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Laboratory Data Quality Review

2019 Semiannual Groundwater Monitoring

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South Macomb Disposal Authority Landfills 9/9A

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Introduction

This Laboratory Data Quality Review was conducted by TRC at the request of the Michigan Department of Environment, Great Lakes, and Energy (EGLE) to assess recent data collected during groundwater sampling performed at the South Macomb Disposal Authority (SMDA) Landfill Sites 9 and 9A located at 21410 24 Mile Road, Macomb Township, Michigan (Site). The Laboratory Data Quality Review was performed by TRC Senior Chemist Jeff Ramey and peer reviewed by TRC's Quality Assurance & Chemistry Systems Director, Elizabeth Denly. Mr. Ramey and Ms. Denly are degreed chemists with over 15 and 30 years of experience, respectively, in environmental chemistry and data quality assessment and reviews.

The level of data assessment performed is directly correlated with the end use of the data. Data generated for risk assessment, remediation decisions, and monitoring programs may receive more scrutiny than data generated for disposal or field screening purposes. Data assessment identifies the presence of potential low or high biases, potential heterogeneity issues or potential false positive or false negative results in a data set. Data quality and usability issues can be present even when laboratories follow all method-required procedure. Assessing the usability of laboratory generated data increases assurance and data integrity by systematically identifying discrepancies and errors.

Sampling Events

Groundwater samples were collected by Midwest Analytical Services, Inc. (MAS) for the May and November 2019 groundwater monitoring events. Samples were analyzed for chloride, sulfate, metals, alkalinity, nitrate, nitrite, ammonia, total dissolved solids (TDS), and volatile organic compounds (VOCs) by MAS's laboratory in Ferndale, MI. The methane analysis was subcontracted to Brighton Analytical (BA) in Brighton, MI. Analytical results were reported in laboratory sample delivery groups (SDGs) 1905029 re-issue, 1905031, 1905123, 1905133 re-issue, 1911050, 1911064, 1911068, and 1911072.

During each of the May and November 2019 sampling events, a groundwater sample was collected from the following wells:

- MW-9734
- MW-9733
- MW-211R
- MW-103
- MW-594-35R2
- MW-118
- MW-9743
- MW-9745
- MW-9712
- MW-500-2-2
- MW-9736
- MW-527
- MW-9746
- MW-9705
- MW-9709-3
- MW-9731
- MW-9738
- MW-9732-2
- MW-9711
- MW-9735
- MW-526-2-2
- MW-113
- MW-521R
- MW-9708-2
- MW-9739
- MW-9744
- MW-201-R
- MW-501-2-4

Each sample was analyzed for the following constituents:

Analyte Group	Method
Chloride	SW-846 9212
Sulfate	EPA 375.4
Total Metals	SW-846 6010B
Alkalinity (Carbonate/ Bicarbonate)	SM 2320B
Nitrogen, Nitrate	SM 4500-NO3 D
Nitrogen, Nitrite	EPA 353.2
Nitrogen, Ammonia	EPA 350.2
Total Dissolved Solids	EPA 160.1
Volatile Organic Compounds	SW 846 8260B
Methane	RSK 175 SOP

TRC reviewed the laboratory data to assess data usability. The following sections summarize the data review procedure and the results of the review.

Data Usability Review Procedure

The analytical data were reviewed using TRC's Analytical Data Review Checklist (*Internal Use Only - version 2015*). The following items were included in the evaluation of the data:

- Sample receipt;
- Technical holding times for analyses;
- Reporting limits (RLs) compared to project-required RLs;
- Data for method blanks, equipment blanks, and field blanks. Method blanks are used to assess potential contamination arising from laboratory sample preparation and/or analytical procedures. Field and equipment blanks are used to assess potential contamination arising from field procedures;
- Data for laboratory control samples (LCSs) and laboratory control sample duplicates (LCSDs), when performed. The LCSs and/or LCSDs are used to assess the accuracy and/or precision of the analytical method using a clean matrix;
- Percent recoveries for matrix spike (MS) and matrix spike duplicates (MSD), when performed on project samples. Percent recoveries are calculated for each analyte spiked and used to assess bias due to sample matrix effects;
- Data for laboratory duplicates, when performed on project samples. The laboratory duplicates are replicate analyses of one sample and are used to assess the precision of the analytical method;
- Data for blind field duplicates. Field duplicate samples are used to assess variability introduced by the sampling and analytical processes; and
- Overall usability of the data.

