

Dear County Commissioners,

Please find a thorough review, evaluation, and crucial conclusions to the WCEC letter written May 4, 2023 for the May 8, 2023 Williamson County Commission meeting. This document also highlights the strong position for precinct pre-printed hand marked paper ballot voting model that can be successfully accomplished in a reasonable amount of time following existing TN laws. The WCEC May 4, 2023 letter to the Williamson County Commissioners has and exhibits:

- Mischaracterizations
- Pertinent data missing
- Misleading statements
- Inaccurately cited sources
- Unbalanced evaluation of options
- Bias and lack of objectivity
- Questionable WCEC knowledge on the subject matter

In regards to your upcoming June 12, 2023 County Commissioner Budget meeting, the WCEC is proposing to spend ~\$50,000 for a hand marked paper study for a 9 month period, which was stated in their May 18th WCEC meeting. It is not responsible to lease and/or buy a full BMD system while doing an unnecessary hand marked paper study. It seems WCEC would have you believe you are appeasing TN state and constituents by voting “yes” to WCEC amendment and that somehow this paper ballot study amendment is providing the right next step for hand marked paper ballots, but this is a façade. Remember pre-printed precinct paper ballots have been successful for decades and is the standard for voter intent. While, machine technology has had issues for decades moving from punch card, mechanical lever, to DREs, BMDs, and internet voting. The pre-printed hand marked ballots have the ability to advance technology in the ballot and decouples the security threats of more machines. 68.6% of voters in jurisdictions use hand marked paper ballots across the USA according to 2022 VerifiedVoting.org. Hand marked paper ballots cost less, they give back our front-line security defense at the precincts, dramatically increase polling place throughput, decouple the ability for large scale corruption, many computer/IT experts & scholars recommend hand marked ballots and a hand marked ballot system increases reliability.

The executive review below will build clarity to move towards a stronger voter transparency and security model with pre-printed hand marked paper ballots and give confidence to the County Commission to reinstate our precinct voting in Williamson County. I ask for you to take the challenge to help make pre-printed hand marked paper ballots and precincts a reality. Plus, stop our county from wasting years and costs on a less secure BMD models with a new ~\$1,500,000 price tag pre-discounts & pre-incentives. The 2024 WCEC vote center capital addition should be added to the current cost analysis for proper capital evaluation of other voting models. Having the 2024 capital addition to the \$1.5MM will be a reasonable comparison to a pre-printed precinct system at ~\$800,000 pre-discounts & pre-incentives.

Executive Review: This section highlights the strong position for precinct pre-printed hand marked paper ballot voting model. This model utilizes the existing certified absentee ballot paper already approved by the TN legislation. These points below also cover concerns and request investigation into a number of statements within the WCEC 4th May 2023 letter to the Williamson County Commissioners.

1. **Cost** Revised 11 June 23 w/ additional inputs provided

- a. The WCEC letter and Jonathan Duda verbally stated at the May 8, 2023 County Commissioner meeting that Hand Marked Paper ballots are more expensive. Actually in reality, utilizing precincts with pre-printed hand marked paper ballots is an estimated \$800,000 versus WCEC’s 200 BMD system of \$1.5MM or \$1.6MM if you add WCEC’s 2024 three additional vote centers. Hand Marked paper ballots are cheaper.
- b. Did you know that the WCEC had the 200 BMD system quoted by Unisyn and ES&S and did their own estimate for the Ballot on Demand (BoD) proposal’s cost and discounts? If WCEC says they have seriously been looking at the hand marked paper for 2 years, the logical step would be to get the hand marked paper ballot option the citizens want quoted and confirm vendor discounts. But, WCEC

- did not and therefore created a situation with an “Estimated” Ballot on Demand (BoD) system by WCEC as a supposed comparison to the quoted ES&S 200 BMD system with ES&S’s confirmed discounts. The WCEC RFP also did not include a pre-printed hand marked paper ballot capital quote.
- c. Why is the below cost analysis ES&S discount line item \$0 for both BMD model and Ballot on Demand paper model, which is just below the Gross Total row below? This minimizes that the BMD discount is much greater than the BoD discount. This is concerning and should be questioned.

		ES&S Vote System	ES&S Additional Vote System Options	
		Configuration as Voted on by WCEC 2/1/2023 Adds ExpressVote Printing (Printing of Ballot Style)	Vote Center Hand-Marked Paper Ballot as Primary Voting System With BMD Support to Fulfill ADA Requirements ²	Voter Given Choice Hand-Marked Adds Ballot on Demand for Early Voting Voting at V
		Scenario 1	Scenario 2	Scenario 3
Hardware		\$1,505,104	\$1,277,604	\$1,980,000
	Ballot Marking Devices	\$782,000	\$195,500	\$782,000
	Vote Center Tabulators	\$505,725	\$505,725	\$505,725
	Central Tabulator	\$56,595	\$56,595	\$56,595
	Election Management System Hardware	\$4,449	\$4,449	\$4,449
	Express Vote Printers	\$116,000	\$0	\$116,000
	Ballot on Demand Hardware ¹	\$0	\$475,000	\$475,000
	Other	\$40,335	\$40,335	\$40,335
Software		\$29,445	\$22,815	\$29,445
	Licensing	\$14,320	\$9,845	\$14,320
	Software Other	\$15,125	\$12,970	\$15,125
Gross Total		\$1,534,549	\$1,300,419	\$2,000,000
	Applicable Discount from ES&S ³	\$0	\$0	\$0
	Shipping and Handling (ExpressVote Printers)	\$1,235	\$0	\$1,235
Net Total		\$1,025,279	\$1,125,419	\$1,500,000
	Financial Assistance from State of Tennessee ³	\$909,279	\$757,820	\$909,279
	Estimated Net Williamson County Cost	\$116,000	\$367,599	\$590,721
Services (Annual Cost)		\$78,325	\$46,850	\$78,325
	Annual Licensing and Warranties	\$78,325	\$46,850	\$78,325

*** Notes to Above**

- 1) ES&S Ballot On Demand Vote Center Printing Option costs are Estimated from Prior Pricing Provided.
 2) Vote Center Hand-Marked Paper Ballot option assumes 50 BMDs for ADA Compliance, 50 Ballot on Demand Printers, and 75 DS200 Tabulators. All costs are Estimated.
 3) Financial Assistance from State of Tennessee and Applicable Discount from ES&S for Scenarios 2 and 3 are Estimated.

- d. Even though, the ES&S discount is stated as \$0 above, it is \$510,505. The ES&S official quote confirms “Credit for Rental Fees Paid and Additional Discounts” at \$510,505.
- i. Duda confirmed the \$138,000 recent 4-month rental is waived if WCEC buys ES&S equipment, so not part of the budget numbers above in any of the scenarios.
 - ii. There are two other 2022 rental agreements. Williamson County has already paid ~\$415,000 excluding the install, training, shipping, and project management.
 - iii. Without fully knowing at this time, one can assume the ES&S’s “Credit for Rental Fees Paid...” is the \$415,000 already paid. Therefore, the overall discount of \$510,505 is subtracted by \$415,000 = \$95,000 additional ES&S discount. This will have to be confirmed.
- e. As noted in 1.b., WCEC did not do an RFP for any hand marked system. WCEC created the estimate and discount of \$175,000 for the BoD scenario 2 above. Please note this value is not shown, because they have \$0 above, but the Net Cost is reduced by \$175,000.
- i. If you take out 150 BMDs and left with the 50 BMDs in WCEC’s scenario 2, the remaining ES&S lease payments are \$250,000. If ES&S actually were asked to do a quote, one would assume the \$250,000 “credit for rental fees paid...” by ES&S. Also, ES&S says they gave “...additional discount.” So, scenario 2 is estimated at \$250,000 plus some additional discount. The big miss is WCEC not including citizens request to quote the hand marked paper ballot for RFP process. Why is the WCEC estimating a \$175,000 discount?
- f. Note other vote equipment discount % as comparisons:
- i. The WCEC Dominion 2019 signed contract had an overall general discount of 35% for BMD/scanner equipment.
 - ii. The ES&S signed contract for Dickson County TN in May 2020 had a “Tabulation Hardware discount.” That is a 53% discount on the tabulators or if including the rest of the hardware it is a 20% discount.

- g. Duda has noted the state of Tennessee is providing financial assistance to replace equipment previously owned by Williamson County. Thus, the state would provide financial aid for replacement of any equipment used prior to Tre Hargett’s Feb 2022 letter recommending to stop using Dominion.
 - i. As you can see in the scenario 1, the only cost WCEC is stating needs to be paid is \$116,000, which is same price for the ExpressVote Ballot printing option, which was equipment not being used pre-February 2022.
 - ii. Therefore, using the same assumption, the state will cover the citizen and county requested precinct pre-printed hand marked paper ballot option, since all the machines being purchased for that model were being used pre-February 2022, with a cost of \$0 for County.
 - iii. The precinct pre-printed ballot system (green in table below) is the lowest estimate at ~\$800K pre-discount utilizing the ES&S Williamson County February 2, 2023 quote. This model assumes equipment at precinct with 45 BMDs for ADA requirements including spares, same count for scanners at 75 scanners (Dominion contract was for 60), no \$475K system for ballot on demand, keeping central tabulation and EMS system. Since WCEC only did one RFP on the 200BMDs, it is uncertain ES&S’ discount. The leasing of equipment also adds confusion. But using the same calculations as 1.d. and 1.e., a minimum ES&S discount could be \$243,000 + ES&S’ “...additional discounts” like they added for the WCEC 200 BMD system. Net Cost with the assumed minimal ES&S discount is ~ \$560K versus WCEC model over \$1MM. The yellow column is WCEC’s 200 BMD proposal. The 2nd yellow includes WCEC’s 3 additional vote centers. The orange is WCEC’s BoD estimate (no RFP).

	ES&S BMD		+3 Vote Centers		ES&S		Precinct	
	# of Units	System \$/Units	# of Units	System \$/Units	# of Units	Ballot-on-Demand System \$/Units	# of Units	Pre-Printed Ballots System \$/Units
Hardware	\$1,505,104		\$1,613,344		\$1,277,604		\$783,054	
1 Ballot Marking Devices (BMDs)	200	\$782,000	224	\$875,840	50	\$195,500	45	\$175,950
2 Tabulators (DS200s) - w/ box & case	70	\$477,400	70	\$477,400	70	\$477,400	70	\$477,400
3 Tabulators (DS200s) - w/o box & case	5	\$28,325	5	\$28,325	5	\$28,325	5	\$28,325
4 Central Tabulation (DS450/Absentee)	1	\$56,595	1	\$56,595	1	\$56,595	1	\$56,595
5 Election Mgmt Sys. Hardware (EMS)	1	\$4,449	1	\$4,449	1	\$4,449	1	\$4,449
6 Express Vote Printers	145	\$116,000	163	\$130,400	0		0	
7 Ballot-on-Demand Hardware				\$0	50	\$475,000	0	
8 Other		\$40,335		\$40,335		\$40,335		\$40,335
Software	\$29,445		\$29,445		\$22,815		\$22,815	
9 Licensing - EMS	1	\$9,845	1	\$9,845	1	\$9,845	1	\$9,845
10 Licensing - Express Link	1	\$4,475	1	\$4,475	0	\$0	0	
11 Software Other	1	\$15,125	1	\$15,125	1	\$12,970	1	\$12,970
Gross Total	\$1,534,549		\$1,642,789		\$1,300,419		\$805,869	
12 ES&S Rental Credit *		(\$415,000)		(\$415,000)		(\$249,005)		(\$243,455)
13 Applicable ES&S Discount *		(\$95,505)		(\$95,505)				
14 Express Vote Shipping	1	\$1,235	1	\$1,235				
Net Total	\$1,025,279		\$1,133,519		\$1,051,414		\$562,414	
15 TN State Discounts		(\$909,279)		(\$909,279)		(\$757,820)		(\$562,414)
Estimated Net Williamson County Cost	\$116,000		\$224,240		\$293,594		\$0	

*The highlighted yellow is still in question, and still in question. Unfortunately, WCEC did not include in their RFP and only asked for their BMD model.

