

Post-Construction Haul Route Evaluation Report

North Bend Wind Project
Hyde County, South Dakota
UEI Project No. 23.22932

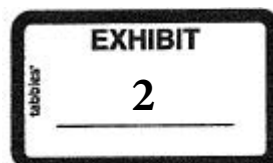


*Prepared for
Hyde County, South Dakota*

*Prepared by
Ulteig Engineers, Inc.
July 2024*



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North Bend Wind Project

Hyde County, South Dakota

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1. Background

North Bend Wind developed a wind farm in Hyde County. As part of this development, construction vehicles used designated haul routes on paved and unpaved public rural roadways. The designated haul routes identified for evaluation consist of two (2) miles of asphalt highway and forty-three (43) miles of gravel roadways in Hyde County.

This report, the *Post-Construction Haul Route Evaluation Report*, is the second of two reports. The *Pre-Construction Haul Route Evaluation Report (and Supplement 1)* was the first report to which the results of this report are compared.

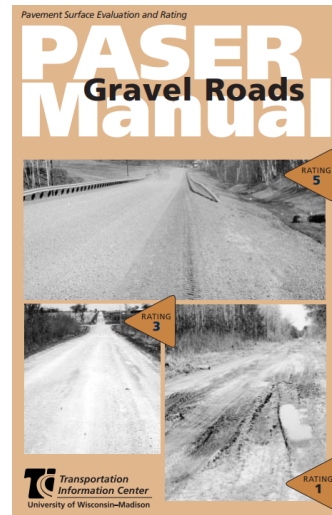
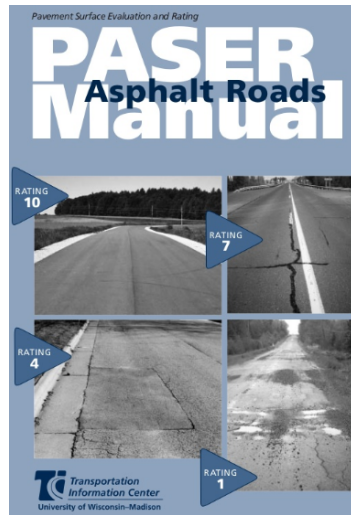
The purpose of this report is to determine the condition of the designated haul routes using the PASER rating system, where inspection is performed not more than sixty (60) days after construction is completed. This report also follows up on pre-construction inspections of spot distress locations of concern, gravel surface depth information, asphalt rut measurements, and bridge & culvert inspection documentation. Additionally, a post-construction “punch list” was created to identify issues as part of the post-construction evaluation, many of which would not be covered within the overall condition assessments. A preliminary punch list was sent to the developer in December 2023, as well as in July 2024, in advance of this report to facilitate a more rapid response if desired by the developer. There were no changes to the final punch list as submitted in July 2024.

The following references were used:

- *PASER Asphalt Roads Manual*
- *PASER Gravel Roads Manual*

2. The PASER Rating System

The PASER rating system (developed by University of Wisconsin-Madison Transportation Information Center) focuses on the surface condition of concrete, asphalt, or gravel roadways. For this project, asphalt roadway segments are rated on a PASER rating scale of 1-10 (where 10 the best condition) and the gravel roadway segments are rated on a PASER scale of 1-5 (where 5 the best condition). The key to useful condition evaluation is to identify the different types of distresses present, their extent and severity, and correlating them with a cause. Certain distresses are a sign of what kind of deterioration can be expected in the future. The PASER rating also helps indicate what kind of maintenance will be effective in extending the life of the roadway. A periodic inspection evaluation is most useful in determining the deterioration of a roadways over the course of time.



Figures 1 & 2: PASER Asphalt Roads Manual (left) & PASER Gravel Roads Manual (right)

A. Asphalt PASER Rating

When assigning a PASER condition rating for asphalt roadways, there are four major categories of distress to take into consideration: surface defects, surface deformation, cracks, and patches and potholes. These distresses are caused by environmental weathering/aging and repeated structural loading. A newly constructed asphalt roadway starts in excellent condition (Rating 10), with deterioration over time to a failed condition (Rating 1). Deterioration typically accelerates as the combined effects of structural loading and moisture infiltration begin to take place. Periodic maintenance such as crack sealing, sealcoating, or overlays will extend the life of the pavement by helping to prevent moisture infiltration and/or adding structural support. Additionally, proper maintenance action will temporarily improve the condition rating.

Asphalt PASER Rating		General Condition	Needed Maintenance or Repair
10	Excellent	New	No maintenance required
9	Excellent	Like new	No maintenance required
8	Very Good	Initial cracking	Little or no maintenance
7	Good	First signs of aging	Routine maintenance, cracksealing and minor patching
6	Good	Definite signs of aging	Preservative treatments (sealcoating)
5	Fair	Definite signs of distress	Preservative treatments (sealcoating)
4	Fair	Losing strength	Structural improvements & leveling (overlay or recycling)
3	Poor	Some loss of strength	Structural improvements & leveling (overlay or recycling)
2	Very Poor	Severe deterioration	Reconstruction
1	Failed	Disintegration	Reconstruction

Table 1: Asphalt PASER Ratings (from *PASER Asphalt Roads Manual*)

B. Gravel PASER Rating

When assigning a PASER condition rating for gravel roadways, there are five conditions to take into consideration: crown, drainage, gravel layer, surface deformation, and surface defects. A newly constructed gravel roadway starts in excellent condition (Rating 5), with deterioration over time to a failed condition (Rating 1). As with asphalt, distresses and defects accumulate and worsen over time. Periodic maintenance such as regrading, ditch improvement, or placing additional aggregate will extend the life of the roadway by improving moisture drainage or structural support. Additionally, proper maintenance action will temporarily improve the condition rating.