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This data usability report addresses the following items:

- Usability of the data if quality control (QC) results suggest potential problems with all or some of the data;
- Actions regarding specific QC criteria exceedances.

Review Summary

Overall, the data quality objectives and laboratory completeness goals for the project were met, and the data are usable for their intended purpose with the below exceptions. A summary of the data quality review, including non-conformances and issues identified in this evaluation, are noted below.

- Data are usable for the purposes of the assessment monitoring program.
- When the data are evaluated through an assessment monitoring statistical program, findings below may be used to support the removal of outliers.

QA/QC Sample Summary:

- All sample preservation and temperature criteria were met with the following exceptions.
  - Samples from SDGs 1911064, 1911068, and 1911072 were received by laboratory above 6°C but were on ice and were received the same day of sample collection; data are therefore not affected.
  - The pH of the VOC sample for MW-526-2-2 from May 2019 was >2. Since the VOC analysis was performed within 7 days of collection, data are not adversely affected.
- Holding time criteria were met for all samples except for the methane analyses of all samples in SDGs 1911050 and 1911064 which were performed one to two days past the recommended 14-day holding time. The results of the samples are biased low, as summarized in the attached table, Attachment A.
- An estimated quantitation limit (EQL) of 6.5 µg/L for lead analysis was reported for all samples. The non-detect results for all samples are therefore above the residential/ non-residential drinking water criteria of 4.0 µg/L; the affected samples are summarized in the attached table, Attachment A.
- Several samples were diluted for matrix interference or select target analyte results above the calibration range. The EQLs for the non-detected results for all diluted samples met the project limits.
- For the VOC analyte lists in all SDGs, chlorodibromomethane and dibromochloromethane are both reported but these are the same compound (CAS #: 124-48-1). All sample results are non-detect for this compound.
- Method 6200B is specified in the AEW monitoring report as the analytical method for VOCs and SW 846 8260B was utilized by the lab to analyze for VOCs. This method substitution is acceptable for groundwater.
- Method 200.7 is specified in the AEW monitoring report as the analytical method for metals and SW 846 6010B was utilized by the laboratory to analyze for metals. This method substitution is acceptable for groundwater

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- A method blank was analyzed with each analytical batch. Target analytes were not detected in the method blank samples with the following exception. Ammonia was detected (0.057 mg/L) in the method blank associated with all samples in SDG 1911064. The samples with ammonia results <5x the concentration in the method blank have possible false positive results for ammonia; the affected samples are summarized in the attached table, Attachment A.
- No equipment or field blank samples were collected. Trip blanks were collected with each SDG. Target analytes were not detected in the trip blank samples with the following exceptions.
  - Carbon disulfide was detected at 1.4 µg/L in the trip blank associated with SDG 1911050. All samples with detected carbon disulfide results in the SDG are possible false detections; the affected samples are summarized in the attached table, Attachment A.
  - Carbon disulfide was detected at 1.7 µg/L in the trip blank associated with SDG 1911068. No samples in the SDG detected positive results for carbon disulfide and no data are therefore affected.
- The LCS and/or LCSD recoveries and relative percent differences (RPDs), where applicable, for all analytes were within QC limits. It should be noted that for SDG 1905029, the lower and upper control limits for the LCS for the TDS analysis were incorrectly entered but all criteria were met.
- MS and MSD analyses were performed on the samples listed below; all recoveries and RPDs were within the QC limits with the following exceptions.

  Note: The MS/MSD RPDs for metals were incorrectly calculated on the QC summary file in SDGs 1905029, 1905031, 1905123, 1911050, and 1911064. The corrected MS/MSD RPDs for all metals are within method criteria (<20%).

