



TO: William Keeling, Virginia Department of Environmental Quality

CC: Modeling Workgroup

FROM: Chesapeake Bay Program (CBP) Modeling Team

DATE: September 1st, 2026

SUBJECT: The Use of Different NHD Catchment Scales in the Dynamic Watershed Model (DWSM) and the Chesapeake Assessment Scenario Tool (CAST) in Phase 7.

This memorandum provides technical documentation for the proposed use of different stream network scales in Phase 7. Generally, the CBP Watershed Model has always used different scales due to the scale of data availability, sometimes on a county level scale, sometimes on different grid scales, or on different hydrologic scales. In this case, the memo specifically addresses the use of the National Hydrography Dataset (NHD) 1:24,000 (1:24k) flowlines within the Chesapeake Assessment Scenario Tool (CAST) for management purposes, contrasted with the continued reliance on NHD 1:100,000 (1:100k) flowlines for topology and routing within the Dynamic Watershed Model (DWSM) and CalCAST. This type of scale change has been a common practice which enables the advantages of data scale detail when practical to model application.

The primary role of stream length in the Phase 7 CAST is to convey stream bed and bank erosion loads and represent the extent of possible stream Best Management Practice (BMP) implementation, which are summarized at the Land-River Segment – Federal Agency scale. Conversely, the Phase 7 DWSM and CalCAST utilize NHD 1:100k flowlines to maintain a consistent hydrologic topology necessary for the routing of flows and loads and the subsequent estimation of delivery factors.

Technical requirements are indifferent to these scales being identical. The BMP scenarios are fully processed and characterized within CAST before the resulting data is passed to the DWSM. The same decoupling was also present in Phase 6, where the DWSM utilized a distinct flowline network that differed from the management scale. The use of 1:24k in CAST is advantageous because of significant spatial inaccuracies identified in the 1:100k dataset in estimating stream length, particularly regarding geographic coverage (see table 1 below).

The NHD 1:100k layer exhibits a well-documented issue with inconsistent resolution in specific regions, notably western Virginia and eastern West Virginia (see figures 1 and 2). Furthermore, the 1:100k network undercounts streams in the District of Columbia (D.C.), an issue that was



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previously identified in P6 (see figure 3). Adopting the 1:24k scale resolves these inconsistencies, ensuring a uniform and accurate baseline across all jurisdictions.

Evaluation of the stream restoration BMPs across all sectors (where sufficient location data is available) reveals that the 1:24k network provides a superior representation of where these practices occur in the field (Figure 4 below). As shown in Table 2 (below), the 1:24k resolution captures a significantly higher percentage of BMPs within critical proximity thresholds than the 1:100k resolution.

At the August 24th Clean Water Goal Team, the decision was made based on the Agriculture Workgroup's recommendation to use the Phase 6 stream miles for E3, not a percentage of Phase 7 1:24k stream miles. Given that decision, the decision on stream scale for Phase 7 CAST will have no influence on E3 scenarios.



Table 1. Comparison of stream length (in miles) using NHD 1:100k and NHD 1:24k flowlines and the percent increase of stream length from 1:100k when using 1:24k resolution.

State (CBWS Only)	Stream Length (Miles) using 1:100k	Stream Length (Miles) using 1:24k	Percent Increase (%)
DC	23	101	348%
DE	980	1,382	41%
MD	9,687	17,371	79%
NY	6,470	10,747	66%
PA	23,889	38,247	60%
VA	24,327	53,429	120%
WV	4,055	7,484	85%



