

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ALABAMA
SOUTHERN DIVISION**

EVAN MILLIGAN, *et al.*,

Plaintiffs,

V.

JOHN H. MERRILL, in his official capacity as Alabama Secretary of State, *et al.*,

Defendants.

Case No. 2:21-cv-1530-AMM

THREE-JUDGE COURT

DECLARATION OF THOMAS BRYAN

Attached hereto is the expert report which I have prepared for filing in this case, along with a copy of my curriculum vitae. The conclusions I express in my report are provided to a reasonable degree of professional certainty.

Pursuant to 28 U.S.C. §1746, I declare under penalty of perjury under the laws of the United States that the foregoing, my expert report, and my curriculum vitae are true and correct to the best of my knowledge and belief.

Done on this 14th day of December, 2021.


Thomas Bryan

My name is Thomas Bryan¹. I am a professional demographer and political redistricting expert witness. I have been retained by the State of Alabama to provide analysis and support in the case of *Milligan v. Merrill* and *Caster v. Merrill*.² A copy of my CV is attached to this report.

I am over 18 years of age and I have personal knowledge of the facts stated herein.

EXPERT QUALIFICATIONS

I graduated with a Bachelor of Science in History from Portland State University in 1992. I graduated with a Master of Urban Studies (MUS) from Portland State University in 1996, and in 2002 I graduated with a Masters in Management and Information Systems (MIS) from George Washington University. Concurrent with earning my Management and Information Systems degree, I earned my Chief Information Officer certification from the GSA.³

My background and experience with demography, census data and advanced analytics using statistics and population data began in 1996 with an analyst role for the Oregon State Data Center. In 1998 I began working as a statistician for the US Census Bureau in the Population Division – developing population estimates and innovative demographic methods. In 2001 I began my role as a professional demographer for ESRI Business Information Solutions, where I began developing my expertise in Geographic Information Systems (GIS) for population studies. In May 2004 I continued my career as a demographer, data scientist and expert in analytics in continuously advanced corporate roles, including at Altria and Microsoft through 2020.

In 2001 I developed a private demographic consulting firm “BryanGeoDemographics” or “BGD”. I founded BGD as a demographic and analytic consultancy to meet the expanding demand for advanced analytic expertise in applied demographic research and analysis. Since then, my consultancy has broadened to include litigation support, state and local redistricting, school redistricting, and municipal infrastructure initiatives. Since 2001, I have undertaken over 150 such engagements in three broad areas:

- 1) state and local redistricting,
- 2) applied demographic studies, and
- 3) school redistricting and municipal Infrastructure analysis.

¹ <https://www.linkedin.com/in/thomas-bryan-424a6912/>

² <https://redistricting.ils.edu/case/milligan-v-merrill/> and <https://redistricting.ils.edu/case/caster-v-merrill/>

³ Granted by the General Services Administration (GSA) and the Federal IT Workforce Committee of the CIO Council.

My background and experience with redistricting began with McKibben Demographics from 2004-2012, when I provided expert demographic and analytic support in over 120 separate school redistricting projects. These engagements involved developing demographic profiles of small areas to assist in building fertility, mortality and migration models used to support long-range population forecasts and infrastructure analysis. Over this time, I informally consulted on districting projects with Dr. Peter Morrison. In 2012 I formally began performing redistricting analytics and continue my collaboration with Dr. Morrison to this day.

I have been involved with over 40 significant redistricting projects, serving roles of increasing responsibility from population and statistical analyses to report writing to directly advising and supervising redistricting initiatives. Many of these roles were served in the capacity of performing Gingles analyses, risk assessments and Federal and State Voting Rights Act (VRA) analyses in state and local areas.

In each of those cases, I have personally built, or supervised the building of, one or more databases combining demographic data, local geographic data and election data from sources including the 2000, the 2010 and now 2020 decennial Census. I also innovated the use of the US Census Bureau's statistical technique of "iterative proportional fitting" or "IPF" of the Census Bureau's American Community Survey (ACS) and the Census Bureau's Special Tabulation of Citizen Voting Age Population Data to enable the development of districting plans at the Census block level. This method has been presented and accepted in numerous cases we have developed or litigated. These data have also been developed and used in the broader context of case-specific traditional redistricting principles and often alongside other state and local demographic and political data.

In 2012 I began publicly presenting my work at professional conferences. I have developed and publicly presented on measuring effective voting strength, how to develop demographic accounting models, applications of using big data and statistical techniques for measuring minority voting strength – and have developed and led numerous tutorials on redistricting. With the delivery of the 2020 Census, I have presented on new technical challenges of using 2020 Census data and the impact of the Census Bureau's new differential privacy (DP) system. This work culminated with being invited to chair the "Assessing the Quality of the 2020 Census" session of the 2021 Population Association of America meeting, featuring Census Director Ron Jarmin.

I have written professionally and been published since 2004. I am the author of “Population Estimates” and “Internal and Short Distance Migration” in the definitive demographic reference “The Methods and Materials of Demography”. In 2015 I joined a group of professional demographers serving as experts in the matter of *Evenwel, et al. v. Texas* case. In *Evenwel* I served in a leadership role in writing an Amicus Brief on the use of the American Community Survey (ACS) in measuring and assessing one-person, one vote. I also successfully drew a map for the State of Texas balancing both total population from the decennial census and citizen voting age population from the ACS (thereby proving that this was possible – a key tenet of the case). We believe this was the first and still only time this technical accomplishment has been achieved in the nation at a state level. In 2017 I co-authored “From Legal Theory to Practical Application: A How-To for Performing Vote Dilution Analyses.” In 2019 I co-authored “Redistricting: A Manual for Analysts, Practitioners, and Citizens”. In 2021 I authored an assessment of the impact of the U.S. Census Bureau’s approach to ensuring respondent privacy and Title XIII compliance by using a disclosure avoidance system involving differential privacy and was certified as an expert by the US District Court of Alabama Eastern Division. In 2021 I also co-authored ““The Effect of the Differential Privacy Disclosure Avoidance System Proposed by the Census Bureau on 2020 Census Products: Four Case Studies of Census Blocks in Alaska”.

I have been retained to develop, analyze and/or critique four state redistricting plans in 2021, including the state legislature for the Republican Texas House Committee on Redistricting, the state senate for Democratic Counsel for the State of Illinois, and state senate and legislature for Republican Counsel for the State of Wisconsin.

I maintain membership in numerous professional affiliations, including:

- International Association of Applied Demographers (Member and Board of Directors)
- American Statistical Association (Member)
- Population Association of America (Member)
- Southern Demographic Association (Member)

I have been deposed once in the last four years, in the matter of *Harding v. County of Dallas*.

My rate is \$350 per hour for analysis, research and report writing, and \$500 per hour for depositions and testimony.

In this report, I provide:

- 1) A demographer's perspective on the Alabama redistricting process and the *Milligan v. Merrill* and *Caster v. Merrill*.⁴
- 2) A summary and interpretation of traditional redistricting principles.
- 3) A discussion and analysis of the census and DOJ definitions of "Black" population.
- 4) An independent and factual analysis of the plaintiffs' plan and the State of Alabama's enacted plan using the traditional redistricting criteria of:
 - A. communities of interest, including:
 - B. core retention analysis;
 - C. incumbency; and
 - D. compactness.

This includes an in-depth analysis of proposed remedial Black majority districts 2 and 7.

Note that I use the terms "*Milligan*" and "*Hatcher Plan*" referring to plan characteristics and maps throughout my report interchangeably.

⁴<https://redistricting.lls.edu/case/milligan-v-merrill/> and <https://redistricting.lls.edu/case/caster-v-merrill/>

1) A demographer's perspectives on the Alabama redistricting process and issues posed in *Milligan v. Merrill* and *Caster v. Merrill*

The Alabama State Legislature is responsible for drawing both congressional and state senate and state house boundaries, as well State Board of Education districts. Both chambers of the state legislature must approve a single redistricting plan. The governor may veto the lines drawn by the state legislature⁵ On May 5, 2021 the State of Alabama issued the "Reapportionment Committee Redistricting Guidelines", which stated among other things:

- "No district shall be drawn that subordinates race-neutral districting criteria to considerations of race, color, or membership in a language minority group (except...) to comply with Section 2";
- "Districts shall be composed of contiguous and reasonably compact geography";
- "Districts shall respect communities of interest...including but not limited to ethnic, racial, economic, tribal, social, geographic or historical identities"; and
- "The legislature shall try to preserve the cores of the existing districts"

Using population estimates from the Census Bureau, the Alabama legislature began to develop redistricting plans in May of 2021. Once the 2020 Census data were delivered in August of 2021, the Alabama legislature utilized that data to continue the redistricting process⁶. Plans were drawn in compliance with the published criteria for redistricting⁷, which includes (among other guidance):

- Ila. Districts shall comply with the United States Constitution, including the requirement that they equalize total population; and
- Iib. Congressional districts shall have minimal population deviation.

On November 4, 2021 the proposed plans were signed into law⁸ by Governor Kay Ivey.

⁵ https://ballotpedia.org/Redistricting_in_Alabama_after_the_2020_census

⁶ <https://www.census.gov/newsroom/press-releases/2021/population-changes-nations-diversity.html>,
<https://www.census.gov/newsroom/press-releases/2021/2020-census-redistricting-data-easier-to-use-format.html>

⁷ <http://www.legislature.state.al.us/aliswww/reapportionment/Reapportionment%20Guidelines%20for%20Redistricting.pdf>

⁸ Alabama enacted a congressional map on Nov. 4, 2021, after Gov. Kay Ivey (R) signed the proposal into law.[1] The Alabama House of Representatives voted 65-38 in favor of the map on Nov. 1 followed by the Alabama State Senate voting 22-7 on Nov. 3.[1][2] This map takes effect for Alabama's 2022 congressional elections.

Alabama enacted state legislative maps for the state Senate and House of Representatives on Nov. 4, 2021, after Gov. Kay Ivey (R) signed the proposals into law.[1] Senators approved the Senate map on Nov. 1 with a 25-7 vote.[3]

This report is submitted in *Milligan v. Merrill* and *Caster v. Merrill*. Plaintiffs in both cases allege that Section 2 of the Voting Rights Act requires Alabama to draw two majority-black districts (the Milligan Plaintiffs also assert claims of racial gerrymandering and intentional gerrymandering). The Milligan plaintiffs present a plan in their complaint (“the Hatcher plan”) that significantly changes the representational landscape of the state and deviates far from a “least change” approach.

Districts 2 and 7 are majority black by plaintiffs’ calculations, but barely so. In order for them to have accomplished this, some of the most obvious changes introduced by the Hatcher plan include numerous splits of counties that have always remained whole in districting plans and in aggregate have remained in the same congressional district for decades. The most significant of these splits are the ones of District 1 and District 2 through Mobile and Baldwin counties. In the Hatcher plan, District 2 connects the areas in Mobile County that are heavily black in population with counties in the Black Belt region, including Barbour and Russell counties on the Georgia line. District 1 connects the whiter areas of Mobile County with wiregrass counties, extending along the Florida line to Houston County. In the Hatcher plan, District 7 includes areas of west central Alabama that are heavily black in population – also with counties in the Black Belt region. The *Caster* plaintiffs have not yet presented a demonstrative plan, and no plaintiffs will submit an expert report until the day this report is due.

For purposes of this report, I am assuming that the demonstrative plans in both cases will be based on the same basic structure as the Hatcher plan, even if there are differences around the edges. If any plaintiffs present a demonstrative plan with a substantially different structure or that alters the opinions herein, those issues will be addressed in a supplemental or rebuttal report. Because of time constraints during this accelerated schedule, most of my focus will be on the *Milligan* plaintiffs’ allegations, but the opinions asserted about the “Hatcher plan” apply equally to *Caster* to the extent the *Caster* plaintiffs rely on a similar demonstrative plan. Some of my opinions asserted in my report for *Singleton v. Merrill* (the “whole county” case) may be

Representatives approved the Senate map on Nov. 3 with a 76-26 vote.[1] For the House proposal, representatives voted 68-35 in favor on Nov. 1 and senators followed on Nov. 3 with a 22-7 vote.[4] These maps take effect for Alabama's 2022 legislative elections.

Alabama's seven United States representatives and 140 state legislators are all elected from political divisions called districts. District lines are redrawn every 10 years following completion of the United States census. Federal law stipulates that districts must have nearly equal populations and must not discriminate on the basis of race or ethnicity.

Source: https://ballotpedia.org/Redistricting_in_Alabama_after_the_2020_census

applicable to arguments made in *Milligan* and *Caster*, and I understand that my Singleton report may be submitted for that purpose. I reserve the right to supplement this report.

2) Traditional Redistricting Principles

In addition to these mandatory standards set out by the U.S Constitution and the Voting Rights Act, states may adopt their own redistricting criteria, or principles, for drawing the plans. Those criteria appear in state constitutions or statutes, or may be adopted by a legislature, chamber, or committee, or by a court that is called upon to draw a plan when the legislative process fails. The Congressional Research Service explains⁹:

“Many of the “rules” or criteria for drawing congressional boundaries are meant to enhance fairness and minimize the impact of gerrymandering. These rules, standards, or criteria include assuring population equality among districts within the same state; protecting racial and language minorities from vote dilution while at the same time not promoting racial segregation; promoting geographic compactness and contiguity when drawing districts; minimizing the number of split political subdivisions and “communities of interest” within congressional districts; and preserving historical stability in the cores of previous congressional districts.”

