Cabin John Creek

Cabin John Creek Watershed

3.16 Lower Booze Creek Stream Restoration

3.16.1 Introduction

In 2003, the Lower Booze Creek was identified by the Department of Environmental Protection (DEP) as being a priority for stream restoration. The stream within the project site was severely eroded, had exposed sewer lines and manhole risers, and had a sparsely vegetated riparian zone (***Figure 3.16.1***). The design for this project includes stabilizing the stream banks, cleaning and protecting the sewer infrastructure, improving the instream habitat for stream biota, and planting riparian vegetation. Construction of this project is scheduled for 2012. This is a pre-restoration report; it describes the project goals, pre-restoration monitoring plan, and the results of the monitoring performed to establish baseline conditions at this site.

Figure 3.16.1 – Lower Booze Creek Stream Prior to Restoration (2007)

Subwatershed facts

Subwatershed Drainage Area: 532.7 acres
Subwatershed Imperviousness: 20 Percent

Project Facts

Project Area: The stream restoration will begin approximately 150 feet downstream of River Road and will end approximately 300 feet upstream of Cabin John Parkway. The project includes stabilizing approximately 4,646 linear feet of stream and planting native vegetation.
Estimated Costs: Structural ($615,000), Reforestation ($85,000), Funded in part through Maryland State Highway Administration TEA-21 Enhancement Program, administered by Federal Highway Administration.
Anticipated Completion Date: Construction - April 2012, Final Planting – December 2012
Property Ownership: Maryland-National Capital Park and Planning Commission

Project Selection

Montgomery County has a continuing commitment to protect and improve its water resources. The Countywide Stream Protection Strategy, (CSPS, 1998, updated 2003), published by the Department of Environmental Protection (DEP), evaluated biological, chemical, and habitat conditions of streams in the county, and identified impaired "priority" subwatersheds for restoration, including the Booze Creek subwatershed (***Figure 3.16.6***). Following the CSPS, The Cabin John Watershed Study (August 2002) evaluated more than 25 miles of Cabin John Watershed and its tributaries to identify specific stream restoration and stormwater management opportunities. The Study identified 16 priority stream restoration sites, including the Booze Creek tributary of Cabin John Watershed.

Pre-Restoration Conditions

The Booze Creek tributary exhibited widespread, severe bank erosion with many vertical banks exceeding 6-8 feet in height (***Figure 3.16.2***).

Figure 3.16.2 – Severe Streambank Erosion along Lower Booze Creek, Prior to Restoration (2007)

Numerous sewer lines and manhole risers have been exposed by scour and were in danger of being severely damaged by continued erosion (***Figure 3.16.3***).

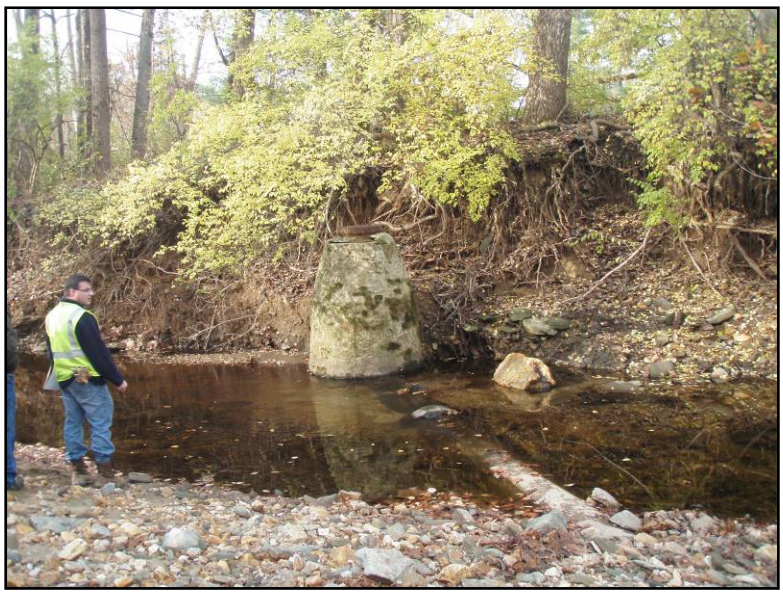


Figure 3.16.3 – Exposed Sewer Line and Manhole Riser in Lower Booze Creek, Prior to Restoration (2010)

Many trees were being undercut and falling into the stream resulting in debris jams and additional localized bank erosion (***Figure 3.16.4***).

Figure 3.16.4 – Undermined Tree, Debris Jam, and Streambank Erosion along Lower Booze Creek, Prior to Restoration (2004)

The stream appeared to be somewhat over-widened resulting in poor sediment transport, sediment deposition, lateral erosion, and the loss of habitat features (***Figure 3.16.5***).

