

STATE BOARD OF ELECTIONS

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December 22, 2016

Honorable Edward J. Kasemeyer, Chair
Senate Budget and Taxation Committee
3 West Miller Senate Office Building
Annapolis, Maryland 21401

Honorable Joan Carter Conway, Chair
Senate Education, Health and Environmental Affairs Committee
2 West Miller Senate Office Building
Annapolis, Maryland 21401

Honorable Maggie McIntosh, Chair
House Appropriations Committee
Room 121 House Office Building
Annapolis, Maryland 21401

Honorable Sheila E. Hixon
House Ways and Means Committee
Room 131 House Office Building
Annapolis, Maryland 21401

Re: *State Board of Elections – Joint Chairman’s Report on the 2016 Post-Election Tabulation Audit*

Dear Senator Kasemeyer, Senator Conway, Delegate McIntosh and Delegate Hixon:

I am pleased to submit this report pursuant to section D38I01.01 of the 2016 *Joint Chairmen’s Report* (JCR), regarding the post-election tabulation audit conducted by this office following the November 8, 2016 General Election. The JCR added language to the State Board of Elections’ (SBE) general fund appropriation withholding \$50,000 until a report answering the following questions was submitted.

1. Detailed Description of Post-Election Tabulation Audit Performed After the 2016 General Election.

A. Background and Selection of Post-Election Tabulation Audit Method

Post-election tabulation audits are used to verify and confirm the accuracy of a voting system’s reported results. Post-election tabulation audits are not recounts,

which are conducted when a particular contest is very close. Rather, post-election audits are concerned with the actual performance of the primary voting system, serving to ensure that the system is tallying ballots and calling the winners of all contests correctly. When used in conjunction with pre-election logic and accuracy (“L&A”) testing, post-election tabulation audits serve to increase public confidence in the election results, election administration and the democratic process.

SBE began preparations to implement a post-election tabulation audit in early 2016. In June 2016, SBE conducted a pilot program in cooperation with the Carroll and Montgomery County Boards of Elections using ballot images from the April 2016 Primary Election.¹ The pilot program tested three different post-election tabulation audit methodologies (an independent automated audit, a ballot level audit applying risk limiting principles and a fixed percentage audit) and was guided by the following evaluation criteria:

- Maximize the technological functions of the new voting system;
- Minimize human error and eliminate chain of custody issues by using securely stored ballot images, rather than actual voted paper ballots;
- Minimize the use of valuable staff time at Local Boards of Elections (“LBEs”) in the days following an election;
- Complete the audit prior to legally binding certification and swearing-in deadlines;
- Be conducted at the ballot level, *i.e.* tally actual voted ballot images to audit the voting system results; and
- Be entirely independent of the primary voting system.

The decision to use ballot images, rather than actual voted paper ballots, was considered at length by SBE. An important feature of Maryland’s new paper-based voting system (Election System & Software’s (ES&S) EVS 5.2.0.0) is its ability to capture an image of each voted ballot when the paper ballot is fed through the scanner at the voting location or at the local board of elections, as is the case with absentee and provisional ballots. After considering its goals for the pilot program and for post-election tabulation audits generally, SBE determined that the use of ballot images would allow it to take advantage of this functionality, minimize human error, maintain secure storage of voted ballots, reduce costs and LBE staff time, and fulfill SBE’s legislative mandate to maximize the use of technology in election administration.²

The decision to use ballot images for a post-election tabulation audit should not suggest that there would *never* be a time that the examination of actual voted paper ballots would be required. Indeed, such an examination might be entirely necessary

¹ A full report on the pilot program is available at [http://www.elections.state.md.us/press room/documents/Post%20Election%20Tabulation%20Audit%20Pilot%20Program%20Report.pdf](http://www.elections.state.md.us/press%20room/documents/Post%20Election%20Tabulation%20Audit%20Pilot%20Program%20Report.pdf).

² Md. Code Ann. Election Law § 2-102(a)(7).

and proper under the appropriate circumstances, using guidelines developed for that purpose. Such an examination of actual voted paper ballots, however, would be far more successful and secure if guided by data allowing for a targeted and precise review. In the context of a comprehensive post-election tabulation audit, SBE determined that the use of ballot images was the best way to achieve stated goals.

At the conclusion of the pilot program, SBE and the participating pilot counties agreed that an independent, automated audit would be the most efficient, accurate and comprehensive audit method for use following the 2016 General Election. This conclusion was based a number of factors, including the fact that the comprehensive nature of the independent, automated audit (*i.e.* re-tabulating 100% of ballots cast in all counties and precincts) provides the public with far more confidence in the reported election results than the audit of any small, random sample of ballots could ever provide, regardless of how those ballots are tabulated. While the comprehensive nature of an independent, automated audit results in a somewhat greater cost, in the estimation of SBE and the participating pilot counties, this increased cost is worth the far greater assurance in the reported results provided by a complete, 100% audit of all ballots cast.

In addition, the speed with which an independent, automated audit can be performed allows the public, candidates and other interested parties timely reassurances regarding results before the certification deadlines so that county and local candidates can be sworn into office in accordance with applicable county laws and charters.³ An independent, automated audit also significantly reduces the time that LBE staff would need to spend on the audit, freeing staff to focus on canvassing absentee and provisional ballots and other required post-election tasks. Finally, the independent, automated audit confers additional benefits regarding the maintenance and operation of voting equipment (scanners); the programming and coding of the primary voting system; and the improvement of poll-worker and election official training. These serve to improve election administration and the voting experience for Marylanders.

B. Detailed Description of Post-Election Audit Process

Following the November 8, 2016 General Election, SBE conducted an independent, automated post-election tabulation audit of every ballot cast in every county and precinct in Maryland, including ballots cast during early voting, on election day, and absentee and provisional ballots. Independent, automated audits use software, entirely independent from the software used by the primary voting system, to re-tabulate ballot images captured by the primary voting system. The results from this independent tabulation are then compared to the reported results

³ Many county charters require local officials to be sworn into office the first Monday in December. *See, e.g.* Anne Arundel County Charter, Section 203; Baltimore City Charter, Section 1b (Tuesday after the first Monday in December); Baltimore County Charter, Section 203; Howard County Charter, Section 202c; Montgomery County Charter, Section 105; Prince George's County Charter, Section 306.

from the primary voting system and any discrepancies or variations are resolved by elections officials. The ability to compare the results from two separate tabulations produce thousands of data points, all which can be used to evaluate any significant discrepancies between the two tabulations.

