Iowa DNR's Ambient Groundwater Quality Monitoring Program

National Ground Water Monitoring Network – December 2017

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Program Summary

- Original collaboration between USGS and Iowa Geological Survey (IGS) and State Hygienic Laboratory (SHL): 1982 – 2006
- Original random design, stratified by aquifer – modified over time
- Sampling plan varied over the years, with more frequent sampling of vulnerable aquifers/wells
- Additional projects related to private wells, springs, and dedicated monitoring wells
- Data gap from 2007-2011, resumed in 2012, virus and pharm study in 2013
- Groundwater quality monitoring became responsibility of Iowa DNR in 2014 after IGS became part of the University of Iowa
- Parameters include pH, temp, major ions, metals, nutrients, radionuclides, tritium, VOC's, pesticides, pathogens, microbial indicators, and pharmaceuticals
- Most analyses by SHL at the University of Iowa
- Supplemental analyses by USGS laboratories (and others)
- Sample collection by trained IGS, IDNR, SHL, or USGS staff when methods require
- Annual sample collection by municipal water operators for basic analytes (timing has shifted from summer to winter)
- QA/QC: Always 10% duplication by trained staff, plus field blanks

Iowa's Ambient Groundwater Quality Monitoring Goals

1. To characterize the quality of groundwater by aquifer and region

2. To evaluate long-term trends in groundwater quality

3. To assess new or emerging issues of groundwater quality concern

General Plan

- Sample Vulnerable Wells Annually (focus on surface-related contaminants)
- Sample Confined Buried Sands and Bedrock wells every 5 years (focus on natural contaminants)
- Special Projects when resources are available (e.g. Viruses and pharmaceuticals, neonics, isotopes)
- 250 wells sampled since 2002 for >400 analytes

Status of NGWMN Project

PLAN: Link a subset of 137 actively monitored sites (wells) to NGWMN for water quality