Gravel PASER Rating		General Condition	Needed Maintenance or Repair
5	Excellent	No distress	No Maintenance Required
4	Good	Minor signs of distress	Routine Maintenance
3	Fair	Definite signs of distress	Needs regrading, minor ditch maintenance, and spot gravel application
2	Poor	Slow travel speeds required	Needs additional aggregate layer, major drainage improvements
1	Failed	Travel is difficult or impossible	Complete rebuilding required

Table 2: Gravel PASER Ratings (from *PASER Gravel Roads Manual*)

3. Drainage Structure Rating System

All transverse drainage structures along designated haul routes were inventoried visually, but no structural analysis is included. Drainage structures were documented by location, type, size, and condition. Locations were geospatially recorded by a mobile GIS application. Pictures were taken at each structure and any applicable notes were added.

The main objective of the drainage structure inventory was to evaluate if existing structures had changed in condition over the course of construction.

The following definitions of Good/Fair/Poor conditions were used to evaluate the conditions of the circular drainage structures:

Drainage Structure Rating	General Condition
Good Condition	Good cover (if needed)
	Drainage had little or no resistance
	Little or no damage to this structure
Fair Condition	Good cover (if needed)
	Drainage had minor blockage but still allowed drainage
	Minor structure damage to culvert ends
Poor Condition	Structure had minimal or no cover (if needed)
	Drainage was significantly blocked
	Major structure damage including deformations and/or buckling

Table 3: Drainage Structure Ratings

4. Pre-Construction Conditions

The pre-construction evaluation was finalized in the *Pre-Construction Haul Route Evaluation Report (June 2023)* and the *Supplement 1 (August 2023)*.

5. Post-Construction Conditions

Ulteig was notified that wind farm construction had concluded for the North Bend Wind Farm Project in two separate stages. After Ulteig was notified that stage one was completed, a post-construction haul route inspection was conducted on November 16-28, 2023. Similarly, inspection after stage two was conducted on June 3-5, 2024. The inspections after stage one and stage two included PASER condition evaluation by visual inspection and a follow-up inspection at spot distress locations, gravel surface depth locations (approximately every 1/4 mile), asphalt rut measurement locations (approximately every 1/8 mile), and bridge & culvert inspection documentation locations. Bridge structures were structurally inspected on June 11, June 26, and July 18, 2024.

Post-construction drone imagery of all the roadways was collected on May 28-31, 2024, using two quadcopter drones. This data serves as a “snapshot” of roadway conditions after construction was completed. The orthomosaic drone imagery, which aided post-construction conclusions, is hereby made a part of this post-construction haul route evaluation, though not included in this submittal.

A post-construction “punch list” was created to identify issues as part of the post-construction evaluation, many of which would not be covered within the overall condition assessments. The post-construction inspection is a useful medium for the developer to ensure that issues can be catalogued and identified in a well-ordered, well-described punch list. Common issues identified in the punch list include unrestored culverts, signs, and inslopes. A total of 27 punch list items are shown in Appendix I, including a map showing each location.

A preliminary punch list after stage one of construction, which included 20 items, was submitted to the developer on December 6, 2023, as an initial evaluation of designated haul route restoration items to be addressed. It also provided a means to expedite restoration prior to winter conditions setting in, but it did not represent the final conclusions of the post-construction haul route evaluation, as presented in this report. The preliminary punch list items that were not addressed after stage two of construction are also included in Appendix I.

The post-construction conditions are summarized in the following sections.

A. Asphalt

In the pre-construction assessment, the two (2) miles of asphalt roadway were rated 5 (Fair).

The post-construction assessment determined that two (2) miles of asphalt roadway had decreased in PASER condition rating. Mileage that decreased in condition rating changed from PASER rating 5 (Fair) to PASER rating 4 (Fair). It was also determined that two (2) new spot distresses require repairs. Detailed asphalt PASER ratings and spot distress locations are shown in Appendix A, B, and C.

Rutting measurements were also collected in the post-construction assessment at the same sample locations that were collected pre-construction. Of the 64 sample measurements, 1 had increased in rutting depth 0” to 1/16” compared to pre-construction measurements. This represents 1.6% of the samples, representing 0.13 single wheel path miles. Because of the impracticality of repairing such minor changes in rutting depth, it is not necessary to deploy immediate maintenance to any of the rutting locations as a result of construction activity from the wind farm construction. Rut measurements are shown in Appendix D.

Note: It is understood that discussions are being held to address the worsened asphalt conditions. Asphalt repairs are expected later in the fall 2024.