To conduct the independent, automated post-election tabulation audit, SBE contracted with the Boston-based elections technology company, Clear Ballot Group, Inc., and used its ClearAudit software product. ClearAudit is the only currently available, market-ready software product that can perform an independent, automated post-election tabulation audit using ballot images imported from another voting system.⁴ A timeline of the post-election audit process is provided below:

In October 2016, SBE provided Clear Ballot with PDF files of all ballot styles for all 24 counties.⁵ SBE also provided Clear Ballot with pre-election reports from the primary voting system for all precincts showing no votes cast (“EL30A Reports”), as well as the information required to assign ballot styles to the appropriate precinct and the files needed to process ballots voted with the ExpressVote ballot marking device.⁶ Upon receipt of this data, Clear Ballot created a Ballot Definition File (“BDF”) for each county, tested and validated each of these BDFs, and created a ClearAudit database for each county.⁷

In addition to the required L&A testing conducted on all voting units prior to the election, SBE staff compared voted ballots against the primary system’s ballot images of these ballots to ensure that the ballot images were a faithful representation of the underlying physical ballots. This was accomplished by generating a test deck (a sample set of ballots) for a chosen jurisdiction, Baltimore City. Each sample ballot in the test deck had a unique identification number printed on the bottom of the ballot. The test deck was then scanned in a precinct scanner (DS 200) and a high-speed scanner (DS 850), and the results were printed. The results were then loaded into the primary voting system’s Election Results Manager (“ERM”) software and the results and ballot images were acquired from the ERM software. All ballot images and Cast Vote Records (“CVR”) were compared against each physical ballot in the test deck. The unique identification number assigned to the test ballot was recorded on a spreadsheet, along with the CVR number and the result of the comparison (*i.e.* whether there was a match between the test deck ballot and the ballot image produced by the primary voting system) was recorded. All of the sample ballots

⁴ For more information about Clear Ballot Group, Inc. and its ClearAudit solution, visit www.clearballot.com.

⁵ SBE is responsible for creating all ballot styles used by the LBEs and for sending those ballot styles to the ballot printer.

⁶ Following the 2016 Primary Election, Clear Ballot worked with representatives from ES&S to develop procedures for the automated tabulation of ExpressVote ballots. These ballots are tabulated using a proprietary 2D barcode.

⁷ A BDF is a zipped set of text files, one per county, viewable in Excel, which contains the information needed by ClearAudit to compute the detailed election results. BDFs include a BallotMap file which shows the X, Y coordinate of every oval associated with every choice across every ballot style.

matched the ballot images produced by the primary voting system, and SBE was satisfied that the images were sufficient to conduct a post-election audit.⁸

Before election day, Clear Ballot shipped an external hard drive to each of the 24 LBEs. After election day, the LBEs uploaded ballot images from election day and early voting on to the external hard drives and returned the drives to Clear Ballot by November 11, 2016. When Clear Ballot received the external hard drives from the LBEs, the ballot images were first copied into the county's corresponding audit database. Clear Ballot then performed an automatic tabulation of the ballot images from election day and early voting, resolved unreadable ballots, performed an audit database review and sent a Preliminary Statement of Votes Cast to SBE for each county.

Only upon receipt of the Preliminary Statement of Votes Cast from Clear Ballot did SBE send precinct-level results from the primary voting system for election day and early voting to Clear Ballot. This delay in sending the precinct-level results to Clear Ballot was intentionally built into the audit process and results in what is effectively a "blind" audit, where Clear Ballot published the results of its tabulation before knowing the results from the primary voting system. A blind audit ensures the integrity of the audit and boosts confidence in the audit. Clear Ballot then used the precinct-level results from the primary voting system to create the Comparison of Votes Cast, a report that compares the tabulation results from the two independent tabulations, for each county.

On or about November 21, 2016, the LBEs uploaded on the external hard drive all ballot images, including images of all absentee and provisional ballots cast and returned the external hard drive to Clear Ballot. Clear Ballot then added these ballot images into the appropriate county database, performed an automatic tabulation of voted absentee and provisional ballot images, resolved unreadable ballots and generated a Comparison of Votes Cast for the absentee and provisional ballots. Clear Ballot also provided each LBE with login access to its county audit database and provided SBE access to all audit databases.

C. Audit Reports

The ClearAudit technology provides visual reporting tools that allow election officials to generate sortable contest, ballot and precinct reports that create a visual connection to each ballot image and provide detailed information about how it was adjudicated. Clear Ballot produced the following audit reports for each county:

⁸ For the 2016 General Election post-election tabulation audit, SBE used a sample single jurisdiction to confirm that the ballot images were identical to the ballots that would be cast by voters. In the future, it would be possible to have each jurisdiction conduct its own such testing during the L&A process before each election.

- Comparison of Cards Cast for each canvass: This report compares the number of ballots counted during early voting, on election day, during both absentee canvasses, and during the provisional canvass against the number of ballots tabulated by ClearAudit. This ensures that ClearAudit tabulated the same number of ballots as the primary voting system.
- Comparison of Ballots Cast by Precinct: This report compares the number of ballots cast in each precinct against the number of ballots tabulated by ClearAudit. This is another way to ensure that ClearAudit tabulated the same number of ballots as the primary voting system.
- Comparison of Votes Cast: This report compares the results from the primary voting system against the results tabulated by ClearAudit and identifies possible discrepancies by candidate or choice.
- Contest Vote Discrepancy Threshold Report: This report shows – by contest – the number of vote differences between the two systems, the total votes cast by the primary voting system, and the vote difference as a percentage. Before the audit was performed, SBE determined that a percentage of 0.5% or higher would trigger an additional review, which could include a manual review of voted paper ballots.

At the conclusion of the audit, ClearAudit had independently re-tabulated 4,632,199 cards⁹ from 24 jurisdictions (2,127 precincts), 283 contests and 727 candidates/choices. ClearAudit then performed 10,650 ballot count comparisons and 363,644 vote count comparisons. The results from the audit were made available to the public through the SBE website on December 14, 2016, and are available at: http://www.elections.maryland.gov/voting_system/ballot_audit_reports_PG16.html

2. The manner in which the public was permitted to comment on the audit procedures before the audit, observe the audit, and comment on the conduct and results of the audit after the audit is complete.

A. Public Comment on Audit Procedures Before the Audit

Members of the public had several opportunities to comment on the audit procedures before the audit. While the audit procedures were posted for public comment on SBE's website on November 4, 2016, the public discussion regarding the post-tabulation audit began much earlier, in the Spring of 2016, as SBE began preparing for the pilot program.

Information regarding the post-election tabulation audit pilot program was included in the *Administrator's Report* at both the March 24, 2016 and May 19, 2016 SBE meetings. On June 30, 2016, Clear Ballot conducted a presentation regarding its audit methodology for the SBE members and any members of the public in

⁹ A "ballot" consists of all the contests for which the voter can cast her vote. Some counties have a single page ballot, which equals one "card." Other counties have two-paged ballots which equal two "cards." In other words, each page of the ballot is a "card."

attendance.¹⁰ Prior to the June 30th SBE meeting, SBE's Deputy Administrator also personally notified interested parties of the Clear Ballot presentation.

On July 26, 2016, the Deputy Administrator received an email comment opposing the selection of an independent, automated post-election tabulation audit method from a Montgomery County voter and on August 23, 2016, SBE received written comments from the Verified Voting Foundation opposing the use of an independent, automated audit, advocating for use of a hand-count method for the audit, and strongly recommending the use of risk-limiting audits. The Verified Voting Foundation comments were distributed at the August 26, 2016 SBE meeting and are attached hereto as Exhibit A.

