

WATER PERMIT NO. 1989-1

Name of Applicant: Luff Exploration Company

Address: 1580 Lincoln St, Suite 850, Denver CO 80203

Phone: 303 503-8444

Amount of Water Claimed: 0.10 cfs

Total Acres: NA

Source of Water Supply: groundwater (one well)

Water to be used for: industrial use

County: Harding

Type of Waste Disposal System:

Location: 19 miles north of Buffalo

PRIORITY

Date Received: 4-9-19

Application/License Fee: \$ 700

Corrected Application Received:

Period of Annual Use: January 1 – December 31

Remarks:

Diversion Point: NE 1/4 SW 1/4 Sec 24-T22N-R4E

Land to be Irrigated: NA

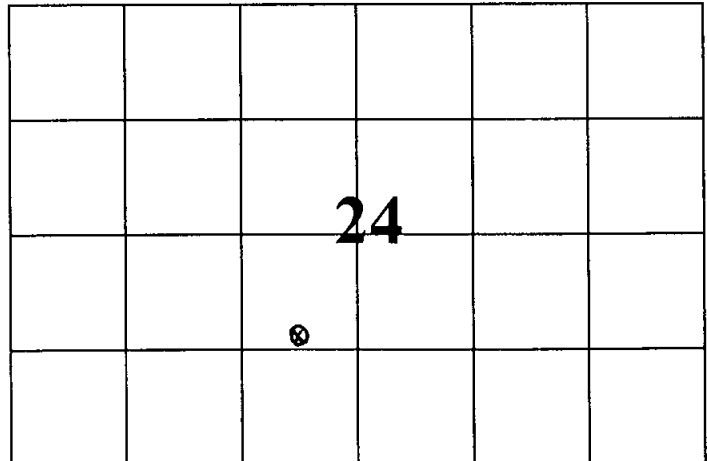
Depth of Well: 5,207 feet deep

Well Driller:

Remarks:

Type of Map: plat

Prepared by:



Reviewed and the Number Assigned on: 4-15-19

By: **Karen Schlaak**

Notice of Hearing - date to intervene: _____

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SD EForm - 1585LD V5

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

APR 09 2019

PAID

APR 09 2019

Ck# 72059

Mail to: DENR - Water Rights 523 E Capitol Ave Pierre, SD 57501-3182 ph. (605) 773-3352	No. <u>1989-1</u> (office use only) Hydrologic Unit <u>10130302</u>	WATER RIGHTS PROGRAM
	Basin <u>Grand River</u>	
	Newspaper <u>Nation's Center News, Buffalo</u>	
	<u>Black Hills Pioneer, Spearfish</u>	

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

Check use(s) of water:

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

Type of Application:
(check one)

☒ New	☐ Vested Right (Use predates Mar 2, 1955)	☐ Future Use Reservation
☐ 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.)

_____1. Name to Appear on Water Permit Luff Exploration CompanyMailing Address 1580 Lincoln Street, Suite 850 Denver CO 80203
(Address) (City) (State) (Zip Code)Phone _____ Mobile (303) 503-8444 Email rd.george@luffex.com2. Amount of water claimed _____ *CFS or 43.75 **GPM and 58.8 ***AF or 19,162,500 (per year) Gallons
Flow rate and volume are both required. (*Cubic Feet per Second) (**Gallons per Minute) (***)Acre Feet - storage capacity of dam/dugout or annual use3. Source of water supply Well to be completed in Dakota (Inyan Kara) formation4. Location of point of diversion Well in NE SW, Sec. 24, T22N, R4E County Harding
(example - 3 wells in SW1/4 NE1/4 section 12-T104N-R53W)If not a public water supply (e.g. municipal), will water be used outside of the area described above? ☐ Yes ☐ NoIf "Yes," where will water be used? _____
(example - NW1/4 section 12-T104N-R53W)5. County or counties where water will be used Harding6. Annual period during which water is to be used January 1 through December 31

7. 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)

This well is the Alyce K-24. Produced Dakota (Inyan Kara) water from this well will be injected into the Red River "B" zone in the newly formed Clarkson Ranch Red River Unit. Maximum requested injection rate of 1,500 BBLS/Day equals 43.75 Gals/minute.

Enclosed information include a location plat, casing and cementing details and an open-hole resistivity log.

I, Richard D. George

Name of Person

Manager of Engineering

Title (if applicable)

, the applicant, certify under

penalty of perjury that I have read this application, examined the attached map, and that the matters stated are true. I further certify, if acting on behalf of an entity or individual other than myself, that I am authorized to submit this application.

Supplemental Information

(type or print)

1. Well Information (check one or both as applicable) ☐ Drilling new well(s) ☒ Using existing well(s)

- a) If new wells, how many ____ Have test holes been drilled ☐ Yes ☐ No Drilled by _____
(if yes, please provide copies of logs)
- b) If existing wells, how many 1 Provide copy of log(s), if available. Drilled by Luff Exploration Company

For either Existing or Proposed Wells:

- c) Well Depth (**required**) 5207 Depth to Top of Water Bearing Material 4840 Depth to Water from Surface _____
- d) Distance to nearest domestic well on applicant's property _____ 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:

b) Freeboard _____

c) Crest Width _____

Crest Length _____

d) Height _____

e) Primary Outlet Capacity _____

If pipe, diameter _____

f) Secondary Spillway Capacity _____

Spillway Width _____

g) X & Y Slope (e.g. 3 to 1 is a typical slope)

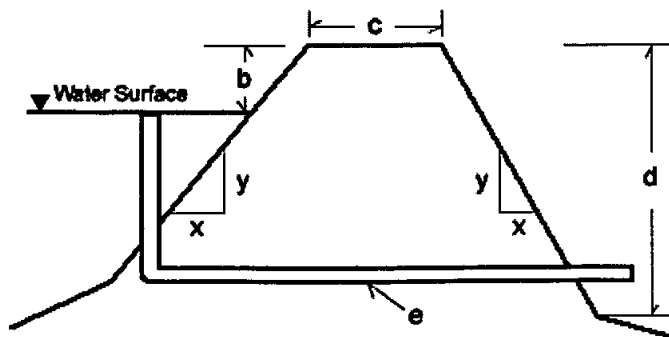
Upstream _____

Downstream _____

h) Surface Area of Impoundment _____

i) Storage _____ Acre Feet

j) Drainage Area Above Dam _____ Acres



**SOUTH DAKOTA
WATER PERMIT NO. 1989-1**

Date of first receipt of application April 9, 2019.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 1989-1 to Luff Exploration Company, 1580 Lincoln St, Suite 850, Denver CO 80203 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 1989-1 appropriates 58.8 acre-feet of water annually at a maximum pump rate of 0.10 cubic feet of water per second from one well completed into the Inyan Kara Aquifer (5,207 feet deep) located in the NE 1/4 SW 1/4 Section 24-T22N-R4E. This site is located approximately 19 miles north of Buffalo SD.
2. The water appropriated shall be used for the purpose of industrial use 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. 1989-1 is July 1, 2019.
5. The date from which applicant may claim right is April 9, 2019.
6. One-fifth of the construction is to be completed on or before January 1, 2022.
7. All construction is to be completed on or before July 1, 2024.
8. Water is to be put to beneficial use on or before July 1, 2028.
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. The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. The permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Inyan Kara aquifer.
3. Water Permit No. 1989-1 authorizes a total annual diversion of 58.8 acre feet of water.

WATER MANAGEMENT BOARD

By: *Jeanne Goodman*
Jeanne Goodman, Chief Engineer

Water Rights Program

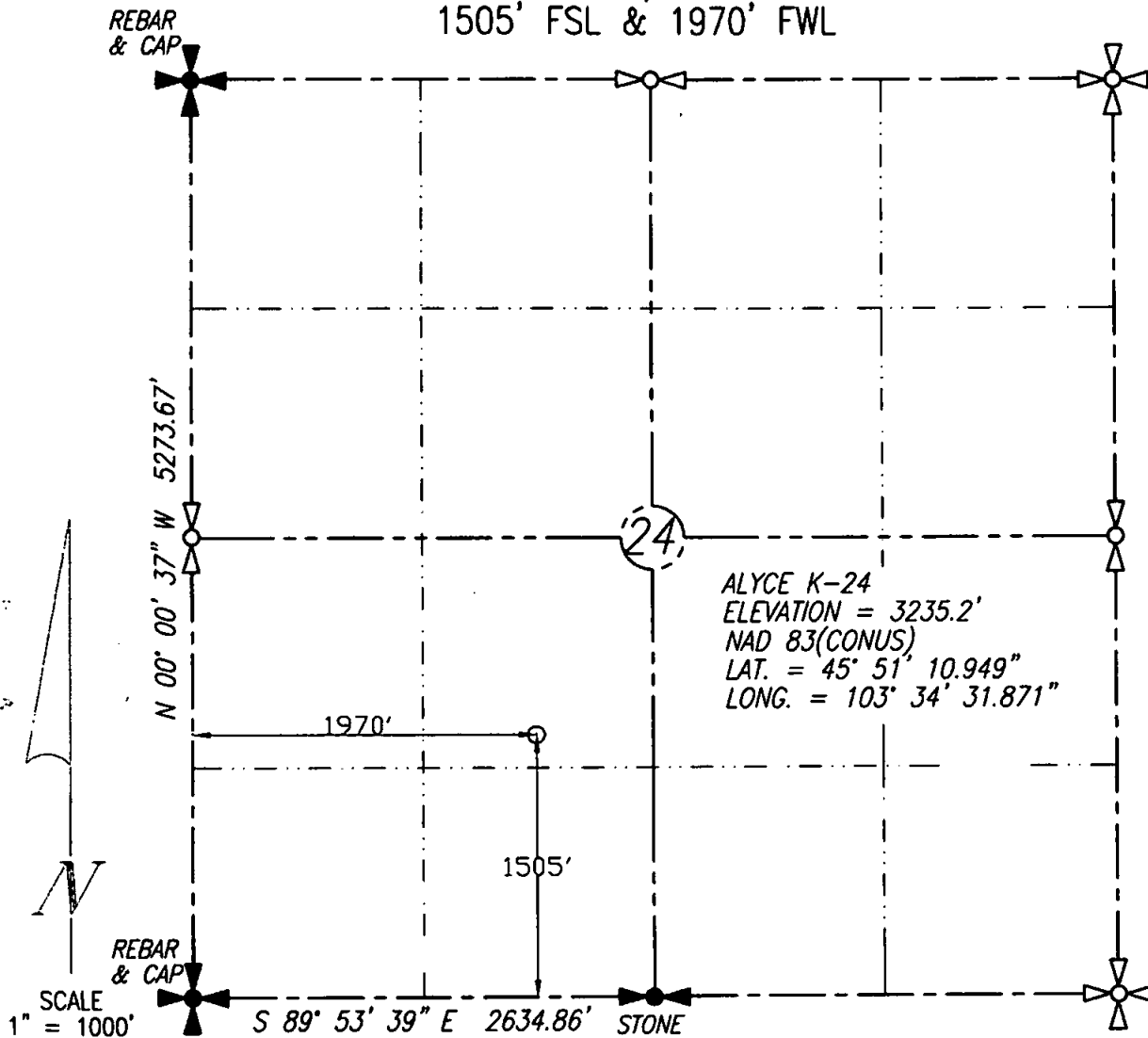
Department of Environment and Natural Resources

