FARGO-MOORHEAD DIVERSION PROJECT
FARGO, ND
MOORHEAD, MN

MARKET STUDY OF THE EFFECTS ON FARMLAND VALUE DUE TO FLOODING & FLOOD EASEMENTS
PHASE 1B

PREPARED FOR
FARGO-MOORHEAD DIVERSION AUTHORITY
& ITS MEMBER ENTITIES
BY CROWN APPRAISALS, INC.
AS OF AUGUST 18, 2020

Crown Appraisals, Inc.

August 18, 2020

Mr. Eric Dodds
AE2S
4170 28th Avenue South
Fargo, ND 58104

RE: Market Study of the Effects on Value due to Flooding & Flood Easements -- *Phase 1B*
Assignment Request No. 03-27-20 per J. Paulsen

Dear Mr. Dodds:

In accordance with the written agreement dated December 21, 2017, Crown Appraisals, Inc. conducted research and analysis pertaining to potential impacts on the market value of tillable farmland due to flooding and due to the presence of a flood easement. That market study (Phase 1) was completed in 2018.

On March 27, 2020, an amendment to the original agreement was created requesting Crown Appraisals, Inc. to include data from recent years. This second market study of the effects on value due to flooding and flood easements is referred to as Phase 1B. The same methodology and techniques were utilized in Phase 1B as in the original study.

The Fargo-Moorhead Diversion Authority (DA) and its member entities are the clients and users of this report. The report is for the Diversion Authority's internal use as part of the Fargo-Moorhead Diversion Project. The DA is proposing to purchase permanent flowage easements on many thousands of acres south of the Fargo-Moorhead metropolitan area to create a "staging area" for use during major flood events. The flowage easement will give the DA the right to temporarily flood properties in the staging area as long as necessary to manage Red River water flows through and around Fargo during periods of extremely high water volumes.

All or a part of the staging area will be available to be temporarily flooded to manage water flows. Land closer to the river and at a lower elevation will be flooded to a greater depth, more frequently, and of a longer duration than land located further from the river and at a higher elevation where flood depths will be shallower, less frequent, and of a shorter duration.

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American Society of Farm Managers and Rural Appraisers
American Society of Appraisers

The DA recognizes that establishing an appropriate value for the flowage easements is an important task. The DA authorized the Consultant (Crown Appraisals, Inc.) to conduct Phase 1 & 1B of the flowage easement valuation process. Phase 1B's purpose is to perform research to identify market data which could be utilized in a future Phase 2 of the project to form an opinion of just compensation due landowners as a result of flowage easements which are anticipated to be placed on the land within the staging area.

Phase 1B of the flowage easement analysis included developing a regression analysis model, and a paired sales analysis utilizing sales of properties that are encumbered with an easement, as well as unencumbered properties in representative markets from across the country. Under future phases of the flowage easement valuation process, the regression analysis model in conjunction with the matched pair analysis will provide a platform which will allow a valuation unique to each parcel. The severity of the impacts associated with operation of the Project specific to each parcel within the proposed upstream mitigation area will be able to be identified in future phases of the flowage easement valuation project.

Phase 1B is a consulting assignment which includes research and analysis of market sales. It is not a valuation project even though Phase 1B is performed by appraisers. Crown Appraisals, Inc. assembled a team of expert appraisers and a PhD economist to research, gather, assemble and analyze market data to conclude a range of percentages which may then be applied to individual properties in Phase 2 of the flowage easement project.

Regression Analysis

Regression analysis is a statistical approach that incorporates a large set of data to estimate the effect of flooding on the value of agricultural land. The dataset collected for the analysis in this report includes detailed information on the price and property characteristics of arms-length agricultural land sales from Cass, Clay, Norman, Richland, Traill, and Wilkin counties between 1992 and 2020. This period includes seven major flood events in the research area: 1997, 2001, 2006, 2009, 2010, 2011, and 2019. A total of 2,060 unimproved, agricultural land sales were collected.

The results from the regression analysis provide robust evidence that inundation negatively affects the price of agricultural land in this six county region. Traditional methods comparing flood versus non-flood property, before and after a flood event, show an average reduction in agricultural land values of 8.5% in the year following a flood event. Recognizing that agricultural property in the study area does not uniformly flood, hydraulic modeling data was incorporated to evaluate how flood severity affects land value. Estimates highlight a discount of 0.010% for each additional percent of inundated land (i.e., a 10.0% discount for 100% inundation), and a discount of 2.4% for a one-foot increase in flood level. Non-linear effects of flood depth were also examined: a 5.5% discount was estimated for the first foot of flooding that diminishes for each additional foot of inundation. All of these effects are temporary as they disappear within two years after a flood event.

Paired Sales Analysis

In completing a matched pairs analysis to analyze the effect of flowage easements and flooding on farmland values, several areas of the US were researched to obtain sale data. To this end, sales research was conducted along the Missouri River in Iowa, Missouri, and Nebraska; the northern Red River Valley in North Dakota and Minnesota; and the Birds Point-New Madrid Floodway along the Mississippi River in southeast Missouri.

Research was fruitful in the Birds Point-New Madrid area, allowing for a paired sales analysis to be developed to identify the market reaction to the presence of flowage easements on farmland. Many parcels in the Birds Point area are encumbered with a flowage easement similar to the easement being proposed in the FM Diversion staging area. We were able to identify several sales of easement encumbered land, as well as unencumbered land for comparison. In the Red River Valley, the sales that were found were affected by natural causes. The Birds Point area, however, flooded in 2011 as a result of a voluntary breach in the levee in order to reduce the flooding effects on the city of Cairo, IL. We feel that it is important to not only consider natural flooding events but also, more importantly, to include recent man made events. Analysis of the Birds Point data identifies the market's reaction to the loss of rights.

Dozens of sales on the Minnesota and North Dakota sides of the Red River north of Grand Forks were assembled for the purpose of identifying the market's reaction to reasonably frequent natural flooding events along the Red River. Percentage differences indicated by the market sales are discussed in this report.

Based on the evidence presented in the paired sales analysis and taking into consideration factors such as the existence of a flowage easement and the frequency of a flood event, a discount of 8% to 10% would be appropriate to apply for the properties that will have a flowage easement placed on them. If the potential for the frequency of flooding events increases, the discount increases and could be expected to be in the 10% to 25% range. Placement of a flowage easement results in the loss of property rights and provides the Diversion Authority with the right to flood the property at any time and this needs to be reflected as such. The additional factor to consider then is the frequency of flooding which would result in a higher discount than that reflected only by the loss of property rights.

Conclusions

In conclusion, both the regression techniques employed in measuring the impact of flooding on properties in the Red River Valley and the paired sales analysis completed based on both natural flooding and properties subject to a flowage easement indicated very similar results. There is strong evidence from the market to support a diminution in value for the loss of property rights due to the acquisition of a flowage easement. There is also support for a diminution in value resulting from flood events. It is the opinion of the authors of this study that a discount of 8-10% would be appropriate to apply for the loss of property rights. An incremental diminution in value, dependent on the severity of the flood event considering the degree of inundation, is to be considered that may indicate an additional diminution in value of 7% to 25%. Please note that the high end of the range is only applicable to those properties which will experience the most frequent flooding, at the deepest depth, and for the longest duration—essentially a worst case scenario. A synopsis of our results from the various analyses is presented on the following page. It is also important to note that the amount of development rights lost varies between the four mitigation zones proposed by diversion officials.

Study	Area	Estimate
Regression Diminution from Flood Event	Southern Red River Valley	7-10%
Paired Sales Diminution from Frequent Floods	Northern Red River Valley	11-43%
Paired Sales Loss in Property Rights	Birds Point-New Madrid Floodway	8-10%

It is critical to understand that the properties in the staging area will be affected by two aspects. First, they will be affected by the loss of property rights, for which they should be compensated approximately 8-10% of market value. Second, they should then receive additional compensation for the increased risk of flooding. Based on the two Red River Valley analyses, we believe that compensation for increased flood risk should be approximately 7-25%. These are two separate issues and should be treated as such. Assuming a 10% factor for loss of property rights, an example of how this may be applied based on flooding severity is as follows:

	Minor	Moderate	Extreme
Loss of property rights	10%	10%	10%
Plus increased flood risk	+10%	+15%	+25%
TOTAL diminution in value	20%	25%	35%

Examples listed are only examples and should not be interpreted as set levels of compensation. In Phase 2 compensation will be calculated for each property individually based on multiple criteria and may not match the example figures exactly.

Additional Support

- Following completion of the initial market study in 2018, Tim Hodge, the PhD economist on the Crown Appraisal team, submitted the regression analysis portion of the study for publication in a peer-reviewed journal. After thorough feedback from editors and reviewers, as well as a few minor changes, the study was accepted in March, 2020. The conclusions of the 2018 market study were unchanged. Dr. Hodge's manuscript titled "Flooding and the Value of Agricultural Land" will appear in the February 2021 issue of *Land Economics*, a highly regarded journal.

  The level of scrutiny that the regression analysis methodology and manuscript underwent in the publication process was intense. Its approval adds tremendous support to Phases 1 and 1B, and indicates the methodology is sound.

- In the spring of 2019 major flooding occurred along the Missouri River in Nebraska and Iowa which resulted in levees washing out and devastating adjacent farmland. Those properties did not have flowage easements in place, but experienced tremendous deposits of sand, silt, and debris from the floodwaters.

  We researched the impacted area in an effort to see if a paired sales analysis similar to those conducted in the northern Red River Valley could be conducted in Nebraska-Iowa. Our research found that there were very few, if any, good arm's-length transactions of flood impacted land. According to multiple real estate experts in the area, the farmland market essentially seized. That is a similar reaction to what we found in the Birds Point-New Madrid are in 2011 after that levee was blown. In both instances the market basically stopped while buyers and sellers were determining how to proceed under the new circumstances.

  Another means of measuring the impact can be through cash rental rates for farmland. Farm managers who negotiate leases on numerous properties in the NE-IA area stated that although there have been no sales, cash rents negotiated for the 2020 crop season on land impacted by the 2019 flood were often 10-15% lower than in 2019. Although this data is anecdotal, the 10-15% decrease in cash rent is within the value diminution range concluded in this Phase 1B market study and adds further support.

- The Buffalo - Red River Watershed District (BRRWD) is currently working on a water retention project along Stony Creek about 4-5 miles northwest of Barnesville, MN. Negotiations between BRRWD and landowners regarding acquisition of flowage easements has taken place over the past few years. It is our understanding based on conversations with a landowner involved with the project, that a sale price for the easement has been agreed upon, and that the transaction is expected to close in October 2020 once the State of Minnesota bonding bill is passed.

According to project information, roughly 1,000 acres will be included in this retention project that is expected to cost $15,000,000. A 110' wide by 14' high dike will be constructed around the area, holding back water from Stony Creek primarily during spring melt, to help reduce flooding along the Buffalo River and Red River. The project has a drainage area of 35 square miles and will provide 7,000 acre-feet of gated storage with more than 80% reduction to the peak flow contributed by Stony Creek.

It is anticipated that water will be retained by the project roughly 2 out of every 5 years, or 40% of the years. In contrast, the current FM Diversion is expected to operate about once every 20 years, or 5% of the years, which is quite different. Similar to the FM Diversion project, the landowner will be allowed to farm the land after the water recedes and during years in which the project is not utilized. If a crop cannot be planted, the landowner is not due any further payment.

A one-time payment for the easement will be made to the landowner. For land that may still be utilized on dry years, the landowner will be paid 100% of assessed value as determined by the Clay County Assessor. For land that will have the dike constructed on it and be taken entirely out of production, the landowner will be paid 120% of assessed value. An additional $900/acre over and above the assessed value will be paid for land that has subsurface drain tile installed.

Risks associated with farming the land include crop loss due to drown out, the inability to purchase federal crop flood insurance, the inability to apply fertilizer in the fall, and the inability to grow longer maturity or high input cost crops.

The percentage of market value paid for acquiring the flowage easements for the Stony Creek Project is clearly significantly higher than the range indicated in this market study. That is due in part to the fact that the Stony Creek Project is expected to be utilized much more frequently than the FM Diversion. However, this discussion is included in this report because there may be some extreme cases of properties in the FM Diversion Mitigation Zone 1 in which it is appropriate to conclude a percentage above the range indicated in this market study.

Other

- There are numerous comments in this report regarding rights acquired in the proposed flowage easements and other specific details of the diversion project plan. For more detailed information please refer to the Property Rights Acquisition and Mitigation Plan version 5, released by the Diversion Authority on June 1, 2020 and approved by the North Dakota State Engineer. Comments in the report are based on the most current information available as of the date of this report.

- We are not engineers or flood control experts. Details about the diversion project included in this report are as explained to us by project officials, public information, etc.

Thank you for this opportunity to be of service. Should questions arise, please don't hesitate to contact us.

Sincerely,

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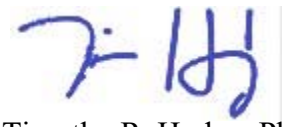

Timothy R. Hodge, PhD
Assistant Professor
Oakland University

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Red River Valley

Area Analysis

The Red River of the North is formed by the confluence of the Otter Tail and Bois de Sioux rivers at the sister cities of Wahpeton, ND, and Breckenridge, MN, in the southeast corner of North Dakota. The river serves as most of the border between the two states. It is a remnant of the ancient Lake Agassiz which covered a large portion of what is now eastern North Dakota and northern Minnesota, as well as parts of the Canadian provinces of Manitoba and Ontario. As the lake drained it left a wide valley of relatively flat land with fertile silty loam soils. This area stretches from near the South Dakota border to Lake Winnipeg and is known as the Red River Valley (RRV).

Unlike many rivers in the northern hemisphere, the water of the Red flows from south to north. The river is fairly shallow with many turns and oxbows, and it moves slowly across the near level topography of the basin. It widens as it moves north, eventually draining into Lake Winnipeg approximately 550 miles from its origin at Wahpeton-Breckenridge and then into Hudson Bay via the Nelson River. Although the topography of the RRV is very flat with wide-open spaces and few trees, the Red drains a basin of more than 40,000 square miles.

As American settlement of the area began around the 1880s, the states and counties were formed. Today the Red River Valley includes land in the Minnesota counties of (from north to south) Kittson, Marshall, Polk, Norman, Clay, and Wilkin; while North Dakota counties include (from north to south) Pembina, Walsh, Grand Forks, Traill, Cass, and Richland. Major economic centers include the sister cities of Fargo, ND, and Moorhead, MN, as well as Grand Forks, ND, and East Grand Forks, MN. The Red River also flows through Winnipeg, Manitoba, a major Canadian city. For several decades following settlement of the region, the Red River was utilized as a major transportation corridor for goods between Fargo, Winnipeg, and the Hudson Bay.

The RRV has a continental climate with warm summers and cold winters. The average frost free growing season is about 120 days and extends from mid-May to mid-September. The area generally receives about 20 to 22 inches of annual precipitation, about 75% of which falls during the crop growing season.

Farming is the major economic enterprise in the region. Major crops grown include corn, spring wheat, durum wheat, barley, sunflowers, soybeans, sugar beets, potatoes and dry edible beans. Soils were formed by ancient glaciers as they receded some 10,000 years ago. Generally, soils are relatively heavy and irrigation is unnecessary. While much of the farmland in the RRV is quite similar in quality and soil characteristics, the regression portion of this assignment focuses on the south half of the valley; specifically, the agricultural areas surrounding Fargo-Moorhead (F-M).

REGRESSION ANALYSIS BACKGROUND

The F-M area is the largest urban population center (approximately 200,000) in the tri-state area with the exception of Minneapolis-St. Paul, which is some 240 miles to the southeast. The Metropolitan Strategic Area (MSA 2520) includes Fargo, Moorhead, and surrounding communities. The total Cass County (North Dakota) and Clay County (Minnesota) population is 240,000, which is defined by the U.S. Census Bureau as being the F-M Standard Metropolitan Statistical Area.

West Fargo is one of the communities of the F-M area that has been growing tremendously over the past several years, with its population more than doubling since 2000 from approximately 15,000 to 35,000. Fargo has also been growing steadily, though not at the staggering pace of West Fargo, from approximately 90,000 in 2000 to more than 120,000 today. Development in the two cities is now connected for several miles as both cities have annexed land on the south end of each city. Moorhead's population has also increased to roughly 45,000 residents, but its development, though steady, has been much slower than Fargo and West Fargo.

Residential construction has been active in the F-M area over the past two decades. Home building is occurring primarily in the southern portions of Fargo, Moorhead, and West Fargo. Housing starts were down somewhat in the F-M area between 2008-2010 from the record pace set in the early to mid-2000's, but rebounded in 2011 and continues to increase as the local economy remains strong. Currently, houses are being built at a near record pace in Fargo-Moorhead-West Fargo, and the cities continue to expand steadily, though limited by the current flood plain.

While the fertile soils of the RRV and surrounding areas makes agriculture the major industry in the area, the F-M area is reportedly the largest commercial trade center between Minneapolis and the West Coast in the northern tier of states. Several manufacturing facilities in the F-M area process the abundant agricultural produce. Manufacturing, retail, and technology industries also remain strong and vibrant in the RRV.

Historic Flooding

Springtime flooding from melting snow has occurred in the region in some capacity throughout history. Most years it is manageable and buildings are protected because they are built on slightly higher elevations and away from the most naturally flood prone areas. However, as the cities expanded in population and territory, as roads were constructed, and as man broke up and farmed the majority of the land in the area, the natural flow of water was altered.

A system of ditches, dikes, and drains has been constructed, reshaped, and improved over the years. This system sufficiently handles much of the water from snow runoff and heavy spring rains experienced most years. However, widespread flooding is still a fairly frequent occurrence. Despite all of the efforts to control flooding, a significant portion of the area is currently within the 100-year (1.0% chance of occurring) flood plain as determined by the Federal Emergency Management Agency (FEMA), and even more is within the 500-year (0.2% chance) plain.

REGRESSION ANALYSIS BACKGROUND

Several rivers converge near Fargo-Moorhead and empty in the Red River including the Maple, Rush, Sheyenne, and Wild Rice Rivers in Cass County, as well as the Buffalo River in Clay County. Flooding is an occasional hazard along certain parts of the tributary rivers, especially in Fargo, West Fargo, and communities north of Fargo along the Red. A Sheyenne River Diversion project completed in the early 1990s diminished flooding in West Fargo and allowed much of the city to be removed from the 100-year flood plain. However, the Sheyenne Diversion does not protect the vast majority of Fargo.

Our research for this assignment covers the last nearly 29 years (1992-present). Over that time period, the F-M area averaged precipitation greater than is historically common, contributing to several major flood events. In fact, according to the National Weather Service more than half of the top 10 floods recorded in Fargo's history have occurred over the last 25+/- years during this "wet cycle."

Following a wet fall season and the heaviest snowfall on record for the region in the winter of 1996-1997, an historic flood occurred that exceeded the 100-year level. Although homes in Fargo and Moorhead were largely saved by a tremendous effort, other cities were not as fortunate. Substantial damage occurred in several other cities in the RRV. Most notably the cities of Grand Forks and East Grand Forks lost much of their downtown and residential structures as floodwaters topped the dikes and the Red River engulfed much of the cities. In the south end of the valley, the river destroyed large sections of Wahpeton-Breckenridge.

It is reported that over $1 billion has been spent on flood control projects in the RRV since the historic 1997 flood. A diversion was constructed around Breckenridge, while a massive levee system and diversions were built in Grand Forks and East Grand Forks. In 2009 a flood that saw the Red River crest at an even higher level than in 1997 was mitigated by these permanent flood protections. Other major floods during the study period occurred in 2001, 2006, 2010, 2011, and 2019. Some additional years over that time period experienced lesser degrees of flooding. It should be noted that Fargo-Moorhead still does not have comprehensive permanent flood protection and relied on significant emergency measures during the 2009 flood fight. (Source: MPR News, Apr. 17, 2017)

REGRESSION ANALYSIS BACKGROUND

F-M Diversion

Reason for Diversion
Please note that we are not engineers or flood control experts. Details about the project included in this report are as explained to us by project officials, public information, etc.)

The Red River Valley is very prone to flooding for two major reasons. First, the area's extremely flat topography allows water from the Red River and other area rivers to spread out over many thousands of acres after overflowing its banks. Several smaller tributary rivers empty into the Red near Fargo-Moorhead. Because of the "table top" topography, the river constantly twists and turns as it winds its way north. On average, the gradient of the river drops 5" (inches) per mile of length. However, as it approaches the Canadian border the slope lessens to just 1.5" per mile, further slowing the flow of water and causing the river to widen, particularly during floods. The Red's elevation is approximately 950' above sea level at its source and around 710' at its mouth on the south end of Lake Winnipeg, a drop of only about 240' over 550 miles. (Source: North Dakota State University)

Second, the river flows north. Although this attribute is not unique, the cold climate of the northern plains creates an issue. During spring thaw, it is common for snow and river ice to melt on its southern end near Fargo-Moorhead prior to its more northern reaches of Grand Forks and Winnipeg. The ice in northern areas can backup water to the upstream areas in the south. In Fargo-Moorhead, the Red River has exceeded flood stage in 51 of the past 112 years, including every year from 1993 to 2011. It is not believed that the proposed F-M Diversion would have been utilized in all of those years, as most flooding is relatively minor in nature and is largely handled by the existing system of ditches and rivers. (Source: www.FMDiversion.com)

According to NDSU, flood stage of the Red River at Fargo-Moorhead is reached when the river level rises to 18.0' deep at the Fargo Water Treatment Plant gaging station. At 18.0' there are minor effects to the community, although the river is out of its banks in some places. Impacts increase as water levels rise. The 100-year flood interval level is reached at the 39.3' depth according to FEMA. In recent years, the river has crested at 35.04' in 2019; at 36.99' in 2010; at 38.81' in 2011; at 39.72' in 1997; and at 40.84' in 2009. Flooding in recent years has been more frequent and largely with higher crests than during most of the city's history.

According to project officials, the standard measure for flooding occurs when the combined flow of the Red River and the Wild Rice River exceeds 17,000 cubic feet per second (cfs) in Fargo. United States Geological Survey data reveal that the flow of these two rivers have reached or exceeded 17,000 cfs a total of ten times within the last fifty years. Table 1 highlights the years, dates, and maximum CFS of these events. As Table 1 shows, the severity and frequency of these events has increased over time as six of the ten events occurred within the last twenty years. In Plan B, the diversion will operate when river flow exceeds 21,000 cfs.

REGRESSION ANALYSIS BACKGROUND

Figures 1-4 provide a glimpse of the extent of four of previous six events for the six-county region surrounding the F-M area. As the figures show, the area inundated with floodwater is extensive. The Federal Emergency Management Agency's (FEMA) effective flood insurance rate map (FIRM) estimates 175,680 acres of flooding in a 100-year flood event in Cass County and 78,330 acres of in Clay County. The 500-year flood event estimates are 202,321 acres and 111,149 acres in Cass and Clay counties, respectively.

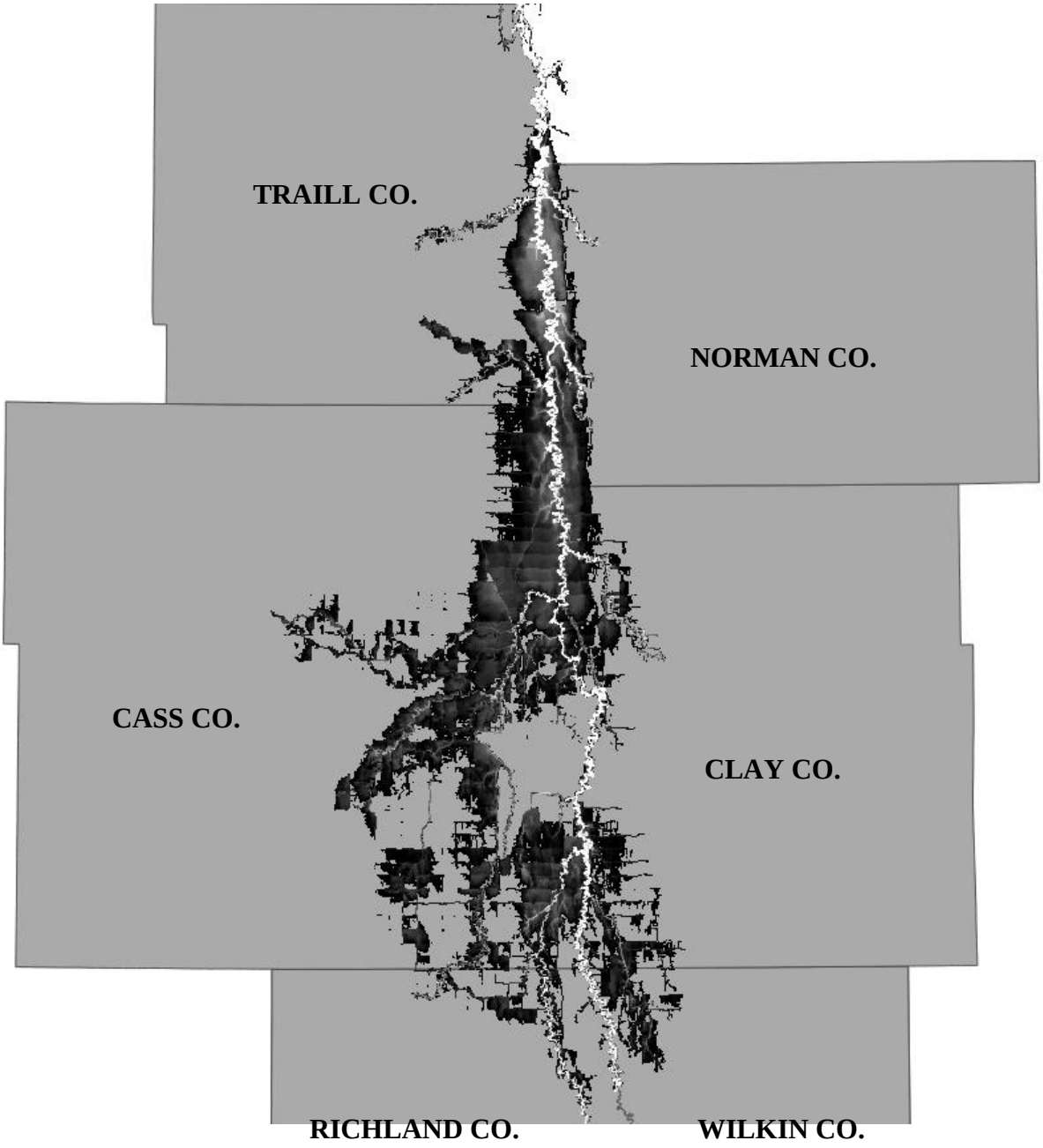
Table 1: Flood Event History in the Fargo-Moorhead Area

Year	Dates with 17,000 cfs	Maximum cfs
1969	April 13-18	24,800
1978	April 3	17,000
1979	April 19	17,200
1989	April 8-10	18,600
1997	April 9-28	27,800
2001	April 12-17	20,200
2006	April 3-7	19,800
2009	March 25 - April 3	29,100
2010	March 19-24	21,100
2011	April 7-17	26,100

Source: U.S. Geological Survey (2015)

