Annual Monitoring Report

Joe Branch Surface Mine No. 1
Beech Branch Stream Restoration

1.0 Narrative

JMAC Leasing, Inc. (JMAC) of Olive Hill, Kentucky contracted Heritage Technical Associates, Inc. (HTA) of Chapmanville, West Virginia to conduct the annual monitoring on Beech Branch for the Joe Branch Surface Mine No. 1 located near Cyclone in Wyoming County, West Virginia (Attachment 1). Annual monitoring has been conducted to assess mitigation efforts implemented to compensate for impacts of the Joe Branch Surface Mine No. 1. Section I., Monitoring and Long-Term Management, of the Compensatory Mitigation Plan (CMP) requires annual monitoring to determine the success of the restoration plan based on the pre-determined performance standards. The CMP stipulates completion of in-stream structures (As-Built) and seeding of the stream restoration area within Beech Branch, a tributary of Huff Creek, which drains into the Guyandotte River. The scope of the restoration efforts associated with Beech Branch includes long-term physical structure and stability of the channel, establishment of native species within the riparian zone and enhancement to the aquatic habitat.

To achieve long-term channel stability, a V-ditch was constructed within Beech Branch. The 'V' configuration more closely resembles the configuration of the existing jurisdictional waters while providing sufficient cross-sectional area for the flow of storm water. Boulders[1] were placed in the stream to provide vertical control and minimize erosion. The use of the 'V' configuration assures that even minimal flows are concentrated into a defined channel, thus maximizing the biological benefits of the water flow. This concentration of water flow will assist in the transportation of sediment through the restored stream channel preventing the clogging of the restored system by sediment. This design will sufficiently control the high energy flows that may be expected in the restored stream channel while providing sediment transport capability. A typical 'V' channel configuration can be found in Attachment 8 of the CMP. The stream restoration on Beech Branch is comprised of approximately 390 linear feet. Restoration extends from the access road that runs parallel to Sediment Ditch No. 20 (3+90) and continues downstream to station 0+00. The Spatial Relations Map provides the site location as well as locations for the proposed Valley Fills 3 and 4 (Attachment 1).

[1] The boulders proposed will consist of D-50 size riprap which provides for a minimum average diameter of 18". Boulders larger than 18" in diameter will comprise a portion of the material used for channel lining. The use of this type channel lining material mimics bedrock control, creating artificial bedrock vertical control of stream. This type channel lining material also assures that erosion in the restored channel is minimized.

To quantify success of the in-stream structures, conditions of the V-ditch were examined and compared to the initial as-built configuration. Additional monitoring conducted includes analyses of benthic macroinvertebrate surveys, water chemistry, habitat survey, stream channel stability and documentation of vegetative cover. Vantage points, areas with long continual vistas of riparian disturbances, were selected along the stream to assist in annual evaluation and documentation. Annual photographs, taken from the same locations, are used to monitor and compare the progression and naturalization of the mitigation sites. These Vantage Point photographs are located in Attachment 5. A detailed description of management actions implemented throughout the year and photographic confirmation of the mitigation efforts were also incorporated.

2.0 Applicant Information

This proposed project was undertaken by JMAC Leasing, Inc. (JMAC), Route 3, Box 579, Olive Hill, KY 41164.

3.0 Project Overview

The primary objective for this restoration plan was to construct a stream channel capable of supporting an ecosystem comparable to the pre-mitigation ecosystem, while minimizing impacts from past mining practices. The jurisdictional waters proposed for impact have a heterotrophic[2] food web[3]. In this type of system, coarse particulate organic matter (CPOM), such as leaves, sticks or wood, provides the primary source of energy to aquatic organisms. The organisms that feed on CPOM may be transported downstream, providing food for larger organisms and fishes. The constructed stream channels are anticipated to maintain a similar heterotrophic ecosystem, while reducing channel instabilities.

The stream restoration techniques implemented more than compensate for the anticipated impacts to jurisdictional waters. The completion of mitigation efforts and water quality improvements that are expected after the remining of this project, will provide a habitat with the potential for an increase in the number and diversity of taxa within the streams.

3.1 Project Goals and Objectives

Mitigation actions should produce a more stable stream channel with an equivalent or improved ecosystem in the areas of temporary impacts and below the valley fills.

A V-ditch has been established within the stream in Beech Branch to create a diverse habitat, dissipate energy within the channel, and control the anticipated erosional stresses. The V-ditch installed is capable of accommodating "bankfull" flow events and enhance channel morphology.

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[2]Heterotrophic is defined as “obtaining nourishment from organic substances,...” (The American Heritage Dictionary, Second College Edition, 1982.)

[3]A heterotrophic food web derives its energy source from the contribution of organic matter from other sources such as leaves, sticks and wood as compared to an autotrophic system which produces energy from photosynthesis.