These traditional districting principles (or criteria) have been adopted by many states and serve as the framework that I will use in this report:

- *Preservation of communities of interest*: District boundaries should respect geographic areas whose residents have shared interests, such as neighborhoods and historic areas.
- *Continuity of representation*. There is a benefit to continuing the political and geographic stability of districts. This can be measured with:
 - *Preservation of districts (“core retention”)*: A redrawn district should include as much of the same residential population as the former district did, as allowed by the minimum population that needs to be rebalanced.
 - *Incumbents*: Districts should not be drawn to include pairs of incumbents.
- *Compactness*: Districts should be geographically compact and not irregular.
- *Contiguity*: All parts of a district should be connected at some point with the rest of the district. Simply put, contiguity means that a pedestrian could walk from any point within the district to any other point within it without needing to cross the district’s boundaries; and finally:
- *Preservation of counties and other political subdivisions*: District boundaries should not cross county, city, or town, boundaries to the extent practicable.

⁹ <https://crsreports.congress.gov/product/pdf/R/R42831/3>

3) Census Race Definitions

In the field of demography, and indeed in redistricting cases, the definition of the population in question is critical. Since the foremost purpose of the census is to generate statistics for the purpose of apportionment and redistricting, it is unclear why here plaintiffs refer to undocumented voting strength statistics rather than census Black Voting Age Population. Before we proceed, we will here try to define and document the true “Black” population of the two Black districts in the plaintiff’s remedial plan.

The 2010 Census allowed respondents to self-declare their ethnic and racial identification:

In order to facilitate enforcement of the Voting Rights Act, the Census Bureau asks each person counted to identify their race and whether they are of Hispanic or Latino origin. Beginning with the 2010 Census (and continuing in 2020) the racial categories available in the Census were: White, Black, American Indian, Asian, Native Hawaiians and other Pacific Islanders, and Some Other Race. Persons of Hispanic or Latino origin might be of any race. Persons were given the opportunity to select more than one race – and that race could be in combination with Hispanic or non-Hispanic origin.¹⁰

The result is that the Census Bureau reports 263 different population counts for each level of Census geography in the country. A “Black” in Alabama therefore can be Black alone, or perhaps in combination with other races or possibly even also Hispanic. Since 2010, the number and proportions of multi-race populations in the United States has grown markedly.¹¹ An examination of Appendix 1 (P.31) “Census 2020 Alabama Black Population Total, non-Hispanic and Hispanic Combinations” reveals numerous new and important findings on who Blacks are in Alabama.

In Appendix 1 (P.31) the population is reported starting in total, then progressing by row through race alone and race in combination for Alabama’s Black population. Column A shows the total population and Column B shows the % of the total population for that group. Column C shows the non-Hispanic population and Column D shows the % of the total population for that group. Column E shows the Hispanic population and Column F shows the % of the total population for that group. In Appendix 2 (P.32), the same format follows for the Alabama Black Voting Age Population (VAP).

¹⁰ “How to Draw Redistricting Plans That Will Stand Up In Court”, National Conference of State Legislators (NCSL), January 22, 2011, p. 17.

¹¹ Experts own independent observations.

In Appendix 1 (P.31), Column A (Total Population) we see that the Black or African American alone population is 1,296,162 – or 25.8% of the population. At the bottom of the table, we see the incremental impact of Black alone or in combination. When all other race combinations are added, the Black population is 1,364,736 – or 27.2% of the population. This represents an additional 68,574 Blacks, or 5.0% of the total Alabama Black population.

In Appendix 2 (P.32), Column A (Voting Age Population) we see that the Black or African American alone population is 981,723 – or 25.1% of the population. At the bottom of the table, we see the incremental impact of Black alone or in combination. When all other race combinations are added, the Black population is 1,014,372 – or 25.9% of the VAP. This represents an additional 68,574 Blacks, or 3.2% of the Alabama Black VAP.

In this matter precise definitions matter. This “alone” definition is the one most consistently used historically in VRA cases because a) a multi-race classification did not exist prior to 2000; and b) the “alone” definition has been most defensible from a political science / Gingles 2 voting behavior perspective. On September 1, 2021 the DOJ published “Guidance under Section 2 of the Voting Rights Act, 52 U.S.C. 10301, for redistricting and methods of electing government bodies”¹² which states:

“The Department’s initial review will be based upon allocating any response that includes white and one of the five other race categories identified in the response. Thus, the total numbers for “Black/African American,” “Asian,” “American Indian/Alaska Native,” “Native Hawaiian or Other Pacific Islander,” and “Some other race” reflect the total of the single-race responses and the multiple responses in which an individual selected a minority race and white race. The Department will then move to the second step in its application of the census data by reviewing the other multiple-race category, which is comprised of all multiple-race responses consisting of more than one minority race. Where there are significant numbers of such responses, the Department will, as required by both the OMB guidance and judicial opinions, allocate these responses on an iterative basis to each of the component single-race categories for analysis.”¹³

In order to facilitate analysis that reflects current DOJ guidance, we will include analysis containing both Black alone or in combination (hereafter referred to as the “All Black” definition in this report as appropriate.

¹² <https://www.justice.gov/opa/pr/justice-department-issues-guidance-federal-statutes-regarding-redistricting-and-methods>

¹³ *Georgia v. Ashcroft*, 539 U.S. 461, 473, n.1 (2003).

Table 4.1 Hatcher Plan Total Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	717,754	110,043	121,355	15.3%	16.9%
2	717,755	369,876	383,401	51.5%	53.4%
3	717,753	153,144	163,967	21.3%	22.8%
4	717,753	50,872	58,822	7.1%	8.2%
5	717,755	129,314	143,250	18.0%	20.0%
6	717,754	85,270	93,167	11.9%	13.0%
7	717,755	389,640	400,774	54.3%	55.8%
Grand Total	5,024,279	1,288,159	1,364,736	25.6%	27.2%

Table 4.2 Hatcher Plan Voting Age Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	556,317	81,316	86,113	14.6%	15.5%
2	559,876	278,856	286,698	49.8%	51.2%
3	563,228	117,517	122,319	20.9%	21.7%
4	555,304	38,846	41,937	7.0%	7.6%
5	562,504	99,539	106,140	17.7%	18.9%
6	553,734	64,095	67,699	11.6%	12.2%
7	566,203	296,563	303,466	52.4%	53.6%
Grand Total	3,917,166	976,732	1,014,372	24.9%	25.9%

Table 4.3 HB1 Plan Total Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	717,754	185,771	196,827	25.9%	27.4%
2	717,755	216,019	228,648	30.1%	31.9%
3	717,754	175,783	187,284	24.5%	26.1%
4	717,754	51,314	59,655	7.1%	8.3%
5	717,754	123,355	136,782	17.2%	19.1%
6	717,754	137,209	145,897	19.1%	20.3%
7	717,754	398,708	409,643	55.5%	57.1%
Grand Total	5,024,279	1,288,159	1,364,736	25.6%	27.2%

Table 4.4 HB1 Plan Voting Age Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	557,535	137,354	142,777	24.6%	25.6%
2	557,677	161,893	167,971	29.0%	30.1%
3	564,281	135,659	141,011	24.0%	25.0%
4	556,133	39,507	42,819	7.1%	7.7%
5	561,187	95,014	101,339	16.9%	18.1%
6	552,286	100,385	104,551	18.2%	18.9%
7	568,067	306,920	313,904	54.0%	55.3%
Grand Total	3,917,166	976,732	1,014,372	24.9%	25.9%

Table 4.5 Existing 2011 Plan Total Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	726,276	188,431	199,586	25.9%	27.5%
2	693,466	211,862	224,221	30.6%	32.3%
3	735,132	186,438	198,228	25.4%	27.0%
4	702,982	46,919	54,662	6.7%	7.8%
5	761,102	130,351	144,648	17.1%	19.0%
6	740,710	120,130	128,681	16.2%	17.4%
7	664,611	404,028	414,710	60.8%	62.4%
Grand Total	5,024,279	1,288,159	1,364,736	25.6%	27.2%

Table 4.6 Existing 2011 Plan Voting Age Population by District

District	Total Pop	Black Alone Pop	All Black Pop	% Black Alone	% All Black
1	564,302	139,380	144,863	24.7%	25.7%
2	539,812	159,212	165,202	29.5%	30.6%
3	576,455	143,415	148,910	24.9%	25.8%
4	543,423	36,006	39,038	6.6%	7.2%
5	595,873	100,325	107,050	16.8%	18.0%
6	572,838	89,754	93,787	15.7%	16.4%
7	524,463	308,640	315,522	58.8%	60.2%
Grand Total	3,917,166	976,732	1,014,372	24.9%	25.9%

Precision here is important. Plaintiffs cite numerous demographic figures without defining them. In districts they are proposing such as D2, the Black alone population is 49.8% - e.g. not a majority.¹⁴ While the Black alone *or in combination* population is 51.2%. Whether D2 is defensible as a majority district depends on the definition being used. In this case, if the plaintiffs use any other definition of Black besides “Black alone” an analysis of the voting behavior of those incremental, not Black alone voters would be warranted for a Gingles claim.

Using the tables above and Appendix 1(P.31) / Appendix 2 (P.32) I documented the demographic references by paragraph in the Milligan report and attempted to replicate them.

- Para 42. “On August 12, 2021, the U.S. Census Bureau released the results of the 2020 Census. Alabama’s population grew by 5.1% between 2010 and 2020. Alabama’s current population identifies as 63.1% non-Hispanic white, 26.9% as any part Black, 5.3% as Hispanic or Latino, 2.3% as any part American Indian/Alaska Native, and 2% as any part Asian.” My analysis shows that the 26.9% Black here is actually Black alone and Hispanic and Black + White and Hispanic. The true % any part Black is in fact 27.2%

¹⁴ Milligan complaint paragraph 88

- Para 87. “Demonstrative CD 7 would have a BVAP of 52.6%, which is sufficient for Black voters to elect a representative of choice despite the persistence of racially polarized voting in Alabama.” My analysis in Table 4.2 (P.10) shows BVAP for Hatcher D7 as being 52.4% and All Black as 53.6%. I am unable to ascertain the definition of the BVAP of 52.6% or the defense of it being sufficient for Black voters.
- Para 100. “District 1 is a district that was approximately 25.7% BVAP.” My analysis in Table 4.6 (P.11) shows D1 All Black as 25.7%.
- Para 101. “District 1 is a district that was approximately 30.6% BVAP.” My analysis in Table 4.6 (P.11) shows D2 All Black as 30.6%.
- Para 102. “District 1 is a district that was approximately 25.8% BVAP.” My analysis in Table 4.6 (P.11) shows D3 All Black as 25.8%.
- Para 165. “In the HB 1 plan signed by the Governor, the BVAP in CD 1 is 25.6%, the BVAP in CD 2 is 30.1%, and the BVAP in CD 3 is 25%.” My analysis in Table 4.4 (P.10) shows all three of these populations as being “All Black”.

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4) Analysis and Evaluation of Plans

Next, we analyze and evaluate the enacted Alabama plan and plaintiffs' proposed plan and using the following traditional redistricting principles:

- A. communities of interest, including:
- B. core retention analysis
- C. incumbency; and
- D. compactness.

A. Communities of Interest

The concept of "communities of interest" (COIs) is frequently used, but not always easy to apply to redistricting. The U.S. Supreme Court has specified districts should contain "communities defined by actual shared interests."¹⁵ The concept of COI can be difficult to define, and, consequently, making use of such an intangible concept in the actual constructing of boundaries may be difficult and arbitrary.¹⁶ A broad, commonly used definition is "a group of people who share similar social, cultural, and economic interests, and who live in a geographically defined area". Others have gone to greater lengths. The University of Michigan Center for Urban, State and Local Policy (CLOSUP) defined communities of interest as:

"While there is no set definition of COIs, we think of a COI as a group of people in a specific geographic area who share common interests (such as economic, historic, cultural, or other bonds) that are linked to public policy issues that may be affected by legislation. CLOSUP's research suggests that COIs can consist of religious, ethnic, or immigrant communities, neighborhoods, people in tourism areas, regional media markets, outdoor recreation or natural resource areas, economic zones, and much more. Examples of COIs include: historical communities; economic communities; racial communities; ethnic communities; cultural communities; religious communities; immigrant communities; language communities; geographic communities; neighborhoods; economic opportunity zones; tourism areas; school districts; outdoor recreation areas; communities defined by natural features; creative arts communities; media markets, etc."

Alabama is a state rich in history and diversity. With over 5 million residents, the yellowhammer state spans from the mountainous Tennessee Valley to the south by Mobile Bay covering over

¹⁵ *Miller v. Johnson*, 515 U.S. 900, 919–20 (1995).

¹⁶ Matthew J. Streb, *Rethinking American Electoral Democracy*, 2nd ed. (New York: Routledge, 2011), p. 111; Brunell, *Redistricting and Representation*, p. 66; Brickner, "Reading Between the Lines...", p. 16.

