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SECTION 1 - OVERVIEW

Purpose and Disclaimer: The purpose of this guidance document is to provide instruction and assistance to the regulated community on how to properly prepare, complete, and submit Discharge Monitoring Report forms (DMRs). The procedures and/or methods described in this document are provided for information only. This guidance is not meant to modify or replace permit language or applicable laws and regulations. In the event of a conflict between this guidance and permit language or applicable laws and regulations, the permit and/or laws and regulations shall govern. It remains the responsibility of the permittee to read and fully understand the terms and requirements of all permits, laws and regulations.

Introduction: The sample collection and analytical results required by the Colorado Discharge Permit System permits must be reported to the Water Quality Control Division through the submission of DMRs (EPA Form 3320-1). Original copies of the DMRs must be submitted to the division by the 28th day of the month following the monitoring period, as required by the permit. This data is then entered into the U.S. Environmental Protection Agency’s Integrated Compliance Information System (ICIS) and is available to the public through the EPA’s Enforcement and Compliance History Online website at http://echo.epa.gov/.

It is extremely important that the data reported on the DMR form be complete, accurate, timely, and legible to ensure that facility compliance status is correctly reflected. Reported data will be compared with the current limits contained in a facility’s permit to determine the facility’s compliance. Since DMRs and permits contain limits and information specific to an individual facility, it is the permittee’s responsibility to verify that each parameter specified in the permit is included on the DMR form. The responsible person completing the DMR needs to ensure they are using the correct DMR and that the information on the DMR matches their permit. Contact the division if any discrepancies are found.

Q&A:

Q: “My facility didn’t have a discharge this month/quarter; do I still need to submit a DMR?”

A: Yes. DMRs must be submitted every month/quarter, even if no discharge occurred. See “No Discharge” on page 4 for more information.

Submit your DMRs Electronically!!

Save Money - Postage - Time!

WQCD is pleased to offer an alternative to paper DMRs. For more information, contact us at 303-691-4046.

Colorado Department of Public Health and Environment, Water Quality Control Division
SECTION 2
Understanding The Form

Note: You can click on any bolded term below to see where each part is located on a DMR form.

Permittee Name/Address
The permittee name and address is obtained and recorded from information in the permit and as provided with the permit application. Please check to verify that the mailing address, facility name, and facility contact are correct on the DMRs. Contact the division if any changes need to be made to the DMRs (See Appendix A for a list of contacts).

Facility Location
This identifies the physical location of the wastewater treatment facility. Contact the division if any changes need to be made to the DMRs (See Appendix A for a list of contacts).

Permit Number
The permit number is the unique number assigned to a treatment facility. If the permit number begins with a “CO” prefix, it is an individual permit specific to that facility only. If the number begins with “COG,” “COX,” or “COR” prefix, it represents a facility specific certification issued under a general permit that provides permit coverage for activities and/or facilities that are similar in nature.

Discharge Number
The discharge number (e.g. 001A, 002A, 300I, etc.) represents a specific monitoring point or outfall, as described and identified in the permit. If the facility has more than one monitoring point, make sure the information reported on the DMR corresponds with the correct discharge number.

Monitoring Period
The monitoring period corresponds with the reporting requirements of the permit and is listed on the DMR as the first day of the monitoring period through the last day of the monitoring period. The monitoring period can be monthly, quarterly, seasonal, or annual. The information reported on the DMR must correspond with the specific monitoring period listed on the DMR.

No Discharge
Mark this box if your facility did not discharge from an external outfall (discharge number) during the monitoring period.

- Do not mark the “No Discharge” box if the facility had a discharge but you failed to sample.
- Do not mark the “No Discharge” box on the DMR for an internal outfall (discharge number 300) if there was influent flow. Similarly, do not mark the “No Discharge” box if there was influent flow but you failed to sample.
- Note: Publicly Owned Treatment Works are required to monitor influent parameters as specified in the permit regardless of whether or not an effluent discharge occurs.

Parameter
The effluent parameters specified in the permit are listed in this column. Each box will display the parameter name followed by a numeric code used for data entry by the division.
Permit Requirement
The gray boxes in these rows list the permit effluent limitation(s) that correspond to each parameter.

Sample Measurement
Sample measurement data for each parameter is reported under the “Quantity or Loading” or “Quality or Concentration” columns in accordance with the facility permit. Enter the sample measurement data in the blank white boxes. Asterisks (****) in any box indicate that no entry is required in that box. Do not leave blank spots on the DMR unless that information is not available. Any white box that does not have asterisks (****) must contain a reported value.

Units
The DMR includes the units (e.g., mg/l, MGD, lbs/day, etc.) in which the sample measurement must be reported, as specified by the permit. It may be necessary to convert the data to the required units prior to entering it on the DMR.

No. Ex (Number of Exceedances or Exceptions)
Enter the number of sample measurement values that exceeded the permit limit for each parameter. This number represents the sum of all sample exceedances/exceptions measured during the monitoring period (i.e., how many times a limit was not met). In the case of a maximum or minimum limit, each sample analysis that violates either limit shall be counted. For an average (7-day, 30-day average, etc.) limit, each average in excess of the limit should be counted.

Frequency of Analysis
The frequency of analysis represents the number of times the discharge was actually sampled and analyzed during the reporting period. This frequency must be at least the minimum required by the permit. The frequency of analysis should be reported in the same units as specified in the permit. Any additional monitoring must be included in the DMR calculations and reported in the “Frequency of Analysis” box for that parameter. If a different frequency of analysis is conducted, report the least frequent number of samples collected and include an asterisk (*) indicating that a comment is attached outlining actual monitoring for each period (Example comment: “week one - 1/7, week two - 5/7, week three - 2/7, week four - 1/7”).

