# Syers Creek Large Wood Augmentation
## Pre- and Post-Treatment Monitoring Report, October 2016

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**PROJECT BACKGROUND**

Syers Creek is a small cold-water tributary to the Little Manistee River that supports self-sustaining populations of five salmonid species (Chinook and coho salmon, steelhead, brown, and brook trout), one or more sculpin species (mottled and/or slimy), and a number of cool-water species (Tonello 2001 and 2001a). Augmentation of large wood in the Syers Creek channel to improve habitat was first suggested by Tonello (2001, 2001a). In the fall of 2010, the Little Manistee Watershed Conservation Council and Conservation Resource Alliance proposed to the Forest Service augmenting wood in the short segment on National Forest System lands immediately upstream of the confluence with the Little Manistee River and downstream of the M-37 culvert. Pre-treatment surveys measuring channel morphology characteristics and a National Environmental Policy Act (NEPA) analysis were completed in the spring of 2011 during low-flow conditions. A second survey of channel morphology was completed the spring of 2012 prior to the addition of wood structures that summer. A post-treatment survey of channel morphology characteristics was made during June 2013, August 2015, and again in October 2016. These pre- and post-treatment data are compiled and presented here in this report

Representative photographic comparison of channel structures under low-flow and bankfull channel conditions are presented below (Figure 1) to provide a perspective of the wood structures and how they function during a variety of flows.

Syers Creek, low flow conditions, 11 July 2012 | Same location, bankfull flow, 31 Jan 2013 | Same location, bankfull flow, 16 April 2013

Figure 1. Photographic comparison of wood structures installed in the Syers Creek channel under low and bankfull flood conditions.

**DESIGN GOALS AND OBJECTIVES**

The target segment of Syers Creek is a pool-riffle channel type (C channel type; Rosgen 1996). As a primary goal, CRA and DNR staff identified a need for the addition of wood to Syers Creek to help create scour and expose buried gravels in the substrate that provide optimal spawning habitat for various salmonid species, notably the steelhead trout population of the Little Manistee River. Wood additions would also help provide cover to juvenile fish important to their survival and recruitment to older age classes. Additional benefits to channel

morphology expected included narrowing of what was considered to be an over-widened channel, and an increase to channel depth and sinuosity. These goals were identified in the NEPA analysis.

The objectives to meeting these goals were to: 1) remove alder growing horizontally into the channel and 2) install log structures mimicking log jams at strategically spaced locations along the the stream bank. The expectation was that alder removal and structure installment would influence scour laterally and vertically, increasing depth (pools) and sinuosity while also "flushing" sediments into depositional areas such that the channel would narrow. Using Rosgen's channel typing convention, the morphology of the channel was expected to evolve from that of a "C" channel toward more of an "E" channel type.

**CHANNEL MORPHOLOGY**

Syers Creek is a low gradient pool-riffle channel type draining 5,460 acres of sandy glacial outwash plains in the headwaters of the Little Manistee River basin. The treatment section entails the 479 feet of channel immediately confluent to the Little Manistee River and has increased with sinuosity. Surrounding habitat is primarily forested uplands and seasonal wetlands comprised of mixed hardwood forest canopy. Alder saplings growing horizontally into the channel were removed as part of the original treatment. Stream bed surface substrate was dominated by sand with some patches of small gravel exposed. Large wood existed in the channel at low levels, some of which was buried completely in the substrate functioning as localized hydraulic controls. Data were analyzed using box plot distribution in Figures 2-5.

