

WATER PERMIT NO. 2446-2

Name of Applicant: Edward & Teresa Keefe

Address: RR 1 Box 138, Colome SD 57528

Phone: 605 842-3800

Amount of Water Claimed: 87 acre-feet

Total Acres: NA

Source of Water Supply: runoff

Water to be used for: fish & wildlife propagation and livestock water

County: Tripp

Type of Waste Disposal System:

Location: approximately 6 miles southeast of Winner

PRIORITY Date Received: 9-8-2000

Fee: \$150

Corrected Application Received: 9-15-2000

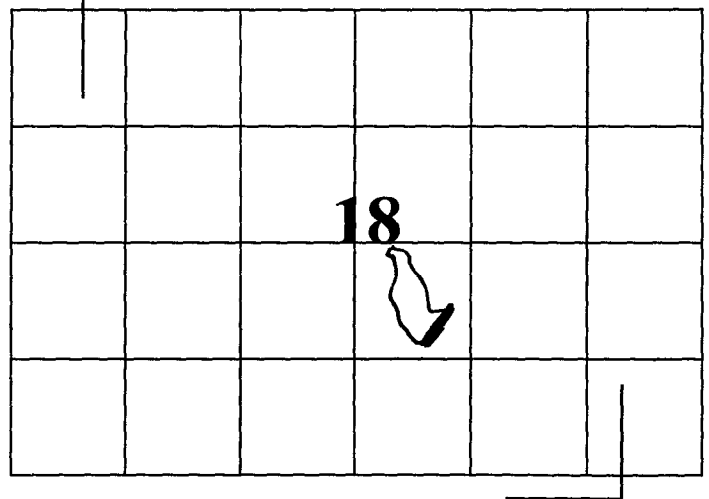
Period of Annual Use: January 1 – December 31

Remarks:

Diversion Point: NW ¼ SE ¼ Sec 18-T98N-R75W

Water Impounded: NW ¼ SE 1/4

Sec 18-T98N-R75W



Depth of Well: NA

Well Driller: :

Remarks:

Type of Map: topo

Prepared by: James Reedy, NRCS

Reviewed and the Number Assigned on: 9-15-2000

By: Karen Schlaak

Notice of Hearing - date to intervene: _____

**REISSUED
SOUTH DAKOTA
WATER PERMIT NO. 2446-2**

Date of first receipt of application September 8, 2000.

Date of return to applicant for corrections, amendments or changes September 11, 2000.

Date of receipt of corrected application September 15, 2000.

The Chief Engineer, on behalf of the Water Management Board, reissues Water Permit No. 2446-2 to Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 authorizing the construction of the dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 2446-2 authorizes impoundment of 100 acre-feet of water from runoff by constructing a dam located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ Section 18; with water impounded in portions of the SE $\frac{1}{4}$ Section 18; all in T98N-R75W.
2. The water appropriated shall be used for the purpose of supplying water for fish and wildlife propagation and livestock watering and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of readvertised Permit No. 2446-2 is December 3, 2001.
5. The date from which applicant may claim right is September 8, 2000.
6. One-fifth of the construction is to be completed on or before May 20, 2003.
7. All construction is to be completed on or before November 20, 2005.
8. Water is to be put to beneficial use on or before November 20, 2009.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

QUALIFICATIONS

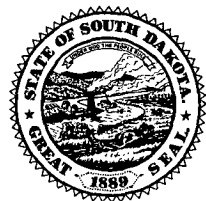
1. Water Permit No. 2446-2 authorizes a dam with a storage capacity of 100 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

WATER MANAGEMENT BOARD

By: Garland Erbele
Garland Erbele, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

JAN 15 2002

date



**SOUTH DAKOTA
WATER PERMIT NO. 2446-2**

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The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 2446-2 to Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 authorizing the construction of the dam and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 2446-2 authorizes impoundment of 87 acre-feet of water from runoff by constructing a dam located in the NW ¼ SE ¼ Section 18; with water impounded in portions of the SE ¼ Section 18; all in T98N-R75W.
2. The water appropriated shall be used for the purpose of supplying water for fish and wildlife propagation and livestock watering and may not exceed the amount of water needed for beneficial use.
3. The water is to be used during the following described annual period: January 1 – December 31.
4. The date of approval of Permit No. 2446-2 is November 20, 2000.
5. The date from which applicant may claim right is September 8, 2000.
6. One-fifth of the construction is to be completed on or before May 20, 2003.
7. All construction is to be completed on or before November 20, 2005.
8. Water is to be put to beneficial use on or before November 20 2009.
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QUALIFICATIONS

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WATER MANAGEMENT BOARD

By: Garland Erbele

Garland Erbele, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

JAN 02 2001

date



FORM 2: Application for uses other than irrigation
(type or print)



Mail to: Water Rights Program Joe Foss Building 523 E. Capitol Pierre, SD 57501-3181 (605) 773-3352	No. <u>2446-2</u>	(office use only) Hydrologic Unit <u>10140204</u>
	Basin <u>White River</u>	
	Newspaper <u>Winner Advocate, Winner</u>	

Application For Permit To Appropriate Water Within The State Of South Dakota

Check use(s) of water:

☐ Municipal	☐ Suburban Housing	☐ Recreational	☐ Institutional
☐ Rural Water System	☐ Commercial	☒ Fish & Wildlife	☐ Geothermal Heat
☐ Domestic (over 18 gpm)	☐ Industrial	☐ Other	

Type of Application: ☒ New ☐ Vested Right (Use predates Mar 2, 1955) ☐ Future Use Reservation
(check one) ☐ Place to Beneficial Use Water Reserved by Future Use Permit No. _____
☐ Amendment/Correction to Permit No. _____

Description of amendment/correction: (i.e. change diversion point(s), add diversion point(s), change use, etc.) _____

- Name of Applicant Edward Keefe & Teresa Keefe Phone 605 842-3800
(check one) ☒ Owner ☐ Tenant/lessee
Mailing Address RR1 Box 138 Colome State SD 57528
(Street, RR, or Box) (Zip Code)
- Amount of water claimed _____ *CFS or _____ **GPM 87 ***AF
(*Cubic Feet per Second) (**Gallons per Minute) (**Acre Feet - storage capacity of dam/dugout or annual use if applicable)
- Source of water supply Runoff
- Location of point of diversion (example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W) NW 1/4 SE 1/4 Sec. 18-T98N-R75W
Water Impounded: SE 1/4 Sec. 18-T98N-R75W
County _____
- County or counties where water will be used Tripp
- Annual period during which water is to be used Year-round Jan 1-Dec. 31
- Give a description of the project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)

See attached plans.

STATE OF SOUTH DAKOTA)
County of TRIPP SS

Attachments: Attach Form 2A if diversion is from a well or dugout, or if storage of water is proposed. Attach map and any other technical information. (see instructions)

I, Teresa M. Keefe, the applicant, certify that I have read this application, have examined the attached map and that the matters stated are true and that I intend, and am able to complete the necessary construction.

Signed _____

Subscribed and sworn to before me this _____ day of _____ 19 _____

19 _____

My Comm. Expires: 3/13/2003

Michael L. Snyder
Notary Public

Supplemental Information

(type or print in ink)

1. Well Information - Proposed Construction

- a) Drill Hole Diameter _____ Depth _____
- b) Casing Type _____ Diameter _____ Thickness _____
- c) Screen Type _____ Diameter _____ Thickness _____
- d) Gravel Pack _____ Length of Gravel Pack _____
- e) Depth to Top of Water Bearing Material _____
- f) Depth to Water (ground surface to water level) _____
- g) Distance to nearest existing domestic well: _____

On applicants property _____ On property owned by others _____

2. Wastewater Disposal System Information

- a) Type of System (i.e. septic tank, drain field) _____
- b) System Capacity (gallons) _____ Year Constructed _____
- c) Connected to the City of _____ Sanitary System _____

3. Dugout Information

- a) Surface Dimensions _____ Depth _____
- b) Depth to water (ground surface to water level) _____

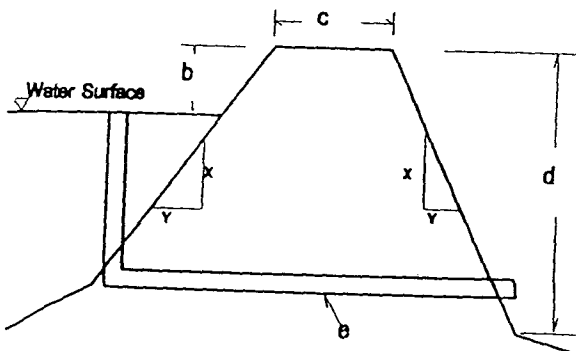
4. Water Storage Dams

If the proposed water use system contains one or more storage dams, please furnish the information requested below for each dam. The locations of the dams need to be shown on the map submitted with the application.

- a) If a private engineering firm or government agency was involved in the design of this dam, please give their name and address:

USDA-NRCS, James A. Reedy, P.E.

113 S. Madison, Suite 100
Winner, SD 57580



- b) Freeboard 3' to Secondary Spillway
7' to top of Dam
- c) Crest Width 16' top
Crest Length 774'
- d) Height 22' to top of dam, 18' to E.S.
- e) Primary Outlet Capacity 77.6 cfs
If pipe, diameter 30"
- f) Secondary Spillway Capacity 842 cfs
Spillway Width 125'
- g) X & Y Slope 3:1 both
Upstream _____
Downstream _____
- h) Surface Area of Impoundment 21.4 Acres
- i) Storage 87 Acre Feet
- j) Drainage Area Above Dam 3886 Acres



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3181
www.state.sd.us/denr

September 11, 2000

Edward & Teresa Keefe
RR 1 Box 138
Colome SD 57528

Dear Mr. & Mrs. Keefe:

Thank you for submitting the *Application for a Permit to Appropriate Water* for 87 acre-feet storage dam located in Tripp County. As stated on the yellow note, the application fee is \$150.00 and the license fee is \$50.00. It will not be necessary to file the Location Notice for Dam/Dugout since a water right permit is being obtained. Therefore, the \$10.00 fee is not required.

Enclosed is your check in the amount of \$210.00. Please submit a check for \$200.00. I have enclosed a postage prepaid envelope for your return use.

Upon receipt of the correct fee, further processing of the application will proceed. Thanks for your cooperation. If you have any questions, please contact me.

Sincerely,

Karen Schlaak

Karen Schlaak
Water Rights Program
605 773-3352

enclosure

*Opps!
Thank you. Let's
try this again.
Sincerely,
Tori Keefe*

SOIL LEGEND

The first capital letter is the first letter of the soil name. The letter that follows separates mapping units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second letter is a capital if the mapping unit is broadly defined; otherwise it is a small letter. The third letter is a capital letter and shows the slope class. Symbols without a slope letter are mostly for nearly level soils. A final number 2 in the symbols indicates that the soil is eroded.

SYMBOL	NAME	SYMBOL	NAME
AaB2	Anselmo loamy fine sand, 0 to 9 percent slopes, eroded	Ms	Mosher-Jerauld silt loams
AbB	Anselmo fine sandy loam, 3 to 6 percent slopes	Mu	Munjon fine sandy loam
AbC	Anselmo fine sandy loam, 6 to 9 percent slopes	OAF	Okaton association, 25 to 40 percent slopes
AbD	Anselmo fine sandy loam, 9 to 15 percent slopes	OBE	Okaton-Lakoma association, 15 to 40 percent slopes
AhC	Anselmo-Holt fine sandy loams, 3 to 9 percent slopes	OcF	Okaton-Rock outcrop complex, 25 to 60 percent slopes
AtD	Anselmo-Tassel fine sandy loams, 10 to 20 percent slopes	On	Onita silt loam
AvA	Anselmo-Vetal fine sandy loams, 0 to 3 percent slopes	Oo	Onita-Mosher silt loams
Ba	Bankard complex	OpC	Opal clay, 3 to 9 percent slopes
BmC	Boro-Millboro silty clays, 5 to 9 percent slopes	OsE	Opal-Sansarc clays, 9 to 25 percent slopes
BnC	Boyd clay, 5 to 9 percent slopes	Ow	Orwet loam
BOD	Boyd-Okaton association, 9 to 25 percent slopes	PrA	Promise clay, 0 to 3 percent slopes
Bp	Bridgeport complex	PrB	Promise clay, 3 to 6 percent slopes
Bt	Bridgeport complex, channeled	PrC	Promise clay, 6 to 9 percent slopes
CaB	Canning loam, 2 to 5 percent slopes	PsA	Promise clay, channeled, 0 to 2 percent slopes
CbD	Canning-Murdo loams, 6 to 15 percent slopes	PtA	Promise clay, loamy substratum, 0 to 2 percent slopes
Cc	Carter silty clay loam	RaA	Ree loam, 0 to 3 percent slopes
Cd	Cass fine sandy loam	RaB	Ree loam, 3 to 6 percent slopes
ChA	Chappell fine sandy loam, 0 to 3 percent slopes	RaC	Ree loam, 6 to 9 percent slopes
CnC	Chappell-Dix fine sandy loams, 6 to 9 percent slopes	RaD	Ree loam, 9 to 15 percent slopes
DaA	Dix fine sandy loam, 0 to 3 percent slopes	ReA	Reliance silty clay loam, 0 to 3 percent slopes
DbD	Dix soils, 9 to 18 percent slopes	ReB	Reliance silty clay loam, 3 to 6 percent slopes
DgB	Doger loamy fine sand, 0 to 6 percent slopes	ReC	Reliance silty clay loam, 6 to 9 percent slopes
DmA	Doger-Elsmere complex, 0 to 3 percent slopes	ReC2	Reliance silty clay loam, 6 to 9 percent slopes, eroded
DnC2	Dunday loamy fine sand, 3 to 9 percent slopes, eroded	RfA	Ronson fine sandy loam, 0 to 4 percent slopes
DuC	Dunday-Doger loamy fine sands, 3 to 9 percent slopes	RoB	Ronson-Tassel fine sandy loams, 0 to 6 percent slopes
Em	Elsmere fine sandy loam	RsB	Rosebud loam, 3 to 6 percent slopes
EpE	Epping soils, 12 to 25 percent slopes	RuC	Rosebud-Canyon loams, 6 to 9 percent slopes
Er	Erd clay	RuD	Rosebud-Canyon loams, 9 to 15 percent slopes
Es	Erd-Hurley complex	SAE	Sansarc-Opal association, 15 to 40 percent slopes
Ha	Haverson soils	ScF	Sansarc-Shale outcrop complex, 25 to 40 percent slopes
HbA	Holt-Anselmo fine sandy loams, 0 to 3 percent slopes	ShE	Schamber-Murdo complex, 15 to 40 percent slopes
HgA	Huggins silt loam, 0 to 3 percent slopes	So	Scott silt loam
HkB	Huggins-Kadoka silt loams, 3 to 9 percent slopes	SsB	Shena silt loam, 0 to 9 percent slopes
Hr	Hurley silt loam	Sw	Swanboy clay
Ia	Inavale loamy fine sand	TaE	Tassel fine sandy loam, 9 to 40 percent slopes
Ic	Inavale complex, channeled	TrF	Tassel-Rock outcrop complex, 15 to 40 percent slopes
KaA	Kadoka silt loam, 0 to 3 percent slopes	VaD	Valentine fine sand, 6 to 15 percent slopes
KbD	Kadoka-Epping silt loams, 6 to 12 percent slopes	VdC	Valentine-Dunday complex, 3 to 9 percent slopes
Ke	Keya silt loam	VnD	Valentine-Tassel complex, 6 to 15 percent slopes
Ko	Kolis clay	Vt	Vetal fine sandy loam
LkC	Lakoma-Millboro silty clays, 5 to 9 percent slopes	Wa	Wanblee-Wortman silt loams
LoD	Lakoma-Okaton silty clays, 9 to 15 percent slopes	Wb	Wann fine sandy loam
LwA	Lowry silt loam, 0 to 4 percent slopes	WeE	Westover loam, 9 to 25 percent slopes
MaA	Manter fine sandy loam, 0 to 3 percent slopes	WfA	Wewela loamy fine sand, 0 to 4 percent slopes
MaB	Manter fine sandy loam, 3 to 9 percent slopes	WgA	Wewela fine sandy loam, 0 to 3 percent slopes
MfE	Manter-Anselmo fine sandy loams, 15 to 30 percent slopes	WgB	Wewela fine sandy loam, 3 to 6 percent slopes
Mh	Marsh	Wh	Whitelake fine sandy loam
MoA	Millboro silty clay, 0 to 3 percent slopes	Wk	Whitelake-Lute fine sandy loams
MoB	Millboro silty clay, 3 to 6 percent slopes	Wn	Witten silty clay
MoC	Millboro silty clay, 6 to 9 percent slopes	Wo	Wortman silt loam
Mr	Mosher silt loam		

1DAMS2 XEQ 04/20/** STRUCTURE SITE ANALYSIS COMPUTER PROGRAM
 REV 01/01/90 SCS TECHNICAL RELEASE 48, (USER MANUAL) DATED JAN. 1990
 TIME 14:20:36

***** THIS PROGRAM IS IN TEST STATUS *****

***** 80-80 LIST OF INPUT DATA *****

DAMS2 01/01/90 ED KEEFE DAM ROUTING 02/29/00
 STRUCTURE KEEFE Location: TRIPP COUNTY

73.0	0.00	0.0
75.0		0.6
80.0		14.0
85.0		69.2
87.0		87.1
90.0		169.2
94.0		327.8

ENDTABLE

WSDATA	1A101	AC	80	3886.00	8.60
PDIRECT	1.0		3.7		
PSDATA	1		100	30	4.80
PSINLET	ELEV		1.0	12.5664	87.0
POOLDATA	ELEV			87.0	
PCREST	ELEV		90.0		
ESDATA	28		100	0.030	3
BTMWIDTH	FEET		120	125	150

COMMENT Route a 10 year storm through the principal
 COMMENT spillway and a 50 yr storm through the emergency spillway.
 COMMENT Routed by Jim Reedy.

GO, DESIGN L	TYPE2	24	TYPE2	24
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ENDJOB

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
 ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES.

1DAMS2 XEQ 04/20/**
 REV 01/01/90 AM ROUTING 02/29/00

WSID = ED KEEFE

Route a 10 year storm through the principal
 spillway and a 50 yr storm through the emergency spillway.
 Routed by Jim Reedy.

1DAMS2	-----				
XEQ 04/20/**	AM ROUTING 02/29/00				WSID= ED KEEFE
REV 01/01/90	ocation: TRIPP COUNTY				SUBW= 01
TIME 14:20:36	SITE = KEEFE	PASS=	1		PAGE= 1

*****	BASIC DATA	*****
ARID- SEMIARID CLIMATE AREA		DESIGN CLASS A1 =LT 3000

STORM DISTRIBUTION-PSH 24 HOUR TYPE II RAINFALL DISTRIBUTION

STORM DISTRIBUTION ESH...24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP.-	P-PS1 DAY	P-PS10 DAY	P-ES	P-FB
	3.70	.00	4.80	4.80

WSDATA-	CN	DA-SM	TC/L	-/H
	80.00	6.07	8.60	.00

SITEDATA-	PERM POOL	CREST PS	FP SED	QRF
	.00	87.00	.00	.00

BASEFLOW	INITIAL EL	EXTRA VOL.
.00	.00	.00

PSDATA-	NO. COND.	COND L	D/W	-/H
	1.00	100.00	30.00	.00

	PS N .025	KE 1.00	WEIR L 12.57	TW EL 73.00	
	2ND STG 87.00	ORF H .00	ORF L .00	START ES .00	
CRESTS-	ES1 90.00	ES2 .00	ES3 .00	ES4 .00	ES5 .00
EMG DATA-	SIDE SLOPE 3.00	EXIT N .035	EXIT SLOPE .040		
EMG DATA-	ES TYPE 28	ES LENGTH 100	ES ENTRANCE N .030		
BTM WIDTH-	BW1 120.00	BW2 125.00	BW3 150.00	BW4 .00	BW5 .00

***** NOTE - THIS IS ONLY A PRELIMINARY EMG RATING CURVE OF DISCHARGE/FT OF WIDTH AND DOES NOT INCLUDE SIDESLOPE CORRECTION OR REVISED RATING USING ACTUAL EMG. CONFIGURATION.

EMG ID CODE	28	ELEVATION INCREMENT (FT) = 1.000
DISCHARGES-Q1	Q2	Q3
1.989	6.714	13.276
		21.371
Q5	Q6	Q7
30.689	41.133	52.528
		64.883
Q9	Q10	Q11
78.101	92.064	106.796
		122.278

1DAMS2 -----
 XEQ 04/20/** AM ROUTING 02/29/00 WSID= ED KEEF
 REV 01/01/90 ocation: TRIPP COUNTY SUBW= 01
 TIME 14:20:36 SITE = KEEFE PASS= 1 PAGE= 2

CREST PS	87.00 FT	87.1 ACFT	.00 AC	.0 CFS
SED ACCUM	87.00 FT	87.1 ACFT	.00 AC	.0 CFS
2ND STAGE	87.00 FT	87.1 ACFT	.00 AC	.0 CFS
STARTING E	87.00 FT	87.1 ACFT	.00 AC	.0 CFS

1DAMS2 -----
 XEQ 04/20/** AM ROUTING 02/29/00 WSID= ED KEEF
 REV 01/01/90 ocation: TRIPP COUNTY SUBW= 01
 TIME 14:20:36 SITE = KEEFE PASS= 1 PAGE= 3

ES CREST	90.00 FT	169.2 ACFT	.00 AC	69.7 CFS
PS STORAGE	82.1 ACFT	BETWEEN ES CREST AND SED ACCUM ELEVATIONS		
STARTING E	87.00 FT	87.1 ACFT	.00 AC	.0 CFS

ELEVATION OF LOW POINT IS ZERO. NO CRITERIA CHECK MADE FOR STRUCTURE CLASSIFICATION

SCS-ESH	D= 24.00 HR	P= 4.80 IN	Q= 2.72 IN	DA = 6.07 SM
	TC= 8.60 HR	CN= 80.00	VOL= 880.6 ACFT	

Q PEAK = 1148.5 CFS, AT 17.5 HRS.

