PRITCHARD MINING CO., INC.

P. O. Box 3311

Charleston, WV 25333

As-Built Status Report

February 2010

OFF-SITE MITIGATION FOR THE FOURMILE OF LENS CREEK SURFACE MINE, AMENDMENT NO. 1 (S-3007-96), U.S. ACE PERMIT NO. 2006-2154 KAN NPDES NO. WV1015184

Racine Quad, Kanawha County

Prepared By:

Decota Consulting Company, Inc.

4984 West Washington Street, Cross Lanes, WV 25313

AS-BUILT STATUS REPORT
FOR
PRITCHARD MINING COMPANY, INC.'S
OFF-SITE MITIGATION FOR THE
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U.S. ACE Permit No. 2006-2154 KAN
SMA No. S-3007-96 AMD No. 1
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PREPARED FOR:

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March 2, 2010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 PROJECT OVERVIEW

1.1 Permit Numbers

Fourmile of Lens Creek Surface Mine, Amend. No.1 (S-3007-96)
WV NPDES No. WV1015184
U.S. ACE Permit No. 2006-2154 KAN

1.2 Contact Information

Permittee:	Pritchard Mining Company, Inc. P. O. Box 3311 Charleston, WV 25333 (304) 949-6642
Construction Contractor:	Pritchard Mining Company, Inc. P. O. Box 3311 Charleston, WV 25333 (304) 949-6642
Planting Contractor:	New Forest Services P.O. Box 255 Manistee, MI 49660 (910) 512-6754
Monitoring Consultant:	Decota Consulting Company, Inc. 4984 West Washington Street Cross Lanes, WV 25313 (304) 776-3333

Decota Consulting Co., Inc. (Decota) was hired by Pritchard Mining Co., Inc. (Pritchard) to provide design and construction management services as well as evaluation of the completed off-site mitigation implemented on Mary Fork in the Kanawha River drainage. This work was completed as part of the Compensatory Mitigation Plan (CMP) associated with Fourmile of Lens Creek Surface Mine, Amend. No.1. The CMP was originally submitted by Decota on February 26, 2007 (Decota, 2007) and was subsequently revised on March 20, 2007 as well as May 7, 2007 (Decota, 2007) and later approved on October 3 2007. WV DEP approval came on June 2, 2008. Construction was completed by Pritchard Mining Company, Inc. in October 2008. Planting of the riparian zone was completed by New Forest Services (New Forest) in March 2009.

1.3 Project Purpose and Summary

The Fourmile of Lens Creek Surface Mine, Amendment No. 1 project is an expansion of a current operation which includes areas of pre-law contour and auger mining in the Winifrede coal bed. Utilization of the pre-existing (pre-law) bench to place excess overburden was part of the material placement plan, however under WVDEP AOC methodology, the excess burden could not all be contained on-bench (Decota, 2007). Therefore, mining excavation and placement of materials

associated with the Fourmile Fork of Lens Creek Surface Mine, Amendment No.1 includes placement of excess overburden into one new durable rock fill (Valley Fill No.4) located in the remote reaches of Road Fork in Boone County, WV, and one existing durable rock fill (Valley Fill No.3) located in the headwaters of Little Rich Fork in Boone County. Construction and placement within these areas will permanently impact approximately 4,612 linear feet of intermittent channel and 1,058 linear feet of ephemeral channel. Sediment ponds and mine-through are temporarily impacting approximately 1,106 linear feet of intermittent channel and 492 feet of ephemeral channel. Additional backfill will be placed as over-stack on the fills to reduce impacts to jurisdictional waters. A total of 7,268 linear feet of stream is proposed for impact (Decota, 2007).

Mitigation for permanent impacts to ephemeral and intermittent segments was conducted off-site in approximately 6,400 linear feet of perennial stream in the mainstem of Mary Fork. (**Note:** Additional mitigation was conducted on Spruce Fork and two (2) unnamed tributaries of Mary Fork as part of the "Stream Restoration and Enhancement Plan for Unnamed Tributaries of Mary Fork of Spruce Fork of Fourmile of Lens Creek". This work, permitted under a Nationwide Permit No. 27, is meant to compliment the work authorized under the Compensatory Mitigation Plan associated with the Fourmile of Lens Creek Surface Mine, Amendment No. 1. Upon completion, these additional sites will be reported under a separate cover, as authorized in that permit's special conditions (Decota, 2008)). This construction utilized natural channel design techniques detailed in the "Compensatory Mitigation Plan for Permanent and Temporary Impacts to Intermittent and Ephemeral Unnamed Tributaries of/and including Mary Fork, Road Fork and Little Rich Fork" (Decota, 2007) and subsequent revisions and approval. This off-site mitigation was completed concurrently with the related impacts. Additional, on-site mitigation for temporary impacts will be completed upon completion of the approved durable rock fills.

