Making HDPE the Best it Can Be

Thoughts, Tips, and Advice

From 15 years in the field

Gregg Sorenson, Landscapes Unlimited

AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

– 2022 –

NATIONAL CONFERENCE

Hotel Monteleone

NEW ORLEANS

The following are my thoughts on Fusion based on my 15 year experience with using it on Golf Course projects

Review of Basic fusion principles and techniques

- Prepare/Clean
- Align
- Heat
- Fuse—Apply pressure

4 commonly used types of fusion in irrigation:

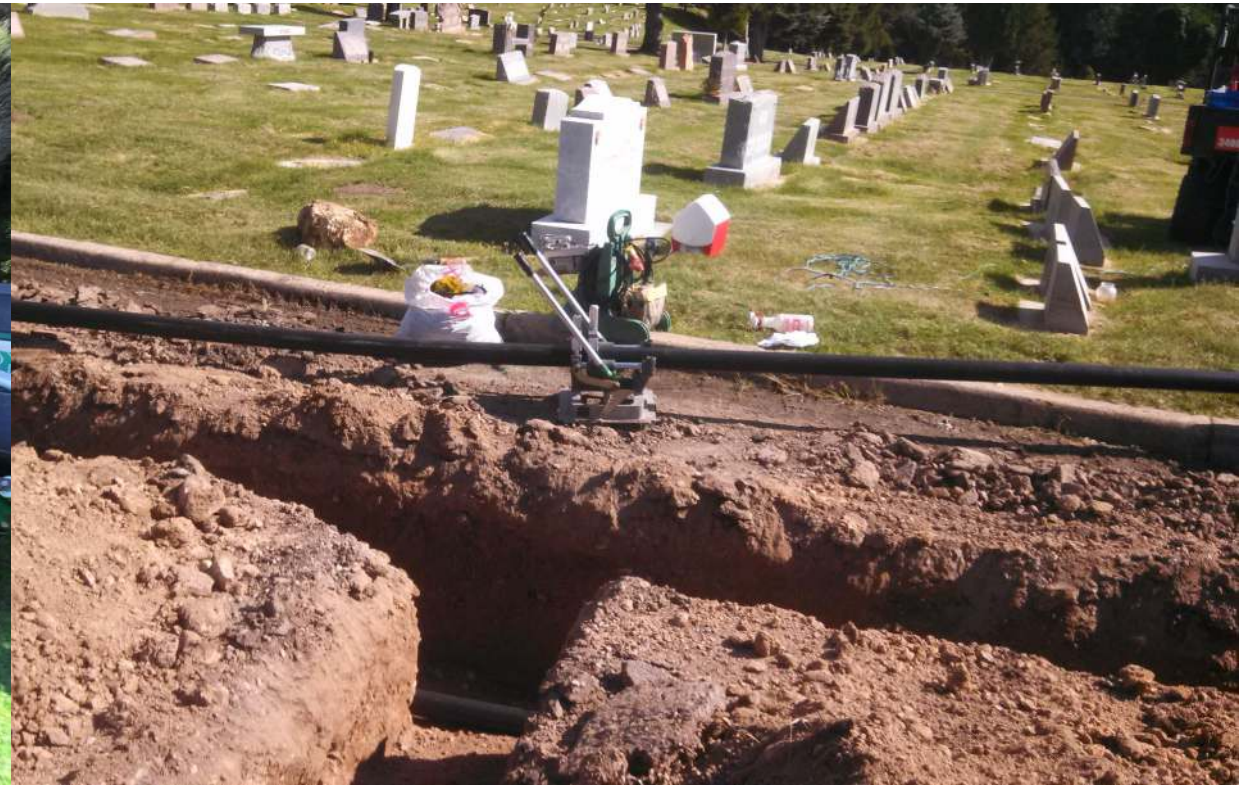
--Butt Fusion

--Electrofusion

--Sidewall Fusion

--Socket Fusion

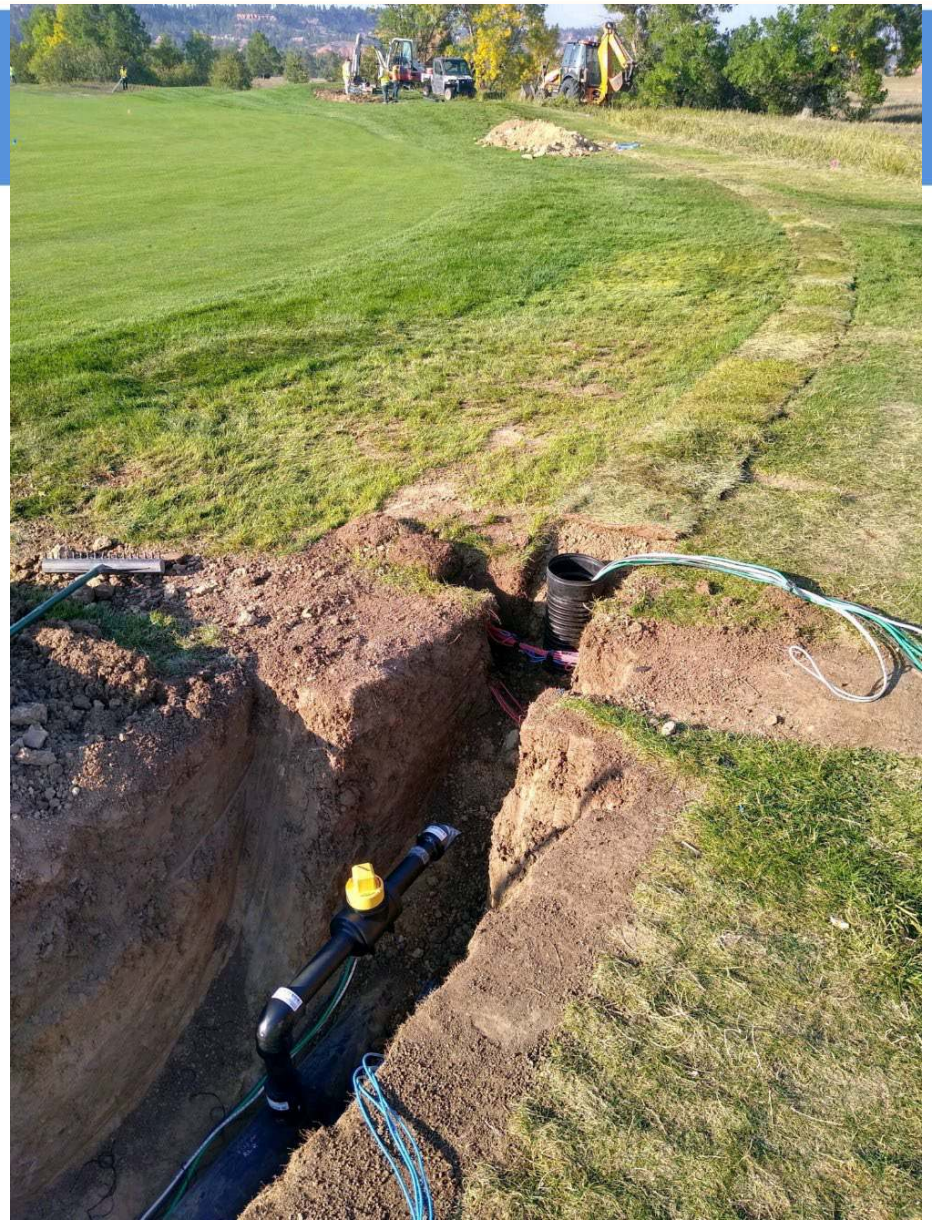
- Butt Fusion



Butt Fusion

- Electrofusion

Sidewall Fusion



Socket Fusion

Mobilization With HDPE pipe

- 40’ and 50’ sticks– Unloading and moving
- Stacking pipe lifts

- How to protect the pipe?

Why Protect the pipe?

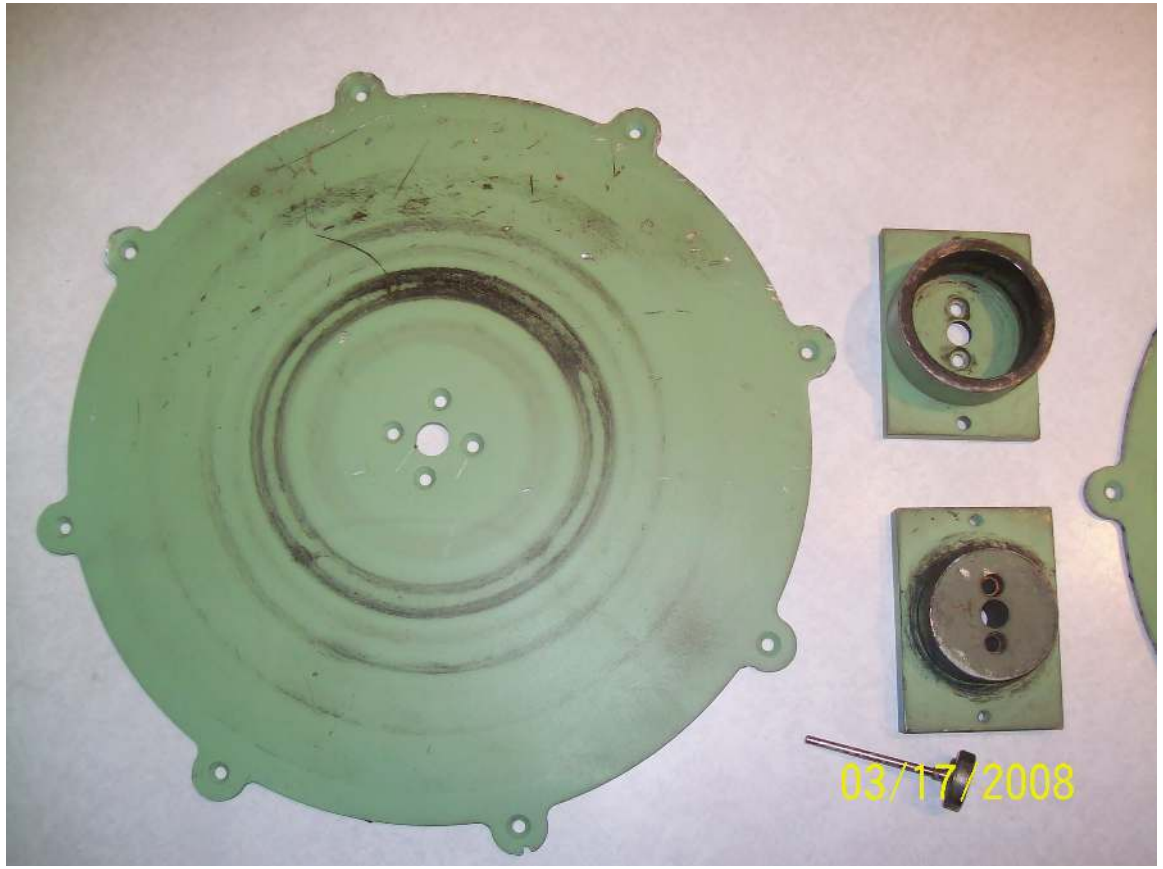
Fusion Machines

Different Brands—Familiarity

Manual vs Hydraulic

Wear Parts on Butt Fusion Machines:

- Jaws
- Gauges
- Generators
- Hydraulic parts
- Facer blades
- Heater plates, elements



Fusion machine issues

Wear parts on Electrofusion Processors

Bar code scanner

Power cable and power plug

Barcode stickers

Generator sizing issues

Must be calibrated regularly

Wear parts on Sidewall and Socket fusion Tooling

Heater plates

Gauges

Handles

Cords

heaterbags


McELROY MFG.

Data Loggers ---- the good and the bad

- Lateral sidewall saddle install -------Using a portable vacuum



Fusion Training and Certification

Things to watch out for

=

Things I’ve seen

- Defective Pipe

Molded vs Fabricated fittings

- Defective fittings

Over pressurized pipe blowout

Fusing different DR’s

- Electrofusion Repair


01/03/


04/25/2008
NOTICE

- EF saddle (poor fit)

- EF Fittings must stay in original plastic

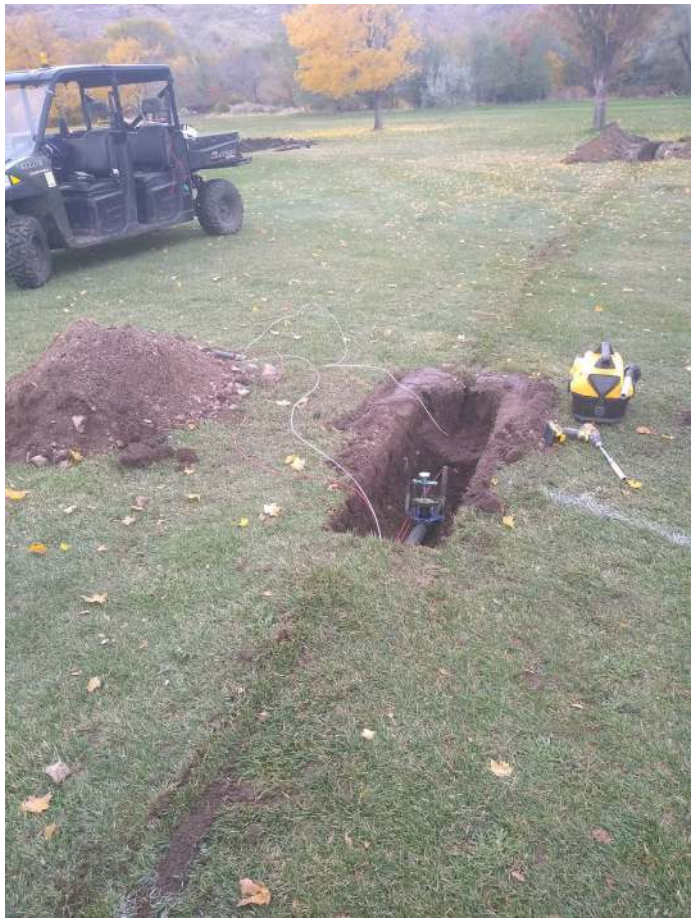
Double checking your heater and generator


01/03/2007

- Fusing in Adverse weather


Old Home
WHITE
SANDWICH

- Using a Joint Restraint as a Pipe Re-Rounder



Questions?

Irrigation and the Use of Groundwater

Presented by

James M. Emery, PG

Emery & Garrett Groundwater Investigations,

A Division of GZA

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NEW ORLEANS

OVERVIEW

- Brief Introduction – Who is Emery & Garrett Groundwater Investigations?
- Why use groundwater? What are the advantages?
- Who have we conducted irrigation groundwater investigations for?
- How do we determine if groundwater resources are available and can be used for irrigation at any one site?
- Can you save money using Groundwater?
- Questions & Answers

CORPORATE BACKGROUND

Emery & Garrett Groundwater Investigations, LLC is, as its name implies, *strictly* a groundwater consulting company. EGGI's entire focus is on the exploration, development, management, and permitting of groundwater resources. EGGI was founded in 1989 and has assembled an experienced groundwater exploration team that has successfully completed over 2,000 groundwater investigations for golf courses, public water authorities, municipalities, and commercial industries. In 2018, EGGI was acquired by GZA GeoEnvironmental, Inc. and is now a Division of GZA. EGGI has received local, state, and regional recognition for excellence in groundwater consulting from southern Georgia to northern Maine.

Why Use Groundwater for Irrigation?

1. Cost of groundwater is typically a fraction of the cost of purchasing water.
2. Groundwater can often be developed on site...it just takes a detailed investigation.
3. No prepayment for water contract volumes – you pay O&M costs only for what you pump from the ground after the source is developed.
4. Considered a very ***"green"*** option as less energy is used to produce the water source. Why use treated potable water for irrigating grass and shrubbery?
5. Water quality is often more favorable – no chlorine, fluoride, or possible trihalomethanes (chlorination byproducts).
6. Groundwater resources are more ***resistant to drought.*** Often public water sources will curtail providing irrigation supplies if they need to conserve water to meet potable needs.

A brief sampling of some of the clients who have hired EGGI to conduct groundwater investigations include the following:

- Walt Disney Development Corporation
- AUGUSTA NATIONAL
- IBM
- Xerox Corporation
- Virginia Department of Corrections (VDOC)
- American Security Council Foundation
- Professional Golf Association (Mid-Atlantic)
- Nicklaus-Sierra Development Corporation (multiple courses)
- Golf South, Inc. (two courses)
- Chevy Chase Country Club
- Virginia State Golf Association (Major golf training center with multiple golf courses)
- Senior Tour Players Association
- National Golf Association (two 18-hole golf courses)
- Pendleton Golf Course
- Howard Hughes Medical Institute
- Barclay Ridge – Jack Nicklaus design
- Bear National Golf Course – Jack Nicklaus design

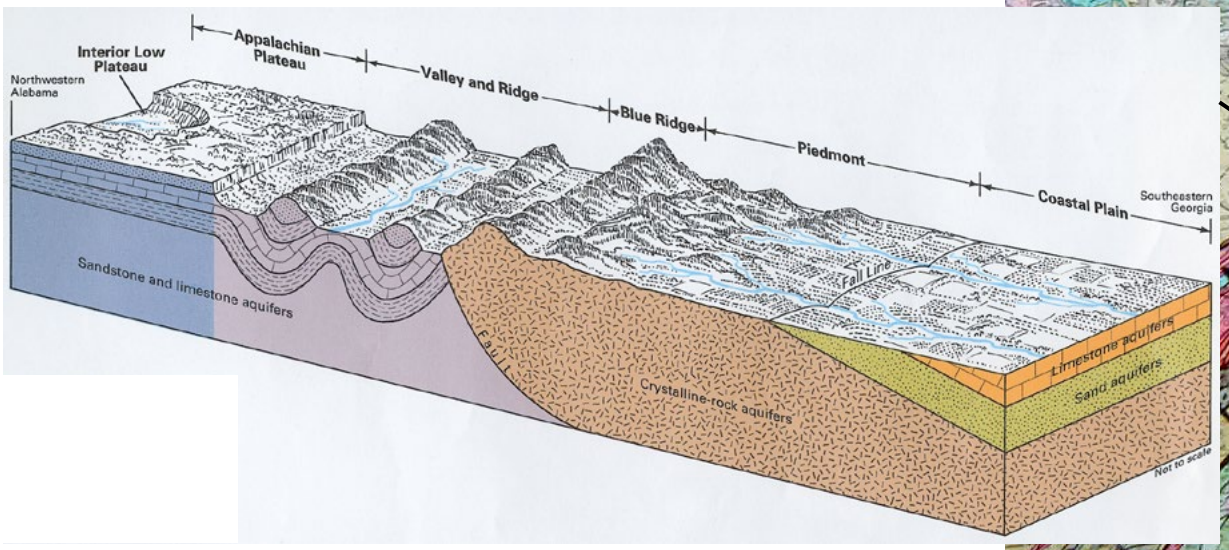
- Trafalgar House Property, Inc. (South Riding Golf Course)
- Northern Virginia Regional Park Authority – Brambleton Golf Course
- U.S. Home Corporation (Heritage Hunt Golf Course)
- Fairfax County ark Authority (two courses) – Twin Lakes & Richard Jones Golf Course
- Dan Maples Golf Course Design Group (multiple)
- Maryland Golf Academy (18-hole golf course)
- Rockwell International
- Siemens Power Corporation
- K. Hovnanian Homes
- Centex Homes
- Toll Brothers, Inc.
- Van Metre Homes
- National Park Service -- U.S. Department of the Interior
- U.S. Environmental Protection Agency
- National Recreation and Park Authority

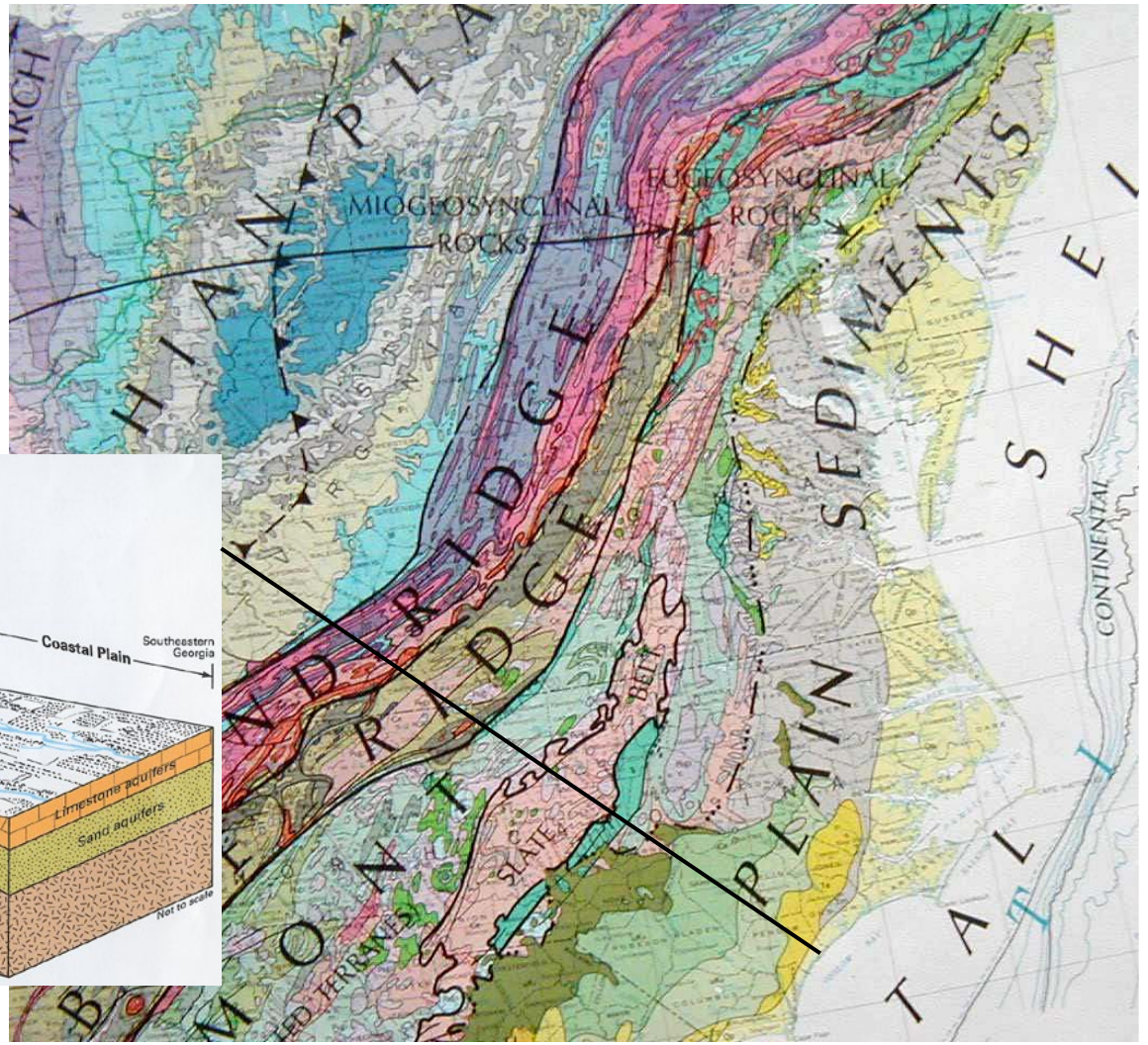
EGGI Clients & Professional Recognition

Existing and prior clients for whom EGGI has developed critical new water supplies have become our best professional references.

