

ANALYSIS OF
GRINDSTONE CREEK
(FROM WAGGONER LAKE TO THE CONFLUENCE WITH THE
BAD RIVER)

NORTH OF PHILIP
HAAKON COUNTY, SOUTH DAKOTA

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South Dakota
Department of Environment and Natural Resources
Division of Environmental Services
Pierre, South Dakota

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Executive Summary

Name of Waterbody: Grindstone Creek

Location: Haakon County

Boundaries of Waterbody under Assessment:

Grindstone Creek, from Lake Waggoner to its confluence with the Bad River

Condition/Description of Creek Segment: At the time of the Department of Environment and Natural Resources site visit, Grindstone Creek had flow at Site # 1 and Site #2.

Water quality in Grindstone Creek meets standards established by Administrative Rules of South Dakota (ARSD) Chapter 74:51:01 for its current classification (9) Fish and wildlife propagation, recreation, and stock watering waters; and (10) Irrigation waters; and for recommended reclassification to include (6) Warmwater marginal fish life propagation waters; and (8) Limited-contact recreation waters.

Grindstone Creek appears to have good flow throughout most of the year and is home to multiple age classes of fish and a variety of species.

Recommendation: It is recommended that the assigned beneficial uses for Grindstone Creek from Lake Waggoner to the confluence with the Bad River be changed to include (6) Warmwater marginal fish life propagation waters; and (8) Limited-contact recreation waters.

Introduction

Min-kota Fisheries is located north of Philip in Haakon County in the center of Section 7, Township 1 North, Range 21 East. For their fishery operation, Min-kota uses water from a geothermal well that is owned by the City of Philip. The hot water is used to maintain water temperature and freshness in the fish rearing ponds. Min-kota discharges wastewater to two separate outfalls. Wastewater is discharged directly into Grindstone Creek and also to a cooling pond before being discharged into Lake Waggoner. Water from the geothermal well that is not used in the facility operations is bypassed and intermingles with wastewater that is discharged into Grindstone Creek and Lake Waggoner. Potential discharge into Grindstone Creek may be diverted to an irrigation pond at the nearby golf course. Pat Siegar, a co-owner of the fishery operation stated that the bypassed geothermal water is essential in maintaining the water level in Lake Waggoner.

Min-kota Fisheries has applied for a wastewater discharge permit for their existing facility (not previously permitted) and a business expansion that would include fish rearing and processing facilities.

Pursuant to ARSD Chapter 74:51:01:02.01, an assessment was performed for the creek to which Min-kota discharges wastewater. The purpose of the assessment was to ensure the currently assigned beneficial uses for the creek are appropriate. Grindstone Creek is currently assigned the beneficial uses of (9) Fish and wildlife propagation, recreation, and stock watering waters; and (10) Irrigation waters.

On March 9, 2006, DENR department staff performed an in-stream and visual study of Grindstone Creek. The specific segments under review are Grindstone Creek from Lake Waggoner (which is also a discharge point for Min-kota Fisheries) to its confluence with the Bad River.

General Site Description

Grindstone Creek originates in Haakon County northwest of Philip in Section 18, Township 3 North, Range 20 East. The creek flows southeast and empties into Lake Waggoner. Grindstone Creek then continues in a southeast direction overflowing from Lake Waggoner until its confluence with the Bad River. The confluence with the Bad River is located in the northwest corner of Section 21, Township 1 North, Range 21 East.

Current Assigned Beneficial Uses

Grindstone Creek is currently assigned the beneficial uses of (9) Fish and wildlife propagation, recreation, and stock watering waters and (10) Irrigation waters.

The department has performed an analysis of Grindstone Creek and is recommending it be upgraded to add the beneficial uses of (6) Warmwater marginal fish life propagation waters; and (8) Limited-contact recreation waters.

Soils/Groundwater

In the segment of Grindstone Creek that is under review, the soils are of the Ottumwa-Razor-Midway Association. This includes very deep, moderately deep, and shallow, well-drained, nearly level to steep, clayey and loamy soils on undissected and dissected plains.

There is currently no literature available on groundwater sources or aquifers in Haakon County. However, based on the information available including the low flow of Grindstone Creek and the amount of water discharged by Min-kota Industries, it is unlikely that there are any sources of groundwater that contribute to the flow of Grindstone Creek.

Surface Water

Grindstone Creek flows through private land that is a combination of wetlands, pastureland, hayland, and cropland.

Little Grindstone Creek and several unnamed tributaries flow into Grindstone Creek. Grindstone Creek empties into Lake Waggoner, overflows at the spillway, and continues until the

confluence with the Bad River. The segment of Grindstone Creek under review receives water from Lake Waggoner and wastewater discharge from Min-kota Fisheries at Outfall #001. The drainage basin of Grindstone Creek is approximately 50 square miles.

