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July, 7 2017

Angela Gallagher
Site Remediation Section
Southeast Regional Office
Department of Environmental Protection
20 Riverside Drive
Lakeville, MA 02347

Re: WSA-4-26179
Immediate Response Action
PFOS/PFOA in Groundwater

Dear Ms. Gallagher:

This is the seventh IRA monthly remedial monitoring and status report for the IRA approved by the Department in a letter dated November 10, 2016. This report includes a status report on the pump and treat, the post soil removal monitoring and the results of the comprehensive sampling of groundwater.

Pump and Treat System

The pump and treat system operated continuously throughout the month with a two day shut down due to a blown electrical contactor. The average PFOS concentrations in influent for two samples was 3250 ng/l. The monthly pump volume was 1.68 million gallons with an estimated removal of 28.8 grams of PFOS. Earlier estimates of pump volume and amount removed were incorrect due to a math error. The pump has maintained a 40 gpm rate. The well and force mains were unable to be scheduled for cleaning to improve flow in June. A diagnosis is scheduled for July 10th.

Breakout of PFOS was detected in the effluent sample on June 1 at 4.1 ng/l. The PFOS concentration in effluent on June 15 is 120 ng/l which is over the Health Advisory limit of 70 ng/l. An immediate sampling of effluent was obtained with a 5 day turn around, results received on July 7 indicate an effluent PFOS concentration of 210 ng/l and

BFTA

1

Immediate Response Action

July 7, 2017

PFOA concentration of 15 ng/l. Calgon Carbon was contacted to schedule a carbon exchange. The scheduled date for the carbon exchange is July 17. The system was kept operating in the interim to continue to contain the Hot Spot plume because: 1) The effluent concentration is 10 to 20 times below the PFOS concentrations found at the portion of the site where it is discharged; 2) The total amount returned to the aquifer based upon the pumped volume and effluent concentration of 120 ng/l is 1 gram or 0.002 lbs per month; 3) Approximately 4% of the captured PFOS is being returned; and 4) the discharge is upgradient of the capture well.

Post Soil Removal Monitoring

The monitoring wells and Flintrock Pond will be sampled for PFAS in July. As described in the May RMR report, the only metals to be analyzed is Aluminum.

Comprehensive Sampling Results

A comprehensive sampling of groundwater in monitoring wells was conducted in April to evaluate the distribution of PFAS in groundwater and the effectiveness of the pump and treat system. The Comprehensive sampling consisted of 56 monitoring wells and Mary Dunn and Flintrock Ponds. Field data for water level, total depth, specific Conductance, Dissolved Oxygen, Temperature and pH were collected. The wells were selected with Waterra sampling tubes with a D25 foot valve and electric actuator. The monitoring wells included three new locations PC-37, PC-38 and PC-39 identified in the IRA for further investigation. PC-37 is located on the northeast side of Flintrock Pond to evaluate discharge from the northern portion of the pond to groundwater. The PFOS concentration in PC-37 was 45 ng/l, below the Health Advisory Limit of 70 ng/l. PC – 38 and PC-39 are located along the southern edge of the known area of PFOS contamination. A PFOS concentration of 1,200 ng/l was detected at PC-39, but there was no detection of PFOS at PC-38, which would define the southern limit of contamination.

The information from the comprehensive sampling is presented as three maps, including a, PFOS (ng/l) BFTA Data Point Map (which shows the PFOS concentrations next to the labeled data point), a conceptual PFOS plume configuration map and a PFOA (ng/l) BFTA Data Point Map (which shows the PFOA concentrations next to the labeled data point). The color key to PFOS concentrations follows a similar format as the IRA Plan maps: < 70 ng/l, > 70 ng/l, >1000 ng/l and > 2000 ng/l. The color key to

PFOA concentrations follows a similar format as the IRA Plan maps: < 70 ng/l, > 70 ng/l, >500 ng/l and > 1000 ng/l.