JUL 18 2019

date

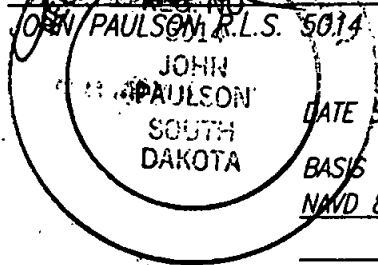


WELL LOCATION PLAT
LUFF EXPLORATION
ALYCE K-24
SECTION 24, T22N, R4E
HARDING COUNTY, SOUTH DAKOTA
1505' FSL & 1970' FWL



I CERTIFY THAT THIS PLAT CORRECTLY REPRESENTS
WORK PERFORMED BY ME OR UNDER MY RESPONSIBLE
CHARGE, AND IS TRUE AND CORRECT TO THE BEST OF
MY KNOWLEDGE AND BELIEF

[Signature]
JOHN PAULSON R.L.S. 5014
12-28-17



DATE STAKED: 12-28-2017

BASIS OF VERTICAL DATUM:
NAD 88 GEOID 12B

PERSON AUTHORIZING SURVEY;
RICK FRETHEIM

EXPLANATION AREA: (NAD 27)
USGS TRIPOINT CROOK (FEET ND S ZONE)
N = 83,305.5 LAT. = 45° 51' 10.946"
E = 1,216,540.6 LONG. = 103° 34' 30.177"

BASIS OF BEARING:
TRUE NORTH

BROSZ ENGINEERING INC.

BOX 357
BOWMAN, N.D. 58623
PHONE: 701-523-3340
FAX: 701-523-5243
PROJECT NO. 17-52

Luff Exploration Company

1580 Lincoln Street, #850, Denver, CO 80203 Phone: (303) 861-2468 Fax: (303) 861-2481

Well Report of Operations

ALYCE K-24, CLARKSON RANCH FIELD, NESW, SEC 24-T22N-R4E

Key Rig #887

HARDING COUNTY, SOUTH DAKOTA

AFE T18-12 Convert to WSW

04/22/18 Present Depth: 5926'. Present Op: RU casing crew. 24 hr footage: 0'. Days: 12. Operations: Wait on cement. RU cementers. Set cement plugs as follows: Plug #1 = 70 sks @ 8881' - 9120'; plug #2 = 30 sks @ 8412' - 8512'; plug #3 = 40 sks @ 6905' - 7005'; plug #4 = 95 sks @ 6251' - 6509'; plug #5 = 40 sks @ 5926' - 6026'. Lay down drill pipe. Circ at 5400'. Lay down rest of drill pipe. RU casers. Daily oil mud losses: 0 bbls. Total oil mud losses: 705 bbls.

Cost: \$28,666

Cum Cost: \$28,666

04/23/18 Present Depth: 5207'. Present Op: Rig down. 24 hr footage: 0'. Days: 13. Operations: RU casers. Run 121 jts 7" 23# J55 LTC csg to 5207'. Circ. RU cementers. Pump 30 bbls spacer. Cement with 283 sks Lite tailed with 159 sks Premium. Displace with 203 bbls fresh water. Bump Plug. 25 bbls spacer to surface. Set slips. Cut off 7" casing. Install tubing head. Secure well. Release rig at 00:00 4/23/18. Daily oil mud losses: 165 bbls. Total oil mud losses: 870 bbls.

7" Casing Detail:	Length	Interval
Float Shoe	1.20'	5205.80' - 5207'
1 jt 7", 23#, J55, LTC Casing	43.98'	5161.82' - 5205.80'
Float Collar	1.00'	5160.82' - 5161.82'
120 jts 7", 23#, J55, LTC Casing	5165.43'	-4.61' - 5160.82'

Cement Detail: Lead w/ 283 sks Lite cmt (12.7 ppg & 1.98 ft³/sx yield) tailed w/ 159 sks Premium cmt (13.5 ppg & 1.66 ft³/sx yield). 25 bbls spacer to pit. No cement.

Cost: \$200,531

Cum Cost: \$229,197

05/02/18 Work on water line.

Cost: \$1,507

Cum Cost: \$230,704

05/03/18 Work on water line.

Cost: \$2,722

Cum Cost: \$233,426

05/04/18 Work on water line.

Cost: \$2,225

Cum Cost: \$235,651

05/08/18 Install pipeline.

Cost: \$7,533

Cum Cost: \$243,184

05/14/18 Work on pipeline.

Cost: \$5,737

Cum Cost: \$248,921

05/17/18 Install pipe line.

Cost: \$13,253

Cum Cost: \$267,734

05/18/18 Install pipe line.

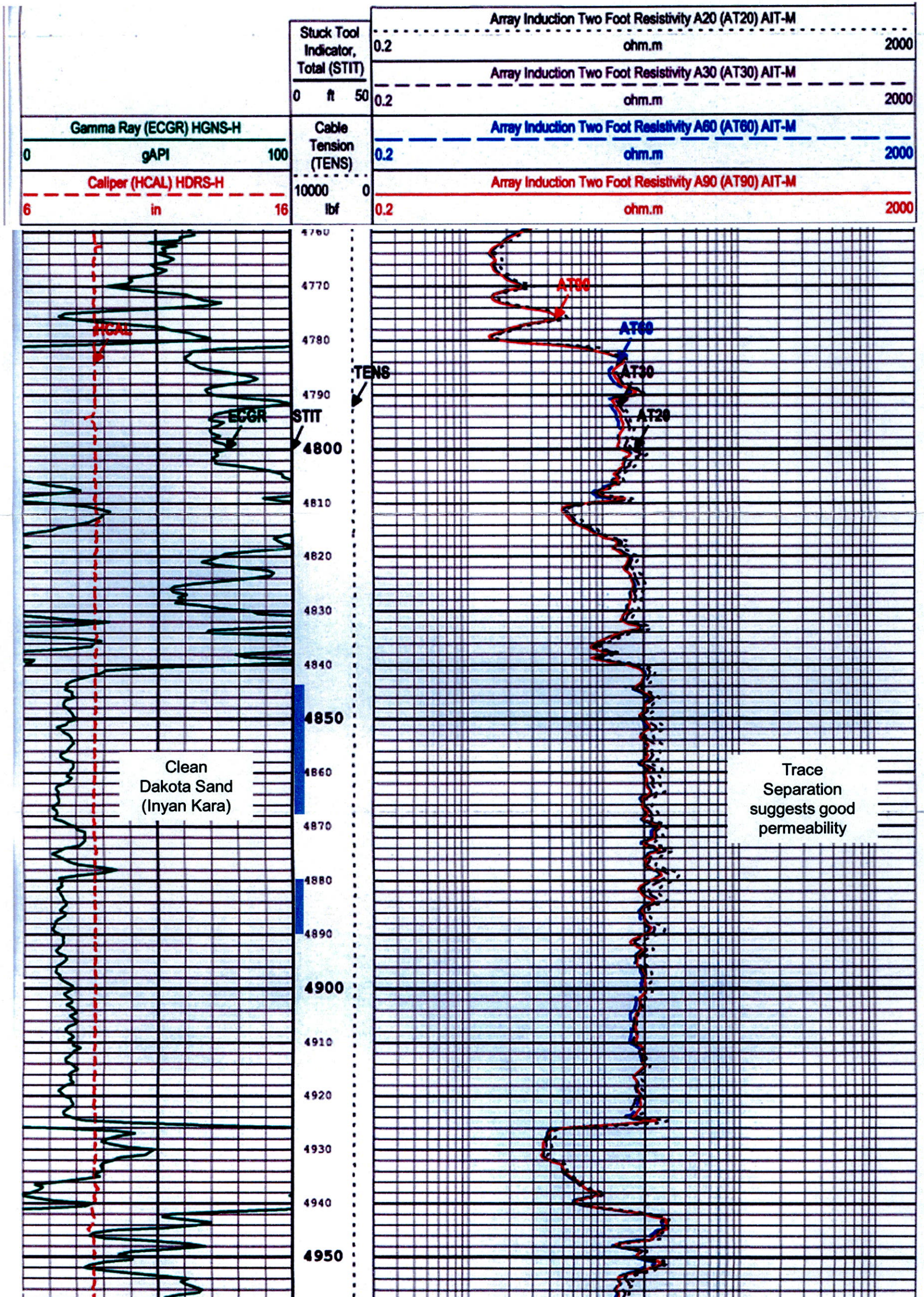
Cost: \$9,322

Cum Cost: \$277,056

Alyce K-24
NE SW, Sec. 24, T22N, R4E

K.B. 3,248 ft

Schlumberger
Platform Express
Array Induction Tool





DEPARTMENT of ENVIRONMENT and NATURAL RESOURCES
Minerals & Mining Program
2050 West Main, Suite #1, Rapid City, SD 57702-2493
Telephone: 605-773-4201, FAX: 605-394-5317