The 1994 National Wetlands Inventory maps classify most wetlands in and along Grindstone Creek as seasonally or temporarily flooded riverine wetlands of the intermittent subsystem and streambed class. Riverine wetlands are confined within the stream channel and lack persistent emergent or woody vegetation. The intermittent subsystem wetlands typically contain water during only part of the year.

Temporarily flooded palustrine wetlands of the forested class and seasonally flooded palustrine wetlands of the emergent class are occasionally found in and along the Grindstone Creek. Palustrine wetland areas are dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. These wetlands are less than 20 acres in size, lack wave-formed or bedrock shoreline features, and are less than 2 meters in depth. Forested class wetlands contain tall trees. Emergent class wetlands are characterized by erect, herbaceous hydrophytes (trees, shrubs, persistent emergents) excluding mosses and lichens.

Precipitation

Based upon a review of precipitation data available on the SDSU Climate and Weather Information Homepage, it appears that the area received below normal precipitation for the past several years which includes the time of the stream survey.

Assessment Results

On March 9, 2006, DENR personnel performed a visual and in-stream analysis of Grindstone Creek from Lake Waggoner to its confluence with the Bad River. DENR personnel performed a visual reconnaissance of Grindstone Creek and sampled in two locations (Site # 1 and Site #2). Photographs were taken of the sample locations along Grindstone Creek and are included as Attachments 1 through 8. A site map is included as Attachment 9.

Two sites were selected for in-stream sampling. Site # 1 was on Grindstone Creek, approximately one half mile from the confluence with the Bad River. Site # 2 was on Grindstone Creek about a quarter mile downstream from Lake Waggoner. At each sample site, photographs were taken, water depth and channel width was measured, field water quality measurements were taken, water samples were collected for laboratory analysis, stream velocity was recorded, and fish were collected. Fish collection was attempted at Site #1 using an Engineering Technical Services (ET) Model APB-3 electroshocker. Fish collection was performed at Site #2 using a seine net. Further details pertaining to sample activities performed at each site are discussed below.

Site # 1 (Section 17, Township 1 North, Range 21 East):

Site #1 is on Grindstone Creek approximately one half mile south of US Route 14 and about one half mile northwest from the confluence with the Bad River. Attachment 9 is a map showing the sample site location. Attachment 4 is a photograph of the sample site.

Grindstone Creek measured about 7 feet in width and had flow of about 0.76 cubic feet per second. Water quality met standards for a 9, 10 waterbody, and for the proposed reclassification to a 6, 8, 9, and 10 waterbody. Laboratory analysis and field analysis results are summarized in Attachment 13. Flow measurement data is available in Attachment 11.

Using an Engineering Technical Services (ET) Model APB-3 electroshocker, DENR personnel attempted fish collection in Grindstone Creek for approximately 100 feet. No fish species were collected or observed. The landowner of Site #1, Darryl Peterson, stated that fish are typically present in this creek segment later in the year.

This segment of Grindstone Creek runs through private property. There is no public access or facilities available. At the time of the site visit, the creek ranged in depth from several inches up to 2 feet. The landowner, Darryl Peterson, stated that segments of the creek go dry later in the year. There is no evidence that any immersion recreation activities such as swimming, skiing, boating, etc. occur in this segment of Grindstone Creek. Due to the seasonal presence of fish, limited-contact recreation is possible.

Site #2 – (Section 6, Township 1 North, Range 21 East):

Site #2 is on Grindstone Creek, approximately one quarter mile downstream from Lake Waggoner. Attachment 9 is a map showing the sample site location. Attachments 5 through 8 are photographs of the sample site.

At this location on March 9, 2006, Grindstone Creek had a flow rate of 0.24 cubic feet per second. At the site where flow was measured, the creek was 14 feet wide and had a maximum depth of 1.95 feet. The creek bottom had a thick layer of fine silt-like mud that may have affected the calculated water flow.

Water quality in Grindstone Creek meets standards established by ARSD Chapter 74:51:01 for a 9 & 10 waterbody and the proposed reclassification to a 6, 8, 9, and 10 waterbody. Laboratory analysis and field analysis results are summarized in Attachment 13. Flow measurement data is available in Attachment 12.

Fish collected include common carp, black bullhead, black crappie, bluegill, largemouth bass, northern pike and green sunfish. Of the fish collected, bluegill, black crappie, and black bullhead appear to be representative of more than one age class. A list of fish collected by DENR personnel is available in Attachment 10.

At the time of the site visit, Lake Waggoner was not overflowing into Grindstone Creek. The only visible sources of flow were from Min-kota's Outfall #001 and a wetland area (possibly a leak from the dam) immediately south of the dam.

