Stormwater Quality Monitoring under a Watershed-based Permit
Middle Rio Grande, New Mexico

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Middle Rio Grande Watershed-based MS4 Permit

- National Academy of Sciences/National Research Council commissioned by USEPA in 2006
- *Urban Stormwater Management in the United States* issued in 2009; problems cited in the report:
  - Information on BMP longevity and performance
  - Varying requirements on monitoring
  - Lack of resources
  - Land use/water quality functions decoupled
  - Financial support
What is a watershed-based permit?

- A pilot program from EPA-HQ designating a watershed (urbanized area) boundary as the permit boundary, as opposed to a political jurisdiction.

Why watershed-based permitting?

- Addresses all stressors within the hydrologically-defined drainage basin (watershed).
- More environmentally effective results.
- Allows cooperation between separate political jurisdictions/entities to reduce compliance costs and/or provide efficiencies in permit compliance activities.
New Mexico is one of four states that does not have primacy of the NPDES program.

USEPA Region 6 issues all NPDES permits and conducts all NPDES-related enforcement in New Mexico.

The New Mexico watershed-based permit for the Middle Rio Grande MS4s (NMR04A000) was issued in December 2014.
In 2010, USEPA Headquarters designated:

- Ramsey Washington Watershed District, Minnesota
  1 entity, established in 1975 under the Minnesota Watershed District Act
- Milwaukee Metro Watershed, Wisconsin
  1 entity, created in 1982 by the Wisconsin legislature
- Middle Rio Grande, New Mexico
  18 entities, no oversight governmental body

Draft small system MS4 permit for New Mexico was published in 2015
Cooperation / Co-permittees

- Cities/towns/villages, counties, and flood control authorities/NMDOT occupy same geographical area.
- Eligible entities under this Permit:

<table>
<thead>
<tr>
<th>Class A Permittees:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• City of Albuquerque</td>
</tr>
<tr>
<td>• Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA)</td>
</tr>
<tr>
<td>• University of New Mexico (UNM)</td>
</tr>
<tr>
<td>• New Mexico Department of Transportation (NMDOT), District 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class B Permittees:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bernalillo County</td>
</tr>
<tr>
<td>• Sandoval County</td>
</tr>
<tr>
<td>• Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)</td>
</tr>
<tr>
<td>• City of Rio Rancho</td>
</tr>
<tr>
<td>• Village of Corrales</td>
</tr>
<tr>
<td>• Los Ranchos de Albuquerque</td>
</tr>
<tr>
<td>• Kirtland Air Force Base (KAFB)</td>
</tr>
<tr>
<td>• Town of Bernalillo</td>
</tr>
<tr>
<td>• State Fair Grounds/Expo</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Class C Permittees:</th>
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</thead>
<tbody>
<tr>
<td>• Eastern Sandoval County Arroyo Flood Control Authority</td>
</tr>
<tr>
<td>• Sandia Labs and the Department of Energy (DOE)</td>
</tr>
</tbody>
</table>
Middle Rio Grande Watershed-based MS4 Permit
Middle Rio Grande Watershed-based MS4 Permit

Overlapping jurisdictional boundaries

- 2 counties
- 1 town
- 2 villages
- 2 cities
- 3 flood agencies
- 1 university
- 1 AFB/DOD
- 1 National Lab/DOE
- 1 Fair Grounds/State
- 1 NM DOT
- 3 Pueblos
The watershed has one perennial water body, the Rio Grande.

Additionally, there is a complex network of drains, ditches, and laterals through the MRG Conservation District (Agricultural).
The Permit allows a cooperative approach to wet weather monitoring.

- Objective of monitoring approach is to assess the impact of the watershed on the river, not necessarily each entity’s impact.
- If there is a water quality exceedance permittees must track down the source.
Technical Advisory Group (TAG) - Exchange of information between entities

- An agreement where the participating entities cooperate and exchange information
- Complexity
  - No money could be required
  - Needed to be a non-binding obligation
  - Allows entities to be part of the group and exchange information
- Fourteen signatories to the TAG.
- All levels of government represented (except Tribal).
- TAG started meeting in early 2014 and have met monthly or bi-monthly since the permit was issued.
Members of the TAG formed a cooperative working group, the Compliance Monitoring Cooperative (CMC), to develop a stormwater quality monitoring plan.

