May 2013

MITIGATION MONITORING REPORT
Reach 6 - 2nd YEAR

Revelation Energy, LLC
KDNR Permit No. 813-0357
Corps ID No. 2000-1696

Responsible Organization
Revelation Energy, LLC
160 Lank Branch Suite 2
Pikeville, KY 41501

Project Location
Big Laurel Branch of Big Caney Creek
Breathitt County, KY

Date of Preparation
May 2013

Prepared by:
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Revelation Energy, LLC
KDNR Permit No. 813-0357
USACE ID No. LRL-2000-1696
Mitigation Reach 6

PROJECT OVERVIEW

Introduction

Revelation Energy, LLC has been charged with performing remedial stream enhancement work as part of a compensatory mitigation package approved by the U.S. Army Corps of Engineers (COE) for KDNR Permit No. 813-0357 (formerly KDNR Permit No. 813-0341 and 813-0306) Corps ID No. LRL-2000-1696. A detailed work plan for all mitigation was outlined in the Compensatory Mitigation Plan (CMP) prepared by Walturn Engineering, Inc. of Hueysville, Kentucky, dated June 2003. The mitigation performed for Big Laurel Branch (Reach 6) will serve to partially mitigate losses associated with the placement of fill or dredged material into the jurisdictional waters of the U.S. under the Nationwide 21 permit authorized by the Louisville District of the COE. This report specifically addresses the second year mitigation status of Reach 6.

In-kind mitigation for both temporary and permanent impacts will consist of off-site stream restoration and enhancement of 5214 linear feet of the Big Laurel Branch (Reach 6), though construction was halted after 3,092 linear feet of stream mitigation in 2010 due to inclement weather conditions. This reach is a tributary of Big Caney Creek of Quicksand Creek of the North Fork Kentucky River in Breathitt County, Kentucky. The mitigation project utilizes the East Kentucky Stream Assessment Protocol (EKSAP) to establish both pre- and post-mitigation work stream function for impacted and mitigation stream reaches as applicable.

The Nationwide 21 authorization for KDNR No. 813-0357 states that impacts to jurisdictional waters would result in a net loss of EIUs. The ultimate post-mitigation goal is to produce an EII Rating of 0.50 at maturity for Reach 6, resulting in an EIU value of 2,607.00. Attaining this post-mitigation goal would mean a net increase of 1,616.34 EIUs.

The restoration and enhancement of Reach 6 was initiated in the fall and winter 2010 by R&R Excavating, with field visits and inspection conducted by Summit Engineering, Inc. personnel. The construction report was submitted in January, 2011. This construction report states that the construction had to halt at station 30+92 due to inclement weather. A report for the first year of monitoring was submitted by Aquatic Resource Management in December of 2011. The following field visits / surveys were conducted in 2013 as part of the 2012 mitigation monitoring following the transfer of the project to Revelation Energy, LLC.

Field Visits/ Surveys Conducted by Summit Engineering, Inc.

		Parameters Measured or Assessed	
Reach	**Channel**	**Conductivity, Habitat Evaluation, Riparian Vegetation Evaluation, Substrate Assessment, and Maintenance Evaluation**	**Stream Channel Survey**
6	Big Laurel Branch	2/8/13	2/7/13 and 3/28/13

After two monitoring years, Reach 6 is progressing toward performance standards.

Project Description

Reach 6

Big Laurel Branch is a second-order intermittent/ perennial tributary of Big Caney Creek of Quicksand Creek of the North Fork Kentucky River in Breathitt County, Kentucky. The mitigation project begins as the confluence of Big Caney Creek at 37° 35' 33" N, 83° 08' 38" W and continues upstream for 3,092 feet to 37° 36' 01" N, 83° 08' 42" W to the location where construction was halted due to inclement weather. Following

the completion of construction the project will continue upstream for a total of 5,214 linear feet. See Appendix A for additional project location information.

