Allegan County Water Study Workgroup

Meeting Minutes

Wednesday, February 15 2:00 pm

Member Name	Group	Attendance	Notes
Dean Kapenga	County Commission	In Person	
Chad Kraai	Well Driller	Absent	
Brian Talsma	Conservation District	Zoom	
Doug Sweeris	Municipal Water Supply	In Person	
Erick Elgin	Academic	Zoom	
Jay Drozd	Agriculture	Absent	
John "Ric" Curtis	Community	In Person	
John Shagonaby	Tribal	Absent	
Tom Kunetz	Community	In Person	
Zachary Curtis	Consultant	Zoom	

Guests and staff: In Person: Randy Rapp, Jill Dunham, Jaclyn Hulst
Zoom: Scott Jones and Dan Wedge

Next meeting: Wednesday, March 1, 2023

I. Approval of Agenda

A. Agenda approved

II. Action Items from previous meeting

A. Erick Elgin - a list of water conservation groups around the state. Update of list in process, but not complete
B. Tom and Jill working on the RFP with Valdis – in process, next meeting with Valdis 2/23
C. Zach – Research definition of LUST; size? What determined it was leaky? Not complete
D. Randy – How did EGLE select the 7-9 sites that ACHD has to test out of 300+ contamination sites? Has reached out to EGLE – no resolution yet.
E. Zach will provide shape file and excel list of the approx. 300 contamination sites. Shape file provided to Randy; still need to provide the excel list.

III. Discussion

A. Phase 2 Groundwater Study Risk Ranking (Z. Curtis)
   1. Zach reviewed the attached presentation

B. Monitoring Wells Siting Criteria (Kunetz)
   1. Tom shared requirements for identifying sites for monitoring wells
      a) Hydrogeologic Considerations – Zach will recommend 5-10 locations
         i. Area of recharge
         ii. Area of discharge
         iii. Area of consistent water table elevation – soil
         iv. Upgradient at county's boundary
      b) Activity Considerations
         i. Near area of significant withdrawal
            - Municipal well-heads
            - Irrigation
            - Large commercial
         ii. Near area of no significant withdrawal
         iii. Where increased water demand expected – future development areas
      c) Water Quality Considerations
         i. Downgradient of potential contamination plume
         ii. Upgradient of potential contamination plume
         iii. Wellhead area of large municipal withdrawal
   2. Primary criteria will come from Zach as to the target areas for the monitoring wells; water level will be priority to be analyzed over time; utilize municipal wells for water quality testing and add locations as contamination sources dictate.
   3. Once target areas are provided by Zach, the work group members will be asked to look for land/parcels where wells could be strategically placed.

IV. Future Work Group meeting schedule (Kunetz)

NOTE: All future meetings of the Water Study Workgroup will be held in the County Services Building Board Room (where the Board of Commissioners meets.

Mar 1	Review Risk Ranking results from Hydrosimulatics; Monitoring well locations; Review RFP	
Mar 15	Final comments to Hydrosimulatics on Phase 2	
Spring 2023	Review proposals for Water Supply Master Plan and Public Communication	
Summer 2023	Participate in information gathering sessions with the Water Supply Master Plan and the Public Communications RFP	

V. Action Items

A. Randy – contact EGLE to find out if our Municipalities have transducers (static water level indicators) on their wells.
B. Zach suggested 5-10 monitoring wells, based on Hydrogeologic considerations. He will have a few to suggest for the March 1 meeting.

Meeting adjourned 3:55 pm

Allegan County Groundwater Work Group

Meeting, 2/15/23

Allegan County Groundwater Study - Phase 2 Updates

By Zachary Curtis,
Hydrosimulatics INC.

Outline

- Tasks completed since last meeting,
  perspectives on achievements
- Risk Ranking Analysis (Site Scoring System)
  - General Approach – Metrics and scoring
  - Composite Score
  - Examples
  - Feedback from Work Group
    - Metrics and scoring, weightings
- Next Steps

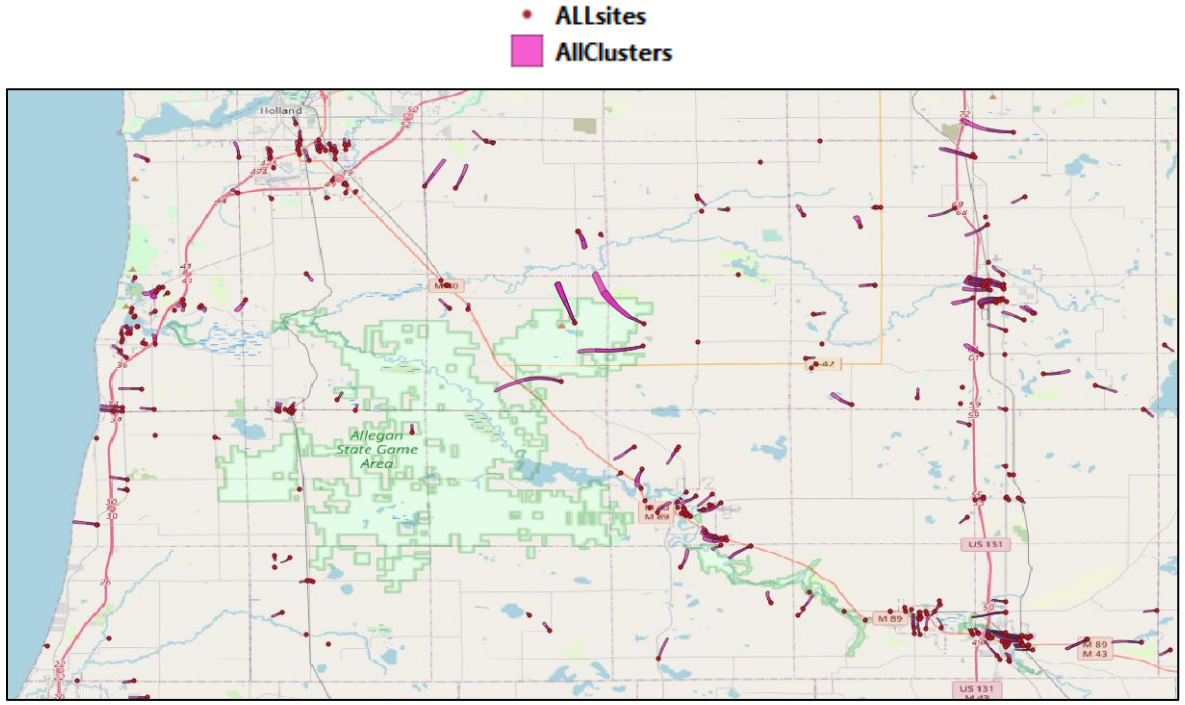
Tasks Completed Since Last Meeting

- Impact Areas (all sites) -> documentation, GIS files sent to Allegan County
  - Very large “graphical” PDF (overview of methods, GW models, Impact area maps and interpretation)
  - GIS Shapefiles (2yr, 10yr, 20yr impact areas for all sites*)
- Aquifer Vulnerability analysis -> documentation sent to Allegan County
- New WHPA delineation -> documentation completed, will send with final Project Report and Recommendations

*where applicable… some sites have “plumes” that intercept surface water before 20yr of estimated travel time

Perspectives on achievements

- Hundreds of sites analyzed with process-based model, calibrated to regional SWL data
  - Unheard of, not possible with traditional approaches…
- Still, spent significant time and effort spent, even with data-enabled modeling system…
  - Iteration in modeling, particle tracking, integrated analysis (not always linear)
- Combined layer overlays provide significant value for decision-support



Risk Ranking Analysis

Development of a “Scoring System” to rank / prioritize Allegan’s Sites of Environmental Concern

