¹	Potential Occurrence in Project Area
Bendire's thrasher <i>Toxostoma bendirei</i>	Open farmlands, grasslands, and brushy arid to semi-arid deserts; breeds mainly in grasslands, shrublands or woodlands.	No
Grace's warbler <i>Dendroica graciae</i>	Open montane forests, especially oaks, junipers, firs, and pines.	Yes
Brewer's sparrow <i>Spizella breweri</i>	Nests in sagebrush, occasionally greasewood, rabbitbrush in desert valleys.	No
Grasshopper sparrow <i>Ammodramus savannarum</i>	Grasslands with few scattered shrubs.	No
Chestnut-collared longspur <i>Calcarius ornatus</i>	Shortgrass or mixed-grass habitats heavily grazed or recently burned.	No
Black rosy-finch <i>Leucosticte atrata</i>	Alpine areas usually near rock piles and cliffs; winters in mountain meadows, high deserts, valleys, and plains.	No
Brown-capped rosy-finch <i>Leucosticte australis</i>	Nests on cliffs or in caves, rock slides or old buildings above timberline.	No
Cassin's finch <i>Carpodacus cassinii</i>	Nests in montane forests with spruce/fir and aspen; also in lower pinyon-juniper woodlands.	Yes
¹ Based on Righter et al., 2004.		

Environmental Consequences/Stipulations

Proposed Action

Underground activities would have no impacts on migratory bird and/or raptor populations. There is potential for disturbance to migratory birds during drilling, access, and site reclamation activities associated with MDW drilling where vegetation would be disturbed on approximately 45 acres of disturbance. This includes direct impacts to unidentified active nests, potential mortalities and injuries to birds and eggs in unidentified nests and disturbance to suitable nesting habitat potentially resulting in incidental "take" of migratory birds. To minimize or avoid effects to nesting migratory birds, where practicable, the lessee would avoid vegetation removal during the migratory bird nesting period (May 15 to August 1).

Raptors nesting in the project area could abandon nests because of noise and human presence during the breeding period, which varies by species. Recent surveys within the LBA tract did not observe raptor nests within woodland habitat 0.25 mile from the LBA tract or within cliffs 0.5 mile from the LBA tract. An historical red-tailed hawk nest site (*Buteo jamaicensis*) is located north of the switchback on Stevens Gulch Road. It is not expected that assumed surface activities would affect nesting raptors.

Cumulative Impacts

Prolonged mining would result in negligible impacts to migratory and other BCC habitat and population dynamics. Dispersed residential development is expected to continue in the area. This development could cause birds sensitive to human activity to seek habitat outside the area of development. The increased presence of houses, other buildings, fences, roads, and traffic would also alter the movement of the birds and increase losses due to human and other

introduced species contact. Migratory and other birds of conservation concern and their habitats would still be present in the area, but they would likely be altered or reduced.

Stipulations

The BLM and the USFS would require the following stipulations:

- For any future proposed disturbances on the lease, a qualified biologist would conduct pre-construction breeding bird and raptor surveys during the breeding period within 0.5 mile of the general disturbance area (drill pads and access roads) if activities would occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys would document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to and approved by the USFS or BLM Biologist, activities may begin within the cleared areas. If active nests are found, development timing would be restricted during the breeding season, as per the USFS or BLM authorized officer.
- Where practicable, surface disturbing activities should not occur during the migratory bird nesting period (May 15 through August 1) to prevent potential take of migratory birds and/or eggs, unless vegetation is removed prior to May 15. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM would be required. If active nests were identified during mine permit related project disturbances, appropriate measures would be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations, and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM.
- All unavoidable surface disturbances would require approval of the USFS or BLM Authorized Officer. The USFS or BLM would coordinate with USFWS to determine the type and extent of allowable variances. A site-specific examination would determine if this stipulation would apply.

Finding on the BLM Public Land Health Standard for Threatened and Endangered Species

The LHA (BLM, 2007) identified this area as meeting Public Land Health Standard 4 for special status species, including threatened and endangered species and migratory birds. However, increased weed infestations have negatively affected the quality of available habitat. The project area was mapped as being at the margins of bald eagle winter range, and populations of wintering bald eagles have increased in the North Fork LHA area. The assumed surface activities should not adversely affect migratory birds or their habitat and should maintain this Standard over the life of mine.

No Action Alternative

Under the No Action Alternative, there would be no impacts to migratory birds within the LBA tract because the lease would not be issued.

WILDLIFE, TERRESTRIAL

Affected Environment

For terrestrial wildlife, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

The LBA tract occurs within CPW Game Management Unit (GMU) 521. Big game species harvested in this GMU include mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), moose (*Alces alces*), black bear (*Ursus americanus*), and cougar (*Puma concolor*). CPW has mapped seasonal ranges utilized by game species (CPW, 2012c), and all portions of the project area are classified as overall range for those big game species, as well as for turkey (*Meleagris gallopavo*) (game bird). CPW identifies the area as part of the overall range for moose on Grand Mesa. Though uncommon in the area, moose may utilize oak habitat present in the LBA. Elk winter range and mule deer summer range have also been classified within the project area. Portions of the lease tract have been identified as black bear fall concentration areas. Turkey and elk populations within the area are doing well (BLM, 2007). Mountain shrub habitat is widespread on the lower slopes of Grand Mesa, and other terrestrial wildlife associated with this habitat type in this area includes species such as coyote (*Canis latrans*), bobcat (*Lynx rufus*), porcupine (*Erethizon dorsatum*), eagles, hawks, dusky grouse (*Dendragapus obscurus*), numerous migratory bird species, small mammals, amphibians, and reptiles (BLM, 2007). Wildlife habitat conditions in the area are generally good, with some areas heavily utilized by mule deer and elk, usually as a result of use constraints imposed by winter weather.

Big Game Critical Winter Habitats and Migratory Routes

The entire project area is mapped as elk winter range. Many elk and deer winter below the proposed project area, but wintering use is influenced by snow depths. In addition, migratory deer and elk utilize the area during two major migration periods during the year when they migrate between high elevation summer range and lower elevation winter range. The migration periods are largely driven by weather patterns and snowline elevations in the fall and spring. The proposed project area is also excellent black bear habitat providing an abundance of native summer vegetation and fall berry and acorn crops which tend to concentrate bears.

Environmental Consequences/Stipulations

Proposed Action

The assumed surface disturbance associated with MDWs and access roads may result in some temporary disturbance and in the displacement of local wildlife species from habitats near surface activities, in response to increased human presence and activity (noise). The disturbance and displacement would result in short-term impacts to individuals; however, due to the limited duration of activities and the availability of other unaffected suitable habitats in the vicinity of the proposed lease area, impacts would not be detrimental to population status and health. Presence of garbage during MDW construction activities could attract bears.

It is assumed that there would be a short-term loss of approximately 45 acres of wildlife habitat resulting from the construction of MDW pads and access roads. These impacts would not be long-term because the drill pads and access roads would be reclaimed after mining. In the long-

term, reclamation would return the habitat to its pre-disturbed condition. Underground activities would not have an impact on terrestrial wildlife.

Based on CPW GIS data (March 7, 2013), the proposed lease area is not within mapped elk production areas; however, elk may calve at any location within the project area. Therefore, if activities occur during calving season, elk may be displaced by project activities. Numerous studies have shown that elk will move back into an area once the disturbance is completed and therefore any such displacement would be temporary (USFS, 2013b).

Cumulative Impacts

Other than what has already been analyzed, prolonged mining would result in negligible impacts to wildlife habitat and population dynamics. Dispersed residential development is expected to continue in the area. This development could cause wildlife sensitive to human activity to seek habitat outside the area of development. The increased presence of houses, other buildings, fences, roads, and traffic would also alter the movement of big game animals, and would restrict hunting and other recreational opportunities. Wildlife and their habitats would still be present in the area, but they would likely be altered or reduced.

Stipulations

The BLM and the USFS would require the following stipulations:

- Facility construction and major scheduled maintenance shall not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times would require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles shall be permitted, but no snow plowing may occur.
- Bear-proof containers shall be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training would include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation shall be utilized on the individual MDW pumps to reduce impacts from their operation.

Finding on the BLM Public Land Health Standard for Plant and Animal Communities (partial, see also Vegetation; Invasive, Non-native Species; and Wildlife, Aquatic)

The area of the proposed lease tract meets Public Land Health Standard 3 for healthy native communities (BLM, 2007). The abundance of exotic and noxious vegetative species is increasing and that could decrease the habitat value for wildlife. With implementation of the measures listed within the invasive, non-native species section and other BMPs, viable wildlife populations and communities would be maintained. The public lands within the LBA tract would continue to meet the standards for healthy plant and animal communities after implementation of the Proposed Action.

No Action Alternative

There would be no impacts to terrestrial wildlife as a result of the coal lease and subsequent coal extraction because the lease would not be issued.

WILDLIFE, AQUATIC

Affected Environment

For aquatic wildlife, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Aquatic habitat is present in Terror Creek and its tributaries. Greenback cutthroat trout are known to be present in the East and West Forks of Terror Creek and are believed to be present in Terror Creek (Speas, 2010; Carrillo, 2010; WWE, 2013a). This species is discussed in the Endangered Species section of this document. Additional species known to be present in this stream system include speckled dace (*Rhinichthys osculus*) and mottled sculpin (*Cottus bairdi*) (Carrillo, 2010; WWE, 2013a). It is likely that additional species are present. Aquatic habitat in the West Fork of Terror Creek is well shaded by riparian vegetation, with stable banks, and a stable substrate. Approximately 2.5 miles of the West Fork of Terror Creek are contained within the proposed lease area.

Environmental Consequences/Stipulations

Proposed Action

Some short-term increases in sediment production associated with MDW drilling could occur, especially during high intensity storm events. The topography is steeper for the LBA tract, which slopes to the West Fork of Terror Creek on the north and east side and Stevens Gulch on the west. Mining of the LBA tract, along with implementation of the stipulations, should result in minimal impacts to aquatic habitat and aquatic life (see also the Endangered Species section of this document). There would be no impacts to Terror Creek stream flows from subsidence related to coal extraction in the current mine plan (WWE, 2013a).

Cumulative Impacts

Disturbance of aquatic species in the Terror Creek watershed would continue to take place as a result of coal mining, livestock grazing, recreation, timber sales, and other human activities. Due to the short-term nature, and small acreage that would be impacted by actions associated with this lease, it is unlikely that they would contribute to a detectable increase in cumulative impacts on aquatic species in the Terror Creek watershed.

Stipulations

No additional stipulations to those in the Wild and Scenic Rivers, and Endangered Species sections of this document.

Finding on the BLM Public Land Health Standard for Plant and Animal Communities

The riparian areas, including riparian vegetation along Terror Creek within the project area and Stevens Gulch downstream of the project area meet Standard 2 (BLM, 2007). These areas have no evident problems with hydrology, vegetation, or excessive erosion and deposition from either the stream channel or watershed, with the exception of weed problems. With the implementation of the BMPs and stipulations described, the aquatic habitats in the lease area would continue to meet public land health standards.

No Action Alternative

There would be no impacts to aquatic species or habitat as a consequence of mining activities associated with the lease because the lease would not be issued. Mining are previously leases lands are not expected to impact aquatic species or their habitat.

WETLANDS AND RIPARIAN AREAS

Affected Environment

For wetlands and riparian areas, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

No wetlands, as defined in Section 404 of the Clean Water Act, have been identified within the LBA tract (National Wetlands Inventory - NWI, 2013). Approximately 11.5 acres of riparian habitat are present within the LBA tract. This riparian habitat is dominated by blue spruce which typically contains limited populations of narrowleaf cottonwood and willows, including strapleaf, mountain or whiplash willow.

Environmental Consequences/Stipulations

Proposed Action

Surface-disturbing activities associated with MDWs would be located so as to minimize direct and indirect impacts to riparian zones and Waters of the U.S., including any wetland/riparian areas associated with Terror Creek (11.5 acres); therefore, the Proposed Action are not expected to impact Waters of the U.S. or wetlands under the Proposed Action and no permit from the U.S. Army Corps of Engineers would be required.

Existing roads through the LBA tract that would be used for MDW construction and operation occur immediately adjacent to both Terror Creek and Stevens Gulch. The operation of vehicles on these roads may slightly increase the rate of sedimentation into the stretches of streams closest to the roads. Newly constructed routes associated with MDW operations may also slightly increase the rate of sedimentation into adjacent riparian areas. With the stipulations shown below, consistent with experiences with other operations nearby, the amount of sedimentation from these activities would be expected to be minimal and short-term.

According to a study of the LBA tract by WWE (2013a), potential subsidence impacts from under-mining riparian areas in the LBA area would be minimal. Impacts to the vegetation community resulting from channel profile changes could occur if water availability along the riparian corridor is significantly altered or if slope instability occurs. Based on the magnitude of slope changes, the wetted perimeter of West Fork Terror Creek is not expected to change noticeably following subsidence. Further, because the net change of channel slope over the LBA tract area should be zero, minimal constriction of the creek's wetted perimeter at certain locations should be balanced by minimal expansion of the creek's wetted perimeter at other locations. Based on the existing presence of steep slopes along the creek and expected magnitude of slope changes, increased slope instability is not expected to a degree that would result in impacts to the vegetation community. Adverse impacts to riparian vegetation resulting from channel profile changes are not expected.

Cumulative Impacts

Mining of coal and dispersed residential development is expected to continue in the general mine area. This development could include or cause such items as additional water diversion, livestock grazing on private lands, or new invasive weeds which would remove or alter local riparian areas and their present vegetation communities on private lands in the area. These activities could cause increased erosion and sedimentation, affecting the water quantity/quality within the hydrographic region. Federal regulations under Section 404 of the Clean Water Act would reduce the potential for developments to remove or impact wetlands in the area.

Stipulations

No additional stipulations would be required to protect wetlands and riparian areas in addition to those identified in the Threatened, Endangered and Sensitive Species section.

Finding on the BLM Public Land Health Standard for Riparian Systems

The proposed LBA tract is identified as meeting Public Land Health Standard 2 for water quality (BLM, 2007). Terror Creek has 11.5 acres of riparian habitat. Based upon the lack of disturbance to wetlands and riparian zones within the proposed lease area, the criteria for this Standard would be met.

No Action Alternative

Under the No Action Alternative, there would be no impacts to wetlands and riparian zones in the LBA tract because the lease would not be issued.

FLOODPLAINS

A 100-year floodplain is defined by the Federal Emergency Management Agency (FEMA) as the area adjacent to a watercourse that has a 1 percent chance of becoming wet in any single year (FEMA, 1989). Floodplain maps have been prepared by FEMA that cover the proposed lease area, and no floodplains have been mapped within that area (FEMA, 1989). Potential subsidence from coal extraction beneath these creeks could result in minor local shifts in channel morphology and gradient. These changes would not be considered floodplain alterations; therefore, no direct, indirect, or cumulative effects on floodplains are expected from the Proposed Action Alternative or the No Action Alternative.

WATER QUALITY, SURFACE AND GROUND

Affected Environment

For water quality, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

The SMCRA and the Colorado Surface Coal Mining Reclamation Act contain provisions for protection of water resources from effects of underground coal mining. Parts of these acts and enabling regulations provide for no disruption of the hydrologic balance (i.e., impart no material damage to these resources).

A cumulative hydrologic impacts analysis (CHIA) for the North Fork of the Gunnison River is periodically updated by DRMS as a means of assessing hydrologic impacts to surface and groundwater resources potentially caused by the three large mines in the North Fork Valley. The CHIA is updated if a permit revision predicts adverse effects to groundwater and surface water. The latest CHIA update was completed in 2009 (DRMS). If no adverse effects to groundwater and surface water are predicted, then the CHIA is not revised. The latest CHIA update is referenced in this findings document.

Under the state coal regulations, various state agencies have permitting authority for the activities associated with mining including reporting of monitoring results in an annual hydrologic report.

WWE with the assistance of C. Richard Dunrud, P.E., prepared a report - Evaluation of Potential Subsidence Impacts of Longwall Mining in the Spruce Stomp Lease Area to Aquatic Life and Water Supply (2013a) (see Appendix F). The report reviews potential subsidence impacts within the LBA tract and on the West Fork of Terror Creek aquatic life and water due to potential mining of the LBA.

Surface Water. The LBA tract is located in the Terror Creek watershed. Terror Creek has a drainage basin of approximately 18,826 acres (9.6 percent is within the LBA). The West Fork of Terror Creek is a perennial stream located on the LBA tract.

The Clean Water Act requires each state to compile a list of impaired waterbodies, known as the 303(d) list, that do not meet water quality standards for their designated uses. Terror Creek is not identified on the 303(d) list or 305(b) report that the CDPHE provides to EPA under the Clean Water Act. The Terror Creek drainage is tributary to the North Fork of the Gunnison River, which is listed on the 2010 303(d) list for selenium (CDPHE, 2010c). According to the most recent update to the Colorado 305(b) report, the leading cause of impairment in Colorado rivers is metals and specifically selenium derived from marine shales (CDPHE, 2010d).

In the project area, the West Fork of Terror Creek is identified as Segment 4 and Segment 5 of the North Fork Basin by the CDPHE-Colorado Water Quality Control Commission (WQCC) (CDPHE, 2010b). Segment 4 includes those portions of the West Fork of Terror Creek that are within NFS lands. Segment 5 includes the reaches of the West Fork of Terror Creek that are downstream of the National Forest boundary. The WQCC has identified designated uses for these segments, which include Aquatic Life Cold (1), Recreation (Existing Primary Contact Use for Segment 4 and Potential Primary Contact Use for Segment 5), Water Supply and Agriculture. These segments are not identified as impaired or requiring monitoring and evaluation on Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List. Table 6 in Appendix F provides a summary of the water quality data at the West Fork of Terror Creek and the identified numeric standards for this waterbody.

In 2003, the U.S. Geological Survey (USGS) completed a study of the streamflow gain-loss in a reach of Terror Creek in the vicinity of current and future mining. The study utilized tracer techniques and also incorporated other streamflow gauges in the study area. The study did not note any significant gains or losses of streamflow in the study reach.

The West Fork of Terror Creek channel contains primarily boulder dominated riffles with some interspersed cobble dominated riffles and small pools (see Figure 7 in Appendix F). Larger pools are found upstream of logjams/beaver dams. The bottoms of these pools have accumulated fine-grained sediments. The West Fork of Terror Creek has an average channel slope of 5.5 percent (see Figure 13 in Appendix F). Typical average channel slopes range from a low of approximately 3 percent to 10.6 percent (based on analysis of 100 foot reaches, see Figure 13 in Appendix F). Light Detection and Ranging (LiDAR) elevation information documents there is significant irregularity in channel slope and characteristics between sections within the LBA tract (see Appendix F) as is typical of a step-pool dominated mountain stream.

West Fork of Terror Creek generally has a 5- to 15-foot wide channel bed that is flanked by steep banks that rise 1 to 3 feet above the channel bottom. In some areas, deeper pools have formed with residual depths of 1.5 to 4 feet. The channel riffles typically had water depths of 0.3 to 1 foot (see photos in Appendix F).

MEC conducted a baseline study of macroinvertebrates within the LBA Tract to determine organism biomass and diversity as an indicator of water quality (WWE, 2013a). Samples of invertebrates were taken at five locations and analyzed in the lab to determine species diversity and biomass. For all sites, the macroinvertebrate metrics indicate very good stream conditions. These baseline results showed that West Fork Terror Creek is in attainment for the aquatic life uses as classified by the CDPHE.

The mean observed water temperature, 8.2°C (46.8°F), is in attainment of the chronic temperature standard. Data from Bowie show that West Fork of Terror Creek temperatures ranged from -0.7°C (30.7°F) to a maximum reported temperature of 26.7°C (80°F), which is well above the standard mean weekly average temperature of 17°C (63°F).

The total suspended solids (TSS) maximum value of 122 milligrams per liter (mg/L) has been reported by Bowie's water quality sampling reports. During WWE's April 2012 site visit, visibility was approximately 2 feet and the water was turbid. During subsequent visits during summer and fall 2012, the creek was typically clear and lacking observable turbidity. The mean reported TSS value of 23 mg/L is consistent with clear water which could support cold-water aquatic life. Generally, TSS and turbidity are positively correlated with stream flow. Relatively higher TSS and turbidity levels would be expected during spring runoff and during years with higher than average flow. Conversely, low flow years, such as 2002, will generally have relatively lower TSS and turbidity.

The North Fork Coal EIS (USFS and BLM, 2000) noted that surface water quality in streams that drain the Iron Point Coal Lease Tract area are relatively consistent. Generally, flows in Hubbard and Terror creeks and the North Fork of the Gunnison River are calcium bicarbonate type water. Four stations: Iron Point Gulch (D34-12), Dove Gulch (D34-15), Lower Freeman Gulch (Free-low), and Lower Stevens Gulch (Steph-low) are calcium/sodium bicarbonate type with high concentrations of TDS. Metals concentrations at these four stations were below detection limits or within the state standards for total iron, manganese, and selenium with one exception: the Dove Gulch station had a concentration of total iron that slightly exceeded the standard in July 1998.

Regional water resources are also summarized in the LHA for the North Fork Area which describes the water sources in the lease area as meeting Land Health Standard 5 (BLM, 2007).

Groundwater. Groundwater resources within the area are primarily associated with alluvial deposits, and the direction of flow follows local topography. Generally, this groundwater resource is of good quality, and is used for both human consumption and agricultural purposes. The overburden range in the LBA tract is from about 950 feet to 2,300 feet. There are no groundwater wells within the LBA tract. Three springs, two ponds, and two pipelines are found in the lease tract (see Hydrology/Water Rights section).

A 2005 USGS report on the hydrology of Terror Creek identified that a significant fraction of stream flow can be located in the hyporheic system (Williams and Leib, 2005). The report also identified that Terror Creek has measurable losses of water to groundwater (both in the report's research and as cited from a 1983 study). The report does not identify if losses are into coal seams, geologic fractures, or other unidentified formations.

There is some groundwater associated with bedrock formations, specifically, the Mancos and Mesa Verde formations. This analysis focuses on the Mesa Verde Formation because this is the formation in which mining would occur. Groundwater resources associated with this formation are minimal to moderate and are primarily associated with sandstone members of the formation. Groundwater flow typically follows the dip (5 degrees) of the bed, which trends to the northeast. Groundwater quantities are higher down-bed and lower near outcrops.

Historically, the Bowie No. 2 Mine has encountered very little water in its B-Seam workings (the area where mining is currently taking place). This is due, in part, to the mine's proximity to the formation's outcrop. Through personnel communication with Art Etter, Project Engineer for Bowie, as Bowie constructed the entry mains under Terror Creek and began to mine west of the creek they found that the B seam is essentially dry (Etter, 2012). Groundwater that has been encountered has been within perched water bearing zones associated with sandstones and has been of limited extent. All groundwater intercepted during mining activities either by removing the coal or subsidence is currently being pumped into mined out portions of the mine, a practice that would continue to occur if mining of the lease tract takes place.

Environmental Consequences/Stipulations

Proposed Action

Surface-disturbing activities associated with the drilling of MDWs would result in no direct impacts to surface waters; however, activities could indirectly result in increased amounts of sediment being deposited into surface waters due to increased erosion resulting from clearing and grading of MDW pads and the construction and use of access roads. These impacts would be mitigated by design features expected to be employed during construction of pads and roads (see the stipulations under Threatened and Endangered Species). Impacts would be mainly short-term, as roads and pads would be reclaimed. Limited impacts to local perennial streams or aquatic wildlife are expected as a result of the implementation of the Proposed Action.

Impacts to the water resulting from the release of hazardous or solid waste are not expected. The potential for impacts resulting from substance release would depend upon the responsible use of chemicals and the immediate containment and adequate clean-up in the event of unintentional releases. The potential for exposure to hazardous or solid wastes would be low and short-term during drilling activities.

Future mining (likely longwall units) could be conducted beneath three springs, two ponds and two pipelines in the lease tract (see Hydrology/Water Rights section). Subsidence would occur in areas above and adjacent to longwall mining. The amount of subsidence would depend upon many factors, including mine plans, coal seam thickness, geologic strata, and overburden depth. Within the LBA, overburden depth is greater than 950 feet to 2,300 feet (see Geology and Minerals section). Based on these overburden data, the maximum measured vertical displacement, after mining is completed for the LBA, would vary from a maximum projected value of 4.2 feet in the western portion to a maximum projected value of 5.7 feet in the eastern portion. The location of this maximum projected subsidence value is located in the southeast corner of the LBA approximately 300 feet south of the West Fork of Terror Creek (see Appendix F).

The lower-B Seam overburden thickness along the West Fork of Terror Creek channel ranges from about 950 to 1,800 feet. Along the West Fork of Terror Creek, the maximum subsidence is expected to be about 5.1 feet. No reduction in surface flow in the West Fork of Terror Creek resulting from the subsidence in the LBA tract is projected based upon this analysis. The conclusion is supported by analysis with similar, nearby coal mines (Bear Creek and West Elk mines) and the amount and makeup of the colluvium material underlying the West Fork of Terror Creek in the LBA tract.

A sediment transport analysis of West Fork Terror Creek within the Spruce Stomp Lease Area was performed by WWE (2013a). The results of this analysis indicate that the creek generates enough sheer stress under normal high flow conditions to move grain sizes which exceed the average measured grain size. Abundant boulders which armor the creek's bed and banks exceed the particle size that would be moved by normal flows. As it pertains to channel profile changes, the primary concern with water quality would be increased suspended solids. Based on the sediment transport analysis, the magnitude of change to the creek's profile is not expected to be sufficient to elicit a significant change in sediment mobilization, transport or deposition of West Fork Terror Creek. While minor steepening or flattening of the channel may occur and these changes would alter sheer stress, the stream is already capable of transporting much of the sediment located between larger boulders. The projected change in transported grain size would be minimal. Also, following completion of mining and establishment of equilibrium, the subsidence would result in a balanced net change (steepened areas would be equal to flattened areas). Accordingly, reaches that may have slightly more suspended sediment as a result of being steepened may be balanced by reaches that would have slightly less suspended sediment as a result of being flattened (WWE, 2013a).

Physical stream characteristics such as pre-and post-project channel profile, slopes, and surface fracture characterization were also investigated within the LBA Tract area (WWE, 2013a). For channel profile, the West Fork Terror Creek channel currently has an approximate average slope

of about 6 percent within the lease tract area. After mining is completed, the channel profile indicates that the studied portions of West Fork Terror Creek would have a new maximum slope of 7.0 percent, or roughly a 1 percent change.

Subsidence would be most noticeable on ridges and steeper slopes. Tension cracks may appear in bedrock outcrops, on steep slopes, and at the edges of subsidence. These cracks would result from shifts in the relative position of surface materials, and would have no connection to the fracture zone above the gob. Tension cracks could be comparatively deep and conspicuous in bedrock; however, they would not extend deeply below the surface. Tension cracks would not result in any potential drainage of surface water to the gob or contamination of groundwater.

Subsidence from mining could alter surface water hydrology by altering surface water drainage patterns. As discussed above, there is little connection between groundwater flow regimes and surface water hydrology within this area, and no indirect impacts are anticipated. Subsidence under surface-water drainages could result in minor changes in channel morphology and gradient, thereby temporarily impacting water quality by inducing minor cutting, pooling, soil erosion, and sedimentation. Surface-tension cracks have the potential to develop within the surrounding surface drainages, which would result in an initial period of erosion and sedimentation after initial periods of run-off after subsidence occurs. Based upon observations from the Bear Creek and other mines in the area, surface-tension cracks would be small and discontinuous and would not result in any extensive rechanneling or draining of the stream channels. The potential for larger surface fractures to develop in drainages where unconsolidated materials occur would be partially mitigated by the ductile nature of the unconsolidated alluvium and colluvium. Settling and tension cracking of the surface would not impact surface water quantity and would result in only local and short-term impacts to water quality. As noted in the introduction to this section, regular monitoring (quarterly/annual) by the lessee will be conducted as permit conditions by State and Federal agencies to ensure impacts are minor.

Water discharge as a consequence of future mining into surface streams could impact the quality of water in the receiving streams. Mine effluent would be regulated, and any discharge to receiving streams would have to meet permitted effluent requirements. Concentrations of total dissolved solids (TDS), iron, manganese, and sulfate could likely increase. All groundwater intercepted during mining activities either by removing the coal or subsidence is currently being pumped into mined out portions of the mine, a practice that would continue if mining of the lease tract takes place.

The MDW drilling is not expected to cause impacts to either surface or groundwater in the project area. Stipulations associated with soils, hazardous materials, and the cutthroat trout are sufficient to protect the water quality in the West Fork of Terror Creek. The potential effects to groundwater as a result of coal mining that is already authorized, or occurring, on the adjacent leases would not be expected to change as a consequence of mining the sections of longwall proposed for the LBA. Leasing and the subsequent mining of the coal in the LBA would increase the potential for indirect impacts to surface and ground water quality due to related subsidence under perennial, intermittent and ephemeral drainages and to springs/seeps within the area.

Cumulative Impacts

Post-lease surface disturbances associated with mining those lands is estimated to be approximately 45 acres. However, current mining activity at the Bowie Mine has had no discernible localized effects to stream morphology, erosion rate, or suspended sediment load. High flows in intermittent and ephemeral surface water resources in smaller tributary drainages are limited to spring runoff and very large thunderstorm events; therefore, subsidence-induced impacts in these drainages would be minimal.

Due to the overriding influence of continued drought in the North Fork basin and the fact that creek flow is unlikely to be affected by subsidence or mine operations; it is unlikely that water resource allocations for the greater watershed would be impacted.

Potential post-lease surface use (exploration drilling, methane drainage) has the potential to affect surface water through surface disturbance related to drill pad and road construction on both federal coal leases and on adjacent private lands. Depending on location of these activities, construction could have impacts on sedimentation in stream channels; however, these effects are able to be mitigated through use of BMPs, including sediment control. The strata are not uniformly saturated, so there is little concern for inter-aquifer communication for installing methane drainage wells or exploration wells as they would be of small diameter and would cause little disturbance to the geologic strata. Methane release from coal mines would not be expected to impact domestic water wells because the wells are below the coal seams to be mined.

Accidental fuel or solvent spills from post-lease activities or through activities on private lands could impact shallow groundwater locally and surface water. Any proposed post-lease activities related to coal operations would be analyzed under a separate process if/when activities are proposed.

Agriculture is an important and substantial activity in the North Fork of the Gunnison Valley. Cumulative effects to surface water quality would be minimal in the North Fork of the Gunnison River Valley.

Minimal logging is anticipated in this area in the future. Based on experience in the area, impacts to surface water would not be expected from small timber sales. Recreation is fairly limited in the area due to the lack of developed recreational facilities. Hunting is the primary recreational activity in this area, and impacts to streams from four-wheeling activity can result in increased sedimentation and damage to drainage channels.

The potential for cumulative groundwater impacts in the study area is expected to be minimal. In adjacent lands private domestic wells could be drilled and septic systems could be installed. Adjacent private lands could be mined and water resource impacts on those lands would be similar to that described above. Appropriate state and county regulations would have to be followed, minimizing impacts to groundwater quantity and quality.

Stipulations

- None in addition to those in the Geology and Minerals and Threatened and Endangered Species sections.

Finding on the BLM Public Land Health Standard for Water Quality

The proposed lease tract area is identified as meeting Public Land Health Standard 2 for water quality (BLM, 2007). Aquatic habitat is present in Terror Creek and its tributaries. Cutthroat trout are known to be present in the East and West Forks of Terror Creek and are believed to be present in Terror Creek. This species is discussed in the Endangered Species section of this document. Aquatic habitat in Terror Creek is believed to be in good condition, well shaded by riparian vegetation, with stable banks, and a stable substrate. Approximately 2.5 miles of the West Fork of Terror Creek is contained within the proposed lease tract, of which 0.18 mile is on BLM-managed lands. The public lands within the LBA tract would continue to meet the Standards for healthy aquatic plant and animal communities after implementation of the Proposed Action.

No Action Alternative

No surface or groundwater quality impacts would occur as a result of coal mining on the lease tract because the lease would not be issued.

WASTES, HAZARDOUS OR SOLID

Affected Environment

For hazardous wastes, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

The equipment and materials needed under the Proposed Action have low potential for accidental spill of regulated or hazardous waste substance. These materials include motor fuel and drilling fluids (bentonite and benign soaps). The lessee would be required to maintain all of the appropriate Material Safety Data Sheets (MSDS) for all chemicals, compounds, and substances to be used during project activities.

Environmental Consequences/Stipulations

Proposed Action

Impacts to the environment resulting from the release of hazardous or solid waste are not expected. The potential for impacts resulting from substance release would depend upon the responsible use of chemicals and the immediate containment and adequate clean-up in the event of unintentional releases. The potential for exposure to hazardous or solid wastes would be low and short-term during drilling activities. Lessee would be required to follow all hazardous material BMPs for their operations.

Cumulative Impacts

Continued mining would produce additional quantities of hazardous and solid waste. These materials would continue to be managed and controlled under current regulations and BMPs. Cumulative impacts would be kept within state and federal guidelines and would be minor. Development of residential and other activities would also generate hazardous and solid wastes. It is expected that the private landowners would contract with private waste management specialists, and the cumulative impacts would be minor.

Stipulations

None in addition to stipulations contained in the Threatened and Endangered Species Section.

No Action Alternative

Under the No Action Alternative, there would be no impacts associated with hazardous or solid wastes from the proposed lease tract because the lease would not be issued.

ENVIRONMENTAL JUSTICE

Affected Environment

Executive Order No. 12898 on Environmental Justice, regarding how federal actions may impact minority and low-income populations, was issued on February 11, 1994. The purpose of the order is to identify and address, as appropriate, disproportionately high and adverse human health and environmental impacts resulting from programs, policies, or activities on minority or low-income populations. U.S. Census Bureau summary data for Gunnison and Delta counties (U.S. Census Bureau, 2008a and 2008b) and 2000 Census data for Census Tract 9639 in Gunnison County (U.S. Census Bureau, 2009) do not indicate that there are ethnic groups or communities or low-income populations within the upper drainage of the North Fork of the Gunnison River area or in adjacent portions of Delta and Gunnison counties that may be impacted by changes in employment at the mine. There are no low-income or minority populations that could be disproportionately impacted by the Proposed Action.

Environmental Consequences/Stipulations

Proposed Action

There are no environmental consequences associated with Environmental Justice under the Proposed Action.

Cumulative Impacts

There would be no cumulative environmental justice impacts resulting from continued mining and other rural development in the LBA area.

Stipulations

None.

No Action Alternative

Under the No Action Alternative, there would be no disproportionate negative impacts to minority and low-income populations because the lease would not be issued.

ACCESS AND TRANSPORTATION

Affected Environment

For access and transportation, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Roads and trails on NFS lands are managed through the GMUG Forest Plan, the Gunnison Basin Federal Lands Travel Management decision (July 2010), and Forest Service Handbook (FSH) 7700. Roads and trails are managed to provide public and administrative access and recreational opportunities while protecting the quality of other resources, such as air quality, water quality, and wildlife habitat. Vehicle use on BLM-managed lands is limited to existing routes until further route-by-route planning is completed in the future. Also, public mechanized and motorized travel is limited to existing routes on NFS lands.

The major transportation route in the Paonia and Somerset region is State Highway 133. This highway serves local vehicular and truck traffic for the communities in Delta and Gunnison counties. The highway provides access to the coal handling facilities and existing spur rail line in the area and to surface operations at the Bowie No. 2 Mine and other mines in the North Fork Valley. State Highway 133 is an asphalt, all-weather, two-lane highway which has been periodically upgraded over the past 20 years.

Two roads provide access to the proposed lease. The Terror Creek road is an unsurfaced road that takes off from State Highway 133 on private land, proceeds up Terror Creek on to BLM land, and continues on to NFS lands (FR 824). The Terror Creek road enters the proposed lease tract and would provide access to the MDWs. This is not a public road and has limited access due to locked gates. Any potential Lessee would be required to acquire a BLM right-of-way (see Realty Authorizations section) for that portion of the road on BLM land; they would also need a road-use-permit for use of any system routes on NFS lands.

The proposed lease tract is also accessed from Paonia by Stevens Gulch Road, a public road, which is initially a Delta County road, and is an asphalt, all-weather, two-lane road to the entrance of the closed Bowie No. 1 Mine (approximately 2.5 miles). Beyond the turnoff to the mine, the Stevens Gulch Road is no longer a county road but is an unpaved gravel road (USFS road # 701) leading to the Gunnison National Forest). Delta County maintains the road under agreement with the National Forest. The Forest Service has acquired easements through private land for the public to access the National Forest on FR 701. The road is not maintained through the National Forest in the winter but is used by snowmobile and other over-snow winter access. The overall condition of the Stevens Gulch Road should be considered as fair, and it requires routine maintenance. The road passes through the proposed lease tract and continues onto the Gunnison National Forest.

Two other USFS roads (FR) are located in Township 12 South, Range 92 West, 6th P.M. S1/2 of Section 36. FR 701.1A is a short spur road that parallels the West Fork of Terror Creek after leaving the Stevens Gulch Road. FR 703 travels west from the Stevens Gulch Road and then turns south before leaving the NF.

Several other roads have been constructed for past coal exploration activities within the proposed lease. These roads have been reclaimed and do not currently serve as access routes into the proposed lease but could be potentially be reconstructed to serve the project as access to MDW pads. Gates would be placed on these temporary roads to prevent public access and reclamation would be accomplished when the MDWs are no longer needed.

It is assumed that the transportation of mined coal would occur as part of the underground operation for the LBA tract. The coal would arrive at the surface to be handled by the existing coal handling facilities and loaded primarily on trains for delivery.

A very small quantity of coal would be hauled by truck locally in the North Fork Valley. The North Fork Coal EIS (USFS and BLM, 2000) analyzed truck and train transportation in association with mining operations. Transportation of coal to rail is by a conveyor system. This EA is tiered to the analysis in the North Fork Coal EIS (USFS and BLM, 2000).

Environmental Consequences/Stipulations

Proposed Action

No additional demand for transportation of employees to the mine surface operations facilities or coal handling and transport facilities would be required. Mining operations and processing would be extended throughout the period required to mine available coal. The existing use of State Highway 133 as access to the mine operations and facilities would continue at close to the existing rate for an additional 3 to 4 years as a result of developing the Spruce Stomp LBA. It is noted that existing rail transportation constraints currently limit the annual production from the North Fork Valley.

The Proposed Action is expected to result in only a minor and temporary impact on access to the LBA tract. MDW activities would result in approximately 4 miles of new temporary access roads (3 to 4 years) on NFS and BLM-managed lands. These roads would remain open during the mining operations for access by light-duty trucks for regular inspections and maintenance of the MDWs. The temporary roads would be reclaimed after mining activities are completed. Roads constructed or reopened for MDW drilling would be kept closed to the public during MDW drilling and operation and appropriate signage would be used. Activities associated with the Proposed Action would not impact current public access to the proposed lease tract.

Longwall panels would likely be situated under the Stevens Gulch Road. The overburden range is from 1,750 feet to 2,150 feet. At that depth there would be measurable subsidence but no visible surface cracking (see Geology and Minerals section). Therefore, it is expected that there would be no subsidence-related disturbance to the public road in Stevens Gulch with implementation of the stipulations.

Some level of drilling traffic on the Stevens Gulch Road/FR 701 and FR 824 would continue until completion of post-leasing surface uses on the LBA are completed. FR 701 and 824 may be used to access the LBA tract for additional coal exploration drilling, MDW installation, ventilation facilities, etc. There would likely be a small amount of traffic associated with installing water monitoring devices and subsidence monitoring devices, along with trips to take measurements at these locations. Any post-lease surface disturbing activity would be evaluated at the time a site-specific proposal was received through subsequent permitting processes.

The Proposed Action impacts from train transportation in association with mining operations would be expected to be within the impacts evaluated in the North Fork Coal EIS (USFS and BLM, 2000). This evaluation concluded that the Proposed Action would not result in substantial

effects beyond the range of effects already analyzed. The proposed transportation of the coal product was analyzed within the North Fork Coal EIS (USFS and BLM, 2000) and presents no significant change to the federal action within that analysis.

Cumulative Impacts

Cumulative effects in the form of wear and tear, traffic, and safety issues would continue on the existing transportation system from vegetation management activities for wildlife habitat improvements, range management, recreational users, private residences and coal mining.

Future mining operations and other development activities would maintain and, potentially, open new related infrastructure for traffic access. Potential oil and gas development, residential development on private land, and other activities may increase access and road infrastructure in the area. The tax revenue generated from mining and other development would contribute to the maintenance of public roads. The railroad traffic related to mining would not impact other traffic with the continuation of mining activities.

Stipulations

Stevens Gulch Road and other public roads would be protected from surface disturbance and subsidence through the following:

- No mining related disturbance would occur within 100 feet of the outside line of the right-of-way of Stevens Gulch Road. The angle of draw used to protect the road from subsidence would be dictated by the approved Colorado DMG Mining and Reclamation Plan (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining-related disturbance may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of the public road would be protected.
- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation shall be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities shall be completed the fall following award of lease. Reports of this survey shall be deliverable to the Forest Service by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) shall be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan shall detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.
- The lessee/operator shall schedule mining activities such that active subsidence of roads occurs during dormant winter months, unless no other practicable alternative exists.

No Action Alternative

Under the No Action Alternative, there would be no new road construction associated with the lease area. Limited impacts to access and transportation within the LBA tract would occur as Bowie is currently utilizing some of the roads for mining related activity (monitoring, data gathering, access to MDW on existing leases, etc.).

REALTY AUTHORIZATIONS

Affected Environment

For realty authorizations, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

There are three existing rights-of-way on USFS and BLM lands within the lease area:

- Right-of-way COC-66873 is an access road to Bowie Resources, LLC for their mining operations.
- Right-of-way COC-22713, held by WAPA, is a 125-foot wide right-of-way for an electrical transmission line with a capacity up to 345 kV.
- The third right-of-way, COC-73374, is for a stream gauge monitoring station to Bowie Resources.

An additional public use, located on private land, includes the Pitkin Mesa Pipeline which is west of Stevens Gulch Road. The pipeline crosses approximately 6,200 feet on the western side of the proposed lease. The original pipeline was built in 1938 and it collects water from a series of springs located north of the proposed lease tract on the National Forest. The pipeline services approximately 160 domestic water taps on Pitkin Mesa.

Environmental Consequences/Stipulations

Proposed Action

Subsidence effects on the 230/345 kV WAPA transmission line could occur. Overburden depth from south to north ranges from approximately 1,100 feet to over 1,500 feet on the north end of the WAPA right-of-way. There is a potential for impacts to the 230/345 kV WAPA transmission line as a consequence of drilling equipment interference with overhead transmission lines or right-of-way access roads from surface drilling operations. There is minimal potential for any impact on future realty actions on NFS and BLM-managed lands.

Cumulative Impacts

Future mining operations and other development activities would maintain and, potentially, require new related infrastructure to support the development. Potential oil and gas development, residential development on private land and other activities may increase the need for infrastructure in the area. There is expected to be minimal impacts due to future realty actions on NFS and BLM-managed lands.

Stipulations

The BLM and the USFS would require the successful lessee to implement the following stipulations (see also Stipulations in Access and Transportation section):

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the transmission line must be properly grounded. In order to avoid static or induced electrical hazards no materials may be stored in the 125-foot wide right-of-way.
- If future longwall mining would come within 100 feet of any transmission line tower foundation, a structural review and acceptance by WAPA would be required.
- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions would be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining related surface disturbance would occur within 100 feet of the outside line of the power line right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.

No Action Alternative

There would be no impacts to current or future realty authorizations within the lease tract because the lease would not be issued.

RANGE MANAGEMENT

Affected Environment

For range management, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Management practices involve systematically grazing individual areas and moving livestock between areas to control grazing intensity to prevent over-grazing of any area and allowing forage to recover between annual grazing intervals. Within individual grazing allotments, livestock distribution and grazing utilization and intensity are controlled primarily by fencing, watering sources, salting, the location of livestock trails, and herding the livestock. The management strategy is designed to improve plant diversity, increase vegetative cover, and

stimulate plant vigor by controlling the frequency and intensity of grazing, while providing sufficient opportunity for forage to grow or re-grow between grazing intervals.

The project area straddles two BLM allotments. Stevens Gulch Common (# 14513) is used for cattle and contains 73 animal unit months (AUMs). Upper Terror Creek (# 14514) is also used for cattle and has 59 AUMs. There is no sheep grazing within the project area on BLM-managed lands. There is a grazing strategy for Stevens Gulch Common but none for Upper Terror Creek, as it is used to trail cattle to and from the adjacent NFS lands.

The NFS lands are within the East Terror Cattle & Sheep allotment (allotment #801). Grazing on the allotment is authorized for both cattle (500 cow/calf pairs) and sheep (800 ewe/lamb sheep). The allotment is grazed using rotational grazing strategies. The rotational grazing strategies provide rangeland vegetation the opportunity to grow before being grazed and/or re-grow after being grazed. Grazing in the project area varies annually, depending on the rotation schedules. The grazing season is June 26 to October 5. The Forest Service and permit holders meet each spring, prior to the beginning of the grazing season, to establish the sequence and duration of grazing for each grazing unit for that annual grazing season.

The East Terror allotment has four pastures for cattle grazing. Cattle graze from 14 to 48 days in each pasture. The sheep graze in the two upper pastures, and their rotation is based on sheep camps. There are five sheep camps on the East Terror allotment. Sheep are grazed in the vicinity of each sheep camp and moved to the next sheep camp/area. Grazing use varies from 4 to 14 days per sheep camp/area. The sheep graze each area one time during the season.

Environmental Consequences/Stipulations

Proposed Action

Subsidence of the land surface could have minor effects on range improvements. Depending on the location of existing stock ponds in relation to mine operations plan configuration, there is potential for surface tension cracks to form near or under a specific stock pond. These cracks could disrupt springs or the surface runoff patterns that feed the ponds, or damage the ponds themselves. A stipulation in the realty authorization section will require that a Surface Facility Monitoring and Mitigation Plan be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan shall detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining. This plan should provide the specific details on livestock grazing facilities that will require monitoring and possible future actions if damage does occur.

Based on past observations in the Somerset, West Elk and Bowie No. 2 mine areas, no permanent loss of flow is predicted when longwall panels are mined in the lower B-seam beneath the West Fork of Terror Creek even if bedrock was exposed in the stream bed. If alluvium and colluvium is present, these materials would fill any near-surface cracking that could develop which would further reduce potential loss of flow. Past drilling near the West Fork of Terror Creek has shown that the surficial material (alluvium and colluviums) is greater than 40 feet in thickness at the points drilled. Surficial material measured at the drill sites was greater than 85

feet thick near the confluence of the West Fork of Terror Creek and Terror Creek (see Appendix F).

Any damage to stock ponds would likely be localized and readily repairable. Because of the thick overburden present and because the springs occurring in the LBA tract issue from alluvial/colluvial deposits, there is low risk of the springs that feed stock ponds being intercepted by subsidence induced tension fractures.

Any effects to existing water sources that support grazing activities would change livestock distribution on the allotment. Stipulations that would require monitoring of the stock ponds in the LBA and requirements for repairing the facilities or replacing water would alleviate these impacts. If post-lease surface use such as exploration or methane drainage drilling occurred, cattle would likely be displaced during the construction of the roads and drainage wells, thereby putting more pressure on the other pastures in the allotment. In addition, cattle could be excluded from reclaimed areas as vegetation established. If any fences or gates are constructed there may be a chance that these gates would be left open and cattle would migrate off of their specific grazing areas, disrupting planned grazing rotation. People in vehicles associated with drilling activities could push cattle outside their prescribed allotment.

Potential surface use areas would temporarily remove vegetation and livestock forage but with successful reclamation disturbed areas would likely regain a healthy herbaceous-dominated state. After an estimated two to three growing seasons, forage levels could return to pre-construction levels on the reclaimed ground. In some cases post-disturbance forage levels are improved over pre-existing conditions due to removal of woody species. Generally, surface disturbance and vehicular travel on grazing allotments also presents the opportunity for the introduction and spread of noxious weeds. Stipulations to prevent the spread of noxious weeds are presented in the Invasive Species section above.

Cumulative Impacts

Sustainable grazing is anticipated to continue, as practiced, and vegetation communities are not expected to be altered by this practice. There may be local displacement of vegetation communities as a result of continued dispersed residential and forest management activities.

Stipulations

The BLM and the USFS would require the following:

- Any construction/operation impacts man-made barriers to livestock movement shall be mitigated by replacing fences, gates, cattle guards, and gates to at least the same condition as they were found before construction, and installation of new fences where needed.

No Action Alternative

Under the No Action Alternative, existing livestock grazing would continue in the area without change. Range management practices would continue to be implemented on an annual basis. Any existing range improvements would be unaffected under this alternative. There would be no impacts to current or future rangeland management in the lease tract because the lease would not be issued.

WILDFIRE

Affected Environment

For fire management, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Warm, dry summers experienced in the LBA tract contribute to a moderate to high risk of wildfire, depending upon specific meteorological conditions. There are no known recent wildfires within the LBA tract or immediate vicinity.

Environmental Consequences/Stipulations

Proposed Action

Potential wildfire hazards resulting from the implementation of the Proposed Action would be low to moderate. Drilling crews would be required to be equipped with appropriate fire-suppression devices designed to respond to project-related fire starts. Equipment would only be operated on roads and drill pads, which would reduce the risk of fire ignition resulting from vehicle use and MDW pumps. Drilling crews would have access to telephones to facilitate calls to Montrose Interagency Fire Dispatch in order to report naturally-occurring wildfires.

Cumulative Impacts

Fire risk and changes to the vegetation communities are not expected to be altered by the continued coal mining in the area. Fire risk may increase slightly due to local displacement of vegetation communities as a result of continued dispersed residential and forest management activities. The potential for methane wells to ignite both at the surface and underground exists and could elevate the risk of wildfire while the MDWs are in use.

Stipulations

None.

No Action Alternative

Under the No Action Alternative, there would be no project-related impacts to the risk of wildfire because the lease would not be issued.

HYDROLOGY/WATER RIGHTS

Affected Environment

For hydrology and water rights, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Water resources in the West Fork Terror Creek watershed include the West Fork of Terror Creek, Holy Terror Reservoir, the Overland Ditch, and tributaries to the West Fork of Terror Creek including Cunningham Creek and other unnamed “blue line” features identified on the USGS 7.5-Minute Topographic Quadrangle mapping for the area.

The Overland Ditch intercepts natural surface flows from the upper third of the West Fork Terror Creek watershed when it is in priority (i.e., a downstream water right owner has not placed a “call” on the water). The Overland Ditch is legally able to intercept surface flow until late June or early July during most years. Additional capture and export of water from the West Fork Terror Creek watershed is achieved at the Holy Terror Reservoir, which is located near the headwaters of the watershed. This reservoir captures water from the uppermost portions of the West Fork Terror Creek watershed and diverts it north to the Leroux Creek watershed.

Hydrologic data from the USGS, Bowie, and others identify typical and dry-year flows in the West Fork of Terror Creek. Stream flows in the West Fork of Terror Creek are highly variable depending on season and year (see Figures 11 and 12 and Table 6 in Appendix F). In addition to climatic influences, the West Fork of Terror Creek flows are manipulated by trans-basin diversions (Holly Terror Reservoir) and tributary wells that collect water and transport it out of the watershed (see Figure 8 in Appendix F). Based on direct measurements, average daily mean flows are highest in March (19.9 cubic feet per second [cfs]) and are lowest during late summer and early fall (approximately 1 cfs in July, August, and September). Based on an analysis of diversion records and USGS flow measurements, dry-year conditions can result in flow reductions in the West Fork of Terror Creek of 70 percent or more compared to average conditions during late summer months when flows are at or near their lowest monthly levels.

West Fork of Terror Creek can have short, extreme high flow events that are reportedly capable of overtopping the culvert at the Terror Creek road and would not be measurable with the current staff gauge at this location. In order to overtop the culvert at the Terror Creek road, flows would be in excess of approximately 230 cfs (based on hydrologic modeling at this location). This type of flow in the West Fork of Terror Creek channel would cause scouring, sediment transport, and movement of large rocks and boulders, all of which would result in significant aquatic habitat disturbance.

Water Rights. Table 19 provides the water rights associated with the lease tract.

Table 19
Water Rights Associated with the Proposed Action

Location	Section Qtr/Qtr	Water Source	Water Right Name	Water Right ID	Structure	Uses
12S 91W	32, SWNENW	Terror Creek	Garvin Mesa Pipeline Co	1616	Spring - Is in seep area has several points of diversion	Domestic
	30	W. Terror Creek	USFS	2043311066	E. Terror 23 - storage	Livestock
	31	W. Terror Creek	USFS	2043311067	E. Terror 13 - storage	Livestock
	31	W. Terror Creek	USFS	2043311069	E. Terror 11 - storage	Livestock
	31	W. Terror Creek	USFS	2043311068	E. Terror 12 - storage	Livestock
	31	W. Terror Creek	USFS	2043311199	Monte - storage	Livestock
	32	E. Terror Creek	USFS	2043311076	E. Terror 9 - storage	Livestock

Location	Section Qtr/Qtr	Water Source	Water Right Name	Water Right ID	Structure	Uses
	32	E. Terror Creek	USFS	2043311075	E. Terror 10 - storage	Livestock
	32, SWSWSE	Terror Creek	Hughes Pipeline	1663	Pipeline	Domestic, stock
13S 91W	5, NENWNW	Terror Creek	Hughes Family Pipeline & Spring	6241	Spring, Pipeline	Domestic, Stock
	5, NENENW	N Fork Gunnison River	Reds Spring and Pipeline	6222	Spring, Pipeline	Domestic, Stock, Wildlife
12S 92 W	36	W. Terror Creek	USFS	2043311262	Flat - storage	livestock

Environmental Consequences/Stipulations

Proposed Action

Future mining (likely longwall units) would be conducted beneath the West Fork of Terror Creek, three springs, two ponds and two pipelines in the lease tract. The overburden range is from about 950 feet to 2,300 feet. It is likely that the longwall mining would be located beneath the West Fork of Terror Creek. Overburden depth above the West Fork of Terror Creek stream channel ranges from about 950 feet near the confluence with the main (or east) fork of Terror Creek to about 1,780 feet.

Under the concept of uniform longwall extraction and related uniform down-warping of the overburden rocks and unconsolidated material as lateral constrained plates, cracks in zones under tensile stress decrease in width with depth, and close at the neutral surfaces. Below the neutral surfaces, the materials are in compression (under compressive stress) (see Figure 1 in Appendix F).

This concept has an important bearing on the hydrologic impacts of mining beneath streams or water-bearing zones located in the continuous deformation zone or near-surface zone. Any surface water or groundwater is prevented from moving downward beyond the neutral surface of a rock unit deforming as a constrained plate. Field observations over a 17-year period in the nearby West Elk mining area have verified this conceptual model in laterally constrained bedrock and surficial material (colluvium, alluvium, mudflow, and debris flow deposits).

If alluvium and colluvium are present, these materials fill any near-surface cracking that may develop which further reduces potential loss of flow. Past drilling near the West Fork of Terror Creek has shown that the surficial material (alluvium and colluviums) is greater than 40 feet in thickness at the points drilled. Surficial material measured at a drill site was greater than 85 feet thick near the confluence of the West Fork of Terror Creek and Terror Creek. The maximum subsidence under the West Fork of Terror Creek is expected to be about 5.1 feet (see Geology and Minerals section). Based on past observations in the Somerset, West Elk, and the Bowie No. 2 mine areas, no permanent loss of stream flow is predicted when longwall panels are mined in the lower B-seam beneath similar creeks even if bedrock were exposed in the stream bed.

Therefore, it is also expected that there would be no subsidence related disturbance to the springs, pipelines, and ponds and the West Fork of Terror Creek.

The existing channel has a maximum slope of 7.3 percent and a minimum slope of 3.0 percent. It is projected that the post mining channel profile would have a new maximum slope of 7.0 percent and a minimum slope of 3.5 percent between the established stations (see Figures 14a – 14g in Appendix F). Based on existing topography and geologic modeling, a maximum estimated 5.1 feet of subsidence along the West Fork of Terror Creek channel is expected to create no more than a 1.5 percent channel slope change. The area adjacent to the creek generally consists of steep terrain (often in excess of 25 percent slopes). Therefore, the expected change in channel slopes is expected to be mostly, if not completely, imperceptible without the aid of survey equipment.

Water Rights. While there are no expected effects to water rights, additional analysis of water right impacts would be addressed by DRMS during their mine plan review process.

Cumulative Impacts

Mining activity in the Terror Creek watershed and Bowie's adjacent leases would continue, and groundwater would continue to be intercepted with minimal expected impacts. Other activities associated with residential development, oil and gas activities, and recreation use may put additional demands on water resources within the area and especially groundwater used for development of commercial or residential property.

Stipulations

Stipulations for hydrologic resources and water rights are normally addressed as part of the DRMS mine plan review process. See Geology and Mineral section for stipulations related to hydrologic resources.

No Action Alternative

Under the No Action Alternative, there would be no project-related impacts to water rights or hydrologic resources because the lease would not be issued.

NOISE

Affected Environment

For noise, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Noise has been recognized as a health hazard with the potential for causing hearing damage. Efforts by industry and regulatory actions have lessened the likelihood for hearing damage occurrence.

The secondary impact associated with noise is the nuisance effects of noise that include interference with speech, unsettling environment at home, work, recreation and other natural environment disruptions. Background noise levels vary greatly due to location and distance from working equipment. There are many factors that determine whether an increase in the noise

level above the existing background is audible. The most important factor is the nature of the new noise source as compared to the nature of the background noise. In some cases a relatively small increase in noise levels caused by mechanical equipment would be noticeable.

Environmental Consequences/Stipulations

Proposed Action

From the surface, the mining of the coal does not create any noise disturbance. However, the noise generated from construction and drilling equipment in adjacent areas would be noticeable. Typically, the noise emissions as a result of adjacent surface facilities for the underground mines would not be expected to be a general nuisance to nearby towns and residents or within the lease area. The Bowie No. 2 Mine surface facilities are located 3 miles from the community of Paonia, and noise control measures include maintenance of existing equipment and screening to contain, or deflect, noise. Impacts would occur locally associated with MDW well pump operations on the lease area. It is possible that under certain meteorological conditions with quiet background, that noise from the surface facilities of the mine could be audible approximately 2 miles away (USFS, 2011). Most of the noise from the surface facilities at the mine would be blocked by topographic features.

Cumulative Impacts

The principal noise sources related to the continued mining operation of the surface facilities include the ventilation fans, MDW pumps, trucks, conveyors, loadout equipment, and trains in the area. Surface disturbance and noise from MDWs construction and use over the life of the LBA could diminish types of recreation for some users, and may impact some wildlife. However, recreational use is low in this area except during hunting season. The dispersed residential development, oil and gas activities, and other recreation activities would also impact background noise levels, due to the increased human presence in the area.

Stipulations

The BLM and the USFS would require the following:

- Noise reduction mitigation shall be utilized on the individual MDW pumps to reduce impacts from their operation and comply with state and federal standards.

No Action Alternative

There would be no additional noise impacts in the project area from activities associated with the lease tract because the lease would not be issued.

RECREATION

Affected Environment

For recreation, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

There is some dispersed recreational use on the LBA tract; however, there are no developed recreational facilities operated by the Forest Service or BLM. The most recreational use occurs during hunting seasons. Other dispersed recreational activities occur in the area including OHV riding, personal firewood gathering, and mountain biking. There is also a limited amount of snowmobiling. The recreational opportunity spectrum for the area is semi-primitive motorized. There are no BLM- or USFS- managed and maintained recreation trails in the LBA tract. OHV and snowmobile users generally ride on NFSR 701, 703, and 824. Some motorized recreation also occurs on the remains of reclaimed drill roads from the 1970s and 1990s.

Environmental Consequences/Stipulations

Proposed Action

Under the Proposed Action, dispersed recreation activities would likely be impacted during the assumed surface activities. The disturbance within the proposed lease area would likely limit recreational use within the LBA tract and the immediate surroundings temporarily. Recreational use of lands within active operational portions of the proposed lease would temporarily be displaced until completion of activities.

Adverse indirect impacts on the recreational experience near the proposed lease, including hunting, hiking, camping, biking, and birding, would possibly be caused by elevated noise levels and a general increase in human activity and traffic stemming from construction activity associated with MDWs and access roads. Elevated noise levels during construction would be temporary and would diminish with distance from the construction sites. As a whole, impacts to recreation would be localized and short-term.

Cumulative Impacts

The mining activities may result in a temporary change in recreation activities within the LBA area or surrounding areas of the Terror Creek watershed. Recreational use is expected to continue and/or increase in the future with residential development, ATV use, and hunting activities.

Stipulations

None in addition to those discussed in the terrestrial wildlife and noise sections.

No Action Alternative

Under the No Action Alternative, there would be no project-related impacts to recreation resources because the lease would not be issued.

VISUAL RESOURCE MANAGEMENT

Affected Environment

The project area and cumulative effects study area for visual resources includes the viewsheds potentially affected by the mining activities associated with the Proposed Action. This area is defined as the Spruce Stomp LBA. Based on the Forest Service's prior Visual Management System, land managers determined Visual Quality Objectives (VQOs) for the 1983 Forest Plan.

Since then, the Forest Service has changed to the Scenery Management System (Agricultural Handbook 701).

The Scenery Management System provides a framework for the orderly inventory, analysis, and management of scenic resources. It presents a vocabulary for managing scenery and a systematic approach for determining the relative value and importance of scenic resources on national forests. Key elements of the system include Landscape Character, Scenic Attractiveness classification, Scenic Integrity, constituent Concern Levels, and Distance Zones. Visual impacts to the LBA will be analyzed based on whether a visual impact is able to be detected from the travel-ways within the LBA and whether or not the viewshed meets the area's scenic integrity objectives.

The LBA tract is located in Delta County, generally north and east of the town of Paonia. The primary sensitive viewing area is State Highway 133 and the community of Paonia. Some motorists exposed to the landscapes would have a concern for scenic quality and would be sensitive to modifications to the landscape. With the exception of dispersed recreation activities (primarily hunting and camping), the public does not visit other areas within, or near, the proposed lease. Most of the tract is on upper slopes and relatively level terraces that are more than 1,000 feet higher in elevation than Paonia and the highway and are not within the viewsheds.

Landscape Character. Landscape character expresses the visual image of a geographic area and consists of the combination of physical, biological, and cultural attributes that make each landscape identifiable or unique. The term delineates landscape attributes that distinguish an area. The landscape character of the LBA tract is generally natural appearing with interspersed Forest Service roads and livestock management facilities such as fences, water tanks, and corrals. Tree cover patterns help shield the access/road and adjacent mining activities, creating a visual combination of rock, water, and trees, which make up the aesthetic qualities of the area. The existing access roads are the predominant man-made feature of the landscape on the LBA tract.

Scenic Attractiveness and Scenic Integrity. Scenic Attractiveness is a class rating of the relative scenic value of a landscape. The Forest Plan assigned the VQO of Modification to the majority of the LBA tract. The VQOs can be translated into the Scenery Management System as having low scenic integrity for modification, which is defined in the Agricultural Handbook 701 as:

- low scenic integrity appears moderately altered, and
- moderate scenic integrity appears slightly altered.

Concern Levels and Distance Zones. The LBA tract is not directly visible from public highways, including the Grand Mesa Scenic and Historic Byway and the West Elk Loop Scenic Byway, both Concern Level I (high) travel-ways. The major transportation route in the Paonia and Somerset region is State Highway 133. This highway serves local vehicle and truck traffic for the communities in Delta County, including providing access to the coal handling facilities, existing spur rail line in the area, and to operations at the Bowie No. 2 Mine in the North Fork Valley. The Forest Service and BLM roads in the area are secondary travel-ways and low use areas. FR 701 traverses through the middle of the LBA tract. A little more than half of the LBA

tract is Concern Level 2 (medium) because it can be seen from a road transecting the LBA; the rest is level 3 (low). The Concern Level 2 areas are seen in the foreground (within ½ mile of the road) and the middle ground (between ½ and 4 miles of the road). The concern level 3 areas are in the background (more than 4 miles from the road).

The BLM has inventoried visual resources within the area with the Visual Resource Management (VRM) system. The BLM recently conducted an updated visual resource management inventory. The proposed affected area falls within a Class III objective in the inventory. Class III objective is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. In the Uncompahgre RMP, the proposed lease tract is in BLM's Management Area 7. The RMP provides management direction for Management Area 7, which is managed primarily for coal development.

Environmental Consequences/Stipulations

Proposed Action

Under the Proposed Action, the lease would be approved and offered for competitive bid, and mining activities could occur under the area. Visual impacts would be limited because underground access to the mine would most likely be via existing Bowie No. 2 Mine. The mining activity would likely lead to subsidence. The subsidence report does not indicate any major visual impacts would be expected from mining, subsidence, or tension cracks related to the Proposed Action. There would be little to no visual impact on the area because the size of the cracks would not be visible from any travel-way, limiting access to the viewshed. There is the slight increase in the possibility of a landslide; however, since landslides occur naturally within the project area and the landslide would be not be a dominant feature of the viewshed, the impact on visual quality would be minimal.

Post-lease surface disturbance would be short-term impacts to the visual character of the landscape from drill pad construction, MDW drilling, and access roads. These impacts would be temporary. The dust from construction activities and the sight of vehicles on access roads used for the transport of equipment and workers would be visible until construction activities are completed.

Long-term impacts associated with the implementation of the Proposed Action would result from the addition of temporary wellhead structures to the landscape and from the operation of ventilation pumps. The surface disturbance and aboveground facilities associated with the project would be located on flat terraces or on drainage slopes that do not face towards the highway or toward Paonia. All surface facilities would be higher in elevation than the viewpoints, with a very low profile that would not intrude into viewsheds. It is anticipated that if any drill pads face sensitive viewing areas they would have minimal to no cut-and-fill slopes.

Lighting on MDWs would alter the nighttime visual setting temporarily during drilling and drainage operations. Additional and/or new light sources could attract the attention of the casual observer.

Cumulative Impacts

Dispersed residential, oil and gas development, and other utility development activities could impact visual resources. The houses, roads, and utility infrastructure could alter the visual character of the landscape. These developments on private land are not subject to VRM management guidelines. Oil and gas, coal, utilities, and other development on public lands would be subject to visual resource guidelines.

Stipulations

None.

No Action Alternative

Under the No Action Alternative, there would be no project-related impacts to visual resources because the lease would not be issued.

PALEONTOLOGY

Affected Environment

For Paleontology, the impact area is the LBA tract area. The cumulative effects analysis area includes the existing Bowie No. 2 Mine leases and permit area.

Exposed bedrock within the LBA tract consists predominantly of the Cretaceous Mesa Verde Group. Residuum and colluvium of the Tertiary-age Wasatch Formation are also present. Both of these formations are ranked as Class 5 formations (very high potential to yield scientifically significant fossils) under the BLM's Potential Fossil Yield Classification (PFYC) System (U.S. Department of Energy - DOE and BLM, 2008). Mammalian taxa are most common in the Wasatch Formation of the southern Piceance Basin and include representatives of the following fossil orders: Pantodonta, Condylarthra, Primata, Taeniodontia, Multituberculata, Rodentia, Tillodontia, and Perissodactyla (Lucas, 1998). Reptiles, amphibians, invertebrate, and plant fossils are also found in the Wasatch Formation. The Mesa Verde Group contains dinosaur, mammal, reptile, crocodile, turtle, invertebrate, and plant fossils (BLM, 2005).

Environmental Consequences/Stipulations

Proposed Action

Under the Proposed Action, scientifically important paleontological resources could be destroyed during road and pad construction, as well as during MDW drilling. Coal, although the remains of ancient vegetation, is not considered a scientifically important fossil.

Cumulative Impacts

The cumulative impacts resulting from the continued underground mining in the LBA area would primarily be due to the removal of large amounts of coal. Paleontology resources in the

overburden of the coal would subside in place. Subsidence would be expected to be relatively uniform over large areas. The impacts of subsidence may include lowering elevations over subsided areas. Dispersed residential and other development activities would result in only localized impacts to paleontology. The overall cumulative impacts of these developments would be minor.

Stipulations

The BLM and the USFS would require the following stipulations:

- The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

No Action Alternative

There would be no project-related impacts to paleontology resources in the lease tract area because the lease would not be issued.

SOCIOECONOMICS

Affected Environment

The area of influence for the social and economic elements of this EA includes Delta County in west central Colorado. Delta County is the area of influence for the population and demographic component because the majority of employees at the coal mining facilities and their families live within the communities in its jurisdiction. Baseline data for Delta County in the area of influence include population and demographic data as well as current business and economic information.

Population. Table 20 presents basic population and demographic information for Delta County and the State of Colorado.

Table 20
Population Characteristics, Delta County and the State of Colorado

Population	Delta County	Colorado
2000 ¹	27,834	4,302,015
2010 ²	30,952	5,029,196
% Change, 2000 – 2010	11.2%	16.9%
2012 ³	30,432	5,187,582
% Change, 2010 - 2012	-1.7%	3.1%
Male (2011) ³	50.2%	50.2%
Female (2011) ³	49.8%	49.8%
Under 5 years (2011) ³	5.3%	6.7%
Under 18 years (2011) ³	21.6%	24.0%
65 years and over (2011) ³	21.0%	11.3%
% Minority (2011) ²	17.3%	30.3%
Below Poverty Level (2007-2011) ³	14.1%	12.5%
Source: ¹ U.S. Census Bureau, 2001. ² U.S. Census Bureau, 2011. ³ U.S. Census Bureau, 2013.		

Delta County comprises 1,142 square miles with 27.1 people per square mile and a total population of 30,432 people in 2012. Delta County's population grew by approximately 11 percent between 2000 and 2010, and is estimated to have contracted approximately 2 percent between 2010 and 2012. Between 1970 and 2010, Delta County grew at an annual average growth rate of 1.8 percent, which was slightly slower than the average annual statewide growth rate of 2.1 percent during this time. The median age in Delta County is 45.6 years, with 22 percent of the population under the age of 18 and 21 percent at 65 years of age or older. Nearly 87 percent of the people age 25 and older in Delta County have graduated from high school and 18 percent have graduated from college (U.S. Census Bureau, 2013).

The Town of Delta is the largest town in Delta County with a 2011 population of 8,769, an increase of 37 percent since 2000. Other communities in the county include Cedaredge (2011 population of 2,208), Crawford (2011 population of 422), Hotchkiss (2011 population of 930), Orchard City (2011 population of 3,061), and Paonia (2011 population of 1,424).

Economic Resources. In 2012, the mining sector employed 760 workers, and accounted for approximately 9 percent of total wage employment in Delta County (wage employment excludes proprietors and self-employed individuals). Average 2012 wages of \$69,455 in Delta County's mining sector were more than twice the average wage level of \$33,228 for other employment sectors in the county (Colorado Department of Labor and Employment, CDLE, 2013). The unemployment rate in Delta County was 8.3 percent in 2012, which was comparable to the statewide average of 8.0 percent for the same period (U.S. Bureau of Labor Statistics, 2013).

The coal mines in Delta County are located in the North Fork Valley. This area includes the towns of Hotchkiss, Paonia and Crawford, which provide many of the mining services, retail, business, and consumer service establishments that serve the mine and its employees. Collectively, the North Fork coal mines provide approximately \$60 million in direct economic benefits to the region (North Fork Valley Network, 2013).

Each mine employed an average of 300-375 full and part time workers (Mine Safety and Health Administration, 2013). Each mine spends many dollars locally for materials, supplies, and services. Each mine also contributes royalty and tax payments to the local and national economy.

Housing Resources. In 2011 there were 14,692 housing units in Delta County that housed 12,660 households. Households had an average of 2.3 persons. Delta County had a home ownership rate of 74.6 percent in 2011, well above the state average of 66.8 percent. The median value of an owner occupied housing unit in Delta County was \$198,400, approximately 16 percent lower than the state average of \$236,700 (U.S. Census Bureau, 2013).

Fiscal Resources. The federal government receives annual payments from coal lease holders based on rents of not less than \$3.00 per acre. The rental rates are specified in the lease. Royalty payments are 8 percent of the value of the coal removed from an underground mine (43 C.F.R. 3473). Royalties from federal coal are distributed in the following way: 51 percent returns to the federal treasury in the general fund and 49 percent is returned to the State where the coal was mined. The largest share of Colorado's FML royalties is distributed to school districts and higher education programs across the state. Other portions of the state's FML royalties are

disbursed to counties, cities and school districts in counties impacted by mineral development, and to the Colorado Water Conservation Board for funding local water supply development projects.

Delta County receives a portion of the severance taxes that are paid on coal production within the county, and a portion of the federal mineral royalties that are paid on coal production on federal lands within the county. Property taxes are one of the largest sources of revenue to Delta County government. In 2012, residential property generated 47 percent of the county's total property tax revenue, commercial property generated 20 percent, agricultural property generated 12 percent, state assessed property (utilities and railroads) generated 10 percent, natural resources (including coal production) accounted for 6 percent, and industrial and vacant lands accounted for 5 percent. Schools receive approximately half of the property taxes paid in Delta County, the county government receives approximately 26 percent, special districts (including fire protection, water conservation, hospital, and library districts) receive approximately 22 percent, and towns receive approximately 2 percent (Delta County, 2012).

Environmental Consequences/Stipulations

Proposed Action

Assuming that Bowie was the successful bidder for the new lease, and that the existing Bowie No. 2 Mine facilities would be used, the Proposed Action is not expected to increase operational employment levels at the Bowie #2 Mine. Under the Proposed Action, mining the coal reserves in the Spruce Stomp lease would extend the life of the Bowie No. 2 Mine for approximately 16 to 18 months. During this time, the local economy would be stimulated by the direct spending of the mine and its employees, and the indirect spending of businesses that support the mine and its workers. A temporary increase in employment would be expected due to the construction workforce needed to build the MDWs. Construction workers are expected to come from Delta County.

The Proposed Action is not expected to have an effect on local or regional population trends, or to create an additional demand for housing or municipal services. Under the Proposed Action, the federal government would receive rents and royalties, and the State of Colorado would receive severance taxes, associated with mining coal in the lease. Delta County would receive a portion of these severance tax and federal royalty payments, as well as property taxes paid on coal production and real and personal property at the mine.

Cumulative Impacts

The cumulative socioeconomic effects of continued mining would include a constant level of employment and tax revenues during the operation of the mine and the removal of that source of income when the mine is closed. Residential and other development activities would increase the local population and infrastructure in the area. The cumulative social and economic effects of past, present, and reasonably foreseeable actions in the North Fork of the Gunnison River Valley relative to coal mining operations would be to extend the mining employment sector proportionately to the length of the remaining reserves.

Stipulations

None.

No Action Alternative

If the lease tract is not issued, coal mining at the Bowie No. 2 Mine would continue at existing rates until existing reserves are depleted. At that point, employment at the mine, which accounts for approximately 40 percent of the employment in Delta County's mining sector, would end. An estimated 8.02 million tons of recoverable federal coal would be bypassed. The local economy would be likely to contract due to the reduction in mining jobs and associated salaries, and reduced spending by the mine and former employees. A sustained loss of employment would depress the housing market. The federal government would not receive the rents and royalties associated with mining coal in the Spruce Stomp lease, the State of Colorado would not receive severance tax from coal production, and Delta County would not receive property tax associated with mining the coal in the lease.

CUMULATIVE IMPACTS

Cumulative impacts for each element or resource are discussed within each of the sections above. Cumulative impacts are the environmental impacts that could result from the implementation of the Proposed Action, when added to the impacts from all other past, present, and reasonably foreseeable activities, regardless of who is conducting such activities. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. The cumulative effects analysis considers the geographic scope of the cumulative effects and past, present, and reasonably foreseeable actions. Geographic scope may vary by resource and will be described within that cumulative impacts section for that specific resource if different than that described below.

For this project that geographic scope is focused upon the expanded watershed area from east of the town of Delta, north to the Mesa/Delta County line, east to the Pitkin County boundary, then south and west along the watershed for the North Fork of the Gunnison River back towards the town of Delta. This area is approximately 566,700 acres in total with National Forest being 57 percent (322,400 acres), BLM 11 percent (61,150 acres), and private land 32 percent (182,150 acres). A portion of the private land has the mineral estate reserved to the United States in the patents. This expanded watershed area does not apply to each resource discussed in the EA. The introduction to each resource section provides a discussion of the direct, indirect, and cumulative area for impact assessment.

Past Actions. The primary existing (past) disturbances within the area of the proposed lease by application are associated with mining, oil and gas, livestock grazing, and residential/agricultural development.

Historic mining activities over the past century include the following:

- Hawks Nest Mine;
- Oliver Mine No. 1 and No. 2;
- Bear Mine No. 1, No. 2, and No. 3;
- Edwards Mine;

- USS Steel Mine;
- Blue Ribbon Mine;
- King Mine;
- Farmers Mine;
- Oxbow Sanborn Creek; and
- Bowie No. 1 Mine (Orchard Valley Mine).

Past oil and gas activity within the region has included coal-bed methane wells and conventional gas wells. The wells within approximately 20 miles of the lease by application area include:

- 59 total wells drilled. 26 are on private surface/private minerals; 13 are split-estate wells (private surface, federal minerals); 20 are on U.S. Forest Service surface; and no wells are on BLM surface.
- 20 wells are producing, 34 are capable of producing but are shut-in, and 5 are temporarily abandoned.
- Total disturbance includes:
 - Well pads – approximately 135 acres.
 - Pipelines – approximately 76.4 acres.
 - Roads – approximately 129.6 acres.
 - Facilities – approximately 48.1 acres.
 - Total disturbance – 389.1 acres (average disturbance per well – 6.8 acres).

Over the last century, there has been noticeable subsidence in a number of areas above the historic mines. However, there has been no known damage to overlying resources or to structures attributable to this subsidence. Subsidence may have aggravated or contributed to some landslide movements, but this is difficult to identify given the pre-mining instability of many areas of the valley.

Present Actions. Present actions are focused on mining, oil and gas, livestock grazing, and residential/ agricultural development.

Mining

Table 21 contains recent production data for the three coal mines in the North Fork Valley.

Table 21
Raw Coal Production – North Fork Valley – BLM UFO

*Average based on:	Bowie	Elk Creek	West Elk	Totals (NF)
5 Yr	2,344,044	4,138,654	5,647,850	12,130,549
1 Yr	3,945,664	2,958,019	6,870,157	13,773,840
* Periods end Dec. 31, 2012				

NOTE: The total yearly production for the North Fork Valley is expected to remain about the same -- between 12 and 14 million tons. Each of these mining operations control coal reserves with a mix of federal and fee coal; however, 90 percent or more of local production is federal. As mining progresses, only federal coal will be available in the reserve base.

- Bowie No. 2 Mine was opened in 1997 as a room-and-pillar mine but converted to a longwall system in late 1999. It is located northeast of Paonia and is operated by Bowie with a loadout northeast of Paonia.
- The Elk Creek Mine is a longwall operation north of Somerset, operated by Oxbow Mining, LLC, with a loadout immediately north of Somerset.
- The West Elk Mine is a longwall operation located south and east of Somerset and is operated by Mountain Coal Company with a loadout about 1 mile east of Somerset. The mine is about the 7th largest underground longwall coal mine in the U.S.

The North Fork Branch of the Union Pacific Railroad operates exclusively to serve these coal mines. This line branches from the main line in Grand Junction and passes through Delta, Hotchkiss, Paonia, and Somerset.

Oil and Gas Leasing

There are approximately 418,469 total acres of federal oil and gas mineral estate within the cumulative impacts area. Overall, there are 173,646 acres currently leased.

Other

- Historically, fruit orchards along the valley floor and low mesas have been important to the local Paonia economy. More recently, vineyards have replaced some orchards in the area.
- Sheep and cattle are grazed in pastureland around Paonia and also at higher elevations near the mining operations during the summer.
- There are a number of water storage reservoirs and canals around the North Fork Valley to serve agriculture and domestic uses.
- WAPA operates the Curecanti-Rifle 230/345 kV transmission line that parallels Terror Creek.
- Residential developments in the area around the communities of Paonia, Hotchkiss, Crawford, and Delta have been growing in population, with many new houses being built. Most of this development has been down-valley from the coal mines in broader portions of the North Fork Valley. This development has increased the traffic load and demand for maintenance on State Highway 133.
- There is little developed recreation in the area; however, the area is widely used for dispersed recreational activities, such as hunting, four-wheeling, hiking, picnicking, horseback riding, snowmobiling, mountain biking and sight-seeing.
- Forest treatments timber sales have been limited in the area.
- Hazardous Fuels Reduction or habitat improvement activities include: 1999 McDonald Mesa Rollerchop and seeding 300 acres, 2001 and 2003 Wolf Park Thinning 100 acres and 60 acres, Paonia Fuels Reduction 244 acres, and the Lambourn/McDonald loop and scatter 180 acres.

Reasonably Foreseeable Future Actions. Underground coal mining would continue in the North Fork Valley. In addition to existing coal leasing and exploration activities, the following are reasonably foreseeable future actions:

- Oxbow Mining, LLC (Elk Creek Mine) was granted a 786-acre lease by application with

surface disturbance of approximately 5.63 acres on public lands and a 157-acre coal lease modification with no surface disturbance on the GMUG.

- Oxbow has also submitted a lease modification of the East Elk Creek lease (COC-70615), requesting to add approximately 364 acres of NFS lands to their existing lease.
- Mountain Coal Company (West Elk Mine) applied to construct, operate, and reclaim up to 159 E Seam MDW sites that would support 171 individual MDWs, and use or construction of approximately 26.1 miles of roads within the GMUG are in the final process of approval. On August 2, 2012, the GMUG issued a Record of Decision on its FEIS and consented to BLM to issue two lease modifications adjacent to each other and to current leases to the south within the GMUG. It would add approximately 1,700 acres to the West Elk Mine, of which an estimated 73 acres would be actively disturbed for the remaining life of the mine. The GMUG and BLM are currently evaluating an exploration plan on these lease modifications.
- Oxbow Mining, LLC (Oak Mesa Project – coal exploration license) submitted a proposal to drill 43 exploration drill holes on private and federal lands into federal subsurface holdings. The entire exploration area covers about 13,873 acres, and temporary surface disturbances from road and pad construction would occur on about 32.9 acres.
- Bowie (Bowie No. 2 Mine) was granted two lease modifications adjacent to current leases to the north under private and public lands. They add approximately 502 acres, and temporary surface disturbances from road and pad construction would occur on about 16.6 acres.
- Bowie (Bowie No. 2 Mine) applied for a lease by application adjacent to current leases to the north under private, national forest and public lands and are in the first stages of NEPA analysis (i.e., the Proposed Action, herein).

Additional actions including coal lease modifications and new coal lease applications could be expected in the North Fork Valley. These factors may affect how longwall mining would continue in this area; however, it is likely that mining would continue for another decade, if not more.

Pending oil and gas activity includes 19 total permits.

- 6 shale well permits;
- 8 coal-bed methane wells; and
- 5 coal mine methane wells.
- Total estimated disturbance based on current permits – approximately 130 acres (based on 6.8 acres of disturbance per well).

It is difficult to forecast future oil and gas development within the cumulative impact assessment region. The area is seeing an increase in development which exceeds the past average. Activity increases are due to changes in technology for the drilling and development of the conventional Mancos Shale wells and wells used to capture methane from coal mines. It is estimated that the area will average 10 new pads per year (average 3 acres of disturbance per pad). This will then create approximately 30 acres of new disturbance per year from oil and gas development.

In addition, the USFS is currently reviewing a proposal for Petrox LLC, involving up to 50 gas wells on 24 drilling locations within the Somerset Unit. The Master Development Plan has not yet been released for scoping.

The USFS recently approved the Surface Use Plan for one multiple-well drill pad on the Paonia Ranger District, however the decision has been appealed and is currently under review.

The USFS is in the roadless consultation process for two SG Interests (SG)APDs on the Paonia Ranger District, one adjacent to the Somerset Unit, the other within the Huntsman Unit. The project has not yet been released for scoping.

SG has proposed a 150 gas well Master Development Plan to develop mineral leases they hold within the Bull Mountain Unit located in Gunnison County, Colorado. SG is proposing to drill and produce 150 wells from approximately 41 individual well pads and associated infrastructure. Approximately 50 percent of the wells are targeting coalbed methane production and the other 50 percent will be exploring other potentially productive natural gas zones encountered by drilling into other geologic zones in the area of the Bull Mountain Unit.

The BLM and the USFS have received an APD for a gas well on private lands (federal minerals), with access on NFS lands. This project proposal is still in development has not yet proceeded with scoping.

Cumulative Impacts Summary. Cumulatively, impacts from the proposed coal LBA could include small increases in deposition of sediment or pollutants into surface waters, increased subsidence within the North Fork Valley, low increase in cumulative emission of GHGs from mine ventilation, and a slight increase in water withdrawal from the Colorado River system that may potentially impact several federally-listed species of fish in downstream portions of the North Fork and Gunnison Rivers. None of these impacts is expected to be significant as analyzed in the specific resource sections above. Impacts resulting from the proposed lease could add incrementally to impacts from the other activities discussed above, resulting in a low-level increase in noise, human presence, soil erosion, invasive weeds, wildlife habitat loss, impacts to air quality and vegetation loss or conversion. Cumulative impacts associated with coal mining activities in the area were analyzed in greater detail in the Uncompahgre Basin RMP EIS (BLM, 1988), as well as in the North Fork Coal EIS (USFS and BLM, 2000).

PERSONS / AGENCIES CONSULTED

The following agencies were contacted for input in the development of this EA. Issues raised during scoping are addressed in more detail in the Scoping and Identified Issues section.

- U.S. Fish and Wildlife Service, Grand Junction, Colorado
- Office of Surface Mining
- Western Area Power Administration
- Colorado Division of Reclamation and Mine Safety
- Colorado Parks and Wildlife
- Delta County Planning Department

INTERDISCIPLINARY REVIEW

The following BLM and USFS personnel have contributed to and have reviewed this EA:

Name	Title	Area of Responsibility
BLM		
Amanda Clements	Ecologist	Wetland and Riparian
Desty Dyer	Mining Engineer	Solid Mineral Leasing
David Epstein	Socioeconomics Specialist	Socioeconomics
Glade Hadden	Archaeologist	Cultural Resources, Paleontology
Edd Franz	Recreation Specialist	Wild and Scenic Rivers
Ken Holsinger	Forest management, wildlife	Forestry, Migratory Birds, Threatened, Endangered and Sensitive Species, Terrestrial and Aquatic Wildlife
Kelly Homstad	Fire Use Specialist	Wildfire, Air Quality/Climate
Julie Jackson	Outdoor Recreation Planner	VRM, Recreation, Wilderness, Transportation
Dave Kauffman	Biological Staff Supervisor	Biological Resources
Alan Kraus	Hazmat Specialist	Solid and Hazardous Wastes
Bruce Krickbaum	NEPA Coordinator	EA/NEPA Review and Compliance
Chad Meister	Air Quality Specialist	Air Quality, Climate
Teresa Pfifer	Land and Minerals Supervisor	Lands and Minerals
Linda Reed	Realty Specialist	Realty Authorizations
Lynae Rogers	Range Specialist	Invasive Species, Range, Vegetation
Jedd Sondergard	Hydrologist	Soil, Water
Thane Stranathan	Natural Resources Specialist	Oil and Gas, GIS data
Forest Service		
Matt Dare	Fisheries Biologist	Fisheries
Dennis Garrison	Wildlife Biologist	Terrestrial Biology
Dan Gray	Natural Resource Specialist	Natural resources
Kevin Kyle	Timber Specialist	Forestry
Liz Lane	Zone Archaeologist	Cultural Resources
Niccole Mortenson	NEPA Specialist	Document review, USFS internet
Gary Shellhorn	Hydrologist/Air Quality reviewer	Hydrology
Mike Surber	Range Specialist	Range resources
Ryan Taylor	NEPA IDT Leader and primary project contact for the USFS	NEPA IDT Leader and primary project contact for the USFS, Soils, Geology

LIST OF ACRONYMS AND ABBREVIATIONS

ACECs	Areas of Critical Environmental Concern
AO	Authorized Officer
APCD	Air Pollution Control Division
AQRVs	Air Quality Related Values
AUMs	animal unit months
BA	Biological Assessment
BCC	Birds of Conservation Concern
BCR	bird conservation regions
BE	Biological Evaluation
BLM	Bureau of Land Management
BMPs	Best Management Practices
Bowie	Bowie Resources, LLC
BTU	British Thermal Unit
CAA	Clean Air Act
CAAQS	Colorado Ambient Air Quality Standards
CAFÉ	corporate average fuel efficiency
CDLE	Colorado Department of Local Affairs
CDPHE	Colorado Department of Public Health and Environment
CEQ	Council on Environmental Quality
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CHIA	cumulative hydrologic impacts analysis
CH ₄	methane
CMM	Coal Mine Methane
CNHP	Colorado Natural Heritage Program
CO	carbon monoxide
CO ₂	carbon dioxide
CO _{2e}	carbon dioxide equivalent
COGCC	Colorado Oil and Gas Conservation Commission
CPW	Colorado Parks and Wildlife
CR	Colorado River
DAU	data analysis unit
DOE	Department of Energy
DPS	Distinct Population Segment
DRMS	Division of Reclamation Mining and Safety
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FCLAA	Federal Coal Leasing Amendments Act
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act
FR	Forest Service roads
FSH	Forest Service Handbook
GBCT	Greenback Cutthroat Trout
GHGs	greenhouse gases
GMU	Game Management Unit
GMUG	Grand Mesa, Uncompahgre, and Gunnison National Forests

GMNF	Grand Mesa National Forest
GVG	gob vent gas
GWP	global warming potential
HAP	hazardous air pollutants
HCFC	hydrochlorofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
LAU	lynx analysis unit
LBA	lease-by-application
LDGT	light duty gasoline truck
LHA	Land Health Assessment
LiDAR	Light Detection and Ranging
LRMP	Land and Resource Management Plan
MBTA	Migratory Bird Treaty Act
MDWs	methane drainage wells
MEC	Miller Ecological Consultants, LLC
Mg/L	milligrams per liter
MLA	Mineral Leasing Act
MIS	management indicator species
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheets
MSHA	Mine Safety and Health Administration
MU	mapping unit
MY	model year
N ₂ O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NDIS	National Diversity Information Source
NEPA	National Environmental Policy Act
NF	North Fork Valley
NFS	National Forest System
NO ₂	nitrogen dioxide
NO _x	nitrogen oxides
NRCS	Natural Resource Conservation Service
NSPS	New Source Performance Standard
NWI	National Wetland Inventory
NWSRS	National Wild and Scenic River System
O ₃	ozone
OC	organic carbon
OHV	off-highway vehicle
ORV	outstandingly remarkable value
OSM	Office of Surface Mining Reclamation and Enforcement
Pb	lead
PBA	Programmatic Biological Assessment
PBO	Programmatic Biological Opinion
PFYC	potential fossil yield classification
PM _{2.5}	particulate matter less than 2.5 microns in effective diameter
PM ₁₀	particulate matter less than 10 microns in effective diameter
PSD	Prevention of Significant Deterioration
RFMP	reasonably foreseeable mine plan
RG	Rio Grande
RMP	Resource Management Plan
SCC	source classification code
SIL	significant impact levels

SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act
SO ₂	sulfur dioxide
SPM	special-purpose monitoring
TDS	total dissolved solids
TE	thermal efficiency
TSP	total suspended particulate
TSS	total suspended solids
UFO	Uncompahgre Field Office
USDI	U.S. Department of the Interior
USGS	U.S. Geological Survey
USFS	U.S. Department of Agriculture Forest Service
USFWS	U.S. Fish and Wildlife Service
VAM	Ventilation Air Methane
VCG	Vessels Coal Gas, Inc.
VMT	vehicle miles travelled
VOCs	volatile organic compounds
VRM	visual resource management
VQOs	visual quality objectives
WAPA	Western Area Power Administration
WQCC	Water Quality Control Commission
WSR	Wild and Scenic River
WSRA	Wild and Scenic Rivers Act
WWE	Wright Water Engineers, Inc.