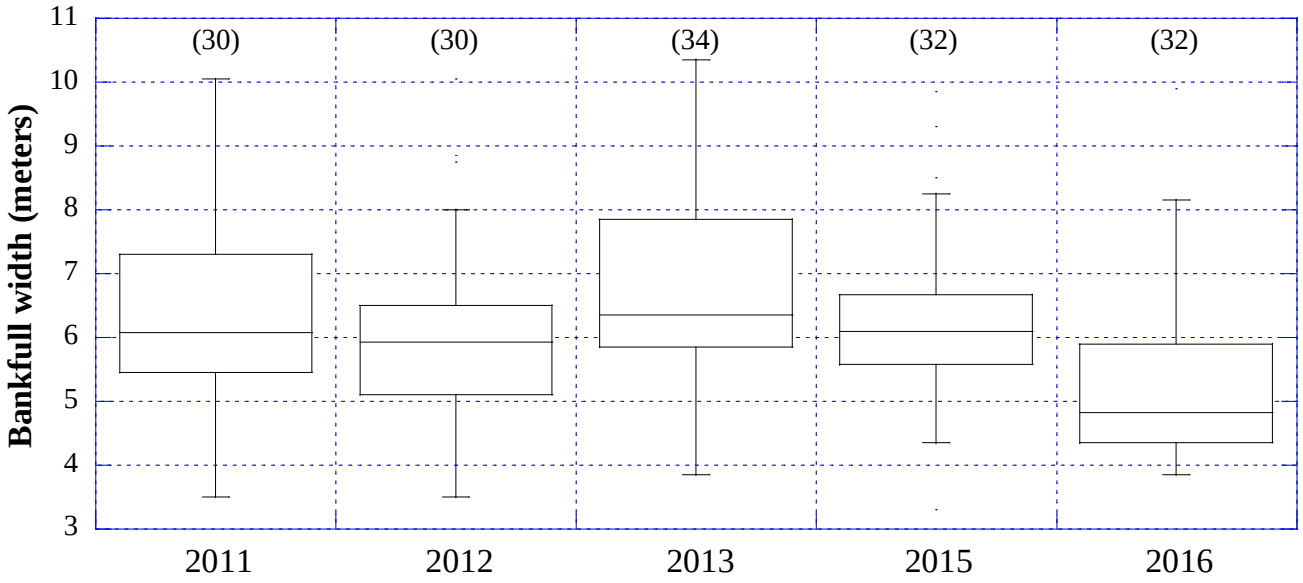


Figure 2. Annual distributions of bankfull width from 2011 through 2016 in the segment of Syers Creek augmented with wood in the late summer of 2012. Numbers in parentheses are the number of bankfull widths measured.

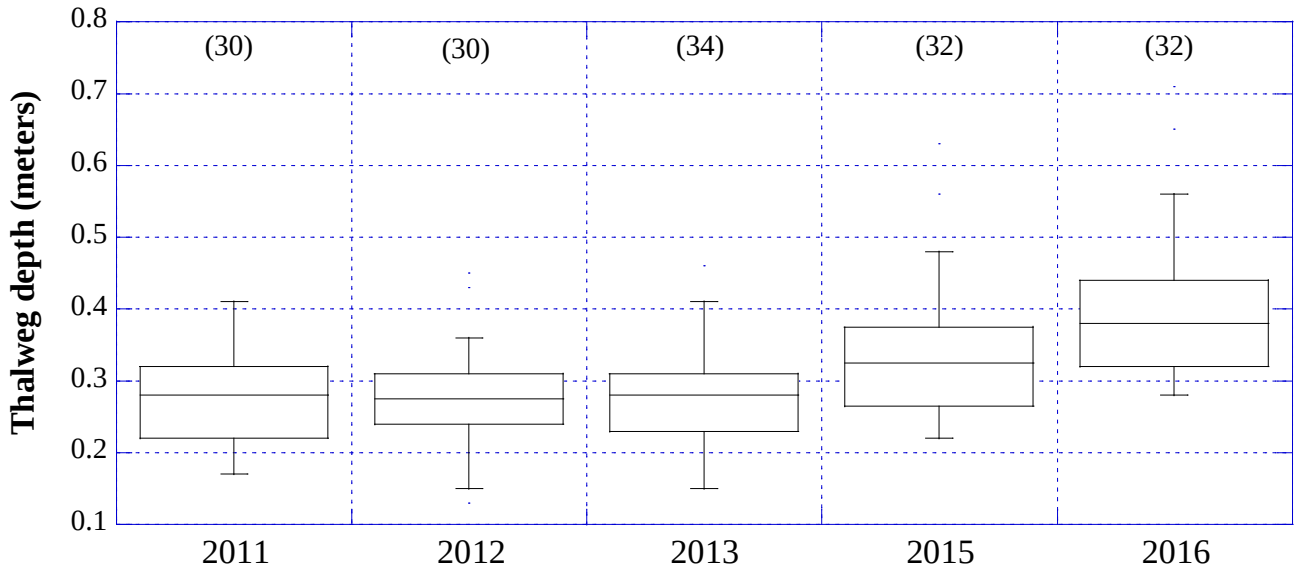


Figure 3. Annual distributions of thalweg depth in the treatment segment of Syers Creek, 2011-2015. Depth is measured as maximum thalweg depth. Numbers in parentheses are the number of depths measured.

