Groundwater Management in Wisconsin: Current Status & Gaps

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Wisconsin DNR
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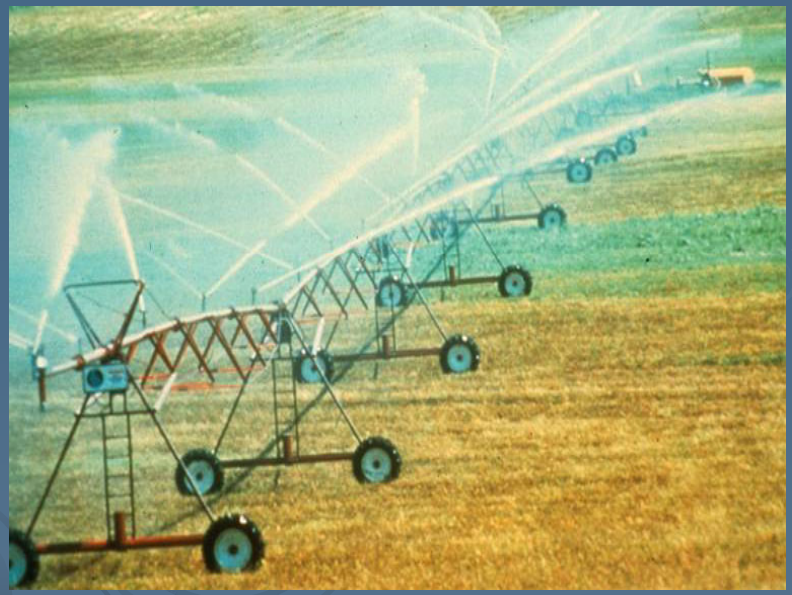


High Capacity Wells

- Wells, individually or collectively, that can pump > 100,000 gpd (70 gpm) from a single property

- Used for irrigation, livestock, manufacturing, aquaculture, mining, beverage bottling, homes, and public water supply

Groundwater Law in WI

- Reasonable Use
  - 1974 - State vs. Michels Pipeline Const., Inc.
  - A landowner is allowed to withdraw groundwater in any amount, provided it:
    - Is for a “beneficial use”
    - Does not cause unreasonable harm to another landowner
    - Does not cause direct and substantial effect on a stream or lake

- ss. 281.34, 281.346 – high capacity well approval and water use permitting in Great Lakes Basin

Applicable Regulatory Authorities

- Ch. NR 820
  - Siting and Environmental impacts of High Capacity Wells
- Ch. NR 812
  - Well Construction, Pump Installation
- Ch. NR 856
  - Water Withdrawal Registration and Reporting
- Ch. NR 860
  - Water Use Permitting (Great Lakes Basin)

Background

- High Capacity Well Review prior to 2004
  - Meet well construction criteria of Ch. NR 812
  - Not adversely impact or reduce the supply of water to any public water utility
- 2004 Groundwater Quantity Law
  - Added environmental review criteria to approval process

Groundwater Quantity Law
(2003 Wisconsin Act 310, NR 820)

- Environmental review if:
  - Water loss greater than 95%
  - In a *groundwater protection area*
    - areas within 1,200 feet of
      - Class 1, 2 or 3 Trout Streams or
      - designated Outstanding or Exceptional Resource Waters

  - Result in significant impacts to a spring with normal flow greater than 1 cfs flow

The “Lake Beulah” Decision

- Wisconsin Supreme Court Decision
  Lake Beulah Management District v. State, 2011 WI 54, 335 Wis.2d 47, 799 N.W.2d 73

- (Decided July 6, 2011)

Key Issue

- Extent of DNR's authority to consider environmental impacts from proposed high capacity well
- Village's Position: Limited to specific high capacity well statutes
- Conservancies' Position: DNR has an obligation to protect State waters that goes beyond high cap well statutes

Lake Beulah Management District v. DNR, WI 54 (2011) Wis. Supreme Court

- The Court concluded that “the DNR has the authority and a general duty to consider whether a proposed high capacity well may harm waters of the state”
- Further, the Court held that “to comply with this general duty, the DNR must consider the environmental impact of a proposed high capacity well when presented with sufficient concrete, scientific evidence of potential harm to waters of the state.”

Statutory Definition
“Waters of the State”

"Waters of the state" includes those portions of Lake Michigan and Lake Superior within the boundaries of this state, and all **lakes**, bays, **rivers**, **streams**, **springs**, **ponds**, **wells**, impounding reservoirs, **marshes**, watercourses, drainage systems and other **surface water or groundwater**, natural or artificial, public or private, within this state or its jurisdiction.