SCS-FBH	D= 24.00 HR	P= 4.80 IN	Q= 2.72 IN	DA = 6.07 SM
	TC= 8.60 HR	CN= 80.00	VOL= 880.6 ACFT	

PEAK = 1148.5 CFS, AT 17.5 HRS.

 RATING TABLE DEVELOPED, SITE = KEEFE
 BY PROGRAM FOR PS AND EMG SPILLWAYS

RATING	TABLE NUMBER 2	ELEV	Q-TOTAL	Q-PS	VOLUME	AREA		
		FEET	CFS	CFS	AC-FT	ACRE		
1		87.00	.00	.00	87.10	.00		
2		87.36	8.31	8.31	96.87	.00		
3		87.71	23.50	23.50	106.64	.00		
4		88.07	43.18	43.18	116.41	.00		
5		88.43	66.47	66.47	126.18	.00		
6		88.62	66.92	66.92	131.56	.00		
7		88.82	67.34	67.34	136.93	.00		
8		89.02	67.76	67.76	142.31	.00		
9		89.21	68.17	68.17	147.69	.00		
10		89.41	68.58	68.58	153.07	.00		
11		89.61	68.99	68.99	158.44	.00		
12		89.80	69.40	69.40	163.82	.00		
13		90.00	69.80	69.80	169.20	.00		
14		90.20	118.16	70.21	177.13	.00		
15		90.40	166.76	70.62	185.06	.00		
16		90.76	254.66	71.35	199.33	.00		
17		91.20	430.02	72.23	216.78	.00		
18		92.00	902.06	73.80	248.50	.00		
19		93.00	1739.02	75.71	288.15	.00		
20		94.00	2797.36	77.58	327.80	.00		

FULL CONDUIT FLOW, ELEV = 88.43 FT

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
SCS-ESH	FT	FT	ACFT	AC	FT	ACFT
	120.0	92.25	258.3	.0	2.25	89.1

PEAK - CFS	Q-PS	Q-ES	Q-TOT
DISCHARGE =	74.3	1034.2	1108.4

EMERGENCY SPILLWAY----	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-S/C	25% OF S/C
	FT	FT/SEC	FT/FT	FT/FT
	1.31	6.39	.017	.022

EMERGENCY SPILLWAY----	DURATION FLOW	ATTACK OE/B	SUMMATION
	HRS	ACFT/FT	VEL**2 DELTA T
	20.0	5.6	(FT/SEC)**2 HRS
			622.8

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 8.37 FT/SEC
EXIT SLOPE = .040 FT/FT
FLOW DEPTH = 1.005

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
SCS-FBH	FT	FT	ACFT	AC	FT	ACFT
	120.0	92.25	258.3	.0	2.25	89.1

PEAK - CFS	Q-PS	Q-ES	Q-TOT
DISCHARGE =	74.3	1034.2	1108.4

EMERGENCY SPILLWAY----	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-S/C	25% OF S/C
	FT	FT/SEC	FT/FT	FT/FT
	1.31	6.39	.017	.022

EMERGENCY SPILLWAY----	DURATION FLOW	ATTACK OE/B	SUMMATION
	HRS	ACFT/FT	VEL**2 DELTA T
	20.0	5.6	(FT/SEC)**2 HRS
			622.8

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 8.37 FT/SEC
EXIT SLOPE = .040 FT/FT
FLOW DEPTH = 1.005

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
	FT	FT	ACFT	AC	FT	ACFT

***** MINIMUM DEPTH IN TR60 IS 3.000 FEET. *****
MINIMUM ES 120.0 93.00 288.1 .0 3.00 118.9

RATING TABLE DEVELOPED, SITE = KEEFE
BY PROGRAM FOR PS AND EMG SPILLWAYS

RATING TABLE NUMBER 3

	ELEV FEET	Q-TOTAL CFS	Q-PS CFS	VOLUME AC-FT	AREA ACRE
1	87.00	.00	.00	87.10	.00
2	87.36	8.31	8.31	96.87	.00
3	87.71	23.50	23.50	106.64	.00
4	88.07	43.18	43.18	116.41	.00
5	88.43	66.47	66.47	126.18	.00
FULL CONDUIT FLOW, ELEV = 88.43 FT					
6	88.62	66.92	66.92	131.56	.00
7	88.82	67.34	67.34	136.93	.00
8	89.02	67.76	67.76	142.31	.00
9	89.21	68.17	68.17	147.69	.00
10	89.41	68.58	68.58	153.07	.00
11	89.61	68.99	68.99	158.44	.00
12	89.80	69.40	69.40	163.82	.00
13	90.00	69.80	69.80	169.20	.00
14	90.20	120.15	70.21	177.13	.00
15	90.40	170.73	70.62	185.06	.00
16	90.76	262.22	71.35	199.33	.00
17	91.20	444.69	72.23	216.78	.00
18	92.00	935.63	73.80	248.50	.00
19	93.00	1805.40	75.71	288.15	.00
20	94.00	2904.21	77.58	327.80	.00

ROUTED RESULTS SCS-ESH	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	EMG. HP FT	VOL-ES ACFT
	125.0	92.20	256.5	.0	2.20	87.3

PEAK - CFS DISCHARGE =	Q-PS 74.2	Q-ES 1036.0	Q-TOT 1110.2
EMERGENCY SPILLWAY----	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-S/C FT/FT
	1.27	6.31	.017
EMERGENCY SPILLWAY----	DURATION HRS	ATTACK OE/B ACFT/FT	SUMMATION VEL**2 DELTA T (FT/SEC)**2 HRS
	20.0	5.3	603.8

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 8.25 FT/SEC
EXIT SLOPE = .040 FT/FT
FLOW DEPTH = .982

ROUTED RESULTS SCS-FBH	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	EMG. HP FT	VOL-ES ACFT
	125.0	92.20	256.5	.0	2.20	87.3

PEAK - CFS DISCHARGE =	Q-PS 74.2	Q-ES 1036.0	Q-TOT 1110.2
EMERGENCY SPILLWAY----	CRITICAL DEPTH FT	CRITICAL VELOCITY FT/SEC	CRITICAL SLOPE-S/C FT/FT
	1.27	6.31	.017
EMERGENCY SPILLWAY----	DURATION HRS	ATTACK OE/B ACFT/FT	SUMMATION VEL**2 DELTA T (FT/SEC)**2 HRS
	20.0	5.3	603.8

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 8.25 FT/SEC
EXIT SLOPE = .040 FT/FT
FLOW DEPTH = .982

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	EMG. HP FT	VOL-ES ACFT
----------------	-----------------	----------------	-----------------	----------------	---------------	----------------

***** MINIMUM DEPTH IN TR60 IS 3.000 FEET. *****						
MINIMUM ES	125.0	93.00	288.1	.0	3.00	118.9

RATING TABLE DEVELOPED, SITE = KEEFE
BY PROGRAM FOR PS AND EMG SPILLWAYS

RATING TABLE NUMBER 4				
ELEV	Q-TOTAL	Q-PS	VOLUME	AREA

	FEET	CFS	CFS	AC-FT	ACRE
1	87.00	.00	.00	87.10	.00
2	87.36	8.31	8.31	96.87	.00
3	87.71	23.50	23.50	106.64	.00
4	88.07	43.18	43.18	116.41	.00
5	88.43	66.47	66.47	126.18	.00
FULL CONDUIT FLOW, ELEV = 88.43 FT					
6	88.62	66.92	66.92	131.56	.00
7	88.82	67.34	67.34	136.93	.00
8	89.02	67.76	67.76	142.31	.00
9	89.21	68.17	68.17	147.69	.00
10	89.41	68.58	68.58	153.07	.00
11	89.61	68.99	68.99	158.44	.00
12	89.80	69.40	69.40	163.82	.00
13	90.00	69.80	69.80	169.20	.00
14	90.20	130.10	70.21	177.13	.00
15	90.40	190.63	70.62	185.06	.00
16	90.76	300.01	71.35	199.33	.00
17	91.20	518.05	72.23	216.78	.00
18	92.00	1103.49	73.80	248.50	.00
19	93.00	2137.29	75.71	288.15	.00
20	94.00	3438.48	77.58	327.80	.00

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
SCS-ESH	FT	FT	ACFT	AC	FT	ACFT
	150.0	92.01	248.8	.0	2.01	79.6

PEAK - CFS	Q-PS	Q-ES	Q-TOT
DISCHARGE =	73.8	1037.0	1110.8

EMERGENCY SPILLWAY----	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-S/C	25% OF S/C
	FT	FT/SEC	FT/FT	FT/FT
	1.13	5.97	.017	.023

EMERGENCY SPILLWAY----	DURATION FLOW	ATTACK OE/B	SUMMATION
	HRS	ACFT/FT	VEL**2 DELTA T
	19.5	4.5	(FT/SEC)**2 HRS
			527.0

EXIT CHANNEL FLOW SUPERCRITICAL:	MAX VELOCITY=	7.71	FT/SEC
	EXIT SLOPE =	.040	FT/FT
	FLOW DEPTH =	.881	

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
SCS-FBH	FT	FT	ACFT	AC	FT	ACFT
	150.0	92.01	248.8	.0	2.01	79.6

PEAK - CFS	Q-PS	Q-ES	Q-TOT
DISCHARGE =	73.8	1037.0	1110.8

EMERGENCY SPILLWAY----	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-S/C	25% OF S/C
	FT	FT/SEC	FT/FT	FT/FT
	1.13	5.97	.017	.023

EMERGENCY SPILLWAY----	DURATION FLOW	ATTACK OE/B	SUMMATION
	HRS	ACFT/FT	VEL**2 DELTA T
	19.5	4.5	(FT/SEC)**2 HRS
			527.0

EXIT CHANNEL FLOW SUPERCRITICAL:	MAX VELOCITY=	7.71	FT/SEC
	EXIT SLOPE =	.040	FT/FT
	FLOW DEPTH =	.881	

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	EMG. HP	VOL-ES
	FT	FT	ACFT	AC	FT	ACFT

***** MINIMUM DEPTH IN TR60 IS 3.000 FEET. *****						
MINIMUM ES	150.0	93.00	288.1	.0	3.00	118.9

1DAMS2....JOB NO. 1 COMPLETE

ED KEEFE AM ROUTING 02/29/00

0 SUBWATERSHED(S) ANALYZED

1 STRUCTURE(S) ANALYZED

6 HYDROGRAPHS ROUTED AT LOWEST SITE

Q TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED VELOCITY(S)

DAMS2.....COMPUTATIONS COMPLETE

1

SUMMARY TABLE 1

DAMS2 VERSION 01/01/90

WATERSHED ID				RUN DATE		RUN TIME			
ED KEEFE				04/20/**		14:20:36			
>>>	SITE ID	SUBWS ID	SUBWS DA (SQ MI)	CURVE NO.	TC (HRS)	TOTAL DA (SQ MI)	TYPE DESIGN	STRUC CLASS	<<<
	KEEFE	01	6.07	80.	8.60	6.07	TR60	A1	
PASS NO.	DIA/ WIDTH (IN/FT)	ES CREST ELEV (FT)	BTM WIDTH (FT)	MAX HP (FT)	MAX ELEV (FT)	YARDAGE EMB (CY)	OE/B* (AF/FT)	EXIT* VELOCITY (FT/SEC)	TYPE HYD
1	30.0	90.00	120.00	3.00	93.00	0.	5.6	8.37	MINIMUM ES
1	30.0	90.00	125.00	3.00	93.00	0.	5.3	8.25	MINIMUM ES
1	30.0	90.00	150.00	3.00	93.00	0.	4.5	7.71	MINIMUM ES

* OE/B AND EXIT VELOCITY ARE BASED ON THE ROUTED HYDROGRAPH AND WILL NOT RELATE TO THE MAX. ELEV. (TOP OF DAM), WHICH IS SET BY MINIMUM DESIGN CRITERIA.

DAMS2.....SUMMARY TABLE 1 COMPLETED

SCS DAMS2 VERSION 01/01/90
ED KEEFE FILES

INPUT = c:\eng\dams2\keefe.dat
OUTPUT = c:\eng\dams2\keefe.OUT

DATED 04/20/** 14:20:36

- Justification of E.S. Btm Width -

4' HP instead of 3' lowers exit velocity

James Reedy, P.E.

4/20/00

GRAPHICAL PEAK DISCHARGE METHOD

Version 2.00

Project : Ed Keefe Pond
 County : Tripp
 Subtitle:

State: SD

User: JAR
 Checked: _____

Date: _____
 Date: _____

Data: Drainage Area : 3886 Acres
 Runoff Curve Number : 80
 Time of Concentration: 8.60 * Hours
 Rainfall Type : I
 Pond and Swamp Area : 10 Acres 0.3 % of Drainage Area

Storm Number	1	2	3	4	5	6	7
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr Rainfall (in)	1.8	2.3	3	3.6	4.2	4.8	5.4
Ia/P Ratio	0.28	0.22	0.17	0.14	0.12	0.10	0.09
Used	0.28	0.22	0.17	0.14	0.12	0.10	0.10
Runoff (in)	0.44	0.75	1.25	1.72	2.21	2.72	3.24
Unit Peak Discharge (cfs/acre/in)	0.072	0.075	0.078	0.080	0.081	0.082	0.082
Pond and Swamp Factor 0.2% Ponds Used	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Peak Discharge (cfs)	120	213	368	517	676	842	1008

* - Value(s) provided from TR-55 system routines

TIME OF CONCENTRATION AND TRAVEL TIME

Version 2.00

Project : Ed Keefe Pond
 County : Tripp
 Subtitle:

State: SD

User: JAR
 Checked: _____

Date: _____
 Date: _____

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.3	300	.02	e					0.464
Shallow Concent'd		1000	.06	u					0.070
Shallow Concent'd		1000	.06	u					0.070
Open Channel		12200						.75	4.519
Open Channel		12500						1	3.472
Time of Concentration =									8.60*
									=====

--- Sheet Flow Surface Codes ---
 A Smooth Surface
 B Fallow (No Res.)
 C Cultivated < 20 % Res.
 D Cultivated > 20 % Res.
 E Grass-Range, Short

F Grass, Dense
 G Grass, Burmuda
 H Woods, Light
 I Woods, Dense
 J Range, Natural

--- Shallow Concentrated ---
 --- Surface Codes ---
 P Paved
 U Unpaved

* - Generated for use by GRAPHIC method

Peak Discharge Calculations using Regional Regression Equations for South Dakota
Taken from "Techniques for Estimating Peak-Flow Magnitude and Frequency Relations for
South Dakota Streams"

Water-Resources Investigations Report 98-4055

Operator Name:

Legal Description:

Drainage Area (Sq Mi.):

Channel Slope (ft/mile): (Subregion F only)

Subregion: ▼

Precip. Intensity Index: ▼ (Subregions A & B only)

2 year Q:	69.75 cfs
5 year Q:	205.60 cfs
10 year Q:	355.12 cfs
25 year Q:	581.75 cfs
50 year Q:	799.44 cfs
100 year Q:	1051.78 cfs
500 year Q:	1809.76 cfs

Natural Resources Conservation Service
 113 South Madison, Suite 100
 Winner, SD 57580-1313
 605-842-0603, ext. 3
 Wed Feb 09 15:43:15 2000

PROJECT: C:\Spectra\Tmodwin\projects\keefe.pro

HYDROLOGIC REPORT - POND DEPTH VS STORAGE PROVIDED

POND: Stage-Storage

ELEV feet	DEPTH feet	AREA sq.ft.	VOLUME cu.ft.	SUMVOL cu.ft.
73.0		881.1		0.0
74.0	1.0	8848.3	4864.7	4864.7
75.0	1.0	32162.9	20505.6	25370.3
	1.0		42849.3	68219.6
76.0	1.0	53535.7	68552.7	136772.3
77.0	1.0	83569.8	94772.7	231545.0
78.0	1.0	105975.6	149539.8	381084.8
79.0	1.0	193104.0	228987.2	610072.0
80.0	0.0	264870.4	0.0	610072.0
80.0	1.0	300.4	193644.3	803716.3
81.0	1.0	386988.2	432319.3	1236035.6
82.0	1.0	477650.4	515396.0	1751431.6
83.0	1.0	553141.6	592312.0	2343743.6
84.0	1.0	631482.5	670932.5	3014676.1
85.0	1.0	710382.5	363525.9	3378202.0
86.0	0.0	16669.3	0.0	3378202.0
86.0	0.0	1.0	0.0	3378202.0
86.0	1.0	819090.8	414291.2	3792493.2
87.0	0.0	9491.5	0.0	3792493.2
87.0	1.0	930474.0	1034913.1	4827406.3
88.0	2.0	1139352.2	2542182.2	7369588.5
90.0	2.0	1402830.0	3115989.7	10485578.2
92.0	2.0	1713159.7	3792656.3	14278234.5
94.0		2079496.6		

**CONSTRUCTION SPECIFICATIONS
AND BID SCHEDULE**

for

ED & TERRY KEEFE

WILDLIFE POND

SE ¼ SECTION 18 T98N R75W, TRIPP COUNTY, SD

Prepared by:

**USDA - NATURAL RESOURCES CONSERVATION
SERVICE**

JAMES A. REEDY, P.E.

AGRICULTURAL ENGINEER

April 19, 2000

Assisting:

HAMILL CONSERVATION DISTRICT

NATURAL RESOURCES CONSERVATION SERVICE
NATIONAL ENGINEERING HANDBOOK
SECTION 20
SPECIFICATIONS FOR CONSTRUCTION CONTRACTS

INDEX TO SPECIFICATIONS FOR:

ED & TERRY KEEFE
WILDLIFE POND
TRIPP COUNTY, SOUTH DAKOTA

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CONSTRUCTION SPECIFICATION

SD-5 EXCAVATION

5.1 SCOPE

The work shall consist of all excavations to the lines and grades as shown on the drawing and the use and disposal of the excavated materials.

5.2 CLASSIFICATION

Common excavation shall be defined as the excavation of all materials that can be removed and transported by heavy duty construction equipment having a power rating of at least 200 net peak flywheel horsepower 1/, and includes boulders and loose rock less than 1 cu. yd. in volume.

Rock excavation shall be defined as the excavation of all hard compacted or cemented materials requiring blasting or larger equipment than defined under common excavation, including boulders and loose rock 1 cu. yd or greater in volume.

5.3 USE OF EXCAVATED MATERIALS

Excavated materials deemed satisfactory by the technician shall be used for earth or rock fill to the extent needed.

5.4 DISPOSAL OF WASTE MATERIAL

All surplus or waste material shall be disposed of in areas shown on the drawings or as directed by the technician, and left in a neat, sightly condition and sloped to provide drainage.

5.5 BRACING AND SHORING

Excavated surfaces too steep to be stable shall be supported to prevent soil movement. The contractor shall furnish, place, and subsequently remove the supports.

5.6 STRUCTURE AND TRENCH EXCAVATION

Structure or trench excavation shall be approved by the technician before any structure, pipe, or earth fill is placed in the excavation.

5.7 BORROW EXCAVATION

When quantities of suitable materials obtained from specified excavations are insufficient to construct specified fills. Additional materials shall be obtained

from the designated borrow area as directed by the technician.

Borrow pits shall be excavated and finely dressed in a manner to eliminate steep or unstable side slopes or other hazardous or unsightly conditions.

5.8 BLASTING

The transportation, handling, storage, and use of dynamite and other explosives shall be directed by a person of proven experience and ability in blasting operations.

Blasting shall be done in such a way as to prevent damage to the work or unnecessary fracturing of the foundation.

1/ D-8 Caterpillar or equivalent

CONSTRUCTION SPECIFICATION

SD-7S EARTH FILL-CLASS S

7S.1 SCOPE

The work shall consist of the construction of compacted earth fills where the amount of compaction is to be controlled by a method type of specification.

7S.2 MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing and disposition of materials shall be subject to approval by the technician.

Fill materials shall not contain frozen material, sod, brush, roots, or other perishable materials, or rocks larger than 8 inches in diameter. Fill shall not be placed on a frozen surface.

7S.3 FOUNDATION PREPARATION

After stripping (see stripping specification), the foundation shall be scarified or plowed to a minimum depth of 4 inches. The entire foundation area shall then be compacted by the process used on the fill.