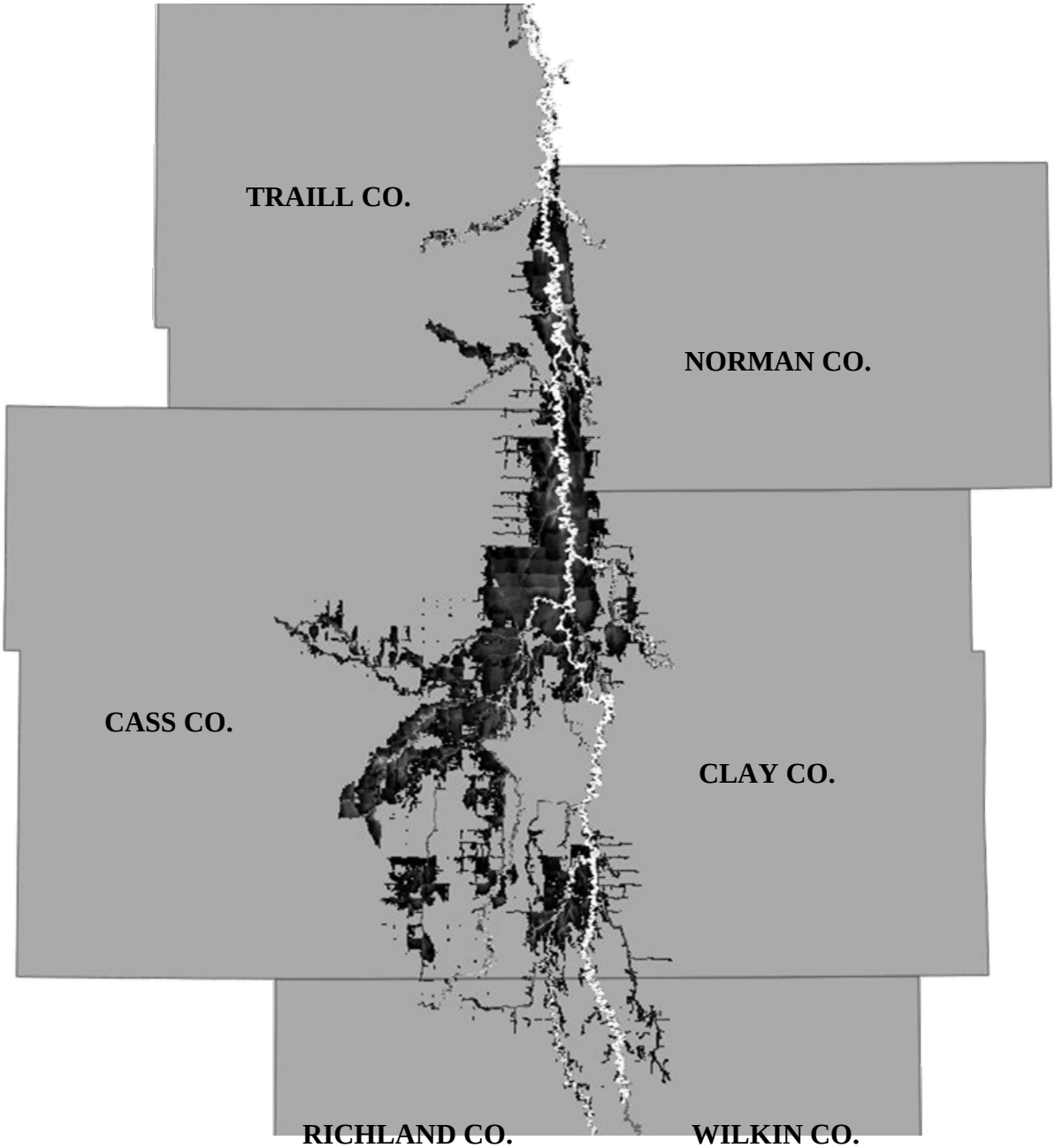
REGRESSION ANALYSIS BACKGROUND

Figure 1: Hydraulic Modeling of 1997 Flood Event



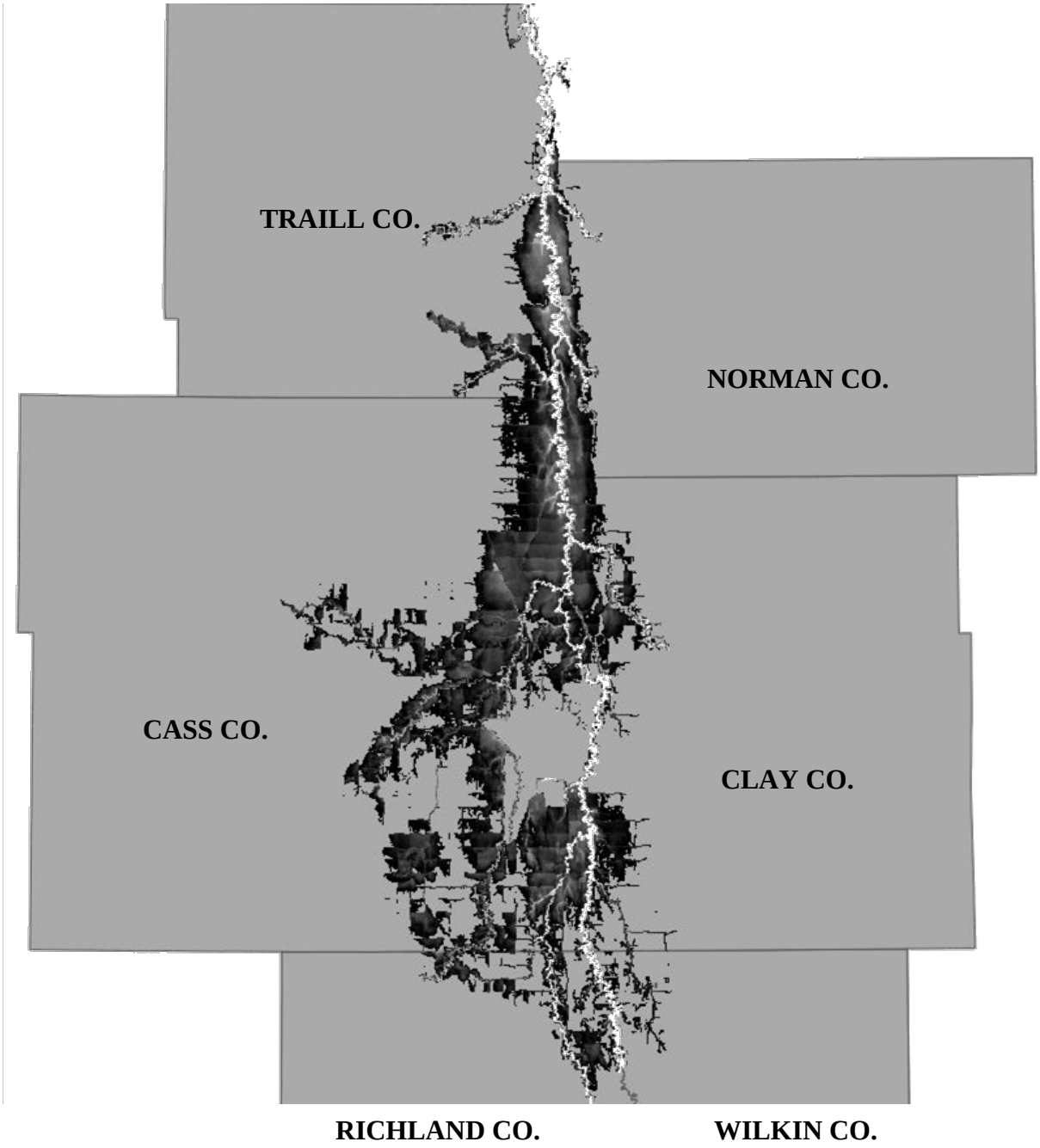
REGRESSION ANALYSIS BACKGROUND

Figure 2: Hydraulic Modeling of 2006 Flood Event



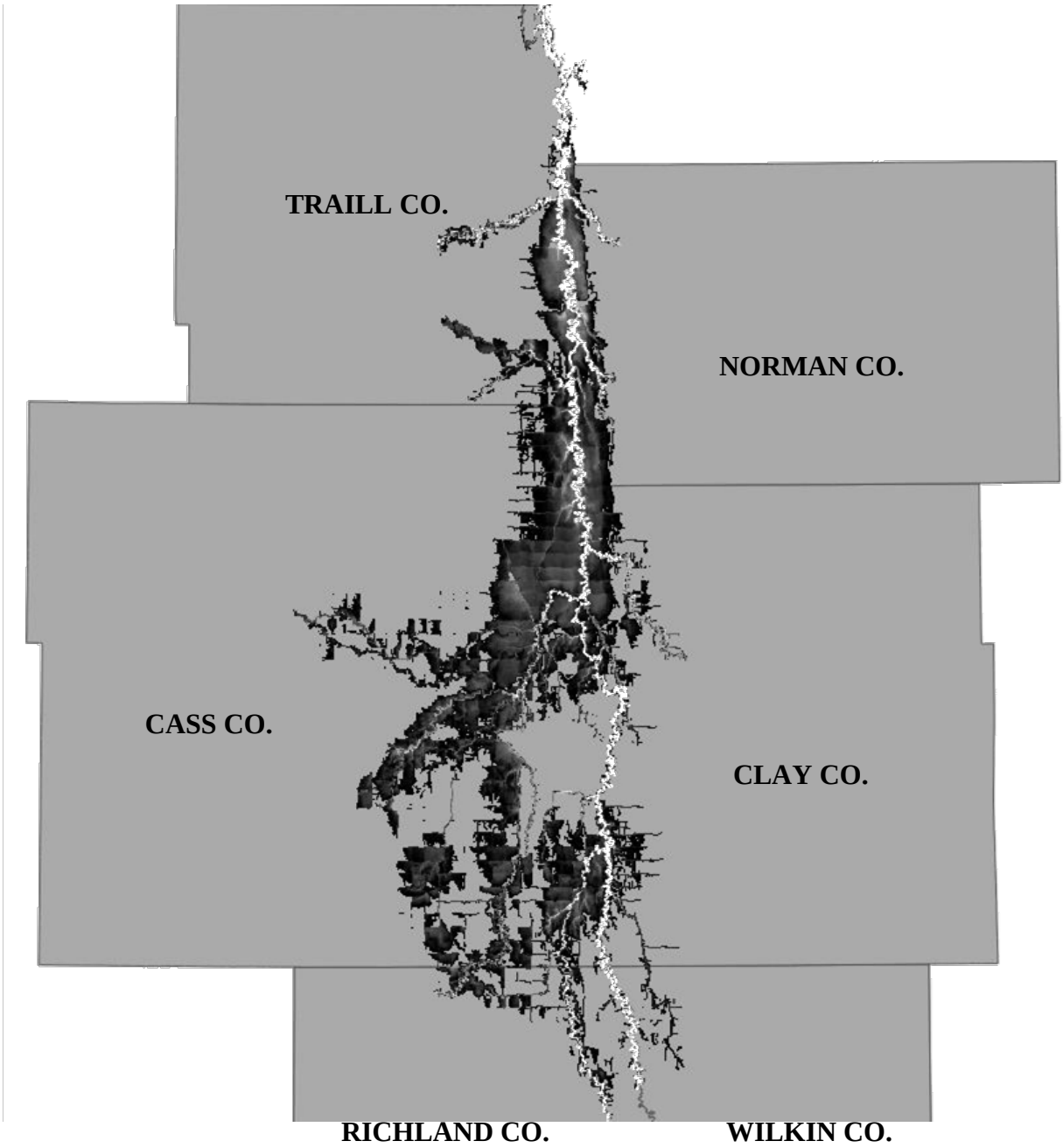
REGRESSION ANALYSIS BACKGROUND

Figure 3: Hydraulic Modeling of 2009 Flood Event



REGRESSION ANALYSIS BACKGROUND

Figure 4: Hydraulic Modeling of 2011 Flood Event



REGRESSION ANALYSIS BACKGROUND

In an effort to provide permanent flood protection for the F-M metro area, a project is proposed that will, reportedly, be able to protect the cities from a 100-year flood event. According to project officials, the proposal includes a roughly ¼ mile wide ditch to be constructed around the city, which will handle excess water from the area during flood events. A dam, or dike, will also be constructed to hold back water upstream onto many thousands of acres. This area is termed the "staging area" or "pool area". The staging area will be located south of the city and was originally projected to be approximately 48,000 acres in size. By holding back water in the staging area the Diversion Authority will control the flow of water into the diversion channel.

The diversion channel itself will remove roughly 6,500 acres of Red River Valley farmland from production. Landowners and farmers in the staging area are concerned with how their land will be affected by floodwaters, and by how frequently. In order to construct the diversion with a staging area the Diversion Authority must purchase the right to flood land in the staging area as needed during flood events. This has caused consternation amongst landowners and farmers uncertain as to how they will be impacted. This is the impetus for our study.

The F-M Diversion project was under scrutiny in recent years as a ruling in Federal District Court forced the Diversion Authority to reconsider the plan. A legal ruling in September 2017 halted construction of the diversion and forced the US Army Corps of Engineers to reevaluate the project due to a permit denied by the Minnesota Department of Natural Resources (DNR). A task force co-chaired by Governor Doug Burgum of North Dakota and Governor Mark Dayton of Minnesota was created and included 16 individuals from several interested groups--both diversion proponents and opponents.

From that task force a "Plan B" was developed that will allow more water to move through the city during flood events via the Red River, decreasing the size of the staging area and altering its location, and reducing the impact on Richland, Wilkin, and Clay counties. Plan B includes controlling flows in the Red River at the Fargo gage to 37' for a 100-year flood and 40' for a 500-year event. It also decreases the number of acres protected by the diversion. A permit for Plan B was issued by the Minnesota DNR in December 2018 which includes more than 50 conditions that the plan needs to meet. However, construction is once again allowed to move forward.

However, as of June 2020, Plan B is still being fought in the court system as the Buffalo-Red River Watershed District (BRRWD), along with the cities of Comstock and Wolverton and the Richland/Wilkin Joint Powers Authority, is contesting the issuance of the DNR permit. Therefore, many comments in this report are based on information published and received regarding the original diversion plan. Regardless, Plan B will also include holding water in a "staging area" and temporarily flooding property south of the metro. The diversion is designed to have no effect on areas outside the staging area.

REGRESSION ANALYSIS BACKGROUND

Current Plan

The project originally proposed in the early 2010s involves construction of a 30 mile long, 1,500' wide, 20' deep channel around the F-M metropolitan area. The dike will begin at the Red River approximately 4-5 miles south of Fargo's current city limits, diverting flood water into the channel which starts south of Horace and then west around the cities of Fargo, West Fargo, Horace, and Harwood, finally dumping water back into the Red River several miles north of Fargo. Reportedly, the channel will be able to handle 20,000 cubic feet per second of water and reduce the water level in the Red River during a 100-year flood event from 42.4' to 37' (at the Water Treatment Plant Gage). It is not designed to protect the city from a 500-year flood event. An embankment dam roughly 20 miles long will also be constructed to hold back water in order to control the flow of water into the diversion channel.

Currently, much of the city of Fargo and its extraterritorial area are located within the 100-year flood plain, making further development challenging. It is fair to say that a significant portion of the metro area has an existing flood risk. Reportedly, this project will bring a greater level of flood protection to Fargo and the surrounding the metro area. The cities of West Fargo and Horace are already largely protected from the Sheyenne River by the Sheyenne River Diversion, which was constructed many years ago. They are not protected from the Red River. The cities of Mapleton, Harwood, and Argusville are also near the Sheyenne River, but not protected by its diversion.

Although the city of Fargo will be protected, thousands of acres south of the diversion will be negatively impacted by taking on excess water during flood events. This area is termed the diversion's "upstream staging area", inundating acreage in both ND and MN during flood events. Plan B proposals estimate 25,000 to 30,000 acres of land will be in the staging area, the vast majority of which is tillable farmland.

Plan B allows more water to move through the city during flood events via the Red River, decreasing the size of the staging area and altering its location, and reducing the impact on Richland, Wilkin, and Clay counties. Plan B includes controlling flows in the Red River at the Fargo gage to 37' for a 100-year flood and 40' for a 500-year event. It also decreases the number of acres protected by the diversion. It is important to understand that regardless of the exact location, much of the land in the staging area either does not currently flood or floods at a lesser degree than what is proposed.

Impact on Farmland

If the proposed F-M Diversion is constructed, it will certainly impact properties in the area. Much of the land located inside the diversion channel will become flood protected and will no longer be within FEMA's 100-year flood plain. However, land located in the staging area will be negatively affected.

REGRESSION ANALYSIS BACKGROUND

This assignment concentrates on farmland because the vast majority of impacted ground in the staging area is vacant tillable land. There are other land uses in the area, but our focus is farmland. According to diversion officials a permanent flowage easement will be purchased on all staging area land.

Potential impacts of the easement and flooding on farmland in the staging area are numerous. One of the key components of the easement is that development or construction of any sort is prohibited in the portion of the staging area which will be defined by FEMA as "floodway". Approximately 26,000 acres of the proposed 29,200 acres, or nearly 90% of the staging area will be within the floodway (Zone 1). The remaining acres will be termed by FEMA as being within the "flood plain." Development in the flood plain may be allowed in accordance with ordinances, rules, regulations, and the terms of the flowage easement. This is not an issue for most of the land since it is unlikely to be developed for residential, commercial, or industrial use in the reasonably foreseeable future. However, it may be an issue for land located near the south end of the metro (Fargo & Horace) and getting closer to development every year as urban sprawl continues southward. Those properties may have a current use as tillable farmland, but only as an interim use until the land is ready to be developed with commercial or residential properties. Development land typically has market value substantially above the value of farmland.

Project officials anticipate that the diversion will most likely only be utilized in the spring during snowmelt, prior to planting season. In fact, project officials stated that in Fargo's history there has never been a summertime flood severe enough to require the diversion channel and staging area to be utilized. If that were to happen, the effect on growing crops would be substantial. Furthermore, if it were to occur after planting during the growing season, crop insurance would be an issue for farm operators because crop insurance does not typically cover a manmade flood event. The insurance issue is complicated. Please refer to the Property Rights Acquisition and Mitigation Plan for explanation.

Flooding occurs most often in late March and early April. When the diversion is utilized prior to planting, it may delay planting for land in the staging area. Some properties will be delayed more than others as the tracts located further north towards the embankment will be inundated with standing water for a longer period of time than land on the south end of the staging area. These properties will also likely be flooded every time the diversion is utilized, whether it's a 25-year flood or a 500-year flood. Farms on the fringes of the staging area will have flood waters recede sooner and they will not be flooded to the same degree each time the diversion project is utilized. There may be smaller flood events in which the waters do not reach the fringe areas.

REGRESSION ANALYSIS BACKGROUND

Agronomic scientific data shows that delayed planting has a direct effect on the yield potential of all crops (i.e., the later the planting, the lower the yield potential). However, not all major crops in the RRV are planted simultaneously. Wheat and sugar beets are typically planted first, as soon as the soil temperature is sufficient in late April. Corn, potatoes, and soybeans follow in May. Therefore, depending on the crop a farmer intends to plant in a particular field based on rotations, some yields may be more impacted by delayed planting than others in a given year. If a field in the staging area is delayed substantially, farmers will be forced to plant soybeans regardless of their original intention. This can interrupt normal crop rotations implemented to optimize the health and productivity of the soil. A study conducted by NDSU determined that when the diversion is operated, planting would be delayed by less than one week on most land in the staging area. (Source: www.fmdiversion.com)

According to the FM Diversion official website, the diversion would only be used for flood events larger than a 20-year flood (5.0% annual chance). This means that it would not have been used in 2005 and 2007, but would have been used in 1997 and the spring of 2009. (Source: www.fmdiversion.com)

In their examination of historical data for the F-M area, Bangsund et al. (2015) found that major flood events do not always result in later planting. This was particularly evident when examining years that planting started later without flooding. However, the general trend appears to be later planting in flood years.

The losses associated with delayed planting depend on the crop planted. Corn incurs about 2% to 5% yield decline per delayed planting day, wheat loses about 1.67% per day, sugar beets lose about 1% per day, and soybeans experience relatively little loss due to a later planting season (Bangsund et al., 2015). Losses grow exponentially with the increase in delayed planting days for all crops. To indicate the importance of timing in a different way, estimates show the timing of planting corn accounts for approximately 24% of the variability in yield from year to year (Nielson, 2013).

Table 2 on the following page highlights the early and general planting dates for recent flood event years. Shown is the timing of the flood events during the period of study ("Flood Event End"). An important note regarding the flood event end is that it represents the date when the floodwaters recede below 17,000 cfs, not the end of lingering inundation in fields required for dry-down. Dry-drown refers to the time required for inundated land to dry out to resume field operations and averages 10 days in length for the F-M area (Bangsund et al., 2015). Including the dry-down period provides a very different view of the flood. Most of the flood end dates represented in the table are before early planting, unless you include the dry-down period. Once included, there is overlap in 1997, 2001, 2006, and 2011. In fact, the Bangsund study estimates that the annual probability that planting delays will occur for corn, sugar beets, and wheat in a flood year is between 40% and 60%, and less than 15% for soybeans.

REGRESSION ANALYSIS BACKGROUND

Additional costs incurred to the farmer from a flood event include changes in soil productivity due to erosion and compaction, excessive sediment and contaminant deposition, post-flood cleanup, as well as a loss in the option value through potentially higher development costs (Bangsund et al., 2015; Forster et al., 2008). Development costs may be higher since floodplain land requires extra investment to mitigate flooding or lower premiums from the additional risk.

Table 2: Planting and Flood Event Overlap

Year	Early Planting*	General Planting**	Flood Event End
1997	na	na	April 29
2001	April 22	May 6	April 18
2006	April 16	April 23	April 8
2009	April 19	May 3	April 4
2010	April 11	April 18	March 25
2011	April 24	May 8	April18

Source: Bangsund et al., 2015, National Agricultural Statistics Service (2015)

Lastly, as mentioned briefly, other potential impacts on farmland due to flooding include soil erosion, sand deposits, and debris deposits. Soil erosion occurs as floodwaters wash away or cover (bury) productive topsoil. This can dramatically decrease the crop production capabilities of a property. Sand deposits from rivers or other areas may also decrease productivity. However, it is worth mentioning that our research of other areas in the U.S. prone to major flooding indicated that some actually experience a boost in productivity due to the highly productive river silt deposited on the land. That is not the case in all circumstances and it varies with the type of silt deposited and the speed of the floodwaters. In the F-M area, water inundation is primarily from snow runoff and is not as beneficial to soils as river water. Furthermore, the flat topography of the RRV does not lend itself to fast moving floodwaters—at least not fast enough to move tremendous amounts of topsoil. According to project officials, flooding in the staging area would be primarily from the rivers.

During a flood event, large volumes of logs, branches, and other debris may be floated by the floodwaters and left scattered around the countryside as the water recedes. Debris must be removed to make the ground farmable again. Please refer to the Property Rights Acquisition and Mitigation Plan for explanation of post-operation cleanup.

Sales Research

Research Area

Although flooding is common and the topography and soil quality are very similar throughout the Red River Valley, our sales research focused on the south half of the valley. Specifically, we researched tillable farmland sales in the North Dakota counties of Cass, Richland, and Traill, as well as Clay, Norman, and Wilkin counties on the Minnesota side. Sales were researched over 29 years and were all compiled for use in a hedonic regression analysis.

REGRESSION ANALYSIS BACKGROUND

Because not all land in the counties listed is within the RRV, our sales research only includes farmland in those portions considered to be "valley ground". The area is roughly the east half of the North Dakota counties and the west half of the Minnesota counties. Land located outside the valley in these counties is on what is considered the beach ridge of ancient Lake Agassiz and has different soil complexions.

Farmland in the area described is similar to land included in the proposed staging area. Since the entire proposed staging area is to be located south of Fargo-Moorhead in the RRV, it was determined that sales from the RRV areas of the listed counties are most applicable to this portion of the assignment. The RRV area of the counties is also the primary area affected by historic floods, as the beach ridge does not tend to flood to the same degree.

Farmland Quality

All tillable land in the sale research area is reasonably similar in terms of soil types, soil productivity, productivity index (PI) ratings, drainage, salinity, rocks, shape, and types of crops grown. It is highly productive ground and does not require irrigation. Major crops in the area are corn, soybeans, hard red spring wheat and other small grains, as well as specialty crops of sugar beets and potatoes.

The RRV is the largest sugar beet producing region in the United States, raising approximately one-third of the country's beet acreage. There are two farmer owned sugar cooperatives in the region and several sugar processing facilities. In the six county research area there is a processing facility owned by Minn-Dak Farmers Cooperative in Wahpeton, ND (Richland Co.) and facilities owned by American Crystal Sugar Company in Moorhead (Clay Co.) and Hillsboro, ND (Traill Co.).

Both sugar cooperatives have several receiving stations, known as "piler stations," scattered throughout the area where farmers deliver their crop during harvest. The strength of the sugar industry and sugar beet prices have a substantial effect on the overall health of the RRV farm economy. Over the years, profits generated by sugar beet production have been a significant economic driver in the RRV.

Although some soils in the RRV are more preferable for raising beets than others, sugar beets are raised throughout the research area. Historically, higher prices are paid for land that is preferable for beet production. However, as corn became a major crop in the area in the late 1990s and early 2000s, the difference has become less noticeable. For the past decade or two, similar prices have been paid for land that is capable of growing corn, soybeans, and wheat as those paid for sugar beet ground.

REGRESSION ANALYSIS BACKGROUND

Sale Selection

Sales were researched in all six counties from 1992 to present as available, compiling 29 years of data. This time period covers several flood events of varying degrees of severity. Sales utilized came from Crown Appraisals' historic files, county assessing offices, and other local farmland experts. Every county keeps records in different formats, but all six counties researched provided us with many years of sale information.

We received sales for the following years from county offices:

- Cass County 1992-present
- Richland County 1992-present
- Traill County 2000-present
- Clay County 1992-present
- Norman County 1993, 2000-present
- Wilkin County 1996-present

We were unable to obtain sales in all 29 years studied from all counties as not all counties have electronic records dating back to the early 1990s. However, we were able to receive all 29 years worth of sales from Cass and Clay Counties, the two counties that were impacted most by previous flooding and will be impacted the most by the staging area. It is also important to understand that North Dakota was a non-disclosure state until 2013, meaning that sale prices could be kept confidential if the parties involved chose to do so. Therefore, obtaining sale prices for older sales in North Dakota not already in our records was more difficult.

We do not claim to have every relevant sale that transacted within the six county area, but we did our best to include all that we could reasonably locate. As mentioned, we utilized several resources to compile the sales as best we could. Many more sales were located than were utilized. Although at one point during data collection we had collected around 2,500 sales not all sales were relevant and included in the final database. Sales were excluded for the following reasons:

- Not arm's-length
  - Buyer & seller are family members or closely related parties
    - But if based on appraisal or market, then it is included
- Land is enrolled in a government easement program such as CRP, WRP, etc.
- Irrigation system installed
- Subsurface drain tile installed. Drain tile removes excess moisture and salts from the soil; therefore improving its production capability. The vast majority of land in the area is not tiled. Furthermore, because tiling has really only gained area wide acceptance in the past decade, very few sales of tiled ground have occurred.

- Has building improvements
- Deeply discounted for whatever reason… oftentimes between landlord and longtime tenant
- Parcel numbers no longer exist (older sales), making it difficult to accurately determine which property sold. This occurred if multiple parcels were involved in the sale
- Duplicate sales

After sorting through 29 years of sale records and determining the validity of each sale, we finished with a total of about 2,060 Red River Valley tillable farmland sales. Not all sales were confirmed directly with the parties involved. In those instances, reliability was placed in the information obtained from other sources. To the best of our knowledge, all sales utilized are considered good, arm's length sales at market levels.

Historic Farmland Market (1992-present)
Sales collected for use in the regression analysis took place over many years. The local farmland market has seen many changes over the last 29 years--lows, highs, stability, and volatility. Unlike many types of real estate, farmland market values fluctuate due to forces outside the control of the owners. Commodity prices, interest rates, and weather patterns are three such external forces.

In the early years of our research the market was climbing out of the agricultural crisis of the mid to late 1980s. That was a period of high interest rates and seriously deflated land values which caused significant amounts of land to go back to lenders. Lenders then sold the land at very favorable terms. By the early-mid 1990s, the land market had stabilized, but sale prices did not start increasing until near the end of the decade.

The early 2000s saw disappointing sugar beet prices, dropping the value of beet cooperative stock. That depressed the farmland market in our research area for some time. In the 2004 to 2006 timeframe, 1031 Tax Free Exchange buyers drove the tillable land market with strong competition from local farmers. In late 2006, the number of 1031 buyers diminished somewhat, but higher commodity prices encouraged farmers to pay more for tillable land and for cash rent, so farmers became the major driving factor in the area's tillable land market. Sale prices then moved upward for several years with rapid increases in 2007-08. Sales in 2009 remained roughly stable with 2008 prices, but there were fewer sales in 2009. Crop prices declined significantly in 2009 from 2008 levels, but demand for tillable land remained strong.

REGRESSION ANALYSIS BACKGROUND

Crop prices rebounded in 2010 and continued to be quite strong in 2011 and 2012 as prices reached record levels in the area for corn, soybeans, and sugar beets. In late October-early November 2010 there was a sharp increase in farmland sale prices. Land began selling for 10-20% above sale prices from summer and early fall 2010—some land sold for as much as 30-40% higher. A similar increase occurred in late October-early November 2011 and 2012. This is attributable to several factors, primarily good local crop yields, high commodity prices, and low supply of land available for purchase. When land was offered for sale at auction, bidding was often aggressive, pushing the sale price upward. Late 2011 and 2012 the area saw an increased investor presence. Both farmers and investors are now present in the local farmland market.

Late 2012 saw land sale prices again increase dramatically, which carried into the first half of 2013. This time period is referred to as a "super cycle" in the ag economy. In mid-2013, commodity prices dropped nearly in half, greatly altering the land market. Late 2013 saw a plateauing of sale prices and even a decline in prices for ground not viewed as "top quality."

That trend continued through 2014 and resulted in what was essentially a two-tiered market in which the top quality land continued to sell for high prices, but below 2012-2013 levels on a dollar per tillable acre basis. However, if a property was not top quality and had issues with drainage, rocks, alkali, configuration, etc., it was selling for significantly less. Currently, all qualities of land are down from 2012-13 levels. The decline is mainly attributable to substantially lower commodity prices for the 2013-19 crops.

Seven harvests with lower commodity prices have had an effect on cash rental rates and land sale prices. As of mid-2020 the farmland market has remained essentially level with 2016 prior to harvest. The market appears to have settled into a more reliable pattern for good quality land. Commodity prices are projected to remain low through 2020, which may keep the land market level. Some agricultural economists view this period as a return to normalcy following the super cycle rather than a depressed market. That being said, crop prices experienced over the last seven years have been below profitability levels for many producers. The agricultural economy has now been depressed for about seven years.

Corn prices hit $8.00+/bushel in summer/early fall 2012, suggesting that another dramatic increase in land value was possible. That was certainly the case as counties throughout the region hit all-time high farmland prices. Interest in the area was high and bidding was aggressive until the decline of commodity prices in mid-2013. As of mid-2020, cash bids for corn were approximately $2.80/bushel, well less than half of the high in 2012. The price of soybeans also dropped from about $18/bushel in 2012 to about $7.90/bushel.

REGRESSION ANALYSIS BACKGROUND

These dramatic decreases have tempered enthusiasm for land. However, because the supply of available land for sale has reduced, demand for high quality soil remains strong. Top quality ground can still bring good prices, but not near the record levels seen in late 2012 and early 2013. Good but not great quality ground has felt the effects of lower crop prices more so than has top quality ground—as has marginal quality land. Buyers appear more discerning in the current farmland market than in previous years when crop prices were high. Although they will still pay well for high quality land, they will not overpay for lesser quality farmland.

It is also important to mention that there have been significantly fewer auction sales since late 2013 than in previous years. As the aggressiveness of buyers has lessened, many sellers are opting to list a property for sale with a broker or realtor and wait for their asking price. Many are also choosing to privately negotiate sales with tenants or neighboring farmers.

Although auctions were the most popular sale method when the market was booming, attendance has dropped over the last few years. There have even been several "no sales" in which bidding did not reach an acceptable price and the seller rejected all bids. All of these signs point to a tempering of the local farmland market.

Farmers that forward contracted crops at higher prices more than a year in advance were able to avoid suffering a large hit at harvest in 2013 and 2014. Some may have even contracted a portion of their crop for 2015 at higher prices. As crop prices remained at low levels, cash rents and land sale prices declined further in 2016. Since 2016 farmland sale prices have been relatively stable.

However, in late 2017 and continuing today, a slight uptick in the market may have occurred. Buyers who did not purchase land at the highs of 2012-13 appear to now be spending. Although that may be somewhat speculative as there have been few sales significantly above 2016 levels. Improved sugar beet prices in 2017 and '18 may have contributed to the slightly renewed optimism for some producers. Beet prices for the 2019 crop decreased significantly following a very wet fall that left thousands of acres of beets unharvested.

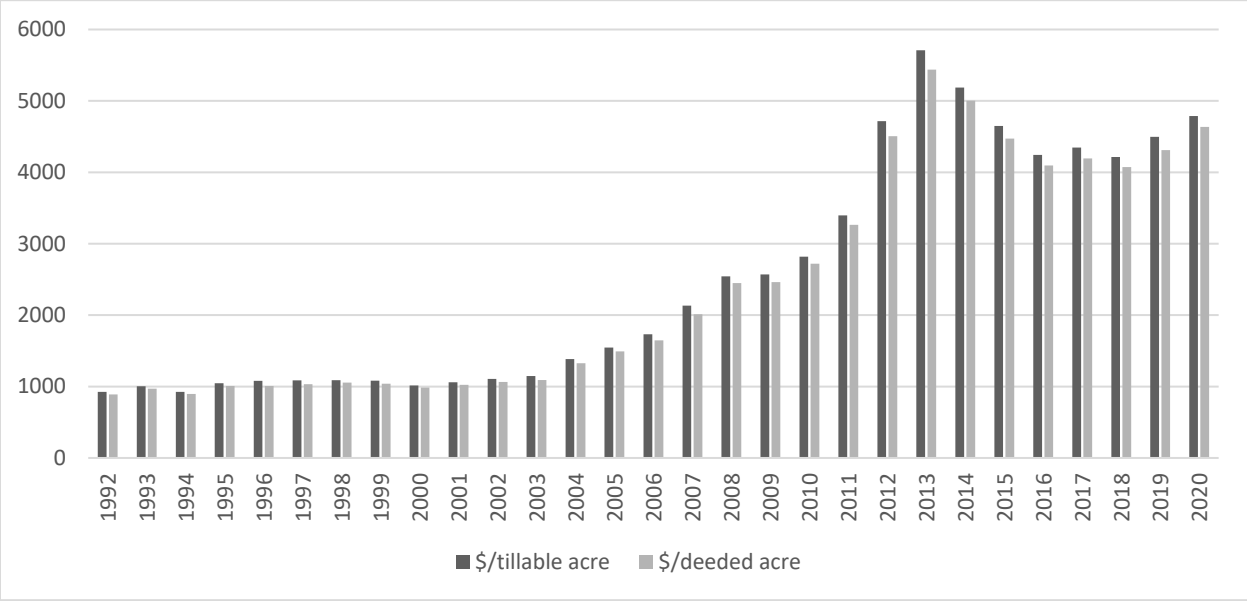
Significantly fewer sales have occurred since late 2013 than in previous years. This is partly attributable to the fact that there were a substantial number of landowners wanting to close sales prior to the end of 2012 due to a combination of record high land prices and uncertainty about new tax laws that went into effect in 2013. There is currently a relatively low supply of land available and fewer arm's-length sales available for comparison.

Typically farmland values fluctuate in the spring and fall of each year. Values change in the fall based on crop prices and yields from the recently completed harvest. Values then change again in the spring when farmers are preparing for the upcoming growing season based on crop prices at which they are able to contract. Farmland does not frequently sell during the summer growing season.

REGRESSION ANALYSIS BACKGROUND

Figure 5 shows in bar graph form how farmland sale prices in the area have changed over the last 29 years. The actual, unadjusted nominal average sale price per tillable acre and per deeded acre over the entire six county research area is shown. Please note that Figure 5 contains only the sales selected for utilization in our regression analysis, not all sales in the area.

Figure 5: Average Nominal Price per Acre



Factors Tracked

Several factors are considered to have an impact on sale prices and were tracked for each of the roughly 2,060 local sales used in the regression analysis. Those factors include sale date, soil productivity index rating, drainage, rocks, topography, salinity, and field shape. While crop prices influence farmland prices, they affect properties similarly in any given year. The impact of crop prices is further discussed in the regression analysis itself.

- Soil Productivity Index (PI) rating: PI rates soil quality on a scale of 1 to 100, with 100 being the best soil that has the greatest ability to get high crop yields. A higher PI suggests better yields with fewer production risks and greater production consistency, which in turn creates greater market value for the farmland. While there are certainly other factors that affect farmland value, sale prices tend to correlate with PIs. Typically the sales with the highest price per tillable acre have the highest PI ratings—but of course there are always exceptions.

  Please note that the NRCS recently changed soil names and PI ratings, but the transition has not been smooth. Many inaccurate ratings were given. In this assignment, the current PI ratings are utilized for all 29 years of sales for purposes of consistency and stability.

REGRESSION ANALYSIS BACKGROUND

- Drainage: This can have a significant effect on the value of farmland. A property that drains well almost always achieves a higher sale price than land that has marginal or poor drainage. If a property is not well drained, water tends to sit on it after periods of heavy rain and during spring thaw. In our analysis, drainage is rated as poor, fair, average, or good. As previously mentioned, land with subsurface drain tile installed is not considered. Internal soil drainage is considered in PI. However, while surface and subsurface drainage improvements increase production capability, they do not change a property's PI rating.

- Rocks: The RRV is nearly rock-free. It is very uncommon for land in the research area to have really any rocks to speak of, and certainly not enough rocks to warrant a farmer picking them from the field. Because rocks are so rare in the area, no rocks are listed for a sale unless a party involved in the sale specifically expressed their presence.

