

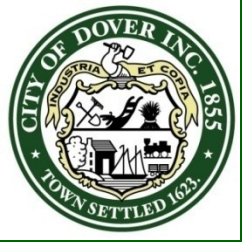
Dover, New Hampshire, City Council

Pudding Hill Aquifer

Status and Next Steps

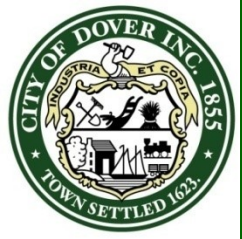
December 4, 2019





Pudding Hill Aquifer Update

- 2 Anticipated Agenda Items for City Council Meeting of December 11, 2019
 - #1 - Approve MOU w/ Schnitzer
 - 6th collaborative amendment to initial MOU
 - Schnitzer agrees to fund WTP design
 - #2 - Authorize Underwood Engineers to begin design of WTP



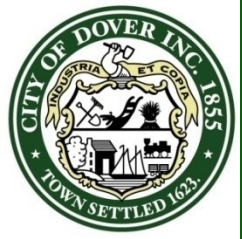
Pudding Hill Aquifer Update

- Current update builds upon previous workshops
- Presentations available www.dover.nh.gov
- Dates & titles of previous workshop presentations
 - January 3, 2018 – Everything Water
 - July 25, 2018 – Pudding Hill Aquifer, Status & Next Steps
 - January 2, 2019 – Water System Improvements, Status Update



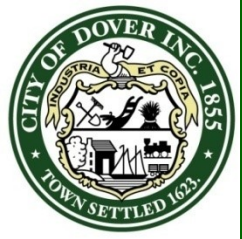
Importance of Pudding Hill Aquifer

- Pudding Hill critical for long-term water supply
- Approx. 1 million gallons per day supply
- 40% of current average daily demand
- State committed to maintaining viability of aquifer
 - \$1.3 million funding to construct DPH-1
 - \$1.3 million grant – Bellamy Recharge Facility
- Alternative supplies are limited



Pudding Hill Aquifer Update

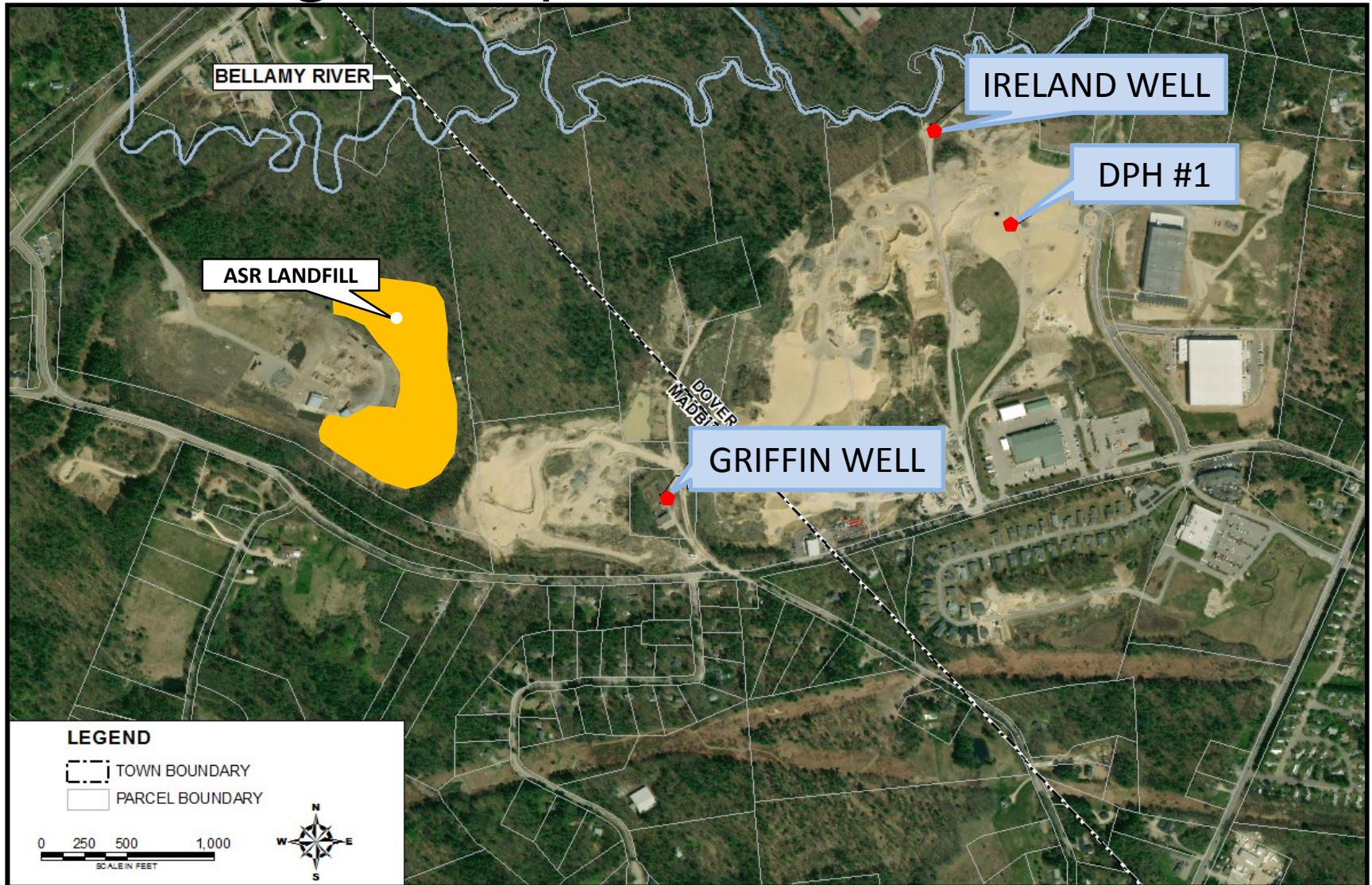
- Contamination traced to former Madbury Metals site
 - Griffin well offline – December 2015
 - Ireland well offline – June 2018
 - Schnitzer remains committed to addressing issues
 - Schnitzer submitted Remedial Action Plan to NH DES, September 2019



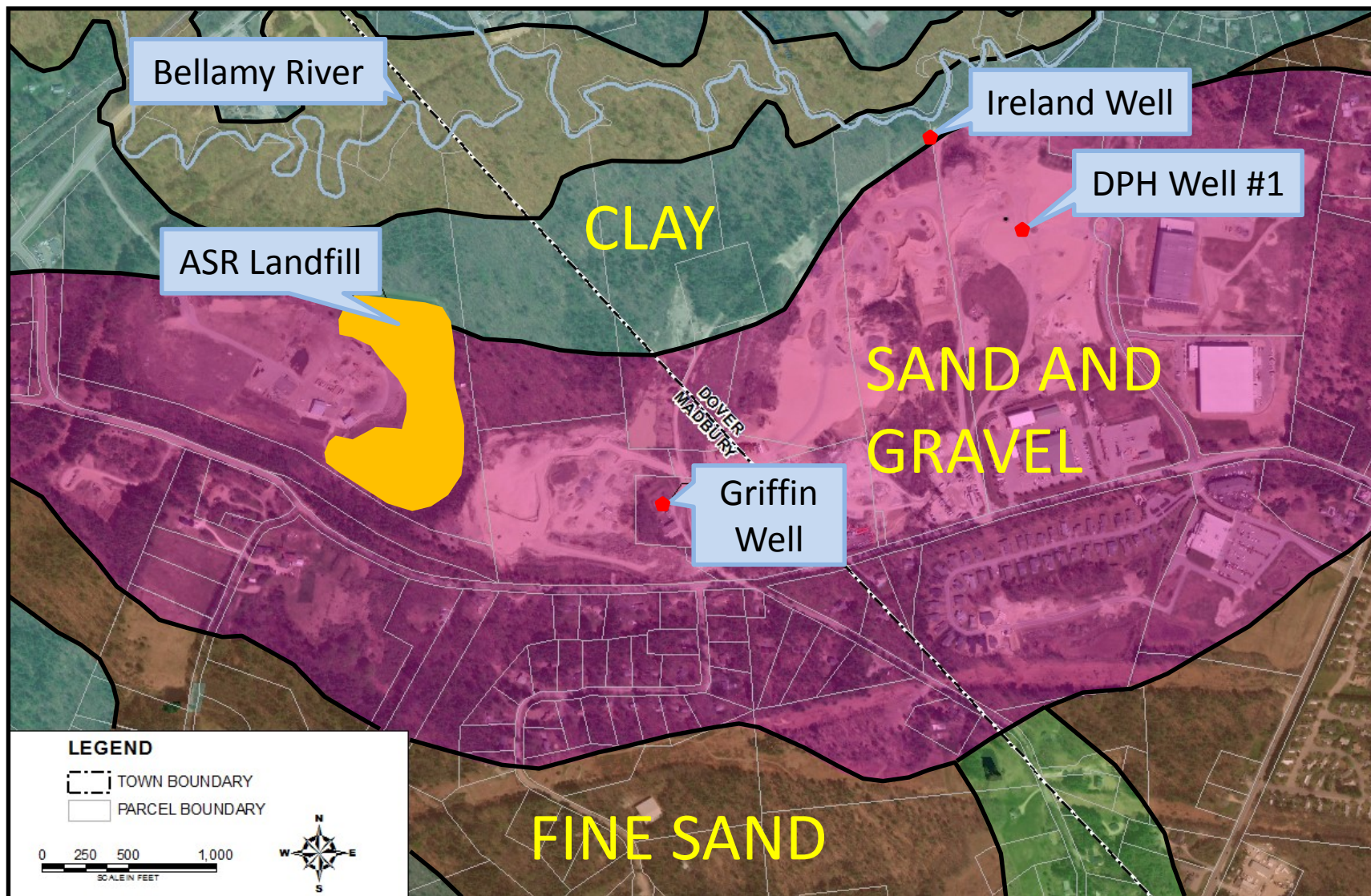
Pudding Hill Aquifer Update

- ❖ Jamie Emery from, EGGI/GZA will discuss hydrogeologic work, monitoring, and artificial recharge
- ❖ EGGI actively monitoring water quality
- ❖ Keith Pratt from Underwood Engineers will discuss pilot-study results for treatment alternatives
 - Underwood worked w/ UNH
 - Treatment effectiveness