- h. The BoD scenario 2 estimate uses 2 BMDs per vote center; Duda wants backup. A more reasonable estimate is 28 BMDs for ADA, which includes spares dropping the budget to \$1.17MM. I reached out to a couple of out of state counties utilizing pre-printed hand marked paper ballots, and they have confirmed they use one ADA machine per precinct and one was an election official noting their pre-printed precincts are sufficient with one ADA. Yet the WCEC is saying two because of the potential concern for BMD reliability issues.

- i. The County Commission should review the 2024 budget request for 3 new vote centers to confirm the all-in price for the WCEC BMD proposal. Note state will not cover this ~\$100,000 add because this is more equipment than WCEC had deployed pre-February 2022. Jonathan Duda stated to the county commission “we do have a plan to increase our vote centers next year that is not part of this resolution, but our capital needs requested has been forwarded to you for next year’s budget does include additional vote centers and equipment ... to help provide additional options.” They are not fully comparing their vote center model to their ballot on demand system, and the pre-printed ballot system costs.
- j. With the pre-printed hand marked paper ballot option, the ongoing software, firmware, and hardware costs will be reduced by eliminating most of the BMDs. The paper cost is offset by reduced ongoing support costs and ES&S’ own consumable costs.

2. Security

- a. A number of computer science experts, listed below, confirm their strong support of “voter marked” (another word for hand marked) paper ballots and they also call out security issues with Ballot Marking Devices (BMDs). Hand Marked Paper Ballots are a necessity for going towards a stronger voting model and is the beginning for further election integrity advancements, which Williamson County citizens are ready to achieve driving a best-in-class voting model. These are key professionals in the industry that support hand marked paper ballots over BMDs:
 - i. Philip Stark
 1. Associate Dean, Mathematical and Physical Sciences, UC Berkeley
 2. Federally appointed advisor to the US Election Assistance Commission
 - ii. J. Alex Halderman, Ph.D.
 1. Computer Security and Privacy – Professor of Electrical Engineering and Computer Science at University of Michigan
 - iii. Andrew W. Appel, Ph.D.
 1. Professor of Computer Science at Princeton University
 2. Member of The National Academies of Science, Engineering, & Medicine
 - iv. Richard Painter
 1. Professor of Corporate Law – University of Minnesota supports voting by hand marked paper ballots
 2. Chief White House ethics lawyer George W. Bush Administration
- b. Utilizing the certified absentee pre-printed paper supply can provide the watermark feature, which was a security bill (Senate Bill 1315) passed by the TN legislature. This will increase security and there are more security features and processes that can be incorporated. This is a bipartisan agreed beneficial security improvement that should be added to our precincts.
- c. Using pre-printed ballots in precincts gives us back our frontline defense in the polling location with our precinct poll officials. They are only focused on the statistics of their precinct voters, they know the people coming into the polling location, the scanner poll tapes have meaning to the poll officials, and the poll books can be paper so this eliminates the need for computer network connectivity of voter centers in our polling locations
- d. It is also an extremely important point in the Tre Hargett and Mark Goines’ Feb 16, 2022 letter ¹ to WCEC on why BMDs pose even unintentional risks versus pre-printed hand marked paper ballots. The TN SOS letter states that **both** the BMD’s ICX firmware and the scanner’s ICP firmware did not match certification by the VSTLs for a number of the units in the October 2021 Franklin City Election. The problem is the BMDs print out the programmable bar code vote, which are upstream of the barcode paper ballots which were used to certify the election, and the BMD ICX firmware was wrong. As per Philip B. Stark, he clearly states “*the only remedy is a new election*” because “*...there is no way to figure out which (BMD) ballots were affected, nor how many ballots were affected.*” This is quoted from August 21, 2019 education paper titled “There is no Reliable Way to Detect Hacked Ballot-Marking Devices” (BMDs) in section 5.1 page 10. ²

¹ SSDOE Hargett & Goins Letter to WCEC Feb 16, 2022 – provided as supplemental PDF directly to Williamson County Commission

² Philip B. Stark There is no reliable way to detect hacked Ballot Marking Devices - <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

- e. Within the United States District Court for the Northern District of Georgia Atlanta Division, J. Alex Halderman provided a declaration *“In my report – a 25,000 word document that is the product of twelve weeks of intensive testing of the Dominion equipment provided by Fulton County – I find that Georgia’s BMDs contains multiple severe security flaws. Attackers could exploit these flaws to install malicious software, either with temporary physical access (such as that of voters in the polling place) or remotely from election management systems. I explain in detail how such malware, once installed, could alter voters’ votes while subverting all the procedural protections practiced by the State, including acceptance testing, hash validation, logic and accuracy testing, external firmware validation, and risk-limiting audits (RLAs)...that the BMDs’ vulnerabilities compromise the auditability of Georgia’s paper ballots; that the BMDs can be compromised to the same extent as or more easily than the DREs they replaced; and that using these vulnerable BMDs for all in-person voters, as Georgia does, greatly magnifies the level of security risk compared to using hand-marked paper ballots...”*¹

3. The National Academies

- a. WCEC’s May 4th, 2023 letter page 5 references The National Academies of Science, Engineering, and Medicine’s BMD recommendation. Why do they not mention that the National Academies recommends hand marked paper ballots? Why do they not mention the National Academies concerns with BMD systems versus hand marked paper ballots? This is very concerning, misleading, and raises questions into why the next statement is declared in the WCEC letter to the Williamson County Commissioners while omitting hand marked paper ballot recommendation. Can the County Commissioners please confirm why?
- b. The below WCEC statement is made in the titled section “Hand-Marked Paper Ballots,” which discusses hand marked paper ballots versus BMD. WCEC statement below leads one to believe the hand marked paper ballot model is not recommended. Yet the actual National Academies wording in the document supports hand marked paper ballot as the standard provided in 3.c below. WCEC states on page 5 referring to the WCEC 200 BMD voting model recommendation *“It should be noted that this configuration is recommended by the 2018 Consensus Study Report of the Committee on the Future of Voting by The National Academies of Sciences, Engineering and Medicine...{footnote} ‘Securing the Vote: Protecting American Democracy’; 2018.”* The National Academies on page 6 recommends *“...human-readable paper ballots. These may be marked by hand or by machine (using a ballot-marking device).”*² The WCEC only references this “authority” source for their model and neglects to confirm to the County Commission that hand marked paper ballots are recommended. The National Academies continue on page 79 *“This has prompted calls for hand-marked (as opposed to BMD-produced) paper ballots whenever possible.”*² Did the WCEC read thoroughly the 159 pages beyond page 6 before making the statement? Why would the WCEC reference a source inaccurately leaving out highly relevant data pertaining to the National Academy recommendation of hand marked paper ballots? Is this ethical of the WCEC to provide a biased report to the County Commission?
- c. Therefore, it is important for you to review a larger reading of the National Academies document which states on page 79: *“Well designed, voter-marked paper ballots are the standard for usability for voters without disabilities. Research on VVPATs has shown that they are not usable/reliable for verifying that the ballot of record accurately reflects the voter’s intent, but there is limited research on the usability of BMDs for this purpose. BMDs moreover, may produce either a full ballot, a summary ballot, or a “selections-only” ballot. Unless a voter takes notes while voting, BMDs that print only selections with abbreviated names/descriptions of the contests are virtually unusable for verifying voter intent. {footnote} By hand marking a paper ballot, a voter is, in essence, attending to the marks made on his or her ballot. A BMD-produced ballot need not be reviewed at all by the voter. Furthermore, it may be difficult to review a long or complex BMD-produced ballot. This has prompted calls for hand-marked (as opposed to BMD-produced) paper ballots whenever possible.”*²

¹ Expert Rebuttal Declaration – J. Alex Halderman – Civil Action No. 1:17-CV-2989-AT – <https://www.documentcloud.org/documents/21038844-20210802-expert-rebuttal-declaration-of-j-alex-halderman>

² National Academies – “Securing the Vote: Protecting American Democracy”; 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

- d. Given a few years have passed since publication of the National Academies document cited in WCEC letter, there are currently a number of experts, that presented at the National Academies and some National Academies members which are listed above under the #2 Security section, recommending the use of hand marked paper ballots and not recommending using BMD systems besides for ADA.

4. Efficiency

- a. The polling location bottleneck (slowest point in the system) is the BMD in most cases. To increase the throughput, you have to spend more money for more BMDs. Paper ballot voting method can easily add stations for much cheaper cost, minimal real estate, and it moves the bottleneck most likely to the check-in stations.
- b. I saw a number of our citizens in multiple elections that could not wait for the long BMD lines and had to leave the polling locations. Such situations are a disenfranchisement of Williamson County voters. This has been witnessed by others as well.
- c. Jonathan Duda verbally commented at the May 8, 2023 County Commissioner meeting that there were long lines across the state of TN with BMDs and hand marked paper ballots, but the fact is hand marked paper ballot model greatly increases the throughput rate at polling locations. Let's take a simple example of 10 people arriving to vote to understand why hand marked paper ballots have a much higher throughput versus BMD machines. Let's say it takes 10 minutes to complete a ballot. For the hand marked paper ballot solution, there are 9 people that vote with paper & pen and one person via the ADA. All 10 can complete the ballot marking task together (in parallel) for a total of 10 minutes. In comparison, 10 people arrive to vote at a 2 BMD polling location, that means only 2 can vote at a time, so it takes five cycles to get everyone through voting for a total of 50 minutes or 5X longer than hand marked paper ballots. If you increase to 4 BMDs, it takes 30 minutes to get everyone through, which is 3X as long. If you go further and add 6 BMDs, it still takes twice as long to get everyone through at 20 minutes. BMDs are a bottleneck and when you add reliability issues into this equation, the BMD system becomes even less efficient. For a more advanced understating of bottlenecks and Theory of Constraints (TOC) learned by Industrial Engineers, the books by Dr. Eliyahu Goldratt are wonderful learnings: The Goal {story book explanation}, and Theory of Constraints.¹

5. Reliability

- a. Williamson County Poll Workers, including myself, experience BMDs not working properly, so they have to be reset multiple times or shutdown, causing further throughput delays.
- b. The pre-printed hand-marked paper ballot precinct model has less reliance on equipment, network use, and proprietary software reducing cyber threats, and reduces energy consumption. This model can remove network requirements at precincts for poll books, so voter rolls can go fully offline and freeze rolls during elections driving further security back into our elections.
- c. The National Academies in their "Securing the Vote: Protecting American Democracy" 2018 book page 43 states *"Electronic voting systems introduce challenges in and of themselves. Such systems are, for example, more costly than systems that use paper exclusively. Technical support for such systems is often necessary and adds to their cost over time. Such systems may also be more prone to breakdowns, are subject to technological obsolescence, and as discussed in Chapter 5, vulnerable to cyberattacks and other threats."*²

¹ Dr. Goldratt – <https://www.toc-goldratt.com/en/biography-of-eli-goldratt> and *The Goal: A Process of Ongoing Improvement* book - https://www.goodreads.com/book/show/113934.The_Goal

² National Academies – *Securing the Vote – 2018* - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

- d. There are BMD calibration issues causing wrong selections than the voter intended. Commissioner Christopher Richards noted in the May 8th, 2023 commission meeting, *"...the ballot marking device touch pad during a municipal election - my wife was trying to select one candidate and it selected another candidate. Have you heard of other complaints?"* Jonathan Duda noted *"We occasionally hear that type of feedback, but we have a process in place for assistance by poll workers who either move them to a different machine...or have technicians go test the machine before we deploy it."* In the Poll working training, I remember them mentioning the screen can get build-up and cause different choices, but this should be verified. These are examples of reliability issues of wrong selections or BMDs just not functioning properly seen in multiple elections.
- e. BMDs can be setup incorrectly or have glitches as the firmware issue in the Williamson County's October 2021 election and other state elections. This can happen with Dominion, ES&S, etc. voting equipment.