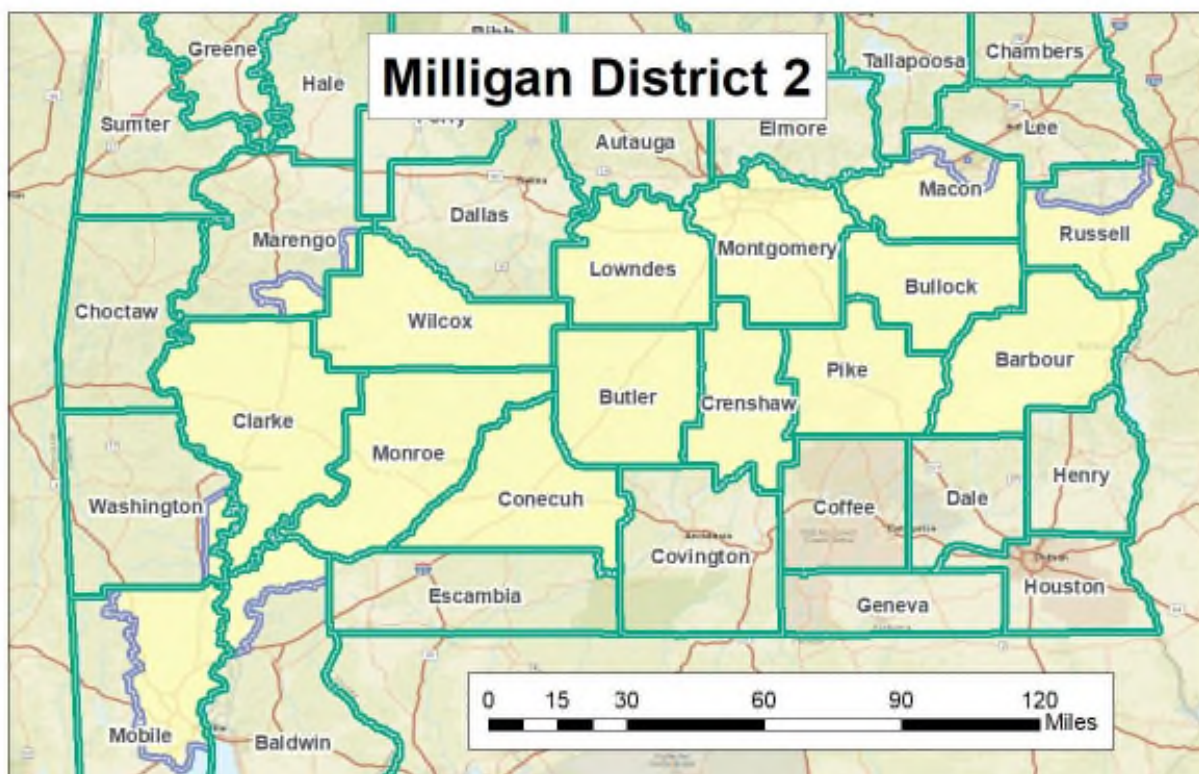
52,000 square miles. It contains some of the richest farming country in the nation, alongside tech corridors and growing urban areas.

Here I assess the Hatcher plan Districts 2 and 7 – the *Milligan* remedial majority Black districts. In examining Map Appendix 7 (P.44 Hatcher Percent Black Alone VAP by VTD) it seems visually obvious that two majority Black districts cannot be created without some equitable division of the Black belt – adding some portion to Mobile to create a Black majority District 2 and adding some portion Birmingham to create a Black majority District 7.

Hatcher Plan District 2

In examining Figure 4.1 below, I note that several previously intact counties have been split – including Baldwin, Mobile, Macon, Marengo, Macon, Russell and Washington, none of which have historically been split between districts.

Figure 4.1 Milligan District 2



In examining District 2 – my attention was drawn to the southeasterly Mobile / Baldwin County area – which have been split in a way in the Hatcher plan that is not consistent with any existing administrative or physical geography. My investigation revealed that neither Mobile nor Baldwin County have ever been split in any historical congressional configuration. And since the 1970s, both counties have been paired together in one whole district with the same representative.

Looking closer at Map Appendix 11 (P.48, D2 Division of Mobile in Hatcher Plan) it can be seen that District 2 was drawn into Mobile County just as far as was necessary to include the several heavily Black populous VTDs¹⁷ in and around Mobile. In fact, no effort was made to try and conform the boundaries of D2 to the existing city boundaries of Mobile. Doing so would have included several heavily *non-Black* VTDs that would dilute the percent Black in D2 to something less than a defensible majority. It is difficult to argue that the extension of D2 into central Mobile County was for any other purpose than adding Black population to reach the bare majority plaintiffs claim to have achieved there. There are no other surrounding (non-Black) areas that were included.

I have reviewed the testimony of Bradley Byrne and Jo Bonner from the case of *Chestnut v. Merrill*, where I understand the plaintiffs requested essentially the same relief as the *Milligan* and *Caster* plaintiffs (two majority-black districts with a structure similar to the Hatcher plan). As former Congressmen who represented District 1, I would expect them to be knowledgeable of communities of interest in the area. Aside from racial differences, the entire southwest corner of Alabama represents a significant Alabamian community of interest (COI) – with numerous strong economic, transportation, cultural and historic interests. Mobile County has a rich history as the first European settlement in Alabama and as one of the oldest cities in the U.S., Mobile is also home to North America’s first Mardi Gras celebration. The history steeped in being Alabama’s only port and its coastal location brings the people of Mobile County together economically as well as socially.

This COI has similar and shared economic, geographical, historical and social interests, as well as being key to Alabama’s economy. Mobile and Baldwin Counties make up Alabama’s only coastal district and the state’s only port (Mobile) is in Mobile County. Major shipping, rail and highways merge along the Mobile River and Mobile Bay. Mobile County has many large employers in key industries such as aviation/aerospace, shipbuilding, chemical, steel manufacturing, healthcare, and oil/gas. Many residents in Mobile County work in these industries. Highways and major interstates (10 and 65) connect the different parts of the county so people who live in different parts of the county can easily get to the main port of Mobile where the economy and culture thrive. The county is a national leader in training and workforce development. They train locals who live in Mobile County to stay and work there as well.

¹⁷ VTDs are Voting Districts. “VTD” is a census term for a geographic area, such as an election precinct, where election information and data are collected; boundaries are provided to the Census Bureau by the states. Since boundaries must coincide with census blocks, VTD boundaries may not be the same as the election precinct and may include more than one precinct. Source: <https://www.ncsl.org/research/redistricting/the-redistricting-lexicon-glossary.aspx>

Baldwin County is the fastest growing county in the state. It is connected to Mobile County by Interstates 10 and 65. There are shipyards in both counties and Alabama's shoreline covers both counties. Baldwin County is a major tourist area along the Gulf Coast. The economic development of both sides of the two counties have been merging. There is also cooperation between the local governments of both counties as they have a shared economy and shared political interest. Mobile, Baldwin County and adjacent counties should be considered a unified community of interest (COI) when creating districts.

As Congressman Bradley Byrne testified in the *Chestnut v Merrill* case in 2019, Mobile and Baldwin Counties are closely connected culturally and economically:

"you've got people who have some sort of a connection on both sides of the bay. And we've found over the last 20 years that the economic development efforts of both sides of the bay have been merging. And so we're actually doing a lot more cooperative things between the two counties. And each county sort of living off of the other in various ways. So the cooperation between local government, local economic developers, local civic leaders on both sides of the bay is something we've worked very, very hard on. And it's paying off for us in a big way."¹⁸

Former Congressman Josiah Bonner also testified at the *Chestnut v Merrill* case, arguing that Mobile County and Baldwin County represent a Community of Interest:

"...you've got Mobile and Baldwin counties in the southern part of the district that not only are connected by Mobile Bay but front the Gulf of Mexico. And so, therefore, everything -- I would call it a hub and spoke. Everything that radiates out radiates from the shared economies, the shared history, the shared social occasions, such as Mardi Gras, the shared political interests from Mobile and Baldwin counties."¹⁹

Due to time constraints, I will rely on this history, evidence and testimony as my defense of why Mobile and Baldwin counties are an inseparable COI. I have limited my assessment of the D2 impact of the Hatcher plan to Mobile and Baldwin counties with population changes and the traditional redistricting principles of core retention and compactness. Other county splits in the Hatcher plan are not trivial – but it is my professional assessment that the splits in Mobile and Baldwin would create the most harm.

¹⁸ Chestnut v. Merrill, Transcript of Bench Trial V. IV page 679

¹⁹ Chestnut v. Merrill, Transcript of Bench Trial V. IV page 764

Comparing Table 4.2 Hatcher Plan Voting Age Population by District (P.10) with Table 4.6 Existing 2011 Plan Voting Age Population by District (P.11) with the numeric impact of the Hatcher plan on the Black population in D1 is clear. They are reduced from 139,380 (or 24.7% Black alone) to 81,316 (or 14.6% Black alone) – resulting in over 58,000 Blacks changing representation from their neighbors to a new constituency including large Black populations east to Montgomery and beyond. What is notable is that displacement of 58,000 Blacks is from areas where they have a high percentage of the total population. These “high percentage” Blacks replace very nearly the same number of Blacks from southeastern Alabama that had been in District 2 previously – that Hatcher now moves out into District 1. That is – the Hatcher plan trades a similar number of Blacks between D1 and D2 but just exchanges low Black density and high Black density populations. This effect can be seen in the core retention analysis (CRA) I performed on the Hatcher plan (P.23).

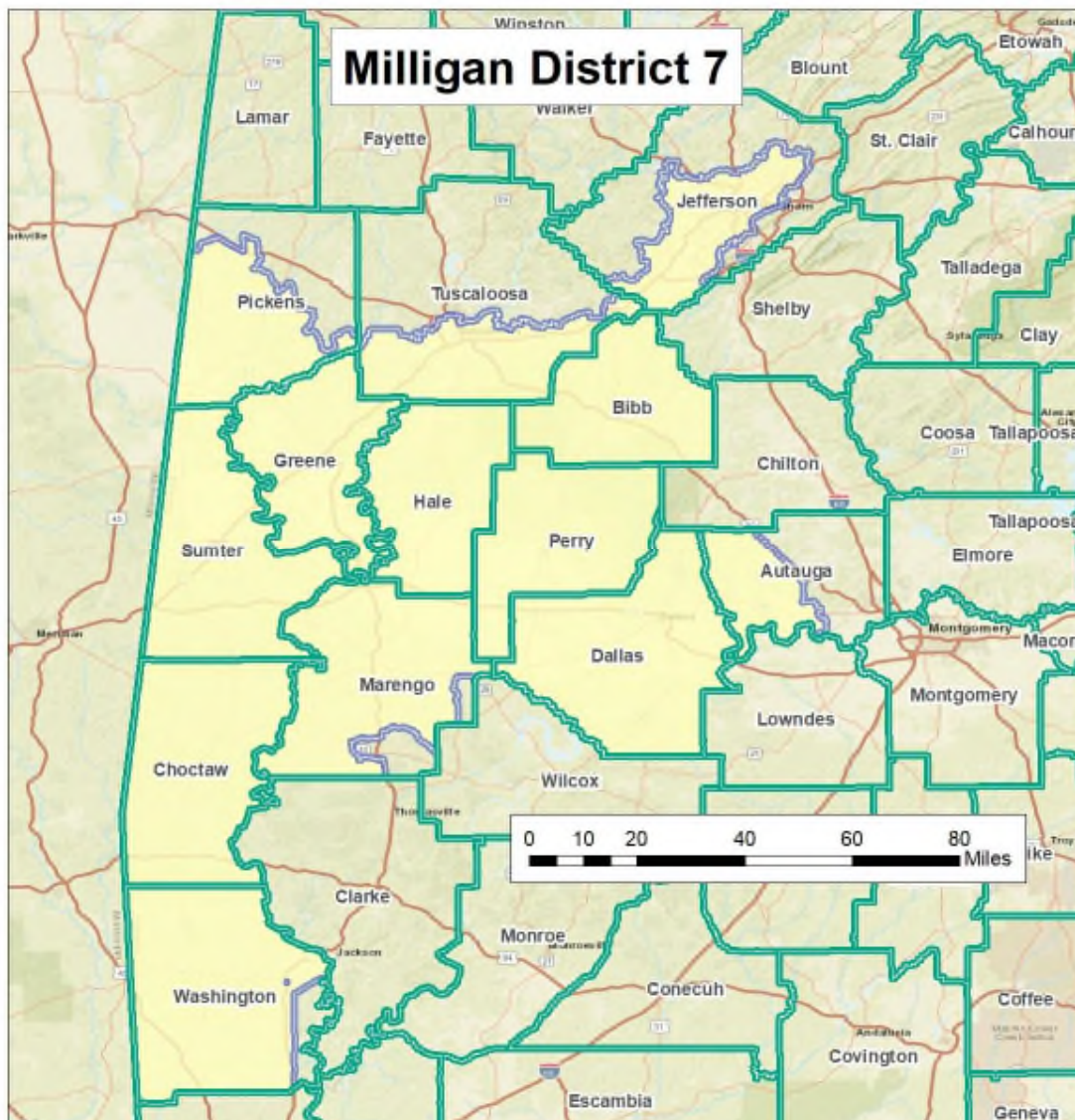
In my CRA Figure 5.2 (P.23) I show that District 1 (from which *Milligan* plaintiffs excise the Black portions of Mobile County) retains 58.7% of its total population while only retaining 27.6% of its Black population. Over 72% of the Black population (largely from Mobile) in District 1 would lose their continuity of representation under the Hatcher plan because they would be getting moved to District 2. In D2 I show that only 36.8% of the total population and 58.7% of the Black population is retained (because numerous non-Black populations were moved out of the district). If Plaintiffs wanted to strengthen D2 as a Black district – how does disgorging 41% of the existing Black population in the district accomplish that? The apparent answer is that the existing Black populations and neighborhoods in D2 were not the *right* Black populations. *Milligan* plaintiffs needed to replace them with a different Black population that represented a higher share of their neighboring population – no matter how far geographically they had to stretch or what consequences to communities of interest that created.. This leads me to compactness.

