

Rebuttal

Expert Demographic Report of Thomas M. Bryan

Christian Ministerial Alliance

v.

State of Arkansas

September 23, 2024



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1. I, Thomas M. Bryan, affirm the conclusions I express in this report and that these opinions are provided to a reasonable degree of professional certainty.

I. SUMMARY AND OPINIONS

2. My assignment in this case was to assess the report Plaintiffs’ demographic expert William Cooper. Mr. Cooper states (Cooper Report, ¶ 9 Section B) that attorneys for the Plaintiffs asked him to offer his expert opinion on:

- a. demographic information against the backdrop of the congressional district map passed by the Arkansas General Assembly (the “Legislature”) on October 7, 2021 (the “Enacted Plan”), including with a specific focus on the composition of one of the Enacted 4 Plan’s four single-member districts, Congressional District 2 (“CD” 2);

- b. the splitting of the central and southeast portion of Pulaski County, where the Black population is concentrated among CDs 1, 2, and 4 in the Enacted Plan; and

- c. whether splitting the central and southeast portion of Pulaski County among CDs 1, 2, and 4 was necessary to create a plan that: (1) equalizes population across the four congressional districts, (2) adheres to other traditional redistricting principles, including keeping the political boundaries of Pulaski County and other communities of interest whole, and/or (3) achieves the Enacted Plan’s level of partisan effect.

3. Since the demographic information against the backdrop of the congressional district map passed by the Arkansas General Assembly and the splitting of Pulaski County have already been reviewed in my original report, I focus this report on Cooper’s **Section B** part c. In the original complaint, Plaintiffs stated that “Other plans could have fulfilled partisan goals without singling out Black voters to such a degree.” (Am. Compl. ¶ 22).¹ But they did not provide any illustrative maps that demonstrated this was possible. In the recent *Alexander v. S.C. State Conf. of the NAACP* decision, the court stated²:

“In addition to all this, the District Court also critically erred by failing to draw an adverse inference against the Challengers for not providing a substitute map that shows how the State “could have achieved its legitimate political objectives” in District 1 while producing “significantly greater racial balance.”

And

¹ See also Plaintiffs’ Opposition to Defendant’s Motion to Dismiss Amended Complaint P.31: “the Complaint also alleges that other plans could have fulfilled partisan goals without singling out and harming Black voters this way. (¶¶ 22, 25, 116, 188-91).”

² *Alexander v. S.C. State Conf. of the NAACP*, 144 S. Ct. 1221 (2024), see https://www.supremecourt.gov/opinions/23pdf/22-807_3e04.pdf p. 22

“we have said that when all plaintiffs can muster is “meager direct evidence of a racial gerrymander” “only [an alternative] ma[p] of that kind” can “carry the day.””

4. Acknowledging this, I generated two alternatives (BGD1 and BGD2) in my original report to test whether an alternative map was possible that would have fulfilled partisan goals in D2 while still meeting other traditional redistricting criteria. I presented several maps (see Bryan Report, **Figure VIII.B.2** for example) to show that Democrats (of any race) are heavily concentrated in SE Pulaski County, and that any partisan draw would by necessity need to be focused there. I showed that two other reasonable plans (which moved little to none of SE Pulaski) did *not* begin to fulfill partisan goals – let alone meet or exceed the other traditional redistricting criteria from the 2011 Enacted Plan. In my report, I concluded that the 2021 Enacted Plan performed well across the traditional redistricting principles of geographic splits, compactness and core retention – and that the only way the partisan performance of D2 could be significantly improved would be through splitting SE Pulaski County. In my analysis, I showed that Pulaski County could have been split even moreso to achieve even greater partisan gains – but was not.
5. In his report, Mr. Cooper presents his own two alternative plans. One (Alt1) is a statewide plan, whose D2 is very similar to my BGD2 plan (which I drew for D2 alone) and the whole-county plan presented by Nelda Speaks (see Bryan Report **Appendix G.1**). Cooper states “Alternative Plan 1 is a “least change plan” that prioritizes core retention without splitting Pulaski County.” (Cooper Report ¶ 66). Cooper’s other alternative plan (Alt2) is a radical departure from any map I reviewed that was considered by the Arkansas Legislature – and represents a significant reconfiguration of the existing 2011 Enacted Plan. Cooper states “Alternative Plan 2 demonstrates that, even if the legislature prioritized partisan goals over traditional redistricting criteria, splitting Pulaski County was still unnecessary.” (Cooper Report ¶ 70). I test these two plans to assess their features and determine whether the Plaintiffs were correct in stating that “Other plans could have fulfilled partisan goals without singling out Black voters to such a degree” (Am. Compl. ¶ 22).
6. Mr. Cooper’s report also presents a series of hypothetical maps that compare what Arkansas *could have* been in order to maximize the percent Black in a district in past rounds of redistricting. I do not assess the array of “hypothetical” plans he creates (or the conclusions he draws from them). Each of the hypothetical draws is an entirely new plan without any regard for existing districts. This is reflected in their low core retention scores (see Cooper’s **Figure 7** showing 73.5% core retention). Cooper’s conclusion that the “cracking” in the [2021] Enacted Plan is “an order of magnitude more severe than the 2 point BVAP cut to the Benchmark Plan” (Cooper Report, ¶ 32), based on an observation that the 2021 Enacted Plan’s BVAP is 20.3 percentage points different from a plan that never existed more than twenty years ago is a false narrative. If the hypothetical plan actually *had* been in place twenty years ago, there is virtually no chance the 2021 Enacted Plan would look like it does today. It is

counterfactual to state that “the “cracking” in the [2021] Enacted Plan is “an order of magnitude more severe” when the plan that is his basis of comparison (in 2000) never actually existed. Therefore, I focus on Mr. Cooper’s Alt1 and Alt2 maps, and his interpretations and conclusions based on them.

7. In this report, enacted and alternative plans are demographically assessed using total population, voting age (VAP) and citizen voting age population (CVAP) – because each metric provides a unique and valuable view of the demographic characteristics of the state. Within these metrics, I assess the total, white, non-Hispanic (WNH), Any Part Black (APB) and Hispanic populations.³ I find:

- the Cooper Alt1 map *decreases* the number of APB in D2 by -167, but increases the %APB for total, VAP and CVAP by +0.5 percentage points for D2 compared to the 2011 Enacted Plan (see [Table IV.B.2](#) – also comparable to BGD2).
- the Cooper Alt2 map *decreases* the number of APB in D2 by -7,642, and *decreases* the %APB for total, VAP and CVAP by -0.4 to -0.5 percentage points for D2 compared to the 2011 Enacted Plan (see [Table IV.B.2](#)).

8. I assess the geographic compactness of Cooper’s plans (see [Section 5 Geographic Compactness](#)). By comparing the actual compactness values under a variety of most-used compactness values by district – and their values on average for the plan as a whole⁴, I find:

Under the Alt1 plan:

- D2’s compactness is similar to the 2011 Enacted Plan, but not as good as under the 2021 Enacted Plan.
- Overall compactness is an improvement over the 2011 Enacted Plan because of the significant improvement in D3 – and is comparable to the 2021 Enacted Plan.

Under the Alt 2 plan:

- D2’s compactness is also similar to the 2011 Enacted Plan, but not as good as under the 2021 Enacted Plan.
- Overall compactness is comparable to the 2011 Enacted Plan, which is worse than both Alt1 and the 2021 Enacted Plan.

³ Note, my tables do not include other races such as Asian, American Indian and Alaska Natives, Native Hawaiian and Pacific Islander and other. APB includes a relatively small number of Blacks or African Americans who are Hispanic, thus there is some double counting between APB and Hispanics.

⁴ I do not include the “Composite Compactness Measure” presented by Mr. Cooper from his source “Dave’s Redistricting” because there is no documentation of this source and the statistical relationship of values it yields other than “higher = better” (See Cooper fn. 12).

9. Cooper acknowledges that Alt2's compactness is inferior to the 2021 Enacted Plan – but that the Enacted Plan is still “within the norm based on widely used compactness measures” (Cooper, ¶ 2). Cooper does not provide sources or a statistical defense of what he means by “within the norm” so I assessed their differences statistically. When assessing the plans by their national ranking among all congressional districts, I find that the 2021 Enacted Plan's compactness ranks at approximately the first quartile of all districts. By comparison, Cooper's Alt2 plan's compactness ranks at the midpoint of the national distribution – a drop of approximately 100 places and an entire quartile lower than the 2021 Enacted Plan (see [Table V.E.7](#)).
10. Next, I perform a Differential Core Retention Analysis (DCRA) – examining overall core retention as well as by race and ethnicity. In Cooper's report, he characterizes the Alt1 plan as “a “least change plan” that prioritizes core retention without splitting Pulaski County.” (Cooper Report ¶ 66). The Alt2 plan represents a significant reconfiguration – and was not expected to have strong core retentions.
11. I find the core retention for Cooper Alt1 is *worse* than the 2021 Enacted Plan (see Cooper Exhibits G-8 and H8⁵) which was criticized by Plaintiffs for moving more people than were minimally necessary “in order to comply with the equal-population requirements of the Constitution.” (Am. Compl. ¶ 55). My analysis shows that the 2021 Enacted Plan moves a total of 234,113 people (see [Appendix B.1](#)) while the Alt1 plan moves 374,187 people (see [Appendix B.2](#)). The Alt1 plan moves virtually no APB out of D2, but moves -11,157 APB out of D1, -13,365 APB out of D3 and -38,990 APB out of D4. In total, Alt1 moves -63,717 APB out of their existing districts, while the 2021 Enacted Plan only moves -27,093 – or less than half as many APB. The core retention of Alt1's D1 and D2 are in fact “least change” but are offset by very large changes and corresponding very low core retention in D3 and D4. I conclude that with 92.2% core retention the 2021 Enacted Plan is a much stronger overall “least change” plan than Cooper's Alt1 “least change” plan with only 87.6% core retention.
12. As expected, Cooper's Alt2 plan has much worse core retention (see [Appendix B.3](#)) than either the 2021 Enacted or Alt1 plans. The Alt2 plan moves -6,738 APB out of D1, -14,380 APB out of D2 (or nearly as many as the 2021 Enacted Plan did), -3,224 APB out of D3 and -66,212 APB out of D4 (or nearly half of the APB population there). Virtually all of that change is driven by the movement of nearly all of Jefferson, and all of Cleveland, Calhoun, Bradley, Drew, Lincoln and Ashley counties from D1 in the 2011 Enacted Plan to D4 in Alt2 (see [Figure VI.1](#)). Not only does the Alt2 plan reduce the number of APB in D2 (which is one of

⁵ Note that Cooper's source for core retention (Maptitude) calculates core retention as the number and percent of people in the current district who were in the same district previously. BGD calculates core retention as the number and percent of people in the previous district who remain in the current district. Neither analysis is right or wrong, and the same overall conclusions will be reached with either method.

the Plaintiffs’ claimed problem with the 2021 Enacted Plan) – but it also breaks the continuity of representation for nearly half of the APB in D4 in the process.