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APR 18 2019

DEPT OF ENVIRONMENT & NATURAL
RESOURCES - RAPID CITY

SUNDRY NOTICE AND REPORT ON WELLS

Operator Name: Luff Exploration Company		Telephone: 303 861 2468					
Address: 1580 Lincoln Street Suite 850 Denver, CO 80203							
Permit No.: 2074	API No.: 40-063-20781	Well Name and Number: Alyce K-24	Location: (Qtr-Qtr, Sec, Twp, Rge, County) NESW, Sec 24, T22N, R4E, Harding				
REPORT OF: <table border="0" style="width: 100%;"><tr><td style="vertical-align: top; width: 50%;">☐ Acidize ☐ Perforate ☐ Fracture Treatment ☐ Change of Operator ☐ Spud ☐ Plug and Abandon ☐ Pull, Alter or Test Casing ☐ Squeeze Cement ☐ Change of Elevation ☐ Mechanical Integrity Test ☐ Venting or Flaring Gas ☐ Interim or Final Reclamation ☐ Spill, Fire, Break, or Blowout ☐ Drilling Progress ☐ Working Fluid Level ☐ Change to Dry Hole Marker</td><td style="vertical-align: top; width: 50%;">☐ Repairs ☐ Gas/Oil Ratio ☐ Work-Over ☐ Change in Drilling or Casing Program ☐ Shut-In Pressure ☐ Work Affecting Different Source of Supply ☐ BOP Pressure Test/Program ☐ Tank Battery Meter Tests ☐ Injection System Problems or Failure ☐ Commence Injection Operations ☐ Discontinue Injection Operations ☐ Directions to Well Site ☐ Other: REQUEST FOR APPROVAL: ☐ Temporarily Abandon ☐ Proposed Plugging Program ☐ Changes in Cementing Program </td><td style="vertical-align: top; width: 50%;">☐ Drill without BOP ☐ Construction of Produced Water Handling Facilities ☐ Conversion of Mud Pit to Evaporation Pit ☐ Method of Determining Production from Separate Pools ☐ Use Produced Water for Dust Suppression ☐ Change in Method of Annual Gas Well Open Flow Test ☐ Atmospheric Discharge of Produced Water ☐ Change of Producing Formation ☐ Change of Surface Location ☐ Release of Reclamation Liability ☐ Dissolve Abandoned Field ☐ Method of Checking Tank Meters ☐ Extend Permit Term Beyond 12 months ☐ Confidentiality of Technical Data ☐ Change in Injection Fluid, Pressure, or Volume ☐ Other: Complete as Inyan Kara Fm. water supply well</td></tr></table>				☐ Acidize ☐ Perforate ☐ Fracture Treatment ☐ Change of Operator ☐ Spud ☐ Plug and Abandon ☐ Pull, Alter or Test Casing ☐ Squeeze Cement ☐ Change of Elevation ☐ Mechanical Integrity Test ☐ Venting or Flaring Gas ☐ Interim or Final Reclamation ☐ Spill, Fire, Break, or Blowout ☐ Drilling Progress ☐ Working Fluid Level ☐ Change to Dry Hole Marker	☐ Repairs ☐ Gas/Oil Ratio ☐ Work-Over ☐ Change in Drilling or Casing Program ☐ Shut-In Pressure ☐ Work Affecting Different Source of Supply ☐ BOP Pressure Test/Program ☐ Tank Battery Meter Tests ☐ Injection System Problems or Failure ☐ Commence Injection Operations ☐ Discontinue Injection Operations ☐ Directions to Well Site ☐ Other: REQUEST FOR APPROVAL: ☐ Temporarily Abandon ☐ Proposed Plugging Program ☐ Changes in Cementing Program	☐ Drill without BOP ☐ Construction of Produced Water Handling Facilities ☐ Conversion of Mud Pit to Evaporation Pit ☐ Method of Determining Production from Separate Pools ☐ Use Produced Water for Dust Suppression ☐ Change in Method of Annual Gas Well Open Flow Test ☐ Atmospheric Discharge of Produced Water ☐ Change of Producing Formation ☐ Change of Surface Location ☐ Release of Reclamation Liability ☐ Dissolve Abandoned Field ☐ Method of Checking Tank Meters ☐ Extend Permit Term Beyond 12 months ☐ Confidentiality of Technical Data ☐ Change in Injection Fluid, Pressure, or Volume ☐ Other: Complete as Inyan Kara Fm. water supply well	
☐ Acidize ☐ Perforate ☐ Fracture Treatment ☐ Change of Operator ☐ Spud ☐ Plug and Abandon ☐ Pull, Alter or Test Casing ☐ Squeeze Cement ☐ Change of Elevation ☐ Mechanical Integrity Test ☐ Venting or Flaring Gas ☐ Interim or Final Reclamation ☐ Spill, Fire, Break, or Blowout ☐ Drilling Progress ☐ Working Fluid Level ☐ Change to Dry Hole Marker	☐ Repairs ☐ Gas/Oil Ratio ☐ Work-Over ☐ Change in Drilling or Casing Program ☐ Shut-In Pressure ☐ Work Affecting Different Source of Supply ☐ BOP Pressure Test/Program ☐ Tank Battery Meter Tests ☐ Injection System Problems or Failure ☐ Commence Injection Operations ☐ Discontinue Injection Operations ☐ Directions to Well Site ☐ Other: REQUEST FOR APPROVAL: ☐ Temporarily Abandon ☐ Proposed Plugging Program ☐ Changes in Cementing Program	☐ Drill without BOP ☐ Construction of Produced Water Handling Facilities ☐ Conversion of Mud Pit to Evaporation Pit ☐ Method of Determining Production from Separate Pools ☐ Use Produced Water for Dust Suppression ☐ Change in Method of Annual Gas Well Open Flow Test ☐ Atmospheric Discharge of Produced Water ☐ Change of Producing Formation ☐ Change of Surface Location ☐ Release of Reclamation Liability ☐ Dissolve Abandoned Field ☐ Method of Checking Tank Meters ☐ Extend Permit Term Beyond 12 months ☐ Confidentiality of Technical Data ☐ Change in Injection Fluid, Pressure, or Volume ☐ Other: Complete as Inyan Kara Fm. water supply well					
Describe Proposed or Completed Operations (clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work). Use additional page(s) if appropriate. Proposed Alyce K-24 completion procedure is attached. Attachment - Proposed procedure.							
I hereby certify that the foregoing as to any work or operation performed is a true and correct report of such work or operation. <table border="0" style="width: 100%;"><tr><td style="text-align: center; width: 30%;"> Signature</td><td style="text-align: center; width: 30%;">Richard D. George Name (Print)</td><td style="text-align: center; width: 30%;">Manager of Engineering Title</td><td style="text-align: center; width: 10%;">4/16/2019 Date</td></tr></table>				 Signature	Richard D. George Name (Print)	Manager of Engineering Title	4/16/2019 Date
 Signature	Richard D. George Name (Print)	Manager of Engineering Title	4/16/2019 Date				
FOR OFFICE USE ONLY (forms will be signed and returned only in cases where approval by DENR is required)							
Approved by: _____ Title: _____ Date: _____							
Conditions, if any:							

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APR 18 2019

**DEPT OF ENVIRONMENT & NATURAL
RESOURCES - RAPID CITY**

**Attachment to Alyce K-24 Sundry Notice
Proposed Completion Procedure**

Luff Exploration Company
Alyce K-24, API No. 40-063-20781, Permit No. 2074
NESW, Sec 24, T22N, R4E, Harding County, South Dakota

Proposed completion procedure. Estimated start date: May 15, 2019.
All depths based on open hole Schlumberger Platform Express Array Induction Log.

- 1) Notify SD-DENR before work starts.
- 2) Move in, rig up, install BOP.
- 3) Run in hole with bit, scraper and tubing. Tag bottom for plug back TD. If bottom of cased hole above 5100', drill down and clean out to 5100'. Pressure test casing to 1000 psi. Pull out of hole with tubing
- 4) Run CBL with gamma and casing collar locator. Correlate CBL depth with gamma curve on Schlumberger open hole Platform Express Array Induction Log.
- 5) Perforate 7" casing across Inyan Kara Formation from 4844' to 4868' and 4880' to 4890' with 4 spf. Perforated intervals based on Schlumberger Induction Log.
- 6) Run in hole with 7" packer and tubing. Set packer at 4810' +/- . Swab test perforations. Note fluid level. Evaluate for adequate fluid rate. Acidize perforations if needed and swab until clean fluid recovered. Pull out of hole with tubing and packer.
- 8) Run in hole with tail pipe, tubing anchor, 2-3/4" tubing pump and 2-7/8" production tubing. Set anchor at 4810' +/- .
- 9) Run in hole with on/off tool and rods. Latch onto pump. Stroke and test pump.
- 10) Secure well, rig down.
- 11) Set beam pumping unit and install surface equipment.

