A Class III Reconnaissance Survey

Rush River-Amenia South Levee Alternative Project

Cass County Joint Water Resource District

T141N; R52W, Portions of Section 23, 24, 25 and 26

Cass County, North Dakota

Christopher A. Plount
State Cultural Resources Specialist-East Zone
May 29, 2020

US Department of Agriculture
Natural Resources Conservation Service
North Dakota State Office

Appendix D-5

Abstract:
The Cultural Resources Survey: Rush River-Amenia South Levee Alternative investigates the potential impacts the construction of a pumping plant, levee and diversion system will have on cultural resources and historic properties eligible for listing on the National Register. The undertaking, as designed, completely encircles the town of Amenia, North Dakota, defining the area of potential effect (APE), and includes portions of four Public Land Survey System Sections. The report concludes that there are no known cultural resources nor properties eligible for the National Register of Historic Places within the APE. The undertaking, as proposed, has benefited from a literature review, pedestrian survey encompassing the entirety of the APE, limited shovel probeing and produced no cultural material. Therefore, a finding of "***No Effect***" to historic properties is recommended.

Table of Contents

Figures and Tables

Project Title: Rush River-Amenia South Levee Alternative
Legal Location: T141N; R52W, Portions of Section 23, 24, 25 and 26
County: Amenia Township**,** Cass County
USGS 7.5' Quadrangle: Arthur, North Dakota 2018
Personnel: Christopher A. Plount (Principal Investigator), Joshua Monson (Fargo District Conservationist), Pat Downs (Moore Engineering Representative).
Proposed Total Acres Surveyed: Approx. 133 linear acres

Project Description:
Construction of a pumping plant, levee and diversion system to control potential flooding. NRCS Practice 587 (Water Control), 356 (Dike), 362 (Diversion) listed in Appendix B.

Introduction:
The USDA Natural Resources Conservation Service North Dakota (NRCS) desires to construct a water pumping facility and associated control structure encircling the town of Amenia, North Dakota. The town has recently been mapped by the Federal Emergency Management Agency into a high-risk flood zone and the increased probability of flood damage will be alleviated by the construction of the proposed undertaking.

On May 19, 2020 the State Cultural Resources Specialist-East Zone completed a pedestrian survey and limited shovel testing of the APE. Representatives of the NRCS Fargo Field Office and Moore Engineering were present. Several sites listed with the North Dakota State Historic Preservation Office and located within the area of potential effect (APE) are destroyed or unlocatable due to generalized site form data. A literature review was conducted in 2016 by SWCA Environmental Consultants (Appendix A) and its findings were reconfirmed by NRCS in 2020.

Research Goals and Methods:
Historic maps, topographic maps, literature review, oral histories and in person interviews were combined with LiDAR, satellite imagery and engineering plans to pinpoint areas of interest. Field reconnaissance was designed to achieve four goals:

- Positive location and identification of known cultural resources.
- Discovery and recordation of unknown cultural resources.
- Field assessment of NRHP eligibility of any cultural resources.
- Determine effects of the undertaking on any NRHP eligible properties.

Environment:
The project is in western Cass County, North Dakota within the boundaries of glacial lake Agassiz and east of the Pembina Escarpment. The proposed APE is south of the Rush River channel which has been heavily modified by both natural and anthropogenic forces since the original 1874 mapping (Figure 1). Clay loam (I518A) and silty loam (I490A) soils dominate the area (Figure 2, Table 1) and rest above deeply buried glacial sediment of the Coleharbor Group (Bluemle, 1977). The thick lake bottom clay is impregnated with humic material primarily of historic agricultural origin. The material includes domesticated varieties of corn, soy and sugar beets. Elevation of the APE is relatively constant at 945 feet above sea level.

Native flora and fauna are negligible due to the heavy agricultural use of the APE but, as of 20 May 2020, no known Native American traditional medicine or culturally significant plants needing protection are known to be in the area (NRCS-Plants 2020). Faunal resources include White-tailed Deer (*Odocoileus virginanus*), common rabbit (*Leporidae*), racoon (*Procyon lotor*), common pheasant (*Phasianidae*) and turkey (*Meleagridinae*).

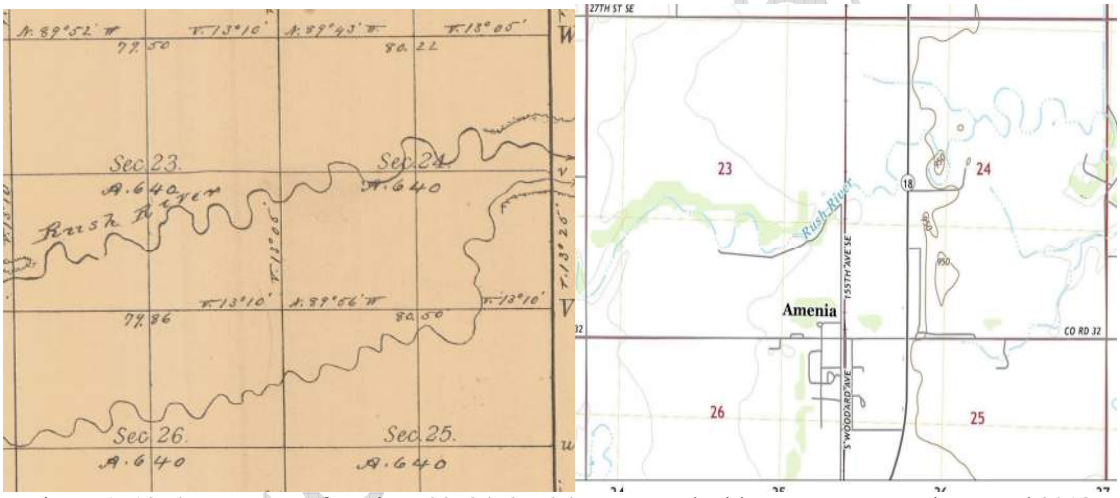

Figure 1: 1874 GLO map of sections 23, 24, 25, 26. Compared with USGS Topo Arthur Quad 2018
Source: North Dakota State Water Commission Archives; USGS Topo View

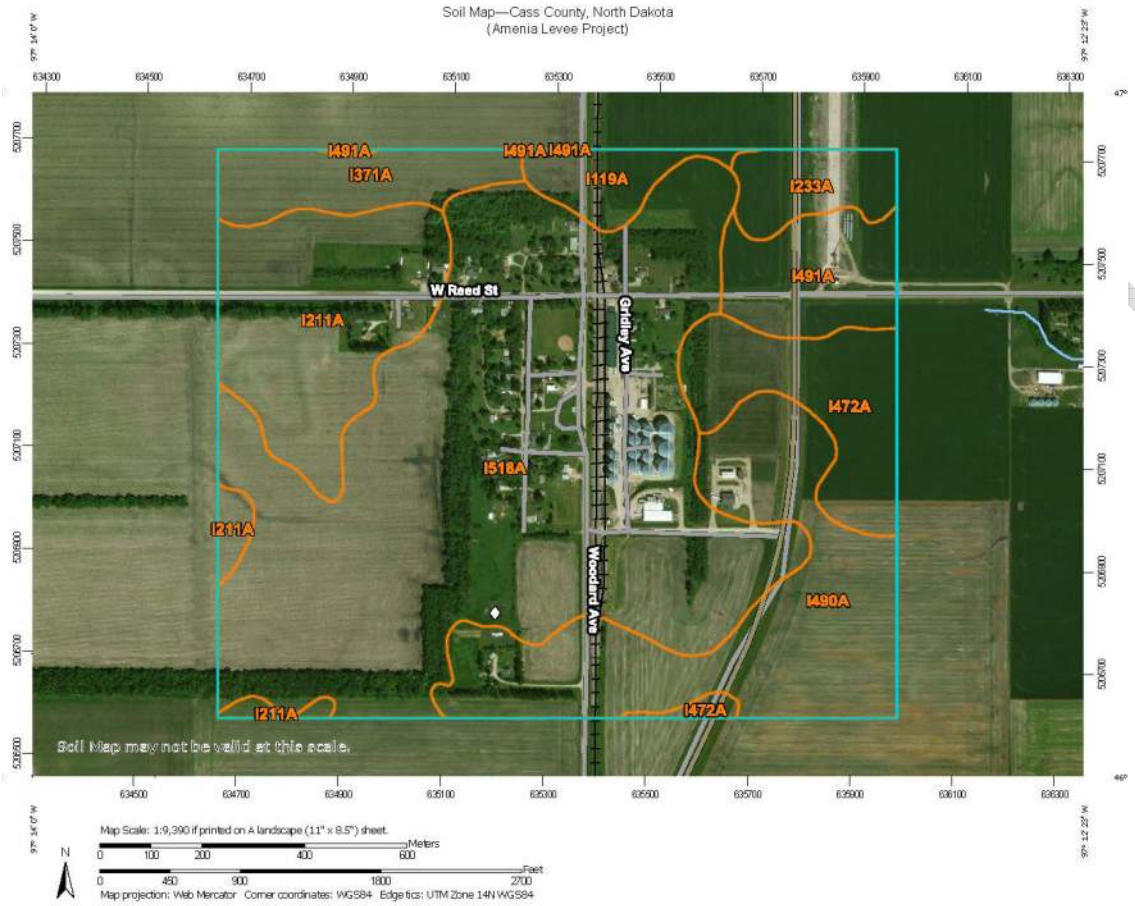

Figure 2: Soil Map of Amenia APE. Map expands beyond APE for clarity.
Source: USDA Web Soil Survey

Soil Type	Soil Classification	Total Acres On Map	Percentage Of Acres
I119A	Bearden silty clay loam, 0 to 2 percent slopes	8.8	2.4%
I211A	Wyndmere loam, 0 to 2 percent slopes	46.3	12.7%
I233A	Fargo silty clay loam, 0 to 1 percent slopes	10.9	3.0%
I371A	Bearden-Kindred silty clay loams, 0 to 2 percent slopes	16.5	4.5%
I472A	Perella silty clay loam, 0 to 1 percent slopes	25.8	7.1%
I490A	Glyndon-Tiffany silt loams, 0 to 2 percent slopes	59.6	16.3%
I491A	Galchutt-Fargo silty clay loams, 0 to 2 percent slopes	18.5	5.1%

I518A	Overly silt loam, 0 to 2 percent slopes	178.8	49.0%
Totals for Area of Interest		**365.2**	**100.0%**

Table 1: Soil types of the APE
Source: USDA Web Soil Survey

Literature Review and Reconnaissance Inventory:
The APE is mixed use industrial-agricultural-residential. Residential structures are concentrated in the NE, NE of Section 26 and industrial structures in the NW, NW of Section 25. The APE is bisected by the Burlington Northern Railway. The area has been subjected to heavy ground disturbance through intensive agricultural production, demolition of structures deemed no longer of use, building of residential homes on the footprint of prior structures and the construction of industrial infrastructure, county roads and state highways (Figure 2).

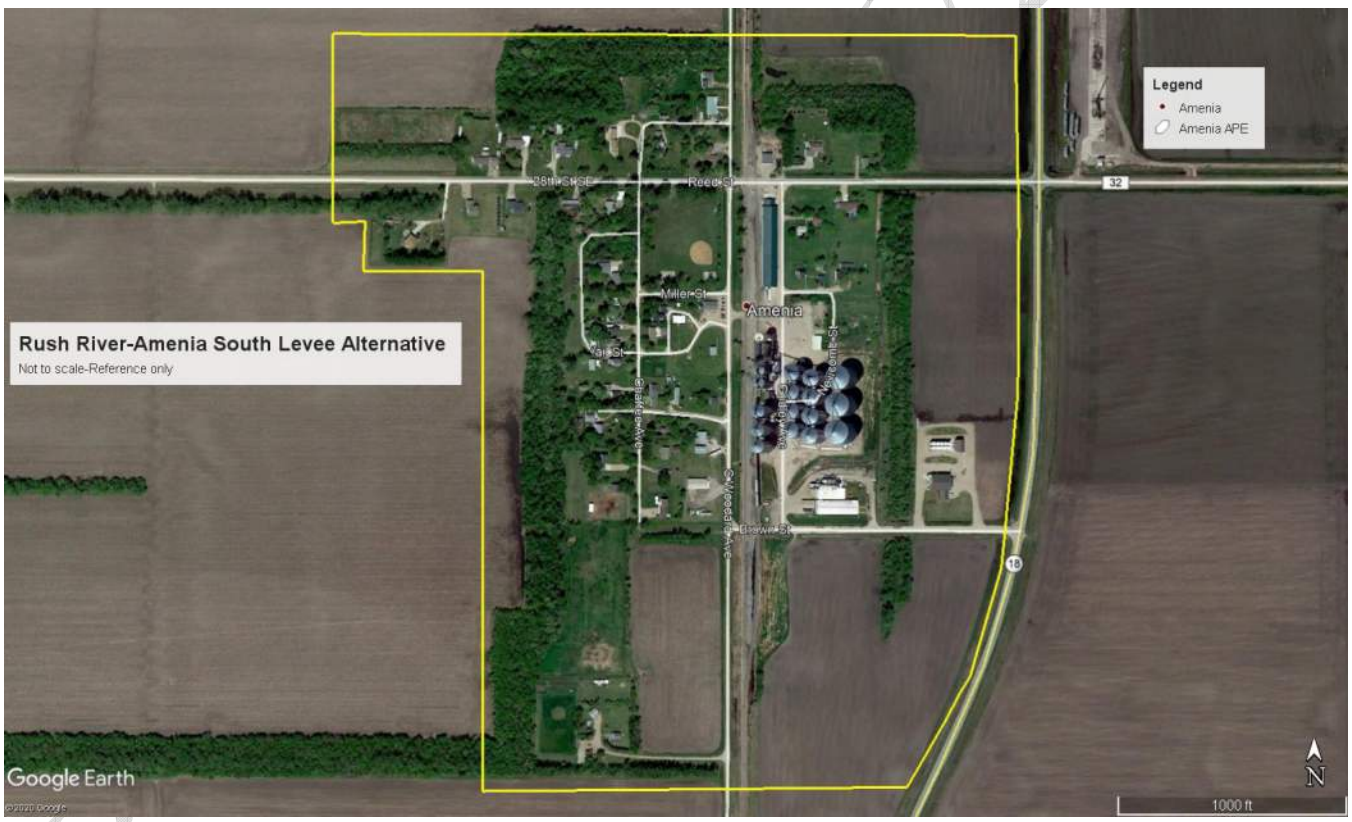

Figure 2: 2018 satellite imagery showing present day Amenia.
Source: Google Earth, 2019.