13. Last, I perform a political performance analysis using the 2022 election. I find that the political performance of Republicans in D2 under Cooper’s Alt1 plan would be worse for Republicans in all of the major 2022 races than the 2011 Enacted Plan, and significantly worse than the 2021 Enacted Plan (see [Table VII.A.1](#)). The political performance of Republicans in D2 under Cooper’s Alt2 plan would be slightly better for Republicans in all of the major 2022 races than the 2011 Enacted Plan, but still worse than the 2021 Enacted Plan.
14. In conclusion - of the Alt1 plan, Cooper states “Alternative Plan 1 is drawn for the purposes of my report in this lawsuit, from what I understand to be the relevant criteria, and adheres to traditional redistricting principles to the same extent as, if not to a greater extent than, the Enacted Plan.” (Cooper Report ¶ 10). In fact, while the Alt1 (least change) plan slightly increases the %APB in D2 over the 2011 Enacted Plan and has comparable compactness to the 2021 Enacted Plan, it has worse core retention than the 2021 Enacted Plan. It has worse political performance for Republicans than the 2011 Enacted plan, and much worse political performance than the 2021 Enacted Plan. That is – the plan would have been politically regressive and thus would be a non-starter in a map-drawing process controlled by a Republican-led legislature. Thus, Alt1 is not a plan that demonstrates superior performance in each traditional redistricting criteria, nor does it illustrate that comparable political performance could have been achieved some other way than dividing Pulaski County.
15. In describing his draw of the Alt2 plan, Cooper describes his adherence to traditional redistricting principles differently than the Alt1 plan. Of the Alt1 Plan, Cooper states “adheres to traditional redistricting principles to the same extent as, if not to a greater extent than, the Enacted Plan.” While of the Alt2 Plan he states that he “maintains the partisan tilt in the Enacted Plan without splitting Pulaski County, while still adhering to traditional redistricting principles. This is an important difference. The Alt1 Plan appears to have been drawn prioritizing traditional redistricting principles, while Alt2 was drawn to prioritize political performance, while simply adhering to traditional redistricting principles (without regard for their relationship to the 2021 Enacted Plan). In order for a competitive alternative plan to be fairly compared to the 2021 Enacted Plan – it would have to achieve the goals of both Alt1 and Alt2 within the same plan. What I find is that neither the Alt1 or Alt2 plans achieve individually what Cooper claims – let alone together in one plan that would be competitive with the 2021 Enacted Plan.
16. While Cooper later compares the traditional redistricting performance of the 2021 Enacted Plan and Alt2 side by side (**Figure 28**) – all that his own data show are some improvements in the number of splits, but that Alt2 has worse compactness, a larger (worse) population deviation and much worse core retention. My analysis corroborates his compactness and core

retention findings and challenges any assertion that Alt2 could have been considered on traditional redistricting criteria – let alone its political performance. Which I examined next.

17. Of his Alt2 plan, Cooper makes multiple claims about political performance, which are in conflict. Cooper separately states:

- “Alternative Plan 2 demonstrates the split of Pulaski County was not necessary to maintain the same partisan advantage as is reflected in the Enacted Plan.” (Cooper Report, ¶ 10 Section d.ii)
then
- “[Alt2] maintains the partisan tilt in the Enacted Plan without splitting Pulaski County, while still adhering to traditional redistricting principles.” (Cooper Report, ¶ 10 Section d.ii).

These two statements are fundamentally different. The first statement suggests that the Alt2 has “the same political advantage” as the 2021 Enacted Plan, while the second statement asserts the Alt2 plan “maintains the partisan tilt” – which could be interpreted as any partisan benefit between the 2011 and 2021 Enacted plans. Later, Cooper states:

- “Alternative Plan 2 also achieves the same or superior partisan outcomes as in the Enacted Plan.” (Cooper Report, ¶ 65 *Section VI*)

This statement is an enhancement of Cooper’s first statement that Alt2 “maintains the same partisan advantage as is reflected in the Enacted Plan” suggesting that the reader should expect even better partisan performance under his Alt 2 plan.

18. Among this variety of claims, I find that only the second (“[Alt2] maintains the partisan tilt...”) to be somewhat true. District 2 already had a “partisan tilt” for Republicans under the 2011 Enacted Plan (see [Figure VII.A.2](#)), and this has been increased to “safe / solid” under the 2021 Enacted Plan see [Figure VII.A.3](#).. While Alt2’s political performance is improved over the 2011 Enacted Plan – it remains worse than the 2021 Enacted Plan by about half (see [Table VII.A.2](#) showing ~2 percentage points of gain under the 2021 Enacted Plan compared to ~1 percentage points of gain under the Alt2 Plan). Cooper’s Alt2 does *not* “maintain the same partisan advantage as is reflected in the Enacted plan” let alone “achieves the same or superior partisan outcomes as in the Enacted Plan.”.

19. Cooper claims “The two alternative plans (Alternative Plan 1 and Alternative Plan 2) presented in this section are drawn to demonstrate different plan configurations that would keep Pulaski County intact and entirely within CD 2, with overall superior traditional redistricting metrics as compared to the Enacted Plan.”. Neither alternative plan achieves the overall performance Mr. Cooper claims. Each plan performs comparably, or worse than the 2021 Enacted Plan by a variety of traditional redistricting criteria – and neither results in a partisan outcome that approaches that of the 2021 Enacted Plan.

II. REPORT OVERVIEW

20. [Section III](#), provides an overview of the Cooper Report on *CMA v. Arkansas*
21. [Section IV](#), provides major demographic concepts and the demographics each plan.
22. [Section V](#), provides an analysis of the compactness of each plan.
23. [Section VI](#), provides a differential core retention analysis (or “DCRA”).
24. [Section VII](#), provides an assessment of political performance of the 2022 elections.
25. [Section VIII](#), provides conclusions
26. [Section IX](#), provides references.
27. [Section X](#), provides appendices.
28. In forming my opinions, I have considered all materials cited in my original report as well as William Cooper’s Expert Report.
29. I reserve the right to further supplement my report and opinions.

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III. Cooper Report on CMA v. Arkansas

30. I received a copy of Mr. Cooper's expert report on September 16, 2024. Here I present my initial impressions, as well as Figures demonstrating Cooper's Alt1 and Alt2 plans compared to the 2011 and 2021 Enacted plan for reference.

A. Errors and Inconsistencies

31. In reviewing Mr. Cooper's report, I first observed several items which appeared to be errors and inconsistencies, as follows:

- In **Figure 2** of his report, Mr. Cooper reports Arkansas's 2020 total population as 3,013,544. It is in fact 3,011,524.⁶ This value is reported on every US Census Bureau page referencing the 2020 Census and Arkansas and is also the value arrived at by summing individual district values from figures throughout Cooper's own report (see **Figure 6, Figure 14, Figure 20, Figure 24** and **Figure 27**) for example.

Figure 2: Arkansas – 1990-2020 Population by Race and Ethnicity⁴

	1990 Number	Percent	2000 Number	Percent	2010 Number	Percent	2020 Number	Percent	Total Pop Change from 1990 to 2020
Total Population	2,350,725	100.00%	2,673,400	100.00%	2,915,918	100.00%	3,013,544	100.00%	662,819
NH white	1,933,08	82.23%	2,100,135	78.56%	2,173,469	74.54%	2,063,550	68.48%	130,468
Minority Subtotal	406,528	17.78%	573,265	21.44%	742,449	25.46%	949,994	31.52%	543,466
Latino	19,876	0.85%	86,866	3.25%	186,050	6.38%	256,847	8.52%	236,971
Any Part Black	373,912	15.91%	427,152	15.98%	468,710	16.07%	495,968	16.46%	122,056

- This error is repeated in Figure 10.

Figure 10: Arkansas – 2010 and 2020 Population by Race and Ethnicity⁹

	2010 Number	Percent	2010 Number	Percent	2020 Number	Percent	2010-2020 Change	2010-2020 % Change
Total Population	2,915,918	100.00%	2,915,918	100.00%	3,013,544	100.00%	97,626	3.35%
NH white	2,173,469	74.54%	2,173,469	74.54%	2,063,550	68.48%	-109,919	-5.06%
Minority Subtotal	742,449	25.46%	742,449	25.46%	949,994	31.52%	207,545	27.95%
Latino	186,050	6.38%	186,050	6.38%	256,847	8.52%	70,797	38.05%
Any Part Black	468,710	16.07%	468,710	16.07%	495,968	16.46%	27,258	5.82%

- I am unable to find a source or explanation for the 3,013,544 value. As a consequence, Cooper's reported 2010-2020 numeric change and percent change are also incorrect.
- In **Figure 7**, Cooper reports the number of geographic splits for the 2011 and 2021 Enacted Plans. Cooper reports 5 "Split Municipalities" in 2011 resulting in 10 "Municipal Splits", but 12 "Split Municipalities" in 2021, resulting in only 6 "Municipal Splits". In theory, if a municipality is split, there must be more pieces than

⁶<https://www.census.gov/library/stories/state-by-state/arkansas-population-change-between-census-decade.html>

the number of municipalities. However, Mr. Cooper reports *fewer* municipal split pieces.

Figure 7: Redistricting Metrics – Benchmark and Enacted vs. Hypothetical⁶

Metric	2011 Benchmark	2021 Enacted	Hypothetical Plan
Total Split Counties*	5	2	1
Total County Splits*	10	5	2
VTD Splits*	1	0	0
Split Municipalities*	5	12	2
Municipal Splits*	10	6	4
Core-based Statistical Area splits*	13	11	9
Unified School District splits*	100	84	57
One-person, one-vote (deviation)*	20.26%	0.09%	0.27%
DRA Compactness higher=better) #	41	59	61
Core Retention	NA	92.16%	73.5%
Incumbent Conflicts	0	0	0
CD 2 BVAP	22.64%	20.33%	38.80%

- In referring to Cooper’s own *Exhibit J-1*, which he provides the table directly from Maptitude shows 6 “Split Municipalities” in 2021, resulting in 12 “Municipal Splits”. I conclude that Mr. Cooper’s Figure 7 was copied incorrectly from the Maptitude report and is in error. The Maptitude estimates of split municipalities (below) match the BGD estimates exactly. I conclude that the Maptitude data are correct, but Mr. Cooper’s entry of those data into his report are not.

