

TRIENNIAL STANDARDS REVIEW OF
KOSHKONONG CREEK, DANE CO., WI
LOWER ROCK DRAINAGE BASIN

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
DECEMBER, 1989

Prepared by David Marshall

Koshkonong Creek is an agricultural drainage ditch that originates near the City of Sun Prairie and flows 42 miles to the confluence with the Rock River. At the headwaters, flow is intermittent and the USGS estimated Q7,10 is .01 CFS. During dry periods, industrial cooling water contributes the only flow above the municipal wastewater treatment plant. Habitat in the stream is also limited by a combination of channelization, sediment, and excessive aquatic plant growth. Consequently, the stream supports unbalanced aquatic communities tolerant of low flow and poor habitat.

In November, 1988, fish and macroinvertebrates were collected from three locations in the marginal classification zone (MARG-E). Above the wastewater treatment plant, the fishery was limited to brook sticklebacks and green sunfish only. Representative macroinvertebrates indicated "poor" water quality based on a Hilsenhoff Biotic Index (HBI) value of 7.91. A short distance below the wastewater treatment facility, the fishery consisted of numerous bluntnose minnows, brook sticklebacks, and green sunfish. The HBI value at that location was 7.68, also reflecting "poor" conditions. Further downstream where the fish and aquatic life (FAL-B) classification begins, the fishery was expanded to include white suckers, fathead minnows, and johnny darters. The HBI (7.19) indicated "fairly poor" water quality and a slight improvement compared to upstream sampling stations.

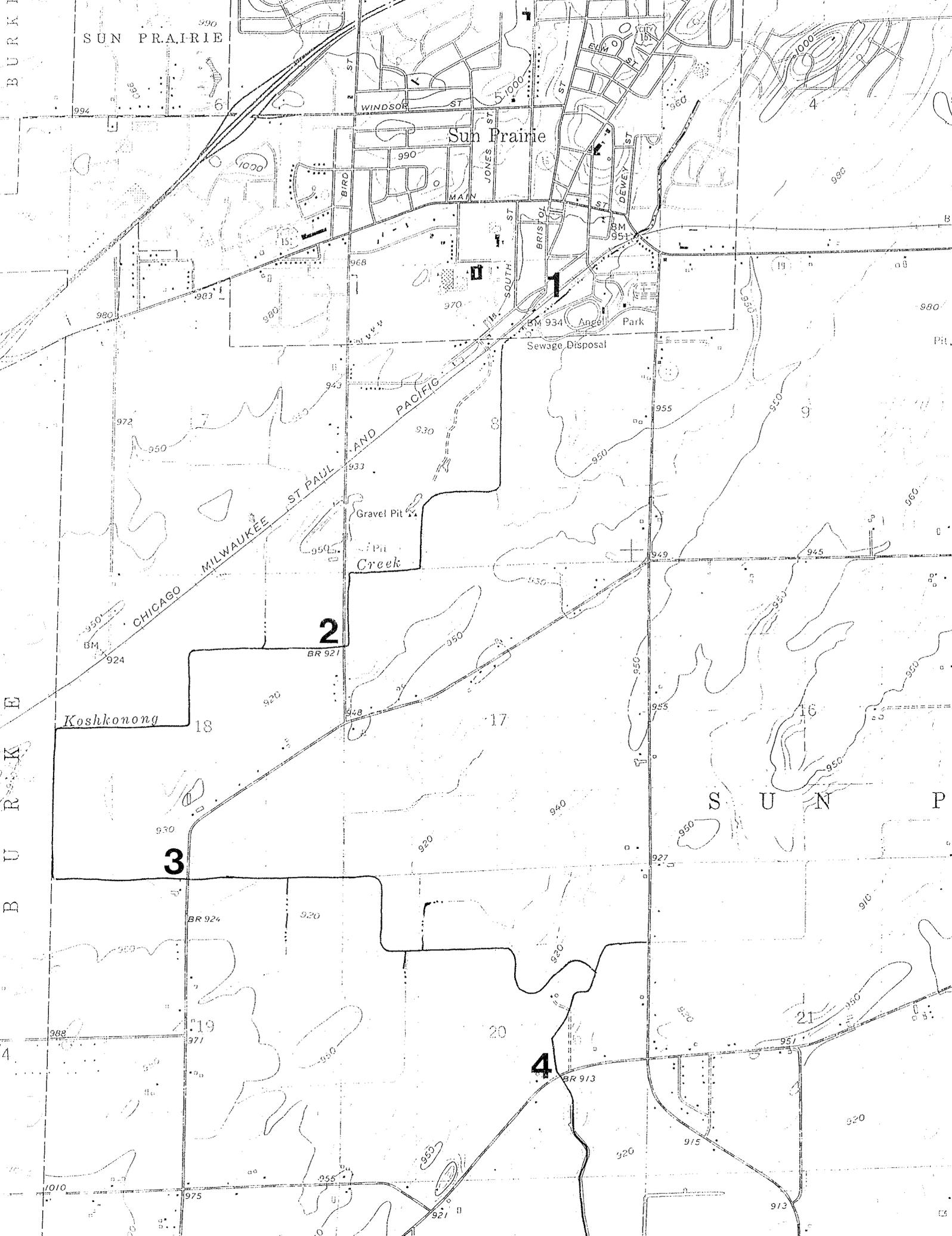
Table 1 compares 1980 HBI values, collected prior to wastewater treatment upgrade in 1982, with post-operational BI values from 1983 to 1988. In general, the water quality improved from "very poor" to "poor" after the new treatment plant became operational. Further water quality improvements are limited by a combination of low flows, channelization, urban nonpoint source pollution and agricultural nonpoint source pollution. The marginal classification (MARG-E) accurately characterizes low stream use potential.

