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Memorandum

From: Ruth Greenwood, Senior Legal Counsel

To: House Select Committee on Redistricting and Senate Redistricting Committee

Date: August 22, 2017

Subject: Proposed 2017 House and Senate Redistricting Plan: Efficiency Gap Analysis

I have analyzed the districts and the associated data for each of the 2017 House Redistricting Plan (hereafter "Proposed House Plan") and the 2017 Senate Redistricting Plan (hereafter "Proposed Senate Plan"), using the "stat pack" (composed of past statewide election results by district) made available on the North Carolina General Assembly website.

I conclude that both the Proposed House Plan and the Proposed Senate Plan will likely provide **a large and durable** advantage to Republican voters and candidates in the coming two elections due to the large efficiency gaps likely to be exhibited, even as the statewide vote swings over a range of 10 percentage points. The expected value of the efficiency gap, based on the stat pack released by the State with the draft plans is **-11.98%** for the Proposed House Plan and **-11.87%** for the Proposed Senate Plan.[1] By historical standards, these are extraordinarily large figures, revealing an enormous Republican edge.

This memo sets out a brief explanation of what the efficiency gap measures, a summary of the data gathered and methods used, and then presents the results of my analyses showing the large efficiency gaps that are predicted for the Proposed House Plan and Proposed Senate Plan.

The Efficiency Gap

The efficiency gap (EG) is one of several tools that social scientists use to gauge partisan symmetry (or lack thereof) in districting plans. Partisan symmetry exists when a district map gives political parties an equal opportunity to translate votes for their candidates into legislative seats. It means that "'the electoral system treat[s] similarly-situated parties equally.'"[2]
The EG has already become an accepted method for measuring partisan gerrymandering.

A three-judge federal court has allowed Plaintiffs to proceed in their challenge of North Carolina's 2016 Congressional Redistricting Plan on a theory of liability that is based on partisan symmetry generally, as measured by the EG.[3] A three-judge federal court in Wisconsin has likewise determined that

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[1] By social science convention, negative numbers indicate Republican advantage and positive numbers indicate Democratic advantage.

[2] *League of United Latin Am. Citizens v. Perry*, 548 U.S. 399, 466 (2006) (Stevens, J., concurring in part and dissenting in part) (citation omitted).

[3] *Common Cause v. Rucho*, No. 1:16-CV-1026, 2017 WL 876307, at *3-4, *12 (M.D.N.C. Mar. 3, 2017).

"the EG is corroborative evidence of" partisan gerrymandering for state legislative bodies.[4] The EG provides strong evidence of whether a district map is biased toward one political party.

The EG assesses partisan asymmetry by focusing on the techniques that map-drawers use to create partisan gerrymanders. Gerrymanders are created by "packing" some of the opposing party's voters into overwhelmingly one-sided districts, and "cracking" the remaining opposing-party voters apart across other districts, so they are insufficiently numerous in each of those districts to elect their chosen candidates.[5] Both of these methods create what social scientists refer to as "wasted" votes—votes that were not necessary to the winning candidate's victory.[6] Any votes cast for a losing candidate, or cast for a winning candidate in excess of what's needed to prevail, are considered "wasted."[7] In a partisan gerrymander, the map-drawing party forces the opposing party to waste many more votes, making it more difficult for that party's supporters to translate votes into seats.[8]

EG analysis involves three steps. First, add up all of the votes each party wastes due to packing and cracking, across all of the races for a particular legislative body. Second, take the difference between the wasted votes cast for each major political party. Third, divide this difference by the total number of votes cast.[9] The resulting percentage measures how much more effectively one party's voters are distributed compared to the other party's voters.

Expert analysis indicates that the value of an EG that suggests a partisan skew is likely to be large and durable for state legislative plans if it is greater in magnitude than +/-7%. Expert Report of Professor Simon Jackman at 5, *Whitford v. Gill*, 218 F.Supp.3d 837 (W.D. Wis. 2016), ECF No. 62 (hereafter "Jackman Report"). [10]

Data and Methods

Data - The Proposed House Plan

The shapefiles and data associated with the Proposed House Plan were released on August 21, 2017, on the North Carolina General Assembly, House Select Committee on Redistricting website.[13] The "NC House

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[4] *Whitford*, 218 F. Supp. 3d at 910.

[5] *See Vieth v. Jubelirer*, 541 U.S. 267, 286 n.7 (2004) (plurality opinion).

[6] Nicholas O. Stephanopoulos & Eric M. McGhee, *Partisan Gerrymandering and the Efficiency Gap*, 82 U. Chi. L. Rev. 831, 849-50 (2015). Note that the word "wasted" is not meant as a pejorative: everyone's vote is meaningful. Rather, it is a technical term of art, developed by social scientists.

[7] *See Whitford v. Gill*, 218 F. Supp. 3d 837, 903–04 (W.D. Wis. 2016), *jur. postponed*, 137 S. Ct. 2268 (2017).

[8] For instance, if Party A can win 60% of the seats with only 51% of the vote, but Party B would need 56% of the vote to win that same 60% of the seats, Party B is wasting many more votes than Party A.

[9] In mathematical terms, the efficiency gap can be calculated as $(W_A - W_B) / n$, where W_A and W_B are the total number of wasted votes cast for Party A and Party B, respectively, and n is the total number of votes cast.

[10] *See also Whitford*, 218 F. Supp. 3d at 905; Stephanopoulos & McGhee, *supra* note 6, at 888-89.

[13] http://www.ncleg.net/gascripts/DocumentSites/browseDocSite.asp?nID=356.

2017_Stat Pack_8.21.17" offered district by district vote totals for each district in the Proposed House Plan, for the following races:

1. 2012 Governor
2. 2012 Lt. Governor
3. 2014 U.S. Senate
4. 2016 President
5. 2016 U.S. Senate
6. 2016 Governor
7. 2016 Attorney General
8. 2012 President

I created an average expected vote in each of the 120 House districts by adding the vote totals for the Democrats and dividing by eight (the number of elections in the data set), and doing the same for the Republican votes.

I calculated the efficiency gap for the Proposed House Plan at this expected value of the vote, by adding the wasted votes for the Democrats and Republicans, and dividing by the total number of votes. I then calculated the effects of swinging the vote by five percent in each direction (that is, up to five percent more favorable to Democrats, and up to five percent more favorable to Republicans), for a total swing of ten percentage points. I calculated the EG at one percent increments across this vote swing. This technique is called "sensitivity testing," and is the standard method for predicting a plan's performance over a range of electoral environments.

Finally, I compared the expected EG to the EGs that have been exhibited by state house plans from 1972 to 2016, using data from the Jackman Report.

Data - The Proposed Senate Plan

The shapefiles and data associated with the Proposed House Plan were released on August 21, 2017, on the North Carolina General Assembly, Senate Redistricting website.[14] The "NC SENATE 2017_Stat Pack_8.21.17" offered district by district vote totals for each district in the Proposed House Plan, for the following races:

1. 2010 U.S. Senate
2. 2012 President
3. 2012 Governor
4. 2012 Lt. Governor
5. 2014 U.S. Senate
6. 2016 President
7. 2016 U.S. Senate

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[14] http://www.ncleg.net/gascripts/DocumentSites/browseDocSite.asp?nID=357.

