Responsive Report to the Kansas Analysis of the Nebraska Cooperative Republican Platte Enhancement

(N-CORPE) Plan

February 7, 2014

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I. Introduction

I have prepared this report in response to the State of Kansas' expert reports regarding the "Nebraska Cooperative Republican Platte Enhancement Plan" (Project). I reviewed three reports prepared by Kansas experts in this case. They are all titled exactly the same, "Report on the Nebraska N-CORPE Augmentation Plan, Republican River Compact, Response to proposal from State of Nebraska," dated June 10, 2013. These reports largely repackage the same concepts Kansas previously pursued in the Rock Creek Arbitration. One of the primary themes of these reports is the supposed transit loss of water after it discharges into the upper reaches of Medicine Creek.

From review of the reports and depositions of the authors, it appears that Kansas' understanding of physical conditions of Medicine Creek rests almost entirely on hypothetical scenarios developed using the RRCA Groundwater Model, and in Mr. Book's case, review of some of the historical stream flow data. I understood all of Kansas' experts to suggest they had never been to Medicine Creek and if they had, it was not upstream of Harry Strunk Reservoir and not in the last decade.

In contrast to Kansas' <u>conceptual</u> reports, my report presents the <u>actual</u> conditions of Medicine Creek. I base my opinions on personal review of stream flow data, historical reports, and most importantly, on multiple field observations including field trips to the basin where I observed actual streamflow conditions and construction of the N-CORPE pipeline and appurtenances.

II. Medicine Creek Background

The Medicine Creek watershed has a drainage area of more than 900 square miles[1] at its confluence with the Republican River. See Figure 1. The watershed is generally divided into two geographic features. The uplands of the watershed are primarily sandhills. This is the region where the N-CORPE well field is located. Near the discharge of the N-CORPE pipeline into Medicine Creek, the area gives way to the loess mantled Great Plains.

Medicine Creek is a baseflow dominated stream. *Kansas v. Nebraska and Colorado, No. 126 Original*, Final Settlement Stipulation (FSS) Vol. 5, J3-2; (WSY/RC J64, p.1023). There are many seeps and springs located throughout Medicine Creek and

[1] The literature quotes various drainage areas of the watershed. Many do not include the area of the sandhills as contributing to runoff and because of this may report a smaller drainage area for Medicine Creek. The sandhills area is on the order of 150 square miles.

they provide evidence of a groundwater-fed, gaining stream (Dvorak, June 1967). Some of these gains are clearly visible in seeps discharging directly to the stream. The N-CORPE discharge pipe enters Medicine Creek at a point where the drainage is a clearly defined channel. Here, farmers have constructed several ditches over the years to drain the high groundwater from soils in the area. Figure 2 shows the location of these ditches along with the discharge of the N-CORPE water.

I previously offered testimony in the Rock Creek Arbitration. It is important to note that the physical characteristics and setting of this stream is analogous to Rock Creek. In particular, the conditions below the discharge points for the two projects are comparable and the distance from discharge to point of perennial flow is of the same general scale (miles).

III. Observations of the Actual Conditions of Medicine Creek

I have conducted a number of field visits to the Medicine Creek basin as a professional engineer. Through my many visits to the watershed and working with flow records and other data I have established a good understanding of the watershed characteristics.

While some of my professional visits go back over 10 years, I draw primarily from my more recent experience in the basin. In the past 15 months, I have made no less than nine visits to the basin. These visits have been in support of the design and construction of the N-CORPE well field, pipeline, and project appurtenances. While not the design engineer of record, I have conducted a number of construction observation visits in addition to being consulted on outfall works, culvert sizing, and stream morphology.

Through these visits I have made several key observations about this baseflow dominated stream. While I have made observations at locations along the entire reach of Medicine Creek several times, I have been particularly focused on the reach of Medicine Creek from the N-CORPE discharge to where the stream flows under US Hwy 83 near Wellfleet, Nebraska. See Figure 1. The distance from the Project discharge to US Hwy 83 is on the order of 15 miles.