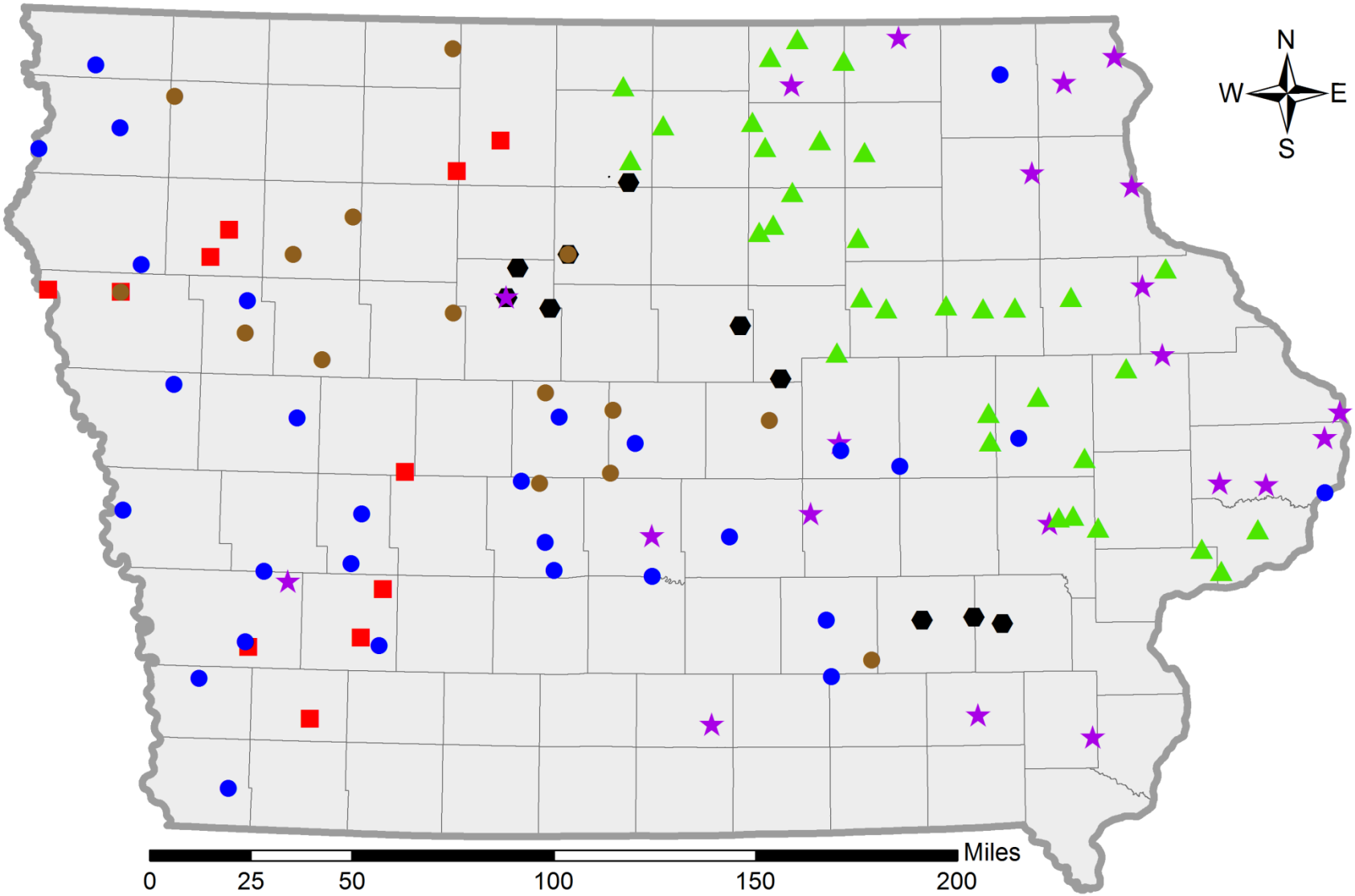
- Task 1: Selected 118 wells (further refinement possible)
- Task 2: Subnetwork classification based on water quality completed. Categories assigned based on planned monitoring frequency. Backbone trend wells monitored pre-2000, annually from 2002-2006, and annually since 2014.
- Task 3: Local and national aquifer codes identified, but some consultation required for mismatched codes. Well construction and lithology will come from IIHR/IGS GEOSAM database. (*Site ID question remains: STORET is preferred to facilitate use of data portal, but also a need to be consistent with IGS, so use of Geosam well ID is preferred. Is use of USGS ID only way to link to NWIS?)*
- Task 4: Plan to begin using Well Registry after January 1 once ID issue is addressed.
- Task 5: Script for transforming most lab data to WQX is available. Jamie Mootz is very familiar with creating webservices, if necessary.

	2017						2018					
Task	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
1 - Site Selection												
2 – Site Classification												
3 – Data elements												
4 – Well Registry												
5 – Database linkage												
6 - Reporting												

Site Selection Criteria

- Monitored multiple times since 2014
- Municipality likely to maintain well in active or standby mode
- Cooperative municipal operator
- Some reduction due to proximity - No more than one well per aquifer per community
- Limited due to density of recommended glacial sites (?)

NGWMN Selected Wells
from Iowa Ambient Groundwater Monitoring Network



Draft Subnetwork Criteria

Documented changes

- Nitrate + nitrite as N > 2 in more than 1 sample
- And/Or Detection of pesticides in more than 1 sample

Suspected changes (at least 2 of the following)

- Nitrate detected, but < 2 mg/L
- Detection of pesticides in 1 sample
- Pharmaceutical detected (USGS method)
- Virus or bacteria by qPCR (Borchardt)
- Microbial indicators detected