Information regarding the post-election tabulation audit was also included in the *Administrator's Report* for the September 29, 2016 and October 28, 2016 SBE meetings. In addition, Poorvi Vora, a professor at George Washington University and a member of the Verified Voting Foundation's Board of Advisors, spoke in opposition to the independent, automated audit at the October 28th meeting SBE meeting. Dr. Vora submitted written comments of her testimony on November 6, 2016. These comments are attached hereto as Exhibit B.

As previously stated, the audit procedures were posted on SBE's website for public comment on November 4, 2016. Public comments on the procedures were accepted until December 9, 2016.¹¹ This deadline was then extended to January 31, 2017 to allow for further comment on the audit results. The Deputy Administrator sent an email on November 11, 2016 informing interested parties that the overview of the post-election tabulation audit procedures was available on the SBE website and soliciting comments. In response to the online solicitation for public comments, SBE received six comments from citizens urging SBE to conduct a post-election tabulation audit by hand counting paper ballots (five of the six comments were short emails, the sixth was more detailed), one letter from Delegates Marc Korman and Andrew Platt also asking SBE to consider hand counting paper ballots and one letter from a group of academics and activists from around the country, including Dr. Vora, to the same effect. Copies of these public comments are available upon request.

Furthermore, a number of news reports and opinion pieces regarding post-election tabulation audit methodologies and Maryland's use of an independent, automated post-election tabulation audit, appeared in publications of record during the Fall of 2016. *See, e.g.,* Justin Wm. Moyer, *Officials Seek to Allay Fears of a 'Rigged' Election*, WASHINGTON POST, Oct, 23, 2016; Michael Dresser, *Maryland Will Audit All Votes Cast in General Election*, BALTIMORE SUN, Nov. 5, 2016; Philip B. Stark and Poorvi L. Vora, *Maryland Voting Audit Falls Short*, BALTIMORE SUN, Oct. 28, 2016; Mary H. Kiraly, *Md. Diminishes the Value of Paper Ballots*, BALTIMORE SUN, Oct. 31, 2016.

¹⁰ Clear Ballot also conducted the same presentation at the annual meeting of the Maryland Association of Elected Officials ("MAEO") on June 26, 2016.

¹¹ This date was originally selected so that SBE could receive comments before this report was due.

B. Public Observation of the Audit

Because the re-tabulation of ballot images is an automated process, it is conducted by computers using independent software and does not lend itself to public observation. Only the re-tabulation process, however, is not observable by the public. The results derived from the re-tabulation process, and the manner in which they are presented, give citizens unprecedented access to voting information and provide a far greater amount of data transparency than previously available. Online availability of county and precinct-level data, coupled with the ability to visualize and assess actual marks on ballots, all presented in a user-friendly and understandable manner, greatly enhance the public's comfort with and confidence in the voting system and represent a major leap forward in using technology to further democracy.

Clear Ballot conducted two online training sessions on December 19, 2016 and December 21, 2016, to provide the LBEs with information on how to view audit results and other reports and generally enhance their use of the data available on the county audit databases. In January 2017, SBE and Clear Ballot will schedule a similar training session for the public and provide the opportunity to ask questions of Clear Ballot regarding the county audit databases and the available reports. Citizens who are not able to participate in January 2017 online training sessions may contact SBE to make alternate arrangements to receive training.

C. Public Comment on the Conduct and Results of Audit after Audit was Complete

Following the completion of the audit, members of the public had, and continue to have, opportunities to comment on the conduct and results of the audit. The audit results were posted to the SBE website on December 14, 2016. As stated earlier, SBE has extended the public comment period to January 31, 2017 so that further public comments on the audit results can be collected. In addition, a formal public presentation of the statewide audit results was made by Clear Ballot at the December 15, 2016 SBE meeting. Dr. Vora attended the meeting at which she made a presentation encouraging SBE to supplement the independent, automated audit methodology with a hand count audit of a smaller sample of paper ballots.

3. The cause of any discrepancies revealed by the audit and how any discrepancies revealed by the audit were resolved

As an initial matter, an Audit Threshold Ratio ("ATR"), or acceptable variance level, of 0.5% was established for Maryland's post-election tabulation audit. The setting of a minimum threshold is an accepted best practice in jurisdictions that conduct independent, automated post-election tabulation audits.¹² The ATR is calculated as the percentage of all discrepancies in a contest divided by the total

¹² In the seven Florida counties that use ClearAudit to conduct independent automated audits (Leon, Bay, Putnam, St. Lucie, Nassau, Broward and Columbia) an ATR of 0.5% is used.

number of votes in that contest (absolute value). As a result, in any contest where there is a discrepancy level greater than 0.5% between the ClearAudit tabulation and the primary voting system tabulation, the adjudication of *all* ballot images from that contest by *both* tabulation systems will be compared.

Small discrepancies in the vote count between two independent tabulation systems that do not reach the level of the ATR are typical and can be explained by algorithmic variations between the two tabulation systems (*e.g.* one system “counts” a lighter shaded oval, while the other does not; one system “counts” a mark that strays outside the oval, while the other does not).

Out of 4,632,199 cards re-tabulated, the primary voting system originally reported 1,972 more cards than were seen by ClearAudit. This discrepancy included 1,960 cards from precinct 15-26 in Baltimore County, where it was determined that the primary voting system transferred the election results, but not the ballot images, resulting in an ATR of greater than .5%. The discrepancy also included 10 cards from Harford County, where 10 timely absentee ballots were received and tabulated after the ballot images had been sent to Clear Ballot; two cards from precinct 1-19 in Anne Arundel County, where there were two errors regarding the review of write-in candidates who did not file as write-in candidates; and one card from Wicomico County, where a elections officials separated a two page ballot into “page one” and “page two” piles for scanning during the second absentee ballot canvass and inserted a single blank “page one” sheet into the scanner which requires the first page in order to scan the second page. These discrepancies did not impact the review of the primary voting system results.

In Garrett County, election results for the county’s two ballot questions were required to be reported by precinct, rather than county-wide. In order to do this, SBE created a unique contest for each ballot question for each precinct. When ClearAudit tabulated the ballot images from Garrett County, however, they were tabulated by ballot question, rather than by precinct, which is why the ATR for the ballot questions exceeded the 0.5% ATR.

Finally, throughout the audit, discrepancies regarding the tabulation of write-in votes were discovered. Pursuant to Maryland law, write-in votes are to be counted where the voter writes the name of a write-in candidate in the designated write-in space – even if the voter does not fill in the corresponding write-in oval. COMAR 33.08.02.02C(1). Accordingly, Maryland’s primary voting system is coded to count votes where anything is detected in the write-in space, regardless of whether or not the write-in oval is filled in. On the contrary, the ClearAudit software was coded only to count write-in votes where the corresponding write-in oval was filled in and a name appeared in the write-in space. While none of these discrepancies exceeded the 0.5% ATR threshold, they (like the coding issue in Garret County described above) illustrate the how algorithmic and coding differences between the primary voting system and the audit tabulation system can produce different results.

Of the over 4.6 million cards re-tabulated by ClearAudit, each and every discrepancy that was discovered (a miniscule and statistically insignificant percentage of the overall total) was accounted for and clearly explained in a logical and transparent manner.

