

**APPENDIX A: Richmond First Plan**

<b>District</b>	<b>Dem Gov '09</b>	<b>Dem Lt Gov '09</b>	<b>Dem Atty Gen '09</b>	<b>Dem Pres '12</b>	<b>Dem U.S. Sen '12</b>	<b>Dem Pres '08</b>
1	60.2	62.4	62.8	67.7	68.5	72.7
2	36.1	39.1	37.6	<b>47.2</b>	<b>48.4</b>	<b>47.3</b>
3	56.9	59.3	57.3	69.5	69.0	68.1
4	35.5	<b>40.3</b>	37.2	46.0	47.6	45.9
5	47.0	49.0	46.8	59.0	60.5	58.7
6	31.8	33.9	34.0	42.2	43.2	44.2
7	<b>36.8</b>	38.4	<b>36.7</b>	45.6	46.6	46.5
8	34.0	34.1	32.9	40.0	40.8	41.6
9	32.8	33.5	33.5	35.3	37.9	40.0
10	46.9	49.5	50.2	58.0	58.9	57.4
11	40.7	43.3	42.8	56.4	56.4	55.6
Median District % <sup>1</sup>	36.8	40.3	37.6	47.2	48.4	47.3
Mean District % <sup>2</sup>	41.7	43.9	42.9	51.5	52.5	52.0
Median – Mean Difference <sup>3</sup>	-4.9	-3.6	-5.3	-4.3	-4.1	-4.7
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem	Dem	Dem	Dem
Contra-Majority Result for						

Disad- vantaged Party <sup>5</sup>	~ ~ ~	~ ~ ~	~ ~ ~	Yes	Yes	Yes
Gerrymander Effect <sup>6</sup>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX B: Plaintiffs' Plan**

<b>District</b>	<b>Dem Gov '13</b>	<b>Dem Lt Gov '13</b>	<b>Dem Atty Gen '13</b>
1	43.0	48.4	42.7
2	55.5	61.2	52.5
3	71.8	72.6	69.3
4	54.1	58.8	52.2
5	36.4	43.6	35.6
6	44.9	48.3	42.4
7	41.2	47.7	41.1
8	71.2	72.9	70.1
9	34.0	38.8	32.7
10	<b>49.3</b>	<b>52.1</b>	<b>49.8</b>
11	63.0	65.1	62.5
Median District % <sup>1</sup>	49.3	52.1	49.8
Mean District % <sup>2</sup>	51.3	55.4	50.1
Median – Mean Difference <sup>3</sup>	-2.0	-3.3	-0.3
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem
Contra-Majority Result for			

Disad- vantaged Party <sup>5</sup>	Yes	~ ~ ~	Yes
Gerrymander Effect <sup>6</sup>	<i>Yes</i>	<i>No</i>	<i>Yes</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX C: Rapoport Plan**

<b>District</b>	<b>Dem Gov '13</b>	<b>Dem Lt Gov '13</b>	<b>Dem Atty Gen '13</b>	<b>Dem Pres '08</b>
1	44.8	49.8	44.2	47.5
2	<b>48.6</b>	<b>55.2</b>	<b>46.0</b>	<b>49.3</b>
3	67.8	68.8	65.1	67.5
4	62.3	66.1	60.6	61.8
5	44.2	48.6	42.8	48.4
6	37.4	41.8	35.3	42.4
7	39.9	48.0	40.0	43.0
8	71.3	72.9	70.2	68.7
9	34.2	39.1	32.8	40.8
10	49.3	52.1	49.8	51.9
11	63.0	65.1	62.5	62.3
Median District % <sup>1</sup>	48.6	52.1	46.0	49.3
Mean District % <sup>2</sup>	51.2	55.2	49.9	53.1
Median – Mean Difference <sup>3</sup>	-2.6	-3.1	-3.9	-3.8
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem	Dem
Contra-Majority Result for Disad-	Yes	No	~ ~ ~	Yes

vantaged Party <sup>5</sup>				
Gerrymander Effect <sup>6</sup>	<i>Yes</i>	<i>No</i>	<i>NA</i>	<i>Yes</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX D: Intervenors' Plan #2**

