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April 8, 2020

Vanman Levee Trustees
31938 130th St
Missouri Valley, IA 51555

RE: Original Plan Datum Equation
Vanman Levee District
Pottawattamie County, Iowa
Project No.: A16.120834

Dear Trustee Board Members:

We wish to provide the following report to document the development of datum equation correlating the 1946 As-Built Plans for the Vanman Levee District to the modern NAVD 88 datum. This report should be filed with the district records for future reference.

Following is a narrative description of the steps taken to develop the datum equation for the original plans:

1. **c.1946 Vanman Levee As-Built Plans** – Through several searches by Corey McIntosh, John Erickson, myself and likely several others, design profiles of the Vanman Levee district have yet to be located. A plat of the district is located in the records in the Auditor's storage room, and a scanned copy is available on the Pottawattamie County GIS website. The plat available online appear to be as-built plans of the district, and include many ground elevations measured throughout the district, but no stated benchmarks listed on the sheet.

   Using the location of the surveyed elevations, approximate locations were determined for estimating LIDAR elevations at 24 points. 12 points were taken from field locations and 12 pulled from current road elevations. These LIDAR elevations were compared with the surveyed elevations to determine a difference in elevation across all 24 points.

   It quickly became apparent the road elevations were measured before the roads were regraded and raised by the county, as current elevations of the roads were tightly clustered, approximately 3 feet higher than the set of 12 field elevations. Instead of pulling road elevations, adjacent field elevations were pulled and entered to table. Engineering judgment was used to correct outlier data based on the lack of specificity for location of each recorded point.

   The plat along with the elevation comparison is attached to this report. The vertical datum equation for the elevations shown on the plan sheet is:

   Original Datum + 1.52 feet = NAVD 88

2. **1943 Vanman Engineer's Report** – The original Engineer's Report for the Vanman Levee describes the levee grade as being 3 feet higher than the recorded high-water mark recorded on April 12, 1943. Two HWM elevations are recorded on the plan sheet, with the southern mark labelled with the date 4-12-43.

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North HWM – 1000.40 + 1.52 + 3 = 1004.92 @ ~sta 345
South HWM – 995.48 + 1.52 + 3 = 1000.00 @ sta 27

Using these two points to set the top grade resulted in a levee grade of 0.02% throughout the district. This grade was compared to the surveyed elevation of the top of the DeSoto Bend cut-off levee at the junction of the two structures. The Two elevations matched nearly exactly at the junction. The grade was then compared via LIDAR to existing ground elevations on the land side of the levee. The general ground elevations and the levee grade gave satisfactory agreement throughout the district.

3. **c.1924 Coulthard Drainage District Plans** – After determining the grade for the Vanman Levee, we attempted to match that grade to the old Coulthard Levee Plans to determine the level of protection of that levee in relation to the Vanman. We were unable to correlate the two plans, as it appears the 1924 plans in our possession were for construction of the ditches only. The levee shown on those plans appears to be part of the older Nobles Lake improvements and represents an existing structure, not a planned levee.

4. **1945 Coulthard Engineer's Report** – In 1945, an Engineer's Report was filed for the Coulthard Levee describing concern that the existing Original Coulthard Levee was 2 feet lower than the newly constructed Vanman Levee and that work should be undertaken to raise and Strengthen the Coulthard to match. We have not yet been able to access the Coulthard records due to the current health situation, but we have anecdotal evidence that the bids to complete the work were rejected and not rebid. This elevation is likely useless for the Vanman Levee, but the datum equation for the 1945 Coulthard plan sheet is:

1945 Plan Datum + 897.63 = NAVD 88

1956 USAC Missouri River Plan Sheet No. 67 on USGS Quad Map – We were provided several documents by Corey McIntosh showing the river prior to the DeSoto Bend cutoff. One map of great interest is a plan developed by the Army Corps in 1956. The plan is drawn on the 1946-1947 USGS Quadrangle Map. Several versions of these quad maps have been created over the years. The quad maps generally show 5 and 10 vertical contours as well as several labeled benchmarks which can be located and surveyed, and they also contain several surveyed point elevations.

The Surveyed point elevations are the most interesting as there is an elevation located directly on top of the Vanman Levee at approximate station 326, less than 1 year after construction of the levee. The elevation for sta 326 developed from the 1946 plans is 1004.63.

The elevations are of limited value as they are rounded to the nearest foot. The elevations are recorded on the M.S.L. 29 datum, the conversion of which to the modern NAVD 88 datum requires the addition of 0.47 feet. The recorded elevation of the levee top is 1004. Conversion to the NAVD 88 datum gives a new value of 1004.47 with a potential range from 1003.97 to 1004.97.

The adjusted elevation of the recorded survey elevation matches very closely with the developed datum equation, supporting the estimated datum from the 1946 plans.

5. **1959 USAC DeSoto Cut-Off Plans** – Tom Cox with the Fish & Wildlife Service at DeSoto Bend was able to supply a set of plans from the construction of the cut-off canal and levees constructed in 1959. These plans state the elevations are based upon M.S.L. 1929. The plans show the connection of the DeSoto Levee to the Vanman Levee at an elevation 1003.5 at approximate station 310. The

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elevation from the developed datum equation at this location is 1004.48. No other benchmark data is present on the plans.

