Rush River – Project Team RCPP/PL 566 Watershed Planning

Rush River -Watershed
Cass County Joint Water Resource District

Economic Appendix

Updated 8/10/2021

Appendix D-3

Tables and Figures

Tables:

Figures

Exhibits

Introduction

This analysis follows the procedures outlined in the Water Resources Council Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G), the Natural Resource Conservation Services Economics Handbook Part 611 – Water Resources, the National Watershed Program Handbook (April, 2014), and Red River Regional Conservation Partnership Program Selection Criteria under PL 83-566 dated 8/23/2019. Unless otherwise noted, all values in the analysis are in 2020 prices and all annual values have been discounted using the Fiscal Year (FY) 2020 federal discount rate for water resources projects of 2.75 percent.

An additional budgeting summary has been added to the end of the report to reflect more detailed design costs and the Fiscal Year (FY) 2020 federal discount rate for water resources projects of 2.75 percent.

Scope of the Study

The initial study included the Rush River Basin but as the meetings with the local planning committee progressed the focus became the town of Amenia, ND. While seeing little historic flooding, FEMA designated the community to be mapped for the first time. The analysis of flooding issues for the FEMA mapping effort identified a fairly substantial area of the community with in the 100-year flood plain. Exhibit 1 shows the floodplain map for the City of Amenia and the study area.

Purpose and Need:

To prevent flood damage to homes, businesses and infrastructure within the City of Amenia from the 100-year (1% chance) recurrence interval event.

The City of Amenia

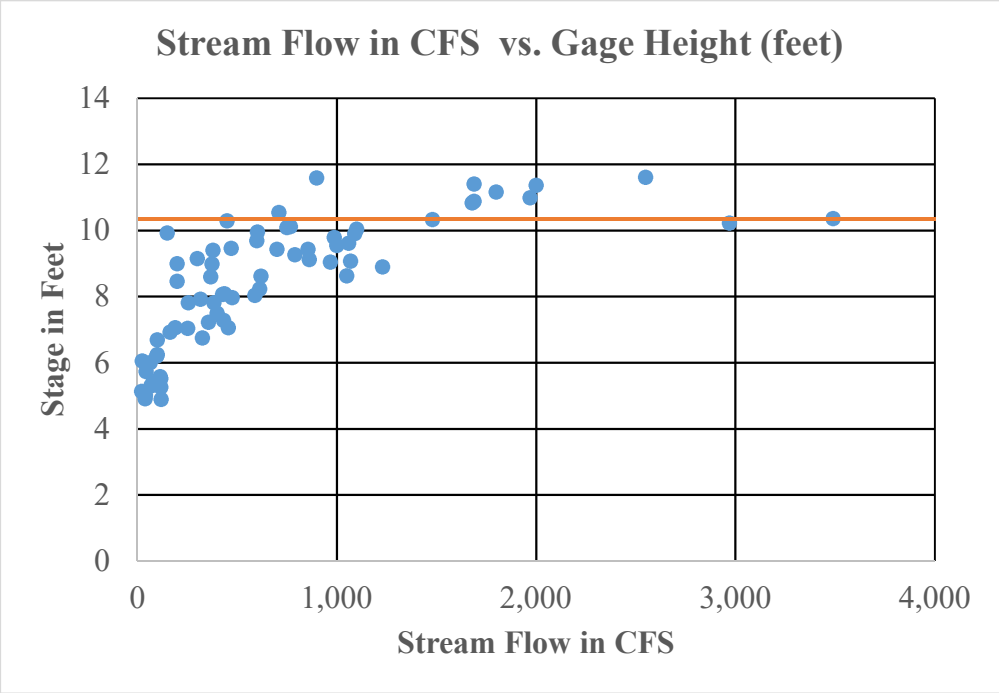
The City of Amenia was founded in 1880 near the home of Eban W. Chaffe a representative of east coast investors from Amenia, New York who looked at the land and an opportunity to participate in the bonanza farming enterprises of that time. The town grew with the addition of a grain mill and depot and by the mid 1880's had a large enough population to attract a church and to build a school.

The population of The City of Amenia reached a recorded peak in 1950 of 127, and currently stands at 96 as of the 2019 census update. Eighty-seven people reported white as their sole race. The community has a broad age distribution of people it cannot be classified as a retirement community nor a young family community. The 2019 census reported that there were approximately 38 occupied residential units. There is no longer a school or church in the community, there is a small building used for government file storage and one business is co located there. Businesses located in Amenia are primarily agricultural service related, and serve a much wider area. Most workers commute by vehicle to jobs outside of Amenia with the average commute estimated at between approximately 21 minutes (2017 American Community Service- ACS). Income is normally distributed with a median income estimated at approximately $74,000 and mean income at approximately $67,000 by the ACS 2017.

The Nature of Flooding

Only one instance of flooding was reported by residents of the community. They have vivid memories of canoeing down the streets in town. While the memory is vivid the date is obscure. They hydrologic and hydraulic analysis estimates the current 50 -year event at 3,365 cfs and the 100 -year event at 4,215 cfs. The highest estimated flow historically was in 1974 at 3,490 just slightly over the 50-year event. However, ice flows and obstructions in the channel have caused 9 or 12% of the historic floods to have elevations higher than the 1974 flood. Figure 1 below shows a plot of the gage data for historic events.

Figure 1



Details on the elevation of those 9 floods below the can be found in the H&H appendix. Based on the anecdotal evidence it is suspected that the remembered flood was either the 1965 or 1969 flood. Gage data for these events may be higher than recorded. There are no actual damage events on which to base the flood damage analysis.

When flooding does occur, it can come directly from the channel north of town or cross country from upstream break outs. The Red River Basin that contains the Rush River is fairly flat and very large floods form a flooded area that looks like the return of Glacial Lake Agassi. From the air the valley looks like a large lake with islands of protected areas. Transportation systems including interstates are inundated often making travel within the valley almost impossible.

The current analysis is based on the FEMA hydrology and hydraulics (H&H) which was the best available at the time of this report. See the H&H appendix for a more detailed discussion.