Valley Fill No. 3 has been constructed since the AMR in 2006. The USACE authorization (USACE No. 19900756-2) for Valley Fill No.'s 3 and 4 has been reinstated since their suspension. Valley Fill No. 4 has yet to be constructed.

During construction, precautions were taken to minimize disturbance of the existing riparian zone and reduce or prevent erosion and sedimentation from occurring as presented in prior reports.

Thus far, the restoration plan has proved successful, accomplishing the primary restoration objective; to establish a stable channel capable of supporting an ecosystem comparative to the pre-mitigation ecosystem, while minimizing impacts from past mining practices.

3.2 Performance Standards

The performance or success standards for this mitigation plan have established qualitative and quantitative gauges of success. Performance standards set forth in the CMP previously accepted by the USACE are described in detail below:

3.2.1 Riparian Zone Vegetation

The project will be successful if native species are established on at least 80 percent of the mitigation sites. Species proposed for planting are considered native species. It is anticipated that natural succession will occur and that adjacent tree and other floral species will migrate into the mitigation sites. The project will not be considered successful if non-native species prevent the establishment of at least 80 percent of the native species. Success will be determined by visual analyses and inventory of the site.

3.2.2 Stream Stability

Stream morphology will be visually examined to determine if erosion is controlled. The project will be considered successful if the stream and structures installed are stable, both laterally and vertically.

3.2.3 Stream Geometry

The mitigation plan will be deemed successful if the structures are constructed in the approximate location proposed in the pre-plans. The structures should have vertical tolerances of +/- one foot. Stream channel geometry will be surveyed on an as-built basis.

3.2.4 Benthic Populations

Benthic macroinvertebrates will be monitored until the project is determined successful by the USACE. Benthic analysis will help assess the overall health of the restored stream. However, benthic population, including the presence of certain species, will not be used for the gauge of success since barriers in the form of railroads, highways and poor water quality may prevent migration of certain species.

3.2.5 Project Success

The overall project will be deemed a success once the following has occurred: 1) Construction of restored stream channels, 2)

Vigorous vegetation has been established in appropriate areas, 3) Native species have been established in over 80 percent of the mitigation site, 4) The reclamation bond for the operation is released by the WVDEP. Since the reclamation bond can only be released after a minimum of five years, the five year project success time frame will be obtained

Presently, the mitigation plan is progressing as planned and it is anticipated that the project will achieve the proposed performance standards. JMAC Leasing, Inc. is responsible for all phases of construction and compliance proposed within the original CMP. JMAC is obligated to maintain compliance with criteria set forth in the CMP and make adequate repairs to the site when necessary. The site must meet requirements set forth by the State of West Virginia, including the requirements for water quality.

JMAC has provided the financial assurances needed to achieve project success. Financial assurance guarantees implementation of the proposed mitigation actions and maintenance of the mitigation sites until final acceptance by the USACE. Thus, it is assured that JMAC will adequately comply with the requirements within the original CMP.

JMAC will not be responsible for damages to the site caused by violations of the proposed restrictive covenants or any damage caused by parties other than JMAC Leasing, Inc.

Thus far, mitigation efforts are progressing accordingly and there are no indications that the actions proposed within the CMP will not be successful. However, if mitigation cannot be implemented successfully in the proposed locations, adjacent jurisdictional waters that have also been impacted by mining may be included in a future, revised CMP.

3.2.6 Monitoring and Management

For at least five years following completion of the mitigation site construction, mitigated areas will be monitored annually to determine project success based on the pre-determined performance standards. Annual monitoring will occur once each calendar year after completion of the project, until final WVDEP reclamation bond release and USACE approval. Areas to be inspected and monitored include the stability of the stream channel and success of the vegetation. Maintenance will be performed on an as-needed basis to assure that CMP objectives are accomplished.

Cross-sections established on as-built maps provide a baseline reference for the restored stream channels. Cross-sections were conducted at critical areas, such as restored channels through the reclaimed sediment pond areas. Cross-sections were also established in other reaches of the restored stream channels in intervals not exceeding 500 feet. These cross-sections will help identify any adverse changes to dimensions of the restored channels. Permanent survey markers were used to monument the

cross-sections. Limits of the mitigation reaches were delineated by the establishment of a monument in the form of marker or sign.

Mitigation sites were not fenced, since the restored streams provide water resources for the wildlife indigenous to the area.

Five representative sections, vantage points, with long continual vistas of riparian disturbances were selected along the stream to assist in annual evaluation and documentation. Photographs will be taken from the same locations annually to monitor and compare the progression and naturalization of the mitigation sites.

4.0 Site Integrity

The integrity of the site is guaranteed by JMAC, Inc. through the implementation of the restrictive covenants set forth in the agreement with the landowner that accompanies this NWP21 application. The current landowner is Pardee Land Company, 300 Capital Street, Suite 910, Charleston, WV 25301.