Adjusting the 1959 plan elevation using the conversion stated earlier gives an elevation 1003.97. These elevations are not close enough to support the developed equation, indicating a potential error in either the developed datum equation or the 1959 plans.

6. **1956 USAC Missouri River Plan Sheet No. 67 Benchmarks** – While searching for additional benchmark data, we contacted both the Pottawattamie and Harrison County Engineer's for additional information. The Harrison County Engineer supplied a copy of the same 1956 USAC Missouri River Plan as described above and a copy of the benchmark data for that sheet from the same plan. After reviewing these benchmarks and comparing the current recorded elevations for the same we found a datum shift from the 1956 plans to the modern NAVD 88 datum of 0.73-0.76', roughly 0.28' larger than the standard M.S.L. 1929 conversion. This benchmark data has been added to the 1956 USAC map as part of this report.

   Because the Missouri River Plan and the DeSoto Bend Cut-Off Plan were developed within only a few years of each other, by the same engineering organization, it can safely be assumed that both plans had the same vertical datum shift. Adjusting the 1959 plan elevation of 1003.5 gives a new elevation of 1004.25, or 0.23' lower than the equation derived from the 1946 Plans.

   This difference is equivalent to less than three inches different. It is very plausible that the Vanman Levee would have had variations in top elevation greater than 3 inches when constructed, and even more likely that the levee had settled by more than 3 inches in the 10 years between its' construction and the survey conducted by the USAC. We therefore believe these plans confirm the datum equation developed from the 1946 As-Built Plans.

In addition to the work to re-establish the Vanman Levee grade, time was also spent to determine the location of the existing junction of the Vanman and Coulthard Levees and the existing rights-of-way of each facility. We felt this work necessary because of the several damaged sections of levees visible on the ground, and confusion regarding the location of platted Coulthard easements in Pottawattamie County.

We have included three maps showing the junction of the two levees and the easements owned by each district at the time the photos were taken. This research indicates the junction of the two levees was moved approximately 400 feet southwest in 1952.

Sincerely,

Bolton & Menk, Inc.

Jonathan P. Rosengren, P.E.
Project Manager

Cc: Pottawattamie County Auditor

Encl: 1946 Vanman Levee As-Builts w/ Datum Information
1956 USAC Missouri River Plan w/ Datum Information
Vanman/Coulthard Junction Maps (3)

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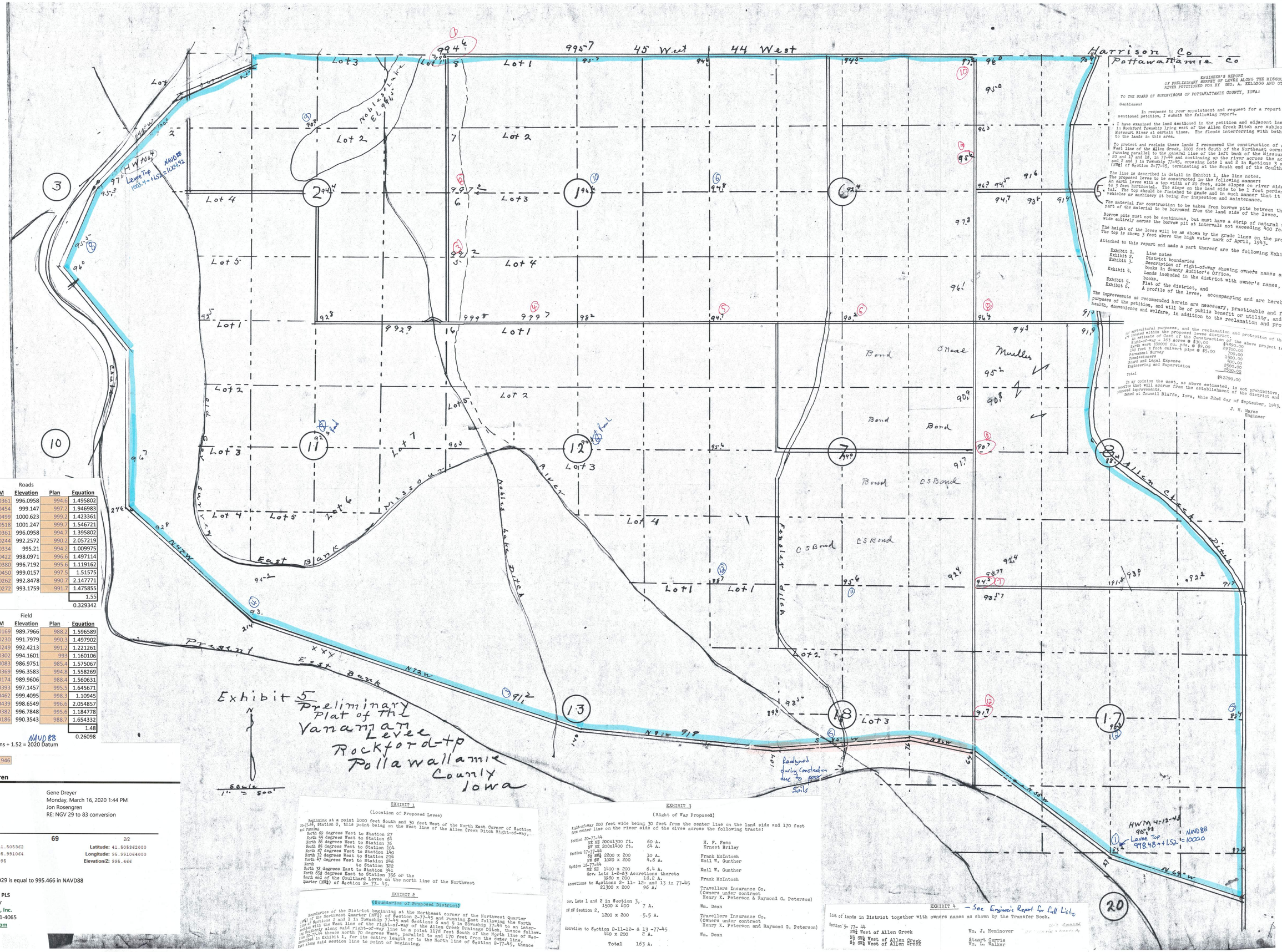