This segment of Grindstone Creek runs through private property. There is no public access or facilities available. At the time of the site visit, the creek depth was about one foot. There is no evidence that any immersion recreation activities such as swimming, skiing, boating, etc. occur in this segment of Grindstone Creek. Due to the presence of fish, limited-contact recreation is possible.

Outfall #001 & #002

Attachments 1 through 3 are pictures of Min-kota's discharge locations. Attachment 9 is a map that shows the outfall locations. Attachment 1 shows Outfall #001 discharging into Grindstone Creek. This water flow was included in the assessment of Grindstone Creek. Attachment 2 is a picture of Outfall #001 and a bypass T-valve that allows the fishery to bypass water from the discharge location to an irrigation pond in the nearby golf course. Attachment 3 is a photo of Outfall #002 discharging into Lake Waggoner. Discharge from Outfall #002 into Lake Waggoner was not sampled or included in the assessment of Grindstone Creek.

Recreation Use

The depth of Grindstone Creek near the spillway of Waggoner Lake averages approximately 1.5 feet; the depth near the confluence with the Bad River averages approximately 1 foot. Despite the depth, this reach of Grindstone Creek is contained within private property and meanders through grazing and hay pastures. Public access is limited to intersections with public roads. Grindstone Creek contains underwater hazards including submerged trees. In addition, aquatic macrophytes make the creek an inhospitable environment for immersion recreation activities. There is no evidence that immersion recreation is taking place by visual accounts and by verbal communication with landowners.

The beneficial use classification of (7) Immersion recreation waters is not recommended due to the overall shallow depth of the stream and the absence of public access or facilities.

Due to the possibility that limited contact activities such as fishing are possible, the beneficial use classification for (8) Limited contact recreation waters is recommended.

Summary

Based on field reconnaissance, sampling, and data review, Grindstone Creek downstream from Lake Waggoner to its confluence with the Bad River usually has flow. Most of Grindstone Creek is classified as seasonally or temporarily flooded riverine wetlands of the intermittent subsystem and streambed class. There does not appear to be base flow from any groundwater sources.

Water quality in Grindstone Creek meets standards established by ARSD Chapter 74:51:01 for the currently assigned beneficial uses of (9) Fish and wildlife propagation, recreation, and stock watering waters; and (10) Irrigation waters. Grindstone Creek also meets water quality standards established for the proposed reclassification to include (6) Warmwater marginal fish life propagation waters; and (8) Limited-contact recreation waters.

Fish life was found at Site #2 but not at Site #1. Site #2 had deeper pooled areas that may serve as a refuge for fish species during times of low water flow in the creek. The diversity of fish species and multiple age classes at Site #2 may be influenced by overflow events from Lake Waggoner, but it is also likely that natural reproduction is occurring in some species. In addition, the health of the fish indicate their ability to survive in the stream. Grindstone Creek has the ability to support the recommended beneficial use classification of (6) Warmwater marginal fish life propagation waters.

Reference Documents

South Dakota Department of Environment and Natural Resources, 1999. Recommended Procedures for Reviewing Beneficial Use Designations, with Special Emphasis on Fishery and Recreational Uses.

South Dakota Department of Environment and Natural Resources. Chapters 74:51:01 and 74:51:03, Surface Water Quality Standards.

South Dakota Department of Transportation, 1981. General Highway Map, Haakon County, South Dakota.

DeLorme, 1997. South Dakota Atlas and Gazetteer.

South Dakota State University, 2002. South Dakota Climate Information Homepage, maintained by Office of State Climatologist.

U.S. Department of the Interior, Fish and Wildlife Service, 1994. National Wetlands Inventory Map, Philip SE, South Dakota

Locations of Topeka Shiners in South Dakota, Database provided by South Dakota Department of Game, Fish, and Parks.

United States Department of Agriculture, 1991. Soil Survey of Haakon County, South Dakota.

ATTACHMENT 1



Grindstone Creek

Outfall #001:

This picture was taken on March 9, 2006. The photograph shows water being discharged from Min-kota Fisheries to Grindstone Creek below Lake Waggoner. The photographer was facing north.

ATTACHMENT 2



Grindstone Creek

Outfall #001:

Outfall #001 has a T in the plumbing which allows Min-kota Fisheries to divert the water from Outfall #001 to an irrigation pond at the Municipal Golf Course. The photograph was taken on March 9, 2006, the photographer was facing north.

ATTACHMENT 3



Lake Waggoner

Outfall #002:

This photograph was taken March 9, 2006. Min-kota Fisheries discharges water from Outfall #002 (bottom left hand corner of photo) into Lake Waggoner. The photographer was facing north.

ATTACHMENT 4



Grindstone Creek

Site # 1:

Picture was taken on March 9, 2006. The water at the site was flowing, however no fish were found. The photograph was taken near a culvert where Grindstone Creek intersects with the Darryl Peterson Ranch road south of US Route 14. The photographer was facing west.

