Operable Units 1 and 3 Program Update – October 2020 through October 2021

US Army Corps of Engineers ®
Omaha District

Cornhusker Army Ammunition Plant
Grand Island, Nebraska

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Agenda

- **Year in Review: Oct 2020 – Oct 2021**
  - **OU1 Rebound Study**
    - Temporary shutdown of extraction well EW7 and Groundwater Treatment Facility (GWTF)
    - Quarterly Groundwater Monitoring
  - **OU1 Subsurface Injections**
    - 600 points/600,000 gallons of substrate upgradient of EW7
    - Quarterly Groundwater Performance Monitoring
  - **Annual OU1 and OU3 Groundwater Long-Term Monitoring (LTM)**

Agenda

- **Up Next: Oct 2021 – Oct 2022**
  - **OU1 Rebound Study**
    - Maintain shutdown of EW7 and GWTF
    - Continued Quarterly Monitoring until February 2022
  - **OU1 Post Rebound Study**
    - Conclusions of Rebound Study
    - Recommending modification to current remedy
    - Next round of documents to modify remedy
    - Path forward after remedy has been modified
  - **Annual OU1 and OU3 Groundwater Monitoring (LTM)**

Year in Review – OU1 Rebound Study

OU1 Rebound Study

- **Objective – Optimize the Remedy**
  - Decreasing explosives concentration trends and numerical modeling simulations suggested that groundwater extraction/treatment was no longer needed to prevent plume migration
  - Shutting down energy-intensive extraction and treatment operations decreases carbon footprint and reduces associated operations and maintenance (O&M) costs
  - Concurrent OU1 subsurface injections will decrease overall remedial timeframe and lifecycle costs through in situ biodegradation

OU1 Rebound Study

- **OU1 Rebound Study Components**
  - Temporary shutdown of pump and treatment operations (EW7 and GWTF)
    - Maintain routine O&M: monthly inspections and compressor bumps, mowing, pest control, security, etc.
    - EW7 and GWTF will remain in standby status for resumption of operation, if necessary
  - Quarterly Groundwater Monitoring
    - Ensure explosives plume remains stable
    - 30 on- and off-post wells (explosives and MNA analysis)
    - Direct push off-post location sampling (explosives analysis only)
      - Establish off-post concentrations/trends and verify horizontal extent
      - Vertical profile sampling
    - Completed 7 events to date (Oct 2019, Feb 2020, May 2020, Sep 2020, Feb 2021, May 2021, Oct 2021 – results pending)