Q&A:
Q: “I neglected to take a sample this month, what do I report on my DMR?”
A: If you do not sample your effluent or if your sample cannot be analyzed by your lab (e.g. missed holding time), please write “Failed to Sample” on the DMR form and attach a cover letter of explanation.
Sample Type
The permittee must report the actual sample type (method) used to collect the sample(s) during the monitoring period. Enter “GRAB” for individual grab samples, “CONT” for continuous monitoring, “COMP” for composite sampling, etc.

Name/Title Principle Executive Officer
The name and title of the legally responsible person should be printed at the bottom of the form. This person should sign and date the form in the Signature section. A description of an authorized signatory official can be found in your permit and in the Colorado Discharge Permit System regulations at 5 CCR 1002-61. It includes:

- In the case of corporations, a principal executive officer of at least the level of vice-president or his or her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the application originates.
- In the case of a proprietorship, a general partner.
- In the case of a sole proprietorship, the proprietor.
- In the case of a municipal, state, or other public facility, either the principal executive officer, ranking elected official, or duly authorized employee.

Signatory authority may be delegated to a duly authorized representative (DMR Cognizant Official) if such authorization has been made in writing by an authorized signatory official. The authorization must specify either an individual or a position having responsibility for the overall operation of the regulated facility or activity. The authorization must be submitted in writing to the division and comply with the requirements of 5 CCR 1002-61, §§61.4(1)(f).

Signature
Every page of the DMR must be signed by the Principle Executive Officer or duly authorized representative. It is important to read and understand the certification statement. By signing the DMR, the Principle Executive Officer or duly authorized representative is certifying to the division, under penalty of law, that the information on the DMR is true and accurate.

Telephone
The telephone number of the Principal Executive Officer must be printed in this section.

Date
The date must be the actual date that the DMR is signed by the Principal Executive Officer or duly authorized representative certifying and authenticating the data submitted on the DMR.
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>VALUE</th>
<th>UNIT</th>
<th>NO. EX</th>
<th>FREQUENCY OF ANALYSIS</th>
<th>SAMPLE TYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>*****</td>
<td>*****</td>
<td>SU</td>
<td>Weekly</td>
<td>In-situ</td>
</tr>
<tr>
<td>Effluent Gross</td>
<td>6.5</td>
<td>Minimum</td>
<td>9.0</td>
<td>Maximum</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: You can click on any colored box below to be taken to the term definitions listed above.
SECTION 3

SAMPLING AND REPORTING INFORMATION

Sampling and analytical procedures must comply with EPA approved methods listed in 40 CFR §136. Self-monitoring samples taken in compliance with the monitoring requirements specified in a permit shall be taken at the location(s) designated in the permit and/or the certification authorizing discharge under the permit, following final treatment but prior to entering the receiving stream.

**Reporting of Additional Samples**

If the permittee, using an approved analytical method, monitors any parameter more frequently than required by the permit, the results of such monitoring must be included in the calculation and reporting of the values required in the permit and DMRs.

It is the division’s expectation that compliance sampling for effluent parameters required by the permit, which is conducted at a point following final treatment but prior to entering the receiving stream, be performed at the discharge monitoring location(s) designated in the permit, as required by the permit. However, any sampling that takes place at a point following final treatment and prior to entering the receiving stream, but which is not conducted at the location designated in the permit, should also be included in the averaging and reporting of analytical results on the DMR (provided the sample type is consistent with the permit requirements and the analytical procedure complies with 40 CFR §136). In these cases, the permittee should review the terms and conditions of their permit and ensure that all future sampling following final effluent treatment is conducted at the location specified in the permit.

**Understanding Averages and Maximum/Minimum Limitations**

“Average” is normally the arithmetic average (geometric mean for bacterial parameters) of all sample data for each parameter obtained during the specified monitoring period. Examples of common reporting averages include 30-day average and 7-day average. For DMR reporting purposes, the 30-day average is based on a calendar month, regardless of how many days are in the month. In other words, the 30-day average is calculated using the number of actual days in the reporting month. For the purpose of this guidance, “monthly average” and “30-day average” are used interchangeably.

**March 2015**

<table>
<thead>
<tr>
<th>Sun</th>
<th>Mon</th>
<th>Tues</th>
<th>Wed</th>
<th>Thurs</th>
<th>Fri</th>
<th>Sat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
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<td>15</td>
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<td>17</td>
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<td>21</td>
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<td>24</td>
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<td>26</td>
<td>27</td>
<td>28</td>
</tr>
<tr>
<td>29</td>
<td>30</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this example, the 30-day average is based on all 31 days of March, regardless of the term “30-day average”.
Many permits require monthly and/or weekly *monitoring* and quarterly *reporting*. The following are common averaging scenarios encountered by permitees with quarterly reporting:

- **Quarterly Reporting and Monthly Monitoring**: Three samples are obtained (1 sample/month). The highest of the three samples is reported as the 30-day average and Max 7-day average.

- **Quarterly Reporting and Weekly Monitoring**: If each month in the quarter had four weeks, 12 samples are obtained. The highest of the 12 samples is reported as the Max 7-day average. The weekly samples are averaged within each month and the highest of these averages is reported as the 30-day average.

