USING TILE DRAINAGE WATER AND DETENTION PONDS TO SUPPLEMENT OVERHEAD IRRIGATION

“Irrigating with limited water resources”

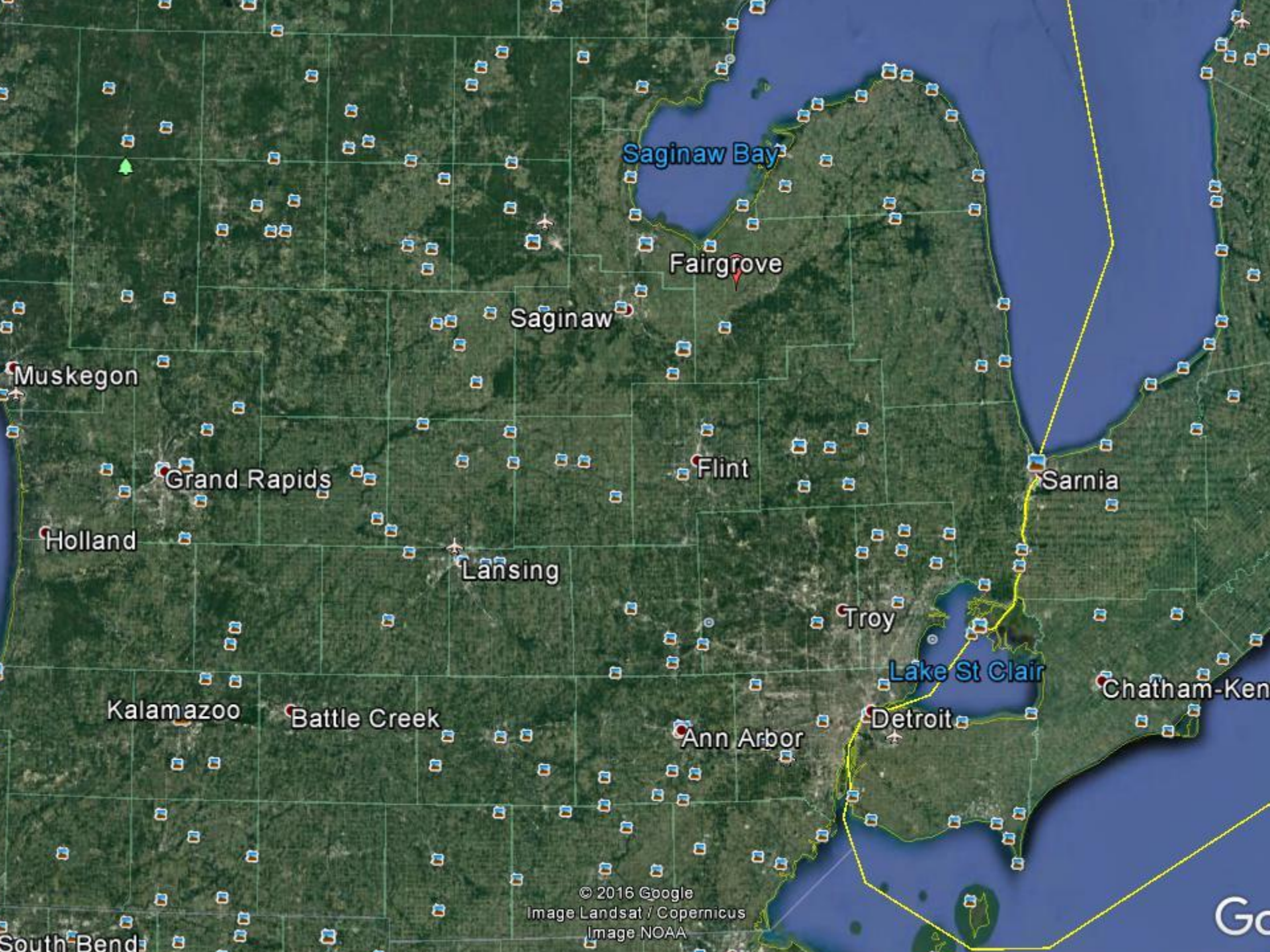
March 3, 2017

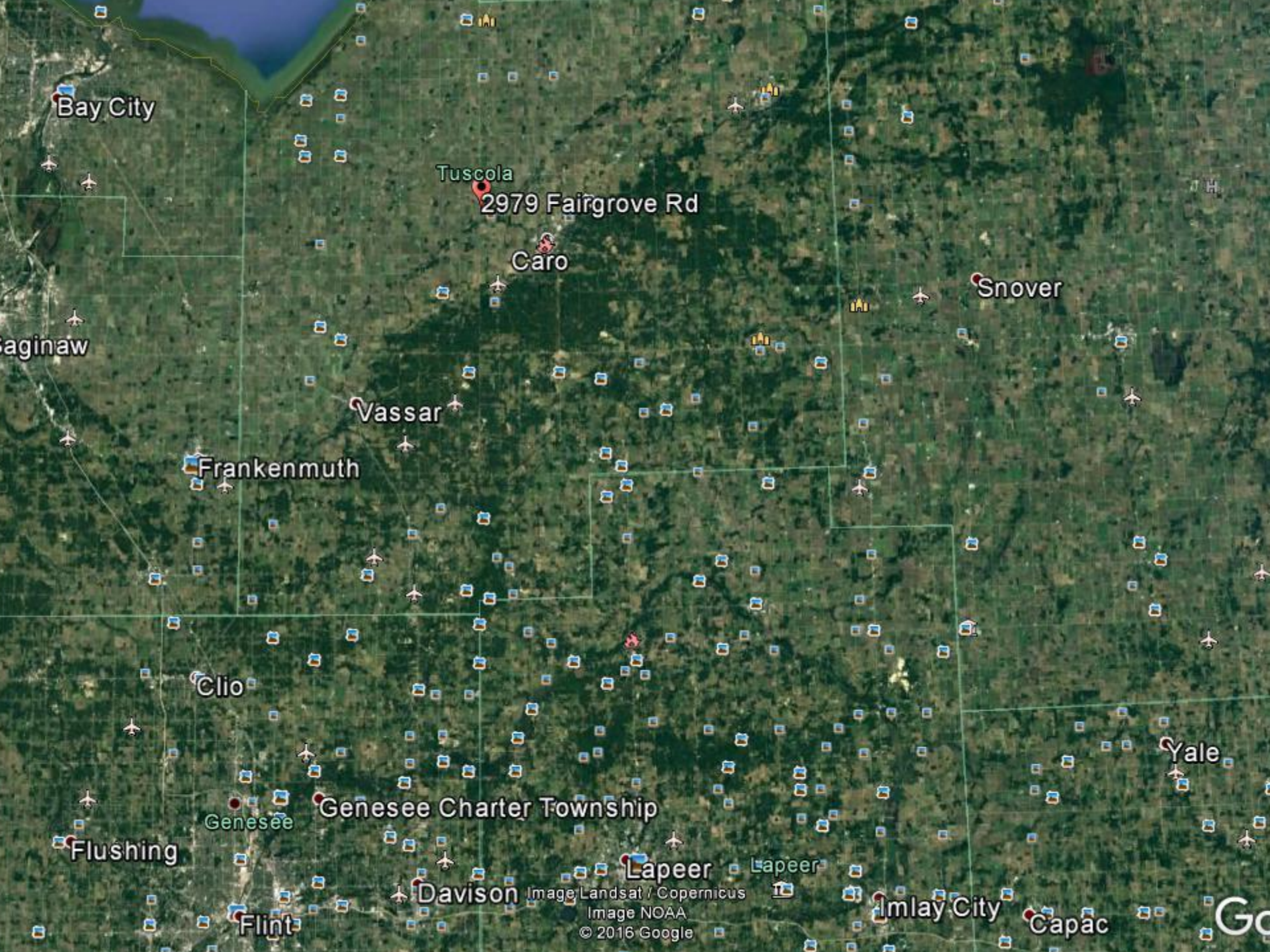
Profile:

Bob Mantey was born and raised in Tuscola County, Michigan. He attended Michigan State University and received a Bachelor of Science degree in engineering, specializing in soil and water problems. He worked 4 years for the Michigan Department of Natural Resources, Water Management Division, as a Hydrologic Engineer before returning to the family seedcorn farm, in Tuscola County. He is also the Tuscola County Drain Commissioner. Bob and his brother Don raise conventional seedcorn, soybeans and wheat on 400 acres of overhead irrigation. They also grow organic seedcorn on dryland acreage.

Abstract:

Information will be presented on how to use tile drainage and detention ponds to supplement overhead irrigation. This will also involve information on the use of controlled drainage in partnership with the overhead irrigation, since this was a sub irrigated system converted over to overhead irrigation. The history, current use and problems that were encountered while developing this unique system will be discussed.

