



**TECHNICAL MEMORANDUM
ECONOMIC ASSESSMENT
MUNCY BOROUGH
LYCOMING COUNTY, PENNSYLVANIA**



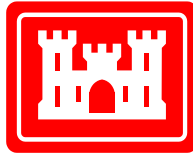
Prepared for: ***Lycoming County Planning and
Community Development Department
48 West Third Street
Williamsport, Pennsylvania 17701***

Prepared by: ***U.S. Army Corps of Engineers
Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201***

MARCH 2022

This page intentionally left blank

**TECHNICAL MEMORANDUM
ECONOMIC ASSESSMENT
FOR
MUNCY BOROUGH
LYCOMING COUNTY, PENNSYLVANIA**



Prepared For:

Lycoming County Planning and
Community Development Department
48 West Third Street
Williamsport, Pennsylvania 17701

Prepared By:

U.S. Army Corps of Engineers
Baltimore District
2 Hopkins Plaza
Baltimore, Maryland 21201

MARCH 2022

This page intentionally left blank

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1. BACKGROUND.....	1
1.2. PURPOSE OF STUDY	1
1.3. STUDY AUTHORITY	1
1.4. STUDY AREA.....	2
2. METHODOLOGY	2
2.1. HYDROLOGY INPUTS.....	3
2.2. ASSUMPTIONS	4
3. FLOOD DAMAGE COMPUTATION RESULTS.....	4
3.1. FUTURE WITHOUT PROJECT CONDITIONS	6
4. FLOODPRONE BUILDING INVENTORY GIS DATA-LAYER.....	7

FIGURES

Figure 1.1: Glade Run 10-Year Storm – Damages by Structure

Figure 1.2: Glade Run 100-Year Storm – Damages by Structure

Figure 2.1: Muncy Creek 10-Year Storm – Damages by Structure

Figure 2.2: Muncy Creek 100-Year Storm – Damages by Structure

Figure 3.1: Western Branch Susquehanna River 10-Year Storm – Damages by Structure

Figure 3.2: Western Branch Susquehanna River 100-Year Storm – Damages by Structure

ATTACHMENTS

Electronic Project Disc (Digital Report, GIS Data)

This page intentionally left blank

1. INTRODUCTION

1.1. BACKGROUND

According to the Greater Muncy Resilience Plan Scope of Work, dated June 2016, the Greater Muncy Area, Lycoming County, Pennsylvania, has experienced significant damages from flooding throughout the years, with the most recent flooding occurring during 2011's Tropical Storm Lee. The convergence of Glade Run, Muncy Creek, and the West Branch Susquehanna River contribute to 41% of all commercial and residential structures being located in the 100-year (1% annual chance) floodplain. With the majority of the structures being built before 1980, most buildings are not built to be resilient to continual flooding.

The partnership of Muncy Borough, Lycoming County, and the Pennsylvania Department of Community and Economic Development have requested the assistance of the U.S. Army Corps of Engineers (USACE), Baltimore District, in providing floodplain management support to complete tasks outlined in the Greater Muncy Resilience Plan Scope of Work.

This technical memorandum serves as an appendix to the *Flood Risk Assessment for Muncy Borough* study completed by USACE, Baltimore District for the Lycoming County Planning and Community Development office in July 2019. For additional background information and results from the hydraulic and hydrologic analyses of the riverine flooding for the Greater Muncy Area, the background details on the study area, and data sources utilized, please refer to the above-mentioned report. Collection methodology for the building surveys which provide the structure elevation inputs for the flood damages model can be found in Section 2.3 of that report.

1.2. PURPOSE OF STUDY

The purpose of this technical memorandum is to report the data, methodology and results of the economic analysis of the existing and future without project condition damages to properties in the Greater Muncy Area from flood events associated with the three pertinent riverine flood sources (Glade Run, Muncy Creek, and the West Branch Susquehanna River).

1.3. STUDY AUTHORITY

This study was conducted by the Planning Division of the USACE, Baltimore District, under the the Planning Assistance to States (PAS) program, which is authorized by Section 22 of the Water Resources Development Act of 1974 (PL93-251), as amended. The PAS program is designed to provide planning-level assistance to communities and partners for water resource related issues. No detailed design or construction will result from this investigation. Lycoming County served as the non-federal project sponsor for this effort.

1.4. STUDY AREA

The study area is the area within Muncy Borough limits (Figure 1).



Figure 1. Study area for the economic analysis was confined to the Muncy Borough limits

2. METHODOLOGY

The USACE Hydraulic Engineering Center Flood Damage Analysis (HEC-FDA) tool (version 1.4.2) was used to model storm damages for the properties within the study area of Muncy Township, PA. The HEC-FDA model is built and supported by the USACE to perform Monte-Carlo simulation-based estimation of flood damages using calculated flood levels, surveyed structure elevations (e.g., elevation of lowest opening, first floor elevations) structure and content values, and specified depth-damage functions which attribute percentage damages to certain depths of structure and content flooding. Structure values were collected from the Lycoming County Assessment Office web app viewer website, using the tax assessed improvement value for each structure. This tax assessed data was collected in November, 2021 (<https://lyco.maps.arcgis.com/apps/webappviewer/index.html>).

Depth-damage functions from the USACE Institute for Water Resources (IWR) are used to calculate the percentage of the value of the structure and its contents that is damaged at a given flood water level. These functions use stages to represent feet above or below a structure's elevation at which flood waters would begin to cause damages to that property and calculate a percentage of the total value (both structure and content value) which is lost at that water depth. Table 1 lists a selection of depth damage functions for the various occupancy types found within

the Muncy Borough study area. Data for structures in the study area was collected using a combination of field survey techniques and desktop analysis. The structural inventory includes data on features such as number of stories, building use, square footage, presence of a basement, and is included as a GIS shapefile as a part of this study.

Occupancy Type	Category Name	Damage Type	Stage												
			-2	-1	0	1	2	3	4	5	6	7	8	9	10
One Story, No Basement															
IWR1	Residential	Structure	0	2.5	13.4	23.3	32.1	40.1	47.1	53.2	58.6	63.2	67.2	70.5	73.2
IWR1	Residential	Contents	0	2.4	8.1	13.3	17.9	22	25.7	28.8	31.5	33.8	35.7	37.2	38.4
Two Stories, No Basement															
IWR2	Residential	Structure	0	3	9.3	15.2	20.9	26.3	31.4	36.2	40.7	44.9	48.8	52.4	55.7
IWR2	Residential	Contents	0	1	5	8.7	12.2	15.5	18.5	21.3	23.9	26.3	28.4	30.3	32
One Story, With Basement															
IWR4	Residential	Structure	13.8	19.4	25.5	32	38.7	45.5	52.2	58.6	64.5	69.8	74.2	77.7	80.1
IWR4	Residential	Contents	10.5	13.2	16	18.9	21.8	24.7	27.4	30	32.4	34.5	36.3	37.7	38.6
Two Stories, With Basement															
IWR5	Residential	Structure	10.2	13.9	17.9	22.3	27	31.9	36.9	41.9	46.9	51.8	56.4	60.8	64.8
IWR5	Residential	Contents	8.4	10.1	11.9	13.8	15.7	17.7	19.8	22	24.3	26.7	29.1	31.7	34.4
Nonresidential, No Basement															
N13	Nonresidential	Structure	0	0	0	9	16.8	23.7	29.7	35	39.6	43.7	47.2	50.3	53
N13	Nonresidential	Contents	0	0	0	21.6	36.6	47.1	54.4	59.5	63	65.5	67.2	68.4	69.2
Nonresidential, With Basement															
N14	Nonresidential	Structure	0	0	6.7	14.9	22	28.2	33.7	38.5	42.7	46.3	49.5	52.3	54.8
N14	Nonresidential	Contents	0	0	9.7	28.3	41.3	50.4	56.7	61.1	64.1	66.3	67.7	68.8	69.5

Table 1. Depth Damage Functions utilized for the Muncy Bourgh economic analysis; these are IWR derived percentage damages for a structure and its contents at each specified stage (water depth) based on occupancy type. Per this depth damage function table, an IWR1 occupancy type structure (i.e. a residential one story, with no basement) experiencing a flood event of 3 feet of water at the structure will have the a total calculated damages equal to 40.1% of its structure value plus 22% of its content value.

Project benefits were not calculated for this analysis, as the purpose at this stage of the study was to calculate the existing condition damages and future conditions “without-project” (no flood risk reduction projects considered). A discount rate of 2.25% was used over the 50-year period of analysis with the Capital Recovery Factor of 0.034 to annualize the damages. A future study effort could include conceptual level development of flood risk reduction alternatives (known as “with-project” conditions) for the Muncy Borough area, which would allow for an economic benefits calculation due to reduction in flood damages from those conceptual alternatives.

2.1. HYDROLOGY INPUTS

For this analysis three separate models were run, one for each flood source in the study area as flooding events from the three different sources can be considered mutually exclusive based on their hydrologic inputs. Each model was calculated using one reach; Glade Run (GR), Muncy

Creek (MC), and West Branch of the Susquehanna (WBS) respectively. Flooding from Glade Run is concentrated in the center of town, with structures on the eastern and western edges of the study area outside of that floodplain. Flooding from Muncy Creek primarily affects structures on the northern edge of town, as the creek flows into the Susquehanna from north of Muncy Township. Finally, the West Branch Susquehanna flood plain encompasses the majority of structures surveyed, with only ten structures located on the town's southeastern edge falling outside of it.

Eight water surface profiles and their associated Annual Exceedance Probabilities (AEP) (0.5, 0.2, 0.1, 0.04, 0.02, 0.01, 0.005, and 0.002) developed under the 2019 USACE study were entered into the model for existing conditions and future without-project conditions. These AEPs reflect flood events of the 2, 5, 10, 25, 50, 100, 200, and 500-year storm events, respectively.

2.2. ASSUMPTIONS

The following assumptions are made for this analysis:

- a. Inflation is not factored into the analysis and all prices are in constant FY 2022 dollars
- b. Land use zoning and construction codes will not change during the period of analysis
- c. Damaged or destroyed properties will be restored to pre-storm conditions and remain in the structure inventory for the 50-year period of analysis
- d. Empirical storm frequencies are based on historical records and indicate the probability of future events
- e. Damages are related to the elevation of residential and non-residential structures and their contents; roads, bridges, vehicles, and other assets are not in the inventory

3. FLOOD DAMAGE COMPUTATION RESULTS

Six-hundred and ninety-six (696) total structures were found to be affected by flooding in some capacity, however no flooding source impacts the entire study area. The Glade Run floodplain includes 308 of the 696 structures in the inventory; the Muncy Creek floodplain includes 459 structures; and the West Branch Susquehanna floodplain includes 686 structures.

Site surveys were conducted for the study area to collect data on foundation type, low opening, low floor, and ground elevation. Desktop analysis using Google Earth and a Google Search was conducted to determine building uses for nonresidential properties as well as the occupancy type for each structure in the study area. The value of both the residential and nonresidential structures was found using the tax assessed value listed on the Lycoming County Tax Assessment website.

Content value for each structure was predetermined using content to structure ratio for each structure type. Standard Industrial Classification (SIC) codes were gathered for each non-residential property type. The Analysis of Nonresidential Content Value and Depth-Damage for Flood Damage Reduction Studies (IWR Report 96-R-12 May 1996) was used to calculate the content value ratio for the non-residential properties in the study area. For residential properties, content value is assumed to be equal to the value of each structure, since the depth-damage functions model content damage as a percentage of the structure value. Table 2 shows the Lycoming County Tax Assessed Value, which for this analysis was utilized as the Structure Value,

for a sample of properties from the inventory. Table 3 breaks down the study area by occupancy types and lists total values of structures in dollars.

Structure ID	Structure Address	Tax Assessed Value (\$)	Number of Stories	Structure Value in the Inventory (\$)
28	19 South Washington St	\$60,470	2	\$60,470
33	107 Sherman St	\$51,630	2	\$51,630
44	35 Green St	\$73,260	2	\$73,260
87	255 Pepper St	\$43,090	2	\$43,090
142	104 E Mechanic St	\$48,770	2	\$48,770
248	110 North Main St	\$74,860	2	\$74,860
387	56 Green St	\$65,590	1	\$65,590
623	45 Heberling Rd	\$68,630	2	\$68,630

Table 2: Sample of Muncy structural inventory Structure Values

Structure Occupancy Type	Description	Number of Structures	Total Structure Value by Occupancy Type (\$)	Total Content Value by Occupancy Type (\$)	Total Value (\$)
IWR1	One Story/ No Basement	72	\$9,587,860	\$9,587,860	\$19,175,720
IWR2	Two Story/ No Basement	2	\$127,880	\$127,880	\$255,760
IWR4	One Story/ With Basement	3	\$102,440	\$102,440	\$204,880
IWR5	Two Story/ With Basement	478	\$29,335,050	\$29,335,050	\$58,670,100
N13	Nonresidential/ No Basement	95	\$16,709,950	\$13,699,040	\$31,088,290
N14	Nonresidential/ With Basement	46	\$8,768,800	\$5,047,480	\$13,816,280
Total		696	\$70,473,960	\$65,846,430	\$136,320,390

Table 3: Structure types and total counts and values by structure type

3.1. FUTURE WITHOUT PROJECT CONDITIONS

A 50-year period was used to analyze and determine the future “without-project” conditions for the study area of Muncy Township. Table 4 displays annual and total annualized damages across the period of analysis by reach. Total damages are calculated using a Capital Recovery Factor (0.034) which is used to calculate the future value of annual damages. Assuming no changes to the study area, the total damages shown below are expected to occur over the 50-year period. 279 of the total (696) structures are located within all three reaches and fewer are located within just a single floodplain. See Table 5.1 of the 2019 *Flood Risk Assessment for Muncy Borough* for a description of the number of structures at risk of damages by flooding source and storm size. Figures 1.1 through 3.2, attached at the end of the memorandum, graphically display the calculated damages in thousands of dollars for each structure by flood source for the 10-year and 100-year storm events.

Damage Reach	Annual Damages	Total Annualized Damages
Glade Run	\$76,220	\$2,273,978
Muncy Creek	\$89,140	\$2,659,438
West Branch Susquehanna	\$794,190	\$23,694,179
Totals	\$959,550	\$28,627,595

Table 4: HEC-FDA derived Annual and Total Annualized 50-year Period Damages by Reach for Muncy Borough

4. FLOODPRONE BUILDING INVENTORY GIS DATA-LAYER

Please see Appendix A of the 2019 USACE report titled “Flood Risk Assessment for Muncy Borough” completed by Baltimore District for the Lycoming County Planning and Community Development office for the list and description of the fields included in the attribution table of the original flood prone building inventory. The following list includes the additional fields included in the attribution table required to perform the economic analysis.

StrVal, ContVal

These are the structure values and content values in tens of thousands of dollars (e.g. a value of 35.5 is equivalent to \$35,500) for each structure in the database. Structure value was taken from the Lycoming County Assessment Office web app viewer website using the tax assessed improvement value for each structure. This tax assessed data was collected in November, 2021 (<https://lyco.maps.arcgis.com/apps/webappviewer/index.html>).

Content value for each structure was predetermined using content to structure ratio for each structure type. Standard Industrial Classification (SIC) codes were gathered for each non-residential property type. The Analysis of Nonresidential Content Value and Depth-Damage for Flood Damage Reduction Studies (IWR Report 96-R-12 May 1996) was used to calculate the content value ratio for the non-residential properties in the study area. For residential properties, content value is assumed to be equal to the value of each structure, since the depth-damage functions model content damage as a percentage of the structure value.

DBD

This field identifies the depth of beginning damages (the depth at which flood waters first interact with the structure in a way that has been assessed to cause damages based on the elevation of the lowest opening).

***GR_Dp_2YR, GR_Dp_5YR, GR_Dp_10YR, GR_Dp_25YR, GR_Dp_50YR, GR_Dp_100YR, GR_Dp_200YR, GR_Dp_500YR;
MC_Dp_2YR, MC_Dp_5YR, MC_Dp_10YR, MC_Dp_25YR, MC_Dp_50YR, MC_Dp_100YR, MC_Dp_200YR, MC_Dp_500YR;
WB_Dp_2YR, WB_Dp_5YR, WB_Dp_10YR, WB_Dp_25YR, WB_Dp_50YR, WB_Dp_100YR, WB_Dp_200YR, WB_Dp_500YR:***

Flood Depths at Building

There are eight fields in the building inventory that represent the flood events for each reach and for each building from the revised USACE Study. Eight flood depths were included in the analyses in the study, ranging from small, frequent events (such as a 2-year flood, which is a flood event which has a 50-percent chance of occurring in any given year) to large, less frequent events (such as a 500-year flood, which is a flood event which has a 0.2-percent chance of occurring in any given year). “GR” represents Glade Run, “MC” represent Muncy Creek, and “WB” represents

the West Branch Susquehanna River. A “-901” means that flooding from that respective flooding source does not impact the building at that frequency flood event.

GR_TD_2YR, GR_TD_5YR, GR_TD_10YR, GR_TD_25YR, GR_TD_50YR, GR_TD_100YR, GR_TD_200YR, GR_TD_500YR;

MC_TD_2YR, MC_TD_5YR, MC_TD_10YR, MC_TD_25YR, MC_TD_50YR, MC_TD_100YR, MC_TD_200YR, MC_TD_500YR;

WB_TD_2YR, WB_TD_5YR, WB_TD_10YR, WB_TD_25YR, WB_TD_50YR, WB_TD_100YR, WB_TD_200YR, WB_TD_500YR;

Total Damages at Building

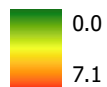
This field displays the total damages (structure plus content damages) at each structure, for each reach at the associated storm event elevation. Damages were calculated using USACE HEC-FDA tool (version 1.4.2), which modeled storm damages for the properties within the study area of Muncy Township, PA. The HEC-FDA model is built and supported by the USACE to perform Monte-Carlo simulation-based estimation of flood damages using calculated flood levels, surveyed structure elevations (e.g. elevation of lowest opening, first floor elevations) structure and content values, and specified depth-damage functions which attribute percentage damages to certain depths of structure and content flooding.

FIGURES

This page intentionally left blank

Glade Run 10-Year Storm - Damages by Structure

x \$1,000



Muncy Borough Limits

Existing-Conditions Glade Run 10 Year Floodplain

Streams

Muncy Creek

West Branch
Susquehanna River

Glade Run



Figure 1.1
10-Year Glade Run
Flood Damages by Structure (\$1K's)



0 500 1,000 2,000 Feet

1:14,400

This page intentionally left blank

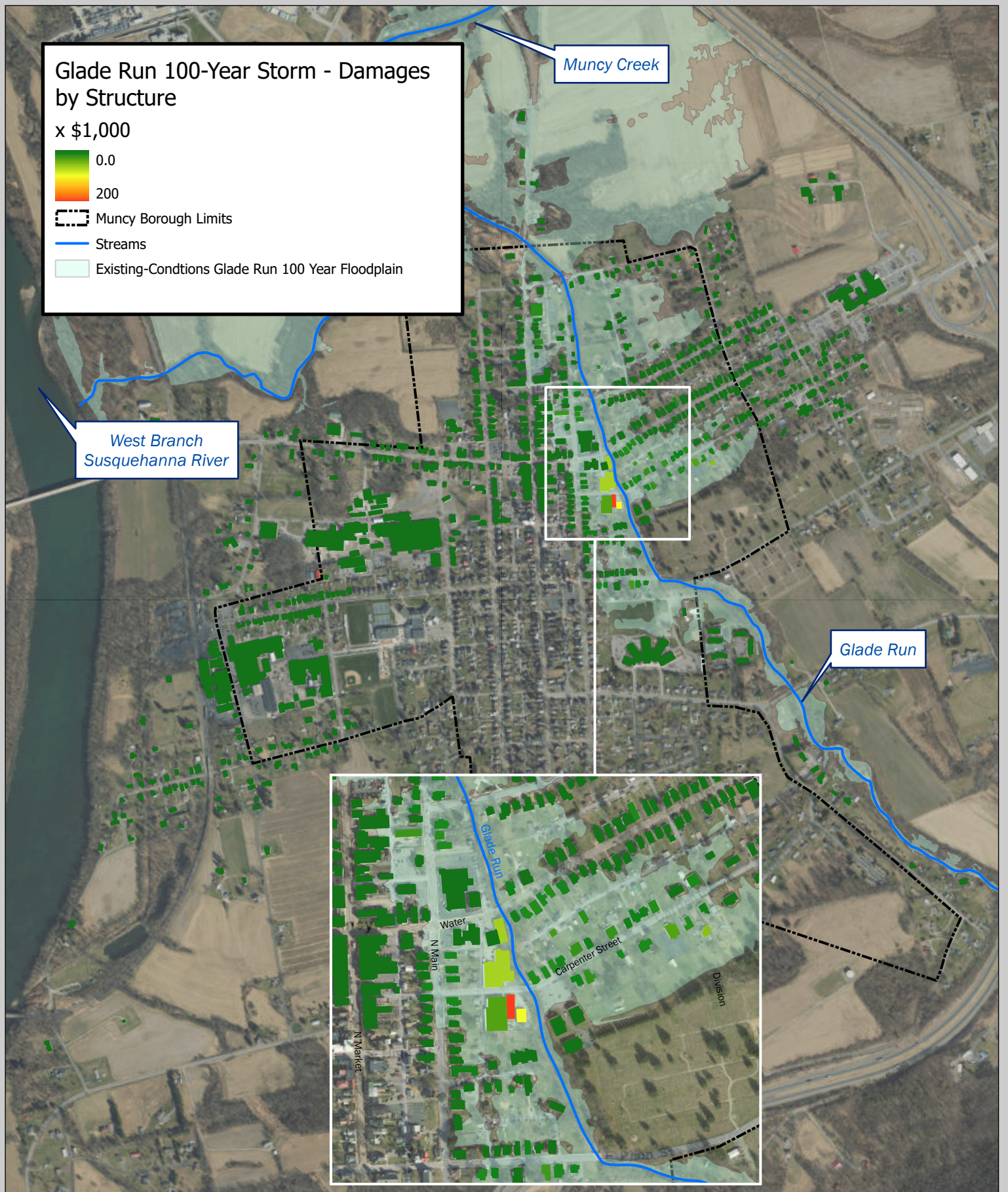


Figure 1.2
100-Year Glade Run
Flood Damages by Structure (\$1K's)



0 500 1,000 2,000
Feet

1:14,400

This page intentionally left blank

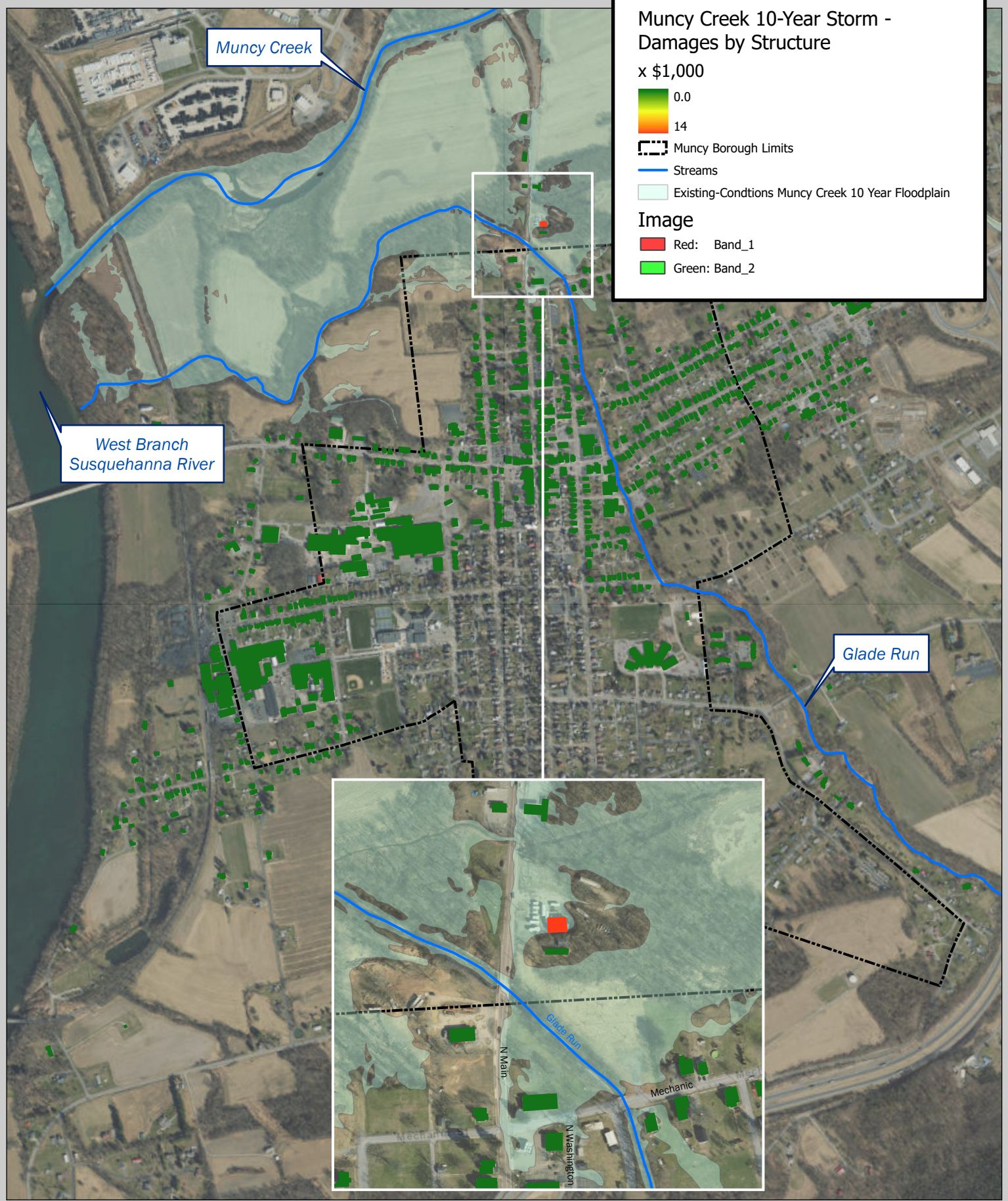
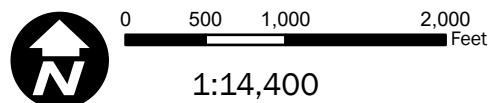


Figure 2.1
10-Year Muncy Creek
Flood Damages by Structure (\$1K's)



This page intentionally left blank

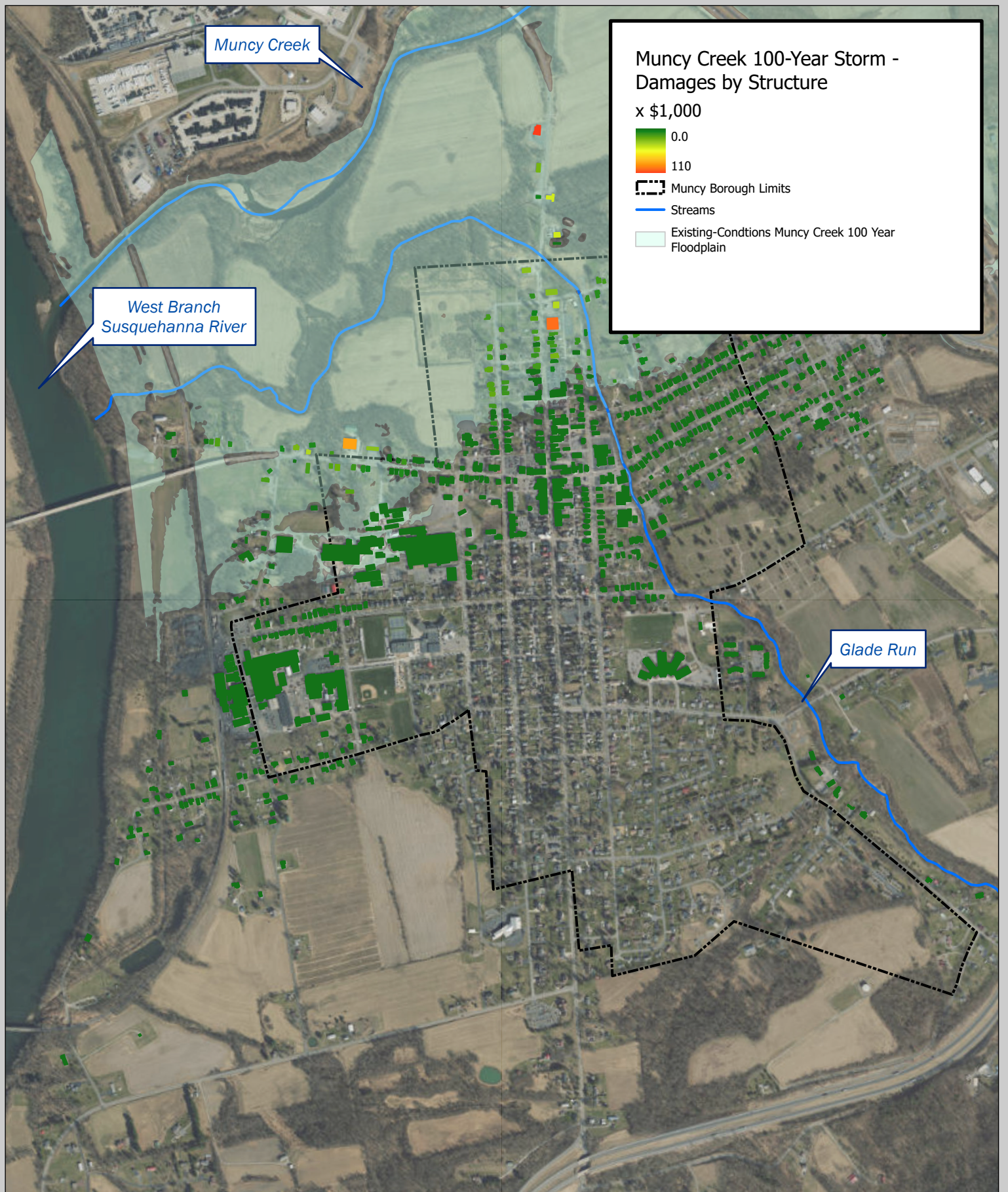


Figure 2.2
100-Year Muncy Creek
Flood Damages by Structure (\$1K's)



0 500 1,000 2,000
Feet

1:14,400

This page intentionally left blank

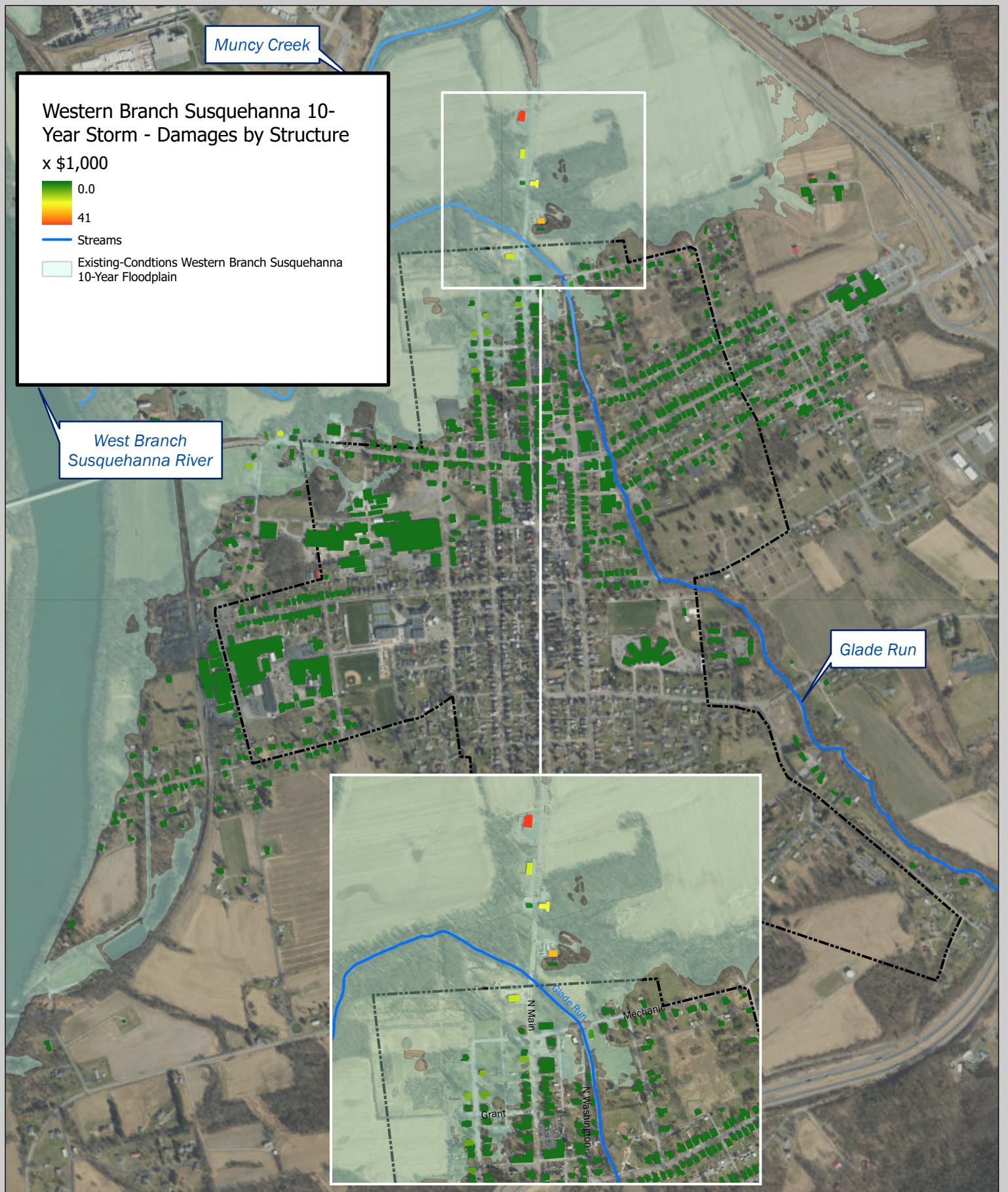


Figure 3.1
10-Year Western Branch Susquehanna
Flood Damages by Structure (\$1K's)



0 500 1,000 2,000
Feet

1:14,400

This page intentionally left blank

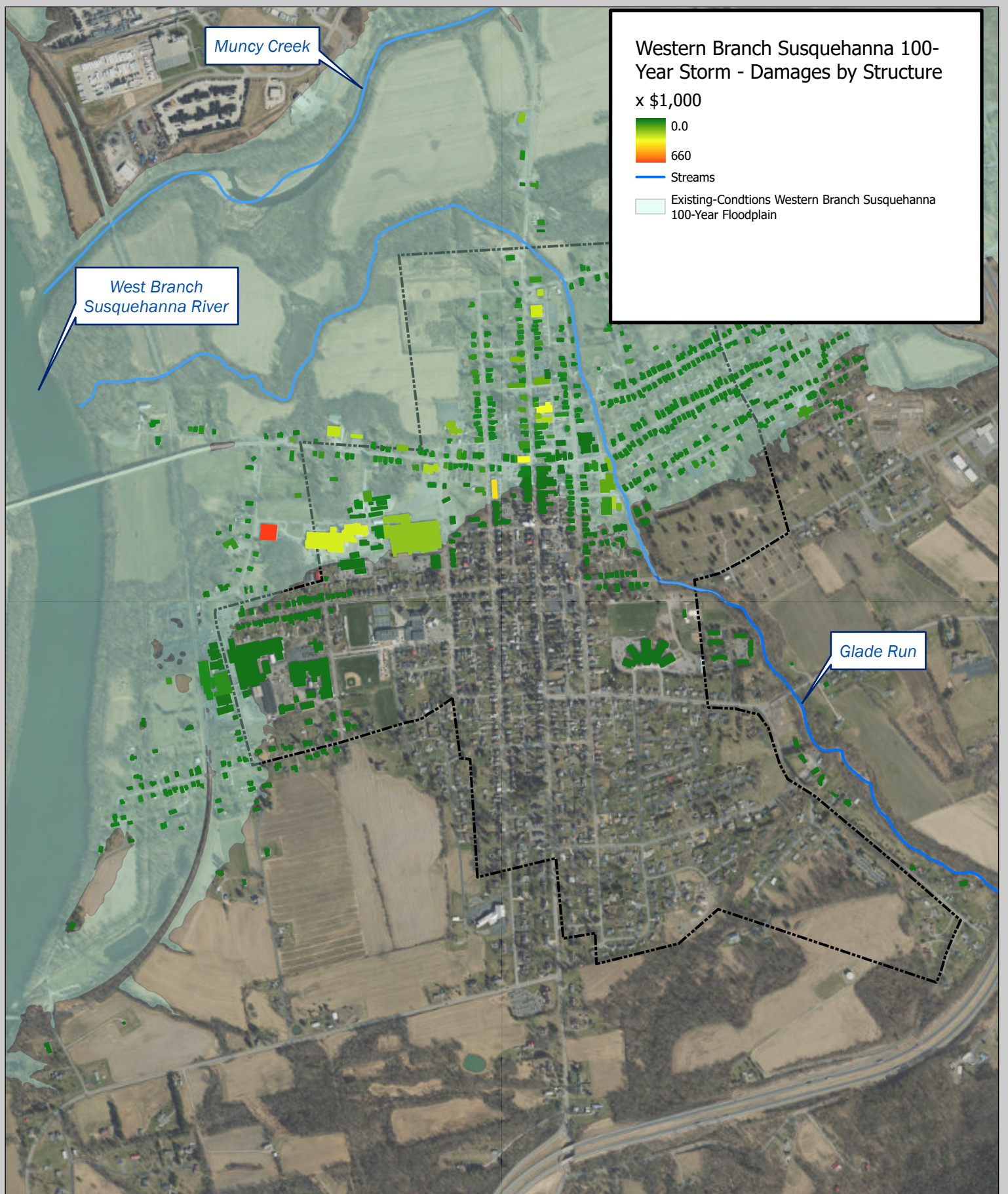


Figure 3.2
100-Year Western Branch Susquehanna
Flood Damages by Structure (\$1K's)



0 500 1,000 2,000 Feet

1:14,400

This page intentionally left blank