Metric	2011 Benchmark	2021 Enacted
Total Split Counties*	5	2
Total County Splits*	10	5
VTD Splits*	1	0
Split Municipalities*	5	6
Municipal Splits*	10	12

Source: Cooper *Exhibit J-1* / Maptitude

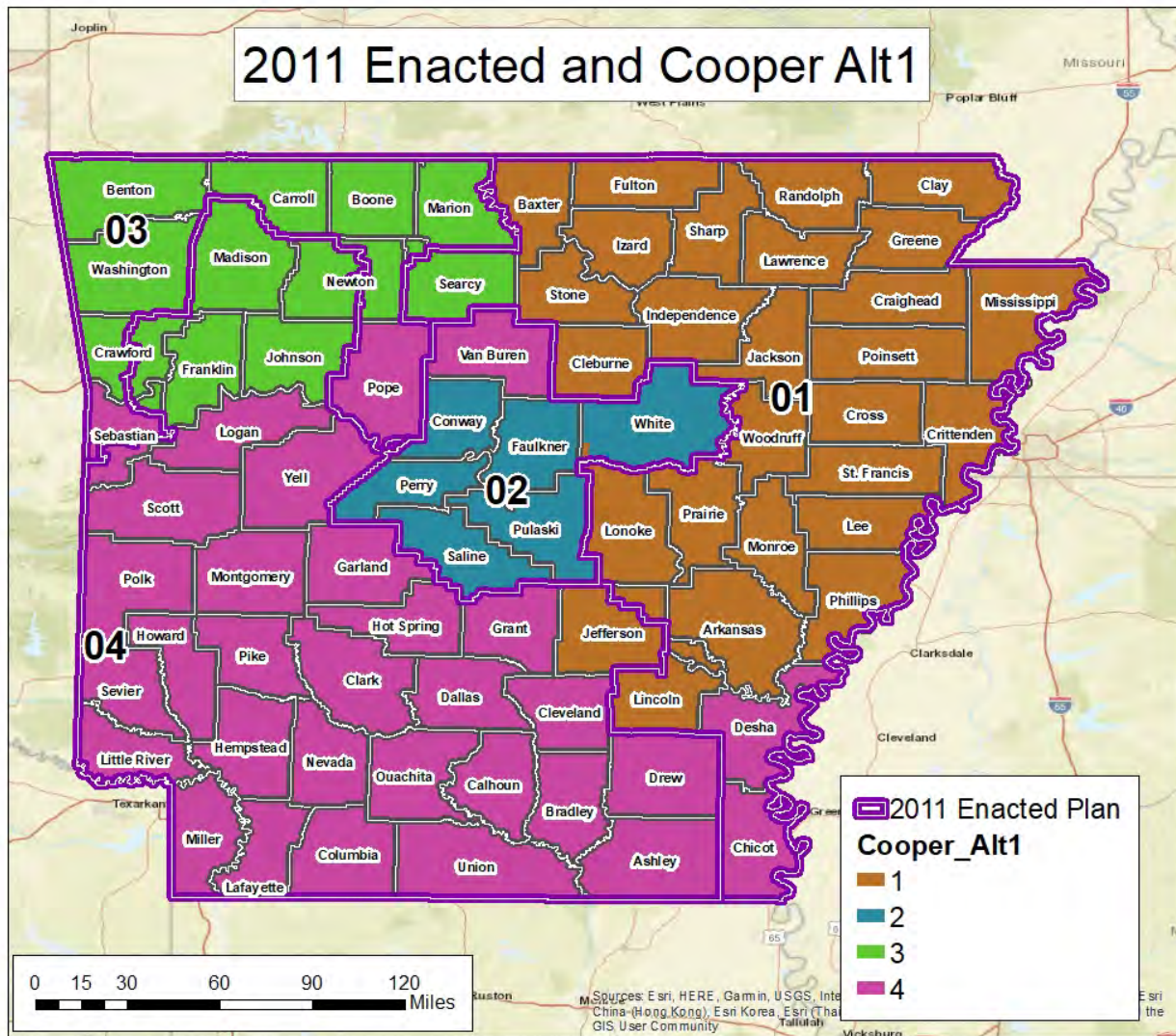
32. I attempted to replicate Mr. Cooper’s neighborhood analysis (Cooper Report, ¶ 52) but was unable to because his link to “a shapefile depicting neighborhood boundaries onto 2020 census blocks. Source: https://data.littlerock.gov/Quality-of-Life/Neighborhood-Associations/hzuh-draj/about_data.” that he claims to have used does not exist.

33. I present these errors as illustrative examples, but not a complete inventory of all errors and inconsistencies in Mr. Cooper's report.

B. Alt1 and Alt2 Plans

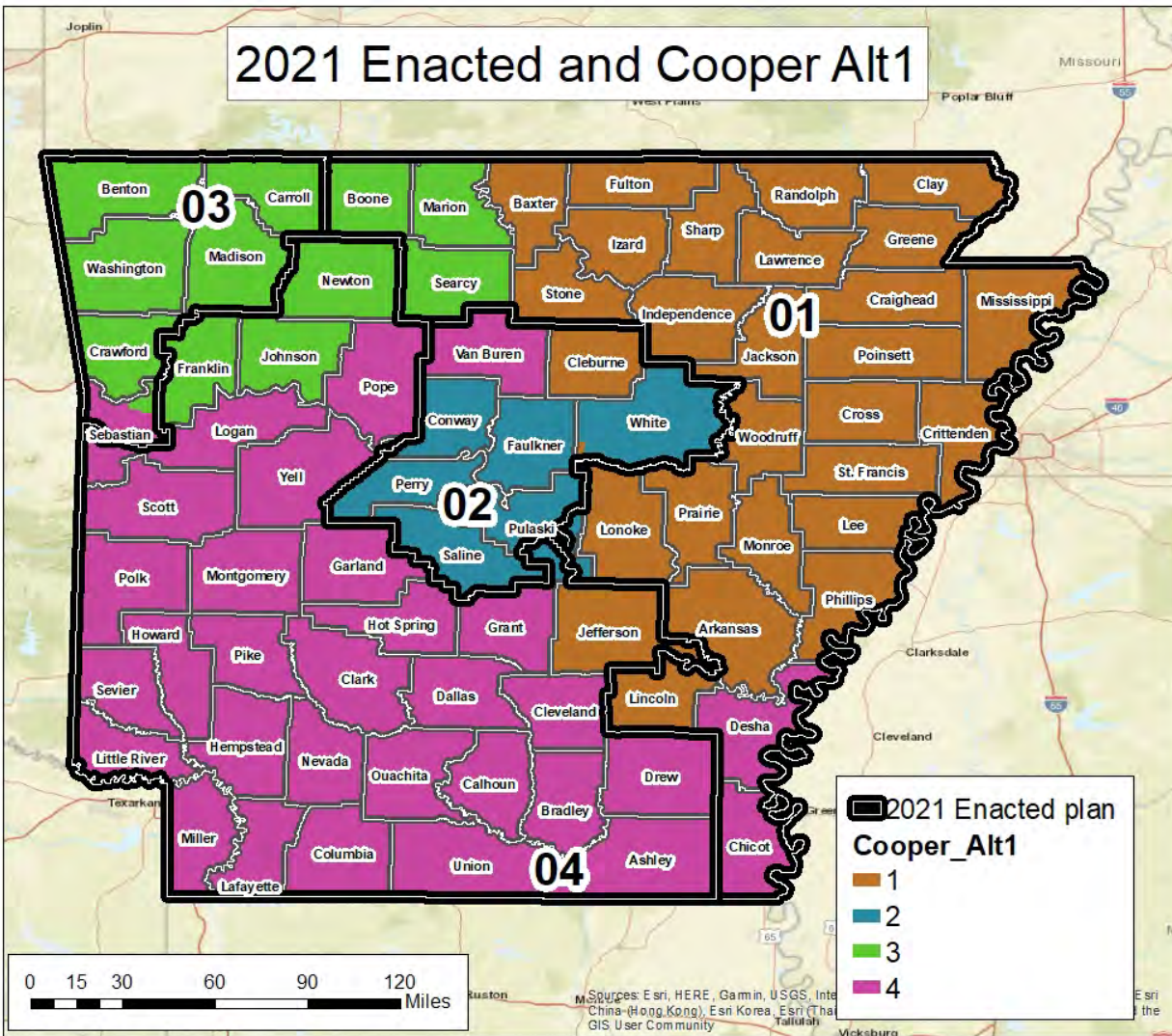
34. Here I present illustrations of Cooper's Alt1 and Alt2 plans, compared with the 2011 and 2021 Enacted plans, for reference.

Figure III.B.1: 2011 Enacted and Cooper Alt1 Plan



Sources: 2020 U.S. Census TIGER, 2020 U.S. Census PL94-171 P2, BGD calculations, built with 2020 VTDs.

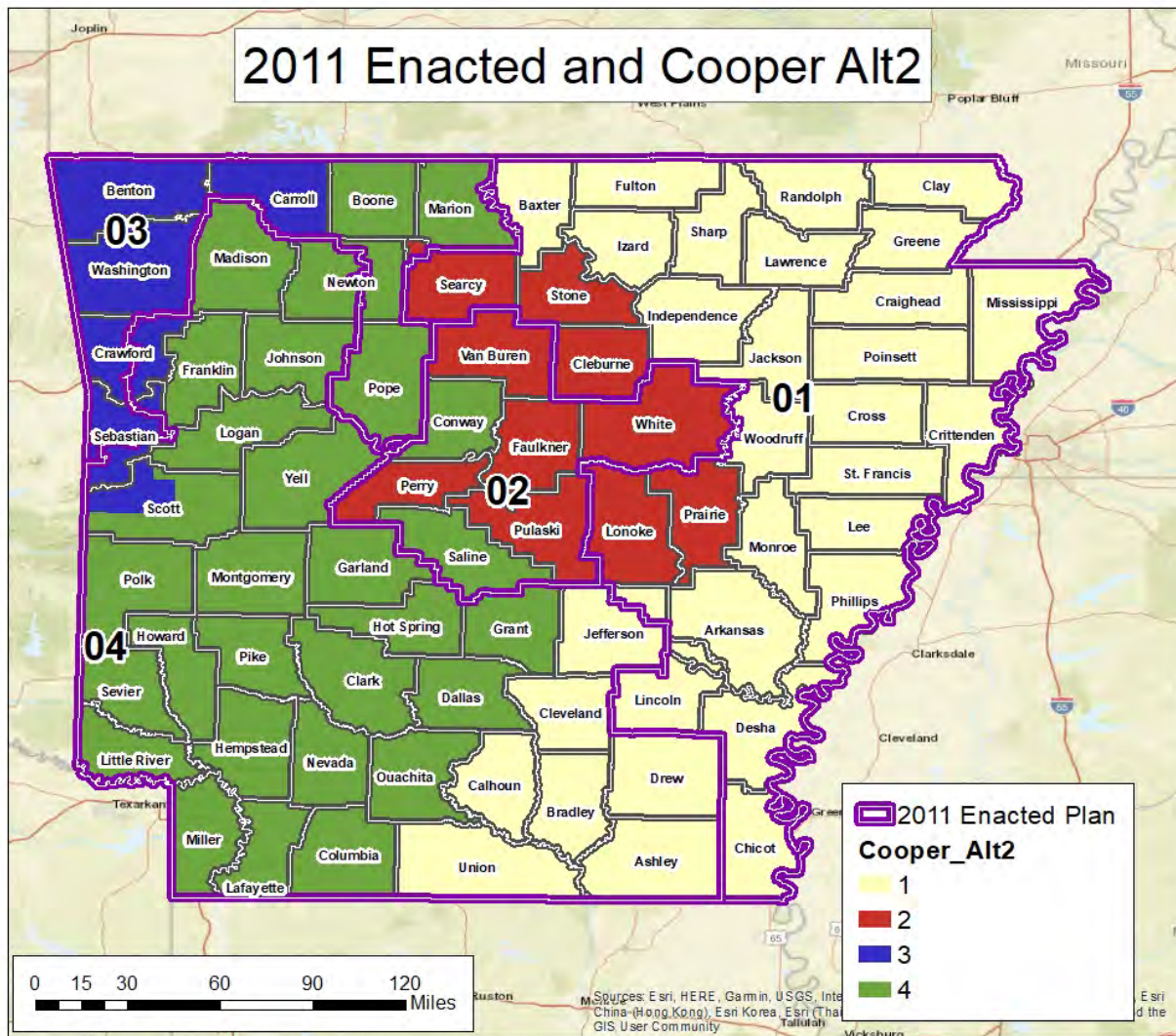
Note: the exact split of Sebastian County under Alt1 is unclear from Cooper's map shown in his **Figure 23**. I have done my best to replicate Alt1 faithfully here.