REFERENCES

- Adams, R.A. 2003. Bats of the Rocky Mountain West. University of Colorado Press, Boulder, Colorado.
- Andrews, R. and R. Righter. 1992. Colorado Birds: a Reference to their Distribution and Habitat. Denver Museum of Natural History. Denver, Colorado.
- Beason, J.P. 2009. Yellow-billed Cuckoos in Western Colorado. Tech Rep. R-YBCUCPW & USFWS-08-1. Rocky Mountain Bird Observatory, Brighton, Colorado, 27 pp. Accessed online at : http://rmbo.org/public/monitoring/PDF_Reports/CPW_USFWS_YBCU_REPORT_26JAN09v3.pdf.
- Bureau of Land Management. 1988. Uncompahgre Basin Proposed Resource Management Plan and Final Environmental Impact Statement, September 1988. 196 pages.
- Bureau of Land Management. 1989. Uncompahgre Basin Resource Management Plan and Record of Decision (amended, 1992, 1994, 1997, 2001). Uncompahgre Field Office. Montrose, Colorado.
- Bureau of Land Management. 2002. Canada Lynx Habitat Mapping, GIS data. Uncompahgre Field Office, Montrose, Colorado.
- Bureau of Land Management. 2005. Little Snake Resource Management Plan, Analysis of the Management Situation. April 2005.
- Bureau of Land Management. 2007. North Fork Land Health Assessment, 2006-2007. Bureau of Land Management, Uncompahgre Field Office, Montrose, Colorado. 110 pages.
- Bureau of Land Management. 2009. BLM Colorado State Director's Sensitive Species List. Accessed online: <http://www.blm.gov/pgdata/etc/medialib/blm/co/programs/botany.Par.8609.File.dat/BLM%20CO%20SD%20Sensitive%20Spec.%20List.pdf>. November.
- Bureau of Land Management. 2010. Final Wild and Scenic River Eligibility Report for the BLM Uncompahgre Planning Area. June 2010.
- Bureau of Land Management. 2011. BLM's Land and Mineral Legacy Rehost 2000 System-LR2000. Accessed online: <http://www.blm.gov/lr2000/>.
- Bureau of Land Management. 2013. BLM's Land and Mineral Legacy Rehost 2000 System-LR2000. Accessed online: <http://www.blm.gov/lr2000/>.
- Carrillo, Michael. 2010. Fish Species in the Terror Creek System. E-mail with WestWater Engineering. March 30, 2010.
- Chronic, H. and F. Williams. 2002. Roadside Geology of Colorado. Second Edition. Mountain Press Publishing Company, Missoula, Montana.
- Climate Analysis Indicators Tool (CAIT-US). 2011. Version 4.0. World Resources Institute, Washington, DC. Accessed online: <http://cait.wri.org/>. March 28, 2011.

- Colorado Department of Agriculture. 2011. Colorado Noxious Weed List. Noxious Weed Management Program. Accessed online: <http://www.colorado.gov/cs/Satellite/Agriculture-Main/CDAG/1174084048733>. September.
- Colorado Department of Labor and Employment. 2013. Labor Market Information. Quarterly Census of Employment and Wages. Accessed online: www.colmigateway.com.
- Colorado Department of Natural Resources. 2011. Colorado Decision Support Systems, Water Rights Database. Colorado Department of Natural Resources, Division of Water Resources, Denver. Available online: <http://cdss.state.co.us/onlineTools/Pages/WaterRights.aspx>.
- Colorado Department of Public Health and Environment. 2008. Colorado Air Quality Control Commission Report to the Public 2007-2008. 60 pages.
- Colorado Department of Public Health and Environment. 2010a. Colorado 2009 Air Quality Data Report. Colorado Department of Public Health and Environment, Air Pollution Control Division, Denver. August 2010.
- Colorado Department of Public Health and Environment. 2010b. State of Colorado Integrated Water Quality Monitoring and Assessment Report Prepared Pursuant to Section 303(d) and Section 305(b) of the Clean Water Act. Colorado Department of Public Health and Environment, Water Quality Control Commission, Denver. Accessed online: http://www.cdphe.state.co.us/op/wqcc/Resources/waterstatus_305_b/305bRept2010.pdf.
- Colorado Department of Public Health and Environment. 2010c. Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List, Regulation No. 93, effective April 30, 2010. Colorado Department of Public Health and Environment, Water Quality Control Commission, Denver. Accessed online: <http://www.cdphe.state.co.us/regulations/wqccregs/100293wqlimitedsegmdlsnew.pdf>.
- Colorado Department of Public Health and Environment. 2010d. Integrated Water Quality Monitoring and Assessment Report, 2010 Update to the 2008 305(b) Report. Colorado Department of Public Health and Environment, Water Quality Control Division, Denver.
- Colorado Department of Public Health and Environment. 2011. Letter from Nancy Chick to Ralph Morris, Environ Corporation, Summary of rural area background concentration estimates for the BLM Grand Junction and Uncompahgre Field Office Resource Management Plans. Colorado Department of Public Health and Environment, Air Pollution Control Division, Denver. June 6 2011.
- Colorado Division of Wildlife, Bureau of Land Management, and Forest Service. 2003. Colorado Vegetation Classification Project. Accessed online: <http://ndis.nrel.colostate.edu/coveg/>.
- Colorado Natural Heritage Program. 2012. Rare Plant Guide. Colorado State University. Accessed online: <http://www.cnhp.colostate.edu/>.
- Colorado Parks and Wildlife. 2011. Colorado's Biological Map and Data Resource. Natural Diversity Information Source, Colorado Division of Wildlife. Accessed online: <http://ndis.nrel.colostate.edu/>.
- Colorado Parks and Wildlife. 2012a. Species Profiles. Accessed online: <http://wildlife.state.co.us/WILDLIFESPECIES/PROFILES/Pages/WildlifeProfiles.aspx>.

- Colorado Parks and Wildlife. 2012b. Natural Diversity Information Source. Colorado State University. Accessed online: <http://ndis.nrel.colostate.edu/>.
- Colorado Parks and Wildlife. 2012c. Colorado Hunting Atlas. Accessed online: <http://ndis-flex.nrel.colostate.edu/HuntingAtlas/>.
- Colorado Parks and Wildlife. 2013a. Species Profiles. Accessed online: <http://wildlife.state.co.us/WILDLIFESPECIES/PROFILES/Pages/WildlifeProfiles.aspx>.
- Colorado Parks and Wildlife. 2013b. 2011 Elk Harvest Summaries. <http://wildlife.state.co.us/SiteCollectionDocuments/DOW/Hunting/BigGame/Statistics/Elk/2011ElkHarvestSurvey.pdf>.
- Colorado Parks and Wildlife. 2013c. Elk 2011 Post-hunt Population Estimates. <http://wildlife.state.co.us/SiteCollectionDocuments/DOW/Hunting/BigGame/Statistics/Elk/2011ElkPopulationEstimate.pdf>.
- Conner, C., B. Davenport, and J. Smith. 2012. Class III Cultural Resources Inventory and Paleontological Assessment of the Proposed Spruce Stomp Lease Modification Area (1850 Acres) in Delta County, Colorado, for Bowie Resources, LLC. GMUG NF Report No. R2012-020408-123. Submitted to the Paonia Ranger District of the GMUG National Forest and Uncompahgre Field Office of the BLM. Manuscript on File, Grand Mesa, Uncompahgre, and Gunnison (GMUG), National Forests Supervisor's Office, Delta, Colorado.
- Culver, D.R., P. Lyon, and J. Huggins. 2008. Survey of Critical Biological Resources, Rio Blanco County, Colorado. Prepared for Rio Blanco County, Meeker, CO, U.S. Environmental Protection Agency, Region 8, Denver CO, and Colorado Department of Natural Resources, Division Wildlife, Wetlands Program, Denver, Colorado.
- Dare, M., M. Carrillo, and C. Speas. 2011. Cutthroat trout (*Oncorhynchus clarkii*) Species and Conservation Assessment for the Grand Mesa, Uncompahgre, and Gunnison National Forests. Grand Mesa, Uncompahgre, and Gunnison National Forests, Delta, Colorado.
- Dare, M. 2013. *Grand Mesa, Uncompahgre, and Gunnison National Forests. Personal Communication. August, 2013.*
- Delta County. 2012. Assessor's Office. Summary of Assessments and Levies – 2012. Accessed online: www.deltacounty.com/DocumentCenter/View/7445.
- Dunrud, C.R. 1976. Some engineering geologic factors controlling coal mine subsidence in Utah and Colorado: U.S. Geological Survey Professional Paper 969, 39p.
- Dunrud, C.R. 1989. Geologic Map and Coal Stratigraphic Framework of the Paonia area, Delta and Gunnison Counties, Colorado: U.S. Geological Survey Coal Investigations Maps C-115 and C-116.
- Etter, A. 2012. Project Engineer – Bowie Resources, LLC. Personal Email Communication with Jim Ferguson. WestWater Engineering. January 10, 2012.
- Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Museum of Natural History and University Press of Colorado. Niwot, Colorado.

- Federal Emergency Management Agency. 1989. Flood Insurance Rate Map, Gunnison County, Colorado (Unincorporated Areas). Community Panel Numbers 080078 275 B, 080078 125 B, and 080078 235 B. September 29, 2008.
- Forest Service. 2005. Merriam's Turkey (*Meleagris gallapovo merriami*) Species Assessment. Grand Mesa, Uncompahgre, and Gunnison National Forests. Delta, Colorado.
- Forest Service. 2011. Environmental Assessment for Federal Coal Lease Modification COC-61357. Paonia Ranger District (Grand Mesa, Uncompahgre, and Gunnison National Forests). August 2011.
- Forest Service. 2013a. Vegetation from shapefile received from USFS entitled: Terror_Creek_HUC6_veg_022613_V1.
- Forest Service. 2013b. Biological Evaluation and Management Indicator Species Assessment for Spruce Stomp Lease by Application. Paonia Ranger District, Grand Mesa, Uncompahgre, Gunnison National Forest Delta County, Colorado. March, 2013.
- Forest Service and Bureau of Land Management. 2000. Final Environmental Impact Statement, Iron Point Exploration License, Iron Point Coal Lease Tract, Elk Creek Coal Lease Tract, Delta and Gunnison Counties, Colorado, February 2000. (North Fork Coal EIS).
- Hammerson, G.A. 1986. Amphibians and Reptiles in Colorado. Colorado Division of Wildlife, Denver, Colorado.
- Intergovernmental Panel on Climate Change (IPCC). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 – Energy. Table 2.2 Default Emission Factors for Stationary Combustion in the Energy Industries. ISBN 4-88788-032-4. Accessed on March 28, 2011 from < <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>>.
- Junge, W.R. 1978. Surficial Geology of the Bowie Quadrangle. Colorado Geological Survey. Plate 2 of 7. Surficial geology, Hotchkiss-Paonia Reservoir area, Delta and Gunnison Counties, Colorado, Denver.
- Kingery, Hugh E., ed. 1998. Colorado Breeding Bird Atlas. Colorado Bird Atlas Partnership and Colorado Division of Wildlife, Denver. 636 pages.
- Knick, S.T., and J.T. Rotenberry. 2001. Effects of Habitat Fragmentation on Passerine Birds Breeding in Intermountain Shrubsteppe. *Studies in Avian Biology* No. 25:130-140.
- Kowalski, D. 2010. Greenback Cutthroat Trout in Terror Creek. Personal Communication with WestWater Engineering, December 9, 2010.
- Lane, E. 2013. Assessment of Effects of Subsidence to Historic Properties within the Proposed Spruce Stomp Lease Modification Area. GMUG NF Report No. R2012-020408-123A. Manuscript on File, Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests Supervisor's Office, Delta, Colorado.
- Lucas, S.G. 1998. Fossil Mammals and the Paleocene/Eocene Series Boundary in Europe, North America, and Asia. *In* Late Paleocene-Early Eocene Climatic and Biotic Events in the Marine and Terrestrial Records, Marie-Pierre Aubry, M-P., Lucas, S.G., and Berggren, W.A., (eds.). Columbia University Press, New York.

- Mine Safety and Health Administration. 2013. Mine Data Retrieval System. Accessed at www.msha.gov/drs/drshome.htm.
- National Wetlands Inventory. 2013. Shapefile. Accessed online: <http://www.fws.gov/wetlands/Data/State-Downloads.html>.
- Natural Diversity Information Source. 2011. Colorado's Biological Map and Data Resource. Colorado Division of Wildlife. Accessed online: <http://ndis.nrel.colostate.edu/>.
- Natural Resources Conservation Service. 2013a. Soil Data Mart. Prime and Other Important Farmlands report. CO679 Paonia Area, Colorado, Parts of Delta, Gunnison, and Montrose Counties, Delta County, Colorado. Accessed online: <http://soildatamart.nrcs.usda.gov/>. March.
- Natural Resources Conservation Service. 2013b. Soil Data Mart. Mapping Unit reports generated for CO679 Paonia Area, Colorado, Parts of Delta, Gunnison, and Montrose Counties, Delta County, Colorado. Accessed online: <http://soildatamart.nrcs.usda.gov/>. March.
- Natural Resources Conservation Service. 2013c. Soil Data Mart. Mapping unit reports for CO660 Grand Mesa – West Elk Area, Colorado, Parts of Delta, Garfield, Gunnison, Mesa, and Montrose Counties. Accessed online: <http://soildatamart.nrcs.usda.gov/>. March.
- North Fork Valley Network. 2013. Northfork Valley of Colorful Colorado website. Accessed online: www.northforkvalley.net.
- Righter, R., R. Levad, C. Dexter, and K. Potter. 2004. Birds of Western Colorado Plateau and Mesa County. Grand Valley Audubon Society, Grand Junction, Colorado.
- Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 - 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD. Accessed February 7, 2013.
- Speas, C. 2010. Programmatic Water Depletion Biological Opinion for Grand Mesa, Uncompahgre Gunnison National Forest. E-mail communication, March 29.
- Speas, C. 2011. Personal Communication with Jim Ferguson, WestWater Engineering regarding lynx buffer zones, and stream flows in the East Fork of Terror Creek. November 21, 2011.
- Stewart, C, G. Hunt and C. Mark. 2006. Geology, Ground Control and Mine Planning at Bowie Resources, Paonia, Colorado. 25th International Conference on Ground Control in Mining, July 2006, Morgantown, West Virginia.
- Tweto, O. 1979. USGS geologic map of Colorado. 1:500,000 scale. Accessed online: <http://geology.about.com/library/bl/maps/blcoloradomap.htm>.
- U.S. Bureau of Labor Statistics. 2013. Local Area Unemployment Statistics. Accessed online: www.bls.gov/data/.
- U.S. Census Bureau. 2001. 2000 Census. Accessed online: www.census.gov.
- U.S. Census Bureau. 2011. 2010 Census. Accessed online: www.census.gov.

- U.S. Census Bureau. 2012. 2007 – 2011 American Community Survey 5-Year Estimates. Accessed online: www.census.gov.
- U.S. Census Bureau. 2013. State and County QuickFacts. Accessed online: www.census.gov.
- U.S. Department of Energy and Bureau of Land Management. 2008. Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States (DOE/EIS-0386). Appendix N: Potential Fossil Yield Classifications (PFYC) for Geologic Formations Intersecting Proposed Corridors under the Proposed Action by State. November 2008.
- U.S. Energy Information Administration. 2009. Annual Energy Review 2009. Table 7.3 Coal Consumption by Sector, Selected Years, 1949-2009. DOE/EIA-0384(2009). August 2009. Accessed online: <http://www.eia.doe.gov/aer/>. March 28, 2011.
- U.S. Fish and Wildlife Service. 1973. Endangered Species Act of 1973. 16 U.S.C. 1544. U.S. Fish and Wildlife Service, Washington, D.C.
- U.S. Fish and Wildlife Service. 1977. Endangered and Threatened Wildlife and Plants; Proposed Threatened Status for Greenback Cutthroat Trout (50 CFR 17). U.S. Department of the Interior, U.S. Fish and Wildlife Service, Federal Register, Vol. 42. No. 168. September 26, 1977. 48901- 48902. Accessed online: http://ecos.fws.gov/docs/federal_register/fr162.pdf. December 4, 2010.
- U.S. Fish and Wildlife Service. 1994. Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Colorado River Endangered Fishes: Razorback Sucker, Colorado Squawfish, Humpback Chub, and Bonytail Chub. Federal Register 59(54): 13374–13400.
- U.S. Fish and Wildlife Service. 1998. Greenback cutthroat trout recovery plan. U.S. Fish and Wildlife Service, Denver, Colorado. Accessed online: http://ecos.fws.gov/docs/recovery_plan/980301.pdf. December 3, 2010.
- U.S. Fish and Wildlife Service. 2008. Birds of Conservation Concern 2008. Division of Migratory Bird Management, Arlington, Virginia. 87 pages. Accessed online: <http://www.fws.gov/migratorybirds/reports/BCC2008/BCC2008m.pdf>.
- U.S. Fish and Wildlife Service. 2009a. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for the Contiguous United States Distinct Population Segment of the Canada Lynx.
- U.S. Fish and Wildlife Service. 2009b. Consultation Guidance for DeMinimis Water Depletions in the Upper Colorado River Basin. U.S. Fish and Wildlife Service. Ecological Services. Lakewood, Colorado.
- U.S. Fish and Wildlife Service. 2010. Kurt Broderdorp, U.S. Fish and Wildlife Service, personal communication with Jim Ferguson, WestWater Engineering, Grand Junction, Colorado, regarding lynx habitat use on Grand Mesa. July 7, 2010.
- U.S. Fish and Wildlife Service. 2012. Updated FWS Position Paper on ESA Consultations on Greenback Cutthroat Trout, Including the Cutthroat Referred to as Lineage GB. USFWS, October 4, 2012.

- U.S. Fish and Wildlife Service. 2013a. Current Delta County species list. Accessed online: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=08029.
- U.S. Fish and Wildlife Service. 2013b. Endangered and Threatened Wildlife and Plants: Threatened Status for the Distinct Population Segment of the North American Wolverine Occurring in the Contiguous United States. Federal Register/Vol. 78, No. 23, February 4, 2013. Pages 7864-7890.
- U.S. Fish and Wildlife Service. 2013c. Endangered and Threatened Wildlife and Plants: Establishment of a Nonessential Experimental Population of the North American Wolverine in Colorado, Wyoming, and New Mexico. Federal Register/Vol. 78, No. 23, February 4, 2013. Pages 7890-7905.
- U.S. Global Change Research Program. 2009. Reports and Assessments, USGCRP Scientific Assessments, Key Findings. Accessed online: <http://globalchange.gov/publications/reports/scientific-assessments/us-impacts/key-findings>. June 22, 2009.
- Vessels Coal Gas, Inc. (VCG). 2012. Methane Recovery Evaluation – Bowie Resources, LLC-Bowie No. 2 Mine. November 21, 2012.
- Weber, W.A., and R.C. Wittmann. 1987. Colorado Flora, Western Slope. University Press of Colorado. Niwot, Colorado.
- Western Regional Climate Center, 2012. General Climate Summary Data for Paonia, Colorado. Accessed online: <http://www.wrcc.dri.edu>.
- WestWater Engineering. 2011. Biological Assessment, Bowie Resources, LLC, Underground Coal Mining Associated Surface Activities and Facilities. Prepared for: Bureau of Land Management Uncompahgre Field Office. November 2011.
- Williams, C.A. and K.J. Leib. 2005. Using Tracers to Evaluate Streamflow Gain-Loss Characteristics of Terror Creek, in the Vicinity of a Mine-Permit Area, Delta County, Colorado, Water Year 2003. Scientific Investigations Report 2005-5018.
- Woodling, J. 1985. Colorado's Little Fish – A Guide to the Minnows and Other Lesser Known Fishes in the State of Colorado. Colorado Division of Wildlife. Denver, Colorado.
- Wright Water Engineers, Inc. 2013a. Evaluation of Potential Subsidence Impacts of Longwall Mining in the Spruce Stomp Lease Area to Aquatic Life and Water Supply. Prepared for Bowie Resources, LLC. January 2013.
- Wright Water Engineers, Inc. 2013b. Biological Assessment for Longwall Coal Mining. Spruce Stomp Lease Area. May 2013.
- Young, M. K. 2009. Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*): a technical conservation assessment. U.S. Department of Agriculture, U.S. Forest Service, Rocky Mountain Region. Accessed online: <http://www.fs.fed.us/r2/projects/scp/assessments/greenbackcutthroattrout.pdf>. December 30, 2010.

APPENDIX A

Unsuitability Criteria

APPENDIX A

COAL UNSUITABILITY CRITERIA

DESCRIPTION OF THE FEDERAL LANDS INVOLVED

This unsuitability analysis has been prepared for the proposed Spruce Stomp Lease by Application (LBA) COC-75916.

LEGAL DESCRIPTION:

COC-75916

Township 12 South, Range 91 West, 6th P. M
Section 31: Lots 11 through 26 inclusive
Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.
Section 36: S2

Township 13 South, Range 92 West, 6th P.M.
Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.
Section 5: lots 2, 3, 4, 10, & 11, W/2W/2NENE, NWNE, NESWNE, SESWNE, N/2NWSWNE, N/2NW, N/2N/2SENE, E/2NW/SE, W/2W/2NESE, N/2NENESE, NENWNESE;
Section 6: Lots 1 through 4 inclusive

*containing 1,789.2 acres more or less

Bowie Resources, LLC (Bowie) submitted an application on October 12, 2012 to the Bureau of Land Management (BLM) seeking to lease federal coal. The BLM Uncompahgre Field Office (BLM) and the U.S. Forest Service, Paonia Ranger District (Forest Service or USFS), have lands which are under consideration within the proposed coal lease on National Forest System (NFS) and Public Lands. The BLM notified the Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG) that Bowie applied for a competitive coal lease-by-application (LBA), COC-75916 (1,789.2 acres), immediately adjacent to existing coal leases held by Bowie. Within the LBA tract, the Forest Service manages 1,332.6 surface acres, BLM manages 88.4 surface acres, and the remaining 368.2 acres are private surface with public minerals. All of the coal mineral estate is administered by the BLM. The application area contains approximately 8.02 million tons of coal. The BLM is required by law to consider leasing federal coal for economic recovery.

As a first step in this analysis, areas were identified that would likely to be affected by subsidence causing surface effects. Other post-leasing surface disturbance that could be

reasonably anticipated include methane drainage well (MDW) drilling, exploration drilling, seismic exploration, groundwater monitor well installation, ventilation facilities, subsidence and hydrology monitoring facilities, and access roads needed for these facilities.

In compiling this analysis and report, the unsuitability criteria published in 43 CFR 3461 were used. The unsuitability criteria were applied individually to the area being considered. Exceptions to certain criteria allow areas to be considered further even though they have been determined to be unsuitable. These exceptions to the criteria are noted where applied.

ANALYSIS OF THE UNSUITABILITY CRITERIA

Exceptions to the criteria are described only if they apply.

CRITERION 1

All federal lands included in the following land systems or categories shall be considered unsuitable: National Park System, National Wildlife Refuge System, National System of Trails, National Wilderness Preservation System, National Wild and Scenic Rivers System, National Recreation Areas, lands acquired with money derived from the Land and Water Conservation Fund, National Forests, and federal lands in incorporated cities, towns, and villages.

Exceptions

(i) A lease may be issued within the boundaries of any National Forest if the Secretary finds no significant recreational, timber, economic or other values which may be incompatible with the lease; and (A) surface operations and impacts are incident to an underground coal mine, or (B) where the Secretary of Agriculture determines, with respect to lands which do not have significant forest cover within those National Forests west of the Meridian, that surface mining may be in compliance with the Multiple-Use Sustained-Yield Act of 1960, the Federal Coal Leasing Amendments Act of 1976 and the Surface Mining Control and Reclamation Act of 1977.

Analysis

The lands within the LBA tract were proclaimed National Forest on June 6, 1905 and are within the Grand Mesa National Forest. Conditions under which coal leasing may occur are listed in the Amended Land and Resource Management Plan (LRMP), Grand Mesa, Uncompahgre and Gunnison National Forests - General Direction on pages III-62 through III-70. Lands in the Spruce Stomp tract are unclassified lands and are available for mineral leasing.

The LRMP allows for multiple use management on the lands in the LBA, which are principally managed for wildlife habitat, however management includes livestock grazing, motorized recreation and vegetation treatment. No significant recreational, timber, economic or other values which may be incompatible with the LBA are present on the tracts. There are no National Forest System trails within the LBA. Recreation use in this area is mostly hunting and will not be adversely affected by leasing these lands. Although suitable timber is identified within the Forest Plan for the LBA area, it is a relatively small amount (56 acres) and mostly limited to steep slopes and along the edge of the lease boundary where no surface disturbing activities would likely occur. No current timber sales are proposed or authorized for this area. Historically

the LBA area has not had focused timber management. No outfitter guides are operating within the LBA. Other than livestock grazing, no natural, processed or manufactured products that enter commerce are produced from the LBA. No current management activities or reasonably foreseeable activities on the LBA are incompatible for leasing these lands. In addition, foreseeable surface operations and impacts will be incident to an underground coal mine. Therefore, for reasons stated above, the exception can apply to this criterion.

BLM inventoried area streams and rivers in 2006 as part of the evaluation of Wild and Scenic Rivers (WSR) in the UFO. A 1.21-mile segment of the West Fork of Terror Creek has Outstandingly Remarkable Values and is potentially suitable for inclusion into the National Wild and Scenic River System. There are BLM surface lands and private surface with the subsurface minerals managed by BLM. The following portions of the proposed lease are within ¼ mile of the BLM stream segment.

Township 13 South, Range 91 West, 6th P.M., Section 5: W/2W/2SENE – approximately 10 acres

Township 13 South, Range 91 West, 6th P.M., Section 6: lots 1 & 2 – approximately 80 acres

In early 2011 the Gunnison Basin stakeholder group concluded public meetings and submitted their suitability recommendations for eligible segments in the Gunnison River basin to the BLM UFO. These recommendations, as well as other public comment, are being considered during formulation of the preferred alternative for the Uncompahgre Resource Management Plan, which is currently under development.

The RMP will make recommended decisions concerning this section and ultimately Congress will have the final decision under the Wild and Scenic Rivers Act. BLM policy is to protect the resource values found in the segments pending decisions by Congress on the eligibility of the various river segments.

Current plans for mining may include the lands under the West Fork of Terror Creek. Subsidence associated with the Proposed Action is expected to be minimal to negligible, and would generally affect the area immediately overlying those areas that are mined; therefore, there are likely no impacts to the West Fork of Terror Creek resources resulting from subsidence. Lands inventories are suitable for coal leasing after applying the exceptions to the criteria. In order to protect the West Fork of Terror Creek inventoried segment of the Wild and Scenic River, the following lease stipulation would be required:

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw [angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence], etc.) shall be used to control subsidence.
- No surface developments (i.e., MDWs or access roads) shall be allowed within the ½ mile wide river study corridor (i.e., 1/4 mile wide on each side of the West Fork of Terror Creek) on BLM lands/minerals. This stipulation will no longer apply if the eligible

segment on West Fork of Terror Creek is found not suitable for inclusion in the National Wild and Scenic River System, or if suitable, if it is dropped from further consideration by Congress.

CRITERION 2

Federal lands that are within rights-of-way or easements or within surface leases for residential, commercial, industrial, or other public purposes, on federally-owned surface shall be considered unsuitable.

Exceptions

A lease may be issued, and mining operations approved, in such areas if the surface management agency determines that (i) all or certain types of coal development (e.g., underground mining) will not interfere with the purpose of the right-of-way or easement, or (ii) the right-of-way or easement was granted for mining purposes, or (iii) the right-of-way or easement was issued for a purpose for which it is not being used, or (iv) the parties involved in the right-of-way or easement agree, in writing, to leasing, or (v) it is impractical to exclude such areas due to the location of coal and method of mining and such areas or uses can be protected through appropriate stipulations.

Analysis

There are three existing rights-of-way on USFS and BLM lands within the lease area:

- Right-of-way COC-66873 is an access road to Bowie Resources, LLC for their mining operations.
- The third right-of-way, COC-44585, is for a stream gauge monitoring station to Bowie Resources.
- Right-of-way COC-22713, held by Western Area Power Administration (WAPA), is a 125-foot wide right-of-way for an electrical transmission line with a capacity up to 345 kV.

Subsidence effects on the transmission line could occur. Overburden depth from south to north ranges from approximately 1,100 feet to more than 1,500 feet on the north end of the WAPA right-of-way.

Lands involved in these rights-of-way are suitable for coal leasing after applying the exceptions to the criteria. The first two rights-of-way would fall under exceptions (i) and (ii). The power line would be protected by exception (v) above. The power line right-of-way is 125 feet in width and includes access roads. In order to protect the power line, the following lease stipulations would be required:

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the right-of-way must be properly grounded. In order to avoid static or induced electrical hazards no materials may be stored in the transmission line right-of-way.
- If future longwall mining would come within 100 feet of any transmission line tower

foundation, a structural review and acceptance by WAPA would be required.

- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions would be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining related surface disturbance would occur within 100 feet of the outside line of the power line right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.
- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation will be performed at the lessee's expense.
 1. Baseline condition surveys of existing facilities will be completed the fall following award of lease. Reports of this survey will be deliverable to the Forest Service by December 1 of that same year.
 2. A Surface Facility Monitoring and Mitigation Plan (Plan) will be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan will detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.

There is a General Land Office Order, 6/1/1910, which classifies the lands within the application area for coal. The lands are also within the Paonia-Somerset Known Recoverable Resource Area, COC-20093. No other easements or surface leases for residential, commercial, industrial, or other public purposes are determined to exist within the LBA tract.

CRITERION 3

Federal lands affected by section 522(e)(4) and (5) of the Surface Mining Control and Reclamation Act of 1977 shall be considered unsuitable. This includes lands within 100 feet of the outside line of the right-of-way of a public road, or within 100 feet of a cemetery, or within 300 feet of any public building, school, church, community or institutional building or public park, or within 300 feet of an occupied dwelling.

Exceptions

A lease may be issued for lands (i) used as mine access roads or haulage roads that join the right-of-way for a public road, (ii) for which the Office of Surface Mining Reclamation and Enforcement has issued a permit to have public roads relocated, (iii) if, after public notice and opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of a public road will be protected, or (iv) for which owners of occupied dwellings have given written permission to mine within 300 feet of their buildings.

Analysis

No cemeteries, occupied dwellings, public buildings, schools, churches, community, or institutional buildings exist within this area. National Forest System Roads 701, 703, 701.1A, and 824 pass through the LBA tract. These roads are used by the general public to access the National Forest for recreation and access special use permitted facilities, etc. The overburden range is from approximately 1,750 feet to 2,200 feet. At that depth there would be measurable subsidence but no visible surface cracking (see Geology and Minerals section). Therefore, it is expected that there would be no subsidence related disturbance to the road. The Forest Service has the authority to permit other uses of the lands and roads in the area.

CRITERION 4

Federal lands designated as wilderness study areas shall be considered unsuitable while under review by the Administration and Congress for possible wilderness designation. For any federal land which is to be leased or mined prior to completion of the wilderness inventory by the surface management agency, the environmental assessment or impact statement on the lease sale or mine operations plan shall consider whether the land possesses the characteristics of a wilderness study area. If the finding is affirmative, the land shall be considered unsuitable, unless issuance of noncompetitive coal leases and mining on leases is authorized under the Wilderness Act and the Federal Land Policy and Management Act of 1976.

Analysis

The USFS and BLM lands within the Spruce Stomp LBA tract are unclassified lands that are available for mineral leasing (Forest Service, 1991). No lands within the review area are designated Wilderness Study Areas or Lands with Wilderness Characteristics. The West Elk Wilderness area is located about more than seven miles to the south-southeast of the tract. Congressionally designated wilderness areas were withdrawn from mineral entry in 1983.

CRITERION 5

Scenic federal lands designated by visual resource management analysis as Class I (an area of outstanding scenic quality or high visual sensitivity) but not currently on the National Register of Natural Landmarks shall be considered unsuitable. A lease may be issued if the surface management agency determines that surface coal mining operations will not significantly diminish or adversely affect the scenic quality of the designated area.

Analysis

No lands within the review area are designated as visual resource management Class I areas. The West Elk wilderness located seven miles to the south is a Class I visual resource area (see Criterion 4).

CRITERION 6

Federal lands under permit by the surface management agency, and being used for scientific studies involving food or fiber production, natural resources, or technology demonstrations and experiments shall be considered unsuitable for the duration of the study, demonstration, or experiment except where mining could be conducted in such a way as to enhance or not jeopardize the purposes of the study, as determined by the surface management agency, or where the principal scientific use or agency give written concurrence to all or certain methods of mining.

Analysis

No lands within the review area are under permit for scientific study.

CRITERION 7

All publicly-owned places on federal lands which are included in the National Register of Historic Places shall be considered unsuitable. This shall include any areas that the surface management agency determines, after consultation with the Advisory Council on Historic Preservation and the State Historic Preservation Officer, are necessary to protect the inherent values of the property that made it eligible for listing in the National Register.

Analysis

No publicly-owned places on federal or fee lands within the review area are included in the National Register of Historic Places.

CRITERION 8

Federal lands designated as natural areas or as National Natural Landmarks shall be considered unsuitable.

Analysis

No lands within the review area are designated as natural areas or as National Natural Landmarks.

CRITERION 9

Federally designated critical habitat for listed threatened or endangered plant and animal species, and habitat proposed to be designated as critical for listed threatened or endangered plant and animal species or species proposed for listing, and habitat for federal threatened or endangered species which is determined by the Fish and Wildlife Service (Service) and the surface management agency to be of essential value and where the presence of threatened or endangered species has been scientifically documented, shall be considered unsuitable.

Exceptions

A lease may be issued and mining operations approved if, after consultation with the Fish and Wildlife Service, the Service determines that the proposed activity is not likely to jeopardize the continued existence of the listed species and/or its critical habitat.

Analysis

USFWS (2012) identified 12 species as endangered, threatened, or candidate under the Endangered Species Act (ESA) that may occur in Delta County (see Table A-1). In addition to federally-listed species, the USFS and BLM identified 19 other species as sensitive with the potential to occur within the general area of the LBA tract (see Table A-2).

Table A-1
Federally Threatened, Endangered, or Candidate Species in Delta County

Common Name/ Scientific Name	Status ¹	Potential Occurrence in the Analysis Area ²	Discussed in EA	Habitat ³
Mammals				
Black-footed ferret <i>Mustela nigripes</i>	E, SE	None	No	Requires large prairie dog colonies in open habitat such as grasslands, steppe, and shrub steppe.
Canada lynx <i>Lynx canadensis</i>	T, SE	Unlikely	Yes	Coniferous forests interspersed with thickets of trees and shrubs, rocky outcrops, large woody debris; closely associated with snowshoe hares. Present on Grand Mesa.
North American wolverine <i>Gulo gulo lucus</i>	C, SE	None	Yes	High elevation boreal and alpine habitats.
Birds				
Gunnison sage-grouse <i>Centrocercus minimus</i>	C, SC	None	No	Expansive sagebrush with grasses, forbs, and healthy riparian ecosystems; project outside of expected range.
(Western) Yellow-billed cuckoo <i>Coccyzus americanus</i>	C, SC	None	No	Riparian forested habitats dominated by cottonwoods. Observed on North Fork of Gunnison River (Beason, 2009).
Fish				
Colorado pikeminnow <i>Ptychocheilus lucius</i>	E, SE	Unlikely	Yes	Fast, deep, white-water rivers with backwater areas and eddy habitats 2 to 3 feet deep that support aquatic insects, small fish as prey species.
Greenback cutthroat trout <i>Oncorhynchus clarki stomias</i>	T, ST	Present	Yes	Cold, clear, gravely headwater streams and mountain lakes with abundant insects; originally in the Arkansas and South Platte river drainages of Colorado and Wyoming. Recent genetic testing indicates populations exist in the Colorado River drainage.
Razorback	E, ST	Unlikely	Yes	Slow backwater habitats or large rivers and

Common Name/ Scientific Name	Status ¹	Potential Occurrence in the Analysis Area ²	Discussed in EA	Habitat ³
sucker <i>Xyrauchen texanus</i>				impoundments, not small tributaries or headwaters, with mud, sand or gravel substrate.
Plants				
Clay-loving wild buckwheat <i>Eriogonum pelinophilum</i>	E, SE	None	No	Restricted to the badlands/Adobe Hills east of Delta and Montrose, CO.
Colorado hookless cactus <i>Sclerocactus glaucus</i>	E, SE	None	No	Rocky hills, alluvial benches, and lower mesa slopes in desert shrub communities from 4,500 to 6,000 feet.
¹ Status: T – Federally Threatened; E – Federally Endangered; C – Federal Candidate; SE – Colorado Endangered; ST – Colorado Threatened; SC – Colorado Candidate. (USFWS, 2013a). ² Potential Occurrence based on habitat associations and known distributions: None: May occur in Delta County but restricted distributions are distant and/or habitat is not present in the project area. Unlikely: May occur in Delta County and marginally suitable habitat present in the project area. Possible: Occurs in Delta County, suitable habitat is present, but not observed in the project area. Present: Observed in the project area and/or occupied habitat includes the project area. ³ Source: CPW, 2012a; CNHP, 2012.				

Table A-2
BLM and USFS Sensitive Species that May Be Present in or near the LBA Tract

Common Name/ Scientific Name	USFS Status	BLM Status	CPW Status ¹	Potential Occurrence in the Analysis Area ²	Habitat ³
Mammals					
American marten <i>Martes americana</i>	Sensitive	N/A	N/A	Likely	Subalpine, spruce-fir and lodgepole pine forests, alpine tundra and occasionally Montane forests. Generally associated with older growth or mixed age stands of spruce fir and lodgepole pine.
Spotted bat <i>Euderma maculatum</i>	Sensitive	Sensitive	N/A	Possible	Ponderosa pine in montane forest, pinyon-juniper woodlands, aspen, semi-desert shrublands.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	Sensitive	Sensitive	SC	Possible	Montane forests, pinyon-juniper woodlands, semi-desert shrublands.
Fringed myotis <i>Myotis thysanodes</i>	Sensitive	Sensitive	N/A	Possible	Ponderosa pine, greasewood, oakbrush, saltbush shrublands.
Hoary bat <i>Lasiurus cinereus</i>	Sensitive	N/A	N/A	Likely	Roosts in deciduous trees, forages over open watercourses and ponds.
Allen's (Mexican) big-eared bat <i>Idionycteris</i>	N/A	Sensitive	N/A	Unlikely	Ponderosa pine, pinyon-juniper woodland, oak brush, riparian woodland (cottonwood); typically found near rocky outcrops, cliffs, and boulders; often

Common Name/ Scientific Name	USFS Status	BLM Status	CPW Status ¹	Potential Occurrence in the Analysis Area ²	Habitat ³
<i>phyllotis</i>					forages near streams and ponds.
Big free-tailed bats <i>Nyctinomops macrotis</i>	N/A	Sensitive	N/A	Possible	Occur in rocky areas and rugged terrain in desert and woodland habitats. Roost in rock crevices in cliffs and caves, and occasionally in tree cavities.
Birds					
American peregrine falcon <i>Falco peregrinus anatum</i>	Sensitive	Sensitive	SC	Possible	Open conifer forests, riparian forests, and cliffs; migrant in western Colorado.
Bald eagle <i>Haliaeetus leucocephalus</i>	Sensitive	Sensitive	SC	Possible	Reservoirs, rivers, wintering in semi- desert and grasslands.
Northern goshawk <i>Accipiter gentilis</i>	Sensitive	Sensitive	N/A	Possible	Forests of aspen, ponderosa pine, lodgepole pine; larger trees for nesting.
Ferruginous hawk <i>Buteo regalis</i>	Sensitive	Sensitive	N/A	Unlikely	Grassland, semi-desert shrublands, rare in pinyon-juniper; nest on isolated structures.
Flammulated owl <i>Otus flammeolus</i>	Sensitive	Sensitive	N/A	Possible	Old growth and mature ponderosa pine, Douglas fir, lodgepole pine, spruce/fir mixed with aspen, pinyon-juniper, hardwood forests from 6,000-10,000 feet.
Purple martin <i>Progne subis</i>	Sensitive	N/A	N/A	Possible	Inhabits old growth aspen, mixed aspen/ponderosa pine or Douglas fir, deciduous riparian woodlands, burns with snags. Migratory. Known to nest in watershed.
Olive-sided flycatcher <i>Contopus cooperi</i>	Sensitive	N/A	N/A	Present	Inhabits open mature spruce/fir and Douglas Fir. Forages in woodlands near edges, clearings, bogs, streams, and burned areas. Uses tall exposed perches in tops or high exposed limbs of trees. Migratory.
Lewis's woodpecker <i>Melanerpes lewis</i>	Sensitive	Sensitive	N/A	Possible	Open forest and woodland, often logged or burned, including oak, coniferous forest (often ponderosa), riparian woodland, and orchards, less often in pinyon-juniper.
Fish					
Colorado River cutthroat trout <i>Oncorhynchus clarki pleuriticus</i>	Sensitive	Sensitive	SC	Possible	Clear, headwater streams in the Colorado River drainage, clear mountain streams; no known populations of pure strain cutthroats on public lands managed in the LBA tract.
Amphibians					
Northern leopard frog <i>Rana pipiens</i>	Sensitive	Sensitive	SC	Present	Margins, banks of marshes, ponds, streams, other permanent water.
Reptiles					

Common Name/ Scientific Name	USFS Status	BLM Status	CPW Status ¹	Potential Occurrence in the Analysis Area ²	Habitat ³
Milk snake <i>Lampropeltis triangulum taylori</i>	N/A	Sensitive	N/A	Possible	Grasslands, sandhills, canyons, open woodlands ponderosa, pinyon-juniper; known along the North Fork of the Gunnison River.
Midget faded rattlesnake <i>Crotalus viridis concolor</i>	N/A	Sensitive	SC	Possible	Most terrestrial habitats in west-central Colorado including grasslands, shrublands, pinyon-juniper woodlands, coniferous forests.
¹ Colorado Parks and Wildlife Status Codes: SC = State Special Concern (not a statutory category) (CPW, 2013a). ² Potential Occurrence based on habitat associations and known distributions: Unlikely: May occur in Delta County and marginally suitable habitat present in the project area. Likely: Occurs in Delta County, suitable habitat is present, likely to be present in the project area. Possible: Occurs in Delta County, suitable habitat is present, but not observed in the project area. Present: Observed in the project area and/or occupied habitat includes the project area. ³ Sources: CNHP, 2013; CPW, 2012a; Weber and Wittmann, 1987; Andrews and Righter, 1992; Hammerson, 1986; Woodling, 1985; Fitzgerald et al., 1994.					

No lands within the review area are designated as Critical Habitat, proposed to be designated as Critical Habitat, or determined to be essential habitat for any federally-listed Threatened or Endangered plant or animal species, or species proposed for listing. However, Critical Habitat for the endangered Colorado River fish does exist off-site in the Colorado River drainage which potentially could be affected by water depletion from this action (USFWS, 1994). USFWS has concluded that any water depletion in the upper Colorado River Basin “may affect” these Endangered fish species and their Critical Habitat.

Current plans for mining may include the lands under the West Fork of Terror Creek. Subsidence associated with the Proposed Action is expected to be minimal to negligible and would generally affect the area immediately overlying those areas that are mined. Therefore, no subsidence related disturbance to the flows in Terror Creek or to Threatened greenback cutthroat trout are predicted as a result of proposed mining on the LBA tract. Lands are suitable for coal leasing after applying the exceptions to the criteria. In order to protect the West Fork of Terror Creek and related habitat for the Threatened greenback cutthroat trout, the following lease stipulations would be required for the LBA tract:

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) would occur within 200 feet of greenback cutthroat trout occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer. These techniques would provide for maximum coal removal while protecting the values associated with the threatened greenback cutthroat trout habitat.
- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective BMPs, would be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.

- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee shall, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor shall contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under this BA, lessee shall submit the compiled monthly inspection reports to BLM UFO by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads shall be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure shall be placed at the barricades.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year – October through March.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.
- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.

- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- No surface disturbance, such as road widening or upgrading would occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the greenback cutthroat trout, unless exceptions were approved by the Authorized Officer.
- Site-specific surveys for sensitive plants would be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There would be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions were approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures would avoid overspray or drift onto desirable species or sensitive plants.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- The lessee/operator would design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator would design and implement a stream flow measurement

program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on continuous measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to conduct site visits to ensure continuous flow measurements are recorded on a minimum monthly schedule, weather permitting. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and USFWS.

- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) every two years during and twice following the mining activities (at 5 and 10 years periods) prior to bond release. A report should be distributed to the BLM, USFS and USFWS documenting if statistically significant declines are observed related to mining activities. If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the lessee/operator will work with CPW to capture and grow out fish populations from appropriate breeding stock. The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual Monitoring Report and distributed accordingly.

CRITERION 10

Federal lands containing habitat determined to be critical or essential for plant or animal species listed by a state pursuant to state law as endangered or threatened shall be considered unsuitable.

Exceptions

A lease may be issued and mining operations approved if, after consultation with the state, the surface management agency determines that the species will not be adversely affected by all or certain stipulated methods of coal mining.

Analysis

No lands within the review area, or off-site that would be affected by this action, have been determined by the state of Colorado as critical or essential habitat for any state-listed Endangered or Threatened plant or animal species (see Table A-2).

CRITERION 11

A bald or golden eagle nest site on federal lands that is determined to be active and an appropriate buffer zone of land around the nest site shall be considered unsuitable.

Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exceptions

A lease may be issued if (1) it can be conditioned in such a way, either in manner or period of operation, that eagles will not be disturbed during the breeding season, or (2) the surface management agency, with the concurrence of the Fish and Wildlife Service, determines that the golden eagle nest(s) will be moved, or (3) buffer zones may be decreased if the surface management agency determines that the active eagle nests will not be adversely affected.

Analysis

Presently, no bald or golden eagle nest sites exist on federal lands within the review area. A buffer zone of one-quarter mile radius around bald and golden eagle nest sites are considered adequate protection. Underground coal mining and nesting bald or golden eagles are compatible on the same tract of land unless surface facilities or surface disturbance cause nest-site abandonment. Lands are suitable for coal leasing after applying the exceptions to the criteria. With respect to bald or golden eagle nests that may be established on the review area during the life of the project, the following special stipulations would apply:

1. No new permanent surface facilities or disturbance except subsidence would be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.
2. No surface activities would be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles. Any proposed surface facilities, disturbance, or activities (as noted above) in or adjacent to these buffer zones would require approval from the surface management agency on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

CRITERION 12

Bald and golden eagle roost and concentration areas on federal lands used during migration and wintering shall be considered unsuitable.

Analysis

The bald eagle is present as a winter resident along the North Fork of the Gunnison River. The river and adjacent habitats are designated as Bald Eagle Winter Forage Range by CPW (2011). Biological surveys indicate that bald eagle activity has been observed along the North Fork Valley, but that no bald eagles have been sighted in the Bowie mine area, or in areas near the mine, for several years. Lands are suitable for coal leasing after applying the exceptions to the criteria.

With respect to bald or golden eagle roost sites or concentration areas which may be established on the review area during the life of the project, the following special stipulation would be applied:

- No surface activity, except subsidence, would occur within a one-quarter mile radius of winter roosts between November 15 and March 15. Development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity would be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

CRITERION 13

Federal lands containing a falcon (excluding kestrel) cliff nesting site with an active nest and buffer zone of federal land around the nest site shall be considered unsuitable. Consideration of availability of habitat for prey species and of terrain shall be included in the determination of buffer zones. Buffer zones shall be determined in consultation with the Fish and Wildlife Service.

Exceptions

A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not adversely affect the falcon habitat during the periods when such habitat is used by the falcons.

Analysis

An active peregrine falcon nest is located in the upper end of Dove Gulch. This is the only active peregrine nest known to occur in this general area. The nest is located over a high ridge and would be than two miles from any activity associated with road and pad construction and drilling activity. It is not expected to be affected by the activities associated with the LBA tract. Lands are suitable for coal leasing after applying the exceptions to the criteria.

With respect to peregrine falcon nests which may be established in the review area during the life of the project, the following special stipulations would be applied (also see Criterion 14 for additional conditions):

1. No new permanent surface facilities or disturbance would be located within a one-quarter mile radius buffer zone around each peregrine falcon nest site.
2. No aboveground activities would be allowed within a one-half mile radius buffer zone around each active peregrine falcon nest site from February 1 to July 15.
3. Any proposed surface facilities, disturbance, or activities in, or adjacent to, these buffer zones would require approval from the USFS or BLM on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

CRITERION 14

Federal lands which are high priority habitat for migratory bird species of high federal interest on a regional or national basis, as determined jointly by the surface management agency and the Fish and Wildlife Service, shall be considered unsuitable.

Exceptions

A lease may be issued where the surface management agency, after consultation with the Fish and Wildlife Service, determines that all or certain stipulated methods of coal mining will not

adversely affect the migratory bird habitat during the periods when such habitat is used by the species.

Analysis

The Migratory Bird Treaty Act (916 U.S.C. 703-711) identifies numerous bird species of the southwestern U.S. that are assigned a migratory status. USFS and BLM have signed Memorandums of Understanding (MOUs) with the USFWS, which are intended to strengthen migratory bird conservation efforts by identifying and implementing strategies to promote conservation and reduce or eliminate adverse impacts on migratory birds. The focus of the agencies' conservation efforts is on migratory species and some non-migratory game bird species that are listed as Birds of Conservation Concern (BCC). BCC have been identified by the USFWS (2008) for different Bird Conservation Regions (BCR) in the United States to identify those species in the greatest need of conservation action, outside of those species already listed by the USFWS as threatened or endangered. The entire project area is in BCR 16, the Southern Rockies/Colorado Plateau region. The USFWS lists 27 species (see Table A-3) that are BCC in BCR 16 (USFWS, 2008). Table A-3 also shows the probable status for each species within the LBA tract (Kingery, 1998; CPW, 2011).

Based on species' known distributions and habitat associations in western Colorado, 12 species are known or have potential to occur in the project area (see Table A-15). Two of these species were observed on-site during surveys: peregrine falcon and golden eagle. An active peregrine falcon nest is located in the upper end of Dove Gulch. This is the only active peregrine nest known to occur in this general area. The nest is located over a high ridge and more than two miles from any assumed activity associated with road and pad construction and drilling activity.

The bald eagle is present as a winter resident along the North Fork of the Gunnison River. The river and adjacent habitats are designated as Bald Eagle Winter Forage Range by CPW (2011), of which a small portion of the designated range overlaps the southern boundary of the LBA tract and access roads. Biological surveys indicate that bald eagle activity has been observed along the North Fork Valley, but that no bald eagles have been sighted in Bowie's mine area or in areas near the mine for several years.

Table A-3
Birds of Conservation Concern within BCR 16

Common Name Scientific Name	Habitat ¹	Potential Occurrence in Project Area
Gunnison sage-grouse <i>Centrocercus minimus</i>	Expansive sagebrush with grasses, forbs, and healthy riparian; project outside of expected range.	No
American bittern <i>Botaurus lentiginosus</i>	Dense freshwater marshes and extensive wet meadows.	No
Bald eagle <i>Haliaeetus leucocephalus</i>	Nests and roosts in large cottonwoods along rivers near prey or carrion during winter.	Yes
Ferruginous hawk <i>Buteo regalis</i>	Nests in isolated trees, rock outcrops, artificial structures, ground near prey base.	No
Golden eagle <i>Aquila chrysaetos</i>	Nest on open cliffs and in canyons or in tall trees (cottonwoods) in open country	Yes

Common Name Scientific Name	Habitat ¹	Potential Occurrence in Project Area
	and riparian zones.	
Peregrine falcon <i>Falco peregrinus</i>	Nests on high cliff faces, often near water; forages in adjacent habitats.	Yes
Prairie falcon <i>Falco mexicanus</i>	Nests in cavities on cliffs, rock outcrops adjacent to open grassland, shrublands.	Yes
Snowy plover <i>Charadrius alexandrinus</i>	Barren or sparsely vegetated alkaline flats and river bars.	No
Mountain plover <i>Charadrius montanus</i>	Short-grass prairie and shrub-steppe landscapes.	No
Long-billed curlew <i>Numenius americanus</i>	Short-grass grasslands, wheat fields, dry land agriculture near water.	No
Yellow-billed cuckoo <i>Coccyzus americanus</i>	Riparian forested habitats dominated by cottonwoods.	No
Flammulated owl <i>Otus flammeolus</i>	Nests in forest of ponderosa pine and Douglas-fir with aspen, and in aspen stands.	Yes
Burrowing owl <i>Athene cunicularia</i>	Nests in burrows, especially prairie dog / badger burrows in grasslands, desert shrub.	No
Lewis's woodpecker <i>Melanerpes lewis</i>	Nests in open stands of cottonwood riparian or urban stands, also in aspen, oak shrub.	Yes
Willow flycatcher <i>Empidonax traillii</i>	Dense riparian habitats along rivers, streams, or other wetlands.	No
Gray vireo <i>Vireo vicinior</i>	Nests in open pinyon-juniper stands with mountain mahogany, deciduous shrub interspersed.	Yes
Pinyon jay <i>Gymnorhinus cyanocephalus</i>	Nest in pinyon and/or juniper woodlands, feed/cache pinyon nuts, juniper berries.	Yes
Juniper titmouse <i>Baeolophus griseus</i>	Nests in pinyon and/or juniper open or dense woodlands, often intermixed with Gambel oak.	Yes
Veery <i>Catharus fuscescens</i>	Damp deciduous/mixed woodlands with dense understory, wood swaps/lowlands, and damp ravines.	No
Bendire's thrasher <i>Toxostoma bendirei</i>	Open farmlands, grasslands, and brushy arid to semi-arid deserts; breeds mainly in grasslands, shrublands or woodlands.	No
Grace's warbler <i>Dendroica graciae</i>	Open montane forests, especially oaks, junipers, firs, and pines.	Yes
Brewer's sparrow <i>Spizella breweri</i>	Nests in sagebrush, occasionally greasewood, rabbitbrush in desert valleys.	No
Grasshopper sparrow <i>Ammodramus savannarum</i>	Grasslands with few scattered shrubs.	No
Chestnut-collared longspur <i>Calcarius ornatus</i>	Shortgrass or mixed-grass habitats heavily grazed or recently burned.	No
Black rosy-finch <i>Leucosticte atrata</i>	Alpine areas usually near rock piles and cliffs; winters in mountain meadows, high deserts, valleys, and plains.	No

Common Name Scientific Name	Habitat ¹	Potential Occurrence in Project Area
Brown-capped rosy-finch <i>Leucosticte australis</i>	Nests on cliffs or in caves, rock slides or old buildings above timberline.	No
Cassin's finch <i>Carpodacus cassinii</i>	Nests in montane forests with spruce/fir and aspen; also in lower pinyon-juniper woodlands.	Yes
¹ Based on Righter et al. 2004.		

Underground activities would have no impacts on migratory bird and/or raptor populations. There is potential for disturbance to migratory birds during drilling, access, and site reclamation activities associated with MDW drilling where vegetation would be disturbed on approximately 45 acres. This includes direct impacts to unidentified active nests, potential mortalities and injuries to birds and eggs in unidentified nests, and disturbance to suitable nesting habitat potentially resulting in incidental “take” of migratory birds. To minimize or avoid effects to nesting migratory birds, where practicable, the lessee would avoid vegetation removal during the migratory bird nesting period (May 15 to August 1).

Raptors nesting in the project area could abandon nests because of noise and human presence during the breeding period, which varies by species. Recent surveys within the LBA tract did not observe raptor nests within woodland habitat 0.25 mile from the LBA tract or within cliffs 0.5 mile from the LBA tract. It is not expected that assumed surface activities would affect nesting raptors.

- For any future proposed disturbances on the lease, a qualified biologist would conduct pre-construction breeding bird and raptor surveys during the breeding period within 0.5 mile of the general disturbance area (drill pads and access roads) if activities would occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys would document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to and approved by the USFS or BLM Biologist, activities may begin within the cleared areas. If active nests are found, development timing would be restricted during the breeding season, as per the USFS or BLM authorized officer.
- Where practicable, surface disturbing activities should not occur during the migratory bird nesting period (May 15 through August 1) to prevent potential take of migratory birds and/or eggs, unless vegetation is removed prior to May 15. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM would be required. If active nests were identified during mine permit related project disturbances, appropriate measures would be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations, and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM.
- All unavoidable surface disturbances would require approval of the USFS or BLM Authorized Officer. The USFS or BLM would coordinate with USFWS to determine the

type and extent of allowable variances. A site-specific examination would determine if this stipulation would apply.

CRITERION 15

Federal lands which the surface management agency and the state jointly agree are habitat for resident species of fish, wildlife and plants of high interest to the state and which are essential for maintaining these priority wildlife and plant species shall be considered unsuitable. Examples of such lands which serve a critical function for the species involved include: (i) active dancing and strutting grounds for sage grouse, sharp-tailed grouse, and prairie chicken, (ii) winter ranges crucial for deer, antelope, and elk, (iii) migration corridor for elk, and (iv) extremes of range for plant species.

Exception

A lease may be issued if, after consultation with the state, the surface management agency determines that all or certain stipulated methods of coal mining will not have a significant long-term impact on the species being protected.

Analysis

The entire proposed project area is mapped as elk winter range. Many elk and deer winter below the proposed project area, but wintering use is influenced by snow depths. In addition, migratory deer and elk utilize the area during two major migration periods during the year when they migrate between high elevation summer range and lower elevation winter range. The migration periods are largely driven by weather patterns and snowline elevations in the fall and spring. Although CPW identifies the area as part of the overall range for moose on Grand Mesa, the plant communities on the lease area are marginally suitable for moose, and except for rare occasions, they are not expected to be present. The proposed project area is also excellent black bear habitat providing an abundance of native summer vegetation and a fall berry crop which tends to concentrate bears.

Surface disturbing activities in this area caused by underground coal mining would impact elk and mule deer winter ranges and fall black bear use. Lands are suitable for coal leasing after applying the exceptions to the criteria. The review area is suitable for coal leasing with inclusion of the following special protective stipulations on those areas that are currently, or may be, designated as crucial winter range and fall black bear concentration during the life of the project:

- Facility construction and major scheduled maintenance shall not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times would require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles shall be permitted, but no snow plowing may occur.
- Bear-proof containers would be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training would include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation would be utilized on the individual MDW pumps to reduce impacts from their operation.

No other federal lands within the review area, or off-site that would be affected by the Proposed Action are considered critical or essential habitat for resident species of fish, wildlife or plants of high interest to the state of Colorado.

CRITERION 16

Federal lands in riverine, coastal, and special floodplains (100-year recurrence interval) on which the surface management agency determines that mining could not be undertaken without substantial threat of loss of life or property shall be considered unsuitable for all or certain stipulated methods of coal mining.

Analysis

The application lands are not within a riverine, coastal, or special floodplain.

CRITERION 17

Federal lands which have been committed by the surface management agency to use as municipal watersheds shall be considered unsuitable.

Analysis

None of the lands in the proposed lease tract are within a municipal watershed.

CRITERION 18

Federal lands with National Resource Waters, as identified by states in their water quality management plans, and a buffer zone of federal lands ¼-mile from the outer edge of the far banks of the water, shall be unsuitable.

Analysis

None of the lands in the proposed lease tract are identified as a National Resource Water.

CRITERION 19

Federal lands identified by the surface management agency, in consultation with the state in which they are located, as alluvial valley floors according to the definition in Subpart 3400.0-5(a) of this title, the standards of 30 CFR 822, the final alluvial floor guidelines of the Office of Surface Mining Reclamation and Enforcement when published, and approved state programs under the Surface Mining Control and Reclamation Act of 1977, where mining would interrupt, discontinue, or preclude farming, shall be considered unsuitable. Additionally, when mining federal land outside an alluvial valley floor would materially damage the quantity or quality of water in surface or underground water systems that would supply alluvial valley floors, the land shall be considered unsuitable.

Analysis

The application lands are not within an alluvial valley floor, but such lands drain into the North Fork Gunnison River, along which both surface irrigated and potentially irrigable sites exist. However, material damage to the quality and quantity water arising on or flowing over the proposed lease tract is not anticipated.

CRITERION 20

Federal lands in a state to which is applicable a criterion (i) proposed by the state or Indian tribe located in the planning area, and (ii) adopted by rulemaking by the Secretary, shall be considered unsuitable.

Analysis

This criterion is not presently in effect in the State of Colorado.

CONSULTATION AND COORDINATION

The following agencies and organizations were contacted to gain information pertinent to the application of the 20 coal suitability criteria:

Federal Agencies

U.S. Department of the Interior
Fish and Wildlife Service
Western Colorado Supervisor
Ecological Services
764 Horizon Drive, Building B
Grand Junction, CO 81505-3946

U.S. Department of the Interior
Office of Surface Mining
Reclamation and Enforcement – Western Region
1999 Broadway, Suite 3320
Denver, CO 80202

APPENDIX B

Tract Delineation Report

PRELIMINARY

Spruce Stomp Tract LBA (COC75916)

Tract Delineation Report - Year 2013

Prepared by:
Desty Dyer, Mining Engineer
Montrose UFO
April 2013

Reviewed by:
Kyle Free, Mining Engineer
Colorado State Office
April 2013

I. General Location.

The Spruce Stomp Tract (hereafter referred to as the SST) is located in Delta County, Colorado, 6 miles directly north of Paonia off of highway 133. The Stevens Gulch road passes through the LBA. The proposed lease covers approximately 1,789.2 acres being split between 1,332.6 acres of NFS land, 88.4 acres of BLM land and 368.2 acres of private surface all with federal minerals. All of the coal mineral estate is administered by the BLM. West Terror Creek trends west-northwest along the south side of the SST. The location of the tract is shown on Figure 1. Attachment 1 contains a legal description of the tract as applied for and determined acceptable by BLM.

II. Background and History.

The Spruce Stomp Tract was delineated in response to a competitive lease by application (LBA) filed on October 12, 2012, by Bowie Resources, LLC, (BRL). The current delineation retains the proposed boundary in the original LBA. The tract lies to the north of BRL federal leases COC37210 and COC61209. The SST lease would include the federal coal reserves in the B-Seam and all coal seams below the B-Seam within the SST.

The SST coal data is determined by data from seven drill holes within the tract and an additional six drill holes near the tract, putting the data within the range of indicated reserves. The SST was delineated in order to cover all potential mineable coal reserves. The coal seams above the B-Seam reserves were not included due to a complete lack of mineable thickness and/or being displaced by an igneous sill. There are two to four splits of the A-Seam present on the SST all being mostly two thin to be mineable; however, there may be a mineable portion in the northwest area of the SST. Because of that potential the A-Seam is included in the leasable reserves.

If BRL is the successful bidder they intend to extend their current Bowie No. 2 Mine workings into the B-Seam reserves within the SST. BRL currently operates the Bowie No. 2 underground longwall mine that occupies their federal coal leases COC37210 and COC61209 that are adjacent to the SST on its south boundary. North Mains in the B-Seam have been projected along the center of the existing property and BRL proposes to extend them on to the SST. Longwall blocks would branch out both east and west off the North Mains.

The mineable reserves in the SST could be accessed via the existing Bowie No. 2 Mine as mentioned above using their existing surface facilities that would serve for the life of mining on the SST. BRL holds both federal leases COC37210 and COC61209 in good standing and should be able to make a smooth transition from mining on that lease to mining in the SST if they were the successful bidder.

Production from the Bowie No. 2 Mine was 3.8 million tons in 2012 using the longwall mining method, and is expected to maintain that yearly production rate. Any longwall mine on the SST could operate at the 3.8 million tpy rate which BLM will use as the projected rate.

III. General Description.

The SST is located in the Paonia coal field on the north side of the North Fork valley. The formations in the area of the SST dip N-NE about 3.5 - 5 degrees. Coal in the Paonia field is found as six identified seams (generally by alphabet starting with A as the lowest seam) within the Mesaverde Group of late Cretaceous age. In the mine permit area the A, B, and D seams have hosted producing mines.

Access to the SST coal could most easily be achieved from the present Bowie No. 2 Mine surface and mine facilities near Paonia Colorado. Federal coal leases held by BRL have been and are being mined. They are adjacent on the south of the delineated SST. B-Seam overburden ranges from about 700' to 2,700' from SE to NW across the tract. About 66% of the mineable reserves are between 1,500' and 2,000' deep. About 19.5% are less than 1,500' deep while 14.5% are greater than 2,000' deep. The average depth of mineable reserves is about 1,700'. These overburden ranges pose a moderate constraint to economic recovery. The southern boundary of the SST was decided by existing federal leases COC37210 and COC61209 and the northern boundary by deep cover on the west end and known faults and sill influence on the east end. The west boundary is determined by evidence of all seams splitting into thin unmineable units. The east boundary is determined by thinner seams as well as influence from igneous sill and faulting. Coal resources exist to the north of the applied for area, but cover depths become increasingly prohibitive to mining safety and economics.

Opportunities to enhance the competitiveness of the SST during tract delineation rely on the economic value of the recoverable reserves. These reserves are of good quality but minimal in quantity and essentially locked in by virtue of limited surface access and the fact that BRL already controls adjoining federal coal. If there were a successful bidder other than BRL they would likely need to sublease back to BRL (because they would not have the advantage of existing coal handling facilities or control of adjacent coal reserves as does BRL). Subleasing would be a high-risk business proposition for an outside bidder because BRL may refuse any such sublease agreement. The coal does not outcrop on the SST, therefore no portals could be located, and there may not be any reasonable shaft locations.

The SST surface topography varies in elevation from about 7,000 feet in the SE portion to about 8,680 feet in the NW portion. As noted above, the SST is not likely to have competitive interest and if the potential reserves are not recovered as part of the BRL mining operation, they would most likely be bypassed.

The SST has been delineated to include all potentially recoverable coal reserves in the B-Seam lying within the SST as described above. All seams below the B-Seam are included in the event that any present a mineable portion within the SST. The competitive lease application submitted by BRL identified an area of approximately 1789.2 acres and will be accepted as the tract for reasons described above. The coal estate in the entire SST is managed by BLM.

IV. Geologic Data.

Stratigraphy. The sediments underlying the tract are of Cretaceous and Tertiary age and are described in descending order:

The Ruby (Wasatch) formation overlies the Mesa Verde formation and consists of red and buff shales, red sandstones, and red to grey conglomerates. It can be 1600 ft. thick. The Mesa Verde formation contains four members. The top member is called the Barren member, can be 1500 ft. thick, and is composed predominately of buff lenticular sandstones. The Paonia member lies below the Barren member, contains two coal horizons, and ranges from 300 to 500 ft. thick. The top portion of this member is a lenticular cliff forming sandstone which can occur at slightly different stratigraphic horizons. The Bowie member is the lower coal bearing member and ranges from 270 to 350 ft. thick. It is composed predominately of grey shale and contains several coal beds in three coal horizons. The top of the member is marked by a massive buff sandstone 90 ft. thick. The Rollins sandstone member lies below the Bowie, is a massive cliff-forming buff-white sandstone 120 to 200 ft. thick, and serves as the most persistent marker horizon in the area. The Rollins clearly defines the lower limit of coal occurrences in the area. Below the Rollins Sandstone member of the Mesa Verde is the Mancos Shale formation which is approximately 4000 ft. thick. The upper portion of the formation which is exposed in the area is composed of grey marine shales and minor buff sandstones.

Coal Seam

BLM reviewed existing coal resource data in all the seams in the tract but found none were mineable except those applied for in the B-Seam with a minimal potential existing in the A-Seam. The C through F seams are either very thin, non-existent, or displaced by igneous sill.

The upper B-Seam is missing due to being intruded by an igneous sill or split into two thin unmineable seams throughout the SST. The lower B-Seam is approximately 85 feet above the Rollins Sandstone and consists of upper and lower splits which are coalesced or only minimally separated by a thin parting from the eastern side to the center of the SST. Continuing to the west the lower split of the lower B-Seam is mineable but thins to less than 7' beyond which it is considered unmineable. The average mineable thickness for the lower B-Seam is 9' on the the SST with very little ranging above or below that average. This seam is known to have mineable reserves extending beyond the southern boundary of the proposed lease tract on the existing BRL federal leases.

Structural Setting. The Paonia-Somerset coal field is located in the southeastern end of the Piceance Basin. The area is bounded by Laramide structural and physiographic features: Grand Mesa to the north, Gunnison Uplift to the south, the Elk and Elk Creek Mountains to the east, and the Gunnison River drainage and Uncompahgre Plateau to the west.

Structural Geology and Geologic Hazards. In the area of the SST, the Mesaverde Formation strikes N60W to N70W and dips about 3.5 - 5 degrees to the northeast. Landslide deposits are common throughout the area. Unstable colluviums materials exist in the drainages. Their potential effect on an underground mining operation such as the Bowie No. 2 mine is expected to be negligible.

Mining at the Bowie No. 2 mine, adjacent to the south of the SST, has encountered some rolls in the B-Seam coal bed as well as tectonic faults. Within the SST there are no projected fault zones. Rock spars are expected to be very minimal to none. Heavy inflow of methane could occur in the longwall gob and is expected during mining on the SST. Gob-Vent Bore Holes like those now used at the Bowie No. 2 mine would also be employed to eliminate the methane flows (and deal with the residual flows) during mining on the SST.

The B-Seam roof strata as well as portions of the upper coal in the seams are subject to having sandstone channel deposits (often called “washouts”) present. This is especially true for the immediate roof of the B-Seam. These sandstone channel deposits tend to set up stress differences in the strata which sometimes translate to roof failure any time after excavation of the coal. Also, roof and rib conditions would require extra ground support in conjunction with higher stresses resulting from the greater overburden.

V. Coal Data

The coal is ranked low-volatile B. BLM analyzed drill-hole data derived from five holes influencing the SST. The resulting analysis shows a product with somewhat less quality value than product currently being mined to the south. Some data taken in the vicinity of igneous sill showed less volatile matter but did not quite meet metallurgical coal standards.

This product does easily meet current contract specifications. There would be some out of seam dilution during mining and more so to the west because of the presence of bone and/or thin carbonaceous shale partings. Toward the east boundary the lower B-Seam splits into two separate horizons becoming unmineable due to these splits each being too thin to mine economically as a separate seam.

Coal quantity determinations were calculated by the BLM-UFO mining engineer in February 2013 for the SST LBA. Since coal thickness diminished to the east and west in the SST, only about 60% of the SST was considered in determining mineable tons.

The table shown on the following page indicates calculation parameters and shows the mineable thickness related to its area of influence, in-place tons, mineable tons, and recoverable tons. Total mineable acres and the breakdown of those acres by overburden ranges are also shown.

Estimated Recoverable B-Seam Tons - Spruce Stomp LBA				
Calculations made using areas of average thickness, 1830 tons per acre-ft., 75% of In-Place is mineable, 60% of Mineable is Recoverable.				
From DH data and Map		BLM Calculations		
Thickness	Acres	In-Place	Mineable	Recoverable
7' or less	709.3	5,190,000	None	-
9	1054.2	17,360,000	13,020,000	7,810,000
10.5	25.7	490,000	360,000	210,000
Totals:	1789.2	23,040,000	13,380,000	8,020,000
	1079.9	Total Mineable		
	154	> 2000 ft. OB		
	208	< 1500 ft. OB		
	717.9	1500 to 2000 ft. OB		

Narrative Description of Calculation Data & Methods First, underground longwall mining was considered the method of extraction. Then all in-place reserves that presented no coal seam greater than 7' thick was dropped from consideration. The remaining in-place tons were considered to be 75% mineable which allows for possible losses due to geologic conditions. After that the longwall recovery of 60% was applied to mineable reserves.

BLM reviewed existing coal resources in all the seams in the SST but found none were currently economically mineable except those included in the B-Seam with the possibility of minimal recovery from the A-Seam.

Estimated Recoverable Reserves As tabulated above, the estimated recoverable reserves in the delineated SST is **8.02 million tons**.

VI. Mining Considerations

Surface Facilities BRL could access the SST from their existing Bowie No. 2 mine portals on their fee property 3.1 miles SE of the delineated SST. They also have existing coal handling facilities including a train load-out which serves the Bowie No. 2 mine. That train load-out facility could also serve the SST. Mining the coal on the delineated SST could be well accomplished using the surface coal handling facilities already available for the operation of the Bowie No. 2 mine.

If the SST were not acquired by BRL it is not likely that its coal resources would be accessed by a different mining company. When viewed as a stand-alone property the SST is considered relatively small and its coal resources difficult to access therefor unattractive to coal investors other than BRL.

Mining Method & Mine Life Geologic constraints dictate that underground mining be employed to

extract the coal from the SST. For BRL, that method is restricted to the longwall method of mining due to their commitment to employ that method in all their mining ventures. BRL would use continuous miner equipment to develop mains and gate roads to provide access for longwall extraction from the coal reserves. The operation in the Bowie No. 2 mine adjacent to the SST successfully mines coal using continuous miners to develop longwall panels.

Mining Equipment The following is a list of longwall equipment projected for use by BRL and is typical for an underground longwall operation:

Typical Longwall Mining Equipment List					
Continuous Miners	3	Roof Bolters	3	Main Mine Fan	2
Shuttle Cars	9	Utility Loaders	4	Shield Haulers	2
Lube Truck	1	Utility Mantrips	6	LW Face Shields	180
Timber Truck	1	Auxiliary fans	14	Shearer	2
60" Belt Drives	2	72" Belt Drive	7	LW Pan Line	2

Employment Requirements Production from the SST could proceed with a no increase in the level of employment requirements if BRL were the successful bidder. The life of the existing coal operations would have been extended; however, which could allow for an extended period of employment for the existing office, surface, and underground employees. The projected employment level is approximately 320 employees with a low of about 290 and a high of about 340. Those levels include contractors which range in number from 10 to 50.

Figure 1.

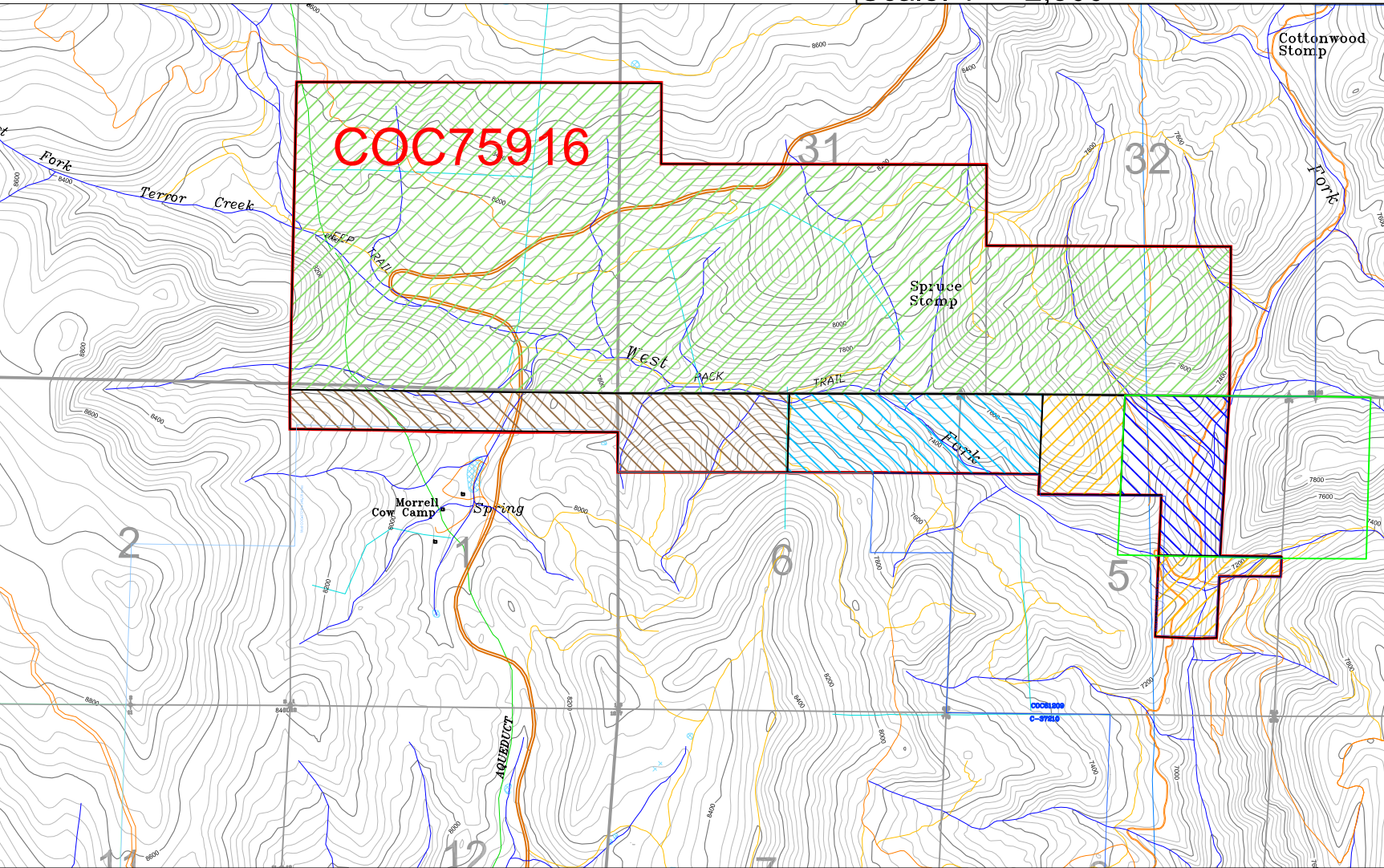


Google Earth View

Scale: 1" = 5,000'

Topo View

Scale: 1" = 2,500'



Bowie Resources, LLC - Spruce Stomp LBA - COC75916

Google Earth and Topo

Scale Shown Above

Drawing by BLM

Date: April 2013

Fig. 1 (BLM TD Report)

Legend:

Proposed Coal LBA

74.5% United States Forest Service

4.9% Bureau of Land Management

6.8% Bowie Resources LLC

8.9% Turkey Track Ranch

4.8% Brian Hughes

Topo Contours on 200' Intervals

Attachment 1. Legal Description of the Spruce Stomp Tract.

The legal description for the COC75916 lease tract as applied for by Bowie and accepted by BLM by virtue of delineation is as follows:

COC75916

Township 12 South, Range 91 West, 6th P. M

Section 31: Lots 11 through 26 inclusive

Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West, 6th P.M.

Section 36: S2

Township 13 South, Range 92 West, 6th P.M.

Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.

Section 5: lots 2, 3, 4, 10, & 11, W/2W/2NENE, NWNE, NESWNE, SESWNE, N/2NWSWNE, N/2NW,N/2N/2SENE, E/2NW/SE, W/2W/2NESE, N/2NENESE, NENWNESE;

Section 6: Lots 1 through 4 inclusive

*containing 1,789.2 acres more or less

Note: The proposed lease covers approximately 1,332.6 acres of National Forest System (NFS) land, 88.4 acres of BLM land and 368.2 acres of private surface. All of the coal mineral estate is administered by the BLM. The Spruce Stomp LBA tract will be referred to hereafter as the LBA.

Attachment 2 Bibliography

2012 Bowie Resources, LLC, Mine and Reclamation Plan.

2012 Production Verification & Inspection and Enforcement Plan, BLM-UFO.

2012 Bowie Resources, LLC, Competitive Coal Lease Application, Spruce Stomp Tract. .

2012 Bowie Resources, LLC, Proposed Action, Spruce Stomp Tract.

2012, Geologic and Engineering / Maximum Economic Recovery Report, Bowie Lease Modifications – COC61209 and COC37210, BLM-UFO.

2000 North Fork Coal Environmental Impact Statement and Record of Decision.

APPENDIX C

Lease Stipulations

Appendix C

Lease Stipulations

Stipulations Identified in the Unsuitability Criteria

Wild and Scenic River

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw [angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence], etc.) shall be used to control subsidence.
- No surface developments (i.e., MDWs or access roads) shall be allowed within the ½ mile wide river study corridor (i.e., 1/4 mile wide on each side of the West Fork of Terror Creek) on BLM lands/minerals. This stipulation will no longer apply if the eligible segment on West Fork of Terror Creek is found not suitable for inclusion in the National Wild and Scenic River System, or if suitable, if it is dropped from further consideration by Congress.

Rights-of-Way

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the right-of-way must be properly grounded. In order to avoid static or induced electrical hazards no materials may be stored in the transmission line right-of-way.
- If future longwall mining would come within 100 feet of any transmission line tower foundation, a structural review and acceptance by WAPA would be required.
- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions would be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining related surface disturbance would occur within 100 feet of the outside line of the power line right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide

for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.

- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation will be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities will be completed the fall following award of lease. Reports of this survey will be deliverable to the Forest Service by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) will be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan will detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.

Threatened and Endangered Species

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) would occur within 200 feet of greenback cutthroat trout occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer. These techniques would provide for maximum coal removal while protecting the values associated with the threatened greenback cutthroat trout habitat.
- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective BMPs, would be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.
- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee shall, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor shall contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under this BA, lessee shall submit the compiled monthly inspection reports to BLM UFO by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads shall be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure shall be placed at the barricades.

- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year – October through March.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.
- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- No surface disturbance, such as road widening or upgrading would occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the greenback cutthroat trout, unless exceptions were approved by the Authorized Officer.

- Site-specific surveys for sensitive plants would be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There would be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions were approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures would avoid overspray or drift onto desirable species or sensitive plants.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- The lessee/operator would design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator would design and implement a stream flow measurement program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on continuous measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to conduct site visits to ensure continuous flow measurements are recorded on a minimum monthly schedule, weather permitting. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and USFWS.
- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) every two years during and twice following the mining activities (at 5 and 10 years periods) prior to bond release. A report should be distributed to the BLM, USFS and USFWS documenting if statistically significant declines are observed related to mining activities. If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the

lessee/operator will work with CPW to capture and grow out fish populations from appropriate breeding stock. The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual Monitoring Report and distributed accordingly.

Bald and Golden Eagle Nest Sites

- No new permanent surface facilities or disturbance except subsidence would be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.
- No surface activities would be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles. Any proposed surface facilities, disturbance, or activities (as noted above) in or adjacent to these buffer zones would require approval from the surface management agency on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Bald and Golden Eagle Roost Sites

- No surface activity, except subsidence, would occur within a one-quarter mile radius of winter roosts between November 15 and March 15. Development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity would be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Peregrine Falcon Nest

- No new permanent surface facilities or disturbance would be located within a one-quarter mile radius buffer zone around each peregrine falcon nest site.
- No aboveground activities would be allowed within a one-half mile radius buffer zone around each active peregrine falcon nest site from February 1 to July 15.
- Any proposed surface facilities, disturbance, or activities in, or adjacent to, these buffer zones would require approval from the USFS or BLM on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Migratory Birds

- For any future proposed disturbances on the lease, a qualified biologist would conduct pre-construction breeding bird and raptor surveys during the breeding period within 0.5 mile of the general disturbance area (drill pads and access roads) if activities would occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys would document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to and approved by the USFS or BLM Biologist, activities may begin within the cleared areas. If active

nests are found, development timing would be restricted during the breeding season, as per the USFS or BLM authorized officer.

- Where practicable, surface disturbing activities should not occur during the migratory bird nesting period (May 15 through August 1) to prevent potential take of migratory birds and/or eggs, unless vegetation is removed prior to May 15. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM would be required. If active nests were identified during mine permit related project disturbances, appropriate measures would be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations, and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM.
- All unavoidable surface disturbances would require approval of the USFS or BLM Authorized Officer. The USFS or BLM would coordinate with USFWS to determine the type and extent of allowable variances. A site-specific examination would determine if this stipulation would apply.

State Priority Species

- Facility construction and major scheduled maintenance shall not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times would require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles shall be permitted, but no snow plowing may occur.
- Bear-proof containers would be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training would include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation would be utilized on the individual MDW pumps to reduce impacts from their operation.

**NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM
UNDER JURISDICTION OF
DEPARTMENT OF AGRICULTURE**

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by a permit/operation plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Foreset Supervisor, Grand Mesa-Uncompahgre-Gunnison NF
2250 Hwy 50, Delta, Colorado 81416
970-874-6600

who is the authorized representative of the Secretary of Agriculture.

NOTICE

CULTURAL AND PALEONTOLOGICAL RESOURCES - The FS is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the BLM/FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:
2. Engage the services of a cultural resource specialist acceptable to the BLM/FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/FS for review and approval at the time a surface disturbing plan of operation is submitted.
3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing, salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

ENDANGERED OR THREATENED SPECIES - The FS is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine

effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the FS that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the FS. An acceptable report must be provided to the FS identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

Stipulations Identified Through Resource Evaluations

Air Quality and Climate

- Fugitive emissions from all vehicles traveling on regularly-used non-paved surfaces during all project phases shall be controlled utilizing a variety of suppression techniques applied to the non-paved roads.
- Storage piles shall be watered or covered as necessary to limit wind erosion potential and reduce fugitive emissions.

Geology and Minerals

- No surface occupancy would be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the lessee, at their expense will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, stock pond, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, livestock and wildlife use, or other land uses as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.
- The operator/lessee would be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee would be required to establish or amend a monitoring program to be used

as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program shall provide the procedures and methodologies to adequately assess interrelationships between geology, topography, hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program shall incorporate baseline data so as to provide a continuing record over time.

Vegetation - Invasive Plant Species

- An inventory shall be completed for noxious weeds within the LBA tract before construction begins in order to determine whether there is a need for pre-treatments (with results of the inventory shared with the USFS and BLM weed specialist).

Access and Transportation

- No mining related disturbance would occur within 100 feet of the outside line of the right-of-way of Stevens Gulch Road. The angle of draw used to protect the road from subsidence would be dictated by the approved Colorado DMG Mining and Reclamation Plan (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining-related disturbance may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of the public road would be protected.
- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation shall be performed at the lessee's expense.
 - Baseline condition surveys of existing facilities shall be completed the fall following award of lease. Reports of this survey shall be deliverable to the Forest Service by December 1 of that same year.
 - A Surface Facility Monitoring and Mitigation Plan (Plan) shall be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan shall detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.
- The lessee/operator shall schedule mining activities such that active subsidence of roads occurs during dormant winter months, unless no other practicable alternative exists.

Range Management

- Any construction/operation impacts man-made barriers to livestock movement shall be mitigated by replacing fences, gates, cattle guards, and gates to at least the same condition as they were found before construction, and installation of new fences where needed.

APPENDIX D

Example Calculations

Example Calculations

1.) Horsepower-hour Calculations for Underground Mobile Sources

Known Parameters:

- | | |
|--|------------------------------|
| 1.) Bowie annual diesel fuel use 461,000 (270,000 Under, 191,000 Surf) gal | *source: Bowie Resources |
| 2.) The average density of the diesel fuel is 7.11 lb/gal | *source: LSD MSDS |
| 3.) The LHV based energy density of the diesel fuel is 18,500 btu/gal | *source: Ave. of literature |
| 4.) Conversion: btu/hp-hr = 2,544.43 | *source: Common conversion |
| 5.) CO ₂ EF = 642.323 g CO ₂ /hp-hr | *source: EPA Nonroad (2008a) |
| 6.) Carbon content of diesel fuel = 2,778 g C/gal | *source: 40 CFR 600.113 |
| 7.) CO ₂ : C Molecular Weight Ratio = 44/12 = 3.667 (unit less) | *source: Periodic Table |

Calculate Parameters (Underground Equipment Example):

- | | | |
|---|---|---------------------|
| 1.) Total Available Energy of fuel =
270,000 gal x 7.1 lb/gal x 18,500 btu/lb | = | 35,464.5 MMbtu |
| 2.) Energy Converter to HP (Energy IN) =
35,464,500,000 btu / 2544.43 btu/hp-hr | = | 13,938,092.23 hp-hr |
| 3.) Convert CO ₂ EF of Diesel Fuel to C EF =
642.323 g CO ₂ /hp-hr x 3.667 ⁻¹ | = | 175.179 g C/hp-hr |
| 4.) Derived hp-hr/gal of fuel from known Carbon Content of fuel =
2,778 g C/gal / 175.179 g C/hp-hr | = | 15.858 hp-hr/gal |
| 5.) Derived hp-hr from fuel use (Energy Out) =
15.858 hp-hr/gal x 270,000 gal | = | 4,281,660.0 hp-hr |
| 6.) TE = Energy Out / Energy IN x 100% =
4,281,660.0 hp-hr / 13,938,092.23 hp-hr x 100% | = | 30.72% |

Conclusions:

The Thermal Efficiency of the underground equipment is approximately 30.72% based on the EPA Model data for CO₂. Although low for typical diesel engines based on the literature, it is realistic for working engines where hp is developed at various RMPs (based on loading and work cycles). Further the EPA Model takes this into account when developing the EFs (see Nonroad Technical Document NR009d "Exhaust and Crankcase Emission factors for Nonroad Engine Modeling – Compression-Ignition"). All emissions estimates are based on the EPA Nonroad Model emissions factors and the total hp-hrs derived in calculated parameter 5 for each equipment class, i.e. underground or surface.

2.) Example Emissions Calculations for Diesel Mobile Sources

General Equation for all Emissions:

$$\text{Emissions (tons)} = \text{Total hp-hr (Energy Out)}^1 \times \text{NR EF}_E \text{ g/hp-hr} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton}$$

Where:

EF_E = Either the Underground or Surface Equipment Emissions Factor

¹ For N₂O, substitute (Energy In). EF based on fuel use only.

A.) For N₂O (surface)

$$3,028,878.0 \text{ hp-hr} \times 0.005 \text{ g/hp-hr} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton} = 0.016 \text{ tons}$$

B.) NO_x (underground)

$$4,281,660.0 \text{ hp-hr} \times 10.163 \text{ g/hp-hr} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton} = 47.97 \text{ tons}$$

3.) Example Emissions Calculations for Gasoline Mobile Sources

Known Parameters:

- 1.) OMLLC annual unleaded fuel use 11,000 gal *source: Bowie Resources
- 2.) 2004 CAFE for LDGT = 20.7 miles per gallon (mpg) *source: NHTSA (2004)
- 3.) Emissions Factors (grams per vehicle mile traveled (g/VMT) are from 2003 IERA Mobile Source Emissions Tables 4.5, 4.6, 4.7, & 4.50
- 4.) Gasoline carbon content per gallon = 2,421 g C/gal *source: EPA 420-F-05-001, 2005
- 5.) CO₂ : C Molecular Weight Ratio = 44/12 = 3.667 (unit less) *source: Periodic Table

Calculate Parameters:

- 1.) Total Vehicle Miles Traveled (theoretical) =
 $11,000 \text{ gal} \times 20.7 \text{ mpg} = 227,700 \text{ miles}$
- 2.) CO₂ Emissions Factor =
 $11,000 \text{ gal} \times 2,421 \text{ g C/gal} \times 3.667 \times 348,257^{-1} \text{ miles} = 280.41 \text{ g/VMT}$

General Equation for all Emissions:

$$\text{Emissions (tons)} = \text{Total Annual Fuel Use (gal)} \times \text{CAFE (mi/gal)} \times \text{EF g/mi} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton}$$

A.) CO

$$11,000 \text{ gal} \times 20.7 \text{ mi/gal} \times 2.9 \text{ g/mi} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton} = 0.73 \text{ tons}$$

B.) CO₂

$$11,000 \text{ gal} \times 20.7 \text{ mi/gal} \times 428.84 \text{ g/mi} \times 453.6^{-1} \text{ g/lb} \times 2000^{-1} \text{ lb/ton} = 107.64 \text{ tons}$$

Table D-1
EPA Nonroad Emissions Factors (g/hp-hr)

Equipment Type	SCC	PM	PM ₁₀	PM _{2.5}	NMOG ²	CO	NO _x	SO ₂	CO ₂	CH ₄ ³	N ₂ O ⁴
Underground Mining Equipment	2270009000	1.446	1.446	1.403	2.216	8.555	10.163	0.138	642.323	0.034	0.005
Surface Mining Equipment ¹	2270002036 2270002051 2270002060 2270002069 2270002033	0.535	0.535	0.519	0.652	3.458	7.393	0.116	537.869	0.010	0.005
Passenger Vehicles ⁵	LDGT	0.13	0.13	0.12	0.20	2.90	0.30	0.096	428.84	ND	ND
¹ Emissions factors from listed SCC equipment was averaged together to produce a composite emissions factor to represent likely equipment present at the facility. The individual equipment emissions did not statistically vary significantly, with the exception of the bore/drill rigs, within the model results. However, the drilling and boring equipment is not expected to be as heavily used as the other surface equipment, and therefore a straight average of all the emissions factors was used to develop the composite factor (conservative) vs. a weighted average which would have considered area equipment population data. Data was not available for site fleet data to produce a facility specific weighted average. ² NMOG (Non-Methane Organic Gases) used to represent potentially reactive VOC species that may participate in ground level Ozone formation. NMOG is the sum of crankcase and exhaust emissions. ³ CH ₄ is represented from TOG (Total Organic Gases) – NMOG. CH ₄ is the sum of crankcase and exhaust emissions. ⁴ N ₂ O factor derived from EPA Climate Leaders GHG Inventory Protocol (EPA430-K-08-004) Direct Emissions from Mobile Combustion Sources, Appendix A, Table A-6. N ₂ O factor reported as 0.08 g/kg of fuel combusted. Factor was converted to g/hp-hr based on calculated hp-hr from total annual fuel use (Appendix XX, Example TE Calculation). ⁵ Passenger vehicle emissions factors are in grams per vehicle mile traveled (g/VMT).											