In 2016 SWCA Environmental Consultants (SWCA) reported that there are seven sites within the APE. The age of the report necessitated a secondary search of NDSHPO records. The search conducted on April 7, 2020 confirmed the findings of the SWCA report. See Table 2, 3 and Figure 3 for APE detail and Appendix C for germane site forms.

Site	Location	Description	Eligibility
32CS7	T141N, R52W, S26	BURLINGTON NORTHERN PACIFIC DEPOT	NOT ELIGIBLE
32CSX142	T141N, R52W, S25	SITE LEAD	NOT ELIGIBLE
32CSX143	T141N, R52W, S25	BURLINGTON NORTHERN SITE LEAD	NOT ELIGIBLE
32CSX144	T141N, R52W, 25	CHAFFEE BONANZA SITE LEAD	NOT ELIGIBLE
32CSX145	T141N, R52W, S26	AMENIA TOWNSITE LEAD	NOT ELIGIBLE
32CS196	T141N, R52W, S26	LUTHERAN CHURCH	NOT ELIGIBLE
32CS5120	T141N, R52W, S23	DWELLING, SINGLE UNIT	UNEVLAUATED

Table 2: Known sites.

MANUSCRIPT NUMBER	AUTHOR	TITLE	SITE WITHIN 1 MILE OF APE
006449	BORCHERT, JEANI L.	North Dakota Department of Transportation Safety Project Cultural Resource Review 1992-1994	N
017394	SNORTLAND BANKS, DIEDRA	Cass County Electric Cooperative's Arthur Service Center AR604 Electric Line: A Class III Cultural Resource Inventory in Cass County, North Dakota	N

Table 3: NDSHPO Manuscripts.

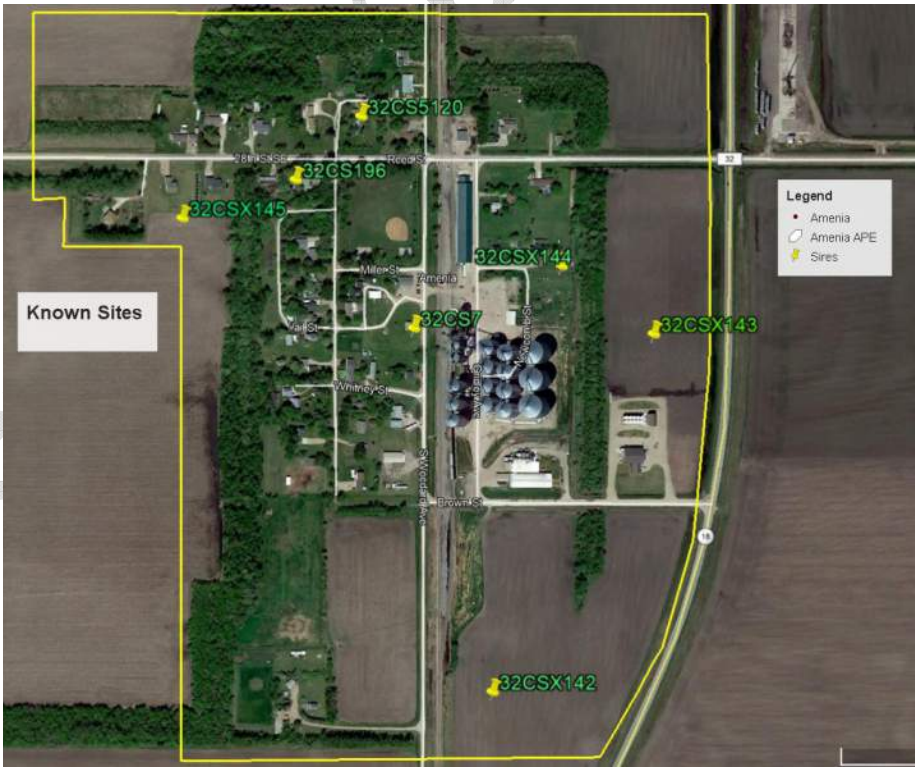

Figure 3: Known sites within the APE
Image Source: Google Earth 2020

Engineering plans (Appendix B) show that there will be no direct effect to NRHP eligible properties and will provide a protective barrier from potential flooding. Known sites and the undertaking's effcts are as follows:

32CS7-
Northern Pacific Depot Burlington Northern: Site form update October 11, 2016 states that structure burned down in approximately 1990.

Undertaking Assessment-No effect.

32CSX0142-
Unknown Site Lead- Site is an active agricultural field. Pedestrian survey revealed no sign of precontact or historic cultural resources. LIDAR imagery (Figure 4) revealed no subsurface structures such as cellars or foundations.

Undertaking Assessment- No effect.

Report continues next page.

Figure 4: Approximate location of 32CSX142
Image Source: North Dakota State Water Commission

32CSX143-
Amenia Burlington Northern: Site form describes exterior boundaries encompassing the entirety of the NW 1/4 of Section 25. The site form, authored January 1980, is assumed to be an attempt of precision over accuracy. Pedestrian survey was restricted to the APE and negative. NRCS has no authority to exceed the APE.

Undertaking Assessment- No effect.

32CSX144:
E. W. Chaffee Bonanza- Site form encompasses the entire eastern portion of Amenia. It is an area where the majority of agricultural infrastructure has been built. While the location of the Chaffee Bonanza farm is documented (Figure 5), as of May 2020 there was no evidence of barns, worker barracks, grain storage or implements from the era. The location is now an active agricultural field with varying plow depths.

Undertaking Assessment-No Effect.

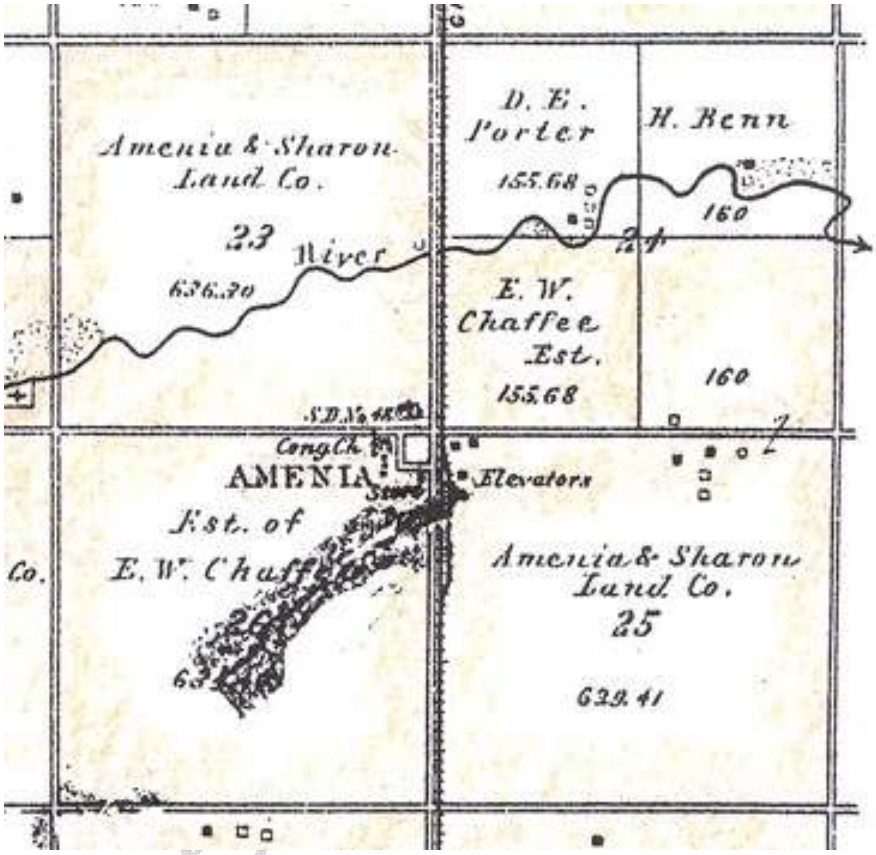

Figure 5: Plat of Amenia Township 1893.
Image Source: North Dakota Historical Society.

32CSX0145:
Amenia Townsite- Includes modern (post 1970) residences and a baseball field. The context of any possible subsurface finds has been disrupted by home construction, sewer, water, natural gas, and telephony installation in addition to agricultural production and engineered street installations. Pedestrian survey revealed no cultural resources (Figure 6, 7). Shovel probes were not permitted as individual homeowner permission had not been obtained.

Undertaking Assessment- No effect.

Figure 6: 32CSX0145 location facing North. 47.005386, -97.223956

Figure 7: 32CSX0145 location facing West. 47.005386, -97.223956

32C190:
Trinity Lutheran Church-Per site form, the church was struck by lightning in 1949 and burned. The steeple survived in private ownership (Chaffee, 1977) until the steeple was donated to the Amenia City Cemetery and is under the care of the cemetery association. Its current condition of the steeple is unknown and possession by the cemetery association is unverified.

Undertaking Assessment- No effect.

32CS5120:
Reed House-Structure bears the characteristics of a Stick Victorian as described by McAllester (pg. 255). While some elements, such as the front gable decorated verge boards, borrow from Queen Anne, the steeply pitched cross gabled roof, curved porch braces, turned porch supports and horizontal bands raised from the exterior wall for emphasis all adhere to type.

The property is damaged. Property may be bank owned (personal communication Keith Peltier, ProSeed General Manager). Brick foundation is being cannibalized. Windows are intact but layers of grime prevented interior view. No permission was obtained to enter the structure. See Appendix C for photographs and updated site form.

Figure 8: 32CS5120 Oblique facing Northwest. 47.006476, - 97.220032

Undertaking Assessment-No direct effect. Visual effect possible during winter.

Results of Field Reconnaissance:
When the 1893 township map is overlaid with current satellite imagery (Figure 9) the consistency of structure type and location choice during the 127 years is striking. The original elevators, mercantile, congregational church and several homes burned prior to 1950 (Chaffee, 1977) and modern equivalents were rebuilt almost on the building's footprints.

Figure 9: 1893 map overlay with 2018 satellite image
Image Source: North Dakota Historical Society; Google Earth 2020.

The levee project will be built by adding elevation to the existing ground except for the retention pond and water pump installation in the far Northeast of the APE. Agricultural operations resulted in heavy ground disturbance and necessitated a large separation between shovel probes to maximize the probability of cultural resource discovery. The five shovel probes were spaced 20 (+/-) meters apart from a central point, following cardinal directions. Each shovel probe was approximately 30-centimeter diameter and 50-centimeter depth divided and into arbitrary 10-centimeter levels. The excavated heavy Red River valley clay was remarkably consistent and had no discernable A-B horizon. The clay prohibited traditional screening through .25-inch mesh cloth and required hand troweling. No cultural material was discovered during the shovel probes.

The entirety of the linear APE was walked by a team of three. One team member on centerline and a team member 15 meters either side. Several machine manufactured bolts, washers and beverage cans,

randomly dispersed, were visible across the APE with no discernable pattern. It is assumed that the material was left behind during cultivation practices. The eastern portion is used by Pioneer Seed as test plots. No cultural material was observed.

Figure 10: Shovel probeing
Image Source: Google Earth, 2020

SHOVEL PROBE	CULTURAL MATERIAL	MUNSELL	TEXTURE	LAT/LON WGS 84 UTM Z14
1	NEGATIVE	10YR 2/1	HEAVY CLAY	47.0073, -97.2150 635680, 5207520
2	NEGATIVE	10YR 2/1	HEAVY CLAY	47.0075, -97.2151 635679, 5207598
3	NEGATIVE	10YR 2/1	HEAVY CLAY	47.0073, -97.2153 635663, 5207520
4	NEGATIVE	10YR 2/1	HEAVY CLAY	47.0073, -97.2148 635701,5207521
5	NEGATIVE	10YR 2/1	HEAVY CLAY	47.0071, -97.2151 635679,5207498

Table 3: Shovel Probe Results

Directly behind 32CS5120 is a side gabled, gambrel roofed 1.5 story, wood structure. The building contains multiple mismatched elements making an accurate date of construction or building style challenging. An original chimney remains in the easternmost portion of the structure, but doors, windows and dormers do not conform to any specific architectural style. Electrical service was installed post construction. It has no known association with the Chaffee Bonanza Farm nor, as a standalone structure, does it qualify for the NRHP under established criteria. Images of the structure are in Appendix C and is assigned field number NRCS 20017001.

Conclusions and Recommendations:

Rush River-Amenia South Levee Alternative undertaking was subjected extensive literature review by both NRCS staff and a contractor. In addition, NRCS staff performed field survey and limited shovel probeing. The investigation resulted in no cultural artifacts or properties that require avoidance. The Burlington Northern Site Lead (32CSX143), Amenia Townsite (32CSX145), Lutheran Church (32CS196), and Chaffee Bonanza Site Lead (32CSX144) have all been either razed, destroyed by fire or built over.

32CS5120 should be evaluated for NRHP eligibility due to a possible connection to the Chaffee Bonanza Farm and a determination of eligibility requested from NDSHPO. Such formal assessment is beyond the scope of this report. While the undertaking will have no direct effect to 32CS5120, the visual effects will be minimal as the 5-7-foot-high, grass covered levee will be obscured in the Summer and Fall due to tree leaf-out and crop growth.

A determination of "***no effect to historic properties"*** is recommended.