**Example:**

1st Quarter 2015 Total Suspend Solids Samples: Monthly Monitoring, Quarterly Reporting

<table>
<thead>
<tr>
<th>Sample Results</th>
<th>Data Reported on DMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan - 30 mg/L</td>
<td></td>
</tr>
<tr>
<td>Feb - 37 mg/L</td>
<td>30 day average = 37 mg/L</td>
</tr>
<tr>
<td>Mar - 28 mg/L</td>
<td>Max 7- day average = 37 mg/L</td>
</tr>
</tbody>
</table>

1st Quarter 2015 Total Suspended Solids samples: Weekly Monitoring, Quarterly Reporting

<table>
<thead>
<tr>
<th>Sample Results</th>
<th>Monthly Averages</th>
<th>Data Reported on DMR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan (5 weekly samples) - 30 mg/L</td>
<td>Jan average - 21 mg/L</td>
<td>30 day average = 32 mg/L</td>
</tr>
<tr>
<td>28 mg/L</td>
<td>Feb average - 32 mg/L</td>
<td></td>
</tr>
<tr>
<td>15 mg/L</td>
<td>Mar average - 17 mg/L</td>
<td></td>
</tr>
<tr>
<td>14 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feb (4 weekly samples) - 37 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mar (4 weekly samples) - 28 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 mg/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 mg/L</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The averages for bacteria concentrations shall be determined by using the geometric mean instead of the arithmetic mean. For information on how to calculate the geometric mean, refer to SECTION 4.

“**Maximum**” and “**Minimum**” are the highest and lowest measurements obtained during the specified monitoring period (usually a calendar month). The “**Daily Maximum Limitation**” for all parameters (except temperature, pH, total residual chlorine, oil & grease, and dissolved oxygen) means the limitation is applied as an average of all samples collected in a calendar day or any 24-hour period that reasonably represents the calendar day. For DMR purposes,
the highest daily average calculated in the month shall be reported as the daily maximum value. If only one measurement or sample is taken during a calendar day or representative 24-hour period, the single measured value for a pollutant will be considered the daily maximum measurement for that calendar day or representative 24-hour period. For pH, total residual chlorine, oil & grease, and dissolved oxygen, the daily maximum limitation (and/or minimum) is an instantaneous maximum (and/or instantaneous minimum) value. The instantaneous value is defined as the analytical result of any individual sample. For DMR purposes, the maximum (and/or minimum) instantaneous value for pH, total residual chlorine, oil and grease, and dissolved oxygen measured within the calendar month shall be reported as the daily maximum (and/or minimum) value. Note: the “Daily Maximum Limitation” as it relates to pollutants with limitations expressed in units of mass (e.g. lbs/day), shall be determined by summing the total mass of the pollutant discharged over the day in which sampling occurs. For information on how to calculate daily loading values, refer to section 4.

Q&A:
Q: “My permit contains an average and a maximum limit for a parameter (e.g. 30-day average and daily maximum) but we only sample once a month. What should I report on our DMR?”
A: If only one sample is taken, the result for that sample must be placed in both the average box and the maximum box.

Q&A:
Q: “My permit requires quarterly reporting and contains a 30-day average for a parameter with monthly monitoring, what should I report on my DMR?”
A: The highest 30-day average of the quarter should be reported on the DMR.

Reporting Timeframes
- A calendar week begins on Sunday and ends on Saturday
- “Daily” is the discharge of effluent measured during a calendar day of any 24-hour period that reasonably represents the calendar day
- If a calendar week begins in one month and ends in the next month, the weekly monitoring results shall be included in DMR for the next month.
BDL/PQL: Reporting & Calculating Data Below the Detection Limit or less than the Practical Quantitation Limit

EPA approved methods (as defined by 40 CFR 136) must be used to collect and analyze effluent samples for permit compliance. The division has established practical quantitation limits (PQLs) that set the precision and accuracy expectations associated with these methods. These PQLs (state PQLs) are identified in each permit and in the division’s Practical Quantitation Limits (PQLs) Policy.

If a permit contains a numeric effluent limit for a parameter, then the analytical method used by the permittee shall be the one that can measure at or below the numeric effluent limit. This means that the PQL achieved by the permittee’s laboratory (laboratory PQL) must be less than or equal to the effluent limit. **Note:** some laboratories may be able to quantify a concentration of an analyte at a level lower than the state PQLs (these quantification levels are sometimes referred to as the minimum level (ML), minimum reporting limit (MRL) or reporting limit (RL)). For DMR reporting purposes, when the laboratory PQL is less than or equal to the permit limit and the permittee’s analytical result is less than the laboratory PQL, then “<X” shall be reported on the DMR (where X is the laboratory PQL).

However, for certain parameters, the state PQLs may not be able to quantify measurements at or below the numeric effluent limit in the permit. When the state and laboratory PQL is greater than the numeric effluent limit specified in the permit, the analytical method with the lowest available laboratory PQL shall be used for the analysis. When the analytical method which complies with this requirement yields a result that is less than the laboratory PQL, the permittee shall report “BDL” (below detection limit) on the DMR. Such reports will not be considered violations of the permit limit, as long as the laboratory PQL is equal to or less than the present lowest state PQLs.

For parameters that have a report only limitation, the laboratory PQL must be sufficiently sensitive to quantify the result to the applicable water quality criterion (i.e., future numeric effluent limit, half of the water quality standard, etc.). **Note:** the permit-specific applicable water quality criterion will be identified in the water quality assessment associated with the permit. Further explanation of this concept can be found in the division’s PQL Policy. When the analytical method that complies with this requirement yields a result that is less than the laboratory PQL, “<X” shall be reported on the DMR (where X is the laboratory PQL).

To calculate average concentrations (e.g., 7-day average, 30 day average, 2-year average), any individual analytical result that is less than the PQL shall be considered as zero for calculation purposes. When reporting:

- If all individual analytical results are less than the laboratory PQL, the permittee shall report either “BDL” or “<X” following the guidance above.
- If one or more individual analytical results are greater than the laboratory PQL, an average shall be calculated and reported. Note that it does not matter if the final
calculated average is greater or less than the laboratory PQL - it must be reported as a value.

To calculate mass loading (e.g., lbs/day), any individual analytical result that is less than the laboratory PQL shall be considered as zero.