Implications of Lake Beulah Decision

- Consideration of impacts on “waters of the state”
  - Expanded review of surface waters
    - Outside of GPA (>1,200’ from trout stream, ORW, ERW)
    - Non-GPA waters – all streams, lakes, ponds
    - Wetlands
    - Springs < 1cfs (0.25 cfs)
  - Private well screening
- Outside interested parties may compel review by submitting concrete, scientific evidence of potential harm
- Avoid significant adverse environmental impact
- Does not address areas of cumulative impacts

Significant Adverse Impact (NR 820)

- **“Significant adverse environmental impact” means** alteration of groundwater levels, groundwater discharge, surface water levels, surface water discharge, groundwater temperature, surface water temperature, groundwater chemistry, surface water chemistry, or other factors to the extent such **alterations cause significant degradation of environmental quality** including biological and ecological aspects of the affected water resource.
- **Case-by-case**
- **Qualitative**
- **Professional judgment with accepted analytical methods**

Environmental Review in Practice

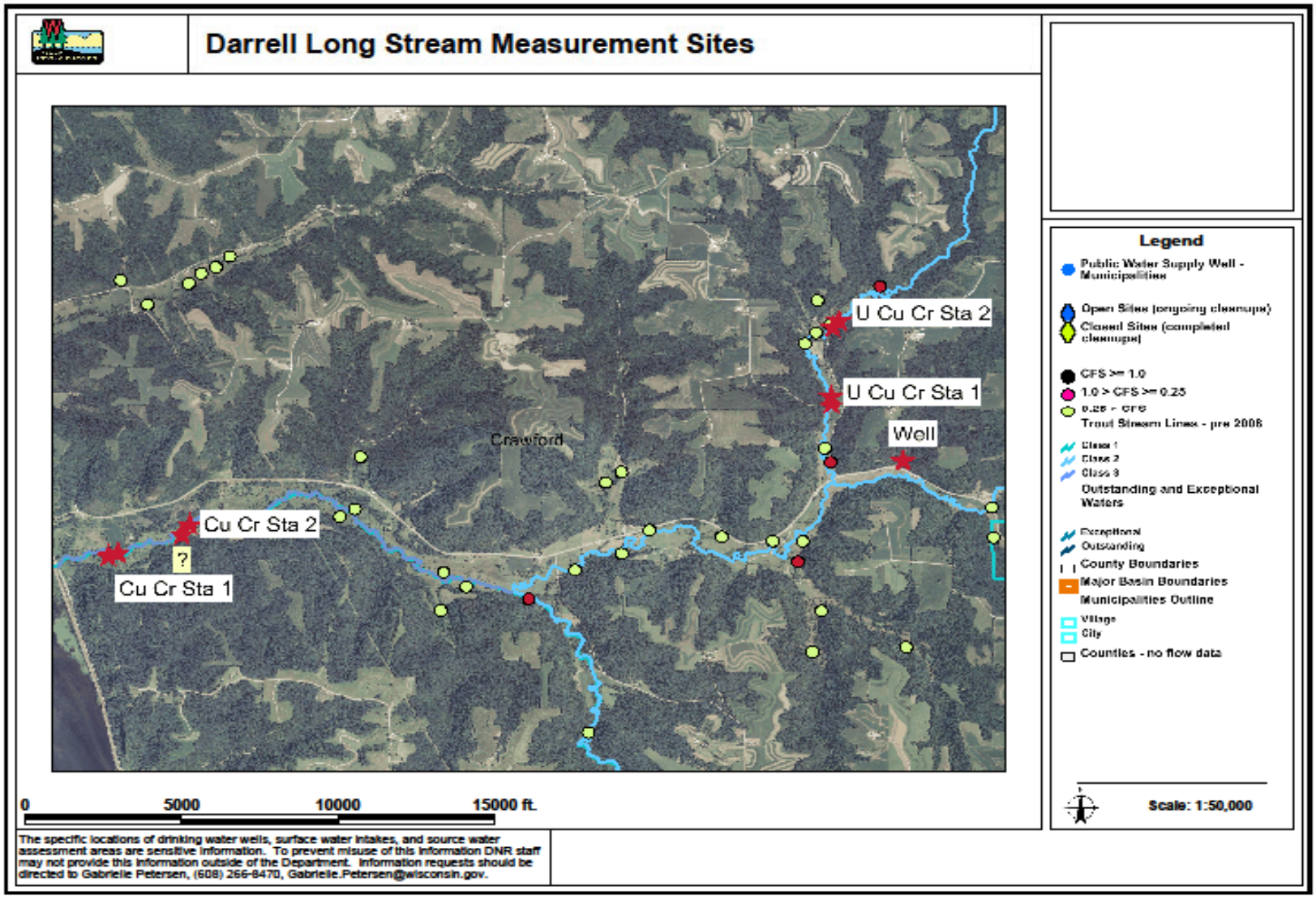
- Continue using Groundwater Quantity Protection Rules (NR 820) – Wells in GPAs
  - Trout Streams , ORWs, ERW's
  - Springs >1 cfs
  - Water loss > 2 million gallons/day
  - Screening criteria determine potential for adverse impact and need for Environmental Assessment
- Use same assessment tools:
  - outside of GPA's,
  - for other streams, lakes and wetlands
  - for springs with flow >0.25 cfs (within 2 miles)