TABLE 1: Koshkonong Creek HBI Values - 1987 Revision

Location (See Map)	1980		1983		1988
	Spring	Fall	Spring	Fall	Fall
1	6.58	6.78	6.0	5.16-6.36	7.91
2	9.63	9.25	7.11	7.57	
3	9.98	9.98	6.45	7.86	7.68
4	8.43		7.93	7.85	7.19

TABLE 2: 1988 Fish Shocking Survey

Location	
1	Brook sticklebacks - abundant Green sunfish - abundant
3	Bluntnose minnows - abundant Brook sticklebacks - abundant Green sunfish - common
4	Bluntnose minnows - abundant Brook sticklebacks - abundant Fathead minnows - abundant Green sunfish - 4 Johnny darters - abundant White suckers - 6



SUN PRAIRIE

Sun Prairie

2

3

4

Koshkonong

Gravel Pit
Creek

Angel Park
Sewage Disposal

S U N P R A I R I E

Stream Koshkonong Reach Location MARG-E ZONE Reach Score/Rating 252 Poor
 County Dane Date 11-88 Evaluator Marshall Classification MARG-E

Rating Item	Category			
	Excellent	Good	Fair	Poor
Watershed Erosion	No evidence of significant erosion. Stable forest or grass land. Little potential for future erosion. 8	Some erosion evident. No significant "raw" areas. Good land mgmt. practices in area. Low potential for significant erosion. 10	Moderate erosion evident. Erosion from heavy storm events obvious. Some "raw" areas. Potential for significant erosion. 14	Heavy erosion evident. Probable erosion from any run off. 16
Watershed Nonpoint Source	No evidence of significant source. Little potential for future problem. 8	Some potential sources (roads, urban area, farm fields). 10	Moderate sources (small wetlands, tile fields, urban area, intense agriculture). 14	Obvious sources (major wetland drainage, high use urban or industrial area, feed lots, impoundment). 16
Bank Erosion, Failure	No evidence of significant erosion or bank failure. Little potential for future problem. 4	Infrequent, small areas, mostly healed over. Some potential in extreme floods. 8	Moderate frequency and size. Some "raw" spots. Erosion potential during high flow. 16	Many eroded areas. "Raw" areas frequent along straight sections and bends. 20
Bank Vegetative Protection	90% plant density. Diverse trees, shrubs, grass. Plants healthy with apparently good root system. 6	70-90% density. Fewer plant species. A few barren or thin areas. Vegetation appears generally healthy. 9	50-70% density. Dominated by grass, sparse trees and shrubs. Plant types and conditions suggest poorer soil binding. 15	<50% density. Many raw areas. Thin grass, few if any trees and shrubs. 18
Lower Bank Channel Capacity	Ample for present peak flow plus some increase. Peak flow contained. W/D ratio <7. 8	Adequate. Overbank flows rare. W/D ratio 8-15. 10	Barely contains present peaks. Occasional overbank flow. W/D ratio 15-25. 14	Inadequate, overbank flow common. W/D ratio >25. 16
Lower Bank Deposition	Little or no enlargement of channel or point bars. 6	Some new increase in bar formation, mostly from coarse gravel. 9	Moderate deposition of new gravel and coarse sand on old and some new bars. 15	Heavy deposits of fine material, increased bar development. 18
Bottom Scouring and Deposition	Less than 5% of the bottom affected by scouring and deposition. 4	5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools. 8	30-50% affected. Deposits and scour at obstructions, constrictions and bends. Some filling of pools. 16	More than 50% of the bottom changing nearly year long. Pools almost absent due to deposition. 20
Bottom Substrate/ Available Cover	Greater than 50% rubble, gravel or other stable habitat. 2	30-50% rubble, gravel or other stable habitat. Adequate habitat. 7	10-30% rubble, gravel or other stable habitat. Habitat availability less than desirable. 17	Less than 10% rubble gravel or other stable habitat. Lack of habitat is obvious. 22
Avg. Depth Riffles and Runs	Cold >1' 0 Warm >1.5' 0	6" to 1' 6 10" to 1.5' 6	3" to 6" 18 6" to 10" 18	<3" 24 <6" 24
Avg. Depth of Pools	Cold >4' 0 Warm >5' 0	3' to 4' 6 4' to 5' 6	2' to 3' 18 3' to 4' 18	<2' 24 <3' 24
Flow, at Rep. Low Flow	Cold >2 cfs 0 Warm >5 cfs 0	1-2 cfs 6 2-5 cfs 6	.5-1 cfs 18 1-2 cfs 18	<.5 cfs 24 <1 cfs 24
Pool/Riffle, Run/Bend Ratio (distance between riffles ÷ stream width)	5-7. Variety of habitat. Deep riffles and pools. 4	7-15. Adequate depth in pools and riffles. Bends provide habitat. 8	15-25. Occasional riffle or bend. Bottom contours provide some habitat. 16	>25. Essentially a straight stream. Generally all flat water or shallow riffle. Poor habitat. 20
Aesthetics	Wilderness characteristics, outstanding natural beauty. Usually wooded or un-pastured corridor. 8	High natural beauty. Trees, historic site. Some development may be visible. 10	Common setting, not offensive. Developed but uncluttered area. 14	Stream does not enhance aesthetics. Condition of stream is offensive. 16