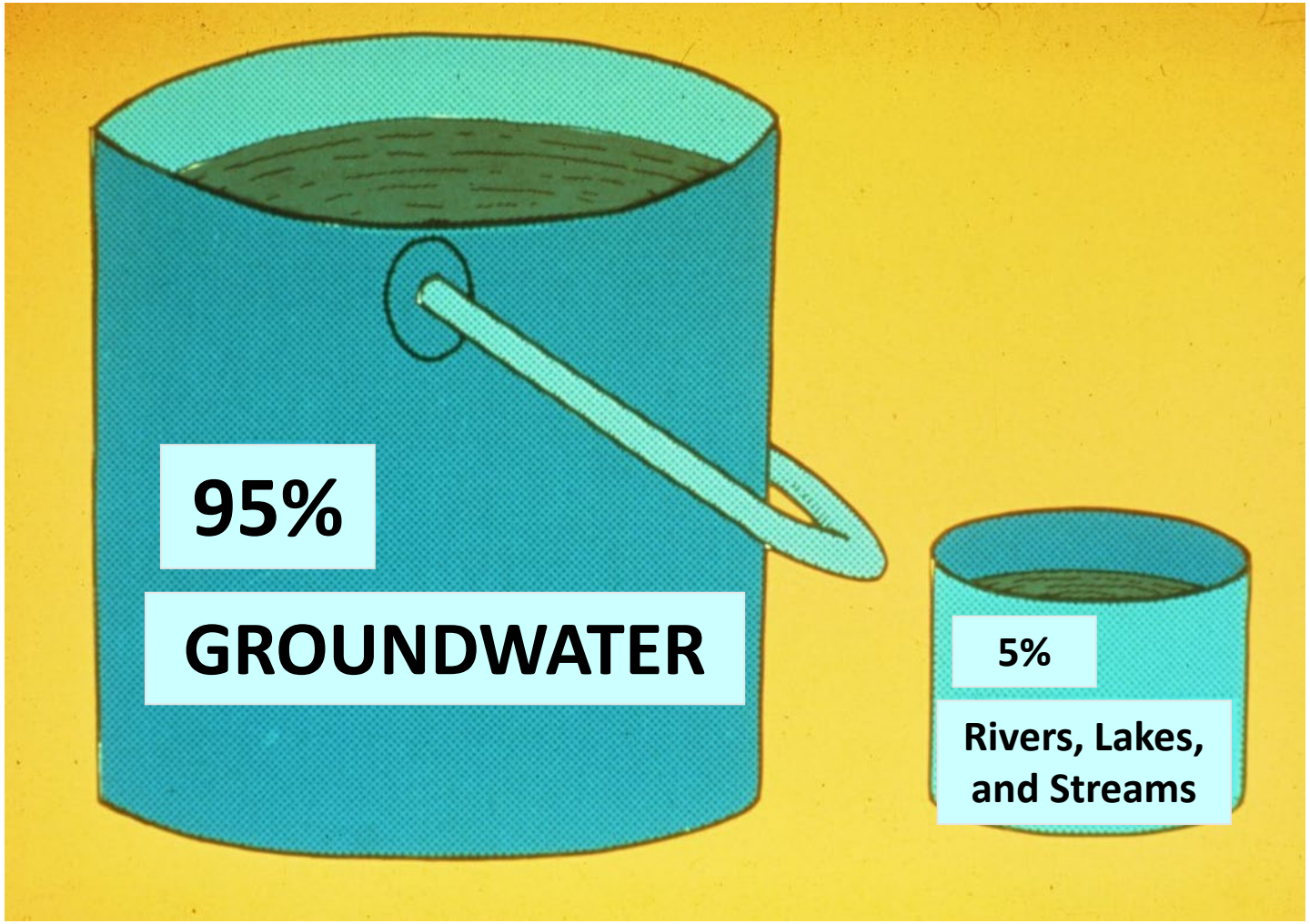
- EGGI's promotion of sound scientific solutions to complex groundwater projects and resource protection has resulted in local, state, and national recognition for excellence.

Geology of Central Eastern United States





Groundwater



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HOW DO YOU DISCOVER IF GROUNDWATER IS AVAILABLE ON SITE FOR IRRIGATION USE

Groundwater Exploration – Phases I-VII

(Starting with Satellite Image Analyses to Production Well)

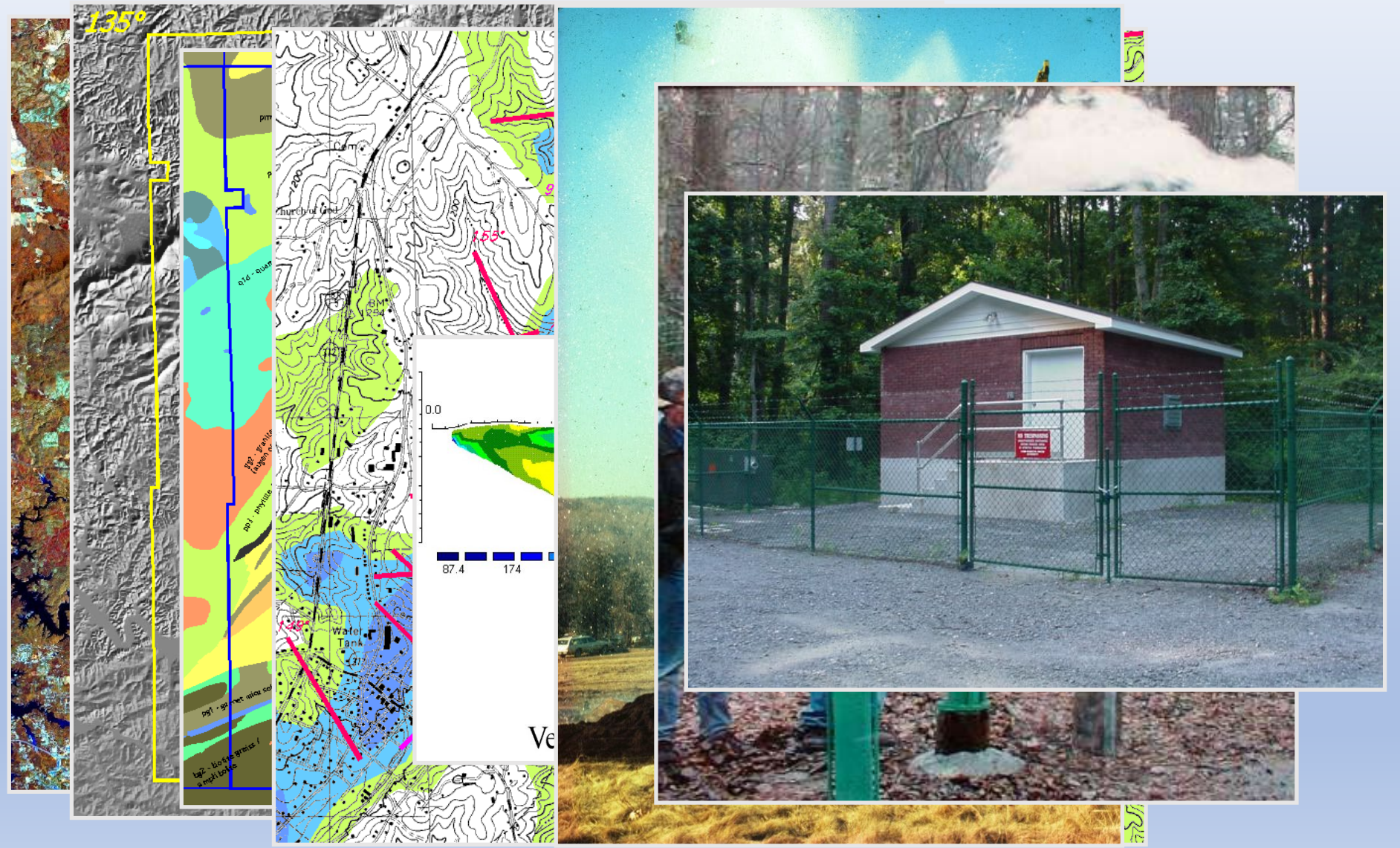
Emery & Garrett Groundwater Investigations, A Division of GZA

GROUNDWATER INVESTIGATION
Irrigation Water Supplies

PHASE I	**– HYDROGEOLOGIC EVALUATION**
PHASE II	**– GEOPHYSICAL SURVEYS - SELECTION OF TEST WELL DRILLING TARGETS**
PHASE III	**– TEST WELL DRILLING**
PHASE IV	**– PRODUCTION WELL DRILLING**
PHASE V	**– TESTING of YIELD and QUALITY**
PHASE VI	**– DEVELOP GROUNDWATER USE MANAGEMENT PLAN**
PHASE VII	**– DESIGN and CONSTRUCT PUMPING and DISTRIBUTION FACILITIES**

Groundwater Exploration

– from satellite image analyses to production well



Groundwater Investigation - Irrigation Water Supplies

PHASE I

LINEAMENT ANALYSIS

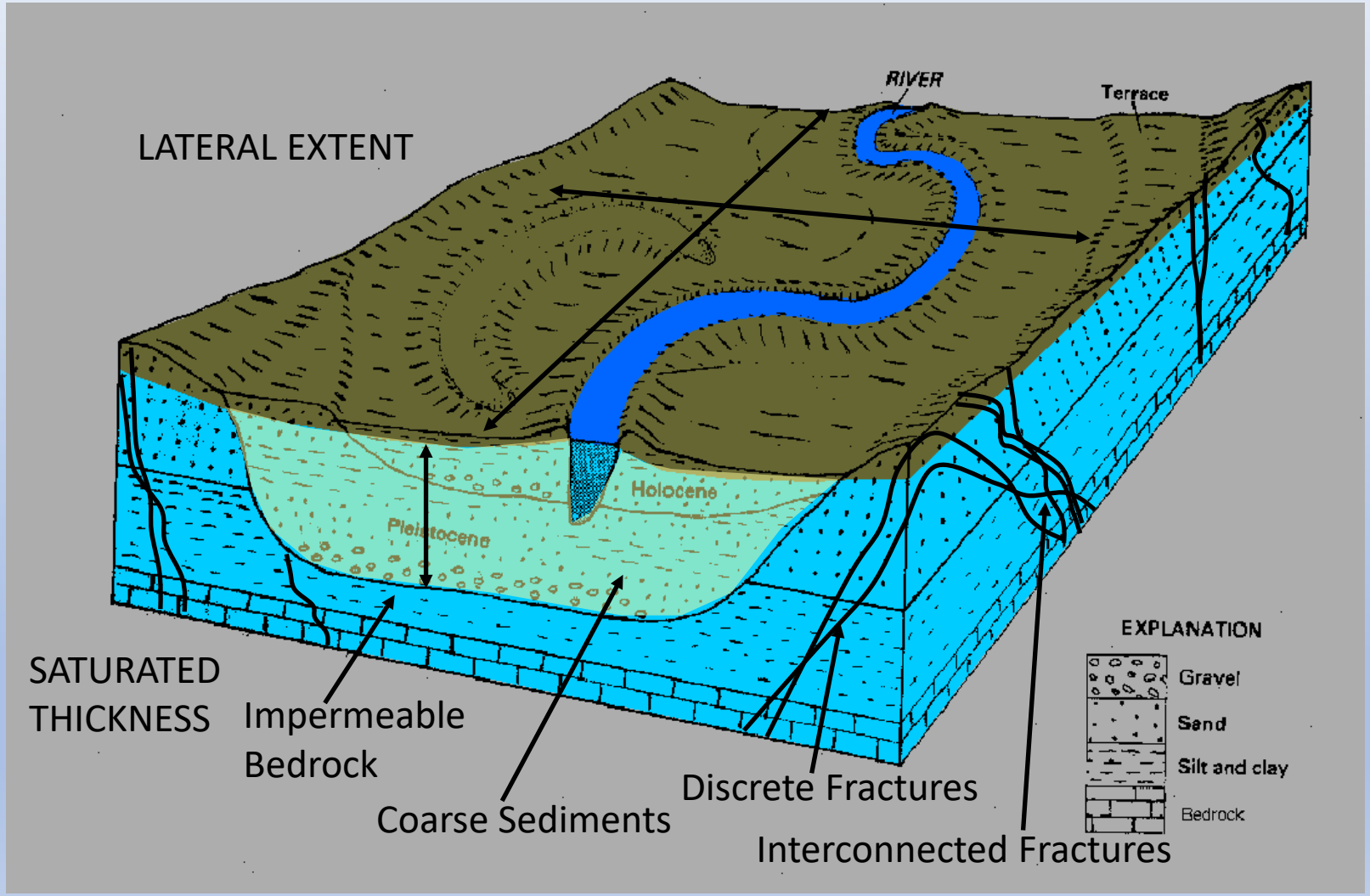
FIELD INVESTIGATIONS

CONTAMINANT THREATS REVIEW

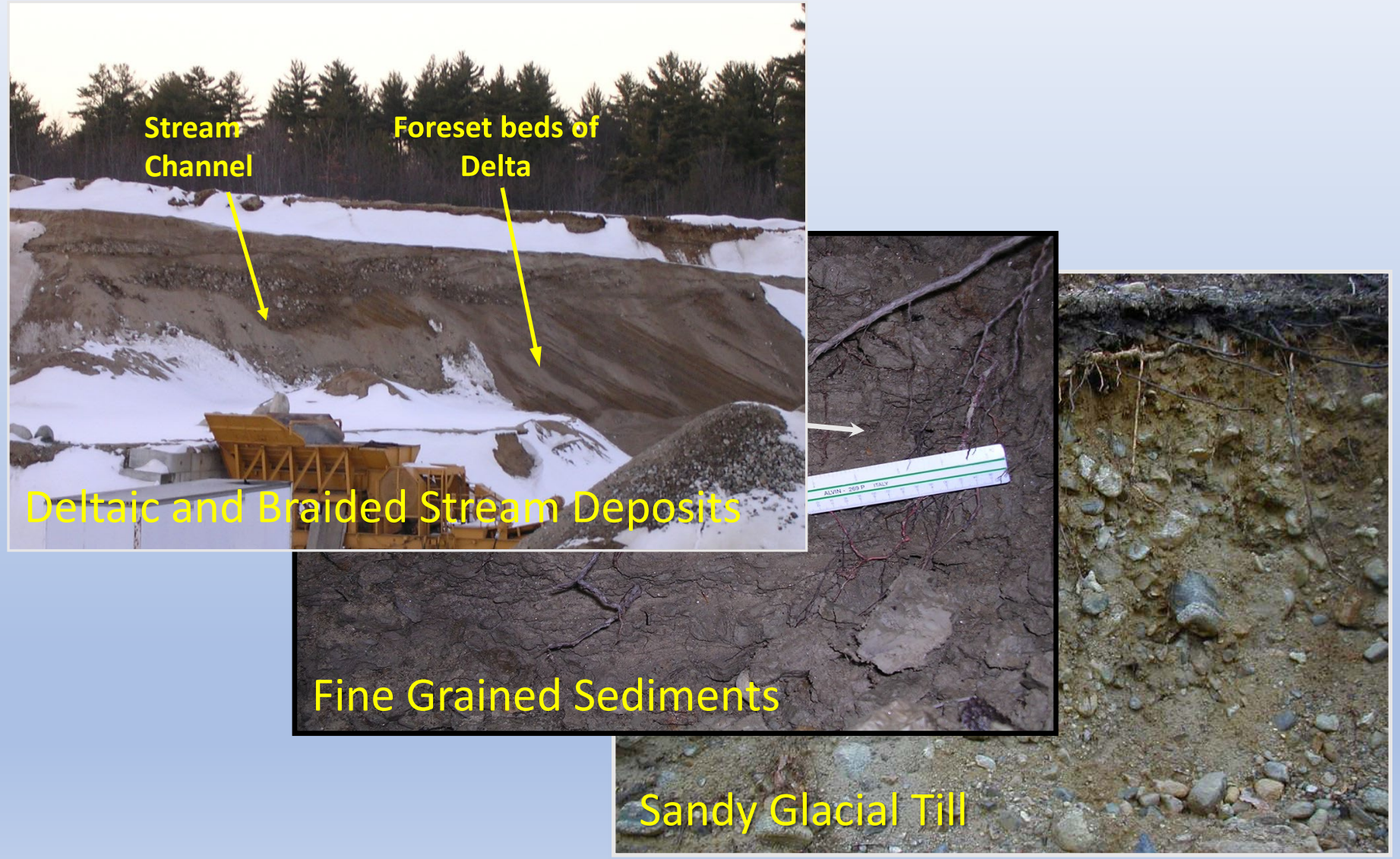
RECHARGE REVIEW

SELECTION OF FAVORABLE AREAS FOR GROUNDWATER DEVELOPMENT

Conceptual Model for Groundwater Resources



Unconsolidated Sediment Aquifers



Sand and Gravel

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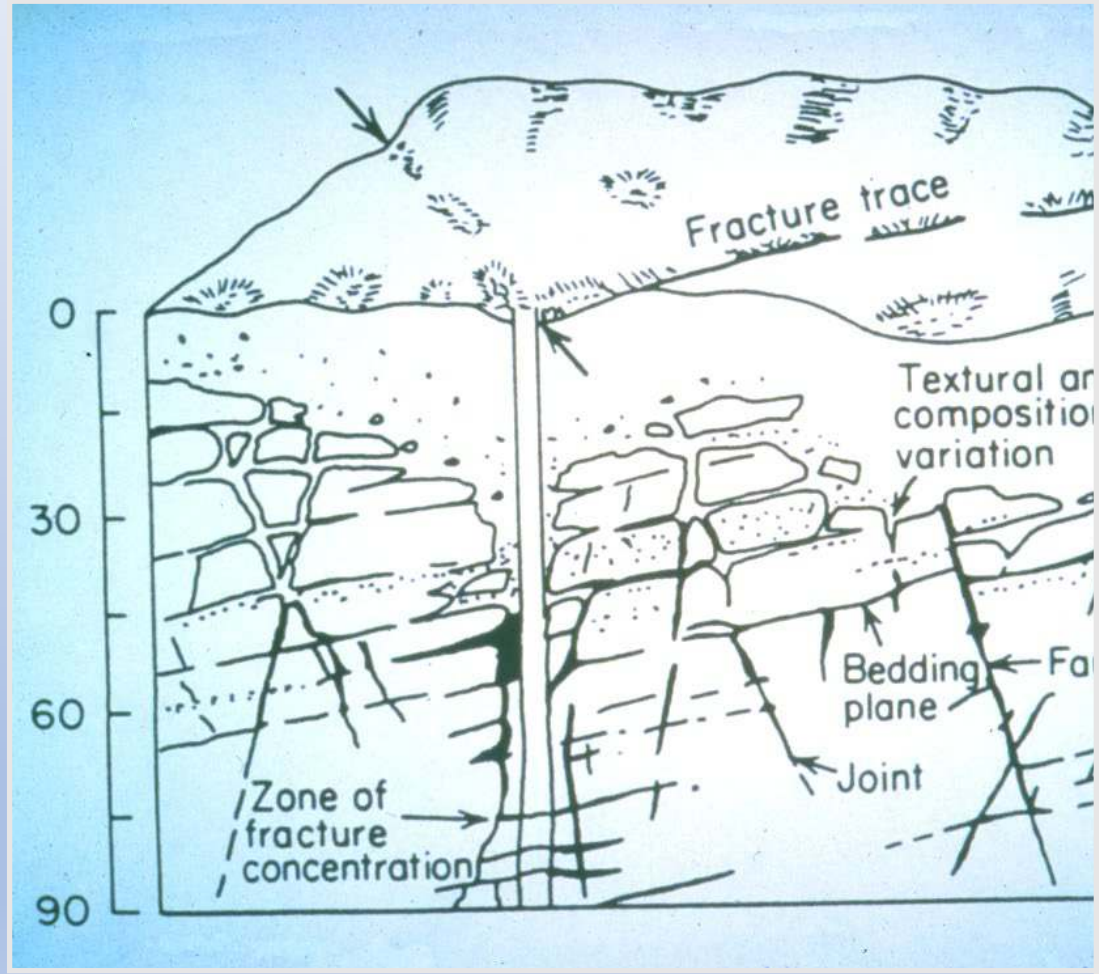
Fractured Bedrock Aquifer – Conceptual View



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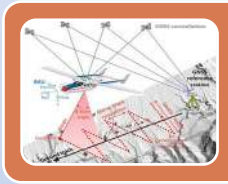
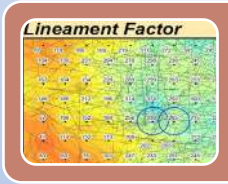
EGGI's Groundwater Resource Investigations

Remote Sensing Data Collection and Analyses

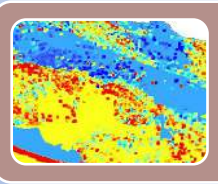
SATELLITE MULTISPECTRAL IMAGERY ENHANCED for MAPPING GEOLOGY and STRUCTURAL FEATURES



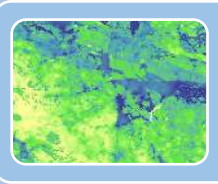
DIGITAL ELEVATION MODELS ENHANCED for DETECTION of LINEAMENTS and FAULT ZONES