There are several important observations about the configuration of PFOS in groundwater. One, the Hot Spot and its downgradient plume area are defined with detections greater than 2000 ng/l. Two, the Hot Spot Plume is cut off by the interim pump and treat capture well located at PRW-4. Three, a portion of the Hot Spot plume was not captured likely due to the lower pumping rate early in the year. Three, diluted Hot Spot slug of PFOS (>1000 ng/l) is in the vicinity of Mary Dunn road at PC-14 and PC-22. This is likely an area of contamination that migrated prior to the 2015 start of the Pump and Treat system and is subject to dispersion due to alternating pumping schedules of the three Mary Dunn Water Supply Wells. Four, contamination south of the site and downgradient of Flintrock Pond, as defined by PFOS >1000 ng/l but less than 2000 ng/l might have been influenced by the former discharge at the southern discharge basin from the pump and treat system for Perchlorate (2007-2010) when it was used in tandem with the northern basin. The north basin is now used exclusively for the PFAS treated effluent to avoid the southern site area. Five, there are still discrete areas of high PFOS concentrations on the site: near the pond, at the old burn pile stock-pile at PFW-3 and PFW-4; and near the old Tank Pit at PFW-5. Six, the configuration of PFOS concentrations indicate an intermittent or slug type of release of contaminant from the site upgradient of the recovery well at PC-7 and PC-31. Seven, PFOS concentrations have decreased overall through the Hot Spot and downgradient area, excluding hot spot slugs within the plume core. Eight, the north portion of the site does not appear to contribute PFAS directly to the Mary Dunn 3 well, but PFAS detected in its production water indicates that it likely pulls a portion of the plume. The concentration of PFOS is consistently higher in MD2 than in MD1 or MD3. MD3 has the lowest PFOS concentration in production water, consistent with the comprehensive sampling and due to less active pumping of the well. The plume configuration and production well data indicate that the under average conditions the flow path of the plume core is to MD2

The PFAS water quality data statistics are shown in the Table below.

				2017 Comprehensive Sampling STATS			
				High	Median	Avg	% Detection
			6:2 Fluorotelomer sulfonate	6200	95	468	78%
			8:2 Fluorotelomer sulfonate	3100	9.8	158	55%
			N-ethylperfluorooctane sulfonamide	0	0	0	0%
			N-ethylperfluorooctane sulfonamide	0	0	0	0%
			N-methylperfluorooctane sulfonamide	5.7	0	0	0%
			N-methylperfluorooctanesulfonamidol	0	0	0	0%
			Perfluorobutane Sulfonate (PFBS)	230	41	50	74%
			Perfluorobutanoic acid	350	50	76	84%
			Perfluorodecane Sulfonate	0	0	0	0%
			Perfluorodecanoic Acid (PFDA)	74	7.85	9	66%
			Perfluorododecanoic Acid (PFDoA)	0	0	0	0%
			Perfluoroheptane sulfonate	740	29	67	78%
			Perfluoroheptanoic Acid (PFHpA)	580	109	139	97%
			Perfluorohexane Sulfonate (PFHxS)	4800	500	856	95%
			Perfluorohexanoic Acid (PFHxA)	1800	220	352	97%
			Perfluoro-n-Octanoic Acid (PFOA)	2000	110	207	95%
			Perfluorononanoic Acid (PFNA)	420	66.5	92	93%
			Perfluorooctane Sulfonamide (PFOSA)	2700	8.8	72	55%
			Perfluorooctane Sulfonate (PFOS)	38000	1600	3611	98%
			Perfluoropentanoic Acid (PFPeA)	1800	190	307	97%
			Perfluorotetradecanoic Acid	0	0	0	0%
			Perfluorotridecanoic Acid	7.4	0	0	2%
			Perfluoroundecanoic Acid (PFUnA)	760	21	64	72%

