(3.6) Fisheries and Watershed

(3.6a) Existing Condition and Resource-Specific Information

Watershed Condition

The rivers and tributaries within the Project Area are typically ground water fed with stable flow, high water quality, and carry a relatively high sediment load. This sediment loading is due, in part, to the inherently fine soils and surface alluvium across the landscape that are sensitive to management. Visual evidence of historic human use (i.e. timber harvesting and agriculture) is present in the form of old log rollways, drained wetland areas, and a highly-developed transportation network. The combination of these has influenced stream bank integrity, channel geomorphology, sediment budget, and the flood hydrograph such that channel function is impaired in most systems.

The watersheds in the Project Area exist within a fragmented landscape, in regard to both hydrology (dams, increasing road density, loss of wetlands, etc.,) and forest cover. Most forms of hydrologic fragmentation tend to narrow and heighten the flood hydrograph, increasing the risk of damage to stream bank integrity, channel morphology, aquatic habitat, and facilities located in the riparian/floodplain zone. Dams are one form of fragmentation that generally reduce the risk of flood impacts, but do have considerable impacts upon sediment regimes and biological processes, particularly species migration/population connectivity, timing of water delivery, and water temperature.

Forest cover fragmentation occurs over space and time as a result of natural processes (wildfire, wind events, other natural disturbances), but can be augmented when human activities (timber harvest, agricultural and urban land clearing, road building, etc.) increase the quantity and rate of fragmentation. Typically, mature forested stands protect watershed integrity, whereas increasing proportions of open land cover and immature stands (<15 years old) have negative impacts on watershed function and biological function. Such impacts particularly affect the rate of runoff, leading to flashier flows and changes in channel morphology. The Forests Plan (2006) addresses this issue of forest cover impacts to watershed function with a Desired Future Condition (DFC) of no more than 66% of any 6th level watershed on the forest being in early successional (open or immature) forest cover types. The existing percent open area in all four 6th code HUCs of the project area are less than the DFC.

Table 3.20: Early Successional Forest Cover (open area) in the Four 6th Code HUCs of the Project Area, including Percent Open Area (acreages approximate).

6th Code Watershed	Watershed Acres	Existing Open Acres	Existing Percent Open Area
Sand Creek – White River	30,920	5,528	18
South Branch White River	27,889	10,713	38
North Branch White River	29,248	10,693	37
Carlton Creek	17,845	7,826	44

Data quantified from current HMNF GIS data.

Roads and trails, collectively referred to as routes, are another form of fragmentation that can negatively impact streams and wetlands in a number of ways. As with open space, routes can accelerate the rate of runoff, and may also intercept and divert subsurface flow, reduce groundwater recharge and indirectly lead to the conversion of wetland vegetation types to upland types (Brooks, et. al. 1997). Where inappropriately designed or constructed structures create physical barriers at route/stream crossings, the upstream migration of aquatic organisms can be limited. Route crossings also act as point sources of fine sediment delivered to streams that can impact habitat important to a wide range of aquatic biota. The density of roads and trails (miles/mile^2) is a relative index of the impacts of routes to aquatic resources, and is reported in Table 3.21. Across the four 6th code HUCs of the Project Area, the density of road and motorized trails is ~2.4 miles per square mile of land, with the highest in the South Branch White River HUC (~2.9 mi/mi^2) and the least occurring in the Carlton Creek HUC (~1.9 mi/mi^2).

The national direction for assessing watershed condition (Potyondy, et. al. 2009) rates road densities as <1.0 mi/mi^2 as "Good", 1.0-2.4 mi/mi^2 as "Fair", and >2.4 mi/mi^2 as "Poor". Using these criteria, the watershed condition is poor in the South Branch White River sub-drainage, fair-to-poor in both the Carlton Creek and the Sand Creek-White River sub-drainages, and fair in the North Branch White River sub-drainage. Overall, the impacts to watershed condition from existing road densities within the Project Area are fair, and exceed the Forest Plan standard for Management Area 6.1 (Semiprimitive Nonmotorized). The Forest Plan (2006) identifies the maximum average road densities for all roads in Rural Management Areas (MA 4.4) as 0-3 mi/mi^2 (page II-40). This is met for the Project Area.

