

IN THE SUPREME COURT OF WISCONSIN

No. 2021AP001450 OA

BILLIE JOHNSON, ERIC O'KEEFE, ED PERKINS and RONALD ZAHN,

Petitioners,

BLACK LEADERS ORGANIZING FOR COMMUNITIES, VOCES DE LA FRONTERA, LEAGUE OF WOMEN VOTERS OF WISCONSIN, CINDY FALLONA, LAUREN STEPHENSON, REBECCA ALWIN, CONGRESSMAN GLENN GROTHMAN, CONGRESSMAN MIKE GALLAGHER, CONGRESSMAN BRYAN STEIL, CONGRESSMAN TOM TIFFANY, CONGRESSMAN SCOTT FITZGERALD, LISA HUNTER, JACOB ZABEL, JENNIFER OH, JOHN PERSA, GERALDINE SCHERTZ, KATHLEEN QUALHEIM, GARY KRENZ, SARAH J. HAMILTON, STEPHEN JOSEPH WRIGHT, JEAN-LUC THIFFEAULT, and SOMESH JHA,

Intervenors-Petitioners,

v.

WISCONSIN ELECTIONS COMMISSION, MARGE BOSTELMANN in her official capacity as a member of the Wisconsin Elections Commission, JULIE GLANCEY in her official capacity as a member of the Wisconsin Elections Commission, ANN JACOBS in her official capacity as a member of the Wisconsin Elections Commission, DEAN KNUDSON in his official capacity as a member of the Wisconsin Elections Commission, ROBERT SPINDELL, JR. in his official capacity as a member of the Wisconsin Elections Commission and MARK THOMSEN in his official capacity as a member of the Wisconsin Elections Commission,

Respondents,

THE WISCONSIN LEGISLATURE, GOVERNOR TONY EVERS, in his official capacity, and JANET BEWLEY SENATE DEMOCRATIC MINORITY LEADER, on behalf of the Senate Democratic Caucus,

Intervenors-Respondents.

**RESPONSIVE BRIEF OF INTERVENORS-PETITIONERS
CITIZEN MATHEMATICIANS AND SCIENTISTS**

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TABLE OF CONTENTS

ARGUMENT1

I. THE PARTIES FAILED TO FOLLOW THE HIERARCHY OF REQUIREMENTS IN THIS COURT’S NOVEMBER 30 ORDER.....1

A. Parties Wrongly Elevated “Least Change” over Express Legal Requirements.....4

B. B.Parties Failed to Achieve the Required Level of Population Equality.6

C. C.Parties Misunderstood the Requirements of the Voting Rights Act.....7

D. D.Parties Failed to Comply with the Constitution’s Directive to Follow County, Town, and Ward Lines in Drawing Assembly Districts.....8

E. E.Parties Failed to Make Assembly Districts “as Compact as Practicable.”.....10

F. F.Parties Ignored the Court’s Directive to Avoid the Political Thicket.....11

G. G.Parties Did Not Properly Account for Other Traditional Neutral Redistricting Criteria.....12

II. THE MATHSCI PROPOSED MAPS FULLY IMPLEMENT THE ORDER’S DIRECTIVES13

CONCLUSION.....21

FORM & LENGTH CERTIFICATION.....23

CERTIFICATION OF COMPLIANCE WITH RULE 809.19 (12)24

TABLE OF AUTHORITIES

CASES

<i>Baumgart v. Wendelberger</i> , No. 01-C-0121, 2002 WL 34127471 (E.D. Wis. May 30, 2002), <i>amended</i> , 2002 WL 34127473 (E.D. Wis. July 11, 2002).....	9, 10
<i>Burns v. Richardson</i> , 384 U.S. 73 (1966).....	12
<i>Cooper v. Harris</i> , 137 S. Ct. 1455 (2017)	8
<i>Johnson v. De Grandy</i> , 512 U.S. 997 (1994).....	7
<i>Karcher v. Daggett</i> , 462 U.S. 725 (1983).....	11
<i>State ex rel. Attorney General v. Cunningham</i> , 81 Wis. 440, 51 N.W. 724 (1892).....	6, 7, 9, 10
<i>White v. Weiser</i> , 412 U.S. 783 (1973)	12
<i>Wisconsin State AFL-CIO v. Elections Board</i> , 543 F. Supp. 630 (E.D. Wis. 1982)	7, 9, 10

CONSTITUTIONAL PROVISIONS

Wis. Const. art. IV, § 4	3, 8, 10, 11
Wis. Const. art. IV, § 5	10

Intervenors-Petitioners Citizen Mathematicians and Scientists respectfully submit this response brief in further support of their proposed congressional, senate, and assembly maps (the “MathSci Proposed Maps”). Unlike the other parties, the MathSci Proposed Maps carefully followed this Court’s instructions in its November 30, 2021 Order (“Order”). The MathSci Proposed Maps used the existing 2011 maps as a template and changed them only as necessary to fully implement all legal requirements, most importantly population equality, which is the entire reason a judicial redistricting remedy is needed. As compared to the other parties’ maps, the MathSci Proposed Maps achieve either the best or near-best scores on each applicable federal and state requirement, while still maintaining a high degree of fidelity to the existing maps.¹ Accordingly, the Citizen Mathematicians and Scientists respectfully submit that the MathSci Proposed Maps are the judicial remedy this Court should adopt.