Figure III.B.2: 2021 Enacted and Cooper Alt1 Plan

Sources: 2020 U.S. Census TIGER, Cooper Expert Report

Note: the exact split of Sebastian County under Alt1 is unclear from Cooper's map shown in his *Figure 23*. I have done my best to replicate Alt1 faithfully here.

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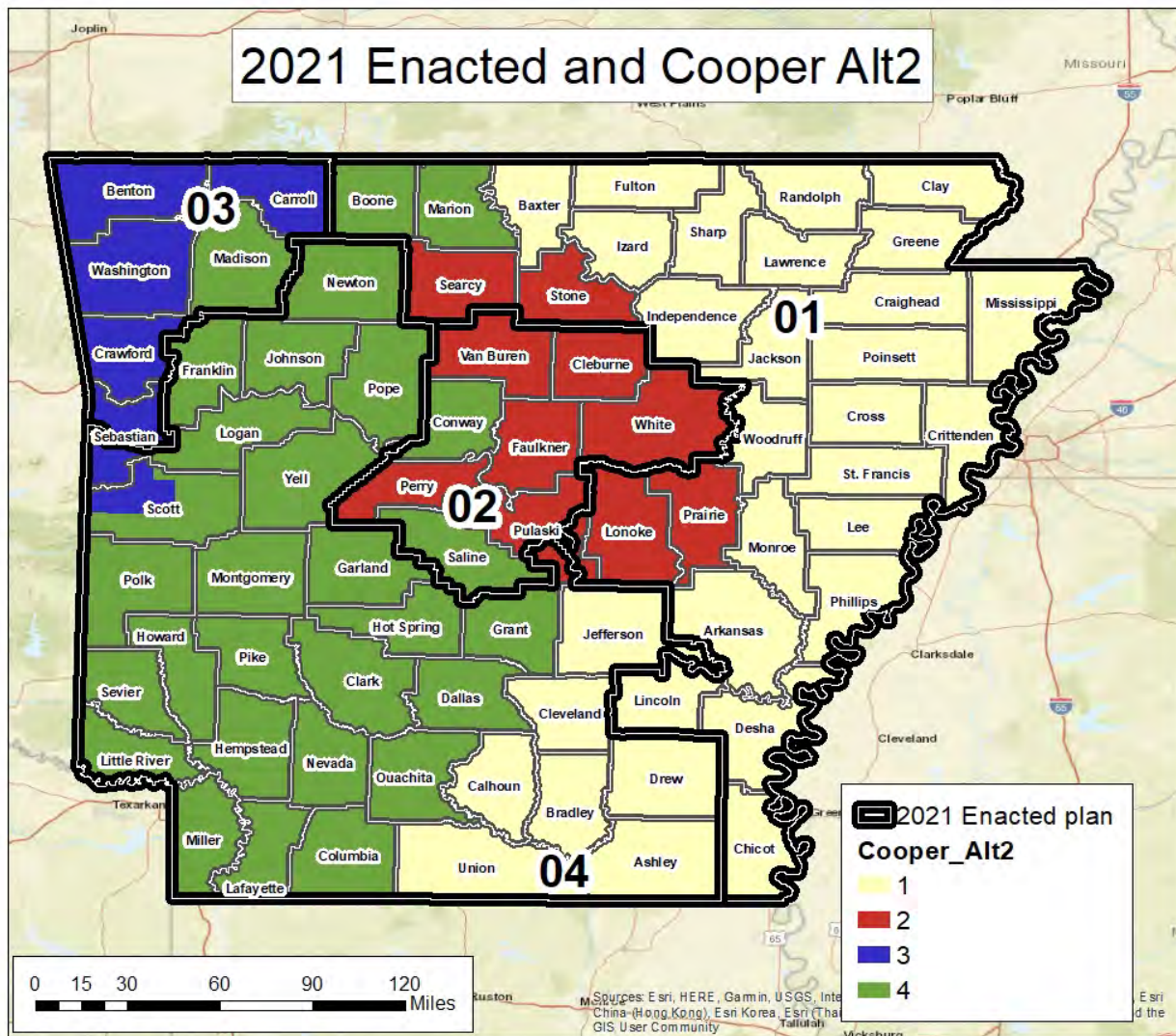
Figure III.B.3: 2011 Enacted and Cooper Alt2 Plan

Sources: 2020 U.S. Census TIGER, Cooper Expert Report

Note: the exact split of Scott County under Alt2 is unclear from Cooper's map shown in his *Figure 26*. I have done my best to replicate Alt2 faithfully here.

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Figure III.B.4: 2021 Enacted and Cooper Alt2 Plan



Sources: 2020 U.S. Census TIGER, Cooper Expert Report

Note: the exact split of Scott County under Alt2 is unclear from Cooper's map shown in his **Figure 26**. I have done my best to replicate Alt2 faithfully here.

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IV. DEMOGRAPHIC ANALYSIS

35. In this section I assess the total population, voting age population (VAP) and citizen voting age population (CVAP) for the 2011 and 2021 Enacted Plans, and Cooper's Alt1 and Alt2 plans.

C. Demographics of 2011 Enacted Plan

36. [Table IV.A.1](#) shows the 2020 population and by race and ethnicity for the 2011 Enacted Plan in D2. The Any Part Black (APB) population makes up 24.4% of the total population, 22.6% of the VAP and 23.4% of CVAP.

Table IV.A.1: 2011 Enacted Plan D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	769,391	487,210	188,021	53,622		63.3%	24.4%	7.0%
VAP	593,620	393,757	134,409	34,272		66.3%	22.6%	5.8%
CVAP	577,490	411,131	134,915	15,991		71.2%	23.4%	2.8%

Sources: 2020 U.S. Census PL94-171 P1, P2, P3 and P4, 2018-2022 American Community Survey, BGD calculations

37. [Table IV.A.2](#) shows the 2020 population and by race and ethnicity for the 2011 Enacted Plan for D2. The Any Part Black (APB) population makes up 22.1% of the total population, 20.3% of the VAP and 20.6% of CVAP.

Table IV.A.2: 2021 Enacted Plan D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	752,710	498,838	166,319	46,673		66.3%	22.1%	6.2%
VAP	582,706	402,756	118,487	30,008		69.1%	20.3%	5.1%
CVAP	566,916	419,664	117,047	14,651		74.0%	20.6%	2.6%

Sources: 2020 U.S. Census PL94-171 P1, P2, P3 and P4, 2018-2022 American Community Survey, BGD calculations

38. [Table IV.A.3](#) shows 2020 population and by race and ethnicity for Cooper's Alt1 Plan for D2. The Any Part Black (APB) population makes up 25% of the total population, 23.1% of the VAP and 23.9% of CVAP.

Table IV.A.3: Cooper's Alt1 Plan D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	752,901	472,275	187,854	53,093		62.7%	25.0%	7.1%
VAP	580,289	381,551	134,314	33,951		65.8%	23.1%	5.9%
CVAP	564,071	398,467	134,787	15,718		70.6%	23.9%	2.8%

Sources: 2020 U.S. Census PL94-171 P1, P2, P3 and P4, 2018-2022 American Community Survey, BGD calculations

39. [Table IV.A.4](#) shows the 2020 population and by race and ethnicity for Cooper's Alt2 Plan for D2. The Any Part Black (APB) population makes up 24.0% of the total population, 22.3% of the VAP and 22.9% of CVAP.

Table IV.A.4: Cooper's Alt2 Plan D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	752,455	483,064	180,379	49,027		64.2%	24.0%	6.5%
VAP	581,465	389,851	129,445	31,458		67.0%	22.3%	5.4%
CVAP	566,120	405,281	129,638	15,760		71.6%	22.9%	2.8%

Sources: 2020 U.S. Census PL94-171 P1, P2, P3 and P4, 2018-2022 American Community Survey, BGD calculations

D. Analysis of Population Changes from the 2011 Plan

40. In summary, how many persons in total and by which characteristic were moved between the 2011 and 2021 Enacted Plans? [Table IV.B.1](#) shows the (necessary) reduction of total population in D2, which is a net of an increase in the WNH population offset by a decrease in the population of APB and Hispanics.

Table IV.B.1: 2011 to 2021 Enacted Plan Changes in D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	-16,681	11,628	-21,702	-6,949		2.9%	-2.3%	-0.8%
VAP	-10,914	8,999	-15,922	-4,264		2.8%	-2.3%	-0.6%
CVAP	-10,574	8,532	-17,868	-1,340		2.8%	-2.7%	-0.2%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD calculations

41. [Table IV.B.2](#) shows the change in total, VAP and CVAP population from the 2011 Enacted Plan to the Cooper Alt1 Plan. This plan achieves the necessary population reduction in D2 to meet the one-person, one-vote requirement by moving Van Buren County (which is both heavily white and Republican) out of D2. Virtually no APB were moved out of D2 under this plan.

Table IV.B.2: 2011 to Cooper Alt1 Plan Changes in D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	-16,490	-14,935	-167	-529		-0.6%	0.5%	0.1%
VAP	-13,331	-12,206	-95	-321		-0.6%	0.5%	0.1%
CVAP	-13,419	-12,665	-128	-273		-0.6%	0.5%	0.0%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD calculations

42. [Table IV.B.3](#) shows the change in total, VAP and CVAP population from the 2011 Enacted Plan to the Cooper Alt2 Plan. This plan results in a reduction of -16,936 in D2 - bringing D2's population down to 752,455 or a deviation of -426 (see [Table IV.A.4](#)).⁷ Notably, in achieving this reduction, Cooper removes nearly twice as many net APB as WNH (-7,642 vs. -4,146) out of D2. As I will discuss shortly in the [Section VI. Differential Core Retention](#) – this net reduction in APB in D2 is actually a result of exporting -14,380 APB to D4 (mostly from Conway and Saline counties) and replacing them with +6,738 APB from D1 (mostly from Searcy, Stone, Lonoke and Prairie counties).

Table IV.B.3: 2011 to Cooper Alt2 Plan Changes in D2

Population	Total	WNH	APB	Hispanic		% WNH	% APB	% HISP
Total	-16,936	-4,146	-7,642	-4,595		0.9%	-0.5%	-0.5%
VAP	-12,155	-3,906	-4,964	-2,814		0.7%	-0.4%	-0.4%
CVAP	-11,370	-5,850	-5,277	-231		0.4%	-0.5%	0.0%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD calculations

43. It is important to understand the political ramifications of these moves on D2. As shown in [Table IV.B.4](#), Cooper's proposed move of Conway and Saline Counties from D2 out to D4 would have removed 19,078 votes for Rep. Elliott from D2. The number of Democratic votes that would have moved into D1 from D2 is unknown because Rep. Cooper ran unopposed in 2020.