8. 2016 Governor
9. 2016 Attorney General

I created an average expected vote in each of the 50 Senate districts by adding the vote totals for the Democrats and dividing by nine (the number of elections in the data set), and doing the same for the Republican votes.

I calculated the efficiency gap for the Proposed Senate Plan at this expected value of the vote, by adding the wasted votes for the Democrats and Republicans, and dividing by the total number of votes. I then calculated the effects of swinging the vote by five percent in each direction (that is, up to five percent more favorable to Democrats, and up to five percent more favorable to Republicans), for a total swing of ten percentage points. I calculated the EG at one percent increments across this vote swing.

The Proposed House Plan: Efficiency Gap Results

The Proposed House Plan has an extremely large EG across a range of vote shares. The expected value is - 11.98% (that is, 11.98% in favor of Republican voters), but the total range of the EG for the ten percent swing in the vote goes from a high of -5.22% to a low of -17.48%. Assuming a statewide uniform swing in the vote, in order for there to be a Republican majority in the House, Republicans will only need a statewide vote of 45.7%. By contrast, a Democratic statewide vote share of 54.8% will be needed to secure a Democratic majority in the House. This is asymmetrical, and evidences a severe bias in favor of Republican voters.

The EG results from the swing analysis are shown in tabular and chart format below.

Projected vote	Proposed House Plan Efficiency Gap
Dem Vote-5%	-5.22%
Dem Vote -4%	-6.33%
Dem Vote -3%	-6.77%
Dem Vote -2%	-8.77%
Dem Vote -1%	-10.77%
Expected EG (Statewide Dem vote share 48.3%)	-11.98%
Dem Vote +1%	-12.99%
Dem Vote +2%	-14.22%
Dem Vote +3%	-15.48%
Dem Vote +4%	-17.48%
Dem Vote +%5	-16.38%

Table 1: Efficiency Gap scores for Proposed House Plan at Democratic vote shares from 43.3% to 53.3% (one percent intervals)

NC Proposed House Plan Efficiency Gaps for Vote Shares over a 10% statewide vote swing

Democratic Vote Share at "Expected EG" is 48.3%, vote is swung 1% for each increment. The red line shows -7% efficiency gap (the level at which an EG is considered large and durable)
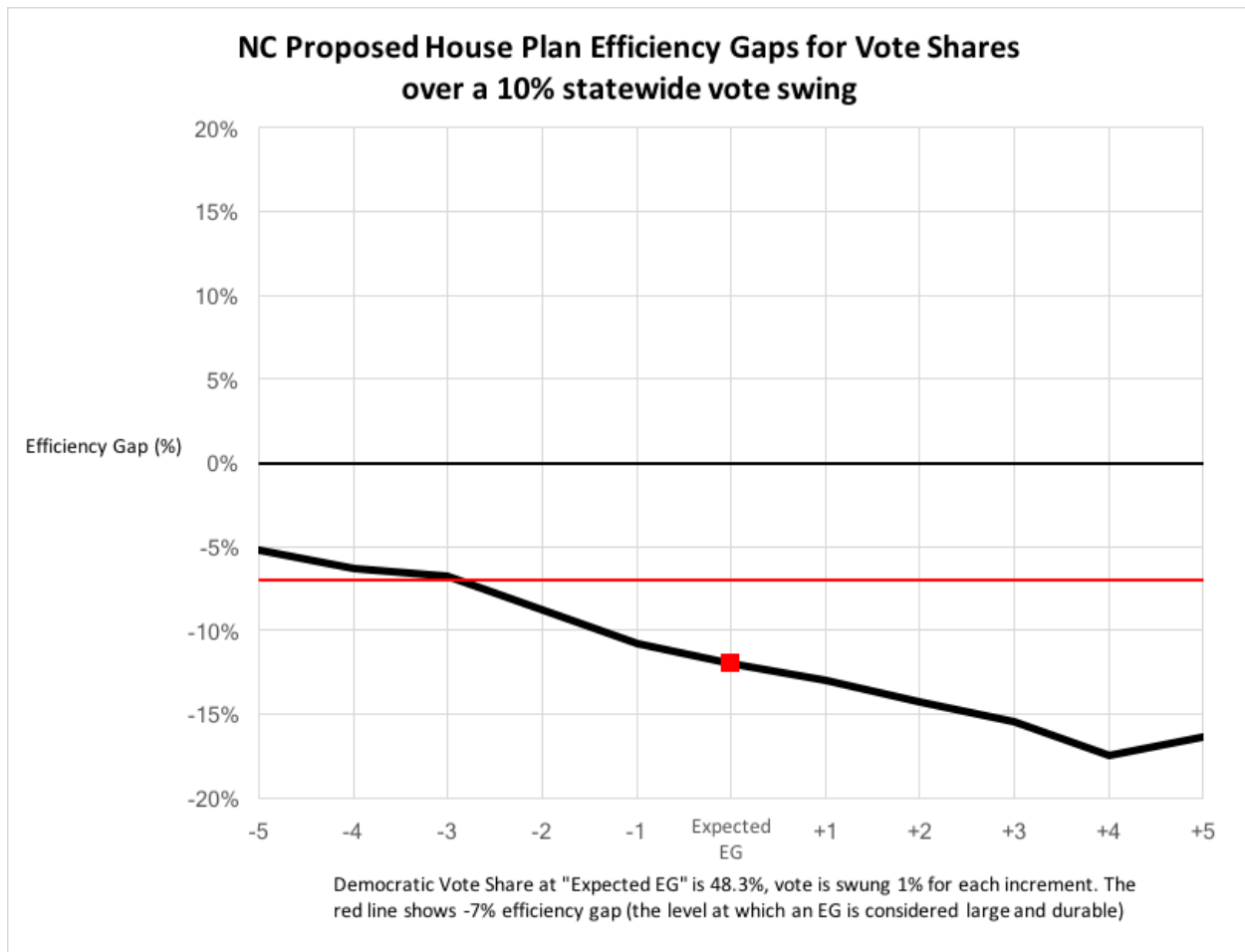
Figure 1: Efficiency Gap scores for Proposed House Plan at Democratic vote shares from 43.3% to 53.3% (one percent intervals)
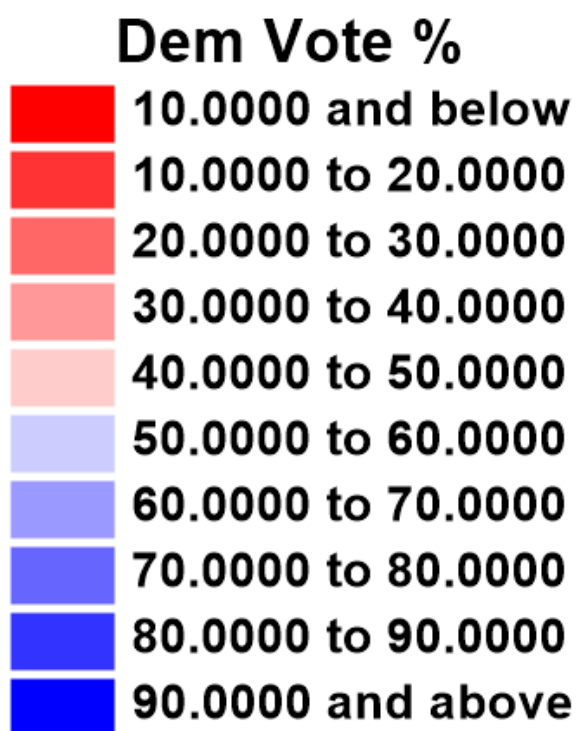
The following chart shows the expected EG in the context of EGs exhibit by state house plans from 1972-2016.
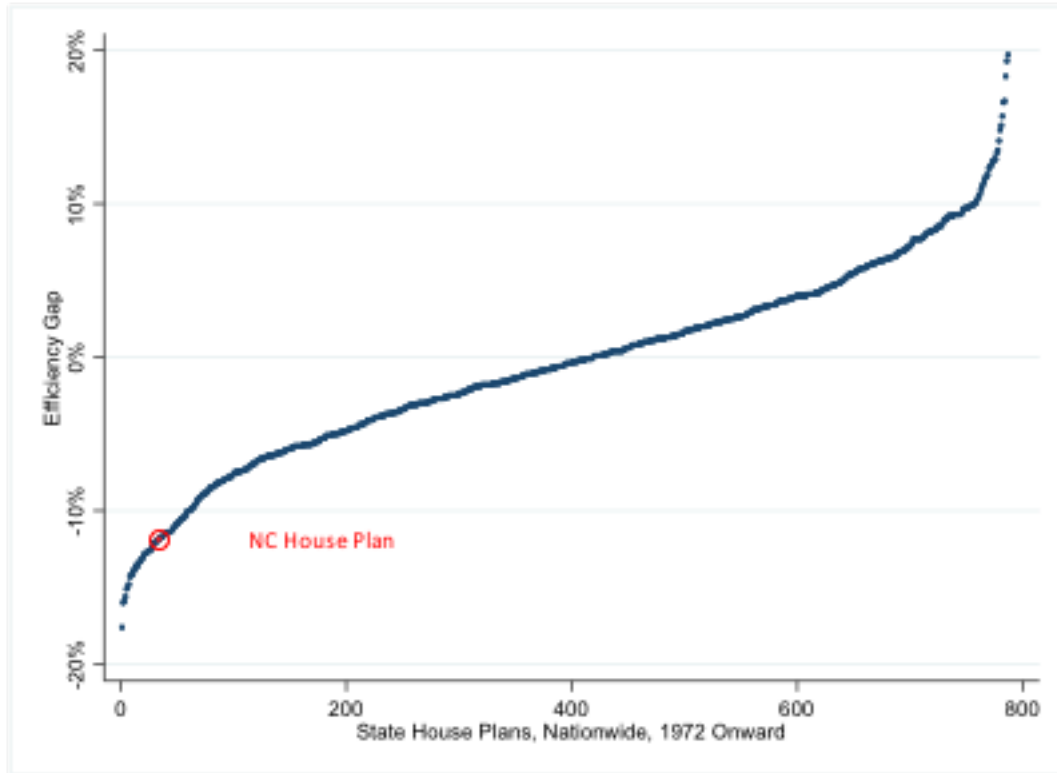
Figure 2: Expected efficiency gap score for Proposed House Plan compared with EGs shown by State House Plans nationwide from 1972-2016.

