Engineer's Report - Annexation

Rand-Peterson Levee District

Harrison and Pottawattamie Counties, Iowa

November, 2018

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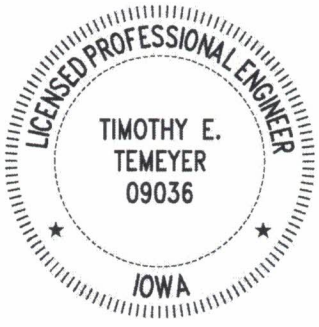

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed professional engineer under the laws of the State of Iowa. My renewal date is December, 2018.

By: Timothy E. Temeyer
Timothy E. Temeyer, P.E.
License No. 09036

Date: Nov. 15, 2018

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During the Missouri River Flood of 2011, flood stages along the Missouri River in western Iowa caused some levees to be overtopped resulting in extensive flooding and flood damages behind the levees. In the area northwest, west, and southwest of Missouri Valley, Iowa there are levees operated by the Rand-Peterson, Cutoff Lake, Coulthard, and Vanman Levee Districts that provide protection from Missouri River flooding. Private levees also exist in this area. These levees extend from the Boyer River on the south to the Soldier River on the north, a length of approximately 28.2 miles. During the Flood of 2011, when flood forecasts indicated that the levees would be overtopped, a local flood fight coalition composed of several entities including the levee districts undertook emergency efforts to strengthen and raise the levees where necessary to prevent levee failure or overtopping. During the flood, although Missouri River water levels were within 1 to 2 feet of the top of the strengthened levees, upstream from Highway 30 the emergency measures were successful and the levees held. These efforts prevented flooding the cities of Modale and western Missouri Valley and inundation of approximately 49,000 acres of farmland north of the UPRR roadway. The efforts also prevented the overtopping and closure of Interstate 29 roadway north of Missouri Valley and prevented major damage from erosion to the UPRR embankment and Highway 30 roadway in areas west of Missouri Valley.

The Rand-Peterson and New Beck Levee Districts (which were recently combined into the single Rand Peterson Levee District) currently encompass an area of approximately 30,000 acres. After review of the areas that could have been inundated if the levees had failed, it became apparent that additional study was necessary with the goal of annexation of appropriate parcels and reclassification of the area receiving benefits from the levees to more accurately reflect current conditions in the Missouri River floodplain.

The Rand-Peterson Levee District Board of Trustees appointed an engineer to determine what areas are receiving material flood control benefits from the levees, and to recommend annexation of any additional lands that are receiving material flood control benefits but are not already within the levee district. This analysis involved utilizing levee performance information during the 2011 Missouri River flood, computed water surface profiles from the U.S. Army Corps of Engineers, and development of areas receiving material benefits from the levees using Iowa Lidar topographic mapping. The levees are located on the east bank of the Missouri River and extend approximately from River Mile 635.6 to River 663.9, a total of 28.2 river miles. Following is a list of the levees beginning near the confluence of the Soldier River with the Missouri River. Also included are the Desoto Bend roadway chute closure which also acts as a flood control embankment, and high ground areas where a levee is not required because existing high ground provides sufficient protection.

Missouri River Levees (Iowa) – Soldier River to Boyer River			
	Approximate River Mileage	Approximate Levee Length (feet)	Average Levee Height (feet)
Private Levee	662.3 to 663.9	10,700	7
Rand-Peterson Levee	658.6 to 662.3	20,600	5
High Ground	658.3 to 658.6	2,100	0
Private Levee	656.8 to 658.3	7,800	3
High Ground	656.0 to 656.8	4,100	0
Rand-Peterson Levee	653.4 to 656.0	11,900	6
High Ground	653.3 to 653.4	700	0
Rand-Peterson Levee	648.3 to 653.3	34,300	7
2011 Flood Fight Levee	645.2 to 648.3	16,800	0 to 12
Cutoff Lake Levee	644.0 to 645.0	6,000	7
DeSoto Bend Roadway	641.8 to 645.2	14,900	N/A
Coulthard Levee	641.5 to 643.8	22,100	7
Vanman Levee	635.7 to 641.5	30,500	8
Total	28.2	176,500	