Table 3.21: Existing Miles and Densities of Roads and Trails (by 6th Code HUC).

6th Code HUC	USFS Road Miles / Density	USFS Trail Miles / Density	County Road Miles / Density	State Road Miles / Density	Total Miles / Density
Carlton Creek (27.9)	9.8 / 0.4	0.0 / 0.0	52.8 / 1.9	1.0 / 0.0	63.6 / 2.3
Sand Creek – White River (48.4)	21.4 / 0.4	17.9 / 0.4	70.1 / 1.5	0.0 / 0.0	109 / 2.3
South Branch White River (43.6)	27.4 / 0.6	28.7 / 0.7	70.0 / 1.6	5.0 / 0.1	126 / 2.9
North Branch White River (45.7)	11.1 / 0.2	0.0 / 0.0	64.8 / 0.8	10.1 / 0.2	86.0 / 1.9
Total (165)	**69.7 / 0.4**	**46.6 / 0.3**	**258 / 1.6**	**16.1 / 0.01**	**390 / 2.4**

**Numbers in parentheses are watershed area in square miles.*

Biological Resources

The Forest Plan recognizes 118 fish species and 16 mollusk species occurring within lakes and streams of the Forest's boundaries. The White River Watershed Preliminary Habitat Assessment (Annis Institute 2003) identifies 75 species of fish occurring in the White River basin. Many of these species exist within the Project Area, with typical warm-water game fish species including largemouth bass, smallmouth bass, northern pike, walleye, bluegill, and yellow perch. Common cold-water species include brook, brown, and rainbow trout, and mottled sculpin. Lake sturgeon is noted in the Forest Plan as occasionally straying into the White River system. Introduced species include chinook and coho salmon, and steelhead trout, which migrate from Lake Michigan into the White River and its tributaries to reproduce.

The Regional Forester has identified two sensitive aquatic species (Forest Plan, page III-71; *http://www.fs.fed.us/r9/wildlife/tes/docs/rfss_animals.pdf*) that may occur in the White River basin. These species are analyzed under the Biological Evaluation for this project and include the Lake sturgeon and the Creek heelsplitter. There are two management indicator species (MIS) identified in the Forest Plan: brook trout and mottled sculpin.

Within the Project Area, the creeks and rivers on National Forest System lands include the Main, South, and North Branches of the White River and Carlton, Mud, Sand, and Knutson Creeks. All of these are designated as brook trout streams by the State of Michigan. The only fish population data available for any of these streams was an outdated sample collected in an unknown length of lower Carlton Creek in August 1986. Rainbow trout, brook trout, and juvenile coho salmon (up to 10" in length) were recorded. Peterson mark-recapture estimates (combining all length classes by species) are provided below in Table 3.22.

Table 3.22: Electro-fishing Results of Lower Carlton Creek, August 18-20, 1986.

Species	Marked	New	Recaptures	Population Estimate
Rainbow trout	44	46	8	297
Brook trout	31	22	10	102
Coho salmon	7	8	1	63

In a study evaluating the probability of brook trout extirpation, Thieling (2006) identified a threshold range for route densities of 1.8-2.0 mi/mi² for predicting extirpation at the watershed scale. Theiling's criteria suggest that these densities in the Project Area are high enough to cause concern for brook trout populations, which are an MIS species on the HMNF. It should be noted that Thieling's criteria were developed for a wide variety of watershed types. Given the relatively low relief and the natural groundwater hydrology of the Project Area, brook trout populations may not be at as high of a risk of extirpation. Continued monitoring at the Forest scale will help better understand the distribution and health of brook trout populations.

Thieling also found that managers should be concerned when agricultural land cover (a subset of open space) is in the 12-19% range, or higher. While data describing agricultural land cover is not available in the HMNF GIS database and precludes such an analysis, Thieling's recommendation reflects how open space can impact brook trout and potentially other aquatic species and is worth considering.