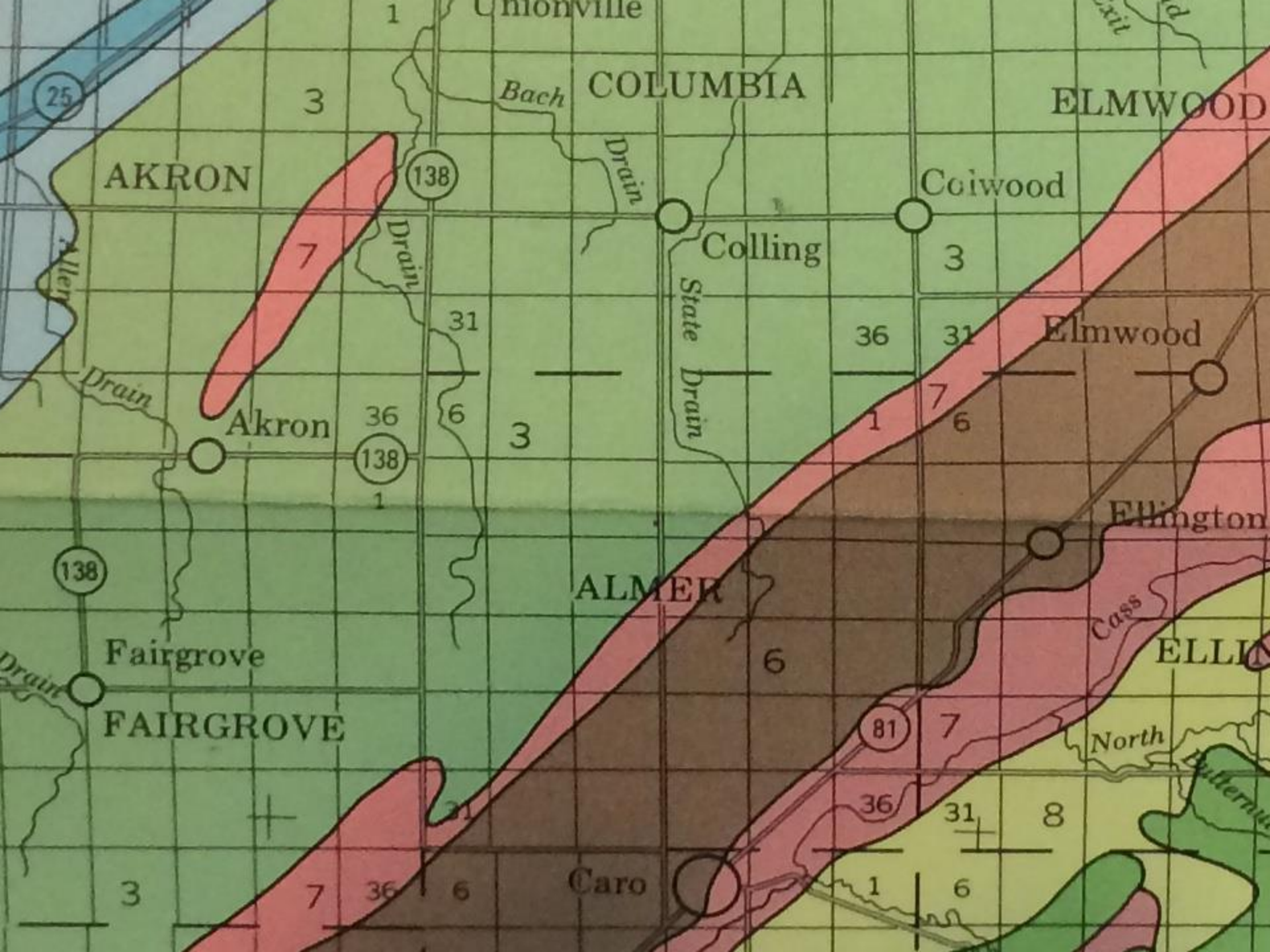

Saginaw Bay
Fairgrove
Saginaw
Muskegon
Grand Rapids
Flint
Sarnia
Holland
Lansing
Troy
Lake St Clair
Chatham-Ken
Kalamazoo
Battle Creek
Detroit
Ann Arbor
© 2016 Google
Image Landsat / Copernicus
Image NOAA
South Bend

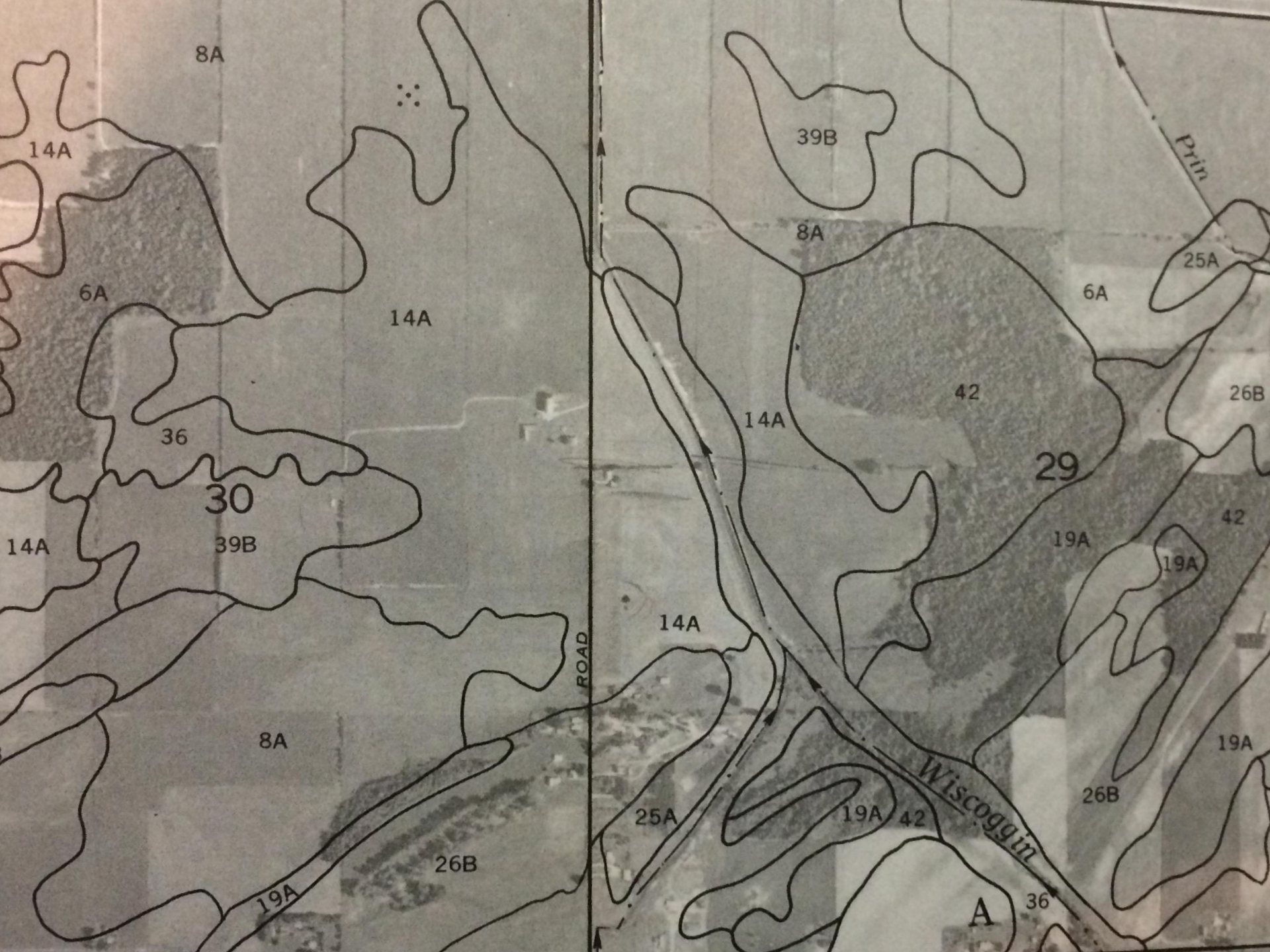

Bay City
Tuscola
2979 Fairgrove Rd
Caro
Snover
Saginaw
Vassar
Frankenmuth
Clio
Yale
Genesee Charter Township
Genesee
Flushing
Lapeer
Lapeer
Davison
Image Landsat / Copernicus
Image NOAA
© 2016 Google
Imlay City
Capac
Flint