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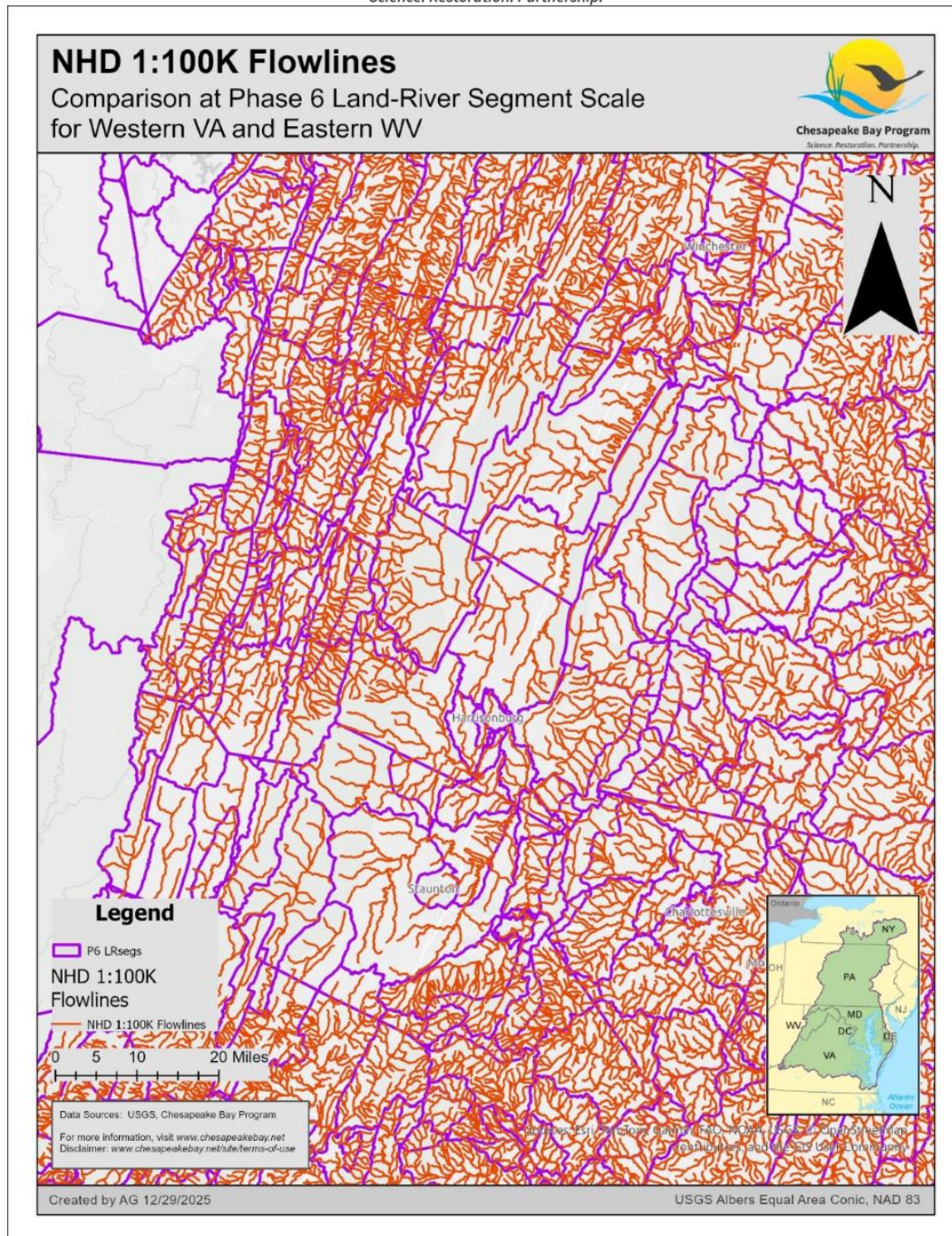


Figure 1. NHD 1:100k flowlines (orange) at the Phase 6 Land-River Segment Scale (purple) for western VA and eastern WV. At this scale, there are noticeable artifacts in the NHD 1:100k flowlines.