Roads				
Point No	DEM	Elevation	Plan	Equation
1	30361	996.0958	994.6	1.495802
2	30454	999.147	997.2	1.946983
3	30499	1000.623	999.2	1.423361
4	30518	1001.247	999.7	1.546721
5	30361	996.0958	994.7	1.395802
6	30244	992.2572	990.2	2.057219
7	30334	995.21	994.2	1.009975
8	30422	998.0971	996.6	1.497114
9	30380	996.7192	995.6	1.119162
10	30450	999.0157	997.5	1.51575
11	30262	992.8478	990.7	2.147771
12	30272	993.1759	991.7	1.475855
				1.55
				0.329342

Field				
Point No	DEM	Elevation	Plan	Equation
1	30169	989.7966	988.2	1.596589
2	30230	991.7979	990.3	1.497902
3	30249	992.4213	991.2	1.221261
4	30302	994.1601	993	1.160106
5	30083	986.9751	985.4	1.575067
6	30369	996.3583	994.8	1.558269
7	30174	989.9606	988.4	1.560631
8	30393	997.1457	995.5	1.645671
9	30462	999.4095	998.3	1.10945
10	30439	998.6549	996.6	2.054857
11	30382	996.7848	995.6	1.184778
12	30186	990.3543	988.7	1.654332
				1.48
				0.26098

NAVD 88

Datum = 1946 plans + 1.52 = 2020 Datum

Plan Year 1946

Jon Rosengren

From: Gene Dreyer
Sent: Monday, March 16, 2020 1:44 PM
To: Jon Rosengren
Subject: RE: NGV 29 to 83 conversion

69 2/2

Latitude: 41.505362 **Latitude:** 41.505362000
Longitude: 95.991064 **Longitude:** 95.991064000
Elevation/Z: 995 **Elevation/Z:** 995.466

995.00 in NGVD29 is equal to 995.466 in NAVD88

Gene R Dreyer, PLS
Survey Manager
Bolton & Menk, Inc.
Mobile: 515-291-4065
Bolton-Menk.com

ENGINEER'S REPORT
OF PRELIMINARY SURVEY OF LEVEE ALONG THE MISSOURI
RIVER PETITIONED FOR BY GEO. A. KELLOGG AND OTHERS

TO THE BOARD OF SUPERVISORS OF POTTAWATTAMIE COUNTY, IOWA:

Gentlemen:

In response to your appointment and request for a report complying with the above sectioned petition, I submit the following report.

I have examined the land mentioned in the petition and adjacent lands, and find that the lands in Rockford Township lying west of the Allen Creek Ditch are subject to overflow from the Missouri River at certain times. The floods interfering with both the use of and the access to the lands in this area.

To protect and reclaim these lands I recommend the construction of a Levee commencing at the West line of the Allen Creek, 1000 feet South of the Northeast corner of Section 2-77-44 and running parallel to the general line of the left bank of the Missouri River across Sections 20 and 17 and 18, in 77-44 and continuing up the river across the accretions to Sections 2 and 3 and 3 in Township 77-45, crossing Lots 1 and 2 in Sections 3 and the Northwest Quarter (NW¼) of Section 2-77-45, terminating at the South end of the Coulthard Levee.

The line is described in detail in Exhibit 1, the line notes.
The proposed levee to be constructed in the following manner:
An earth levee with a top width of 20 feet, side slopes on river side to be 1 foot perpendicular to 3 feet horizontal. The slope on the land side to be 1 foot perpendicular to 1½ feet horizontal. The top should be finished to grade and in such manner that it can be sund as a road for vehicles or machinery it being for inspection and maintenance.

The material for construction to be taken from borrow pits between the levee and the river. No part of the material to be borrowed from the land side of the levee.

Borrow pits must not be continuous, but must have a strip of natural undisturbed earth 15 feet wide entirely across the borrow pit at intervals not exceeding 400 feet.

The height of the levee will be as shown by the grade lines on the profile, marked Exhibit 6. The top is shown 3 feet above the high water mark of April, 1943.