- 12 MS4s are currently cooperating on wet weather monitoring.
- The CMC worked with NMED and EPA to develop the wet weather monitoring plan.

<table>
<thead>
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<th>Class A Permittees:</th>
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<td>Sandoval County</td>
<td>• Sandia Labs and the Department of Energy (DOE)</td>
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<tr>
<td>University of New Mexico (UNM)</td>
<td>Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA)</td>
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<tr>
<td>New Mexico Department of Transportation (NMDOT), District 3</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>State Fair Grounds/Expo</td>
<td></td>
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</tbody>
</table>
How do you address cost allocation for cooperative monitoring?
Stormwater quality samples are collected in-stream, not from outfalls.
Middle Rio Grande Conservancy District

- Several entities, through agreements with the MRGCD, discharge stormwater into the agricultural drains
- How do we monitor stormwater in these drains?
Middle Rio Grande Conservancy District

Instead of trying to monitor stormwater discharged into the MRGCD irrigation canal network, monitoring upstream and downstream sampling locations are moved to above and below MRGCD diversions and outfalls

Impacts to entire watershed
MRG MS4 Permit
Wet Weather Monitoring

- Upstream sampling location
MRG MS4 Permit
Wet Weather Monitoring

- Downstream sampling location
MRG MS4 Permit
Wet Weather Monitoring

- Cooperation - Wet weather monitoring
  - Significant permit incentive for MS4s to cooperate on monitoring
Wet Weather Monitoring

- What is a qualifying storm?
  - Permit: 0.25 inches of ppt in a 24-hour period
  - Rarely rains over the entire watershed – first flush
  - Worked with NMED and EPA to address: now a qualifying storm is any storm within the watershed with total precipitation of 0.25 inches or more
- Storm events in New Mexico are isolated, scattered
- Dry, hydrophobic soils can yield more runoff
MRG MS4 Permit

Wet Weather Monitoring

- Weather in New Mexico
  - Storms occur over very short periods of time
  - Storms are very localized
  - Upstream sampling must occur prior to event
MRG MS4 Permit

Wet Weather Monitoring

- Weather in New Mexico
  - Did the storm discharge?
Mr. Greene predicted 0.27" on the whiz bang predictor model. We all know that locally it could be greater.

What the hey, I say we collect.

Collect and hope for rain I say!

Wed, Sep 21, 5:56 PM

Maybe some rain on the way? Keeping my fingers crossed...

Yes, this will qualify

Yay!

Anyone know off hand what the travel time is from Alameda to Isleta? Gotta start scheduling

3.6 hrs

Hmmmm...well that would leave the sampling time tomorrow at like 2:30AM....maybe we wait to get the runoff from the next wave and set the time off that?

The other thing we can do is watch the usgs hydrographs and as long as there is still discharge at say ndc, sdc, etc and calculate from that time.

Agreed.

Good idea with the hydrographs: at 6:20 next USGS alert from the north diversion channel

I thought so, gives us a little more flexibility on sample timing.

Lots of rain here too

It's coming in waves up here

I have my text alert set as well for the north diversion channel gauge

Me too

The force is strong with you two

Does the USGS data update hourly?

Yes. Next one at 7:20
Sample Timing

- For downstream, in-stream sampling, it can take as long as 15 hours for the stormwater plug to make it to the sampling point.