ARGUMENT

I. THE PARTIES FAILED TO FOLLOW THE HIERARCHY OF REQUIREMENTS IN THIS COURT’S NOVEMBER 30 ORDER.

The Court’s Order established a hierarchy of factors to be weighed in evaluating proposed legislative and congressional maps.

First and foremost, this Court is here to determine “a judicial remedy for malapportionment,” Order ¶38, and therefore must ensure that any proposed plan achieves the degree of population equality required under Article I, Section 2 of the Federal Constitution for

¹ The accompanying report of Dr. Daryl DeFord measures all the parties’ compliance with applicable legal requirements, as well as their adherence to least-change principles and application of other traditional redistricting criteria.

congressional plans and under its state “counterpart, Article IV, Section 3 of the Wisconsin Constitution.” *Id.* ¶33. Thus, the Court’s primary duty in this malapportionment case is to “prevent one person’s vote—in an underpopulated district—from having more weight than another’s in an overly populated district.” *Id.*

Second, “[i]n determining a judicial remedy for malapportionment,” this Court held that it “will ensure preservation of the[] justiciable and cognizable rights explicitly protected under the United States Constitution, the V[oting] R[ights] A[ct], [and] Article IV, Sections 3, 4, or 5 of the Wisconsin Constitution.” *Id.* ¶38. Thus, any proposed plan must not subordinate any of these legal requirements to anything other than achieving population equality.

Third, the Court held that because its “power to issue a mandatory injunction does not encompass rewriting duly enacted law, [its] judicial remedy ‘should reflect the least change’ necessary” from the current enacted maps “to comport with relevant legal requirements” as described above. *Id.* ¶72 (citation omitted). Thus, the parties should use “the existing maps ‘as a template’ and implement[] only those remedies necessary to resolve constitutional or statutory deficiencies.” *Id.*

Fourth, the concurring opinion stated that if the Court receives “multiple proposed maps that comply with all relevant legal requirements, and that have equally compelling arguments for why the proposed map most aligns with current district boundaries,” it can consider other traditional neutral districting criteria such as preserving communities of interest and minimizing the number of people who must wait six years to vote for state senator. *Id.* ¶83 & n.9 (Hagedorn, J., concurring).

Finally, the Court was emphatic that it would not consider the partisan makeup of districts, nor issues of partisan fairness more generally. As the Court stated, “the standards under the Wisconsin Constitution that govern redistricting are delineated in Article IV” and to impose “additional requirements would violate axiomatic principles of interpretation, while plunging this court into the political thicket lurking beyond its constitutional boundaries.” *Id.* ¶63 (citation omitted).

The maps and supporting briefs from other parties submitted on December 15 fail to follow this hierarchy. Many parties elevated “least change” from a principle of judicial modesty to an overarching legal requirement, prioritizing it over the express dictates of federal and state law. Several proposed maps do not adequately equalize district populations, as demanded by the federal and state constitutions. *See* Order ¶28. Others violate the Wisconsin Constitution’s requirements that assembly districts be “bounded by county, precinct, town or ward lines,” and be “in as compact form as practicable.” Wis. Const. art. IV, § 4; Order ¶¶35, 37.

Strict construction of these requirements is particularly important here where maps will be adopted by the Judiciary rather than enacted by the political branches. While the latter may concern themselves with “political and policy decisions” in redistricting, this Court is concerned only with strictly following the plain text of the Constitution. Order ¶19 (quoting *Jensen v. Wis. Elections Bd.*, 2002 WI 13, ¶10, 249 Wis. 2d 706, 639 N.W.2d 537 (per curiam)).

Nonetheless, several parties have invited the Court to enter the “political thicket” by arguing that this Court should consider incumbent protection. But in Wisconsin and elsewhere, incumbent protection has rightly been viewed as tied inextricably to questions of partisan fairness

and proportional representation. Repackaging incumbent protection as a measure of “least change” conflicts with this Court’s Order. Likewise, the Governor’s and the Legislature’s assertions that their respective maps deserve special status is just an invitation to pick political winners and losers that this Court should decline.

A. Parties Wrongly Elevated “Least Change” over Express Legal Requirements.

The Order repeatedly recognized that “least change” principles should guide *how* parties satisfy federal and state constitutional requirements, not *whether* to satisfy them. *See, e.g.*, Order ¶8 (plurality op.) (“[T]his court will confine any judicial remedy to making the minimum changes necessary in order to conform the existing congressional and state legislative redistricting plans to constitutional and statutory requirements.”); *id.* ¶72 (proposed maps should “reflect the least change necessary for the maps to comport with the relevant legal requirements” (internal quotation marks omitted)).

The Order also made clear that the least-change principle is not a standalone legal requirement. Because “Article IV [is] the *exclusive* repository of state constitutional limits on redistricting,” the Court properly refused to read into the Wisconsin Constitution any mandates beyond Article IV’s “series of discrete requirements governing redistricting.” *Id.* ¶63 (emphasis added). Further, the Order characterized least-change as an “approach” intended to “guide [the Court’s] exercise of power in affording the Petitioners a remedy,” not to dictate the precise scope of a proper remedy. *Id.* ¶64. Elevating least change to an end in itself—to be pursued to the same or greater degree than *actual legal requirements*—is the exact opposite of the judicial modesty that underlies the Court’s least-change approach.