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Appendix A
SWCA Class 1 Report

Appendix B
Engineering Design and NRCS Practices

RCPP/PL566
RUSH RIVER - AMENIA
SOUTH LEVEE ALTERNATIVE

CASS COUNTY JOINT
WATER RESOURCE DISTRICT

CASS COUNTY, NORTH DAKOTA

moore engineering, inc.
Consulting Engineering · · Land Surveying
925 10th Avenue East · · West Fargo, North Dakota
www.mooreengineeringinc.com

VICINITY MAP

PROJECT No. 18747

PRELIMINARY

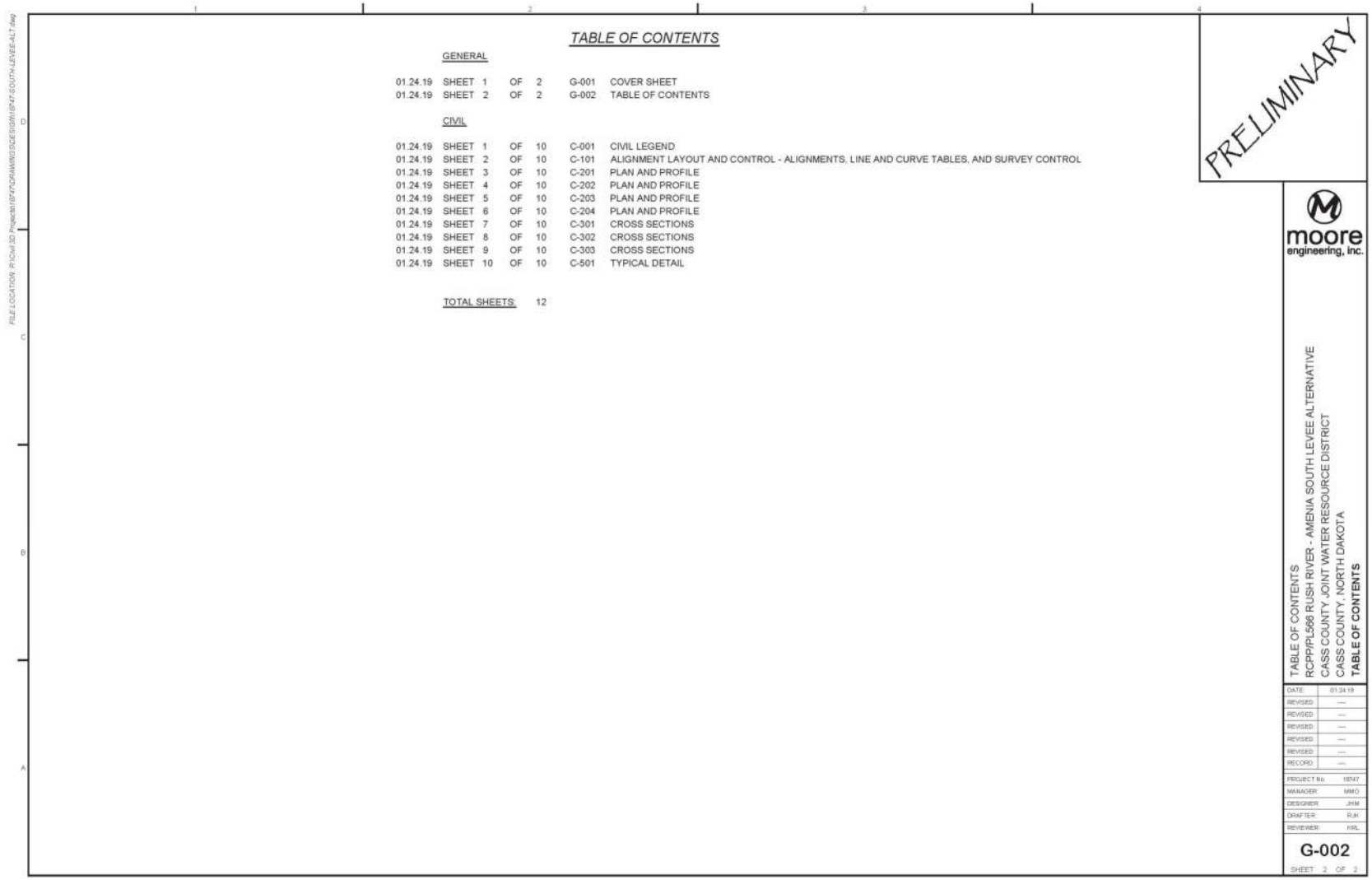


TABLE OF CONTENTS

GENERAL

01.24.19	SHEET	1	OF	2	G-001 COVER SHEET
01.24.19	SHEET	2	OF	2	G-002 TABLE OF CONTENTS

CIVIL

01.24.19	SHEET	1	OF	10	C-001 CIVIL LEGEND
01.24.19	SHEET	2	OF	10	C-101 ALIGNMENT LAYOUT AND CONTROL - ALIGNMENTS, LINE AND CURVE TABLES, AND SURVEY CONTROL
01.24.19	SHEET	3	OF	10	C-201 PLAN AND PROFILE
01.24.19	SHEET	4	OF	10	C-202 PLAN AND PROFILE
01.24.19	SHEET	5	OF	10	C-203 PLAN AND PROFILE
01.24.19	SHEET	6	OF	10	C-204 PLAN AND PROFILE
01.24.19	SHEET	7	OF	10	C-301 CROSS SECTIONS
01.24.19	SHEET	8	OF	10	C-302 CROSS SECTIONS
01.24.19	SHEET	9	OF	10	C-303 CROSS SECTIONS
01.24.19	SHEET	10	OF	10	C-501 TYPICAL DETAIL

TOTAL SHEETS: 12

PRELIMINARY

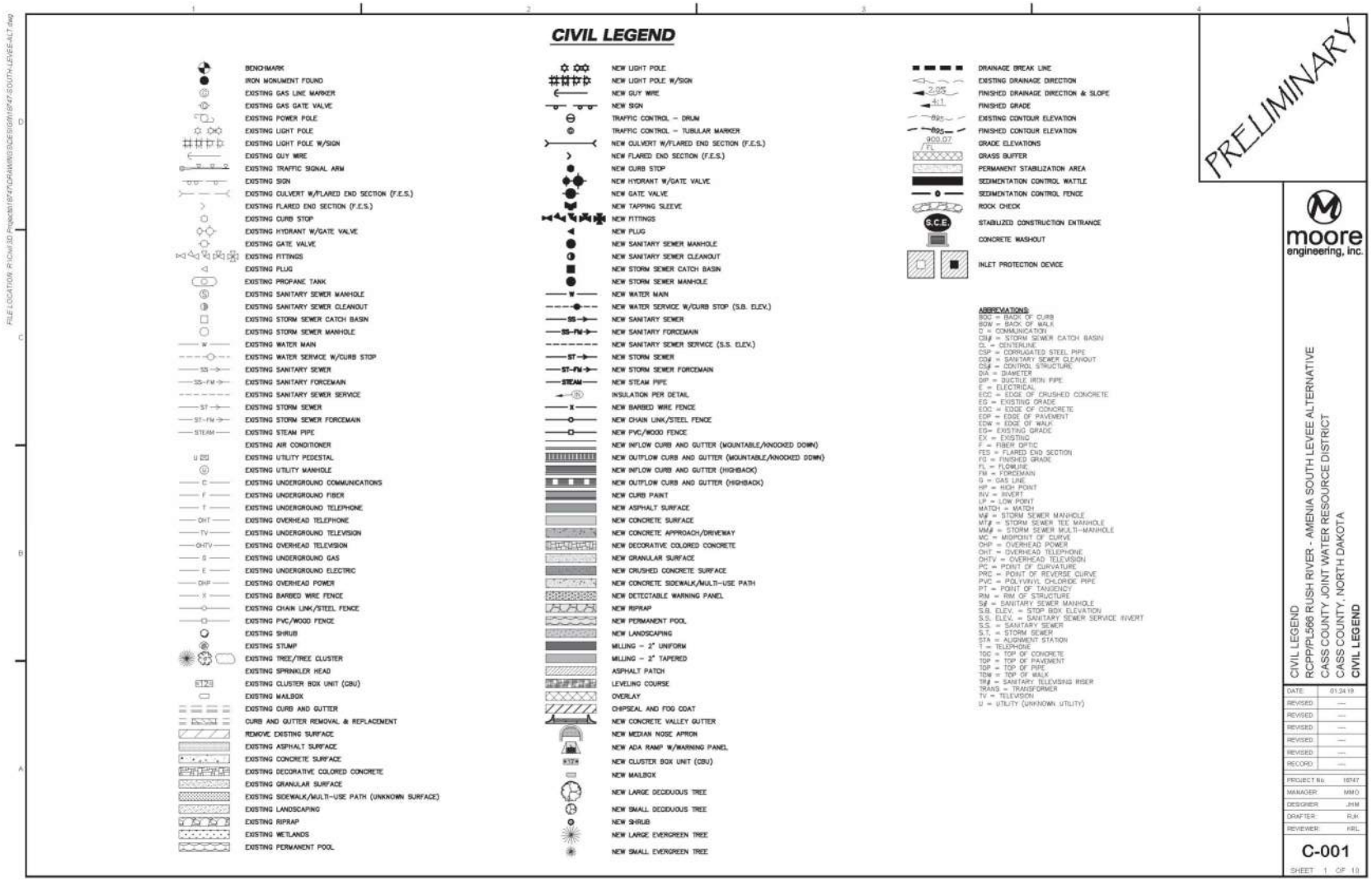
moore engineering, inc.

TABLE OF CONTENTS
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
TABLE OF CONTENTS

DATE:	01.24.19
REVISED:	---
REVISED:	---
REVISED:	---
REVISED:	---
REVISED:	---
RECORD:	---
PROJECT No:	16747
MANAGER:	MMO
DESIGNER:	JHM
DRAFTER:	RJH
REVIEWER:	KRL