Figure 3.16.5 – Over-widened Stream Channel in Lower Booze Creek, Prior to Restoration (2010)

Additionally, shading of the stream by the forest canopy is low due to the width of the channel and areas of poor riparian vegetation.

Proposed Restoration Actions

The Booze Creek project will use in-stream restoration techniques and reforestation to help stabilize streambanks and enhance riparian habitat. The proposed instream structures include rock and log vanes, which will direct water away from unstable stream banks, create downstream scour pools, and provide stable and suitable habitat for fish. Rock cross vanes will also function as grade control structures, which will slow the erosive process of stream down-cutting. Root wad revetments are instream structures that are proposed to help stabilize streambanks, create scour holes, and provide overhead cover for fish.

Boulder rocks will be installed at the toe of the streambank slopes to help stabilize the area of the stream channel subject to the greatest erosive or "shear" stress. The slopes above the reinforced toe will be graded back to create new floodplain terraces and will be planted with native trees and shrubs to further stabilize the streambanks. The project will attempt to save undercut streambank trees with supportive "rock packing". More seriously damaged trees will be flush cut, allowing the root systems to remain in the bank for stabilization. To increase and enhance the riparian habitat and stream buffer, approximately 2,400 live stakes, 2,400 tubelings, 1,500 shrubs, and 950 trees are scheduled to be planted after the in-stream portion of the project is complete.