<table>
<thead>
<tr>
<th>Zonal Segments of River (north to south travel times)</th>
<th>Western Side of Watershed (west to east travel times)</th>
<th>Eastern Side of Watershed (east to west travel times)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.4 hours</td>
<td>3 hours --&gt; 1.5 hours --&gt;</td>
<td>&lt;= 20 min.  &lt;= 40 min.</td>
</tr>
<tr>
<td>Rio Grande at Angostura to Rio Grande at Alameda</td>
<td>NM-SN-59  NM-SN-70</td>
<td>N/A  N/A</td>
</tr>
<tr>
<td>4.4 hours</td>
<td>NM-BR-113  NM-BR-144</td>
<td>NM-BR-71  NM-BR-162</td>
</tr>
<tr>
<td>Rio Grande at Alameda to Rio Grande at Central</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.2 hours</td>
<td>NM-BR-159  NM-BR-104</td>
<td>NM-BR-150  NM-BR-41</td>
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<tr>
<td>Rio Grande at Central to Rio Grande at Isleta 147 Bridge</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 1 – Hydrograph Timing for Rain Events to Southern Sampling Point*
Challenges

- Predicted events don’t always pan out
  - Upstream samples have to be collected prior to qualifying event
- Qualifying event but where did it discharge?
  - Minimal runoff depending on location of storm event
  - Volume of runoff may be insufficient to push water out of ponds and other flood/water quality features
- Rainfall event may occur outside of laboratory hours
  - Exceed some hold times, specifically E. coli
  - During the 2016 wet season, 52% of the 27 qualifying events occurred on weekends/holidays/after lab hours
Per Section 303(d) of the CWA, impairments in the MRG list include:
- Dissolved Oxygen
- Gross alpha
- PCBs
- Temperature

Total Maximum Daily Load (TMDL) in the MRG for E. coli
- A TMDL establishes the maximum amount of a pollutant allowed in a waterbody; used as a tool for restoring water quality
Wet weather monitoring

Required analytes:
- TSS
- COD
- Ammonia
- Dissolved oxygen
- PCBs
- Copper and lead
- Hardness
- Temperature
- Select VOCs and SVOCs
- Phosphorus
- BOD5
- Nitrate/nitrite
- pH
- Gross Alpha
- Conductivity
- TDS
- E. coli
- TKN
- Oil & Grease
How do we calculate a waste load (WL) from a resultant concentration?
**MRG MS4 Permit**  
**Waste Load Calculation**

---

**E. Coli Loading Calculation:**

\[
E.\text{ Coli Concentration } \left( \frac{\text{CFU}}{100\text{mL}} \right) \times 28,316.85 \left( \frac{\text{mL}}{\text{ft}^3} \right) \times \text{Mean Daily Flow} \left( \frac{\text{ft}^3}{\text{sec}} \right) \times 3,600 \left( \frac{\text{sec}}{\text{hr}} \right) \times 24 \left( \frac{\text{hr}}{\text{day}} \right) = \text{E. coli Loading} \left( \frac{\text{CFU}}{\text{day}} \right)
\]

<table>
<thead>
<tr>
<th>Monitoring Location</th>
<th>E. coli Concentration (CFU/100 mL)</th>
<th>Daily Mean Flow (cfs)</th>
<th>E. coli Loading (CFU/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rio Grande North</td>
<td>28.1</td>
<td>639</td>
<td>4.39E+11</td>
</tr>
<tr>
<td>Rio Grande South</td>
<td>1,106</td>
<td>703</td>
<td>1.90E+13</td>
</tr>
<tr>
<td>Delta in E. coli Loading</td>
<td></td>
<td></td>
<td>1.86E+13</td>
</tr>
</tbody>
</table>

**Delta in E. coli Loading Between North and South Locations**
MRG MS4 Permit

TMDL

TMDL - ALLOWED LOAD ALLOCATIONS - ISLETA TO ALAMEDA - HIGH FLOW CONDITIONS IN THE RIVER

Load Allocation (Natural Background) - 63.8%

Margin of Safety - 26.5%

CMC WLA - 4.8%

Remaining MS4 WLA - 2.3%

ABCWUA - 2.6%

Sandia Peak Ski Co. - 0%
New Mexico Environment Department MRG stream segments and assessment units
Calculate E. coli loading per stream segment reach and compare to total TMDL:

<table>
<thead>
<tr>
<th>Stream Segment</th>
<th>Stream Name / Related USGS Gage</th>
<th>Contributing Area Ratio for Each Segment</th>
<th>E. coli Loading (CFU/day) for Each Segment</th>
<th>Total TMDL for Segment</th>
<th>TMDL Exceedance?</th>
</tr>
</thead>
<tbody>
<tr>
<td>2105.1_00</td>
<td>Alameda to Angostura Non-Pueblo Alameda Bridge to Angostura Diversion / 08329928 - Rio Grande near Alameda</td>
<td>0.77</td>
<td>1.43E+13</td>
<td>5.83E+11</td>
<td>TMDL Exceeded</td>
</tr>
<tr>
<td>2105_50</td>
<td>Isleta to Alameda Isleta Pueblo Boundary to Alameda Street Bridge / 0833000 - Rio Grande at Albuquerque, NM (Central)</td>
<td>0.23</td>
<td>4.27E+12</td>
<td>9.03E+11</td>
<td>TMDL Exceeded</td>
</tr>
</tbody>
</table>
Calculate CMC MS4 E. coli loading per stream segment reach – apply percent based on CMC WLA compared to total TMDL:

<table>
<thead>
<tr>
<th>Stream Segment</th>
<th>Stream Name / Related USGS Gage</th>
<th>Flow Conditions</th>
<th>Percent of E. coli Associated with CMC Members</th>
<th>Total CMC E. coli Loading (CFU/day) for Each Segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2105.1_00</td>
<td>Alameda to Angostura Non-Pueblo Alameda Bridge to Angostura Diversion / 08329928 - Rio Grande near Alameda</td>
<td>Dry</td>
<td>5.9%</td>
<td>8.38E+11</td>
</tr>
<tr>
<td>2105_50</td>
<td>Isleta Pueblo Boundary to Alameda Street Bridge / 0833000 - Rio Grande at Albuquerque, NM (Central)</td>
<td>Mid</td>
<td>5.5%</td>
<td>2.36E+11</td>
</tr>
</tbody>
</table>
Compare Storm Event E. coli loading to WLA for CMC:

<table>
<thead>
<tr>
<th>Stream Segment</th>
<th>Stream Name / Related USGS Gage</th>
<th>CMC E. coli Loading (CFU/day) for Each Segment</th>
<th>Flow Conditions</th>
<th>WLA for CMC for Flow Conditions</th>
<th>WLA - Potential Exceedance or Acceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>2105.1_00</td>
<td>Alameda to Angostura Non-Pueblo Alameda Bridge to Angostura Diversion / 08329928 - Rio Grande near Alameda</td>
<td>8.38E+11</td>
<td>Dry</td>
<td>3.24E+10</td>
<td>WLA Potential Exceedance</td>
</tr>
<tr>
<td>2105_50</td>
<td>Isleta to Alameda Isleta Pueblo Boundary to Alameda Street Bridge / 0833000 - Rio Grande at Albuquerque, NM (Central)</td>
<td>2.36E+11</td>
<td>Mid</td>
<td>4.22E+10</td>
<td>WLA Potential Exceedance</td>
</tr>
</tbody>
</table>
Water Quality Standard for E. coli

- Isleta Pueblo standard water quality standard:
  - Geometric mean maximum *Escherichia coli* (E. coli): 47 per 100mL (geometric mean calculation based on a minimum of five samples taken over a maximum of 30 days) single sample maximum: 88 colonies/100 mL

- NMED water quality standard
  - Primary contact: The monthly geometric mean of E. coli bacteria of 126 cfu/100 mL or MPN/100 mL and single sample of 410 cfu/100 mL or MPN/100 mL

NMED: http://164.64.110.239/nmac/parts/title20/20.006.0004.pdf
Table D.1 - Rio Grande (non-Pueblo Alameda Bridge to Angostura Diversion)