The attached Plate 1 shows the location of the levees and high ground areas. Also shown are water surface profiles for the 10-, 50-, 100- and 500-year floods, and high water mark elevations for the 2011 Missouri River flood. The water surface profiles were obtained from the Upper Mississippi River System Flow Frequency Study (UMRSFFS), U.S. Army Corps of Engineers, January, 2004. As shown on this plate, upstream from the Highway 30 bridge at Blair, the high water elevations for the 2011 flood are approximately equal to or slightly lower than the elevations for the 500-year flood event. This is consistent with the peak discharge of 209,000 cubic feet per second (cfs) at Blair, NE for the 2011 flood being slightly lower than the discharge of the 500-year flood, which is 237,800 cfs at Blair, NE. Additionally, in the hydraulic model for the 500-year flood event, the overbank flow was assumed to be unconfined by the local levee systems. However, for the 2011 flood event on the Iowa side Missouri River flood flows were confined riverward of the Rand-Peterson and private levees, which would have raised the flood elevations for the 2011 flood higher than would have been experienced if the overbank flow was unconfined by local levees. This may also account for the 2011 flood levels being very close to the 500-year flood levels, even though the 2011 discharge is less than the 500-year discharge.

Downstream from the Highway 30 bridge, the 2011 high water mark elevations are approximately 3 feet below the elevations for the 500-year flood event. This is consistent with the fact that there were major levee failures on the Iowa side in the reach from Highway 30 downstream to Council Bluffs which would have produced lower flood levels for the Missouri River.

Also shown on Plate 1 are the top of levee elevations for the Rand-Peterson and private levees. These elevations indicate that except for one location during the 2011 flood event there was approximately 1 to 2 feet of freeboard available between the peak 2011 flood levels and the top of levee elevations. At

River Mile 656.7 the profile indicates there was only 0.1 feet of freeboard available. However there was a setback levee constructed at this location that provided 1 to 2 feet of freeboard.

For purposes of defining the area provided material flood control benefits by the levee system, the area flooded during a 500-year flood event (237,800 cfs at Blair, NE) was plotted using the water surface elevations for the 500-year flood shown on Plate 1, and the latest topographic mapping for the floodplain. The 500-year flood was used because the 500-year water surface profile is similar to the 2011 high water marks, the 500-year water surface profile is an unconfined condition which better represents the flow conditions in the overbank areas landward of the levee, and the 500-year profile better represents conditions downstream of Highway 30 if the levees in this area are repaired and can contain a flow of 209,000 cfs. The mapping utilized was the 2 foot contour interval LIDAR mapping obtained by the state of Iowa.

Plate 2 shows in blue the resulting flooded area. Plate 3 shows the same area, only with parcel boundaries outlined in the map. This is the area that is considered to be provided flood protection material benefits due to the existence of the Rand-Peterson, Coulthard, Vanman, DeSoto Bend chute closure/roadway, and private levees from the Boyer River to the Soldier River. This area amounts to approximately 49,000 acres north of the UPRR embankment and 26,000 acres south of the UPRR embankment, for a total of 75,000 acres or 117 square miles. Note that during the 2011 flood event there was a flood fight levee constructed from Highway 30 in a southeasterly direction and connected to the Desoto Bend chute closure/roadway. Although this levee failed during the 2011 flood event and some portions were subsequently removed, for purposes of this study it was assumed that the levee is intact and capable of containing the 2011 flood event.

Plate 2 also shows the current boundary of the Rand-Peterson, Vanman and Coulthard Levee Districts. There are several options which could be considering when determining the overall extent of the annexation. Following is a description of the options.