Attached to this report and made a part thereof are the following Exhibits:

Exhibit 1. Line notes
Exhibit 2. District boundaries
Exhibit 3. Description of right-of-way showing owners names as shown by the transfer books in County Auditor's Office.
Exhibit 4. Lands included in the district with owner's names, as shown by the transfer books.
Exhibit 5. Plat of the district, and
Exhibit 6. A profile of the levee,

The improvements as recommended herein are necessary, practicable and feasible in carrying out the purposes of the petition, and will be of public benefit or utility, and conducive to the public health, convenience and welfare, in addition to the reclamation and protection of the said lands for agricultural purposes, and the reclamation and protection of the public rights of way that are located within the proposed levee district.

An estimate of Cost of the Construction of the above project is as follows:

Right-of-way - 163 Acres @ $30.00	$4890.00
Earth work 350000 cu. yds. @ $.09	29700.00
140 feet 3 foot culvert pipe @ $5.00	700.00
Permanent Survey	1900.00
Commissioners	500.00
Court and Legal Expense	2500.00
Engineering and Supervision	2500.00
Total	$42290.00

In my opinion the cost, as above estimated, is not prohibitive, and is far less than the benefits that will accrue from the establishment of the district and the construction of the proposed improvements.

Dated at Council Bluffs, Iowa, this 22nd day of September, 1943.

J. H. Hayne
Engineer

EXHIBIT 1

(Location of Proposed Levee)

Beginning at a point 1000 feet South and 30 feet West of the North East Corner of Section 20-77-44, Station 0, this point being on the West line of the Allen Creek Ditch Right-of-way, and running

North 60 degrees West to Station 27
North 55 degrees West to Station 64
North 86 degrees West to Station 76
South 85 degrees West to Station 104
North 87 degrees West to Station 140
North 72 degrees West to Station 234
North 47 degrees West to Station 246
North to Station 322
North 32 degrees East to Station 591
North 65½ degrees East to Station 356 or the South end of the Coulthard Levee on the north line of the Northwest Quarter (NW¼) of Section 2- 77- 45.

EXHIBIT 2

(Boundaries of Proposed District)

Boundaries of the District beginning at the Northeast corner of the Northwest Quarter (NW¼) of the Northwest Quarter (NW¼) of Section 2-77-45 and running East following the North line of Sections 2 and 1 in Township 77-45 and Sections 6 and 5 in Township 77-44 to an intersection with the West line of the right-of-way of the Allen Creek Drainage Ditch, thence following Southerly along said right-of-way line to a point 1176 feet South of the North line of Section 20-77-44 thence north 70 degrees West, parallel to and 170 feet from the Center line, described in Exhibit 1, for its entire length or to the North line of Section 2-77-45, thence East along said section line to point of beginning.

EXHIBIT 3

(Right of Way Proposed)

Right-of-way 200 feet wide being 30 feet from the center line on the land side and 170 feet from center line on the river side of the elvee across the following tracts:

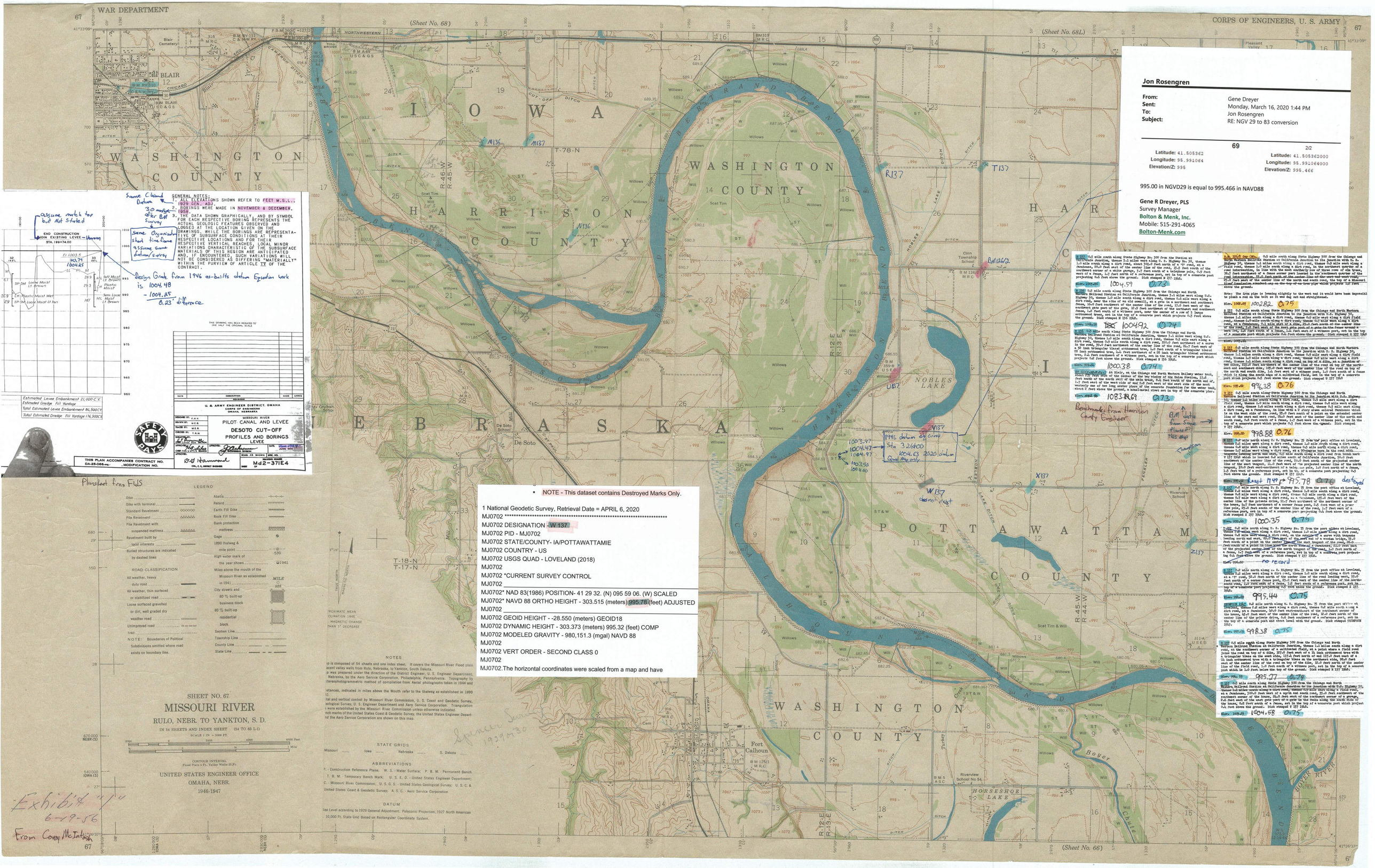
Section 20-77-44			
NE NE	200x1300 ft.	60 A.	H. F. Foss
NW NE	200x1400 ft.	64 A.	Ernest Briley
Section 17-77-44			
SE SW¼	2200 x 200	10 A.	Frank McIntosh
NW SW	1020 x 200	4.8 A.	Emil W. Gunther
Section 18-77-44			
NE SE	1400 x 200	6.4 A.	Emil W. Gunther
Gov. Lots 1-2-&3 Accretions thereto	3960 x 200	18.2 A.	Frank McIntosh
Accretions to Sections 2- 11- 12- and 13 in 77-45	21300 x 200	96 A.	Travellers Insurance Co. (Owners under contract Henry K. Peterson & Raymond G. Peterson)
Gov. Lots 1 and 2 in Section 3,	1500 x 200	7 A.	Wm. Dean
SW SW Section 2,	1200 x 200	5.5 A.	Travellers Insurance Co. (Owners under contract Henry K. Peterson and Raymond G. Peterson)
Accretion to Section 2-11-12- & 13 -77-45	440 x 200	2 A.	Wm. Dean
Total		163 A.	

EXHIBIT 4 — See Engineer's Report for full list.

List of lands in District together with owners names as shown by the Transfer Book.

Section 5- 77- 44

NW¼ West of Allen Creek	Wm. J. Heminover
N½ SW¼ West of Allen Creek	Stuart Currie
S½ SW¼ West of Allen Creek	Wm. L. Walker