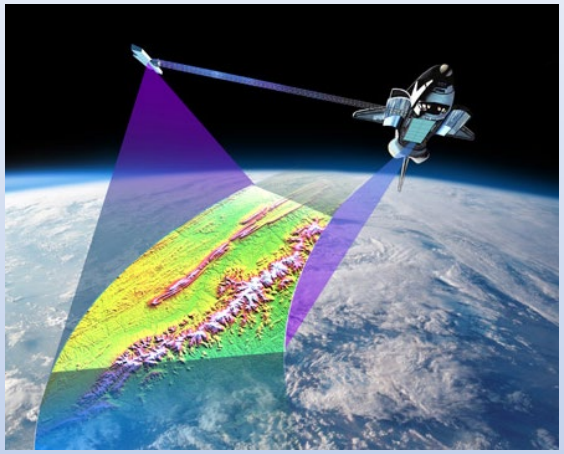
GENERATION of LINEAMENT FACTOR MAPS and LINEAMENT DOMAIN ANALYSIS through GRIDDED ROSE DIAGRAMS



STRUCTURAL DATA EVALUATION\BEDROCK FRACTURE-FABRIC ANALYSIS\DIP DOMAIN ANALYSIS

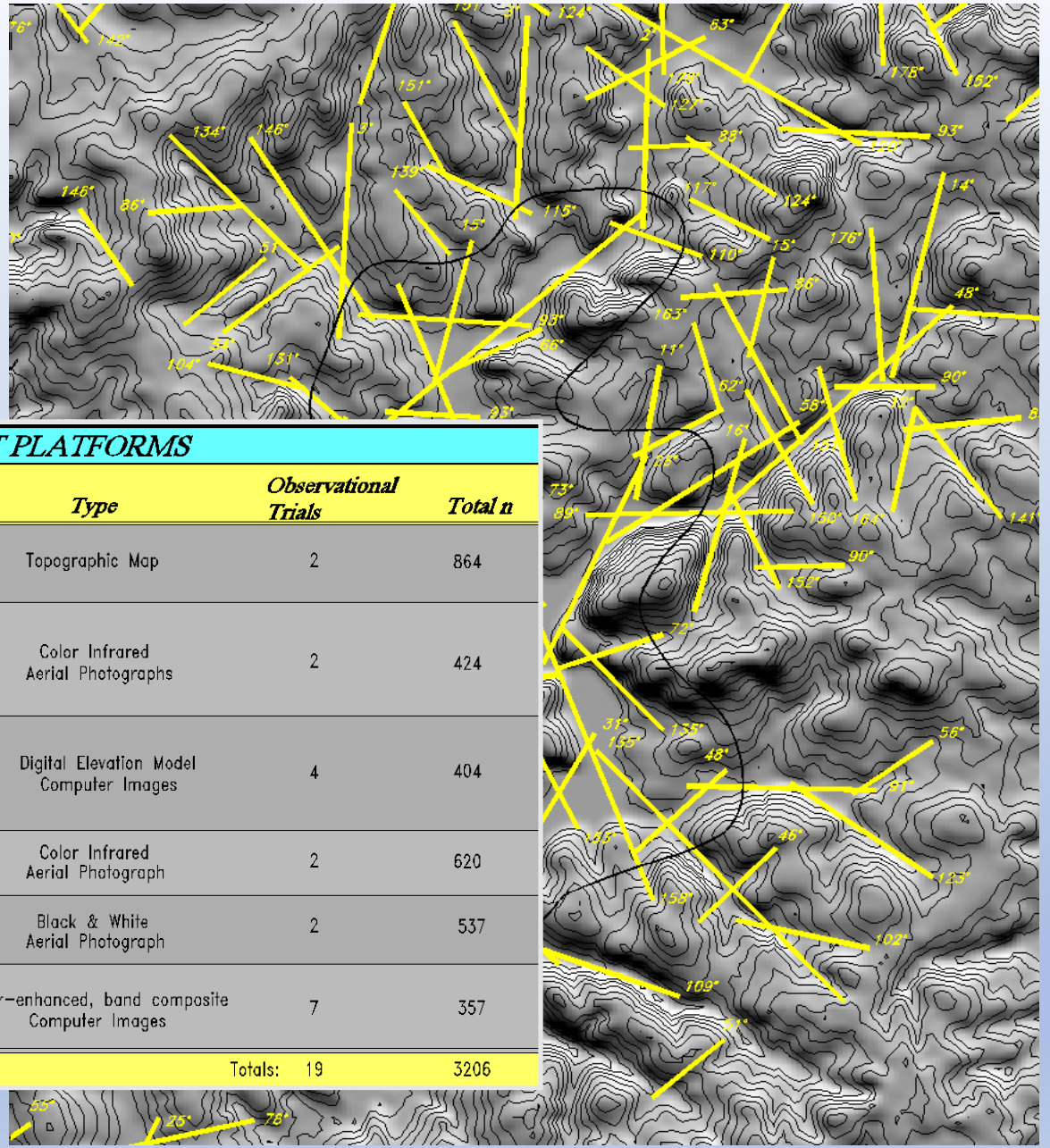


INVESTIGATION of SUBSURFACE HYDROGEOLOGY THROUGH GEOPHYSICAL SURVEYS



LANDSAT/ASTER/LIDAR/DEM

Lineament Analysis



LINEAMENT PLATFORMS

Scale	Image ID (Name / Roll /Frame)	Type	Observational Trials	Total n
1:6000	2-foot contour map	Topographic Map	2	864
1:20000	NAPP 7702 196 NAPP 7702 197	Color Infrared Aerial Photographs	2	424
1:30000	Digital Elevation Model Side-illuminated at: 0°, 45°, 90°, and 135° from North	Digital Elevation Model Computer Images	4	404
1:58000	NHAP80 17 18	Color Infrared Aerial Photograph	2	620
1:80000	NHAP80 16 13	Black & White Aerial Photograph	2	537
1:30000	LANDSAT TM Band combinations as Red-Green-Blue: 453, 543, 742, and 754. Also Principal Components 1-2-3, thermal (band 6), and band 5/7 ratio.	Color-enhanced, band composite Computer Images	7	357
(* - of each image)			Totals: 19	3206

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Field Investigations

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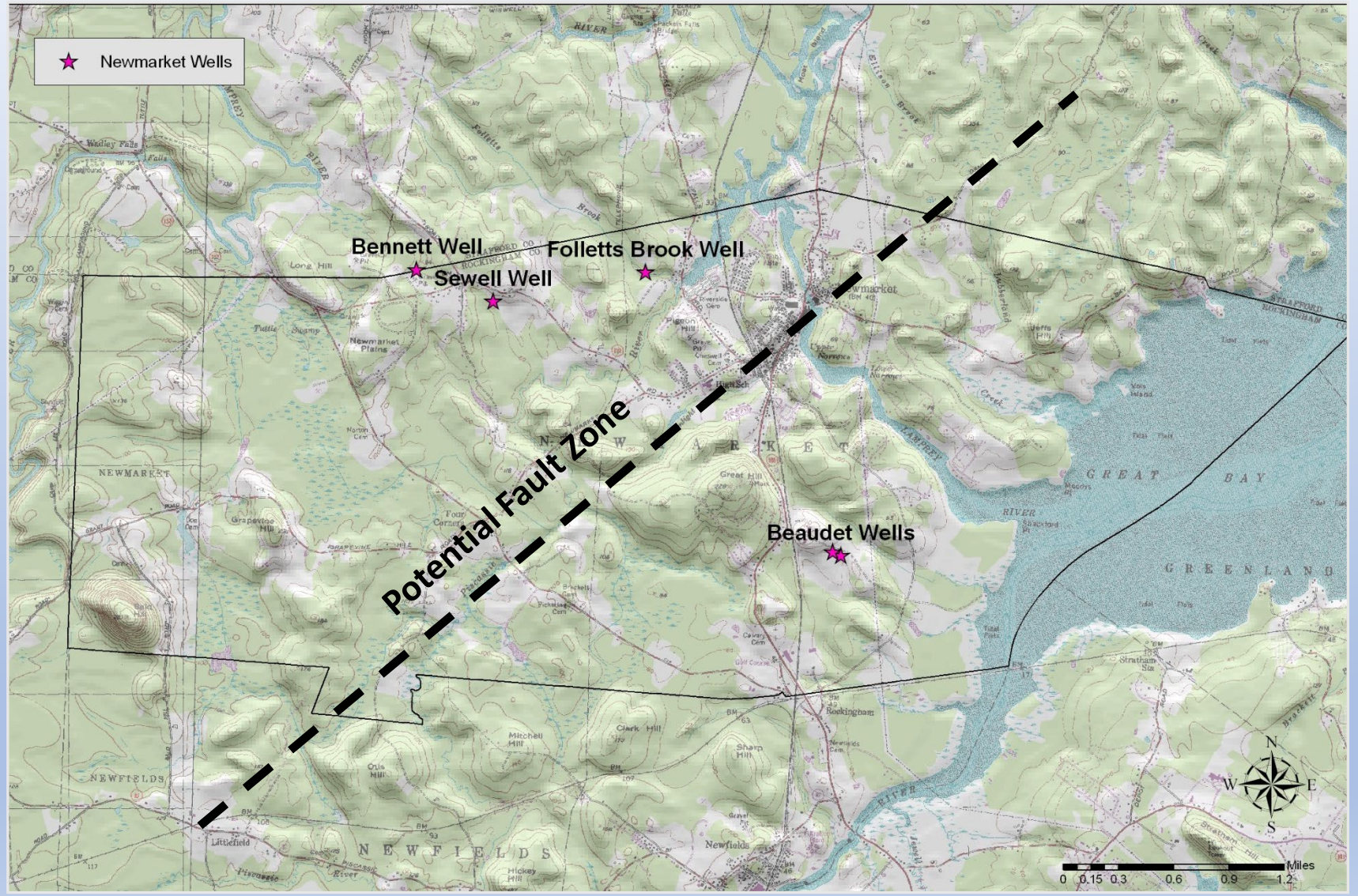
Field Investigations

OBLIQUE FRACTURES

Field Investigations

NO FRACTURES

Structural Analysis



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Review of Contaminant Threats to Groundwater Quality

Old Unregistered Dump

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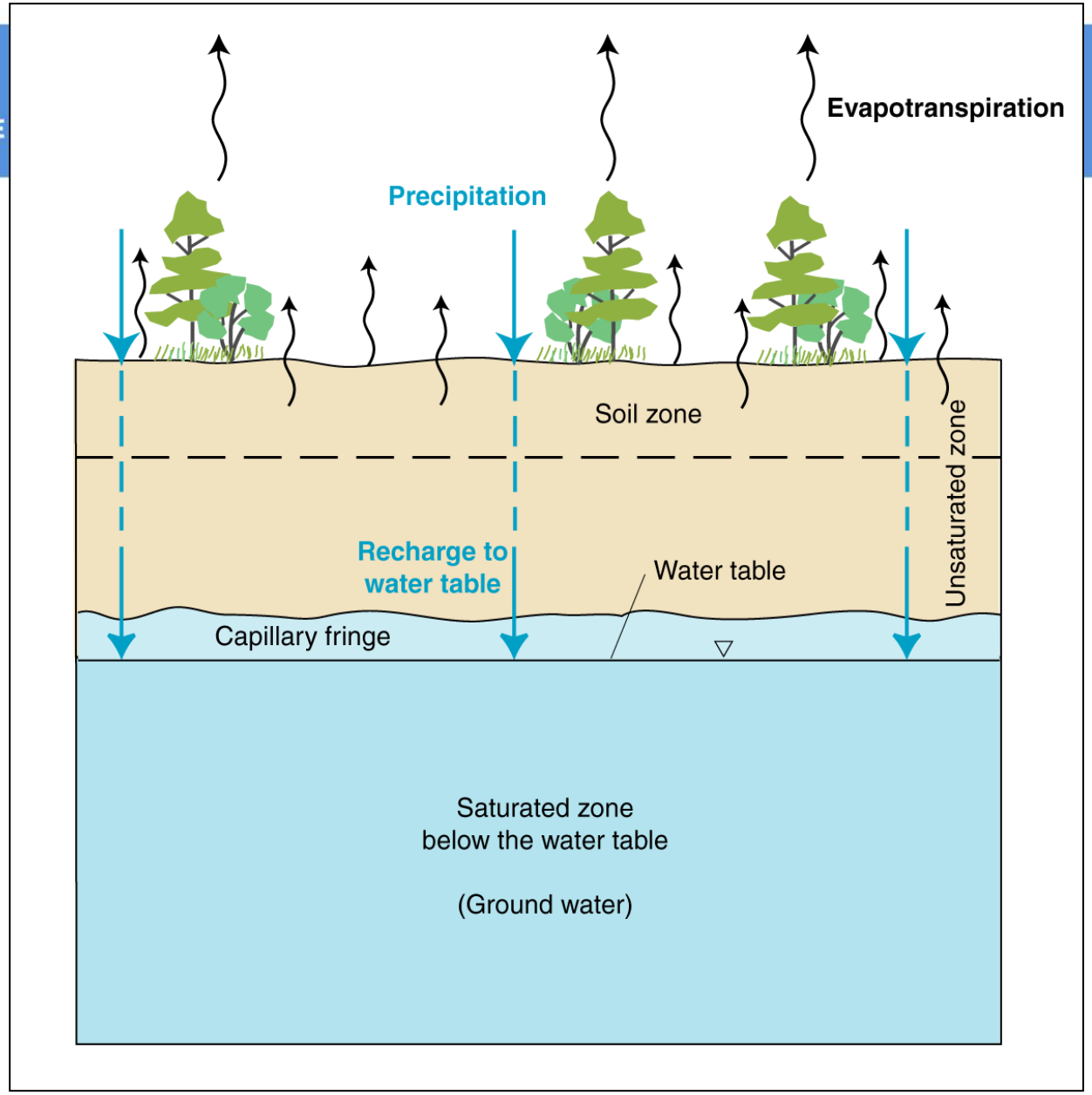
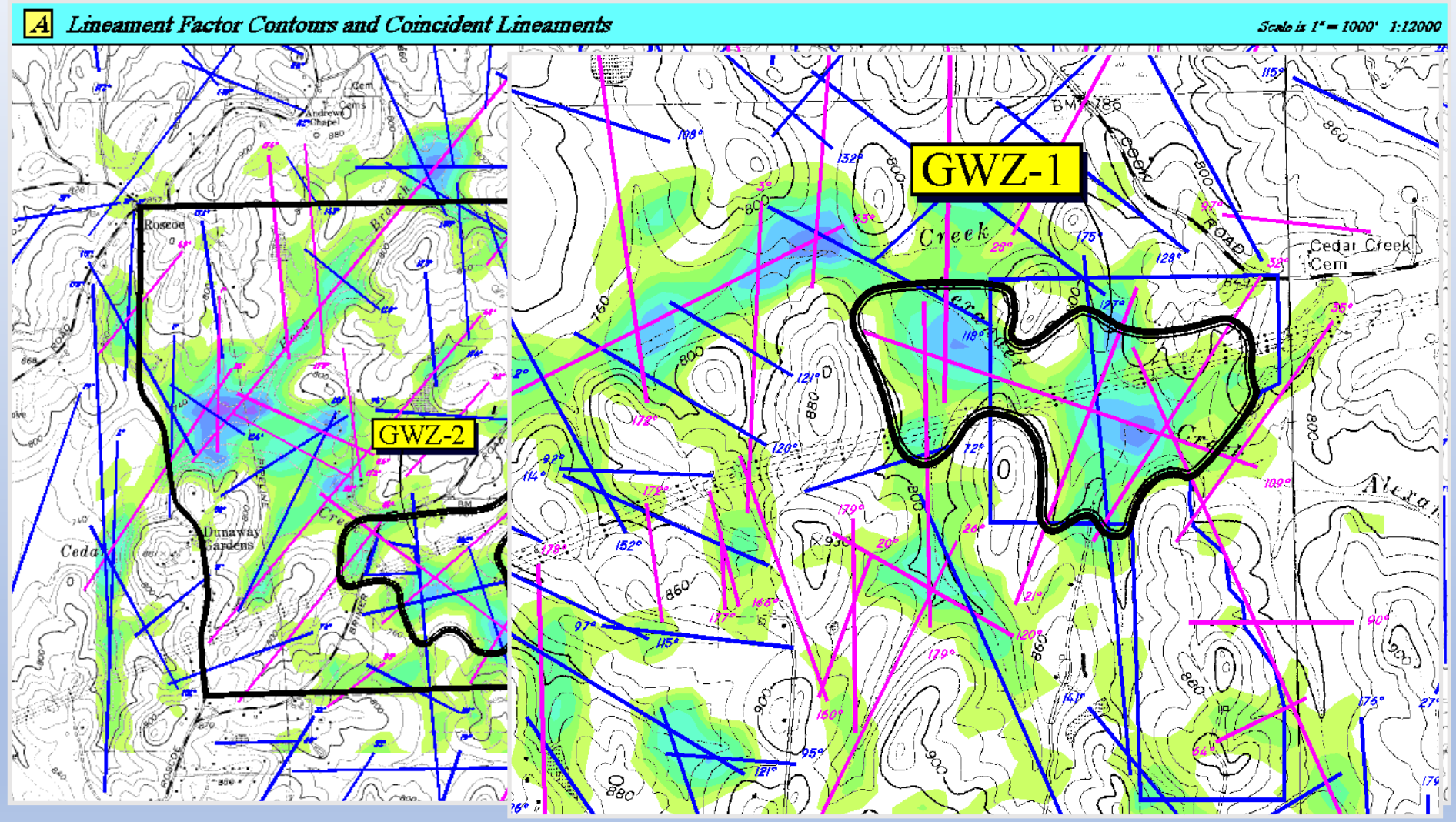
Assess Groundwater Recharge Potential



Groundwater Favorability Analyses – Coweta County, Georgia



Analyses of Lineaments: Lineament Factor Maps & Rose Diagrams

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Groundwater Exploration – Phase II

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Groundwater Investigation - Irrigation Water Supplies

PHASE II

GEOPHYSICAL SURVEYS

SELECTION OF EXPLORATORY TEST WELL SITES

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Geophysical Investigations

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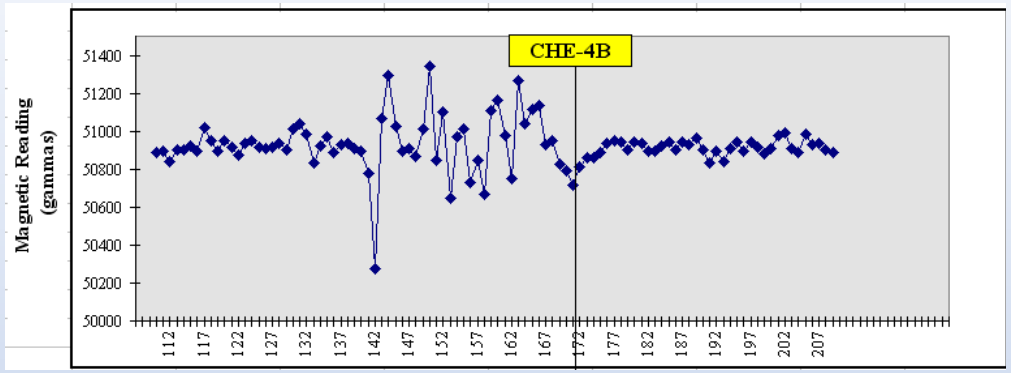
Groundwater Exploration

Conduct geophysical surveys to locate sub-surface, water-bearing zones

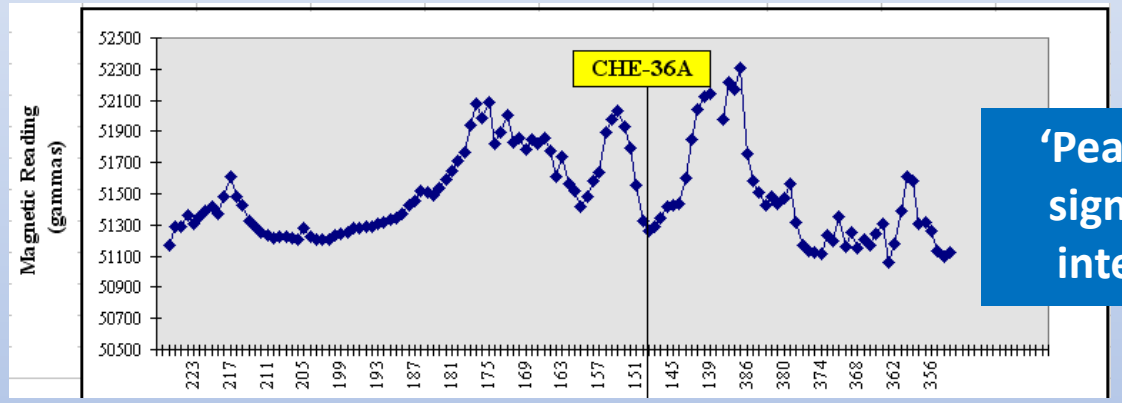
ENVI – Combined magnetic and electro-magnetic (very low frequency) measurements. Reconnaissance site assessment.

ABEM – Electrical resistivity surveys. Detailed site assessment – placement of stakes indicating test well candidate location.