Environmental Review in Practice

- Impacts to Public utility wells
  - Avoid drawdown of 10 ft or greater
- Private wells
  - Screen for private wells within 1000 ft
  - Additional review if projected drawdown at private well is >5 ft

Typical Assessment Tools

- Internal web viewer – Surface Water Features
- Jenkins-Walton Stream Flow Depletion Spreadsheet Model
- Theis and Jacob Drawdown Models
- Wisconsin Stream Flow and Habitat Model
- Fishery Staff survey notes and discharge measurements
- Well Construction Reports – WGNHS Well Logs
- Available Geology/Hydrogeology Information
- Michigan table for allowable stream flow reduction
- Wisconsin Wetland Inventory, Natural Heritage Inventory
- Site visits w/ other DNR staff


Darrell Long Stream Measurement Sites
U Cu Cr Sta 2
U Cu Cr Sta 1
Well
Crawford
Cu Cr Sta 2
?
Cu Cr Sta 1
0
5000
10000
15000 ft.
Legend
Public Water Supply Well - Municipalities
Open Sites (ongoing cleanups)
Closed Sites (completed cleanups)
CFS >= 1.0
1.0 > CFS >= 0.25
0.25 > CFS
Trout Stream Lines - pre 2008
Class 1
Class 2
Class 3
Outstanding and Exceptional Waters
Exceptional
Outstanding
County Boundaries
Major Basin Boundaries
Municipalities Outline
Village
City
Counties - no flow data
Scale: 1:50,000
The specific locations of drinking water wells, surface water intakes, and source water assessment areas are sensitive information. To prevent misuse of this information DNR staff may not provide this information outside of the Department. Information requests should be directed to Gabrielle Petersen, (608) 266-8470, Gabrielle.Petersen@wisconsin.gov.

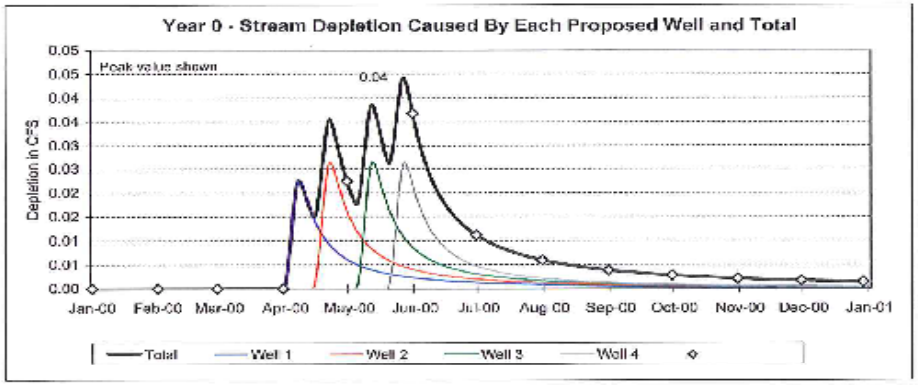
Estimate of Stream Depletion Caused By Up to Four Proposed High Capacity Wells Near a Linear Stream

