



CAFO Precipitation Challenges

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CAFOs and Precipitation



Production area runoff leading to storm water drain.

- CAFOs and precipitation are inexorably linked.
- Over the last 50 years there have been increases in the average farm size and increases in total annual precipitation.
- Farm infrastructure is designed with precipitation in mind but will often exceed the intended lifespan.

Precipitation Challenges: Operations & Maintenance

- Proper operation and maintenance of clean storm water areas to ensure they do not become production areas.



Swine Farm. September 1, 2023



Poultry Farm. February 9, 2023

Precipitation Challenges: Improper Operations & Maintenance

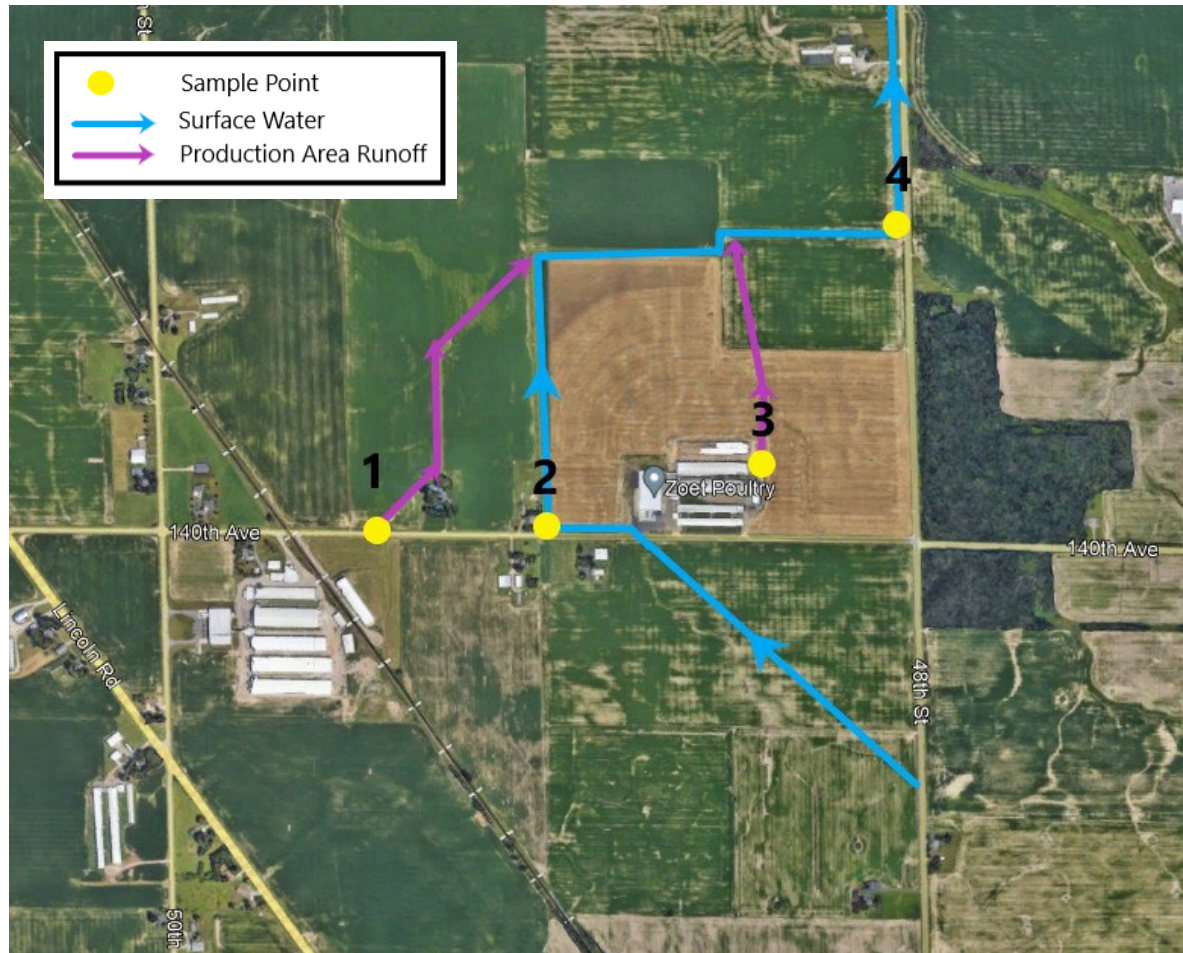


Catch basin with runoff from CAFO waste pile.



