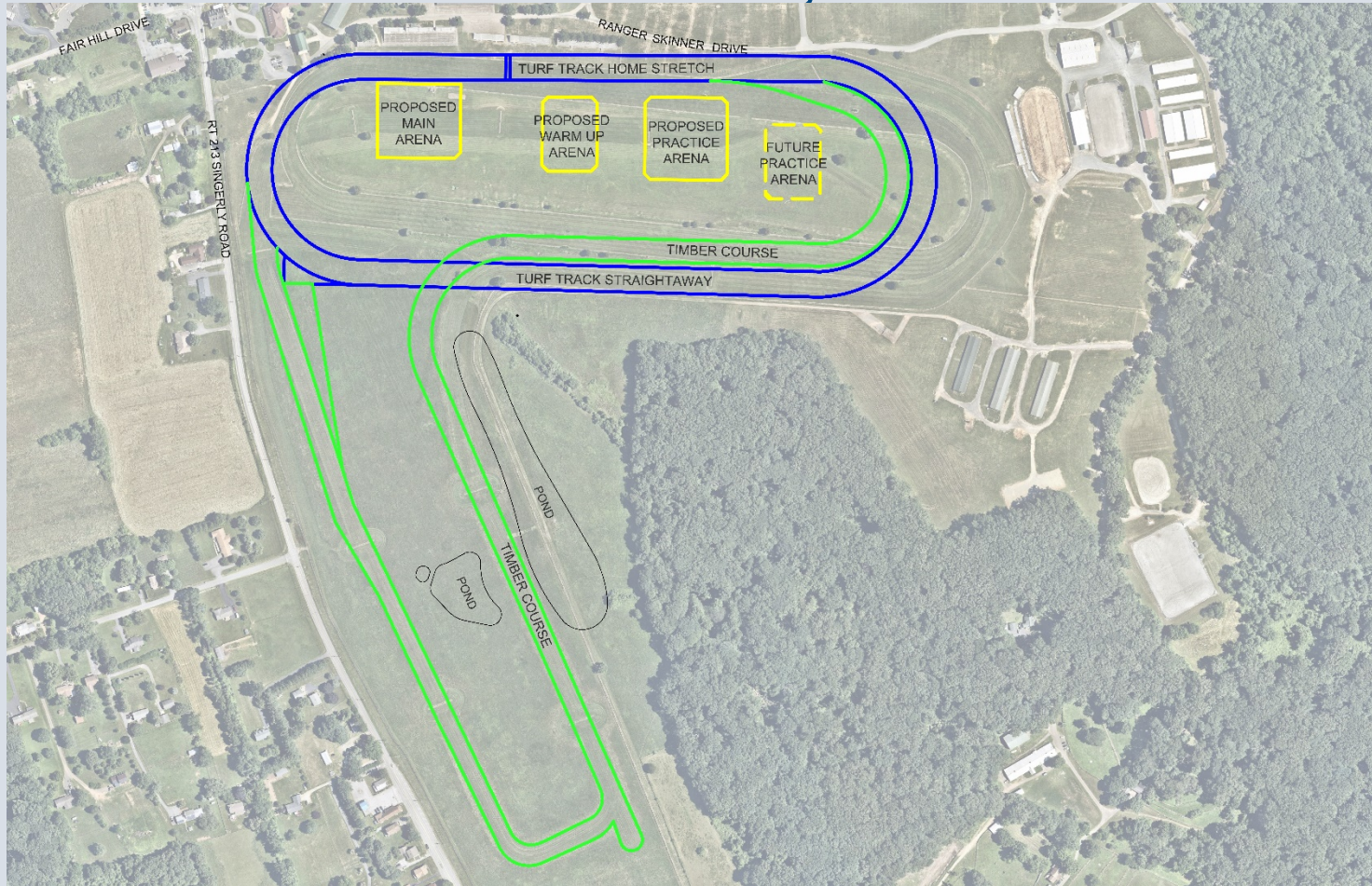


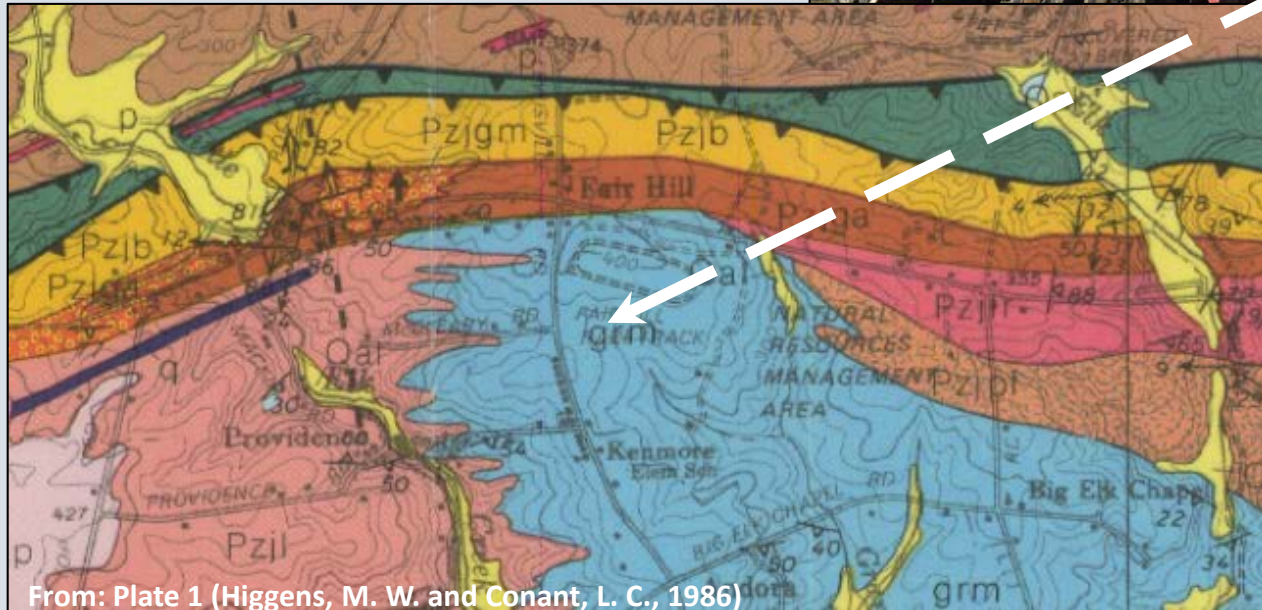
Fair Hill Special Event Zone Area Improvements Public Hearing & Information Session for Water Appropriations November 12, 2019



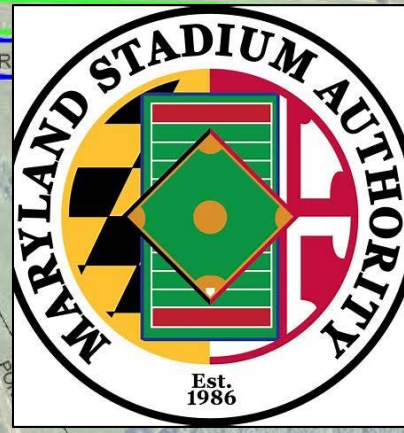
Presentation Agenda

- Project Team & Summary
- Project Purpose
- Project Overview
- Hydrogeologic Testing
- Conclusions
- Questions and Answers

Monitor Well Construction



From: Plate 1 (Higgins, M. W. and Conant, L. C., 1986)



Jones Well Drilling

Project Summary

A sustainable irrigation system was designed and tested.