The highest PFOS concentration is 38,000 ng/ (at the Hot Spot source area), the average PFOS concentration is 3,611 ng/l and the median is 1,600 ng/l. The highest downgradient PFOS concentration occurs in PC-7 at 36,000 ng/l which is downgradient of the site and just upgradient to the PRW-4 recovery well. The highest PFOA concentration is 2,000 ng/l at the Hot Spot source area, the average PFOA concentration is 207 ng/l and the median is 110 ng/l. The highest PFOA concentration

are at the Hot Spot and surprisingly the Northeast corner at OW-8a. OW-8a is located at the demolished “Tank Pit” and will be resampled as there is no obvious reason for this high concentration. PFOA concentrations at wells downgradient of the recovery well are below the Health Advisory of 70 ng/l, except in the previously mentioned diluted Hot Spot slug at PC 14 and 24. The Mary Dunn Production wells are also below the HAL for PFOA. The other PFAS constituents indicate smaller breakdown products as well as the 8:2 and 6:2 fluorotelomers.

General parameters

Groundwater at the BFTA and downgradient has low dissolved oxygen to with an average DO of 2.8mg/l. Monitoring wells on the periphery had higher DO. The average specific conductance of 100 *umho/cm* indicates groundwater has a low amount of dissolved ionic substances. The average temperature of 11 degrees Celsius and pH of 5.5 is typical of Cape groundwater. In general, it is held that the summer condition of Flintrock pond discharges low DO water to groundwater and that residual petroleum at the site contributes to biological activity which decreases the DO along the plume flow path. The reducing conditions of groundwater contribute to the iron problem at the PRW-4 recovery well.

	SpecCond <i>umho/cm</i>	DO mg/l	Temp ‘C	pH
count	55	53	54	54
average	100.3	2.8	10.9	5.5
max	210	9.9	13	6.1
low	70	0.1	8.5	3.78

Mary Dunn Wells

January samples from the Mary Dunn wells production water are at 140 ng/l, 200 ng/l and 72 ng/l PFOS in MD 1, MD2 and MD3 respectively for the April-June 2017 period. Mary Dunn #3 was off line through the first half of the year. The Mary Dunn Pond has a PFOS concentration of 150 ng/l. The Mary Dunn monitoring well couplets detected 150 ng/l PFOS in the deep groundwater at the HW-2 location downgradient of the Pond and only 25 ng/l in shallow groundwater at HW-1 north of the Pond.

The comprehensive sampling data justifies the continued use of the interim Pump and Treat system to cut off the high PFAS concentrations from further migration to the

supply wells. The County recently renewed our contracts for O&M and laboratory services. The cost to operate the system, without oversight labor, is approximately \$75,000 annually. The data also indicates that further actions will be necessary to reduce PFAS at the site. Any new pumping scheme to hasten cleanup would likely require an increase in treatment capacity, especially when treatment breakthrough has been more rapid than expected. This would require a substantial increase in capital cost at a time when the County has committed annual funds to the Town of Barnstable in our Settlement agreement to address the Imminent Hazard condition. Criteria for a revised pumping scheme must prioritize, continued Hot Spot Plume capture, capture and treatment at the site to hasten a reduction of PFOS concentrations at the source and piloting innovative technologies for source soil and groundwater.

The County requests a meeting with DEP to discuss our cleanup criteria and options at the BCFRTA site, and requests a separate collective meeting with the Town and Barnstable Fire District to discuss the regional aspects of our collective data and findings. We suggest a meeting time in August.