The Proposed Senate Plan: Efficiency Gap Results

The Proposed Senate Plan also has an extremely large EG across a range of vote shares. The expected value is -11.87% (that is, 11.87% in favor of Republican voters), but the total range of the EG for the ten percent swing in the vote goes from a high of -5.20% to a low of -15.87%. Assuming a statewide uniform swing in the vote, in order for there to be a Republican majority in the House, Republicans will only need a statewide vote of 46.15%. By contrast, a Democratic statewide vote share of 55.15% will be needed to secure a Democratic majority in the House. This is asymmetrical, and evidences a severe bias in favor of Republican voters.

The EG results from the swing analysis are shown in tabular and chart format below.

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Projected vote	Proposed House Plan Efficiency Gap
Dem Vote-5%	-5.20%
Dem Vote -4%	-7.20%
Dem Vote -3%	-9.20%
Dem Vote -2%	-9.30%
Dem Vote -1%	-9.87%
Expected EG (Statewide Dem vote share 47.8%)	-11.87%
Dem Vote +1%	-13.87%
Dem Vote +2%	-15.87%
Dem Vote +3%	-15.81%
Dem Vote +4%	-11.89%
Dem Vote +%5	-12.15%

Table 2: Efficiency Gap scores for Proposed Senate Plan at Democratic vote shares from 42.8% to 52.8% (one percent intervals)
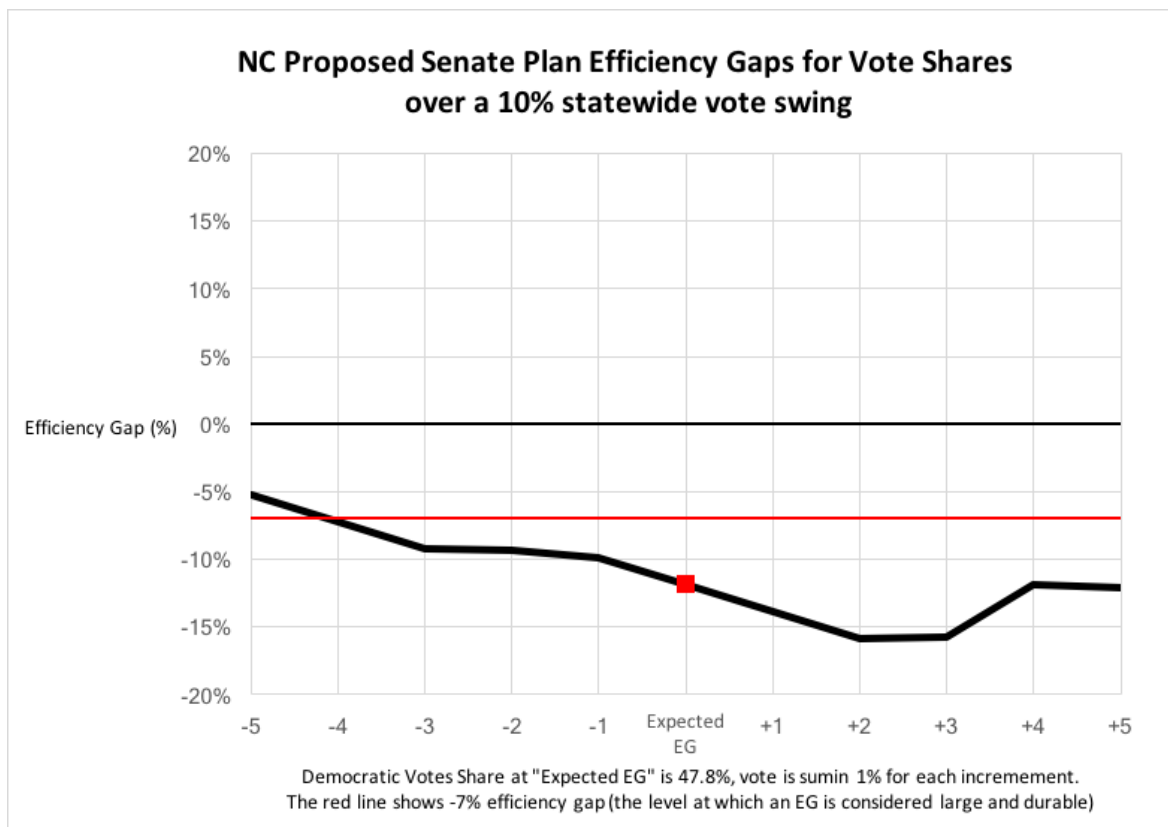
Figure 3: Efficiency Gap scores for Proposed Senate Plan at Democratic vote shares from 42.8% to 52.8% (one percent intervals)