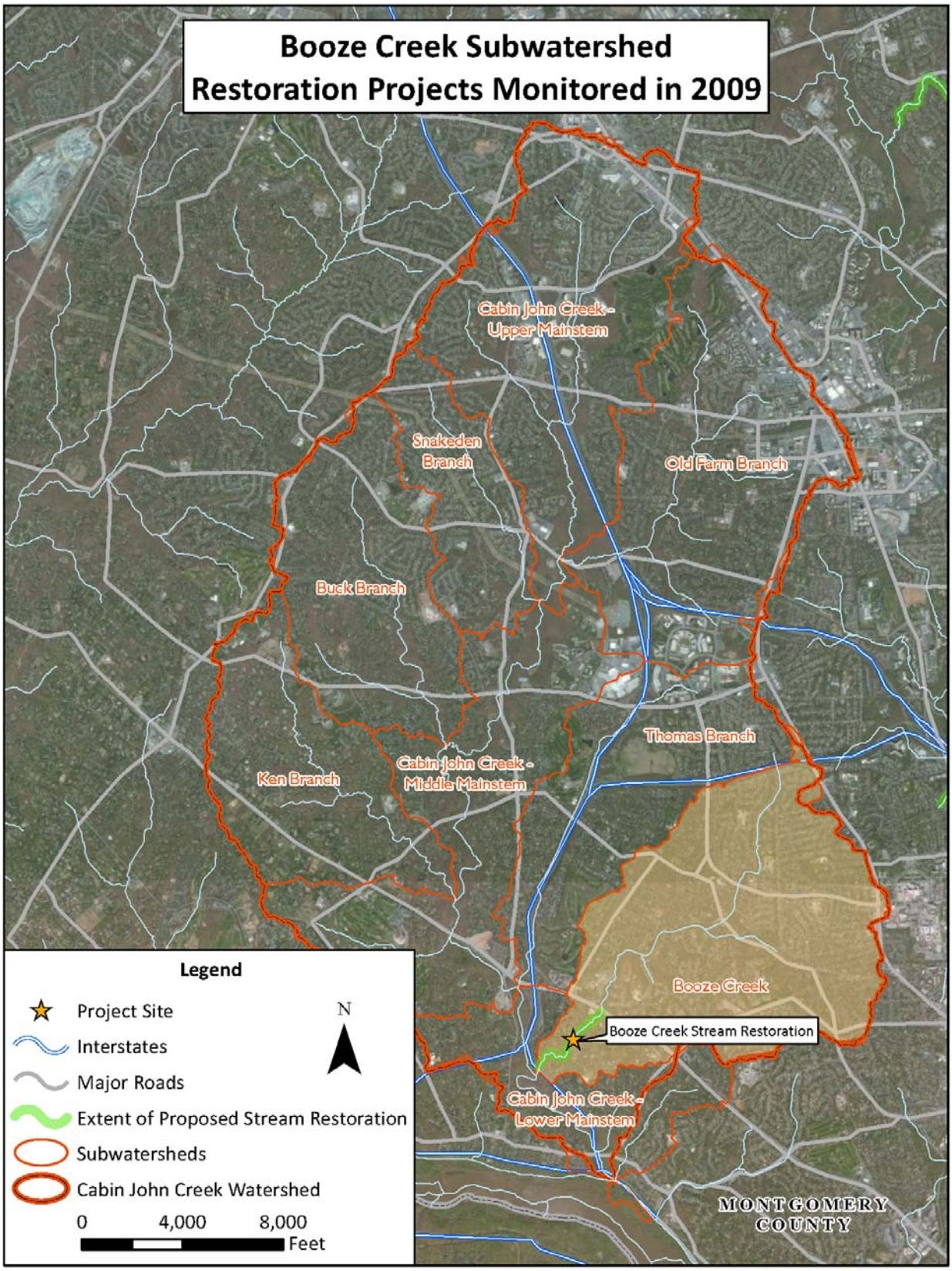


Figure 3.16.6 – Booze Creek Subwatershed Projects Monitored in 2009

Montgomery County is working closely with the Washington Suburban Sanitary Commission (WSSC) to protect buried sewer lines with channel grade controls and divert stream water flow away from exposed manholes. The WSSC will use the County's temporary construction access to clean and reline existing sewer lines, further protecting sewer infrastructure. Additionally, WSSC will replace an exposed water main located downstream of River Road.

3.16.2 Restoration Goals

Restoration goals were defined during the planning stages of the Lower Booze Creek Stream Restoration project. This is a pre-restoration monitoring report that summarizes the baseline conditions within the Lower Booze Creek Stream Restoration project area. ***Table 3.16.1*** below presents the restoration goals, monitoring performed to establish baseline conditions against which to evaluate the future success of the goals, and when and where the monitoring occurred.

Table 3.16.1 – Summary of Restoration Project Goals and Associated Monitoring

Why: Restoration Goals	What: Monitoring Done to Evaluate Goal	When: Years Monitored	Where: Station or Location Monitored
• Improve water quality in the Lower Booze Creek tributary to Cabin John Creek • Improve aquatic habitat conditions	• Aquatic communities: ▪ Benthic macroinvertebrates ▪ Fish ▪ Freshwater mussels • Qualitative habitat • Water chemistry	2005 and 2009 (pre)	CJBC203
• Reduce stream erosion and sedimentation • Reduce erosive stream flows	• Quantitative habitat (stream morphology surveys)	2005 and 2009 (pre) [1]	CJBC203

[1] Quantitative habitat surveys were scheduled for 2009, but were delayed due to missing benchmarks. These benchmarks were located and survey work was performed in 2010. The 2010 report will include updates for this monitoring.

3.16.3 Methods to Measure Project Goals

The basic sampling design for the Lower Booze Creek Stream Restoration project is pre-restoration (before) and post-restoration (after) monitoring. In 2005 and 2009, the County conducted pre-restoration monitoring which included the sampling of the biological communities (benthic macroinvertebrates, fish, and freshwater mussels), rapid habitat assessments (RHAB), and collection of in-situ water chemistry measurements at one biological monitoring site (CJBC203) to evaluate the water quality and aquatic habitat conditions (***Figure 3.16.7***).