G-002

SHEET 2 OF 2


CIVIL LEGEND
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EXISTING POWER POLE
EXISTING LIGHT POLE
EXISTING LIGHT POLE W/SIGN
EXISTING GUY WIRE
EXISTING TRAFFIC SIGNAL ARM
EXISTING SIGN
EXISTING CULVERT W/FLARED END SECTION (F.E.S.)
EXISTING FLARED END SECTION (F.E.S.)
EXISTING CURB STOP
EXISTING HYDRANT W/GATE VALVE
EXISTING GATE VALVE
EXISTING FITTINGS
EXISTING PLUG
EXISTING PROPANE TANK
EXISTING SANITARY SEWER MANHOLE
EXISTING SANITARY SEWER CLEANOUT
EXISTING STORM SEWER CATCH BASIN
EXISTING STORM SEWER MANHOLE
EXISTING WATER MAIN
EXISTING WATER SERVICE W/CURB STOP
EXISTING SANITARY SEWER
EXISTING SANITARY FORCEMAIN
EXISTING SANITARY SEWER SERVICE
EXISTING STORM SEWER
EXISTING STORM SEWER FORCEMAIN
EXISTING STEAM PIPE
EXISTING AIR CONDITIONER
EXISTING UTILITY PEDESTAL
EXISTING UTILITY MANHOLE
EXISTING UNDERGROUND COMMUNICATIONS
EXISTING UNDERGROUND FIBER
EXISTING UNDERGROUND TELEPHONE
EXISTING OVERHEAD TELEPHONE
EXISTING UNDERGROUND TELEVISION
EXISTING OVERHEAD TELEVISION
EXISTING UNDERGROUND GAS
EXISTING UNDERGROUND ELECTRIC
EXISTING OVERHEAD POWER
EXISTING BARBED WIRE FENCE
EXISTING CHAIN LINK/STEEL FENCE
EXISTING PVC/WOOD FENCE
EXISTING SHRUB
EXISTING STUMP
EXISTING TREE/TREE CLUSTER
EXISTING SPRINKLER HEAD
EXISTING CLUSTER BOX UNIT (CBU)
EXISTING MAILBOX
EXISTING CURB AND GUTTER
CURB AND GUTTER REMOVAL & REPLACEMENT
REMOVE EXISTING SURFACE
EXISTING ASPHALT SURFACE
EXISTING CONCRETE SURFACE
EXISTING DECORATIVE COLORED CONCRETE
EXISTING GRANULAR SURFACE
EXISTING SIDEWALK/MULTI-USE PATH (UNKNOWN SURFACE)
EXISTING LANDSCAPING
EXISTING RIPRAP
EXISTING WETLANDS
EXISTING PERMANENT POOL
NEW LIGHT POLE
NEW LIGHT POLE W/SIGN
NEW GUY WIRE
NEW SIGN
TRAFFIC CONTROL – DRUM
TRAFFIC CONTROL – TUBULAR MARKER
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NEW FLARED END SECTION (F.E.S.)
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NEW PLUG
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NEW SANITARY SEWER CLEANOUT
NEW STORM SEWER CATCH BASIN
NEW STORM SEWER MANHOLE
NEW WATER MAIN
NEW WATER SERVICE W/CURB STOP (S.B. ELEV.)
NEW SANITARY SEWER
NEW SANITARY FORCEMAIN
NEW SANITARY SEWER SERVICE (S.S. ELEV.)
NEW STORM SEWER
NEW STORM SEWER FORCEMAIN
NEW STEAM PIPE
INSULATION PER DETAIL
NEW BARBED WIRE FENCE
NEW CHAIN LINK/STEEL FENCE
NEW PVC/WOOD FENCE
NEW INFLOW CURB AND GUTTER (MOUNTABLE/KNOCKED DOWN)
NEW OUTFLOW CURB AND GUTTER (MOUNTABLE/KNOCKED DOWN)
NEW INFLOW CURB AND GUTTER (HIGHBACK)
NEW OUTFLOW CURB AND GUTTER (HIGHBACK)
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NEW ASPHALT SURFACE
NEW CONCRETE SURFACE
NEW CONCRETE APPROACH/DRIVEWAY
NEW DECORATIVE COLORED CONCRETE
NEW GRANULAR SURFACE
NEW CRUSHED CONCRETE SURFACE
NEW CONCRETE SIDEWALK/MULTI-USE PATH
NEW DETECTABLE WARNING PANEL
NEW RIPRAP
NEW PERMANENT POOL
NEW LANDSCAPING
MILLING – 2" UNIFORM
MILLING – 2" TAPERED
ASPHALT PATCH
LEVELING COURSE
OVERLAY
CHIPSEAL AND FOG COAT
NEW CONCRETE VALLEY GUTTER
NEW MEDIAN NOSE APRON
NEW ADA RAMP W/WARNING PANEL
NEW CLUSTER BOX UNIT (CBU)
NEW MAILBOX
NEW LARGE DECIDUOUS TREE
NEW SMALL DECIDUOUS TREE
NEW SHRUB
NEW LARGE EVERGREEN TREE
NEW SMALL EVERGREEN TREE
DRAINAGE BREAK LINE
EXISTING DRAINAGE DIRECTION
FINISHED DRAINAGE DIRECTION & SLOPE
FINISHED GRADE
EXISTING CONTOUR ELEVATION
FINISHED CONTOUR ELEVATION
GRADE ELEVATIONS
GRASS BUFFER
PERMANENT STABILIZATION AREA
SEDIMENTATION CONTROL WATTLE
SEDIMENTATION CONTROL FENCE
ROCK CHECK
S.C.E.
STABILIZED CONSTRUCTION ENTRANCE
CONCRETE WASHOUT
INLET PROTECTION DEVICE
ABBREVIATIONS:
BOC = BACK OF CURB
BSW = BACK OF WALK
C = COMMUNICATION
CB# = STORM SEWER CATCH BASIN
CL = CENTERLINE
CSP = CORRUGATED STEEL PIPE
CO# = SANITARY SEWER CLEANOUT
CS# = CONTROL STRUCTURE
DIA = DIAMETER
DIP = DUCTILE IRON PIPE
E = ELECTRICAL
EOC = EDGE OF CRUSHED CONCRETE
EG = EXISTING GRADE
EOC = EDGE OF CONCRETE
EOP = EDGE OF PAVEMENT
EOW = EDGE OF WALK
EG= EXISTING GRADE
EX = EXISTING
F = FIBER OPTIC
FES = FLARED END SECTION
FG = FINISHED GRADE
FL = FLOWLINE
FM = FORCEMAIN
G = GAS LINE
HP = HIGH POINT
INV = INVERT
LP = LOW POINT
MATCH = MATCH
M# = STORM SEWER MANHOLE
MT# = STORM SEWER TEE MANHOLE
MM# = STORM SEWER MULTI-MANHOLE
MC = MIDPOINT OF CURVE
OHP = OVERHEAD POWER
OHT = OVERHEAD TELEPHONE
OHTV = OVERHEAD TELEVISION
PC = POINT OF CURVATURE
PRC = POINT OF REVERSE CURVE
PVC = POLYVINYL CHLORIDE PIPE
PT = POINT OF TANGENCY
RIM = RIM OF STRUCTURE
S# = SANITARY SEWER MANHOLE
S.B. ELEV. = STOP BOX ELEVATION
S.S. ELEV. = SANITARY SEWER SERVICE INVERT
S.S. = SANITARY SEWER
S.T. = STORM SEWER
STA = ALIGNMENT STATION
T = TELEPHONE
TOC = TOP OF CONCRETE
TOP = TOP OF PAVEMENT
TOP = TOP OF PIPE
TOW = TOP OF WALK
TR# = SANITARY TELEVISING RISER
TRANS = TRANSFORMER
TV = TELEVISION
U = UTILITY (UNKNOWN UTILITY)
PRELIMINARY
moore engineering, inc.
CIVIL LEGEND
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
CIVIL LEGEND
DATE: 01.24.19
REVISED: ---
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REVISED: ---
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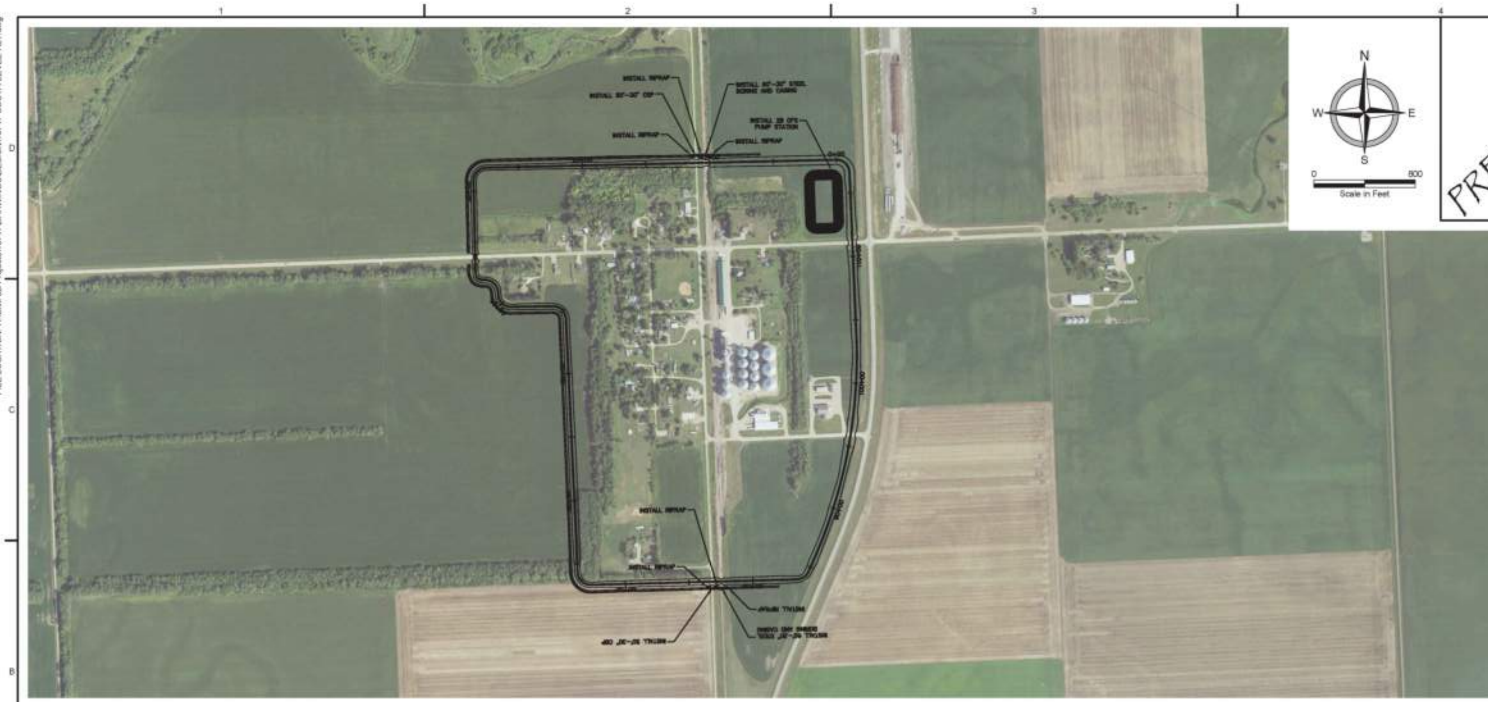
REVISED: ---
RECORD: ---
PROJECT No. 16747
MANAGER: MMO
DESIGNER: JHM
DRAFTER: RJK
REVIEWER: KRL
C-001
SHEET 1 OF 19



PRELIMINARY

moore engineering, inc.

ALIGNMENT LAYOUT AND CONTROL
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
ALIGNMENTS, LINE AND CURVE TABLES AND SURVEY CONTROL

DATE:	01.24.19
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PROJECT No:	18747
MANAGER:	MMO
DESIGNER:	JHM
DRAFTER:	RJK
REVIEWER:	KRL

C-101

SHEET 2 OF 10

HORIZONTAL CONTROL

NORTH DAKOTA COORDINATE SYSTEM OF 1983, NAD83, SOUTH ZONE
COMBINATION FACTOR (cf) = .9998875
ALL COORDINATES ARE CASS COUNTY GROUND COORDINATES

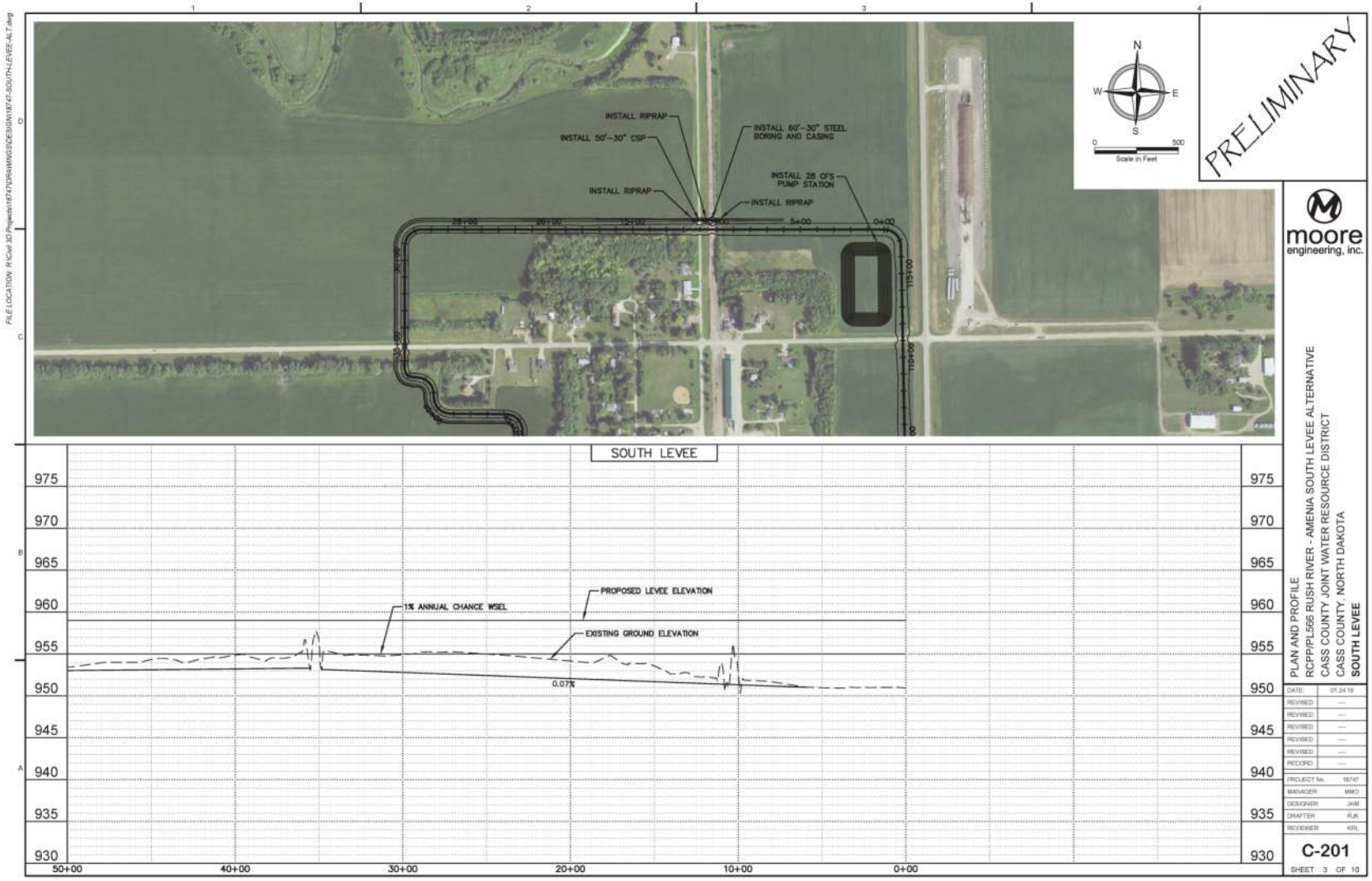
VERTICAL CONTROL

NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

BENCHMARKS/SURVEY CONTROL

PRIOR TO PROJECT START, OWNER WILL SET AND ESTABLISH BENCHMARKS AND SURVEY CONTROL FOR THE PROJECT, AND CLEARLY MARK RIGHT-OF-WAY.

FILE LOCATION: R:\Civil 3D Projects\18747\DRAWINGS\DESIGN\18747-SOUTH-LEVEE-ALT.dwg


INSTALL RIPRAP
INSTALL 50'-30" CSP
INSTALL 80'-30" STEEL BORING AND CASING
INSTALL 28 CFS PUMP STATION
INSTALL RIPRAP
INSTALL RIPRAP
N
W
E
S
0
500
Scale in Feet
PRELIMINARY
SOUTH LEVEE
1% ANNUAL CHANCE WSEL
PROPOSED LEVEE ELEVATION
EXISTING GROUND ELEVATION
0.07%
975
970
965
960
955
950
945
940
935
930
50+00
40+00
30+00
20+00
10+00
0+00
moore engineering, inc.
PLAN AND PROFILE
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
SOUTH LEVEE
DATE: 01.24.19
REVISED: ---
REVISED: ---
REVISED: ---
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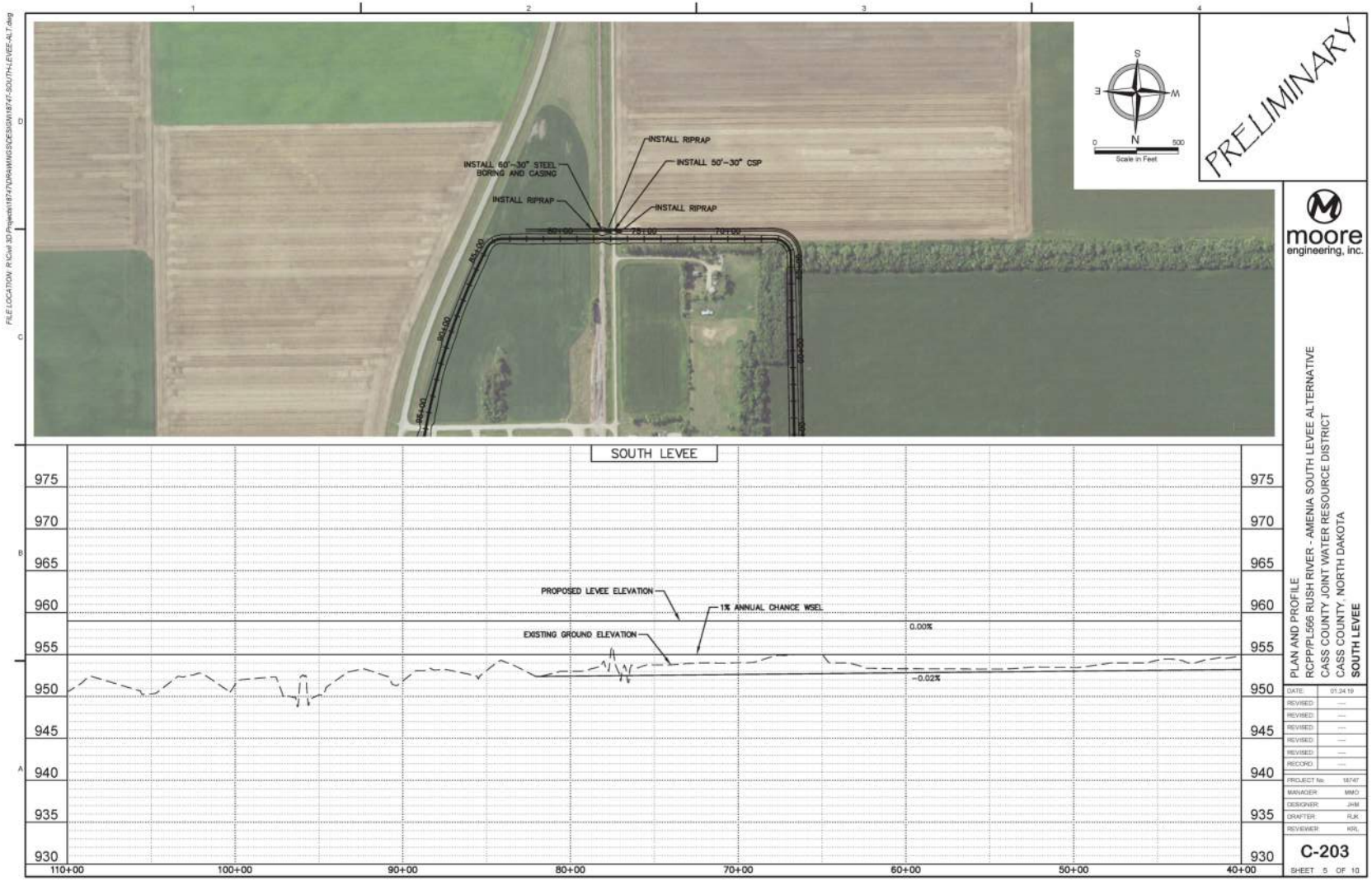
REVISED: ---
RECORD: ---
PROJECT No. 16747
MANAGER: MMD
DESIGNER: JHM
DRAFTER: RJK
REVIEWER: KRL
C-201
SHEET 3 OF 10