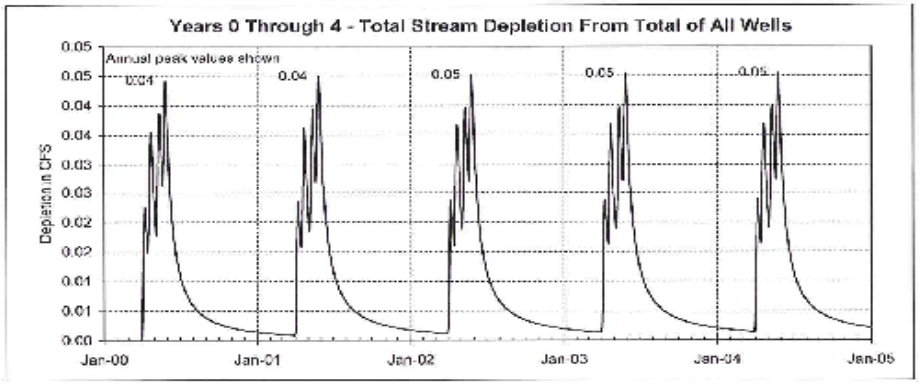
Spreadsheet Template by George Mickelson, WDNR, Version 1.6

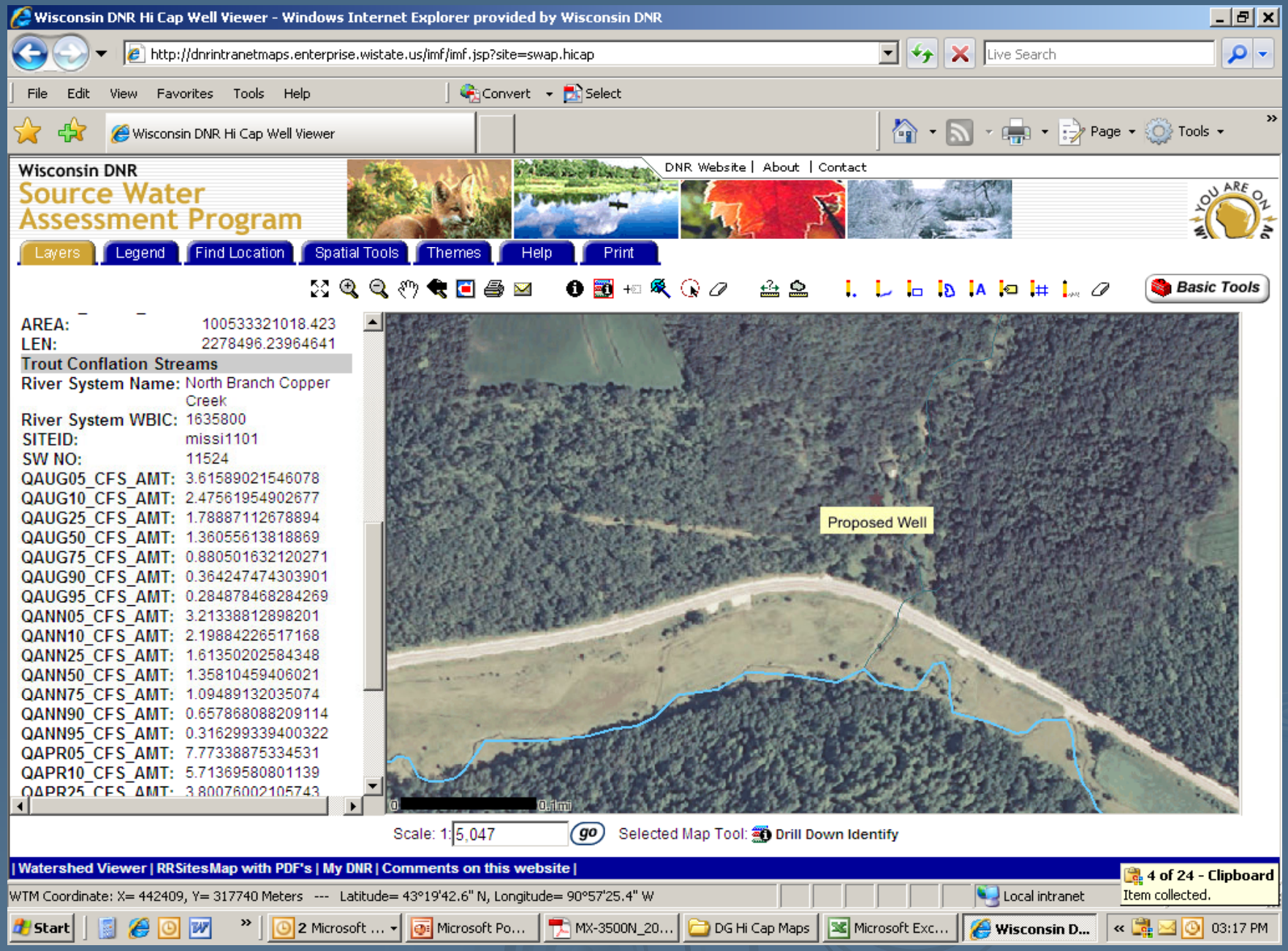
Project Name =	0			
Date and Time of Analysis =	25-Oct-11	8:20 AM		
Input Aquifer Parameters				
Transmissivity =	1,650	ft^2/day or	12,342	gpd/ft
Storage or Specific Yield =	0.20000	unitless or	2.00E-01	