Year in Review – OU1 Subsurface Injections

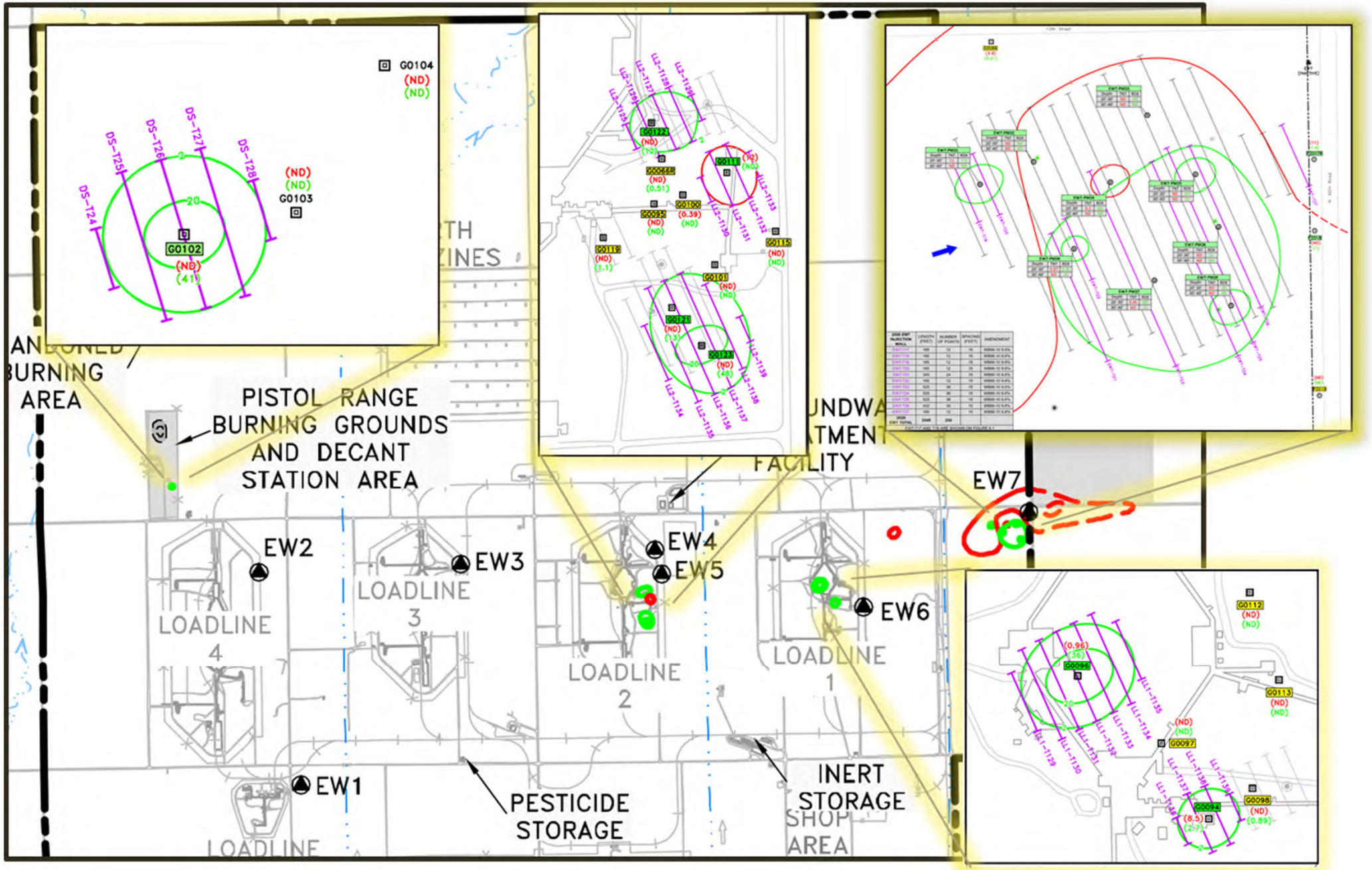
OU1 Subsurface Injections

- **Objective – Optimize the Remedy**
  - Build on success of previous injections at the site (in Load Lines)
  - Injections upgradient of EW7 help ensure shutdown of extraction well and GWTF is successful
  - Decreasing explosives concentrations in groundwater reduces overall remedial timeframe and lifecycle costs