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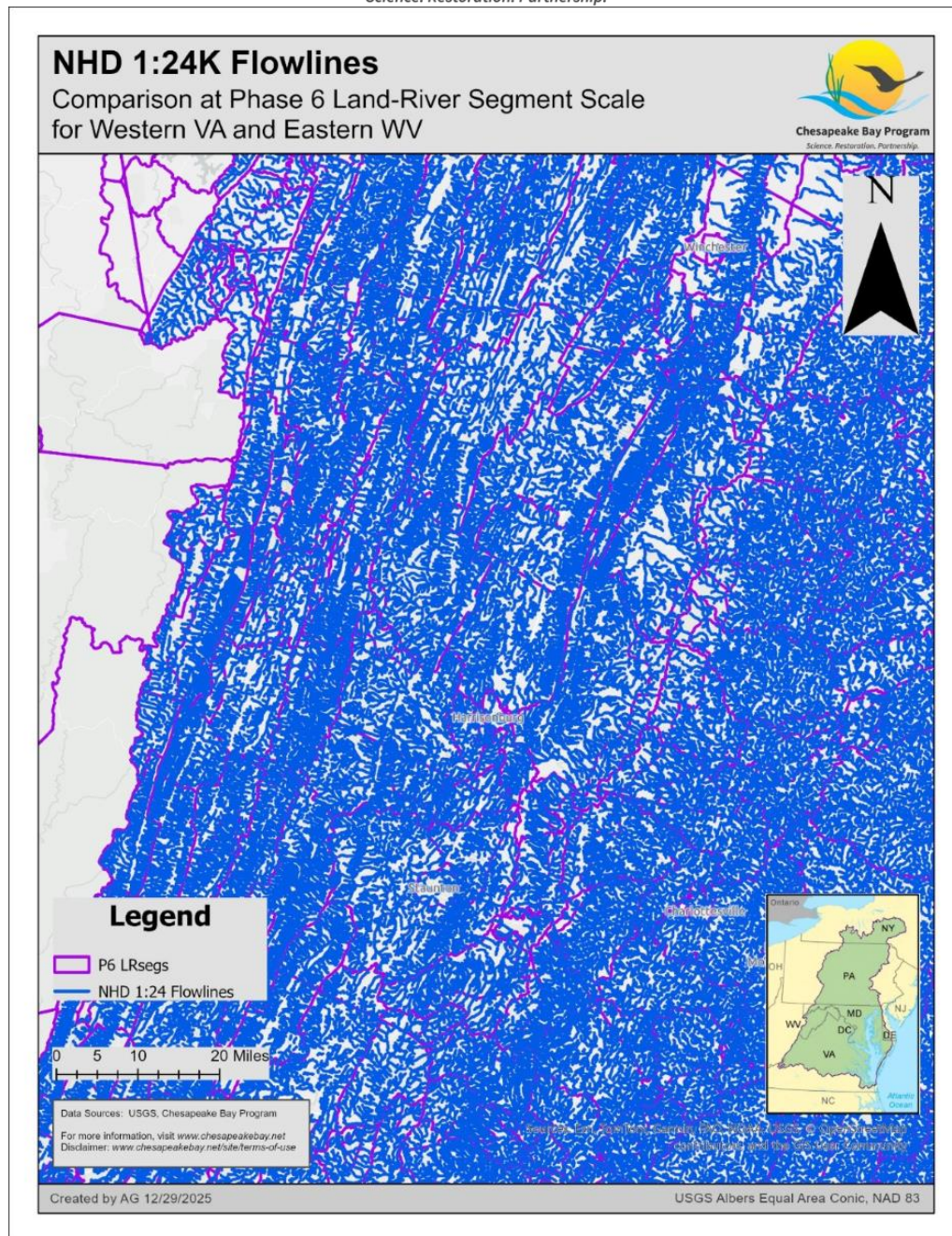


Figure 2. NHD 1:24k flowlines (blue) at the Phase 6 Land-River Segment Scale (purple) for western VA and eastern WV. The NHD 1:24k flowlines do not share the artifacts present in the NHD 1:100k flowlines (see Figure 1).