- Topography: All farmland in the RRV is relatively flat, but topographical maps of the area show that there is some natural slope to the land. Land in Minnesota tends to slope to the west and land in North Dakota tends to slope east, both towards the Red River. Although some sale tracts may have a slightly undulating topography, most are relatively flat. For the most part only tracts adjacent to a river tend to have more elevation change as they slope toward the river. Unless otherwise known, it was assumed that a sale had flat topography.

- Salinity: High levels of salt, or alkali, present in soil reduces crop productivity. Although some salt is necessary for plant growth, too much is harmful. Because farmland with salinity issues produces lower yields, those properties most often sell for a lower $ per tillable acre than land with normal salt levels. Salinity levels on the sales utilized are listed based on NRCS soil descriptions for the property.

- Field Shape: Because the RRV is very flat with few trees, the majority of farmland tracts have a regular square or rectangular shape with long, straight rows and right angle corners. This allows farmers to utilize large modern farm machinery. Irregular shaped fields are somewhat less desirable to buyers because the operator will have to farm around more corners and at irregular angles, creating wedge rows or short rows. Odd shaped fields with wedges and corners are more difficult when maneuvering large modern farm equipment. This can also cause weed control issues in unseeded areas, as well as over seeding and over spraying issues. For these reasons, irregularly shaped fields often sell at a lower $ per tillable acre level than regularly shaped fields.

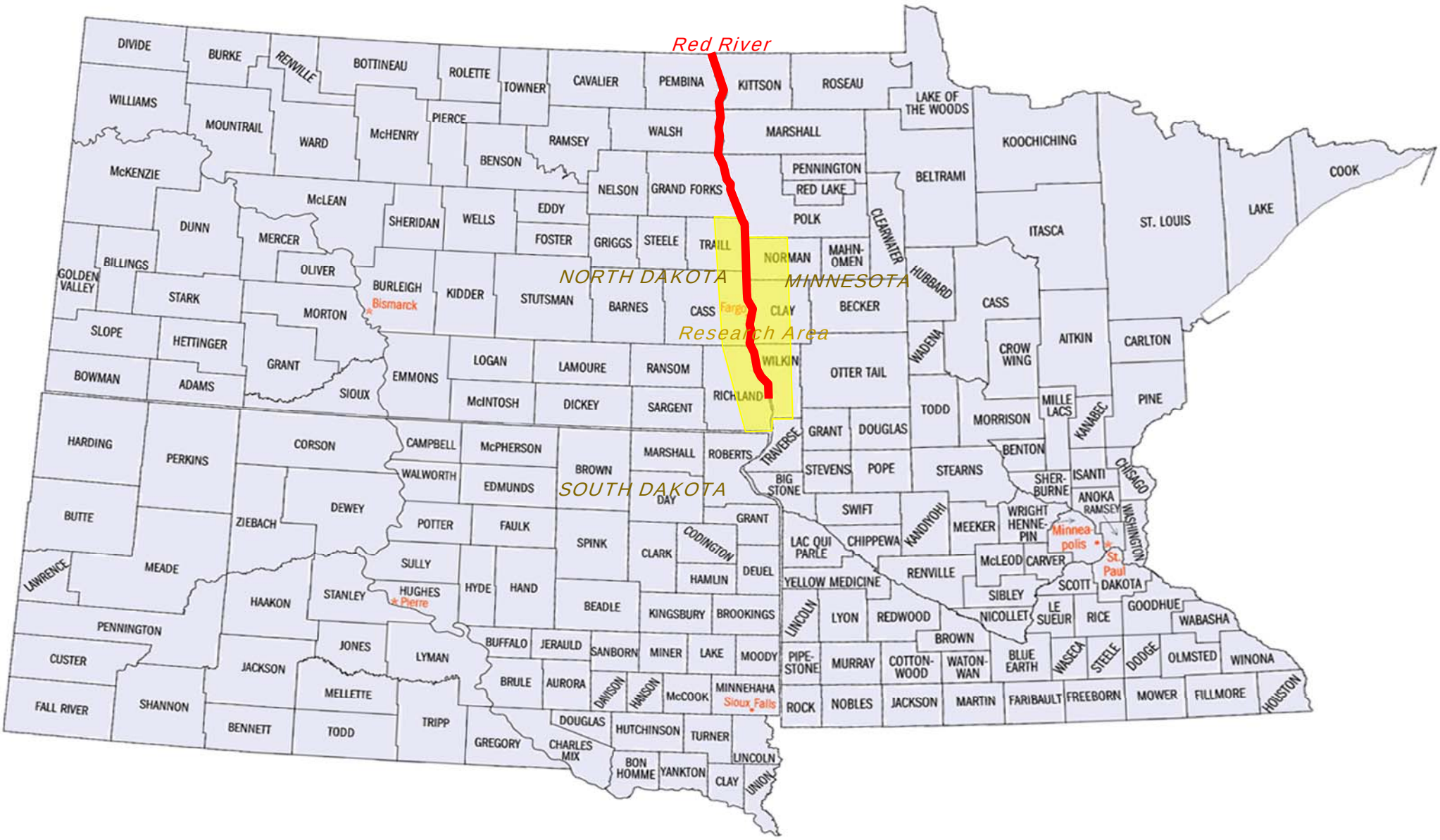
REGRESSION ANALYSIS BACKGROUND

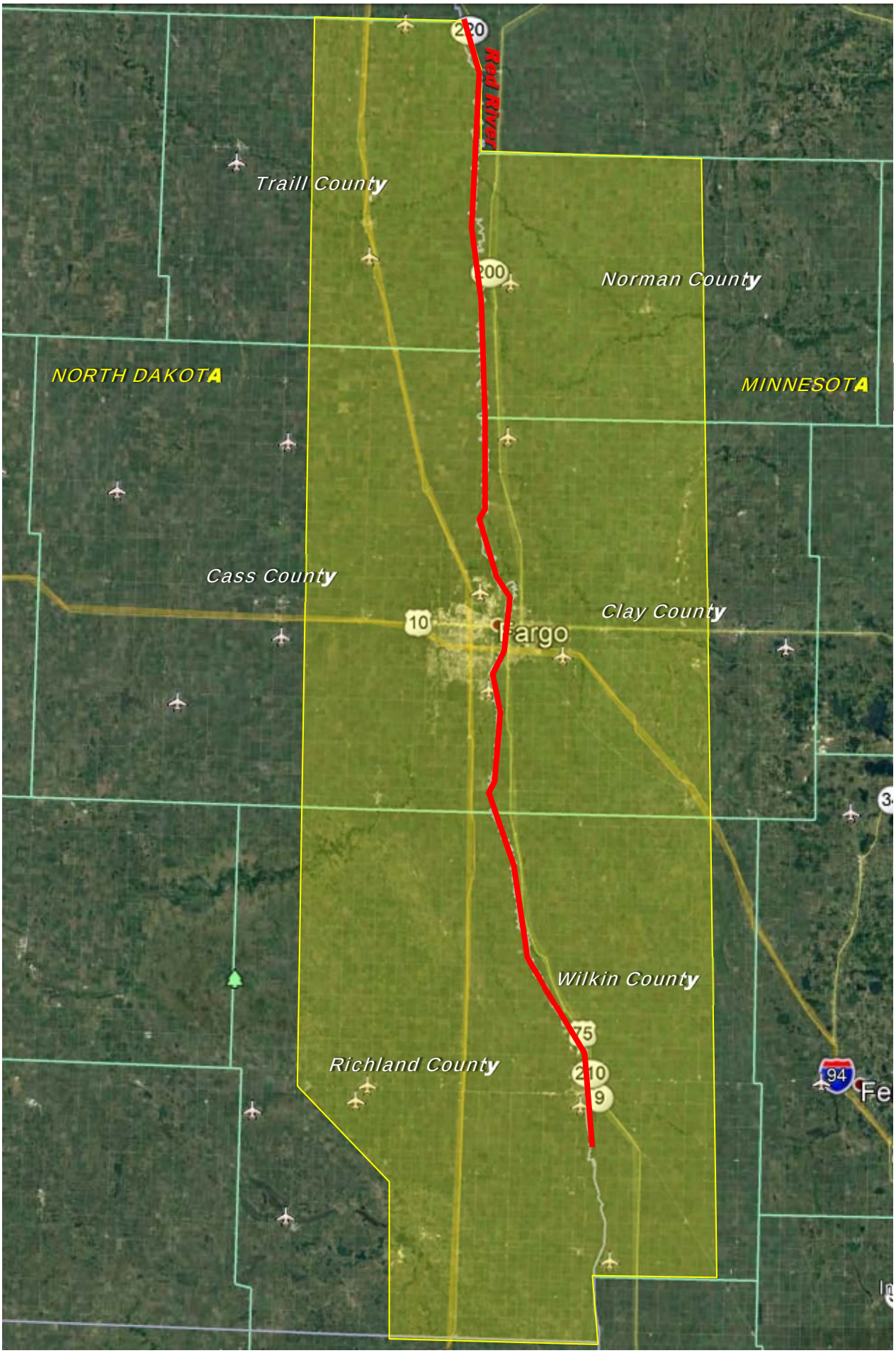
Field shape is listed either as regular or some degree of irregular severity. "Minor irregular" is typically a large tract with a small portion removed, but remains relatively square or rectangular, or when a portion removed is at a gradual angle to the rest of the field. "Moderate irregular" is a large tract with a large portion removed or drastically angled property lines. "Major irregular" is when a property is triangular in shape, or when severed into multiple odd shaped fields, such as when a highway or railroad crosses a farm diagonally, creating two wedge shaped tracts. This can also occur when a river winds either along a property's edge or through the middle of it.

- A price per tillable acre is listed for each sale. While price per deeded acre is also tracked, it can be greatly impacted by the amount of non-tillable or wasteland acreage. Farmland is bought and sold based on the price per tillable acre, and this is how farmers in the area track their cost of production. Because the RRV has very few trees and little wooded or grassy areas substantial enough in size to have value as recreational or hunting land, the vast majority of vacant land sales have all value placed on tillable acres.

- A cash rental rate per tillable acre was also estimated for each sale property. It is the cash rent considered achievable for the property at the date of sale. Some cash rents shown are actual rents received for that particular property as confirmed by a knowledgeable party involved in the transaction. Most were estimated based on our historic knowledge and tracking of cash rents in the area.

Regression Analysis
Sales Research Area
South Red River Valley




Red River
Traill County
Norman County
NORTH DAKOTA
MINNESOTA
Cass County
Clay County
Fargo
Wilkin County
Richland County
220
200
10
75
94

REGRESSION ANALYSIS

Previous Regression Analysis Research

There is a long history of research examining the effect of flood hazard on property valuation. With a variety of focal points, there are a number of ways to present these studies: floodplain effect vs. actual flood event, simple hedonic model vs. spline regression vs. spatial hedonic model, coastal vs. inland flooding, information and disclosure effects, among others (Skantz and Strickland, 1987; Speyrer and Ragas, 1991; Harrison, Smersh, and Schwartz, 2001; Chivers and Flores, 2002; Troy and Romm, 2004; Bin and Polasky, 2004; Bin and Kruse, 2006; Bin, Kruse, and Landry, 2008; Pope, 2008; Kousky, 2010; McKenzie and Levendis, 2010; Samarasnghe and Sharp, 2010; Eves and Wilkinson, 2014; Rajapaksa et al., 2016).[1] Researchers have also examined the amnesia of property buyers in the wake of a flood event (Pryce, Chen, and Galster, 2011; Atreya, Ferreira, and Kriesal, 2013; Bin and Landry, 2013). Negative effects from flooding typically range between 5% to 18% of total property value, with the effect lasting 4 to 9 years after an event. However, estimates have been as high as 44% in the year following a flood.

While the results are interesting and the models are useful guides for this study, one common theme exists among all of the aforementioned studies that prevents direct comparison, expectation, or inference of their findings for the current work: residential property. The factors affecting residential property values vastly differ from those affecting agricultural land values. Purchasing residential property is a personal decision. The willingness to pay for certain structural characteristics and surrounding amenities (e.g., school district, neighbors, etc.) stem from tastes, preferences, and factors related to the individual (e.g., family size, job, etc.). Purchasing agricultural land is a financial decision based on the expected stream of income associated with the land. Productivity and characteristics of the land that facilitate or hinder production are key drivers in purchasing decisions and the price buyers are willing to pay for a particular piece of land.

Despite the differences between agricultural and residential property, two papers examining residential property are relevant for this study. First, Shultz and Fridgen (2001) use a traditional hedonic method to examine the impact of floodplain status on housing values in the Fargo-Moorhead (F-M) area. They estimate that a 100-year floodplain status lowers home values by $8,990, while 500-year floodplain status increases home values by $3,100. The latter result is surprising at first glance; however, the authors link their findings to floodplain insurance and disclosure requirements. They conclude that flood insurance premiums account for approximately 81% of the 100-year floodplain depreciation, while lack of disclosure requirements generate the unaffected status of property in 500-year floodplains.

Zhang (2016) builds on their simple estimation method and incorporates spatial and quantile regression techniques to estimate the effect of flooding on residential property in the F-M area. Zhang's estimates are nearly identical: houses located in the 100-year floodplain sell for approximately 5.97% (or $8,355) less than non-flood property. In addition, Zhang analyzes the

[1] The list of referenced work is not meant to be exhaustive, but to provide a scope on the variety of published papers. A number of additional researchers have examined the effect of flooding on residential property. For example, Shultz and Fridgen (2001) cite additional works not listed above.

temporal decay of flood event effects on housing values. House values experience large decreases in the year following a flood event (approximately 17%, or $24,000), with the effect significantly diminishing shortly thereafter. Although expectations on how flooding will affect farmland valuation may differ from residential property, these papers are important to recognize as they provide evidence that property owners in the F-M area are sensitive to flooding and flood risk. This lends credibility for the need to evaluate this issue in the F-M area from an agricultural perspective.

To date, only two published papers investigate how flooding affects agricultural land valuation. Struyk (1971) analyzes three subareas on the Missouri River and estimates that flood risk leads to a 6.5% differential ($25/acre). Forster et al. (2008) examine a planned detention area along the Elbe River in Germany and anticipate a significant impact in agricultural areas. Both of these papers further the expectation that farmland values in the F-M area may be adversely affected by flooding. However, imposing these findings directly to the F-M area is not recommended for three key reasons.

First, Struyk (1971) estimates the effect using agricultural land value appraisals made by the U.S. Army Corps of Engineers rather than actual sales. This is in direct opposition to Ma and Swinton's (2012) recent finding: "…appraised values are a poor substitute for sale prices if the research goal is to understand dynamically evolving determinants of land value." Second, Forster et al. (2008) use potential damages and estimated losses to anticipate changes with a planned staging area rather than actual observation. Finally, willingness to pay for agricultural land differs across time and space, as highlighted in Table 3.

Agricultural land values within a given region may also vary substantially (not shown in Table 3). For example, 2015 values in the Mountain region varied from $510/acre in New Mexico to $3,780/acre in Arizona. As willingness to pay for agricultural land differs across time and space, so might the effects of flooding. This lends credibility for the need to evaluate this issue in the F-M area using actual sales data from relatively recent sales.

Table 3: Average Price per Acre, by Year and Region

	Year							
Region	1980	1985	1990	1995	2000	2005	2010	2015
Northeast	1,269	1,346	1,848	2,414	2,470	4,020	4,690	5,020
Lake	1,065	952	843	1,048	1,490	2,480	3,300	4,740
Corn Belt	1,643	1,108	1,111	1,448	1,840	2,550	3,680	6,350
Northern Plains	485	412	401	458	526	704	1,070	2,340
Appalachian	1,014	1,035	1,178	1,436	1,940	2,860	3,520	3,730
Southeast	1,005	1,068	1,300	1,533	1,920	2,740	3,570	3,670
Delta	966	1,012	806	972	1,230	1,710	2,230	2,780
Southern Plains	472	675	504	550	631	900	1,530	1,900
Mountain	284	300	265	346	440	599	911	1,100
Pacific	1,037	1,293	1,259	1,549	1,890	2,700	4,050	4,780

Source: USDA

REGRESSION ANALYSIS

Regression Methods

Hedonic Method

Use of hedonic analysis to determine the effect of flood inundation on agricultural property values follows the general theoretical approach outlined by Rosen (1974).[2] As with any product, agricultural land is composed of a vector of n objectively measured attributes ($L = l_1, l_2,\ldots, l_n$). Such attributes encompassed in the land include the characteristics of the land (e.g., soil productivity, slope, etc.) and the location in which it exists. Each attribute has its own implicit price and the sum of these prices determine a property's total value ($P_L = \sum_{k=1}^{n} l_k$). However, the price of each attribute is not readily observed as the property cannot be disaggregated and sold in separate markets. For example, one cannot sell the soil quality of the land apart from selling the land itself. Therefore, one must use the final price of the property and the levels of attributes to derive the hedonic price function [$P(L) = F(l_1, l_2,\ldots, l_n)$]. The hedonic price function, in turn, allows empirical estimation of the implicit marginal price of a given attribute (Palmquist, 1984). Quoting Rosen (1974, pg. 34): "Econometrically, implicit prices are estimated by the first-step regression analysis (product prices regressed on characteristics) in the construction of hedonic price indexes" [$\hat{P}(L)$]. Using the first-step regression, the implicit marginal price that individuals are willing to pay for a small change in the kth attribute is defined as $\hat{p}_k = \partial \hat{P}(L)/ \partial l_k$. (Goodman, 1978).

The hedonic pricing method is a popular statistical technique to estimate the value of various property attributes, including the effect of local externalities. Nearly all of the articles cited in the literature section above used the hedonic method to analyze the effects of flooding on property values; however, these represent only a few studies within a much broader set of literature. For example, the hedonic technique has been used to analyze the (dis)amenity effects of transmission lines (Brown, 1976; Colwell and Sanders, 2017), ethanol plants (Hodge, 2011), urban proximity (Shi, Phipps, and Colyer, 1997), erosion control/drainage (Palmquist and Danielson, 1989), protection easements (Nickerson and Lynch, 2001; Lynch, Gray, and Geoghegan, 2007), and various ecosystem services (Henderson and Moore, 2006; Ma and Swinton, 2011) on farmland values. For a more extensive discussion on studies measuring local externalities with hedonic analysis, see Sirmans, Macpherson, and Zietz (2005). For an overview of studies focusing on farmland valuation, see Bergstrom and Ready (2009).

Much of the popularity of the hedonic technique stems from its use of market data (i.e., revealed preferences) to measure an impact rather than stated preferences analyzed in surveys. Stated preferences may not reveal the true valuation of an externality because consumers often have an incentive to overstate or understate potential effects. They may overstate an impact if they believe compensation will be provided for externalities imposed on them, and may understate the value if they believe fees or taxes will be required of them to pay for future benefits. Hedonic regression analysis "reflects what buyers and sellers actually do, opposed to what potential buyers say they

[2] Rosen was not the first to employ hedonic pricing techniques to estimate implicit prices of products as Haas (1922a), Wallace (1926), and Court (1939) are a few examples of those who used regression techniques along the hedonic tradition. However, he was the first to support interpretation and estimation through a well-defined theoretical model.

might do, under specified hypothetical circumstances" (Kinnard and Dickey, 1995). That is, it mitigates subjectivity bias stemming from surveys of those (potentially) affected.[3]

Hedonic regression analysis also mitigates potential subjectivity bias stemming from appraisers. The income, cost, and sales comparison approaches represent three appraisal alternatives to the survey approach. Like hedonic modeling, all three represent an improvement over surveys by incorporating actual sales data. However, as Chalmers and Voorvaart (2009) note, ¨...multiple regression has the significant advantage of not relying on the subjective judgment of the appraiser. Rather, it represents an objective reflection of the data together with measures of reliability that attach to the results." The appraisal method relies on a few handpicked sales to estimate how numerous characteristics affect valuation, which may have been 'data mined' to support a preconceived value conclusion. Whereas hedonic analysis incorporates statistical modeling and large samples to estimate effects. Without large sample sizes, it only takes one or two outliers to skew data and results.

The hedonic pricing method is popular because it presents a powerful approach for valuing property characteristics. However, it is not free from error and suffers from the same potential pitfalls as the appraisal approach, specifically: sample size and subjectivity. Regarding sample size, not every study can support the use of hedonic techniques as not every market area has enough sales, or variation in property characteristics among sales, to properly measure a (dis)amenity affect. In fact, many rural areas cannot be used for estimating such effects since inference drawn from hedonic regressions with small sample sizes is unreliable. A general rule of thumb for a sufficient sample size is 10-20 times the number of variables. If five features are recognized as determinants of market price, 50-100 sales are suggested to use the hedonic regression technique. Regarding subjectivity, data may be 'mined' or 'massaged' to provide results consistent with preconceived notions. Rather than blindly rely on the results obtained through statistical techniques, attention must be given to the sample sizes, definitions, and specifications incorporated in any model. Only when valid arguments and techniques are implemented, whether industry standards or unique issues for a particular study, may we have confidence in the results.

Model

Following the general framework to evaluate the effect of a flood event on land values provided by Kousky (2010) and Atreya, Ferreira, and Kriesel (2013), the hedonic model incorporated in this study is represented as:

$$P_{it} = \alpha + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3 (Flooded_i * PostFlood_{it}) + X_i\delta + L_i\gamma + \tau_t + \varepsilon_{it} \qquad [1]$$

[3] The intention of this discussion is not to invalidate the survey approach altogether. Jackson and Pitts (2010) credit the usefulness of surveys with the following statement: "While 'stated preferences' in surveys do not provide an adequate basis for estimating price effects, surveys can and do provide important insights into the market's perception of these structures and their potential impacts on certain types of real property."

where P_{it} is the real sale price per tillable acre for each agricultural land sale i at time t. Prices are adjusted to 2010 dollars using the annual GDP implicit price deflator.[4] Since farmers who purchase land are predominately interested in its productive capacity, estimation incorporates the price per *tillable* acre rather than price per *deeded* acre.[5] X_i is a vector of property characteristics and L_i is a vector of locational characteristics that are expected to influence an agricultural property's sale price. τ_t represents year and month fixed effects to control for temporal changes affecting all agricultural land values, such as seasonality and market trends, and ε_{it} is the error term.

To examine the effects of flood risk and flooding on the value of agricultural land, three variables are of interest: $Flooded_i$, $PostFlood_{it}$, and their interaction $Flooded_i$*$PostFlood_{it}$. $Flooded_i$ is a measure of flood risk for property i and controls for price differences between the treatment and control group not associated with a flood event. $PostFlood_{it}$ is a dummy variable equal to one if the sale occurred within one year after a flood event. Previous studies using this approach generally capture a collective 'before event' period and a collective 'after event' period, regardless of the number of years after the event, since they examine a single event. The data in this study include six separate floods events. Therefore, the 'after event' period for each of these six events is considered, measured as one year after the event in the $PostFlood_{it}$ variable. This also recognizes the diminishing negative effect within a short time period after a flood event (Atreya, Ferreira, and Kriesal, 2013; Bin and Landry, 2013; Zhang, 2016). Changes to this length of time and buyer amnesia are estimated in additional specifications below. Finally, the interaction of $Flooded_i$*$PostFlood_{it}$ represents the effect of flooding on property values.

The objective of equation [1] is to provide a clear examination of whether a flood event adversely affects agricultural land sales. As presented, this model compares agricultural land sales within a flood prone area ($Flooded_i$) with non-flood prone sales, and uses the timing before and after flood events ($PostFlood_{it}$) to measure the effect of floodwater inundation on the value of agricultural land ($Flooded_i$*$PostFlood_{it}$). This is known as a difference-in-differences (DD) model: a quasi-experimental approach to control for contemporaneous influences (e.g., macroeconomic changes to agricultural values or the local agricultural land) and isolate the effects of a flooding. Estimates consider what happened to treated/flooded sales relative to untreated/comparison sales before and after a flood event. The key variable of interest is $Flooded_i$*$PostFlood_{it}$.

Property Characteristics (X)

Local appraisers who specialize in agricultural land valuation were consulted to identify the key determinants of agricultural land prices in the F-M area. The land characteristics collected for this analysis include soil productivity, drainage, rocks, topography, salinity, and shape. Each of these characteristics affect sale prices in a positive way: higher soil productivity, better drainage, no

[4] Using the annual GDP implicit price deflator is not unique to this study. A recent report of farmland values generated by the United States Department of Agriculture's Economic Research Service (USDA ERS) uses the same deflator to compare current prices with farmland value dating back to the 1960s: https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-value/.

[5] Unreported models use the sale price as the dependent variable, as well as the price per deeded acre. The general results are available upon request and are consistent with what is presented below.

rocks, level ground, lower salinity, and a regular shape (i.e., better or easier farming conditions) should generate higher prices. Furthermore, controlling for drainage may be of particular importance as we think about how these features affect the price of land during flood events. Better drainage facilitates faster removal of floodwater, reducing dry-down time.

A common problem that plagues farmland valuation studies is the presence of residential or farmstead structures. With a residential structure, it may be difficult to separate the effects of flooding on the value of the residential structure from the effect on the land itself. This is important to consider since evidence suggests flooding negatively affects residential property, especially in the F-M area (Shultz and Fridgen, 2001; Zhang, 2016).

A common solution is to use a constructed sale price of land, either by subtracting the appraised value of buildings from the sale price or multiplying the sale price by the percentage of appraised value of land over the total appraised value of land (Guiling, Brorsen, and Doye, 2009; Zhang and Nickerson, 2015). This issue and any subjective valuation by an assessor or appraiser is avoided by only including land sales without building improvements.

Locational Characteristics (L)

The list of potential locational characteristics is extensive. However, the list was reduced through additional discussion with local appraisers. The included attributes are distance from the F-M city limit, distance to the Red River, and distance to beet piling stations.[6] Distance from the city and beet piling stations are expected to be negative, while there is no expectation for distance to the Red River after controlling for flooding. Distance to the city may reflect buyer speculation of future city development/expansion. This is an important consideration as the Fargo-Moorhead area has experienced steady growth during the study period. Not only has the population grown by over 80,000 since 1992, from approximately 153,000 in 1990 to 238,00 in 2017) U.S. Census Bureau), the city limits have expanded by more than 70%, from 39.9 square miles in 1990 to 68.6 square miles in 2017. Distance to beet piling stations is also important since sugar beets are an important crop in the region. Farms closer to beet piling stations may incur lower transportation costs and increase net farm income. Finally, squared distances for each measure will also be included to account for non-linear effects since it is reasonable that each effect disappears after a certain distance.

Other Considerations

Expected net farm income is another important factor that may drive land values, separate from locational or property characteristics (Reynolds and Timmons, 1969). The larger the stream of expected future income, the higher the expected present value. Unfortunately, there is no explicit measure of 'typical' farm income for each sale in the F-M area, present or historical. Even if a present measure of 'typical' farm income existed, imposing this measure on all farmers in the area would be insufficient since there is too much variability in crops and farming practices.

[6] Distances to beet piling stations are fixed to the location of stations present at the time of this study. We recognize this as a limit since locations may have changed over time, but we do not have information on previous beet piling station locations. Controlling for the current locations is better than ignoring this effect altogether. Most of the stations currently in use have been in the same location for many years.

Furthermore, the crop options of farmers in the F-M area have changed over time. Corn was not a major crop in the 1990s, but has become a standard option within the last 20 years with the introduction of genetically modified and hybrid seeds that mature quicker, allowing for shorter growing seasons. Despite this lack of data and variability in crops/farming practices, commodity prices may be used as a proxy for expected income for three reasons.

First, commodity prices represent a portion farm income that is highly visible and monitored by farmers. Second, commodity prices are highly correlated. Including a single commodity price may capture the expectations and trends of other prices.[7] Finally, historical data on commodity prices are readily available. The daily commodity price of soybeans at the time of sale for each observation is included and a positive effect is expected. That is, an increase in the price of soybeans should be associated with an increase in expected farm income and an increase in the sale price.

Functional Form

While hedonic price models have been routinely used to analyze the market price of multiple property attributes, a common issue faced by researchers using hedonic analysis has been the choice of functional form (Cropper, Deck, and McConnell, 1988). Theory provides no *a priori* guidance regarding functional form and it has become common practice to empirically determine the functional form that best fits the data (Palmquist, Roka, and Vukina, 1997). Following previously cited literature, two general functional forms are considered: linear and semi-log (natural logarithm of the dependent variable). To determine the best fitting model, each specification's sum of squared residuals was compared and tested after the observed prices were normalized by their geometric means. Palmquist and Danielson (1989) show that this procedure is equivalent to the Box-Cox criterion. Following this procedure, the semi-log model provides the best fit. This is not surprising given similar findings of previous research using the Box-Cox criterion for determining the best functional form for valuing agricultural land (Ma and Swinton, 2011; Zhang and Nickerson, 2015). This alters the model to:

$$\ln(P_{it}) = \alpha + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3 (Flooded_i * PostFlood_{it}) + X_i\delta + L_i\gamma + \tau_t + \varepsilon_{it} \quad [2]$$

where $\ln(P_{it})$ represents the natural logarithm of the real price per tillable acre for each agricultural land sale. Although the results from equation [2] are presented below, additional analysis to determine the result sensitivity stemming from alternative functional forms was undertaken. The results are very similar to what are presented below and are available upon request.

[7] Correlation coefficients between soybean, corn, and hard red spring wheat commodity prices that were collected daily from January 2, 1990 to July 20, 2018, exhibit strong correlation. Specifically, 0.92 between soybeans and corn, 0.87 between soybeans and hard red spring wheat, and 0.87 between corn and hard red spring wheat.

REGRESSION ANALYSIS

Spatial Considerations

An oft-cited problem with hedonic analysis is spatial dependence, potentially leading to inefficient or inconsistent estimates (Anselin and Bera, 1998). As the *first law of geography* states, "Everything is related to everything else, but near things are more related than distant things" (Tobler, 1970). This "law" translates spatial dependence as two or more sales that are close tend to be more similar to each other – with respect to a given attribute or unobserved characteristics – than are spatially distant objects.

Zhang and Nickerson (2015) highlight two general approaches to mitigate spatial bias, noting that the true structure and sources of spatial correlation are unknown to the researcher. The first method is a spatial fixed-effects model, represented as:

$$\ln(P_{it}) = \alpha + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3(Flooded_i * PostFlood_{it}) + X_i\delta + L_i\gamma + \tau_t + \theta_m + \varepsilon_{it} \quad [3]$$

where θ_m is added to represent spatial fixed effects at the county level (m).[8] Including these fixed effects controls for a wide range of observed and unobserved time-invariant spatial heterogeneity such as natural amenities and locational influences not explicitly considered. For example, property tax rates may vary across county lines that generate different discounts or premiums, capitalized in land prices.

The second approach suggested by Zhang and Nickerson (2015) is the spatial error model. While spatial dependence may correspond with the chosen fixed effect scale (i.e., county) and be mitigated with this explicit measure of location, there may remain substantial spatial correlation that varies within this level. In addition, spurious spatial error may be introduced if county boundaries do not correspond with the unobserved characteristics (Anselin and Arribas-Bel, 2013). Simply stated, county-level fixed effects may mitigate some bias, but there may be more localized effects not captured at this level. An alternative to equation [3] for getting unbiased and efficient estimates requires the recognition and correction for inherent spatial dependence. Spatial autocorrelation (or spatial error) that arises from unobserved characteristics is another common problem cited in the hedonic literature and is popular among hedonic papers, a few examples include Ma and Swinton (2011 and 2012), Bin and Landry (2013), and Zhang and Nickerson (2015). The spatial error model is represented as:

$$\ln(P_{it}) = \alpha + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3(Flooded_i * PostFlood_{it}) + X_i\delta + L_i\gamma + \tau_t + \varepsilon_{it} \quad [4]$$
$$\text{with } \varepsilon_{it} = \rho \mathrm{W}_{ij}\varepsilon + u_{it}$$

where W_{ij} is an $n \times n$ spatial weights matrix, ρ is the spatial autocorrelation coefficient, u is the spatially uncorrelated error term, and all other coefficients are as defined in equations [1] and [2]. A min-max normalized inverse distance spatial weights matrix is incorporated, where spatial

[8] State-level differences, while important to distinguish for the appraisal approach, are not explicitly needed in this portion of the analysis since counties already control for the variation expected across state lines.

dependence decays with distance. The min-max approach preserves symmetry and basic model specification (Drukker et al., 2011).

Spatial error is not the only approach for thinking about spatial connection between observations. An alternative method for examining spatial dependence is the spatial lag model, an approach previously used for estimating flood effects on Fargo residents (Zhang, 2016). The spatial lag model is represented as:

$$\ln(P_{it}) = \alpha + \lambda \mathrm{W}_{ij} \ln(P_{nt}) + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3 (Flooded_i * PostFlood_{it}) + X_i\delta + L_i + \tau_t + \varepsilon_{it} \quad [5]$$

where λ is the spatial lag parameter capturing the impact of neighboring land sale j on the current sale i. Both the spatial lag model and spatial error model are intuitively reasonable. Spatial lag recognizes the price of land depends on the prices of neighboring land. Spatial error suggests one landowner/farmer may be influenced in their farming practice decisions by neighboring farmers (e.g., when to plant, fertilizer use, etc.). These practices, in turn, may influence yield and other observed or unobserved independent variables that affect the sale price a landowner is able to receive.