Column Totals:

Column Scores E _____ +G _____ +F _____ +P _____ = 252 = Score

<70 = Excellent, 71-129 = Good, 130-200 = Fair, >200 = Poor

Study of Wastewater Impacts on the
Water Quality of Koshkonong Creek
Before and After Construction
of a New Wastewater Treatment
Facility at Sun Prairie, Wisconsin

Wisconsin Department of Natural Resources

December, 1985

General Information

Drainage Basin: Lower Rock - 012
USGS Est. Q_{7,10}: 0.1 CFS Above WWTP
Average Gradient: 3.8 Feet Per Mile
Study Reach: T8N, R11E, Sections 8, 18, 19,
20, 28, Dane County, Wisconsin

Pre-Operational Survey Dates

May 7, 1980
October 8, 1980
June 11-12, 1981

Post-Operational Survey Dates

July 21, 1982
April 20, 1983
October 24, 1983

Study Author: Dave Marshall - DNR, Southern District,
Madison Area Headquarters

Water Resources Investigators: Dave Marshall, Water Resources
Management Biologist
Dan Moran, Environmental Engineer
Tom Bainbridge, Water Resources
Management Unit Leader

SUMMARY AND CONCLUSIONS

Consistent with water quality monitoring conducted on Koshkonong Creek during the 1970's, the pre-operational waste assimilation survey (1981) showed severe organic pollution below the former Sun Prairie wastewater treatment plant. The former treatment facility was hydraulically overloaded and ineffective. Consequently, it discharged high concentrations of BOD and nutrients into the creek. Dilution of the poorly treated wastewater was insignificant because of very low natural stream flow. High concentrations of organic wastes stimulated nuisance growths of filamentous bacteria at least 3.5 miles below the former plant. Assimilation of organic wastes was slow because of minimal reaeration potential in this low gradient agriculturally ditched stream. As a result, polluted conditions extended for miles below the former treatment plant. Macroinvertebrate samples also reflected very poor water quality below the former treatment plant. Two of the Biotic Index samples indicated worst case conditions of organic enrichment.

In January of 1982 the new treatment system replaced the old one. A waste assimilation study performed in July of 1982 demonstrated the benefits of improved wastewater treatment. Very low BOD and ammonia concentrations discharged at the new facility exemplify effective wastewater treatment. Responses in Koshkonong Creek to reduced organic loadings were elevated dissolved oxygen levels and the disappearance of nuisance filamentous bacterial growths. Macroinvertebrate communities responded as well but not to the level of improvements that water chemistry data indicated. Post-operational macroinvertebrate samples showed a trend toward improved Biotic Indices, less tolerant species, and greater diversity. Establishment of more intolerant aquatic communities, however, are limited by the persistence of sludge deposits (from the former treatment plant) and marginal habitat in the stream. Macroinvertebrate samples collected above the treatment plant also reflect marginal stream characteristics of the Koshkonong Creek headwaters. The current classification of marginal surface waters (MARG-E) appears to be accurate for the upper six miles of the stream.

OBJECTIVE

This report completes a study designed to document the performance of the upgraded Sun Prairie wastewater treatment plant and associated water quality improvements in Koshkonong Creek. The study consisted of two monitoring phases. First, the water quality of Koshkonong Creek was studied in 1980-81 to evaluate the impacts of the former wastewater treatment facility (pre-operational phase). Secondly, water quality characteristics of the stream were studied again in 1982-83 after the new facility was operational (post-operational phase). Data collected from Koshkonong Creek prior to construction of the new facility was presented in an interim pre-operational report. In this report, data collected from both the pre-operational and post-operation surveys are compared to document predicted water quality improvements. Semore data from 1983 is also included to illustrate the level of wastewater treatment achieved after the completion of the new facility.

GENERAL STREAM CHARACTERISTICS

Koshkonong Creek is a long, ditched stream which drains 138 square miles of land in the drumlin-marsh area of eastern Dane County. The creek originates near Sun Prairie and flows forty two miles southeast to join the Rock River at Lake Koshkonong.