⁷ See William Cooper Expert Report Figure 27, P.42

Table IV.B.4: 2011 Enacted Plan to Cooper Alt2 Plan Congressional Votes in 2020

2011 Enacted	COOPER2	D2RHILL	D2DELLIOTT
2	2	137,631	129,332
	4	46,462	19,078
2 Total		184,093	148,410

Sources: Arkansas SOS Election Results, BGD calculations

44. In their Amended Plaintiffs, state (Am. Compl. ¶ 2) :

Fewer than 16,510 residents needed to be moved out of Arkansas’s Second Congressional District to achieve one person, one vote parity after the 2020 Census. To achieve its unconstitutional purpose, however, the 2021 Redistricting Plan moved over 41,000 residents in portions of Pulaski County resided in by heavy concentrations of Black people out of the Second Congressional District and replaced that population with approximately 25,000 people from overwhelmingly white Cleburne County.

45. That is, in the 2021 Enacted Plan –41,392 people were sent out of D2 into D1 and D4, and 24,711 people were brought into D2 from D1 (see Bryan Expert Report *Appendix D.1*). It is notable then that Cooper’s Alt2 plan sends -144,131 people (or more than 3x as many as the 2021 Enacted Plan) out of D2 into D4 and replaces them with +126,644 people from D1 and 551 people from D3 (see [Appendix B.3](#)).

46. Focusing on the APB population:

- Cooper moves nearly twice as many APB total population (-7,642) out of D2 as WNH (-4,146).
- This loss of -7,642 APB is a function of sending -14,380 APB out to D4 and bringing +6,738 APB into D2 from D1 (see [Appendix B.3](#)).
- This compares with the 2021 Enacted plan sending -21,904 APB out to D4 and bringing +202 APB in to D2 from D1 (see [Appendix B.1](#)).
- Cooper’s Alt2 Plan displaces nearly as many APB from D2 to D4 as the 2021 Enacted Plan does.
- The result is that the %APB in D2 is reduced by -0.4% to -0.5%. The only reason these losses are not higher is that Cooper replaces the large number of APB he displaces from D2 with new APB from D1.

47. Since the point of the Plaintiffs’ complaint is that the 2021 Enacted Plan “divides and dilutes the power of the state’s largest community of Black voters” (Am. Compl. ¶ 2) this makes Cooper’s Alt2 Plan a questionable remedy.

V. GEOGRAPHIC COMPACTNESS

48. I have discussed each of the compactness measures in my original report. BGD independently calculates compactness scores. Our compactness scores have consistently been highly reliable and match other reputable sources of compactness analysis such as Maptitude.
49. Cooper presents an analysis of compactness in his report and assess his Alt1 and Alt2 plans using the Reock and Polsby-Popper Measures. Cooper also uses “composite compactness measure” available on “Dave’s Redistricting Application” or “DRA” (pp. 36-37). He states:
- “The composite compactness measure reported in Figure 21 and throughout the text of this declaration is published by the widely used redistricting website, Dave’s Redistricting Application (“DRA”). The DRA composite compactness score (higher is better) is based on the Reock and Polsby Popper measures using the methodology as described at <https://medium.com/dra-2020/ratings-deep-dive-c03290659b7>. The district-by-district compactness scores reported in the exhibits that I have attached by plan are produced using Maptitude for Redistricting and report the raw Reock and Polsby-Popper scores, which are the two most widely referenced compactness measures.”
50. Cooper does not share any information about the composite compactness measure. The link to <https://medium.com> discusses ranking based on compactness scores, but the word “composite” does not appear on this page nor does any methodology to show how this score is arrived at.

A. 2011 Enacted Plan Compactness

51. [Table V.A.1](#) shows the compactness scores by district, by method under the 2011 Enacted Plan.

Table V.A.1 Compactness Scores of 2011 Enacted Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.13	0.37	0.71	2.80
2	0.24	0.46	0.71	2.02
3	0.14	0.33	0.52	2.67
4	0.28	0.41	0.80	1.88
All	0.20	0.39	0.68	2.34

Source: Calculations by BGD.

B. 2021 Enacted Plan Compactness

52. [Table V.B.1](#) shows the compactness scores by district, by method under the 2021 Enacted Plan.

Table V.B.1 Compactness Scores of 2021 Enacted Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.12	0.34	0.68	2.87
2	0.27	0.49	0.77	1.94
3	0.43	0.44	0.83	1.52
4	0.26	0.48	0.80	1.95
All	0.27	0.44	0.77	2.07

Source: Calculations by BGD.

C. Cooper Alt1 Plan Compactness

53. [Table V.C.1](#) shows the compactness scores by district, by method under the Cooper Alt1 Plan. The BGD Polsby-Popper and Reock estimates match those reported by Maptitude in Cooper's *Exhibit H-5*.

Table V.C.1 Compactness Scores of Cooper Alt1 Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.18	0.50	0.81	2.36
2	0.24	0.40	0.72	2.03
3	0.47	0.58	0.90	1.47
4	0.19	0.45	0.69	2.31
All	0.27	0.48	0.78	2.04

Source: Calculations by BGD.

D. Cooper Alt2 Plan Compactness

54. [Table V.D.1](#) shows the compactness scores by district, by method under the Cooper Alt2 Plan. The BGD Polsby-Popper and Reock estimates match those reported by Maptitude in Cooper's *Exhibit I-5*.

Table V.D.1 Compactness Scores of Cooper Alt2 Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.13	0.33	0.64	2.79
2	0.23	0.47	0.72	2.08
3	0.26	0.28	0.64	1.95
4	0.20	0.39	0.79	2.22
All	0.21	0.37	0.70	2.26

Source: BGD Calculations

E. Difference in Compactness between 2011 and 2021 Enacted Plan

55. [Table V.E.1](#) shows the difference in compactness scores by district, by method between the 2011 and 2021 Enacted Plans. The compactness of D1 deteriorates very slightly. With the introduction of Cleburne County to the northeast corner of the district, the change in compactness of D2 is slightly improved for each measure. The compactness of D3 improves significantly by every measure. While the change in compactness of D4 is slightly up or down, depending on the measure. The average improvement of all districts, driven by D3, is significant for each measure.

Table V.E.1: Difference in Compactness between 2011 and 2021 Plans

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	-0.01	-0.03	-0.02	0.06
2	0.02	0.03	0.06	-0.08
3	0.29	0.11	0.31	-1.15
4	-0.02	0.07	0.00	0.07
All	0.07	0.04	0.08	-0.27

Source: Calculations by BGD.

56. [Table V.E.2](#) shows the difference in compactness scores by district, by method between the 2011 Enacted and Cooper Alt1 Plans. The compactness of D1 and D3 improves. D2 changes minimally by all measures except Reock, where the decline is notable. Conversely, D4 declines by all measures except Reock, where the improvement is notable. On average, the Cooper Alt1 plan's compactness is an improvement over the 2011 Enacted Plan and is comparable with the 2021 Enacted Plan.

Table V.E.2: Difference in Compactness between 2011 and Cooper Alt1 Plans

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.05	0.13	0.10	-0.44
2	0.00	-0.07	0.01	0.01
3	0.33	0.25	0.37	-1.20
4	-0.10	0.05	-0.11	0.43
All	0.07	0.09	0.09	-0.30

Source: Calculations by BGD.

57. [Table V.E.3](#) shows the difference in compactness scores by district, by method between the 2011 and 2021 Enacted Plans. The compactness of D1 and D2 declines. D3's compactness generally improves with the exception of except Reock, where there is a decline. Conversely, D4 declines by all measures. On average, the Cooper Alt2 plan's compactness is comparable with the 2011 Enacted Plan, but worse than the 2021 Enacted Plan. In his report, Cooper states "Alternative Plan 2 is less compact than the Enacted Plan but still within the norm based on widely used compactness measures." (§ 22).

Table V.E.3: Difference in Compactness between 2011 and Cooper Alt2 Plans

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	0.00	-0.04	-0.06	-0.02
2	-0.01	0.01	0.01	0.06
3	0.12	-0.05	0.11	-0.71
4	-0.08	-0.01	-0.01	0.34
All	0.01	-0.02	0.01	-0.08

Source: Calculations by BGD.

58. While Cooper is correct that “Cooper Alternative Plan 2 is less compact than the Enacted Plan” he does not explain “but still within the norm based on widely used compactness measures.” Cooper does not provide any references, documentation or statistical analysis to show what “norm” the changes are within. All we have in Cooper’s report is an undocumented third-party “composite compactness score (where higher is better)” but without any idea relative to what.
59. In the past year I have conducted a compactness analysis of all congressional districts in the United States following the 2011 and 2021 redistricting cycles. I measured the compactness of every district, for each of the four compactness measures I present here – then rank each of them nationally. The interpretation of the following tables is that those are the ranking of Arkansas’s districts among all US congressional districts by measure. [Table V.E.4](#) shows the ranking of each of Arkansas’s districts after 2011 redistricting. For example, using the Polsby-Popper measure, Arkansas’s D1 ranked 362nd in the nation after 2011, and fell to 403rd after 2021. Using the Reock measure, D3 ranked 285th in the nation after 2011, and leapt 114 places to 171st after 2021.

Table V.E.4: National Ranking of Compactness of Arkansas Congressional Districts Following 2011 Redistricting

<u>113th</u>	<u>Polsby-Popper</u>	<u>Reock</u>	<u>Convex Hull</u>	<u>Schwartzberg</u>
1	362	228	236	362
2	191	114	229	191
3	348	285	402	348
4	148	175	114	148
Average	150	115	140	150

Source: Calculations by BGD.

60. [Table V.E.5](#) shows the ranking of each of Arkansas’s districts after 2021 redistricting.

Table V.E.5: National Ranking of Compactness of Arkansas Congressional Districts Following 2021 Redistricting

<u>118th</u>	<u>Polsby-Popper</u>	<u>Reock</u>	<u>Convex Hull</u>	<u>Schwartzberg</u>
1	403	303	313	403
2	226	96	198	226
3	56	171	86	56
4	238	110	139	238
Average	132	97	105	132

Source: Calculations by BGD.

61. What if Cooper's Alt2 plan was in place after 2021 redistricting instead of the 2021 Enacted Plan? [Table V.E.6](#) shows the national ranking of each of Cooper's districts under each compactness measure.

Table V.E.6: National Ranking of Compactness of Cooper's Alt2 Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	394	311	356	398
2	278	122	268	277
3	239	371	357	237
4	315	232	148	310
Average	228	201	245	228

Source: Calculations by BGD.

62. How would Cooper's districts have ranked nationally compared to the 2021 Enacted Plan? [Table V.E.7](#) shows the change in rankings for each district. Cooper's D1 would ranked similarly, his D2 and D4 would have ranked worse, and his D3 would have ranked much worse. On average, nationally, Cooper's Alt2 districts would fall from being in the top quartile to only being average. It would be difficult to argue that a plan falling ~100 places (out of 435) would be within any kind of norm.