While much of the hedonic literature chooses either the spatial error or spatial lag model to correct for unknown spatial dependence, a final model including both a spatial lag parameter and a spatial autocorrelation coefficient is considered to correct for both types of spatial dependence. Incorporating the spatial weights matrix, W_{ij}, into a spatially lagged and autoregressive model is referred as a SARAR model (Anselin and Florax, 1995), represented as:

$$\ln(P_{it}) = \alpha + \lambda \mathrm{W}_{ij} \ln(P_{nt}) + \beta_1 Flooded_i + \beta_2 PostFlood_{it} + \beta_3 (Flooded_i * PostFlood_{it}) + X_i\delta + L_i + \tau_t + \varepsilon_{it} \quad [6]$$
$$\text{with} \quad \varepsilon_{it} = \rho \mathrm{M}_{ij} \varepsilon + u_{it}$$

λ and ρ represent the spatial lag and spatial autocorrelation coefficients, respectively.[9] A common assumption in this study is to set $\mathrm{W}_{ij} = \mathrm{M}_{ij}$ (Fingleton, 2008; Fingleton and Le Gallo, 2008; Kissling and Carl, 2008; Kelejian and Prucha, 2010; Atreya, Ferreira, and Kriesal, 2013).
Like Zhang and Nickerson (2015), this study does not "choose a side" in the ongoing debate of how best to deal with the potential problem of spatial dependence (e.g., Kuminoff, Parameter, and Pope, 2010; Anselin and Arribas-Bel, 2013). Instead, each of the spatial specifications discussed

[9] All of the spatial error and spatial lag models are estimated using a generalized spatial two-stage least squares (GS2SLS) estimator to produce consistent estimates, rather than implement maximum likelihood (ML) which assumes normality of the error term. Footnote 7 of Atreya, Ferreira, and Kriesel (2013) provides a discussion on how the SARAR estimators are produced under this approach.

above is estimated (equations [3]-[6]). The extent to which results are robust to various corrections of spatial dependence can be easily examined.[10]

Data and Summary Statistics

The dataset collected for the analysis in this report includes detailed information on the price and property characteristics of arms-length agricultural land sales from Cass, Clay, Norman, Richland, Traill, and Wilkin counties between 1992 and 2018.[11] This period includes six major flood events in the research area: 1997, 2001, 2006, 2009, 2010, and 2011. A total of 1,900 unimproved, agricultural land sales were collected.

Two issues require attention before estimating the hedonic models presented above: 1) the locational attributes and flood characteristics of each sale need to be determined; and 2) unique coordinates are required to estimate spatial weighting matrices. To identify locational attributes, each parcel was matched/mapped with geographic information systems (GIS) software using parcel-level shapefiles provided by Houston Engineering, Traill County, and Norman County. Distance to Fargo-Moorhead city limits and distance to the Red River were then calculated using the GIS software. Distances to beet piling stations in the six-county region were also calculated using GIS software after station locations were either discovered or provided by Norman County.

To identify flood attributes, Houston Engineering provided hydraulic model flood-event data to identify which parcels were inundated with floodwater during the 1997, 2006, 2009, and 2011 flood events.[12] Although the data was not provided, flooding events that occurred in 2001 and 2010 cannot be ignored. 2006 flood information was used for 2001 and 2010 since hydraulic modeling data for these periods was not provided and the 2006 flood event was similar to flooding during those periods. Combining sales information with parcel-level GIS shapefile data resulted in 82 dropped observations due to parcel number mismatch.[13]

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[10] Additional model specifications, robustness checks, and alternate control variables have been tested in the forthcoming, peer-reviewed journal article by Hodge (2021). Overall, results concerning the coefficient of interest are consistent with the results presented in this study (i.e., *Flooded*PostFlood*).

[11] The dates and results presented in the "REGRESSION ANALYSIS" section of this report reflect findings from the initial study completed for the Diversion Authority (2018). Additional farmland sales have been collected to allow an updated view, presented in the "APPENDIX." The results concerning the coefficient of interest with the additional sales are slightly larger than those presented in this report, however, they are very reasonable since they are within the 95% confidence interval of the initial results.

[12] Notice the use of the term "parcel" rather than "sale" in this section. Many of the sales included multiple parcels. To properly identify the locational and flooding characteristics, each parcel from land sales were mapped. Data was then collected for each parcel and merged back into the original dataset. The closest distance, or identification of any of the parcels flooding, were then used as the final measure for related variables.

[13] This is not surprising given the length of time for which sales were collected. Parcel numbers may change over time as land is divided and resold. In addition, some of the sales may reflect new parcel numbers (i.e., recently split) while shapefiles are not current.

REGRESSION ANALYSIS

The second issue with the dataset stems from estimation of the spatial weighting matrices. To create an inverse distance matrix and control for spatial dependence from lag and error, observations must have unique coordinates. Atreya, Ferreira, and Kriesel (2013) cite a similar concern and limit their sample to the most recent sales. Rather than preserve the most recent sale and potentially drop sales inundated by flooding, sales with duplicate coordinates that were not sold during flood event years are removed (resulting in 128 dropped sales). The spatial fixed effects results without dropping these observations are also presented since it does not require a spatial weighting matrix for estimation.

Upon examining the data, two minor issues required attention: 2 observations had missing information and an additional 44 sales were likely the same sale as they included the same parcels of land and sold within a few days for the same price. These observations were excluded to avoid estimation bias resulting from duplicate sales. The final dataset includes 1,772 total sales using alternate coordinates, and 1,644 sales when dropping all with duplicate coordinates.

Figure 5 highlights the location of agricultural sales used in this analysis overlayed with the 1997 flood event. The full list of variables and their descriptions are in Table 4. Also included in Table 4 are the summary statistics for non-flood properties and flood properties, identified by the $Flooded_i$ variable discussed above. There is little variation between the flood and non-flood samples. Of particular interest, the average price per tillable acre for both samples is approximately $2,600 and not statistically different. The only substantial differences stem from their location relative to the river: shape is irregular for properties close to the river as property lines may correspond with river contours, and flooded properties are closer to the F-M area (i.e., City Distance) since the largest extent of flooding surrounds the F-M area.

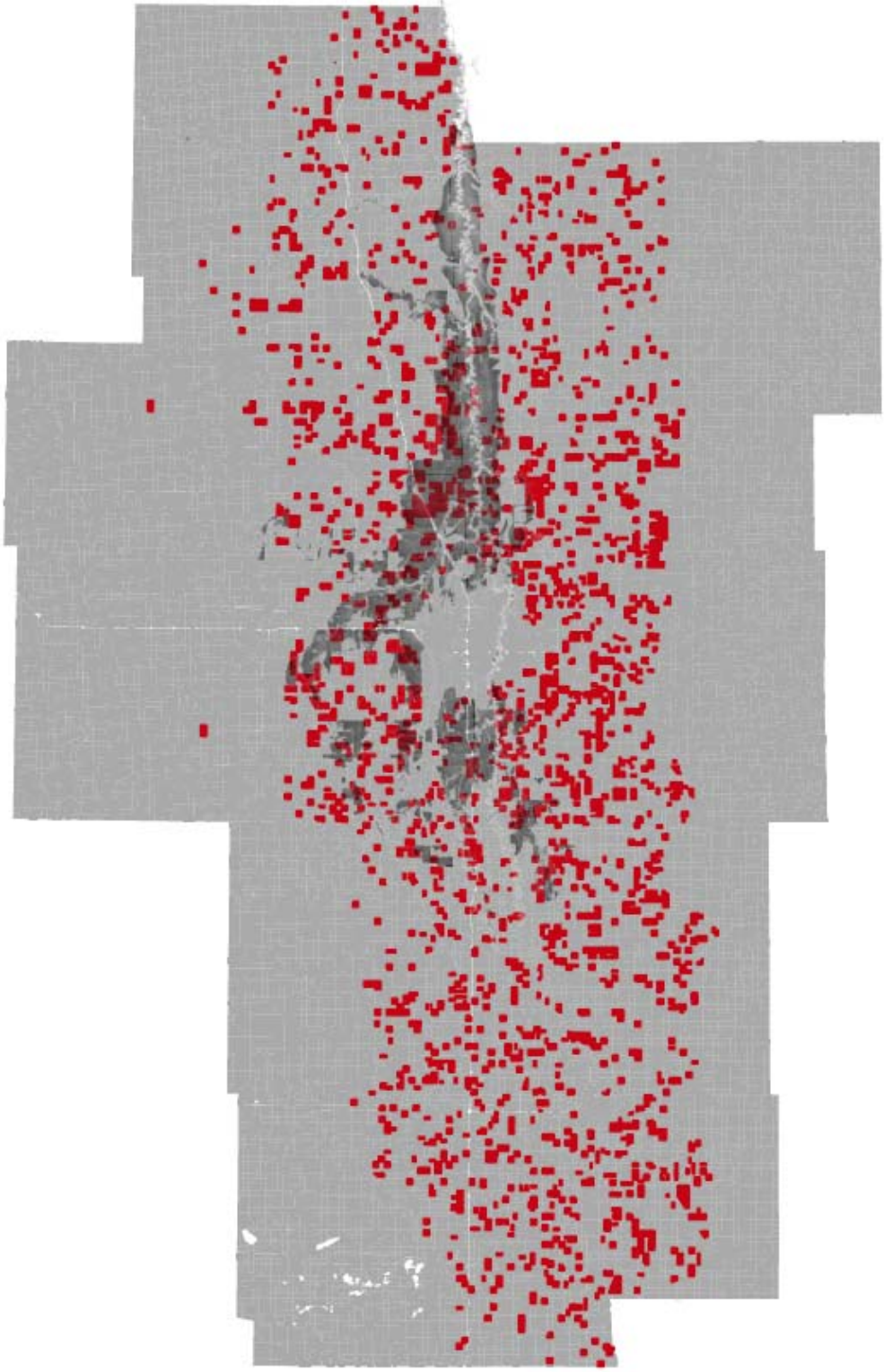
REGRESSION ANALYSIS

Table 4: Variable Descriptions and Summary Statistics

		$Flooded_i = 0$		$Flooded_i = 1$	
Variable	Unit (Description)	Mean	Std. Dev.	Mean	Std. Dev.
Land sales price					
Price per acre	Dollars (adjusted to 2010 prices)	2,591	1,462	2,666	1,544
ln(price per acre)	Dollars (adjusted to 2010 prices)	7.709	0.550	7.726	0.571
PostFlood	Binary (=1 if sold within 1 year after flood)	0.254	0.435	0.243	0.430
Property Attributes					
PI	Number (scale of soil quality ranging from 1 to 100, 100 = best soil quality)	83.99	10.45	86.28	4.991
Drainage Average	Binary (=1 if *AVERAGE* drainage)	0.630	0.483	0.563	0.497
Drainage Fair	Binary (=1 if *FAIR* drainage)	0.256	0.437	0.275	0.447
Drainage Good	Binary (=1 if *GOOD* drainage)	0.077	0.266	0.068	0.252
Drainage Poor	Binary (=1 if *POOR* drainage)	0.037	0.189	0.094	0.293
No Rocks	Binary (=1 if *NO* rocks)	0.986	0.119	1.000	0.000
Rocks	Binary (=1 if *SOME* rocks)	0.014	0.119	0.000	0.000
Topography Level	Binary (=1 if *LEVEL*)	0.993	0.084	0.984	0.125
Topography Uneven	Binary (=1 if *NOT LEVEL*)	0.007	0.084	0.016	0.125
Salinity No	Binary (=1 if *NO* salinity)	0.884	0.320	0.966	0.182
Salinity Some	Binary (=1 if *SOME* salinity)	0.054	0.226	0.016	0.125
Salinity Most	Binary (=1 if *MOST* salinity)	0.062	0.241	0.018	0.134
Shape Regular	Binary (=1 if *REGULAR*)	0.731	0.444	0.571	0.496
Shape Minor Irr.	Binary (=1 if *MINOR IRREGULAR*)	0.123	0.328	0.217	0.413
Shape Moderate Irr.	Binary (=1 if *MODERATE IRREGULAR*)	0.090	0.286	0.084	0.277
Shape Major Irr.	Binary (=1 if *MAJOR IRREGULAR*)	0.057	0.232	0.128	0.335
Locational Attributes					
City Distance	Miles	22.85	13.23	6.898	6.209
Beet Piler Distance	Miles	5.929	3.001	6.579	2.787
Red River Distance	Miles	7.870	4.526	4.301	4.202
Other					
Soybeans	Dollars (Futures price at date of sale)	8.923	3.349	9.081	3.330
Number of obs.		1,262		382	

REGRESSION ANALYSIS

Figure 5: 1997 Flood and Agricultural Land Sales from 1992-2018



REGRESSION ANALYSIS

Regression Results

Difference-in-Difference Estimates

Table 5 presents the coefficient estimates for each of the spatial models (equations [3]-[6]). Column I provides the estimates of the spatial fixed effects model without eliminating observations with duplicate coordinates. The remaining columns have duplicate coordinates removed to create the spatial weighting matrix, as discussed above. While the results are consistent across all models, discussion will focus on results from the SARAR model in column V since the spatial error and spatial lag coefficients suggest the presence of spatial dependence. That is, both spatial dependencies are statistically significant at the 1% level and in the expected direction: positive.[14]

First, consider the results for the property attributes included in the analysis. Most variables have their expected sign. In addition, the variables appear to be reasonable estimates when transformed to dollar values. A one-unit increase in productivity (*PI*) leads to a 0.43% increase in the price per tillable acre (nearly $11.20 per tillable acre), on average. Good drainage provides an 11% increase and poor drainage requires a 20% discount, relative to property with average drainage. Finally, while higher levels of salinity are not statistically significant in column V, the other models suggest a premium of 8% to 13%. This result is surprising. Upon further examination of the data, 80% of the observations with high salinity are in Richland County. High salinity in Richland County is an accepted issue as it is more typical than in other counties, and the agricultural land market is highly competitive among relatively large farms. The combination of these factors is the likely culprit of this unexpected result.

Next consider the locational attributes. Again, all variables have their expected sign and indicate that price decreases as distance increases. For example, the coefficient representing distance from beet piling stations is interpreted as a decrease in price of 2.1% for each additional mile away. Note the general trend of each locational effect diminishing as spatial lag and spatial error are included, not surprising as additional unobserved characteristics are controlled. It may be surprising to find distance to the Red River is negative and statistically significant. However, this is reasonable since flood effects are already controlled and major highways (I-29 and US-75) correlate with the river path. The proximity to these North-South highways may represent lower transportation costs and thus would explain the negative coefficient for distance to the Red River.

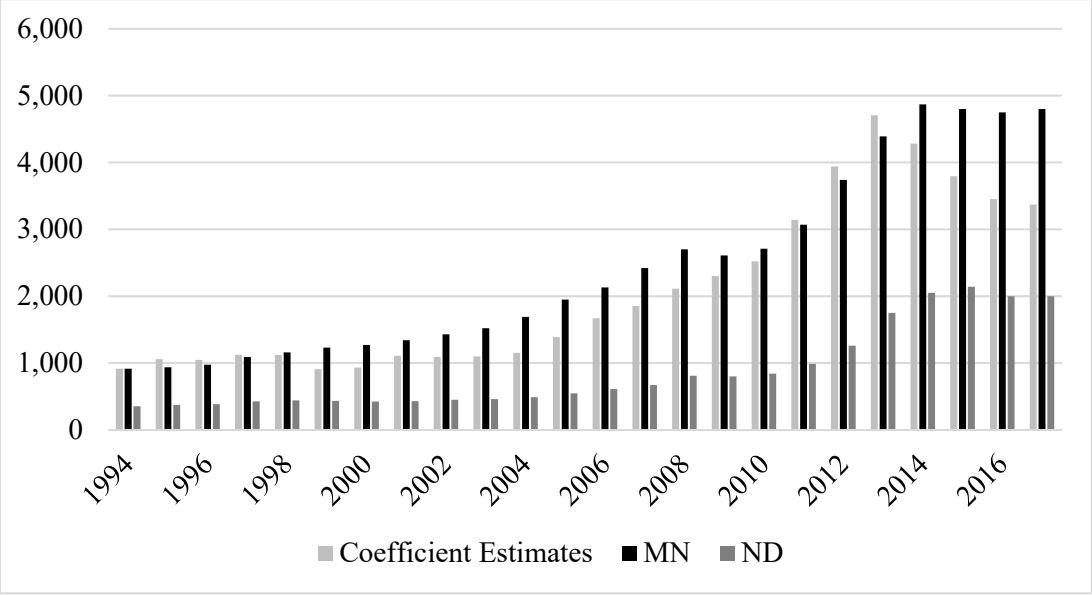
Although year-month fixed effects to capture market trends are not reported in Table 5, Figure 6 presents coefficient estimates capturing yearly trends over time. Figure 6 also includes USDA cropland values per acre for Minnesota and North Dakota to compare with estimated results. The estimated yearly trends track well with changes in agricultural land markets over time, generally between per acre values from Minnesota and North Dakota. These provide additional confidence in the accuracy of the models. Beyond the market trends, the relationship between future

[14] Two transformations are required to interpret the coefficients in the SARAR model. First, interpreting a dummy variable in any semilogarithmic equation requires the Halvorsen and Palmquist (1980) adjustment. Second, the presence of spatial lag requires adjusting regression coefficients by the spatial multiplier, $1/1-\lambda$ (Kim, Phipps, and Anselin, 2003). These adjustments are made in the results discussion.

expectations of farm income on the sale price of agricultural land is examined through inclusion of daily soybean futures price (*Soybeans*). Once again, the sign follows expectation and is reasonable: a one dollar increase in the futures price leads to a 1% increase in price of agricultural land.

The coefficients estimating the effect of flooding on agricultural land value shows whether or not there is a discount associated with flood risk and flood events. First, there is no statistically significant decline for flood properties (*Flooded*), suggesting no discount between treatment (flood zone properties) and control (all other properties) groups in the absence of a flood event. This result is consistent with previous literature citing that buyers may be insensitive to flood risk in the absence of such events (Kousky, 2010; Atreya, Ferreira, and Kriesel, 2013; Bin and Landry, 2013). Second, some of the models associate a small, statistically significant discount for all property after a flood event (*PostFlood*). This is again consistent with previous research examining residential property. However, this effect is not statistically significant when controlling for spatial error. Finally, using the Difference-in-Difference assumption that properties outside flood zones represent a valid control group, the casual effect attributable to a flood event on flood-zone property values is reflected in the coefficients for *Flooded*PostFlood*.[15] The effect is statistically significant and similar across all specifications. On average, properties that flood decrease in value by 7.9% in the year following a flood event.

Figure 6: Estimated Average Price per Acre Compared with Actual Values (Source: USDA)



[15] The aforementioned article by Hodge (2021) formally tests the assumption that properties outside the flood zone represents a valid control group, finding no difference in agricultural sale price trends between flood and non-flood properties prior to flood events.

REGRESSION ANALYSIS

Table 5: Difference-in-Difference Regression Results

Variable	I. FE	II. FE	III. Error	IV. Lag	V. SARAR
Flooded	-0.025	-0.022	0.000	-0.014	0.001
	(0.017)	(0.018)	(0.020)	(0.018)	(0.021)
PostFlood	-0.045**	-0.037*	-0.031	-0.036*	-0.029
	(0.019)	(0.020)	(0.019)	(0.020)	(0.019)
*Flooded*PostFlood*	-0.060**	-0.064**	-0.074***	-0.072**	-0.077***
	(0.028)	(0.030)	(0.028)	(0.030)	(0.028)
PI	0.005***	0.005***	0.004***	0.002***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Drainage Fair	-0.117***	-0.119***	-0.112***	-0.134***	-0.112***
	(0.013)	(0.014)	(0.013)	(0.014)	(0.013)
Drainage Good	0.103***	0.107***	0.100***	0.116***	0.099***
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
Drainage Poor	-0.231***	-0.220***	-0.213***	-0.260***	-0.209***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Rocks	-0.070	-0.075	-0.047	-0.077	-0.034
	(0.050)	(0.051)	(0.052)	(0.053)	(0.052)
Topography Uneven	-0.058*	-0.060*	-0.035	-0.074*	-0.027
	(0.033)	(0.036)	(0.036)	(0.043)	(0.036)
Salinity Some	0.017	0.020	0.022	0.046	0.024
	(0.029)	(0.032)	(0.031)	(0.032)	(0.031)
Salinity Most	0.072**	0.084**	0.041	0.119***	0.037
	(0.033)	(0.033)	(0.035)	(0.034)	(0.036)
Shape Minor Irr.	0.011	0.007	-0.006	0.011	-0.002
	(0.016)	(0.017)	(0.017)	(0.017)	(0.017)
Shape Moderate Irr.	0.002	-0.000	0.003	0.009	0.010
	(0.020)	(0.021)	(0.020)	(0.021)	(0.020)
Shape Major Irr.	-0.003	-0.009	-0.022	-0.006	-0.018
	(0.019)	(0.020)	(0.019)	(0.021)	(0.019)
City Distance	-0.012***	-0.012***	-0.017***	-0.010***	-0.002
	(0.002)	(0.002)	(0.004)	(0.002)	(0.004)
City Distance^2	0.000***	0.000***	0.000***	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Beet Piler Distance	-0.020***	-0.021***	-0.021***	-0.019***	-0.020**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Beet Piler Distance^2	0.000	0.000	0.001	0.001	0.001
	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)
Red River Distance	-0.021***	-0.021***	-0.019***	-0.021***	-0.018***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
Red River Distance^2	0.001***	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Soybeans	0.007	0.008*	0.010**	0.011**	0.010**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	6.945***	6.946***	7.016***	6.597***	6.437***
	(0.096)	(0.100)	(0.095)	(0.129)	(0.167)
ρ	-	-	2.734***	-	3.793***
			(0.214)		(0.374)
λ	-	-	-	0.077***	0.068***
				(0.011)	(0.019)
Year-Month FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	No	No	No
R-squared	0.865	0.861	-	-	
Observations	1,772	1,644	1,644	1,644	1,644

Notes: Robust standard errors are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

REGRESSION ANALYSIS

Severity and Temporal Decay Estimates

While the estimates above provide a basis for the average effect of flooding on agricultural land values, it equally identifies all property as simply flooded or not flooded. The hydraulic model data provided by Houston Engineering not only allows identification of which parcels were inundated with floodwater, but to identify the severity of flooding experienced by each parcel. Specifically, the average flood depth and percentage of each sale covered by a flooding event may be calculated. These are important to consider since it is unlikely, as well as unreasonable to assume, that all property that floods is equally affected. For example, there is no reason to expect that properties with 50% inundation experience the same negative effect as properties with 100% inundation. Those with less flooding may be able to continue farming as only a portion of their land experiences delay. Furthermore, it is reasonable to assume that varying levels of flooding affect farmers differently. The required time to allow floodwaters to recede will be longer with higher levels of flooding, delaying dry-down cycles.

Two additional models to account for differences in flood severity are considered. The first model replaces the binary flood variables (i.e., $Flooded_i$ and $Flooded_i \times PostFlood_{it}$) with the percent of each sale that is flooded.[16] The second model replaces the binary flood variables with the average flood depth experienced by each sale. Both approaches allow for different magnitudes of flooding effects. The core results from each of these models can be viewed in columns I and II of Table 6. As before, there is no statistically significant decline for flood properties in the absence of a flood event (*Flooded*), while all property require a small discount after a flood event (*PostFlood*). More importantly, the estimates capturing the severity of flooding are both negative and statistically significant. A 1% increase in inundated land leads to a 0.097% discount and a one-foot rise in floodwater levels translates to a 2.3% discount. As anticipated, these results are slightly larger than treating all inundated land uniformly. Previous estimates indicated a 7.9% discount, regardless of inundation levels. Therefore, a parcel with 100% flooding would be given a 7.9% reduction in the total value of land. However, the results now indicate that a parcel that with 100% flooding experiences a 9.7% discount. Using the "Flood Depth" discount from column II, the average flooded property experiences a 5% discount.[17] Non-linear effects of flood depth are also examined in column III of Table 6. As expected, results indicate larger discounts for initial flood depths (equal to 5.2%) that diminish as floodwaters rise.

[16] Multiple steps were required to calculate the percent flooded for each sale since many of the sales included multiple parcels and mapping data was at the parcel level. First, each parcel from a particular sale was mapped and the total flooded area for each parcel was calculated. In addition, the total area of each parcel was calculated. Each parcel was then added back into the original dataset using unique indentifiers. Finally, the total area flooded for each sale could be summed by adding the flood area of each parcel in the sale, along with the total area of each sale, and the percentage flooded was easily calculated by dividing the total area flooded by the total area of the sale.

[17] This was calculated by multiplying the average depth of flooding among flooded property, approximately 2.18 feet, by the per-foot discount of 2.3%.

REGRESSION ANALYSIS

While estimates show a negative effect of flooding on agricultural land values, they have focused strictly on the effect in the following year. Lingering effects have been noted in the residential literature; however, buyers eventually forget, or no longer care, about flood risk and discounts diminish to zero. With this consideration, it is important to examine how long flooded agricultural land values are affected. The estimated impact of flooding shown above may be smaller than the true overall impact if the effect extends beyond the first year. With this consideration, the simplest temporal decay specification is analyzed: a longer post-flood period.[18] The results are presented in column IV of Table 6. The coefficient of interest (i.e., *Flooded*PostFlood*) is smaller than previously estimated and is no longer statistically significant. It appears that buyers of farmland either forget or no longer care about flooding when buying flood-prone property within two years after a flood event. These findings are in line with Bin and Landry (2013), "recent experience with flooding awakens or reinforces perceived risks and costs associated with flooding, and that a lack of flooding experience allows these perceptions to diminish."

Table 6: Regression Results Analyzing Severity and Time Effects

Variable	I. % Flooded	II. Flood Depth	III. Non-linear Flood Depth	IV. Temporal
Flooded	-0.0002	-0.008	0.007	0.008
	(0.0003)	(0.007)	(0.007)	(0.021)
PostFlood	-0.033*	-0.037**	-0.031*	-0.033
	(0.019)	(0.018)	(0.019)	(0.029)
*Flooded*PostFlood*	-0.0009**	-0.022*	-0.053***	-0.018
	(-0.0003)	(-0.009)	(0.017)	(0.024)
*(Flooded*PostFlood)^2*	_	_	0.0045***	_
			(0.0016)	
Property Characteristics	Yes	Yes	Yes	Yes
Location Characteristics	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Observations	1,644	1,644	1,644	1,644
Model	SARAR	SARAR	SARAR	SARAR

Notes: Robust standard errors are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Although the SARAR models are shown, results are robust to other specifications.

[18] An alternative approach is to include interaction terms between the flooded properties and year dummies after a flood event. This approach does not impose a particular functional form in the time decay function and has shown similar results as more complicated measures (Atreya, Ferreira, and Kriesal, 2013). These results are consistent with the approach incorporated in the discussion: the negative effect from flooding disappears in year two.

REGRESSION ANALYSIS

Regression Conclusions

This study provides a first look at the impact of flooding on the value of agricultural land. Using agricultural land sales data from the flood-prone F-M area, evidence that inundation negatively affects the price of agricultural land is provided. These results are robust across a variety of specifications. Traditional methods comparing flood versus non-flood property, before and after a flood event, show an average reduction in agricultural land values of 7.9% in the year following a flood event.

Recognizing that agricultural property in the study area does not uniformly flood, hydraulic modeling data was incorporated to evaluate how flood severity affects land value. Estimates highlight a discount of 0.097% for each additional percent of inundated land (i.e., a 9.7% discount for 100% inundation), and a discount of 2.3% for a one-foot increase in flood level. Non-linear effects of flood depth are also examined: a 5.2% discount was estimated for the first foot of flooding that diminishes for each additional foot of inundation. All of these effects are temporary as they disappear within two years after a flood event.

These findings have practical significance for the F-M community. The F-M Area Diversion Project is currently planning and constructing a 30 mile diversion channel in North Dakota, a 12-mile southern embankment, and various bridges and control structures to protect approximately 95,000 households from future flooding. This will remove flood insurance requirements and costly premiums for residents in the floodplain. However, the proposed diversion project affects agricultural land in two ways. First, agricultural property that already floods may be subject to more severe flooding, with greater coverage, greater depths, longer dry-down cycles, and larger discounts for those properties. Second, agricultural land that did not flood will now be susceptible to inundation in a 100-year flood event.