6. Voter Intent

- a. Also noted in #3 above, the National Academies of Science, Engineering, and Medicine pg 79 notes *"Well designed, voter-marked paper ballots are the standard for usability for voters without disabilities."*¹
- b. Many do not see a barcode or QR code with printed vote selections as a true voter intent, which is the voting model the WCEC is proposing. The bar code is the actual vote which is not human readable while in polling locations. The "voter marked" or hand marked paper ballots are human readable and clearly have voter intent. It is extremely important to understand some barcode basics to help understand the security risk pointed out by experts. A barcode can give different values depending on how the barcode reader is programmed. Therefore, the WCEC system's voter intent relies on computer programming creating a false sense of security. For example, imagine going to buy a box of cereal and it is on sale. You go to the register and it charges \$2.50. You come back the next day, and the sale is over. They ring up the same box of cereal with the exact same bar code & it rings up at \$3.50. Why does the barcode provide a different value? It is programmed, which is the same case for the BMD proposed model.
- c. According to a Science Daily March 19, 2021 article referencing a Tokyo Japan research *"Actually, paper is more advanced and useful compared to electronic documents because paper contains more one-of-a-kind information for stronger memory recall,"*² said Professor Kuniyoshi L. Sakai, a neuroscientist at the University of Tokyo. Similar findings are noted by Psychology Today Magazine, which notes *"Writing by hand connects you with the words and allows your brain to focus on them, understand them and learn from them."*³ These are key benefits to voter intent and voter awareness for the hand marked paper ballot.
- d. The National Academies 2018 note page 44 *"Research on the rate of voter verification of BMD ballots relative to the rate of verification of VVPATs or voter-marked paper ballots had been limited."*¹ Yet we now have two studies from the UGA and J. Alex Halderman from the University of Michigan that show the poor rate of voter verification of the BMD barcode ballots which further contradicts the voter intent of BMD versus a voter marked paper ballots. These are described in his declaration to the United States District Court for the Northern District of Georgia Atlanta Division. On page 11 it notes *"The participants in my study who were similarly prompted to review their ballots caught 14% of errors. Therefore, real voters in Georgia are likely to catch substantially less than 14% or errors."*⁴ Also on page 10, *"The University of Georgia researchers report that 20% of voters they observed did not check their ballots at all. Only about 49% examined their ballots for at least one second."*⁴

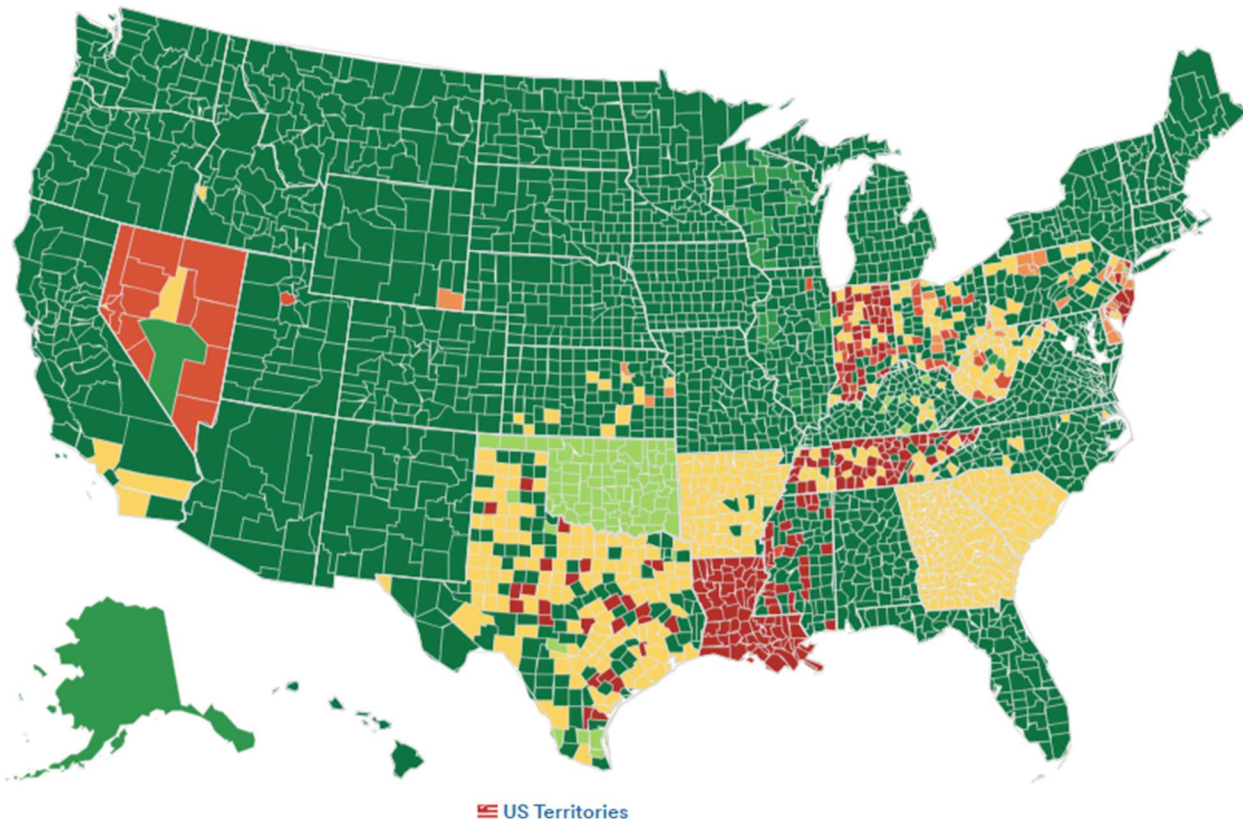
¹ National Academies – Securing the Vote – 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

² Science Daily - Study shows stronger brain activity after writing on paper than on tablet or smartphone - March 19 2021 - <https://www.sciencedaily.com/releases/2021/03/210319080820.htm#>

³ Psychology Today - Is It Better to Write By Hand or Computer Oct 2 2017 – <https://www.psychologytoday.com/us/blog/memory-catcher/201710/is-it-better-write-hand-or-computer>

⁴ Expert Rebuttal Declaration – J. Alex Halderman – Civil Action No. 1:17-CV-2989-AT – <https://www.documentcloud.org/documents/21038844-20210802-expert-rebuttal-declaration-of-j-alex-halderman>

e. Voter Intent section is incomplete without reminding the WCEC and County Commission that VerifiedVoting.org states in 2022 68.6% of voters in jurisdictions use hand marked paper ballot shown as green in the USA map below ¹. Yellow represents the BMDs without hand marked and red are DREs with no paper. The state of TN is turning to Georgia’s full Yellow highlighted BMD model, which is incentivized by SSDOE. The citizens desire green like Florida. The precinct pre-printed hand marked paper ballot is the foundation for further election transparency and security improvements. By instituting the precinct pre-printed hand marked paper ballots with TN’s already strong voter ID, absentee requirements, & voter registration deadline requirements, Williamson County drives closer to best-in-class. A full BMD model is not a best-in-class model.










Per VerifiedVoting.org 2022 View

Hand Marked Paper Ballots

 **68.6%**

Percentage of registered voters living in jurisdictions using Hand Marked Paper Ballots for most voters

Election Day Equipment ?	
	Hand marked paper ballots and BMDs 66.6%
	Hand marked paper ballots and DREs with VVPAT 0.3%
	Hand marked paper ballots and DREs without VVPAT 0.1%
	Ballot Marking Devices for all voters 21.1%
	Hybrid BMD/Tabulator for all voters 2.5%
	DREs with VVPAT for all voters 2.3%
	DREs without VVPAT for all voters 5.5%

Paper ballots marked by hand create a tangible, tamper-evident and auditable record of voter selections. Jurisdictions in which most voters mark their votes by hand offer BMDs or DREs to provide accessibility for voters with disabilities. While some smaller jurisdictions count paper ballots by hand, most are counted initially with optical scanners, though they can also be counted manually in a post-election audit or recount. Paper ballots, whether marked by hand or through the use of an assistive device, should be carefully reviewed by the voter before casting.

¹ VerifiedVoting.org – <https://verifiedvoting.org/verifier/#mode/navigate/map/ppEquip/mapType/normal/year/2022>

7. Ballot Box Stuffing & The Heritage Foundation

- a. Within the section *“Hand-Marked Paper Ballots”* on page 3, WCEC notes *“Ballot box ‘stuffing’ on a large scale is not a hypothetical risk, it has actually occurred in other Counties across the United States.”* WCEC has a footnote 7 referencing this sentence *“There are over 750 documented cases of casting of ineligible ballots recorded by the Heritage Foundation including...”* From the Heritage Foundation *“Election Fraud Cases”* website.¹
- b. Did the WCEC review the details in these categories of Election Fraud? If so, what of the +750 cases referenced are they relating to precinct hand marked paper ballots being an issue with large scale ballot box stuffing? It is concerning the WCEC is providing, in multiple cases, data that does not support the purchase of a 200 BMD system or reasonable claims why not to use a precinct pre-printed hand marked paper ballot system. What level of WCEC investigative research was conducted to conclude the forementioned +750 documented cases have to do with moving to a hand marked paper ballot system and are related to increasing ballot box stuffing? Upon a thorough database search, I found no large-scale risk or small-scale risk associated with precinct hand marked paper ballots. There are in total 73 pages of different types of fraud cases with 15 cases per page for a total of 1,095. The oldest case reviewed was 1988.
- c. Please find the summary table below generated from the Heritage Foundation database. These are not all the cases, but are the categories called out by WCEC. The causes of fraud in the database do not correlate these 725 cases below to precinct polls’ pre-printed hand marked paper ballots. After reviewing many of the cases’ drop-down details in each of these categories there could not be found any basis for a reason against pre-printed hand marked paper ballots cast in precincts or for the benefit of BMDs.

	Heritage Category	Database Further Comments	Count
1	Ineligible Voting	Not citizen, not registered, felon, false registration	298
2	Duplicate Voting	Vote in 2 states, 2 counties, same county, etc.	135
3	Impersonation Fraud at the Polls	Using Absentee Ballot, Duplicate, ineligible Voting	25
6	Fraudulent Use of Absentee Ballots	Mail-in Ballot, Absentee used at Poll, etc.	267
		Total	725

- d. The Frontline defense in a precinct might reduce, deter and/or avoid fraud attempts with the limited number of voters arriving versus vote centers where you have cross traffic. At precinct voting, you have clean scanner tapes with only your county details for clear statistics. Note, the Nov 2020 Williamson County election, there were only 3,200 voters on average per precinct, so someone working in their own precinct for years gets a good knowledge of their fellow voters. This is not true with vote centers.
- e. Page 3 notes *“Without stringent chain of custody controls, Hand-Marked Paper Ballots are highly vulnerable to tampering.”* Any good election model has stringent chain of custody controls, which are incorporated in many states. The 200 BMDs, flash drives, computers, scanners, central tabulations, and scanners are *“highly vulnerable to tampering”* per a number of experts, scholars, and elected officials. Without stringent chain of custody control in a BMD system or a hand marked paper ballot system, you are highly vulnerable to tampering.
- f. Therefore, the precinct polling location hand marked paper ballot is not the Root Cause for any of the WCEC ballot box stuffing claims and leads to the questioning of WCEC reasoning and motive in making such claim. This is another reason Jonathan Duda said he could not accept hand marked paper ballots at this time. The clearer details of the Heritage Foundation database should be suffice to feel confident hand marked paper ballots are the correct solution.