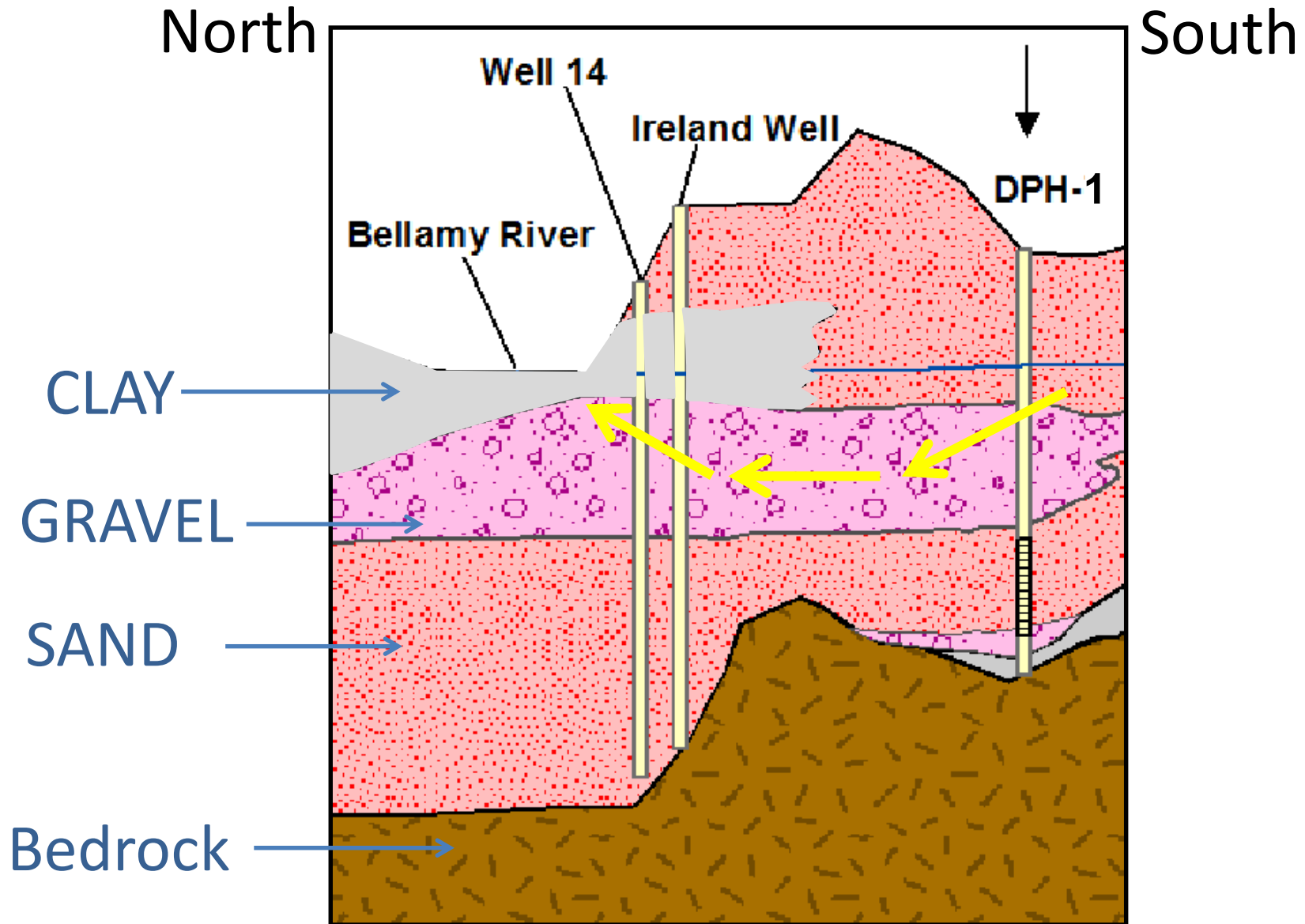
Pudding Hill Aquifer - Production Wells



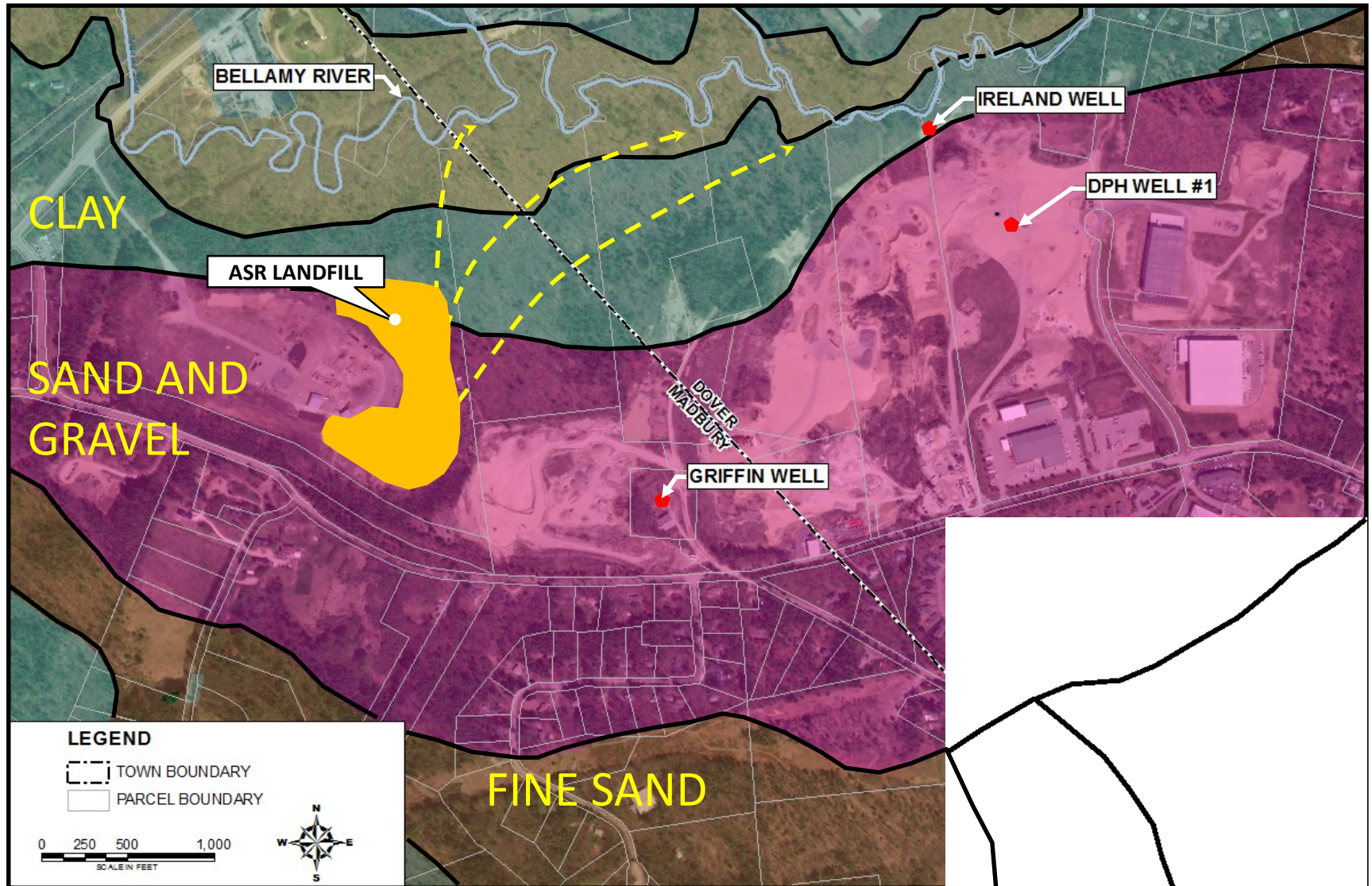
Hydrogeologic Setting- Pudding Hill Aquifer



