

Integration and Goal Setting

In the context of a watershed, water quality cannot be measured or understood using a handful of water chemistry indicators. It is important to also look at the hydrology, biology, and physical conditions of watershed and its water bodies. In addition, the feeling and perceptions of watershed residents relative to water quality must be considered. Numerous professional disciplines, as well as many residents, were involved in the South Branch Root River diagnostic study to help attain a comprehensive understanding of the watershed. This understanding provides a basis for setting realistic goals.

It is a significant challenge to integrate the various aspects of water quality in a meaningful ways. Anticipated cause-and-effect relationships are not always apparent. Decent fish habitat, for example, was found in areas of intensive row cropping and high sedimentation. In some cases, the three-year duration of a diagnostic study is simply not long enough to account for the substantial year-to-year variability in weather, water chemistry, and stream biology.

Table IG-1 is an attempt to summarize some key watershed and water quality characteristics revealed from the diagnostic study. The table is divided into the three subwatersheds defined by the three primary flow and water chemistry monitoring stations, and subdivided into the minor watersheds included in the subwatersheds. It will be helpful to review the table in conjunction with the many maps prepared for the projects. These maps display basic watershed features, monitoring station locations, and the results of geographic information system analysis.

The diagnostic study provides the basis for goal setting and prioritization that reflects the varying physical, chemical, biological, and landscape conditions found in the watershed. Flow stabilization and nitrate reduction is a clear goal in the upper portion of the watershed. Efforts to reduce sedimentation and protect mussel species focus on the middle portion. Citizen monitoring efforts have provided areas within the middle portion

to target for transparency improvements. Maintaining the economically important trout fishery is critical for the lower South Branch Root, as well as Etna, Canfield, and Forestville creeks. Table IG-2 describes these and other goals and priority areas.

It needs to be acknowledged that some of the numeric water chemistry goals are based on annual flow-weighted mean concentrations meeting a particular level or standard. There will still be times, perhaps periods of days or even weeks, when these levels or standards will be exceeded. This is a realistic approach to water chemistry goal setting in stream systems and should belie the aggressive nature of the goals.

Table IG-1. South Branch Root River Summary Table

Primary subwatersheds (in bold) and minor watersheds	Drainage Area (acres)	Land Use and Topography	Hydrologic Characteristics	Water Chemistry Concerns	Biology	Stream Physical Condition
Upper South Branch	9,500	flat; very high percentage row crop	intensive tile drainage; very high runoff	fecal coliform bacteria; nitrate	warm water; no live mussels present; impaired based on invertebrates; somewhat better based on fish	channelized; has regained more natural form
Judicial Ditch 1 North	5,962	flat; very high percentage row crop	intensive tile drainage; very high runoff	fecal coliform bacteria; nitrate	warm water; no live mussels present; impaired based on invertebrates; somewhat better based on fish	channelized; has regained more natural form
Judicial Ditch 1 South	3,263	flat; very high percentage row crop	intensive tile drainage; very high runoff	nitrate	warm water; relatively good overall based on fish, invertebrates, and mussels	some channelization; has regained more natural form

Table IG-1 (continued)

Primary subwatersheds (in bold) and minor watersheds	Drainage Area (acres)	Land Use and Topography	Hydrologic Characteristics	Water Chemistry Concerns	Biology	Stream Physical Condition
Middle South Branch (also referred to as South Branch West)	19,794	moderate slopes; high percentage row crop	less tile drainage than upper site; karst features; runoff high, but less than upper subwatershed	suspended solids; phosphorus; fecal coliform bacteria; transparency	warm water; highest mussel abundance and diversity; fair to good based on fish and invertebrates	natural channel; high gradient in some areas; functioning flood plain in some areas
Lower South Branch (also referred to as South Branch East)	44,941	steep slopes; large areas of forest; highest density of livestock facilities and animal units	karst; runoff slightly lower than middle subwatershed	suspended solids; phosphorus	only “poor” site based on fish; better based on invertebrates	natural channel; entrenched in many areas; eroding banks
Etna Creek	4,403	moderate slopes; somewhat less row crop than areas to east	some hydric soils in upper portion of minor watershed	see Lower South Branch	cold water; some impairment based on fish and invertebrates; no live mussels found in coldwater sections	natural channel