  <u>SDG 1905029 re-issue:</u>

  - An MS and MSD were performed on sample MW-9734 for metals. The parent sample results for calcium, magnesium, and sodium are greater than 4x the matrix spike concentration and the matrix spike low (MSL) flags are therefore not necessary for sample MW-9734 for these analytes. The percent recovery (%R) of iron in the MS is below the control limit and flagged matrix spike low "MSL." Potential low bias exists for the results of all samples in this SDG for iron; the affected samples are summarized in the attached table, Attachment A.
  - An MS was performed on sample MW-9734 for ammonia and nitrite. The MS %R is incorrectly calculated on the provided excel file and does not include the parent sample results. The %R for the MS for ammonia is below control limits and MW-9734 is flagged MSL. Potential low bias exists for the results of samples in this SDG for ammonia; the affected samples are summarized in the attached table, Attachment A.

  <u>SDG 1905031:</u>

  - Samples from SDG 1905031 were included in the preparation and analytical batch with the MS and MSD performed on sample MW-9734 for metals and nitrite in SDG 1905029. Thus, potential low bias exists for the results of all samples in this SDG for iron; the affected samples are summarized in the attached table, Attachment A.

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SDG 1905123:

- An MS and MSD were performed on sample MW-9708-2 for metals. The parent sample results for calcium, magnesium, and sodium are greater than 4x the matrix spike concentration and MSL and MS high (MSH) flags are therefore not necessary for sample MW-9708-2. The %Rs of potassium are below the control limit. Potential low bias exists for the results of all samples in this SDG for potassium; the affected samples are summarized in the attached table, Attachment A.

SDG 1905133 re-issue:

- Samples from SDG 1905033 re-issue were included in the preparation and analytical batch with the MS and MSD performed on sample MW-9708-2 for metals in SDG 1905123. Thus, potential low bias exists for the results of all samples in this SDG for potassium; the affected samples are summarized in the attached table, Attachment A.

SDG 1911050:

- An MS and MSD were performed on sample MW-594-35R2 for metals. The parent sample results for calcium, magnesium, and sodium are greater than 4x the matrix spike concentration. Data usability was therefore not affected.
- An MS and MSD were performed on sample MW-9746 for ammonia. MS/MSD %Rs for ammonia were below control limits and all ammonia sample results in this SDG are biased low; the affected samples are summarized in the attached table, Attachment A.

SDG 1911064:

- An MS and MSD were performed on sample MW-9705 for ammonia and metals. The parent sample results for calcium, magnesium, sodium, and ammonia are greater than 4x the matrix spike concentration and MSL, MSH, and MS/MSD recoveries hindered by sample matrix (SMS) flags are therefore not necessary for sample MW-9705. Data usability is not affected.

SDG 1911068:

- An MS and MSD were performed on sample MW-9712 for ammonia. MS/MSD %Rs for ammonia were well above the control limit and the detected ammonia results for all samples in this SDG are biased high; the affected samples are summarized in the attached table, Attachment A.
- MS/MSD RPD (25.1%) is outside of method criteria for ammonia. Uncertainty exists for all results for ammonia in this SDG; the affected samples are summarized in the attached table, Attachment A.

SDG 1911072:

- Samples from SDG 1911072 were included in the preparation and analytical batch with the MS and MSD performed on sample MW-9712 for ammonia in SDG 1911068. Thus, the detected ammonia results for all samples in this SDG are biased high; the affected samples are summarized in the attached table, Attachment A.

- In SDG 1905133, sample MW-9712 was flagged by the laboratory for duplicate reproducibility out of range “DR” for sulfate but a sulfate duplicate analysis was not included in the QC summary file. Therefore, data usability was not affected.