Based on my personal and professional observations, I can state the following:

a. Medicine Creek becomes a perennial stream between two and three miles downstream from the Project discharge. Groundwater is located very near the surface at this location and supports wetland vegetation near the outfall and along the Medicine Creek valley.

b. Groundwater expresses along the length of the stream and, at a number of locations, is clearly visible in the form of discharging seeps.
c. High groundwater levels near the Project outfall required dewatering for the pipe installation to be completed. The dewatering area was approximately a quarter mile upstream (See Figure 2) of the Project discharge. The dewatering discharge was on the order of 200 gpm, or less than ½ cubic feet per second. Even this small discharge found its way to the channel that the pipeline discharges to and continued to progress downstream before dewatering activities ceased.
d. Groundwater in the area of the Project discharge is near the ground surface. Less than 100 feet upstream of the Project discharge, groundwater infiltrated into a concrete vault that will house a flow meter. During my most recent site visit (February 3, 2014) the vault had filled with groundwater and was beginning to overtop the open flange fitting for the flow meter flowing into the discharge pipe itself.
e. At a culvert installation approximately seven miles downstream from the Project discharge, groundwater pressure heads result in groundwater discharging into the streambed. This discharge under pressure results in the streambed liquefying and created construction challenges. Objects (in this case culverts) placed on the liquefied streambed sink to the level at which the weight of the culvert filled with water is equal to the weight of the displaced streambed/water mix. Field engineering changes were required to address the problem.
f. The Nebraska Department of Natural Resources collected a series of stream measurements along Medicine Creek. The locations where data were collected are shown on Figure 1, and the results of these measurements are summarized in Table 1. Location 1 is the most upstream measurement location with the numbering proceeding downstream. These data were collected at times of no apparent surface water runoff. Therefore, they reflect the baseflow condition of Medicine Creek. Less than five miles downstream from the Project discharge stream flow is already several cubic feet per second. The table demonstrates the gaining nature of Medicine Creek and comports to my observations over the years.

Table 1: Streamflow Measurements, cubic feet per second (cfs)[2]

	Location					
Date	1	2	3	4	5	6
1/21/2014	1.53	8.74	12.8	24.3	27.1	41.5
1/27/2014	1.66	8.80	13.0	23.0	27.2	NA

[2] Notes for streamflow measurements can be found in Appendix A

IV. Conclusions and Opinions

Field reconnaissance is necessary in order to fully understand the actual conditions at the Project site and Medicine Creek.

In the real world, the Project discharge is streamflow that can actually be measured. In the Model results presented by Kansas, streamflow apparently would not exist in Medicine Creek where I actually observed it.

In the real world, groundwater is actually near the ground surface. Less than a cubic feet per second of discharge from construction dewatering efforts traveled beyond the Project discharge into the Medicine Creek stream channel. The Model results from Kansas experts suggest groundwater levels that are apparently at such depths that most, if not all, of the Project discharge will apparently be lost near the Project outfall.

I cannot reconcile the physical reality of actual groundwater conditions, the gaining nature of the stream, and the overall setting of Medicine Creek with the Model results presented by Dr. Perkins and Mr. Larson. Their report suggests increased groundwater levels of more than nine feet at the Project outfall as a result of Project operations. That much of a groundwater level increase overlaid on the actual conditions would result in water levels higher than the ground surface.

The Model is a useful and practical tool and serves an important function to the RRCA. However, it is just a representation of the physical system and at a coarse scale (one-mile grid cells) that cannot offer the necessary data that actual measurements and site observation provide.

Based on the foregoing, I do not believe transit losses associated with the N-CORPE Project to be anything more than *de minimis*. In my opinion, to use the Model to measure streamflow falls short of the mark and rests on invalid assumptions.

V. References

Dvorak, Verne and Heinemann, Herman. June 1967. Cooperative Runoff and Sediment Investigations on Medicine Creek Watershed in Nebraska. Agricultural Research Service. ARS 41-130. U.S. Department of Agriculture.

Brice, James C. 1958. Origin of Steps on Loess-Mantled Slopes: Contributions to General Geology. Geological Survey Bulletin 1071-C. U.S. Government Printing Office, Washington, D.C.

Brice, James C. 1966. Erosion and Deposition in the Loess-Mantled Great Plains, Medicine Creek Drainage Basin, Nebraska. Geological Survey Professional Paper 352-H. U.S. Department of the Interior.