Koshkonong Creek has a very low overall gradient of 3.8 feet/mile. The gradient in the stretch from the Rockdale Millpond to Lake Koshkonong is even lower, 1.9 feet/mile. Most of the creek has been dredged and straightened, but many ditched portions are clogged by vegetation or debris. Consequently, the flow in the creek is generally very sluggish, and in some areas, small impoundments have been created by dams of debris. Just below Sun Prairie, the creek has a rocky bottom, but most of the creek bottom is covered by a foot or more of silt.

Natural flow is limiting at the headwaters above Sun Prairie. The USGS estimated $Q_{7,10}$ at the site of the former wastewater treatment plant is .01 cfs. Most of the flow near the headwaters originates as effluent from the wastewater treatment plant and cooling water discharges from Goodyear Tire and Oconomowoc Canning Company. Below these sources, stream flow is substantial. Thirty two miles downstream of Sun Prairie at the Rockdale Dam, the estimated $Q_{7,10}$ is 9.2 cfs.

The fishery near the headwaters of Koshkonong Creek has been limited from a combination of low flow, pollution, and stream channelization. In 1975, the WDNR - Bureau of Research conducted an intensive fish shocking survey on the stream. Above CTH TT, the creek supported only a few tolerant forage species and low numbers of bullheads. Below that point, the numbers of fish and diversity of species increased.

The classification of Koshkonong Creek from the headwaters downstream to CTH T is marginal (MARG-E) surface waters. Below that point, the classification changes to full fish and aquatic life (FAL-B) supporting a warm water sport fishery.

STUDY PLAN

Study methodology for the pre-and post-operational surveys were essentially the same. Chemical waste assimilation surveys were performed in the summer during periods of low flow. The reason for sampling at this time is because wastewater discharges have the most critical impacts on receiving surface waters during summertime low flow.

SUN PRAIRIE
DANE COUNTY

July 7, 1975

The Sun Prairie waste water treatment plant discharges to Koshkonong Creek which has a 7Q10 of .02 cfs at the treatment plant site. Koshkonong Creek for roughly 3 miles below the treatment plant appears to be a straightened channel and could best be described as a modified stream. The creek flows through rich, agricultural land and eventually empties into Lake Koshkonong.

At the Market Street Bridge, approximately 500 yards above the treatment plant outfall, the creek appears to be noncontinuous but having a natural channel. This section of stream has been subjected to varying none point sources of pollution. At a point about 50 yards below the Market Street Bridge, the combined Oconomowoc Canning Company cooling water and a Sun Prairie storm sewer enter Koshkonong Creek and adds considerable flow. This juncture also represents a possible source of pollution for the creek. At the time of survey, a heavy growth of sphaerotilus was noted in this area. At the Bird Street Bridge, roughly 1-3/4 stream miles below the treatment plant outfall, the creek was very sluggish due to its channelized profile. The water was extremely turbid with heavy loads of suspended solids.

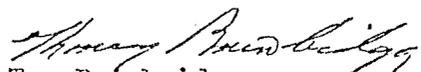
The Bailey Road Bridge, approximately 3 miles below the above point showed improved stream conditions. The waters in this area were less turbid and velocities had increased. The stream also did not exhibit the same channelized characteristics as above.

At the CTH "T" Bridge, approximately 2½ stream miles below the above site, and approximately 7 miles below the Sun Prairie treatment plant outfall, a noticeable increase in flow was noted due in part by a joining stream. Flat stemmed pond weed beds were observed in the stream at this point and water clarity had improved greatly. The stream in this section continues to border croplands with very little buffering vegetation.

RECOMMENDATIONS

From the headwaters of Koshkonong Creek, downstream to the Angel Park Foot Bridge, roughly 200 yards above the treatment plant outfall the classification should be noncontinuous agricultural use. From this Park Foot Bridge continuing downstream to the CTH "T" Bridge, the classification should be continuous agricultural use. From the CTH "T" Bridge extending downstream for the remainder of Koshkonong Creek, the classification should be continuous fish and aquatic life.

The above recommendations represent a concurrence of opinion of the stream classification team who are as follows: Roy Lembcke, District Engineer; Clifford Brynildson, Area Fish Manager; and Tom Bainbridge, Stream Classification Coordinator.


Tom Bainbridge
Stream Classification Coordinator

Region <u>SCR</u>	County <u>Dane</u>	Report Date <u>12/1989</u>	Classification <u>LAL</u>
Water Body: <u>Koshkonong Creek</u>			
Discharger: <u>Sun Prairie WWTP</u>			

If stream is classified as Limited Forage Fish (LFF) or Limited Aquatic Life (LAL), check any of the following Use Attainability Analysis factors that are identified in the classification report:

- Naturally occurring pollutant concentrations prevent the attainment of use
- Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met
- Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place
- Dams, diversions or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or operate such modification in a way that would result in the attainment of the use
- Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses
- Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact

Supporting Evidence in the report (include comments on how complete/thorough data is)

- Biological Data (fish/invert)
- Chemical Data (temp, D.O., etc.)
- Physical Data (flow, depth, etc.)
- Habitat Description
- Site Description/Map
- Other: photos

Historical Reports in file:

- 12/1989 - Dave Marshall
- 7/7/1975 - Tom Bainbridge

Additional Comments/How to improve report:

- stream is limited by low flow. Also by urban/ag NPS pollution -- how do these come into play? How limiting is flow?
- good data in report
- check in w/region

SUN PRAIRIE
DANE COUNTY

July 7, 1975

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The Bailey Road Bridge, approximately 3 miles below the above point showed improved stream conditions. The waters in this area were less turbid and velocities had increased. The stream also did not exhibit the same channelized characteristics as above.