Floodplain Inventory

To identify the study areas vulnerable properties within the recently mapped FEMA zone A 100 year floodplain and FEMA zone X – outside of the 100 year floodplain but with int the 500 year floodplain were analyzed. There are also some properties in Amenia that are outside of the 500-year floodplain, based on the FEMA analysis. Geographic Information Systems (GIS) tax parcel data was obtained from the Cass County, North Dakota Tax Assessors Offices. The parcels were then allocated using the Assessor's Use Code descriptions into the following categories:

- Residential properties
- Commercial/Industrial businesses (made up of several structures)
- Public (government-owned properties)

The accuracy of the parcels database and Use Codes was verified through a field review, and current photographs of each parcel, and an examination of aerial photography. The structure and type of business was noted.

Structures

Amenia

Exhibit 2 shows the land use in the City of Amenia.

A total of 105 separate structures, with many of them being associated groups of commercial structures, fell within the 500-year floodplain. These structures consist of 41 residential structures (there are three additional structures that are outside the 500 floodplain but within the city boundaries), 16 with basements, 10 commercial properties (there are also some commercial properties and portions of commercial properties outside of the FEMA 500 year boundaries) and 4 vacant residential structures; one 1 public facility and 1 municipal park. An

exterior visual inspection was also done on all properties to estimate the level of the first floor above the ground elevation and to determine whether the structure had a basement and the number of floors.

Those structures are summarized in Table 1.

Table 1 - Parcels by FEMA Flood Zone

Parcels by FEMA flood Zone		
Residential, Business and Public Inventory	**Zone A Parcels**	**Zone X Parcels**
Residential		
No Basement		
One story	9	4
Two story and Split Entry	6	6
With Basement		
One story	5	3
Two story	3	5
Commercial	9	1
Public	2	0
Total	**34**	**19**

Tax assessment data for structure values was validated through field inspection discussions with the County Assessor, a review of current sales and offered properties, and are considered representative of depreciated replacement value. Table 2 sums up the total value of structures in the Amenia 500-year floodplain.

Table 2 - Total value of structures in the Amenia 500-year floodplain

Market Value (Depreciated Replacement Value) of Structures in the Amenia 500-Year Flood Plain		
Structure Type	**Value**	**Percentage**
Residential	$ 3,403,600	33.4%
Garages	$ 111,400	1.1%
Public	$ 8,200	0.1%
Commercial	$ 6,658,220	65.4%
Total	**$ 10,181,420**	**100.0%**

Project Damages and Benefits

Methodology

Based on guidance provided in the in the Red River Regional Conservation Partnership Program Selection Criteria under PL 83-566 dated 8/23/2019 and without a more detailed analysis of the effects of channel blockage and overland flow an abbreviated analysis is used to estimated the benefits for the project. It is the analysis permitted by the above guidance to use the flood insurance data as a proxy for flood damages. For the purpose of this analysis, it is assumed that all businesses and residential properties in Zone A will purchase flood insurance. While those using traditional financing will comply almost immediately there will be a lag time for those that have no current debt relationship with a finance institution. Risk and uncertainty in this methodology will be discussed under the benefit section of the report.

The development of content values in Zone A was done with a mix of interviews for commercial properties and standardized tables. All commercial property owners were contacted by phone and in person if available for interviews. For those that did not respond standardized ratios were used to estimate the content value based on the Table 3. Residential structures were divided into four categories with and without basement, and with one or two stories.

Table 3 - Depth Percent Damage, Content to Structure Value Ratio (CSVR) by Structure Type for the City of Amenia

Depth Percent Damage, Content to Structure Value Ratio (CSVR) by Structure Type For the City of Amenia.		
Description		**CSVR**
1-Story without basement	C	0.46
1-Story with basement	C	0.46
2-Story without basement	C	0.56
2-Story with basement	C	0.56
Split Level	C	0.56
Mobile home	C	0.64
Auto Repair	C	0.7
Beauty Shop	C	1.7
Construction Company	C	0.07
Garage	C	0.068
Office - General	C	1.45
Restaurant	C	0.4
Tavern	C	interview
Warehouse	C	interview

1. Final Report: DEPTH-DAMAGE RELATIONSHIPS FOR STRUCTURES, CONTENTS, AND VEHICLES AND CONTENT-TO-STRUCTURE RATIOS (CSVR) IN SUPPORT OF THE LOWER ATCHAFALAYA REEVALUATION AND MORGANZA TO THE GULF, LOUISIANA FEASIBILITY STUDIES; Dated May, 1997.
2. Analysis for Nonresidential Content Value and Depth Damage Data for Flood Damage Reduction Studies: IWR Report 96-R-12; May, 1996.
3. Final Report DEPTH-DAMAGE RELATIONSHIPS FOR STRUCTURES, CONTENTS, AND VEHICLES AND CONTENT -TO -STRUCTURE RATIOS (CSVR) IN SUPPORT OF THE DONALDSONVILLE TO GULF LOUISIANNA FEASIBILITY STUDY; March, 2006.

Using only those structures in Zone A the structure value and content value is shown in table 4. Included in the commercial total are several large agricultural products and crop input dealers with multiple structure facilities. Interviews with some of those owners indicated that during the

flood season the estimates of the contents at that time of year is equal or in some cases greatly exceed the value of the pole building structure.

Table 4 - Estimated Damages by Event Amenia – Existing Conditions

Structure and Content Value in Zone A to the nearest $100		
Residential, Business and Public Values	**Structure**	**Contents**
Residential	$ 1,590,600	$ 798,000
Commercial/Public	$ 2,187,400	$ 1,839,000
Total	$ 3,778,000	$ 2,637,000

Total Damages Base Year

Estimate Annual Insurance Costs

For the purpose of this analysis, it is assumed that all businesses and residential properties in Zone A will purchase flood insurance. While those with financing will comply almost immediately. Other assumptions will be addressed in the risk and uncertainty analysis.

The most applicable rates for flood insurance can be found in FEMA memo W18021a, dated October 1, 2019, titled "Write Your Own (WYO) Principal Coordinators and the National Flood Insurance Program (NFIP) Servicing Agent" Appendix J Table 2A. Exhibits #3 & #4.

https://nfipservices.floodsmart.gov/sites/default/files/w-18021a.pdf

Annual estimated insurance costs for only those structures in Zone A, the 100-year flood zone, are shown in

Table 5.