CAFO waste outside of manure barn.

Precipitation Challenges: Surface Water Impacts



Sampling event at facilities with improper maintenance and operation of clean storm water areas.

1.

Parameter	Result	Units
Chloride	8.5	mg/L
Conductivity	169	umhos/cm
Ortho Phosphate-P	0.83	mg/L
Total Phosphorus-P	3.9	mg/L
Total Suspended Solids	600	mg/L
Turbidity	630	NTU
Ammonia-N	2.7	mg/L
Kjeldahl Nitrogen-N	8.0	mg/L
Nitrate/Nitrite-N	2.4	mg/L
Total Organic Carbon	9.7	mg/L
pH	7.6	pH Units
TBOD5	19.1	mg/L
E. Coli	241,960	MPN
E. Coli	-	MPN
E. Coli	-	MPN

2.

Parameter	Result	Units
Chloride	5.8	mg/L
Conductivity	108	umhos/cm
Ortho Phosphate-P	0.53	mg/L
Total Phosphorus-P	3.7	mg/L
Total Suspended Solids	970	mg/L
Turbidity	1240	NTU
Ammonia-N	0.24	mg/L
Kjeldahl Nitrogen-N	4.3	mg/L
Nitrate/Nitrite-N	1.6	mg/L
Total Organic Carbon	8.4	mg/L
pH	7.6	pH Units
TBOD5	8.1	mg/L
E. Coli	1,607	MPN
E. Coli	1,223	MPN
E. Coli	1,376	MPN

3.

Parameter	Result	Units
Chloride	5.2	mg/L
Conductivity	217	umhos/cm
Ortho Phosphate-P	2.5	mg/L
Total Phosphorus-P	18	mg/L
Total Suspended Solids	2300	mg/L
Turbidity	1020	NTU
Ammonia-N	13	mg/L
Kjeldahl Nitrogen-N	37	mg/L
Nitrate/Nitrite-N	3.3	mg/L
Total Organic Carbon	30	mg/L
pH	7.8	pH Units
TBOD5	187.2	mg/L
E. Coli	241,960	MPN
E. Coli	241,960	MPN
E. Coli	-	MPN

4.

Parameter	Result	Units
Chloride	5.6	mg/L
Conductivity	134	umhos/cm
Ortho Phosphate-P	0.62	mg/L
Total Phosphorus-P	4.2	mg/L
Total Suspended Solids	920	mg/L
Turbidity	965	NTU
Ammonia-N	0.91	mg/L
Kjeldahl Nitrogen-N	5.4	mg/L
Nitrate/Nitrite-N	2.8	mg/L
Total Organic Carbon	9.0	mg/L
pH	7.7	pH Units
TBOD5	13.9	mg/L
E. Coli	15,531	MPN
E. Coli	24,196	MPN
E. Coli	14,136	MPN

Precipitation Challenges: Improper Operations & Maintenance Results



Storm water outlet at the farm. 241,960 *E.coli*/100 mL.



Overland flow from storm water outlet to surface water drain.

Precipitation Challenges: Land Application



Land applied field during rain event. February 27, 2023.



Land applied field after rain event. October 6, 2023.

Precipitation Challenges: Areas of Concentrated Flow



Downstream of contaminated floodplain.