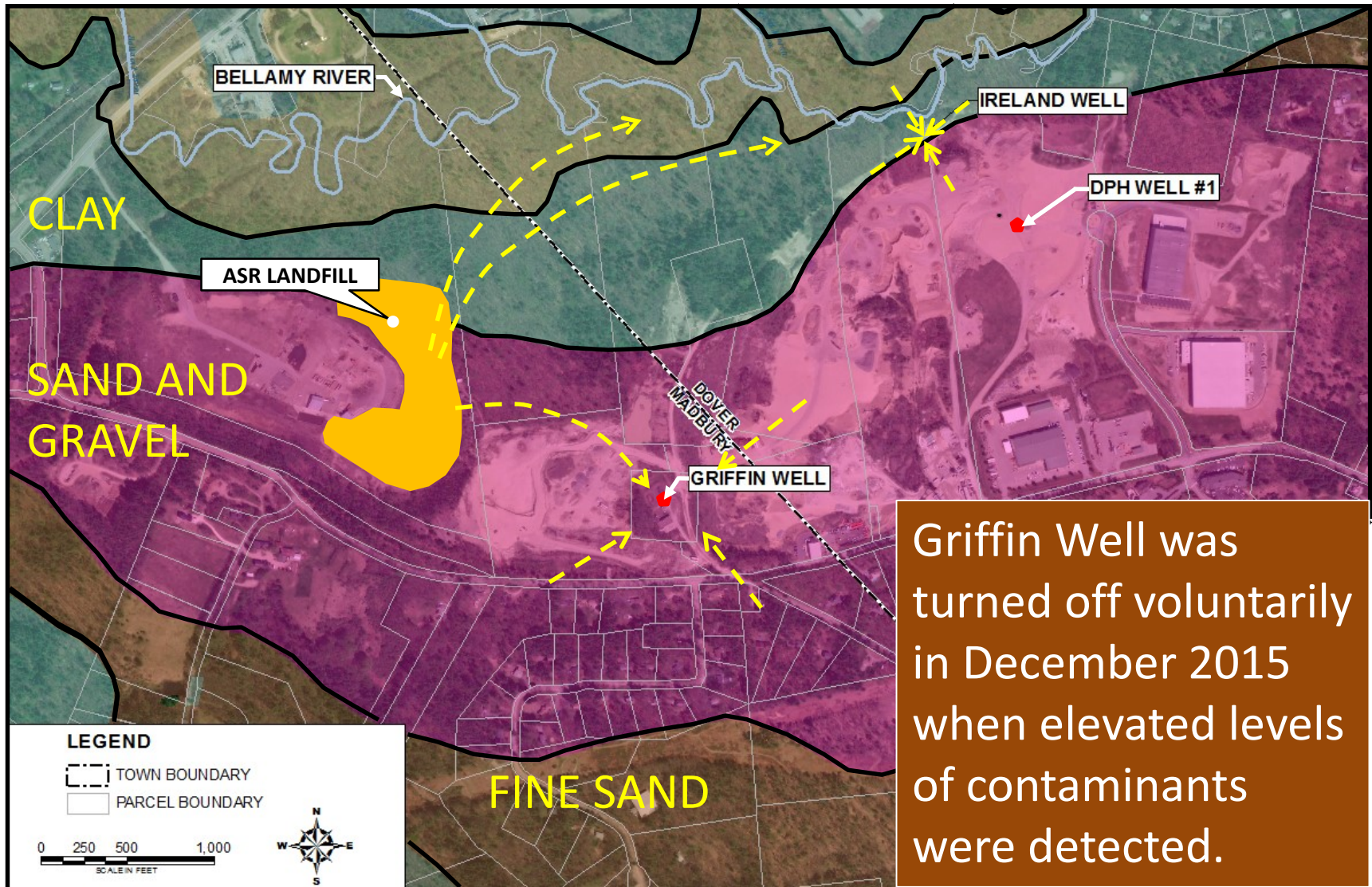
Geologic Cross Section



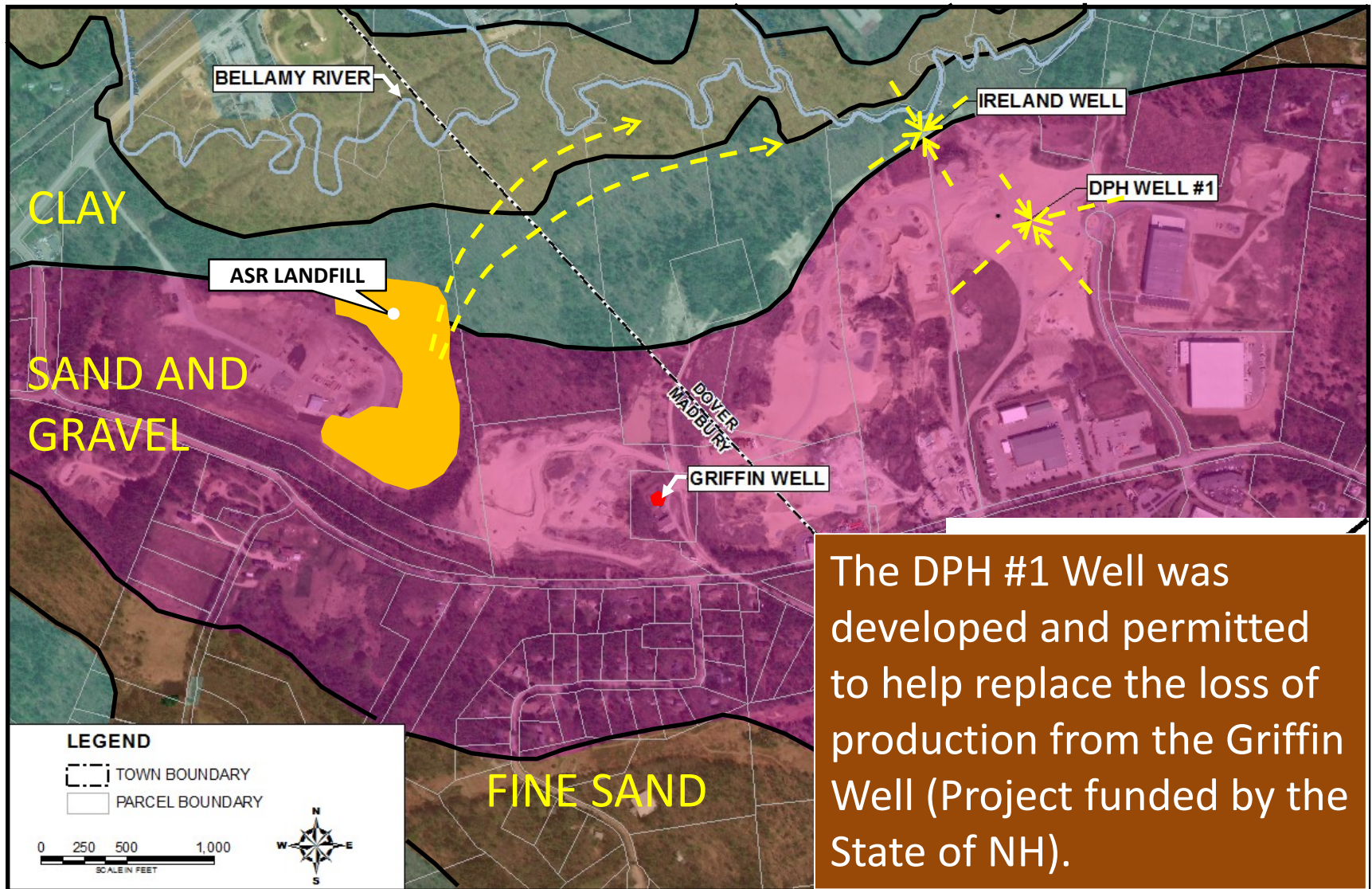
Groundwater Flow - Ambient



Groundwater Flow – Pumping

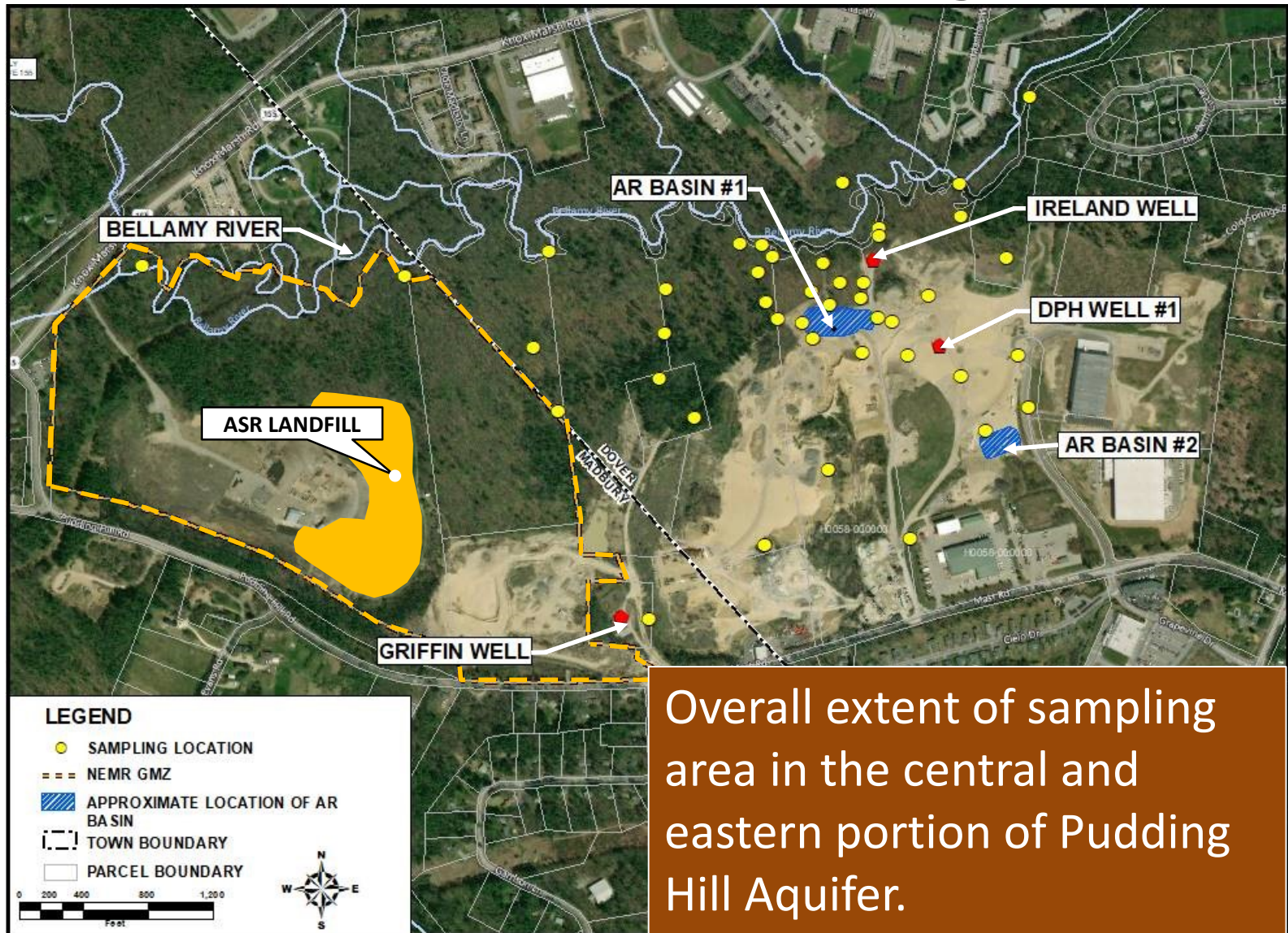