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Tom Bainbridge
Stream Classification Coordinator

TB:lg

OCONOMOWOC CANNING COMPANY, SUN PRAIRIE
DANE COUNTY

July 7, 1975

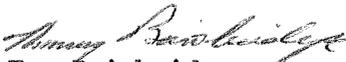
The Oconomowoc Canning Company discharges its cooling waters to Koshkonong Creek, roughly one-quarter mile above the Sun Prairie wastewater treatment plant. A more detailed description of Koshkonong Creek can be found in the classification report for the Sun Prairie wastewater treatment plant. The classification of Koshkonong Creek remains the same for both point sources.

RECOMMENDATIONS

From the headwaters of Koshkonong Creek downstream to the Angel Park footbridge, roughly 200 yards above the treatment plant outfall, the classification should be noncontinuous agricultural use. From this Park footbridge continuing downstream to the County Trunk Highway T bridge, the classification should be continuous agricultural use. From the County Trunk Highway T bridge extending downstream for the remainder of Koshkonong Creek, the classification should be continuous fish and aquatic life.

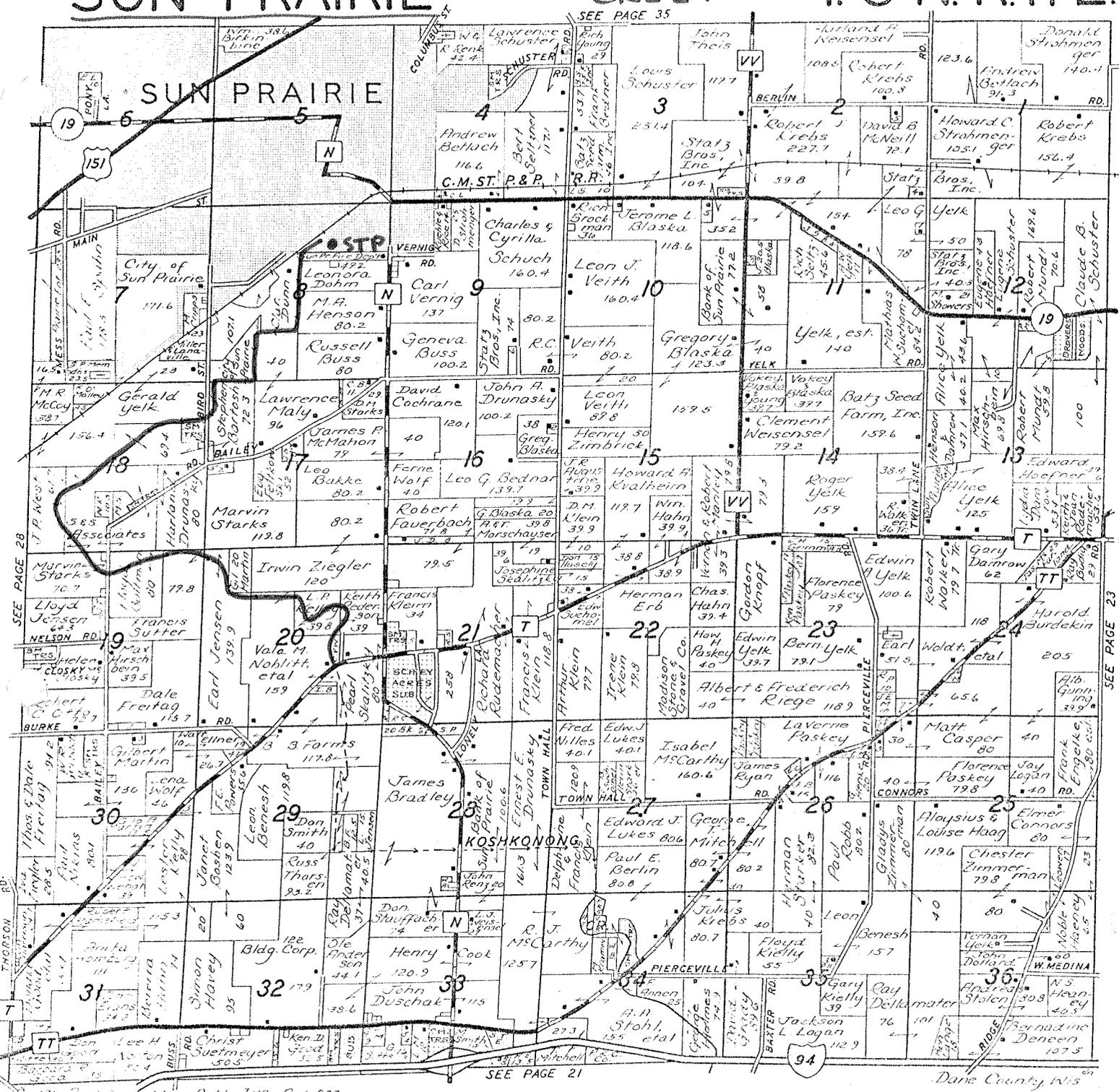
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Tom Bainbridge
Stream Classification Coordinator

