

→ DUANE SCHUETTPELZ WRM/Z
JOE

Stream Classification
Unnamed Tributary to
The West Twin River

Tim Doelger

FEB - 4 1987

Survey Oct. '86

Report Jan. '87

Introduction

The Village of Francis Creek constructed a new sewage treatment plant in 1982. This plant consists of three ponds with seepage from the ponds or from spray irrigation providing additional treatment. Upon completion of the STP the discharge to a tributary of the West Twin River ceased and water quality improved dramatically. This improvement was documented by the attached pre and post operational surveys.

Continued clearwater problems, poor construction and the inability to utilize its spray irrigation option have made it necessary for the Village to discharge to the tributary periodically. Additionally strict groundwater standards recently introduced will probably eliminate the seepage method of treatment and force a permanent surface water discharge.

If this does occur discharge limits should be imposed that would protect the resource.

This stream is presently classified as noncontinuous marginal which would assign 20/20 monthly average and 30/30 weekly average limits automatically. Since there have been measurable water quality improvements and the proposed outfall will be a different location. It was necessary to re-survey the tributary to determine if the present classification is correct and if those marginal limits would protect the stream in its present state.

Method

On October 28, 1986, Jeff Haack and myself inspected the STP and two sites on the stream (see map) to confirm the information presented in the 1983 post-op report.

Photos, flows, and water chemistries were taken as well as Stream System Habitat Rating Forms being completed at the two stream sites (all attached). Macro invertebrates were not collected because of equipment failure. Additional sites were not established as this inspection was not undertaken to duplicate the pre-post surveys, but rather to confirm them so that the extensive data collected in conjunction with them could be used to assign the correct classification.

Description

Both stations are physically very similar flowing through well buffered fallow land which is dominated by cedars.

The bottom is composed primarily of sand interspersed with large (1-2') rocks. There is a mixture of detritus and silt in pockets and in some areas along the edges.

The water is lightly stained and depths average between 6" and 1½'. There is a good mixture of pools, runs and riffles and the banks appear stable with little evidence of overflow.

All in all, this appears to be a healthy, stable stream system in the area in question and in addition it is aesthetically pleasing.

Conclusions/Recommendations

Based on all the information available and presented here it is apparent that real water quality improvements have occurred as the result of eliminating the STP discharge and that it is very probable that the marginal classification resulted from the discharge of poorly treated domestic wastewater and is now incorrect.

It is my recommendation that this stream be upgraded to a fish and aquatic classification and that electrofishing be performed in the near future to ascertain what species are present.

To protect the improvements achieved here from being degraded discharge limits will have to be low and this would be a reasonable candidate for wasteload allocated limits.