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- In SDG 1911050, sample MW-594-35R2 was flagged by the laboratory "DR" for bicarbonate alkalinity but a duplicate analysis was not included in the QC summary file. Therefore, data usability was not affected.
- Field duplicate samples were submitted with the samples; all RPDs were within the QC limits with the following exceptions.
  - SDG 1905209 – MW-9733 and Duplicate. The RPDs for chloride (31%), bicarbonate alkalinity (38.6%), sulfate (41.9%), barium (120%), boron (75%) iron (154%), sodium (35.3%), zinc (103%), methane (73.2%) exceed the acceptance limits. Select analytes were detected in only one of the paired samples; RPDs were not calculable for these results but variability was outside criteria for nitrate (<0.1 mg/L; 4.9 mg/L) and chloromethane (<1 ug/L; 6.1 ug/L). Potential uncertainty exists for all samples in this SDG for these parameters; the affected samples are summarized in the attached table, Attachment A.
  - SDG 19050131 – MW-113 and Duplicate. The RPD for methane (32.3%) exceeds the acceptance limit. Potential uncertainty exists for all samples in this SDG for methane; the affected samples are summarized in the attached table, Attachment A.
  - SDG 19050133 re-issue – MW-9712 and MW-Duplicate. All criteria were met.
  - SDG 1911050 – MW-594-35R2 and MW-Duplicate. The RPDs for barium (31%) and zinc (40%) exceed the acceptance limits. Lead was detected in only one of the paired samples; the RPD was not calculable for this result but variability was outside criteria (<6.5 ug/L; 77 ug/L). Potential uncertainty exists for all samples in this SDG for these parameters; the affected samples are summarized in the attached table, Attachment A.
  - SDG 1911064 – MW-521R and MW-Duplicate. The RPD for methane (36.4%) exceeds the acceptance limit. Potential uncertainty exists for all samples in this SDG for methane; the affected samples are summarized in the attached table, Attachment A.
  - SDG 1911068 – MW-9712 and MW-Duplicate. The RPD for TDS (50.4%) exceeds the acceptance limit. Potential uncertainty exists for all samples in this SDG for TDS; the affected samples are summarized in the attached table, Attachment A.
  - SDG 1911072 – MW-9733 and MW-Duplicate. The RPDs for nitrate (40%), nitrite (33%), and sulfate (52%) exceed the acceptance limits. Potential uncertainty exists for all samples in this SDG for these parameters; the affected samples are summarized in the attached table, Attachment A.
- Surrogate recoveries were within the acceptance criteria in the VOC analyses with the following exceptions:
  - One surrogate recovered below the acceptance criteria in the Trip Blank sample in SDG 1911050 and sample MW-9743 in SDG 1905123. All VOC results in these samples are biased low; the affected samples are summarized in the attached table, Attachment A.

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Conclusions

TRC performed a data quality review of the laboratory data as described above. The laboratory data generated from the samples collected and analyzed by MAS from May and November 2019 is considered useable for monitoring the closed landfill constituents in groundwater. After the 2019 groundwater sampling events, AEW & MAS have implemented measures to improve sampling integrity and data quality. This includes MAS reevaluating sampling protocols and standard operating procedures (SOPs), staff retraining, and other corrective actions with the goal of improving overall data quality. Moving forward, MAS is incorporating the EPA Low Flow sampling methods, which will result in increased precision of field data for future semi-annual groundwater monitoring. Additionally, TRC is updating to the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) to direct and document the required procedures and objectives needed to maintain compliance for the Site 9 & 9A. The results of all of these measures will improve data quality and integrity at the site.

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Attachment A
SMDA 2019 GW DQR