Groundwater Flow – Ireland - DPH #1 Pumping

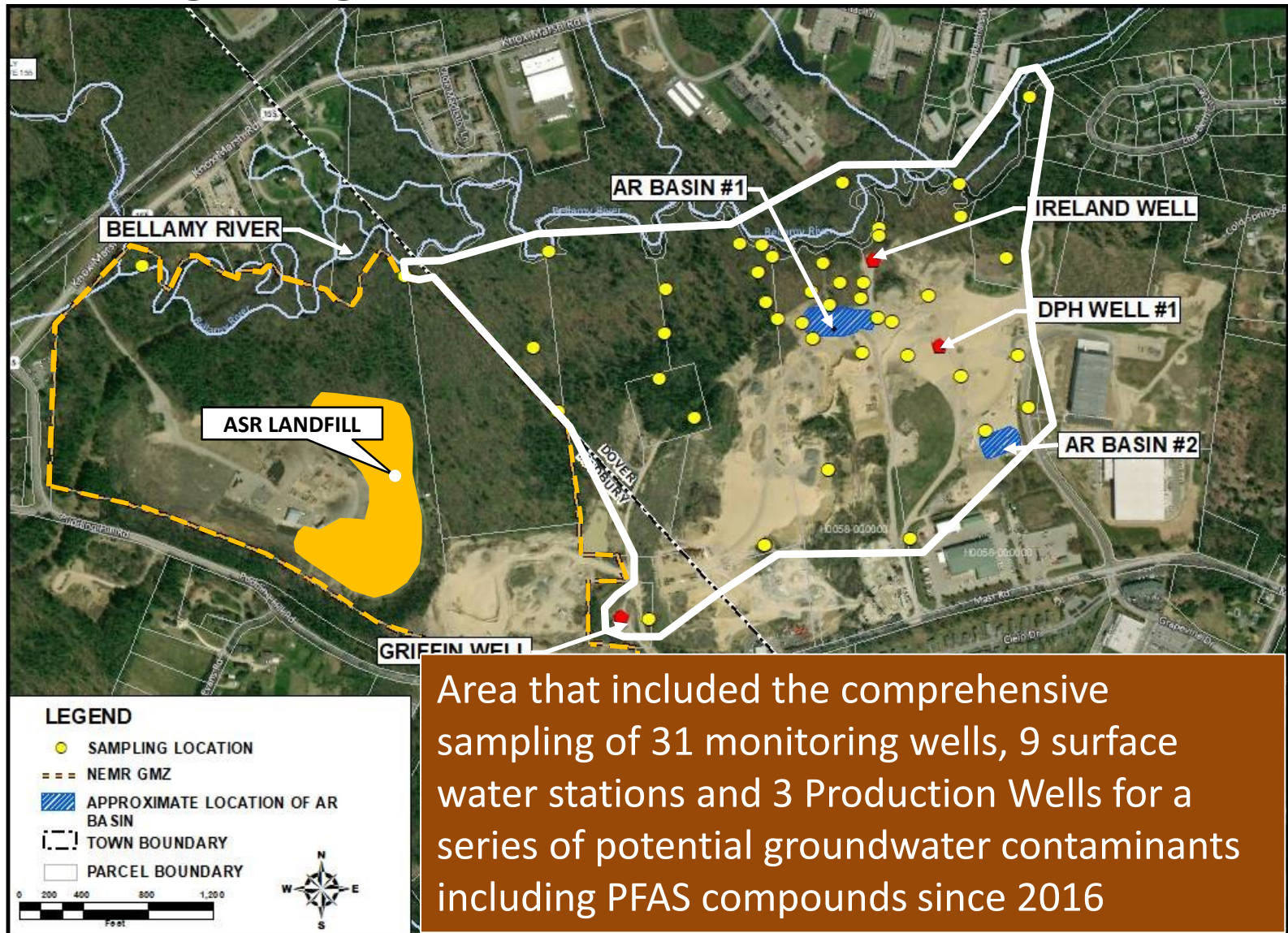


The DPH #1 Well was developed and permitted to help replace the loss of production from the Griffin Well (Project funded by the State of NH).