B. Gravel

In this post-construction assessment, gravel segments along the designated haul routes ranged from a rating of 3 (Fair) to 4 (Good).

The post-construction assessment determined that approximately ten (10.1) miles of gravel roads had decreased in PASER condition rating, and there were no instances of road failure. All gravel mileage that decreased in condition rating decreased by a rating of 1, and in all cases primarily due to soft shoulders. Any gravel road that is widened has the potential for soft shoulders, steepened inslopes, plugged culverts, etc. The prevalence of soft shoulders varied from minor to frequent depending on the location. If frequent, the PASER rating was lowered for the entire mile segment.

It was also determined that all gravel spot distress locations recorded pre-construction had been addressed as part of regular maintenance or had no change in condition.

Post-construction gravel cores indicated zero instances where gravel depth decreased along the haul route utilized by the wind farm equipment. The only exception is along a section of 209th Street which is understood to not have been used by wind farm equipment. Reduction in gravel depths is associated with routine gravel maintenance activities which blades existing gravel from one side of the road to the other.

Detailed gravel PASER ratings and spot distress locations are shown in Appendix A, E, F. Additionally, gravel surface depths and road widths are shown in Appendix G.

Note: It is understood that discussions are being held to address the worsened gravel conditions.



Photo Caption: This sign was placed along 209th St. It is believed that wind farm equipment was not used along most of the 209th St route.

C. Culverts

In the pre-construction assessment, transverse culvert structures were inventoried visually by the appearance of object markers. Transverse drainage structures without object markers were also documented if visually verified in the field. The circular culverts were evaluated on a scale of Good/Fair/Poor condition. The same culvert structures were reviewed in the post-construction assessment, again, without structural or condition assessment for box culverts. Structural analysis is outside the scope of this report.

It was determined that five (5) transverse (centerline) culverts along the designated haul route warranted the creation of punch list items. Punch list items were created for transverse culverts if conditions had clearly changed, even if not necessarily due to wind farm operations

Punch list items were also created if issues were noted with new culverts under wind turbine approaches. The post-construction assessment for transverse culverts is shown in Appendix H.

D. Bridges

In the pre-construction assessment, there were four (4) bridges and one (1) box culvert observed along the designated haul routes. The same bridge structures were documented in the post-construction assessment:

- 35-123-440
- 35-010-366
- 35-030-341
- 35-030-363 (Box culvert)
- 35-030-262

There were no visually discernable changes in condition to any of the five (5) bridge structures and there are no repairs required as part of this haul route assessment. The post-construction assessment for bridges is shown in Appendix H.

6. Conclusion

Ulteig concludes that repairs and restoration are required to reestablish the conditions of some asphalt and gravel roadways in Hyde County to that of pre-construction conditions. Individual PASER ratings do not automatically dictate the final maintenance or rehabilitation techniques. Repairs and restoration efforts will vary depending on specific factors not fully encompassed by PASER rating alone. It is understood that discussions are being held to address the worsened asphalt and gravel conditions. Asphalt repairs are expected later in the fall 2024.

Approximately two (2) miles of asphalt mileage had decreased PASER ratings compared to pre-construction conditions, as well as two (2) new spot distress locations. A complete list of asphalt mileage and locations where overall conditions decreased is shown in Appendix A, B, C, and D.

Approximately ten (10.1) miles of gravel mileage had decreased in PASER rating compared to pre-construction conditions. A complete list of gravel mileage and locations where overall conditions decreased is shown in Appendix A, E, F, and G.