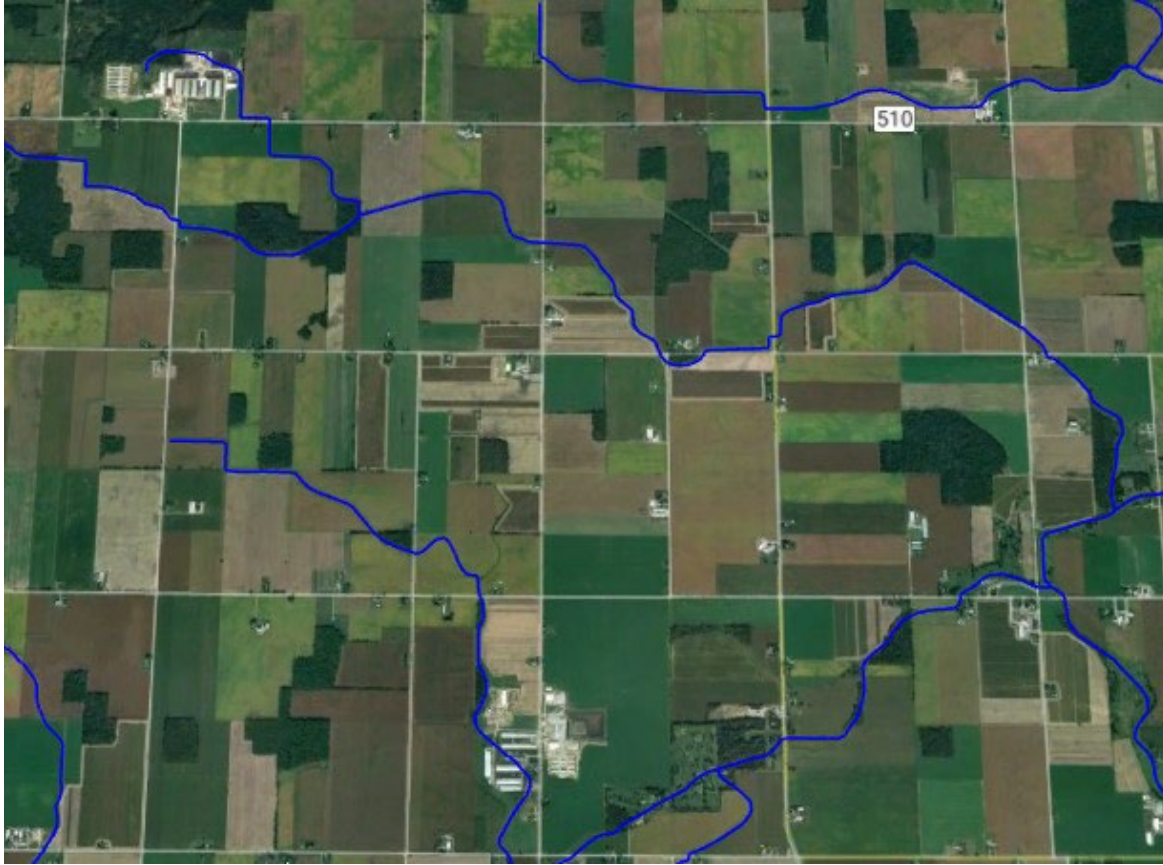


Overland flow residing in floodplain.



Overland flow across land applied field.

Precipitation Challenges: Production Areas & Siting



Identified surface waters near and in CAFO production areas.



Production area exposed to precipitation.

Precipitation Challenges: Production Area Expansion

Farm aerial, 1999.



Farm aerial, 2005.