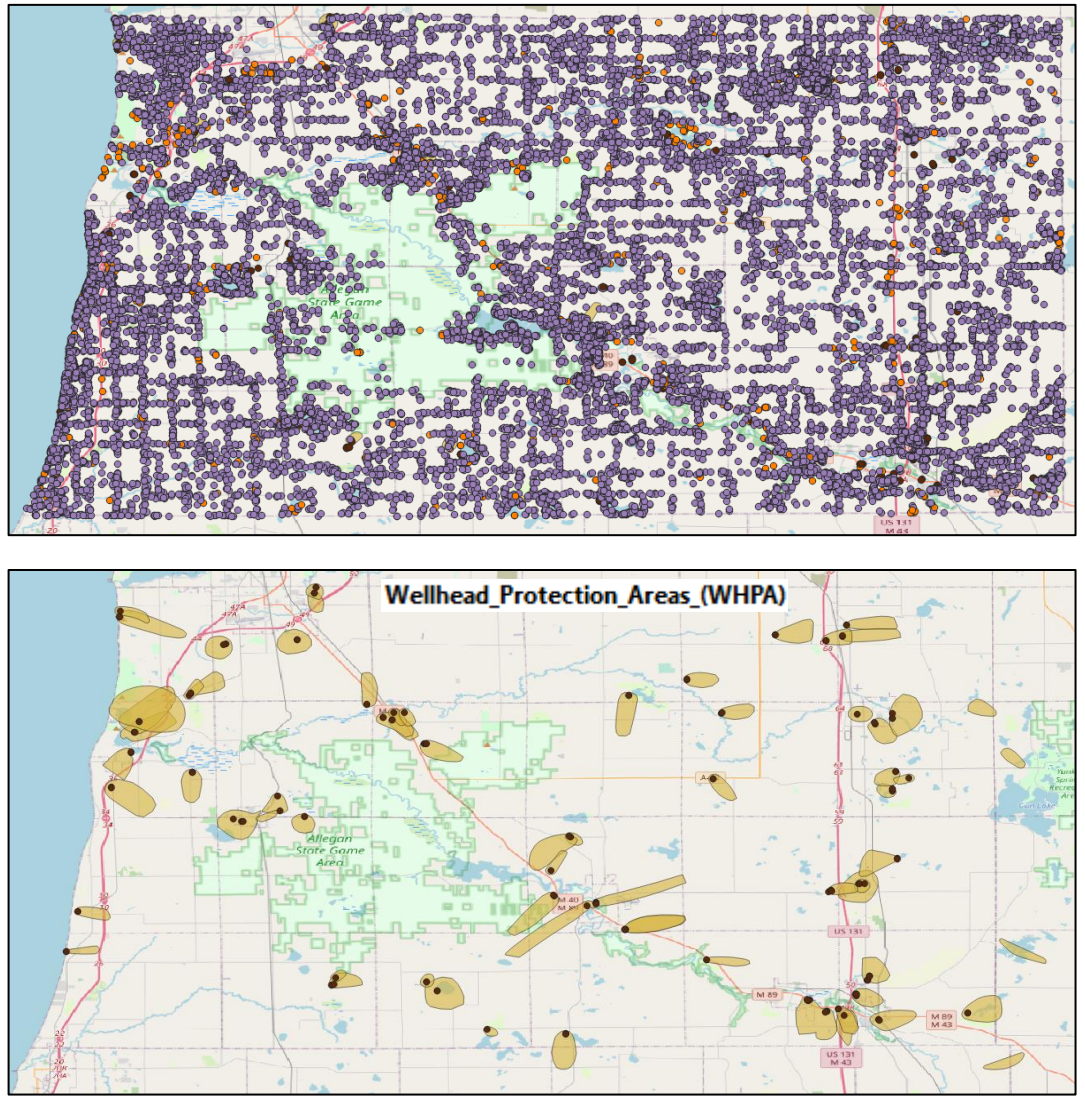
4 Major Metrics

- Impact areas in relation to drinking water wells
- Impact areas in relation to wells for other purposes
- Impact areas in relation to surface water bodies
- Aquifer vulnerability at the site

We will rank sites based on each metric, and then combine into a composite ranking using a weighted average

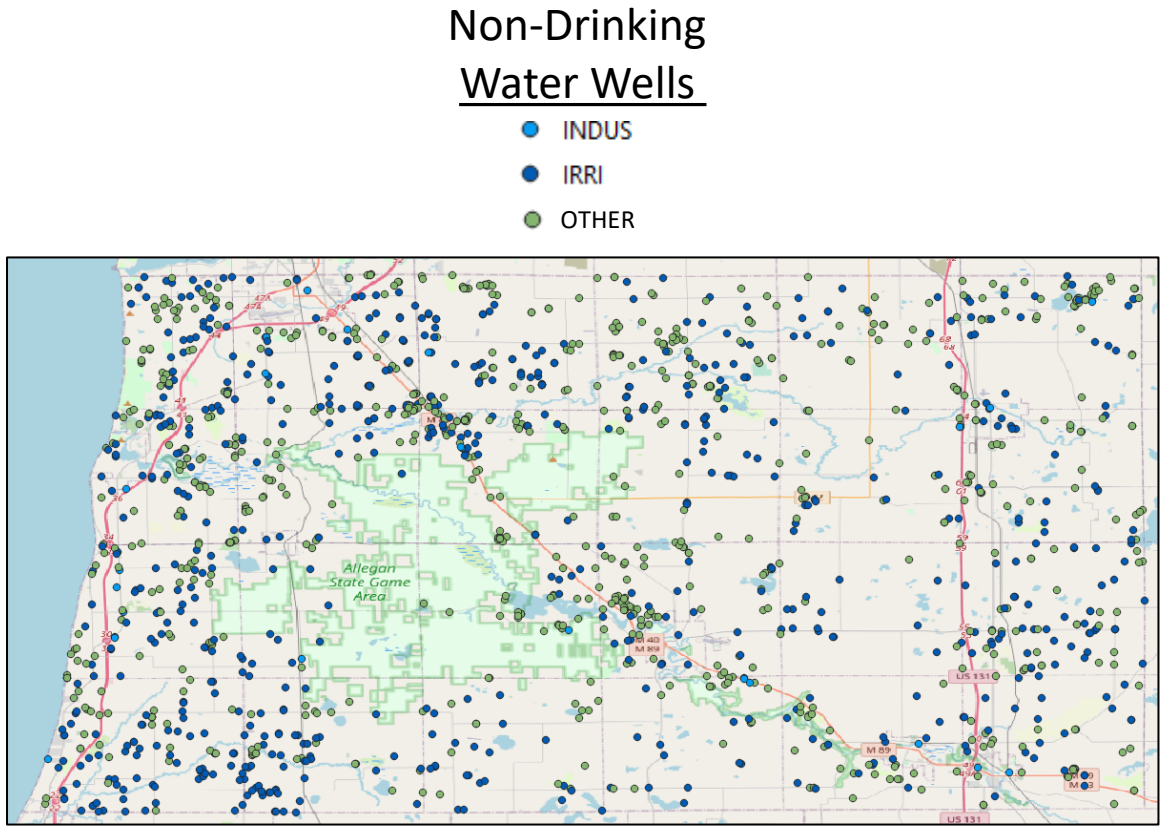
Impact Areas in Relation to Drinking Water Wells

- Receptors / layers of interest:
  - Type 1 Wells and their WHPAs
  - Type 2 or Type 2 PS wells
  - Private household wells
- Total Score out of 100
  - 100/100 represents highest risk
  - 0/100 represents no risk
- What leads to higher scores?
  - Private wells or Public wells within or near impact areas
    - Higher score if wells is directly within an impact area
    - higher score if within/close to for 2yr vs. 10 yr. or 20yr. Impact areas
    - Higher score when relatively large number of private wells and/or at least one community wells
  - Impact areas overlap / are within WHPA
    - Higher Score if impact areas are completely contained in WHPA



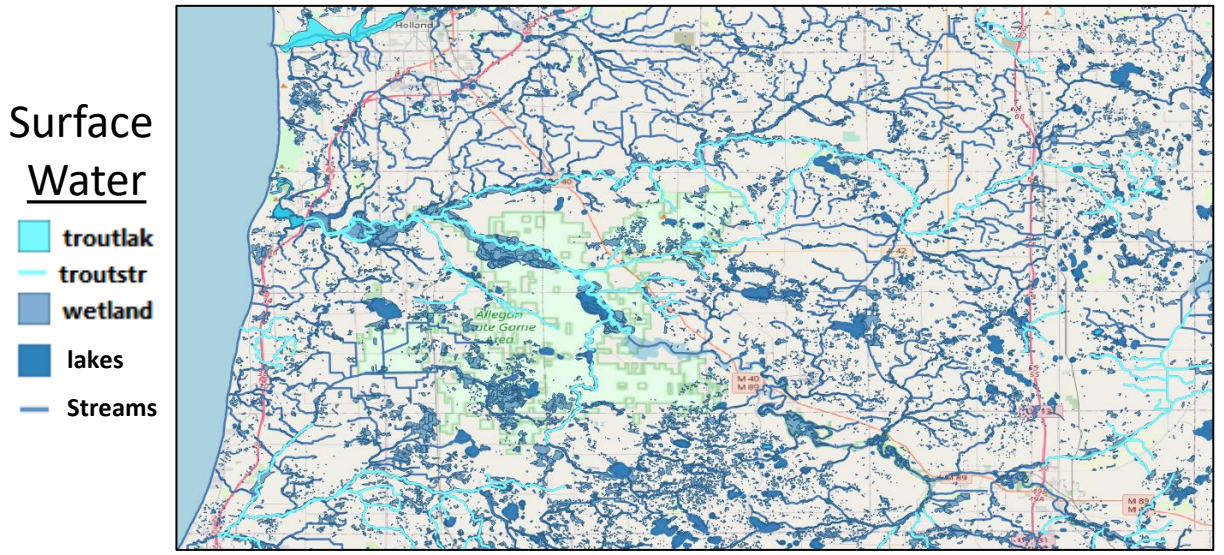
Impact areas in Relation to Wells for Other Purposes

- Receptors / layers of interest:
  - Irrigation Wells
  - Industrial wells
  - Other wells (including, e.g., those used in power generation)
- Total Score out of 100
  - 100/100 represents highest risk
  - 0/100 represents no risk
- What leads to higher scores?
  - Non-drinking wells within or near impact areas
    - Higher score if wells is directly within an impact area
    - higher score if within/close to for 2yr vs. 10 yr. or 20yr. Impact areas
    - Higher score when relatively large number of high-capacity wells



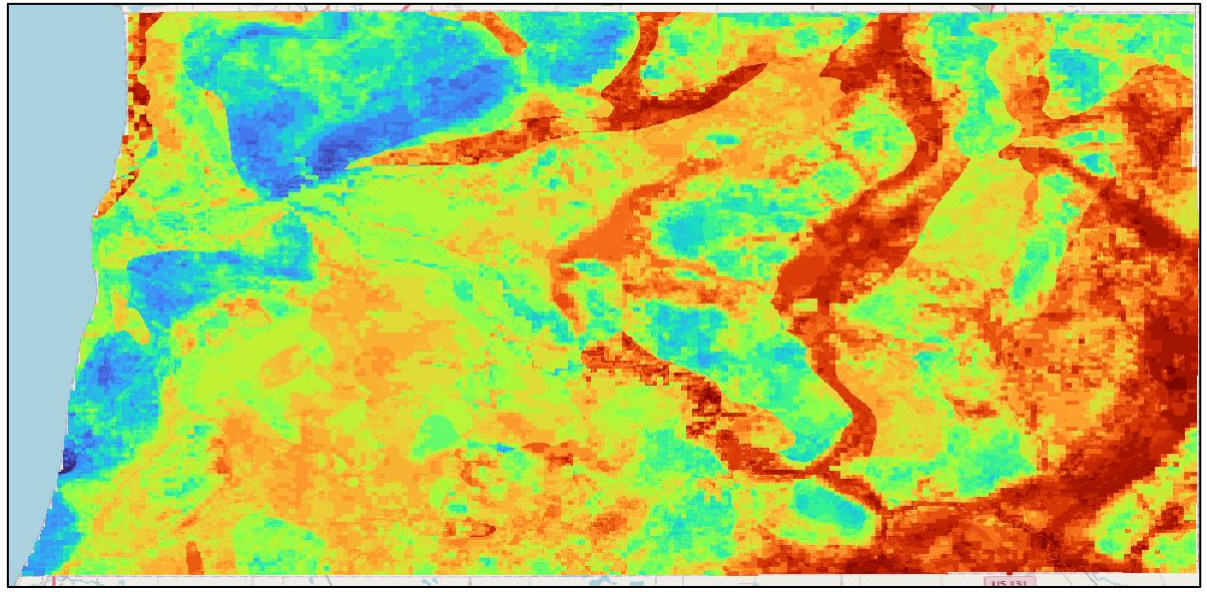
Impact Areas in Relation to Surface Water Bodies