The irrigation system meets the reasonable use requirements of the State of Maryland that -

- 1) environmental impacts are not anticipated and
- 2) the model predicts the availability of groundwater to the residences and businesses will not be diminished.

Irrigation components include a new stormwater retention/irrigation pond and a new groundwater well

FAIR HILL SPECIAL EVENT ZONE HYDROGEOLOGIC REPORT for WELL D

Contract No. 17260
MDE No. CE1988G083/08
CECIL COUNTY, MD



June 2019



Prepared For
Maryland Stadium Authority



Prepared By
Rummel, Klepper & Kahl, LLP
700 East Pratt Street, Suite 500
Baltimore, MD 21202

Project Purpose

Identify Project Irrigation Requirements & Determine Sources for Irrigation Water

- 1) Design of a stormwater (irrigation) pond
- 2) Well siting, construction and testing
- 3) Hydrogeological impact evaluation

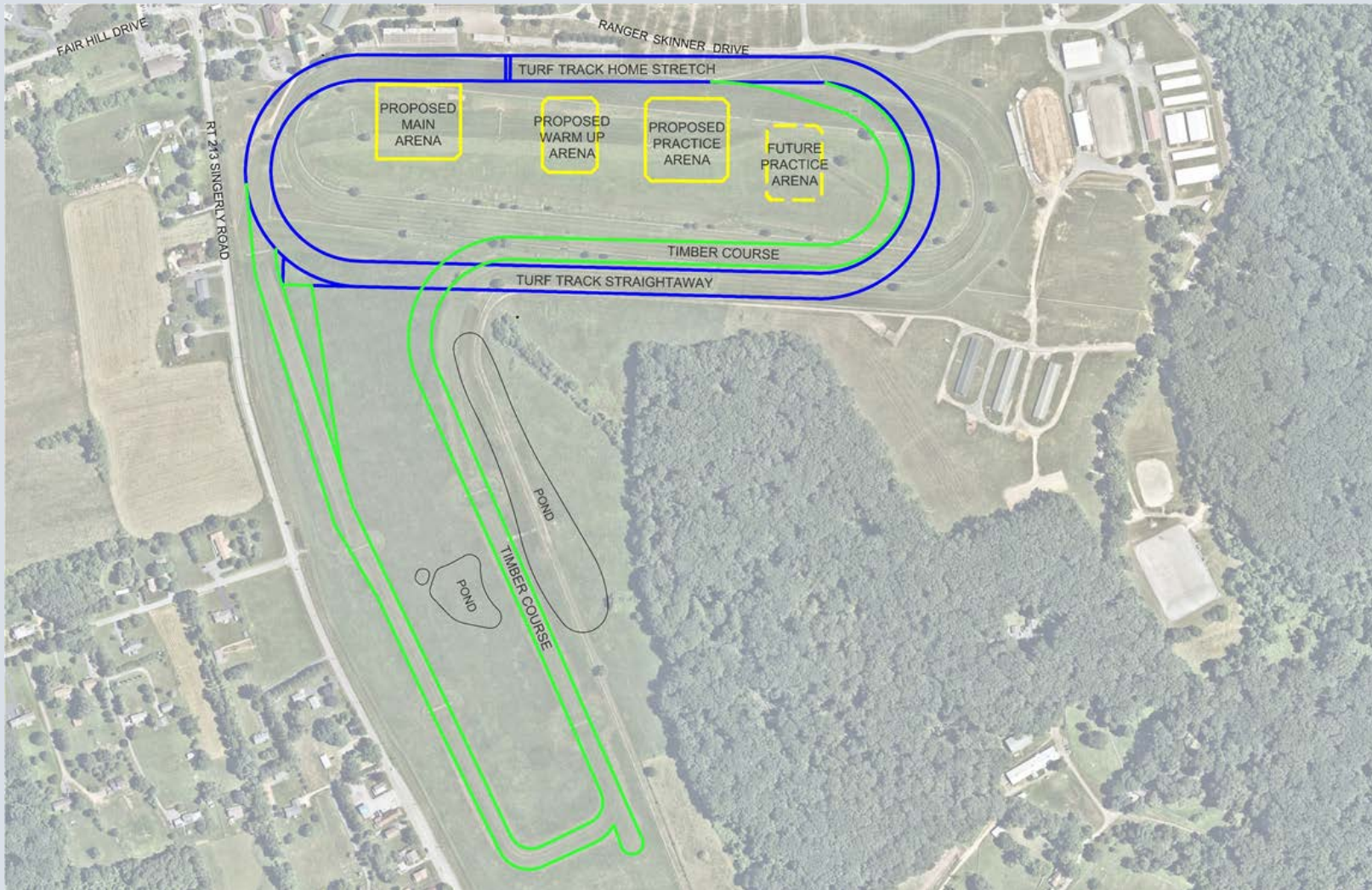


Project Overview – Areas of Irrigation

Oval Turf Track ~12 acres

Arenas ~6 acres

Timber Course ~16 acres



Project Overview – Irrigation Demands

Assumptions

- Three 6-hours watering events per week
- Oval track piped irrigation
- Timber track and Arenas manual irrigation
- No irrigation November through February
- Winter water storage for next growing season