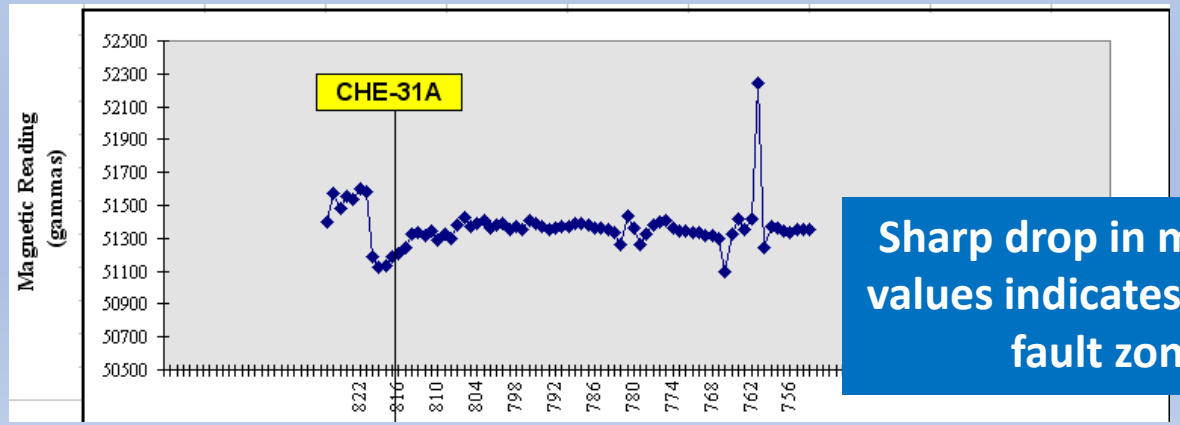
PHASE II – Results



Examples of
Selected Exploratory Drilling
Targets based on MAGNETIC data



'Peaks and Valleys' in magnetic signature of bedrock indicates interlayered package of rocks



Sharp drop in magnetic values indicates bedrock fault zone

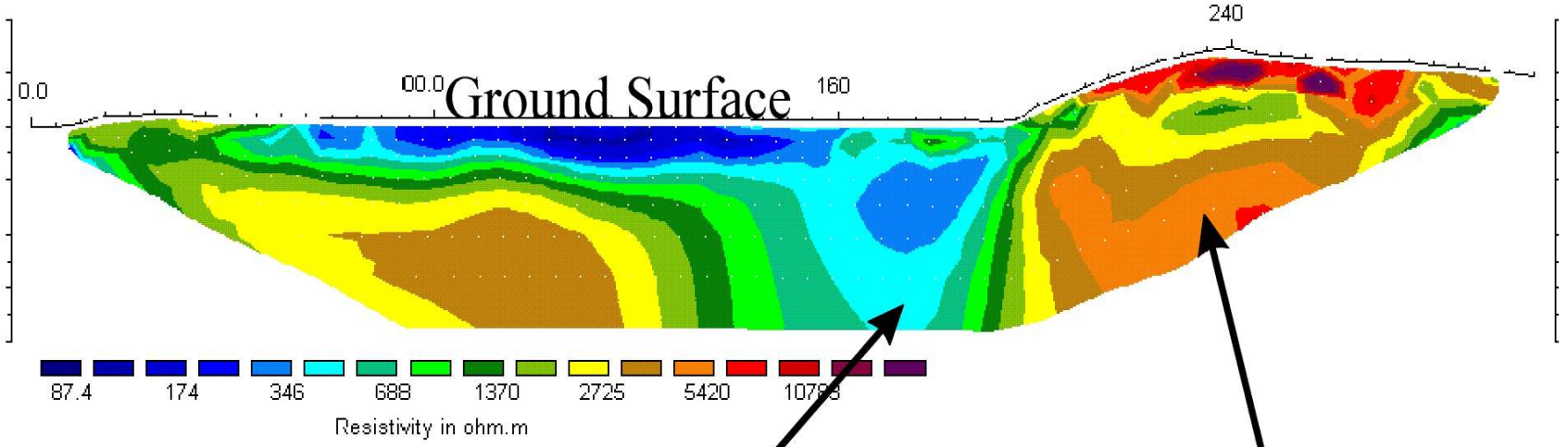
Geophysical Investigations

RESISTIVITY / INDUCED POLARIZATION METHOD

Measures the subsurface material's ability to transmit electricity and hold an electrical charge

GEOPHYSICAL INVESTIGATIONS

Cross-Section in Metamorphic Bedrock



Bedrock Fracture Zone

Solid, Unfractured Bedrock

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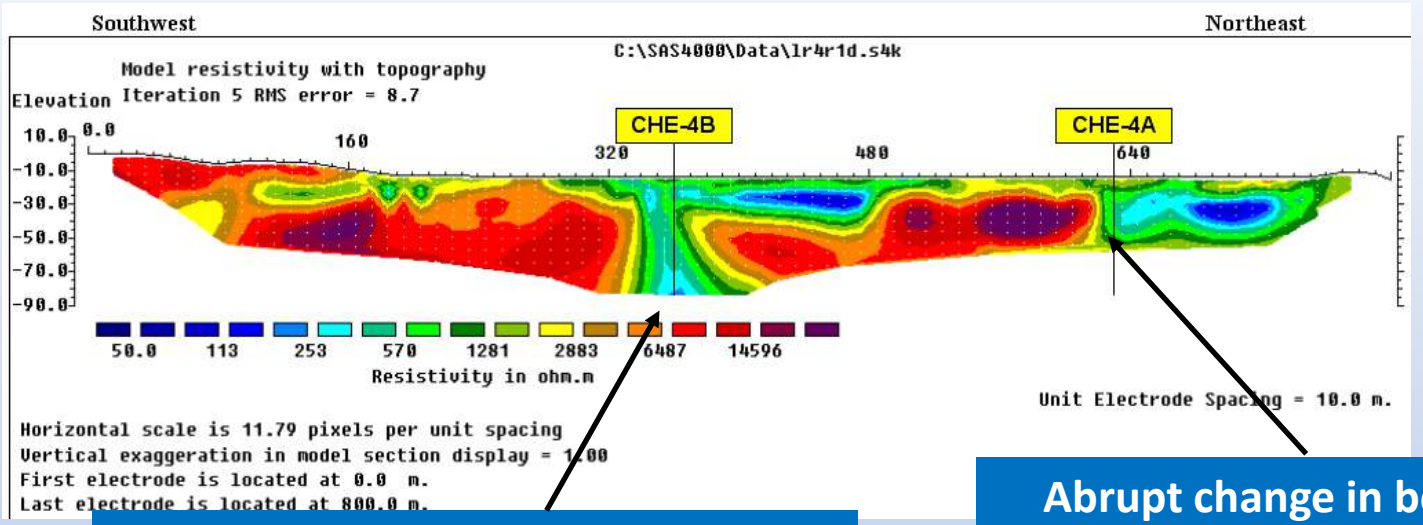
PHASE II – Results

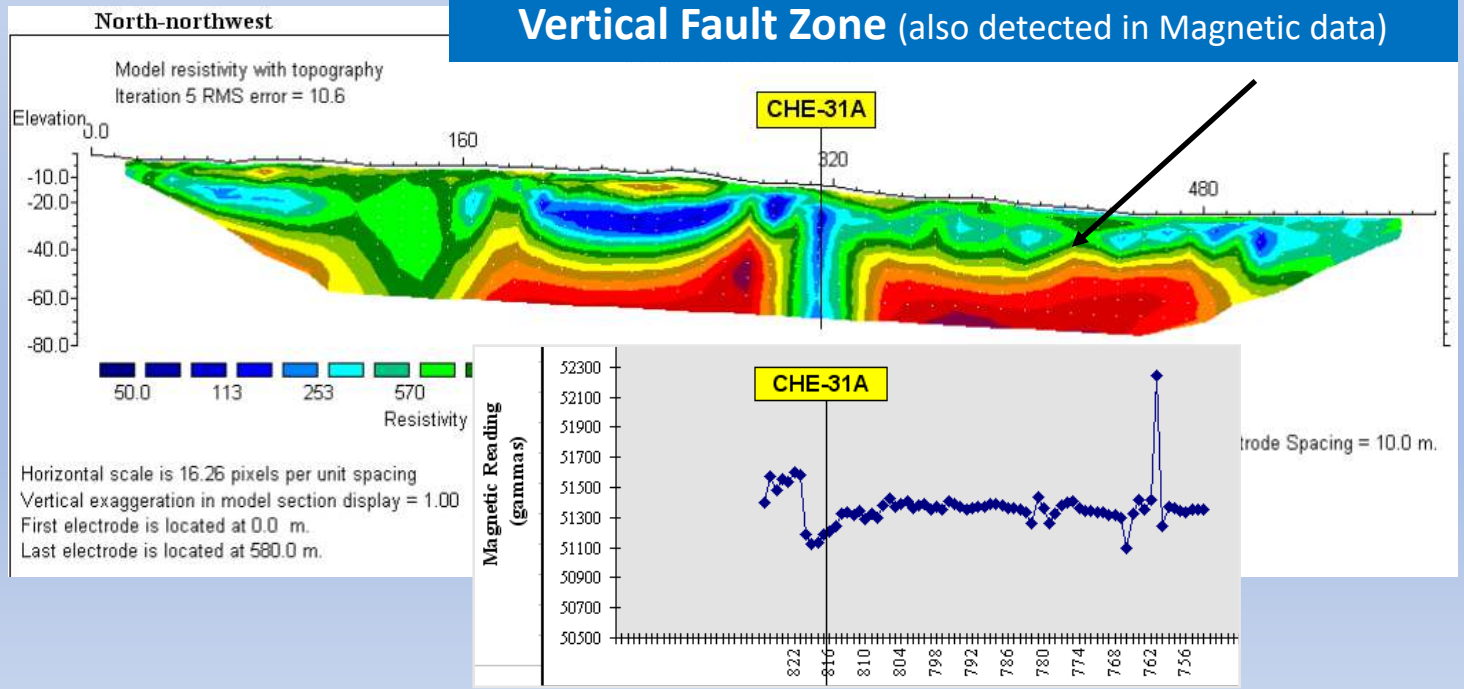


Examples of Electrical Resistivity Targets

Abrupt change in bedrock types

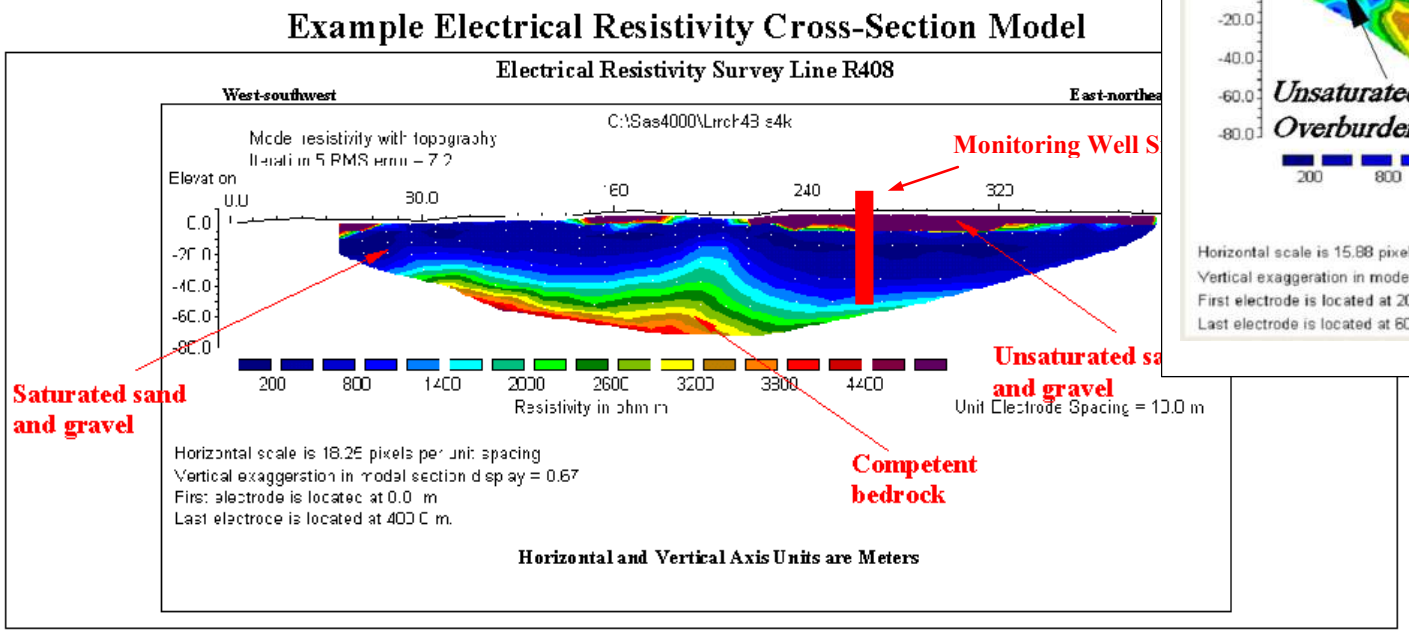
Steeply inclined fracture/fault zone

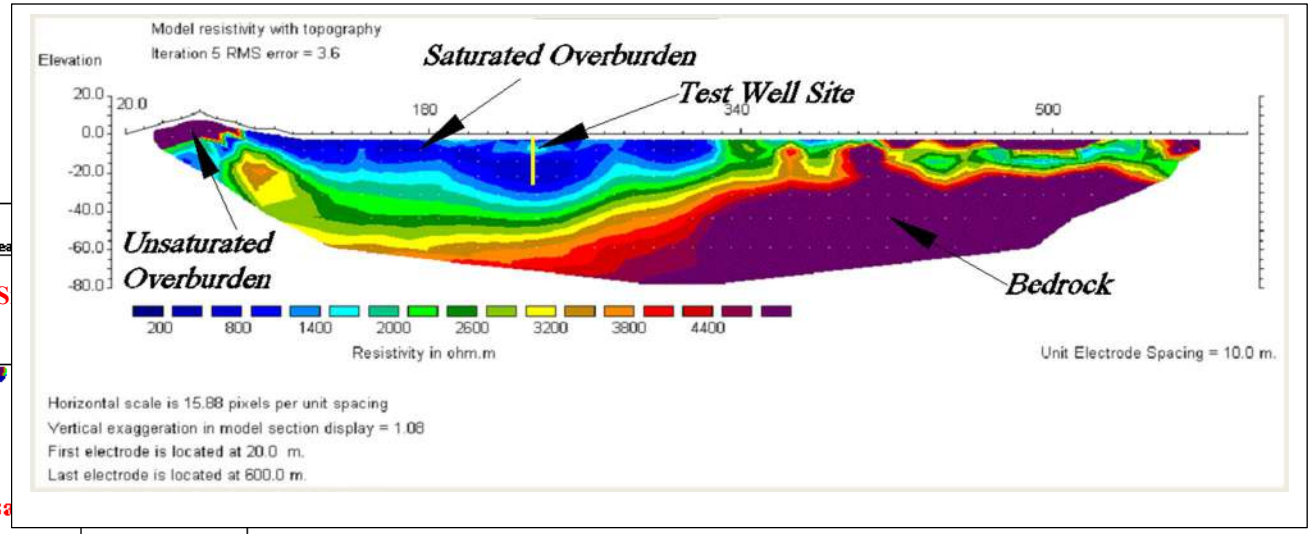
Vertical Fault Zone (also detected in Magnetic data)



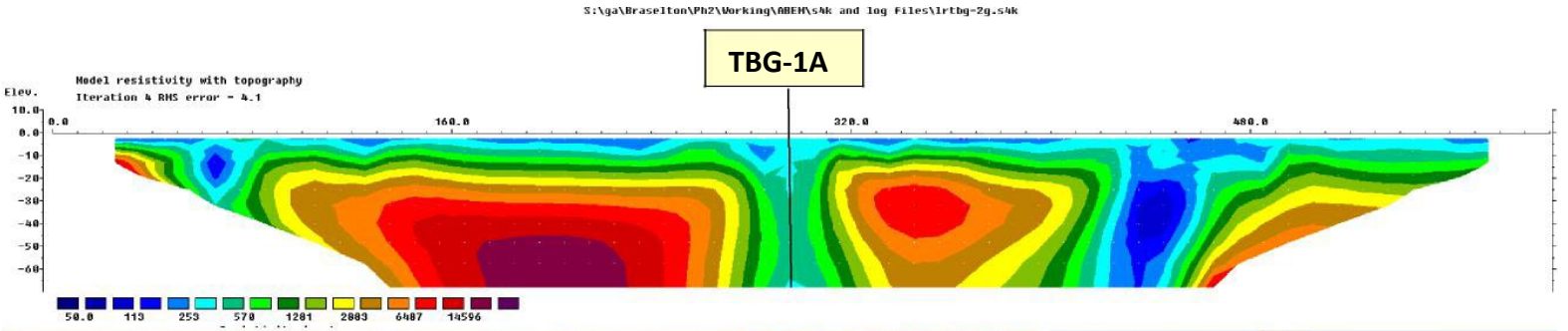
GEOPHYSICAL INVESTIGATIONS

Cross-Section in Sand and Gravel





GEOPHYSICAL INVESTIGATIONS



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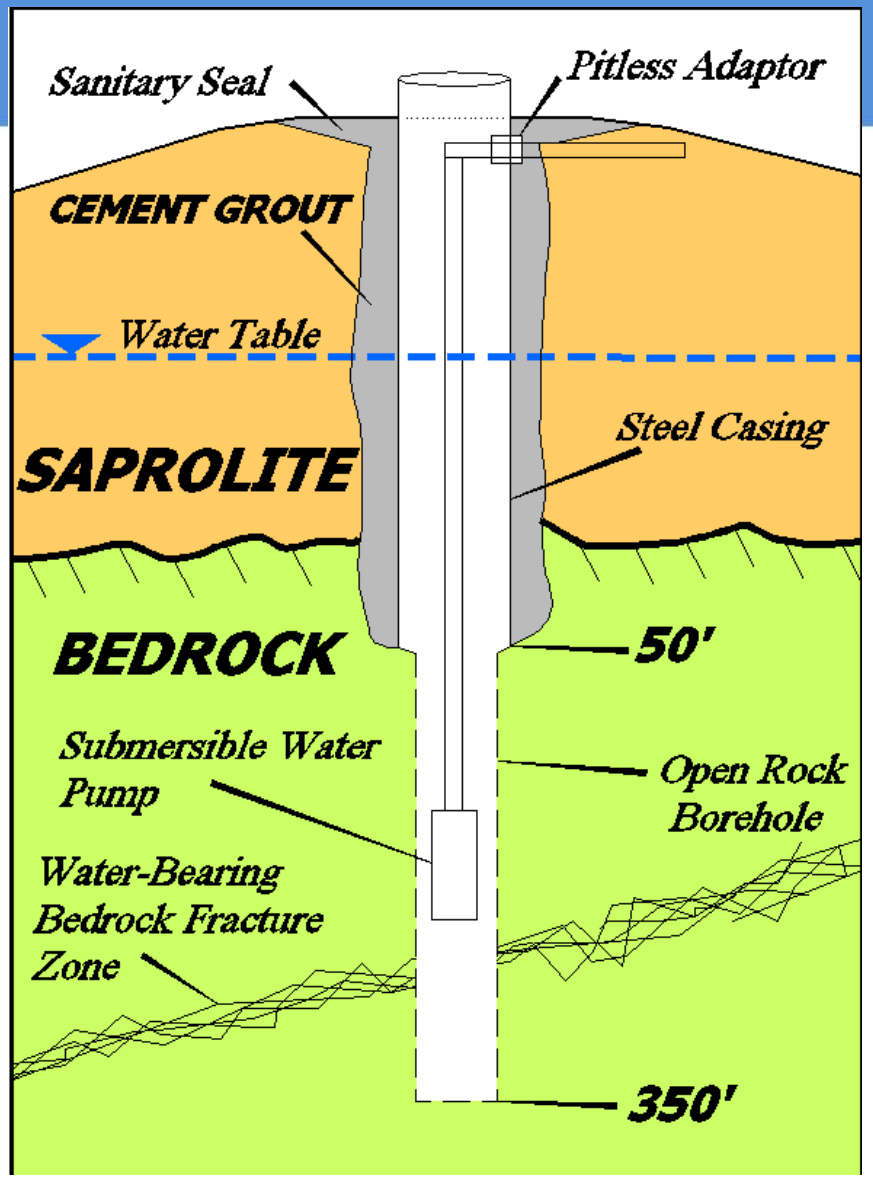
Groundwater Investigation - Irrigation Water Supplies

PHASE III

DRILL 6-INCH-DIAMETER TEST WELLS AT BEST AVAILABLE TARGET LOCATIONS WITHIN STUDY AREA

ESTIMATE PRELIMINARY YIELD AND QUALITY OF GROUNDWATER SOURCES

Schematic Diagram of a Bedrock Well



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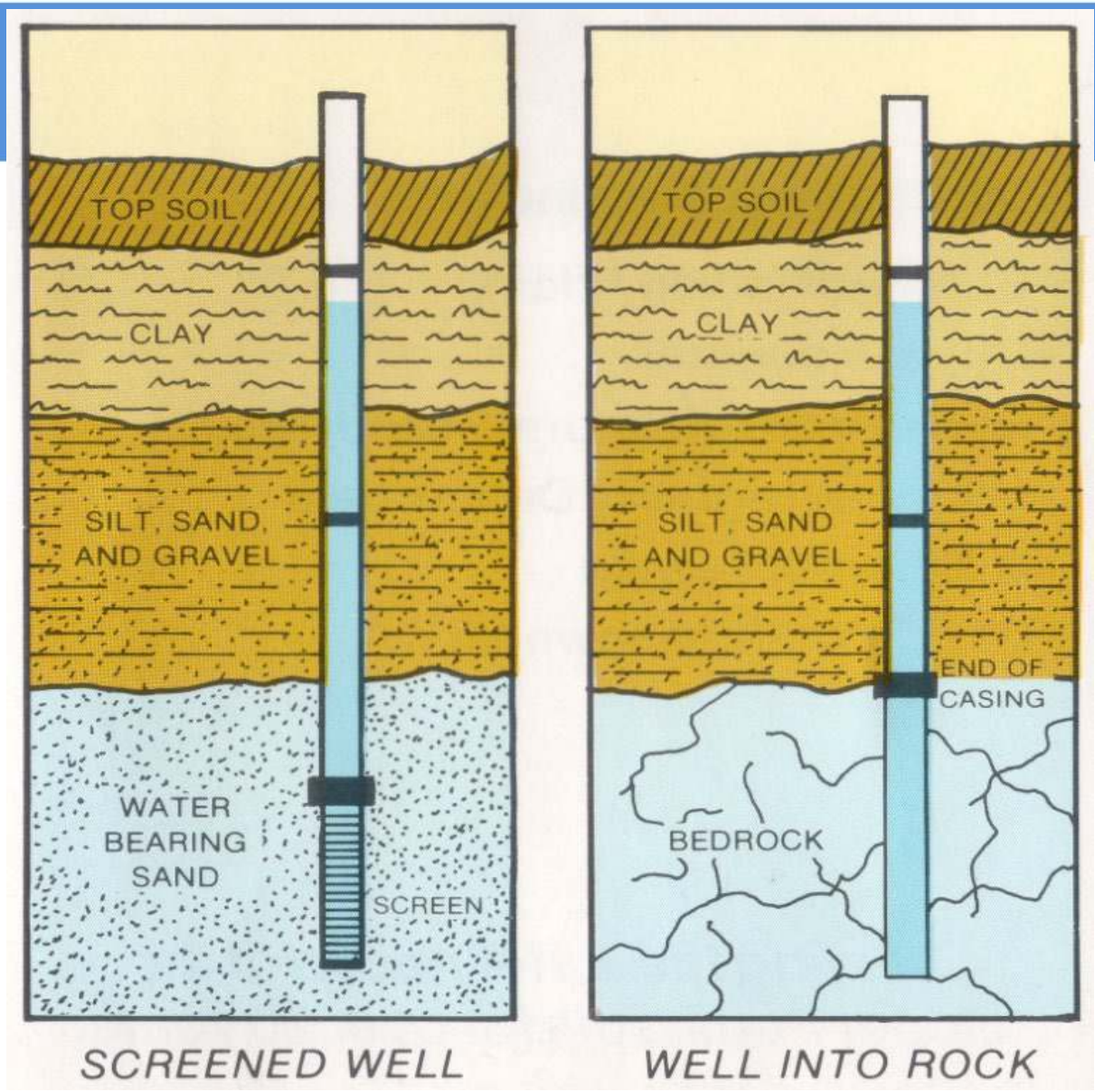
Production Wells in Sand & Gravel and Bedrock Aquifers