History

- 1988: drilled first test wells - local well driller sent pumping information to the State Hydrologist and we were advised we could pump approximately 100gpm on every 40 acres (660' distance) without adversely affecting the aquifer.
- 1989: sub irrigated first 40 acres. Tried to add about 40 acres per year.
- 1995: We were put in contact with Jim Hergott, Project Coordinator for the Saginaw Bay Resource Conservation and Development, from connections with the Maumee Valley RC&D. Let him know that MDOT was constructing M-24 through our property and we were interested in having a pond dug for two reasons: To help with inadequate tile drainage and to possibly use as overhead irrigation for areas not suitable for sub irrigation. He in turn put us in contact with Larry Protasiewicz, of Spicer Engineering. Larry had worked with Dr. Bud Belcher, at Michigan State University on sub-irrigation and controlled drainage. A grant was received, from the Saginaw Bay National Watershed Initiative, to collect data on the quantity and quality of the tile drainage and also to design a detention pond.
- 1996: MDOT constructed M-24 and it was not economically feasible to construct the 12.9 acre site as designed. However, negotiations with the contractor allowed us to develop a 2 acre site and also another 1 acre pond. The two acre site was constructed similar to the planned design, with approximately 100 acres draining to it, instead of the potential 250-300 acres that was originally designed.
- 1999: First overhead pivot was installed near the 2 acre site. Observing our tile flow after overhead irrigation was applied gave us the idea to coordinate controlled drainage into areas where we will be putting overhead pivots.
- Currently we have 11, three tower, pivots that irrigate over 350 acres. All our sub irrigation was to converted to overhead irrigation with controlled drainage used where it was applicable.


© 2016 Google

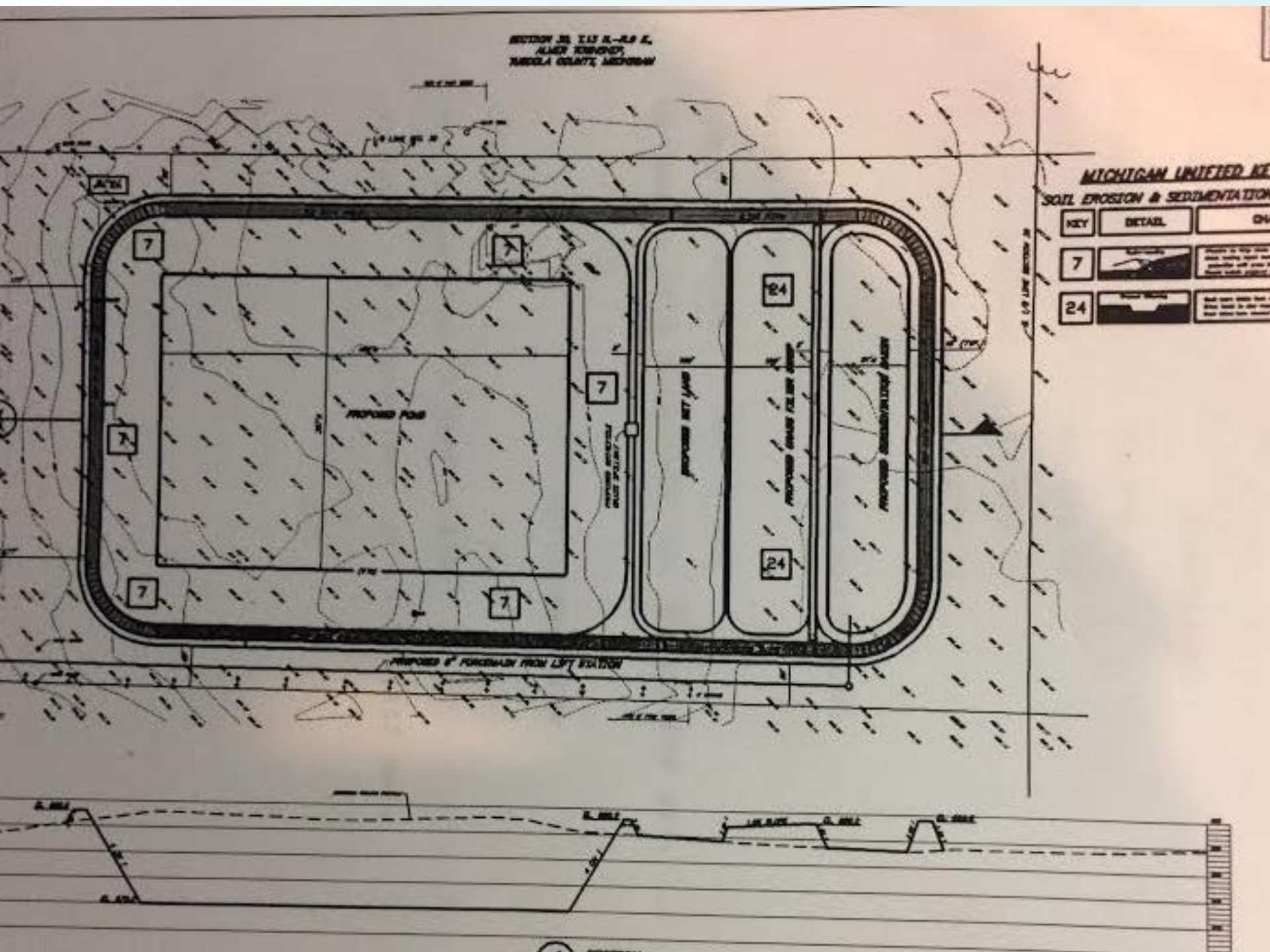

Unionville
COLUMBIA
ELMWOOD
AKRON
Bach
Drain
Colwood
Colling
State Drain
Elmwood
Akron
Ellington
ALMER
Cass
Fairgrove
FAIRGROVE
North
Caro
25
138
81
36
31
1
3
6
7
8