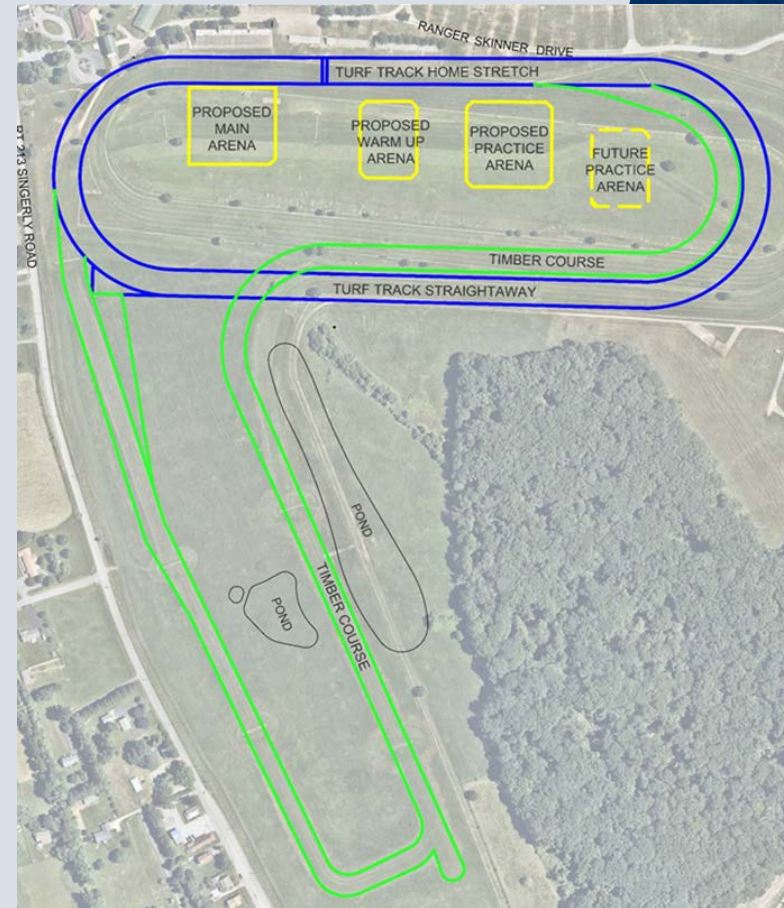
Irrigation Requirements

Oval turf track: ~30.2 ac-in/year

Timber course: ~18.8 ac-in/year

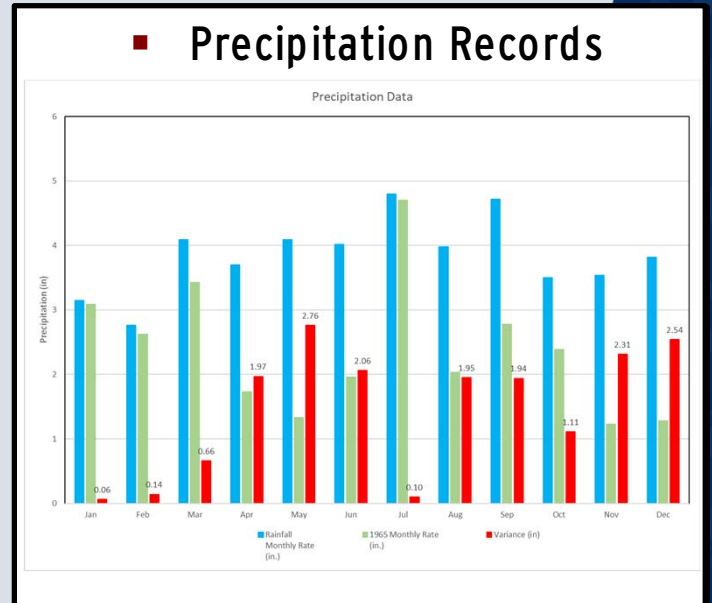
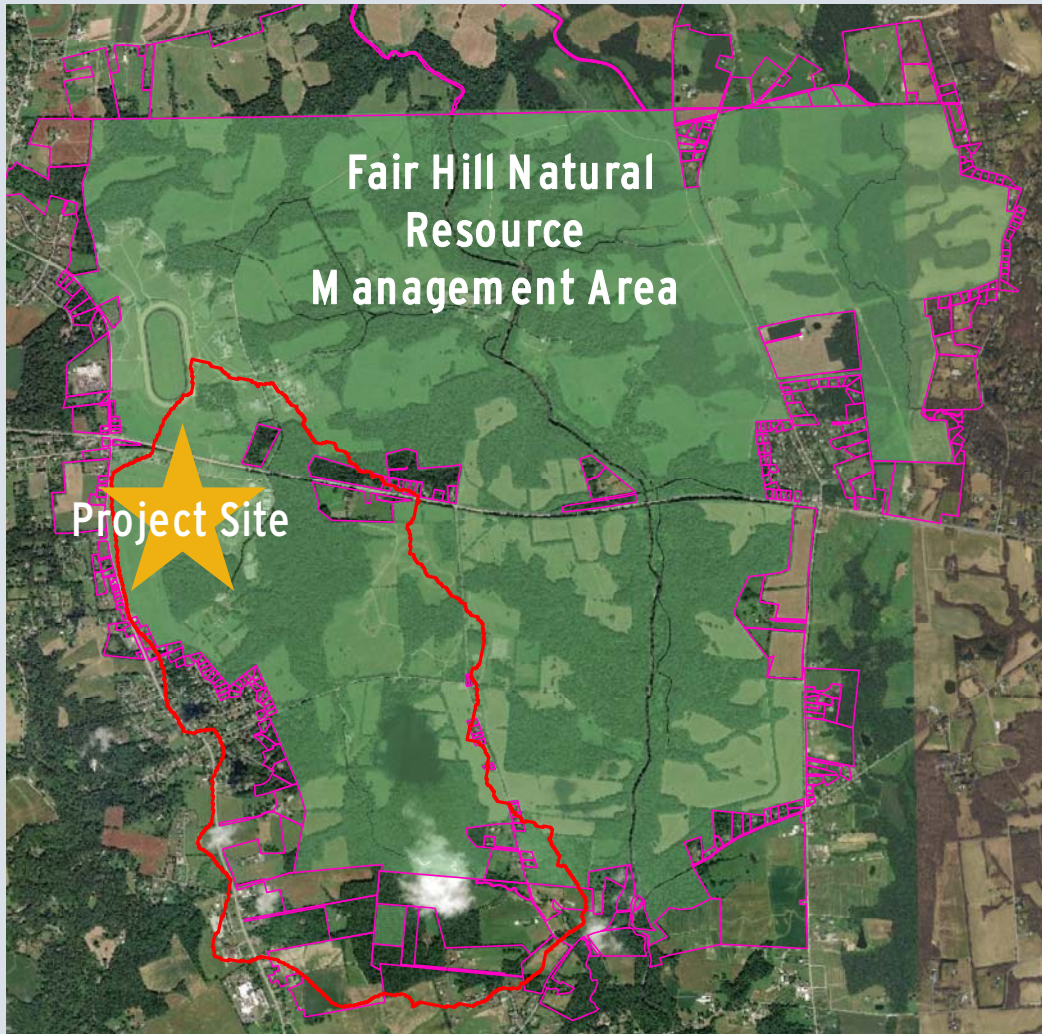
Arenas: ~27.4 ac-in/year