FC-1
ARROW RD.
FACING EAST



FC-2
SOUTH OF LAGOONS
FACING WEST



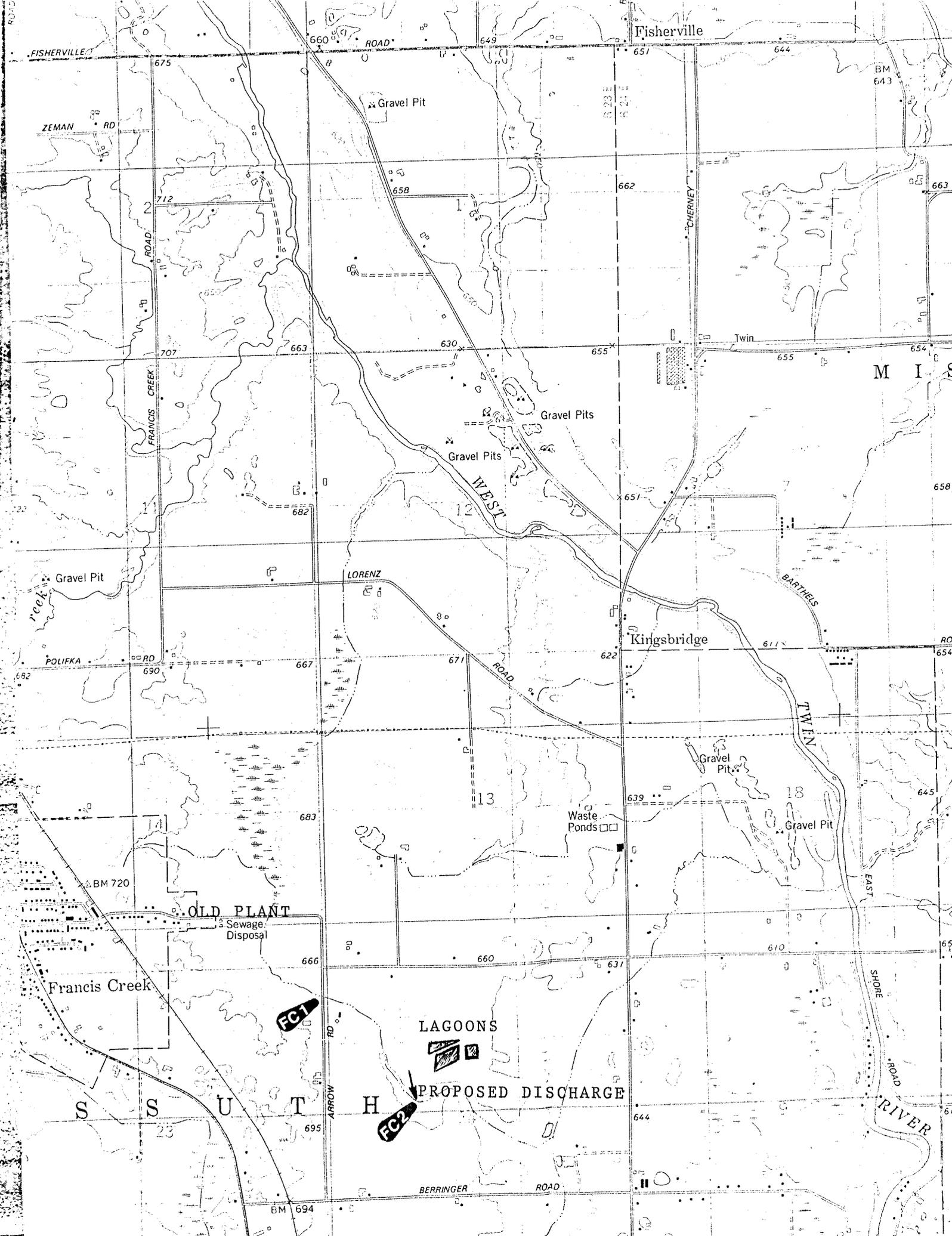
FC-2
FROM FURTHER
DOWNST. FACING S.W



AT CTHs V & Q
FACING N.E.



LAGOON



Fisherville

FISHERVILLE

ZEMAN RD

ROAD

Gravel Pit

FRANCIS CREEK

CHERNEY

M I S

Gravel Pits

Gravel Pits

WEST

Gravel Pit

LORENZ

Kingsbridge

BARTHES

POLIFKA RD

ROAD

Gravel Pit

Waste Ponds

Gravel Pit

OLD PLANT

Sewage Disposal

Francis Creek

LAGOONS

PROPOSED DISCHARGE

FC1

FC2

ARROW RD

BERRINGER ROAD

EAST

SHORE

RIVER

SAMPLE RESULTS

LOCATION	DATE	TIME	DEPTH	ACCOUNT-#	LAB-SLIP-#	END-DATE	END-TIME
36MISC	861028	1035	M000	050060	038235		
TEST-#	STORET-#	TEST-NAME-AND-UNITS		TEST-VALUE			
EXTRA INFORMATION ABOUT SAMPLE: TJD							
EXTRA INFORMATION ABOUT SAMPLE: F#FC1							
131	00010	WATER	TEMP	CENT	10.0		
091	00300	DO		MG/L	9.9		
026	00310	BOD	5 DAY	MG/L	<3		
106	00530	RESIDUE	TOT NFLT	MG/L	2		
100	00665	PHOS-TOT		MG/L	0.12		
136	00671	PHOS-DIS	ORTHO	MG/L P	0.107		
087	00625	TOT KJEL	DL N	MG/L	1.0		
086	00608	NH3-N	DISS	MG/L	0.02		
085	00631	NO2&NO3	N-DISS	MG/L	4.1		
***** COMMENT: ARROW RD CULVERT FRANCIS CREEK ABOVE							