<b>District</b>	<b>Dem Gov '09</b>	<b>Dem Lt Gov '09</b>	<b>Dem Atty Gen '09</b>	<b>Dem Pres '12</b>	<b>Dem U.S. Sen '12</b>	<b>Dem Pres '08</b>
1	34.4	37.1	36.5	46.1	47.1	46.2
2	38.9	44.0	40.9	51.5	52.7	50.7
3	64.3	66.2	64.3	75.1	75.0	74.1
4	<b>37.8</b>	40.5	<b>38.3</b>	<b>49.2</b>	<b>50.0</b>	<b>48.7</b>
5	38.0	39.4	38.0	46.2	46.6	47.3
6	32.8	33.2	32.4	39.9	40.7	41.7
7	34.9	37.4	35.6	45.3	47.7	46.3
8	60.1	62.2	62.5	67.7	68.5	66.9
9	33.9	34.3	34.2	35.7	38.3	40.3
10	37.5	<b>39.7</b>	40.0	<b>49.2</b>	50.1	50.0
11	50.2	53.0	53.5	62.7	63.2	61.2
Median District % <sup>1</sup>	37.8	39.7	38.3	49.2	50.0	48.7
Mean District % <sup>2</sup>	42.1	44.3	43.3	51.7	52.7	52.1
Median – Mean Difference <sup>3</sup>	-4.3	-4.6	-5.0	-2.5	-2.7	-3.4
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem	Dem	Dem	Dem

Contra-Majority Result for Disadvantaged Party <sup>5</sup>	~ ~ ~	~ ~ ~	~ ~ ~	Yes	Maybe	Yes
Gerrymander Effect <sup>6</sup>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Yes</i>	<i>Maybe</i>	<i>Yes</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.



**APPENDIX E: Intervenors' Plan #1**

<b>District</b>	<b>Dem Gov '09</b>	<b>Dem Lt Gov '09</b>	<b>Dem Atty Gen '09</b>	<b>Dem Pres '12</b>	<b>Dem U.S. Sen '12</b>	<b>Dem Pres '08</b>
1	34.4	37.1	36.5	46.1	47.1	46.2
2	38.9	44.0	40.9	51.5	52.7	50.7
3	64.6	66.4	64.5	75.6	75.6	74.6
4	<b>37.7</b>	40.4	<b>38.2</b>	<b>49.1</b>	<b>49.9</b>	<b>48.7</b>
5	38.0	39.4	38.0	46.2	46.6	47.3
6	32.8	33.2	32.4	39.9	40.7	41.7
7	34.6	37.1	35.3	45.0	47.3	45.8
8	60.1	62.2	62.5	67.7	68.5	66.9
9	33.9	34.3	34.2	35.7	38.3	40.3
10	37.5	<b>39.7</b>	40.0	49.2	50.1	50.0
11	50.2	53.0	53.5	62.7	63.2	61.2
Median District % <sup>1</sup>	37.7	39.7	38.2	49.1	49.9	48.7
Mean District % <sup>2</sup>	42.1	44.3	43.3	51.7	52.7	52.1
Median – Mean Difference <sup>3</sup>	-4.4	-4.6	-5.1	-2.6	-2.8	-3.4
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem	Dem	Dem	Dem
Contra-Majority Result for Disad-	~ ~ ~	~ ~ ~	~ ~ ~	Yes	Yes	Yes

vantaged Party <sup>5</sup>						
Gerrymander Effect <sup>6</sup>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX F: NAACP Plan**