Most parties, however, privileged least change over nearly all other considerations. For example, the Congressmen expressly claim that, “when evaluating a proposed remedial map,” “this Court should first consider whether the map follows a ‘least-change’ approach.” Congressmen Br. 33. And the Governor repeatedly asserts that compliance with least-change is the Court’s “primary concern.” Governor’s Br. 8, 9, 10, 19. But these statements misread the Order. Indeed, the very language from Justice Hagedorn’s concurrence on which the Governor relied makes this clear: The Court’s “primary concern is modifying only what we must to ensure the 2022 elections are conducted under districts *that comply with all relevant state and federal laws.*” Order ¶87 (Hagedorn, J., concurring) (emphasis added).

Many of the parties treat the Constitution’s express requirements only as tiebreakers when deciding where to shift lines that must be moved due to population changes. For example, the BLOC Petitioners expressly state that they used the Constitution’s requirements as “decisional criteria” “[i]n choosing *how* to make necessary population shifts.” BLOC Br. 51 (emphasis in original); *see also* Hunter Br. 6–7, 19–21 (treating constitutional requirements for assembly districts as “traditional redistricting criteria” and “str[i]v[ing]” to take them into account only after satisfying population equality and least change).

In keeping with the hierarchy this Court established, the MathSci Proposed Maps deploy a least-change approach, as measured by several metrics. But the MathSci Proposed Maps properly prioritize population equality first and compliance with all other applicable federal and state laws second. This is what the Order required. Other parties’ adherence to a least-change approach cannot excuse their failure to achieve “as close to an approximation to exactness as possible” with respect to population equality. Order ¶28 (internal

quotation marks omitted). Nor can it excuse their failure to follow county and ward lines, or achieve compactness, as mandated by the plain text of the Constitution.

B. Parties Failed to Achieve the Required Level of Population Equality.

As this Court recognized, “the concept of equal representation by population” is enshrined in both the Federal and Wisconsin Constitutions. Order ¶¶9–11, 13. Indeed, this is the sole basis for the Court’s intervention in the redistricting process. *See id.* ¶8 (“Revisions are now necessary only to remedy malapportionment produced by population shifts made apparent by the decennial census.”).

“‘Absolute population equality’ is ‘the paramount objective’” in drawing congressional districts. *Id.* ¶25 (quoting *Abrams v. Johnson*, 521 U.S. 74, 98 (1997)). There is “‘no excuse for the failure to meet the objective of equal representation for equal numbers of people in congressional districting other than the practical impossibility of drawing equal districts with mathematical precision.’” *Id.* (quoting *Mahan v. Howell*, 410 U.S. 315, 322 (1973)). Yet the Governor’s and Hunter’s proposed plans fail to satisfy even this fundamental requirement because they exhibit more than the mathematical minimum population deviation between districts. DeFord Report 9–10.

The Wisconsin Constitution also requires “proportional representation by population,” Order ¶34, by providing that legislative districts should be drawn “according to the number of inhabitants,” *id.* ¶28 (quoting Wis. Const. art. IV, § 3). This provision requires “as close an approximation to *exactness* as possible” with respect to legislative-district populations. *Id.* (quoting *State ex rel. Att’y Gen. v. Cunningham*, 81 Wis. 440, 484, 51 N.W. 724 (1892)). The plain import of this constitutional demand is that population inequality between

legislative districts is permitted only as necessary to satisfy other requirements of state or federal law. *See Wis. State AFL-CIO v. Elections Bd.*, 543 F. Supp. 630, 632 n.1 (E.D. Wis. 1982) (rejecting population inequality not “directed toward maintaining the integrity of political subdivisions”).

Several parties rely on federal redistricting precedent to argue that any plan with less than 2% population deviation automatically complies with federal and state requirements. *See, e.g.*, Hunter Br. 9, 18–19. But 2% is not a safe harbor. This Court has held that the Wisconsin Constitution demands “as close an approximation to exactness as possible.” Order ¶28 (quoting *Cunningham*, 81 Wis. at 484).

The MathSci Proposed Maps achieve a better “approximation to exactness” than any other map. The MathSci Proposed Congressional Map has only a one-person deviation, and the MathSci Proposed Senate and Assembly Maps achieve greater population equality than other proposed plans—while also complying with all federal and state requirements. The MathSci Proposed Maps thus provide the best remedy here.

C. Parties Misunderstood the Requirements of the Voting Rights Act

The Voting Rights Act (“VRA”) requires that members of a racial or language-minority group must have an adequate opportunity to nominate and elect representatives of their choice in a number of districts roughly proportional to their share of the State’s adult citizen population. *See Johnson v. De Grandy*, 512 U.S. 997, 1008 (1994). What matters, however, is that the districts are effective for racial and language-minority voters, not whether the districts reach some specific demographic threshold, such as “majority-minority”

status. Indeed, arbitrarily seeking to create majority-minority districts without first determining whether a district is effective for minority voters risks an excessive focus on race that could violate the Fourteenth Amendment. *See Cooper v. Harris*, 137 S. Ct. 1455, 1469–72 (2017).