7S.4 PLACEMENT

All foundation excavations and/or preparation shall be completed before placing fill. The fill shall be placed such that the distribution of materials is essentially uniform throughout the entire fill and is free from lenses, pockets, streaks, or layers of materials differing substantially from surrounding material.

Fill, adjacent to structures, shall be placed in a manner that will prevent damage to the structures and allow the structures to assume the backfill loads gradually and uniformly. Equipment weighing more than 400 pounds shall not be operated within 2 feet of any structure.

Fill shall be placed in approximately equal horizontal layers. Fill layer thicknesses shall not exceed 9 inches for machine compaction or 4 inches for hand compaction (including hand directed power tampers adjacent to structures).

7S.5 MOISTURE CONTENT

The fill material shall have a moisture content that when kneaded in the hand will form a ball which does not

easily crumble when struck sharply with a pencil or which does not crumble when pressed between the hands.

If the soil is too wet, it will yield free water when kneaded in the hand. The fill may have to be wetted or dried to achieve proper moisture control.

7S.6 COMPACTION (CLASS S)

The fill shall be compacted by one of the following methods.

- a. By routing the hauling and spreading equipment such that all points of the fill is traversed by at least one tread track of the loaded equipment, parallel to the centerline of the fill.
- b. By at least two passes of a tamping (sheepfoot) roller weighing at least 100 pounds per square inch of bearing area.

Fill adjacent to structures shall be compacted to a density equivalent to that of the surrounding fill by means of hand tamping or manually directed power tampers or plate vibrators. Heavy equipment shall not be operated within 2 feet of any structure.

Compaction of fill adjacent to concrete structures shall not be started until the following time limits have elapsed after placement of the concrete.

<u>Structure</u>	<u>Time Interval</u>
Walls and counterforts	14 days
Conduits and Spillway Risers (cast in place)	14 days
Conduits, precast, cradled	2 days
Conduits, precast, bedded	1 day
Anti-seep Collars and Cantilever pipe props	3 days

CONSTRUCTION SPECIFICATION

SD-9 DRAIN FILL AND FILTER

9.1 SCOPE

The work shall consist of furnishing and placing drain fill and filter sands or gravels.

9.2 MATERIALS

a. Quality

Aggregates shall be sand, gravel, or crushed stone, composed of clean, hard, durable mineral particles free from organic matter, clay balls, soft particles or other substances that would interfere with their free draining properties.

Not more than 5 percent of the material may be crushed limestone, not more than 15 percent may be flat, elongated particles, and not more than 5 percent may be finer than a No. 200 sieve.

b. Gradation

The aggregates shall meet the following gradation requirements unless otherwise specified in the plans.

<u>Size</u>	<u>% Finer</u>
3"	100%
1"	90-100%
#4	50-85%
#50	10-40%
#200	0-5%

9.3 BASE PREPARATION

Surfaces on which drain fill will be placed shall be as undisturbed as possible (do not scarify), and will be free of standing water during placement of the fill. Care shall be taken to prevent trench walls from sliding.

9.4 PLACEMENT

Material shall be placed in uniform, approximately 6-inch thick layers. Extreme care shall be taken to assure uniformity of the drain fill, and to prevent segregation

or contamination of the drain fill with foreign matter.
When collector pipes are included in drains, the fill
materials shall be placed in a manner to avoid displacing
the pipe.

CONSTRUCTION SPECIFICATION

SD-10 SALVAGING AND SPREADING TOPSOIL

10.1 SCOPE

The work shall consist of salvaging topsoil from borrow pits or other excavations and spreading it in the designated areas to the specified depths.

10.2 QUALITY OF TOPSOIL

Topsoil shall consist of friable soil reasonably free of grass, roots, weeds, sticks, stones, or other foreign materials.

10.3 EXCAVATION

Topsoil shall be removed after clearing and grubbing and removing vegetation and shall be stockpiled at locations approved by the technician. Objectionable materials shall be removed and buried, or disposed of, at locations approved by the technician.

10.4 SPREADING

Spreading shall not be done when the ground or topsoil is frozen, excessively wet or otherwise in a condition detrimental to the work. Surfaces to be covered shall be lightly scarified just prior to the spreading operation.

All earth fills not to be submerged shall be covered with topsoil to a depth of 6 to 18 inches measured normal to the surface of the fill and placed to the neat lines shown on the drawings.

After placement is completed, the topsoil surface shall be left in a condition that will permit seeding equipment to be operated without excessive smoothing.

CONSTRUCTION SPECIFICATION

SD-12B CONCRETE FOR MINOR STRUCTURES

(FOR STRUCTURES UP TO 10 C.Y.)

12B.1 SCOPE

The work shall consist of proportioning, forming, placing, finishing, and curing portland cement concrete.

Acceptance:

The acceptance or rejection of concrete made under this specification will depend upon adherence to the procedures set forth herein, and the appearance of the finished structure.

12B.2 MATERIALS

Portland Cement shall be Type II or Type IIA Portland Cement. Cement that is partially hydrated or otherwise damaged shall not be used.

Fine Aggregate is defined as all material which will pass a 1/4-inch screen. Fine aggregate shall compose between 35 and 45 percent of the total aggregate and shall not contain more than 1 percent clay lumps or more than 4 percent finer than a No. 200 sieve. Coal in fine aggregate shall not exceed 1/2 of 1 percent.

Coarse Aggregate is defined as all material larger than 1/4 inch. Maximum size aggregate shall not exceed:

- 1 inch - Concrete thickness of 4 inches or less
- 1 1/2 inch - Concrete thickness of 4 inches or more

Coarse aggregate shall compose between 55 and 65 percent of total aggregate and shall not contain more than 1/4 of 1 percent of clay lumps or more than 1 percent of material finer than No. 200 sieve. Coal shall not exceed one percent.

Mixed fine and coarse aggregate or pit-run aggregate may be used provided the requirements stated above are met.

Water shall be clean and free of harmful chemicals (suitable for drinking).

12B.3 DESIGN OF CONCRETE MIX

The contractor or person in charge of construction shall be responsible for designing a high quality concrete mix conforming to this specification.

The mix shall contain less than 6 gallons of water per bag of cement, and at least 6 bags of cement per cubic yard of concrete. The air-entrainment shall be between 4 and 7 percent by volume, and the slump after mixture shall be between 2 and 4 inches.

The following table is recommended as a guide for developing a satisfactory mix to give 3000 psi compressive strength for air-entrained concrete.

Max. Size Aggregate	Gal. Water per sack of cement	%of Fine Aggregate	Sacks Cement per cu. yd.	Pounds Fine Aggregate per sack	Pounds Coarse Aggregate per sack
1"	6.0	40	6.0	190-200	311-310
1 1/2"	6.0	35	6.0	180-190	330-340

Ready Mixed concrete may be used provided it meets the requirements of these specifications. Upon request the vendor shall provide the owner with a signed delivery ticket giving the quantities of concrete, cement, fine aggregate, coarse aggregate and water contained in the batch.

Measurements of materials shall be by weight where suitable scales are available. Where suitable scales are not available, volume measurement may be used provided volume-weight relationships are carefully determined. Calcuim chloride or other accelerators or anti-freeze compounds shall not be used.

Measurements (by weight) of materials in the mix shall be made available to the technician.

12B.4 FORMS FOR CONCRETE

Forms shall be made of wood, plywood, steel or other approved material. The type, size, shape, quality and strength of forms will be subject to approval by the technician.

All forms shall be true to line and grade, mortar tight, and rigid enough to prevent bulging or displacement. Tolerances will be close enough to assure that the structure appears and performs well.

All forms shall be removed from the concrete. Forming shall not be embedded in the concrete.

12B.5 PLACING CONCRETE

Concrete shall be placed in final position within one and one-half hours after mixing with cement.

Concrete shall be consolidated by hand spading and tamping or by mechanical vibration.

All concrete placed on earth shall be placed on clean damp surface, free of frost, ice, or running water. Concrete shall not be dropped more than 5 feet vertically unless suitable equipment is used to prevent segregation.

Uniformed surfaces (excluding slip form concrete) exposed in the completed work shall have a wood float finish. Exposed concrete edges shall be chamfered for finished with molding tools.

Concrete shall be placed at air temperatures between 40 degrees F. and 80 degrees F. unless special measures are taken to protect the concrete. Concrete shall be protected from freezing for 7 days after placement.

12B.6 CURING CONCRETE

All concrete shall be cured by keeping all exposed surfaces wet for 7 days or by applying a spray type curing compound to exposed concrete surfaces immediately after the free water has disappeared after pouring.

12B.7 DEFECTIVE CONCRETE

Honey combed areas and other voids in concrete will be promptly repaired with mortar patching immediately upon discovery.

Concrete subjected to damage and/or other violations of this specification will be rejected.

CONSTRUCTION SPECIFICATION

SD-13 STEEL REINFORCEMENT

13.1 SCOPE

The work shall consist of furnishing and placing steel reinforcement for reinforced concrete.

13.2 MATERIALS

All reinforcement shall be free from all flaky rust, oil, grease, paint, mill scale, or other foreign substance.

Steel bar reinforcement shall be deformed billet steel conforming to either ASTM specification A 15 Intermediate Grade or A 615 Grade 40.

Welded steel wire fabric reinforcement shall conform to the requirements of ASTM Specification A 185.

13.3 CUTTING AND BENDING

Reinforcing bars may be mill or field cut or bent. All bends shall be made without heating and accordance with standard practices (See American Concrete Institute Standard 315). Bars with kinks, cracks, or improper bends will be rejected.

13.4 SPLICING BAR REINFORCEMENT

Unless otherwise specified on the drawings, splices of reinforcing bars shall provide an overlap equal to at least 30 times the diameter of the smaller bar in the splice but not less than 12 inches.

Welded wire fabric shall be overlapped one full mesh (not counting cut portions) and tied as necessary to keep the fabric in place during pouring.

13.5 PLACING

All reinforcing shall be placed as shown on the drawings, and shall be supported and tied in a manner assuring that it will not be moved during concrete placement. Tack welding of bars will not be allowed. Dimensions shown on the plans, indicating concrete cover, are the clear distances from the concrete surface to the reinforcing steel.

Reinforcement hangers and supports shall be of a type and used in such a manner that they will not be exposed or contribute to discoloration and deterioration of the concrete. On structures exceeding one cubic yard in volume, concrete shall

not be placed until the reinforcement has been inspected and approved by the technician.

CONSTRUCTION SPECIFICATION

SD-16 TIMBER FABRICATION AND INSTALLATION

16.1 SCOPE

This specification covers the quality and installation of plywood and pressure treated structural timber poles, posts, and lumber structure and timber and lumber portions of composite structure.

16.2 MATERIAL

a. Plywood

Plywood for above ground use shall be new, exterior grade, and shall meet Product Standard PS 1.

Plywood for use underground shall be pressure treated in accordance with the American Wood Preservers Bureau AWPB- FDN Standard (stamped on plywood).

b. Structural Timber and Lumber

Structural timber and lumber shall be structural grade or better. Structural timber, poles, posts, and lumber shall be new, sound, decay free, straight, not warped or cracked. Unless otherwise specified on the drawings, all lumber and timber except redwood and red cedar shall be treated by any of the following preservatives:

- Commercial Coal Tar Creosote
- Hot and Cold Bath Creosote
- Pentachlorophenol-Commercial Treatment
- Pentachlorophenol-Cold Soaking Method
- AWPB- FDN Standard Preserving Salts

c. Hardware

Bolts, rods, nuts, washers, and other hardware shall be an appropriate grade of steel, and if to be placed underground, shall be galvanized or otherwise corrosion protected.

16.3 INSTALLATION

The material shall be of the dimensions, and installed at the location, as shown on the drawings. All lumber to be treated shall be cut to size, insofar as practical, prior to treatment. Raw ends of lumber which has been cut after treatment shall be immersed in the preservative

solution, or painted with four (4) heavy coats of the solution. Each application should be allowed to dry. For home treatment, the preservative manufacturer's directions shall be carefully followed.

CONSTRUCTION SPECIFICATION

SD-17 METAL FABRICATION AND INSTALLATION

17.1 SCOPE

The work shall consist of furnishing, fabricating, and installing metalwork including metal parts of composite structures.

17.2 MATERIALS

A. Steel

Except as noted below, steel shall be carbon steel of a malleable, weldable quality.

High strength, weather resistant steel shall conform to the requirements of ASTM A-242, A-588, or A-514.

Bolts, nuts, washers, rods, rivets, etc., shall be of a material equal to the steel being fastened.

B. Aluminum

Aluminum alloy products shall be Alloy 6061-T6.

17.3 PROTECTIVE COATINGS

A. Galvanizing

If specified on the drawings, steel shall be galvanized. Galvanizing shall conform to ASTM A-386, A-153, A-164 Type RS, or A-165 Type TS.

B. Painting

Unless shown otherwise on the plans, non galvanized metal shall be cleaned and painted using the following procedure.

- (1) Cleaning - Remove all dirt, oil, and grease by means of mineral spirit cleaning. Next, thoroughly wet the metal with a dilute (about 5 percent strength) phosphoric acid solution. Allow the acid to dry and then thoroughly rinse the surfaces with clear water and again allow to dry.
- (2) Paint - Apply two coats of one of the following paints:
 - a. Zinc Dust - Zinc Oxide Primer conforming to Federal Specification TT-P-641, Type III.

- b. Zinc Dust Chlorinated Rubber conforming to Federal Specification TT-P-1046a.
 - c. Zinc Dust Paint conforming to Military Specification MIL-P-21035.
 - d. Epoxy-Polyamide Paint conforming to Defense Specification DOD-P-15145B.
- (3) Application - Paints shall be thoroughly mixed at the time of application. The first coat of paint shall be applied by brushing. All other coats may be applied by brush or spray. Each coat shall be applied in such a manner as to produce a continuous paint film of uniform thickness.

Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is less than 50 degrees F. Painting shall be done only when the humidity and temperature of the surrounding air and the temperature of the metal surfaces are such that evaporation rather than condensation will result during the application and drying time.

The finished surface of each coat shall be free from runs, drops, ridges, laps, or excessive brush marks and shall present no variation in color, texture, and finish. Surfaces shall be thoroughly dry before application of each coat of paint. The surface of each dried coat shall be cleaned as necessary before application of the next coat. After installation of the metalwork, all damage to painted surfaces shall be repaired.

17.4 FABRICATION

Metal items shall be fabricated to close fit, closely conforming to the drawings. Joints to be welded, shall be welded all around, in a manner developing as much strength as possible.

17.5 ERECTION

The metal shall be erected true and plumb, closely conforming to the drawings.

Riveting and welding shall not be done until as much of the structure as will be stiffened thereby has been properly aligned.

CONSTRUCTION SPECIFICATION

SD-28 SEEDING

28.1 SCOPE

The work shall consist of furnishing all labor, equipment, and materials for seeding a permanent grass mixture on the areas shown on the drawings.

28.2 GENERAL

The seeding and related operations shall be performed at such times as designated below.

Dates:

Between May 15 and September 1

28.3 FERTILIZER

The fertilizer, where required, shall be a regular commercial fertilizer (including liquid form) meeting the requirements of the applicable state laws, and shall be in such physical condition to insure uniform application over the area to be fertilized. Rates of application per acre shall be as specified below. Organic fertilizers may be used when specifically authorized.

Types and Rates:

N/A

28.4 SEED

The required seed species, variety, or seed source, and the required rate of seeding are designated below. Documentation will be provided showing that the seed meets the current state seed laws for sale of seed. The seed must be planted within one year of the date of its latest germination test.

Switchgrass

5.0 lbs PLS per acre

28.5 PREPARATION OF SEEDBED

The entire area to be seeded shall be reasonably smooth and firm and all washes and gullies shall be filled to conform to the desired cross section before actual seedbed preparation is begun. At this stage of the operation, the fertilizer, if required, shall be applied uniformly and incorporated into the top 3 inches of the

soil with suitable tillage equipment. The Contractor shall suspend operations when the soil is too wet or too dry.

28.6 COVER CROP

For spring seeding of a grassed waterway immediately after final shaping, a protective cover crop should be seeded as stated below (example, oats at the rate of 1.5 bushels per acre, or milo at a rate of 9 pounds per acre). Clip the cover in late boot stage, leaving a 6-10 inch stubble. Then seed the grass mix between approximately August 1 and September 1.

N/A

28.7 NURSE CROP

When waterway construction is completed after approximately August 1 and soil moisture is adequate for germination, the grass mix will be seeded at the same time as an oats nurse crop. The seeding rate for oats should be one-half of normal rate as specified below.

N/A

28.8 SOWING THE SEED

Unless otherwise specified, the seeding operation shall be preformed immediately after preparation of the seedbed. The seed shall be drilled or broadcast with approved types of equipment that will insure uniform distribution of the seed.

When a grassed waterway is seeded, all machinery operations will be performed by traveling in a figure eight or serpentine pattern for the entire width of the seeded portion of the waterway. All operations in the center portion of the waterway will be at a skew to the direction of flow.

28.7 MULCHING

Grassed waterways should be mulched and/or netted when seeding cannot be accomplished before approximately September 1.

The required mulching shall be performed as soon as possible after seeding unless otherwise specified. The mulch shall be applied uniformly over the area. The

type, rate, and methods of anchoring shall be as specified below.

N/A

CONSTRUCTION SPECIFICATION

8. MOBILIZATION AND DEMOBILIZATION

1. SCOPE

The work shall consist of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required under the contract.

This work shall not include mobilization and demobilization for specific items of work for which payment is provided elsewhere in the contract.

Mobilization will not be considered as work in fulfilling the contract requirements for commencement of work.

2. EQUIPMENT AND MATERIALS

Mobilization shall include all activities and associated costs for transportation of Contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the Contractor's operations at the site; premiums paid for performance and payment bonds, including coinsurance and reinsurance agreements as applicable; and other items specified in Section 4 of this specification.

Demobilization shall include all activities and costs for transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal and site clean up, of offices, buildings and other facilities assembled on the site specifically for this contract.

This work includes mobilization and demobilization required by the contract at the time of award. If additional mobilization and demobilization activities and costs are required during the performance of the contract as a result of changed, deleted, or added items of work for which the Contractor is entitled to an adjustment in contract price, compensation for such costs will be included in the price adjustment for the item or items of work changed or added.

3. PAYMENT

Payment will be made as the work proceeds, after presentation of paid invoices and/or documentation of direct costs by the Contractor showing specific mobilization and demobilization costs and supporting evidence of the charges of suppliers, subcontractors, and

others. When the total of such payments is less than the lump sum contract price, the balance remaining will be included in the final contract payment. Payment of the lump sum contract price for mobilization and demobilization will constitute full compensation for completion of the work.

Payment will not be made under this item for the purchase costs of materials having a residual value, the purchase costs of materials to be incorporated in the project, or the purchase costs of operating supplies.

4. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to be performed in accordance with this specification and the construction details are:

A. BID ITEM NO. 1 ✕ MOBILIZATION AND DEMOBILIZATION

This item consists of mobilizing and demobilizing the contractors' equipment and work force.

CONSTRUCTION SPECIFICATION

45. PLASTIC PIPE

1. SCOPE

The work shall consist of furnishing and installing plastic pipe, except corrugated polyethylene tubing, and the necessary fittings as shown on the drawings or as specified herein.

2. MATERIALS

Pipe, fittings, and gaskets shall conform to the requirements of Material Specification 547 and as specified in Section 14 of this specification or as shown on the drawings.

Perforated pipe shall conform to the requirements of Material Specification 547 and as specified in Section 14 of this specification or as shown on the drawings.

Unless otherwise specified, concrete shall conform to the requirements of Construction Specification 32, Structure Concrete, and Section 8 of this specification.

Unless otherwise specified, earthfill shall conform to the requirements of Construction Specification 23, Earthfill.

Unless otherwise specified, drainfill shall conform to the requirements of Construction Specification 24, Drainfill.

3. HANDLING AND STORAGE

Pipe shall be delivered to the job site and handled by means which provide adequate support to the pipe and does not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surfaces or rocks). All special handling requirements of the manufacturer shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at temperatures of 40° F or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically manufactured to withstand exposure to ultraviolet radiation, it shall be covered with an opaque

material when stored outdoors for a period of 15 days or longer.

4. EXCAVATION

Excavation shall be in accordance with Construction Specification SD-5, Excavation, and Section 14 of this specification or as shown on the drawings.

The pipe foundation shall be excavated a minimum of four inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other materials that may cause pipe damage are encountered at planned pipe grade.

5. LAYING THE PIPE

Plastic pipe conduits complete with fittings and other related appurtenances shall be installed to the lines and grades shown on the drawings or specified in Section 14 of this specification. The pipe shall be installed so that there is no reversal of grade between joints unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than one (1) inch in diameter to ensure that rock will not be displaced and impact the pipe.

Just prior to placement, each pipe section shall be inspected to insure that all foreign materials are removed from the inside of the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the end of work each day or when work is stopped for any extended period, all open ends of the pipeline shall be closed off by a suitable cover or plug.

Care shall be taken to prevent distortion and damage during periods of hot or cold weather. During unusually hot weather (day-time high temperatures greater than 90° F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe does not vary more than 40° F.

Perforated pipe shall be installed with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the Engineer for backfill.