- Receptors / layers of interest:
  - Streams, lakes and rivers
  - Trout streams, trout lakes
  - Wetlands
- Total Score out of 100
  - 100/100 represents highest risk
  - 0/100 represents no risk
- What leads to higher scores?
  - Impact areas “intercepted” by surface water body
    - Higher score if interception is relatively short or “immediate”
    - Higher score if it is a trout stream or trout lake

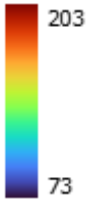


Aquifer Vulnerability at the Site

- Layer of interest:
  - Countywide aquifer vulnerability map (Task 3)
- Total score out of 1
  - 1/1 means highest vulnerability
  - 0.1/1 means lowest vulnerability
  - Recall: Vulnerability varies from 73-203 …so 10 “bins” for scoring
    - Vulnerability of 73-86 => 0.1/1
    - Vulnerability of 86-99 => 0.2/1
    - ….
- Aquifer Vulnerability score is then used as a “modifier” of “well metrics” (see next slide)



Aquifer Vulnerability



Final Composite Score of Risk Ranking

- **Overall Site Risk Score**:

$$\frac{(DW * AQvul * w_{DW}) + (NDW * AQvul * w_{NDW}) + (SW * w_{SW})}{w_{DW} + w_{NDW} + w_{SW}}$$

Where:

DW = drinking water well metric score
Aqvul = aquifer vulnerability score
NDW = non-drinking water well score
SW = surface water metric score
$\mathbf{w_{DW}}$ = weighting for drinking water metric
$\mathbf{w_{NDW}}$ = weighting for non-drinking water metric
$\mathbf{w_{SW}}$ = weighting for surface water metric

Weighting the Importance of Different Metrics

- Simplest approach:
  - All weights are equal (i.e., $\boldsymbol{w_{DW} = w_{NDW} = w_{SW}} = 1$)

  - Equation for calculating composite score (overall risk score) becomes:

$$\frac{(\boldsymbol{DW} * \boldsymbol{AQvul}) + (\boldsymbol{NDW} * \boldsymbol{AQvul}) + (\boldsymbol{SW})}{\boldsymbol{3}}$$

Weighting the Importance of Different Metrics

- Suggested approach, prioritizing drinking water supply:

$$w_{DW} = 0.5 \qquad w_{NDW} = 0.3 \qquad w_{SW} = 0.2$$

- Equation for calculating composite score (overall risk score) becomes:

$$(DW * AQvul * 0.5) + (NDW * AQvul * 0.3) + (SW * 0.2)$$

- Expect scores of 40+ to be of high risk using this approach
- Scores of 10 or less are low/very low risk

Examples

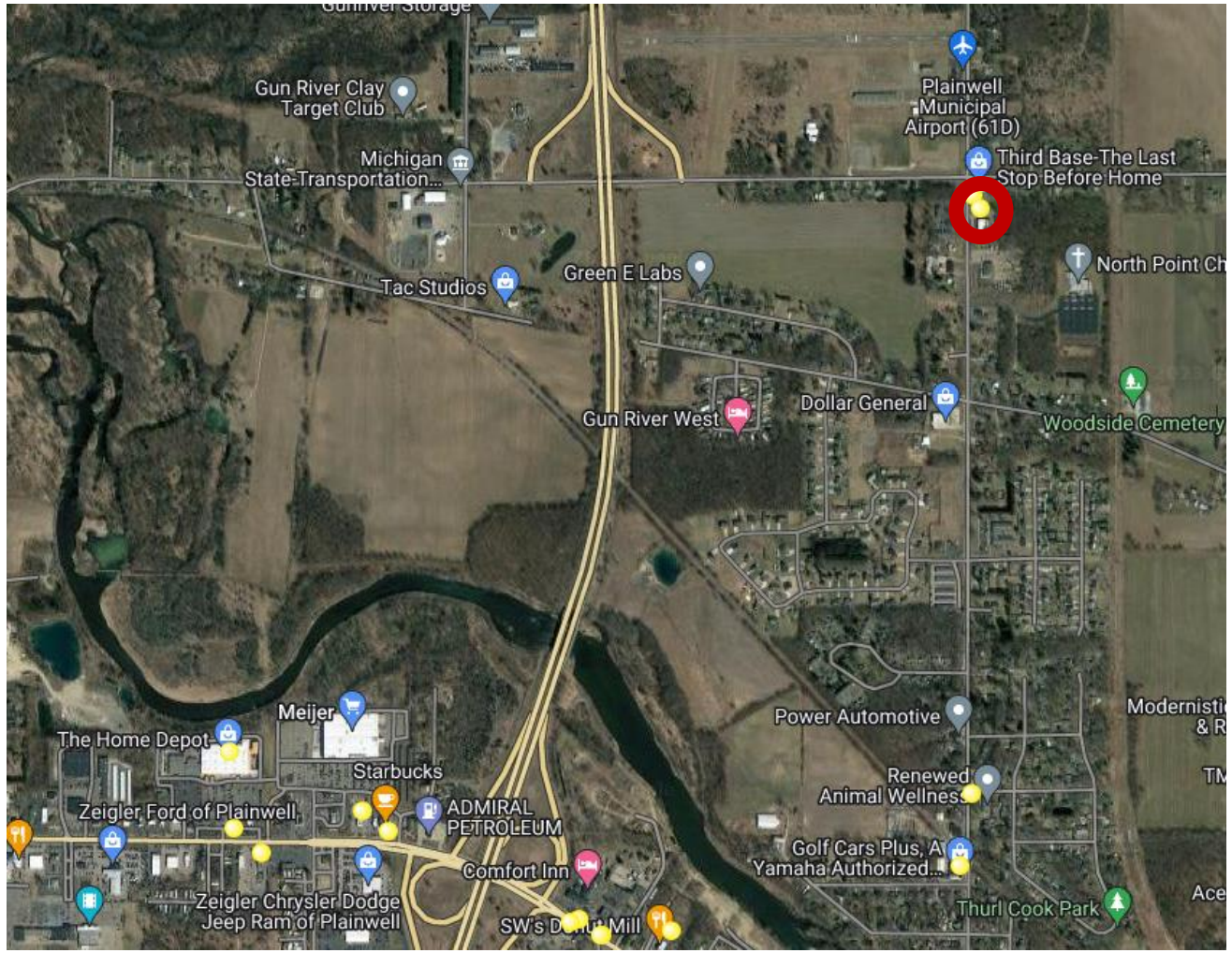
High risk

Medium risk

Low risk

Very High Risk Example :
03000211 – 585 10th St. Plainwell

(north of Plainwell)



03000211 – 585 10th St. Plainwell

DW score (Drinking Water wells): 80/100

- Household wells in 2yr impact area, 2 wells in 20yr impact area, many just outside impact areas
- Type 2 PS well in 20yr impact area
- Site, 2, yr. and 10yr impact areas inside of WHPA; multiple type 1 well 900ft outside of 10yr impact area