1. At the northern end of the area receiving benefits there is a triangular area of about 1,300 acres downstream from the Soldier River (between River Mile 662 to 664) that is protected by a private levee. This area would not have to be annexed because there is high ground at the upstream end of the existing Rand-Peterson levee system that could provide a tie-off to the levee system. However this high ground would have to be closely monitored during a flood event to provide adequate freeboard for this tieoff area. It is recommended this area not be annexed at this time, but possibly considered for annexation at a later date if ongoing maintenance or improvements to the levee system would benefit from this annexation.

2. The Vanman Levee in Pottawattamie County is an integral part of the overall line of protection provided to the area receiving benefits from the levee system. However, since the Vanman Levee District Board of Trustees is already assessing parcel owners and operating and maintaining this section of levee independent from the actions of the Rand-Peterson Board of Trustees, it is recommended that parcels within the Vanman Levee District not be annexed. If this area is not annexed, as long the

Vanman Levee District Board of Trustees continues to operate and maintain the levee, the area outside the Vanman Levee District would continue to receive the material benefits as outlined in this report.

3. Downstream from Highway 30 the primary line of protection as evaluated in this study extends from Highway 30 in a southeasterly direction for about 1.5 miles though a high ground area until it connects with service roads for the DeSoto Bend National Wildlife Refuge that also serve as a flood protection embankment. The Coulthard Levee, that is in both Harrison and Pottawattamie County, is therefore not part of the primary line of protection that provides the flood protection benefits as outlined in this report. However the Coulthard levee does provide a secondary line of protection to the area east of the Coulthard levee, and is also in integral part of the tieoff to high ground for the Vanman levee. The Coulthard Levee District is managed by the Harrison County Board of Supervisors. Similar to the Vanman Levee, since the Coulthard Levee District /Board of Supervisors are already assessing parcel owners and operating and maintaining this section of levee independent from the actions of the Rand-Peterson Board of Trustees, it is recommended that parcels that are within the Coulthard Levee District not be annexed. If this area is not annexed, as long the Coulthard Levee District/Board of Supervisors continue to operate and maintain the levee, the area outside the Coulthard Levee District would continue to receive the material benefits as outlined in this report. Note however that there are three large scour holes remaining in the Coulthard levee as a result of overtopping during the Missouri River flood of 2011. If these holes are not repaired, consideration should be given to annexing the parcels within the Coulthard Levee District.

4. The Cutoff Lake Levee was originally designed to provide flood protection from Missouri River before the closure of the oxbow which created the DeSoto Bend National Wildlife Refuge. However it is no longer part of the existing primary line of protection as evaluated in this report. Additionally, all parcels that are part of the Cutoff Lake Levee and Drainage District are already within the Rand-Peterson Levee District. Therefore it is recommended that no change be made to the status of these parcels.

5. The Desoto Bend chute closure/roadway is part of the primary line of protection as outlined in this report, and parcels within the DeSoto Bend National Wildlife Refuge are within the area receiving material benefits from the levees. If assessments are made to these parcels, the federal government/U.S. Fish & Wildlife Service is not obligated to pay the assessments. However, it is recommended that parcels within the DeSoto Bend National Wildlife Refuge that are also within the state of Iowa be annexed, in the event that the federal government/U.S. Fish & Wildlife Service has the ability to pay the assessments. Parcels within the DeSoto Bend National Wildlife Refuge that are within the state of Nebraska can only be annexed if there is a cooperative agreement with another levee district in Nebraska. Since this is not the case, parcels within Nebraska will not be annexed.

6. During the 2011 flood event there was a flood fight levee constructed from Highway 30 in a southeasterly direction and connected to the Desoto Bend chute closure/roadway. Although this levee was subsequently removed, current operational plans for the Rand-Peterson Levee District include reconstructing this emergency levee in the event that flood forecasts by the Corps of Engineers or National Weather Service indicate that extensive flooding would occur without the emergency levee. A functional levee at this location, whether an emergency levee or a permanent levee, is necessary in

order to provide the material benefits as outlined in this report. It is recommended that after the annexation process is complete, consideration be given to constructing a permanent levee at this location.