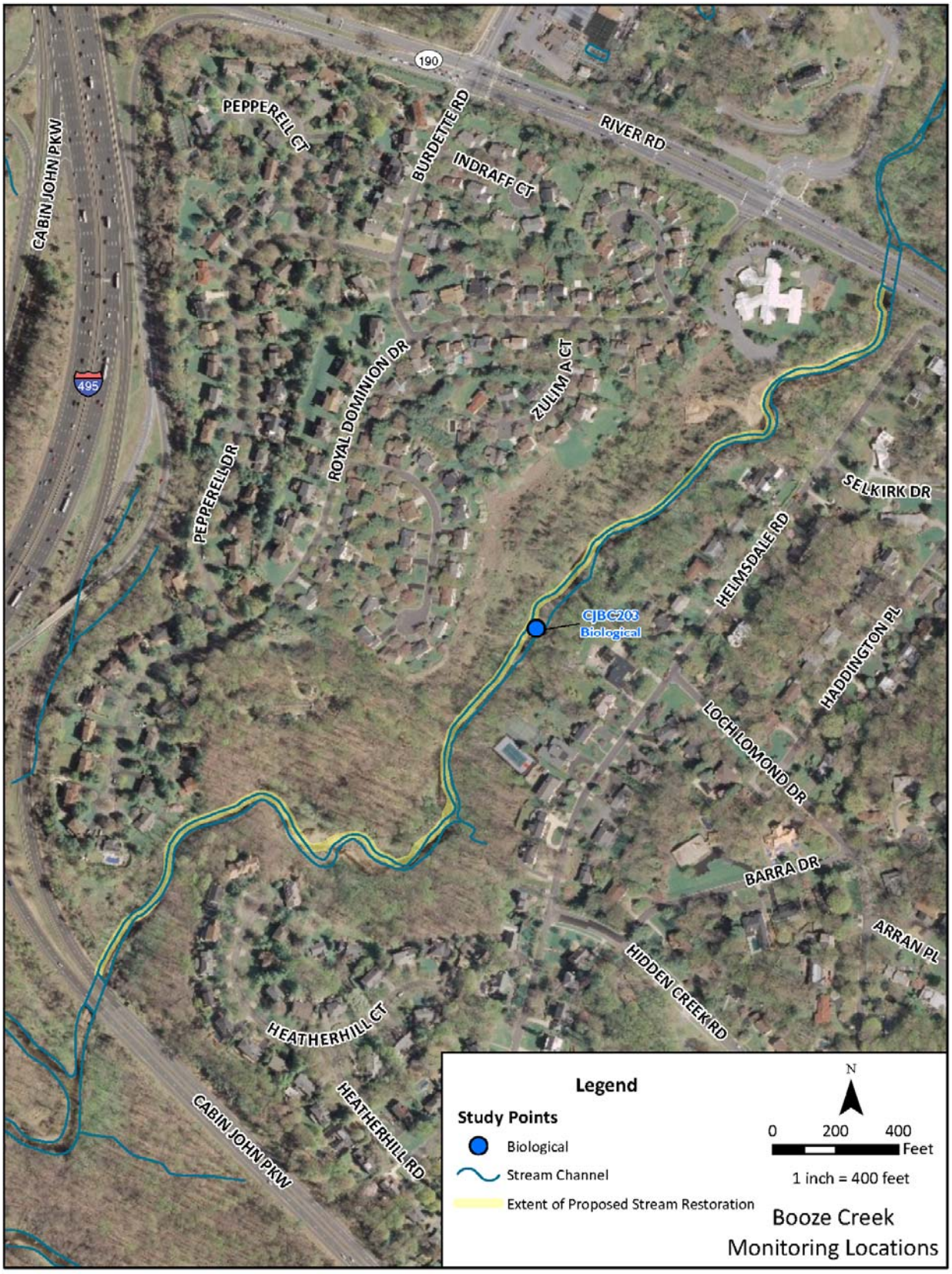


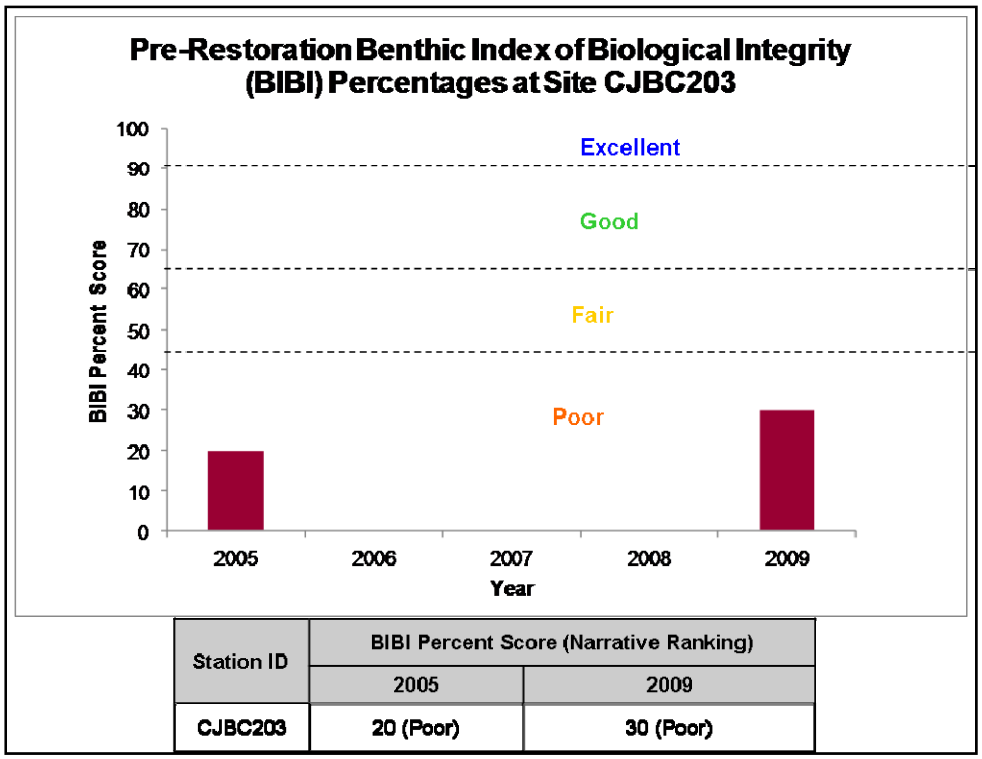
Figure 3.16.7 – Map of 2009 Booze Creek Monitoring Locations