LOCATION	DATE	TIME	DEPTH	ACCOUNT-#	LAB-SLIP-#	END-DATE	END-TIME
36MISC	861028	1110	M000	050060	038236		
TEST-#	STORET-#	TEST-NAME-AND-UNITS		TEST-VALUE			
EXTRA INFORMATION ABOUT SAMPLE: TJD							
EXTRA INFORMATION ABOUT SAMPLE: F#FC2							
131	00010	WATER	TEMP	CENT	10.0		
091	00300	DO		MG/L	9.6		
026	00310	BOD	5 DAY	MG/L	<3		
106	00530	RESIDUE	TOT NFLT	MG/L	2		
100	00665	PHOS-TOT		MG/L	0.08		
136	00671	PHOS-DIS	ORTHO	MG/L P	0.074		
087	00625	TOT KJEL	DL N	MG/L	0.8		
086	00608	NH3-N	DISS	MG/L	<0.02		
085	00631	NO2&NO3	N-DISS	MG/L	3.9		
***** COMMENT: FARMERS RD CULVERT FRANCIS CREEK NEAR OUTFALL (PROPOSED)							

PENDIX: Stream System Habitat Rating Form

Stream TRIB W. TWIN Reach Location ARROW RD FC-1 Reach Score/Rating 178 Good
 County MANITO Date 10/28/86 Evaluator DOE/CL Classification C - F & A

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 runoff. 18
Watershed Nonpoint Source	No evidence of significant source. Little potential for future problem. 4	Some potential sources. (roads, urban area, farm fields). 8	Moderate sources. (Small wetlands, tile fields, urban area, intense agriculture). 16	Obvious sources. (Major wetland drainage, high use urban or industrial area, feed lots, impoundment). 20
Bank Erosion, Failure	No evidence of significant erosion or bank failure. Little potential for future problem. 6	Infrequent, small areas, mostly healed over. Some potential in extreme floods. 9	Moderate frequency and size. Some "raw" spots. Erosion potential during high flow. 15	Many eroded areas. "Raw" areas frequent along straight sections and bends. 18
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 flows 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. 18
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	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. 20
Average Depth at Rep. Low Flow	Greater than 24 inches. 0	12 inches to 24 inches. 6	6 inches to 12 inches. 18	Less than 6 inches. 20
Flow, at Rep. Low Flow	Warm water >5 cfs. Cold water >2 cfs. 0	Warm water 2-5 cfs. Cold water 1-2 cfs. 6	Warm water 0.5-2 cfs. Cold water 0.5-1 cfs. Continuous blow. 18	Less than 0.5 cfs. Stream may cease to flow in very dry years. 20
Pool/Riffle, Run/Bend Ratio	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 inches or shallow riffle. Poor habitat. 20
Aesthetics	Wilderness characteristics, outstanding natural beauty. Usually wooded or unpastured 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. 18

Column Total Without Effluent —
 Column Total With Effluent —
 Add Column Scores Without Effluent, E 20 + G 49 + F 49 + P _____ = Reach Score
 Add Column Scores With Effluent, E _____ + G _____ + F _____ + P _____ = Reach Score
 <70 = Excellent, 71-129 = Good, 130-200 = Fair, >200 = Poor

SEGMENT DATA SHEET

Treatment Plant: FRANCIS CR.

Segment # _____

Date: 10/23/86

Observation # _____

Recorders Int.: TJD

Stake &/or Sample # FC-1

Distance Downstream _____ paces or feet

Time _____ PH _____

Measurement Conditions

DO 9.9 (Unit # _____)

Sun - Shade
Riffle - Run - Pool
Before - With - After/Dye

Temp 10 °C

% Overcast 90

% Shade 90

Est. Stream Width 12' Est. Stream Depth Ave.

Bottom Type DETRITUS, MUCK, ~~GRASS~~ SAND, LARGE ROCKS

% Stream Found

Comments

SLUDGE _____ % Depth _____

MUD _____ % Depth _____

MACROPHYTES _____ %

	Scarce	Common	Abundant
- Elodea	s	c	a
- Potomageton	s	c	a
- Sagittaria	s	c	a
- Myriophyllum	s	c	a
- Vallisineria	s	c	a
-	s	c	a
-	s	c	a

FILAMENTOUS ALGAE _____ % Stream

SLIMES _____ % Stream

LITTER & DETRITUS _____ % Depth

Fish Observed MINNOWS

Land marks (major) _____

Land Use CEDAR SWAMP

Other _____

APPENDIX: Stream System Habitat Rating Form

FRANCIS CP.