¹ Heritage Foundation – Election Fraud Cases - <https://www.heritage.org/voterfraud/search>

8. Error Rate & Adjudication

- a. The tabulator/scanners confirm ballots are readable. If not readable, the scanner will inform the voter, and they can take the ballot back to a hand marked station. This is called self-adjudication, so this WCEC adjudication concern is addressed.
- b. During the May 8th, 2023 County Commission meeting, Jonathan Duda noted in some cases the election workers are not able to confirm the voter intent, so that vote is not counted, so he cannot recommend hand marked paper ballots. Jonathan Duda's objection for hand marked paper ballots is referring to absentee when the voter is not present. This situation is not relevant for precinct hand marked paper ballots given the scanners can provide self-adjudication. The scanners will notify voter of blank ballots, undervote (missing votes), and overvote (to many selections in a race), or inappropriate marks/"doodling." This allows for in person correction.
- c. The absentee hand marked paper ballots do not change with any proposed model, so its error rates are not a factor in the precinct pre-printed ballot requested voting model.
- d. Also, WCEC noted the Williamson County GOP elections had 19 people use Xs or circle candidate names so the tabulators did not accept. Those people were able to correct the ballot and their vote was counted as intended. The County can utilize more education campaigns to educate citizens like at libraries, etc. not to place an X over the bubble.
- e. The ES&S literature use positive targeting recognition to *"...ensure even the most poorly marked ballots are read accurately and consistently – protecting voter intent"* and reducing adjudication needs. So, one more reason error rate is not a concern.¹ Thus these points clearly address error rate concerns and precinct hand marked paper ballots have resolutions to ensure voter intent that do not impact polling throughput efficiency.

Enhanced Voting Experience

The DS200 is a precinct-based scanner and vote tabulator equipped with the latest in ES&S' patented technology. Fully certified and compliant with EAC guidelines, the DS200 enhances the voting experience for voters and election officials alike. Our patented Intelligent Mark Recognition (IMR[®]) and patented Positive Target Recognition & Alignment Compensation (PTRAC[®]) technologies ensure even the most poorly marked ballots are read accurately and consistently — protecting voter intent. All of this is designed to make everyone's job easier.

3.0.0 | © 2021 Election Systems & Software, LLC. For certification details, visit [essvote.com/certification](https://www.essvote.com/certification)

9. Hand Marked Paper Ballot Transition Timeline

The WCEC note concerns on timing ability to change over to hand marked paper ballots by next election cycle and the 2024 primary elections. WCEC and County Commissioners the requested change is extremely feasible for pre-printed paper ballots cast in precincts. Case in point, the SSDOE Tre Hargett letter² recommending Dominion to be removed was dated February 16, 2022 and the next election started April 13, 2022, which is less than 2 months that the WCEC switched out complete equipment, programs, and processes from Dominion to ES&S. Secondly, Williamson County can utilize our existing pre-printed certified absentee ballots with ADA devices and maintain the same ES&S scanners, purchase central tabulation for absentee and purchase the existing EMS central controls. In a TheNews article on May 9, 2022, it was stated *"The commission secured an entirely new voting system when the 2022 primary election was only six weeks out, and they credit meticulous planning, collaboration and ES&S personnel and products for the relatively seamless transition. 'It's just really pretty phenomenal the work that was done,' said Jonathan Duda, Chairman of the Williamson County Election Commission. 'The collaborative work of our teams – ES&S and the Williamson County Election Commission – demonstrated what can happen when you work together.' "*³

¹ DS200 Data sheet - https://www.essvote.com/storage/2022/04/DS200_one-sheet.pdf

² SSDOE Hargett Goins Letter to WCEC Feb 16 2022 – provided as supplemental PDF

³ TheNews article "Williamson County election officials pleased with new voting system after May run" - https://www.thenewstn.com/brentwood/williamson-county-election-officials-pleased-with-new-voting-system-after-may-run/article_4fe05e32-cfd1-11ec-ab6a-bfab22a45f7d.html

Conclusion

The nine aforementioned discussion points in this executive review are in stark contrast to Jonathan Duda's verbal comments at the May 8, 2023 County Commission meeting *"...I know tonight you heard that there will be more reliability, cheaper, and that there's better security with hand marked paper ballots. Our findings actually have found the opposite for Williamson County. The implementation of putting in hand marked paper ballots cost more than the proposal that we have for this evening... the utilization, the cost, the reliability. All the factors that we looked at are how we arrived at the decision we did."*

In summary, this document has provided each county commissioner a clear reason to vote against the WCEC 200 BMD system recommendation and to vote against funding an unnecessary WCEC recommended \$50,000 nine month hand marked paper ballot study, which is a distraction considering years of supporting data and expert recommendations for hand marked paper ballots.

Williamson County Commissioners and Election Commissioners should discuss the above pertinent details to move towards utilizing the existing absentee approved ballots for the polling locations. As a County Commissioner you should utilize your capabilities to re-instate Williamson County precinct voting. Williamson County should remove the vote centers that impede election integrity with the poor, lacking in transparency BMD vote model. Vote centers eliminate the frontline defense at the precinct polls, which is a strong benefit to all voters. Jonathan Duda noted that vote centers increased voter turnout, which was reported as reason to keep them. He noted there was a 9% increase from presidential 2016 election versus 2020 election. According to both Fox and CNN media, 2016 and 2020 voting numbers for Williamson County were a 31% increase, with a 13% population increase. Maury County, with precincts, was also a 31% increase from 2016 to 2020 presidential election turnout. Maury County also had a 13% population increase. TN overall was a 21% voter turnout increase in 2020 and a 4% population increase. These statistics do not show a voter turnout improvement with vote centers. Jonathan Duda also notes a cost savings. Very simply, you cannot take one small cost piece (ie vote centers) and compare it without the other components to this overall cost analysis. The Return on Investment (ROI) for hand marked paper ballots to the BMD model is tremendous and even confirmed by the National Academies. The ongoing machine upkeep year-over-year expenses drop as well with the pre-printed hand marked paper ballot proposal. The precinct operational cost piece increases to allow for 42 precincts versus the 25 + X vote centers added in 2024. Yet the incremental precinct expense is a smaller cost % that does not offset the higher BMD model capital cost and YOY maintenance cost and more machines would need to be bought again before offsetting any precinct expense costs. Also, the precincts can throttle back voting days on smaller elections as an option to minimize cost. The security gained with hand marked paper ballots and precinct voting far out weights Chad Grey's statistics of some areas having 60% voting outside their precinct. Local community polling locations are close to home and still have a level of convenience. Plus, on average there are only 3,200 voters per precinct, so with ample early vote days, this number of voters is extremely manageable.

County Commissioners should ask the following questions for Williamson County citizens pertaining to WCEC conduct:

- Why did the WCEC tell the County Commission that hand marked paper ballots are more expensive? Why did the WCEC not take the time to get a BoD and a pre-printed hand marked paper scanner quote from election equipment vendors knowing that many citizens have been and are still asking for it? Why would they not show the BoD ES&S discount in the cost analysis? Why did they provide a very small ES&S BoD discount, which then made their 200 BMD system's Net Cost appear to be less? Why leave the discount line as \$0 on the budget analysis avoiding closer scrutiny?
- Why did the WCEC state the National Academies recommend the full 200 BMD system proposal and not mention the National Academies recommendation of hand marked paper ballots and the National Academies' concerns pertaining to the use of BMDs?

- Why did the WCEC reference the Heritage Foundation Fraud +750 cases as WCEC's purported reason for WCEC's claim that hand marked paper ballots are an issue, when the Heritage Foundation report showed no relevance to the WCEC claims? Careful review of the Heritage Foundation fraud database shows there are no links to precinct hand marked paper ballot. There are a few cases of people bringing in absentee ballots to the polls, which is not allowed in Tennessee nor does it have anything to do with precinct pre-printed ballots.
- Why did the WCEC state that BMDs are more reliable given calibration reset issues, wrong firmware issues, and the National Academy noting *"Such systems may also be more prone to breakdowns?"*¹
- Why did the WCEC not explain that BMD ballots utilize bar codes, which have to be programmed and since they are programmed are a contradiction to human readable ballots? Why do they ignore many of the experts that push for hand marked paper ballots?
- Why did the WCEC not clearly communicate to the County Commission that scanners can allow for self-correction (self-adjudication) which subtracts out WCEC worst case claim that hand marked paper ballots have 5% error rate issues? Did they not know the scanner self-adjudicates? Jonathan Duda noted he really would like to use hand marked paper ballots but could not because of those votes that are not readable and people lose their vote. Yet we are providing the WCEC with clear support that addresses this concern. WCEC witnessed this feature at the Williamson County GOP Reorganization Convention elections.
- Does the WCEC understand the psychology studies that show writing by hand connects the voter with the words and allows their brain to focus on words versus computers? As noted by the National Academies page 79 note *"By hand marking a paper ballot, a voter is, in essence, attending to the marks made on his or her ballot. A BMD-produced ballot need not be reviewed at all by the voter?"*¹

In conclusion, the precinct pre-printed hand marked paper ballot model provides better cost, better reliability, better efficiency, better security, and stronger voter intent as outlined in the executive review.

¹ National Academies – Securing the Vote – 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

Additional Specifics on the WCEC Letter and comments from WCEC and County Commission Meetings:

1. **“Recommendation” versus “...we could no longer use” on February 16, 2022:** WCEC incorrectly states in their May 4, 2023 letter they were told they had to ditch the \$1.5MM Dominion System, “...notified by the SSDOE that we could no longer use the election equipment...”
 - a. The SOS Feb 16, 2022 letter to WCEC actually gave a recommendation. The letter states “...it is our recommendation that Dominion voting machines not be used in Williamson County.”
 - b. Wanda Graham, WCEC Secretary, was the sole election commissioner present against the SOS recommendation in the election meeting preceding the SOS letter. Bob Brown, while WCEC’s Chairman, stated when Tre Hargett says “...Jump, I say how high.” Then in the May 18, 2023 WCEC meeting as a WCEC member, he reiterated this sentiment by stating “Yes sir & how high.” The commission commented on when they get a state suggestion, we do it.

2. **Costs:** The new election commission member, Rod Williamson, states in the May 18, 2023 WCEC meeting “...that to get pushed into this expensive, complicated alternative by the minority is a mistake.” Expensive and complicated is not accurate but is what is being purported and told to Williamson County Commission. It is concerning the group that is leading the election proposals has this viewpoint after the Cost section clearly show hand marked paper ballots are less expensive.

3. **Too Many Ballots:** Page 4 states “*Pre-printed ballots would be problematic due to the requirement of securely storing potentially over a hundred ballot styles at each location.*”
 - a. The Vote Centers are the cause of this irrelevant option of trying to have all pre-printed ballot styles at each vote center. With local community small precinct voting, it minimizes ballots to one to a few and this concern is not applicable.

4. **Costs:** On page 4 WCEC letter notes “*The costs to add Hand-Marked Paper Ballot as an option for voting in Williamson County are higher than a system of Paper Ballots prepared by a Ballot Marking Device (BMD).*”
 - a. WCEC assumes using the vote centers so they have to print out “...over one hundred fifty (150) different ballot style...” at each vote center. This is not an effective comparison.
 - b. With precincts, the pre-printed hand-marked paper ballot option is the most cost-effective voting model with estimates close to a 50% cost reduction from the BMD WCEC proposal and close to 40% less than the WCEC’s Ballot on Demand proposal.

5. **Tennessee is ranked #1 in the Nation for Election Integrity by The Heritage Foundation:** This was referenced in the WCEC’s Q/A question #12. The Heritage Foundation ranked 12 items that do not pertain to BMDs or hand marked paper ballots. This website confirms they are focused on laws and regulations, which does not provide a true ranking of voter safety as evidence in Georgia, which was ranked #1 previously and now #2. Per the website, “*The Heritage Foundation has published this Election Integrity Scorecard, which compares the election laws and regulations of each state and the District of Columbia that affect the security and integrity of the process to the Foundation’s best-practices recommendations.*”¹ Hence irrelevant to promoting a BMD voting model or making reference that BMD is better than a hand marked paper ballot.