APPENDIX E

Informal Section 7 Consultation for Bowie Resources Underground Coal Mining Associated Surface Activities and Facilities (February 2012)

Informal Section 7 Consultation for Biological Assessment for Longwall Coal Mining Spruce Stomp Lease Area (June 2013)

PRELIMINARY



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES/CO:BLM/UFO/Bowie
TAILS 65413-2011-I-0102

February 21, 2012

Memorandum

To: Field Manager, Bureau of Land Management, Uncompahgre Field Office, Montrose, Colorado

From: Acting Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Informal section 7 consultation for Bowie Resources Underground Coal Mining Associated Surface Activities and Facilities

The U.S. Fish and Wildlife Service (Service) received your November 30, 2011, request for informal section 7 consultation under the Endangered Species Act. The consultation concerns the Bowie Resources (Bowie), LLC, Underground Coal Mining Associated Surface Activities and Facilities potential effects on greenback cutthroat trout (*Oncorhynchus clarkii stomias*) lineage (GBCT), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), Canada lynx (*Lynx canadensis*), wolverine (*Gulo gulo luscus*), and yellow-billed cuckoo (*Coccyzus americanus*). Beginning on June 6, 2011, we provided comments on several drafts of the BLM's Programmatic Biological Assessment (PBA) for this project. On December 12, 2011, we requested additional information to support the BLM's "may affect, not likely to adversely affect" determination for GBCT. This information was received by our office via email on February 2, 2012, and via letter on February 7, 2012, and hereby amends the PBA.

Proposed Action

The proposed action includes surface disturbance associated with underground mining based on Reasonably Foreseeable Development projections for Bowie activities. Surface disturbance would result from the installation of gob vent boreholes, drilling of exploration holes for baseline geologic data, installation of deep bedrock water monitoring wells, construction of future ventilation shafts, and construction or restoration of roads to access these facilities. Proposed activities would take place in a 19,385-acre area (action area) located in Delta County, Colorado, approximately 8 air miles north of Paonia, Colorado. The activities would occur in the watersheds of Terror Creek, Stevens Gulch, Hubbard Creek, Roatcap Creek, and one small

unnamed watershed, all of which are tributaries of the North Fork of the Gunnison River. Lands involved are managed by the Paonia Ranger District of the Grand Mesa, Uncompahgre, and Gunnison National Forest, the Uncompahgre Field Office of the BLM, and private landowners, including Bowie. Within the action area, the Federal government retains rights for all minerals on approximately 17,075 acres; the mineral rights for oil, gas and coal on 476 acres; and the mineral rights for coal on 1,522 acres. There are approximately 312 acres of private surface with private (fee) minerals. Additional details of the proposed action are provided in the PBA (BLM 2011) for this project.

BLM (2011) addresses Bowie's mining-related surface activities and facilities through December 31, 2021, with a maximum of 71.4 acres of new surface disturbance within the Terror Creek watershed over the life of the PBA. An average total of 31.5 acres of disturbance would exist at any one time, with an estimated 18.6 acres of long-term disturbance in the Terror Creek watershed. By September 30 each year, Bowie will submit an annual report that describes site-specific activities or projects covered under the umbrella of this consultation. BLM will determine whether a project falls under the umbrella of the consultation and will coordinate with the Service if there are uncertainties. Reports will contain a brief description of the project, project location, and total acres of disturbance. The BLM will provide annual reports to the Service and will track disturbance to ensure activities do not exceed the 71.4-acre threshold. If disturbance differs from that evaluated in the PBA, or if the 71.4-acre threshold would be exceeded as a result of a planned activity, BLM will reinitiate consultation with the Service. Actions that do not fall under the umbrella of the consultation and the proposed action description will require separate consultation.

Effects Determinations and Concurrence

[Note: This letter and our concurrence are based on the information provided in the PBA (BLM 2011). Your letter dated November 30, 2011, requesting informal section 7 consultation provided effects determinations and rationale different than that of the PBA.]

You determined that the proposed action would have no effect on yellow-billed cuckoo or North American wolverine. Therefore, Section 7 consultation and concurrence are not necessary for these species.

BLM (2011) estimates that .15 acre-feet of water would be depleted annually, and 1.6 acre-feet total over the ten-year period, as a result of proposed activities. The Service has determined that water depletions adversely affect the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail and their critical habitats. Small water depletions associated with the project would be addressed and reported under the Programmatic Biological Opinion (PBO) for *Water Depletions Associated with BLM Projects (Excluding Fluid Mineral Development)* (ES/GJ-6-CO-08-F-0010) within the Upper Colorado River Basin in Colorado. All other water depletions not meeting the requirements and conditions of the PBO would need to be addressed under separate section 7 consultation.

Avoidance of direct disturbance of suitable habitat would minimize project impacts on Canada lynx, and disturbance or displacement of animals would be extremely unlikely to occur.

Therefore, we concur with your determination that the proposed action may affect, but is not likely to adversely affect Canada lynx, due to discountable effects.

A suite of conservation measures designed to protect GBCT will be applied as part of the proposed action, including project setbacks from occupied streams, reclamation standards, erosion/ sediment control measures and implementation monitoring, and measures to avoid take, entrapment, and entrainment of fish during water pumping activities (Appendix A). In particular, no new surface disturbance will occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, and maintenance of roads or other existing features within this zone will be limited to the existing road prism or footprints. To clarify, we understand *surface disturbance* to be any project-related disturbance resulting in direct and pronounced alteration, damage, removal, displacement, or mortality of vegetation, soil, or substrates, or similar effects. Also, BLM has committed to ensuring that adequate and proper erosion control measures are implemented and effective, such that adverse effects do not occur to GBCT and its habitat. An *adverse effect* is an effect occurring as a direct or indirect result of the proposed action or its interrelated or interdependent actions, where the effect is not discountable, insignificant, or wholly beneficial. Based on this information, we concur with your determination that the proposed action may affect, but is not likely to adversely affect greenback cutthroat trout, due to discountable and insignificant effects.

Conclusion

This concludes section 7 consultation for the Bowie Resources (Bowie), LLC, Underground Coal Mining Associated Surface Activities and Facilities. As provided in 50 CFR §402.16, re-initiation of consultation is required if: 1) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not previously considered, 2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered, or 3) a new species is listed or critical habitat designated that may be affected by the action. In addition, the Proposed Action section of this letter provides specific requirements for reinitiation of consultation, per the programmatic terms.

Thank you for your interest in conserving threatened and endangered species. If we can be of further assistance, please contact Charlie Sharp at (970) 243-2778, extension 18.

Literature Cited

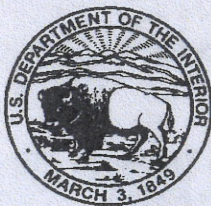
Bureau of Land Management (BLM). 2011. Biological assessment: Bowie Resources, LLC, underground coal mining associated surface activities and facilities (November draft). Prepared for the BLM Uncompahgre Field Office, Montrose, Colorado, by WestWater Engineering, Grand Junction, Colorado.

Appendix A

BLM Required Conservation Measures:

- In order to insure that BMPs relating to the control of sediment from disturbed sites are in place, and functional, Bowie will, on a monthly basis from May through August, use an independent contractor to inspect Bowie's well pad sites and access roads within the Terror Creek watershed. The independent contractor will contact Bowie and the BLM Uncompahgre Field Office (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Bowie will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with BLM. For each year that Bowie operates under this BA, Bowie shall submit the compiled monthly inspection reports to BLM Uncompahgre Field Office by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- In order to prevent increased risk of sediment being generated as a result of pumping related disturbance, pumping from East Terror Creek would not take place until after the April and May peak runoff period has past. Therefore, pumping from East Terror Creek would not begin until June. The AO may grant an exception that would allow pumping in May if runoff flows have dropped to the normal mean monthly levels for June (6.9 cfs) and USFWS has concurred via informal consultation.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the BLM Western Slope fisheries biologist, Tom Fresques (970-876-9078; tfresqu@blm.gov), for his approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), Bowie will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year; October through March.
- There will be no new surface disturbing activities within 200 feet of any occupied greenback cutthroat trout habitat, as measured from the normal high water mark.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.

- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No overstory or understory vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM Uncompahgre Field Office hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Bowie must report their annual water depletions to the BLM Uncompahgre Field Office by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- Conditions which will trigger re-initiation of consultation with the USFWS are:
 1. The types of impacts associated with the proposed actions differ from, or exceed those evaluated in this BA.
 2. In the future, species that could be impacted by Bowie's activities in the Action Area are added to the list of Threatened or Endangered species.
 3. Surface disturbance within the Terror Creek watershed exceeds 71.4 acres.
 4. Bowie submits to BLM requests for exceptions to the conservation measures of this BA.
 5. If future genetic information results in a change in GBCT's status as Threatened under the ESA, the conservation measures contained in this BA will be reviewed and updated as appropriate.
- Bowie Best Management Practices (Appendix A of BLM (2011)), including erosion/ sedimentation control measures, will be applied to project activities.



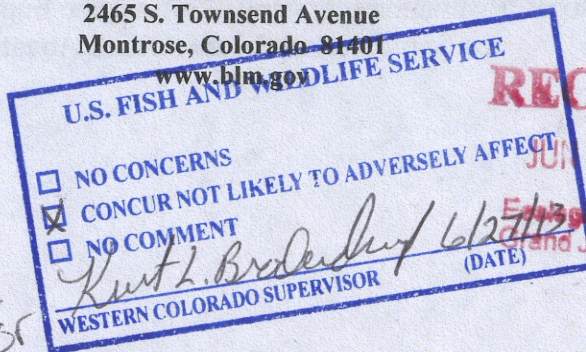
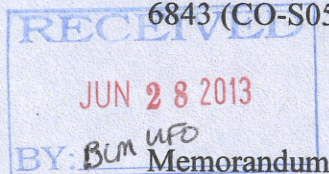
Tails 06E24100-2013-I-0151

United States Department of the Interior
BUREAU OF LAND MANAGEMENT

Uncompahgre Field Office
2465 S. Townsend Avenue
Montrose, Colorado 81401

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JUL 03 2013

Biological Services
Grand Junction, CO

To: Patty S. Gelatt, U.S. Fish and Wildlife Service

From: Barbara L. Sharrow, BLM Uncompahgre Field Office Manager

Subject: Informal Section 7 Consultation for **Biological Assessment for Longwall Coal Mining Spruce Stomp Lease Area**

Barbara L. Sharrow

Attached is a Biological Assessment (BA) submitted on behalf of the BLM Uncompahgre Field Office, USFS Grand Mesa Uncompahgre and Gunnison Forests, Office of Surface Mining Reclamation and Enforcement, and Bowie Resources, LLC (Bowie). Since each of the respective agencies retains some level of discretion in the approval process for the proposed Federal Coal Lease Application, the BLM has been designated as the lead agency to satisfy the respective Endangered Species Act (as amended) Section 7 responsibilities of the cooperating agencies. This BA assesses the effects of longwall coal mining and the anticipated subsidence in the proposed Spruce Stomp Lease by Application Area (LBA) on Greenback cutthroat trout (*Oncorhynchus clarki ssp. Stomias*) in the West Fork of Terror Creek and Canada Lynx (*Lynx Canadensis*).

The Uncompahgre Field Office has determined that Bowie's proposed underground coal mining activities in the Spruce Stomp LBA "may affect, is not likely to adversely affect" the threatened greenback cutthroat trout and threatened Canada lynx.

We request written concurrence with our determination of "may affect, but is not likely to adversely affect" for greenback cutthroat trout and Canada lynx.

Please contact Ken Holsinger, Biologist with the Uncompahgre Field Office (970-240-5389) with any questions.

Enclosure:

1. Biological Assessment for Longwall Coal Mining Spruce Stomp Lease Area

APPENDIX F

Evaluation of Potential Subsidence Impacts of Longwall Mining in the Spruce Stomp Lease Area to Aquatic Life and Water Supply

PRELIMINARY

Evaluation of Potential Subsidence Impacts of Longwall Mining in the Spruce Stomp Lease Area to Aquatic Life and Water Supply



Prepared for
Bowie Resources, LLC



Wright Water Engineers, Inc.

January 2013

121-014.000

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1	Cited Resources
2	Sediment Transport Analysis for West Fork Terror Creek
3	West Fork Terror Creek 2012 Fish Population and Macroinvertebrate Sampling Results
4	Subsidence Evaluation of the Western Mining District and the Spruce Stomp Lease Area (Richard Dunrud, P.E.)

EVALUATION OF POTENTIAL SUBSIDENCE IMPACTS OF LONGWALL MINING IN THE SPRUCE STOMP LEASE AREA TO AQUATIC LIFE AND WATER SUPPLY

1.0 REPORT PURPOSE

Wright Water Engineers, Inc. (WWE), with the assistance of C. Richard Dunrud, P.E., prepared this report to present results of an investigation of the potential impacts to aquatic life in West Fork Terror Creek resulting from vertical displacement (subsidence) associated with mining the Spruce Stomp Lease Area (see Figure 1). The results of this investigation are intended to facilitate U.S. National Forest Service (NFS) and U.S. Bureau of Land Management (BLM) decisions regarding the lease and the environmental permitting feasibility of the Potential Project. It should be noted that Bowie Resources, LLC (Bowie) currently operates the Bowie No. 2 Coal Mine which abuts the Spruce Stomp Lease Area on the south. Bowie has proposed specific lower B-seam longwall coal mining activities within the Spruce Stomp Lease Area (Potential Project). This report reviews potential subsidence impacts on West Fork Terror Creek aquatic life and water supply due to potential mining of the Spruce Stomp Lease Area. If the Spruce Stomp Lease Area is mined in another manner, the results of this report may not be applicable.

2.0 SUMMARY OF FINDINGS

The Potential Project is expected to result in a maximum subsidence of about 5.7 feet at the center, near the eastern edge, of the longwall panel with the smallest overburden thickness. This location is approximately 300 feet south of the West Fork Terror Creek channel. Based on existing topography and geologic modeling, a maximum estimated 5.1 feet of subsidence along the West Fork Terror Creek channel is expected to create no more than a 1.5 percent channel slope change. In light of the fact that the Potential Project area generally consists of steep terrain (often in excess of 25 percent slopes), the expected change in slopes is expected to be mostly, if not completely, imperceptible without the aid of survey equipment. Other subsidence related impacts, such as surface cracking or water loss are not expected to the degree that they would

negatively impact the quality of the aquatic habitat of the Potential Project area. Based on this analysis, adverse impacts to aquatic life are not expected as a result of the Potential Project.

3.0 INVESTIGATION APPROACH

The overall strategy of the investigative approach was to: (1) characterize West Fork Terror Creek in the Spruce Stomp Lease Area with emphasis on the existing physical, chemical and biological conditions; (2) predict likely subsidence effects resulting from the Potential Project using geologic modeling; and (3) consider the existing condition of West Fork Terror Creek and the likely subsidence effects to assess expected impacts to aquatic life, particularly cutthroat trout (*Oncorhynchus clarki*).

The investigation emphasized the use of existing published and readily available information including Environmental Impact Statements, Biological Assessments, Conservation Assessments, U.S. Geologic Survey information (including topography, geologic mapping and hydrology), information obtained from other coal mines in the vicinity and information provided by Bowie Resources personnel. For a complete list of reviewed materials, please see the Cited Resources in Appendix 1.

In addition to a review of existing materials, the investigation included the following data collection efforts:

- Biologic baseline monitoring activities, including:
 - Fish sampling (density, mass and genetics);
 - Benthic macroinvertebrate sampling; and
 - Physical stream habitat inventory.
- Light Detection And Ranging (LiDAR) 2' elevation contour mapping.
- Geographic Information System (GIS) mapping and spatial analysis.
- Development of West Fork Terror Creek channel profile using LiDAR elevation information.

- Evaluation of existing subsurface data of alluvium and colluvium thickness in the vicinity of the Potential Project.
- Weekly monitoring of flow and turbidity with more frequent (twice weekly) sampling for total suspended solids and total dissolved solids until peak flows were observed.
- Geologic subsidence modeling.
- Post-subsidence channel profile, cross section and habitat modeling.

4.0 BACKGROUND AND PHYSICAL SETTING

4.1 West Fork Terror Creek Watershed

4.1.1 Geographic Setting

The Spruce Stomp Lease Area is located in Delta County, Colorado, approximately six miles northeast of the Town of Paonia (see Figure 1). The Potential Project area is located to the northwest of the existing Bowie No. 2 Coal Mine, with potential mine panels to be located in areas underlying West Fork Terror Creek (see Figure 2). At the downstream end of the Potential Project area, the West Fork Terror Creek watershed consists of approximately 19 square miles of land (see Figure 3) owned by the U.S. Forest Service, the Bureau of Land Management and private owners. Downstream of the Potential Project area, West Fork Terror Creek combines with East Fork Terror Creek to form Terror Creek, which is a tributary of the North Fork of the Gunnison River (North Fork).

4.1.2 Topography and Land Use

The West Fork Terror Creek watershed ranges in elevation from approximately 7,100 feet near the confluence with East Fork Terror Creek up to nearly 11,000 feet at the headwater peaks. Overall, the terrain in the watershed is very steep, with mean watershed terrain slopes of approximately 20 percent (based on 10-meter data analyzed by USGS StreamStats).

The land in the area is primarily used for grazing cattle and subsurface coal mining. Additional uses include water supply for downgradient farms and municipalities, recreation, hunting, fishing and limited timber harvest.

4.1.3 Geology/Geologic Features

The underlying geology of the West Fork Terror Creek watershed consists of primarily sedimentary deposits of the Tertiary Wasatch Formation, Upper Cretaceous Mesaverde Formation and Quaternary deposits (U.S. Department of Agriculture, 2000). The Mesaverde Formation is the primary coal-bearing formation in this area. The Tertiary Wasatch Formation was transported and relocated following the Mesaverde Formation and consists of sandstone, shales and conglomerates. Quaternary deposits (alluvium, colluvium and landslides) consist of soil and rocks which have been deposited as a result of mass wasting processes. The West Fork Terror Creek watershed contains primarily historic geologic hazards, but during high periods of rain, landslides on steep slopes may occur (U.S. Department of Agriculture, 2000, U.S. Department of Interior, 2005). Regional and site specific surficial geologic mapping in the Potential Project area are shown on Figures 4 and 5, respectively.

Landslide activity was observed along one reach of West Fork Terror Creek within the Potential Project area during an April 2012 site visit. Signs of earth movement included trees growing at irregular angles, exposed bare earth at small head scarps, downed trees and areas with trees of a single age class. The scope and magnitude of the observed landslide activity was within the expected range for this area based on terrain, location and underlying geology.

4.1.4 Soils

Surface soils in the Potential Project area are mapped in two separate reports: *Soil Survey of Grand Mesa – West Elk Area, Parts of Delta, Garfield, Gunnison, Mesa and Montrose Counties* and *Soil Survey of Paonia Area, Parts of Delta, Gunnison, and Montrose Counties* (see Figure 6). The West Fork Terror Creek channel in the Potential Project area is covered by two mapped soil units: 158 Herm-Fughes-Kolob family complex, 25 to 40 percent slopes, and 39 Fughes loam, 25 to 65 percent slopes (see Figure 6).

Typical soil types in the area around West Fork Terror Creek include clay, loam, clay loam, stony to very stony clay and loam, and gravelly to very gravelly clay and loam. The mapped soil units generally have low to moderate erosion potentials, with K factors ranging from 0.10 to 0.28.

During 2012 site visits, exposed soils were typically observed only in the vicinity of active or recently active disturbances (e.g., landslide, roads, cattle paths). Additional bare soil was observed in locations where the West Fork Terror Creek channel is not lined with cobble or larger rocks and is downcutting into fine-grained soils. Based on observations of the area, soils are typically well vegetated with 70 – 90 percent coverage. However, when soils are exposed due to disturbance, they are prone to erosion.

4.1.5 Vegetation Communities/Ecosystems

The vegetation communities within the West Fork Terror Creek watershed are primarily influenced by elevation, aspect and water availability. At the lower extent of the watershed, upland hill slopes are largely vegetated with dense stands of Gambel oak, serviceberry, large sagebrush, and upland grasses and forbs. Quaking aspen are common throughout the watershed, but particularly on gently sloped terrain and at the outer fringe of riparian areas. Typical associated understory plants within the aspen forest stands include Wood's rose, mountain brome, American vetch and other upland and marginally hydrophytic grasses and forbs. Dominant riparian vegetation includes willow and dogwood shrubs on lower gradient stream banks and aspen or Douglas fir and Colorado blue spruce on north facing slopes. At the upper end of the watershed, conifer woodland is present on steeper slopes with aspens and meadows occupying the less steep terrain.

4.1.6 Climate

Based on data from the Western Regional Climate Center gage located in Paonia, the approximate mean annual precipitation (NCDC 1981 – 2010 Monthly Normals) near the Potential Project area is 15 inches. Dry year precipitation at this station can be approximately 33 – 40 percent lower than the average (based on 1975 and 2002 total precipitation). Average

maximum temperatures range from 90°F in July to 40°F in January with average minimum temperatures from 57°F in July to 16°F in January (NCDC 1981 – 2010 Monthly Normals). Average snowfall over the entire period of record at the gage is calculated to be over 47 inches annually. This gage is the closest official weather station to the site.

Higher elevations receive more snowfall, though, and data provided by the NRCS show that annual precipitation in the West Fork Terror Creek watershed is approximately 24 – 36 inches, based on data averaged from 1971 – 2000 (PRISM). The average annual maximum temperature ranges from 46° – 56°F with average annual minimum temperatures between 28-34°F (PRISM, 71-00 data).

4.1.7 Water Bodies (Reservoirs, Creeks, Ditches and Springs)

Significant water bodies in the West Fork Terror Creek watershed include West Fork Terror Creek, Holy Terror Reservoir, the Overland Ditch and tributaries to West Fork Terror Creek including Cunningham Creek and other unnamed “blue line” features identified on the USGS 7.5-Minute Topographic Quadrangle mapping for the area (see Figure 3).

The Overland Ditch intercepts natural surface flows from the upper third of the West Fork Terror Creek watershed when it is in priority (i.e., a downstream water right owner has not placed a “call” on the water). According to Steve Tuck, the water commissioner for the North Fork watershed, the Overland Ditch is legally able to intercept surface flow until late June or early July during most years. Additional capture and export of water from the West Fork Terror Creek watershed is achieved at the Holy Terror Reservoir, which is located near the upper extreme of the watershed. This reservoir captures water from the uppermost portions of the West Fork Terror Creek watershed and diverts it north to the Leroux Creek watershed.

4.2 West Fork Terror Creek in Vicinity of Potential Project Area

The Potential Project would expand B-seam longwall mining into the Spruce Stomp Lease Area and under approximately 2.5 miles of West Fork Terror Creek with the upstream limits of

potential subsidence located approximately 7,800 feet above sea level and the downstream limits of potential subsidence located at approximately 7,200 feet above sea level.

4.2.1 Physical Characteristics

I. Stream Flows

Available hydrologic informational data from the USGS, Bowie and others was investigated to identify typical and dry-year flows in West Fork Terror Creek in the Spruce Stomp Lease Area. Stream flows in West Fork Terror Creek are highly variable depending on season and year (refer to Figures 11 and 12 and Table 6). In addition to being influenced by climatic influences, West Fork Terror Creek flows are manipulated by transbasin diversions, and tributary wells that collect water and transport it out of the watershed (see Figure 8). Based on direct measurements made by Bowie, average daily mean flows are highest in March (19.9 cubic feet per second [cfs]) and are lowest during late summer and early fall (approximately 1 cfs in July, August and September). Based on an analysis of diversion records and USGS flow measurements, dry-year conditions can result in flow reductions in West Fork Terror Creek of 70 percent or more compared to average conditions during late summer months when flows are at or near their lowest monthly levels.

Based on communication with individuals familiar with the location, West Fork Terror Creek can have short, extreme high flow events. These events are reportedly capable of overtopping the culvert at the Terror Creek road and would not be measurable with the current staff gage at this location. It is valuable to note that in order to overtop the culvert at the Terror Creek Road, flows would be in excess of approximately 230 cfs (based on hydrologic modeling at this location). This type of flow in the West Fork Terror Creek channel would cause scouring, sediment transport and movement of large rocks and boulders, all of which would result in significant aquatic habitat disturbance.

II. Channel Profile, Slope, Sinuosity, Bed and Bank Composition, etc.

Within the Spruce Stomp Lease Area, the West Fork Terror Creek channel contains primarily boulder dominated riffles with some interspersed cobble dominated riffles and small pools (see

Figure 7). Larger pools are found upstream of logjams/beaver dams. The bottoms of these pools have accumulated fine-grained sediments. Over the Potential Project area, West Fork Terror Creek has an average channel slope of 5.5 percent (see Figure 13). Within the Potential Project area, typical average channel slopes range from a low of approximately 3 percent to 10.6 percent (based on analysis of 100 foot reaches, see Figure 13). Based on a review of LiDAR elevation information and site observations made during several 2012 site visits, there is significant irregularity in channel slope and characteristics between sections within the Spruce Stomp Lease Area.

A sediment transport analysis of West Fork Terror Creek within the Spruce Stomp Lease Area was performed (see Appendix 2). The results of this analysis indicate that the creek generates enough sheer stress under normal high flow conditions to move grain sizes which exceed the average measured grain size. Abundant boulders which armor the creek's bed and banks exceed the particle size that would be moved by normal flows.

III. Typical Channel Cross Sections

West Fork Terror Creek generally has a 5- to 15-foot wide channel bed that is flanked by steep banks that rise 1 – 3 feet above the channel bottom. In some areas, deeper pools have formed with residual depths of 1.5 to 4 feet. During a September 2012 field visit, the channel riffles typically had water depths of 0.3 – 1 foot (see photos in Appendix 3).

IV. Physical Habitat Description

Overall, West Fork Terror Creek in the vicinity of the Potential Project is diverse and provides a range of microhabitats for the types of aquatic organisms typically associated with a trout fishery. The channel includes well developed boulder dominated riffle-pool sequences with cobble substrate. Riffle features range from confined, cascading water to broad (10 – 20 feet wide) straight run channel shots. Many riffle sections have small side pools that provide refuge for smaller organisms. Pools are typically limited to 1 – 3 feet in depth and no more than approximately 20 feet in length (although typically much shorter). In addition to these features, logjam/beaver dam features create deeper pools that filter through large and small woody debris.

At the request of Bowie, WWE conducted detailed habitat surveys at five reaches within the Spruce Stomp Lease Area. These surveys were conducted using the methodology described by Winters and Gallagher (Winters, 1997) and adopted by the Pike and San Isabel National Forests. Surveyed reach lengths ranged from approximately 500 feet to 1,200 feet and included measurements of habitat and cover type, area, volume, and substrate. The results of these surveys are summarized on Figure 7 and are available upon request. The surveyed reaches had riffle habitats composing 59-85 percent of the overall channel area. Pools composed between 13-30 percent of the overall channel area. Glides were largely absent (not unexpected for a high gradient headwater creek) and composed between 0-11 percent of the overall channel area. Based on observations made during other studies of fish habitat in similarly high gradient streams, riffle-associated pocket waters may contain abundant microhabitat that is used by cutthroat trout (Young, 2008)

Willows grow densely along and within the creek's ordinary high-water mark. This growth, in combination with large cottonwoods and firs, contributes significant large and small woody debris and helps support resident heterotrophs. Further, this dense riparian vegetation provides significant habitat modification when trees fall within or across the channel and modify flow and sediment transport.

An analysis of existing creek sediment transport identified that under high flows, the structure velocity produces sufficient shear stress to move much of the sediment located within the channel (see Appendix 2). Larger boulders (> 1 meter diameter) resist movement during normal high flows and as a result, many of the observed riffle and pool areas are formed by these features.

4.2.2 Water Quality (Designated Uses, Standards and Baseline Quality)

In the Spruce Stomp Lease Area, West Fork Terror Creek is identified as Segment 4 and Segment 5 of the North Fork Basin by the Colorado Water Quality Control Commission (WQCC). Segment 4 includes those portions of West Fork Terror Creek that are within U.S. National Forest property. Segment 5 includes the reaches of West Fork Terror Creek that are downstream of the U.S. National Forest Service boundary. The WQCC has identified designated

uses for these segments which include Aquatic Life Cold (1), Recreation (Existing Primary Contact Use for Segment 4 and Potential Primary Contact Use for Segment 5), Water Supply and Agriculture. This segment is not identified as impaired or requiring monitoring and evaluation on Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List. Table 6 summarizes the water quality data at West Fork Terror Creek and the identified numeric standards for this water body.

Based on water quality and flow data provided by Bowie, West Fork Terror Creek temperatures ranged from -0.7°C to a maximum reported temperature of 26.7°C , which is well above the standard mean weekly average temperature of 17°C . Flow was not observed concurrent with the high observed water temperature, making it difficult to explain the cause of this exceedance. The mean observed water temperature, 8.2°C is in attainment of the chronic temperature standard.

The total suspended solids (TSS) maximum value of 122 milligrams per liter (mg/L), as reported by Bowie's water quality sampling reports, is low considering personal communication with Bowie personnel who report that for much of the spring, West Fork Terror Creek has high turbidity, described as similar to "chocolate milk." WWE has observed muddy spring runoff in other drainages in the North Fork River Valley. During WWE's April 2012 site visit, visibility was approximately 2 feet and the water was markedly turbid. During subsequent visits during summer and fall 2012, the creek was typically clear and lacking observable turbidity. The mean reported TSS value of 23 mg/L is consistent with clear water which could support cold-water aquatic life. Reports from the 1970s and 1980s identify West Fork Terror Creek as erosive and "milky" (West Water Engineering, 2011). It is not clear whether these accounts coincide with particular activities which were occurring during that period or if they are indicative of the ambient water quality. Generally, TSS and turbidity are positively correlated with stream flow. Relatively higher TSS and turbidity levels would be expected during spring runoff and during years with higher than average flow. Conversely, low flow years, such as 2002, will generally have relatively lower TSS and turbidity. While other provided water quality parameters do not appear to be problematic for the water's designated uses, the reviewed water quality data do not

include many of the constituents relevant to aquatic life (e.g., metals, dissolved oxygen, nutrients).

4.2.3 Biological

I. Aquatic and Riparian Vegetation

Aquatic vegetation within the West Fork Terror Creek channel is limited likely due to highly variable flows and the absence of fine-grained silt and loam soils within the channel banks. Algal mats were not observed during 2012 site visits. As is common in headwater streams, the primary source of organic carbon in the system is likely woody debris and leaf litter which falls or is washed into the stream from adjacent areas. Riparian vegetation is dense along West Fork Terror Creek through the Spruce Stomp Lease Area, with thick stands of willow shrubs flanked by spruce, fir and aspens which cumulatively provide dense canopy cover.

II. Benthic Macroinvertebrates

Miller Ecological Consultants, LLC (MEC), at the request of Bowie, conducted benthic macroinvertebrate sampling at five locations using EPA methodology and at one location using the WQCC multi metric index (MMI) methodology. The results of this work are presented in Appendix 3 and summarized in Figure 7. To summarize, West Fork Terror Creek within the Spruce Stomp Lease Area has consistently high measurements for density (1,965-5,399), Shannon-Weiner diversity (3.23-4.07), Hilsenhoff Biotic Index (3.12-4.58) and MMI (81). Please refer to Appendix 3 for detailed description of these index scores. These values indicate that existing water quality, riparian vegetation and sediment composition are supporting a robust montane stream invertebrate community.

III. Fish

Fish species reported to be present in West Fork Terror Creek include cutthroat trout (*Onchorynchus clarki*), speckled dace (*Rhinichthys osculus*) and mottled sculpin (*Cottus bairdii*) (see Appendix 3). Of these, potential impacts to cutthroat trout are expected to be of particular interest to USFS and BLM based on the genetic lineage of fish present in West Fork Terror Creek (discussed in detail in following paragraphs).

The observed presence of cutthroat trout in West Fork Terror Creek dates to at least 1978, when Colorado Division of Wildlife (CDOW) sampling efforts yielded cutthroat trout and speckled dace at two locations near the up- and downstream end of West Fork Terror Creek as it flows through the Spruce Stump Lease Area. The lower location (Station 1) sampling data lead the CDOW to estimate that there were 4.6 pounds of cutthroat trout per acre of stream. Assuming an average channel width of 20 feet, with would roughly equate to 11 pounds per mile. The upper location (Station 2) sampling data lead the CDOW to estimate that there were 0.8 pounds of cutthroat trout per acre of stream. Assuming an average channel width of 20 feet, this would roughly equate to 2 pounds per mile. The underlying cause for the difference in fish densities is not readily apparent based on available data and notes from this work. Although the watershed was not impacted by coal mining or drilling activities in 1978, impacts related to the installation of the Curecanti-Rifle powerline were present.

Following the 1978 sampling effort, more than two decades passed before the next available fish sampling efforts were conducted in 2005 by the USFS. This sampling effort examined West Fork Terror Creek and Cunningham Creek (a tributary to West Fork Terror Creek that is located upgradient from the Action Area). These sampling efforts identified 166 adult Colorado cutthroat trout per mile in West Fork Terror Creek and 245 adult Colorado cutthroat trout per mile in Cunningham Creek. These two populations were assigned genetic purity ratings of “A”, indicating low rates of hybridization with other cutthroat subspecies or rainbow trout.

The USFS conducted additional West Fork Terror Creek fish sampling in 2010. This sampling occurred following publication of genetic research that reported a genetic signature shared by the federally listed greenback cutthroat and certain cutthroat trout found in the Grand Mesa, Uncompahgre and Gunnison National Forest areas (GMUG). The GMUG cutthroat trout that shared this genetic signature with greenback cutthroat trout were identified as GB-lineage cutthroat trout. The 2010 sampling efforts resulted in estimates of 652 +/- 61 fish/mile and 267 +/- 58 adult fish/mile at a lower West Fork Terror Creek sampling location and 678 +/- 58 fish/mile and 117 +/- 21 adult fish/mile at an upper West Fork Terror Creek sampling location. In addition to fish density measurements, this study included genetic analysis to identify the

genetic lineage. This analysis identified the West Fork Terror Creek and Cunningham Creek cutthroat trout populations as GB-lineage cutthroat trout.

MEC, working under the direction of Bowie, conducted sampling at five locations along West Fork Terror Creek in 2012. This effort produced density estimates of 563 +/- 35 fish/mile and 352 +/- 35 adult fish/mile at a lower West Fork Terror Creek sampling location and 1,319 +/- 47 fish/mile and 600 +/- 14 adult fish/mile at an upper West Fork Terror Creek sampling location. MEC also sampled fish at three locations not previously sampled by the USFS. These locations had similarly high fish density measurements (see Appendix 3).

MEC also collected cutthroat trout fin clips for analysis of mtDNA sequence. Based on this analysis, the cutthroat trout population in West Fork Terror Creek has approximately 94 percent purity as GB-lineage cutthroat trout.

Concurrent with the preparation of this report, an article was published in the *Journal of Molecular Ecology* that further examines the historic genetic diversity and ranges of cutthroat trout populations in Colorado (Metcalf, 2012). This research identifies that the only existing population of greenback cutthroat trout is located in the Arkansas River watershed. Further, the fish previously assigned to the GB-lineage were found to share genetic signatures with historical fish collections from the Colorado River basin. Based on this, GB-lineage cutthroat trout, including the West Fork Terror Creek cutthroat trout population, are not members of the greenback subspecies. The USFWS indicates that they plan to reassess the Agency's position toward GB-lineage cutthroat trout populations in the Grand Mesa, Uncompahgre and Gunnison National Forest.

Based on the best available information, it appears likely that the West Fork Terror Creek cutthroat trout population is of the Colorado River variety. In 1999, the USFWS determined that the Colorado River cutthroat trout did not warrant inclusion on the listing as an endangered or threatened species. The Colorado River cutthroat trout is identified as a sensitive species requiring special management designation by the USFS and BLM. Additionally, the Colorado State Parks and Wildlife identify this subspecies as a species of special concern. As such, special conservation requirements may apply to activities that may impact the fish.

4.2.4 Groundwater–Surface Water Interactions

Three springs and one stock pond are identified in the 2000 U.S. Department of Agriculture’s Final Environmental Impact Statement. These water features are in close vicinity to the Potential Project location, to the south of West Fork Terror Creek. A 2005 USGS report on hydrology of Terror Creek identifies that a significant fraction of stream flow can be located in hypoheric system (Williams, 2005). This report also identifies that Terror Creek has measurable losses of water to groundwater (both in the report’s research and as cited from a 1983 study). The report does not identify if losses are into coal seams, geologic fractures or other unidentified formations.

4.3 Existing Anthropogenic Influences to West Fork Terror Creek

The West Fork Terror Creek watershed is under low to moderate anthropogenic influences, as evidenced by the NFS assignment of an Integrity Class II score for the watershed (Monarch and Associates, 2010). The class scores range from I to IV, with Class I indicative of high integrity and Class IV indicative of higher potential for degradation.

4.3.1 Utility Lines (Including Above- and Below-Ground Power Lines, Aqueducts and Water Ditches)

The Curecanti-Rifle 230/345 kV electric transmission line runs north/south, roughly parallel to Terror Creek on the west side of Terror Creek. The transmission line crosses West Fork Terror Creek as it continues north past the confluence. The line is owned and operated by the Western Area Power Administration and consists of steel lattice structures with buried reinforced concrete bases (U.S. Department of Agriculture, 2000). Taking into account access roads, the transmission line has a 125 foot wide right-of-way and is protected from mining impacts.

4.3.2 Roads and Railroads

In the Potential Project area, two roads cross West Fork Terror Creek. An unpaved road (41.75 Dr/FR 824) runs through the Terror Creek Winery before following the main stem of Terror Creek. This road crosses West Fork Terror Creek near the downgradient terminus of the

Potential Project. Stevens Gulch Road (40.10 DR) is an unsealed two-lane country road (U.S. Department of Agriculture, 2000) approximately 30 feet wide. The road crosses West Fork Terror Creek near the upstream end of the Potential Project area.

The North Fork Branch of the Union Pacific Railroad serves the mines in the North Fork Valley. The railroad passes through Delta, Hotchkiss, Paonia and Somerset, running alongside the North Fork and Highway 133 near Bowie No. 2 Mine. The railroad remains downgradient of the Potential Project area.

4.3.3 Mines

For over 100 years, coal mining has been a prevalent land use in the area surrounding the West Fork Terror Creek watershed area. Currently operating mines in the North Fork Valley include the Bowie No. 2 Mine, the Sanborn Creek Mine, and the West Elk Mine. Sanborn Creek and West Elk mines are located to the east of the Bowie Mine area, near Somerset, in Gunnison County.

4.3.4 Water Diversion and Storage Facilities

Flows in West Fork Terror Creek are manipulated by Overland Ditch and Holy Terror Reservoir diversions and releases. These structures result in a net loss of water from the watershed. Additional reductions of surface water are likely caused by one or more wells.

4.3.5 Agriculture (Including Farming, Ranching and Silviculture)

The West Fork Terror Creek watershed is used for cattle grazing. Upstream from the Project area, the U.S. Forest Service leases the West Terror grazing allotment to the Campbell & Sons Ranch, which has been in continuous operation since the 1880s.

Some timber harvesting has occurred in the Terror Creek watershed, affecting only a very small portion of the watershed (U.S. Department of Agriculture, 2000). Based on the terrain and vegetation present, it appears unlikely that timber harvesting would occur in the vicinity of West Fork Terror Creek in the Potential Project area.

4.3.6 Other

The BLM and the Forest Service do not have any developed recreation facilities in the area but some limited recreation such as hunting, four-wheeling and hiking occur (U.S. Department of the Interior, 2005).

5.0 POTENTIAL MINING ACTIVITIES, ANTICIPATED SUBSIDENCE AND PROJECT EFFECTS

Bowie is currently mining the upper B-seam coal in the Western Mining District area as shown on Figure 2. The current mining includes a group of seven panels located west of Terror Creek. Five of these panels are oriented in a north–south direction with two panels oriented in an east–west direction. These panels are 850 to 880 feet wide, vary in length, and have an upper B-seam overburden thickness between about 450 and 2,000 feet.

Within the Potential Project area, Bowie has already received approval for mining of four longwall panels in the lower B-seam coal generally oriented in an east–west direction to the north of their current operations and south of the West Fork Terror Creek. These panels are to be 880 feet wide with a maximum length of 5,200 feet. The lower B-seam overburden thickness in this area is about 850 to 2,150 feet. Just north of these panels are the remaining eight panels of the Potential Project (see Figure 2) which are also proposed to mine the lower B-seam coal. These proposed eight longwall panels are within the Spruce Stomp Lease Area. These proposed panels will be 880 feet wide, have lengths between 3,150 and 5,700 feet with lower B-seam overburden thickness of between 950 and 2,300 feet. Four of the eight proposed panels in the Spruce Stomp Lease Area are partly located beneath the channel of West Fork Terror Creek. The lower B-seam overburden thickness along the West Fork Terror Creek channel ranges from about 950 to 1,800 feet.

Surface activities proposed for the Potential Project area are limited; access is already provided by the Stevens Gulch Road on the west and the Terror Creek Road on the east. As a result, the primary surface effects are expected to be related to subsidence resulting from lower B-seam

longwall mining. A quantitative evaluation of this subsidence and its pre- and post-mining effects on West Fork Terror Creek are discussed in the remainder of this section.

5.1 Subsidence Evaluation of the Terror Creek Mining Area

In 2012, C. Richard Dunrud, P.E. performed a subsidence evaluation of the Terror Creek Mining Area as a means to quantitatively assess the expected limits and magnitude of the subsidence associated with the Proposed Project. This evaluation is summarized in a report entitled “*Subsidence Evaluation of the Western Mining District and Spruce Stomp Lease Area*” and is included with this report as Appendix 4. The following discussion summarizes the detailed analysis presented in Appendix 4.

From this evaluation, Mr. Dunrud found that the average draw angle (angle of influence) associated with the current upper B-seam mining is 22° from vertical as measured from the edge of the longwall panel (see Figure 4 in Appendix 4) and the maximum observed vertical displacement (subsidence) is 7.5 feet with an overburden thickness of about 860 feet. This same draw angle is expected for lower B-seam mining in the Potential Project area given to proximity and similar geology. With lower B-seam overburden thicknesses in excess of 950 feet in the Potential Project area, the projected maximum subsidence value is about 5.7 feet at a distance approximately 300 feet south of the West Fork Terror Creek channel. Along West Fork Terror Creek, the maximum subsidence is expected to be about 5.1 feet. Mr. Dunrud further concludes that there will be no reduction in surface flow in West Fork Terror Creek resulting from the subsidence in the Potential Project area. This conclusion is based on experience with similar, nearby longwall coal mines and the amount and makeup of the colluvium material underlying West Fork Terror Creek in the Potential Project area.

5.2 Characterization of Surface Impacts

Based on the magnitude of subsidence predicted by Mr. Dunrud, there will be some morphological changes to West Fork Terror Creek drainage. This will include (1) changes in the channel profile and slope angles, (2) development of potential surface fractures, and (3) potential influences on existing geologic hazards. Each of these areas is discussed below.

5.2.1 Pre- and Post- Project Channel Profile

The existing West Fork Terror Creek channel profile within the Spruce Stomp Lease Area was investigated using 2-foot LiDAR elevation information collected at the direction of Bowie. The “Post-Project” channel profile prediction was developed by applying Mr. Dunrud’s subsidence model to the existing condition (see Appendix A for model description). The Post-Project profile study was limited to subsidence model stations that were established at locations along the channel where the expected impacts of subsidence are greatest, i.e., where the channel transitions from an area with longwall panel mining to an area with barrier pillars or no mining (see Figures 14a – 14g). These are the locations where the slope of the channel are most likely affected.

Based on the review of current conditions, the West Fork Terror Creek channel currently has an approximate average slope of about 6 percent within the Potential Project area (see Figure 13). Within the Spruce Stomp Lease Area and at a resolution of 100-foot long reaches, West Fork Terror Creek has maximum slopes of 10.6 percent and minimum slopes of 3.0 percent (see Figures 13). Along profiles A-F (Figures 14a-14g), the existing channel has a maximum slope of 7.3 percent and a minimum slope of 3.0 percent.

The Post-Project channel profile indicates that the studied portions of West Fork Terror Creek would have a new maximum slope of 7.0 percent and a minimum slope of 3.5 percent between the established stations (see Figures 14a – 14g).

5.2.2 Characterization of Pre- and Post- Project Area Slopes

Existing terrain slopes in the Spruce Stomp Lease Area were characterized using USGS 10 meter (approximately 30 foot) contour information. In the vicinity of West Fork Terror Creek this characterization also used 2-foot LiDAR elevation information. Based on this analysis, terrain that is draining to West Fork Terror Creek in the Spruce Stomp Lease Area often have approximate slopes in excess of 20 percent. Based on observations made during site visits, isolated side slopes can be even steeper, approaching 1H:1V by visual observation.

Characterization of Post-Project slopes is based on the existing slope characterization in conjunction with Mr. Dunrud's subsidence model. As with the channel profile characterization, the greatest magnitude of change is expected to occur at the transitions between longwall panels and barrier pillars or unmined areas. These changes could lead to accelerated erosion rates for short periods of time until stable slopes are reestablished similar to those present in the area today.

5.2.3 Characterization of Surface Fractures

Surface subsidence fractures have been observed above mined longwall panels at several area coal mines, including, for example, the West Elk Mine, for which WWE has conducted annual to semiannual subsidence surveys for the past 17 years. Observed fractures have typically occurred on consolidated areas such as roadways, drilling pads or other disturbed and compacted areas. These subsidence fractures tend to disappear within several months as erosion and weathering fill in the areas. No such fractures have been observed to date in saturated alluvial deposits. In several cases, fractures have been observed where brittle sandstone outcrops or subcrops with little or no lateral support and where they overlie portions of longwall panels with the greatest tensile strain.

Mr. Dunrud reports an observation of cracks along Bear Creek above the U.S. Steel mine at Somerset during the summer and early fall of 1976. The subject area was located above a B-seam room-and-pillar mine where the coal extraction thickness was 10 feet and the overburden depth ranged from only 250 to 500 feet.

Irregular, en-echelon (offset) cracks as much as 1-foot wide, and 25 to 50 feet long were observed in weathered bedrock and thin colluvium (a few feet thick) on the east side of the valley 75 to 100 feet above Bear Creek. The crack depth ranged between 3 and 10 feet deep before sloughing began. Cracks 4 to 8 inches wide and 10 to 20 feet long were also mapped on the west side of Bear Creek. These cracks occurred on either side of the extraction panel, crossed the road and extended eastward upslope and westward towards the stream.

U.S. Steel personnel reported that the cracks were located on either side of the panel and also

in the stream bed. However, Mr. Dunrud observed no cracks in the stream bed on his first visit to the area about a day after the visit by U.S. Steel personnel. Mr. Dunrud did observe small, irregular cracks a fraction of an inch to an inch or two wide, 10 to 25 feet long, and a few inches to perhaps 1-foot deep, in colluvium an estimated 10 to 20 feet thick and located 15 to 30 feet above the stream. He observed no cracks in saturated alluvium underlying the Bear Creek stream. There was no observed or reported loss of flow downstream in Bear Creek from this area, and no inflows to the mine were reported from this area.

Two possibilities (or a combination of both) provide an explanation for these observations:

- 1) The alluvium stretched without rupturing when mine subsidence occurred in the stream channel.
- 2) Cracks in the alluvium healed and sealed by sloughing prior to observation by Mr. Dunrud. Healing and sealing of any cracks present in the stream alluvium is a viable alternative, because the vertical limit of cracks would only be about one-half the alluvium thickness. The alluvium would be in compression below its neutral surface (see Figure 1 in Appendix 4).

It is important to note that there was no observed or reported reduction in stream flow in Bear Creek or inflow to the mine due to the subsidence from the time of the observation in the mid-1970s to the spring of 1999.

5.2.4 Characterization of Pre- and Post-Mining Geologic Hazards

The surface geology in the West Fork Terror Creek mining area consists of primarily unconsolidated deposits of clays and silts of the Wasatch Formation intermixed with basalt boulders derived from extrusive rocks capping Grand Mesa. This material, mapped as debris flows (Dunrud 1989), is commonly stable and resistant to stream erosion and to mass-gravity movements. No movement was observed on this type of material (which is Wasatch clays and silts mixed with intrusive igneous rocks) in the West Elk mining area during a 17-year period of subsidence observations (1996 – 2012, inclusive) by Mr. Dunrud.

However, the terminal points of landslide/debris flow deposits are located on the north and south edge of the West Fork Terror Creek channel where the flow gradient begins to increase eastward (Dunrud, 1989). These deposits are visible on a detailed satellite or aerial image of the area. The northern, more extensive deposit shows no sign of recurring movement. The lower part of the southern slide, however, shows signs of renewed movement since it was initially deposited. These landslides/debris flows consist of unconsolidated basalt boulders and Wasatch clays that were remobilized during periods of very high precipitation, precipitation that was probably much higher than any recorded during the approximately hundred-year history of coal mining in the North Fork Valley. There is no indication of any recent movement.

Subsidence related to longwall mining has the potential to trigger landslides, debris flows and rockfalls in areas currently prone to wasting events. However, these events have occurred naturally in this area for a long time without adversely impacting the continued existence of wildlife and vegetation.

5.3 Reasonableness Checking—Comparison to Nearby Mines

Mr. Dunrud has over 17 years' experience monitoring subsidence above more than 25 longwall panels at the nearby West Elk Mine. During this time, Mr. Dunrud reports that cracks were not observed in the stream and impacts to stream flow were not identified. The overall magnitude and scope of subsidence impacts modeled for the Potential Project were compared to those observed for the West Elk Mine and were found to be comparable.

6.0 POTENTIAL IMPACTS TO WEST FORK TERROR CREEK'S ASSOCIATED AQUATIC LIFE

Projections for the impacts to aquatic life in West Fork Terror Creek resulting from the Potential Project's subsidence were developed using the existing habitat and biologic conditions, the sediment transport analysis (Appendix 2), and Mr. Dunrud's subsidence characterization (Appendix 4). The potential impacts are summarized in Table 7.

Section 6.1 summarizes potential impacts resulting from changes in channel profile, Sections 6.2 and 6.3 address potential changes from fracturing and geologic hazards.

6.1 Impacts Resulting from Channel Profile Changes

As described above, the channel profile changes (over limited reaches) are expected to range from 0 percent slope to 1.5 percent slope. These changes can be evaluated relatively; that is, what is the relative impact of a 0 – 1.5 percent change to channel reaches with existing slopes of 3.0 – 10.6 percent? This question is explored below.

6.1.1 Changes in Fish Habitat

Based on the magnitude of absolute channel slope change (0 – 1.5 percent) and the typical existing channel slope (3.0 – 10.6 percent), the areas with the most pronounced subsidence impacts are not expected to have sufficient alteration so as to result in an observable change in the ratio of pools:riffles. It is important to note that based on the maximum absolute slope change of 1.5 percent and the minimum existing channel slope of 3.0 percent, there are no reaches where slope change would cause impoundment (i.e., no portions of channel would have positive slopes following mining). While existing pooled areas may be expanded slightly in areas with flattened stream slope (see Section 6.1.2 immediately below), this would be countered by pooled areas that would be contracted slightly in areas with steepened slopes.

6.1.2 Changes in Stream Flow

Based on modeling by Mr. Dunrud in this location and experience at other longwall mines in the vicinity, stream flows are not expected to be altered by the Potential Project. Based on this, adverse impacts to aquatic life resulting from decreased or increased stream flow are not expected, nor will there be adverse impacts to water rights downstream.

6.1.3 Changes in Water Quality

As it pertains to channel profile changes, the primary concern with water quality would be increased suspended solids. Based on the sediment transport analysis, the magnitude of change to the creek's profile is not expected to be sufficient to elicit a significant change in sediment

mobilization, transport or deposition of West Fork Terror Creek. While minor steepening or flattening of the channel may occur and these changes will alter sheer stress, the stream is already capable of transporting much of the sediment located between larger boulders. The projected change in transported grain size is minimal. Also, following completion of the Potential Project and establishment of equilibrium, the subsidence will result in a balanced net change (steepened areas will be equal to flattened areas). Accordingly, reaches that may have slightly more suspended sediment as a result of being steepened may be balanced by reaches that would have slightly less suspended sediment as a result of being flattened.

The long-term impact to aquatic life resulting from minimal changes in water quality described above would likely be masked by existing variability in TSS and turbidity. The scope of the expected change is negligible compared to what is likely experienced by aquatic life during high spring runoff conditions. Adverse impacts to aquatic life resulting from a deterioration of water quality caused by channel profile changes are not expected.

6.1.4 Potential for New Fish Travel Barriers or Conduits

When the potential for new fish travel barriers or conduits is considered, it is important to note that West Fork Terror Creek currently has barriers consisting of culverts with plunge pools. These features create larger obstacles to fish travel than the Potential Project is expected to create (e.g., steepened reaches). Further, GB-lineage cutthroat trout are present upstream, downstream and within the Potential Project area. Based on these considerations, it is highly unlikely that the Potential Project would result in a measureable increase in fish travel barriers nor would a new travel conduit be formed that would allow fish to enter the Potential Project area where they had previously been excluded. Adverse impacts to aquatic life resulting from new fish travel barriers or conduits are not expected.

6.1.5 Potential for Impacts to Vegetation Community

Impacts to the vegetation community resulting from channel profile changes could occur if water availability along the riparian corridor is significantly altered or if slope instability occurs. Based on the magnitude of slope changes, the wetted perimeter of West Fork Terror Creek is not

expected to change noticeably following subsidence. Further, since the net change of channel slope over the Potential Project area should be zero, minimal constriction of the creek's wetted perimeter at certain locations should be balanced by minimal expansion of the creek's wetted perimeter at other locations. Based on the existing presence of steep slopes along the creek and expected magnitude of slope changes, increased slope instability is not expected to a degree that would result in impacts to the vegetation community. Adverse impacts to riparian vegetation resulting from channel profile changes are not expected.

6.2 Potential Impacts Resulting from Surface Fractures

If the Potential Project were expected to have significant fractures within bedrock at the surface, there could be a variety of impacts to aquatic life. Based on the geologic analysis performed by Mr. Dunrud, surface fractures are expected to be minimal, as follows.

- Changes in Stream Flows - Based on the analysis of Mr. Dunrud, subsidence associated with longwall mining is not expected to result in a change to stream flows. Thus, adverse impacts to aquatic life and downstream water users from this activity are not expected.
- Changes in Water Quality - Based on the amount of unconsolidated colluvium under West Fork Terror Creek within the Potential Project area, fractures in bedrock would appear to be sufficiently deep such that they would not be likely to result in altered water quality as a result of enhanced weathering. Thus, adverse impacts to aquatic life are not expected.
- Changes in Physical Habitat - Since fractures are not expected or persist within the West Fork Terror Creek channel, adverse impacts to aquatic life are not expected.

6.3 Impacts Resulting from Geologic Hazards

When assessing the potential for new or increased geologic hazards occurring and adversely impacting aquatic life, it is important to note that West Fork Terror Creek in the Potential Project area is actively and continuously undergoing change from geologic hazards. During WWE's April 2012 field visit, several areas with active or recently active landslides were identified. In addition, more localized erosion and earth movement were occurring along the channel banks.

These ongoing natural processes result in the deposition of sediment, the removal of riparian vegetation, the input of large woody debris and the movement of the channel from one side of the drainage bottom to the other. The question is, would the Potential Project intensify or introduce new geologic hazards to the point where West Fork Terror Creek would have measureable and significant changes? Based on an analysis of the subsidence model, consideration of nearby subsidence mining projects and the field observations and experience of WWE staff and Mr. Dunrud at many coal mines in the North Fork valley, it is unlikely that the Potential Project would result in new or additional geologic hazards that would adversely impact aquatic life in West Fork Terror Creek.

6.3.1 Changes in Water Quality

Changes in water quality resulting from the Potential Project's possible increase to geologic hazards are not anticipated to be significant. If changes were going to occur, they would likely be as a result of increased sediment transport into West Fork Terror Creek from new landslide activity or general land instability. Because these impacts are expected to be minimal and short lived, it is unlikely that changes in water quality resulting from new/increased geologic hazards would adversely impact aquatic life in West Fork Terror Creek.

6.3.2 Impacts Resulting from Discrete Events

Adverse impacts to aquatic life resulting from discrete events would include the deterioration of habitat from landslides. Since the Potential Project's possible increase in geologic hazards are anticipated to be significant, new and adverse impacts to aquatic life are not expected.

7.0 SUMMARY OF FINDINGS

Based on the existing physical and biological conditions and the extent and scope of impacts expected from the Potential Project, longwall coal mining in the Spruce Stomp Lease Area would not result in significant adverse impacts to water quality, water quantity or fish. This conclusion is based on the best available information and professional judgment.

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TABLES

TABLE 1
Monthly Mean Discharge 2001 – 2012
USGS 09132985 E. Fork Terror Creek below Cottonwood Stomp near Bowie, CO

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001									1.32	0.367		
2002						1.98	1.94	1.77	1.03	0.758		
2003							5.85	2.84	1.03			
2004						5.07	4.51	5.12	4.17	0.944		
2005							5.67	5.53	6.09	3.34		
2006						5.14	4.74	5.22	3.46	1.76		
2007						3.15	4.98	5.93	2.30	0.822		
2008			0.870	13.4	27.0	10.1	4.22	5.35	4.67	1.25		
2009			1.80	11.2	12.8	3.54	4.50	4.99	2.70	0.119		
2010			0.354	12.4	11.3	3.97	4.84	3.43	4.07	0.303		
2011			0.775	9.03	19.9	15.2	3.39	5.41	4.37			
2012				3.49	1.77	2.85						
Mean of monthly Discharge			0.95	9.9	15	5.7	4.5	4.6	3.2	1.1		
** No incomplete data have been used for statistical calculation.												

TABLE 2
Annual Peak Discharge 2008 – 2011
USGS 09132985 E. Fork Terror Creek below Cottonwood Stomp near Bowie, CO

Water Year	Date	Peak Streamflow (cfs)
2008	May 07, 2008	68.0
2009	Apr 21, 2009	47.0
2010	Apr 19, 2010	43.0
2011	May 08, 2011	61.0

TABLE 3
Monthly Mean Discharge 2001 – 2012
USGS 09132995 Terror Creek at Mouth near Bowie, CO

YEAR	Monthly Mean in cfs											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001							0.066	0.103	0.104	0.055	0.190	0.043
2002	0.039	0.112	1.47	15.3	1.32	0.186	0.063	0.039	0.012	0.075	0.469	0.060
2003	0.094	0.317	4.18	49.0	104.2	3.82	1.48	0.215	0.171	0.020	0.604	0.025
2004	0.039	0.300	18.3	54.6	22.7	10.4	0.252	0.191	0.582	0.783	1.45	0.754
2005	1.05	1.42	5.55	74.3	138.8	75.9	1.84	0.467	0.751	2.38	1.12	0.426
2006	0.774	1.75	3.45	58.4	30.5	2.43	0.428	0.631	0.876	9.94	4.04	1.94
2007	1.55	1.79	35.0	67.3	21.3	0.977	0.303	1.09	0.727	0.958	1.15	0.912
2008	0.965	1.27	4.26	61.7	152.9	39.2	1.58	3.51	0.253	0.210	0.290	0.285
2009	0.307	0.686	6.44	53.3	73.4	3.86	0.230	0.234	0.152	0.099	0.174	0.107
2010	0.105	0.111	0.189	74.5	57.8	7.83	0.837	1.82	0.803	0.784	0.556	1.19
2011	1.40	2.08	5.22	58.8	110.3	60.5	1.01	0.528	0.628			
2012			13.1	22.9	0.941	0.253						
Mean of Monthly Discharge	0.63	0.98	8.8	54	65	19	0.74	0.80	0.46	1.5	1.0	0.57
** No incomplete data have been used for statistical calculation.												

TABLE 4
Annual Peak Discharge 2002 – 2011
USGS 09132995 Terror Creek at Mouth near Bowie, CO

Water Year	Date	Peak Streamflow (cfs)
2002	May 06, 2002	135
2003	May 18, 2003	335
2004	Jun. 21, 2004	172
2005	May 09, 2005	425
2006	Apr. 23, 2006	113
2007	Mar 20, 2007	167
2008	May 20, 2008	476
2009	Apr 30, 2009	343
2010	Apr 21, 2010	457
2011	May 08, 2011	328

TABLE 5
Average Monthly Flows--West and East Forks

Month	West Fork Terror Creek Flow ¹ (cfs)	East Fork Terror Creek Flow ² (cfs)
January	--	1.4
February	--	1.3
March	19.9	6.3
April	16.6	13.1
May	14.1	17.4
June	4.0	6.7
July	1.0	3.5
August	1.0	3.3
September	1.1	2.2
October	1.7	1.9
November	1.9	0.6
December	1.7	0.3

Notes:

¹ Flows in West Fork Terror Creek were calculated using depth measurements made by Bowie Resources and culvert rating curve developed by WWE.

² Flows in East Fork Terror Creek measured in Parshall Flume and calculated by Bowie Resources.

TABLE 6
West Fork Terror Creek Water Quality

Water Quality Parameter	UNITS	Min	Ave	Max	Count	Numeric Standard
Ammonia (unionized) as N (Nitrogen)						Table Value Standard (TVS)
Arsenic	ug/L					0.02 (total recoverable, chronic) / (340 acute)
Bicarbonate	mg/L	10.1	77.8	153.7	17.0	None provided
Boron	mg/L					0.75
Cadmium	ug/L					0.306* (chronic) / 1.88* (acute)
Calcium (Dissolved)	mg/L	9	17	29	18	None provided
Carbonate	mg/L	2.4	2.4	2.4	1.0	None provided
Chloride	mg/L	<MDL	2	4	13	250
Chlorine	mg/L					0.011 (chronic) / 0.019 (acute)
Chromium (hexavalent)	ug/L					11
Chromium (trivalent)	ug/L					50 (total recoverable)
Conductivity (field measurement)	umhos/cm	40	127	315	147	None provided
Conductivity (laboratory measurement)	umhos/cm	68	148	240	17	None provided
Copper	ug/L					6.2* (chronic) / 11.9* (acute)
Cyanide (free)	mg/L					0.005
Dissolved Oxygen	mg/L					6.00
E. coli	CFU/100ml					126 (seg 4) / 205 (seg 5)
Hardness	mg/L	35	65	105	17	None provided
Iron	mg/L					1.00 (total recoverable, chronic) / 0.30 (dissolved, chronic standard if water supply exists)
Lead	ug/L					40.28* (acute) / 1.57* (chronic)
Magnesium (Dissolved)	mg/L	3	5	8	18	None provided
Manganese	ug/L					2,585* (acute) / 1,416* (chronic)
Mercury	ug/L					0.01 (total)
Nickel	ug/L					325* (acute) / 36* (chronic)
Nitrate as (nitrogen)	mg/L					10
Nitrite as (nitrogen)	mg/L					0.05
pH (field measurement)	su	5.8	8.2	9.4	146.0	6.5-9.0
pH (laboratory measurement)	su	6.8	7.7	8.7	16.0	6.5-9.0
Potassium	mg/L					None provided
Selenium	ug/L					18.4 (acute) / 4.6 (chronic)
Silver	ug/L					0.97* (acute) / 0.36* (chronic, trout)
Sodium Absorption Ratio (SAR)		0.20	0.44	0.85	18.00	None provided
Sodium (Dissolved)	mg/L	3	9	20	18	None provided
Sulfate	mg/L	<MDL	13	49	16	250 (only applies for actual water supply uses)
Sulfide (undissociated H2S)	mg/L					0.002
Total Dissolved Solids (TDS)--Residue Filterable	mg/L	65	110	182	18	None provided
Total Suspended Solids (TSS)--Residue NonFilterable	mg/L	<MDL	23	122	16	None provided
Temperature	Celsius	-0.7	8.9	26.7	148.0	17 (mean weekly average)
Zinc	ug/L					99* (acute) / 86* (chronic)

*Table value standard based on average hardness of 65 mg/L

Notes:




- 1) All data provided by Bowie Resources and obtained at SWO1 sampling location.
- 2) Standards are based on Water Quality Control Commission Regulation No. 35

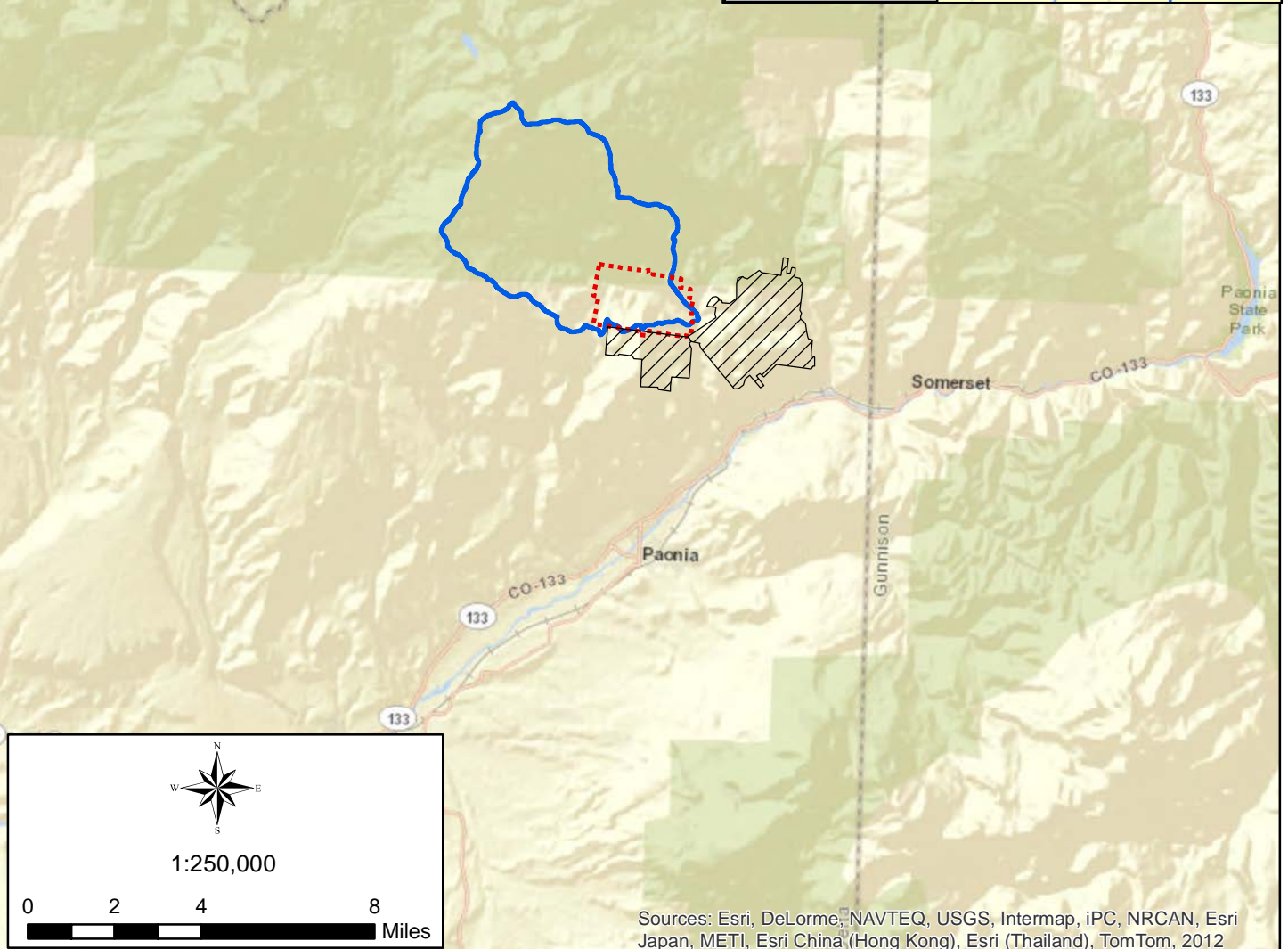
TABLE 7
Potential Aquatic Life Impacts Summary Table

Type of Surface Impact	Potential Stress to Aquatic Life	Preliminary Anticipated Outcome	Baseline Data Used To Assess Expected Impacts/Stress	Monitoring Data Needed for Early Detection of Impacts/Stress
Subsidence of areas underlain by mining panel	Change in stream structural habitat	Minor. At the panel centers the maximum expected change in stream slope is 1.5% (compared to average stream slopes of 5-10%). Subsidence transitions are expected to be gradual and may not be easily recognized without survey.	Elevation information and structural habitat observations to identify stream characteristics. Review of existing biologic data to identify current community and expected habitat requirements.	Collection of stream survey and biologic monitoring to identify if structural habitat is undergoing changes and if these changes are eliciting a shift in the biologic community.
	Changes in stream hydrology	Minor. Some areas could see minimal increased or decreased water velocity due to slight grade changes. Stormwater runoff and shallow groundwater hydrology changes are expected to be minimal.	Consideration of flow volume and velocity paired with precipitation data as well as review of hydrology characteristics of nearby creeks underlain by subsidence mining.	Monitoring of flow volume and velocity as well as precipitation. Periodic comparison of data to historic record would identify shifts in hydrologic regime.
	Increased erosion and sediment transport	Minor. Certain areas within the stream or adjacent terrain may become steeper by up to approximately 1.5% which could increase rates of erosion and sediment transport.	Elevation and survey information in the vicinity of the stream channel. Soil and outcrop mapping with erosion potential. Water quality data including TSS and turbidity. Consideration of observed impacts at a nearby stream underlain by subsidence mining.	Collection of elevation and survey information to identify areas which are becoming steeper. Periodic visits to site to identify new areas of erosion and monitor existing erosion areas. Regular water quality monitoring to include analysis of TSS and turbidity.
Fractures in bedrock at or near the surface	Increased percolation of water into subsurface material which would reduce flows, especially low flows	None to minor. Based on geologic analysis, fractures are expected to "heal" rapidly.	Geologic analysis of colluvial thickness within Potential Project to identify possible exposure of bedrock fractures to shallow groundwater. Consideration of studies from nearby streams underlain by subsidence mining.	Monitoring of surface water flows in conjunction with monitoring potential water seepage into the mine. Use data to identify if pre-mining characteristics are changing (e.g., changing from gaining to losing stream).
	Changes in water chemistry due to increased rate of weathering of previously unexposed material	None to minor. From what we know of the geology, the material that could be exposed as a result of fracturing is not likely to undergo significantly higher rates of weathering leading to dramatic water chemistry changes.	Geologic mapping to identify types of rock that could be exposed to surface water following fracturing. Existing water quality data for metals and other chemicals which are encountered during mining activities in this part of Colorado.	Ongoing water quality monitoring to identify if any chemical parameters begin to increase following the commencement of mining.

FIGURES

Legend

-  Potential Project Area
-  Existing/Previously Permitted Mine Areas
-  West Fork Terror Creek Watershed



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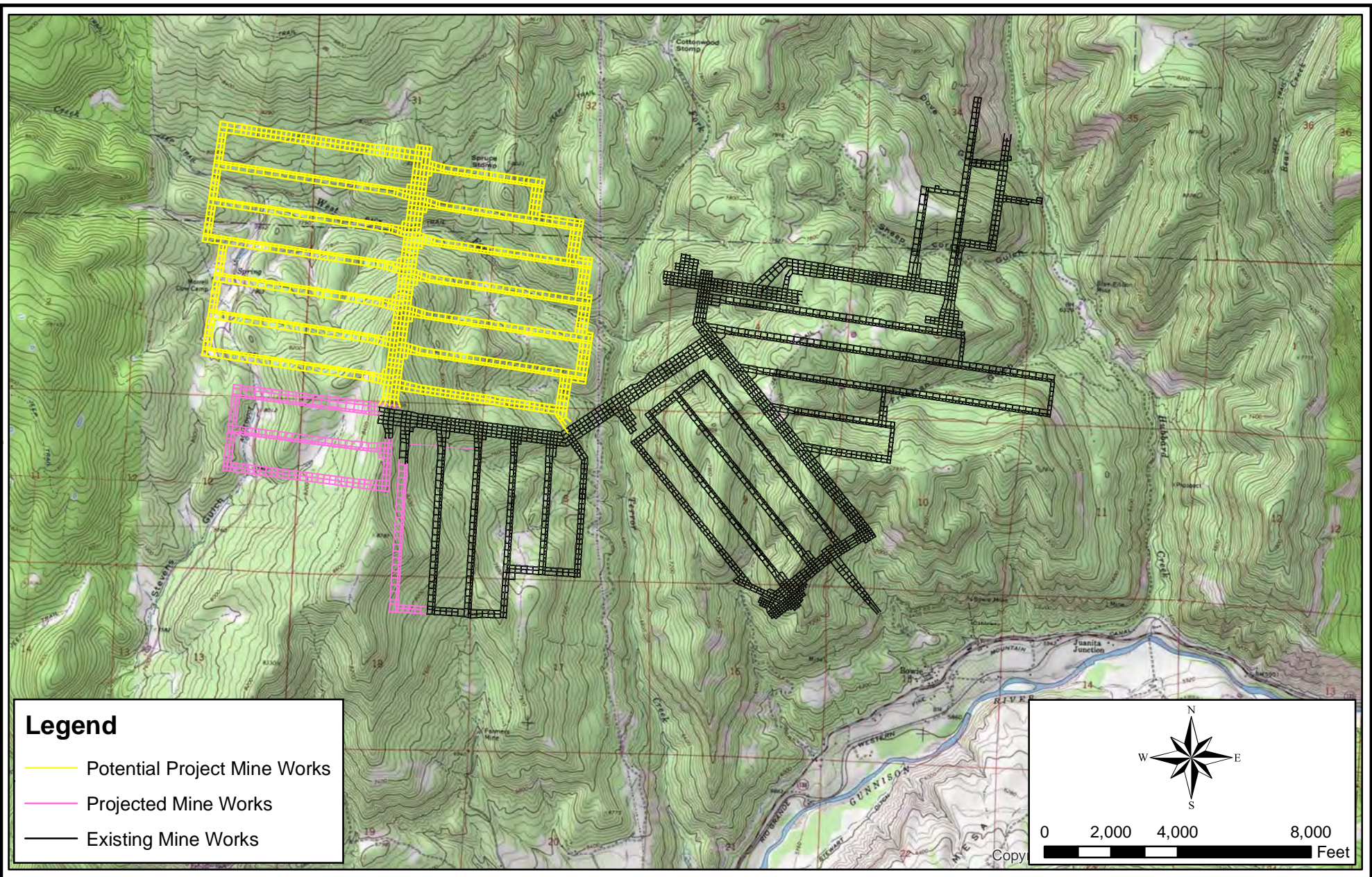
Base Map: USGS 1:24k Topographic

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DELTA COUNTY, COLORADO LOCATION MAP SPRUCE STOMP LEASE AREA POTENTIAL MINING

PROJECT NO.
 121-014.000

FIGURE
 1



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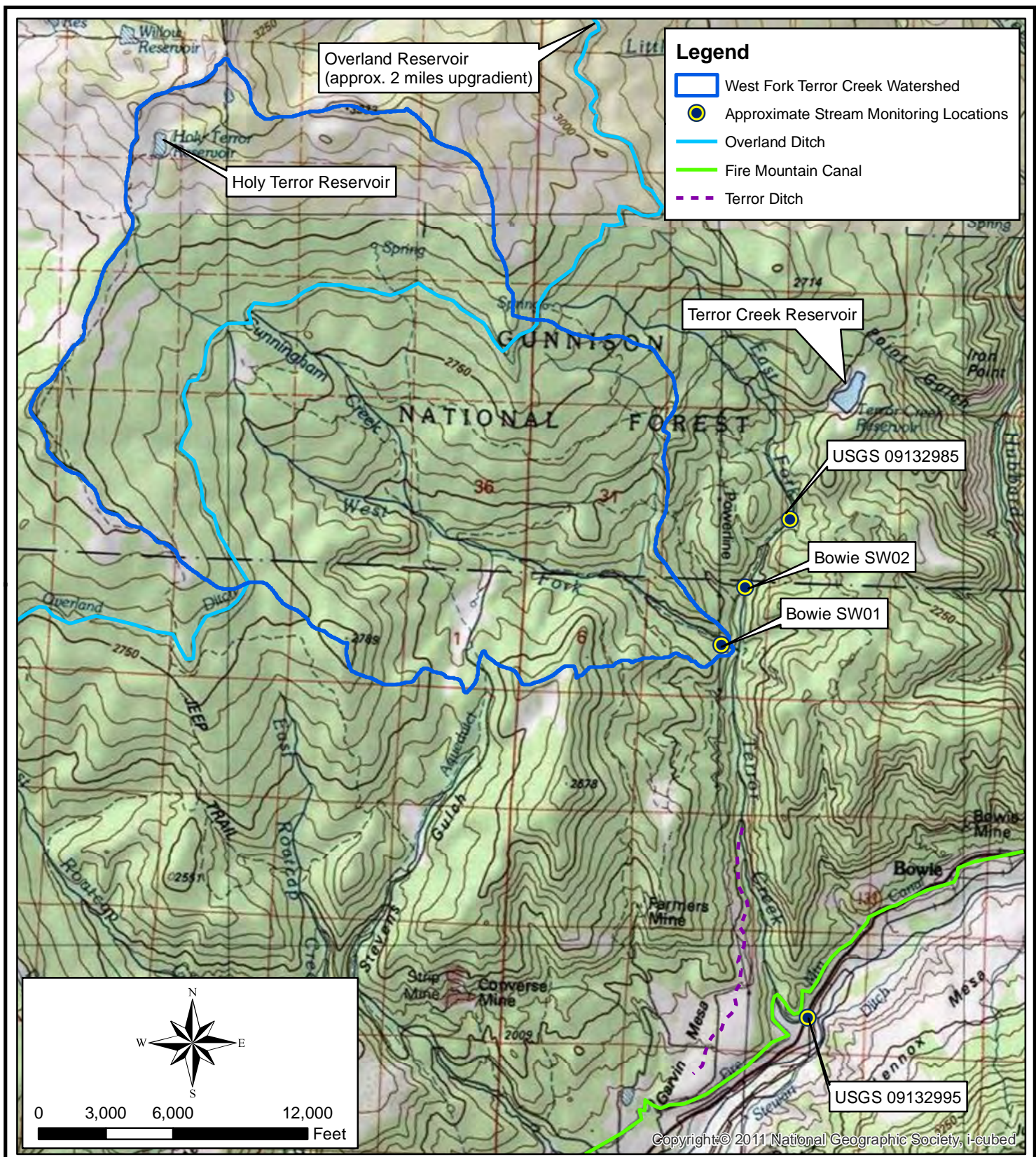
DELTA COUNTY, COLORADO

SUB-SURFACE B-SEAM MINE WORKS

POTENTIAL PROJECT IN SPRUCE STOMP LEASE AREA

PROJECT NO.
 121-014.000

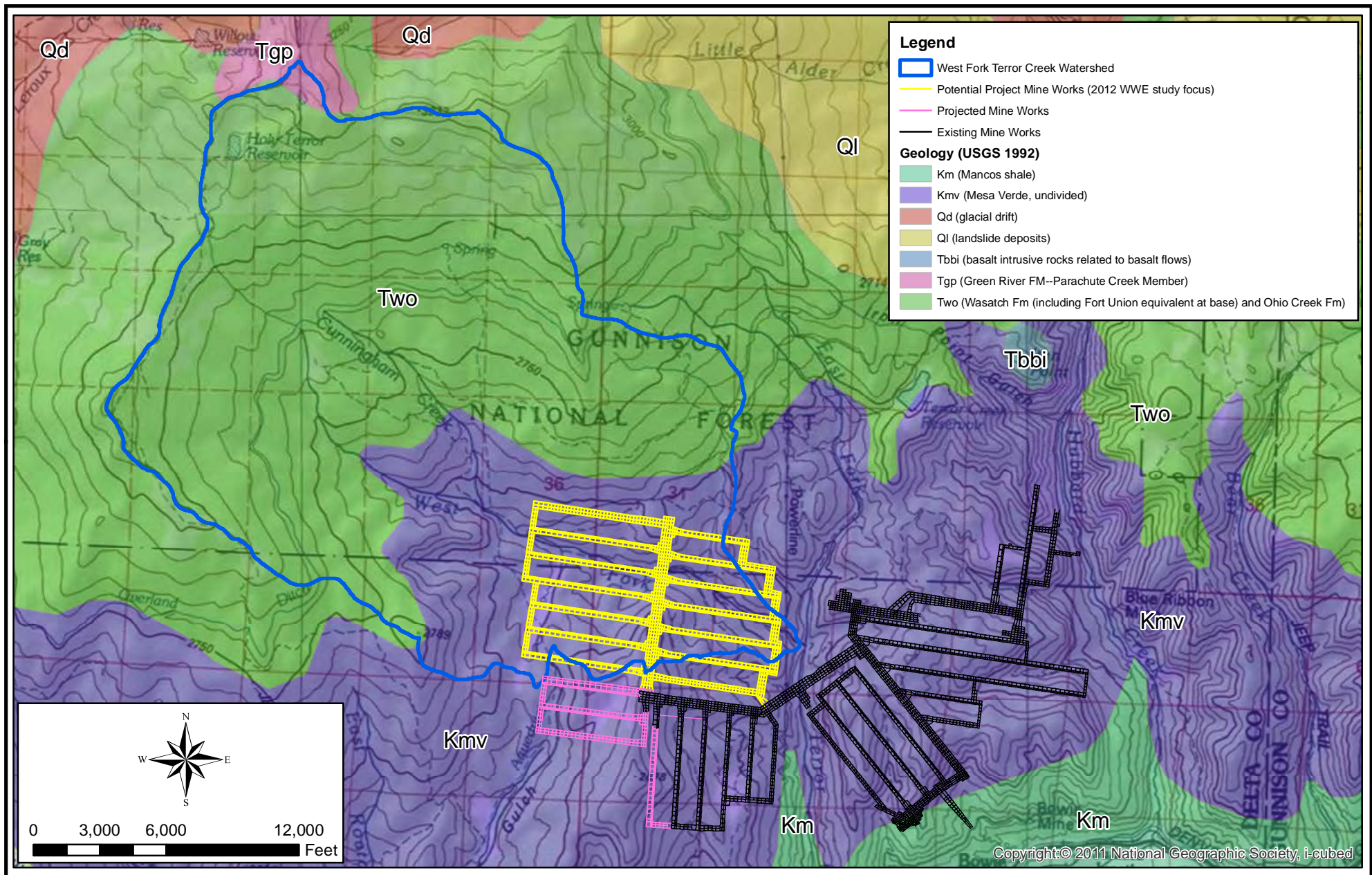
FIGURE
 2



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Base Map: USGS 1:24k Topographic

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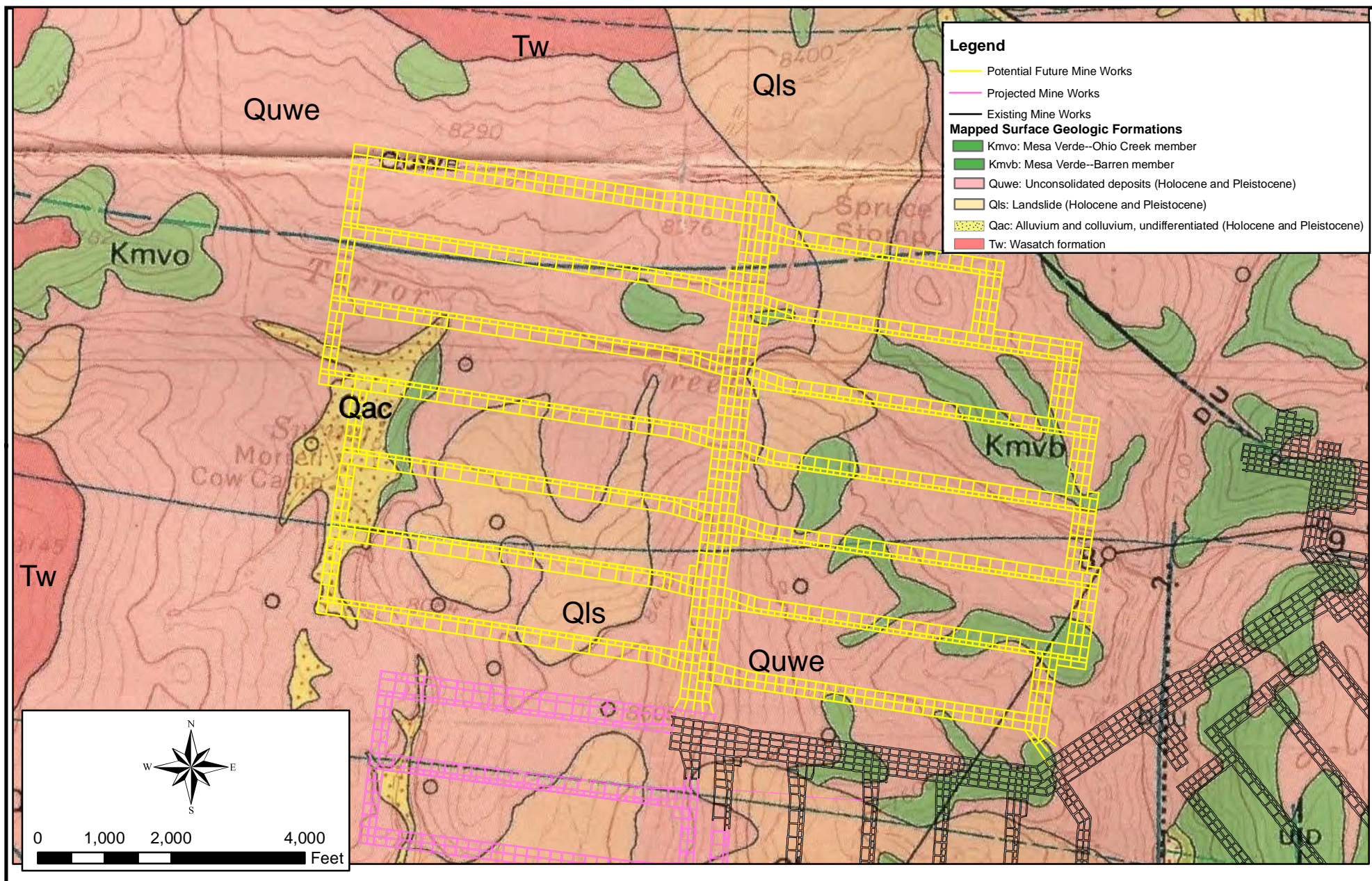
DELTA COUNTY, COLORADO

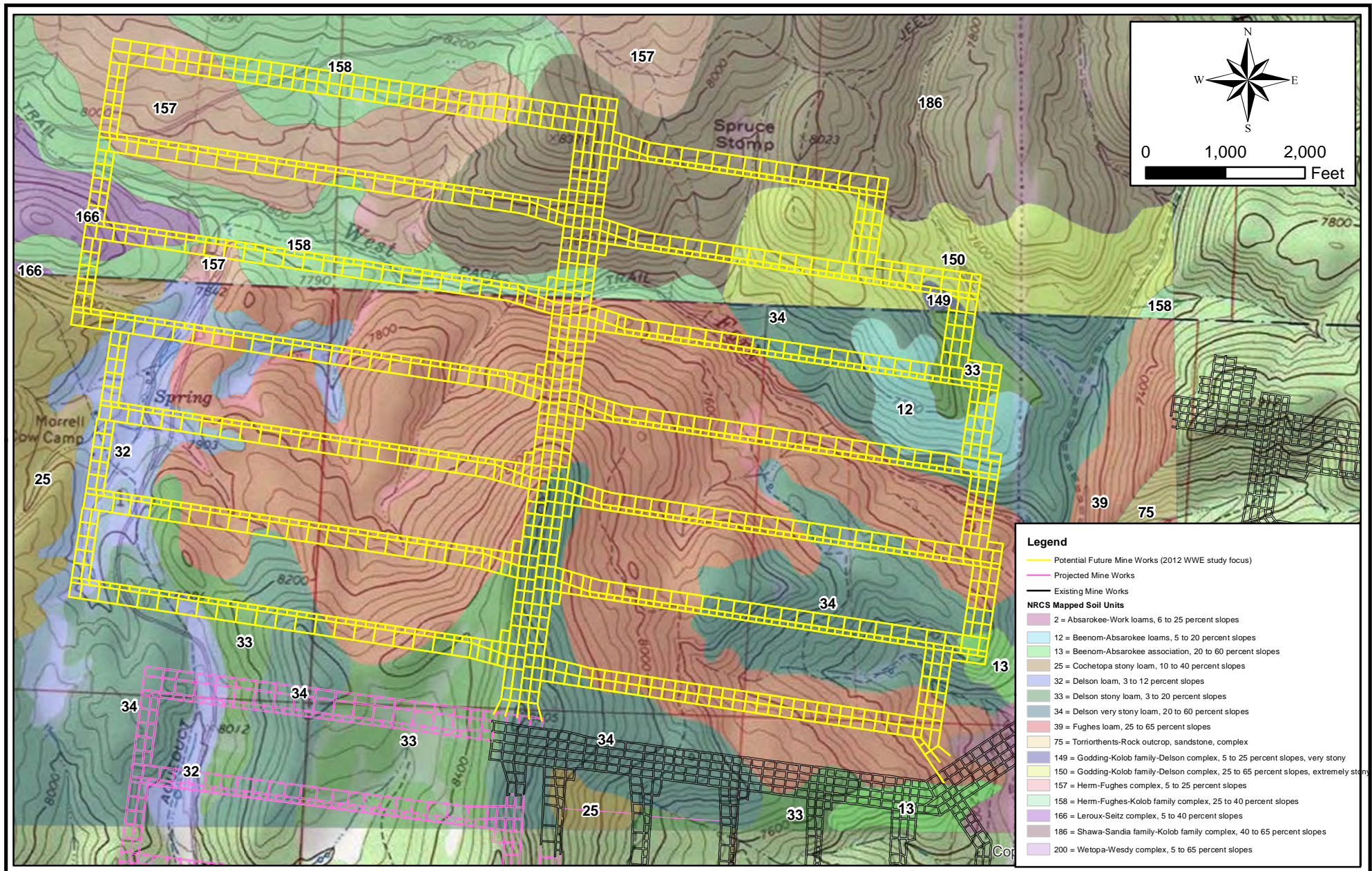
WEST FORK TERROR CREEK WATERSHED SURFACE GEOLOGIC MAPPING

POTENTIAL PROJECT IN SPRUCE STOMP LEASE AREA

PROJECT NO.
 121-014.000

FIGURE
 4





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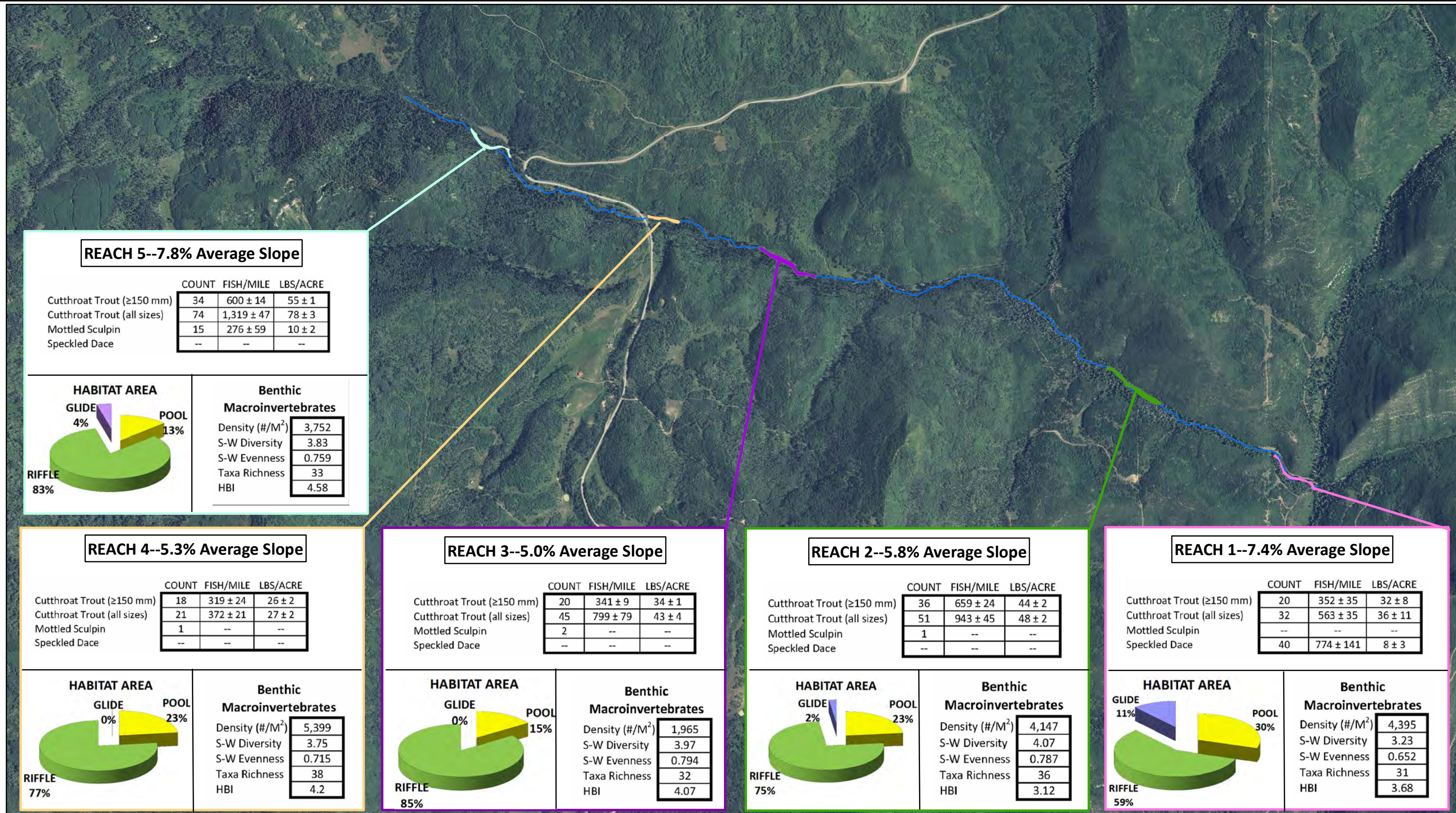
Base Map: USGS 1:24k Topographic

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DELTA COUNTY, COLORADO
NATURAL RESOURCES CONSERVATION SERVICE
MAPPED SOILS--POTENTIAL PROJECT AREA
 SPRUCE STOMP LEASE AREA

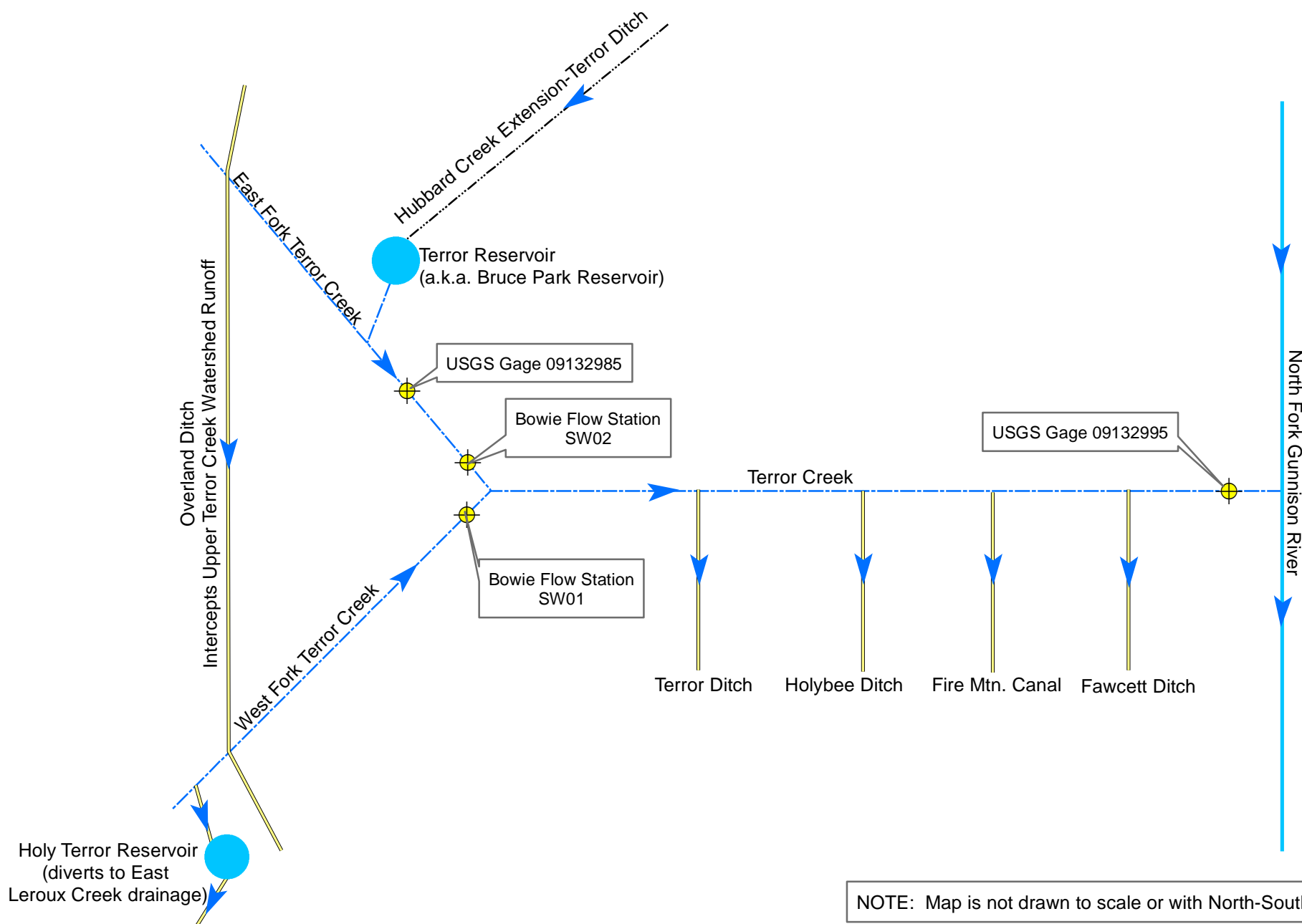
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 121-014.000

FIGURE
6



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Base Map: USDA NAIP 2009



NOTE: Map is not drawn to scale or with North-South orientation.