Restrictive covenant areas are depicted on maps enclosed in the CMP (Attachments 10 and 11) previously accepted by the USACE.

4.1 Mitigation Actions

The proposed mitigation plan consisted of three phases. JMAC is currently in the first phase and have enhanced the 551 linear feet below Valley Fill 3. The remaining two phases are currently progressing as planned.

Mitigation actions taken to date are described below and illustrated in the revised phase map (Attachment 3). As mentioned above, these measures included all or parts of Phases I, II, and III. Table 1 describes the objectives and proposed restoration for the project.

Table 1. Objectives and Proposed Restoration

Impacted Reach	**Replacement Proposed – Structure and Function**
Entire project (not tied to direct impact)	Area below the old mining bench to have erosion control installed, 551 lf below VF-3, 737 lf below VF 4 **(Restores habitat while preventing contributions of solids to the streams).**
VF 3 – 380 lf (0.12 ac) of permanent impact VF 4 – 1940 lf (0.37 ac) of permanent impact	4461 lf of ephemeral stream constructed along VF edges. **(Restores habitat, mimics streams currently in place, mimics current ecological functions).**
	1316 lf of intermittent stream reconstruction in former sediment channels. **(Restores natural functions to streams constructed along existing mine bench).**

Temporary Impacts - Total impacted lengths = 0 lf
Total replaced lengths = 0 lf
Ratio is not applicable

Permanent Impacts - Total impacted lengths = 2330 lf
Total replaced lengths = 7065 lf
Ratio = 3.03:1

4.1.1 Phase I

Phase I will see that the erosion is controlled in the areas below the pre-law mining bench. The stream banks have steep faces that are contributing sediment yields to the stream channel. These banks will be flattened and will have vegetation re-established. This erosion control will take place in approximately 551 linear feet of intermittent stream below Valley Fill No. 3 and in approximately 737 linear feet of intermittent stream below Valley Fill No. 4 for a total of approximately 1288 linear feet of intermittent stream restoration and enhancement. The performance of portions of this erosion control will allow the restoration or enhancement of enough length of stream to allow the disturbance of the stream within the confines of Valley Fill No. 3 without the need for financial assurances.

4.1.2 Phase II

Once the erosion control has been accomplished on a minimum of 380 linear feet of stream below the pre-law, up to 380 linear feet of the streams in Valley Fill No. 3 can be disturbed. As construction of Valley Fill No. 3 is accomplished and the final configurations of the valley fill lofts are in place, the ephemeral stream channels along the sides of the fill will be installed. The construction of these stream channels will be timed in such a manner that when included in the length of stream upon which erosion control has taken place, equals or is in excess of the length of stream proposed to be impacted by the disturbance of streams within the confine of Valley Fill No. 4. At no time will the length of disturbed stream channel exceed the length of constructed, reconstructed or restored stream channel.

4.1.3 Phase III

After mining is completed and final reclamation of the mine site is accomplished, a waiting period of at least two years must expire before the sediment control structures can be removed. At this time, the sediment channels serving as sediment control structures will not be completely removed but will have an inner-channel or "bankfull" event channel established through the channel. Theses sediment channels, due to their location at the toes of the valley fills are expected to become intermittent streams because of the water retention and controlled released properties of these valley fills. The cross-sectional plans for these sediment channels are included in the NWP21 (Attachment 9 of the NWP 21).

Mining operations will permanently impact approximately 904 lf of ephemeral stream and 1426 lf of intermittent stream, totaling 2330 lf of permanent impacts. Restoration efforts, completed in phase's one through three, will restore approximately 4461 lf of ephemeral stream and 2604 lf of intermittent stream totaling 7065 lf of restored streams.

4.2 Monitoring and Sampling Methods and Results

Environmental biologists for Heritage Technical Associates, Inc. of Chapmanville, West Virginia attempted to conduct the annual monitoring and sampling for Beech Branch on November 11 and 17, 2008. Benthic sites within

Beech Branch were dry, thus benthic organisms were not collected and, accordingly, no habitat assessment was conducted.

Recommended monitoring and sampling methods are described in detail in the following sections:

4.2.1 Macroinvertebrate Survey Analysis

Benthic macroivertebrates were monitored to help assess the overall health of the restored stream. However, benthic population, including the presence of certain species, will not be used for the gauge of success for this restoration project.

Benthic macroinvertebrates were sampled in accordance with the Standard Conditions for Environmental Assessments on Wadeable Streams issued by the West Virginia Division of Natural Resources and Scientific Collection Permits, which are based upon the United States Environmental Protection Agency (EPA) Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers. This survey provides taxonomical baseline data on the benthic macroinvertebrates collected, substrate composition, habitat composition, and physical stream characteristics present between October 15, 2008 and December 15, 2008.