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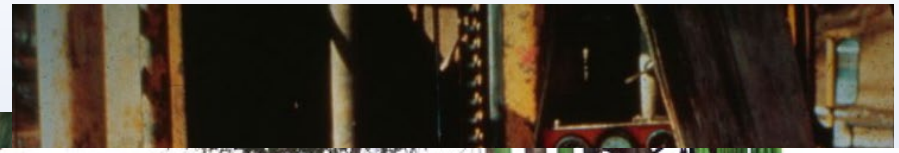
Drilling



Groundwater Exploration – Phase IV

(Construction of Production Well)

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Groundwater Investigation - Irrigation Water Supplies

PHASE IV

REAM THE MOST FAVORABLE TEST WELLS TO 8- TO 10-INCH-DIAMETER PRODUCTION WELLS

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Reaming

Groundwater Exploration – Phase V

(Testing the yield and Quality of the Production Well)

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Groundwater Investigation - Irrigation Water Supplies

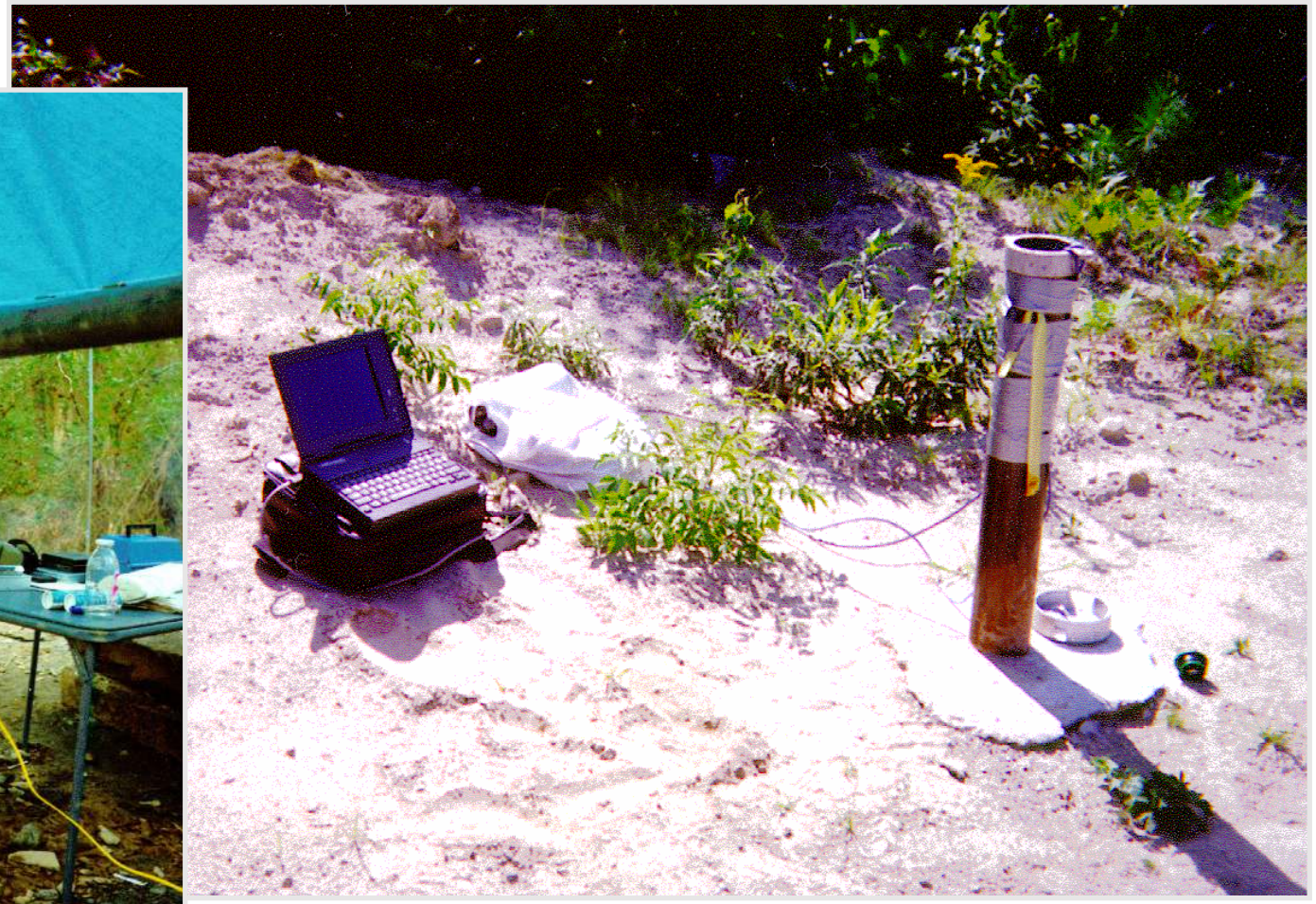
PHASE V

- FINAL TESTING TO ASSESS YIELD AND QUALITY
- 48- TO 96-HOUR PUMPING TEST / PER WELL
- WATER QUALITY ANALYSIS
- RECOVERY TESTS

Field Investigations

Emery & Garrett Groundwater Investigations, A Division of GZA

Groundwater Monitoring Program



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Field Investigations

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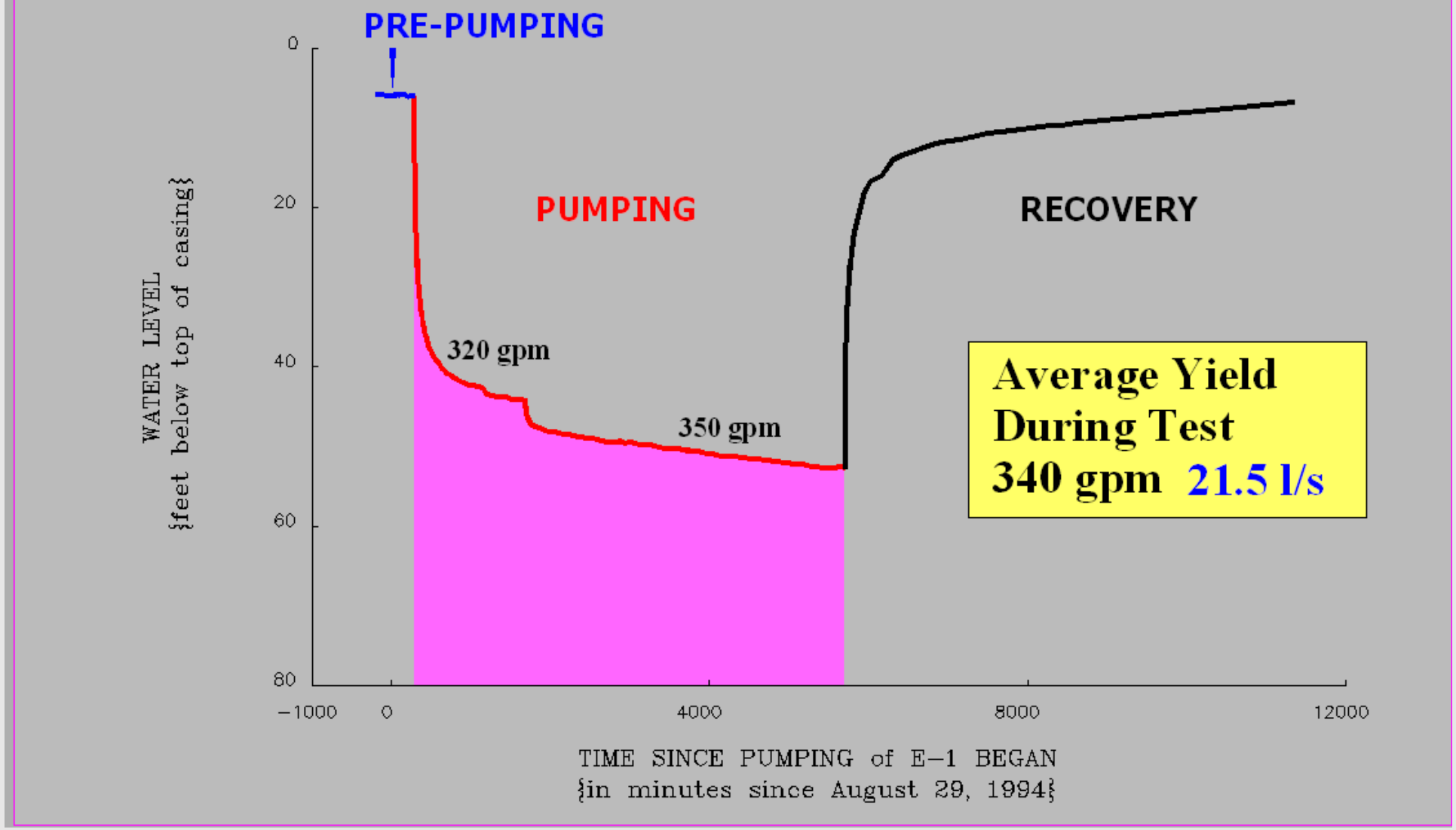
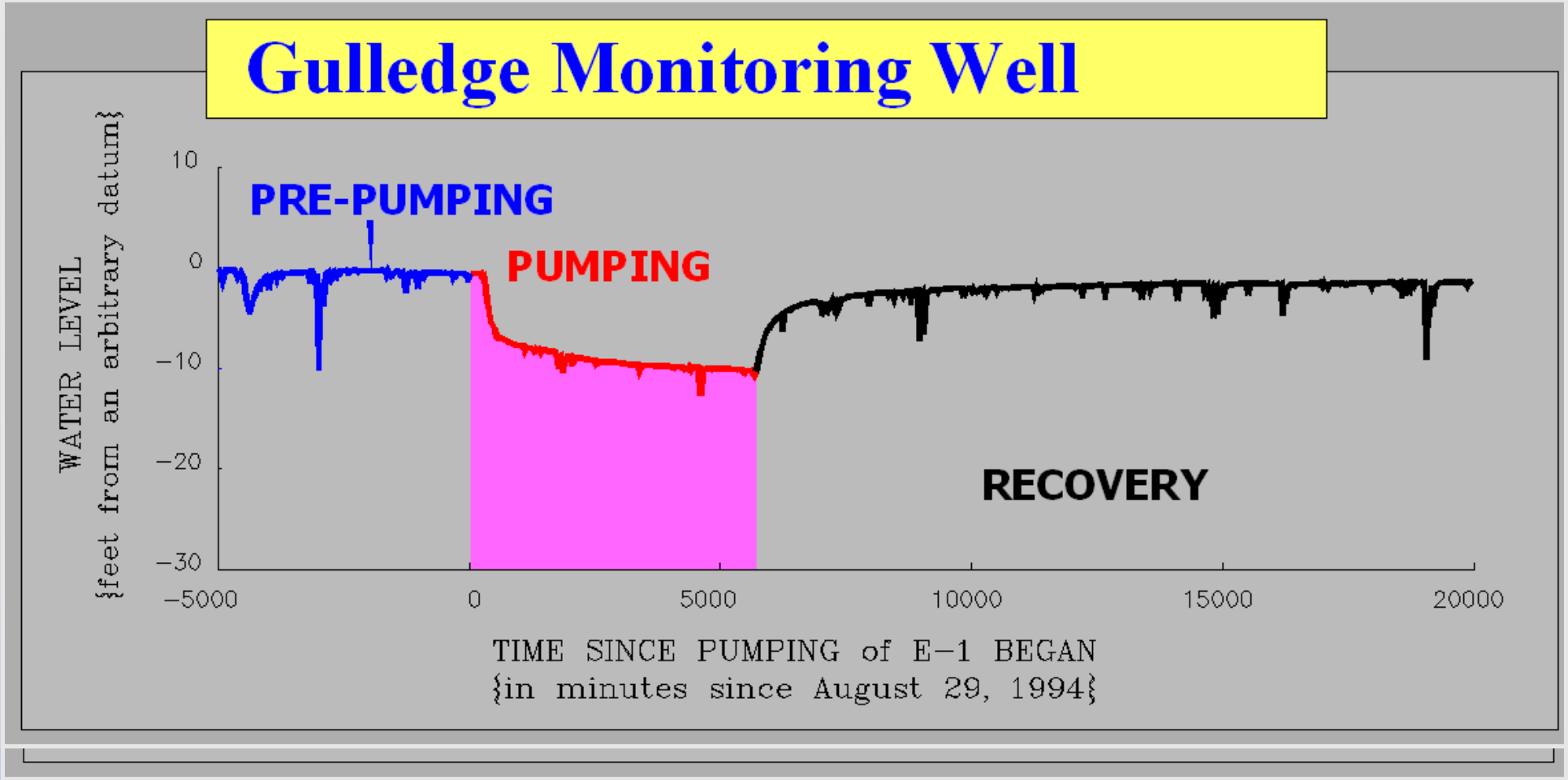
E-6 Pumping Well

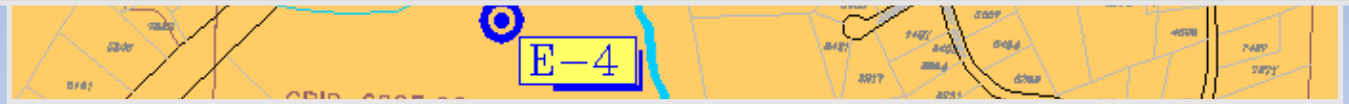


Average Yield During Test
340 gpm 21.5 l/s

Hydrogeologic Investigations

Gulledge Monitoring Well





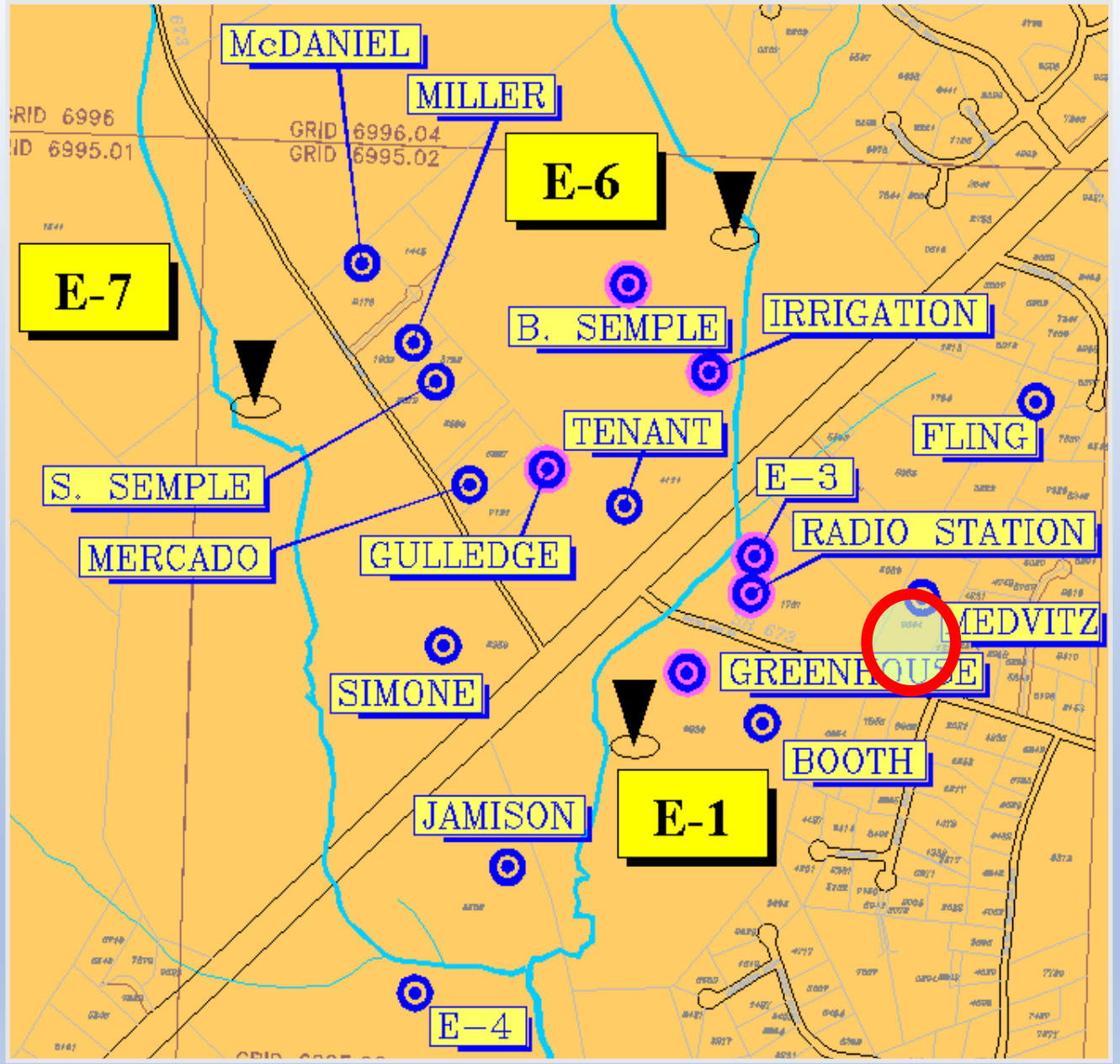
WATER QUALITY ANALYSIS

Analysis Performed	MCL (mg/l)	LRL	Level Detected
Total coliform	P	P	NBS
Inorganic chemicals			
Aluminum			
Arsenic			
Barium			
Cadmium			
Calcium			
Chromium			
Copper			
Iron			
Lead			
Magnesium			
Manganese			
Mercury			
Nickel			
Selenium			
Silver			
Sodium			
Zinc			

Inorganic chemicals - other, and physical factors:			
Alkalinity (Total as CaCO3)	---	20	90
Chloride	250	5.0	8
Corrosivity	---	---	0.40
Fluoride	4	0.5	ND
Foaming Agents			
Hardness (as CaC			
Nitrate as N			
Nitrite as N			
pH (Standard Unit			
Sulfate			
Total Dissolved S			
Turbidity (Turbic			
Organic chemical			
Bromodichlorometh			
Bromoform			
Chloroform			
Dibromochlorometh			
Total THMs			

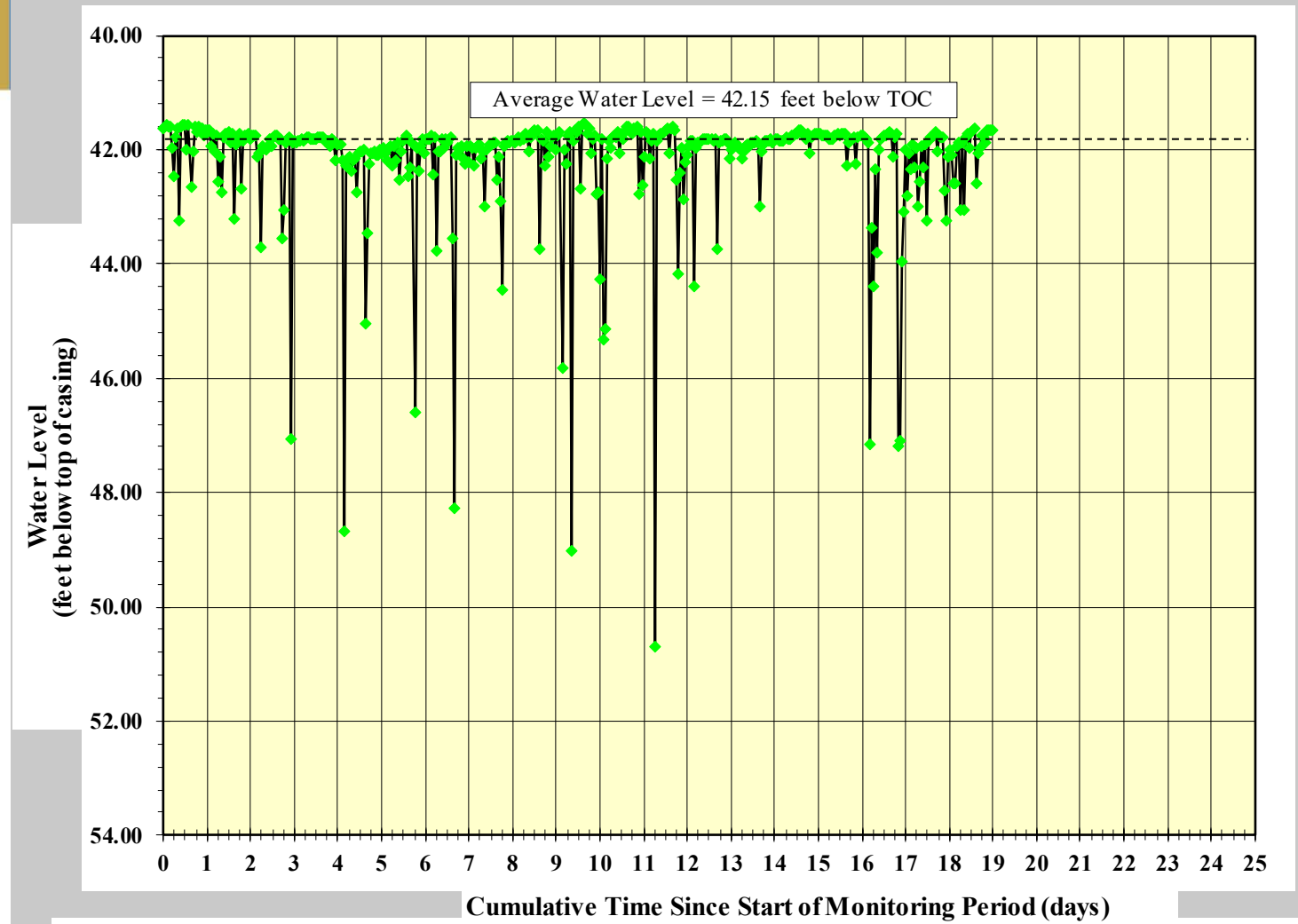
Analysis performed	MCL (mg/l)	LRL	Level Detected
Organic chemicals - volatiles:			
1,1,1,2-Tetrachloroethane	---	0.002	ND
1,1,1-Trichloroethane	0.2	0.001	ND
1,1,2,2-Tetrachloroethane	---	0.002	ND
1,1,2-Trichloroethane	0.005	0.002	ND
1,1-Dichloroethane	---	0.002	ND
1,1-Dichloroethene	0.007	0.001	ND
1,1-Dichloropropene	---	0.002	ND
1,2,3-Trichlorobenzene	---	0.002	ND
1,2,3-Trichloropropane	---	0.002	ND
1,2,4-Trichlorobenzene	0.07	0.002	ND
1,2-Dichlorobenzene	0.6	0.001	ND
1,2-Dichloroethane	0.005	0.001	ND
1,2-Dichloropropane	0.005	0.002	ND
1,3-Dichlorobenzene	---	0.001	ND
1,3-Dichloropropane	---	0.002	ND
1,4-Dichlorobenzene	0.075	0.001	ND
2,2-Dichloropropane	---	0.002	ND
2-Chlorotoluene	---	0.001	ND
4-Chlorotoluene	---	0.001	ND
Benzene	0.005	0.001	ND