4. The final results of the audit for each contest that was audited

The complete and final audit results for every contest audited in each county contest are available on the SBE website at: http://www.elections.maryland.gov/voting_system/ballot_audit_reports_PG16.html As a sample, a Comparison of Votes Cast report from Howard County is attached hereto as Exhibit C.

5. The calculated risk that the reported outcome of each audited contest is incorrect

Because of the comprehensive nature (100% of all ballots cast) of the independent, automated audit, it is not necessary to calculate the risk that the reported outcome of any audited contest is incorrect. Nor is it necessary to set a "confidence rate" in the reported outcome of the audit. The concepts of calculated risk and confidence rates are only introduced into the post-election audit process when an audit of less than 100% of all ballots cast is conducted.

6. The cost of the audit

The cost to perform the independent, automated audit was \$275,000, plus a limited amount of staff time at both SBE and the LBEs. The Board of Public Works unanimously approved SBE's contract with Clear Ballot on October 19, 2016. The contract included the tabulation of all ballots cast, including absentee and provisional ballots, in all 24 counties. The cost per ballot image was approximately \$0.06. The LBEs' share of the audit ranged from \$495 (Kent County) to \$23,430 (Montgomery County).

In addition to the cost of the contract, there was a limited amount of staff time required to complete the audit. SBE staff spent approximately 10 hours developing instructions for the LBEs on how to export the ballot images and files to the external hard drives and providing support to the LBEs as they worked to export the same. LBE staff spent time preparing to export ballot images and files. Once the preparation was complete, however, the export process is self-executing and LBE staff was available to perform other duties.

This limited imposition on staff, particularly staff at the LBEs, was one of the primary reasons SBE selected an independent, automated post-election tabulation audit following the pilot program. Of the three piloted audit methodologies, the independent automated audit required the least (and most predictable, from a budgetary and staffing perspective) amount of work from the LBE staff, who are

understandably exhausted and overtasked following the 80 hour workweeks that are routine in the weeks surrounding an election.

7. If an audit is conducted using electronic images of voter-verifiable paper records:

A. How the electronic images were used to validate the election results

As described above, the PDFs of the 2016 General Election ballots are parsed by Clear Ballot to map contests and candidates and their relative positions on each ballot style, creating a Ballot Map file which shows the X, Y coordinate of every oval associated with every choice across every ballot style. BDFs are then created for each ballot style. Once the ballot images are received from the LBEs they are converted into raw image files. The ClearAudit tabulator is then run on the raw image files, re-tabulating the ballot images. Using the reported results from the primary voting system and the results from the ClearAudit tabulation, a Comparison of Votes Cast report is created to compare the two tabulations. Because the audit was “blind,” Clear Ballot performed its tabulation using the ballot images *prior* to receiving any results from the primary voting system.

B. Why hand and eye inspection of actual voter-verified paper ballots is not necessary to reliably determine the intent of the voters

The use of hand to eye inspection of actual voter-verified paper ballots is not necessary to reliably determine the intent of voters because the results of the primary voting system can be verified using an automated method as long as the appropriate safeguards are built into the audit process to ensure that the ballot images being used are faithful representations of voter-verified paper ballots. In addition to conducting the required pre-election L&A testing, SBE developed a method of ensuring that the ballot images are faithful replicas of the underlying physical ballots and was satisfied that the images sufficient to conduct a post-election audit.

While hand and eye inspection may be a viable counting method if only a small number of ballots are being examined, it can quickly be eliminated as an unworkable method if one seeks to conduct a more complete and thorough post-election tabulation audit. Following the pilot program, SBE determined that the benefits of a comprehensive audit, in which 100% of all ballots cast were audited, far outweigh any benefits conferred by hand counting a small, random sample of ballots. Hand counting a small subset of ballots simply cannot provide the kind of robust analysis and comparison provided by an independent, automated audit. A comprehensive independent, automated audit can detect both systemic *and* isolated problems that any examination of a small sample or percentage of ballots, no matter how random, will undoubtedly miss.

Finally, there is a considerable amount of academic and social science research suggesting that hand counts are unreliable and prone to human error, particularly

when conducted under stress or when the human counters are tired. Quite simply, machines don't feel the stress to "get the job done quickly and accurately" that human counters do, nor do they become tired, distracted or bored like humans do. See, Stephen Ansolabehere, *et al. Wisconsin Recount May Have a Surprise in Store After All*, WASHINGTON POST, Dec. 5, 2016; see also, Stephen N. Goggin, Michael D. Byrne, and Juan E. Gilbert, *Post-Election Auditing: Effects of Procedure and Ballot Type on Manual Counting Accuracy, Efficiency, and Auditor Satisfaction and Confidence*, ELECTION LAW JOURNAL: RULES, POLITICS, AND POLICY, March 2012 (where the authors found that hand counting of votes in post-election audit or recount procedures can result in error rates of up to 2 percent); Stephen Ansolabehere and Andrew Reeves, *Using Recounts to Measure the Accuracy of Vote Tabulations: Evidence from New Hampshire Elections 1946-2002*, CALTECH/MIT VOTING TECHNOLOGY PROJECT, Jan. 2004 (where the authors examined the agreement between initial machine counts and hand recounts of paper ballots in six races following the 2002 election and found that machine counts produce a lower discrepancy between the initial count and the recount compared to hand-counted paper).

8. How the State Board of Elections plans to conduct post-election tabulation audits in future elections

SBE's goal in implementing a post-election tabulation audit was to verify and confirm the accuracy of the primary voting system's reported results. This goal was achieved by Clear Ballot's ClearAudit software solution, which confirmed that the primary voting system correctly called the winners in every contest in every county and precinct in Maryland. This independent, automated tabulation audit provided a comprehensive approach (re-tabulating 100% of all ballots cast) and required a limited amount of staff time at SBE and the LBEs. It was also completed fairly quickly, with 90% of all ballot images tabulated before local certification deadlines. The miniscule number of discrepancies that were discovered after the independent tabulation were explained in a transparent and logical way that is understandable to the public.

The independent, automated post-election tabulation audit also had the major benefit of providing SBE with statewide, comprehensive information regarding the maintenance and operation of voting equipment (scanners); the programming and coding of the primary voting system; voter behavior and the improvement of poll-worker and election official training. In the months ahead, SBE will use this information to work with the vendor of the primary voting system and the LBEs to continue to improve the voting experience for all Marylanders. The ability to consistently improve upon the performance of Maryland's voting system and election administration, evident after conducting a single independent, automated audit, is a very exciting development.

As with any new software or program, there were lessons learned and things SBE would do differently as we move forward and determine how to conduct post-

election tabulation audits in future elections. Evaluation of the post-election audit process is ongoing, but some of the initial observations are listed below:

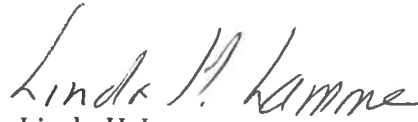
- The time it took the LBEs to transfer ballot images to the external hard drives for shipment to Clear Ballot was slower than SBE would have liked. By working with the vendor of the primary voting system, SBE hopes to speed up this process.
- The audit process revealed a number of infrequent issues with both ballots and scanners (creases on absentee ballots from folding created overvotes, dust or scratches on scanner lenses created overvotes, some contest headers were scanned too darkly and were difficult to read, crooked images due to improper scanning, scanners which sometimes pulled two pages of a ballot at time) that will require SBE to work with both the vendor of the primary voting system and the LBEs to resolve and improve.
- The audit process provided increased awareness and understanding of the many different ways voters mark ballots. SBE hopes to use this information to improve the tabulation functions of the primary voting system and election judge training materials.