¹ Heritage Foundation – Election Integrity Scorecard -- <https://www.heritage.org/electionscorecard/index.html>

Dear County Commissioners,

Please find a thorough review, evaluation, and crucial conclusions to the WCEC letter written May 4, 2023 for the May 8, 2023 Williamson County Commission meeting. This document also highlights the strong position for precinct pre-printed hand marked paper ballot voting model that can be successfully accomplished in a reasonable amount of time following existing TN laws. The WCEC May 4, 2023 letter to the Williamson County Commissioners has and exhibits:

- Mischaracterizations
- Pertinent data missing
- Misleading statements
- Inaccurately cited sources
- Unbalanced evaluation of options
- Bias and lack of objectivity
- Questionable WCEC knowledge on the subject matter

In regards to your upcoming June 12, 2023 County Commissioner Budget meeting, the WCEC is proposing to spend ~\$50,000 for a hand marked paper study for a 9 month period, which was stated in their May 18th WCEC meeting. It is not responsible to lease and/or buy a full BMD system while doing an unnecessary hand marked paper study. It seems WCEC would have you believe you are appeasing TN state and constituents by voting “yes” to WCEC amendment and that somehow this paper ballot study amendment is providing the right next step for hand marked paper ballots, but this is a façade. Remember pre-printed precinct paper ballots have been successful for decades and is the standard for voter intent. While, machine technology has had issues for decades moving from punch card, mechanical lever, to DREs, BMDs, and internet voting. The pre-printed hand marked ballots have the ability to advance technology in the ballot and decouples the security threats of more machines. 68.6% of voters in jurisdictions use hand marked paper ballots across the USA according to 2022 VerifiedVoting.org. Hand marked paper ballots cost less, they give back our front-line security defense at the precincts, dramatically increase polling place throughput, decouple the ability for large scale corruption, many computer/IT experts & scholars recommend hand marked ballots and a hand marked ballot system increases reliability.

The executive review below will build clarity to move towards a stronger voter transparency and security model with pre-printed hand marked paper ballots and give confidence to the County Commission to reinstate our precinct voting in Williamson County. I ask for you to take the challenge to help make pre-printed hand marked paper ballots and precincts a reality. Plus, stop our county from wasting years and costs on a less secure BMD models with a new ~\$1,500,000 price tag pre-discounts & pre-incentives. The 2024 WCEC vote center capital addition should be added to the current cost analysis for proper capital evaluation of other voting models. Having the 2024 capital addition to the \$1.5MM will be a reasonable comparison to a pre-printed precinct system at ~\$800,000 pre-discounts & pre-incentives.

Executive Review: This section highlights the strong position for precinct pre-printed hand marked paper ballot voting model. This model utilizes the existing certified absentee ballot paper already approved by the TN legislation. These points below also cover concerns and request investigation into a number of statements within the WCEC 4th May 2023 letter to the Williamson County Commissioners.

1. **Cost** Revised 11 June 23 w/ additional inputs provided

- a. The WCEC letter and Jonathan Duda verbally stated at the May 8, 2023 County Commissioner meeting that Hand Marked Paper ballots are more expensive. Actually in reality, utilizing precincts with pre-printed hand marked paper ballots is an estimated \$800,000 versus WCEC’s 200 BMD system of \$1.5MM or \$1.6MM if you add WCEC’s 2024 three additional vote centers. Hand Marked paper ballots are cheaper.
- b. Did you know that the WCEC had the 200 BMD system quoted by Unisyn and ES&S and did their own estimate for the Ballot on Demand (BoD) proposal’s cost and discounts? If WCEC says they have seriously been looking at the hand marked paper for 2 years, the logical step would be to get the hand marked paper ballot option the citizens want quoted and confirm vendor discounts. But, WCEC

- did not and therefore created a situation with an “Estimated” Ballot on Demand (BoD) system by WCEC as a supposed comparison to the quoted ES&S 200 BMD system with ES&S’s confirmed discounts. The WCEC RFP also did not include a pre-printed hand marked paper ballot capital quote.
- c. Why is the below cost analysis ES&S discount line item \$0 for both BMD model and Ballot on Demand paper model, which is just below the Gross Total row below? This minimizes that the BMD discount is much greater than the BoD discount. This is concerning and should be questioned.

		ES&S Vote System	ES&S Additional Vote System Options	
		Configuration as Voted on by WCEC 2/1/2023 Adds ExpressVote Printing (Printing of Ballot Style)	Vote Center Hand-Marked Paper Ballot as Primary Voting System With BMD Support to Fulfill ADA Requirements ²	Voter Given Choice Hand-Marked Adds Ballot on Demand for Early Voting Voting at V
		Scenario 1	Scenario 2	Scenario 3
Hardware		\$1,505,104	\$1,277,604	\$1,980,000
	Ballot Marking Devices	\$782,000	\$195,500	\$782,000
	Vote Center Tabulators	\$505,725	\$505,725	\$505,725
	Central Tabulator	\$56,595	\$56,595	\$56,595
	Election Management System Hardware	\$4,449	\$4,449	\$4,449
	Express Vote Printers	\$116,000	\$0	\$116,000
	Ballot on Demand Hardware ¹	\$0	\$475,000	\$475,000
	Other	\$40,335	\$40,335	\$40,335
Software		\$29,445	\$22,815	\$29,445
	Licensing	\$14,320	\$9,845	\$14,320
	Software Other	\$15,125	\$12,970	\$15,125
Gross Total		\$1,534,549	\$1,300,419	\$2,000,000
	Applicable Discount from ES&S ³	\$0	\$0	\$0
	Shipping and Handling (ExpressVote Printers)	\$1,235	\$0	\$1,235
Net Total		\$1,025,279	\$1,125,419	\$1,500,000
Financial Assistance from State of Tennessee ³		\$909,279	\$757,820	\$909,279
Estimated Net Williamson County Cost		\$116,000	\$367,599	\$590,721
Services (Annual Cost)		\$78,325	\$46,850	\$78,325
	Annual Licensing and Warranties	\$78,325	\$46,850	\$78,325

*** Notes to Above**

- 1) ES&S Ballot On Demand Vote Center Printing Option costs are Estimated from Prior Pricing Provided.
 2) Vote Center Hand-Marked Paper Ballot option assumes 50 BMDs for ADA Compliance, 50 Ballot on Demand Printers, and 75 DS200 Tabulators. All costs are Estimated.
 3) Financial Assistance from State of Tennessee and Applicable Discount from ES&S for Scenarios 2 and 3 are Estimated.

- d. Even though, the ES&S discount is stated as \$0 above, it is \$510,505. The ES&S official quote confirms “Credit for Rental Fees Paid and Additional Discounts” at \$510,505.
- i. Duda confirmed the \$138,000 recent 4-month rental is waived if WCEC buys ES&S equipment, so not part of the budget numbers above in any of the scenarios.
 - ii. There are two other 2022 rental agreements. Williamson County has already paid ~\$415,000 excluding the install, training, shipping, and project management.
 - iii. Without fully knowing at this time, one can assume the ES&S’s “Credit for Rental Fees Paid...” is the \$415,000 already paid. Therefore, the overall discount of \$510,505 is subtracted by \$415,000 = \$95,000 additional ES&S discount. This will have to be confirmed.
- e. As noted in 1.b., WCEC did not do an RFP for any hand marked system. WCEC created the estimate and discount of \$175,000 for the BoD scenario 2 above. Please note this value is not shown, because they have \$0 above, but the Net Cost is reduced by \$175,000.
- i. If you take out 150 BMDs and left with the 50 BMDs in WCEC’s scenario 2, the remaining ES&S lease payments are \$250,000. If ES&S actually were asked to do a quote, one would assume the \$250,000 “credit for rental fees paid...” by ES&S. Also, ES&S says they gave “...additional discount.” So, scenario 2 is estimated at \$250,000 plus some additional discount. The big miss is WCEC not including citizens request to quote the hand marked paper ballot for RFP process. Why is the WCEC estimating a \$175,000 discount?
- f. Note other vote equipment discount % as comparisons:
- i. The WCEC Dominion 2019 signed contract had an overall general discount of 35% for BMD/scanner equipment.
 - ii. The ES&S signed contract for Dickson County TN in May 2020 had a “Tabulation Hardware discount.” That is a 53% discount on the tabulators or if including the rest of the hardware it is a 20% discount.

- g. Duda has noted the state of Tennessee is providing financial assistance to replace equipment previously owned by Williamson County. Thus, the state would provide financial aid for replacement of any equipment used prior to Tre Hargett’s Feb 2022 letter recommending to stop using Dominion.
 - i. As you can see in the scenario 1, the only cost WCEC is stating needs to be paid is \$116,000, which is same price for the ExpressVote Ballot printing option, which was equipment not being used pre-February 2022.
 - ii. Therefore, using the same assumption, the state will cover the citizen and county requested precinct pre-printed hand marked paper ballot option, since all the machines being purchased for that model were being used pre-February 2022, with a cost of \$0 for County.
 - iii. The precinct pre-printed ballot system (green in table below) is the lowest estimate at ~\$800K pre-discount utilizing the ES&S Williamson County February 2, 2023 quote. This model assumes equipment at precinct with 45 BMDs for ADA requirements including spares, same count for scanners at 75 scanners (Dominion contract was for 60), no \$475K system for ballot on demand, keeping central tabulation and EMS system. Since WCEC only did one RFP on the 200BMDs, it is uncertain ES&S’ discount. The leasing of equipment also adds confusion. But using the same calculations as 1.d. and 1.e., a minimum ES&S discount could be \$243,000 + ES&S’ “...additional discounts” like they added for the WCEC 200 BMD system. Net Cost with the assumed minimal ES&S discount is ~ \$560K versus WCEC model over \$1MM. The yellow column is WCEC’s 200 BMD proposal. The 2nd yellow includes WCEC’s 3 additional vote centers. The orange is WCEC’s BoD estimate (no RFP).

	ES&S BMD		+3 Vote Centers		ES&S		Precinct	
	# of Units	System \$/Units	# of Units	System \$/Units	# of Units	Ballot-on-Demand System \$/Units	# of Units	Pre-Printed Ballots System \$/Units
Hardware	\$1,505,104		\$1,613,344		\$1,277,604		\$783,054	
1 Ballot Marking Devices (BMDs)	200	\$782,000	224	\$875,840	50	\$195,500	45	\$175,950
2 Tabulators (DS200s) - w/ box & case	70	\$477,400	70	\$477,400	70	\$477,400	70	\$477,400
3 Tabulators (DS200s) - w/o box & case	5	\$28,325	5	\$28,325	5	\$28,325	5	\$28,325
4 Central Tabulation (DS450/Absentee)	1	\$56,595	1	\$56,595	1	\$56,595	1	\$56,595
5 Election Mgmt Sys. Hardware (EMS)	1	\$4,449	1	\$4,449	1	\$4,449	1	\$4,449
6 Express Vote Printers	145	\$116,000	163	\$130,400	0		0	
7 Ballot-on-Demand Hardware				\$0	50	\$475,000	0	
8 Other		\$40,335		\$40,335		\$40,335		\$40,335
Software	\$29,445		\$29,445		\$22,815		\$22,815	
9 Licensing - EMS	1	\$9,845	1	\$9,845	1	\$9,845	1	\$9,845
10 Licensing - Express Link	1	\$4,475	1	\$4,475	0	\$0	0	
11 Software Other	1	\$15,125	1	\$15,125	1	\$12,970	1	\$12,970
Gross Total	\$1,534,549		\$1,642,789		\$1,300,419		\$805,869	
12 ES&S Rental Credit *		(\$415,000)		(\$415,000)		(\$249,005)		(\$243,455)
13 Applicable ES&S Discount *		(\$95,505)		(\$95,505)				
14 Express Vote Shipping	1	\$1,235	1	\$1,235				
Net Total	\$1,025,279		\$1,133,519		\$1,051,414		\$562,414	
15 TN State Discounts		(\$909,279)		(\$909,279)		(\$757,820)		(\$562,414)
Estimated Net Williamson County Cost	\$116,000		\$224,240		\$293,594		\$0	

*The highlighted yellow is still in question, and still in question. Unfortunately, WCEC did not include in their RFP and only asked for their BMD model.