Evidence of Packing and Cracking

The following pages show a series of maps of North Carolina. On each map I have used an average of Republican and Democratic votes from twenty state-wide elections over 2008 to 2014, and displayed areas of the state that voted more heavily for Republicans in red and those that voted more heavily for Democrats in blue. The same scale is used in each map. The election data was downloaded from the North Carolina General Assembly Redistricting page.[15]
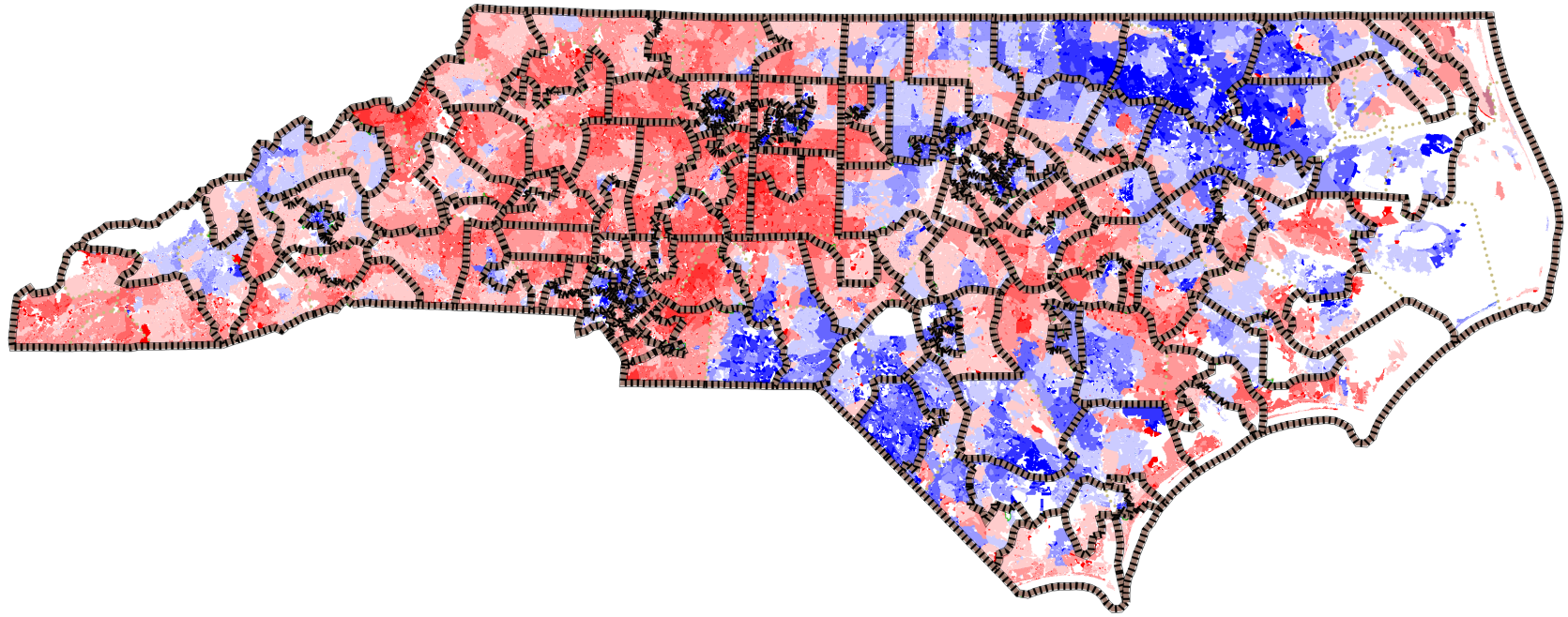
The maps show the district lines for the Proposed House Plan and the Proposed Senate Plan, and identify where groups of Democratic voters have either been cracked or packed.

The color scale used for each map is as follows:

Dem Vote %

🟥	10.0000 and below
🟥	10.0000 to 20.0000
🟥	20.0000 to 30.0000
🟥	30.0000 to 40.0000
🟥	40.0000 to 50.0000
🟦	50.0000 to 60.0000
🟦	60.0000 to 70.0000
🟦	70.0000 to 80.0000
🟦	80.0000 to 90.0000
🟦	90.0000 and above

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[15] http://www.ncleg.net/representation/Content/BaseData/BD2016.aspx