8A
14A
6A
14A
36
30
39B
14A
8A
26B
19A
ROAD
39B
8A
6A
25A
Prin
42
26B
14A
29
19A
42
19A
14A
19A
26B
Wiscoggin
25A
19A
42
36
A

3A	Shebeon loam, 0 to 1 percent slopes
4B	Covert sand, 0 to 6 percent slopes
6A	Tappan-Avoca complex, 0 to 3 percent slopes
8A	Tappan-Londo loams, 0 to 2 percent slopes
10B	Pipestone fine sand, 0 to 4 percent slopes
11B	Metamora sandy loam, 0 to 4 percent slopes
12	Corunna sandy loam
13A	Wixom-Belleville loamy fine sands, 0 to 3 percent slopes
14A	Avoca loamy fine sand, 0 to 3 percent slopes
18	Essexville loamy fine sand
19A	Wasepi sandy loam, 0 to 3 percent slopes
20B	Guelph-Londo loams, 0 to 6 percent slopes
20C	Guelph loam, 6 to 12 percent slopes
20D2	Guelph loam, 12 to 18 percent slopes, eroded
21B	Wixom loamy fine sand, 0 to 4 percent slopes
25A	Londo loam, 0 to 3 percent slopes
26B	Perrin loamy sand, 0 to 4 percent slopes
27B	Boyer sandy loam, 0 to 6 percent slopes
27C	Boyer sandy loam, 6 to 12 percent slopes
28B	Marlette-Capac complex, 0 to 6 percent slopes
28C	Marlette sandy loam, 6 to 12 percent slopes
28D	Marlette sandy loam, 12 to 18 percent slopes
28E	Marlette sandy loam, 18 to 35 percent slopes
29B	Metea loamy fine sand, 1 to 6 percent slopes
30B	Spinks loamy fine sand, 0 to 6 percent slopes
30C	Spinks loamy fine sand, 6 to 12 percent slopes
30D	Spinks loamy fine sand, 12 to 18 percent slopes
30E	Spinks loamy fine sand, 18 to 35 percent slopes
32B	Thetford loamy fine sand, 0 to 4 percent slopes
33	Granby loamy fine sand
35	Wolcott loam
36	Tappan loam
37	Adrian muck
38	Tobico loamy fine sand
39B	Ottokee loamy fine sand, 0 to 6 percent slopes
40B	Chelsea fine sand, 0 to 6 percent slopes
40C	Chelsea fine sand, 6 to 12 percent slopes
42	Gilford sandy loam
45	Houghton muck
52A	Landes fine sandy loam, 0 to 3 percent slopes
53	Sloan loam
54B	Capac loam, 1 to 5 percent slopes
55	Cohoctah sandy loam
56	Edwards muck
57	Palms muck
58	Thomas muck
59	Pella silt loam
62A	Sanilac silt loam, 0 to 3 percent slopes
63	Bach very fine sandy loam
64	Tappan-Lenawee Variant complex
65B	Fulton silty clay loam, 1 to 5 percent slopes
66	Latty silty clay loam

1995 Grant Notes

- Need & Objectives:
- What is the quality and quantity of tile discharge water?
- Should this water be used for irrigation?
- Is a pond a dependable and feasible source for irrigation water?
- This practice would reduce the irrigation water demand on fragile groundwater aquifers.
- Non point source pollution will be improved with storing both tile water and surface runoff on site.
- This project will demonstrate the water quality benefits of cumulative individual land use decisions and how they will improve the water quality and reduce the net loadings of nutrients and pesticides to Saginaw Bay.