OU1 Subsurface Injections

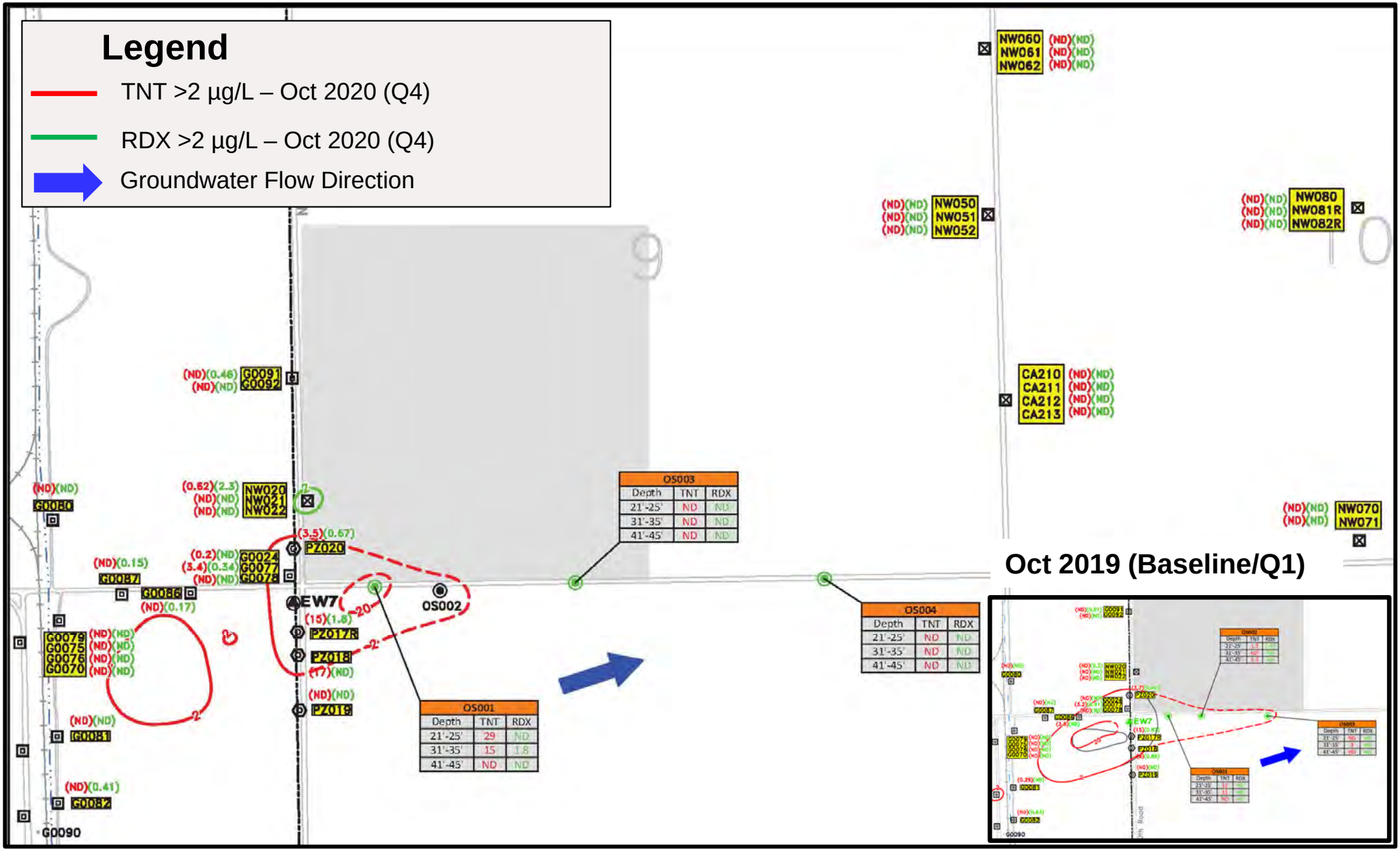
- **2020 Injections**
  - Injection Design:
    - Injections completed upgradient of EW7, LL1, LL2, and Decant Station (focusing on locations with RDX+TNT >2 micrograms per liter [µg/L])
    - 42 transects (600 points total)
    - Injection depths between 15 and 40 feet below ground surface
    - 1,000 gallons of substrate per point (9.8% by volume of a proprietary molasses blend)
    - Four quarterly performance monitoring events
  - Completed in October-November 2020
  - Quarterly Performance Monitoring (concurrent with rebound study)
    - Completed 3 events following the 2020 injections (Feb 2021, May 2021, Oct 2021). Final event scheduled for Feb 2022.
    - 20 performance monitoring wells