Two benthic macroinvertebrate sites were chosen based on stream features, pre-determined Vantage Points and on the Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers.[4] Approximate locations of the collection sites in relation to proposed permit boundaries, stream delineation, valley fills, and associated sediment ponds are indicated in Attachment 4.

Samples were collected with a 0.5 meter rectangular dipnet. The bottom substrate was disturbed for approximately 0.25m² by foot and hand in front of the net. The coarse Particular Organic Matter (CPOM) and Fine Particulate Organic mater (FPOM) were allowed to flow into the dipnet. After suspended materials settled the net was lifted from the sample location. The net contents were washed into a five-gallon bucket. Larger materials (pebbles > 20 mm, leaves or sticks) were washed and discarded from the sample. The sample was poured into a sieve to remove excess water and fine soil particles. The sieve was rinsed into a one liter sample container. This procedure was repeated until four riffle/run sections were sampled. After completion of the final sample location the rectangular kick net and five gallon bucket were closely examined for any remaining debris and or macroinvertebrates. Remaining debris and or macroinvertebrates found were placed into the sample container. Ninety-five percent ethanol was added to each sample for preservation.

Benthic Macroinvertebrates sample sorting and identification was based on a 200 ± 20 percent organism sub-sample procedure. Samples were rinsed and spread evenly over a 36 cm x 30 cm pan. A 6 cm x 6 cm grid was placed over the sample and random generated numbers determined the grid that would be identified. This was repeated until a

[4] Site locations for benthic samples were based upon the EPA Interim Chemical and Biological Protocols for Mountaintop Removal

sub-sample of 220 organisms was removed. All grids were inspected in situations where 200 organisms were not present. Species were identified to the family level using the key in Aquatic Insects of North America.

Attachment 4 contains benthic survey results in detail, habitat assessments, stream characterization, representative photographs, watershed features and sediment/substrate types.

Ranges and ranks of the WVSCI are shown in Table 2.

Table 2. WVSCI Scoring Criteria

WSCI Scoring Criteria	
Not-Impaired	78.01-100 = Very Good
	68.01-78.00 = Good
	60.61-68.00 = "Gray Zone"
Impaired	45.01-60.60 = Slightly Impaired
	22.01-45.00 = Moderately Impaired
	0-22.00 = Severely Impaired

4.2.2 Structures

The V-ditch placed in Beech Branch was constructed in order to achieve the restoration objectives described in the CMP. Mitigation practices began 0+00, approximately 390 feet downstream of the access road that runs parallel to Sediment Ditch No. 20 (3+90), amassing a total stream length of 390 lf.

Large boulders were placed in Beech Branch in order provide stability for the left and right banks. The purpose of the V-ditch was to provide bank stabilization and prevent further riparian erosion. Placing the V-ditch structure along the riparian zone increases the probability of raising Habitat Assessment scores for Epifaunal Substrate/Available Cover and Velocity/Depth Regime of Beech Branch. Location and photographs depicting the As-Built structures may be reviewed in Attachment 2.

The entire length of restored channel appears to be stable and the contribution of solids to the jurisdictional waters has been greatly reduced or eliminated.

4.2.3 Vegetation

Five representative sections, vantage points, with long continual vistas of riparian disturbances along the stream were used to quantify the vegetative progression of the restored sites. Vantage Point locations are shown in Attachment 5. Each Vantage Point has an upstream and downstream photograph except Vantage Point 5 (3+90). An upstream photograph at Vantage Point this location would not adequately represent riparian areas of concern. Vantage Point photographs and visual

evaluations conducted in the field were used to document and compare annual site assessments.

Although no vegetative seed mixture was applied there was a combination of grasses, understory, and overstory native species that have naturally repopulated the riparian zone. Lespedeza cuneata (G.Don serica lespedeza) was the only non-native and invasive species identified within the annual monitoring area. Besides Lespedeza cuneata there was no presence of non-native species identified within the restored area. The understory species consisted of Jewel Weed (Impatiens capensis), Golden Rod (Solidago), Smart Weed (Polygonum lapathifolium), Coltsfoot (Tussilago farfara), Blackberry (Rubus laudatus), Stinging Nettle (Urtica dioica), and Brown-Eyed Susan (Rudbeckia hirta). Lespedeza cuneata (G. Don serica lespedeza) was the identified within the mitigation area and although it is an invasive species it was not considered dominant. The overstory species consisted of Red Maple (Acer rubrum) and Yellow Poplar (Liriodendron tulipifera). Vegetation progress has been evaluated and is evident in the annual Vantage Point pictures (Attachment 5). The established grasses have created a protective vegetative cover on the impacted banks. On all impacted areas the grasses and native species have thrived and increased in density since the previous year.