The constructed off-site mitigation consisted of one reach. The reach began on Spruce Fork approximately 150 ft. from the confluence with Mary Fork and continued up stream into Mary Fork over 6,400 feet, total (*Figure 2*). All work was completed during low-flow conditions. Work in the mitigation reach was conducted by starting at the upper most end of the reach and continuing downstream in increments until all work was completed. Installation of natural material structures were implemented to deflect the main flow away from the banks there by improving their stability and enhancing localized flows. No more than 1,000 linear feet of stream bank was disturbed at any one time before the area was seeded and mulched. Typical cross sections are included as an attachment. Upon completion, all disturbed areas were seeded and mulched with a seed mixture consisting of native species including: Switchgrass, Virginia wild rye, big blue stem, little blue stem, indiangrass and partridge pea. During and after all mitigation construction, logging was also being conducted in the upper portion of the watershed, within the headwaters of Mary Fork. The logging company was required to maintain a 100 ft. buffer on both sides of the stream in order to minimize disturbance to the stream as well as the riparian zones. However, fords in the stream used frequently by the logging company as well as the logging operation being conducted during the fall and winter when there is minimal or no vegetation growth, increased the amount of sediment within the stream filling pools and covering substrate. As designed, the restored channel is beginning to recover from this influx of sediment by flushing sediment from pools and substrate during storm events and appropriately depositing the sediment along the banks.

The primary goal of the plan was to offset impacts on a functional and structural basis by providing supplemental mitigation off-site. Function, as it relates to the plan document, is defined as a streams ability to transport water and sediment downstream, while maintaining overall stability (Rosgen 1996). Structure, as it relates to the plan document, is the stable pattern, dimension, and profile of a stream, having optimal in-stream habitat and bed features (i.e. riffles, runs, pools, and glides).

1.4 Location Description

The project is located on Mary Fork, in the Racine 7.5 minute USGS quadrangle in Kanawha County, WV. Mary Fork is a subwatershed of Spruce Fork, a tributary of Fourmile Fork of Lens Creek, which flows into the Kanawha River near Hernshaw, West Virginia (*Figure 1*). Mary Fork, a second-order stream, is approximately 1.45 stream miles in length and drains approximately 19.9 square miles.

Mary Fork and its tributaries have been previously impacted by timbering, oil and gas exploration and recovery, and mining related activities. Increased sediment inputs and sediment retention has resulted in poor aquatic habitat, unstable lateral and vertical morphology, and consequently more tolerant and sparse biological communities.

1.5 Mitigation Site Directions

1. From I-64 E, take Exit 89. At bottom of ramp turn RIGHT onto WV-94 S. Go approx. 3.1 miles.
2. Turn right onto 4 Mile Rd. / CR-44. Go approx. 0.5 miles.
3. Turn left onto Spruce Fork Rd. / CR-44/2. Go approx. 1 mile.
4. Spruce Fork turns into Mary Fork. (See *Figure 2.* for beginning and end of mitigation reach.)

1.6 Commencement/Completion Dates

The on-site mitigation areas proposed in the approved mitigation plan (Decota, 2007) are to be restored and created after the mining and operations phase of the project which has yet to be completed. Construction at the off-site mitigation area began on June 23, 2008. Final construction was completed on October 17, 2008. The seeding and mulching of Mary Fork was completed by Pritchard and was accomplished concurrently as the mitigation progressed downstream. Riparian seedlings were planted on March 20th through 22nd, 2009 by New Forest Services. The as-built surveys were conducted by Decota Consulting Company, Inc. on October 7th & 8th, 2008.

1.7 Performance Standard Compliance

After construction completion, three assessment points (AP-UTMF 9-11) were reviewed using EPA's, RBP - Habitat Assessment Value (HAV), NRCS' Stream Visual Assessment Protocol (SVAP), Pfankuch Stream Stability Assessment, Interim Functional Assessment Approach (IFAA), and Pebble Count Evaluations (*Figure 2*). These same locations will be monitored annually for a period of ten (10) years and their values compared to baseline data to determine if an overall increase in functional value is obtained.