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REGRESSION ANALYSIS: APPENDIX

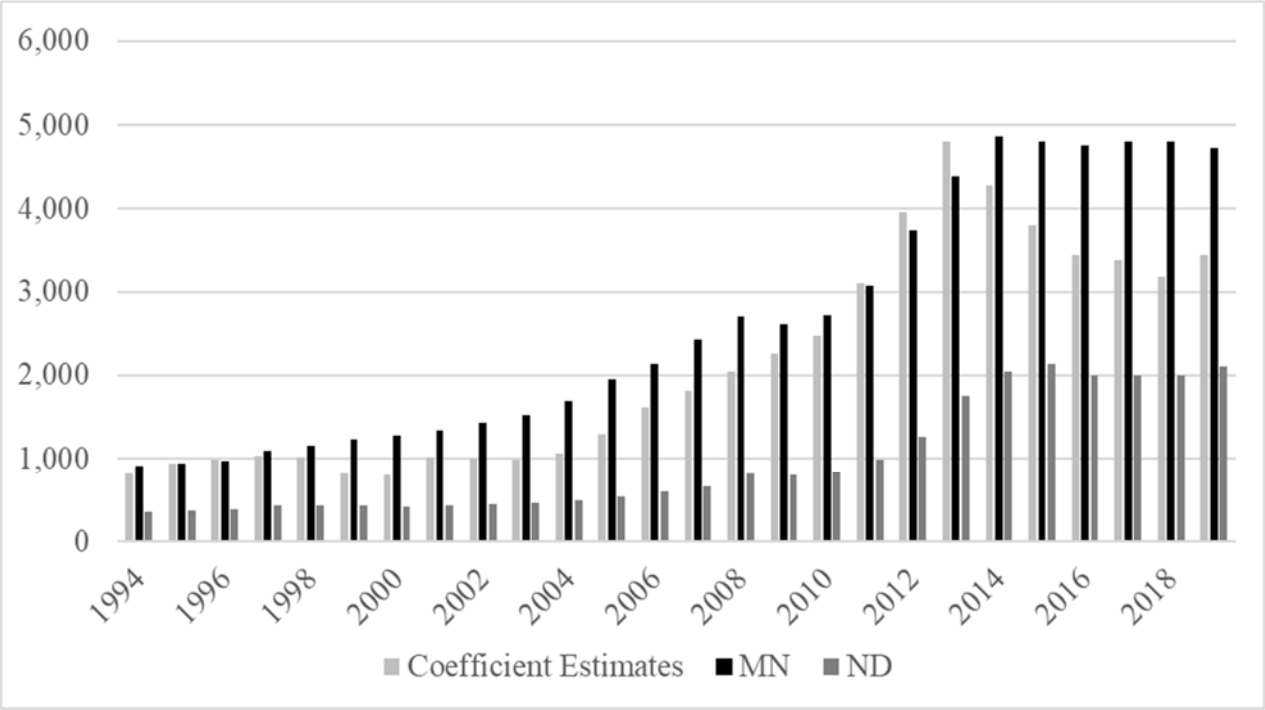
The summary statistics and regression results presented in this appendix mirror those provided in the "REGRESSION ANALYSIS" section of the report (Tables 4, 5, and 6). However, additional sales are included to provide an update to the previous study. In particular, vacant farmland sales for the Fargo-Moorhead area from the end of the previous study's period (April 2018) through April 2020 have been added to the database. This generated a total of 160 additional sales in the database: 44 sales from 2018, 95 from 2019, and 21 from 2020. Similar attention was given to these sales before estimating the hedonic models to avoid estimation bias (e.g., sales with missing information were dropped, as were duplicate sales). This reduced the usable sample of additional sales to 130 sales, 100 of which were available when sales with duplicate coordinates were dropped (following the same criteria outlined on page 41 of the initial report). The results below reflect these changes. As mentioned in the "REGRESSION ANALYSIS" section of the report (footnote 11), the results concerning the coefficient of interest with the additional sales are slightly larger than those presented in the initial report. However, they are very reasonable since they are within the 95% confidence interval of the initial results

Table A1: Variable Descriptions and Summary Statistics (updated w/ sales through April 2020)

		$Flooded_i = 0$		$Flooded_i = 1$	
Variable	Unit (Description)	Mean	Std. Dev.	Mean	Std. Dev.
Land sales price					
Price per acre	Dollars (adjusted to 2010 prices)	2,661	1,449	2,708	1,536
ln(price per acre)	Dollars (adjusted to 2010 prices)	7.739	0.550	7.744	0.572
PostFlood	Binary (=1 if sold within 1 year after flood)	0.238	0.426	0.234	0.424
Property Attributes					
PI	Number (scale of soil quality ranging from 1 to 100, 100 = best soil quality)	84.17	10.33	86.25	4.936
Drainage Average	Binary (=1 if *AVERAGE* drainage)	0.627	0.484	0.569	0.496
Drainage Fair	Binary (=1 if *FAIR* drainage)	0.258	0.438	0.277	0.448
Drainage Good	Binary (=1 if *GOOD* drainage)	0.079	0.271	0.065	0.248
Drainage Poor	Binary (=1 if *POOR* drainage)	0.035	0.184	0.088	0.284
No Rocks	Binary (=1 if *NO* rocks)	0.987	0.115	1.000	0.000
Rocks	Binary (=1 if *SOME* rocks)	0.013	0.115	0.000	0.000
Topography Level	Binary (=1 if *LEVEL*)	0.992	0.090	0.982	0.132
Topography Uneven	Binary (=1 if *NOT LEVEL*)	0.008	0.090	0.018	0.132
Salinity No	Binary (=1 if *NO* salinity)	0.883	0.321	0.967	0.178
Salinity Some	Binary (=1 if *SOME* salinity)	0.054	0.226	0.015	0.122
Salinity Most	Binary (=1 if *MOST* salinity)	0.062	0.242	0.018	0.132
Shape Regular	Binary (=1 if *REGULAR*)	0.734	0.442	0.582	0.494
Shape Minor Irr.	Binary (=1 if *MINOR IRREGULAR*)	0.122	0.327	0.209	0.407
Shape Moderate Irr.	Binary (=1 if *MODERATE IRREGULAR*)	0.087	0.281	0.083	0.276
Shape Major Irr.	Binary (=1 if *MAJOR IRREGULAR*)	0.057	0.232	0.126	0.332
Locational Attributes					
City Distance	Miles	22.82	13.24	6.963	6.232
Beet Piler Distance	Miles	5.879	2.995	6.590	2.770
Red River Distance	Miles	7.949	4.518	4.357	4.245
Other					
Soybeans	Dollars (Futures price at date of sale)	8.933	3.247	9.061	3.256
Number of obs.		1,347		397	

REGRESSION ANALYSIS: APPENDIX

Figure 1A: Estimated Average Price per Acre Compared with Actual Values



REGRESSION ANALYSIS: APPENDIX

Table A2: Difference-in-Difference Regression Results (updated w/ sales through April 2020)

Variable	I. FE	II. FE	III. Error	IV. Lag	V. SARAR
Flooded	-0.015	-0.012	0.009	-0.007	0.009
	(0.016)	(0.017)	(0.019)	(0.017)	(0.020)
PostFlood	-0.046**	-0.039**	-0.033*	-0.037*	-0.032*
	(0.019)	(0.019)	(0.019)	(0.020)	(0.019)
*Flooded*PostFlood*	-0.066**	-0.073**	-0.081***	-0.080***	-0.083***
	(0.028)	(0.029)	(0.027)	(0.029)	(0.028)
PI	0.005***	0.005***	0.004***	0.002**	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Drainage Fair	-0.110***	-0.113***	-0.108***	-0.131***	-0.108***
	(0.012)	(0.013)	(0.013)	(0.013)	(0.013)
Drainage Good	0.108***	0.110***	0.103***	0.119***	0.102***
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
Drainage Poor	-0.231***	-0.221***	-0.214***	-0.264***	-0.211***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Rocks	-0.068	-0.074	-0.044	-0.075	-0.032
	(0.051)	(0.052)	(0.053)	(0.054)	(0.053)
Topography Uneven	-0.056*	-0.060*	-0.041	-0.081**	-0.038
	(0.029)	(0.032)	(0.031)	(0.039)	(0.032)
Salinity Some	0.005	0.007	0.014	0.034	0.017
	(0.028)	(0.030)	(0.029)	(0.031)	(0.029)
Salinity Most	0.072**	0.077**	0.034	0.114***	0.034
	(0.031)	(0.031)	(0.033)	(0.032)	(0.033)
Shape Minor Irr.	0.002	-0.001	0.001	0.007	0.007
	(0.019)	(0.020)	(0.019)	(0.020)	(0.019)
Shape Moderate Irr.	-0.006	-0.012	-0.025	-0.011	-0.021
	(0.018)	(0.019)	(0.018)	(0.020)	(0.018)
Shape Major Irr.	0.007	0.005	-0.008	0.010	-0.004
	(0.016)	(0.017)	(0.016)	(0.016)	(0.016)
City Distance	-0.011***	-0.011***	-0.016***	-0.010***	-0.003
	(0.002)	(0.002)	(0.004)	(0.002)	(0.004)
City Distance^2	0.000***	0.000***	0.000***	0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Beet Piler Distance	-0.017***	-0.020***	-0.020***	-0.016**	-0.019***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)
Beet Piler Distance^2	0.000	0.000	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Red River Distance	-0.020***	-0.022***	-0.020***	-0.023***	-0.019***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
Red River Distance^2	0.001***	0.001***	0.001***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Soybeans	0.007	0.008	0.009**	0.011**	0.009**
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Constant	6.919***	6.937***	7.024***	6.618***	6.528***
	(0.093)	(0.097)	(0.093)	(0.128)	(0.165)
ρ	-	-	2.715***	-	3.416***
			(0.211)		(0.294)
λ	-	-	-	0.075***	0.058***
				(0.011)	(0.019)
Year-Month FE	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	No	No	No
R-squared	0.870	0.866	-	-	-
Observations	1,902	1,744	1,744	1,744	1,744

Notes: Robust standard errors are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

REGRESSION ANALYSIS: APPENDIX

Table A3: Severity and Time Regression Results (updated w/ sales through April 2020)

Variable	I. % Flooded	II. Flood Depth	III. Non-linear Flood Depth	IV. Temporal
Flooded	-0.0002	0.009	0.008	0.003
	(0.0003)	(0.007)	(0.007)	(0.020)
PostFlood	-0.036**	-0.040**	-0.035*	-0.036
	(0.018)	(0.018)	(0.018)	(0.028)
*Flooded*PostFlood*	-0.001***	-0.023*	-0.056***	-0.030
	(-0.0004)	(-0.012)	(0.017)	(0.024)
*(Flooded*PostFlood)^2*	–	–	0.0046***	–
			(0.0016)	
Property Characteristics	Yes	Yes	Yes	Yes
Location Characteristics	Yes	Yes	Yes	Yes
Year-Month FE	Yes	Yes	Yes	Yes
Observations	1,744	1,744	1,744	1,744
Model	SARAR	SARAR	SARAR	SARAR

Notes: Robust standard errors are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Although the SARAR models are shown, results are robust to other specifications.

PAIRED SALES ANALYSIS

Methods

In rural appraisal one of the best measures of differences between properties can be based on what is known as the "paired sales analysis". In completing a paired sales analysis the theory is to find a pair of sales that are similar in all aspects except for one difference which can be isolated and the difference measured. Paired data analysis is defined as "A quantitative technique used to identify and measure adjustments to the sale prices or rents of comparable properties. To apply this technique, sales or rental data on nearly identical properties, or adjusted data, is compared to isolate and estimate a single characteristic's effect on value or rent. Often referred to as paired sales analysis."[1]

Paired data analysis should be developed with extreme care to ensure that the properties are truly comparable and that other differences do not exist. It is difficult to obtain truly comparable sales that differ in only one characteristic. In valuing residential property there are many differences such as size, location, condition, features, etc. that make pairing a concept that is difficult to accomplish accurately. Similarly, in valuing agricultural properties, there are also many features of property that may cause differences in values that cannot always be attributed to a particular characteristic. Features such as productivity, drainage, access, soil types, amount of tillable land, woods, etc. are all characteristics that can differ greatly between properties, again, making paired sales analysis extremely difficult to accomplish. When sufficient data is available for "pure" pairings (i.e., pairs of sales or rental data from properties that are identical except for the single element being measured), paired data analysis may be a foundation for quantitative adjustments.[2]

As noted in the 14th Edition of The Appraisal of Real Estate, although paired data analysis of sales or rents is a theoretically sound method, it may be impractical and produce unreliable results when only a narrow sampling of sufficiently similar properties is available. An adjustment derived from a single pair of sales is not necessarily indicative, just as a single sale does not necessarily reflect market value.

Special care must be taken when relying on pairs of adjusted prices because the difference measured may not represent the actual difference in value attributable to the characteristic being studied. The difference may include other aspects of the property, not just the one characteristic being studied. Pure pairing may be analyzed first. Pairings of adjusted sales should only be used as an analytical tool when truly pure pairings are unavailable. When more than one element of comparison involved, additional pairs can be studied to isolate and extract the differing elements of comparison.

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[1] Dictionary of Real Estate Appraisal, Sixth Edition, page 167, published by the Appraisal Institute, 2015

[2] The Appraisal of Real Estate, 14th edition, page 399, published by the Appraisal Institute, 2013

PAIRED SALES ANALYSIS

A related technique, grouped data analysis, involves grouping data by an independent variable such as date of sale and calculating equivalent typical values. The grouped sales are studied in pairs, or sets, to identify the effect on a dependent variable such as the unit price (i.e. $ per tillable acre) of comparable properties. In a case such as the present, the use of grouped data analysis would compare a group of sales that are affected by the existence of a flowage easement or floodway to a group of sales that are not affected by an easement. The sales could be used to develop a range and then reconcile the value indications. This technique extends the logic of paired data analysis to a larger data set. The comparable sales are grouped by an independent variable such as date of sale then the groups are studied as pairs. The average of the grouped pairs will give a measure of the difference due to the characteristic being studied.

Birds Point-New Madrid Floodway Study

In completing the paired sales analysis for the Fargo–Moorhead Diversion Authority research was conducted along the Mississippi River in Illinois and Missouri, and along the Missouri River as it runs through Nebraska and Iowa. A number of property transactions were found and data was obtained. Many of the properties experienced a flood event in 2011 along the Missouri River in western Iowa, however, these sales were not fully developed as this was a natural flood and there were no easements in place on any of the property that was flooded. Data regarding natural flooding is available closer to Fargo-Moorhead and is presented in the northern Red River study. When researching areas further away from Fargo-Moorhead, sales of eased land were targeted.

The main emphasis on the analysis has been to find farmland sales that were flooded as a result of being located in a flowage easement area that could be considered similar to the subject project “staging area”. Numerous appraisers were contacted for information along the Mississippi River and all pointed to the potential of completing an analysis of the Birds Point – New Madrid Floodway area that is located in Mississippi and New Madrid Counties of Missouri and known to have flowage easements in place.

Flowage easements were placed by the US Army Corps of Engineers in the Birds Point area along the west side of the Mississippi River levee as a result of the Flood Control Act of 1928. Levee construction began in 1929 and was completed in 1932. However, acquisition of the flowage easements was not completed until 1942. The levee protected adjoining cropland for several decades until excessive precipitation across the Mississippi River and Missouri River watersheds caused major flooding. A flood event in occurred on May 2, 2011 when the levee was voluntarily breached by officials in order to prevent major flooding in the city of Cairo, IL. The levee is located along the river for the purpose of containing flood waters during times when the river floods. Many lower lying areas along the Mississippi typically have levees installed. When necessary the levee can be breached to alleviate flooding in upstream areas utilizing the flowage easements in place for dissipation of the flood waters.

PAIRED SALES ANALYSIS

Sales data was obtained for farmland in this area and the paired sales analysis includes properties that are encumbered by the flowage easement and properties that are outside of the easement area in order to provide an indication of the possible diminution in value that results from being encumbered with a flowage easement with the potential to flood. A total of 53 sales were found in the neighborhood of the floodway that are outlined on the following spreadsheets. These sales occurred from 2009 through 2018, with sales occurring in every year except 2013. Particular interest was paid to sales immediately prior to the 2011 event and to the sales which occurred subsequent to the event.

In completing the pairing analysis, sales with characteristics that are as similar as possible are paired for the purpose of isolating the characteristic that is being measured. In this instance, the characteristic of interest is the presence of the flowage easement on the property or whether the property has experienced any flood events. The first step in the process is to identify which properties are similar enough to pair. In selecting the pairs the first thing to consider is the date of sale. By taking into consideration the date of sale it removes any influence that market conditions may have on a pair sale transactions. Pairings were made based on sales that occurred within the year or within the range of one year if possible. The second consideration that must be taken into account is the difference in the composition of the property's land use.

In Missouri several classes of land are accounted for and an adjustment is made to bring the two sales being analyzed to a similar level of land use, referred to as a land mix adjustment. In this case, the property that is not affected by the existence of an easement, or flooding, is used as the control sale and the property that is affected is adjusted to the equivalent of the land use, resulting in a land mix adjustment. After the land use adjustment is made the two sales are considered to be equivalent to each other and any other characteristic difference would be reflected in the resulting difference in indicated values. Care was taken to pair sales that were as similar as possible.

In completing the analysis for the Birds Point market area, of the 53 sales that were analyzed a total of 28 pairings were completed between properties within and outside of the flowage easement area. The sales were paired based on their geographic location and the date of sale, as well as the potential of being affected by the flowage easement.

Prior to the 2011 flood event, the analysis indicates that a premium was paid for land located within the flowage easement ranging from 12% to 50% over land that was outside of the easement area. Many times following the flooding of farmland there is a subsequent increase in productivity due to the additional fertility that results from the materials deposited by the flood. Ancient civilizations recognized the value of flooding property and many of the most significant arable areas were located along river bottom areas which were more fertile than upland areas.

PAIRED SALES ANALYSIS

We did not find any sales within the area during 2011, the year of the flood event. However, in subsequent years, between 2012 and 2015, the data indicates that non flood land sale prices exceeded land sale prices in the flowage easement area ranging from a slight premium of 1% to a diminution of value between 5% and 42%. Essentially the market flipped. Land with an easement, which had been selling at a premium due to soil production, began selling at a discount due to the fear of being flooded again. We have termed this the “ah ha moment” in our analysis because it is the moment in time when market participants were reminded that flooding beyond their control is possible and that they do not have the right to prevent it. Market participants had basically forgotten about the flowage easements because they had not been utilized for decades. Following the 2011 event the market corrected, or perhaps overcorrected, to adjust to the reality of potential floods.

After several years it appears that the diminution in value is erased, likely due to the “amnesia effect.” Beginning with sales in 2016 a premium for property in the flowage easement area is noted. Sales in the years 2016 and into 2018 indicate a range from a diminution of 4% to 15% and a premium ranging from 8% to 40%. Over the entire span of time from 2010 through 2018 the overall range of difference between properties affected by the flowage easement and properties outside the flowage easement area indicated a range from a premium of 50% to a diminution of 42% with a mean of a diminution of 3% and a median diminution of 8%. During the years immediately following the 2011 levee breach it is interesting to note that the mean diminution increased to 13% with a median diminution of 11%, clearly indicating the “amnesia affect” of a flooding event. The following spreadsheet outlines the results of the pairings completed and a location map for the sales data utilized.

Although the flowage easements in the Birds Point – New Madrid Floodway may have somewhat different restrictions than the easements which will be placed on land in the Fargo-Moorhead staging area the underlying premise is the same, temporary flooding during periods of high river flow. A list of the restrictions of each easement is included in the addenda of this report, along with an actual easement from Birds Point and a sample easement from the Property Rights Acquisition and Mitigation Plan. For more detailed information regarding the restrictions in the Fargo-Moorhead staging area, refer to the mitigation plan.

Paired Sales Analysis

Birds Point - New Madrid Flowage Easements

Pair	Non-Flood Sale No.	$/deed	vs.	Flood Sale No.	$/deed	Land Mix % change	*Date*		Sale #	
1	35	$3,798		38	$4,250	-12%	*2010*	premium for river ground	2	flood eased
2	42	$3,471		38	$4,250	-22%	*2010*		20	
3	33	$2,840		38	$4,250	-50%	*2010*		21	
4	50	$3,572		38	$4,250	-19%	*2010*		22	
							2011	levee blown!	26	
5	53	$5,912		55	$6,000	-1%	*2012*	market "Ah Ha" moment	31	
6	53	$5,568		54	$4,268	23%	*2012*		38	
7	53	$5,568		56	$4,500	19%	*2012*		54	
8	13	$7,202		21	$5,957	17%	*2014*		55	
9	13	$7,073		2	$5,664	20%	*2014*		56	
10	23	$6,345		2	$5,664	11%	*2014*		9	non-flood eased
11	14	$6,019		2	$5,664	6%	*2014*		10	
12	10	$9,688		2	$5,664	42%	*2014*		12	
13	30	$6,258		21	$5,957	5%	*2014-15*		13	
14	17	$6,427		2	$5,664	12%	*2014-15*		14	
15	9	$6,103		2	$5,664	7%	*2014-15*		16	
16	30	$6,146		2	$5,664	8%	*2014-15*		17	
17	28	$6,320		2	$5,664	10%	*2014-15*		18	
18	28	$6,435		21	$5,957	7%	*2014-15*		19	
19	30	$6,082		31	$5,455	10%	*2015*		23	
20	28	$6,254		31	$5,455	13%	*2015*		24	
21	17	$6,360		31	$5,455	14%	*2015*		28	
22	18	$5,976		20	$6,438	-8%	*2016*	market amnesia back to premium	29	
23	24	$4,604		20	$6,438	-40%	*2016*		30	
24	24	$5,795		22	$6,745	-16%	*2016*		33	
25	18	$7,523		22	$6,745	10%	*2016*		35	
26	16	$7,053		26	$6,000	15%	*2017-18*		42	
27	29	$6,228		26	$6,000	4%	*2018*		50	
28	19	$5,581		26	$6,000	-8%	*2018*		53	

overall stats

Range -50% to 42%

Mean 3%

Median 8%

"Ah Ha" stats

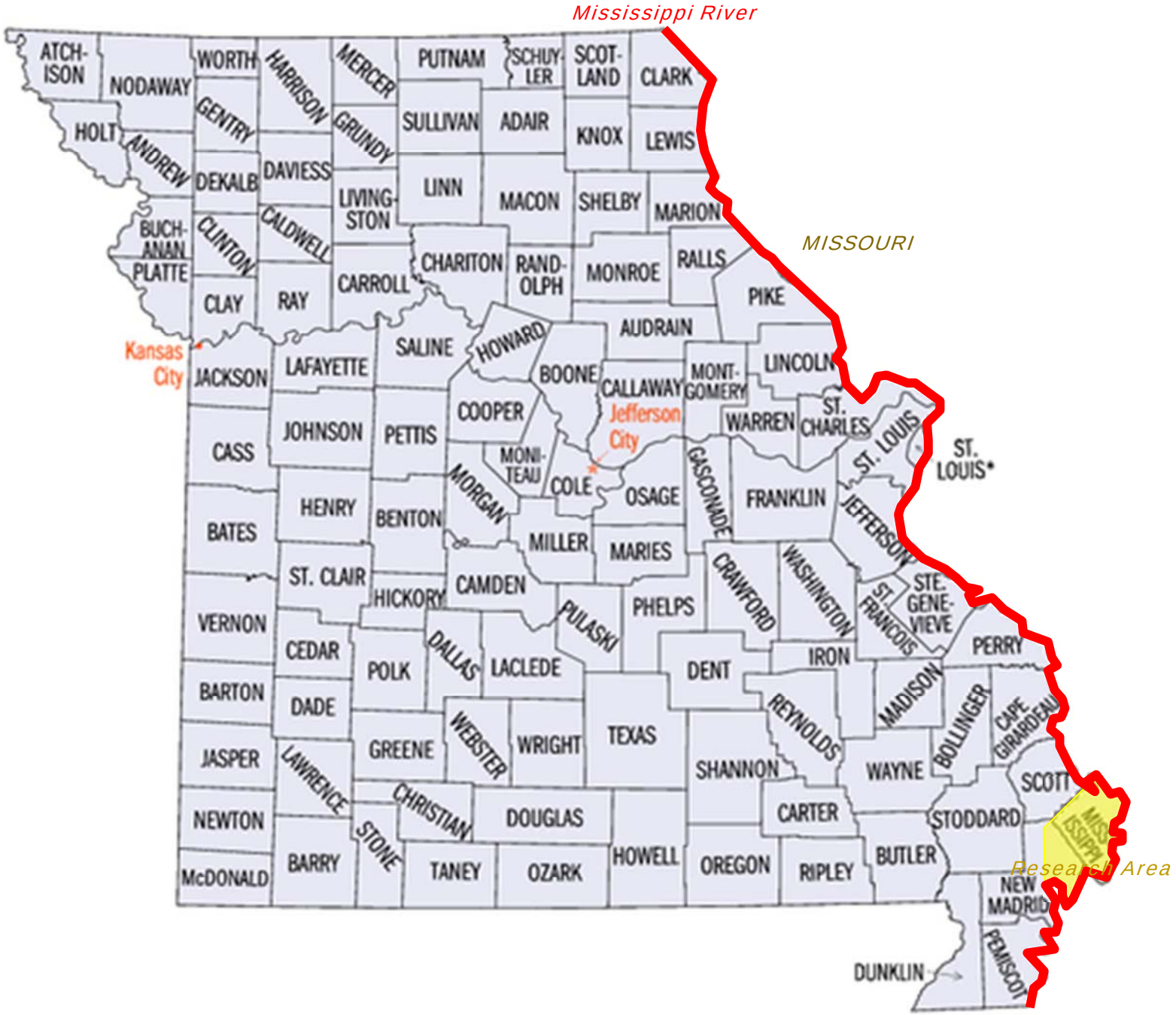
Range -1% to 42%

Mean 13%

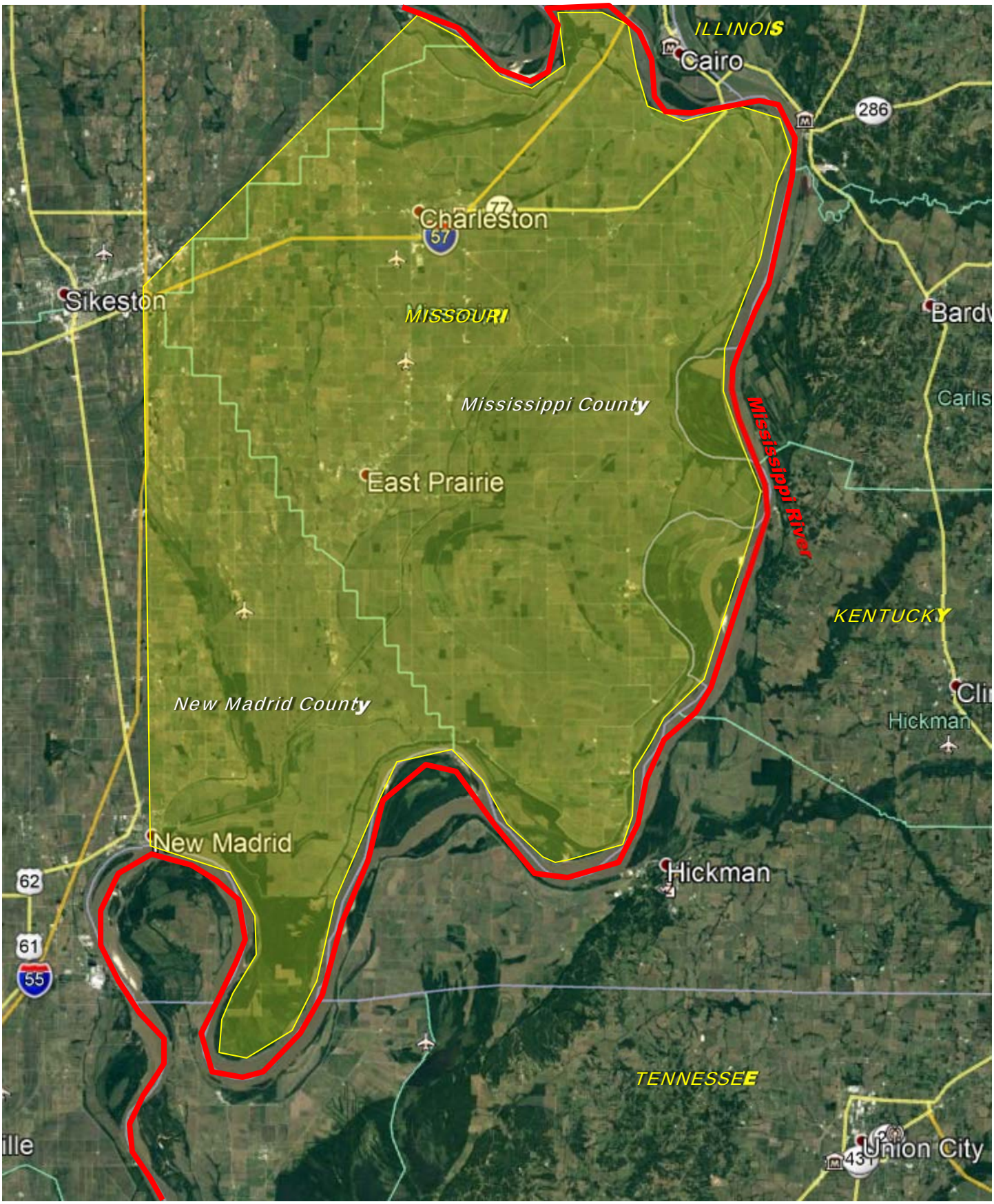
Median 11%

Note: Negative numbers (**black**) represent a premium was paid for flood eased land. Positive numbers (**red**) mean a discount was applied to eased land.

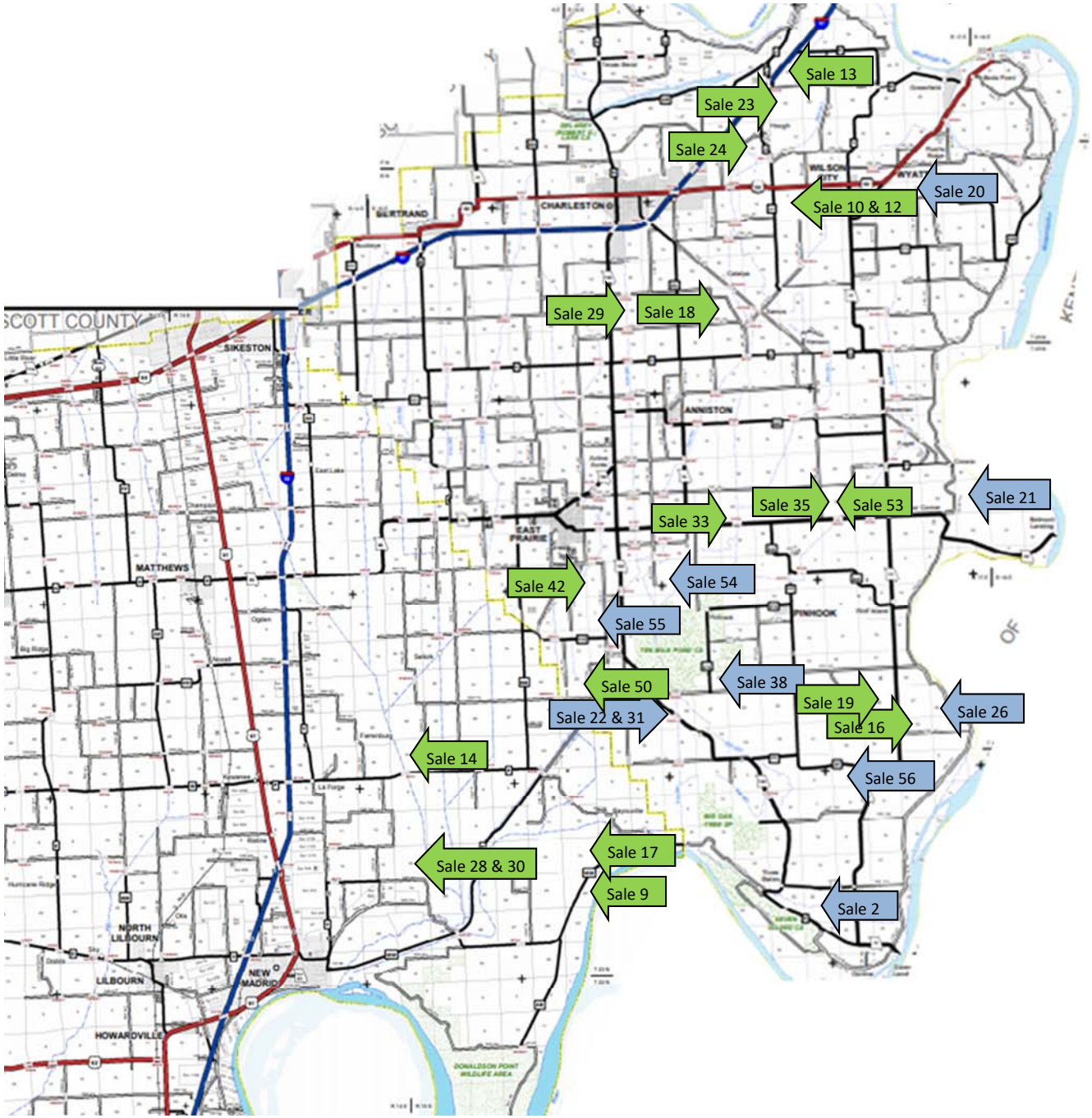
Paired Sales Analysis
Sales Research Area
Birds Point-New Madrid Floodway



Paired Sales Analysis
Sales Research Area
Birds Point-New Madrid Floodway



Sales Map
Paired Sales Analysis
Birds Point-New Madrid Floodway



PAIRED SALES ANALYSIS

Northern Red River Valley Study

In addition to the Birds Point area, extensive sales research was performed in the northern Red River Valley from Grand Forks to the Canadian border to determine the local market reaction to fairly frequent flood events along the Red River. All of the sales were located within a few miles of the river, had similar soil types and similar crop production capabilities. None of the sales were encumbered with flowage easements. During research a number of sales on both sides of the river were found, with some sales frequently flooding and others that either flood infrequently or not at all. For properties located in Marshall and Polk Counties in Minnesota, a total of 31 pairings of the data was made between sales that flood and those that do not.

There is a preponderance of evidence that indicates a distinct trend in values between flood sales and non-flood sales. While the pairings indicate a range between a premium of 21% to a discount of 41%, the vast majority of the pairings indicate a discount. The mean of the pairings in the Minnesota data set indicates a mean discount of 15% with a median discount also of 14%. In grouping the pairs between the flood prone properties and the non-flooding properties a similar discount of 18% is indicated.

On the North Dakota side of the river in Pembina and Walsh Counties a number of pairings were also analyzed. The data in North Dakota was divided in a more granular fashion with sales classified as “non-flood”, “medium flood prone” and “flood prone”. The “medium flood prone” sales are of properties that have the potential to flood or have flooded during prior major flood events while the “flood prone” sales are properties that flood frequently in the spring regardless if a major event occurs or not.

The data indicates a clear trend in the market with the “flood prone” sales indicating a higher discount than those sales that are “medium flood prone” and both of the flood categories showing a discount over the property that is not subject to any flooding. Eleven pairs were analyzed between the “flood prone” and the “non-flood” properties indicating a range between a premium of 32% to a discount of 65%, with a mean discount of 37% and a median discount of 28% and in grouping the pairs a 43% discount for this group is indicated. In comparing the “medium flood” properties to the “flood prone” properties the range indicates a range between a 33% and 54% discount with a mean discount of 42% and a median discount of 37%, and in grouping the pairs a mean discount of 28% is indicated.

This data pairing indicates that there is a smaller discount evident in the market between properties with differing severity of flooding in comparison to properties that flood and do not flood. A third grouping was able to be analyzed with sales of “non-flood prone” properties and the “medium flood” prone properties. Only two pairs were able to be analyzed for this grouping and the outcome indicates a smaller discount, as would be expected. The mean discount between “non-flood” and “medium flood” properties is only 3%, while the grouped pairs indicate a discount of 11% for this pairing. The following spreadsheet outlines the results of the pairings completed and a location map for the sales data utilized.