PRELIMINARY
moore engineering, inc.
PLAN AND PROFILE
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
SOUTH LEVEE
C-202
SOUTH LEVEE
PROPOSED LEVEE ELEVATION
EXISTING GROUND ELEVATION
1% ANNUAL CHANCE WSEL
0.07%
0.00%
-0.02%
INSTALL 50'-30" CSP
RIPRAP
N
S
E
W
Scale in Feet


INSTALL 60"-30" STEEL BORING AND CASING
INSTALL RIPRAP
INSTALL RIPRAP
INSTALL 50'-30" CSP
INSTALL RIPRAP
S
E
W
N
0
500
Scale in Feet
PRELIMINARY
SOUTH LEVEE
PROPOSED LEVEE ELEVATION
1% ANNUAL CHANCE WSEL
EXISTING GROUND ELEVATION
0.00%
-0.02%
975
970
965
960
955
950
945
940
935
930
110+00
100+00
90+00
80+00
70+00
60+00
50+00
40+00
moore engineering, inc.
PLAN AND PROFILE
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
SOUTH LEVEE
DATE: 01.24.19
REVISED: ---
REVISED: ---
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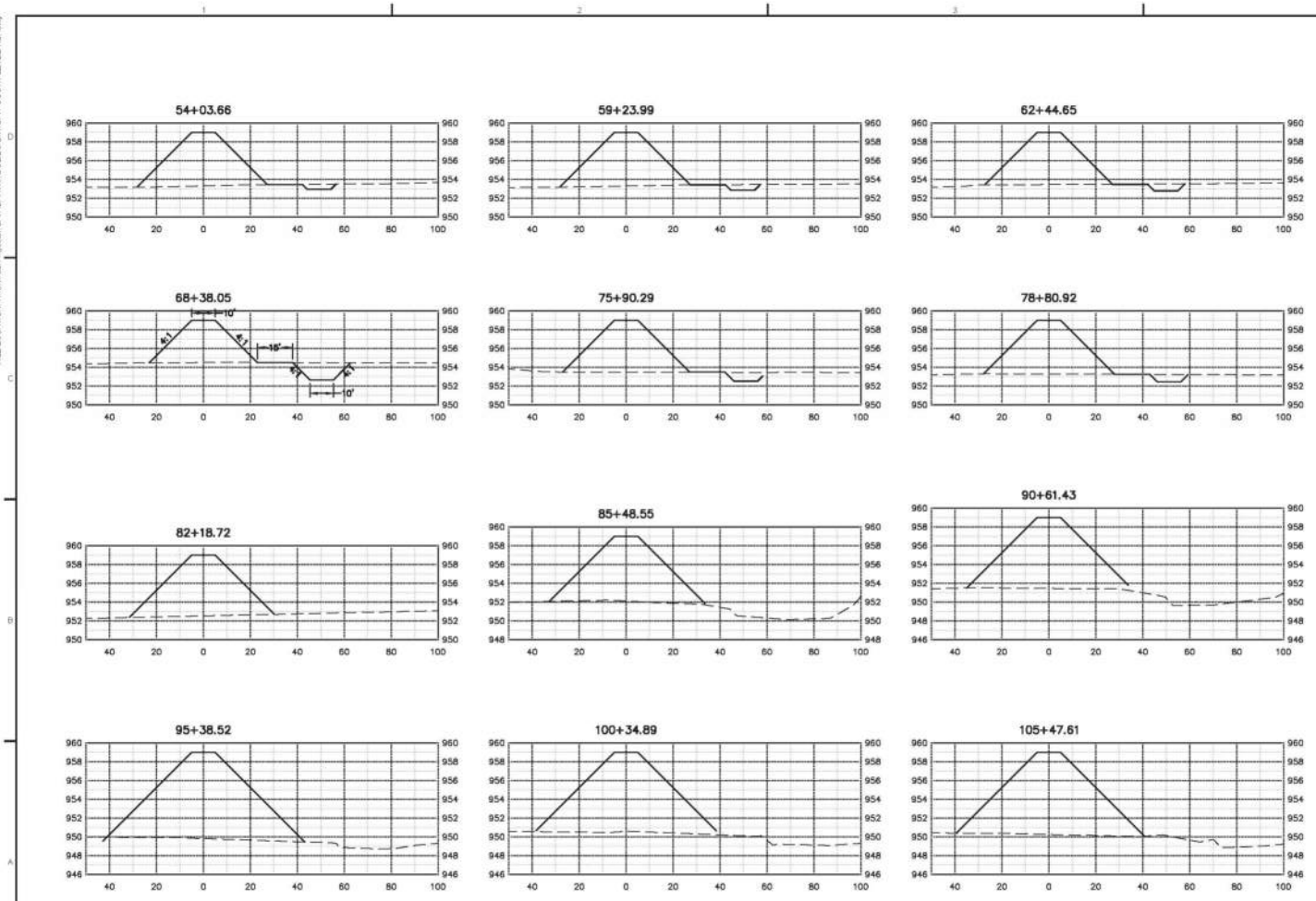
RECORD: ---
PROJECT No. 16747
MANAGER: MMD
DESIGNER: JHM
DRAFTER: RJK
REVIEWER: KRL
C-203
SHEET 5 OF 10

PRELIMINARY
moore engineering, inc.
PLAN AND PROFILE
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
SOUTH LEVEE
C-204
SHEET 6 OF 10
SOUTH LEVEE
PROPOSED LEVEE ELEVATION
EXISTING GROUND ELEVATION
1% ANNUAL CHANCE WSEL
0.02%
0.00%
INSTALL 60"-30" STEEL BORING AND CASING
INSTALL RIPRAP
INSTALL 2# CFS PUMP STATION
INSTALL RIPRAP
INSTALL 60"-30" STEEL BORING AND CASING
Scale in Feet
N
S
E
W

PRELIMINARY
moore engineering, inc.
CROSS SECTIONS
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
CROSS SECTIONS
C-301
0+19.95
3+02.61
8+03.41
13+57.46
18+66.47
23+57.74
28+38.97
30+95.99
33+46.43
34+54.99
35+91.86
36+82.38
40+12.26
42+66.42
49+04.47



PRELIMINARY

moore engineering, inc.

CROSS SECTIONS
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
CROSS SECTIONS

DATE:	01.24.19
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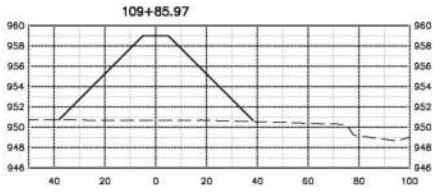
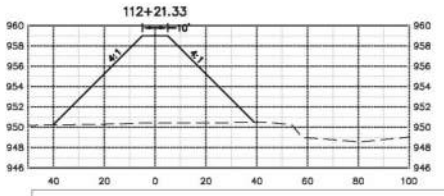
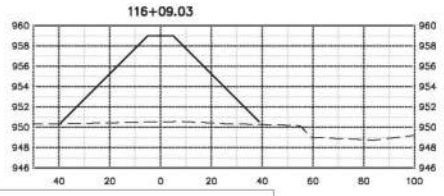
RECORD:	---
PROJECT No.	16747
MANAGER:	MMO
DESIGNER:	JHM
DRAFTER:	RJH
REVIEWER:	KRL

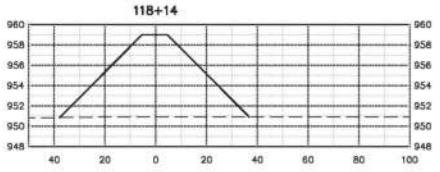
C-302

SHEET 8 OF 10









EARTHWORK VOLUMES

Station	Cut Area (Ft^2)	Fill Area (Ft^2)	Cut Vol (Yd^3)	Fill Vol (Yd^3)	Total Cut (Yd^3)	Total Fill (Yd^3)
0+19.95	0.00	339.39	0.00	0.00	0.00	0.00
3+02.61	0.00	338.32	0.00	3547.43	0.00	3547.43
8+03.41	6.52	287.23	60.48	5801.49	60.48	9348.92
13+57.46	11.88	230.45	188.80	5311.50	249.28	14660.42
18+66.47	49.67	152.82	580.14	3612.77	829.42	18273.19
23+57.74	59.39	110.44	992.18	2395.11	1821.60	20668.30
28+38.97	53.46	74.35	1090.83	1646.34	2912.42	22314.64
30+95.99	41.29	113.88	518.06	895.20	3430.48	23209.84
33+46.43	27.92	112.00	320.99	1047.63	3751.47	24257.46
34+54.99	43.99	87.31	144.58	400.70	3896.05	24658.16
35+91.86	89.57	65.77	338.52	388.01	4234.57	25046.17
36+82.38	24.45	120.33	257.33	311.22	4491.90	25357.39
40+12.26	26.79	100.92	321.68	1351.27	4813.58	26708.66
42+66.42	11.35	145.85	202.37	1161.53	5015.95	27870.19
49+04.47	6.83	168.18	189.62	3708.31	5205.57	31578.50
54+03.66	6.75	186.33	125.48	3277.11	5331.05	34855.61
59+23.99	7.77	187.01	139.85	3597.46	5470.90	38453.07
62+44.65	9.64	179.16	103.38	2174.39	5574.28	40627.46
68+38.05	31.64	126.27	513.19	3355.69	6087.48	43983.15
75+90.29	12.49	178.58	614.73	4246.62	6702.21	48229.77
78+80.92	10.16	188.74	121.89	1976.94	6824.09	50206.71
82+18.72	0.00	232.58	63.53	2635.54	6887.63	52842.25
85+48.55	0.00	264.20	0.00	3035.17	6887.63	55877.42
90+61.43	0.00	303.36	0.02	5391.07	6887.65	61268.49
95+38.52	0.33	432.69	2.88	6503.73	6890.52	67772.21
100+34.89	0.00	376.25	2.97	7436.79	6893.49	75209.01
105+47.61	0.00	394.70	0.00	7320.70	6893.49	82529.70
109+85.97	0.00	360.80	0.00	6132.95	6893.49	88662.65
112+21.33	0.00	384.29	0.00	3247.47	6893.49	91910.12
116+09.03	0.00	379.80	0.00	5485.92	6893.49	97396.04
118+14	0.00	342.13	0.00	2736.48	6893.49	100132.52

PRELIMINARY

moore engineering, inc.

CROSS SECTIONS
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
CROSS SECTIONS

DATE:	01.24.19
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RECORD:	---
PROJECT No.	16747
MANAGER:	MMO
DESIGNER:	JHM
DRAFTER:	RJH
REVIEWER:	KRL

C-303

SHEET 9 OF 10

PRELIMINARY
moore engineering, inc.
TYPICAL DETAILS
RCPP/PL566 RUSH RIVER - AMENIA SOUTH LEVEE ALTERNATIVE
CASS COUNTY JOINT WATER RESOURCE DISTRICT
CASS COUNTY, NORTH DAKOTA
TYPICAL DETAILS
C-501
STORM POND DETAIL - SOUTH LEVEE ALTERNATIVE
TYPICAL LEVEE SECTION

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

DIKE

(Feet)

CODE 356

DEFINITION

A barrier constructed of earth or manufactured materials.

PURPOSES

- To protect people and property from floods.
- To control water level in connection with crop production, fish and wildlife management, or wetland maintenance, improvement, restoration or construction.

CONDITIONS WHERE PRACTICE APPLIES

All sites that are subject to damage by flooding or inundation and where it is desired to reduce the hazard to people and to reduce damage to land and property.

Sites where the control of water level is desired.

The dike standard does not apply to sites where the Pond, Water and Sediment Control Basin, Diversion, or Terrace standards are appropriate. Dikes used to reduce flooding are normally constructed adjacent and/or parallel to a stream, river, wetland or water body and are not constructed across the stream, river or water body. Dikes used to control water levels usually have small interior drainage areas in comparison to the surface area of the regulated water level.

CRITERIA

General Criteria Applicable to All Purposes

Classification. The dike classification is determined by the hazard to life and the value of the protected land, crops, and property. Classification must consider land use changes likely to occur over the life of the dike.

Class I dikes are located on sites where failure of the dike may cause loss of life or serious damage to homes, primary highways, industrial buildings, commercial buildings, major railroads, or important public utilities.

All dikes with a design water height of more than 12 feet (3.7m) above normal ground surface, exclusive of crossings of sloughs, old channels, or low areas shall be Class I.

Class II dikes are located on sites where failure of the dike may cause damage to isolated homes, secondary highways, minor railroads, relatively important public utilities, high value land, or high value crops.

Class III dikes are located on sites where damage likely to occur from failure will be minimal.