At this time, SBE has not made a final decision as to how it will conduct post-election tabulation audits in future elections. Any post-election audit solution, however, would need to take the following into account:

- **Comprehensiveness.** The value of auditing 100% of ballots simply cannot be overstated. Auditing a handful of ballots from a random sample of precincts (whether they are audited by machine or by hand) virtually ensures that any issues that occur with ballots that are not part of the sample size will not be discovered.
- **Training and Equipment.** Any post-election audit methodology must be able to provide election officials with data that can be used across the state to improve training for poll workers and help SBE improve upon the performance of the primary voting system.
- **Timing.** Any post-election audit methodology should ideally be completed before the deadline for local and county certification.
- **Budgeting and Staffing.** For planning purposes, any post-election audit method must consider the cost to SBE and the LBEs and include the cost for staff time (permanent and temporary) to conduct the audit.

Please feel free to contact me with any questions or comments regarding the post-election tabulation audit or this report. As always, we look forward to working closely with the General Assembly to improve election administration and the voting experience for all Marylanders.

Sincerely,

A handwritten signature in cursive script that reads "Linda H. Lamone".

Linda H. Lamone
State Administrator

cc: The Honorable Thomas V. Mike Miller, Senate President
The Honorable Michael E. Busch, House Speaker

Exhibit A



Nikki Charlson -SBE- <nikki.charlson@maryland.gov>

Before the Board on Thursday

1 message

Mary Kiraly <[REDACTED]>

Tue, Jul 26, 2016 at 12:35 PM

Reply-To: Mary Kiraly <[REDACTED]>

To: "Ms. Nikki Trella Charlson" <ntrella@elections.state.md.us>, David McManus <dmcmanus@bbsclaw.com>

Cc: Mary Kiraly <mhowekiraly@yahoo.com>

July 26, 2016 via EMAIL

Ms. Linda Lamone, State Administrator
Mr. David J. McManus, Chair
Members of the State Board of Elections

Dear Ms. Lamone and Mr. McManus, Members of the Board,

The SBE is planning for a November post-election audit during this very hectic time for election administration. Maryland is one of a small group of states with a statewide voting system, and Ms. Lamone is chair of the Post-Election Audit group under NIST. Therefore, any decision that Maryland's State Board of Elections makes about post-election audit procedures will have national implications.

For this reason, it is especially important that the SBE provide timely information about how it will meet the legislatively-mandated requirement for a public comment period on post-election audit procedures. This comment period provides an opportunity for the Board to hear from a range of auditing experts who have experience in auditing voting systems.

The June Board Meeting minutes online indicate that Ms. Charlson stated that "the process for public comment has not yet been determined and that no decisions by the State Board are required." My notes from that meeting indicate that, in response to a question about the public comment period from the Chair, Ms. Charlson stated that Ms. Amanda LaForge will put out a procedural document for comment; and that it would provide all 3 proposed audit methods for public comment.

In addition, my notes indicate that several presenters at the June Board meeting assured the Board that all audit procedures under discussion would produce an audit that is "software independent." Clear Ballot is a software-based computerized election auditing system. The plan presented to the Board calls for transferring the ballot images, and the election results system, from the software-based ES&S optical scan system to Clear Ballot. I believe that it is important for the Board and the public to understand, therefore, how the audit proposals under consideration would meet the "software independent" objective.

I very much appreciate your attention to these important issues.

Sincerely,

Mary H. Kiraly
Bethesda, Maryland

cc: Ms. Nikki Charlson

Audit Pilots in Maryland

Comment by Verified Voting Foundation 08/23/2016

Maryland recently transitioned successfully to a voter-marked paper ballot scanner system. We commend the State for providing voters with the means to check that their votes were captured as they intended on a physical record of their intent, i.e. the ballot. **The greatest benefit is that those records of voter intent can be used to demonstrate accuracy of the outcome of elections** in Maryland, giving election officials a tool to audit and prove correct functioning of the system and make ongoing improvements. The Maryland General Assembly clearly wants the new system to fulfill its full potential by being subject to a “post-election tabulation audit”. The majority of states with paper ballots today conduct post-election vote tabulation audits.¹ Only 17 states do not have audits.²

The process for Maryland’s post-election audit must use the paper ballots to independently check the results of the voting system; **if it relies only on images produced by the software in the system it purports to check, it does not qualify as a valid audit.** Since such images may or may not faithfully replicate the intent of the voter (some commercial scanners adjust images for various reasons), additional validation steps are needed beyond only checking images. Fortunately these are not difficult to accomplish, and using the physical ballots for auditing is a best practice done by most states that do conduct audits.

Substantial research and best practices documents are available to support Maryland’s process. We would be pleased to provide information, introduction to audit experts and links to such documents at your request. For your review, we offer comment to help support the goal of improving voter confidence and the public’s understanding that elections are being properly conducted in Maryland.

A. The June State Board of Elections meeting Minutes describe three “audit” options: hand count of voted paper ballots; hand count of digital images of the voted ballots, and use of independent software to tabulate digital images of the voted ballots. The Minutes indicate that after reviewing the options a decision was made to use the digital images of the ballots.

If used without any manual comparison or review of the actual voted ballots for validation against digital images, this option does not constitute a post-election tabulation audit.

Vote tabulation audits, to ensure validity, involve a hand count or manual review of some portion of the voted paper ballots. Obtaining digital images of the ballots and using those digital images may have a place in the conduct of post-election audits, but not without also carrying out some manual review of the actual voted ballots for validation that the images comport faithfully with the content of the voted ballots. The use of independent software to tabulate digital images of the voted ballots is not, by itself, a vote tabulation audit, nor does

¹ <https://www.verifiedvoting.org/resources/post-election-audits/>

² http://www.ncsl.org/research/elections-and-campaigns/post-election-audits635926066.aspx#_ftn2

it take advantage of the “software independence”³ property of the voting system. It does, as suggested in the Minutes, aid in preserving the ballots, but the necessary step of validating digital images against actual ballots must be part of the process.

Much excellent literature exists on this topic. In “Retabulations, Machine-Assisted Audits, and Election Verification” (*Lindeman et al., 2013*)⁴, the authors point out that a machine retabulation system without a manual audit “squanders the benefit of software independence.” They clarify that machine-assisted audits based on a retabulation can support ballot-level comparison audits, and describe the steps necessary to conduct a risk-limiting audit using an independent system, which include the comparison of each ballot in a random sample being manually compared with the corresponding retabulation cast vote record for validity.

“Crucially, a machine-assisted audit does not rely upon the accuracy of the retabulation, but rather verifies it, in two steps: (1) Confirm that the cast-vote records produce the totals reported by the retabulation; (2) Manually confirm a high degree of correspondence between the cast-vote records and the corresponding ballots.”