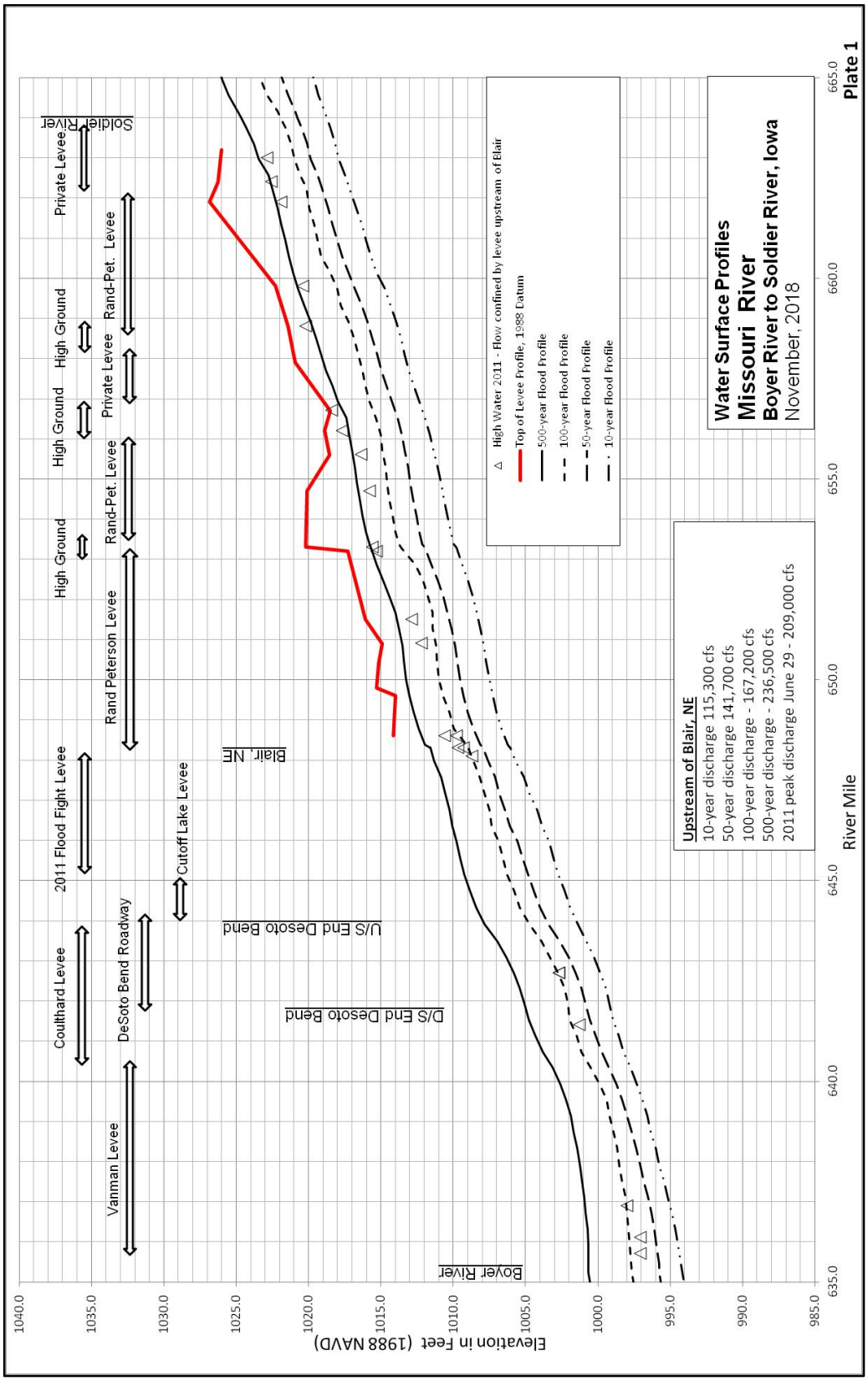
7. There are approximately 40 parcels that are within the current Rand-Peterson Levee District that do not receive material flood control benefits from the existence of the Rand-Peterson levee. Most of these parcels are south of Highway 30 and riverward (west) of the location for an emergency levee, as described in paragraph 5. Although the current operational plans for this emergency levee will not provide flood protection for these parcels, it is recommended that these parcels remain in the levee district, but with a zero assessment, at least until a location for a permanent levee is finalized.

