4.3 Flooding

4.3.1 Hazard Profile

A flood occurs when an area that is normally dry becomes inundated with water. Floods may result from the overflow of surface waters, overflow of inland and tidal waters, dam breaks, or mudflows. Flooding can occur at any time of the year, with peak in the late winter and early spring. Snowmelt and ice jam breakaway contribute to winter flooding; seasonal rain patterns and torrential rains from hurricanes and tropical systems also can contribute to flooding. Development of flood-prone areas usually increases the frequency and degree of flooding.

4.3.1.1 Riverine Flooding and Flash Flooding

The two most common types of flooding that would affect the CVPDC area are riverine flooding (or inland flooding) and flash flooding (or urban flooding).

A *riverine flood* occurs when water levels rise over the top of river banks. This can occur from either excessive rain from tropical systems making landfall, persistent thunderstorms over the same area for extended periods of time, combined rainfall and snowmelt, or as a result of an ice jam (The National Severe Storms Laboratory), thus it is a naturally occurring and inevitable event. Some river floods occur seasonally when winter or spring rainfalls fill river basins with too much water, too quickly.

The two key elements to a *flash flood* are rainfall intensity and duration. Topography, soil conditions, and ground cover also play an important role. A flash flood is defined as being caused by heavy or excessive rainfall in a short period of time, generally less than 6 hours. Flash floods are usually characterized by post-heavy rainfall raging torrents that rip through river beds, urban streets, or mountain canyons, sweeping everything before them. They can occur within minutes or a few hours of excessive rainfall. They can also occur even if no rain has fallen, for instance after a levee or dam has failed, or after a sudden release of water by a debris or ice jam (National Weather Service).[5]

4.3.1.2 Nuisance Flooding

Nuisance flooding (NF; aka. clear-sky or sunny-day flooding) refers to low levels of inundation that do not pose significant threats to public safety or cause major property damage. These floods can, however, disrupt routine day-to-day activities, put added strain on infrastructure systems such as roads and sewers, and cause minor property damage. Nuisance flooding usually refers to high tide flooding caused by climate-related sea level rise; however, low levels of flooding are widespread and deserve greater attention. Moftakhari, et al. (2018) define nuisance flooding as an extra layer of water that occurs at depths between 3 and 10 cm, regardless of the source, which travels at less than 3 meters per second.

[5] National Weather Service. https://www.weather.gov/mrx/flood_and_flash

This definition of NF is not limited to high tide flooding but rather is inclusive of all possible flood drivers, including pluvial, fluvial, and oceanic, and can capture trends in NF resulting from trends in, and compounding effects of, flood drivers.

Nuisance flood monitoring poses significant challenges given the number of processes capable of generating localized flood depths in the 3–10 cm range, including precipitation, extreme high tides, high river stage, channel and culvert blockages, surcharging sewers, leaks in flood walls, and broken water supply pipes. Indeed, NF is strongly linked to the interaction of natural processes and civil infrastructure systems, which in turn are linked to human activity.

While the science community has mainly focused on extreme events with large acute impacts, the cumulative impacts of chronic nuisance flooding may be greater in some areas than the acute impacts of a rare event. One of the main roadblocks in understanding NF and its impacts is lack of NF data. A promising direction for NF monitoring is mining real-time flood information from social media, combined with traffic/security cameras and/or drone imagery. Data records of NF will encourage more research in this area and frame the likely benefits of protection/adaptation measures.[6]

4.3.1.3 Geographic Location/ Extent

Low-lying areas in the region are subject to flooding. The occurrence of tropical storms during hurricane season (June - November) are responsible for the more severe flooding experienced in the region. Creek flooding can also occur after locally heavy thunderstorms.

The floodplains of the James River near Lynchburg are developed, containing warehouses, factories, businesses, and the necessary rail, highway, and utility services for the city. Floodplain development for all other streams in the city is mainly residential, with some commercial and industrial sites adjacent to the floodplain areas. In Appomattox County, lower ground along smaller streams is sometimes damaged by flooding of crops, deposition of silt on crops, and by channels silting up and preventing proper drainage. In Amherst County, Williams Run is much more

> Flood or Flooding means:
>
> (a) A general and temporary condition of partial or complete inundation of normally dry land areas from:
>
> (1) The overflow of inland or tidal waters.
>
> (2) The unusual and rapid accumulation or runoff of surface waters from any source.
>
> (3) Mudslides (i.e., mudflows) which are proximately caused by flooding as defined in paragraph (a)(2) of this definition and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.
>
> (b) The collapse or subsidence of land along the shore of a lake or other body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as flash flood or an abnormal tidal surge, or by some similarly unusual and unforeseeable event which results in flooding as defined in paragraph (a)(1) of this definition.
>
> (Source: Electronic code of federal regulations, Section 59.1 Definitions)

[6] https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018WR022828

responsive to localized storms with intense rainfall. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future (FEMA, 2019). In Bedford County, floodplains usually consist of farmlands and woodlands. Principal concentrations of flood plain development lie along Hunting Creek in the Big Island community, along Mill Creek in the Moneta community, and along Roanoke River, including Smith Mountain Lake and Leesville Lake. Other minor concentrations of commercial and residential structures within flood plains are scattered throughout the county. Low-lying areas of the county are subject to periodic flooding caused by overflow of the following streams: Goose Creek, Big Otter River, and Little Otter River and their tributaries, which drain most of the county and empty into the Roanoke River. James River and its tributaries drain a small area in the northern portion of the county (FEMA, 2010). In Campbell County, the major portions of the floodplain are located along James and Roanoke (Staunton) Rivers, as well as larger creeks. Low-lying areas adjacent to these waters are subject to periodic flooding. The most severe flooding is usually a result of heavy rains from tropical storms, while, on the smaller creeks, the major floods are the result of local thunderstorms or frontal systems.

4.3.1.4 Magnitude/ Severity

Floods are typically characterized in terms of severity and frequency of occurrence. The severity of a flood event is typically determined by a combination of several factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and degree of vegetative clearing and impervious surface. Generally, floods are long-term events that may last for several days. Smaller floods occur more frequently, and larger floods have lower probabilities of occurrence.

The severity of a flood is determined by the duration and intensity of rainfall in the catchment of the river within the flood hazard area. The magnitude of a flood is based on flood depth and flood velocity. The Federal Emergency Management Agency (FEMA) categorizes areas on the terrain according to how the area will convey the discharge of flood water. The extent of flood damages can be expected to be more damaging in the areas where a base flood can occur. A base flood is defined by FEMA as a flood having a 1-percent chance of being equaled or exceeded in any given year. This is the regulatory standard also commonly referred to as the "100-year flood" or base flood. The 1-percent annual chance flood is the national standard used by the National Flood Insurance Program (NFIP) and all Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development.[7] A Special Flood Hazard Area (SFHA) is defined as an area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. Moderate flood hazard areas are the areas between the limits of the base flood and the 0.2-percent annual chance flood (also commonly referred to as "500-year flood). The areas of minimal flood hazard, are the areas outside the SFHA and higher than the elevation of the 0.2-percent annual chance flood (FEMA).[8] Figure 4-5 shows the 1-percent and 0.2-percent annual chance flood area in the CVPDC.

[7] https://floodmaps.fema.gov/tutorials/check-ras/0.3_glossary.shtml

[8] https://www.fema.gov/flood-zones

Flood zones are the categories that are mapped on Flood Insurance Rate Maps.[9] Table 4-9 provides a description of FEMA flood zones and the flood impact in terms of severity or potential harm. Flood Zone A, AE and X are the hazard areas that have mapped in the CVPDC area. Zone A is interchangeably referred to as the 100-year flood, 1-percent annual chance flood, Special Flood Hazard Area (SFHA), or more commonly, base flood. Zone A is the area where the base flood will occur, and therefore constitutes a threat to the region.

[9] https://snmapmod.snco.us/fmm/document/fema-flood-zone-definitions.pdf

FEMA Special Flood Hazard Area Map for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020

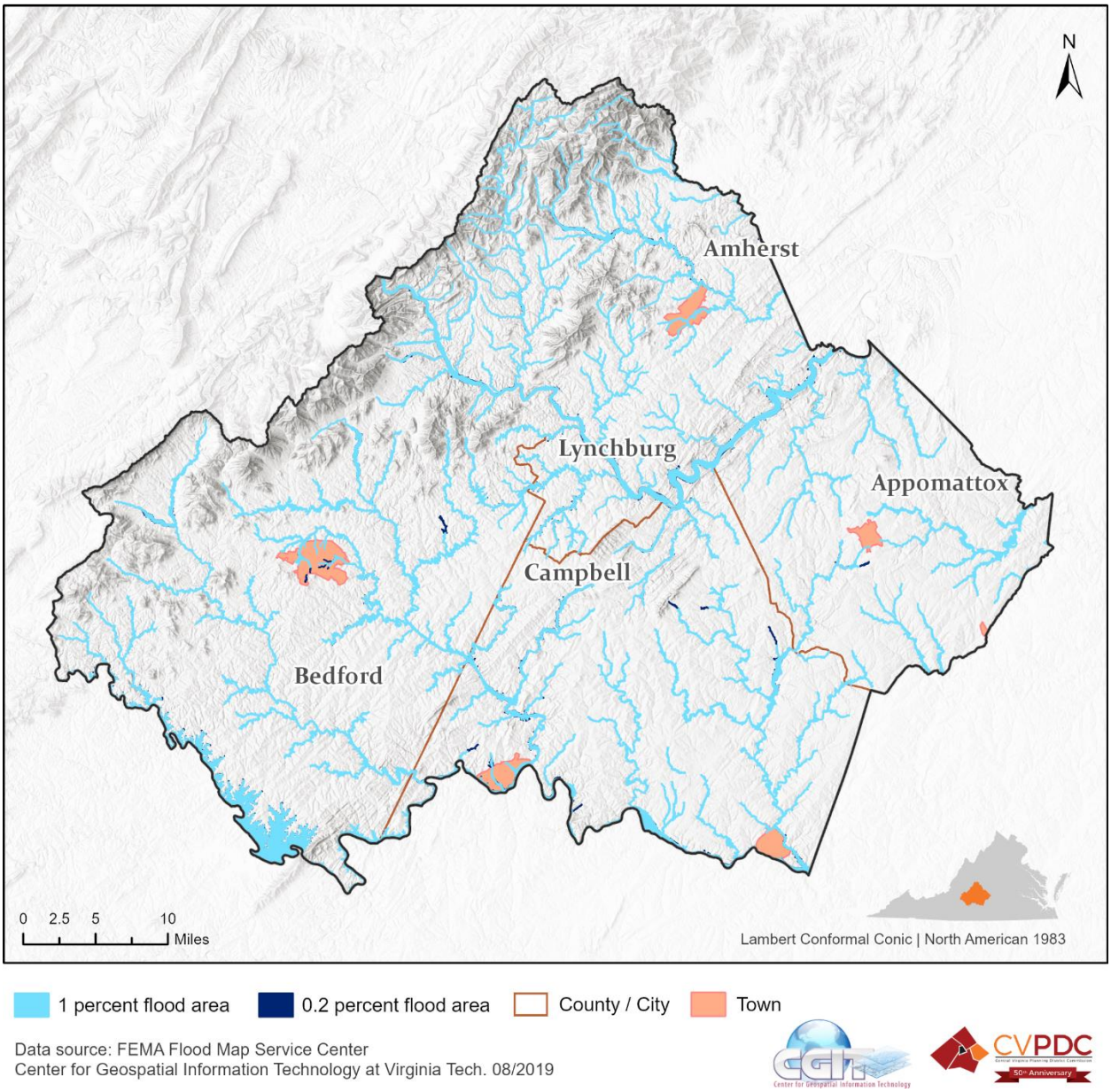


Figure 4-5 FEMA Special Flood Hazard Area Map for CVPDC Area (Source: FEMA Map Service Center) [10]

Table 4-9 Classification of Flood Zones

Intensity	Zone	Description
High	A	Areas with a 1% annual chance of flooding and a 26% chance of flooding over the life of a 30-year mortgage. Detailed analyses are not performed for such areas; no depths or

[10] FEMA Flood Map Service Center. https://msc.fema.gov/portal/advanceSearch

Intensity	Zone	Description
		base flood elevations are shown within these zones.
	AE	The base floodplain where base flood elevations are provided. AE Zones are now used on new format FIRMs, instead of A1-A30 Zones
	A1-30	These are known as numbered A Zones (e.g., A7 or A14). This is the base floodplain where the FIRM shows a Base Flood Elevation (BFE) (old format).
	AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
	AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
	AR	Areas with a temporarily increased flood risk due to the building or restoration of a flood control system (such as a levee or a dam). Mandatory flood insurance purchase requirements will apply, but rates will not exceed the rates for unnumbered A zones if the structure is built or restored in compliance with Zone AR floodplain management regulations.
	A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones
Moderate to Low	X500	An area inundated by 500-year flooding; an area inundated by 100- year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding.

Note: In communities that participate in the NFIP, mandatory flood insurance purchase requirements apply to all high risk zones. Source: FEMA

4.3.1.5 Previous Occurrences

The CVPDC region has been impacted by several flooding events ranging in location, magnitude, and impact. A large percentage of the region's declared disasters were due to flooding. A table of all the major flood events that have occurred in the CVPDC area is included in the Appendix H: Hazard Events. Events have been broken down by the date of occurrence and when available, by individual community descriptions. When no community specific description is available, the general description should be used as representing the entire planning area. Historical data is provided by the Storm Prediction Center (NOAA) and National Centers for Environmental Information (NCEI) databases for the CVPDC area, by county, from 1996 through 2017. These historical flood and flash flood events and associated damages are provided in Table 4-10 and Table 4-11.

Table 4-10 Flood Events in the CVPDC area (Source: NCEI database, 1996–2019) [11]

[11] https://www.ncdc.noaa.gov/stormevents/

Locality	Number of Flood Events	Property Damage ($K)	Crop Damage ($K)	Total ($K)
Amherst County	17	50	0	50
Appomattox County	7	0	0	0
Bedford County	17	120	55	175
Campbell County	24	50	20	70
Lynchburg	3	5	0	5

Towns included in the county numbers.

Table 4-11 Flash Flood Events in the CVPDC area (Source: NCEI database, 1996–2019)

Locality	Number of Flash Flood Events	Property Damage ($K)	Crop Damage ($K)	Total ($K)
Amherst County	24	820	0	820
Appomattox County	22	1,189	100	1,289
Bedford County	49	560	100	660
Campbell County	40	1,961	500	2,461
Lynchburg	11	18,020	0	18,020

Towns included in the county numbers.

4.3.1.6 Relationship to Other Hazards

Figure 4-6 shows the interrelationship (causation, concurrence, *etc.*) between this hazard and other hazards discussed in this plan update.

4.3.2 Impact and Vulnerability

The results of flooding can be moderate to severe and can affect both populations and property. Floods have the potential to pick up chemicals, sewage, and toxins from roads, factories, and farms. Therefore, any property affected by the flood may be contaminated with hazardous materials. Debris from vegetation and man-made structures may also be hazardous following the occurrence of a flood. In addition, floods may threaten water supplies and water quality, as well as initiate power outages.

Flooding can pose some significant secondary impacts to the area where the event has taken place. Some of the impacts to consider include infrastructure and utility failure, and impacts to roadways, water service, and wastewater treatment. These impacts can affect the entire planning district, making the area vulnerable to limited emergency services.

Many factors contribute to the relative vulnerability of areas within the floodplain. Some of these factors include development or the presence of people and property in the floodplain, flood depth, velocity, elevation, construction type, and flood duration. The principal flood problems in each locality are addressed in the jurisdictional analysis section of this chapter.

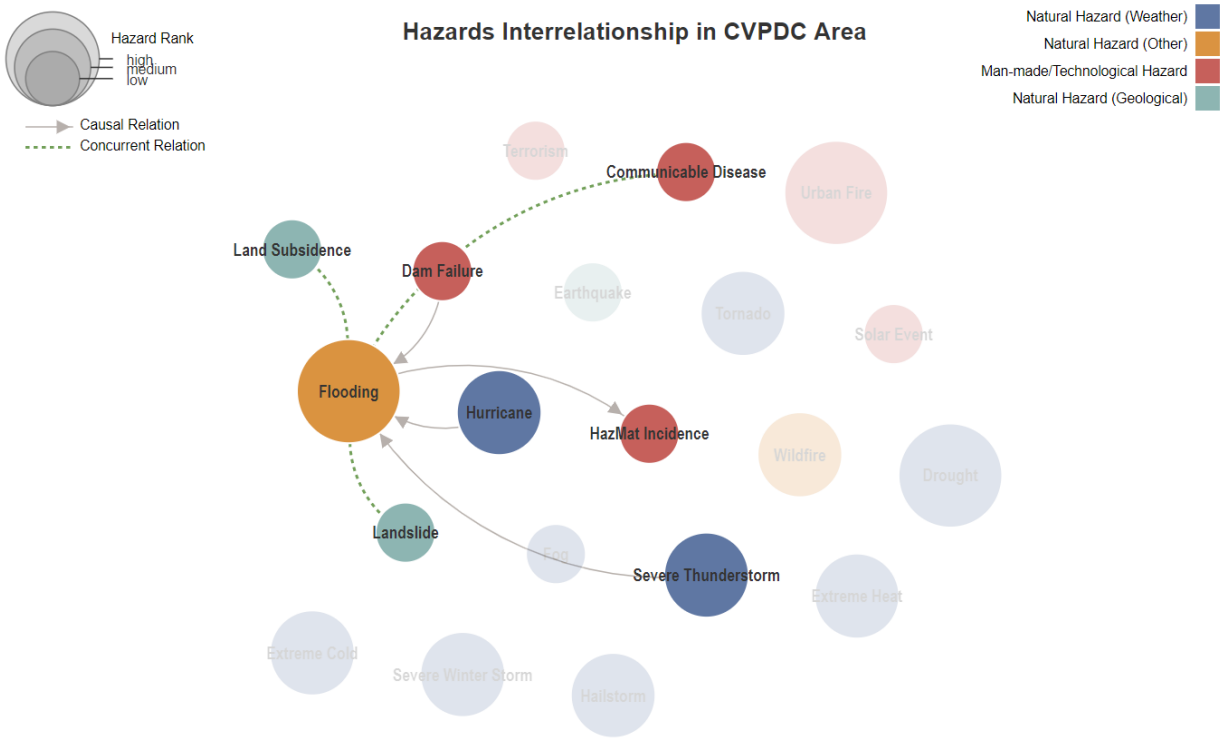


Figure 4-6 Hazards interrelationship

4.3.2.1 National Flood Insurance Program

The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on private and public structures by providing affordable insurance to property owners, renters, and businesses. It also encourages communities to adopt and enforce floodplain management regulations to help mitigate the effects of flooding on new and improved structures (FEMA).[12] Individual locality participation in the NFIP is voluntary. In addition, all participating communities can reduce the cost of policyholder premiums by participating in the Community Rating System (CRS) Program. This program awards points to communities that implement flood protection measures beyond minimum NFIP requirements, as well as other defined benchmarks. Twenty-six communities currently participate in CRS across Virginia, but zero are within the CVPDC (DCR).[13] Table 4-12 indicates the localities' participation in the NFIP.

Table 4-12 Communities participating in the NFIP (01/01/1978 - 09/30/2018)

[12] https://www.fema.gov/national-flood-insurance-program

[13] https://www.dcr.virginia.gov/dam-safety-and-floodplains/fp-crs

Locality	Entry in NFIP	FIRM Current Effective Date	Flood Insurance Policies	Insured Value ($K)		Total Loss Events	Total Value in Losses Paid ($K)
				Insurance In-force whole	Written Premium In-force		
Amherst County*	7/17/1978	09/19/2007	35	8,591.7	53.51	49	1,363.68
Appomattox County*	7/17/1978	01/02/2008	7	915.7	7.98	9	256.14
Campbell County*	10/17/1978	08/28/2008	38	10,037.9	25.13	18	558.05
Bedford County*	9/29/1978	09/29/2010	127	34,145.5	108.45	30	229.68
City of Lynchburg	9/1/1978	06/03/2008	101	30,099.3	284.67	134	3,585.51
Town of Amherst	11/2/1977	09/19/2007	4	1,350	6.27	35	132.07
Town of Appomattox	5/25/1984	01/02/2008	2	604.8	2.92	-	-
Town of Brookneal	3/1/1978	08/28/2008	3	589.4	10.33	-	-
Town of Altavista	8/1/1978	08/28/2008	6	2,108.2	12.46	10	159.53
Town of Bedford	6/1/1978	09/29/2010	14	4,301.7	42.36	1	0

* Unincorporated areas of the county only.[14]

4.3.2.2 Repetitive Loss Properties

The Hazard Mitigation Assistance Program defines Repetitive Loss as having incurred flood-related damage on two occasions, in which the cost of the repair, on average, equaled or exceeded twenty-five percent (25%) of the market value of the structure at the time of each such flood event; and, at the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage (FEMA).[15] The NFIP defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP.[16]

The identification of repetitive loss properties is an important element to conducting a local flood risk assessment, as the inherent characteristics of properties with multiple flood losses strongly suggest that they will be threatened by continual losses. Repetitive loss properties are also important to the NFIP, since structures that flood frequently put a strain on the National Flood Insurance Fund.

Since 1978, FEMA has provided a Repetitive Loss list of properties in communities that have received two or more flood insurance claims greater than $1,000 from NFIP within a rolling ten-year period. The Repetitive Loss list includes pertinent information regarding the property address, dates of claims, amounts received, and owner information. Some of this information is protected by the Privacy Act of

[14]Losses paid - https://bsa.nfipstat.fema.gov/reports/1040.htm#51

NFIP Claims - https://bsa.nfipstat.fema.gov/reports/1011.htm#VAT

FIRM Current Effective Date - https://msc.fema.gov/portal/advanceSearch

[15] FY 2019 Flood Mitigation Assistance (FMA) Grant Program. https://www.fema.gov/media-library-data/1578520288733-d372d995bdbb6aea6c88ed39636138fb/FMAFactSheetFY19_1.8.20.pdf

[16] National Flood Insurance Program: Frequently Asked Questions. https://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt

1874 and has been withheld from Table 4-13. As of September 30, 2019, there are 27 repetitive loss properties in the CVPDC area, with a total payment of $2,800,967.36 (an average payment of $103,740 per structure, see Table 4-13). Most of the repetitive loss structures for the region are nonresidential properties. Note that FEMA designated counties, cities, and towns separately in the table. This table provides a listing of the structures that have repetitive loss and does not include all structures that have had damage due to flooding. Figure 4-7 shows a general location of the repetitive loss properties in the region. Due to privacy concerns, the general area is depicted instead of the individual sites.

4.3.2.3 Severe Repetitive Loss Properties

The NFIP also designates severe repetitive loss (SRL) properties in a community. As defined by the Flood Insurance Reform Act of 2004, SRLs are 1-4 family residences that either have had four or more claims of $5,000 or more, or have had at least two claims that cumulative exceed the building's value. The CVPDC area has 11 SRL properties identified by NFIP.[17]

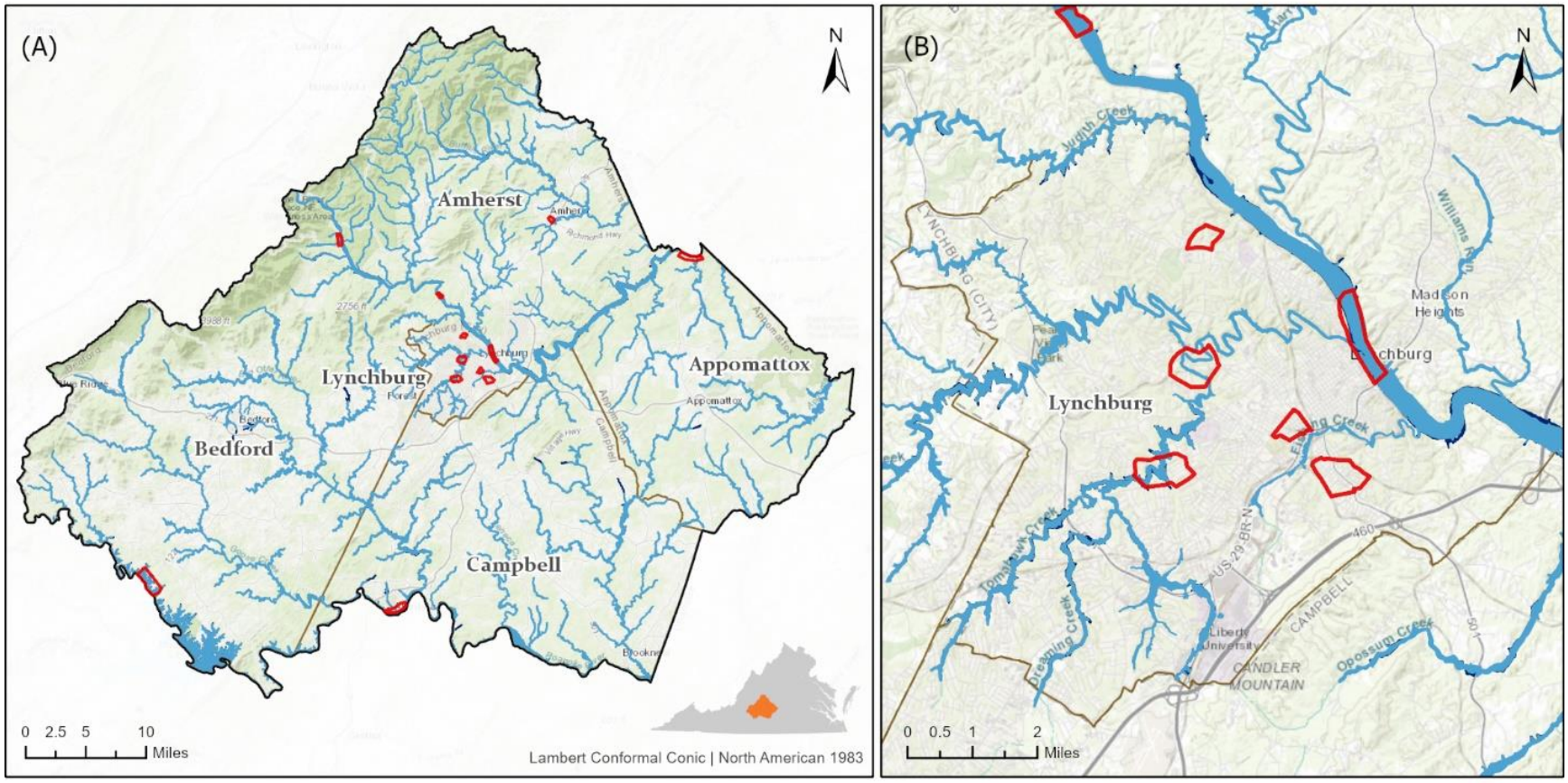
Table 4-13 NFIP Repetitive Loss and Severe Loss Properties (As of September 30, 2019; Source: Virginia Department of Conservation and Recreation/FEMA)

Locality	Number of Properties		Payment ($K)		
	Repetitive Loss Properties	Severe Repetitive Loss Properties	Building Payment	Contents Payment	Total
Amherst County	1	1	65.78	8.95	74.73
Town of Amherst	1	1	99.00	23.01	122.01
Appomattox County	2	1	204.50	42.43	246.93
Town of Appomattox	-	-	-	-	-
Town of Pamplin City	-	-	-	-	-
Bedford County	3	1	103.85	18.42	122.27
Town of Bedford	-	-	-	-	-
Campbell County	-	-	-	-	-
Town of Altavista	1	0	56.84	3.58	60.42
Town of Brookneal	-	-	-	-	-
Lynchburg City	19	7	1,066.21	1,108.39	2,174.60

[17] NFIP/CRS: https://crsresources.org/files/500/rlaa-guide-2017.pdf

Repetitive Loss Areas in the Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: Virginia Department of Conservation and Recreation; FEMA Flood Map Service Center
Center for Geospatial Information Technology at Virginia Tech. 08/2020

Figure 4-7 Repetitive Loss Areas in the CVPDC Area

4.3.3 Risk Assessment

The 1-percent annual chance flood area in the CVPDC area covers 112.2 square miles, accounting for 5.2% of the entire CVPDC area. There are 827 vulnerable structures (primary structure only), 54 critical facilities, and 384 road bridges in the floodway. The 0.2-percent annual chance flood area is 117.4 square miles, which covers 5.5% of the area of the CVPDC. 1,369 primary structures, 60 critical facilities, and 393 road bridges are within this floodplain. Table 4-14 and Table 4-15 indicate the area and number of structures breakdown for each locality.

There are several reasons bridges fail during floods, such as:

- Water, salt, or debris damages critical parts of the structure.
- Pressure from water or debris breaks apart the bracing system.
- Water lifts the structure off its supports.
- Piers or abutments are knocked out by large debris, such as boats or vehicles that get caught in rapidly flowing water.
- Extreme scour compromises the foundation.
- Approach roads are cut, weakening structural supports.

Among those, the main reason bridges are destroyed by floods is because of a phenomenon known as scour. It is one of the three main causes of bridge failure (the others being collision and overloading) in the United States. Bridge scour is the removal of sediment such as sand and gravel from around bridge abutments or piers. Scour caused by floodwaters can remove large amounts of foundation material from under the footings of a bridge. A scour critical bridge is at risk of becoming unstable during a flood therefore must be monitored and identified. This is also required by Code of Federal Regulations; Chapter 23 Highways – Section 650.313(3)(3); 2005 National Bridge Inspection Standards. The Scour Critical ratings for all road bridges within CVPDC was derived from US DOT National Bridge Inventory. Those road bridges with lowest score and located in the floodplain were identified as at high risk.

Among the 393 road bridges located in 1-percent or 2-percent annual chance flood areas within CVPDC, 45 are identified at high risk (with Scour Critical rating as 1-4), and 1 in Amherst County has unknown status.

Table 4-14 1-percent and 0.2-percent annual chance flood area by jurisdiction

Locality *	Total Area (sq.mi)	1% Annual Chance Flood Area (sq. mi)	% of Total Area	0.2% Annual Chance Flood Area (sq. mi)	% of Total Area
Amherst County	478.9	25.3	5.3%	26.4	5.5%
Town of Amherst	4.9	0.3	6.1%	0.3	6.1%
Appomattox County	335.5	15.3	4.6%	15.5	4.6%
Town of Appomattox	2.3	0.02	0.9%	0.02	0.9%
Bedford County	776.3	40.6	5.2%	42.3	5.5%
Town of Bedford	8.7	0.4	4.6%	0.5	5.7%

Locality *	Total Area (sq.mi)	1% Annual Chance Flood Area (sq. mi)	% of Total Area	0.2% Annual Chance Flood Area (sq. mi)	% of Total Area
Campbell County	507.1	28.0	5.5%	29.7	5.9%
Town of Altavista	5.2	1.0	19.2%	1.1	21.2%
Town of Brookneal	3.6	0.3	8.3%	0.3	8.3%
Lynchburg City	49.5	3.0	6.1%	3.5	7.1%

** County data includes town data*

Table 4-15 Number of structures, critical facilities and road bridges in floodplain by jurisdiction

Locality *	Within 1% Annual Chance Flood Area			Within 2% Annual Chance Flood Area		
	Primary Structure**	Critical Facility	Road Bridge	Primary Structure	Critical Facility	Road Bridge
Amherst County	163	9	115	182	9	118
Town of Amherst	4	1	7	4	0	7
Appomattox County	45	0	51	51	1	52
Town of Appomattox	2	0	0	2	1	0
Bedford County	368	26	120	787	29	121
Town of Bedford	29	7	2	38	7	2
Campbell County	91	13	78	114	14	79
Town of Altavista	21	4	4	23	4	4
Town of Brookneal	1	4	1	2	4	1
Lynchburg City	160	6	20	235	7	23
CVPDC Total	**827**	**54**	**384**	**1369**	**60**	**393**

** County data includes town data. ** Only the primary structure within a parcel was taken into account; see "Data cleaning process" sidebar in Risk Assessment section.*

4.3.3.1 Hazus Level 2 Analysis

Riverine Hazus level-2 analysis was completed for the 2020 revision using 1-percent and 0.2-percent annual chance scenarios. The Hazus methodology was developed for the Federal Emergency Management Agency (FEMA) by the National Institute of Building Sciences to provide a tool for developing loss estimates for various hazards. User-specified flood depth grids and extensive property data was used to estimate the losses for the CVPDC area.

Detailed building inventory at parcel level was prepared for the region and the following building related attributes were required to produce accurate loss estimates:

- Foundation type
- First floor height
- Occupancy type
- Number of stories
- Building replacement values/ cost

- Contents replacement cost
- Location (latitude/ longitude)

The above information was obtained from a combination of sources and in place of missing values, assumptions were made. RSMeans standards from Hazus were used to estimate the property values.

Similarly, flood grids for a 1-percent annual chance flood were prepared for this analysis using 1/3 arc second Digital Elevation Models (DEMs) and National Flood Hazard Layer (NFHL) for the region.

Data cleaning process

Development of a detailed building inventory in a flooding event damage assessment is vital and the first step to produce accurate flood loss estimates. When importing a building point dataset into the Hazus flood model for site specific analysis, the depth of water at a given point is applied from the depth grid to the structure based on its physical coordinate location. Having the building point locations as accurate as possible can greatly increase the results accuracy for the region. The potentially impacted buildings are identified from the intersection between building footprint data and the Standard Digital Flood Insurance Rate Map (DFIRM) data. These building footprints are converted to points using a polygon to point conversion. Some resulting point locations are adjusted within to make sure each point on a structure is placed inside the flooded area.

It is worth mentioning that only the primary structure within each parcel is involved in the building inventory data. A data cleaning process is applied to the initial inventory data to further reduce some building points. Such excluded building points include:

- Affiliated or small structures exist within the same parcel with conventional housing, such as sheds or detached garages
- Out-buildings that are less than 200 square foot for residential, agricultural, or commercial / industrial use
- Vacant or abandoned residential buildings in bad condition according to structure attributes in parcel information
- Recreational vehicles (RV) or trailer homes in the A Zones by Smith Mountain Lake
- Shelters and covered boat docks by water area

Although these aforementioned, non-conventional structures are excluded for loss estimate, it is important for the localities to notify owners of these structures to make them aware of the hazards. It is common that homeowners store fuel, oil, and machinery in the sheds, which could contaminate the surface water during the flood. RVs skirt around regulations because it is assumed they can be moved out of the floodplains to a safer location when a flooding threatens, but they should be identified, as they would pose potential risk.

Foundation Type information was readily available for all the counties except Appomattox. Foundation type and year built of the structure was further used to calculate the First Floor Height (FFH) of the structures. FFH and foundation data for Lynchburg was developed by the HMP Team. For Appomattox, the data was updated using realtor websites and google street maps, and assumptions were made where the data was not available.

Occupancy and number of stories information for all the counties was derived from parcel data. Data for Lynchburg was already available.

Square footage of all the structures in the floodplain considered in this analysis was obtained using calculated geometry, parcel data. VGIN and Microsoft data was used for this.

Means Cost, Content Cost Percentage, and Residential and Non-Residential Locational Factors were obtained from Hazus software (version 4.2).

4.3.3.2 Economic Losses: 1-percent Annual Chance Flooding Scenario

The direct economic loss estimates at locality level by general occupancy in the 1-percent annual chance flooding scenario are generated from Hazus Flood analysis (Table 4-16 and Table 4-17).

Table 4-16 Direct Economic Losses for User Defined facilities (1-percent annual chance flooding)

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure ($K)	Contents Exposure ($K)	Building Loss ($K)	Contents Loss ($K)	Inventory Loss ($K)	Total Loss ($K)
Amherst County	36,869	31,319	22,267	21,015	945	44,226
Appomattox County	8,379	4,190	2,900	1,319	0	4,218
Bedford County	57,964	33,526	19,397	12,970	89	32,456
Campbell County	24,859	17,080	7,761	8,199	186	16,146
Lynchburg	255,138	336,783	114,235	211,622	14,450	340,307
Total	**383,209**	**422,898**	**166,558**	**255,124**	**15,670**	**437,353**

Notes: All values are in thousands of dollars. County totals include town loss estimates.

Figure 4-8 displays the buildings that will be damaged from a 1-percent annual chance flood event based on the losses incurred in the CVPDC area. According to the analysis, Lynchburg has the highest susceptibility to a 1-percent annual chance flood event in the region. There is also a cluster of structures along the Smith Mountain Lake in the south-western portion of Bedford County that are exposed to damage from a 1-percent annual chance flood.

Table 4-17 Direct Economic Losses by Building Occupancy - Total Loss (1-percent annual chance of flooding)

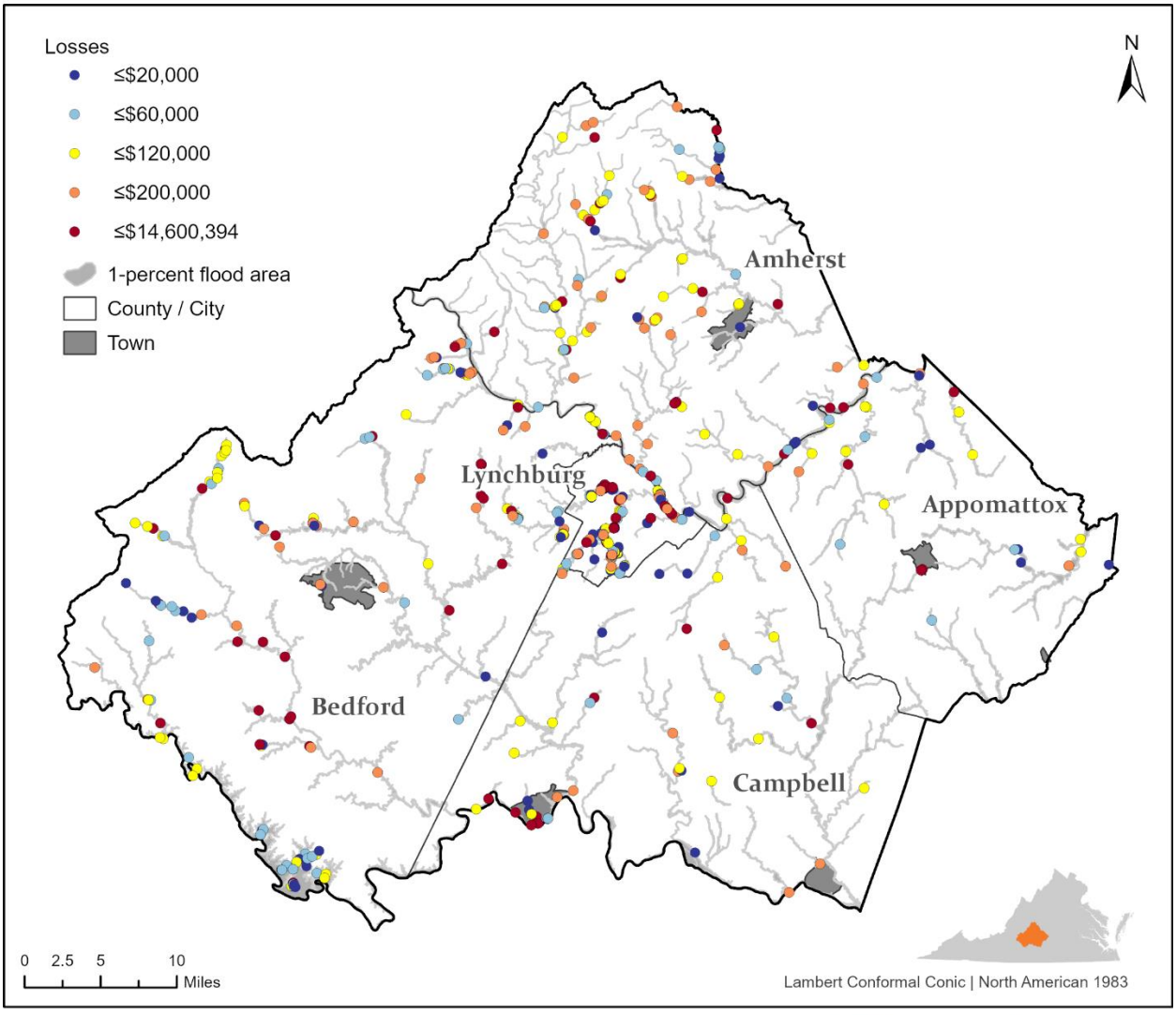
Locality	Residential ($K)	Commercial ($K)	Industrial ($K)	Government ($K)	Religion ($K)
Amherst County	17,060.9	11,147.3	14,026.8	-	769.2
Town of Amherst	276	-	-	-	-
Appomattox County	3,914.1	-	-	-	-
Town of Appomattox	304.3	-	-	-	-
Bedford County	25,084.4	2,592.1	296.9	-	4,071.9
Town of Bedford	3,518.3	5,321.4	-	-	-
Campbell County	6,994.3	765.3	-	-	-
Town of Altavista	1,532.2	2,304.8	-	4,031.3	-
Town of Brookneal	-	-	-	331.7	-

Locality	Residential ($K)	Commercial ($K)	Industrial ($K)	Government ($K)	Religion ($K)
Lynchburg City	38,903.6	20,748.5	26,6205.0	-	-

Notes: All values are in thousands of dollars. County totals do not include the town loss estimates

Building Losses in 1-percent Annual Chance Flooding Scenario for Central Virginia PDC

Central Virginia PDC Hazard Mitigation Plan Update 2020



Data source: FEMA Flood Map Service Center
Center for Geospatial Information Technology at Virginia Tech. 08/2019

Figure 4-8 Building Losses in 1-percent Annual Chance Flooding Scenario for CVPDC area

4.3.3.3 Economic Losses: 0.2-percent Annual Chance Flooding Scenario

In most cases, the 1-percent annual chance flood is appropriate for risk identification and assessment of general structures. However, a higher standard (0.2-percent probability flood) may be appropriate for regulating certain types of structures to avoid losses from catastrophic failure, such as critical facilities and infrastructure. Errors may exist in the floodplain modeling considering the age of the current flood model (which was developed in 1978 with some revisions in 1983 and 2008). It would be safe to take additional flooding scenarios into consideration. Moreover, the 0.2-percent probability flood event can be used as a broad generalization of flood risk under unknown circumstances, such as debris blockages and future conditions when there may be more development and precipitation in the CVPDC.

The direct economic loss estimates in the 0.2-percent annual chance flooding scenario are provided in Table 4-18 and Table 4-19. For Bedford County, the number of structures and losses from a 0.2-percent annual chance flood increases significantly.

Table 4-20 and Table 4-21 shows the percentage difference of economic losses between 0.2-percent and 1-percent annual chance of flooding scenarios for all communities in CVPDC. The difference between the two scenarios is substantial for Bedford County. Most of the structures in the 0.2-percent flood zone are located near Smith Mountain Lake in the southwestern part of the county.

Table 4-18 Direct Economic Losses for User Defined facilities (0.2-percent annual chance of flooding)

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure ($K)	Contents Exposure ($K)	Building Loss ($K)	Contents Loss ($K)	Inventory Loss ($K)	Total Loss ($K)
Amherst County	48,598	38,435	24,359	25,065	815	50,239
Appomattox County	13,659	7,161	6,740	2,850	7	9,597
Bedford County	209,621	111,417	84,109	36,918	138	121,165
Campbell County	54,775	32,459	19,909	14,356	232	34,497
Lynchburg	553,366	646,498	183,994	379,858	19,109	582,960
Total	**880,019**	**835,971**	**319,111**	**459,046**	**20,301**	**798,458**

Notes: All values are in thousands of dollars. County totals include town loss estimates.

Table 4-19 Direct Economic Losses by Building Occupancy - Total Loss (0.2-percent annual chance of flooding)

Locality	Residential ($K)	Commercial ($K)	Industrial ($K)	Government ($K)	Religion ($K)
Amherst County	24,918.7	6,356.4	11,808.1	4,093.8	1,495.0
Town of Amherst	752.4	-	-	-	-
Appomattox County	8,737.3	-	-	-	-
Town of Appomattox	411.8	-	-	-	-
Town of Pamplin	-	-	-	-	-

Locality	Residential ($K)	Commercial ($K)	Industrial ($K)	Government ($K)	Religion ($K)
Bedford County	109,274.6	4,039.9	1,274.3	687.1	5,562.2
Town of Bedford	6,252.3	7,610.5	-	-	4,765.3
Campbell County	18,250.1	1,023.9	-	-	-
Town of Altavista	4,679.4	2,940.2	-	-	-
Town of Brookneal	77.5	-	-	-	-
Lynchburg City	73,029.3	214,938.9	275,372.9	510.2	-

Notes: All values are in thousands of dollars. County totals do not include the town loss estimates

Table 4-20 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses for user defined facilities.

Locality	Capital Stock Exposure		Capital Stock Losses			
	Building Exposure	Contents Exposure	Building Loss	Contents Loss	Inventory Loss	Total Loss
Amherst County	14%	10%	4%	9%	7%	6%
Appomattox County	24%	26%	40%	37%	100%	39%
Bedford County	57%	54%	63%	48%	21%	58%
Campbell County	38%	31%	44%	27%	11%	36%
Lynchburg	37%	31%	23%	28%	14%	26%

Table 4-21 Percentage difference between 1-percent and 0.2-percent annual chance of flooding in direct economic losses by building occupancy - total loss

Locality	Residential	Commercial	Industrial	Government	Religion
Amherst County	19%	27%	9%	100%	32%
Town of Amherst	46%	-	-	-	-
Appomattox County	38%	-	-	-	-
Town of Appomattox	15%	-	-	-	-
Town of Pamplin	-	-	-	-	-
Bedford County	63%	22%	62%	100%	15%
Town of Bedford	28%	18%	-	-	100%
Campbell County	45%	14%	-	-	-
Town of Altavista	51%	12%	-	100%	-
Town of Brookneal	100%	-	-	100%	-
Lynchburg City	30%	82%	2%	100%	-

4.3.4 Jurisdictional Analysis

4.3.4.1 Amherst County and Town of Amherst

Amherst County is located near the geographic center of Virginia just north of the City of Lynchburg. The county was created in 1761 from Albemarle County and is named for Major-General Jeffery Amherst, a

hero of the battle of Ticonderoga. It is bounded on the northwest by Rockbridge County, to the south and southwest by Bedford County, Campbell County, and the City of Lynchburg and on the northeast by Nelson County. James River borders the county on the south and east, with the crest of the Blue Ridge Mountains forming the western boundary. According to the American Community Survey, Amherst County's population dropped by 1.09 percent to 31,999 between 2010 and 2016. Half the population is located in the south central portion of the county near the City of Lynchburg and around Madison Heights. According to Virginia's Career and Workforce-Labor Market Information, the top five largest employers of Amherst County (excluding local government) in 2019 are Glad Manufacturing Company, Greif Packaging LLC, WalMart, Sweet Briar College, and Johnson Health Center.[18]

The Town of Amherst was incorporated in 1910 and is situated on the topographic divide separating Tribulation Creek and Rutledge Creek. It was renamed from its original names "The Oaks" and "Seven Oaks" in 1807, after Nelson County divided from Amherst County. The Town of Amherst serves as the county seat. As of the 2017 population estimate, the town has a total population of 2,519.

4.3.4.1.1 Community Characteristics

Amherst County entered the National Flood Insurance Program (NFIP) on July 17, 1978, with emergency entry on March 1, 1974. The current effective date for the FIRMs is September 19, 2007. They are currently in good participating standing with the program. The unincorporated area of the county has 36 flood policies in force, of which 17 policies in the effective flood high hazard area. Total loss paid since 1978 is about $1.2 M. Amherst County plans to continue NFIP compliance. There were 14 county wide presidential disaster declarations for Amherst County (Figure 4-9). The 1-percent and 0.2-percent annual chance flood areas in Amherst County take 25.3 and 26.4 square miles, accounting for 5.3% and 5.5% total area of the entire county, respectively.

The Town of Amherst entered into the NFIP November 2, 1977 with emergency entry on February 7, 1974. The current effective date for the FIRMs is also September 19, 2007. They are currently in good participating standing with the program. The town has 4 flood policies in force, including 2 policies in the effective flood high hazard area. $132 K losses have been paid since 1978 (Figure 4-10). The Town of Amherst plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Amherst take 0.3 and 0.3 square miles, accounting for 6.6% and 6.8% total area of the town, respectively.

[18] https://virginiaworks.com/download-center

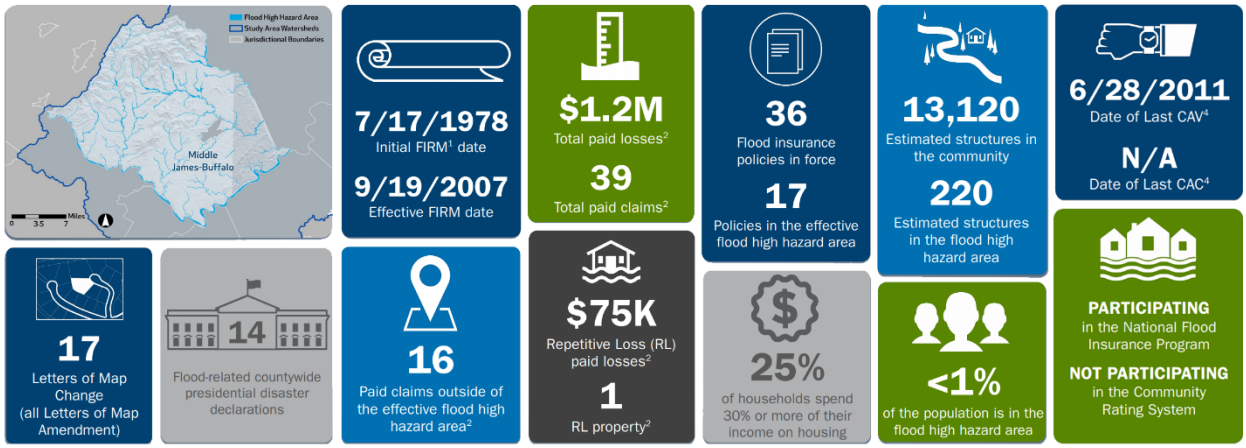


Figure 4-9 Community dashboard of Amherst County (Unincorporated Areas)

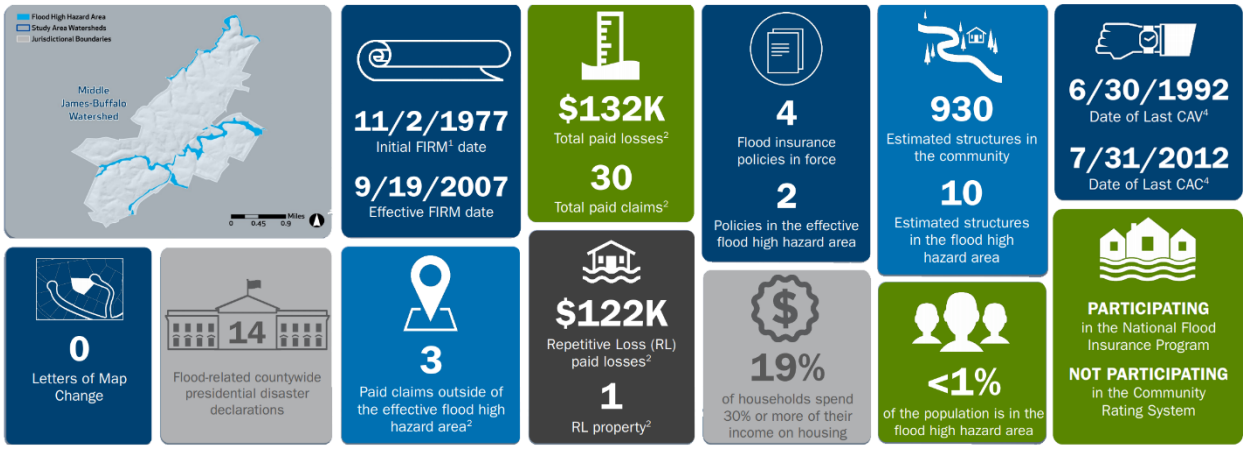


Figure 4-10 Community dashboard of Town of Amherst

4.3.4.1.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Amherst County using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan. The following principal flood problems have been identified for Amherst County and Town of Amherst.

- Low-lying areas along James River are subject to periodic flooding.
- Tropical storms are responsible for some of the larger floods experienced on James River. Flooding from these storms almost always occurs in the period of May through November, which is hurricane season.
- Williams Run is much more responsive to localized storms with intense rainfall. Most flooding along Williams Run is minor backyard-type flooding. The increased development in this area is changing watershed parameters and could cause more severe flooding in the future.

- Critical facilities located in the floodplain include: Henry L. Lanum, Jr. Water Filtration Plant, Williams Run Sewage Pump Station, ACSA's major sewage pump station along James River, Water Treatment Plant and raw water intake on Harris Creek, Rutledge Creek WWTP, the Town's raw water intake, Pedlar Volunteer Fire and Rescue, and Monacan Ancestral Museum.
- Trunk line for the public sewer serving half of Madison Heights, the County's commercial hub and largest town, is on the north bank of James River and threatened by river bank erosion. Some of the water lines and many of the sewer lines follow the streams. A pump station is also in the base floodplain and other pump stations are inaccessible during flood events.
- Natural gas line located in floodplain.
- 20 high risk bridges and 1 bridge with unknown status in the floodplain.
- Two repetitive loss properties and two severe repetitive loss properties
- Older population located in the floodplain.

4.3.4.1.3 Vulnerable Population and Structures

Certain people and households are especially sensitive to flooding events (or other natural hazards), such as low-income households, children, elderly, disabled, and minorities. These vulnerable populations are typically less likely to prepare for hazards, may be unable to undertake self-protective actions, or lack the resources to take recommended loss-reduction or evacuation measures.

Demographic data with dasymetric mapping techniques at census block level were used for profiling the vulnerable population in or adjacent to floodplains within the incorporated area of Amherst County. The dasymetric census blocks have attempted to remove the unpopulated areas from the official census blocks. FEMA's Risk Map program identified "Less than 1% of the population is in the floodplain" for the county. However, up to 10.9% (or 11.2%) of the county's population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 6.3% of them are at a low-income level, 21.7% are young (age < 16), and 19.2% are seniors (age > 65). Whites make up the largest share (75.7%) of the total residents in Amherst County. Likewise, whites dominate in or around the floodplain, representing 82.9% of the vulnerable population. Blacks are 11.9% of the vulnerable population, Hispanic or Latino are 0.1%, Asians are 0.1%, and Native Americans are 0.4%. Table 4-22 and

Table 4-23 provide more demographics of the vulnerable population in Amherst County, in terms of ethnic group, income level, and age group.

Table 4-22 Ethnic group in and adjacent to floodplains of Amherst County and Town of Amherst

	Population	Households	White	Black	Hispanic	Asian	Native Am
Amherst	32353	12560	24491 (75.7%)	6104 (18.9%)	625 (1.9%)	153 (0.5%)	296 (0.9%)
1% Floodplain	3539 (10.9%)	1363	2933 (82.9%)	420 (11.9%)	90 (2.5%)	4 (0.1%)	13 (0.4%)
0.2% Floodplain	3636 (11.2%)	1403	3026 (83.2%)	421 (11.6%)	92 (2.1%)	4 (0.1%)	14 (0.4%)

Table 4-23 Income level and age group in floodplains of Amherst County and Town of Amherst

	Population	Households	Income <$20k/Yr	Age <16	Age >65
Amherst	32353	12560	2404 (7.4%)	6940 (21.5%)	5330 (16.5%)
1% Floodplain	3539	1363	222 (6.3%)	768 (21.7%)	679 (19.2%)
0.2% Floodplain	3636	1403	230 (6.3%)	786 (21.6%)	705 (19.4%)

The unincorporated area of Amherst County has 159 (or 178) primary structures identified in the 1-percent (or 0.2-percent) floodplain and are shown in Figure 4-11. Most vulnerable structures are located in the following areas:

- Woodson / Lowesville area. This remote residential area has about 30 structures in the floodplain, including houses, retail stores, and a church along Woodson Rd (Figure 4-12, Panel D).
- Willow / Forks of Buffalo area. Approximately 20 structures (including the Pedlar Volunteer Fire And Rescue facility) along Route 60 and N Fork Rd (Figure 4-12, Panel F).
- Bank of James River in the south border of the county. There are over 30 homes and retail stores in the floodplain (Figure 4-12, Panel A). This is also part of the county's community growth area (Figure 4-15).
- Stapleton area. 16 homes on Galts Mill Rd along James River (Figure 4-12, Panel E).
- The north end of Thrashers Creek Rd along the South Fork Thrashers Creek and tributary streams in the north of the county (Figure 4-12, Panel B).
- Dancing Creek Rd and Wagon Trail Rd near Pera area (Figure 4-12, Panel C).

The Town of Amherst has 4 (or 4) structures (single family homes) in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-14. As mentioned in the data cleaning process section of this chapter, only primary structures are identified in the floodplain. It is possible that small outbuildings/sheds of the primary structure may exist in the floodplain as well.

There are 8 critical facilities and infrastructure in both 1-percent and 0.2 percent floodplain of the unincorporated area of Amherst County. These include 2 campgrounds (Oronoco Campground and Otter Creek Campground), 2 energy facilities (Snowden Hydro Power Plant and Cushaw Hydro Power Plant), 1 HazMat facility (Lynchburg Steel & Specialty Co., Inc.), Monacan Ancestral Museum, Pedlar Volunteer Fire and Rescue, Henry L. Lanum, Jr. Water Filtration Plant, Williams Run Sewage Pump Station, ACSA's major sewage pump station along James River, Water Treatment Plant and raw water intake on Harris Creek, and a pump station by Route 718 (Table 4-24). According to the Locality Vulnerability Meeting, a trunk sewer which collects about 50% of waste produced by Madison Heights, the County's commercial hub and largest town is on the north bank of James River. Also, a portion of a natural gas line is within the flood zone.

In the Town of Amherst, Rutledge Creek Waste Water Treatment Plant (WWTP) is identified in the 1-percent flood zone. The headworks of the facility are not in a high elevation area. It is known that the town's raw water intake is also in the flood zone.

Table 4-24 Critical facility and infrastructure in floodplain of Amherst County and Town of Amherst

Facility Name	Address	Facility Type	Coordinates	Flood Zone *
Monacan Ancestral Museum	2009 Kenmore Rd, Amherst	Attractions	37.5729, -79.1270	1%; 0.2%
Oronoco Campground	Jordan Rd, Vesuvius	Campground	37.7488, -79.2653	1%; 0.2%
Otter Creek Campground	60851 Blue Ridge Pkwy, Monroe	Campground	37.5760, -79.3379	1%; 0.2%
Cushaw Hydro Power Plant	Mt Grove Cr-01 600 N., Warm Springs	Energy Facility	37.5929, -79.3813	1%; 0.2%
Snowden Hydro Power Plant	7443 Elon Road, Big Island	Energy Facility	37.5736, -79.3715	1%; 0.2%
Pedlar Volunteer Fire and Rescue	4893 Lexington Turnpike, Amherst	Fire Stations	37.6725, -79.2171	1%; 0.2%
Lynchburg Steel & Specialty Co Inc	275 Francis Avenue, Monroe	HazMat Facility	37.5075, -79.1230	1%; 0.2%
Sewer Pump Station	Route 718 / Buffalo River, Amherst	Sewer Pump Station	37.6091, -79.0384	1%; 0.2%
Rutledge Creek WWTP **	731 Industrial Dr, Amherst	Wastewater Treatment Plant	37.5844, -79.0304	1%; 0.2%
ACSA Henry L. Lanum Water Filtration Plant	1355 Elon Road, Madison Heights	Water Treatment	37.4846, -79.166	1%; 0.2%
ACSA Williams Run Sewage Station	101 Carolina Avenue, Madison Heights	Sewage Pump Station	37.4053, -79.1004	1%; 0.2%
ACSA Madison Heights Trunk Sanitary Sewer	North bank, James River	Sanitary Sewer	37.3992, -791157	1%; 0.2%

Note: * 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. ** Located in the Town of Amherst.

In the unincorporated areas of Amherst County, there are 183 flood-prone roads (13 are US or state primary roads), with a total of over 51 miles road segments in the floodplain (Table 4-25). The top five susceptible roads are all US or state primary roads, including Blue Ridge Pkwy, Lexington Tpke, N. Fork Rd, Galts Mill Rd, and Woodson Rd. Some other roads that have more than multiple flood-prone locations along their route include: Buffalo Springs Tpke, Wagon Trail Rd, Elon Rd, River Rd, Thrashers Creek Rd, Little Piney Rd, and Little Irish Rd. Among the county's total 150 road bridges, 108 (or 111) are within 1-percent (or 0.2-percent) flood zones which includes 20 bridges at high risk (scour potential between 1- 4) and 1 bridge with unknown risk status (unknown scour potential). These are shown in Table 4-27 and Figure 4-13.

In the Town of Amherst, there are 12 roads that may be impacted during flooding. Road segments in the floodplain total about 1.7 miles and are shown in Table 4-26 and Figure 4-14. The five most susceptible roads are the ramp on Route 29NB (near Amherst County High School), Monacan Pkwy, S Amherst Hwy, N Amherst Hwy, and Scotts Hill Rd. There are 7 road bridges in the floodplain (

Table 4-28). Two locations (79.04443°W, 37.58063°N; 79.03949°W 37.58328°N) on Norfolk Southern Railroad tracks along Rutledge Creek are within 1-percent annual chance floodplain. The tracks could be overtopped during flooding events, as there

are no bridges or culverts underneath the railroad at these locations. Besides, 7 broad bridges across Rutledge Creek and Buffalo River in the town are identified inside the floodplain (

Table 4-28), but none of them are rated at high risk (scour critical).

Table 4-25 Top 50 flood-prone roads in Amherst County (unincorporated area)

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
1	Blue Ridge Pkwy	USPRI	10	6.49
2	Lexington Tpke	USPRI	15	2.99
3	N Fork Rd	STPRI	18	2.95
4	Galts Mill Rd	USPRI	1	2.53
5	Woodson Rd	USPRI	2	2.41
6	Buffalo Springs Tpke	SEC	9	1.61
7	Wagon Trail Rd	USPRI	10	1.48
8	Elon Rd	SEC	13	1.47
9	River Rd	USPRI	4	1.39
10	Thrashers Creek Rd	SEC	4	1.37
11	Little Piney Rd	SEC	16	1.36
12	Little Irish Rd	SEC	16	1.35
13	Puppy Creek Rd	SEC	10	1.23
14	Monacan Pkwy	SEC	12	1.21
15	E Perch Rd	SEC	1	1.07
16	Fancy Hill Rd	SEC	1	0.98
17	Ashby Woods Rd	URB	4	0.84
18	Franklin Creek Rd	URB	7	0.83
19	High Peak Rd	SEC	3	0.82
20	Alhambra Rd	SEC	14	0.79
21	Coffeytown Rd	UMS	7	0.78
22	Reservoir Rd	SEC	9	0.77
23	Bateau Ln	URB	1	0.77
24	Hercules Rd	USPRI	10	0.75
25	Perkins Mill Rd	SEC	5	0.72
26	Mount Horeb Rd	SEC	8	0.72
27	Pedlar River Rd	SEC	12	0.69
28	Lynchburg Expy	SEC	2	0.68
29	C And O Ln	SEC	1	0.65
30	Salt Creek Rd	URB	1	0.61
31	Riverville Rd	SEC	3	0.59
32	Beck Creek Rd	URB	5	0.59
33	Slapp Creek Rd	SEC	12	0.55
34	Dancing Creek Rd	SEC	3	0.54
35	Lowesville Rd	SEC	6	0.54
36	Monacan Park Rd	SEC	1	0.54
37	Amelon Expy	SEC	6	0.53

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
38	S Amherst Hwy	URB	12	0.53
39	Matohe Rd	SEC	4	0.52
40	Indian Creek Rd	SEC	9	0.51
41	Dillard Hill Rd	SEC	2	0.46
42	Moss Rock Rd	SEC	2	0.46
43	Waughs Ferry Xing	SEC	5	0.46
44	Wilderness Creek Rd	SEC	3	0.43
45	Poor House Farm Rd	URB	1	0.40
46	Wiggins Spring Rd	SEC	6	0.37
47	Fiddlers Green Way	SEC	2	0.37
48	Wares Gap Rd	SEC	2	0.35
49	Peters Hollow Rd	SEC	3	0.32
50	Angel Hollow Ln	SEC	1	0.31

Table 4-26 Flood-prone roads in Town of Amherst

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (feet)
1	Ramp on Route 29NB	Ramp	2	2,470
2	Monacan Pkwy	Primary	3	1,945
3	S Amherst Hwy	Primary	5	1,109
4	N Amherst Hwy	Primary	2	825
5	Scotts Hill Rd	Secondary	1	595
6	Amherst Hwy	Primary	3	522
7	Industrial Park Dr	Secondary	1	498
8	Union Hill Rd	Secondary	1	472
9	Richmond Hwy	Primary	1	168
10	Lexington Tpke	Primary	1	124
11	S Main St	Primary	1	113
12	Macadam Rd	Secondary	1	50

Table 4-27 Road bridges at high risk (scour critical) in floodplain in Amherst County

Name	Location	Crossing	Coordinate
Winesap Road	.35-Rt.1430/2.37-Rt.652	Harris Creek	37.4932, -79.1526
Elon Road	0.80-Rt 635 / 8.63-Rt 501	Maple Creek	37.5455, -79.2660
Patrick Henry Hwy.	2.99-Nel CL / .40-Rt 662	Naked Creek	37.6640, -79.0109
Toytown Road	0.70-Rt.765/1.00-Rt.739	Turner Creek	37.6134, -78.9946
Puppy Creek Road	2.20-Rt 717 / .10-Rt 60	Buffalo River	37.6558, -79.1496
Dancing Creek Road	1.40-Rt 635 / 1.00-Rt 641	Pedlar River	37.6005, -79.2639
Sandidges Road	0.50-Rt.617/0.60-Rt.632	Thrashers Creek	37.6658, -79.1350
Puppy Creek Rd	0.02-Rt.803/1.00-Rt.636	Puppy Creek	37.6301, -79.1868

Name	Location	Crossing	Coordinate
Dancing Creek Rd.	0.40-Rt.641/2.00-Rt.635	Dancing Creek	37.5980, -79.2706
Earley Farm Road	6.75-Rt.604/1.35-Rt.814	Partridge Creek	37.4827, -78.9928
Earley Farm Road	1.20-Rt.814/6.90-Rt.604	Partridge Creek	37.4810, -78.9931
Dug Hill Road	.70-Rt.713/.20-Rt.758	Mill Creek	37.6909, -79.0909
Little Piney Road	2.20-RT.698/1.20-RT.781	Little Piney River	37.7430, -79.1020
Meadow Hollow Road	1.00-Dead End/0.80-Rt 799	Horsley Creek	37.5926, -79.2345
Ramsey Road	0.00-Rt 643/3.70-Rt 647	Pedlar River	37.5734, -79.2592
Glade Road	.53-Rt 663 / 1.17-Rt 670	Stovall Creek	37.4623, -79.0574
Pryors Creek Road	0.10-Rt 610/0.70-Dead End	Pryor Creek	37.6059, -79.2124
Pierce Mountain Rd	.15-Rt 617/.65-Dead End	Thrashers Creek	37.6983, -79.1458
Possum Island Rd	0.25-Rt 1349/0.35-Rt 701	Trib Mf Stovall Creek	37.4775, -79.0861
Rte 210 Connector	0.50-Rt.622/1.70-Rt.29BYP	Williams Run	37.4162, -79.1119

Table 4-28 Road bridges in floodplain in Town of Amherst

Location	Crossing	Name	Coordinates	Floodplain
.47-SCL Amherst/.97-29Byp	Williams Creek	Route 29 Business	37.5728, -79.0590	1%; 0.2%
.09-29 Bus/1.76-Rt 60	Rutledge Creek	Route 29	37.5611, -79.0638	1%; 0.2%
1.18-S Bus 29 / .67-Rt 60	Rutledge Creek	NBL&SBL Amherst Hwy	37.5733, -79.0522	1%; 0.2%
.84-S Bus 29 / 1.01-Rt 60	Rutledge Creek	NBL Amherst Hwy	37.5715, -79.0527	1%; 0.2%
0.00-Rt.608 / 0.60-Rt.739	Buffalo River	Amherst Highway	37.6052, -79.0264	1%; 0.2%
0.15-Rt 838/0.22-ECL	Rutledge Creek	Richmond Highway	37.5776, -79.0433	1%; 0.2%
0.10-Rt.1125/0.80-Rt.606	Rutledge Creek	Union Hill Road	37.5767, -79.0483	1%; 0.2%

Note: None of the bridges in the Town of Bedford is rated as at high risk (scour critical).

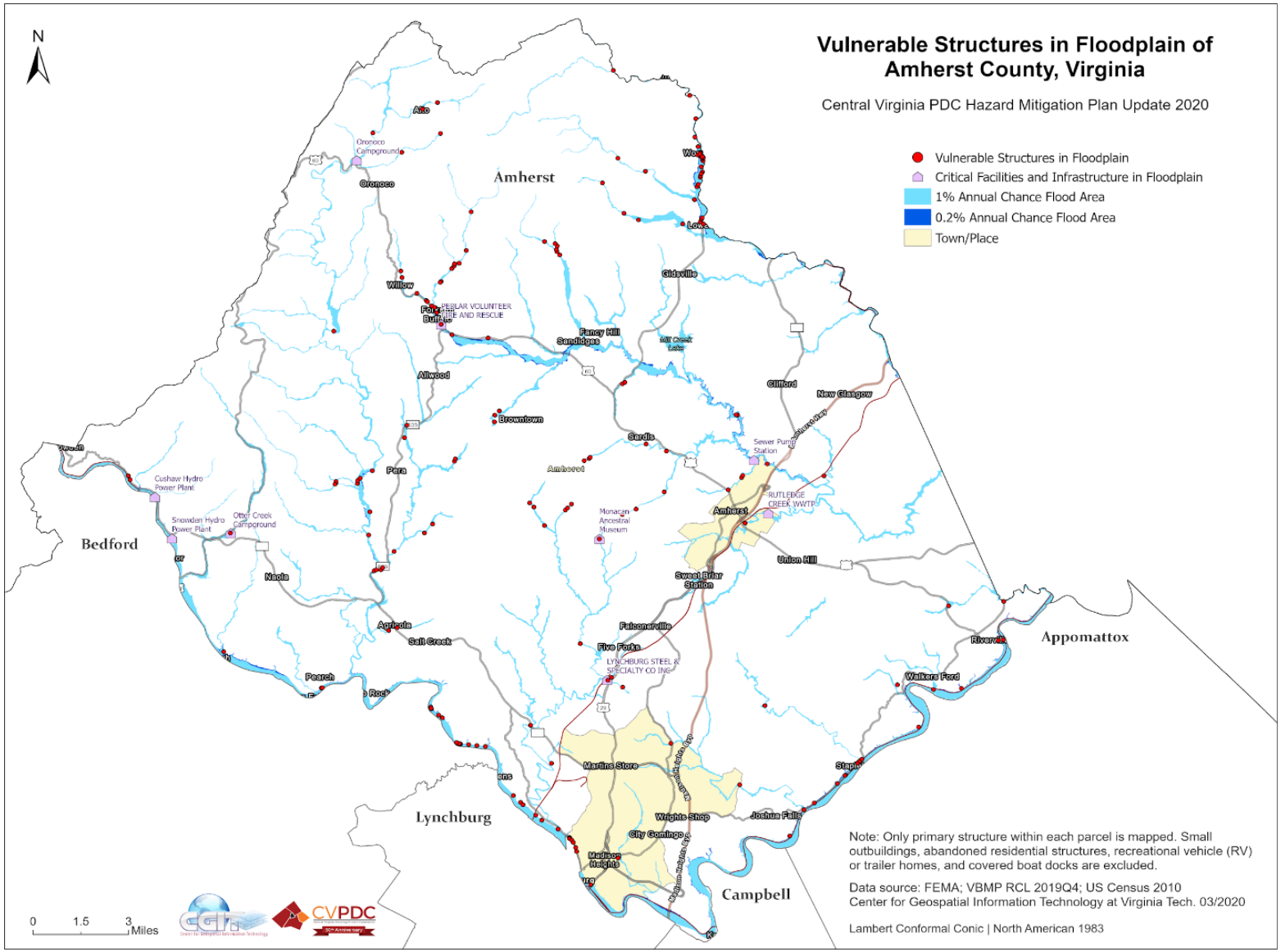


Figure 4-11 Vulnerable structures in floodplain of Amherst County, Virginia (overview map)

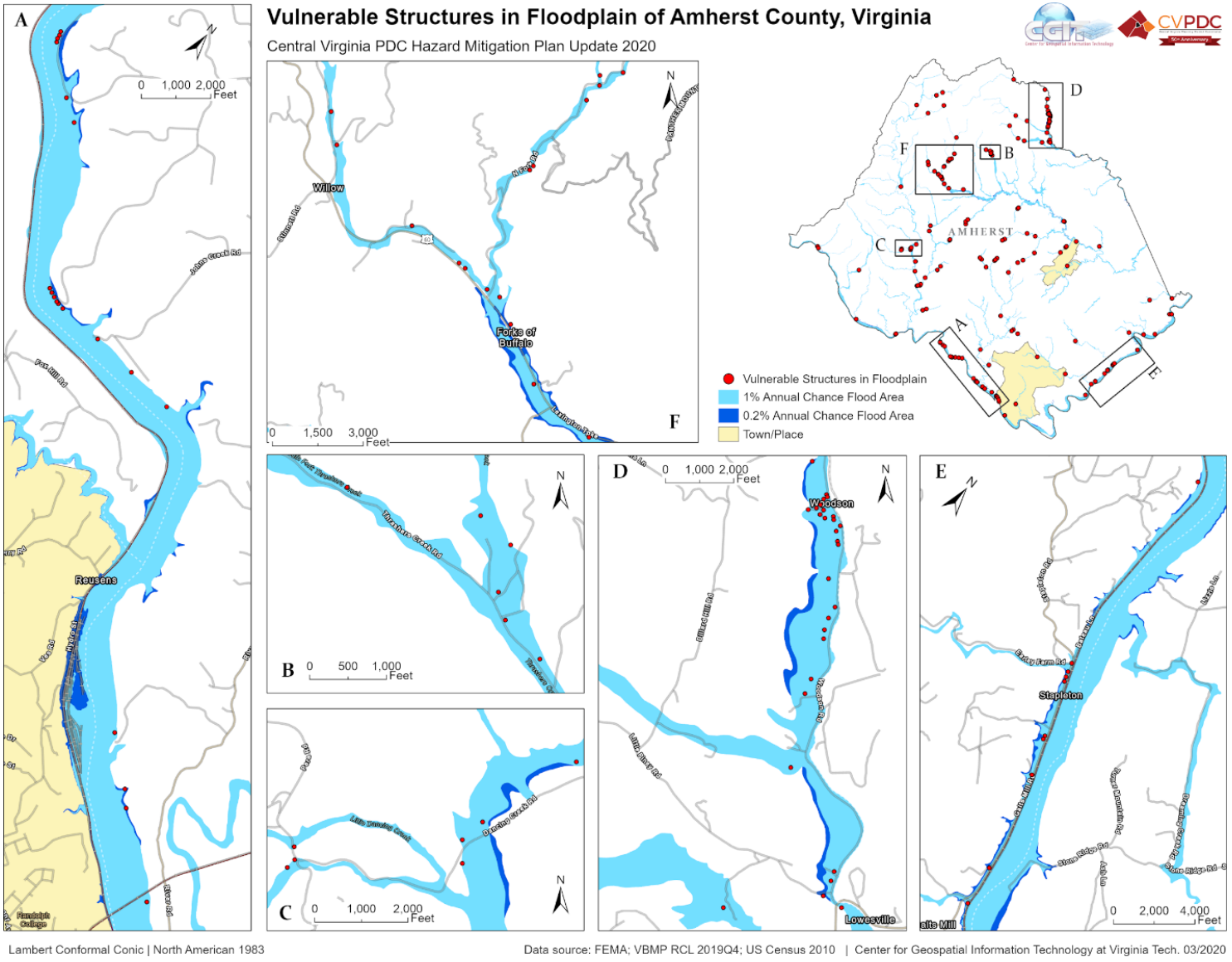


Figure 4-12 Vulnerable structures in floodplain of Amherst County, Virginia (detailed map)

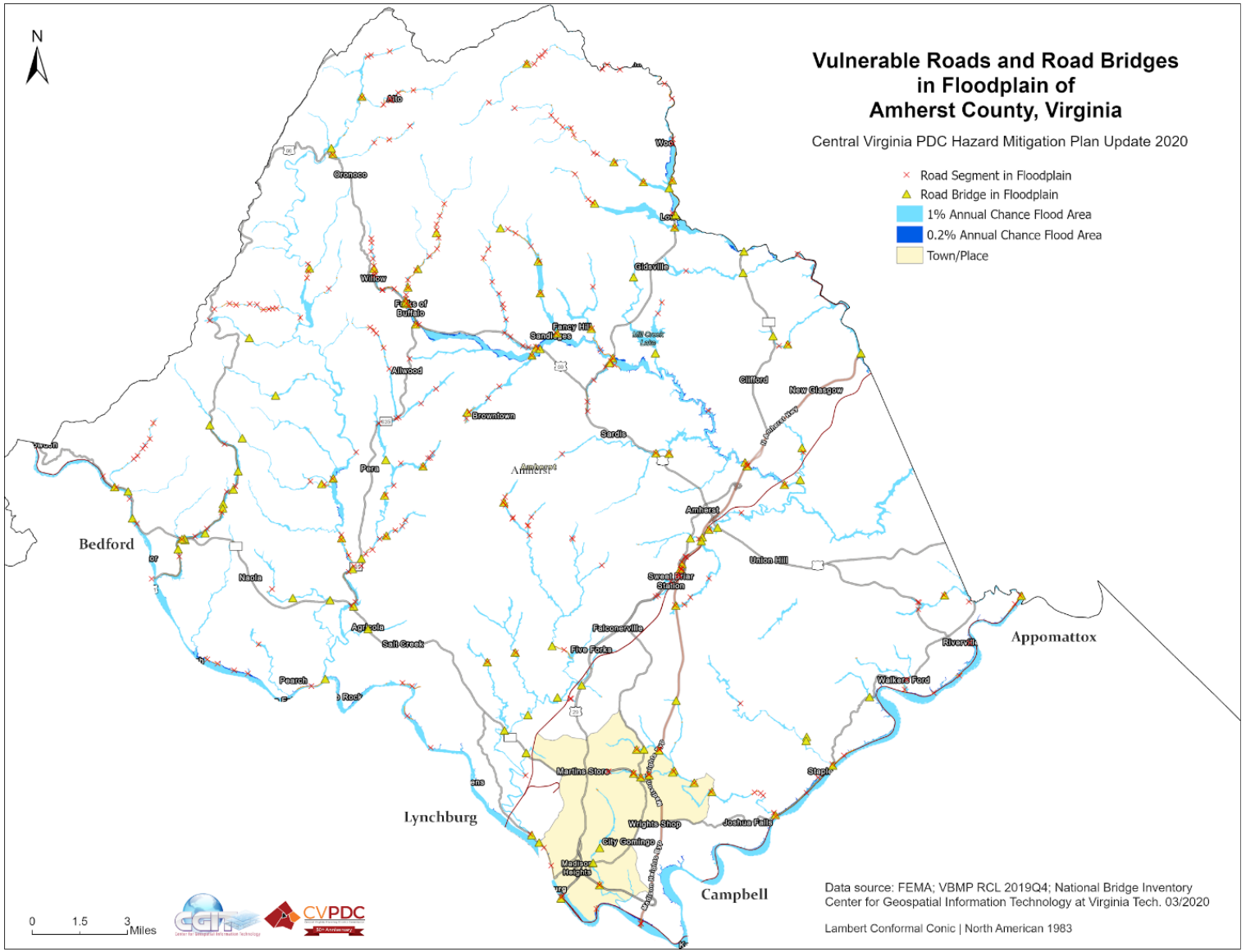


Figure 4-13 Vulnerable roads and bridges in floodplain of Amherst County, Virginia

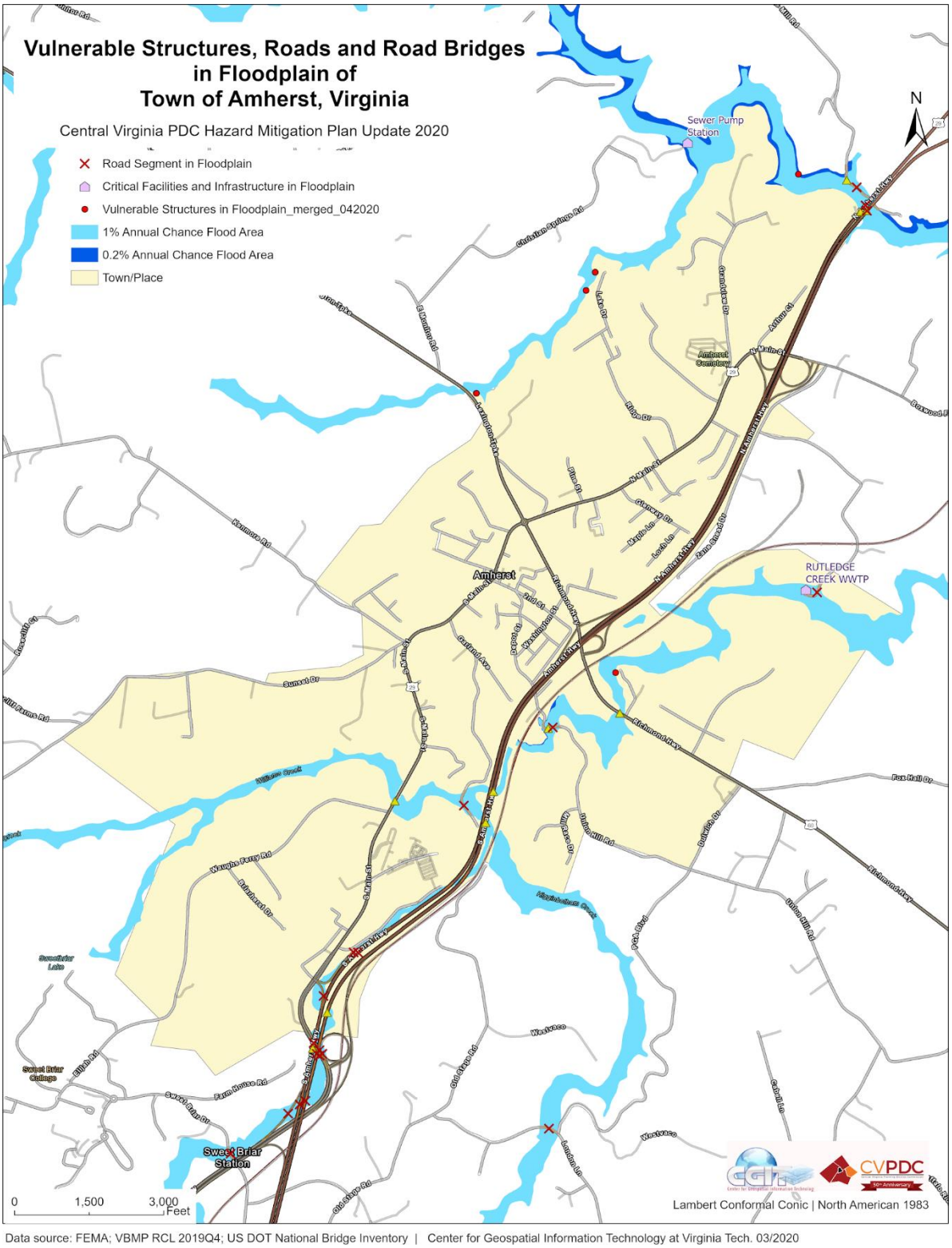


Figure 4-14 Vulnerable structures, roads and road bridges in floodplain of Town of Amherst, Virginia

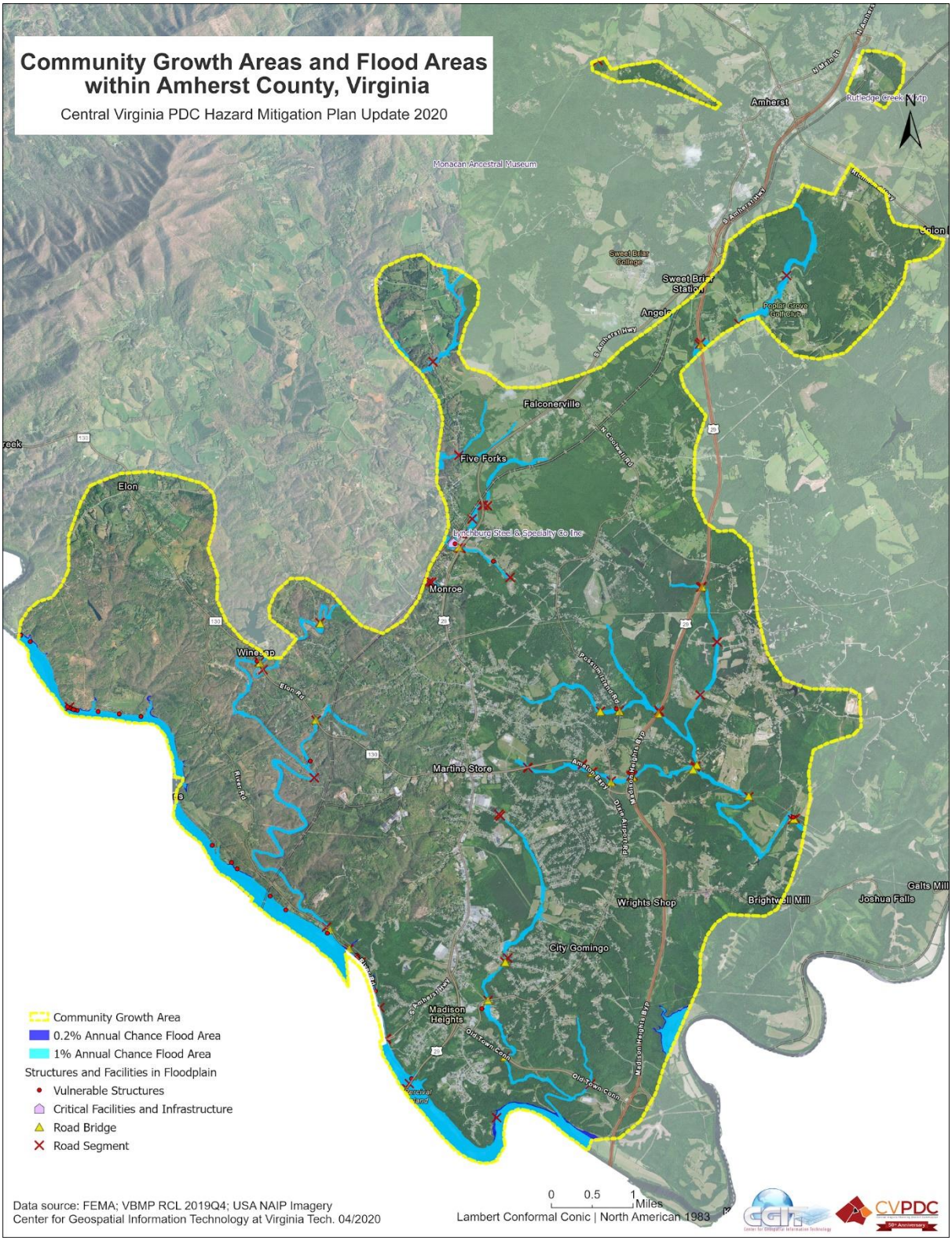


Figure 4-15 Community growth areas and floodplain within Amherst County, Virginia

4.3.4.2 Appomattox County and Town of Appomattox

Appomattox County is located at the geographic center of Virginia. The county consists of 343 square miles of gently rolling terrain indicative of Virginia's Piedmont Region. Elevations range from 460 feet to 1,151 feet above sea level. Drainage is provided by James River, Appomattox River, Roanoke River Drainage Area, and Bent and Wreck Island Creeks. Appomattox County is perhaps best known in history as the site of the end of the Civil War at Appomattox Court House. The county is bordered to the north by Amherst County, Buckingham County, and Nelson County, to the south by Charlotte County, to the east by Prince Edward County, and Campbell County to the west. James River serves as the northwest border. The towns of Pamplin and Appomattox are within the county, with the Town of Appomattox being the county seat. The 2016 population of Appomattox County was 15,314. The top six employers (excluding local government) in Appomattox are WalMart, Delta Response Team LLC, Kroger, Gretna Health Care Center, Petrochem Recovery Services, and Farmers Bank of Appomattox.

4.3.4.2.1 Community Characteristics

Appomattox County entered into the NFIP on July 17, 1978, with emergency entry on February 11, 1974. The current effective date for the FIRMs is January 2, 2008. It is currently in good participating standing with the program. The county has 8 flood policies in force, with $256,000 losses paid. Appomattox County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance floodplain in unincorporated areas of Appomattox County cover 15.3 and 15.5 square miles, accounting for 4.6% and 4.6% total area of the county, respectively. The community dashboard for Appomattox County is shown in Figure 4-16.

The Town of Appomattox entered into the NFIP on May 25, 1984 with emergency entry on February 22, 1974. The current effective date for the FIRMs is January 2, 2008. It is currently in good participating standing with the program. The town has 2 flood policies in force, with no loss paid. The Town of Appomattox plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Appomattox both cover approximately 0.2 square miles, accounting for 0.7% total area of the town. The community dashboard for the Town of Appomattox is shown in Figure 4-17.

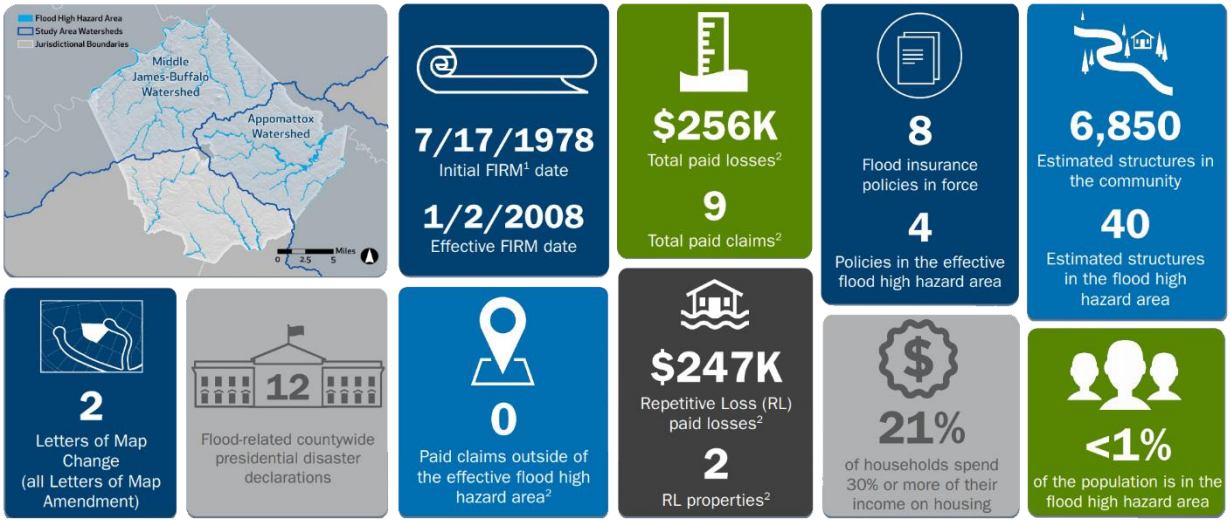


Figure 4-16 Community dashboard of Appomattox County (Unincorporated Areas)

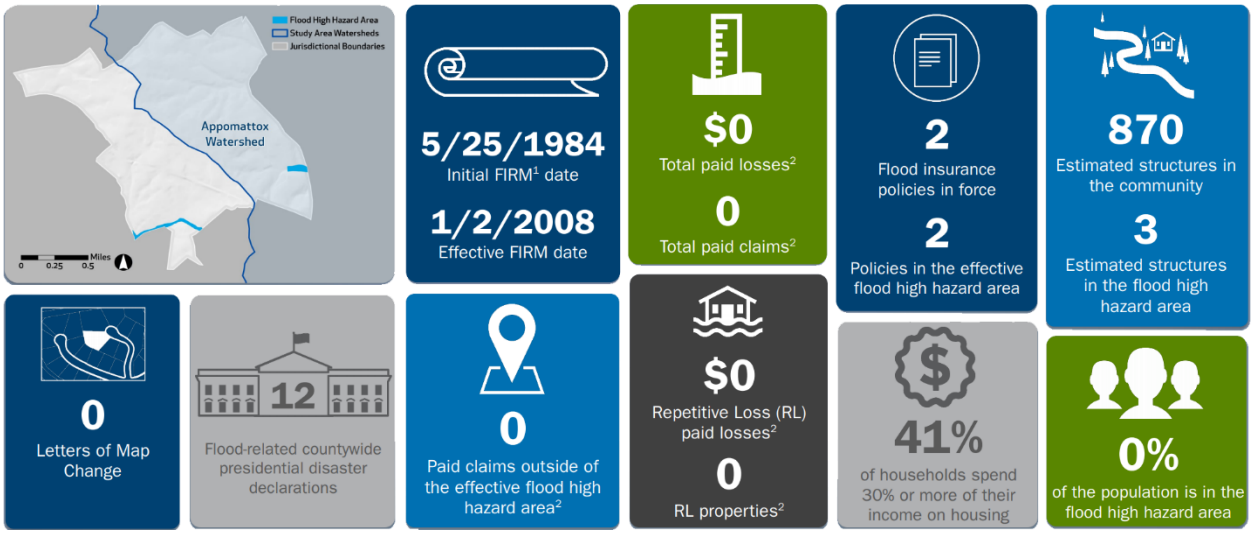


Figure 4-17 Community dashboard of Town of Appomattox

4.3.4.2.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Appomattox County using the Flood Risk Discovery Report of Appomattox Watershed (FEMA, 2018) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan. The following principal flood problems have been identified for Appomattox County.

- Lower grounds along the county's smaller streams are sometimes damaged by flooding of crops, deposition of silt on crops, and by channels silting up and preventing proper drainage.
- Low-lying areas along James River are subject to periodic flooding.
- Tropical storms are responsible for some of the larger floods experienced on James River. Flooding from these storms almost always occurs in the period of May through November, which is hurricane season.
- Flooding on James River, however, may also be caused by heavy rains at any time.
- Streambank stabilization issues in the Sunnydale/ South Church area.
- Natural gas line located in floodplain.
- 9 high risk bridges in the floodplain.
- Two repetitive loss properties and one severe repetitive loss property
- Lower income population located in the floodplain.

4.3.4.2.3 Vulnerable Population and Structures

Demographic data with dasymetric mapping techniques at census block level were used for profiling the vulnerable population in or adjacent to floodplains within the Appomattox County incorporated area FEMA's Risk Map program identified zero of the population is in the floodplain for the county. However, the county's up to 3.6% (or 5%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 9.2% of them are at a low-income level, 23.3% are young, and 13.2% are seniors. Whites make up the largest percentage (76.7%) of Appomattox County residents. Likewise, whites also predominate in or around the floodplain,

representing 73.9% of the vulnerable population. Blacks are 21.8% of the vulnerable population, Hispanic or Latino are 1.5%, Asians are 0.2%. There are no Native Americans in the floodplain. Table 4-29 and Table 4-30 provide more demographics of the vulnerable population in Appomattox County, in terms of ethnic group, income level, and age group.

Table 4-29 Ethnic group in floodplains of Appomattox County

	Population	Households	White	Black	Hispanic	Asian	Native Am.
Appomattox	14973	6033	11483 (76.7%)	2998 (20.0%)	167 (1.1%)	35 (0.2%)	28 (0.2%)
1% Floodplain	532 (3.6%)	211	393 (73.9%)	116 (21.8%)	8 (1.5%)	1 (0.2%)	0 (0.0%)
0.2% Floodplain	748 (5.0%)	304	589 (78.7%)	126 (16.8%)	16 (2.1%)	1 (0.1%)	0 (0.0%)

Table 4-30 Income level and age group in floodplains of Appomattox County

	Population	Households	Income <$20k/Yr	Age <16	Age >65
Appomattox	14973	6033	1280 (8.5%)	3325 (22.2%)	2607 (17.4%)
1% Floodplain	532 (3.6%)	211	49 (9.2%)	124 (23.3%)	70 (13.2%)
0.2% Floodplain	748 (5.0%)	304	82 (11.0%)	161 (21.5%)	118 (15.8%)

The unincorporated area of Appomattox County has only 43 (or 49) primary structures identified in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-18. Most are scattered within the county. No critical facility or infrastructure was found in the floodplains. The growth areas do contain floodplains shown in Figure 4-21. Two clusters of vulnerable structures are located in the following areas:

- Bent Creek area along James River. About 10 homes or commercial buildings are in the floodplain.
- North bank of James River near the river bend, where 5 homes are concentrated.

The Town of Appomattox has 2 primary structures inside of both 1-percent and 0.2-percent floodplains shown in Figure 4-20. One pump station near State Rte. 1036 (between Hunter St and Morris Ave) is in the 0.2-percent floodplain (very close to the 1% floodplain) shown in Table 4-31.

Table 4-31 Critical facility and infrastructure in floodplain of Appomattox County and Town of Appomattox

Facility Name	Address	Facility Type	Coordinates	Flood Zone *
Pump Station	State Rte. 1036, Appomattox	Sewer Pump Station	37.3481, -78.8272	0.2%

Note: 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone

In the unincorporated areas of Appomattox, there are 75 flood-prone roads, with a total of about 14 miles road segments in the floodplain (Figure 4-19). The top five susceptible roads are located along James River, including Chase Trail Ln, Dreaming Creek Rd, Stone Ridge Rd, Oakville Rd, Riverside Dr, and Mill Pond Rd.

Wheelers Spring Rd and Whispering Pine Rd have multiple flood-prone locations along their route. Among the 52 road bridges located in the floodplains, 9 are scour critical bridges which identified as at high risk (Table 4-32).

There are very few road segments in the Town of Appomattox within the floodplain. These include Morris Ave, Dogwood St, Richmond Hwy (Route 460), Red House Rd, and Church St. Total flood-prone road segments are about 0.1 miles (Table 4-33). No vulnerable road bridges are found within the town boundary.

Table 4-32 Top 50 flood-prone roads in Appomattox County (unincorporated area)

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
1	Chase Trail Ln	STR	1	1.01
2	Dreaming Creek Rd	SEC	7	0.93
3	Stone Ridge Rd	SEC	3	0.78
4	Oakville Rd	STR	4	0.76
5	Riverside Dr	STR	3	0.71
6	Mill Pond Rd	SEC	3	0.61
7	Coleman Mountain Rd	SEC	1	0.59
8	River Bottom Ln	SEC	2	0.53
9	Holiday Lake Rd	STR	1	0.39
10	Red House Rd	SEC	2	0.34
11	Jersey Ln	SEC	1	0.30
12	River Ridge Rd	USPRI	2	0.28
13	Wheelers Spring Rd	SEC	7	0.27
14	Blackberry Ln	SEC	2	0.25
15	Aldridge Ln	SEC	2	0.24
16	Hixburg Rd	SEC	2	0.24
17	Whispering Pine Rd	SEC	5	0.23
18	Buck Creek Rd	SEC	2	0.22
19	Anderson Hwy	SEC	2	0.22
20	Cutbanks Rd	SEC	1	0.21
21	Quarry Rd	STR	2	0.19
22	Horseshoe Rd	STR	1	0.18
23	James River Rd	SEC	2	0.18
24	Silo Rd	STR	1	0.18
25	Old Courthouse Rd	STR	1	0.17
26	Old Grist Mill Rd	SEC	1	0.17
27	Little Cub Rd	SEC	1	0.16
28	Hancock Rd	SEC	2	0.15
29	Hollywood Rd	SEC	1	0.15
30	Mount Pleasant Rd	STR	3	0.14
31	Spring Grove Rd	SEC	2	0.14
32	Fork Rd	STR	1	0.13
33	Whipoorwill Rd	SEC	1	0.13

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (mi)
34	Watt Abbitt Rd	SEC	1	0.13
35	Creek Rd	SEC	1	0.13
36	Liberty Chapel Rd	STR	1	0.12
37	Rock Spring Rd	STR	1	0.11
38	Cedar Bend Rd	UMS	1	0.11
39	Hummingbird Ln	SEC	1	0.11
40	Colemans Mill Rd	SEC	1	0.11
41	Trents Mill Rd	SEC	1	0.10
42	Swan Rd	STR	1	0.10
43	Old Bethany Rd	SEC	1	0.10
44	Rough Creek Rd	SEC	1	0.09
45	County Line Rd	INST	1	0.09
46	Rocks Church Rd	STR	1	0.09
47	Poorhouse Creek Rd	SEC	1	0.09
48	Willow Oak Rd	STR	1	0.09
49	Paradise Rd	SEC	2	0.07
50	Salem Rd	STR	1	0.07

Table 4-33 Flood-prone roads in Town of Appomattox

Rank	Road Name	Road Type	Road Segments in Floodplain	
			Count	Total Length (feet)
1	Morris Ave	Secondary	1	187
2	Dogwood St	Secondary	1	160
3	Richmond Hwy	Primary	1	135
4	Red House Rd	Primary	1	107
5	Church St	Secondary	1	65

Table 4-34 Road bridges at high risk (scour critical) in floodplain in Appomattox County

Name	Location	Crossing	Coordinate
Route 24	0.52-Rt 627 / 0.66-Rt 656	Appomattox River	37.3819, -78.7898
Mt. Pleasant Road	0.40-Rt.626/2.50-Rt.601	Cabin Branch	37.3501, -78.6057
Liberty Chapel Rd.	0.68-Rt 686 / 1.10-Rt 616	Bent Creek	37.4767, -78.8208
Oakville Road	0.80-Rt 660 / 0.65-Rt 711	North Creek	37.4158, -78.8575
Stonewall Road	0.05-Rt.666/2.65-Rt.665	Wreck Island Creek	37.4382, -78.9081
Bellview Road	1.30-Rt 667 / 0.20-Rt 666	Wreck Island Creek	37.4541, -78.9192
Poorhouse Creek Rd	0.40-Rt 633 / 0.45-Rt 639	Rough Creek	37.3359, -78.6959
Hummingbird Lane	1.60-Rt.608 / 1.30-Rt.668	Holts Branch	37.3925, -78.9275
Arrowhead Road	0.60 -Rt611 / 0.60 -Rt610	Stonewall Creek	37.4088, -78.9825

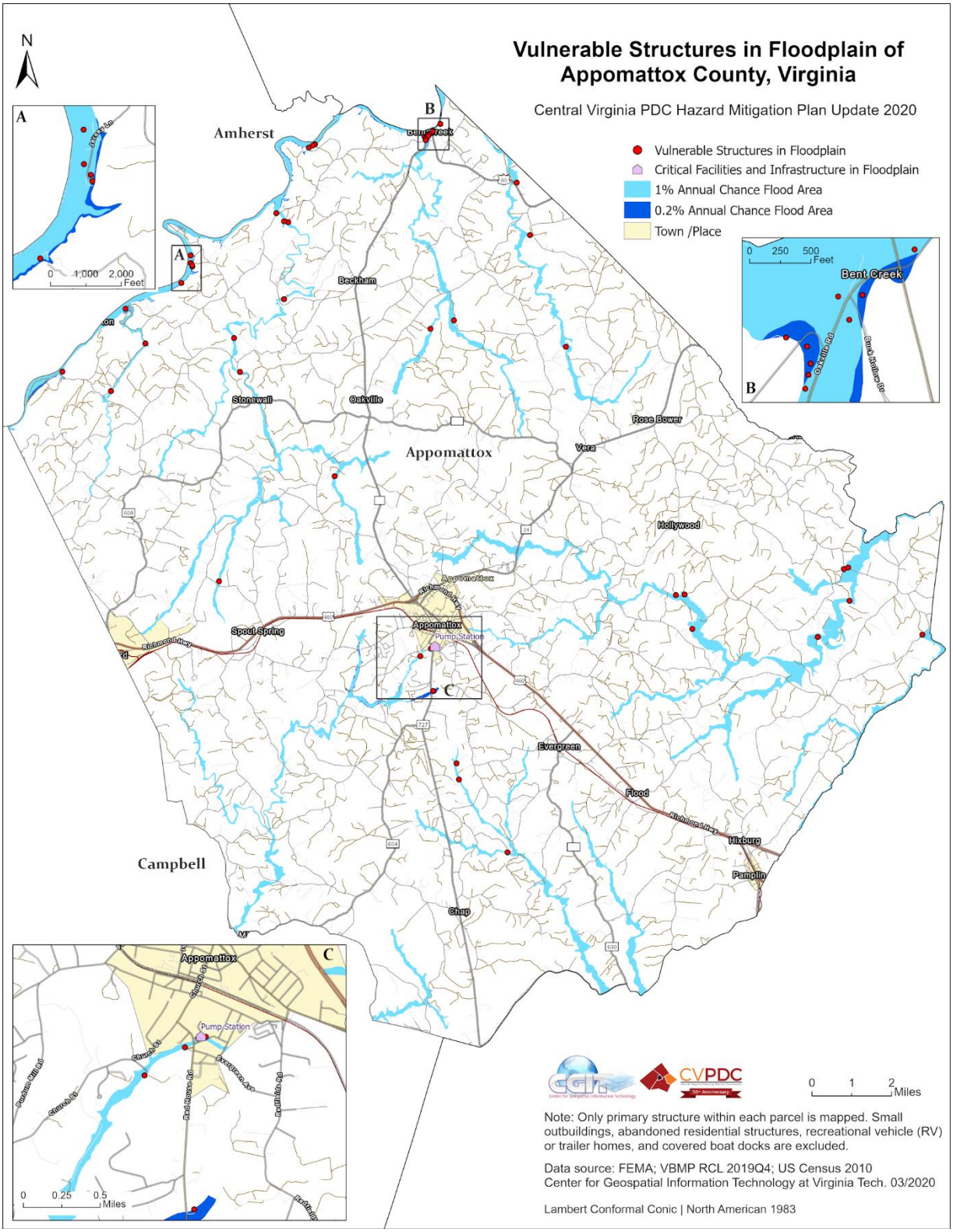


Figure 4-18 Vulnerable structures in floodplain of Appomattox County, Virginia

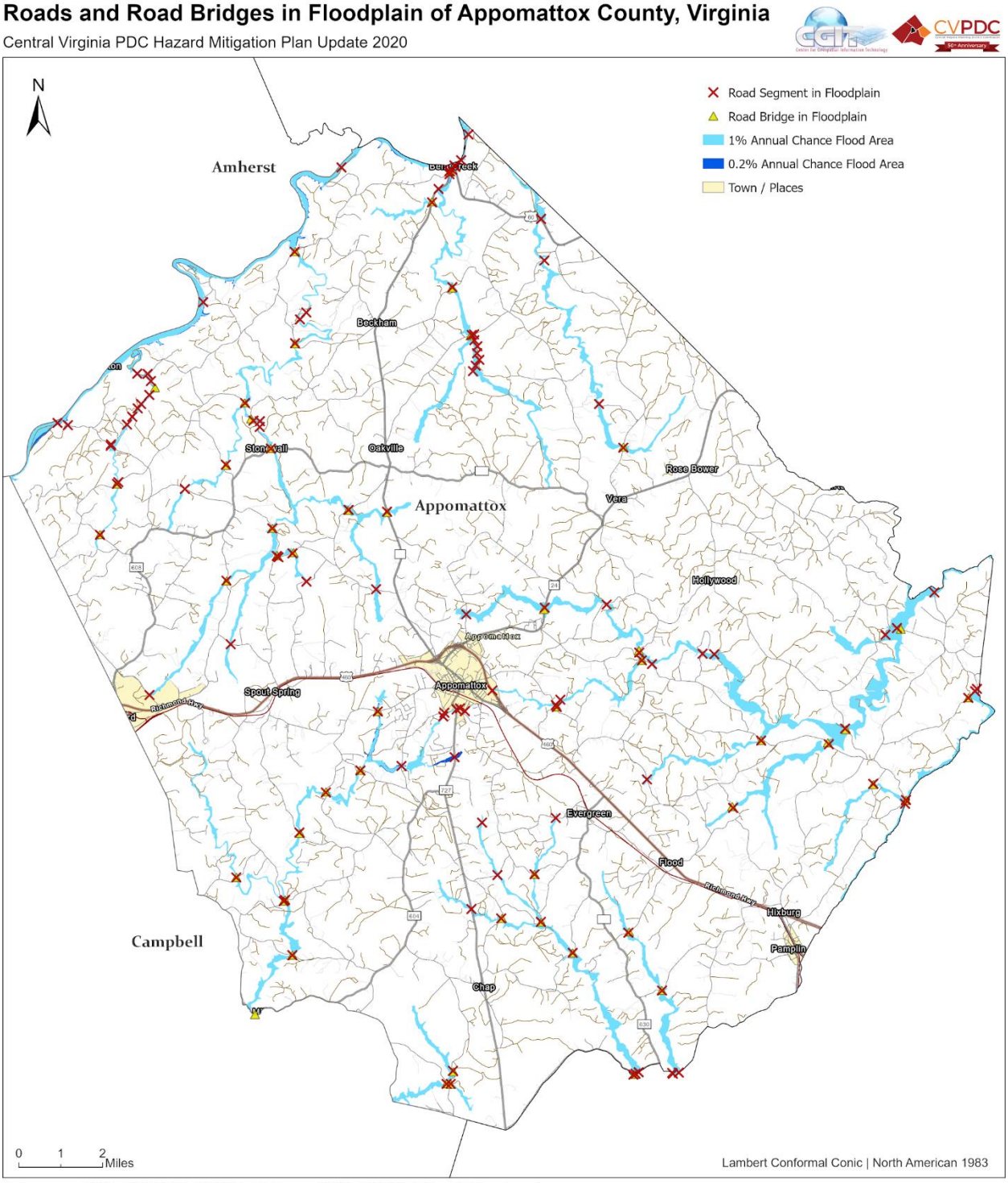


Figure 4-19 Roads and road bridges in floodplain of Appomattox County, Virginia

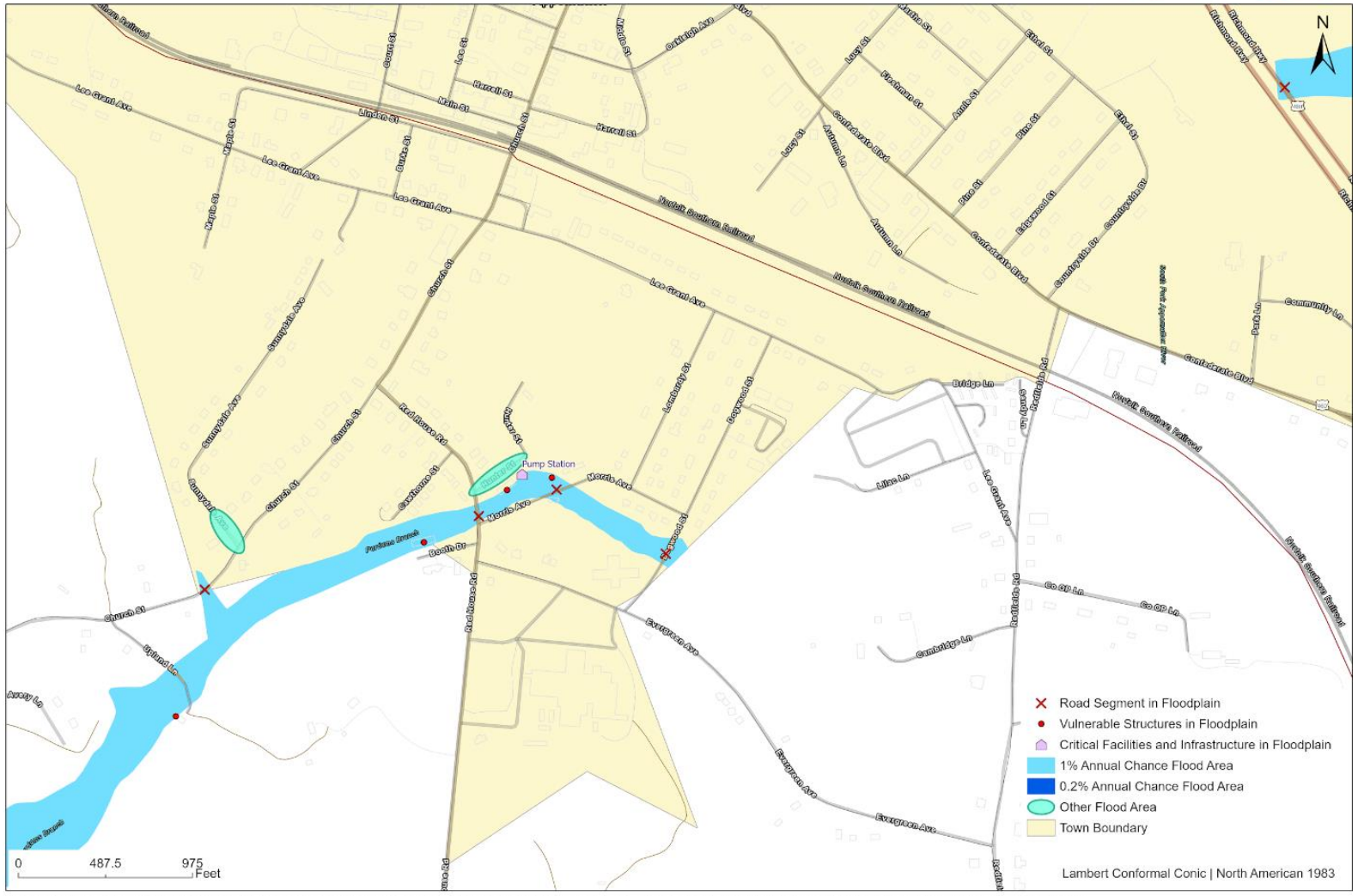


Figure 4-20 Vulnerable structures, roads and road bridges in floodplain of Town of Appomattox, Virginia

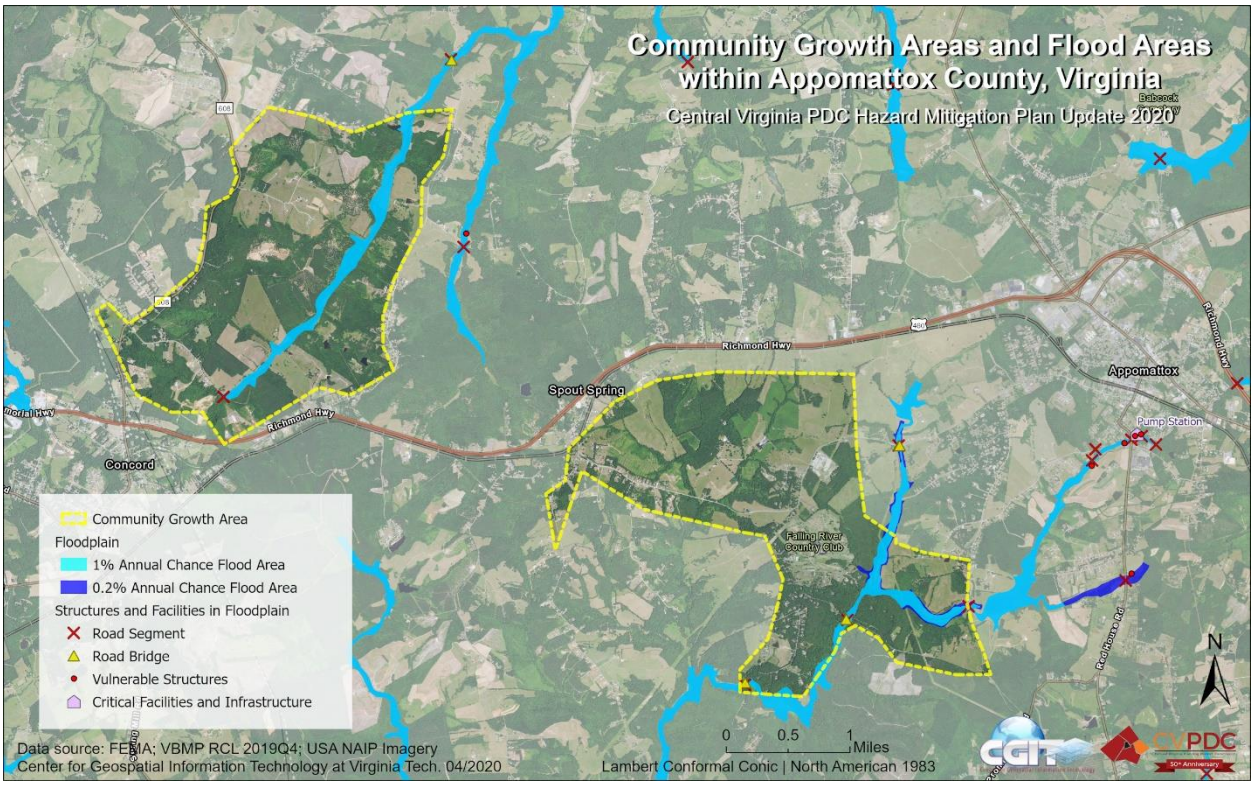


Figure 4-21 Community Growth Areas and Flood Areas within Appomattox County, Virginia

4.3.4.3 Bedford County and the Town of Bedford

Bedford County consists of 764 square miles located in west-central Virginia, just east of the Roanoke metropolitan area. Bedford County was formed in 1754 and named for the Fourth Duke of Bedford, a British Government official. In 1839, the Town of Liberty (now Town of Bedford) was established within the county limits. The scenic Blue Ridge Mountains make up the county's western border. James River forms the northeast boundary. The 23,400-acre Smith Mountain Lake is situated to the south on Roanoke River. The area has rolling to hilly terrain, with elevations from 800 feet to 4,200 feet above sea level, including the famous Peaks of Otter, Sharp Top and Flat Top along the Blue Ridge Parkway on the county's western border. Communities bordering Bedford include Rockbridge County to the northwest, Amherst County to the north and northeast, Campbell County to the east, Pittsylvania County to the south and Franklin, Roanoke, and Botetourt Counties to the west. According to the 2016 American Community Survey five year estimates, the population of Bedford County is 68,676, a 12% increase from the 2010 U.S. Census. The top five largest employers in Bedford County in 2019 are Centra Health, Elwood Staffing Services Inc, WalMart, Mail America Communications Inc, and GP Big Island LLC.

In 2013, Bedford City abandoned its status as an independent city and became a town in Bedford County. The reversion of Bedford City added approximately 6,222 residents (2010 Census) and nearly seven square miles to Bedford County. Additionally, it increased the town's boundaries by 1.5 square miles. The reversion brought changes to the tax structure, utility provision, public safety, schools, representation, election districts, etc.

4.3.4.3.1 Community Characteristics

Bedford County entered into the NFIP on September 29, 1978, with emergency entry on January 16, 1974. The current effective date for the FIRMs is September 29, 2010. It is currently in good participating standing with the program. The county has 128 flood policies in force (122 policies within the unincorporated areas), with $227,000 losses paid by 2019 (Figure 4-22). Bedford County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Bedford County cover 40.6 and 42.3 square miles, accounting for 5.2% and 5.5% total area of the entire county, respectively.

Figure 4-22 Community dashboard of Bedford County (Unincorporated Areas)

The Town of Bedford entered into the NFIP on June 1, 1978, with emergency entry on March 12, 1974 (Figure 4-23). The current effective date for the FIRMs is also September 29, 2010. It is currently in good participating standing with the program. The town plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Bedford cover 0.4 and 0.5 square miles, accounting for, respectively, 4.3% and 5.2% total area of the town.

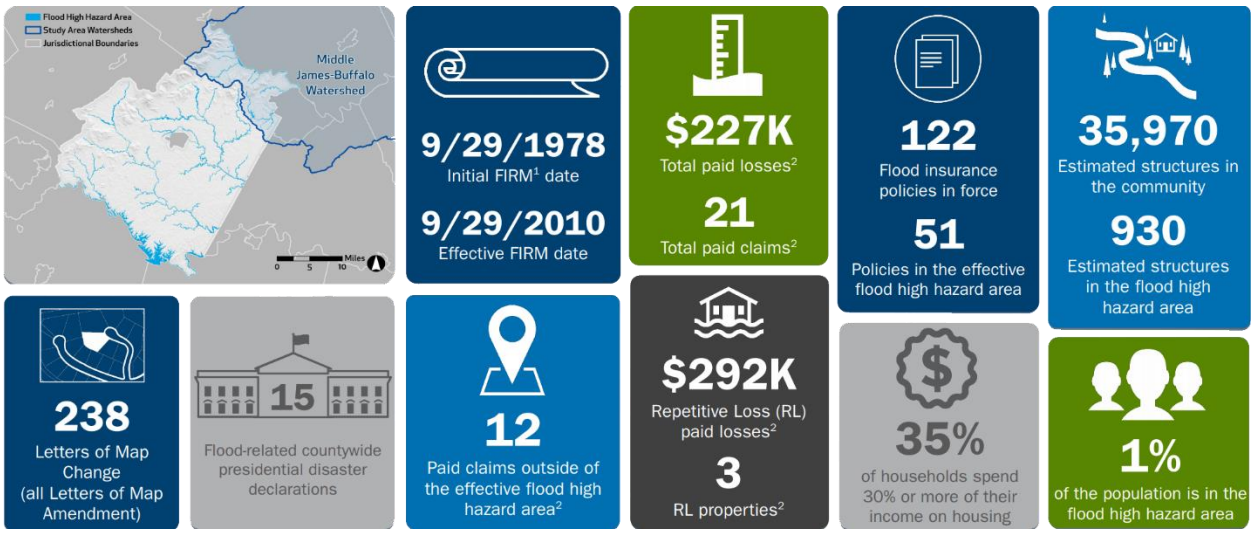


Figure 4-23 Community dashboard of Town of Bedford

4.3.4.3.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Bedford County. Using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for Bedford County and the Town of Bedford:

- Low-lying areas of Bedford County are subject to periodic flooding caused by overflow of the streams.
- The most severe flooding is usually the result of heavy rains from tropical storms; however, creek flooding occurs after locally heavy thunderstorms.
- Fill placement in the floodway has modified water-surface elevations from the downstream end of the Westgate Shopping Center culvert to West Main Street due to loss of storage and changes to the type, diameter, and length of drainage structures.
- Critical facilities located in the floodplain include: three pump stations and three electric substations.
- 6 high risk bridges in the floodplain.
- Three repetitive loss properties and one severe repetitive loss property.
- Older and lower income population located in the floodplain.

4.3.4.3.3 Vulnerable Population and Structures

Demographic data with dasymetric mapping techniques at census block level of Bedford County (incorporated area) were used for profiling the vulnerable population in or adjacent to floodplains. FEMA's Risk Map program identified around 1% of the County population is in the floodplain. However, the county's up to 13.8% (or 17.7%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 6.8% are at a low-income level, 20.9% are young (age < 16), and 17.9% are seniors (age > 65). Whites make up the vast majority (90.3%) of Bedford County residents. Likewise, whites predominate in or around the floodplain, representing 90.7% of the vulnerable population. Blacks are 5.1% of the vulnerable population, Hispanic or Latino are 1.7%, Asians are 0.9%, and Native Americans are 0.2%. Table 4-35 and Table 4-36 provide more demographics of the vulnerable population in Bedford County, in terms of ethnic group, income level, and age group.

Table 4-35 Ethnic group in floodplains of Bedford County

	Population	Households	White	Black	Hispanic	Asian	Native Am
Bedford	68676	27465	62035 (90.3%)	3909 (5.7%)	1090 (1.6%)	700 (1.0%)	172 (0.3%)
1% Floodplain	9443 (13.8%)	3965	8562 (90.7%)	481 (5.1%)	160 (1.7%)	88 (0.9%)	20 (0.2%)
0.2% Floodplain	12129 (17.7%)	5162	10825 (89.2%)	789 (6.5%)	196 (1.6%)	105 (0.9%)	36 (0.3%)

Table 4-36 Income level and age group in floodplains of Bedford County

	Population	Households	Income <$20k/Yr	Age <16	Age >65
Bedford	68676	27465	3914 (5.7%)	15305 (22.3%)	11147 (16.2%)
1% Floodplain	9443	3965	646 (6.8%)	1969 (20.9%)	1672 (17.7%)
0.2% Floodplain	12129	5162	854 (7.0%)	2392 (19.7%)	2467 (20.3%)

The unincorporated area of Bedford County has 339 (or 749) primary structures and 19 (or 22) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-24. Most vulnerable structures are located in the following areas:

- Smith Mountain Lake / Roanoke River. More than half of the vulnerable structures are concentrated here (Figure 4-28, Panel B and C). Several vulnerable campgrounds or RV park resorts are also located in this area. As mentioned in the data cleaning process section of this chapter, recreational vehicles or trailer homes and covered boat docks in this area are excluded from inventory and loss analysis. However, it is important to know their existence and to notify owners of these structures to make them aware of the potential hazard.
- Major / Powells Store area. Over 50 homes and a church near James River and Big Island Hwy are in the floodplain (Figure 4-29, Panel D). The Georgia-Pacific Corporation Big Island LLC, one of the top 5 employers of the county, is also in the floodplain of this area.

- Forest area. This area is also designated as the largest one of the community growth areas (Figure 4-32). Approximately 50 homes are in the floodplain (Figure 4-29, Panel E).
- Montvale area. A row of homes north of W Lynchburg Salem Tpke (Route 221) are in the floodplain (Figure 4-27, Panel A).

The Town of Bedford has 29 (or 38) primary structures and 7 (or 7) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-27). Most of the vulnerable structures are located along Route 221 (E Main St and W Main St) of the town.

Table 4-37 provides the vulnerable critical facilities and infrastructures of Bedford County and the Town of Bedford (shown in Figure 4-25). Within the Bedford County unincorporated areas, there are 6 campgrounds, 2 electrical substations, 4 energy facilities, 6 sewer pump stations, 1 water booster pump station, and 2 wastewater treatment plants situated in the floodplain. In the Town of Bedford, there are 2 electrical substations, 4 sewer pump stations, and the Bedford Wastewater Treatment Plant (partially in floodplain) in either 1-percent or 0.2-percent floodplain (Table 4-37).

It is worth mentioning that 5 facilities not in the floodplain still need attention. It is either because a corner of the parcel is in a flood zone but the structure isn't, or the property is very close to the floodplain. Table 4-38 lists these potential vulnerable structures adjacent to floodplains, including 3 schools, 1 assisted care facility, 1 hazmat facility, and 1 sewer pump station. For example, the athletic field of Montvale Elementary is in the floodplain, but the school buildings are not.

Table 4-37 Critical facility and infrastructure in floodplain of Bedford County and the Town of Bedford

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Halesford Harbour Rv Park Resort	1336 Campers Paradise Trl, Moneta	Campground	37.1583, -79.6617	1%; 0.2%
Hannabass-Crouch Campground	1241 Hannabass Dr, Goodview	Campground	37.1548, -79.6994	1%; 0.2%
Mitchell'S Point Marina & Campground	3553 Trading Post Rd, Huddleston	Campground	37.0622, -79.5601	1%; 0.2%
Moorman Marina	1510 Moorman Rd, Goodview	Campground	37.2232, -79.7753	1%; 0.2%
Tri-County Marina	1261 Sunrise Loop, Lynch Station	Campground	37.0595, -79.4468	1%; 0.2%
Waterfront Park Campground	1000 Waterfront Dr, Moneta	Campground	37.1397, -79.6464	1%; 0.2%
Electrical Substation **	678 Orange St, Bedford	Electrical Substation	37.3334, -79.5123	1%; 0.2%
Electrical Substation **	Macon St, Bedford	Electrical Substation	37.3393, -79.5414	1%; 0.2%
Electrical Substation	Big Island Hwy / North Otter Creek	Electrical Substation	37.4599, -79.4651	1%; 0.2%
Electrical Substation	1026 Churchill Rd, Big Island	Electrical Substation	37.5411, -79.3978	1%; 0.2%
Coleman Falls Dam Hydro	6007 Lee Jackson Hwy,	Energy	37.5021,	1%; 0.2%

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Plant	Coleman Falls	Facility	-79.3006	
Georgia-Pacific Big Island Plant	9363 Lee Jackson Highway, Big Island	Energy Facility	37.5351, -79.3573	1%; 0.2%
Holcomb Rock Dam Hydro Plant	4839 Holcomb Rock Road, Holcomb Rock	Energy Facility	37.5036, -79.2628	1%; 0.2%
Smith Mountain Dam Hydro Plant	Route 1, Penhook	Energy Facility	37.0413, -79.5356	1%; 0.2%
Georgia Pacific Corp - Big Island Mill	9363 Lee Jackson Highway, Big Island	HazMat Facility	37.5328, -79.3556	1%; 0.2%
Lake Vista Pump Station	2474 Cottontown Rd, Forest	Sewer Pump Station	37.3953, -79.2606	1%; 0.2%
Moneta Wwtp/ Influent Pump Station Ps 3	1622 White House Rd, Moneta	Sewer Pump Station	37.1722, -79.6121	1%; 0.2%
Pump Station	Craddock Creek / Coves End Rd, Huddleston	Sewer Pump Station	37.0934, -79.5646	1%
Pump Station	Huddleston	Sewer Pump Station	37.0874, -79.5700	1%; 0.2%
Pump Station #2 **	1725 Whitfield Dr, Bedford	Sewer Pump Station	37.3504, -79.5224	1%; 0.2%
Pump Station #3 **	1012 Orange St, Bedford	Sewer Pump Station	37.3388, -79.4941	1%; 0.2%
Pump Station #5**	Oliver St, Bedford	Sewer Pump Station	37.3559, -79.5081	1%
Pump Station #6	Peaks Rd / Woods Rd, Bedford	Sewer Pump Station	37.3894, -79.5516	1%; 0.2%
Pump Station #8 **	Villa Oak Cir, Bedford	Sewer Pump Station	37.3537, -79.5212	1%; 0.2%
Sewer Pump Station #2	13080 S Old Moneta Rd, Moneta	Sewer Pump Station	37.1820, -79.6157	1%; 0.2%
Bedford Wastewater Treatment Plant **	852 Orange St, Bedford	Wastewater Treatment Plant	37.3336, -79.5067	1%; 0.2%
Moneta Regional WWTP	Rte 608, White House Rd, Moneta	Wastewater Treatment Plant	37.1727, -79.6128	1%; 0.2%
Montvale Wastewater Treatment	185 Little Patriot Dr, Bedford	Wastewater Treatment Plant	37.3752, -79.7078	1%
Water Pump Station - 5 (Town of Bedford Water)	4690 Peaks Rd, Bedford	Water Booster Pump Station	37.3897, -79.5531	1%; 0.2%

Note: * 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. ** Located in the Town of Bedford.

Table 4-38 Critical facility and infrastructure located outside of (but adjacent to) floodplain of Bedford County and Town of Bedford

Facility Name	Address	Facility Type	Coordinates	Note
Bedford Science and Technology Center	600 Edmund Street, Bedford	Schools	37.3272, -79.5251	Corner of parcel in floodplain - bus lot
Buckeye Terminals, LLC - Roanoke Terminal	1070 Oil Terminal Rd, Montvale	HazMat Facility	37.3842, -79.7342	The lot is in floodplain not building
English Meadows Elks Home Campus	931 Ashland Avenue, Bedford	Assisted Care	37.3429, -79.5349	Parts of property are in floodplain (pathways)
Forest Middle	100 Ashwood Drive, Forest	Schools	37.3693, -79.3096	Back of property in floodplain
Montvale Elementary	1 Little Patriot Drive, Montvale	Schools	37.3759, -79.7084	Athletic field in floodplain
Pump Station #1	1601 Nichols Rd, Bedford	Sewer Pump Station	37.3524, -79.5363	Very close to floodplain

In the unincorporated areas of Bedford County, there are 236 flood-prone roads (including primary and secondary roads, and ramps) with a total of about 51 miles road segments in the floodplain (Table 4-39). The top 10 susceptible roads are Rocky Mountain Rd, Lee Jackson Hwy, Elk Valley Rd, Oslin Creek Rd, Fontella Rd, Big Island Hwy, Bore Auger Rd, Goose Creek Valley Rd, Turner Branch Rd, and Blue Ridge Pkwy. All these roads have multiple flood-prone locations along their route. There are 6 high risk (scour critical) road bridges identified (Table 4-41).

In the Town of Bedford, there are 25 roads that could be impacted during flooding. Road segments in the floodplain are about 2 miles in total (Table 4-40). The top five most susceptible roads are Macon St, Blue Ridge Ave, Dr Martin Luther King Jr Byp, Woodhaven Dr, and Peaks Rd. Among these roads, Blue Ridge Ave and Dr Martin Luther King Jr Byp have multiple locations that could be flooded. Two road bridges on Peaks road and Route 112 within the town boundary are in floodplain but not rated as at high risk (Table 4-42).

Table 4-39 Top 50 flood-prone roads in Bedford County (unincorporated area)

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Rocky Mountain Rd	SEC	15	3.47
2	Lee Jackson Hwy		11	2.64
3	Elk Valley Rd	UMS	8	1.79
4	Oslin Creek Rd	SEC	8	1.62
5	Fontella Rd	SEC	2	1.61
6	Big Island Hwy	SEC	11	1.51
7	Bore Auger Rd	SEC	9	1.47
8	Goose Creek Valley Rd	SEC	12	1.19

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
9	Turner Branch Rd	SEC	5	1.06
10	Blue Ridge Pkwy	UMS	5	1.03
11	Hunting Creek Rd		1	1.02
12	Drewrys Hill Rd	SEC	1	0.97
13	W Lynchburg Salem Tpke	SEC	2	0.81
14	Peters Creek Rd	STR	6	0.64
15	Hardy Rd	STR	4	0.62
16	Nemmo Rd	STR	1	0.62
17	Peaks Rd	STR	3	0.59
18	Fishermans Cove Rd	SEC	1	0.57
19	Wilkerson Mill Rd	STR	1	0.53
20	Wyatts Way	STR	2	0.52
21	Oil Terminal Rd	STR	1	0.52
22	Battery Creek Dr	SEC	2	0.51
23	Riverside Cir	SEC	5	0.51
24	Roaring Run Rd	SEC	2	0.50
25	Stewartsville Rd	STR	5	0.50
26	Hawkins Ridge Rd	SEC	1	0.48
27	Simmons Mill Rd	USPRI	4	0.48
28	Patterson Mill Rd	SEC	7	0.47
29	Red Hill Rd	SEC	3	0.47
30	Hurricane Dr	STR	3	0.46
31	Woods Rd	SEC	2	0.45
32	E Lynchburg Salem Tpke	SEC	6	0.43
33	Lankford Mill Rd	STR	3	0.42
34	Sheep Creek Rd	STR	2	0.42
35	Lazenbury Rd	UMS	1	0.41
36	Jordantown Rd	STR	5	0.39
37	Forest Rd	SEC	5	0.35
38	Churchill Rd	SEC	1	0.34
39	Lick Mountain Dr	SEC	1	0.34
40	Goodview Rd	STR	4	0.33
41	Moneta Rd	SEC	4	0.33
42	Anthony Home Rd	SEC	1	0.31
43	Forbes Mill Rd	SEC	2	0.31
44	Smith Mountain Lake Pkwy	SEC	2	0.30
45	Otterville Rd	SEC	2	0.28
46	Stony Brook Rd	SEC	1	0.28
47	Saunders Rd	URB	3	0.28
48	Penns Mill Rd	SEC	2	0.28
49	Holcomb Rock Rd	STR	1	0.27
50	Cove Creek Farm Rd	URB	1	0.27

Table 4-40 Flood-prone roads in Town of Bedford

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Macon St	Secondary	1	2,036
2	Blue Ridge Ave	Primary	5	1,408
3	Dr Martin Luther King Jr Byp	Primary	4	1,312
4	Woodhaven Dr	Secondary	1	656
5	Peaks Rd	Primary	1	610
6	Panorama Ln	Secondary	1	431
7	Liberty St	Secondary	1	386
8	Independence Blvd	Primary	1	326
9	Summit St	Secondary	1	321
10	Activity Pl	Secondary	1	305
11	Gold Rd	Secondary	1	287
12	Jeter St	Secondary	1	266
13	E Main St	Primary	2	265
14	Monroe St	Secondary	1	233
15	Park St	Secondary	1	227
16	Burks Hill Rd	Primary	1	209
17	W Cook St	Secondary	1	187
18	Crenshaw St	Primary	1	187
19	Pinecrest Ave	Secondary	1	186
20	Roberts Ln	Secondary	1	181
21	Orange St	Secondary	1	163
22	Haynes Aly	Secondary	1	117
23	Nichols Rd	Secondary	1	107
24	Whitfield Dr	Secondary	1	102
25	Maxwell Cir	Secondary	1	98

Table 4-41 Road bridges at high risk (scour critical) in floodplain in Bedford County

Name	Location	Crossing	Coordinate
Wyatts Way/24	1.79-Camb Co; 0.19-Rt 709	Br. Of Big Otter River	37.2456, -79.3450
Lee-Jackson Hwy501	0.02 Rt 604; 0.02 Rt 122	Hunting Creek	37.5369, -79.3665
Goshen Road / 664	0.40 Rt 646; 0.30 End Mt	Elk Creek	37.3853, -79.3487
Goose Ck Vly R 695	0.02 Rt 680; 3.72 BRPkwy	N. Fork Goose Creek	37.4436, -79.6686
Dickerson Mill 746	0.65 Rt 691; 2.05 Rt 801	Goose Creek	37.2806, -79.6143
BLUE RIDGE PARKWAY	2.0 MILES TO VA ROUTE 130	James River & U.S. Route	37.5549, -79.3699

Table 4-42 Road bridges in floodplain in Town of Bedford

Name	Location	Crossing	Coordinates	Floodplain
PEAKS RD./43	0.00 NCL BEDFORD; 0.00 BEDFORD COUNTY	Little Otter River	37.3553, -79.5355	1%; 0.2%
RTE. 122	0.87 RT.460;0.91 RT. 221	Rt.122 Over Johns Creek	37.3372, -79.4964	1%; 0.2%

Note: No high risk (scour critical) bridge is identified in the Town of Bedford

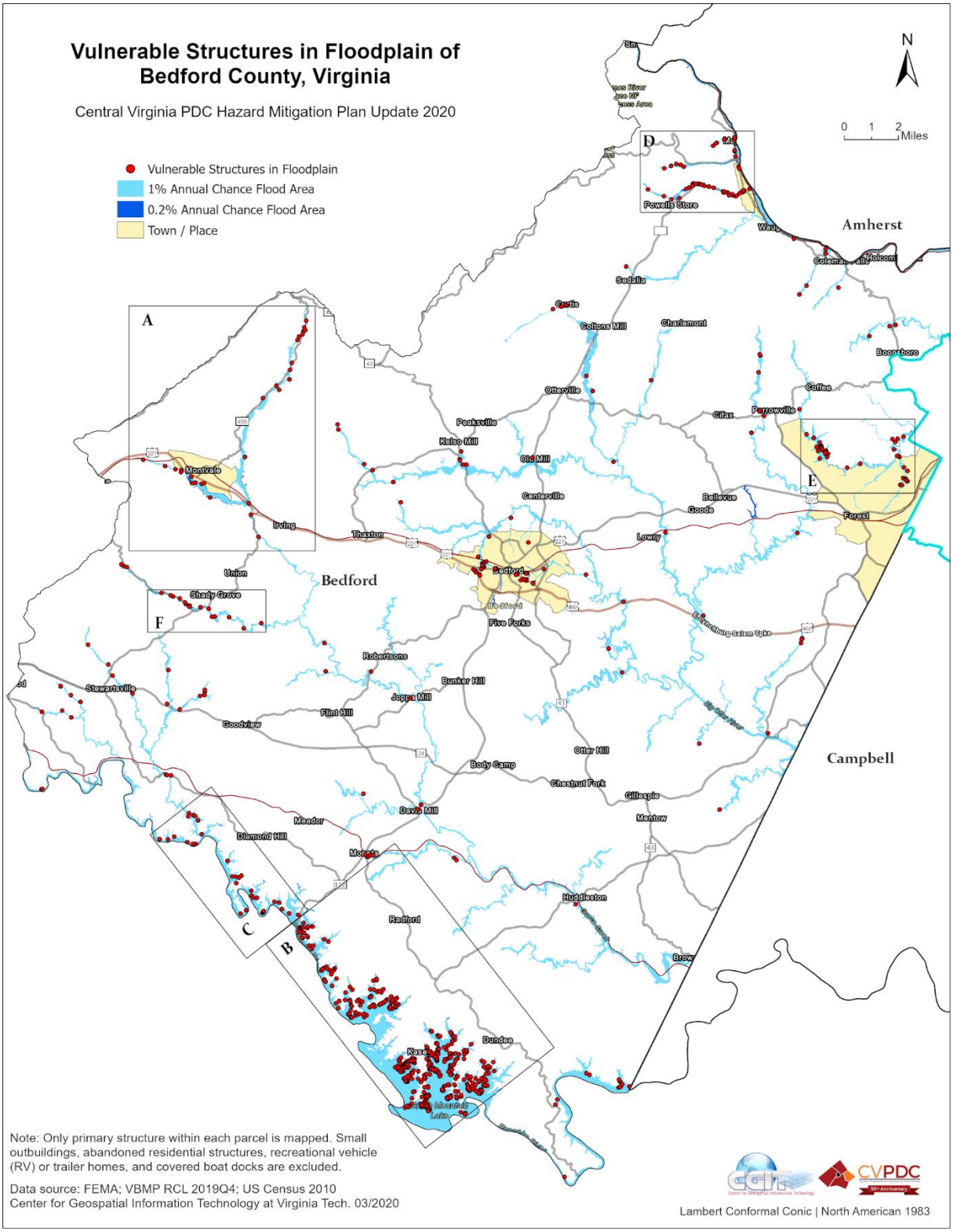


Figure 4-24 Vulnerable structures in floodplain of Bedford County, Virginia

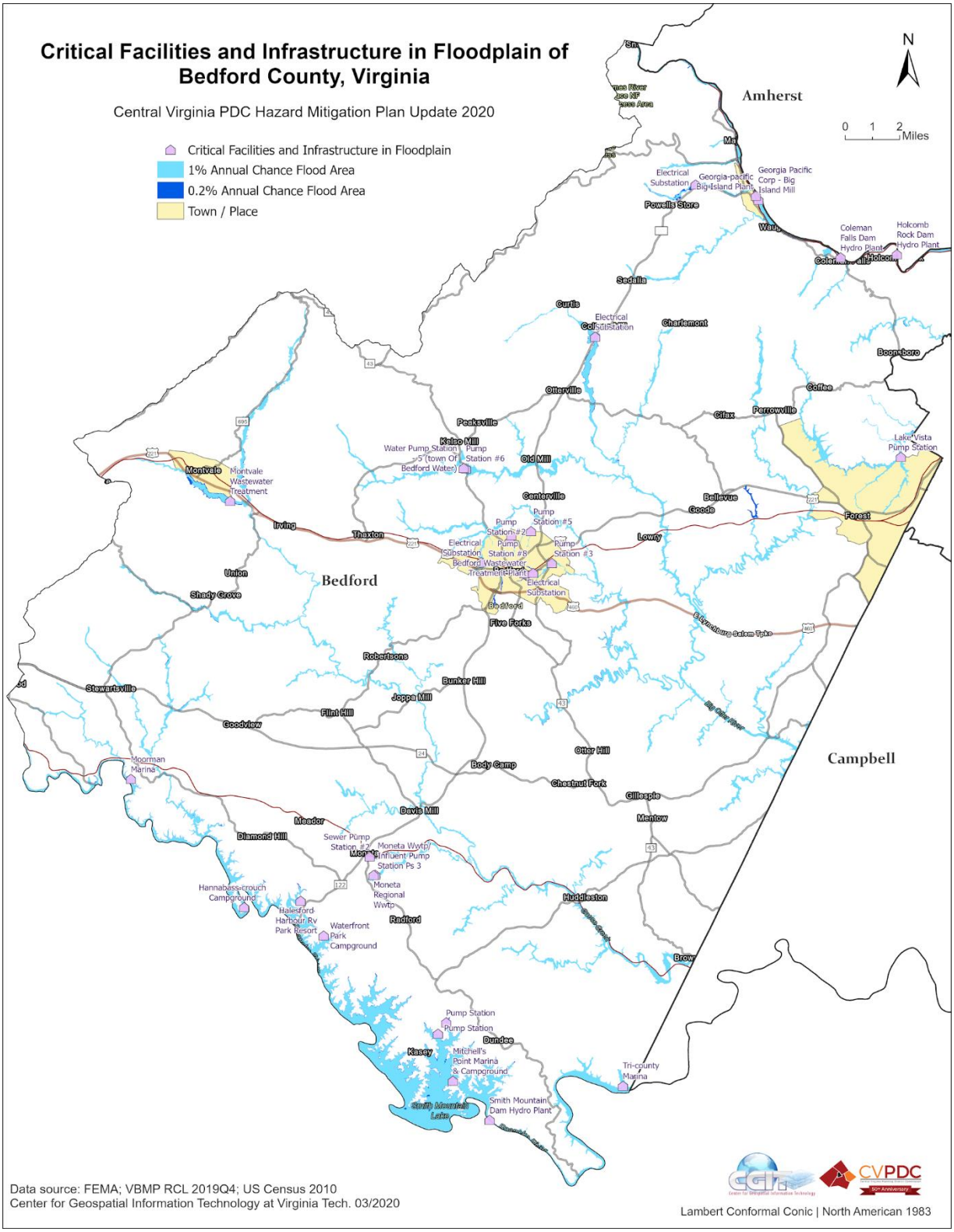


Figure 4-25 Critical facilities and infrastructure in floodplain of Bedford County, Virginia

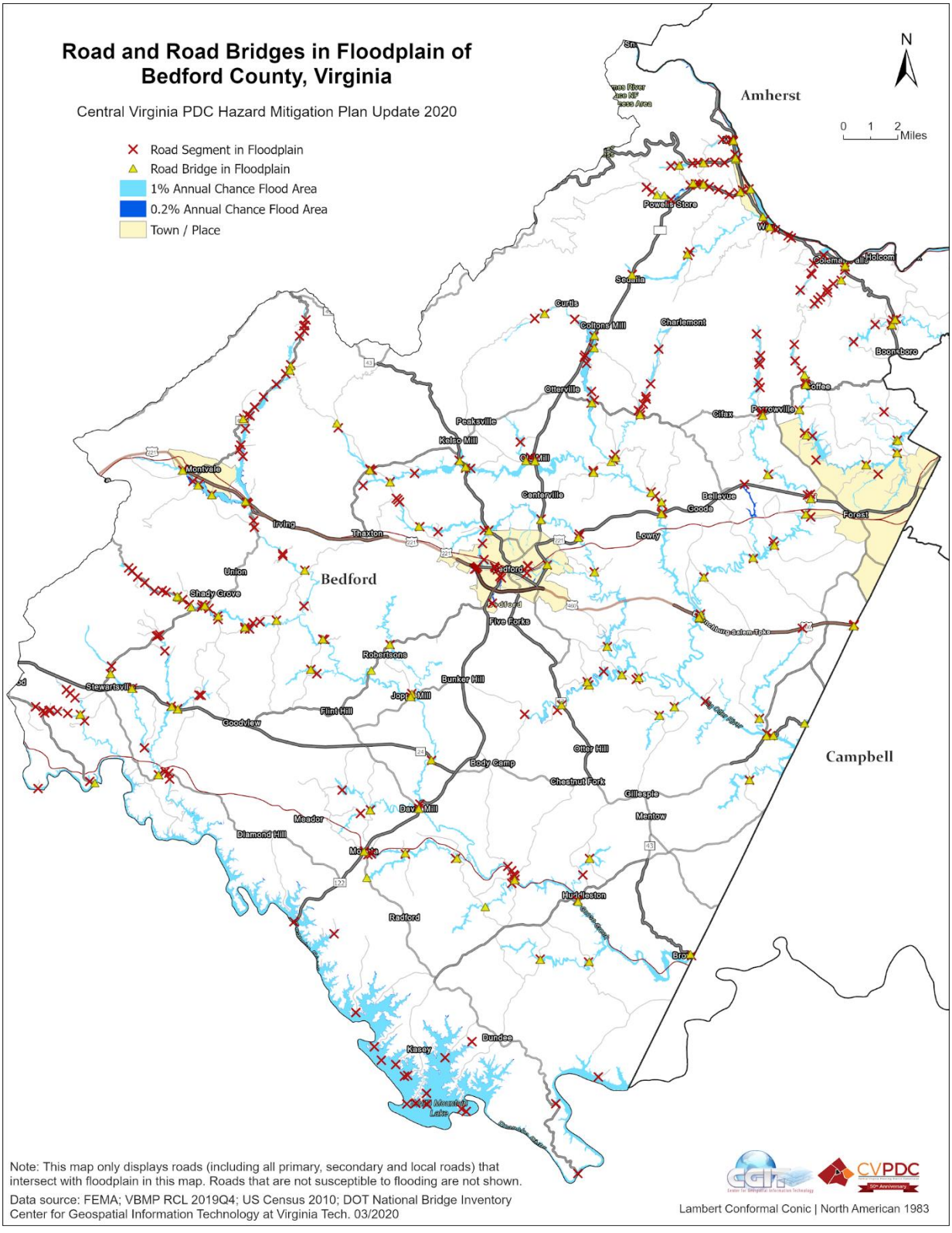


Figure 4-26 Road and road bridges in floodplain of Bedford County, Virginia

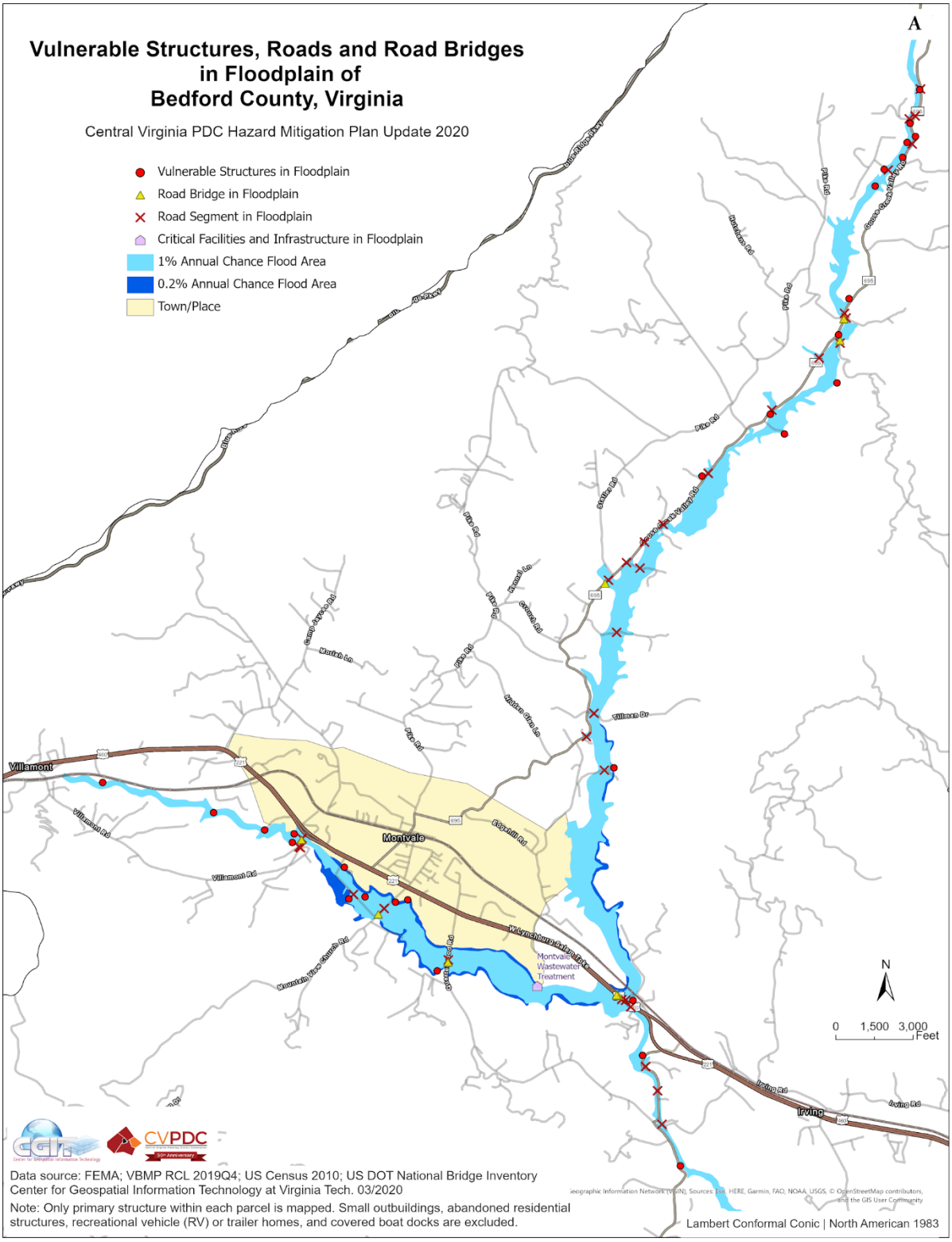


Figure 4-27 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford, Virginia (Panel A)

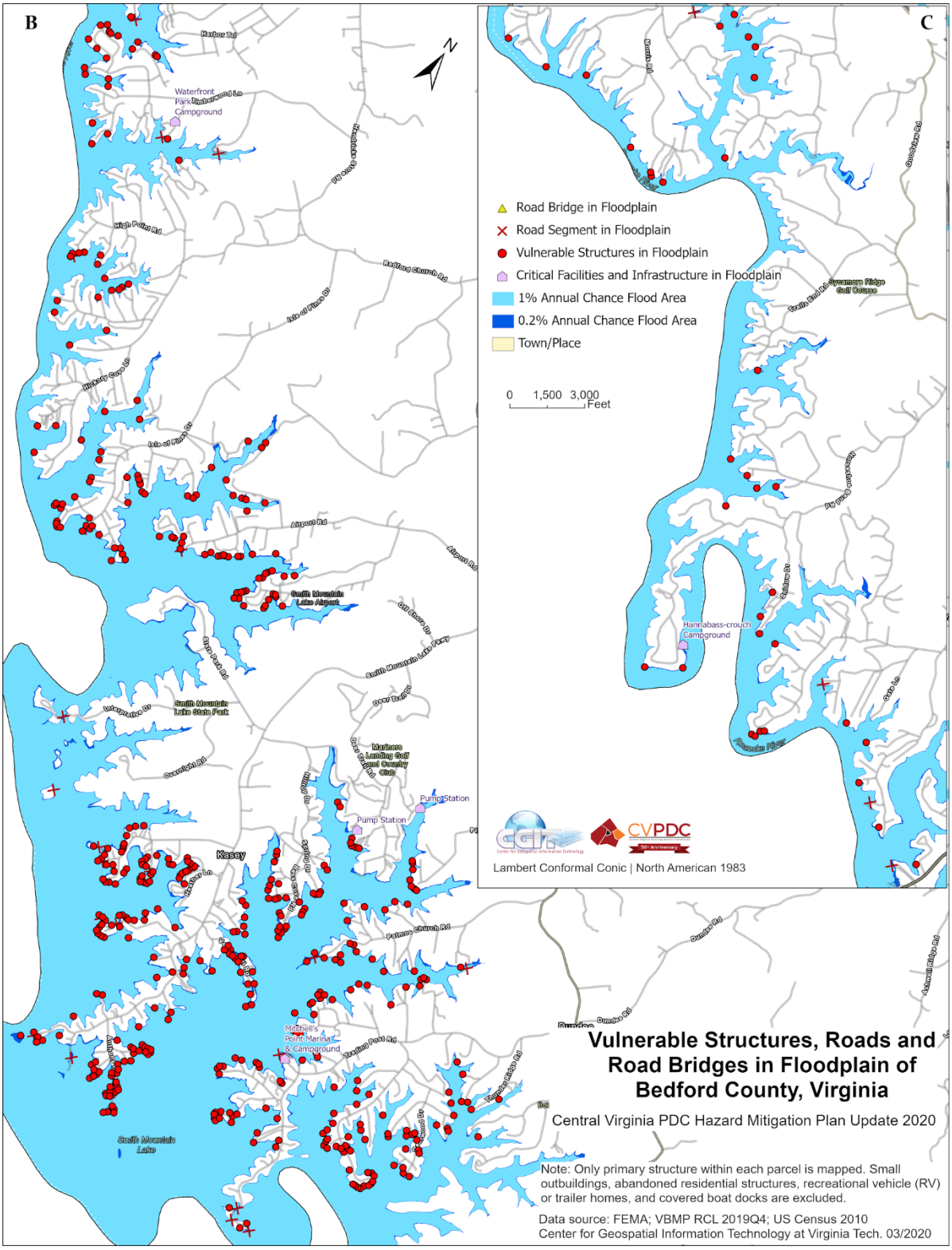


Figure 4-28 Vulnerable structures, roads and road bridges in floodplain of Bedford County, Virginia (Panel B, C)

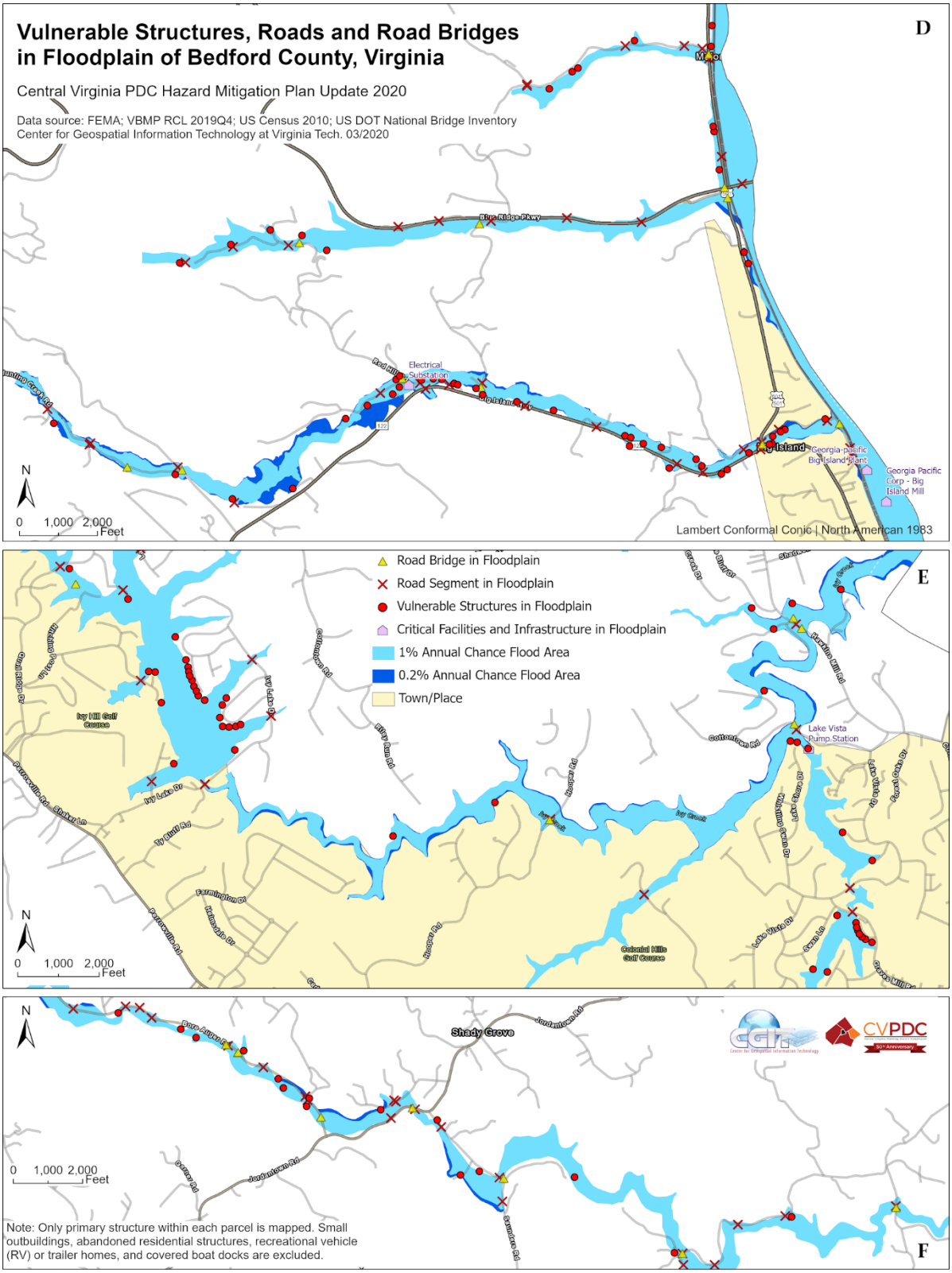


Figure 4-29 Vulnerable structures, roads and road bridges in floodplain of Bedford County and Town of Bedford, Virginia (Panel D, E, F)

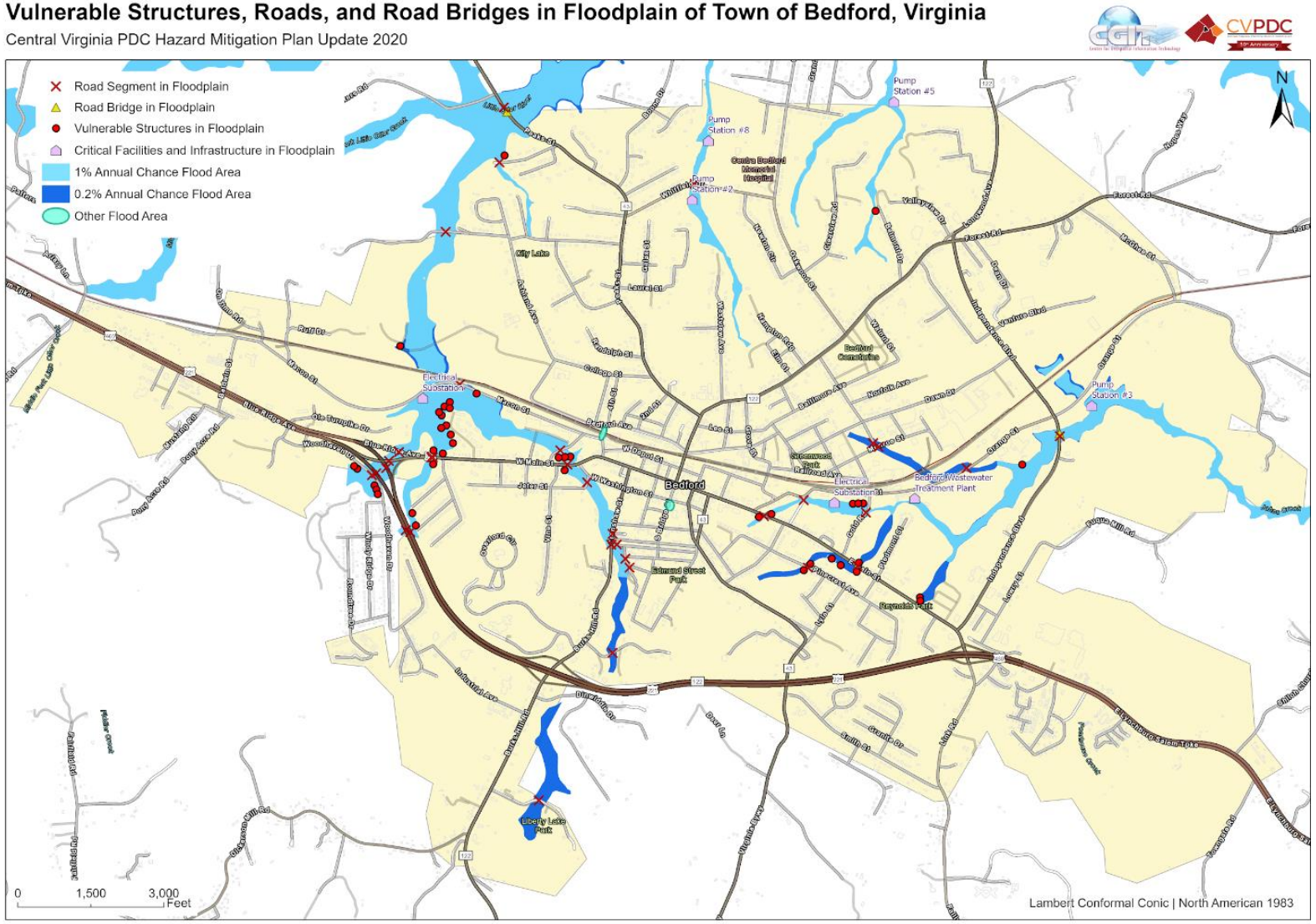


Figure 4-30 Vulnerable structures, roads and road bridges in floodplain of Town of Bedford, Virginia

Community Growth Areas and Flood Areas within Bedford County, Virginia

Central Virginia PDC Hazard Mitigation Plan Update 2020

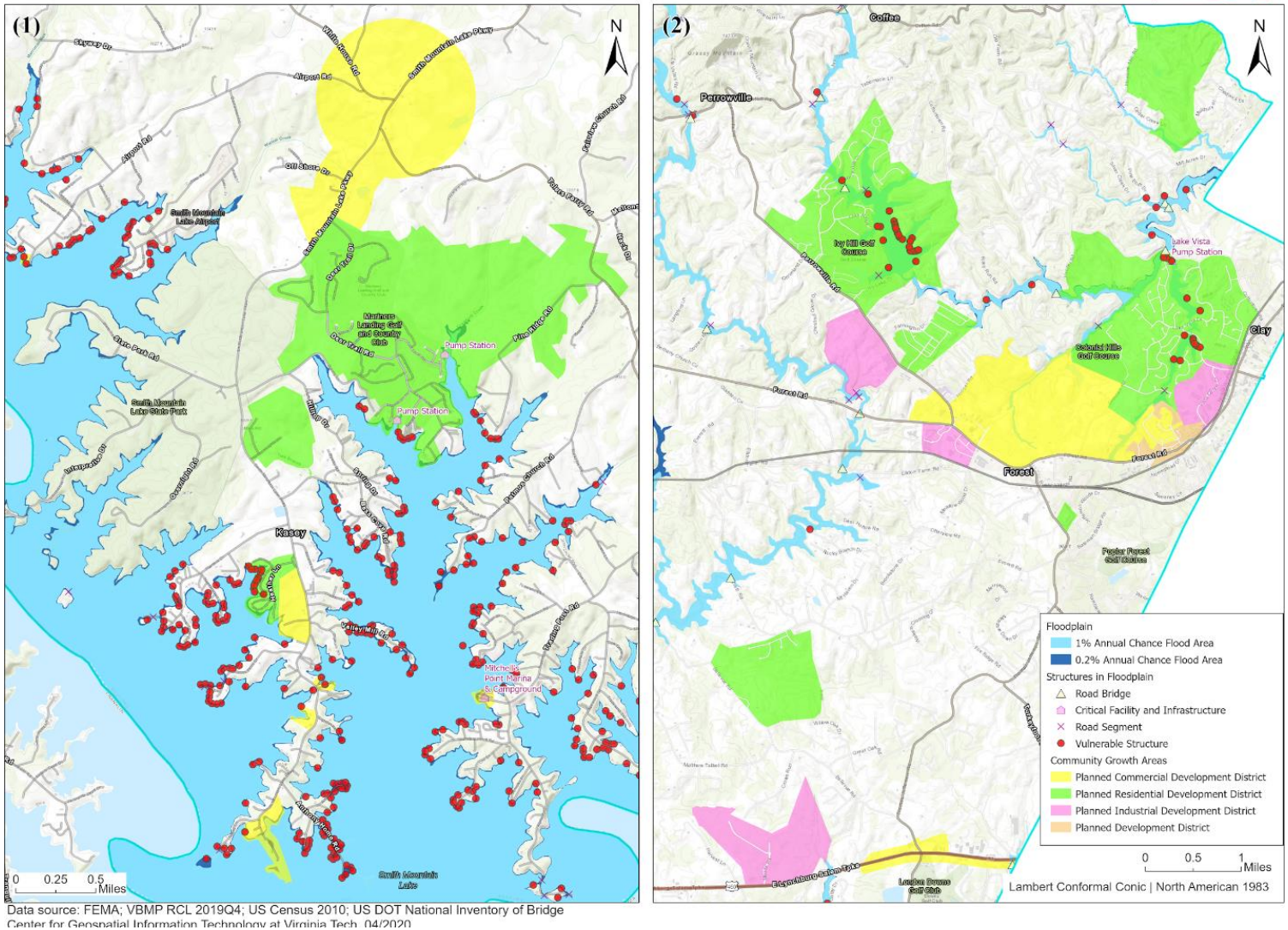


Figure 4-31 Community growth areas and floodplain within Bedford County, Virginia (Panel 1, 2)

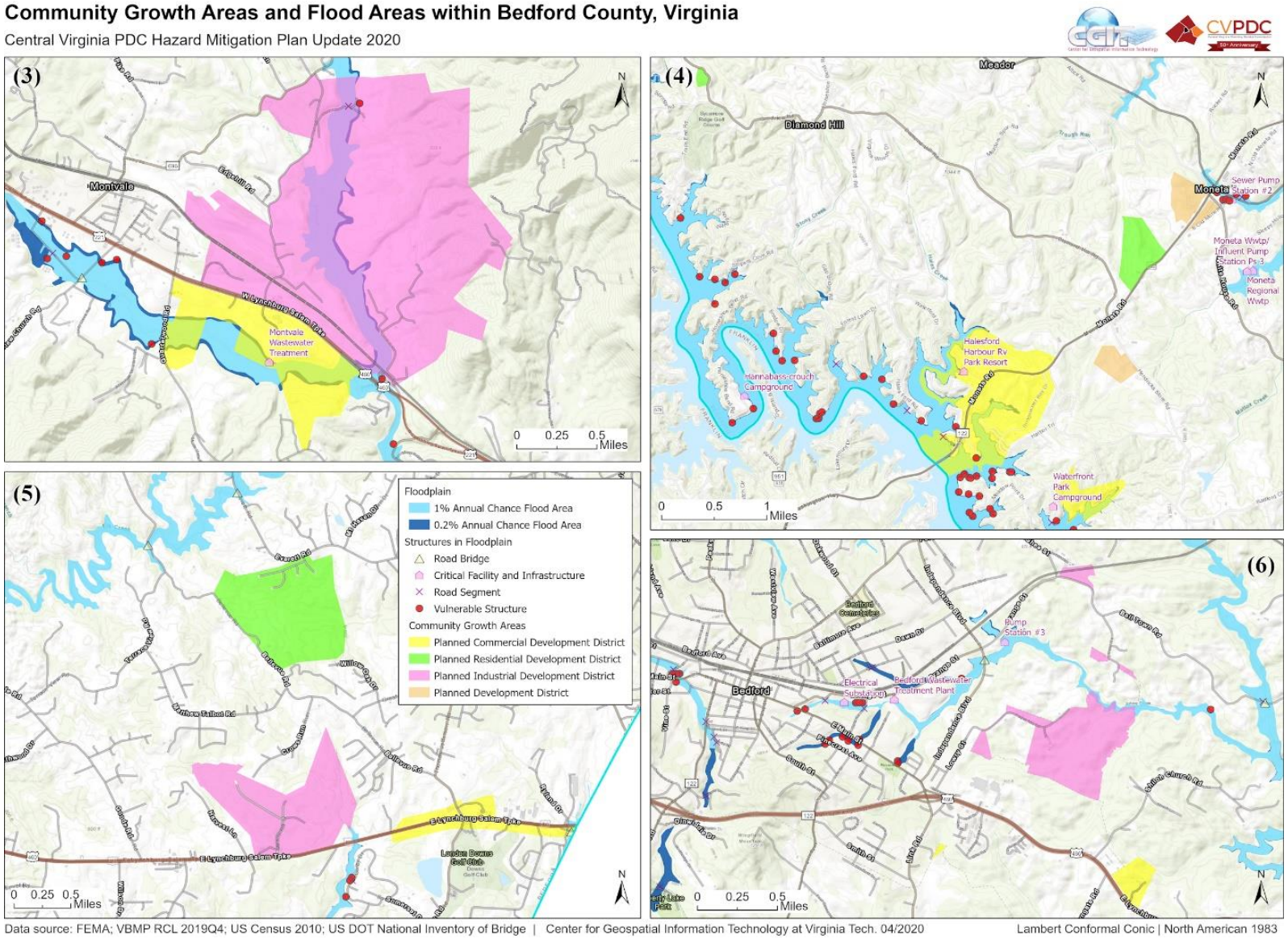


Figure 4-32 Community growth areas and floodplain within Bedford County, Virginia (Panel 3 to 6)

4.3.4.4 Campbell County, Town of Brookneal, and Town of Altavista

Campbell County is located in the south-central Piedmont Region of Virginia, 115 miles west of Richmond, in the foothills of the Blue Ridge Mountains. From its beginnings in 1781 as a frontier settlement, to its emergence as a tobacco producer and then a center for industrial manufacturing, Campbell County has continually evolved and grown with national and world changes. The county is bordered on the north by the City of Lynchburg and James River and in the South by Roanoke (Staunton) River. According to the 2016 American Community Survey five year estimates, the population of Campbell County is 55,061—about 1% increase from the 2010 Census. The top five major employers in Campbell County in 2019 are BWXT Nuclear Operations Group Inc, BGF Industries Inc., Abbott Laboratories, Moore's Electrical and Mechanical, and WalMart.

The Town of Brookneal, near Phelps Creek and Falling River, has been a center for commerce for the surrounding counties of Campbell, Charlotte, and Halifax since its founding in 1802. The unincorporated Town of Rustburg serves as the county seat.

The Town of Altavista is a relatively new town in southern Campbell County, incorporated in 1912. Residential and industrial growth occurred within the town boundaries until around 1960, after which the concentration of new development took place outside the boundaries.

4.3.4.4.1 Community Characteristics

Campbell County entered into the NFIP on October 17, 1978, with emergency entry on December 27, 1973. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The county has 42 flood policies in force (31 policies within the unincorporated areas) with $717,000 losses paid. Campbell County plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Campbell County take 28.0 and 29.7 square miles, accounting for 5.5% and 5.8% total area of the entire county respectively.

Town of Altavista entered into the NFIP on August 1, 1978, with emergency entry on February 19, 1974. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The town has 12 flood policies in force with $159,000 losses paid. Town of Altavista plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Altavista take 1.0 and 1.1 square miles, accounting for respectively 20% and 21.6% total area of the town.

Town of Brookneal entered into the NFIP on March 1, 1978, with emergency entry on January 15, 1974. The current effective date for the FIRMs is August 28, 2008. They are currently in good participating standing with the program. The Town of Brookneal has 3 flood policies in force with $0 losses paid. The Town of Brookneal plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in the Town of Brookneal take 0.3 and 0.3 square miles, accounting for respectively 8.7% and 9.4% total area of the town.

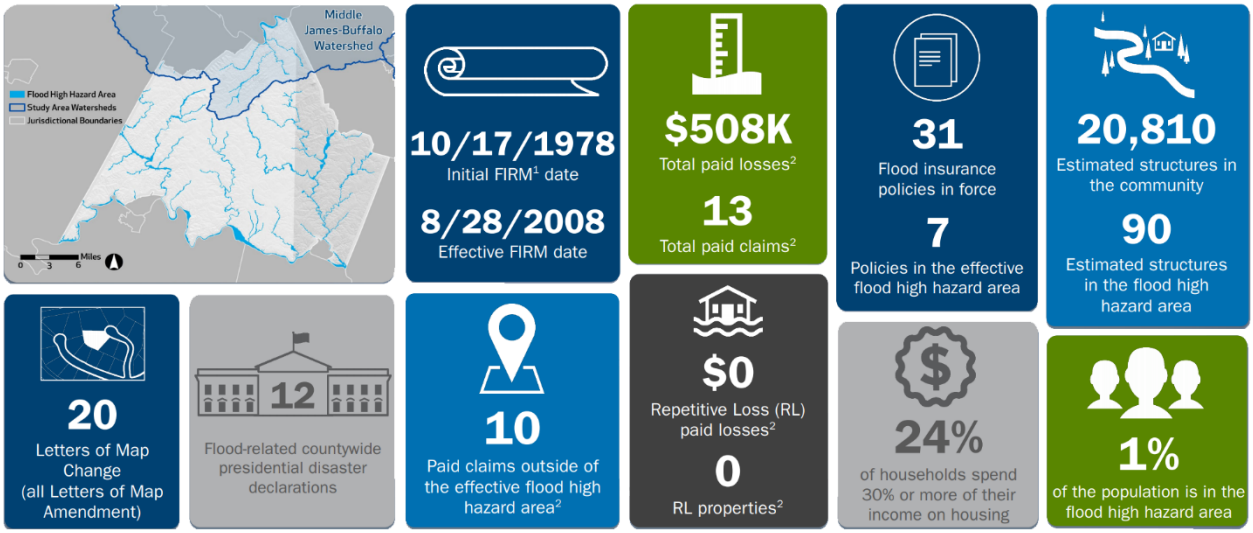


Figure 4-33 Community dashboard of Campbell County (Unincorporated Areas)

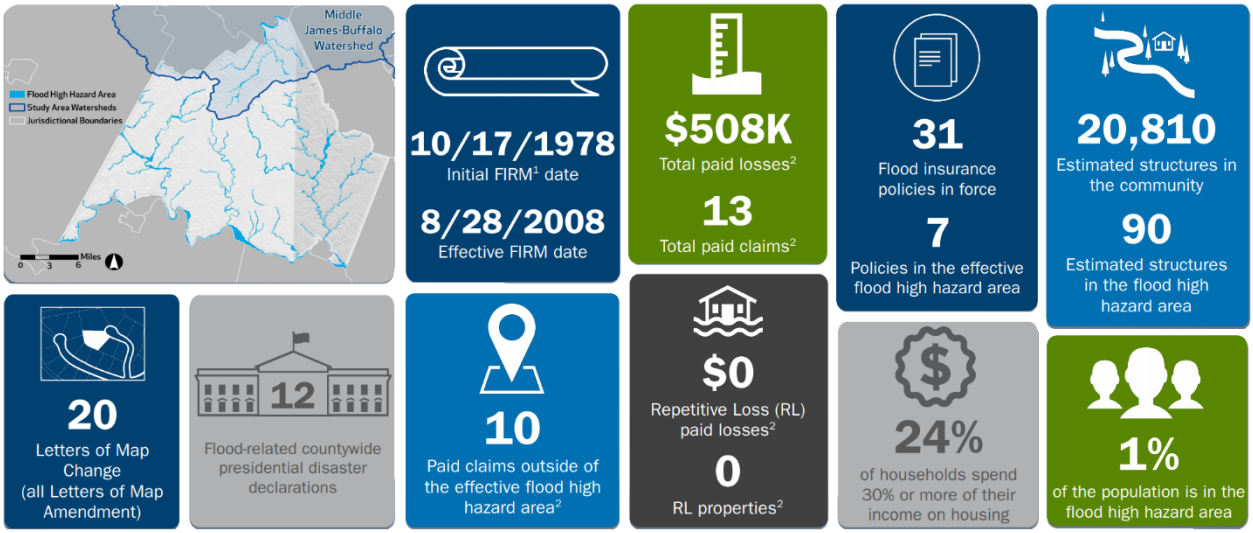


Figure 4-34 Community dashboard of Altavista

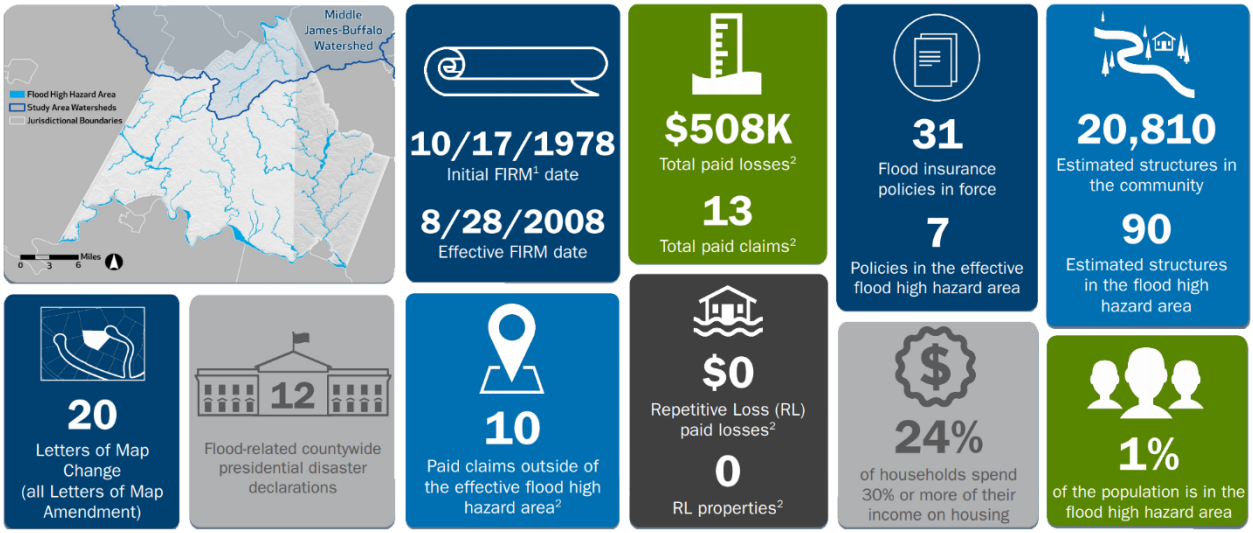


Figure 4-35 Community dashboard of Brookneal

4.3.4.4.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of Campbell County using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for Campbell County.

- Low-lying areas of Campbell County adjacent to streams studied by detailed methods are subject to periodic flooding.
- The most severe flooding is usually a result of heavy rains from tropical storms, while on the smaller creeks, the major floods are the result of local thunderstorms or frontal systems.
- Critical facilities located in the floodplain include: nuclear facility property (and major employer), Falling River Treatment Plant, Staunton River Treatment Plant, Campbell County Utility and Service Authority, and Flat Creek Pump Station.
- 8 high risk bridges in the floodplain.
- Natural gas line and fuel pipeline located in floodplain.
- One repetitive loss property and no severe repetitive loss properties.
- Older population located in the floodplain.

The nuclear facility identified in this HMP falls in the Nuclear Reactors, Materials, and Waste Sector classification (Cybersecurity & Infrastructure Security Agency). The subcategory of this critical infrastructure sector is the Nuclear Fuel Cycle Facility category. The hazards of a Nuclear Fuel Cycle Facility are very different than those found in a nuclear power reactor or a nuclear waste facility.

4.3.4.4.3 Vulnerable Population and Structures

The vulnerable population in or adjacent to floodplains within the incorporated area of Campbell County was profiled using demographic data with dasymetric mapping techniques at census block level. FEMA's

Risk Map program identified 1% of the population is in the floodplain for the county. However, the county's up to 3.1% (or 4%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 8% of them are at a low-income level (annual income < $20K), 22.2% are young (age < 16), and 16.2% are seniors (age > 65). Whites make up the largest share (81.3%) of the total residents in Campbell County. Likewise, whites also predominate in or around the floodplain, representing 85.4% of the vulnerable population. Blacks are 11.8% of the vulnerable population, Hispanic or Latino are 1%, Asians are 0.1%, and Native Americans are 0.3%. Table 4-43 and Table 4-44 provide more demographics of the vulnerable population in Campbell County, in terms of ethnic group, income level, and age group.

Table 4-43 Ethnic group in floodplains of Campbell County

	Population	Households	White	Black	Hispanic	Asian	Native Am
Campbell	54842	22441	44595 (81.3%)	7737 (14.1%)	918 (1.7%)	543 (1.0%)	142 (0.3%)
1% Floodplain	1726 (3.1%)	683	1474 (85.4%)	204 (11.8%)	18 (1.0%)	1 (0.1%)	5 (0.3%)
0.2% Floodplain	2203 (4.0%)	891	1813 (82.3%)	319 (14.5%)	32 (1.5%)	3 (0.1%)	6 (0.3%)

Table 4-44 Income level and age group in floodplains of Campbell County

	Population	Households	Income <$20k/Yr	Age <16	Age >65
Campbell	54842	22441	4844 (8.8%)	12044 (22.0%)	8685 (15.8%)
1% Floodplain	1726 (3.1%)	683	138 (8.0%)	383 (22.2%)	279 (16.2%)
0.2% Floodplain	2203 (4.0%)	891	175 (7.9%)	474 (21.5%)	378 (17.2%)

The unincorporated area of Campbell County has 69 (or 89) primary structures, 5 (or 6) critical facilities and infrastructures identified in the 1-percent (or 0.2-percent) floodplain. These are shown in Figure 4-36. Most of the structures and facilities are scattered within the county. There are a dozen homes concentrated near the East Brook / Kelly area in the north of the county. Table 4-45 lists critical facilities and infrastructures in the floodplain, including 1 energy facility, 1 nuclear facility, 1 hazmat facility, 2 historic sites, and 2 sewer pump stations (shown in Figure 4-37).

The Town of Altavista has 21 (or 23) primary structures identified in the 1-percent (or 0.2-percent) floodplain (shown in Figure 4-39). They are:

- Single family homes along Lynch Rd which parallels Lynch Creek.
- Single family homes or commercial buildings between Norfolk Southern Railroads and Roanoke River bank.

Five critical facilities and infrastructures, including Lane Home Furnishings, Altavista Area YMCA Family Center, Altavista Wastewater Plant, and BGF Industries Inc are in the floodplain. Among these facilities, the BGF Industries Inc is also one of the largest employers of Campbell County (ranks #4). The Altavista

Water Plant and the Intake Pump Station are also in the floodplain. The Plant is in Pittsylvania County and the intake is in Campbell County.

The Town of Brookneal has 1 (or 2) primary structures in the 1-percent (or 0.2-percent) floodplain. There are 4 critical facilities and infrastructures in both 1-percent and 0.2 percent floodplains, including 1 communication facility, 1 historic site (Cat Rock Sluice), and 2 wastewater treatment plants (in Falling River and Staunton River). These are shown in Figure 4-40.

The floodplains overlaid with the community growth areas are shown in Figure 4-41 and Figure 4-42 for Campbell County, Altavista, and Brookneal.

Table 4-45 Critical facility and infrastructure in floodplain of Campbell County, Altavista, and Brookneal

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
WODI - AM - The Rain Broadcasting, Inc. ***	1230 Radio Road Brookneal	Communication Facility	37.0384, -78.9420	1%; 0.2%
Leesville Hydro Plant	Rt. 754, Hurt	Energy Facility	37.0931, -79.4022	1%; 0.2%
BGF Industries **	401 Amherst Avenue, Altavista	HazMat Facility	37.1122, -79.2782	1%; 0.2%
Lane Home Furnishings **	701 5Th St, Altavista	HazMat Facility	37.1097, -79.2855	1%; 0.2%
Lynchburg Casting Industries	1132 Mt Athos Rd, Lynchburg	HazMat Facility	37.4027, -79.0595	1%
Cat Rock Sluice ***	General Location, Brookneal	Historic Site	37.0436, -78.9599	1%; 0.2%
Harpers Mill	3771 Hat Creek Rd, Brookneal	Historic Site	37.1397, -78.8988	1%; 0.2%
Six Mile Bridge	Mount Athos Rd & James River, Lynchburg	Historic Site	37.3932, -79.0612	1%; 0.2%
Altavista Area YMCAFamily Center **	1000 Franklin Ave, Altavista	Large Population Venue	37.1140, -79.2889	1%; 0.2%
Campbell Co Util And Serv Auth/Sewer Pump Station	9625 Leesville Rd, Evington	Sewer Pump Station	0.0000, 0.0000	1%; 0.2%
Flat Creek Pump Station	13238 Wards Rd N, Lynchburg	Sewer Pump Station	37.3096, -79.1831	1%; 0.2%
Altavista Wastewater Plant **	Ln Access Rd, Altavista	Wastewater Treatment Plant	37.1123, -79.2740	1%; 0.2%
Brookneal Town - Falling River ***	Wickliffe Ave, Brookneal	Wastewater Treatment Plant	37.0522, -78.9340	1%; 0.2%
Brookneal Town - Staunton River ***	Radio Rd, Brookneal	Wastewater Treatment Plant	37.0376, -78.9391	1%; 0.2%

*Note: * 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone. ** Located in the Town of Altavista. *** Located in the Town of Brookneal.*

In the unincorporated areas of Campbell County, there are 104 flood-prone roads (including primary and secondary roads, and ramps) with a total of about 21 miles road segments in the floodplain (shown in Figure 4-38). The top 5 susceptible roads are Campbell Hwy, Mt Athos Rd, Halseys Bridge Rd, Richmond Hwy, and Johnson Creek Rd. All these roads have multiple flood-prone locations along their route. Norfolk Southern Railroad tracks along the south bank of James River may be impacted during flooding events. There are 7 road bridges identified as at high risk (scour critical) in the floodplain (Table 4-46).

Total of 14 roads in the Town of Altavista intersect with the floodplain. The top 5 most flood-prone roads are Lane Access Rd, Main St, Pittsylvania Ave, 3rd St, and Lynch Rd. Total road segments in the floodplain are about 3 miles. One road bridge on Clarion Road is identified as at high risk.

In the Town of Brookneal, total road segments in the floodplain are about 0.9 miles. These roads include Dog Creek Rd, Radio Rd, Wickliffe Ave, Lusardi Dr, and Juniper Cliff Rd. No high risk bridges are identified in the town.

Table 4-46 Top 50 flood-prone roads in Campbell County (unincorporated area)

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Campbell Hwy	STR	9	1.47
2	Mt Athos Rd	SEC	2	1.43
3	Halseys Bridge Rd	SEC	4	1.26
4	Richmond Hwy	SEC	5	1.05
5	Johnson Creek Rd	SEC	9	0.95
6	Red Oak School Rd	SEC	2	0.79
7	Long Island Rd	STR	1	0.79
8	Bedford Hwy	STR	5	0.76
9	Leesville Rd	STR	2	0.56
10	Seneca Rd		2	0.49
11	Three Creeks Rd	SEC	2	0.42
12	U S Highway No 29	SEC	5	0.41
13	Red House Rd	STR	3	0.40
14	Lynch Rd	SEC	1	0.34
15	Railroad Ave	STR	2	0.31
16	Dearborn Rd	STR	4	0.30
17	Tardy Mountain Rd	STR	1	0.28
18	Riverbend Rd	STR	2	0.28
19	Beaver Creek Xing	STR	2	0.27
20	Taylor Pl	SEC	1	0.25
21	Wheeler Rd	STR	1	0.23
22	Colonial Hwy	SEC	2	0.23
23	Eastbrook Rd	SEC	2	0.23
24	Flat Creek Ln	UMS	2	0.21
25	Deer Haven Dr	SEC	3	0.20
26	Pigeon Run Rd	SEC	2	0.19
27	Stevens Rd	SEC	1	0.19

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
28	Stage Rd	SEC	3	0.19
29	Gladys Rd	SEC	3	0.19
30	Trestle Rd	SEC	1	0.18
31	Lawyers Rd	UMS	2	0.18
32	Whitehall Rd	SEC	3	0.17
33	Richmond Hwy Ramp	SEC	1	0.17
34	Lynchburg Hwy	SEC	2	0.17
35	Camp Hydaway Rd	SEC	1	0.16
36	Lynbrook Rd	UMS	1	0.16
37	Morris Church Rd	SEC	1	0.15
38	Swinging Bridge Rd	SEC	2	0.15
39	Wards Rd	STR	3	0.15
40	Chellis Ford Rd	SEC	1	0.14
41	Shirlen Dr	SEC	1	0.14
42	English Tavern Rd	SEC	1	0.13
43	Masons Mill Rd	STR	2	0.13
44	Five Links Ln	SEC	1	0.12
45	Two Bid Rd	SEC	2	0.12
46	Bethany Rd	SEC	2	0.11
47	Bear Creek Rd	STR	2	0.11
48	East Ferry Rd	STR	2	0.11
49	Evington Rd	SEC	1	0.11
50	Hurt Rd	STR	2	0.11

Table 4-47 Flood-prone roads within Town of Altavista

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Lane Access Rd	Secondary	2	3228
2	Main St	Primary	3	2795
3	Pittsylvania Ave	Primary	2	2283
4	3rd St	Secondary	1	2028
5	Lynch Rd	Secondary	1	1700
6	Clarion Rd	Primary	1	682
7	Broad St	Secondary	1	604
8	Lynch Mill Rd	Primary	1	503
9	7th St	Secondary	1	492
10	Riverbend Rd	Primary	1	391
11	West Rd	Secondary	1	341
12	U S Highway No 29	Primary	1	120
13	5th St	Secondary	1	78
14	Avoca Ln	Secondary	1	66

Table 4-48 Flood-prone roads within Town of Brookneal

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (feet)
1	Dog Creek Rd	Primary	1	2130
2	Radio Rd	Secondary	1	1693
3	Wickliffe Ave	Primary	1	518
4	Lusardi Dr	Primary	1	365
5	Juniper Cliff Rd	Secondary	1	243

Table 4-49 Road bridges at high risk (scour critical) in floodplain in Campbell County

Name	Location	Crossing	Coordinate
Red House Road	1.6-Rt 643 / 1.00-Rt 648	Falling River	37.1953, -78.9495
Mitchell Mill Road	1.00-Rt 699/1.60-Rt 701	Big Seneca Creek	37.1570, -79.1205
Clarion Road	0.09-Rt.714/1.10-Rt.712	Stream	37.5611, -79.0638
Red House Road	2.50-Rt 736/0.40-Rt 834	Little Falling River	37.1918, -78.8777
Hurt Road	1.50-Rt 601/0.45-Rt 618	Little Falling River	37.1405, -78.9153
Three Creeks Road	0.90-Rt.652/0.60-Rt.708	Mollys Creek	37.1706, -78.9724
East Ferry Road	0.60 Rt 727 / 1.00 Rt 751	Seneca River	37.1925, -79.1250
Evington Road	0.60-Rt 934/2.10-Bedfo CL	Buffalo Creek	37.2473, -79.3052

Table 4-50 Road bridges in floodplain in Town of Altavista

Name	Location	Crossing	Coordinates	Floodplain
Route 29 Bus.	0.00-CmpbCo./0.00-PittCo.	Staunton River & Ns Pwy	37.1268, -79.2707	1%; 0.2%
Riverbend Road	0.05-Rt 875/0.20-Rt 29B	Otter River	37.1388, -79.2441	1%; 0.2%
Main Street	0.30-Rt 43/2.83 NCL Altav	Lynch Creek	37.1104, -79.2874	1%; 0.2%
Clarion Road *	0.09-Rt.714/1.10-Rt.712	Stream	37.1294, -79.2743	1%; 0.2%

Note: * Identified as high risk (scour critical) road bridge.

Table 4-51 Road bridges in floodplain in Town of Brookneal

Name	Location	Crossing	Coordinates	Floodplain
Wickliffe Avenue	.06-E Brknl / 4.20-Cha Co	Falling River	37.0536, -78.9358	1%; 0.2%

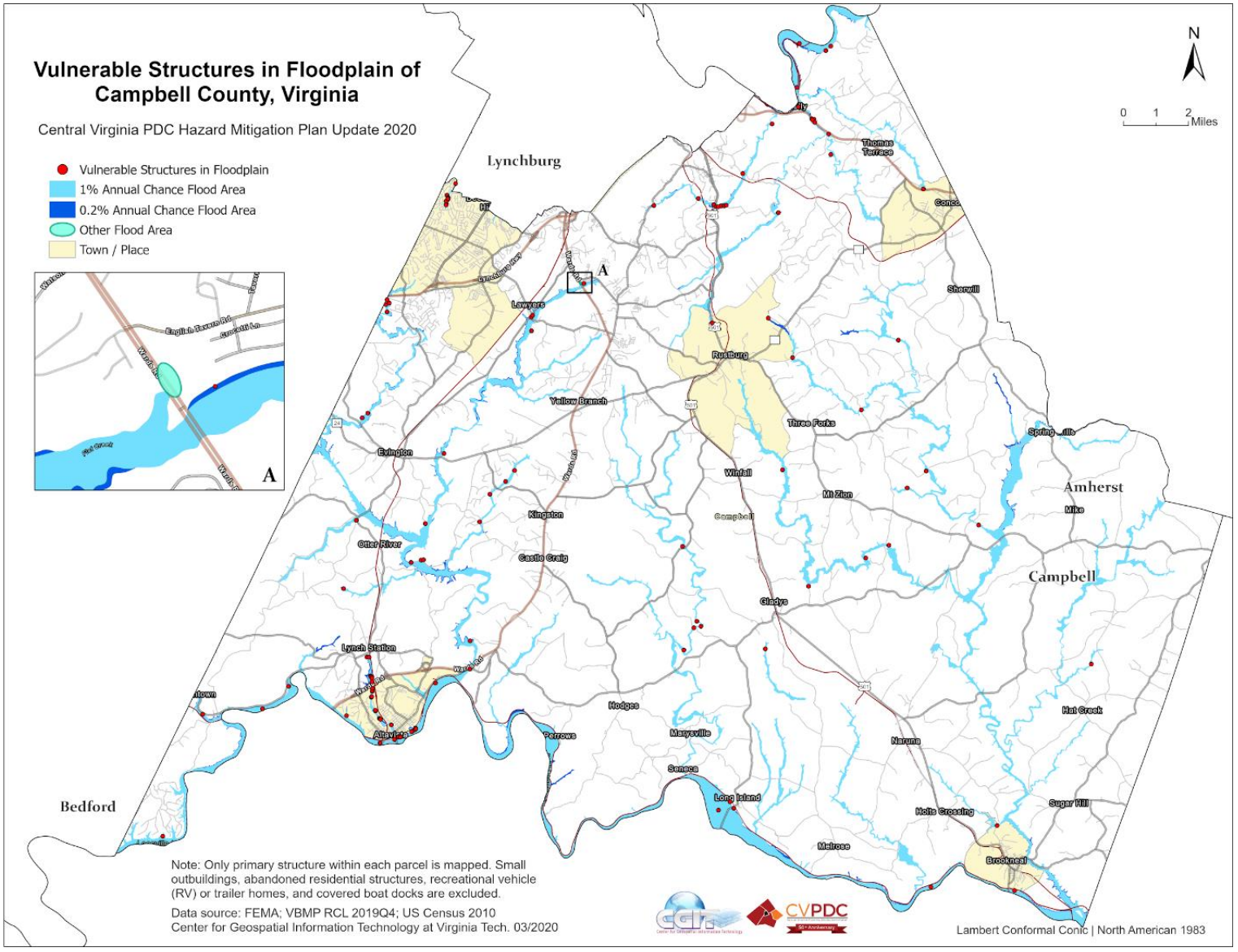


Figure 4-36 Vulnerable structures in floodplain of Campbell County, Virginia

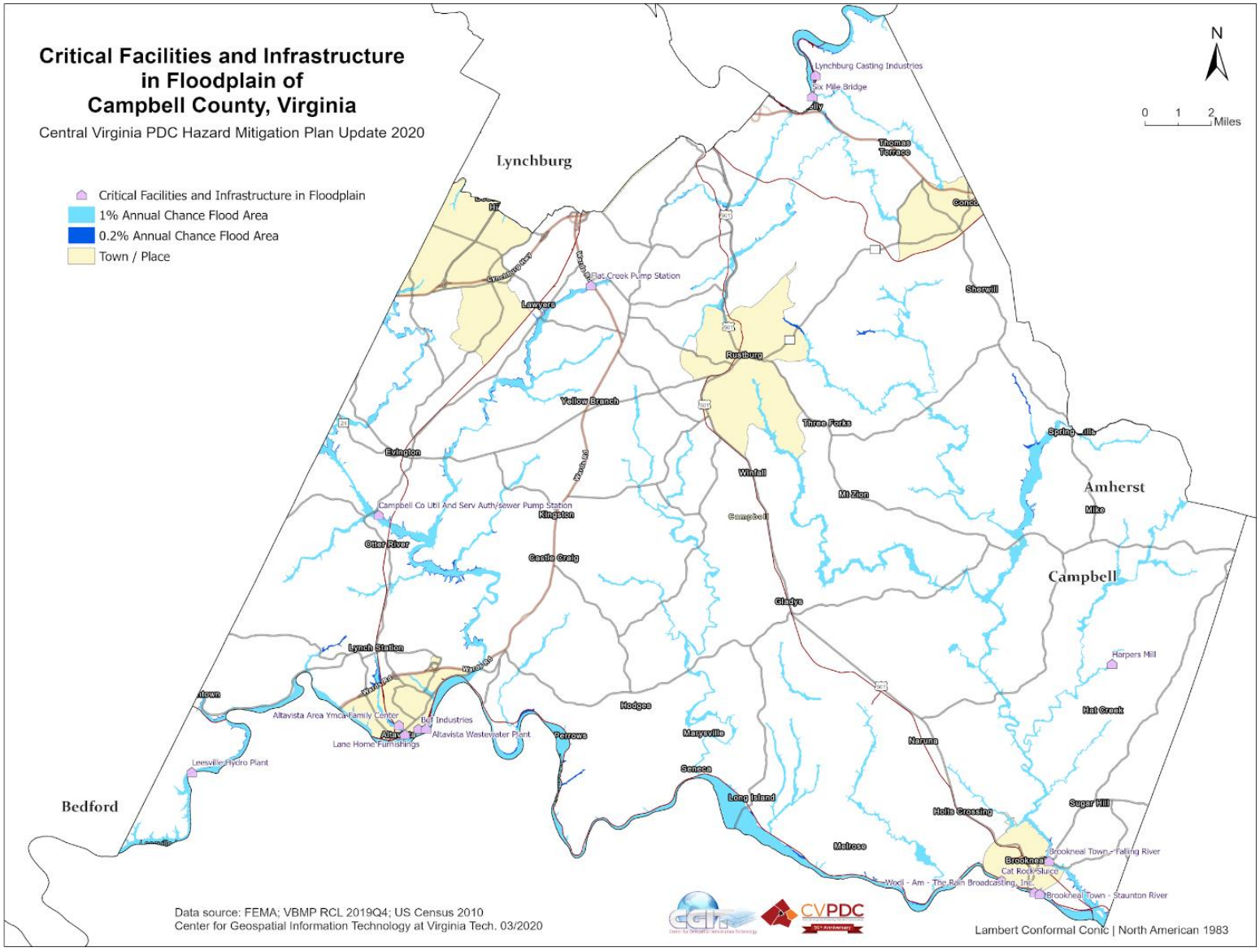


Figure 4-37 Critical facilities and infrastructure in floodplain of Campbell County, Virginia

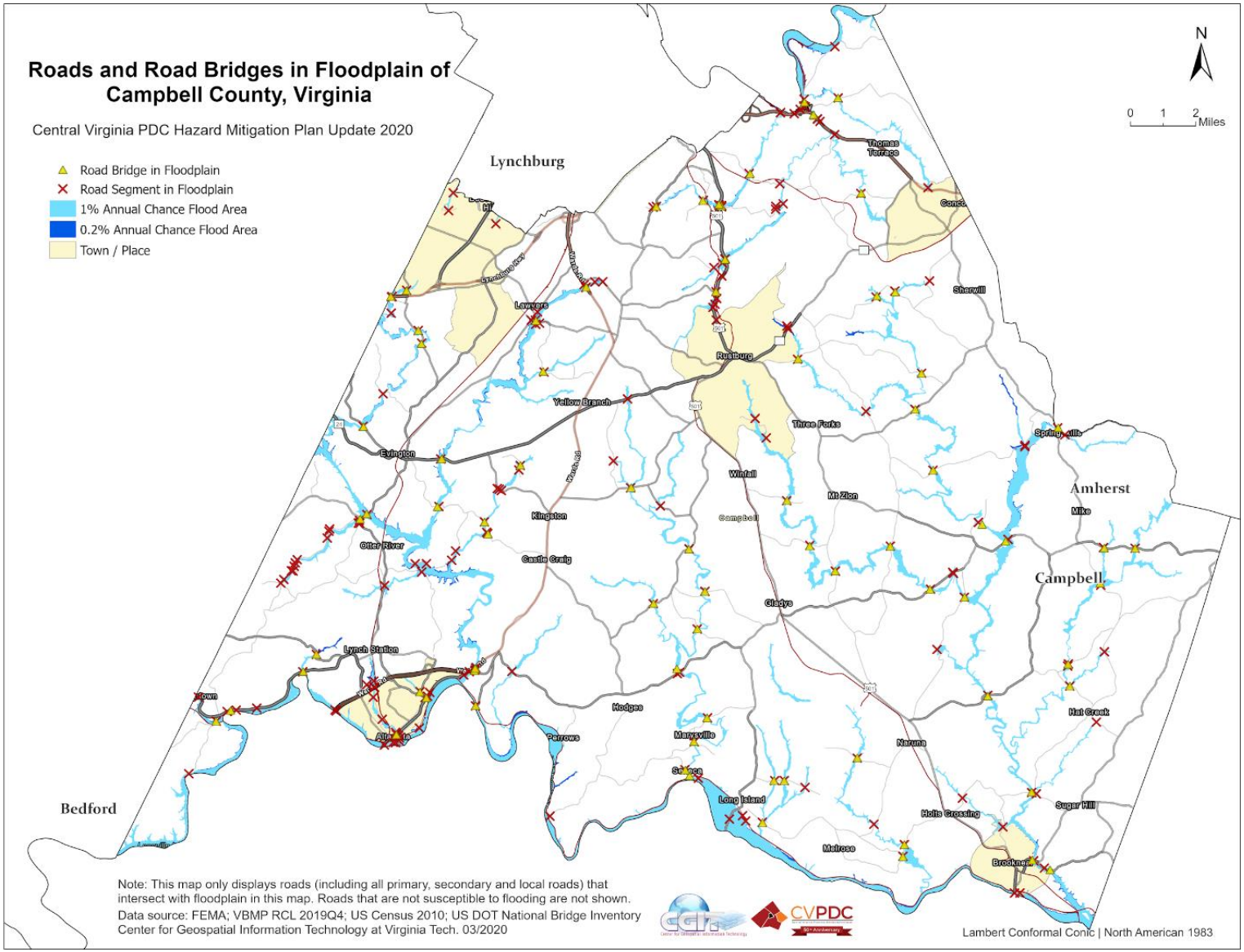


Figure 4-38 Roads and bridges in floodplain of Campbell County, Virginia

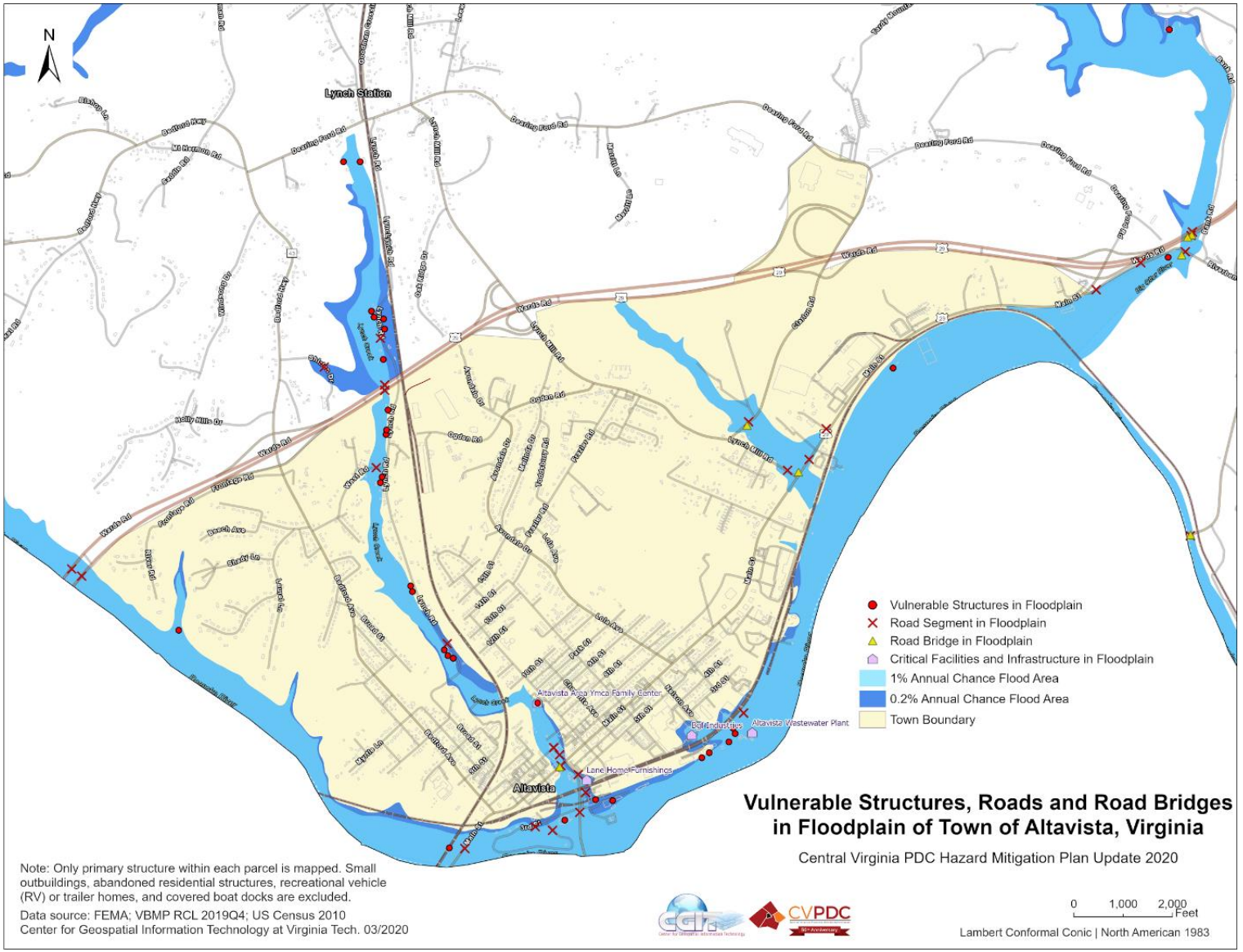


Figure 4-39 Vulnerable structures in floodplain of Town of Altavista, Virginia

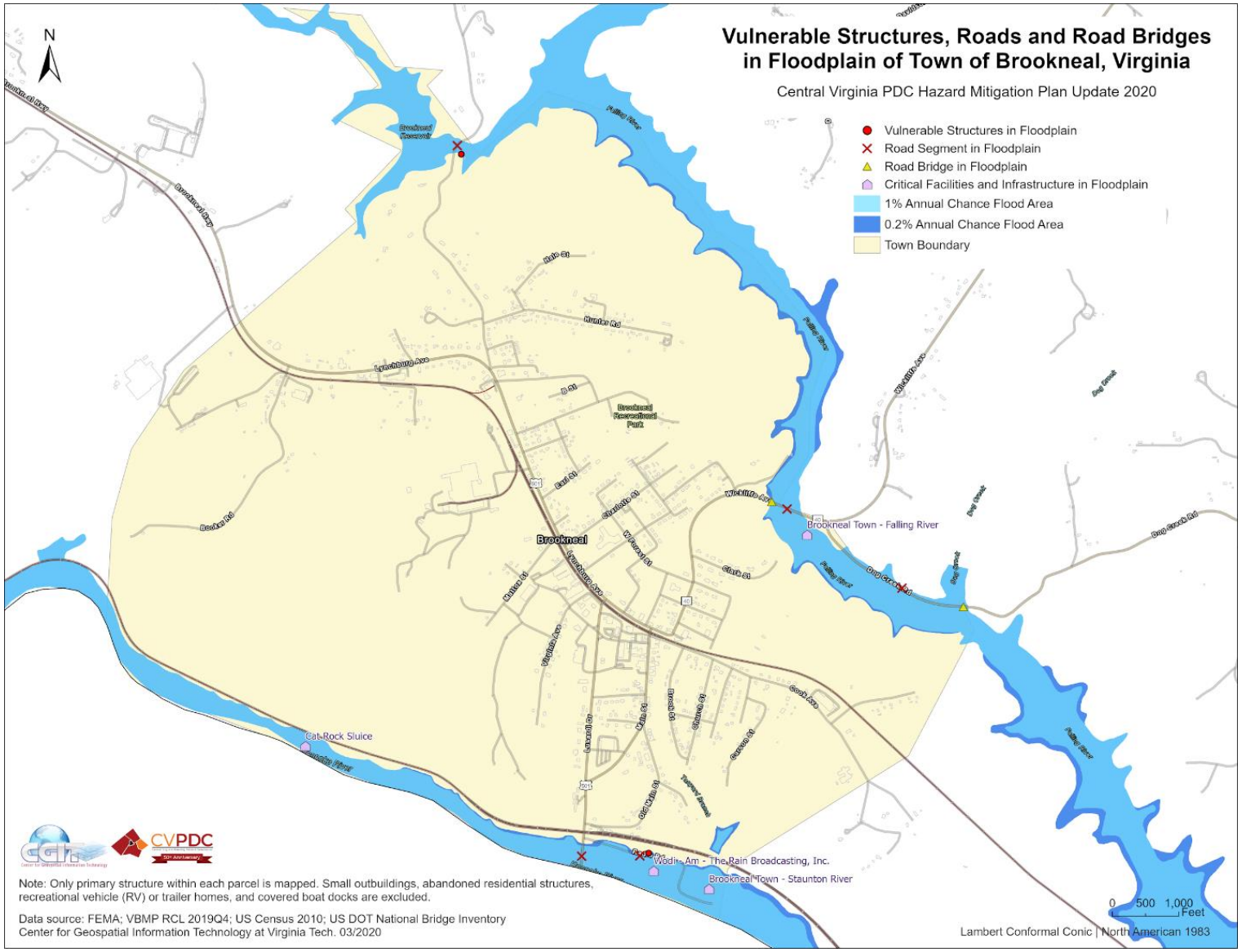


Figure 4-40 Vulnerable structures in floodplain of Town of Brookneal, Virginia

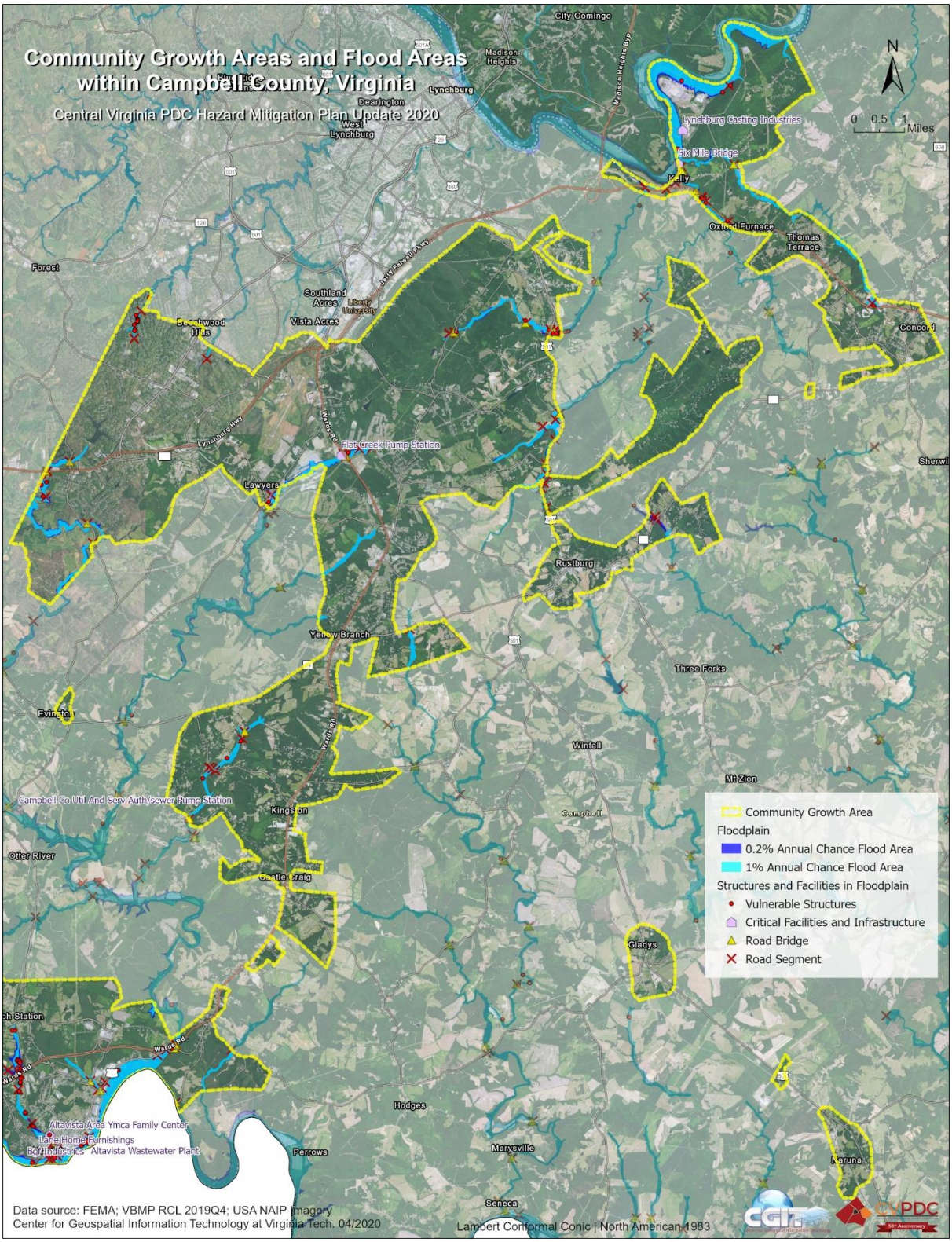


Figure 4-41 Community growth areas and floodplain within Campbell County, Virginia (map 1)

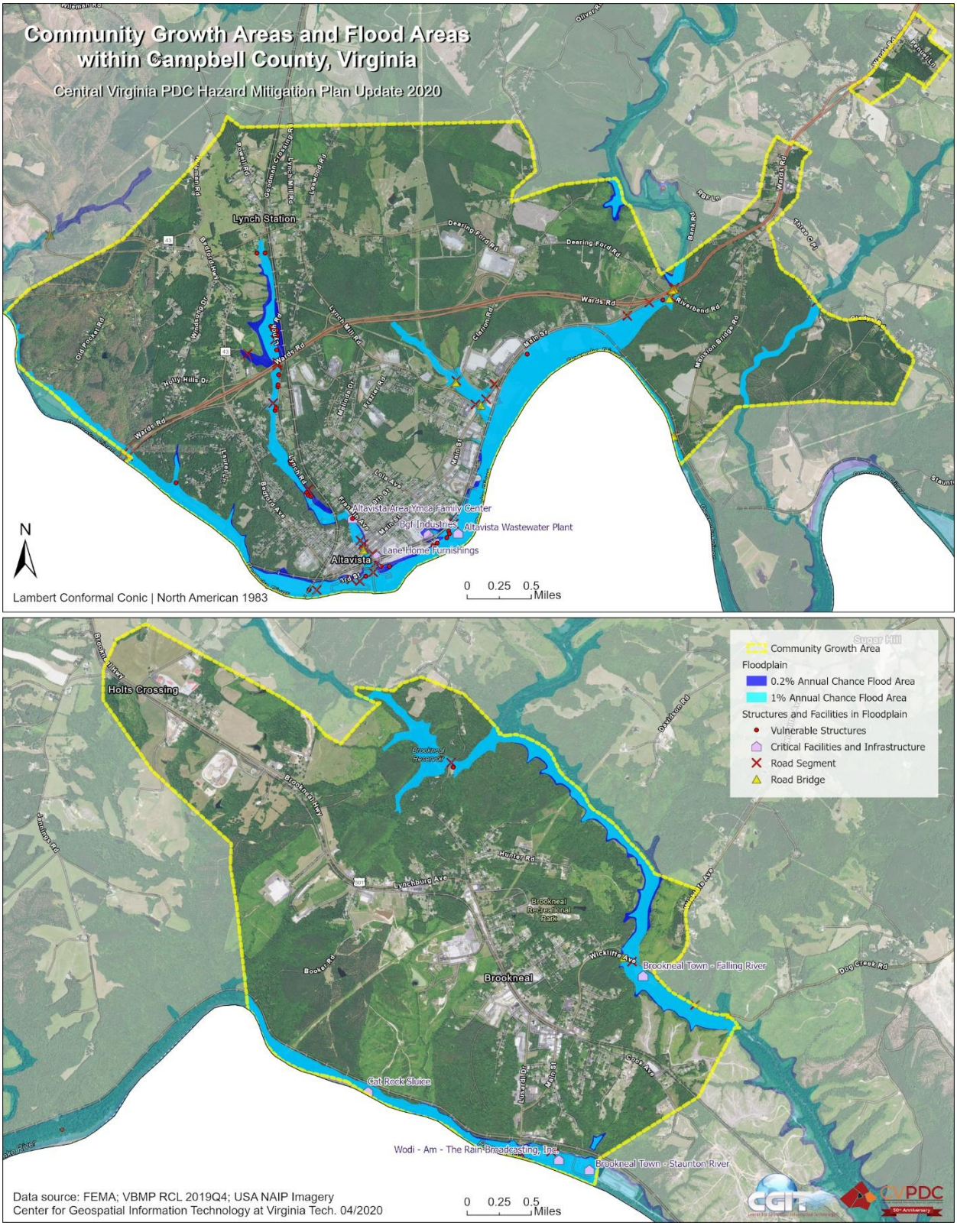


Figure 4-42 Community growth areas and floodplain within Campbell County, Virginia (map 2)

4.3.4.5 City of Lynchburg

The City of Lynchburg is located near the geographic center of Virginia. In 1757, John Lynch established a ferry service on the James. The ferry service remained profitable for many years, and by the end of the American Revolution, the village at Lynch's Ferry had itself become an important center of trade. Lynch saw the possibilities of establishing a town on the hill overlooking the ferry site, and in late 1784 petitioned the General Assembly of Virginia for a town charter. In October, 1786, the charter was granted, founding the town of Lynchburg. Located on James River, the city has a land area of 48 square miles and is bordered on the west by the Blue Ridge Mountains and Bedford County, to the south by Campbell County, and to the North by Amherst County. According to the 2016 American Community Survey five year estimates, the City of Lynchburg has a population of 78,755, a 4.2% increase from the 2010 Census.

The city is a major highway and transportation hub that has contributed to its status as a broadly diversified manufacturing center. Lynchburg is 115 miles west of Richmond, the state capital; 52 miles east of Roanoke; 180 miles southwest of Washington, D.C.; and 200 miles west of the Port of Hampton Roads. Lynchburg is the central city of the Lynchburg Metropolitan Statistical Area (MSA), which—according to the 2016 Census American Community Survey—has a total population of 258,062. Liberty University, a private coeducational Christian university, was founded in 1971 and encompasses 4,400 acres located in the foothills of the Blue Ridge Mountains and south of James River. The U.S. Department of Education reports Liberty as the third largest university in the country with 80,494 total enrollment (Fall 2015). However, the majority of these students are enrolled in distance education, with roughly 15,000 living locally. The top five largest employers in Lynchburg in 2019 are Liberty University, Centra Health Inc, J. Crew Outfitters, Areva NP Inc, and University of Lynchburg.

4.3.4.5.1 Community Characteristics

Lynchburg City entered into the NFIP on September 1, 1978, with emergency entry on September 18, 1973. The current effective date for the FIRMs is June 6, 2010. They are currently in good participating standing with the program. The city has 97 flood policies in force with $3.2 M losses paid (shown in the Figure 4-43 dashboard). Lynchburg City plans to continue NFIP compliance. The 1-percent and 0.2-percent annual chance flood areas in Lynchburg City take 3 and 3.5 square miles, accounting for 6.2% and 7% total area of the entire city, respectively.

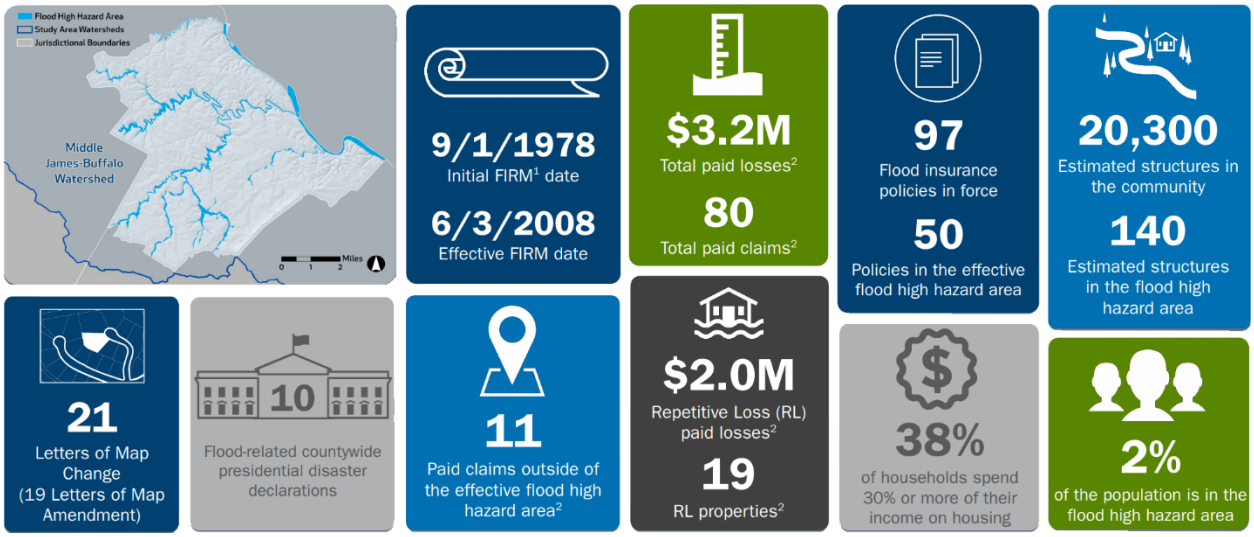


Figure 4-43 Community dashboard of City of Lynchburg

4.3.4.5.2 Principal Flood Problems

This flood risk assessment identifies impacts to the people and property of the City of Lynchburg. The floodplains of the James River near the city are intensely developed, containing numerous warehouses, factories, businesses, and the necessary rail, highway, and utility services for the city. Floodplain development for all other streams in the city is mainly residential, with some commercial and industrial sites adjacent to the floodplain areas. Using the Flood Risk Discovery Report of Middle James-Buffalo Watershed (FEMA, 2019) developed under FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program and the detailed risk analysis developed for this Hazard Mitigation Plan, the following principal flood problems have been identified for the City of Lynchburg:

- Critical facilities located in the floodplain including: wastewater treatment plant, energy facility, and hazmat facilities.
- 2 high risk bridges in the floodplain.
- Natural gas line and fuel pipeline located in floodplain.
- Several critical facilities sit outside of but very close to floodplain
- Downtown redevelopment area partially located in floodplain.
- Nineteen repetitive loss properties and seven severe repetitive loss properties.
- Older and lower income population located in the floodplain.

4.3.4.5.3 Vulnerable Population and Structures

The vulnerable population in or adjacent to floodplains within the City of Lynchburg was profiled using demographic data with dasymetric mapping techniques at census block level. FEMA's Risk Map program identified about 2% of the population is in the floodplain for the city. However, the city's up to 7.3% (or 14.5%) population have the potential to be impacted by flooding because of living in or close to 1-percent (or 0.2-percent) flood zones. Among those populations, 11.7% of them are at a low-income level (annual income < $20 k), 23.1% are young (age < 16), and 15.2% are seniors (age > 65). Whites make up the largest share (63%) of the total residents in the City of Lynchburg. Likewise, whites also predominate in or around the floodplain, representing 64.8% of the vulnerable population. Blacks are 25.2% of the vulnerable

population, Hispanic or Latino are 3.8%, Asians are 3.1%, and Native Americans are 0.4%. Table 4-52 and Table 4-53 provide more demographics of the vulnerable population in the city, in terms of ethnic group, income level, and age group.

Table 4-52 Ethnic group in floodplains of City of Lynchburg

	Population	Households	White	Black	Hispanic	Asian	Native Am
Lynchburg	75568	28476	47574 (63.0%)	21984 (29.1%)	2300 (3.0%)	1852 (2.5%)	200 (0.3%)
1% Floodplain	5544 (7.3%)	2479	3590 (64.8%)	1395 (25.2%)	209 (3.8%)	170 (3.1%)	20 (0.4%)
0.2% Floodplain	10964 (14.5%)	4920	7051 (64.3%)	2799 (25.5%)	438 (4.0%)	334 (3.0%)	27 (0.2%)

Table 4-53 Income level and age group in floodplains of City of Lynchburg

	Population	Households	Income <$20k/Yr	Age <16	Age >65
Lynchburg	75568	28476	7559 (10.0%)	14774 (19.6%)	10556 (14.0%)
1% Floodplain	5544 (7.3%)	2479	651 (11.7%)	1281 (23.1%)	840 (15.2%)
0.2% Floodplain	10964 (14.5%)	4920	1328 (12.1%)	2435 (22.2%)	1807 (16.5%)

The City of Lynchburg has 160 (or 235) primary structures identified in the 1-percent (or 0.2-percent) floodplain shown in Figure 4-44. Most vulnerable structures are concentrated in the following areas:

- Southwest bank of James River. This area is the major floodplain of the city which consists of a strip of land averaging about 400 feet wide by 3 miles long. The area is highly developed with industrial establishments, warehouses, and commercial buildings. All of these are vulnerable to high water. A quarter of identified vulnerable structures throughout the city are located here. Five critical facilities, including Amazement Square Child Museum, U.S. Pipe (former Griffin Pipe Products Co, LLC), Lynchburg Foundry Co Lower Basin Plant [19], Westrock Converting Company, and Lynchburg City Sewage Treatment are also in this floodplain (Table 4-54 and Figure 4-46, Panel A).

[19] The Lynchburg Foundry Co. Lower Basin Plant no longer exists. However, the site potentially releases toxic pollution during a flood. According to the EPA, numerous hazardous chemicals and petroleum products were historically used during the manufacturing process at this facility. See: https://www.epa.gov/hwcorrectiveaction/hazardous-waste-cleanup-intermet-archer-creek-foundry-currently-virginia-casting

- Reusens area. Over 30 homes and train warehouses of CSX Railroad sit in this floodplain. Two facilities, the Reusens Dam Hydro Plant and an electrical substation, are located here (Figure 4-46, panel B).
- Forest Hill / Blue Ridge Farms area. Some homes and buildings of Peak View Park are in the floodplain (Figure 4-47, Panel C).
- Lynchburg Expressway (Route 460) / Timberlake Rd (Route 501) interchange. Several clusters of townhouses, single family houses, and duplexes are in the floodplain near this interchange along Burton Creek (Figure 4-48, Panel D).

It is worth mentioning that 2 facilities not in the floodplain still need attention. The electrical substation in Stonewall St is very close to the floodplain. Valley View Retirement Community (assisted care facility) has a corner of the property in a flood zone but the structure is not (Table 4-55). Walmart ranks #8 of the largest employers of the city. The Walmart Supercenter on Wards Rd near Liberty University sits partially in the floodplain. Most of its parking lot is within the flood zone.

Table 4-54 Critical facility and infrastructure in floodplain of City of Lynchburg

Facility Name	Address	Facility Type	Coordinates	Flood Zone*
Amazement Square Child Museum	27 9Th St, Lynchburg	Attractions	37.4162, -79.1403	1%; 0.2%
Electrical Substation		Electrical Substation	37.4622, -79.1872	1%; 0.2%
Reusens Dam Hydro Plant	4300 Hydro Street, Lynchburg	Energy Facility	37.4630, -79.1867	1%; 0.2%
U.S. Pipe (former Griffin Pipe Products Co Llc)	10 Adams Street, Lynchburg	HazMat Facility	37.4208, -79.1413	1%; 0.2%
Lynchburg Foundry Co Lower Basin Plant	Garnet Street And Concord Turnpike, Lynchburg	HazMat Facility	37.4071, -79.1318	1%; 0.2%
Westrock Converting Company	1801 Concord Turnpike, Lynchburg	HazMat Facility	37.4034, -79.1281	1%; 0.2%
Lynchburg City Sewage Treatment	2301 Concord Tpke, Lynchburg	Wastewater Treatment Plant	37.3968, -79.1141	1%; 0.2%

Note: 1% (or 0.2%) indicates 1-percent (or 0.2-percent) annual chance flood zone

Table 4-55 Critical facility and infrastructure located outside of (but adjacent to) floodplain of City of Lynchburg

Facility Name	Address	Facility Type	Coordinates	Note
Electrical Substation	127 Stonewall St, Lynchburg,	Electrical Substation	37.4194, -79.1446	Very close to floodplain
Valley View	1213 Long	Assisted Care	37.3717,	Property contains a

Facility Name	Address	Facility Type	Coordinates	Note
Retirement Community	Meadows Drive, Lynchburg		-79.1993	floodplain but not the building.

In the City of Lynchburg, there are 77 flood-prone roads (including primary and secondary roads, and ramps/exits) with a total of about 12 miles road segments in the floodplain (Table 4-56 and Figure 4-45). The 5 most susceptible roads are Blackwater Creek Trl, Concord Tpke, Wards Rd, 5th St, and Hydro St. All these roads together with Lynchburg Expy, Evergreen Rd, and Graves Mill Rd all have multiple flood-prone locations along their route. CSX Railroad tracks along the bank of James River may be impacted during flooding events. Among the 23 road bridges in the floodplain, 2 scour critical bridges across Blackwater Creek and Fishing Creek are identified as at high risk (Table 4-57).

Table 4-56 Top 50 flood-prone roads in City of Lynchburg

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
1	Blackwater Creek Trl	SEC	15	2.28
2	Concord Tpke	SEC	2	1.66
3	Wards Rd	SEC	8	1.10
4	5th St	STR	2	0.56
5	Hydro St	SEC	2	0.55
6	Cornerstone Trl	SEC	3	0.53
7	Exit 9	SEC	3	0.50
8	Jefferson St	STR	1	0.38
9	Evergreen Rd	SEC	3	0.37
10	Lynchburg Expy	SEC	8	0.37
11	Rte 29 Byp	STR	2	0.22
12	29 Exs Expw	SEC	1	0.19
13	Wards Ferry Rd	STR	2	0.19
14	Fort Ave	SEC	2	0.15
15	Greenwood Dr	URB	1	0.12
16	Enterprise Dr	SEC	2	0.11
17	7th St	SEC	1	0.11
18	Mill Stream Ln	RMP	1	0.10
19	Graves Mill Rd	SEC	3	0.10
20	Robin Dr	SEC	1	0.10
21	501 Exn Expw	SEC	1	0.09
22	Coffee Rd	SEC	1	0.09
23	Trents Ferry Rd	SEC	1	0.09
24	Garnet St	SEC	1	0.08
25	Timberlake Rd	SEC	2	0.07
26	501 Ex	STR	1	0.06
27	Link Rd	STR	1	0.06
28	Rivermont Ave	URB	2	0.06
29	Adams St	SEC	1	0.06

Rank	Road Name	Road Type	Road segments in Floodplain	
			Count	Total Length (mi)
30	Creekside Dr	SEC	1	0.06
31	On Ramp	UMS	3	0.06
32	Mcconville Rd	STR	1	0.05
33	Fenwick Dr	SEC	1	0.05
34	Washington St	SEC	1	0.05
35	Wade Ln	SEC	1	0.05
36	Atlanta Ave	URB	1	0.04
37	Indian Hill Rd	SEC	1	0.04
38	Buckingham Dr	SEC	1	0.04
39	Jefferson Ridge Pkwy	SEC	1	0.04
40	Simons Run	SEC	4	0.04
41	Windsor Hills Dr	STR	1	0.04
42	Exit 11	SEC	1	0.03
43	Badcock Pl	STR	1	0.03
44	Rhonda Rd	SEC	1	0.03
45	Ivy Dr	SEC	1	0.03
46	Wiggington Rd	STR	1	0.03
47	Horseford Rd	SEC	1	0.03
48	Cranehill Dr		1	0.03
49	Carroll Ave	SEC	2	0.03
50	Cvcc Campus Dr	SEC	1	0.03

Table 4-57 Road bridges at high risk (scour critical) in floodplain in City of Lynchburg

Name	Location	Crossing	Coordinate
Hollins Mill Road	.89 RT 501 / .84 RT 29 B	Blackwater Creek	37.4253, -79.1595
501 Business	0118128 000829	Fishing Creek	37.3982, -79.1503

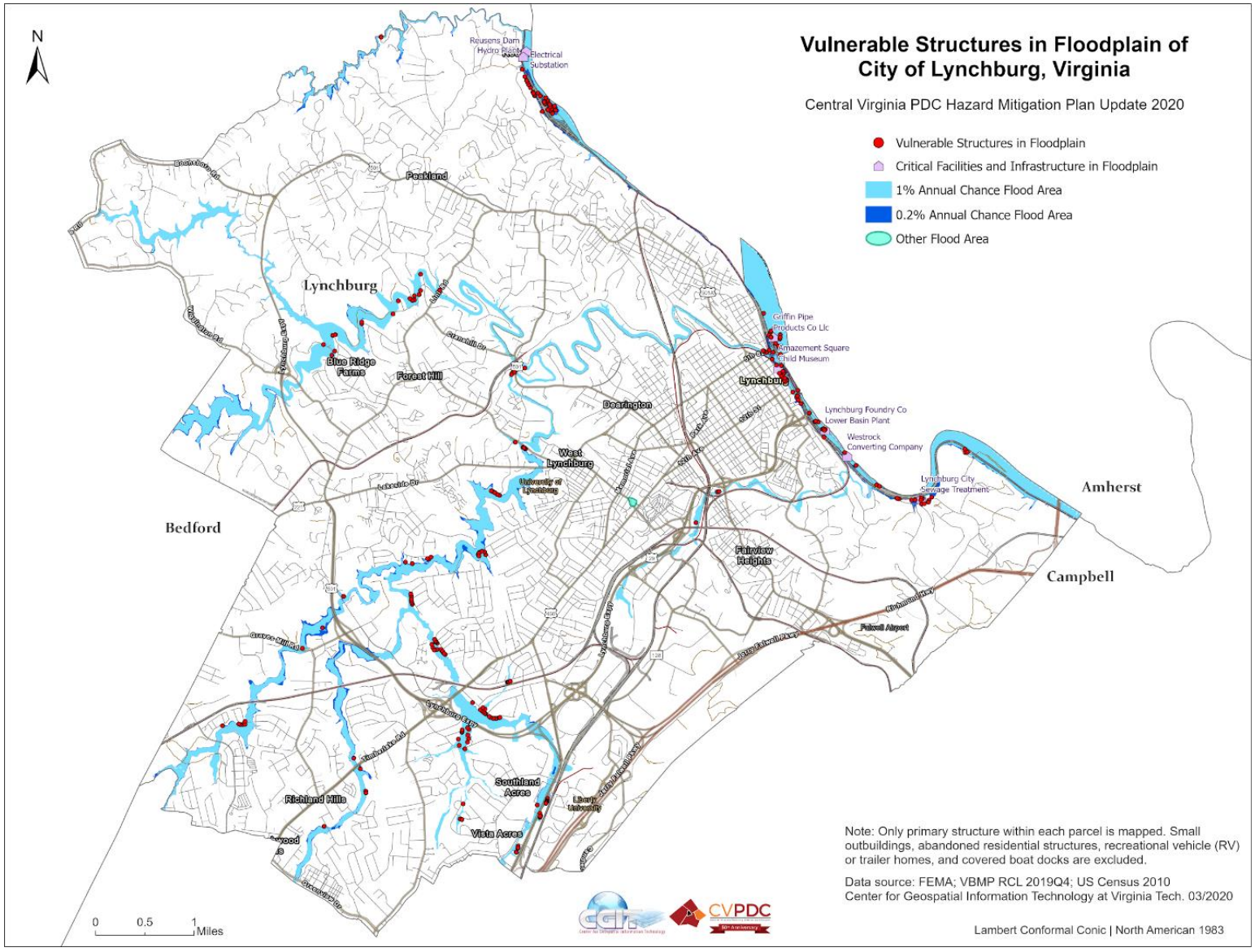


Figure 4-44 Vulnerable structures in floodplain of City of Lynchburg

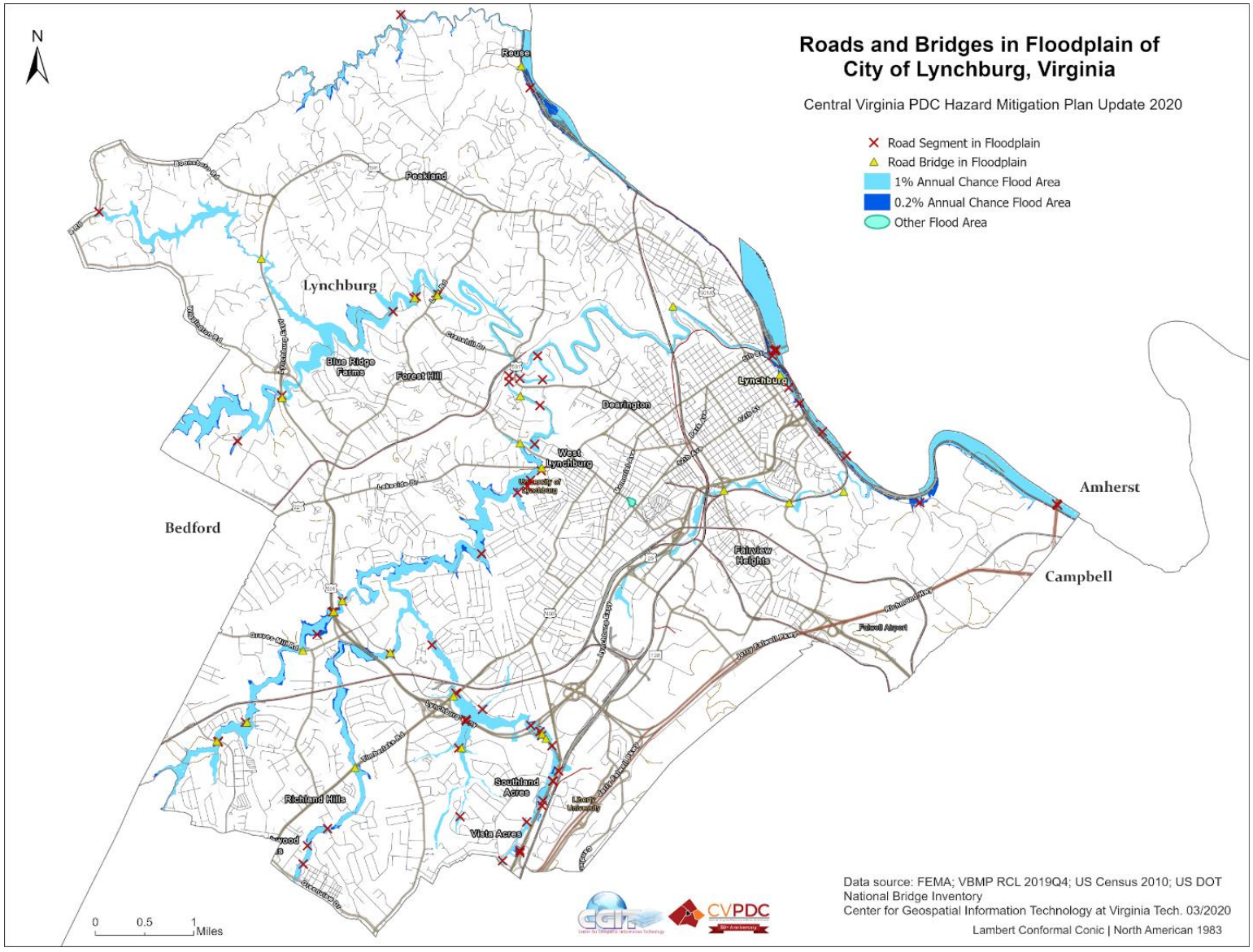


Figure 4-45 Roads and bridges in floodplain of City of Lynchburg

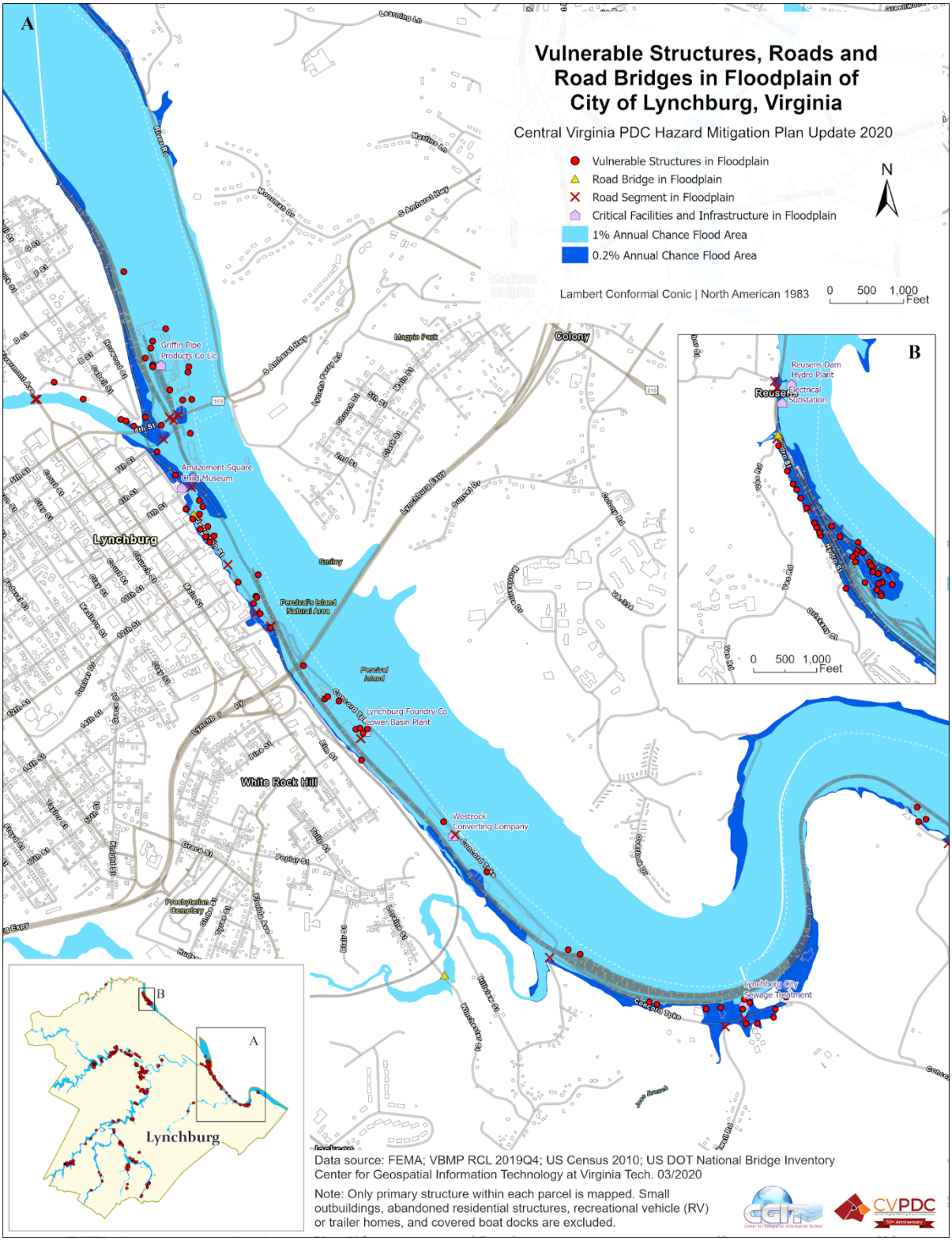


Figure 4-46 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel A, B)

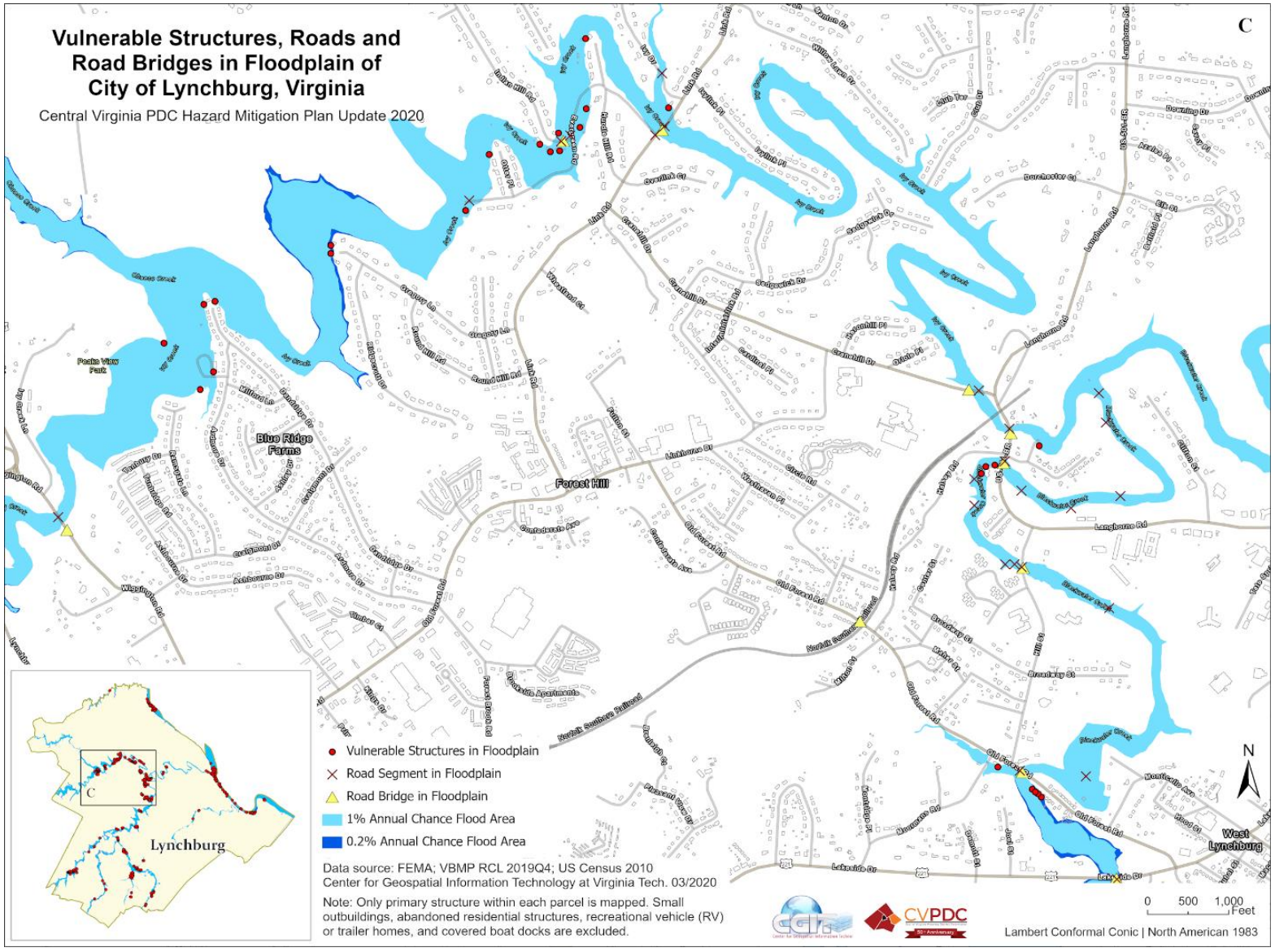


Figure 4-47 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel C)

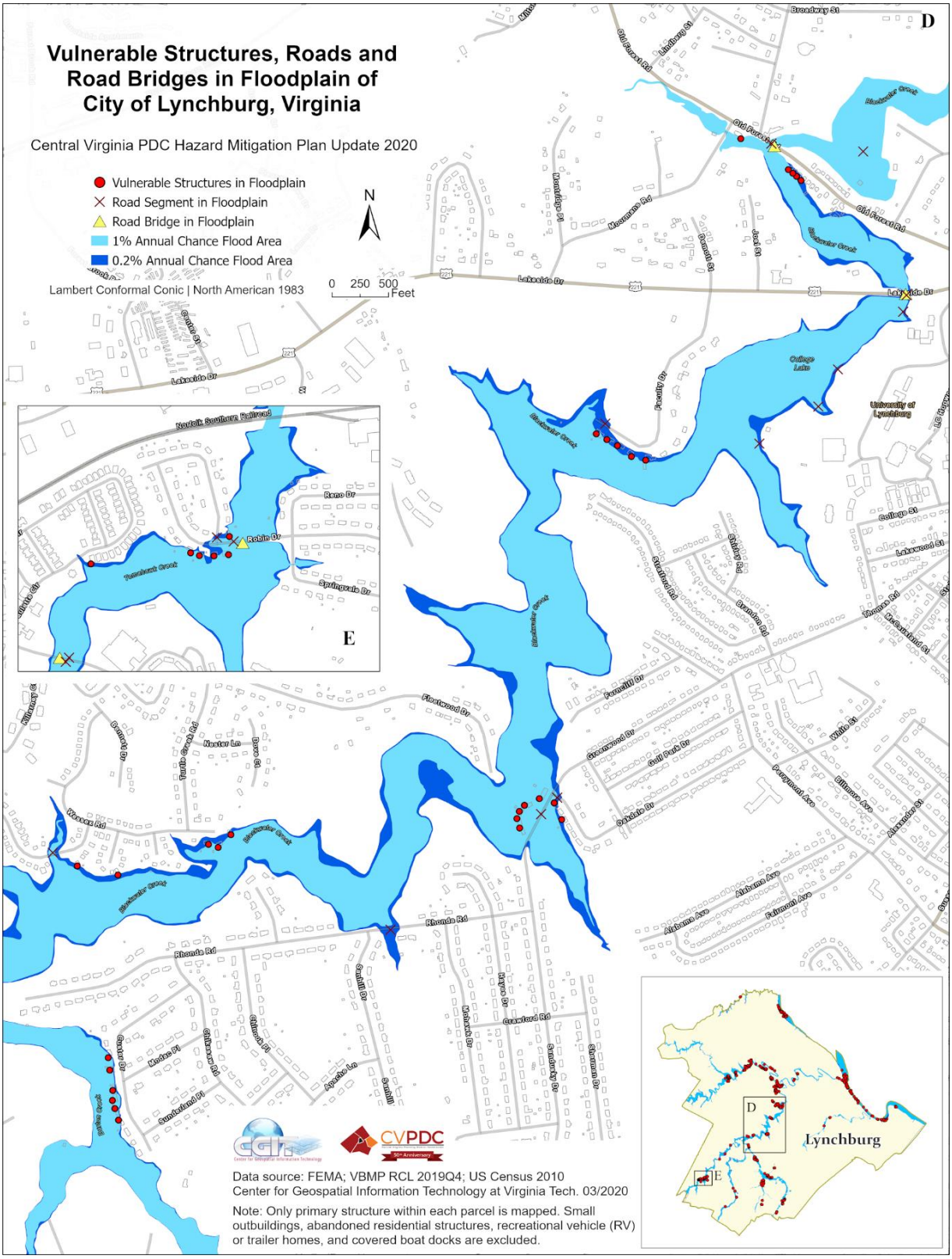


Figure 4-48 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel D)

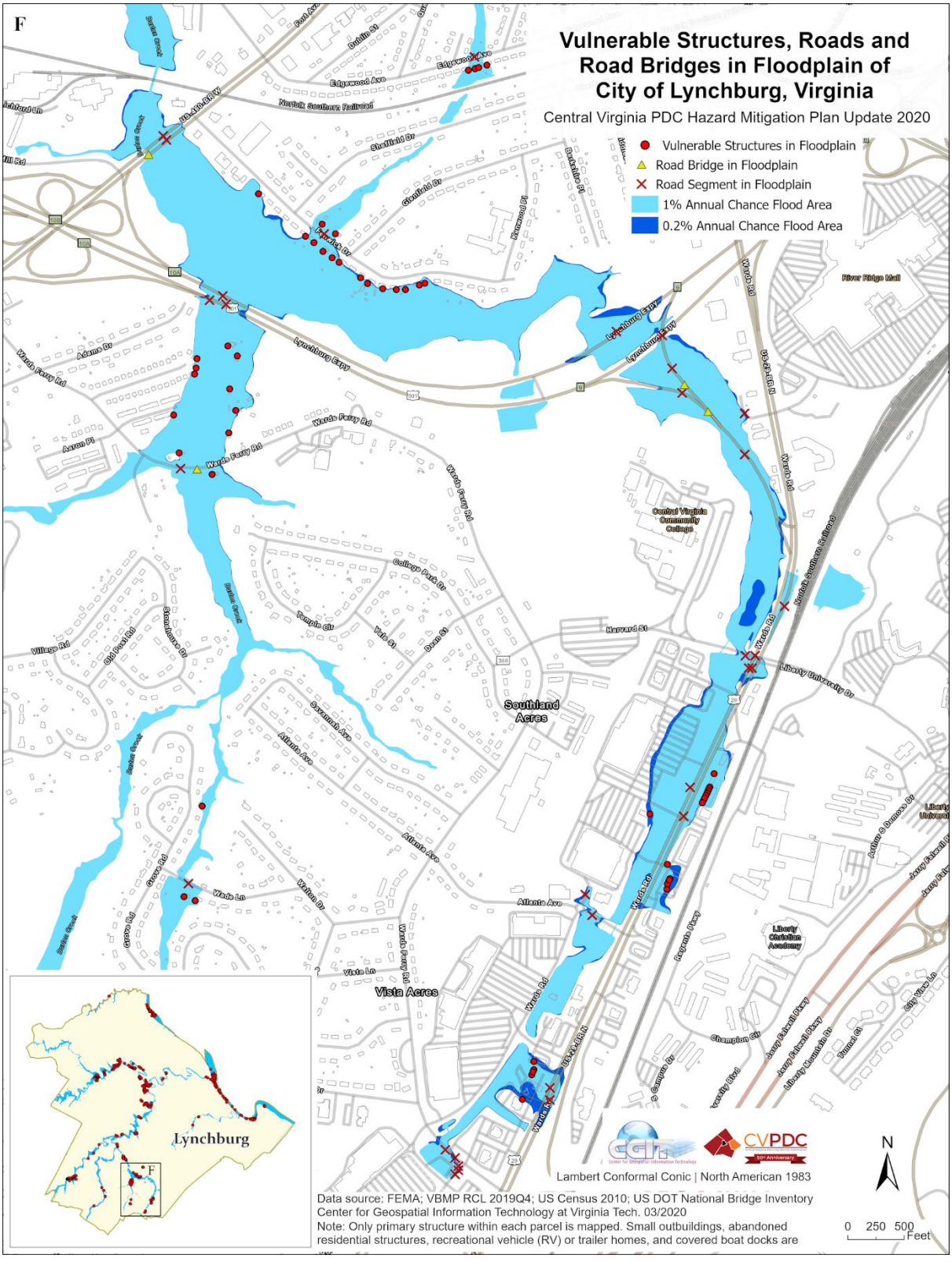


Figure 4-49 Vulnerable structures, roads and road bridges in floodplain of City of Lynchburg, Virginia (Panel F)

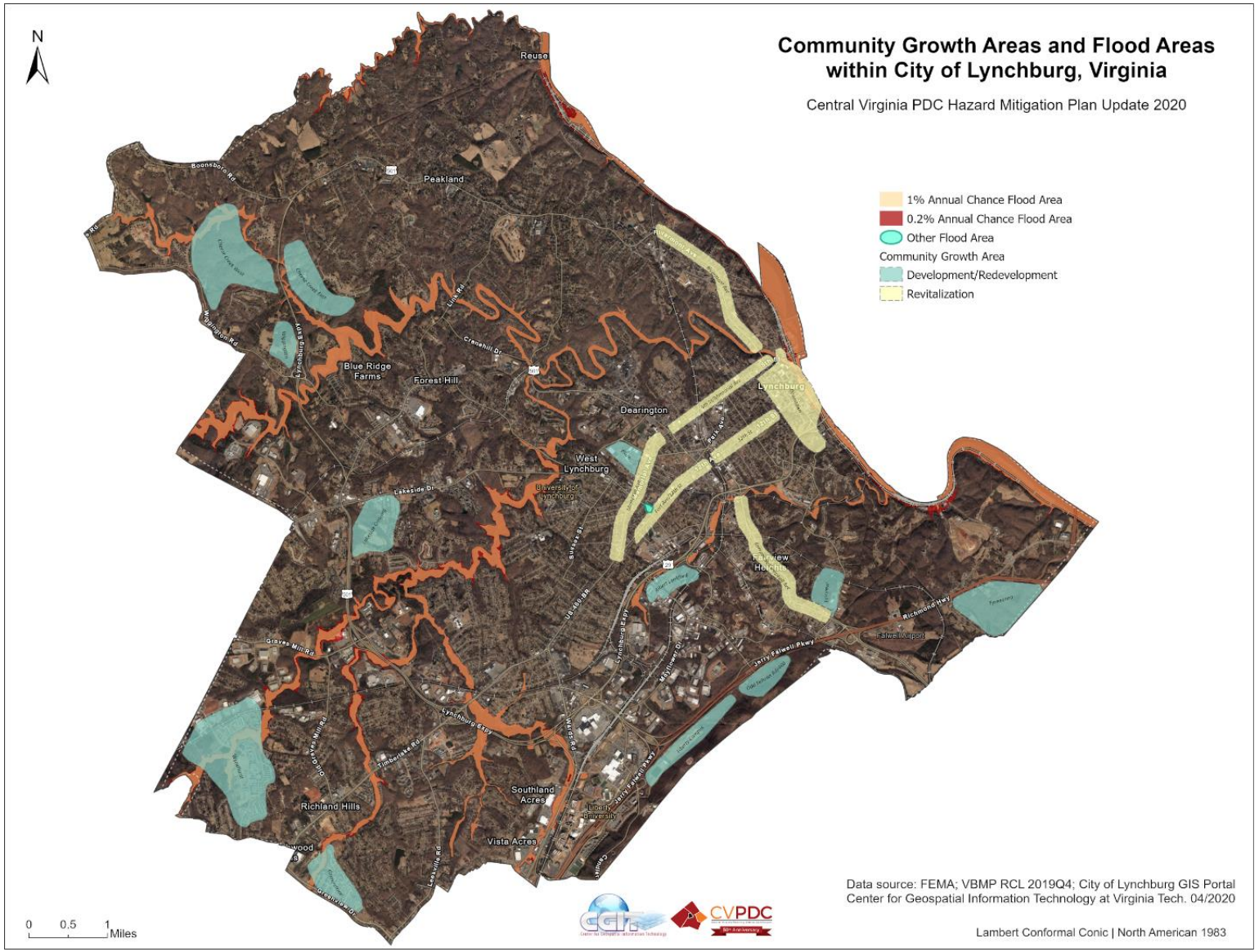


Figure 4-50 Community growth areas and floodplain within City of Lynchburg, Virginia

4.3.5 Probability of Future Occurrences

Based on recorded historical occurrences over the past 23 years (1996–2019), a flood event is a highly likely occurrence for the CVPDC.

4.3.6 References

- U.S. Government Publishing Office. Title 44 of the Code of Federal Regulation (44 CFR), Chapter 1, Subchapter B. Section 59.1 Definitions https://www.ecfr.gov/cgi-bin/text-idx?SID=b4bb956de1cd97fcde4e45957579e523&mc=true&node=pt44.1.59&rgn=div5#se44.1.59_11. (Accessed on July 19, 2019)
- National Weather Service, https://www.weather.gov/mrx/flood_and_flash
- FEMA. Definitions of FEMA Flood Zone Designations. https://snmapmod.snco.us/fmm/document/fema-flood-zone-definitions.pdf
- FEMA. Hazus Flood Model FEMA Standard Operating Procedure for Hazus Flood Level 2 Analysis. June 2018. https://www.fema.gov/media-library-data/1530821743439-e16c13c1f6266bbe374dc00a00ac9910/Hazus_Flood_Model_SOP_level2analysis.pdf
- FEMA. *Travel Trailers In the A-zone or V-zone: The Basics*. http://www.laseagrant.org/wp-content/uploads/FEMA-Travel-Trailers.pdf
- Moftakhari, Hamed R., Amir AghaKouchak, Brett F. Sanders, Maura Allaire, and Richard A. Matthew. *What Is Nuisance Flooding? Defining and Monitoring an Emerging Challenge*. Water Resources Research 54, no. 7 (July 2018): 4218–27. https://doi.org/10.1029/2018WR022828.
- FEMA. Flood Insurance Study: Bedford County, Virginia and Incorporated Areas. September 2010.
- FEMA. Middle James-Buffalo Watershed Discovery Report. in Flood Risk Discovery Report series. January 2019. https://www.bedfordcountyva.gov/home/showdocument?id=5882
- FEMA. Appomattox Watershed Discovery Report. in Flood Risk Discovery Report series. November 2018.
- Amherst County. Amherst County Comprehensive Plan, 2007-2027. https://www.countyofamherst.com/egov/apps/document/center.egov?view=item;id=3773
- Appomattox County. Appomattox County Comprehensive Plan. http://www.appomattoxcountyva.gov/home/showdocument?id=1576
- Bedford County. Bedford County 2030 Comprehensive Plan. https://www.bedfordcountyva.gov/home/showdocument?id=3948
- Campbell County. Campbell County Comprehensive Plan 2014-2029. https://www.co.campbell.va.us/166/Comprehensive-Plan
- City of Lynchburg. Comprehensive Plan: Planning for the Future 2013-2030. http://www.lynchburgva.gov/comprehensive-plan
- Town of Amherst. 2017 Comprehensive Plan. http://amherstva.gov/wp-content/uploads/town-code/2017-Comprehensive-Plan-Approved-170412-.pdf