Stream W TWIN TRIB Reach Location 100 YDS SOUTH OF LAGOON

Reach Score/Rating 126 GOOD

County MANTOLOOC Date 10/28/86 Evaluator DZG

Classification C- FEA

FIELD # FC-2

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 runoff.
Watershed Nonpoint Source	No evidence of significant source. Little potential for future problem. 4	Some potential sources. (roads, urban area, farm fields). (8)	Moderate sources. (Small wetlands, tile fields, urban area, intense agriculture). 16	Obvious sources. (Major wetland drainage, high use urban or industrial area, feed lots, impoundment).
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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.
Lower Bank Channel Capacity	Ample for present peak flow plus some increase. Peak flows 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.
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.
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.
Bottom Substrate	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.
Average Depth at Rep. Low Flow	Greater than 24 inches. 0	12 inches to 24 inches. 6	6 inches to 12 inches. (18)	Less than 6 inches.
Flow, at Rep. Low Flow	Warm water >5 cfs. Cold water >2 cfs. 0	Warm water 2-5 cfs. Cold water 1-2 cfs. 6	Warm water 0.5-2 cfs. Cold water 0.5-1 cfs. Continuous blow. (18)	Less than 0.5 cfs. Stream may cease to flow in very dry years.
Pool/Riffle, Run/Bend Ratio	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 inches or shallow riffle. Poor habitat.
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Column Total Without Effluent —
Column Total With Effluent —

Add Column Scores Without Effluent, E 20 + G 53 + F 53 + P _____ = Reach Score
Add Column Scores With Effluent, E _____ + G _____ + F _____ + P _____ = Reach Score

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

SEGMENT DATA SHEET

Treatment Plant: FRANCIS CR

Segment # _____

Date: 10/28/86

Observation # _____

Recorders Int.: TSD

Stake &/or Sample # FC-2

Distance Downstream _____ paces or feet

Time 11:15 pH _____

Measurement Conditions

DO 9.6 (Unit # _____)

Sun - Shade
Riffle - Run - Pool
Before - With - After/Dye

Temp 10 °C

% Overcast 40

% Shade 90

Est. Stream Width _____ Est. Stream Depth Ave _____

Bottom Type SAND, ROCKS, SILT

	% Stream Found	Depth	Comments
SLUDGE	<u>0</u> %	_____	
MUD	<u>10</u> %	_____	
MACROPHYTES	<u>0</u> %		

	Scarce	Common	Abundant
- Elodea	s	c	a
- Potomageton	s	c	a
- Sagittaria	s	c	a
- Myriophyllum	s	c	a
- Vallisineria	s	c	a
-	s	c	a
-	s	c	a

FILAMENTOUS ALGAE 0 % Stream

SLIMES 0 % Stream

LITTER & DETRITUS 20 % Depth _____

Fish Observed _____

Land marks (major) STP

Land Use CEDAR SWAMP

Other _____

080
Committed to
W. B. Tavin
C. G. M.

Francis Creek Pre-Construction Intensive Survey

July 27, 1981

Prepared By

Michael P. Russo

Green Bay Area Biologist

The Village of Francis Creek is located in Manitowoc County. A pre-construction intensive survey was conducted on July 27, 1981 on an unnamed tributary to the West Twin River in conjunction with the Village of Francis Creek. The purpose of the study was to determine what effect the upgraded Publicly Owned Treatment Works (POTW) will have in comparison to the existing POTW on the water quality of the tributary to the West Twin River. The survey was conducted by: Dennis Weisensel, District Biologist; Tim Doelger, Assistant District Biologist; Jeff Haack, Area Engineer; and Mike Russo, Area Biologist.

This is the first stage in documenting these changes. A post-construction study will be done after the permit is modified and sufficient time is given so the stream environment can stabilize to these new conditions.

Description of Study Area

The Village of Francis Creek discharges to an unnamed tributary of the West Twin River. The tributary flows approximately 3 stream miles before reaching the West Twin River. The $Q_{7, 2}$ and $Q_{7, 10}$ were not possible to determine since the discharge is primarily effluent.

Description of Francis Creek POTW

The Village of Francis Creek operates an activated sludge plant in the extended aeration mode. The plant was designed for an average daily flow of 0.062 MGD. During the spring thaw and after even a moderate rainfall event the sewer system is subjected to excessive Infiltration/Inflow. Peak flow to the plant has been estimated at 0.432 MGD.