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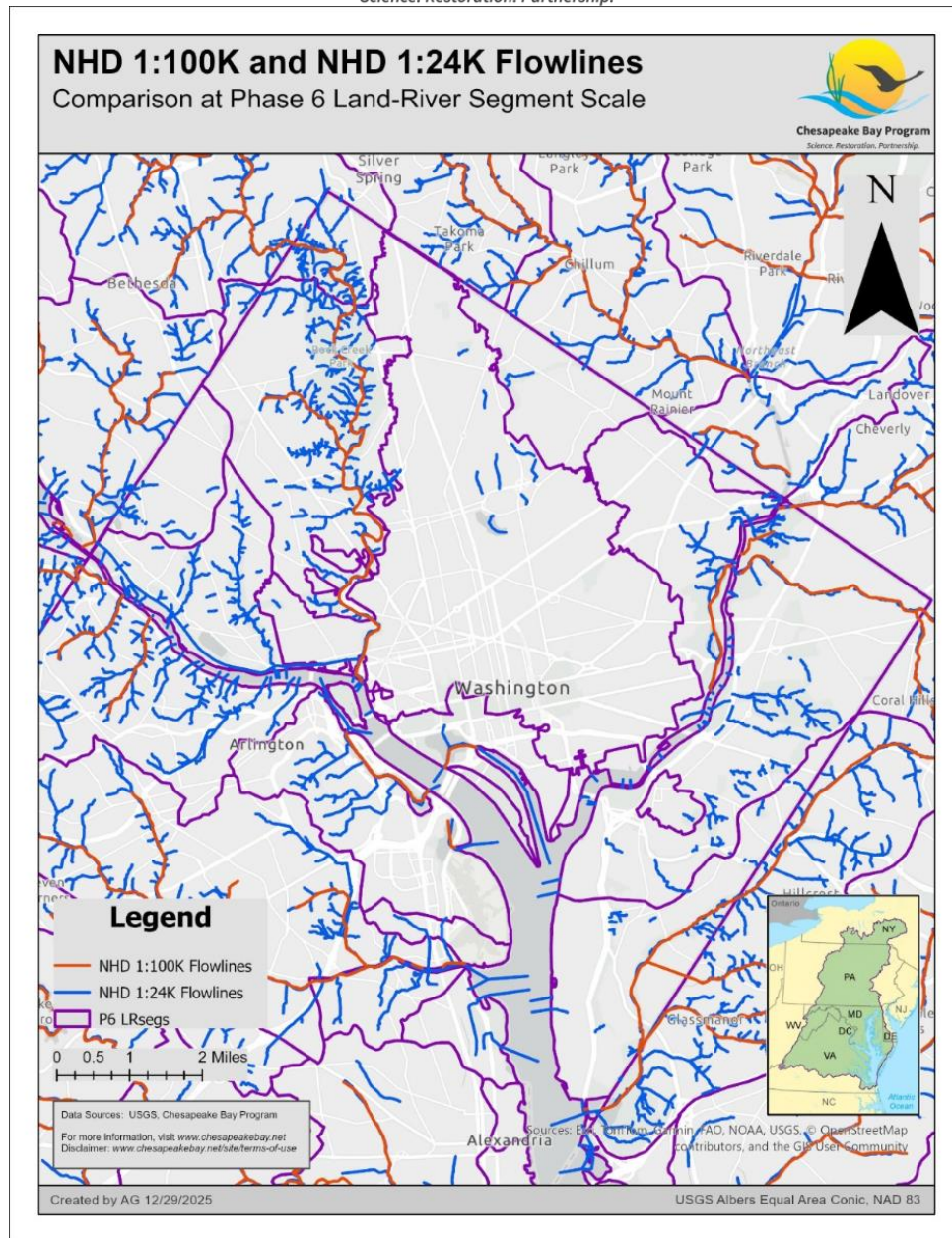


Figure 3. Comparison of NHD 1:100k flowlines (orange) with NHD 1:24k flowlines (blue) at the Phase 6 Land-River Segment Scale (purple) for DC. The NHD 1:24k flowlines demonstrate greater representation of streams in Northwest DC compared to the NHD 1:100k flowlines.