Input Well Data	Well 1	Well 2	Well 3	Well 4
Distance to Stream (feet) =	500	500	500	500
Pumping Rate (gpm) =	70	70	70	70
First Day of Annual Pumping =	1-Apr	15-Apr	5-May	20-May
Last Day of Annual Pumping =	5-Apr	20-Apr	10-May	25-May

The first year is year zero, not year one due to the way that Excel quantifies dates in the formulae that are used.






Wisconsin DNR Hi Cap Well Viewer - Windows Internet Explorer provided by Wisconsin DNR
http://dnrintranetmaps.enterprise.wistate.us/imf/imf.jsp?site=swap.hicap
Live Search
File Edit View Favorites Tools Help
Convert
Select
Wisconsin DNR Hi Cap Well Viewer
Page
Tools
Wisconsin DNR
Source Water Assessment Program
DNR Website | About | Contact
Layers
Legend
Find Location
Spatial Tools
Themes
Help
Print
Basic Tools
AREA: 100533321018.423
LEN: 2278496.23964641
Trout Conflation Streams
River System Name: North Branch Copper Creek
River System WBIC: 1635800
SITEID: missi1101
SW NO: 11524
QAUG05_CFS_AMT: 3.61589021546078
QAUG10_CFS_AMT: 2.47561954902677
QAUG25_CFS_AMT: 1.78887112678894
QAUG50_CFS_AMT: 1.36055613818869
QAUG75_CFS_AMT: 0.880501632120271
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QANN95_CFS_AMT: 0.316299339400322
QAPR05_CFS_AMT: 7.77338875334531
QAPR10_CFS_AMT: 5.71369580801139
Proposed Well
0 0.1mi
Scale: 1:5,047
go
Selected Map Tool: Drill Down Identify
| Watershed Viewer | RRSitesMap with PDF's | My DNR | Comments on this website |
WTM Coordinate: X= 442409, Y= 317740 Meters --- Latitude= 43°19'42.6" N, Longitude= 90°57'25.4" W
Local intranet
4 of 24 - Clipboard
Item collected.
Start
2 Microsoft ...
Microsoft Po...
MX-3500N_20...
DG Hi Cap Maps
Microsoft Exc...
Wisconsin D...
03:17 PM

Michigan stream flow reduction guidance (MI DEQ)

Allowable Percentage Reduction in Index Flow.

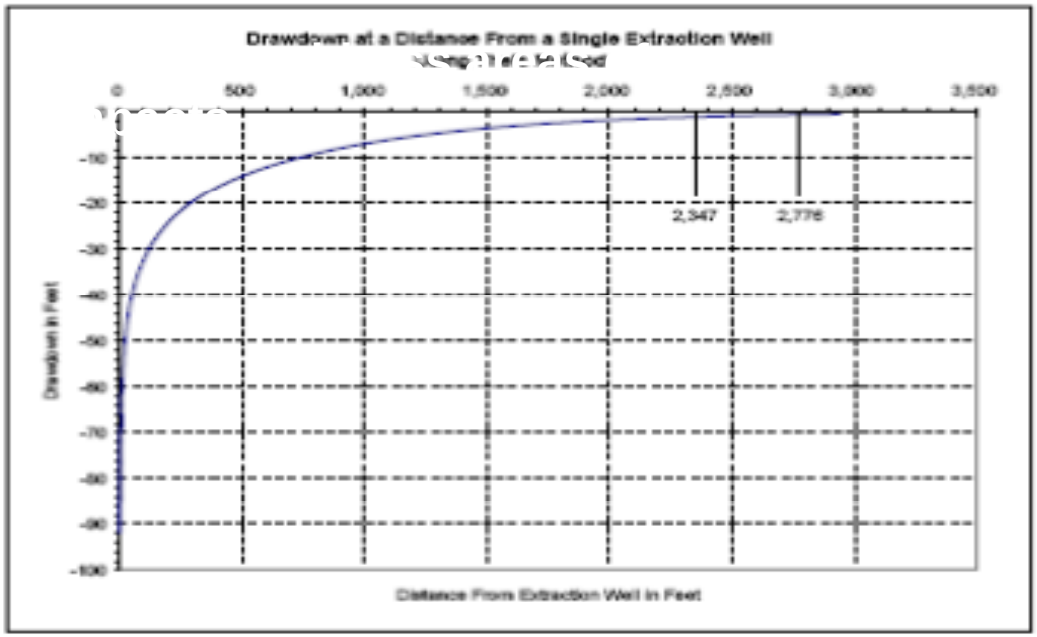
		Zone A	Zone B	Zone C	Zone D (ARI)
Cold River Systems	Streams	Less than 14%	None	14% to less than 20%	20% or more
	Small Rivers	Less than 10.5%		10.5% to less than 21%	21% or more
Cold Transitional River Systems	Streams	None	Less than 4%	None	4% or more
	Small Rivers		Less than 2%		2% or more
	Large Rivers		Less than 3%		3% or more
Cool River Systems	Streams	Less than 6%	6% to less than15%	15% to less than 25%	25% or more
	Small Rivers	Less than 15%	15% to less than 19%	19% to less than 25%	25% or more
	Large Rivers	Less than 14%	14% to less than 19%	19% to less than 25%	25% or more
Warm River Systems	Streams	Less than 10%	10% to less than 18%	18% to less than 24%	24% or more
	Small Rivers	Less than 8%	8% to less than 13%	13% to less than 17%	17% or more
	Large Rivers	Less than 10%	10% to less than 16%	16% to less than 22%	22% or more