During the as-built survey, cross-section locations were staked, flagged, and marked with orange paint to verify exact locations of surveys for subsequent monitoring purposes. Longitudinal profiles were conducted through typical restored/enhanced segments of the mitigation reach. These morphological evaluations will also be compared to baseline and as-built conditions to examine progression of the project.

1.8 Corrective/Maintenance Activity Dates

The approved mitigation plan states that the mitigation areas shall be maintained annually in accordance with all permit requirements for a period of ten (10) years. All construction, maintenance, and monitoring shall be the responsibility of Pritchard Mining Company, Inc. They will ensure that qualified personnel, particularly engineers and biologists, are used during all phases of the mitigation work. As indicated in the CMP (Decota, 2007), natural channel design structures were used in order to reduce near bank shear stress, provide grade control, and provide riffle and pool habitat. Upon completion of as-built monitoring, no major structure malfunctions or failures were observed, therefore, no recommendations for any corrective or remedial actions are provided at this time. Further decisions on corrective/maintenance activities will be made following the first year monitoring period. To date, no corrective or maintenance activity has been reported since mitigation activities have been completed.

1.9 Recommendations

Upon completion of the as-built monitoring effort, no major recommendations are being made. As required by the 401/404 authorizations, yearly monitoring of the mitigation area will be completed in order to evaluate functional trends. Special attention will be allocated toward enhancement structures during future evaluations to determine if they are working properly or need any maintenance. If any problems are found with the project during the first year monitoring effort, then recommendations will be provided for future correction activity.

2.0 SUMMARY OF DATA

Restoration and enhancement included:

- creating additional meanders with proper channel dimensions and radii of curvature,
- installing in-stream structures (i.e. rootwads, log cross vanes, log j-hook vanes) to adequately convey flow, reduce near bank stress, and provide adequate habitat and cover for fish and benthic macroinvertebrates. In-stream structures also provide streambed grade control and promote appropriate bed sequences.
- re-establishing any surrounding vegetation, and
- protecting drive-through crossings by utilizing natural channel design structures.

Within the mitigation reach of Mary Fork, multiple structures were constructed. These structures consisted of log j-hooks, rootwads, log cross vanes, bank boulders, and log step pools. Appendix D contains typical photos of these structures. These structures were implemented in-channel during low flow conditions. Permanent seeding and mulching was completed concurrently as the mitigation efforts progressed downstream and appears to be growing at satisfactory rates. Bare root seedlings were installed at each of the mitigation areas on March 20th through 22nd, 2009. A copy of "Planting report at Mary Fork, Hernshaw, West Virginia" prepared by New Forest Services is included in Appendix E.

The project reach was split up into an upper section and a lower section. A total of eight (8) permanent monumented cross-sections were established on Mary Fork along with two (2) longitudinal profiles (Appendix A). Each section of the reach (e.g. upper section and lower section) consisted of one (1) longitudinal profile and four (4) cross-sections. The monuments were established in pool and riffle bed features. (See also, Section 2.7 Morphological Data for more details). This morphological data

was collected immediately after construction (October 2008) to document the true "As-Built" condition.

As stated in the Special Conditions section of the permit, habitat assessment values (HAV's), Stream Visual Assessment Protocol (SVAP), Pfankuch Stream Stability Assessments (Pfankuch's), Interim Functional Assessment Approach (IFAA), and representative pebble count data were collected throughout the mitigation stream reach during the as-built survey (Appendix B). Three (3) assessment points were established along the mitigated reach. Two (2) within the mitigated reach; assessment point MF 10 (AP-MF 10) and assessment point MF 11 (AP-MF 11), and one (1) downstream of the mitigated reach labeled assessment point MF 9 (AP-MF 9) (*Figure 2*). AP-MF 9 was established outside of the mitigated reach in order to show comparison between mitigated versus non-mitigated conditions. In addition to these assessments, physical and chemical water quality parameters will also be analyzed annually in conjunction with benthic surveys. These parameters are not considered success standards, but they do give insight into the overall quality of the enhancement reach and provide yearly data comparison. Delay in collection of this data was intentional to provide needed recovery time. Approximately one year was provided between construction completion and the collection of various assessment data.

2.1 Habitat Assessments (HAV's)

The habitat assessments (HAV's) conducted by Decota (2007) during the baseline survey for the selected mitigation stream reach ranged from 79 (marginal) at survey site AP-MF 11 to 100 (marginal) at survey site AP-MF 10.