The understory and overstory native species should supply bank stability to prevent erosion, shade the stream, and produce Course Particulate Organic Matter (CPOM) for the aquatic ecosystem.

Mitigation areas were examined to determine if non-native species such as knotweed or kudzu had invaded. *Lespedeza cuneata* was the only invasive species identified in the mitigation area. Control efforts will be considered if the Lespedeza cuneata prevents native species from establishing a cover of at least 80 percent on the mitigation site.

4.2.4 Erosion Control

Stream morphology was visually examined to determine if erosion has been controlled during the past year. The stream channel and restoration structures were inspected to determine if they were stable, both laterally and vertically. The channel appears to have morphology similar to the channel form assessed immediately after as-built completion. There was no evidence that any erosion had occurred after the construction of the V-ditch. Since no measurable bank instabilities have occurred as a result of undercut banks, it is concluded that the in-stream structures have successfully dissipated energy, relieved near bank stresses and achieved lateral stability.

5.0 Proposed or Implemented Corrective Measures

No corrective measures are necessary since most structures are intact and functioning as intended.

6.0 Discussion

Annual monitoring has been conducted on Beech Branch for the Joe Branch Surface Mine No. 1 to evaluate success of the restoration plan. Mitigation actions should produce a more stable stream channel with an equivalent or improved ecosystem in the areas of temporary and permanent impacts associated with valley fills. The CMP stipulates completion of in-stream structures (As-Built) in the restoration area within Beech Branch, a tributary of Huff Creek, which drains into the Guyandotte River. The project will be deemed a success once the following has occurred: 1) Restored stream channels have been constructed, 2) Vigorous vegetation has been established in appropriate areas, 3) Native species are present in over 80 percent of the mitigation sites, 4) The reclamation bond for the operation is released by the WVDEP.[5]

The V-ditch established within Beech Branch will be successful if it creates a diverse habitat, dissipates energy within the channel, and controls the anticipated erosional stresses. The V-ditch was constructed to stabilize the stream. To quantify success of the V-ditch, stability conditions were visually examined and compared to initial as-built configurations. The V-ditch appeared to be functioning as intended, providing stabilized banks and preventing future erosion from occurring.

Although no seeding with native grasses, trees, or shrubs occurred, the riparian zone consisted of several understory and overstory native species that were present prior to construction of the V-ditch. These restoration practices are anticipated to increase soil stability, reduce erosion potential, and enhance the aquatic habitat by providing shade and CPOM to the ecosystem. Vegetating the riparian zone will assure that ecological functions, present prior to mitigation, return to the restored streams.

Annual Vantage Point photographs have proved to be an efficient method to determine the naturalization of vegetation within the mitigation sites.
The grasses and forbs have created a protective vegetative cover on the disturbed banks. On all impacted areas the grasses and forbs have thrived and increased in density since the previous year.

The stream restoration techniques implemented more than compensate (390 lf of restored channel) for the impacts to jurisdictional waters to date (0 lf of impacted channel). The mitigation effort is providing a habitat with the potential for an increase in the number and diversity of taxa within the streams.

7.0 Conclusions

Mitigation actions have increased channel stability, decreased erosion potential by reducing near bank stresses with water control structures and established a vegetative cover consisting of native species. It is anticipated that an equivalent or improved ecosystem will develop in the areas of temporary and permanent impacts associated with valley fills. Results from the As-Built survey conducted in 2005 and the annual monitoring report for 2006 – 2008 will be

[5] The applicant may request, in later documents, a change in the time frame for success if released of the WVDEP reclamation bonds is delayed. In no circumstances will the applicant request a determination of final success before the passage of five years from the time of completion of restoration in any section.

compared to future monitoring to evaluate habitat, vegetative regression and channel morphology.

No major corrective measures were found to be necessary. Channel geometry appeared stable, with the structures intact and functioning as intended.

Benthic macroinvertebrates could not be collected due to dry stream conditions, thus, WVSCI and habitat scores could not be compared to previous monitoring years.

The current vegetation has continued to create a protective vegetative cover on the impacted banks, significantly decreasing erosion potential. Lespedeza cuneata was the only invasive species identified within the mitigation area and corrective measures will be considered if necessary. Thus far, the restoration plans have proved successful, accomplishing the primary restoration objective; to achieve long-term physical structure and stability of the channel and to establish native vegetation within the riparian zone.