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Attachment A

Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
South Macomb Disposal Authority - Landfills 9 and 9A Groundwater Monitoring Program
Macomb County, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-594-35R2	11/17/2019	Methane	Analysis performed past holding time; sample results may be biased low.
MW-Duplicate	11/17/2019		
MW-9708-2	11/17/2019		
MW-118	11/17/2019		
MW-9746	11/17/2019		
MW-211R	11/17/2019		
MW-9745	11/17/2019		
MW-9744	11/17/2019		
MW-9738	11/17/2019		
MW-9732-2	11/17/2019		
MW-9731	11/17/2019		
MW-9736	11/17/2019		
MW-113	11/17/2019		
MW-103	11/17/2019		
MW-9705	11/18/2019		
MW-521R	11/18/2019		
MW-Duplicate	11/18/2019		
MW-201R	11/18/2019		
MW-526-2-2	11/18/2019		
MW-527	11/18/2019		
MW-9735	11/18/2019		
MW-9734	11/18/2019		
MW-9709-3	11/18/2019		
MW-9734	5/6/2019	Lead	Estimated Quantitation Limit (EQL) for non-detected results above regulatory criteria
MW-9736	5/6/2019		
MW-9735	5/6/2019		
MW-9733	5/6/2019		
Duplicate	5/6/2019		
MW-527	5/6/2019		
MW-526-2-2	5/6/2019		
MW-211R	5/6/2019		
MW-9746	5/6/2019		
MW-9705	5/7/2019		
MW-521R	5/7/2019		
MW-9709-3	5/7/2019		
MW-118	5/28/2019		
MW-9731	5/28/2019		
MW-9739	5/28/2019		
MW-9743	5/28/2019		
MW-9738	5/28/2019		
MW-9744	5/28/2019		
MW-9745	5/28/2019		
MW-9732-2	5/28/2019		
MW-201-R	5/28/2019		
MW-9712	5/29/2019		
MW-Duplicate	5/29/2019		
MW-9711	5/29/2019		
MW-501-2-4	5/29/2019		
MW-500-2-2	5/29/2019		
MW-594-35R2	11/17/2019		
MW-9708-2	11/17/2019		
MW-9746	11/17/2019		
MW-211R	11/17/2019		
MW-9738	11/17/2019		
MW-9731	11/17/2019		
MW-9736	11/17/2019		
MW-113	11/17/2019		
MW-9705	11/18/2019		
MW-521R	11/18/2019		
MW-Duplicate	11/18/2019		
MW-526-2-2	11/18/2019		
MW-9735	11/18/2019		
MW-9712	11/19/2019		
MW-Duplicate	11/19/2019		
MW-501-2-4	11/19/2019		
MW-9733	11/20/2019		
MW-9739	11/20/2019		
MW-9743	11/20/2019		
MW-Duplicate	11/20/2019		
MW-500-2-2	11/20/2019		
MW-521R	11/18/2019	Ammonia	Analyte detected in method blank; Results <5x the blank result; indicates possible false positive detection
MW-Duplicate	11/18/2019		
MW-527	11/18/2019		
MW-9735	11/18/2019		
MW-9734	11/18/2019		
MW-9709-3	11/18/2019		
MW-113	11/17/2019	Carbon Disulfide	Analyte detected in trip blank; Results <5x the blank result; indicates possible false positive detection
MW-103	11/17/2019		