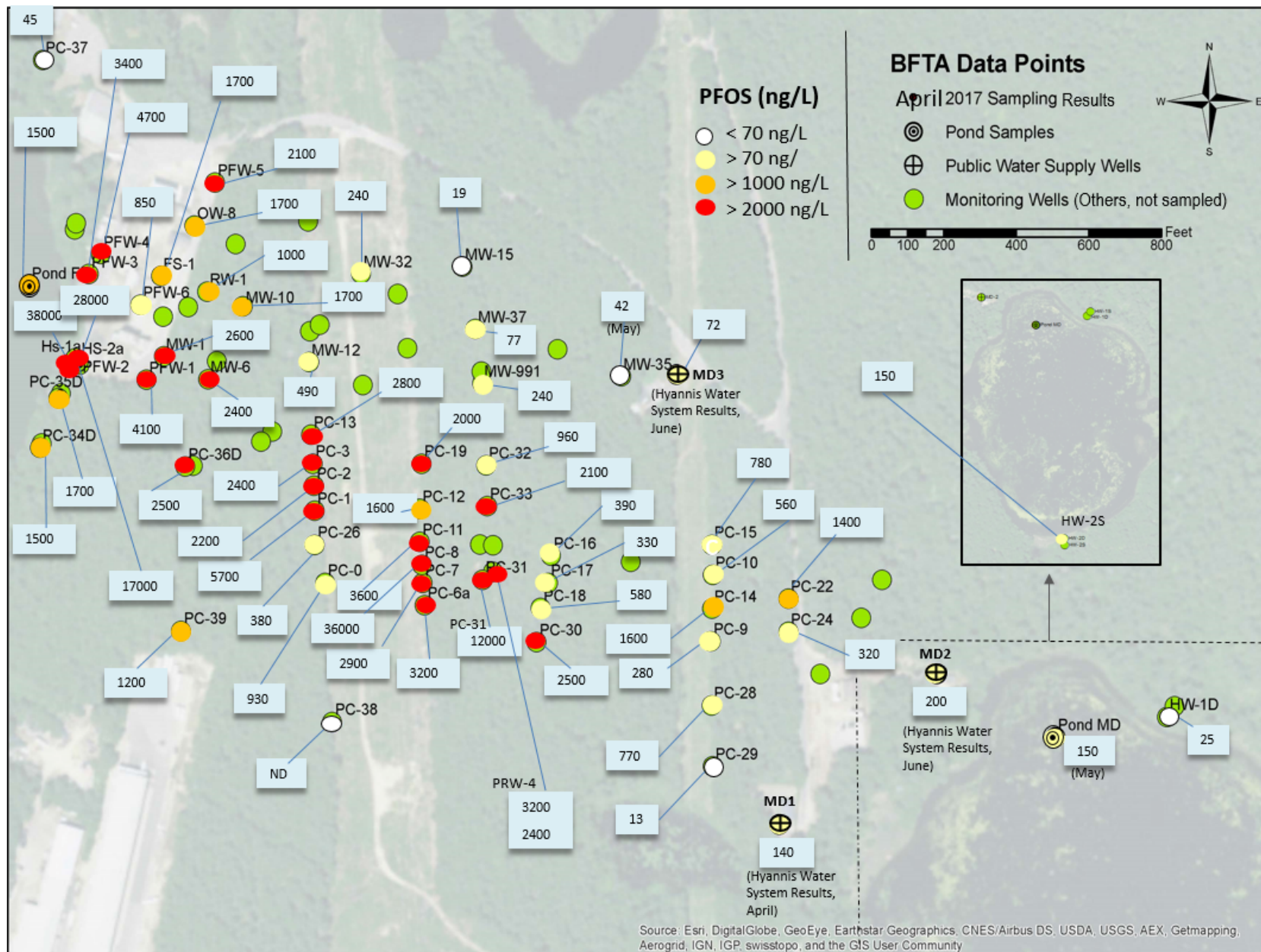
Please contact me if you have any questions on this submittal.