**Note:** When calculating Total Inorganic Nitrogen ("T.I.N.") for a single sampling event, any value of less than the laboratory PQL (for total ammonia and/or total nitrate plus nitrite) shall be treated as zero. The T.I.N. concentration for a single sampling event shall then be determined as the sum of the analytical results (zero if applicable) of same-day sampling for total ammonia and total nitrate plus nitrite. From these calculated T.I.N. concentrations, the daily maximum and 30-day average concentrations shall be calculated and must be reported as a value.

**Example:** Below are a few examples of how to report common laboratory data on the DMRs.

<table>
<thead>
<tr>
<th>Lab Result</th>
<th>Lab PQL</th>
<th>State PQL</th>
<th>Permit Limit</th>
<th>DMR Value</th>
<th>Violation</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>&lt;2</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>Yes- The result is greater than the permit limit and the lab PQL</td>
</tr>
<tr>
<td>&lt;6</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>BDL</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>No</td>
</tr>
<tr>
<td>&lt;6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>Invalid Test- Did not achieve required PQL</td>
<td>Yes</td>
</tr>
<tr>
<td>&lt;6</td>
<td>6</td>
<td>7</td>
<td>Report Only</td>
<td>&lt;6</td>
<td>No</td>
</tr>
</tbody>
</table>

**Rounding-off Rules**

All data reported on DMRs must contain the same number of significant digits set in the permit limit. Therefore, some analytical data may require the rounding off of numbers. If rounding-off is necessary, use the following procedure:

- If the digit following those to be retained is less than 5, the digit is dropped and the preceding digit is kept unchanged. As an example, 11.443 is rounded off to 11.44.
- If the digit following those to be retained is greater than 5, the digit is dropped and the preceding digit is raised by 1. As an example, 11.446 is rounded off to 11.45.
- If the digit following those to be retained is 5, the 5 is dropped and the preceding digit is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.
Reporting Permit Exceedances, Failures to Sample, or Other Permit Violations

A cover letter must accompany your DMR when the DMR includes a violation of a permit condition, including failure to sample. The cover letter must explain the cause(s) of the violation and the actions that the facility has taken and/or plan to take to remedy the violations.

Revised/ Corrected DMRs

Sometimes it will be necessary for the facility to submit a revised or corrected DMR either because the division has requested it or the facility has discovered an error. In this instance, the information should be updated with the submittal of a revised DMR. To submit a revised DMR, follow this procedure:

- Revised DMRs must have a new, original authorized signature and date of signature;
- Revised data should be highlighted;
- DMRs must be clearly marked as a revised DMR. At the top of the DMR, write “Revised”;
- Provide a short cover page describing the changes to the DMR.

If using NetDMR, enter the updated/corrected information in NetDMR and include a comment that identifies what was changed on the DMR. NetDMR will then have two copies of record for the monitoring period (the originally submitted DMR and the revised DMR).

Transmittal

Whether submitting by mail or electronically via NetDMR, the DMR must be received by the division no later than the 28th day of the month following the end of the reporting period. The DMR must contain an original signature (or electronic signature if submitting via NetDMR) from the Principle Executive Officer (or the authorized representative), and must be complete. Permit holders must retain copies of the DMRs for at least three (3) years.

Q&A:

Q: “I don’t have any DMR forms, how do I get them?”

A: DMR forms are e-mailed prior to the effective date of a permit. If you cannot find record of your DMR forms, please contact Leslie Simpson (see contact information in Appendix A).

Q: “I’m submitting a revised DMR form, do I need to re-sign it?”

A: Yes. All revised and resubmitted DMRs must have a new signature and date on each DMR page. The word “REVISED” should be written and clearly visible on each page of the DMR.
SECTION 4
HOW TO CALCULATE SAMPLE VALUES

Calculating a Geometric Mean

For bacteria (e.g. *E. coli*) concentrations, the 30-day and 7-day averages shall be determined by using the geometric mean instead of the arithmetic average. The geometric mean may be calculated using two different methods. For the methods shown, “a, b, c, d…” are individual sample results and “n” is the total number of samples.

**Method 1:** Geometric Mean = \((a \times b \times c \times d \times \ldots)^{1/n}\) \((^* = multiply)\)

**Method 2:** Geometric Mean = \(\text{antilog} \left( \frac{\log(a) + \log(b) + \log(c) + \log(d) + \ldots}{n} \right)\)

In calculating the geometric mean, any analytical result of “0” shall be converted to “1.” Additionally, for any analytical result reported by the laboratory as “less than” a numeric value shall be converted to “1” in the calculations. If all individual analytical results for the month are reported to be less than numeric values, then report "less than" the largest of those numeric values on the DMR. Otherwise, report the calculated value.

Any individual analytical result of Too Numerous to Count (TNTC) is considered invalid and another sample shall be promptly collected for analysis. If another sample cannot be collected within the same sampling period for which the invalid sample was collected (same month if monthly sampling is required, same week if weekly sampling is required, etc.), then the following procedures apply:

- **A minimum of two samples shall be collected for bacterial analysis within the next sampling period.**
- **If the sampling frequency is monthly or less frequent:** For the period with the invalid sample results, leave the spaces on the corresponding DMR for reporting coliform results empty and attach a letter to the DMR noting that a result of TNTC was obtained for that period, and explain why another sample for that period had not been collected.
- **If the sampling frequency is more frequent than monthly:** Eliminate the result of TNTC from any further calculations, and use all the other results obtained within that month for reporting purposes. Attach a letter noting that a result of TNTC was obtained, and list all individual analytical results and corresponding sampling dates for that month.
**BOD\textsubscript{5} and TSS Percent Removal Calculations**