During installation, the pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified in Section 14 of this specification or as shown on the drawings. Bell-holes shall be made in the bedding material under bells, couplings and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade will not be permitted.

6. PIPE EMBEDMENT

Earth Bedding.

The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an in-place earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

Unless otherwise specified, a groove that closely conforms to the outside diameter of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

Earth bedding shall be compacted to a density not less than adjacent undisturbed in-place earth materials or be compacted earth backfill. Earthfill materials used for compacted earth bedding shall be free of rocks or stones greater than one (1) inch in diameter and earth clods greater than two (2) inches in diameter. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its final approved placement.

Sand, Gravel, or Crushed Rock Bedding.

When sand, gravel, or crushed rock bedding is specified, the pipe shall be firmly and uniformly placed on the bedding material. Material for bedding shall not exceed one (1) inch in diameter. Unless otherwise specified in

Section 14 of this specification or shown on the drawings, the coarse-grained bedding material shall be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe shall be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.

Pipe Encased in Drainfill.

The pipe shall be firmly and uniformly placed on a bedding of specified drainfill. Drainfill shall be placed and compacted as specified in Section 14 of this specification or as shown on the drawings to form a continuous uniform support around the entire circumference of the pipe. The pipe shall be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

7. BACKFILL

a. Initial Backfill.

Unless otherwise specified, initial backfill to six (5) inches above the top of the conduit is required. Earth haunching and initial backfill materials shall consist of soil material that is free of rocks, stones or hard clods greater than one (1) inch in diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock or drainfill material.

Initial backfill shall be placed in two (2) stages. The first stage (haunching) backfill is placed to the pipe spring line (center of pipe). The second stage backfill is placed to six (6) inches above the top of the pipe. The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers approximately six (6) inches maximum thickness and compacted as specified in Section 14 of this specification or as shown on the drawings. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.

When pressure testing is not specified, the pipe shall be covered with a minimum six (6) inches of backfill material as soon as possible following assembling of the pipe in the trench, but not later than within the same day that placement has occurred. When pressure testing is specified, sufficient backfill material shall be placed over the pipe to anchor the conduit against movement during pressure testing activities.

b. Final Backfill.

Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within two (2) feet of the top of the pipe shall be free of debris or rocks larger than three (3) inches nominal diameter. Coarse backfill materials shall be the specified sand, gravel, crushed rock or drainfill. Final backfill shall be placed in approximately uniform, compacted layers. Final backfill compaction requirements shall be as specified in Section 14 of this specification or as shown on the drawings.

Vehicles or construction equipment shall not be allowed to cross the pipe until the minimum earth cover and required density as specified in Section 14 of this specification has been obtained.

8. PIPE ENCASEMENT IN CONCRETE

Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe as specified in Section 14 of this specification or as shown on the drawings. Pipes encased in concrete shall be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1 1/2 inches shall be maintained between the pipe and the reinforcing steel.

The concrete for the encasement shall conform to the requirements of Construction Specification 32, Structure Concrete, unless otherwise specified.

9. JOINTS

Unless otherwise specified in Section 14 of this specification or shown on the drawings, joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or joined by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious effect on the gasket or pipe materials.

Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances.

When solvent cement joints are specified for PVC or ABS pipe and fittings, they shall be made in accordance with the following ASTMs and the related appendix of each ASTM; D 2855 for PVC pipe and fittings, and D 2235 for ABS pipe and fittings.

Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints shall be used when joining polyethylene (PE) and high density polyethylene (HDPE) pipe and fittings, unless otherwise specified in Section 14 of this specification or as shown on the drawings.

Pipe ends shall be cut square and be de-burred to provide uniform, smooth surfaces for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

10. FITTINGS

Unless otherwise specified, steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer.

Fittings for non-pressure pipe shall be of the same or similar materials as the pipe and shall provide the same durability, watertightness, and strength as the pipe, unless otherwise specified.

11. THRUST BLOCKS AND ANCHORS

When specified, concrete thrust blocks and anchors shall be installed as shown on the drawings or specified in Section 14 of this specification.

The concrete for the thrust blocks and anchors shall conform to the requirements of Construction Specification 32, Structure Concrete, unless otherwise specified in Section 14 of this specification.

When excavation beyond the designated trench widths and depths as shown on the drawings or specified in Section 14 of this specification occurs at locations where installation of concrete thrust blocks is required, the Contractor shall install an alternative thrust block provision. The concrete thrust block shall have a thickness of one pipe diameter and a contact face area as shown on the drawings or specified in Section 14 of this specification, which shall be formed against the pipe. Backfill shall be placed on all sides of the thrust block and to the sides of the excavation and compacted as specified for initial backfill.

12. PRESSURE TESTING

Method 1 Pressure testing of the completed conduit is not required.

Method 2 The conduit shall be tested for leaks in the following manner:

a. Prior to pressure testing:

- (1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.
- (2) Pipeline shall be flushed and clean.
- (3) All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of three (3) days.
- (4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and shall be compacted as specified in

Section 14 of this specification or as shown on the drawings.

- (5) The conduit shall be braced and/or anchored at each end to restrict all potential pipe movement.
 - (6) The ends of the conduit shall be plugged. The upstream plug shall have a standpipe installed with a minimum diameter of two (2) inches and shall be equipped with a shutoff valve. All high points in the line shall be vented to evacuate air pockets. The conduit and the standpipe shall be slowly filled with water such that no air is entrapped during the filling operation. After filling is complete, all vents shall be closed.
- b. During pressure testing, the water level in the standpipe shall be continuously maintained at a minimum of ten (10) feet above the highest invert elevation of the conduit for a period of not less than two (2) hours, unless otherwise specified in Section 14 of this specification or as shown on the drawings.

The volume of water leakage in the two (2) hour test period shall be recorded. The maximum allowable leakage (L) in gallons per hour shall exceed 0.02 times the nominal pipe diameter (D) in inches for each 1000 feet of pipe line which is approximately 50 pipe joints ($L = 0.02D$).

- h. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be re-tested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The Contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

Method 3 The conduit shall be tested for leaks in the following manner:

- a. Prior to pressure testing:

- (1) Joints of the assembled pipeline shall be allowed to cure as recommended by the manufacturer.
 - (2) Pipeline shall be flushed and cleaned.
 - (3) All concrete anchors and thrust blocks shall be in place and allowed to cure for a minimum of three (3) days.
 - (4) Earth backfill shall be sufficient to anchor the conduit against movement during the pressure testing and compacted as specified in Section 14 of this specification or as shown on the drawings.
 - (5) The conduit shall be braced and/or anchored at each end to prevent all potential pipe movement.
 - (6) The ends of the conduit shall be plugged and a pressure gage shall be attached to the upstream and downstream ends. All high points along the line shall be vented to permit the complete removal of all air within the pipeline. The conduit shall be slowly filled with water such that no air is entrapped during the filling operations.
- b. The testing pressure specified in Section 14 shall be continuously maintained at the upstream gage for a minimum period of two (2) hours. The pressure at the downstream gage shall not exceed the pressure rating of the pipe.
 - c. The volume of water leakage for the two (2) hour test period shall be recorded. Maximum allowable leakage shall be in accordance with the following:

ALLOWABLE LEAKAGE FOR PLASTIC PIPE
(GALLONS PER HOUR PER 1,000 FEET OR 50 PIPE JOINTS) **

Nominal Pipe Size (Inches)	Test Pressure in The Pipeline - P.S.I.			
	50	100	150	200
	Allowable Leakage			
4	.19	.27	.33	.38
6	.29	.41	.50	.57
8	.38	.54	.66	.76
10	.48	.68	.83	.96
12	.57	.81	.99	1.15
14	.67	.95	1.16	1.34
15	.72	1.02	1.25	1.44
16	.76	1.07	1.32	1.52
18	.86	1.22	1.49	1.72

** Computation Basis $L = \frac{ND(p^{1/2})}{7400}$

Where: L = allowable leakage in gallons per hour
 N = number of joints (pipe and fittings)
 D = nominal diameter of pipe in inches
 P = test pressure in pounds per square inch (psi)

- d. When observed leakage exceeds the allowable, leaks shall be sealed by replacement of pipe and fittings as necessary. The conduit shall be re-tested as described above. This procedure shall be repeated until the conduit leakage does not exceed the allowable specified above.

The Contractor shall be fully responsible for any and all work required to correct leakage exceeding the amount specified.

13. MEASUREMENT AND PAYMENT

Method 1 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting,

and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and all other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for those items.

Method 2 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe including excavation, shoring, backfill, bedding, thrust blocks, and all fittings, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for those items.

Method 3 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined to the nearest foot by measurement of the laid length along the crown centerline of the conduit. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances listed separately in the bid schedule will be made at the contract prices for those items.

Method 4 For items of work for which specific unit prices are established in the contract, the quantity of each kind, size, and class of pipe will be determined as the sum of the nominal laying lengths of the sections used. Payment for each kind, size, and class of pipe will be made at the contract unit price for that kind, size, and class. Such payment will constitute full compensation for furnishing, transporting, and installing the pipe including shoring, all fittings, thrust blocks, appurtenances, and other items necessary and incidental to the completion of the work. Payment for appurtenances

listed separately in the bid schedule will be made at the contract prices for those items.

Methods 3 and 4 Excavation, backfill, and bedding will be paid separately under their respective bid items.

All Measurement and Payment Methods Compensation for any items of work described in the contract but not listed in the bid schedule will be included in the payment for the item of work to which it is made subsidiary. Such items and items to which they are made subsidiary are identified in Section 14 of this specification.

14. ITEMS OF WORK AND CONSTRUCTION DETAILS

Items of work to performed in accordance with this specification and the construction details are:

A. BID ITEM NO. X - 30-INCH DIAMETER HDPE PIPE

- (1) This item shall consist of furnishing and installing the 30-inch diameter high density polyethylene (HDPE) pipe as shown on the drawings.
- (2) In Section 6, PIPE EMBEDMENT, both Earth Bedding and Pipe Encased in Drainfill shall apply. Anti-seep drainfill location and dimensions are as shown on the drawings. Drainfill compaction and placement shall be in accordance with Construction Specification SD-9, Drain Fill and Filter.
- (3) In Section 7, BACKFILL, final backfill compaction shall be in accordance with Construction Specification SD-7S, Earth Fill - Class S. A minimum of three (3) feet of cover shall be placed over the pipe before heavy equipment is allowed to cross.
- (4) In Section 8, PIPE ENCASEMENT IN CONCRETE, reference to steel reinforcement and clear distance does not apply. Non-reinforced concrete will be used to cradle the pipe at the riser outlet.
- (5) Section 11, THRUST BLOCKS AND ANCHORS, shall not apply.

- (6) In Section 12, PRESSURE TESTING, Method 1 shall apply.
- (7) In Section 13, MEASUREMENT AND PAYMENT, Method 1 shall apply.

MATERIAL SPECIFICATION

547. PLASTIC PIPE

1. SCOPE

This specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings and joint materials.

2. MATERIALS

a. Pipe

The pipe shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties and free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122.

Unless otherwise specified, the pipe shall conform to the requirements listed in this specification and the applicable reference specifications in Table 547-2, the requirements specified in Construction Specification 45, Plastic Pipe, and the requirements shown on the drawings.

b. Fittings and Joints

Fittings and joints shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D 2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties and free from visible cracks, holes, foreign inclusions, or other defects.

Fittings and joints shall conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified in Construction Specification 45, and the requirements shown on the drawings.

c. Solvents

Solvents for solvent welded pipe joints shall be compatible with the plastic pipe used and shall conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joint.

d. Gaskets

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

3. PERFORATIONS

When perforated pipe is specified, perforations shall conform to the following requirements, unless otherwise specified in Construction Specification 45 or shown on the drawings:

- a. Perforations shall be either circular or slots.
- b. Circular perforations shall be $1/4 \pm 1/16$ -inch diameter holes arranged in rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight (8) times the perforation diameter. Perforations may appear at the ends of short and random lengths. The minimum perforation opening per foot of pipe shall be as shown in Table 547-1.

Rows shall be arranged in two (2) equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations shall be separated by an arc of not less than 60° or more than 125° . The uppermost rows of perforations shall be separated by an arc not to exceed 166° . The spacing of rows between these limits shall be uniform. The minimum number of rows shall be as shown in Table 547-1.

- c. Slot perforations shall be symmetrically located in two (2) rows, one on each side of the pipe centerline. Slot perforations shall be located within the lower quadrants of the pipe with slots no wider than $1/8$ inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe shall be as shown in Table 547-1.

TABLE 547-1
PERFORATIONS

Nominal Pipe Size (Inches)	Minimum Number of Rows		Minimum Opening/Foot
	Circular	Slot. (Square Inches)	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

- d. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges, and any materials that would reduce the effective opening.

TABLE 547-2
PIPE SPECIFICATION

<u>POLY VINYL CHLORIDE (PVC) PIPE</u>	<u>SPECIFICATION</u>
Plastic Pipe - Schedules 40, 80, 120	ASTM D 1785
Pressure Rated Pipe - SDR Series	ASTM D 2466
	AWWA C 900
Plastic Drain, Waste, and Vent Pipe and Fittings	ASTM D 2241
	ASTM D 2665
Joints for IPS PVC Pipe Using Solvent Weld Cement	ASTM D 2672
Composite Sewer Pipe	ASTM D 2680
Type PSM PVC Sewer Pipe and Fittings	ASTM F 3034
Large-Diameter Gravity Sewer Pipe and Fittings	ASTM F 679
Smooth-Wall Underdrain Systems for Highway, Airport, and Similar Drainage	ASTM F 758
Type PS-46 Gravity Flow Sewer Pipe and Fittings	ASTM F 789
Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter	ASTM F 794
Corrugated Sewer Pipe With a Smooth Interior and Fittings	ASTM F 949
Pressure Pipe, 4-inch through 12-inch for Water Distribution	AWWA C 900
Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch	AWWA C 905

TABLE 547-2 (CONTINUED)
PIPE SPECIFICATIONS

<u>POLYETHYLENE (PE) PLASTIC PIPE</u>	<u>SPECIFICATION</u>
Schedule 40	ASTM D 2104
SIDR-PR Based on Controlled Inside Diameter	ASTM D 2239
Schedules 40 and 80 Based on Outside Diameter	ASTM D 2447
SDR-PR Based on Controlled Outside Diameter	ASTM D 3035
 <u>HIGH DENSITY POLYETHYLENE (HDPE) PLASTIC PIPE</u>	 <u>SPECIFICATION</u>
Plastic Pipe and Fittings	ASTM D 3350
SDR-PR Based on Controlled Outside Diameter	ASTM F 714
Plastic Moldings and Extrusion Compounds	ASTM D 1248
Heat Joining Polyolefin Pipe and Fittings	ASTM D 2657
 <u>ACRYLONITRILE-BUTADIENE-STYRENE (ABS) PIPE</u>	 <u>SPECIFICATION</u>
Plastic Pipe, Schedules 40 and 80	ASTM D 1527
Plastic Pipe, SDR-PR	ASTM D 2282
Schedule 40 Plastic Drain, Waste, and Vent Pipe	ASTM D 2661
Composite Sewer Pipe	ASTM D 2680
Sewer Pipe and Fittings	ASTM D 2751

HIDDEN TIMBER LAKE
DAM REPAIR

TRIPP COUNTY, SOUTH DAKOTA

BID SCHEDULE
DIVISION – I – MOBILIZATION AND DEMOBILIZATION

ITEM NO.	WORK OR MATERIAL	SPEC. NO.	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	Mobilization and Demobilization	8	1	Job	XXX	\$ _____

TOTAL BID – DIVISION I – MOBILIZATION AND DEMOBILIZATION.....\$ _____

HIDDEN TIMBER LAKE
DAM REPAIR

TRIPP COUNTY, SOUTH DAKOTA

BID SCHEDULE
DIVISION - II - EARTHWORK/SEEDING

ITEM NO.	WORK OR MATERIAL	SPEC. NO.	QUANTITY	UNIT	UNIT PRICE	AMOUNT
2	Excavation, Common (Subsidiary to Earthfill)	11	22,968	CY	XXX	\$ _____
3	Earthfill + 5%	7S	27,673	CY	\$ _____	\$ _____
4	Core Trench Excavation	5	1339	CY	\$ _____	\$ _____
5	Stripping under fills	5	1445	CY	\$ _____	\$ _____
6	Topdressing (Incl. Fills and Emerg. Spillway)	10	2994	CY	\$ _____	\$ _____
7	Seeding (Incl. Fills and Emerg. Spillway)	28	3.7	AC	\$ _____	\$ _____

TOTAL BID - DIVISION II - EARTHWORK/SEEDING.....\$ _____

HIDDEN TIMBER LAKE
DAM REPAIR
TRIPP COUNTY, SOUTH DAKOTA

BID SCHEDULE
DIVISION – III – PRINCIPAL SPILLWAY/APPURTENANCES

ITEM NO.	WORK OR MATERIAL	SPEC. NO.	QUANTITY	UNIT	UNIT PRICE	AMOUNT
8	30" Dia. HDPE Pipe (Corrugated, Smooth-Lined)	45	110	LF	\$_____	\$_____
9	48" Dia. X 5' Concrete Riser	--	1	EA	\$_____	\$_____
10	4" Dia. Perf. PVC Pipe	45	33	LF	\$_____	\$_____
11	4" Dia. Non-Perf. PVC Pipe	45	18	LF	\$_____	\$_____
12	Reinforced Concrete	12B	2	CY	\$_____	\$_____
13	Filter Sand	9	8	CY	\$_____	\$_____
14	Anti-vortex Baffle and Trash Rack	16 or 17	1	EA	\$_____	\$_____
15	Timber Pipe Support	16	1	EA	\$_____	\$_____

TOTAL BID – DIVISION III – PRINCIPAL SPILLWAY/APPURTENANCES.....\$_____

Mail to: Water Rights Program
DENR, Foss Bldg.
523 E. Capitol
Pierre, SD 57501-3181
(605) 773-3352

LOCATION NOTICE

COPY

FOR DAM/DUGOUT

Tripp

County

Location Notice No. (Office Use)

I, Teresa M. Keefe, of

Name

RR1 Box 138 Colome, SD 57528

Address & Zip Code

Tripp

County

(check one) ☒ owner, ☐ operator, of the following described land, do hereby notify

the Water Management Board of the State of South Dakota and all others concerned that I am exercising my

right under SDCL 46-4, for construction of a (check one) ☒ dam, ☐ dugout for the purpose of

impounding runoff waters for wildlife purposes.

(type of use - livestock, recreation, etc.)

The following data is presented in compliance with SDCL 46-4-3 and 46-4-4.

(1) Date of:

(a) This notice June 15, 2000

(b) Proposed construction year 2000

(2) Legal description of the land upon which the dam/dugout is located:

NW 1/4 SE 1/4 Section 18 T98N R75W

(describe to the nearest 40 acre subdivision)

(3) Location of the dam/dugout from a section corner:

550' North and 550' West of SE Corner of said Section

(describe distance N.S.E.W. in feet from the corner)

(4) County Tripp

(5) Name of landowner Edward Keefe & Teresa Keefe

(6) Acre feet of water claimed annually 87

NOTES: If the storage of the proposed structure at the spillway crest or overflow elevation exceeds twenty five (25) acre feet, a water permit from the Water Management Board is required.

A location notice is required on a dugout only if the dugout captures surface water



(7) Complete the following information for the proposed dam/dugout:

*Items to be completed for a dugout

*a) Dam/Dugout designed by James A. Reed, P.E.
USDA-NRCS, Winner, SD

b) Freeboard 3' to Secondary Spillway
to top of dam

c) Crest Width 16' top

Crest Length 774'

d) Height 22' to top of dam 18' to E.S.

* Depth, if Dugout _____

e) Outlet Dimensions

Pipe diameter 30"

Spillway width 125'

f) X & Y Slope:

Upstream 3:1

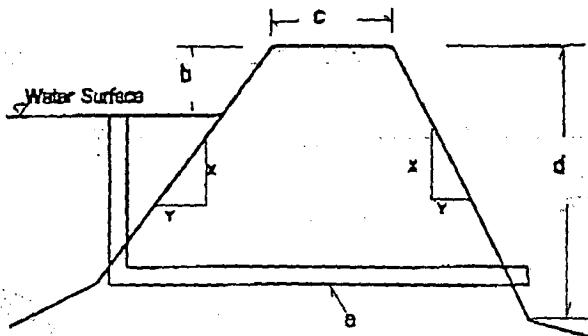
Downstream 3:1

*g) Water surface area 21.4 acres

*h) Storage at spillway crest or overflow elevation
(acre feet) 87 AC-Fe

i) Maximum storage to top of dam crest
(acre feet) 328 AC-Fe

*j) Drainage area above dam/dugout
(acres) 3886



Enclosed is ten dollars (\$10.00). The Water Management Board is requested to file this copy of the Location Notice in their official records. The original Location Notice has been filed (do not record) with the Register of Deeds of TRIPP County in accordance with SDCL 46-4-3.

STATE OF SOUTH DAKOTA
COUNTY OF TRIPP

I, Teresa M. Kute the applicant, certify that I have read this Location Notice and that the matters stated in this notice are true and that I intend, and am able to start construction within sixty days after the filing of this notice.