Average: ~24.2 ac-in/year



Project Overview – Water Balance

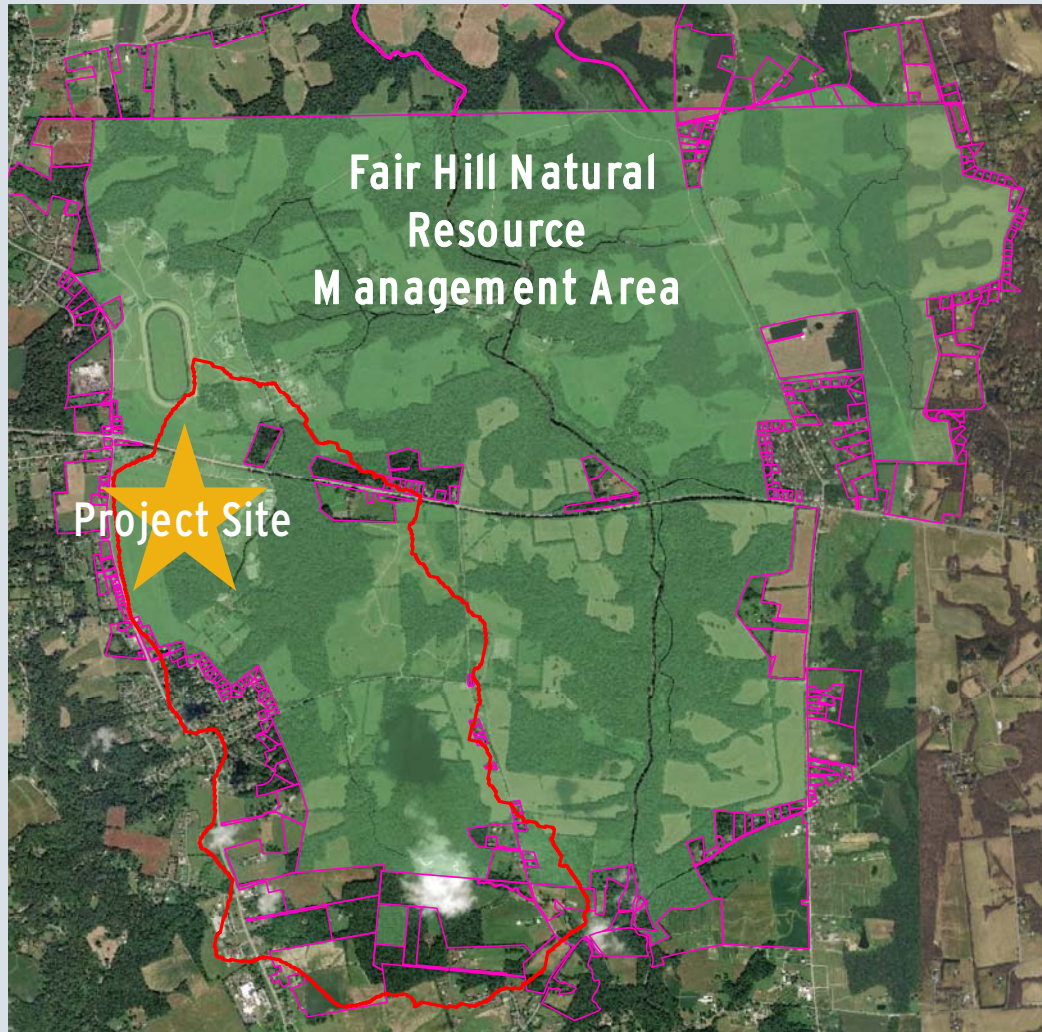
- Water Balance for Fair Hill Natural Resource Management Area



Precipitation run-off is generally adequate to irrigate the facility

Project Overview – Water Balance

- Water Balance for Fair Hill Natural Resource Management Area



Groundwater Recharge

- Grammies Run watershed
 - 3.1 Sq Miles
- M DNR land holdings
 - 1,210 Acres
- Other losses
 - Impervious Area (5%)
 - Existing users (12kgpd)
- Hydrologic Data
 - 1-in-10 = 4.9 in/yr
 - 7Q10 = 2.9 inches

Precipitation run-off is generally adequate to irrigate the facility

Groundwater supply is sustainable

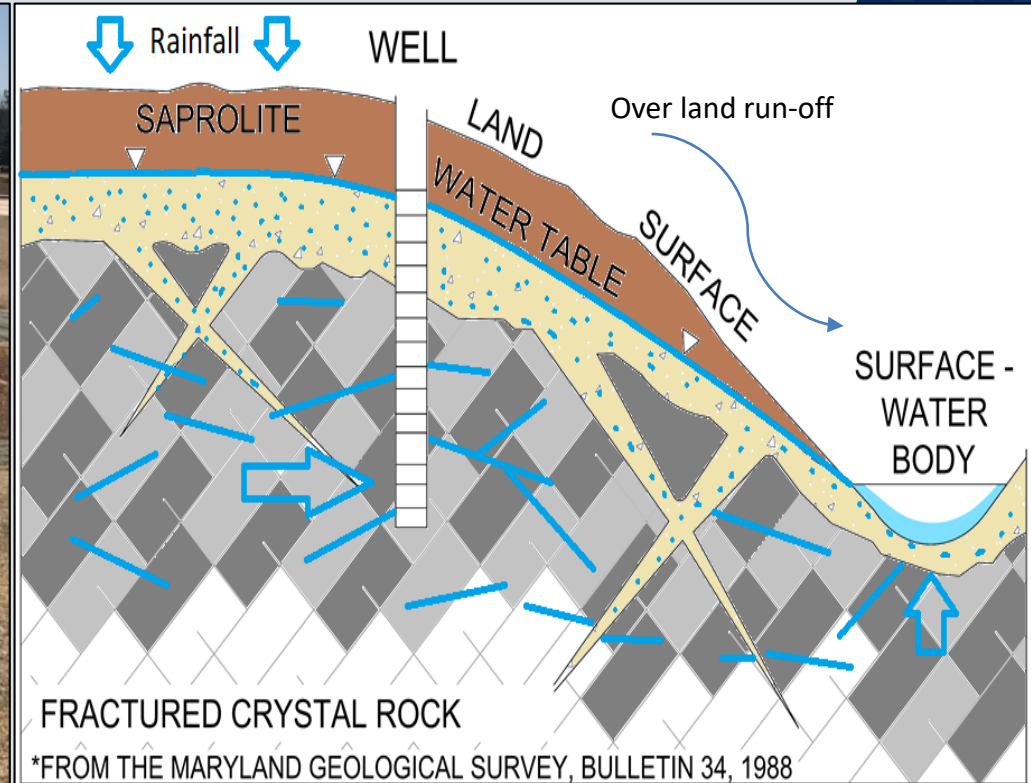
Project Overview – Water Resources & Facilities

- Stormwater (irrigation) Pond

- Rainwater harvesting
- Drainage basin of 74.5 acres
- Lined pond storage = 9.8 ac-ft or 3.2 MG