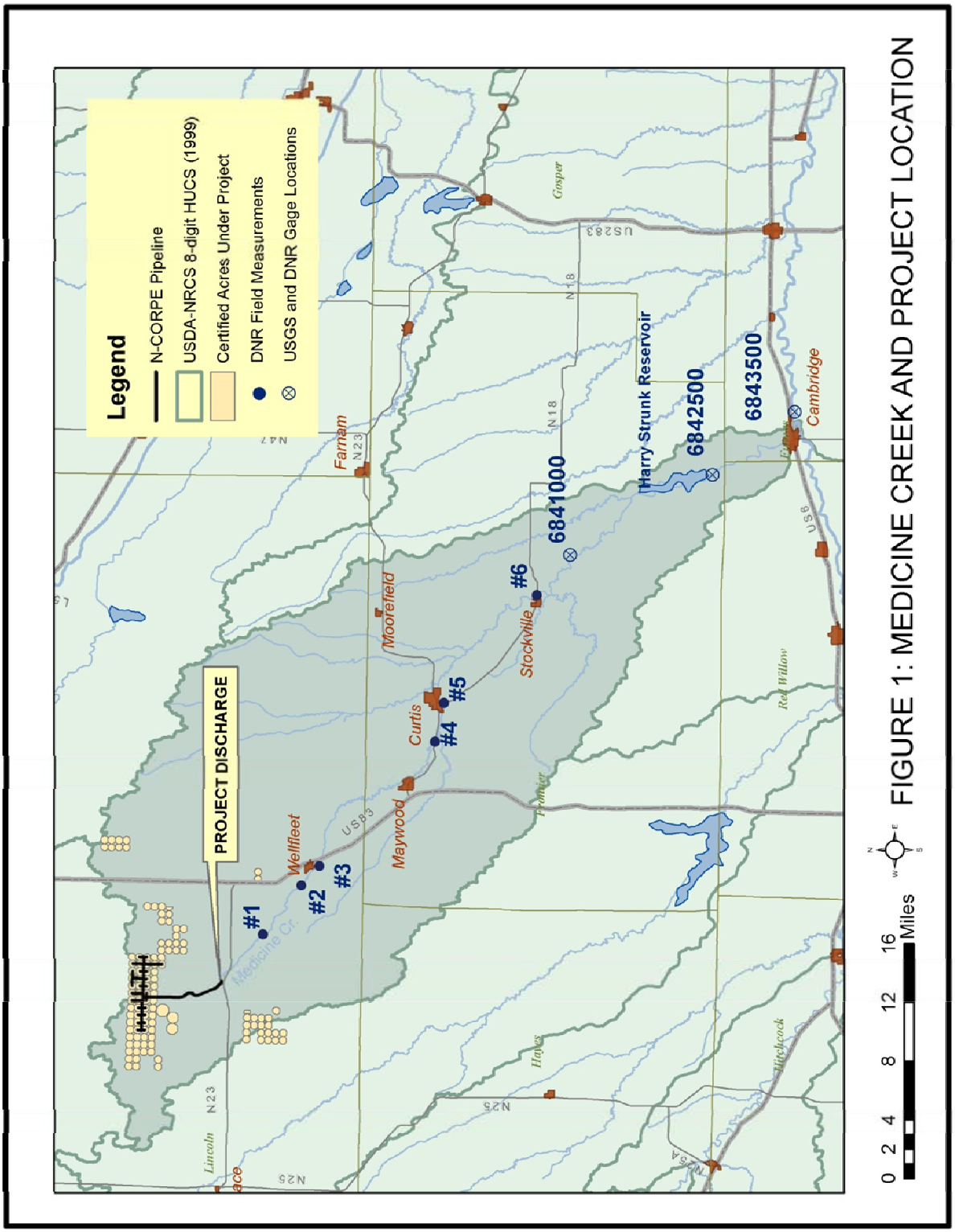

FIGURE 1: MEDICINE CREEK AND PROJECT LOCATION

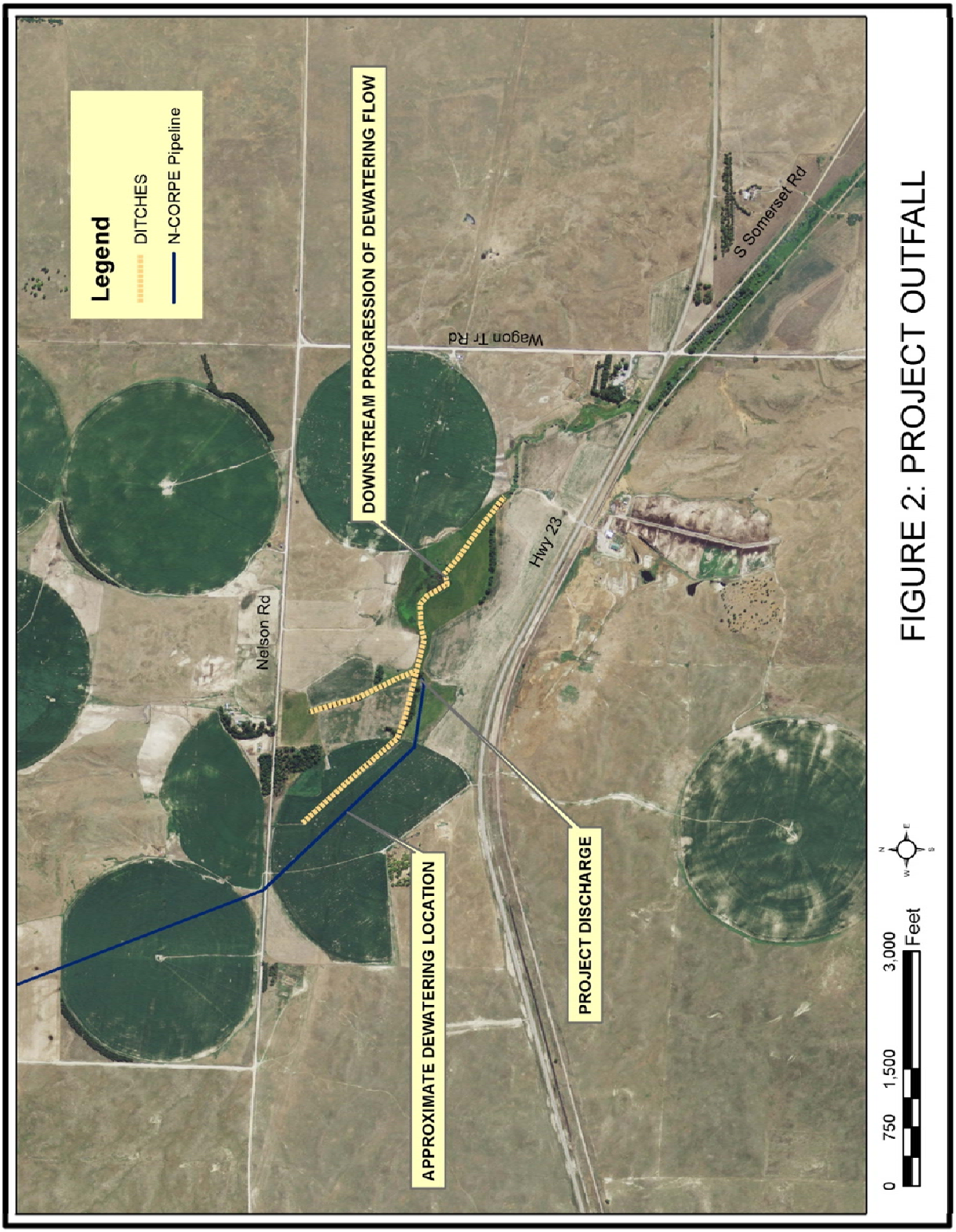

FIGURE 2: PROJECT OUTFALL

VI. Appendix A – Streamflow Measurement Notes

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____
Comp. by AC 29N00542

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek @ Darnell Bridge

Date 1-21, 2014 Party S. Stanton + D. Gunderson

Width 5.0 Area 2.54 Vel. 0.60 G.H. — Disch. 1.53

Method .6 No. secs. 17 G.H. change NA in 0.27 hrs. Susp. T-set Rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. 2.06

Type of meter Pygmy Date rated 6-99 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 63s ~~after~~ on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS				
Time	Inside	___	___	___	Outside
SM 1015					
FM 1035					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge 25 feet mile, above, below gage. bridge

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow even

Cross section gravel + light silt

Control open section

Gage operating yes Weather Sunny Calm

Intake/Orifice cleaned _____ Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____
Comp. by 23N00542

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek Above Wellfleet Reservoir

Date 1-21, 20 14 Party S. Stanton, D. Gunderson

Width 8.0 Area 7.80 Vel. 1.12 G.H. – Disch. 8.74

Method 6 No. secs. 17 G.H. change NA in 0.28 hrs. Susp. T-set Rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04168

Type of meter Price AA Date rated _____ Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 3min 43s after on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS					
	Time	Inside	—	—	—	Outside
SM	1055					
FM	1115					
	Weighted M.G.H.					
	G.H. correction					
	Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge 15 feet mile, above, below gage. bridge

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow light boils

Cross section Gravel

Control open section light shore Ice

Gage operating – Weather Sunny calm

Intake/Orifice cleaned _____ Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks light shore Ice

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by Aug 28 N00542

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek Below Wellfleet Reservoir

Date 1-21, 2014 Party S. Stanton + D. Sundberson

Width 11.0 Area 12.9 Vel. .990 G.H. — Disch. 12.8

Method 6 No. secs. 23 G.H. change N/A in .35 hrs. Susp. Tsetkal

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04160

Type of meter Price AA Date rated _____ Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 3min 43s after on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS					
	Time	Inside	—	—	—	Outside
SM	1130					
FM	1200					
	Weighted M.G.H.					
	G.H. correction					
	Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downst., side bridge 200 feet, mile, above, below gage. bridge