Hydrogeologic Investigations



Emery & Garrett Groundwater Investigations, A Division of GZA

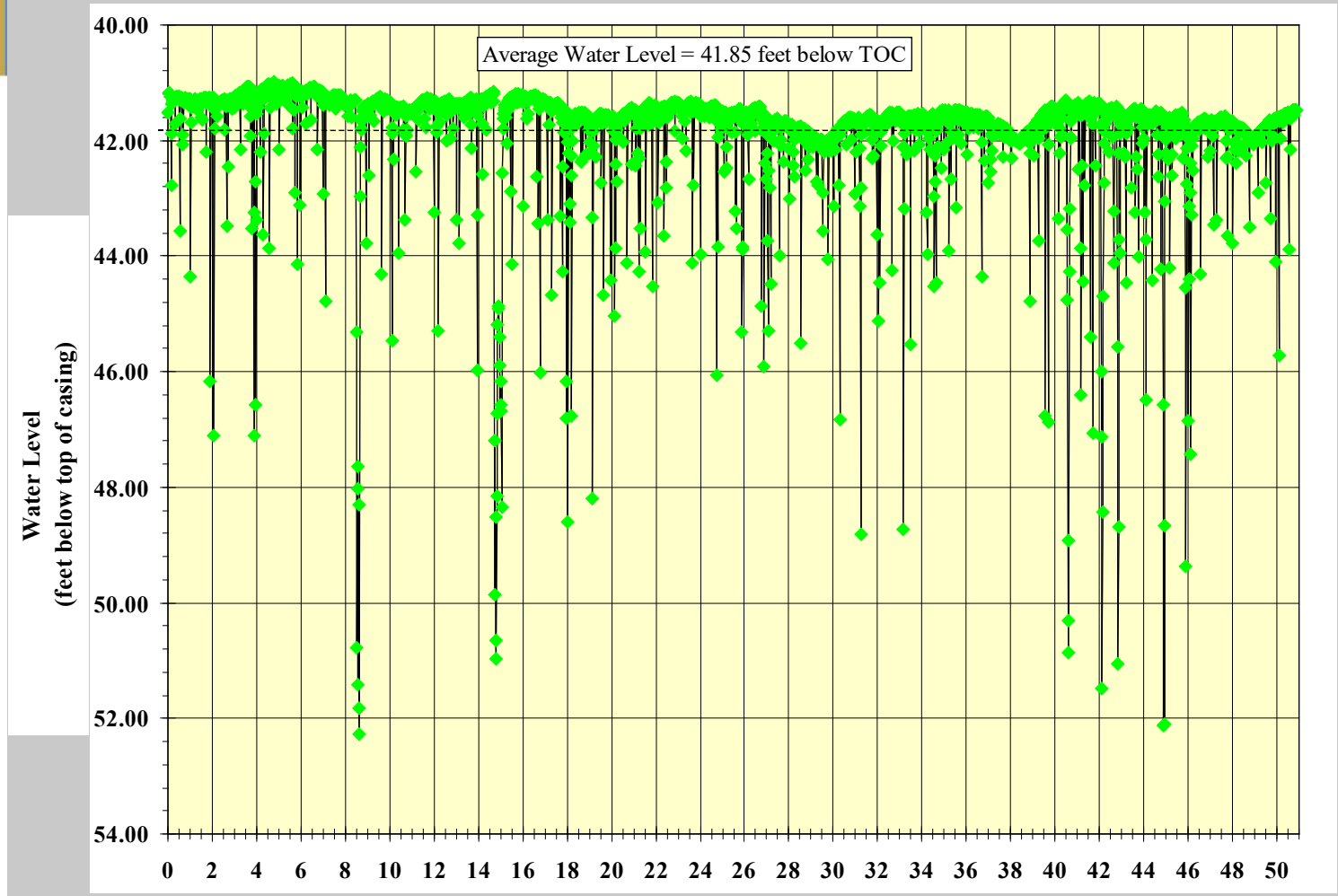
1994 Water Level Data - Medvitz Domestic Well



Plot of Water Level versus Time for August 23 to September 11, 1994

Medvitz Domestic Well Monitoring

2004 Water Level Data - Medvitz Domestic Well



Plot of Water Level versus Time for August 10 to September 30, 2004

Medvitz Domestic Well Monitoring

ASIC – 2022 – NATIONAL CONFERENCE

Groundwater Exploration – Phase VI and VII

Reporting, Permitting, and Construction

Emery & Garrett Groundwater Investigations, A Division of GZA

Groundwater Investigation - Irrigation Water Supplies

PHASE VI

DEVELOP GROUNDWATER USE MANAGEMENT PLAN

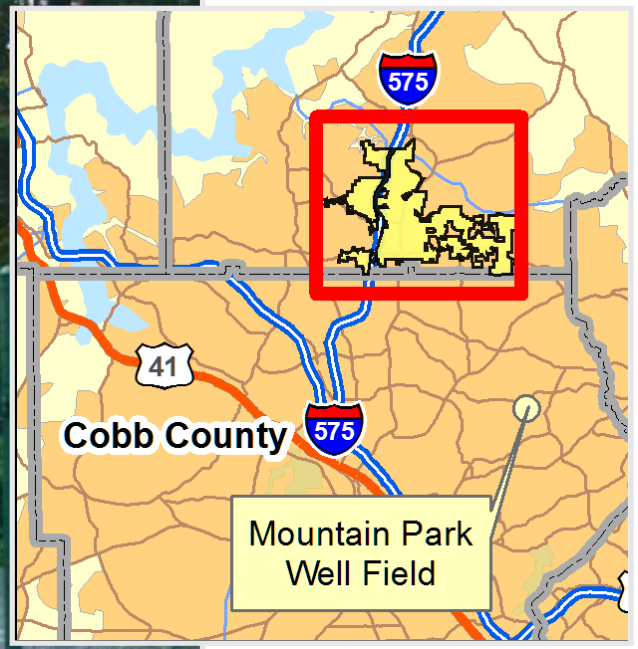
SUBMIT FINAL HYDROGEOLOGIC REPORT AND OBTAIN FINAL PERMIT

Groundwater Investigation - Irrigation Water Supplies

PHASE VII

DESIGN AND CONSTRUCT PUMPING AND DISTRIBUTION FACILITIES (as needed)

Groundwater Pumping Station



Cost of Purchasing Water versus Pumping On-Site Groundwater

Irrigation Water Needed (Yield)	*Cost of Groundwater O & M Costs $.50/1,000 Gallons per Day (gpd)	Cost of Purchased Water $3/1,000 Gallons per Day (gpd)	Cost of Purchased Water $5/1,000 Gallons per Day (gpd)	Groundwater Cost for 90 Days	Groundwater Cost for 180 Days	Purchased Water Cost for 90 Days $3/1,000 Gallons per Day (gpd)	Purchased Water Cost for 180 Days $3/1,000 Gallons per Day (gpd)	Purchased Water Cost for 90 Days $5/1,000 Gallons per Day (gpd)	Purchased Water Cost for 180 Days $5/1,000 Gallons per Day (gpd)
50,000 gpd	$25/day	$150/day	$250/day	$2,250	$4,500	$13,500	$27,000	$22,500	$45,000
100,000 gpd	$50/day	$300/day	$500/day	$4,500	$9,000	$27,000	$54,000	$45,000	$90,000
200,000 gpd	$100/day	$600/day	$1,000/day	$9,000	$18,000	$54,000	$108,000	$90,000	$180,000
300,000 gpd	$150/day	$900/day	$1,500/day	$13,500	$27,000	$81,000	$162,000	$135,000	$270,000

*Note: Does not include the cost to develop groundwater sources on site.

Cost of Purchasing Water versus Pumping On-Site Groundwater

Irrigation Water Needed (Yield)	Savings from Using Groundwater versus Purchased Water for 90 Days $3/1,000 Gallons per Day (gpd)	Savings from Using Groundwater versus Purchased Water for 180 Days $3/1,000 Gallons per Day (gpd)	Savings from Using Groundwater versus Purchased Water for 90 Days $5/1,000 Gallons per Day (gpd)	Savings from Using Groundwater versus Purchased Water for 180 Days $5/1,000 Gallons per Day (gpd)
50,000 gpd	$11,250	$22,500	$20,250	$40,500
100,000 gpd	$22,500	$45,000	$40,500	$81,000
200,000 gpd	$45,000	$90,000	$81,000	$162,000
300,000 gpd	$67,500	$135,000	$121,500	$243,000

*Note: Does not include the cost to develop groundwater sources on site.

QUESTIONS

Client Satisfaction

We Have Received an Extraordinary Number of Letters Of Thanks From Our Clients, Such As The Following:

"Never In My Twenty Plus Years Have I Had The Pleasure Of Being Responsible For A Contract That Was Accomplished In Such Professional, Conscientious And Timely Manner. Your Knowledge, Technical Expertise And Public Forum Abilities Are A True Credit To Your Profession."

Richard E. McNear, Deputy County Administrator Of Planning, Board Of Supervisors Of Fauquier County, Virginia

CORPORATE EXPERIENCE

Our clients range from the very large (i.e., City of Atlanta, Georgia; Walt Disney Company) to small residential developments. **We have completed (or are currently engaged in) substantial groundwater irrigation projects for many recreational parks and golf courses including Augusta National, Walt Disney Company, and many golf courses built and/or designed by Jack Nicklaus, Donald Ross, Robert Trent Jones, Rees Jones, Brian Silva, and other leading golf architects… to name a few**. Many of these investigations have resulted in the development of individual wells capable of yielding 100,000 gallons per day (gpd) to more than 1.0 million gallons per day (MGD).

Bedrock Well

Groundwater Exploration

Conduct geophysical surveys to locate sub-surface water-bearing zones

ENVI – combined magnetic and electro-magnetic (very low frequency) measurements. Reconnaissance site assessment.

ABEM – electrical resistivity surveys. Detailed site assessment – placement of stakes indicating test well candidate location.

More Than Just a Drone

Jason VanBuskirk, Greensight Agronomics

AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

– 2022 –

NATIONAL CONFERENCE

Hotel Monteleone

NEW ORLEANS

GREENSIGHT

Visionary robotics. Actionable data. Agronomic responsibility.

Jason VanBuskirk
VP Sales & Marketing

@URITurf

AMERICAN SOCIETY OF
IRRIGATION CONSULTANTS

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NEW ORLEANS

More Than Just A Drone


HYANNISPORT CLUB
TOM COLOMBO, CGCS

Our Senses Are Still Some of the BEST Data Collection Tools Available

THE CHALLENGES

Golf courses face rising irrigation costs

- National Average: >$75K/year
- $500k+ is not uncommon in Western USA

Applications must be efficiently managed

- Chemicals and fertilizer <$40,000 annually (per 18-holes)
- Regulation and limitation

Public Pressure to reduce water, chemical use

- New water regulations
- New pesticides/fungicide bans and regulations
- Stewardship

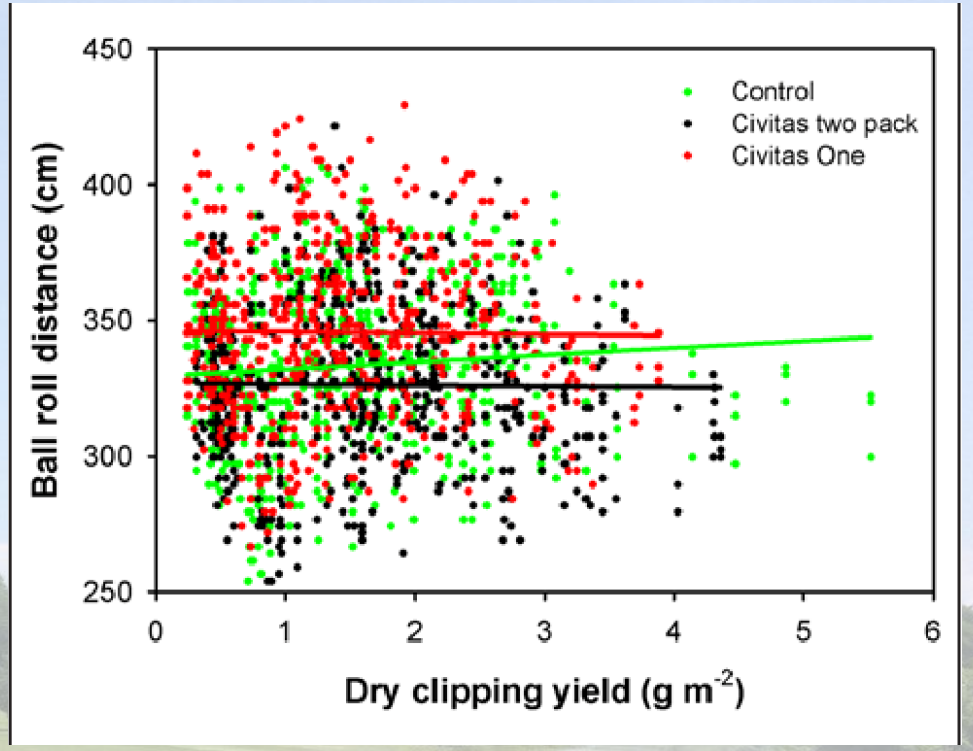

Using tech & data to help
make decisions


EVENT
0.44
INCH
Total
FLOOD WATCH ALARM ON: ALERT WHEN CONDITIONS RIGHT FOR FLOOD
RAIN ALARM ON: RAIN EVENT STARTS
3:06 PM
6/03/13
TODAY'S TIME & DATE
FLOOD WATCH
RAIN ALARM
+
SET
ACURITE

Rain gauge

Surface temperature

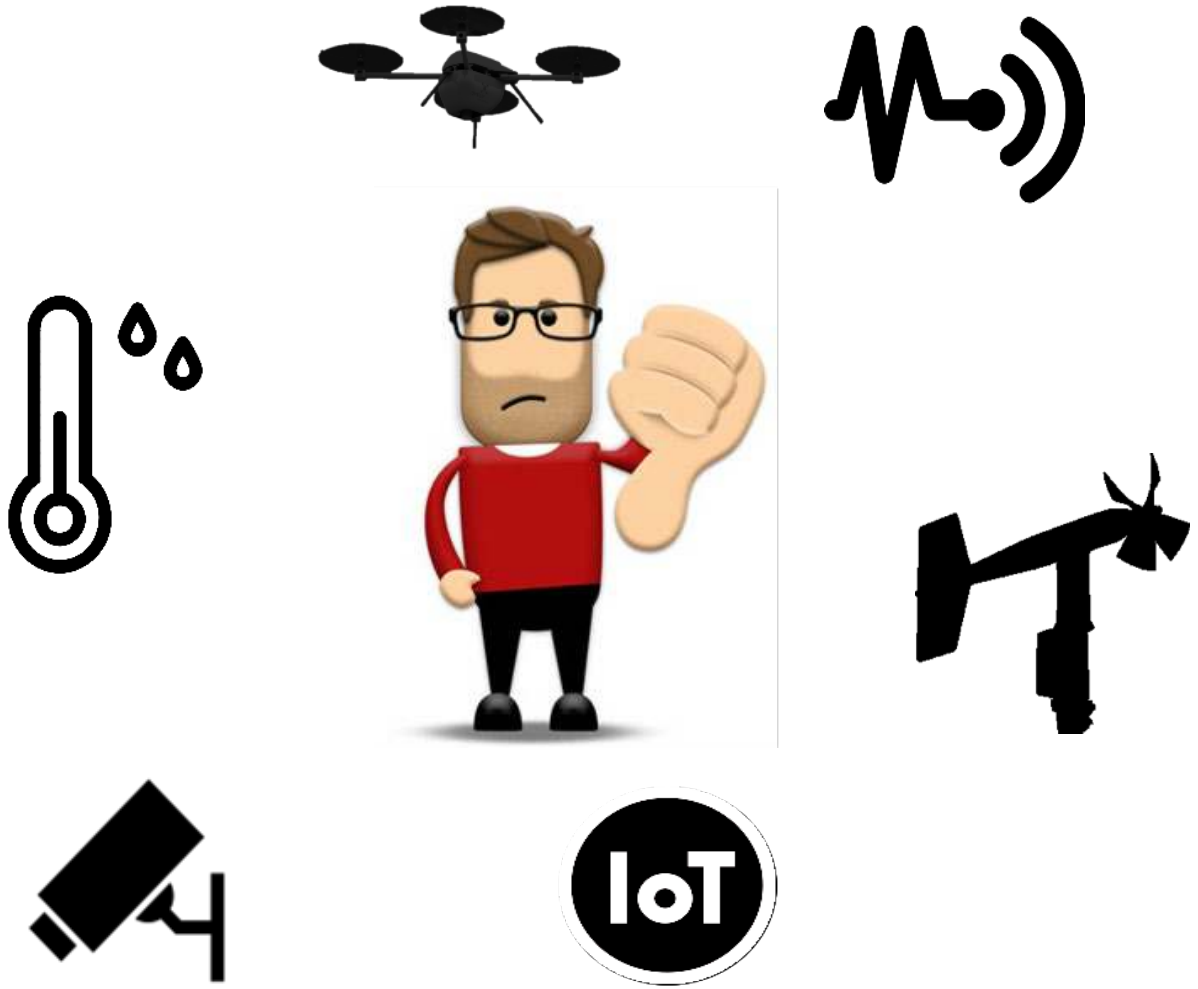
Soil temperature



Clipping yield


Board Meetings
2020 Scouting
2021 Pesticide Use
2020 Equipment Repair
2021 Daily Schedules
Water Usage
Weather Reports
2020 Pesticide Use
2019 Pesticide Use
2019 Budget