- Production Well

- Supplemental irrigation water supply
- Artesian bedrock aquifer well
- Total depth 402 feet below land surface



Hydrogeological Testing and Evaluation Process

- Installation and testing of production well
- Submittal of initial permit documents, construction and testing plans
- Coordination with Maryland Department of Environment (MDE) and local residents
- Installation of Monitor wells
- Conduct 72-hour Aquifer Performance Test (APT)
 - Monitoring of Private wells
 - Monitoring of Onsite Wells
- Evaluation of data

FAIR HILL SPECIAL EVENT ZONE HYDROGEOLOGIC REPORT for WELL D

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Hydrogeological Testing – Aquifer Monitoring Network

Aquifer Monitoring Network

Five (5) on-site monitor wells

Two (2) off-site monitor wells

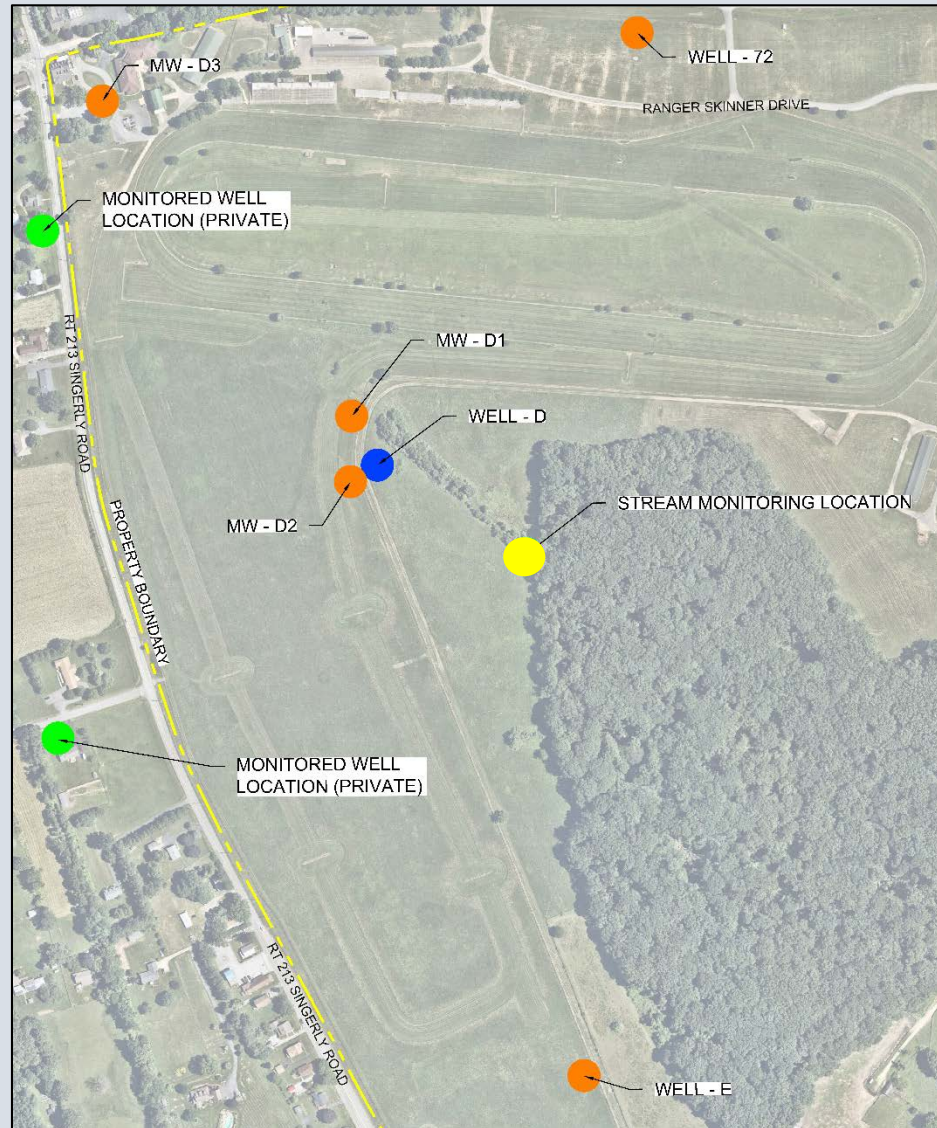
One (1) in-stream piezometer

Testing Parameters

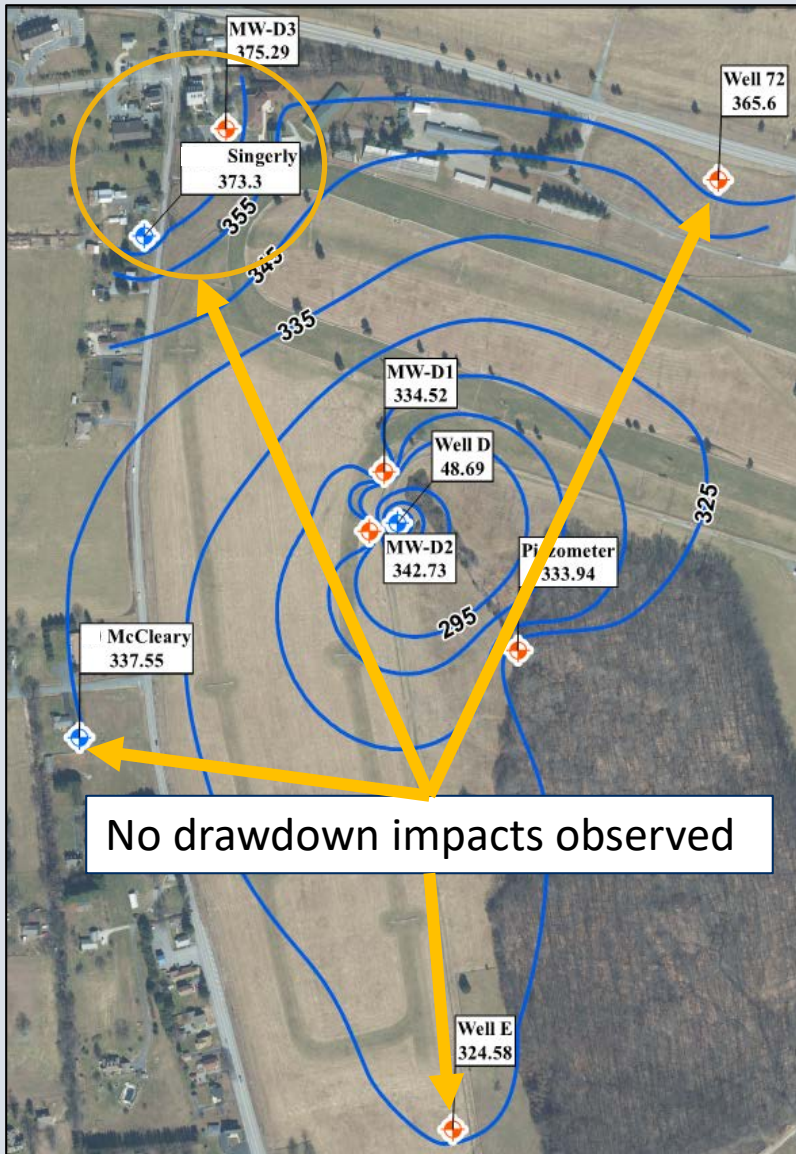
72-hours steady-state pumping

Water level data collection

Groundwater quality analysis



Hydrogeological Testing – APT Ending Conditions

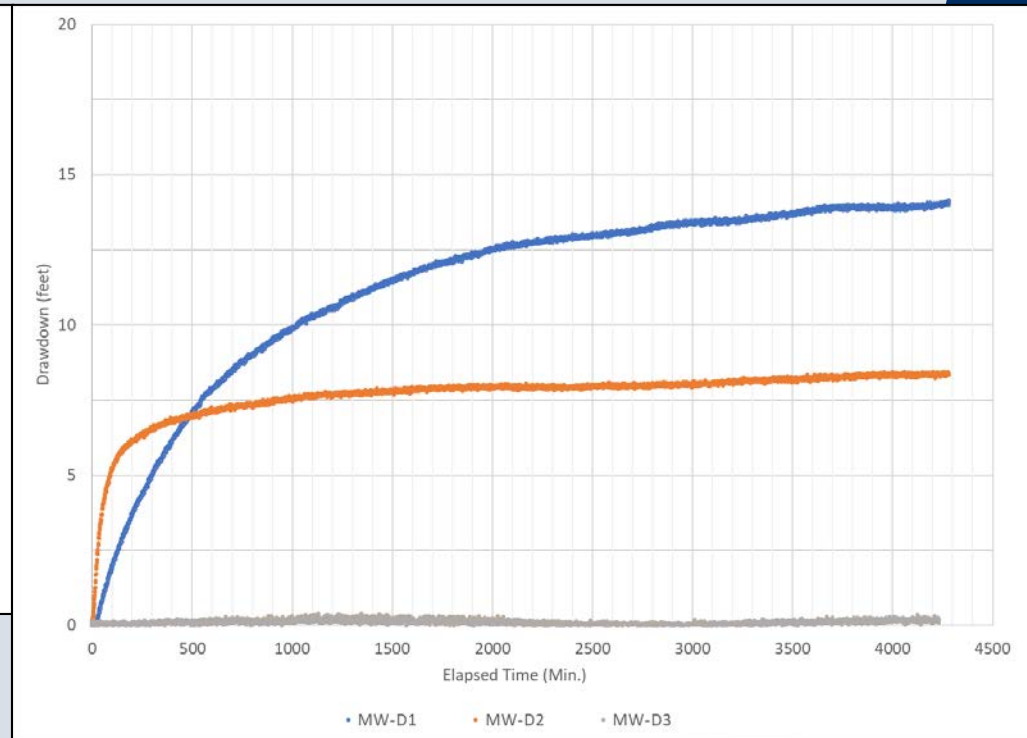
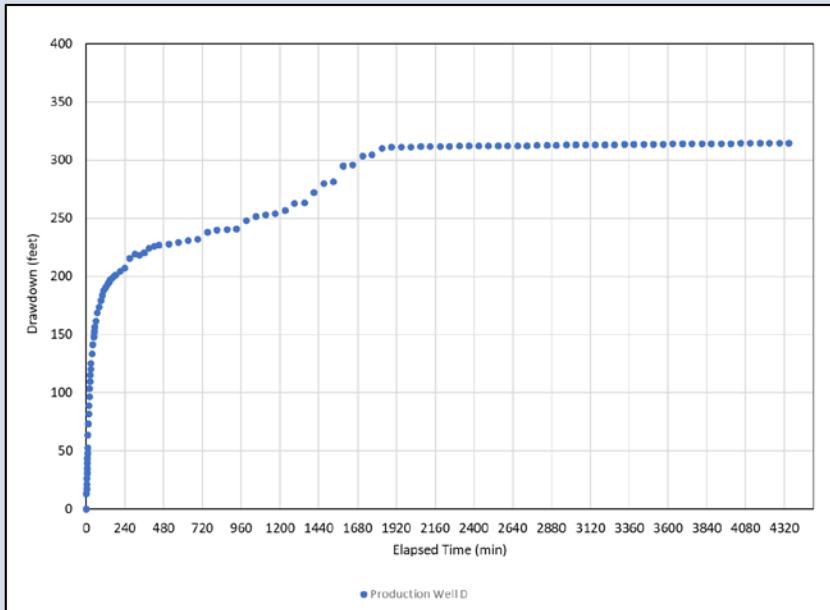


Monitor Well	Approximate Distance (ft)	Water Level Change (ft)
MW-D1	171	14
MW-D2	97	8
MW-D3	1,413	0.4
Well E	1,994	0
Well No. 72	1,562	0
Singerly Road*	1,260	0
McCleary Road*	1,370	0

As expected water level declines were observed in the monitor wells near the production well.