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Steady + Smooth

Cross section gravel with light silt

Control Open Section

Gage operating — Weather Sunny Clear

Intake/Orifice cleaned _____ Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks No ice

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by _____

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek near Curtis (west of Curtis)

Date 1/21, 2014 Party D. Gunderson S. Stanley

Width 14.5 Area 16.9 Vel. 1.44 G.H. – Disch. 24.3

Method 6 No. secs. 28 G.H. change – in 0.43 hrs. Susp. Top Set Rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A0416X

Type of meter Price AA Date rated _____ Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 3min 43s after on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS					
	Time	Inside	—	—	—	Outside
SM	1230					
FM	1305					
	Weighted M.G.H.					
	G.H. correction					
	Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge @ bridge feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Steady

Cross section Moderate rocks

Control Clear section control

Gage operating – Weather _____

Intake/Orifice cleaned _____ Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks measured @ Highway 23 bridge west of Curtis

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by _____

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek at Curtis (South of Curtis)

Date 1/21, 20 14 Party D. Gunderson, S. Stanley

Width 18.3 Area 23.8 Vel. 1.14 G.H. — Disch. 27.1

Method .6 No. secs. 27 G.H. change — in 0.43 hrs. Susp. Top Set Rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. [redacted]

Type of meter Price AA Date rated _____ Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 3min 43s after on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS					
	Time	Inside	—	—	—	Outside
SM	1335					
FM	1405					
	Weighted M.G.H.					
	G.H. correction					
	Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge @ bridge _____ feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Steady

Cross section Silt and gravel

Control Clear section control

Gage operating — Weather _____

Intake/Orifice cleaned — Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks Measured @ Highway 18 bridge South of Curtis

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by _____

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek @ Stockville (East of Stockville)

Date 1/21, 20 14 Party D. Anderson, S. Stmin

Width 22.0 Area 32.5 Vel. 1.28 G.H. — Disch. 41.5

Method .6 No. secs. 27 G.H. change — in 0.43 hrs. Susp. Top Set Rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04168

Type of meter Price AA Date rated _____ Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 3min 43s after on 1-21-2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

	GAGE READINGS					
	Time	Inside	—	—	—	Outside
SM	1430					
FM	1500					
	Weighted M.G.H.					
	G.H. correction					
	Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge @ bridge feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Uneven on the edges; steady in the middle

Cross section Silt on the edges with gravel in the middle

Control Clear section control; no ice

Gage operating — Weather _____

Intake/Orifice cleaned — Air _____ °C@ _____ Water _____ °C@ _____

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks Measured @ Highway 18 bridge East of Stockville

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by 13020151

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek at Darnell Road

Date Jan 27, 20 14 Party A Saul

Width 5.9 Area 3.22 Vel. 0.500 G.H. — Disch. 1.66

Method 0.6 No. secs. 19 G.H. change — in 0.33 hrs. Susp. topset rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. P11089

Type of meter PYGMY Date rated 6/99 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 50 sec after Jan 27 2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

GAGE READINGS					
Time	Inside	—	—	—	Outside
1120					
1140					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found _____ changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge 30 feet mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Steady

Cross section fine sand/silt

Control section

Gage operating _____ Weather overcast calm

Intake/Orifice cleaned _____ Air -11 °C@ 1140 Water 1.6 °C@ 1140

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1-34.8-12

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by 13070151

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek above Wellfleet Lake

Date Jan 27, 2014 Party A S-1

Width 7.6 Area 8.65 Vel. 1.02 G.H. — Disch. 8.80

Method 0.6 No. secs. 16 G.H. change — in 0.27 hrs. Susp. topset rod

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04133

Type of meter Price AA Date rated 6/99 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 4:03 after Jan 27 2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

GAGE READINGS					
Time	Inside	___	___	___	Outside
1350					
1410					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found — changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge _____ feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on the following cond:

Flow steady

Cross section soft silt / firm silt / soft silt

Control Section

Gage operating _____ Weather overcast smooth swirl

Intake/Orifice cleaned _____ Air -8.3 °C@ 1410 Water 0.6 °C@ 1410

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

2-33-17

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by 13070151

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek Below Wellfleet Lake

Date Jan 27, 2014 Party A. Sand

Width 10.5 Area 14.1 Vel. 0.920 G.H. — Disch. 13.0

Method ~~top~~ 0.6 No. secs. 21 G.H. change 0 in 0.37 hrs. Susp. top set rod

Method coef. 1.0 Hor. angle coef. See note Susp. coef. 1.0 Meter No. A04133

Type of meter Price AA Date rated 8/94 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 4:03 after Jan 27 2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