Sincerely,

Tom Cambareri
Technical Services Director for Water Resources
LSP #3788

Cc: Gerard Martin, DEP-SERO
Jack Yunits, County Administrator

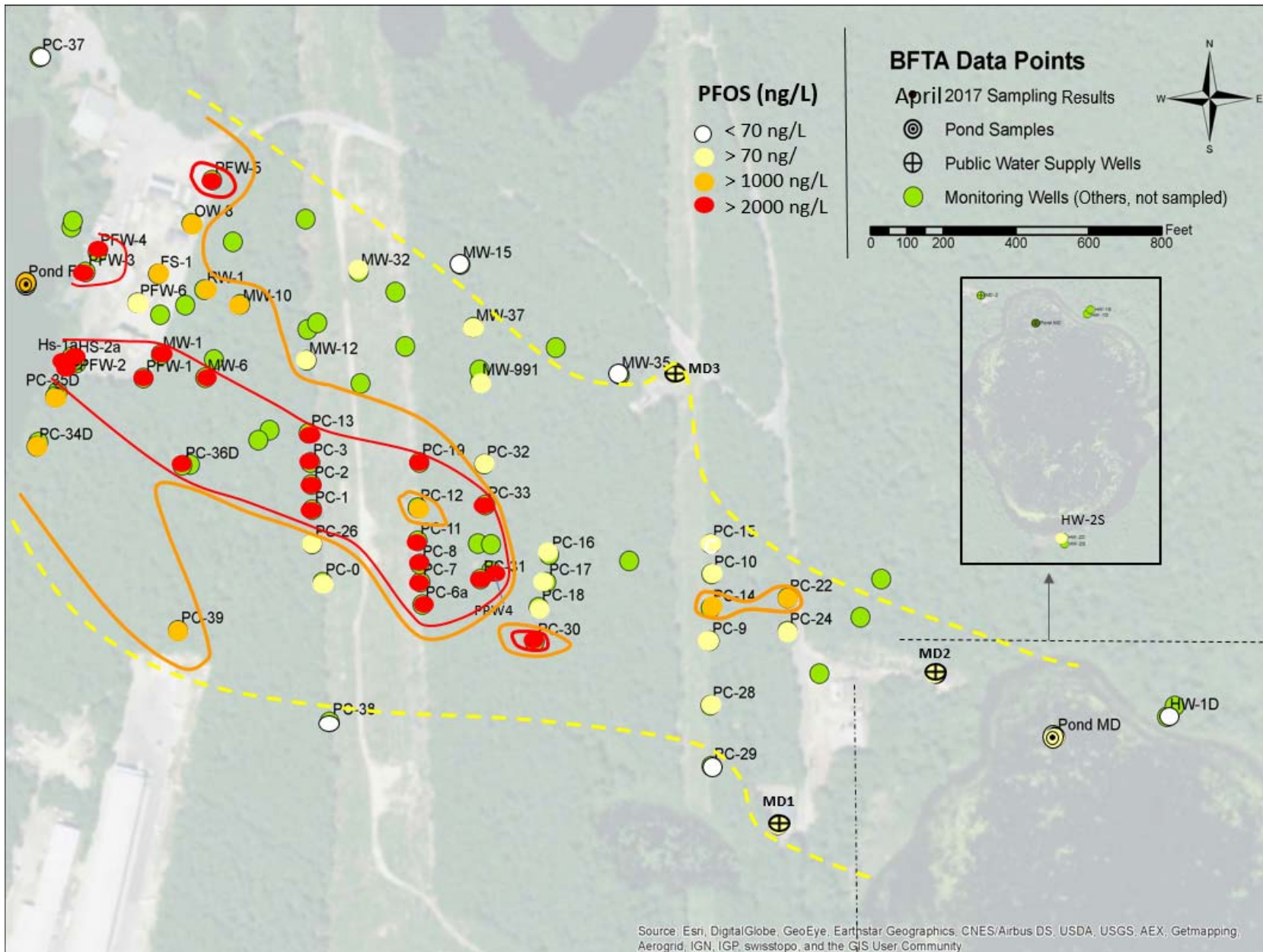
Encl: Maps
Portfolio #1 – field and laboratory data