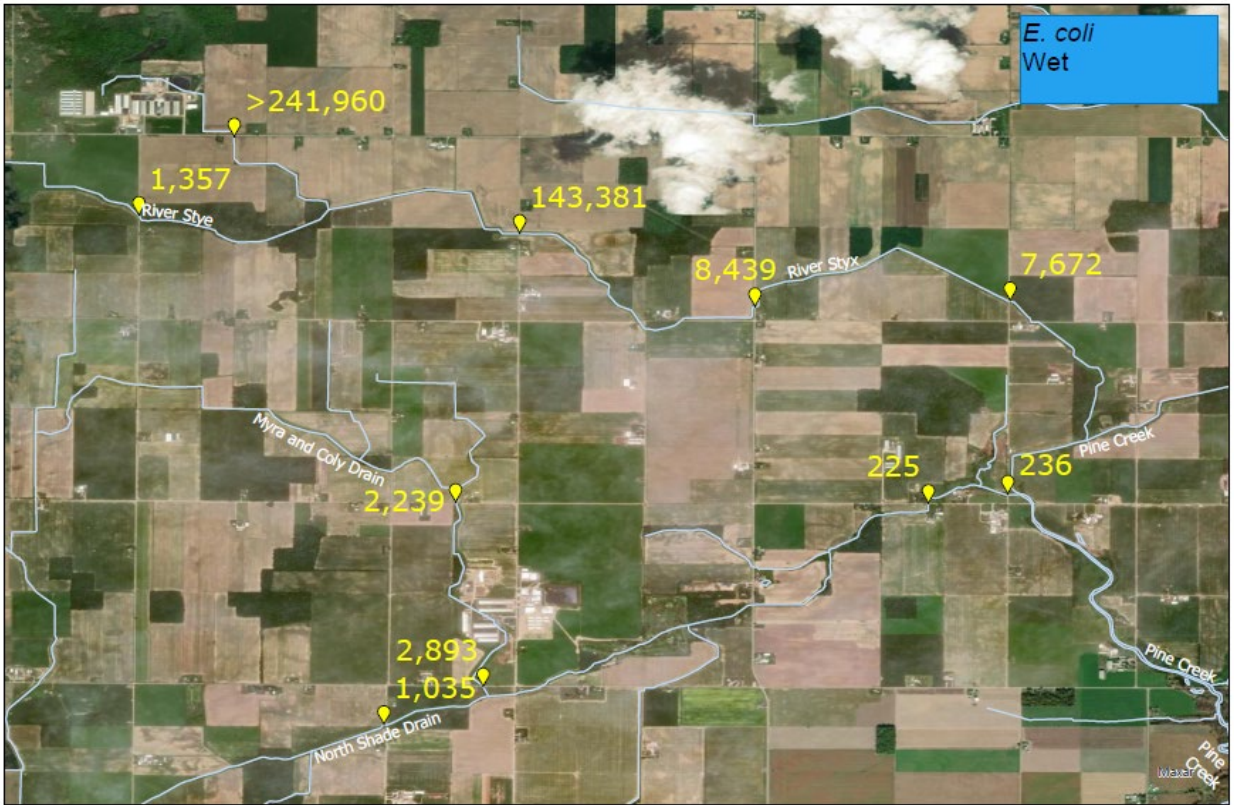


Farm aerial, 2020.

Precipitation Challenges: Surface Water Impacts (E.coli)