References and Coordination:

1. West Virginia Geological and Economic Survey – *"Trace Elements in Coal"*
2. United States Department of Energy, Energy Information Administration – *"Challenges of Electric Power Industry reconstruction for Fuel Suppliers"*, 1997
3. Rural Policy Research Institute – *"West Virginia Demographic and Economic Profile"*, 2000
4. United States Department of Energy, Energy Information Administration – *"Coal Resources, Reserves and Mine Sizes, West Virginia"*, 2000; *Various other publications by this agency*
5. Statement of Mary J. Hutzler, Energy Information Administration, Department of Energy, before the Subcommittee on Energy and air Quality, Committee on Energy and Commerce, United States House of Representatives, Hearing on Coal, March 14, 2001
6. West Virginia Office of Miner's Health, Safety and Training – *Various publications including coal production figures*
7. National Mining Association – *Various publications including national production figures*
8. West Virginia Bureau of Employment Programs – *Various publications including job sectors, wages and unemployment rates*
9. US Census Bureau – *Population trends and figures*
10. US Federal Emergency Relief Administration – *December 7, 1934 Letter to Mr. Hopkins concerning historic coal production*
11. West Virginia Office of the Treasury – *Coal severance tax information*
12. US Environmental Protection Agency – *"Environmental Impact Statement" concerning coal and mountaintop removal surface mining*
13. Canaan Valley Institute
14. West Virginia Department of Environmental Protection – *Various information including regulations, AMD fact sheets, policies, watershed management information*
15. United States Fish and Wildlife Service – *"An Atlas of Cerulean Warbler Populations, Final Report to USFWS: 1997 – 2000 Breeding Seasons" – Rosenburg, Barker & Rohibaugh, Cornell Laboratory of Ornithology, Ithaca, NY, December, 2000*
16. USACE – Mitigation Guidelines for WV (PN200400008 – WV, 9-23-04)
17. West Virginia University – Bureau of Business and Economic Research – *"County Data Profile, Mingo County, September, 2000"*
18. West Virginia Department of Health and Human Resources, Bureau for Public Health, Health Statistics Center – *"A look at West Virginia's Population by Decade, 1950-2000, Brief No. 8"*

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Annual Benthic Monitoring Results for Beech Branch and the Unnamed Tributary of Beech Branch, 2008.

1.0 Introduction

JMAC Leasing Inc. of Olive Hill, Kentucky contracted Heritage Technical Associates, Inc. (HTA) of Chapmanville, West Virginia to conduct a Benthic Macroinvertebrate Survey on the Unnamed Tributary of Beech Branch (UT of Beech Branch) and Beech Branch located near the town of Cyclone in the Oceana District, Wyoming County, West Virginia. The purpose of annual monitoring is to compare yearly assessments, which will show improvements or impairments to the health of Beech Branch and the UT of Beech Branch. This report will be included in the Annual Monitoring Report, which will be submitted to the United States Army Corps of Engineers (USACE) fulfilling mitigation requirements.

Benthic macroivertebrates are monitored to help assess the ecological health of the stream. Sampling methods were conducted in accordance with the Rapid Bioassessment Protocols for use in Streams and Wadeable Rivers (RBPs) Environmental Protection Agency (EPA). The survey provides taxonomical data for the benthic macroinvertebrates. This is the third year benthic and habitat analyses have been conducted. Survey data was not collected for the 2008 monitoring period due to dry or insufficient flows in the streams.

2.0 Site Location

The study sites are located within the Beech Branch watershed near the town of Cyclone in Wyoming County, West Virginia. Two sites were sampled for monitoring purposes. Site 003 / 016 was located at (37º 44' 58", 81º 44' 08") and extended downstream 100 m on Beech Branch. Site 004 / 015 was located at (37º 44' 58", 81º 44' 06") and extended upstream 100 m on the UT of Beech Branch. Both reaches were established within riffle/run stream sections. Stream reach areas were determined based on the RBPs. A site location map showing reach locations are located at the end of the benthic report. Representative photographs for the UT of Beech Branch and Beech Branch are located below:

Downstream view of Benthic Site 015 in the UT of Beech Branch

Upstream view of Benthic Site 015 in the UT of Beech Branch

Downstream view of Benthic Site 016 in Beech Branch

Upstream view of Benthic Site 016 in Beech Branch

3.0 Methods and Materials

3.1 Habitat Assessment

Habitat was assessed in the field using the high gradient field data sheets from the RBPs (Table 1). Habitat scores were rated for ten parameters in three categories (primary, secondary and tertiary) using the RBPs. Primary components analyze substrate and instream cover, secondary components assess channel morphology, and tertiary components address riparian zones and stream banks. Primary and secondary parameters are evaluated a on a numerical scale of 0 to 20, while tertiary components are ranked on a scale of 0-10.

Primary and secondary numerical scores range from optimal (20 to 16), suboptimal (15 to 11), marginal (10 to 6) and poor (5 to 0). Tertiary category ranges are optimal (10 to 9), suboptimal (8 to 6), marginal (5 to 3) and poor (2 to 0).