Constructed Elevation. The constructed elevation of a dike whose purpose is to prevent flooding shall be the sum of the following:

- The water elevation attained by a flood or high tide of the design frequency in Table 1 with the critical duration and timing. This is the design high water.
- The larger of the minimum freeboard in Table 1 or the wave height caused by wind or boat traffic.
- The allowance for settlement.

The constructed elevation of a dike whose purpose is to control water level shall be the sum of the following:

- The water elevation at the highest water level control.
- The rise in water height above the highest water level control caused by a flood of the design frequency in Table 1. This is the design high water.
- The larger of the minimum freeboard in Table 1 or the wave height caused by wind of the design frequency in Table 1.
- The allowance for settlement.

Settlement. The allowance for settlement of compacted earth fill material shall be a minimum of 5 percent of the dike height unless an analysis shows that a lesser amount is adequate. For fill material that is hauled from off-site, dumped, and shaped (referred to as "dumped and shaped"), the allowance for settlement shall be a minimum of 15 percent of the dike height. For fill material that is excavated adjacent to the dike and dropped from the excavator (referred to as "dropped"), the allowance for settlement shall be a minimum of 20 percent of the dike height. The allowance for settlement of dumped and shaped or dropped organic soil fill material shall be a minimum of 40 percent of the dike height.

For the purpose of this standard, organic soils are described as follows:

- Soil layers that are not saturated with water for more than a few days at a time are organic if they have 20 percent or more organic carbon.
- Layers that are saturated for longer periods, or were saturated before being drained, are organic if:

  they have 12 percent or more of organic carbon and no clay, or

  18 percent or more organic carbon and 60 percent or more clay, or

  a proportional amount of organic carbon, between 12 and 18 percent, if the clay content is between 0 and 60 percent.

- All soils described in the local soil survey as an organic soil.

Top Width and Side Slopes. The minimum top widths and side slopes for earth embankments shall be that shown in Table 1.

Berms. The need for a constructed berm on an embankment will be based on the results of an embankment and foundation stability analysis. If a stability analysis is not done, all earth dikes shall have berms either constructed or occurring naturally on both sides meeting the following criteria:

- Constructed berms shall be at a constant elevation and sloped away from the dike.
- Where dikes cross channels, ditches, borrow areas, streams, sloughs, swales, gullies, etc. they shall have a berm constructed on each side. The top elevation of these berms will be at least 1 foot above the average ground surface on each side of the channel, ditch, borrow area, stream, slough, swales, gully, etc. and slope away from the dike.
- The minimum top width of natural or constructed berms shall be as shown in Table 1.
- The minimum side slope ratio of constructed berms shall be 2:1.
- Slope protection shall be determined and installed based on site conditions.

Dike Materials. Manufactured materials are non-erosive materials such as concrete, PVC, and steel that provides the structural strength for the dike. Manufactured dike materials shall have a structural analysis completed for the various loads the dike will be subjected to during its life. These include hydrostatic, ice, uplift, earth, and equipment. The dike shall be analyzed for stability using acceptable safety factors for each loading condition.

Earth dike materials should be a well-graded mineral soil with a minimum of 95 percent passing the Standard Number 4 Sieve and no fraction being larger than 6 inches in diameter.

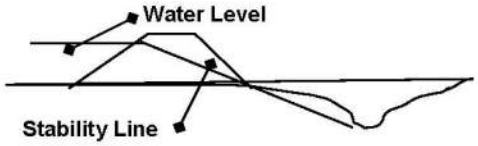
Embankment and Foundation Seepage. Embankment and foundation drainage and seepage control shall be designed on the basis of site investigation, laboratory data, seepage analysis, and stability analysis. The resulting design shall minimize seepage, prevent piping or undermining, and provide a stable embankment and foundation.

In the absence of more detailed data and analysis, the following criteria for a foundation cutoff apply for Class I dikes less than 6 feet in height, Class II dikes less than 8 feet in height and Class III dikes (H = dike height):

- Minimum of H feet deep for $H<3$ feet
- Minimum of 3 feet deep for $H\geq3$ feet
- Minimum of 4 feet bottom width
- 1:1 or flatter side slopes

A stream, channel, ditch, borrow area, slough, swale, gully, etc. shall be far enough away from the dike so that the extension of a line drawn from the design high water elevation on one side of the dike to the dike toe on the opposite side shall not intersect any stream, channel, etc. This line criterion applies to both sides of the

dike. This criterion will minimize the hazard to the dike caused by piping through the foundation.



Interior Drainage. Dikes to prevent flooding shall be provided with interior drainage systems for the area being protected. The interior drainage system shall prevent flood damage to the interior area from a flood of the design frequency in Table 1 for both the 1-day and the 10-day storm duration. The interior drainage system may include storage areas, gravity outlets, and pumping plants as needed to provide the required level of flood protection.

Pipes. Pipes through a Class I dike below the design high water with a dike height greater than 12 feet shall meet the requirements for principal spillways as found in NRCS Technical Release 60 - Earth Dams and Reservoirs, except for the minimum size requirements.

Pipes through all other Class I and Class II dikes shall meet the requirements for a principal spillway in Practice Standard 378, Ponds.

Dikes shall be protected from scour at pipe inlet and outlet locations by appropriate measures. A pump discharge pipe through a dike shall be installed above design high water, if feasible. Pump discharge pipes shall be equipped with a flexible connection or similar coupling to prevent vibration of the pumping plant being transmitted to the discharge pipe.

Protection. Dikes shall be protected from sheet, rill, and gully erosion, erosion from flowing floodwaters, and wave action created by wind and/or boat traffic.

A protective cover of grasses shall be established on exposed surfaces of the dike and other disturbed areas, as needed to prevent erosion. Seedbed preparation, seeding, fertilizing, mulching, and fencing shall comply with the recommendations in the standard for Critical Area Planting (342).

If grass vegetation will not control erosion, rock riprap, sand-gravel, soil cement, or special vegetation shall be utilized as needed.

Regulatory Requirements. This practice must conform to all Federal, State, and local laws and regulations. Laws and regulations of particular concern include those involving water rights, land use, land disturbance by construction, pollution control, property easements, wetlands, preservation of cultural resources, and endangered species.

CONSIDERATIONS

Flood of Record. When establishing top of dike elevation for Class I dikes, the flood of record should be considered if it exceeds the minimum 100 year design frequency.

Location. When locating the site for the dike, consider the foundation soils, property lines, setbacks from property lines, exposure to open water, distance to streambanks, availability of outlets by gravity or pumping, buried, utilities, cultural resources, and natural resources such as wetlands, natural areas, and fish and wildlife habitat.

Fluvial geomorphological concepts contained in NEH Part 653, Stream Corridor Restoration Principles, Processes, and Practices should be evaluated when placing a dike near a stream.

Access. All dikes must be accessible for maintenance activities. Typically, this may be along the top of the dike or along the berm. Access roads shall provide adequate width for the maintenance equipment and inspection vehicles. The minimum width for one-way traffic should be 12 feet. Provide wider areas for passing and turning around at regular intervals. Access roads may need to be controlled to prevent vandalism, accidents, and damage.

Berms. Give special consideration to wider berms, additional setbacks, or protecting the berm side slope when adjacent to actively eroding or moving streams to protect the dike for its design life.

Adverse Impacts. Adverse environmental impacts from the proposed dike will be evaluated. Any increases in flood stage caused by dike induced flow restrictions will be evaluated for adverse impacts to unprotected areas. Adverse impacts should be minimized.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and

shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

For Class I dikes with a height greater than 12 feet, an emergency action plan meeting the requirements of 500.70 of the National Operation and Maintenance Manual shall be completed prior to construction of the dike.

For Class I and Class II dikes, a detailed Operation and Maintenance Plan in accordance with 500.40 through 500.42 of the National Operation and Maintenance Manual shall be completed and provided to the owner.

Typical items related to proper operations of a dike include, but are not limited to, the following:

- Inspect regularly for damage, especially after storm events. Items to monitor include settlement, seepage, soil cracking, animal burrows and trails, pipe structures, and control gates.

Typical items related to proper maintenance of a dike include, but are not limited to, the following:

- Vegetation should be maintained by removing or reseeding as needed. Earth fill, riprap, and other structural components need to be repaired in a timely manner.

Table 1 – Minimum Design Criteria

Minimum Dike Class	Dike Material[1]	Height (H) in Feet[2]	Minimum Design Frequency in Years	Minimum Freeboard in Feet	Minimum Top Width in Feet	Minimum Side Slope Ratio[3]	Berm Width in Feet
Class I	Earth	0 to 6	100	H/3	10	2:1	12
		>6 to 12	100	2	10	Note 4	Note 4
		>12 to 25	100	3	12	Note 4	Note 4
		>25	100	3	14	Note 4	Note 4
	Manufactured	0 to 8	100	H/4	N/A	N/A	Note 4
		>8 to 12	100	2	N/A	N/A	Note 4
		>12	100	3	N/A	N/A	Note 4
Class II	Earth	0 to 6	25	H/3	6	2:1	12
		>6 to 12	25	2	8	2:1	15
	Manufactured	0 to 8	25	H/4	N/A	N/A	Note 4
		>8 to 12	25	2	N/A	N/A	Note 4
Class III	Mineral Soils	0 to 3	10	H/3	4	2:1	8
		>3 to 6	10	1	6	2:1	8
		>6 to 12	25	2	8	2:1	8
	Organic Soils[5]	0 to 2	10	H/2	4	2:1	10
		>2 to 4	10	1	6	2:1	10
		>4 to 6	10	2	8	2:1	15

[1] Earth includes rock. Manufactured materials are non-erosive materials such as concrete, PVC, and steel that provides the structural strength for the dike.
[2] Height is the difference between normal ground elevation at the dike centerline and the design high water elevation. When determining normal ground elevation, exclude crossings of channels, sloughs, small low areas, small ridges, swales, or gullies
[3] Minimum side slope ratios are for compacted earth fill. Dumped earth fill without compaction will be flatter.
[4] Side slope ratios and berm widths shall be determined by a stability analysis.
[5] Organic soils are permitted only for Class III dikes 6 feet or less in height. Higher dike heights result in excessive settlement and decomposition.

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

DIVERSION

Code 362

(ft)

I. DEFINITION

A channel generally constructed across the slope with a supporting ridge on the lower side.

II. PURPOSE

This practice may be applied to support one or more of the following purposes:

- Break up concentrations of water on long slopes, on undulating land surfaces and on land that is generally considered too flat or irregular for terracing.
- Divert water away from farmsteads, agricultural waste systems, and other improvements.
- Collect or direct water for storage, water-spreading, or water-harvesting systems.
- Protect terrace systems by diverting water from the top terrace where topography, land use, or land ownership prevents terracing the land above.
- Intercept surface and shallow subsurface flow.
- Reduce runoff damages from upland runoff.
- Reduce erosion and runoff on urban or developing areas and at construction or mining sites.
- Divert water away from active gullies or critically eroding areas.
- Supplement water management on conservation cropping or stripcropping systems.

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where surface runoff water control and management are needed, and where soils and topography are such that the diversion can be constructed and a suitable outlet is available or can be provided.

This practice does not apply to:

- **Natural stream channels, except those that meet the NEH Part 654, Chapter 8 definition of threshold channels.**

IV. CRITERIA

Compliance

The installation and operation of this practice shall be planned, designed, and constructed to comply with all Federal, State, and local laws and regulations. Construction specifications and/or drawings will specify that NRCS be provided copies of all required permits prior to construction. Excavation or ridge work within or near streams and wetlands may require a permit from the U.S. Army Corps of Engineers in accordance with Section 404 of the Clean Water Act (Bismarck Regulatory Office 701-255-0015). Projects that disturb more than 1 acre are required to develop a Stormwater Pollution Prevention Plan, and submit it along with a Notice of Intent to the ND Department of Health

(stormwater@nd.gov). Projects within the ordinary high water mark of navigable lakes and streams require a Sovereign Lands Permit from the ND State Water Commission (sovereignlands@nd.gov). Ensure that proposed ridges and/or overall site gradings involving fill do not increase the Base Flood (100-year recurrence interval) Elevation within Special Flood Hazard Areas (SFHA) by more than the allowable as defined by the local County Floodplain Administrator. Obtain a floodplain development permit through the local County Floodplain Administrator and the ND State Water Commission Floodplain Management Regulatory Program as necessary.

In addressing the National Environmental Policy Act (NEPA) for conservation practices within or near wetlands, sequencing must be conducted as per Executive Order 11990 included in Section G. Wetlands of the NRCS-CPA-052. Sequencing must include avoiding impacts if feasible. If avoidance is not feasible, a determination will be made using the North Dakota Minimal Effect Evaluation Worksheet. If the effects are determined to be minimal, the determination will be included in the NRCS-CPA-052. If the determination is not minimal, wetland mitigation must be completed. Implementation of the conservation practice(s) impacting the wetland(s) may begin upon obtaining all signatures on the wetland mitigation plan and agreement.

Capacity

Diversions as temporary measures, with an expected life-span of less than 2 years, will be designed for a minimum capacity for the peak discharge from the 2-year frequency, 24-hour-duration storm.

Diversions that protect agricultural land must have a minimum capacity for the peak discharge from a 10-year frequency, 24-hour-duration storm.

Diversions designed to protect areas such as urban areas, buildings, roads, and animal waste management systems require a minimum capacity for the peak discharge from a storm frequency consistent with the hazard involved but not less than a 25-year frequency, 24-hour-duration storm. Freeboard minimum depth is 0.3 ft. **Consider use of 0.5 feet of freeboard for diversions associated with animal waste management systems.**

Design depth is the channel storm-flow depth plus freeboard.

The design storm peak flow should be determined from appropriate methods considering location, drainage basin size, and watershed parameters. Statistical analysis can be used if a streamflow gage is near the site for reasonable number of years for the applicable design storm frequency. Peak discharge for ungaged sites should be calculated from the ND Supplement to NEH Part 650, Chapter 2 (EFH-2) for drainage areas less than 2,000 acres. Refer to USGS ND StreamStats for larger drainage areas where a stream channel is present and the drainage area falls within the regional parameters. Use TR-55 or HEC-HMS when watershed parameters are outside the range of USGS ND StreamStats. Apply Tables 5-1, 5-2, and 5-3 flow adjustment factors for ponding/wetlands present in the drainage area.