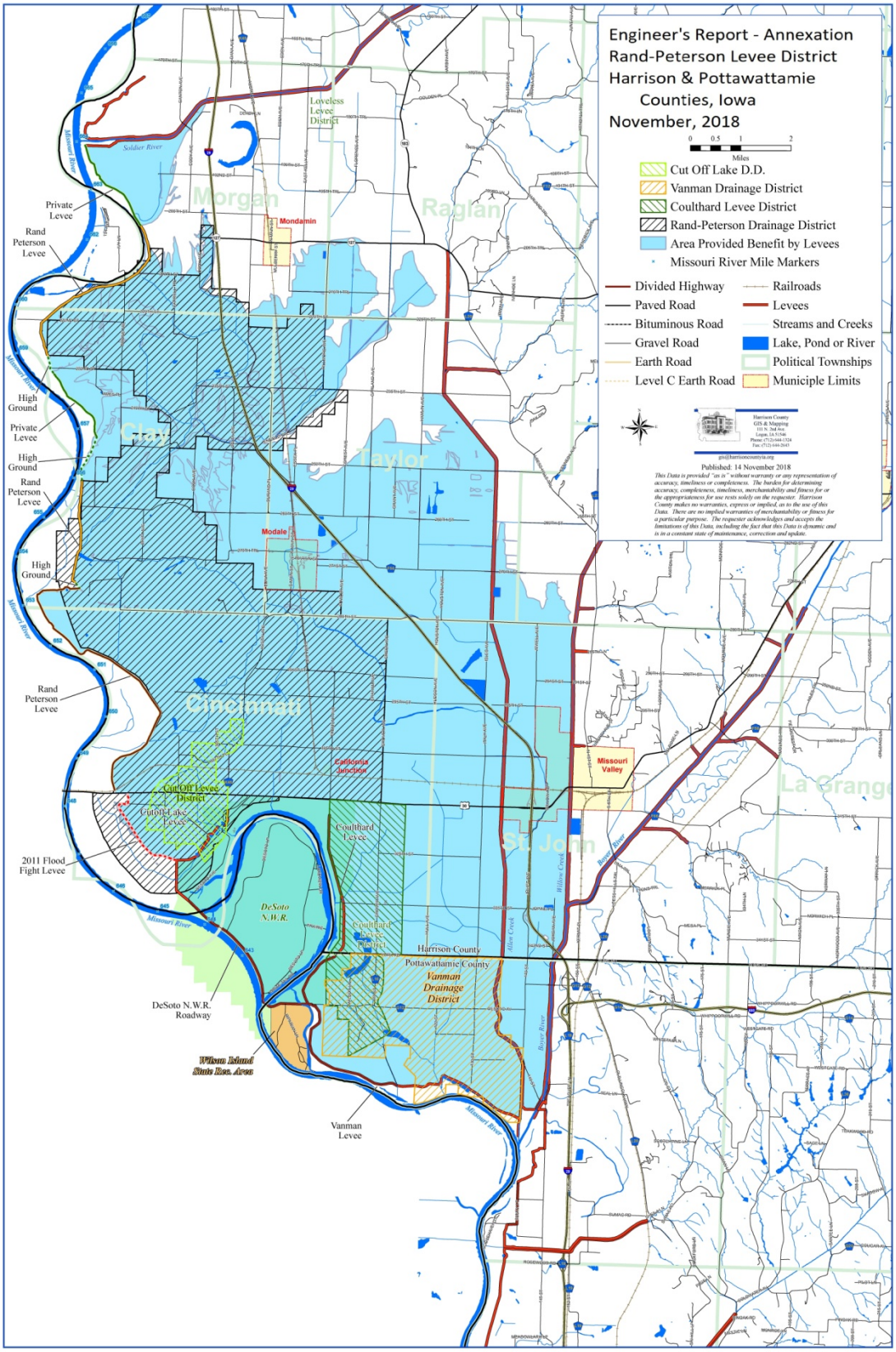
Based upon the information outlined in this report, annexation of additional parcels by the Rand-Peterson Levee District would provide for more accurate assessment to parcels that are receiving material flood control benefits from the Rand-Peterson Levee District levees along the Missouri River that extend from the Boyer River upstream to River Mile 662 (approximately 2 miles downstream from the Soldier River). Plate 3 shows the area receiving material flood control benefits, the existing parcels in the Rand-Peterson Levee District with cross hatching, and the parcels proposed to be annexed in light blue. It is recommended that the Rand-Peterson Board of Trustees take the following steps to accomplish annexation of additional parcels as outlined in this report.