Thus, the Citizen Mathematicians and Scientists agree with the Legislature that districts need not be majority-minority to be effective for minority voters. *See Alford Report* ¶¶24–26 & n.9. Unlike the BLOC Petitioners, who drew all their VRA districts as majority-minority, the MathSci Proposed Senate and Assembly Maps draw districts at a range of percentages, some below 50%, but all solidly effective for minority voters. *See DeFord Report* 5–6 . The MathSci Proposed Senate and Assembly Maps thus avoid an excessive focus on race.

However, the Citizen Mathematicians and Scientists part ways with the Legislature and almost all the other parties with respect to the number of districts that would provide a safe harbor against potential Voting Rights Act liability. Given the growth in the Black population over the past decade, a seventh assembly district that is effective for Black voters is appropriate and would avoid potential federal lawsuits. Accordingly, the MathSci Proposed Assembly Map contains seven Milwaukee County assembly districts that are effective for Black voters. *See DeFord Report* 17–18.

D. Parties Failed to Comply with the Constitution’s Directive to Follow County, Town, and Ward Lines in Drawing Assembly Districts.

Several parties failed to adhere to the Constitution’s requirement that assembly districts “be bounded by county, precinct, town or ward lines.” Wis. Const. art. IV, § 4; Order ¶35. This requirement applies equally to senate districts, given the need for nesting, and has been

recognized as a traditional redistricting principle for congressional districts. *See, e.g., Baumgart v. Wendelberger*, No. 01-C-0121, 2002 WL 34127471, at *3 (E.D. Wis. May 30, 2002) (three-judge court), *amended*, 2002 WL 34127473 (E.D. Wis. July 11, 2002).

The Legislature and the BLOC Petitioners suggest that following ward or municipal lines is sufficient. *See* Legislature Br. 31 (touting that “every district follows 2020 ward boundaries”); BLOC Br. 50 (stating that Wisconsin Constitution requires “respecting municipal and ward boundaries”). That is inconsistent with the plain text of the Constitution. As two concurring justices in the seminal *Cunningham* case separately explained, if district boundaries need only follow town or ward lines, “the word ‘county’ would have been superfluous, because county lines are in all cases identical with town or ward lines.” *State ex rel. Att’y Gen. v. Cunningham*, 81 Wis. 440, 514, 51 N.W. 724 (1892) (Pinney, J., concurring); *see also id.* at 521 (Lyon, C.J., concurring).

The singular importance of county lines (over even town and ward lines) in redistricting is grounded in Wisconsin’s history, as well as Article IV’s text. Counties are the basic unit of local government in Wisconsin, and their boundaries (unlike town and ward boundaries) are stable and thus provide a neutral criterion for map-drawing. *See* MathSci Br. 19–21.² Indeed, until 1964, Wisconsin county lines were considered “inviolable.” *Id.* at 21–22 (quoting *Wis. State AFL-CIO*, 543 F. Supp. at 635).

Other parties’ suggestion that all “municipal” lines have the same status under the Wisconsin Constitution is misguided. The

² Hunter emphasizes their map’s respect for “precinct” boundaries. Hunter Br. 20. But the “precincts” referenced in Article IV are not modern-day voting precincts and ceased to exist long ago. *See Cunningham*, 81 Wis. at 520 (Lyon, C.J., concurring).

borders of cities and villages were omitted from Article IV precisely because those borders (unlike towns') crossed county lines, and thus respecting those borders would have required "the disregarding of county lines, and the dismembering of counties." *Cunningham*, 81 Wis. at 521 (Lyon, C.J., concurring). While more recent federal cases have considered city and village splits when assessing maps, a lower number of city or village splits cannot compensate for unnecessarily split counties. *See, e.g., Wis. State AFL-CIO*, 543 F. Supp. at 635 (recognizing that preserving city and village lines, while laudable, is not constitutionally required).

The MathSci Proposed Maps best comply with these legal requirements, by far. The MathSci Proposed Maps split fewer counties than any other proposed plans. And because they are composed of whole wards, they do not split any wards for legislative plans and split fewer wards than any other congressional plan with perfect population equality.

E. Parties Failed to Make Assembly Districts "as Compact as Practicable."

Some parties also failed to prioritize geographic compactness. *See* Wis. Const. art. IV, § 4 (requiring that assembly districts be "in as compact form as practicable"); Wis. Const. art. IV, § 5 (requiring that senators be elected from "convenient ... territory"); *see also, Baumgart*, 2002 WL 34127471, at *3 (compactness is a traditional neutral redistricting principle applicable to congressional districts). Although this Court has "never adopted a particular measure of compactness," Order ¶37, the parties here all used Polsby-Popper and Reock scores to measure compactness.

The MathSci Proposed Legislative Maps achieve the constitutional requirement to be "in as compact form as practicable."

Wis. Const. art. IV, § 4. The MathSci Proposed Assembly Map has Polsby-Popper and Reock scores second only to that of Hunter, which has a far greater population deviation and splits more counties. The MathSci Proposed Senate Map has the second-best Polsby-Popper and the best Reock score.