ATTACHMENT 5



Grindstone Creek

Site # 2:

Picture was taken on March 9, 2006. The water at the site was flowing and several fish species were found. The photographer is facing northeast looking upstream. The site location is approximately ¼ mile downstream from Lake Waggoner on Grindstone Creek.

ATTACHMENT 6



Grindstone Creek

Site # 2:

Picture was taken on March 9, 2006 of a Northern Pike.

ATTACHMENT 7



Grindstone Creek

Site # 2:

Picture was taken on March 9, 2006. The photograph was taken approximately ¼ mile downstream from Lake Waggoner on Grindstone Creek. The photographer was facing west.

ATTACHMENT 8



Grindstone Creek

Site # 2:

Picture was taken on March 9, 2006 of a Largemouth Bass.

ATTACHMENT 10

**SITE #2
FISH COLLECTION DATA**

Seined 100 yards		March 9, 2006									
Fish Species	Black Bullhead	Bluegill			Northern Pike		Green Sunfish	Black Crappie		Largemouth Bass	Common Carp
Size in mm	130 113 70 60	75 164 89 95	80 84 107 82	97 93 86 99	420 352 357 363	339 327	54 66 55 50	165 194 153 172	151 171 164 160	179	330
Number of Fish	4	12			6		4	8		1	1
Maximum Length	130	164			420		66	194		179	330
Minimum Length	60	75			327		50	151		179	330
Average Length	93	88			360		56	166		179	330

ATTACHMENT 11

SITE # 1			
VELOCITY MEASUREMENTS* AND CALCULATED FLOW RATE			
7 FOOT WIDTH			
MARCH 9, 2006			
<u>FIELD DATA</u>			
LOCATION (DISTANCE FROM BANK)	WATER DEPTH (FEET)	VELOCITY (FEET/SECOND)	CALCULATED FLOW (CUBIC FEET/SECOND)
0.5	1.0	0.09	0.09
1.5	1.95	0.13	0.254
2.5	1.0	0.07	0.07
3.5	0.9	0.13	0.117
4.5	1.0	0.12	0.12
5.5	1.0	0.11	0.11
6.5	0.7	0.00	0.0
Flow Rate at Site # 1:			0.76

*As Determined Using A Marsh McBirney Model-201D Flow Meter.

ATTACHMENT 12

SITE # 2			
VELOCITY MEASUREMENTS* AND CALCULATED FLOW RATE			
14 FOOT WIDTH			
MARCH 9, 2006			
<u>FIELD DATA</u>			
LOCATION (DISTANCE FROM BANK)	WATER DEPTH (FEET)	VELOCITY (FEET/SECOND)	CALCULATED FLOW (CUBIC FEET/SECOND)
0.5	0.3	0.0	0.0
1.5	0.6	0.0	0.0
2.5	0.85	0.01	0.0085
3.5	0.9	0.0	0.0
4.5	1.0	0.0	0.0
5.5	1.0	0.02	0.02
6.5	1.0	0.11	0.11
7.5	1.1	0.06	0.066
8.5	1.0	0.01	0.01
9.5	0.9	0.0	0.0
10.5	1.0	0.0	0.0
11.5	0.75	0.03	0.0225
12.5	0.75	0.01	0.0075
13.5	0.55	0.0	0.0
Flow Rate at Site # 2:			0.24

*As Determined Using A Marsh McBirney Model-201D Flow Meter.

ATTACHMENT 13

FIELD ANALYSIS PARAMETERS, INSTRUMENTS, AND RESULTS				
MARCH 9, 2006				
PARAMETER	INSTRUMENT	REFERENCE METHOD	RESULTS	
			SITE # 1	SITE # 2
Temperature				
Air (°C)	Thermometer	EPA (170.1)	16	15
Water (°C)	Hanna 9025 portable pH meter	EPA (170.1)	7.1	18
Dissolved oxygen (mg/L)	YSI 550 portable dissolved oxygen meter	EPA (360.1)	9.46	10.44
pH (su)	Hanna 9025 portable pH meter	EPA (150.1)	7.94	8.07
Flow (cubic feet/second)	Marsh McBirney Model-201E Flow Meter	N/A	0.76	0.24

PARAMETER	REFERENCE	RESULT	
		Site #1	Site #2
Fecal Coliform Bacteria (/100 ml)	SM(9222D)	10	40
Ammonia (mg/L)	EPA Method (350.1)	<0.02	<0.02
Conductivity (umhos/cm)	EPA Method (120.1)	2030	1770
Nitrate (mg/L)	EPA Method (353.2)	<0.1	<0.1
BOD (mg/L)	EPA Method (405.1)	<2	<2
Total Suspended Solids (mg/L)	EPA Method (160.2)	2	2
Total Dissolved Solids (mg/L)	EPA Method (160.1)	1693	484