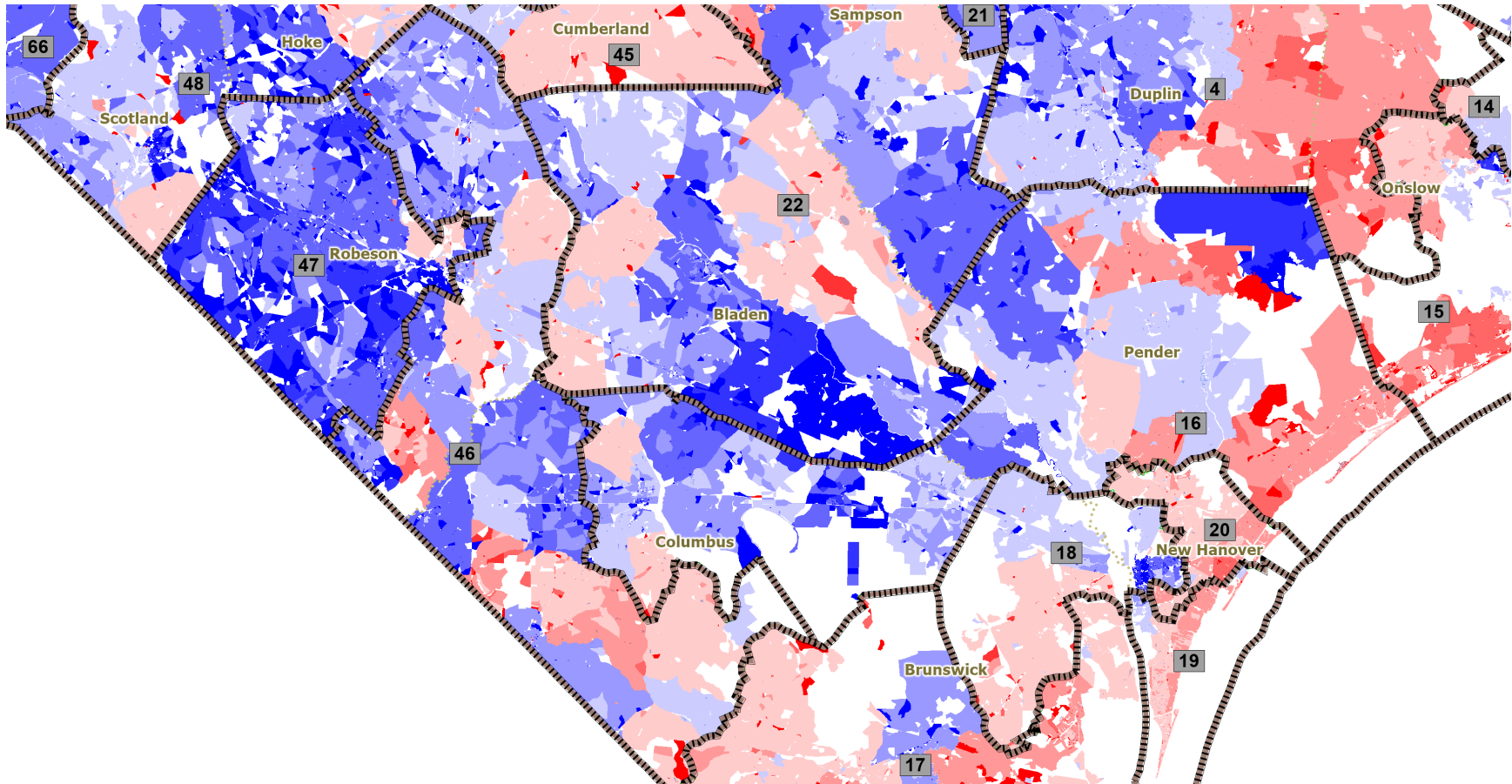# Proposed House Plan – Full State

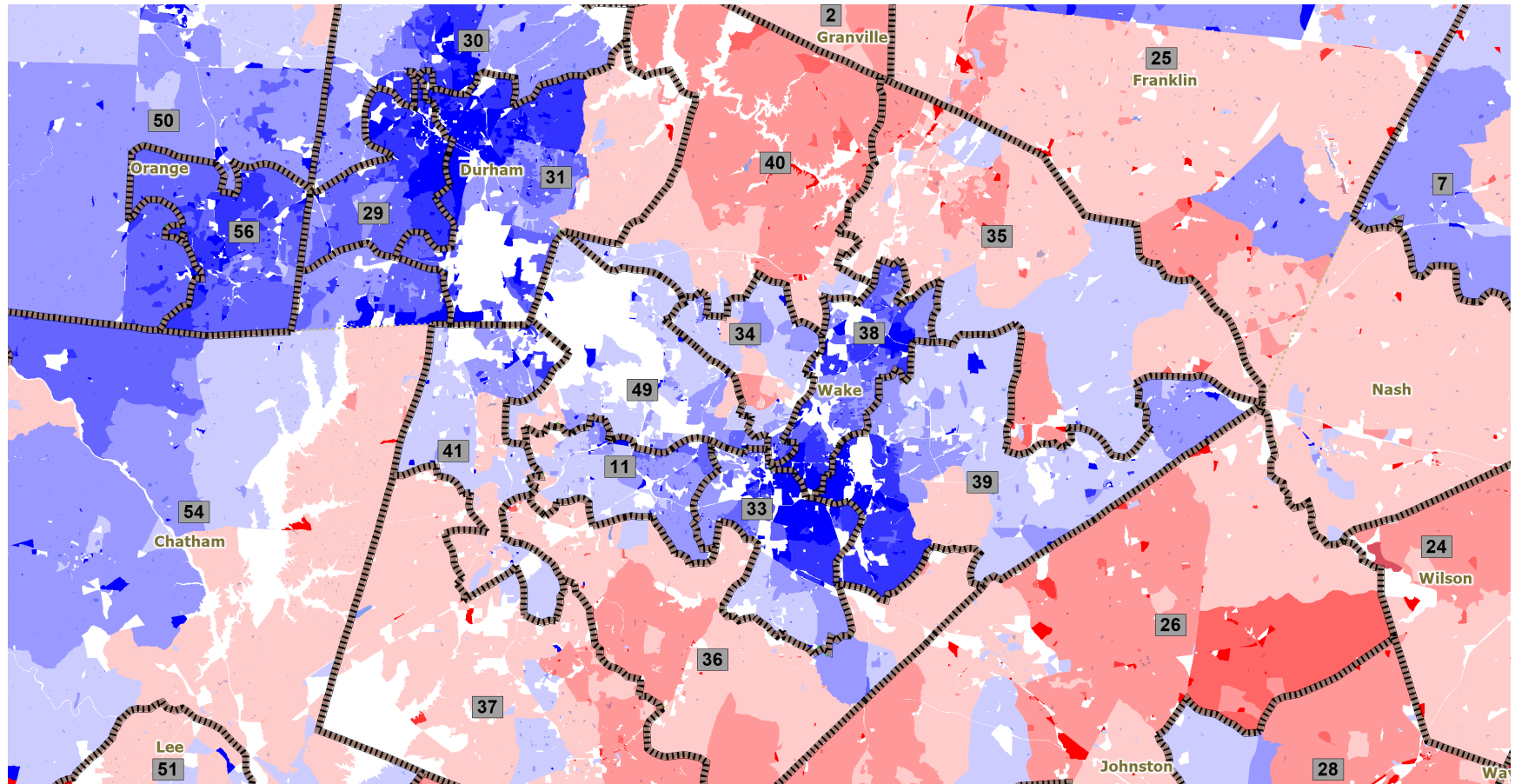# Proposed House Plan – Greene County zoom
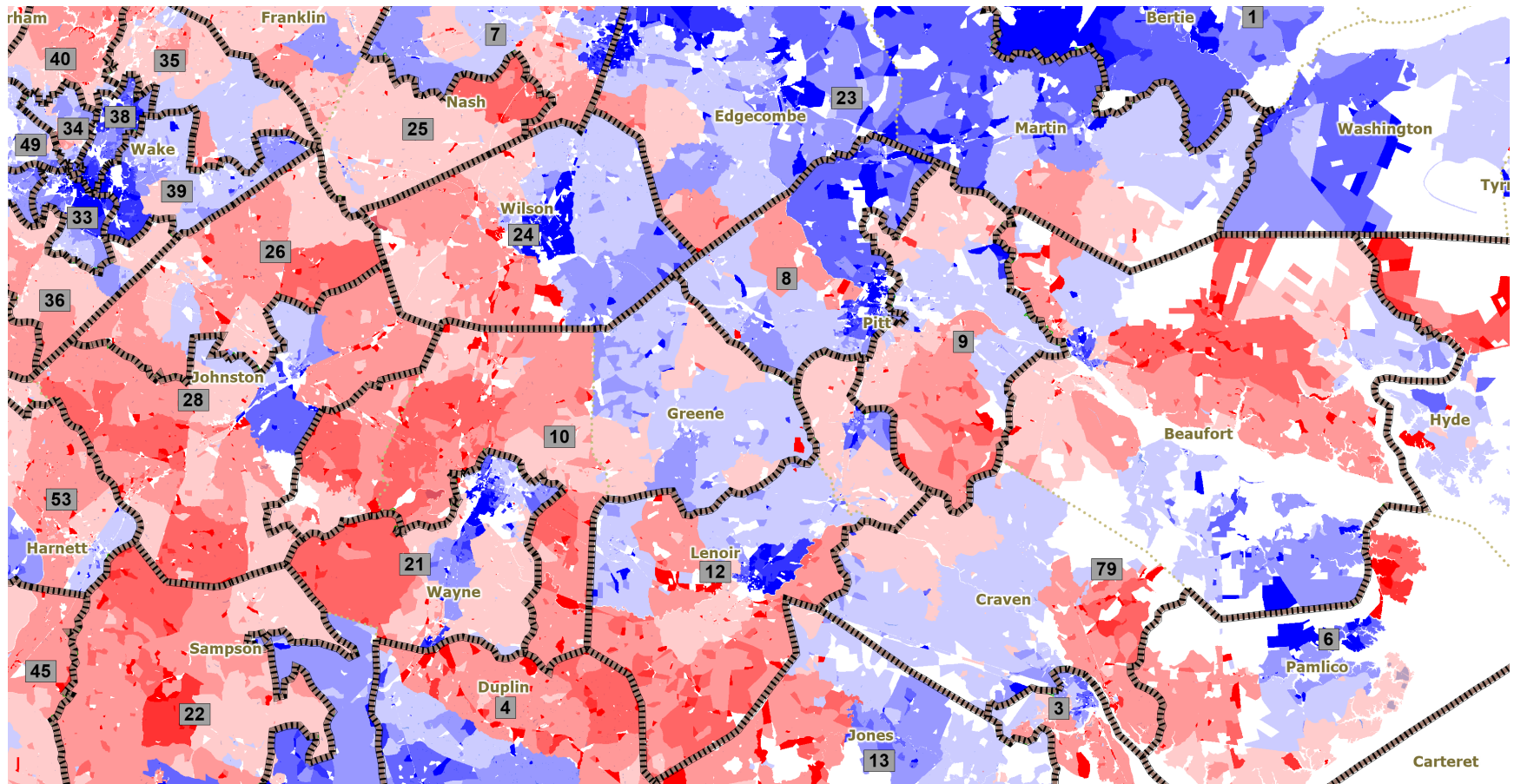