WAR DEPARTMENT
CORPS OF ENGINEERS, U. S. ARMY
(Sheet No. 68)
(Sheet No. 68L)
(Sheet No. 66)
IOWA
NEBRASKA
WASHINGTON COUNTY
HARRISON COUNTY
POTTAWATTAMIE COUNTY
BLAIR
NOBLES LAKE
HORSESHOE LAKE
Fort Calhoun
De Soto
Riverview School No 54
Cinn Township School
Pleasant Valley
Boyer River
Boyer Chute
Missouri River
Willows
Scat Tim & Will
T-78-N
T-18-N
T-17-N
R 46 W
R 45 W
R 44 W
R 12 E
R 13 E
GENERAL NOTES:
1. ALL ELEVATIONS SHOWN REFER TO FEET M.S.L., 1929 GEN. ADJ.
2. BORINGS WERE MADE IN NOVEMBER & DECEMBER, 1958.
3. THE DATA SHOWN GRAPHICALLY, AND BY SYMBOL FOR EACH RESPECTIVE BORING REPRESENTS THE ACTUAL GEOLOGIC FEATURES OBSERVED AND LOGGED AT THE LOCATION GIVEN ON THE DRAWINGS. WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL MINOR VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THIS REGION ARE ANTICIPATED AND, IF ENCOUNTERED, SUCH VARIATIONS WILL NOT BE CONSIDERED AS DIFFERING "MATERIALLY" WITHIN THE PURVIEW OF ARTICLE IV OF THE CONTRACT.
THIS DRAWING HAS BEEN REDUCED TO ONE HALF THE ORIGINAL SCALE
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA
MISSOURI RIVER
PILOT CANAL AND LEVEE
DESOTO CUT-OFF
PROFILES AND BORINGS
LEVEE
THIS PLAN ACCOMPANIES CONTRACT NO. DA-23-066-eng-
MODIFICATION NO.
Md2-371E4
Estimated Levee Embankment 21,000 C.Y.
Estimated Dredge Fill Yardage
Total Estimated Levee Embankment 86,500CY
Total Estimated Dredge Fill Yardage 176,900CY
END CONSTRUCTION
JOIN EXISTING LEVEE
Same Datum
30 months after BM Survey
Same Organization short time frame assume same datum/survey
Design Grade from 1946 as-builts datum Equation work is 1004.48 - 1004.25 0.23' difference
Plansheet from FWS
LEGEND
ROAD CLASSIFICATION
NOTES
STATE GRIDS
ABBREVIATIONS
DATUM
SHEET NO. 67
MISSOURI RIVER
RULO, NEBR. TO YANKTON, S. D.
IN 54 SHEETS AND INDEX SHEET (54 TO 83 L-1)
SCALE 1 IN = 2000 FT.
CONTOUR INTERVAL
Flood Plain 5 Ft., Valley Walls 20 Ft.
UNITED STATES ENGINEER OFFICE
OMAHA, NEBR.
1946-1947
Exhibit 4
6-19-56
From Corey McIntosh
Spencer Sunn 1929 to 30
NOTE - This dataset contains Destroyed Marks Only.
1 National Geodetic Survey, Retrieval Date = APRIL 6, 2020
MJ0702 **********
MJ0702 DESIGNATION - W 137
MJ0702 PID - MJ0702
MJ0702 STATE/COUNTY- IA/POTTAWATTAMIE
MJ0702 COUNTRY - US
MJ0702 USGS QUAD - LOVELAND (2018)
MJ0702
MJ0702 *CURRENT SURVEY CONTROL
MJ0702 ___
MJ0702* NAD 83(1986) POSITION- 41 29 32. (N) 095 59 06. (W) SCALED
MJ0702* NAVD 88 ORTHO HEIGHT - 303.515 (meters) 995.78 (feet) ADJUSTED
MJ0702 ___
MJ0702 GEOID HEIGHT - -28.550 (meters) GEOID18
MJ0702 DYNAMIC HEIGHT - 303.373 (meters) 995.32 (feet) COMP
MJ0702 MODELED GRAVITY - 980,151.3 (mgal) NAVD 88
MJ0702
MJ0702 VERT ORDER - SECOND CLASS 0
MJ0702
MJ0702.The horizontal coordinates were scaled from a map and have
Jon Rosengren
From: Gene Dreyer
Sent: Monday, March 16, 2020 1:44 PM
To: Jon Rosengren
Subject: RE: NGV 29 to 83 conversion
69
2/2
Latitude: 41.505362
Longitude: 95.991064
Elevation/Z: 995
Latitude: 41.505362000
Longitude: 95.991064000
Elevation/Z: 995.466
995.00 in NGVD29 is equal to 995.466 in NAVD88
Gene R Dreyer, PLS
Survey Manager
Bolton & Menk, Inc.
Mobile: 515-291-4065
Bolton-Menk.com
Elev. 1003.66 1004.59 0.73
Elev. 1002.92 1004.92 0.74
Elev. 999.80 1000.38 0.74
Elev. 1083.96 1083.69 0.73
Elev. 996.38 996.38 0.76
Elev. 998.12 998.88 0.76
Elev. 999.60 1000.35 0.75
Elev. 994.69 995.44 0.75
Elev. 997.63 998.38 0.75
Elev. 994.93 995.77 0.74
Elev. 1004.03 1004.68 0.75
Benchmarks from Harrison County Engineer
BM data from Sonny plotted on this map
Transfer
Elev. 995.44 + 0.74 = 995.78 destroyed
Elev. 998.88 + 0.75 = 998.88 destroyed