Interim Effluent Limitations until 6/30/81

BOD ₅ Monthly	30 mg/l
BOD ₅ Weekly	45 mg/l
Suspended Solids Monthly	30 mg/l
Suspended Solids Weekly	45 mg/l
pH	6-9
Total Residual Cl ₂	0.5 mg/l
Fecal Coliform	#/100 ML

Water Quality Limits

No water quality limits have been proposed because the facility has plans submitted for seepage cells and there will be no outfall. In the event that a discharge will occur a wasteload survey will be conducted.

Performance Parameters for July, 1981, the Month of the Survey

	Average Value for Month
Flow	.060
BOD ₅	16 mg/l
Suspended Solids	18 mg/l
Fecal Coliform	9600/100 ML
Total Residual Cl ₂	0.4 mg/l
pH	7.9

Performance Parameter for April, 1981, during Excessive I/I

	Average Value for Month
Flow	.115
BOD ₅	88 mg/l
Suspended Solids	146 mg/l
Fecal Coliform	12400/100 ML
Total Residual Cl ₂	.25 mg/l
pH	7.4

Methods and Procedures

Physical and chemical parameters were conducted at 5 stations located on the tributary to the West Twin River. Station #1, the above, was located on CTH V. Station #2 is the POTW outfall. The mix zone is station #3. This is the area where the discharge is thoroughly mixed with the receiving water and it is located 50' below the outfall. Station #4, the intermediate station, is located 600' below the outfall. Station #5, the end point, is located at Arrow road approximately 1,500' downstream of the outfall. See Figures 1 & 2.

Chemical and physical parameters of D.O., temp, pH, suspended solids, Ammonia NH₃-N, BOD₅ (because of the sampling date BOD was 6 day), fecal coliforms, and flow were taken (See Tables 1 & 2). Chemical parameters were sent to the Lab of Hygiene for analysis.

A macro-invertebrate sample was taken in the fall of 1981. The sample was taken approximately 1.5 stream miles downstream from the end station since this was the first site where a sufficient amount of macro-invertebrates were found to sample. A square D net was used to collect insect larvae

from the river substrate. The collected sample was placed in a pint jar containing 70% alcohol. The larvae were keyed and the Hilsenhoff Biotic index was used to determine water quality (See Table 3).

Results and Conclusions

Macro-invertebrate populations were virtually non-existent throughout the study area. Samples were unable to be collected throughout the study area because of poor substrate. Macro-invertebrates collected downstream from the study area were abundant and good water quality species indicating the effect of the POTW on the tributary is insignificant this far downstream. The Biotic Index was 2.20, which falls in the very good category with possibly slight pollution present.

Major POTW upset occurs during periods of precipitation, low flow conditions usually are relatively small problems as can be seen in the POTW performance in comparing the average values for the months of April and July of 1981.