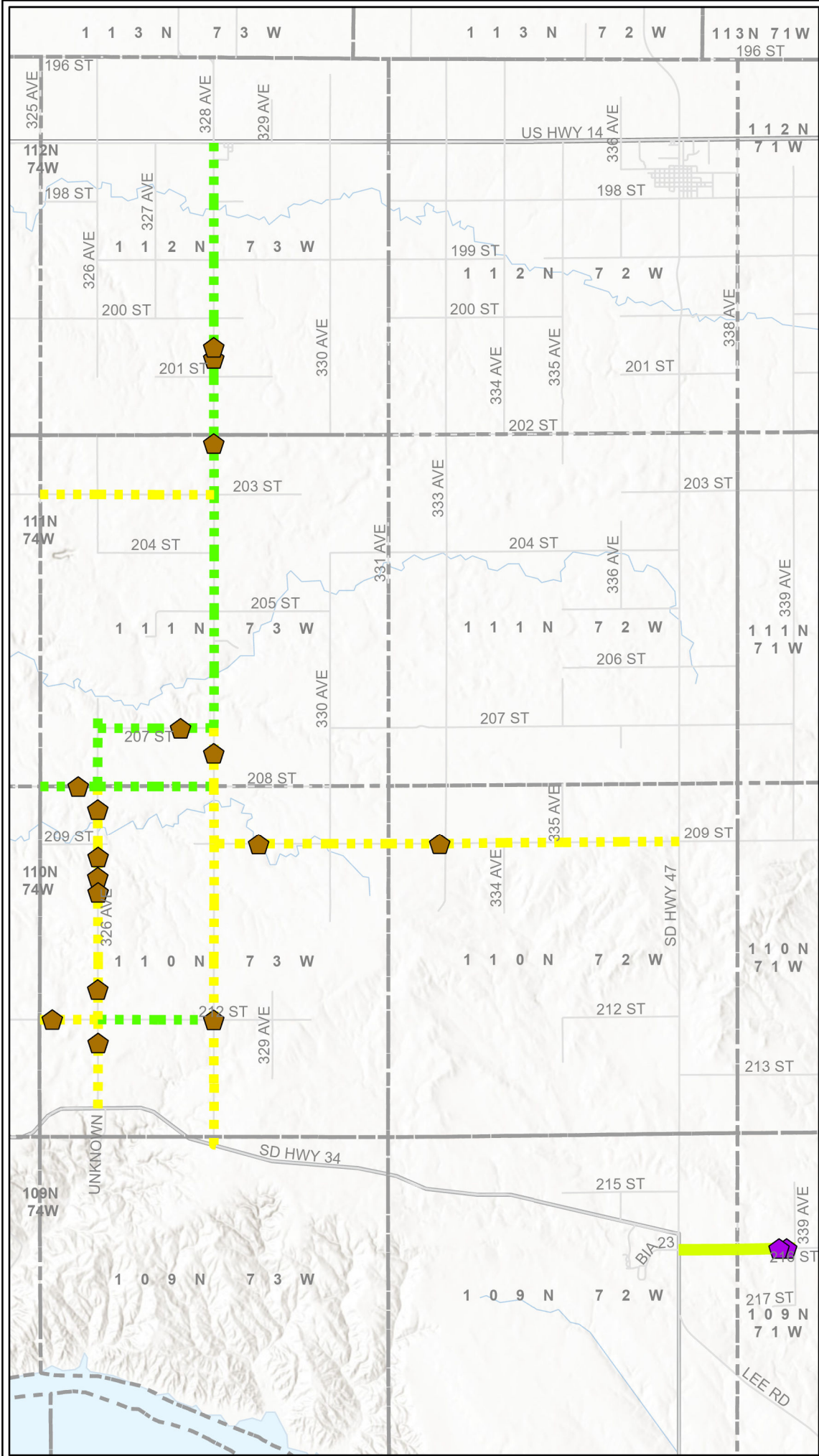
A total of twenty-seven (27) punch list items were noted, and are miscellaneous in nature, including unrestored culverts, signs, and inslopes. For gravel and asphalt roads that decreased in PASER ratings, punch list items are not included if they were inherent to the distresses that decreased the PASER ratings. The punch list items are shown in Appendix I, including a map of each location.



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Appendix A

Haul Route Condition Map

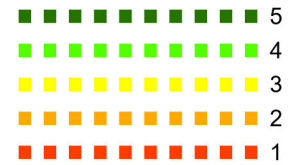


Post-Construction Haul Route Evaluation (2024)

Roads in Hyde County,
SD
North Bend Wind
Project

Haul Route PASER Rating

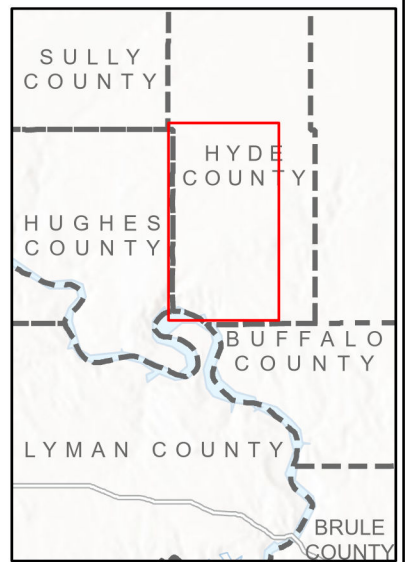
Gravel



Asphalt



Distress Spot Locations





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Appendix B

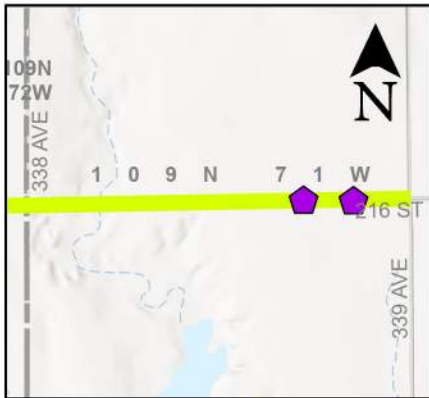
Asphalt Haul Routes

Route	Post-Con ID	Owner	Location		Length (mi)	Roadway Width (ft)	Pre-Con PASER Rating (1-10)		Post-Con PASER Rating (1-10)		Recommended Restoration	Post-Construction Notes
			Start	End								
216th St	2	Hyde County	SD Hwy 47	338th Ave	1.0	28		5		4	Action needed.*	Conditions appear to have worsened overall.
216th St	1	Hyde County	338th Ave	339th ave	1.0	28		5		4	Action needed.*	Conditions appear to have worsened overall. Two new asphalt spot distresses noted.

*It is understood that discussions are being held to address the worsened asphalt conditions.