Table 5 - Insurance Assuming In Zone A

Insurance Assuming In Zone A	
Using 2020 rate sheet	
Structure	**Without project**
Residential	
Annual Premium	$ 29,600
Administrative Costs	$ 4,200
Subtotal	$ 33,800
Zone A only	**W/0**
Commercial/Public	$ 165,600
Administrative Costs	$ 1,600
Sub Total	$ 167,200
Total All Insurance	**$ 201,000**

This proxy method of analyzing average annual damages for the without project condition estimates that the average annual damages are $201,000.

Benefits Base Year Condition

There are two proposed levee alternatives for Amenia: Alternative 1, the south option shown in Exhibit #5, and Alternative 2, the north option shown in Exhibit #6. Both of these levees will provide protection for the 100-year event and some freeboard protection for the 500-year event. The construction period is one year and the base year for project completion is two years from now given the provision of total construction funding.

Average Annual Benefits for 100-year protection

There is no regulatory requirement for insurance purchase for Zone X. So that portion of the floodplain is not included in either the damages or benefit calculation. It is unlikely that anyone will continue with flood insurance after the project is in place. For this analysis the average annual benefits for either alternative is the benefit of reduced flood insurance payments

is estimated at $ 201,000.

Risk and Uncertainty

Risk and uncertainty in the estimated proxy for damages and benefits comes from a number of factors.

The actual probabilities or risk of stages exceeding those identified by the FEMA study will be completed in the design stage of the project. The available H&H analysis does not account for cross country flow evidence of which can be seen in Google Earth maps for the latest year. Given the trends in the basin it is likely that higher flows and more frequent flooding is a possibility. Until there is a further refinement of the infrequent flood analysis to account for overland flow and channel obstruction flood risk cannot be more accurately assessed which is why the FEMA insurance method was chosen to approximate the damages. The lack of clarity in risk also doesn't allow for an accurate estimate of other damages such as vehicle damages although they likely to occur because of the inundated transportation system makes it unlikely they will be moved.

Uncertainty is present in all economic analysis. The estimate is based on the proxy of insurance costs. There is of course uncertainty as to whether the insurance premiums actually represent the annualized flood damages but that is unknowable without different hydrology. But even if it is an accurate representation of insurable losses it does not represent all losses nor compensating payments. Separate residential garages are not insurable under the national flood insurance program nor is basement content. Therefore, additional losses could be incurred that are not covered by insurance compensation. In addition, because there is no good way at this time to estimate actual damages resulting in insurance pay outs that would be subtracted from this total. There are additional unknowns as to the percentage of structures that would immediately be required to purchase flood insurance. While estimates of residential mortgages in communities are made by the census the formulation and selection of an alternative is not sensitive to the residential portion of the insurance payments. Residential payments could be eliminated from the benefits and the same alternative would still be selected and the project would still be feasible. Commercial insurance payments used are based on the best available information which is the FIA rate table but is likely to be presented as a package with the

individual insurers calculating the overall risk for the property from all perils and including it in a lump sum quote. This is likely unknowable because this is information businesses are unlikely to disclose.

Based on a 50-year project life these benefits support capital costs of $ 6,991,300 at an interest rate of 2.75%, and $ 2,871,400 at an interest rate of 7.0%.

Benefits Future Conditions

The City of Amenia has been fairly stable in population with new houses replacing some of the old and older structures being remodeled. There is no current demand internally or externally to develop the City. Although both alternatives inadvertently protect additional land to provide sound levee design and that does present some opportunity for intensification, other constraints such as sewer and water limitations from fairly new systems represent a significant constraint. No future intensification benefits have been taken for this analysis.

Regional Losses and Benefits

The loss of income to households and increased cost for businesses will ripple through the Cass County economy. A simple analysis of the impact on the Cass County economy was done by Dean Bangsund, a regional economist at North Dakota State University, using the IMPLAN model for Cass County. For the purposes of this analysis the damages were broken into two categories residential and commercial.

Only one commercial sector was selected the warehouse sector which was assumed to be fairly representative of the activity of the largest contributor to the economic loss and similar to other businesses. Buildings included as warehouses are metal pole buildings and large agricultural bins which store agricultural inputs and products which can exceed the value of the structure. It was also assumed that it would be a loss to business expenses not in return to shareholders.

Additional regional losses over and above their direct expenditure in the residential sector were $33,800.

Table 6 - Cass County - Reduction on Regional Household expenditures flood insurance

Cass County - Reduction on Regional Household expenditures flood insurance				
Impact Type	**Employment**	**Labor Income**	**Total Value Added**	**Output**
Direct Effect	0.0	$ -	$ -	$ -
Indirect Effect	0.6	$ 14,000	$ 29,900	$ 43,800
Induced Effect	0.2	$ 3,400	$ 6,000	$ 10,000
Total Effect	**0.8**	**$ 17,400**	**$ 35,900**	**$ 53,800**

The losses in additional expenditures in the business sector assuming a change in operating costs are shown in Table 7.

Table 7 - Cass County - Impact of decreased business spending

Cass County - Impact of decreased business spending				
Impact Type	**Employment**	**Labor Income**	**Total Value Added**	**Output**
Direct Effect	0.0	$ -	$ -	$ -
Indirect Effect	2.0	$ 94,700	$ 140,500	$ 220,600
Induced Effect	0.5	$ 23,200	$ 40,200	$ 68,100
Total Effect	**2.5**	**$ 117,900**	**$ 180,700**	**$ 288,700**

If the assumption is made that administrate costs stayed in the community the RED losses would be approximately 2.8 % lower.

Estimated total annual regional economic loss, including NED loss, equals $ 543,500.

Benefit-Cost Summary

Table #8 presents a summary of project benefits, costs, and benefit-cost ratios applicable to the alternatives considered for implementation and interest rate. The applicable interest rate used for discounting and amortization purposes for 2020 planning studies is 2.75%. A benefit-

cost ratio using a rate of 7% is also presented.