Subscribed and sworn to before me this 2nd day of May, 2000, 1900

(seal)

My Com. Expires: 3/13/2003

Signed

Teresa M. Kute
Michelle L. Lundy
Notary Public

Water Permit Application No 2446-2
Edward & Teresa Keefe

"Redesign"

Cut. 3 - Low Hazard Dam

Top of Dam Elev. - 92.5
2nd Spillway Elev. - 89
Primary Spillway Elev. - 86
DB Toe Elev. - 77.5

Ht. = 20 ft

Normal Storage Capacity - 100 A·Ft
Int. Storage Capacity - 179 A·Ft
Max. Storage Capacity - 310 A·Ft

Int. Capacity x Eff Ht. = $179 \times 17 = 3043 \approx 3000$ i. 50 yr
Minimum Spillway Design

From USGS WRI 80-80 "Tech. for Est. Flood Peaks in SD"
DA = 3886 Ac = 6.07 mi.²
Slope = 45 Hmi
SI = 2.05

$$\begin{aligned} Q_{50} &= 106 A^{.63} S^{.45} S_i^{-.64} \\ &= 106 (6.07)^{.63} (45)^{.45} (2.05)^{-.64} \\ &= 106 (3.1146) (5.55) (0.6084) \\ &= \underline{1116 \text{ cfs}} \end{aligned}$$

$$\begin{aligned} Q_{100} &= 132 A^{.65} S^{.46} S_i^{-.67} \\ &= 132 (6.07)^{.65} (45)^{.46} (2.05)^{-.67} \\ &= 132 (3.23) (5.7607) (0.6182) \\ &= \underline{1518 \text{ cfs}} \end{aligned}$$

Secondary Spillway Flow

$$\begin{aligned} Q &= C L H^{3/2} \quad \frac{3}{4} C = 2.6 \quad L = 125 \quad H = 3.5 \\ &= (2.6)(125)(3.5) \\ &= \underline{2128 \text{ cfs}} \end{aligned}$$

Section 74:02:08:09

1. Topo Map - OK
2. Dam Axis Profile - OK
3. Dam Max X-Sec - OK
4. Area Capacity - OK
5. Outlet Details - OK
6. Spillway Capacity - OK
7. Spillway Details - OK
8. Specs - std NRCS - OK
9. EPP - N/A Cut. 3 - OK



United States
Department of
Agriculture

Natural Resources
Conservation
Service

Federal Building, Room 239
515 9th Street
Rapid City, SD 57701-2663

October 25, 2001

Tim Schaal
DENR, Safety of Dams
Foss Building
523 East Capitol
Pierre, SD 57501-3182

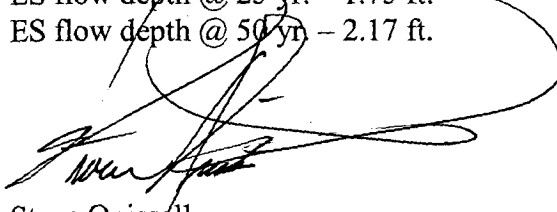
Tim,

Attached for review and approval by your staff is a set of plans and specifications for a wildlife pond for Ed Keefe, Tripp County South Dakota. The dam is classified as "hazard class a" as per NRCS criteria. This dam was originally submitted as designed by Jim Reedy and approved by your staff on 10/24/2000. It has since been modified, lowering the dam by 1 ft. and increasing the principal spillway capacity.

Structure Data is as follows:

DA. - 3886 ac.
Storage X Height - 2980
Max. water depth - 13.5
Height of Dam - 20 ft.
Principal Spillway - twin 48" cmp
Risers - 66" X 12ft. cmp
Permanent Storage - 100 ac-ft.
Storage to ES crest - 179.4 ac-ft.
Storage to top of dam - 310 ac-ft.
Surface area - 20.5 ac.
ES - 125 foot wide, 150 ft. level crest
ES capacity - 691 cfs (@ 2ft. flow depth)
ES flow depth @ 25 yr. - 1.75 ft.
ES flow depth @ 50 yr. - 2.17 ft.




Steve Quissell
Field Support Engineer,
Natural Resources Conservation Service
1530 Samco Rd, suite 4
Rapid City, SD 57702-8007

cc. Steve Higgins, DC, NRCS, Winner SD

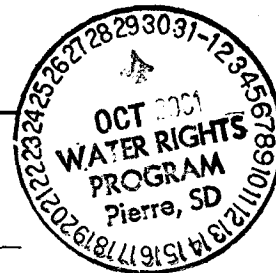
TRANSMITTAL OF INFORMATION VIA FACSIMILE MACHINE

United States Department of Agriculture
Natural Resources Conservation Service
Field Support Office
1530 Samco Road, Suite # 4
Rapid City, SD 57702-8007
Office # (605) 343-1643 FAX # (605) 343-6310

DATE:

10/29/01

TO:

Tim Schaefer

Telephone # _____

FAX # _____

FROM:

J. Russell

PAGES:

Transmittal Sheet + 16 pages

If there are problems with transmission call:

COMMENTS:

 SITES XEQ 10/11/2001 WATER RESOURCE SITE ANALYSIS COMPUTER PROGRAM
 VER 96.1 (USER MANUAL - DATED MAY 1996)
 TIME 13:36:26

***** 80-80 LIST OF INPUT DATA *****

SITES 05/01/2000
 SAVMOV 0 101
 SAVMOV 101 1
 STRUCTURE

72	0.0
75.0	.7
80.0	20.4
85.0	80.0
87.0	120.0
90.0	210.0
94.0	380.0

ENDTABLE
 WSDATA 5A1 AC 79 3886 7.0
 PDIRECT 3.3 4.20 4.80
 POOLDATA ELEV 86.0 86.0 72.0 72.0 SC
 PSINLET .8 34.55 (2-66" risers)
 PSDATA 2 110 48 barrels .025 76.0
 ASDATA 41 300 300 3 .08 2
 ASINSURF 41 .035
 ASINLET 41 0.0 0.0 150 0.0 3
 300 2.25 350 7.25

ENDTABLE
 ASEXSURF 41 .035
 .7 0
 2
 1 0
 .02

ENDTABLE
 ASEXIT 41 N 160
 BTMWIDTH FEET 125
 GRAPHICS 1
 GO, DESIGN HLCP TYPE2 24 TYPE1378 24
 SAVMOV 2 101 1
 ENDJOB

6.071875 H7

Final Design Routing

1 PSH = 3.3" rainfall TYPE I storm
 (10 yr storm = 3.5")

Structure will handle 7 yr storm
 between P.S. CREST & E.S. CREST ELEV'S

2 - 48" CMP w/ 66" risers

125' wide E.S. w/ 150'

Long Low Crest

hp @ 25 yr = 1.75'
 TYPE II

hp @ 50 yr = 2.17'
 TYPE II

Riser height needed

Max Flow w/ 2 barrels
 = 372 cfs = 186 cfs ea.
 - Full Pipe Flow @ EL. 88.2

***** MESSAGE - ALTERNATE STRUCTURE ID (S 1) BEING USED
 SINCE USER DID NOT INPUT AN ID.

***** MESSAGE - ALTERNATE SUBWATERSHED ID (A) BEING USED SINCE
 USER DID NOT INPUT AN ID.

***** MESSAGE - DRAINAGE AREA FROM WSDATA CONTROL BEING CONVERTED FROM
 ACRES TO SQUARE MILES FOR COMPUTATION PURPOSES. = 6.6'

1SITES
 XEQ 10/11/2001

WSID= 66

∴ 88.25 - 6.6' - 1/2 PIPE DIA =
 EL. 79.65

barrel invert

Riser Crest EL. 86.0 - 79.65 = 6.35' riser height
 with 1' embedment in riser base = 7.35' tall
 Use 8' risers - minimum

VER 96.1
TIME 13:36:26 SITE = S 1 SUBW= A
PASS= 1 PART= 1

***** BASIC DATA *****
CLIMATE AREA - NOT DEFINED DESIGN CLASS A1 = LT 3000.

STORM DISTRIBUTION-PSH 24 HOUR TYPE I RAINFALL DISTRIBUTION

STORM DISTRIBUTION AUX. -24 HOUR TYPE II RAINFALL DISTRIBUTION

PRECIP. - P-PS,1-DAY P-PS,10-DAY P-SD P-FB
3.30 0.00 4.20 4.80

WSDATA - CN DA-SM TC/L -/H QRF
79.00 6.07 7.00 0.00 0.00

SITEDATA- PERM POOL CREST PS FP SED VALLEY FL 378?
86.00 86.00 0.00 72.00 YES

BASEFLOW INITIAL EL EXTRA VOL SITE TYPE
0.00 0.00 0.00 DESIGN

PSDATA - NO. COND COND L DIA/W -/H
2.00 110.00 48.00 0.00

PS N KE WEIR L TW EL
0.025 0.80 34.55 76.00

2ND STG ORF H ORF L START AUX.
0.00 0.00 0.00 0.00

ASCRESTS - AUX.1 AUX.2 AUX.3 AUX.4 AUX.5
0.00 0.00 0.00 0.00 0.00

AUX.DATA - REF.NO. RETARD. CI TIE STATION INLET LENGTH
41 0.00 300.00 300

AUX.DATA - INLET N SIDE SLOPE EXIT N EXIT SLOPE ACTUAL AUX?
0.035 3.00 0.035 0.080 NO

BTM WIDTH - BW1 BW2 BW3 BW4 BW5
ft 125.00 0.00 0.00 0.00 0.00

AUXILIARY SPILLWAY RATING DEVELOPED USING WSPVRT.

1***** DETAILED LIST OF BASIC DATA *****
WEIR COEF. FOR ORIFICES..... 3.10 RATIO OF I_a TO S (CH.10,NEH4). 0.20
WEIR COEF. FOR DROP INLET..... 3.10 TIME INCS TO PEAK OF UNIT HYD. 5.
DISCHARGE COEF. FOR ORIFICES..... 0.60 NO. POINTS FOR DESIGN HYD. ... 101

HOOD, WEIR INLET COEF. 0.60 DRAWDOWN TIME LIMIT - DAYS.... 10.0
HOOD, PIPE ENTRANCE COEF. 0.60 DRAWDOWN RATIO STORAGE LIMIT.. 0.00
HOOD, SLUG FLOW COEF. 0.00 OTHER DRAWDOWN RATIOS APPLY ? NO

PS ACCURACY OF FULL FLOW CALC.,FT 0.01 WSP ALLOWABLE FSS VEL. CHANGE. 0.05

FILLET SIZE FOR BOX CONDUITS..... 6.00 WSP FSS CALC. PRECISION, FT.. 0.005

GRAVITATIONAL CONSTANT..... 32.16 AUX. SPILLWAY MIN. CAP. COEF. 237.0
MIN. NHCP378 PS PIPE AREA SQFT.. 0.545 AUX. SPILLWAY MIN. CAP. EXP. 0.493

MIN. TR60 DEPTH AUX. TO TOP DAM.. 3.00 MIN. AUX. BW IN BW SOLUTION, FT 20.0
MIN. NHCP378 DEPTH AUX. TO TOP DAM 2.00 PRECISION OF BW SOLUTION..... 1.0
MIN. NHCP378 DEPTH PS - AUX. CREST 1.00 OLD TR60 CRITERIA USED NO
MIN. NHCP378 DEPTH DESIGN Q - TOD 1.00 OLD NHCP378 CRITERIA USED NO

EMBANKMENT TEMPLATE: TOP WIDTH = (calc.), MAX. CROWN = 0.667 ft,
SIDE SLOPE WAVE BERM MULTIPLE STABILITY BERMS SEPARATE STABILITY BERMS
RATIOS WIDTH U&D/S WIDTHS DELTA H WIDTHS, ft HEIGHTS, ft
U/S D/S ft ft ft U/S D/S U/S D/S
2.50 2.50 10.0 0.0 0.00 0.00 0.00 0.00

DIMENSIONLESS UNIT HYDROGRAPH
STANDARD DIMENSIONLESS UNIT HYDROGRAPH
PEAK FACTOR = 484.0 | TIME INC. = 0.020 | NO. INC. TO PEAK = 5.00
PRODUCT ORDINATE AND TIME INC. = 0.2669787

0.0000	0.0300	0.1000	0.1900	0.3100
0.4700	0.6600	0.8200	0.9300	0.9900
1.0000	0.9900	0.9300	0.8600	0.7800
0.6800	0.5600	0.4600	0.3900	0.3300
0.2800	0.2410	0.2070	0.1740	0.1470
0.1260	0.1070	0.0910	0.0770	0.0660
0.0550	0.0470	0.0400	0.0340	0.0290
0.0250	0.0210	0.0180	0.0150	0.0130
0.0110	0.0090	0.0080	0.0070	0.0060
0.0050	0.0040	0.0030	0.0020	0.0010
0.0000				

1NRCS DESIGN STORM RAINFALL DISTRIBUTION (CHAPTER 21, NEH4 & TR-60).

0.000	0.008	0.016	0.025	0.033
0.043	0.052	0.063	0.074	0.086
0.099	0.112	0.126	0.142	0.160
0.180	0.205	0.255	0.345	0.437
0.530	0.603	0.633	0.660	0.684
0.705	0.724	0.742	0.759	0.775
0.790	0.804	0.818	0.831	0.844
0.856	0.868	0.879	0.890	0.900
0.910	0.920	0.930	0.939	0.948
0.957	0.966	0.975	0.983	0.992
1.000				

24 HOUR TYPE II RAINFALL DISTRIBUTION
IDENTIFICATION NAME IS TYPE2 GIVEN DURATION = 24.0 HRS

0.000	0.001	0.002	0.003	0.004
0.005	0.006	0.007	0.008	0.009
0.010	0.012	0.013	0.014	0.015

0.016	0.017	0.018	0.020	0.021
0.022	0.023	0.024	0.026	0.027
0.028	0.029	0.031	0.032	0.033
0.034	0.036	0.037	0.038	0.040
0.041	0.042	0.044	0.045	0.047
0.048	0.049	0.051	0.052	0.054
0.055	0.057	0.058	0.060	0.061
0.063	0.065	0.066	0.068	0.070
0.071	0.073	0.075	0.076	0.078
0.080	0.082	0.084	0.085	0.087
0.089	0.091	0.093	0.095	0.097
0.099	0.101	0.103	0.105	0.107
0.109	0.111	0.113	0.116	0.118
0.120	0.122	0.125	0.127	0.130
0.132	0.135	0.138	0.141	0.144
0.147	0.150	0.153	0.157	0.160
0.163	0.166	0.170	0.173	0.177
0.181	0.185	0.189	0.194	0.199
0.204	0.209	0.215	0.221	0.228
0.235	0.243	0.251	0.261	0.271
0.283	0.307	0.354	0.431	0.568
0.663	0.682	0.699	0.713	0.725
0.735	0.743	0.751	0.759	0.766
0.772	0.778	0.784	0.789	0.794
0.799	0.804	0.808	0.812	0.816
0.820	0.824	0.827	0.831	0.834
0.838	0.841	0.844	0.847	0.850
0.854	0.856	0.859	0.862	0.865
0.868	0.870	0.873	0.875	0.878
0.880	0.882	0.885	0.887	0.889
0.891	0.893	0.895	0.898	0.900
0.902	0.904	0.906	0.908	0.910
0.912	0.914	0.915	0.917	0.919
0.921	0.923	0.925	0.926	0.928
0.930	0.931	0.933	0.935	0.936
0.938	0.939	0.941	0.942	0.944
0.945	0.947	0.948	0.949	0.951
0.952	0.953	0.955	0.956	0.957
0.958	0.960	0.961	0.962	0.964
0.965	0.966	0.967	0.968	0.970
0.971	0.972	0.973	0.975	0.976
0.977	0.978	0.979	0.981	0.982
0.983	0.984	0.985	0.986	0.988
0.989	0.990	0.991	0.992	0.993
0.994	0.996	0.997	0.998	0.999
1.000				

1SITES -----

XEQ 10/11/2001

WSID= 66

VER 96.1

SUBW= A

TIME 13:36:26

SITE = S 1

PASS= 1 PART= 2

PERM POOL 86.00 FT 100.0 ACFT 0.00 AC 0.0 CFS

CREST PS 86.00 FT 100.0 ACFT 0.00 AC 0.0 CFS

SED ACCUM 86.00 FT 100.0 ACFT 0.00 AC 0.0 CFS

START ELEV 86.00 FT 100.0 ACFT 0.00 AC 0.0 CFS

NRCS-PSH D= 24.00 HR P= 3.30 IN Q= 1.41 IN DA= 6.07 SM
TC= 7.00 HR CN= 79.00 VOL= 457.3 ACFT

PEAK = 497.8 CFS, AT 15.3 HRS.

ROUTED RESULT - HYD TYPE EMAX VOL-MAX AMAX QMAX
NRCS-PSH 88.98 FT 179.4 ACFT 0.00 AC 372.4 CFS*MAX POOL @ 3.3", 7 yr. storm*

PS STORAGE 79.4 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

DRAWDOWN (DDT) TEST 86.00 FT 100.0 ACFT 0.00 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME = 1.56 DAYS, TO 0.0 CFS (LIMIT = 10.00 DAYS)

PLOT OF PRINCIPAL SPILLWAY HYDROGRAPH, 1 INCH= 100. CFS

						0.	100.	200.	300.	400.	500.	600.	700.
Time	Qin	Qout	Elev	Vol	Area	ExtVel	I	I	I	I	I	I	I
0.00	0	0	86.0	100.0	0.0	.							
0.45	0	0	86.0	100.0	0.0	.							
0.90	0	0	86.0	100.0	0.0	.							
1.35	0	0	86.0	100.0	0.0	.							
1.81	0	0	86.0	100.0	0.0	.							
2.26	0	0	86.0	100.0	0.0	.							
2.71	0	0	86.0	100.0	0.0	.							
3.16	0	0	86.0	100.0	0.0	.							
3.61	0	0	86.0	100.0	0.0	.							
4.06	0	0	86.0	100.0	0.0	.							
4.51	0	0	86.0	100.0	0.0	.							
4.96	0	0	86.0	100.0	0.0	.							
5.42	0	0	86.0	100.0	0.0	.							
5.87	0	0	86.0	100.0	0.0	.							
6.32	0	0	86.0	100.0	0.0	.							
6.77	0	0	86.0	100.0	0.0	.							
7.22	0	0	86.0	100.0	0.0	.							
7.67	0	0	86.0	100.0	0.0	.							
8.12	0	0	86.0	100.0	0.0	.							
8.57	1	0	86.0	100.0	0.0	.							
9.03	1	0	86.0	100.0	0.0	.							
9.48	4	1	86.0	100.1	0.0	.							
9.93	10	1	86.0	100.3	0.0	.							
10.38	26	4	86.0	100.9	0.0	.	I						
10.83	55	9	86.1	102.2	0.0	.	P	I					
11.28	95	18	86.2	104.5	0.0	.	P	I					
11.73	149	33	86.4	108.1	0.0	.	P	I					
12.18	217	58	86.7	113.3	0.0	.	P	I					
12.64	290	101	87.0	119.7	0.0	.	P	I					
13.09	356	149	87.2	127.1	0.0	.	P	I					
13.54	410	199	87.5	134.9	0.0	.	P	I					

13.99	451	250	87.8	142.6	0.0	.	P		I
14.44	480	303	88.0	149.7	0.0	.	P		I
14.89	494	348	88.2	155.7	0.0	.	P		I
15.34	498	363	88.4	160.9	0.0	.	P		X
15.79	492	366	88.5	165.8	0.0	.	P		I
16.25	476	368	88.7	170.2	0.0	.	P		I
16.70	453	370	88.8	173.8	0.0	.	P		I
17.15	429	371	88.9	176.4	0.0	.	P		I
17.60	408	372	88.9	178.1	0.0	.	P		I
18.05	389	372	89.0	179.1	0.0	.	P		I
18.50	371	372	89.0	179.4	0.0	.	X		
18.95	355	372	89.0	179.0	0.0	.	I	P	
19.40	339	372	88.9	178.1	0.0	.	I	P	
19.86	325	371	88.9	176.6	0.0	.	I	P	
20.31	312	370	88.8	174.7	0.0	.	I	P	
20.76	301	369	88.7	172.4	0.0	.	I	P	
21.21	290	368	88.7	169.6	0.0	.	I	P	
21.66	279	366	88.6	166.6	0.0	.	I	P	
22.11	269	364	88.4	163.2	0.0	.	I	P	
22.56	260	363	88.3	159.5	0.0	.	I	P	
23.01	250	348	88.2	155.7	0.0	.	I	P	
23.47	241	323	88.1	152.4	0.0	.	I	P	
23.92	232	302	88.0	149.6	0.0	.	I	P	
24.37	224	284	87.9	147.1	0.0	.	I	P	
24.82	214	268	87.8	145.0	0.0	.	I	P	
25.27	204	253	87.8	143.1	0.0	.	I	P	
25.72	193	240	87.7	141.3	0.0	.	I	P	
26.17	181	228	87.7	139.6	0.0	.	I	P	
26.62	167	217	87.6	137.8	0.0	.	I	P	
27.08	152	205	87.5	135.9	0.0	.	I	P	
27.53	136	192	87.5	133.9	0.0	.	I	P	
27.98	120	178	87.4	131.7	0.0	.	I	P	
28.43	105	164	87.3	129.5	0.0	.	I	P	
28.88	90	150	87.2	127.3	0.0	.	I	P	
29.33	77	136	87.2	125.1	0.0	.	I	P	
29.78	65	122	87.1	122.9	0.0	.	I	P	
30.23	54	108	87.0	120.8	0.0	.	I	P	
30.69	45	95	86.9	118.9	0.0	.	I	P	
31.14	37	84	86.9	117.1	0.0	.	I	P	
31.59	31	73	86.8	115.4	0.0	.	I	P	
32.04	26	63	86.7	114.0	0.0	.	I	P	
32.49	22	55	86.6	112.7	0.0	.	I	P	
32.94	19	47	86.6	111.5	0.0	.	I	P	
33.39	15	42	86.5	110.5	0.0	.	I	P	
33.84	13	38	86.5	109.5	0.0	.	I	P	
34.30	11	35	86.4	108.6	0.0	.	I	P	
34.75	9	31	86.4	107.8	0.0	.	I	P	
35.20	8	28	86.3	107.0	0.0	.	I	P	
35.65	6	25	86.3	106.2	0.0	.	I	P	
36.10	5	22	86.3	105.6	0.0	.	I	P	
36.55	4	20	86.2	105.0	0.0	.	P		
37.00	4	18	86.2	104.4	0.0	.	P		
37.45	3	16	86.2	103.9	0.0	.	P		
37.91	2	14	86.2	103.5	0.0	.	P		
38.36	2	12	86.2	103.1	0.0	.	P		
38.81	2	11	86.1	102.7	0.0	.	P		