3.16.4 Results and Analysis

Benthic Macroinvertebrates

BIBI (Benthic Index of Biological Integrity) Scores

The benthic macroinvertebrate community at CJBC203, as assessed using the MCDEP Benthic Index of Biological Integrity (BIBI), was Poor in both years in the pre-restoration period (***Figure 3.16.8***). The BIBI percentage in 2005 was 20, the lowest possible percentage. In 2005, only seven individuals were collected. In order to calculate an accurate BIBI score there must be at least 60 individuals collected per sample. If there are fewer than 60 individuals, the BIBI is automatically given the lowest possible percent score of 20. Therefore, the 2005 BIBI percent score was given a 20. In 2009, greater than 60 individuals were collected and the BIBI percentage increased to 30. The community in 2009 had a high proportion of shredders with this individual metric scoring in the highest range. Field data sheets from the 2009 benthic macroinvertebrate monitoring task are included in ***Appendix D***.



Station ID	BIBI Percent Score (Narrative Ranking)	
	2005	2009
CJBC203	20 (Poor)	30 (Poor)

Figure 3.16.8 – Pre-Restoration Benthic Index of Biological Integrity (BIBI) Percentages at CJBC203

Dominant Taxa and Tolerance Values

The pre-restoration community of benthic macroinvertebrates at CJBC203 was dominated by Chironomidae (non-biting midges), which comprised 80 percent of the community. Midges are considered tolerant taxa. *Tipula* sp. (cranefly) was the second most dominant taxon prior to restoration, representing 8 percent of individuals collected. Craneflies are considered intermediate in sensitivity. Overall, this site was dominated by tolerant taxa (85 percent) prior to

restoration, with the remaining 15 percent represented by taxa intermediate in sensitivity (***Figures 3.16.9***). Taxa sensitive to pollution were absent during the pre-restoration period.

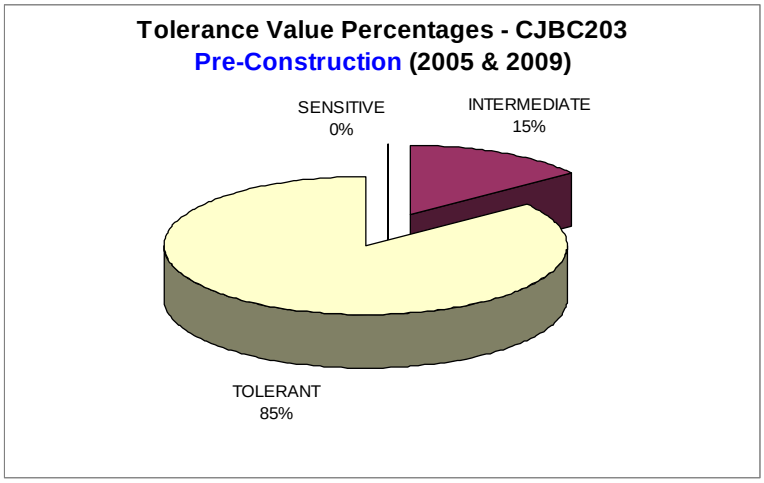


Figure 3.16.9– Benthic Macroinvertebrate Tolerance Composition at CJBC203 Prior to Restoration

Functional Feeding Groups

Collectors were the most dominant functional feeding group at CJBC203 prior to restoration. Collecters do not require specific stream conditions and are not considered a specialized feeding group. Scrapers and shredders are considered more specialized feeders that require less degraded stream conditions or specific habitat features. Scrapers were not collected at this site and shredders comprised eight percent of the community (***Figure 3.16.10***).