REQUIREMENTS

Review of Compensation Goals

The authorized CMP outlined six parameters to be measured annually in order to measure success and/or failure of the mitigation projects. Bioassessment scores, conductivity, propriety and function of stream enhancement structures, bank stability, and riparian zone vegetation density and diversity are to be evaluated annually. These parameters are to be evaluated from the confluence of Big Laurel Branch with Big Caney Creek at 37° 35' 33" N, 83° 08' 38" W upstream for 3,092 feet in Reach 6 to 37° 36' 01" N, 83° 08' 42" W. Following the completion of construction these parameters are to be evaluated for the entire proposed mitigation length of 5,214 linear feet from the confluence of Big Laurel Branch with Big Caney Creek. See Appendix A for additional project location information.

The primary goals of the mitigation projects for Reach 6 are to improve aquatic biodiversity within the watershed, to reduce sediment loading by watershed improvements and improving bank stability, and to improve riparian functions. Please find below a table outlining the proposed improvements in EII ratings and EIU values for these reaches as compared to the pre-mitigation scores.

Reach	Pre-Mitigation EIU Value	5-Year Post-Mitigation EII Rating Goal	5-Year Post-Mitigation EIU Value	Net Increase of EIUs
6	990.66	0.5	2,607.00	1616.34

Compensatory Mitigation Details

According to the as-built Construction Report dated January, 2011, designs were developed by Abbot Engineering, Inc. and Summit Engineering, Inc. was contracted to inspect R&R Excavating's construction of these designs. The mitigation project was initiated in the fall and winter of 2010, and halted at station 30+92 due to inclement weather. Following the construction, Aquatic Resources Management of Lexington, Kentucky was contracted to evaluate bioassessment scores, conductivity, propriety and function of stream enhancement structures, bank stability, and riparian zone vegetation density and diversity as well as author the first annual monitoring report. Following the pending transfer of the KDNR Permit No. 813-0357 from Laurel Mountain Resources, LLC to KDNR Permit No. 813-0385 under Revelation Energy, LLC, Summit Engineering, Inc. was contracted to assume these monitoring and reporting responsibilities and provide input on any repairs that may be required if the success criteria is not met. Included in the original permit application as well as the Construction Report was the Success Criteria and Monitoring Plan. Refer to Table I.

The authorized CMP proposed to utilize in-stream and watershed restoration and enhancement techniques to improve the functions of Reach 6, a watershed impacted by mining, timbering, and natural gas/oil activities. Before mitigation efforts were utilized, these reaches appeared to be impaired from past mining and logging activities as substantial amounts of sediment have removed and replaced natural aquatic habitat.

Success Criteria

The success of off-site mitigation areas will be based upon attainment of the RBP habitat parameter values and admissible specific conductivity measurements such that the five year EII goals for each mitigation area are met. The predicted EII values which are to be in-place at the end of the five year monitoring period are listed in Table I. As EII values are calculated with RBP parameter scores, it will be acceptable for an individual habitat parameter to be lower than predicted as long as the resulting loss is offset by an

unpredicted gain in one or more other parameters. Increase in RBP habitat scores will be verified through field investigations and specific conductivity will be measured annually. In addition, success criteria for the physical conditions and revegetation success of the mitigation areas are as follows:

- Mitigation areas should show no signs of substantial erosion.
- Stream enhancement structures should be in-place and properly functioning.
- Determination of successful tree and shrub stocking of the revegetated area will utilize the following standards:
    - A minimum stocking density of 436 trees or trees/shrubs per acre determined with a statistical confidence of 90 percent, with tree (not shrub) species comprising at least 75% of the total stock, shall be achieved on at least 70 percent of the area stocked.
    - At least 6 species of trees and shrubs shall be planted in a mixed distribution pattern with each of the 6 species comprising at least 10 percent of the total stock; however, none of the species shall comprise more than 50% of the total stock.
    - Should unwanted invading non-native non-riparian vegetative species become prevalent within any area, they will be controlled or eliminated by mechanical or manual methods.
    - Volunteer native riparian vegetation will be encouraged.

Table I. Predicted Five Year EII Scores by Reach

Mitigation Type	Mitigation Reach	Predicted Post-Mitigation EII Score (5 Years)
Off-Site	Reach 6: Big Laurel Branch	0.5

Monitoring Plan

The monitoring and management plan will evaluate the success of the mitigation work and will allow for any necessary adjustments to assure success of the mitigation site. Short term plans for all mitigation sites are limited to achieving the required improvement and/or attainment of performance standards and aquatic functions as described previously. The success of the mitigation work will is dependent upon achieving success standards previously described. Thus, the success of the mitigation work will be determined by monitoring the parameters in Table II.