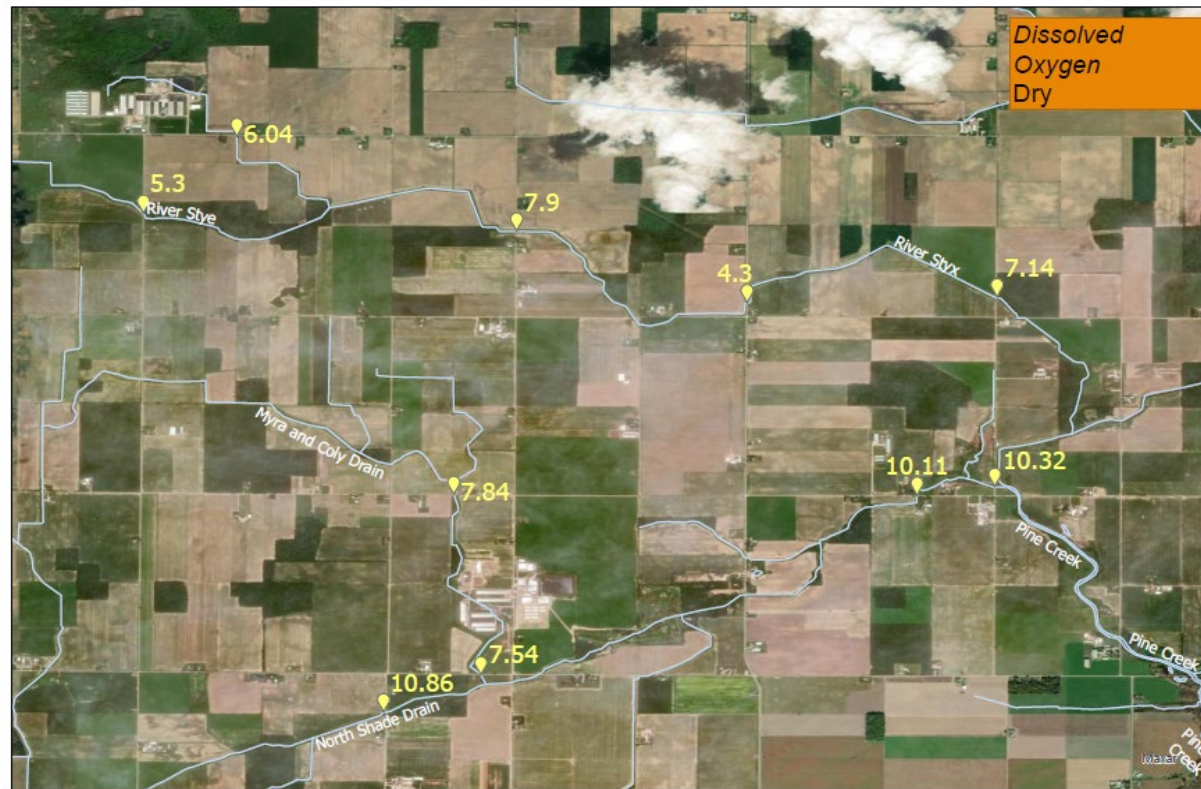


River Styx and North Shade Drain
0.0 inches of rain in prior 48 hours
E. coli (MPN/100mL) on 7/19/2023