GM 4-16-2019

**JACAM LABORATORIES****DownHole R_x****DEPOSITION POTENTIAL INDICATORS**LUFF EXPLORATION
BART HONEYMANJOHNSON B-16 WSW WELLHEAD
HARDING SDReport Date: 05-08-2012 Sampled: 04-25-2012
Sample #: 17375 at 0000**SATURATION LEVEL**

Calcite (CaCO ₃)	0.319
Aragonite (CaCO ₃)	0.276
Witherite (BaCO ₃)	< 0.001
Strontianite (SrCO ₃)	0.107
Calcium oxalate (CaC ₂ O ₄)	0.00
Magnesite (MgCO ₃)	0.0236
Anhydrite (CaSO ₄)	0.0460
Gypsum (CaSO ₄ *2H ₂ O)	0.0727
Barite (BaSO ₄)	5.46
Celestite (SrSO ₄)	0.377
Fluorite (CaF ₂)	0.00
Calcium phosphate	0.00
Hydroxyapatite	0.00
Silica (SiO ₂)	0.00
Brucite (Mg(OH) ₂)	< 0.001
Magnesium silicate	0.00
Iron hydroxide (Fe(OH) ₃)	0.317
Strengite (FePO ₄ *2H ₂ O)	0.00
Siderite (FeCO ₃)	0.170
Halite (NaCl)	< 0.001
Thenardite (Na ₂ SO ₄)	< 0.001
Iron sulfide (FeS)	0.00

MOMENTARY EXCESS (Lbs/1000 Barrels)

Calcite (CaCO ₃)	-0.143
Aragonite (CaCO ₃)	-0.175
Witherite (BaCO ₃)	-9.01
Strontianite (SrCO ₃)	-0.760
Calcium oxalate (CaC ₂ O ₄)	-0.116
Magnesite (MgCO ₃)	-2.08
Anhydrite (CaSO ₄)	-603.43
Gypsum (CaSO ₄ *2H ₂ O)	-505.28
Barite (BaSO ₄)	0.0987
Celestite (SrSO ₄)	-16.93
Fluorite (CaF ₂)	-12.57
Calcium phosphate	>-0.001
Hydroxyapatite	-223.30
Silica (SiO ₂)	-46.57
Brucite (Mg(OH) ₂)	0.00134
Magnesium silicate	-87.42
Iron hydroxide (Fe(OH) ₃)	< 0.001
Strengite (FePO ₄ *2H ₂ O)	>-0.001
Siderite (FeCO ₃)	-0.0710
Halite (NaCl)	-160905
Thenardite (Na ₂ SO ₄)	-43802
Iron sulfide (FeS)	-0.296

SIMPLE INDICES

Langelier	-0.424
Ryznar	7.45
Puckorius	6.00
Larson-Skold Index	15.07
Stiff Davis Index	-0.520
Oddo-Tomson	-0.575

BOUND IONS

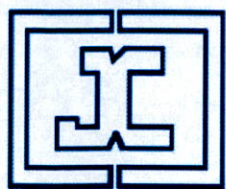
BOUND IONS	TOTAL	FREE
Calcium	182.00	161.51
Barium	0.204	0.204
Carbonate	0.336	0.115
Phosphate	0.00	0.00
Sulfate	350.00	289.12

OPERATING CONDITIONS

Temperature (°F)	85.00
Time(secs)	0.00

JACAM LABORATORIES**205 S. Broadway • P.O. Box 96 • Sterling, KS 67579-0096**

DownHole SAT™ Water Analysis Report



JACAM LABORATORIES

SYSTEM IDENTIFICATION

LUFF EXPLORATION
JOHNSON B-16 WSW WELLHEAD
BART HONEYMAN
HARDING SD

Sample ID#: 17375
ID: 2677
Report Date: 05-08-2012
Sample Date: 04-25-2012
at 0000

WATER CHEMISTRY

CATIONS

Calcium(as Ca)	182.00
Magnesium(as Mg)	15.90
Barium(as Ba)	0.204
Strontium(as Sr)	16.12
Sodium(as Na)	1464
Potassium(as K)	162.80
Lithium(as Li)	8.20
Iron(as Fe)	0.0510
Field Iron(as Fe)	0.00
Ammonia(as NH ₃)	0.00
Aluminum(as Al)	0.00
Manganese(as Mn)	0.0120
Zinc(as Zn)	0.0820
Lead(as Pb)	0.00

ANIONS

Chloride(as Cl)	2400
Sulfate(as SO ₄)	350.00
Bromine(as Br)	0.00
Dissolved CO ₂ (as CO ₂)	30.00
Bicarbonate(as HCO ₃)	305.00
Carbonate(as CO ₃)	0.00
Silica(as Si)	0.00
Phosphate(as PO ₄)	0.00
H ₂ S (as H ₂ S)	0.00
Fluoride(as F)	0.00
Nitrate(as NO ₃)	0.00
Boron(as B)	5.53

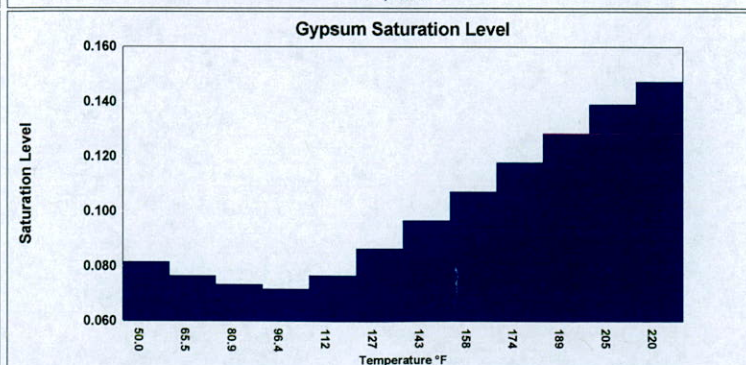
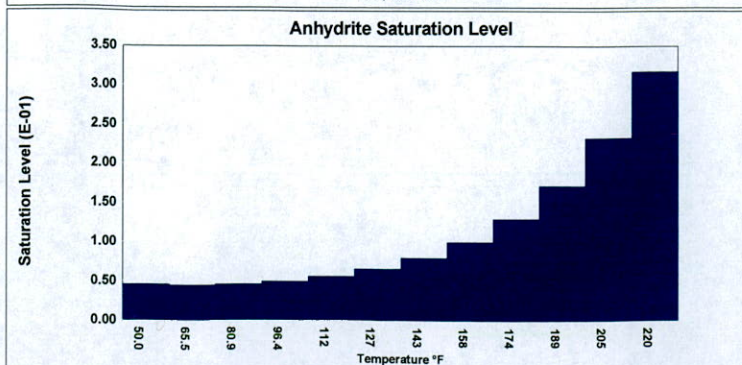
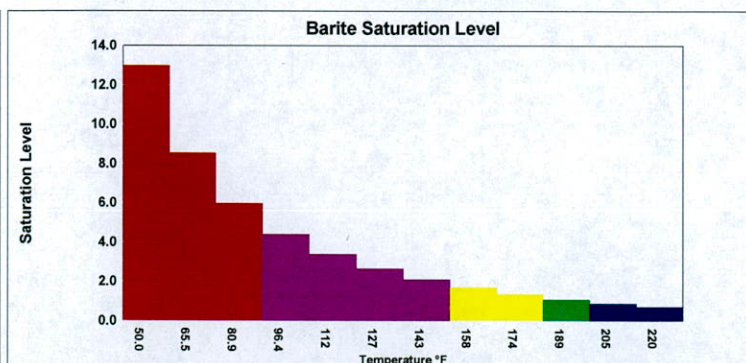
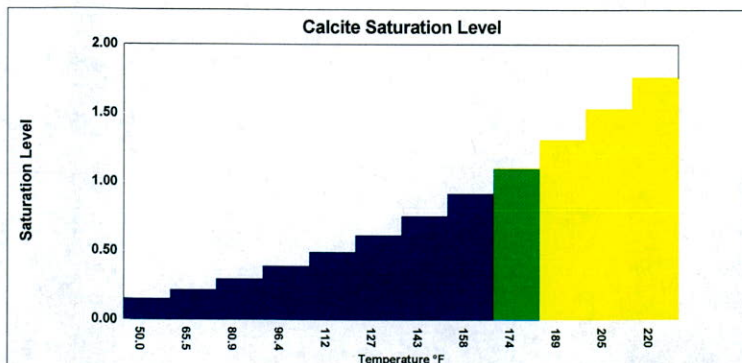
PARAMETERS

Temperature(°F)	85.00
Sample pH	6.60

SCALE AND CORROSION POTENTIAL

Temp. (°F)	Press. (atm)	Calcite CaCO ₃		Anhydrite CaSO ₄		Gypsum CaSO ₄ *2H ₂ O		Barite BaSO ₄		Celestite SrSO ₄		Siderite FeCO ₃		Mackawenite FeS		CO ₂ (mpy)	pCO ₂ (atm)
50.00	0.00	0.150	-0.240	0.0455	-622.27	0.0815	-477.60	12.96	0.111	0.395	-15.84	0.0614	-0.124	0.00	-0.291	0.00	0.00
65.45	0.00	0.216	-0.193	0.0441	-627.83	0.0765	-494.18	8.51	0.107	0.373	-17.23	0.0995	-0.0981	0.00	-0.293	0.00	0.00
80.91	0.00	0.296	-0.153	0.0453	-611.12	0.0733	-503.82	5.95	0.100	0.374	-17.12	0.153	-0.0762	0.00	-0.295	0.00	0.00
96.36	0.00	0.388	-0.118	0.0490	-576.03	0.0716	-507.13	4.39	0.0932	0.388	-16.19	0.223	-0.0577	0.00	-0.297	0.00	0.00
111.82	0.00	0.492	-0.0877	0.0554	-527.16	0.0765	-480.36	3.38	0.0850	0.408	-14.97	0.312	-0.0423	0.00	-0.300	0.00	0.00
127.27	0.00	0.613	-0.0604	0.0652	-469.18	0.0864	-437.31	2.64	0.0750	0.427	-13.89	0.427	-0.0291	0.00	-0.302	0.00	0.00
142.73	0.00	0.754	-0.0350	0.0794	-406.33	0.0966	-400.22	2.08	0.0627	0.444	-13.00	0.573	-0.0179	0.00	-0.305	0.00	0.00
158.18	0.00	0.916	-0.0110	0.0999	-342.18	0.107	-368.15	1.65	0.0476	0.459	-12.25	0.753	-0.00849	0.00	-0.309	0.00	0.00
173.64	0.00	1.10	0.0119	0.129	-279.53	0.118	-340.35	1.32	0.0294	0.472	-11.63	0.971	>-0.001	0.00	-0.312	0.00	0.00
189.09	0.00	1.30	0.0342	0.171	-220.40	0.128	-316.21	1.07	0.00740	0.484	-11.14	1.23	0.00526	0.00	-0.316	0.00	0.00
204.55	0.00	1.53	0.0559	0.232	-166.09	0.139	-295.25	0.864	-0.0190	0.493	-10.75	1.52	0.00986	0.00	-0.320	0.00	0.00
220.00	0.171	1.76	0.0771	0.317	-119.45	0.147	-280.80	0.694	-0.0532	0.492	-10.77	1.83	0.0132	0.00	-0.326	0.00	0.00
			Lbs per xSAT Barrels		Lbs per xSAT Barrels		Lbs per xSAT Barrels		Lbs per xSAT Barrels		Lbs per xSAT Barrels		Lbs per xSAT Barrels		Lbs per xSAT Barrels		