FIGURE 9

**Monthly Mean Discharge USGS 09132985 E. Fork Terror Creek
below Cottonwood Stomp near Bowie, CO**

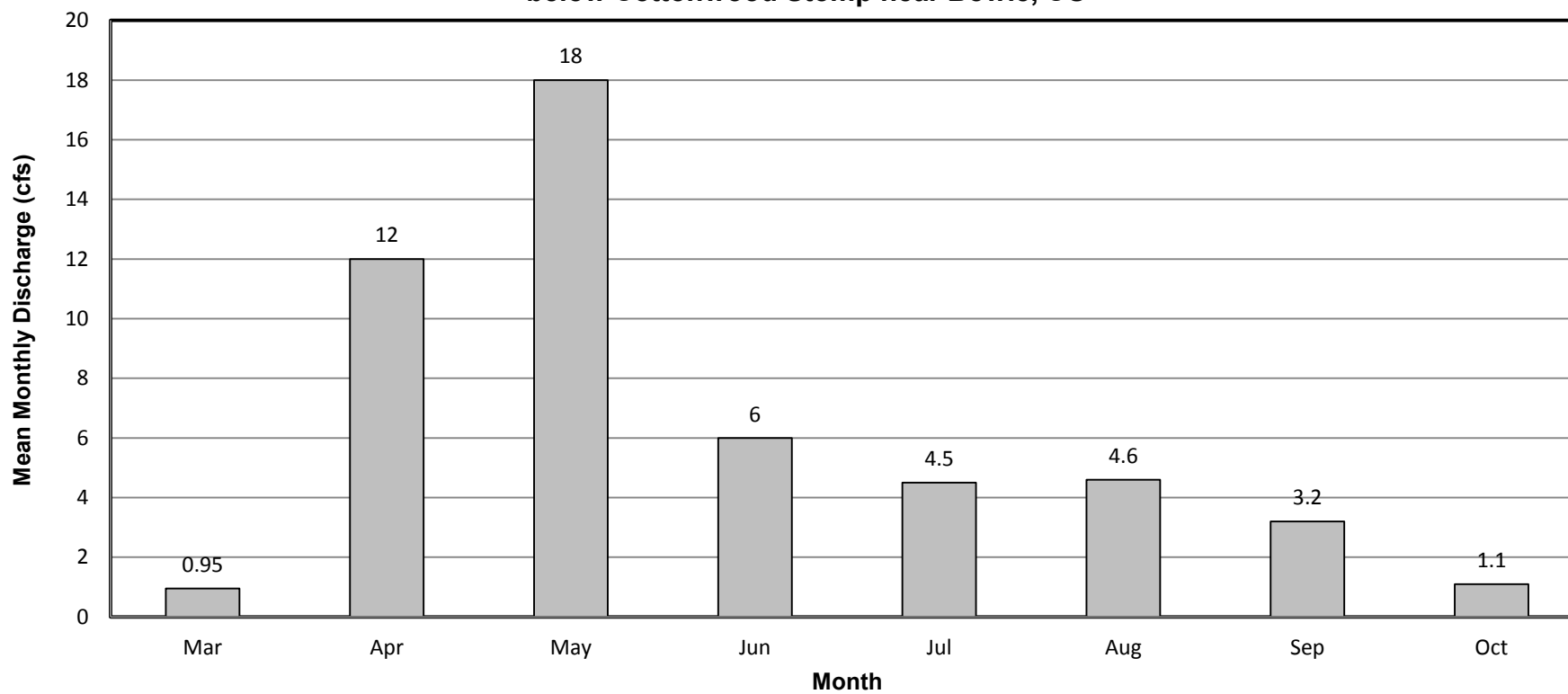


FIGURE 10
Monthly Mean Discharge USGS 09132995 Terror Creek at Mouth near Bowie, CO

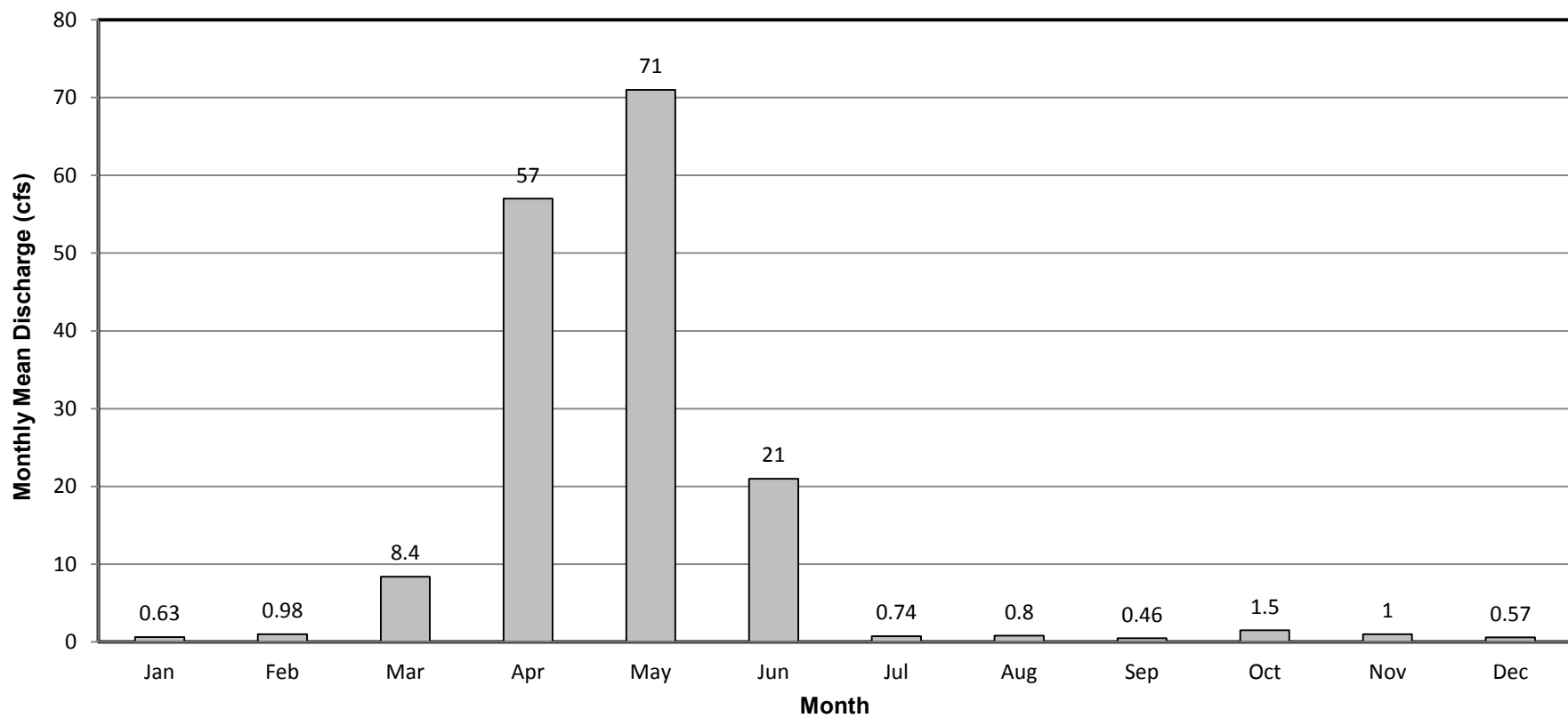


FIGURE 11
Flows in West Fork Terror Creek Near Confluence

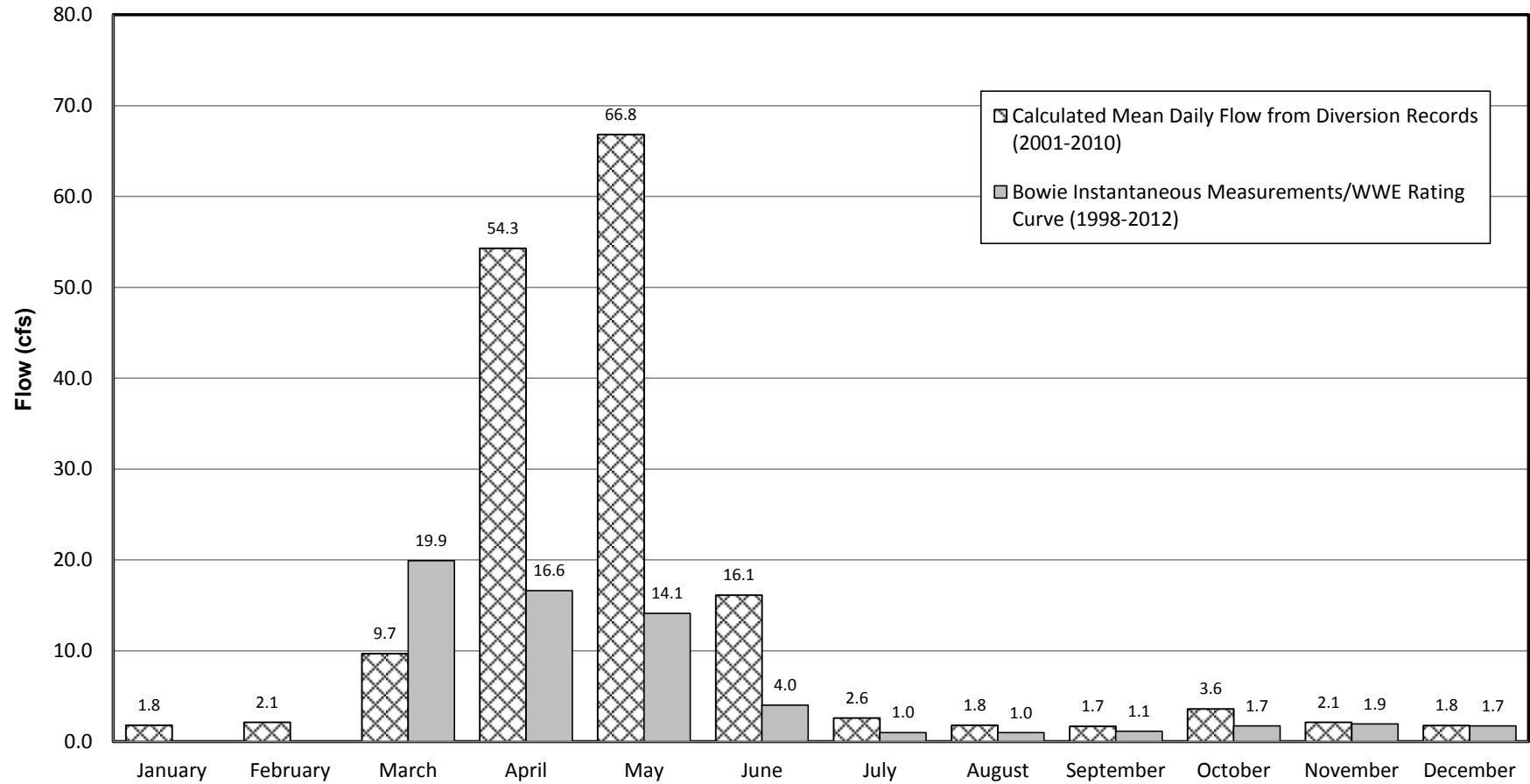
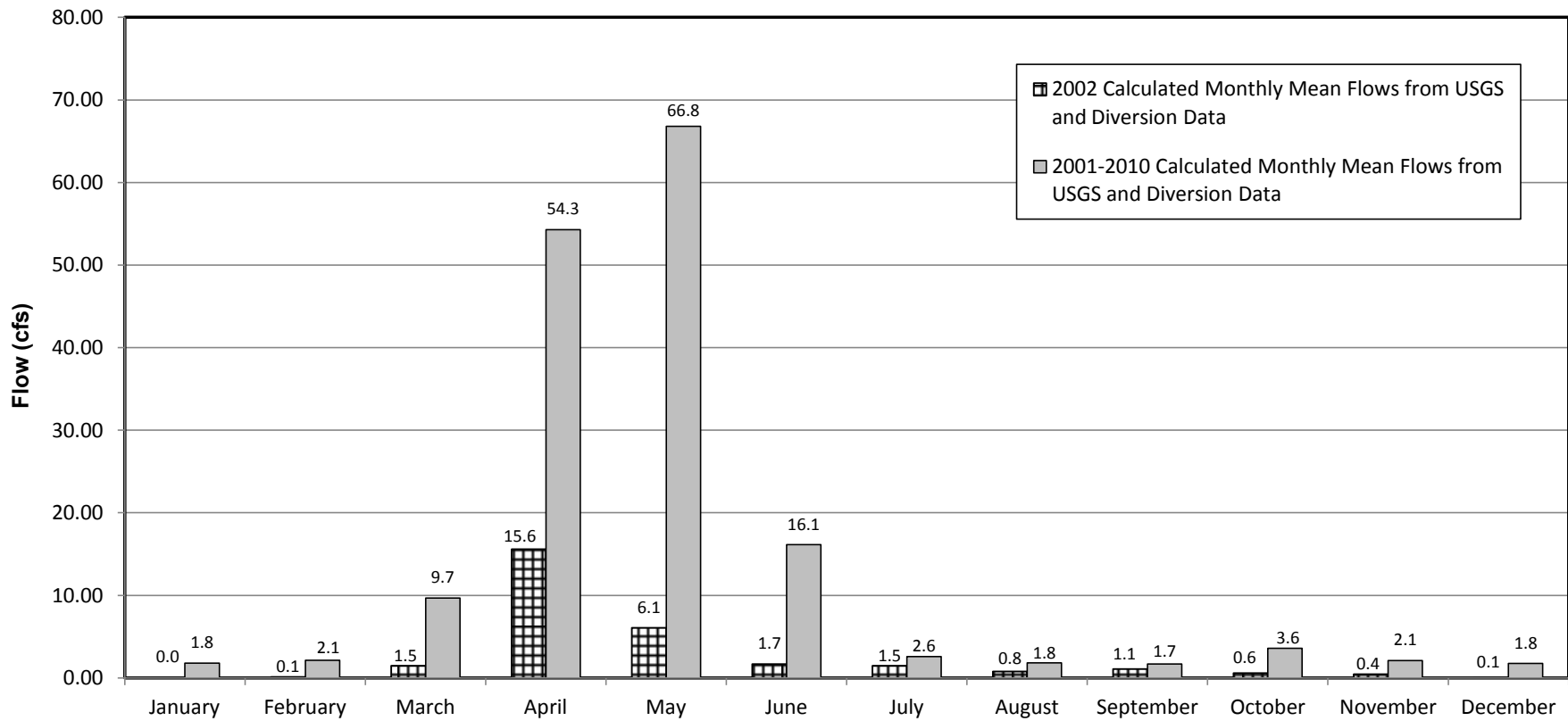
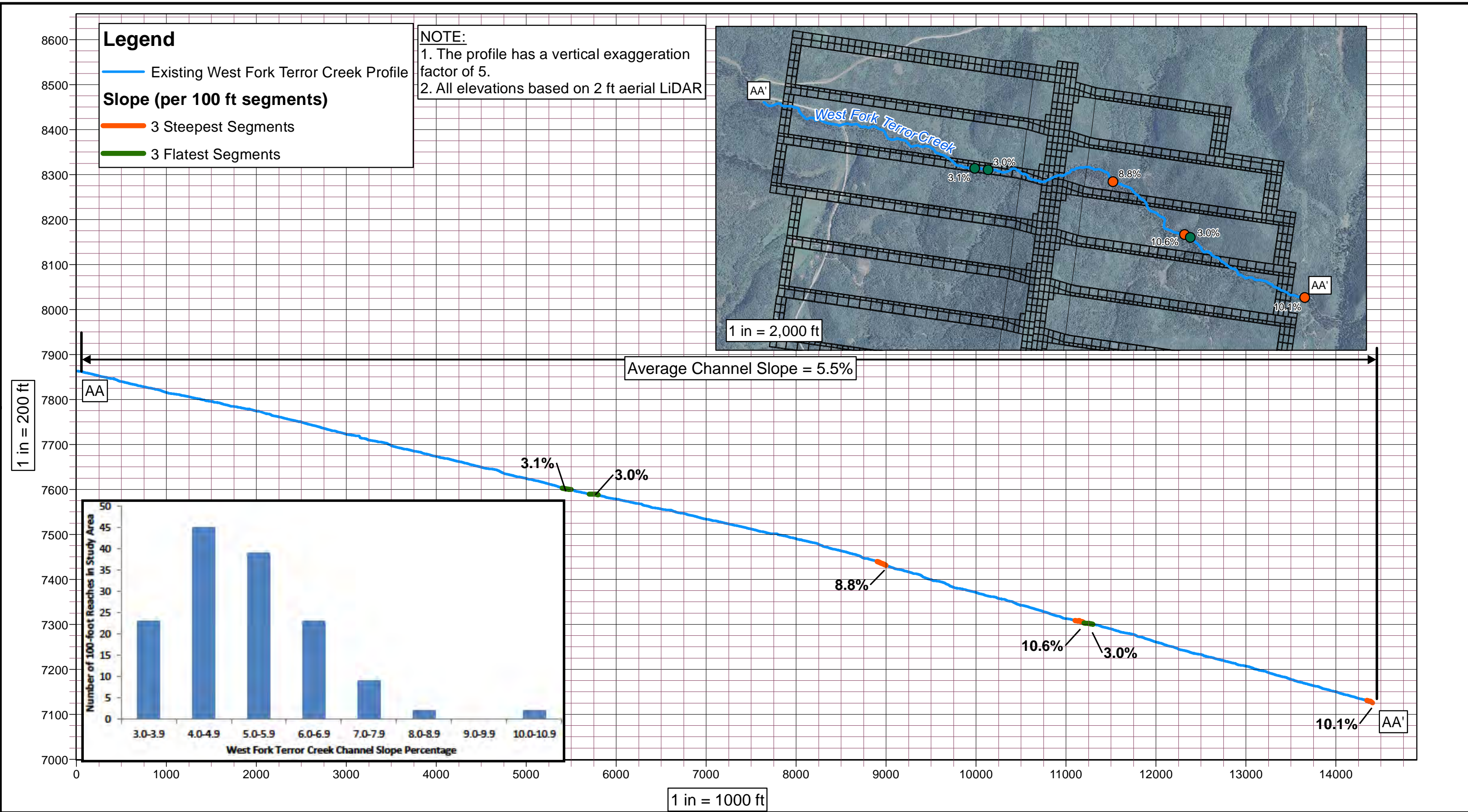


Figure 12
West Fork Terror Creek Flows - 2002 Compared to 2001-2010





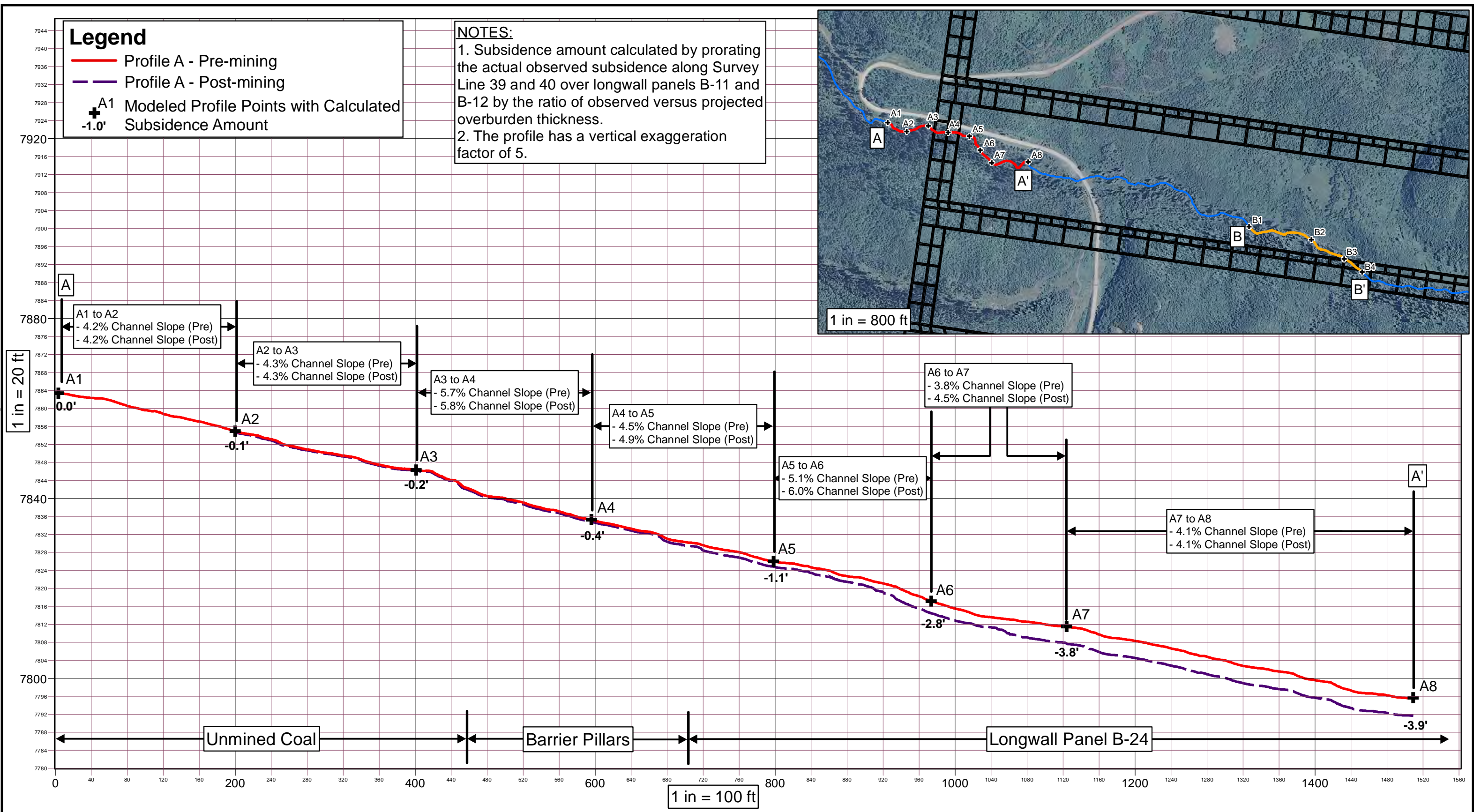
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Base Map: USDA NAIP 2009

 WRIGHT WATER ENGINEERS, INC. 2490 W 26TH AVE 100A DENVER, CO. 80211 (303) 480-1700	<i>DELTA COUNTY, COLORADO</i>		 1 inch = 1,000 feet  0 500 1,000 2,000 Feet	PROJECT NO. 121-014.000	FIGURE 14a
	WEST FORK TERROR CREEK THALWEG PROFILE OVERVIEW				
	POTENTIAL PROJECT--SPRUCE STOMP LEASE AREA				



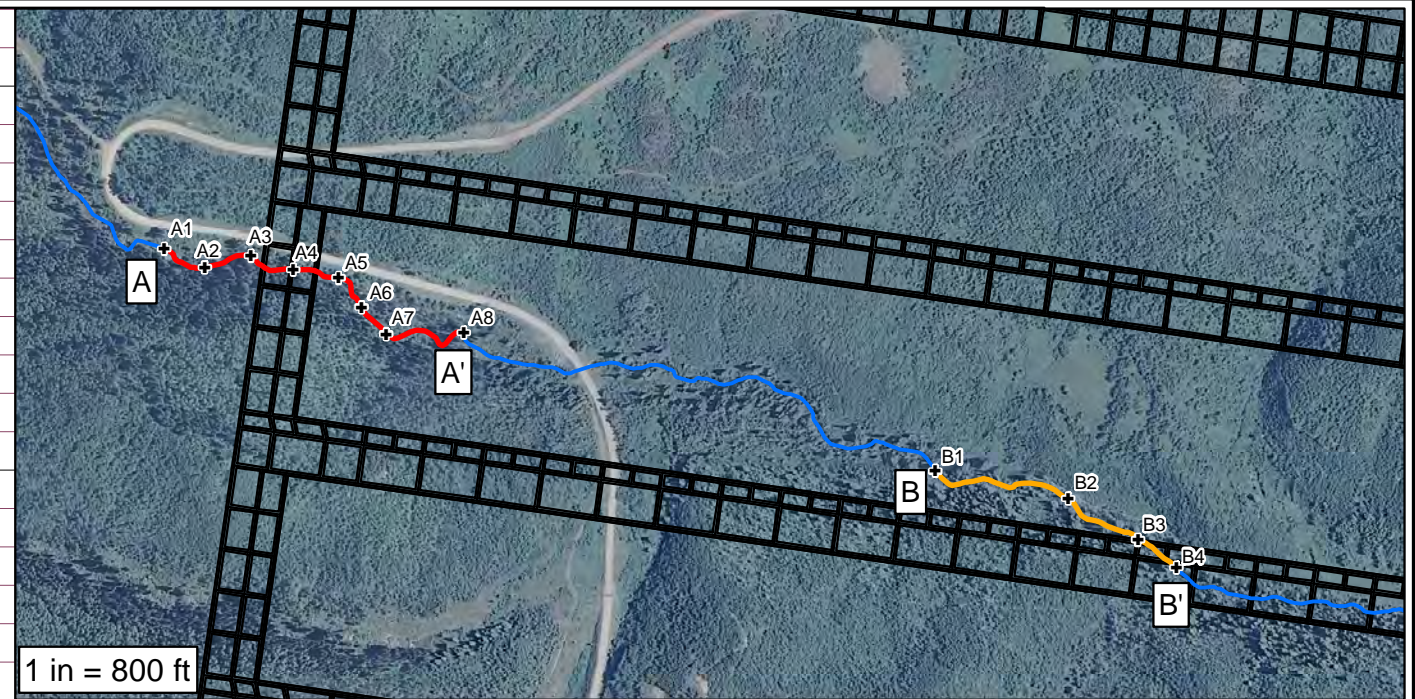
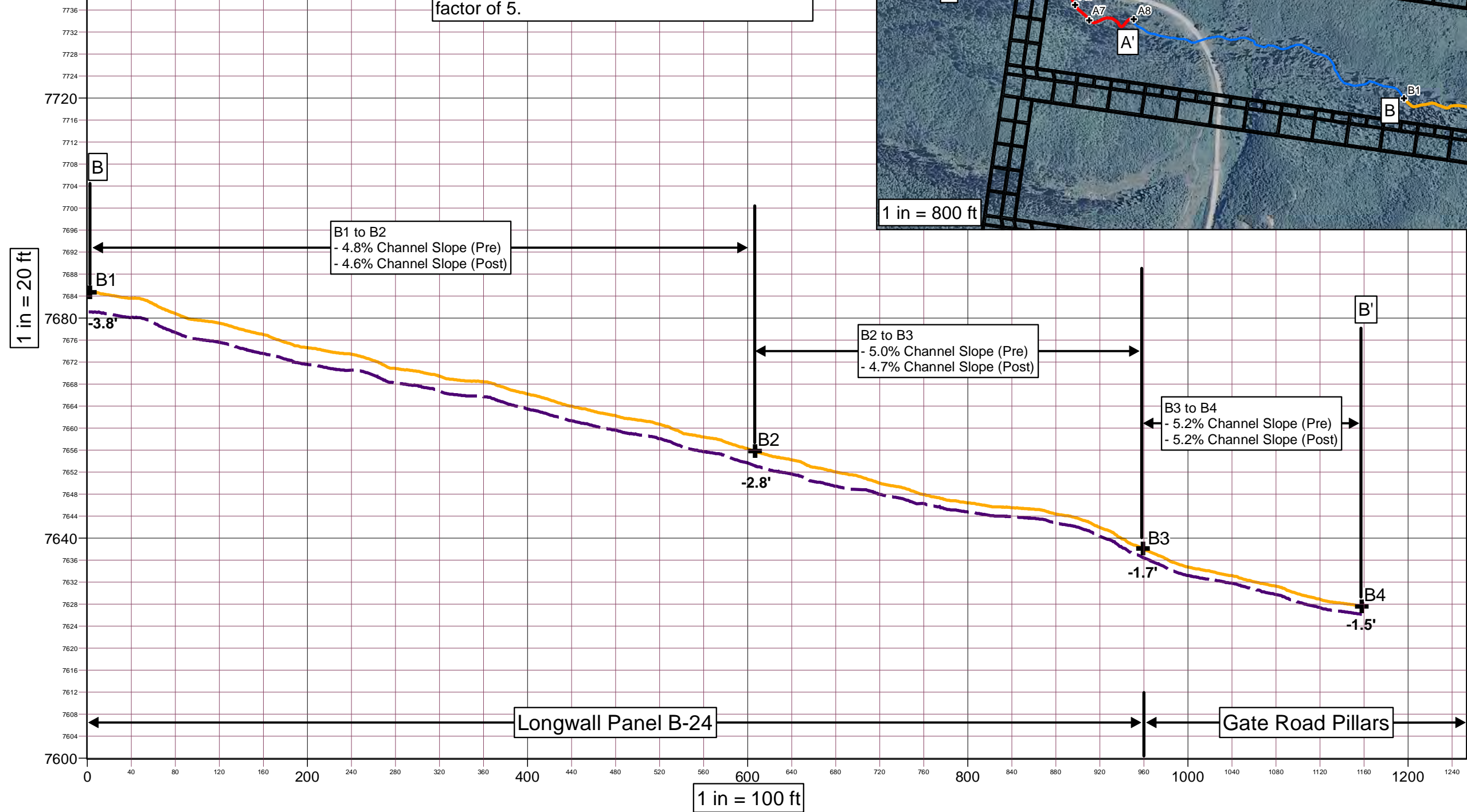
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Legend

- Profile B - Pre-mining
- - - Profile B - Post-mining
- + Modeled Profile Points with Calculated Subsidence Amount

NOTES:

1. Subsidence amount calculated by prorating the actual observed subsidence along Survey Line 39 and 40 over longwall panels B-11 and B-12 by the ratio of observed versus projected overburden thickness.
2. The profile has a vertical exaggeration factor of 5.



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THALWEG PROFILE B (PRE- AND POST-MINING)

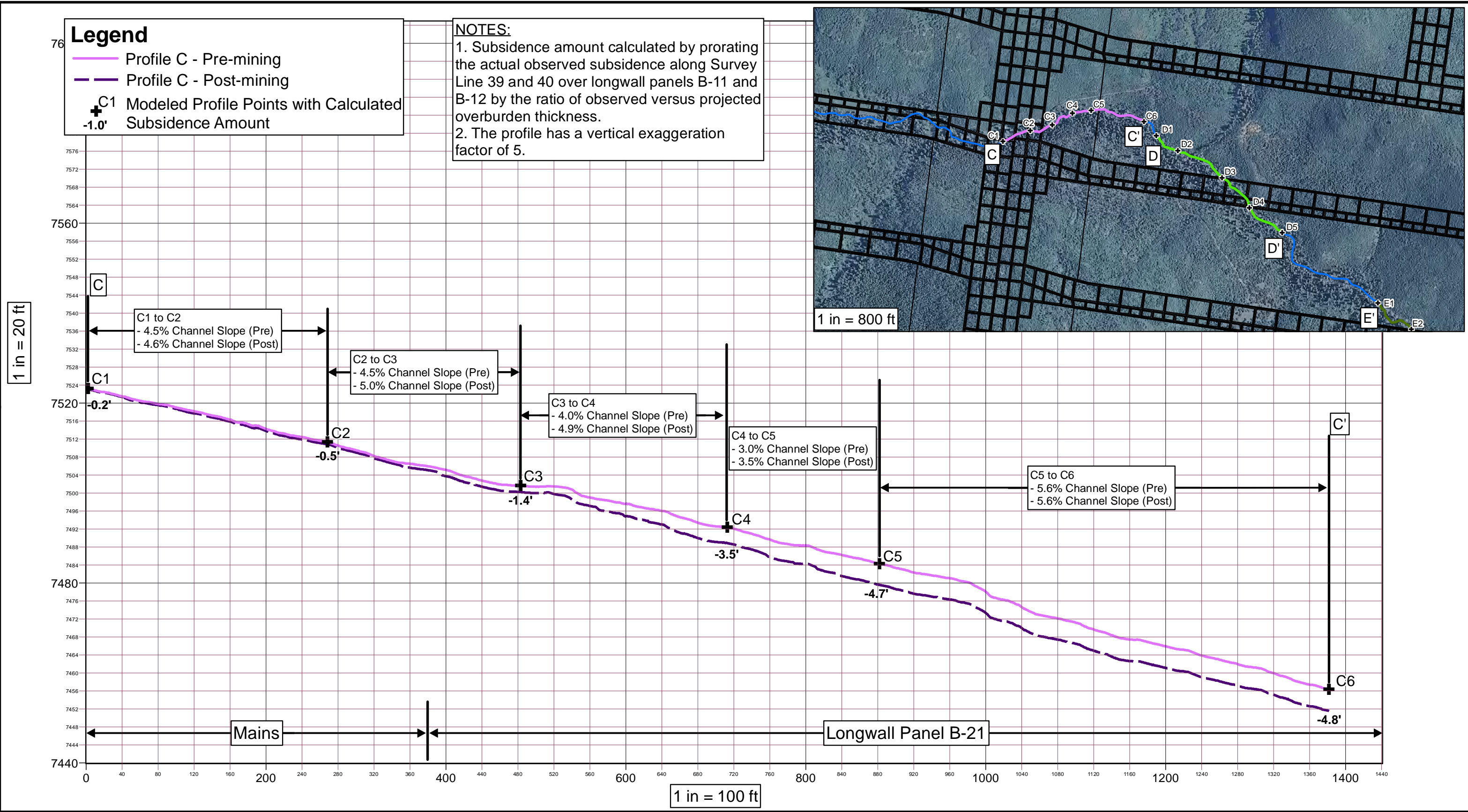
POTENTIAL PROJECT--SPRUCE STOMP LEASE AREA

PROJECT NO.

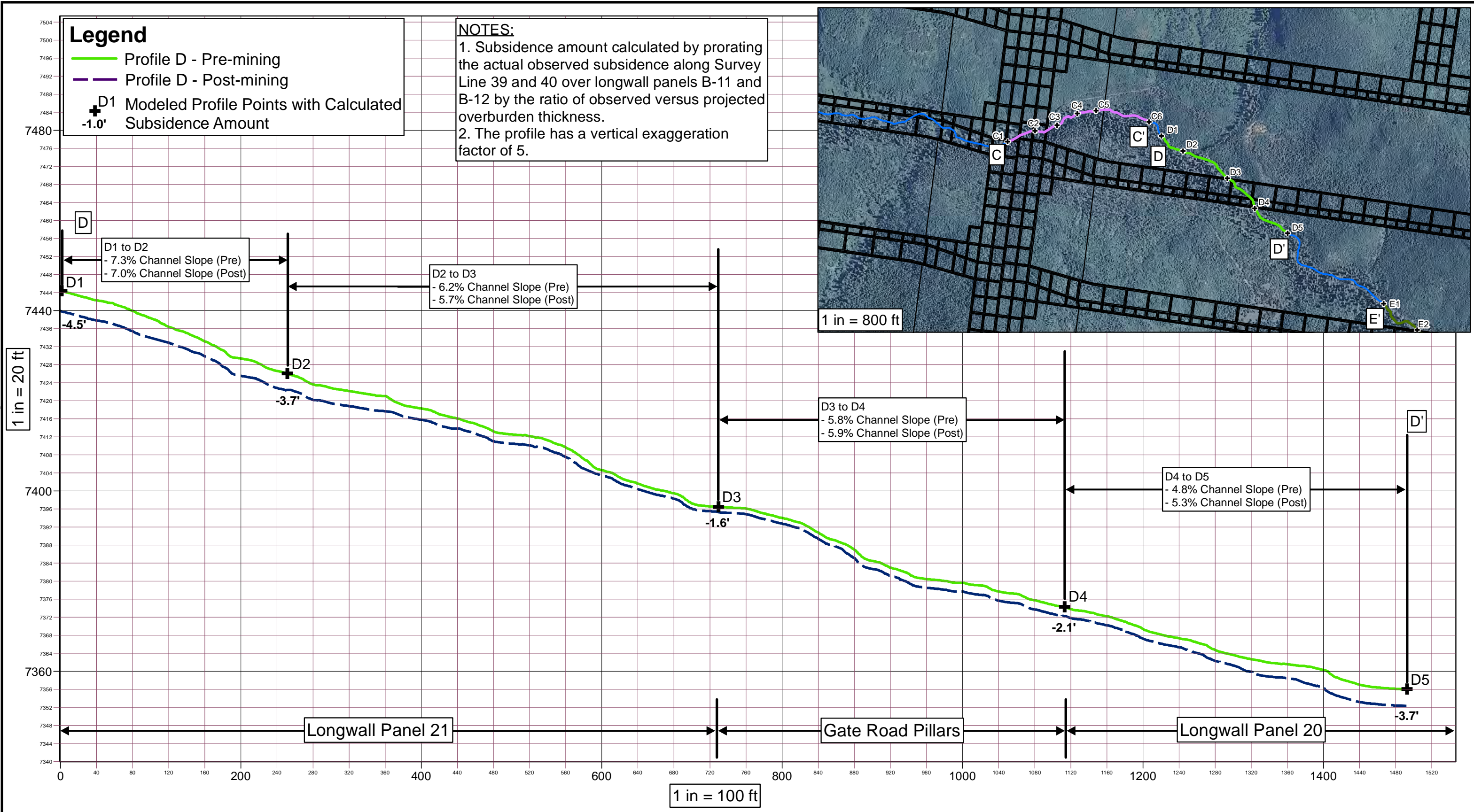
121-014.000

FIGURE

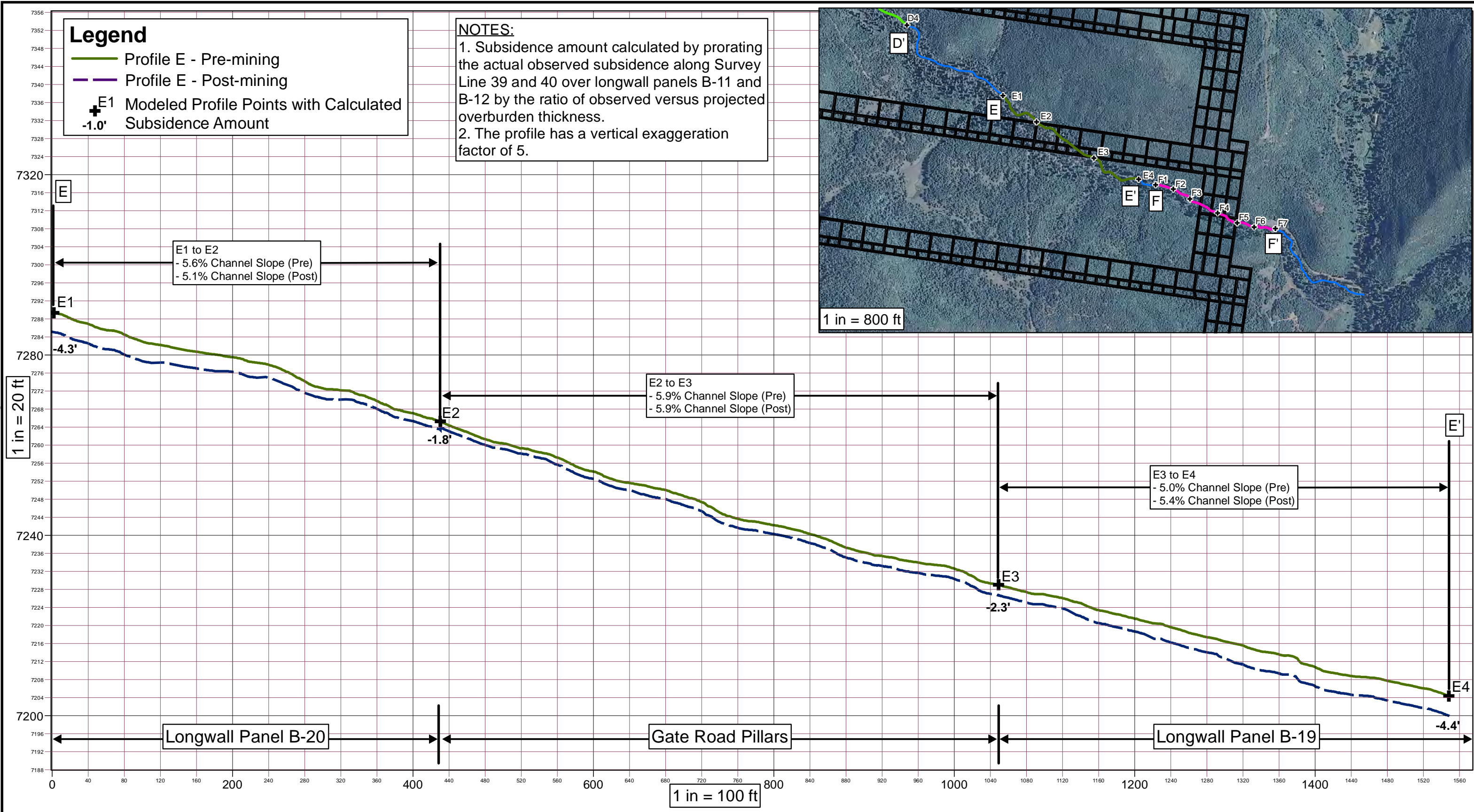
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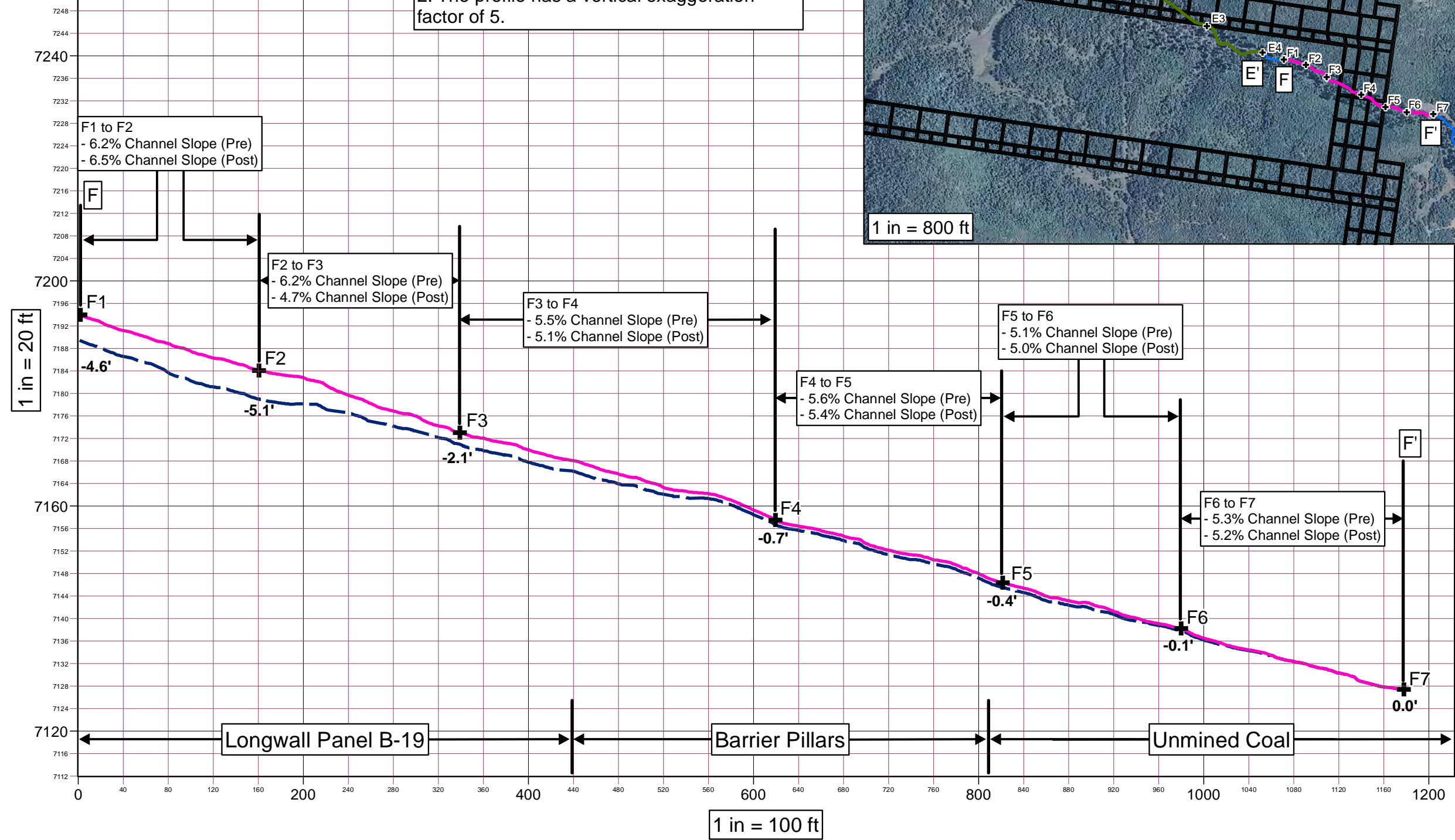
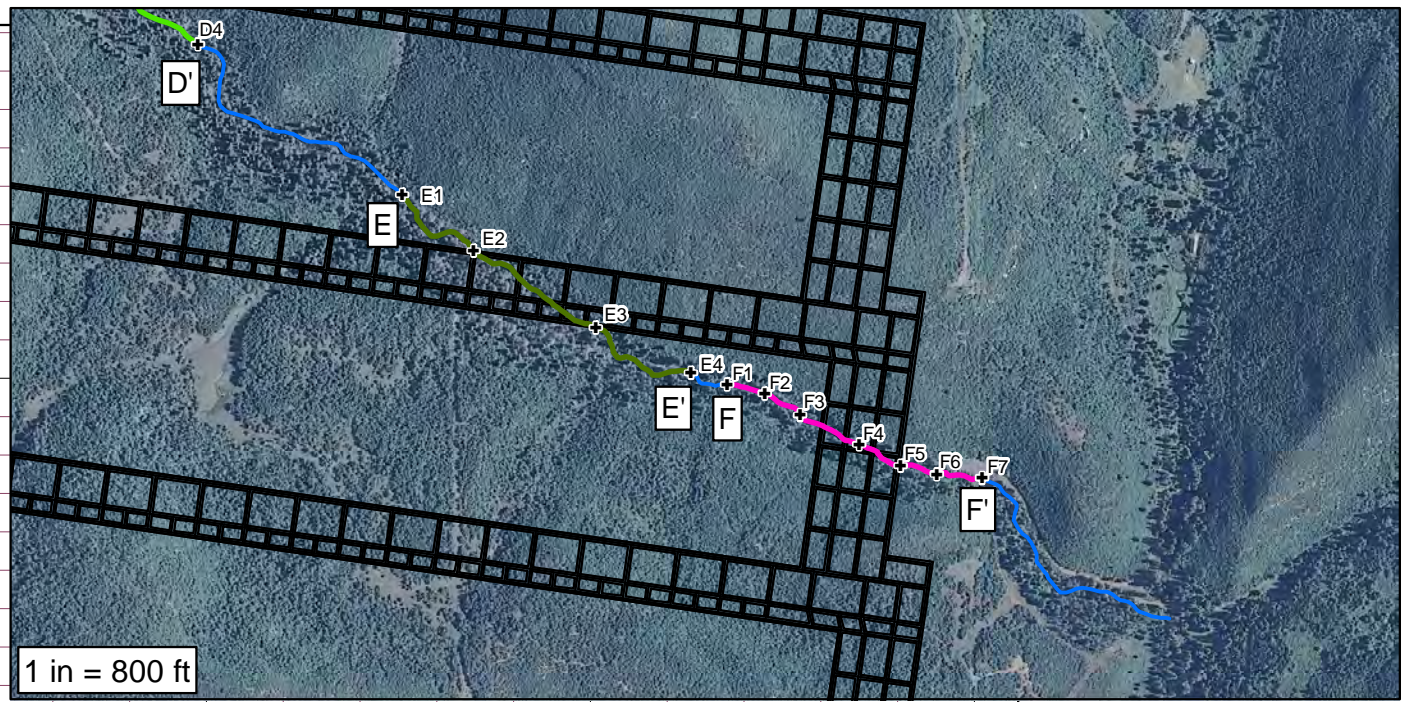
Legend

— Profile F - Pre-mining
— Profile F - Post-mining
+ F1 Modeled Profile Points with Calculated Subsidence Amount
+ -1.0'

NOTES:

1. Subsidence amount calculated by prorating the actual observed subsidence along Survey Line 39 and 40 over longwall panels B-11 and B-12 by the ratio of observed versus projected overburden thickness.

2. The profile has a vertical exaggeration factor of 5.



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APPENDICES

APPENDIX 1

Cited References

- Capesius, Joseph P. and Verlin C. Stephens. 2010. *Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado*. Scientific Investigations Report 2009-5136.
- Colorado State University, Colorado Natural Heritage Program. 2004. *Survey of Critical Wetlands and Riparian Areas in Gunnison County*. Prepared for Colorado Department of Natural Resources.
- Dare, Matthew, Michael Carrillo and Clay Speas. 2011. *Cutthroat Trout (Oncorhynchus clarkii) Species and Conservation Assessment for the Grand Mesa, Uncompahgre, and Gunnison National Forests, Delta, Colorado*.
- Dunrud, C.R., 1989. Geologic map and coal stratigraphic framework of the Paonia area, Delta and Gunnison Counties, Colorado. U.S. Geological Survey Coal Investigation Map C-115.
- James, Christopher and Clay Speas. 2005. *Colorado River Cutthroat Trout (Oncorhynchus clarkii pleuriticus) Species and Conservation Assessment*. Prepared for the Grand Mesa, Uncompahgre and Gunnison National Forests.
- Lyon, Peggy and Earl Williams. 1998. *Natural Heritage Biological Survey of Delta County, Colorado*. Prepared for Delta County Commissioners. Colorado Natural Heritage Program.
- Metcalf, J.L., Stowell, S. Love, Kennedy, C.M., Rogers, K.B., McDonald, D., Epp, J., Keepers, K., Cooper, A., Austin, J.J., and Martin, A.P. 2012. *Historical stocking data and 19th century DNA reveal human-induced changes to native diversity and distribution of cutthroat trout*. Molecular Ecology.
- Monarch & Associates. 2009. *Biological Assessment and Biological Evaluation for Bowie Resources, LLC 2009 Spruce Stomp Coal Exploration Lease Drilling Program*. Prepared for Bowie Resources, LLC. August.
- Monarch & Associates. 2010. *Biological Assessment for Bowie Resources, LLC 2010 Coal Exploration and Air Shaft Drilling Program*. Prepared for Bureau of Land Management. March 26.
- Oregon State University. 2012. Prism Climate Group Web Site. <http://prism.oregonstate.edu/>.
- Stewart, Collin; Greg Hunt, and Christopher Mark. 2006. Geology, Ground Control and Mine Planning at Bowie Resources, Paonia, CO. In *25th International Conference on Ground Control in Mining*, pp. 284-290.
- U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management. 2000. *Final Environmental Impact Statement, Iron Point*

Exploration License, Iron Point Coal Least Tract, Elk Creek Coal Lease Tract, Delta and Gunnison Counties, Colorado.

- U.S. Department of Agriculture, Natural Resources Conservation Service. 2012. Web Soil Survey. <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>.
- U.S. Department of Agriculture, Natural Resources Conservation Service. 2009. *North Fork Gunnison Watershed Hydrologic Unit Code 14020004 Rapid Assessment*.
- U.S. Geological Survey. 2012. Colorado StreamStats Web Page. <http://streamstats.usgs.gov/colorado.html>.
- U.S. Geological Survey. 2012. National Water Information: Web Interface. <http://nwis.waterdata.usgs.gov/nwis>.
- U.S. Department of the Interior, Bureau of Land Management and U.S. Department of Agriculture, Forest Service. 2005. *Environmental Assessment Bowie Resources, LLC Spruce Stomp Federal Coal Exploration License (150-200543)Delta County, Colorado*.
- WestWater Engineering. 2011. *Biological Assessment Bowie Resources, LLC, Underground Coal Mining Associated Surface Activities and Facilities*. Prepared for Bureau of Land Management and Grand Mesa Uncompahgre Gunnison National Forest.
- Williams, Cory A. and Kenneth J. Leib. 2005. *Using Tracers to Evaluate Streamflow Gain-Loss Characteristics of Terror Creek, in the Vicinity of a Mine-Permit Area, Delta County, Colorado, Water Year 2003*. Scientific Investigations Report 2005-5018.
- Winters, David S., and Gallagher, J. Peter. 1997. *Basin-Wide Stream Habitat Inventory, A Protocol*. Prepared for the Pike and San Isabel National Forests & Cimarron and Comanche National Grasslands.
- Young, Michael K. 2008. *Colorado River Cutthroat Trout (Oncorhynchus clarkii pleuriticus): A Technical Conservation Assessment*. Prepared for the USDA Forest Service, Rocky Mountain Region, Species Conservation Project.

APPENDIX 2

WWE
MEMORANDUM

To: 121-014.000

From: Hayes A. Lenhart, P.E.
Reviewed by Ian Paton, P.E.
Wright Water Engineers, Inc.

Date: January 10, 2013

Re: Sediment transport analysis for West Fork Terror Creek at Spruce Stomp Lease Area

This memorandum, prepared by Wright Water Engineers, Inc. (WWE), documents the results of a sediment transport analysis on West Fork Terror Creek in Delta County, Colorado. The purpose of this analysis is to quantify existing sediment transport characteristics and quantitatively predict how sediment transport might change if longwall coal mining occurs underneath the creek. Based on an analysis by C. Richard Dunrud, longwall mining in the Spruce Stomp Lease Area could result in approximately 5 feet of vertical displacement of the West Fork Terror Creek channel. This displacement has the potential to alter the channel's longitudinal slope, potentially affecting sediment transport characteristics.

1.0 INTRODUCTION

A stable stream has flow and physical characteristics which allow it to move a sediment load downstream without aggrading or degrading its channel bottom. There are two categories of sediment which make up the total sediment load: 1) bedload and 2) suspended load. Bedload moves along the channel bottom by rolling, sliding or hopping (saltating) along the channel bottom. The suspended load moves downstream in the water column and is typically composed of sands, silts, and clays.

In order to quantitatively evaluate the effects that channel settlement may have on West Fork Terror Creek's sediment transport characteristics, sediment and cross-section data were collected at 4 sites along the creek by WWE between September 18 and 19, 2012. Two evaluation techniques were used to determine the particle class-size distribution at the sample sites: 1) a Wolman Pebble Count with a bar sample, and 2) a pavement and subpavement analysis.

At the time of the data collection, flow in the stream was less than 5 cfs. Visual bankfull indicators, including erosion, sediment deposition, vegetation, and channel bars, were used to estimate the bankfull extents. General observations of the sediment indicate the stream bed consists of large basalt boulders (many with an intermediate diameter greater than 1000 mm), gravel and cobble sized material, and some fines.

2.0 SAMPLE METHODS

A Wolman Pebble Count with a bar sample is used to characterize the size of the material carried by a stream. The pebble count is performed by recording the intermediate diameter from at least 100 particles at a cross section by zigzagging from left water's edge to the right water's edge at normal flow. These results are plotted to determine a particle size distribution of the large material. A bar sample is collected from the lower third of a well-developed point bar in the stream. This is performed by placing a bottomless 5-gallon bucket over the sampling location, recording the intermediate axis of the two largest particles within the bucket area, and collecting the remaining material down to a depth of 4 to 6 inches for sieving and weighing.

A pavement and subpavement analysis is an alternative set of sampling techniques used to characterize the size of the material carried by a stream. This analysis is performed by using a 5-gallon bottomless bucket and isolating a section of a riffle which is most depositional. The bucket is pushed into the riffle to eliminate flow of water through the sample area. The top surface layer is then removed, the intermediate axis of the two largest particles within the bucket area are recorded, the top layer is then collected and placed into a sample bag for sieving and weighing of the pavement (this is equivalent to the pebble count). The subpavement is then excavated to twice the depth of the largest particle found in the subpavement. This material is then placed into a sample bag for sieving and weighing (this is equivalent to the bar sample). The sieve analyses were conducted by Ground Engineering, Inc. in Denver, CO.

A pavement and subpavement analysis was performed at site 1, and a Wolman Pebble Count with a bar sample was performed at sample sites 2, 3 and 5 (see Figure 1). A cross-section level survey was performed at all sites. Using these data, particle class-size distribution graphs for the sediment carried by the creek were developed for each site (see Attachment 1). Using these graphs, and surveyed channel characteristics, WWE quantified the expected changes to the sediment transport capability of the stream following long wall coal mining under the creek.

3.0 CALCULATIONS AND RESULTS

3.1 Existing Sediment Transport Characteristics

Sediment transport in streams with gravel and cobble beds (characteristic of West Fork Terror Creek) is typically analyzed by estimating the ability of the stream to move a particular size particle or by calculating the bankfull shear stress. Using the methodology described in NRCS (2007), both the critical dimensionless shear stress and the bankfull shear stress were calculated based on the sediment field data collected by WWE.

3.1.1 Critical Shear Stress Analysis

The critical shear stress (τ_{ci}^*) is a measure of the force required to mobilize and transport a particular size particle which is at rest on the channel bed. The τ_{ci}^* is calculated from the ratio of the median diameter of the pavement sample (or pebble count) (d_{50}) to the median diameter of the

subpavement (or bar sample) (d_{50}^\wedge). When the ratio of these two numbers is between 3.0 and 7.0 the τ_{ci}^* is calculated as follows:

$$\tau_{ci}^* = 0.0834 \times \left(\frac{d_{50}}{d_{50}^\wedge} \right)^{-0.872} \quad \text{Equation 1}$$

If the $\frac{d_{50}}{d_{50}^\wedge}$ ratio is not between the values of 3.0 and 7.0 then the τ_{ci}^* is calculated from the ratio of the largest particle from the subpavement (or bar sample) (d_i) to the median diameter of the pavement sample (or pebble count) (d_{50}). If this ratio is between the values of 1.3 and 3.0 the τ_{ci}^* is calculated as follows:

$$\tau_{ci}^* = 0.0384 \times \left(\frac{d_i}{d_{50}} \right)^{-0.872} \quad \text{Equation 2}$$

For ratios that do not fall in these ranges, an alternate method to calculate the shear stress is described in NRCS (2007).

Once the τ_{ci}^* is determined, the minimum bankfull mean depth (D_r) required for entrainment of the largest particle of the subpavement sample (or bar sample) can be calculated as a function of the sediment density (1.65), the τ_{ci}^* , the d_i , and the existing water surface slope (S_e) using the following equation:

$$D_r = \left(\frac{1.65 \times \tau_{ci}^* \times d_i}{S_e} \right) \quad \text{Equation 3}$$

The results of this analysis are presented in Table 1.

Table 1. Calculated Critical Dimensionless Shear Stress at each sample site.

Sample Location	Pavement (d_{50}) (inches)	Subpavement (d_{50}^\wedge) (inches)	Subpavement (d_i) (inches)	$\frac{d_{50}}{d_{50}^\wedge}$	$\frac{d_i}{d_{50}}$	Critical Dimensionless Shear Stress (τ_{ci}^*)
Site 1	2.13	0.48	6.00	4.4	2.8	0.023
Site 2	3.78	1.3	5.40	2.9	1.4	0.028
Site 3	4.92	1.6	3.94	3.1	0.8	0.031
Site 5	3.78	1.7	4.90	2.2	1.3	0.031

Note: Shaded cells represent the ratio used to calculate critical dimensionless shear stress (see Equations 1 and 2)

Using the critical dimensionless shear stress, the minimum bankfull mean depth required for entrainment of the largest bed material particle can be calculated using the following equation:

$$D_r = \left[\frac{1.65 \times \tau_{ci}^* \times d_i}{S_e} \right] \quad \text{Equation 4}$$

where D_r is the minimum bankfull mean depth required for entrainment of the largest bed material particle, and S_e is the existing slope through the riffle section. Table 2 provides a summary of the D_r values for each sample site:

Table 2. Calculated Bankfull Mean Depth Required to Move the Largest Bed Material Particle

Sample Location	Calculated τ_{ct}^*	Subpavement (d_i) (ft)	Existing Slope (ft/ft)	Existing Mean Bankfull Depth (ft)	Bankfull Mean Depth Required (D_r) (ft)
Site 1	0.023	0.50	0.098	1.03	0.19
Site 2	0.028	0.45	0.042	1.41	0.49
Site 3	0.031	0.33	0.043	1.42	0.39
Site 5	0.031	0.41	0.087	1.12	0.24

Comparison of the existing mean bankfull depth (see Attachment 2) and the D_r shows that the stream is currently capable of moving sediment larger than the largest bed material recorded when flow in the creek is less than bankfull (i.e., sediment is being removed from the bed and the banks). Stated another way, the existing mean bankfull depth is greater than the mean bankfull depth required to mobilize the largest bed material particle. Note this analysis reflects mobilization of the bed material only, and does not indicate that large boulders in the stream (many greater than 1000 mm) are mobilized during less than bankfull events.

3.1.2 Bankfull Shear Stress Analysis

Changes in channel velocity, depth, and stream slope result in changes to channel dimension, pattern, and profile. These changes in the hydraulic characteristics are reflected in values of shear stress. The existing shear stress at bankfull was calculated for each site based on the surveyed cross-section data (see Attachment 2) and the average channel slope. Shear stress is defined as:

$$\tau = \gamma \times R \times S \quad \text{Equation 5}$$

where τ is the bankfull shear stress (lb/ft²), γ is the specific weight of water (62.4 lbs/ft³), R is the hydraulic radius of the riffle cross section (ft) and S is the average water surface slope (ft/ft). Table 3 provides a summary of the average channel slope, hydraulic radius, and the largest sediment sizes at each site.

Table 3. Existing Bankfull Shear Stress and Largest Particle Sizes at Sample Sites

Sample Location	Hydraulic Radius (ft)	Existing Average Stream Slope (ft/ft)	Bankfull Shear Stress (lbs/ft ²)	Largest Particle from Bed Material (mm)	Largest Particle from Surface Material (mm)
Site 1	1.26	0.0675	5.33	153	NA
Site 2	1.39		5.85	137	512 to 1024
Site 3	1.39		5.87	100	512 to 1024
Site 5	1.09		4.61	140	512 to 1024

The calculated range of shear stress and the largest particle from the bed material is shown on Shields Diagram (Figure 2). Using the Colorado data trendline on Figure 2, the existing shear stress at bankfull has the capability to move particles between 400 and 500 mm in size. Field sampling results indicated the largest particle for the bed material ranged from 100 to 153 mm and for surface material from 512 to 1024 mm.

Based on this analysis, the stream is easily mobilizing the largest recorded bed material (approximately 153 mm) during bankfull events. However, based on the data from the pebble

count, and field observations by WWE, sediment particles exist in the stream which are greater than 500 mm and will not be moved during bankfull events.

3.2 CHANGES TO SEDIMENT TRANSPORT CHARACTERISTICS AS A RESULT OF CHANNEL SETTLEMENT

The change of the channel's sediment transport characteristics, following settling of the channel, was quantified using the same methodology presented in Sections 3.1.1 and 3.1.2. As a result of long wall coal mining underneath the channel, the overall slope of the channel is predicted to have a maximum absolute change of 1.5%. For illustrative purposes, WWE analyzed channel slope increases of 1% and 2% would affect sediment transport characteristics. Tables 4 and 5 provide the expected change in D_r and the expected change in bankfull shear stress as a result of either a 1% or 2% increase in channel slope.

Table 4. Calculated Bankfull Mean Depth Required to Move the Largest Bed Material Particle

Sample Location	τ_{ci}^*	Subpavement (d_i) (ft)	Channel Slope (ft/ft)			Bankfull Mean Depth Required (D_r) (ft)		
			Existing	Increase 1%	Increase 2%	Existing	Increase 1%	Increase 2%
Site 1	0.023	0.50	0.098	0.108	0.118	0.17	0.15	0.14
Site 2	0.028	0.45	0.042	0.052	0.062	0.49	0.40	0.34
Site 3	0.031	0.33	0.043	0.053	0.063	0.40	0.32	0.27
Site 5	0.031	0.41	0.087	0.097	0.107	0.24	0.21	0.19

Table 4 shows that a 1% or 2% increase in channel slope will decrease the minimum bankfull depth required for entrainment of the largest bed material particle (D_r) by 9 to 19% or 17 to 32%, respectively.

Table 5. Changes to Bankfull Shear Stress as a Result of Settlement

Sample Location	1% Increase in Average Stream Slope (ft/ft)	Resulting Shear Stress from a 1% Increase in Channel Slope (lbs/ft ²)	2% Increase in Average Stream Slope (ft/ft)	Resulting Shear Stress from a 2% Increase in Channel Slope (lbs/ft ²)
Site 1	0.0775	6.12	0.0875	6.90
Site 2		6.71		7.58
Site 3		6.74		7.61
Site 5		5.29		5.98

The calculated shear stress as a result of the increase in slope is shown on the Shields Diagram (Figure 2). Using the Colorado data trendline on Figure 2, the calculated shear stress at bankfull, as a result of the increase in slope, has the capability to move particles between 500 and 650 mm in size. The largest particle for the bed material ranged from 100 to 153 mm and for the surface material from 512 to 1024 mm.

4.0 SUMMARY AND CONCLUSIONS

As discussed in Sections 3.1.1 and 3.2.2 the existing channel is currently mobilizing the largest particle in the bed material during bankfull events. Therefore, as a result of the change in channel

slope, the effect on the bed material will not be substantially different since the largest bed material is already being mobilized under existing conditions.

The resulting increase in shear stress will result in the stream moving larger sized particles of surface material under bankfull conditions. Based on WWE's field observations and pebble count data, many of the large particles in the riffles of this stream are greater than 650 mm. While some larger material will be mobilized following channel slope increase induced by subsidence, the overall stability of the largest particles should not be significantly compromised as a result of the slope change.

REFERENCES

NRCS, 2007. Rosgen Geomorphic Channel Design. Part 654 Stream Restoration Design National Engineering Handbook. Natural Resources Conservation Service. United States Department of Agriculture.

ATTACHMENTS

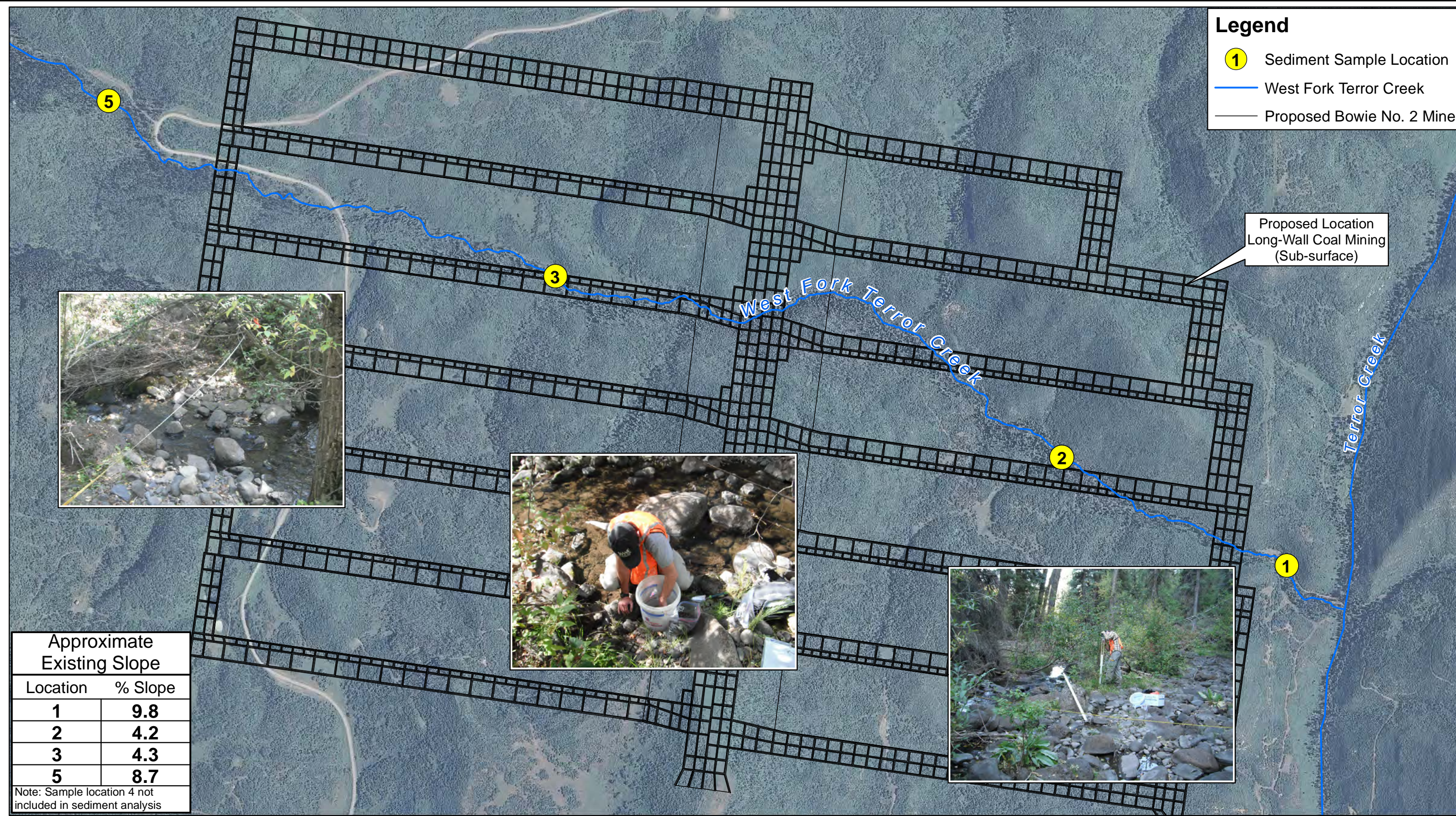
Figure 1 – West Fork Terror Creek Sediment Sampling Locations Map

Figure 2 – Shields Diagram (NRCS, 2007) with West Fork Terror Creek Data

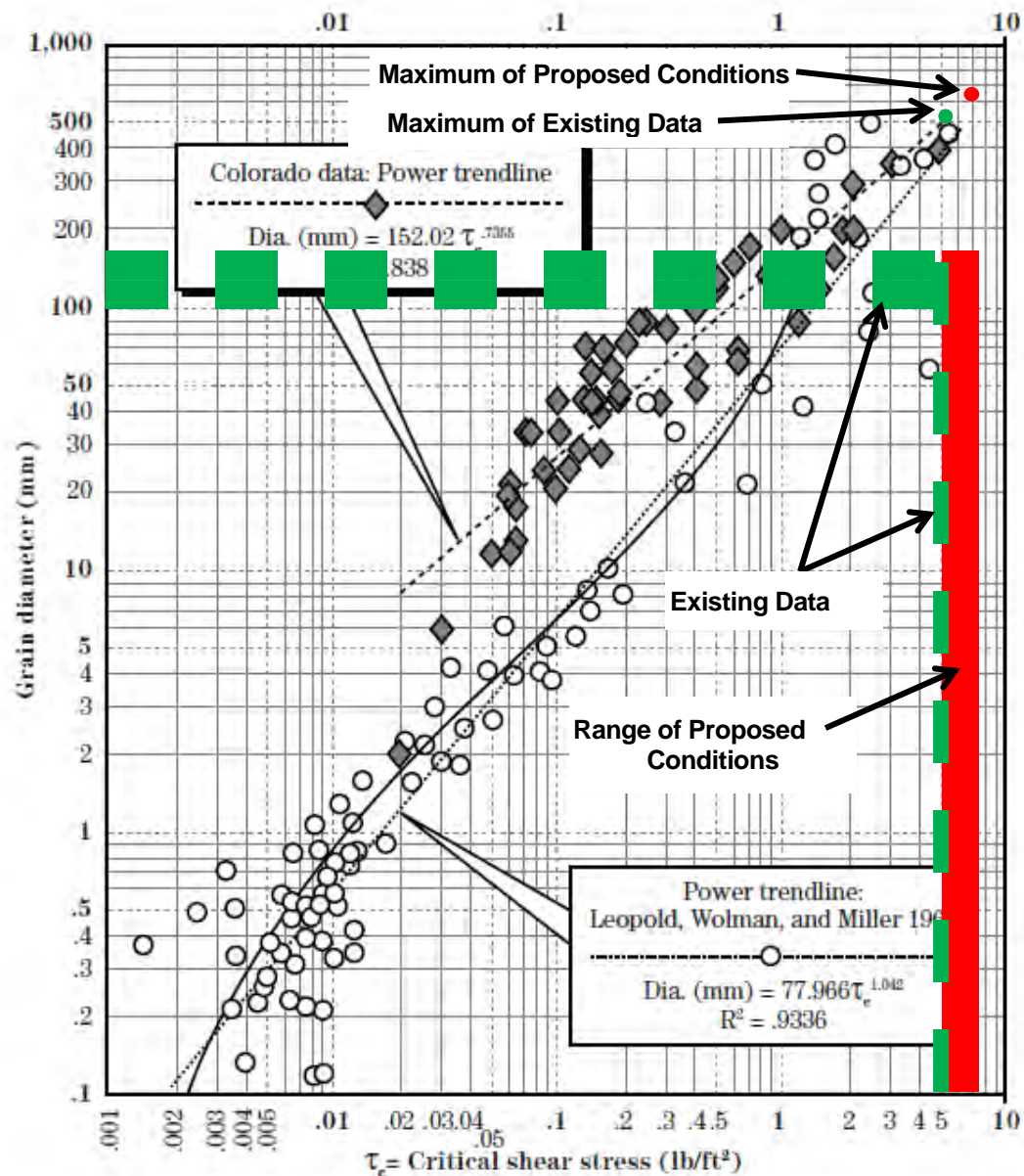
Attachment 1 – Particle Class Size Distribution Plots and Supporting Field Data

Attachment 2 – Survey Data and Cross Section Analysis

Attachment 3 – Critical Shear Stress and Bankfull Shear Stress Calculations



Path: Z:\Project Files\121-014\121-014.000\CAD-GIS\GIS\Figure1_SedimentSamples.mxd Base Map: USDA NAIP 2009



Laboratory and field data on critical shear stress required to initiate movement of grains (Leopold, Wolman, and Miller 1964). The solid line is the Shields curve of the threshold of motion; transposed from the θ versus R_* form into the present form, in which critical shear is plotted as a function of grain diameter.

- Leopold, Wolman, and Miller 1964
- ◆ Colorado data (Wildland Hydrology)

Figure 2. Shields Diagram (NRCS, 2007) with West Fork Terror Creek Data

GROUND

ENGINEERING CONSULTANTS

GRADATION PROPERTIES

Project: **Wright Water Engineering**
Job Number: **12-1218**

Date: October 9, 2012

Reported to: Wright Water Engineers, Inc
2490 W. 26th Ave. Suite 100A
Denver, CO 80211
Attn: Hayes Lenhart, P.E.

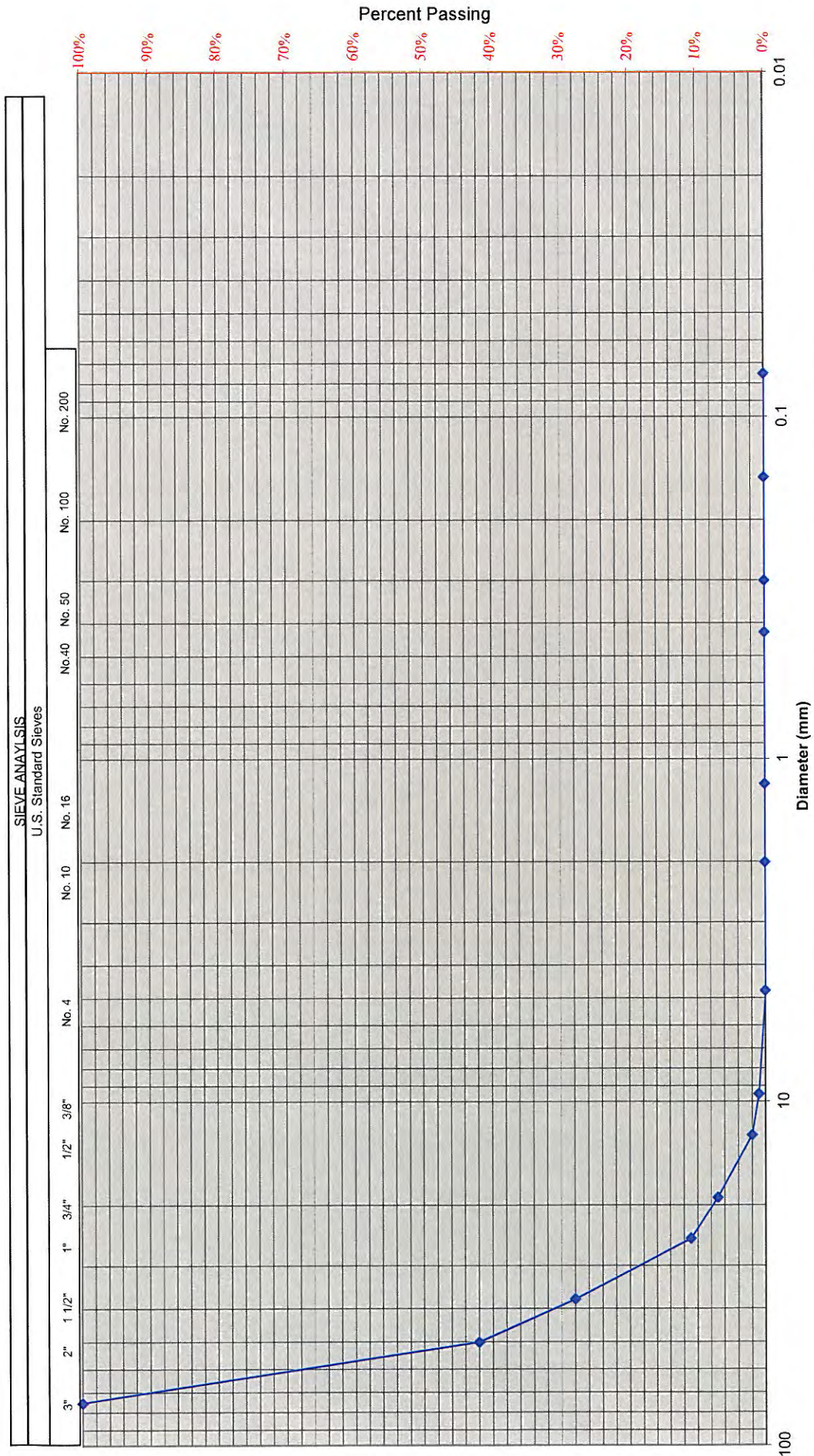
Sample Information

Sample Number: 3567
Sample Location: Site 1 Pavement
Aggregate Identification: Delivered By Contractor
Date Sampled: 9/28/2012
Sampled By: Contractor

Gradation Analysis

Sieve Size (opening)	Passing (%)
3"	100
2"	42
1 1/2"	28
1"	11
3/4"	7
1/2"	2
3/8"	1
#4	-
#10	-
#16	-
#40	-
#50	-
#100	-
#200	0.0

SIEVE ANALYSIS ASTM D 422



Gravel	100.0%	Sand			0.0%	Silt and Clay	0.0%
Job Name: Wright Water Engineering Lab Testing							
		Coarse	0.0%	Medium	0.0%	Fine	0.0%
						Ground Job # 12-1218	

Job Name: Wright Water Engineering
Sample Location: Site 1 Pavement
Sample ID: 3567

GROUND

ENGINEERING CONSULTANTS

GRADATION PROPERTIES

Project: **Wright Water Engineering**
Job Number: **12-1218**

Date: October 9, 2012

Reported to: Wright Water Engineers, Inc
2490 W. 26th Ave. Suite 100A
Denver, CO 80211
Attn: Hayes Lenhart, P.E.

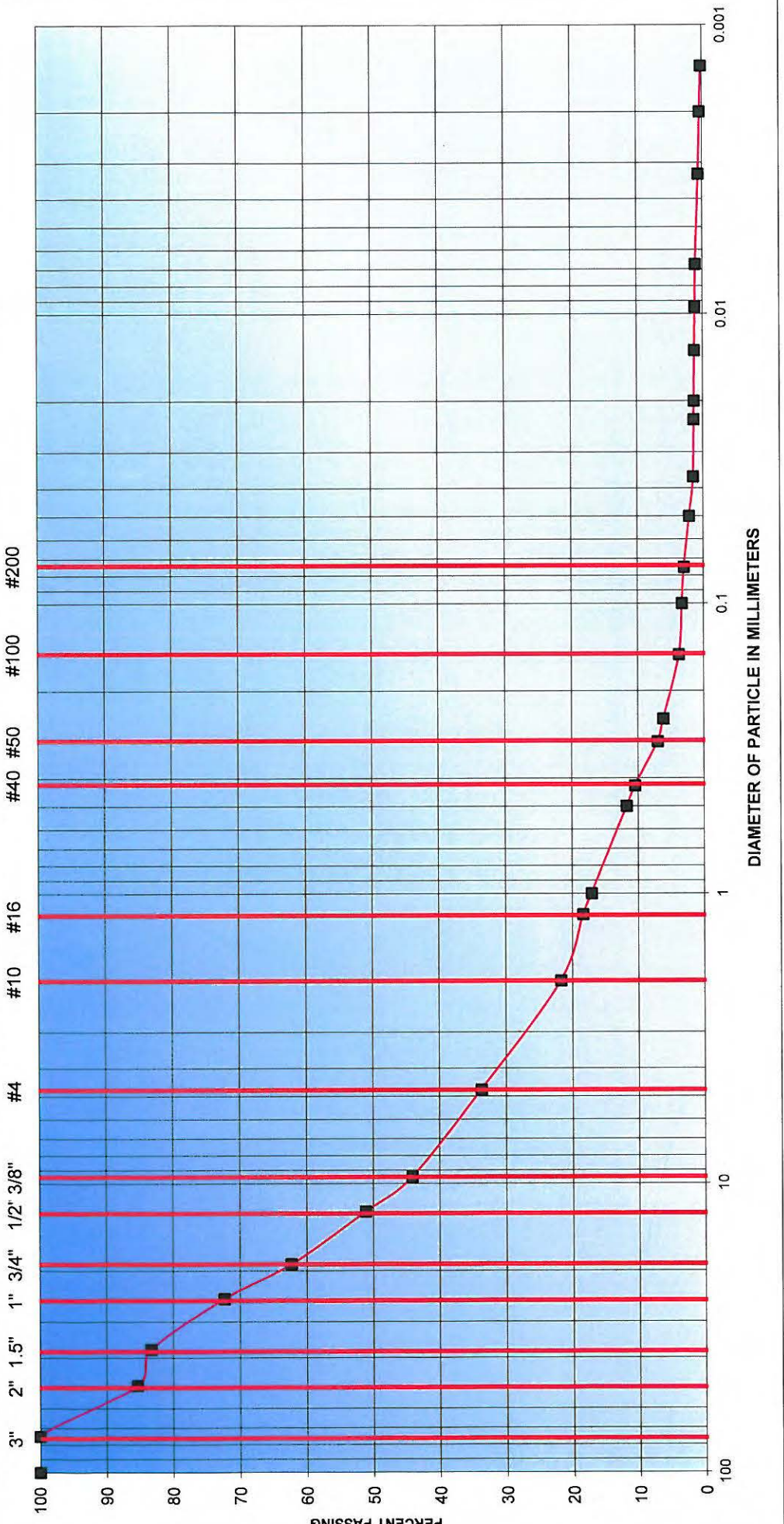
Sample Information

Sample Number: 3566
Sample Location: Site 1, Subpavement
Aggregate Identification: Delivered By Contractor
Date Sampled: 9/28/2012
Sampled By: Contractor

Gradation Analysis

Sieve Size (opening)	Passing (%)
3"	100
2"	85
1 1/2"	83
1"	72
3/4"	62
1/2"	51
3/8"	44
#4	34
#10	22
#16	18
#40	11
#50	7
#100	4
#200	3.0

SIEVE ANALYSIS: ASTM C 136 with C 117 or D 1140	HYDROMETER ANALYSIS: ASTM D 422
Sieve Openings: U.S. Standard Sieves	Timed Readings



Sample of:	CLAY									
	SILT									
	FINE SAND									
From: Site 1, Subpavement	MEDIUM SAND									
	COARSE SAND									
	GRAVEL									
	COARSE GRAVEL									
	FINE GRAVEL									
	COBBLE									
Gravel 66%		Sand 31%		Silt and Clay 3%						
Ground Engineering Consultants		Job No.: 12-1218		Figure: 3566						
Gradation Test Results										

GROUND

ENGINEERING CONSULTANTS

GRADATION PROPERTIES

Project: **Wright Water Engineering**
Job Number: **12-1218**

Date: October 9, 2012

Reported to: Wright Water Engineers, Inc
2490 W. 26th Ave. Suite 100A
Denver, CO 80211
Attn: Hayes Lenhart, P.E.