NDW score (non-drinking water wells): 60/100

- Two irrigation wells <700ft outside of 20 yr. impact area

SW score (surface water receptors): 20/100

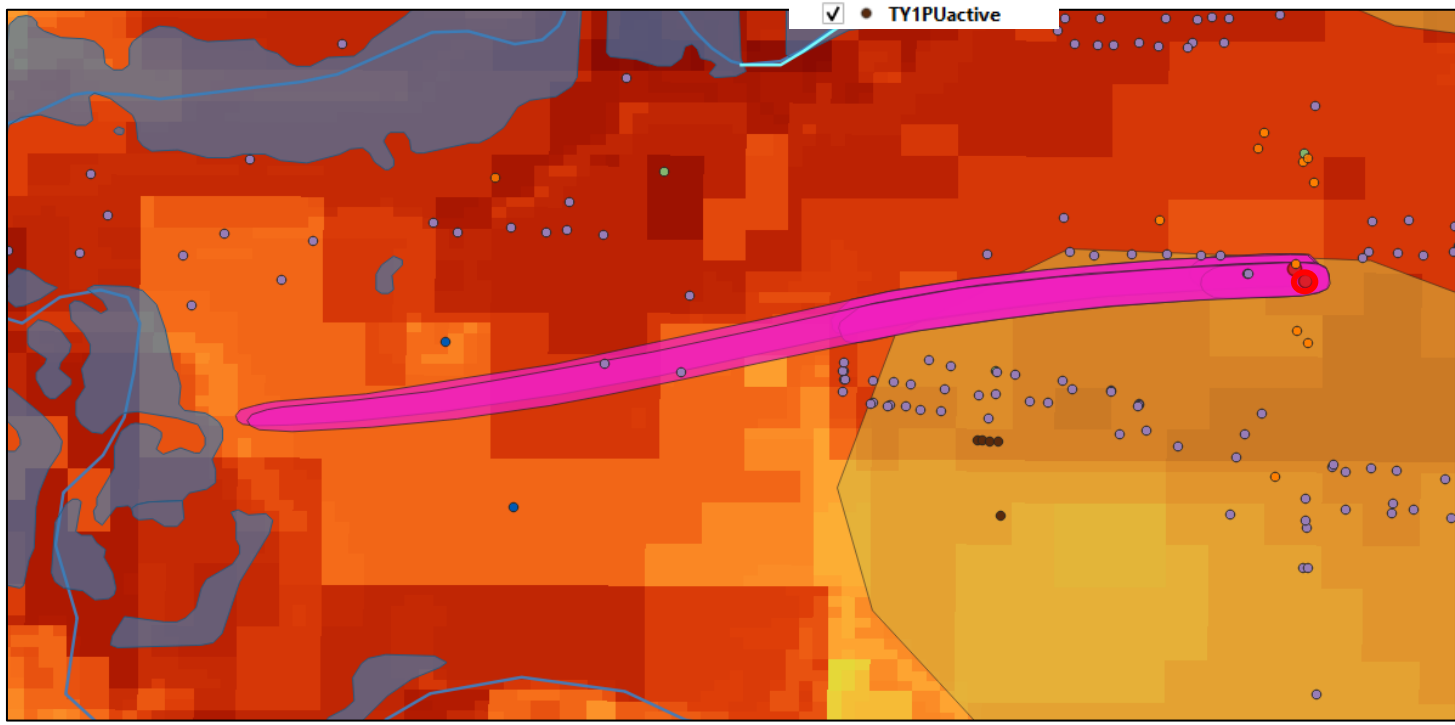
- Wetlands and Kalamazoo River downstream of Kalamazoo River

Aquifer vulnerability: 0.9

- Vulnerability of 185 at site (177-190 => 0.9 score)

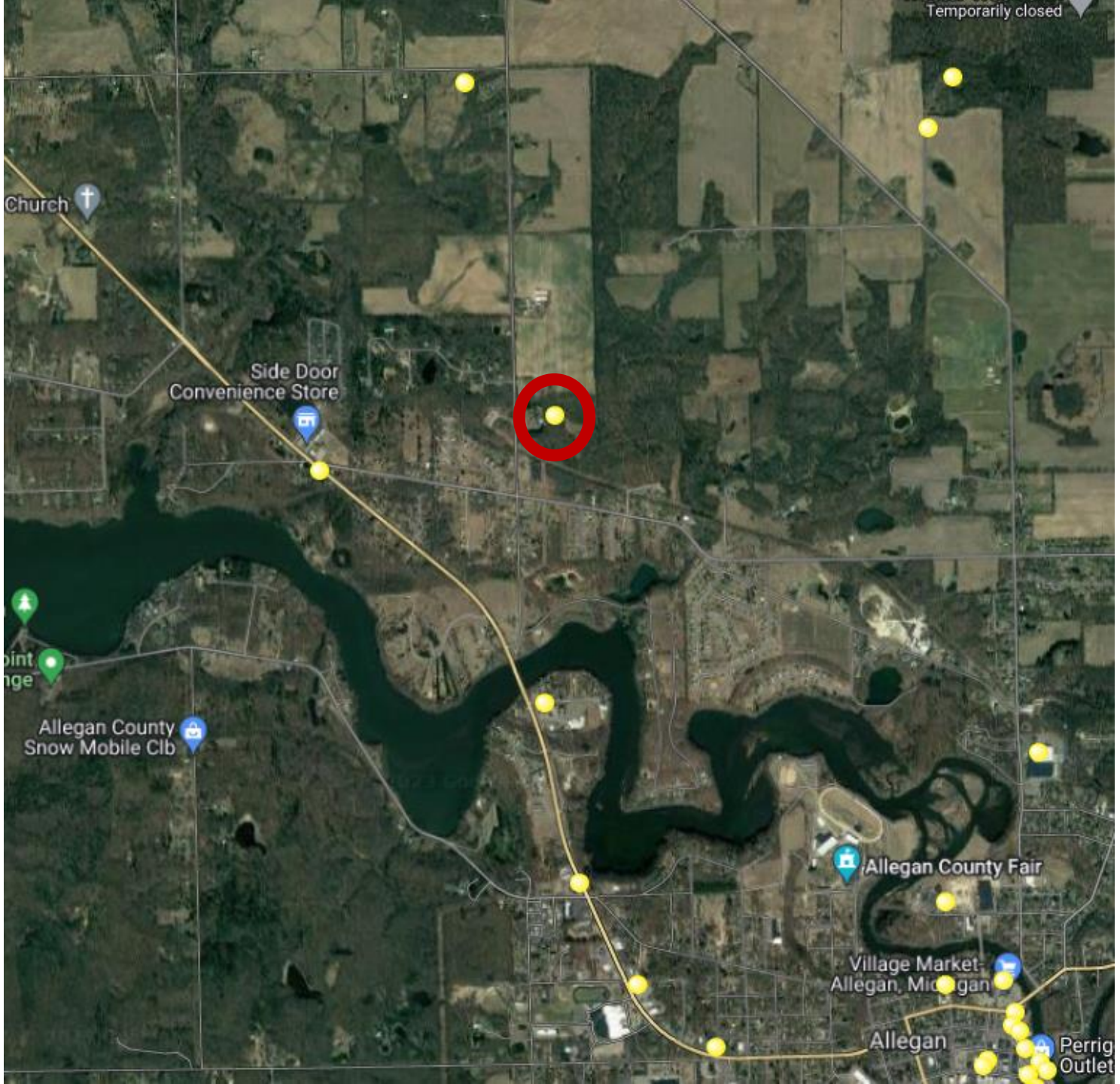
Overall score:

(80*0.9*0.5) + (60*0.9*0.3)+(20*0.2) = 56.2



High Risk Example :
Site 95, Allegan Township Dump

(north of Allegan)



Site 95 – Allegan Township Dump

DW score (Drinking Water wells): 95/100

- 10+ household wells in 10yr impact area, 3 wells in 20yr impact area, many just outside impact areas
- Type 2 PS well in 20yr impact area
- Site, 2, yr. and 10yr impact areas inside of WHPA; type 1 well just outside of 10yr impact area

NDW score (non-drinking water wells): 70/100

- Irrigation well just outside of 20 yr. impact area

SW score (surface water receptors): 40/100

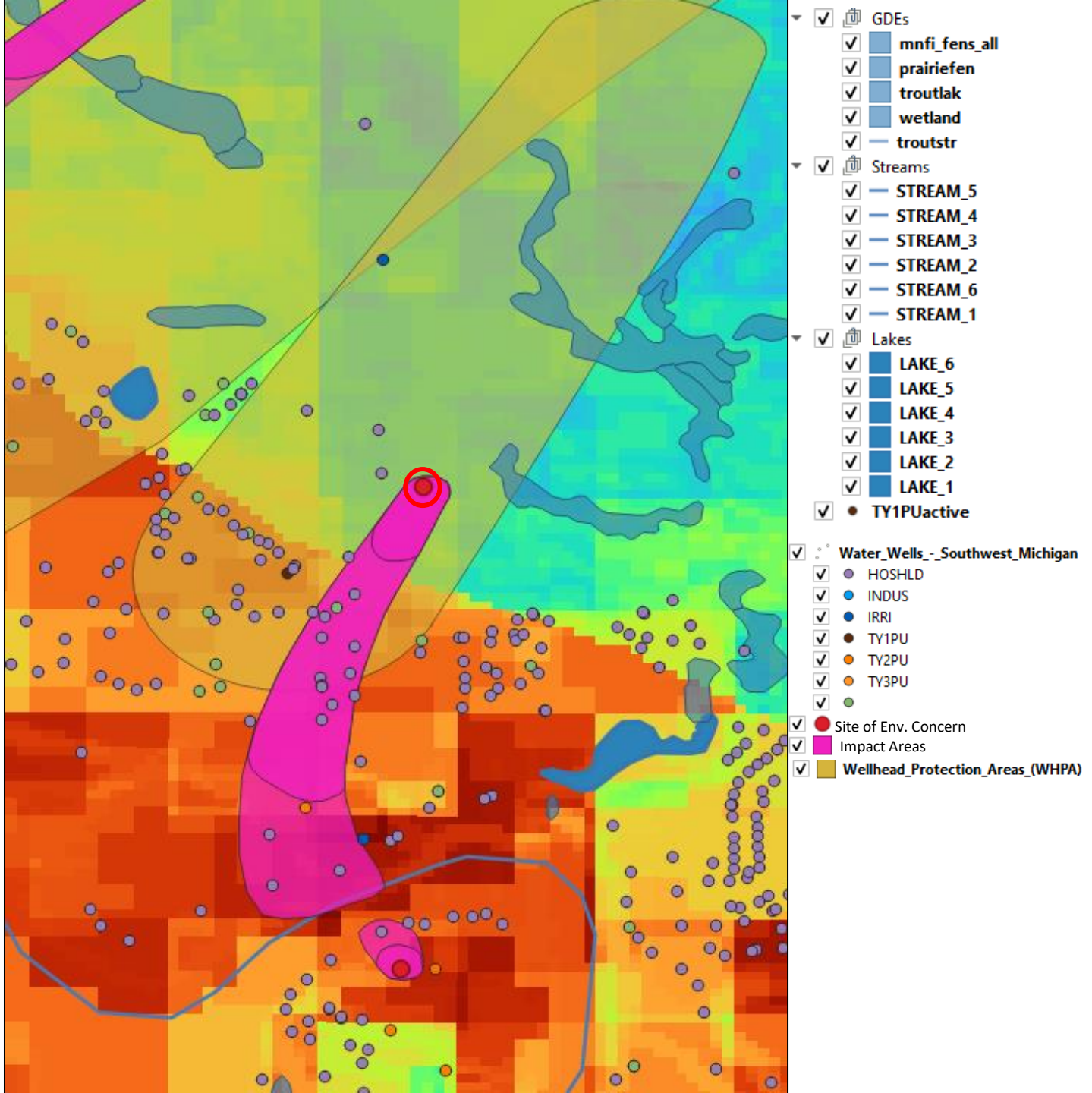
- Interception by Kalamazoo River at 20 yr. travel-time