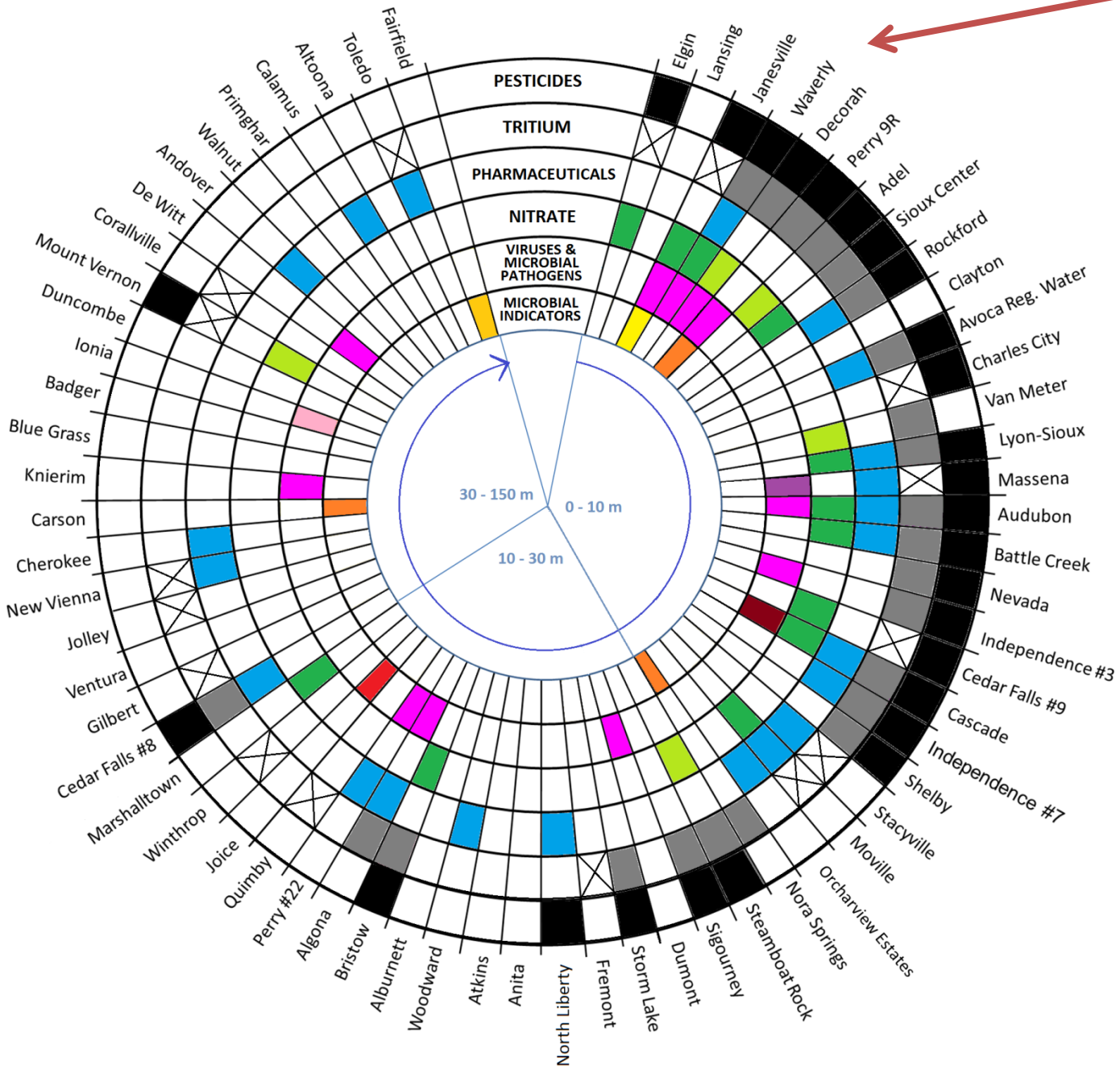
Background conditions

- No nitrate, pesticides, pharmaceuticals, or microbial contaminants detected

Unclassified

- Less than 5 years of data available

From 2013:

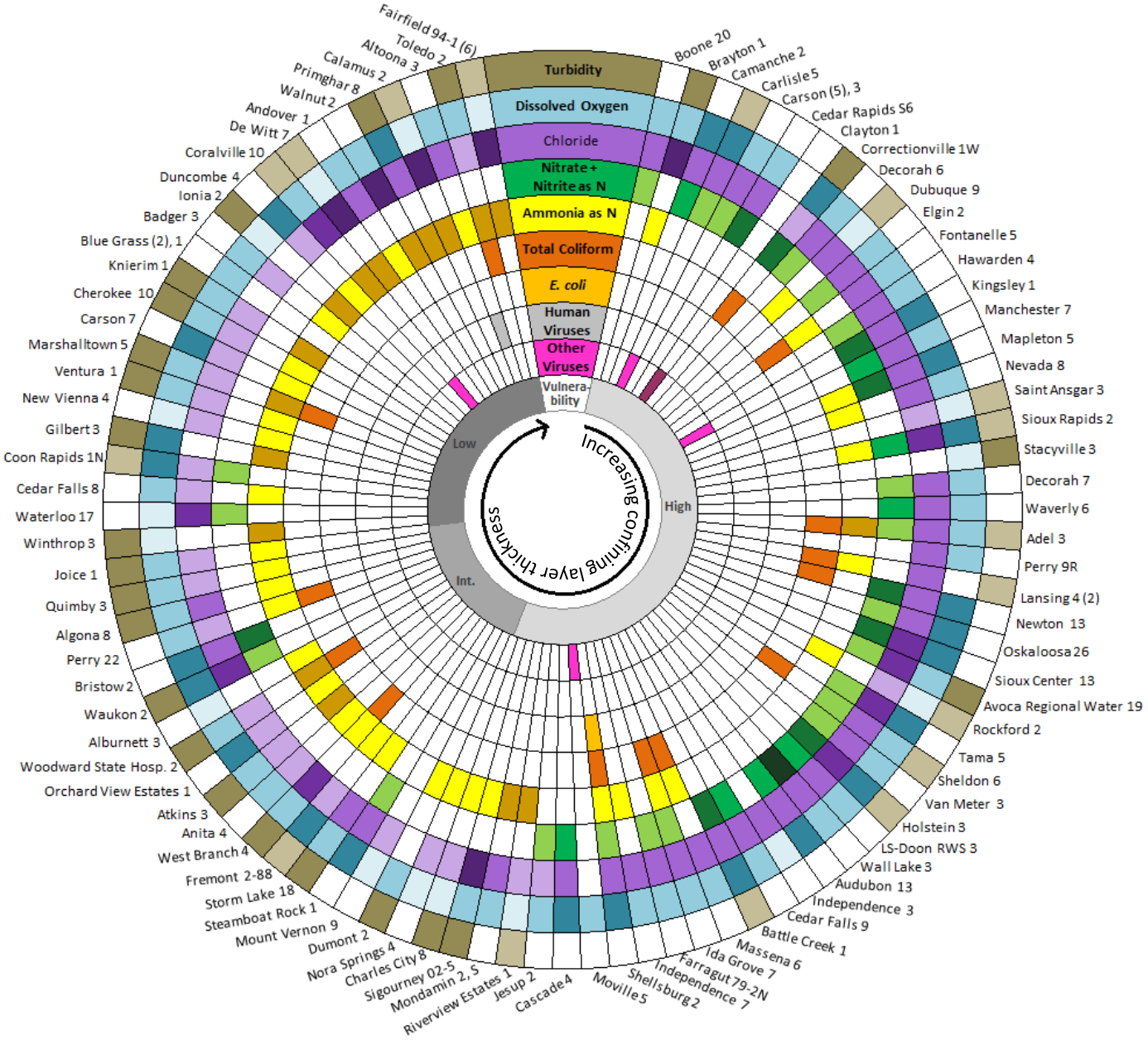


Most Vulnerable
(based on estimated confining layer thickness)

LEGEND

- Pesticide Detected
- Tritium Detected
- No Tritium Analysis
- Pharmaceutical Detected
- Nitrate + Nitrite as N > 2.0 mg/L
- Nitrate + Nitrite as N <= 2.0 mg/L
- Pepper Mild Mottle Virus Det.
- Bovine Polyomavirus Det.
- GII Norovirus Det.
- Human Polyomavirus Det.
- Campylobacter Det.
- Total Coliform Bacteria Det.
- Enterococci Det.
- Male Specific Coliphage Det.