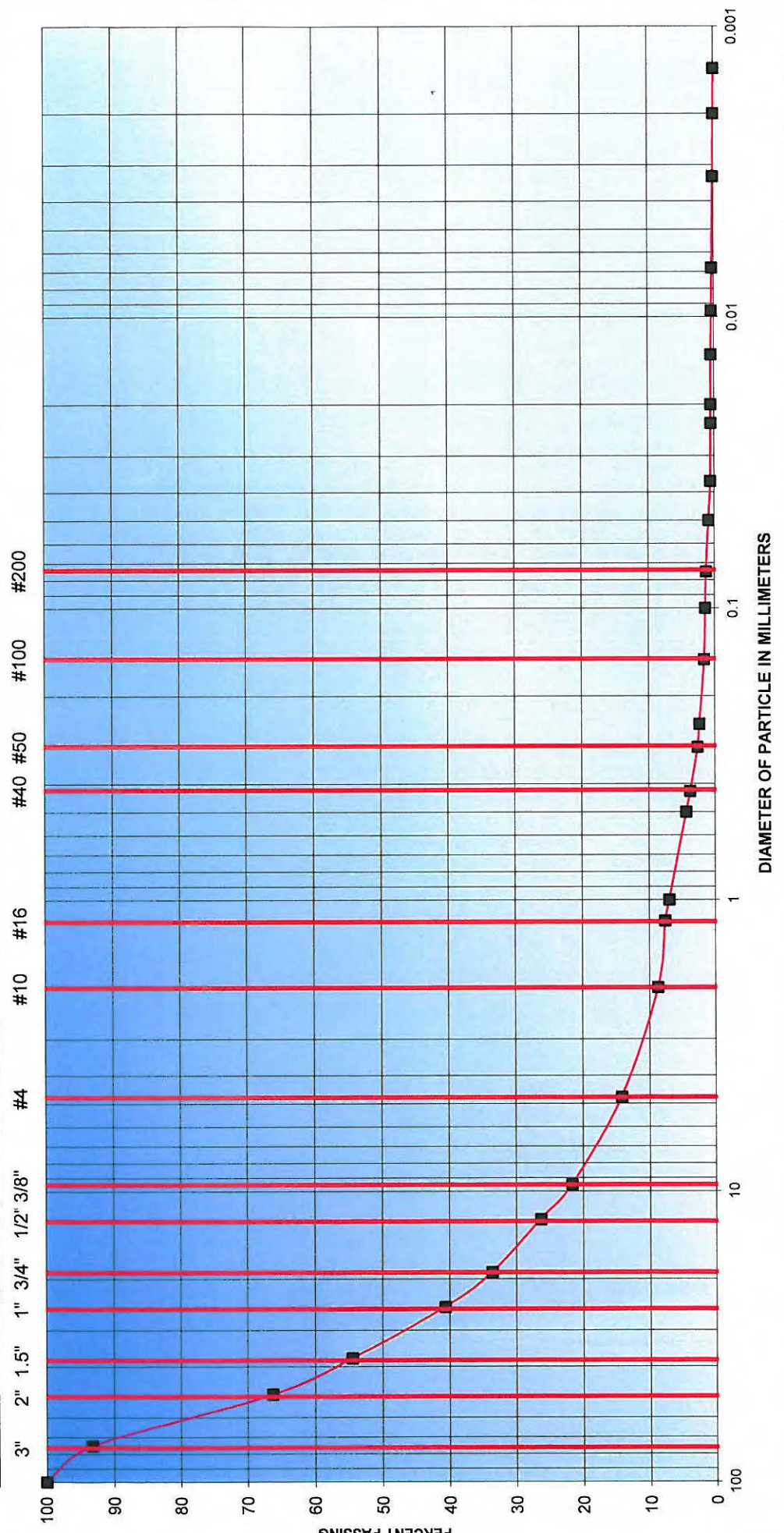
Sample Information

Sample Number: 3565
Sample Location: Site 2, Bar Subpave and Pavement Mix
Aggregate Identification: Delivered By Contractor
Date Sampled: 9/28/2012
Sampled By: Contractor

Gradation Analysis

Sieve Size (opening)	Passing (%)
4"	100
3"	93
2"	66
1 1/2"	54
1"	40
3/4"	34
1/2"	26
3/8"	22
#4	14
#10	9
#16	8
#40	4
#50	3
#100	2
#200	1.3

SIEVE ANALYSIS: ASTM C 136 with C 117 or D 1140	HYDROMETER ANALYSIS: ASTM D 422
Sieve Openings: U.S. Standard Sieves	Timed Readings



Sample of: From: Site 2, Bar Subpave and Pavement Mix	Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY
	GRAVEL		SAND				
	Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY
	Gravel	86%	Sand	13%	Silt and Clay	1%	
GRADATION TEST RESULTS							
JOB NO.: 12-1218							
FIGURE: 3565							

GROUND

ENGINEERING CONSULTANTS

GRADATION PROPERTIES

Project: **Wright Water Engineering**
Job Number: **12-1218**

Date: October 9, 2012

Reported to: Wright Water Engineers, Inc
2490 W. 26th Ave. Suite 100A
Denver, CO 80211
Attn: Hayes Lenhart, P.E.

Sample Information

Sample Number: 3564
Sample Location: Site 3, Bar Subpave and Pavement Mix
Aggregate Identification: Delivered By Contractor
Date Sampled: 9/28/2012
Sampled By: Contractor

Gradation Analysis

Sieve Size (opening)	Passing (%)
4"	100
3"	85
2"	66
1 1/2"	40
1"	31
3/4"	23
1/2"	17
3/8"	14
#4	11
#10	8
#16	7
#40	4
#50	3
#100	1
#200	1.1

GROUND

ENGINEERING CONSULTANTS

GRADATION PROPERTIES

Project: **Wright Water Engineering**
Job Number: **12-1218**

Date: October 9, 2012

Reported to: Wright Water Engineers, Inc
2490 W. 26th Ave. Suite 100A
Denver, CO 80211
Attn: Hayes Lenhart, P.E.

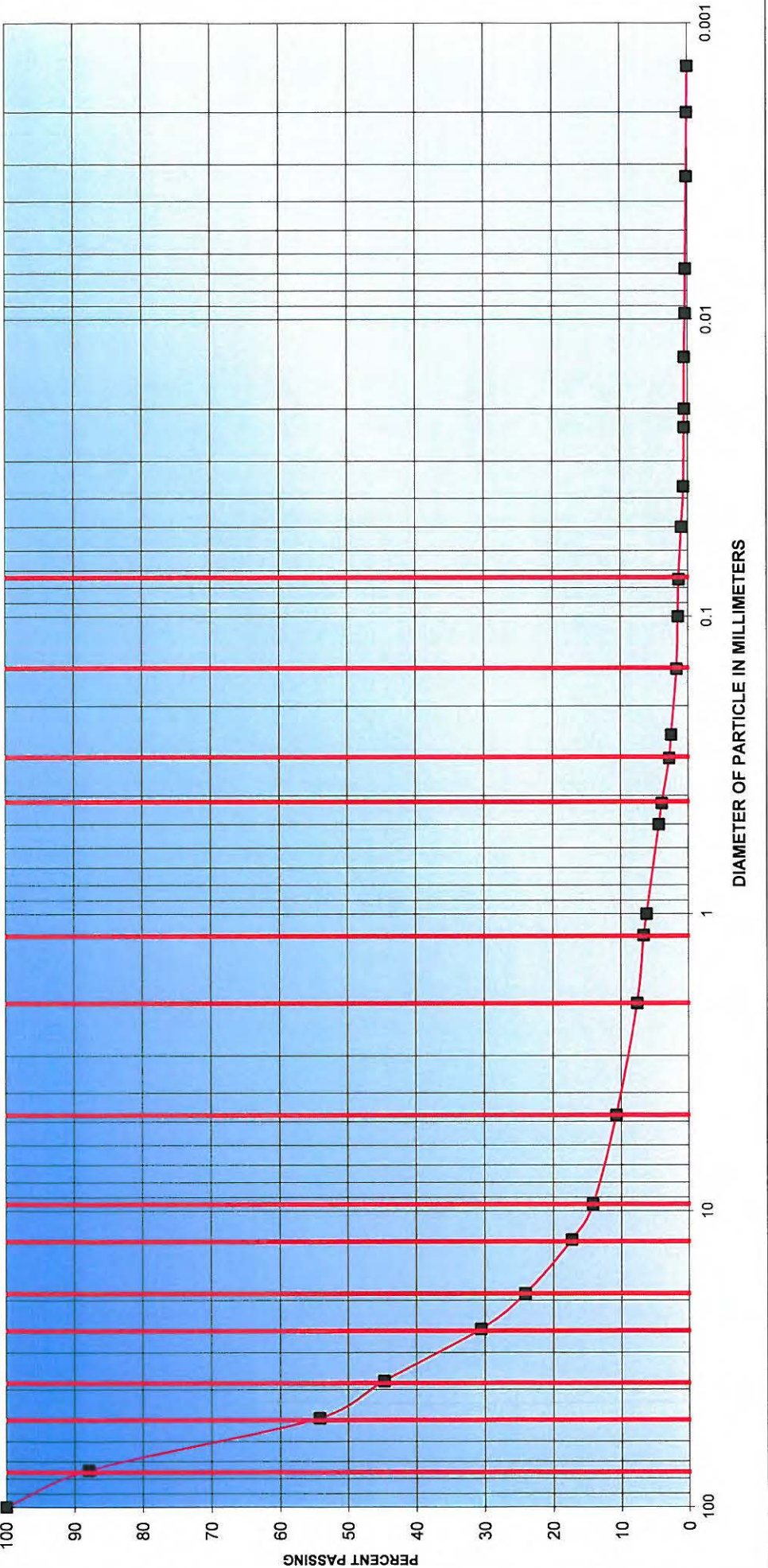
Sample Information

Sample Number: 3563
Sample Location: Site 5, Subpave and Pavement Mix
Aggregate Identification: Delivered By Contractor
Date Sampled: 9/28/2012
Sampled By: Contractor

Gradation Analysis

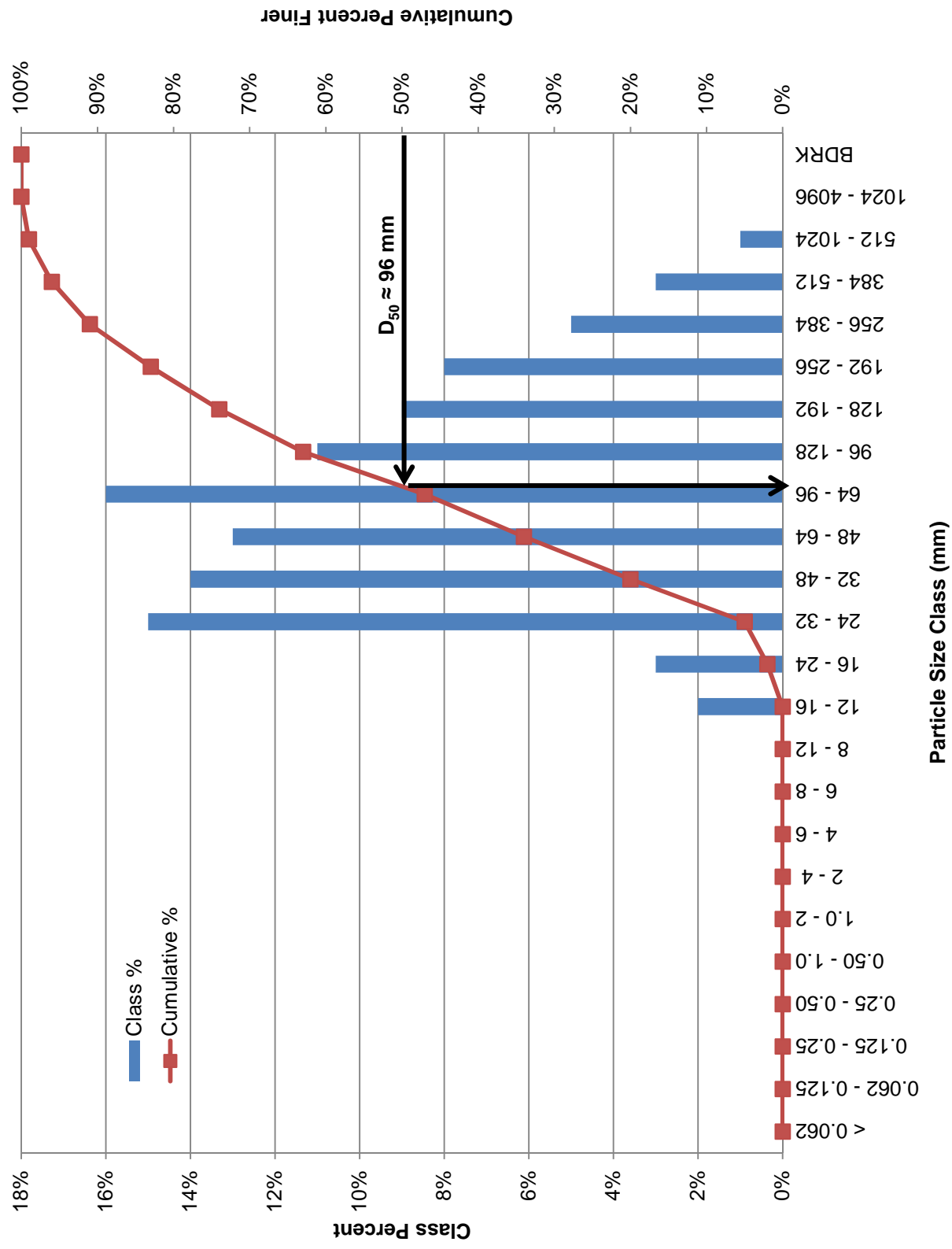
Sieve Size (opening)	Passing (%)
4"	100
3"	88
2"	54
1 1/2"	45
1"	31
3/4"	24
1/2"	17
3/8"	14
#4	11
#10	8
#16	7
#40	4
#50	3
#100	2
#200	1.4

SIEVE ANALYSIS: ASTM C 136 with C 117 or D 1140	HYDROMETER ANALYSIS: ASTM D 422
Sieve Openings: U.S. Standard Sieves	Timed Readings

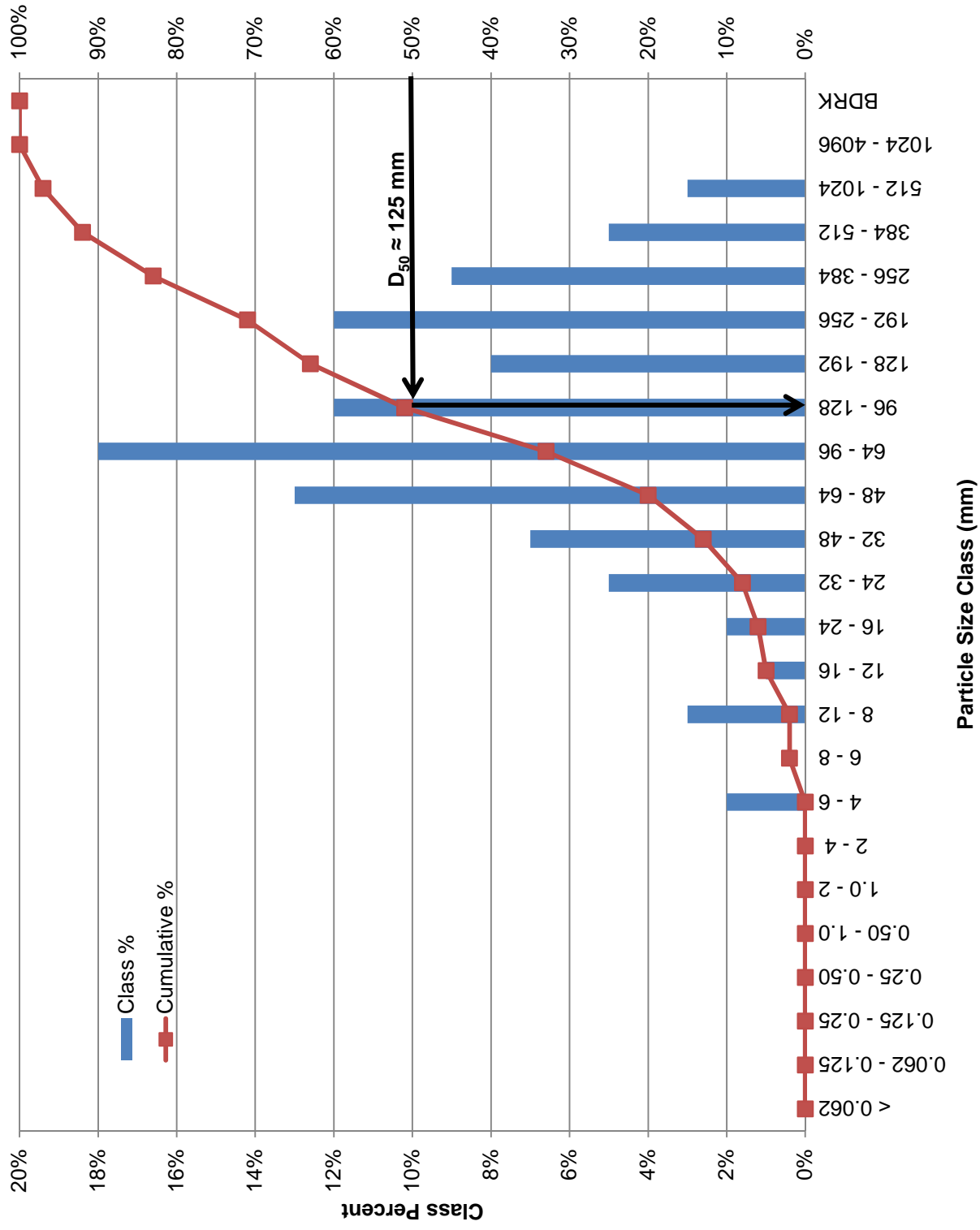


From: Site 5, Subpave and Pavement Mix	Sample of:	Gravel	89%	Medium SAND	Fine SAND	SILT	CLAY
		Coarse GRAVEL					
		Coarse					
Sieve Analysis: ASTM C 136 with C 117 or D 1140		Hydrometer Analysis: ASTM D 422		GRADATION TEST RESULTS			
Sieve Openings: U.S. Standard Sieves		Timed Readings		JOB NO.: 12-1218			
				FIGURE: 3563			

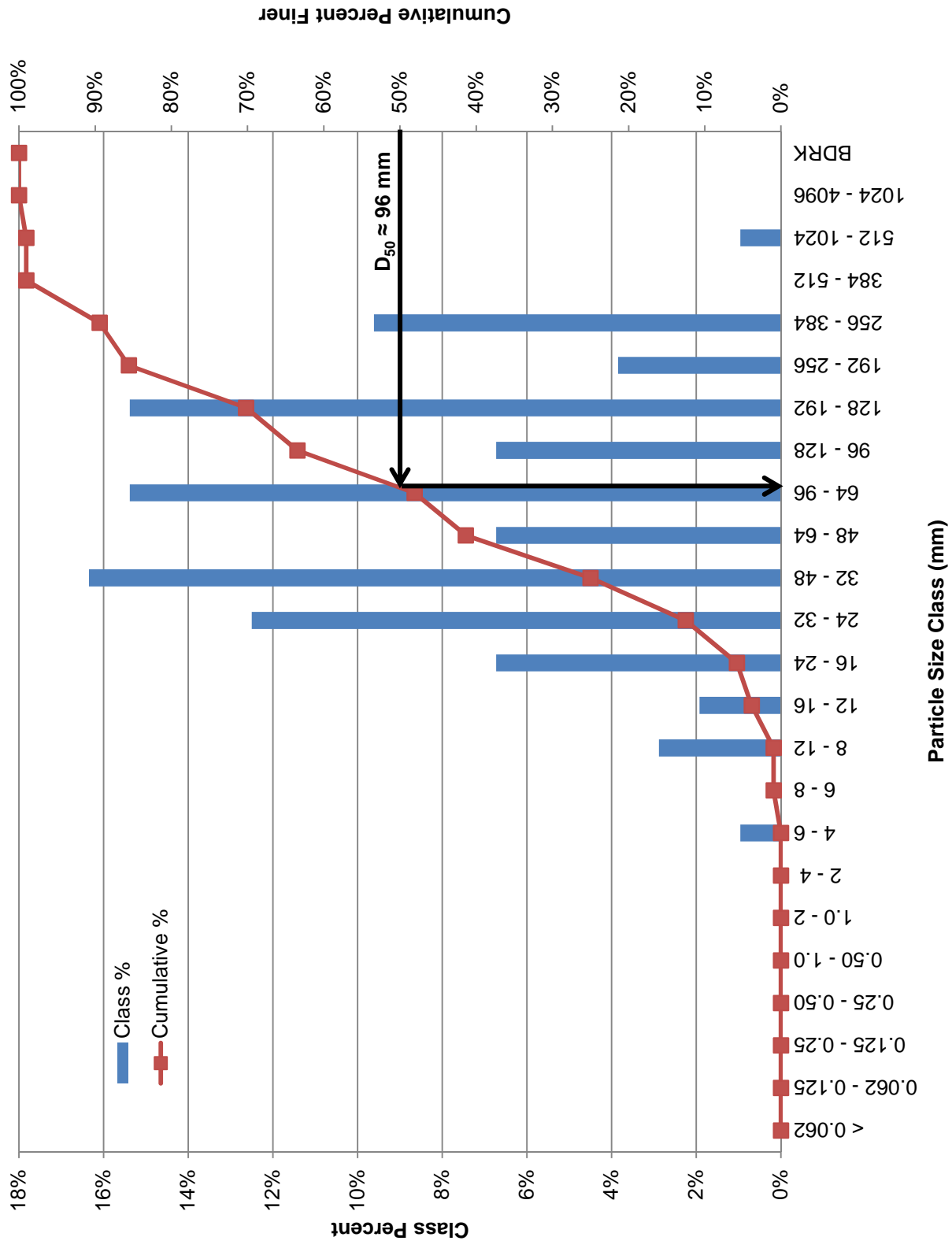
West Fork Terror Creek - Pebble Count from Sample Site 2



West Terror Creek - Pebble Count from Sample Site 3



West Fork Terror Creek - Pebble Count from Sample Site 5



WWE CALCULATION SHEET

Project: Bowie
 Job. No.: 121-014.000
 Date: 09/19/12
 Subject: Sediment Transport Analysis - Existing Conditions

Design: HAL
 Check: IP

Purpose: Task 1: Calculate D50 of the Pavement at each Sample Site along West Fork Terror Creek
 Task 2: Present the Largest Sediment Samples Collected from the Bar Material at each Sample Site along West Fork Terror Creek

References: 1. NRCS, 2007. Rosgen Geomorphic Channel Design. Part 654 Stream Restoration Design National Engineering Handbook
 2. North Carolina Stream Restoration Institute - Stream Restoration, A Natural Channel Design Handbook
 3. Pebble Count Data Collected by WWE on 9/18/2012 and 9/19/2012

Task 1: Calculate D50 of the Pavement at each Sample Site along East Fork Terror Creek

Table 1. Pebble Count Results for 3 Sample Sites in Terror Creek

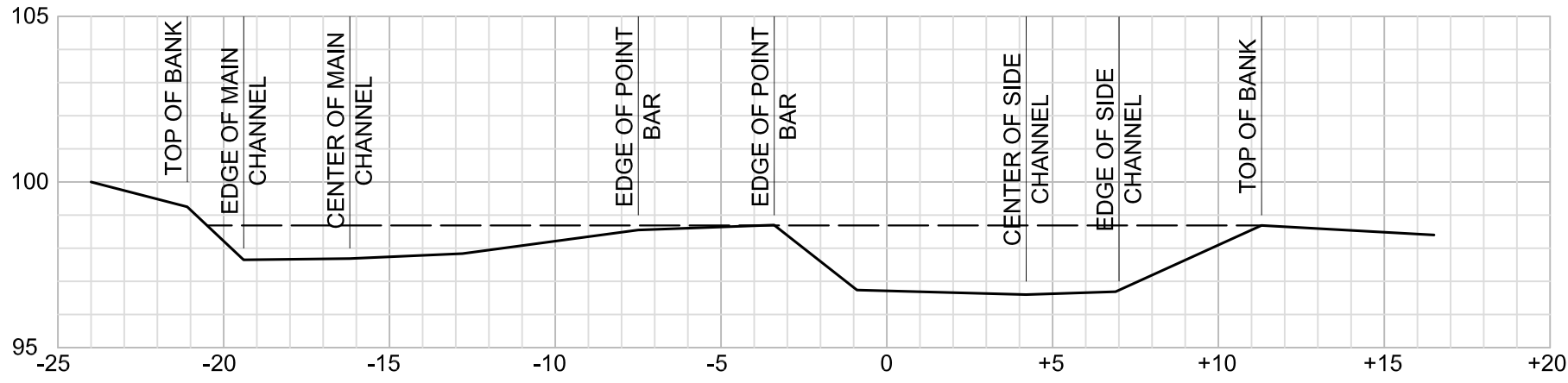
Intermediate Diameter (mm)	Sample Site 2			Sample Site 3			Sample Site 5		
	Pebble Count	Class %	Cumulative %	Pebble Count	Class %	Cumulative %	Pebble Count	Class %	Cumulative %
< 0.062		0%	0%		0%	0%		0%	0%
0.062 - 0.125		0%	0%		0%	0%		0%	0%
0.125 - 0.25		0%	0%		0%	0%		0%	0%
0.25 - 0.50		0%	0%		0%	0%		0%	0%
0.50 - 1.0		0%	0%		0%	0%		0%	0%
1.0 - 2		0%	0%		0%	0%		0%	0%
2 - 4		0%	0%		0%	0%		0%	0%
4 - 6		0%	0%	2	2%	0%	1	1%	0%
6 - 8		0%	0%		0%	2%		0%	1%
8 - 12		0%	0%	3	3%	2%	3	3%	1%
12 - 16	2	2%	0%	1	1%	5%	2	2%	4%
16 - 24	3	3%	2%	2	2%	6%	7	7%	6%
24 - 32	15	15%	5%	5	5%	8%	13	13%	13%
32 - 48	14	14%	20%	7	7%	13%	17	16%	25%
48 - 64	13	13%	34%	13	13%	20%	7	7%	41%
64 - 96	16	16%	47%	18	18%	33%	16	15%	48%
96 - 128	11	11%	63%	12	12%	51%	7	7%	63%
128 - 192	9	9%	74%	8	8%	63%	16	15%	70%
192 - 256	8	8%	83%	12	12%	71%	4	4%	86%
256 - 384	5	5%	91%	9	9%	83%	10	10%	89%
384 - 512	3	3%	96%	5	5%	92%		0%	99%
512 - 1024	1	1%	99%	3	3%	97%	1	1%	99%
1024 - 4096		0%	100%		0%	100%		0%	100%
BDRK		0%	100%		0%	100%		0%	100%
TOTALS	100	100%	100%	100	100%	100%	104	100%	100%

Task 2: Present the Largest Sediment Particles Collected from the Bar Material at each Sample Site along West Fork Terror Creek

Table 2. Largest Particle Obtained from West Fork Terror Creek Bar Samples

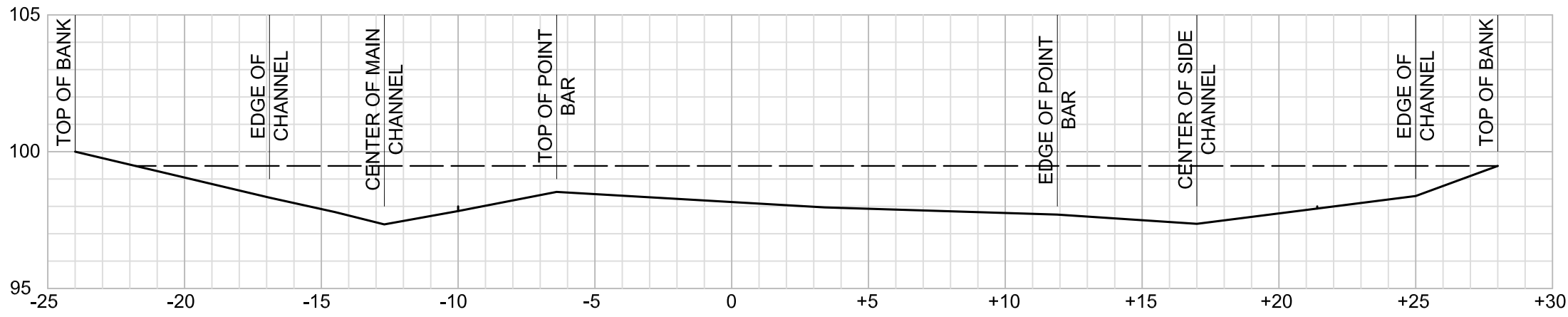
Bar Sample Site	Largest Particle Diameter (mm)	
	Intermediate Axis (d _i)	Longest Axis
Site 2	137	145
Site 3	100	145
Site 5	140	150

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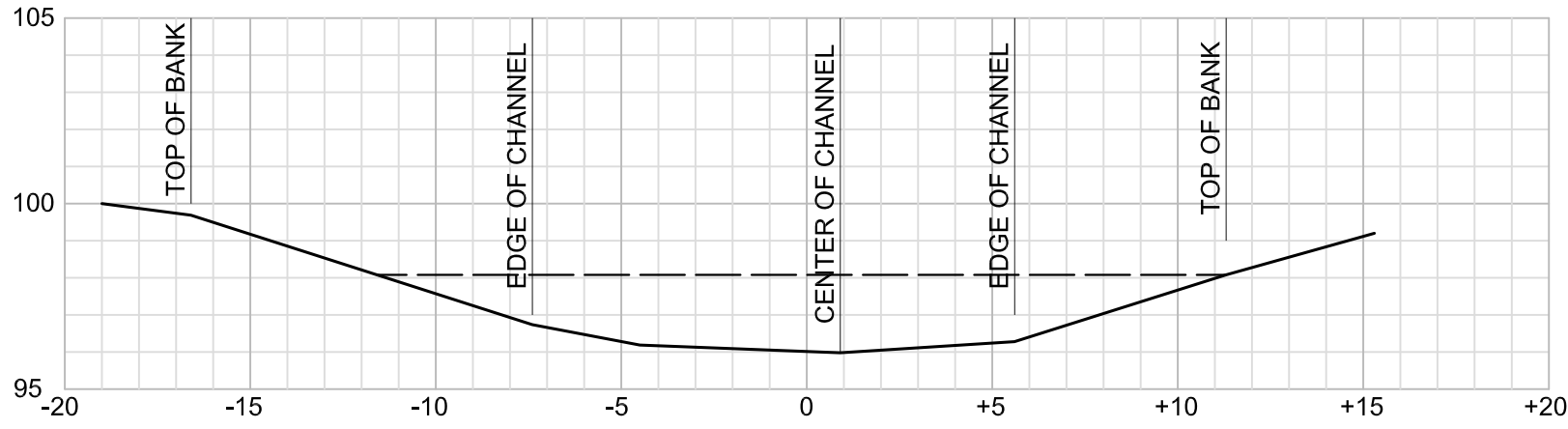


CROSS-SECTION PROPERTIES				
SAMPLE SITE	FLOW AREA (SQFT)	WETTED PERIMETER (FT)	HYDRAULIC RADIUS (FT)	EXISTING SLOPE (FT/FT)
1	32.5	25.7	1.26	0.098
2	70.1	50.5	1.39	0.042
3	32.6	23.4	1.39	0.043
5	23.1	21.1	1.09	0.087

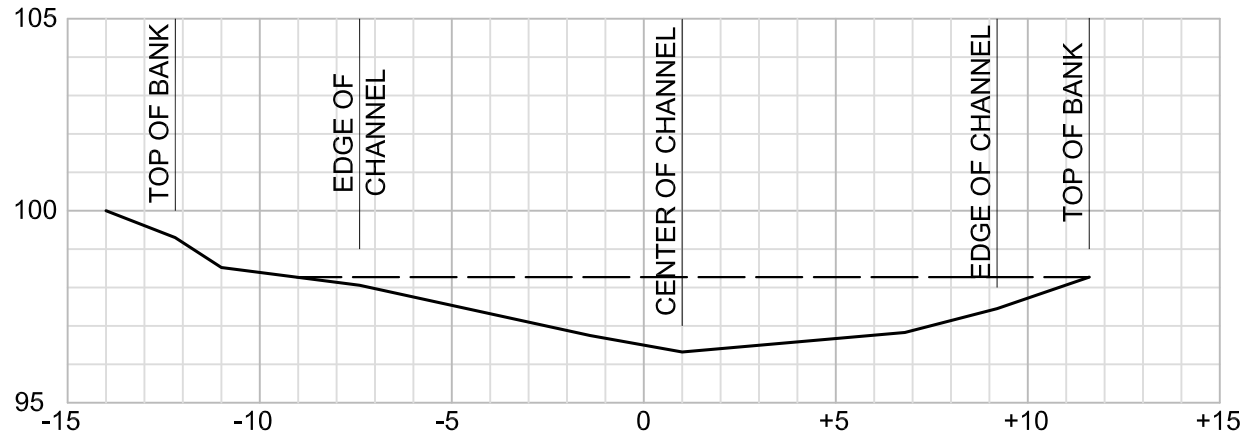
SAMPLE SITE 1 CROSS-SECTION



SAMPLE SITE 2 CROSS-SECTION



SAMPLE SITE 3 CROSS-SECTION



SAMPLE SITE 5 CROSS-SECTION

LEGEND

- EXISTING GRADE
- APPROXIMATE BANKFULL WATER SURFACE ELEVATION



WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. SUITE 100A
DENVER, CO 80211
(303)480-1700 FAX(303)480-1020

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WWE CALCULATION SHEET

Project: Bowie
 Job No.: 121-014.000
 Date: 09/20/12
 Subject: Sediment Transport Analysis - Existing Conditions

Design: HAL
 Check: IP

Purpose: Task 1: Calculate the Critical Dimensionless-Shear-Stress
 Task 2: Calculate the Minimum Bankfull-Mean-Depth and Slope Required for Entrainment
 Task 3: Calculate the Existing Bankfull Shear Stress at Each Sampled Riffle
 Task 4: Calculate the Bankfull Shear Stress at Each Sampled Riffle with a 1% Increase in Average Stream Slope
 Task 5: Calculate the Bankfull Shear Stress at Each Sampled Riffle with a 2% Increase in Average Stream Slope

- References: 1. NRCS, 2007. Rosgen Geomorphic Channel Design. Part 654 Stream Restoration Design National Engineering Handbook.
 2. North Carolina Stream Restoration Institute - Stream Restoration, A Natural Channel Design Handbook
 3. Ground Engineering Sediment Particle Distribution Analysis. Samples Collected by WWE on 9/18/2012 and 9/19/2012

Task 1: Calculate the Critical Dimensionless-Shear-Stress for all Sample Sites

Step 1: Calculate the following ratios

$$\text{Ratio 1} \quad d_{50(pavement)} / d_{50(subpavement)}$$

$$\text{Ratio 2} \quad d_{l(subpavement)} / d_{50(pavement)}$$

Step 2.1: If ratio 1 is between 3.0 and 7.0 calculate the Critical Dimensionless-Shear-Stress as:

$$\tau_{cl} = 0.0834 \left[\frac{d_{50(pavement)}}{d_{50(subpavement)}} \right]^{-0.872}$$

Step 2.2: If ratio 1 is not between 3.0 and 7.0, and ratio 2 is between 1.3 and 3.0 calculate the Critical Dimensionless-Shear-Stress as:

$$\tau_{cl} = 0.0384 \left[\frac{d_{l(subpavement)}}{d_{50(pavement)}} \right]^{-0.887}$$

Sample Location	Pavement d ₅₀ (inches)	Subpavement d ₅₀ (inches)	Subpavement d _l (inches)	d ₅₀ Subpavement to Pavement Ratio	d _l Subpavement to Pavement Ratio	Critical Dimensionless Shear Stress (τ _{cl}) (lbs/ft ²)
Site 1	2.13	0.48	6.00	4.4	2.8	0.023
Site 2	3.78	1.3	5.40	2.9	1.4	0.028
Site 3	4.92	1.6	3.94	3.1	0.8	0.031
Site 5	3.78	1.7	4.90	2.2	1.3	0.031

Task 2: Calculate the Minimum Bankfull-Mean-Depth Required for Entrainment

Step 1: Calculate the minimum bankfull mean depth required for entrainment of the largest bed material particle

$$D_r = \left[\frac{1.65 \times \tau_{cl} \times d_l}{S_e} \right]$$

Step 2: Calculate the bankfull water surface slope required for entrainment of the largest bed material particle

$$S_r = \left[\frac{1.65 \times \tau_{cl} \times d_l}{D_e} \right]$$

Sample Location	Critical Dimensionless Shear Stress (τ _{cl})	Largest Particle Size D _l in bar sample (or subpavement sample) (ft)	Existing Slope (ft/ft)	Existing Bankfull Area (ft ²)	Existing Bankfull Width (ft)	Existing Mean Bankfull Depth (ft)	Bankfull Mean Depth Required D _r (ft)	Bankfull Water Surface Slope Required S _r (ft)
Site 1	0.023	0.50	0.098	32.5	31.5	1.03	0.19	0.018
Site 2	0.028	0.45	0.042	70.1	49.8	1.41	0.49	0.015
Site 3	0.031	0.33	0.043	32.6	22.9	1.42	0.39	0.012
Site 5	0.031	0.41	0.087	23.1	20.6	1.12	0.24	0.018

Sample Location	Critical Dimensionless Shear Stress (τ _{cl})	Largest Particle Size D _l in bar sample (or subpavement sample) (ft)	1 % Increase in Slope (ft/ft)	2 % Increase in Slope (ft/ft)	1% Increase Bankfull Mean Depth Required D _r (ft)	2% Increase Bankfull Mean Depth Required D _r (ft)	% Decrease from Existing 1% Increase in Slope 2% Increase in Slope
Site 1	0.023	0.50	0.108	0.118	0.16	0.34	9% 17%
Site 2	0.028	0.45	0.052	0.062	0.40	0.34	19% 32%
Site 3	0.031	0.33	0.063	0.063	0.27	0.27	19% 32%
Site 5	0.031	0.41	0.097	0.107	0.21	0.19	10% 19%

Task 3: Calculate the Existing Bankfull Shear Stress at Each Sampled Riffle

Step 1: Calculate the shear stress at each riffle cross section

$$\tau = \gamma \times R \times S$$

Sample Location	Bankfull Area (A) (ft ²)	Wetted Perimeter (ft) (P)	Hydraulic Radius (R) (ft)	Existing Average Stream Slope (ft/ft)	Shear Stress (lbs/ft ²) (τ)
Site 1	32.50	25.7	1.26	0.0675	5.33
Site 2	70.10	50.5	1.39	0.0675	5.85
Site 3	32.60	23.4	1.39	0.0675	5.87
Site 5	23.10	21.1	1.09	0.0675	4.61

Task 4: Calculate the Bankfull Shear Stress at Each Sampled Riffle with a 1% Increase in Average Stream Slope.

Sample Location	Bankfull Area (A) (ft ²)	Wetted Perimeter (ft) (P)	Hydraulic Radius (R) (ft)	1% Increase in Average Stream Slope (ft/ft)	Shear Stress (lbs/ft ²) (τ)
Site 1	32.50	25.7	1.26	0.0775	6.12
Site 2	70.10	50.5	1.39	0.0775	6.71
Site 3	32.60	23.4	1.39	0.0775	6.74
Site 5	23.10	21.1	1.09	0.0775	5.29

Task 5: Calculate the Bankfull Shear Stress at Each Sampled Riffle with a 2% Increase in Average Stream Slope.

Sample Location	Bankfull Area (A) (ft ²)	Wetted Perimeter (ft) (P)	Hydraulic Radius (R) (ft)	2% Increase in Average Stream Slope (ft/ft)	Shear Stress (lbs/ft ²) (τ)
Site 1	32.50	25.7	1.26	0.0875	6.90
Site 2	70.10	50.5	1.39	0.0875	7.58
Site 3	32.60	23.4	1.39	0.0875	7.61
Site 5	23.10	21.1	1.09	0.0875	5.98

APPENDIX 3

FINAL REPORT



WEST FORK TERROR CREEK-SPRUCE STOMP LEASE AREA- 2012 FISH POPULATION AND MACROINVERTEBRATE SAMPLING RESULTS

**Prepared For:
Bowie Resources, LLC
Paonia, Colorado**

**Prepared By:
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And
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Fort Collins, Colorado**



January 21, 2013



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CONSULTANTS, INC.**
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Introduction

A Biological Assessment (BA) was completed by WestWater Engineering for the Bureau of Land Management for Bowie Resources, LLC's (Bowie) currently approved operations in the Terror Creek watershed. Biological data for the BA came from existing data from Colorado Parks and Wildlife and the US Forest Service. Forest Service fish sampling included genetic analysis of the cutthroat trout. The genetics results showed that the trout were Lineage GB cutthroat trout (Dare et al. 2011). A recommendation for additional monitoring of the fish populations was made during the discussions for the BA. Bowie Resources, LLC is also requesting that the Forest Service and Bureau of Land Management lease the Spruce Stomp Lease Area for subsurface coal extraction. The Spruce Stomp Lease Area includes the studied portion of West Fork Terror Creek. The purposes of the 2012 sampling that is presented here are to satisfy the previous requests that Bowie monitor West Fork Terror Creek fish populations and to establish baseline conditions for future comparative purposes in the event that mining is permitted to occur in this area.

Study Area

The study area is West Fork Terror Creek from the confluence with East Fork Terror Creek to a point approximately 0.25 miles upstream of Stevens Gulch Road. Five sites were sampled for both fish and benthic macroinvertebrates. Site 1 is the downstream-most site and is about 200 feet upstream of the confluence with East Terror Creek (Figure 1). Site 2 is 0.5 mile upstream of Site 1. Terror Creek Road crosses the creek between these two sites. The culvert that is present under the road has created a barrier that is unlikely to be passable for fish except at high flows. Site 3 is approximately 1.3 miles upstream of Site 2 and 0.5 mile downstream of Stevens Gulch Road. Site 4 begins 300 feet downstream from Stevens Gulch Road and ends at the large culvert under the road. Site 5 is approximately 0.6 miles upstream from Stevens Gulch Road. Each site was approximately 300 feet long (Table 1). The benthic macroinvertebrate multi-metric index (MMI) sample site (discussed below) was located immediately upstream of Stevens Gulch Road.

Study Components and Objectives

The objective of the fish study was to provide additional information about the fish population within West Fork Terror Creek. The specific goals of this study were to describe the relative differences, if any, in the density, biomass, and structure of the fish population between the five sites. The estimation of multiple population parameters is a valid and robust means of characterizing a population and aids in the analytical comparison among fish populations experiencing different habitat conditions.

The objective of the macroinvertebrate study was to identify baseline status of macroinvertebrate populations in the West Fork Terror Creek project area. Information about the macroinvertebrate community is useful not only in describing the availability of food for trout but also because certain macroinvertebrate metrics are indicators of water quality and ecological stream functions.

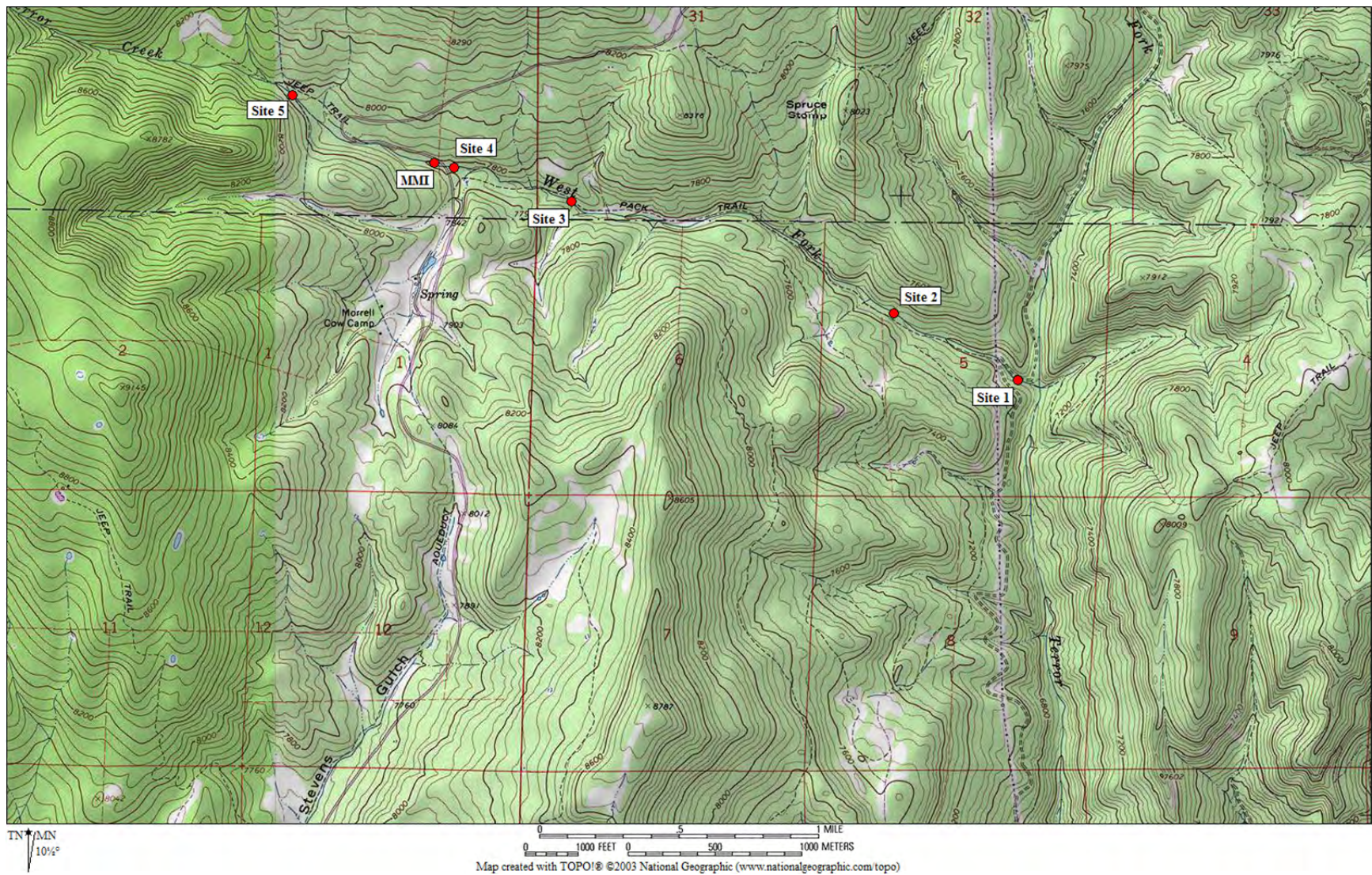


Figure 1. Sampling sites on West Fork Terror Creek.

Table 1. Site lengths, average widths, length of site in terms of stream width, and UTM coordinates (UTM Zone 13).

Site	Length (ft)	Avg. Width (ft)	Stream Lengths	UTM Northing (m)*	UTM Easting (m)*
1	300	10	30	4314225	276808
2	290	13	22	4314625	276083
3	310	9	34	4315309	274236
4	300	11	27	4315781	272849
5	300	9	33	4315954	272640

*Coordinates are for the downstream end of the site.

Methods

Fish

The methodology and analytical techniques described below are generally accepted practices for the purpose of comparing fish populations among sites. A Smith-Root 15B Backpack electrofishing unit was used at all sites. Backpack electrofishing is the common method employed in this size of stream and was the method used for this study. The standard practice for population estimates uses a multiple-pass depletion methodology to achieve the industry-standard depletion rate. Typically, two passes are made at each site. If the capture probability of trout greater than 6 inches falls below 80% then a third pass is completed. For this study, two passes were made at each site with the exception of Site 1, which required a third pass.

West Fork Terror Creek was sampled for fish on September 18 and 19, 2012. Captured fish were processed using standard methods: process fish from each pass separately, weigh to nearest 0.1 gram (g), and measure to nearest millimeter (mm). All collected fish data were entered into the program JakeOmatic from Colorado Parks and Wildlife (CPW) for analysis. JakeOmatic does not calculate population parameters for sites in which more than two passes were made. Instead, for Site 1, the program MicroFish from the American Fisheries Society Computer User Section was used. For population density, the 95% confidence interval about the population estimate (for the site) was calculated for each species and also reported as numbers of fish per acre and fish per mile. Biomass was calculated based on surface area of the sampling area as determined from wetted width and length measurements in the field and reported as pounds per acre. Population structure was determined by categorizing size classes of fish from each site into 10-mm increments and calculating the frequency of fish in each category.

Genetic material was collected from trout captured in West Fork Terror Creek for analysis of the genetic strain of cutthroat trout. These data supplement the data collected in 2010 by the Forest Service. A small portion of the upper lobe of the caudal fin was removed from 6 fish at each site, for a total of 30

fish. We followed the protocol for sample collection and storage as suggested by CPW (Rogers 2007). Samples were submitted to Pisces Molecular Lab (Boulder, CO) for analysis.

Macroinvertebrates

Benthic macroinvertebrate sampling occurred on September 17, 2012, before any of the sites were sampled for fish. At each site, three replicate samples were taken from riffle habitat using a Surber sampler. Selection of specific sampling locations was based on similarity of habitat characteristics. An effort was made to take all samples in areas of similar-sized substrate and similar depth in order to avoid bias that may be associated with these variables. Substrate within the sampler was thoroughly agitated and individual rocks were scrubbed by hand to dislodge all benthic organisms. All macroinvertebrates were rinsed into sample jars and preserved in a 70% ethanol solution. Each sample jar contained labels (with date, location and sample ID number) on the inside and outside of the jar. Samples were returned to the laboratory where specimens were sorted using a 600 count subsample in a gridded sorting tray using a random selection process for selecting the sorting grids. All sorted macroinvertebrates were identified to the lowest practical taxonomic level (Merritt and Cummins 1996; Ward et al. 2002) and then dried and weighed for biomass estimates. Identification to the “lowest practical taxonomic level” means that all specimens are identified down to the level that is permitted by the available morphological characteristics. Early life stages of many species sometimes lack certain anatomical characteristics that allow the specimen to be identified to the genus or species level. In these cases the “lowest practical taxonomic level” may mean only the family level; however, if the available characteristics are consistent with a species that has been previously confirmed during this study then the individual may be included as a member of that taxon. As a means of quality assurance, qualified personnel inspected each sample after sorting to ensure that less than 5% of total sorted invertebrates remained in the sample. Any samples with more than 5% were resorted and individual specimens removed to the appropriate container for identification. Macroinvertebrate species lists were developed for all 5 sites, as well as the MMI site. Data were used in various indices recommended by the Environmental Protection Agency’s Rapid Bioassessment Protocols (Barbour et al. 1999) to provide information regarding macroinvertebrate community structure, function, and general aquatic conditions. The following paragraphs provide descriptions of each index (metric) that was used in this study.

A measure of macroinvertebrate standing crop at each site was determined using density and biomass. Macroinvertebrate density was reported as the mean number of macroinvertebrates per square meter found at each location. Biomass was reported as the mean dry weight of macroinvertebrates per square meter at each site location. Biomass values were obtained by drying macroinvertebrates from each sample in an oven at 100° C for 24 hours or until all water content had evaporated (no decrease in weight could be detected). Biomass values offer production-related information in terms of quantitative weight of macroinvertebrates produced at each site. Density and biomass provide a means of measuring and comparing standing crop and provide an indication of productivity for the macroinvertebrate portion of the food web at each sampling location.

Shannon-Weaver diversity (diversity) and evenness (evenness) values were used to detect changes in macroinvertebrate community structure. In pristine waters, diversity values typically range from near 3.0 to 4.0. In polluted waters this value is generally less than 1.0. The overall evenness value ranges between 0.0 and 1.0, with values lower than 0.3 indicative of organic pollution (Ward et al. 2002). Diversity and evenness are similar measurements because they both rely heavily on the numerical distribution of taxa (although taxa richness also influences diversity). Both indices are designed to detect unbalance in communities (where a few species are represented by a large number of individuals). These situations are usually the result of pollution/disturbance-induced changes to the aquatic community. Diversity and evenness were used in this study as a surrogate for water quality monitoring. They are not necessarily sensitive indicators of sediment-related problems; however, some sediment-induced changes related to microhabitat availability might influence these values.

The Ephemeroptera, Plecoptera, Trichoptera (EPT) index was employed to assist in the analysis of data. The EPT index is reported as the total number of distinguishable taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera found at each site. It is a direct measure of taxa richness among species that are generally considered to be sensitive to disturbances (Barbour et al. 1999). Most macroinvertebrate species have specific habitat requirements. The value produced by this metric will indicate locations with preferred habitat as well as areas of disturbance or habitat modification. This value may vary spatially if a change in location results in a change in physical habitat features. Results provided by this metric will naturally vary among river systems, but are valuable when comparing samples taken from the same stream reach. The EPT index was used in analysis of this data to monitor the distribution of disturbance-sensitive species.

Taxa richness was also reported for each location in the study area. This measurement is simply reported as the total number of identifiable taxa collected from each site. It is similar to the EPT index, except that it includes all aquatic macroinvertebrate species (including those that are thought to be tolerant to disturbance). Taxa richness is useful when describing differences in habitat complexity or aquatic conditions between rivers or site locations. Taxa richness values also provide an indication of habitat preference and complexity. Increasing richness correlates with increasing health of the macroinvertebrate community.

The Hilsenhoff Biotic Index (HBI) is often used in macroinvertebrate studies as a means of detecting organic enrichment. Organic pollution includes such factors as sewage runoff, feedlot or grazing area runoff, and other types of contaminants that deplete dissolved oxygen from the water. Because the HBI requires modification for use in many areas, the number indicating a certain water quality rating will vary among regions. Comparison of the values produced within a given system should, however, provide information regarding differences in sites based on nutrient enrichment. Values for the HBI range from 0 to 10 and increase as water quality decreases (Barbour et al. 1999).

An analysis of macroinvertebrate functional feeding groups was also conducted. This metric provides a measurement of macroinvertebrate community function as opposed to other metrics that measure community structure. Aquatic macroinvertebrates were categorized according to feeding strategy to determine the relative proportion of various groups. Taxa were placed into functional feeding groups based on acquisition of nutritional resources (Merritt and Cummins 1996; Ward et al. 2002). The

proportion of certain functional feeding groups in the macroinvertebrate community can provide insight to various types of stress in river systems (Ward et al. 2002). River ecosystems that provide a variety of feeding opportunities usually maintain good representation of each corresponding functional feeding group. Numerous variables (including habitat quality) may affect the proportions of certain functional feeding groups. A measure of functional feeding groups is often recommended as part of benthic macroinvertebrate analysis and evaluation (Ward et al. 2002). Typically the collector-gatherer group is dominant in western streams, but other groups should be well represented.

The Colorado Water Quality Control Division developed the Multi-Metric Index (MMI), a bioassessment tool composed of separate metrics that respond to stressors affecting aquatic communities (Colorado Water Quality Control Commission (CWQCC) 2010a). The MMI is used to determine if a water body supports aquatic life uses as described in Water Quality Control Commission Regulation No. 31: Basic Standards and Methodologies for Surface Water (CWQCC 2010b). The MMI is designed to detect environmental stressors that result in the alteration of the aquatic community, but it does not identify specific stressors. The metrics used in the MMI depend on the biotype of the area. For this study the biotype was Biotype 1: Transition. The metrics selected for the Biotype 1 MMI represent categories of community characteristics such as richness, composition, functional feeding group, mode of locomotion, and pollution tolerance. To calculate the MMI for a site, data are entered into the Colorado Ecological Data Application System (EDAS), which generates an MMI score based on a 300-count subsample of the data. Scores range from 0 to 100. For Biotype 1, the attainment threshold is 52. This means that water bodies with an MMI score of at least 52 support aquatic life uses as defined by CWQCC. The MMI sample was collected using the protocol specified in Policy Statement 10-1, Appendix B (CWQCC 2010a).

Other indices that were calculated include: number of Ephemeroptera (mayfly) taxa, number of Plecoptera (stonefly) taxa, number of Trichoptera (caddisfly) taxa, % EPT, % Ephemeroptera, number of intolerant taxa (tolerance values of 0 or 1), % tolerant organisms (tolerance value of 10), and % non-insect organisms.

Results and Discussion

Fish

Electrofishing Results

Cutthroat trout, mottled sculpin (*Cottus bairdi*), and speckled dace (*Rhinichthys osculus*) were the three species captured during the survey. Speckled dace were only captured at Site 1. Mottled sculpin were captured at sites 2-5 (Table 2). Caudal fin clips were taken from 30 trout and submitted for genetic analysis. The results are discussed in the next section. The trout were categorized as lineage GB cutthroat trout (*Oncorhynchus clarkii stomias*) or the current common name “greenback” cutthroat trout. For simplicity we use the term “cutthroat trout” or “trout” in this report. For trout greater than 150 mm total length, density was greatest at Site 2 (in terms of fish per mile) and Site 5 (in terms of fish per acre) (Figure 2 and Figure 3). For all sizes of trout, density was greatest at Site 5 (Figure 4 and Figure

5). Biomass was greatest at Site 5 for both trout greater than 150 mm total length and trout of all sizes, followed by Site 2 (Figure 6 and Figure 7).

There are multiple year classes of trout present in the West Fork Terror Creek. The majority of trout were between 130 and 180 mm (Figure 8) at most of the sites. The exception was Site 3, which also had many trout in the 60-80 mm range. No trout were larger than 250 mm (10 inches), but this is typical for small streams such as the West Fork Terror Creek. The length frequency for fish at each individual site is presented in Appendix A.

Overall, sites 5 and 2 had the greatest trout density and biomass. Site 4 had the least amount of trout density and biomass. Population structure was not noticeably different between sites. It seems likely that the culvert on Terror Creek Road between sites 1 and 2 is an upstream barrier to speckled dace, given that dace were only found at Site 1. In addition, the large culvert on Stevens Gulch Road, which separates sites 4 and 5 is a barrier at low flows.

Table 2. Fish metrics for sites on West Fork Terror Creek.

Species	Data	Site 1	Site 2	Site 3	Site 4	Site 5
Cutthroat trout (≥ 150 mm)	Count	20	36	20	18	34
	Average Total Length (mm)	171	172	176	170	168
	Average Weight (g)	49	48	49	49	45
	Population Estimate ¹	20 ± 2	36 ± 1	20 ± 1	18 ± 1	34 ± 1
	Fish / mile	352 ± 35	659 ± 24	341 ± 9	319 ± 24	600 ± 14
	Fish / acre	290 ± 29	418 ± 15	312 ± 8	239 ± 18	550 ± 13
	Lbs. / acre	32 ± 8	44 ± 2	34 ± 1	26 ± 2	55 ± 1
Cutthroat trout (all sizes)	Count	32	51	45	21	74
	Average Total Length (mm)	143	146	126	162	139
	Average Weight (g)	35	37	27	44	29
	Population Estimate ¹	32 ± 2	52 ± 2	47 ± 5	21 ± 1	75 ± 3
	Fish / mile	563 ± 35	943 ± 45	799 ± 79	372 ± 21	1319 ± 47
	Fish / acre	465 ± 29	598 ± 29	733 ± 72	279 ± 16	1209 ± 43
	Lbs. / acre	36 ± 11	48 ± 2	43 ± 4	27 ± 2	78 ± 3
Mottled sculpin	Count	—	1	2	1	15
	Average Total Length (mm)	—	135	123	120	106
	Average Weight (g)	—	31	26	24	18
	Population Estimate ¹	—	—	—	—	16 ± 3
	Fish / mile	—	—	—	—	276 ± 59
	Fish / acre	—	—	—	—	253 ± 54
	Lbs. / acre	—	—	—	—	10 ± 2
Speckled dace	Count	40	—	—	—	—
	Average Total Length (mm)	72	—	—	—	—
	Average Weight (g)	6	—	—	—	—
	Population Estimate ¹	44 ± 8	—	—	—	—
	Fish / mile	774 ± 141	—	—	—	—
	Fish / acre	639 ± 116	—	—	—	—
	Lbs. / acre	8 ± 3	—	—	—	—

¹ All confidence intervals are 95%

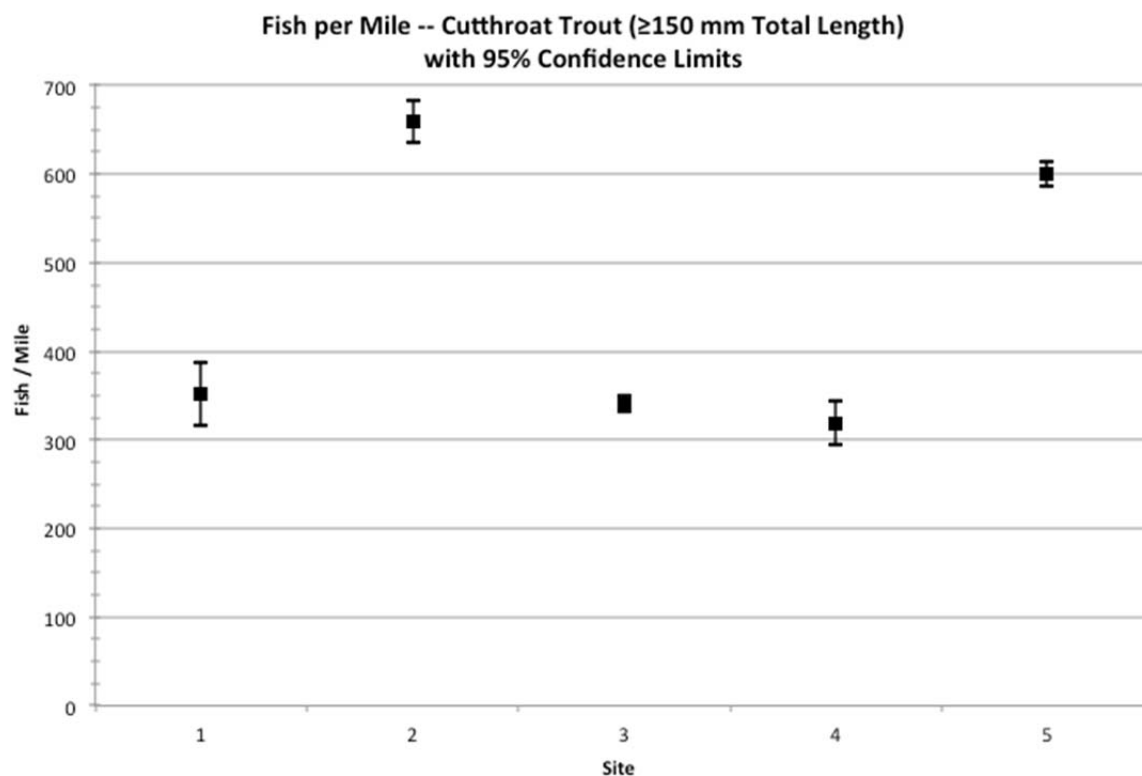


Figure 2. Population density (fish per mile) of trout greater than 150 mm total length.

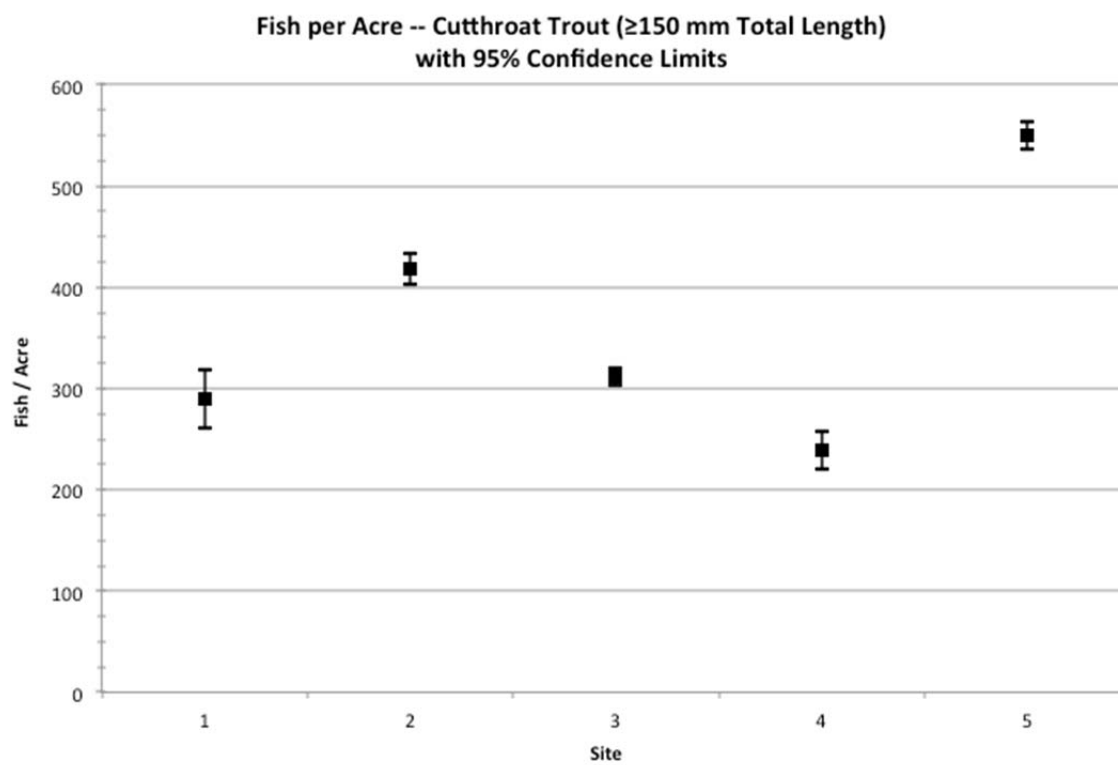


Figure 3. Population density (fish per acre) of trout greater than 150 mm total length.

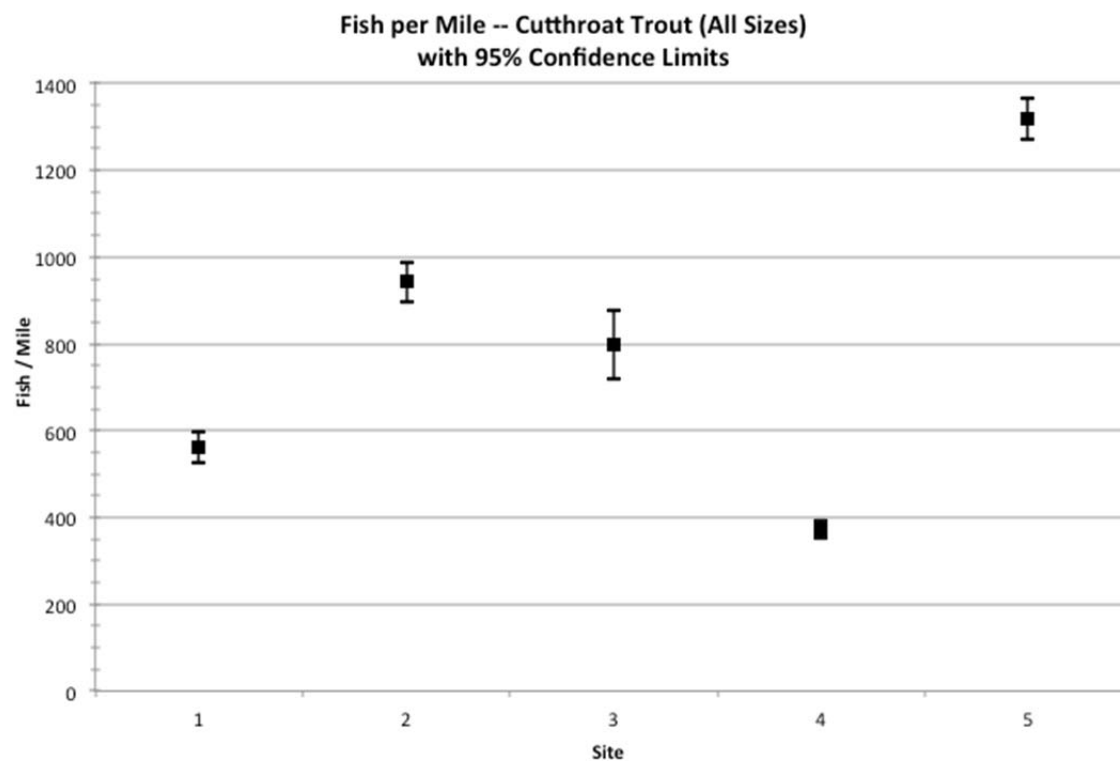


Figure 4. Population density (fish per mile) of trout of all sizes.

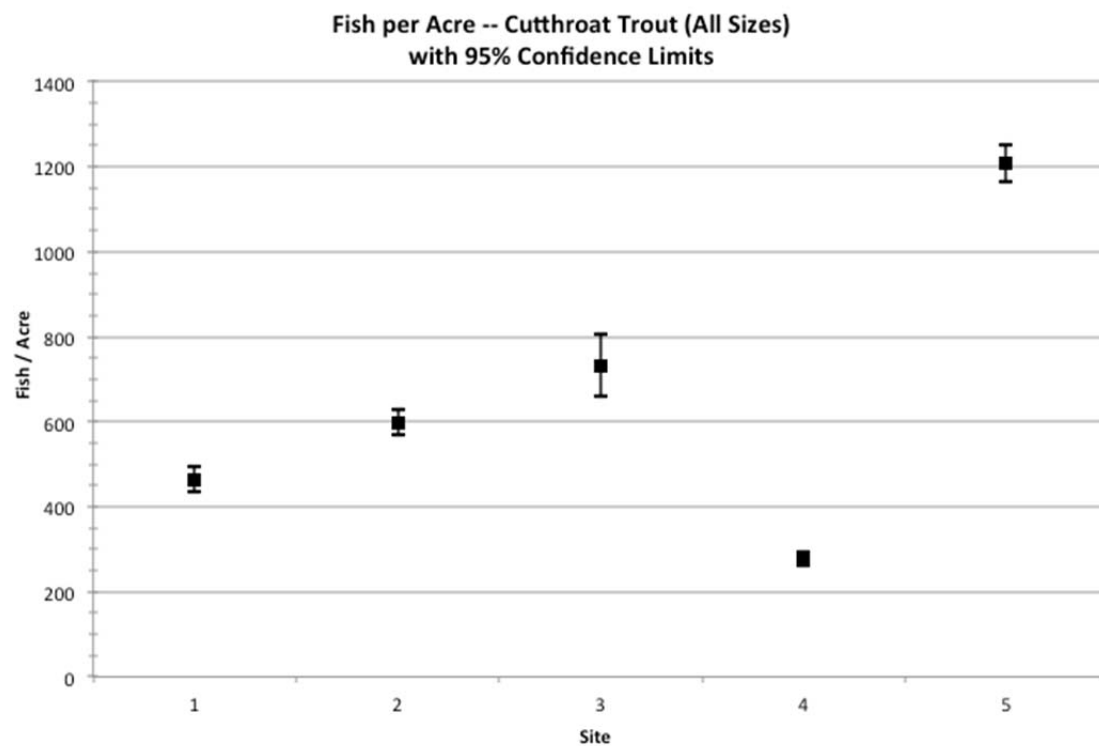


Figure 5. Population density (fish per acre) of trout of all sizes.

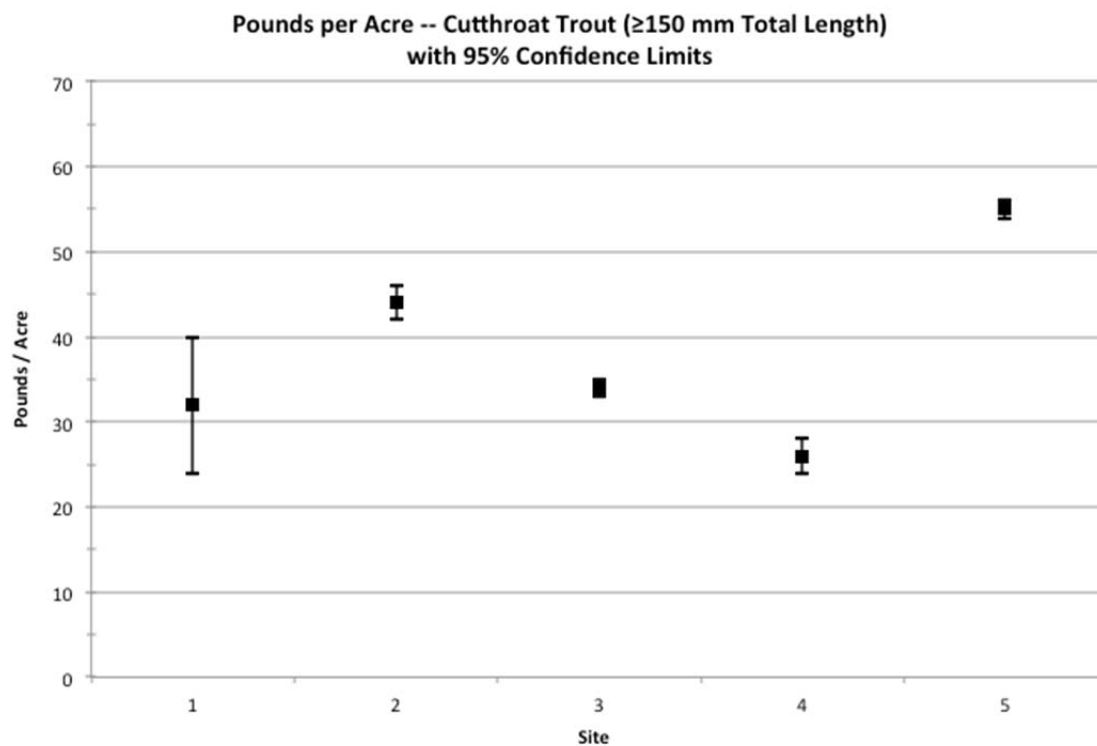


Figure 6. Biomass (pounds per acre) of trout greater than 150 mm total length.

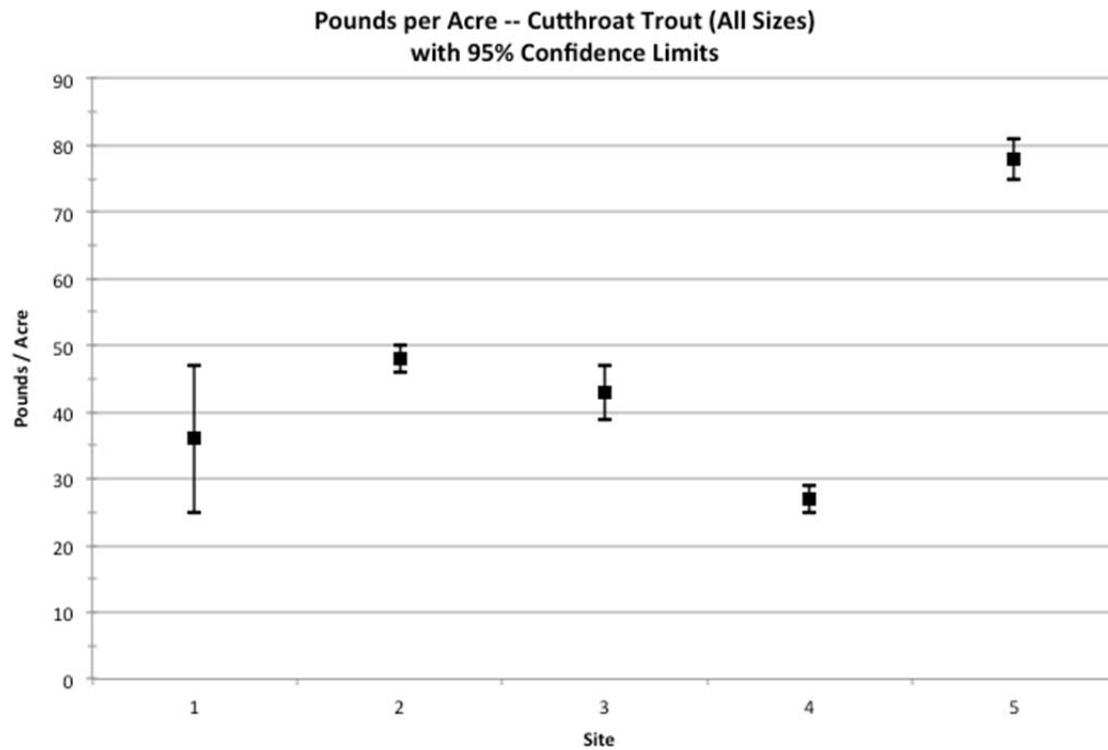


Figure 7. Biomass (pounds per acre) of trout of all sizes.

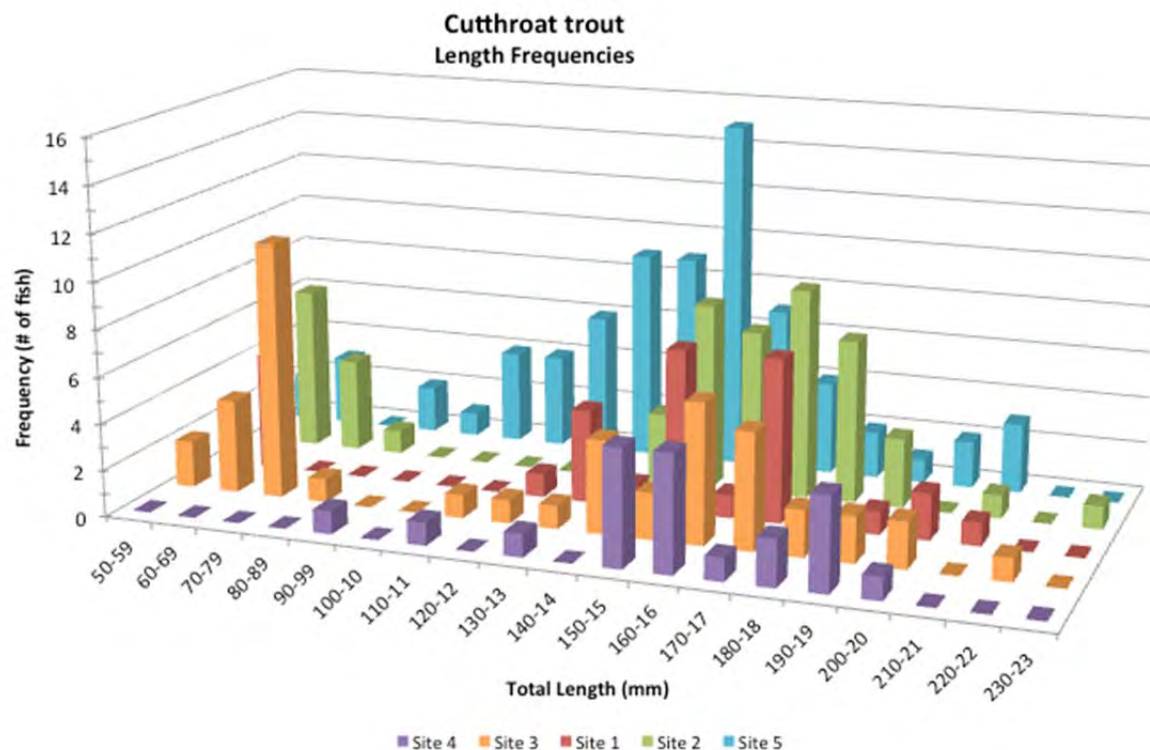
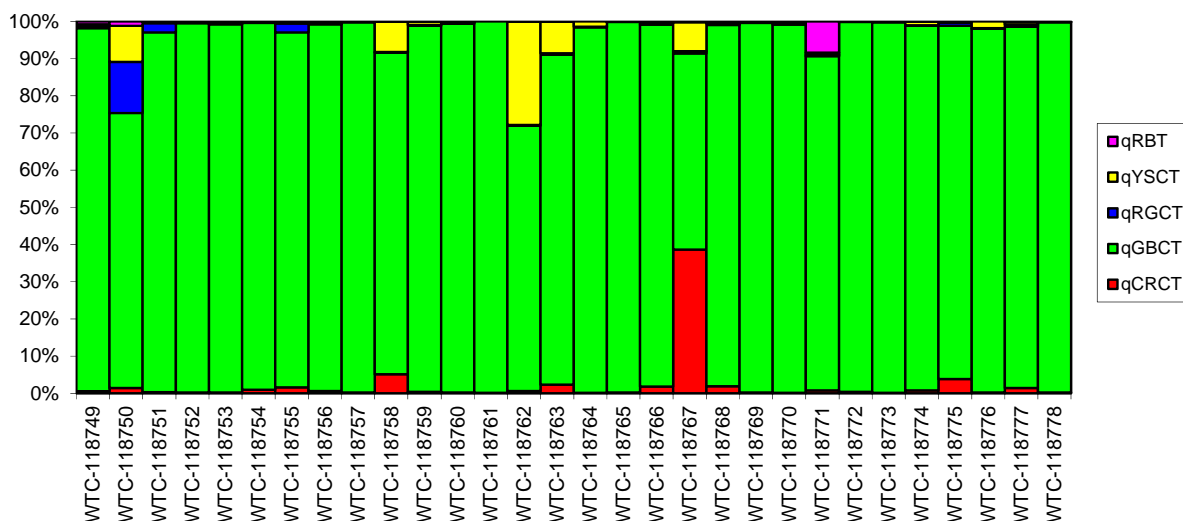


Figure 8. Cutthroat trout length frequencies.

Genetic Analysis

Results from the genetic analysis indicated that our sample of 30 fish were 94% lineage GB (Figure 9). These results are similar to the sampling and genetic analysis conducted in 2010, which found the trout in West Fork Terror Creek were predominately lineage GB (Dare et al. 2011). See Appendix A for genetic percentages for individual fish from the current study.

West Terror Creek Individual Sample Admixture Proportions

West Terror Creek Species Admixture Proportions
(STRUCTURE q values)

	qCRCT	qGBCT	qRGCT	qYSCT	qRBT
Population Average q	0.02	0.94	0.01	0.02	0.00

Number of samples scored:	30
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Figure 9. Results from the cutthroat trout genetic analysis. CRCT = Colorado River cutthroat trout; GBCT = greenback cutthroat trout; RGCT = Rio Grande cutthroat trout; YSCT = Yellowstone cutthroat trout; RBT = rainbow trout.

Macroinvertebrates

Site 1: Samples from Site 1 were dominated by chironomid midges from the subfamily Orthocladiinae and riffle beetles (*Optioservus* sp. and *Zaitzevia* sp.). Together, these three taxa comprised 63% of the samples (by number of organisms). Diversity and evenness scores suggest that the site is fairly undisturbed and has minimal to no inputs of organic pollutants (Table 3). Collector-gatherer was the dominant functional feeding group (Figure 10). Complete taxa lists are provided in Appendix B.

Site 2: Samples from Site 2 were also dominated by *Zaitzevia* sp., *Optioservus* sp., and Orthocladiinae midges. Together, these three taxa comprised 42% of the samples. Mayflies (primarily *Paraleptophlebia* sp. and *Cinygmula* sp.) comprised 25% of the samples. Diversity and evenness scores suggest that the site is relatively undisturbed and has minimal to no inputs of organic pollutants. This site had the highest diversity score (Figure 11) and the largest number of EPT taxa (Figure 12). It also had the lowest HBI score (Figure 13). Collector-gatherer was the dominant functional feeding group.

Site 3: Samples from Site 3 were dominated by the mayfly *Cinygmula* sp., ostracods (seed shrimp), and Orthocladiinae midges. Together, these three taxa comprised 49% of the samples. 15% of the samples consisted of beetles, primarily *Optioservus* sp. and *Zaitzevia* sp. Diversity and evenness scores suggest that the site is relatively undisturbed and has minimal to no inputs of organic pollutants. This site had the highest *composite* evenness score (Site 2 had the largest average score) (Figure 14). Collector-gatherer was the dominant functional feeding group but there was also a high percentage of scrapers.

Site 4: Samples from Site 4 were dominated by *Optioservus* sp., Orthocladiinae midges, and ostracods. Together, these three taxa comprised 54% of the samples. 13% of the samples consisted of the caddisfly *Lepidostoma* sp. Diversity and evenness scores suggest that the site is relatively undisturbed and has minimal to no inputs of organic pollutants. This site had the largest number of taxa (composite score; Site 2 had the highest *average* number of taxa) (Figure 15) and the highest density (Figure 16) and biomass (Figure 17), suggesting it was the most productive. Collector-gatherer was the dominant functional feeding group.

Site 5: Samples from Site 5 were dominated by *Cinygmula* sp., *Heterlimnius corpulentus* (a riffle beetle), ostracods, and chironomid midges from the subfamily Diamesinae. Together, these four taxa comprised 53% of the samples. Diversity and evenness scores suggest that the site is relatively undisturbed and has minimal to no inputs of organic pollutants. Collector-gatherer was the dominant functional feeding group.

Overall, Site 2 and Site 4 could be considered to have the “best” water quality because they had the highest values for biomass, density, taxa richness, diversity, and EPT index. Site 1 had the lowest values for taxa richness, EPT index, diversity, and evenness. For all sites though, the macroinvertebrate metrics indicate very good stream conditions. The statistical comparison for various metrics shows that most sites are not significantly different from each other.

The MMI sample was collected upstream of the Stevens Gulch Road. There were 31 individual taxa in the sample, which is similar to the other sites. The MMI score was 70, which indicates that West Fork Terror Creek at the MMI site is in attainment for the aquatic life uses as classified by the Colorado Department of Public Health and Environment. The diversity for the sample was 3.94. The HBI tolerance metric was 3.76. Both of these scores further confirm the MMI attainment score.

Table 3. Metrics for macroinvertebrate samples collected in West Fork Terror Creek, September 2012.

Metric	Site				
	1	2	3	4	5
Density (#/m ²)	4069	3839	1819	4998	3473
Biomass (g/m ²)	0.758	0.945	0.409	0.947	0.596
S-W Diversity	3.23	4.07	3.97	3.75	3.83
S-W Evenness	0.652	0.787	0.794	0.715	0.759
Taxa Richness	31	36	32	38	33
# EPT Taxa	15	22	16	18	17
HBI	3.68	3.12	4.07	4.20	4.58
Functional Feeding Group					
% Filterers	0.3	2.2	2.0	2.3	6.2
% Gatherers	51.9	49.1	46.5	50.4	60.5
% Scrapers	28.7	24.6	34.5	25.5	21.9
% Predators	3.9	11.8	9.7	7.2	7.3
% Shredders	15.3	12.3	7.1	14.6	4.0
# Ephemeroptera Taxa	6	7	6	6	6
# Plecoptera Taxa	3	8	5	4	6
# Trichoptera Taxa	6	7	5	8	5
% EPT	26.6	49.5	50.9	30.9	42.4
% Ephemeroptera	4.9	24.7	33.3	8.4	30.8
# Intolerant Taxa	7	12	10	10	10
% Tolerant Organisms	0	0	0	0	0
% Non-insect Organisms	0.9	0.7	13.8	16.4	11.3
MMI*	70				

*MMI was calculated from a separate sample collected for this purpose. The collection site was between sites 4 and 5.

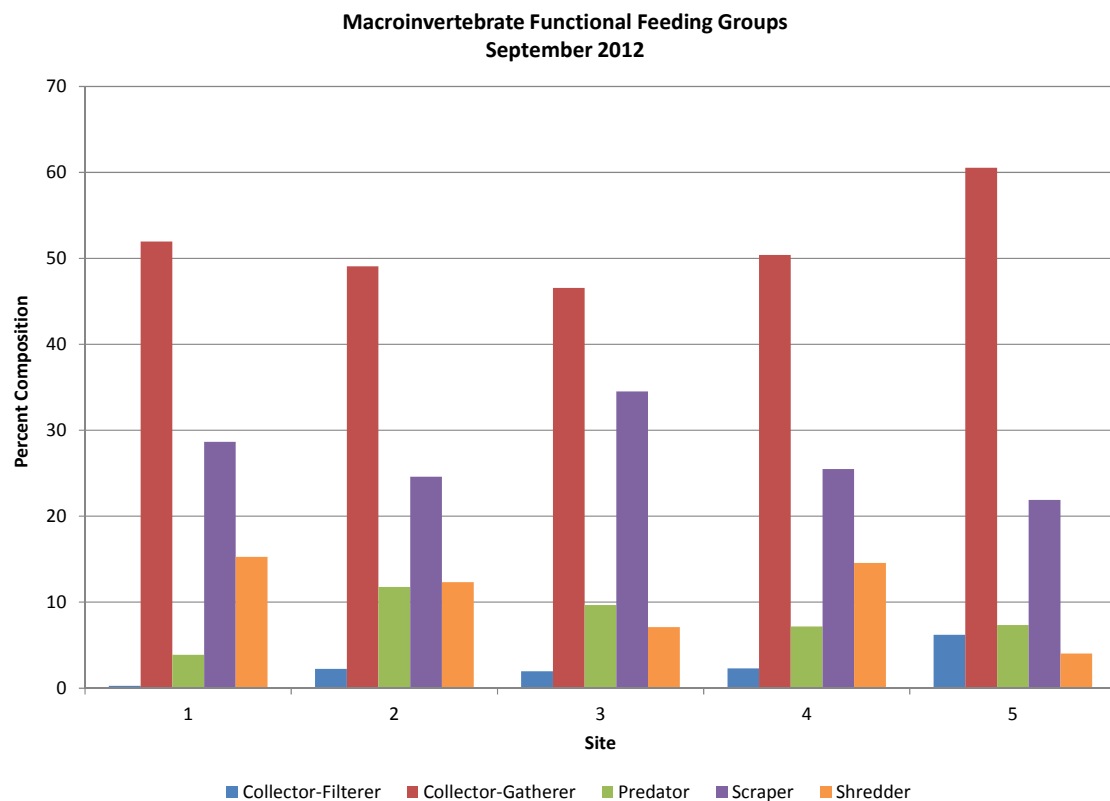


Figure 10. Macroinvertebrate functional feeding groups.

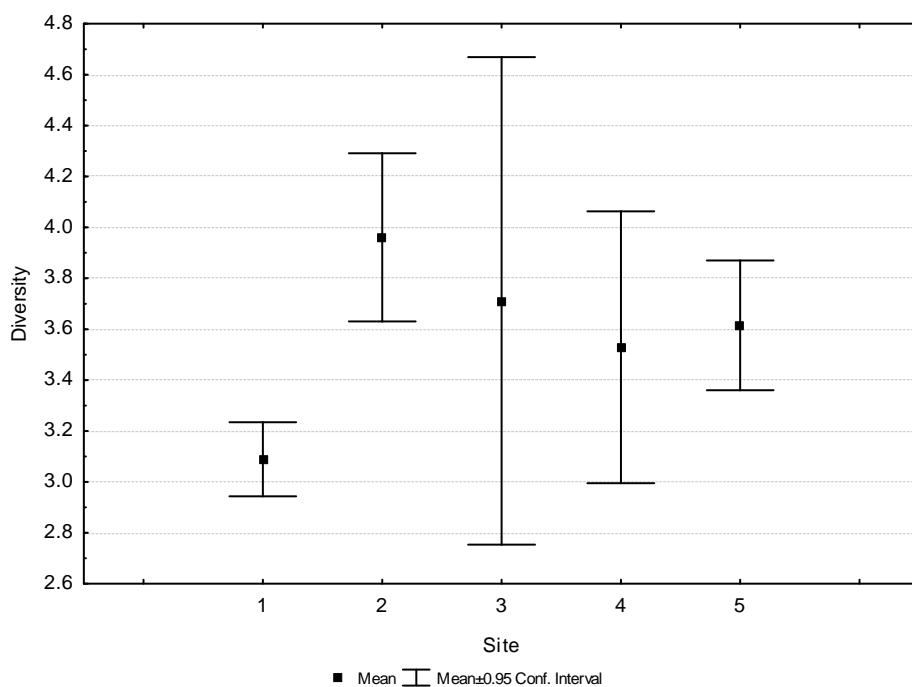


Figure 11. Average macroinvertebrate diversity scores with 95% confidence intervals.

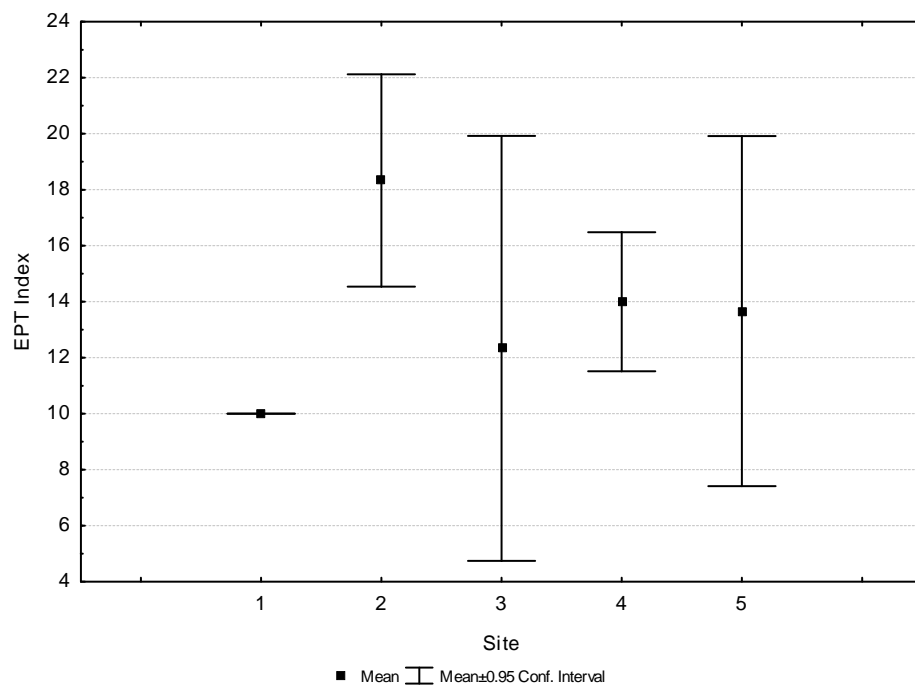


Figure 12. Average macroinvertebrate EPT index scores with 95% confidence intervals.