<table>
<thead>
<tr>
<th>Station</th>
<th>Date</th>
<th>Result (cfu/100mL)</th>
<th>Flow (cfs)</th>
<th>Rainfall (inches)</th>
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<tbody>
<tr>
<td>USGS 833918</td>
<td>2/18/2004</td>
<td>490</td>
<td>498</td>
<td>0</td>
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<tr>
<td>USGS 833918</td>
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<td>119</td>
<td>953</td>
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<tr>
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<td>928</td>
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<td>8/15/2006</td>
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<td>1800</td>
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</tr>
<tr>
<td>USGS 833918</td>
<td>12/9/2006</td>
<td>&lt;1</td>
<td>825</td>
<td>0</td>
</tr>
<tr>
<td>USGS 833918</td>
<td>5/4/2007</td>
<td>&gt;180</td>
<td>3280</td>
<td>0</td>
</tr>
</tbody>
</table>

Red values indicate those above the State and Tribal water quality standard. Blue values indicate those above the Tribal water quality standards.

1 USGS gage 0833000
2 Angostura NMSU weather site. Rainfall data for the previous day was used.

Table D.2 - Rio Grande (Isleta Pueblo Blvd to Alameda Bridge)

<table>
<thead>
<tr>
<th>Station</th>
<th>Date</th>
<th>Result (cfu/100mL)</th>
<th>Flow (cfs)</th>
<th>Rainfall (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USGS 833000</td>
<td>12/8/2004</td>
<td>1000</td>
<td>859</td>
<td>0</td>
</tr>
<tr>
<td>3RGrd419.7</td>
<td>3/23/2005</td>
<td>43</td>
<td>873</td>
<td>0</td>
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<tr>
<td>USGS 833000</td>
<td>4/8/2005</td>
<td>&lt;47</td>
<td>1100</td>
<td>0</td>
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<tr>
<td>3RGrd419.7</td>
<td>5/26/2005</td>
<td>40.4</td>
<td>5610</td>
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<tr>
<td>3RGrd419.7</td>
<td>6/22/2005</td>
<td>1553.1</td>
<td>4230</td>
<td>0</td>
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<tr>
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<td>7/7/2005</td>
<td>20</td>
<td>1290</td>
<td>0</td>
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<tr>
<td>3RGrd419.7</td>
<td>7/27/2005</td>
<td>245.3</td>
<td>392</td>
<td>0</td>
</tr>
<tr>
<td>USGS 833000</td>
<td>8/12/2005</td>
<td>1000</td>
<td>486</td>
<td>0</td>
</tr>
<tr>
<td>3RGrd419.7</td>
<td>8/24/2005</td>
<td>290.9</td>
<td>363</td>
<td>0</td>
</tr>
<tr>
<td>3RGrd419.7</td>
<td>9/28/2005</td>
<td>275.5</td>
<td>393</td>
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<td>3RGrd419.7</td>
<td>10/26/2005</td>
<td>290.9</td>
<td>281</td>
<td>0</td>
</tr>
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<td>USGS 833000</td>
<td>2/22/2006</td>
<td>&gt;2</td>
<td>570</td>
<td>0</td>
</tr>
<tr>
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<td>5/17/2006</td>
<td>28</td>
<td>554</td>
<td>0</td>
</tr>
<tr>
<td>USGS 833000</td>
<td>7/19/2006</td>
<td>&gt;1</td>
<td>498</td>
<td>0</td>
</tr>
<tr>
<td>USGS 833000</td>
<td>8/5/2006</td>
<td>120</td>
<td>2530</td>
<td>0</td>
</tr>
<tr>
<td>USGS 833000</td>
<td>6/25/2007</td>
<td>730</td>
<td>674</td>
<td>0</td>
</tr>
</tbody>
</table>

Red values indicate those above the State and Tribal water quality standard. Blue values indicate those above the Tribal water quality standards.