Cross Section

The channel may be parabolic, V-shaped, or trapezoidal. The diversion side slopes are based on stability and access requirements for maintenance. **Side slopes and bottom widths shall be selected based on equipment available for construction and maintenance.**

The minimum top width of the supporting ridge is 4 feet **except** for diversions with less than 10 acres of drainage area above cropland, pastureland, or woodland, where the minimum top width of the supporting ridge may be 3 feet.

The top of the constructed ridge at any point must not be lower than the design depth plus the specified overfill for settlement. **The minimum settlement height shall be proportioned from total ridge height at 5% for compacted fill, 15% for dumped and shaped, 20% for dropped, and 40% for organic fill. Organic soils are described CPS 356- Dike.**

The diversion design depth at a culvert crossing must equal the headwater depth for the culvert design storm plus freeboard.

The front and cut slopes for permanent diversions should not be steeper than 3:1 for maintenance purposes and preferably 4:1. The back slope of the ridge is not to be steeper than 2:1 and preferably 4:1. For temporary diversions, the side slope should not be steeper than 1:1 under any conditions.

Farmed diversions should have front slopes, back slopes, and cut slopes which are 5:1 or flatter. Where agricultural equipment must cross, slopes of 8:1 or flatter are recommended.

Channel Stability and Capacity

Channel grades may be uniform or variable. Determine minimum depth and width requirements for channel stability by using the procedures in the National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 9, Diversions; or Agricultural Research Service (ARS) Agricultural Handbook 667, Stability Design of Grass-Lined Open Channels (Sept. 1987); or other equivalent methods. The ARS handbook can be found on the USDA National Agricultural Library Digital Collections Web site.

When a retardance class method is used to determine capacity (Q) of the diversion by the relationship

$$Q=AV,$$

and, the velocity (V) is calculated by using Manning's Equation; use the highest expected value of Manning's "n", which represents the flow retardance due to the height, density and type of vegetation.

For vegetated channels, the flow retardance and vegetal cover factor for stability design shall be based on the sparsest and shortest vegetation expected. Vegetal cover factors and retardance values for various vegetative covers and conditions are given in Table 9-2 and Table 9-7, respectively, of the Engineering Field Handbook Chapter 9 – Diversions. A vegetal cover of 0.75 and a Class "D" retardance value shall not be exceeded.

See CPS 468- Lined Waterway or Outlet for roughness values and design criteria for concrete, rock, grid paver, turf reinforcement map, or articulated concrete block lined diversion channels.

Stability of unvegetated, unlined, earthen channels shall be designed utilizing methods outlined in NEH Part 654 Chapter 8.

Protection Against Sedimentation

Diversions normally should not be used below high sediment-producing areas. When they are, a practice or combination of practices for the drainage area are needed to prevent damaging accumulations of sediment in the channel. This may include practices such as land treatment erosion control practices, cultural or tillage practices, vegetated filter strip, or structural measures. Install needed sediment control practices in conjunction with or before the diversion construction.

If movement of sediment into the channel is a problem, include extra capacity for sediment accumulation in the design and instructions for periodic removal in the operation and maintenance plan. **A minimum design**

velocity of 1.5 feet per second during the design storm event is recommended to facilitate sediment transport within channel.

Outlets

Each diversion must have a safe and stable outlet with adequate capacity. The outlet may be a grassed waterway, a lined waterway, vegetated or paved area, a grade stabilization structure, an underground outlet, a stable watercourse, a sediment basin, or a combination of these practices. The outlet must convey runoff to a point where outflow will not cause damage. Install vegetative outlets before diversion construction to insure establishment of stable vegetative cover in the outlet channel.

When using an underground outlet, the diversion ridge must contain the design storm runoff combined with an underground outlet release rate to protect from overtopping. To prevent the diversion from overtopping, the designed outflow capacity of the outlet(s) must be achieved at, or below, the design depth of the diversion at their junction.

Vegetative Establishment

Vegetate diversions according to NRCS Conservation Practice Standard (CPS) Critical Area Planting (Code 342) **and the North Dakota ND-CPA-9 – Planning or Data Sheet for Grass and/or Legume Seeding Job Sheet**. Select species suited to the site conditions and intended uses. Use plant species that exhibit the capacity to achieve adequate density, height, and vigor within an appropriate time frame to stabilize the diversion.

Establish vegetation as soon as conditions permit. Use mulch anchoring, nurse crop, rock, straw or hay bale dikes, fabric checks, filter fences, or runoff diversion to protect the vegetation until it is established. Planting of a close-growing crop, (e.g., small grains or millet), on the contributing watershed prior to construction of the diversion can significantly reduce the flow through the diversion during establishment.

Lining

If the soils or climatic conditions preclude the use of vegetation for erosion protection, nonvegetative linings such as concrete, gravel, rock riprap, cellular block, or other approved manufactured lining systems may be used.

Design diversion channel liners in accordance with CPS Lined Waterway or Outlet (Code 468).

V. CONSIDERATIONS

A diversion in a cultivated field should be aligned and spaced from other structures or practices to permit use of modern farming equipment. The side slope lengths should be sized to fit equipment widths when cropped.

At noncropland sites, consider planting native vegetation in areas disturbed due to the diversion construction.

Diversion of upland water to prevent entry into a wetland may convert a wetland by changing the hydrology. In analyzing downslope impacts, minimize adverse effects to existing wetland functions and values. Similarly consider how to maximize wetland functions and values with the diversion design.

Provide construction inspection to ensure that the top of the constructed ridge at any point meets the design depth plus the specified overfill for settlement.

Any construction activities should minimize disturbance to wildlife habitat. Opportunities should be explored to restore and improve wildlife habitat, including habitat for threatened, endangered, and other species of concern.

For vegetated diversions, avoid areas where unsuitable subsurface, subsoil, substratum material that limits plant growth such as salts, acidity, root restrictions, etc., may be exposed during implementation of the practice. Where these areas cannot be avoided, seek recommendations from a soil scientist for improving the condition or, if not feasible, consider stock piling the topsoil, over excavating the diversion and replace the topsoil over the excavated area to facilitate vegetative establishment.

VI. PLANS AND SPECIFICATIONS

Prepare plans and specifications for diversions that describe the requirements for applying the practice according to this standard. As a minimum, the plans and specifications must include—

1. A plan view of the layout of the diversion.
2. Typical cross sections of the diversion(s).
3. Profile(s) of the diversion(s) that include both the channel bottom and supporting ridge top.
4. Disposal requirements for excess soil material.
5. Vegetative establishment requirements.

VII. OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for use by the client. Include specific instructions for maintaining diversion capacity, storage of runoff water, ridge height, and outlets in the plan.

The minimum requirements to be addressed in the operation and maintenance plan are—

1. Provide periodic inspections, especially immediately following significant storms.
2. Promptly repair or replace damaged components of the diversion as necessary.
3. Maintain diversion capacity, ridge height, and outlet elevations especially if high sediment-yielding regions are in the drainage area above the diversion. Establish necessary clean-out requirements.
4. Each inlet for underground outlets must be kept clean and sediment buildup redistributed so that the inlet is at the lowest point. Inlets damaged by farm machinery must be replaced or repaired immediately.
5. Redistribute sediment as necessary to maintain the capacity of the diversion.
6. Maintain vegetation and trees and control brush by hand, chemical, and mechanical means. Maintenance of vegetation will be scheduled outside of the primary nesting season for grassland birds.
7. Control pests that will interfere with the timely establishment of vegetation.
8. Keep machinery away from steep-sloped ridges. Keep equipment operators informed of all potential hazards.

VIII. REFERENCES

USDA, ARS. 1987. Stability design of grass-lined open channels. Agriculture Handbook 667.

USDA, NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chap. 9, Diversions.

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

STRUCTURE FOR WATER CONTROL

Code 587

(No.)

I. DEFINITION

A structure in a water management system that conveys water, controls the direction or rate of flow, maintains a desired water surface elevation, or measures water.

II. PURPOSE

Apply this practice as a component of a water management system to control the stage, discharge, distribution, delivery, or direction of water flow.

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies to a permanent structure needed as an integral part of a water control system to serve one or more of the following functions:

Convey water from one elevation to a lower elevation within, to, or from a water conveyance system such as a ditch, channel, canal, or pipeline. Typical structures include drops, chutes, turnouts, surface water inlets, head gates, pump boxes, and stilling basins.

Control the elevation of water in drainage or irrigation ditches. Typical structures include checks, flashboard risers, and check dams.

Control the division or measurement of irrigation water. Typical structures include division boxes and water measurement devices.

Keep trash, debris or weed seeds from entering pipelines. Typical structures include trash racks and debris screens.

Control the direction of channel flow resulting from tides and high water or backflow from flooding. Typical structures include tide and water management gates.

Control the water table level, remove surface or subsurface water from adjoining land, flood land for frost protection, or manage water levels for wildlife or recreation. Typical structures include water level control structures, flashboard risers, pipe drop inlets, and box inlets.

Convey water over, under, or along a ditch, canal, road, railroad, or other barriers. Typical structures include bridges, culverts, flumes, inverted siphons, and long span pipes.

Modify water flow to provide habitat for fish, wildlife, and other aquatic animals. Typical structures include chutes, cold water release structures, and flashboard risers.

Provide silt management in ditches or canals. Typical structures include sluice gates and sediment traps.

Supplement a resource management system on land where organic waste or commercial fertilizer is applied.

Create, restore, or enhance wetland hydrology.

IV. CRITERIA

All structures designed under this standard must comply with applicable Federal, Tribal, State, and local laws, rules, and regulations. Obtain all required permits before construction begins.

Construction specifications and/or drawings will specify that NRCS be provided copies of all required permits prior to construction. Excavation or embankment work within or near streams and wetlands may require a permit from the U.S. Army Corps of Engineers in accordance with Section 404 of the Clean Water Act (Bismarck Regulatory Office 701-255-0015). Projects that disturb more than 1 acre are required to develop a Stormwater Pollution Prevention Plan, and submit it along with a Notice of Intent to the ND Department of Health (stormwater@nd.gov). Projects within the ordinary high water mark of navigable lakes and streams require a Sovereign Lands Permit from the ND State Water Commission (sovereignlands@nd.gov). Ensure that proposed embankments and/or overall site gradings involving fill do not increase the Base Flood (100-year recurrence interval) Elevation within Special Flood Hazard Areas (SFHA) by more than the allowable as defined by the local County Floodplain Administrator. Obtain a floodplain development permit through the local County Floodplain Administrator and the ND State Water Commission Floodplain Management Regulatory Program as necessary.

In addressing the National Environmental Policy Act (NEPA) for conservation practices within or near wetlands, sequencing must be conducted as per Executive Order 11990 included in Section G. Wetlands of the NRCS-CPA-052. Sequencing must include avoiding impacts if feasible. If avoidance is not feasible, a determination will be made using the North Dakota Minimal Effect Evaluation Worksheet. If the effects are determined to be minimal, the determination will be included in the NRCS-CPA-052. If the determination is not minimal, wetland mitigation must be completed. Implementation of the conservation practice(s) impacting the wetland(s) may begin upon obtaining all signatures on the wetland mitigation plan and agreement.

Follow the North Dakota Century Code Section 61-04-02 requirement that structures with a water storage capacity (spillway elevation) exceeding 12.5 acre-feet secure a water permit from the SWC prior to construction or modification activities. The SWC Water Appropriates Division oversees Applications for Conditional Water Permits (SFN 60157). In these instances, construction specifications developed for the project should specify that NRCS be provided a copy of the water permit prior to construction.

Follow the North Dakota Century Code Section 61-04-02 requirement that structures with a water storage capacity (spillway elevation) less than 12.5 acre-feet notify the state engineer (SWC) of the location and capacity of such constructed works, dams, or dugouts. The SWC Water Regulatory Division oversees notifications of structure constructions (SFN 51695). In these instances, construction specifications developed for the project should specify that NRCS be provided a copy of the notification prior to construction.

A. General Criteria Applicable to All Purposes

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in NRCS Conservation Practice Standard (CPS) Critical Area Planting (Code 342). When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in CPS Mulching (Code 484) to install inorganic cover material such as gravel. **The structure shall be fenced, if cattle are grazed in the area, to protect the vegetation.**

Do not raise the water level upstream of water control structures on adjacent landowners without their permission. **Structures shall not be installed that have an adverse effect on septic filter fields. Structures must be designed to control erosion, keep upstream water levels within planned limits, and take into account the effects of freezing ambient temperatures. Where manufactured structures are used, the hydraulic design shall be provided by the manufacturer. Reinforcement products such as articulated concrete block and turf reinforcement mats, can be used in exit channels- see CPS 468 (Lined Waterway**

Outlet) for design guidance.

All water impoundment structures built under this practice shall meet the requirements of practice standard Pond (378).

All stream crossing structures built under this practice shall meet the requirements of practice standard Stream Crossing (578).

All irrigation water control structures built under this practice shall be designed to supply or measure the irrigation application rates as determined by CPS 443- Irrigation System Surface and Subsurface, CPS 442- Irrigation System Sprinkler, or CPS 441- Irrigation System Microirrigation.

B. Criteria for Drainage Water Management/Subsurface Drainage Systems

The drainage water management system shall be designed in accordance with practice standard Drainage Water Management (554). A water management strategy shall be developed, including target water levels, for applicable crop rooting depths, while meeting non-cropped period operational requirements from practice standard 554. Operational requirements are for managed drainage model within 30 days after season's final field operation, and until at least 30 days before commencement of the next season's field operations.

The rate of outflow and the level of the water table shall be controlled by structures or pumps. Structures or pumps shall be located where they are accessible and subject to convenient control. Designs of critical components shall be in accordance with pertinent NRCS Practice Standards.

Water level control structures shall be sized to provide adequate drainage flow and not to restrict drainage capacity. Drainage flows shall be calculated to adequately design the system. Applicable computer models (i.e. DrainMod) or drainage equations (i.e. van Schilfgaarde or those outlined in Chapter 4 of NEH Section 16, Drainage of Agricultural Land) shall be used for subsurface drain system outflows. The water level control structure shall be designed so as to allow the water table to fluctuate to satisfy the intended purpose. Connect at least 20 feet of solid pipe to the control structure on both the upstream and downstream sides.

C. Structural Design Criteria

Structure designs shall be based on site surveys, required hydraulic function during normal operations and anticipated internal/external loads including hydrostatic uplift, surcharge loads, surface and impact loads, stability during flood and ice jam events, avoidance of downstream erosion, sediment transport, and efficient operation and maintenance.