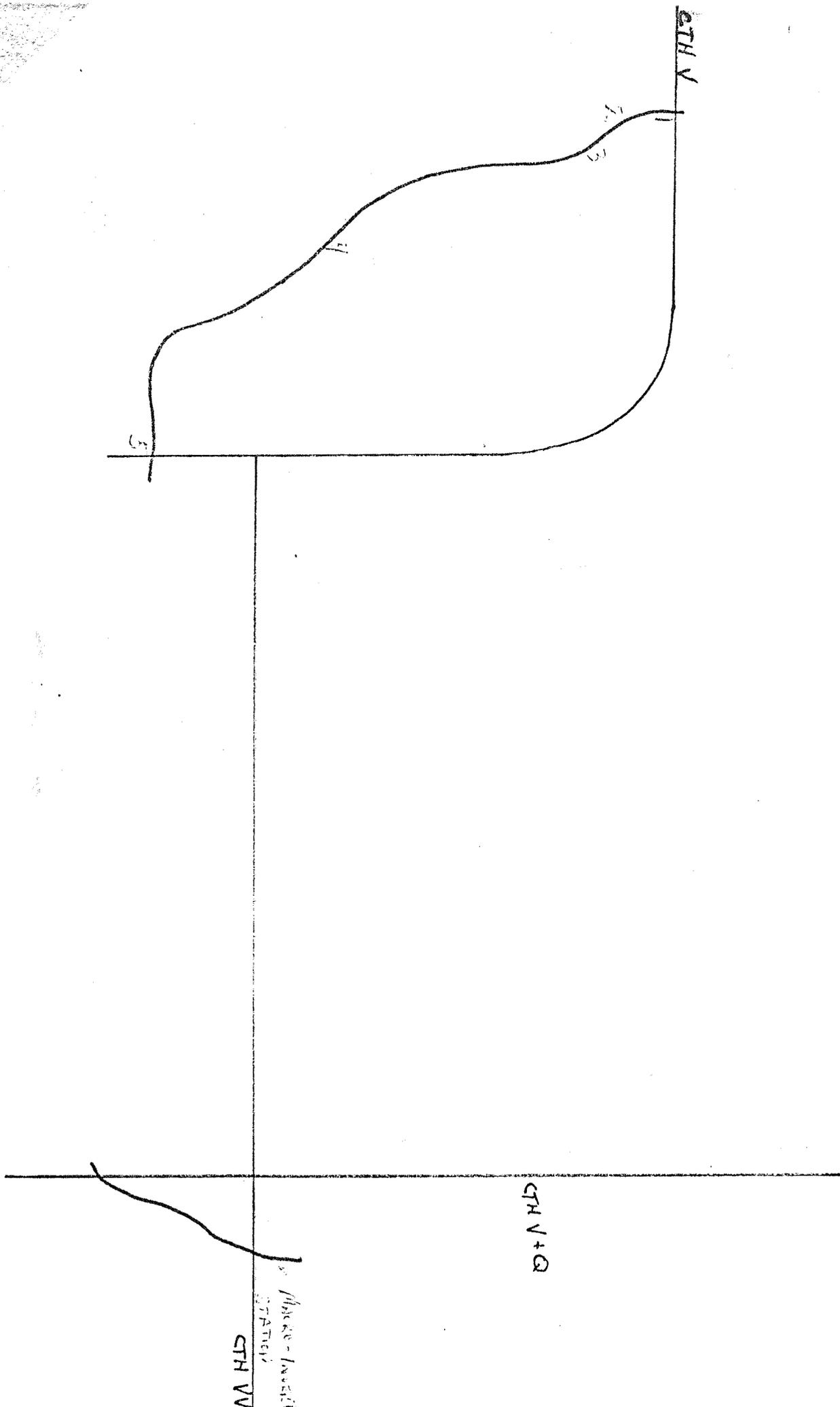
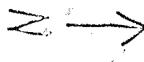
The immediate stream area near the POTW outfall is significantly affected by the discharge. Large sludge deposits were found in the mix zone, station 3.

The chemical data collected indicates the POTW is contributing loadings of BOD₅, suspended solids, and ammonia both in total and unionized levels. The LD₅₀ for unionized ammonia is 0.02 which is exceeded throughout the entire study area. See Table 1. This is the most significant contribution by the POTW. Suspended solids and BOD₆ data reveal some

effect. The general water quality throughout the study area is poor, largely due to the nature of the tributary (effluent ditch). The unnamed tributary is buffered from agricultural land use or other contributors to nonpoint source pollution and is able to recover by the time it crosses CTH VV where the macro-invertebrate sample was taken.

cc: District file (2)

Area file (1)



Francis (over R. ...)

Figure 1

PHYSICAL AND CHEMICAL CHARACTERISTICS

* In mg/l

Station LOCATION	ABOVE CTH V	OUTFALL	MIX 50' Below Outfall	INTERMEDIATE 600' Below Outfall	END Arrow Road
TIME	09:50	10:42	10:46	11:33	11:10
FLOW (cfs)	0	(.066 mgd) .102+	.025 *	.13	.281
TEMP (°c)	16	17	17	17	15
D.O.	0.6	0.5	1.2	3.5	8.5
pH	7.4	7.6	7.6	7.8	8.0
SUSPENDED * SOLIDS	2	34	18	97	12
(unionized)* AMMONIA * NH ₃ - N	(0.006) 0.69	(0.03) 2.4	(0.04) 3.3	(0.08) 4.2	(0.06) 2.5
BOD ₅ *	3.7	39	13	13	16
FECAL * COLIFORM	210/100				540/100
BIOTIC INDEX					2.2 ⁰
COMMENTS		Flow incontinuous	Flow taken through swamp area		01.5 miles down stream arrow Rd. At CTH VV