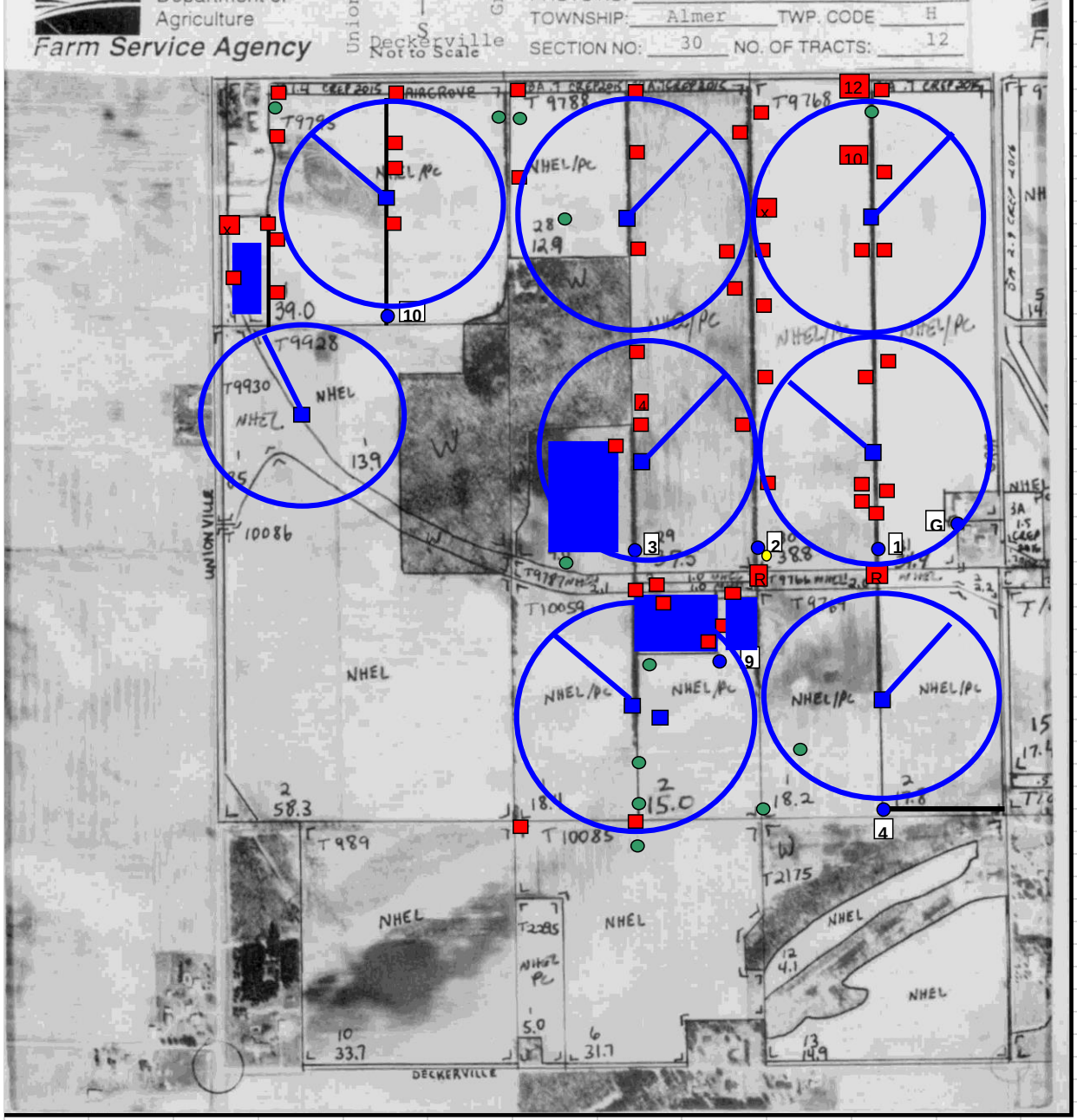

MICHIGAN UNITED
SOIL EROSION & SEDIMENTATION
KEY
DETAIL
7
24
PROPOSED POND
PROPOSED 6" FORCEMAIN FROM LIFT STATION

1995 assumptions

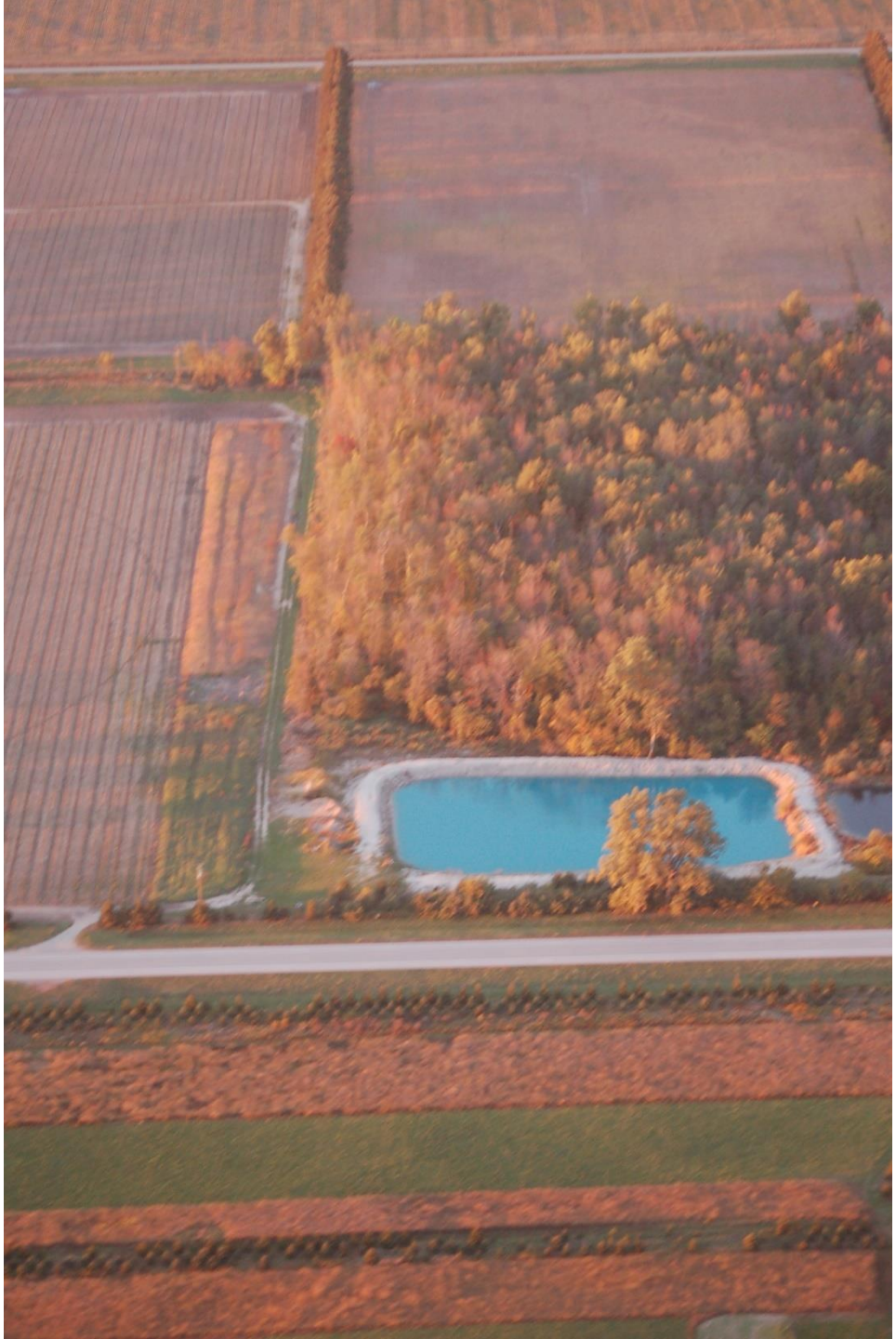
- Measurements of tile drainage and estimates were made of 18 million gals of drainage water would be produced in one year from 180 acres. This is equivalent to 100,000 gal/acre(3-4 inches)
- The original pond design was a 12.9 acre site but about 8 acres would be pond. The rest was settling basin, grassed waterway and wetland.