During the 2009 as-built evaluation, the HAV scores ranged from 136 (sub-optimal) at AP-MF 11 to 155 (sub-optimal) at AP-MF 10, showing a substantial improvement (Appendix B, Table B-1). ***Table 1*** below provides a comparison between baseline HAV conditions and the as-built HAV conditions. The actual HAV scores for the as-built survey are higher than the predicted as-built scores from the compensatory mitigation plan (CMP) report, with the exception of AP-MF 11 (Decota, 2007). Overall, these scores are expected to continue to improve over time. The channel sinuosity scores, in particular, were low due to valley type and anthropogenic influences. Mary Fork has a valley type with an average valley slope of 2.4% and very little flood plain, thereby reducing the channel's ability to be sinuous. Additionally, the stream is often confined within the valley by numerous roads associated with development activities such as oil and gas and logging. This also contributes to the channel's inability to be sinuous. These conditions will likely be permanent and a sinuosity score increase over time is highly unlikely. Additionally, sediment deposition scores were somewhat lower due to logging within the upper section of the mitigation reach and the headwaters. As previously mentioned, the logging company maintained a 100 ft. buffer on both sides of the stream to help protect the stream and adjacent riparian zones. Sediment impacts did occur. However, unlike sinuosity, sediment deposition scores are expected to increase over time and improve overall HAV scores.

***Table 1*. Summary of HAV scores during the Baseline and As-Built Surveys**

Mitigation Assessment Points	Baseline Survey	As-Built Survey
AP-MF 9*	92 (marginal)	144 (sub-optimal)
AP-MF 10	100 (marginal)	155 (sub-optimal)
AP-MF 11	79 (marginal)	136 (sub-optimal)

* Biostation MF-9 is outside of the mitigation reach and is only used as a comparison between restored vs. non-restored stream reach.

2.2 West Virginia Stream Condition Index (WVSCI)

The West Virginia Stream Condition Index (WVSCI) scores from the spring 2007 baseline benthic macroinvertebrate survey ranged from 68.4 (Good) for biostation MF-11 to 72.1 (Good) for biostation MF-9. These scores denote an overall rating of "Good" for the stream. During the fall 2009 as-built benthic survey, the WVSCI scores ranged from 52.8 (Slightly Impaired) for biostation MF-10 to 62.5 ("Gray Zone") for biostation MF-9.

Results indicate a decrease in the benthic metrics for the fall 2009 survey, as compared to the spring 2007 survey. ***Table 2*** below, shows this comparison. These decreases in metric scores can be related to many different factors and influences. The Hilsenhoff Biotic Index (HBI) is a metric used to calculate the WVSCI score. It evaluates the tolerance or intolerance of a macroinvertebrate to organic pollution by assigning a numerical value on a scale from one (1) to ten (10). 1 = most intolerant and 10 = most tolerant. Therefore, the higher the HBI score, the lower the WVSCI score. The HBI scores for the surveyed sites have increased since stream restoration which indicates more tolerant macroinvertebrate communities within the mitigated stream reach. This shift to a more tolerant community may be due, in part, to the increase in sediment and the overall disruption of benthic habitat during mitigation construction. As the sediment load within a stream increases, the available niche space for macroinvertebrates decreases. Also, due to disruption from construction within the reach, various macroinvertebrate communities may need time for reestablishment. The % EPT is another metric used to calculate the WVSCI. This metric deals with the percentage of three (3) macroinvertebrate orders (e.g. Ephemeroptera, Plecoptera, and Trichoptera) which are the most intolerant and sensitive orders within the macroinvertebrate community. The % EPT scores for the surveyed sites have decreased, possibly correlating to the increase in the HBI scores as well as to the disruption of habitat. EPT taxa typically inhabit riffle and run features within a stream bed. The disruption to these features during construction may have caused a drop in abundance of these taxa. Over time it is expected that the % EPT scores will improve as the macroinvertebrate population is reestablished. For a more detailed description of all benthic macroinvertebrate results from the 2009 benthic survey, please refer to the "Benthic, Habitat, and Water Chemistry Surveys of Mary Fork Associated With the Mitigation Monitoring for Fourmile Surface Mine, Amendment No. 1" document which is included as an attachment to this report.

Table 2. **Summary of WVSCI Scores and Related Metrics for 2007 and 2009 Benthic Surveys**

Benthic Survey Sites	WVSCI	HBI	% EPT
2007 Benthic Survey			
MF-9*	72.1 (Good)	4.93	51.8
MF-10	70.2 (Good)	4.13	65.2
MF-11	68.4 (Good)	3.55	73.4
2009 Benthic Survey			
MF-9*	62.5 ("Gray Zone")	5.59	38.4
MF-10	52.8 (Slightly Impaired)	5.64	55.7
MF-11	58.8 (Slightly Impaired)	5.67	54.5

* Biostation MF-9 is outside of the mitigation reach and is only used as a comparison between restored vs. non-restored stream reach.