Coulthard/Vanman Levee Junction

Vanman Levee District

1938 Coulthard Levee Location

April 2020

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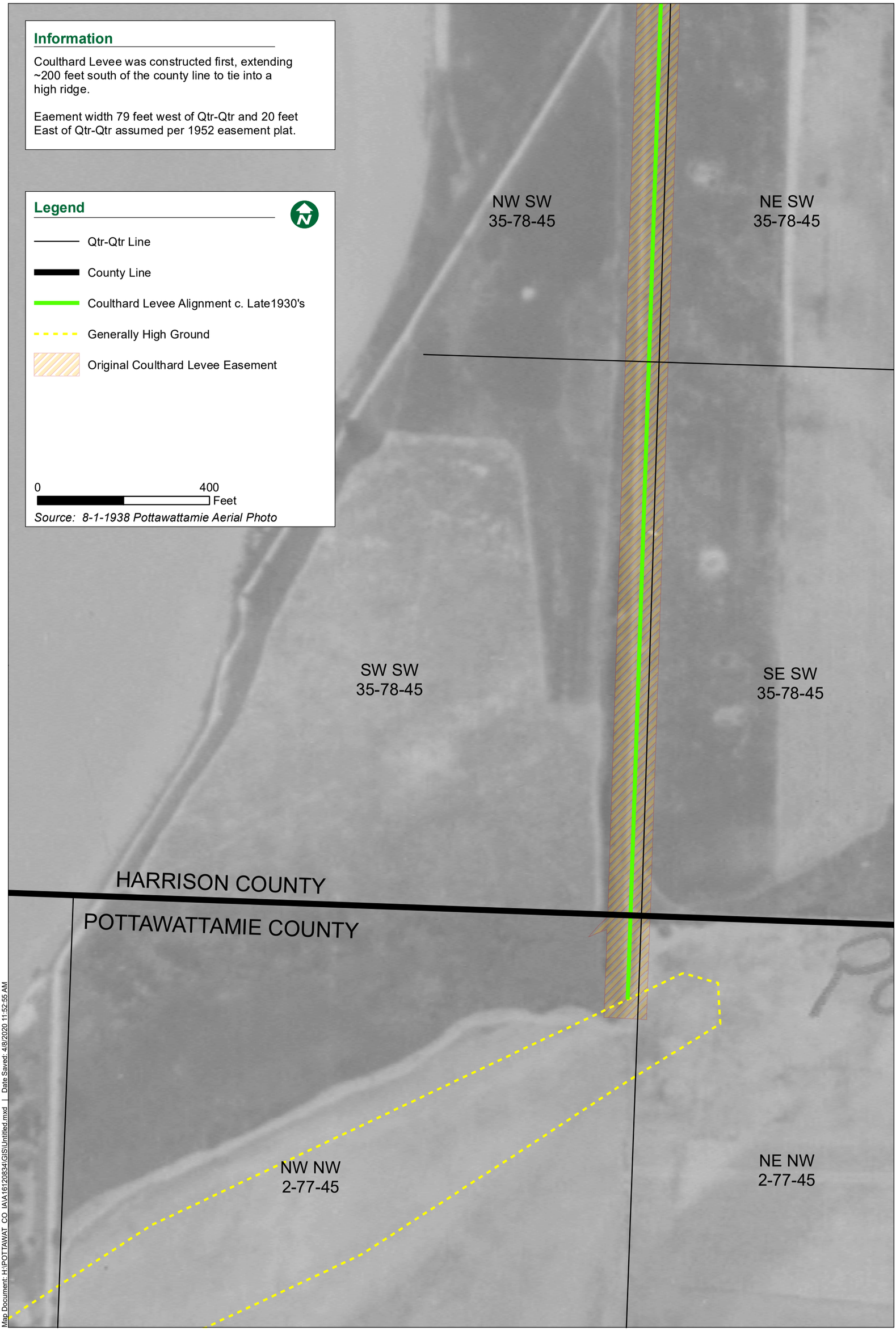

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Coulthard/Vanman Levee Junction

Vanman Levee District

1950 Coulthard & Vanman Levee Location

April 2020

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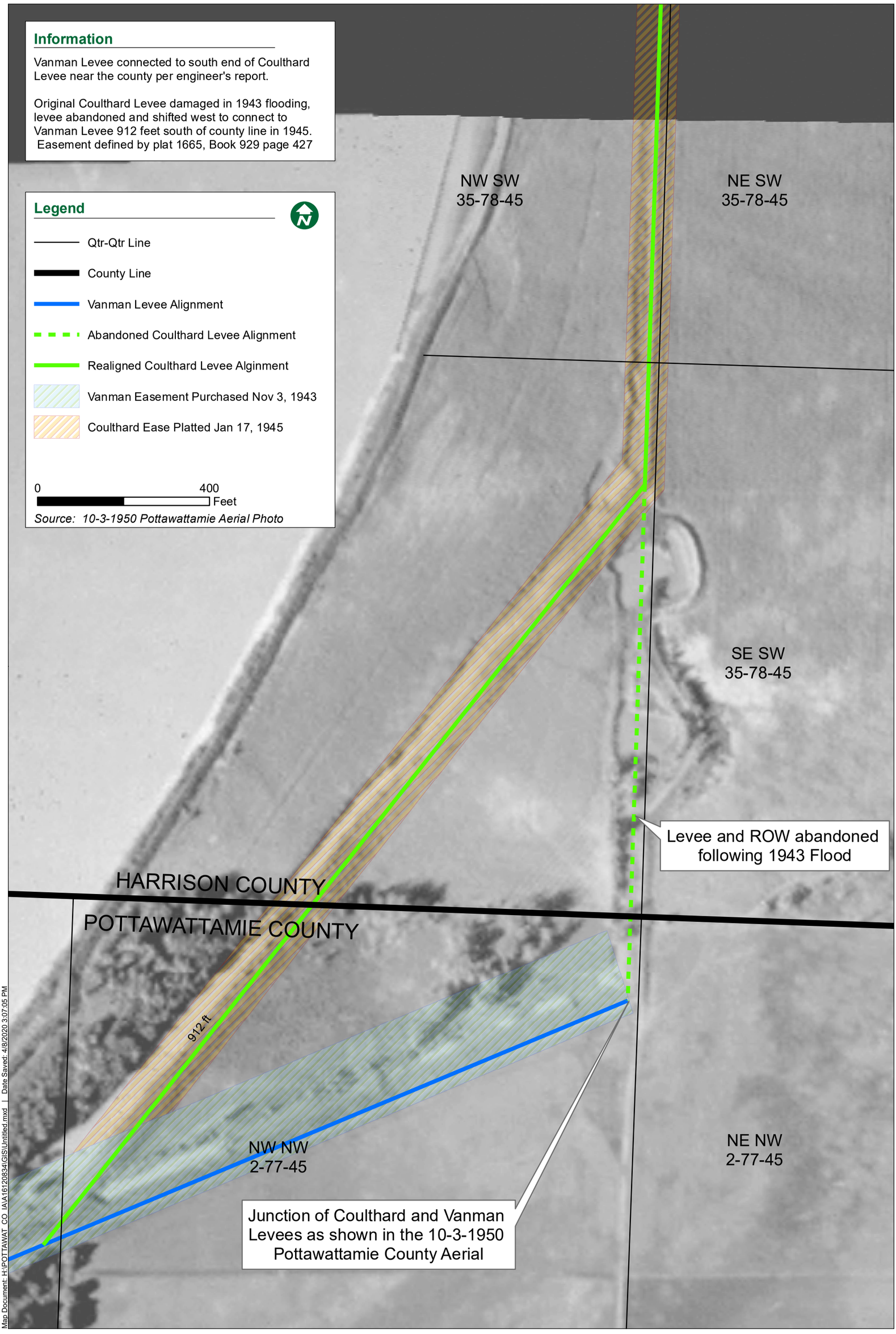