1. Tentatively approve this report.
2. Notify landowners to be annexed.
3. Conduct the required public hearing.
4. Annex to the district the lands determined to be provided material benefits.

Submitted by:

Timothy Temeyer, P.E.


Water Surface Profiles
Missouri River
Boyer River to Soldier River, Iowa
November, 2018
Plate 1
High Water 2011 - Flow confined by levee upstream of Blair
Top of Levee Profile, 1988 Datum
500-year Flood Profile
100-year Flood Profile
50-year Flood Profile
10-year Flood Profile
Upstream of Blair, NE
10-year discharge 115,300 cfs
50-year discharge 141,700 cfs
100-year discharge - 167,200 cfs
500-year discharge - 236,500 cfs
2011 peak discharge June 29 - 209,000 cfs
Elevation in Feet (1988 NAVD)
River Mile
Boyer River
D/S End Desoto Bend
U/S End Desoto Bend
Blair, NE
Cutoff Lake Levee
Rand Peterson Levee
Rand-Pet. Levee
Private Levee
High Ground
2011 Flood Fight Levee
Coulthard Levee
DeSoto Bend Roadway
Vanman Levee
Soldier River
Private Levee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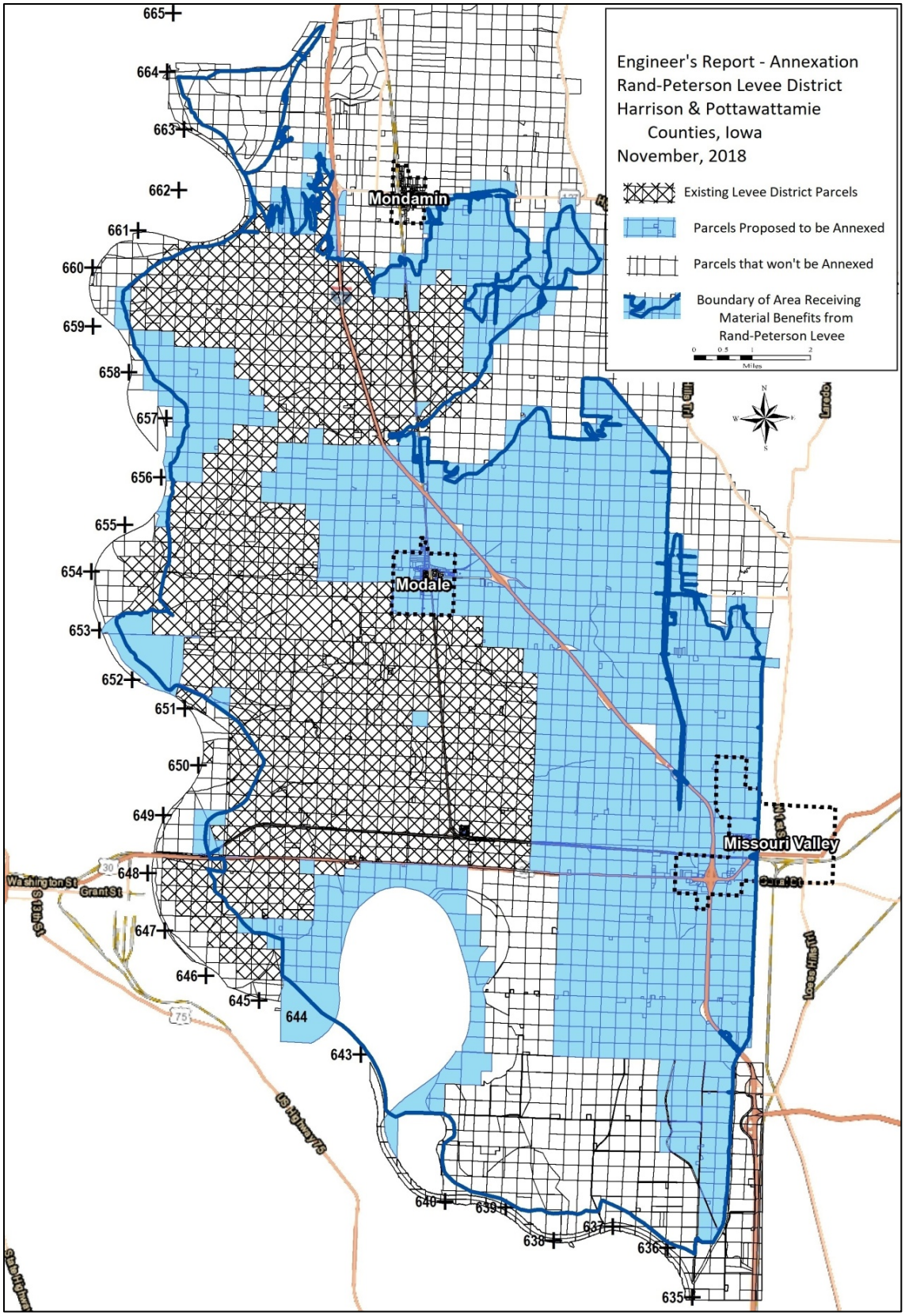
Miles
Cut Off Lake D.D.
Vanman Drainage District
Coulthard Levee District
Rand-Peterson Drainage District
Area Provided Benefit by Levees