2.3 Water Quality Analysis

During benthic macroinvertebrate surveys conducted in the spring of 2007 and the fall of 2009 water chemistries were obtained from three separate sites (MF-9, MF-10, & MF-11) on Mary Fork. Water was analyzed using field measurements as well as lab analysis. Decota (2007, 2009) used portable meters to field test various water parameters including pH, temperature, conductance, dissolved oxygen, total dissolved solids, and flow. Water samples were also collected and sent to Sturm Environmental Services (2007) and Bio-Chem Testing, Inc. (2009) for laboratory testing. ***Table 3*** below, illustrates a summary of the field water chemistry results for all three (3) benthic sites on Mary Fork in 2007 and 2009. The pH values for the field analysis have increased over time and have become more basic. Also, the total dissolved solids (TDS) and conductance (COND) for each site has increased over time. The increase in TDS may be due to increased sediment load from logging activities and the increased conductance can be due to multiple factors. In particular, an increase in temperature, which is shown from the 2007 results to the 2009 results, can cause the conductance to increase. Also, the decrease in flow from 2007 to 2009 may also have caused the conductance to be higher. These scores are expected to improve over time as the restored channels physical and chemical properties continue to improve. Please refer to the 2007 and 2009 "Benthic, Habitat, and Water Chemistry Surveys" in Appendix C for laboratory results.

***Table 3*. Summary of Water Quality Field Analysis for 2007 and 2009 Benthic Surveys**

		2007 Benthic Survey			2009 Benthic Survey		
Benthic Survey Sites→		**MF-9***	**MF-10**	**MF-11**	**MF-9***	**MF-10**	**MF-11**
Field Parameters	**Units**	**Results**					
pH	pH units	6.60	6.60	6.90	8.32	8.30	8.20
Temperature	°C	7.3	7.8	7.3	21	20	20
Conductance (COND)	µmhos/cm	860	1310	1530	1550	1800	1950
Dissolved Oxygen (DO)	mg/L	N/A	N/A	N/A	7.5	7.9	8.1
Total Dissolved Solids (TDS)	ppm	400	500	800	780	900	970
Flow	gpm	1111.28	757.69	471.45	194.34	140.76	73.77

* Biostation MF-9 is outside of the mitigation reach and is only used as a comparison between restored vs. non-restored stream reach.

2.4 Stream Visual Assessment Protocol (SVAP)

Stream Visual Assessment Protocol (SVAP) evaluations conducted during the baseline survey indicated scores for the selected mitigation stream reach ranged from 5.15 (poor) at Assessment Point - MF 9 (AP-MF 9) to 6.38 (fair) at Assessment Point – MF 10 (AP-MF 10).

During the as-built survey, the SVAP scores ranged from 6.76 (fair) at AP-MF 11 to 7.84 (good) at AP-MF 10, showing an improvement (Appendix B, Table B-3). ***Table 4*** below, provides a comparison between the baseline SVAP conditions to the as-built SVAP conditions. The actual as-built survey scores were lower than the predicted as-built survey scores from the CMP (Decota, 2007). These scores are expected to continue to improve over time. Riparian zone scores were somewhat lower due to recent construction, which has disturbed some of the riparian zone immediately adjacent to the stream. However, seeding, mulching, and seedling plantings should increase the riparian zones functions over time. Also, pool scores were somewhat low because of the shallowness of many of the pools. This may be due to increased sediment load previously mentioned. These scores are anticipated to increase over time and improve overall SVAP scores.

***Table 4*. Summary of SVAP scores during the Baseline and As-Built Surveys**

Mitigation Assessment Points	Baseline Survey	As-Built Survey
AP-MF 9*	5.15 (poor)	7.76 (good)
AP-MF 10	6.38 (fair)	7.84 (good)
AP-MF 11	6.08 (poor)	6.76 (fair)

***** AP-MF 9 is located outside of the mitigation reach and will only be used for restored vs. non-restored comparison.

2.5 Pfankuch Stream Stability Assessment

The Pfankuch Stream Stability Assessments (Pfankuch) conducted during the baseline survey indicates scores for the selected mitigation stream reach ranged from 73 (Fair) at Assessment Point MF 9 (AP-MF 9) to 94 (Poor) at Assessment Point MF 11 (AP-MF 11).