POST-CONSTRUCTION HAUL ROUTE EVALUATION (2024)

Asphalt PASER Condition: 216th St -- 338th Ave to 339th Ave



ID	1	Apparent Recent Maintenance	Seal Coat/Chip Seal
Owner	Hyde County	Primary Distress Type	Block Cracking
Route (St/Ave)	216th St	Secondary Distress Type (1)	Transverse Cracking
Start	338th Ave	Secondary Distress Type (2)	Rutting
End	339th Ave	Secondary Distress Type (3)	Potholes
PASER Rating (1-10)	4	Secondary Distress Type (4)	Flushing
Roadway Width (ft)	28	Length (miles)	1
Comment	Conditions appear to have worsened overall. Two new asphalt spot distresses noted.		



POST-CONSTRUCTION HAUL ROUTE EVALUATION (2024)

Asphalt PASER Condition: 216th St -- SD HWY 47 to 338th Ave



ID	2	Apparent Recent Maintenance	Seal Coat/Chip Seal
Owner	Hyde County	Primary Distress Type	Block Cracking
Route (St/Ave)	216th St	Secondary Distress Type (1)	Transverse Cracking
Start	SD HWY 47	Secondary Distress Type (2)	Rutting
End	338th Ave	Secondary Distress Type (3)	Patching
PASER Rating (1-10)	4	Secondary Distress Type (4)	Flushing
Roadway Width (ft)	28	Length (miles)	1
Comment	Conditions appear to have worsened overall.		





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Appendix C

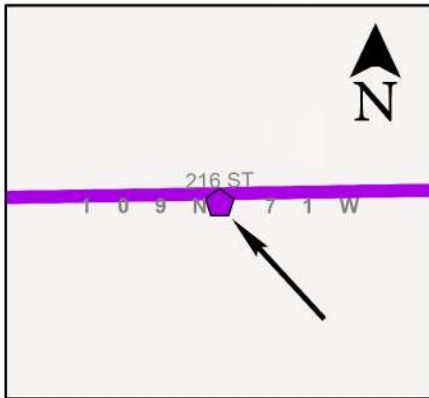
Asphalt Spot Distresses

Route	Post-Con ID	Owner	Location	Primary Distress	Pre-Construction Notes	Post-Construction Notes
-	1	-	-	-	-	Mistakenly entered as pre-Con test point. Does not exist.
216th St	2	Hyde County	0.15 mi W of 339th Ave	Alligator Cracking	N/A	New post-con condition: Rutting approx 1 inch and distressed asphalt due to turning traffic into the pit.*
216th St	3	Hyde County	0.3 mi W of 339th Ave	Frost Heave	N/A	New post-con condition: Frost heave and minor patching will continue to deteriorate.*

*It is understood that discussions are being held to address the worsened asphalt conditions.

POST-CONSTRUCTION HAUL ROUTE EVALUATION (2024)

Asphalt Spot Distress Location

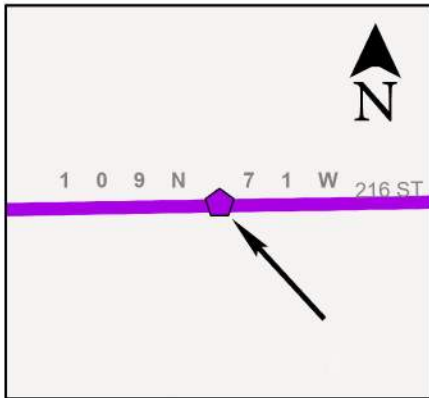


ID	2	Primary Distress Type	Alligator Cracking
Lat/Long	44.252227, -99.404303	Secondary Distress Type (1)	Rippling/Shoving
Route	216th St	Secondary Distress Type (2)	
MRM Location	0.15 mi W of 339th	Apparent Recent Maintenance	None
Notes	New post-con condition: Rutting approx 1 inch and distressed asphalt due to turning traffic into the pit.		



POST-CONSTRUCTION HAUL ROUTE EVALUATION (2024)

Asphalt Spot Distress Location



ID	3	Primary Distress Type	Frost Heave
Lat/Long	44.252246, -99.406922	Secondary Distress Type (1)	Rutting
Route	216th St	Secondary Distress Type (2)	Patching
MRM Location	0.3 mi W of 339th Ave	Apparent Recent Maintenance	Other
Notes	New post-con condition: Frost heave and minor patching will continue to deteriorate.		