<b>District</b>	<b>Dem Gov '13</b>	<b>Dem Lt Gov '13</b>	<b>Dem Atty Gen '13</b>
1	43.0	47.5	43.2
2	45.3	<b>51.4</b>	43.2
3	67.2	69.3	64.2
4	69.6	71.1	67.4
5	<b>45.6</b>	49.9	<b>44.4</b>
6	33.5	38.8	31.7
7	41.1	50.4	40.9
8	71.2	72.9	70.1
9	36.8	41.2	35.2
10	49.3	52.1	49.8
11	63.0	65.1	62.5
Median District % <sup>1</sup>	45.6	51.4	44.4
Mean District % <sup>2</sup>	51.0	55.1	49.7
Median – Mean Difference <sup>3</sup>	-5.4	-3.7	-5.3
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem
Contra-Majority Result for Disad-	Yes	~ ~ ~	~ ~ ~

vantaged Party <sup>5</sup>			
Gerrymander Effect <sup>6</sup>	<i>Yes</i>	<i>No</i>	<i>NA</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat's two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party's voters.

<sup>4</sup> **Disadvantaged Party** reports which party's voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX G: Petersen Plan**

<b>District</b>	<b>Dem Gov '09</b>	<b>Dem Lt Gov '09</b>	<b>Dem Atty Gen '09</b>	<b>Dem Pres '12</b>	<b>Dem U.S. Sen '12</b>	<b>Dem Pres '08</b>
1	39.5	43.9	41.5	51.9	52.9	51.4
2	43.9	47.8	45.1	55.3	56.1	54.2
3	60.9	62.3	60.5	72.6	72.6	71.6
4	32.6	34.9	33.9	43.3	44.8	44.1
5	36.3	38.8	36.7	45.9	48.2	46.7
6	37.4	37.6	36.2	43.7	44.3	45.2
7	30.0	31.2	30.9	39.4	39.9	41.1
8	58.8	61.0	61.2	67.0	67.8	66.1
9	31.0	31.8	31.7	33.4	36.0	38.0
10	43.8	46.5	46.0	58.0	58.1	57.6
11	45.9	48.4	49.3	56.5	57.6	56.0
Median District % <sup>1</sup>	39.5	43.9	41.5	51.9	52.9	51.4
Mean District % <sup>2</sup>	41.8	44.0	43.0	51.5	52.6	52.0
Median – Mean Difference <sup>3</sup>	-2.3	-0.1	-1.5	+0.4	+0.3	-0.6
Disadvantaged Party <sup>4</sup>	Dem	Dem	Dem	Rep	Rep	Dem

Contra-Majority Result for Disadvantaged Party <sup>5</sup>	~ ~ ~	~ ~ ~	~ ~ ~	~ ~ ~	~ ~ ~	No
Gerrymander Effect <sup>6</sup>	NA	NA	NA	NA	NA	No

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX H: Governor’s Plan**

<b>District</b>	<b>Dem Gov ‘09</b>	<b>Dem Lt Gov ‘09</b>	<b>Dem Atty Gen ‘09</b>	<b>Dem Pres ‘12</b>	<b>Dem U.S. Sen ‘12</b>	<b>Dem Pres ‘08</b>
1	33.5	35.6	35.2	44.2	45.1	45.2
2	34.3	39.1	36.2	45.3	46.8	44.8
3	54.0	57.2	55.3	67.0	66.9	64.3
4	56.7	58.4	54.6	68.1	68.3	66.7
5	<b>43.3</b>	<b>44.4</b>	<b>42.9</b>	<b>52.3</b>	<b>52.6</b>	<b>52.3</b>
6	28.1	29.0	28.4	35.3	36.2	36.8
7	31.0	33.7	31.5	40.6	43.2	41.2
8	54.3	56.8	56.6	66.9	66.9	64.8
9	33.4	33.6	33.5	34.4	37.0	38.5
10	45.7	47.9	48.2	54.6	55.7	54.8
11	50.7	53.3	54.0	61.3	62.0	59.5
Median District % <sup>1</sup>	43.3	44.4	42.9	52.3	52.6	52.3
Mean District % <sup>2</sup>	42.3	44.5	43.3	51.8	52.8	51.7
Median – Mean Difference <sup>3</sup>	+1.0	-0.1	-0.4	+0.4	-0.2	+0.6
Disadvantaged Party <sup>4</sup>	Rep	Dem	Dem	Rep	Dem	Rep
Contra-Majority Result for Disad-	No	~ ~ ~	~ ~ ~	~ ~ ~	No	~ ~ ~

vantaged Party <sup>5</sup>						
Gerrymander Effect <sup>6</sup>	<i>No</i>	<i>NA</i>	<i>NA</i>	<i>NA</i>	<i>No</i>	<i>NA</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat’s two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party’s voters.