Transient Drawdown Analysis for Evaluating Cone of Depression to Determine Distance to 0.5 and 1.0 Feet of Drawdown From a Single Extraction Well Using Theis

Spreadsheet Template by George Mickelson, WDNR, Version 2.9

Project Name =	Example of Spreadsheet for Estimating Cone of Depression		
Date and Time of Analysis =	27-Jun-08	8:04 AM	
Transmissivity =	2,700.00	feet^2/day or	20,196.00 gpd/ft
Pumping Rate =	1,000.00	gpm	
Extraction Well Diameter =	12.00	inches	
Time of Pumping =	90.00	days	
Storage Coefficient =	0.2000000	unitless or	2.00E-01
Distance Modeled =	2,940	feet	
Distance to 1.0 feet of depression =	2,347		
Distance to 0.5 feet of depression =	2,776		
Drawdown in Extraction Well =	91.96	feet using Theis	
Predicted Specific Capacity =	10.88	gpm / foot of drawdown	

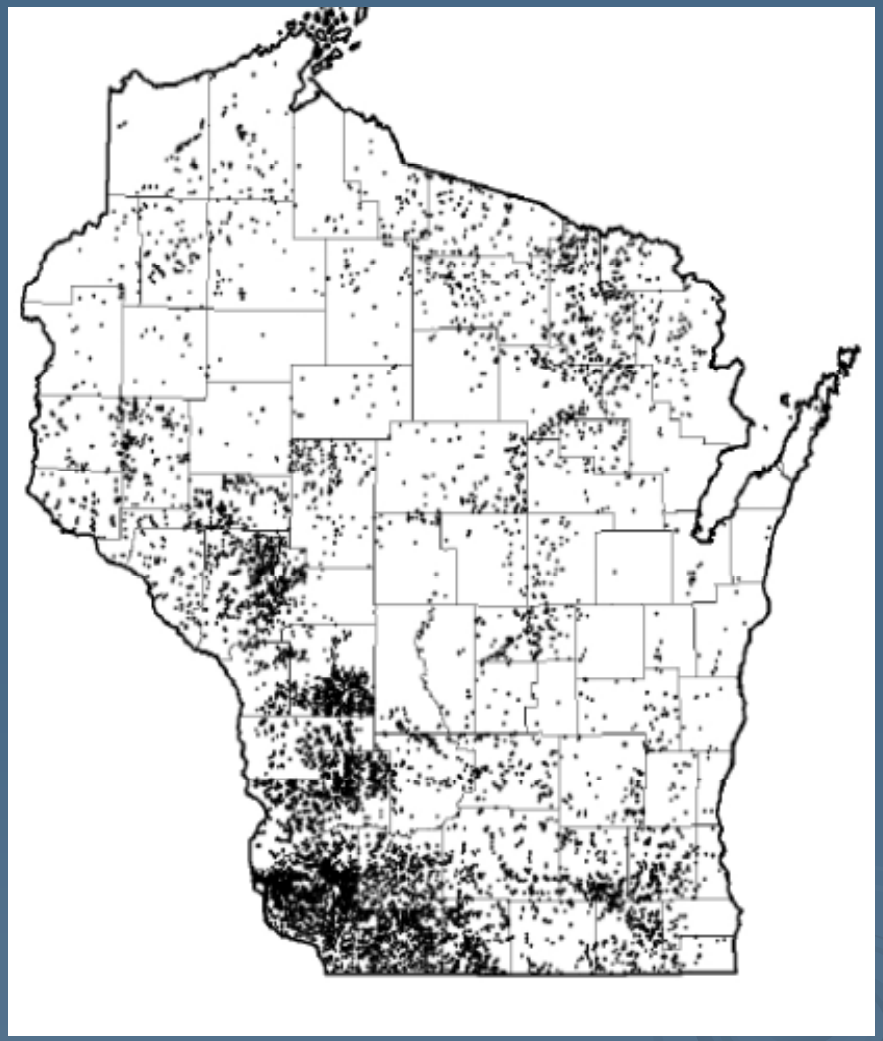
Note: Estimated drawdown in extraction well assumes a 100 percent efficient fully penetrating well.
Note: Estimated storage coefficient was entered.