The monthly average percent removal is not calculated by averaging the daily percent removal values. Instead, the monthly average percent (%) removal is calculated from two numbers: the monthly average influent concentration and the monthly average effluent concentration. The percent removal calculations are performed using the following formula:

\[
\% \text{ Removal} = \left( \frac{\text{monthly average influent concentration} - \text{monthly average effluent concentration}}{\text{monthly average influent concentration}} \right) \times 100
\]

**Loading Calculation**

To determine representative 30-day average loading values, use the total daily influent wastewater flow (MGD) on the day that the BOD composite sample is collected in the calculation. The loading calculation is performed using the following formula:

\[
\text{Loading} = (\text{total daily influent flow in MGD} \times \text{BOD concentration in mg/l}) \times 8.34 = \text{Loading in lbs/day}
\]

Systems monitoring one time per week or more during the monitoring period shall calculate daily loading values using the formula outlined above and average all loading values for the week. For DMR reporting purposes, the 7-day average loading is the highest of the 7-day averages calculated during the monitoring period. For DMR reporting purposes, the 30-day average loading value is an average of each daily loading value during the month.

Note: Representative loadings are not obtained by using the 30-day average flow and the average of all concentration results for the corresponding 30-day period. This same concept applies to the 7-day average calculation.

**Percent Design Capacity Calculations**

Pursuant to §25-8-501, C.R.S., domestic wastewater treatment works are required to 1) initiate engineering and financial planning for expansion whenever throughput and treatment reaches 80% of design capacity, and 2) commence construction of such expansion whenever throughput and treatment reaches 95% of design capacity. The hydraulic and organic design capacities for a specific facility are identified in the permit and/or certification to the permit. The percent capacity calculations for hydraulic and organic loading are performed using the following formulas:

\[
\% \text{ Hydraulic Capacity} = \frac{\text{monthly hydraulic loading (MGD)}}{\text{hydraulic design capacity (MGD)}} \times 100
\]

\[
\% \text{ Organic Capacity} = \frac{\text{monthly organic loading (lbs BOD\textsubscript{5}/day)}}{\text{organic design capacity (lbs BOD\textsubscript{5}/day)}} \times 100
\]
**Rolling Average**

A rolling average is calculated by using data results from the current monitoring period and the respective designated interval prior to the current monitoring period.

**Example:** 12 month rolling average. Calculate the current monthly average and the previous 11 monthly averages and divide the total by 12.

\[ 12 \text{ MRA} = \frac{(\text{MA}_C + \text{MA}_1 + \text{MA}_2 + \ldots + \text{MA}_{11})}{12} \]

- \( \text{MA}_C \) = Current monthly average
- \( \text{MA}_1 \) = First prior month’s monthly average
- \( \text{MA}_2 \) = Second prior month’s monthly average
- \( \text{MA}_{11} \) = Eleventh prior month’s monthly average

**Composite Sampling/ Flow Proportioned Sample Calculations**

Procedures for Calculating Flow Proportioned Sampling:

1) Determine required composite sample volume by contacting analytical lab and obtain five (5) containers of the required composite sample size

2) Collect four (4) grab samples at predetermined intervals and store samples at ≤ 6°C, but above freezing
   a) **Hour 0:** Record totalized flow (if not there at Hr 0, utilize chart recorder or totalizer history read out to find totalized flow)
   b) **Hour 2:** Read totalized flow and grab first sample
   c) **Hour 4:** Read totalized flow and grab second sample
   d) **Hours 6 and 8:** Read totalized flow and grab samples

3) Calculate grab sample proportion \((Q \div \text{Total Q})\) of each grab sample to be added to the composite:
   a) Calculate volume of flows between each of the 2-hour increments (e.g., Hour 2 totalized Flow - Hour 0 totalized Flow)
   b) Calculate volume of Total Flow (Q) by subtracting the Hour 0 totalizer reading from the Hour 8 totalizer reading
   c) Calculate grab sample proportion by dividing 2-hour Flows by the total Q and then record in Grab Sample Proportion Column

4) Calculate grab sample volumes into composite = **Volume of Composite sample required \(\times\)** Grab Sample Proportion

5) Measure out proportioned grab sample volume for each grab sample and place in Container Five (5), the “Composite Sample”

**Example:** Influent Composite Sample

- Total Composite Sample Volume Required by Lab = 4,000 ml
- Composite Sample Start Time = 06:00 to 14:00

<table>
<thead>
<tr>
<th>Composite Time (Hours)</th>
<th>Time of Day (Hours)</th>
<th>Read Flow Meter Totalizer (gal)</th>
<th>Flow (Q) (gal)</th>
<th>Grab Sample Time</th>
<th>Grab Sample Proportion (ratio)</th>
<th>Volume of Grab Sample Taken (ml)</th>
<th>Grab Sample Volume into Composite (ml)</th>
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</thead>
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<tr>
<td>0</td>
<td>6:00</td>
<td>7,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>1</td>
<td>7:00</td>
<td>5,000</td>
<td></td>
<td></td>
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</tbody>
</table>
A consistent period of composite sampling should be selected and adhered to. For those facilities that conduct composite sampling on a daily frequency, if problems are encountered during the collection of daily composite samples, the composite sampling period should not be restarted. The permittee should analyze all samples that were properly collected and composited during a specific 24-hour period, average all data in accordance with the permit, document the problem or issue that was encountered, and explain the problem or issue when submitting DMRs in accordance with the notification procedures in the permit. In the event of an automatic sampler failure, automatic samples and manual samples can be composited as long as each sample is proportioned according to flow and is representative of the parameter being monitored.