F. Parties Ignored the Court’s Directive to Avoid the Political Thicket.

This Court was express that it would not consider partisanship when imposing a judicial remedy. Yet several parties invite the Court to do so. In particular, the Legislature, Bewley, and the Governor assert that the Court should select maps that protect incumbents, as an aspect of the “least change” analysis. Legislature Br. 28–30; Bewley Br. 8; Governor Br. 18. This Court did not include incumbent protection among the requirements in its Order, and with good reason. Considering incumbency would “plung[e] this court into the political thicket lurking beyond its constitutional boundaries.” Order ¶63.

The Court should reject the invitation to reward or penalize existing officeholders. *See* Order ¶61 (“[N]one of our cases establishes an individual’s right to have a fair shot at winning.” (quoting *N.Y. State Bd. of Elections v. Lopez Torres*, 552 U.S. 196, 205 (2008) (internal quotation marks omitted))). Minimizing incumbent pairing is an inherently political question akin to the partisan makeup of districts, which the Court has disavowed considering. *See* Order ¶¶39–63.

Neither the Legislature, the Governor, nor Bewley provides support for the proposition that incumbent protection should be repackaged as an aspect of “least change.” The U.S. Supreme Court cases cited by the Legislature simply state that incumbent protection can be a legitimate aim of the *political* branches. *See Karcher v Daggett*, 462 U.S. 725, 740 (1983) (listing “avoiding contests between

incumbent Representatives” among legitimate “legislative policies”); *White v. Weiser*, 412 U.S. 783, 791 (1973) (“not disparag[ing]” state’s interest in “maintaining existing relationships between incumbent congressmen and their constituents”); *Burns v. Richardson*, 384 U.S. 73, 89 n.16 (1966) (stating that map’s minimization of incumbent pairing “does not in and of itself establish invidiousness”). But the separation of powers requires this Court to refrain from the types of political considerations that the Legislature might take into account. Order ¶65. While the Legislature might be free to pick and choose political winners and losers, that is not the Judiciary’s role.

Likewise, the Court should avoid choosing sides between the Governor and the Legislature. The Governor boasts that he “most squarely represents the people’s interests in redistricting,” Governor’s Br. 7, but ignores that the Constitution assigns the task of redistricting to the Legislature. *See* Order ¶19. And the Legislature trumpets its submissions as “the true people’s maps,” Legislature’s Br. 6, 37, but ignores that they were vetoed by a directly elected Governor.³ The reality is that the political process reached an impasse, and neither political branch is entitled to any deference here. *See* Order ¶18.

G. Parties Did Not Properly Account for Other Traditional Neutral Redistricting Criteria.

Given “the equitable nature of a judicial remedy in redistricting,” courts evaluating proposed maps often consider, in addition to legal requirements, “appropriate, useful, and neutral” factors such as “communities of interest.” *See* Order ¶¶82–83 & n.4 (Hagedorn, J., concurring). Compliance with the Constitution’s

³ This Court has already rejected one attempt by the Legislature to claim the mantle of “the polic[y] and preferences of the State,” rightly holding that the “argument fails because the recent legislation did not survive the political process.” Order ¶72 n.8 (quoting Legislature Br. 19).

requirement of preserving political subdivisions is one way to preserve communities of interest. DeFord Report 8.

Another neutral criterion the Court may consider is minimizing voters moved from odd-numbered to even-numbered senate districts, who must wait six years between senate elections. *See* Order ¶83 n.9 (Hagedorn, J., concurring). Contrary to the Legislature’s assertion, however, this is not an aspect of least change. Legislature Br. 25–28. Justice Hagedorn expressly identified it as “a traditional and neutral redistricting criterion that may assist [the Court], but does not implicate a legal right per se.” Order ¶83 n.9 (Hagedorn, J., concurring).

II. THE MATHSCI PROPOSED MAPS FULLY IMPLEMENT THE ORDER’S DIRECTIVES.

The Citizen Mathematicians and Scientists used the 2011 maps as a template and engaged in a computational process to develop proposed maps that—when compared to the other parties’—achieved the best or near-best scores on each one of the legal requirements.

A. The MathSci Proposed Congressional Map Best Complies with the Order.

The MathSci Proposed Congressional Map best complies with the Order. It achieves perfect population equality by limiting deviation among congressional districts to a single person, DeFord Report 9-10; complies with the VRA by creating one Black opportunity district, *id.* 10; and applies the least-change approach, achieving an average core retention of 91.5%, and only 3.0% area moved, *id.* 11.

Moreover, the MathSci Proposed Map significantly outperforms other parties’ proposed maps on traditional redistricting criteria adopted from the Wisconsin Constitution. It splits the fewest counties (7), the fewest municipalities (13), and the fewest wards (8). *Id.* It is

also the most compact map, with a mean Polsby-Popper score of 0.305 and a mean Reock score of 0.464. *Id.* 12.