Saturation Levels (xSAT) are the ratio of ion activity to solubility, e.g. {Ca}{CO₃}/K_{sp}. pCO₂ (atm) is the partial pressure of CO₂ in the gas phase.
Lbs/1000 Barrels scale is the quantity of precipitation (or dissolution) required to instantaneously bring the water to equilibrium.



RECEIPT

WATER RIGHTS PROGRAM

South Dakota Department of Environment and Natural Resources

Date April 9, 2019

RECEIVED OF Luff Exploration Company 1580 Lincoln Street, Suite 850 Denver CO 80203

The following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. <u>1989-1</u> to Appropriate Water, to construct and to put water to beneficial use	500	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. <u>1989-1</u>	200	00
Fee for Filing Transfer Form _____		
Fee for _____		
Fee for Issuing New Well Driller's License No. _____ for C.Y. _____		
Fee for Renewal of Well Driller's License No. _____ for C.Y. _____		
Fee for Issuing Well Pump Installer's License No. _____ for C.Y. _____		
Fee for Renewal of Well Pump Installer's License No. _____ for C.Y. _____		
(Any Other Work Provided by Law)	TOTAL	700 00

No. **09112**

By Jeanne Goodman
Chief Engineer 2m7

Schlaak, Karen

From: Gronlund, Eric
Sent: Tuesday, April 09, 2019 1:46 PM
To: Schlaak, Karen
Subject: FW: [EXT] Water supply well permit application
Attachments: E1585LDV5-NONIRRIG.pdf

From: Gronlund, Eric
Sent: Monday, March 11, 2019 4:55 PM
To: 'Richard George'
Subject: RE: [EXT] Water supply well permit application

Mr. George:

Attached is the application form with instruction sheet. The application form along with proposed well construction (Form2A), a map showing the location of the well, propose area of use and application filing fee will need to be submitted. Once reviewed and a recommendation is made, the application will need to be public noticed. We walk you through that once we get to that point but the cost of the publication is the applicant's responsibility.

Let me know if you have questions.

Eric

From: Richard George [<mailto:rd.george@luffex.com>]
Sent: Monday, March 11, 2019 4:48 PM
To: Gronlund, Eric
Subject: [EXT] Water supply well permit application

Eric Gronlund:

I need to file an application with your Ground Water group regarding a permit for a water supply well completed in the Inyan Kara (Dakota). The resulting water supply well would be similar to the existing Johnson B-16 water supply well in Harding County.

What is the current form, and what are the permit application requirements (other than filling out the form)?

Thanks,
Richard George
Luff Exploration Company

Schlaak, Karen

From: Richard George <rd.george@luffex.com>
Sent: Tuesday, April 09, 2019 4:45 PM
To: Schlaak, Karen
Subject: RE: [EXT] Water Permit Application

Karen:

For an annual volume, we submit:

1,250 BBLS/Day times 365 times 42, or 19,163 gals per year.

Richard George
Luff Exploration Company

From: Schlaak, Karen <Karen.Schlaak@state.sd.us>
Sent: Tuesday, April 09, 2019 1:54 PM
To: Richard George <rd.george@luffex.com>
Subject: Water Permit Application

Mr. George,

We received your water permit application today. The application requests an appropriation of 43.75 gallons per minute. In addition to the pump rate, the application needs to include the annual volume in either gallons/year or acre feet/year. In calculating the annual volume, be reasonable but also plan for the maximum annual volume of use from the well at full development.

If you have questions, please contact Eric Gronlund or me.

Karen Schlaak
SD DENR, Water Rights Program
(605) 773-3352



Kilts, Whitney (DENR)

From: Gronlund, Eric
Sent: Monday, May 13, 2019 4:28 PM
To: Kilts, Whitney (DENR)
Subject: FW: [EXT] Water supply well permit application
Attachments: Johnson B-16 WSW - water analysis - 2012-04-25.pdf

FYI

From: Richard George [<mailto:rd.george@luffex.com>]
Sent: Monday, May 13, 2019 4:00 PM
To: Gronlund, Eric
Subject: RE: [EXT] Water supply well permit application

Eric:

A Dakota (Inyan Kara) completion at the Alyce K24 should be similar to the Dakota (Inyan Kara) at the Johnson B-16, where there is a ground water permit in place. Attached is a water analysis from that well, for you to forward to your staff engineer.

Thanks,

Richard George
Luff Exploration

From: Gronlund, Eric <Eric.Gronlund@state.sd.us>
Sent: Monday, May 13, 2019 12:07 PM
To: Richard George <rd.george@luffex.com>
Subject: RE: Water supply well permit application

The application was assigned to a staff engineer to conduct the standard review that is conducted on all water permit application regarding availability of water and impairment of existing rights. The Chief Engineer bases the recommendation largely on the staff report. I have not received the report back yet from the engineer. DENR has 60 days to review the application for the purpose of making a recommendation. The 60 day period ends June 9th. I do not anticipate receiving the staff report for a couple more weeks.

Eric Gronlund
Water Rights Program, DENR
605 773-3352
eric.gronlund@state.sd.us

From: Richard George [<mailto:rd.george@luffex.com>]
Sent: Monday, May 13, 2019 12:36 PM
To: Gronlund, Eric
Subject: RE: [EXT] Water supply well permit application

What is the status of our application for the Alyce K-24 Dakota (Inyan Kara) water supply application?

Thanks,



JACAM LABORATORIES

DownHole R_x

WATER CHEMISTRY

LUFF EXPLORATION
BART HONEYMAN

JOHNSON B-16 WSW WELLHEAD
HARDING SD

Report Date: 05-08-2012
Sample #: 17375

Sampled: 04-25-2012
at 0000

CATIONS

Calcium (as Ca)	182.00
Magnesium (as Mg)	15.90
Barium (as Ba)	0.204
Strontium (as Sr)	16.12
Sodium (as Na)	1464
Potassium (as K)	162.80
Lithium (as Li)	8.20
Ammonia (as NH ₃)	0.00
Aluminum (as Al)	0.00
Iron (as Fe)	0.0510
Manganese (as Mn)	0.0120
Zinc (as Zn)	0.0820
Lead (as Pb)	0.00

ANIONS

Chloride (as Cl)	2400
Sulfate (as SO ₄)	350.00
Bromine (as Br)	0.00
Dissolved CO ₂ (as CO ₂)	30.00
Bicarbonate (as HCO ₃)	305.00
Carbonate (as CO ₃)	0.00
Oxalic acid (as C ₂ O ₄)	0.00
Silica (as Si)	0.00
Phosphate(as PO ₄)	0.00
H ₂ S (as H ₂ S)	0.00
Fluoride (as F)	0.00
Nitrate (as NO ₃)	0.00
Boron (as B)	5.53

PARAMETERS

pH	6.60
Temperature (°F)	85.00
Density(g/mL)	1.00
Pressure(atm)	1.00
Calculated T.D.S.	5027
Molar Conductivity	7942
Dissolved O ₂	0.00

JACAM LABORATORIES

205 S. Broadway · P.O. Box 96 · Sterling, KS 67579-0096

Schlaak, Karen

From: Richard George <rd.george@luffex.com>
Sent: Monday, June 10, 2019 12:16 PM
To: Schlaak, Karen
Subject: RE: [EXT] Water Permit Application No.1989-1

Karen:

1 acre foot per year is not correct.

Our application requested 1,500 BBLS/day, or 43.75 gals per minute.

Richard George

From: Schlaak, Karen <Karen.Schlaak@state.sd.us>
Sent: Monday, June 10, 2019 10:17 AM
To: Richard George <rd.george@luffex.com>
Subject: Water Permit Application No.1989-1

Attached is the report, recommendation and information regarding the public notice for Water Permit Application No. 1989-1, Luff Exploration Company. As stated in the letter, you need to contact the papers to authorize publication and arrange for payment. Actually, the Spearfish paper also publishes the Buffalo paper, so I believe you may be able to authorize publication is both papers by just calling the Spearfish paper. The notice has been emailed to the paper. This same information is going in the mail to you today.

If you have questions, please let me know.

Karen Schlaak

SD DENR, Water Rights Program
(605) 773-3352



Schlaak, Karen

From: Richard George <rd.george@luffex.com>
Sent: Monday, June 10, 2019 1:12 PM
To: Gronlund, Eric
Cc: Schlaak, Karen; Kilts, Whitney (DENR)
Subject: RE: [EXT] Water Permit Application

Yes, please amend to 58.8 acre feet of water per year.

I was in a hurry when I answered Karen's email. Over the course of a 60 day review, I am surprised the very, very low resulting value of acre feet per year was not questioned.