Table II. Monitoring Parameters

Parameter	Frequency of Assessment
Bioassessment Score	Assess and complete RBP at target reference points annually
Conductivity	Measure at target reference points annually
Propriety and Function of Stream Enhancement Structures	Assess and document annually
Bank Condition	Assess and document annually
Vegetation Density	Assess and Document Annually
Vegetation Diversity	Assess and Document Annually

Monitoring Methods

An annual site visit will be conducted in order to determine the progress of the mitigation project. Following are the parameters and the methodologies that were utilized in 2013 to assess the 2012 monitoring period:

- Bioassessment Score – The U.S. EPA's Rapid Bioassessment Protocol for Use in Streams and Wadeable Rivers was utilized to assess each of the previously-determined evaluation sites, to be

compared to the pre-work habitat values. RBP sheets and EII calculation sheets are included in Appendices B and C, respectively.

- Conductivity – Conductivity was obtained using digital meters and recorded on the RBP sheets which can be found in Appendix B.
- Stream Morphology– Summit Engineering, Inc. personnel, utilizing standard surveying methods as described in the approved mitigation plan, conducted surveying of the mitigation reaches. The surveyed cross sections are included in Appendix A. In addition photographic documentation of stream bank stabilization measures and enhancement structures can be found in Appendix E. A discussion of the bank stability and enhancement structure evaluation can be found in the Summary Data section of this report.
- Riparian Vegetation – A field evaluation of the previous plantings throughout the restored riparian zones, including tree and shrub transects, was completed to assess the density and diversity riparian zone revegetation. Tree transect field sheets and summary tables can be found in Appendix D. Photographic documentation of ground cover is included in Appendix E.

SUMMARY DATA

Table III. Big Laurel Branch (Reach 6) Monitoring Results

Water Quality Parameters and Bioassessment Scores of Big Laurel Branch (Reach 6)			
Parameter	**Immediately After Mitigation 2010**	**Year 1 2011**	**Year 2 2012**
Average RBP Score	109	137	126
Conductivity (uhmos)	Data Not Reported	Data Not Reported	332.5
Average EII Score	0.19	Data Not Reported	0.43
Average Temperature (°C)	Data Not Reported	Data Not Reported	6.5
Average pH (SU)	Data Not Reported	Data Not Reported	8.7
Average Dissolved Oxygen (mg/L)	Data Not Reported	Data Not Reported	12.2

Enhancement Structure Status of Big Laurel Branch (Reach 6)	
Monitoring Year	**Comments**
Immediately After Mitigation 2010	The following structures have been included in the enhancement design: boulder clusters, single and double deflectors, log sills, step pools, root wads, and rock riffles
Year 1 2011	Rock and log cross vanes were installed at designated intervals within each segment to increase sediment transport and create macroinvertebrate habitat.
Year 2 2012	Some log deflectors now lie above water level, while some log sills are now submerged. Cribbing structures remain in place for the most part. Other log sills, boulder clusters, J-Hooks, step pools, and rock riffles all functioning.

Bank Stability of Big Laurel Branch (Reach 6)	
Monitoring Year	**RBP Score**
Immediately After Mitigation 2010	Data Not Reported
Year 1 2011	Sub-optimal - moderately stable, infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of erosion
Year 2 2012	Monitoring Location 6: Sub-optimal - moderately stable, infrequent, small areas of erosion mostly healed over, 5-30% of bank in reach has areas of erosion Monitoring Location 4: Poor to Suboptimal- The left bank scoring in the poor range being unstable with many eroded areas; 60-100% of the bank with erosional areas. The right bank, however, scored in the sub-optimal range with moderately stable, infrequent, small areas of erosion that are mostly healed over; 5-30% of bank in reach has areas of erosion.