(3.6b) Area of Analysis

The Savannah Ecosystem Restoration (SER) Project Area occurs within four 6th code sub-drainages of the White River basin; North Branch White River, South Branch White River, Sand Creek – White River, and Carlton Creek. The boundaries of each of these sub-drainages are defined and standardized nationally by the US Geological Survey at the 6th code hydrologic unit (HUC) level. While the area of the proposed project encompasses a relatively lesser portion of the four affected 6th code HUCs, the analysis of watershed effects is appropriate at the 6th code scale.

(3.6c) Direct and Indirect Effects of Alternative 1

The area of analysis for direct and indirect effects is defined by the combined outer boundary of the four 6th code HUCs that the project occurs in. Under this alternative poorly maintained roads and stream crossings would continue to contribute non-point source pollution – particularly fine sediments - to bodies of water within the Project Area. Poorly designed and/or installed stream crossings would continue to block passage of aquatic organisms. The high density and poor design of many of the routes would continue to fragment the watersheds and degrade their conditions. Early successional habitat within these watersheds would remain high.

(3.6d) Cumulative Effects of Alternative 1

The area of analysis for cumulative effects is defined by the combined outer boundary of the four sub-drainages that are present within the Project Area. This area was selected because all of the proposed activities occur within these sub-drainages and the effects of these activities should be limited to these areas. Cumulative effects are discussed for the foreseeable future, which is approximately 10 years.

Watershed management in these areas would continue to concentrate on erosion control by upgrading road stream crossings and rehabilitating the streambanks of at-risk areas. Incorporating woody debris in stream channels, along with improving old growth conditions in riparian corridors that are a source of wood debris to channels, would also be an additional focus of future watershed management activities. Overall, water quality and aquatic habitat in these watersheds would remain stable or improve slightly over time. Competition and predation by other fish species upon MIS fish populations in these watersheds would likely remain stable (see Table 3.23).

Table 3.23: Aquatic Management Indicator Species

MIS Species	Habitat	Status	Alternative 1	Alternative 2	Alternative 3
Brook trout (*Salvelinus fontinalis*)	Cold, spring-fed streams	Brook trout are common in the Project Area.	No change	Possible impacts to watershed function, but not likely to impact population	Possible impacts to watershed function, but not likely to impact population
Mottled sculpin (*Salmo trutta*)	Cold, spring-fed streams	Mottled sculpin are abundant in the Project Area.	No change	Possible impacts to watershed function, but not likely to impact population	Possible impacts to watershed function, but not likely to impact population