During the as-built survey, the Pfankuch scores ranged from 71 at AP-MF 10 to 87 at AP-MF 11, showing a slight improvement (Appendix B, Table B-4). The actual as-built scores for the assessment points have increased as compared to the predicted as-built scores from the compensatory mitigation plan (CMP) report, thereby categorizing them as "fair" or "poor" compared to "good" (Decota, 2007). The Pfanckuch scoring system is based on the principle that the lower the overall score, the better the stream is categorized. ***Table 5*** below provides a comparison between baseline Pfankuch conditions to those of the as-built Pfankuch condition. These scores are expected to continue to improve over time. Scouring and deposition scores within the bottom of the channel have worsened due to the increased sediment load previously mentioned. These scores should improve as the sediment is transported through the channel. Additionally, categories related to scouring and deposition of the lower bank scored fair. It is anticipated as vegetation is given time to establish and natural sorting of substrate occurs, these parameters will increase, ultimately improving total Pfankuch scores. A summary of the scores for the baseline survey in comparison to the as-built survey is located in ***Table 5***.

***Table 5*. Summary of Pfankuch scores during the Baseline and As-Built Surveys**

Mitigation Assessment Points	Baseline Survey	As-Built Survey
AP-MF 9*	73 (Fair)	81 (Fair)
AP-MF 10	92 (Poor)	71 (Fair)
AP-MF 11	94 (Poor)	87 (Poor)

***** AP-MF 9 is located outside of the mitigation reach and will only be used for restored vs. non-restored comparison.

2.6 Interim Functional Assessment Approach (IFAA)

The Interim Functional Assessment Approach (IFAA) conducted during the baseline survey indicates scores for the selected mitigation stream reach ranged from 8,498 Functional Credit Units (FCU's) for assessment point MF 10 (AP-MF 10) to 8,516 FCU's for assessment point MF 11 (AP-MF 11). During the as-built survey, the IFAA scores ranged from 939 for assessment point MF 9 (AP-MF 9) to 9,672 for assessment point MF 11 (AP-MF 11). AP-MF 9 scored the lowest; however, this site is located outside of the mitigation reach and will only be used for restored versus non-restored comparison and analysis.

Upon comparison of the as-built IFAA evaluations to that of the baseline conditions, it is evident that the total combined FCU score of AP-MF 10 and AP-MF-11 has increased by a total of 1,907 FCU's. This shows an increasing trend toward success throughout the enhancement area. However, this increase is still lower than the predicted increase of 2,978 FCU's, which was originally proposed before construction. Watershed impacts have caused an increase in sediment and deposition throughout the mitigation reach. These processes have slowed the progression of the enhancement, and may explain why trends toward improvement are slightly less than anticipated. These same

assessment points will be monitored yearly in order to determine any changes in quality and function of the enhancement area. Moreover, the FCU scores for these assessment points are predicted to continually increase over time as conditions improve within the watershed. A summary of the as-built IFAA conditions as compared to baseline conditions are located in ***Table 6***.

Table 6. **Summary of IFAA Scores during Baseline and As-Built Surveys**

	BASELINE CONDITIONS	AS-BUILT CONDITIONS	GAIN
AP-MF 9* (328 ft.)	**FCU**	**FCU**	**FCU**
Hydrology Functions	N/A	237	-
Biogeochemical Functions	N/A	217	-
Plant Community Functions	N/A	240	-
Habitat Functions	N/A	245	-
Total	N/A	939	-
AP-MF 10 (3,200 ft.)	**FCU**	**FCU**	**FCU**
Hydrology Functions	2,288	2,441	153
Biogeochemical Functions	2,274	2,281	455
Plant Community Functions	1,880	2,406	526
Habitat Functions	2,056	2,544	488
Total	8,498	9,672	1,174
AP-MF 11 (3,200 ft.)	**FCU**	**FCU**	**FCU**
Hydrology Functions	2,295	2,376	81
Biogeochemical Functions	2,280	2,119	0
Plant Community Functions	1,880	2,347	467
Habitat Functions	2,061	2,407	346
Total	8,516	9,249	733

***** AP-MF 9 is located outside of the mitigation reach and will only be used for restored vs. non-restored comparison.

2.7 Representative Pebble Count Evaluations

A total of three (3) pebble count evaluations were completed during the as-built assessments conducted by Decota in February 2010 (Table 7). Two pebble counts were completed within the enhancement area (AP-MF 10 & 11), and one pebble count was conducted just downstream of the end of the enhancement reach (AP-MF 9) (*Figure 2*). Pebble counts were conducted in order to complete one of the restoration objectives of the mitigation project, which is to show an increase in the D50 particle size. During the as-built monitoring, the D50 of Mary Fork ranged from 12 to 29. However, assessment point AP-MF 9 is not actually within the mitigated reach of Mary Fork. This assessment point is actually just outside of the restored area and will be used to compare the restored/enhanced versus un-restored section of stream. These areas will continue to be monitored during yearly evaluations in order to determine if there is coarsening of the substrate. ***Table 7*** contains the as-built pebble count summary information.