Revelation Energy, LLC					
Tree and Shrub Assessment of Big Laurel Branch (Reach 6) Monitoring Location 4					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	2	3	5	8.20
Acer saccharum	Sugar Maple	2	1	3	4.92
Carpinus caroliniana	Ironwood	5	0	5	8.20
Fagus grandifolia	American Beech	8	1	9	14.75
Liriodendron tulipifera	Tulip Poplar	0	3	3	4.92
Magnolia macrophylla	Large Leaf Magnolia	0	7	7	11.48
Platanus occidentalis	Sycamore	0	2	2	3.28
Tsuga canadensis	Eastern Hemlock	5	0	5	8.20
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		39			
Trees per Square Foot		0.0078			
Trees per acre		339.768			

Revelation Energy, LLC					
Tree and Shrub Assessment of Big Laurel Branch (Reach 6) Monitoring Location 6					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	2	0	2	3.28
Betula lenta	Sweet Birch	3	0	3	4.92
Fagus grandifolia	American Beech	1	1	2	3.28
Oxydendrum arboreum	Sourwood	2	0	2	3.28
Platanus occidentalis	Sycamore	1	0	1	1.64
Quercus alba	White Oak	0	3	3	4.92
Rhododendron calendulaceum	Rhododendron	7	0	7	11.48
Tsuga canadensis	Eastern Hemlock	20	36	56	91.80
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		76			
Trees per Square Foot		0.0152			
Trees per acre		662.112			

Vegetation Density and Diversity Summary of Big Laurel Branch (Reach 6)		
Goals	**Year 2 (2012)**	
	Monitoring Location 4	**Monitoring Location 6**
> 436 stems/acre	339 stems per acre (22% below stocking goal)	662 stems per acre (51% above stocking goal)
Tree species > 75% of stems/acre	Tree species comprise 100% of stems/acre	Tree species comprise 88.52% of stems/acre
> 6 species of trees and shrubs	8 species	8 species
Each species ≥ 10% of stems/acre, but < 50%	No species comprises as much as 50% of the population. However, only two species comprise more than 10% of the population.	*Tsuga Canadensis* comprises 91.80% of the population. Only one other species comprises as much as 10%.
Presence of invasive species	None noted.	None noted.

Substrate Particle Size Distribution of Big Laurel Branch (Reach 6)		
Percent less than	**Year 2 (2012) Particle Size (mm)**	
	Site 4	**Site 6**
D16	17.697	8.288
D35	24.07	13.66
D50	30.1	18.4
D65	39	24
D84	56	31
D95	114	41

Channel Dimensions of Big Laurel Branch (Reach 6)		
Parameter		**Year 2 (2012)**
Average Channel Width (ft)		11.60
Average Channel Depth (ft)		0.92
Average Water Depth (ft)		0.35
Average Bank Slope	**Left Descending Bank**	9.94 : 1
	Right Descending Bank	2.85 : 1

Current Mitigation Status Summary

The primary goals of the mitigation projects for Reach 6 are to improve aquatic biodiversity within the watersheds, to reduce sediment loading by watershed improvements and improving bank stability, and to improve riparian functions. The post mitigation goal is to produce an EII rating of 0.5 in Reach 6 within 5 years after construction. Currently Reach 6 has an average EII rating of 0.43 (an average of both EII ratings at Monitoring Location 4: 0.31 and Monitoring Location 6: 0.55 after the 2nd year of monitoring.

The average conductivity measurement for Reach 6 is 332.5. It is anticipated that the conductivity levels for this channel will continue to decline throughout the monitoring period as areas of erosion heal with vegetation and sediments are flushed from the channels.

For the most part, the stream enhancement structures lie in their original placements and are functioning well. These enhancement structures are functioning to sequester sediments and increase dissolved oxygen while protecting stream banks. Enhancement structures are being assimilated into these reaches and aiding in their return to natural settings where populations of aquatic organisms associated with lotic habitats can thrive as they once did before impacts occurred. Minor maintenance is needed on a few enhancement structures and this will be addressed during a period of low flow in future monitoring periods, as necessary. See appendix E for photographic documentation of stream enhancement structure placement and function.

For the most part the bank stability of Reach 6 has remained in the sub-optimal range, however the bank stability of some areas within Reach 6 has declined slightly since the first year evaluation from a ranking of sub-optimal to one of poor. The right bank of monitoring location 6 is experiencing more heavy erosion than other banks within the locations monitored for 2012. Maintenance of these erosional areas will be addressed during a period of low flow in future monitoring periods, as necessary.