Machine assisted audits – using some automated tools to support, but not supplant, the review of actual ballots – can be useful if done correctly. Digital images of the ballots can facilitate review of votes, including repeated reviews, while preserving the ballot originals undamaged. Most importantly, however, without validation against original ballots, the use of independent software to tabulate digital images of the voted ballots does not constitute a legitimate post-election tabulation audit.

This is especially true where the “independent software” is not tabulating digital images produced independently of the first system—such as through a secondary scan—but instead is (re)tabulating images transmitted digitally from the original system. This can only be described as a re-tabulation, with limited value.

The voter’s marks on the ballot are the only evidence election officials have of voter intent. Voters do not verify digital images; they can only verify their original ballot. If there is a flaw in the voting system’s software, digital images may not comport with voters’ actual intent. It is possible that neither the original tabulation of votes nor the retabulation using a secondary system will correctly reflect voter intent. Using anything other than original

³ Software Independence is not the same as Independent Software. Software independence (SI) is defined as follows: *A voting system is software-independent if an undetected change or error in its software cannot cause an undetectable change or error in an election outcome.* The National Institute of Standards and Technology (NIST), as part of their work on improving US voting systems and activities in support of the Help America Vote Act, examined the concept of software independence (SI) and auditability of voting systems, through an Auditability Working Group³. They described the problem SI seeks to address in this way (paraphrasing): *Assume that all electronic records are compromised; without any other records, it is not possible to compare records to audit the result.* The working group concluded that using an independent record verifiable by the voter (e.g. voter-marked paper ballot as Maryland now uses), provides a mitigation to the threat SI attempts to resolve. They also concluded that using an electronic independent verification device provided-- at best -- an incomplete response to such threats.

⁴ <https://www.stat.berkeley.edu/~stark/Preprints/retabulation13.htm>

intent fails to support conclusions of accuracy or proper functioning of the system. Confirming that original intent is reflected in the images does not require manually reviewing all of the ballots, but some must be validated.

B. The Minutes state the goal of the pilot was to evaluate three piloted methods: a risk-limiting ballot level audit, a fixed percentage precinct level audit, and an independent automated audit. Only the first two of these are audits. As described above, an “independent automated audit” is not an audit, though it can contain steps that could be used to support a legitimate audit.

The term “Risk-limiting Audit” has a specific meaning⁵: a procedure for *manually* checking a sample of ballots that is guaranteed to have a large, pre-specified chance of correcting the reported outcome if the reported outcome is wrong. The largest chance that an outcome will not be corrected by the audit is the “risk limit”. Risk limiting audits can be highly adaptable. They are designed to check outcomes, though that is not the only benefit. **We strongly recommend risk-limiting audits.**

Ballot level risk limiting audits can be very efficient. However, the description in the Minutes lacks clarity about the risk-limit established for this audit, how it was established, and whether / how individual ballots were to be examined in order to validate the process.

C. The Minutes represent that independent software “confirmed that the voting system’s results were accurate and that differences between the two systems’ results are based on different approaches to tallying incorrectly marked ballots.”⁶ This statement indicates that there were **discrepant results**. For genuine confirmation of accuracy – in either system – ballots should have been **manually examined** to confirm whether the images re-tabulated by the second system conformed to the original voter intent on those ballots.

Researchers have identified and reported on flaws in some commercial scanning software that could skew results if used for scanning ballots. These may not exist in Maryland’s new voting system (or a secondary system), but correct functioning of software should never be taken for granted, no matter how independent nor how many systems are used.

We are delighted that Maryland is now “auditable” and is conducting audit pilots. We strongly urge that the audits will be done in such a way as to fulfill the promise and capitalize on the value of the voter-verified paper ballots. Research shows well-conducted audits have the capacity to improve voter confidence⁷ in elections, of crucial importance in today’s political climate. Verified Voting looks forward to further opportunities to comment or assist in any way.

⁵ <http://www.stat.berkeley.edu/~stark/Preprints/RLAwhitepaper12.pdf>

⁶ To put this into context of Maryland’s previous voting system, one might say electronic votes tallied on one TS machine were transmitted to a different machine and recounted, with the same approximate result.

⁷ “Confidence in the Electoral System: Why We Do Auditing”, M. W. Traugott and F. G. Conrad, in Confirming Elections: Creating Confidence and Integrity through Election Auditing. Palgrave, 2012

Exhibit B

6 November 2016

Chairman McManus, Vice-Chair Hogan, State Board of Elections Members,

Thank you for the opportunity to address you during the SBE meeting of 28 October 2016. After my presentation, the Deputy Administrator and the Administrator answered questions posed by Chair McManus. I was not given an opportunity to respond to what they said. I am writing to provide my responses—which include technical guidance and suggestions to address the issues of manpower planning and ballot custody—and to make an offer to help conduct a real pilot audit.

As I said at the meeting, because your proposed post-election procedures are not independent of the voting software and do not examine ballots, a finding of no discrepancy has no significance. Maryland's voters are denied the main benefit of paper ballots—confidence in election outcomes. Confidence could be increased greatly if you would augment your plans with a small but robust manual examination of a sample of paper ballots. On behalf of several experts in voting technology and election auditing, I restate the offer I made at the meeting: **we can help you with a real pilot audit; our assistance will be at no expense to the state.**

Technical guidance

A. Erroneous understanding of what is possible through testing: Ms. Charlson said that she was confident that the scan data represents the ballots because they had tested the equipment, by having humans compare the scans to the ballots. She also said that she anticipated testing the audit system similarly.

One is tempted to think that the scans consist of a set of images, untouched by any computers, which completely and correctly represent all ballots. Like a set of photographs on film, created by a physical process and not a computerized one. All one needs to do is check that the scanning equipment is well-calibrated and working; as one might check that a film camera is good after looking at a few of the photographs it produces. However, this is not correct. Crucially, while the scans do originate through a physical process, they can only be delivered as ones and zeroes, by software, through the computerized scanner. They are computer data, handled by computer software, and can be deleted, replaced or tampered with.

A reasonably competent attacker would have the software behave differently when tested. Consider, for example, the fact that Volkswagen's 2L Diesel cars were found to use more emission controls when they were being tested than during normal use. On examination, it was found that their software was written so as to detect a test. In our case, software manipulated without vendor knowledge could also present human testers with the scans they expected to see, and then, once it had convinced them that it was performing correctly, it could do something different when used in the election.

B. Erroneous understanding of the transparency of the proposed post-election procedures: When the Administrators were asked whether the public would be able to witness the audits, they responded "no," that the audits were software audits and that Clear Ballot would announce the tabulation results after they were obtained and compared with the ES&S counts. There is no difference in transparency

between Clear Ballot announcing some results and ES&S announcing some results. Both counting mechanisms are hidden in the software that is running on the respective computers, and there is no evidence being provided to the voter or the candidates that the declared counts match the ballots. Additionally, while ES&S voting systems are federally certified to count votes, Clear Ballot systems are not.