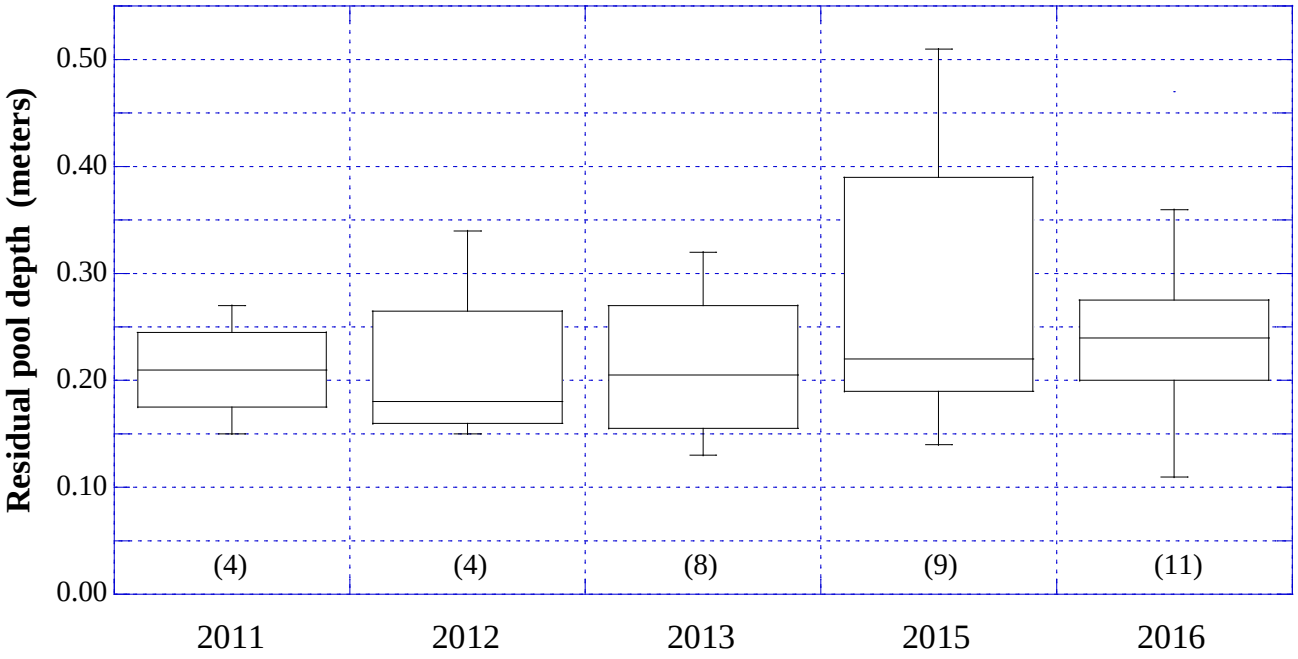


Figure 4. Annual distributions of residual pool depth in the treatment segment of Syers Creek, 2011-2015. Numbers in parentheses are the number of pools.

Results indicate that previous to 2015, distributions of bankfull width (Figure 2) and maximum thalweg depth (Figure 3) remained fairly similar to pre-treatment values. Since 2015, the trend in channel configuration has been a narrowing of bankfull width and deepening of the thalweg, although water depth measures may be confounded by measurements made at different discharges in individual years. Relative to pre-treatment values, pool abundance doubled by 2015, and tripled by 2016 (Figure 4). The trend in median residual pool depth has increased annually since 2012, although a trend is not strongly apparent in the box-plot distributions. In 2015, all pools identified were associated with structures, and while not all structures exhibit scour or pools, the data indicate that the intended vertical scour of the channel is occurring.

Channel length increased dramatically in 2013, but has decreased somewhat in 2015 and 2016. Measures of percent dominant substrate varied from 2011 to 2013 (Table 1), however the recent trend has been an increase in percent sand in 2015 and 2016. This is supported by observations during the habitat survey of considerable areas of the stream bed being covered with soft deposits of sand, easily felt underfoot. Given that vertical scour is occurring at structures and channel width is narrowing throughout the reach, one possibility may be that the sediment regime is being augmented by a new source of fine sediments located upstream. Overall, the channel is narrowing and deepening, however the objective of creating spawning habitat from scouring the bed to expose gravel patches is not currently being achieved. This may be due to what appears to be a high bedload of fine sediments that may be entering the system from an unknown upstream source.