Primary components are associated with substrate and instream cover. Primary component habitat parameters include epifaunal substrate / available cover, embededdness and the velocity depth regime and are described as follows;

- Epifaunal substrate and available cover refers to the quantity and variety of natural structures in the stream. The greater variety of submerged structures increases habitat conditions for aquatic organisms by increasing niche space.
- Embeddedness is the extent in which rocks and snags are surrounded by the substrate of the stream bottom. Generally when there is a high degree of embeddedness there is less surface area available to macroinvertebrates and fishes, decreasing options for shelter, spawning and egg incubation.
- Velocity depth regime determines the presence of stable aquatic environments within stream channels. High quality streams have four flow patterns present including slow-deep, slow-shallow, fast-deep and fast-shallow.

The secondary, channel morphology, components include sediment deposition, channel flow status, channel alteration and frequency of riffles and are described below;

- Sediment deposition is the amount of sediment that has accumulated within the channel and the resultant channel alterations. High quantities of sediment deposition are indicators of an unstable and changing environment that is not suitable for many aquatic organisms.
- Channel flow status refers to the amount of water filling the channel bed. Flow status will fluctuate during different seasons. When water does not fill much of the streambed, the amount of suitable substrate for aquatic organisms is limited.

- Channel alteration assesses the large-scale changes in stream morphology. Altered channels have less habitat areas for aquatic organisms and plants than naturally occurring channels. Examples of channel alteration include artificial embankments, artificial bank stabilization, and rip-rap.
- Frequency of riffles or bends measures the sequence of riffles within the stream. High quality habitat areas and diverse fauna are located in riffle areas, thus a greater frequency of riffles generally increases diversity of aquatic communities.

Tertiary components are habitat parameters associated with streambanks and the surrounding vegetative communities. Tertiary components include bank stability, bank vegetative protection and riparian vegetation zone width and are presented below:

- Bank stability measures the degree of erosive sediment that enters the stream. Eroding streambanks indicate that there may be a sediment transport problem, a lack of vegetative cover, and decreased organic contribution.
- Bank vegetative protection assesses the degree of vegetative cover on streambanks. The establishment of vegetation decreases the erosion potential and provides food and refuge to aquatic organisms
- Riparian vegetation zone is the width of natural vegetation from the edge of the streambank throughout the riparian zone. The riparian zone controls erosion, generates habitat and nutrient inputs into the stream, and buffers pollutants from runoff or erosion

Table 1. Habitat Field Assessment sheets for High Gradient streams (RBPs).

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Primary Components	**1. Epifaunal Substrate and Available Cover**	> 70% substrate favorable for epifaunal colonization and fish cover, mix of snags, submerged logs, undercut banks, or cobble and at stage to allow full colonization potential (logs are not new fall and not transient).	40-70% mix of stable habitat; has full colonization potential; adequate habitat for population maintenance; presence of additional substrate in the form of new fall, not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles 0-25% surrounded by fine sediment. Cobble layering provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	Gravel, cobble, and boulder particles more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity-Depth Combinations	Four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Determined by 1 velocity/depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Table 1 Continue. Habitat Field Assessment sheets for High Gradient streams (RBPs).

	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
Secondary Components	**4. Sediment Deposition**	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fines on bars; 30-50% of bottom affected; deposits at obstructions and bends; moderate deposition of pools.	Heavy deposits of fines, increased bar development; > 50% of bottom changing frequently; pools almost absent due to deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills > 75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel, mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments: evidence of past channelization (dredging) may be present, recent channelization (within 20 yrs) not present.	Channelization may be extensive; embankments or shoring structures present on both banks: and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement: over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of riffles or bends	Riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1; variety of habitat is key. In streams where riffles are continuous, boulder or natural obstruction placement is key.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of > 25.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Tertiary Components	**8. Bank Stability (left and right bank)**	Banks stable; evidence of erosion or banks failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; frequent; obvious bank sloughing; 60-100% of bank has erosion scars.
	Score per bank	10 9	8 7 6	5 4 3	2 1 0
	9. Vegetation Protection	> 90% of streambank surfaces and riparian zone covered by native vegetation; vegetative disruption minimal or not evident; almost all plants allowed to grow naturally.	70-90% of streambank covered by native vegetation, one class of plants is not well-represented; disruption evident but not affecting plant growth potential.	50-70% of streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or cropped vegetation common.	Less than 50% of the streambank surfaces covered by vegetation; disruption is very high.
	Score per bank	10 9	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone	Riparian zone > 18 meters; human activities (parking lots, roadbeds, clear-cuts) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Riparian zone width 6-12m; human activities impacted zone a great deal.	Riparian zone < 6m; little riparian vegetation due to human activities.
	Score per bank	10 9	8 7 6	5 4 3	2 1 0