FY2017 Ambient Groundwater Quality Results
in Order of Increasing Confining Layer Thickness (clockwise)



LEGEND

Turbidity
- <1 NTU
- 1 - 4.9 NTU
- 5 - 40 NTU

Dissolved Oxygen
- < 0.1 mg/L
- 0.1 - 0.9 mg/L
- 1 - 4.9 mg/L
- 5 - 10 mg/L

Chloride
- < 1 mg/L
- 1 - 9.9 mg/L
- 10 - 39.9 mg/L
- 40 - 99.9 mg/L
- >100 mg/L

Nitrate + Nitrite as N
- < 0.1 mg/L
- 0.1 - 4.9 mg/L
- 5 - 9.9 mg/L
- 10 - 39.9 mg/L
- 40 mg/L

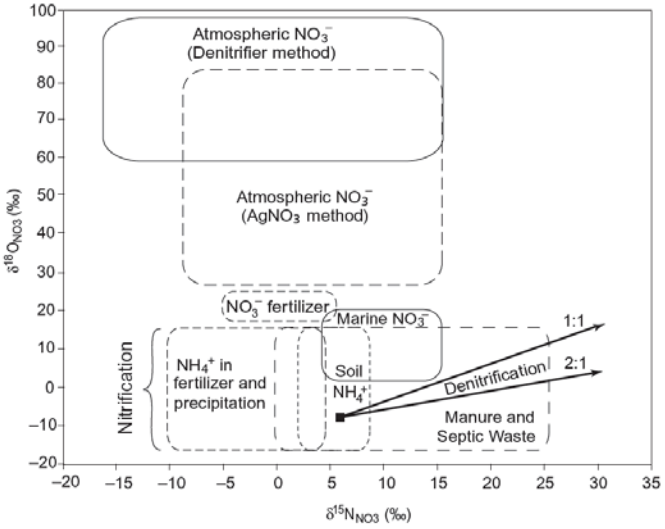
Ammonia as N
- < 0.05 mg/L
- 0.05 - 1.0 mg/L
- >1.0 mg/L

Indicator Bacteria
- Total Coliform Detected
- *E. coli* Detected

Viruses by qPCR
- Human Adenovirus C,D,E
- Pepper Mild Mottle Virus
- Bovine Polyomivirus

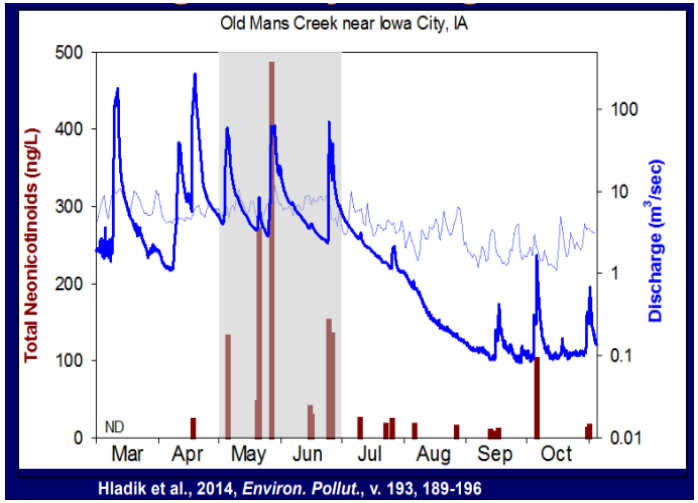
Coming Soon in FY2018:

- N^{15} – O^{18} isotopic analyses for vulnerable wells with nitrate

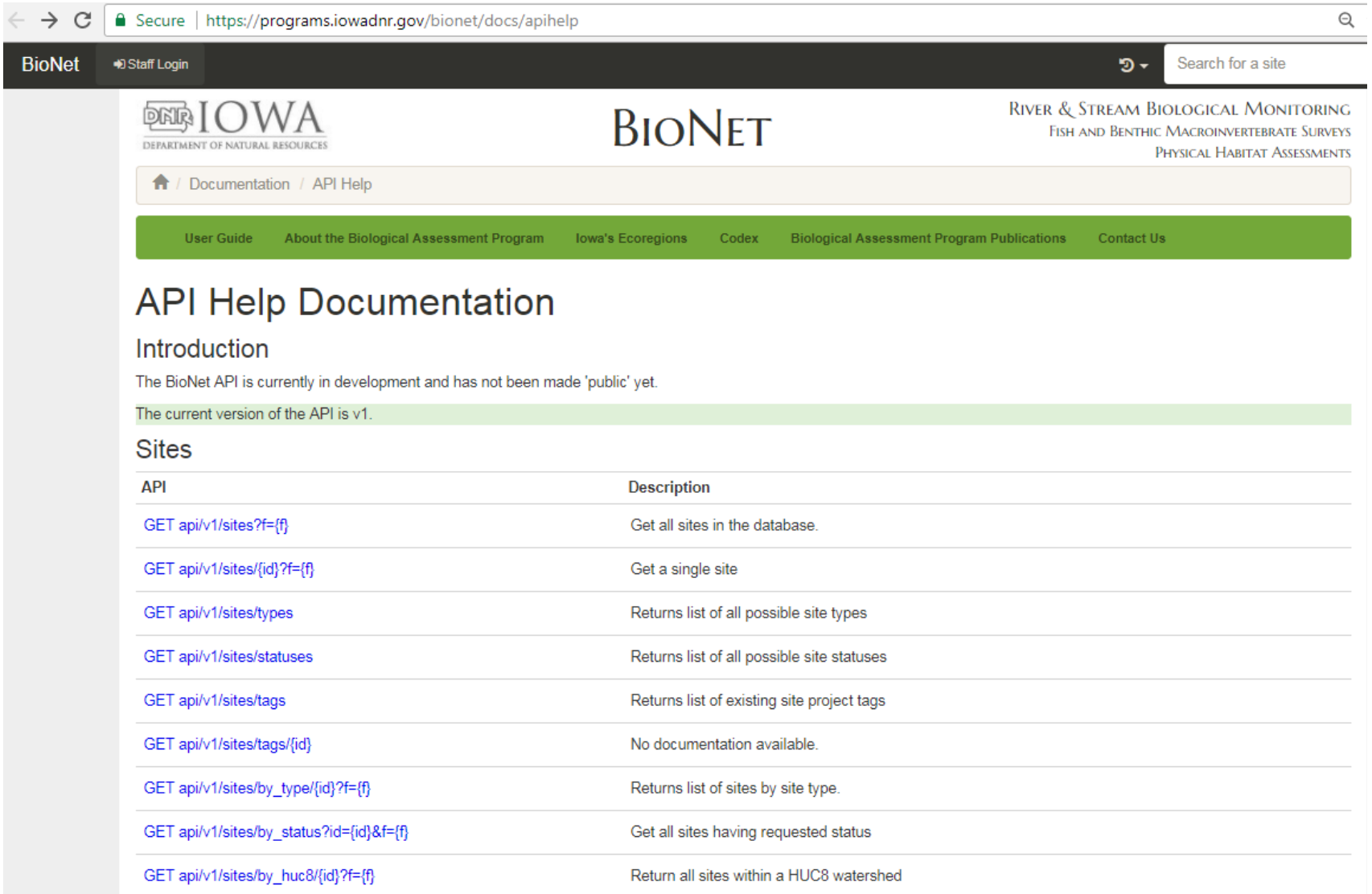


- Po-210, Pb-210, U-235, U-238, Ra-226, gross Alpha, and gross Beta in buried sands and bedrock wells

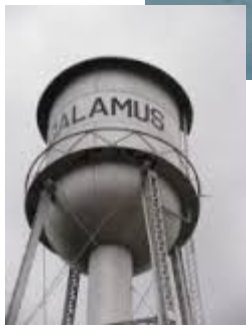
- 3 sets of samples (Oct-Dec, April-June, July -August) for neonicotinoids in vulnerable wells



Examples of web service development



Questions?



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