Table V.E.7: Change in National Ranking of Compactness of Cooper's Alt2 Plan

District	Polsby-Popper	Reock	Convex_Hull	Schwartzberg
1	9	-8	-43	5
2	-52	-26	-70	-51
3	-183	-200	-271	-181
4	-77	-122	-9	-72
Average	-96	-104	-140	-96

Source: Calculations by BGD.

VI. DIFFERENTIAL CORE RETENTION

64. While Arkansas's 2011 Enacted Plan was in need of significant change to rebalance the population between districts, it is important to note that Arkansas's legislature is not legally required to consider "minimizing change" as one of its redistricting criteria. Therefore it should be no surprise that the 2021 Enacted Plan would have more change than is absolutely, minimally necessary to rebalance the population from the 2021 Enacted Plan boundaries.
65. In my original report, I document how the 2021 Enacted Plan has a very high core retention of 92.2% - even though Arkansas does not require redistricting plans to minimize change. Throughout their complaint, Plaintiffs argue that the changes were excessive and unnecessary (Am. Compl. ¶ 2). [Appendix B.1](#) shows the 2020 Census total population, by race and ethnicity for the 2011 Enacted Plan, and how those populations were retained and moved in the 2021 Enacted Plan.
66. [Appendix B.2](#) shows the 2020 Census total population and by race and ethnicity for the 2011 Enacted Plan, and how those populations were retained and moved in Cooper Alt1 Plan. The 2021 Enacted Plan moves 234,113 people and the Alt1 plan moves 374,187 people. The Alt1 plan moves virtually no APB out of D2, but moves -11,157 APB out of D1, -13,365 APB out of D3 and -38,990 APB out of D4. In total, Alt1 moves 63,717 APB out of their existing districts, while the 2021 Enacted Plan only moves 27,093 - or more than twice as many. I conclude that with 92.2% core retention the 2021 Enacted Plan is a much stronger "least change" plan than Cooper's Alt1 plan with only 87.6% core retention.
67. [Appendix B.3](#) shows the 2020 Census total population and by race and ethnicity for the 2011 Enacted Plan, and how those populations were retained and moved in Cooper Alt2 Plan. As expected, the Alt2 plan has much worse core retention than either the 2021 Enacted or Alt1 plans. The Alt2 plan moves -6,738 APB out of D1, -14,380 APB out of D2 (or nearly as many as the 2021 Enacted Plan did), -3,224 APB out of D3 and -66,212 APB out of D4 (or nearly half of the APB population there). Nearly all of that is driven by the movement of Jefferson, Cleveland, Calhoun, Bradley, Drew, Union and Ashley counties.

Table VI.1: Overall Core Retention by Plan

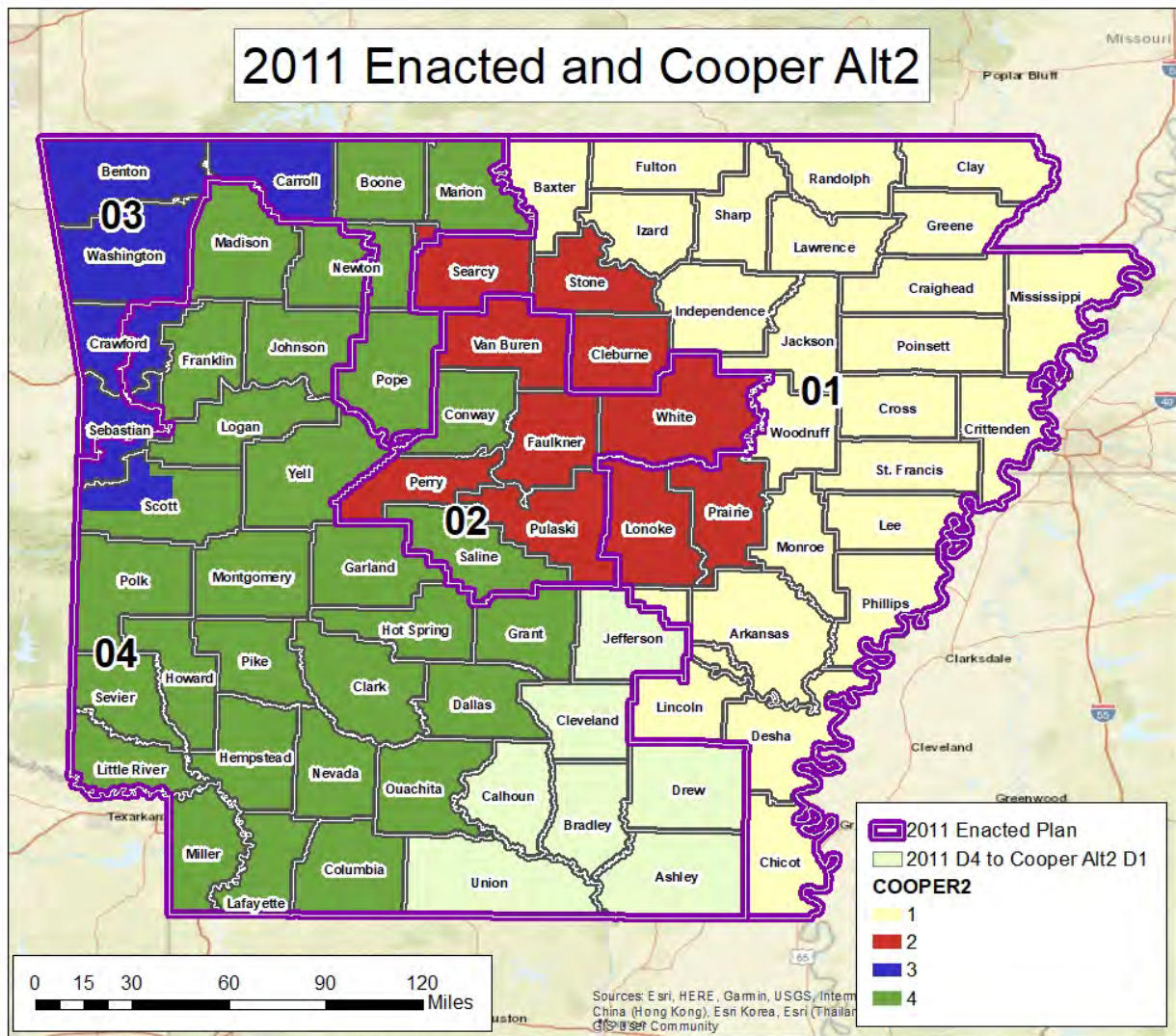
Plan	Total	WNH	APB	Hispanic
2021 Enacted	92.2%	91.5%	94.5%	93.0%
Alt 1	87.6%	88.0%	87.2%	86.6%
Alt 2	80.4%	78.6%	81.7%	88.2%

Source: Calculations by BGD.

Table VI.2: Change in Core Retention between 2021 Enacted and Cooper Alt1 and Alt2 Plans

Plan	Total	WNH	APB	Hispanic
Alt 1	-4.7%	-3.5%	-7.4%	-6.4%
Alt 2	-11.9%	-12.9%	-12.8%	-4.9%

Source: Calculations by BGD.

Figure VI.1: 2011 Enacted and Cooper Alt 2, with D4 to D1 Changes

Source: Calculations by BGD.

VII. Political Performance

68. Here I analyze the political performance of the 2021 Enacted plan and compare it to that of Cooper's Alt1 and Alt2 plans using the major races in the 2022 Election..

A. 2022 Election

69. The results of the 2022 election allow us to see the political impact of the changes that were made to D2 in the 2021 Enacted Plan. Here I examine the 2022 senate, congressional, governor, attorney general (AG) and secretary of state (SOS) races by congressional district.

70. In [Table VII.A.1](#) and [Figure VII.A.1](#) we see the results of the 2022 political races for D2 by plan. As shown in [Table VII.A.2](#), the 2021 Enacted Plan delivers +2.0 percentage points of improvement for Republicans over the 2011 Enacted Plan in each race. Cooper's Alt1 plan results in worse political performance than the 2011 Enacted Plan (with an average loss of -0.6 percentage points) and much worse performance than the 2021 Enacted Plan (with an average difference of -2.6 percentage points). Cooper's Alt2 plan results in better political performance than the 2011 Enacted Plan (with an average improvement of +1.0 percentage points) but worse performance than the 2021 Enacted Plan (with an average difference of 1.0 percentage points, or half of the 2021 Enacted Plan).

Table VII.A.1 2022 Republican Performance in D2 by Plan

2022 Race D2 Results	2011 Enacted	2021 Enacted	Cooper Alt1	Cooper Alt2
Senate	57.2%	59.1%	56.6%	58.1%
Congressional	58.1%	60.0%	57.6%	59.4%
Governor	53.5%	55.5%	52.9%	54.6%
Attorney General	59.5%	61.5%	58.9%	60.5%
Secretary of State	58.6%	60.6%	58.0%	59.5%

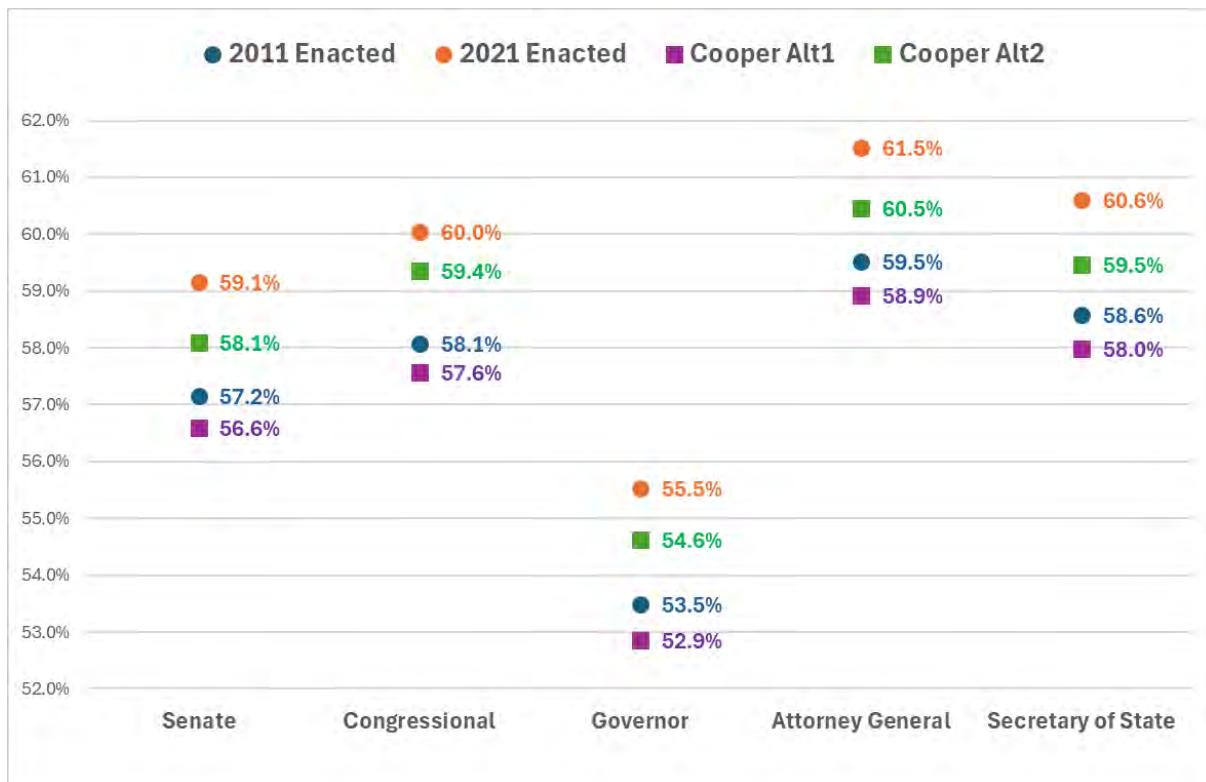
Source: Arkansas Secretary of State, BGD Calculations. See also:

https://ballotpedia.org/Arkansas%27_2nd_Congressional_District_election,_2022#General_election_race_ratings for more information on the 2022 congressional race in D2.