* Off site private well

Hydrogeological Testing – Onsite Observations



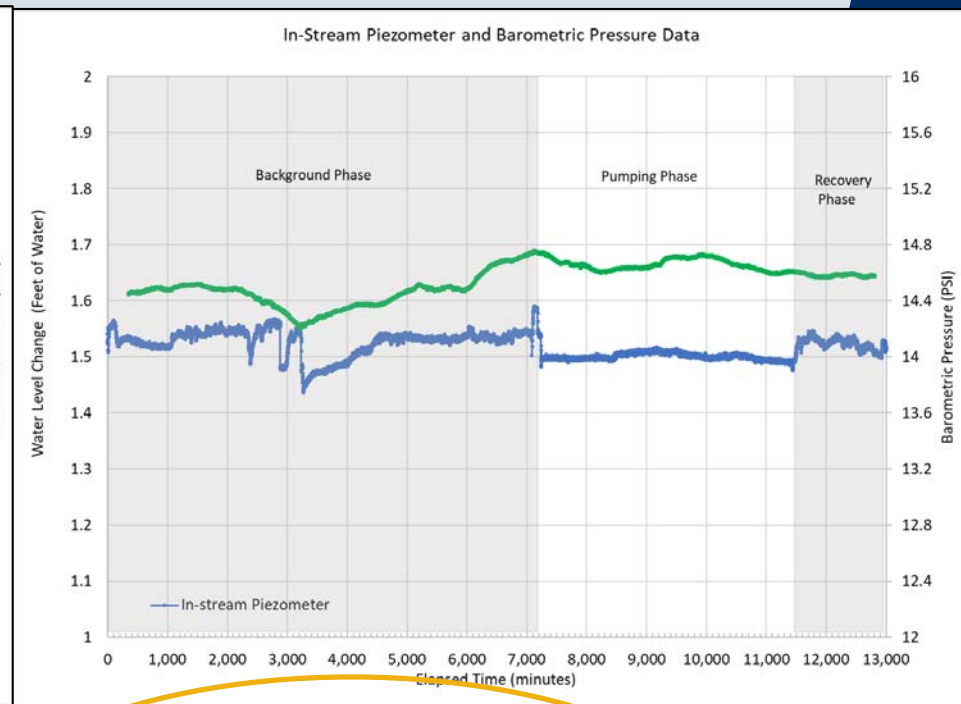
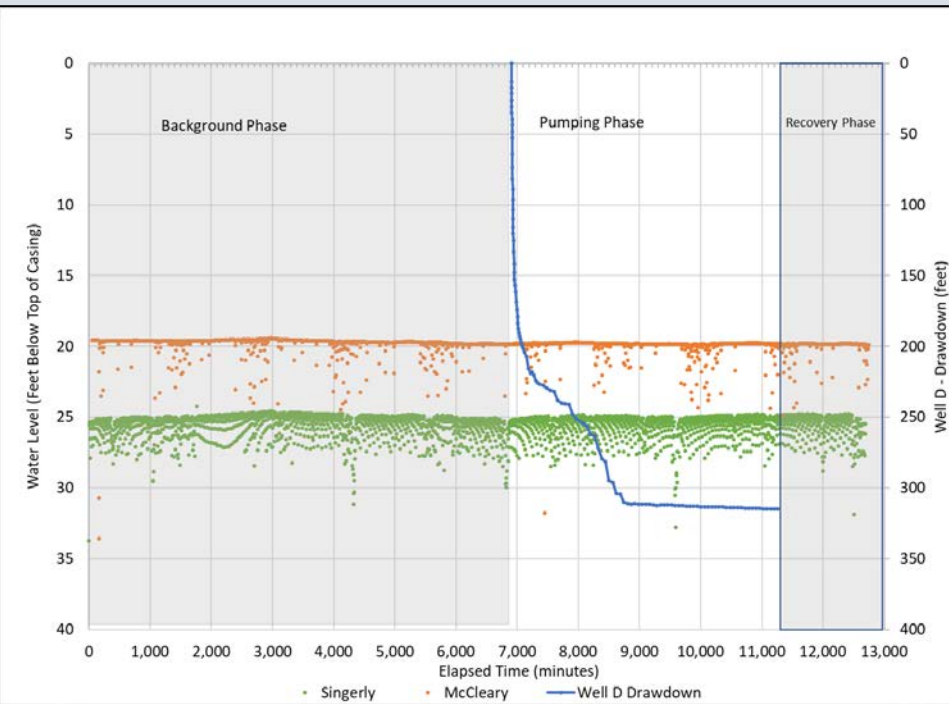
Observed Drawdown

- Production Well – 315 feet
- Average pump rate 37 gpm

Observed Drawdown

- MW-D1 – 14.0 feet
- MW-D2 – 8.0 feet
- MW-D3 – 0.4 foot

Hydrogeological Testing – Off-site / Surface Observations



APT Timeline

- Background started at 10:00 AM on April 24
- Pumping started at 10:00 AM on April 29
- Recovery started at 10:00 AM on May 3

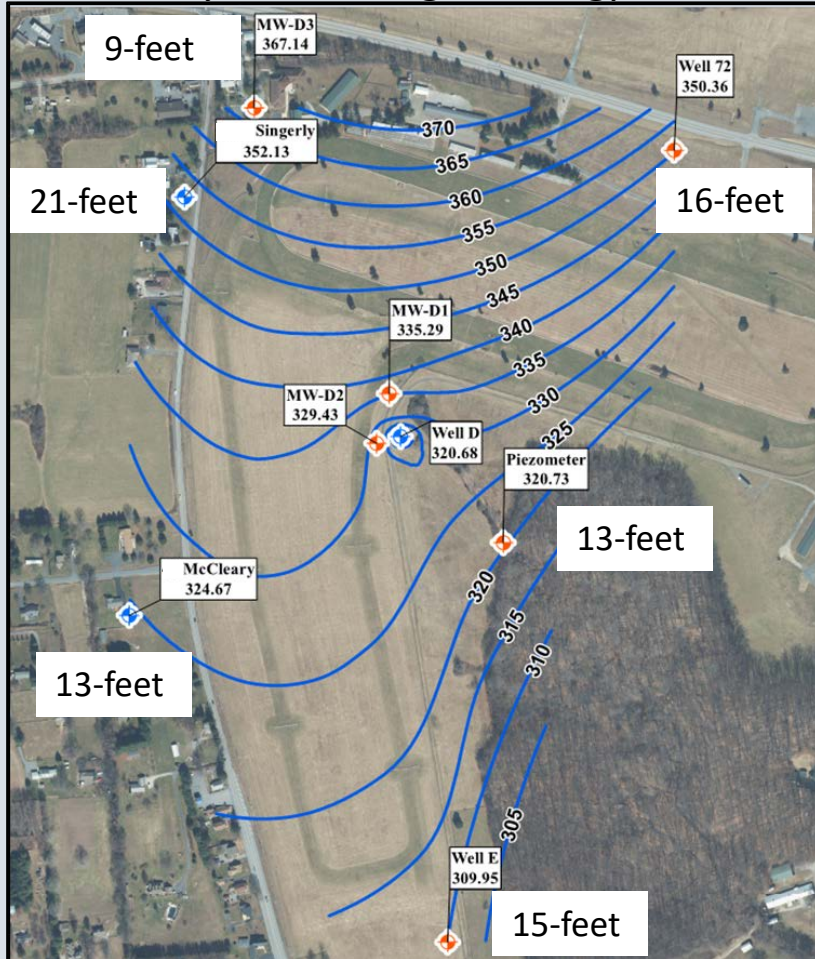
APT Observed Drawdown (feet)