GAGE READINGS					
Time	Inside	—	—	—	Outside
1305					
1330					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found — changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge _____ feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%), based on the following cond:

Flow steady

Cross section REW - 1.5' weeds/soft - firm silt + REW - 1' soft silt

Control Section

Gage operating _____ Weather calm cloudy

Intake/Orifice cleaned _____ Air -9.4 °C @ 1330 Water 1.6 °C @ 1330

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM — _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by 13070151

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek at Hwy 23 (New Cuntis)

Date Jan 27, 20 14 Party A Sand

Width 14.4 Area 16.0 Vel. 1.44 G.H. — Disch. 23.0

Method 0.6 No. secs. 27 G.H. change — in 0.45 hrs. Susp. topsetter

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04133

Type of meter Price AA Date rated 6/99 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 4:03 after Jan 27 2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

GAGE READINGS					
Time	Inside	—	—	—	Outside
1440					
1520					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found — changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge _____ feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow steady

Cross section soft silt

Control section

Gage operating _____ Weather P cloud, 5-10 mph Sw wind

Intake/Orifice cleaned _____ Air _____ °C@ 1520 Water _____ °C@ 1520

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

3V.8-15

1970-2A

STATE OF NEBRASKA
DEPARTMENT OF NATURAL RESOURCES

Meas. No. _____

Comp. by 1307151

Sta. No. _____ **DISCHARGE MEASUREMENT NOTES** Checked by _____

Medicine Creek at Hwy 18 (Curtis)

Date JAN 27, 2014 Party A Saul

Width 13.4 Area 24.1 Vel. 1.13 G.H. — Disch. 27.2

Method See note No. secs. 25 G.H. change — in 0.42 hrs. Susp. top set rd

Method coef. 1.0 Hor. angle coef. 1.0 Susp. coef. 1.0 Meter No. A04133

Type of meter Price AA Date rated 6/99 Tag checked _____

Meter _____ ft. above bottom of wt. Spin before meas. 4:03 after Jan 27 2014

Meas. Plots _____ % diff. from _____ rating. Levels obtained _____

GAGE READINGS					
Time	Inside	—	—	—	Outside
1545					
1625					
Weighted M.G.H.					
G.H. correction					
Correct M.G.H.					

Check bar. chain found — changed to _____ at _____

Wading, cable, ice, boat, upstr., downstr., side bridge _____ feet, mile, above, below gage.

Measurement rated excellent (2%), good (5%), fair (8%), poor (over 8%); based on the following cond:

Flow Steady

Cross section LEW + 2.5' weeds soft silt - soft silt - REW - 1' weeds

Control section

Gage operating — Weather p cloudy 5-10 mph Sand

Intake/Orifice cleaned _____ Air -8.3 °C @ 1625 Water 0.7 °C @ 1625

Record removed _____ Extreme Indicator: Max. _____ Min. _____

Manometer N_2 Pressure Tank _____ Feed _____ Bbl rate _____ per min. _____

CSG checked _____ Stick reading _____

Observer _____

HWM — _____ outside, in well

Remarks _____

G. H. of zero flow _____ ft. Sheet No. _____ of _____ sheets

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VII. Appendix B – Qualifications and Compensation

I have prepared this expert report on behalf of the State of Nebraska. A true and accurate copy of my curriculum vitae follows in this appendix. The opinions contained in this report are made to a reasonable decree of scientific certainty. I was compensated $170 per hour for my work.

Thomas E. Riley, P.E.

THOMAS E. RILEY, P.E.
Water Resources/Environmental Engineer

SUMMARY OF PROFESSIONAL QUALIFICATIONS...

- President and operating partner of successful Midwest environmental consulting firm.
- Exhibited success in project direction, supervision, and management, as well as proposal development and client cultivation.
- Skilled in hydraulic and hydrologic modeling, computer aided drafting and design, project cost-estimating, and instrument-oriented surveying.
- Directed multiple inter-disciplinary projects, including efforts related to water resources engineering, hazardous and solid waste investigations, groundwater restoration, and environmental compliance.
- Illustrated problem-solving abilities and strong facilitation skills for developing solutions for multi-objective groups.

ACADEMIC PROFILE...