TB:cb

SUN PRAIRIE CREEK T. 8 N.-R. 11 E. 29

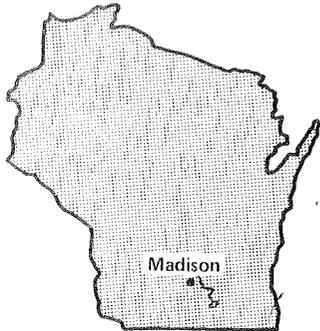


SUN PRAIRIE TOWNSHIP OFFICERS

- | | | |
|------------------|------------------------|---------------------|
| CHAIRMAN | CLAUDE SCHUSTER..... | MARSHALL - R.2 |
| SUPERVISORS..... | FRANCIS KLEIN | SUN PRAIRIE - R.1 |
| | LLOYD YELK..... | MARSHALL - R.2 |
| CLERK | AUGUST J. BAUMANN..... | COTTAGE GROVE - R.1 |
| TREASURER..... | JAMES BRADLEY | SUN PRAIRIE - R.1 |
| ASSESSOR | GLEN HENKE | MARSHALL - R.1 |



Water Quality Progress Report



Koshkonong Creek, Wisconsin

Over the past 5 years, the Wisconsin Department of Natural Resources (WDNR) has conducted more than 50 monitoring surveys to document water quality impacts resulting from the construction of

new or upgraded wastewater treatment plants. The primary objective of these surveys is to ensure that water quality standards are being met; a secondary objective is to evaluate mathematical models that may have been used to assign effluent limits. Most of the surveys to date have been carried out on small streams where advanced wastewater treatment (AWT) was required.

WDNR has developed a streamlined procedure in which effluent and instream water samples are collected during a 1- or 2-day period of low stream flow both before and after the startup of a new or upgraded treatment plant. Biomonitoring is included in the procedure through the use of a macroinvertebrate screening survey. This survey is usually carried out during the spring and fall prior to, and 1 or 2 years after the improved treatment processes have been in use.

This report documents one such monitoring study, conducted on Koshkonong Creek in southern Wisconsin. This creek is one of many small streams that has been subject to gross organic pollution due to inadequate wastewater treatment. Construction of the new Sun Prairie publicly owned treatment works (POTW), an AWT facility with ammonia removal and tertiary sand filters, has brought about greatly reduced pollutant loadings and a corresponding improvement in ambient water quality.

THE STUDY AREA

Koshkonong Creek is a channelized stream draining 138 square miles near Madison, Wisconsin. The creek originates in the town of Sun Prairie (population approximately 14,000) and flows 42 miles through agricultural areas to join the Rock River. The creek is effluent dominated with most of the flow originating as the discharges from Sun Prairie's POTW and cooling water from two industrial facilities.

While much of Koshkonong Creek has been dredged and straightened to facilitate agricultural drainage, the stream has a very low gradient and many channelized portions are clogged by vegetation. Consequently, flow in the creek is sluggish, and most of the creek bottom is covered by a foot or more of silt. Figure 1 shows the configuration of the creek along with the locations of water monitoring stations used in the surveys.

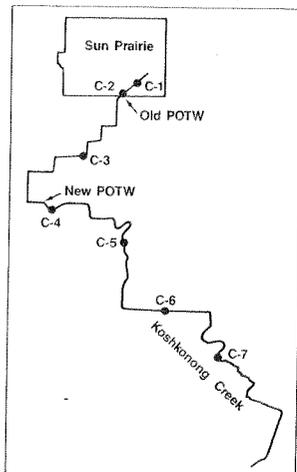


Figure 1. Koshkonong Creek showing the location of POTWs and sampling stations.

Largely as a result of these physical constraints (channelization and low flow), the creek's current designated use, from the headwaters to station C-5, is "marginal surface water." As such, the stream is considered suitable for only very tolerant aquatic insects and forage fish. Below station C-5, the creek is designated for warm water sport fishing, full aquatic life, and surface water recreation such as canoeing.

PREVIOUS MONITORING STUDIES

Water quality monitoring conducted on Koshkonong Creek during the 1970's showed severe organic pollution below the original Sun Prairie POTW. This treatment facility was hydraulically overloaded and discharged high levels of biochemical oxygen demand (BOD) and nutrients into the creek. Because of the low natural stream flow, dilution of the wastewater was insignificant, and the concentrated organic wastes stimulated nuisance growths of filamentous bacteria extending nearly 4 miles below the plant. Samples of the macroinvertebrate population (bottom-dwelling aquatic and other organisms) also indicated very poor water quality below the former treatment plant.