- h. The BoD scenario 2 estimate uses 2 BMDs per vote center; Duda wants backup. A more reasonable estimate is 28 BMDs for ADA, which includes spares dropping the budget to \$1.17MM. I reached out to a couple of out of state counties utilizing pre-printed hand marked paper ballots, and they have confirmed they use one ADA machine per precinct and one was an election official noting their pre-printed precincts are sufficient with one ADA. Yet the WCEC is saying two because of the potential concern for BMD reliability issues.

- i. The County Commission should review the 2024 budget request for 3 new vote centers to confirm the all-in price for the WCEC BMD proposal. Note state will not cover this ~\$100,000 add because this is more equipment than WCEC had deployed pre-February 2022. Jonathan Duda stated to the county commission “we do have a plan to increase our vote centers next year that is not part of this resolution, but our capital needs requested has been forwarded to you for next year’s budget does include additional vote centers and equipment ... to help provide additional options.” They are not fully comparing their vote center model to their ballot on demand system, and the pre-printed ballot system costs.
- j. With the pre-printed hand marked paper ballot option, the ongoing software, firmware, and hardware costs will be reduced by eliminating most of the BMDs. The paper cost is offset by reduced ongoing support costs and ES&S’ own consumable costs.

2. Security

- a. A number of computer science experts, listed below, confirm their strong support of “voter marked” (another word for hand marked) paper ballots and they also call out security issues with Ballot Marking Devices (BMDs). Hand Marked Paper Ballots are a necessity for going towards a stronger voting model and is the beginning for further election integrity advancements, which Williamson County citizens are ready to achieve driving a best-in-class voting model. These are key professionals in the industry that support hand marked paper ballots over BMDs:
 - i. Philip Stark
 1. Associate Dean, Mathematical and Physical Sciences, UC Berkeley
 2. Federally appointed advisor to the US Election Assistance Commission
 - ii. J. Alex Halderman, Ph.D.
 1. Computer Security and Privacy – Professor of Electrical Engineering and Computer Science at University of Michigan
 - iii. Andrew W. Appel, Ph.D.
 1. Professor of Computer Science at Princeton University
 2. Member of The National Academies of Science, Engineering, & Medicine
 - iv. Richard Painter
 1. Professor of Corporate Law – University of Minnesota supports voting by hand marked paper ballots
 2. Chief White House ethics lawyer George W. Bush Administration
- b. Utilizing the certified absentee pre-printed paper supply can provide the watermark feature, which was a security bill (Senate Bill 1315) passed by the TN legislature. This will increase security and there are more security features and processes that can be incorporated. This is a bipartisan agreed beneficial security improvement that should be added to our precincts.
- c. Using pre-printed ballots in precincts gives us back our frontline defense in the polling location with our precinct poll officials. They are only focused on the statistics of their precinct voters, they know the people coming into the polling location, the scanner poll tapes have meaning to the poll officials, and the poll books can be paper so this eliminates the need for computer network connectivity of voter centers in our polling locations
- d. It is also an extremely important point in the Tre Hargett and Mark Goines’ Feb 16, 2022 letter ¹ to WCEC on why BMDs pose even unintentional risks versus pre-printed hand marked paper ballots. The TN SOS letter states that **both** the BMD’s ICX firmware and the scanner’s ICP firmware did not match certification by the VSTLs for a number of the units in the October 2021 Franklin City Election. The problem is the BMDs print out the programmable bar code vote, which are upstream of the barcode paper ballots which were used to certify the election, and the BMD ICX firmware was wrong. As per Philip B. Stark, he clearly states “*the only remedy is a new election*” because “*...there is no way to figure out which (BMD) ballots were affected, nor how many ballots were affected.*” This is quoted from August 21, 2019 education paper titled “There is no Reliable Way to Detect Hacked Ballot-Marking Devices” (BMDs) in section 5.1 page 10. ²

¹ SSDOE Hargett & Goins Letter to WCEC Feb 16, 2022 – provided as supplemental PDF directly to Williamson County Commission

² Philip B. Stark There is no reliable way to detect hacked Ballot Marking Devices - <https://www.stat.berkeley.edu/~stark/Preprints/bmd-p19.pdf>

- e. Within the United States District Court for the Northern District of Georgia Atlanta Division, J. Alex Halderman provided a declaration *“In my report – a 25,000 word document that is the product of twelve weeks of intensive testing of the Dominion equipment provided by Fulton County – I find that Georgia’s BMDs contains multiple severe security flaws. Attackers could exploit these flaws to install malicious software, either with temporary physical access (such as that of voters in the polling place) or remotely from election management systems. I explain in detail how such malware, once installed, could alter voters’ votes while subverting all the procedural protections practiced by the State, including acceptance testing, hash validation, logic and accuracy testing, external firmware validation, and risk-limiting audits (RLAs)...that the BMDs’ vulnerabilities compromise the auditability of Georgia’s paper ballots; that the BMDs can be compromised to the same extent as or more easily than the DREs they replaced; and that using these vulnerable BMDs for all in-person voters, as Georgia does, greatly magnifies the level of security risk compared to using hand-marked paper ballots...”*¹

3. The National Academies

- a. WCEC’s May 4th, 2023 letter page 5 references The National Academies of Science, Engineering, and Medicine’s BMD recommendation. Why do they not mention that the National Academies recommends hand marked paper ballots? Why do they not mention the National Academies concerns with BMD systems versus hand marked paper ballots? This is very concerning, misleading, and raises questions into why the next statement is declared in the WCEC letter to the Williamson County Commissioners while omitting hand marked paper ballot recommendation. Can the County Commissioners please confirm why?
- b. The below WCEC statement is made in the titled section “Hand-Marked Paper Ballots,” which discusses hand marked paper ballots versus BMD. WCEC statement below leads one to believe the hand marked paper ballot model is not recommended. Yet the actual National Academies wording in the document supports hand marked paper ballot as the standard provided in 3.c below. WCEC states on page 5 referring to the WCEC 200 BMD voting model recommendation *“It should be noted that this configuration is recommended by the 2018 Consensus Study Report of the Committee on the Future of Voting by The National Academies of Sciences, Engineering and Medicine...{footnote} ‘Securing the Vote: Protecting American Democracy’; 2018.”* The National Academies on page 6 recommends *“...human-readable paper ballots. These may be marked by hand or by machine (using a ballot-marking device).”*² The WCEC only references this “authority” source for their model and neglects to confirm to the County Commission that hand marked paper ballots are recommended. The National Academies continue on page 79 *“This has prompted calls for hand-marked (as opposed to BMD-produced) paper ballots whenever possible.”*² Did the WCEC read thoroughly the 159 pages beyond page 6 before making the statement? Why would the WCEC reference a source inaccurately leaving out highly relevant data pertaining to the National Academy recommendation of hand marked paper ballots? Is this ethical of the WCEC to provide a biased report to the County Commission?
- c. Therefore, it is important for you to review a larger reading of the National Academies document which states on page 79: *“Well designed, voter-marked paper ballots are the standard for usability for voters without disabilities. Research on VVPATs has shown that they are not usable/reliable for verifying that the ballot of record accurately reflects the voter’s intent, but there is limited research on the usability of BMDs for this purpose. BMDs moreover, may produce either a full ballot, a summary ballot, or a “selections-only” ballot. Unless a voter takes notes while voting, BMDs that print only selections with abbreviated names/descriptions of the contests are virtually unusable for verifying voter intent. {footnote} By hand marking a paper ballot, a voter is, in essence, attending to the marks made on his or her ballot. A BMD-produced ballot need not be reviewed at all by the voter. Furthermore, it may be difficult to review a long or complex BMD-produced ballot. This has prompted calls for hand-marked (as opposed to BMD-produced) paper ballots whenever possible.”*²

¹ Expert Rebuttal Declaration – J. Alex Halderman – Civil Action No. 1:17-CV-2989-AT – <https://www.documentcloud.org/documents/21038844-20210802-expert-rebuttal-declaration-of-j-alex-halderman>

² National Academies – “Securing the Vote: Protecting American Democracy”; 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

- d. Given a few years have passed since publication of the National Academies document cited in WCEC letter, there are currently a number of experts, that presented at the National Academies and some National Academies members which are listed above under the #2 Security section, recommending the use of hand marked paper ballots and not recommending using BMD systems besides for ADA.

4. Efficiency

- a. The polling location bottleneck (slowest point in the system) is the BMD in most cases. To increase the throughput, you have to spend more money for more BMDs. Paper ballot voting method can easily add stations for much cheaper cost, minimal real estate, and it moves the bottleneck most likely to the check-in stations.
- b. I saw a number of our citizens in multiple elections that could not wait for the long BMD lines and had to leave the polling locations. Such situations are a disenfranchisement of Williamson County voters. This has been witnessed by others as well.
- c. Jonathan Duda verbally commented at the May 8, 2023 County Commissioner meeting that there were long lines across the state of TN with BMDs and hand marked paper ballots, but the fact is hand marked paper ballot model greatly increases the throughput rate at polling locations. Let's take a simple example of 10 people arriving to vote to understand why hand marked paper ballots have a much higher throughput versus BMD machines. Let's say it takes 10 minutes to complete a ballot. For the hand marked paper ballot solution, there are 9 people that vote with paper & pen and one person via the ADA. All 10 can complete the ballot marking task together (in parallel) for a total of 10 minutes. In comparison, 10 people arrive to vote at a 2 BMD polling location, that means only 2 can vote at a time, so it takes five cycles to get everyone through voting for a total of 50 minutes or 5X longer than hand marked paper ballots. If you increase to 4 BMDs, it takes 30 minutes to get everyone through, which is 3X as long. If you go further and add 6 BMDs, it still takes twice as long to get everyone through at 20 minutes. BMDs are a bottleneck and when you add reliability issues into this equation, the BMD system becomes even less efficient. For a more advanced understating of bottlenecks and Theory of Constraints (TOC) learned by Industrial Engineers, the books by Dr. Eliyahu Goldratt are wonderful learnings: The Goal {story book explanation}, and Theory of Constraints.¹

5. Reliability

- a. Williamson County Poll Workers, including myself, experience BMDs not working properly, so they have to be reset multiple times or shutdown, causing further throughput delays.
- b. The pre-printed hand-marked paper ballot precinct model has less reliance on equipment, network use, and proprietary software reducing cyber threats, and reduces energy consumption. This model can remove network requirements at precincts for poll books, so voter rolls can go fully offline and freeze rolls during elections driving further security back into our elections.
- c. The National Academies in their "Securing the Vote: Protecting American Democracy" 2018 book page 43 states *"Electronic voting systems introduce challenges in and of themselves. Such systems are, for example, more costly than systems that use paper exclusively. Technical support for such systems is often necessary and adds to their cost over time. Such systems may also be more prone to breakdowns, are subject to technological obsolescence, and as discussed in Chapter 5, vulnerable to cyberattacks and other threats."*²

¹ Dr. Goldratt – <https://www.toc-goldratt.com/en/biography-of-eli-goldratt> and *The Goal: A Process of Ongoing Improvement* book - https://www.goodreads.com/book/show/113934.The_Goal

² National Academies – *Securing the Vote – 2018* - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

- d. There are BMD calibration issues causing wrong selections than the voter intended. Commissioner Christopher Richards noted in the May 8th, 2023 commission meeting, *"...the ballot marking device touch pad during a municipal election - my wife was trying to select one candidate and it selected another candidate. Have you heard of other complaints?"* Jonathan Duda noted *"We occasionally hear that type of feedback, but we have a process in place for assistance by poll workers who either move them to a different machine...or have technicians go test the machine before we deploy it."* In the Poll working training, I remember them mentioning the screen can get build-up and cause different choices, but this should be verified. These are examples of reliability issues of wrong selections or BMDs just not functioning properly seen in multiple elections.
- e. BMDs can be setup incorrectly or have glitches as the firmware issue in the Williamson County's October 2021 election and other state elections. This can happen with Dominion, ES&S, etc. voting equipment.