Based on other Inyan Kara permits in place, this change should not affect the review. Our Johnson B-16 value is over 80 acre feet per year.

Please update me on timing when timing is known.

Richard George

From: Gronlund, Eric <Eric.Gronlund@state.sd.us>
Sent: Monday, June 10, 2019 12:03 PM
To: Richard George <rd.george@luffex.com>
Cc: Schlaak, Karen <Karen.Schlaak@state.sd.us>; Kilts, Whitney (DENR) <Whitney.Kilts@state.sd.us>
Subject: FW: Water Permit Application

We went off the 19,163 gallons per year in your April 9th email. Since that was less than 1 acre foot it was just round up. The number below equate to 58.8 acre feet of water annually. I presume you want the application amended accordingly?

We will need to change the report, recommendation and public notice and resend. We will need to check with the staff engineer that prepared the report on the application so see if that in any way changes her review.

We will get back to you.

Please respond back if you want the application amended to an annual volume of 58.8 acre feet of water?

Eric

From: Richard George [<mailto:rd.george@luffex.com>]
Sent: Monday, June 10, 2019 12:35 PM
To: Schlaak, Karen
Subject: FW: [EXT] Water Permit Application

I found this email.

1,250 BBLs/day time 365 times 42 would be 19,162,500 gals per year, not 19,163.

Richard George

From: Richard George
Sent: Tuesday, April 09, 2019 3:45 PM
To: 'Schlaak, Karen' <Karen.Schlaak@state.sd.us>
Subject: RE: Water Permit Application

Karen:

For an annual volume, we submit:

1,250 BBLS/Day times 365 times 42, or 19,163 gals per year.

Richard George
Luff Exploration Company

From: Schlaak, Karen <Karen.Schlaak@state.sd.us>
Sent: Tuesday, April 09, 2019 1:54 PM
To: Richard George <rd.george@luffex.com>
Subject: Water Permit Application

Mr. George,

We received your water permit application today. The application requests an appropriation of 43.75 gallons per minute. In addition to the pump rate, the application needs to include the annual volume in either gallons/year or acre feet/year. In calculating the annual volume, be reasonable but also plan for the maximum annual volume of use from the well at full development.

If you have questions, please contact Eric Gronlund or me.

Karen Schlaak
SD DENR, Water Rights Program
(605) 773-3352





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3182
<http://denr.sd.gov>

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 1989-1, Luff Exploration Company**

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. 1989-1, Luff Exploration Company, c/o Richard D George, 1580 Lincoln Street, Suite 850, Denver CO 80203.

The Chief Engineer is recommending APPROVAL of Application No. 1989-1 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. The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. The permit holder shall report to the Chief Engineer annually the amount of water withdrawn from the Inyan Kara aquifer.
3. Water Permit No. 1989-1 authorizes a total annual diversion of 58.8 acre feet of water.

See report on application for additional information.

Jeanne Goodman, Chief Engineer
June 10, 2019

Report to the Chief Engineer
Water Permit Application No. 1989-1
Luff Exploration Company
June 10, 2019

Water Permit Application No. 1989-1 for Luff Exploration Company c/o Richard D. George proposes to appropriate 58.8 acre-feet of water annually at a maximum instantaneous diversion rate of 0.10 cubic feet per second (cfs) for industrial use. The proposed diversion point is one well completed into the Inyan Kara aquifer located in the NE ¼ SW ¼ Section 24-T22N-R4E. The wellsite for this application is located approximately 19 miles north of Buffalo, SD in Harding County.

Aquifer: Inyan Kara (INKR)

Aquifer Characteristics

The well for this application was originally drilled for oil exploration in 2018. The information provided with this application indicates that to convert this well to a water supply well the lower portion of the well will be plugged and the intervals from 4,844 to 4,868 and 4,880 to 4890 feet below grade will be targeted for water production. A “Sundry Notice and Report of Wells” for conversion of this well to a water supply well has been filed with the SD DENR Minerals and Mining Program (SDGS, 2019).

The water source this application proposes to use is the Inyan Kara aquifer, however the available documentation on this well also uses the term “Dakota Formation.” In the Williston Basin, the term “Dakota” is commonly applied to either of two Cretaceous aged sandstone formations, the Newcastle sandstone or the Inyan Kara Group. Historically, there has been debate by geologists over the use of the term “Dakota Formation” and the subject is discussed at length by Schoon (1971). The Dakota as mapped and described by Schoon (1971) does not extend west into Harding County. The western stratigraphic equivalent to the Dakota Sandstone is the Newcastle Sandstone (Fahrenbach et al, 2010). The Newcastle Sandstone is underlain by the Skull Creek Shale, and the Skull Creek Shale is underlain by the formations of the Inyan Kara Group (Fahrenbach et al, 2010). The Inyan Kara Group is composed of a sequence of interbedded sandstones, siltstones, and mudstones contained in the Fall River Formation and the underlying Lakota Formation (Martin et al., 2004). A review of the available information for this well and area geologic information indicates the targeted interval for water production corresponds to the Inyan Kara Group (Gries, 1981 and SDGS, 2019).

The Inyan Kara is a large regional geologic group that underlies portions of South Dakota, North Dakota, Wyoming, and Nebraska. The Inyan Kara aquifer consists of the permeable and porous portions of the Lower Cretaceous aged Inyan Kara Group. For the purpose of appropriations, the Water Management Board and the DENR-Water Rights Program considers the permeable and porous portions of the Inyan Kara Group a single aquifer. The Inyan Kara aquifer underlies an estimated 23,239,040 acres of Western South Dakota (Allen et al., 1985).

The aquifer underlies the entirety of Harding County with an estimated 22,528,800 acre-feet of recoverable water in storage in the county.

South Dakota Codified Law (SDCL) 46-2A-9

Pursuant to SDCL 46-2A-9, a permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the proposed diversion can be developed without unlawful impairment of existing rights and that the proposed use is a beneficial use and in the public interest. This report will address the availability of unappropriated water and existing rights from the aquifer that are pertinent to this application.

Water Availability

The probability of unappropriated water being available from an aquifer can be evaluated by considering SDCL 46-6-3.1 which requires "No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable that the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source." If the source of the water is older or lower than the Greenhorn Formation and the application is for a water distribution system defined pursuant to SDCL 46-1-6 (17), the Board need not consider the recharge/withdrawal issue. Here, the Inyan Kara aquifer is older or lower than the Greenhorn Formation, however a water distribution system is not involved, therefore the withdrawal/recharge issue must be considered.

Observation Wells

In determining the availability of unappropriated water for a permit application Administrative Rule 74:02:05:07 requires the Water Management Board to rely on the record of observation well measurements, in addition to other data, to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated annual recharge.

The Water Rights Program monitors nine observation wells completed into the Inyan Kara aquifer; eight of which are located in and around the Black Hills. The nearest Inyan Kara observation well to the well for this application is located about 90 miles to the south (Water Rights, 2019a). Due to the distance between the well for this application and the nearest Inyan Kara observation well and the observation well's close proximity to the outcrop, it is not expected to be reflective of the localized aquifer conditions in the area of the well site for this application.

Hydrologic Budget

Recharge

The average annual recharge to the Inyan Kara aquifer in its entirety has not been quantified. However, using data from 1950-1998 the precipitation component of the recharge to

the aquifer from the Black Hills outcrop area in South Dakota was estimated to be 11,600 acre-ft per year by Driscoll and Carter (2001). This estimate was only for the outcrop area located in South Dakota, so there is additional precipitation recharge to the Inyan Kara aquifer from outcrops in other states. The well site for this application is located approximately 80 miles from the nearest area of Inyan Kara outcrop in South Dakota.

Discharge

Farmer (2018) recently estimated average annual withdrawals from the Inyan Kara aquifer in South Dakota to be 10,451.2 acre-feet per year. The estimate of Farmer (2018) was based on updating the estimate of Buhler (2012) which based a water use estimate on: (1) annual water use reported in the latest public water system survey for municipal, rural water system, and suburban housing development appropriations where applicable; (2) calculated annual use based on permitted animals and rates of 20 gallons per day (gpd) for beef cattle, 5 gpd for swine, 15 gpd per 100 turkeys, and 9 gpd per 100 chickens for large confinement operations permitted by the DENR; (3) irrigation questionnaire reporting for irrigation permits when available; (4) the most current water use reported for non-irrigation appropriations that are required to report, and (5) assuming unreported water rights/permits limited to an annual volume will be used to the maximum and water rights/permits limited by diversion rate will be used 60% of continuous pumping at the maximum diversion rate for their annual use period. Since the completion of Farmer (2018), four water permits (Water Permit Nos. 8334-3, 1982-1, 1983-1, and 8299-3) for the Inyan Kara aquifer have been approved, and there is one pending application to appropriate water from the aquifer (Water Permit Application No. 2797-2). Water Permit Application No. 2797-2 for West River/Lyman-Jones Rural Water Systems Inc. proposes to appropriate 455 acre-feet of water annually at a maximum instantaneous diversion rate of 1.0 cfs. Using the same methodology as Farmer (2018), water use for these four permits and pending application can be estimated to be less than 1,929 acre-feet of water per year. Assuming that the other water uses have not significantly changed the current estimated average annual withdrawal plus this appropriation is 12,380.3 acre-feet per year.

Although this estimated average annual withdrawal slightly exceeds the estimated average annual precipitation recharge to the aquifer from the Black Hills outcrop area in South Dakota of 11,600 acre-feet per year, it is emphasized that this recharge estimate is for precipitation recharge on the outcrop area in the South Dakota portion of the Black Hills only and does not take into account the recharge from other sources (i.e. streamflow across the outcrop, groundwater inflow from out of state, or groundwater inflow from underlying aquifers).