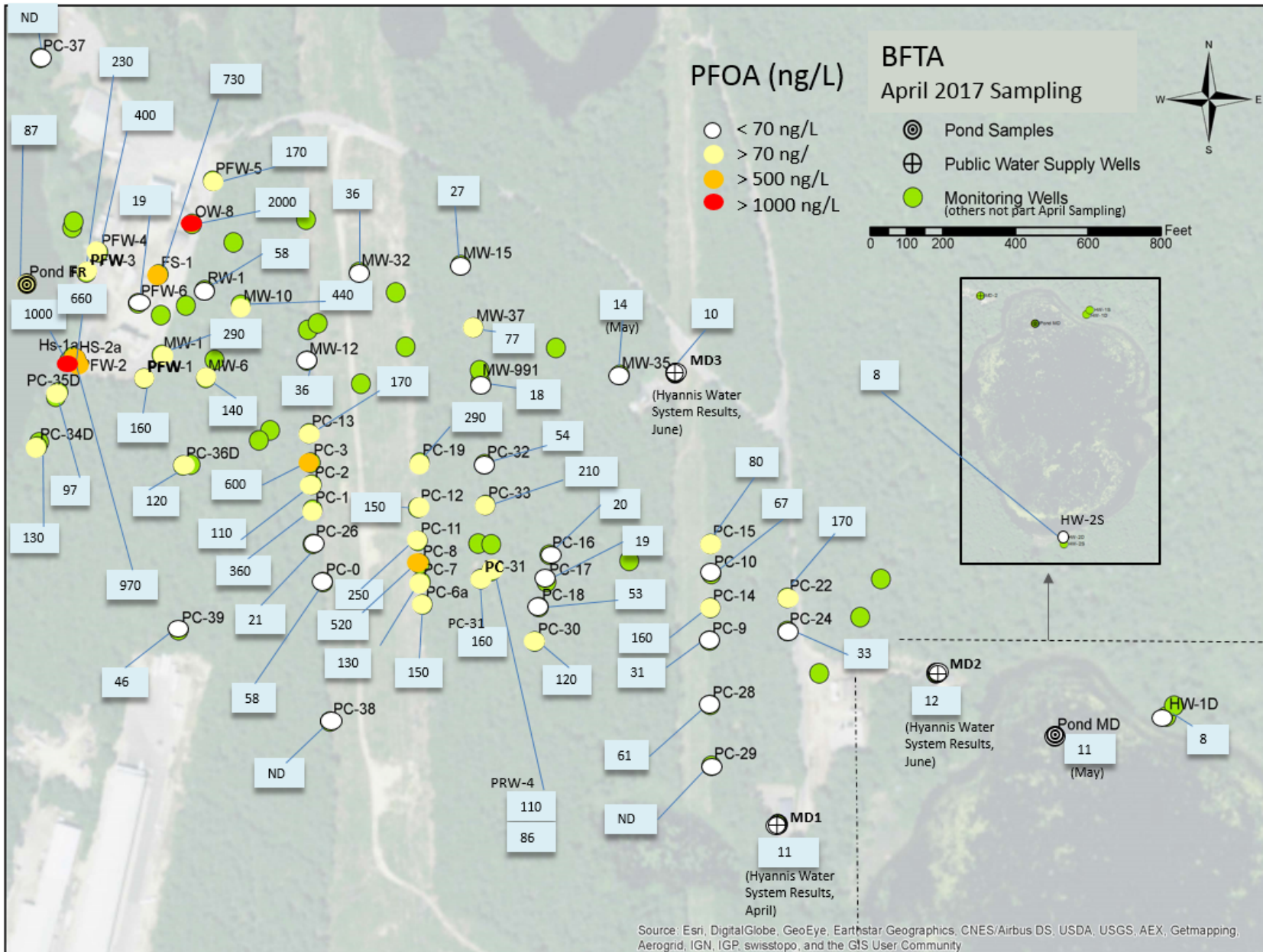
BFTA

Immediate Response Action

July 7, 2017



BFTA
 Immediate Response Action
 July 7, 2017



BFTA

Immediate Response Action

July 7, 2017