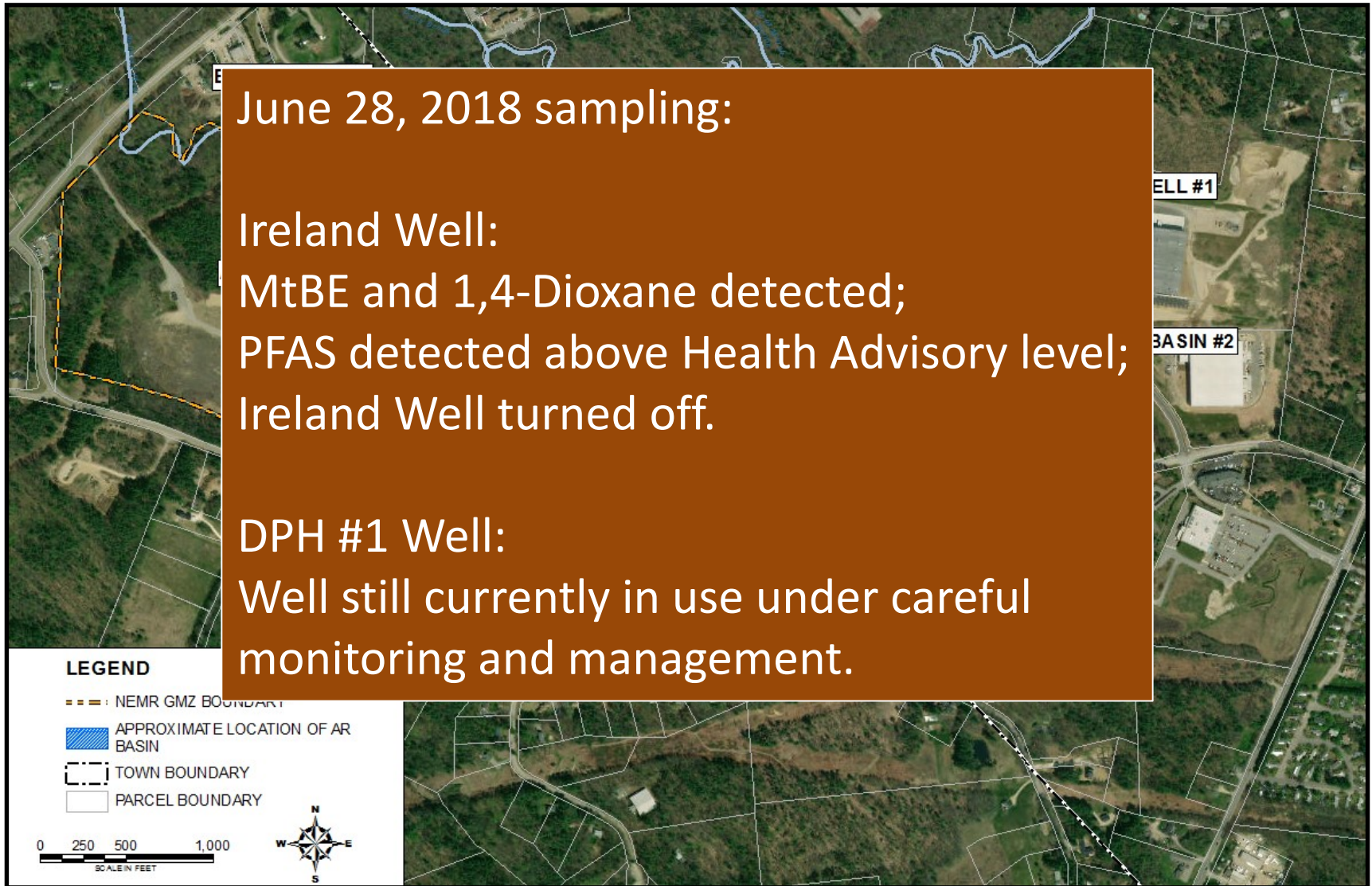
Delineation of Sampling Area



Monitoring Programs- Groundwater & Surface Water

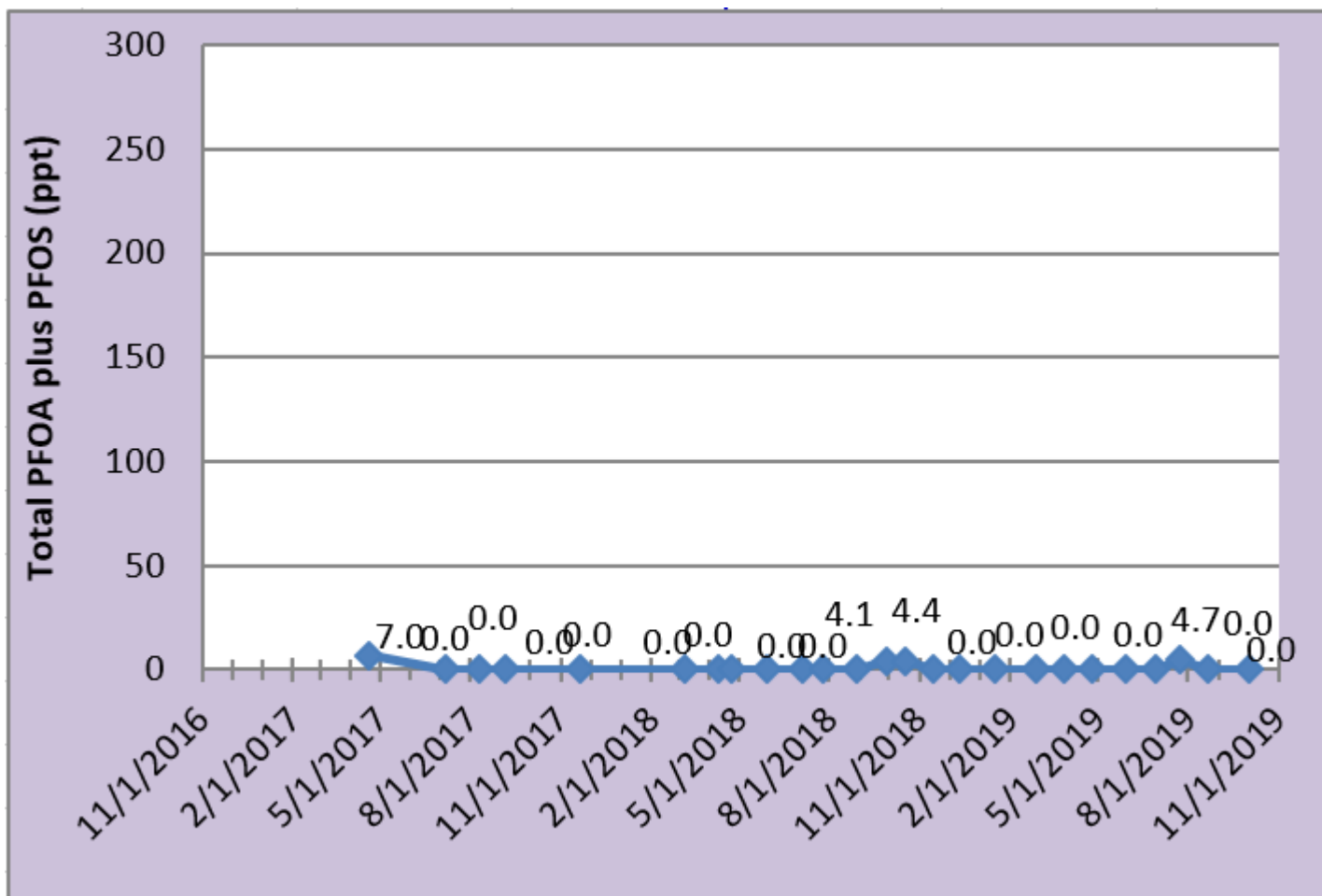


Water Quality Results

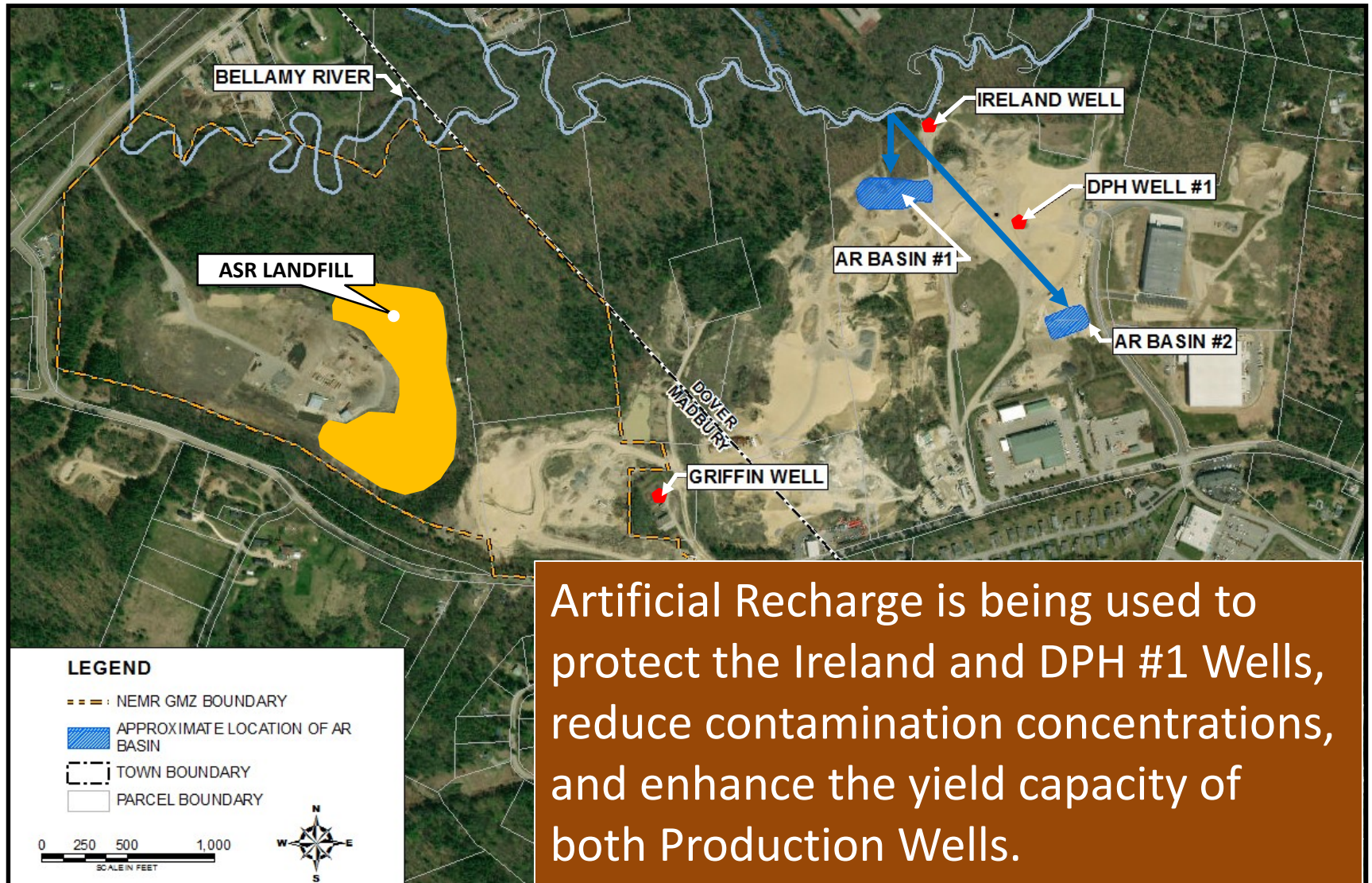


DPH Well #1

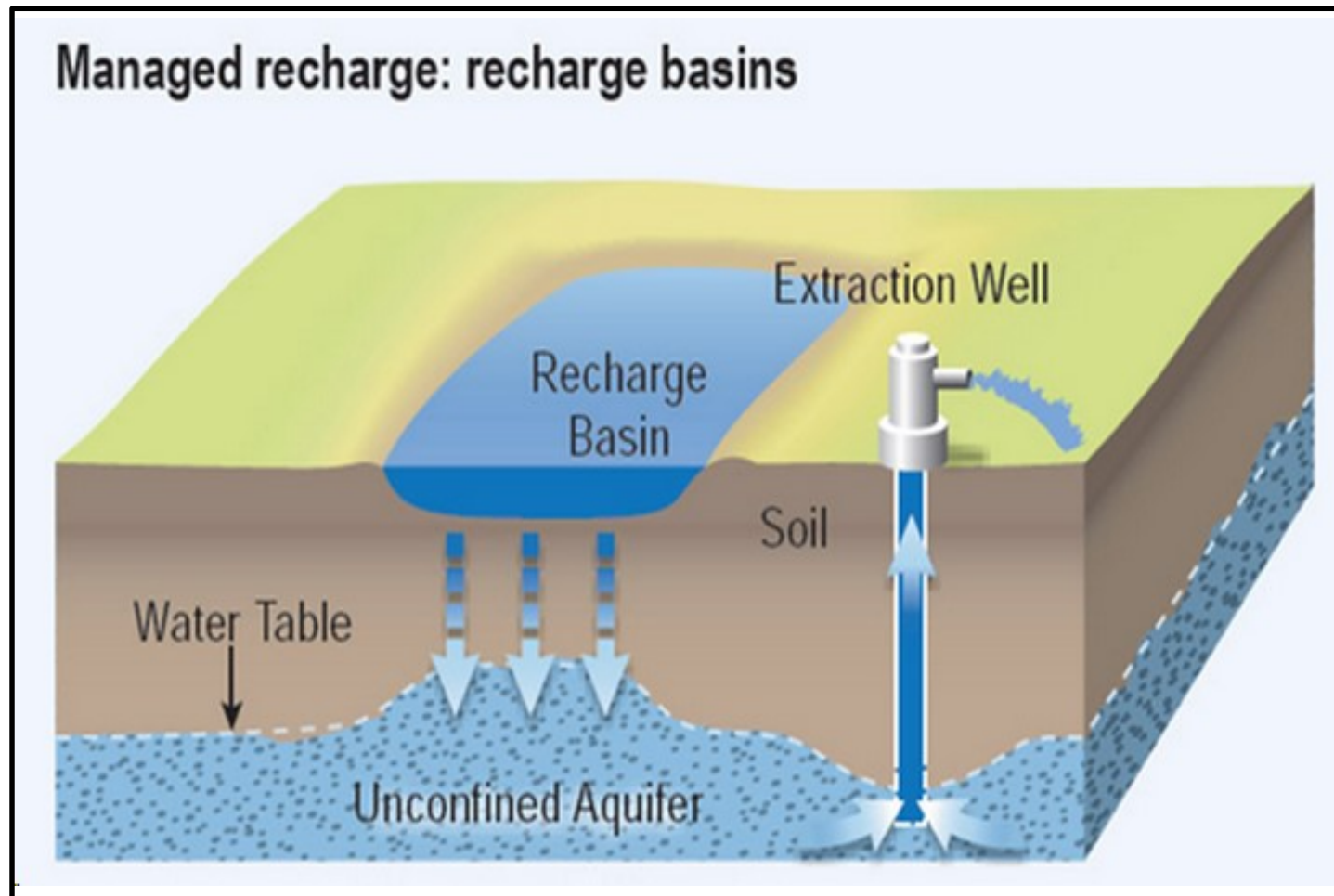
Total PFOA plus PFOS (ppt)