Aquifer vulnerability: 0.5

- Vulnerability of 130 at site (125-138 => 0.5 score)

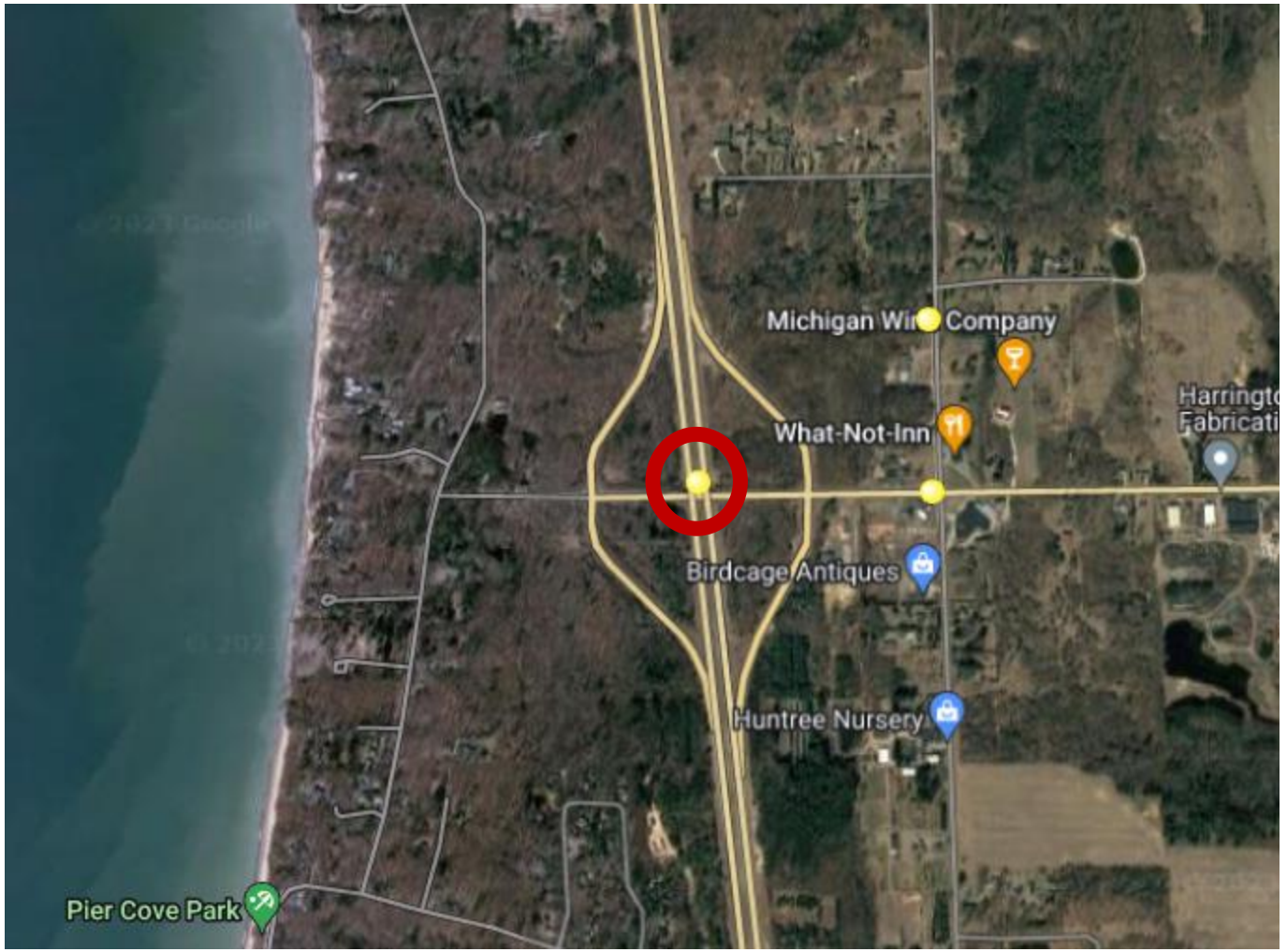
Overall score:

(95*0.5*0.5) + (70*0.5*0.3)+(40*0.2) = 42.25



Medium Risk Example:
03000286 – 124th Ave (M-89) & I-196 (US-31) Highway

(South of Saugatuck)



03000286 – 124th Ave (M-89) & I-196 (US-31) Highway

DW score (Drinking Water wells): 60/100

- 10 household wells in 10yr impact area, many just outside impact areas
- Type 2 PS well in 10yr impact area

NDW score (non-drinking water wells): 50/100

- Irrigation well ~300ft outside of 10 yr. impact area

SW score (surface water receptors): 50/100

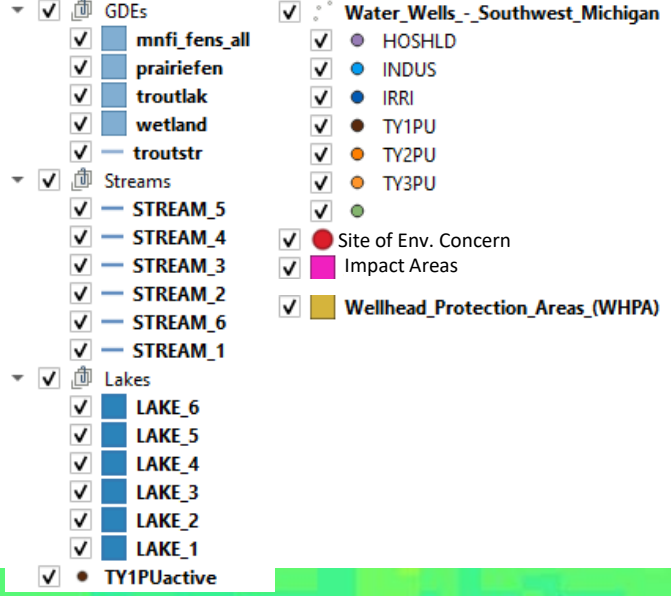
- Possible interaction with wetlands at 2-5yr. travel-time
- Discharge to Lake Michigan at 10yr. travel-time

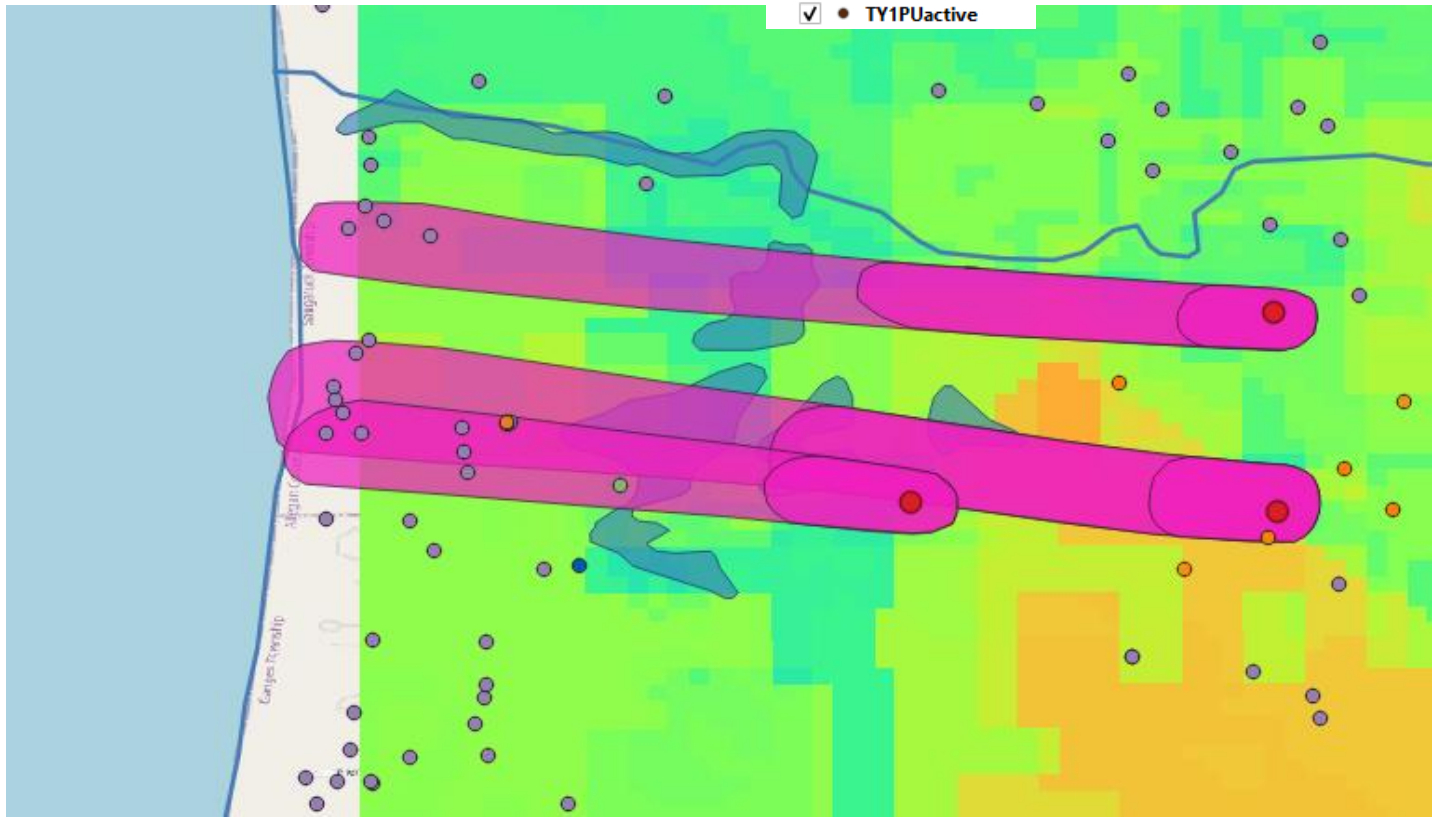
Aquifer vulnerability: 0.4

- Vulnerability of 120 at site (112-125 => 0.4 score)