Table VII.A.2 2022 Political Performance Difference from 2011 Enacted Plan in D2 by Plan

2022 Race	2021 Enacted	Cooper Alt1	Cooper Alt2
Senate	2.0%	-0.6%	0.9%
Congressional	2.0%	-0.5%	1.3%
Governor	2.0%	-0.6%	1.1%
Attorney General	2.0%	-0.6%	1.0%
Secretary of State	2.0%	-0.6%	0.9%

Source: Arkansas Secretary of State, BGD Calculations. Note – numbers may not foot due to rounding.

Figure VII.A.1 2022 Republican Performance in D2 by Plan

Source: Arkansas Secretary of State, BGD Calculations. Note – numbers may not foot due to rounding.

71. It is informative to report how independent, objective sources view the partisanship of races under the 2011 vs. 2021 Enacted Plans. In 2020, Ballotpedia race ratings from a variety of different sources: including The Cook Political Report, Inside Elections and Sabato's Crystal Ball. As the 2020 congressional race (held under the 2011 Enacted Plan) unfolded in District 2, Ballotpedia reported the following race ratings, which are “informed by a number of factors, including polling, candidate quality, and election result history in the race's district or state”.⁸ The ratings ranged from tilt to lean to toss-up (see [Figure VII.A.2](#)). As the 2022 congressional race (held under the 2021 Enacted Plan) unfolded in District 2 (see [Figure VII.A.3](#)) each rating ranged from solid to safely Republican. This is not to say that any other plan with less of a

⁸*Safe* and *Solid* ratings indicate that one party has a clear edge and the race is not competitive.

Likely ratings indicate that one party has a clear edge, but an upset is possible.

Lean ratings indicate that one party has a small edge, but the race is competitive.

Toss-up ratings indicate that neither party has an advantage.

partisan improvement might not have gotten the same outcome – but we can be certain what was achieved by the 2021 Enacted Plan

Figure VII.A.2 2020 Congressional Race District 2 Race Ratings

Race ratings: Arkansas' 2nd Congressional District election, 2020				
Race tracker	Race ratings			
	November 3, 2020	October 27, 2020	October 20, 2020	October 13, 2020
<i>The Cook Political Report</i> ↗	Toss-up	Lean Republican	Lean Republican	Lean Republican
<i>Inside Elections with Nathan L. Gonzales</i> ↗	Toss-up	Tilt Republican	Tilt Republican	Lean Republican
<i>Larry J. Sabato's Crystal Ball</i> ↗	Lean Republican	Lean Republican	Lean Republican	Lean Republican
Note: Ballotpedia updates external race ratings every week throughout the election season.				

https://ballotpedia.org/Arkansas%27_2nd_Congressional_District_election,_2020#General_election_race_ratings

Figure VII.A.3 2022 Congressional Race District 2 Race Ratings

Race ratings: Arkansas' 2nd Congressional District election, 2022				
Race tracker	Race ratings			
	November 8, 2022	November 1, 2022	October 25, 2022	October 18, 2022
<i>The Cook Political Report with Amy Walter</i> ↗	Solid Republican	Solid Republican	Solid Republican	Solid Republican
<i>Inside Elections with Nathan L. Gonzales</i> ↗	Solid Republican	Solid Republican	Solid Republican	Solid Republican
<i>Larry J. Sabato's Crystal Ball</i> ↗	Safe Republican	Safe Republican	Safe Republican	Safe Republican
Note: Ballotpedia reviews external race ratings every week throughout the election season and posts weekly updates even if the media outlets have not revised their ratings during that week.				

https://ballotpedia.org/Arkansas%27_2nd_Congressional_District_election,_2022#General_election_race_ratings

72. In his report, Cooper states “The two alternative plans (Alternative Plan 1 and Alternative Plan 2) presented in this section are drawn to demonstrate different plan configurations that would keep Pulaski County intact and entirely within CD 2, with overall superior traditional redistricting metrics as compared to the Enacted Plan. Alternative Plan 2 also achieves the same or superior partisan outcomes as in the Enacted Plan.” (Cooper Report, ¶ 65). In the analysis of his Alt1 plan (*Section VI.A*), Cooper presents no analysis of political outcomes – perhaps because it achieves the opposite of this stated objective. In his analysis of Alt2 (*Section VI.B*), Cooper presents one comparison of political outcomes – only reporting the results of the 2020 presidential race for the 2021 Enacted Plan (*Figure 28*). Cooper reports that under the 2021 Enacted Plan, Trump would have gotten 56.7% of the vote, but only 55.7% under the Alt2 Plan.⁹ Simply put – Cooper’s own data disproves what he states he is showing us. A critical component of the Plaintiffs’ claim is that there is some other configuration of D2 that affords comparable political performance. Cooper’s report offers no such plan.

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⁹ Note that Cooper’s calculation of the presidential race measures only the combined percent within the Trump-Biden votes. My analysis of the 2020 presidential race measures the number of Trump votes in D2 (183,964) divided by all presidential votes in D2 (333,041) or 55.2%. The interpretation and conclusion that the Alt2 plan performs worse than the 2021 Enacted Plan is unaffected by this difference in calculation.

VIII. CONCLUSIONS

73. In this report I have assessed Mr. William Cooper’s expert demographic report on *CMA v. Arkansas*. Cooper presents (Cooper Report, ¶ 9 Section B) an analysis of demographic information (a), the splits of Pulaski County (b) and whether splitting Pulaski County was necessary (c). In this report I have focused on Cooper’s part c.
74. In conclusion - of the Alt1 plan, Cooper states “Alternative Plan 1 is drawn for the purposes of my report in this lawsuit, from what I understand to be the relevant criteria, and adheres to traditional redistricting principles to the same extent as, if not to a greater extent than, the Enacted Plan.” (Cooper Report ¶ 10). In fact, while the Alt1 (least change) plan slightly increases the %APB in D2 over the 2011 Enacted Plan and has comparable compactness to the 2021 Enacted Plan, it has worse core retention than the 2021 Enacted Plan. It has worse political performance for Republicans than the 2011 Enacted plan, and much worse political performance than the 2021 Enacted Plan. That is – the plan would have been politically regressive and thus would be a non-starter in a map-drawing process controlled by a Republican-led legislature. Thus, Alt1 is not a plan that demonstrates superior performance in each traditional redistricting criteria, nor does it illustrate that comparable political performance could have been achieved some other way than dividing Pulaski County.
75. Of the Alt2 Plan, Cooper states “Alternative Plan 2 demonstrates the split of Pulaski County was not necessary to maintain the same partisan advantage as is reflected in the Enacted Plan (Cooper Report, ¶ 10 Section d.ii) and that “Alternative Plan 2 also achieves the same or superior partisan outcomes as in the Enacted Plan.” (Cooper Report, ¶ 65 *Section VI*). Simply put: Cooper’s Alt2 Plan does neither of these things.
76. In summary, neither of Cooper’s alternative plans achieves what he claims. Each performs comparably, or worse than the 2021 Enacted Plan by a variety of traditional redistricting criteria – and neither results in a partisan outcome that approaches that of the 2021 Enacted Plan.
77. **Table VIII.1** compares the 2021 Enacted Plan and Cooper’s alternative plans by key metrics. The percent APB in D2 is slightly higher under Alt and slightly lower under Alt2. There is effectively no difference in county splits. The compactness of the 2021 Enacted and Alt1 plans are identical using Cooper’s “DRA Composite”, while the compactness of Alt2 is much worse. The core retention of Alt1 is worse and Alt2 is much worse – reflecting Cooper’s moves of hundreds of thousands more people than were moved under the 2021 Enacted Plan. Finally, the political performance in the 2022 Election of the 2021 Enacted Plan is much better than Alt1 and somewhat better than Alt2.

Table VIII.1 2020 Plan Comparison by Key Metrics

Metric	2021 Enacted	Cooper Alt1	Cooper Alt2
%APB in D2	-2.3% to -2.7%	+0.5%	-0.4% to -0.5%
County Splits	2	2	1
National Compactness Ranking (average)	~117 ~27 th percentile	N/A	~226 ~52 nd percentile
Cooper's Compactness	59	59	43
Core Retention Total	92.2%	87.6%	81.7%
Total Population Moved	234,113	374,187	591,312
2022 Political Performance in D2	+2.0%	-0.6%	+1.0%

Notes: %APB in D2 is range of total, VAP and CVAP values in D2 compared to 2011 Enacted Plan.

Population Moved is the total number of persons moved to a different district under each plan. 2022 Political Performance is the average difference in Republican performance in five races compared to the 2011 Enacted Plan.

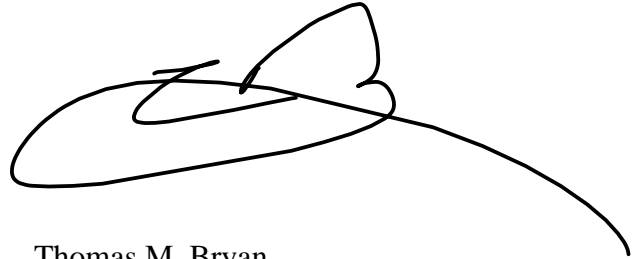
78. In conclusion - of the Alt1 plan, Cooper states “Alternative Plan 1 is drawn for the purposes of my report in this lawsuit, from what I understand to be the relevant criteria, and adheres to traditional redistricting principles to the same extent as, if not to a greater extent than, the Enacted Plan.” (Cooper Report ¶ 10). In fact, while the Alt1 (least change) plan slightly increases the %APB in D2 over the 2011 Enacted Plan and has comparable compactness to the 2021 Enacted Plan, it has worse core retention than the 2021 Enacted Plan. It has worse political performance for Republicans than the 2011 Enacted plan, and much worse political performance than the 2021 Enacted Plan. That is – the plan would have been politically regressive and thus a non-starter in a map-drawing process controlled by a Republican-led legislature. Thus, Alt1 is not a plan that demonstrates superior performance in each traditional redistricting criteria, nor does it illustrate that comparable political performance could have been achieved some other way than dividing Pulaski County.