C. The need for clearly-specified post-election procedures: I would like to caution the Board to treat both the scan data and the proposed “audits” with care. In particular, if the Board’s position is that the scan data does truly represent the ballots, and hence voter intent, and that one can determine whether the election outcome is correct based on this data, then the data should go through all the procedures of a secure chain of custody. When it is data that is being protected, as opposed to ballots, one typically needs to publish digitally signed cryptographic commitments to the data, and check these at every stage. Even so, all one can vouch for is that the other links in the chain are identical to the first one, but not that the first one matches the data collected by the scanning sensor.

As a computer security expert, I have the following questions about the post-election procedures:

1. How does the public know that the scan data represent the ballots?
2. How does the public know that the scan data exported by the scanner is the same data imported by Clear Ballot; that there is no error or tampering?
3. How does the public know that the scan data obtained by Clear Ballot is that processed by Clear Ballot? How are they planning to handle the scan data so that it is not tampered with, with or without their knowledge, while it is in their custody? What is their expertise in computer and information security?
4. What will Clear Ballot do with the scan data? Have they ever performed an audit from scan data in the past? Have they handled audits at the state-level?
5. To determine if the ES&S outcomes are correct, Clear Ballot plans to count votes using the electronic scan data. Is Clear Ballot federally certified to count votes: whether from scan data or directly, from ballots?
6. What information will Clear Ballot provide to the public about the audit procedures as the audits are being performed; and how will they make this information available? How will it demonstrate to the public that the information it is providing is correct? When humans count paper ballots in an audit, the public knows the specifics of the counting process (whether, for example, two people are counting together or one is reading and the other watching etc.), and is typically allowed to observe it. This is a demonstration to the public that the output of the counting process is correct, within well-understood error bounds. Clear Ballot’s approach to counting, however, is not known to the public. Even if it were to be described, neither the public nor computer experts would have any means of knowing that the described procedure was the one that ran on the Clear Ballot computer.
7. What happens if the two counts differ in some significant manner? The Board should describe both how it will be involved in adjudicating the difference, and how it will inform the public of this fact.

8. What will be the significance of a finding of no discrepancy between the outcomes, given that the scans themselves may have obscured voter intent from both the primary voting technology and the post-election check?

I urge the Board to treat these issues with the seriousness they deserve. We can help with the above questions as well, but the Administrators have not been forthcoming with details.

On manpower planning and ballot custody

The Administrators' answers to Chair McManus' questions provided some more information about the constraints of the audit.

I understood, from what was said, that the Administrators were concerned about manpower planning and ballot custody issues.

It is possible to carry out a fixed-time-fixed-manpower audit. You would determine, ahead of time, the number of person-hours available for the audit, and the number of physical locations where ballots may be accessed. You can carry out batch-level, or even scanner-level, risk-measuring audits, where you examine batches of ballots, get done at a pre-determined time, and announce the risk reduction. That is, you would **not perform a risk-limiting audit** with a pre-specified risk, but, instead, perform the audit you are able to, and declare the quality of the audit once it is done. Perhaps, at that time, it might make sense to concentrate on a particular local race or on a few precincts. **Anything you do that involves independent examination of the paper ballots will provide an infinite improvement in election confidence over what you have now.**

Our offer to help

I can commit to organizing a team of 4-5 experts including myself and other academics, with members chosen for their expertise in election audits and/or voting technology. We can design an audit that meets your constraints, supervise the counting (and comparisons or scanning if you should choose to do those though you don't have to), help you make the random choices (which precincts or batches or ballots to audit) and compute the risk reduction. **Our assistance will be at no expense to the state.**

Maryland can demonstrate the leadership necessary in this election cycle. Its voters deserve as much.

Sincerely,

Poorvi L. Vora

Professor, Computer Science

The George Washington University

Email: poorvi@gwu.edu

Website: <https://www.seas.gwu.edu/~poorvi/>

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Exhibit C

Howard County, MD, General Election, Nov 8, 2016

Comparison of Cards Cast with Counter Groups

Precinct:

Counter Group:

[Change](#)

[Show / hide columns](#)

Counter Group	Cards		
	Comparison System	This System	Difference
AB1	6,283	6,283	0
AB2	3,682	3,682	0
ED	91,294	91,294	0
EV	59,623	59,623	0
PROV	2,692	2,692	0

Howard County, MD, General Election, Nov 8, 2016

Comparison of Cards Cast with Precincts

Precinct:

Counter Group:

[Change](#)

[Show / hide columns](#)

Precinct	Cards			# Boxes
	Comparison System	This System	Difference	
001-001	1,214	1,214	0	1
001-002	295	295	0	1
001-003	929	929	0	1
001-004	1,549	1,549	0	1
001-005	262	262	0	1
001-006	855	855	0	1
001-007	273	273	0	1
001-008	1,029	1,029	0	1
001-009	775	775	0	1
001-010	685	685	0	1
001-011	469	469	0	1
001-012	439	439	0	1
001-013	735	735	0	1
001-014	851	851	0	1
001-015	1,177	1,177	0	1
001-016	323	323	0	1
001-017	283	283	0	1
001-018	196	196	0	1
001-019	23	23	0	1
001-020	253	253	0	1
001-021	779	779	0	1
002-001	786	786	0	1
002-002	1,189	1,189	0	1
002-003	1,195	1,195	0	1
002-004	710	710	0	1
002-005	566	566	0	1
002-006	694	694	0	1
002-007	748	748	0	1
002-008	948	948	0	1

Precinct	Cards			# Boxes
	Comparison System	This System	Difference	
002-009	878	878	0	1
002-010	594	594	0	1
002-011	716	716	0	1
002-012	839	839	0	1
002-013	343	343	0	1
002-014	364	364	0	1
002-015	695	695	0	1
002-016	996	996	0	1
002-017	189	189	0	1
002-018	862	862	0	1
002-019	789	789	0	1
002-020	376	376	0	1
002-021	133	133	0	1
002-022	25	25	0	1
002-023	531	531	0	1
002-024	522	522	0	1
002-025	605	605	0	1
002-026	616	616	0	1
003-001	731	731	0	1
003-002	1,340	1,340	0	1
003-003	938	938	0	1
003-004	100	100	0	1
003-005	1,436	1,436	0	1
003-006	997	997	0	1
004-001	933	933	0	1
004-002	1,030	1,030	0	1
004-003	1,148	1,148	0	1
004-004	1,312	1,312	0	1
004-005	1,040	1,040	0	1
004-006	1,290	1,290	0	1
005-001	1,434	1,434	0	1
005-002	288	288	0	1
005-003	992	992	0	1
005-004	886	886	0	1
005-005	1,186	1,186	0	1