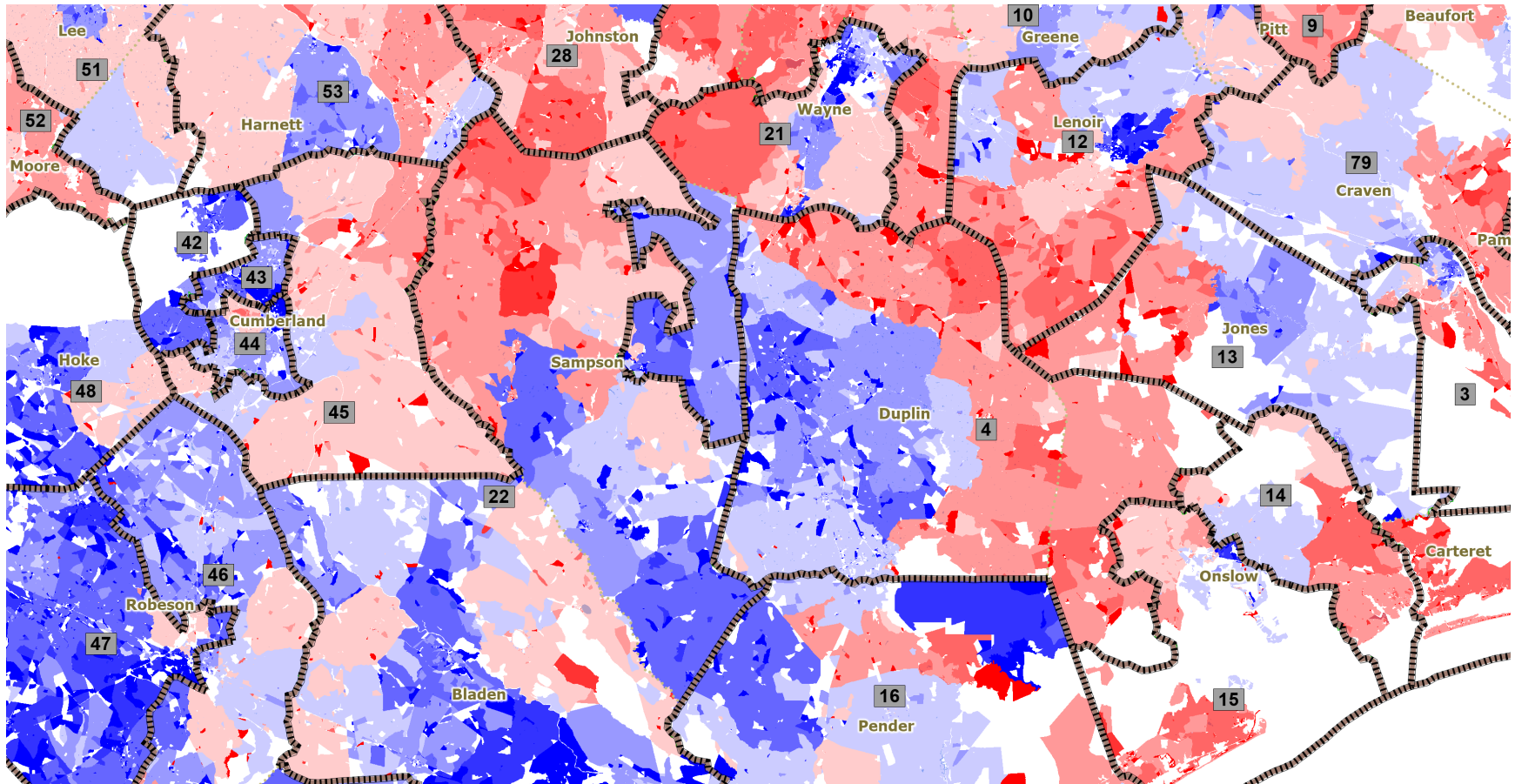# Proposed House Plan – Mecklenburg County zoom
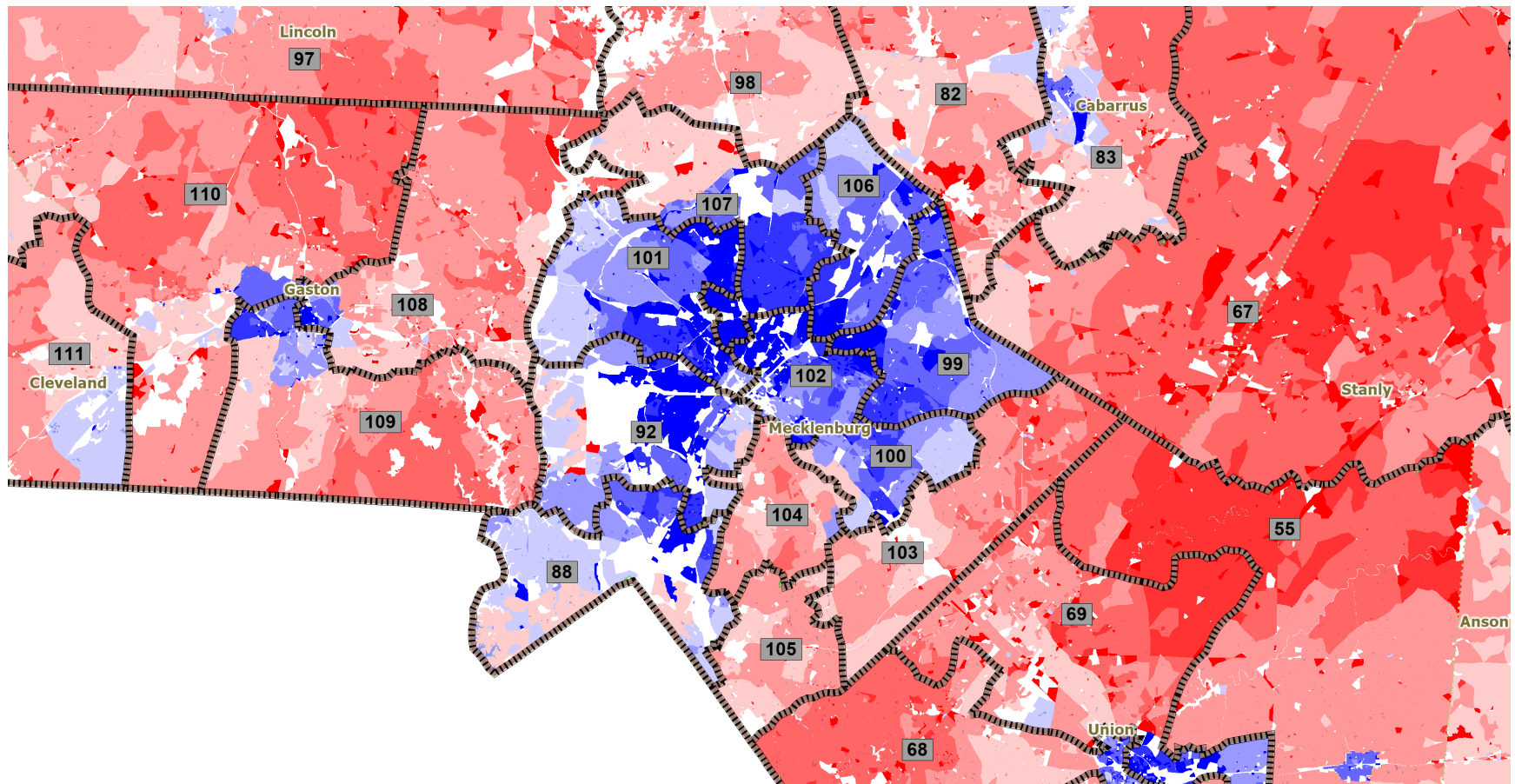
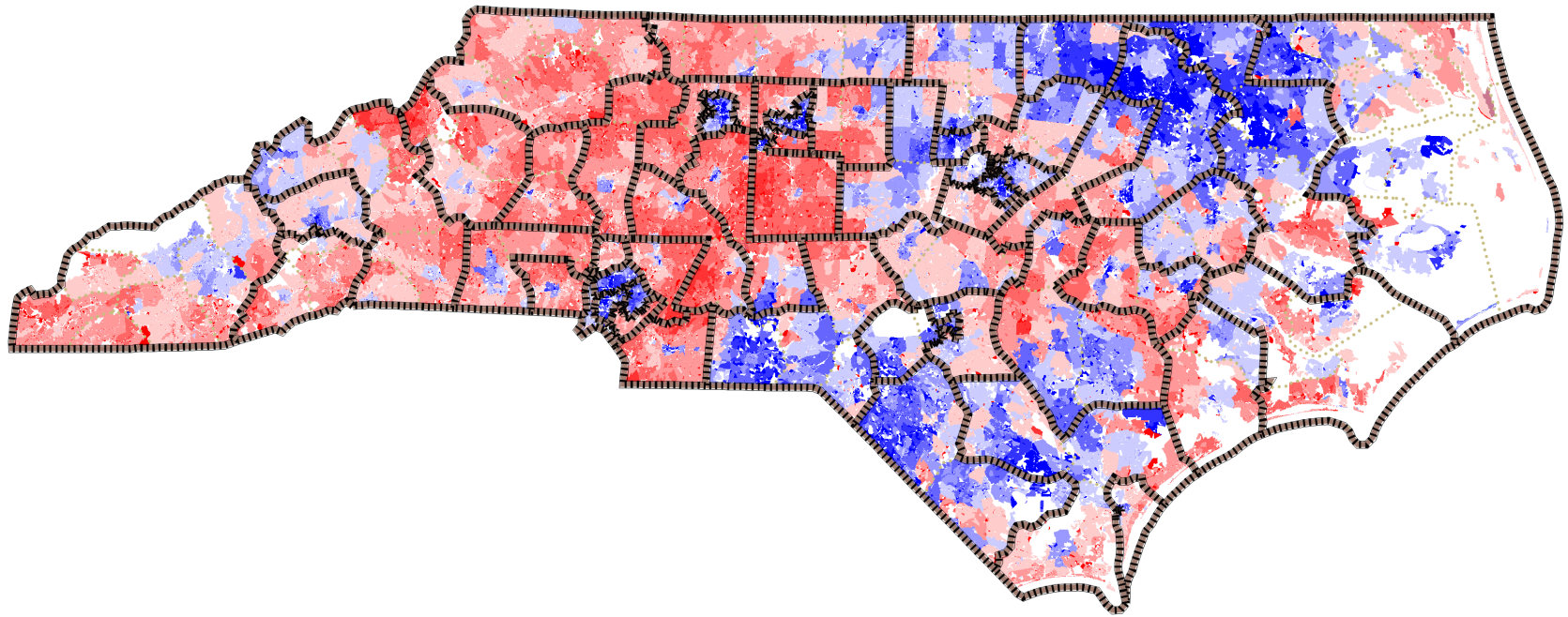# Proposed House Plan –Robeson