**Sodium Adsorption Ratio (SAR), Adjusted SAR, and Electrical Conductivity (EC)**

The sodium adsorption ratio (SAR) and electrical conductivity (EC) limitations are implemented in permits as measures of salts in the effluent to protect irrigated crops and soils downstream of the discharge. Each permit with SAR and EC monitoring and reporting requirements has unique SAR and EC limitations based on the agricultural usages of water downstream of the facility's discharge. The fact sheet and water quality assessment associated with the facility's permit explain the rationale for the SAR and EC limitations in depth and should be referred to for more facility specific information on SAR and EC.

SAR, adjusted SAR, and permit compliance shall be determined using the following procedure:

1) Determine the EC of your effluent

2) Calculate the allowable SAR (ie., permit limit) using the actual EC of the effluent (30-day average value) with the following equation:

\[
\text{SAR} = [(7.1 \times \text{EC}) - 2.48]
\]

- This calculated SAR value is reported on the DMR as the “Sodium Absorption Ratio at Monitoring Location ‘EG’”

3) Determine the adjusted SAR of your effluent using the sodium (Na⁺), magnesium (Mg²⁺), calcium (Ca²⁺), and bicarbonate (as HCO₃⁻) concentrations in your effluent (expressed in units of milliequivalents per liter (meq/l)), and the “Modified Calcium Determination for Adjusted Sodium Adsorption Table” found in your permit. Adjusted SAR is calculated with the following equation:

\[
\text{SAR-adj} = \frac{\text{Na}^+}{\sqrt{\frac{\text{Ca}^{++} + \text{Mg}^{++}}{2}}}
\]

Colorado Department of Public Health and Environment, Water Quality Control Division
• This adjusted SAR value is reported on the DMR as the “Sodium Absorption Ratio at Monitoring Location ‘P’.”

4) The permit limit for SAR is expressed as a Pass/ Fail limit, with “0” indicating “pass” and “1” indicating “fail.” If the adjusted SAR is less than or equal to the calculated SAR, report “0” on the DMR as the SAR at Monitoring Location “1.” If the adjusted SAR is greater than the calculated SAR, report “1” on the DMR as the SAR at Monitoring Location “1.”

For additional information on SAR, please refer to the division’s Policy WQP24 Implementing Narrative Standards in Discharge Permits for the Protection of Irrigated Crops.

**Daily Maximum Temperature (DM)**

DM is the highest 2-hour average water temperature measured by a continuous recorder during a given 24-hour period. This is determined using a rolling 2-hour maximum temperature. For example, if the recorder collects data every 15 minutes, a 2-hour maximum can be determined on every data point after the initial 2 hours of collection. Note that the time periods that overlap days (e.g., Wednesday night to Thursday morning) are inconsequential to calculating and reporting because the value on the DMR is the greatest of all the 2-hour averages.

For example, data points collected at:

• 08:15, 08:30, 08:45, 09:00, 09:15, 09:30, 09:45, 10:00, would be averaged for a single 2 hour average data point
• 08:30, 08:45, 09:00, 09:15, 09:30, 09:45, 10:00, 10:15, would be averaged for a single 2 hour average data point
• 08:45, 09:00, 09:15, 09:30, 09:45, 10:00, 10:15, 10:30, would be averaged for a single 2 hour average data point

This would continue throughout the course of a calendar day. The highest of these 2-hour averages over a month would be reported on the DMR as the daily maximum temperature. At the end/beginning of a month, the collected data should be used for the month that contains the greatest number of minutes in the 2-hour maximum. Data from 11 pm to 12:59 am, would be included in the calculations for the previous month. Data collected from 11:01 pm to 1:00 am would be included in the calculations for the new month.

**Maximum Weekly Average Temperature (MWAT)**

The MWAT is the largest mathematical mean of multiple, equally spaced, daily temperatures over a seven-day consecutive period, with a minimum of three data points spaced equally through the day.

The MWAT is calculated by averaging all temperature data points collected during a calendar day, and then averaging the daily average temperatures for 7 consecutive days. This 7 day averaging period is a rolling average, i.e. on the 8th day, the MWAT is the average of the daily averages of days 2-8. The MWAT value reported on the DMR is the highest of all the rolling 7-day averages throughout the month. For those days that are at the end/beginning of the month, the data shall be reported for the month that contains 4 of the 7 days.

Day 1: Average of all temperature data collected during the calendar day.
Days 2 through 6: Average of all temperature data collected during the calendar day.
Day 7: Average of all temperature data collected during the calendar day.

1st MWAT Calculation as average of previous 7 days
Day 8: Average of all temperature data collected during the calendar day.

2nd MWAT Calculation as average of previous 7 days

Day 9: Average of all temperature data collected during the calendar day.

3rd MWAT Calculation as average of previous 7 days

For additional information on MWAT, see the division’s Policy WQP23 Procedures for Conducting Assessments for Implementation of Temperature Standards in Discharge Permits.

Two (2) -Year Rolling Average (Antidegradation limits)

Two (2) -Year Rolling Average (Antidegradation limits) is the average of all monthly average data collected in a two year period. DMR reporting of the two-year rolling average result begins once the reporting requirement has been in place for a two year period (i.e., 24 months), regardless of the permit term and the frequency that the facility discharges. Ongoing reporting is required across permit terms when: 1) a two year rolling average permit limit/reporting requirement has been in place; and/or, 2) two years worth of monthly average data exists. In other words, the two-year rolling average continues to “roll” when a permit is renewed and reissued and data from the previous permit term should be used to calculate the two year rolling average. Note, if a renewed and reissued permit contains a compliance schedule to meet a more stringent two year rolling average, do not use data from the previous permit term to calculate the two year rolling average (in this case, data collection starts upon the effective date of the renewed and reissued permit).