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Coulthard/Vanman Levee Junction

Vanman Levee District

1954 Coulthard & Vanman Levee Location

April 2020

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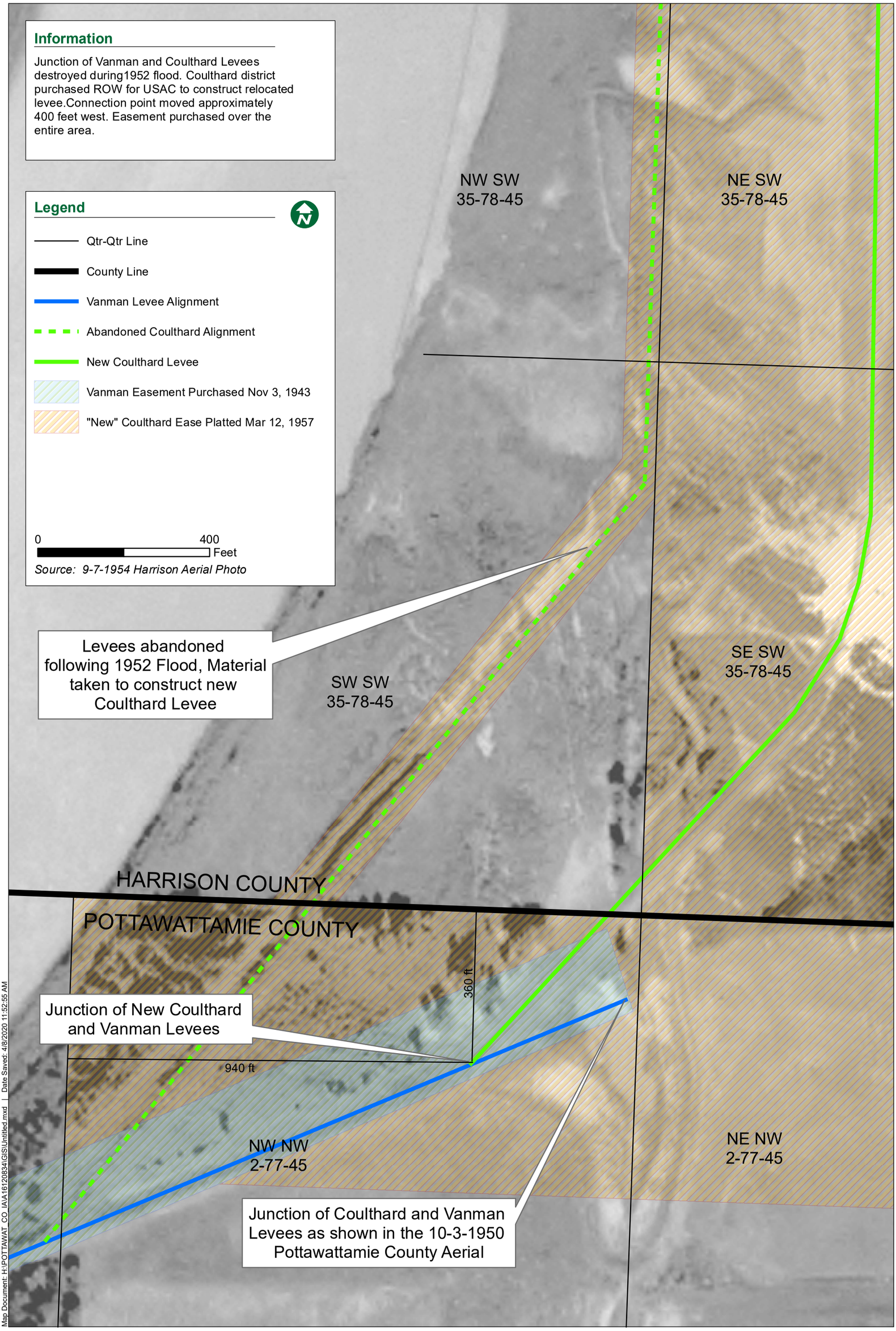

Map Document: H:\POTTAWAT_CO_IA\A16120834\GIS\Untitled.mxd | Date Saved: 4/8/2020 11:52:55 AM