79. Of the Alt2 plan, Cooper states “Alternative Plan 2 demonstrates the split of Pulaski County was not necessary to maintain the same partisan advantage as is reflected in the Enacted Plan.” (Cooper Report, ¶ 10). In fact, the Alt2 plan decreases the %APB in D2, it has worse compactness and much worse core retention than the 2021 Enacted Plan. While Alt2's political performance is slightly improved over the 2011 Enacted Plan – it remains worse than the 2021

Enacted Plan. Alt2 is not a plan that demonstrates superior performance in each traditional redistricting criteria and does not “maintain the same partisan advantage as is reflected in the Enacted plan” (Cooper Report, ¶ 10).

** *

Submitted: September 23, 2024

A handwritten signature in black ink, consisting of a large, stylized 'T' and 'B' that are interconnected, with a long horizontal stroke extending to the right.

Thomas M. Bryan

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X. APPENDICES

Appendix A: Compactness Measures

Appendix B: Differential Core Retention

Appendix C: Terms and Definitions

Appendix A: Compactness

The Reock compactness score (Reock, 1961) is computed by dividing the area of the district by the area of the smallest circle that would completely enclose it. Since the circle encloses the district, its area cannot be less than that of the district, and so the Reock compactness score will always be a number between 0 and 1 (which may be expressed as a percentage). 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.

(Reock score)
$$R = \frac{A_D}{A_{MBC}}$$

The Area/Convex Hull test computes the ratio of is the ratio of the area of the district A_D to the area of the convex hull of the district (A_{MCP} - the minimum convex polygon which completely contains the district). This measure is always between 0 and 1, with 1 being the most compact.

(Convex Hull score)
$$CH = \frac{A_D}{A_{MCP}}$$

The Polsby-Popper (PP) measure 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). The factor 4π ensures that the resulting score takes a value between 0 and 1 - with 1 being entirely circular and the most compact.

(Polsby-Popper score)
$$PP(D) := \frac{4\pi A_D}{P_D^2},$$

Reock: Area of district relative to area of smallest circle that contains it.



Convex-Hull: Area of district relative to area of smallest convex polygon containing it.



Polsby-Popper: Area of district relative to area of circle with same circumference as the district perimeter.



The Schwartzberg test (Schwartzberg, 1966) is a perimeter-based measure that compares a simplified version of each district to a circle, which is considered to be the most compact shape possible. Taking the square root of the inverse Polsby-Popper score gives the Schwartzberg score (Belotti, 2023) which notably results in an identical ranking of geographies. Unlike other measures, the scale of Schwartzberg values is *above* 1, with *lower* values approaching 1 being most compact.

$$(\text{Schwartzberg score}) \quad PP(D)^{-1/2} := \frac{P_D}{\sqrt{4\pi A_D}},$$

Schwartzberg: Ratio of district to a circle with the same area as the district.



The Polsby-Popper and Schwartzberg ratios place high importance on district perimeter. One criticism of perimeter-related scores is that they suffer from the Coastline Paradox in which boundary lengths are not well-defined and depend on the choice of map projection and the “size of your ruler” (Bar-Natan et al. 2020, Barnes and Solomon 2021). Another criticism can be summarized with the slogan “land does not vote; people do”. In 2010, 47% of all census blocks were uninhabited (Freeman 2014); reassigning these blocks to different districts can significantly change the Polsby-Popper score, but the districts would function the same.

This is precisely why it is 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.

Appendix B.1: Differential Core Retention of Total, White, non-Hispanic, Any Part Black and Hispanic Populations between the 2011 and 2021 Enacted Plans

2011 Enacted District	2021 Enacted District	Total	WNH	APB	Hispanic
1	1	689,147	498,980	134,334	27,605
	2	24,711	22,748	202	632
	4	2,530	1,208	1,190	112
2011 Enacted 1 Total		716,388	522,936	135,726	28,349
2	1	8,612	2,884	5,226	332
	2	727,999	476,090	166,117	46,041
	4	32,780	8,236	16,678	7,249
2011 Enacted 2 Total		769,391	487,210	188,021	53,622
3	1	54,750	49,668	361	1,360
	3	713,443	475,768	31,346	122,384
	4	70,954	56,664	2,924	6,565
2011 Enacted 3 Total		839,147	582,100	34,631	130,309
4	3	39,776	34,061	512	1,689
	4	646,822	437,243	137,078	42,878
2011 Enacted 4 Total		686,598	471,304	137,590	44,567
Grand Total		3,011,524	2,063,550	495,968	256,847

D1 Retained	689,147	498,980	134,334	27,605
D1 Moved	27,241	23,956	1,392	744
D1 Total	716,388	522,936	135,726	28,349
D1 Core Retention	96.2%	95.4%	99.0%	97.4%
D2 Retained	727,999	476,090	166,117	46,041
D2 Moved	41,392	11,120	21,904	7,581
D2 Total	769,391	487,210	188,021	53,622
D2 Core Retention	94.6%	97.7%	88.4%	85.9%
D3 Retained	713,443	475,768	31,346	122,384
D3 Moved	125,704	106,332	3,285	7,925
D3 Total	839,147	582,100	34,631	130,309
D3 Core Retention	85.0%	81.7%	90.5%	93.9%
D4 Retained	646,822	437,243	137,078	42,878
D4 Moved	39,776	34,061	512	1,689
D4 Total	686,598	471,304	137,590	44,567
D4 Core Retention	92.2%	91.5%	94.5%	93.0%
Total Retained	2,777,411	1,888,081	468,875	238,908
Total Moved	234,113	175,469	27,093	17,939
Total	3,011,524	2,063,550	495,968	256,847
Total Core Retention	92.2%	91.5%	94.5%	93.0%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD Calculations

Appendix B.2: Differential Core Retention of Total, White, non-Hispanic, Any Part Black and Hispanic Populations in the Cooper Alt1 Plan

2011 Enacted District	Alt 1 District	Total	WNH	APB	Hispanic
1	1	687,505	507,726	124,529	26,862
	3	7,277	6,591	38	132
	4	21,603	8,619	11,157	1,354
1 Total		716,385	522,936	135,724	28,348
2	1	694	616	20	28
	2	752,901	472,275	187,854	53,093
	4	15,796	14,319	147	501
2 Total		769,391	487,210	188,021	53,622
3	3	660,318	459,765	21,266	105,029
	4	178,829	122,335	13,365	25,280
3 Total		839,147	582,100	34,631	130,309
4	1	64,733	24,022	37,568	1,377
	3	85,255	71,156	1,422	5,642
	4	536,613	376,126	98,602	37,549
4 Total		686,601	471,304	137,592	44,568
Grand Total		3,011,524	2,063,550	495,968	256,847

Alt 1	Total	WNH	APB	Hispanic
D1 Retained	687,505	507,726	124,529	26,862
D1 Moved	28,880	15,210	11,195	1,486
D1 Total	716,385	522,936	135,724	28,348
D1 Core Retention	96.0%	97.1%	91.8%	94.8%
D2 Retained	752,901	472,275	187,854	53,093
D2 Moved	16,490	14,935	167	529
D2 Total	769,391	487,210	188,021	53,622
D2 Core Retention	97.9%	96.9%	99.9%	99.0%
D3 Retained	660,318	459,765	21,266	105,029
D3 Moved	178,829	122,335	13,365	25,280
D3 Total	839,147	582,100	34,631	130,309
D3 Core Retention	78.7%	79.0%	61.4%	80.6%
D4 Retained	536,613	376,126	98,602	37,549
D4 Moved	149,988	95,178	38,990	7,019
D4 Total	686,601	471,304	137,592	44,568
D4 Core Retention	78.2%	79.8%	71.7%	84.3%
Total Retained	2,637,337	1,815,892	432,251	222,533
Total Moved	374,187	247,658	63,717	34,314
Total	3,011,524	2,063,550	495,968	256,847
Total Core Retention	87.6%	88.0%	87.2%	86.6%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD Calculations

Appendix B.3: Differential Core Retention of Total, White, non-Hispanic, Any Part Black and Hispanic Populations in the Cooper Alt2 Plan

2011 Enacted District	Alt 2 District	Total	WNH	APB	Hispanic
1	1	589,741	414,690	128,986	23,558
	2	126,644	108,246	6,738	4,790
1 Total		716,385	522,936	135,724	28,348
2	2	625,260	374,317	173,641	44,229
	4	144,131	112,893	14,380	9,393
2 Total		769,391	487,210	188,021	53,622
3	2	551	501	0	8
	3	717,506	479,160	31,407	122,503
	4	121,090	102,439	3,224	7,798
3 Total		839,147	582,100	34,631	130,309
4	1	163,033	86,395	65,639	6,785
	3	35,863	30,398	573	1,649
	4	487,705	354,511	71,380	36,134
4 Total		686,601	471,304	137,592	44,568
Grand Total		3,011,524	2,063,550	495,968	256,847

Alt 2	Total	WNH	APB	Hispanic
D1 Retained	589,741	414,690	128,986	23,558
D1 Moved	126,644	108,246	6,738	4,790
D1 Total	716,385	522,936	135,724	28,348
D1 Core Retention	82.3%	79.3%	95.0%	83.1%
D2 Retained	625,260	374,317	173,641	44,229
D2 Moved	144,131	112,893	14,380	9,393
D2 Total	769,391	487,210	188,021	53,622
D2 Core Retention	81.3%	76.8%	92.4%	82.5%
D3 Retained	717,506	479,160	31,407	122,503
D3 Moved	121,641	102,940	3,224	7,806
D3 Total	839,147	582,100	34,631	130,309
D3 Core Retention	85.5%	82.3%	90.7%	94.0%
D4 Retained	487,705	354,511	71,380	36,134
D4 Moved	198,896	116,793	66,212	37,783
D4 Total	686,601	471,304	137,592	44,568
D4 Core Retention	71.0%	75.2%	51.9%	81.1%
Total Retained	2,420,212	1,622,678	405,414	226,424
Total Moved	591,312	440,872	90,554	59,772
Total	3,011,524	2,063,550	495,968	256,847
Total Core Retention	80.4%	78.6%	81.7%	88.2%

Sources: 2020 U.S. Census PL94-171 P1 and P2, BGD Calculations

Appendix C: Terms and Definitions

Term	Description
ACS	American Community Survey. See: https://www.census.gov/programs-surveys/acs
APB	Any Part Black population – defined as Black or African American alone or in combination, including Hispanic.
CPS	Current Population Survey. See: https://www.census.gov/programs-surveys/cps.html
CES	Cooperative Election Study. See: https://cces.gov.harvard.edu/
CVAP	Citizen Voting Age Population. See: https://www.census.gov/programs-surveys/decennial-census/about/voting-rights/cvap.2019.html
DCRA	Differential Core Retention Analysis - which measures how many total VAP were retained in each district when the new plan was drawn (the “core”) and how many VAP by race and ethnicity were retained (the “differential”) by district.
VAP	Voting Age Population, 18+. See: https://www.census.gov/topics/public-sector/voting/about/faqs.html
VEP	Voting Eligible Population, typically CVAP less ineligible voters such as felons and those mentally incapacitated. See: https://electionlab.mit.edu/research/voter-turnout
VRA	Voting Rights Act of 1965 See: https://www.archives.gov/milestone-documents/voting-rights-act
VTD	Voting Tabulation District, comparable with precincts.