Table 1: Proposed Congressional Maps⁴					
Criteria	Metric⁵	Congressmen's Map	Governor's Map	Hunter Map	MathSci Map
Population Equality	<i>Population deviation (min to max)</i>	1	2	2	1
The Voting Rights Act	Minority opportunity districts	1	1	1	1
Least Change	Core retention	93.5%	94.5%	93.0%	91.5%
	<i>Population moved</i>	384,456 (6.5%)	324,415 (5.5%)	411,777 (7.0%)	500,785 (8.5%)
	<i>Area Percent moved</i>	9.1%	1.5%	3.4%	3.0%
	Preserved internal edges	486,746	487,087	487,245	487,096
	County overlap	8/8	8/8	8/8	8/8
	District overlap	8/8	8/8	8/8	8/8
	<i>Average buffer distance</i>	11.5	4.8	9.6	5.1
Respect for County, Municipal, and Ward Lines	<i>County splits</i>	10	12	11	7
	<i>Municipal splits</i>	24	30	20	13
	<i>Ward splits</i>	48	32	18	8

⁴ DeFord Report 9–13.

⁵ Italics indicates metrics where a lower number is better.

Criteria	Metric⁵	Congressmen's Map	Governor's Map	Hunter Map	MathSci Map
Compactness	Mean	0.280	0.243	0.272	0.305
	Polsby-Popper				
	Mean Reock	0.456	0.458	0.425	0.464
	Mean convex hull ratio	0.779	0.758	0.733	0.776
	<i>Cut edges</i>	3,410	3,774	3,661	3,228

The other proposed maps fall well short:

- The Congressmen's map does not achieve "least change." It is far behind all other parties in terms of areal displacement, moving 6.1 percentage points more of the state's area than the MathSci Map and 7.6 percentage points more than the Governor's Map. *Id.* 11. With respect to core retention, the Congressmen's map moves about 60,000 more people than the Governor's Map. *Id.* The Congressmen's map underperforms on traditional redistricting criteria, splitting 3 more counties and 11 more municipalities than the MathSci map and by far the most wards (48) of any proposed congressional map. *Id.* 12.
- The Governor's and Hunter maps fail to achieve maximum population equality, because each exhibits a two-person deviation. *Id.* 10. This should be disqualifying, since maximum population equality is a constitutional requirement. The Governor's Map splits the most counties (12) and municipalities (30) of any Proposed Congressional Map. *Id.* 12. The Hunter map splits almost as many counties as the Governor's Proposed Map (11), and nearly as many municipalities as the Governor's

(20). *Id.* With respect to compactness, the Governor's map has the lowest mean Polsby-Popper score, and the Hunter map has the lowest mean Reock score of all the proposed Congressional maps. *Id.* 12.

B. The MathSci Proposed Legislative Maps Best Comply with the Order.

The MathSci Proposed Legislative Maps best comply with the Order. Specifically, they:

- achieve the smallest population deviation for both senate and assembly of any proposed map. *Id.* 13, 17.
- comply with the requirements of the VRA. *Id.* 14, 18.
- far outperform all the other maps on county lines, splitting 10 fewer counties than the next closest assembly map and 14 fewer than the next closest senate map. *Id.* 15, 18.
- split zero wards and the second-smallest number of municipalities. *Id.*
- are as compact as practicable, achieving the best mean Reock and the second-best mean Polsby-Popper scores among proposed senate maps and the second-best mean Reock and mean Polsby-Popper scores among proposed assembly maps. *Id.* 16, 19.

TABLE 2: Proposed Legislative Maps⁶							
Criteria	Metric⁷	Bewley Maps	BLOC Maps	Governor Maps	Hunter Maps	Legislature's Maps	MathSci Maps
Population Equality	<i>Population deviation (min to max)</i>	<u>Senate:</u> 2,871 (1.608%)	<u>Senate:</u> 1,719 (0.962%)	<u>Senate:</u> 2, 138 (1.197%)	<u>Senate:</u> 1,698 (0.951%)	<u>Senate:</u> 1,026 (0.574%)	<u>Senate:</u> 895 (0.501%)
		<u>Assembly:</u> 1,104 (1.854%)	<u>Assembly:</u> 784 (1.317%)	<u>Assembly:</u> 1,121 (1.883%)	<u>Assembly:</u> 1,083 (1.819%)	<u>Assembly:</u> 452 (0.759%)	<u>Assembly:</u> 438 (0.736%)
The Voting Rights Act	Black opportunity districts	<u>Senate:</u> 2 <u>Assembly:</u> 6	<u>Senate:</u> 2 <u>Assembly:</u> 7	<u>Senate:</u> 2 <u>Assembly:</u> 7	<u>Senate:</u> 2 <u>Assembly:</u> 7	<u>Senate:</u> 2 <u>Assembly:</u> 6	<u>Senate:</u> 2 <u>Assembly:</u> 7
	Latino opportunity districts	<u>Senate:</u> 1 <u>Assembly:</u> 2	<u>Senate:</u> 1 <u>Assembly:</u> 2	<u>Senate:</u> 1 <u>Assembly:</u> 2	<u>Senate:</u> 1 <u>Assembly:</u> 2	<u>Senate:</u> 1 <u>Assembly:</u> 2	<u>Senate:</u> 1 <u>Assembly:</u> 2
Respect for County, Municipal, and Ward Lines	<i>County splits</i>	<u>Senate:</u> 48 <u>Assembly:</u> 55	<u>Senate:</u> 42 <u>Assembly:</u> 53	<u>Senate:</u> 45 <u>Assembly:</u> 53	<u>Senate:</u> 42 <u>Assembly:</u> 50	<u>Senate:</u> 42 <u>Assembly:</u> 53	<u>Senate:</u> 28 <u>Assembly:</u> 40
	<i>Municipal splits</i>	<u>Senate:</u> 67 <u>Assembly:</u> 99	<u>Senate:</u> 73 <u>Assembly:</u> 104	<u>Senate:</u> 117 <u>Assembly:</u> 175	<u>Senate:</u> 109 <u>Assembly:</u> 181	<u>Senate:</u> 28 <u>Assembly:</u> 48	<u>Senate:</u> 31 <u>Assembly:</u> 70
	<i>Ward splits</i>	<u>Senate:</u> 161 <u>Assembly:</u> 285	<u>Senate:</u> 65 <u>Assembly:</u> 94	<u>Senate:</u> 179 <u>Assembly:</u> 258	<u>Senate:</u> 132 <u>Assembly:</u> 257	<u>Senate:</u> 0 <u>Assembly:</u> 0	<u>Senate:</u> 0 <u>Assembly:</u> 0
Compactness	Mean Polsby- Popper	<u>Senate:</u> 0.213	<u>Senate:</u> 0.197	<u>Senate:</u> 0.217	<u>Senate:</u> 0.268	<u>Senate:</u> 0.224	<u>Senate:</u> 0.260
		<u>Assembly:</u> 0.253	<u>Assembly:</u> 0.227	<u>Assembly:</u> 0.251	<u>Assembly:</u> 0.340	<u>Assembly:</u> 0.243	<u>Assembly:</u> 0.282