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Appendix D

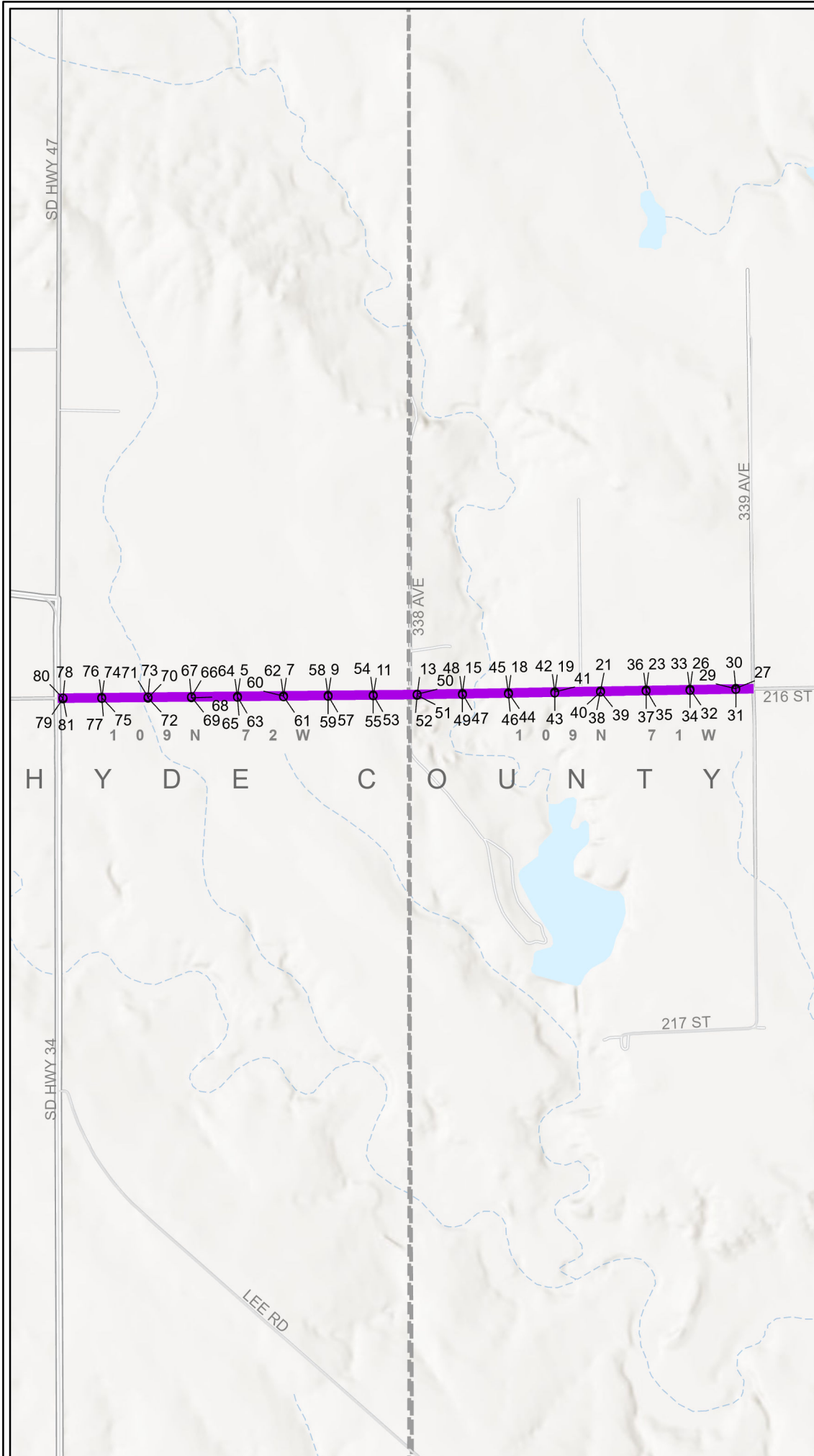
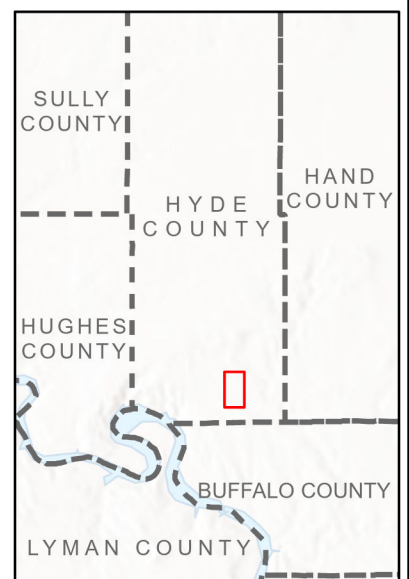
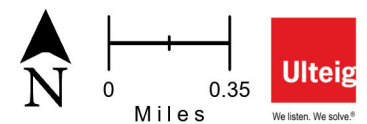
Asphalt Rutting

Post-Construction Haul Route Evaluation (2024)

Asphalt Rutting in Hyde
County, SD
North Bend Wind
Project

Asphalt Rutting
(Object ID)