- **Singerly - None**
- **McCleary – None**
- **In-Stream Piezometer - 0.05**

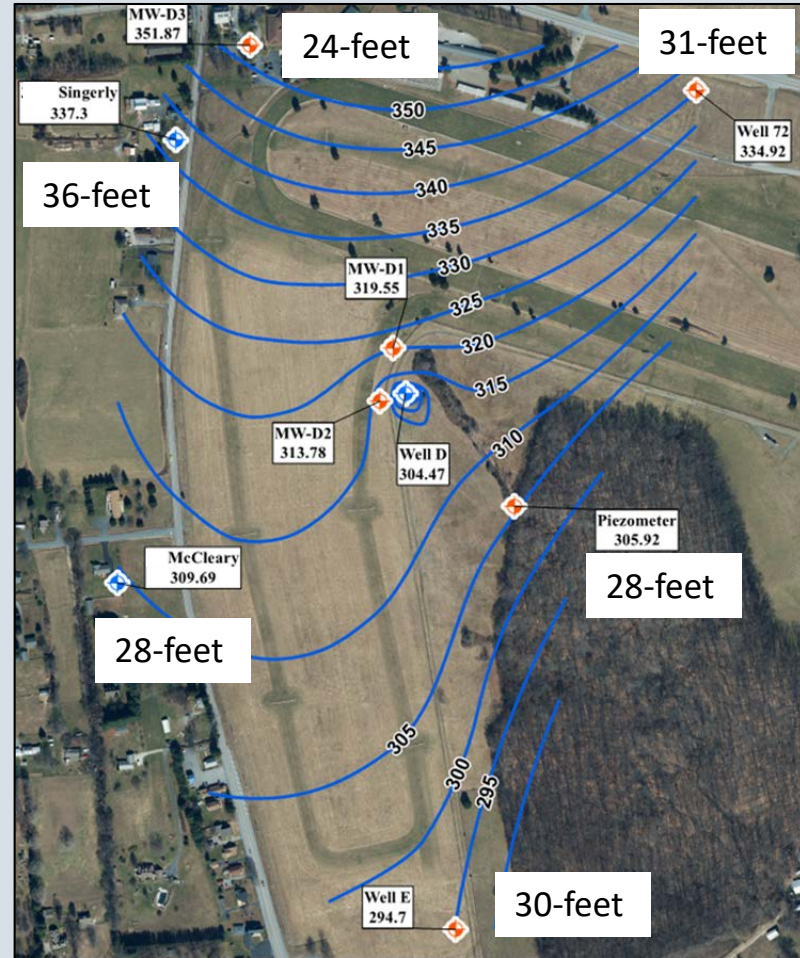
Hydrogeological Analysis & Groundwater Modeling

- Computerized modeling evaluation

90-day no recharge at 35 gpm



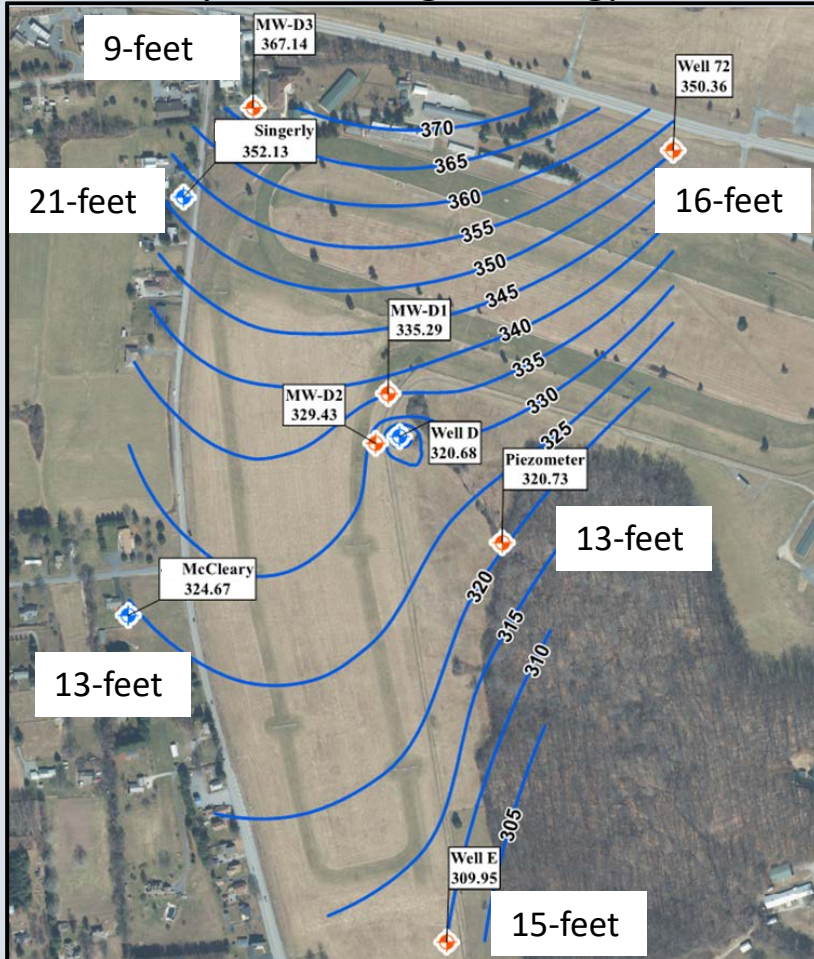
Scenario1 + idealized drought condition



Hydrogeological Analysis & Groundwater Modeling

- Computerized modeling evaluation

90-day no recharge at 35 gpm



90-day no recharge at 35 gpm



Project Overview – Water Appropriations

- Calculated irrigation demand of 24.2 inches per acre/year
 - Equivalent to ~22.2 Million Gallons per year (MGY)
 - Based on 33.7 Acres
- Combined groundwater permit includes both the previously permitted Domestic and Irrigation components
- Combined permitted volume of 88.5 ac-ft
 - equivalent to ~28.8 MGY

Existing Permit				
Permit	Average Day (gpd)	Maximum Day (gpd)	Total Volume (Ac-ft)	Total Volume (gallons)
Groundwater	12,000	62,000	13.4	4,380,000
Proposed Modified Permit				
Permit	Average Day (gpd)	Maximum Day (gpd)	Total Volume (Ac-ft)	Total Volume (gallons)
Surface Water	79,000	160,000	88.5	28,835,000
Groundwater (1)	39,500	69,000	44.2	14,417,500
Combined and Supplemental Volume (2)	79,000		88.5	28,835,000

(1) Groundwater utilized for irrigation will be placed in the lake prior to use

(2) Combined surface and groundwater utilization volume of 79,000 gpd annual average

~11 inches of water per acre (or ~10 MGY) more groundwater than previously authorized

Conclusions

Captured stormwater will be the major irrigation supply component:

- Attenuate peak downstream discharges and
- Reduce groundwater demand

Groundwater is a supplemental irrigation:

- Groundwater recharge exceeds the groundwater demands
- Low potential for decreased groundwater availability to residents and business
- Low potential for impacts to the ecosystem

Site specific aquifer information:

- Production zone is confined which lowers the probability of water table impacts
- During the APT no off-site impacts were observed





**On behalf of Maryland
Department of Natural Resources
and
Maryland Stadium Authority
Thank you
Questions?**

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