© 2016 Google


© 2016 Google



slide headstands		For Gamble 2 Field:
float headstand	**Not Used**	Gamble 2W headstand does nothing now.
wells		Retiled north end and 1W is tied into 2E(12")
surface drains		

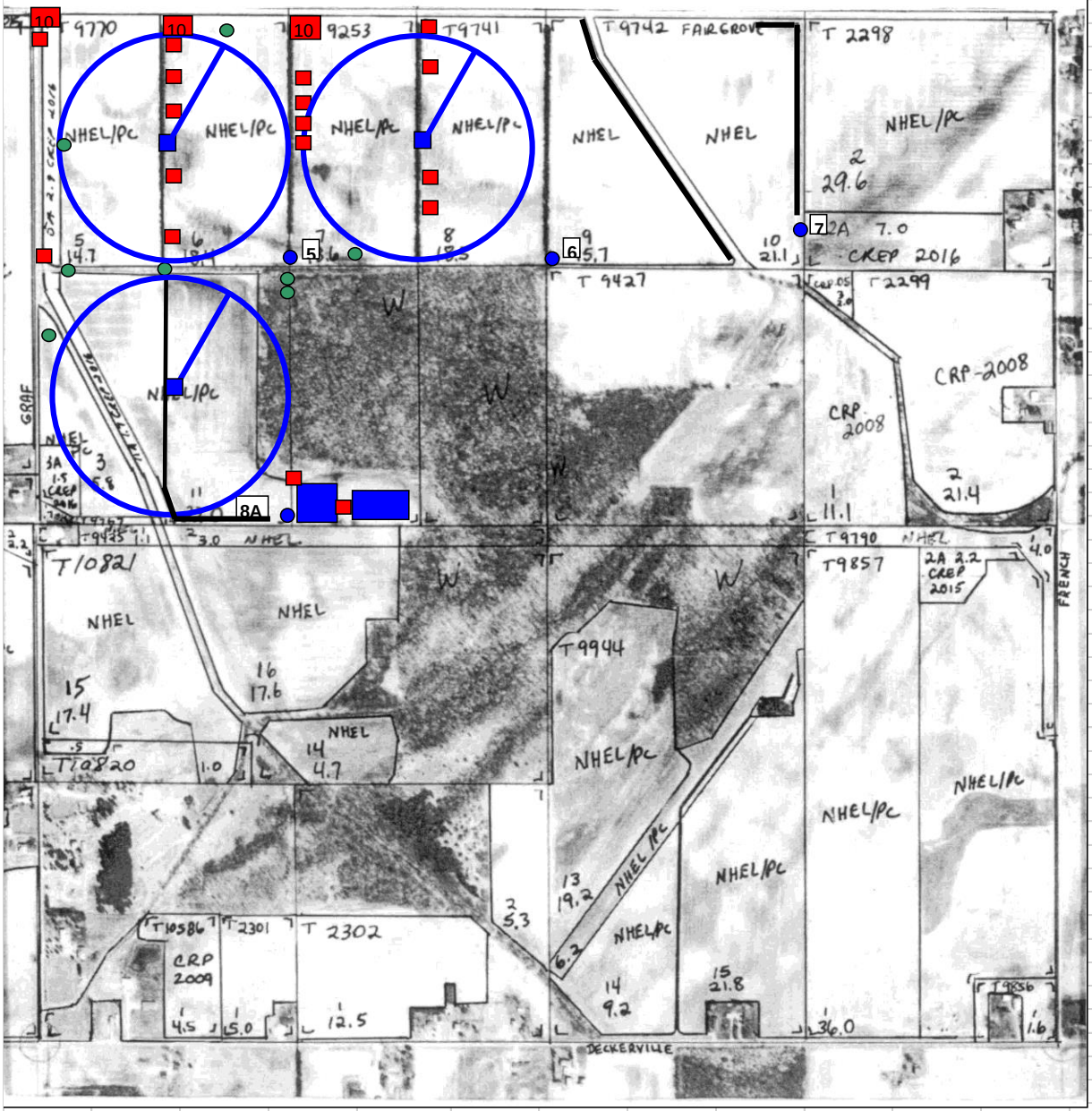


Farm Service Agency

Not to Scale

TOWNSHIP: Allen TWP. CODE H

SECTION NO: 29 NO. OF TRACTS: 15



- slide headstands
- wells
- surface drains


ROYAL

Current Pond Drainage

- We now have approximately 8 acres of ponds with the 4 ponds that take drainage water from 100 acres.
- Measuring the fill time of the largest pond has made us realize that our original estimate of drainage water is low and may be more like 300,000 gal/ acre in one year (equivalent to 10-12 inches)