Asphalt
Gravel

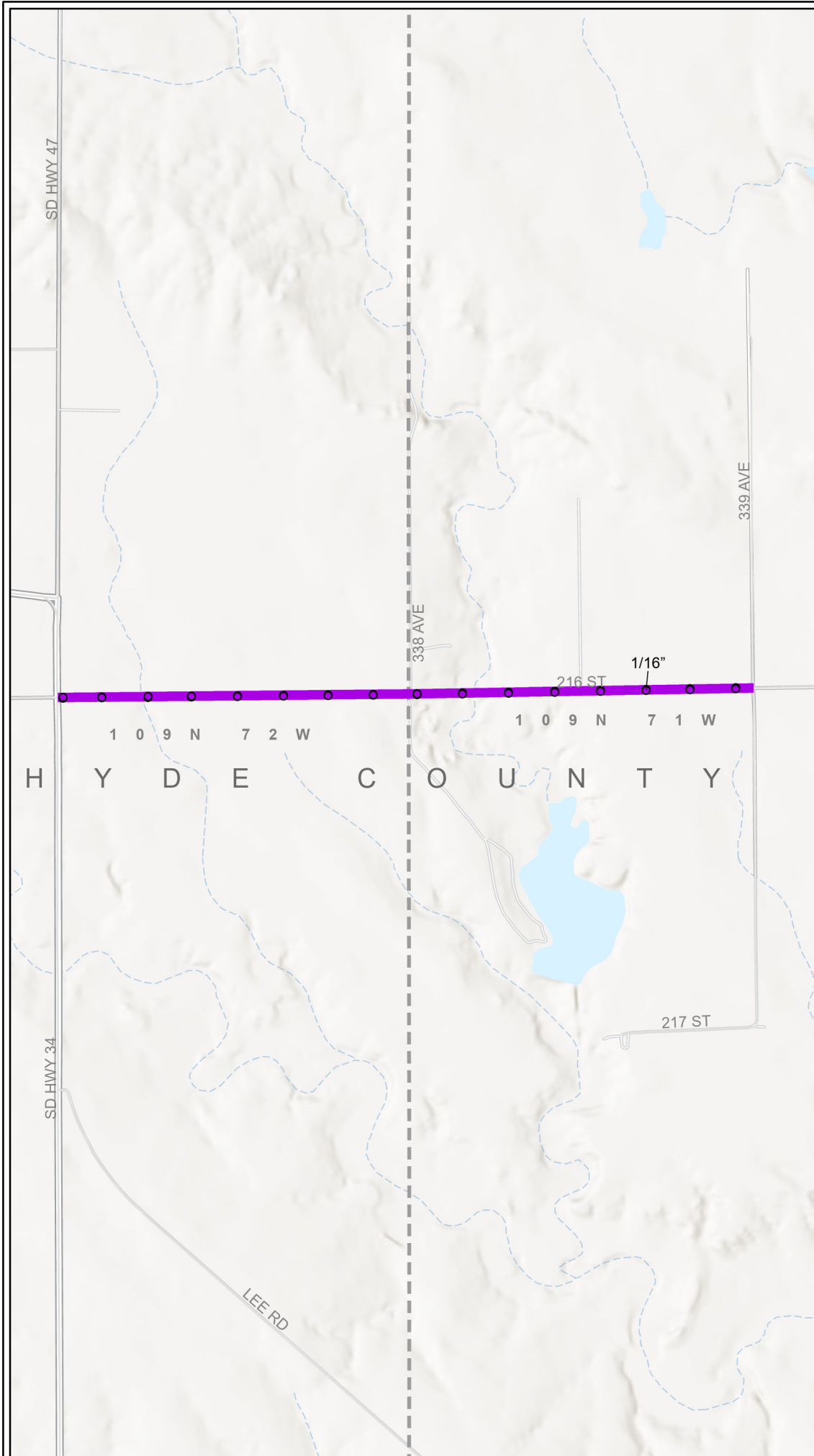
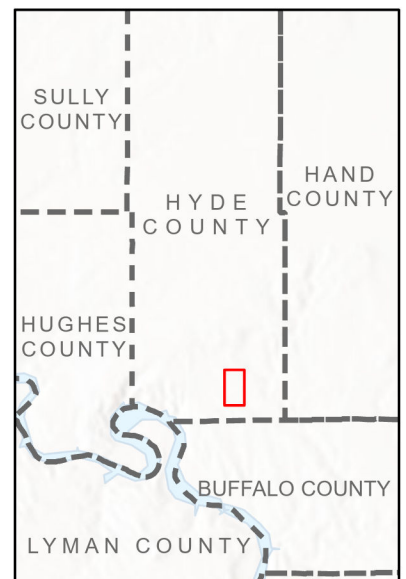
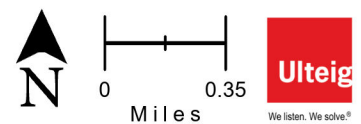


Post-Construction Haul Route Evaluation (2024)

Asphalt Rutting in Hyde
County, SD
North Bend Wind
Project

Asphalt Rutting
(Pre-Con/Post-Con
Depth Difference in
Inches)