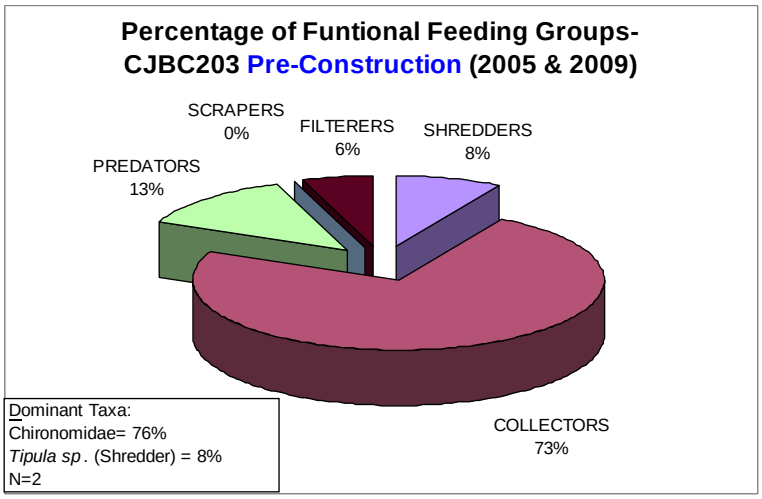
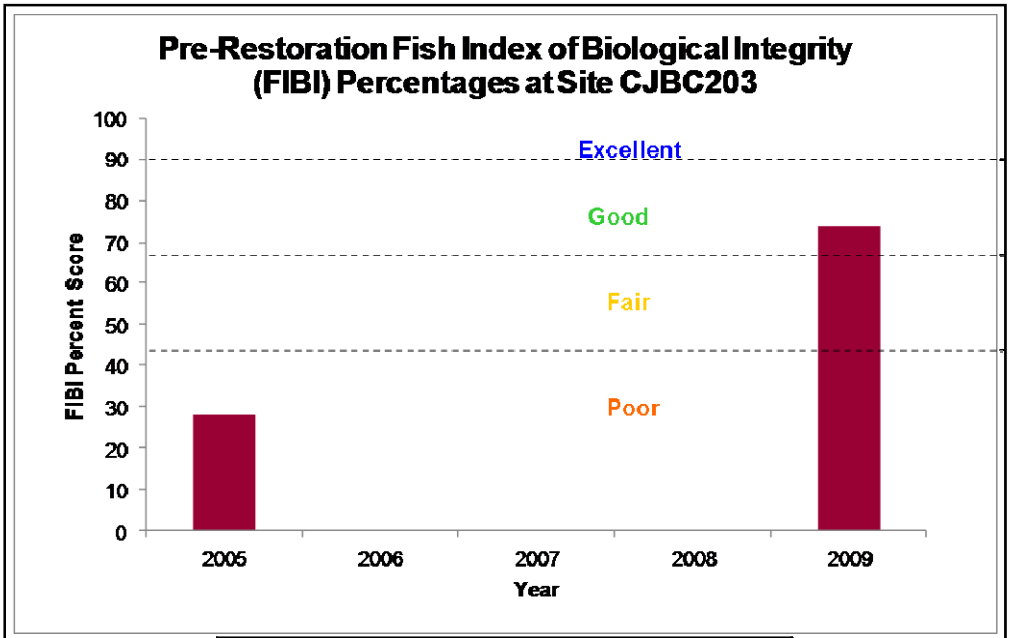


Figure 3.16.10 – Benthic Macroinvertebrate Functional Feeding Group Composition and Dominant Species at CJBC203 Prior to Restoration

Fish

FIBI (Fish Index of Biological Integrity) Scores

The pre-restoration fish community, as assessed using the MCDEP Fish Index of Biological Integrity (FIBI), was Poor (28 percent) in 2005 and Good (74 percent) in 2009 (***Figure 3.16.11***). Fish abundance was very low in 2005; only three individuals were collected. Similarly, the abundance of benthic macroinvertebrates in the 2005 community was also very low. In 2009, 935 individuals were collected at this site, a substantial increase from 2005. The increase in FIBI percentages between 2005 and 2009 was likely due to the considerable increase in fish abundance. Seven out of nine individual metrics increased between 2005 and 2009, including the total number of fish species, number of riffle benthic insectivorous individuals, number of minnow species, proportion of tolerant individuals, proportion of pioneering species, and total number of individuals. Field data sheets from the 2009 fish monitoring task are included in ***Appendix D***.



Station ID	FIBI Percent Score (Narrative Ranking)	
	2005	2009
CJBC203	28 (Poor)	74 (Good)

Figure 3.16.11 – Pre-Restoration Fish Index of Biological Integrity (FIBI) Percentages at CJBC203

Dominant Species

The pre-restoration fish community at CJBC203 was dominated by *Rhinichthys atratulus* (blacknose dace) and *Rhinichthys cataractae* (longnose dace), which made up 55 percent and 13 percent of the community, respectively. Several other species were collected including *Notropis procne* (swallowtail shiner), *N. buccatus* (silverjaw minnow), *Lepomis cyanellus* (green sunfish), *Catostomus commersonii* (white sucker), *L. macrochirus* (bluegill), *Pimephales notatus* (bluntnose minnow), *Semotilus atromaculatus* (creek chub), and *Campostoma anomalum* (central stoneroller).