In my compactness analysis (P.27-29) I show that the overall Hatcher plan performs much more poorly than the existing (2011) Alabama Congressional plan – driven in part by the very poor compactness of the new D2 and even moreso by the collateral compactness damage done to D1. In the existing plan, the sum of the four compactness scores for D1 (Table 5.3, P.28) was 1.70 and D2 was 1.93. In the Alabama enacted plan, the sum of compactness scores (Table 5.4, P.29) was improved for D1 at 1.75 and D2 at 2.02. By comparison – the Hatcher compactness scores worsened considerably (Table 5.5, P.30) with the sum of compactness scores in D1 at 1.29 and D2 at 1.51.

Milligan District 7

In examining Figure 4.2 below, I note that several previously intact counties have been split – including Autauga, Marengo, Pickens and Washington (Tuscaloosa and Jefferson were already split).

Figure 4.2 Milligan District 7



Of these splits, the most closely examined historically is the often maligned “thumb” of D7 into Birmingham. . In examining Map Appendix 9 (P.46) (D6 to D7 Moves of Populous Black VTDs in Hatcher Plan – marked with dots) I closely studied the Hatcher plan relative to the existing 2011 plan boundaries. Knowing that the plaintiffs in *Milligan* had to add Black population in order to reach their Black majority requirement, I noted that the existing boundaries around Birmingham were expanded in a very nearly exact way to only add heavily Black VTDs, and to avoid less Black VTDs. These VTDs are noted with blue “dots” in Map Appendix 9.

Looking even more closely at Map Appendix 10 (P.47) (D6 to D7 Populous Black VTDs in Hatcher Plan) – it can be clearly seen that the HB1 boundary (in grey and white) is actually drawn more closely into Birmingham than the existing 2011 plan boundaries. This apparent race-blind attempt to improve D7 compactness has the effective consequence of disgorging several heavily Black VTDs out of D7 into D6. That is, the result of HB1 was that Black population was unpacked (rather than packed) out of the district. By comparison, plaintiffs clearly and deliberately drew their plan with the only purpose of *including* Black population. They made no apparent attempt to align their new boundaries with Birmingham municipal boundaries or any other community of interest, except those VTDs that are heavily Black.

As with our analysis of D1 and D2, we can see the impact of the changes in the Hatcher plan to D6 and D7. The core retention of Blacks in D6 is significantly altered. 81.5% of the total population in D6 is retained – while only 60% of the Black population is retained. The result here is that the continuity of representation for 40% of the Black population in D6 is disrupted. Further, the resulting core retention in the Hatcher plan for D7 (at 84.5% of total and 83.4% of Blacks) lags that of HB1 (at 90.6% of total and 89.5% of Blacks).

In my compactness analysis (P.27--29) I show that the Hatcher plan performs comparably to the existing (2011) Alabama Congressional plan for Districts 6 and 7. In the existing plan, the sum of compactness scores for D6 was 1.63 and D7 was 1.49. In the Alabama enacted plan, the sum of the four compactness scores for D6 was worse at 1.55 and for D7 was significantly better at 1.74. By comparison – the Hatcher compactness for D6 was identical at 1.63 and for D7 was only slightly worse at 1.42.

B. Core Retention Analysis

Courts have recognized the need to preserve the core of a prior established district as a legitimate redistricting criterion,²⁰ as well as the avoidance of contests between incumbents.²¹ Core retention fosters the continuity of political representation. A *Core Retention Analysis* (CRA) is simply a demographic accounting of the addition, subtraction, and substitution of persons that would be brought about by a proposed realignment of a district's existing boundaries. A CRA is a way of quantifying precisely how a proposed realignment would affect the continuity of political representation among a district's current residents and eligible voters.

Here, a CRA can be especially useful in exposing differential effects on specific groups of residents that amount to the denial or abridgement of the right to vote. To illustrate: suppose that 1,000 people now reside in a district in which Blacks constitute 480 (48%) of all the district's eligible voters (a Black "influence" district). Since this district now has too many residents (based upon the 2020 Census), a proposed boundary change retains 800 of its current residents and resituate 200 others in an adjacent district with too few people, thereby satisfying the newly-established requirement that every newly-drawn district be properly apportioned with 800 residents. Here, the "core" of the former district has been fully retained numerically: all 800 residents of the newly-drawn district were part of the former district, maintaining the continuity of political representation among the proposed new district's current residents and eligible voters.

The CRA might also show that 150 of all 200 proposed resituated residents are Black. By this measure, "core retention" differs markedly for Blacks, because only 330 (480 minus 150) of the original 480 Black "core" of the former district has been retained. In short, the proposed new district would retain only 69% of the original Black core, thereby depriving 31% of Blacks of continuity of political representation.

Core Retention Analysis has usually only considered only the total populations of districts in comparisons across plans. As illustrated above, that limitation obscures other potentially problematic aspects of redistricting. In this case, we have broadened this standard demographic accounting model, using standard methodology, to present a full evaluation of various alternative redistricting plans, focusing on the right to vote by a protected group.

²⁰ *Abrams v. Johnson*, 521 U.S. 74, 84 (1997).

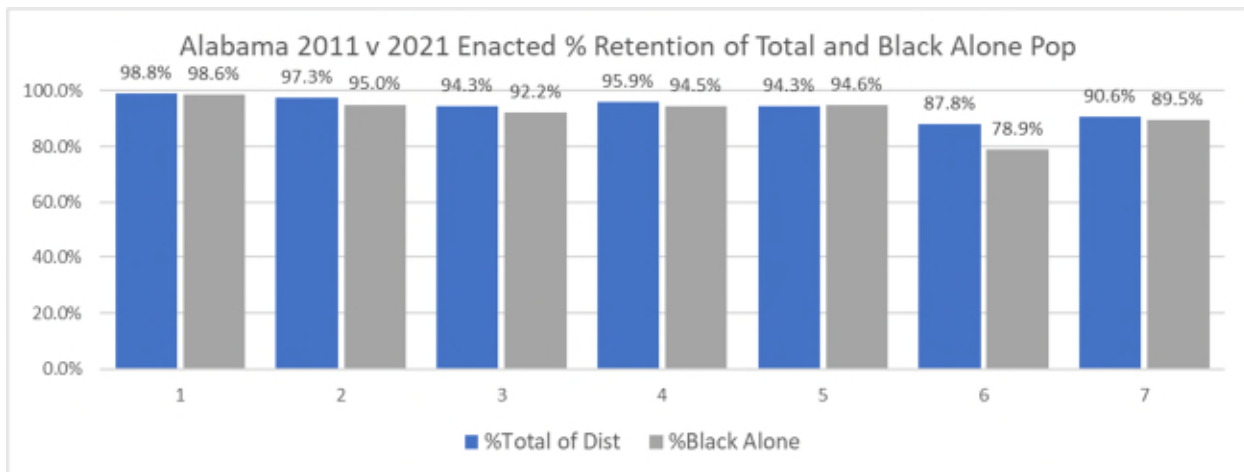
²¹ *Bush v. Vera*, 517 U.S. 952 (1996).

Three core retention analyses follow:

- 1) Alabama 2011 v Alabama 2021 enacted
- 2) Alabama 2011 v Hatcher
- 3) Alabama 2021 v Hatcher

In Figure 5.1 it can plainly be seen that core retention of the total population and the Black population by the State of Alabama 2021 enacted plan compared to the 2011 existing Alabama plan is significant, consistent and comparable, which should have been expected given the least change approach of the 2021 plan.

Figure 5.1 Core Retention of Total and Black Population: 2011 Existing v 2011 Enacted Plans



In Table 5.1 (P.22) the 2011 existing plan is shown in column 1, and the 2021 enacted plan is shown in column 2. The total population in column 3 is the number of total persons, and the Black population in column 4 is the number of Black persons who were retained and displaced in the 2021 enacted plan. For example, in the first row (1, 1) the total population is 717,754. This is intuitive. The existing 2011 D1 was reduced by exactly the number of persons necessary to balance – leaving 739 persons displaced to D2 and 7,783 persons displaced to D7. Concurrently, 185,771 Black persons are retained in D1, while 158 are displaced to D2 and 2,502 are displaced to D7.

At the bottom of Table 5.1 (P.22) is a row named “Number Retained” which is the population in Alabama that did not change districts in the 2021 plan. The next row is “Percent Retained” which is the percent of the population that did not change districts in the 2021 plan. Alabama kept a remarkable 94.1% of the total population and 91.8% of the Black population intact with their 2021 enacted plan. The remainder is “Number Displaced” that were moved to some other district.

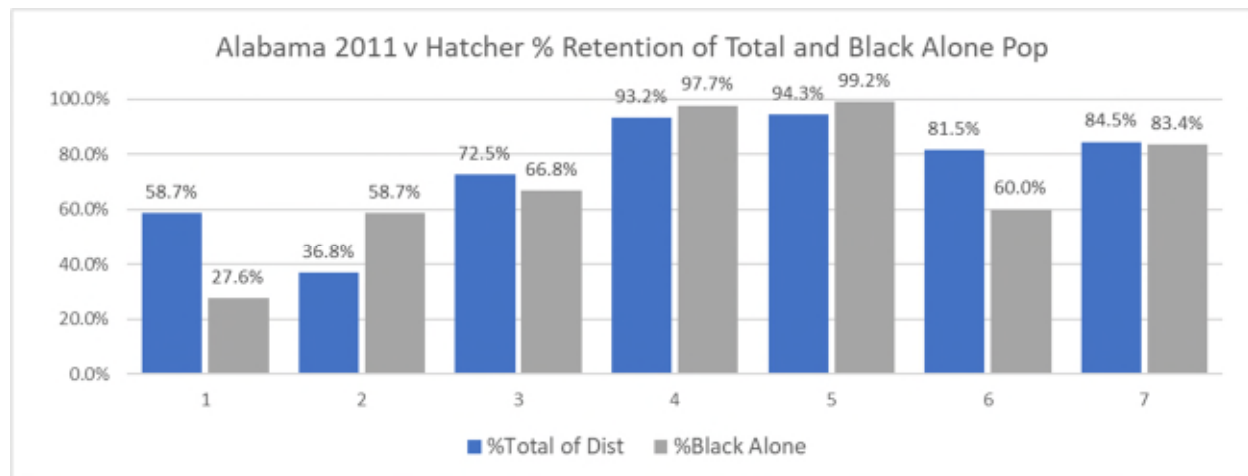
Table 5.1 Core Retention of 2011 Existing and 2021 Enacted Plan

Current 2011 Base District	New 2021 Enacted District	Total Population	Black Alone Population
1	1	717,754	185,771
	2	739	158
	7	7,783	2,502
1 Total		726,276	188,431
2	2	674,947	201,201
	7	18,519	10,661
2 Total		693,466	211,862
3	2	41,867	14,534
	3	693,265	171,904
3 Total		735,132	186,438
4	3	1,697	2
	4	674,218	44,318
	5	185	0
	6	5,012	18
	7	21,870	2,581
4 Total		702,982	46,919
5	4	43,533	6,996
	5	717,569	123,355
5 Total		761,102	130,351
6	3	22,792	3,877
	6	650,382	94,806
	7	67,536	21,447
6 Total		740,710	120,130
7	2	202	126
	4	3	0
	6	62,360	42,385
	7	602,046	361,517
7 Total		664,611	404,028
Number Retained		4,730,181	1,182,872
Percent Retained		94.1%	91.8%
Number Displaced		294,098	105,287
Grand Total		5,024,279	1,288,159

Figure 5.2 presents a core retention analysis of total population and Black population for the Hatcher plan compared to the 2011 existing Alabama plan. Here we can see two significant effects. First, the Hatcher plan has significantly lower core retention, due to the large movements of population necessary to support their plan objective. To that end, we can see that the core retention of the Black population relative to total is:

- much poorer in D1 (due to Black population around Mobile being disgorged to D2 as part of the apparent attempt to improve the Black racial performance in D2 - see Map Appendix 11, P.49);
- much better in D2 (due to significant *non*-Black population being disgorged to other districts as part of the apparent attempt to improve the Black racial performance in D2);
- worse in D6 (due to Black population around Birmingham being disgorged to D7 as part of the apparent attempt to improve the Black racial performance in D7 - see Map Appendix 9 and 10, P.47-48).
- comparable in D7

Figure 5.2 Core Retention of Total and Black Population: State of Alabama 2011 v Hatcher



Clearly, the State of Alabama's newly enacted 2021 plan registers consistently and significantly higher levels of core retention for both total and Black population than the Hatcher plan - a result that should have been anticipated by the plaintiffs.