Project costs – Total project cost for Alternative 1, the levee around Amenia, is estimated at $3,282,200. For Alternative 2, the levee along the river, total project cost is estimated at $5,500,000. These costs include the costs of emergency closures during floods. Although it is uncertain when or how frequently they would be used to insure that the costs are covered they were added to the first costs and thus have the greatest impact on the benefit cost ratio. Costs are expressed in October 2020 price level.

Interest during construction – Interest during construction accounts for the opportunity cost of funds set aside during the construction season that could otherwise be applied to alternative investments. The construction season over which this cost is generated is one year in length. The applicable interest rate is 2.75%.

Operation, maintenance, replacement costs – Annual operation and maintenance costs include mowing ($5,000), rodent abatement ($1,000), lift station maintenance ($3,000) and electricity ($1,000). In addition, pump replacements ($50,000 total cost with an annual cost of $2,000 per year) will be necessary midway through the 50-year project life. Lastly, there will be a cost to provide temporary road closure of approximately $25,000 likely occurring once during the project life to provide additional freeboard during a 100 year flood event (with a cost of $1,050 per year for the temporary road closures). In total, these costs amount to $13,050 per year.

Benefit-cost ratio – Of the four alternative/interest rate combinations presented in Table #8, only Alternative 1 at 2.75% appears to be an economically feasible option. This is also the only option with positive Net Benefits, the metric used for the purpose of plan selection.

Table 8 - Benefit – Cost Summary

Benefit – Cost Summary				
	BCRs @ 2.75%		BCRs @7%	
Item	Alt 1	Alt 2	Alt 1	Alt 2
Project Cost	$ 3,282,200	$ 5,500,000	$ 3,282,200	$ 5,500,000
Interest during Construction	$ 44,800	$ 75,300	$ 112,900	$ 189,700
Total Investment	**$ 3,3247,00**	**$ 5,575,300**	**$ 3,395,100**	**$ 5,689,700**
Int. & Amort. Over 50 years	$ 123,200	$ 207,100	$ 246,000	$ 413,300
Avg. Annual OM&R	$ 13,050	$ 13,050	$ 13,050	$ 13,050
Total Avg. Annual Cost	**$ 136,250**	**$ 220,150**	**$ 259,050**	**$ 426,350**
Avg. Annual Benefits	$ 201,000	$ 201,000	$ 201,000	$ 201,000
Net Benefits	**$ 64,750**	**$ -19,150**	**$ -58,050**	**$ -225,350**
Benefit-Cost Ratio	**1.475**	**0.91**	**0.77**	**0.47**

Alternative 1 is the NED plan and the preferred plan.

Regional Economic Development Benefits

In addition to the prevention of annual losses of $ 543,500 to the regional economy identified above the preferred alternative would provide a one time increase in household income from local labor hired for the project. The estimated labor cost for the project. The labor portion of project costs is estimated to be $594,100. Given that Cass County is the heart of the metro region and contains all of the essential services it is likely that this labor will come from the local area. Unlike the other RED benefits which will be annual these are a one time boost to the local economy.

Table 9 - Cass County - Increase in Regional Household expenditures from local labor for construction

Cass County - Increase in Regional Household expenditures from local labor for construction				
Impact Type	**Employment**	**Labor Income**	**Total Value Added**	**Output**
Direct Effect	0.0	$ -	$ -	$ -
Indirect Effect	0.6	$ 246,400	$ 525,500	$ 769,100
Induced Effect	0.2	$ 60,200	$ 104,400	$ 177,100
Total Effect	**0.8**	**$ 306,600**	**$ 629,900**	**$ 946,200**