39.26	1	10	86.1	102.4	0.0	.P
39.71	1	8	86.1	102.1	0.0	.P
40.16	1	7	86.1	101.8	0.0	.P
40.61	1	6	86.1	101.6	0.0	.P
41.06	1	6	86.1	101.4	0.0	.P
41.52	0	5	86.1	101.2	0.0	.
41.97	0	4	86.1	101.1	0.0	.
42.42	0	4	86.0	100.9	0.0	.
42.87	0	3	86.0	100.8	0.0	.
43.32	0	3	86.0	100.7	0.0	.
43.77	0	2	86.0	100.6	0.0	.
44.22	0	2	86.0	100.5	0.0	.
44.67	0	2	86.0	100.4	0.0	.
45.13	0	2	86.0	100.4	0.0	.
45.58	0	1	86.0	100.3	0.0	.
46.03	0	1	86.0	100.3	0.0	.
46.48	0	1	86.0	100.2	0.0	.
46.93	0	1	86.0	100.2	0.0	.
47.38	0	1	86.0	100.2	0.0	.
47.83	0	1	86.0	100.2	0.0	.
48.28	0	1	86.0	100.1	0.0	.
48.74	0	0	86.0	100.1	0.0	.
49.19	0	0	86.0	100.1	0.0	.
49.64	0	0	86.0	100.1	0.0	.
50.09	0	0	86.0	100.1	0.0	.
50.54	0	0	86.0	100.1	0.0	.
50.99	0	0	86.0	100.1	0.0	.
51.44	0	0	86.0	100.0	0.0	.
51.89	0	0	86.0	100.0	0.0	.
52.35	0	0	86.0	100.0	0.0	.
52.80	0	0	86.0	100.0	0.0	.
53.25	0	0	86.0	100.0	0.0	.
53.70	0	0	86.0	100.0	0.0	.
54.15	0	0	86.0	100.0	0.0	.
54.60	0	0	86.0	100.0	0.0	.
55.05	0	0	86.0	100.0	0.0	.
55.50	0	0	86.0	100.0	0.0	.
55.96	0	0	86.0	100.0	0.0	.
56.41	0	0	86.0	100.0	0.0	.
56.86	0	0	86.0	100.0	0.0	.
57.31	0	0	86.0	100.0	0.0	.
57.76	0	0	86.0	100.0	0.0	.
58.21	0	0	86.0	100.0	0.0	.
58.66	0	0	86.0	100.0	0.0	.
59.11	0	0	86.0	100.0	0.0	.
59.57	0	0	86.0	100.0	0.0	.
60.02	0	0	86.0	100.0	0.0	.
60.47	0	0	86.0	100.0	0.0	.
60.92	0	0	86.0	100.0	0.0	.
61.37	0	0	86.0	100.0	0.0	.
61.82	0	0	86.0	100.0	0.0	.
62.27	0	0	86.0	100.0	0.0	.
62.72	0	0	86.0	100.0	0.0	.
63.18	0	0	86.0	100.0	0.0	.
63.63	0	0	86.0	100.0	0.0	.
64.08	0	0	86.0	100.0	0.0	.

64.53	0	0	86.0	100.0	0.0	.
64.98	0	0	86.0	100.0	0.0	.
65.43	0	0	86.0	100.0	0.0	.
65.88	0	0	86.0	100.0	0.0	.
66.33	0	0	86.0	100.0	0.0	.
66.79	0	0	86.0	100.0	0.0	.
67.24	0	0	86.0	100.0	0.0	.
67.69	0	0	86.0	100.0	0.0	.
68.14	0	0	86.0	100.0	0.0	.
68.59	0	0	86.0	100.0	0.0	.
69.04	0	0	86.0	100.0	0.0	.
69.49	0	0	86.0	100.0	0.0	.
69.94	0	0	86.0	100.0	0.0	.
70.40	0	0	86.0	100.0	0.0	.
70.85	0	0	86.0	100.0	0.0	.
71.30	0	0	86.0	100.0	0.0	.
71.75	0	0	86.0	100.0	0.0	.
72.20	0	0	86.0	100.0	0.0	.
72.65	0	0	86.0	100.0	0.0	.
73.10	0	0	86.0	100.0	0.0	.
73.55	0	0	86.0	100.0	0.0	.
74.01	0	0	86.0	100.0	0.0	.
74.46	0	0	86.0	100.0	0.0	.
74.91	0	0	86.0	100.0	0.0	.
75.36	0	0	86.0	100.0	0.0	.
75.81	0	0	86.0	100.0	0.0	.
76.26	0	0	86.0	100.0	0.0	.
76.71	0	0	86.0	100.0	0.0	.
77.16	0	0	86.0	100.0	0.0	.
77.62	0	0	86.0	100.0	0.0	.
78.07	0	0	86.0	100.0	0.0	.
78.52	0	0	86.0	100.0	0.0	.
78.97	0	0	86.0	100.0	0.0	.
79.42	0	0	86.0	100.0	0.0	.
79.87	0	0	86.0	100.0	0.0	.
80.32	0	0	86.0	100.0	0.0	.
80.77	0	0	86.0	100.0	0.0	.
81.23	0	0	86.0	100.0	0.0	.
81.68	0	0	86.0	100.0	0.0	.
82.13	0	0	86.0	100.0	0.0	.
82.58	0	0	86.0	100.0	0.0	.
83.03	0	0	86.0	100.0	0.0	.
83.48	0	0	86.0	100.0	0.0	.
83.93	0	0	86.0	100.0	0.0	.
84.38	0	0	86.0	100.0	0.0	.
84.84	0	0	86.0	100.0	0.0	.
85.29	0	0	86.0	100.0	0.0	.
85.74	0	0	86.0	100.0	0.0	.
86.19	0	0	86.0	100.0	0.0	.
86.64	0	0	86.0	100.0	0.0	.
87.09	0	0	86.0	100.0	0.0	.
87.54	0	0	86.0	100.0	0.0	.
87.99	0	0	86.0	100.0	0.0	.
88.45	0	0	86.0	100.0	0.0	.
88.90	0	0	86.0	100.0	0.0	.
89.35	0	0	86.0	100.0	0.0	.

89.80	0	0	86.0	100.0	0.0	.
90.25	0	0	86.0	100.0	0.0	.
90.70	0	0	86.0	100.0	0.0	.
91.15	0	0	86.0	100.0	0.0	.
91.60	0	0	86.0	100.0	0.0	.
92.06	0	0	86.0	100.0	0.0	.
92.51	0	0	86.0	100.0	0.0	.
92.96	0	0	86.0	100.0	0.0	.
93.41	0	0	86.0	100.0	0.0	.
93.86	0	0	86.0	100.0	0.0	.
94.31	0	0	86.0	100.0	0.0	.
94.76	0	0	86.0	100.0	0.0	.
95.21	0	0	86.0	100.0	0.0	.
95.67	0	0	86.0	100.0	0.0	.
96.12	0	0	86.0	100.0	0.0	.
96.57	0	0	86.0	100.0	0.0	.
97.02	0	0	86.0	100.0	0.0	.
97.47	0	0	86.0	100.0	0.0	.
97.92	0	0	86.0	100.0	0.0	.
98.37	0	0	86.0	100.0	0.0	.
98.82	0	0	86.0	100.0	0.0	.
99.28	0	0	86.0	100.0	0.0	.
99.73	0	0	86.0	100.0	0.0	.
100.18	0	0	86.0	100.0	0.0	.
100.63	0	0	86.0	100.0	0.0	.
101.08	0	0	86.0	100.0	0.0	.
101.53	0	0	86.0	100.0	0.0	.
101.98	0	0	86.0	100.0	0.0	.
102.43	0	0	86.0	100.0	0.0	.
102.88	0	0	86.0	100.0	0.0	.
103.34	0	0	86.0	100.0	0.0	.
103.79	0	0	86.0	100.0	0.0	.
104.24	0	0	86.0	100.0	0.0	.
104.69	0	0	86.0	100.0	0.0	.
105.14	0	0	86.0	100.0	0.0	.
105.59	0	0	86.0	100.0	0.0	.
106.04	0	0	86.0	100.0	0.0	.
106.49	0	0	86.0	100.0	0.0	.
106.95	0	0	86.0	100.0	0.0	.
107.40	0	0	86.0	100.0	0.0	.
107.85	0	0	86.0	100.0	0.0	.

Time	Qin	Qout	Elev	Vol	Area	ExtVel	1	1	1	1	1	1	1
					0.	100.	200.	300.	400.	500.	600.	700.	

END NRCS-PSH PLOT

RATING TABLE DEVELOPED, SITE = S 1:
 BY PROGRAM FOR PS AND AUX. SPILLWAYS
 AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 1

	ELEV.	Q-TOTAL	Q-PS	Q-AUX.	VOLUME	AREA
	FEET	CFS	CFS	CFS	AC-FT	ACRE
1	86.00	0.00	0.00	0.00	100.00	0.00

2	86.56	45.22	45.22	0.00	111.26	0.00
3	87.13	127.89	127.89	0.00	123.77	0.00
4	87.69	234.95	234.95	0.00	140.65	0.00
5	88.25	361.72	361.72	0.00	157.53	0.00
FULL CONDUIT FLOW, ELEV = 88.25 FT						
6	88.97	372.24	372.24	0.00	179.09	0.00
7	89.69	382.42	382.42	0.00	200.65	0.00
8	90.41	392.33	392.33	0.00	227.29	0.00
9	91.13	401.99	401.99	0.00	257.83	0.00
10	91.84	411.43	411.43	0.00	288.38	0.00
11	92.56	420.66	420.66	0.00	318.92	0.00
12	93.28	429.69	429.69	0.00	349.46	0.00
13	94.00	438.53	438.53	0.00	380.00	0.00

1SITES

XEQ 10/11/2001

WSID= 86

VER 96.1

SUBW= A

TIME 13:36:26

SITE = S 1

PASS= 1 PART= 3

AUX. CREST 88.98 FT 179.4 ACFT 0.00 AC 372.4 CFS

PS STORAGE 79.4 ACFT, BETWEEN AUX. CREST AND SED. ACCUM ELEVATIONS.

START ELEV 86.00 FT 100.0 ACFT 0.00 AC 0.0 CFS

EFFECTIVE HEIGHT(H)= 17.0 FEET, PRODUCT= 3046. (H * STORAGE AT CREST AUX.).

INPUT DESIGN CLASS = A1 = LT 3000. PRODUCT.

***** WARNING - NHCP-378 CRITERIA DOES NOT APPLY WHEN THE EFFECTIVE HEIGHT
IS OVER 35 FEET OR THE PRODUCT IS 3000 OR GREATER.

NRCS-SDH D= 24.00 HR P= 4.20 IN Q= 2.13 IN DA= 6.07 SM

TC= 7.00 HR CN= 79.00 VOL= 888.7 ACFT

PEAK = 1042.9 CFS, AT 16.7 HRS. *25 yr. Peak*

NRCS-FBH D= 24.00 HR P= 4.80 IN Q= 2.63 IN DA= 6.07 SM

TC= 7.00 HR CN= 79.00 VOL= 851.7 ACFT

PEAK = 1297.6 CFS, AT 16.7 HRS. *50 yr Peak*

RATING TABLE DEVELOPED, SITE = S 1:
BY PROGRAM FOR PS AND AUX. SPILLWAYS
AUX. RATING USED WSPVRT METHOD.

RATING TABLE NUMBER 2

	ELEV. FEET	Q-TOTAL CFS	Q-PS CFS	Q-AUX. CFS	VOLUME AC-FT	AREA ACRE
1	86.00	0.00	0.00	0.00	100.00	0.00
2	86.56	45.22	45.22	0.00	111.26	0.00

3	87.13	127.89	127.89	0.00	123.77	0.00
4	87.69	234.95	234.95	0.00	140.65	0.00
5	88.25	361.72	361.72	0.00	157.53	0.00
FULL CONDUIT FLOW, ELEV = 88.25 FT						
6	88.34	363.13	363.13	0.00	160.26	0.00
7	88.43	364.47	364.47	0.00	163.00	0.00
8	88.52	365.80	365.80	0.00	165.73	0.00
9	88.62	367.13	367.13	0.00	168.46	0.00
10	88.71	368.45	368.45	0.00	171.20	0.00
11	88.80	369.77	369.77	0.00	173.93	0.00
12	88.89	371.08	371.08	0.00	176.66	0.00
13	88.98	372.39	372.39	0.00	179.39	0.00
14	89.23	392.09	375.97	16.12	186.93	0.00
15	89.48	421.53	379.52	42.00	194.46	0.00
16	89.93	541.37	385.83	155.54	208.01	0.00
17	90.49	768.42	393.40	375.02	230.65	0.00
18	91.49	1411.32	406.81	1004.52	273.32	0.00
19	92.74	2495.80	422.97	2072.63	326.66	0.00
20	94.00	3890.60	438.53	3452.07	380.00	0.00

FULL PIPE FLOW
2.25' ABOVE CREST RISE
(0.75' BELOW E.S. CREST)

SUMMARY OF AUXILIARY SPILLWAY SURFACE CONDITIONS USED IN COMPUTATIONS BY REACH

REACH	FROM STA	TO STA	SLOPE	RETARDANCE	VEGETAL	MAINT.	ROOTING	REACH
	(ft)	(ft)	(%)	INDEX@	COVER	CODE	DEPTH	LOCATION
					FACTOR		(ft)	*
1	0.	150.	-1.5	0.035	**	**	**	INLET
2	150.	300.	0.0	0.035	**	**	**	CREST
3	300.	460.	8.0	0.035	0.70	2	1.0	EXIT

@ The program interprets retardance curve index entries of less than 1 as Manning's n values.

* Upper case indicates a reach of constructed spillway channel.

** The program does not use vegetal cover factor, maintenance code, and rooting depth for inlet and crest reaches in computations.

! Reach 3 used in computing exit channel velocities.

ROUTED RESULTS	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	AUX.-HP	VOL-AUX.
	FT	FT	ACFT	AC	FT	ACFT
NRCS-SDH	125.0	90.73	241.2	0.0	1.75	61.8

PEAK - CFS Q-PS Q-AUX. Q-TOT.
DISCHARGE = 396.7 530.2 926.9

HP @ 25 YR
TYPE II

CRITICAL CRITICAL CRITICAL 25% OF Q
DEPTH VELOCITY SLOPE-Sc Sc
AUXILIARY FT FT/SEC FT/FT FT/FT
SPILLWAY --- 0.82 5.08 0.019 0.026

AUXILIARY SPILLWAY DURATION FLOW = 9.5 HOURS

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 7.8 FT/SEC
 EXIT SLOPE = 0.080 FT/FT
 FLOW DEPTH = 0.5 FT

EFFECTIVE STRESS FOR STABILITY ANALYSIS OF AUX. EXIT CHANNEL
 (Refer to Ag. Handbook 667, Chapt. 3, for allowable stresses.)
 Aux. Discharge = 530. cfs; Bottom Width = 125. ft

REACH FROM TO SLOPE MANNING'S VELOCITY STRESS

NO. STA STA % n ft/s lb/ft^2
 3 300. 460. 8.00 0.035 7.83 0.530

PLOT NRCS-SDH

1 IN = 200. CFS

EXIT SLOPE = 0.080

Time	Qin	Qout	Elev	Vol	Area	ExtVel	0.	200.	400.	600.	800.	1000.	1200.	1400.
0.00	0	0	86.0	100.0	0.0	0.00								
0.45	0	0	86.0	100.0	0.0	0.00								
0.90	0	0	86.0	100.0	0.0	0.00								
1.35	0	0	86.0	100.0	0.0	0.00								
1.81	0	0	86.0	100.0	0.0	0.00								
2.26	0	0	86.0	100.0	0.0	0.00								
2.71	0	0	86.0	100.0	0.0	0.00								
3.16	0	0	86.0	100.0	0.0	0.00								
3.61	0	0	86.0	100.0	0.0	0.00								
4.06	0	0	86.0	100.0	0.0	0.00								
4.51	0	0	86.0	100.0	0.0	0.00								
4.96	0	0	86.0	100.0	0.0	0.00								
5.42	0	0	86.0	100.0	0.0	0.00								
5.87	0	0	86.0	100.0	0.0	0.00								
6.32	0	0	86.0	100.0	0.0	0.00								
6.77	0	0	86.0	100.0	0.0	0.00								
7.22	0	0	86.0	100.0	0.0	0.00								
7.67	0	0	86.0	100.0	0.0	0.00								
8.12	0	0	86.0	100.0	0.0	0.00								
8.57	0	0	86.0	100.0	0.0	0.00								
9.03	0	0	86.0	100.0	0.0	0.00								
9.48	0	0	86.0	100.0	0.0	0.00								
9.93	1	0	86.0	100.0	0.0	0.00								
10.38	2	0	86.0	100.1	0.0	0.00								
10.83	4	1	86.0	100.2	0.0	0.00								
11.28	8	1	86.0	100.3	0.0	0.00								
11.73	16	3	86.0	100.7	0.0	0.00								
12.18	46	7	86.1	101.7	0.0	0.00								
12.64	107	16	86.2	104.1	0.0	0.00	P							
13.09	195	35	86.4	108.8	0.0	0.00	P							
13.54	315	78	86.8	116.2	0.0	0.00	P							
13.99	469	146	87.2	126.6	0.0	0.00	P							
14.44	644	233	87.7	140.3	0.0	0.00	P							
14.89	800	353	88.2	156.3	0.0	0.00	P							
15.34	920	370	88.8	174.9	0.0	0.00	P							
15.79	997	432	89.5	195.7	0.0	3.13	A							
16.25	1037	604	90.1	214.3	0.0	5.50	A							
16.70	1043	742	90.4	228.0	0.0	6.64	A							X

Time	Qin	Qout	Elev	Vol	Area	ExtVel
17.15	1016	857	90.6	236.6	0.0	7.42
17.60	972	917	90.7	240.5	0.0	7.78
18.05	907	927	90.7	241.2	0.0	7.83
18.50	821	899	90.7	239.3	0.0	7.67
18.95	735	846	90.6	235.8	0.0	7.35
19.40	664	782	90.5	231.5	0.0	6.93
19.86	603	731	90.4	227.0	0.0	6.57
20.31	549	683	90.3	222.1	0.0	6.19
20.76	503	633	90.2	217.2	0.0	5.77
21.21	462	586	90.1	212.4	0.0	5.31
21.66	423	541	89.9	207.9	0.0	4.82
22.11	389	502	89.8	203.6	0.0	4.33
22.56	359	466	89.6	199.5	0.0	3.78
23.01	332	432	89.5	195.6	0.0	3.11
23.47	308	411	89.4	191.8	0.0	2.60
23.92	286	396	89.3	187.8	0.0	2.10
24.37	267	384	89.1	183.6	0.0	1.56
24.82	250	372	89.0	179.2	0.0	0.00

END NRCS-SDH PLOT

DRAWDOWN USING FREEBOARD STORM FOLLOWS, STARTING AT ELEVATION 88.98 FT.

DRAWDOWN (DDT) TEST 86.00 FT 100.0 ACFT 0.00 CFS
CONTROL IS 0.000 DETENTION STORAGE

TIME = 1.41 DAYS, TO 0.0 CFS (LIMIT = 10.00 DAYS)

ROUTED RESULTS	BTM WIDTH FT	MAX ELEV FT	VOL-MAX ACFT	AREA-MAX AC	AUX.-HP	VOL-AUX.
NRCS-FBH	125.0	91.15	258.9	0.0	2.17	79.5

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGE =	402.	792.	1195.