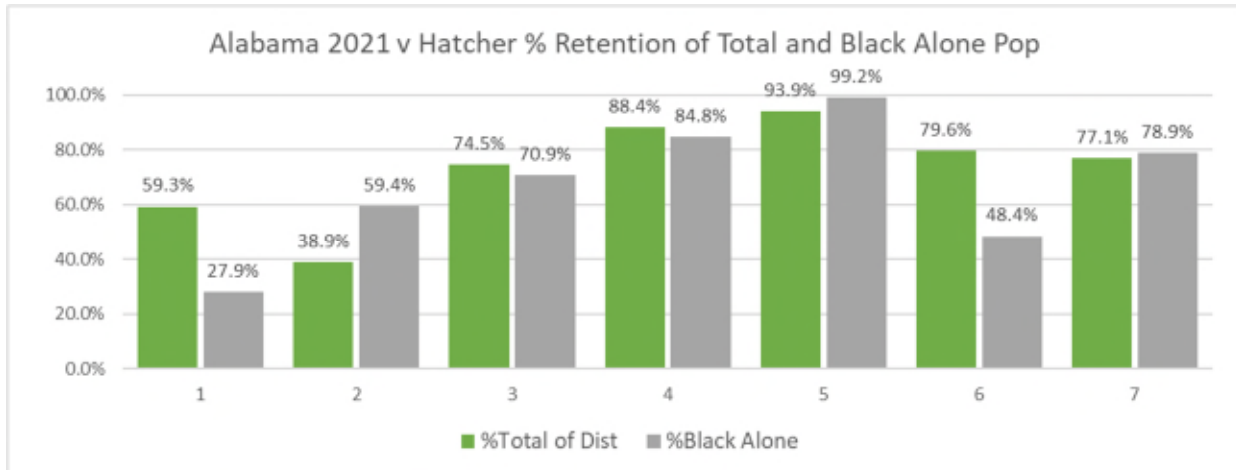
Table 5.2 (P.24) is consistent with Table 5.1 (P.22) except that it compares the Hatcher plan with the 2011 existing plan. The significant difference shown in Figures 5.1 and 5.2 are reflected numerically here. The total population and Black population retained is significantly lower than Alabama's CRA shows, and the number displaced is significantly higher. At the bottom of Table 5.2 is the total retained population: 3,752,981 and Black retained population: 885,238. The Hatcher plan displaces 977,200 more total and 297,634 more Black Alabamians than the enacted 2021 enacted Alabama plan.

Table 5.2 Core Retention of 2011 Existing and Hatcher Proposed Plan

Current 2011 Base District	Proposed 2021 Hatcher District	Total Population	Black Alone Population
1	1	426,386	52,042
	2	285,394	133,723
	7	14,496	2,666
1 Total		726,276	188,431
2	1	291,368	58,001
	2	255,316	124,383
	3	142,954	27,717
	7	3,828	1,761
2 Total		693,466	211,862
3	2	94,200	48,989
	3	533,053	124,597
	6	107,879	12,852
3 Total		735,132	186,438
4	3	41,746	830
	4	655,082	45,831
	5	185	0
	6	5,012	18
	7	957	240
4 Total		702,982	46,919
5	4	43,532	1,037
	5	717,570	129,314
5 Total		761,102	130,351
6	6	603,905	72,114
	7	136,805	48,016
6 Total		740,710	120,130
7	2	82,845	62,781
	4	19,139	4,004
	6	958	286
	7	561,669	336,957
7 Total		664,611	404,028
Number Retained		3,752,981	885,238
Percent Retained		74.7%	68.7%
Number Displaced		1,271,298	402,921
Grand Total		5,024,279	1,288,159

This analysis is followed by a core retention analysis of the Hatcher plan compared to the State of Alabama 2021 enacted plan. Since the Alabama 2021 enacted plan is similar to the original 2011 plan – it is no surprise that the pattern of retention by district, by total and Black population is consistent – but just slightly different.

Figure 5.3 Core Retention of Total and Black Population: State of Alabama 2021 v Hatcher



This superior record for the State’s Plan reflects the advantage of a least change approach: simply adjusting existing boundaries where necessary, instead of completely redrawing all districts, as plaintiffs did. Overall, the differences in core retention shows the significant incremental loss of the continuity of representation borne disproportionately by Alabama’s Black population.

It is also worth noting that in the process of reapportioning the state population after Census 2020, the state effectively unpacked District 7 in an effort to balance each district's population. In examining Table 4.5 (P.11) we see that the existing (that is, pre-apportionment) plan had 664,611 total and 404,028 Black alone population. We see in Table 4.3 (P.10) that the new 2021 HB1 plan has 717,754 total and 398,708 Black alone population. That is, D7 added (717,754-664,611) or 53,143 total persons, while disgorging (404,028 – 398,708) or 5,320 Black alone persons to adjacent districts. It is difficult to argue that the State of Alabama deliberately packed Black population when their plan demonstrates that they in fact *unpacked* District 7 (resulting in a reduction in Black alone population from 60.8% to 55.5%) of the total population.to the degree practicable while holding other traditional redistricting criteria.

C. Incumbency Analysis

The current residential address of congressional incumbents were geocoded on 11-14-2021. This file is acknowledged to be highly confidential and will be maintained as such throughout the analysis. Alabama's enacted plan respects incumbents (Figure 5.6).

While not stated explicitly in their report, the plaintiff plan *does not* respect incumbents (Figure 5.4).

Plaintiff's plan pairs Rep. Moore and Rep. Carl in proposed District 1 and leaves District 2 unrepresented.

Plaintiff's plan goes on to pair Rep. Sewell and Rep. Palmer both in District 6 leaving District 7 unrepresented.

Figure 5.4 Hatcher Plan

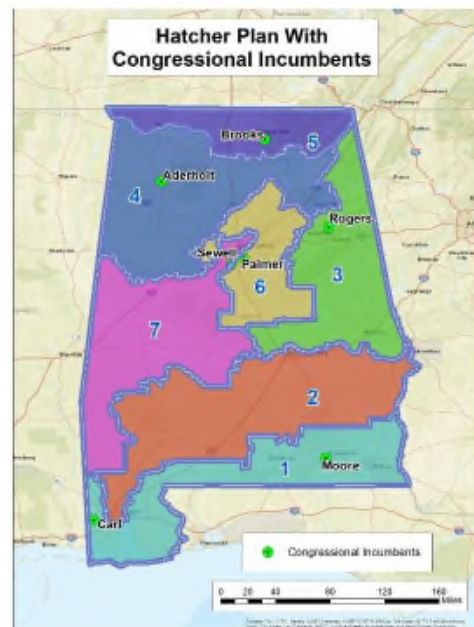


Figure 5.5 Alabama Existing 2011 Plan

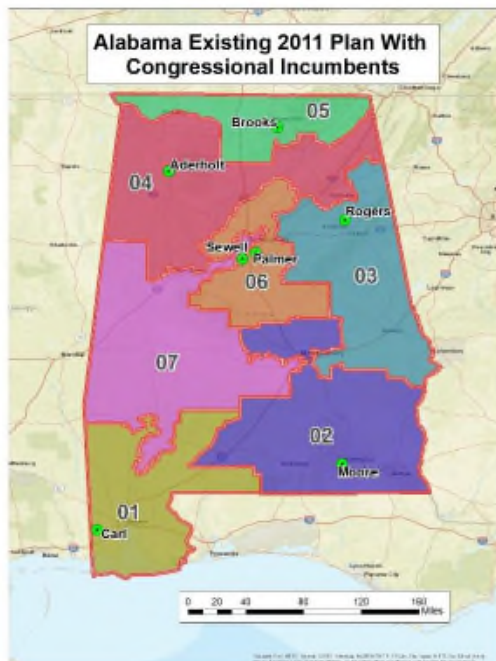
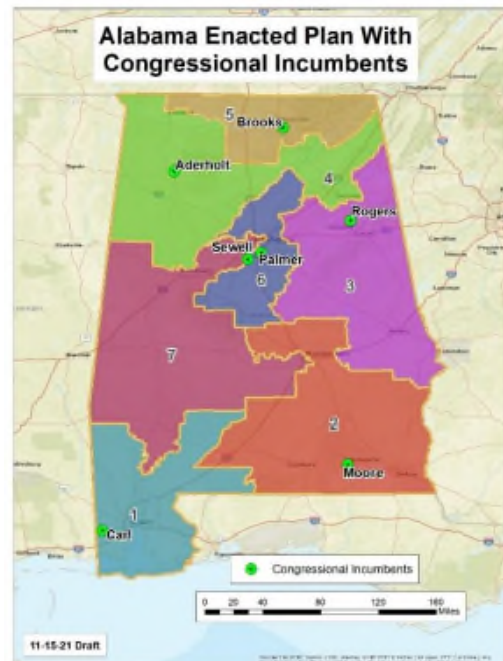


Figure 5.6 Alabama Enacted Plan



D. Compactness

Compactness of districts is a measure to ensure that districts do not excessively deviate from being “reasonably shaped” that is intended to deter gerrymandering. This of course is an enormously ambiguous and arbitrary description of what compactness actually is. Compactness was relatively easy to attain before “One Person One Vote”. However, with the development of both technology²² and redistricting law (especially *Baker v. Carr*, which led to splitting of geography as population deviations were driven lower) compactness became less and less possible. Today, while most compactness measures are absolute, they can still effectively serve as a tool compare one plan against another and to determine which is superior (even if multiple plans have poor compactness).²³ But what measure does an expert use? “To deter gerrymandering, many state constitutions require legislative districts to be “compact.” Yet, the law offers few precise definitions other than “you know it when you see it,” which effectively implies a common understanding of the concept. In contrast, academics have shown that compactness has multiple dimensions and have generated many conflicting measures”.²⁴ There is no professional consensus on a “right” measure, and every widely used measure works differently. A district that is “most compact” by one measure can easily and frequently be less compact by another. For this reason, we pick four of the most common statistical measures (Polsby-Popper, Schwartzberg, Reock and Convex Hull) - each of which has unique features, and strengths and weaknesses.²⁵ We then compare the compactness of each district of each plan individually and in aggregate.



²² The 1971 and 1981 Reapportionments used limited computer mapping for the first time. 1991 added significant geographic technology— Census Tiger Files— Geographic Information Systems.

²³ <https://www.ncsl.org/Documents/legismgt/Compactness-Hofeller.pdf>

²⁴ “How to Measure Legislative District Compactness If You Only Know it When You See it” <https://gking.harvard.edu/presentations/how-measure-legislative-district-compactness-if-you-only-know-it-when-you-see-it-7>

²⁵ The Polsby-Popper and Schwartzberg ratios place high importance on district perimeter. Thus, they are highly susceptible to bias due to shoreline complexity. Therefore, districts that are trimmed around shorelines may end up with a low compactness score through no fault of the district's authors and may not necessarily be a true indicator of gerrymandering. This is precisely why it's important to use multiple compactness scores (in this case the Polsby-Popper, Schwartzberg, Reock and Convex Hull measures) and let the reader judge which one is a better fit based on the geography of the district and method of calculation each score uses. A higher score means more compact, but the scores using different measures cannot be directly compared to each other. Source: https://cdn.azavea.com/com.redistrictingthenation/pdfs/Redistricting_The_Nation_Addendum.pdf

In Table 5.3 below we assess the State of Alabama compactness by district, by method. Within each method, the higher the score the better. Using District 5 as an example, it scores highest in Polsby-Popper, Schwartzberg and Convex Hull, but in fact performs the worst in Reock. This table enables us to assess the performance of individual districts across methods. This illustrates exactly why it is beneficial to look at multiple, highly regarded methods when performing compactness analysis. Since the values within each method are similar (but are in fact mathematically different) it is not possible to summarize accurately across plans. In order to compare the Alabama enacted plan with the plaintiff plan, we summarize the compactness scores by method.

In Table 5.3 we see the existing scores by district, by compactness measure. The scores shaded in green are the “best” in each measure, that is: most compact. The scores shaded in red are the poorest, that is: least compact. Not all districts are ranked the same in each measure, which is why we use multiple measures and examine each individually as well as in aggregate. The last column “Total” is simply a sum of the scores across plans for that district and is designed to provide a final summary ranking of the compactness of each district. The last row “Sum” is simply a sum of the scores for all districts in the plan for that measure. This is calculated to enable a summary comparison of metrics from one plan to another. A higher score in “Sum” means that by that measure, that plan is more compact. For this exercise, we interpret whichever plan has the majority of high scores to be the “more compact” plan. Table 5.3 is the compactness scores for the existing Alabama 116th congressional plan and serves as a basis for comparison.

Table 5.3 Alabama Existing (2011) 116th Plan Compactness Scores

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.16	0.40	0.42	0.71	1.70
2	0.22	0.47	0.49	0.74	1.93
3	0.22	0.47	0.36	0.73	1.79
4	0.18	0.43	0.36	0.62	1.59
5	0.29	0.53	0.22	0.77	1.82
6	0.14	0.37	0.43	0.69	1.63
7	0.13	0.36	0.38	0.62	1.49
Sum	1.34	3.04	2.66	4.90	

In Table 5.4 below the results pass the “eyeball test” that is: you can just look at District 2 and see that it has simple geometry. It has numerous straight segments and is compact in the sense it fits nicely in its circumscribing circle. But some details in the table are not intuitive. The districts with significant lengths of riparian boundaries tend to score poorly (and are hard to see from a statewide map). Smaller river segments have greater sinuosity, thus greater lengths. Districts 1, 4, 6, and 7 have long lengths of river boundaries. District 5 has numerous straight line segments but suffers from being elongated (that is, it fits poorly in a circle).

Table 5.4 Alabama 2021 Enacted Plan Compactness Scores

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.20	0.44	0.40	0.71	1.75
2	0.26	0.51	0.50	0.76	2.02
3	0.25	0.50	0.36	0.77	1.88
4	0.19	0.44	0.36	0.61	1.60
5	0.32	0.56	0.30	0.80	1.98
6	0.15	0.39	0.31	0.68	1.55
7	0.19	0.44	0.43	0.68	1.74
Sum	1.55	3.28	2.67	5.01	

In Table 5.4, we first note that by looking at the “Sum” row at the bottom - compactness scores are higher in each measure than the 2011 congressional plan. As expected, each method ranks each district differently. Polsby-Popper and Schwartzberg and Convex-Hull ranks D5 as being the best, while Reock ranks D2 highest. In looking at the last column “Total” we see that D2 actually prevails as the most compact district. My interpretation is that the highest ranking districts are comparable, but that D4, D6 and D7 are least compact – due in part to a significant amount of border being waterways at the Bankhead Lake intersection.