***Table 7*. Summary of Pebble Counts during the As-Built Survey**

Mitigation Assessment Points →	AP-MF 9*	AP-MF 10	AP-MF 11
Bedform Feature Composition	17% Pool 28% Riffle 5% Glide 50% Run	10% Pool 50% Riffle 9% Glide 31% Run	10% Pool 41% Riffle 6% Glide 43% Run
% Silt/Clay	4	2	10
% Sand	8	5	28
% Gravel	65	76	49
% Cobble	16	14	13
% Boulder	3	3	0
% Bedrock	4	0	0
D50 (mm)	29	27	12

***** AP-MF 9 is located outside of the mitigation reach and will only be used for restored vs. non-restored comparison.

2.8 Morphological Data

During the as-built monitoring period, Decota established two longitudinal profiles and eight cross sections within the Mary Fork mitigation project area (Appendix A). The project reach was split into an upper section and a lower section, with each reach containing a longitudinal profile and four cross sections. Within each reach, two cross sections were established within a pool and two were established within riffles. The determined profile length for each reach was based on the channel width. These same areas will be surveyed annually in order to determine changes in stream morphology and structure, and to help determine success of the mitigation. Also, by understanding the streams morphological structure, we can better understand how it will adapt to certain stressors. All of the morphological parameters that were studied and presented within this report are subject to change as flows transport sediment throughout the system and natural adjustment occurs.

2.8.1 Upper Section

One 442.3 ft. longitudinal profile and four cross sections were established within the upper section of the Mary Fork mitigation project (*Figure 2*). Two cross sections were evaluated within riffles, and two cross sections were evaluated in pools. Upon completion of the as-built survey of this upper reach, data was evaluated from the longitudinal profile and the two representative riffle cross sections in order to understand the streams existing geomorphology. Evaluation of the morphological data found the bankfull width to range from 11.7 ft. to 12.05 ft., bankfull mean depth ranged from 1.08 ft. to 1.19 ft. and the entrenchment ratio ranged from 1.76 ft. to 1.95 ft. The width to depth ratio for the upper reach was found to be 10.48 ft. Evaluation of the upstream reach's longitudinal survey shows the stream has a bankfull slope of 0.02138 ft/ft, an average pool slope of 0.00692 ft/ft and a valley slope of 0.0257 ft/ft. Also, bank height ratio was found to be 1.29 ft. for this reach and pool to pool spacing averaged 34.82 ft. Sinuosity was 1.2 for this section. From these results this stream was classified as a Rosgen B4 stream type. A detailed summary of the as-built restored morphological parameters is located within ***Table 8*.**

***Table 8*. Summary of Upper Reach Average Restored Morphological Parameters**

Parameter		As-Built (2008)
Rosgen Stream Type		B4
Reach Length Surveyed (ft.)		442.3
Dimension	Bankfull Width (ft.)	11.88
	Bankfull Mean Depth (ft.)	1.14
	Width/Depth Ratio	10.48
	Bankfull Area (sq. ft.)	13.52
	Bankfull Max Depth (ft.)	1.65
	Width of Floodprone Area (ft.)	22.04
	Entrenchment Ratio	1.85
	Max Pool Depth (ft.)	2.90
	Ratio of Max Pool Depth to Bankfull Depth	1.86
	Pool Width (ft.)	11.1
	Ratio of Pool Width to Bankfull Width	0.934
	Pool to Pool Spacing (ft.)	34.82
	Ratio of Pool to Pool Spacing to Bankfull Width	2.93
	Bank Height Ratio	1.29
Pattern	Sinuosity	1.2
Profile	Valley Slope (ft./ft.)	0.0257
	Bankfull Slope (ft./ft.)	0.02138
	Pool Slope (ft./ft.)	0.00692
	Ratio of Pool Slope to WS Slope	0.32367