1. **Geologic investigations for foundations shall be completed, as outlined in NEH Part 631, and appropriate for the project. The geologic investigation shall provide adequate data to support foundation design computations, and evaluate the need for structure cutoffs, drainage, foundation reinforcement, or slope stabilization measures.**
2. **Foundation design will address bearing capacity, sliding, overturning, uplift, settlement, and piping potential. Cutoff requirements shall be determined by use of NEH Section 11, Lane's Theory of Weighted Creep, or flow net procedures outlined in NRCS Soil Mechanics Technical Note 5, Flow Net Construction and Use.**
3. **Lateral earth pressures should be calculated based on NRCS Technical Release 210-74. Small structures may be designed utilizing presumptive lateral earth pressure values in CPS 313- Waste Storage Facility or Table 6.2-1 NEH Section 6.**
4. **Concrete structures shall be designed based the American Concrete Institute 350 Code Requirements for Environmental Engineering Concrete Structures.**
5. **Steel structures shall be galvanized or epoxy coated, and be designed based on the Manual for Steel Construction (American Institute of Steel Construction) or the Handbook of Steel Drainage and Highway Construction Products (American Iron and Steel Institute).**
6. **Timber structures will be designed based on the National Design Specification for Wood Construction.**

D. Safety

Design measures necessary to prevent serious injury or loss of life in accordance with requirements of Title 210, National Engineering Manual (NEM), Part 503, Safety.

E. Cultural Resources

Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

V. CONSIDERATIONS

Consider the following items when planning, designing, and installing this practice:

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Potential for a change in the rate of plant growth and transpiration because of changes in the volume of soil water.
3. Effects on downstream flows or aquifers that would affect other water uses or users.
4. Effects on the field water table to ensure that it will provide a suitable rooting depth for the anticipated crop.
5. Potential use for irrigation management to conserve water.
6. Effect of construction on aquatic life.
7. Effects on stream system channel morphology and stability as it relates to erosion and the movement of sediment, solutes, and sediment-attached substances carried by runoff.
8. Effects on the movement of dissolved substances below the root zone and to ground water.
9. Effects of field water table on salt content in the root zone.
10. Short term and construction-related effects of this practice on the quality of downstream water.
11. Effects of water level control on the temperatures of downstream waters and their effects on aquatic and wildlife communities.
12. Effects on wetlands or water-related wildlife habitats.
13. Effects on the turbidity of downstream water resources.
14. Conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.
15. **Saturated buffer and denitrifying bioreactors as primary outlet from structure for water control. These shall be designed in accordance with practice standard Saturated Buffer (604) and Denitrifying Bioreactor (605), respectively. Saturated buffer and denitrifying bioreactors reduce nitrate levels from subsurface agricultural drainage flow to improve water quality of receiving water bodies. Saturated buffer can be used to create, restore, and enhance wetlands; therefore, can be used in conjunction with practice standards Wetland Restoration (657), Wetland Creation (658), and Wetland Enhancement (659).**
16. **Where necessary, design seepage collars or filter diagrams along outlet conduits to reduce likelihood of internal erosion failure mode along conduit.**

VI. PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. As a minimum, include—

1. A plan view of the layout of the structure for water control.
2. Typical profiles and cross sections of the structure for water control.
3. Structural drawings adequate to describe the construction requirements.
4. Requirements for vegetative establishment and mulching, as needed.
5. Safety features.
6. Site-specific construction and material requirements.

VII. OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

1. Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenances.
2. Prompt removal of trash from pipe inlets and trash racks.
3. Prompt repair or replacement of damaged components.
4. Prompt removal of sediment when it reaches predetermined storage elevations.
5. Periodic removal of trees, brush, and undesirable species.
6. Periodic inspection of safety components and immediate repair if necessary.
7. Maintenance of vegetative protection and immediate seeding of bare areas as needed.

REFERENCES

USDA NRCS. National Engineering Handbook (NEH), Part 636, Structural Engineering. Washington, DC.

USDA NRCS. NEH, Part 650, Engineering Field Handbook. Washington, DC.

USDA NRCS. National Engineering Manual. Washington, DC.

USDA SCS. May 1971. National Engineering Handbook, Section 16. Washington, D.C.

Appendix C
Site Forms and Imagery

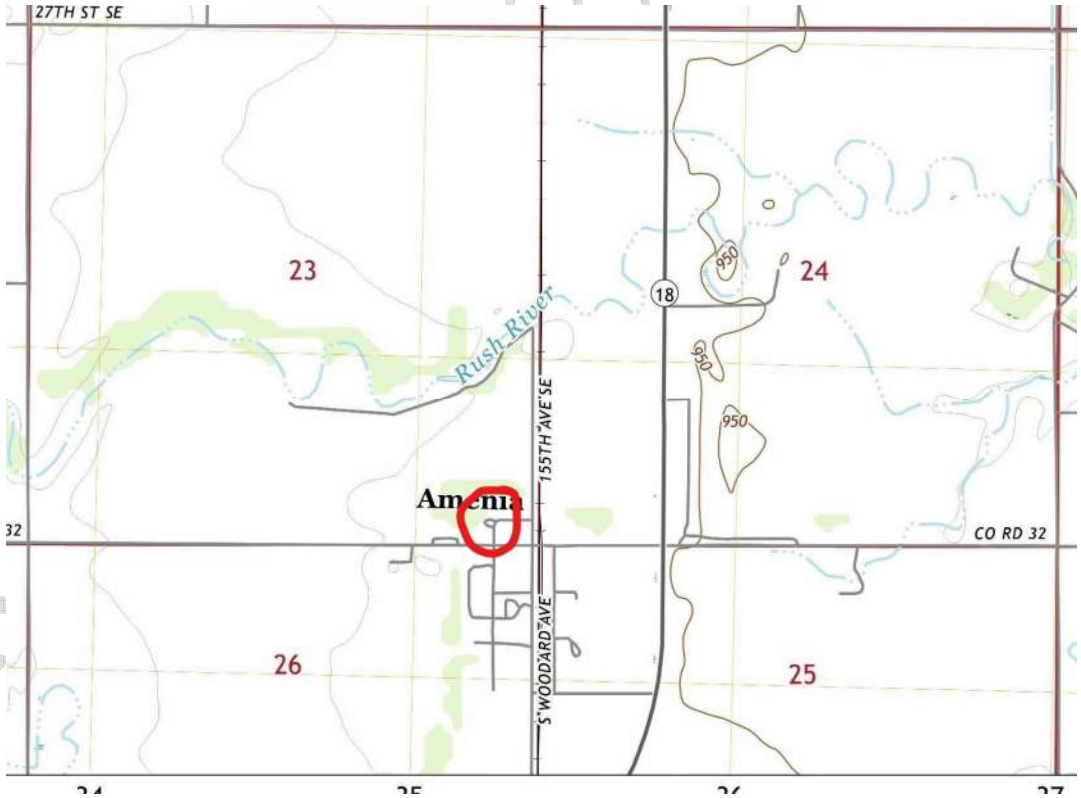
South Side NRCS 20017001

East Side Oblique South Side NRCS 20017001

West Side Oblique South Side NRCS 20017001

North Side South Side NRCS 20017001

Chimney East Side Image facing Northwest NRCS 20017001



USGS Topographic map Arthur Quad (2017)

Image Source: https://ngmdb.usgs.gov/

NDCRS *ARCHITECTURAL* SITE FORM
PAGE 1

UPDATE

Field Code _____ **SITS# 32** 32 5120

SITE IDENTIFICATION

Map Quad ARTHUR Site Name REED HOUSE
Map Quad _____ Site Name _____

LTL ___ TWP 141	R 52	SEC 23	QQQ 7	QQ 7	Q 7
LTL ___ TWP _____	R _____	SEC _____	QQQ _____	QQ _____	Q _____
LTL ___ TWP _____	R _____	SEC _____	QQQ _____	QQ _____	Q _____
LTL ___ TWP _____	R _____	SEC _____	QQQ _____	QQ _____	Q _____

NAD 1983, UTM 5207466 **N** **ZONE** 14N
NAD 1983, UTM 635271 **E**

Subsection:
1 = N½
2 = E½
3 = S½
4 = W½
5 = NE¼
6 = SE¼
7 = SW¼
8 = NW¼

City: AMENIA

Street Number: _____

Street Name: REED STREET

Urban Legal Description: _____

SITE DATA

Total # ***Architectural*** Features: 1

Fieldwork Date: **05/20/2020**

Reconnaissance Survey ✓ Intensive Survey ___

Project & Principal Investigator:

Amenia Levee System-Christopher A. Plount

Report Title & Author(s):

Cultural Resources Survey: Rush River-Amenia South Levee Alternative
Christopher A. Plount

Contracting firm or Agency completing the form:

US Department of Agriculture Natural Resources Conservation Service North Dakota State Office

Additional Information:

UPDATE TO SITE FORM DATED 10/05/1980 BY LORNA MEIDINGER
EXCEPTING THE UPDATED CONDITION ALL INFORMATION COPIED FROM ORIGINAL

SHSND USE

Area of Significance_____	Ecozone _____	Verified Site _____	CR Type _____
Area of Significance_____	Ecozone _____		
Area of Significance_____	Ecozone _____		

Recorded By **CHRISTOPHER A. PLOUNT** **Date Recorded** **05/20/2020**
(First Name & Last Name) **(mm/dd/year)**

Instructions to complete this form: (1) Download ; (2) Save A Copy; (3) Submit a paper copy of the form to the SHSND and a PDF version of the form and corresponding GIS shapefiles to the FTP site of the SHSND.

NDCRS *ARCHITECTURAL* SITE FORM
PAGE 2—*Feature Data*

UPDATE

Field Code _____ SITS# 32 32 5120

Complete one Page 2 for *each* architectural feature at the site.

Architectural Feature # 1

Construction Date _____ Feature Type 40 Condition 6

Feature Date 2 Context 30 Plan Shape 5

Structural System 25 Primary Exterior 26 Style Gabled Front: L/T

Original Owner's Ethnicity _____ Secondary Exterior N/A Architect/Builder _____

Other Information: _____

Foundation STONE SURROUNDED BY CREAM BRICK Stories 2.5

Roof/Cornice GABLE

Window ORIGINAL AND REPAIRED

Dating Method(s): ORIGINAL SITE FORM

***Feature* Preservation Recommendation(s) (Check all that apply):**

___ Individual nomination

___ Contributes to a potential district

___ No nomination potential

___ Will not contribute to a district

___ Potential district—feature would be a contributing element if other properties constitute a district

___ Thematic nomination potential

___ Component of a historic site or landscape

___ Moved (specify all applicable choices)—a) relocation occurred within a historic period; b) recreates original site, orientation, landscape, & spatial relationships; c) compatible in context with neighboring structures; d) relocation has damaged eligibility

✓ Historical associations require further investigation

Recorded By CHRISTOPHER A. PLOUNT **Date Recorded** 05/20/2020
(First Name & Last Name) (mm/dd/year)

Instructions to complete this form: (1) Download ; (2) Save A Copy; (3) Submit a paper copy of the form to the SHSND and a PDF version of the form and corresponding GIS shapefiles to the FTP site of the SHSND.

NDCRS *ARCHITECTURAL* SITE FORM
PAGE 3—*Feature Data*

UPDATE

Field Code _____ SITS# 32 32 5120

Complete a Page 3 for each feature.

1. *Feature* Description, Integrity, Eligibility:

Features mentioned on original site form are germane with the following additions:

There appears to be a stone foundation that is surrounded by cream and red brick.

The brick portion is being cannibalized.

Chimney in need of repair.
Shingles are in need of replacement.

Front porch is beginning to sag on the east side. The porch enclosures appear to be installed after the original construction. Porch posts are lathe turned posts.

Interview with Keith Peltier- GM ProSeed- proffered that structure may be in foreclosure and bank owned.

Site rests within the boundary of a proposed levee system that will encompass Town of Amenia. No direct effect to the structure and during summer months the levee will not be visible but fall/winter will will have a visual effect due to leaf loss creating a clear line of sight.

Recorded By CHRISTOPHER A. PLOUNT **Date Recorded** 05/20/2020
(First Name & Last Name) (mm/dd/year)

Instructions to complete this form: (1) Download ; (2) Save A Copy; (3) Submit a paper copy of the form to the SHSND and a PDF version of the form and corresponding GIS shapefiles to the FTP site of the SHSND.

NDCRS *ARCHITECTURAL* SITE FORM
PAGE 4—*SITE DESCRIPTION*

UPDATE

Field Code _____ **SITS# 32 32 5120**

Complete one Page 4 for the entire *site*.

2. Owner's Contact Information:

3. Access (to rural areas):
ONE MILE WEST OF INTERSECTION HIGHWAY 32 AND 18 CASS COUNTY NORTH DAKOTA

4. Site Area (**ft²**): _____

5. Description of ***SETTING***:
TOWN OF AMENIA

Recorded By **CHRISTOPHER A. PLOUNT** **Date Recorded** **05/20/2020**
(First Name & Last Name) **(mm/dd/year)**

Instructions to complete this form: (1) Download ; (2) Save A Copy; (3) Submit a paper copy of the form to the SHSND and a PDF version of the form and corresponding GIS shapefiles to the FTP site of the SHSND.

NDCRS *ARCHITECTURAL* SITE FORM
PAGE 5—*SITE DESCRIPTION*

UPDATE

Field Code _____ SITS# 32 32 5120

6. *Summary of ALL* Site Features & Evaluation of Significance:

Significance undetermined. Structure would benefit from evaluation and research by qualified architectural archaeologist/historian.

7. References/Comments:

Site form 32CS5120

Recorded By CHRISTOPHER A. PLOUNT **Date Recorded** 05/20/2020
(First Name & Last Name) (mm/dd/year)

Instructions to complete this form: (1) Download ; (2) Save A Copy; (3) Submit a paper copy of the form to the SHSND and a PDF version of the form and corresponding GIS shapefiles to the FTP site of the SHSND.

32CS5120 Southeast Oblique facing Northwest

32CS5120 South West Oblique facing Northeast

32CS5120 East Oblique Facing Southwest

32CS5120 Porch Brick Removal

32CS5120 Brick Removal from Structure Foundation

32CS5120 East Porch and Brick Removal