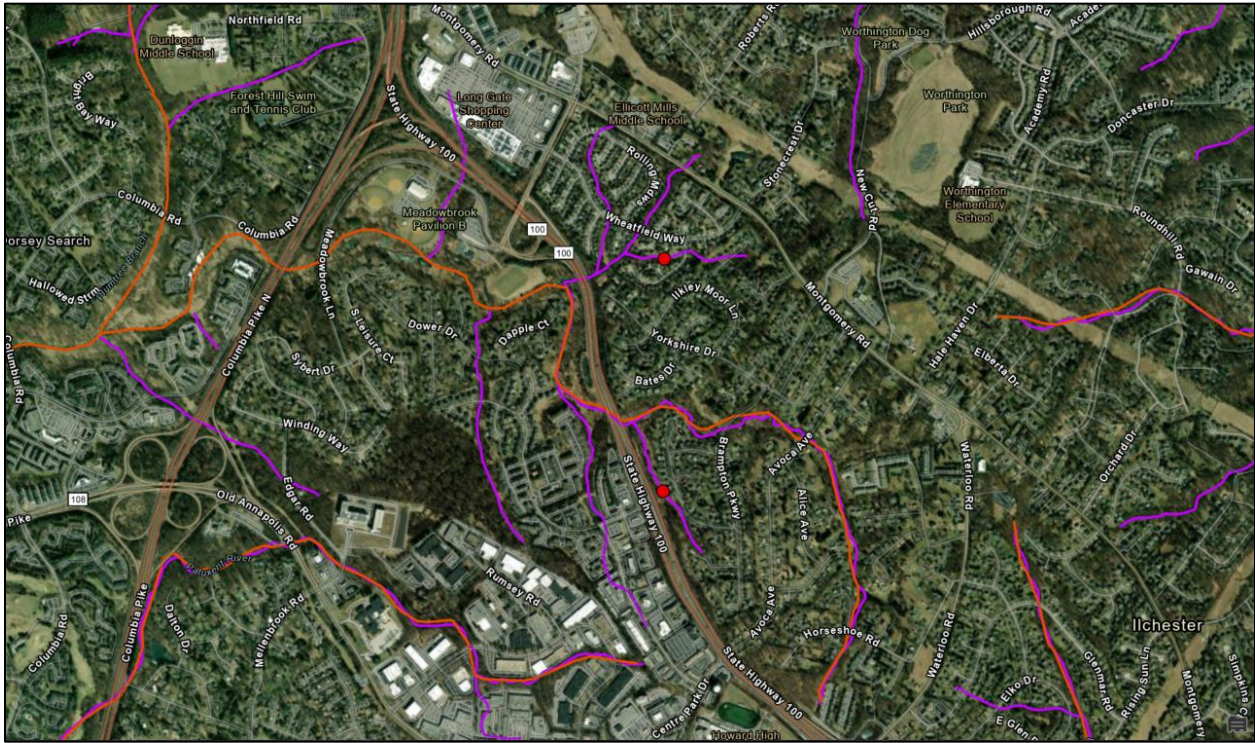


Figure 4. Example of stream restoration BMPs located along NHD 1:24K 1st and 2nd order streams in Howard County, MD. Red Dots = Stream Restoration BMPs, Orange Lines = 1st and 2nd order NHD 1:100K streams, Purple Lines = 1st and 2nd order NHD 1:24K streams.

Stream Network	Stream Restoration BMPs Within 10m	Stream Restoration BMPs Within 30m	Stream Restoration BMPs Within 100m
NHD 1:24k (1st and 2nd Order)	23%	37%	54%
NHD 1:100k (1st and 2nd Order)	12%	28%	42%

Table 2. Comparison of stream restoration BMPs within multiple distance intervals of NHD 1:24k and NHD 1:100k 1st and 2nd order streams.