In Table 5.5, we see the compactness scores by district for the Hatcher proposed plan. In aggregate by method - all of the compactness scores are inferior not just to the HB1 plan but also the existing (2011) Alabama plan. Only D4 and D6 in the Hatcher plan outperform the Alabama existing 2011 plan – while the remaining five new Alabama districts outperform the Hatcher plan.

Table 5.5 Hatcher Plan Compactness Scores

District	Polsby-Popper	Schwartzberg	Reock	Convex_Hull	Total
1	0.14	0.38	0.20	0.57	1.29
2	0.15	0.39	0.27	0.69	1.51
3	0.18	0.43	0.27	0.72	1.60
4	0.19	0.44	0.43	0.71	1.76
5	0.26	0.51	0.20	0.82	1.79
6	0.14	0.37	0.41	0.71	1.63
7	0.14	0.38	0.27	0.63	1.42
Sum	1.20	2.89	2.06	4.85	

Conclusion

In my opinion as a demographer, the Hatcher plan is inferior not just to the existing 2011 plan but to the State's 2021 enacted plan in several ways. District 2 of the Hatcher plan shows evidence of racial gerrymandering in that the population was clearly separated by race in Mobile County (see Map Appendices 7, 11 P.44, 48). That split, and dividing parts of Mobile from Baldwin County, also disrupts a long-standing and important community of interest. District 7 in the Hatcher plan also shows evidence of racial gerrymandering in Jefferson County in that adjacent Black population from D6 was separated by race and packed into D7 (see Map Appendices 7, 9 P.44,46) while the Alabama enacted plan *unpacked* Black population in the same area.

The Hatcher plan performs more poorly than the 2021 enacted plan with respect to all traditional districting criteria. It splits communities of interest, splits counties unnecessarily, scores worse on core retention and compactness, and creates two pairs of incumbents in two districts. I see considerable evidence that D2 and D7 were drawn with race as the prevailing factor; and I do not see evidence of accommodating any traditional districting criteria that could explain the ways in which Mobile and Jefferson Counties are split in the Hatcher plan.

Appendix 1: Census 2020 Alabama Black Population Total, non-Hispanic and Hispanic Combinations (through 3 races, excluding 4-, 5- and 6-race Black combinations)

Race	Total (A)	% of Total (B)	AL non-Hisp (C)	% of Total (D)	AL Hispanic (E)	% of Total (F)
Total, Hispanic or Latino:	5,024,279		4,760,232		264,047	
Population of one race:	4,767,326	94.89%	4,575,614	91.07%	191,712	3.82%
Black or African American alone	1,296,162	25.80%	1,288,159	25.64%	8,003	0.16%
Population of two races:	243,473	4.85%	175,750	3.50%	67,723	1.35%
White; Black or African American	45,429	0.90%	43,911	0.87%	1,518	0.03%
Black or African American; American Indian and Alaska Native	6,301	0.13%	6,012	0.12%	289	0.01%
Black or African American; Asian	2,049	0.04%	1,939	0.04%	110	0.00%
Black or African American; Native Hawaiian and Other Pacific Islander	492	0.01%	456	0.01%	36	0.00%
Black or African American; Some Other Race	5,421	0.11%	2,983	0.06%	2,438	0.05%
Population of three races:	12,093	0.24%	8,085	0.16%	4,008	0.08%
White; Black or African American; American Indian and Alaska Native	4,493	0.09%	3,986	0.08%	507	0.01%
White; Black or African American; Asian	972	0.02%	899	0.02%	73	0.00%
White; Black or African American; Native Hawaiian and Other Pacific Islander	172	0.00%	165	0.00%	7	0.00%
White; Black or African American; Some Other Race	1,441	0.03%	573	0.01%	868	0.02%
Black or African American; American Indian and Alaska Native; Asian	124	0.00%	115	0.00%	9	0.00%
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander	13	0.00%	13	0.00%	0	0.00%
Black or African American; American Indian and Alaska Native; Some Other Race	146	0.00%	72	0.00%	74	0.00%
Black or African American; Asian; Native Hawaiian and Other Pacific Islander	145	0.00%	129	0.00%	16	0.00%
Black or African American; Asian; Some Other Race	86	0.00%	43	0.00%	43	0.00%
Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race	27	0.00%	20	0.00%	7	0.00%
Total "All Black"	1,364,736	27.2%	1,350,192	26.9%	14,544	0.3%

Appendix 2: Census 2020 Alabama Black Voting Age Population, non-Hispanic and Hispanic Combinations (through 3 races, excluding 4-, 5- and 6-race Black combinations)

Race	VAP (A)	% of VAP (B)	AL non-Hisp (C)	% of Total (D)	AL Hispanic (E)	% of Total (F)
Total:	3,917,166		3,750,310		166,856	
Population of one race:	3,751,169	95.76%	3,630,366	92.68%	120,803	3.08%
Black or African American alone	981,723	25.06%	976,732	24.93%	4,991	0.13%
Population of two races:	158,371	4.04%	114,790	2.93%	43,581	1.11%
White; Black or African American	18,106	0.46%	17,569	0.45%	537	0.01%
Black or African American; American Indian and Alaska Native	4,692	0.12%	4,530	0.12%	162	0.00%
Black or African American; Asian	1,130	0.03%	1,075	0.03%	55	0.00%
Black or African American; Native Hawaiian and Other Pacific Islander	262	0.01%	250	0.01%	12	0.00%
Black or African American; Some Other Race	3,470	0.09%	2,024	0.05%	1,446	0.04%
Population of three races:	6,741	0.17%	4,620	0.12%	2,121	0.05%
White; Black or African American; American Indian and Alaska Native	2,714	0.07%	2,452	0.06%	262	0.01%
White; Black or African American; Asian	325	0.01%	295	0.01%	30	0.00%
White; Black or African American; Native Hawaiian and Other Pacific Islander	75	0.00%	69	0.00%	6	0.00%
White; Black or African American; Some Other Race	721	0.02%	344	0.01%	377	0.01%
Black or African American; American Indian and Alaska Native; Asian	80	0.00%	73	0.00%	7	0.00%
Black or African American; American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander	12	0.00%	12	0.00%	0	0.00%
Black or African American; American Indian and Alaska Native; Some Other Race	103	0.00%	55	0.00%	48	0.00%
Black or African American; Asian; Native Hawaiian and Other Pacific Islander	82	0.00%	76	0.00%	6	0.00%
Black or African American; Asian; Some Other Race	51	0.00%	31	0.00%	20	0.00%
Black or African American; Native Hawaiian and Other Pacific Islander; Some Other Race	14	0.00%	11	0.00%	3	0.00%
	1,014,372	25.9%	1,006,083	25.7%	8,289	0.2%

Appendix 3 Compactness Measures

Polsby-Popper

The Polsby-Popper (PP) measure (Polsby & Popper, 1991) is the ratio of the area of the district (A_D) to the area of a circle whose circumference is equal to the perimeter of the district (P_D). A district's Polsby-Popper score falls with the range of $[0, 1]$ and a score closer to 1 indicates a more compact district.

$$PP = \frac{4\pi}{P_D^2} \times A_D$$



Circumference Equal to District Perimeter

Schwartzberg

The Schwartzberg score (S) compactness score is the ratio of the perimeter of the district (P_D) to the circumference of a circle whose area is equal to the area of the district. A district's Schwartzberg score as calculated below falls with the range of $[0, 1]$ and a score closer to 1 indicates a more compact district.

$$S = \frac{1}{P_D/C} = \frac{1}{P_D/(2\pi\sqrt{A_D/\pi})}$$



Circle with Area Equivalent to the District

Source: <https://fisherzachary.github.io/public/r-output.html>

Appendix 3 Compactness Measures (continued)

Reock Score

The Reock Score (R) is the ratio of the area of the district (A_D) to the area of a minimum bounding circle (A_{MBC}) that encloses the district's geometry. A district's Reock score falls within the range of $[0, 1]$ and a score closer to 1 indicates a more compact district.

$$R = \frac{A_D}{A_{MBC}}$$



Minimum Bounding Circle of Original Gerrymander

Convex Hull

The Convex Hull score is a ratio of the area of the district to the area of the minimum convex polygon that can enclose the district's geometry. A district's Convex Hull score falls within the range of $[0, 1]$ and a score closer to 1 indicates a more compact district.