3.2 Benthic Macroinvertebrate Collection and Analysis

Benthic sampling was initiated by walking the stream and assessing the characteristics (frequency of riffle/run, pools, etc.). A 100 meter representative stream reach was chosen based on these characteristics. Samples were collected with a 0.5 meter rectangular dipnet. The bottom substrate was disturbed for approximately 0.25m² by foot and hand in front of the net. Coarse Particular Organic Matter (CPOM) and Fine Particulate Organic mater (FPOM) were allowed to flow into the dipnet. After suspended materials settled the net was lifted from the sample location. Net contents were washed into a three-gallon bucket. Larger materials (pebbles > 20 mm, leaves or sticks) were washed and discarded from the sample in the field. This procedure was repeated until a minimum of 2 m^2 composited sample was collected. Once the 2m^2 was collected, the sample was poured through a #30 mesh sieve to remove excess water and fine soil particles. The sieve was rinsed into a one liter sample container and preserved with 95% ethanol.

Benthic macroinvertebrate sample sorting and identification was based on a 200 ± 20% organism sub-sample procedure. Samples were rinsed and spread evenly over a 6cm x 6cm gridded, 36 cm x 30 cm sorting pan, and allowed to soak in water. A random number list was generated and used to determine the grid number that would be picked. This was repeated until a sub-sample of 220 organisms was removed. All grids were selected and picked (complete pick) in situations where 200 organisms were not present. Species were identified to family level using the key in Aquatic Insects of North America.

A benthic bench sheet was completed and the data was entered into the WVSCI Calculation Database for Contractors and Consultants. The West Virginia Stream Condition Index (WVSCI) was calculated. The WVSCI is used as an indicator of ecosystem health, and can identify impairment with respect to a reference. The WVSCI includes six metrics that represent elements of the structure and function of the macroinvertebrate assemblage. The six metrics include EPT (Ephemeroptera, Plecoptera, Trichoptera) Taxa, Total Taxa, % EPT, % Chironomidae, % Two Dominant Taxa and HBI (Hilsenoff Family Biotic Index. Ranges and ranks of the WVSCI are shown in Table 2.

Table 2. Scoring Criteria for the WVSCI.

WSCI Scoring Criteria	
Not-Impaired	78.01-100 = Very Good
	68.01-78.00 = Good
	60.61-68.00 = "Gray Zone"
Impaired	45.01-60.60 = Slightly Impaired
	22.01-45.00 = Moderately Impaired
	0-22.00 = Severely Impaired

3.3 Channel Material Assessment

Channel substrates influence benthic habitats. Generally, sandy or finer substrates are poor habitats due to the shifting nature of bed, a lack of suitable attachment sites, and poor food conditions.

Channel materials were assessed using the modified Wolman pebble count method (Rosgen, 1993a). The sampling method is based on the frequency of riffle/pools occurring within a channel reach that is 20 to 30 bankfull channel widths in lengths. The percent of channel features per reach were determined. The sample size was at least 100 observations. The particles were sampled in the Zig-Zag method due to the stream width (<2m). Samples were selected on the "first blind touch" to avoid the potential for bias. This technique ensures that a representative pebble count is obtained through proportional sampling of channel features.

3.4 Water Quality Assessment

Water samples were collected November 6, 2006 and on December 12, 2007. The samples were sent to Appalachian States Analytical, L.L.C. for analysis. The parameters analyzed are Total Suspended Solids (TSS), Total Iron (Fe), Alkalinity, Total Manganese (Mn), Specific Conductance (SC), Total Aluminum (Al), Lab pH, Total Hot Acidity, Dissolved Aluminum (Al), and Total Dissolved Solids (TDS).

Water quality is an important factor in determining the viability of aquatic habitats. Poor water quality is a limiting factor for intolerant benthic macroinvertebrates. Table 3 below shows the freshwater organisms ranges for some water quality parameters.

Table 3. Water quality ranges for freshwater organisms.

Water Quality Parameter	Range for Freshwater Organisms	Source
pH	6 to 9	Stumm and Morgan 1996
Total Hot Acidity	Not available	
Alkalinity	10 to 400 mg/L	Jenkins et al. 1995
TDS	Not available	
Iron	< 1 mg/L	Jenkins et al. 1995
Manganese	< 1.0 mg/L	Heinen 1996; Jenkins et al. 1995
Aluminum	< 0.087 mg/L	Jenkins et al. 1995
TSS	Not available	

4.0 Results

Environmental biologists for Heritage Technical Associates, Inc. of Chapmanville, West Virginia attempted to conduct the annual monitoring and sampling for Beech Branch on November 11 and 17, 2008. Benthic sites within Beech Branch and the Unnamed Tributary of Beech Branch were dry or had an insufficient flow for benthic collection, thus benthic organisms were not collected and, accordingly, no habitat assessment or water collection was conducted. Because benthic macroinvertebrates could not be collected, WVSCI and habitat scores could not be compared to previous monitoring years.

5.0 References

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