⁶ DeFord Report 13–19. The Duchin Report submitted on December 15, 2021 contained two inadvertent errors that have been corrected here and in the DeFord Report. The first error was with regard to the population deviation of the Legislature's Proposed Assembly Map (reporting 456 rather than 452). The second error was the number of county overlaps for the MathSci Proposed Assembly Map (reporting 87 rather than 93 overlaps).

⁷ Italics indicates metrics where a lower number is better.

TABLE 2: Proposed Legislative Maps⁶							
Criteria	Metric⁷	Bewley Maps	BLOC Maps	Governor Maps	Hunter Maps	Legislature's Maps	MathSci Maps
	Mean Reock	<u>Senate:</u> 0.401 <u>Assembly:</u> 0.405	<u>Senate:</u> 0.395 <u>Assembly:</u> 0.374	<u>Senate:</u> 0.392 <u>Assembly:</u> 0.397	<u>Senate:</u> 0.397 <u>Assembly:</u> 0.442	<u>Senate:</u> 0.395 <u>Assembly:</u> 0.379	<u>Senate:</u> 0.402 <u>Assembly:</u> 0.406
	Mean convex hull ratio	<u>Senate:</u> 0.717 <u>Assembly:</u> 0.734	<u>Senate:</u> 0.695 <u>Assembly:</u> 0.698	<u>Senate:</u> 0.710 <u>Assembly:</u> 0.720	<u>Senate:</u> 0.739 <u>Assembly:</u> 0.783	<u>Senate:</u> 0.710 <u>Assembly:</u> 0.717	<u>Senate:</u> 0.735 <u>Assembly:</u> 0.736
	<i>Cut edges</i>	<u>Senate:</u> 10,688 <u>Assembly:</u> 18,420	<u>Senate:</u> 11,776 <u>Assembly:</u> 20,096	<u>Senate:</u> 11,147 <u>Assembly:</u> 18,441	<u>Senate:</u> 9,565 <u>Assembly:</u> 15,353	<u>Senate:</u> 10,785 <u>Assembly:</u> 19,196	<u>Senate:</u> 9,754 <u>Assembly:</u> 17,781
Least Change	Core retention	<u>Senate:</u> 90.2% <u>Assembly:</u> 83.3%	<u>Senate:</u> 89.6% <u>Assembly:</u> 84.1%	<u>Senate:</u> 92.2% <u>Assembly:</u> 85.8%	<u>Senate:</u> 80.8% <u>Assembly:</u> 73.1%	<u>Senate:</u> 92.2% <u>Assembly:</u> 84.2%	<u>Senate:</u> 74.3% <u>Assembly:</u> 61.0%
	<i>Population moved</i>	<u>Senate:</u> 576,321 (9.8%) <u>Assembly:</u> 984,336 (16.7%)	<u>Senate:</u> 610,568 (10.4%) <u>Assembly:</u> 939,513 (15.9%)	<u>Senate:</u> 461,228 (7.8%) <u>Assembly:</u> 837,659 (14.2%)	<u>Senate:</u> 1,128,878 (19.2%) <u>Assembly:</u> 1,586,059 (26.9%)	<u>Senate:</u> 459,061 (7.8%) <u>Assembly:</u> 933,604 (15.8%)	<u>Senate:</u> 1,513,824 (25.7%) <u>Assembly:</u> 2,299,625 (39.0%)
	<i>Percent area moved</i>	<u>Senate:</u> 9.8% <u>Assembly:</u> 16.8%	<u>Senate:</u> 6.1% <u>Assembly:</u> 9.6%	<u>Senate:</u> 5.0% <u>Assembly:</u> 11.3%	<u>Senate:</u> 14.0% <u>Assembly:</u> 18.2%	<u>Senate:</u> 7.1% <u>Assembly:</u> 16.5%	<u>Senate:</u> 29.1% <u>Assembly:</u> 38.5%
	Preserved internal edges	<u>Senate:</u> 476,575 <u>Assembly:</u> 465,157	<u>Senate:</u> 476,621 <u>Assembly:</u> 466,205	<u>Senate:</u> 477,745 <u>Assembly:</u> 467,562	<u>Senate:</u> 476,482 <u>Assembly:</u> 466,597	<u>Senate:</u> 477,558 <u>Assembly:</u> 466,249	<u>Senate:</u> 477,230 <u>Assembly:</u> 465,050
	County overlap	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 93/99
	District overlap	<u>Senate:</u> 33/33 <u>Assembly:</u> 98/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 99/99	<u>Senate:</u> 33/33 <u>Assembly:</u> 85/99