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
South Macomb Disposal Authority - Landfills 9 and 9A Groundwater Monitoring Program
Macomb County, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-9734	5/6/2019	Iron	Low recovery in matrix spike; indicates potential low bias
MW-9736	5/6/2019		
MW-9735	5/6/2019		
MW-9733	5/6/2019		
Duplicate	5/6/2019		
MW-527	5/6/2019		
MW-526-2-2	5/6/2019		
MW-211R	5/6/2019		
MW-9746	5/6/2019		
MW-113	5/7/2019		
Duplicate	5/7/2019		
MW-103	5/7/2019		
MW-9705	5/7/2019		
MW-521R	5/7/2019		
MW-594-35R2	5/7/2019		
MW-9709-3	5/7/2019		
MW-9734	5/6/2019	Ammonia	Low recovery in matrix spike; indicates potential low bias
MW-9736	5/6/2019		
MW-9735	5/6/2019		
MW-9733	5/6/2019		
Duplicate	5/6/2019		
MW-527	5/6/2019		
MW-526-2-2	5/6/2019		
MW-211R	5/6/2019		
MW-9746	5/6/2019		
MW-9708-2	5/28/2019	Potassium	Low recovery in matrix spike; indicates potential low bias
MW-118	5/28/2019		
MW-9731	5/28/2019		
MW-9739	5/28/2019		
MW-9743	5/28/2019		
MW-9738	5/28/2019		
MW-9744	5/28/2019		
MW-9745	5/28/2019		
MW-9732-2	5/28/2019		
MW-201-R	5/28/2019		
MW-9712	5/29/2019		
MW-Duplicate	5/29/2019		
MW-9711	5/29/2019		
MW-501-2-4	5/29/2019		
MW-500-2-2	5/29/2019		
MW-594-35R2	11/17/2019	Ammonia	Low recovery in matrix spike and matrix spike duplicate; indicates potential low bias
MW-Duplicate	11/17/2019		
MW-9708-2	11/17/2019		
MW-118	11/17/2019		
MW-9746	11/17/2019		
MW-211R	11/17/2019		
MW-9745	11/17/2019		
MW-9744	11/17/2019		
MW-9738	11/17/2019		
MW-9732-2	11/17/2019		
MW-9731	11/17/2019		
MW-9736	11/17/2019		
MW-113	11/17/2019		
MW-103	11/17/2019		
MW-9712	11/19/2019	Ammonia	Significantly high recoveries in matrix spike and matrix spike duplicate; indicates potential high bias
MW-9711	11/19/2019		
MW-Duplicate	11/19/2019		
MW-501-2-4	11/19/2019		
MW-500-2-2	11/20/2019		
MW-9712	11/19/2019	Ammonia	MS/MSD RPD >20%. Potential uncertainty.
MW-9711	11/19/2019		
MW-Duplicate	11/19/2019		
MW-501-2-4	11/19/2019		
MW-500-2-2	11/20/2019		
MW-9734	5/6/2019	Chloride, Alkalinity, Sulfate, Barium, Boron, Iron, Sodium, Zinc, Methane, Nitrate, Chloromethane	Field duplicate variability. Potential uncertainty.
MW-9736	5/6/2019		
MW-9735	5/6/2019		
MW-9733	5/6/2019		
Duplicate	5/6/2019		
MW-527	5/6/2019		
MW-526-2-2	5/6/2019		
MW-211R	5/6/2019		
MW-9746	5/6/2019		
MW-113	5/7/2019	Methane	Field duplicate variability (RPD >30%). Potential uncertainty.
Duplicate	5/7/2019		
MW-103	5/7/2019		
MW-9705	5/7/2019		
MW-521R	5/7/2019		
MW-594-35R2	5/7/2019		
MW-9709-3	5/7/2019		

Attachment A
Summary of Data Non-Conformances for Landfill Groundwater Analytical Data
South Macomb Disposal Authority - Landfills 9 and 9A Groundwater Monitoring Program
Macomb County, Michigan

Samples	Collection Date	Analyte	Non-Conformance/Issue
MW-594-35R2	11/17/2019	Barium, Lead, Zinc	Field duplicate variability. Potential uncertainty.
MW-Duplicate	11/17/2019		
MW-9708-2	11/17/2019		
MW-118	11/17/2019		
MW-9746	11/17/2019		
MW-211R	11/17/2019		
MW-9745	11/17/2019		
MW-9744	11/17/2019		
MW-9738	11/17/2019		
MW-9732-2	11/17/2019		
MW-9731	11/17/2019		
MW-9736	11/17/2019		
MW-113	11/17/2019		
MW-103	11/17/2019		
MW-9705	11/19/2019	Methane	Field duplicate variability (RPD >30%). Potential uncertainty.
MW-521R	11/19/2019		
MW-Duplicate	11/19/2019		
MW-201R	11/19/2019		
MW-526-2-2	11/19/2019		
MW-527	11/19/2019		
MW-9735	11/19/2019		
MW-9734	11/19/2019		
MW-9709-3	11/19/2019		
MW-9712	11/19/2019	TDS	Field duplicate variability (RPD >30%). Potential uncertainty.
MW-9711	11/19/2019		
MW-Duplicate	11/19/2019		
MW-501-2-4	11/19/2019		
MW-9733	11/20/2019	Nitrate, Nitrite, Sulfate	Field duplicate variability (RPD >30%). Potential uncertainty.
MW-9739	11/20/2019		
MW-9743	11/20/2019		
MW-Duplicate	11/20/2019		
MW-500-2-2	11/20/2019		
MW-9743	11/17/2019	All VOCs	Low surrogate recovery. Low bias.
Trip Blank	11/17/2019		