Asphalt
Gravel



ID	Owner	Route	Wheel Line	Latitude	Longitude	Pre-Con Rut Depth (inches)	Post-Con Rut Depth (inches)	Pre-Con/Post-Con Depth Difference (inches)
78	Hyde County	216th St	1	44.251876	-99.44151	0"	0"	0"
79	Hyde County	216th St	2	44.251891	-99.44151	0"	0"	0"
81	Hyde County	216th St	4	44.251922	-99.44151	0"	0"	0"
80	Hyde County	216th St	3	44.251907	-99.44151	0"	0"	0"
74	Hyde County	216th St	1	44.251897	-99.43926	0"	0"	0"
76	Hyde County	216th St	4	44.251942	-99.43926	0"	0"	0"
77	Hyde County	216th St	2	44.251911	-99.43926	0"	0"	0"
75	Hyde County	216th St	3	44.251930	-99.43926	0"	0"	0"
71	Hyde County	216th St	4	44.251959	-99.43657	0"	0"	0"
72	Hyde County	216th St	2	44.251930	-99.43657	0"	0"	0"
70	Hyde County	216th St	1	44.251914	-99.43657	0"	0"	0"
73	Hyde County	216th St	3	44.251947	-99.43657	0"	0"	0"
66	Hyde County	216th St	4	44.251973	-99.43404	0"	0"	0"
69	Hyde County	216th St	3	44.251960	-99.43404	0"	0"	0"
68	Hyde County	216th St	1	44.251928	-99.43404	0"	0"	0"
67	Hyde County	216th St	2	44.251942	-99.43404	0"	0"	0"
5	Hyde County	216th St	4	44.251991	-99.43137	0"	0"	0"
63	Hyde County	216th St	3	44.251975	-99.43137	0"	0"	0"
65	Hyde County	216th St	1	44.251944	-99.43137	0"	0"	0"
64	Hyde County	216th St	2	44.251957	-99.43137	0"	0"	0"
60	Hyde County	216th St	3	44.251998	-99.42868	0"	0"	0"
7	Hyde County	216th St	4	44.252011	-99.42868	0"	0"	0"
62	Hyde County	216th St	1	44.251967	-99.42868	0"	0"	0"
61	Hyde County	216th St	2	44.251981	-99.42868	0"	0"	0"
59	Hyde County	216th St	1	44.251985	-99.42609	0"	0"	0"
57	Hyde County	216th St	3	44.252016	-99.42609	0"	0"	0"
58	Hyde County	216th St	2	44.251998	-99.42609	0"	0"	0"
9	Hyde County	216th St	4	44.252031	-99.42609	0"	0"	0"
11	Hyde County	216th St	1	44.252003	-99.42347	0"	0"	0"
55	Hyde County	216th St	2	44.252014	-99.42347	0"	0"	0"
54	Hyde County	216th St	4	44.252047	-99.42347	1/16"	1/16"	0"
53	Hyde County	216th St	3	44.252034	-99.42347	0"	0"	0"
51	Hyde County	216th st	1	44.252028	-99.42091	0"	0"	0"
50	Hyde County	216th St	4	44.252076	-99.42091	0"	0"	0"
13	Hyde County	216th St	2	44.252041	-99.42091	0"	0"	0"
52	Hyde County	216th St	3	44.252061	-99.42091	0"	0"	0"
47	Hyde County	216th St	4	44.252105	-99.41828	1/16"	1/16"	0"
15	Hyde County	216th St	3	44.252093	-99.41828	0"	0"	0"
49	Hyde County	216th St	1	44.252062	-99.41828	0"	0"	0"
48	Hyde County	216th St	2	44.252076	-99.41828	0"	0"	0"
44	Hyde County	216th St	4	44.252135	-99.41560	0"	0"	0"
18	Hyde County	216th St	3	44.252121	-99.41560	0"	0"	0"
45	Hyde County	216th St	2	44.252103	-99.41560	0"	0"	0"
46	Hyde County	216th St	1	44.252088	-99.41560	0"	0"	0"
41	Hyde County	216th St	4	44.252171	-99.41290	0"	0"	0"
42	Hyde County	216th St	3	44.252159	-99.41290	0"	0"	0"
43	Hyde County	216th St	1	44.252123	-99.41290	0"	0"	0"
19	Hyde County	216th St	2	44.252139	-99.41290	0"	0"	0"
38	Hyde County	216th St	4	44.252211	-99.41025	1/16"	1/16"	0"
21	Hyde County	216th St	3	44.252196	-99.41025	0"	0"	0"
39	Hyde County	216th St	2	44.252183	-99.41025	0"	0"	0"
40	Hyde County	216th St	1	44.252168	-99.41025	0"	0"	0"

ID	Owner	Route	Wheel Line	Latitude	Longitude	Pre-Con Rut Depth (inches)	Post-Con Rut Depth (inches)	Pre-Con/Post-Con Depth Difference (inches)
35	Hyde County	216th St	4	44.252253	-99.40759	1/16"	1/16"	0"
23	Hyde County	216th St	3	44.252239	-99.40759	0"	1/16"	1/16"
36	Hyde County	216th St	2	44.252219	-99.40759	0"	0"	0"
37	Hyde County	216th St	1	44.252202	-99.40758	0"	0"	0"
26	Hyde County	216th St	3	44.252275	-99.40504	0"	0"	0"
33	Hyde County	216th St	2	44.252253	-99.40504	0"	0"	0"
32	Hyde County	216th St	4	44.252286	-99.40504	0"	0"	0"
34	Hyde County	216th St	1	44.252239	-99.40503	1/16"	1/16"	0"
30	Hyde County	216th St	2	44.252285	-99.40237	0"	0"	0"
27	Hyde County	216th St	4	44.252320	-99.40237	1/16"	1/16"	0"
31	Hyde County	216th St	1	44.252271	-99.40237	1/16"	1/16"	0"
29	Hyde County	216th St	3	44.252302	-99.40237	0"	0"	0"