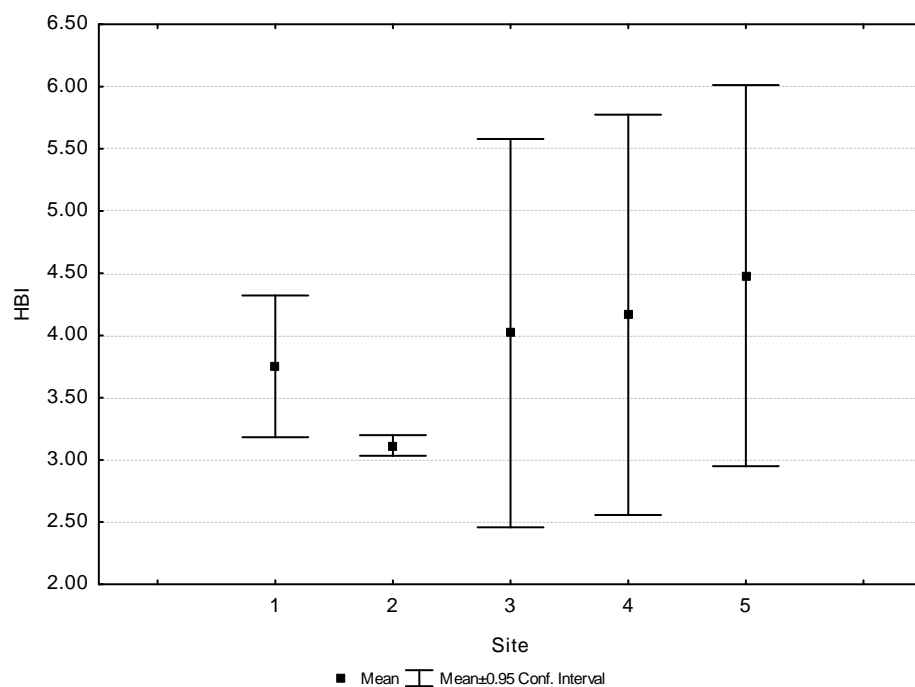


Figure 13. Average macroinvertebrate HBI scores with 95% confidence intervals.

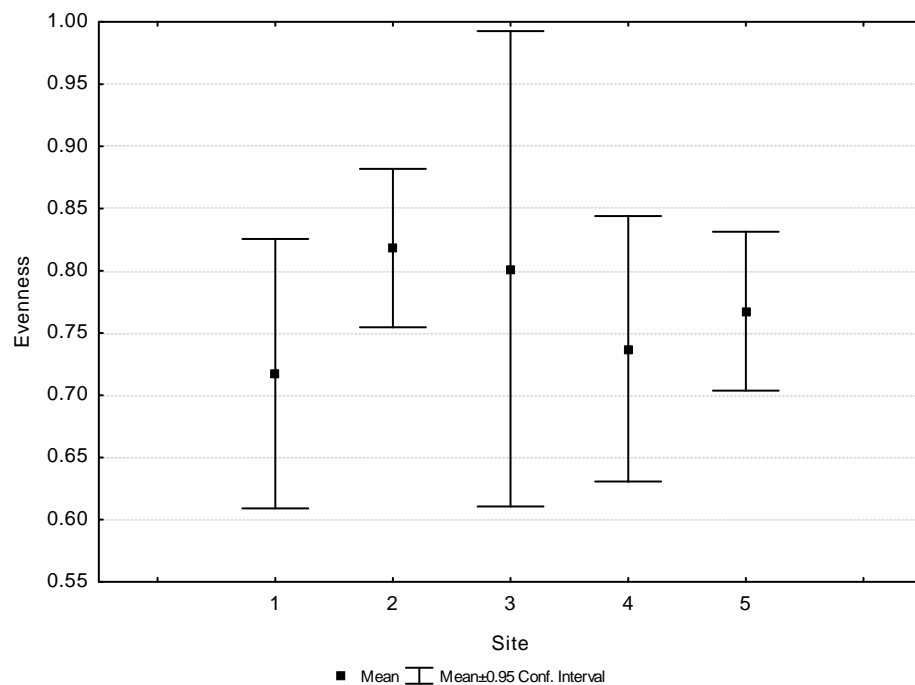


Figure 14. Average macroinvertebrate evenness scores with 95% confidence intervals.

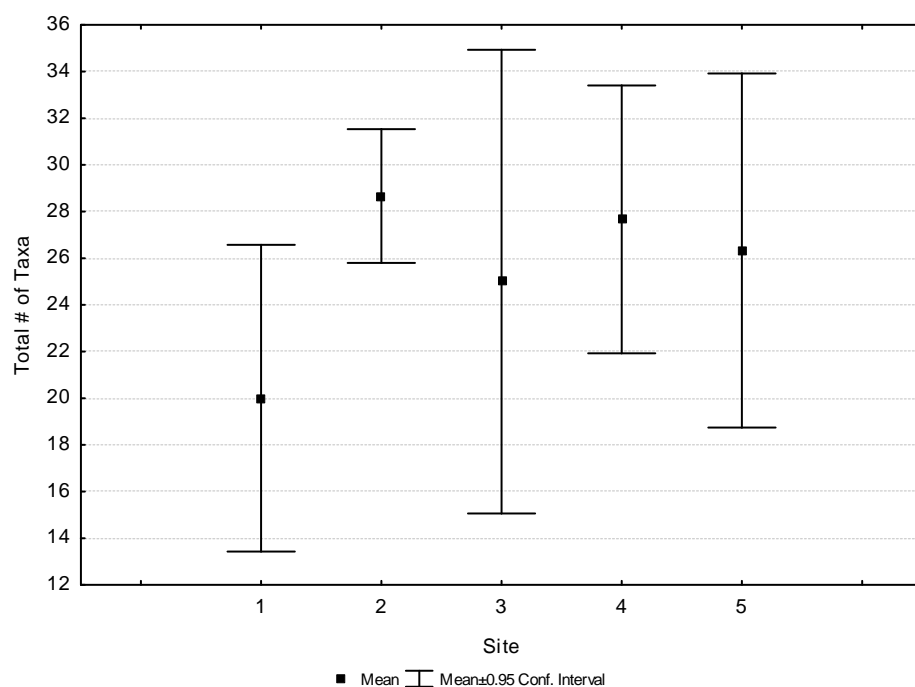


Figure 15. Average number of total macroinvertebrate taxa with 95% confidence intervals.

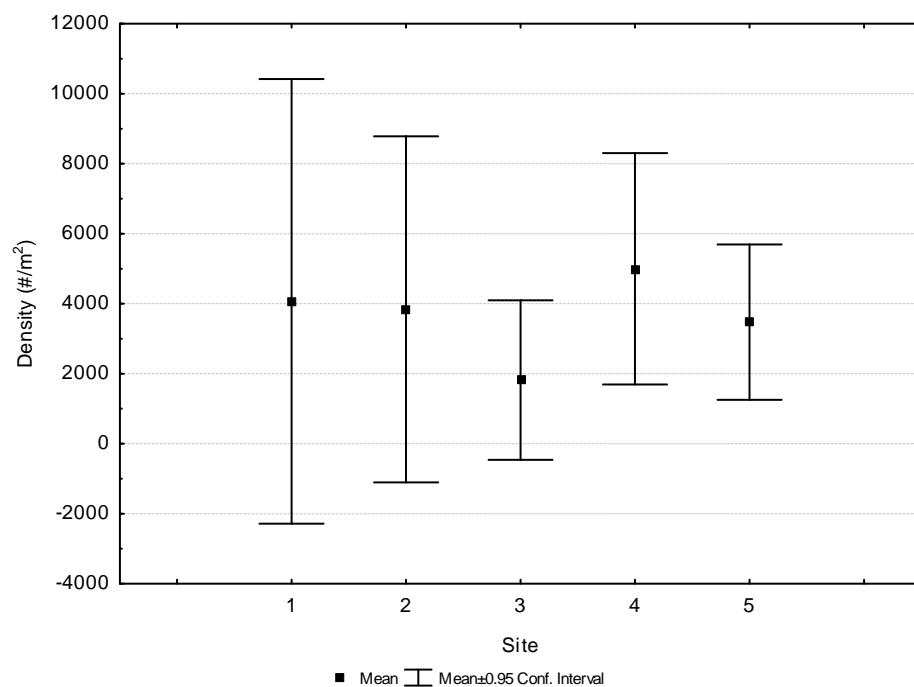


Figure 16. Average macroinvertebrate density with 95% confidence intervals.

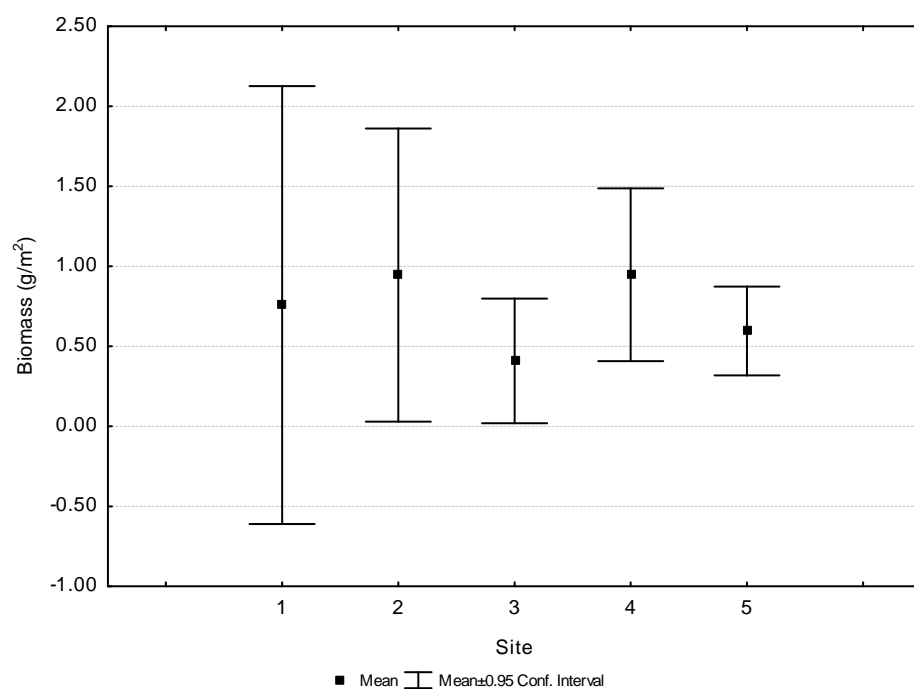


Figure 17. Average macroinvertebrate biomass with 95% confidence intervals.

References

Barbour MT, Gerritsen J, Snyder BD, Stribling JB. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish. 2nd ed. Washington (D.C.): U.S. Environmental Protection Agency, Office of Water. EPA 841-B-99-002.

Colorado Water Quality Control Commission [CWQCC]. 2010a. Aquatic life use attainment: methodology to determine use attainment for rivers and streams. Denver (CO): Colorado Department of Public Health and Environment, Water Quality Control Commission. Policy Statement 10-1.

CWQCC. 2010b. The basic standards and methodologies for surface water (5 CCR 1002-31). Denver (CO): Colorado Department of Public Health and Environment, Water Quality Control Commission. Available from: <http://www.cdphe.state.co.us/regulations/wqccregs/>

Dare, M, M. Carrilo, and C. Speas. 2011. Cutthroat trout (*Onchorhynchus clarki*) Species and Conservation Assessment for the Grand Mesa, Uncompahgre and Gunnison National Forests, Grand Mesa, Uncompahgre and Gunnison National Forests, Delta, Colorado.

Merritt RW, Cummins KW. 1996. An introduction to the aquatic insects of North America. 3rd ed. Dubuque (IA): Kendall/Hunt.

Pope KL, Kruse CG. 2007. Condition. In: Guy CS, Brown ML, editors. Analysis and interpretation of freshwater fisheries data. Bethesda (MD): American Fisheries Society. p. 423-472.

Rogers K. 2007. A suggested protocol for collecting cutthroat trout tissues for subsequent genetic analysis. Steamboat Springs (CO): Colorado Parks and Wildlife, Aquatic Research.

Ward JV, Kondratieff BC, Zuellig RE. 2002. An illustrated guide to the mountain stream insects of Colorado. 2nd ed. Boulder (CO): University Press of Colorado.

APPENDIX A: FISH DATA

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Table A-1. Individual cutthroat trout lineage proportions. CRCT = Colorado River cutthroat trout; GBCT = greenback cutthroat trout; RGCT = Rio Grande cutthroat trout; YSCT = Yellowstone cutthroat trout; RBT = rainbow trout.

West Terror Creek Individual Sample Admixture Proportions (STRUCTURE q values)						
Sample	qCRCT	qGBCT	qRGCT	qYSCT	qRBT	Source ID
WTC-118749	0.01	0.98	0.00	0.01	0.01	WT1-1
WTC-118750	0.01	0.74	0.14	0.10	0.01	WT1-2
WTC-118751	0.00	0.97	0.03	0.00	0.00	WT1-3
WTC-118752	0.00	0.99	0.00	0.00	0.00	WT1-4
WTC-118753	0.00	0.99	0.00	0.01	0.00	WT1-5
WTC-118754	0.01	0.99	0.00	0.00	0.00	WT1-6
WTC-118755	0.02	0.95	0.02	0.01	0.00	WT2-1
WTC-118756	0.01	0.99	0.00	0.01	0.00	WT2-2
WTC-118757	0.00	1.00	0.00	0.00	0.00	WT2-3
WTC-118758	0.05	0.87	0.00	0.08	0.00	WT2-4
WTC-118759	0.00	0.98	0.00	0.01	0.00	WT2-5
WTC-118760	0.00	0.99	0.00	0.00	0.00	WT2-6
WTC-118761	0.00	1.00	0.00	0.00	0.00	WT3-1
WTC-118762	0.01	0.71	0.00	0.28	0.00	WT3-2
WTC-118763	0.02	0.89	0.00	0.09	0.00	WT3-3
WTC-118764	0.00	0.98	0.00	0.02	0.00	WT3-4
WTC-118765	0.00	1.00	0.00	0.00	0.00	WT3-5
WTC-118766	0.02	0.97	0.01	0.00	0.00	WT3-6
WTC-118767	0.39	0.53	0.01	0.08	0.00	WT4-1
WTC-118768	0.02	0.97	0.00	0.01	0.00	WT4-2
WTC-118769	0.00	0.99	0.00	0.00	0.00	WT4-3
WTC-118770	0.00	0.99	0.01	0.00	0.00	WT4-4
WTC-118771	0.01	0.90	0.00	0.01	0.08	WT4-5
WTC-118772	0.00	0.99	0.00	0.00	0.00	WT4-6
WTC-118773	0.00	1.00	0.00	0.00	0.00	WT5-1
WTC-118774	0.01	0.98	0.00	0.01	0.00	WT5-2
WTC-118775	0.04	0.95	0.01	0.00	0.00	WT5-3
WTC-118776	0.00	0.98	0.00	0.02	0.00	WT5-4
WTC-118777	0.01	0.97	0.01	0.01	0.00	WT5-5
WTC-118778	0.00	1.00	0.00	0.00	0.00	WT5-6
Population Average q	0.02	0.94	0.01	0.02	0.00	
Lower 95% CL	0.01	0.90	0.00	0.01	0.00	
Upper 95% CL	0.05	0.97	0.02	0.05	0.01	

Note: Definitions for Source ID- WT1=Site 1, WT2=Site 2, WT3=Site 3, WT4=Site 4, WT5=Site 5

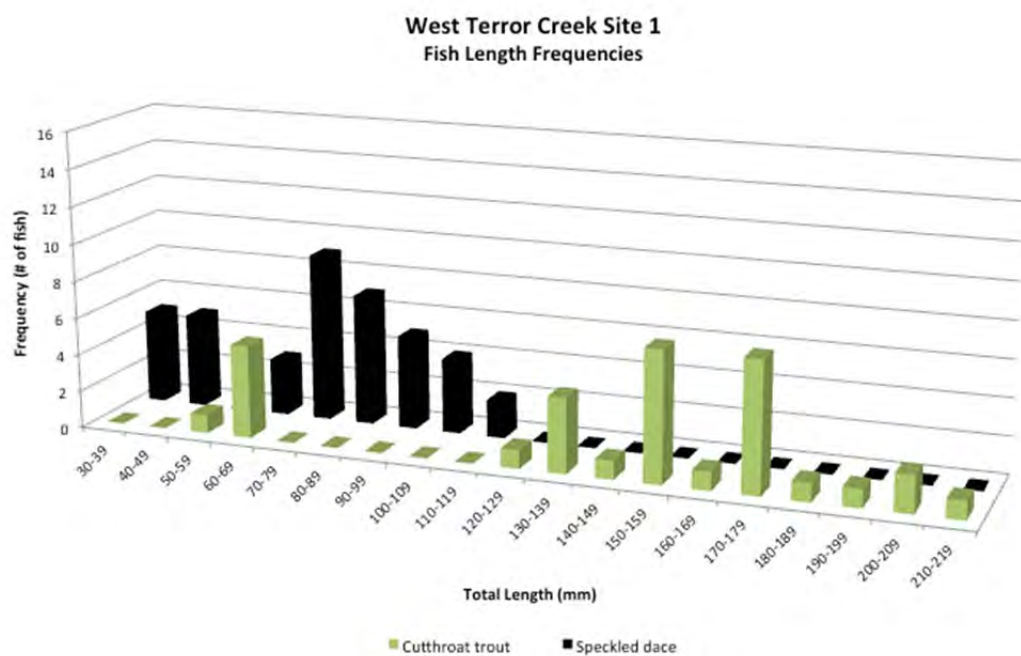


Figure A-1. Site 1 Fish length frequencies.

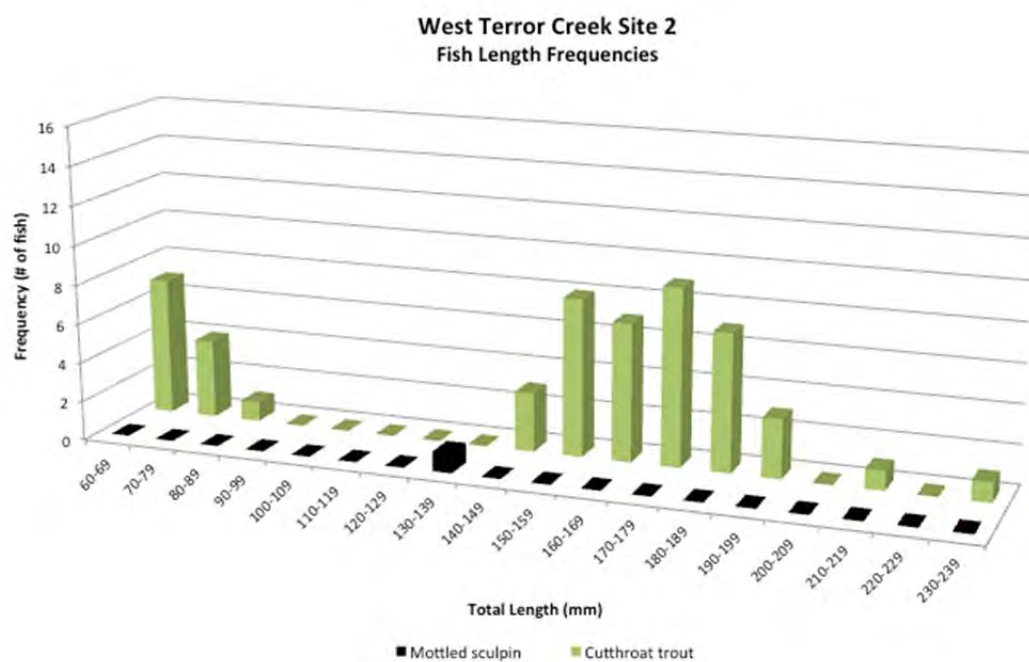


Figure A-1. Site 2 Fish length frequencies.

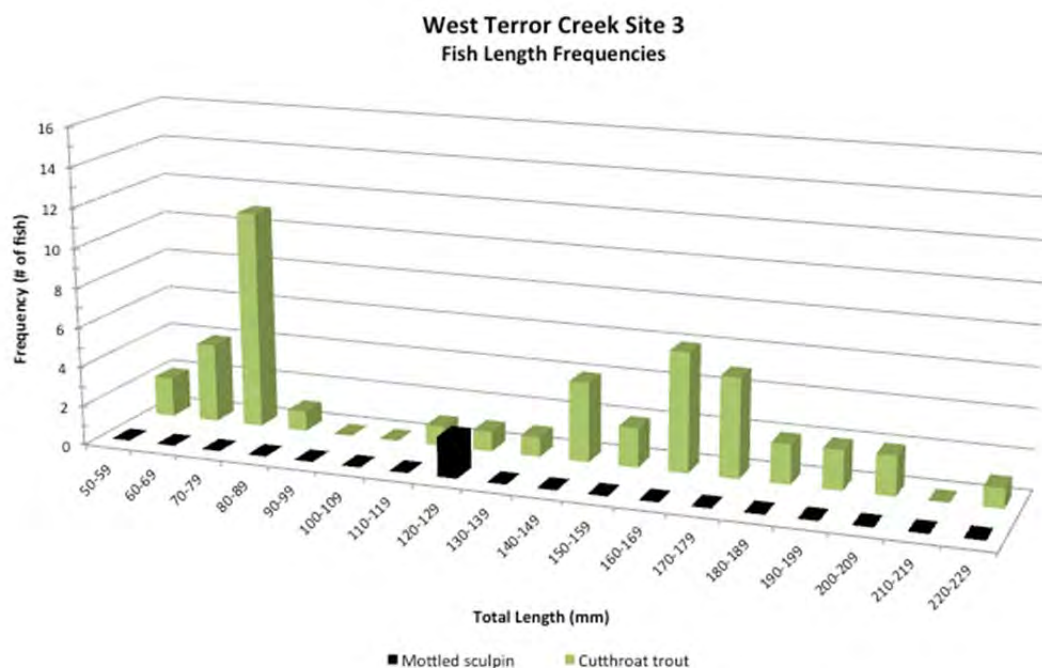


Figure A-1. Site 3 Fish length frequencies.

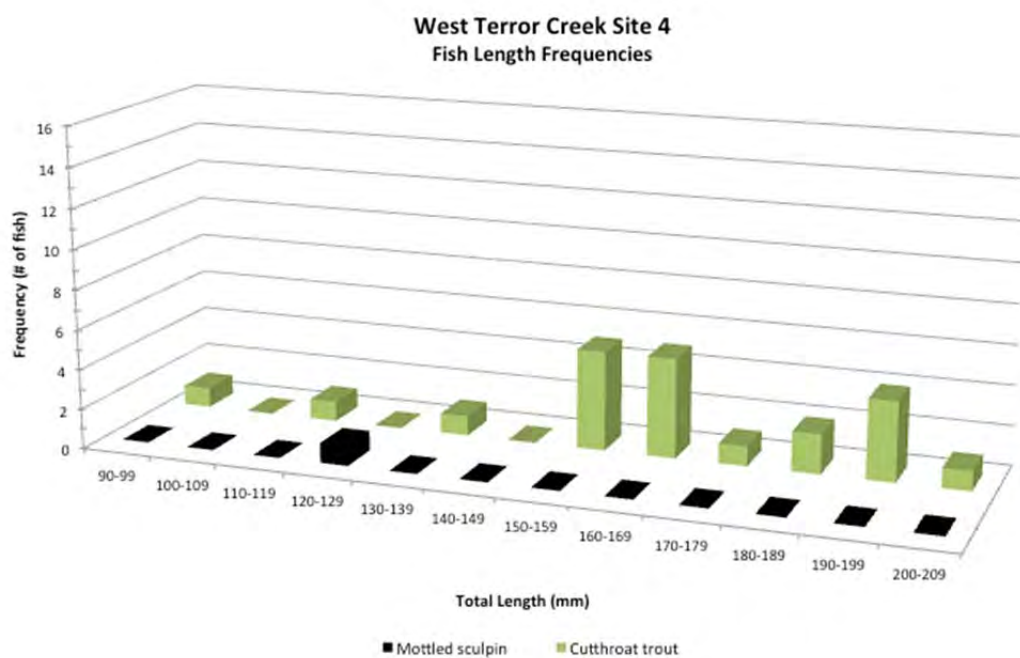


Figure A-1. Site 4 Fish length frequencies.

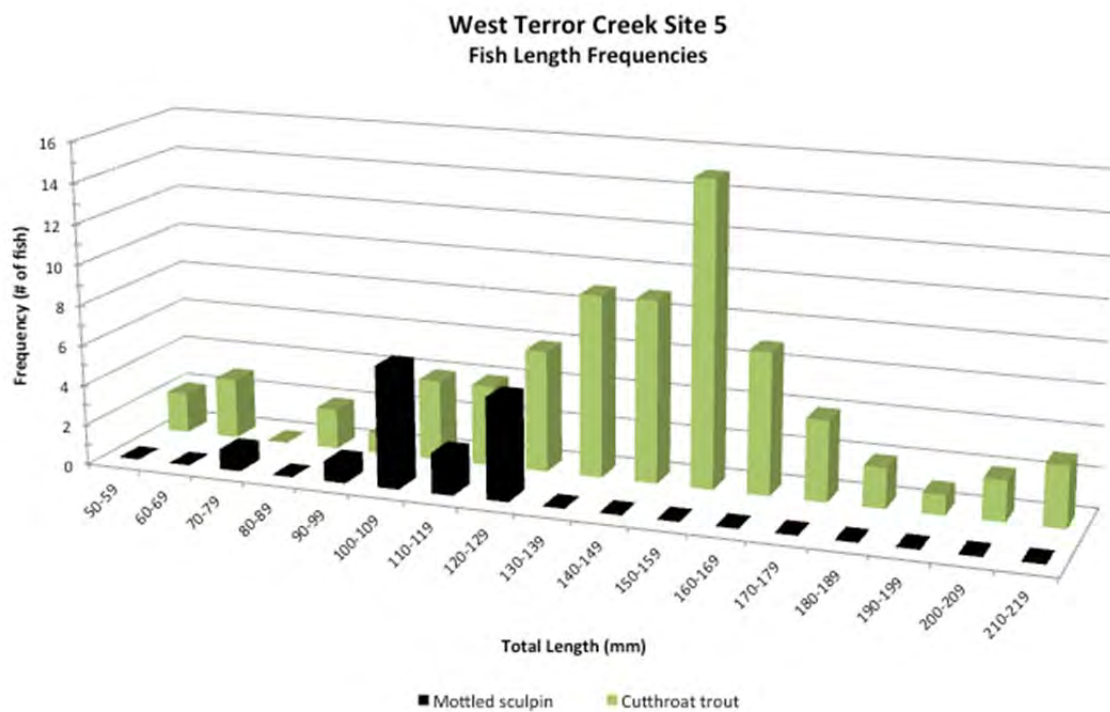


Figure A-1. Site 5 Fish length frequencies.

APPENDIX B: MACROINVERTEBRATE DATA

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Table B-1. Macroinvertebrate taxa list, Site 1, September 2012.

West Terror Creek Site 1 9-17-12			Rep 1	Rep 2	Rep 3	Total
Ephemeroptera						
Ameletidae	Ameletus	sparsatus	1		1	2
Baetidae	Baetis	sp.				
	Baetis	bicaudatus	2	10	16	28
	Baetis	tricaudatus		1	4	5
Ephemerellidae	Drunella	sp.				
	Serratella	sp.				
Heptageniidae	Cinygmula	sp.	2	1	14	17
	Epeorus	sp.		2		2
	Rhithrogena	sp.			2	2
Leptophlebiidae	Paraleptophlebia	sp.				
Plecoptera						
Capniidae	Capnia	sp.				
Chloroperlidae	Sweltsa	sp.	5	2	10	17
Nemouridae	Amphinemura	banksi				
	Zapada	sp.				
Perlidae	Hesperoperla	pacifica				
Perlodidae	Cultus	sp.				
	Isoperla	sp.		2		2
	Skwala	americana			8	8
Pteronarcyidae	Pteronarcella	badia				
Trichoptera						
Brachycentridae	Micrasema	bactro	53	6	16	75
Hydropsychidae	Hydropsyche	sp.	1	1		2
Hydroptilidae	Hydroptila	sp.				
	Ochrotrichia	sp.				
Lepidostomatidae	Lepidostoma	sp.	48	3	45	96
Leptoceridae	Oecetis	sp.	7			7
Limnephilidae	Psychoronia	costalis	1			1
Rhyacophilidae	Rhyacophila	sp. 2 no gills				
		sp.1 gills				
Uenoidae	Oligophlebodes	sp.	27	1	10	38
Coleoptera						
Dryopidae	Helichus	striatus	1			1
Elmidae	Heterlimnius	corpulentus (L)				
	Heterlimnius	corpulentus (A)				
	Optioservus	sp. (L)	167	21	76	264
	Optioservus	sp. (A)	2		7	9
	Zaitzevia	parvula (L)	98	12	34	144
	Zaitzevia	parvula (A)	1		3	4
Dystiscidae	Nebrioporus	sp.		1		1

Table B-1 continued.

Chironomidae						
Chironomidae	Tanypodinae					
	Chironominae	Tanytarsini				
	Diamesinae		6	1	5	12
	Orthocladiinae		92	34	174	300
	pupae		4		4	8
Other Diptera						
Ceratopogonidae	Palpomyia	sp.				
Empididae	Chelifera	sp.				
Psychodidae	Pericoma	sp.	1	1	1	3
Simuliidae	Simulium	sp.	1			1
	pupae					
Stratiomyidae	Euparyphus	sp.		1		1
Tipulidae	Antocha	sp.	41	11	21	73
	Dicranota	sp.				
	Hexatoma	sp.	1			1
Other						
Lymnaeidae	Lymnaea	sp.			1	1
Planorbidae	Armiger	sp.	1			1
Ostracoda						
Turbellaria	Dugesia	sp.				
Sperchonidae	Sperchon	sp.	2		5	7
Lebertiidae	Lebertia	sp.	1			1
Protziidae	Protzia	sp.				
Torrenticolidae	Testudacarus	sp.				
Totals			566	111	457	1134

Table B-2. Macroinvertebrate taxa list, Site 2, September 2012.

West Terror Creek Site 2 9-17-12			Rep 1	Rep 2	Rep 3	Total
Ephemeroptera						
Ameletidae	Ameletus	sparsatus	2	3		5
Baetidae	Baetis	sp.				
	Baetis	bicaudatus	2	8	2	12
	Baetis	tricaudatus	3	6	1	10
Ephemerellidae	Drunella	sp.				
	Serratella	sp.				
Heptageniidae	Cinygmula	sp.	5	55	31	91
	Epeorus	sp.	7	8	1	16
	Rhithrogena	sp.	3	15	4	22
Leptophlebiidae	Paraleptophlebia	sp.	12	61	35	108
Plecoptera						
Capniidae	Capnia	sp.				
Chloroperlidae	Sweltsa	sp.	7	38	26	71
Nemouridae	Amphinemura	banksi	1			1
	Zapada	sp.	2	25	2	29
Perlidae	Hesperoperla	pacifica	5	4	4	13
Perlodidae	Cultus	sp.	1		1	2
	Isoperla	sp.		8		8
	Skwala	americana	8	4	4	16
Pteronarcyidae	Pteronarcella	badia		4	1	5
Trichoptera						
Brachycentridae	Micrasema	bactro	3	6	4	13
Hydropsychidae	Hydropsyche	sp.	2	7	2	11
Hydroptilidae	Hydroptila	sp.				
	Ochrotrichia	sp.	1			1
	Lepidostoma	sp.	23	37	24	84
Leptoceridae	Oecetis	sp.				
Limnephilidae	Psychoronia	costalis				
Rhyacophilidae	Rhyacophila	sp. 2 no gills	1			1
		sp. 1 gills	1	1	1	3
		sp.	4	1	3	8
Uenoidae	Oligophlebodes	sp.				
Coleoptera						
Dryopidae	Helichus	striatus				
Elmidae	Heterlimnius	corpulentus (L)				
	Heterlimnius	corpulentus (A)				
	Optioservus	sp. (L)	24	67	35	126
	Optioservus	sp. (A)	6	8	3	17
	Zaitzevia	parvula (L)	34	87	48	169
	Zaitzevia	parvula (A)	3	3	2	8
Dystiscidae	Nebrioporus	sp.				

Table B-2 continued.

Chironomidae						
Chironomidae	Tanypodinae		1			1
	Chironominae	Tanytarsini		5	2	7
	Diamesinae		4	12	5	21
	Orthocladiinae		35	64	34	133
	pupae		4	7	5	16
Other Diptera						
Ceratopogonidae	Palpomyia	sp.				
Empididae	Chelifera	sp.				
Psychodidae	Pericoma	sp.	4	5	3	12
Simuliidae	Simulium	sp.		6		6
	pupae					
Stratiomyidae	Euparyphus	sp.				
Tipulidae	Antocha	sp.	4	2	7	13
	Dicranota	sp.		2	1	3
	Hexatoma	sp.				
Other						
Lymnaeidae	Lymnaea	sp.				
Planorbidae	Armiger	sp.				
Ostracoda						
Turbellaria	Dugesia	sp.				
Sperchonidae	Sperchon	sp.			1	1
Lebertiidae	Lebertia	sp.				
Protziidae	Protzia	sp.		5		5
Torrenticolidae	Testudacarus	sp.		1	1	2
Totals			212	565	293	1070

Table B-3. Macroinvertebrate taxa list, Site 3, September 2012.

West Terror Creek Site 3 9-17-12			Rep 1	Rep 2	Rep 3	Total
Ephemeroptera						
Ameletidae	Ameletus	sparsatus				
Baetidae	Baetis	sp.				
	Baetis	bicaudatus	6	5	2	13
	Baetis	tricaudatus				
Ephemerellidae	Drunella	sp.			1	1
	Serratella	sp.				
Heptageniidae	Cinygmula	sp.	35	74	16	125
	Epeorus	sp.		9	2	11
	Rhithrogena	sp.		1		1
Leptophlebiidae	Paraleptophlebia	sp.	3	7	8	18
Plecoptera						
Capniidae	Capnia	sp.				
Chloroperlidae	Sweltsa	sp.	7	17	1	25
Nemouridae	Amphinemura	banksi				
	Zapada	sp.		10		10
Perlidae	Hesperoperla	pacifica				
Perlodidae	Cultus	sp.		8		8
	Isoperla	sp.				
	Skwala	americana	1	2	3	6
Pteronarcyidae	Pteronarcella	badia		3	4	7
Trichoptera						
Brachycentridae	Micrasema	bactro	2	2	3	7
Hydropsychidae	Hydropsyche	sp.		5	2	7
Hydroptilidae	Hydroptila	sp.				
	Ochrotrichia	sp.				
Lepidostomatidae	Lepidostoma	sp.	1	3	5	9
Leptoceridae	Oecetis	sp.				
Limnephilidae	Psychoronia	costalis				
Rhyacophilidae	Rhyacophila	sp. 2 no gills				
		sp.1 gills	1	1	2	4
Uenoidae	Oligophlebodes	sp.	1	1	4	6
Coleoptera						
Dryopidae	Helichus	striatus	3			3
Elmidae	Heterlimnius	corpulentus (L)	1	2	2	5
	Heterlimnius	corpulentus (A)				
	Optioservus	sp. (L)	6	8	18	32
	Optioservus	sp. (A)	1	2	6	9
	Zaitzevia	parvula (L)	13	8	7	28
	Zaitzevia	parvula (A)		1		1
Dystiscidae	Nebrioporus	sp.				

Table B-3 continued.

Chironomidae						
Chironomidae	Tanypodinae					
	Chironominae	Tanytarsini	1	1	1	3
	Diamesinae		1	6	2	9
	Orthocladiinae		4	44	7	55
	pupae			3	3	6
Other Diptera						
Ceratopogonidae	Palpomyia	sp.				
Empididae	Chelifera	sp.		1		1
Psychodidae	Pericoma	sp.	11	1	8	20
Simuliidae	Simulium	sp.				
	pupae					
Stratiomyidae	Euparyphus	sp.				
Tipulidae	Antocha	sp.	1	1	2	4
	Dicranota	sp.		1		1
	Hexatoma	sp.	1	1		2
Other						
Lymnaeidae	Lymnaea	sp.				
Planorbidae	Armiger	sp.				
Ostracoda			27	38	2	67
Turbellaria	Dugesia	sp.	1			1
Sperchonidae	Sperchon	sp.				
Lebertiidae	Lebertia	sp.				
Protziidae	Protzia	sp.		1	1	2
Torrenticolidae	Testudacarus	sp.				
Totals			128	267	112	507

Table B-4. Macroinvertebrate taxa list, Site 4, September 2012.

West Terror Creek Site 4 9-17-12			Rep 1	Rep 2	Rep 3	Total
Ephemeroptera						
Ameletidae	Ameletus	sparsatus	5	1		6
Baetidae	Baetis	sp.	10	8	13	31
	Baetis	bicaudatus				
	Baetis	tricaudatus				
Ephemerellidae	Drunella	sp.	2	2	4	8
	Serratella	sp.			1	1
Heptageniidae	Cinygmula	sp.	7	10	38	55
	Epeorus	sp.				
	Rhithrogena	sp.				
Leptophlebiidae	Paraleptophlebia	sp.	10	2	4	16
Plecoptera						
Capniidae	Capnia	sp.				
Chloroperlidae	Sweltsa	sp.	26	16	6	48
Nemouridae	Amphinemura	banksi				
	Zapada	sp.				
Perlidae	Hesperoperla	pacifica			1	1
Perlodidae	Cultus	sp.				
	Isoperla	sp.	2	2		4
	Skwala	americana	1	4	3	8
Pteronarcyidae	Pteronarcella	badia				
Trichoptera						
Brachycentridae	Micrasema	bactro	4	5	5	14
Hydropsychidae	Hydropsyche	sp.		1	4	5
Hydroptilidae	Hydroptila	sp.		1	1	2
	Ochrotrichia	sp.				
Lepidostomatidae	Lepidostoma	sp.	85	86	16	187
Leptoceridae	Oecetis	sp.	2			2
Limnephilidae	Psychoronia	costalis				
Rhyacophilidae	Rhyacophila	sp. 2 no gills			3	3
		sp.1 gills	4	1	2	7
Uenoidae	Oligophlebodes	sp.	14	17	1	32
Coleoptera						
Dryopidae	Helichus	striatus			2	2
Elmidae	Heterlimnius	corpulentus (L)	10	13	2	25
	Heterlimnius	corpulentus (A)				
	Optioservus	sp. (L)	87	128	51	266
	Optioservus	sp. (A)	7	20	13	40
	Zaitzevia	parvula (L)	13	36	8	57
	Zaitzevia	parvula (A)	4		11	15
Dystiscidae	Nebrioporus	sp.	1			1

Table B-4 continued.

Chironomidae						
Chironomidae	Tanypodinae		3		2	5
	Chironominae	Tanytarsini	21	2		23
	Diamesinae		3	10	12	25
	Orthocladiinae		105	34	91	230
	pupae		5		3	8
Other Diptera						
Ceratopogonidae	Palpomyia	sp.		1		1
Empididae	Chelifera	sp.				
Psychodidae	Pericoma	sp.		11		11
Simuliidae	Simulium	sp.	1		3	4
	pupae					
Stratiomyidae	Euparyphus	sp.				
Tipulidae	Antocha	sp.	1	4	10	15
	Dicranota	sp.				
	Hexatoma	sp.	1	3	2	6
Other						
Lymnaeidae	Lymnaea	sp.				
Planorbidae	Armiger	sp.				
Ostracoda			161	23	38	222
Turbellaria	Dugesia	sp.	1			1
Sperchonidae	Sperchon	sp.			2	2
Lebertiidae	Lebertia	sp.	1		2	3
Protziidae	Protzia	sp.	1			1
Torrenticolidae	Testudacarus	sp.				
Totals			598	441	354	1393

Table B-5. Macroinvertebrate taxa list, Site 5, September 2012.

West Terror Creek Site 5 9-17-12			Rep 1	Rep 2	Rep 3	Total
Ephemeroptera						
Ameletidae	Ameletus	sparsatus	1	2	2	5
Baetidae	Baetis	sp.	20	32	35	87
	Baetis	bicaudatus				
	Baetis	tricaudatus	1		1	2
Ephemerellidae	Drunella	sp.	2	2	1	5
	Serratella	sp.				
Heptageniidae	Cinygmula	sp.	39	67	73	179
	Epeorus	sp.				
	Rhithrogena	sp.				
Leptophlebiidae	Paraleptophlebia	sp.	8	4	8	20
Plecoptera						
Capniidae	Capnia	sp.	13	7	11	31
Chloroperlidae	Sweltsa	sp.	8	17	15	40
Nemouridae	Amphinemura	banksi				
	Zapada	sp.	2	1	1	4
Perlidae	Hesperoperla	pacifica	1		1	2
Perlodidae	Cultus	sp.				
	Isoperla	sp.	3			3
	Skwala	americana	1	2	1	4
Pteronarcyidae	Pteronarcella	badia				
Trichoptera						
Brachycentridae	Micrasema	bactro	1			1
Hydropsychidae	Hydropsyche	sp.				
Hydroptilidae	Hydroptila	sp.	1			1
	Ochrotrichia	sp.				
Lepidostomatidae	Lepidostoma	sp.			3	3
Leptoceridae	Oecetis	sp.				
Limnephilidae	Psychoronia	costalis				
Rhyacophilidae	Rhyacophila	sp. 2 no gills	1	2	1	4
		sp.1 gills				
Uenoidae	Oligophlebodes	sp.	4	10	5	19
Coleoptera						
Dryopidae	Helichus	striatus				
Elmidae	Heterlimnius	corpulentus (L)	38	52	31	121
	Heterlimnius	corpulentus (A)		3	4	7
	Optioservus	sp. (L)		9	4	13
	Optioservus	sp. (A)				
	Zaitzevia	parvula (L)	1	1		2
	Zaitzevia	parvula (A)				
Dystiscidae	Nebrioporus	sp.				

Table B-5 continued.

Chironomidae						
Chironomidae	Tanypodinae		2	1	4	7
	Chironominae	Tanytarsini	11	26	23	60
	Diamesinae		41	24	42	107
	Orthocladiinae		36	16	24	76
	pupae		3	2	6	11
Other Diptera						
Ceratopogonidae	Palpomyia	sp.				
Empididae	Chelifera	sp.	6	1	4	11
Psychodidae	Pericoma	sp.	12	5	6	23
Simuliidae	Simulium	sp.				
	pupae					
Stratiomyidae	Euparyphus	sp.				
Tipulidae	Antocha	sp.	4	2	1	7
	Dicranota	sp.	1		2	3
	Hexatoma	sp.			1	1
Other						
Lymnaeidae	Lymnaea	sp.				
Planorbidae	Armiger	sp.				
Ostracoda				2	105	107
Turbellaria	Dugesia	sp.				
Sperchonidae	Sperchon	sp.				
Lebertiidae	Lebertia	sp.			1	1
Protziidae	Protzia	sp.				
Torrenticolidae	Testudacarus	sp.			1	1
Totals			261	290	417	968

Table B-6. Macroinvertebrate taxa list, MMI site, September 2012.

West Terror Creek MMI Sample 9-17-12			Counts
Ephemeroptera			
Ameletidae	Ameletus	sparsatus	1
Baetidae	Baetis	sp.	4
	Baetis	bicaudatus	20
	Baetis	tricaudatus	
Ephemerellidae	Drunella	sp.	2
	Serratella	sp.	
Heptageniidae	Cinygmula	sp.	86
	Epeorus	sp.	
	Rhithrogena	sp.	1
Leptophlebiidae	Paraleptophlebia	sp.	10
Plecoptera			
Capniidae	Capnia	sp.	
Chloroperlidae	Sweltsa	sp.	15
Nemouridae	Amphinemura	banksi	
	Zapada	sp.	5
Perlidae	Hesperoperla	pacifica	1
Perlodidae	Cultus	sp.	3
	Isoperla	sp.	
	Skwala	americana	
Pteronarcyidae	Pteronarcella	badia	3
Trichoptera			
Brachycentridae	Micrasema	bactro	3
Hydropsychidae	Hydropsyche	sp.	18
Hydroptilidae	Hydroptila	sp.	
	Ochrotrichia	sp.	
Lepidostomatidae	Lepidostoma	sp.	21
Leptoceridae	Oecetis	sp.	
Limnephilidae	Psychoronia	costalis	
Rhyacophilidae	Rhyacophila	sp. 2 no gills	3
		sp.1 gills	6
Uenoidae	Oligophlebodes	sp.	3
Coleoptera			
Dryopidae	Helichus	striatus	
Elmidae	Heterlimnius	corpulentus (L)	5
	Heterlimnius	corpulentus (A)	
	Optioservus	sp. (L)	36
	Optioservus	sp. (A)	7
	Zaitzevia	parvula (L)	27
	Zaitzevia	parvula (A)	2
Dystiscidae	Nebrioporus	sp.	

Table B-6 continued.

Chironomidae				
Chironomidae	Tanypodinae			
	Chironominae	Tanytarsini	1	
	Diamesinae		7	
	Orthocladiinae		19	
	pupae			
Other Diptera				
Ceratopogonidae	Palpomyia	sp.		
Empididae	Chelifera	sp.		
Psychodidae	Pericoma	sp.	2	
Simuliidae	Simulium	sp.	3	
	pupae			
Stratiomyidae	Euparyphus	sp.		
Tipulidae	Antocha	sp.		
	Dicranota	sp.	1	
	Hexatoma	sp.	3	
Other				
Lymnaeidae	Lymnaea	sp.		
Planorbidae	Armiger	sp.		
Ostracoda			45	
Turbellaria	Dugesia	sp.	4	
Sperchonidae	Sperchon	sp.	1	
Lebertiidae	Lebertia	sp.	2	
Protziidae	Protzia	sp.	5	
Torrenticolidae	Testudacarus	sp.		
Totals			375	

Table B-7. Macroinvertebrate biomass analyses, September 2012.

Individual Weights Sep-12				Mean Weights Sep-12		
Site	Rep	Weight (g)	Weight (g/m ²)	Site	Weight (g)	Weight (g per m ²)
1	1	0.119	1.279	1	0.070	0.758
	2	0.017	0.181			
	3	0.076	0.814			
2	1	0.066	0.708	2	0.088	0.945
	2	0.127	1.370			
	3	0.070	0.758			
3	1	0.029	0.314	3	0.038	0.409
	2	0.055	0.590			
	3	0.030	0.323			
4	1	0.107	1.155	4	0.088	0.947
	2	0.090	0.966			
	3	0.067	0.721			
5	1	0.060	0.644	5	0.055	0.596
	2	0.044	0.468			
	3	0.063	0.676			

Table B-8. Macroinvertebrate density analyses, September 2012.

Individual Density Sep-12				Mean Density Sep-12		
Site	Rep	Number	# per m ²	Site	Number	# per m ²
1	1	566	6092	1	378	4069
	2	111	1195			
	3	457	4919			
2	1	212	2282	2	357	3839
	2	565	6082			
	3	293	3154			
3	1	128	1378	3	169	1819
	2	267	2874			
	3	112	1206			
4	1	598	6437	4	464	4998
	2	441	4747			
	3	354	3810			
5	1	261	2809	5	323	3473
	2	290	3122			
	3	417	4489			

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APPENDIX C: PHOTOGRAPHS

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Figure C-1. Site 1, lower terminus of site, upstream view.



Figure C-2. Site 1, upper terminus of site, downstream view.



Figure C-3. Site 2, lower terminus of site, upstream view.



Figure C-4. Site 2, macroinvertebrate sampling.



Figure C-5. Site 2, upper terminus of site, downstream view.



Figure C-6. Site 3, lower terminus of site, upstream view.



Figure C-7. Site 3, upper terminus of site, downstream view.



Figure C-8. Site 4, lower terminus of site, upstream view.



Figure C-9. Site 4, upper terminus of site, downstream view.



Figure C-10. Site 5, lower terminus of site, upstream view.



Figure C-11. Site 5, upper terminus of site, downstream view.

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APPENDIX 4

SUBSIDENCE EVALUATION OF THE WESTERN MINING DISTRICT AND THE SPRUCE STOMP LEASE AREA

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January 2013
121-014.000

Subsidence Evaluation of the Western Mining District and the Spruce Stomp Lease Area

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January 2013

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MAP

1	Existing and Proposed Longwall Panel Configuration in the Terror Creek Mining Area
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SUBSIDENCE EVALUATION OF THE WESTERN MINING DISTRICT AND THE SPRUCE STOMP LEASE AREA

SUMMARY OF MAJOR FINDINGS

Subsidence quantification and processes projected for the Spruce Stomp Lease Area as developed in this report are summarized below. These findings are based on detailed subsidence analysis in the adjacent Western Mining District to the south.

1. Maximum measured vertical displacement (S) values in the Western Mining District range from about 6.0 to 7.5 feet in the upper B-seam above longwall panels B-10, B-11, and B-12, where the overburden depth ranges from 600 to 1,050 feet. The greatest measured S value (7.5 feet) is located above mined panel B-11 due to yield on adjacent gate road pillars caused by mining of adjacent panels. Based on these data, the S values after mining is complete for the Spruce Stomp Lease Area (i.e., northern 8 longwall panels) vary depending on overburden depths from a maximum projected value of 4.2 feet in the proposed western panels to a maximum projected value of 5.7 feet in the proposed eastern panels. The location of this maximum projected subsidence value is located approximately 300 feet south of West Fork Terror Creek.
2. Based on maximum measured tilt (M) in the Western Mining District, the maximum tilt in the Spruce Stomp Lease Area is projected to range from 2.7 S/d where W/d equals 0.4 to 2.0 S/d where W/d ratio is greater than 0.8.
3. Tensile strain for the Spruce Stomp Lease Area is projected to be approximately 1.0 S/d for mining panels with W/d ratios of 0.4 to 1.0. Compressive strain is expected to range from -2.5 to -0.95 S/d for a W/d ratio of 0.30 to 1.6.
4. The average draw angle as projected for the Spruce Stomp Lease Area is 22 degrees based on measured survey data.
5. Under the concept of uniform longwall extraction and related uniform downwarping of the overburden rocks and unconsolidated material as lateral constrained plates, cracks in zones under tensile stress decrease in width with depth, and close at the neutral surfaces.

Below the neutral surfaces, the materials are in compression. Therefore any surface water or groundwater is prevented from moving downward beyond the neutral surface of a rock unit deforming as a constrained plate.

Field observations over a 17-year period in the West Elk mining area have verified this conceptual model in laterally constrained bedrock and surficial material. Based on past observations in the Somerset, West Elk and Bowie No. 2 mine areas, no permanent loss of flow is predicted when longwall panels are mined in the lower B-seam beneath West Fork Terror Creek if bedrock were exposed in the stream bed. However, the 42 to 85 feet of alluvium and colluvium present, as measured by drilling near the stream area in the eastern half of West Terror Creek, will further reduce any possible loss of stream flow.

1.0 INTRODUCTION

Subsidence amounts and processes observed in the Terror Creek mining area (Delta County, Colorado) as operated by Bowie Resources, LLC (Bowie), are described and analyzed for potential longwall mining of the lower B-seam coal in the Spruce Stomp Lease Area. Mining in this area will occur via the Bowie No. 2 Mine (Bowie Mine). This report updates Appendix K of the North Fork Environmental Impact Statement (Feb., 2000), and presents subsidence data of current longwall mining in the Western Mining District (an upper B-seam mining area west of Terror Creek and south of the Spruce Stomp Lease Area as well as observational information from other North Fork of the Gunnison River (North Fork) valley mines. This information will be used to project subsidence values and potential effects from proposed lower B-seam longwall mining in the Spruce Stomp Lease Area.

2.0 DEFINITION OF TERMS AND SYMBOLS

Terms used to evaluate and analyze subsidence processes and amounts are described below.

Bedrock: Rock that has been consolidated under natural conditions; commonly underlies unconsolidated material, such as colluvium, alluvium, and soil.

Bulking Factor: The volumetric increase of caved rock fragments relative to its volume prior to caving (in-place volume).

Bump, Bounce or Rock Burst: The sudden release of strain energy that produces an explosion-like sound and shock waves in locations where stress on the rock exceeds its strength.

Coal Bump (or bounce): The sudden release of strain energy that causes explosion-like sounds and shock (seismic) waves in locations where stresses (pressure) on the coal exceed its strength.

Coal Extraction Thickness (t): The thickness of coal being mined; this value may be less than the actual seam thickness, because some coal of low quality may not be mined. Some coal may be left in the roof (~~top~~ coal”) for roof stability, or the seam may be too thick to be mined completely.

Critical Mining Width: The width of a mining panel necessary to cause maximum

subsidence at a point on the ground surface. The length of the mining panel must also be equal to, or exceed this critical width. Critical width varies from 1.0 to 1.4 times the mining depth (overburden thickness).

Critical Mining Length: The length of the mining panel (length of coal area extracted) necessary to cause maximum vertical displacement (1.0 to 1.4 times the overburden depth).

Draw (Limit) Angle (ϕ): The angle (from a vertical reference) of a straight line projected from the edge of the mining panel to the limit of subsidence at the surface above the edge of panel. This term is also known as the angle of draw.

Fault: A fracture surface, parting, or series of partings in rock, often more extensive than joints, where rock on either side of the surface, or surfaces, is displaced (offset).

Head Gate: Gate roads (development entries) are driven on the side of the longwall mining panel adjacent to unmined coal, and on the side of the panel that is in the direction of further panel development.

Joint: A fracture surface or parting in rock, usually planar, without displacement, which often occurs periodically to form a joint set.

Longwall Mining Panel and mining procedure: A rectangular mining area where mine openings are developed and coal is extracted. In longwall mining panels, development entries, or gate roads, are driven at either side of the panel boundaries and the intervening coal is extracted with a longwall cutting machine.

Maximum Horizontal Strain (E, -E): The amount of horizontal change in length between two points of measurement divided by the horizontal distance between these two points (unit change in length); tensile strain is lengthening between these two points (unit elongation), compressive strain is shortening between these two points (unit shortening).

Maximum Vertical Displacements (Maximum Subsidence) (S): The maximum vertical downward movement of the overburden and ground surface caused by extracting the coal.

Mining Length and Width (W, L): The length and width of the longwall panel where coal is being extracted.

Mining panel (W): The width of a longwall mining panel measured from gate road pillars on

either side.

Overburden Depth (d): The vertical distance between the top of the coal seam being mined and the ground surface above it.

Subsidence Trough: A trough like depression (downwarped area) that occurs above the panel where coal is being extracted; the trough is caused by differential vertical displacement of the ground surface.

Supercritical Mining Length and Width: A mining panel with a length and width that is greater than critical mining width.

Tail Gate: Gate roads driven on the opposite side of the longwall mining panel from the head gate entries.

Tilt (m) and Maximum Tilt (M): The change in vertical displacement between two points at the ground surface divided by the horizontal distance between these points (differential vertical displacement); maximum tilt is the maximum projected for this area of the subsidence trough.

3.0 GENERAL MINING INFORMATION

Longwall mining is occurring in the current Western Mining District (upper B-seam) and is proposed in the Spruce Stomp Lease Area (lower B-seam) (see Map 1). It should be noted that only the eight northern longwall panels of the twelve east-west-oriented panels shown in yellow on Map 1 are included in the Spruce Stomp Lease Area. The four southern panels of this group have already been approved for mining under an existing lease. All twelve of these longwall panels will be mining the lower B-seam.

3.1 Panel and Pillar Design

Longwall panels B-10 to B-12 have been, or are being currently, mined in the upper B-seam of the Western Mining District. These are the three eastern panels of a group of five panels oriented in a north-south direction. Two additional panels, oriented in an east-west direction, are located to the west of the north-south-oriented panels (see Map 1). All eight of these longwall panels are mining the upper B-seam.

The pillar sizes for these eight panels are designed to increase with overburden depth. Each of

the longwall panels is 850 to 880 feet wide, and range from 3,100 to about 4,800 feet in length. A row of yield pillars and rigid pillars is located between each longwall panel, and are arranged on 65-foot centers (yield pillars) by 120 to 180-foot centers (rigid pillars relative to overburden depth) (Map 1 see notes top of p 4). Cross cuts in the rigid pillars are from 200 to 250 foot centers; cross cuts in the yield pillars, which are on the headgate side of the panel, are one half the distance of the rigid pillars. The coal extraction thickness (t) in all panels equals 10 feet. Overburden depths (depth of cover), relative to the upper B-seam, vary from about 450 feet to more than 2,000 feet above these proposed panels.

To the north of the upper B-seam longwall panels located west of Terror Creek are twelve longwall panels which are proposed to mine the lower B-seam. As stated previously, the four southern panels have been approved for mining under an existing lease. The proposed eight northern panels are part of the Spruce Stomp Lease Area.

Of the twelve longwall panels proposed to mine the lower B-seam, six panels will be on either side of a north-trending, five-entry main line haulageway. These twelve longwall mining panels range in length from about 3,150 to 5,700 feet, and are 880 feet wide. Barrier (rigid) pillars of the eastern block of six longwall panels (i.e., east of the mains) are 150 feet wide by 250 feet long (150 ft x 250 ft centers). Barrier pillars of the western longwall panels are 160 to 190 feet wide (width increases with overburden depth) by approximately 250 feet long (160-190 ft x 250 ft centers). Yield pillars on the headgate side of each panel are 75 feet wide (75 ft centers) and one-half the length of the barrier (rigid) pillars.

3.2 Previous Mining

Coal from the upper D-seam and upper and lower B-seam were mined by the longwall method in the Bowie Mining District east of Terror Creek. Ten feet of coal was first extracted in the upper D-seam, followed by 10 feet of coal in the upper or lower B-seam depending on the mining district. The D-seam coal is stratigraphically separated from the B-seam coal by about 300 feet of sandstone, siltstone, shale, and thin coal seams (Dunrud, 1989). The upper B-seam is currently being mined by longwall methods west of Terror Creek (see Map 1).

3.3 Mine-induced stresses

As coal is extracted in the longwall mining method, the weight of the overburden is transferred by the compression arching process to abutment zones ahead of, behind, and either side of the area being mined. This transfer of overburden stress is similar in concept to the way stone arch bridges transfer their weight and load to their abutments.

A compression arch can support relatively high stresses, compared to tensile stresses, because rock is much stronger in compression than it is in tension. The major abutment zones in a longwall mining panel are (1) the caved zone (gob) behind the supports, (2) the unmined coal ahead of the face, and (3) the gate road pillars.

In a longwall mining operation, where the roof rocks cave readily behind the supports, much of the overburden weight is borne by the re-compressed gob. This minimizes the abutment stress on the coal ahead of the face. Abutment stresses ahead of the face are lowest where the roof caves near the supports, because the length of the arch and the superincumbent load are the smallest.

Caving (as necessary to form an abutment zone) is largely controlled by the lithology of the roof rocks. Thin layered sandstones, shales, and claystones often cave readily, whereas, thick sandstones cave less readily increasing the cave span and related stress. Spontaneous release of strain energy (bumps or bounces) at coal mines commonly occur in greater frequency and magnitude where the roof rocks are thick, strong sandstones.

Abutment stresses increase with overburden depth, particularly as the overburden increases above 1,500 to 2,000 feet (personal communication with various mine personnel). Bumps and bounces (and related seismic events) occur in greater number and magnitude as stresses increase, particularly where large uncaved areas develop behind longwall support, or where large pillars (which can store large amounts of strain energy) are left for protection of personnel and property.

4.0 GEOLOGICAL AND GEOTECHNICAL FACTORS INFLUENCING SUBSIDENCE

4.1 Structure

The attitude of the bedrock, faults, lineaments, joints, and cleat are important factors to consider in the design of longwall mining panels. In the Western Mining District and the Spruce Stomp Lease Area, the bedrock dips northeastward at approximately 4.5 degrees. This gentle dip does not affect the angle of draw more than 4 or 5 degrees from that of flat-lying beds based on NCB information (NCB, 1975). The gentle dip of bedrock in these mining districts also will allow wide latitude in the design of the most efficient panel design and resource recovery.

Orientation of joints in the roof rocks and the cleat in the coal commonly controls the way the roof rocks break and cave and how the coal breaks off when cut by the longwall machine. For example, the roof caves readily behind the longwall supports where joints in the roof rocks are oriented nearly parallel to the longwall face.

4.2 Strength and Behavioral Properties of the Rocks

The strength and behavioral properties of the overburden rocks control the amount and rate of subsidence. Strong, brittle sandstones and siltstones, for example, tend to break and cave to the mine floor in larger blocks and fragments than do softer, more yieldable shales and siltstones, which controls the bulking (swelling) factor of the caved debris.

The height of caving above the mine workings is reduced, for example, where the roof rocks consist of strong sandstones, compared to weak shales. However, the height of fracturing may be greater for strong, brittle sandstones compared to weak, more yieldable shales.

4.3 Stratigraphic Sequence

The stratigraphic position of strong and weak rocks within the overburden, in addition to the rocks near the mine workings, commonly affects subsidence in these various ways:

- Strong, brittle sandstones tend to reduce the amount of subsidence compared to weak, more yieldable shales. However, strains are often greater in these sandstones, because their greater compressive strength produces more extension in the tension zone than do the weaker, yieldable shale.

- The draw (limit) angle, from a vertical reference, is smaller in overburden consisting of strong rocks, such as brittle sandstones, and is greater where the overburden consists of weaker shales, mudstone, or siltstones. The measured draw angle over D-seam longwall mining at the Bowie Mine is about 22 degree. The measured draw angle in the Somerset and West Elk mining area ranges from 9 to 18 degrees.

4.4 Moisture Content

Wet rocks in the mine roof and overburden tend to reduce the bulking factor of the caved rocks near the mine level and also tend to cause the rocks to be weaker and more yieldable than their dry counterparts. This reduction in bulking factor occurs because wet rocks usually are weaker (in compressive, shear, and tensile strength) compared to their dry counterparts.

For a given stratigraphic sequence and coal extraction thickness, subsidence amount and affected area generally increase with moisture content. In saturated strata, for example in the U.K. and former Yugoslavia, maximum subsidence reportedly ranges from 0.9 to 0.98 times the coal extraction thickness in wet and disturbed overburden, and the draw (limit) angle ranges from 30 to 45 degrees (from a vertical reference) (Dunrud, 1998, p. 85-99).

5.0 SUBSIDENCE EVALUATION OF B-SEAM LONGWALL MINING IN THE WESTERN MINING DISTRICT AND THE SPRUCE STOMP LEASE AREA

The subsidence prediction method used herein was developed by the National Coal Board of the United Kingdom (NCB, 1975).

The National Coal Board (NCB) is one of the world's foremost organizations studying and analyzing subsidence caused by underground mining. Using their expertise, which was developed over many decades by this organization, coal is routinely mined under cities, rivers, and other sensitive structures and areas. Knowledge and use of the NCB method is therefore very useful in analyzing subsidence processes and parameters and in evaluating subsidence impacts in a proposed mining area.

The NCB method—which is basically a conceptual model consisting of the fundamental factors of coal extraction thickness, subsidence amount, mining width, and overburden depth—can be adjusted for overburden lithology, moisture conditions, mining panel width, and coal extraction

thickness.

The NCB subsidence method of analysis—in addition to concepts of different zones of deformation and subsidence within the overburden that was developed engineers (such as Peng and others)—has been readily adapted and modified for local conditions observed and measured in longwall mines in the North Fork valley.

6.0 SUBSIDENCE ZONES

There are four zones to consider and analyze, in the downwarping (trough subsidence) process, based on studies and experience by the author and others (e.g., Peng, 1992). These are the (1) caved, (2) fractured, (3) continuous deformation, and (4) near-surface zones (see Figure 1).

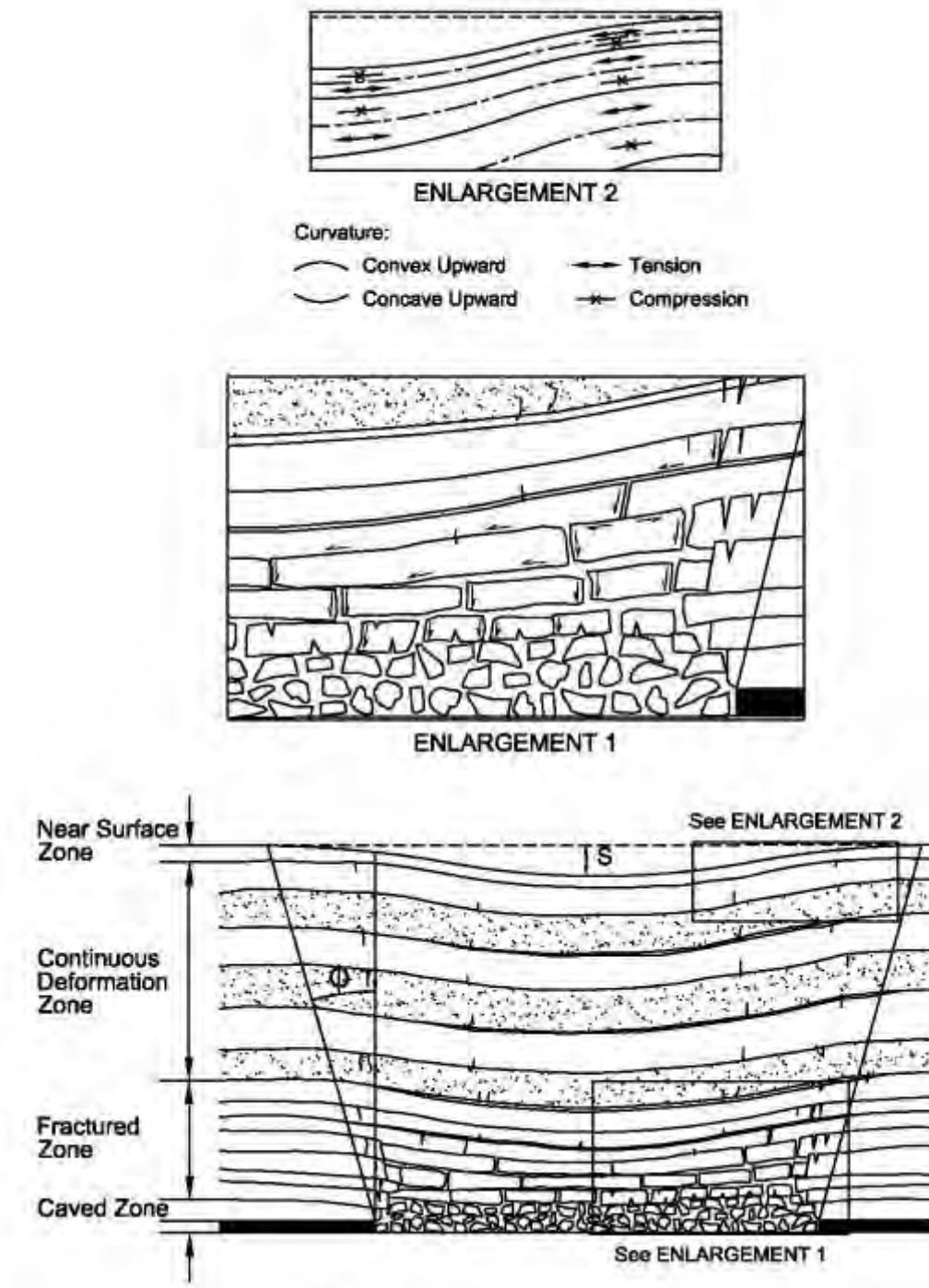


FIGURE 1 - Conceptual diagram showing typical subsidence processes shortly after longwall mining is complete. Enlargement 1 shows potential water flow directions (if present) along fractures and separated bedding planes in the caved and fractured zone. Enlargement 2 shows deflections of material in the near-surface and continuous deformation zone. The resulting positive and negative curvature above and below the neutral surfaces (short and long dashed lines) in rock and unconsolidated units behaving as laterally constrained plates (in three dimensions) and beams (in two dimensions) prevent surface water or ground water in this zone from leaking downward.

6.1 Caved Zone

This zone, according to Peng (1992, p. 1-2) ranges from 2 to 8 coal extraction thicknesses (2t to 8t), depending on lithology and moisture content of the roof rocks.

In the Terror Creek mining area, 2 to 4 coal extraction thicknesses (2t-4t), with an average of 3 coal extraction thicknesses (3t) are projected for the caved zone, based on the author's experience with this lithology and the commonly dry conditions in the rocks above the B-seam. See Figure 12, Typical Geologic Cross-Section, in the attached EIS figure volume.

The height of the caved zone may range from 3 to 6 times the coal extraction thickness (3t to 6t), where coal or associated rocks in the overburden are water-bearing.

6.2 Fractured Zone

Rocks in this zone undergo fracturing within rock layers and along the boundaries of these layers. The fractured zone is transitional to the underlying caved zone (see Figure 1). For a given lithology, displacements and intensity of fracturing tends to decrease upward. Thus water (hydraulic) conductivity also tends to decrease upward.

Peng (1992, p. 143) states that the upper 1/3 of this zone has only minor, unconnected fractures and thus has only minor potential for water conductivity, that most of the water conductivity potential is in the lower two-thirds of this zone, and that the water conductivity increases downward.

According to Peng (1992, p. 6-8), the height of fracturing is a function of lithology and thickness of stratigraphic layers. According to Liu (1981, in Peng, 1992, p. 6-9), the fracture zone ranges from 20 to 30 times the coal extraction thickness (20t to 30t) for overburden comprised predominantly of hard, brittle sandstones and limestones, whereas, the zone ranges from 9 to 11 times the coal extraction thickness (9t to 11t) for overburden consisting predominantly of ductile shales and claystones.

For the Western Mining District and the Spruce Stomp Lease Area, the height of the fractured zone is projected to be 5 to 15 times the coal extraction thickness (5t to 15t), with an average of 10 times the coal extraction thickness (10t). This projection is based on the lithology and

strength of the overburden in the area (see deformation in a typical stratigraphic section in Figure 1).

6.3 Continuous Deformation Zone

This zone, which is transitional to the underlying fracture zone, occurs from the upper limit of the fractured zone upwards to the near-surface zone (see Figure 1, Enlargement 1). The downwarping process (trough subsidence) causes various rock units in the overburden to deform as laterally constrained multiple plates (or as multiple beams in two dimensions).

The downwarping of strata as multiple plates causes tensile strains to develop where convex-upward curvature occurs above the neutral surface, and compressive strains where concave-downward curvature occurs below the neutral surface of the plate (see Figure 1, Enlargement 2).

Crack depth is therefore controlled by the distance to the neutral surface of the rock unit being downwarped, because compression occurs below the neutral surface. Therefore cracks are not vertically continuous, but are controlled by the thickness of the individual rock units.

Slippage (flexural slip) also occurs at the surfaces between the rock units behaving as plates.

6.4 Near-Surface Zone

Nearly all measurements are made at the top (surface) of this zone (see Figure 1). This zone typically consists of (1) bedrock, (2) weathered bedrock, (3) colluvium, and (4) alluvium or some combination thereof.

The behavior of the material in this zone is a function of its deformational characteristics (i.e. its ability to yield or stretch without rupturing or breaking). Bedrock is typically the most rigid (least yieldable) except perhaps in a soft claystone; alluvium commonly is the least rigid (most yieldable), particularly in saturated clays and silts.

A case example of the complete healing and sealing ability of saturated clays is presented under impacts of subsidence in sensitive areas. In Section 8.0 of this report, it will be shown that even room-and-pillar mining beneath a stream in shallow overburden had little to no observable impact on the stream.

7.0 ANALYSIS OF SUBSIDENCE PARAMETERS FOR THE WESTERN MINING DISTRICT AND THE SPRUCE STOMP LEASE AREA

Subsidence parameters analyzed are (1) maximum vertical displacement (commonly called subsidence) (S); (2) tilt (M); (3) positive and negative horizontal strain (extension, E; compression, -E); and (4) draw (limit) angle (ϕ). Calculated parameters are shown in Figure 1.

7.1 Maximum Vertical Displacement (Subsidence)

Maximum vertical displacement (S), or what is commonly called subsidence, ranges from a measured value of 0.6 times the coal extraction thickness (0.6t) for subcritical longwall mining panels in the West Elk Mine to as much as 0.85 times the coal extraction thickness (0.85t) for a supercritical longwall mining panel in the York Canyon Mine of New Mexico (Gentry and Abel, 1978, p. 191-220 and Dunrud, 1998. p. 89).

Measured S values above the northernmost longwall panel in the upper D-seam of the Bowie Mine is 5.6 feet (0.56 t) (Figure 2). In the Western Mining District, measured S values range from 5.9 to 7.5 feet (0.59t to 0.75t) in the upper B-seam above longwall panels B-10, B-11, and B-12 (November 2012 data from survey lines 39 and 40), where the overburden depth ranges from 600 to 1,050 feet (Figure 2). The greatest measured S value is above mined panel B-11 due to low overburden and additional yield on gate road pillars caused by mining of adjacent panels. Note that the overburden depth is greater in the Spruce Stomp Lease Area, so the S values will be less.

S values for the Western Mining District and the Spruce Stomp Lease Area for various mining depths can be determined from the Bowie Mine curve shown in Figure 2. Maximum S values above longwall panels are determined from the subsidence data as follows (Figures 3 and 4):

Point 1 (S. L. 40, point A): $S/t=0.60$; $W/d=880/1050=0.84$,

Point 2 (S. L. 39, point O): $S/t=0.61$; $W/d=880/850=1.03$.

Point 3 (S. L. 39, point A: $S/t=0.63$; $W/d=880/725=1.21$

Point 4 (S. L. 38, point H: $S/t=0.65$; $W/d=880/655=1.34$

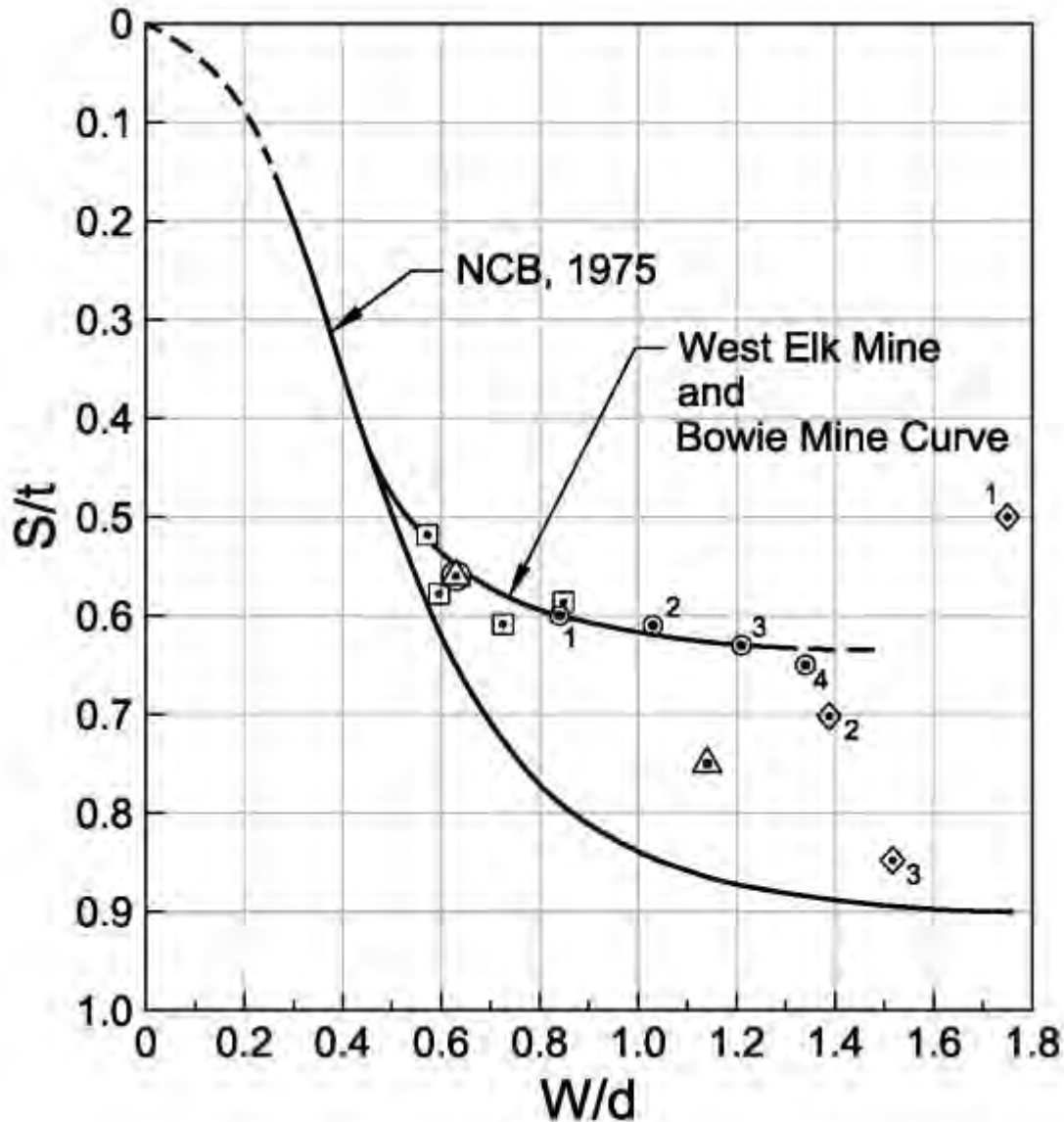


FIGURE 2 - Graph showing the ratio of maximum vertical displacement to coal extraction thickness (S/t) versus longwall mining panel width to depth ratio (W/d) for the West Elk, York Canyon and Bowie longwall mines. West Elk Mine data are represented by squares and the York Canyon Mine data from mountainous terrain of New Mexico are represented by diamonds (1 - in a draw, 2 - on a ridge, 3 - maximum for the area). Bowie Mine data for panels B-10, B-11, and B-12 are represented by circles and triangles. The Bowie Curve represents vertical displacement at four measured locations (and is similar to the West Elk Mine curve) as follows: (circled points: 1 - survey point 40-A, 2 - survey point 39-O, 3 - survey point 39-A, 4 - survey point 38-H). The triangle is survey point 39-I, located above mined panel B-11 (i.e., between adjacent yielded gate road pillars). See Figures 3 and 4 for details of the vertical displacement above panels B-10, B-11 and B-12. The circled triangle point is Point D of Survey line 21 above the northernmost east-west trending mined panel in the upper D-seam of the Bowie Mine.

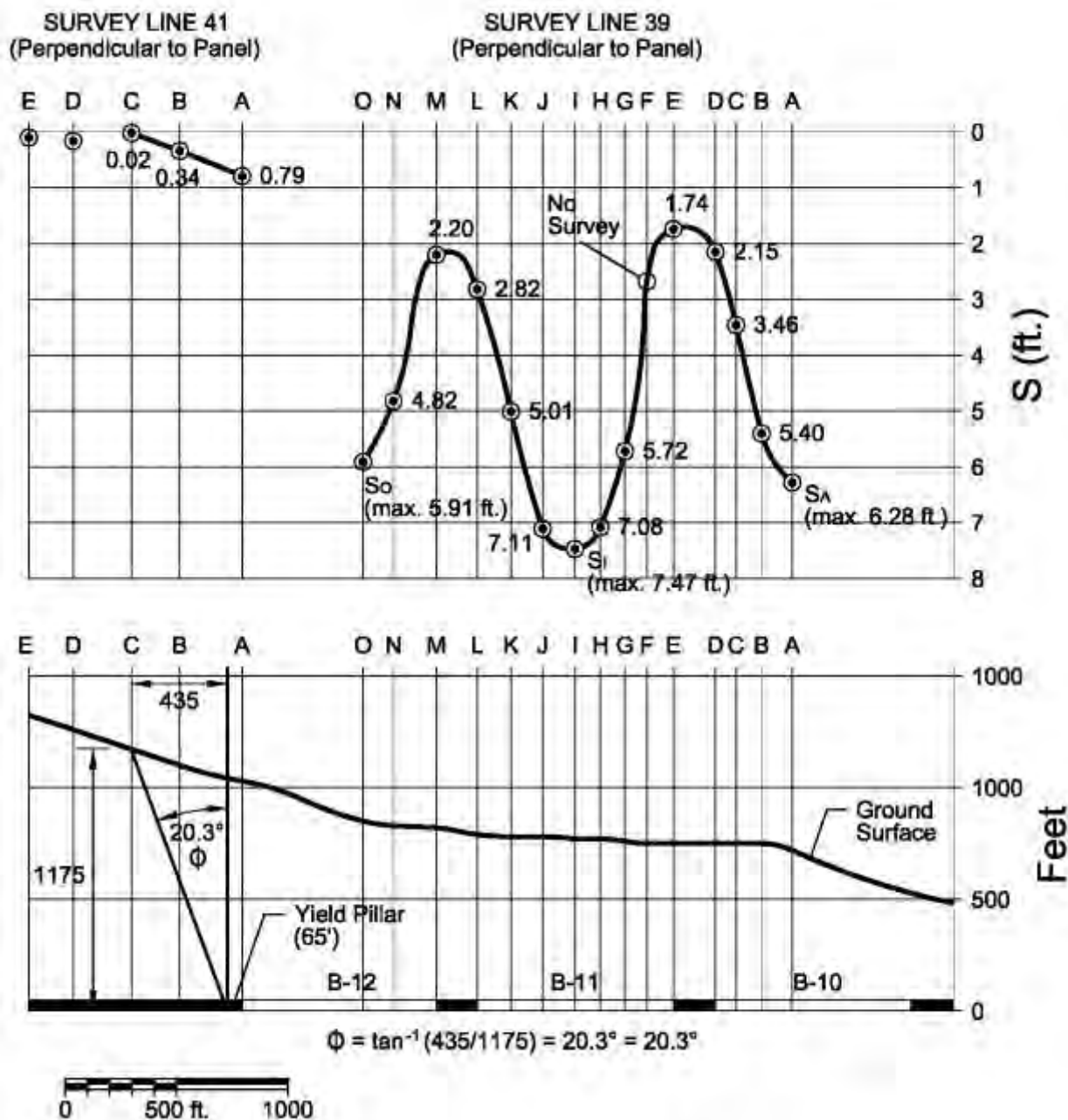


FIGURE 3 - Subsidence graph for survey Lines 39 and 41 projected perpendicular to the panel center line over the upper B-seam of the Bowie Mine west of Terror Creek showing maximum vertical displacement (S) and angle of draw (ϕ). Scale (lower left) applies to the horizontal and vertical scale of cross section (lower graph) only.

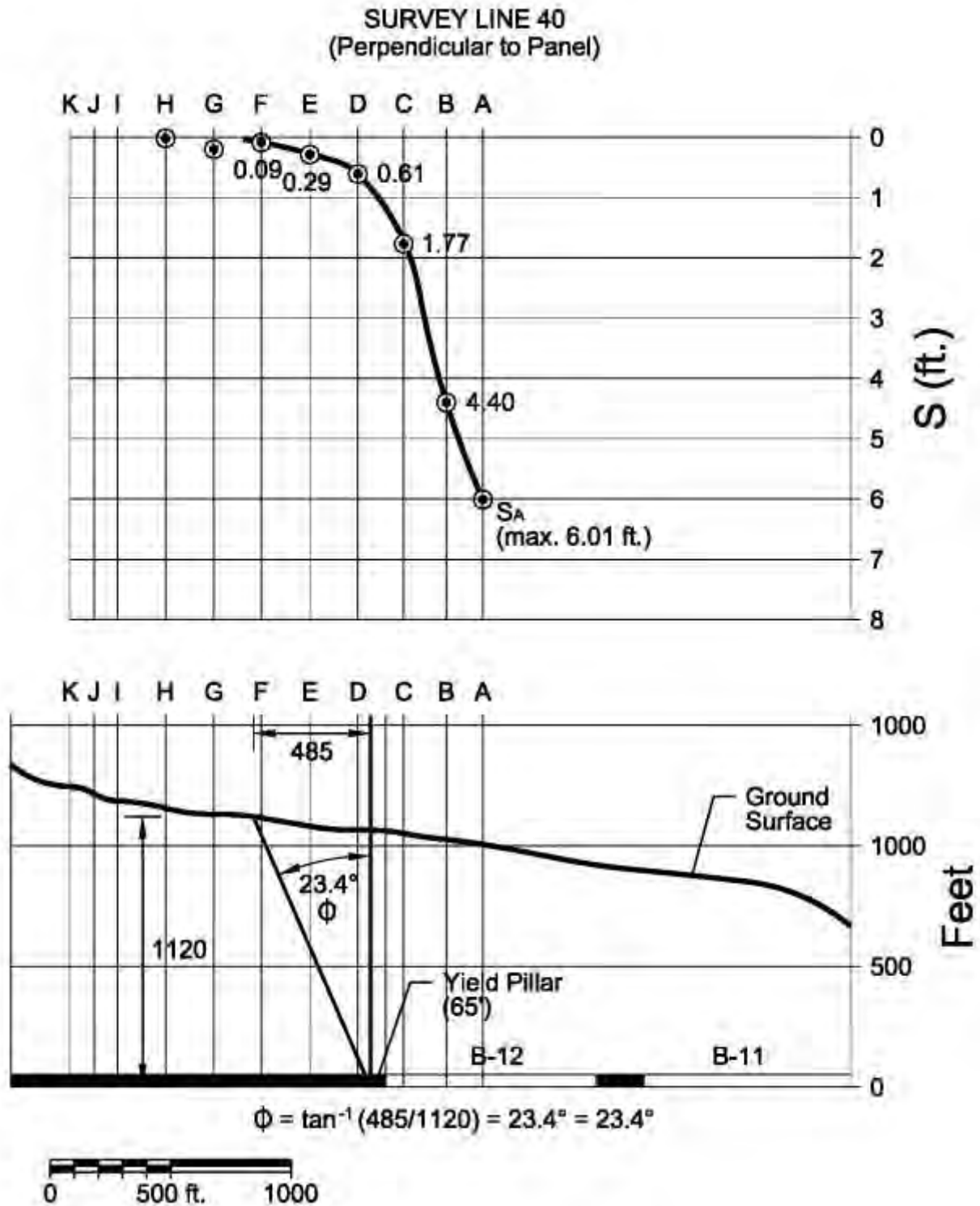


FIGURE 4 - Subsidence graph for survey Line 40 above projected perpendicular to the B-12 longwall mining panel of the West Terror Creek Mine showing maximum vertical displacement (S) and angle of draw (ϕ). Lower scale only applies to horizontal and vertical scale of cross section (lower graph).

7.2 Maximum Tilt (M)

Maximum tilt (called slope by NCB, 1975 but herein referred to as tilt to distinguish it from the slope of the terrain) is plotted and analyzed in terms of the fundamental ratios of maximum vertical displacement to overburden depth (S/d) versus the ratio of mining panel width to overburden depth (W/d). Calculated values for the Western Mining District, and projected values for the Spruce Stomp Lease Area, are shown on Figure 5.

Graphs of the ratio of S/d versus W/d provides tilt and strain values for mining at any depth and has proved useful in various mining areas where subsidence occurs above mines only 60 to 100 feet deep, as in the Sheridan, Wyoming area, to mines greater than 2,000 feet deep in various areas of Utah. As overburden depth increases, maximum tilt decreases. For example, the tilted surface at the margins of subsidence depressions, in overburden above mine workings of 60 to 100-feet in the Sheridan, Wyoming area, was too steep to stand upon comfortably. Tilt, however, was not noticeable in the West Elk Mine area where the ground surface was 2,200 feet above the longwall mining panels.

Maximum tilt (M) in terms of (S/d) can be determined for various W/d from the BR curve shown in Figure 5. The BR curve in Figure 5 is plotted as an average of the calculated data points. For example, M above longwall panels B-10 to B-12 range from 2.7 to 2.0 where W/d values range from 0.4 to 1.6. A sample calculation to determine maximum tilt (of data point 2 in Figure 5), relative to panel width (W) and depth (d), between points J and L of survey line 39 (SL39), is shown below (also see Figure 5):

$$M_{SL39} = (S_J - S_L)/290 \text{ ft} = (7.11 - 2.82)/290 = 4.29 \text{ ft}/290 \text{ ft} = 0.014793 = 1.48\%$$

To convert this value to S/d, divide 0.014793 by the ratio of maximum vertical displacement (S) to the overburden depth (d) at the centerline of longwall panel B-11:

$$M_{S/d} (SL39) = 0.014793/(7.47/770) = 0.014793/0.00970 = 1.525 = 1.52. \text{ For this survey line 39 above the centerline of panel 11, point 1, } W/d = 880/770 = 1.14. \text{ These coordinates are the values used to plot point 2 on Figure 5.}$$

To convert point 2 back to slope, in percent, multiply 1.52 by the calculated value of S/d x 100:

$$M_{SL39} = 1.525 \times 0.00970 = 0.01479 = 0.148 \times 100 = 1.48\%.$$

For points 1-4, and the corresponding survey lines, the $M_{S/d}$ coordinates and W/d values are calculated in a similar way and plotted on Figure 5 as follows (point 3 coordinates are shown again for convenience):

1. $M_{S/d} = 2.28$, $W/d = 1.34$ (Survey Line 38, S_I-S_J/150)
2. $M_{S/d} = 1.52$, $W/d = 1.14$ (Survey Line 39, S_J-S_L/290)
3. $M_{S/d} = 1.35$, $W/d = 1.22$ (Survey Line 39, S_A-S_D/350)
4. $M_{S/d} = 2.26$, $W/d = 0.83$ (Survey Line 40, S_A-S_C/330)

For the geologic conditions and longwall mine geometry in the Western Mining District and the Spruce Stomp Lease Area, the $M_{S/d}$ curve plotted from these four points (the BR curve on Figure 5) will provide an average value by knowing the W/d . To determine the maximum tilt for the panel of interest and its corresponding W/d value, multiply the $M_{S/d}$ value on the BR tilt curve by its calculated S/d value. For example, determine the maximum expected tilt, in percent, 1,000 feet above a longwall panel that is 880 feet wide. The maximum vertical displacement (from Figure 2) is 6.1 ft:

$$W/d = 880\text{ft}/1000\text{ft} = 0.88,$$

$$M_{S/d} = 1.9 \text{ on the BR tilt curve (from Figure 5),}$$

$$M (@W/d=0.88) = 1.9 \times S/d = 1.9 \times 6.1/1000 = 0.01159,$$

$$M (@W/d=0.88 \text{ in } \%) = 0.01159 \times 100 = 1.16\%.$$

7.3 Maximum Strain

Strain is determined from curvature of the downwarped strata. Curvature is the first derivative of tilt with respect to distance between points of observation, or first finite difference of tilt with respect to distance between points of observation of the downwarped strata. One needs to know the thickness of the unit in order to calculate the tensile strain (due to positive curvature) above the neutral surface of the plate or beam being evaluated and the compressive strain (due to negative curvature) below the neutral surface (see and Figure 5).

Maximum tensile and compressive strain (E , $-E$) is determined using local data that is compared

to NCB (NCB, 1975, Figure 3) information. Strain data for this report are derived from the West Elk longwall mine and the York Canyon longwall mine in New Mexico (Gentry and Abel, 1978). Strain is plotted in terms of the ratio of maximum vertical displacement to overburden depth (S/d) versus the ratio of mining panel width to depth (W/d) (see Figure 5).

Tensile strain for the Western Mining District and the Spruce Stomp Lease Area is projected to range from 1.0 S/d for mining panels with mining width-to-depth ratios of 0.40 (W/d=0.40) to 1.1 S/d where W/d=0.70 to 1.0 S/d for width-to-depth ratios of mining panels greater than 1.0 (W/d=1.0) (Figure 5). Compressive strain is projected to vary from -2.5 S/d for a mining panel W/d ratio of 0.30 to -1.00 S/d for a mining panel with a W/d ratio of 1.0 to 0.95 for a W/d ratio of 1.6 (see Figure 5 - BR strain curves). The W/d values along West Fork Terror Creek in the Spruce Stomp Lease Area range from 0.51 in the western panels to 0.77 in the eastern panels.