Paired Sales Analysis

Northern Red River Valley

Pair	Non-Flood Sale No.	$/till	vs.	Flood Sale No.	$/till	$/till % change	Land Mix adj. %
1	11	$3,800		1	$2,754	28%	28%
2	7	$3,862		1	$2,754	29%	29%
3	2	$3,061		1	$2,754	10%	10%
4	13	$2,929		1	$2,754	6%	6%
5	8	$3,860		1	$2,754	29%	29%
6	2	$3,061		3	$3,547	-16%	-17%
7	8	$3,860		3	$3,547	8%	7%
8	11	$3,800		3	$3,547	7%	6%
9	13	$2,929		3	$3,547	-21%	-22%
10	2	$3,061		4	$2,670	13%	13%
11	11	$3,800		4	$2,670	30%	30%
12	7	$3,862		4	$2,670	31%	31%
13	8	$3,860		4	$2,670	31%	31%
14	13	$2,929		4	$2,670	9%	9%
15	13	$2,929		5A	$2,295	22%	22%
16	7	$3,862		5A	$2,295	41%	41%
17	11	$3,800		5A	$2,295	40%	40%
18	13	$2,929		5B	$2,613	11%	11%
19	7	$3,862		5B	$2,613	32%	32%
20	11	$3,800		5B	$2,613	31%	31%
21	11	$3,800		6	$3,303	13%	13%
22	7	$3,862		6	$3,303	14%	14%
23	8	$3,860		6	$3,303	14%	13%
24	2	$3,061		6	$3,303	-8%	-8%
25	13	$2,929		6	$3,303	-13%	-13%
26	7	$3,862		9	$3,185	18%	18%
27	11	$3,800		9	$3,185	16%	16%
28	13	$2,929		9	$3,185	-9%	-9%
29	2	$3,061		9	$3,185	-4%	-4%
30	8	$3,860		9	$3,185	17%	17%
31	32	$3,627		31	$2,640	27%	26%

Minnesota Sales:
Marshall & Polk Counties

PI	*Year*	Sale #	$/tillable acre	
90	*2017*	1	$2,754	flood prone
90	*2017*	3	$3,547	
90	*2017*	4	$2,670	
90	*2018*	5A	$2,295	
89	*2018*	5B	$2,613	
86	*2018*	6	$3,303	
90	*2018*	9	$3,185	
88	*2020*	31	$2,640	
92	*2017*	2	$3,061	non-flooding
89	*2017*	7	$3,862	
92	*2017*	8	$3,860	
91	*2018*	11	$3,800	
90	*2017*	13	$2,929	
88	*2020*	32	$3,627	

Individual Pairs

Range	-21% to 41%
Mean	15%
Median	14%

Grouped Pairs

Non-Flood Prone Mean	$3,523
Flood Prone Mean	$2,876
% Change	18%

Note: Final statistics shown are based on $ per tillable acre.

Note: Negative numbers (**black**) represent a premium was paid for flood prone land. Positive numbers (**red**) mean a discount was applied to flood prone land.

Paired Sales Analysis

Northern Red River Valley

Comparing non-flooding to flood prone

Pair	Non-Flood Sale No.	$/till	vs.	Flood Sale No.	$/till	$/till % change	Land Mix adj. %
1	24	$3,100		15	$1,996	36%	36%
2	25	$3,105		15	$1,996	36%	36%
3	24	$3,100		16	$1,943	37%	37%
4	25	$3,105		16	$1,943	37%	37%
5	22	$4,250		23	$4,015	6%	6%
6	26	$3,101		23	$4,015	-29%	-29%
7	28	$3,030		23	$4,015	-32%	-32%
8	41	$4,015		42	$2,250	44%	45%
9	47	$3,877		48	$1,373	65%	65%
10	22	$4,250		33	$1,538	64%	64%
11	26	$3,101		33	$1,538	50%	50%

Individual Pairs

Range -32% to 65%

Mean 28%

Median 37%

Grouped Pairs

Non-Flood Prone Mean $3,497

Flood Prone Mean $1,984

% Change 43%

Comparing "medium" flood prone to flood prone

12	19*	$2,449		17	$1,563	36%	36%
13	19*	$2,449		18	$1,630	33%	33%
14	19*	$2,449		27	$1,546	37%	37%
15	20*	$3,004		15	$1,996	34%	34%
16	20*	$3,004		16	$1,943	35%	35%
17	21*	$3,354		17	$1,563	53%	53%
18	21*	$3,354		18	$1,630	51%	51%
19	21*	$3,354		27	$1,546	54%	54%

Individual Pairs

Range 33% to 54%

Mean 42%

Median 37%

Grouped Pairs

Med-Flood Prone Mean $2,936

Flood Prone Mean $2,116

% Change 28%

Comparing non-flooding to "medium" flood prone

20	24	$3,100		20*	$3,004	3%	3%
21	25	$3,105		20*	$3,004	3%	3%

Individual Pairs

Range 3% to 3%

Mean 3%

Median 3%

Grouped Pairs

Non-Flood Prone Mean $3,317

Med-Flood Prone Mean $2,936

% Change 11%

Note: Final statistics shown are based on $ per tillable acre.

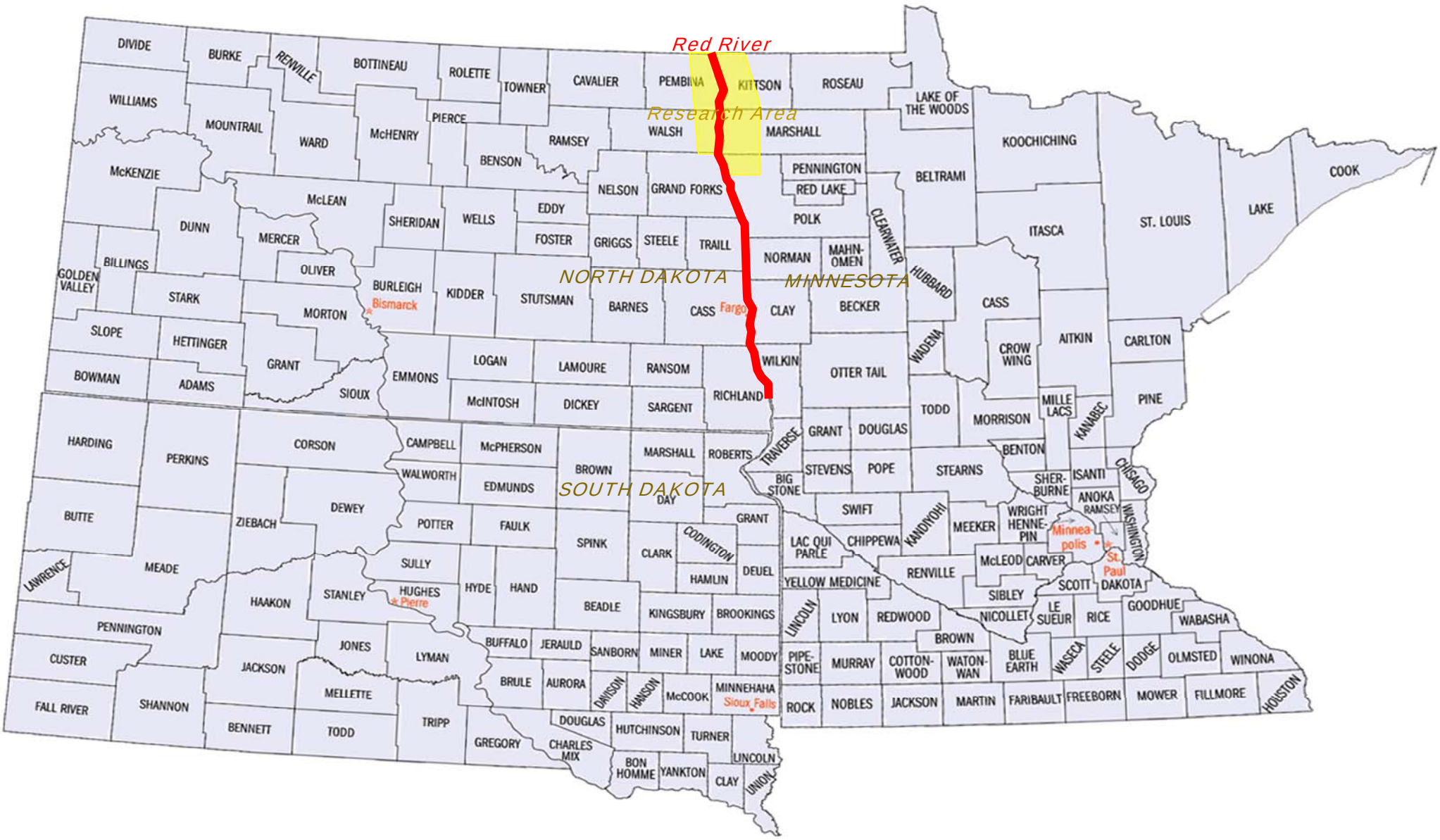
Note: Negative numbers (**black**) represent a premium was paid for flood prone land. Positive numbers (**red**) mean a discount was applied to flood prone land.

North Dakota Sales:
Pembina & Walsh Counties

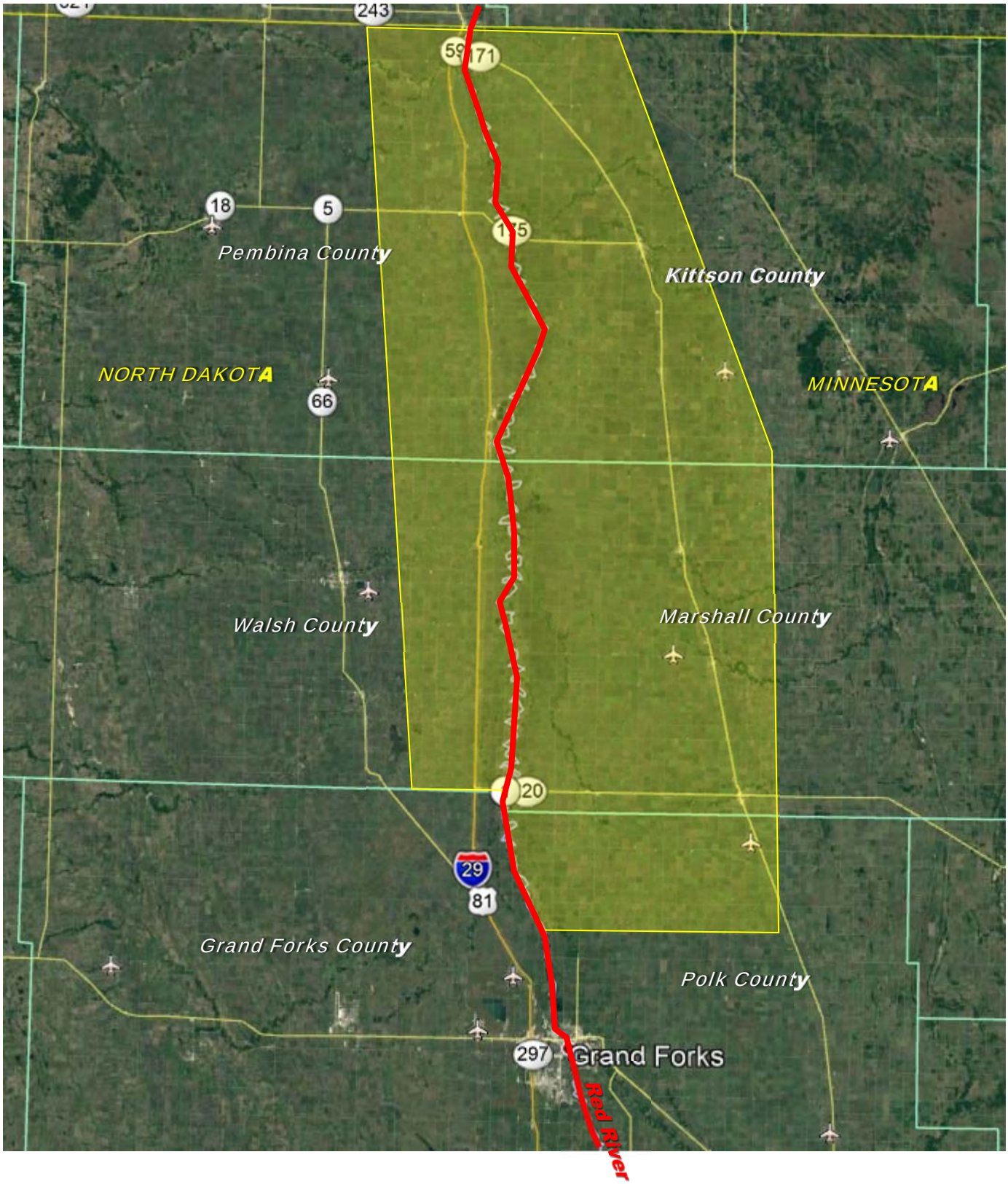
	PI	Year	Sale #	$/tillable acre	
flood prone	82	2017	15	$1,996	
	83	2015	16	$1,943	
	83	2017	17	$1,563	
	81	2017	18	$1,630	
	86	2017	23	$4,015	
	80	2018	27	$1,546	
	80	2018	33	$1,538	
	82	2019	42	$2,250	
	83	2020	48	$1,373	
	83	2018	19	$2,449	
	80	2017	20	$3,004	
	82	2017	21	$3,354	
non-flooding	83	2018	22	$4,250	
	77	2017	24	$3,100	
	75	2018	25	$3,105	
	83	2017	26	$3,101	
	89	2018	28	$3,030	
	82	2019	41	$4,015	
	82	2020	47	$3,877	

**Sales 19-21 are medium flood prone*

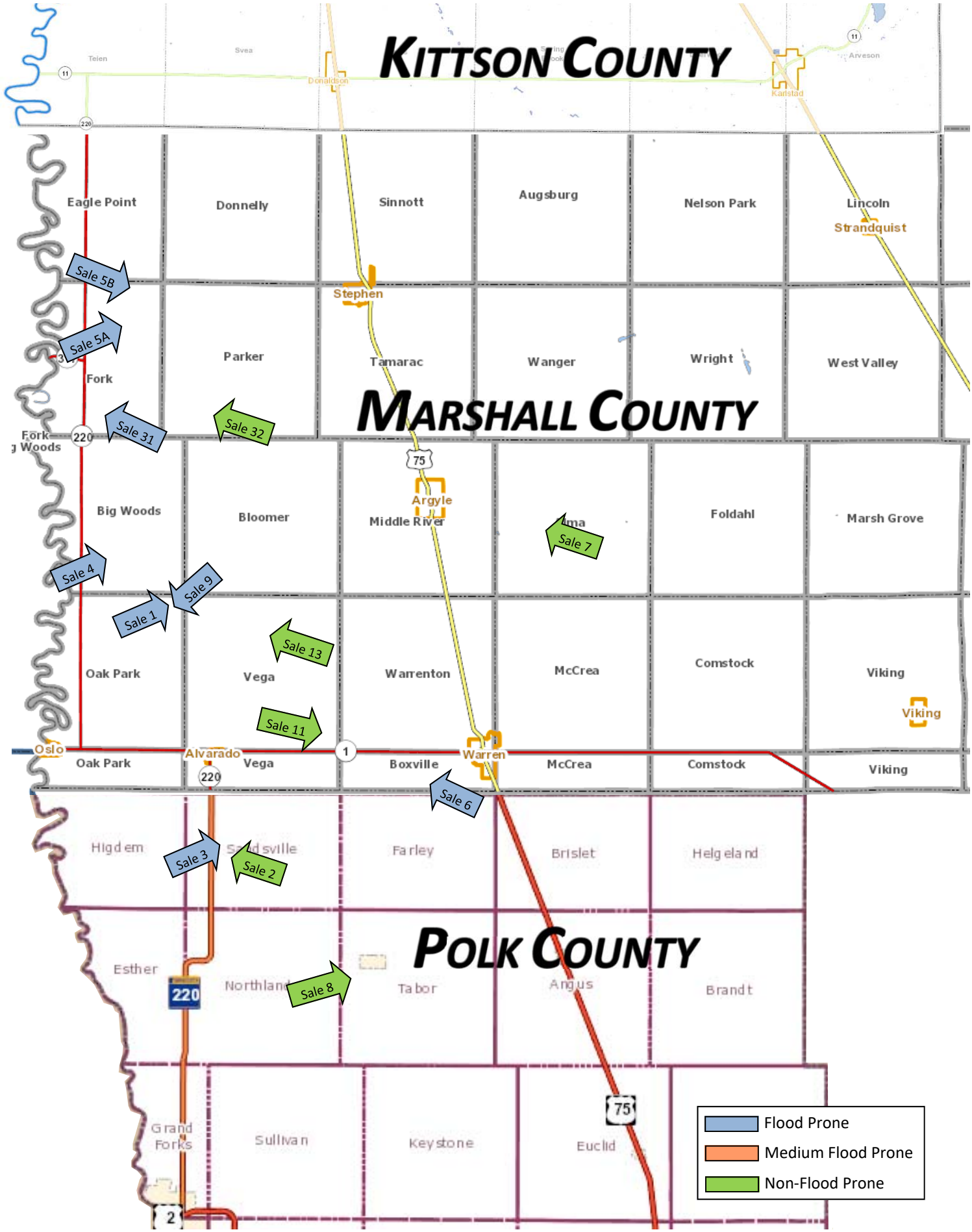
Paired Sales Analysis
Sales Research Area
North Red River Valley



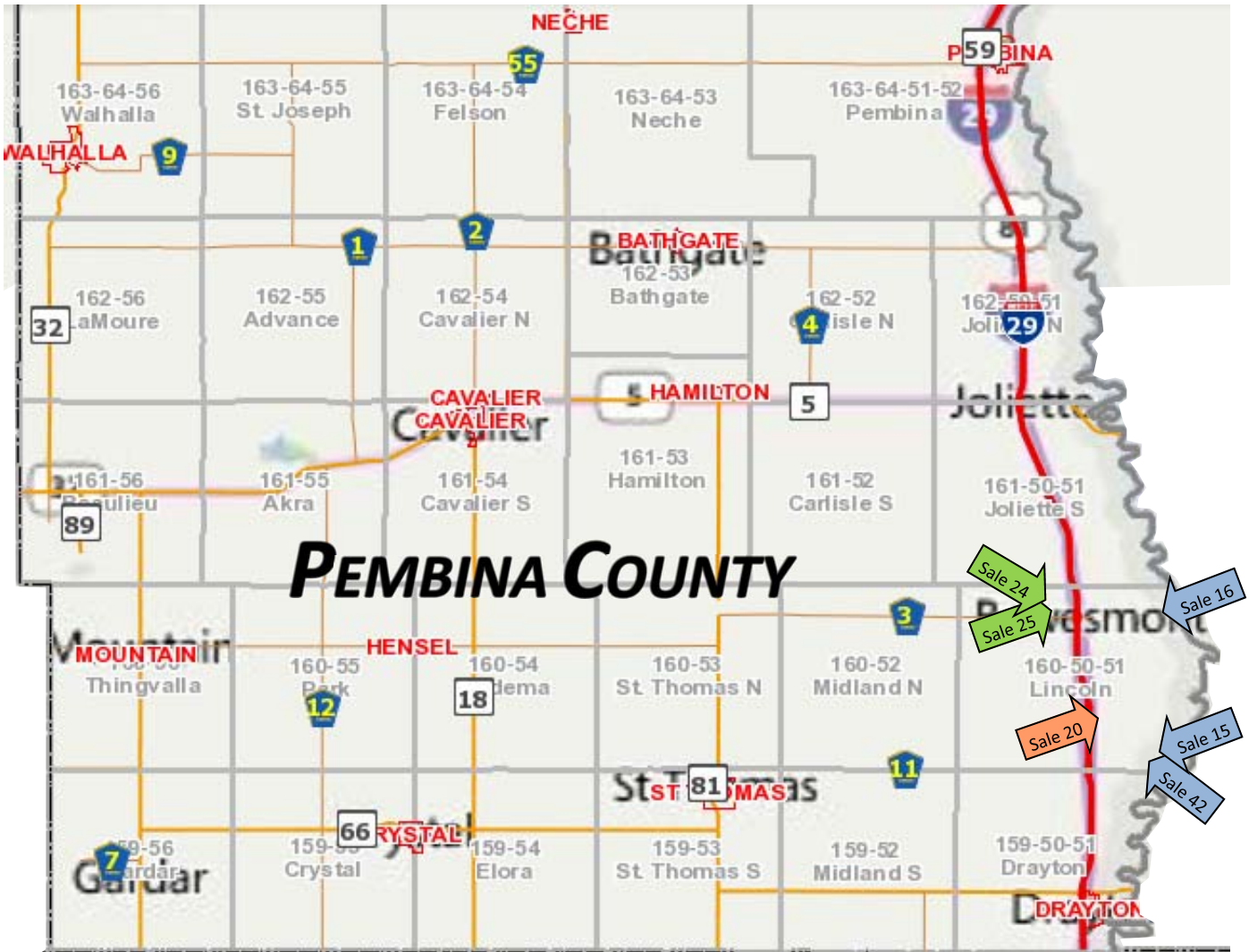
Paired Sales Analysis
Sales Research Area
North Red River Valley

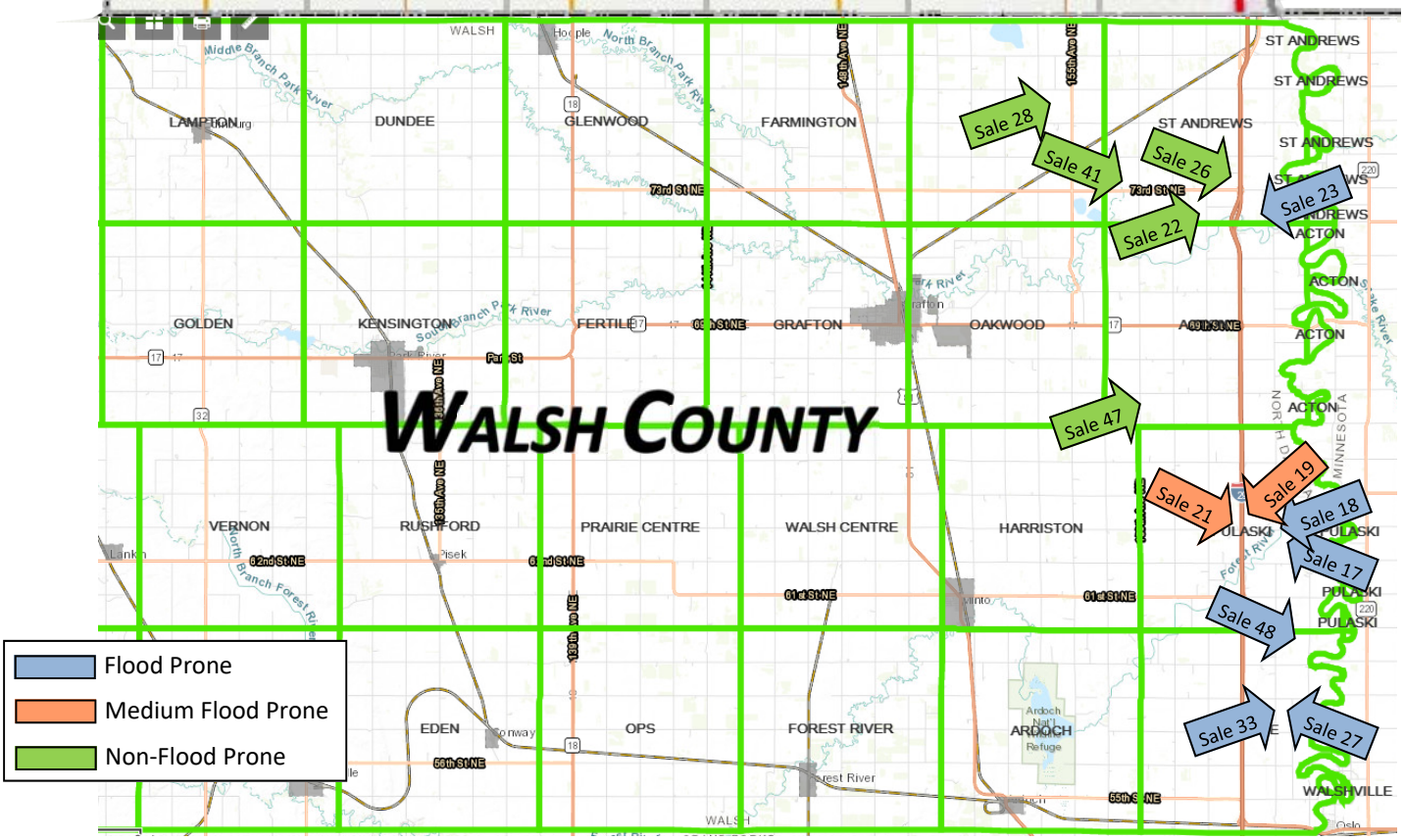


Sales Map
Paired Sales Analysis
Northern Red River Valley — Minnesota



Sales Map
Paired Sales Analysis
Northern Red River Valley — North Dakota





Paired Sales Conclusions

In summary, the land sales in Missouri reflect a range in effect of the property being located in the floodway between a premium of 50%, indicating a positive effect of being in the floodway, to a diminution of 42%, indicating that land values in the flowage easement area are negatively affected by the imposition of the easement over the property. The average (mean) effect of the flowage easement is 3% overall including both the time frame immediately prior to the 2011 event and in the subsequent years. The decreasing impact of the flood event in subsequent years certainly lends credence to the "amnesia" effect of any flood event in this area. This is a similar result that has been indicated by other studies.

The sales in Minnesota indicate a range in effect between negative 21% and 41%, again reflecting that some buyers may not be concerned about the effect of the flooding or find that flooding is a positive consideration. The average effect of the flooding on the Minnesota properties is 15%, indicating that the market recognizes the potential of natural flooding as an impact on market values. Similarly, the analysis completed on the North Dakota side of the Red River indicates that property that frequently floods sells for a discount to property that either does not flood (43% discount). There is a diminishing effect between property that varies in frequency of flooding ("medium flood" to "flood prone" indicating a discount of 28%). There is a further reduction in the discount when comparing the "medium flood" property to the "non-flood" property which indicates a discount of only 11%.

Overall, the indication is that some diminution in property values will result from the imposition of a flowage easement onto farmland. Anecdotal evidence gathered in the process of obtaining the market data indicated that there is some impact but that it varies, which is borne out by the results of the paired sales analysis completed.

Based on the evidence presented in the paired sales analysis and taking into consideration factors such as the existence of a flowage easement and the frequency of a flood event, a discount of 8% to 10% would be appropriate to apply for the properties that will have a flowage easement placed on them. If the potential for the frequency of flooding events increases, the discount increases and could be expected to be in the 10% to 25% range. Placement of a flowage easement results in the loss of property rights and provides the Diversion Authority with the right to flood the property at any time and this needs to be reflected as such. The additional factor to consider then is the frequency of flooding which would result in a higher discount than that reflected only by the loss of property rights.

FINAL CONCLUSIONS

Phase 1B results and conclusions are based on two different research approaches. The first approach is regression analysis, utilizing statistical modeling and a large dataset of market sales to measure the response of market participants to natural floodwater inundation. The second approach is matched paired analysis, utilizing appraisal practices and expertise along with market sales data to provide additional evidence of market participant reaction to floodwater inundation as well as easement rights.

The regression analysis model is based on a very large database of land sales from six counties on either side of the southern Red River Valley, over a period of the past 29 years. Sales in the database were all arm's-length market sales between willing buyers and sellers, each acting in their own self-interest. The quality and quantity of market sales included in the database produces a high level of confidence in the results. Sales were not encumbered by flowage easements, rather were fee simple sales in which all property rights transferred. The regression analysis provides very strong evidence that the local market's response to inundation events is a 7% to 10% reduction in sale prices of land. Examining severity, the regression analysis provides evidence of a reduction between 2.4% and 5.5% for each additional foot of inundation with diminishing effects at increasing depths. That is, increasing the level of inundation by one-foot between zero to one foot has a greater impact than increasing inundation by an additional foot between nine to ten feet.

Another significant factor exposed by the regression analysis was what has been termed "market amnesia." Market participants react to an event, but return to normal activities and decision-making processes after a period of time as they forget the lessons of the past. "Market amnesia" was apparent in the local market, demonstrating that the market returns to normal activity within one to two years after a flood event. Regression analysis was performed with a high level of skill, professionalism, objectivity, and utilizing the most modern analytical methodology.

Matched pairs analysis also provided insightful results. Extensive research focused our efforts on the Birds Point-New Madrid Floodway flowage easement area near southeastern Missouri's Bootheel area. Flowage easements were placed by the US Army Corps of Engineers in the flowage easement area along the west side of the Mississippi River levee as a result of the Flood Control Act of 1928. Levee construction began in 1929 and was completed in 1932. However, acquisition of the flowage easements was not completed until 1942. The levee protected adjoining cropland for several decades until excessive precipitation across the Mississippi River and Missouri River watersheds caused major flooding. In early 2011, the levee was breached to prevent flooding of cities along the Mississippi River which caused massive flooding in the flowage easement area.

FINAL CONCLUSIONS

Market land sale research in and near the flowage easement area during a period of 2010 through 2020 revealed fascinating results. "Market amnesia" was exposed in the Birds Point-New Madrid research area. Prior to the 2011 flood event, river bottom land encumbered with flowage easements sold at higher prices than cropland without flowage easements. Levees had protected the cropland for decades, so market participants may have forgotten, or did not care about the existence of the easements. The more productive river bottom land sold at higher prices than the higher elevation land without flowage easements.

Reality struck as a result of the 2011 levee blowout when approximately 77,000 acres of productive river bottom land was inundated. Market participants may have been lulled into complacency because the levee had protected their farmland for decades. Suddenly, the flooding event provided the market with a dose of reality. Market participants reacted by discounting land encumbered by the flowage easements.

Market data provides strong support for a conclusion of 8% to 10% reduction in sale prices of flowage easement encumbered land. Several dozen sales were analyzed in and near the flowage easement area. This market data is strongly supportive of the diminution in market value on flowage easement encumbered land due to a loss of property rights. This market data provides actual market support for valuation of the flowage easement component in the FM Diversion Staging Area. Paired sales analysis methodology was utilized to directly compare contemporary land sales with flowage easements versus sales without flowage easements. This is very strong market derived data.

Matched pairs analysis was also performed in the northern Red River Valley, which involved researching farmland sales from Grand Forks to the Canadian border. The purpose of this analysis was to determine the local market's reaction to fairly frequent flood events along the Red River. Paired sales analysis was performed on both the Minnesota and North Dakota sides of the river. Sales were not matched across state lines so that component was eliminated from the process. Sales were compared that were geographically near each other. Paired analysis compared sales that routinely flood versus sales that are not prone to flooding, as well as with sales that typically only flood during large flood events. All of the sales were located within a few miles of the river, had similar soil types and similar crop production capabilities. None of the sales were encumbered with flowage easements. All of the sales were arm's-length transactions.

Northern RRV paired sales analysis measured market participants' reaction to the value of land that is prone to frequent flooding. Market comparisons indicated a range of 11% to 43% as the discount for land that has a propensity for flooding. Paired sales analysis was performed carefully and objectively. The analysis is considered to be strong supporting market data pertaining to the frequency, depth and duration component that will eventually be applied to land in the FM Diversion staging area.

FINAL CONCLUSIONS

After extensive market data collection, research, and analysis, we are confident in saying that market data support for the conclusions reached in this Phase 1B study is very strong. The strength of data and market support anticipated by the Phase 1B Task Order has certainly been attained by the work reported in this publication.

In conclusion, both the regression techniques employed in measuring the impact of flooding on properties in the Red River Valley and the paired sales analysis completed based on both natural flooding and properties subject to a flowage easement indicated very similar results. There is strong evidence from the market to support a diminution in value for the loss of property rights due to the acquisition of a flowage easement. There is also support for a diminution in value resulting from flood events. It is the opinion of the authors of this study that a discount of 8-10% would be appropriate to apply for the loss of property rights. An incremental diminution in value, dependent on the severity of the flood event considering the degree of inundation, is to be considered that may indicate an additional diminution in value of 7% to 25%. Please note that the high end of the range is only applicable to those properties which will experience the most frequent flooding, at the deepest depth, and for the longest duration—essentially a worst case scenario. The following is a synopsis of our results from the various analyses:

Study	Area	Estimate
Regression Diminution from Flood Event	Southern Red River Valley	7-10%
Paired Sales Diminution from Frequent Floods	Northern Red River Valley	11-43%
Paired Sales Loss in Property Rights	Birds Point-New Madrid Floodway	8-10%

It is critical to understand that the properties in the staging area will be affected by two aspects. First, they will be affected by the loss of property rights, for which they should be compensated approximately 8-10% of market value. Second, they should then receive additional compensation for the increased risk of flooding. Based on the two Red River Valley analyses, we believe that compensation for increased flood risk should be approximately 7-25%. These are two separate issues and should be treated as such. Assuming a 10% factor for loss of property rights, an example of how this may be applied based on flooding severity is as follows:

	Minor	Moderate	Extreme
Loss of property rights	10%	10%	10%
Plus increased flood risk	+10%	+15%	+25%
TOTAL diminution in value	20%	25%	35%

Examples listed are only examples and should not be interpreted as set levels of compensation. In Phase 2 compensation will be calculated for each property individually based on multiple criteria and may not match the example figures exactly.