Exhibits

Appendix D-3-E

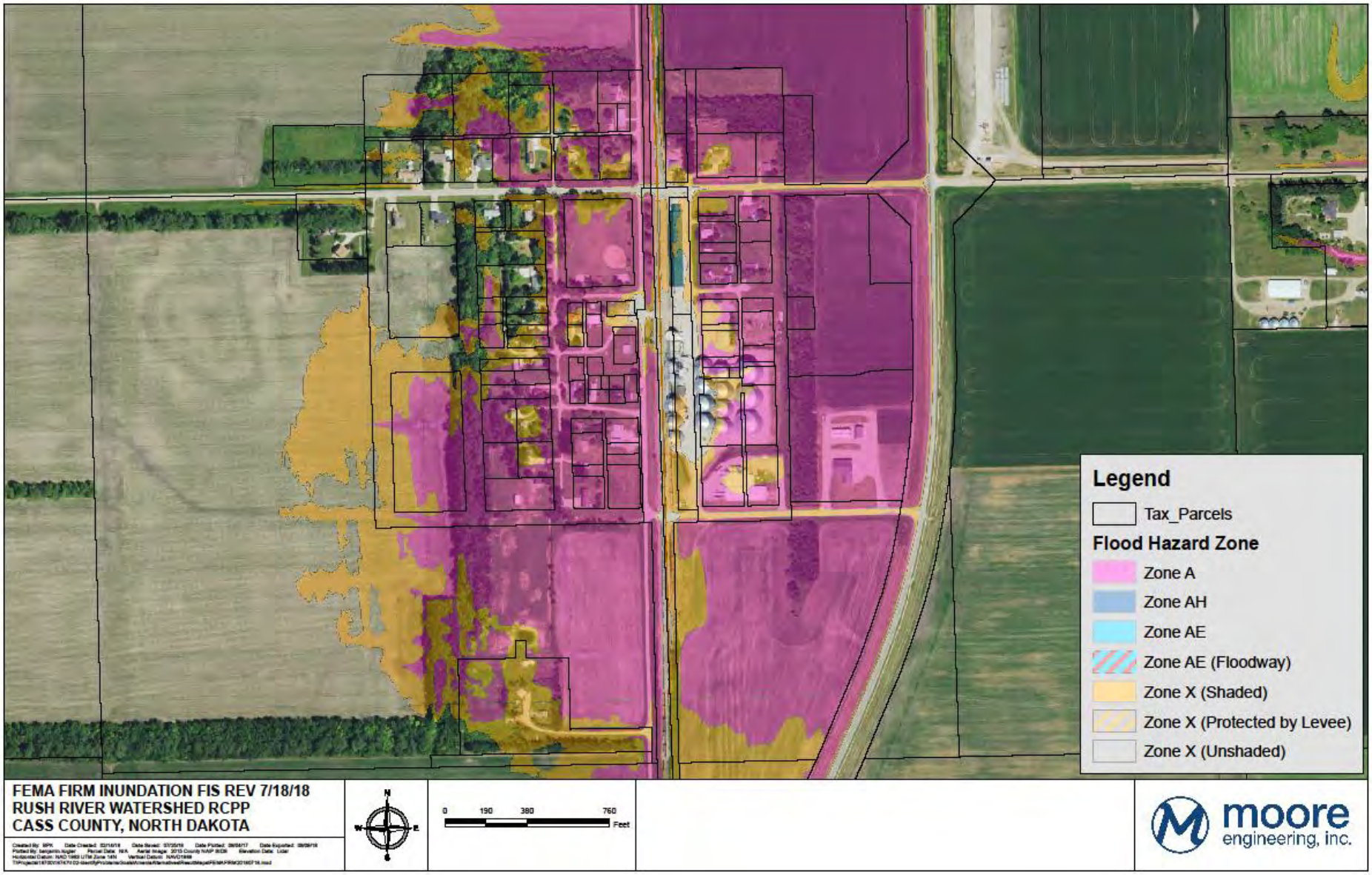

Legend
Tax_Parcels
Flood Hazard Zone
Zone A
Zone AH
Zone AE
Zone AE (Floodway)
Zone X (Shaded)
Zone X (Protected by Levee)
Zone X (Unshaded)
FEMA FIRM INUNDATION FIS REV 7/18/18
RUSH RIVER WATERSHED RCPP
CASS COUNTY, NORTH DAKOTA
N
W
E
0
190
380
760
Feet
moore
engineering, inc.

Exhibit 1

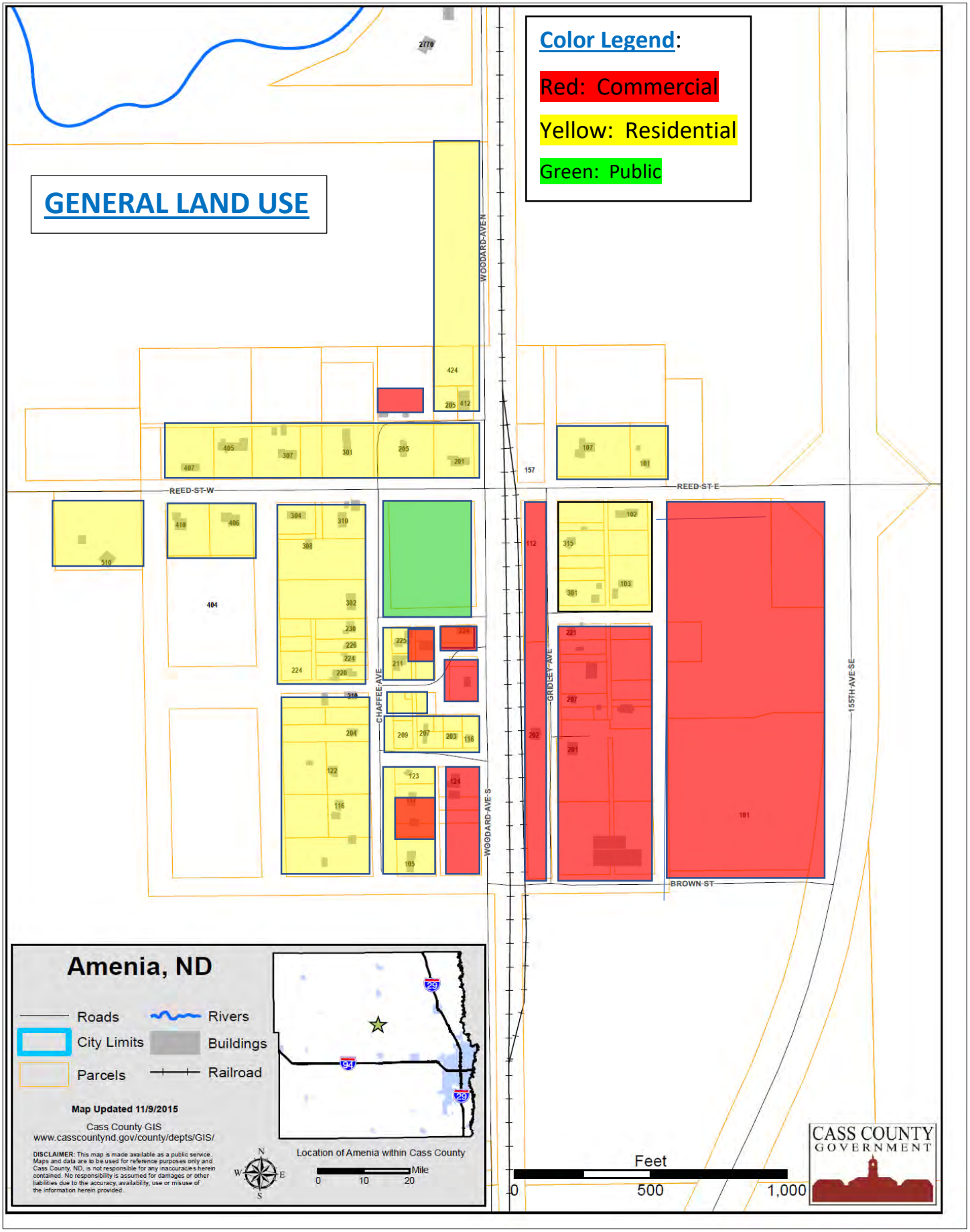
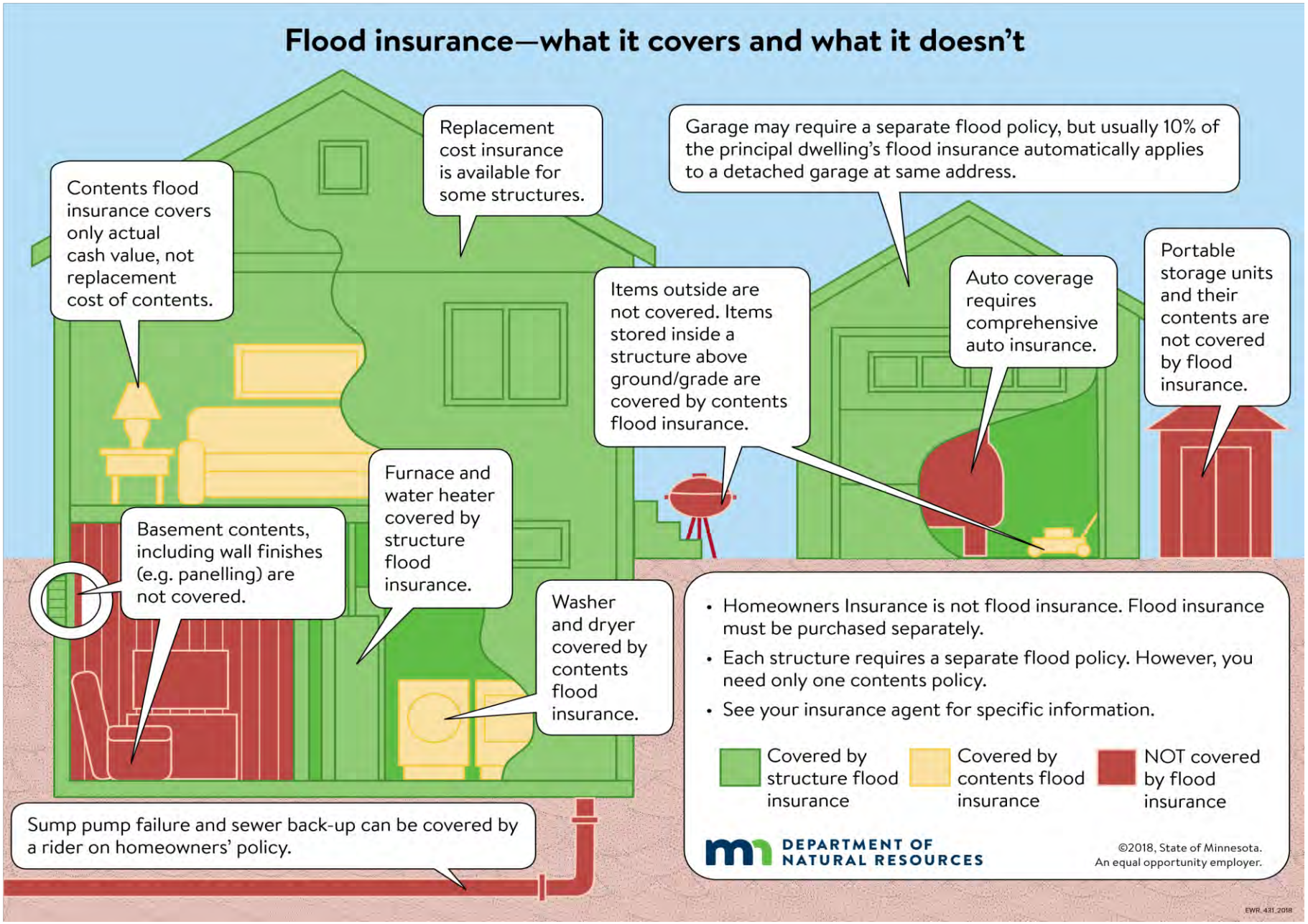