PhD: University of Nebraska, Lincoln: Biological System Engineering; in progress
M.S.; University of Nebraska, Lincoln; Civil Engineering; 1988
B.S.; University of Nebraska, Lincoln; Civil Engineering; 1986

CERTIFICATION and AFFILIATIONS…

Registered Professional Engineer in Nebraska (E-7137), Iowa, Missouri, Kansas & South Dakota
Wetlands Seminar for the Creation of Wetlands for Wastewater Treatment, Enhancement, and Mitigation
40-hour OSHA hazardous waste health and safety training
American Society of Civil Engineers

PROFESSIONAL EXPERIENCE...

Hydrology - Conducts or participates in all phases of hydrologic investigation, including watershed response modeling, stream flow and flood hydrology, and statistical evaluation of hydrologic data. Participates in inter-disciplinary efforts in Wetland Hydrology and restoration. Coordinates data collection and database management, liaison with government agencies (local, state, and federal), application of current hydrologic techniques and software, permit applications, client recommendations, and report writing. Experienced with HEC-1, HEC-HMS, TR-55, HECWRC, and TR-20. Responsible for the development of monitoring program for stream flow monitoring and sampling. Developed and taught university graduate course in hydrology as ad hoc instructor for the University of Nebraska.

Hydraulics - Developed and directed a river model study evaluating roadfill embankments located on floodplains and their effects on flood backwater. Has performed many hydraulic evaluations of bridges, culverts, and floodplains. Experienced user of HEC-2, HEC-RAS, FHWA's HY-7 (WSPRO) program, FESWMS-2DH two-dimensional modeling program, UNET one-dimensional unsteady flow program, and HY-8 Culvert Analysis program. Project director for many wetland restoration projects and lake rehabilitation designs requiring hydraulic design. Manages urban stream bank rehabilitation projects that include two-stage channel design, bioengineering and riparian improvement techniques. Analyzed modeling data to receive a no-rise certification for stream bank projects by ensuring that design components did not increase the height of flood elevations on existing properties.

Project Management - Mr. Riley manages inter-disciplinary multi-office projects in both the environmental and water resources areas. Responsibilities include management of support staff, contract negotiation, proposal preparation, personnel assignment and oversight, coordination of field efforts, subcontractor management, report preparation, QA/QC, client correspondence, agency liaison, and presentations.

Habitat Restoration and Evaluation – Mr. Riley participates in various projects addressing water resources planning and engineering, habitat restoration evaluation and design, watershed and river basin analysis (surface and ground water), stream stability, and geomorphic analysis. Mr. Riley has recently concentrated on solutions for stream degradation and habitat loss for the Salt Creek Tiger Beetle near Lincoln, Nebraska. He also directed the design of Missouri River backwater habitat for the pallid sturgeon. His focus has been ephemeral and perennial streams developing long term interventions for restoration and the development of improved habitat. In particular, he has focused on restoration using his experience, hydrologic/hydraulic modeling, and GIS applications to minimize the anthropogenic effects on hydrologic/geomorphic processes and their effects on aquatic habitat.

Water Supply Management – Mr. Riley assists clients in evaluation of water supply and management issues through the use of multi-objective decision making processes. He uses complex surface and groundwater modeling along with other data to prepare evaluations and solutions for supply issues. He continues to work with DNR in finding solutions to water shortages in the Republican River Basin and with other entities across the region in this time of stressed water supply.

Litigation Support - Provided project management and technical support to the State of Nebraska's Attorney General for the Republican River Compact litigation heard before the Supreme Court. Expert in evaluating and presenting technical information for water dispute resolution.

Hazardous Waste Management - Managed comprehensive CERCLA PA investigations for USACE Civil Works recreational facilities at four mainstem dams on Missouri River. Included coordination of multi-location/disciplinary teams throughout 5 states. The project consisted of the research and reconnaissance of over 400 sites. Senior Engineer for feasibility studies for RI/FS at 12 Operable Units at Ellsworth AFB, SD. Used Presumptive remedy approach to accelerate cleanup and save Air Force resources. Project Manager for PA/SI for Hickam AFB, Hawaii. Project involved extensive community relations and tight schedule and budget. Project Manger for FS phase for Lake City Army Ammunition Plant. Act as facilitator for Army and regulator interactions. Project Engineer for "Fast Track" design of 58 oil/water separators at Fort Campbell, KY. Project Engineer for treatability studies of contaminated wastewater and completed Remedial Design for treatment of contaminated wastewater.