Missouri River Mile Markers
Divided Highway
Paved Road
Bituminous Road
Gravel Road
Earth Road
Level C Earth Road
Railroads
Levees
Streams and Creeks
Lake, Pond or River
Political Townships
Municiple Limits
Published: 14 November 2018
Loveless Levee District
Private Levee
Rand Peterson Levee
High Ground
Private Levee
High Ground
Rand Peterson Levee
High Ground
Rand Peterson Levee
2011 Flood Fight Levee
Cut Off Levee District
Cut Off Lake Levee
Coulthard Levee
Coulthard Levee District
DeSoto N.W.R.
DeSoto N.W.R. Roadway
Wilson Island State Rec. Area
Vanman Levee
Harrison County
Pottawattamie County
Vanman Drainage District
Mondamin
Modale
Cincinnati
California Junction
Missouri Valley
Morgan
Raglan
Clay
Taylor
St John
La Grange
Soldier River
Missouri River
Boyer River
Willow Creek
Mosquito Creek

Plate 2.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Existing Levee District Parcels
Parcels Proposed to be Annexed
Parcels that won't be Annexed
Boundary of Area Receiving
Material Benefits from
Rand-Peterson Levee
Miles
Mondamin
Modale
Missouri Valley
Washington St
Grant St
S 13th St
Harrison Levee
US Highway 75
665
664
663
662
661
660
659
658
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Plate 3.