GENERAL LAND USE
Color Legend:
Red: Commercial
Yellow: Residential
Green: Public
WOODARD AVE N
REED ST W
REED ST E
CHAFFEE AVE
GRIDLEY AVE
WOODARD AVE S
155TH AVE SE
BROWN ST
Amenia, ND
Roads
City Limits
Parcels
Rivers
Buildings
Railroad
Map Updated 11/9/2015
Cass County GIS
www.casscountynd.gov/county/depts/GIS/
DISCLAIMER: This map is made available as a public service. Maps and data are to be used for reference purposes only and Cass County, ND, is not responsible for any inaccuracies herein contained. No responsibility is assumed for damages or other liabilities due to the accuracy, availability, use or misuse of the information herein provided.
Location of Amenia within Cass County
Mile
0 10 20
Feet
0 500 1,000
CASS COUNTY GOVERNMENT

Exhibit 2


Flood insurance—what it covers and what it doesn't
Contents flood insurance covers only actual cash value, not replacement cost of contents.
Replacement cost insurance is available for some structures.
Garage may require a separate flood policy, but usually 10% of the principal dwelling's flood insurance automatically applies to a detached garage at same address.
Items outside are not covered. Items stored inside a structure above ground/grade are covered by contents flood insurance.
Auto coverage requires comprehensive auto insurance.
Portable storage units and their contents are not covered by flood insurance.
Furnace and water heater covered by structure flood insurance.
Basement contents, including wall finishes (e.g. panelling) are not covered.
Washer and dryer covered by contents flood insurance.
Sump pump failure and sewer back-up can be covered by a rider on homeowners' policy.
• Homeowners Insurance is not flood insurance. Flood insurance must be purchased separately.
• Each structure requires a separate flood policy. However, you need only one contents policy.
• See your insurance agent for specific information.
Covered by structure flood insurance
Covered by contents flood insurance
NOT covered by flood insurance
DEPARTMENT OF NATURAL RESOURCES
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EWR-431-2018

Exhibit 3

RATE TABLE 2A. REGULAR PROGRAM – PRE-FIRM CONSTRUCTION RATES[1, 2]

ANNUAL RATES PER $100 OF COVERAGE (Basic/Additional)

FIRM ZONES A, AE, A1–A30, AO, AH, D[3]