(3.6e) Direct and Indirect Effects of Alternatives 2 and 3

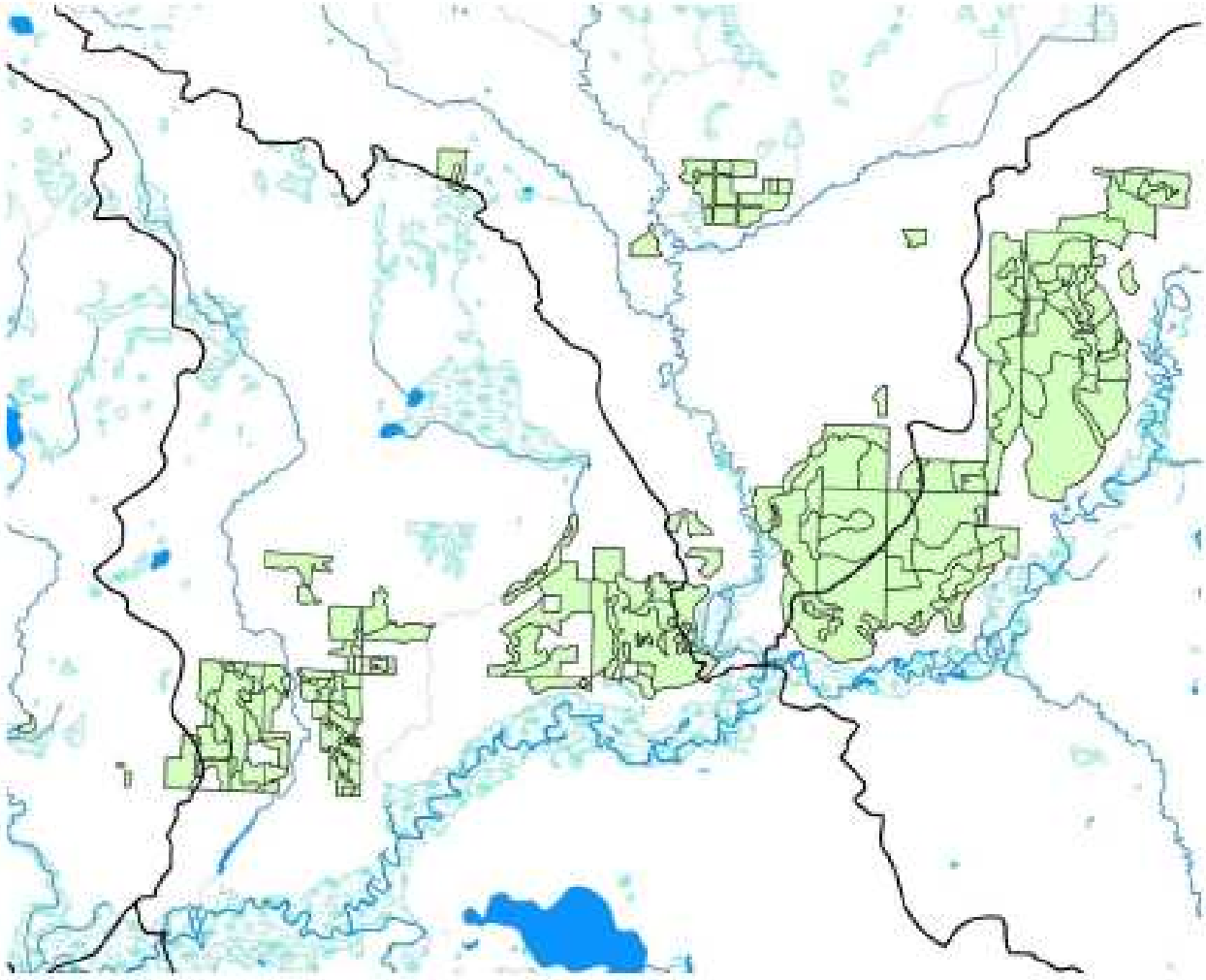
The area of analysis for direct and indirect effects to aquatic resources includes the four 6th code HUCs where treatment occurs. Under both Alternative 2 and Alternative 3, a total of ~4,732 acres (based on the current HMNF GIS data) of management activities are proposed within the Project Area, the majority of which is located in the South Branch White River basin (Table 3.24). The Sand Creek–White River, North Branch White River, and Carlton Creek HUCs contain 28%, 28%, and 2% of the total treatment acres, respectively (Figure 3.6). The use of conservation measures (see Appendix A) and the State of Michigan's Best Management Practices (BMPs), particularly the buffer layout on all streams, would mitigate any direct impacts to aquatic resources from the harvest or treatment of trees or vegetation.

Vegetation treatments would create pockets of non-forest cover (i.e., open acres) in each of the 6th code HUCs, resulting in indirect effects to the flood hydrograph, streambank integrity, channel geomorphology, and sediment budget. The greatest potential change in non-forest cover would occur in the South Branch White River HUC (~10% increase), followed by the North Branch White River and Sand Creek-White River HUCs (~5% each) and Carlton Creek (~1%). For all four 6th code HUCs, increases in non-forest cover resulting from implementation of either Alternative 2 or Alternative 3 would not exceed the DFC of 66% described in the Forests Plan. Adherence to the Watershed Management standards and guidelines (Forests Plan, pages II-18 to II-22), particularly the Streamside Management Zone (SMZ) guideline, would protect aquatic resources from any direct impacts by vegetation management.