Localized Hydrologic Budget

From a local prospective the water use for water rights/permits completed into the Inyan Kara aquifer in Harding County is summarized in Table 1. Buhler (2009) notes that there is some potential that the well supplying Water Permit Nos. 1734-1 and 1870-1 may actually be completed into the Inyan Kara aquifer, therefore they have been included in the localized analysis. Average annual use for the Inyan Kara water rights/permits in Harding County is also presented in Table

1. Estimates assume that water rights/permits limited by maximum instantaneous diversion rate historically use less than 60% of the permitted diversion rate annually, and water rights/permit limited by an annual volume are assumed to use the full annual volume (Water Rights, 2019b). A review of well completion reports on file with the South Dakota Water Rights Program indicates that domestic usage of the Inyan Kara aquifer in Harding County is limited, with the majority of domestic use in Harding County from the much shallower Fox Hills and Hell Creek aquifers (Water Rights, 2019c). Although information is not available to estimate localized recharge to the Inyan Kara aquifer, comparison of the estimated average annual appropriative use from the Inyan Kara aquifer in Harding County (595.4 acre-feet) to the estimated amount of recoverable water in storage in the aquifer in Harding County (22,528,800 acre-feet) would suggest that water is locally available for appropriation.

Table 1: Inyan Kara and Newcastle Water Rights/Permits in Harding County (Water Rights, 2019b)

Permit No.	Name	Status	Use	Aquifer	Rate (cfs)	Estimate water use (acre-feet per year)
1350-1	CITATION OIL & GAS CORPORATION	LC	IND	INKR	0.1	43.4
1734-1	LUFF EXPLORATION COMPANY	PE	IND	NCSL	0.044	19.1
1870-1	LUFF EXPLORATION COMPANY	PE	IND	NCSL	0.013	5.6
1892-1	CONTINENTAL RESOURCES	LC	IND	INKR	0.19	82.5
1905-1	LUFF EXPLORATION COMPANY	LC	IND	INKR	0.195	84.7
1983-1	CONTINENTAL RESOURCES	PE	IND	INKR	0.5	360*
Total					1.042	595.4
*Annual limit, LC- licensed, PE-permitted, IND- industrial, NCSL- Newcastle, INKR- Inyan Kara						

Existing Rights

Area water rights/permits completed into the Inyan Kara aquifer are shown in Figure 2 and summarized in Table 1. Water Permits Nos. 1734-1 and 1870-1 are also shown in Figure 1. The nearest of these are Water Permit Nos. 1734-1 and 1870-1 located approximately 3.3 miles to the west of the well site for this application and are held by the applicant. The nearest water right/permit not belonging to the applicant is Water Right No. 1892-1 for Continental Resources located approximately 4.7 miles to the southwest of the wellsite for this application. There are only a handful of well completions reports for domestic wells with the potential to be completed into the Inyan Kara aquifer in Harding County. These primarily appear to be oil or gas wells converted to water supply wells (Water Rights, 2019c).

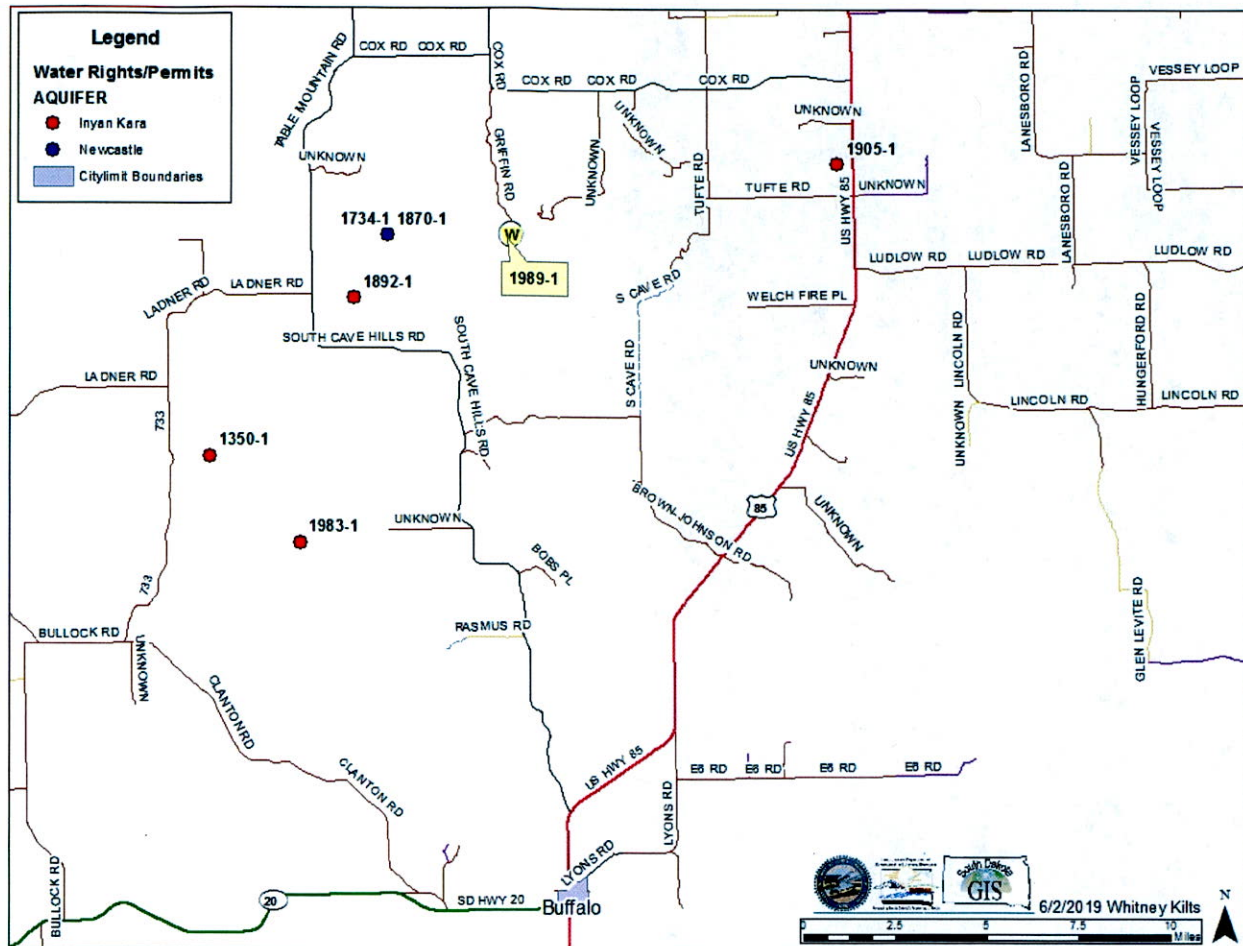


Figure 2: Water rights/permits in the area of the well for this application currently authorized to appropriate water from the Inyan Kara and Newcastle aquifers (Water Rights, 2019b)

Since the majority of wells completed into the Inyan Kara aquifer in this area are oil or gas wells converted to water supply wells, most of these wells do not have a water well completion report associated with them, therefore static water level information on these wells is limited. The water well completion report for Water Right No. 1350-1 indicated a static water level of 2,000 feet below grade (October 20, 1987) and a formation top at about 4,367 feet below grade, indicating that the Inyan Kara is expected to be under confined conditions in this part of Harding County (Water Rights, 2019b and 2019c). The exact amount of drawdown as the result of pumping due to the diversion proposed by this application cannot be quantified without aquifer testing. However, given the amount of artesian head pressure in the area and the relative low diversion rate requested by this application any drawdown as a result of pumping under this application, if approved, is unlikely to adversely impact existing users of the aquifer.

The Water Management Board has promulgated rules that allow water to be placed to maximum beneficial use without the necessity of maintaining artesian head pressure for domestic use. The Board has defined an adversely impacted domestic well as “a well in which the pump intake was set at least 20 feet below the top of the aquifer at the time of construction or, if the

aquifer is less than 20 feet thick, is as near to the bottom of the aquifer as is practical and the water level of the aquifer has declined to a level that the pump will no longer deliver sufficient water for the well owner's needs." In the case of Water Permit Application No. 2313-2 for the Coca-Cola Bottling Company of the Black Hills the Water Management Board adopted findings that noted that if the increased costs or decreased production as a result of the impacts of legitimate users on artesian head pressure could be considered an adverse impact it would conflict with SDCL 46-1-4 (Water Rights, 1995). SDCL 46-1-4 requires the water resources of the state be put to beneficial use to the maximum extent of which they are capable (Water Rights, 1995). Ultimately considering the best available information, there is reasonable probability that this application, if approved, will not adversely impact existing water rights/permits or domestic users with adequate wells.

Conclusions

1. Water Permit Application No. 1989-1 proposes to appropriate 58.8 acre-feet of water annually at a maximum instantaneous diversion rate of 0.10 cfs for industrial use from one well completed into the Inyan Kara aquifer located in the NE ¼ SW ¼ Section 24-T22N-R4E.
2. The well for this application is an oil well that is being converted into a water supply well.
3. Based on the available information, there is a reasonable probability that unappropriated water is available from the Inyan Kara aquifer for this application.
4. There is a reasonable probability the diversion proposed by this application from the Inyan Kara aquifer can be made without adversely impacting existing appropriative users of the Inyan Kara aquifer or domestic users of the Inyan Kara aquifer with adequate wells.



Whitney Kilts

SDDENR-Water Rights Program

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Water Rights. 2019b. Water Right/Permit Files. SD DENR-Water Rights Program, Joe Foss Bldg., Pierre, South Dakota.

Water Rights. 2019c. Well Completion Reports. SD DENR-Water Rights Program, Joe Foss Bldg., Pierre, South Dakota.

Schlaak, Karen

From: Schlaak, Karen
Sent: Monday, June 10, 2019 11:20 AM
To: Legals (legals@bhpioneer.com)
Subject: 1989-1, Luff Exploration Company
Attachments: 1989-1public.short.docx; Form 8.pdf

Attached is a notice to be published on June 20, 2019 in both the Black Hills Pioneer and the Nation's Center News.