STREAM CHARACTERISTICS

Station Location	Above	Outfall	Mix	Intermediate	End
AVE. WIDTH	4'	4'	4'	5'	10'
AVE. DEPTH	0.3'	0.3'	0.3'	0.3'	0.8'
HABITAT	Pool - Run	Pool - Run	Run	Run	Pool
SUBSTRATE	95% muck & silt 5% Detrius	Muck & Silt	80% Muck & Silt 20% Sludge	100% Muck & Silt	40% Gravel 30% Sand 25% Silt 5% Detrius
AQUATIC VEGETATION	None	None	None	None	None
IN STREAM CONDITIONS	Significant Silt & Sediment Slight - Turbidity Slight - Algae		Significant - Sludge Deposits " - Chlorine Scour " - Slimes " - Turbidity	Significant - Silt	Slight-Silt & Sedgements
FACTORS AFFECTING SAMPLING SITE	Cropland Runoff Tile Drains Stream Bank Erosion Low Flow Wetlands Channelization		Tile Drains Cropland Runoff Pot ^w	Low Flow	Covered by sha trees

Tribstow-Twin⁰⁸⁰
CSRM

Post Construction Intensive Survey
at the
Francis Creek Publicly Owned Treatment Works (POTW)

July 19, 1983

By

Michael Russo - Green Bay Area Biologist

The Village of Francis Creek is located at the junction of CTH R and V in the Town of Kossuth northeast Manitowoc County. On July 19, 1983, a post construction intensive survey was conducted on an unnamed tributary to the West Twin River in conjunction with the Village of Francis Creek's Publicly Owned Treatment Works (POTW). The purpose of the study is to draw a comparison with the preconstruction survey and document the effect of upgrading the POTW on the water quality of the receiving stream. The pre-construction survey was conducted on July 27, 1981. The study was conducted by: Tim Doelger, Assistant District Biologist; Jeff Haack, Area Engineer; and Mike Russo, Area Biologist.

Description of Study Area

The Village of Francis Creek discharges to an unnamed tributary to the West Twin River. The tributary flows approximately 3 stream miles prior to the West Twin River. The drainage area is 2.45 MI² at the CTH Q-VV bridge our end station. The Q_{7,2} and Q_{7,10} were unable to be determined since the discharge is primarily effluent.

Description of Francis Creek POTW

The Francis Creek POTW consists of two wastewater stabilization ponds. The primary cell has a high water area of 8 acres while the secondary cell is 2.15 acres. The high water level for both is 5 feet. The cells are to be sealed to a maximum leakage rate of 1000 gals/acre/day. The primary cell is sealed with a synthetic liner while the secondary cell was sealed with native clay. The facility is then authorized to discharge to a seepage cell or a spray irrigation system. The seepage cell bottom area is 2.37 acres. The plant is designed for 70,000 G.P.D. with peak flow at 270,000 G.P.D. Average flows since start-up were approximately 200,000 G.P.D. The POTW is not authorized by their Wisconsin Pollutant Discharge Elimination System (WPDES) permit to discharge to surface waters.

During plant start-up, a surface water discharge existed. Wastewater was siphoned from the primary and secondary ponds. The problem was encountered when the facility started discharging to the seepage cell and it failed to seep. The unpermitted discharge occurred from March 5, 1983, to April 7, 1983. At this time, the performance parameters were as follows:

	Average Value for Month
Flow	.236 M.G.D.
BOD ₅	8.9 mg/l
Suspended Solids	11.3 mg/l
ph	8.3 S.U.
Fecal Coliforms	80/100 ML

Methods and Procedures

Physical and chemical sampling was conducted at 4 stations along the tributary to the West Twin River. Two of the stations were the same as in the pre-construction intensive survey. Since the new POTW was moved to a different location, the post construction intensive survey included the area once considered for a surface water discharge from the stabilization ponds. The post construction survey stations include: Station #1, the above station - this was also the above for the pre-study. Station #2, the intermediate I station - this station was the end station for the pre-study at Arrow Rd.

Station #3, the Intermediate II station was located south of the stabilization ponds and once considered an outfall site. Station #4 was the end station located at CTH's VV and Q - this was the site of the macroinvertebrate sample for the pre-study. (See Figure 1.)

Chemical and physical parameters of Dissolved Oxygen, temperature, pH, BOD₅, total phosphorus, ammonia NH₃-N, fecal coliform, and flow were taken. Unionized ammonia was calculated and field pH was determined all other chemical parameters were analyzed by the State Lab of Hygiene in Madison. (For parameter comparison - see Table 1.)

Macroinvertebrate samples were not collected at this writing but will be done with an addendum to be written containing this information.