Use of Artificial Recharge



Schematic of Artificial Recharge Basin, Well, and Water Table



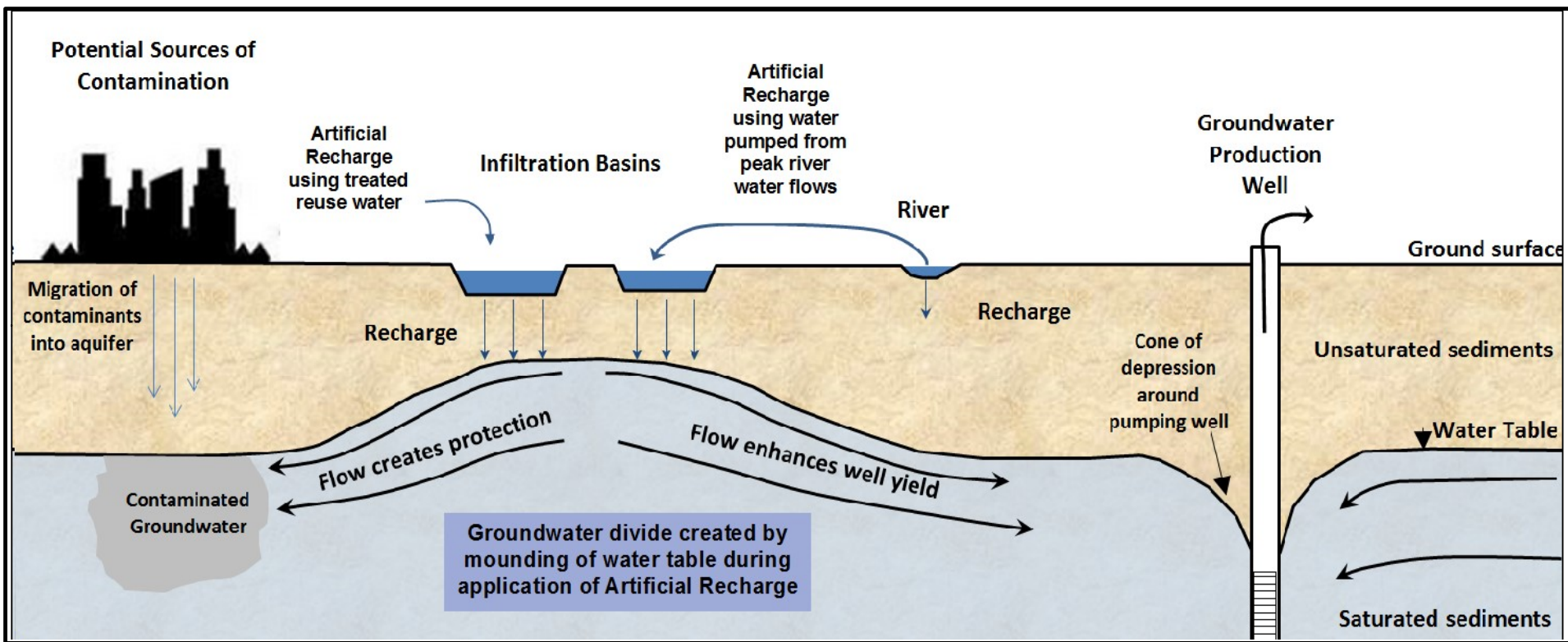
AR Basin #1



AR Basin #2



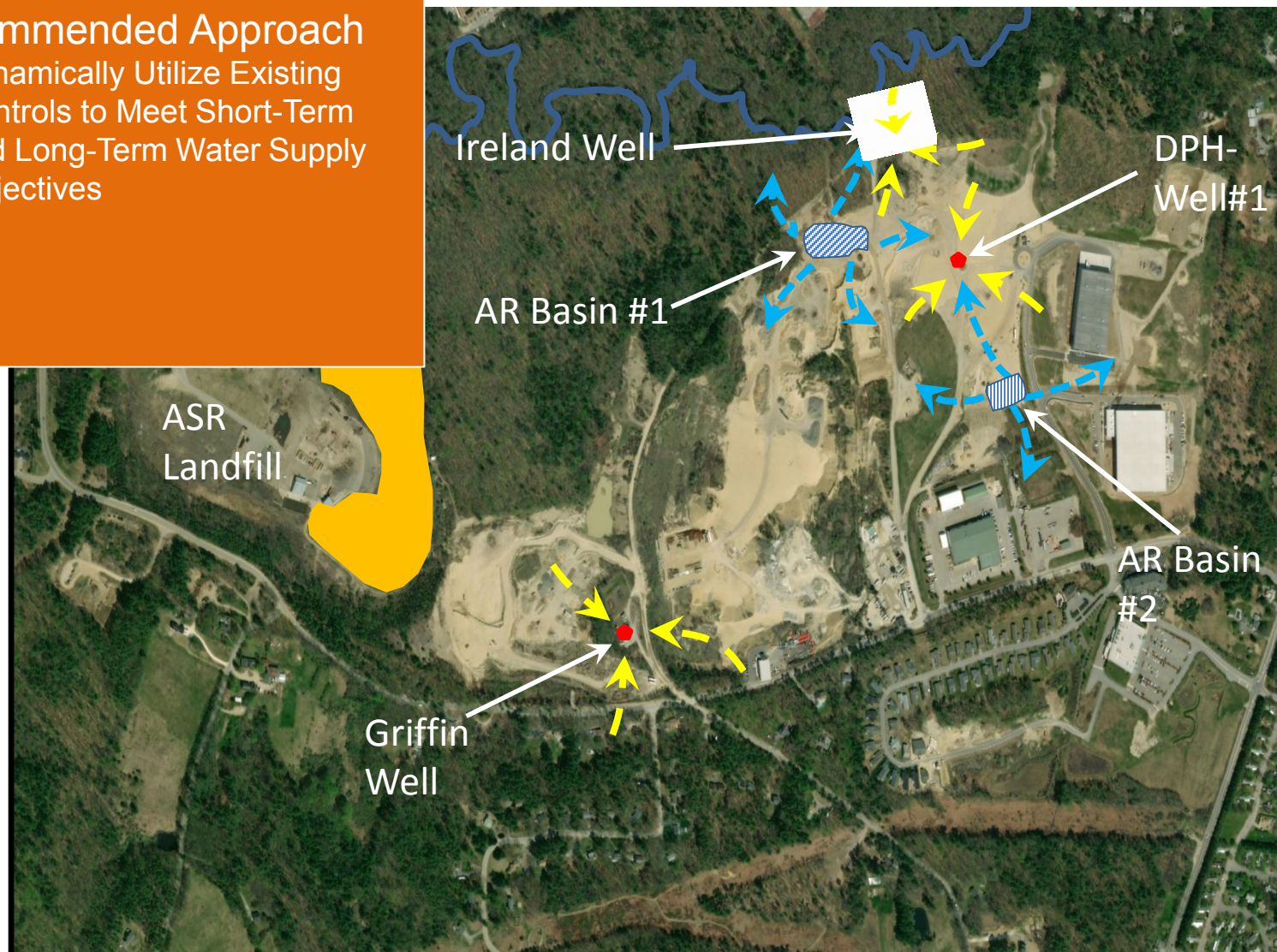
Illustration of the Benefits Using Artificial Recharge



Aquifer Management Design

Recommended Approach

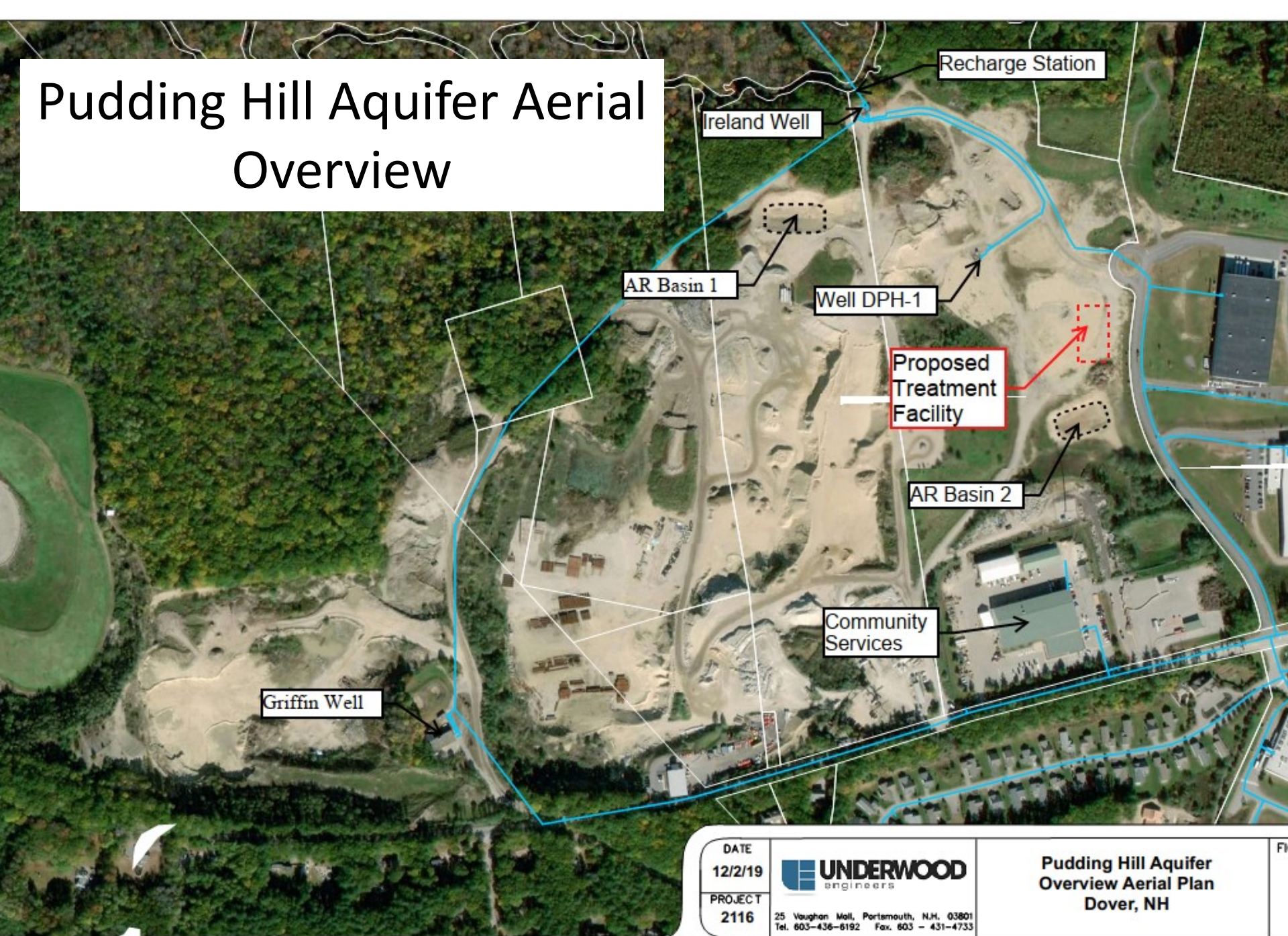
- Dynamically Utilize Existing Controls to Meet Short-Term and Long-Term Water Supply Objectives