Tolerance Values

Tolerant fish species heavily dominated CJBC203 prior to restoration (80 percent) (***Figure 3.16.12***). Tolerant species collected at this site included blacknose dace, bluegill, bluntnose minnow, creek chub, green sunfish, swallowtail shiner, and white sucker. The remainder of individuals collected are considered intermediate in sensitivity, and include central stoneroller, longnose dace, and silverjaw minnow.

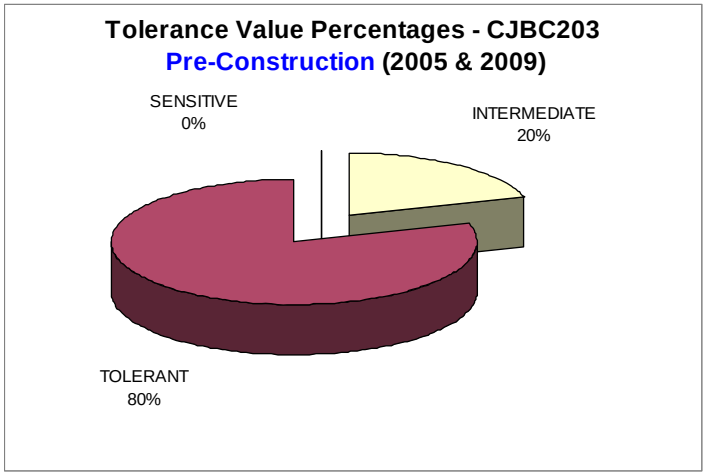


Figure 3.16.12 – Fish Tolerance Composition at CJBC203 Prior to Restoration

Functional Feeding Groups

During the pre-restoration period, site CJBC203 was heavily dominated by omnivorous fish species, which comprised 91 percent of the fish community (***Figure 3.16.13***). Omnivorous fish species collected at this site included blacknose dace, bluntnose minnow, longnose dace, silverjaw minnow, swallowtail shiner, and white sucker. Generalists made up most of the rest of the community (nine percent), with more specialized feeding groups including invertivores (bluegill) comprising only 0.1 percent of the community.