Solid Waste Management - University Instructor for graduate course in Solid Waste Management. Project Engineer for the preparation of a Closure/Post Closure Plan for 120-acre landfill at Minot Air Force Base. Managed projects for the preparation of RCRA Closure Plans, including development of sampling plans and cleanup efforts. For USACE-Nashville, managed development of engineering drawings, calculations, design analysis report, and cost estimate for upgrade of 58 oil/water separators. Led field program to characterize existing conditions at each site and performed sampling of influent and effluent at selected sites. Fast track design project worth over $2 million completed in less than three months.

Surveying and Database Management - Works with current state-of-the-art surveying and data collection equipment. Performed numerous surveys for hydraulics evaluations, topographic analysis, wetland restoration, and dam site evaluation. Developed software for integrating electronic survey data with CADD. Routinely operates database management software by developing custom applications for office users. Laboratory instructor for beginning survey class at the University of Nebraska.

SELECTED PUBLICATIONS...

Coke, Gordon & Riley, Thomas. November/December 2011. "Restoring Eastern Nebraska's Saline Wetlands." Land and Water.

Riley, Tom et al. May/June 1998. "Creative Funding Results in Lake Restoration Success Story." Land and Water.

Riley, T.E., Todd, R. Petersen, D. November 1997. "Road to ROD." The Military Engineer.

Riley, T.E. 1996. Solid and Hazardous Waste Engineering. Undergraduate/Graduate environmental engineering course taught at the University of Nebraska-Lincoln.

Riley, T.E., et al. 1996. A Statistically Biased and Sequential Approach to Data Collection for a Hawaii Wartime Fuel System. Presented at SUPERFUND '96, Washington, D.C.

Todd, R.D., Riley, T.E., et al. 1996. Integrating Presumptive Remedies into the CERCLA Process: A Case Study of the Accelerated RI/FS at Ellsworth Air Force Base, SD. Presented at SUPERFUND '96, Washington, D.C.

Riley, T.E. 1996. Solid and Hazardous Waste Engineering. Undergraduate/Graduate solid waste management taught at the University of Nebraska-Lincoln.

Riley, T.E. 1993. Hydrology. Undergraduate/Graduate water resources course taught at the University of Nebraska-Lincoln.

Dahab, M.F., Becker, H.L., Riley, T.E. July 1991. Treatment of a Wood Products Superfund Wastewater: A Case Study. Canada Journal of Civil Engineering.

Riley, T.E. April 1990. Introductory training workshop for AutoCad users. Inter-office training seminar.

Riley, T.E. 1988. A Hydrologic Evaluation of Twenty-four Small Watersheds in Nebraska. Masters Thesis, University of Nebraska-Lincoln.

Riley, T.E. 1987. Hydrologic and Hydraulic Design of Culverts. Unpublished report for the Nebraska Department of Roads.

EMPLOYMENT HISTORY...

Senior Engineer/Principal, The Flatwater Group, Incorporated; Lincoln, Nebraska; 2000-present

Serves as a firm President and active as project director/manager. Civil engineer with extensive experience in both environmental and water resources engineering. He manages various projects addressing water resources planning and engineering, CERCLA preliminary assessment and site inspections, solid and hazardous waste management, remediation and feasibility studies, database management, and project report writing. Mr. Riley is a project director/manager for inter-disciplinary projects ranging from litigation support; environmental restoration; site inspections; preparation of CERCLA feasibility studies, proposed plans, records of decision, and engineering evaluations/cost assessments; hydrologic analyses; and hydraulic structure evaluation and design.

Senior Engineer/Project Manager, EA Engineering, Science, and Technology, Incorporated; Lincoln, Nebraska; 1988-2000

Served as a civil engineer with extensive experience in both environmental and water resources engineering. He managed various projects addressing water resources planning and engineering, CERCLA preliminary assessment and site inspections, solid and hazardous waste management, remediation and feasibility studies, database management, CADD/GIS, computer graphics and design applications, cost estimation, and project report writing. Mr. Riley was project manager for inter-disciplinary projects ranging from preliminary assessments and site inspections; preparation of CERCLA feasibility studies, proposed plans, records of decision, and engineering evaluations/cost assessments; hydrologic analyses; and hydraulic structure evaluation and design. Project Director for Lake Restoration projects for the Midwest.

Ad-Hoc Instructor, University of Nebraska-Lincoln Civil Engineering Department; Lincoln, Nebraska; 1993-Present

Research Assistant/Graduate Student, University of Nebraska-Lincoln Civil Engineering Department; Lincoln, Nebraska; 1985-1988

--- END REPORT ---

PROFESSIONAL CIVIL ENGINEER
THOMAS E.
RILEY
E-7137
STATE OF NEBRASKA