$$CH = \frac{A_D}{A_{MCP}}$$

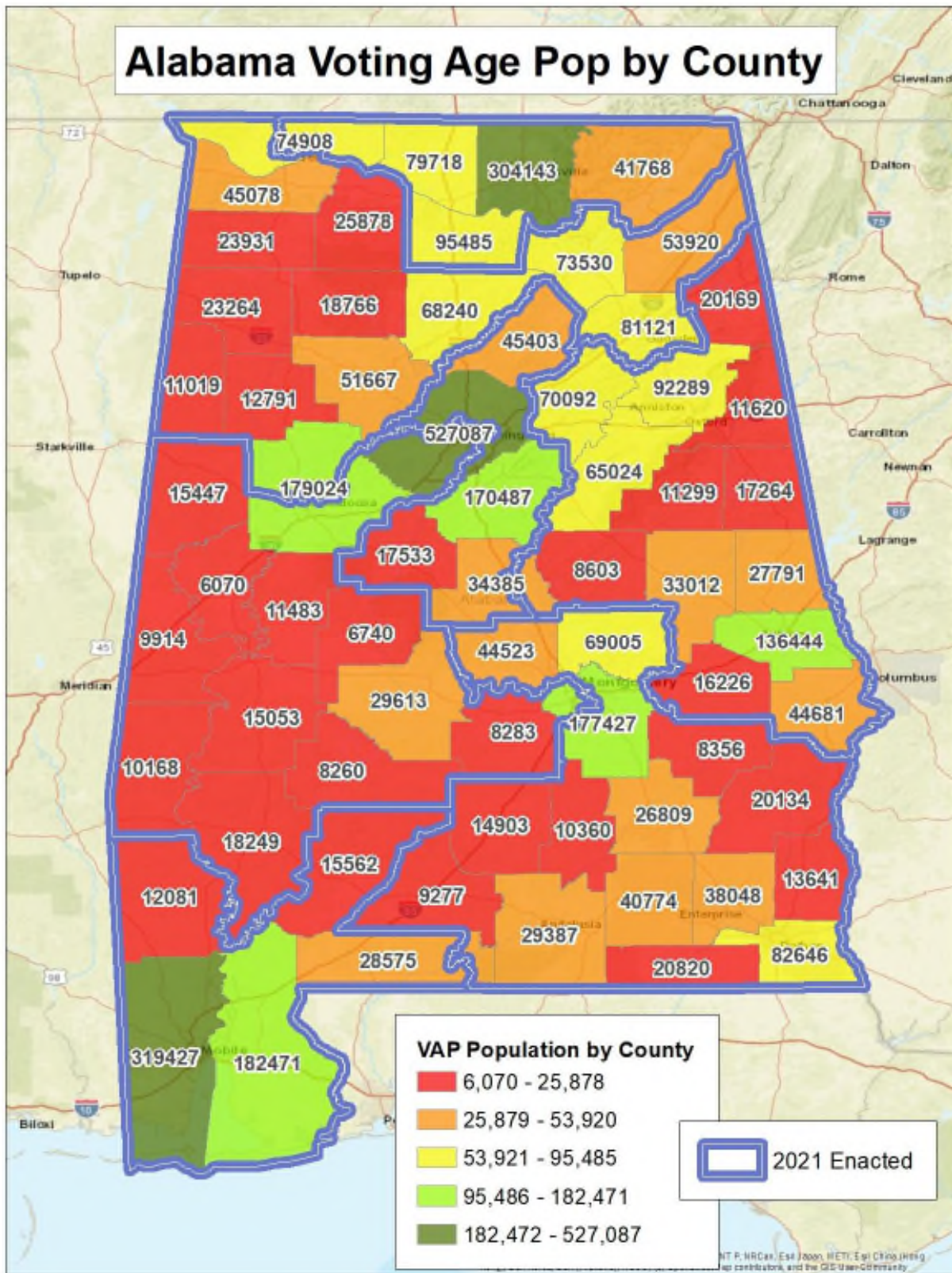


Convex Hull of Original Gerrymander

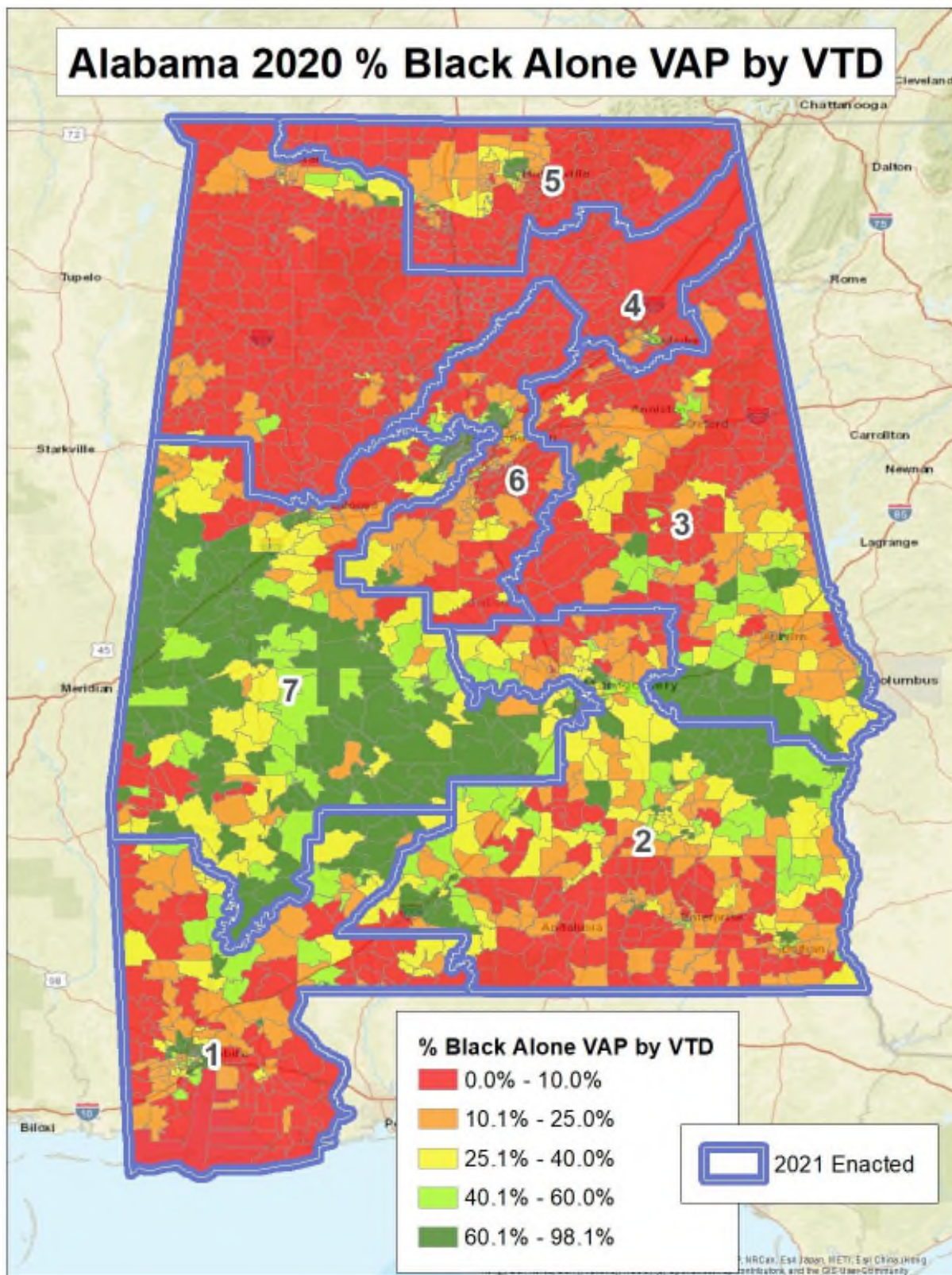
Map Appendices

**Alabama Enacted Plan
Map Appendices
% Black Alone and VAP
By County and VTD**

Thomas M. Bryan Alabama *Milligan* and *Caster* Demographers Report P.38 12/10/2021

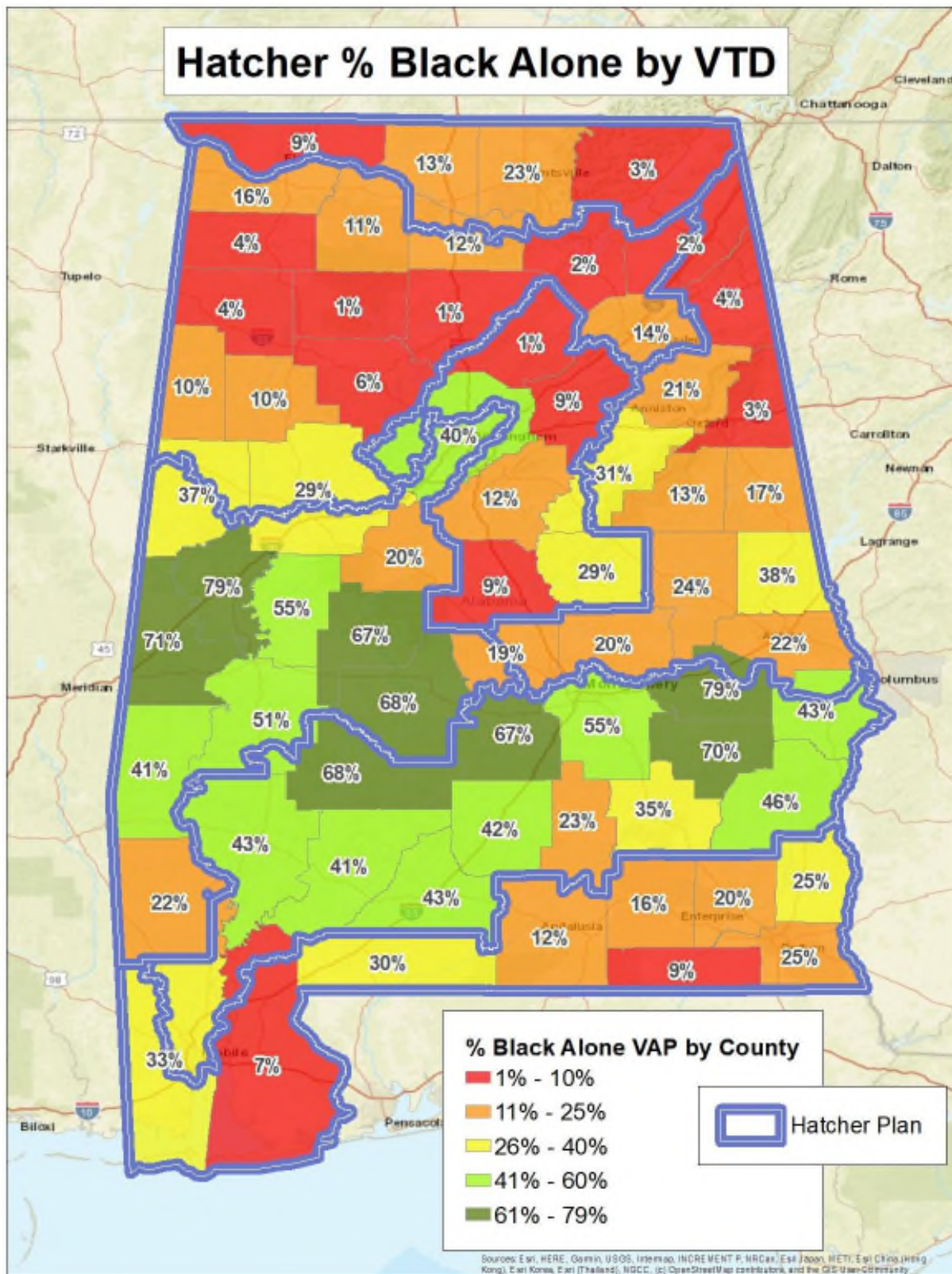


Map Appendix 3 (State of Alabama Enacted Plan Percent Black Alone VAP by VTD)

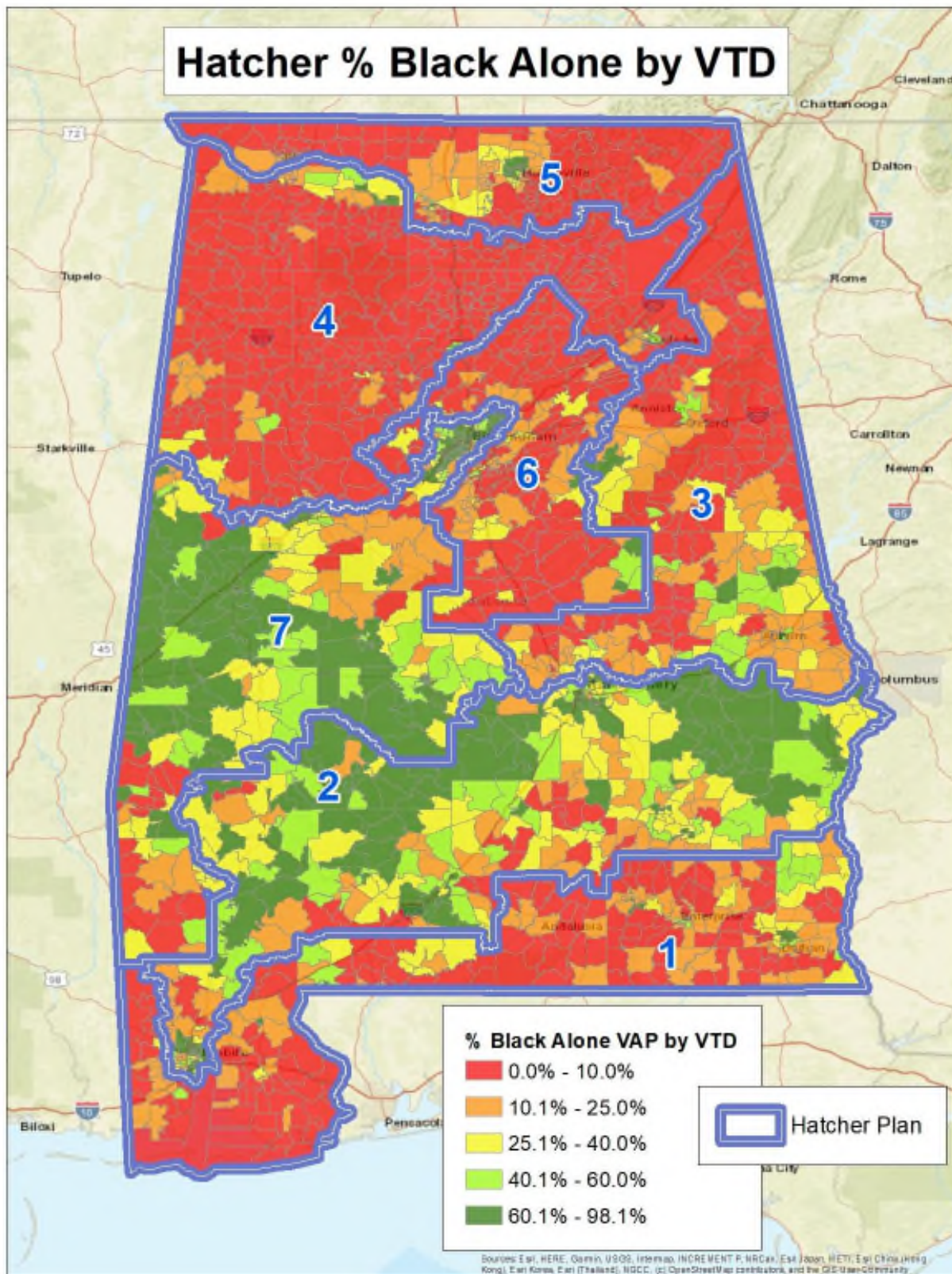


**Hatcher Plan
Map Appendices
% Black Alone and VAP
By County and VTD**

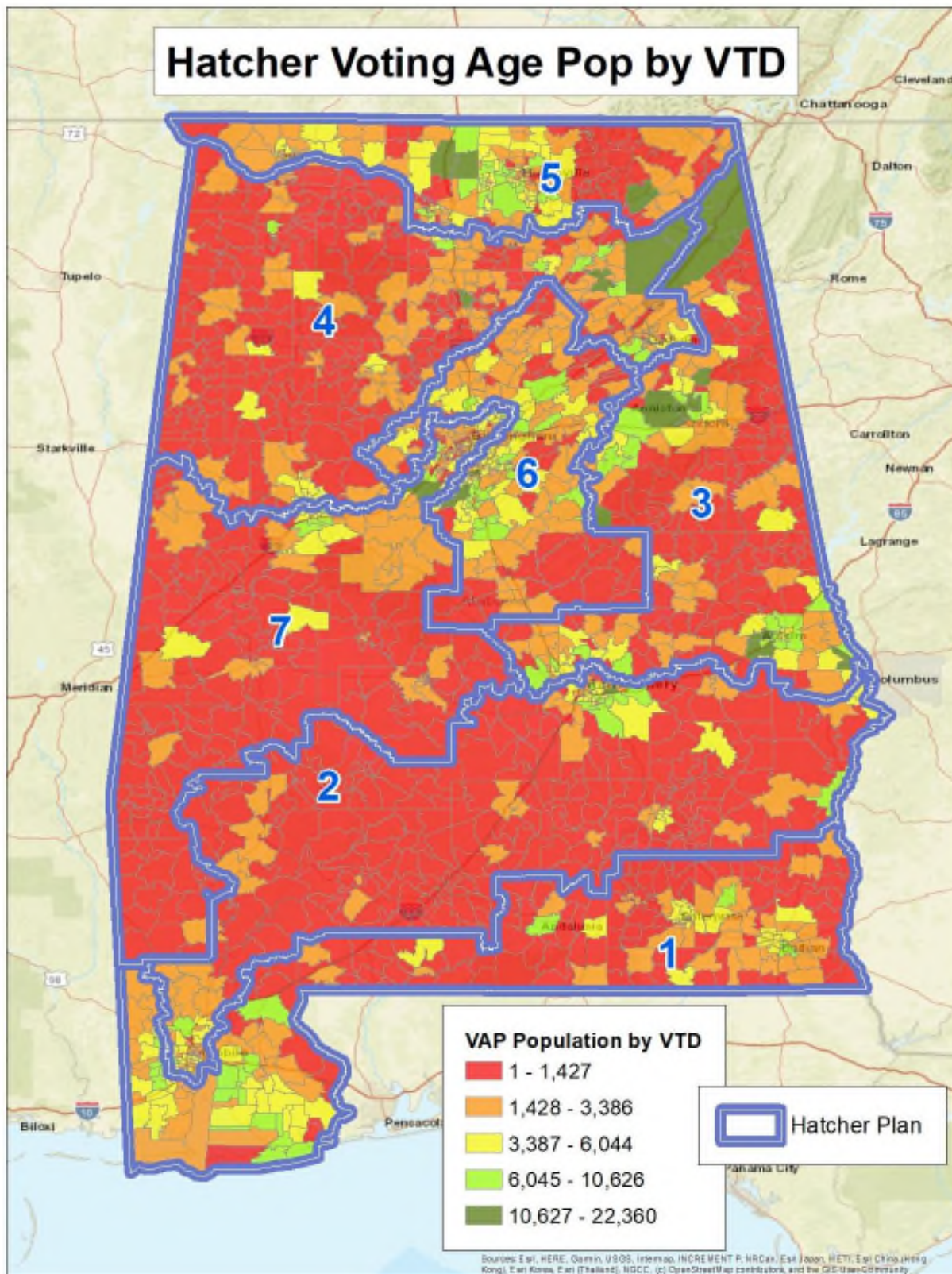
Map Appendix 5 (Hatcher Percent Black Alone VAP by County)