Table 1. Dominant streambed substrate and channel length, Syers Creek, 2011-2016.

| | 2011 | 2012 | 2013 | 2015 | 2016 |
|---|---|---|---|---|---|
| Channel length (m) | 146 | 146 | 167 | 157 | 155 |
| Dominant substrate - % sand | 83 | 90 | 85 | 91 | 94 |
| Dominant substrate - % gravel | 17 | 10 | 15 | 9 | 6 |

Lastly, it should be noted that ash trees in the riparian area have died off in recent years due to infestation by the Emerald ash borer, allowing for greater solar inputs to the stream and riparian corridor.

**FISHERIES SURVEYS**

Backpack electrofishing surveys of the entire treatment reach in Syers Creek have been conducted in 2012, 2015, and 2016, and are compiled in Table 2. In 2012, the community was dominated by a species of sculpin, brown trout, and central mudminnow, and included a warm-water component. Based on known ranges, the sculpin species are either mottled (*Cottus bairdii*) or slimy (*C. cognatus*), or possibly a combination of the two.

Table 2. Results of electrofishing surveys of Syers Creek in the treatment reach, 2012, 2015, and 2016.

| Species | Water temperature type | Range of water temperature preferences (°F) | 14 June 2012 | | 22-24 July 2015 | | 15 Sept 2016 | |
|---|---|---|---|---|---|---|---|---|
| | | | Number of fish caught | Size range (TL mm) | Number of fish caught | Size range (TL mm) | Number of fish caught | Size range (TL mm) |
| Black bullhead | Warm | 46 - 86 | 1 | 79 | | | 2 | 60 - 63 |
| Bluegill | Warm | 34 - 97 | 6 | 47 - 65 | | | 3 | 43 - 53 |
| Pumpkinseed sunfish | Warm | 39 - 72 | 8 | 55 - 91 | | | | |
| Largemouth bass | Warm | 59 - 90 | 7 | 66 - 98 | | | | |
| Blacknose dace | Cool | 66 - 72 | | | | | 4 | 47 - 70 |
| Brook stickleback | Cool | 39 - 64 | 2 | 56 - 57 | 3 | 33 - 51 | | |
| Central mudminnow | Cool | 55 - 72 | 23 | 78 - 46 | 47 | 44 - 80 | 4 | 50 - 79 |
| Creek chub | Cool | 53 - 57 | | | | | 2 | 47 - 54 |
| Iowa darter | Cool | 45 - 77 | | | 1 | 67 | | |
| Johnny darter | Cool | 39 - 64 | | | 7 | 42 - 51 | | |
| Lamprey | Cool | 50 - 68 | 2 | NA | 1 | 115 | 1 | 160 |
| Brook trout | Cold | 43 - 52 | 8 | 137 - 172 | 7 | 45 - 211 | 3 | 85 - 151 |
| Brown trout | Cold | 54 - 61 | 25 | 51 - 225 | 39 | 32 - 249 | 6 | 77 - 196 |
| Chinook salmon | Cold | 54 - 63 | | | 11 | 36 - 90 | 1 | 93 |
| Coho salmon | Cold | 41 - 52 | | | 8 | 38 - 90 | | |
| Rainbow trout | Cold | 52 - 68 | 2 | 51 - 63 | 26 | 35 - 158 | 3 | 123 - 140 |
| Sculpin | Cold | 43 - 56 | 70 | 52 - 100 | 79 | 23 - 108 | 35 | 34 - 95 |

## SUMMARY

Channel morphology in the treatment segment has narrowed and deepened over the last two years, however exposure of gravel from scour has not increased as expected. The channel bedload appears to be experiencing an increase in fine sediments that not only restrict gravel exposure, but also deposits along the bank at a number of the structures, decreasing the channel's bankfull width. Channel deepening is occurring, as measured by both thalweg depth and residual pool depths. The percent gravel, as measured in the thalweg at the streambed surface, has actually decreased slightly with the addition of wood structures, and lends support to the possibility that fine sediment bedload is increasing somewhere upstream. To date, there is not a strong pattern of response in the fisheries community, although this may take some time for fish, particularly salmonids, to respond. Continued monitoring of habitat and fisheries, along with water temperatures, is needed to help better describe both physical and biological responses of this channel to the treatments.

## REFERENCES

Rosgen, D. 1996. Applied River Morphology.

Tonello, M. A. 2001. Fisheries Survey- Syers Creek. Michigan Department of Natural Resources, Cadillac.

Tonello, M. A. 2001a. Fisheries Survey- Unnamed tributary to Syers Creek. Michigan Department of Natural Resources, Cadillac.