Base flow samples collected in 1977 at station C-2 showed that the creek was often devoid of oxygen in the summer, with BOD reaching levels of 15 to 60 mg/L. While ammonia levels were normal in the short stretch of stream above station C-2, below that point, levels were quite high with an average concentration of 7 mg/L and a maximum of 14.5 mg/L ammonia. The 1977 survey also showed extremely high average values for conductivity, chloride, fecal coliforms, and total phosphorus.

"BEFORE AND AFTER" SURVEYS: CHEMICAL STUDIES

Water samples were collected in 1981 (before AWT operation) and in 1982 (after AWT operation) at one upstream station (C-1), the original POTW outfall (C-2), and 3 downstream stations (C-3, C-4, and C-5). Samples were analyzed at the Wisconsin State Laboratory of Hygiene.

Pre-operational Survey. Consistent with previous monitoring results, the 1981 pre-operational survey indicated significant water quality degradation. Assimilation of the high strength organic wastes lowered the upstream dissolved oxygen (DO) level of 8.5 mg/L to 2.5 and 3.4 mg/L at downstream sampling stations C-3 and C-4, respectively. At station C-5, approximately 6 miles below the former discharge point, the stream showed a partial recovery with a maximum DO concentration (noon reading) of 6.7 mg/L.

However, a significant daily fluctuation in DO levels was observed, particularly at station C-5. Here, an early morning concentration of only 0.9 mg/L was apparently caused by respiration of abundant aquatic plants at this location. At station C-3, the daily DO swing was less significant, probably because filamentous bacteria covered all available substrates. At C-4, the substrate was covered with a combination of filamentous bacteria and algae, and the DO fluctuation was of intermediate magnitude.

High fecal coliform and ammonia concentrations during the pre-operational survey also reflected polluted conditions below the former POTW. Upstream (station C-1) concentrations were 700 organisms/100 mL fecal coliforms and 0.06 mg/L ammonia. At C-3, fecal coliform and ammonia concentrations were 50,000 organisms/100 mL and 17 mg/L, respectively. At station C-5, which marks the starting point of the full fish and aquatic life classification zone, the ammonia concentration was 10 mg/L. Considering the temperature and pH at that time, ammonia levels should not have ex-

ceeded 1.6 mg/L to ensure a healthy environment for fish and aquatic life.

Post-operational Survey. The new Sun Prairie POTW, with a capacity of 3.1 million gallons per day, was built to accommodate both municipal waste and substantial seasonal pollutant loading from a local cannery. The facility began operating in December 1981, and the post-operational chemical survey was performed in July 1982. Effluent monitoring data showed that BOD and suspended solids concentrations had been reduced by 45 percent and 92 percent, respectively. Total Kjeldahl nitrogen (TKN; a measure of organic nitrogen plus ammonia nitrogen) dropped from 23 mg/L to 1.1 mg/L.

Water quality in Koshkonong Creek below the new wastewater treatment plant reflected the improved effluent concentrations. As shown in Table 1, BOD, TKN, and ammonia concentrations were low, and nitrate- plus nitrite-nitrogen ($\text{NO}_2 + \text{NO}_3\text{-N}$) concentrations were high. Decreased levels of TKN and ammonia and increased $\text{NO}_2 + \text{NO}_3\text{-N}$ concentrations show effective assimilation of nitrogenous wastes in the treatment plant.

TABLE 1. Water Quality Improvement Downstream of Sun Prairie POTW (mg/L)

Station No.	Year	BOD	TKN	Ammonia nitrogen	$\text{NO}_2 + \text{NO}_3\text{-N}$
C-4	1981	8.0	12.0	9.5	0.15
	1982	3.3	0.8	0.06	6.7
C-5	1981	6.8	12.0	10.0	0.06
	1982	2.4	1.0	0.08	6.1

The increase in DO concentration, as well as the relative magnitude of the diurnal oxygen shift, is shown in Figure 2. The persistence of low nighttime DO levels is caused primarily by aquatic plant respiration although residual sludge deposits in the sediments also may contribute significantly to the total oxygen demand.

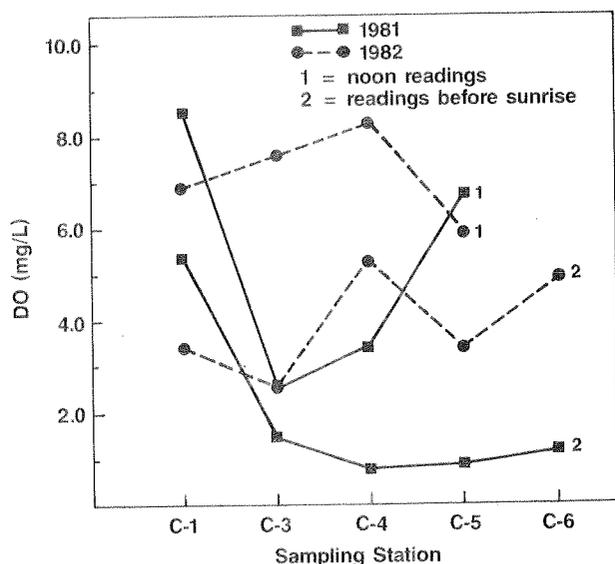


Figure 2. 1981 and 1982 diel dissolved oxygen measurements.