Managers can suffer from data overload…

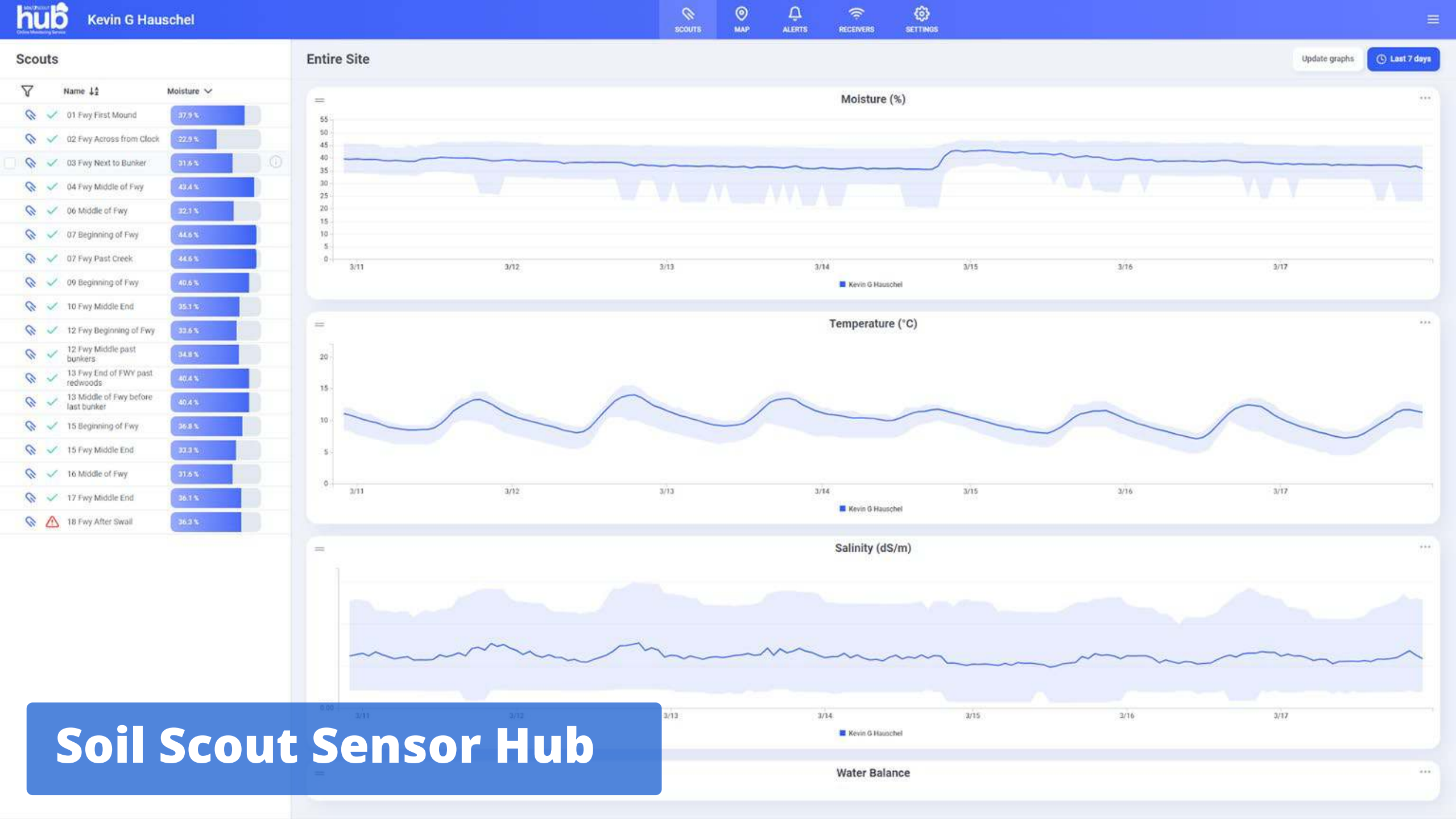


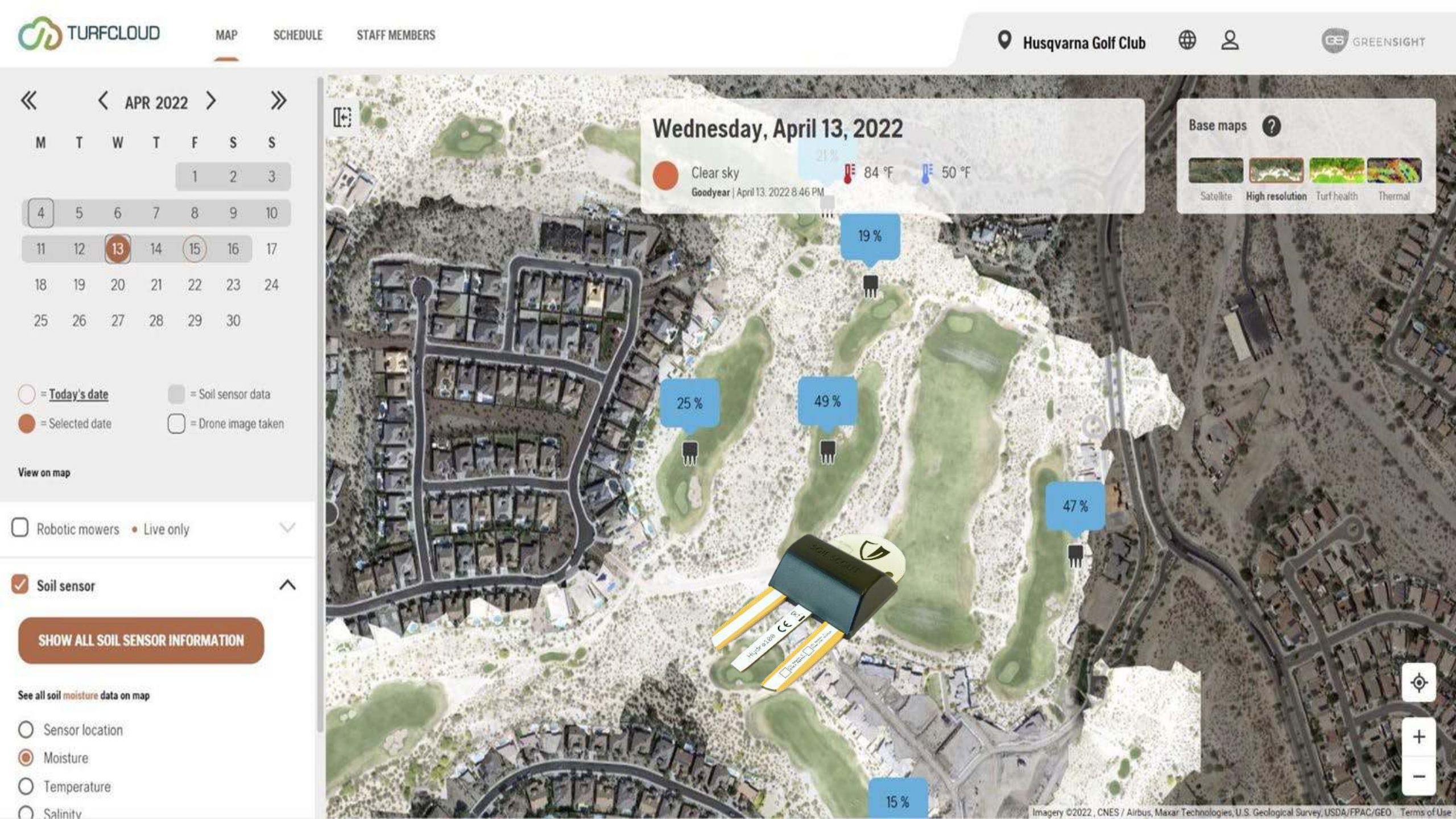
It becomes difficult to: *process* it, *analyze* it, or ***benefit*** from it effectively

Technology is way ahead of adoption

Data = Knowledge = Power

Hand Held Soil Moisture Meter


hub
Kevin G Hauschel
SCOUTS
MAP
ALERTS
RECEIVERS
SETTINGS
Scouts
Name
Moisture
01 Fwy First Mound
02 Fwy Across from Clock
03 Fwy Next to Bunker
04 Fwy Middle of Fwy
06 Middle of Fwy
07 Beginning of Fwy
07 Fwy Past Creek
09 Beginning of Fwy
10 Fwy Middle End
12 Fwy Beginning of Fwy
12 Fwy Middle past bunkers
13 Fwy End of FWY past redwoods
13 Middle of Fwy before last bunker
15 Beginning of Fwy
15 Fwy Middle End
16 Middle of Fwy
17 Fwy Middle End
18 Fwy After Swail
Entire Site
Update graphs
Last 7 days
Moisture (%)
Kevin G Hauschel
Temperature (°C)
Kevin G Hauschel
Salinity (dS/m)
Kevin G Hauschel
Water Balance
Soil Scout Sensor Hub


TURFCLOUD
MAP
SCHEDULE
STAFF MEMBERS
Husqvarna Golf Club
GREENSIGHT
APR 2022
M T W T F S S
1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30
= Today's date
= Soil sensor data
= Selected date
= Drone image taken
View on map
Robotic mowers • Live only
Soil sensor
SHOW ALL SOIL SENSOR INFORMATION
See all soil moisture data on map
Sensor location
Moisture
Temperature
Salinity
Wednesday, April 13, 2022
Clear sky
Goodyear | April 13, 2022 8:46 PM
84 °F
50 °F
Base maps
Satellite
High resolution
Turf health
Thermal
19 %
25 %
49 %
47 %
15 %
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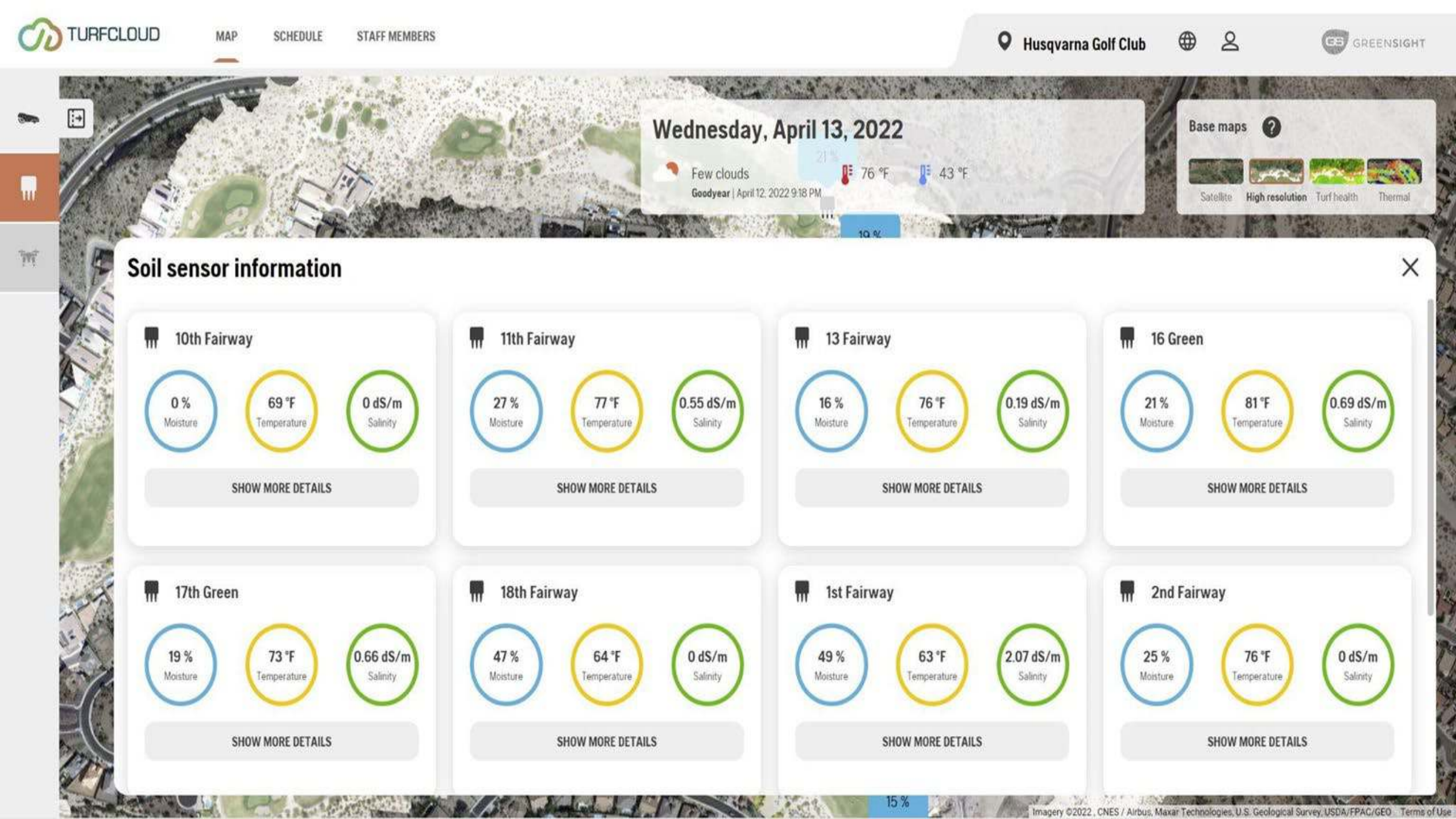
TURFCLOUD
MAP
SCHEDULE
STAFF MEMBERS
Husqvarna Golf Club
GREENSIGHT
Wednesday, April 13, 2022
Few clouds
Goodyear | April 12, 2022 9:18 PM
76 °F
43 °F
Base maps
Satellite
High resolution
Turf health
Thermal
Soil sensor information
10th Fairway
0 %
Moisture
69 °F
Temperature
0 dS/m
Salinity
SHOW MORE DETAILS
11th Fairway
27 %
Moisture
77 °F
Temperature
0.55 dS/m
Salinity
SHOW MORE DETAILS
13 Fairway
16 %
Moisture
76 °F
Temperature
0.19 dS/m
Salinity
SHOW MORE DETAILS
16 Green
21 %
Moisture
81 °F
Temperature
0.69 dS/m
Salinity
SHOW MORE DETAILS
17th Green
19 %
Moisture
73 °F
Temperature
0.66 dS/m
Salinity
SHOW MORE DETAILS
18th Fairway
47 %
Moisture
64 °F
Temperature
0 dS/m
Salinity
SHOW MORE DETAILS
1st Fairway
49 %
Moisture
63 °F
Temperature
2.07 dS/m
Salinity
SHOW MORE DETAILS
2nd Fairway
25 %
Moisture
76 °F
Temperature
0 dS/m
Salinity
SHOW MORE DETAILS
15 %
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THE GREENSIGHT DREAMER UAV

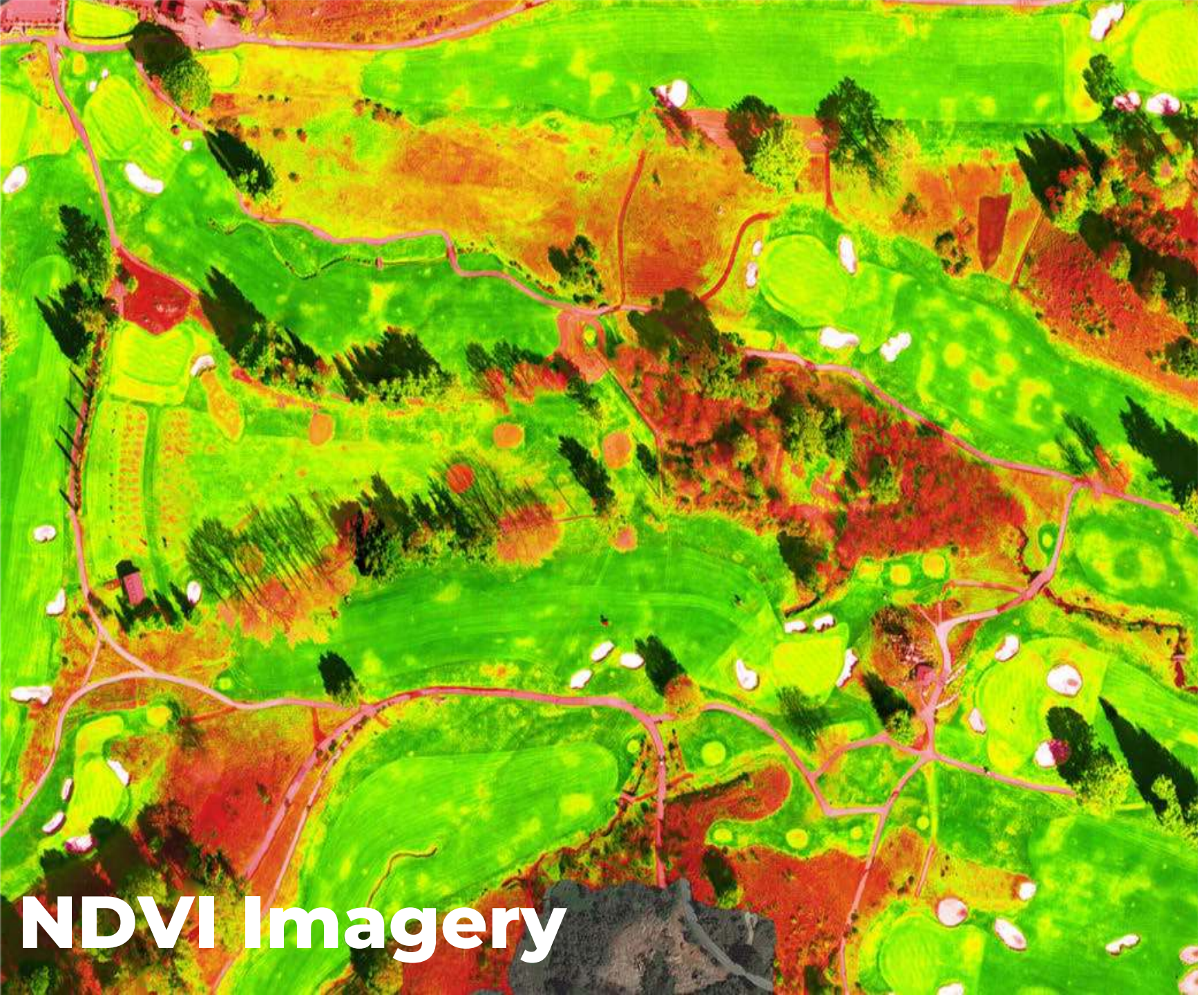
The most advanced agronomic drone on the market

- Built for automation - No experience needed!
- Custom built precision thermal camera
- Industry leading flight time: 60 minutes, 300+ acres/flight
- Visual, NDVI and thermal sensors all in one payload
- Quietest drone on the market!

Key Benefits

- Visually Inspect maintenance practices from anywhere in the world
- Assess sand coverage during aeration
- Remotely check on project progress
- Identify cart traffic without traveling out to the course
- Identify shade patterns and potential issues when trying to justify removing / keeping a tree
- Train employees with daily imagery and better communicate your plan


High Res. Imagery

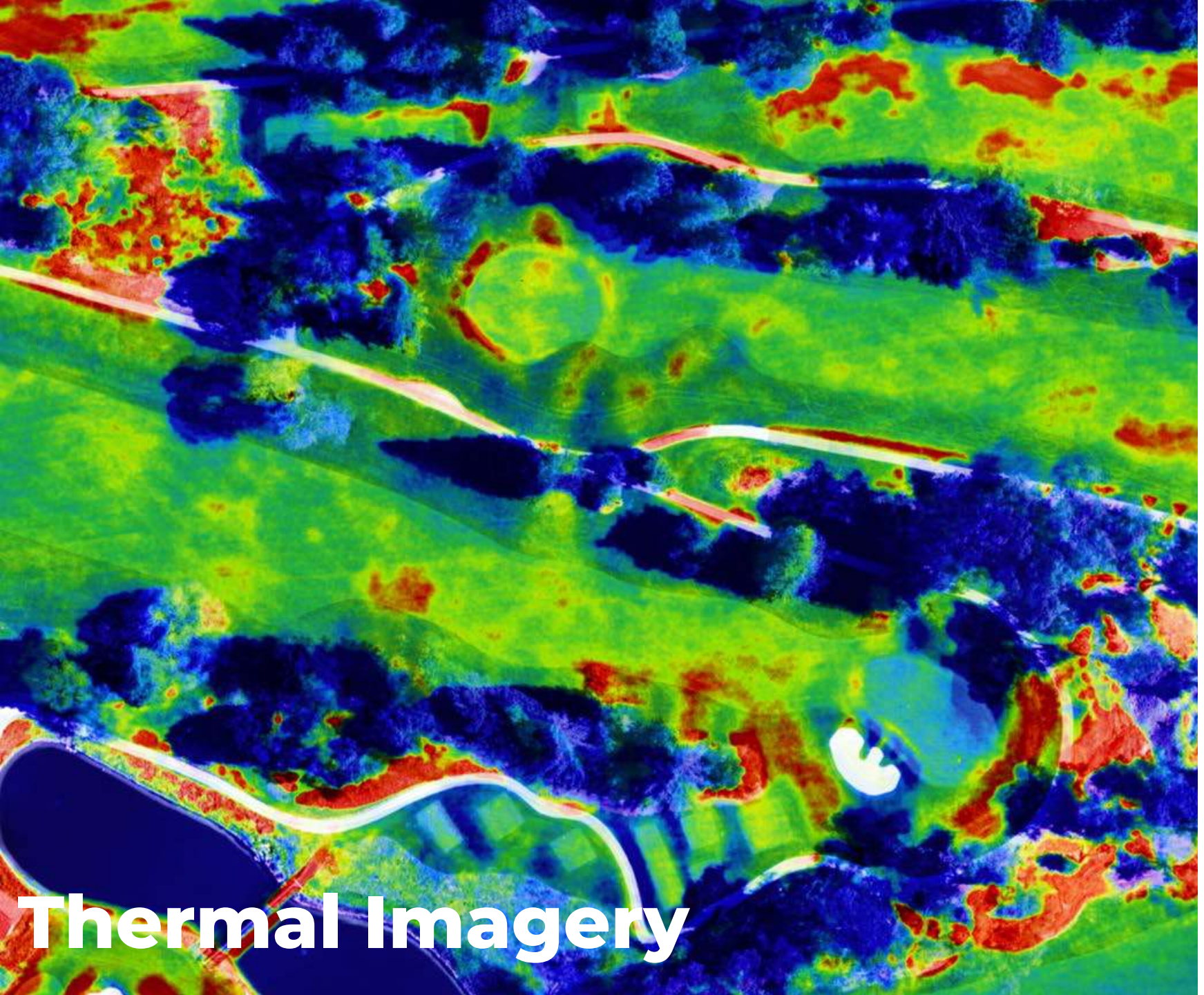


NDVI Imagery

Key Benefits

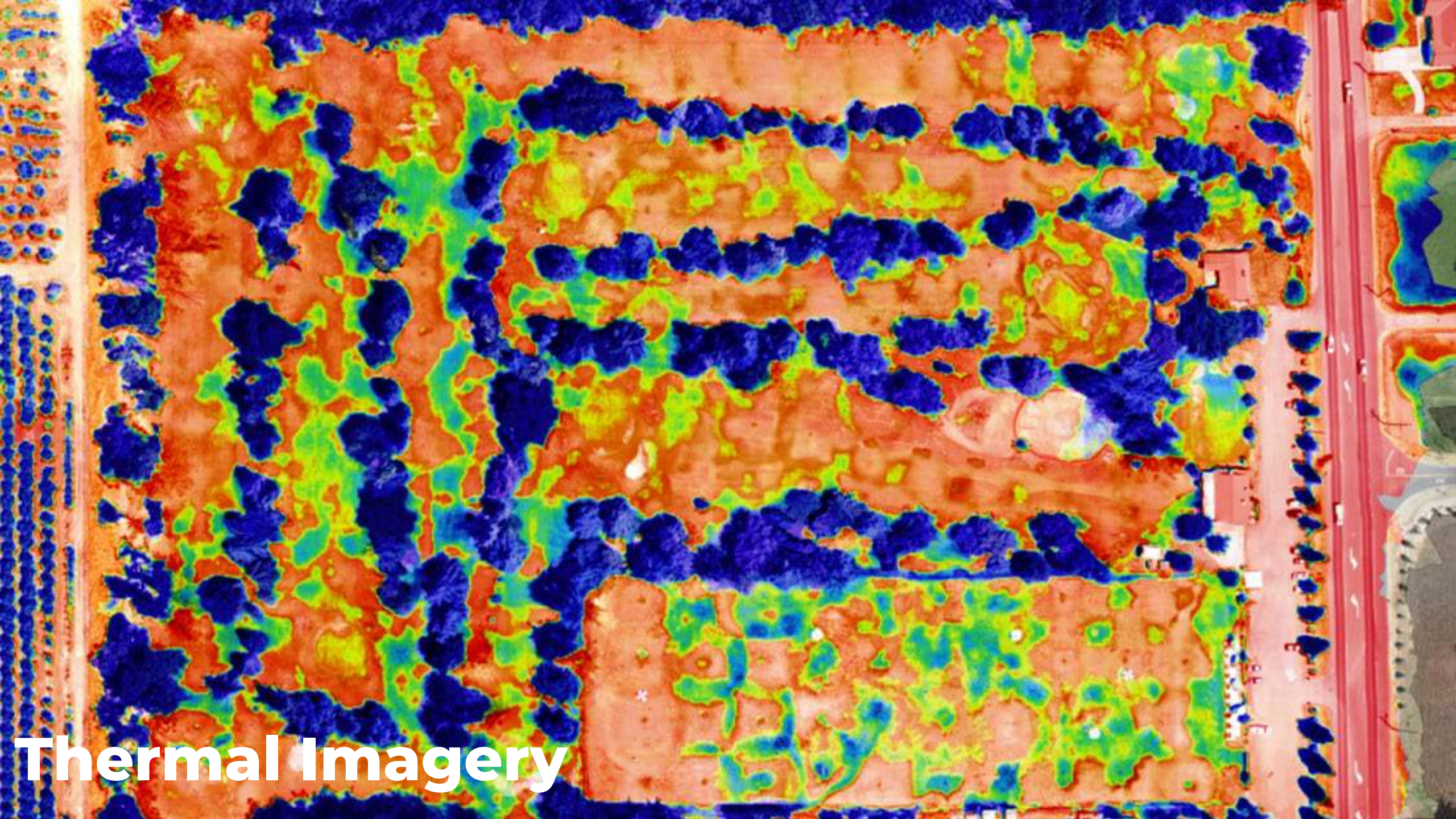
- Scout areas of stress before the eye can see
  - Wilt stress
  - Cart wear
  - Decline
  - Tree root damage
- Verify application efficacy
  - PGR
  - Wetting agents
  - Pesticides
  - Fertility
- Monitor irrigation adjustments
  - Head rotation
  - Nozzles
- Rotate machines based on mechanical stress patterns