Luff Exploration Company, c/o Richard D George, 1580 Lincoln St, Suite 850, Denver CO 80203 (303 503-8444) has been notified to contact you to authorize publication and arrange for payment.

Please send the affidavit or return the attached Proof of Publication form ASAP to the Water Rights Program, 523 E Capitol, Pierre SD 57501.

Let me know if you have questions. Please acknowledge receipt of this email.

Karen Schlaak

SD DENR, Water Rights Program
(605) 773-3352



RECEIVED

JUN 27 2019

WATER RIGHTS
PROGRAM

Affidavit of Publication

STATE OF SOUTH DAKOTA:

COUNTY OF HARDING:

Letitia Lister of said County and State being first duly sworn, on her oath says: That the NATION'S CENTER NEWS is a legal weekly newspaper of general circulation, printed and published in the City of Buffalo, in said County and State by Letitia Lister, and has been such a newspaper during the times hereinafter mentioned; and that said newspaper has a bonafide circulation of at least 200 copies weekly, and has been published within said County in the English language for at least one year prior to the first publication of the notice herein mentioned, and is printed in whole or in part in an office maintained at the place of publication; and that I, Letitia Lister, the undersigned, am the Publisher of said newspaper and have personal knowledge of all the facts stated in this affidavit; and that the advertisement headed:

Notice Of Application
NO. 1989-1

a printed copy of which is hereto attached, was printed and published in said newspaper for 1 successive and consecutive weeks, the first publication being made on the 20th day of June, 2019, and the last publication on the _____ day of _____, _____, that the full amount of fees charged for publishing same, to-wit: The sum of \$ 25.87, insures solely to the benefit of the publisher of the NATION CENTER NEWS, that no agreement or understanding for a division thereof has been made with any person and that no part thereof has been agreed to be paid to any other person whomsoever.

[Signature]
Subscribed and sworn to before me this 25th day of June, 2019

[Signature]
Notary Public, Butte County, South Dakota
My commission expires: 3-21-2023

NOTICE OF APPLICATION NO. 1989-1 to Appropriate Water

Notice is given that Luff Exploration Company c/o Richard D George, 1580 Lincoln Street, Suite 850, Denver CO 80203 has filed an application for a water permit to appropriate 58.8 acre-feet of water annually at a maximum pump rate of 0.10 cubic feet of water per second from one well completed into the Inyan Kara Aquifer (5,207 feet deep) located in the NE 1/4 SW 1/4 Section 24-T22N-R4E for industrial use. This site is located approximately 19 miles north of Buffalo SD.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1989-1 with qualifications 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. The Chief Engineer's recommendation with qualifications, the application, and staff report are available at <http://denr.sd.gov/public> or contact Eric Gronlund for this information, or other information, at the Water Rights Program address provided below.

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 July 1, 2019.

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.

If the applicant does not contest the recommendation of the Chief Engineer and no petition to oppose the application is received, the Chief Engineer shall act on the application pursuant to the recommendation with no hearing held before the Water Management Board. 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 this application. Notice of the hearing will be given to the applicant and any person filing a petition.

Steven M. Pirner,
Secretary,
Department of
Environment and
Natural Resources.

Published once at the
total approximate cost of
\$25.87.

#815
Jun 20

RECEIVED

JUN 27 2019

WATER RIGHTS
PROGRAM

Affidavit of Publication

STATE OF SOUTH DAKOTA:

COUNTY OF LAWRENCE:

Letitia Lister of said County and State being first duly sworn, on her oath says: That the BLACK HILLS PIONEER is a legal daily newspaper of general circulation, printed and published in the City of Spearfish, in said County and State by Letitia Lister, and has been such a newspaper during the times hereinafter mentioned; and that said newspaper has a bonafide circulation of at least 200 copies weekly, and has been published within said County in the English language for at least one year prior to the first publication of the notice herein mentioned, and is printed in whole or in part in an office maintained at the place of publication; and that I, Letitia Lister, the undersigned, am the Publisher of said newspaper and have personal knowledge of all the facts stated in this affidavit; and that the advertisement headed:

Notice OF Application
NO. 1989-1

a printed copy of which is hereto attached, was printed and published in said newspaper for 1 successive and consecutive weeks, the first publication being made on the 20th day of June, 2019, and the last publication on the day of , , that the full amount of fees charged for publishing same, to-wit: The sum of \$25.87, insures solely to the benefit of the publisher of the BLACK HILLS PIONEER, that no agreement or understanding for a division thereof has been made with any person and that no part thereof has been agreed to be paid to any other person whomsoever.

[Signature]
Subscribed and sworn to before me this 25th day of June, 2019

[Signature]
Notary Public, Butte County, South Dakota
My commission expires: 3-21-2023

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Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application No. 1989-1 with qualifications 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. The Chief Engineer's recommendation with qualifications, the application, and staff report are available at <http://denr.sd.gov/public> or contact Eric Gronlund for this information, or other information, at the Water Rights Program address provided below.

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Steven M. Pirner,
Secretary,
Department of
Environment and
Natural Resources.

Published once at the
total approximate cost of
\$25.87.

#275
Jun 20

NOTICE OF APPLICATION NO. 1989-1 to Appropriate Water

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Steven M. Pirner, Secretary, Department of Environment and Natural Resources. Published once at the total approximate cost of _____.

Schlaak, Karen

From: Schlaak, Karen
Sent: Tuesday, June 11, 2019 10:10 AM
To: Legals (legals@bhpioneer.com)
Subject: 1989-1, Luff Exploration Company
Attachments: 1989-1public.short.docx; Form 8.pdf

THIS REPLACES THE EMAIL AND ATTACHMENTS SENT YESTERDAY (JUNE 10TH)

Attached is a notice to be published on June 20, 2019 in both the Black Hills Pioneer and the Nation's Center News.

Luff Exploration Company, c/o Richard D George, 1580 Lincoln St, Suite 850, Denver CO 80203 (303 503-8444) has been notified to contact you to authorize publication and arrange for payment.

Please send the affidavit or return the attached Proof of Publication form ASAP to the Water Rights Program, 523 E Capitol, Pierre SD 57501.

Let me know if you have questions. Please acknowledge receipt of this email.

Karen Schlaak

SD DENR, Water Rights Program
(605) 773-3352



Schlaak, Karen

From: Schlaak, Karen
Sent: Tuesday, June 11, 2019 10:27 AM
To: rd.george@luffex.com
Cc: Gronlund, Eric
Subject: Water Permit Application No.1989-1
Attachments: 1989-1.pdf

Attached is the revised public notice, report and recommendation. The revised notice has been emailed to the papers. As stated below you need to contact the paper to authorize publication and arrange for payment.
Karen

From: Schlaak, Karen
Sent: Monday, June 10, 2019 11:17 AM
To: rd.george@luffex.com
Subject: Water Permit Application No.1989-1

Attached is the report, recommendation and information regarding the public notice for Water Permit Application No. 1989-1, Luff Exploration Company. As stated in the letter, you need to contact the papers to authorize publication and arrange for payment. Actually, the Spearfish paper also publishes the Buffalo paper, so I believe you may be able to authorize publication in both papers by just calling the Spearfish paper. The notice has been emailed to the paper. This same information is going in the mail to you today.

If you have questions, please let me know.

Karen Schlaak

SD DENR, Water Rights Program
(605) 773-3352





**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

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

June 10, 2019

Luff Exploration Company
c/o Richard D George
1580 Lincoln St
Suite 850
Denver CO 80203

Dear Mr. George:

Water Permit Application No. 1989-1 for industrial use has been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice has been sent to the Nation's Center News printed at Buffalo SD (Ph # 605 375-3228) and the Black Hills Pioneer printed at Spearfish SD (Ph # 605 642-2761). You will need to contact the newspapers and authorize publication of this notice. For your information, a copy of the notice, the recommendation of the Chief Engineer and 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 newspapers to authorize publication of your Notice and to arrange for payment. Early contact with the papers can eliminate delays. Upon receiving authorization from you, the publisher has been instructed to publish your notice. The newspaper has also been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the application.

Sincerely,

A handwritten signature in cursive script that reads "Eric Gronlund".

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 57501-3182
<http://denr.sd.gov>

JUL 18 2019

Luff Exploration Company
c/o Richard D George
1580 Lincoln St, Suite 850
Denver CO 80203

Dear Mr. George:

Enclosed is Water Permit No. 1989-1 authorizing construction of the water diversion system and beneficial use of the water, not exceeding the limits as specified in the Water Permit.

An application/license filing fee of \$700.00 was submitted with the application. Based on the amount of water claimed, the fee for this permit should be \$300.00. \$400.00 will be refunded to you. The refund check should be received within the next couple of weeks.

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,

Jeanne Goodman, Chief Engineer
Water Rights Program
(605) 773-3352

enclosures

July 18, 2019

PAYMENT REQUEST FORM

PAYEE: Luff Exploration Company
1580 Lincoln St, Suite 850
Denver CO 80203

FROM: DENR Water Rights Program
523 E. Capitol Ave
Pierre, SD 57501-3181

DESCRIPTION OF SERVICE, PRODUCE OR TRANSFER

Over payment of Application/License Fee

AMOUNT: \$400.00

FUNDING SOURCE:

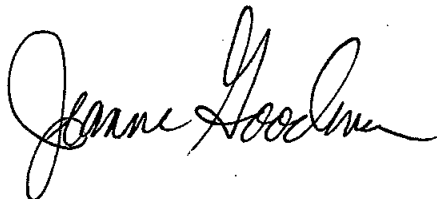
GENERAL: X

FEDERAL:

OTHER:

COMMENTS:

AUTHORIZATION:



I declare and affirm under the penalties of perjury that this claim is in all things, true and correct. I further agree to comply with the provisions of the Civil Rights Act of 1964 and regulations issued thereunder relating to nondiscrimination in federal assisted programs.