Overall score:

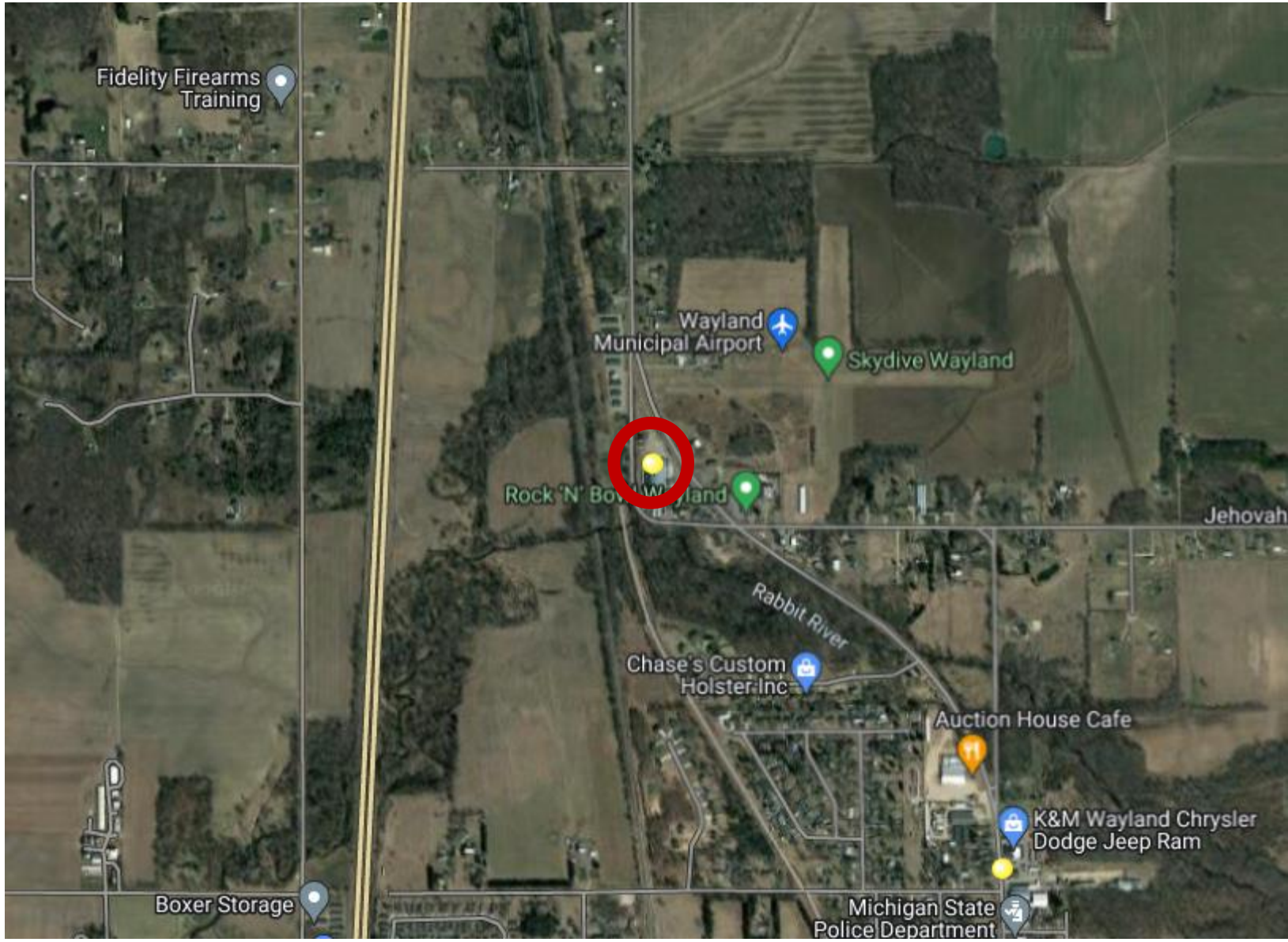
(60*0.4*0.5) + (50*0.4*0.3)+(50*0.2) = 28





Medium Risk Example (surface water priority):
03000329 –
3717 Division Avenue

(Wayland Area)



03000329 – 3717 Division Avenue

DW score (Drinking Water wells): 5/100

- One household wells in 2yr impact area

NDW score (non-drinking water wells): 0/100

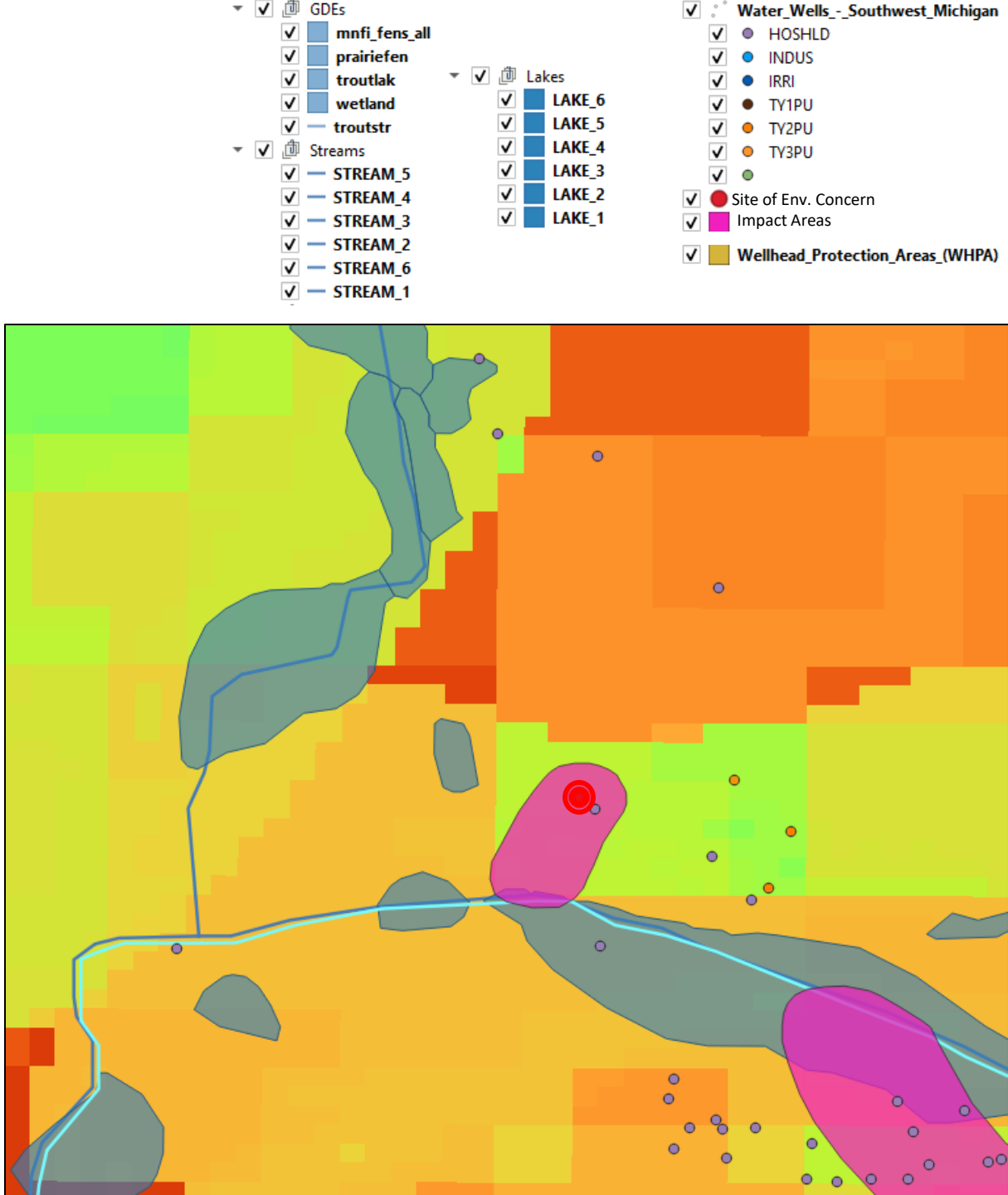
SW score (surface water receptors): 100/100

- 2yr or less discharge to Rabbit River (designated trout stream)

