

Musselshell Watershed Coalition

Salinity Meter End of Season Assessment: February 2019

Summary prepared by Mitchell Hoffman and Adam Sigler 02/26/2019

On February 25, 2019, all 5 meters were assessed at the same time for reading agreement. This was conducted at the USDA NRCS Field Office in Winnett, MT by Mitchell Hoffman. All five meters were placed in the same tub of water and readings were recorded simultaneously while slugs of salt water were added in accordance with the SOPs, to assess agreement among the meters over the range of salinities observed during the monitoring season. The full results are in the table below. Four of the meters had maximum relative percent difference (RPD) from the mean of less than 5%. The ProPlus meter had RPD from the mean ranging over 20% - however at the lower salinity levels, which are closer to what would be seen in the field, the ProPlus was around 5% accurate. In the 2018 season we saw measurements max out at around 2500 uS/cm so it is unlikely that RPD was ever higher than 10% during field measurements. The full results are in the table below

| Time (min) | LMCD 1 | | LMCD 2 | | LMCD 3 | | LMCD 4 | | ProPlus | | Avg. | Notes |
|------------|------------|--------|------------|--------|------------|--------|------------|--------|------------|---------|--------|---|
| | SC (uS/cm) | RPD | SC (uS/cm) | RPD | SC (uS/cm) | RPD | SC (uS/cm) | RPD | SC (uS/cm) | RPD | | |
| 0 | 1742 | -3.95% | 2128 | 17.34% | 1751 | -3.45% | 1741 | -4.00% | 1706 | -5.93% | 1813.6 | Placed probes in tub of Winnett NRCS field office tap water. |
| 1 | 1743 | -1.90% | 1963 | 10.48% | 1754 | -1.28% | 1743 | -1.90% | 1681 | -5.39% | 1776.8 | |
| 5 | 1743 | -0.88% | 1895 | 7.77% | 1748 | -0.59% | 1741 | -0.99% | 1665 | -5.31% | 1758.4 | |
| 8 | 1742 | -0.53% | 1874 | 7.01% | 1743 | -0.47% | 1741 | -0.58% | 1656 | -5.44% | 1751.2 | |
| 10 | 5042 | 4.61% | 4978 | 3.28% | 4933 | 2.35% | 4946 | 2.62% | 4200 | -12.86% | 4819.8 | Added salt water to the tub of tap water/probes, mixed in the salt water. |
| 12 | 5011 | 4.10% | 4984 | 3.54% | 4934 | 2.50% | 4941 | 2.64% | 4199 | -12.77% | 4813.8 | |
| 15 | 4989 | 3.46% | 4980 | 3.28% | 4938 | 2.41% | 4942 | 2.49% | 4261 | -11.63% | 4822.0 | |
| 17 | 4980 | 3.19% | 4977 | 3.13% | 4945 | 2.47% | 4946 | 2.49% | 4282 | -11.27% | 4826.0 | |
| 19 | 7586 | 5.62% | 7516 | 4.65% | 7588 | 5.65% | 7493 | 4.33% | 5728 | -20.25% | 7182.2 | Added salt water to the tub of tap water/probes, mixed in the salt water. |
| 21 | 7581 | 5.03% | 7522 | 4.21% | 7591 | 5.17% | 7498 | 3.88% | 5898 | -18.29% | 7218.0 | |
| 23 | 7577 | 4.70% | 7525 | 3.98% | 7582 | 4.77% | 7501 | 3.65% | 6000 | -17.09% | 7237.0 | |
| 25 | 7574 | 4.53% | 7523 | 3.82% | 7575 | 4.54% | 7502 | 3.53% | 6056 | -16.42% | 7246.0 | |
| 28 | 10367 | 4.74% | 10276 | 3.82% | 10333 | 4.40% | 10347 | 4.54% | 8165 | -17.51% | 9897.6 | Added salt water to the tub of tap water/probes, mixed in the salt water |
| 30 | 10385 | 4.69% | 10272 | 3.55% | 10345 | 4.29% | 10340 | 4.24% | 8257 | -16.76% | 9919.8 | |
| 35 | 10417 | 4.28% | 10311 | 3.22% | 10349 | 3.60% | 10342 | 3.53% | 8526 | -14.65% | 9989.0 | |

Mitch Hoffman subsequently recorded meter readings in 1413 solution before and after cleaning the meter electrodes. The RPD between pre and post cleaning was not greater than 2% for any of the meters. All meters read within 4% of the 1413 solution post cleaning.

| | | LMCD 1 | | | LMCD 2 | | | LMCD 3 | | | LMCD 4 | | | ProPlus | | |
|------|---|------------|------------|----------|------------|------------|----------|------------|------------|----------|------------|------------|----------|------------|------------|----------|
| | | Time (min) | SC (uS/cm) | Temp (C) | Time (min) | SC (uS/cm) | Temp (C) | Time (min) | SC (uS/cm) | Temp (C) | Time (min) | SC (uS/cm) | Temp (C) | Time (min) | SC (uS/cm) | Temp (C) |
| 2018 | Pre-cleaning | 0 | 1396 | 20.9 | 0 | 1407 | 20.6 | 0 | 1447 | 20.4 | 0 | 1397 | 20.2 | 0 | 1434 | 19.9 |
| | | 2 | 1397 | 21.0 | 2 | 1401 | 20.5 | 2 | 1445 | 20.6 | 2 | 1426 | 20.3 | 2 | 1434 | 19.9 |
| | | 4 | 1398 | 21.0 | 4 | 1419 | 20.1 | 4 | 1444 | 20.6 | 4 | 1425 | 20.3 | 4 | 1434 | 19.9 |
| | | | | | 6 | 1421 | 20.1 | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | Post-cleaning | 0 | 1409 | 20.1 | 0 | 1423 | 19.9 | 0 | 1446 | 20.0 | 0 | 1446 | 19.9 | 0 | 1415 | 20.1 |
| | | 2 | 1418 | 19.9 | 2 | 1426 | 20.0 | 2 | 1450 | 20.0 | 2 | 1449 | 19.8 | 2 | 1429 | 20.0 |
| | | 4 | 1418 | 19.9 | 4 | 1427 | 20.0 | 4 | 1454 | 20.1 | 4 | 1450 | 19.9 | 4 | 1430 | 19.9 |
| | | | | | | | | 6 | 1457 | 20.1 | | | | | | |
| | | | | | | | | | | | | | | | | |
| | RPD (pre vs post clean) | | -1.4% | | | -0.4% | | | -0.9% | | | -1.7% | | | 0.3% | |
| | RPD (post clean reading vs 1413 solution) | | 0.4% | | | 1.0% | | | 3.1% | | | 2.6% | | | 1.2% | |

In summary, the difference among meters at the end of the season was less than 5% across salinity levels given proper equilibration time with the exception of the ProPlus, and the difference from calibration solution was less than 4%. This verified high level of accuracy without calibration during the season indicates that the current procedure of calibrating only once at the beginning of the season and checking again at the end produces accurate results while dramatically reducing strain on volunteers.