To calculate a two-year rolling average, add the current monthly average to the previous 23 monthly averages and divide the total by 24. This methodology continues on a rolling basis as long as the two year rolling average reporting and/or effluent limit applies (i.e., in the first reporting period use data from month 1 to month 24, in the second reporting period use data from month 2 to month 25, then month 3 to month 26, etc).

**Example:** Two year rolling average = \((\text{MA}_C + \text{MA}_1 + \text{MA}_2 + \ldots + \text{MA}_{23}) \div 24\)

- \(\text{MA}_C\) = Current monthly average
- \(\text{MA}_1\) = First prior month’s monthly average
- \(\text{MA}_2\) = Second prior month’s monthly average
- \(\text{MA}_{23}\) = Twenty third prior month’s monthly average

Note, if there is not a discharge from the facility in a month during a two year period do not use zero (0) to represent the data for that month in the calculation, but do consider that month as part of the two year time span. The denominator in the two-year rolling average calculation will change to represent the actual number of months there was a discharge.

**Example:** Two year rolling average = \((30 + 45 + \ldots + 25) \div 22\)

- Current monthly average= 30 mg/l
- First prior month’s monthly average= no discharge
- Second prior month’s monthly average= no discharge
- Third prior month’s monthly average= 45 mg/l
- Twenty third prior month’s monthly average= 25 mg/l

For ammonia, two-year rolling averages may be set up for individual months, or may be grouped together for several months. When individual months have a specific limit, calculate the two-year rolling average as follows:

**Example:** Permit is effective January 2014 and there is a two-year rolling average limit specific to the month of January.
January 2014 DMR - Nothing to Report
January 2015 DMR - Two-year rolling average = \( (\text{MA}_C + \text{MA}_1) \div 2 \)
\( \text{MA}_C = \) January 2015 monthly average
\( \text{MA}_1 = \) January 2014 monthly average
January 2016 DMR - Two-year rolling average = \( (\text{MA}_C + \text{MA}_1) \div 2 \)
\( \text{MA}_C = \) January 2016 monthly average
\( \text{MA}_1 = \) January 2015 monthly average

Where several months are grouped together and have the same limit, calculate the two-year rolling average as follows:

**Example:** Permit is effective January 2014 and there is a two-year rolling average limit specific to the months of January, February, and June.
January, February, June 2014 DMR - Nothing to Report

1st Reportable DMR - June 2015 DMR:
Two year rolling average = \( (\text{MA}_C + \text{MA}_1 + \text{MA}_2 + \text{MA}_3 + \text{MA}_4 + \text{MA}_5) \div 6 \)
\( \text{MA}_C = \) June 2015 monthly average
\( \text{MA}_1 = \) February 2015 monthly average
\( \text{MA}_2 = \) January 2015 monthly average
\( \text{MA}_3 = \) June 2014 monthly average
\( \text{MA}_4 = \) February 2014 monthly average
\( \text{MA}_5 = \) January 2014 monthly average

2nd Reportable DMR - January 2016 DMR:
Two year rolling average = \( (\text{MA}_C + \text{MA}_1 + \text{MA}_2 + \text{MA}_3 + \text{MA}_4 + \text{MA}_5) \div 6 \)
\( \text{MA}_C = \) January 2016 monthly average
\( \text{MA}_1 = \) June 2015 monthly average
\( \text{MA}_2 = \) February 2015 monthly average
\( \text{MA}_3 = \) January 2015 monthly average
\( \text{MA}_4 = \) June 2014 monthly average
\( \text{MA}_5 = \) February 2014 monthly average
Calculation of Rolling Statistics - Regulation 85

Methods used to calculate rolling median and 95th percentile values for comparison to Regulation 85 effluent limits.

Definitions
Median: the value lying at the midpoint of observed values.
95th percentile: the value below which 95% of values fall.

Regulation 85 effluent limits statistics
The regulation identifies two types of rolling statistics, as follows:

Annual median: The median of all samples taken in the most recent 12 calendar months. This value is to be calculated on a running or rolling basis of the last 12 months, regardless of calendar year or permit term.

95th percentile: The 95th percentile of all samples taken in the most recent 12 calendar months. This value is to be calculated on a running or rolling basis of the last 12 months, regardless of calendar year or permit term.

Note that all values collected within the last 12 calendar months should be included when calculating the statistic. For example, if you sample weekly, then you will have 4 values per month and 48 total samples per 12 month period.

Annual median calculation
The median value is identified by sorting all values (collected in the most recent 12 months) from smallest to largest. You then count the total number of values you have. The middle number in your list of values is the median. If the total number is odd (eg., 15 values), determine the number in the middle (eg., the value at position 8). If the total number of values is even (eg., 12), determine the pair of values at the middle (eg., values at positions 6 and 7). Add the pair together, then divide by 2 to determine the median value.

The median value can be calculated in Microsoft Excel© or Google Sheets© using the “MEDIAN” function.

95th percentile calculation
When calculating a percentile manually (without a computer), the 95th percentile is determined using the nearest rank method. Start by sorting all values (collected in the most recent 12 months) from smallest to largest. You then count the total number of values you have. You then multiply the total number of values by 0.95 to obtain the index position (eg., 12 x 0.95 = 11.4), rounding up if the index is not a whole number (in this case to 12). Starting from the smallest value, count up to the value in the index position (eg., the 12th value); this value is your approximate 95th percentile.

When calculating a percentile using a computer, the 95th percentile is determined using (most frequently) a linear interpolation method. The median value can be calculated in Microsoft Excel© or Google Sheets© using the “PERCENTILE” function.

Rolling Statistic
Each statistic is a rolling number, so each statistic you calculate is based on the data for the
12 most recent months. For example, the January 2016 statistic would include data for February 2015 through January 2016. The February 2016 statistic would be calculated from data for March 2015 through February 2016.