Aquifer vulnerability: 0.6

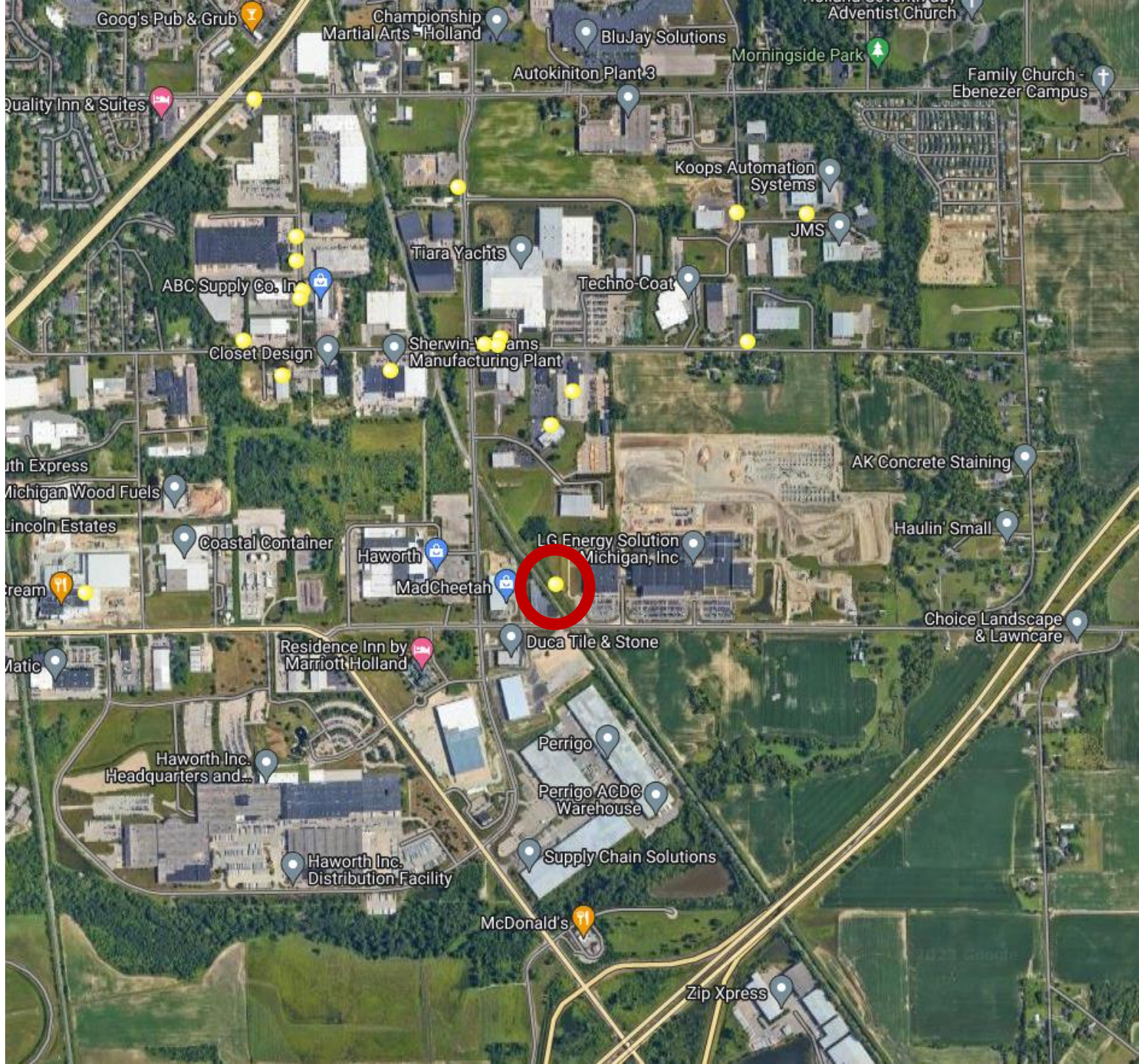
- Vulnerability of 185 at site (177-190 => 0.9 score)

Overall score:
(10*0.6*0.5) + (0*0.6*0.3)+(100*0.2) = 21.5



Low Risk Example:
030000372, 859 East 48th Street

(Holland)



03000365 – 760 E. 40th Street

DW score (Drinking Water wells): 0/100

- No drinking water wells in vicinity

NDW score (non-drinking water wells): 0/100

- **No non-drinking water wells in vicinity**

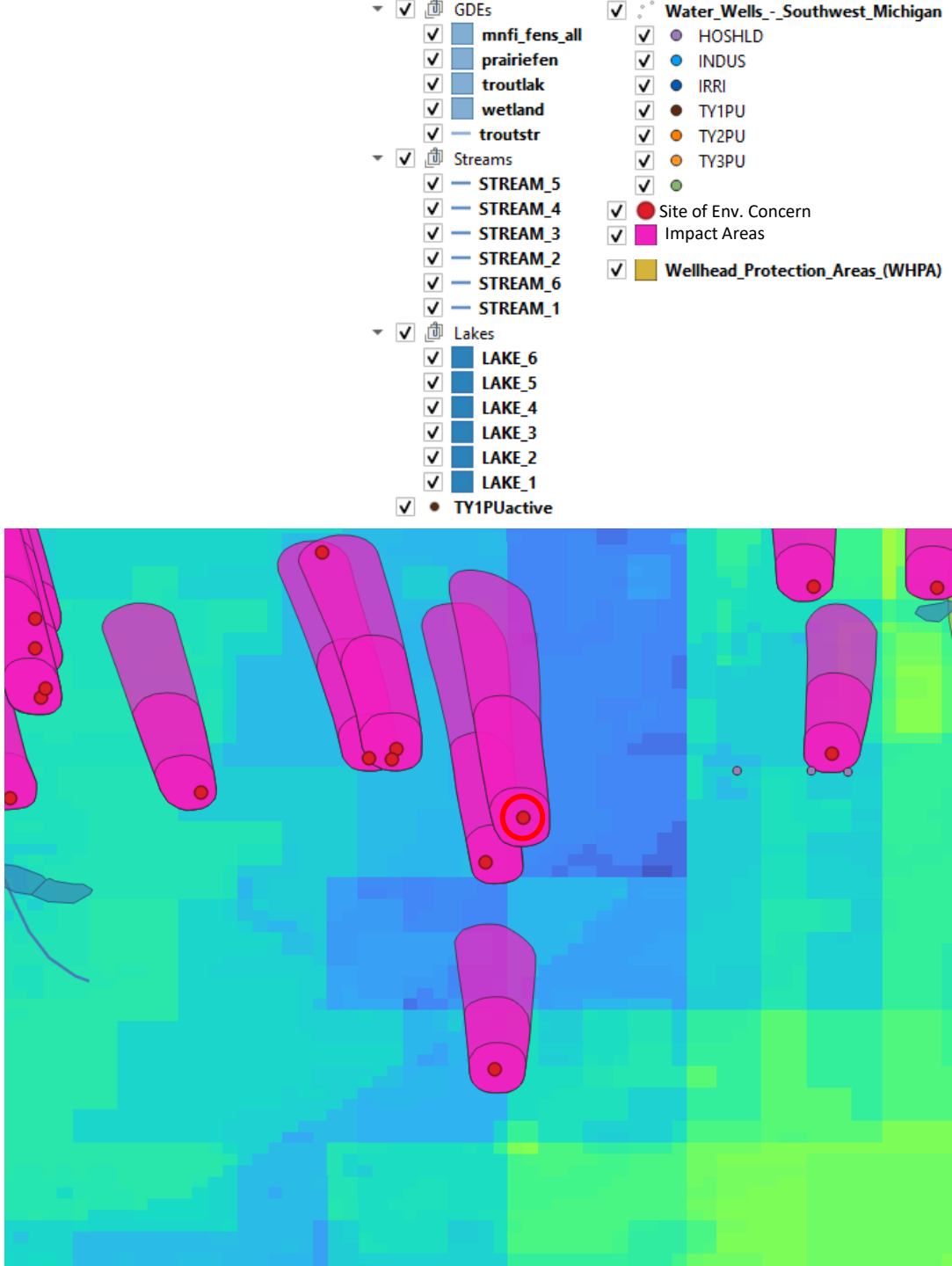
SW score (surface water receptors): 0/100

- No interaction with surface water in 20yr travel

Aquifer vulnerability: 0.2

- Vulnerability of 96 at site (86 - 99 => 0.2 score)

Overall score:
(0*0.2*0.5) + (0*0.6*0.3)+(0*0.2) = 0



Ranking Lists (Example Subset)

Drinking Water Ranking	Site Name	Drinking Water Score
1	Site 95 – Allegan Township Dump	95
2	03000211 – 585 10th St. Plainwell	80
3	03000286 – 124th Ave (M-89) & I-196 (US-31) Highway	60
4	03000329 – 3717 Division Avenue	5
5	03000365 – 760 E. 40th Street	0

Non-Drinking Water Ranking	Site Name	Non-Drinking Water Score
1	Site 95 – Allegan Township Dump	70
2	03000211 – 585 10th St. Plainwell	60
3	03000286 – 124th Ave (M-89) & I-196 (US-31) Highway	50
4	03000329 – 3717 Division Avenue	0
4	03000365 – 760 E. 40th Street	0

Surface Water Ranking	Site Name	Surface Water Score
1	03000329 – 3717 Division Avenue	100
2	03000286 – 124th Ave (M-89) & I-196 (US-31) Highway	50
3	Site 95 – Allegan Township Dump	40
4	03000211 – 585 10th St. Plainwell	20
4	03000365 – 760 E. 40th Street	0

Aquifer Vulnerability	Site Name	Vulnerability Score
1	03000211 – 585 10th St. Plainwell	0.9
2	03000329 – 3717 Division Avenue	0.6
3	Site 95 – Allegan Township Dump	0.5
4	03000286 – 124th Ave (M-89) & I-196 (US-31) Highway	0.4
4	03000365 – 760 E. 40th Street	0.2

Overall Ranking Lists (Example Subset)

Overall Site Ranking	Site Name	Drinking Water Score
1	03000211 – 585 10th St. Plainwell	56.2
2	Site 95 – Allegan Township Dump	42.25
3	03000286 – 124th Ave (M-89) & I-196 (US-31) Highway	28
4	03000329 – 3717 Division Avenue	21.5
5	03000365 – 760 E. 40th Street	0

Feedback from Work Group

Metrics and Scoring

Weightings

Next Steps

- Apply to entire county Site portfolio (next 2 weeks)
- Prepare Priority List for next meeting (by March 1)
- Prepare Final Report and Recommendations (by March 15)

Related Topic: Monitoring Wells Discussion

Example map from Ottawa County Groundwater Study

SUGGESTED MONITORING AREAS

This slide presents two general areas suggested for long-term monitoring of the bedrock aquifer. Both areas have been subject to significant drawdown over the past 50 years and yielded elevated/high Cl concentrations from the water quality analysis. The future modeling suggested Area 1 and Area 2 will experience ≈2m and ≈ 3.5m of drawdown in the bedrock aquifer, respectively, over the next 20 years due to increases in well withdrawals and relatively little recharge from above (because of the clay layer). With continuous time-series Cl and SWL data collected from these locations, it is possible to quantify the increase in Cl concentrations due to deep pumping.