Table IG-1 (continued)

Primary subwatersheds (in bold) and minor watersheds	Drainage Area (acres)	Land Use and Topography	Hydrologic Characteristics	Water Chemistry Concerns	Biology	Stream Physical Condition
Forestville Creek	10,871	steep slopes; lower portions forested; second highest density of livestock facilities but second lowest animal unit density	karst	fecal coliform bacteria; see also Lower South Branch	fair to good based on fish and invertebrates	natural channel
Canfield Creek	18,406	steep slopes; lower portions forested	karst; some hydric soils in upper portion of minor watershed	see Lower South Branch	best overall condition among cold water sites	natural channel

Table IG-2. South Branch Root River Goals and Priorities

Subwatershed	Water Quality and Pollutant Reduction Goals	Priority Areas (minor watershed or other)
Upper South Branch	<ul style="list-style-type: none"> • reduce flows, particularly for events with a recurrence interval of < 20 years • reduce long-term nitrite + nitrate N flow-weighted mean concentrations to < 10 mg/l (25-30% reduction) • reduce fecal coliform bacteria levels to meet state water quality standard (geometric mean < 200; single sample <2000) • maintain and enhance existing stream habitat; and fish, mussel, and invertebrate communities 	<ul style="list-style-type: none"> • Judicial Ditch 1 – North (fecal coliform) • Judicial Ditch 1 – South (biological enhancement)
Middle South Branch	<ul style="list-style-type: none"> • reduce long-term TSS flow-weighted mean concentration to 25 mg/l (60-80% reduction) • reduce turbidity such that a flow-weighted average meets the water quality standard of 25 NTU's • Shorten stream transparency “recovery times” • reduce long-term total phosphorus flow-weighted mean concentration to 0.15 mg/l (40-60% reduction) • reduce fecal coliform bacteria levels to meet state water quality standard (geometric mean < 200; single sample <2000) • protect and enhance existing aquatic habitat and communities, especially that of unionid mussels 	<ul style="list-style-type: none"> • areas identified through citizen stream monitoring as having chronically low transparency • east portion of subwatershed - downstream of Hwy. 63 (protect and enhance mussel populations)

Table IG-2 (continued)

<p>Lower South Branch</p>	<ul style="list-style-type: none"> • reduce long-term TSS flow-weighted mean concentration to 25 mg/l (60-75% reduction) • as an initial goal, reduce turbidity such that a flow-weighted average meets the water quality standard of 25 NTU's; over the long term, try to meet trout stream water quality standard of 10 NTU's • Shorten stream transparency "recovery times," especially during critical time windows of high fishing pressure in the spring and spawning in the fall • reduce fecal coliform bacteria levels to meet state water quality standard (geometric mean < 200; single sample <2000) • reduce long-term total phosphorus flow-weighted mean concentration to 0.15 mg/l (50-70% reduction) • protect and enhance existing aquatic habitat and communities, especially to maintain recreational trout fishery 	<ul style="list-style-type: none"> • Forestville Creek (fecal coliform) • west portion of subwatershed – upstream of Mystery Cave (protect and enhance mussel populations) • downstream of Mystery cave and tributaries (protect and enhance cold water fishery)
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Basis/Justification of numeric goals -

Nitrite + Nitrate N: State drinking water standard of 10 mg/l

Fecal Coliform Bacteria: State water quality standards for Class 2 Waters

Total Suspended Solids: Approximate value of lower 25th percentile for Western Corn Belt Plains Ecoregion Streams; approximately equivalent to 25 NTU water quality standard for turbidity

Turbidity: State water quality standards

Total Phosphorus: EPA guideline of 0.1 mg/l seem unattainable in the short term, so approximate value of lower 25th percentile for Western Corn Belt Plain Ecoregion Stream was applied.