ENGINEERING DESIGN

- Existing Infrastructure and Milestones
- Proposed Water Treatment Plant
- Treatment Goals
- Final Design Scope
- Schedule

Pudding Hill Aquifer Aerial Overview



DATE
12/2/19
PROJECT
2116

UNDERWOOD
engineers

25 Vaughan Mall, Portsmouth, N.H. 03801
Tel. 603-436-6192 Fax. 603 - 431-4733

**Pudding Hill Aquifer
Overview Aerial Plan
Dover, NH**

Milestones - Past

- *1960's – Griffin and Ireland Wells Installed*
- *1990 – Griffin Water Treatment Plant Installed*
- *1997 – Improvements to Griffin WTP*
- *2017 – Well DPH-1 Installed*
- *2017 – Ireland Replaced*
- *2017 – Interim Improvements to Ireland Well and DPH-1*
- *2018 – Pudding Hill Master Plan*
- *2018 – Pilot Study for treatment of Iron and Manganese, PFAS, 1,4-Dioxane and MTBE*

Griffin Well



Griffin WTP



DPH-1 and Ireland Wells (Interim)



Piloting - Complete



UNH Peer Review

- Dr. Jim Malley, PhD
- Complete
 - Master Plan and Pilot Report
- Pending
 - Design Phase

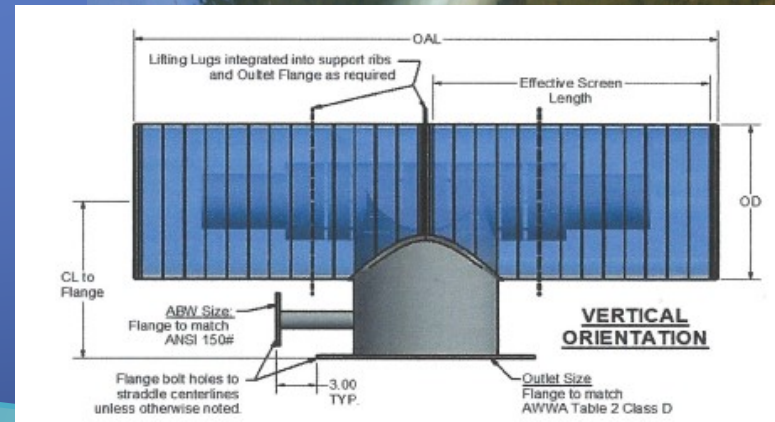


Milestones – Current

- 2019/20 – Preliminary design for treatment
- 2019/20 – Recharge facility design
- 2020 – Recharge facility construction

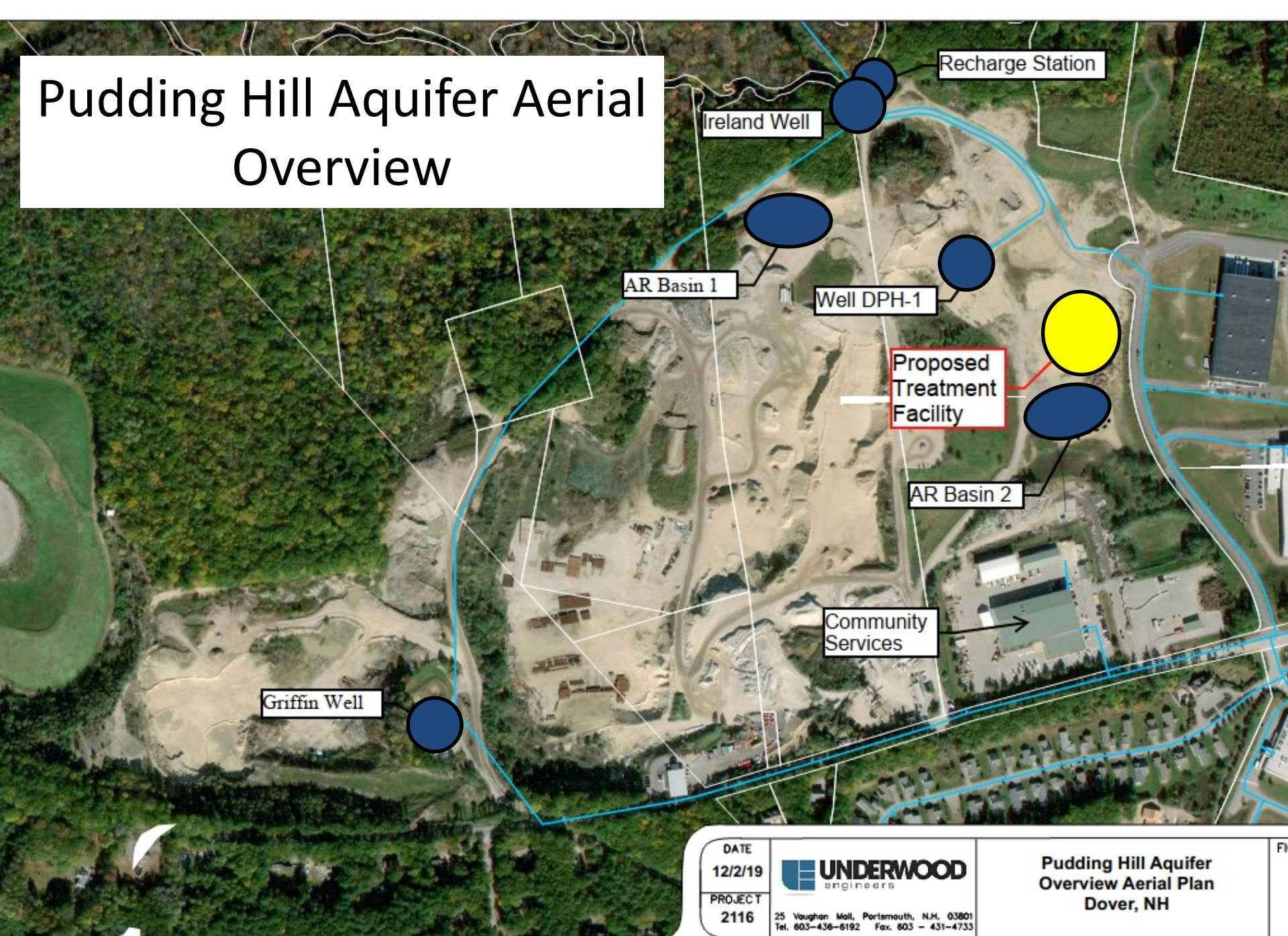
Artificial Recharge

- *Recharge Basins Construction - Completed*
- Recharge Facility
 - Bidding Winter 2019/2020
 - Construction 2020





Pudding Hill Aquifer Aerial Overview



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**Pudding Hill Aquifer
Overview Aerial Plan
Dover, NH**

Pudding Hill Water Treatment Facility

- Approximately 9,000 SF facility (~60'x155')
- 1,000 gpm
- Iron and Manganese Treatment
 - Greensand Plus
- PFAS
 - Ion Exchange Resin or GAC (PFAS)
- MtBE & 1,4-Dioxane
 - Advanced Oxidation
- Chemical Feed

Treatment Process

Greensand Plus
for Fe/Mn

Advanced Oxidation Process
(AOP)
UV Reactors for 1,4 Dioxane
and MTBE

Future
Provisions

GAC/Resin for
PFAS Treatment

Chemical
Feed

Greensand Plus Treatment



05.25.2016

Lowell Ave. Water Treatment Facility



Advanced Oxidation Process (example)



PFAS Treatment

Pease Grafton
Road WTP
Portsmouth, NH



Aquifer Water Quality

- Design for highest contaminant levels observed in aquifer.
 - Highest levels observed in monitoring wells.
 - Contaminant levels observed at production wells much lower.
 - Treatment facility designed for “worst case” scenario.