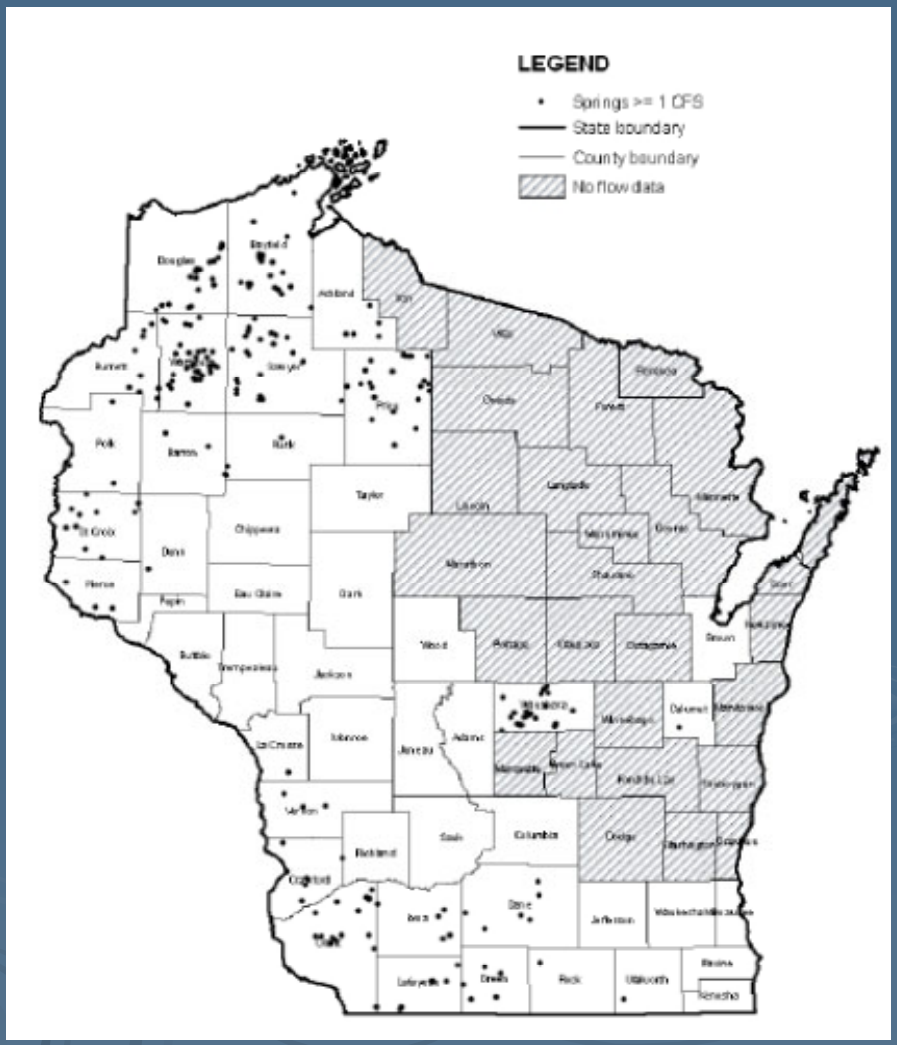


Springs Information

- DNR field staff knowledge
- USGS topographic maps
- County projects
- Wis. Wildlife Federation Springs Inventory (WGNHS Open File Report 2007-03)
  - Compilation of historic (1920s – 1970s) records and recent research on nearly 11,000 springs
  - Inventory and GIS database
  - Limited field verification