FINAL CONCLUSIONS

Additional Support

- Following completion of the initial market study in 2018, Tim Hodge, the PhD economist on the Crown Appraisal team, submitted the regression analysis portion of the study for publication in a peer-reviewed journal. After thorough feedback from editors and reviewers, as well as a few minor changes, the study was accepted in March, 2020. The conclusions of the 2018 market study were unchanged. Dr. Hodge's manuscript titled "Flooding and the Value of Agricultural Land" will appear in the February 2021 issue of *Land Economics*, a highly regarded journal.

  The level of scrutiny that the regression analysis methodology and manuscript underwent in the publication process was intense. Its approval adds tremendous support to Phases 1 and 1B, and indicates the methodology is sound.

- In the spring of 2019 major flooding occurred along the Missouri River in Nebraska and Iowa which resulted in levees washing out and devastating adjacent farmland. Those properties did not have flowage easements in place, but experienced tremendous deposits of sand, silt, and debris from the floodwaters.

  We researched the impacted area in an effort to see if a paired sales analysis similar to those conducted in the northern Red River Valley could be conducted in Nebraska-Iowa. Our research found that there were very few, if any, good arm's-length transactions of flood impacted land. According to multiple real estate experts in the area, the farmland market essentially seized. That is a similar reaction to what we found in the Birds Point-New Madrid are in 2011 after that levee was blown. In both instances the market basically stopped while buyers and sellers were determining how to proceed under the new circumstances.

  Another means of measuring the impact can be through cash rental rates for farmland. Farm managers who negotiate leases on numerous properties in the NE-IA area stated that although there have been no sales, cash rents negotiated for the 2020 crop season on land impacted by the 2019 flood were often 10-15% lower than in 2019. Although this data is anecdotal, the 10-15% decrease in cash rent is within the value diminution range concluded in this Phase 1B market study and adds further support.

- The Buffalo - Red River Watershed District (BRRWD) is currently working on a water retention project along Stony Creek about 4-5 miles northwest of Barnesville, MN. Negotiations between BRRWD and landowners regarding acquisition of flowage easements has taken place over the past few years. It is our understanding based on conversations with a landowner involved with the project, that a sale price for the easement has been agreed upon, and that the transaction is expected to close in October 2020 once the State of Minnesota bonding bill is passed.

FINAL CONCLUSIONS

According to project information, roughly 1,000 acres will be included in this retention project that is expected to cost $15,000,000. A 110' wide by 14' high dike will be constructed around the area, holding back water from Stony Creek primarily during spring melt, to help reduce flooding along the Buffalo River and Red River. The project has a drainage area of 35 square miles and will provide 7,000 acre-feet of gated storage with more than 80% reduction to the peak flow contributed by Stony Creek.

It is anticipated that water will be retained by the project roughly 2 out of every 5 years, or 40% of the years. In contrast, the current FM Diversion is expected to operate about once every 20 years, or 5% of the years, which is quite different. Similar to the FM Diversion project, the landowner will be allowed to farm the land after the water recedes and during years in which the project is not utilized. If a crop cannot be planted, the landowner is not due any further payment.

A one-time payment for the easement will be made to the landowner. For land that may still be utilized on dry years, the landowner will be paid 100% of assessed value as determined by the Clay County Assessor. For land that will have the dike constructed on it and be taken entirely out of production, the landowner will be paid 120% of assessed value. An additional $900/acre over and above the assessed value will be paid for land that has subsurface drain tile installed.

Risks associated with farming the land include crop loss due to drown out, the inability to purchase federal crop flood insurance, the inability to apply fertilizer in the fall, and the inability to grow longer maturity or high input cost crops.

The percentage of market value paid for acquiring the flowage easements for the Stony Creek Project is clearly significantly higher than the range indicated in this market study. That is due in part to the fact that the Stony Creek Project is expected to be utilized much more frequently than the FM Diversion. However, this discussion is included in this report because there may be some extreme cases of properties in the FM Diversion Mitigation Zone 1 in which it is appropriate to conclude a percentage above the range indicated in this market study.

Other

- There are numerous comments in this report regarding rights acquired in the proposed flowage easements and other specific details of the diversion project plan. For more detailed information please refer to the Property Rights Acquisition and Mitigation Plan version 5, released by the Diversion Authority on June 1, 2020 and approved by the North Dakota State Engineer. Comments in the report are based on the most current information available as of the date of this report.

- We are not engineers or flood control experts. Details about the diversion project included in this report are as explained to us by project officials, public information, etc.

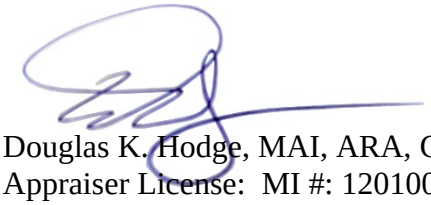
FINAL CONCLUSIONS

Thank you for this opportunity to be of service. Should questions arise, please don't hesitate to contact us.

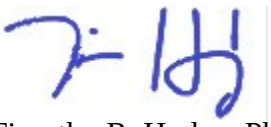
Sincerely,

Jeffrey L. Berg, ARA, ASA, FRICS
Appraiser License: MN #: 40360527
SD #118CG; ND #CG-1050; WI #1395-10
IA #CG03191; CO #100050561; WA #1102536
WY #AP-1406; IL #553002487; OR #C001228
ID #CGA-4551; OH #2017004274; KS #G-3336
MT #REA-RAG-LIC-8551; NE #CG2017015R
MI #1201076623; LA #G4466; MO #2018038790
AR #CG-4163; IN #CG41500069

Brian Field, ARA
Appraiser License: MN #: 20586763
ND #: CG-21016; SD #: 1030CG
MT #: REA-RAG-LIC-10600



Douglas K. Hodge, MAI, ARA, CCIM, MRICS
Appraiser License: MI #: 1201001482



Timothy R. Hodge, PhD
Assistant Professor
Oakland University

Crown Appraisals, Inc.

APPRAISAL QUALIFICATIONS FOR JEFFREY BERG

MEMBER:

Accredited Rural Appraiser (ARA) membership designation--the American Society of Farm Managers and Rural Appraisers, Inc.
Accredited Senior Appraiser (ASA) membership designation--Machinery & Equipment Specialty--American Society of Appraisers
Fellow Royal Institution of Chartered Surveyors (FRICS)
Certified Federal General Appraiser License: MN #40360527; ND #CG-1050; SD #118CG-2018; IA #CG03191; CO #: 100050561; MT #REA-RAG-LIC-8551; WI #: 1395-10; IL #: 553.001487; IN #: CG41500069; WY #: AP-1406; OR #: C001223; NE #CG2017015R; ID #CGA-4551; OH #2017004274; AR #CG-4163; MO #2018038790; WA #1102536
Instructor: ASFMRA--Fundamentals, Principles, and Advanced Rural Appraisal Courses and numerous ASFMRA seminars
Instructor: National Uniform Standards of Professional Appraisal Practice (USPAP) Course, Recertified for 2018/2019 Course
ASFMRA National Appraisal Education Committee Chairman, 2002-2005; Accreditation Chairman, 2006-2008;
2005 recipient of H.E. "Buck" Stalcup Excellence in Education Award from ASFMRA
Recipient of 2008 ASFMRA Appraisal Professional of the Year Award
National ASFMRA President, 2011/2012

CORE APPRAISAL EDUCATION:

American Society of Farm Managers and Rural Appraisers, Inc. courses:
-A-27 and A-28, Income Capitalization courses, 1993 & 1994
-A-20 & A-30, Principles of Rural Appraisal & Advanced Rural Appraisal, 1988 & 1991
-A-25, Eminent Domain Seminar, February 1991, Denver, CO
-A-35, Advanced Appraisal Review, March 2004, St. Cloud, MN
-A-40, Advanced Rural Appraisal Case Studies, June 1991, St. Paul, MN
-American Society of Appraisers courses:
-ME201, 202, & 203 Machinery and Equipment Valuation courses, 1993 & 1994
-ME204 Machinery & Equipment Valuation: Advanced Topics & Report Writing, 4-94, Washington, DC
-ME205 Income Approach, Discount Rate Development & Complex Case Studies, 2-98, San Francisco, CA
-RP401 Allocating Components in Going Concern Appraisals, April 2016, Atlanta, GA
Appraisal Institute Courses:
-Fundamentals of Separating Real Property, Personal Property and Intangible Business Assets, April 2012, St. Paul, MN
B.A. Agriculture/Business Administration, Ambassador University, Big Sandy, TX, 1972
ASFMRA, ASA & RICS conduct mandatory programs of continuing education. I am current with the requirements of the programs. Continuing education classes are not listed.

BACKGROUND AND EXPERIENCE:

Crown Appraisals specializes in the appraisal of agricultural and commercial real estate. Agri-business appraisal experience includes the following classes of real estate: feed mills, grain elevators, dry edible bean processing plants, seed plants, potato warehouses, fruit & vegetable processing & storage facilities, food processing facilities, fertilizer facilities, convenience stores, bulk fuel facilities, manufacturing plants and equipment dealerships. Agricultural appraisal experience includes farmland, on-farm grain handling and storage facilities, feedlots, hog confinement facilities, large freestall dairy facilities and general farm buildings. Jeff Berg has extensive experience in the appraisal of aggregate and gravel reserves. Experience includes expert witness testimony in Federal Bankruptcy court, IRS Tax court and various district courts. Equipment appraisal experience includes food processing, grain handling, seed processing, industrial manufacturing, construction and agricultural equipment. Please refer to website at crownappraisalsinc.com.

In 2014 Jeff authored an appraisal course for the ASFMRA titled "Key Elements of Grain Elevator Appraisal". He has taught the class to over 350 fellow appraisers throughout the country at various ASFMRA events.

Jeffrey Berg, ARA, ASA, FRICS
Accredited Rural Appraiser, Accredited Senior Appraiser
Fellow Royal Institution of Chartered Surveyors

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American Society of Farm Managers and Rural Appraisers
American Society of Appraisers

STATE OF MINNESOTA

JEFFREY L BERG
739 NORTHRIDGE WAY
WEST FARGO, ND 58078

Department of Commerce

The Undersigned COMMISSIONER OF COMMERCE for the State of Minnesota hereby certifies that
JEFFREY L BERG

739 NORTHRIDGE WAY
WEST FARGO, ND 58078

has complied with the laws of the State of Minnesota and is hereby licensed to transact the business of
Non-Resident Appraiser : Certified General

License Number: 40360527

unless this authority is suspended, revoked, or otherwise legally terminated. This license shall be in effect until August 31, 2021.

IN TESTIMONY WHEREOF, I have hereunto set my hand this August 15, 2019.

Steve Kelley

COMMISSIONER OF COMMERCE

Minnesota Department of Commerce
Licensing Division
85 7th Place East, Suite 500
St. Paul, MN 55101-3165
Telephone: (651) 539-1599
Email: licensing.commerce@state.mn.us
Website: commerce.state.mn.us

Notes:

- **Individual Licensees Only - Continuing Education:** 15 hours is required in the first renewal period, which includes a 7 hour USPAP course. 30 hours is required for each subsequent renewal period, which includes a 7 hour USPAP course.
- **Appraisers:** You must hold a licensed Residential, Certified Residential, or Certified General qualification in order to perform appraisals for federally-related transactions. **Trainees do not qualify.** For further details, please visit our website at commerce.state.mn.us.

North Dakota Real Estate Appraiser Qualifications and Ethics Board

Jeffrey L. Berg

Is fully qualified
in the State of North Dakota as a

CERTIFIED GENERAL APPRAISER
ND Permit Number: CG-1050

Date of Issuance: 01/01/2020
Expiration Date: 12/31/2020

Unless sooner suspended or revoked, as provided by law.

Appraiser Signature

STATE OF SOUTH DAKOTA

NO. 118CG
This is to certify that
JEFFREY L. BERG
is a STATE CERTIFIED GENERAL APPRAISER
Issued: August 29, 2019
Expires: September 30, 2020
2020
DEPARTMENT OF LABOR AND REGULATION

BY: M. Hallman

State of Montana

Business Standards Division
Board of Real Estate Appraisers

This certificate verifies licensure as:
CERTIFIED GENERAL APPRAISER

REA-RAG-LIC-8551
Status: **Active**
Expires: **03/31/2021**

JEFFREY LYNN BERG
CROWN APPRAISALS INC
2750 7TH AVENUE SOUTH
FARGO, ND 58103

Montana Department of LABOR & INDUSTRY
RENEW OR VERIFY YOUR LICENSE AT:
https://ebiz.mt.gov/pol

Indiana Professional Licensing Agency
Real Estate Appraiser Licensure Board
402 W. Washington Street, W072
Indianapolis, IN 46204

Certified General Appraiser

License Number	Expire Date
CG41500069	06/30/2022

Jeffrey L Berg

Eric J. Holcomb
Governor
State of Indiana

Deborah J. Frye
Executive Director
Indiana Professional Licensing Agency

State of Wisconsin

DEPARTMENT OF SAFETY AND PROFESSIONAL SERVICES

COMMITTED TO EQUAL OPPORTUNITY IN EMPLOYMENT AND LICENSING

CERTIFIED GENERAL APPRAISER ELIGIBLE TO APPRAISE FEDERALLY RELATED TRANSACTIONS IS AQB COMPLIANT

No. 1395-10 Expires: 12/14/2021

JEFFREY L BERG
CROWN APPRAISALS INC
2750 7TH AVENUE SOUTH
FARGO ND 58103
UNITED STATES

Colorado Department of Regulatory Agencies
Division of Real Estate
Jeffrey Lynn Berg
Certified General Appraiser

CG100050561	12/03/2019
License Number	Issue Date
Active	12/31/2021
License Status	Expiration

Verify this license at http://dora.colorado.gov/dre

Marcia Waters

Director: Marcia Waters — Licensee Signature

STATE OF IOWA

IOWA DEPARTMENT OF COMMERCE
PROFESSIONAL LICENSING AND REGULATION

This is to certify that the below named has been granted a certification as: Certified General Appraiser.

Certification Number: CG03191 Expires: June 30, 2022

Status: Active

Jeffrey Lynn Berg
Crown Appraisals, Inc.
2750 7th Ave S
Fargo, North Dakota 58103

LICENSE NO.
553.002487

Department of Financial and Professional Regulation
Division of Real Estate

CERTIFIED GENERAL REAL ESTATE APPRAISER

JEFFREY L BERG

EXPIRES:
09/30/2021

DEBORAH HAGAN
SECRETARY

MARIO TRETO, JR.
ACTING DIRECTOR

The official status of this license can be verified at www.idfpr.com

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State of Nebraska
Real Property Appraiser Board

Hereby certifies that: JEFFREY L BERG

CROWN APPRAISALS INC
2750 7TH AVE S
FARGO, ND 58103-8710

Is credentialed in the State of Nebraska as a:
Certified General Real Property Appraiser

Holding credential number: CG2017015R
Issued on: Jan 01, 2019 *Set to expire on:* Dec 31, 2020

Nebraska Real Property Appraiser Board Director:

All address changes, business or residence, must be reported to the Real Property Appraiser Board immediately.
This Credentialing Card is proof that such person is credentialed under the Real Property Appraiser Act unless credential has been canceled, surrendered, suspended, or revoked.

Nebraska Real Property Appraiser Board
301 Centennial Mall South, First Floor PO Box 94963
Lincoln, Nebraska 68509-4963
Phone: 402-471-9015 Fax: 402-471-9017 www.appraiser.ne.gov

Administrative Identification Number:	7591-2019	*Registration Fee Paid:*	$550.00
Random Fingerprint Audit Program Fee Paid:	$10.00	*Federal Registry Fee Paid:*	$80.00

WYOMING REAL ESTATE COMMISSION & CERTIFIED APPRAISER BOARD

License Number AP-1406

NON TRANSFERABLE

CERTIFIED REAL ESTATE APPRAISER PERMIT

Issued: 03/27/2019
Expires: 03/26/2021

JEFFREY L BERG
CERTIFIED GENERAL APPRAISER
AS PROVIDED FOR BY THE LAWS OF WYOMING.

CROWN APPRAISALS, INC
2750 7TH AVENUE SOUTH
FARGO, ND 58103

AUTHORIZED BY THE WYOMING CERTIFIED REAL ESTATE APPRAISER BOARD
WITNESS MY HAND AND THE OFFICIAL SEAL AT CHEYENNE, WYOMING.

Nicole Novotny Smith Executive Director

Bureau of Occupational Licenses
Department of Self Governing Agencies

The person named has met the requirements for licensure and is entitled under the laws and rules of the State of Idaho to operate as a(n)

CERTIFIED GENERAL APPRAISER

JEFFREY LYNN BERG
739 NORTHRIDGE WAY
WEST FARGO ND 58078 3118

Kelley Packer	**CGA-4551**	**10/30/2020**
Chief, B.O.L.	**Number**	**Expires**

Appraiser Certification and Licensure Board

State Certified General Appraiser
28 hours of continuing education required

JEFFREY L BERG
CROWN APPRAISALS, INC.
2750 7TH AVE S
FARGO, ND 58103

License No.: C001228
Issue Date: November 01, 2019
Expiration Date: October 31, 2021

Gae Lynne Cooper, Administrator

STATE OF OHIO
DIVISION OF REAL ESTATE AND PROFESSIONAL LICENSING

AN APPRAISER LICENSE/CERTIFICATE has been issued under ORC Chapter 4763 to:

NAME: Jeffrey Lynn Berg
LIC/CERT NUMBER: 2017004274
LIC LEVEL: Cert. General R. E. Appraiser - Out of State
CURRENT ISSUE DATE: 08/15/2019
EXPIRATION DATE: 09/06/2020
USPAP DUE DATE: 09/06/2020

Arkansas Appraiser Licensing & Certification Board

This is to certify that

Jeff L. Berg

Credential # CG-4163

has complied with the requirements of Arkansas code 17-14-201 et seq.; and is the holder of a valid credential. This card is for identification purposes only.

Expiration Date: 10/22/2020 Cary C. Maddux

Chairman

STATE OF MICHIGAN-DEPARTMENT OF LICENSING AND REGULATORY AFFAIRS

BUREAU OF PROFESSIONAL LICENSING

CERTIFIED GENERAL APPRAISER LICENSE

JEFFREY BERG

LICENSE NO.	EXPIRATION DATE	AUDIT NO
1201076623	07/31/2020	3455062

State of Missouri

Division of Professional Registration

State Certified General Real Estate Appraiser

VALID THROUGH SEPTEMBER 28, 2020
ORIGINAL CERTIFICATE/LICENSE NO. 2018038790
JEFFREY L BERG
739 NORTHRIDGE WAY
WEST FARGO ND 58078
USA

STATE OF WASHINGTON

CERTIFIED GENERAL REAL ESTATE APPRAISER

JEFFREY LYNN BERG
739 NORTHRIDGE WAY
2750 7TH AVENUE S
WEST FARGO ND 58078

1102536	10/30/2020	Teresa Berntsen
License Number	Expiration Date	Teresa Berntsen, Director

State of Louisiana

Certified General Appraiser License

A CERTIFIED GENERAL APPRAISER license for the period covered March 2, 2020 through September 2, 2020 is granted to :

JEFFREY L. BERG

Kara Ann Platt
Chairman

Rebecca H. Rothschild
Secretary

License Number: G 4466

State of Kansas

Real Estate Appraisal Board

This is to certify that

Jeffrey L. Berg

has complied with the provisions of the Kansas State Certified and Licensed Real Property Appraisers Act to transact business as a

Certified General Real Property Appraiser

in the State of Kansas

License No: G-3336
Effective Date: 4/20/2020
Expiration Date: 6/30/2020

Chairman

Crown Appraisals, Inc.

APPRAISAL QUALIFICATIONS FOR BRIAN FIELD

MEMBER:
Accredited Rural Appraiser (ARA) membership designation--American Society of Farm Managers & Rural Appraisers (ASFMRA)
Member of both the Minnesota & North Dakota Chapters--American Society of Farm Managers & Rural Appraisers
ASFMRA Executive Council member 2015/18
ASFMRA Early Career Award winner 2018
ASFMRA Young Professionals Network--District Representative & Chair of the national leadership team 2016/18
ASFMRA Government Relations committee Chair 2019/23
Candidate for Designation--Appraisal Institute
Member of North Star Chapter--Appraisal Institute
Certified General Appraiser Licenses: MN #20586763; ND #CG-21016; MT #REA-RAG-LIC-10600; SD #1030CG

CORE APPRAISAL EDUCATION:
American Society of Farm Managers & Rural Appraisers courses:
Code of Ethics, March 2008, Apple Valley, MN
A-20, Principles of Rural Appraisal, October 2006, St. Cloud, MN
A-250, Eminent Domain, March 2011, Denver, CO
A-290, General Market Analysis and Highest & Best Use, August 2008, St. Cloud, MN
A-300, Advanced Approaches to Value for Rural Appraisal, October 2008, Denver, CO
A-360, Introduction to Appraisal Review, October 2007, St. Cloud, MN
A-370, Appraisal Review Under USPAP, October 2007, St. Cloud, MN
A-400, Advanced Rural Case Studies, June 2011, Denver, CO

Appraisal Institute courses:
Business Practices and Ethics, September 2008, Online
Basic Appraisal Principles, January 2006, St. Paul, MN
Basic Appraisal Procedures, January 2006, St. Paul, MN
Residential Market Analysis and Highest & Best Use, February 2006, St. Paul, MN
Income Valuation of Small, Mixed-Use Properties, February 2006, St. Paul, MN
Basic Income Capitalization, March 2007, St. Paul, MN
General Applications, March 2007, St. Paul, MN
National 7 Hour USPAP Update, April 2010, St. Cloud, MN
General Appraiser Report Writing & Case Studies, October 2008, Chicago, IL
Real Estate Finance Statistics & Valuation Modeling, November 2008, Online
General Appraiser Income Approach/Part 2, April 2011, Aurora, CO
Fundamentals of Separating Real Property, Personal Property, & Intangible Business Assets, April 2012, St. Paul, MN
Advanced Concepts & Case Studies, September 2013, St. Paul, MN
Advanced Market Analysis and Highest & Best Use, May 2014, St. Paul, MN
Advanced Income Capitalization, September 2014, Minneapolis, MN

ProSource course: National 15 Hour USPAP, May 2006, St. Paul, MN

American Society of Appraisers courses:
ME 201, Introduction to Machinery and Equipment Valuation, May 2007, St. Cloud, MN
ME 202, Machinery and Equipment Valuation Methodology, October 2007, St. Cloud, MN
ME 203, Machinery and Equipment Valuation-Advanced Topics & Case Studies, August 2008, Minneapolis, MN
ME 204, Machinery and Equipment Valuation-Advanced Topics & Report Writing, August 2009, Skokie, IL

B.A. Business, Concordia College, Moorhead, MN
M.Ed. Sports Management, University of Minnesota, Minneapolis, MN

The American Society of Farm Managers & Rural Appraisers and Appraisal Institute conduct mandatory programs of continuing education. I am current with the requirements of the programs. Continuing education classes are not listed. As of the date of this report, I have completed the Standards and Ethics Education Requirement of the Appraisal Institute for Associate Members.

BACKGROUND AND EXPERIENCE:
Appraisal experience includes grain elevators, fertilizer and agronomy facilities, seed plants, bulk fuel facilities, farm headquarters, horse facilities, meat processing plants, bull stud facilities, convenience stores, eminent domain, commercial buildings, manufacturing facilities, farm implement dealerships, gravel reserves, rural residential buildings and bare land including farm, commercial, industrial and hunting, as well as farm and industrial equipment. Brian also co-instructs a course for the ASFMRA titled "Key Elements of Grain Elevator Appraisal." He teaches the class to fellow appraisers throughout the country.

Jeffrey Berg, ARA, ASA, FRICS
Accredited Rural Appraiser, Accredited Senior Appraiser
Fellow Royal Institution of Chartered Surveyors

2750 7th Avenue South • Fargo, ND 58103
(701) 478-3130 • FAX (701) 478-3156
Email: jeffberg@crownappraisalsinc.com
www.crownappraisalsinc.com

American Society of Farm Managers and Rural Appraisers
American Society of Appraisers

STATE OF MINNESOTA

BRIAN WARD FIELD
P.O. BOX 115
BARNESVILLE, MN 56514

Department of Commerce

The Undersigned COMMISSIONER OF COMMERCE for the State of Minnesota hereby certifies that

BRIAN WARD FIELD

P.O. BOX 115
BARNESVILLE, MN 56514

has complied with the laws of the State of Minnesota and is hereby licensed to transact the business of

Resident Appraiser : Certified General

License Number: 20586763

unless this authority is suspended, revoked, or otherwise legally terminated. This license shall be in effect until August 31, 2021.

IN TESTIMONY WHEREOF, I have hereunto set my hand this August 22, 2019.

Steve Kelley

COMMISSIONER OF COMMERCE
Minnesota Department of Commerce

North Dakota Real Estate Appraiser Qualifications and Ethics Board

Brian W. Field

Is fully qualified
in the State of North Dakota as a

CERTIFIED GENERAL APPRAISER
ND Permit Number: CG-21016

Date of Issuance: 01/01/2020
Expiration Date: 12/31/2020

Unless sooner suspended or revoked, as provided by law.

Brian Field
Appraiser Signature

STATE OF SOUTH DAKOTA
NO. 1030CG
This is to certify that
BRIAN W. FIELD
is a STATE CERTIFIED GENERAL APPRAISER
Issued: August 29, 2019
Expires: September 30, 2020
2020
DEPARTMENT OF LABOR AND REGULATION

BY: M. Haltman

State of Montana
Business Standards Division
Board of Real Estate Appraisers

This certificate verifies licensure as:
CERTIFIED GENERAL APPRAISER

REA-RAG-LIC-10600

Status: **Active**
Expires: **03/31/2021**

BRIAN WARD FIELD
2750 7TH AVE S
FARGO, ND 58103

Montana Department of LABOR & INDUSTRY
RENEW OR VERIFY YOUR LICENSE AT:
https://ebiz.mt.gov/pol

DOUGLAS K. HODGE, MAI, ARA, CCIM, MRICS

2343 Fish Lake Road
LAPEER, MICHIGAN 48446
810-516-5339
Dhodge173@gmail.com

EDUCATION

***Appraisal Institute* - courses completed**
Appraisal Principles, Basic Valuation Procedures, Capitalization Theory & Techniques, Part A and B, Standards of Professional Practice, Case Studies in Real Estate Valuation, Report Writing and Valuation Analysis, Valuation of Conservation Easements Certification Program, Uniform Appraisal Standards for Federal Land Acquisitions (Yellow Book), Seminars and Courses for Continuing Education, USPAP updates on a continuing basis.

***American Society of Farm Managers and Rural Appraisers* - courses completed**
Report Writing Seminar, Principles of Rural Appraisal Challenge, Advanced Rural Appraisal, Advanced Rural Case Studies and additional courses for continuing education on a continuing basis.

***International Right of Way Association* - courses completed**
Course 401 – Appraisal of Partial Acquisitions
Course 403 – Easement Valuation

***CCIM Institute* - courses completed**
Investment Analysis for Commercial Investment Real Estate
Financial Analysis for Commercial Investment Real Estate
Market Analysis for Commercial Investment Real Estate
User Decision Analysis for Commercial Investment Real Estate

***Realtors Land Institute* – courses completed**
Land Investment Analysis
Tax Deferred 1031 Exchanges
Fundamentals of Land Brokerage

Western Forestry and Conservation Association
The Basics of Forest Land and Timber Appraisal

1983	***Ferris State University*** Big Rapids, Michigan B.S. Finance
1977	***Delta College*** University Center, Michigan A.A. Business

EXPERIENCE

2017 – Present	**Nuveen (formerly TIAA Global Asset Management)** Vice President – Risk Management/Appraisal Services Group Sr. Agricultural Appraisal Reviewer
2012 – 2016	***TIAA*** Sr. Director – Global Asset Management/Appraisal Services Group Sr. Agricultural Reviewer
2007 – 2012	***Farmers National Company*** Eastern District Appraisal Manager
1991 – Present	***Capstone Realty Resources (fka Hodge Appraisal Group, Ltd.)*** Lapeer, Michigan President and owner ***Agri Analysts, LLC*** President ***American Society of Farm Managers and Rural Appraisers*** Certified Instructor
1989 - 1991	***Trerice Tosto*** Birmingham, Michigan Staff Appraiser
1986 - 1989	***Hodge and Associates, Inc.*** President **Provided subcontract appraisal services to:** Donald C. Johnson, MAI; Charles R. Green, MAI; Malcolm Milks, MAI; and Dean Appraisal Company in addition to providing appraisal services to clients of Hodge Appraisal and Consulting Service.

1985 - 1986	**Great Lakes Valuation Service** Partner
1985	***Doane Farm Management Co.*** Regional Appraiser
1983 - 1985	***Federal Land Bank Association of Caro*** Loan Officer/Appraiser Certified Appraiser #715

Prior to employment at the Federal Land Bank, self-employed as the owner of a 280 acre dairy farm in Sanilac County, Michigan.

MEMBERSHIP AND AFFILIATIONS

The Appraisal Institute - MAI Designation #9213
American Society of Farm Management and Rural Appraisers - ARA Designation #797
CCIM Institute – CCIM Designation
Royal Institution of Chartered Surveyors – MRICS designation
Michigan Society of Farm Managers and Rural Appraisers
State Certified General Appraiser, State of Michigan License #1201001482
Licensed Real Estate Broker, State of Michigan
Member of the Commercial Board of Realtors
Member of Lapeer County Planning Commission, 1991-1994, 2001- 2007
Member of Lapeer Township Planning Commission, 1993 - 1996, Chairman - 1995/96
Member of Mayfield Township Planning Commission, 1997 - 2001
Certified Instructor, American Society of Farm Managers and Rural Appraisers
Director – Great Lakes Chapter of the Appraisal Institute 1998 – 2001
Chapter officer – Vice President Great Lakes Chapter of The Appraisal Institute 2003; President 2004
Member of ASFMRA National Education and Accreditation Committee
ASFMRA representative to International Building Measurement Standards Committee – 2013 to present
ASFMRA representative to International Ethics Committee – 2014 to present
Lapeer County Board of Road Commissioners 2000 – 2012, Vice Chair 2001-2003; Chairman of the Board 2004 – 2012
District 3 Vice President – ASFMRA 2016 – 2019
President – Michigan Chapter of ASFMRA – 2016
Recipient of ASFMRA Stalcup Excellence in Education Award – 2016
Recipient of Rabo Agri Finance/ASFMRA Appraisal Professional of the Year Award – 2016

AREAS OF SPECIALIZATION

Real estate valuation with emphasis on food processing, agribusiness, large production agriculture, permanent plantings, aggregate properties, right of way for roads, drains, pipeline easements, ad valorem tax appeals, commercial, industrial, multi-family, retail, subdivision analysis, vacant land, wetlands. Valuation studies include fractional interests, partition proceedings, eminent domain, leaseholds, market valuation, and providing expert witness services in accordance with the above types of valuations. Appraisal review services during employment with TIAA/Nuveen including properties in US, Australia, Brazil, Chile, New Zealand and Poland.

REPRESENTATIVE APPRAISAL AND CONSULTING CLIENTS

Aegon USA Realty Advisors
Aetna Life and Casualty
Aetna Realty Investors, Inc.
Anderson, Stull and Kraft
Buckeye Egg Farm
Thomas J. Budzynski, Esq.
Butzel, Keidan, Simon, Meyers and Graham
Chase Bank
Chelsea Milling Co.
Cherry-Ke Orchards
Cigna Investments
Citizens First
Clark Hill
Comerica Bank
Cubitt, Cubitt and Trowhill
DayLay Egg Farm, Inc.
Delta Investments
Dorsey and Whitney
Drillock, Rinn and Drillock
Dykema, Gossett
Exchange National Bank
Farm Bureau Ins. Co.
Greenstone Farm Credit Services
First of America Bank
First Central Mortgage
First National Bank of Chicago
Garard, Moehle and Smith
Grand Traverse Land Conservancy
John Hancock Mutual Life Ins. Co.
David Heyboer, Esq.
Herbruck Poultry Farm, Inc.
Herbruck Foods, Inc.
Honigman Miller
Huron County Road Commission
Independent Bank
ITC
Jaffe, Snyder, Raitt and Heuer
Jay S. Kalish, Esq.
Kingston State Bank
Lapeer County Road Commission
Lambert, Leser, Dahm, Cook and Guinta
LaSalle Bank
Learman, Peters, Sarow and McQuillan
Little Forks Land Conservancy
Marlette Economic Development Corp.
McKay and McKay
Mennel Milling, Inc.
Michigan Dept. of Natural Resources
Michigan Dept. of Transportation
Miller, Canfield, Paddock and Stone
National City Bank
Oakland Land Conservancy
Pelavin and Powers
Providian Capital Management Real Estate Services
RaboAgriFinance
Ransford, Crews and Burgess
Sanilac Mutual Insurance Co.
State of Michigan, Attorney General
TCF Bank
Thumb National Bank
Total Petroleum
United States Government – NRCS, IRS, FmHA, Fish and Wildlife Division, Dept. of Justice
Wruble Elevator Co.
Zelenka Nursery, Inc.