Example calculations

<table>
<thead>
<tr>
<th>Date</th>
<th>Total Inorganic nitrogen (mg/L)</th>
<th>Data Range</th>
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</thead>
<tbody>
<tr>
<td>1/13/2015</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>2/16/2015</td>
<td>6.4</td>
<td></td>
</tr>
<tr>
<td>3/14/2015</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>4/14/2015</td>
<td>9.5</td>
<td></td>
</tr>
<tr>
<td>5/15/2015</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>6/17/2015</td>
<td>6.9</td>
<td></td>
</tr>
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<td>7/18/2015</td>
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<td></td>
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MANUAL CALCULATIONS

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<th>Rank</th>
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<tr>
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</tr>
<tr>
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<tr>
<td>11</td>
<td>10.3</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
</tr>
</tbody>
</table>

Median calculation:
middle pair of values
(7.7 + 7.8) / 2 = 7.75
round value to 7.8
median = 7.8 mg/L

95th percentile calculation:
12 * 0.95 = 11.4
round index to 12
95th percentile = 11 mg/L

SPREADSHEET CALCULATIONS

DECEMBER 2015 STATISTICS

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Spreadsheet formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>=MEDIAN(B3:B14)</td>
<td>7.8</td>
</tr>
<tr>
<td>95th percentile</td>
<td>=PERCENTILE(B3:B14,0.95)</td>
<td>11</td>
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</table>

JANUARY 2016 STATISTICS

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Spreadsheet formula</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Median</td>
<td>=MEDIAN(B3:B14)</td>
<td>7.7</td>
</tr>
<tr>
<td>95th percentile</td>
<td>=PERCENTILE(B3:B14,0.95)</td>
<td>11</td>
</tr>
</tbody>
</table>

Median calculation:
identify middle value
median = 7.7 mg/L

95th percentile calculation:
11 * 0.95 = 10.45
round index to 11
95th percentile = 11 mg/L

References
1 - Regulation 85.5(1)(A)(III) and 85.6(1)(B)
Quality Assurance/Quality Control Techniques

Quality assurance/quality control measures demonstrate the accuracy (how close the real result you are) and precision (how reproducible your results are) of a sample. Quality assurance activities are taken to maintain the quality of a given program. Quality control activities are the steps taken to determine the effectiveness of sampling and analytical procedures. The following are examples of common QA/QC activities:

Field Duplicates (also referred to as field replicates): Field duplicates provide an indication of the precision of the sampling procedure. These are separate samples that are collected from the same location as close as possible to the same point in time and analyzed in the same manner. The analytical results from field duplicates are averaged into calculations and reported on the DMRs.

Field Splits: Split samples provide an indication of the precision of analytical techniques and procedures between laboratories. A field split is a second, ideally identical, aliquot of an environmental sample (i.e., one field sample poured into two sample containers while in the field). Field splits are analyzed by separate laboratories and are not averaged into calculations for DMR reporting purposes. Field splits are to be used as a quality assurance measure for laboratories and specific analytical techniques. If there is a large discrepancy within split sample results, the sample should be recollected and re-analyzed.

Lab Duplicates (also referred to as lab replicates): Lab duplicates provide an indication of the precision of internal laboratory measurements. Lab duplicates are subsamples of a routine sample that is divided into separate containers in the lab and analyzed using the same analytical method (often side by side). Lab duplicates are not averaged into calculations reported on the DMRs.
## APPENDIX A - DIVISION CONTACTS

### Compliance Questions and Problems

<table>
<thead>
<tr>
<th>Domestic Wastewater</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aly Ulibarri (individual permits)</td>
<td>303.692.3163</td>
<td><a href="mailto:aly.ulibarri@state.co.us">aly.ulibarri@state.co.us</a></td>
</tr>
<tr>
<td>Mandy Mercer (general permits)</td>
<td>303.692.2283</td>
<td><a href="mailto:mandy.mercer@state.co.us">mandy.mercer@state.co.us</a></td>
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<tr>
<th>Industrial Wastewater</th>
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<tbody>
<tr>
<td>Eric Mink (individual permits)</td>
<td>303.692.2312</td>
<td><a href="mailto:eric.mink@state.co.us">eric.mink@state.co.us</a></td>
</tr>
<tr>
<td>Andrea Beebout (general permits)</td>
<td>303.692.6498</td>
<td><a href="mailto:andrea.beebout@state.co.us">andrea.beebout@state.co.us</a></td>
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<table>
<thead>
<tr>
<th>Whole Effluent Toxicity (WET)</th>
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<tbody>
<tr>
<td>Eric Mink</td>
<td>303.692.2312</td>
<td><a href="mailto:eric.mink@state.co.us">eric.mink@state.co.us</a></td>
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### DMR Questions

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<thead>
<tr>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Leslie Simpson</td>
<td>303.692.3611</td>
<td><a href="mailto:leslie.simpson@state.co.us">leslie.simpson@state.co.us</a></td>
</tr>
<tr>
<td>Elisa Willard</td>
<td>303.692.3505</td>
<td><a href="mailto:elisa.willard@state.co.us">elisa.willard@state.co.us</a></td>
</tr>
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<table>
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<tr>
<th>For Discrepancies Between DMR and Permit</th>
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</tr>
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<tbody>
<tr>
<td>Tania Watson</td>
<td>303.692.3595</td>
<td><a href="mailto:tania.watson@state.co.us">tania.watson@state.co.us</a></td>
</tr>
</tbody>
</table>

### Net DMR Inquiries

| General Line                                             | 303.691.4046         | CDPHE.WQNetDMRHelp@state.co.us|

### Permit Questions

| General Line                                             | 303.692.3517         |                          |

### Records Requests / Copies of Previously Submitted DMRs

| Records Center                                           | 303.692.3565         |                          |