HP @ 50GR
TYPE II

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY SPILLWAY --	FT	FT/SEC	FT/FT	FT/FT
	1.07	5.79	0.018	0.024

AUXILIARY SPILLWAY DURATION FLOW = 11.3 HOURS
ATTACK, OE/B = 2.5 ACFT/FT

***** MESSAGE - NHCP378 CRITERIA USED BUT AUXILIARY SPILLWAY RATING NOT
BASED ON ASFILE RATINGS.

EXIT CHANNEL FLOW SUPERCRITICAL: MAX VELOCITY= 9.2 FT/SEC
EXIT SLOPE = 0.080 FT/FT
FLOW DEPTH = 0.7 FT

>>>>> NHCP378 RUN - MINIMUM DEPTH, DESIGN FLOW TO TOP OF DAM; 1.00 FT REQUIRED
FOR THIS PASS. NEW TOP OF DAM ELEVATION = 92.15.

ROUTED	BTM WIDTH	MAX ELEV	VOL-MAX	AREA-MAX	AUX.HP	VOL-AUX.
RESULTS	FT	FT	ACFT	AC	FT	ACFT
MINIMUM AUX.	125.0	92.15	301.4	0.0	3.17	122.0

PEAK - CFS	Q-PS	Q-AUX.	Q-TOT.
DISCHARGES =	415.4	1567.5	1982.9

	CRITICAL DEPTH	CRITICAL VELOCITY	CRITICAL SLOPE-Sc	25% OF Q Sc
AUXILIARY SPILLWAY --	FT	FT/SEC	FT/FT	FT/FT
	1.67	7.20	0.015	0.021

PLOT NRCS-FBH 1 IN = 200. CFS EXIT SLOPE = 0.080
0. 200. 400. 600. 800. 1000. 1200. 1400.

Time	Qin	Qout	Elev	Vol	Area	ExtVel
0.00	0	0	86.0	100.0	0.0	0.00
0.45	0	0	86.0	100.0	0.0	0.00
0.90	0	0	86.0	100.0	0.0	0.00
1.35	0	0	86.0	100.0	0.0	0.00
1.81	0	0	86.0	100.0	0.0	0.00
2.26	0	0	86.0	100.0	0.0	0.00
2.71	0	0	86.0	100.0	0.0	0.00
3.16	0	0	86.0	100.0	0.0	0.00
3.61	0	0	86.0	100.0	0.0	0.00
4.06	0	0	86.0	100.0	0.0	0.00
4.51	0	0	86.0	100.0	0.0	0.00
4.96	0	0	86.0	100.0	0.0	0.00
5.42	0	0	86.0	100.0	0.0	0.00
5.87	0	0	86.0	100.0	0.0	0.00
6.32	0	0	86.0	100.0	0.0	0.00
6.77	0	0	86.0	100.0	0.0	0.00
7.22	0	0	86.0	100.0	0.0	0.00
7.67	0	0	86.0	100.0	0.0	0.00
8.12	0	0	86.0	100.0	0.0	0.00
8.57	0	0	86.0	100.0	0.0	0.00
9.03	0	0	86.0	100.0	0.0	0.00
9.48	1	0	86.0	100.0	0.0	0.00
9.93	3	0	86.0	100.1	0.0	0.00
10.38	5	1	86.0	100.2	0.0	0.00
10.83	9	2	86.0	100.4	0.0	0.00
11.28	17	3	86.0	100.8	0.0	0.00
11.73	29	6	86.1	101.5	0.0	0.00
12.18	69	12	86.2	103.0	0.0	0.00
12.64	148	26	86.3	106.4	0.0	0.00
13.09	261	54	86.6	112.5	0.0	0.00
13.54	411	115	87.1	121.9	0.0	0.00
13.99	604	199	87.5	134.9	0.0	0.00
14.44	820	319	88.1	151.8	0.0	0.00
14.89	1012	369	88.8	173.2	0.0	0.00
15.34	1157	455	89.6	198.2	0.0	3.58
15.79	1249	681	90.3	221.9	0.0	6.18
16.25	1295	906	90.7	239.8	0.0	7.71
16.70	1298	1077	91.0	251.1	0.0	8.63
17.15	1261	1166	91.1	257.0	0.0	9.04
17.60	1202	1195	91.2	258.9	0.0	9.17
18.05	1119	1180	91.1	257.9	0.0	9.11

Time	Qin	Qout	Elev	Vol	Area	ExtVel
18.50	1010	1129	91.0	254.6	0.0	8.88
18.95	902	1053	90.9	249.6	0.0	8.51
19.40	814	968	90.8	243.9	0.0	8.06
19.86	737	883	90.7	238.3	0.0	7.58
20.31	670	804	90.5	233.0	0.0	7.08
20.76	613	743	90.4	228.1	0.0	6.65
21.21	561	694	90.3	223.2	0.0	6.28
21.66	513	644	90.2	218.3	0.0	5.87
22.11	470	596	90.1	213.6	0.0	5.42
22.56	433	551	90.0	208.9	0.0	4.93
23.01	400	512	89.8	204.7	0.0	4.46
23.47	371	476	89.7	200.6	0.0	3.94
23.92	345	442	89.6	196.8	0.0	3.34
24.37	321	417	89.4	193.2	0.0	2.74
24.82	300	402	89.3	189.5	0.0	2.33
25.27	280	389	89.2	185.6	0.0	1.81
25.72	261	378	89.0	181.4	0.0	1.15
26.17	242	371	88.9	176.8	0.0	0.00

Time Qin Qout Elev Vol Area ExtVel

0. 200. 400. 600. 800. 1000. 1200. 1400.

END NRCS-FBH PLOT

INFLOW HYD 1 PSH-PEAK =	372.39 CFS AT	18.50 HRS, LOCATION POINT
INFLOW HYD 1 SDH-PEAK =	926.94 CFS AT	18.05 HRS, LOCATION POINT
INFLOW HYD 1 FBH-PEAK =	1194.64 CFS AT	17.60 HRS, LOCATION POINT
HYDOUT 1		

1SITES....JOB NO. 1 COMPLETE.

66

0 SUBWATERSHED(S) ANALYZED.

1 STRUCTURE(S) ANALYZED.

3 HYDROGRAPHS ROUTED AT LOWEST SITE.

0 TRIALS TO OBTAIN BOTTOM WIDTH FOR SPECIFIED STRESS OR VELOCITY.

◆ ◆ ◆

SITES.....COMPUTATIONS COMPLETE

1 SUMMARY TABLE 1 SITES VERSION 96.1
DATED 05/01/2000

WATERSHED ID	RUN DATE	RUN TIME
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-----
66              10/11/2001              13:36:26
>>> SITE SUBWS SUBWS DA CURVE TC TOTAL DA TYPE STRUC <<<
   ID  ID  (SQ MI) NO. (HRS) (SQ MI) DESIGN CLASS
-----
   S  1  A    6.07  79. 7.00   6.07 378CR  A1