	OCCUPANCY	SINGLE FAMILY		2–4 FAMILY		OTHER RESIDENTIAL		NON-RESIDENTIAL BUSINESS[4]		OTHER NON-RESIDENTIAL[4]	
		Building	Contents	Building	Contents	Building	Contents	Building	Contents	Building	Contents
BUILDING TYPE	No Basement/Enclosure	1.12 /1.03	1.41 /1.84	1.12 /1.03		1.12 /2.16		2.36 /4.43		1.22 /2.26	
	With Basement	1.20 /1.51	1.41 /1.55	1.20 /1.51		1.12 /1.80		2.49 /4.32		1.28 / 2.22	
	With Enclosure[5]	1.20 /1.81	1.41 /1.84	1.20 /1.81		1.20 /2.24		2.49 /5.47		1.28 /2.79	
	Elevated on Crawlspace	1.12 /1.03	1.41 /1.84	1.12 /1.03		1.12/2.16		2.36/4.43		1.22 /2.26	
	Non-Elevated with Subgrade Crawlspace	1.12 /1.03	1.41 /1.55	1.12 /1.03		1.12/2.16		2.36/4.43		1.22 /2.26	
	Manufactured (Mobile) Home[6]	1.12 /1.03	1.41 /1.84					2.36/4.43		1.22 /2.26	
CONTENTS LOCATION	Basement & Above[7]				1.41 /1.55		1.41/1.55		4.68 / 7.42		2.39 /3.78
	Enclosure & Above[8]				1.41 /1.84		1.41/1.84		4.68 / 8.90		2.39 /4.52
	Lowest Floor Only – Above Ground Level				1.41/1.84		1.41/1.84		4.68 / 3.89		2.39/ 1.99
	Lowest Floor Above Ground Level and Higher Floors				1.41 /1.28		1.41/1.28		4.68 / 3.31		2.39 /1.71
	Above Ground Level – More Than 1 Full Floor				.35 / .12		.35 / .12		.24/ .12		.24/ .12
	Manufactured (Mobile) Home[6]								4.68 / 3.89		2.39 /1.99

FIRM ZONES V, VE, V1–V30

	OCCUPANCY	SINGLE FAMILY		2–4 FAMILY		OTHER RESIDENTIAL		NON-RESIDENTIAL BUSINESS[4]		OTHER NON-RESIDENTIAL[4]	
		Building	Contents	Building	Contents	Building	Contents	Building	Contents	Building	Contents
BUILDING TYPE	No Basement/Enclosure	1.46 / 2.57	1.81/ 4.39	1.46 / 2.57		1.46 / 4.72		3.14 /10.75		1.63 / 5.46	
	With Basement	1.56 / 3.80	1.81 / 3.72	1.56/ 3.80		1.56 / 7.02		3.31 /15.99		1.71/ 8.10	
	With Enclosure[5]	1.56 / 4.49	1.81 / 4.37	1.56 / 4.49		1.56 / 7.85		3.31 /17.83		1.71/ 9.04	
	Elevated on Crawlspace	1.46 / 2.57	1.81/ 4.39	1.46 / 2.57		1.46 / 4.72		3.14 /10.75		1.63 / 5.46	
	Non-Elevated with Subgrade Crawlspace	1.46 / 2.57	1.81 / 3.72	1.46 / 2.57		1.46 / 4.72		3.14 /10.75		1.63 / 5.46	
	Manufactured (Mobile) Home[6]	1.46/ 8.00	1.81 / 4.37					3.14 /30.38		1.63 /15.36	
CONTENTS LOCATION	Basement & Above[7]				1.81/ 3.72		1.81/ 3.72		6.17 /18.86		3.14 / 9.55
	Enclosure & Above[8]				1.81 / 4.37		1.81 / 4.37		6.17 /20.40		3.14 /10.31
	Lowest Floor Only – Above Ground Level				1.81 / 4.37		1.81 / 4.37		6.17 /17.09		3.14 / 8.66
	Lowest Floor Above Ground Level and Higher Floors				1.81 / 3.84		1.81 / 3.84		6.17 /14.75		3.14/ 7.48
	Above Ground Level – More Than 1 Full Floor				.54 / .47		.54 / .47		.52/ .67		.52/ .67
	Manufactured (Mobile) Home[6]								6.17 /28.41		3.14 /14.37

FIRM ZONES A99, B, C, X

	OCCUPANCY	SINGLE FAMILY		2–4 FAMILY		OTHER RESIDENTIAL		NON-RESIDENTIAL BUSINESS[4]		OTHER NON-RESIDENTIAL[4]	
		Building	Contents	Building	Contents	Building	Contents	Building	Contents	Building	Contents
BUILDING TYPE	No Basement/Enclosure	1.10 / .30	1.69 / .53	1.10 / .30		1.04 / .30		1.04 / .30		1.04/ .30	
	With Basement	1.23 / .42	1.89 / .62	1.23 / .42		1.32 / .42		1.32 / .42		1.32 / .42	
	With Enclosure[5]	1.23 / .46	1.89 / .70	1.23 / .46		1.32 / .46		1.32 / .46		1.32 / .46	
	Elevated on Crawlspace	1.10 / .30	1.69 / .53	1.10 / .30		1.04 / .30		1.04 / .30		1.04/ .30	
	Non-Elevated with Subgrade Crawlspace	1.10 / .30	1.69 / .53	1.10 / .30		1.04 / .30		1.04 / .30		1.04/ .30	
	Manufactured (Mobile) Home[6]	1.10 / .54	1.69 / .53					1.32 / .58		1.32 / .58	
CONTENTS LOCATION	Basement & Above[7]				2.13 / .80		2.13 / .80		2.18 / .87		2.18 / .87
	Enclosure & Above[8]				2.13 / .91		2.13 / .91		2.18 /1.01		2.18 /1.01
	Lowest Floor Only – Above Ground Level				1.69 / .84		1.69 / .84		1.35 / .62		1.35 / .62
	Lowest Floor Above Ground Level and Higher Floors				1.69 / .53		1.69 / .53		1.35 / .43		1.35 / .43
	Above Ground Level – More Than 1 Full Floor				.35 / .12		.35 / .12		.22 / .12		.22 / .12
	Manufactured (Mobile) Home[6]								1.18 / .75		1.18 / .75

1. Pre-FIRM construction refers to a building that has a date of construction or substantial improvement date on or before 12/31/74, or before the effective date of the initial Flood Insurance Rate Map (FIRM), whichever is later. If there has been a lapse in coverage, refer to Table 10, Pre-FIRM Subsidized Rate Ineligibility Determination, to confirm whether Pre-FIRM subsidized rates can be used.
2. Refer to Table 11, Pre-FIRM Rate Table Hierarchy, to determine which Pre-FIRM rate table to use.
3. Pre-FIRM buildings may use Post-FIRM elevation rating if more favorable to the insured. However, when the lowest floor elevation is below the Base Flood Elevation (BFE), follow the Submit-for-Rate procedures for policy processing.
4. For further guidance on Non-Residential Business and Other Non-Residential occupancies, refer to the Before You Start section of this manual.
5. For an elevated building on a crawlspace with an attached garage without openings, use “With Enclosure” rates.
6. Manufactured (Mobile) Homes include travel trailers that meet the definition of a building; refer to Appendix L: Definitions in this manual.
7. Includes subgrade crawlspace.
8. Includes crawlspace.

Exhibit 4

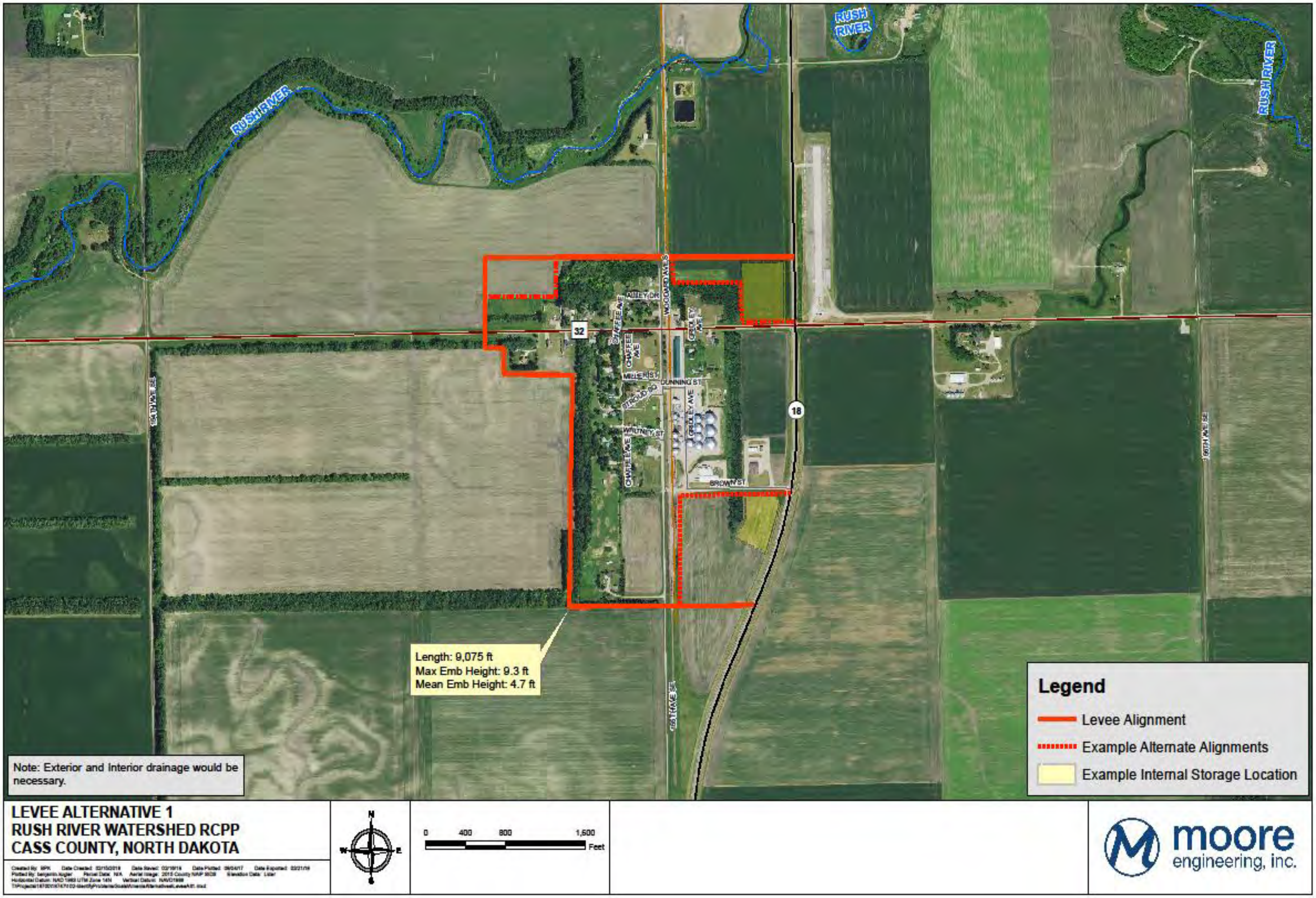
RUSH RIVER
RUSH RIVER
RUSH RIVER
32
18
MILLER ST
DUNNING ST
WHITNEY ST
BROWN ST
Length: 9,075 ft
Max Emb Height: 9.3 ft
Mean Emb Height: 4.7 ft
Legend
Levee Alignment
Example Alternate Alignments
Example Internal Storage Location
Note: Exterior and Interior drainage would be necessary.
LEVEE ALTERNATIVE 1
RUSH RIVER WATERSHED RCPP
CASS COUNTY, NORTH DAKOTA
N
0 400 800 1,600
Feet
moore engineering, inc.

Exhibit 5


Length: 10,085 ft
Max Emb Height: 4.9 ft
Mean Emb Height: 2.1 ft
RUSH RIVER
RUSH RIVER
32
18
Note: Levee alignment in relation to stream contingent on geotechnical evaluation.
Legend
Levee Alignment
LEVEE ALTERNATIVE 2
RUSH RIVER WATERSHED RCPP
CASS COUNTY, NORTH DAKOTA
0 400 800 1,600
Feet
moore engineering, inc.

Exhibit 6