The Marshall aquifer in Area 2 is thin and contains higher Cl concentrations and can be ideal for this type of analysis. On the other hand, Area 1 contains a portion of the Marshall aquifer that is relatively thicker and contains slightly lower Cl concentrations, and thus can be considered an 'emerging areas at risk' – where monitoring can help to determine if Cl-laden water is migrating due to pumping and where different management strategies can be explored through continuous monitoring.

Area 1

ΔSWL ≈ 2m

Rock Cl 200-300 mg/L

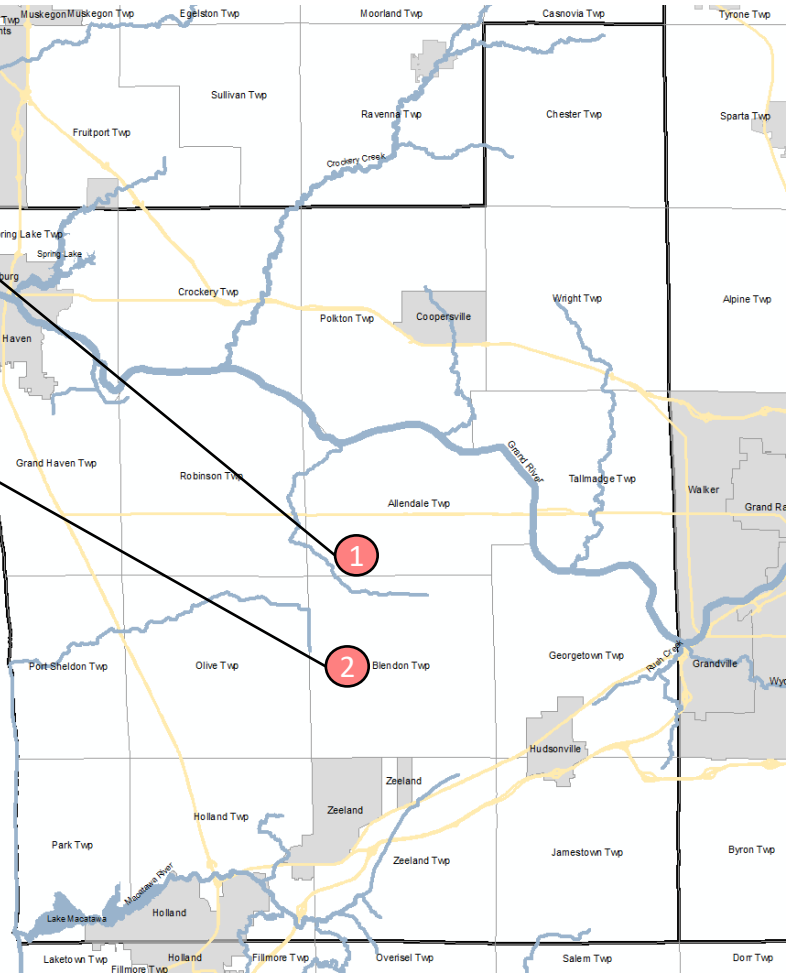
Continuous clay layer above

Area 2

ΔSWL ≈ -3.5 m

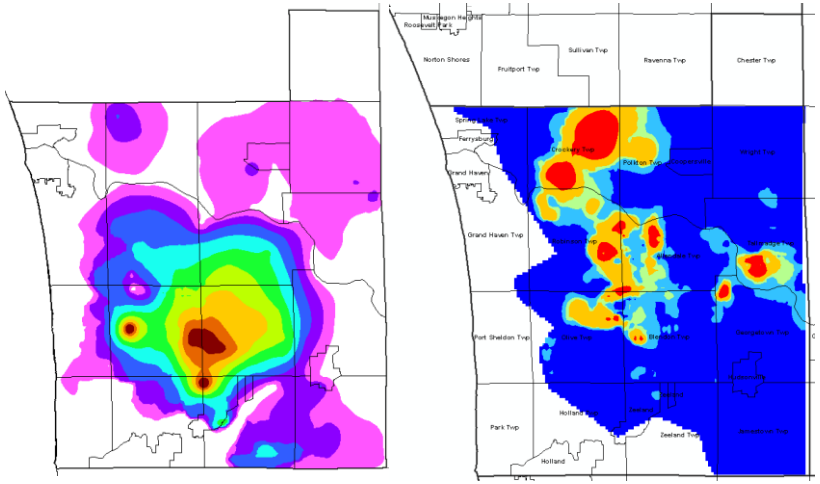
Rock Cl 300-650 mg/L

Thin bedrock; clay present above



ΔSWL (m)

- -4.89 - -3.2
- -3.19 - -2.67
- -2.66 - -2.23
- -2.22 - -1.82
- -1.81 - -1.42
- -1.41 - -1.02
- -1.01 - -0.65
- -0.64 - -0.36
- -0.35 - -0.15
- -0.14 - -0.02

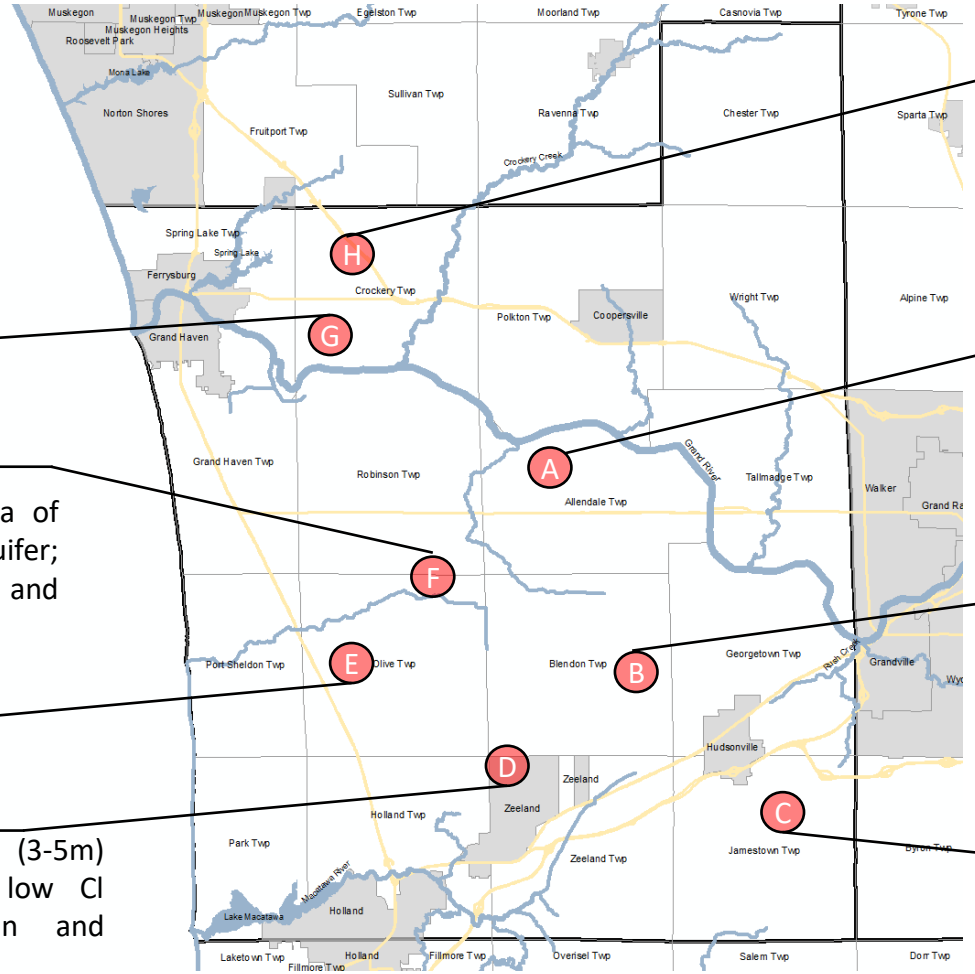


Rock Cl (mg/L)

- 2.2 – 100.0
- 100.1 – 200.0
- 200.1 – 250.0
- 250.1 – 500.0
- 500.1 – 1855.0

Additional Monitoring Areas to Consider

This final slide presents additional monitoring areas to consider in light of the findings from this study. Specific comments regarding the relevance of each area are include. Monitoring at these additional locations might be particularly useful for better understanding water quality (salinity) dynamics.



Area H

Small drawdown (≈ 1m) expected over the next 20 years; elevated Cl detected within area; high Cl detected to the east

Area A

Small drawdown (≈ 1m) expected over the next 20 years; high Cl detected in area; adjacent to section of Grand River impacted by pumping

Area G

Naturally-high Cl concentrations; no significant drawdown due to pumping expected
=> Monitor natural variations of SWL and Cl (e.g., due to seasonal changes in recharge)

Area F

Local recharge area of the bedrock aquifer; high Cl north, east, and south of area

Area B

Modest drawdown (≈ 2m) expected over the next 20 years; elevated Cl observed in and around area

***Area E**

Significant drawdown (≈4m) expected by 2036; high Cl to north and east of area
=> migration of Cl due to pumping? (similar to *Area 1* on previous slide).

Area D

Significant drawdown (3-5m) expected by 2036; low Cl concentrations within and around area

Area C

Important recharge area to the bedrock aquifer; low Cl concentrations