Monitoring location 6 has met and exceeded the standard stocking goal of 436 tree and/or shrub stems per acre as well as the diversity requirement that these stems are comprised of more than 6 individual species. While monitoring location 4 has met the diversity requirement of at least 6 tree and shrub species, the standing population in this area is still 22% below the standard stocking goal. In addition, no invasive species have been noted within these reaches for the second monitoring year. However, the requirement that each of the six species comprise a minimum of 10% of the standing population, but no more than 50%, has not yet been achieved. It may be necessary in future monitoring periods to initiate additional tree planting to meet the diversity goals, though it is still early in the monitoring period.

Each of the reaches had temperature, pH, and dissolved oxygen results sufficient for the support of macroinvertebrate populations. Additionally, the mitigation project in Reach 6 is making progress toward not only the stocking goal of 300 stems per acre, but also the post-mitigation EII rating goals. This mitigation project is progressing toward the primary goal of improving aquatic biodiversity by providing stable and diverse habitats. Continued improvements to bank stability and riparian function, as well as the maintenance of the enhancement structures, will lead to reduced sediment loading and lower conductivity measurements.

Though natural succession will improve diversity and aid in healing erosional areas, additional re-vegetation efforts may prove necessary, as it is still early in the five-year monitoring period. Further, continued increases in tree density and growth will not only aid in bank stabilization, but will also lead to increased shading of the stream, lowering temperatures and contributing to an increased capacity to retain dissolved oxygen concentrations, as well as contributing allochthonous materials which will support benthic macroinvertebrate colonization and detrital food chains, thus supporting improvements to aquatic biodiversity within these reaches.

APPENDIX A: MAPS

APPENDIX B: RBP SHEETS

SUMMIT ENGINEERING, INC.
HIGH GRADIENT FIELD DATA SHEET AND RBP

Stream Name	BS Inset 6-4	**Client**	KEN County
Site Number	6-4	**Project Name**	Mitigation
Latitude (dd-mm-ss)	37.59344	**County**	Buncombe
Longitude (dd-mm-ss)	83.14427	**Quadrangle**	
General Location		**Field Technician(s)**	CHCS
Reach Length	100'	**Date & Time**	1215 4/9/13

WEATHER CONDITIONS

Weather Now	☐ Sunny	☐ Steady Rain	**Weather Past 24 Hours**	☐ Sunny	☐ Steady Rain	**Weather Last 7 Days**	☐ Sunny	☐ Steady Rain
	☑ Cloudy	☐ Heavy Rain		☐ Cloudy	☐ Heavy Rain		☐ Cloudy	☐ Heavy Rain
	☐ Showers	☐ Temp: 48°F		☐ Showers	☐ Snow		☐ Showers	☐ Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O_2 (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
8.4	6.3	11.98	343	1.40	117-4582

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	☐ Ephemeral	☑ Intermittent	☐ Perennial		
Stream Type	√ High-Gradient	☐ Headwater	☐ Wadeable	☐ Warm-water	☐ Cold-water
Odors	☑ None	☐ Sewage	☐ Eggs	☐ Petroleum	☐ Other: _____
Surface Oils	☑ None	☐ Slick	☐ Sheen	☐ Globs	☐ Flecks
Turbidity	☑ Clear	☐ Slightly turbid	☐ Turbid	☐ Opaque	☐ Stained

CROSS-SECTION DATA & FLOW

Across ( )	X												
Depth ( )													

Stream Flow Observed	☐ Dry	☐ Pooled	☐ Low	☐ Normal	**Area (sq. ft)**	
	☐ High	☐ Very Rapid			**Flow (cfs)**	

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	☑ Forest ☐ Partial Forest ☐ Field ☐ Logging ☐ Agriculture ☐ Residential ☐ Commercial ☐ Industrial ☐ Mining		
	☐ Dam ☐ Culvert ☐ Bridge ☐ Paved Road ☐ Gravel Road ☐ Dirt Road ☐ Other:		
Vegetation Assessment	☑ Trees	☐ Fully Exposed (0-25%)	**Vegetative Species**
	☑ Grasses	☑ Partially Exposed (25-50%)	
	☐ Shrubs	☐ Partially Shaded (50-75%)	
	☑ Herbaceous	☐ Fully Shaded (75-100%)	
Describe Substrate	Bed Rock, Small Substrate Also		
Riffle Variability	☐ Shallow Riffles ☑ Moderate Riffles ☐ Thick Riffles		Riffle ___% Pool ___% Run ___%