Criteria	Metric⁷	Bewley Maps	BLOC Maps	Governor Maps	Hunter Maps	Legislature's Maps	MathSci Maps
	<i>Average buffer distance</i>	<u>Senate:</u> 6.7 <u>Assembly:</u> 5.4	<u>Senate:</u> 6.2 <u>Assembly:</u> 4.9	<u>Senate:</u> 5.4 <u>Assembly:</u> 4.8	<u>Senate:</u> 8.5 <u>Assembly:</u> 6.0	<u>Senate:</u> 6.5 <u>Assembly:</u> 6.0	<u>Senate:</u> 17.0 <u>Assembly:</u> 13.0
Traditional Redistricting Criteria	<i>Number of people moved from odd to even senate districts</i>	137,084 (2.3%)	177,698 (3.0%)	139,677 (2.4%)	240,593 (4.1%)	138,753 (2.4%)	422,492 (7.2%)

The other proposed maps fall well short of these standards:

- The Legislature's Proposed Maps underperform on population deviation and compactness in comparison to the MathSci Proposed Maps. *See id.* 13, 16, 17, 19. Further, the Legislature's Proposed Senate and Assembly Maps split more counties than the MathSci Maps (14 more for Senate and 13 for Assembly). *Id.* 15, 18.
- The Governor's Proposed Maps are also weak on population deviation, with a deviation percentage 0.696 points higher than the MathSci Proposed Senate Map, and the worst population deviation of all assembly maps (1.883%). *Id.* 13, 17. The Governor splits more counties than the MathSci Senate Map or Assembly Map (17 and 13 more, respectively). *Id.* 15, 18. It also splits an unacceptable number of wards in both maps. *Id.* The Governor's Maps are also insufficiently compact, with the Governor's Senate Map having the lowest mean Reock score of any senate map. *Id.* 16, 19.

- The Bewley Senate Map has the worst population deviation, and their Assembly Map the second-worst population deviation. *Id.* 13, 17. The Bewley Maps also split the most counties of any proposed maps. *Id.* 15, 18.
- The Hunter Senate Map splits 14 more counties than the MathSci Map, and the Hunter Assembly Map splits 10 more counties than the MathSci Map. *Id.* The Hunter Maps also split the second most municipalities of any of the proposed senate plans and the most of any of the proposed assembly plans (109 and 181 splits, respectively). *Id.* And the Hunter Proposed Maps fail to respect ward lines, splitting 132 wards in their Senate Map and 257 in their Assembly Map. *Id.* The Hunter Proposed Maps also sacrifice population equality. Their Senate Map has 0.45 percentage points greater population deviation than the MathSci map, and their Assembly Map has 1.083 percentage points greater population deviation than the MathSci Map. *Id.* 13, 17.
- Finally, the BLOC Senate Map splits 14 more counties and 42 more municipalities than the MathSci Senate Map. *Id.* 15. The BLOC Assembly Map similarly splits 13 more counties and 34 more municipalities than the MathSci Assembly Map. *Id.* 18. The BLOC Senate Map splits 65 wards and the Assembly Map splits 94 wards, when no split wards were necessary. *Id.* 15, 18. The BLOC Senate Map also has the worst mean Polsby-Popper score, and the BLOC Proposed Assembly Map performs the worst on mean Polsby-Popper and mean Reock. *Id.* 16, 19.

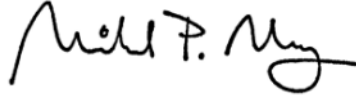
CONCLUSION

The Citizen Mathematicians and Scientists urge the Court to adopt their proposed maps for Congress, the Senate, and the Assembly.

Dated this 30th day of December 2021.

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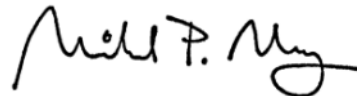
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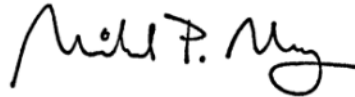
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