NDVI Imagery

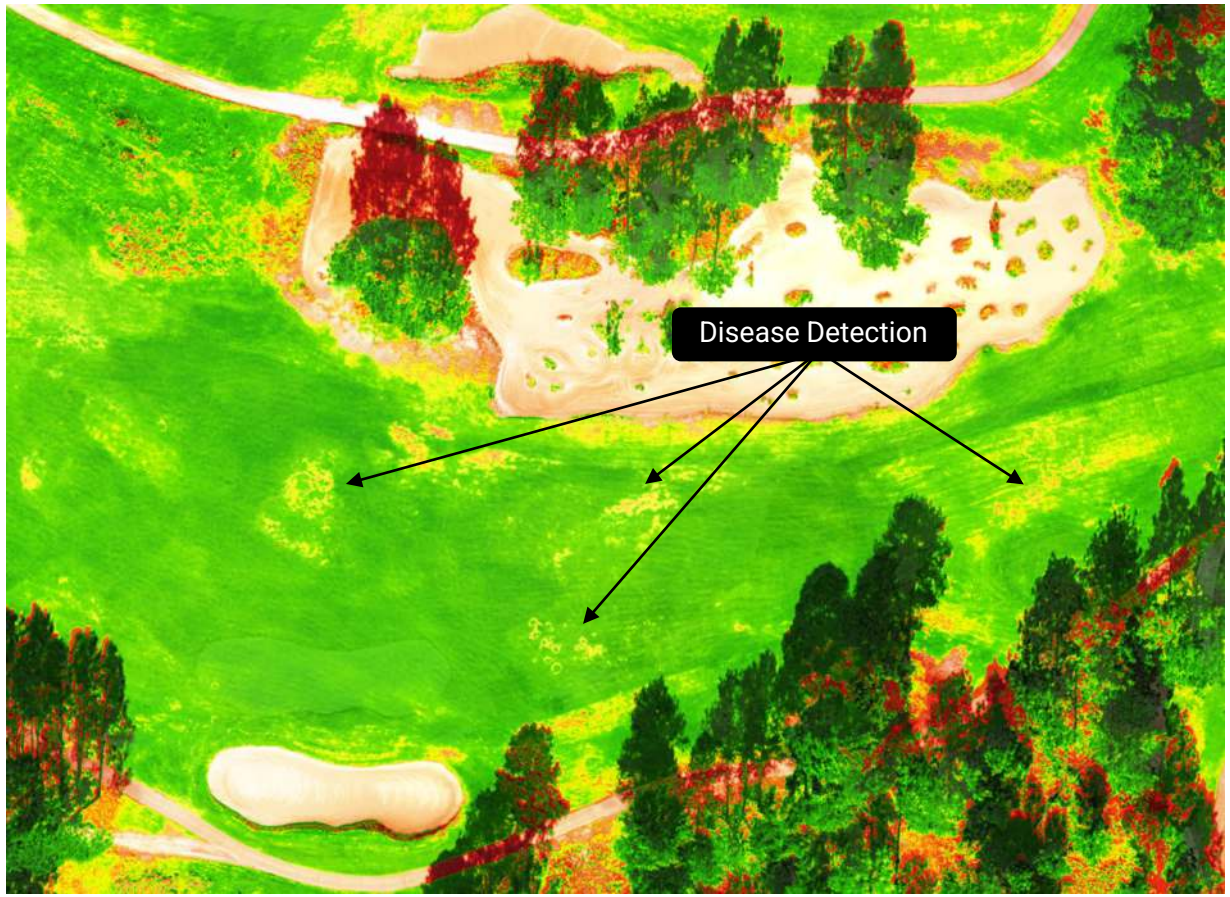


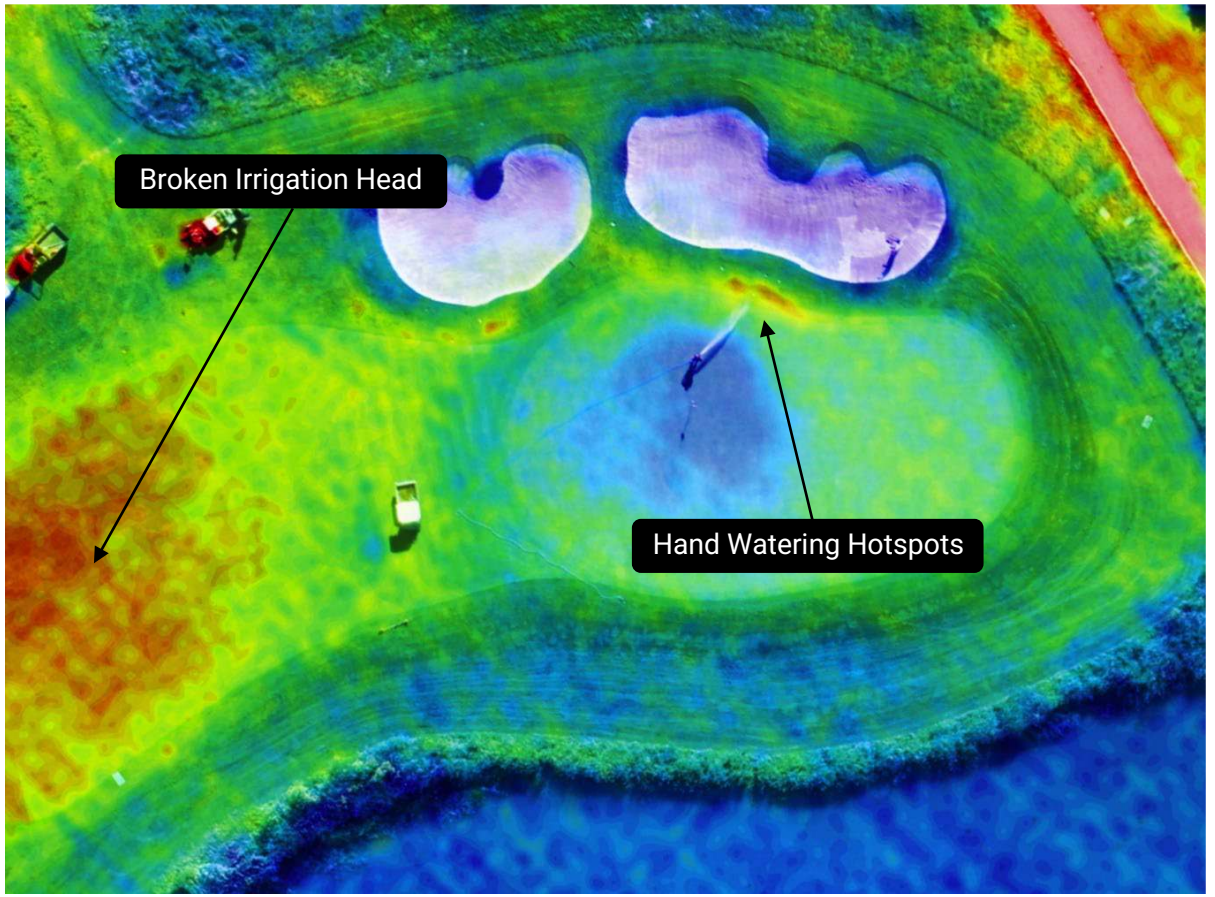
Key Benefits

- Easily spot variations in surface temperature
- Know if turf is stressed from heat or other pressures just by analyzing imagery
- Be able to understand a “new” water plan based surface temperature summary
- Save on the world’s primary resource, WATER…
- Wetting agent efficacy


Thermal Imagery

Solve Issues Before They Become Problems.





Identify and prevent turf issues with valuable insights into plant health, soil moisture, and ground stress patterns

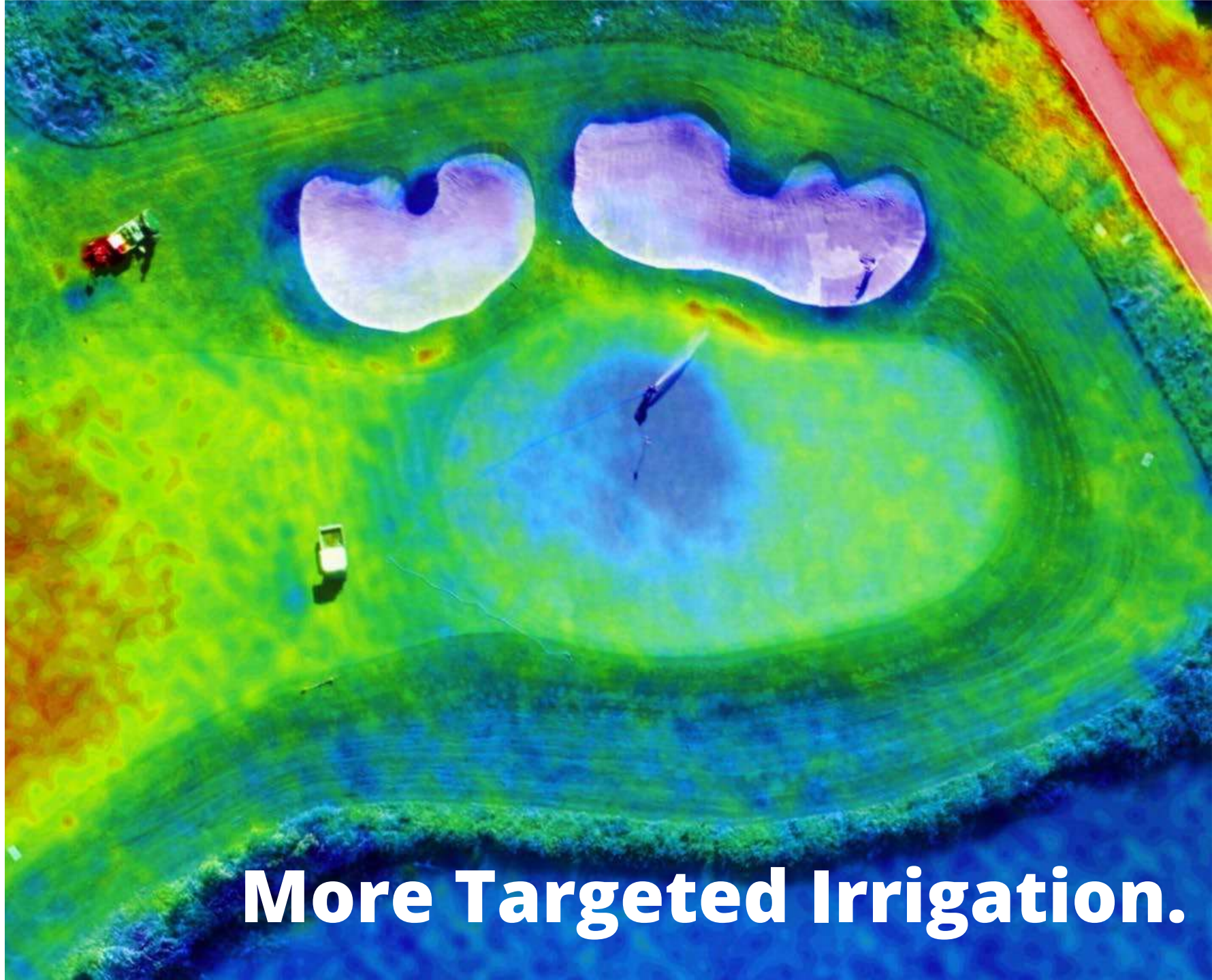

More Targeted Irrigation.

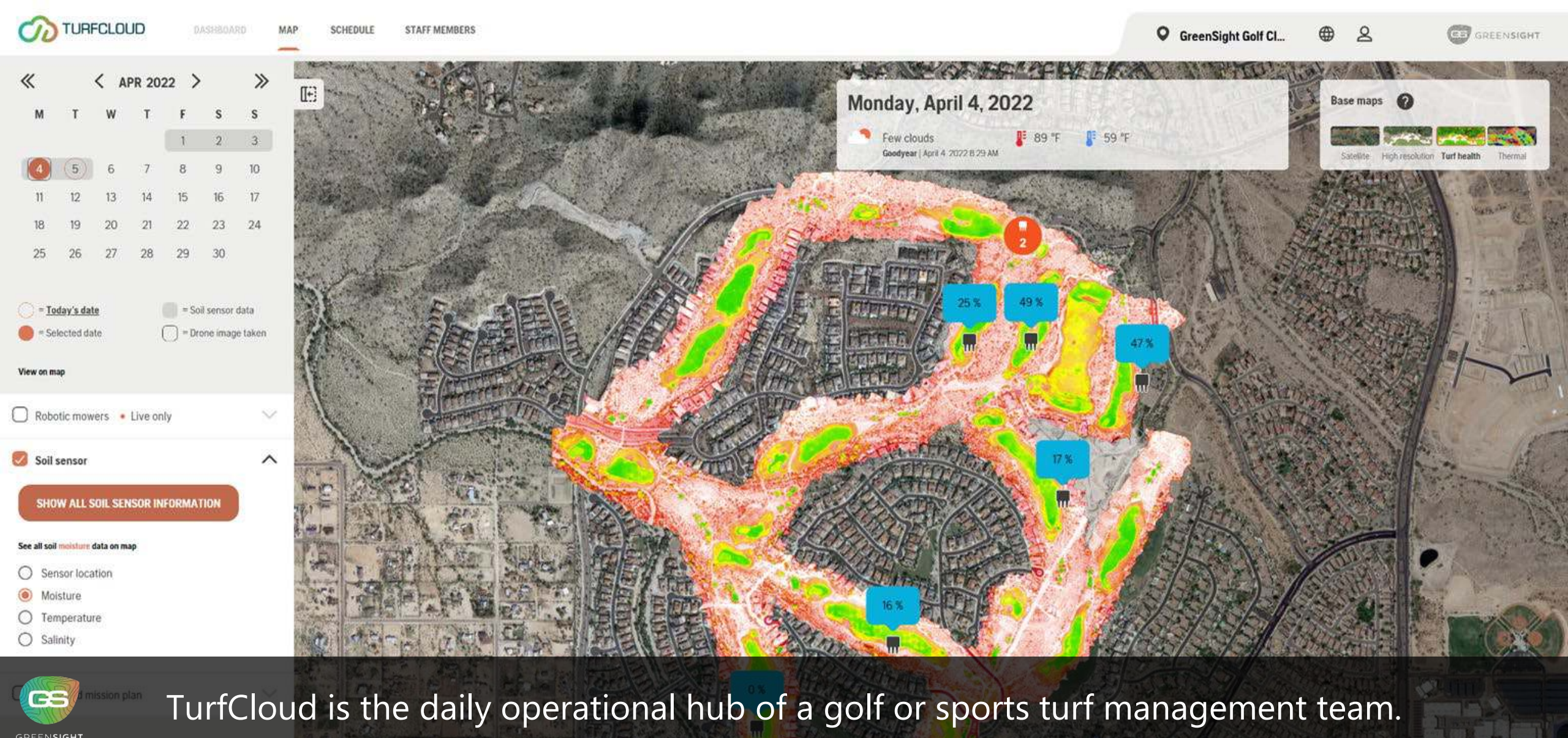
More Targeted Irrigation.

Key Benefits

Improved Water Efficiency at Meadow Club

- With more targeted irrigation, they were watering 28% more area!
- Overall, water usage **decreased** by 10% per acre
- Water use was reduced by nearly 10M gal overall, avoiding 5.5 MT CO2e in pumping emissions, vs. pre-GreenSight irrigation





GREENSIGHT

TurfCloud is the daily operational hub of a golf or sports turf management team.

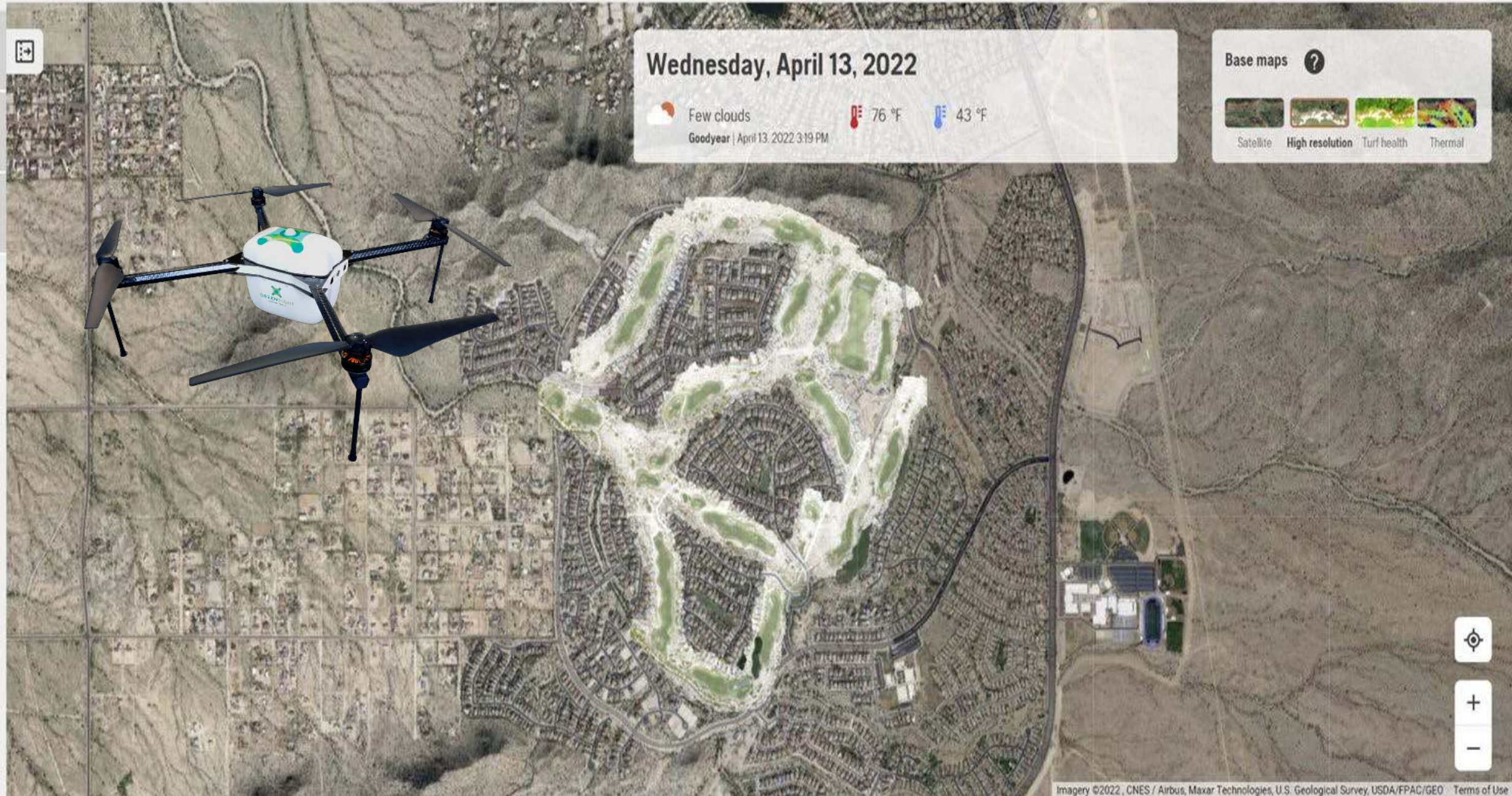
TurfCloud is more than a superficial integration of planning software, robotics, and sensors. It is a unification of next generation turf management tools into common workflows designed to help turf managers solve the issues they face on a daily basis and better plan for the future. All new for 2022, now with **Husqvarna Automower Integration.**

TURFCLOUD

MAP | SCHEDULE | STAFF MEMBERS

Golf Club of Estrella

GREENSIGHT




HYANNISPORT CLUB
TOM COLOMBO, CGCS

52 YEARS

AMERICAN SOCIETY OF IRRIGATION CONSULTANTS

NATIONAL CONFERENCE

Hotel Monteleone

NEW ORLEANS

52 YEARS