6. Voter Intent

- a. Also noted in #3 above, the National Academies of Science, Engineering, and Medicine pg 79 notes *"Well designed, voter-marked paper ballots are the standard for usability for voters without disabilities."*¹
- b. Many do not see a barcode or QR code with printed vote selections as a true voter intent, which is the voting model the WCEC is proposing. The bar code is the actual vote which is not human readable while in polling locations. The "voter marked" or hand marked paper ballots are human readable and clearly have voter intent. It is extremely important to understand some barcode basics to help understand the security risk pointed out by experts. A barcode can give different values depending on how the barcode reader is programmed. Therefore, the WCEC system's voter intent relies on computer programming creating a false sense of security. For example, imagine going to buy a box of cereal and it is on sale. You go to the register and it charges \$2.50. You come back the next day, and the sale is over. They ring up the same box of cereal with the exact same bar code & it rings up at \$3.50. Why does the barcode provide a different value? It is programmed, which is the same case for the BMD proposed model.
- c. According to a Science Daily March 19, 2021 article referencing a Tokyo Japan research *"Actually, paper is more advanced and useful compared to electronic documents because paper contains more one-of-a-kind information for stronger memory recall,"*² said Professor Kuniyoshi L. Sakai, a neuroscientist at the University of Tokyo. Similar findings are noted by Psychology Today Magazine, which notes *"Writing by hand connects you with the words and allows your brain to focus on them, understand them and learn from them."*³ These are key benefits to voter intent and voter awareness for the hand marked paper ballot.
- d. The National Academies 2018 note page 44 *"Research on the rate of voter verification of BMD ballots relative to the rate of verification of VVPATs or voter-marked paper ballots had been limited."*¹ Yet we now have two studies from the UGA and J. Alex Halderman from the University of Michigan that show the poor rate of voter verification of the BMD barcode ballots which further contradicts the voter intent of BMD versus a voter marked paper ballots. These are described in his declaration to the United States District Court for the Northern District of Georgia Atlanta Division. On page 11 it notes *"The participants in my study who were similarly prompted to review their ballots caught 14% of errors. Therefore, real voters in Georgia are likely to catch substantially less than 14% or errors."*⁴ Also on page 10, *"The University of Georgia researchers report that 20% of voters they observed did not check their ballots at all. Only about 49% examined their ballots for at least one second."*⁴

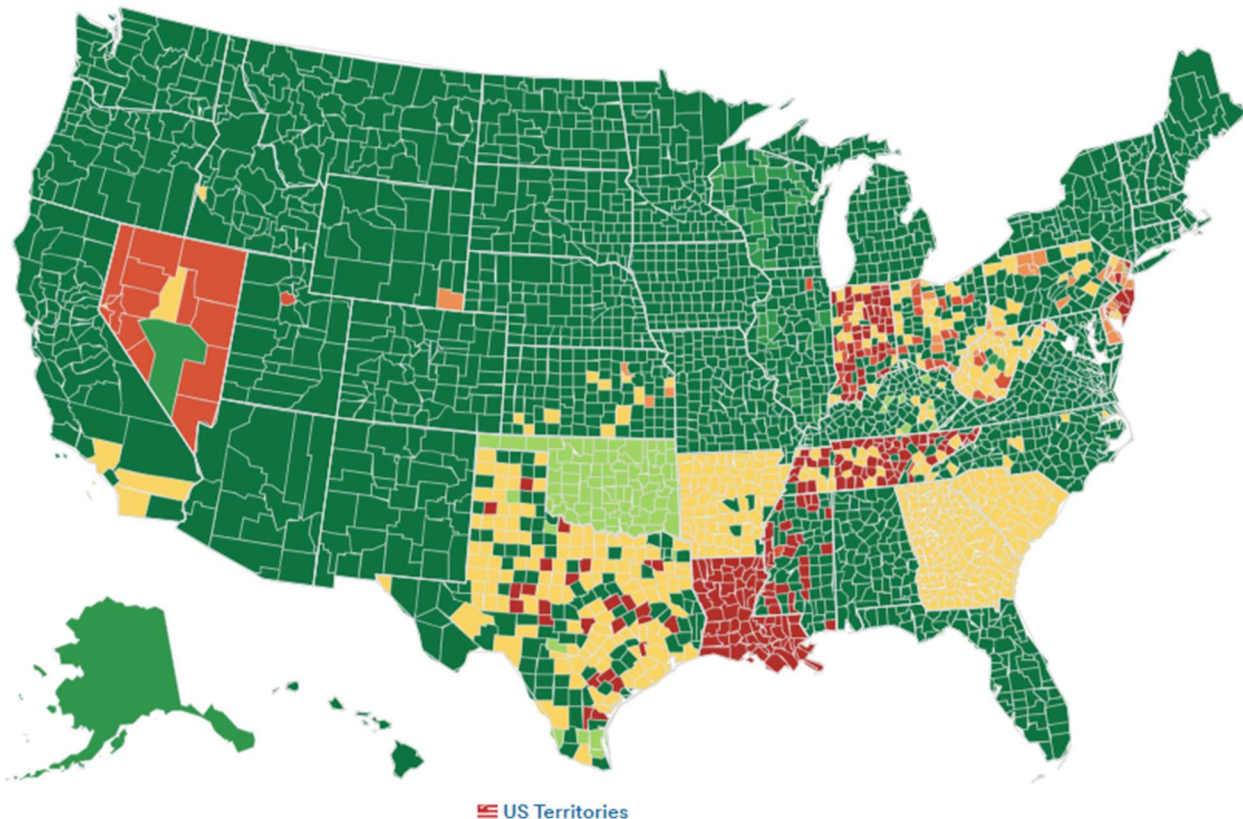
¹ National Academies – Securing the Vote – 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

² Science Daily - Study shows stronger brain activity after writing on paper than on tablet or smartphone - March 19 2021 - <https://www.sciencedaily.com/releases/2021/03/210319080820.htm#>

³ Psychology Today - Is It Better to Write By Hand or Computer Oct 2 2017 – <https://www.psychologytoday.com/us/blog/memory-catcher/201710/is-it-better-write-hand-or-computer>

⁴ Expert Rebuttal Declaration – J. Alex Halderman – Civil Action No. 1:17-CV-2989-AT – <https://www.documentcloud.org/documents/21038844-20210802-expert-rebuttal-declaration-of-j-alex-halderman>

e. Voter Intent section is incomplete without reminding the WCEC and County Commission that VerifiedVoting.org states in 2022 68.6% of voters in jurisdictions use hand marked paper ballot shown as green in the USA map below ¹. Yellow represents the BMDs without hand marked and red are DREs with no paper. The state of TN is turning to Georgia’s full Yellow highlighted BMD model, which is incentivized by SSDOE. The citizens desire green like Florida. The precinct pre-printed hand marked paper ballot is the foundation for further election transparency and security improvements. By instituting the precinct pre-printed hand marked paper ballots with TN’s already strong voter ID, absentee requirements, & voter registration deadline requirements, Williamson County drives closer to best-in-class. A full BMD model is not a best-in-class model.










Per VerifiedVoting.org 2022 View

Hand Marked Paper Ballots

 **68.6%**

Percentage of registered voters living in jurisdictions using Hand Marked Paper Ballots for most voters

Election Day Equipment ?	
	Hand marked paper ballots and BMDs 66.6%
	Hand marked paper ballots and DREs with VVPAT 0.3%
	Hand marked paper ballots and DREs without VVPAT 0.1%
	Ballot Marking Devices for all voters 21.1%
	Hybrid BMD/Tabulator for all voters 2.5%
	DREs with VVPAT for all voters 2.3%
	DREs without VVPAT for all voters 5.5%

Paper ballots marked by hand create a tangible, tamper-evident and auditable record of voter selections. Jurisdictions in which most voters mark their votes by hand offer BMDs or DREs to provide accessibility for voters with disabilities. While some smaller jurisdictions count paper ballots by hand, most are counted initially with optical scanners, though they can also be counted manually in a post-election audit or recount. Paper ballots, whether marked by hand or through the use of an assistive device, should be carefully reviewed by the voter before casting.

¹ VerifiedVoting.org – <https://verifiedvoting.org/verifier/#mode/navigate/map/ppEquip/mapType/normal/year/2022>

7. Ballot Box Stuffing & The Heritage Foundation

- a. Within the section *“Hand-Marked Paper Ballots”* on page 3, WCEC notes *“Ballot box ‘stuffing’ on a large scale is not a hypothetical risk, it has actually occurred in other Counties across the United States.”* WCEC has a footnote 7 referencing this sentence *“There are over 750 documented cases of casting of ineligible ballots recorded by the Heritage Foundation including...”* From the Heritage Foundation *“Election Fraud Cases”* website.¹
- b. Did the WCEC review the details in these categories of Election Fraud? If so, what of the +750 cases referenced are they relating to precinct hand marked paper ballots being an issue with large scale ballot box stuffing? It is concerning the WCEC is providing, in multiple cases, data that does not support the purchase of a 200 BMD system or reasonable claims why not to use a precinct pre-printed hand marked paper ballot system. What level of WCEC investigative research was conducted to conclude the forementioned +750 documented cases have to do with moving to a hand marked paper ballot system and are related to increasing ballot box stuffing? Upon a thorough database search, I found no large-scale risk or small-scale risk associated with precinct hand marked paper ballots. There are in total 73 pages of different types of fraud cases with 15 cases per page for a total of 1,095. The oldest case reviewed was 1988.
- c. Please find the summary table below generated from the Heritage Foundation database. These are not all the cases, but are the categories called out by WCEC. The causes of fraud in the database do not correlate these 725 cases below to precinct polls’ pre-printed hand marked paper ballots. After reviewing many of the cases’ drop-down details in each of these categories there could not be found any basis for a reason against pre-printed hand marked paper ballots cast in precincts or for the benefit of BMDs.

	Heritage Category	Database Further Comments	Count
1	Ineligible Voting	Not citizen, not registered, felon, false registration	298
2	Duplicate Voting	Vote in 2 states, 2 counties, same county, etc.	135
3	Impersonation Fraud at the Polls	Using Absentee Ballot, Duplicate, ineligible Voting	25
6	Fraudulent Use of Absentee Ballots	Mail-in Ballot, Absentee used at Poll,etc.	267
		Total	725

- d. The Frontline defense in a precinct might reduce, deter and/or avoid fraud attempts with the limited number of voters arriving versus vote centers where you have cross traffic. At precinct voting, you have clean scanner tapes with only your county details for clear statistics. Note, the Nov 2020 Williamson County election, there were only 3,200 voters on average per precinct, so someone working in their own precinct for years gets a good knowledge of their fellow voters. This is not true with vote centers.
- e. Page 3 notes *“Without stringent chain of custody controls, Hand-Marked Paper Ballots are highly vulnerable to tampering.”* Any good election model has stringent chain of custody controls, which are incorporated in many states. The 200 BMDs, flash drives, computers, scanners, central tabulations, and scanners are *“highly vulnerable to tampering”* per a number of experts, scholars, and elected officials. Without stringent chain of custody control in a BMD system or a hand marked paper ballot system, you are highly vulnerable to tampering.
- f. Therefore, the precinct polling location hand marked paper ballot is not the Root Cause for any of the WCEC ballot box stuffing claims and leads to the questioning of WCEC reasoning and motive in making such claim. This is another reason Jonathan Duda said he could not accept hand marked paper ballots at this time. The clearer details of the Heritage Foundation database should be suffice to feel confident hand marked paper ballots are the correct solution.