"BEFORE AND AFTER" SURVEYS: BIOMONITORING STUDIES

To further assess water quality improvements following startup of the Sun Prairie POTW, WDNR staff conducted biomonitoring surveys during the spring and fall of 1980 and 1983. Macroinvertebrates were collected (at the same sampling stations used during the chemical surveys) using a D-frame net and kick sampling to collect these bottom-dwelling organisms. Samples were preserved in 95 percent ethyl alcohol in preparation for laboratory sorting and identification.

Macroinvertebrate samples were used to determine the Hilsenhoff Biotic Index at each station. Developed by W. L. Hilsenhoff at the University of Wisconsin-Madison, this method uses the first 100

arthropods (insects, amphipods, and isopods) in a sample to evaluate the water quality of a stream. The index values, which are based on the varying tolerances of different species to organic pollution, range from 0 to 5, with lower values reflecting better water quality. A value of 0 is assigned to species found in pristine streams of high water quality, while a value of 5 indicates species tolerant of severe organic pollution. The biotic index is an average tolerance value for the entire sample.

Upstream of the POTW (station C-1), biotic index values of 2.88 to 3.74 indicated fair (1983) to poor (1980) water quality. Such an unbalanced macroinvertebrate community reflects the intermittent and marginal characteristics of the Koshkonong Creek headwaters.

At station C-3, 1980 surveys resulted in biotic index values ranging from 4.63 to 5.0. These values indicated very poor water quality and severe organic pollution. In all cases, the benthic macroinvertebrate communities were limited to two to four very pollution-tolerant species. In one sample, only eight specimens could be found. Macroinvertebrate samples collected during the post-operational surveys showed a slight increase in pollution-intolerant species and greater species diversity. Figure 3 shows the average biotic index values for the 1980 and 1983 surveys at each stream station. The limited recovery of the macroinvertebrate community may be due in part to the continuing effect of abundant filamentous algae and macrophytes that consume available oxygen.

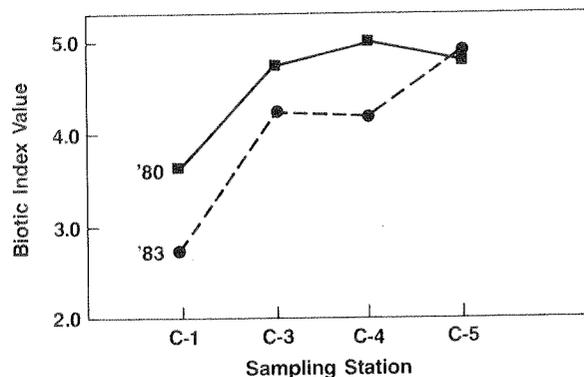


Figure 3. 1980 and 1983 average biotic index values.

The most obvious water quality improvement following completion of the new wastewater treatment plant was the elimination of filamentous bacteria in the stream. Effective treatment at the new facility eliminated the nutrient rich conditions required for this growth, and as a result, algae and other periphyton typical of similar streams in the basin have returned to Koshkonong Creek.

FUTURE IMPROVEMENTS

Koshkonong Creek is an example of a small stream that has been saved from gross organic pollution by the construction of a new POTW. While the physical characteristics of the stream may limit its biological quality, establishment of more diverse aquatic communities in the upper 8 miles of the creek is expected to occur over several years as sludge deposits are gradually reduced. As this progress continues, WDNR will periodically review the stream's use classification for possible upgrading. Additional improvements in the lower portions of the creek, which are classified for full fish and aquatic life uses, are expected as the quality of the upstream water is improved.

Material for this report was furnished by Jerry McKersie, Chief, Evaluation and Special Projects, WDNR, Water Resources Management; Dave Marshall, WDNR Water Resources Management, Southern District; and Noel Kohl, U.S. EPA Region V.

This report is produced by EPA to document progress achieved in improving water quality. Contributions of information for similar reports are invited. Please contact E. F. Drabkowski, EPA, MDS, WH-553, 401 M Street S.W., Washington, D.C. 20460 (202) 382-7056.



Market St. Bridge



Park foot Bridge



↑ Sun Prairie - Market Street
← Bridge, Above STP

↓ Sun Prairie - Koshkonong
Creek, Just Below Storm
Sewer Confluence

Sun Prairie - Bird Street
Branch, below STP, upstream





↑ SUN PRAIRIE - Kosh Konong Creek.



↑ Sun Prairie - Kosh Konong Creek
at CTH "T"