AQUATIC LIFE		ADDITIONAL COMMENTS		HABITAT SAMPLED	AMOUNT
Salamanders	☐		☐	**Undercut/Root (6 jabs & 1 for roots)**	
Crayfish	☐		☐	**Aquatic Vegetation/Justicia (3 jabs)**	
Frogs	☐		☐	**Woody Debris [H=2-4 m, W=3-6 m]**	
Mollusks	☐		☐	**Rocks Picks [H=5 (pools), W=15]**	
Fishes	☐		☐	**Sieved Sediments [3 (1 from ea regime)]**	
Beaver Damage	☐		☐	**Bedrock [3 sweeps (pool/run)]**	
Algae/Periphyton	☐		☐	**Leaf Packs [9 (3 from ea regime)]**	
Aquatic Vegetation	☐		☐	**Aufwuchs (3 jabs)**	

SUMMIT ENGINEERING, INC.
HIGH GRADIENT FIELD DATA SHEET AND RBP

Stream Name	B. Laurel Br.	Client	Rev Energy
Site Number	696	Project Name	Mitigation
Latitude (dd-mm-ss)	37.59267	County	Breathitt
Longitude (dd-mm-ss)	83.14403	Quadrangle	
General Location		Field Technician(s)	CR/RJ
Reach Length	400'	Date & Time	2-8-13 11:30

WEATHER CONDITIONS

Weather Now	☐ Sunny ☑ Cloudy ☐ Showers	☐ Steady Rain ☐ Heavy Rain ☐ Temp: 40°F	Weather Past 24 Hours	☑ Sunny ☑ Cloudy ☐ Showers	☐ Steady Rain ☐ Heavy Rain ☐ Snow	Weather Last 7 Days	☑ Sunny ☑ Cloudy ☑ Showers

☐ Steady Rain ☐ Heavy Rain ☐ Snow

FIELD WATER CHEMISTRY DATA & PHOTOS

pH (S.U.)	Temperature (°C)	Dissolved O_2 (mg/L)	Conductivity (µS)	Velocity (ft/s)	Picture #
8.8	6.7	12.42	322	1.4	117-6565

STREAM CLASSIFICATION & WATER DESCRIPTION

Stream Subsystem	☐ Ephemeral	☑ Intermittent	☐ Perennial		
Stream Type	√ High-Gradient	☐ Headwater	☐ Wadeable	☐ Warm-water	☐ Cold-water
Odors	☑ None	☐ Sewage	☐ Eggs	☐ Petroleum	☐ Other: ________
Surface Oils	☑ None	☐ Slick	☐ Sheen	☐ Globs	☐ Flecks
Turbidity	☑ Clear	☐ Slightly turbid	☐ Turbid	☐ Opaque	☐ Stained

CROSS-SECTION DATA & FLOW

Across ( )	X												
Depth ( )													

Stream Flow Observed	☐ Dry ☐ Pooled ☐ Low ☐ Normal ☐ High ☐ Very Rapid	Area (sq. ft)	
		Flow (cfs)	

PHYSICAL DESCRIPTIONS

Immediate Land Use & Structures	☑ Forest ☐ Partial Forest ☐ Field ☐ Logging ☐ Agriculture ☐ Residential ☐ Commercial ☐ Industrial ☐ Mining ☐ Dam ☐ Culvert ☐ Bridge ☐ Paved Road ☐ Gravel Road ☐ Dirt Road ☐ Other:		
Vegetation Assessment	☑ Trees ☑ Grasses ☐ Shrubs ☑ Herbaceous	☐ Fully Exposed (0-25%) ☐ Partially Exposed (25-50%) ☑ Partially Shaded (50-75%) ☐ Fully Shaded (75-100%)	**Vegetative Species**
Describe Substrate			
Riffle Variability	☐ Shallow Riffles ☐ Moderate Riffles ☐ Thick Riffles		Riffle ___% Pool ___% Run ___%