HITACHI
SODLA
INTERSTATE


KOBELCO
MARK IV
SK200LC

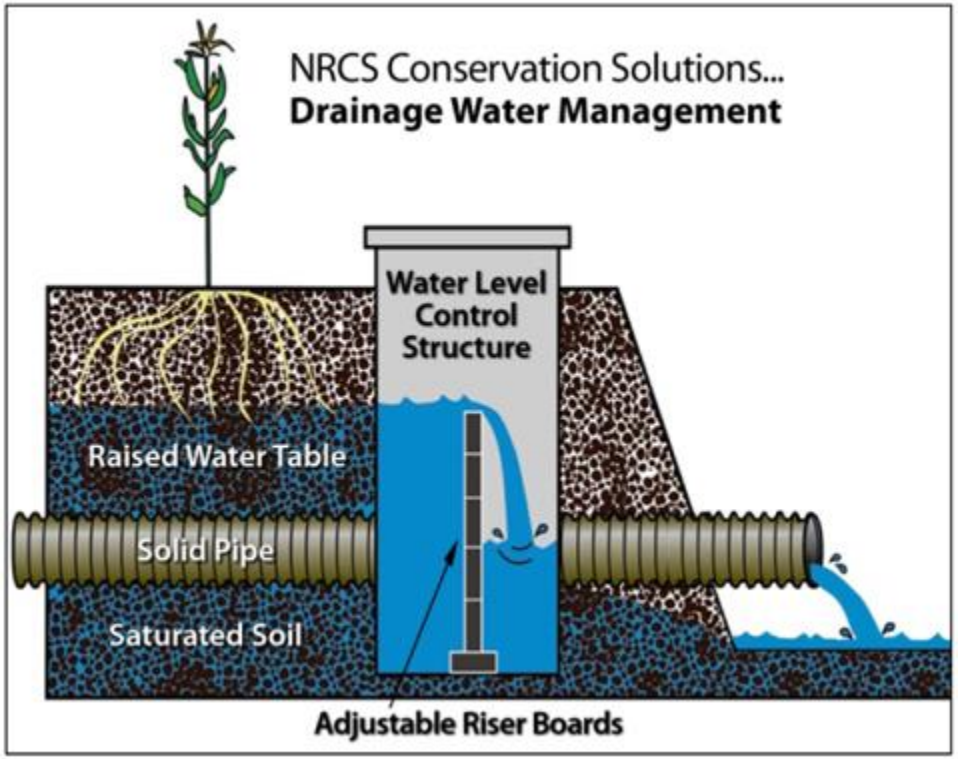
Pond Costs

- 1-2 acre ponds cost was $25-35,000 – Capable of servicing two 40 acre pivots
- 4.5 acre pond cost was $115,000 – Capable of servicing one 160 pivot
- Cost actually goes up with pond size due to moving earth a further distance.
- Costs can be reduced if fill could be sold.

Management

- Inspecting ponds for leaching areas
- Inspecting intake pipes for debris for drainage and pivots
- Aerator maintenance
- Cattail and Phragmites control
- Excessive wildlife; Geese, woodchucks, etc.
- Inspecting pivot operation
- Opening headstands if significant rain occurs
- Draining system properly for winter
- Mowing and Brush control
- Feeding Fish
- Aquashade

- Controlled Drainage:
  - Water table is kept closer to root zone
  - Nutrients are held closer to root zone and are not leached out.
  - In extreme rainfall situations the hydraulic conductivity is increased(wet sponge versus a dry sponge)
  - When rainfall does occur the advantages of a .2” rainfall <u>may</u> give the same effect as .4” or more.
  - Less obstruction of roots in the tile


NRCS Conservation Solutions...
Drainage Water Management
Water Level Control Structure
Raised Water Table
Solid Pipe
Saturated Soil
Adjustable Riser Boards

Equipment Specifications

- Eight 5 “ wells, with 3 additional test wells. 250’-325’ deep with 5hp pumps at 150’(100-115gpm)
- Two 3hp(100gpm) pumps in two ditches. Used in the spring flows or after a significant event.
- Two 5hp(300gpm) pumps in crocks lifting tile drainage water to ponds
- One 10hp(variable to 1000gpm) in crock lifting tile drainage water to ponds.
- Four pivot pumps(20-25hp) delivering 450-500gpm to pivots.
- Ponds 16’-20’ water depth(6 ponds totaling approximately 10 acres)


VALLEY
GPS READY

Conclusions

- Losing 3-5% of your acreage for a pond and the pond cost can be offset by higher crop yields and more consistent crop yields, especially for high value crops.
- Using ponds and tile/surface drainage water to supplement overhead irrigation reduces the demand on aquifers in sensitive areas.
- Tile drainage in our area approaches 10-12 inches annually. Our overhead irrigation use is 4-6 inches annually. Theoretically there should be enough tile drainage to irrigate with 100% tile water, if the amount of storage can be economically built.
- Using controlled drainage in combination with overhead irrigation can reduce the amount of water that needs to be applied overhead.

– “It ain’t what you don’t know that gets you in trouble.
– It’s what you know for sure that just ain’t so”

- Mark Twain


© 2016 Google