1 USGS gage 0833000
2 Albuquerque International Airport weather site. Rainfall data for the previous day was used.
US EPA Approved, Total Maximum Daily Load (TMDL) for the Middle Rio Grande Watershed, June 30, 2010, page 40:

It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems the target load will vary based on the changing flow. Management of the load to improve stream water quality and meet water quality criteria should be a goal to be attained. Meeting the calculated TMDL may be a difficult objective.
MRG MS4 Permit
TMDL

E. coli Coliform Levels – CMC Sampling 2016

- Angostura
- Sites North to South
- Isleta

E. coli coliform (CFU/100ml)

<table>
<thead>
<tr>
<th>Date</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Aug-16</td>
<td></td>
</tr>
<tr>
<td>12-Sep-16</td>
<td></td>
</tr>
<tr>
<td>21-Sep-16</td>
<td></td>
</tr>
<tr>
<td>21-Nov-16</td>
<td></td>
</tr>
</tbody>
</table>
### E. coli Monitoring

**Sample Location**

<table>
<thead>
<tr>
<th>Date</th>
<th>Rio Grande North</th>
<th>Rio Grande South</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Aug-16</td>
<td>3.24E+10</td>
<td>4.22E+10</td>
</tr>
<tr>
<td>12-Sep-16</td>
<td>3.24E+10</td>
<td>1.57E+10</td>
</tr>
<tr>
<td>21-Sep-16</td>
<td>1.68E+10</td>
<td>3.42E+09</td>
</tr>
<tr>
<td>21-Nov-16</td>
<td>No Value</td>
<td>4.22E+10</td>
</tr>
</tbody>
</table>

**Combined WLA for Cooperative (CFU/day)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Rio Grande North</th>
<th>Rio Grande South</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Aug-16</td>
<td>3.24E+10</td>
<td>4.22E+10</td>
</tr>
<tr>
<td>12-Sep-16</td>
<td>3.24E+10</td>
<td>1.57E+10</td>
</tr>
<tr>
<td>21-Sep-16</td>
<td>1.68E+10</td>
<td>3.42E+09</td>
</tr>
<tr>
<td>21-Nov-16</td>
<td>No Value</td>
<td>4.22E+10</td>
</tr>
</tbody>
</table>

**CMC MS4 E.coli Loading Per Reach (CFU/day)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Rio Grande North</th>
<th>Rio Grande South</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Aug-16</td>
<td>7.91E+13</td>
<td>3.19E+13</td>
</tr>
<tr>
<td>12-Sep-16</td>
<td>4.99E+13</td>
<td>1.56E+13</td>
</tr>
<tr>
<td>21-Sep-16</td>
<td>1.31E+13</td>
<td>1.77E+12</td>
</tr>
<tr>
<td>21-Nov-16</td>
<td>--*</td>
<td>2.33E+14</td>
</tr>
</tbody>
</table>

**WLA Exceed/Acceptable?**

<table>
<thead>
<tr>
<th>Date</th>
<th>Rio Grande North</th>
<th>Rio Grande South</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Aug-16</td>
<td>Exceed</td>
<td>Exceed</td>
</tr>
<tr>
<td>12-Sep-16</td>
<td>Exceed</td>
<td>Exceed</td>
</tr>
<tr>
<td>21-Sep-16</td>
<td>Exceed</td>
<td>Exceed</td>
</tr>
<tr>
<td>21-Nov-16</td>
<td>Acceptable</td>
<td>Exceed</td>
</tr>
</tbody>
</table>

*No WLA was made for this flow regime of the Rio Grande, so no exceedance/acceptable calculation was done.
Dry weather sampling locations for E. coli monitoring
MRG MS4 Permit
E. coli Monitoring