<sup>4</sup> **Disadvantaged Party** reports which party’s voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.



**APPENDIX I: Bull Elephant Plan B**

<b>District</b>	<b>Dem Pres '08</b>
1	48.1
2	51.5
3	72.5
4	<b>50.7</b>
5	48.0
6	42.9
7	46.6
8	69.1
9	40.8
10	54.0
11	59.9
Median District % <sup>1</sup>	50.7
Mean District % <sup>2</sup>	53.1
Median – Mean Difference <sup>3</sup>	-2.4
Disadvantaged Party <sup>4</sup>	Dem
Contra-Majority Result for Disad-	No

vantaged Party <sup>5</sup>	
Gerrymander Effect <sup>6</sup>	<i>No</i>

<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat's two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party's voters.

<sup>4</sup> **Disadvantaged Party** reports which party's voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX J: Bull Elephant Plan A**

<b>District</b>	<b>Dem Pres '08</b>
1	62.3
2	48.2
3	51.5
4	72.5
5	<b>50.7</b>
6	48.4
7	42.4
8	46.6
9	69.1
10	40.8
11	51.4
Median District % <sup>1</sup>	50.7
Mean District % <sup>2</sup>	53.1
Median – Mean Difference <sup>3</sup>	-2.4
Disadvantaged Party <sup>4</sup>	Dem
Contra-Majority Result for Disadvantaged Party <sup>5</sup>	No

Gerrymander Effect <sup>6</sup>	<i>No</i>
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<sup>1</sup> **Median District %** is the numerical value among the 11 that, when the Democrat's two-party percentages are ordered from lowest to highest, stands in the middle, i.e., sixth in order with five lower and five higher percentages. It is a simple indicator of which party carried a majority of the districts.

<sup>2</sup> **Mean District %** is the average two-party percentage among the eleven districts.

<sup>3</sup> **Median - Mean Difference** subtracts the mean districts percentage from the median district percentage. A positive value indicates Republican voters have been packed more than Democratic voters; a negative value indicates Democratic voters have been packed more than Republicans. The magnitude loosely indicates the size of the disadvantage suffered by one party's voters.

<sup>4</sup> **Disadvantaged Party** reports which party's voters are relatively more packed.

<sup>5</sup> **Contra-Majority Result for Disadvantaged Party** reports whether harm to the disadvantaged party voters is evident because they failed to carry a majority of districts with a majority of votes. An ~ ~ ~ entry indicates the disadvantaged party voters could not have been harmed because they did not cast a majority of votes.

<sup>6</sup> **Gerrymander Effect** reports whether the outcome of the election indicates the voters of the disadvantaged party suffered harm due to packing because their vote majority carried less than a majority of districts. *Yes* = gerrymandering harm in the election; *No* = no gerrymandering harm in the election; *NA* = not applicable because the disadvantaged party could not suffer harm as it cast only a minority of the votes.

**APPENDIX K:**  
**Checking Symmetry with 1,000 Computer-Generated, Neutral**  
**Districting Plans using the 2008 Presidential and**  
**Three 2013 Statewide Elections**

We generated estimates for the distribution of neutrally drawn maps using a multi-level weighted graph partitioning algorithm. Graph partitioning is a technique used by computer scientists to assign equal numbers of computational tasks to a computer's processors. We use our graph partitioning algorithm to divide geographic regions into districts containing equal numbers of people. The process begins by randomly combining sets of contiguous census blocks. The process randomly combines those sets of blocks until there are only eleven distinct and contiguous districts. We then use the Kernigan-Lin algorithm, a process developed by computer scientists, to adjust the boundaries of the legislative district in order to achieve population parity across all districts in the map.<sup>1</sup> We used the process to produce 1,000 distinct maps of eleven contiguous congressional districts in Virginia. Since the computer is only instructed to draw maps in which each district is contiguous and contains equal population (loosely defined as  $\pm 1.5$  percent of the ideal), there is no reason to believe that the process is prejudiced for or against a particular group.