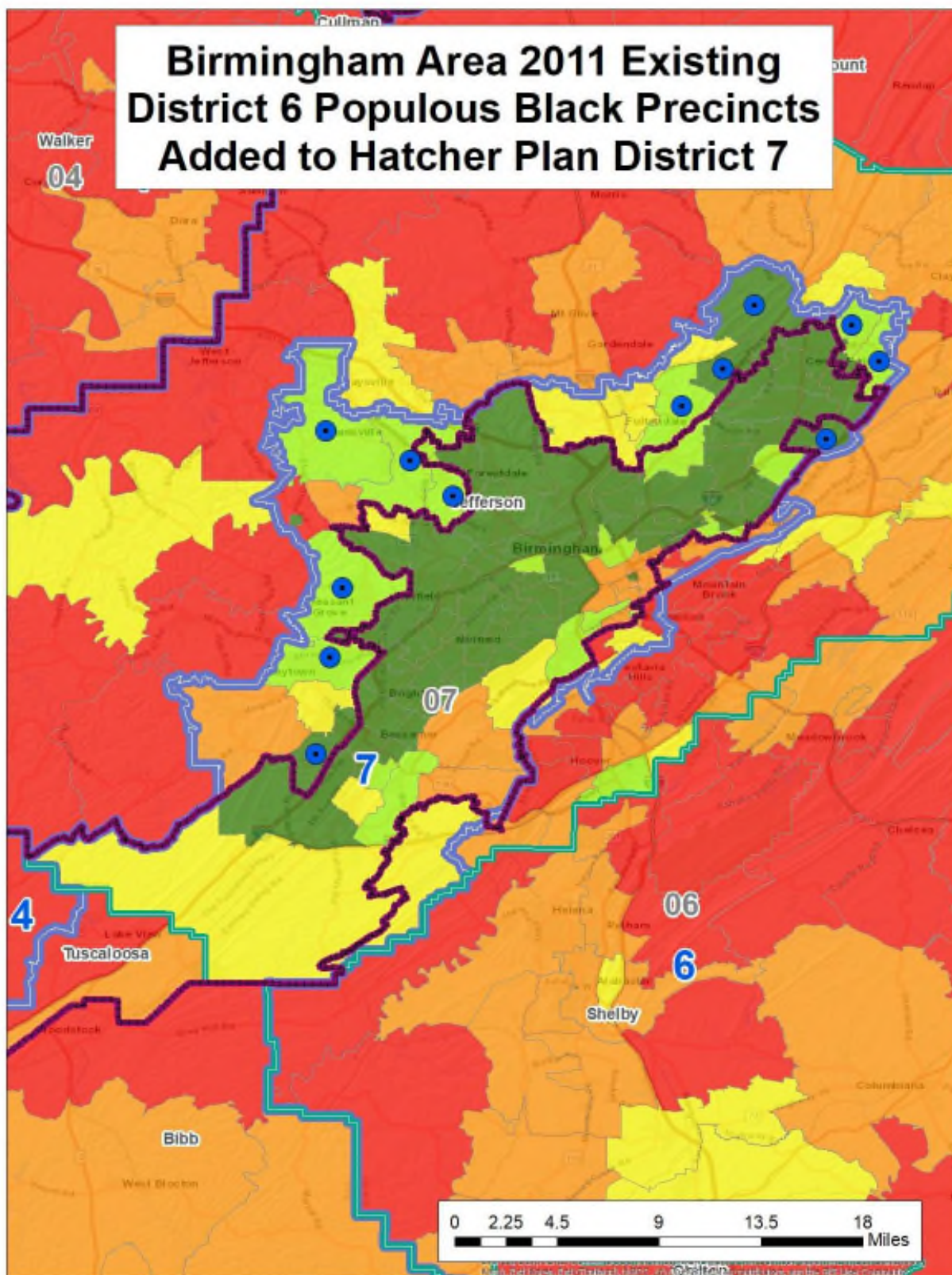
Map Appendix 7 (Hatcher Percent Black Alone VAP by VTD)



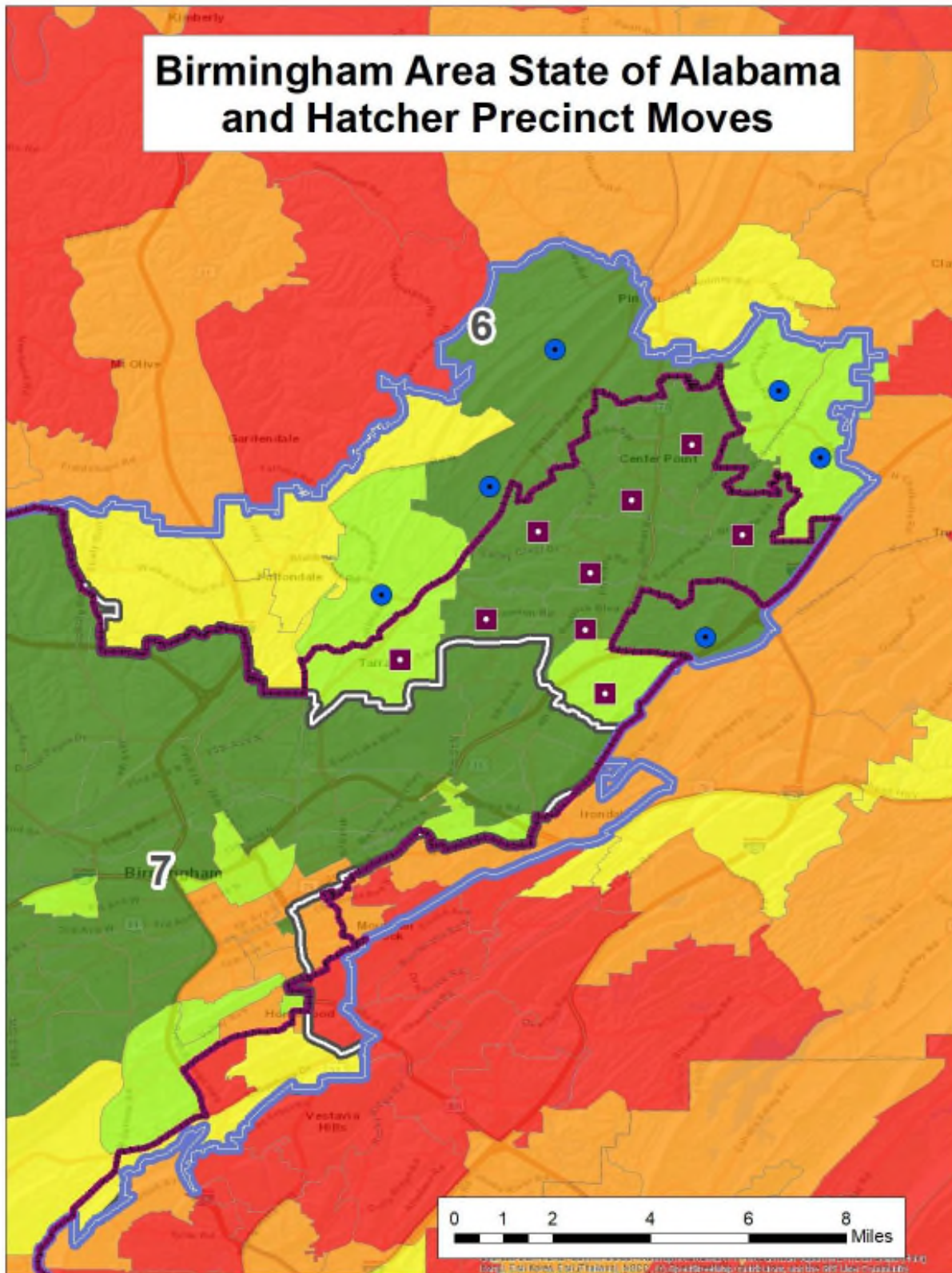
Map Appendix 8 (Hatcher Voting Age Population VAP by VTD)



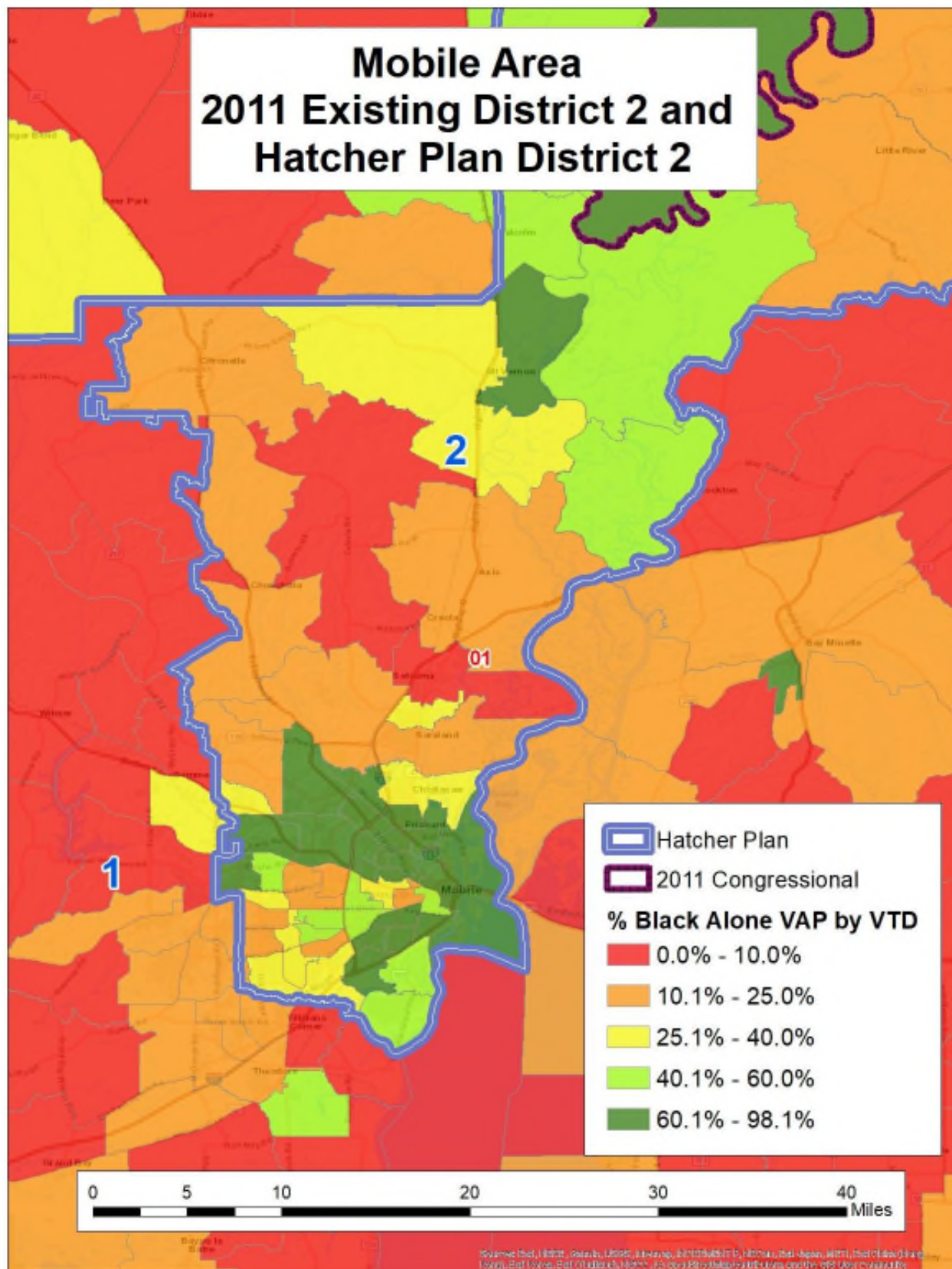
Map Appendix 9 (D6 to D7 Moves of Populous Black VTDs in Hatcher Plan – marked with dots)



Map Appendix 10 (D6 to D7 Moves of Populous Black VTDs in Hatcher Plan – marked with dots, D7 to D6 Moves of Populous Black VTDs in Alabama Enacted Plan marked with squares)



Map Appendix 11 (D2 Division of Mobile in Hatcher Plan)



Map Appendix 12 (State of Alabama Proposed Plan)