Finished Water Quality

- Finished Water Quality Requirements
 - All regulated contaminants to below standard (MCL).
- Finished Water Quality Goals
 - Fe, Mn, 1-4 Dioxane, MTBE, PFAS to as low as practicable (i.e. Non-Detect)

Finished Water Quality

Pudding Hill Aquifer Design Raw Water Quality and Treatment Goals - Revised October 2019						
Analyte	MCL (Note 4)	FOR DESIGN Griffin Well Maximum Concentration Detected (Note 3)	FOR DESIGN Ireland and DPH-1 Wells Maximum Concentration Detected (Note 3)	Maximum Concentration Griffin Well	Maximum Concentration Ireland Well	Maximum Concentration DPH-1 Well
PFAS (ppt) (Note A)						
PFBA	-	49.05	57.7	11.5	14.8	8.97
PFPeA	-	99	104	21.6	28.4	7.2
PFBS	-	73.5	54.5	7.08	13.8	ND
PFHxA	-	147	189	26.0	42.7	6.63
PFHpA						ND
PFHxS						4.66
PFDA						4.42
PFNA						ND
PFOS						ND
PFDA						ND
MeFOSAA						ND
EtFOSAA						ND
PFUnA						ND
PFDoA						ND
PFTeDA						ND
PFTeDA						ND
PFAS (PPT) (N						
4:2 ITS						-
PFPeS						-
6:2 ITS						-
PFOSA						-
PFHpS						-
8:2 ITS						-
PFDS						-
PFNS	-	n/a	n/a	ND	ND	-
MTBE (ppb) (Note 5)	13	12	12	(Note 5) 1.6	(Note 5) 1.9	(Note 5) ND
1,4 Dioxane (ppb)	0.33	4.1	4.1	(Note 6) 0.59	(Note 7) 1.2	(Note 8) 7.34
Fe (mg/L)	0.3	(Note 12) 0.40	(Note 12) 0.40	(Note 2) 0.40	0.19	(Note 11) 0.315
Mn (mg/L)	0.05	(Note 12) 0.30	(Note 12) 0.30	(Note 2) 0.30	(Note 10) 0.238	(Note 11) 0.059

28 Monitored
Contaminants of
Concern (8 Regulated)

Other Design Parameters

- Legacy Issues
 - GAC
 - Resin
- Backwash to WWTF
 - Typically initial conditioning/startup
- Media Change-outs

Other Communities

- Portsmouth – Pease Grafton Road WTP
 - Resin and GAC for PFAS treatment
- Merrimack Village District
 - Greensand for Fe/Mn
 - GAC for PFAS treatment
- Barnstable, MA
 - Greensand for Fe/Mn
 - GAC for PFAS, AOP for 1-4 Dioxane

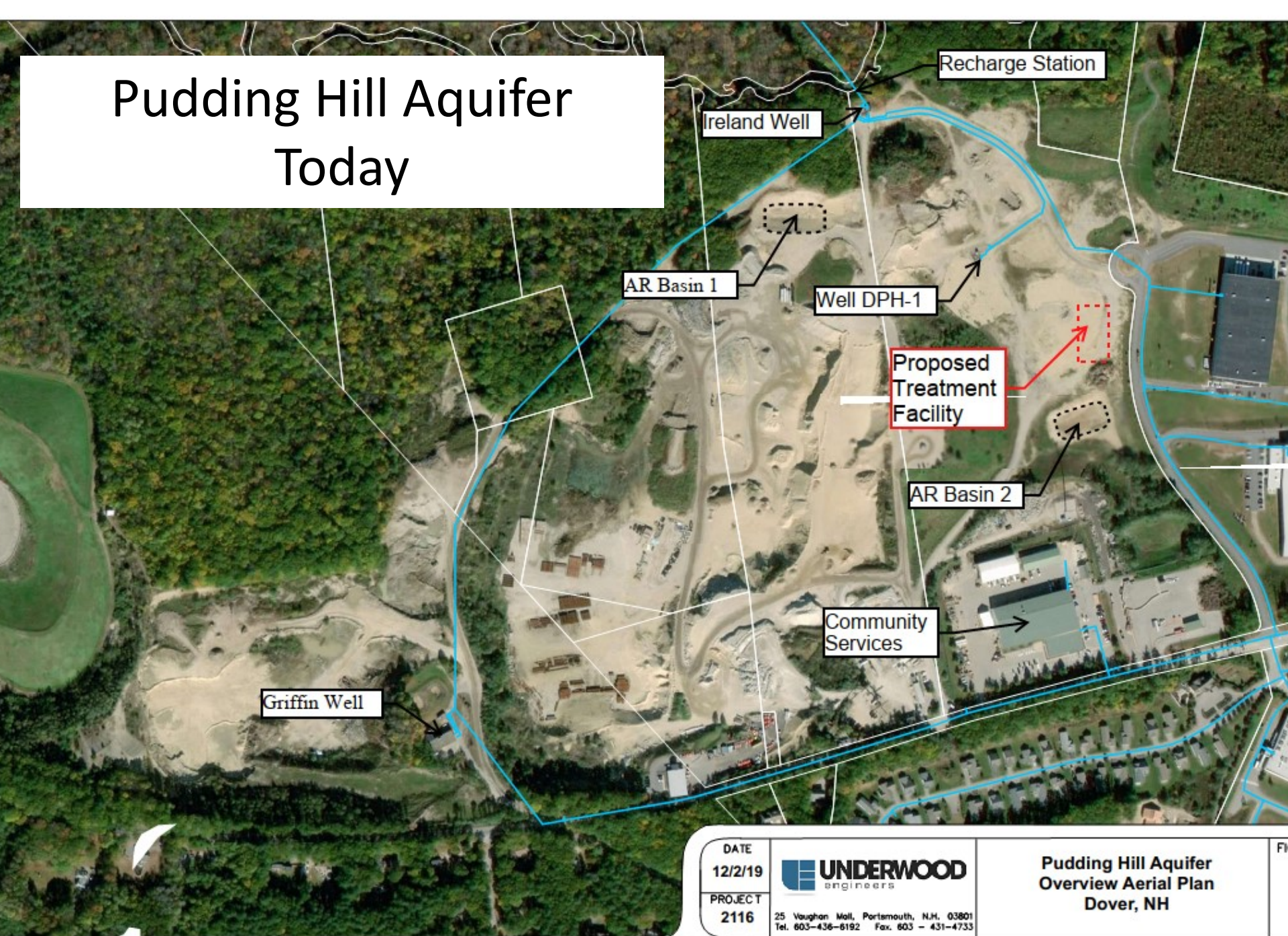
Milestones – Next Steps

- 2020 – Final Design of Treatment Facility
- 2020 – UNH Peer Review
- 2021 to 2022 – Construction of treatment facility
- 2022 to 2023 – New treatment facility online

Final Design Scope

- Final Design
 - Civil, Architectural, Structural, Process, Mechanical, HVAC, Electrical, Instrumentation and Control design.
 - Hydrogeological assistance
 - NHDES design review and approval
 - UNH Peer Review
 - Opinion of cost
- Survey
- Subsurface Investigations
- Bidding Services and Contract Award
- Engineering budget = \$603,000

Pudding Hill Aquifer Today



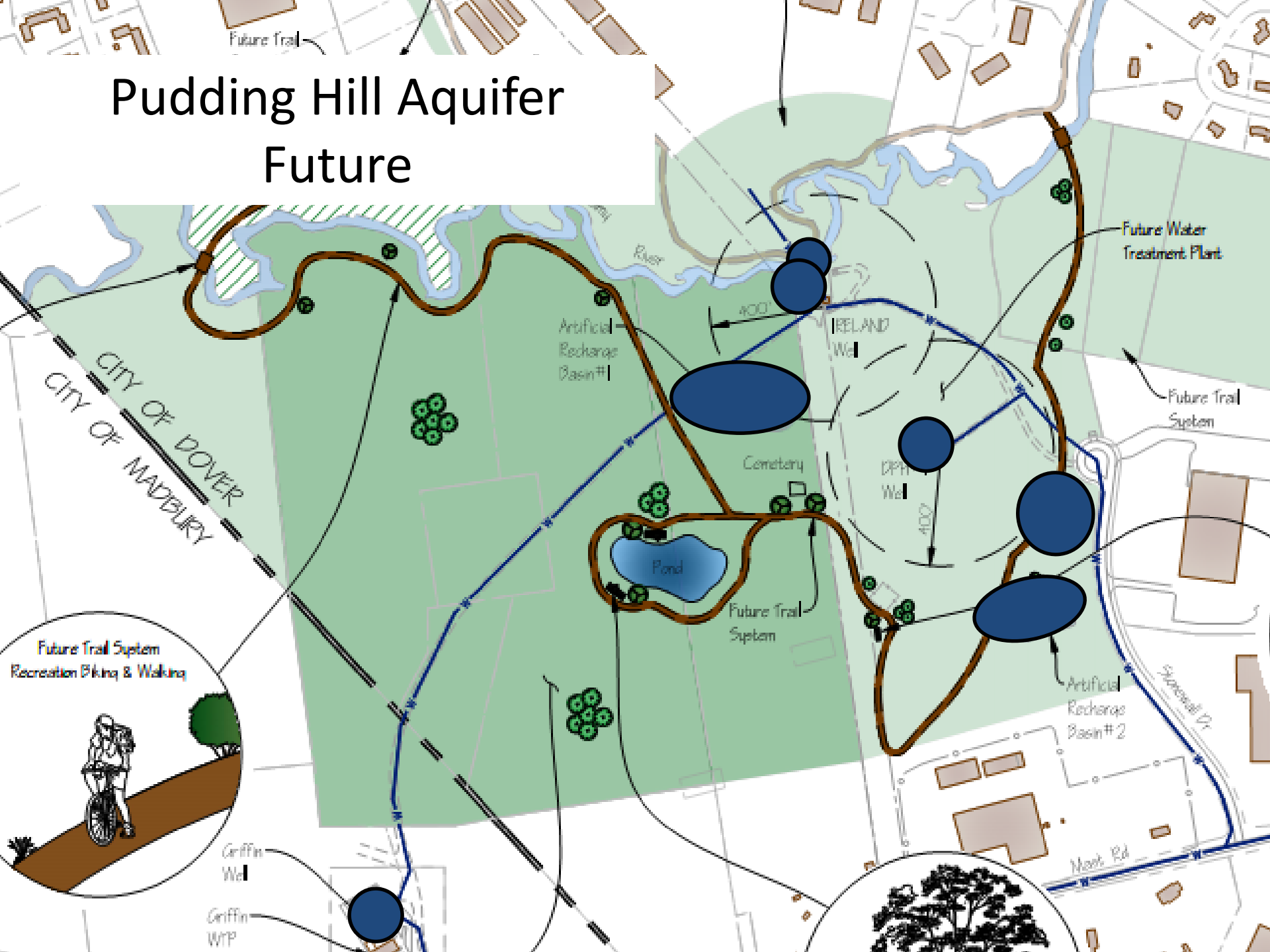
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**Pudding Hill Aquifer
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Pudding Hill Aquifer Future



Questions?