County and Columbus County zoom
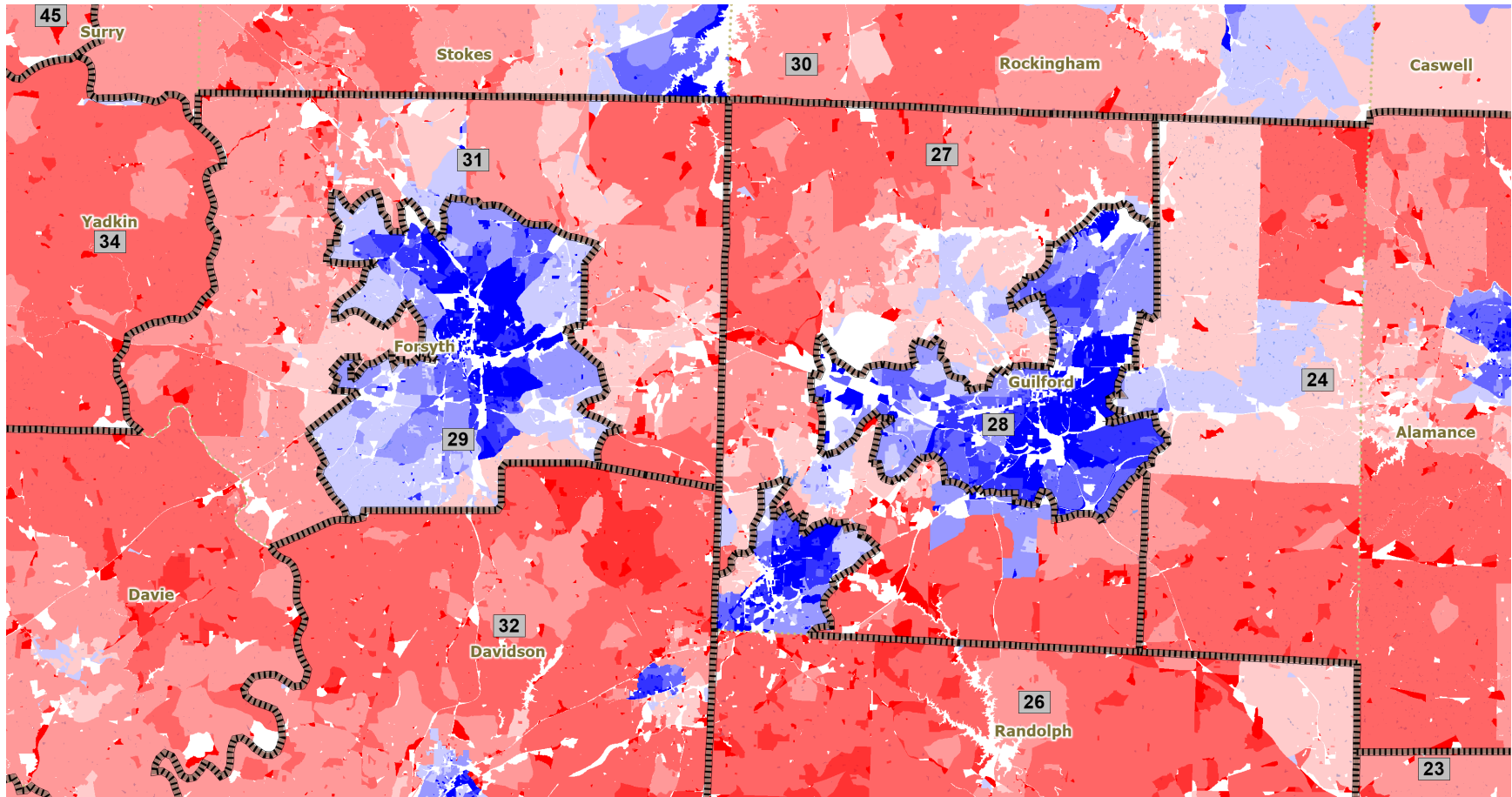
Proposed House Plan – Wake County zoom
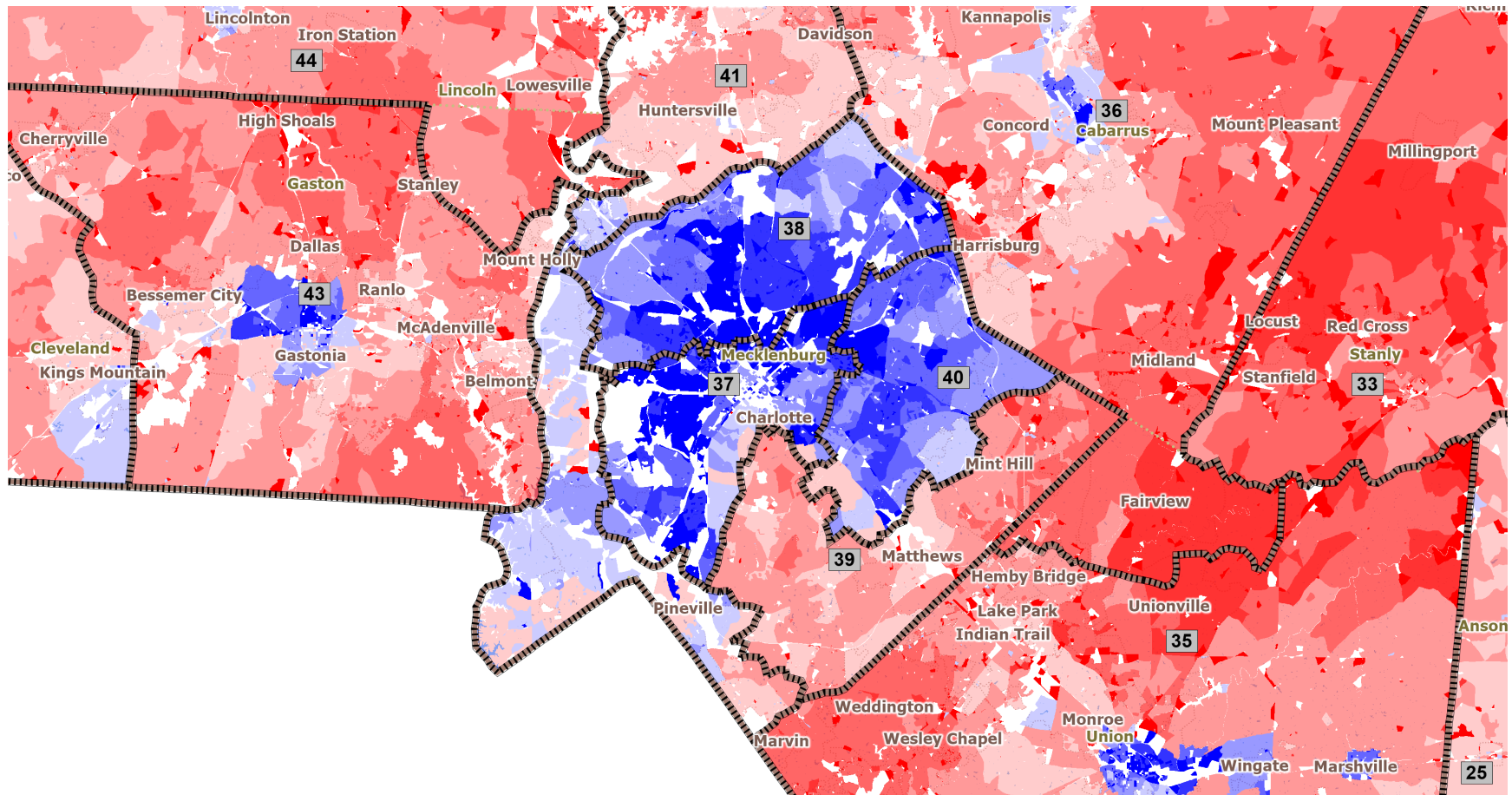
Proposed House Plan – Wayne County zoom

Proposed Senate Plan – Full State

Proposed Senate Plan – Forsyth County and Guilford County zoom

Proposed Senate Plan – Mecklenburg County zoom

Proposed Senate Plan – Wake County and Durham County zoom