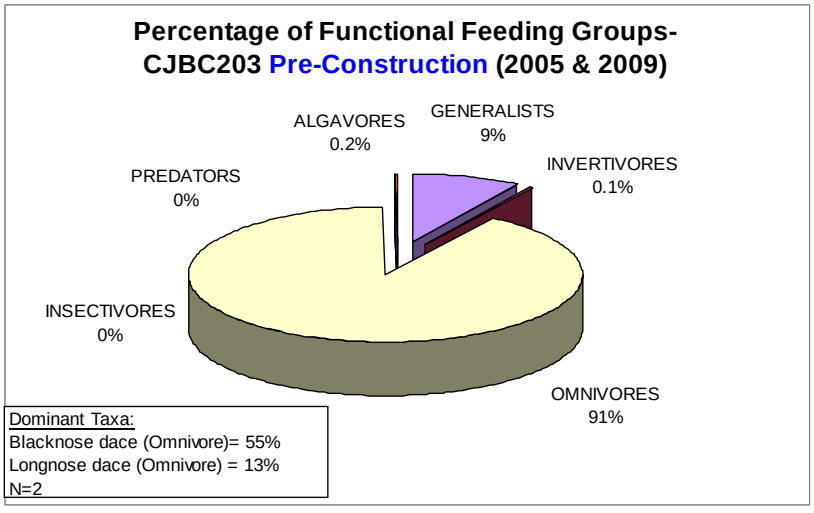


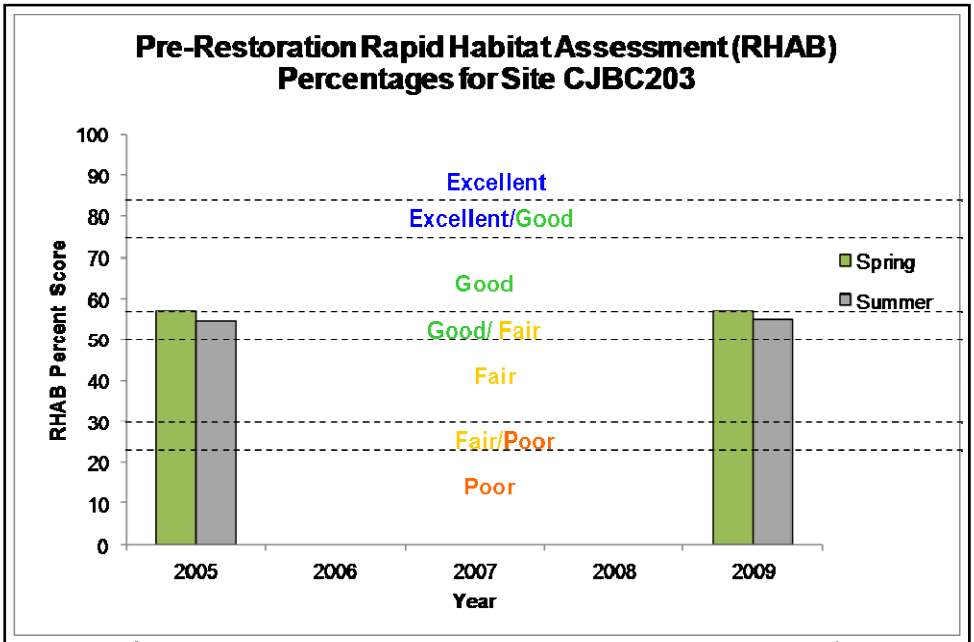
Figure 3.16.13 – Fish Functional Feeding Group Composition and Dominant Species at CJBC203 Prior to Restoration

Pioneer Fish

Non-pioneer fish comprised 33 percent of the community prior to restoration; however non-pioneer species were absent in 2005. Thirty-six percent of the 2009 fish community was made up of non-pioneer fish. The overall increase of fish abundance and diversity from 2005 to 2009 likely contributed to the increase in non-pioneer fish between years.

Qualitative Habitat

Pre-restoration aquatic habitat was evaluated at CJBC203 in the spring and summer of 2005 and 2009. During this time, aquatic habitat percentages were similar, with scores in the Good range in the spring and in the Good/Fair range in the summer of each monitoring year. Epifaunal substrates for benthic macroinvertebrates were generally suboptimal, fish habitats ranged from marginal to suboptimal, and streambanks were moderately stable. ***Figure 3.16.14*** shows aquatic habitat scores before restoration at CJBC203.



Station ID	RHAB Percent Score (Narrative Ranking)			
	2005		2009	
	spring	summer	spring	summer
CJCB203	57(Good)	54.5 (Good/Fair)	57 (Good)	55 (Good/Fair)

Figure 3.16.14 – Pre-Restoration Rapid Habitat Assessment (RHAB) Percentages at CJBC203

Quantitative Habitat

Quantitative monitoring was scheduled to occur at CJBC203 in 2009, but was delayed due to problems locating the benchmarks. Data were collected in 2010 and will be presented in the 2010 report.

Water Chemistry

All in-situ water quality parameters were in compliance with COMAR standards for Use I-P streams during the pre-restoration period (***Table 3.16.2***).

Table 3.16.2 – Pre-restoration in-situ Water Chemistry Data at CJBC203

Water Quality Parameter	Monitoring Year			
	2005		2009	
	spring	summer	spring	summer
Dissolved oxygen (mg/L)	16.36	8.48	-	6.02
Dissolved oxygen (% saturation)	157	101	-	63
pH	7.85	7.55	7.80	6.77
Conductivity (µmhos)	540	539	496	463
Water temperature (ºF)	55.8	75.6	73.4	63.9

Freshwater Mussels

Pre-restoration freshwater mussel communities were assessed at CJBC203 in 2009. During this time, there was no evidence of live or dead freshwater mussels in the vicinity of the stream restoration project.

3.16.5 Discussion

Water Quality and Aquatic Habitat

Overall, the aquatic community, including benthic macroinvertebrates and fish were variable over the pre-restoration period. In 2005, both the benthic macroinvertebrate and fish communities had very low abundances and therefore scored in the Poor BIBI range; only seven and three individuals were collected, respectively. In 2009, abundances of both communities increased substantially and IBI scores therefore improved. The benthic macroinvertebrate community remained in the Poor range but increased in percentage from 20 to 30. The fish community improved to the Good range. Tolerant individuals dominated both the benthic macroinvertebrate and fish communities and individuals intermediate in sensitivity comprised 20 and 15 percent of the communities, respectively. Specialized functional feeding groups were present in only minor amounts, making up eight percent of the benthic macroinvertebrate community and only 0.1 percent of the fish community. No freshwater mussels were observed in the project area prior to restoration. All water chemistry parameters were in compliance with COMAR Use I standards. Aquatic habitat scores were stable prior to restoration, remaining in the Good and Good/Fair ranges.