PASS DIA./ AUX.CREST BTM. MAX. MAX. EMB. INTEGR.* EXIT* TYPE
NO. WIDTH ELEV WIDTH HP ELEV VOL. DIST. VEL. HYD
  (IN/FT) (FT) (FT) (FT) (FT) (CY) (FT) (FT/SEC)
-----
  1 48.0  89.0 125.0 3.2  92.2   0.  0.  9.2 MIN. AUX.

```

* INTEGRITY DIST. AND EXIT VEL. ARE BASED ON THE ROUTED HYDROGRAPH
AND WILL NOT RELATE TO THE MAX. ELEV., (TOP OF DAM),
WHICH IS SET BY MINIMUM DESIGN CRITERIA.

SITES.....SUMMARY TABLE 1 COMPLETED.

NRCS SITES VERSION 96.1 ,05/01/2000
66 FILES

INPUT

C:\Engineer\SITES 99.2\KEFFE\66.d2c

OUTPUT - DATED 10/11/2001 13:36:28
C:\Engineer\SITES 99.2\KEFFE\66.OUT

GRAPHICS FILES GENERATED

OPTION "L" DATED 10/11/2001 13:36:28
C:\Engineer\SITES 99.2\KEFFE\66.DRG

OPTION "P" DATED 10/11/2001 13:36:28
C:\Engineer\SITES 99.2\KEFFE\66.DHY

OPTION "E" DATED 10/11/2001 13:36:28
C:\Engineer\SITES 99.2\KEFFE\66.DEM

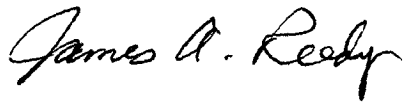
PRELIMINARY RISK ASSESSMENT

FOR

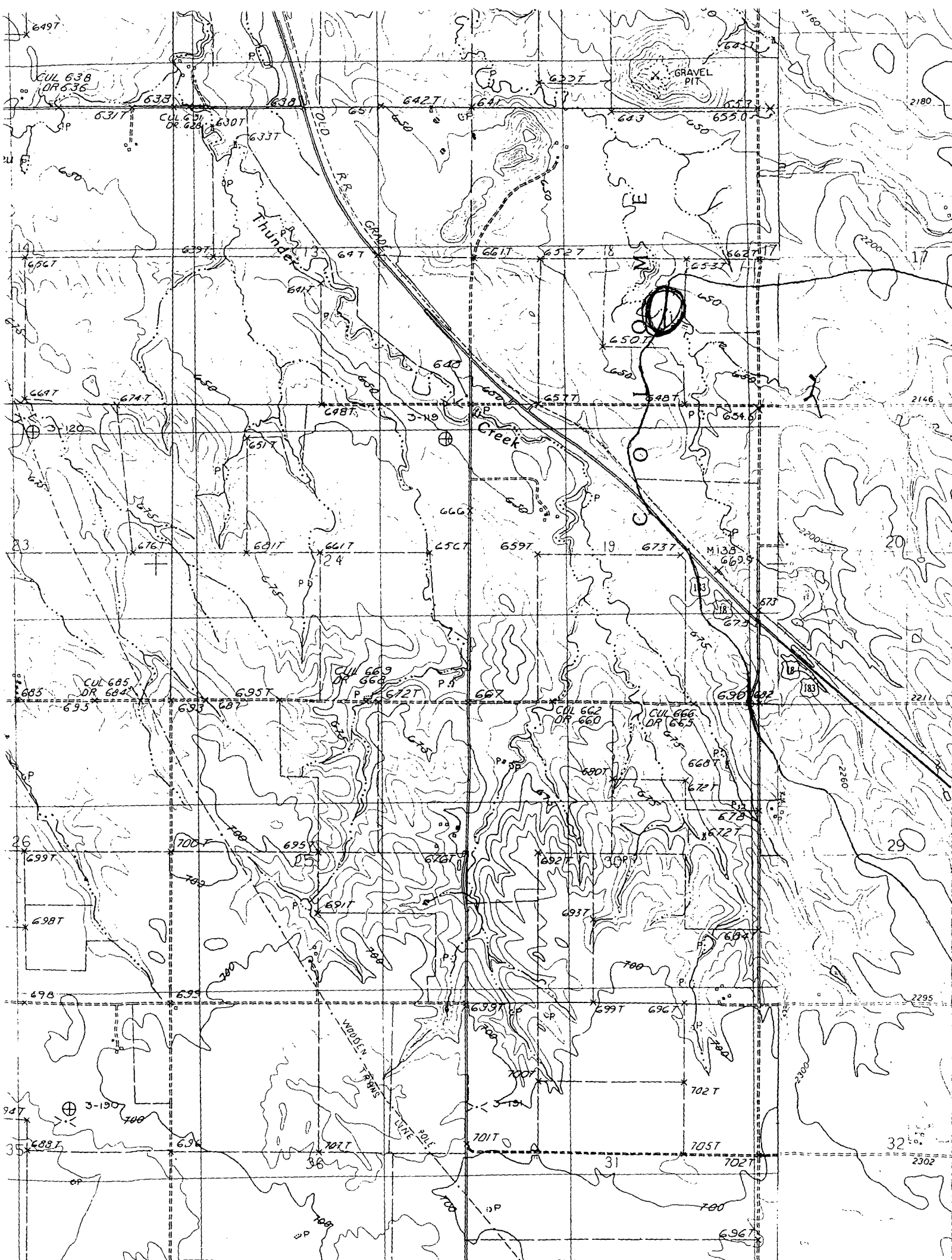
ED AND TERRY KEEFE WILDLIFE POND

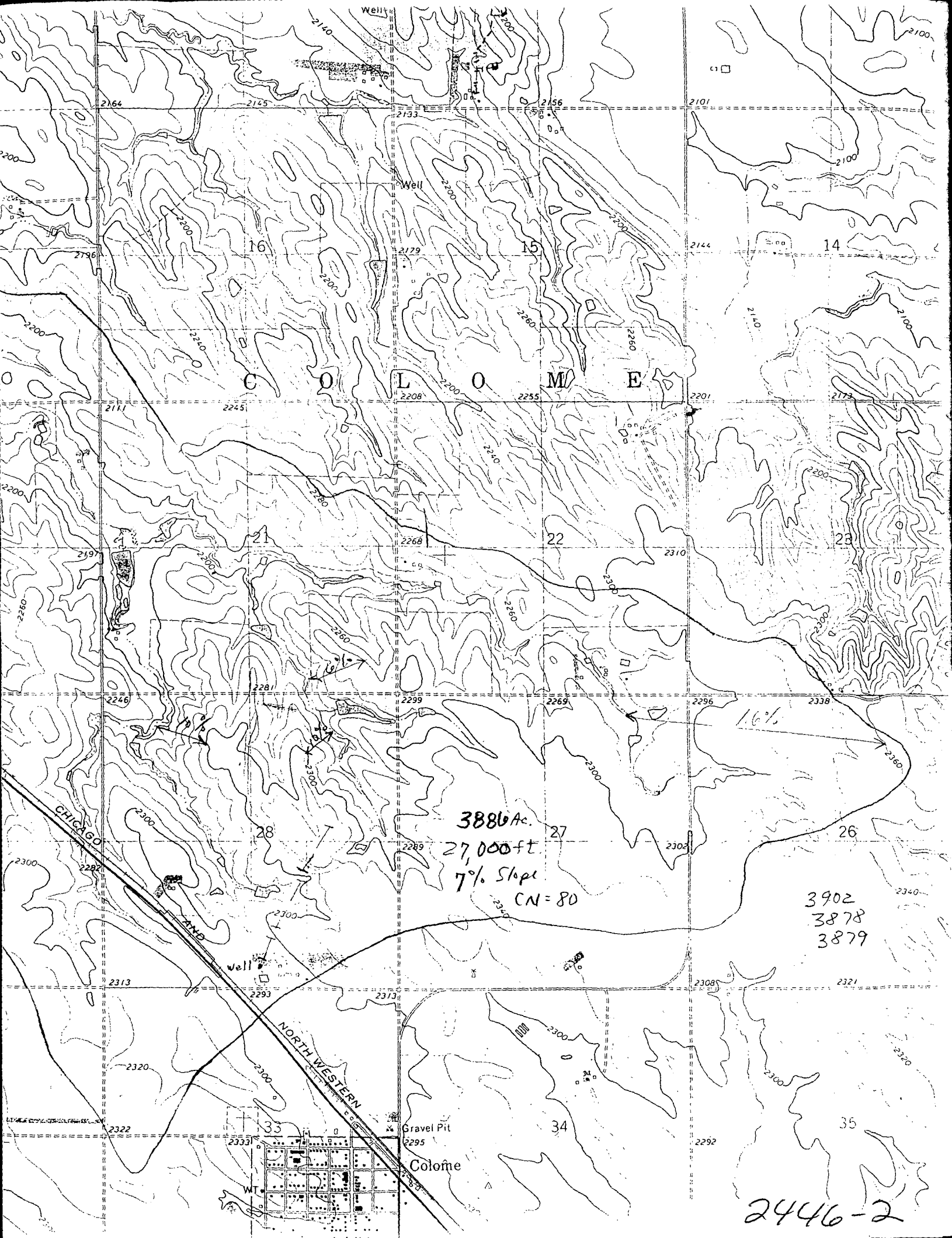
**SE ¼ SEC. 18 T98N R75W
TRIPP COUNTY, SOUTH DAKOTA**

A review of data available for the area of consideration (aerial photos and topography maps) indicates that the closest site that could be impacted by failure or breach of the above dam is U.S. Highway 183/18, approximately 2.7 miles downstream from the site. A farmstead is located approximately 1.0 mile downstream from the site, and is approximately 35 to 40 feet above the channel. Inhabitation of the farmstead is unknown.



James A. Reedy, P.E.
Agricultural Engineer
USDA – NRCS, Winner, SD





3886 Ac.
27,000 ft
7% Slope
CN = 80

3902
3878
3879

2446-2



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3181
www.state.sd.us/denr

October 24, 2000

Edward Keefe
RR 1 Box 138
Colome, SD 57528

Dear Mr. Keefe:

We have reviewed the plans and specifications for your proposed dam project located in the SE 1/4 of Section 18-T98N-R75W, in Tripp County. The plans and specifications as submitted are approved. Approval of the plans and specifications does not authorize construction of the dam. The construction may not begin until Water Permit Application No. 2446-2 is approved.

Our review was to determine compliance with the requirements of the Water Management Board Safety of Dams Rules, Chapter 74:02:08. Approval of these plans and specifications does not release you, as owner of the dam, from the responsibility for operating and maintaining the dam in good repair to ensure the safety of the dam.

The Keefe Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 22 feet and a normal storage capacity of 87 acre-feet and a maximum storage capacity of 328 acre-feet.

If you have any questions, please feel free to contact us.

Sincerely,

Gale N. Selken, P.E.
Natural Resources Engineer Director
for Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

c: Jim Reedy, NRCS, Winner

**REPORT ON
WATER PERMIT APPLICATION NO. 2446-2
Edward & Teresa Keefe
October 16, 2000**

Water Permit Application No. 2446-2 has been filed by Edward & Teresa Keefe to impound 87 acre-feet of water from runoff by constructing a dam located in the NW 1/4 SE 1/4 of Section 18-T98N-R75W, in Tripp County. The application also requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife propagation and livestock watering.

Discussion:

The dam will be classified as a small size, Category 3, Low Hazard dam. The Natural Resources Conservation Service (NRCS) has designed the project. The plans and specifications have been reviewed and will be approved; however, construction of the dam can not begin until Water Permit Application No. 2446-2 is approved.

The Keefe Dam will be 22 feet high with a normal storage capacity of 87 acre-feet with a reservoir level at the primary spillway elevation, and a maximum storage capacity of 328 acre-feet with a reservoir level at the top of dam elevation. A dam of this size and hazard classification is required to have a minimum spillway design capable of passing a 50-year frequency event.

The dam has a drainage area of 6.07 square miles. A 50-year frequency event for this drainage area produces a peak runoff of approximately 1116 cfs. A 100-year frequency event produces a peak of approximately 1518 cfs. The dam is designed to have a 125 foot wide earthcut secondary spillway with 4 feet of available freeboard. The secondary spillway will have a capacity of approximately 2600 cfs.

The annual yield for this drainage area with an 80 percent chance of occurrence, or 8 out of 10 years, is expected to be 110 acre-feet. The annual yield with a 50 percent chance of occurrence, or 1 out of 2 years, is expected to be 260 acre-feet and the annual yield with a 10 percent chance, or 1 out of 10 years, is expected to be 1004 acre-feet.

The Keefe Dam will be located in the NW 1/4 SE 1/4 of Section 18-T98N-R75W on an unnamed tributary of Thunder Creek about two miles upstream of its confluence with Thunder Creek. There are no existing Water Permits/Rights located on the unnamed tributary between the proposed dam and Thunder Creek.

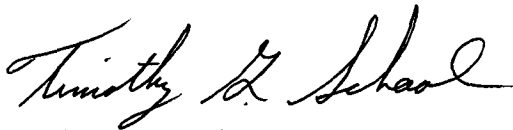
Page 2

Application No. 2446-2

Edward & Teresa Keefe

Conclusions:

1. Water Permit Application No. 2446-2 should be approved since unappropriated water is available and approval should not have any adverse effect on existing Water Permits/Rights.
2. If approved, the low flow bypass requirement for downstream domestic use should be a qualification on Water Permit Application No. 2446-2.



Timothy G. Schaal, P.E.

Natural Resources Engineer Specialist

Approved by:



Gale N. Selken, P.E.

Natural Resources Engineer Director



**DEPARTMENT of ENVIRONMENT
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JOE FOSS BUILDING
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PIERRE, SOUTH DAKOTA 57501-3181
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**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 2446-2, Edward Keefe and Teresa Keefe**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 2446-2, Edward Keefe and Teresa Keefe, RR 1, Box 138, Colome, SD 57528.

The Chief Engineer is recommending APPROVAL of Application No. 2446-2 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualifications:

1. Water Permit No. 2446-2 authorizes a dam with a storage capacity of 87 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

See report on application for additional information.

Garland Erbele, Chief Engineer
October 20, 2000



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
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PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
READVERTISED APPLICATION NO. 2446-2, Edward Keefe and Teresa Keefe**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning readvertised Water Permit Application No. 2446-2, Edward Keefe and Teresa Keefe, RR 1, Box 138, Colome, SD 57528.

The Chief Engineer is recommending APPROVAL of readvertised Application No. 2446-2 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualifications:

1. Water Permit No. 2446-2 authorizes a dam with a storage capacity of 100 acre feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.

See report on application for additional information.

Garland Erbele, Chief Engineer
November 1, 2001

Water Permit Application No. 2446-2
Edward & Teresa Kaefer

Top of Dam Elev. - 94
2nd Spillway Elev. - 90
P. Spillway Elev. - 87
D/S Toe Elev. - 72

Cat. 3 - Low Hazard Dam

Ht. = 22 ft.

Normal Storage Capacity - 87 A.-Ft
Int. Storage Capacity - 169 A.-Ft
Max. Storage Capacity - 328 A.-Ft

Int. Capacity x Eff. Ht. = $169 \times 18 = 3042 > 3000 \therefore 50 \text{ yr}$
Minimum Spillway Design

From USGS WRI 80-80 "Tech for Est. Flood Peaks... in SD"

DA = 3886 Ac = 6.07 mi.²
Slope = 45 ft/mi.
SI = 2.05

$$Q_{50} = 106 A^{.63} S^{.45} \cdot .69$$

$$= 106 (6.07) (45)^{.45} (2.05)^{.69}$$

$$= 106 (3.1146) (5.55) (.6094)$$

$$= \underline{1116 \text{ cfs}}$$

$$Q_{100} = 132 A^{.65} S^{.46} \cdot .67$$

$$= 132 (6.07) (45)^{.46} (2.05)^{.67}$$

$$= 132 (3.23) (5.7607) (.6182)$$

$$= \underline{1518 \text{ cfs}}$$

Secondary Spillway Flow

$$Q = CLH^{3/2} \quad C=2.6 \quad L=125' \quad H=4 \text{ ft}$$

$$= 2.6 (125) (4)^{1.5}$$

$$= \underline{2600 \text{ cfs}}$$

Section 74:02:08:09

1. Topo Map - OK
2. Dam Ar's Profile - OK
3. Dam Max X-Sec - OK
4. Area - Capacity - OK
5. Outlet Details - OK
6. Spillway Capacity - OK
7. Spillway Details - OK
8. Specs - Std. NRCS - OK
9. EPP - NR Cat. 3 - OK

NRCS Annual Yield

CN=80 DA=3886 A ISO=2 1/2

80% chance = 0.34
 $0.34 \times 3886^{1/2} = \underline{110 \text{ A.-Ft}}$

50% chance = 0.80
 $0.80 \times 3886^{1/2} = \underline{260 \text{ A.-Ft}}$

10% chance = 3.1
 $3.1 \times 3886^{1/2} = \underline{1004 \text{ A.-Ft}}$



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www.state.sd.us/denr

**NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.**

October 24, 2000

Edward & Teresa Keefe
RR 1 Box 138
Colome SD 57528

Dear Mr. & Mrs. Keefe:

Water Permit Application No. 2446-2 for fish & wildlife propagation and livestock watering use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice of hearing has been sent to the Publisher of the Winner Advocate printed at Winner, SD (Ph # 605 842-1481). For your information, a copy of the notice, the recommendation of the Chief Engineer and a report on the application are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice of Hearing and to arrange for payment. Early contact with the paper can eliminate delays. The publisher has been instructed to publish your notice once each week for two consecutive weeks with the last publication to occur twenty days before the board meeting. The newspaper has been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,

Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the application.



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3181
www.state.sd.us/denr

October 24, 2000

Winner Advocate
Box 71
Winner SD 57580-0071

ATTENTION: Legal Public Notice

Enclosed is a Notice of Hearing on Application No. 2446-2 to Appropriate Water to be published twice. Please publish the first notice on November 1, 2000 with the second publication 7 days later.

The applicant must verify to you that the notice is to be published, before you make the first publication. **Please BILL the APPLICANT for the cost of publication.** The APPLICANT is Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 (Ph # 605 842-3800).

Please send the Water Rights Program the first publication immediately. The publication is checked for accuracy so any corrections can be made in the second publication. You may use the form below or fax a copy of the first publication. Any fax should be sent to the attention of Karen Schlaak at (605) 773-4068. Publication errors can invalidate the public notice.

After the second publication, **please send us an affidavit or use the enclosed Proof of Publication form.** The applicant pays the cost of publication, but the Water Rights Program records require an affidavit or Proof of Publication. Delays in receiving the affidavit can be costly to the applicant.

Sincerely,

Eric Gronlund /KS
Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CU T HERE-----

No. 2446-2

TO: Eric Gronlund
Water Rights Program
Joe Foss Building
Pierre SD 57501-3181

Date _____

We are in receipt of your letter of October 24, 2000 enclosing Notice of Hearing to Appropriate Water by Application No. 2446-2 which was first published in our issue of _____. **ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.**

Name

Newspaper

Instruction to Newspaper - Publish first Notice on November 1, 2000 with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF APPLICATION NO. 2446-2 to Appropriate Water

Notice is given that Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 has filed an application for a water permit to impound 87 acre-feet of water from runoff by constructing a dam located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ Section 18; with water impounded in portions of the SE $\frac{1}{4}$ Section 18; all in T98N-R75W. This application requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife propagation and livestock watering.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2446-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by November 20, 2000.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

AFFIDAVIT OF PUBLICATION

STATE OF SOUTH DAKOTA, County of Tripp-ss.

Mylan Schroeder

of said county being first duly sworn, on oath says that he is the publisher of the

ADVOCATE

a weekly newspaper printed and published at Winner, said county of Tripp, and has full and personal knowledge of all the facts herein stated that said newspaper is a legal newspaper and has a bona fide circulation of at least two hundred copies weekly and has been published within said County for fifty-two successive weeks prior to the publication of the notice herein mentioned, and was printed wholly or in part in an office maintained at said place of publication; that the

34 lines @ 2 col x 802

Edward & Teresa Keefe

a printed copy of which, taken from the paper in which the same was published, is attached to this sheet, and is made a part of this affidavit, was published in said newspaper at least one in each week for 2 successive weeks, on the day of each week on which said newspaper was regularly published, to wit:

11-1-00

11-8-00

That the full amount of the fees for the publication of the annexed notice is \$ 37.25

Mylan Schroeder

Subscribed and sworn to before me this 8th

day of November, 2000

Patricia Davis

Notary Public

County of Tripp, South Dakota

My Commission Expires 11-05-03

NOTICE OF APPLICATION NO. 2446-2 to Appropriate Water

Notice is given that Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 has filed an application for a water permit to impound 87 acre-feet of water from runoff by constructing a dam located in the NW 1/4 SE1/4 Section 18; with water impounded in portions of the SE1/4 Section 18; all in T98N-R75W. This application requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife propagation and livestock watering.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 2446-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by November 20, 2000.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

(44-45 2251)





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

November 2, 2001

Edward Keefe
RR 1 Box 138
Colome, SD 57528

Dear Mr. Keefe:

We have reviewed the plans and specifications for the redesign of your dam project located in the SE 1/4 of Section 18-T98N-R75W, in Tripp County. The plans and specifications as submitted are approved. Approval of the plans and specifications does not authorize construction of the dam. The redesign of the dam changed the storage capacity authorized under Water Permit No. 2446-2; therefore, the new storage capacity and Water Permit No. 2446-2 will need to be readvertised. The construction of the dam may not begin until Water Permit No. 2446-2 has been readvertised and the time to intervene as set out in the Notice has past (generally 20 days after the first Notice).

Our review was to determine compliance with the requirements of the Water Management Board Safety of Dams Rules, Chapter 74:02:08. Approval of these plans and specifications does not release you, as owner of the dam, from the responsibility for operating and maintaining the dam in good repair to ensure the safety of the dam.

The Keefe Dam will be classified as a small size Category 3, Low Hazard dam with a dam height of 20 feet and a normal storage capacity of 100 acre-feet and a maximum storage capacity of 310 acre-feet.

If you have any questions, please feel free to contact us.

Sincerely,

Gale N. Selken, P.E.
Natural Resources Engineer IV
for Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

c: Steve Higgins, NRCS, Winner
Steve Quissell, NRCS, Rapid City



DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

November 2, 2001

Winner Advocate
Box 71
Winner, SD 57580-0071

ATTENTION: Legal Public Notice

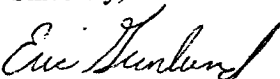
Enclosed is a Notice readvertising Application No. 2446-2 to Appropriate Water to be published twice. Please publish the first notice on November 14, 2001 with the second publication 7 days later.

The applicant must verify to you that the notice is to be published, before you make the first publication. Please **BILL the APPLICANT for the cost of publication.** The APPLICANT is Edward & Teresa Keefe, RR 1 Box 138, Colome, SD 57528 (Ph # 605-842-3800).

Please send the Water Rights Program the first publication immediately. The publication is checked for accuracy so any corrections can be made in the second publication. You may use the form below or fax a copy of the first publication. Any fax should be sent to the attention of Karen Schlaak at (605) 773-4068. Publication errors can invalidate the public notice.

After the second publication, please send us an affidavit or use the enclosed Proof of Publication form. The applicant pays the cost of publication, but the Water Rights Program records require an affidavit or Proof of Publication. Delays in receiving the affidavit can be costly to the applicant.

Sincerely,


Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CUT HERE-----

No. 2446-2

TO: Eric Gronlund
Water Rights Program
Joe Foss Building
Pierre SD 57501-3181

Date _____

We are in receipt of your letter of November 2, 2001 enclosing Notice of Hearing to Appropriate Water by Application No. 2446-2 which was first published in our issue of _____. **ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.**

Name

Newspaper



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.

November 2, 2001

Edward and Teresa Keefe
RR 1 Box 138
Colome SD 57528

Dear Mr. and Mrs. Keefe:

Water Permit No. 2466-2 was issued for a dam with an 87 acre foot storage capacity to be used for fish and wildlife and livestock water use. Since the permit was issued, additional engineering design was conducted and the capacity of the dam will now be 100 acre feet of water. This additional storage capacity necessitates readvertisement to correctly describe the amount of water appropriated.

A notice readvertising the application has been sent to the Publisher of the Winner Advocate, Box 71, Winner SD 57580-0071 (Ph # 605-842-1481). You will need to contact the newspaper and authorize publication of this notice. For your information, a copy of the notice and the revised recommendation of the Chief Engineer are enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice and to arrange for payment. Early contact with the paper can eliminate delays. Upon receiving authorization, the publisher has been instructed to publish your notice once each week for two consecutive weeks with the last publication to occur twenty days before the board meeting. The newspaper has also been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can issue the revised water permit.

Sincerely,

Eric Gronlund
Natural Resources Engineer
(605) 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendation, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing.

Instruction to Newspaper - Publish first Notice on November 14, 2001 with the second publication 7 days later. The applicant is responsible for payment.

READVERTISEMENT of NOTICE OF APPLICATION for WATER PERMIT NO. 2446-2

Notice is given of readvertisement of Water Permit No. 2446-2 filed by Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528. The water permit authorizes a dam with a storage capacity of 87 acre feet of water in Tripp County. The application was originally public noticed November 1 and 8, 2000 in the Winner Advocate. The storage capacity of the proposed dam has increased necessitating readvertisement to correctly describe the amount of water appropriated.

The dam authorized by Water Permit No. 2446-2 will now impound 100 acre-feet of runoff water on an unnamed tributary to Thunder Creek. The dam will be located in the NW $\frac{1}{4}$ SE $\frac{1}{4}$ Section 18; with water impounded in portions of the SE $\frac{1}{4}$ Section 18; all in T98N-R75W. This application requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife propagation and livestock watering.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of readvertised Water Permit No. No. 2446-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by December 3, 2001.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

AFFIDAVIT OF PUBLICATION

State of South Dakota, county of Tripp-ss.

Cheryl Schroeder

of said county being first duly sworn, on oath says that she is the Advertising Manager of the

WINNER ADVOCATE

a weekly newspaper printed and published at Winner, said county of Tripp, and has full and personal knowledge of all the facts herein stated that said newspaper is a legal newspaper and has a bona fide circulation of at least two hundred copies weekly and has been published within said County for fifty-two successive weeks prior to the publication of the notice herein mentioned, and was printed wholly or in part in an office maintained at said place of publication; that the

40 lines @ 2 col x rate x 80%

Edward Keefe

a printed copy of which, taken from the paper in which the same was published, is attached to this sheet, and is made a part of this affidavit, was published in said newspaper at least one in each week for 2 successive weeks, on the day of each week on which said newspaper was regularly published to wit:

11-14-01

11-21-01

That the full amount of the fees for the publication of the annexed notice is \$ 44.93

Subscribed and sworn to before me this 21st

day of November, 2001

Patricia Arvin

Notary Public

County of Tripp, South Dakota

My Commission Expires November 5, 2003

READVERTISEMENT OF NOTICE OF APPLICATION FOR WATER PERMIT NO. 2446-2

Notice is given of readvertisement of Water Permit No. 2446-2 filed by Edward & Teresa Keefe, RR 1 Box 138, Colome, SD 57528. The water permit authorizes a dam with a storage capacity of 87 acre feet of water in Tripp County. The application was originally public noticed November 1 and 8, 2000, in the Winner Advocate. The storage capacity of the proposed dam has increased necessitating readvertisement to correctly describe the amount of water appropriated.

The dam authorized by Water Permit No. 2446-2 will now impound 100 acre-feet of runoff water on an unnamed tributary to Thunder Creek. The dam will be located in the NW 1/4 SE 1/4 Section 18; with water impounded in portions of the SE 1/4 Section 18; all in T98N-R75W. This application requests impoundment of sufficient water to maintain water at the outlet elevation. The water will be used for fish and wildlife propagation and livestock watering.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of readvertised Water Permit No. 2446-2 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. In accordance with SDCL 46-2A-23, the Chief Engineer will act on the application, as recommended, unless a petition is filed opposing the application or the applicant files a petition contesting the Chief Engineer's recommendation. If a petition opposing the application or contesting the recommendation is filed, then a hearing will be scheduled and the Water Management Board will consider the application. Notice of the hearing will be given to the applicant and any person filing a petition.

Any person interested in opposing or supporting this application or recommendation must file a written petition with BOTH the applicant and Chief Engineer. The applicant must file a petition if contesting the Chief Engineer's recommendation. The Chief Engineer's address is "Water Rights Program, Foss Building, 523 E. Capitol, Pierre, SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by December 3, 2001.

The petition may be informal, but must include a statement describing the petitioner's interest in the application, the petitioner's reasons for opposing or supporting the application, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained. Contact Eric Gronlund at the above Water Rights Program address to request copies of information pertaining to this application. Steven M. Pirner, Secretary, Department of Environment and Natural Resources.

(46-47 2471)





JAN 02 2001

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

Edward & Teresa Keefe
RR 1 Box 138
Colome SD 57528

Dear Mr. & Mrs. Keefe:

Enclosed is Water Permit No. 2446-2 authorizing construction of your water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

Form 10, *Notice of Completion of Works and Application of Water to Beneficial Use*, is enclosed. Please return this completed form after you have finished the system and have put the water to beneficial use. An investigation can then be scheduled so the water license may be issued, thus completing the acquisition of a water right.

An informational sheet *Common Water Right Questions* is also enclosed. This sheet is intended to answer some of the questions associated with obtaining and keeping a water right.

Sincerely,

Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures

RECEIPT

Water Rights Program

South Dakota Department of Environment and Natural Resources

2446-2

Nº 416631

Pierre, September 15, 2000

RECEIVED OF Keefe Family Trust, PO Box 271, Winner SD 57580
the following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. _____ to Appropriate Water, to construct
and to put water to beneficial use _____

150 00

Fee for Application for Permit No. _____ to Appropriate Water, for Future
Use _____

Fee to retain Future Use Permit No. _____ after period of seven years.

Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water
License No. _____

50 00

Fee for Filing Transfer Form _____

Fee for Filing Extension Request _____

Fee for _____

(Any Other Work Provided by Law)

Total

By Harland Erbete
Chief Engineer

1155

Permit No. 2446-2
White River - Water District

Report Of Examination Of Works And/Or Application of Water To Beneficial Use

TO: Chief Engineer, Water Rights Program, DENR, Foss Bldg., Pierre, SD 57501

I have this day, May 6, 2004, made a thorough examination of the water use system constructed by Edward & Teresa Keefe of RR 1 Box 138, Colome SD 57528 holder of Permit No. 2446-2, bearing the priority of September 8, 2000 authorizing the storage of 100 acre-feet of the waters of runoff for fish & wildlife propagation and livestock water purposes, in Tripp County.

I have to report on the conditions of the same as follows:

A. Works used to divert the water:

A 20 foot high earthen dam with a normal storage capacity of 100 acre-feet

B. Works used to transport water to place of use:

N/A

C. Works used to apply water to beneficial use:

A 20 foot high earthen dam with a normal storage capacity of 100 acre-feet

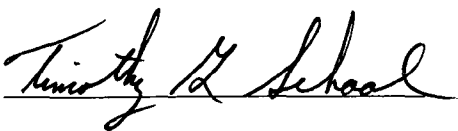
The system is in the following condition **good**. The point of diversion is located **1800 ft. north & 2200 ft. west of the SE corner of Sec. 18-T98N-R75W (NW ¼ SE ¼).** The works are capable of storing **100** acre-feet of water which is to be used for **fish & wildlife propagation and livestock water.** Water has been put to beneficial use to the maximum extent as follows:

A 20 foot high earthen dam with a normal storage capacity of 100 acre-feet

and the license should be issued for **100** acre-feet of storage.

Applicable permit qualifications have been complied with: Yes **X**

Exceptions to compliance are: **none** Date Report Completed: **July 8, 2004**



Timothy G. Schaal, P.E.
Natural Resources Engineer Specialist
DENR, Water Rights Program

REPORT ON INSPECTION OF PERMIT NO. 2446-2

DATE OF INSPECTION: **May 6, 2004**

NAME & ADDRESS OF PERMIT HOLDER: **Edward & Teresa Keefe, RR 1 Box 138,**
Colome, SD 57528

DIVERSION POINT LEGAL LOCATION: **1800 ft. north & 2200 ft. west of the**
SE corner of Sec. 18-T98N-R75W (NW ¼ SE ¼).

DAM INFORMATION:

- 1) Height to crest **20** feet
- 2) Height to primary spillway **13.5** feet
- 3) Height to secondary spillway **16.5** feet
- 4) Crest width **16** feet
- 5) Crest length **774** feet
- 6) Spillway length **XXX** feet
- 7) Spillway width **125** feet
- 8) Approx. storage (Normal) **100** acre-feet
- 9) Approx. storage (Maximum) **310** acre-feet
- 10) Date constructed: **2003**

PERMIT QUALIFICATIONS AND REGULATIONS:

- 1) Soil and water permit lands agree with lands being irrigated and lands listed on permit **N/A**
- 2) Special qualifications to permit being abided by **yes**
- 3) All structures, wells and lands on map **yes**
- 4) Irrigation Questionnaires checked to determine if permit owner started irrigation by the end of construction period **N/A**

Water Permit Application No. 2446-2



South Dakota Department of
Environment and Natural Resources



Protecting South Dakota's Tomorrow ... Today



Timothy G. Schaal
Timothy G. Schaal, P.E.
Natural Resources Engineer Specialist
DENR, Water Rights Program

7/8/04

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 2446-2

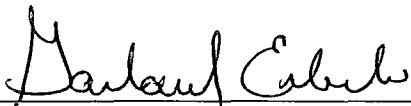
(1) Edward & Teresa Keefe, RR 1 Box 138, Colome SD 57528 made Application No. 2446-2, September 8, 2000 for a water permit to impound 100 acre feet of water from runoff, Tripp County, South Dakota for fish and wildlife propagation and livestock watering purposes. Permit No. 2446-2, with a priority date of September 8, 2000 was approved December 3, 2001 and issued to the applicants for diversion of water with construction of the described water supply system to be completed on or before November 20, 2005 and for the application to beneficial use of water on or before November 20, 2009.

(2) The water supply system has been completed and water applied to beneficial use in accordance with South Dakota State Law. Pursuant to South Dakota Codified Law 46-5-30.1, the holders and/or owners of Water Right No. 2446-2 are issued a license, bearing a priority date of September 8, 2000, to impound 100 acre feet of water.

The location of the storage dam (spillway) is 1,800 feet north and 2,200 feet west of the southeast corner of Section 18-T98N-R75W (NW ¼ SE ¼).

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 2446-2, including the following now applicable qualifications:

1. Water Permit No. 2446-2 authorizes a dam with a storage capacity of 100 acre-feet of water and sufficient water annually to maintain the water level to the outlet elevation.
2. Low flows as needed for downstream domestic use, including livestock water and prior water rights must be by-passed.



Garland Erbele, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

AUG 16 2004

date





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182
www.state.sd.us/denr

AUG 16 2004

2446-2

Edward & Teresa Keefe
RR 1 Box 138
Colome SD 57528

Dear Mr. & Mrs. Keefe:

Enclosed is Water License No. 2446-2. This is the final water right document completing your process of obtaining a Water Right.

As long as you use the water beneficially, as stated in the Water License, State Water Laws provide that you have a continuing right to use the water.

Sincerely,

Garland Erbele, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures