A summary of the new impacts found in the 2008 field reconnaissance are displayed in Table 2-6.

Table 2-6. New Impacts Identified in 2008 Field Reconnaissance

Impact Type	Number of Sites	Comment
Bank Erosion	7	Minor to sever erosion throughout watershed, effecting small tributaries to main channels
Obstruction	4	Minor to moderate, three man made and one natural, causing erosion and head cuts
Headcut	1	Minor cause by natural debris blockage
Wet Ponds	25+	Primarily privately owned, several in poor health due to overgrown vegetation, over fertilization and heavy sedimentation
Pipes	2	Minor to Moderate
Encroachments	2	Standing water is encroaching on Compton Rd and Doyle Rd at tributary crossings, these areas also provides a mosquito habitat

The following pictures show examples of other significant impacts found in the watershed.

Figure 2-12: Standing water encroachment along Compton Rd.

Figure 2-13: Debris obstruction and headcut near Clifton Rd. and Cedar Ridge Dr.

Figure 2-14: Manmade obstruction near Clifton Rd. and Cedar Ridge Dr.

Figure 2-15: Pipe Impact near Clifton Rd. and Cedar Ridge Dr.

2.3.6 Modeling Results

Storm events are classified by the amount of rainfall, in inches, that occurs over the duration of a storm. The amount of rainfall depends on how frequently the storm will statistically occur and how long the storm lasts. Based on many years of rainfall data collected, storms of varying strength have been established based on the duration and probability of that event occurring within any given year. In general, smaller storms occur more frequently than larger storms of equal duration. Hence, a 2-year, 24hr storm (having a 50% chance of happening in a given year) has less rainfall than a 10-year, 24hr storm (having a 10% chance of happening in a given year). Stormwater runoff (which is related to the strength of the storm) is surplus rainfall that does not soak into the ground. This surplus rainfall flows (or 'runs off') from roof tops, parking lots and other impervious surfaces and is ultimately received by storm drainage systems, culverts and streams.

Modeling is a way to mathematically predict and spatially represent what will occur with a given rainfall event. There are two primary types of models that are used to achieve this goal; hydrologic and hydraulic:

- Hydrologic models take into account several factors; the particular rainfall event of interest, the physical nature of the land area where the rainfall occurs and how quickly the resulting stormwater runoff drains this given land area. Hydrologic models can describe both the quantity of stormwater runoff and resulting pollution, such as nutrients (nitrogen and phosphorus) and sediment that is transported by the runoff.

- Hydraulic models represent the effect the stormwater runoff from a particular rainfall event has on both man-made and natural systems. These models can both predict the ability for man-made culverts/channels to convey stormwater runoff and the spatial extent of potential flooding.

The table below shows three storm events and the rationale for being modeled:

Storm Event	Rationale for being Modeled
2-year, 24hr	Represents the amount of runoff that defines the shape of the receiving streams.
10-year, 24hr	Used to determine which road culverts will have adequate capacity to convey this storm without overtopping the road.
100-year, 24hr	Used to define the limits of flood inundation zones

The County is using a customized version of the Environmental Protection Agency's (EPA's) Spreadsheet Tool for the Estimation of Pollutant Loads (STEPL). This customized program (STEPL-FFX) was built in Microsoft (MS) Excel Visual Basic for Application (VBA). It provides a user-friendly interface to create a customized spreadsheet-based model in MS Excel. It employs simple algorithms to calculate nutrient and sediment loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs), including Low Impact Development (LID) practices for urban areas. It computes surface runoff; nutrient loads,

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including nitrogen, phosphorus and 5-day biological oxygen demand (BOD); and sediment delivery based on various land uses and management practices. The land uses considered are user-defined land uses from Fairfax County. For each watershed, the annual nutrient loading is calculated based on the runoff volume and the pollutant concentrations in the runoff water as influenced by factors such as the land use distribution and management practices. The annual sediment load (from sheet and rill erosion only) is calculated based on the Universal Soil Loss Equation (USLE) and the sediment delivery ratio. The sediment and pollutant load reductions that result from the implementation of BMPs are computed using BMP efficiencies.

Existing Conditions water-quality data from the STEPL-FFX is shown on Maps 2-5, 2-6 and 2-7. The color gradient map symbols for pollutant loadings are the same for both the Johnny Moore and Little Rocky Run watersheds. Therefore, for Total Nitrogen (TN), Total Phosphorous (TP) and Total Suspended Solids (TSS), the Johnny Moore subwatersheds are producing relatively low loads. The water-quality analysis is driven by land use and the watershed is predominantly open space and low density/estate residential. With less impervious areas and more natural cover, the results are consistent with expectations. One item to note is that the field reconnaissance effort identified several gulley formations throughout the Johnny Moore Creek watershed, which will be included in an updated STEPL analysis for more accurate TSS loadings. While some open space will be converted to estate residential in the future, no changes associated with the County's 25-yr Comprehensive Plan will significantly impact pollutant loadings for this watershed.

Table 2-7 provides a summary of runoff peak values and pollutant loadings at the outlet of the WMA. The second table is normalized by contributing drainage area.

Table 2-7. Johnny Moore Creek Stormwater Peak Values and Pollutant Loadings

WMA	Stormwater Runoff Peak Values		Pollutant Loadings		
	2-yr storm (cfs)	10-yr storm (cfs)	TSS (tons/yr)	TN (lbs/yr)	TP (lbs/yr)
Johnny Moore Creek	542	1591	249.6	7102.5	1255.7
NORMALIZED BY DRAINAGE AREA					
WMA	**Stormwater Runoff Peak Values**		**Pollutant Loadings**		
	2-yr storm (cfs/acre)	**10-yr storm (cfs/acre)**	**TSS (tons/acre/yr)**	**TN (lbs/acre/yr)**	**TP (lbs/acre/yr)**
Johnny Moore Creek	0.169	0.495	0.078	2.211	0.391

The preliminary hydraulic model for Johnny Moore was developed using United States Army Corps of Engineers (USACE) Hydrologic Engineering Centers River Analysis System (HEC-RAS) to compute water surface profiles. The preliminary model results were used to analyze the water surface elevation and flooding of inline structures.

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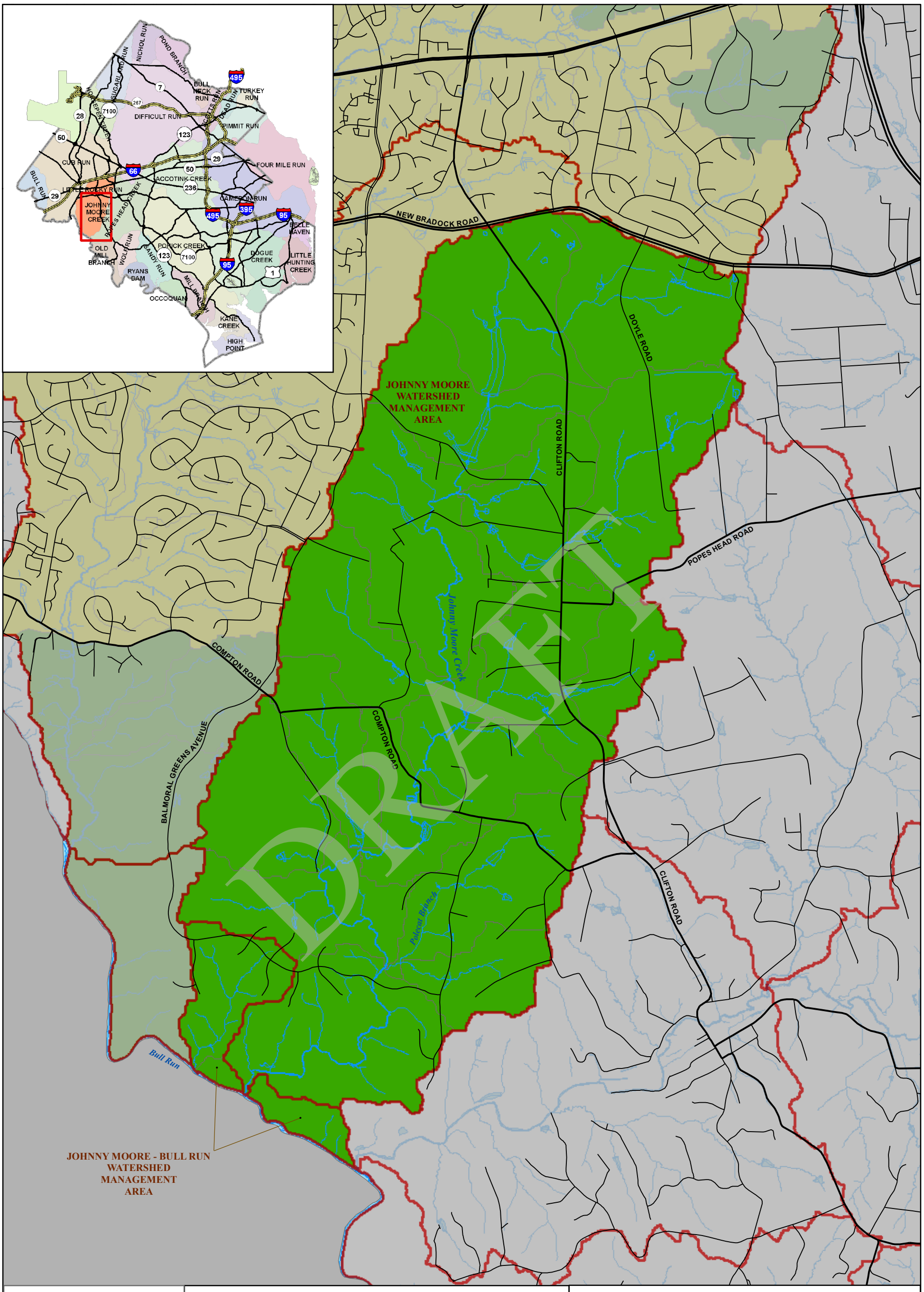
NICHOL RUN
POND BRANCH
SUGARLAND RUN
BULL NECK RUN
TURKEY RUN
DIFFICULT RUN
PIMMIT RUN
CUB RUN
FOUR MILE RUN
ACCOTINK CREEK
LITTLE ROCKY RUN
BULL RUN
JOHNNY MOORE CREEK
POPES HEAD CREEK
CAMERON RUN
BELLE HAVEN
OLD MILL BRANCH
WOLF RUN
POHICK CREEK
BANDY RUN
DOGUE CREEK
LITTLE HUNTING CREEK
RYANS DAM
MILL BRANCH
OCCOQUAN
KANE CREEK
HIGH POINT
NEW BRADOCK ROAD
DOYLE ROAD
JOHNNY MOORE WATERSHED MANAGEMENT AREA
CLIFTON ROAD
POPES HEAD ROAD
Johnny Moore Creek
COMPTON ROAD
BALMORAL GREENS AVENUE
Polecat Branch
Bull Run
JOHNNY MOORE - BULL RUN WATERSHED MANAGEMENT AREA
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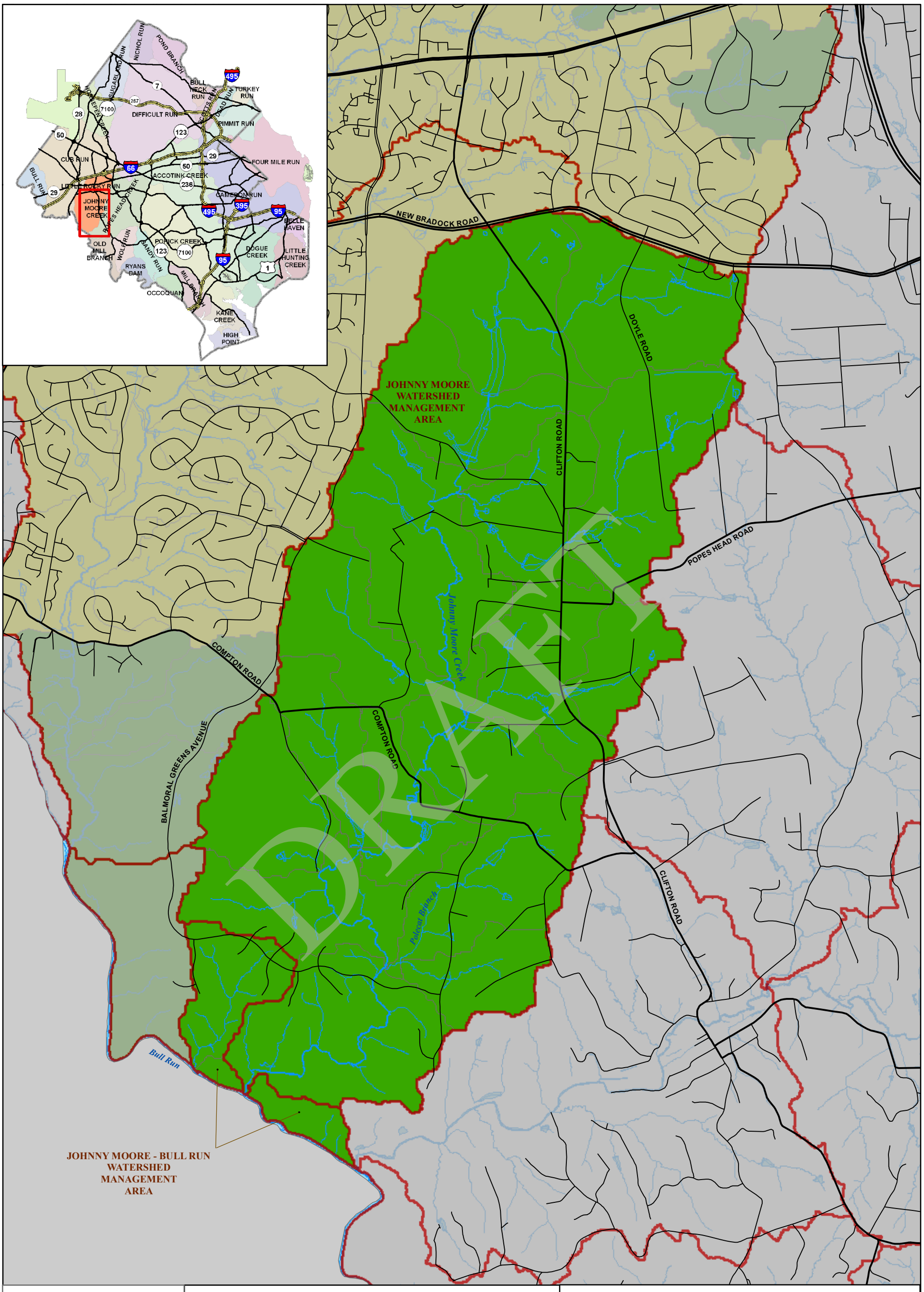
N
0 1,000 2,000 Feet
Legend
MAJOR_ROADS
Arterial Streets
WMA
Johnny Moore WMAs
Other WMAS
Streams
STEPL Existing
Total Nitrogen lbs/ac/yr
0.987500 - 4.287116
4.287117 - 9.069964
9.069965 - 17.802404
Map 2-5
Johnny Moore and Johnny Moore - Bull Run WMAs
Total Nitrogen



N

0 1,000 2,000 Feet

Legend

MAJOR_ROADS
Arterial Streets

WMA

Johnny Moore WMAs
Other WMAS
Streams

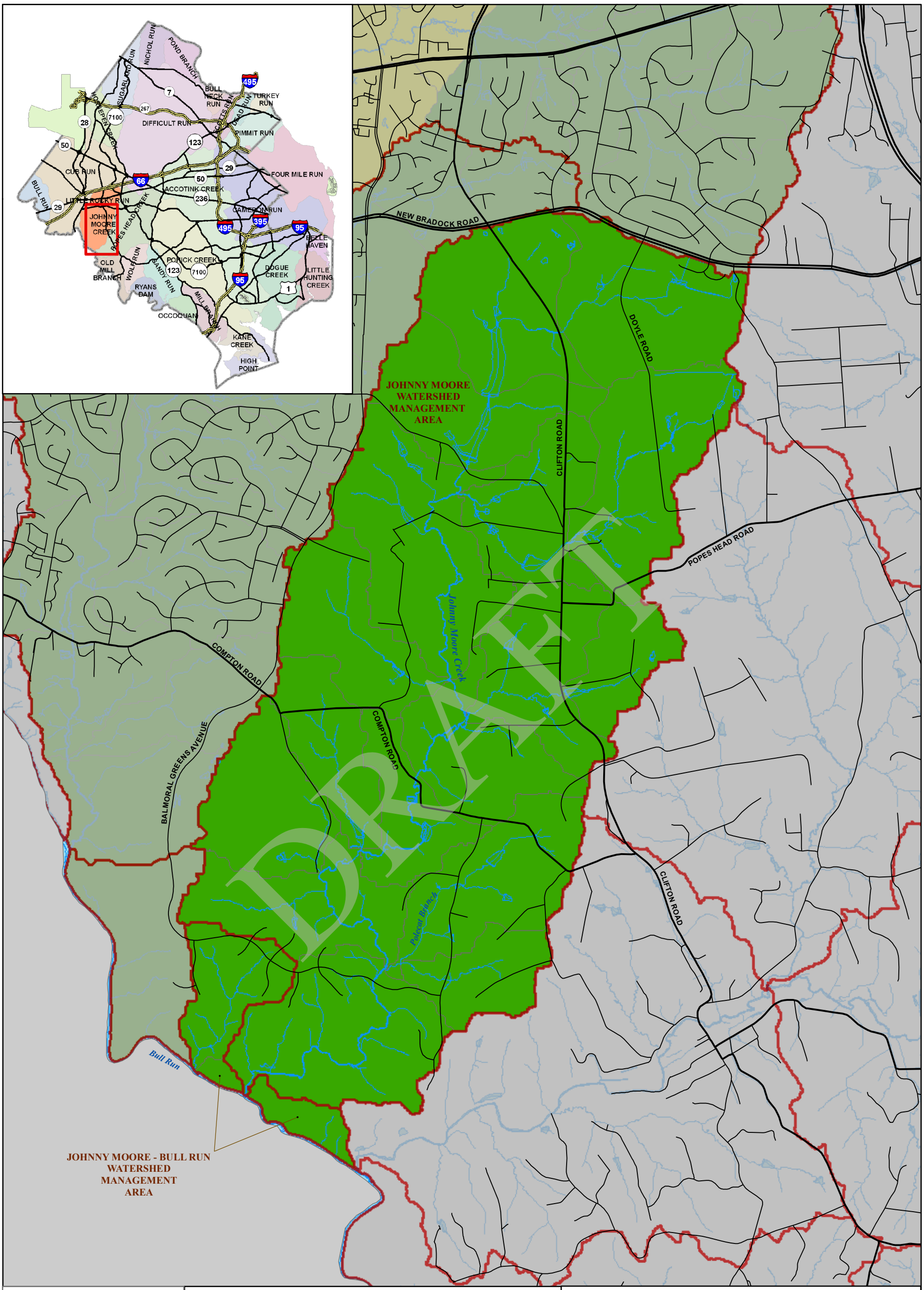
STEPL Existing Phosphorous lbs/ac/yr

0.246100 - 0.645884
0.645885 - 1.441817
1.441818 - 2.874638

Map 2-6

Johnny Moore and Johnny Moore - Bull Run WMAs

Total Phosphorous



N

0 1,000 2,000 Feet

Legend

MAJOR_ROADS
Arterial Streets

WMA

Johnny Moore WMAs
Other WMAS
Streams

STEPL Existing TSS t/ac/yr

0.045347 - 0.180933
0.180934 - 0.316520
0.316521 - 0.452106

Map 2-7

Johnny Moore and Johnny Moore - Bull Run WMAs

Total Suspended Solids

The input data for the HEC-RAS model was extracted using HEC-GeoRAS. HEC-GeoRAS is a tool that processes the geospatial data within the County's GIS, specifically as it pertains to physical features such as stream geometry and flowpath so that these features can be represented in the model. HEC-RAS models were developed for study streams within Johnny Moore watershed using a naming convention unique for each reach. The study streams were defined as having a drainage area of at least 200 acres.

Bridge and Culvert crossings were coded according to available County or Virginia Department of Transportation (VDOT) engineering documents that depict the facility as it was actually built. Where not available, limited field reconnaissance was performed to obtain the crossing data. The crossing elevation data was determined relative to a point where the elevation could be estimated accurately from the County's topographic data.

Manning's 'n' values, which represent surface roughness, were assigned to the channel and overbank portions of the studied streams based on field visits and aerial photographs.

The flow change locations were extracted from the EPA Storm Water Management Model (SWMM) developed to estimate preliminary stormwater runoff flow values. The 2-yr, 10-yr and 100-yr storm flows were determined at several locations in order to provide a detailed flow profile for the hydraulic model. Map 2-8 provides a graphical representation of the SWMM results for the 10-year storm discharge.

The 2-year storm discharge is regarded as the channel-forming or dominant discharge for the purposes of this study. This discharge is the flow value that transports the majority of a stream's sediment load and therefore actively forms and maintains the channel. A comparison of stream dynamics and channel geometry for the 2-year discharge provides insight regarding the relative stability of the system and helps to identify areas in need of restoration.

The 10-year storm discharge is being included to analyze the level of service of stream crossings. Occurring less frequently than the 2-year storm, the flood stage associated with this storm can result in more significant safety hazards to residents. All stream crossings (bridges and culverts) will be analyzed against this storm to see if they are performing at a level that safely passes this storm.

The 100-year storm discharge is used by the Federal Emergency Management Agency (FEMA) to map floodplain inundation zones and establish flood insurance rates. This provides a means to assess which properties are at risk to flooding and determine the appropriate insurance requirements for these at risk properties. The models developed to analyze the system for watershed planning have been built in compliance with FEMA standards in order to update the Flood Insurance Rate Maps for Fairfax County where appropriate.

In summary, the preliminary results for HEC-RAS are as follows:

- 3 stream road crossings in the watershed do not have the capacity to pass the 10-year storm without the road being over topped.
- The 2-year storm exceeds the channel banks in several locations.
- No residential structures are within the modeled 100-year flood inundation zone.

The limit of the 100-year flood is graphically represented in Map 2-9.

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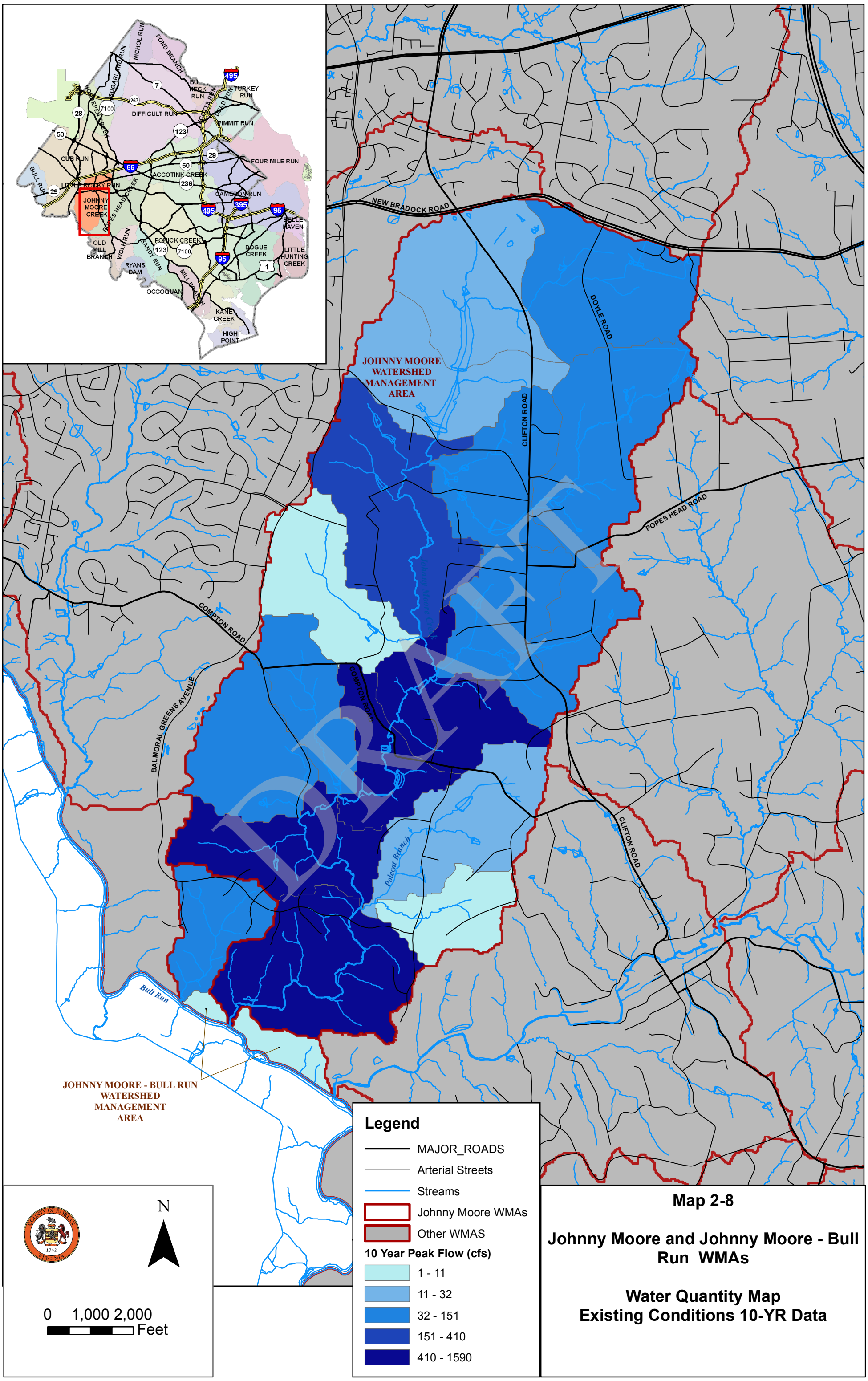
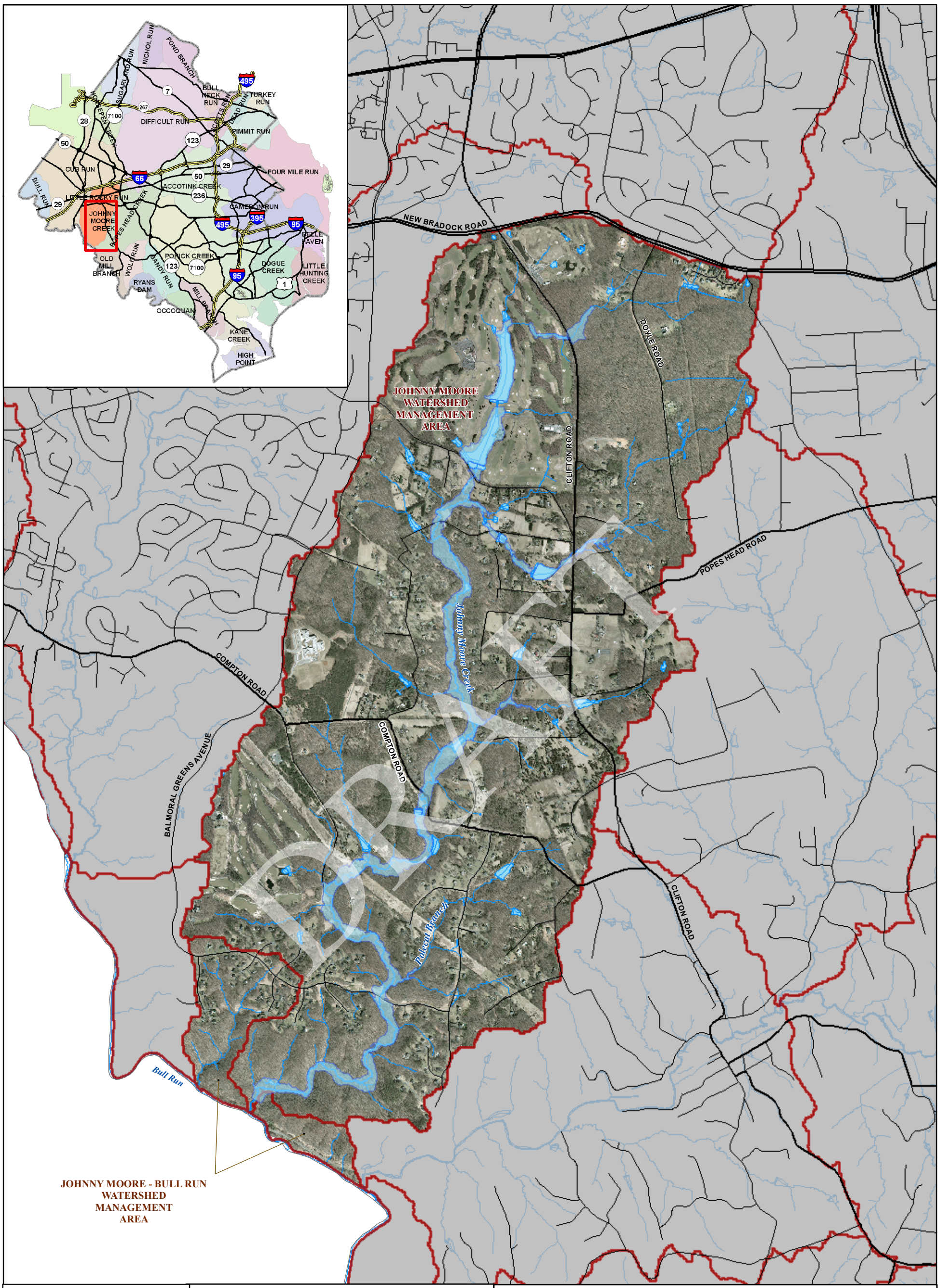


Map 2-8

Johnny Moore and Johnny Moore - Bull Run WMAs

Water Quantity Map
Existing Conditions 10-YR Data



Map 2-9

Johnny Moore and Johnny Moore - Bull Run WMAs

Preliminary 1% Annual Chance Floodplain Boundary

2.3.7 Subwatershed Ranking

It should be noted that all designations of the preliminary ranking results are relative to the area studied for this report. In other words, a 'low quality' designation does not necessarily indicate a poor quality subwatershed, only relative to the 51 other subwatersheds in the Little Rocky Run/Johnny Moore Creek watersheds.

The Johnny Moore Creek WMA contains mostly high quality subwatersheds as summarized on maps 2-33 (Objective Composite Score) and 2-34 (Source Composite Score). Maps 2-26 to 2-32 describe more specific objective criteria, which have been weighted to determine the objective composite score. Please refer to section 2.2 for a more detailed description of impact, source and programmatic indicators and how they are being used to characterize the subwatersheds.

The main stressors in this WMA come from two golf courses, which tend to result in higher pollutant loadings while also having a negative impact on natural stream buffers. Also, noted in the SPA and in the field reconnaissance, there are many gulley formations and unstable banks throughout this watershed, which will increase sediment load, impacting aquatic life throughout the watershed. Otherwise, this watershed is of higher quality than its Little Rocky Run counterparts because of significant land use differences. The predominant Low Density Residential/Open Space watershed results in more natural measures protecting watershed health.

More specifically, the color gradient for Map 2-26 reflects that Lower Little Rocky is rated higher for 'Stormwater Runoff' than Johnny Moore, which is atypical. Stormwater Runoff is determined from equal weights of 5 indicators, including Benthic Communities, Fish Communities, Aquatic Habitat, ICEM Class and Instream Sediment Loading. One item contributing to this WMA scale anomaly is the Fish Communities Indicator. Though community values were similar (ranging from 25 to 31 across 5 sites), the threshold value of 28 used in the ranking gave the Johnny Moore sites a lower score than Little Rocky Run Lower. Also, as noted previously, the SPS/SPA study revealed several reaches in Johnny Moore are experiencing streambank sloughing and are in an active erosive state. Lower scores for ICEM and Instream Sediment are recorded as a result. The remaining two attributes (Benthic Communities and Aquatic Habitat) were comparable.

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