Table 3.24: Watershed Areas and Acres of Open Habitat (stratified by 6th code HUCs)

6th Code Watershed	Watershed Acres	Existing Open Acres	Existing Percent Open Area	Total Unit Acres	Proposed Percent Open Area
Sand Creek – White River	30,955	5,528	18	1,426	22
South Branch White River	27,914	10,713	38	2,180	46
North Branch White River	29,277	10,693	37	1,016	40
Carlton Creek	17,864	7,826	44	63	44

Figure 3.6: Map of the wetland areas that are present in the Project Area.



Areas of treatment are represented by solid gray.

Given the generally flat topography and the lack of any road-stream crossings associated with the roads proposed for closure, there is a low probability of either of the action alternatives reducing the existing amounts of sediment input. Closure of forest system roads under Alternative 2 (9.7 miles) and Alternative 3 (10.4 miles) would each provide a very slight reduction of sediment introduced to local streams.

The creation of 19.7 miles of new horse trail proposed under Alternative 2 would not result in sediment impacts as the trail corridor would be constructed to Watershed Management standards and guidelines (Forests Plan, pages II-18 to II-22). The SMZ guidelines should be effective in protecting aquatic resources from impacts of the proposed horse trail, except at the two locations where riders would be allowed access to the river to collect water by bucket. These two sites would be selected and designed with input from the District Fisheries Biologist to reduce the potential for erosion and sediment routing into the stream. Generally, low levels of human foot traffic would not result in erosion; however, site conditions are an important factor to a site's resistance to trampling. These two sites would be monitored for signs of

erosion. If erosion becomes a problem, alternative designs would include creating off-site water sources. Traditional designs such as hardening of the stream bank should be avoided (Forest Plan, pages II-21 and II-22).

The closure of roads under each alternative would provide a small contribution to increased groundwater recharge. Groundwater input into streams helps keep water temperatures reduced and more suitable for coldwater fish species like brook trout and sculpin (Brooks, et. al. 1997). There would be no discernible difference between Alternative 2 or 3 relative to the effect of increased groundwater recharge.

Glyphosate, Triclopyr and Imazapyr are proposed for use to control the growth of woody vegetation in designated KBB areas and the spread of NNIS throughout the Project Area. A complete analysis of the herbicides proposed for use can be found in Appendix C. There are not expected to be any direct or indirect effects to aquatic species from herbicide application under either Alternative 2 or Alternative 3, as BMPs/conservation measures would be followed.

(3.6f) Cumulative Effects of Alternatives 2 and 3

Watershed management in these areas will continue to concentrate on reducing the potential of erosion and the associated sediment input into streams, upgrading road stream crossings, maintaining/restoring riparian buffer zones, and improving in-stream and lake habitat. These types of projects should lead to improved water quality and aquatic habitat.

Due to the changes in land use within the White River basin over time, there have also been changes in the flood hydrograph. The intense logging of the 1800s, followed by agricultural development, a period of reforestation, and urban development has altered the characteristics of this basin from what occurred historically (late 1700s). Currently, approximately 30% of the White River basin is now considered open (cropland, open field, or early successional forest). Approximately 10% of the wetlands in the watershed have been lost to drains as part of agricultural/urban development (Rediske et al. 2003). As a result of these changes in land use, there have been increases in the rates of flow delivery and bank erosion and changes in channel morphology and the rates of groundwater recharge. As the human population continues to increase within the watershed, the patterns of development will continue to expand, further aggravating these impacts to hydrologic function and aquatic resources.

Vegetation treatments proposed under both action alternatives would further increase open space within the affected HUCs. This is a concern in the White River basin where non-forested area is already relatively high. The creation of additional non-forest area within this basin would further exasperate impacts to the flood hydrograph and other aquatic resources, but do not exceed the DFC in the Forest Plan. These impacts to hydrologic function are known to continue downstream and may impact aquatic resources outside the Project Area, but are difficult to monitor, much less quantify.