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<sup>1</sup> Brian W. Kernighan & Shen Lin, *An efficient heuristic procedure for partitioning graphs*, 49.2 BELL SYSTEM TECH. J. 291, 291-307(1970); BRUCE HENDRICKSON & ROBERT LELAND, A MULTI-LEVEL ALGORITHM FOR PARTITIONING GRAPHS 28 (1995).

## **APPENDIX L: Compiling Data for the 2013 Elections**

Data for the analysis of the 2013 elections come from four main sources: a shapefile of Virginia's election districts in all counties, independently compiled by the Virginia Public Access Project, a shapefile of 2010 census blocks downloaded from the Census Department's website, the block-level demographic reports from the 2010 census reported by the "Census Fact Finder" application on the Census Department's website, and precinct-level election returns reported by the Virginia Department of Elections. We discuss each of these in turn and then describe how the data were merged and the results produced.

Precinct boundaries may change in between elections as counties and independent cities attempt to meet their citizens' needs (usually by dividing or combining precincts). Since local governments draw these districts and there is, in Virginia and many other states, no centralized repository of election maps, finding a usable statewide map is difficult. Recognizing this problem, the Virginia Public Access Project contacted every county and independent city in 2013 and 2014 for copies of their precinct maps, and have produced a statewide map for 2013 in the form of shapefile. We downloaded this map, <https://github.com/vapublicaccessproject/va-precinct-maps/tree/master/shp>, and compared it to election results reported by the Department of Elections. Virginia's precincts are both numbered and named (for the location in which the polling takes place), so we were able to confirm that the shapefile was an accurate representation of the precincts in which votes were cast in 2013.

Given the need to split precincts to keep district populations equal, we followed the lead of many of the parties here by disaggregating the precincts into their component blocks from the 2010 Census. Using GIS, we joined the precinct shapefile to a shapefile of 2010 census blocks downloaded for the Census Department in order to assign each of the 285,762 blocks to a single precinct. We added block-level demographic data, most importantly its population and voting-age population, from the Census website.

Finally, we added 2013 precinct-level returns to the dataset from results from the Department of Elections reports for the general elections for Governor, Lieutenant Governor, and Attorney General. One unusual feature of Virginia's election administration is its treatment of absentee and provisional ballots. Most states report these votes in the precinct where the voter resides. Virginia creates separate countywide precincts for absentee and provisional votes that are unlinked to specific geography. Given the uncertainty of how to allocate these votes within a county or city and the relatively small number of absentee and provisional ballots cast (usually less than 10% of votes in any election), we chose to set these aside and deal only with votes counted directly in a single, definable precinct. (We note, however, that in the extremely close 2013 race for Attorney General, the losing candidate—Obenshain—actually had a small majority among votes attributed to a specific precinct.)

To estimate the candidates' share of votes within a precinct, we calculated the block's share of the precinct's voting-age population and multiplied it by the number of votes cast within a precinct for a particular candidate. For instance, if a candidate received 1,000 votes in a precinct and a given block accounted for 3.34% of its voting-age population, we would estimate they received 33.4 votes on that block. This is a fairly standard method for allocating votes to blocks.

Several of the plans we analyze include a list of 2010 census blocks with their congressional district assignment. We merged these assignments with the larger dataset and summed the raw vote totals for the Democratic and Republican candidates for Governor, Lieutenant Governor, and Attorney General in 2013. We next calculated the two-party vote percentage in each district and calculated the median and mean across all districts. At least one plan, the proposal submitted by the plaintiffs, did not provide a list of district assignments by census blocks, so we used GIS to spatially locate blocks within districts, then repeated the process above.