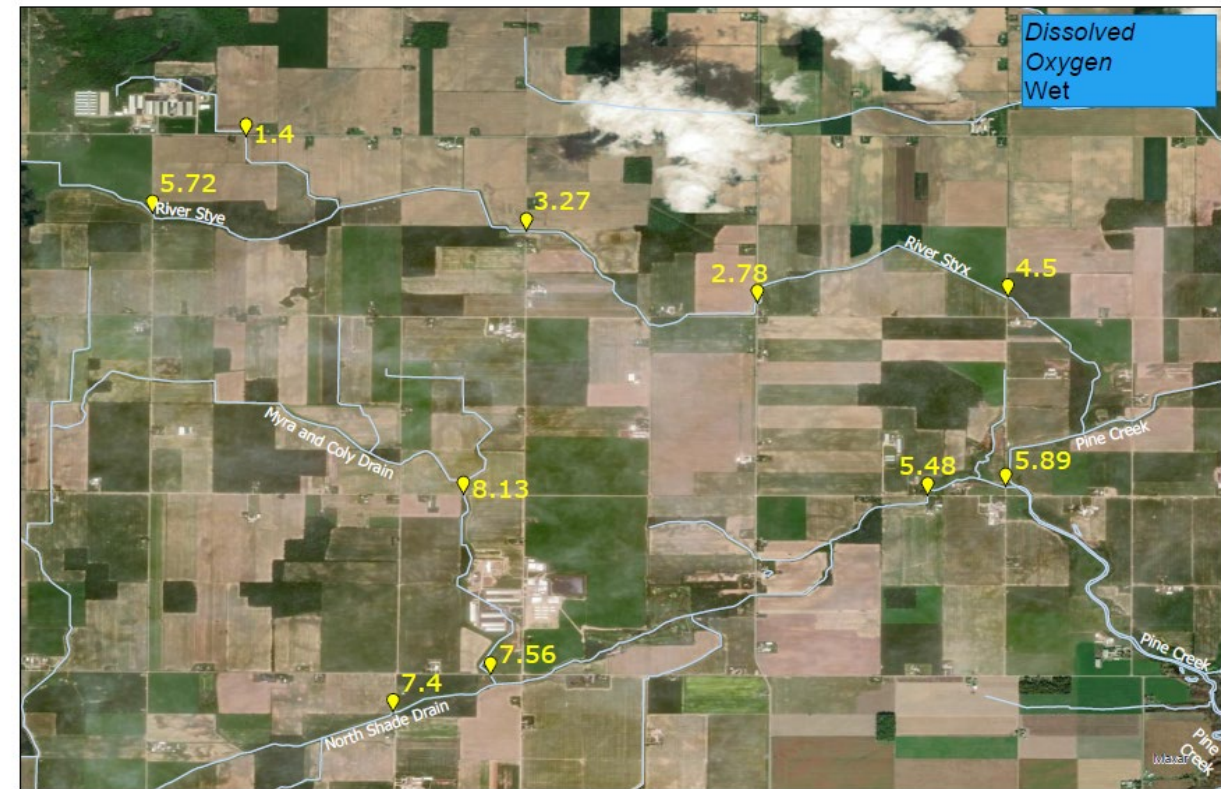


River Styx and North Shade Drain
0.63 inches of rain in prior 24 hours
E. coli (MPN/100mL) on 6/27/2023

Precipitation Challenges: Surface Water Impacts (Dissolved Oxygen)



River Styx and North Shade Drain
0.0 inches of rain in prior 48 hours
Dissolved Oxygen (mg/L) on 7/19/2023



River Styx and North Shade Drain
0.63 inches of rain in prior 24 hours
Dissolved Oxygen (mg/L) on 6/27/2023

Regulating Precipitation Discharges in Michigan

- Direct or indirect discharges into waters of the state is violation of state statute.
 - State statute has the dual purpose of protecting water quality and regulating waste-water disposal.
 - Additional rules under the state statute set the minimum quality requirements by which surface waters of the state shall be managed.



Downstream of tile outlet.

Tools for Regulating Precipitation Discharges

Rules under Michigan Statute

- Water Quality Standard Rules
 - Allow for field staff to assess agricultural discharges for impacts to physical characteristics of the waterbody.
- Wastewater Discharge Permit Rules
 - Gives the state sufficient authority to issue permits for waste or wastewater discharges under the NPDES program.
 - The CAFO NPDES permit prohibits land application discharges.



Discharge to county drain after rain event.

Precipitation Challenges: Present and Future

Present Challenges

- Maintaining clean storm water areas to ensure they do not become production areas.
- Difficult to assess suitability of land application sites during dry weather or through aerial imagery.
- Production area expansion near surface water.

Future Challenges

- Increasing precipitation compared to years prior.
- Waste reduction in waste storage structures during prolonged precipitation events.
- Farm infrastructure exceeding intended lifespan.



Open air waste storage structure failure.

How is Michigan preparing for future precipitation challenges?

- Continue use of NOAA Atlas 14 climate data when designing and reviewing waste storage structures.
- Limiting CAFO waste application during the months of January, February, and March unless the facility meets additional requirements.
- Requirements for facilities to follow 100' setbacks and implement 35' vegetated buffers.
- Increased focus for compliance staff on conservation practices at CAFO fields.



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