AQUATIC LIFE		ADDITIONAL COMMENTS		HABITAT SAMPLED	AMOUNT
Salamanders	☐	THAI Photos for Reach 6 - BLB 117-6565 to 1176599	☐	Undercut/Root (6 jabs & 1 for roots)	
Crayfish	☐		☐	Aquatic Vegetation/Justicia (3 jabs)	
Frogs	☐		☐	Woody Debris [H=2-4 m, W=3-6 m]	
Mollusks	☐		☐	Rocks Picks [H=5 (pools), W=15]	
Fishes	☐		☐	Sieved Sediments [3 (1 from ea regime)]	
Beaver Damage	☐		☐	Bedrock [3 sweeps (pool/run)]	
Algae/Periphyton	☐		☐	Leaf Packs [9 (3 from ea regime)]	
Aquatic Vegetation	☐		☐	Aufwuchs (3 jabs)	

APPENDIX C: EII CALCULATIONS

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)
(Family Level Taxonomy - All Habitats)

Project ID:	Revelation Energy, LLC
Stream/Reach:	Big Laurel Branch (Reach 5) Monitoring Location 4
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.31	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units	Subindex
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells			
	RBP Habitat Parameters			
	1. Epifaunal Substrate	12	no units	
	2. Embeddedness	9	no units	
	3. Velocity/Depth Regime	11	no units	
	4. Sediment Deposition	10	no units	
	5. Channel Flow Status	18	no units	
	6. Channel Alteration	12	no units	
	7. Freq. Of Riffles (bends)	11	no units	
	8. Bank stability (both combined)	8	no units	
	9. Veg. Protection (both combined)	7	no units	
	10. Riparian Width (both combined)	8	no units	
	Total Habitat Score	106	no units	
	Macroinvertebrate Data - Family Level (All Habitats)			
	11. Family Taxa Richness		# of taxa sampled	
	12. Family EPT Richness		# of EPT species sampled	
	13. % Ephemeroptera		% Mayflies (0-100)	
	14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)	
	15. mFBI		no units	
		343		

EII Calculation for High Gradient Streams in Eastern Kentucky Coalfield (Version 2002.6)

****(Family Level Taxonomy - All Habitats)****

Project ID:	Revelation Energy, LLC
Stream/Reach:	Big Laurel Branch (Reach 6) Monitoring Location 6
Assessment Objectives:	2nd Annual Monitoring Period

EII	Model
NA	Ecological Integrity Index (MBI + Habitat Integrity + Conductivity)
0.89	Ecological Integrity Index (Habitat Integrity + Conductivity)

	Variables	Measure	Units
>>>>>>>	Enter quantitative or categorical measure from Field Data Sheet in shaded cells		
	RBP Habitat Parameters		
	1. Epifaunal Substrate	14	no units
	2. Embeddedness	13	no units
	3. Velocity/Depth Regime	18	no units
	4. Sediment Deposition	13	no units
	5. Channel Flow Status	18	no units
	6. Channel Alteration	14	no units
	7. Freq. Of Riffles (bends)	13	no units
	8. Bank stability (both combined)	15	no units
	9. Veg. Protection (both combined)	15	no units
	10. Riparian Width (both combined)	15	no units
	Total Habitat Score	146	no units
	Macroinvertebrate Data - Family Level (All Habitats)		
	11. Family Taxa Richness		# of taxa sampled
	12. Family EPT Richness		# of EPT species sampled
	13. % Ephemeroptera		% Mayflies (0-100)
	14. % Chironomidae & Oligochaeta		% Midges & Worms (0-100)
	15. mFBI		no units
		322	

Subindex

APPENDIX D: RIPARIAN ZONE TREE AND SHRUB TRANSECTS

Tree Density for Mitigation Monitoring Sites

Company: Rev Energy Stream Name: Pigeland Br 6-4

Site No.: 6-4 Lat: _____ Long: _____ Date: 9-8-13

Species: Beech	Species: Tear Wood	Species: Sugar Maple
Seedlings:	Seedlings:	Seedlings:
Saplings: 1111	Saplings: 1111	Saplings:
DBH: 16.3, 18.3, 10.2	DBH:	DBH: 12.5, 13.4,
Species: East Hem	Species: Red Maple	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings: 11	Saplings:	Saplings:
DBH: 8.1, 9.2, 9.0	DBH: 8.1, 7.9, 10.2	DBH:

Tree Density for Mitigation Monitoring Sites

Company: Rev Energy Stream Name: Big Horse Br - L-4

Site No.: L-4 Lat: 37.59374 Long: 83.14427 Date: 3-8-13

Left

Species: Sycamore	Species: Red Maple	Species: Birch
Seedlings: /	Seedlings:	Seedlings:
Saplings:	Saplings: ///	Saplings: /
DBH: 12.3, 19.5,	DBH:	DBH:
Species: Ironwood	Species: Sugar Maple	Species: Tulip Tree
Seedlings: 3	Seedlings:	Seedlings:
Saplings: ////	Saplings:	Saplings:
DBH: 4.0, 7.9, 6.5,	DBH: 10.5,	DBH: 11.5, 12.3, 11.2

Revelation Energy, LLC					
Tree and Shrub Assessment of Big Laurel Branch (Reach 6) Monitoring Location 4					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	2	3	5	8.20
Acer saccharum	Sugan Maple	2	1	3	4.92
Carpinus caroliniana	Ironwood	5	0	5	8.20
Fagus grandifolia	American Beech	8	1	9	14.75
Liriodendron tulipifera	Tulip Poplar	0	3	3	4.92
Magnolia macrophylla	Large Leaf Magnolia	0	7	7	11.48
Platanus occidentalis	Sycamore	0	2	2	3.28
Tsuga canadensis	Eastern Hemlock	5	0	5	8.20
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		39			
Trees per Square Foot		0.0078			
Trees per acre		339.768			

Tree Density for Mitigation Monitoring Sites

Company: Rev Energy Stream Name: Big Laurel Br.

Site No.: Co-6 Lat: 37.57267 Long: 83.14403 Date: 7/8/13

RT BANK

Species: Sweet Birch	Species: Eastern Hem.	Species: Red Maple
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings: IIII	Saplings:
DBH: 10.5, 4.6, 4.9,	DBH: 10.1, 9.3, 4.0, 4.6, 4.4, 5.0, 5.3, 13.4, 5.2, 12.5, 12.8, 9.6, 8.3, 12.2, 7.5,	DBH: 8.8, 11.2,
Species: Sycamore	Species: Beech	Species: Dogwood
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH: 7.5,	DBH: 11.3,	DBH: 5.9, 6.2,

Species: Rhododendron	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings: IIII	Saplings:	Saplings:
DBH:	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Tree Density for Mitigation Monitoring Sites

Company: Kev Grey Stream Name: Bj Lowe Br.

Site No.: 6-6 Lat: 37.57247 Long: 83.14483 Date: 7-8-13

Left Bank

Species: E. Red Elm	Species: Maple	Species: Beech
Seedlings:	Seedlings:	Seedlings:
Saplings: ~~IIII IIII IIII IIII~~ II	Saplings:	Saplings:
DBH: 15.4, 6.5, 5.3, 4.0, 7.5, 4.2, 4.1, 7.3, 9.9, 10.1, 11.4, 4.0, 4.2, 4.3,	DBH: 16.0, 12.2, 7.5,	DBH: 22.4
Species:	Species:	Species:
Seedlings:	Seedlings:	Seedlings:
Saplings:	Saplings:	Saplings:
DBH:	DBH:	DBH:

Revelation Energy, LLC					
Tree and Shrub Assessment of Big Laurel Branch (Reach 6) Monitoring Location 6					
Species	**Common Name**	**Number of Individuals Within Reach**		**Total By Species**	**Percent of Population**
		Right Bank	**Left Bank**		
Acer rubrum	Red Maple	2	0	2	3.28
Betula lenta	Sweet Birch	3	0	3	4.92
Fagus grandifolia	American Beech	1	1	2	3.28
Oxydendrum arboreum	Sourwood	2	0	2	3.28
Platanus occidentalis	Sycamore	1	0	1	1.64
Quercus alba	White Oak	0	3	3	4.92
Rhododendron calendulaceum	Rhododendron	7	0	7	11.48
Tsuga canadensis	Eastern Hemlock	20	36	56	91.80
TOTAL Trees in total Riparian Zone (5,000 Square Feet)		76			
Trees per Square Foot		0.0152			
Trees per acre		662.112			