Results and Conclusions

Overall water quality showed an improvement after the new POTW went online. One major factor is that, except for an emergency situation, the new POTW is a groundwater discharger.

The tributary to the West Twin is a well buffered stream with slight nonpoint source (NPS) problems upstream and increasing significance as it flows towards the main stem.

Water quality improvement based on these two samplings was found throughout the entire study area. The above station had an increase in dissolved oxygen above the fish standards with a decrease in ammonia. The unionized fraction of ammonia exceeded the 96-hour LC₅₀ for warm water fisheries at our station below the POTW during the pre-study. This segment and the entire reach at the time of the post study was significantly lower with unionized ammonia concentrations running from .001 to .002. By comparison, our 2 stations sampled the above - above and end - Intermediate I had unionized ammonia levels of 0.006 - 0.0001 and 0.06 - 0.0001, respectively.

Ammonia NH₃-N and unionized NH₃-N concentrations showed a slight increase during the past survey from the Intermediate II to the end stations. One probable cause for this is that the end station was located in a occupied horse pasture. This was needed to provide adequate habitat for the macroinvertebrate sampling which will be done.

BOD₅ analysis also was found to be significantly lower by comparison of of the two studies. BOD₅ during the pre-study ranged from 3.7 at the above to 3.9 at the outfall and 16 at the end. This BOD analysis was a 6 day test. During the post the range was 3.3 at the common above, 2 at the Intermediate I common station and 1.6 at the end station.

Since the preintensive survey was conducted, CTH V was straightened near the old POTW outfall. This contributed to a temporary NPS problem which may take awhile to correct. Larger amounts of sediment were found at the Intermediate I and II stations then expected. When comparing the % silt from the two studies, 20% more silt was found during the post at the common Arrow Rd. location. (For stream characteristics - see Table 2.)

1983 Post-Operative
Intensive Survey
Village of Francis Creek
Station Pictorial and Location

1. Above at Francis Creek at point where old CTH V Crossed looking upstream.
2. Above looking west.
3. Intermediate I station at Arrow Road looking east.
4. Intermediate II station at proposed discharge looking west.
5. End station at CTH Q and V looking north.

Table 1

Station Location	Above CTH V		Outfall	Mix 50' below outfall	Intermediate Pre below outfall	End - Pre Intermediate Arrow Road		Intermediate 2 POTW	End Post CTH VV-Q
	Pre 09:50	Post 09:31				Pre 11:10	Post 09:50		
Time			10:42	10:46	11:33			10:11	10:30
Flow cfs	0	.005	.066 .102+	.025+	.13	.281	.117	.085	1.25
Temp °C	016	15	17+	17	17	15	19	15	18
* Dissolved Oxygen	0.6	8.2	0.5	1.2	3.5	8.5	7.8	8.7	9.6
pH	7.4	7.2	7.6	7.6	7.8	8.0	8.0	7.9	8.2
* Suspended Solids	2		34	18	97	12			
BOD ₆ BOD ₅	03.7	3.3	039	013	013	016	2	2	1.6
* Total Phosphorus		0.1					0.4	0.22	0.16
* NH ₃ -N	0.69	0.03	2.4	3.3	4.2	2.5	0.04	0.03	0.04
* Unionized Ammonia	0.006	.0001	0.03	0.04	0.08	0.06	.001	.0006	.002
Fecal Coliform	210 /100	530 /100				540 /100	5000 /100		2900 /100
Biotic Index									Pre 2.2
Comments			+Flow Incontinuous	+Flow taken in swamp					

STREAM CHARACTERISTICS

Table 2

Station Location	Above	Intermediate I	Intermediate II	End	
Ave. Width	3'	8'	7'	4'	
Ave. Depth	0.1	0.4'	0.3	0.5'	
Habitat	Riffle	Run-Pool	Run	Riffle-run	
Substrate	50% Mud 10% Gravel 20% Sand 20% Detritus	20% Gravel 30% Sand 45% Silt 5% Detritus	Mud Sand - Gravel Under Under 2' Mud	Sand - Fine Gravel	
Aquatic Vegetation	Filamentous Algae	Filamentous Algae	None	Sagittaria	
In Stream Conditions	Algae Significant Silt & Sediment	Slight Silt		Very Significant Silt	
Factors Affecting Sampling Site	Cropland Runoff Low Flow Wetlands Channelization	Wetlands Shade		Shade Wetlands Construction	Pasture Cropland