For the geologic conditions and existing or proposed mine geometry in the Western Mining District and the Spruce Stomp Lease Area, the $+E_{S/d}$, $-E_{S/d}$ for the (BR) curves should provide average values by knowing the longwall panel width, the overburden depth, and its ratio (W/d). To determine the average strain values, multiply $+E_{S/d}$ and $-E_{S/d}$ (determined from the BR tensile and compressive strain curves) by their S/d value. For example, determine the average maximum tensile strain, in percent where the overburden depth above a longwall panel is 1,500 feet, the longwall panel is 880 feet wide. The maximum vertical displacement (S) from Figure 2 is 5.4 feet:

$$W/d = 880\text{ft}/1500\text{ft} = 0.587 = 0.59,$$

$$+E_{S/d} = 1.05 \text{ from the BR tensile strain curve,}$$

$$+E (@W/d=0.59 \text{ in } \%) = 1.05 \times S/d = 1.05 \times 5.4/1500 = 0.00378 = 0.38\%$$

Maximum tensile strain above gate road pillars between panels in the Western Mining District and the Spruce Stomp Lease Area may be twice the amount shown on Figure 5 because the overburden and surface will subside both ways above the rigid gate road pillars and, therefore, double the tensile strain.

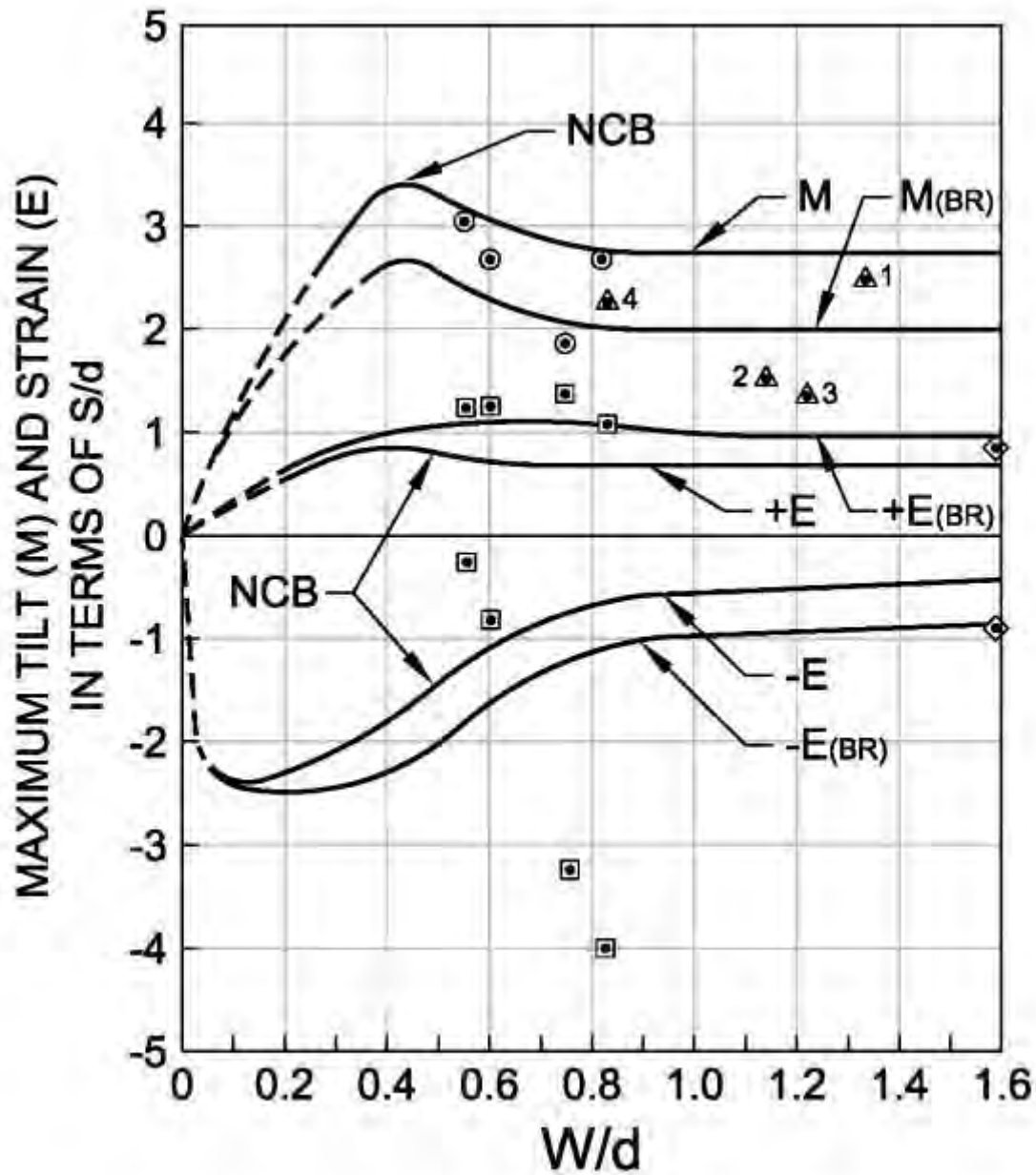


FIGURE 5 - Graph for predicting maximum tilt (M), tensile strain (+E) and compressive strain (-E) versus the longwall mining panel width to overburden depth ratio (W/d) in terms of the ratio of maximum vertical displacement to overburden depth (S/d). NCB curves are from the National Coal Board Handbook, 1975. $M_{(BR)}$, $+E_{(BR)}$, and $-E_{(BR)}$ are maximum tilt, and maximum positive and negative strain curves for Bowie, respectively. Tilt (circles) and strain (squares) are for the West Elk Mine, strain (diamonds) are shown for the York Canyon longwall mine. The average National Coal Board (NCB, 1975) longwall curves for tilt and strain are also shown. Tilt (triangles) are for Bowie Mine panel B-10 (point 1 of survey line 38), points 2 and 3 are above panel B-11 (survey line 39) and point 4 is above longwall panel 12 (survey line 40).

7.4 Draw Angle (limit angle, angle of draw)

The draw, or limit, angle (ϕ) defines the limit of subsidence at the surface in relation to a given mining panel at depth. Therefore, by projecting a series of straight lines from around the edges of a given mining panel to the surface, the surface area affected by extracting the coal in the panel can be determined. As previously mentioned, the draw angle for room-and-pillar and longwall mines in the Somerset area ranges between 9 and 21 degrees (Dunrud, 1976). In the 1990's, a draw angle of 25 degrees was used at West Elk mine to plan future mining panels relative to mine lease boundaries.

The observed draw angles, relative to the edge of the rigid pillars, for survey lines 40 and 41 (upper B-seam Western Mining District) are 23.4 degrees and 20.3 degrees, respectively, for an average of 21.8 degrees. The average draw angle (rounded to the nearest whole number), as determined from the survey data for the Western Mining District (see Figures 3 and 4) is therefore 22 degrees. The draw angles (ϕ), vertically referenced to the edges of the rigid pillars, are calculated and listed below as follows:

Survey Line 40: $\phi = \arctan(485/1120) = 23.4$ degrees,

Survey Line 41: $\phi = \arctan(435/1175) = 20.3$ degrees.

8.0 IMPACTS OF SUBSIDENCE ON ENVIRONMENTALLY SENSITIVE AREAS

8.1 Longwall Mining in Geologic Hazard Areas of Landslides, Rockfalls, and Unstable Slopes

The surface geology in the Western Mining District and the Spruce Stomp Lease Area consist of primarily unconsolidated deposits of clays and silts of the Wasatch Formation intermixed with basalt boulders derived from extrusive rocks capping Grand Mesa. This material, mapped as debris flows in the area (Dunrud 1989), is commonly stable and resistant to stream erosion and to mass-gravity movements. Movement of these Wasatch clays and silts mixed with intrusive igneous rocks in the West Elk mining area has not been observed during more than 17 years of subsidence observations.

However, the terminal points of landslide/debris flow deposits are located on the north and south edge of the West Fork Terror Creek channel where the flow gradient begins to increase eastward

(Dunrud 1989). These deposits are visible on a detailed satellite or aerial image of the area. The northern, more extensive deposit shows no sign of recurring movement. The lower part of the southern slide, however, shows signs of renewed movement since initially deposited (since the mid-1980s during times of very high precipitation). These landslides/debris flows consist of unconsolidated basalt boulders and Wasatch clays that were re-mobilized during periods of very high precipitation—precipitation probably much higher than during the hundred-year or so history of coal mining in the North Fork Valley.

The unconsolidated clay and basalt mixture has locally been eroded away to expose the underlying bedrock in the Western Mining District and the Spruce Stomp Lease Area. The bedrock consists of rocks of the Mesaverde Formation. In ascending order they are: the Rollins Sandstone, the Coal-Bearing Member, the Barren Member, and the Ohio Creek Member. No exposed bedrock has been mapped in the channel area of West Fork Terror Creek as of the time of this report preparation.

8.2 Mining beneath Streams

Longwall mining is proposed in the Spruce Stomp Lease Area (lower B-seam) immediately north of the Western Mining District (upper B-seam). Overburden depths above the 12 proposed panels in the Spruce Stomp Lease Area range from about 800 feet to 2,300 feet. At least four of these twelve proposed mining panels will be partly located beneath West Fork Terror Creek (see Map 1). Overburden depth above the West Fork Terror Creek stream channel ranges from about 950 feet near the confluence with the main (or east) fork of Terror Creek to about 1,780 feet above the proposed second panel from the northwest limit of mining.

Subsidence-related impacts to West Fork Terror Creek flow are not expected based on previous observations by the author; (1) above room-and-pillar mine workings in Bear Creek area in 1976 (Section 8.2.1), and (2) in the West Elk mining area over a 17-year period (1996-2012 inclusive) as discussed below.

8.2.1 Bear Creek Room-and-Pillar Mining area:

The following subsidence case history was observed by the author in the late summer and early fall of 1976 while mapping the geology in the Bear Creek area for the U.S. Geological Survey.

This case history is a local example of how different types of near-surface material behave in response to tensile strain caused by subsidence.

The area is located above a B-seam room-and-pillar mine where the coal extraction thickness was 10 feet and the overburden depth ranged from 250 to 500 feet. Mine records show that the partial extraction mining procedure (about 50 to 60 percent of the coal was removed) occurring at the time of geologic mapping was completed in December 1976.

Pillars were extracted in a panel 400 to 460 feet wide, located 220 to 300 feet (average of about 260 feet) beneath Bear Creek. The pillars—in a zone 350 feet wide beneath Bear Creek—were only partially extracted. The remaining pillars on either side of this zone were completely extracted. The original pillar dimensions were 60 feet square. Two adjacent sides of each pillar in the zone were further mined, so that the remaining pillars measured 30 to 35 feet on a side.

Irregular, en-echelon (offset) cracks as much as 1-foot wide, and 25 to 50 feet long that trended roughly parallel to the stream and the pillar extraction line, were observed by the author in weathered bedrock and thin colluvium (a few feet thick) on the east side of the valley 75 to 100 feet above Bear Creek. The crack depth was difficult to estimate, because extensive sloughing had already occurred. However, the cracks likely ranged between 3 and 10 feet deep before sloughing began.

Cracks 4 to 8 inches wide and 10 to 20 feet long went also mapped on the west side of Bear Creek. These cracks occurred on either side of the extraction panel and trended nearly parallel to the boundaries. The cracks crossed the road and extended eastward upslope and westward towards the stream.

The cracks, as mapped by U.S. Steel personnel, show that the cracks were located on either side of the panel and also in the stream bed. However, the author observed no cracks in the stream bed on his first visit to the area about a day after the visit by U.S. Steel personnel.

Small, irregular cracks a fraction of an inch to an inch or two wide, 10 to 25 feet long, and a few inches to perhaps 1-foot deep, could be seen in colluvium an estimated 10 to 20 feet thick and located 15 to 30 feet above the stream.

No cracks were observed in saturated alluvium underlying the Bear Creek stream. The thickness of the alluvium was estimated to be 10 to 15 feet and the underlying colluvium 30 to 50 feet. Although no flume measurements were made, no loss of flow downstream in Bear Creek from this area was observed or reported.

Two possibilities, or a combination of both, provide an explanation for these observations:

- 1) The alluvium stretched without rupturing when mine subsidence occurred in the stream channel.
- 2) Cracks in the alluvium healed and sealed by sloughing prior to the author visiting the site. Healing and sealing of any cracks present in the stream alluvium is a viable alternative, because the vertical limit of cracks would only be about one-half the alluvium thickness. The alluvium would be in compression below its neutral surface (see Figure 1, Enlargement 2).

It is important to note that there was no observed or reported effect on Bear Creek stream flow due to the subsidence from the time of this observation in the mid-1970s to the spring of 1999.

8.2.2 West Elk Mining Area

The writer has observed neither cracks in alluvium nor any impacts on stream flow when traversing some 25 longwall mining areas during a 17 year period of subsidence observations (1996-2012 inclusive) in the West Elk mining area.

Recent (2012) subsidence measurements above mined longwall panels, along the stream centerline (thalweg) on the Dry Fork of Minnesota Creek shows that there was as much as 9.5 feet of subsidence, where 14 feet of coal was extracted in the underlying longwall panel. However, there has been no reported loss of water to the mine, no complaint of water loss by irrigators relying upon this water supply, and no observed cracks in the alluvium.

8.2.3 Bowie No. 2 Mine Area

The Bowie Annual Hydrologic/Subsidence report of 2011, prepared by J. E. Stover & Associates, Inc., concluded that there were no hydrologic impacts from longwall mining in the Bowie No. 2 Mine. Specifically, there was no subsidence damage to the following ponds and

perennial spring (Jim Stover, oral communication: January 22, 2013):

1. No impact from a subsidence of about 9.5 feet on pond (P-2), located at the head of Freeman Gulch on Bowie private land.
2. No impact from a subsidence of approximately 3.5 feet at another pond and perennial spring (SP-34-11) located in Sheep Corral Gulch on U. S. Forest Service land (USFS Water Right Number 87RIIN805P36).

9.0 CONCLUSIONS

The major findings of subsidence amounts and processes projected for the Spruce Stomp Lease Area have been presented. These findings, which are based on detailed subsidence analyses in the adjacent West Terror Creek mining area to the south, are summarized below.

1. Maximum measured vertical displacement (S) values in the Western Mining District range from about 6.0 to 7.5 feet in the upper B-seam above longwall panels B-10, B-11, and B-12, where the overburden depth ranges from 600 to 1,050 feet. The greatest measured S value (7.5 feet) is located above mined panel B-11 due to yield on adjacent gate road pillars caused by mining of adjacent panels. Based on these data, the S values after mining is complete for the Spruce Stomp Lease Area (i.e., northern 8 longwall panels) vary depending on overburden depths from a maximum projected value of 4.2 feet in the proposed western panels to a maximum projected value of 5.7 feet in the proposed eastern panels. The location of this maximum projected subsidence value is located approximately 300 feet south of West Fork Terror Creek.
2. Based on maximum measured tilt (M) in the Western Mining District, the maximum tilt in the Spruce Stomp Lease Area is projected to range from 2.7 S/d where W/d equals 0.43 (deepest western panel) to 2.0 S/d where W/d is 0.94 (shallowest eastern panel).
3. Tensile strain for the Spruce Stomp Lease Area is projected to be 1.0 S/d for all W/d values. Compressive strain is expected to range from -2.3 S/d where W/d equals 0.43 (deepest western panel) to -1.0 S/d where W/d equals 0.94 (shallowest eastern panel).

4. The average draw angle as projected for the Spruce Stomp Lease Area is 22 degrees based on measured survey data.
5. Longwall mining is generally conceptualized in a model comprising uniform downwarping of various overburden strata and surficial materials that are laterally constrained multiple beams (in two dimensions) or plates (in three dimensions). This model has been verified by subsidence observations in room-and-pillar mining areas in the mid-1970's and, more recently, in longwall mining operations in the West Elk mining area.
6. Under the concept of uniform longwall extraction and related uniform downwarping of the overburden rocks and unconsolidated material as lateral constrained plates, cracks in zones under tensile stress decrease in width with depth, and close at the neutral surfaces. Below the neutral surfaces, the materials are in compression (under compressive stress) (see Figure 1).

This concept has an important bearing on the hydrologic impacts of mining beneath streams or water-bearing zones located in the continuous deformation zone or near-surface zone. Any surface water or groundwater is prevented from moving downward beyond the neutral surface of a rock unit deforming as a constrained plate. Field observations over a 17-year period in the West Elk mining area have verified this conceptual model in laterally constrained bedrock and surficial material (colluvium, alluvium, mudflow, and debris flow deposits). Based on past observations in the Somerset, West Elk and Bowie No. 2 mine areas, no permanent loss of flow is predicted when longwall panels are mined in the lower B-seam beneath West Fork Terror Creek even if bedrock were exposed in the stream bed. If alluvium and colluvium is present, these materials will fill any near-surface cracking that may develop which will further reduce potential loss of flow. Past drilling near West Fork Terror Creek has shown that the surficial material (alluvium and colluviums) is greater than 40 feet in thickness at the points drilled. Surficial material measured at the drill sites were 1) greater than 85 feet thick near the confluence of West Fork Terror Creek and Terror Creek, and 2) 42 feet thick at a site approximately midway above the eastern projected longwall panels.

REFERENCES CITED

- Dunrud, C. R., 1989. Geologic map and coal stratigraphic framework of the Paonia area, Delta and Gunnison Counties, Colorado. U. S. Geological Survey Coal Investigation Map C-115.
- Dunrud, C. R., 1998. Engineering geology applied to the design and operation of underground coal mines. U. S. Geological Survey Bulletin 2147.
- Gentry, D. W. and Able, J. F., Jr., 1978. Surface response to longwall coal mining in mountainous terrain. Association of Engineering Geologists Bulletin, vol. 15, No. 2, p. 191-220.
- National Coal Board, 1975. Subsidence engineers handbook. National Coal Board, United Kingdom, Mining Department.
- Peng, S. S., 1992. Surface subsidence engineering. Society for Mining, Metallurgy and Exploration, Inc.
- Peng, S. S. and Geng, D. Y., 1982. Methods of predicting the subsidence factors, angle of draw and angle of critical deformation. Proceeding of State-of-the-art of Ground Control in Longwall Mining and Mining Subsidence Conference. Littleton, Colorado.
- Stover, J. E., 2013. Oral communication on January 22, 2013.

MAP

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In Reply Refer To:
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14-10-09-09

OCT 3 - 2014

Nicole Caveny
Environmental Protection Specialist
Western Region
U.S. Office of Surface Mining/DOI
1999 Broadway, Suite 3320
Denver, CO 80202-3050

RE: C-1996-083 – PR-14 – Bowie Resources, LLC – BLM Mine Plan Determinations

Dear Ms. Caveny:

We have determined that BRL's mining plan and proposed operations would comply with the Mineral Leasing Act of 1920, as amended, all applicable requirements of both 43 CFR Subpart 3480 and the conditions and special stipulations of the federal leases involved. We also find that maximum economic recovery of the federal coal within LMU 57202 that contains active federal leases COC37210 and COC61209 as well as the recently issued federal lease COC75916 known as Spruce Stomp would be achieved.

Also, as a result of mine plan reviews, and in harmony with BLM's land use plan for the North Fork region, we are giving our consent as a land management agency for underground coal mining where portions of the surface included within boundaries of federal leases COC37210, COC61209, and COC75916 are managed by BLM.

These determinations cover the entire leased lands encompassed in PR-14. If you have any questions, please call Desty Dyer at 970-240-5302.

Sincerely,

Barbara L. Sharrow
Field Office Manager

CC: Bill Bear, Bowie Resources Limited
Susan L. Burgmaier, Colorado Division of Minerals and Geology



United States
Department of
Agriculture

Forest
Service

Grand Mesa,
Uncompahgre and
Gunnison
National Forests

2250 Highway 50
Delta, CO 81416
Voice: 970-874-6600
TDD: 970-874-6660

File Code: 2820

Date: October 21, 2014

Nicole Caveny
Environmental Protection Specialist
OSMRE
1999 Broadway, Suite 3320
Denver, CO 84022

14-10-31-26

Dear Ms. Caveny:

The Grand Mesa, Uncompahgre and Gunnison National Forests have completed review of Bowie Resources, LLC's Federal Coal Mine Lease by Application for the Spruce Stomp Tract, dated October 12, 2012. This competitive coal lease, number COC-75916, was submitted to and ultimately issued by the Bureau of Land Management (BLM).

A joint BLM/OSMRE/Colorado Division of Reclamation, Mining and Safety/Forest Service Environmental Assessment was prepared prior to the issuance of the lease. Our Decision Notice and Finding of No Significant Impact were issued on September 27, 2013 and our consent for BLM to lease was provided on January 29, 2014.

The Forest Service has reviewed the unsuitability criteria published in 43 CFR 3461 (EA Appendix A) and determined that there are no significant recreational, timber, economic or other values that are incompatible with issuing the lease. None of the affected National Forest System (NFS) lands in the lease were found unsuitable for surface control mining and reclamation pursuant to Section 522 of SMCRA.

Regarding the adequacy of measures to protect Federal resources, any activities proposed in the mining plan must be conducted consistent with measures listed in the lease and included herein as Attachment A in order to adequately protect surface resources on NFS lands. We have no additional stipulations to add at this time.

Provided that the conditions of Attachment A are carried forward in the OSMRE's decision, this letter constitutes Forest Service concurrence to the decision.

If you have any questions or concerns, please contact Jessica Lopez Pearce at 970-487-3534 or jlopezpearce@fs.fed.us.

Sincerely,

SCOTT G. ARMENTROUT
Forest Supervisor

Enclosure

cc: Desty Dyer, Jessica Lopez Pearce



Attachment A
Lease Stipulations
Stipulations Identified in the Unsuitability Criteria

Wild and Scenic Rivers

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw [angle between a vertical line drawn upward to the surface from the edge of the underground opening and a line drawn from the edge of the opening to the point of zero surface subsidence], etc.) shall be used to control subsidence.
- No surface developments (i.e., MDWs or access roads) shall be allowed within the ½ mile wide river study corridor (i.e., 1/4 mile wide on each side of the West Fork of Terror Creek) on BLM lands/minerals. This stipulation will no longer apply if the eligible segment on West Fork of Terror Creek is found not suitable for inclusion in the National Wild and Scenic River System, or if suitable, if it is dropped from further consideration by Congress.

Rights-of-Way

- Electrical safety clearances addressed in the Code of Federal Regulations, 29 CFR 1910.333(c) (3) must be maintained at all times.
- All vehicles, equipment, and/or machinery or other materials near the right-of-way must be properly grounded. In order to avoid static or induced electrical hazards no materials may be stored in the transmission line right-of-way.
- If future longwall mining would come within 100 feet of any transmission line tower foundation, a structural review and acceptance by WAPA would be required.
- Any drilling activities within WAPA's right-of-way must be approved by WAPA in advance. Safety provisions would be provided to ensure there are no conflicts with WAPA's transmission line or access.
- The lessee is required to coordinate with WAPA's operations center located in Western Rocky Mountain Region Office in Loveland, Colorado at least two weeks prior to commencement of any work beneath or adjacent to the transmission line.
- Roads used to provide personnel and equipment access to WAPA's facilities cannot be restricted or impaired in a way that denies access. Alternate access must be provided if an access road is blocked or damaged. Damage to WAPA's access roads must be repaired by the lessee or lessee's contractor.
- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining related surface disturbance would occur within 100 feet of the outside line of the power line right-of-way without a written finding from the Authorized Officer and consultation with the right-of-way holder. These techniques would provide for maximum coal removal while insuring that sufficient coal is left in place to prevent subsidence.



- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation will be performed at the lessee's expense.
- Baseline condition surveys of existing facilities will be completed the fall following award of lease. Reports of this survey will be deliverable to the Forest Service by December 1 of that same year.
- A Surface Facility Monitoring and Mitigation Plan (Plan) will be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan will detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.

Threatened and Endangered Species

- State-of-the-art mining techniques (pillar and panel widths, rate of coal development and extraction, mine method, determining angle of draw, etc.) would be used to control subsidence. No mining-related surface disturbance (i.e., MDWs and roads – not including subsidence) would occur within 200 feet of greenback cutthroat trout occupied habitat, as measured from the normal high water mark, without a written finding from the Authorized Officer. These techniques would provide for maximum coal removal while protecting the values associated with the threatened greenback cutthroat trout habitat.
- Adequate sediment control devices, such as silt fences or straw wattles composed of native substances or other effective BMPs, would be placed down slope from the pads and access roads to prevent potential sedimentation effects to West Terror Creek.
- In order to ensure that BMPs relating to the control of sediment from disturbed sites are in place and functional, lessee shall, during major runoff periods, use an independent contractor to inspect the lessee's well pad sites and access roads within the Terror Creek watershed. The independent contractor shall contact lessee, USFS, and the BLM (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Lessee will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with USFS and BLM. For each year that lessee operates under this BA, lessee shall submit the compiled monthly inspection reports to BLM UFO by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- At any time during drilling activities, until successful reclamation or continuing into the future, the point of access to temporary roads shall be blocked with gates to prevent vehicles, including Off-Highway Vehicles (OHVs), from using them. Signs identifying the road closure shall be placed at the barricades.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not

be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the USFS and BLM fisheries biologists for their approval.

- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), lessee will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year – October through March.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.
- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed, only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM or USFS hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Lessee must report their annual water depletions to the BLM UFO by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- No surface disturbance, such as road widening or upgrading would occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, to protect delineated wetlands or riparian areas and maintain riparian vegetation and eliminate potential effects to the greenback cutthroat trout, unless exceptions were approved by the Authorized Officer.
- Site-specific surveys for sensitive plants would be conducted onsite prior to the development of any surface facilities or to other soil-disturbance activities.
- There would be no surface occupancy or soil-disturbing activities within a 100-foot radius of sensitive plant locations unless exceptions were approved by the Authorized Officer.
- Application of herbicides, surfactants, and other weed control measures would avoid overspray or drift onto desirable species or sensitive plants.

- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the coal lessee, at their expense, will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, and wildlife use, as authorized by 36 CFR 251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.
- The lessee/operator would design the layout of longwall panels to minimize impacts to West Fork Terror Creek. Primarily, this will consist of orienting panels approximately parallel with the creek as currently proposed and represented in the Subsidence Report (WWE, 2013a), thus reducing the number and severity of transitions from subsidence to non-subsidence zones.
- The lessee/operator would design and implement a stream flow measurement program. The program will consist of establishing monitoring stations upstream and downstream of the expected subsidence area on West Fork Terror Creek. Flow monitoring stations will be designed and calibrated by water resource engineers and will focus on continuous measurements of low and base flow conditions (i.e., summer through late fall). Lessee/operator staff will have trained staff available to conduct site visits to ensure continuous flow measurements are recorded on a minimum monthly schedule, weather permitting. Flow data will be compiled into an annual report that will include comparisons to previously collected data. This report will be submitted to the BLM, USFS and USFWS.
- The lessee/operator will conduct fish, sediment and macroinvertebrate sampling (as performed by WWE and MEC in 2012) every two years during and twice following the mining activities (at 5 and 10 years periods) prior to bond release. A report should be distributed to the BLM, USFS and USFWS documenting if statistically significant declines are observed related to mining activities. If a statistically significant decline in the fishery within the subsidence area results from the Proposed Action (i.e., a decline at sites within the subsidence area does not correlate with a decline in the fishery outside the subsidence area), the lessee/operator will investigate the cause of the decline. If the decline is resulting from habitat changes as a result of longwall mining induced subsidence, the operator/lessee will engage a fish habitat ecologist to design habitat enhancement structures to mitigate the observed impacts. If a decline in fish numbers persists following mitigation of an observed physical or chemical impact, the lessee/operator will work with CPW to capture and grow out fish populations from appropriate breeding stock. The lessee/operator will establish a minimum of two subsidence monitoring gridlines across the stream channel in areas of anticipated vertical displacement that will be surveyed prior to and following longwall mining beneath the area. These survey data will be used to confirm/refine the subsidence predictions for the area. The results of these surveys, as available, will be included in the previously mentioned annual Monitoring Report and distributed accordingly.

Bald and Golden Eagle Nest Sites

- No new permanent surface facilities or disturbance except subsidence would be located within a one-quarter mile radius buffer zone around each bald or golden eagle nest site.
- No surface activities would be allowed within a one-half mile radius buffer zone around each active eagle nest site from November 15 to July 30 for bald eagles and February 1 to July 15 for golden eagles. Any proposed surface facilities, disturbance, or activities (as noted above) in or adjacent to these buffer zones would require approval from the surface management agency on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Bald and Golden Eagle Roost Sites

No surface activity, except subsidence, would occur within a one-quarter mile radius of winter roosts between November 15 and March 15. Development may be permitted at other periods. If periodic visits are required within the buffer zone after development, activity would be restricted to the hours of 10:00 a.m. and 2:00 p.m. from November 15 through March 15.

Peregrine Falcon Nest

- No new permanent surface facilities or disturbance would be located within a one-quarter mile radius buffer zone around each peregrine falcon nest site.
- No aboveground activities would be allowed within a one-half mile radius buffer zone around each active peregrine falcon nest site from February 1 to July 15.
- Any proposed surface facilities, disturbance, or activities in, or adjacent to, these buffer zones would require approval from the USFS or BLM on a site-specific basis, after consultation with the U.S. Fish and Wildlife Service.

Migratory Birds

- For any future proposed disturbances on the lease, a qualified biologist would conduct pre-construction breeding bird and raptor surveys during the breeding period within 0.5 mile of the general disturbance area (drill pads and access roads) if activities would occur during the breeding season (generally May 15 to August 1, but varies by species). Surveys would document active nests and aspen snag reconnaissance prior to surface disturbance. If no active nests are found and a survey report is submitted to and approved by the USFS or BLM Biologist, activities may begin within the cleared areas. If active nests are found, development timing would be restricted during the breeding season, as per the USFS or BLM authorized officer.

- Where practicable, surface disturbing activities should not occur during the migratory bird nesting period (May 15 through August 1) to prevent potential take of migratory birds and/or eggs, unless vegetation is removed prior to May 15. Nesting surveys conducted within 2 weeks of surface-disturbing activities that indicate no migratory bird species are nesting or otherwise present within the area to be disturbed may also be considered; however, consultation and approval by USFS or BLM would be required. If active nests were identified during mine permit related project disturbances, appropriate measures would be taken in order to reduce impacts to these species, including relocating overland access routes and drill-hole locations; and implementing disturbance-free buffer zones and timing limitations for active nests as recommended by the USFS or BLM.
- All unavoidable surface disturbances would require approval of the USFS or BLM Authorized Officer. The USFS or BLM would coordinate with USFWS to determine the type and extent of allowable variances. A site-specific examination would determine if this stipulation would apply.

State Priority Species

- Facility construction and major scheduled maintenance shall not be authorized within big game winter ranges from December 1 through April 15. All unavoidable surface disturbances within the winter ranges during these times would require approval of the USFS or BLM Authorized Officer and consultation with CPW. Monitoring and access to the sites by over-the-snow vehicles shall be permitted, but no snow plowing may occur.
- Bear-proof containers would be used and refuse collected frequently to minimize potential for human-bear conflicts at construction sites. Employee training would include information to reduce bear-human conflicts including not feeding bears.
- Noise reduction mitigation would be utilized on the individual MDW pumps to reduce impacts from their operation.

Air Quality and Climate

- Fugitive emissions from all vehicles traveling on regularly-used non-paved surfaces during all project phases shall be controlled utilizing a variety of suppression techniques applied to the non-paved roads.
- Storage piles shall be watered or covered as necessary to limit wind erosion potential and reduce fugitive emissions.

Geology and Minerals

- No surface occupancy would be allowed in areas of high geologic hazard or high erosion potential or slopes greater than 60 percent.
- If subsidence adversely affects surface resources in any way (including, but not limited to a documented water loss), the lessee, at their expense will be responsible to: restore stream channels, stock ponds, protect stream flow with earthwork or temporary culverts, restore affected roads, or provide other measures to repair damage or replace any surface water and/or developed groundwater source, stock pond, water conveyance facilities, with water from an alternate source in sufficient quantity and quality to maintain existing riparian habitat, livestock and wildlife use, or other land uses as authorized by 36 CFR

251. An appropriate augmentation plan for replacement water will be decreed prior to commencing mining activities and will consider drought conditions and the limitations of local water supplies.

- Special interdisciplinary team analysis and mitigation plans detailing construction and mitigation techniques may be required on areas where slopes range from 40-60 percent. The interdisciplinary team could include engineers, soil scientist, hydrologist, landscape architect, reclamation specialist and mining engineer.
- The operator/lessee would be required to perform adequate baseline studies to quantify existing surface and subsurface resources. Existing data can be used for baseline analyses provided that the data is adequate to locate, quantify, and demonstrate interrelationships between geology, topography, hydrogeology, and hydrology. The operator/lessee would be required to establish or amend a monitoring program to be used as a continuing record of change over time of area resources in order to assess mining induced impacts. The monitoring program shall provide the procedures and methodologies to adequately assess interrelationships between geology, topography, hydrogeology, and hydrology identified in the baseline assessment to mining activities. The monitoring program shall incorporate baseline data so as to provide a continuing record over time.

Vegetation - Invasive Plant Species

An inventory shall be completed for noxious weeds within the LBA tract before construction begins in order to determine whether there is a need for pre-treatments (with results of the inventory shared with the USFS and BLM weed specialist).

Access and Transportation

- No mining related disturbance would occur within 100 feet of the outside line of the right-of-way of Stevens Gulch Road. The angle of draw used to protect the road from subsidence would be dictated by the approved Colorado DMG Mining and Reclamation Plan (the estimated angle of draw is conservatively estimated to be 25 degrees). However, mining-related disturbance may occur if, after public notice and the opportunity for public hearing in the locality, a written finding is made by the Authorized Officer that the interests of the public and the landowners affected by mining within 100 feet of the public road would be protected.
- The lessee/operator shall be required to perform the following with respect to monitoring, repairing, and/or mitigating subsidence effects on existing facilities under Special Use Permit with the Forest Service. Monitoring, repair and/or mitigation shall be performed at the lessee's expense.
- Baseline condition surveys of existing facilities shall be completed the fall following award of lease. Reports of this survey shall be deliverable to the Forest Service by December 1 of that same year.
- A Surface Facility Monitoring and Mitigation Plan (Plan) shall be submitted to the Forest Service for review and approval not later than 12 months prior to scheduled undermining. The Plan shall detail measures to be taken to monitor, repair, and mitigate subsidence effects on the facilities during actual mining and for one year post mining.

- The lessee/operator shall schedule mining activities such that active subsidence of roads occurs during dormant winter months, unless no other practicable alternative exists.

Range Management

Any construction/operation impacts man-made barriers to livestock movement shall be mitigated by replacing fences, gates, cattle guards, and gates to at least the same condition as they were found before construction, and installation of new fences where needed.

NOTICE FOR LANDS OF THE NATIONAL FOREST SYSTEM UNDER JURISDICTION OF DEPARTMENT OF AGRICULTURE

The permittee/lessee must comply with all the rules and regulations of the Secretary of Agriculture set forth at Title 36, Chapter II, of the Code of Federal Regulations governing the use and management of the National Forest System (NFS) when not inconsistent with the rights granted by the Secretary of Interior in the permit. The Secretary of Agriculture's rules and regulations must be complied with for (1) all use and occupancy of the NFS prior to approval of a permit/operation plan by the Secretary of the Interior, (2) uses of all existing improvements, such as forest development roads, within and outside the area permitted by the Secretary of the Interior, and (3) use and occupancy of the NFS not authorized by a permit/operation plan approved by the Secretary of the Interior.

All matters related to this stipulation are to be addressed to:

Foreset Supervisor, Grand Mesa-Uncompahgre-Gunnison NF
2250 Hwy 50, Delta, Colorado 81416
970-874-6600

who is the authorized representative of the Secretary of Agriculture.

NOTICE

CULTURAL AND PALEONTOLOGICAL RESOURCES - The FS is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator, unless notified to the contrary by the FS, shall:

1. Contact the BLM/FS to determine if a site specific cultural resource inventory is required. If a survey is required, then:
2. Engage the services of a cultural resource specialist acceptable to the BLM/FS to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the area of proposed disturbance to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the BLM/FS for review and approval at the time a surface disturbing plan of operation is submitted.
3. Implement mitigation measures required by the FS and BLM to preserve or avoid destruction of cultural resource values. Mitigation may include relocation of proposed facilities, testing,

salvage, and recordation or other protective measures. All costs of the inventory and mitigation will be borne by the lessee or operator, and all data and materials salvaged will remain under the jurisdiction of the U.S. Government as appropriate.

The lessee or operator shall immediately bring to the attention of the FS and BLM any cultural or paleontological resources or any other objects of scientific interest discovered as a result of surface operations under this lease, and shall leave such discoveries intact until directed to proceed by FS and BLM.

ENDANGERED OR THREATENED SPECIES - The FS is responsible for assuring that the leased land is examined prior to undertaking any surface-disturbing activities to determine effects upon any plant or animal species listed or proposed for listing as endangered or threatened, or their habitats. The findings of this examination may result in some restrictions to the operator's plans or even disallow use and occupancy that would be in violation of the Endangered Species Act of 1973 by detrimentally affecting endangered or threatened species or their habitats.

The lessee/operator may, unless notified by the FS that the examination is not necessary, conduct the examination on the leased lands at his discretion and cost. This examination must be done by or under the supervision of a qualified resource specialist approved by the FS. An acceptable report must be provided to the FS identifying the anticipated effects of a proposed action on endangered or threatened species or their habitats.

Cultural Resources Documentation

Date: 4/24/2013

To: Ryan Taylor

Office: Paonia RD

Project Name: **Bowie Spruce Stomp Lease Modification**

Proponent (optional): **Bowie, LLC**

GMUG Project No.: **R2013-020408-123 and R2013-020408-123A**

Please file the attached information in your **project planning file** as documentation of steps required under the NHPA/NEPA regulations for consideration of cultural resources.

Note—*Cultural resource site location information and maps are confidential* and must not be left in general project files or files accessible to the public.

This documentation contains:

- ☐ Clearance Memo or other input for project NEPA files, no further work needed.
This Clearance is valid only for the project and location described in it.
- ☐ 2010 Programmatic List of Exempt Project Types with no potential to affect sites.
[No SHPO consultation needed. Forest may proceed].

- ☐ Transmittal letter to SHPO for an Inventory—Negative Results
[No SHPO reply is required. Forest may proceed with project.]

- ☒ Copy of transmittal letter conveying report (with sites) to the SHPO
[Forest waits for concurrence for up to 30 days to finalize decision or proceed.]

- ☒ Reply letter from SHPO indicating concurrence
[Forest may proceed with project-- following mitigation measures if any were made.]

****Notes: Two sites must be monitored if the lease is approved and mining occurs. These sites include 5DT90 and 5DT96. 5DT90 is on USFS land; 5DT96 is on USFS and private lands. A stipulation that this will occur should be included in the lease and NEPA documentation. If monitoring shows adverse effects to these sites, further consultation with SHPO and consulting tribes to resolve these effects must occur.**

-
- ☒ **Mitigation Required:** Two sites in project area must be monitored. For specific information--
 - ☐ Copy of report/ list of sites/ or maps attached
 - ☒ Please contact your zone archaeologist for a copy of this report and maps you may need.
-

/s/signed: /s/ Liz Lane

This copy is for: ☒ Original--Planner
☐ District/Zone Cultural Resource File
☐ S.O. Cultural Resource File



April 16, 2013

Scott G. Armentrout
Forest Supervisor
USDA Forest Service
Grand Mesa, Uncompahgre, and
Gunnison National Forests
2250 Highway 50
Delta, Colorado 81416

Re: Assessment of Effects of Subsidence to Historic Properties within the Proposed Spruce Stomp Lease Modification Area (GMUG Report No. R2013-020408-123A) (CHS #63470)

Dear Mr. Armentrout:

Thank you for your correspondence dated April 2, 2013 (received by our office on April 4, 2013) regarding our ongoing consultation for the subject undertaking.


Based on our review of the documentation provided, we concur with your determination that while impacts may result from subsidence to sites 5DT90 and 5DT96, these will not likely alter the qualifying characteristics for which these sites are eligible to the National Register. As such, we concur that the proposed lease sale will result in no adverse effect pursuant to 36 CFR 800.5(b). This project effect finding assumes that cultural resource monitoring, as described on page 3 of the addendum report, will be followed and that if any impacts occur to either site (5DT90 or 5DT96) additional consultation with our office will occur.

Please remember that the consultation process does involve other consulting parties such as local governments and Tribes, which as stipulated in 36 CFR 800.3 are required to be notified of the undertaking. Additional information provided by the local government, Tribes or other consulting parties may cause our office to re-evaluate our comments and recommendations.

Should unidentified archaeological resources be discovered in the course of the project, work must be interrupted until the resources have been evaluated in terms of the National Register eligibility criteria (36 CFR 60.4) in consultation with our office.

Thank you for the opportunity to comment. If we may be of further assistance please contact Mark Tobias, Section 106 Compliance Manager, at (303) 866-4674 or mark.tobias@state.co.us.

Sincerely,


for Edward C. Nichols
State Historic Preservation Officer
ECN/MAT



United States
Department of
Agriculture

Forest
Service

Grand Mesa,
Uncompahgre and
Gunnison
National Forests

2250 Highway 50
Delta, CO 81416
Voice: 970-874-6600
TDD: 970-874-6660

File Code: 2360
Date: April 2, 2013

EDWARD NICHOLS
STATE HISTORIC PRESERVATION OFFICER
OFFICE OF ARCHAEOLOGY & HISTORIC PRESERVATION
HISTORY COLORADO CENTER
1200 BROADWAY
DENVER, CO 80203

Re: Assessment of Effects of Subsidence to Historic Properties within the Proposed Spruce Stomp Lease Modification Area (GMUG Report No. R2013-020408-123A)

Dear Mr. Nichols:

Previously, an inventory was completed to identify historic properties within the proposed Spruce Stomp Lease Modification Area (GMUG Report No. R2012-020408-123). It has been determined that historic properties within the proposed lease area have been identified. A letter from your office dated March 4, 2013, requested additional information about potential effects of the proposed project in order to determine effects to historic properties. The enclosed addendum report provides this information. Four historic properties or potential historic properties were identified within the proposed lease boundary during the inventory. These are listed in the table below.

Site No.	Description	Land Owner	NRHP Eligibility Recommendation & Potential Effect
5DT90	Roatcap Sawmill location dating ca. 1880s-1989 (no buildings remain; scatter of artifacts only) and light prehistoric artifact scatter. All exposed artifacts were previously collected in 1978; only a few artifacts were observed in 2012	USFS	Need Data (potentially eligible under Criterion D). In subsidence zone; slight probability of effects.
5DT96	Jess Barrow homestead and/or cow camp; includes a standing cabin, a privy, 2 corrals, and a tent frame (ca. 1938-present)	USFS, private	Eligible (Criteria A, C). In subsidence zone; low probability of effects.
5DT698	Hughes Cow Camp and recreational cabin (20 th century); includes a standing cabin	private	Eligible (Criteria A, C). Not located in subsidence APE.
5DT1719	Prehistoric artifact scatter (Formative-Proto-historic Periods) that includes a possible thermal feature, a piece of ground stone, and 11 pieces of flaked stone debitage	BLM	Eligible (Criterion D). Not located in subsidence APE.

A review of technical analyses of potential subsidence within the Spruce Stomp lease area has determined that based upon the geology and soils present and the location of the sites relative to the planned support columns, subsidence risk is very low. Therefore, we find that the proposed lease action would have **no adverse effect** to historic properties.

Please contact Liz Lane at 970-263-5823 or ealane@fs.fed.us if you have questions.

Sincerely,

/s/ Corey P. Wong (for)
SCOTT G. ARMENTROUT
Forest Supervisor

Enclosure
cc: Leigh-Ann Hunt





March 4, 2013

Scott G. Armentrout
Forest Supervisor
Grand Mesa, Uncompahgre, and Gunnison National Forests
2250 Highway 50
Delta, Colorado 81416

Re: Spruce Stomp Lease Modification Inventory Report (R2012-020408-123) (CHS #63470)

Dear Mr. Armentrout:

Thank you for your correspondence dated February 5, 2013 (received by our office on February 7, 2013) and the documentation provided regarding the subject project.

Following our review of the information provided, we concur with your determination that sites 5DT96, 5DT698, and 5DT1719 are eligible for the National Register of Historic Places (NRHP). We concur that a finding of need data is appropriate for site 5DT90. We further concur with your determination that sites 5DT88, 5DT699, 5DT1795.3, 5DT1825.2, 5DT1826.2 (entire resource), and 5DT1896 are not eligible for the NRHP.

At this time, we are unable to concur with your determination of effect under Section 106 of the National Historic Preservation Act (36 CFR Part 800). We request that supplemental documentation as outlined in 36 CFR 800.11 be provided. This information should include appropriate analysis of the effects of underground coal mining on historic properties.

The consultation process does involve other consulting parties such as local governments and Tribes, which as stipulated in 36 CFR 800.3 are required to be notified of the undertaking. Additional information provided by the local government, Tribes or other consulting parties may cause our office to re-evaluate our comments and recommendations.

Thank you for the opportunity to comment. We look forward to continued consultation on the subject undertaking. If we may be of further assistance please contact Mark Tobias, Section 106 Compliance Manager, at (303) 866-4674 or at mark.tobias@state.co.us.

Sincerely,

for Edward C. Nichols
State Historic Preservation Officer
ECN/MAT



United States
Department of
Agriculture

Forest
Service

Grand Mesa,
Uncompahgre and
Gunnison
National Forests

2250 Highway 50
Delta, CO 81416
Voice: 970-874-6600
TDD: 970-874-6660

File Code: 2360
Date: February 5, 2013

EDWARD NICHOLS
STATE HISTORIC PRESERVATION OFFICER
OFFICE OF ARCHAEOLOGY & HISTORIC PRESERVATION
HISTORY COLORADO CENTER
1200 BROADWAY
DENVER, CO 80203

Re: Spruce Stomp Lease Modification Inventory Report

Dear Mr. Nichols:

Enclosed for your information in accordance with 36 CFR 800.3—800.5 is the report listed above and associated resource records. The following information applies:

GMUG Project Number: R2012-020408-123

Type of Project: Class III Complete Survey

The Grand Mesa, Uncompahgre, and Gunnison (GMUG) National Forests (USFS) and the Bureau of Land Management Uncompahgre Field Office (BLM) are considering a proposed action to lease around 1,850 acres of coal within the Spruce Stomp Lease Modification Area. Consequently, Grand River Institute conducted a Class III cultural resource inventory and paleontological assessment of the entire proposed lease area, consisting of 1360 acres of National Forest lands, 85 acres of BLM-administered lands, and 405 acres of private land.

Sites or IFs Recorded: The following new or re-evaluated cultural resources were recorded in the survey and records are enclosed:

Site Number	Components Present	NRHP Eligibility Recommendation
5DT88	Historic	Not Eligible
5DT90	Prehistoric, Historic	Need Data
5DT96	Historic	Eligible
5DT698	Historic	Eligible
5DT699	Historic	Not Eligible
5DT1719	Prehistoric	Eligible
5DT1795.3	Historic	Not Eligible
5DT1825.2	Historic	Not Eligible
5DT1826.2	Historic	Not Eligible
5DT1896	Historic	Not Eligible



Four eligible or unevaluated sites lie within the Area of Potential Effect (APE). The effects being analyzed at this time include the action to lease the coal and any reasonably foreseeable effects resulting from removal of underground coal deposits. Any future surface developments needed for the mining would be subjected to separate, additional Section 106 consultation. The only potential effect of the current action consists of subsidence of up to about four feet resulting from coal mining. No resource types that are considered sensitive to subsidence, such as rockshelters, exist within the APE. Therefore, it has been determined that the proposed action will have **no adverse effect** to historic properties.

Please contact Liz Lane at 970-263-5823 or ecalane@fs.fed.us if you have questions.

Sincerely,

SCOTT G. ARMENTROUT
Forest Supervisor

Enclosure

cc: Leigh-Ann Hunt



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Ecological Services
764 Horizon Drive, Building B
Grand Junction, Colorado 81506-3946

IN REPLY REFER TO:
ES/CO:BLM/UFO/Bowie
TAILS 65413-2011-I-0102

February 21, 2012

Memorandum

To: Field Manager, Bureau of Land Management, Uncompahgre Field Office, Montrose, Colorado

From: Acting Western Colorado Supervisor, Fish and Wildlife Service, Ecological Services, Grand Junction, Colorado

Subject: Informal section 7 consultation for Bowie Resources Underground Coal Mining Associated Surface Activities and Facilities

The U.S. Fish and Wildlife Service (Service) received your November 30, 2011, request for informal section 7 consultation under the Endangered Species Act. The consultation concerns the Bowie Resources (Bowie), LLC, Underground Coal Mining Associated Surface Activities and Facilities potential effects on greenback cutthroat trout (*Oncorhynchus clarkii stomias*) lineage (GBCT), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), razorback sucker (*Xyrauchen texanus*), Canada lynx (*Lynx canadensis*), wolverine (*Gulo gulo luscus*), and yellow-billed cuckoo (*Coccyzus americanus*). Beginning on June 6, 2011, we provided comments on several drafts of the BLM's Programmatic Biological Assessment (PBA) for this project. On December 12, 2011, we requested additional information to support the BLM's "may affect, not likely to adversely affect" determination for GBCT. This information was received by our office via email on February 2, 2012, and via letter on February 7, 2012, and hereby amends the PBA.

Proposed Action

The proposed action includes surface disturbance associated with underground mining based on Reasonably Foreseeable Development projections for Bowie activities. Surface disturbance would result from the installation of gob vent boreholes, drilling of exploration holes for baseline geologic data, installation of deep bedrock water monitoring wells, construction of future ventilation shafts, and construction or restoration of roads to access these facilities. Proposed activities would take place in a 19,385-acre area (action area) located in Delta County, Colorado, approximately 8 air miles north of Paonia, Colorado. The activities would occur in the watersheds of Terror Creek, Stevens Gulch, Hubbard Creek, Roatcap Creek, and one small

unnamed watershed, all of which are tributaries of the North Fork of the Gunnison River. Lands involved are managed by the Paonia Ranger District of the Grand Mesa, Uncompahgre, and Gunnison National Forest, the Uncompahgre Field Office of the BLM, and private landowners, including Bowie. Within the action area, the Federal government retains rights for all minerals on approximately 17,075 acres; the mineral rights for oil, gas and coal on 476 acres; and the mineral rights for coal on 1,522 acres. There are approximately 312 acres of private surface with private (fee) minerals. Additional details of the proposed action are provided in the PBA (BLM 2011) for this project.

BLM (2011) addresses Bowie's mining-related surface activities and facilities through December 31, 2021, with a maximum of 71.4 acres of new surface disturbance within the Terror Creek watershed over the life of the PBA. An average total of 31.5 acres of disturbance would exist at any one time, with an estimated 18.6 acres of long-term disturbance in the Terror Creek watershed. By September 30 each year, Bowie will submit an annual report that describes site-specific activities or projects covered under the umbrella of this consultation. BLM will determine whether a project falls under the umbrella of the consultation and will coordinate with the Service if there are uncertainties. Reports will contain a brief description of the project, project location, and total acres of disturbance. The BLM will provide annual reports to the Service and will track disturbance to ensure activities do not exceed the 71.4-acre threshold. If disturbance differs from that evaluated in the PBA, or if the 71.4-acre threshold would be exceeded as a result of a planned activity, BLM will reinitiate consultation with the Service. Actions that do not fall under the umbrella of the consultation and the proposed action description will require separate consultation.

Effects Determinations and Concurrence

[Note: This letter and our concurrence are based on the information provided in the PBA (BLM 2011). Your letter dated November 30, 2011, requesting informal section 7 consultation provided effects determinations and rationale different than that of the PBA.]

You determined that the proposed action would have no effect on yellow-billed cuckoo or North American wolverine. Therefore, Section 7 consultation and concurrence are not necessary for these species.

BLM (2011) estimates that .15 acre-feet of water would be depleted annually, and 1.6 acre-feet total over the ten-year period, as a result of proposed activities. The Service has determined that water depletions adversely affect the Colorado pikeminnow, razorback sucker, humpback chub, and bonytail and their critical habitats. Small water depletions associated with the project would be addressed and reported under the Programmatic Biological Opinion (PBO) for *Water Depletions Associated with BLM Projects (Excluding Fluid Mineral Development)* (ES/GJ-6-CO-08-F-0010) within the Upper Colorado River Basin in Colorado. All other water depletions not meeting the requirements and conditions of the PBO would need to be addressed under separate section 7 consultation.

Avoidance of direct disturbance of suitable habitat would minimize project impacts on Canada lynx, and disturbance or displacement of animals would be extremely unlikely to occur.

Therefore, we concur with your determination that the proposed action may affect, but is not likely to adversely affect Canada lynx, due to discountable effects.

A suite of conservation measures designed to protect GBCT will be applied as part of the proposed action, including project setbacks from occupied streams, reclamation standards, erosion/ sediment control measures and implementation monitoring, and measures to avoid take, entrapment, and entrainment of fish during water pumping activities (Appendix A). In particular, no new surface disturbance will occur within 200 feet of GBCT occupied habitat, as measured from the normal high water mark, and maintenance of roads or other existing features within this zone will be limited to the existing road prism or footprints. To clarify, we understand *surface disturbance* to be any project-related disturbance resulting in direct and pronounced alteration, damage, removal, displacement, or mortality of vegetation, soil, or substrates, or similar effects. Also, BLM has committed to ensuring that adequate and proper erosion control measures are implemented and effective, such that adverse effects do not occur to GBCT and its habitat. An *adverse effect* is an effect occurring as a direct or indirect result of the proposed action or its interrelated or interdependent actions, where the effect is not discountable, insignificant, or wholly beneficial. Based on this information, we concur with your determination that the proposed action may affect, but is not likely to adversely affect greenback cutthroat trout, due to discountable and insignificant effects.

Conclusion

This concludes section 7 consultation for the Bowie Resources (Bowie), LLC, Underground Coal Mining Associated Surface Activities and Facilities. As provided in 50 CFR §402.16, re-initiation of consultation is required if: 1) new information reveals effects of the agency action that may impact listed species or critical habitat in a manner or to an extent not previously considered, 2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered, or 3) a new species is listed or critical habitat designated that may be affected by the action. In addition, the Proposed Action section of this letter provides specific requirements for reinitiation of consultation, per the programmatic terms.

Thank you for your interest in conserving threatened and endangered species. If we can be of further assistance, please contact Charlie Sharp at (970) 243-2778, extension 18.

Literature Cited

Bureau of Land Management (BLM). 2011. Biological assessment: Bowie Resources, LLC, underground coal mining associated surface activities and facilities (November draft). Prepared for the BLM Uncompahgre Field Office, Montrose, Colorado, by WestWater Engineering, Grand Junction, Colorado.

Appendix A

BLM Required Conservation Measures:

- In order to insure that BMPs relating to the control of sediment from disturbed sites are in place, and functional, Bowie will, on a monthly basis from May through August, use an independent contractor to inspect Bowie's well pad sites and access roads within the Terror Creek watershed. The independent contractor will contact Bowie and the BLM Uncompahgre Field Office (970-240-5300), within two business days of discovering sediment control measures that are missing or non-functional. Bowie will have three business days to correct the problem. Ineffective measures would be redesigned and replaced after consultation with BLM. For each year that Bowie operates under this BA, Bowie shall submit the compiled monthly inspection reports to BLM Uncompahgre Field Office by September 30. In the event new sediment control methods are identified or current practices are not working as intended, adaptive management will be used to implement methods that are effective at eliminating offsite movement of soils and sedimentation into resident streams.
- In order to prevent increased risk of sediment being generated as a result of pumping related disturbance, pumping from East Terror Creek would not take place until after the April and May peak runoff period has past. Therefore, pumping from East Terror Creek would not begin until June. The AO may grant an exception that would allow pumping in May if runoff flows have dropped to the normal mean monthly levels for June (6.9 cfs) and USFWS has concurred via informal consultation.
- To prevent mortality of GBCT due to pumping from the East Fork of Terror Creek, the conservation measures are defined as: pumping during the June and July period would require the use of a screened pump intake, with a maximum ¼ inch size mesh. For the August through September period, when GBCT fry would be present in the stream, pump intakes would be screened with no larger than 1/16th mesh screen. The screen would not be confined to just the pump intake, but must cover a larger area, such as a cylinder or box design which has at least 5 times the surface area of the pump intake. Bowie must submit the final design for this screening fixture to the BLM Western Slope fisheries biologist, Tom Fresques (970-876-9078; tfresqu@blm.gov), for his approval.
- During the June through September period, if the flows in East Terror Creek drop below the ten year mean monthly flow for October (1.0 cfs), Bowie will not pump water from the East Fork of Terror Creek.
- To prevent impacts to GBCT fry and fingerlings, pumping would not take place during the base flow (low flow) periods of the year; October through March.
- There will be no new surface disturbing activities within 200 feet of any occupied greenback cutthroat trout habitat, as measured from the normal high water mark.
- If there are existing roads or disturbance features within the 200-foot buffer along GBCT habitat streams, then no additional surface disturbance will be permitted within those areas. Maintenance of roads or other existing features must remain within the existing road prism or footprint of the feature being maintained.

- The operator shall not store equipment, machinery, or construction materials in any locations that are 200 feet or less from the riparian zones of the streams within the Terror Creek watershed.
- No overstory or understory vegetation will be removed from the riparian zone of the streams in the Terror Creek watershed.
- During construction or maintenance activities in proximity to the 200-foot riparian buffer zone, the edge of the buffer zone shall be marked for avoidance by construction equipment and activities.
- Within the Terror Creek watershed only fresh water, free of chemicals or other contaminants, may be used for dust abatement activities.
- Within the Terror Creek watershed, additional crossings of perennial streams will not be constructed
- The BLM Uncompahgre Field Office hydrologist must approve, in advance, the size and composition of riprap material to be used in the East Fork of Terror Creek.
- Bowie must report their annual water depletions to the BLM Uncompahgre Field Office by September 30 each calendar year. This includes depletions that result from surface activities associated with coal mining related activities within the Action Area, regardless of surface ownership.
- Conditions which will trigger re-initiation of consultation with the USFWS are:
 1. The types of impacts associated with the proposed actions differ from, or exceed those evaluated in this BA.
 2. In the future, species that could be impacted by Bowie's activities in the Action Area are added to the list of Threatened or Endangered species.
 3. Surface disturbance within the Terror Creek watershed exceeds 71.4 acres.
 4. Bowie submits to BLM requests for exceptions to the conservation measures of this BA.
 5. If future genetic information results in a change in GBCT's status as Threatened under the ESA, the conservation measures contained in this BA will be reviewed and updated as appropriate.
- Bowie Best Management Practices (Appendix A of BLM (2011)), including erosion/ sedimentation control measures, will be applied to project activities.



Caveny, Nicole <ncaveny@osmre.gov>

Section 7 Consultation Sufficiency Request

Creed Clayton <creed_clayton@fws.gov>
To: Nicole Caveny <ncaveny@osmre.gov>

Tue, Oct 14, 2014 at 2:48 PM

Nicole,

Your message below made its way to me. Given that the mining plan proposed in this action will result in disturbance that is substantially the same as the disturbance analyzed for the EA, and because there are no new listed species in the project area, our previously submitted section 7 consultation documents are still valid. No new section 7 consultation is necessary.

Let me know if you have further questions, Creed.

J. Creed Clayton, PhD

Fish and Wildlife Biologist

U.S. Fish and Wildlife Service

445 West Gunnison Avenue, Suite 240

Grand Junction, CO 81501-5720

Phone: 970-628-7187

----- Forwarded message -----

From: Caveny, Nicole <ncaveny@osmre.gov>

Date: Thu, Oct 9, 2014 at 3:27 PM

Subject: Section 7 Consultation Sufficiency Request

To: FW6 GrandJunctionES <GrandJunctionES@fws.gov>

Dear Sir or Ma'am

The Office of Surface Mining, Reclamation and Enforcement's (OSMRE) Western Region's Federal Operations Branch has reviewed Bowie Resources, LLC's, Permit Application Package (PAP) which proposes to add the Spruce Stomp lease to Colorado state Permit No.C-1996-083. OSMRE is reviewing the PAP for the purpose of a mining plan decision document (MPDD). Bowie Resources, LLC, is proposing to mine 1,789.2 coal acres of coal within BLM lease COC75916. There are approximately 1,789.2 coal acres on Forest Service managed lands, 88 coal acres on BLM managed lands, and 368.2 coal acres with private surface but all of which are federally owned minerals. The disturbed area will not increase from the currently approved 365.1 acres.

In a memorandum dated February 21, 2012 (ES/CO:BLM/UFO/Bowie) U.S. Fish and Wildlife Service (FWS) concluded informal consultation and coordination with the Bureau of Land Management (BLM) for the Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application.

As a cooperating agency with BLM on development of the EA, OSMRE has adopted the EA and the USFWS letter dated February 21, 2012 with required conservation measures for the mining plan action. Subsequently OSMRE sent a letter, dated December 18, 2012, to the state of Colorado's Division of Reclamation, Mining, and Safety (CDRMS). OSMRE's letter notified CDRMS of the required conservation measures and instructed the CDRMS to re-initiate section 7 consultation should any other project elements change that alters the proposed operation described in the EA.

The mining plan proposed in this action will result in disturbance that is substantially the same as the disturbance analyzed for the EA. There have been no current mining operations that affect the determination of effects analyzed in the BA or letter to the State since the EA was completed. Also there are a series of stipulations attached to the BLM lease that Bowie Resources, LLC, has included in the PAP and that CDRMS has included in their stipulations to the permit, in accordance with their agency rules.

To OSMRE's knowledge, there are no new listed species in the area that would require the initiation of new a section 7 consultation.

If the USFWS letter for the leasing action EA dated February 21, 2012 (ES/CO:BLM/UFO/Bowie) is still applicable and USFWS concurs with the Attached BA and letter to the State, please reply to this e-mail and the USFWS's decision on this matter. Otherwise, please inform me if a new section 7 consultation is needed.

If you are unable to see the documents on the google drive, please let me know and I will send them to you in multiple emails.

Sincerely,

Nicole Caveny

 [BowieNo2_Section 7_OSM to DRMS 20121218.pdf](#)

 [20111122_Bowie_Programmatic_BA.pdf](#)

 13-10 EA Bowie Spruce Stomp Final EA.pdf

 EA Appendices #1.pdf

 EA Appendices#2.pdf

 13-10 EA Bowie Spruce Stomp LBA DR.pdf

 13-10 EA Bowie Spruce Stomp LBA FONSI.pdf

 BA Subsidence Report.pdf

 Lease COC75916 .pdf

 Biologic Opinion.pdf

Nicole Caveny

Environmental Protection Specialist

Western Region

U.S. Office of Surface Mining/DOI

1999 Broadway, Suite 3320

Denver, CO 80202-3050

303-293-5078



United States Department of the Interior

OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

Western Region Office
1999 Broadway, Suite 3320
Denver, CO 80202-3050



CO-0103

MEMORANDUM

DATE: October 30, 2014
TO: Bowie No. 2 Mine
FROM: Nicole Caveny, Environmental Protection Specialist *Nicole Caveny*
RE: Endangered Species Act Section 7 Consultation for Determination of Effects at the Bowie No. 2 Mine, Delta County, Colorado, for the Spruce Stomp Lease

The Office of Surface Mining Reclamation and Enforcement (OSMRE) Western Region analyzed the effects, of the above proposed mining plan modification, on threatened and endangered (T&E) species, and their critical habitat. This analysis is to meet our requirements under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.) and our Federal regulations at 30 CFR 746.13 (c) and 816.97. Through a Cooperating Agency (CA) agreement with the Bureau of Land Management (BLM), OSMRE reviewed and adopted BLM's *United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application* for the Bowie No. 2 Mine Federal Coal Lease COC75916 modification application. OSMRE also reviewed BLM's *Biological Assessment for the Bowie Resources, LLC, Underground Coal Mining Associated Surface Activities and Facilities, November 2011*.

BLM Consultation History

On February 23, 2012, U.S. Fish and Wildlife Service (USFWS) provided a biological opinion (BO) (ES/CO:BLM/UFO/Bowie) to BLM's November 30, 2011, request for informal section 7 consultation. The BO is based on BLM's November 2011, biological assessment (BA), and emails regarding the greenback cutthroat trout (*Oncorhynchus clarkii stomias*) occurring on February 2, 2012 and February 7, 2012.

OSMRE's Analysis Process

In August 2013, OSMRE reviewed all section 7 documentation and the EA related to the Bowie No. 2 coal lease modification application and related section 7 consultation documents. On October 09, 2014, OSMRE sent an email to USFWS requesting agreement with our determination to ensure that the February 23, 2012, BO is still applicable and can be used for the Bowie No. 2 Mine Federal Coal Lease COC75916 mining plan modification. OSMRE sent USFWS the following documents:

- A copy of BLM's November 2011, BA
- BLM's Coal Lease for COC75916
- USFWS February 23, 2012, BO
- Bowie Resources May 2013, Revised *Evaluation of Potential Subsidence Impacts of Longwall Mining in the Spruce Stomp Lease Area to Aquatic Life and Water Supply*
- BLM's August 2013, *United States Department of the Interior Bureau of Land Management, Final Environmental Assessment DOI-BLM-CO-S050-2013-0010 EA, September 2013, Spruce Stomp Coal Lease by Application*, appendices, FONSI, and decision record.

OSMRE Determinations of Effect

Based on all the information listed above, OSMRE has determined that the effects of coal mining operations associated with the Bowie No. 2 Mine Federal Coal Lease COC75916, will have the following effects:

"May affect, but is not likely to adversely affect" the Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), humpback chub (*Gila cypha*), and bonytail (*Gila elegans*) because of BLM's (2011) estimates that 0.15 acre-feet of water would be depleted annually.

"May affect, but is not likely to adversely affect" the Canada lynx because avoidance of direct disturbance of suitable habitat would minimize projects impacts and displacements of animals would be extremely unlikely to occur.

"May affect, but is not likely to adversely affect" the greenback cutthroat trout because of ground disturbing activities including the construction of new roads, upgrading existing roads, drilling pads for water wells, vent shafts , exploration holes, gob vent boreholes and water depletions mentioned above. The USFWS has made avoidance of direct disturbance of suitable habitat agreements with the BLM that can be viewed in the attached BO.

"No effect" on the yellow-billed cuckoo (*Coccyzus americanus*) because riparian habitats within the Bowie No. 2 Mine Federal Coal Lease COC75916 are mixed forest/woodland communities, which are narrow, with relatively steep gradients, and higher elevations than the lowland riparian forests typical of this species in western Colorado. As such, there would be no impacts to occupied or potential habitats as a consequence of Bowie Resources, LLC's surface activities within the Bowie No. 2 Mine Federal Coal Lease COC75916 area.

"No effect" on the North American wolverine (*Gulo gulo luscus*) because there are no boreal or arctic habitats within the Bowie No. 2 Mine Federal Coal Lease COC75916 area that would provide the deep snow persisting into the warm season as required for natal denning sites.

USFWS Response to OSMRE's Analysis and Request

In an email dated October 14, 2014, USFWS confirmed that the February 23, 2013, biological opinion is adequate to use for the Bowie No. 2 Mine Federal Coal Lease COC75916.

Mining Plan Approval Documents

UNITED STATES
DEPARTMENT OF THE INTERIOR

This mining plan approval document is issued by the United States of America to:

Bowie Resources, LLC
P.O. Box 483
Paonia, CO 81428

for a mining plan modification for Federal Lease COC75916 at the Bowie No. 2 Mine. This mining plan approval supplements all previous mining plan approvals for the Bowie No. 2 Mine. The approval is subject to the following conditions. Bowie Resources, LLC is hereinafter referred to as the operator.

1. Statutes and Regulations.--This mining plan approval is issued pursuant to Federal Lease COC75916; the Mineral Leasing Act of 1920, as amended (30 U.S.C. 181 *et seq.*); and in the case of acquired lands, the Mineral Leasing Act for Acquired Lands of 1947, as amended (30 U.S.C. 351 *et seq.*). This mining plan approval is subject to all applicable laws and regulations of the Secretary of the Interior which are now or hereafter in force; and all such laws and regulations are made a part hereof. The operator shall comply with the provisions of the Federal Water Pollution and Control Act (33 U.S.C 1251 *et seq.*), the Clean Air Act (42 U.S.C. 7401 *et seq.*), and other applicable federal laws.
2. This document approves the mining plan modification for Federal Lease COC75916 at the Bowie No. 2 Mine and authorizes coal development or mining operations on the Federal leases within the area of mining plan approval. This authorization expands the approved mining plan area into the following federal coal lands.

Lease COC75916

Township 12 South, Range 91 West, 6th P. M
Section 31: Lots 11 through 26 inclusive
Section 32: Lots 10 through 15 inclusive


Township 12 South, Range 92 West, 6th P.M.
Section 36: S2

Township 13 South, Range 92 West, 6th P.M.
Section 1: Lots 5 through 8 inclusive

Township 13 South, Range 91 West, 6th P.M.
Section 5: lots 2, 3, 4, 10, & 11, W/2W/2NENE, NWNE, NESWNE, SESWNE,
N/2NWSWNE, N/2NW, N/2N/2SENW, E/2NW/SE, W/2W/2NESE,
N/2NENESE, NENWNESE;
Section 6: Lots 1 through 4 inclusive

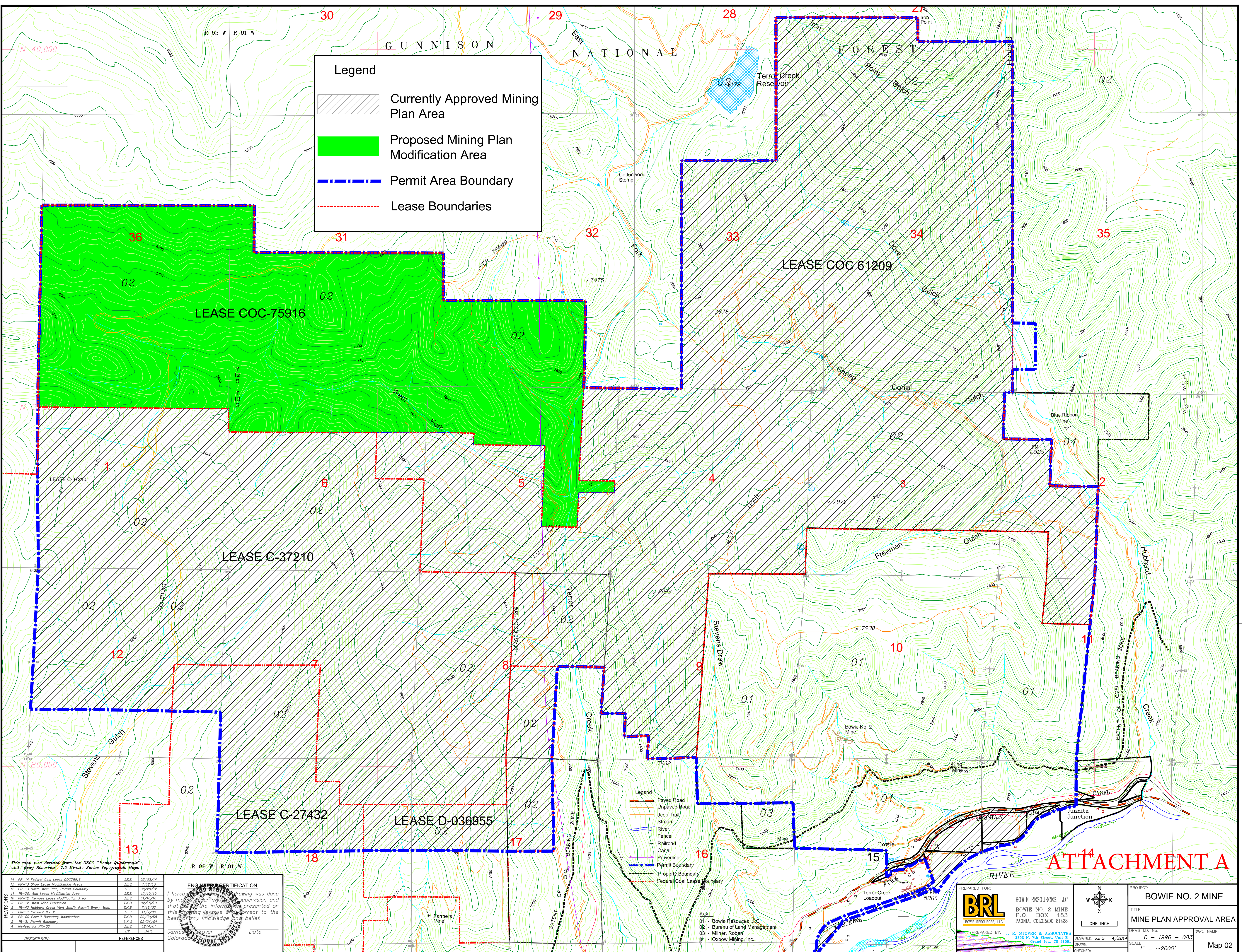
These lands encompass approximately 1,789 acres of Federal coal and are shown on the mining plan approval area map attached hereto as Attachment A.

3. The operator shall conduct coal development or mining operations only as described in the complete permit application approved by the Colorado Division of Reclamation, Mining and Safety, except as otherwise directed in the conditions of this mining plan approval.
4. The operator shall comply with the terms and conditions of the leases, this mining plan approval, and the requirements of the Colorado Permit No. C-1996-083 issued under the Colorado State program, approved pursuant to the Surface Mining Control and Reclamation Act of 1977 (30 U.S.C. 1201 *et seq.*).
5. This mining plan approval shall be binding on any person conducting coal development or mining operations under the approved mining plan and shall remain in effect until superseded, canceled, or withdrawn.
6. If during mining operations unidentified prehistoric or historic resources are discovered, the operator shall ensure that the resources are not disturbed and shall notify the Colorado Division of Reclamation, Mining and Safety and the Office of Surface Mining Reclamation and Enforcement. The operator shall take such actions as are required by the Colorado Division of Reclamation, Mining and Safety in coordination with the Office of Surface Mining Reclamation and Enforcement.
7. The Secretary retains jurisdiction to modify or cancel this approval, as required, on the basis of further consultation with the U.S. Fish and Wildlife Service pursuant to section 7 of the Endangered Species Act, as amended, 16 U.S.C. 1531 *et seq.*


Assistant Secretary,
Land and Minerals Management

3/16/15
Date

Attachment



REVISIONS	14	PR-14 Federal Coal Lease COC75916	J.E.S.	03/03/14
	13	PR-13 Show Lease Modification Area	J.E.S.	07/23/13
	12	PR-12 North Mine Prop. Permit Boundary	J.E.S.	09/26/12
	11	TR-10 Add Lease Modification Area	J.E.S.	12/10/10
REFERENCES	10	PR-10 Renew Lease Modification Area	J.E.S.	11/10/10
	9	PR-10 West Mine Expansion	T.K.B.	02/15/10
	8	TR-07 Hubbard Creek Vent Shaft; Permit Bndry, Mod.	T.K.B.	7/16/07
	7	Permit Renewal No. 2	J.E.S.	11/23/08
DESCRIPTION	6	PR-09 Permit Boundary Modification	T.K.B.	09/30/09
	5	TR-01 Permit Boundary	L.K.J.	02/24/04
	4	Revised for PR-06	J.E.S.	12/4/03
	3		BY	DATE
		James E. Stover Colorado State Engineer		
		I hereby certify that this drawing was done by me or under my direct supervision and that the information presented on this drawing is true and correct to the best of my knowledge and belief.		
		Date		

PREPARED FOR:

BRL
BOWIE RESOURCES, LLC

PREPARED BY: J. E. STOVER & ASSOCIATES
2302 N. 7th Street, Unit B
PAONIA, COLORADO 81428

DESIGNED: J.E.S. 4/2014

DRAWN: _____

CHECKED: _____

PROJECT: BOWIE NO. 2 MINE

TITLE: MINE PLAN APPROVAL AREA

DRMS I.D. No. C - 1996 - 083

SCALE: 1" = ~2000'

DWG. NAME: Map 02

State Permit Findings



COLORADO

Division of Reclamation,
Mining and Safety

Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

October 10, 2014

14-10-17-01

Ann B. Eddins
Delta County Clerk and Recorder
County Clerk
501 Palmer Street, #211
Delta, CO 81416

**Re: Bowie No. 2 Mine (Permit No. C-1996-083)
Permit Revision Application No. 14 (PR-14)
Spruce Stomp Lease**

Dear Sir or Madam:

The Colorado Division of Reclamation, Mining and Safety requests that you maintain the enclosed "Proposed Decision and Findings of Compliance" for the Bowie No. 2 Mine (Permit No. C-1996-083), Permit Revision No. 14 on file for public review for sixty (60) days.

Thank you for your cooperation.

Sincerely,

Susan L. Burgmaier
Environmental Protection Specialist
Susan.burgmaier@state.co.us

Enclosure

C-PR-13





COLORADO
Division of Reclamation,
Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215, Denver, CO 80203 P 303.866.3567 F 303.832.8106 <http://mining.state.co.us>

COAL MINING PERMIT - PERMIT REVISION DECISION

Bowie No. 2 Mine, Bowie Resources, LLC
Permit No. C-1996-083

The Division of Reclamation, Mining and Safety has proposed the decision stated below. Provided there are no objections, the decision will become effective upon the termination of the thirty (30) day public comment period, in accordance with Rule 2.07.4(3)(c).

Permit Revision No. 14

Decision: Approve with conditions

Submittal Date: March 12, 2014

Decision Date: October 10, 2014

Description of Revision: Spruce Stomp Lease

Stipulation(s) attached; Provide authorized signature and return the form to the Division

DIVISION OF RECLAMATION, MINING AND PERMITTEE
SAFETY

Authorized Representative - Division

Authorized Representative - Permittee (if applicable)

Date: October 10, 2014

Date:

CHANGE IN ACREAGE	REVISED TOTAL ACREAGE	PERFORMANCE BOND
Disturbed: 0.00	Disturbed: 402.88	Prior Liability: \$11,327,770.50
Affected: 1,356.30	Affected: 7,148.14	Change in Liability: \$0.00
Permit: 1,790.20	Permit: 10,986.70	Revised Liability: \$11,327,770.50
State: 0.00	State: 0.00	Bond Held: \$11,339,730.57
Federal: 1,431.30	Federal: 5,262.90	
Private: 358.90	Private: 5,723.80	
County: 0.00	County: 0.00	

REVISED APPLICATION PAGES

Volume I: Table of Contents page vi, pages 2.03-4 through 2.03-11, 2.03-15 through 2.03-17, 2.03-23 through 2.03-25, 2.04-11, 2.04-11i, 2.04-11ii, 2.04-12, 2.04-27 through 2.04-126, 2.05-2, 2.05-3, 2.05-84 through 2.05-86, 2.05-98 through 2.05-179, 2.06-1 through 2.06-4, 2.10-1 through 2.10-6; Volume III Tab 1 BLM Lease COC-75916 Document, Volume III

REVISED MAPS

Volume II Maps 01, 02, 3, 4A, 05, 06, 07, 08, 08A, 09, 10-A, 10-B, 12, 13, 14-B, 23, 23A, 25, 27, 27-B

Tab 1 Overland Ditch and Reservoir Company Lease Memorandum; Volume III Tab 2 Application for Conditional Water Right and Appropriative Right of Exchange; Volume III Tab 3 Monitoring Well Completion Details; Volume III Tab 3 Baseline Water Monitoring Data; Volume III Tab 9 USFW Concurrence Letter; Volume III Exhibit 15 Subsidence Prediction; Volume IIIB Tab 23 2013 WWE Study Report; Volume VI Cultural Resource Report for Spruce Stomp Lease
DELETED APPLICATION PAGES

None

C-PR-16

DELETED MAPS

None

Bowie No. 2 Mine (Permit No. C-1996-083)
Permit Revision No. 14

Stipulations

38 - PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE VEGETATION INFORMATION REQUIRED UNDER RULE 2.04.10 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

39 - PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE SOILS RESOURCE INFORMATION REQUIRED UNDER RULE 2.04.9 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

40 - PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL WILL NEED TO EVALUATE THE EFFECTS OF THAT DISTURBANCE ON ANY OF THE SITES LISTED AS ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES, AS DOCUMENTED IN THE 2012 CLASS III CULTURAL RESOURCES INVENTORY REPORT FOR THE LEASE AREA.

41 - PRIOR TO COMMENCING ANY MINING ACTIVITIES THAT COULD CAUSE SUBSIDENCE IN THE SPRUCE STOMP LEASE AREA, BRL MUST DEMONSTRATE THAT, SHOULD MINING ACTIVITIES RESULT IN CONTAMINATION, DIMINUTION OR INTERRUPTION OF WATER IN THE WEST FORK OF TERROR CREEK, BRL HAS OBTAINED SUFFICIENT WATER RIGHTS AND AN APPROVED WATER REPLACEMENT PLAN TO RESTORE, REHABILITATE, OR REPLACE THE WATER SUPPLY. BRL MUST SUBMIT A COPY OF A COURT APPROVED ALTERNATIVE WATER SUPPLY OR COURT APPROVED SOURCES OF AUGMENTATION WATER THAT COULD BE DEVELOPED TO REPLACE THE EXISTING SOURCES. THE ALTERNATE OR SUBSTITUTED WATER SHALL BE OF A QUALITY AND QUANTITY SO AS TO MEET THE REQUIREMENTS FOR WHICH THE WATER HAS NORMALLY BEEN USED.

42 - BRL MUST REHABILITATE OR REPLACE GROUNDWATER MONITORING POINTS CWI-DH-58 AND CWI-CH-60 BY DECEMBER 31, 2014. FOLLOWING COMPLETION OF THE WORK, A MINOR REVISION MUST BE SUBMITTED TO UPDATE THE PERMIT APPLICATION PACKAGE TEXT WITH A DISCUSSION OF THE REHABILITATION OR REPLACEMENT OF THE WELLS.

43 - WITHIN SIXTY DAYS FOLLOWING THE COLLECTION OF A YEAR OF VALID BASELINE DATA FROM THE TWO DOWN-GRADIENT MONITORING WELLS TO BE DRILLED IN 2015 (2015-1B AND 2015-1SS), BRL MUST SUBMIT A TECHNICAL REVISION TO UPDATE THE PROBABLE HYDROLOGIC CONSEQUENCES SECTION OF THE PERMIT TO ESTABLISH THOSE WELLS AS GROUNDWATER POINTS OF COMPLIANCE, IN ACCORDANCE WITH RULES 2.05.6(3)(B)(III) AND (IV).

44 - PRIOR TO INITIATING ANY LONGWALL MINING IN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL MUST OBTAIN APPROVAL FOR A PLAN TO MANAGE REFUSE GENERATED AS A RESULT OF MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA AND ALL CURRENTLY APPROVED COAL MINING ACTIVITIES. THIS RESTRICTION WILL NOT PRECLUDE DEVELOPMENT MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA CONSTRUCTED WITH CONTINUOUS MINING EQUIPMENT. PROPOSED MANAGEMENT PLANS MUST BE PREPARED IN ACCORDANCE WITH RULES 2.05.3(8), 4.10, AND 4.11 AND

BE BASED ON CURRENT AND PREDICTED RATES OF PRODUCTION AND REFUSE
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Stipulations

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REFUSE GENERATION AND INCLUDE REFUSE THAT WILL BE GENERATED FROM ALL CURRENTLY APPROVED MINING PLANS.

Proposed Decision
and
Findings of Compliance
for the

Bowie No. 2 Mine
C-1996-083

Permit Revision No. 14



COLORADO
Division of Reclamation,
Mining and Safety
Department of Natural Resources

Virginia Brannon, Director

Prepared by
Susan L. Burgmaier
Environmental Protection Specialist
October 10, 2014

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Introduction

This document is the decision package prepared by the Colorado Division of Reclamation, Mining and Safety (the Division) for the Bowie No. 2 Mine. This document includes: 1) the proposed decision to approve, with conditions, the permit revision application; 2) a summary which includes a history of the review of the permit application, a description of the environment affected by the operation and a description of the mining and reclamation plan; and 3) the written findings of compliance the Division has made as required by the Colorado Surface Coal Mining Reclamation Act. Detailed information concerning the findings of compliance can be found in the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining.

The Division has received an application for a permit revision to conduct surface coal mining and reclamation operations at the Bowie No. 2 Mine. The application was submitted by Bowie Resources, LLC (BRL, applicant). The Mine will be operated by Bowie Resources, LLC (BRL, operator). The mine is located on federal and private lands within Delta County, Colorado. The legal description of the lands currently included within the permit area is:

Township 13 South, Range 91 West of the 6th P.M.

Section 2: SW $\frac{1}{4}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$

Section 3: All

Section 4: All

Section 5: E $\frac{1}{2}$ W $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ W $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$, E $\frac{1}{2}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, W $\frac{1}{2}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ N $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, S $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$, SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, SW $\frac{1}{4}$, W $\frac{1}{2}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ SE $\frac{1}{4}$

Section 6: Lots 5, 6, 7, S $\frac{1}{2}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$ NW $\frac{1}{4}$, E $\frac{1}{2}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$

Section 7: All

Section 8: NE $\frac{1}{4}$, W $\frac{1}{2}$, W $\frac{1}{2}$ SE $\frac{1}{4}$ (north of Deer Trail Ditch)

Section 9: NE $\frac{1}{4}$, NW $\frac{1}{4}$, SE $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$

Section 10: All

Section 11: SW $\frac{1}{4}$, NW $\frac{1}{4}$

Section 14: NW $\frac{1}{4}$ except south of Union Pacific Railroad right of way

Section 15: NE $\frac{1}{4}$, NW $\frac{1}{4}$, NW $\frac{1}{4}$ SE $\frac{1}{4}$. Portions of the N $\frac{1}{2}$ SE $\frac{1}{4}$, SW $\frac{1}{4}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ SW $\frac{1}{4}$ excluding all private lands not owned or controlled by Bowie Resources LLC or the Union Pacific Railroad

Section 16: N $\frac{1}{2}$ NE $\frac{1}{4}$

Section 17: NW $\frac{1}{4}$, W $\frac{1}{2}$ NE $\frac{1}{4}$

Section 18: Lots 1, 2, NE $\frac{1}{4}$, E $\frac{1}{2}$ NW $\frac{1}{4}$

Section 22: Portions of NW $\frac{1}{4}$ NW $\frac{1}{4}$ on lands owned by the Union Pacific Railroad

Township 13 South, Range 92 West of the 6th P.M.

Section 1: S $\frac{1}{2}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$, Lots 9 – 12

Section 12: Lots 1 through 12 inclusive

Township 12 South, Range 91 West of the 6th P.M.

Section 27: SW $\frac{1}{4}$, S $\frac{1}{2}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, S $\frac{1}{2}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$

Section 28: E $\frac{1}{2}$ SE $\frac{1}{4}$

Section 33: Lots 1, 2, 3, 6, 7, 8, 10, 11, 12, 14, 15, 16, SE $\frac{1}{4}$ NW $\frac{1}{4}$, S $\frac{1}{2}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ NE $\frac{1}{4}$

Section 34: All

Section 35: SW $\frac{1}{4}$ Lot 18, NW $\frac{1}{4}$ Lot 19.

The legal description of lands proposed to be added to the permit area under this permit revision, totaling 1790.2 acres, is:

Township 12 South, Range 91 West of the 6th P.M.

Section 31: Lots 11 through 26 inclusive

Section 32: Lots 10 through 15 inclusive

Township 12 South, Range 92 West of the 6th P.M.

Section 36: S $\frac{1}{2}$

Township 13 South, Range 91 West of the 6th P.M.

Section 5: Lots 2, 3, 4, 10, and 11, W $\frac{1}{2}$ W $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$, NW $\frac{1}{4}$ NE $\frac{1}{4}$, NE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, SE $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ NW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, N $\frac{1}{2}$ NW $\frac{1}{4}$, N $\frac{1}{2}$ N $\frac{1}{2}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$, E $\frac{1}{2}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$, W $\frac{1}{2}$ W $\frac{1}{2}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, N $\frac{1}{2}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$, NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$

Section 6: Lots 1 through 4 inclusive

Township 13 South, Range 92 West of the 6th P.M.

Section 1: Lots 5 through 8 inclusive.

The Bowie No. 2 Mine is approximately five (5) miles northeast of Paonia, Colorado. The mine permit area is located on lands depicted on the U.S. Geological Survey 7.5 minute Bowie Quadrangle Map, and the Bowie No. 2 mine portals are located northwest of the Old King Mine portals (also known as the Bowie Mine). The surface facilities are located north and south of Old State Highway 133 near the old town site of Bowie. The mine is located between Stevens Gulch and Hubbard Creek. A portion of the surface facilities is within 100 feet of the outside right-of-way of old State Highway 133. The location of these facilities extends from the old town site of Bowie to about 500 feet east of the old Bowie power plant.

Proposed Decision

The Colorado Division of Reclamation, Mining and Safety proposes to approve, with conditions, an application for a permit revision.

The application was submitted by Bowie Resources, LLC for the mine. This decision is based on a finding that the operations will comply with all requirements of the Colorado State Program as found in the Colorado Surface Coal Mining Reclamation Act, Section 34-33-101 *et seq.*, C.R.S., and the Regulations promulgated pursuant to the Act. If no request for a formal hearing is made within thirty (30) days of the first publication of the issuance of this proposed decision, this decision will become final. Upon submittal of acceptable surety by the applicant, the permit will be issued. The permit application, all supporting documentation and any stipulations or conditions will become a binding part of the permit.

No coal mining operations may be conducted on any Federal surface or coal until the Secretary of the Interior has approved the proposed mining plan.

There are currently three active stipulations on the permit:

Stipulation No. 34

Within 45 days of issuance of TR-77, BRL must submit a technical revision to address the following for proposed Borrow Areas #1, #2, and #3 at Gob Pile #2:

- a. A topsoil salvage, storage, and redistribution plan, in accordance with Rules 2.05.3(5), 2.05.4(2)(d) and 4.06.4(2);
- b. A regrading plan in accordance with Rules 4.14.1 and 4.14.2;
- c. A revegetation plan in accordance with Rule 4.15;
- d. A sediment control plan in accordance with Rules 2.05.3(4), 2.05.6(3), 4.05.1, and 4.05.2;
- e. Revised map(s) in accordance with Rule 2.10.3, clearly indicating the areas proposed for disturbance;
- f. A reclamation plan and cost estimate in accordance with Rule 2.05.4; and
- g. A commitment from BRL that materials excavated from any borrow area will be direct hauled for the purpose of covering refuse material, and will not be incorporated into the refuse material, such as for drying purposes.

The revision submittal due date was subsequently extended until October 15, 2014.

Stipulation No. 35

Commencing with issuance of TR-77, BRL must conduct a survey to determine the volume of coverfill material in the stockpiles associated with Gob Piles #1, #2, #3, and #4 on at least a quarterly basis. A report summarizing the survey shall be submitted within 30 days of the survey, and must include a statement of whether the volume of available material is sufficient to meet the requirements of Rule 4.10.4(5) and the material balance in the currently approved permit application package.

To date, BRL has submitted the required quarterly surveys. The stipulated requirement to submit quarterly surveys will continue until the refuse areas are reclaimed or BRL discontinues the practice of using cover material to mix with refuse to achieve the required degree of compaction.

With the approval of Permit Revision No. 14, the following additional stipulations will become a binding part of the permit:

Stipulation No. 38

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE VEGETATION INFORMATION REQUIRED UNDER RULE 2.04.10 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

Stipulation No. 39

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE SOILS RESOURCE INFORMATION REQUIRED UNDER RULE 2.04.9 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

Stipulation No. 40

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL WILL NEED TO EVALUATE THE EFFECTS OF THAT DISTURBANCE ON ANY OF THE SITES

LISTED AS ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES, AS DOCUMENTED IN THE 2012 CLASS III CULTURAL RESOURCES INVENTORY REPORT FOR THE LEASE AREA.

Stipulation No. 41

PRIOR TO COMMENCING ANY MINING ACTIVITIES THAT COULD CAUSE SUBSIDENCE IN THE SPRUCE STOMP LEASE AREA, BRL MUST DEMONSTRATE THAT, SHOULD MINING ACTIVITIES RESULT IN CONTAMINATION, DIMINUTION OR INTERRUPTION OF WATER IN THE WEST FORK OF TERROR CREEK, BRL HAS OBTAINED SUFFICIENT WATER RIGHTS AND AN APPROVED WATER REPLACEMENT PLAN TO RESTORE, REHABILITATE, OR REPLACE THE WATER SUPPLY. BRL MUST SUBMIT A COPY OF A COURT APPROVED ALTERNATIVE WATER SUPPLY OR COURT APPROVED SOURCES OF AUGMENTATION WATER THAT COULD BE DEVELOPED TO REPLACE THE EXISTING SOURCES. THE ALTERNATE OR SUBSTITUTED WATER SHALL BE OF A QUALITY AND QUANTITY SO AS TO MEET THE REQUIREMENTS FOR WHICH THE WATER HAS NORMALLY BEEN USED.