E. coli Coliform Levels – BEMP Sampling 2017

- Increase of ~11% under bridge in July
### MRG MS4 Permit

#### E. coli Monitoring

<table>
<thead>
<tr>
<th>Date</th>
<th>Coronado - NDC</th>
<th>NDC - Badger</th>
<th>Badger - Montano</th>
<th>Montano - SLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-Jan-17</td>
<td>No Value</td>
<td>No Value</td>
<td>4.22E+10</td>
<td>4.22E+10</td>
</tr>
<tr>
<td>28-Feb-17</td>
<td>9.09E+10</td>
<td>9.09E+10</td>
<td>4.22E+10</td>
<td>4.22E+10</td>
</tr>
<tr>
<td>29-Mar-17</td>
<td>9.09E+10</td>
<td>9.09E+10</td>
<td>2.51E+11</td>
<td>2.51E+11</td>
</tr>
<tr>
<td>24-Apr-17</td>
<td>3.14E+11</td>
<td>3.14E+11</td>
<td>2.51E+11</td>
<td>2.51E+11</td>
</tr>
<tr>
<td>25-May-17</td>
<td>9.09E+10</td>
<td>9.09E+10</td>
<td>6.29E+10</td>
<td>6.29E+10</td>
</tr>
<tr>
<td>21-Jun-17</td>
<td>9.09E+10</td>
<td>9.09E+10</td>
<td>6.29E+10</td>
<td>6.29E+10</td>
</tr>
<tr>
<td>27-Jul-17</td>
<td>No Value</td>
<td>No Value</td>
<td>1.57E+10</td>
<td>1.57E+10</td>
</tr>
</tbody>
</table>

**CMC MS4 E. coli Loading per Reach (CFU/day)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Coronado - NDC</th>
<th>NDC - Badger</th>
<th>Badger - Montano</th>
<th>Montano - SLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-Jan-17</td>
<td>--</td>
<td>--</td>
<td>4.61E+11</td>
<td>1.67E+13</td>
</tr>
<tr>
<td>28-Feb-17</td>
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<tr>
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<td>6.47E+12</td>
<td>3.54E+12</td>
<td>4.71E+12</td>
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<tr>
<td>24-Apr-17</td>
<td>0.00E+00</td>
<td>1.42E+13</td>
<td>2.94E+13</td>
<td>2.58E+13</td>
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<tr>
<td>25-May-17</td>
<td>1.96E+12</td>
<td>2.50E+12</td>
<td>9.49E+12</td>
<td>0.00E+00</td>
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<tr>
<td>21-Jun-17</td>
<td>1.08E+12</td>
<td>8.35E+11</td>
<td>8.75E+11</td>
<td>3.52E+12</td>
</tr>
<tr>
<td>27-Jul-17</td>
<td>--</td>
<td>--</td>
<td>1.24E+13</td>
<td>5.55E+13</td>
</tr>
</tbody>
</table>

**WLA Exceed or Acceptable?**

<table>
<thead>
<tr>
<th>Date</th>
<th>Coronado - NDC</th>
<th>NDC - Badger</th>
<th>Badger - Montano</th>
<th>Montano - SLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-Jan-17</td>
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<td>Acceptable¹</td>
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<td>Exceed</td>
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<tr>
<td>28-Feb-17</td>
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<td>Exceed</td>
<td>Acceptable²</td>
<td>Exceed</td>
</tr>
<tr>
<td>29-Mar-17</td>
<td>Exceed</td>
<td>Exceed</td>
<td>Exceed</td>
<td>Exceed</td>
</tr>
<tr>
<td>24-Apr-17</td>
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<td>Exceed</td>
<td>Exceed</td>
<td>Exceed</td>
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<tr>
<td>25-May-17</td>
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<td>Exceed</td>
<td>Exceed</td>
<td>Acceptable²</td>
</tr>
<tr>
<td>21-Jun-17</td>
<td>Exceed</td>
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<td>Exceed</td>
<td>Exceed</td>
</tr>
<tr>
<td>27-Jul-17</td>
<td>Acceptable²</td>
<td>Acceptable²</td>
<td>Exceed</td>
<td>Exceed</td>
</tr>
</tbody>
</table>

¹ No WLA was made for this flow regime of the Rio Grande, so no exceedance/acceptable calculation was done
² E. coli levels decreased in the stretch between sample sites
MRG MS4 Permit
E. coli Monitoring

E. coli concentrations in riverbed sediment
Sources of e. coli

- Wildlife
- Pet waste
- Septic systems
- Sewer line leaks
- Improper waste disposal
- Regrowth?
Middle Rio Grande Watershed-based MS4 Permit

Next?

- Have collected 5 of 7 required wet weather monitoring samples for this permit cycle
- High flow suspension?
- Revisit TMDL with new data
- Continue/enhance BMPs including outreach and education
- Source tracking study
- Southern sampling point access issues