2.8.2 Lower Section

Within the lower section of the Mary Fork mitigation project, four cross sections (two in riffles and two in pools) were surveyed in addition to a 446.4 ft. longitudinal profile in order to evaluate the streams morphological characteristics. Upon completion of the survey, this lower section of Mary Fork was classified as a Rosgen type B4 stream. Review of the survey data found bankfull mean depth ranged from 0.99 ft. to 1.11 ft., bankfull width ranged from 12.16 ft. to 15.89 ft., width to depth ratio was 13.5 ft and the entrenchment ratio ranged from 2.81 ft. to 3.27 ft. Evaluation of the downstream section's longitudinal profile indicates the stream has a valley slope of 0.0229 ft/ft, an average pool slope of 0.00621 ft/ft, and a bankfull slope of 0.021 ft/ft. Bank height ratio for the lower section was 0.97 ft, pool to pool spacing was 35.7 ft. and sinuosity was 1.09. A detailed summary of the restored morphological parameters of the lower reach can be found within ***Table 9***.

***Table 9*. Summary of Lower Reach Average Restored Morphological Parameters**

Parameter		As-Built (2008)
Rosgen Stream Type		B4
Reach Length Surveyed (ft.)		446.4
Dimension	Bankfull Width (ft.)	14.03
	Bankfull Mean Depth (ft.)	1.05
	Width/Depth Ratio	13.5
	Bankfull Area (sq. ft.)	14.64
	Bankfull Max Depth (ft.)	2.04
	Width of Floodprone Area (ft.)	43.11
	Entrenchment Ratio	3.04
	Max Pool Depth (ft.)	2.58
	Ratio of Max Pool Depth to Bankfull Depth	1.97
	Pool Width (ft.)	13.4
	Ratio of Pool Width to Bankfull Width	0.96
	Pool to Pool Spacing (ft.)	35.7
	Ratio of Pool to Pool Spacing to Bankfull Width	2.54
	Bank Height Ratio	0.97
Pattern	Sinuosity	1.09
Profile	Valley Slope (ft./ft.)	0.0229
	Bankfull Slope (ft./ft.)	0.021
	Pool Slope (ft./ft.)	0.00621
	Ratio of Pool Slope to WS Slope	0.29571

3.0 CONCLUSION

Over 6,400 linear feet of Mary Fork was enhanced and restored. Multiple natural channel design structures were constructed throughout the enhancement reach. These structures consisted of log j-hooks, rootwads, log cross vanes, bank boulders, and log step pools. These structures were implemented in-channel, during low flow conditions.

The project reach was split up into an upper section and a lower section. A total of eight (8) permanent monumented cross-sections were established along with two (2) longitudinal profiles (Appendix A). In each section of the mitigated reach (e.g. upper section and lower section) a total of one (1) longitudinal profile and four (4) cross-sections were conducted. The monuments were established in bed features to accommodate measurement of pool and riffle characteristics. Profile and cross-section surveys will be completed annually within both reaches in order to evaluate any changes in channel morphology.

Three assessment points (AP-MF 9-11) were also established within Mary Fork for annual evaluation (*Figure 2*). These assessment points are reviewed using EPA's, RBP - Habitat Assessment Value (HAV), NRCS' Stream Visual Assessment Protocol (SVAP), Pfankuch Stream Stability Assessment, Interim Functional Assessment Approach (IFAA), and Pebble Count Evaluations in order to determine

the in-stream and riparian quality within Mary Fork. AP-MF 9 is located outside of the enhancement area and will only be used for comparison which will allow for a better understanding of the restoration function. These same locations will be monitored annually for a period of ten (10) years and their values compared to baseline data to determine if an overall increase in functional value is obtained. Also, benthic macroinvertebrate sampling and water chemistry analysis were conducted within the mitigation reach in order to further evaluate quality of the enhancement area.

Permanent seeding was completed concurrently with construction and appears to be growing at optimal rates. Riparian seedlings were planted on March 20th through 22nd, 2009 by New Forest Services.

After reviewing the mitigation plan and evaluating the completed enhancements and restorations on the selected mitigation reaches for this permit, Decota has determined that construction has met and exceeded specifications laid out in the submitted mitigation plan as applicable under the Clean Water Act (CWA) Section 404 Permit. The mitigation reaches will be continue to be monitored and compared to the baseline conditions and the as-built survey results presented in this report in order to document a need for maintenance, corrective measures, and/or success. Yearly monitoring results, will be submitted to the U.S. Army Corps of Engineers for review and approval.