TYPES OF ASSIGNMENT

Ad Valorem Tax Valuations
Agribusiness Properties
Aggregate Mining Operations
Apartment Buildings
Appraisal Reviews
Automobile Dealerships
Bankruptcy Appraisals
Branch Bank Facilities
Condemnation, Eminent Domain
Conservation Easements
Corridors for Pipeline & Drainage Easements
Development Properties
Department Stores
Estate Appraisal
Food Processing Plants
Farms, specialized (poultry, swine and dairy) and general
Feasibility Studies
Flour Mills
Grain Elevators/Feed Mills
Industrial Plants
Medical & Dental Clinics
Office Buildings
Public Land Acquisitions
Residential Subdivisions
Shopping Centers
Valuation of Development Rights
Wetlands Valuation

Timothy R. Hodge
School of Business Administration, Oakland University

Department of Economics
413 Elliott Hall
Rochester, MI 48309

Office: (248) 370-3524
Cell: (810) 441-7785
trhodge@oakland.edu

EDUCATION

Ph.D. Michigan State University (2013)
M.S. Michigan State University (2011)
B.A. Calvin College (2007)

PROFESSIONAL EXPERIENCE

Assistant Professor, Department of Economics, Oakland University (2016-*present*)
Senior Research Associate, Southeastern Michigan Economic Data Center (2017-*present*)
Econometrician, Ford Motor Credit Company, Dearborn, MI (2015-2016)
Visiting Assistant Professor, Department of Economics, Allegheny College (2013-2014)
Instructor, Department of Economics, Alma College (2012)
Graduate Research Assistant, Michigan State University (2007-2013)

TEACHING EXPERIENCE

Public Finance (Oakland University)
Urban and Regional Economics (Oakland University, Allegheny College)
Health Economics (Oakland University)
Managerial Economics (Oakland University)
Principles of Microeconomics (Oakland University, Allegheny College, Alma College)
Econometrics (Allegheny College)
Introduction to Statistical Analysis for Appraisers (ASFMRA)

RESEARCH INTERESTS

Urban and Regional Economics, Real Estate Economics, Public Finance, Public Economics

PUBLISHED PAPERS

Flooding and the Value of Agricultural Land. *Land Economics*, 97(1), 2021.

Decreasing Delinquency through Assessment Reductions: Evidence from Detroit. *Journal of Urban Affairs*, 2019. DOI: 10.1080/07352166.2019.1578175

Changes in the Benefits of the Taxable Value Cap when Property Values are Decreasing: Evidence from Michigan (with Charles Ballard and Mark Skidmore). *Public Finance and Management*, 18(4), 2018, pp. 313-335.

Stategraft (with Bernadette Atuahene), *Southern California Law Review*. 91(2), 2018. [press coverage: *VICE News Tonight on HBO*, *The Washington Post*, *The New York Times*, *Democracy Now!*]

The Land Value Gradient in a (Nearly) Collapsed Urban Real Estate Market (with Mark Skidmore and Gary Sands), *Land Economics*. 93(4), 2017, pp. 549-566.

Assessment Inequity in a Declining Housing Market: The Case of Detroit (with Daniel McMillen, Gary Sands, and Mark Skidmore), *Real Estate Economics.* 45(2), 2017, pp. 237-258

Capitalizing on Neighborhood Enterprise Zones: Are Detroit Residents Paying for the NEZ Homestead Exemption? (with Timothy M. Komarek), *Regional Science and Urban Economics.* 61, 2016, pp. 18-25.

Assessment Growth Limits and Mobility: Evidence from Home Sale Data in Detroit, Michigan. (with Mark Skidmore and Gary Sands), *National Tax Journal*. 68(3), 2015, pp. 573-600.

Tax Base Erosion and Inequity from Michigan's Assessment Growth Limit: The Case of Detroit. (with Mark Skidmore, Gary Sands, and Daniel McMillen), *Public Finance Review*. 43(5), 2015, pp. 636-660.

Detroit Property Tax Delinquency: Social Contract in Crisis. (with James Alm, Gary Sands, and Mark Skidmore), *Public Finance and Management*. 14(3), 2014, pp.280-305.

The Effect of Ethanol Plants on Residential Property Values: Evidence from Michigan. *Journal of Regional Analysis and Policy*. 41(2), 2011, pp. 148-167.

Property Value Assessment Growth Limits and Redistribution of Property Tax Payment: Evidence from Michigan. (with Mark Skidmore and Charles Ballard), *National Tax Journal*. 63(3), September 2010, pp. 509-37.

WORKING PAPERS

Does Housing Affordability Matter in Migration? (with Jonathan Silberman)

Recurrent Flooding, Information Asymmetries and Real Estate Prices: Evidence from Hampton Roads, VA (with Timothy M. Komarek, Larry Filer, and Jon Loftis)

The Effect of Property Tax and Mortgage Foreclosure on Neighboring Delinquency (with Timothy M. Komarek)

The Munchies: Marijuana Legalization and Food Sales in Washington (with Cooper Hazel and Timothy M. Komarek)

When Mary Jane Moves to Town: The Effect of Medical Marijuana Provisioning Centers on Local Housing Values (with Justin Sarna and Timothy M. Komarek)

PRESENTATIONS

"Millennials Impact on Local and National Housing Markets." Appraisal Institute: The Great Lakes Chapter 7th Annual Economic Summit. Royal Oak, MI (October 2019)

"The Effect of Property Tax and Mortgage Foreclosures on Neighboring Delinquency Decisions." 65th Annual North American Meeting of the Regional Science Association International. San Antonio, TX (November 2018)

"When Mary Jane Moves to Town: The Effect of Medical Marijuana Provisioning Centers on Local Housing Values." Urban Affairs Association 48th Annual Conference. Toronto (April 2018)

"The Munchie Effect: Marijuana Legalization and Food Sales in Washington" Mid-Continent Regional Science Association Annual Conference. Toledo, OH (June 2017)

"Economic Overview and Forecast Using the Housing Market" Rochester Area Chamber of Commerce 2017 Economic Outlook Luncheon (March 2017)

"Capitalizing on Neighborhood Enterprise Zones: Are Michigan Residents Paying for the NEZ Homestead Exemption?" 61st Annual North American Meetings of the Regional Science Association International. Washington D.C. (November 2014)
"Assessment Inequity in a Declining Housing Market: The Case of Detroit." Urban Affairs Association 44th Annual Conference. San Antonio, TX (March 2014)
"Assessment Growth Limits and Mobility: Evidence from Home Sale Data in Detroit, MI" National Tax Association 106th Annual Conference on Taxation. Tampa, FL (November 2013)
"Assessment Inequity in a Declining Housing Market: The Case of Detroit" Mid-Continent Regional Science Association Annual Conference. Kansas City, MO (May 2013)
"Not All Property Taxes Are Created Equal: Inequality from Assessment Growth Limits and Tax Abatements" Mid-Continent Regional Science Association Annual Conference. Minneapolis, MN (June 2012)
"The Effect of Ethanol Plants on Residential Property Values: Evidence from Michigan" Mid-Continent Regional Science Association Annual Conference. Detroit, MI (June 2011)
"Property Value Assessment Growth Limits and Redistribution of the Property Tax Burden: Evidence from Michigan" Mid-Continent Regional Science Association Annual Conference. Milwaukee, WI (May 2009)
"Who Benefits from Michigan's Proposal A?" Department of Agricultural Economics Graduate Research Symposium. (January 2009)

COMMITTEE SERVICE

e-LIS Advisory Committee, 2019-*present*
Economics Scholarship Committee, 2019, 2020
SBA Scholarship Committee, 2019
General Education Committee, 2019
Economics Club Faculty Advisor, 2017-*present*
ACHIEVE, 2017-*present*
Assistant Professor Search Committee, 2017-18
Graduate Student Research Award Mentor, 2017
Honor's Thesis Advisor, 2017-18
Honor's Thesis Advisor, 2016-17

PROFESSIONAL SERVICE

Referee: *Environmental and Planning A, National Tax Journal, Regional Science and Urban Economics (x2), Public Finance Review (x3), Urban Studies, Public Finance and Management (x2), Journal of Urban Affairs (x4), State and Local Government Review, Local Government Studies*

FELLOWSHIPS, GRANTS, AND AWARDS

Oakland University Faculty Research Fellowship, 2020
Oakland University School of Business Administration Summer Research Grant, 2019
Oakland University School of Business Administration Paul F. Lorenz Award for Teaching Excellence, 2017-18

Oakland University School of Business Administration Summer Research Grant, 2018
Oakland University Founders' Day Recognition for Research, 23rd Faculty Recognition Luncheon, 2018
Oakland University College of Art and Sciences Order of the Plume, 2018
Oakland University Faculty Research Fellowship, 2017
C. Lowell Harriss Dissertation Fellow (Lincoln Institute of Land Policy), 2012
M. Jarvin Emerson Student Paper Competition Winner (Mid-Continent Regional Science Association), 2011

OTHER EXPERIENCE

Instructor:
Introduction to Statistical Analysis for Appraisers (ASFMRA), Dundee, MI, 2017
Introduction to Statistical Analysis for Appraisers (ASFMRA), Indian Wells, CA, 2016
Introduction to Statistical Analysis for Appraisers (ASFMRA), Omaha, NE, 2015

Consultant:
The Fargo-Moorhead Area Diversion Project (2018)
ACLU of Michigan (2017)
Lincoln Land Institute/Center for Community Progress (2016-2017)
ITC Holding Corp. (2010-2014)
Crown Appraisals, Inc. (2011-2014)

Extension:
Barry County – Barry County Financial Analysis and Forecast Report (2014)
Lapeer County – The Production and Provision of Public Safety Services (2011)
Berrien County – Berrien County Migration: Where Are the Residents Going? (2009)

Policy Brief:
Memo on Detroit Property Tax System (2017)
Inventory of State Job Creation and Job Retention Incentives, 2010 (2011)

Other:
Tutor and Grader, Department of Economics, Calvin College (2006-2007)

ADDENDUM

--Summary of Birds Point – New Madrid Floodway flowage easements

--Copy of an actual flowage easement from Birds Point – New Madrid Floodway are

--Summary of FM Diversion sample flowage easement

--Copy of sample flowage easement for the FM Diversion staging area

Summary of Birds Point - New Madrid Flowage Easements

*Document language may vary slightly due to state laws and local jurisdictions.

	Document	Date	Restrictions
#1	Bk 113, Pg 451	4/22/1937	...USA acquired full, complete and perpetual easement over and across said lands, and the power, right and privilege to cause said land to be used for the purpose of a floodway… No further description of easement restrictions… simply a court ruling
#2	Bk 231, Pg 73	4/14/1969	…grant, bargain, and sell, convey and confirm… a perpetual and assignable flowage easement in, to, on, over, and across… …to flood and inundate the lands… including any buildings, improvements, or any other property situated thereon, by diversion floodwaters of the Mississippi River and its tributatries in the operation of the Birds Point - New Madrid Floodway …when a stage has been reached which is equivalent to 58.0' on the Cairo gage and a stage in excess of 60' is forecast, whenever such operation is deemed necessary in the judgement and discretion of the Chief of Engineers… …sellers (landowners) agree to hold harmless the buyer (USA) from any and all damages that may be occasioned by or result from the exercise of said rights, and easements granted. HOWEVER, this does NOT INCLUDE compensation as may be due by reason of deposits of sand or gravel upon the lands as a direct result of the planned operation of the floodway…
#3	Bk 113, Pg 307	6/2/1934	Court judgment Upheld the right of USA to acquire easement and flood lands
#4	Bk 231, 281	2/3/1970	Same as document #2 above …said premises are free and clear of any encumbrance done or suffered…
#5	Bk 231, Pg 284	2/3/1970	1 page, simply acknowledges the presence of a flowage easement
#6	Bk 113, Pg 425	4/22/1937	Same as document #2 above … the USA shall have judgment in condemnation against the premises for the therein defined, and against the defendants therein, and each and all of them, jointly and severally, as their rights may appear; and that the said plaintiff shall acquire, and does by these proceedings ACQUIRE THE FULL, COMPLETE AND PERPETUAL EASEMENT over and across said lands, and the power, right and privilege to cause said lands hereinbefore described to be used for the purposed of a floodway as contemplated by the Act of Congress on May 15, 1922… such right shall FOREVER vest in the USA…

FLOWAGE EASEMENT

THIS INDENTURE, made on the 3rd day of February A.D. 19.70, by and between VADINE WOODS SWAYNE and HUGH SWAYNE, her husband

of the County of Hickman State of Kentucky, Part ies of the First Part, and the UNITED STATES OF AMERICA, Party of the Second Part,

WITNESSETH:

That the said Part ies of the First Part, in consideration of the sum of FIFTY and no/100 DOLLARS ($ 50.00) to them paid by said party of the second part, the receipt of which is hereby acknowledged, do by these presents, GRANT, BARGAIN, and SELL, CONVEY AND CONFIRM, unto the said United States of America and its assigns, a perpetual and assignable Flowage Easement in, to, on, over, and across the following described tract or parcel of land lying, being, and situate in the County of Mississippi and State of Missouri, and designated as Tract No. 1357, Birds Point - New Madrid Floodway, Mississippi River and Tributaries, to wit:

All of the SW¼ of the SW¼ of Section 2, and the W½ of the NW¼ of Section 11. All in T 26 N, R 17 E, Mississippi County, Missouri, and containing 120.00 acres, more or less, all of which are included in the description of Tract No. 56; acquired by the United States of America by condemnation proceedings through Suit No. 582, filed September 23, 1931.

LMM 776

The easement herein granted is a perpetual and assignable easement to flood and inundate the lands hereinabove described, including any buildings, improvements or any other property situated thereon, by diversion of floodwaters of the Mississippi River and its tributaries in the operation of the Birds Point-New Madrid Floodway, said floodway to be placed in operation by artificial breaching or crevassing of any part or parts of the fuse plug sections of the frontline levee, between Levee Stations 33/20+46 and 44/20+46, and 82/0+35 and 87/0, when a stage has been reached which is equivalent to 58.0 feet on the Cairo gage and a stage in excess of 60 feet is forecast, whenever such operation is deemed necessary in the judgment and discretion of the Chief of Engineers; reserving, however, to the grantors, their heirs and assigns, all such rights and privileges in and to said lands as may be used and enjoyed without interfering with or abridging the rights, privileges, and easements herein conveyed; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

The easement herein conveyed is in modification of and in addition to the rights in the above described lands heretofore acquired by the United States of America for the construction, operation and maintenance of the Birds Point-New Madrid Floodway.

For the consideration aforesaid, the grantors agree to discharge, release and hold harmless the grantee and its assigns from any and all damages that may be occasioned by or result from the exercise of said rights, privileges and easements granted herein. However, the consideration hereinabove mentioned does not include compensation as may be due the grantors, their heirs and assigns, by reason of deposits of sand or gravel upon the lands hereinabove described as a direct result of the planned operation of the floodway in accordance with the rights and easements herein conveyed.

TO HAVE AND TO HOLD the premises aforesaid with all and singular, the rights, privileges, appurtenances and immunities thereto belonging or in anywise appertaining unto the said Party of the Second Part and its assigns forever, for use in connection with works to be constructed by the United States of America providing for improved flood protection in the Birds Point-New Madrid Floodway; the said Part...ies... of the First Part hereby covenanting that ..they..are..... lawfully seized of an indefeasible estate in fee of the premises herein conveyed; that ..they..have..... good right to convey the same; that subject to existing easements for public roads and highways, public utilities, railroads and pipelines,

said premises are free and clear of any encumbrance done or suffered by ..them... or those under whom ..they.. claim ...; and that ..they... will warrant and defend the title to the said premises unto the said Party of the Second Part and its assigns forever, against the lawful claims and demands of all persons whomsoever.

IN WITNESS WHEREOF, the said Part..ies... of the First Part ha..ve.. hereunto set ..their..... hands... and seal..s.. the day and year above written.

Nadine Moore Swayne (SEAL)
NADINE MOORE SWAYNE

Hugh Swayne (SEAL)
HUGH SWAYNE

ACKNOWLEDGMENT

STATE OF MISSOURI)
SS
COUNTY OF MISSISSIPPI)

On this 3rd day of February A.D. 1970, before me personally appeared NADINE MOORE SHAYNE and HUGH SHAYNE, her husband, ~~his wife~~, to me known to be the persons described in, and who executed the foregoing Flowage Easement and acknowledged that they had executed the same as their free act and deed.

IN TESTIMONY WHEREOF I have hereunto set my hand and affixed my official seal at my office in Said County and State the day and year last above written.

JESSIE D. BROWN (SEAL) NOTARY PUBLIC MISSISSIPPI COUNTY, MISSOURI

Jessie B Brown
NOTARY PUBLIC

My term expires My Commission Expires December 4, 1972

Indexed

Filed for record this the 23rd day of April, 1970 at 4:25 o'clock P. M.

Record and return to:
District Engineer
600 Federal Office Bldg.
Memphis, Tenn. 38103

Ellis H. Howlett
Recorder
Mississippi County, Mo.

By Ada Myers
Deputy

Fee ----------$4.00 pd.

Summary of FM Diversion Sample Flowage Easement

*Document language may vary slightly due to state laws and local jurisdictions.

Document	Date	Restrictions
FM DIVERSION SAMPLE EASEMENT from FM Area Diversion Project "Property Rights and Mitigation Plan" version 5 dated June 1, 2020	sample	29,200 acres need an easement… of which approximately 26,000 acres are located in the floodway. NO development in the floodway Development in the floodplain may be allowed in accordance with local flood plain ordinances, rules, regulations, and the terms and conditions of the easement Right to temporarily inundate property with floodwaters Easement will compensate for all impacts caused by the project, such as loss of development rights, agricultural production, and periodic and temporary flooding impacts (debris) Farming will be allowed, however development will be limited All structures currently in proposed floodway will be required to be removed on or before a certain date, or else they become property of the Diversion Authority Ingress/Egress access rights for project use are granted. Any crop damage will be reimbursed based on area disturbed, APH for the growing crop, owner's yields the year of the damages, and current crop prices at the time of the damages. Easement is perpetual and will run with the property. Owner can mortgage the property as long as the mortgage is subordinate to the easement. Owner cannot encumber the property in any way contrary to project use. ...right, title, and interest in and to the STRUCTURES and improvements now situated on the easement property, excepting fencing, drain tile and related appurtenances, and excepting any existing structures outside the Federal Mitigation Zone 1 FEMA floodway… or grantor MAY IMPROVE to be in compliance with flood plain development ordinances… 1' higher than the base flood elevation and also 0.2% annual chance even water elevation, whichever is higher… also excepting newly constructed structures outside Zone 1 in accordance with ordinances and the MN DNR dam safety and public waters work permit… …no excavation shall be conducted and no fill placed on land within the established FEMA floodway without such approval as to the location and method of excavation and/or placement of fill and verification that the fill will not impact project operation… Can use for crop production, pasture, other farm use, hunting (inc. right to post in ND) …Grantee has right to remove trees, underbrush, obstructions, and any other vegetation, structure, or obstacles on the easement property. HOWEVER, grantor is solely responsible , at grantor's sole expense and discretion, for maintaining the easement property, including grass cutting and weed control, and DEBRIS REMOVAL FOLLOWING INUNDATION…

FLOWAGE EASEMENT

THIS EASEMENT is made this ____ day of _____, 201X, by **[Insert Name(s)]**, **[Insert Marital Status]**, whose post office address is **[Insert Address]** ("Grantor"); and the [**Insert Acquiring Entity Name** , a [pick one: Minnesota / North Dakota] political subdivision, whose post office address is [**Insert Address**], and its successors and assigns ("Grantee").

RECITALS

A. The Grantee is a member of the METRO FLOOD DIVERSION BOARD OF AUTHORITY, a joint powers entity consisting of Clay County, Minnesota; City of Moorhead, Minnesota; Cass County, North Dakota; City of Fargo, North Dakota; and the Cass County Joint Water Resource District (the "Diversion Authority").

B. The Fargo-Moorhead Metro Flood Risk Management Project is a flood risk management project, sponsored by the United States Army Corps of Engineers (the "Corps") and the Diversion Authority, which includes a diversion channel and appurtenant staging and storage areas to reduce flood damages and risks in the region; the parties refer to the project as the FARGO-MOORHEAD METROPOLITAN AREA FLOOD RISK MANAGEMENT PROJECT, which is a federally authorized project pursuant to Section 7002(2) of the Water Resources Reform and Development Act of 2014 (the "Project").

C. Grantor owns certain real property in the vicinity of the Project, more specifically described below, in an area that may be subject to temporary and periodic flooding as a result of the Project.

D. Grantor has agreed to convey to Grantee a permanent easement, as more specifically described below, to permit Grantee to periodically flood portions of Grantor's property as well as granting certain access, survey, and exploration rights to Grantee.

E. Grantor agrees to grant and convey to Grantee an easement over the property described below, subject to the terms and conditions contained in this Easement.

In consideration of $XXX.XX, the mutual covenants contained in this Agreement, and other good and valuable consideration, the receipt and sufficiency of which the parties acknowledge, the parties agree as follows:

AGREEMENT

1. **The Easement Property**. Grantor grants and conveys to Grantee a permanent easement in, on, over, through, and across the following real property in [**Insert County and State**]:

[Insert Description]

The above described tract contains _____ acres, more or less.

(Collectively, the "Easement Property.")

A. Under this Easement, Grantor grants to Grantee, its officers, employees, agents, representatives, contractors, and subcontractors the following perpetual right, power, privilege and easement to occasionally overflow, flood, and submerge the Easement Property in connection with the operation, maintenance, repair, replacement, and rehabilitation of the Project, together with all right, title, and interest in and to the structures and improvements now situated on the Easement Property:
   a. excepting fencing, drain tile and related appurtenances;
   b. and further excepting any existing structures outside the Federal Mitigation Zone 1 that are in compliance, or which Grantor improves to be in compliance with floodplain development ordinances enforced by the local government agency and in compliance with FEMA floodplain development rules by [INSERT DATE IMPROVEMENTS BRINGING STRUCTURE INTO COMPLIANCE NEED TO BE COMPLETED BY];
   c. [Paragraph for ND Easements] and also excepting any newly constructed structures outside the Federal Mitigation Zone 1 on the Easement Property in accordance with floodplain development ordinances enforced by the local government agency and in accordance with FEMA floodplain development rules, which require insurable structures to be elevated at least one foot above the Base Flood Elevation (BFE), and also above the 0.2 percent annual chance event water surface elevation, whichever is higher;
   d. [Paragraph for MN Easements] and also excepting any newly constructed structures outside the Federal Mitigation Zone 1 on the Easement Property in accordance with floodplain development ordinances enforced by the local government agency and in accordance with the requirements of the Minnesota Department of Natural Resources Dam Safety and Public Waters Work Permit 2018-0819;
   e. and that no excavation shall be conducted and no fill placed on land within the Federal Mitigation Zone 1 and established FEMA floodway without approval by Grantee as to the location and method of excavation and/or placement of fill and verification that the fill will not impact Project operation.

B. The above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the property owners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the Project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution.

C. Additionally under this Easement, Grantor grants to Grantee, its officers, employees, agents, representatives, contractors, and subcontractors, and the United States, the

following access rights related to the Project regarding the Easement Property: ingress and egress in, on, over, across, and through the Access Area of the Easement Property as defined in the attached Exhibit "A"; removing structures, obstructions, and any other obstacles from the Access Area of the Easement Property; conducting observations, surveys, reviews, and data collection for environmental assessments; conducting topographic field and parcel surveys, soil analysis, soil borings, and other investigations; conducting water level, erosion, water quality, habitat, environmental, and other relevant monitoring; performing any other testing, surveys, and analysis; and necessary and reasonable rights of ingress and egress to and from the Access Area of the Easement Property subject to the provisions regard crop damages below. Grantee shall notify Grantor prior to exercising the access provisions associated with this Agreement.

2. **Easement Runs with the Easement Property.** This Easement, and all covenants, terms, conditions, provisions, and undertakings created under this Easement, are perpetual and will run with the Easement Property, and will be binding upon Grantor's heirs, successors, and assigns.

3. **Removal of Unapproved Structures.** Grantor must remove all unapproved structures on the Easement Property on or before [Insert Date]. Any unapproved structures remaining on the Easement Property after **[Insert Date]**, will automatically become Grantee's property, without the need for any bill of sale or any other written instrument or agreement; Grantee may then remove any unapproved structures from the Easement Property, at its sole discretion and at its sole cost. All approved existing structures are shown on attached Exhibit "B".

4. **Grantor Covenants.** Grantor warrants that Grantor is the fee simple owner of the Easement Property; that Grantor has the right to execute this Easement and to make the promises, covenants, and representations contained in this Easement; that this Easement does not violate any mortgage or other interest held by any third party regarding the Easement Property, or any portion of the Easement Property; that there are no outstanding unpaid bills incurred for labor, materials, or services regarding the Easement Property, or any portion of the Easement Property; and that there are no recorded or unrecorded liens, security interests, or any outstanding, pending, or threatened suits, judgments, executions, bankruptcies, or other proceedings pending or of record that would in any manner impact title to the Easement Property, or any portion of the Easement Property. Grantor will release, hold harmless, defend, and indemnify Grantee and its officers, agents, representatives, employees, and contractors from and against any and all claims, damages, injuries, or costs arising out of or in any way related to any title defects regarding the Easement Property.

5. **Taxes.** Grantor is solely responsible for all taxes and special assessments or assessments for special improvements due, levied, or assessed regarding the Easement Property for all past, present, and future years. Grantee will not be responsible for payment of any real estate taxes or special assessments regarding the Easement Property.

6. **Use of the Easement Property.**

A. Grantor's Use. Subject to the provisions of this Easement, Grantor has the right and privilege to use the Easement Property at any time, in any manner, and for production of crops, pasture,

and other farm-related activities and hunting, including the right to post the Easement Property at Grantor's sole discretion to restrict public hunting rights. Grantor will promptly cease any activities and remove any structures or obstructions that interfere with Grantee's use of the Easement Property, Grantee's rights and privileges under this Easement, or with the Project, when directed by Grantee. Grantor understands and recognizes any use of the Easement Property is at Grantor's sole risk, and that Grantee is not responsible for any damages to crops or for interference with any other of Grantor's uses of the Easement Property as a result of any inundation or any of Grantee's other rights and privileges regarding the Easement Property.

B. Grantee's Entry. If Grantee enters upon the Easement Property for purposes of conducting any of the surveys or testing permitted under this Agreement, following the conclusion of any surveys or testing, Grantee will return the Easement Property as nearly as practicable to its previous condition, taking into consideration the nature of the work being performed; for example, Grantee will remove any dirt piles or equipment from the Easement Property that might unreasonably interfere with Grantor's permitted uses of the Easement Property. Grantee's ingress and egress rights to the Easement Property will be by the least intrusive means reasonable. Additionally, Grantee will reimburse Grantor for reasonable crop damages resulting from the Grantee's physical entrance upon the Easement Property for purposes of conducting such surveys or testing. Such reasonable crop damages shall be calculated based on the area disturbed, actual production history, Grantor's yields the year of the damages, and current crop prices at the time of the crop damages.

7. **Encumbrances.** Subject to the provisions below regarding the leasing or mortgaging of the Easement Property, Grantor will not encumber the Easement Property or any portion of the Easement Property or enroll the Easement Property or any portion of the Easement Property in any farm or other federal program that would be contrary to, or would in any way disrupt or interfere with, Grantee's use of the Easement Property, Grantee's rights and privileges under this Easement, or with the Project without first obtaining Grantee's consent. However, Grantor may rent or lease the Easement Property, at Grantor's sole discretion without first obtaining Grantee's consent. If Grantor rents or leases the Easement Property, any lessee's rights and uses are subject to this Easement, including the use restrictions described above; Grantor will be fully responsible to Grantee for Grantor's obligations under this Easement, including for any violations by any lessee. Additionally, Grantor may mortgage the Easement Property, at Grantor's sole discretion without first obtaining Grantee's consent so long as any mortgage is subordinate to this Easement.

8. **Waiver of Warranties.** The parties specifically agree neither Grantee nor any of its agents or representatives have made any representations or warranties in any way regarding the Project; Grantor's ability to use the Easement Property following construction of Project; the potential frequency of inundation of the Easement Property; Grantor's ability to enroll the Easement Property in any federal program; or Grantor's ability to obtain any farm insurance regarding the Easement Property.

9. **Maintenance.** Grantee's easement rights include the right, at its discretion and if necessary for purposes of proper operation and maintenance of the Project, to remove trees, underbrush, obstructions, and any other vegetation, structures, or obstacles from the Easement Property. However,

Grantor is solely responsible, at Grantor's sole expense and discretion, for maintaining the Easement Property, including grass cutting and weed control, and debris removal following any inundation. Neither Grantor nor Grantee will store, cause, or permit any spillage, leakage, or discharge of fertilizers, herbicides, fungicides, and pesticides on the Easement Property (in excess of normal applications for farming purposes). Further, in no event will either party cause or permit any spillage, leakage, or discharge of any hazardous substance onto the Easement Property including, but not limited to, spillage of petroleum products or vehicle fuels, gasoline, kerosene, or other products used for the purpose of generating power, lubrication, illumination, heating, or cleaning. If either party causes or permits any spillage, leakage, or discharge of any such hazardous substance onto the Easement Property, that party shall be solely responsible for any damages arising out of such spillage, leakage, or discharge of any such hazardous substance onto the Easement Property to the extent required by law.

10. **Forbearance or Waiver.** The failure or delay of Grantee to insist on the timely performance of any of the terms of this Easement, or the waiver of any particular breach of any of the terms of this Easement, at any time, will not be construed as a continuing waiver of those terms or any subsequent breach, and all terms will continue and remain in full force and effect as if no forbearance or waiver had occurred.

11. **Governing Law**. This Agreement will be construed and enforced in accordance with [Insert STATE] law. The parties agree any litigation arising out of this Agreement will be venued in State District Court in [Insert County, State], and the parties waive any objection to venue or personal jurisdiction.

12. **Severability**. If any court of competent jurisdiction finds any provision or part of this Easement is invalid, illegal, or unenforceable, that portion will be deemed severed from this Easement, and all remaining terms and provisions of this Easement will remain binding and enforceable.

13. **Entire Agreement**. This Easement constitutes the entire agreement between the parties regarding the matters described in this Easement, and this Easement supersedes all other previous oral or written agreements between the parties.

14. **Modifications**. Any modifications or amendments of this Easement must be in writing and signed by Grantor and Grantee and must be recorded with the [INSERT} County Recorder's office.

15. **Representation**. The parties, having been represented by counsel or having waived the right to counsel, have carefully read and understand the contents of this Easement, and agree they have not been influenced by any representations or statements made by any other parties.

16. **Headings**. Headings in this Easement are for convenience only and will not be used to interpret or construe its provisions.

(Signatures appear on the following pages.)

IN WITNESS WHEREOF, Grantor executed this Easement on the date written above.

GRANTOR:

_____
[Insert Name of Grantor]

_____
[Insert Name of Grantor]

STATE OF [INSERT])
) ss.
COUNTY OF [INSERT])

On this ____ day of _____, 201X, before me, a Notary Public, in and for said County and State, personally appeared [Insert Name of Grantor], [Insert Marital Status], known to me to be the persons described in and who executed the within and foregoing instrument, and acknowledged to me that they executed the same.

_____
Notary Public, State of [Insert]
My Commission Expires:

(SEAL)

GRANTEE:

[Acquiring Entity Name]

By: _____
[Name, Title]

ATTEST:

_____
[Name]
[Title]

STATE OF [INSERT])
) ss.
COUNTY OF [INSERT])

On this ____ day of _____, 201X, before me, a Notary Public, in and for said County and State, personally appeared [NAME] and [NAME], known to me to be the Chairman and Secretary-Treasurer, respectively, of the [Insert Acquiring Entity Name] and who executed the within and foregoing instrument, and acknowledged to me that they executed the same on behalf of the [Insert Acquiring Entity Name]

_____
Notary Public, [County, State]
My Commission Expires:

(SEAL)

The legal description contained in this document was prepared by:

[Insert Info of Surveyor]

EXBHIBIT “A”

(MAP SHOWING ACCESS AREA)

EXHIBIT "B"

APPROVED EXISTING STRUCTURES