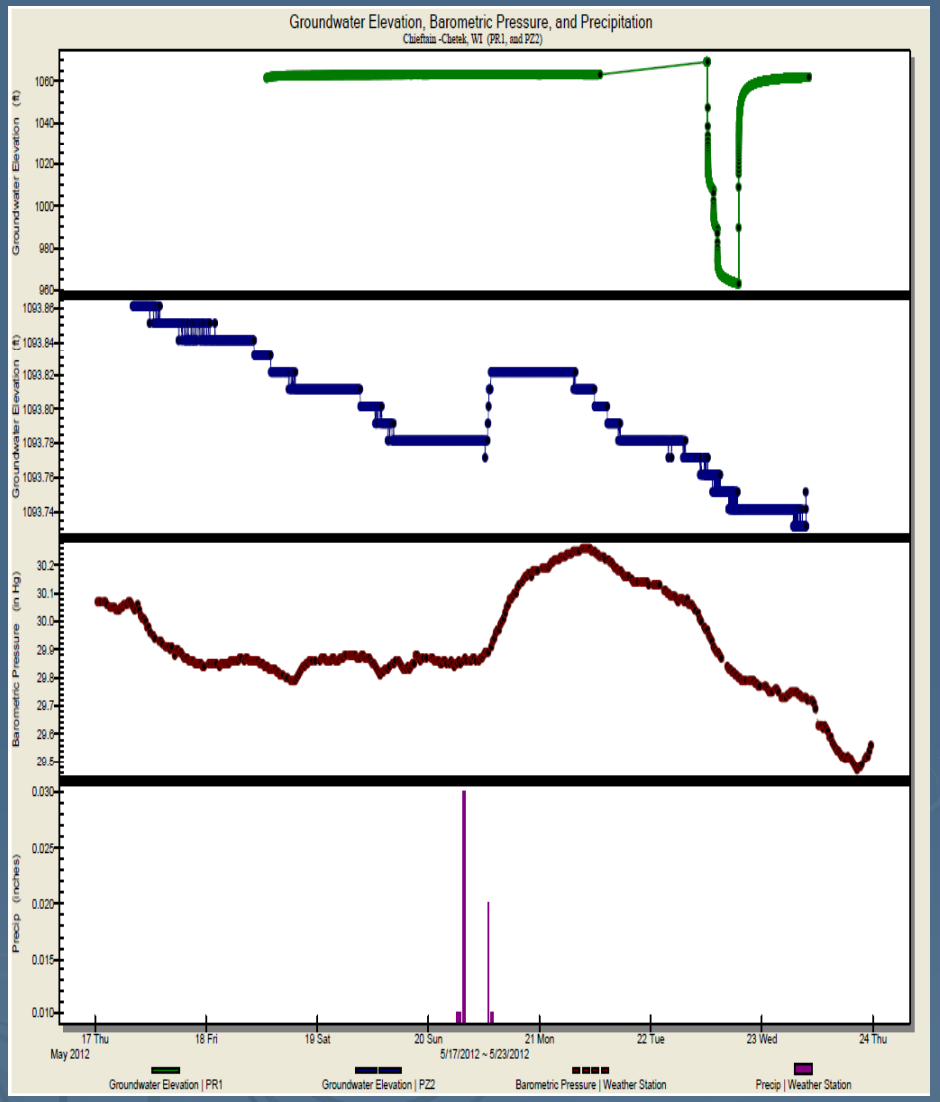
WWF Springs Inventory





Additional Tools

- WGNHS
  - WiscLITH
  - hydrogeologic data viewer
- Pumping tests
- GFLOW models
- ModFlow Models



Approval Conditions

- Must prevent significant adverse environmental impact
  - Specify minimum distance to protected resource
  - Maximum allowable daily water withdrawal
  - Reduction in pumping at certain times of year
  - Pumping schedule restrictions – e.g. every other day, monthly limits
  - Reduce pumping from other wells on property
  - Well construction details – deepen, casing into separate aquifer
  - Monitoring of groundwater and surface water resources
  - Pumpage Reporting – continuous with telemetric access
  - Reopen approval based on future information

Cumulative Impacts

- “Lake Beulah” decision applies to direct impacts of the proposed well and other wells on the same property
- Does not address impacts of the proposed well cumulatively with other water withdrawals in the area

Questions

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