Precinct	Cards			# Boxes
	Comparison System	This System	Difference	
005-006	1,745	1,745	0	1
005-007	584	584	0	1
005-008	616	616	0	1
005-009	704	704	0	1
005-010	1,286	1,286	0	1
005-011	674	674	0	1
005-012	769	769	0	1
005-013	475	475	0	1
005-014	304	304	0	1
005-015	1,034	1,034	0	1
005-016	717	717	0	1
005-017	565	565	0	1
005-018	411	411	0	1
005-019	1,359	1,359	0	1
005-020	1,026	1,026	0	1
005-021	733	733	0	1
005-022	1,428	1,428	0	1
005-023	433	433	0	1
005-024	461	461	0	1
006-001	685	685	0	1
006-002	1,316	1,316	0	1
006-003	725	725	0	1
006-004	1,117	1,117	0	1
006-005	627	627	0	1
006-006	621	621	0	1
006-007	439	439	0	1
006-008	619	619	0	1
006-009	856	856	0	1
006-010	764	764	0	1
006-011	838	838	0	1
006-012	358	358	0	1
006-013	565	565	0	1
006-014	700	700	0	1
006-015	906	906	0	1
006-016	979	979	0	1

Precinct	Cards			# Boxes
	Comparison System	This System	Difference	
006-017	947	947	0	1
006-018	818	818	0	1
006-019	928	928	0	1
006-020	834	834	0	1
006-021	538	538	0	1
006-022	690	690	0	1
006-023	351	351	0	1
006-024	898	898	0	1
006-025	437	437	0	1
006-026	1,117	1,117	0	1
006-027	949	949	0	1
006-028	1,336	1,336	0	1
006-029	1,670	1,670	0	1
006-030	359	359	0	1
006-031	626	626	0	1
006-032	800	800	0	1
006-033	866	866	0	1
006-034	819	819	0	1
006-035	1,488	1,488	0	1
Absentee 1	6,283	6,283	0	1
Absentee 2	3,682	3,682	0	1
EVC-1	11,810	11,810	0	1
EVC-2	22,603	22,603	0	1
EVC-3	25,210	25,210	0	1
Provisional	2,692	2,692	0	1

Howard County, MD, General Election, Nov 8, 2016

Comparison of Votes Cast

Precinct: Counter Group: Contest:

Change

[Show / hide columns](#)

Choice	Ballots With Contest			Votes			Overvoted With Vote for this Choice	Undervoted Without Vote for this Choice
	Comparison System	This System	Difference	Comparison System	This System	Difference		
President - Vice Pres (Vote for 1)								
Clinton-Kaine	163,574	163,574	0	102,597	102,595	-2	163	1,412
Trump-Pence	163,574	163,574	0	47,484	47,447	-37	37	1,412
Johnson-Weld	163,574	163,574	0	6,282	6,283	+1	105	1,412
Write-In	163,574	163,574	0	3,536	3,339	-197	13	1,412
Stein-Baraka	163,574	163,574	0	2,294	2,292	-2	122	1,412
U.s. Senator (Vote for 1)								
Chris Van Hollen	163,574	163,574	0	97,622	97,627	+5	27	4,330
Kathy Szeliga	163,574	163,574	0	55,888	55,883	-5	22	4,330
Margaret Flowers	163,574	163,574	0	5,459	5,457	-2	10	4,330
Write-In	163,574	163,574	0	224	201	-23	5	4,330
Rep In Congress Congressional District 3 (Vote for 1)								
John Sarbanes	51,681	51,681	0	33,182	<u>33,184</u>	+2	12	1,592
Mark Plaster	51,681	51,681	0	15,330	15,329	-1	8	1,592
Nnabu Eze	51,681	51,681	0	1,468	1,469	+1	8	1,592
Write-In	51,681	51,681	0	88	75	-13	4	1,592
Judge Of The Circuit Court Judicial Circuit 5 (Vote for 1)								
Mary Kramer	163,574	163,574	0	118,586	118,560	-26	19	43,295
Write-In	163,574	163,574	0	1,675	1,444	-231	19	43,295
Judge Special Appeals At Large (Vote for 1)								
Yes Dan Friedman	163,574	163,574	0	105,327	105,303	-24	6	38,469
No Dan Friedman	163,574	163,574	0	19,649	19,649	0	6	38,469
Board Of Education (Vote for 3)								
Kirsten Coombs	163,574	163,574	0	81,482	81,606	+124	120	55,864
Christina Delmont-Small	163,574	163,574	0	67,466	67,548	+82	112	58,750
Mavis Ellis	163,574	163,574	0	58,341	58,418	+77	108	57,436
Janet Siddiqui	163,574	163,574	0	53,762	53,820	+58	67	47,081
Vicky Cutroneo	163,574	163,574	0	43,935	44,010	+75	87	58,517
Robert Wayne Miller	163,574	163,574	0	40,484	40,554	+70	68	57,647
Write-In	163,574	163,574	0	1,672	909	-763	13	63,973
Question 1 (Vote for 1)								
For The Constitutional Amendment	163,574	163,574	0	96,412	96,368	-44	43	19,016
Against The Constitutional Amendme	163,574	163,574	0	48,005	47,997	-8	43	19,016
Question A (Vote for 1)								
For Question A	163,574	163,574	0	76,005	75,985	-20	40	18,906
Against Question A	163,574	163,574	0	68,519	68,498	-21	40	18,906
Question B (Vote for 1)								

Choice	Ballots With Contest			Votes			Overvoted With Vote for this Choice	Undervoted Without Vote for this Choice
	Comparison System	This System	Difference	Comparison System	This System	Difference		
For Question B	163,574	163,574	0	85,705	85,673	-32	18	26,564
Against Question B	163,574	163,574	0	51,166	51,150	-16	18	26,564
Rep In Congress Congressional District 2 (Vote for 1)								
C. A. Dutch Ruppertsberger	20,053	20,053	0	12,656	12,659	+3	9	755
Pat McDonough	20,053	20,053	0	5,427	5,427	0	8	755
Kristin S. Kasprzak	20,053	20,053	0	1,140	1,140	0	6	755
Write-In	20,053	20,053	0	48	47	-1	4	755
Rep In Congress Congressional District 7 (Vote for 1)								
Elijah Cummings	91,840	91,840	0	53,059	53,075	+16	10	3,011
Corrogan R. Vaughn	91,840	91,840	0	32,959	32,973	+14	8	3,011
Myles B. Hoenig	91,840	91,840	0	2,577	2,579	+2	4	3,011
Write-In	91,840	91,840	0	186	158	-28	8	3,011

MD State Board of Elections General Election Audit - md_14_howard_2016g - Nov

Audit Stage Filter

All Ballots

Exclude Write-ins

Yes

ContestName	Absolute Value of Vote Discrepancies (see Note 1)	Total Votes Cast	
		According to the Primary Voting System	Audit Threshold Ratio (See Note 2)
President - Vice Pres	66	158,657	0.042%
U.s. Senator	24	158,969	0.015%
Rep In Congress Congressional District 3	26	49,980	0.052%
Judge Of The Circuit Court Judicial Circuit 5	32	118,586	0.027%
Judge Special Appeals At Large	32	124,976	0.026%
Board Of Education	604	345,470	0.175%
Question 1	58	144,417	0.040%
Question A	49	144,524	0.034%
Question B	54	136,871	0.039%
Rep In Congress Congressional District 2	5	19,223	0.026%
Rep In Congress Congressional District 7	56	88,595	0.063%
All Contests	1,006	1,490,268	0.068%

Note 1: Using the absolute value prevents positive and negative discrepancies from cancelling each other.

Note 2: Values of the Audit Threshold Ratio exceeding 0.5% would trigger an examination.