Stipulation No. 42

BRL MUST REHABILITATE OR REPLACE GROUNDWATER MONITORING POINTS CWI-DH-58 AND CWI-CH-60 BY DECEMBER 31, 2014. FOLLOWING COMPLETION OF THE WORK, A MINOR REVISION MUST BE SUBMITTED TO UPDATE THE PERMIT APPLICATION PACKAGE TEXT WITH A DISCUSSION OF THE REHABILITATION OR REPLACEMENT OF THE WELLS.

Stipulation No. 43

WITHIN SIXTY DAYS FOLLOWING THE COLLECTION OF A YEAR OF VALID BASELINE DATA FROM THE TWO DOWN-GRADIENT MONITORING WELLS TO BE DRILLED IN 2015 (2015-1B AND 2015-1SS), BRL MUST SUBMIT A TECHNICAL REVISION TO UPDATE THE PROBABLE HYDROLOGIC CONSEQUENCES SECTION OF THE PERMIT TO ESTABLISH THOSE WELLS AS GROUNDWATER POINTS OF COMPLIANCE, IN ACCORDANCE WITH RULES 2.05.6(3)(B)(III) AND (IV).

Stipulation No. 44

PRIOR TO INITIATING ANY LONGWALL MINING IN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL MUST OBTAIN APPROVAL FOR A PLAN TO MANAGE REFUSE GENERATED AS A RESULT OF MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA AND ALL CURRENTLY APPROVED COAL MINING ACTIVITIES. THIS RESTRICTION WILL NOT PRECLUDE DEVELOPMENT MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA CONSTRUCTED WITH CONTINUOUS MINING EQUIPMENT. PROPOSED MANAGEMENT PLANS MUST BE PREPARED IN ACCORDANCE WITH RULES 2.05.3(8), 4.10, AND 4.11 AND BE BASED ON CURRENT AND PREDICTED RATES OF PRODUCTION AND REFUSE GENERATION AND INCLUDE REFUSE THAT WILL BE GENERATED FROM ALL CURRENTLY APPROVED MINING PLANS.

The following stipulations imposed on previously approved permitting action decisions have been resolved:

Number	Description	Originating Permit Action	Status *	Status Date
1	Bowie Resources, Limited shall not conduct any operations which require an air emissions permit until the air emissions permit is obtained, with a copy of the permit submitted to the Division.	Initial Permit Approval	CW	03/19/1997

Number	Description	Originating Permit Action	Status *	Status Date
2	Bowie Resources, Limited shall not conduct any operations which require blasting permits or permits to store and use explosives until any such permits are obtained, with a copy of the permits submitted to the Division.	Initial Permit Approval	CW	03/20/1998
3	Bowie Resources, Limited shall not disturb any wetland areas until all such activities are approved by the U.S. Army Corps of Engineers, and until any permits required by the U.S. Army Corps of Engineers are obtained, with a copy of the permits submitted to the Division.	Initial Permit Approval	CW	05/23/1997
4	Bowie Resources, Limited shall not construct or operate a sewage treatment plant at the Bowie No. 2 Mine until all applicable permits have been obtained from the Division, and from the Colorado Department of Public Health and Environment. Any applicable Department of Public Health and Environment permits must be submitted to the Division prior to operation of any such treatment facility.	Initial Permit Approval	CW	06/29/1999
5	Bowie Resources, Limited shall, within one month of completion of the backfilling and grading remediation work on the portal cut slide, install two perpendicular ("X") lines on metal fence posts on the backfilled slope to allow for visual monitoring of the stability of the final configuration. The two lines of posts are to be oriented so that each line is at a 45 degree angle to the dip of the slope.	MR-4	CW	03/20/1998
6	With the installation of one 30' diameter culvert under Old Highway 133, at the end of Mine Ditch D-D2, Submit 3 copies of revised Map #20 and Map #21, with the addition of the culvert label, and revised page 31 of Exhibit 8, adding the culvert designation and size to the culvert summary list.	MR-5	CW	01/21/1998
7	Approval of Permit Revision No. 4 for the Bowie No. 2 Mine is conditioned upon the resolution of the following: 1) Kentucky Citation No. C98-081-414-001, associated with Star Fire Mining Company; 2) Kentucky Forfeiture, Cessation Orders Nos. 050265 and 050320 and Civil Penalties Nos. 052522, 052908 and 053099 for permit No. 8980140, associated with Catawaba Industries; 3) West Virginia Cessation Order No. 031-C for Permit No. S012782, associated with Cannelton Industries,	PR-2	TR	09/26/2001

Number	Description	Originating Permit Action	Status *	Status Date
	<p>Inc.</p> <p>Proof of resolution should be submitted to the Colorado Division of Minerals & Geology as soon as it becomes available.</p>			
8	<p>Approval of Permit Revision No. 4 for the Bowie No. 2 Mine is conditioned upon the resolution of the following:</p> <p>1) Violations and forfeitures under the Pittson Settlement:</p> <p>A) Virginia Forfeitures for Permit Numbers 1200724, 2339, 2503, 3053-U, 3394 and 1200551,</p> <p>B) Virginia Violations Numbers C80-001-018-004 AND C80-001-018-005,</p> <p>C) West Virginia forfeitures for Permit Numbers U035700 and U074400.</p> <p>Proof of resolution must be submitted to the Colorado Division of Minerals & Geology as soon as it becomes available.</p>	PR-4	TR	09/26/2001
9	<p>Modified for PR8</p> <p>A detailed subsidence study for Terror Creek Reservoir Dam (Bruce Park Dam) must be completed and approved prior to that time when the projected angle of draw of mining is within one mile of the Bruce Park Dam. The study will establish baseline conditions, potential mining-induced seismicity and potential translated effects to the dam.</p> <p>Mining with a projected angle of draw that is within one mile of the Terror Creek Reservoir (Bruce Park Dam) will not be approved until all necessary monitoring data, analyses, reports and subsidence control plan details are approved by the Division and it is shown that such mining will not adversely impact the dam.</p> <p>Bowie Resources will submit a technical revision to the permit addressing the investigation, data collection, analysis, and monitoring plan to ensure the safety and integrity of the Terror Creek Reservoir Dam (Bruce Park Dam). The revision materials will include, but not be limited to, data, a technical report, compliance schedules, a subsidence control plan, a detailed monitoring plan specific to potential seismicity and any</p>	PR-4	CW	01/02/2009

Number	Description	Originating Permit Action	Status *	Status Date
	<p>other potential impacts induced by the longwall mining. The technical revision shall address:</p> <ol style="list-style-type: none"> 1. The results of the drilling program, as referenced in the Colorado Division of Water Resources letter to the Division, dated February 9, 2001, including installation of piezometers or other down-hole instrumentation. 2. The results of the seismic investigation and evaluation of the structure, including recommendations for any additional instrumentation. 3. The installation of any additional monitoring instrumentation, seismic or otherwise, in accordance with the final instrumentation plan. 4. A report of all baseline data and a description of the baseline conditions within a one mile radius of the dam. 5. A final report and impact analysis prior to anticipated mining with a projected angle of draw that is within one mile of the dam. 			
10	Prior to affecting USDA-Forest Service (FS) water rights by mining, the operator will submit to the Division for approval, a technical revision that includes 1) a revised Map 23, "Water Rights Location" and revised text that describe the FS water rights within the permit and adjacent area, and 2) verification that a court-approved water augmentation plan is in effect for those FS water rights within the permit boundary and adjacent area that may be contaminated, diminished or interrupted by mining.	PR-4	CW	09/07/2004
11	Submit revised permit application page(s) describing operation, including estimated volume of soil that will be removed, and engineer's certification showing approval of the operation as it relates to geotechnical stability.	MR-17	CW	07/03/2001
12	(PR-8) -Permit Revision No. 8 of Bowie No. 2 is conditioned upon resolution of Kentucky state violations and forfeitures under the Island Creek Settlement. Proof of resolution and settlement should be submitted to the Division of Minerals and Geology as soon as they become available.	PR-5	TR	06/22/2007

Number	Description	Originating Permit Action	Status *	Status Date
	<p>(PR-7) - Permit Revision No. 7 of Bowie No. 2 is conditioned upon resolution of Kentucky Citation No. C-89-081-414-01 (Permit Number 4977004) for Star Fire Mining, Kentucky state violations under the Island Creek Settlement, and the Illinois audit debts protected by the bankruptcy. Proof of resolution and settlement should be submitted to the Division of Minerals and Geology as soon as they become available.</p> <p>(PR-6)- The Permit Revision of the Bowie No. 2 Mine is conditioned upon the resolution of Kentucky Citation No. C-89-081-414-01 (Permit Number 4977004) for Star Fire Mining; of Virginia civil penalty violations and bond forfeitures and West Virginia violations and bond forfeitures under the Pittston settlement; of the West Virginia Recon violations (WV 0014783) under payment plan, and of the Kentucky civil penalties, cessation orders and bond forfeitures under the Island Creek settlement. Proof of resolution and settlement should be submitted to the Division of Minerals and Geology as soon as they become available.</p> <p>(PR-5) -The Permit Revision of the Bowie No. 2 Mine is conditioned upon the resolution of Kentucky civil penalty violations, cessation orders and bond forfeitures associated with Permit Number 8980140 under A.T. Massey/Ziegler Settlement; of Kentucky Citation No. C-89-081-414-01 (Permit Number 4977004) for Star Fire Mining; of Virginia civil penalty violations and bond forfeitures, and West Virginia violations and bond forfeitures under the Pittston Settlement; and of the Kentucky civil penalties, cessation orders and bond forfeitures under the Island Creek Settlement. Proof of resolution and settlement should be submitted to the Division of Minerals and Geology as soon as they become available.</p>			
13	Approval of Permit Revision No. 6 is conditioned upon the submittal of the following: 1) The final approved NPDES permit that includes outfalls for Pond J and Pond K; 2) The final approved CDOT access permit for the temporary access road needed for the construction of the mainline rail switch; and 3) The final approved road use agreement from Delta County for County Road 4365, if that county road is to be used for access for the construction of mine facilities.	PR-6	TR	12/13/2002

Number	Description	Originating Permit Action	Status *	Status Date
14	<p>An acceptable shrub planting plan and woody plant density standard must be submitted by Bowie Resources, Limited. The planting plan and density standard must be developed in consultation with the Colorado Division of Minerals and Geology and the Colorado Division of Wildlife.</p> <p>(Old RN-1) Bowie resources must submit verification to the Division that the Colorado Division of Wildlife concurs with the proposed plan concerning the woody plant stem density standard for those areas to be reclaimed at the Bowie No. 2 Mine.</p>	RN-1	CW	07/22/2008
15	The wash plant complex cannot begin washing operations until the necessary air permits are obtained and inserted into the permit application through a minor revision.	TR-27	CW	04/22/2004
16	The operator will determine site-specific characteristics (Moist Unit Weight) and strength parameters of cohesion and angle of internal friction of coal processing waste materials when the first bench of the Gob Pile No. 2 reaches half to three/fourths the design height, and demonstrate to the Division that the proposed fill, as approved, will be stable with a minimum factor of safety 1.5.	TR-30	TR	06/16/2005
17	<p>Attached to the approval of Technical Revision No. 30 are the following:</p> <p>1) No discharge from Pond F is allowed until the operator submits to the Division the NPDES permit that includes the outfall for Pond F;</p> <p>2) No construction proposed in TR-30 is allowed until the operator submits to the Division the air permits for the preparation plan system and Gob Pile No. 2;</p> <p>3) No impoundment of water in Pond F is allowed until the operator submits documentation of the successful resolution of the Section 7 Consultation with the U.S. Fish & Wildlife Service;</p> <p>4) No section of the Deer Trail Ditch can be diverted through a culvert until the operator submits to the Division documentation of the approval from the Deer Trail Ditch Company.</p>	TR-30	CW	02/22/2005
18	Longwall mining in Panels WB-1 AND WB-2 is	TR-31	CW	12/21/2004

Number	Description	Originating Permit Action	Status *	Status Date
	contingent upon the successful completion of the following: 1. Submittal and Division approval of a technical revision that addresses the impacts from subsidence-induced rockfalls from longwall mining in Panels WB-1 AND WB-2, including identification of structures that need to be protected from such rockfalls and the design of appropriate protection measures for those structures and, 2. The construction of the protection measures that are identified in the aforementioned technical revision.			
19	Attached to the approval of Technical Revision No. 34 is the following: The B-SEAM Portal upland conveyor system cannot begin normal operations until Bowie Resources has secured and sent to the Division the necessary air emissions permit.	TR-34	TR	12/29/2004
20	The permit transfer to Bowie Resources, LLC is conditioned upon resolution of Kentucky unpaid Civil Penalty for Violation No. 530151 associated with Kentucky Permit No. 8980503. Proof of Resolution should be submitted to the Division of Minerals and Geology as soon as it becomes available.	SO-02	TR	10/12/2004
21	Revised: The approval of Succession of Operator No. 2 is conditioned upon the submittal to the Division, on or before March 27, 2005, of verification that the Bowie No. 2 Mine Bureau of Land Management coal leases were successfully reassigned from Bowie Resources Limited to Bowie Resources, LLC. The approval of Succession of Operator No. 2 is conditioned upon the submittal to the Division, within 90 days of the date of proposed decision of SO-2, of verification that the Bowie No. 2 Mine Bureau of Land Management coal leases were successfully reassigned from Bowie Resources Limited to Bowie Resources, LLC. (old due date 12/27/04)	SO-02	CW	03/01/2005
22	Submit revised permit text that explains the need for the temporary pumping approval.	MR-52	CW	03/28/2005
23	Submit revised maps and pages for MR61. The revision addresses relocation of Gob Vent Drill Hole B2-B. Submittal should include revised permit text, location map and reclamation cost estimate.	MR-61	CW	09/19/2005
24	The elevated conveyor over Old State Highway 133	TR-45	TR	06/23/2009

Number	Description	Originating Permit Action	Status *	Status Date
	and the Fire Mountain Canal that is proposed in Technical Revision No. 45 cannot be constructed until Bowie Resources, LLC has secured the necessary permits from the Colorado Department of Transportation and the U.S. Bureau of Reclamation.			
25	Submit revised maps and pages for MR84. Revision addresses temporary storage of topsoil from the Hubbard Creek Vent Shaft construction site at the Unit Train Loadout topsoil stockpile. Submittal should include revised permit application pages and maps that describe the topsoil storage project.	MR-84	CW	11/27/2007
26	No coal waste can be transported to Coal Waste Pile No. 3 until necessary construction permits are obtained from the CDPHE and received at the Division.	TR-49	CW	10/28/2013
27	Approval of Technical Revision No. 64 limits the total volume of material to be stored at Gob Pile No. 4 to 3,155,000 tons of coal waste, topsoil and excavated material until the Construction Permit 03DL0923F is modified by the Air Pollution Control Division to allow for a greater amount of stockpile material.	TR-64	CW	09/27/2006
28	Mining is prohibited in the area of Lease Modification FCL-D-036955 Until: 1) Final approval for the Lease Modification is granted from the Bureau of Land Management; and 2) Final approval of a Technical Revision to Permit No. C-1996-083 to include the lease modification area and associated mine plan into the Bowie No. 2 Mine Permit application.	PR-12	CW	01/04/2011
29	Prior to placement of cover on the eastern portion of Gob Pile #4, BRL must survey the eastern portion of the pile to verify that slopes are not steeper than 2:1 and regrade any slopes as necessary to ensure conformity with the approved slope design. Documentation of the corrected slopes must be submitted to and approved by the Division before cover can be placed on the eastern portion of the disposal area. The area to be surveyed and regraded is depicted on the February 8, 2013 review drawing submitted with the Technical Revision No. 75 application.	TR-75	CW	05/20/2013
30	The 14,000 cy of cover fill material approved to be moved from the B Portal storage area must be direct hauled to, and used as permanent cover material for, regraded portions of Gob Pile #4. Material removed from the B Portal storage area may not be mixed with or incorporated into the waste material.	TR-83	CW	07/09/2014
31	Prior to removal of topsoil along the Pitkin Mesa	MR-146	CW	04/04/2014

Number	Description	Originating Permit Action	Status *	Status Date
	pipeline, all snow in the topsoil removal area shall be removed. Topsoil may not be removed if ground conditions are wet or snowy. Photographic documentation of conditions at topsoil removal shall be recorded and submitted to the Division.			
32	Prior to excavation through Stevens Gulch Road, Bowie Resources, LLC must submit, to the Division, documentation of Delta County's acknowledgement of the excavation activities within the roadway.	MR-146	CW	02/07/2014
33	Prior to any Pitkin Mesa Pipeline replacement disturbance, Bowie Resources, LLC (BRL) must determine which subsidence monuments located over the replaced pipeline segment will be disturbed. Any monuments that will be disturbed by the pipeline replacement must be surveyed prior to removal, reset, and surveyed again, with the reset positions calibrated relative to the original locations. No undermining of the pipeline may occur until the monuments are in place and surveyed. BRL must include the survey data and a brief discussion of the relocated monument positions in its next Semi-Annual Subsidence Report.	MR-146	CW	03/26/2014
36	Bowie Resources, LLC must submit a plan for vibrating wire piezometer (VWP) installations on Gob Pile #3 to be approved and implemented during Calendar Year 2014.	TR-84	CW	08/18/2014
37	Within two weeks of the proposed decision to approve, with conditions, Technical Revision No. 87, BRL must submit a revised Form 1403 to clarify that the Coal Sales House is a contributing feature of the King Mine. The Coal Sales House may not be demolished until the form has been approved by History Colorado and the Division.	TR-87	CW	09/30/2014
* AC – Active, CW – Complied With, FU – Future/Ongoing, TR - Terminated				

Summary

The Review Process

Bowie Resources, LLC, (BRL) submitted an application for PR-14 on March 12, 2014. The revision application requested inclusion of the Spruce Stomp Lease area (COC-75916) in the permit area, and approval of the associated mine plan to add eight additional longwall panels.

The Division transmitted adequacy comments on the application to BRL on May 20, 2014, May 29, 2014, August 20, 2014, September 9, 2014, September 11, 2014, September 29, 2014, October 6, 2014, and October 10, 2014. BRL responded to the Division's adequacy concerns and provided revised application materials on July 11, 2014 and September 2, 2014, September 12, 2014, September 16, 2014, September 25, 2014, October 3, 2014, and October 10, 2014.

Comments on the application were received from the Terror Ditch and Reservoir Company, U.S. Army Corps of Engineers, Colorado Division of Water Resources, and History Colorado. A summary of the comments received and the Division's response to those comments follows:

- Terror Ditch and Reservoir Company (TDRC), via email and telephone: TDRC expressed concern with potential damage to water rights, particularly BRL's ability to augment water in a timely fashion, should subsidence result in an interruption of flow in the West Fork of Terror Creek. BRL has applied for approval of an augmentation plan to replace water in the West Fork of Terror Creek, should an interruption occur. The Division has placed a stipulation on this revision approval requiring approval of the augmentation plan before commencing any operations that would result in the subsidence of the West Fork of Terror Creek. BRL has also committed to promptly restore or rehabilitate flows in the West Fork of Terror Creek, should subsidence result in material damage, as required by Rules 4.20.3(1) and 4.20.3(2).

TRDC also inquired about the proximity of the workings to the Bruce Park Dam, and whether subsidence would be expected to impact the dam. The Bruce Park Dam is located outside of the predicted area of subsidence, approximately 8,500' from the outer limits of the predicted angle of draw of the Spruce Stomp mining panels.

- U.S. Army Corps of Engineers (USACE), via email: USACE notified the Division that any project features that result in the discharge of dredged or fill material into waters of the United States will require Department of the Army authorization prior to starting work. The permit revision, as proposed, does not propose the discharge of dredged or fill material into water of the United States.
- Division of Water Resources (DWR), via phone: DWR had received a phone inquiry from TDRC regarding the proposed Spruce Stomp lease mining panels and their proximity to the Bruce Park Dam. The Division informed DWR that the dam was outside of the predicted area of subsidence. DWR requested notification of the Division's proposed decision on the revision; the Division is providing notification and a copy of this findings document to DWR.

- DWR, written comments: DWR reiterated that fact that the Bowie No. 2 Mine is located in an over appropriated stream basin, and restated the requirement for all impounded water to be released within a maximum of 72 hours of impoundment. DWR also provided general information regarding well permitting, for assistance in determining the requirements for any new proposed wells.
- History Colorado, written comments: History Colorado noted that the U.S. Forest Service had initiated contact with History Colorado during preparation of the environmental assessment (EA) associated with the Spruce Stomp lease application. History Colorado noted that the survey conducted in conjunction with the EA identified three sites eligible for listing in the National Register of Historic Places, and recommended, under a determination with conditions, that these sites be periodically monitored to better understand potential future impacts to cultural resources in subsidence zones as well as to ensure that any potential adverse effects are mitigated if necessary. The EA includes a stipulation that the sites be monitored after project activities commence to ensure continued integrity of the sites. BRL has committed to such monitoring in the permit application package, as revised with PR-14.

History Colorado also noted that surface disturbance is not proposed with this revision, and as such determined that their prior effect determination with conditions would still be appropriate. Keeping with current practice of consulting History Colorado when proposed mine operations will create new surface disturbance, the Division will consult with History Colorado when reviewing any revision that proposes surface disturbance within the Spruce Stomp lease area.

Permitting History

The original Bowie No. 2 Mine permit application was submitted by Bowie Resources Limited on February 13, 1996. The permit was issued on April 4, 1997, with an expiration date of April 4, 2002, and has been renewed twice with a current expiration date of April 4, 2017. With approval of a succession of operator request (SO-02) on June 25, 2009 the permit was transferred to Bowie Resources, LLC (BRL).

Since the first permit application was approved for the mine, the Division has reviewed applications for thirteen permit revisions, 94 technical revisions, 164 minor revisions, and three successions of operator. The approved revisions have increased the permit area by 6,870 acres, and allowed for the conversion from a one seam continuous miner/room and pillar operation to a longwall operation in two seams. Four gob piles have been approved for construction, and a unit train loadout was added.

The coal and the surface lands within the present permit area are both federally and privately owned. Of the 9,197 acres of currently approved permit area, a total of 403 acres are approved for surface disturbance. Surface disturbance includes facilities areas, roads, sedimentation ponds, gob piles, gob vent boreholes, ventilation shafts, and a unit train loadout. There is no additional surface disturbance proposed under PR-14. The currently approved affected area acreage is 5,791 acres; PR-14 will add an additional 1,356 acres of affected area.

The original Bowie No. 2 Mine permit application indicated that mining would be conducted in the D Seam using the room and pillar mining method. Permit Revision No. 2 changed the

mining method to longwall mining but kept the rate of production at two million tons per year. Approval of Permit Revision No. 3 increased maximum mine production to five million tons per year. Approval of Permit Revision No. 6 increased coal production to six million tons per year. Approval of Permit Revision No. 7 permitted the construction of portals and facilities to mine the B-2 coal seam. The five year B-2 coal seam mine plan was approved through Permit Revision No. 8. Permit Revisions No. 9, 10, and 11 expanded B seam operations and added permit area acreage. PR-12 abandoned plans to complete mining in the Iron Point Tract, and incorporate unmined areas of the Bowie No. 1 Mine for B-2 seam mining under the Bowie No. 2 Mine permit. PR-13 revised the mine plan in the B-2 coal seam and extended the proposed mine plan to the north through the acquisition of two lease modifications. Current mining is in the B-2 coal seam. Detailed information regarding the Bowie No. 2 Mine and BRL is located in the eleven volumes which comprise the Bowie No. 2 Mine permit application document.

Site Description

Land Use and Cultural and Historic Resource Information

Detailed information regarding land uses and cultural and historic resources within the Bowie No. 2 Mine permit area is provided in Sections 2.04.3 and 2.04.4 of the permit application document. A brief summary is provided below, and this summary is derived from the information presented within Sections 2.04.3 and 2.04.4 of the permit application document.

The Bowie No. 2 Mine permit and adjacent area includes a mix of land uses. The lower elevation areas are used for pasture, cropland, orchards, residential and industrial uses. Agricultural uses are served by irrigation water. The higher elevations within and adjacent to the permit area support some rangeland use, and the areas offer abundant wildlife habitat. The lands also support various recreational uses.

Historic and current mining operations also exist in the general area. The Bowie No. 1 Mine is located west of the Bowie No. 2 Mine permit area. The Terror Creek Loadout is located to the south of the Bowie No. 2 Mine permit area, adjacent to the Unit Train Loadout. The reclaimed Blue Ribbon Mine is also located nearby along Hubbard Creek, as are outlying facilities associated with the Sanborn Creek Mine. Historic coal mines located within and adjacent to the Bowie No. 2 permit boundary include the King Mine, the Gelwick Mine, the Blue Ribbon Mine and the Farmers' Mine. The former town site of Bowie is located within the Bowie No. 2 permit area.

With the initial permit approval, three historic sites not associated with important persons or events in history were evaluated by the Colorado Historical Society. One prehistoric site was determined to be ineligible for the National Register of Historic Places. The town site of Bowie and the King Mine, however, were determined to be eligible the National Register of Historic Places. Although it was determined that deterioration and alteration had lessened their integrity, the Colorado Historical Society found that the structures still retained "a sense of place since new buildings have not been constructed within its borders." The Colorado Historical Society directed BRL to conduct a Level II survey of the two eligible sites; the survey was completed in September 1996. As requested by the Colorado Historical Society, BRL has committed to stop construction of any surface disturbance and evaluate the situation appropriately, in consultation with the Colorado Historical Society, if previously unknown cultural resources should be discovered.

Three sites within the Spruce Stomp lease area have been deemed eligible for listing on the National Register of Historic Places by the State Historic Preservation Officer. No surface disturbance is proposed under this permit revision, and the applicant has predicted that the three sites will not be affected by subsidence. Section 2.05.6(4) of the permit application package includes a discussion of the sites and the determination that the sites will not be negatively affected by mining. Since the determination of no effect is based on the assumption that there will be no surface disturbance within the Spruce Stomp lease area, the following stipulation is placed on the proposed decision to approve PR-14:

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL WILL NEED TO EVALUATE THE EFFECTS OF THAT DISTURBANCE ON ANY OF THE SITES LISTED AS ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES, AS DOCUMENTED IN THE 2012 CLASS III CULTURAL RESOURCES INVENTORY REPORT FOR THE LEASE AREA.

Geology

Detailed information regarding the geology in and adjacent to the Bowie No. 2 Mine permit area is provided in Sections 2.04.5 and 2.04.6 of the permit application document. A brief summary is provided below, and this summary is derived from the information presented within Sections 2.04.5 and 2.04.6 of the permit application.

The Bowie No. 2 Mine permit area is located in the North Fork Valley of the Gunnison River, near the western margin of the Colorado portion of the Central Rocky Mountains. The elevation of the permit area ranges from about 6,000 feet above sea level to over 8,000 feet above sea level. The general area is situated along the southern flank of the Piceance Creek structural and sedimentary basin. The area is bounded by Larimide structural and physiographic features on the following sides: West Elk and Elk Mountains on the east; the Gunnison Uplift on the south; the Uncompahgre Uplift on the west-southwest; and the Grand Mesa-Piceance Basin on the north.

The geologic structure of the permit area exhibits an attitude of N66°W, with a 3 to 5-degree dip to the northeast. There is one identified fault located in the southwest corner of the permit area. The fault trends approximately N55°W and it dips 70 to 80 degrees to the northeast. The throw of the fault ranges from 7 to 30 feet, with the downside located on the south side of the fault.

The coal in the area is situated within the Mesaverde formation which contains interbedded sandstones, mudstones, shales, siltstones and coal beds. The Mesaverde formation lies upon the Rollins Sandstone Member of the Iles formation and below the Wasatch formation. The coal-bearing member of the Mesaverde formation locally contains up to nine (9) coal seams. These seams are located within a stratigraphic interval of approximately 500 to 600 feet above the Rollins Sandstone. These coal seams are, in ascending order, the A-Seam, the B-1 Seam, the B-2 Seam, the C-Seam, the D-1 Seam, the D-2 Seam, the E-1 Seam, the E-2 Seam and the F-Seam.

The B-2 and D-2 Seams are mineable within the permit area. The D-2 Seam overlies the Rollins Sandstone by 350 to 450 feet, and it ranges in thickness from about 8 to 16 feet. The B-2 coal

seam lies between the Rollins Sandstone and the D-2 coal seam and varies in thickness from 9 to 22 feet. Longwall mining in the D-2 coal seam is complete. Longwall mining began in the B-2 coal seam with the approval of Permit Revision No. 8. Permit Revision No. 14 proposes to continue longwall mining in the B-2 seam between Terror Creek and Stevens Gulch, north of Highway 133.

Hydrology

Detailed information regarding the surface and groundwater hydrology in and adjacent to the Bowie No. 2 Mine permit area is provided within Sections 2.04.5, 2.04.7, and Exhibit 3 of the permit application document. A brief summary is provided below, and the summary is derived from the information presented in permit application Sections 2.04.5 and 2.04.7.

The proposed permit and adjacent areas are generally bounded by three (3) perennial streams. These streams are Stevens Gulch, Hubbard Creek and the North Fork of the Gunnison River and are located in the west, east and south areas of the permit area, respectively. Tributary to the perennial streams are the following intermittent and ephemeral streams: Stephens Draw, Freeman Gulch, A-Gulch, B-Gulch, C-Gulch, D-Gulch, Dove Gulch and Sheep Corral Gulch. Terror Creek and West Terror Creek, perennial streams, run roughly north/south through the central permit area. The specific locations of these streams are depicted on permit application Map No. 9.

The North Fork of the Gunnison River drains an area of approximately 526 square miles. The average annual discharge of the North Fork of the Gunnison River for the period of record (1934-2012) is approximately 329,300 acre-feet. The quantity and quality of this river is influenced significantly by agricultural and municipal uses. Near Somerset, Colorado, the water in the North Fork of the Gunnison River is a calcium-bicarbonate type. Total dissolved solids concentrations at the downstream Bowie No. 2 monitoring point have ranged from approximately 50 milligrams per liter (mg/l) to approximately 692 mg/l over the life of the mine.

Perennial streams Terror Creek, Hubbard Creek, and Stevens Gulch drain approximately 29, 57.5, and 8 square miles, respectively. Tributary drainages Stephens Draw, A-Gulch, B-Gulch, C-Gulch, D-Gulch, Sheep Corral Gulch, Iron Point Gulch, and Dove Gulch exhibit ephemeral and intermittent flow regimes.

There are numerous stock ponds located in the permit and adjacent areas. All of the ponds are manmade and store less than 20 acre-feet of water that is generally intended for domestic livestock use. The ponds collect spring season runoff and any available seep water.

Groundwater in the area is located within the alluvial deposits along the North Fork of the Gunnison River and Hubbard and Terror Creeks, within the steep sloped colluvial deposits found within some of the drainages, and in perched water zones located within the lenticular sandstones of the Mesa Verde formation and in the Rollins Sandstone. The Rollins Sandstone is a recognized aquifer in the area.

The groundwater associated with the alluvial deposits of the North Fork of the Gunnison River has been developed for domestic and agricultural uses. The localized groundwater resources associated with the alluvial deposits of Hubbard and Terror Creeks are not significantly developed. The groundwater associated with local colluvial deposits is recharged by snowmelt,

and the water discharges through local intermittent springs and seeps. Most of this colluvial water is lost due to evaporation.

Bedrock groundwater is not abundant in the permit area. The groundwaters of the locally perched bedrock water zones and of the Rollins Sandstone are not significantly developed in the permit and surrounding area, due to relatively poor water quality and low potential quantity yields. The general bedrock groundwater flow direction in the sandstone strata of the Mesaverde formation is from the recharge area near the outcrop of these strata, north toward the lower parts of the basin.

With PR-14, BRL has proposed to construct two new down-gradient groundwater monitoring wells (2015-1B and -1SS) and to rehabilitate two existing up-gradient groundwater monitoring wells (CWI-DH-58 and -60). These actions will supplement the existing baseline data and the water monitoring program; additionally 2015-1B and -1SS will be used to establish groundwater points of compliance. Two associated stipulations are placed on the Division's approval of PR-14:

BRL MUST REHABILITATE OR REPLACE GROUNDWATER MONITORING POINTS CWI-DH-58 AND CWI-DH-60 BY DECEMBER 31, 2014. FOLLOWING COMPLETION OF THE WORK, A MINOR REVISION MUST BE SUBMITTED TO UPDATE THE PERMIT APPLICATION PACKAGE TEXT WITH A DISCUSSION OF THE REHABILITATION OR REPLACEMENT OF THE WELLS. THE FIELD WORK MUST BE COMPLETED BY THE END OF CALENDAR YEAR 2014.

WITHIN SIXTY DAYS FOLLOWING THE COLLECTION OF A YEAR OF VALID BASELINE DATA FROM THE TWO DOWN-GRADIENT MONITORING WELLS TO BE DRILLED IN 2015 (2015-1B AND 2015-1SS), BRL MUST SUBMIT A TECHNICAL REVISION TO UPDATE THE PROBABLE HYDROLOGIC CONSEQUENCES SECTION OF THE PERMIT TO ESTABLISH THOSE WELLS AS GROUNDWATER POINTS OF COMPLIANCE, IN ACCORDANCE WITH RULES 2.05.6(3)(B)(III) AND (IV).

BRL has established an additional surface water monitoring location upstream of mining activities on the West Fork of Terror Creek and at numerous springs, seeps and ponds within the Spruce Stomp lease area, and has provided the Division with one year of monitoring data from those monitoring locations.

Climatological Information

Detailed climate information is presented in Section 2.04.8 of the Bowie No. 2 Mine permit application document, and the information is summarized below. The nearest weather station to the permit area was the Wilcox Ranch Station, located east of the old Bowie town site, in the Hubbard Creek Drainage. The period of record for this station is from 1948 to 1983, and the average annual precipitation of record for this station is 18.50 inches. The station was moved to the West Elk Mine in November 1983, and the station is now referred to as the Somerset IE Station. Other weather stations in the area were the Paonia 3SE and Paonia 1SW stations. The Paonia 3SE and Paonia ISW stations recorded data for the periods 1905 to 1957, and 1957 to present, respectively.

The average minimum temperature in the area is about 36 degrees (Fahrenheit), with the lowest

temperature of -28 degrees recorded in Paonia during 1913. The average high temperature in the area is about 64.5 degrees (Fahrenheit), with the highest recorded temperature in Paonia of 100 degrees during 1927 and 1934.

Soils Information

Detailed information regarding the soils within the permit area is located in Section 2.04.9 of the Bowie No. 2 Mine permit application document. The following summary is derived from Section 2.04.9 of the referenced permit document.

Generally, the soils within the disturbed areas are shallow to deep, moderately steep to very steep, well drained stony soils that formed in residuum, colluvium, and alluvium derived from sedimentary rock and rock outcrop. The soils in the upper elevations in the northern portion of the permit area are deep, nearly level to steep, well drained loam and stony loam that formed in outwash from igneous rock.

The areas within the permit area mapped by BRL exhibit the following soils: the Absarokee (Beenon-Absarokee Association), the Persayo, the Torriorthents, Fughes loam, Cochetopa stony loam, Delson loam, Work loam, Progresso loam, Potts loam, Glenton fine sandy loam, Kech-Rock Outcrop, Saraton-Agua-Fria complex, Haplaquolls, and fluvents.

BRL has provided a general map of soil types located within the PR-14 expansion area. Prior to any surface disturbance in the Spruce Stomp area, BRL will be required to provide detailed information as required by Rule 2.04.9. Accordingly, the following stipulation is placed on the Division's approval of PR-14:

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE SOILS RESOURCE INFORMATION REQUIRED UNDER RULE 2.04.9 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

Vegetation Information

Detailed vegetation information for the Bowie No. 2 permit area is presented in Section 2.04.10 of the permit application document. The following summary is derived from the information

Major plant communities within the permit area are:

- Juniper Woodland, Mixed Shrub and Disturbed Meadow in the vicinity of the mine haul road, benches and facilities, and Gob Piles #1, #2, and #4. The Juniper Woodland and Mixed Shrub communities exhibit such plant species as Snowberry, Gambel oak and Serviceberry. The meadow community is dominated by annual and noxious plant species, such as bindweed, cheatgrass and Japanese brome, but Alfalfa and Kentucky Bluegrass are also present;
- Pasture, Irrigated Hayfield, and Orchard in the area affected by the unit train loadout and Gob Pile #3;
- Mountain Shrub, Aspen, and Spruce-Fir in the areas to be affected by gob vent boreholes.

An area of approximately 0.31 acres is identified as wetland. This area will be disturbed, and this activity will be conducted in compliance with a permit issued by the United States Army

Corps of Engineers. The proposed disturbed area was also surveyed for threatened and endangered plant species; however, no such species were found.

BRL has provided a general map of vegetation communities located within the PR-14 expansion area. Prior to any surface disturbance in the Spruce Stomp area, BRL will be required to provide detailed information as required by Rule 2.04.10. Accordingly, the following stipulation is placed on the Division's approval of PR-14:

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), THE BASELINE VEGETATION INFORMATION REQUIRED UNDER RULE 2.04.10 MUST BE SUBMITTED TO AND APPROVED BY THE DIVISION.

Fish and Wildlife Information

Detailed fish and wildlife information is presented within Section 2.04.11 of the Bowie No. 2 Mine permit application document. This summary is derived from the referenced permit document section.

A detailed list of wildlife species known to occur within the Bowie No. 2 Mine permit area is presented in Volume III, Exhibit 9 of the permit application document. The Bowie No. 2 Mine area is located in an area designated as critical range for deer and elk. The surrounding cliffs are possible nesting and/or roosting sites for all species of raptors. The Colorado Division of Wildlife and the United States Fish and Wildlife Service were both involved with the Bowie No. 2 Mine permit application review. Correspondence from both agencies regarding the proposed Bowie No. 2 Mine is contained within Volume III, Exhibit 9 of the Bowie No. 2 permit application document.

Specific site surveys were conducted to ascertain the presence of and potential impacts on threatened or endangered wildlife species. The field surveys conducted prior to this permit revision did not identify any such species, or predict any such impacts.

With the Spruce Stomp EA, the BLM requested an informal Section 7 Consultation with the US Fish and Wildlife Service (USFWS). The USFWS found that the proposed mining activity in the Spruce Stomp lease area "may affect, is not likely to adversely affect" the Greenback Cutthroat Trout, identified in the EA as present in the lease area, and the Canada Lynx, the presence of which is unlikely in the lease area.

BRL has predicted that the creek may subside as much as 5.1', creating a change in the channel slope by as much as 1.5%. The change in channel gradient is not predicted to have an adverse affect on water quality or quantity, thus subsidence is not likely to adversely affect the Greenback Cutthroat Trout.

To further protect the Greenback Cutthroat Trout habitat, the following stipulations have been placed on the BLM lease and incorporated into the permit application package revised for PR-14:

- The Rules require the establishment of a stream buffer zone within 100' of any perennial stream; the EA requires a buffer zone of 200' along the West Fork of Terror Creek. BRL has committed to the 200' buffer zone in the permit application pages revised with PR-14.
- BRL will not pump water from the East Fork of Terror Creek if flows drop below 1.0 cfs,

or during baseflow periods (October through March).

- BRL will screen the intake pump in the East Fork of Terror Creek to protect Greenback Cutthroat Trout fry.
- BRL will conduct fish, sediment and macroinvertebrate sampling every two years and twice following mining activities.

Description of the Operation and Reclamation Plans

Detailed information regarding the operation and reclamation plans for the Bowie No. 2 Mine is presented in Section 2.05 of the Bowie No. 2 Mine permit application document. Section 2.05 of the permit also contains numerous references to maps and other information related to the Bowie No. 2 Mine operations and reclamation plans, which are contained in various sections of the permit application document volumes. The following summary is derived from the information presented in the Bowie No. 2 Mine permit application document.

Coal from the Bowie No. 2 Mine was originally extracted using the room and pillar mining method. Retreat mining of some of these sections has also occurred. Approval of Permit Revision No. 3 allowed the mining method to change to longwall mining.

The D-2 coal seam was accessed from three (3) entries which were constructed at an elevation of 6880 feet above sea level. This is the elevation where the D-2 coal seam generally outcrops, within the Bowie No. 2 permit area, and this elevation is approximately 800 feet above the old State Highway 133. The main entries were driven down-dip to the north, with the sub-mains being driven east and west from the mains.

The B-2 coal seam is currently being accessed through three (3) mine entries. The B-2 coal seam portals are located below and just to the east of the D-2 coal seam portals, at an approximate elevation of 6630 feet. The development mining and longwall mining of the B-2 coal seam were approved in Permit Revision No. 8. The B-2 coal seam mine plan was amended in Permit Revision No. 9. Mining of the B-2 seam was subsequently expanded with Permit Revisions 10, 11, 12, and 13. PR-14 will further expand B-2 seam mining to the north of existing operations.

Currently, total annual coal production has been capped at 6 million tons per year. Production data from the Colorado Mine Safety and Training Program shows an average production rate of 3.5 million tons over the 2001-2013 period.

The mine facilities have been constructed near the old Bowie town site. Facilities include:

- haul and access roads
- conveyor belt system
- vent shafts
- truck loadout
- unit train loadout
- coal stockpiles
- refuse piles
- drainage and sediment control facilities, and
- portable methane pumps used at gob vent boreholes.

Coal travels by covered conveyor line from the B-2 coal seam portal bench to the D-2 coal seam

portal bench, through the downhill conveyor line to the coal stockpile at the bottom of the hill and, then to the unit train loadout. Refuse material is trucked from the wash plant to the active refuse disposal areas.

There are currently four refuse areas within the permit area, referred to as Gob Piles #1 through #4. Gob Piles #1 and #4 have been filled to their permitted capacity, and will be reclaimed in the fall of 2014. Gob Piles #2 and #3 are active, and used for disposal of refuse material associated with the current mining operations. At the current rate of refuse disposal, it is not likely that the two active disposal areas will have adequate capacity to contain the refuse material to be generated with mining in the Spruce Stomp lease area. Accordingly, the following stipulation is placed on the Division's proposed decision to approved PR-14:

PRIOR TO INITIATING ANY LONGWALL MINING IN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL MUST OBTAIN APPROVAL FOR A PLAN TO MANAGE REFUSE GENERATED AS A RESULT OF MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA AND ALL CURRENTLY APPROVED COAL MINING ACTIVITIES. THIS RESTRICTION WILL NOT PRECLUDE DEVELOPMENT MINING ACTIVITIES IN THE SPRUCE STOMP LEASE AREA CONSTRUCTED WITH CONTINUOUS MINING EQUIPMENT. PROPOSED MANAGEMENT PLANS MUST BE PREPARED IN ACCORDANCE WITH RULES 2.05.3(8), 4.10, AND 4.11 AND BE BASED ON CURRENT AND PREDICTED RATES OF PRODUCTION AND REFUSE GENERATION AND INCLUDE REFUSE THAT WILL BE GENERATED FROM ALL CURRENTLY APPROVED MINING PLANS.

A drainage and sediment control system has been constructed. The system consists of ditches, culverts, sedimentation ponds and alternate sediment control areas referred to as "small area exemptions". Specific details regarding the designs for these systems are presented in Section 2.05, as are references to other sections of the permit application document which present additional design details.

For the currently approved operations, all available topsoil has been salvaged and stored prior to facility construction. Salvaged topsoil from the facilities and refuse areas was placed in stockpiles A, D, E, and F. Specific details regarding the topsoil salvage volumes are presented in Section 2.05, Appendices A of Volumes IX and XI, and Map 32 of the Bowie No. 2 Mine permit application.

Some surface blasting occurred during construction of the facilities. Details regarding the blasting plan are presented within Section 2.05 of the permit application.

The Bowie No. 2 Mine is located in areas known to be subject to mass movement processes. Extensive design efforts and regulatory review were implemented prior to the approval of the Bowie No. 2 Mine and during the review of Permit Revision No. 3 and Permit Revision No. 7. The details regarding the geotechnical aspects of the mining and reclamation plan are presented within Volume VII of the permit application document.

The Bowie No. 2 Mine will be reclaimed to the post-mining land uses of rangeland, wildlife habitat and industrial. The approval of Permit Revision No. 6 added cropland and pastureland to the post-mining land uses. All facilities areas and some roads will be reclaimed to reestablish the approximate original contour of the land. All portals, shafts and monitoring wells will be backfilled, in accordance with the applicable rules and with the reclamation details provided

within the permit application. Some of the roads which existed prior to mining will be retained to serve the postmining land use.

Topsoil will be redistributed on all disturbed areas. The soils will be tested for nutrient deficiencies, and fertilizers will be applied as needed.

Revegetation will be implemented using the seed mixes approved. Seven permanent seed mixes are approved for use in reclamation, and one seed mix has been approved for temporary stabilization during the operational phase. The seven permanent seed mixes will be applied to the following areas: Meadow, Upland (non-USDAFS lands), Mountain Shrub (USDAFS), Aspen (USDAFS), Irrigated Hayland, Pasture, and Concentrated Shrub Clumps. Mulch will be applied at an approximate rate of 4000 pounds per acre.

The USDA-Forest Service provided its own Mountain Shrub and Aspen reclamation seed mixes for disturbed areas on USFS lands. The Division had suggested the addition of three forbs into the seed mixes. However, the Forest Service declined the suggestion. BRL has accepted the Forest Service reclamation seed mixes, with the knowledge that the reclamation success standards will still apply.

Hydrologic and subsidence monitoring will occur throughout the operational and reclamation phases of the Bowie No. 2 Mine project. While deleterious hydrologic or subsidence related impacts are not anticipated, the Bowie No. 2 Mine permit application contains mitigation plans to be implemented if negative impacts are detected.

Findings of the Colorado Division of Reclamation, Mining and Safety
for the
Bowie No. 2 Mine

Explanation of Findings

Pursuant to Rule 2.07.6(2) of the Regulations of the Colorado Mined Land Reclamation Board for Coal Mining, and the approved state program, the Division of Reclamation, Mining and Safety or the Board must make specific written findings prior to issuance of a permit, permit renewal or permit revision. These findings are based on information made available to the Division that demonstrates that the applicant will be able to operate in compliance with the Colorado Surface Coal Mining Reclamation Act and the Regulations promulgated pursuant to the Act.

The findings in the following sections required by Rule 2.07.6(2) are listed in accordance with that Rule. The findings and specific approvals required pursuant to Rule 2.07.6(2)(m) are listed in accordance with Rule 4 and are organized under subject or discipline subtitles.

This findings document has been updated for this permit revision. The following findings have been reevaluated and updated if necessary to reflect changes which will occur as a result of this permit revision.

Section A - Rule 2.07.6

1. The permit application is accurate and complete. All requirements of the Act and these rules have been complied with (2.07.6(2)(a)).
2. Based on information contained in the permit application and other information available to the Division, the Division finds that surface coal mining and reclamation can be feasibly accomplished at the Bowie No. 2 Mine (2.07.6(2)(b)).
3. The assessment of the probable cumulative impacts of all anticipated coal mining in the general area on the hydrologic balance, as described in 2.05.6(3), has been made by the Division. This assessment entitled "North Fork of the Gunnison River Cumulative Hydrologic Impact Assessment" is available for inspection at the offices of the Division. The Division finds that the operations proposed under the application have been designed to prevent damage to the hydrologic balance outside the proposed permit area. Please refer to Section B.III (Probable Hydrologic Consequences) of this document for additional discussion of the predicted hydrologic consequences of mining operations at the Bowie No. 2 Mine (2.07.6(2)(c)).
4. The Division finds that the affected area is, subject to valid rights existing as of August 3, 1977, not within:
 - a) An area designated unsuitable for surface coal mining operations (2.07.6(2)(d)(i));
 - b) An area under study for designation as unsuitable for surface coal mining operations

(2.07.6(2)(d)(ii));

- c) The boundaries of the National Park System, the National Wildlife Refuge System, the National System of Trails, the National Wilderness Preservation System, the Wild and Scenic Rivers System including rivers under study for designation, and National Recreation Areas.

The Environmental Assessment (EA) for the Spruce Stomp lease area addresses Wild and Scenic Rivers (WSR) in the lease area. The assessment stated that:

A 1.21-mile segment of the West Fork of Terror Creek was determined eligible for inclusion in the National Wild and Scenic River System (NWSRS). Of the 1.21 miles that are eligible, only 0.64 mile is within the lease-by-application (LBA) tract; 0.76 mile is on private surface and 0.18 mile is on BLM surface. The following portions of the proposed lease are within the ½ mile river study corridor of the eligible river segment. There are BLM surface lands and private surface with the subsurface minerals managed by BLM.

Township 13 South, Range 91 West, 6th P.M., Section 5: W/2W/2SENE – approximately 10 acres

Township 13 South, Range 91 West, 6th P.M., Section 6: lots 1 & 2 – approximately 80 acres

The BLM is currently drafting a suitability report that determines which segments, from among the eligible segments, are suitable for protection under the Wild and Scenic Rivers Act. Until that report is finalized, the BLM manages eligible segments under interim protections. Specifically, interim protections include protection of the free-flow of the stream, water quality, and the qualifying outstanding remarkable value so as to prevent the segment from losing its eligibility, and to keep the “scenic” classification from degrading to “recreational.”

From the Final Wild and Scenic River Eligibility Report for the Uncompahgre Planning Area (June 2010):

Description: The West Fork of Terror Creek is a perennial headwater stream on the southern flank of Grand Mesa north of Paonia. The creek drains into Terror Creek, which is a tributary of the North Fork of the Gunnison River. The lower terminus of this river segment is its confluence with East Terror Creek, while the upper terminus is the boundary of Grand Mesa National Forest.

Outstandingly Remarkable Values: Fish

*Fish - Based upon the best available genetic information, this river segment harbors a population of greenback cutthroat trout (*Oncorhynchus clarki stomias*), a species listed as threatened under the Endangered Species Act. This is one of 37 greenback populations currently identified on the west slope of Colorado.*

Preliminary Classification: Scenic

Rationale - An unsurfaced road crosses the West Fork of Terror Creek near its confluence with Terror Creek. The remaining river channel and associated corridor are primitive and undeveloped. There is a small impoundment known as Holy Terror Reservoir, as well as Grand Mesa Canal Head Gate #4, an irrigation diversion upstream of the reach.

The Grand Mesa and Uncompahgre National Forest issued a proposed Forest Plan Revision in conjunction with the Gunnison National Forest in March 2007, which included a WSR eligibility study. There were no watercourses adjoining the Uncompahgre Field Office boundary identified as eligible including the West Fork of Terror Creek on National Forest System lands.

The EA further acknowledges that there may be up to 5.1' of subsidence resulting in up to a 1.5% slope change in the West Fork of Terror Creek. The BLM determined that stipulations in the EA will maintain the free-flowing nature, water quality, and the Outstanding Remarkable Value (ORV) for fish. BLM further states that the analysis in the EA does not demonstrate that the proposed lease or future development would harm the ORV for fish or tentative WSR classification of "scenic." The WSR classification of "scenic" does allow some development within 1/4 mile of the segment as long as the "scenic" classification does not degrade to "recreational." BLM determined that surface development, with appropriate siting and screening, would not degrade the segment to "recreational."

The mining plan has been prepared to control subsidence along the West Fork of Terror Creek, and a subsidence monitoring and control plan has been proposed under this permit revision. (2.07.6(2)(d)(iii)(A));

- d) Three hundred feet of any public building, school, church, community or institutional building, or public park (2.07.6(2)(d)(iii)(B));
- e) One hundred feet of a cemetery (2.07.6(2)(d)(iii)(C));
- f) The boundaries of any National Forest unless the required finding of compatibility has been made by the Secretary of the U.S. Department of Agriculture. The required finding of compatibility was made within the September 2013 Environmental Assessment for the Spruce Stomp Coal Lease (DOI-BLM-CO-S050-2013-0010 EA), and subsequent lease award documents. (2.07.6(2)(d)(iii)(D));
- g) One hundred feet of the outside right-of-way line of any public road except where mine access or haul roads join such line, and excepting any roads for which the necessary approvals have been received, notices published, public hearing opportunities provided, and written findings made (2.07.6(2)(d)(iv));

At the time of the initial permit application, a portion of the surface facilities was located within 100 feet of the outside right-of-way of old State Highway 133. The location of these facilities extended from the old Bowie town site to about 500 feet east of the old Bowie power plant.

The Division published a newspaper notice in the *Delta County Independent*, which specifically advised the public of this situation and invited any interested party to request a public hearing. No such requests were received. The publication occurred on August 7, 1996, and the proof of publication was received by the Division on August 12, 1996. Additionally, on July 26, 1996 the Division received a letter dated July 8, 1996 written from the Colorado Department of Transportation to Bowie Resources, LLC specifically allowing such activities within 100 feet of the highway. This letter is presented in Volume III, Exhibit 14 of the Bowie No. 2 Mine permit application document.

The proof of publication and the Department of Transportation letter are on file within the Division's correspondence files for the Bowie No. 2 Mine permit application. Volume III, Exhibit 13 of the permit application also includes a copy of the Colorado Department of Transportation State Highway Access Permits granted for the Bowie No. 2 Mine.

Through Permit Revision No. 3, BRL obtained approval to again construct certain facilities within 100 feet of the right-of-way of old State Highway 133. The facilities included the coal stockpile, coal haul truck loading system and the relocated pond B.

A public notice was published in the *Delta County Independent* informing the public of their right to request an informal conference concerning this situation. No requests were received that specifically requested an informal conference to discuss the right-of-way issue, although two informal conferences were held, on August 5, 1999 and September 13, 1999, to discuss issues pertaining to Permit Revision No. 3 in general. Additionally, BRL submitted a letter from the Colorado Department of Transportation (CDOT), dated January 12, 1999, in which permission was granted for construction of the proposed facilities within 100 feet of the right-of-way of old State Highway 133. A copy of the letter is in Tab 14 of Volume III of the Bowie No. 2 Mine permit application. Tab 13 of Volume III includes the two state highway access permits, numbered 399058 and 399059, required by CDOT for the operations proposed in Permit Revision No. 3.

Approval of Permit Revision No. 6 also permitted the construction of facilities within 100 feet of the right-of-way of State Highway 133 and Old State Highway 133. The facilities include an overhead conveyor line and conveyor support structures within the right-of-way of Old State Highway 133, as well as sedimentation ponds J and K, sections of railroad track construction and a temporary construction access road within the right-of-way of State Highway 133. The public notice of completeness for Permit Revision No. 6, published in the *Delta County Independent* on August 15, 22, 29 and September 5, 2001, informed the public of the right to request an informal conference to discuss the issues in Permit Revision No. 6. There were no requests for an informal conference.

In addition, BRL submitted to the Division a letter dated January 8, 2002 in which CDOT approved of the proposed disturbances within 100 feet of the highway right-of-ways. BRL also submitted a utility permit issued by CDOT, allowing the construction of the overhead conveyor belt over Old State Highway 133. The road access permit for the temporary construction access road was required to be submitted through Stipulation No. 13, attached to the Permit Revision No. 6 decision.

Technical Revision No. 27 provided for the storage of soil and rock material that was

excavated from the wash plant bench construction along the outslope of the gob pile haul road. A portion of the material storage area fell within 100 feet of the right-of-way of old State Highway 133. The public notice of the completeness of this revision also informed the public of the right to request a public hearing. The public notice appeared in the June 25, 2003 edition of the *Delta County Independent*. No one requested a public hearing.

Permit Revision No. 13 allowed for underground mining within 100' of Stevens Gulch Road, and subsequent technical revisions have approved surface disturbances associated with gob vent boreholes within 100' of the right-of-way of Stevens Gulch Road. No requests for an informal conference were received with any of the Stevens Gulch Road permitting actions.

Permit Revision No. 14 will also allow for underground mining beneath Stevens Gulch Road. No requests for an informal conference were received in response to the applicant's public notice of the application.

- h) Three hundred feet of an occupied dwelling unless a written waiver from the owner has been provided (2.07.6(2)(d)(v)).

With the original permit application, there was one occupied dwelling within 300 feet, measured horizontally, of the surface operations or facilities. The dwelling is owned by Hidden Valley Ranch and Cattle Company, Inc. A written waiver is included in Volume III, Exhibit 14, from the dwelling owner, which states that the owner had the legal right to deny mining, and the dwelling owner knowingly waived that right.

For Permit Revision No. 3, some of the proposed operations were within 300 feet of several buildings that had been owned by the Hidden Valley Ranch and Cattle Company. However, under an Option to Purchase, BRL negotiated a Special Power of Attorney that assigned all rights to BRL for the property in question. This documentation is found in Tab 1 of Volume III of the permit application.

Concerning Permit Revision No. 6, several occupied buildings were within 300 feet of the proposed operations. In several cases, BRL purchased the properties and demolished the buildings. In another case, BRL built a replacement home for one citizen whose original home was within 300 feet of the disturbance. BRL, then, received a right-of-entry agreement with the same landowner for access onto the property. BRL also received a right-of-entry agreement with another citizen for property access. The deeds of purchase and right-of-entry agreements are located in Exhibit 1 of Volume III of the permit application.

There are no occupied dwellings within three hundred feet of the affected area proposed under PR-14.

5. The Division finds that all necessary notices and approvals have been received in order to allow the permittee to adversely affect a public park or place listed on or eligible for listing in the National Register of Historic Places as determined by the State Historic Preservation Office. The places which may be affected are structures in and around the old Bowie town site. Approval to affect the structures has been received from the Division and the State Historic Preservation Officer.

For PR-14, History Colorado provided comments that the proposed mine plan would not adversely affect any public park or place listed on or eligible for listing in the National Register of Historic Places. Since the determination of no adverse effect is based on the assumption that there will be no surface disturbance within the Spruce Stomp lease area, the following stipulation is placed on the proposed decision to approve PR-14:

PRIOR TO ANY SURFACE DISTURBANCE OF LANDS WITHIN THE SPRUCE STOMP LEASE AREA (COC-75916), BRL WILL NEED TO EVALUATE THE EFFECTS OF THAT DISTURBANCE ON ANY OF THE SITES LISTED AS ELIGIBLE FOR LISTING ON THE NATIONAL REGISTER OF HISTORIC PLACES, AS DOCUMENTED IN THE 2012 CLASS III CULTURAL RESOURCES INVENTORY REPORT FOR THE LEASE AREA.

Specific surveys, inventories and approval letters for the currently approved permit area and PR-14 expansion area are contained in Volume VI of the Bowie No. 2 Mine permit application document (2.07.6(2)(e)(ii)).

6. For this surface mining operation, private mineral estate has not been severed from private surface estate, therefore, the documentation specified by Rule 2.03.6(2) is not required (2.07.6(2)(f)).
7. On the basis of evidence submitted by the applicant and received from other state and federal agencies as a result of the Section 34-33-114(3) compliance review required by the Colorado Surface Coal Mining Reclamation Act, the Division finds that Bowie Resources, LLC does not own or control any operations which are currently in violation of any law, rule, or regulation of the United States, or any State law, rule, or regulation, or any provision of the Surface Mining Control and Reclamation Act or the Colorado Surface Coal Mining Reclamation Act (2.07.6(2)(g)(i)). However, a query of the Applicant Violator System (AVS) indicates that there are outstanding violations from other entities associated with parent corporations of Bowie Resources, LLC. Those violations are addressed in settlement agreements and accordingly will not preclude approval of this permit revision application. The most recent Applicant Violator System (AVS) check occurred on October 6, 2014.
8. Bowie Resources, LLC does not control and has not controlled mining operations with a demonstrated pattern of willful violations of the Act of such nature, duration, and with such resulting irreparable damage to the environment as to indicate an intent not to comply with the provisions of the Act (2.07.6(2)(h)).
9. The Division finds that surface coal mining and reclamation operations to be performed under this permit will not be inconsistent with other such operations anticipated to be performed in areas adjacent to the permit area (2.07.6(2)(i)).
10. The Division estimates the reclamation liability for mining operations in this permit term to be \$11,327,770.50. The Division currently holds \$11,339,730.57 in reclamation performance bonds for the Bowie No. 2 Mine (2.07.6(2)(j)).
11. The Division has made a negative determination for the presence of prime farmland within the disturbed area. Soil types indicative of prime farmland do occur in the permit area; however, these soil types either will not be disturbed by the Bowie No. 2 Mine or occur on

slopes greater than 6 percent and, therefore, are not considered prime farmland, according to Rule 2.04.12(2)(b). The decision was based on information presented in Section 2.04.12 of the Bowie No. 2 Mine permit application and upon a letter dated June 6, 1996 from the Natural Resource Conservation Service (Volume III, Exhibit 14, Bowie No. 2 Mine permit application document) that demonstrates that no prime farmland mapping units are found within the permit area (2.07.6(2)(k)).

12. The alluvial valley floor exists outside the permit area, is along the North Fork of the Gunnison River and will not be affected by the Bowie No. 2 Mine (2.07.6(2)(k) and 2.06.8(3)(c)).

For additional specific findings concerning this alluvial valley floor please see Section B, XVII.

13. The Division hereby approves the post-mining land use of the operation. It was determined that the proposed post-mining land use of rangeland and wildlife habitat, pastureland, cropland and industrial meets the requirements of Rule 4.16 for the permit area (2.07.6(2)(l)).
14. Specific approvals have been granted or are proposed. These approvals are addressed in the following section, Section B (2.07.6(2)(m)).
15. In consultation with the Colorado Division of Wildlife and the United States Fish and Wildlife Service, the Division finds that the activities proposed by the applicant would not affect the continued existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitats (2.07.6(2)(n)), provided that appropriate mitigation efforts are performed. Letters from both agencies are presented in Volume III, Exhibit 9 of the permit application document. (2.07.6(2)(n)).
16. The Division has contacted the Office of Surface Mining, Reclamation Fees Branch. As of this time, Bowie Resources, LLC, the applicant is current in the payment of reclamation fees required by 30 CFR Chapter VII, subchapter R (2.07.6(2)(o)).

Section B - Rule 4

I. Roads

A. Haul Roads

Two sections of haul roads were built at the Bowie No. 2 Mine. One paved haul road was used to carry coal from the mine portal to the old State Highway 133. With the construction of the conveyor line system and unit train loadout, the haulage of coal by truck on this road was greatly diminished. A second haul road leading to the gob pile was built along an old rail bed. Construction of a third haul road was approved in Permit Revision No. 7, connecting the B-2 coal seam portal bench to the main paved haul road. No haul roads are proposed for construction under this permit revision.

1. Alternative criteria and specifications were not used during the design of haul roads. (4.03.1(1)(e)).

2. The Division approved the retention of a portion of the haul road depicted on Map No. 18, since it is compatible with the approved post-mining land use, and a request for its retention was submitted by the landowner (4.03.1(1)(f)(ii)).
3. The Division does not propose to approve the location of a portion of the haul road in the channel of an ephemeral stream draining a watershed of at least 1 square mile, an intermittent, or a perennial stream (4.03.1(2)(b)).
4. The Division approved haul road encroachment into an ephemeral stream with a watershed less than one (1) square mile during the construction period, since it did not alter normal water flow, contribute sediment, or adversely affect fish or wildlife (4.03.1(2)(c)).
5. The Division does not propose to approve haul road cut slopes steeper than 1.5H:1V in unconsolidated materials or 0.25H:1V in rock (4.03.1(3)(d)(i)).
6. The Division does not propose to approve embankment slopes steeper than 2h:1v (4.03.1(3)(e)(ix)).
7. The Division does not propose to approve the alteration or relocation of a natural channel drainageway (4.03.1(4)(a)(i)).
8. The Division does not propose to approve the use of the alternative specifications for the culverts or bridges (4.03.1(4)(e)(vi)).

B. Access Roads

One access road was built to provide access from the portal bench to the utility bench above the portal bench. Several short length access roads were built that lead from the main paved haul road to important points along the utility corridor, for access to the conveyor line, water line and high voltage power line. There is also an access road south of the unit train loadout. No access roads are proposed for construction under this permit revision.

1. Alternative criteria and specifications were not used during the design of access roads 4.03.2(1)(e)).
2. No landowner has requested the retention of the access road, therefore the Division proposes to approve the current plan for reclamation of the access road (4.03.2(1)(g)(ii)).
3. The Division does not propose to approve the location of a portion of any access road in the channel of an ephemeral stream with a watershed of at least 1 square mile, an intermittent, or a perennial stream (4.03.2(2)(b)).
4. There are no proposed fords of an ephemeral stream with a watershed of at least one square mile or an intermittent stream (4.03.2(2)(c)).
5. The Division does not propose to approve of any cut slopes steeper than 1V:1.5H

or 1V:0.25H (4.03.2(3)(d)(i)).

6. The Division does not propose to approve any embankment slopes steeper than 1.5h:1v (4.03.2(3)(e)(ix)).
7. The Division does not propose to approve the alteration or relocation of any natural channel drainageway during access road construction (4.03.2(4)(a)(i)).
8. No alternative specifications are proposed for any access road culverts (4.03.2(4)(e)(i)).

C. Light-Use Roads

A network of light use roads exists within the permit area, as shown on Map 9 of the approved permit application package. Light use roads have been constructed in association with vent shafts, gob vent boreholes, sediment ponds, and environmental monitoring locations. No light use roads are proposed for construction under this permit revision.

1. The Division does not propose to approve the location of a portion of a light-use road in the channel of an ephemeral stream with an upstream watershed of at least one square mile, an intermittent, or a perennial stream (4.03.3(2)(b)).
2. The Division does not propose to approve a ford of an intermittent, a perennial, or an ephemeral stream which drains at least one square mile. (4.03.3(2)(c)).
3. The applicant has not requested a lesser road grade than required by Rule 4.03.3(3)(a).
4. Pre-existing light-use roads will be retained after reclamation of the Bowie No. 2 Mine site; all other light-use roads will be reclaimed as set forth in the permit application package (4.03.3(7)).

II. Support Facilities

Construction of support facilities will not result in damage, destruction, or disruption of oil, gas, or water wells or pipelines, coal slurry pipelines, railroads, or utility lines which pass over, under, or through the permit area. (4.04(6)).

III. Hydrologic Balance

A. Water Quality Standards and Effluent Limitations

1. The Division granted approval for small area exemptions from the use of sediment ponds, due to the limited size of the areas and due to the fact that ponds and treatment facilities are not necessary for the drainage to meet the effluent limitations of Rule 4.05.2 and applicable State and Federal water quality standards for receiving streams, and also due to the fact that no mixing of surface drainage with a discharge from underground workings will occur. The locations

of the small areas to be exempted are discussed in Section 2.05 of the permit application and are shown on permit document Map 21-1 and Map 95266-02.

Stormwater runoff from several small areas at the mine site are treated alternatively prior to leaving the permit area. Those areas include the material storage area below Pond C; the pump station; the topsoil stockpile near the Gob pile; the coverfill stockpile and topsoil stockpile near Gob Pile #3; the area around the mine engineer's building; the Freeman Gulch, Terror Creek and Hubbard Creek vent sites; the area underneath the conveyor, between old State Highway 133 and the Fire mountain Canal; and nine small areas along the train loadout railroad track outcrops. In addition, alternate sediment control measures are employed at several methane de-gas drill pads. (4.05.2(3)(a)) and (4.05.2(3)(b)(i)).

2. The Division granted an exemption from the use of sediment ponds for drainage from underground mine workings as long as no mixing with surface drainage will occur and as long as ponds and treatment facilities are not necessary for the drainage to meet effluent limitations of Rule 4.05.2 and applicable State and Federal water quality standards for receiving streams. BRL has obtained a discharge permit from the Colorado Department of Health and Environment, Water Quality Control Division, to discharge mine drainage water directly off site. (4.05.2(3)(b)(ii)).
3. The applicant has not proposed the use of a manual lime feeder or other neutralizing agent for the treatment of water with a pH of less than 6.0. Low pH water is not anticipated in the mine water discharge or surface water runoff (4.05.2(8)(a)).

B. Diversions and Conveyance of Overland Flow

1. The Division does not propose to approve the use of an asphalt or concrete lining for a permanent diversion. (4.05.3(3)).
2. The Division does not propose to approve the construction of any diversion on an existing landslide (4.05.3(5)).

C. Stream Channel Diversions

1. The Division does not propose to approve the diversion of an ephemeral stream draining at least one square mile, an intermittent, or a perennial stream. (4.05.4(1) and (4)).
2. Channel lining structures, retention basins, and artificial channel roughness structures are proposed for use to control erosion. These means are proposed to be approved by the Division since they are necessary to control erosion, they are stable and will require infrequent maintenance (4.05.4(2)(a)).
3. The Division does not propose to approve any stream channel diversion with a lesser capacity than the unmodified stream channel immediately above or below

the diversion (4.05.4(2)(b)).

4. The Division does not propose to approve any permanent stream diversions (4.05.4(3)).

D. Sedimentation Ponds

1. The Division does not propose to approve the location of any sediment pond in a perennial stream (4.05.6(1)(b)).
2. The Division does not propose to approve the submittal of reports required by Rule 4.05.6(13) on other than a quarterly basis.
3. Alternative design criteria and specifications have been approved for use in sediment pond design and/or construction. This decision is based on a thorough analytical demonstration by a qualified professional engineer that the resulting sediment pond (Pond D) will be as environmentally sound and structurally stable taking into consideration physical, climatological and other characteristics of the site

The gob pile pond (Pond D) has an embankment with slopes steeper than typical requirements. Bowie Resources, LLC provided the required geotechnical stability analyses to justify the implementation of steeper embankment slopes. Sediment pond design details are presented in Section 2.05 and Volume III, Exhibit 8 of the permit application document (4.05.6(11)).

E. Acid-forming and Toxic-forming Spoil

Based upon information provided by BRL, the Division does not anticipate that any acid-forming or toxic-forming spoil will be encountered during the operation of the Bowie No. 2 Mine (4.05.8(3)).

F. Impoundments

BRL has not proposed the use of alternative design criteria and specifications for impoundment design and construction (4.05.9).

G. Surface and Ground Water Monitoring

The applicant will conduct monitoring of surface and ground water in a manner approved by the Division. The surface and ground water monitoring plan is specified in Section 2.05.6(3)(b)(iv) of the Bowie No. 2 Mine permit application BRL monitors surface water quantity and quality in perennial streams, irrigation ditches, ephemeral drainages, and several springs, both upstream and downstream from the areas affected by mining. Ground water levels and quality are monitored in the D-2 coal seam, the B-2 coal seam and the North Fork alluvium. Monitoring and reporting of mine inflows was added to the hydrology monitoring plan with the approval of Permit Revision No. 2 (4.05.13(1) and 4.05.13(2)).

With PR-14 the monitoring plan is extended to include two new down-gradient wells that will monitor groundwater levels and quality in the B-seam and in the sandstone above the B-seam. It is stipulated earlier in this document that these wells will serve as groundwater points of compliance, to be established when an appropriate quantity of baseline data has been collected.

Also in conjunction with PR-14, surface water monitoring locations have been established upstream on the West Fork of Terror Creek, and at numerous springs, seeps, and ponds throughout the Spruce Stomp lease area.

H. Transfer of Wells

The Division does not propose to approve the transfer of any exploration or monitoring well (4.05.14 (2)).

I. Discharge of Water into an Underground Mine

The Division is not proposing to approve the diversion of water from a surface or underground mine into underground mine workings. (4.05.16(2) and 4.05.3(1)(f)).

J. Stream Buffer Zones

The Division does not propose to approve surface or underground mining activities within 100', or through a perennial stream or stream with a biological community. Additionally, there will be no surface disturbance within 200' the West Fork of Terror Creek. (4.05.18(1)).

K. Probable Hydrologic Consequences

BRL provided an analysis of the Probable Hydrologic Consequences to be expected as a result of mining and reclamation operations at the Bowie No. 2 Mine. The analysis is presented in Section 2.05.6(3)(b)(iii) of the permit application document. Possible hydrologic impacts to the local surface and ground water systems are summarized below.

Surface water systems directly above the mine workings within the permit area could be minimally impacted due to mine subsidence. Surface cracking resulting from subsidence could occur within the ephemeral and intermittent stream channels which overlie the mine; however, such impacts should be minimal and surface cracks should fill with sediment relatively quickly. Actual interruption of surface flows is not expected to be significant.

Stock ponds located above the mine, and within the permit area, could also be impacted by subsidence; however, significant impacts are unlikely, due to the approved subsidence protection plan for the Bowie No. 2 Mine which should minimize subsidence beneath any of the stock ponds. These stock ponds are either owned by BRL or addressed in the approved water augmentation plan.

The required sediment and drainage control plan for the Bowie No. 2 Mine has been

constructed and maintained as permitted. This has been designed to protect all offsite areas from any detrimental impacts from sediment or surface runoff originating on the mine site.

It is possible that offsite areas might receive discharge from such sources as underground mine water, refuse pile leachate, or other mine-related activities. Such parameters as iron and oil and grease are strictly regulated by point source discharge permit standards (issued by the Colorado Department of Public Health and Environment). However, mine-related discharge may exhibit increased levels of total dissolved solids. The Bowie No. 2 Mine permit document provides reasonable predictions of mine-related discharge quantity and quality, specifically emphasizing possible increases in total dissolved solids to the hydrologic system. The predictions indicate that any such increases should not be significant, and downstream uses should not be impacted.

Perched groundwater, located above the mine workings and within the permit boundary, could be impacted by subsidence. Specifically, subsidence could temporarily de-water these zones; however, these water sources are not used, and recharge should occur over time. It is also possible that the local bedrock groundwater quality could be impacted by elevated total dissolved solids concentrations, as the mine fills with water following mining, and as the water infiltrates to surrounding groundwater. Impacts to the Rollins Sandstone should be minimal, due to the vertical separation from the mine workings. Impacts to the seam to be mined (B-seam) and the sandstone that overlies it are more likely, but are difficult to quantify given a relative shortage of data; this is addressed by PR-14 which is approved with a stipulation, described earlier in this document, that will see the construction of two new monitoring wells in those seams. Local alluvial systems downgradient from the mine should not receive sufficient mine water drainage to create any impacts.

IV. Topsoil

Information regarding baseline soil studies may be found in Section 2.04.9 of the permit. Information regarding the salvaging and replacement of topsoil may be found in section 2.05.4 of the permit. With two approved exceptions, all available topsoil will be salvaged from areas to be disturbed by mining prior to disturbance. During reclamation, topsoil will be replaced in a 12 inch deep layer on facilities areas. Six inches of topsoil will be replaced on top of 3.5 feet of fill over Gob Piles #1, #2, and #4; 1.5 feet of topsoil will be replaced on Gob Pile #3 .

- A. The Division does not propose to approve alternative procedures for topsoil protection following removal (4.06.1(2)).
- B. The Division does not propose to waive the requirement for clearing of vegetation cover prior to topsoil removal (4.06.2(1)).
- C. The Division is proposing to grant a variance from topsoil removal in accordance with Rule 4.06.2(2)(a). Topsoil will not be salvaged from areas where topsoil depth is less than three inches, topsoil is extremely rocky, or slopes are steeper than 2:1.

- D. The Division has determined that the B horizon and portions of the C horizon need not be segregated and replaced as subsoil (4.06.2(3)).
- E. The Division has determined selected overburden materials shall be used for, or as a supplement to topsoil. The resulting soil is equal to or better than the available topsoil. This determination is based on physical and chemical analyses approved by the Division (4.06.2(4)(a)). On Gob Piles #1, #2, and #4, available topsoil was limited to 6" replacement depth. BRL has provided the results of chemical and physical soil property analyses that demonstrate that the cover material is a suitable growth medium that, when used to supplement the available topsoil material, will support revegetation efforts.
- F. Alternative methods to protect stockpiled soil materials are not proposed to be approved by the Division (4.06.3(2)(a)).
- G. Alternative treatments to eliminate slippage surfaces, relieve compaction, and provide for root penetration are not proposed to be approved (4.06.4(1)).

V. Sealing of Drilled Holes and Underground Openings

- A. The applicant has not proposed to manage development, exploration, drill or bore holes, wells or other exposed underground openings in a manner other than by sealing and plugging (4.07.1). Gob vent boreholes are utilized to allow methane to be vented from the underground workings, and are typically drilled up to one year in advance of the longwall operation and left open until methane venting has ceased. The applicant will seal and plug gob vent boreholes once methane gas production has ceased, and will fence open holes in the interim.
- B. Holes or openings which are temporarily plugged will be protected by the use of barricades or fences (4.07.2).
- C. The Division will require that each hole, well or other underground opening be capped, sealed, backfilled, or otherwise properly managed (4.07.3).

VI. Use of Explosives

- A. The Division does not propose to approve blasting at times other than those described in the blasting schedule due to unavoidable hazardous situations (4.08.3(2)(b)(v) and (4.08.4(2))).
- B. The applicant has not proposed to conduct blasting less than 1,000 feet from a school, church, hospital, or nursing facility, or less than 500 feet from disposal wells, petroleum or gas storage facilities, municipal water storage facilities, fluid transmission pipelines, gas or oil collection lines, or water or sewage lines (4.08.4(7)).
- C. The Division is not proposing to approve the use of a modified equation to determine maximum weight of explosives per delay (4.08.6(2)).

VII. Disposal of Excess Spoil

This section does not apply to the Bowie No. 2 Mine permit application. All excess material generated during surface construction or during underground mining is considered to be coal mine waste, and such materials will be placed in the approved coal mine waste bank.

VIII. Coal Mine Waste Banks

- A. The Division is proposing to approve plans for use, construction and maintenance of a coal mine waste disposal area (4.10.1(1)). There are four permitted coal refuse disposal areas associated with this operation and the Division, as a stipulation on the approval of PR-14, will require the applicant to provide a plan for disposal of refuse generated by mining in the Spruce Stomp lease area.
- B. The applicant does not propose to dispose of, at the approved disposal area within the permit boundary, mine waste materials generated by activities outside the permit boundary (4.10.1(2)).
- C. The approved refuse disposal areas will be inspected on a regular basis by a qualified professional specialist under the direction of the professional engineer, experienced in construction of similar earth and waste structures. Inspection by this person has been approved by the Division as appropriate (4.10.2(1)).
- D. An alternative subdrainage system for the coal mine waste area has not been proposed (4.10.3(5)).
- E. The Division is not proposing to approve a variation in the requirements for maximum allowable lift thickness and minimum required compaction (4.10.4(3)(a)).
- F. The applicant has not submitted a demonstration based on physical and chemical analyses that shows that revegetation requirements of 4.15 can be met with less than 4 feet of cover on the coal processing waste bank (4.10.4(5)).

IX. Coal Mine Waste

- A. The Division proposes to approve a plan for extinguishing coal mine waste fires. This plan has been approved by MSHA and contains provisions about who will be involved in the extinguishing operations (4.11.1).
- B. The Division is not proposing to approve a plan for removal of burned waste, as burned waste removal is not necessary or required at this time (4.11.2 and 4.11.3).
- C. The applicant has not requested a variance from the requirement for two feet of soil cover on a non-coal waste disposal site. Non-coal waste will not be disposed of on-site. It will be stored at designated locations at the mine site, and then transported to the Delta County landfill for proper disposal (4.11.4(2)).
- D. The Division is not proposing to approve construction of any dam or embankment

using waste (4.11.5(1)(b)).

X. Backfilling and Grading

BRL will reclaim the mine site to achieve approximate original contour. All highwalls will be eliminated during reclamation. BRL has not requested any variances regarding backfilling and grading, nor are any approved with this decision document.

- A. The applicant has not requested additional time for backfilling and grading (4.14.1(1)).
- B. In the case of underground mining operations, the applicant has demonstrated that the fill used to eliminate the highwall and depressions meets all the requirements of 4.05, 4.06, 4.09 and 4.15, and has not requested a variance from returning available materials to approximate original contour (4.14.1(2)(e)).
- C. The Division is not proposing to approve a modification of the general requirements of 4.14.2 for reclamation to approximate original contour 4.14.1(2)(e), (4.14.1(2)(f), and (4.14.1(2)(g)).
- D. The Division is not proposing to approve cut-and-fill terraces (4.14.2(2)).
- E. Small depressions in the backfill will be used to minimize erosion, create or enhance wildlife habitat, conserve soil moisture, and promote revegetation. The Division proposes to approve their construction (4.14.2(3)).
- F. The Division proposes to approve the applicant's plan for disposal of debris, acid-forming or toxic materials, or materials constituting a fire hazard in a manner designed to prevent contamination of ground or surface waters. BRL does not anticipate the occurrence of any acid-forming or toxic materials or materials constituting a fire hazard (4.14.3(1)(a) and (4.14.3(2)).

XI. Revegetation

Information regarding baseline vegetation studies may be found in Section 2.04.10 of the permit. Information regarding revegetation of disturbed areas may be found in Section 2.05.4 of the permit. The goal of revegetation efforts at the Bowie No. 2 Mine is to reestablish a post-mining land use of rangeland and wildlife habitat. Disturbed areas will be seeded with one of two seed mixes, and straw mulch will be applied at a rate of 4000 pounds per acre.

- A. The Division proposes to approve the use of introduced species in the reclamation seed mix. The applicant has submitted information which shows that the introduced species are desirable and necessary to achieve the approved post-mining land use and are not poisonous or noxious. However, the lists of introduced species for Seed Mix No. 2 (meadow), and for Seed Mix No. 3 (upland) were revised in Permit Renewal No. 1. Introduced species in the meadow seed mix include *Poa pratensis* (Kentucky bluegrass), *Medicago sativa* (Alfalfa), *Medicago officinalis* (Yellow sweetclover), and *Astragalus cicer* (Cicer milkvetch). Introduced species in the upland seed mix

include *Poa pratensis* (Kentucky bluegrass), *Medicago sativa* (Alfalfa), and *Sanguisorbia minor* (Small burnet). (4.15.2(3)).

- B. The Division proposes to approve the use of straw mulch as a means to meet soil stabilization requirements (4.15.4).
- C. Methods to measure herbaceous cover and production, species diversity, and woody plant density are discussed in 2.05.4(2)(c)(vi) of the Bowie No. 2 Mine permit application document. The Division proposes to approve of these techniques (4.15.7(1)).
- D. Comparisons between reclaimed and undisturbed areas, in order to demonstrate that success criteria of 4.15.8 and 4.15.10 have been met, will be based on the following:

Areas with pre-mining communities of Juniper Woodland and Mixed Shrubs will be seeded with an upland seed mixture. The success of this revegetation effort will be determined by comparing vegetative cover and herbaceous productivity to reference areas in those two communities. Species diversity will be considered adequate if at least four perennial species are present and each accounts for at least 3% relative cover. At least one of those species will be a forb or shrub. There is no success standard for woody stem density.

Areas where a pre-mining disturbed meadow existed will be seeded with a meadow seed mix. Revegetation of these areas will be considered successful if vegetative cover exceeds 35.3% and herbaceous productivity exceeds 1602 pounds per acre. These reflect the cover and productivity of the disturbed meadows prior to mining disturbance. Species diversity will be adequate if at least two perennial species are present, each accounting for at least 3% relative cover. The Division proposes to approve the basis for this comparison (4.15.7(2)(d)).

- E. The Division proposes to approve of the reference areas which the applicant has selected based on the requirements of Rule 4.15.7(3).
- F. The reference areas will be utilized to determine revegetation success in a manner which the Division finds acceptable (4.15.7(4)).
- G. The Division does not find that either a higher or lower standard is appropriate for cover and/or production in woody vegetation communities (4.15.8(3) and (4)).
- H. The Division does not find that a density standard higher or lower than 90 percent of the density of the approved reference area is appropriate (4.15.8(7)).
- I. The Division does not propose to waive the requirement to establish vegetative cover on an area containing mine support facilities where the pre-mining and approved post-mining land use is industrial or commercial (4.15.10(3)).

XII. Post-mining Land Use

The Division is not proposing to approve an alternative post-mining land use (4.16.3).

XIII. Protection of Fish, Wildlife and Related Environmental Values

A discussion of measures to be taken by the BRL to mitigate impacts to wildlife, and in response to comments and suggestions from the Colorado Division of Wildlife, may be found in Section 2.05.6(2) of the permit.

- A. The applicant has not proposed the use of persistent pesticides on the site during mining and/or reclamation operations. (4.18(5)(g)).
- B. Fish and wildlife habitat is a planned post-mining land use. The applicant has selected appropriate plant species and distributions to benefit fish and wildlife (4.18(5)(i)).

XIV. Protection of Underground Mining

The Division does not propose to approve surface coal mining activities being conducted within 500 feet of an active or abandoned underground mine (4.19(1) and 4.22.4(1)). Surface facilities and refuse areas have been constructed within 500' of the abandoned King Mine and the active Bowie No. 2 Mine workings, but no surface mining activities will be conducted within 500 feet of an active or abandoned underground mine.

XV. Subsidence Control

Section 2.05.6(6) of the permit contains an inventory of structures and renewable resource lands within the permit area, and a discussion of the possible consequences of subsidence on those structures and lands. A subsidence monitoring plan is also included in this section. A report containing subsidence predictions, impacts and possible mitigation measures may be found in Exhibit 15 of the permit.

- A. The applicant has proposed a subsidence control plan in accordance with Rule 2.05.6(6) and has committed to adopt all measures in order to reduce the likelihood of subsidence, prevent material damage, or mitigate the effects. The Division proposes to approve the plan (4.20.1(2) and 4.20.3(1)).

The proposed longwall panels in the Spruce Stomp lease area will be located beneath portions of Stevens Gulch Road, the West Fork of Terror Creek, and other surface water features.

No limited extraction zone will be established beneath Stevens Gulch Road. The applicant predicts that subsidence cracks could develop in the road surface, and has proposed a monitoring and mitigation plan to detect and repair any cracks that develop.

No limited extraction zone will be established under the West Fork of Terror Creek. Longwall panels will be oriented roughly parallel to the creek in order to reduce the severity of transition points and potential flow interrupting knick points in the creek bed.

The applicant predicts that the maximum subsidence in the Spruce Stomp lease area will be about 5.7', occurring approximately 300' south of the West Fork of Terror Creek. Subsidence in the creek is expected to be about 5.1', resulting in no more than a 1.5% channel slope change. The average gradient of the West Fork of Terror Creek is 10.3%, with steeper segments at 20% and flatter areas at 2.5%; the segment of the creek running through the Spruce Stomp lease area is 5.5%. The predicted gradient change for the segments overlying the mine workings would not be inconsistent with the overall stream gradient.

Six ponds, three springs with ponds or tanks, and four springs lie within the Spruce Stomp lease area. The overburden depth beneath all of these features (>800') is such that subsidence is not expected to impact these structures. The ponds and associated springs will be monitored quarterly to verify this prediction, and a mitigation plan has been proposed to repair, rehabilitate, or replace any damaged features with decreed water rights.

- B. The applicant has proposed a subsidence monitoring program, in accordance with Rule 2.05.6(6)(c), designed to determine the commencement and magnitude of subsidence movements. Map No. 27 depicts the location of monuments to be installed and structures to be monitored within the permit and adjacent area. The results of the monitoring program will be submitted to the Division semi-annually. The monitoring program is designed to extend for a time, beyond cessation of mining in any area, consistent with the need for verification of the subsidence prediction. The approved subsidence monitoring plan for the operation is located in Section 2.05.6(6) of the permit application package.

Specific to Permit Revision No. 14 and the Spruce Stomp lease area, the applicant has committed to:

- Quarterly monitoring of the Turkey Track Structures.
- Quarterly monitoring along Stevens Gulch Road.
- Semi-annual monitoring of two cross sections of Terror Creek.
- Quarterly monitoring on the longwall panels within the Spruce Stomp lease area.
- Lidar aerial survey of the flow line of West Terror Creek immediately after longwall mining is complete under the creek and again two years following completion of mining.

Additionally, flows in the West Fork of Terror Creek, collected at flume monitoring stations SW-1 and SW-12, will be available in real time, updated hourly. In the absence of real time data, flow will be measured monthly, increasing to weekly when the West Fork of Terror Creek lies within the predicted angle of draw. Weekly flow measurements will be initiated three months prior and continue for six months following extraction under the West Fork of Terror Creek.

While not likely, based on predictions in the permit application package, there may be

a negative impact to users of water in the West Fork of Terror Creek. Accordingly, the applicant has prepared an augmentation plan to replace any water loss resulting from mining activities in the Spruce Stomp lease area, as required by with Rule 2.04.7(3). The augmentation plan has been submitted to the District Court, Water Division No. 4 and is awaiting approval. The following stipulation is placed on the Division's approval of PR-14:

PRIOR TO COMMENCING ANY MINING ACTIVITIES THAT COULD CAUSE SUBSIDENCE IN THE SPRUCE STOMP LEASE AREA, BRL MUST DEMONSTRATE THAT, SHOULD MINING ACTIVITIES RESULT IN CONTAMINATION, DIMINUTION OR INTERRUPTION OF WATER IN THE WEST FORK OF TERROR CREEK, BRL HAS OBTAINED SUFFICIENT WATER RIGHTS AND AN APPROVED WATER REPLACEMENT PLAN TO RESTORE, REHABILITATE, OR REPLACE THE WATER SUPPLY. BRL MUST SUBMIT A COPY OF A COURT APPROVED ALTERNATIVE WATER SUPPLY OR COURT APPROVED SOURCES OF AUGMENTATION WATER THAT COULD BE DEVELOPED TO REPLACE THE EXISTING SOURCES. THE ALTERNATE OR SUBSTITUTED WATER SHALL BE OF A QUALITY AND QUANTITY SO AS TO MEET THE REQUIREMENTS FOR WHICH THE WATER HAS NORMALLY BEEN USED.

XVI. Concurrent Surface and Underground Mining

This section does not apply to the Bowie No. 2 Mine permit application.

XVII. Operations on Alluvial Valley Floors

A. The Division has determined that an alluvial valley floor does not exist within the affected area; however, an alluvial valley floor does exist in the adjacent area. Therefore, the following findings are made for the alluvial valley floor located along the North Fork of the Gunnison River, downgradient from the Bowie No. 2 Mine.

1. The Division finds that activities proposed by the applicant will not interrupt, discontinue, or preclude farming on the alluvial valley floors that are irrigated or naturally subirrigated (4.24.3(1)).
2. The proposed activities will not materially damage the quantity or quality of water in the surface or ground water systems described above (4.24.3(3) and 2.06.8(5)(a)(ii)).
3. The proposed activities will comply with the requirements of the Act and the Regulations, with respect to alluvial valley floors (2.06.8(5)(a)(iii)).
4. Surface coal mining and reclamation operations will be conducted to preserve the essential hydrologic functions of alluvial valley floors outside the permit area throughout the mining and reclamation process (4.24.2).

B. An environmental monitoring system shall be installed, maintained, and operated by

the permittee to ensure the protection of all alluvial valley floors during surface coal mining and reclamation operations and continued until all bonds are released in accordance with Rule 4.24.4.

XVIII. Operations on Prime Farmland

The Bowie No. 2 Mine will not disturb or affect any prime farmland.

XIX. Mountaintop Removal

This section does not apply to the Bowie No. 2 Mine permit application.

XX. Operations on Steep Slopes

The main haul road, Gob Piles #1, #2, and #4, and several gob vent boreholes are located on slopes in excess of 20°. The refuse areas, permitted under Rules 4.09, 4.10, and 4.11 and being constructed as valley fill structures, will result in a variance from approximate original contour. BRL has not requested, and the Division does not propose to approve any variances pertaining to steep slope mining and approximate original contour for the haul road or gob vent boreholes.

- A. The Division does not propose to approve a variance from meeting approximate original contour for reclaimed areas.
- B. The applicant has not proposed to dispose of woody plant materials in the backfill beneath the highwall (4.27.3(6)).
- C. The Division does not propose to approve of the construction of an unlined or unprotected drainage channel on backfill (4.27.3(7)).
- D. The applicant has not proposed alternative specifications and practices for operations on steep slopes and reclamation of these operations (4.27.3(8)).
- E. Land above the highwall will not be disturbed in order to blend the highwall and backfilled area, control runoff, provide access to the area above the highwall or temporarily store overburden (4.27.4(3)).
- F. The Division does not propose to approve of disposal of excess spoil on a pre-existing bench (4.27.5).

XXI. In-Situ Processing

There will not be any in-situ processing at the Bowie No. 2 Mine site.