¹ Heritage Foundation – Election Fraud Cases - <https://www.heritage.org/voterfraud/search>

8. Error Rate & Adjudication

- a. The tabulator/scanners confirm ballots are readable. If not readable, the scanner will inform the voter, and they can take the ballot back to a hand marked station. This is called self-adjudication, so this WCEC adjudication concern is addressed.
- b. During the May 8th, 2023 County Commission meeting, Jonathan Duda noted in some cases the election workers are not able to confirm the voter intent, so that vote is not counted, so he cannot recommend hand marked paper ballots. Jonathan Duda's objection for hand marked paper ballots is referring to absentee when the voter is not present. This situation is not relevant for precinct hand marked paper ballots given the scanners can provide self-adjudication. The scanners will notify voter of blank ballots, undervote (missing votes), and overvote (too many selections in a race), or inappropriate marks/"doodling." This allows for in person correction.
- c. The absentee hand marked paper ballots do not change with any proposed model, so its error rates are not a factor in the precinct pre-printed ballot requested voting model.
- d. Also, WCEC noted the Williamson County GOP elections had 19 people use Xs or circle candidate names so the tabulators did not accept. Those people were able to correct the ballot and their vote was counted as intended. The County can utilize more education campaigns to educate citizens like at libraries, etc. not to place an X over the bubble.
- e. The ES&S literature use positive targeting recognition to *"...ensure even the most poorly marked ballots are read accurately and consistently – protecting voter intent"* and reducing adjudication needs. So, one more reason error rate is not a concern.¹ Thus these points clearly address error rate concerns and precinct hand marked paper ballots have resolutions to ensure voter intent that do not impact polling throughput efficiency.

Enhanced Voting Experience

The DS200 is a precinct-based scanner and vote tabulator equipped with the latest in ES&S' patented technology. Fully certified and compliant with EAC guidelines, the DS200 enhances the voting experience for voters and election officials alike. Our patented Intelligent Mark Recognition (IMR[®]) and patented Positive Target Recognition & Alignment Compensation (PTRAC[®]) technologies ensure even the most poorly marked ballots are read accurately and consistently — protecting voter intent. All of this is designed to make everyone's job easier.

3.0.0 | © 2021 Election Systems & Software, LLC. For certification details, visit [essvote.com/certification](https://www.essvote.com/certification)

9. Hand Marked Paper Ballot Transition Timeline

The WCEC note concerns on timing ability to change over to hand marked paper ballots by next election cycle and the 2024 primary elections. WCEC and County Commissioners the requested change is extremely feasible for pre-printed paper ballots cast in precincts. Case in point, the SSDOE Tre Hargett letter² recommending Dominion to be removed was dated February 16, 2022 and the next election started April 13, 2022, which is less than 2 months that the WCEC switched out complete equipment, programs, and processes from Dominion to ES&S. Secondly, Williamson County can utilize our existing pre-printed certified absentee ballots with ADA devices and maintain the same ES&S scanners, purchase central tabulation for absentee and purchase the existing EMS central controls. In a TheNews article on May 9, 2022, it was stated *"The commission secured an entirely new voting system when the 2022 primary election was only six weeks out, and they credit meticulous planning, collaboration and ES&S personnel and products for the relatively seamless transition. 'It's just really pretty phenomenal the work that was done,' said Jonathan Duda, Chairman of the Williamson County Election Commission. 'The collaborative work of our teams – ES&S and the Williamson County Election Commission – demonstrated what can happen when you work together.' "*³

¹ DS200 Data sheet - https://www.essvote.com/storage/2022/04/DS200_one-sheet.pdf

² SSDOE Hargett Goins Letter to WCEC Feb 16 2022 – provided as supplemental PDF

³ TheNews article *"Williamson County election officials pleased with new voting system after May run"* - https://www.thenewstn.com/brentwood/williamson-county-election-officials-pleased-with-new-voting-system-after-may-run/article_4fe05e32-cfd1-11ec-ab6a-bfab22a45f7d.html

Conclusion

The nine aforementioned discussion points in this executive review are in stark contrast to Jonathan Duda's verbal comments at the May 8, 2023 County Commission meeting *"...I know tonight you heard that there will be more reliability, cheaper, and that there's better security with hand marked paper ballots. Our findings actually have found the opposite for Williamson County. The implementation of putting in hand marked paper ballots cost more than the proposal that we have for this evening... the utilization, the cost, the reliability. All the factors that we looked at are how we arrived at the decision we did."*

In summary, this document has provided each county commissioner a clear reason to vote against the WCEC 200 BMD system recommendation and to vote against funding an unnecessary WCEC recommended \$50,000 nine month hand marked paper ballot study, which is a distraction considering years of supporting data and expert recommendations for hand marked paper ballots.

Williamson County Commissioners and Election Commissioners should discuss the above pertinent details to move towards utilizing the existing absentee approved ballots for the polling locations. As a County Commissioner you should utilize your capabilities to re-instate Williamson County precinct voting. Williamson County should remove the vote centers that impede election integrity with the poor, lacking in transparency BMD vote model. Vote centers eliminate the frontline defense at the precinct polls, which is a strong benefit to all voters. Jonathan Duda noted that vote centers increased voter turnout, which was reported as reason to keep them. He noted there was a 9% increase from presidential 2016 election versus 2020 election. According to both Fox and CNN media, 2016 and 2020 voting numbers for Williamson County were a 31% increase, with a 13% population increase. Maury County, with precincts, was also a 31% increase from 2016 to 2020 presidential election turnout. Maury County also had a 13% population increase. TN overall was a 21% voter turnout increase in 2020 and a 4% population increase. These statistics do not show a voter turnout improvement with vote centers. Jonathan Duda also notes a cost savings. Very simply, you cannot take one small cost piece (ie vote centers) and compare it without the other components to this overall cost analysis. The Return on Investment (ROI) for hand marked paper ballots to the BMD model is tremendous and even confirmed by the National Academies. The ongoing machine upkeep year-over-year expenses drop as well with the pre-printed hand marked paper ballot proposal. The precinct operational cost piece increases to allow for 42 precincts versus the 25 + X vote centers added in 2024. Yet the incremental precinct expense is a smaller cost % that does not offset the higher BMD model capital cost and YOY maintenance cost and more machines would need to be bought again before offsetting any precinct expense costs. Also, the precincts can throttle back voting days on smaller elections as an option to minimize cost. The security gained with hand marked paper ballots and precinct voting far out weights Chad Grey's statistics of some areas having 60% voting outside their precinct. Local community polling locations are close to home and still have a level of convenience. Plus, on average there are only 3,200 voters per precinct, so with ample early vote days, this number of voters is extremely manageable.

County Commissioners should ask the following questions for Williamson County citizens pertaining to WCEC conduct:

- Why did the WCEC tell the County Commission that hand marked paper ballots are more expensive? Why did the WCEC not take the time to get a BoD and a pre-printed hand marked paper scanner quote from election equipment vendors knowing that many citizens have been and are still asking for it? Why would they not show the BoD ES&S discount in the cost analysis? Why did they provide a very small ES&S BoD discount, which then made their 200 BMD system's Net Cost appear to be less? Why leave the discount line as \$0 on the budget analysis avoiding closer scrutiny?
- Why did the WCEC state the National Academies recommend the full 200 BMD system proposal and not mention the National Academies recommendation of hand marked paper ballots and the National Academies' concerns pertaining to the use of BMDs?

- Why did the WCEC reference the Heritage Foundation Fraud +750 cases as WCEC's purported reason for WCEC's claim that hand marked paper ballots are an issue, when the Heritage Foundation report showed no relevance to the WCEC claims? Careful review of the Heritage Foundation fraud database shows there are no links to precinct hand marked paper ballot. There are a few cases of people bringing in absentee ballots to the polls, which is not allowed in Tennessee nor does it have anything to do with precinct pre-printed ballots.
- Why did the WCEC state that BMDs are more reliable given calibration reset issues, wrong firmware issues, and the National Academy noting *"Such systems may also be more prone to breakdowns?"*¹
- Why did the WCEC not explain that BMD ballots utilize bar codes, which have to be programmed and since they are programmed are a contradiction to human readable ballots? Why do they ignore many of the experts that push for hand marked paper ballots?
- Why did the WCEC not clearly communicate to the County Commission that scanners can allow for self-correction (self-adjudication) which subtracts out WCEC worst case claim that hand marked paper ballots have 5% error rate issues? Did they not know the scanner self-adjudicates? Jonathan Duda noted he really would like to use hand marked paper ballots but could not because of those votes that are not readable and people lose their vote. Yet we are providing the WCEC with clear support that addresses this concern. WCEC witnessed this feature at the Williamson County GOP Reorganization Convention elections.
- Does the WCEC understand the psychology studies that show writing by hand connects the voter with the words and allows their brain to focus on words versus computers? As noted by the National Academies page 79 note *"By hand marking a paper ballot, a voter is, in essence, attending to the marks made on his or her ballot. A BMD-produced ballot need not be reviewed at all by the voter?"*¹

In conclusion, the precinct pre-printed hand marked paper ballot model provides better cost, better reliability, better efficiency, better security, and stronger voter intent as outlined in the executive review.

¹ National Academies – Securing the Vote – 2018 - <https://nap.nationalacademies.org/catalog/25120/securing-the-vote-protecting-american-democracy>

Additional Specifics on the WCEC Letter and comments from WCEC and County Commission Meetings:

1. **“Recommendation” versus “...we could no longer use” on February 16, 2022:** WCEC incorrectly states in their May 4, 2023 letter they were told they had to ditch the \$1.5MM Dominion System, “...notified by the SSDOE that we could no longer use the election equipment...”
 - a. The SOS Feb 16, 2022 letter to WCEC actually gave a recommendation. The letter states “...it is our recommendation that Dominion voting machines not be used in Williamson County.”
 - b. Wanda Graham, WCEC Secretary, was the sole election commissioner present against the SOS recommendation in the election meeting preceding the SOS letter. Bob Brown, while WCEC’s Chairman, stated when Tre Hargett says “...Jump, I say how high.” Then in the May 18, 2023 WCEC meeting as a WCEC member, he reiterated this sentiment by stating “Yes sir & how high.” The commission commented on when they get a state suggestion, we do it.
2. **Costs:** The new election commission member, Rod Williamson, states in the May 18, 2023 WCEC meeting “...that to get pushed into this expensive, complicated alternative by the minority is a mistake.” Expensive and complicated is not accurate but is what is being purported and told to Williamson County Commission. It is concerning the group that is leading the election proposals has this viewpoint after the Cost section clearly show hand marked paper ballots are less expensive.
3. **Too Many Ballots:** Page 4 states “*Pre-printed ballots would be problematic due to the requirement of securely storing potentially over a hundred ballot styles at each location.*”
 - a. The Vote Centers are the cause of this irrelevant option of trying to have all pre-printed ballot styles at each vote center. With local community small precinct voting, it minimizes ballots to one to a few and this concern is not applicable.
4. **Costs:** On page 4 WCEC letter notes “*The costs to add Hand-Marked Paper Ballot as an option for voting in Williamson County are higher than a system of Paper Ballots prepared by a Ballot Marking Device (BMD).*”
 - a. WCEC assumes using the vote centers so they have to print out “...over one hundred fifty (150) different ballot style...” at each vote center. This is not an effective comparison.
 - b. With precincts, the pre-printed hand-marked paper ballot option is the most cost-effective voting model with estimates close to a 50% cost reduction from the BMD WCEC proposal and close to 40% less than the WCEC’s Ballot on Demand proposal.
5. **Tennessee is ranked #1 in the Nation for Election Integrity by The Heritage Foundation:** This was referenced in the WCEC’s Q/A question #12. The Heritage Foundation ranked 12 items that do not pertain to BMDs or hand marked paper ballots. This website confirms they are focused on laws and regulations, which does not provide a true ranking of voter safety as evidence in Georgia, which was ranked #1 previously and now #2. Per the website, “*The Heritage Foundation has published this Election Integrity Scorecard, which compares the election laws and regulations of each state and the District of Columbia that affect the security and integrity of the process to the Foundation’s best-practices recommendations.*”¹ Hence irrelevant to promoting a BMD voting model or making reference that BMD is better than a hand marked paper ballot.

¹ Heritage Foundation – Election Integrity Scorecard -- <https://www.heritage.org/electionscorecard/index.html>