2020 Subsurface Injections

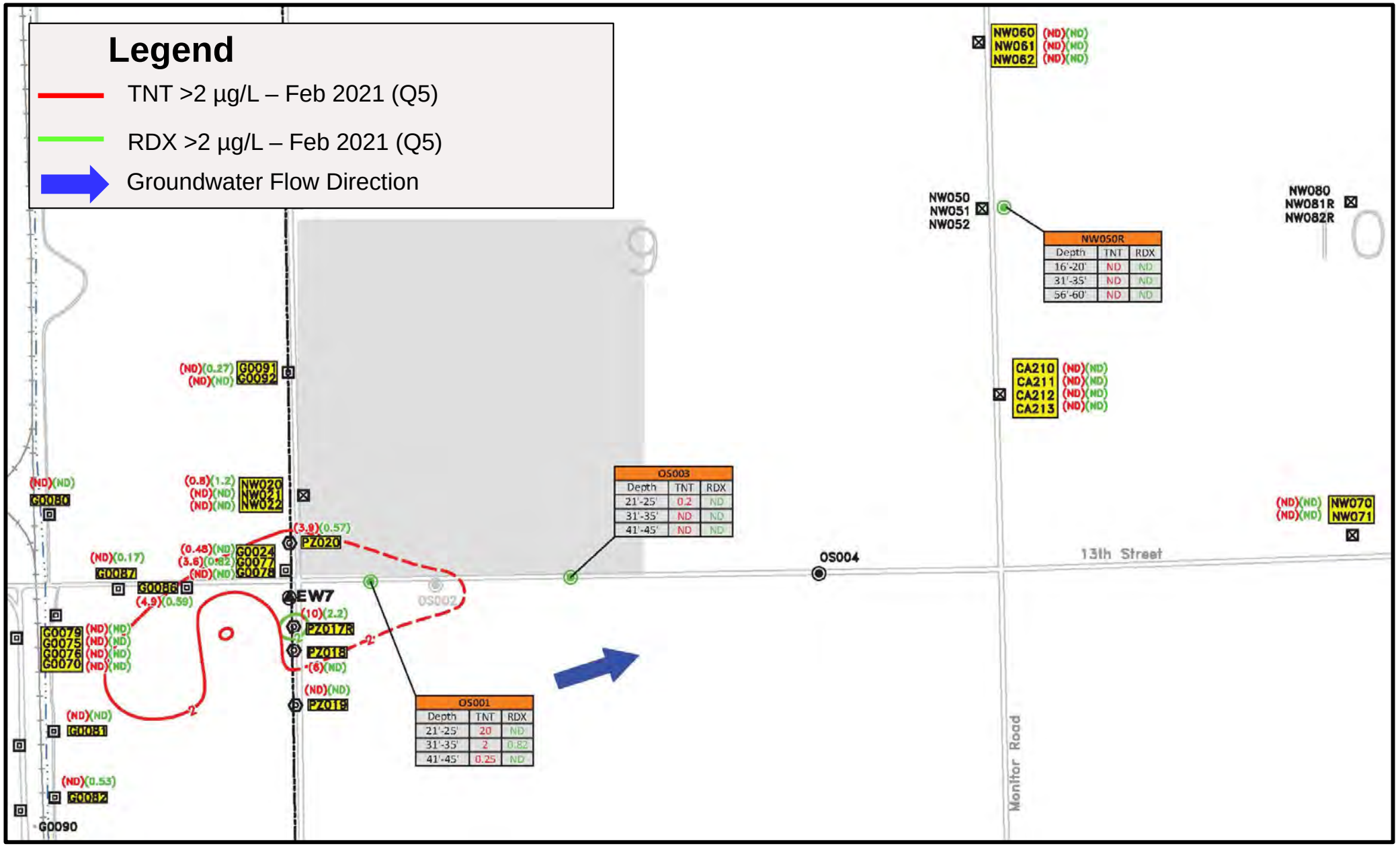


Year in Review – OU1 Rebound Study/Injection Results

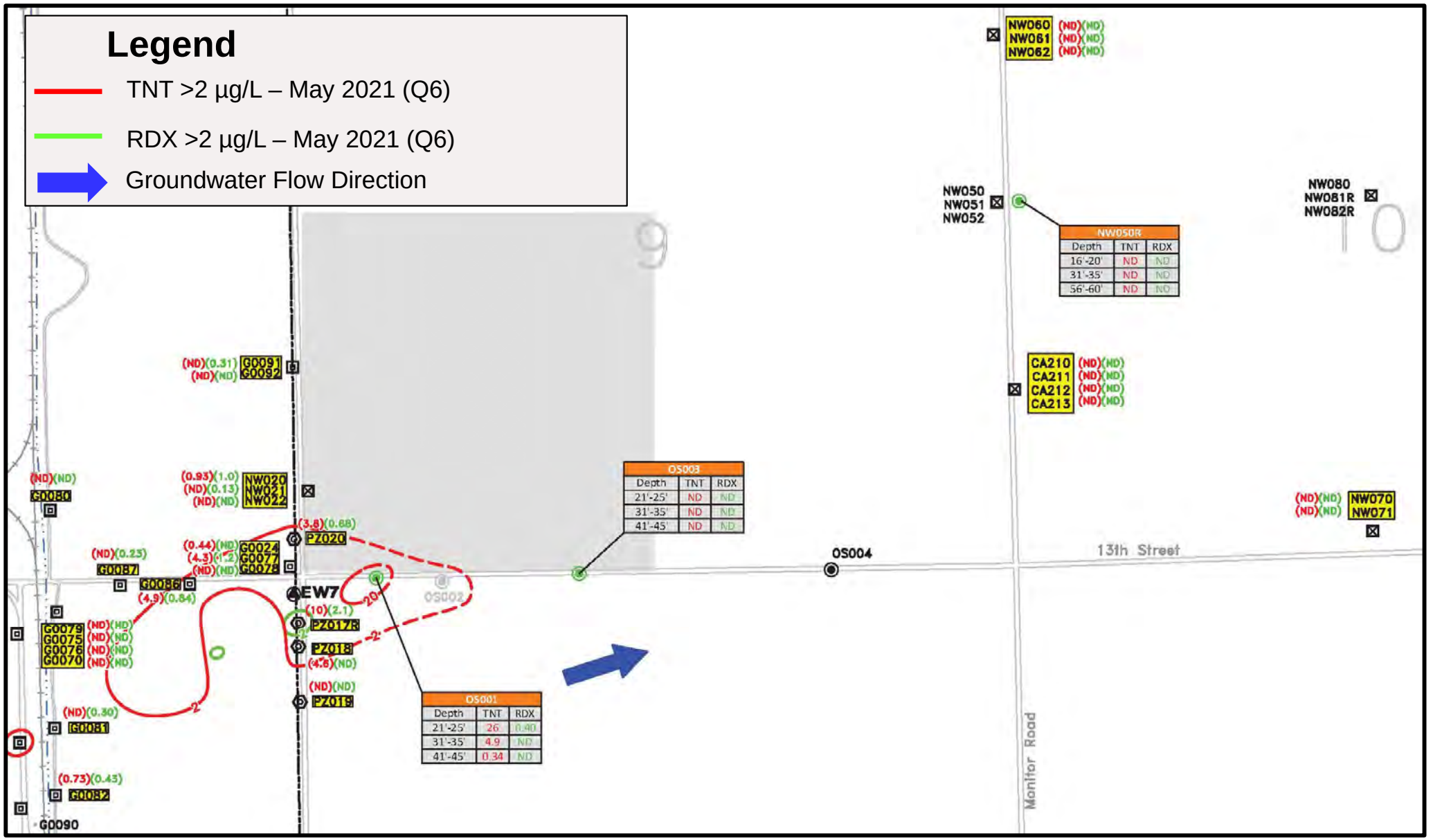
Oct 2020 (Q4) Explosives Plume



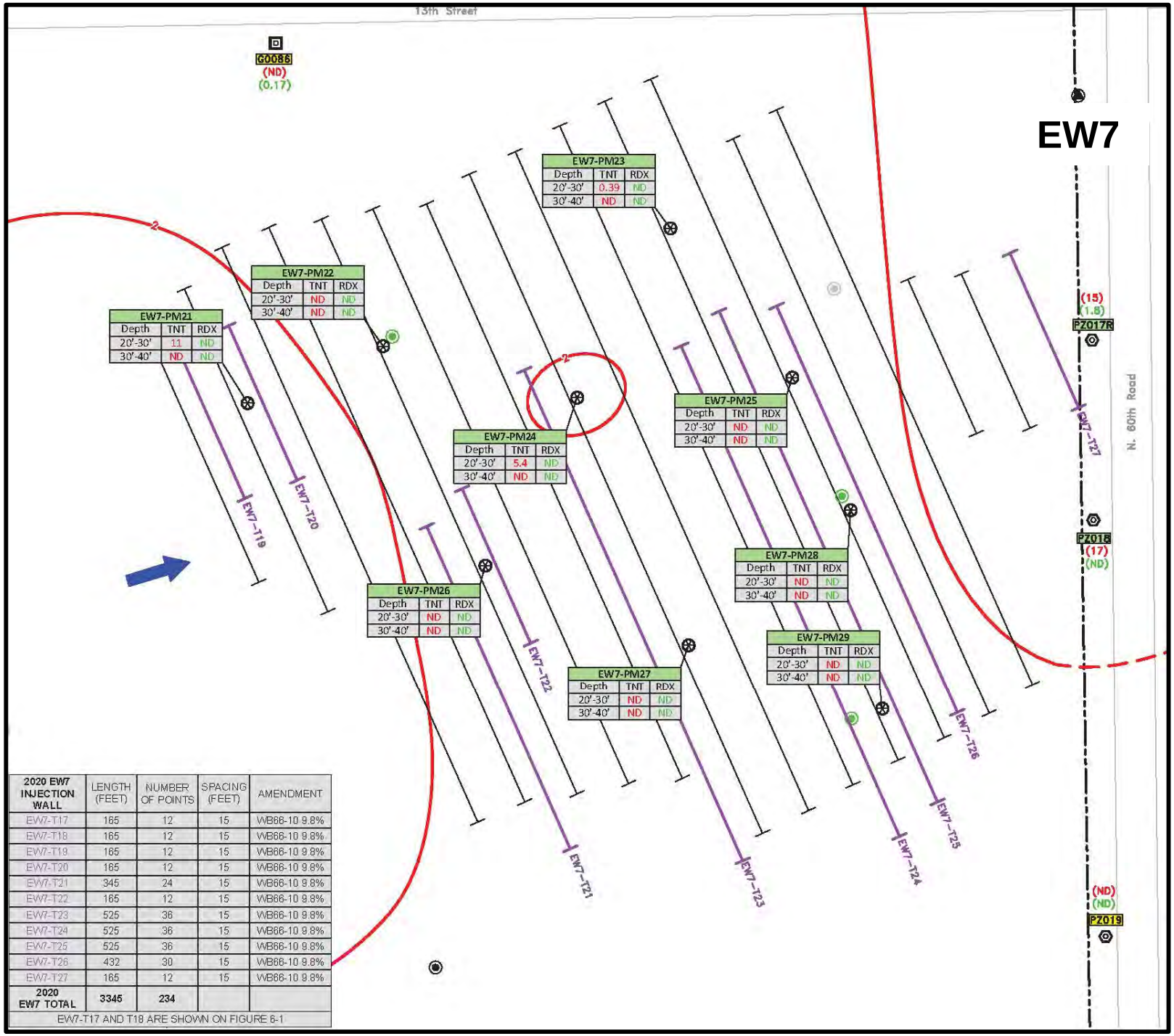
Feb 2021 (Q5) Explosives Plume



May 2021 (Q6) Explosives Plume



Oct 2020 (Q4) Plume Core – Near EW7



2020 EW7 INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
EW7-T17	165	12	15	WB66-10 9.8%
EW7-T18	165	12	15	WB66-10 9.8%
EW7-T19	165	12	15	WB66-10 9.8%
EW7-T20	165	12	15	WB66-10 9.8%
EW7-T21	345	24	15	WB66-10 9.8%
EW7-T22	165	12	15	WB66-10 9.8%
EW7-T23	525	36	15	WB66-10 9.8%
EW7-T24	525	36	15	WB66-10 9.8%
EW7-T25	525	36	15	WB66-10 9.8%
EW7-T26	432	30	15	WB66-10 9.8%
EW7-T27	165	12	15	WB66-10 9.8%
2020 EW7 TOTAL	3345	234		

EW7-T17 AND T18 ARE SHOWN ON FIGURE 6-1

Observations

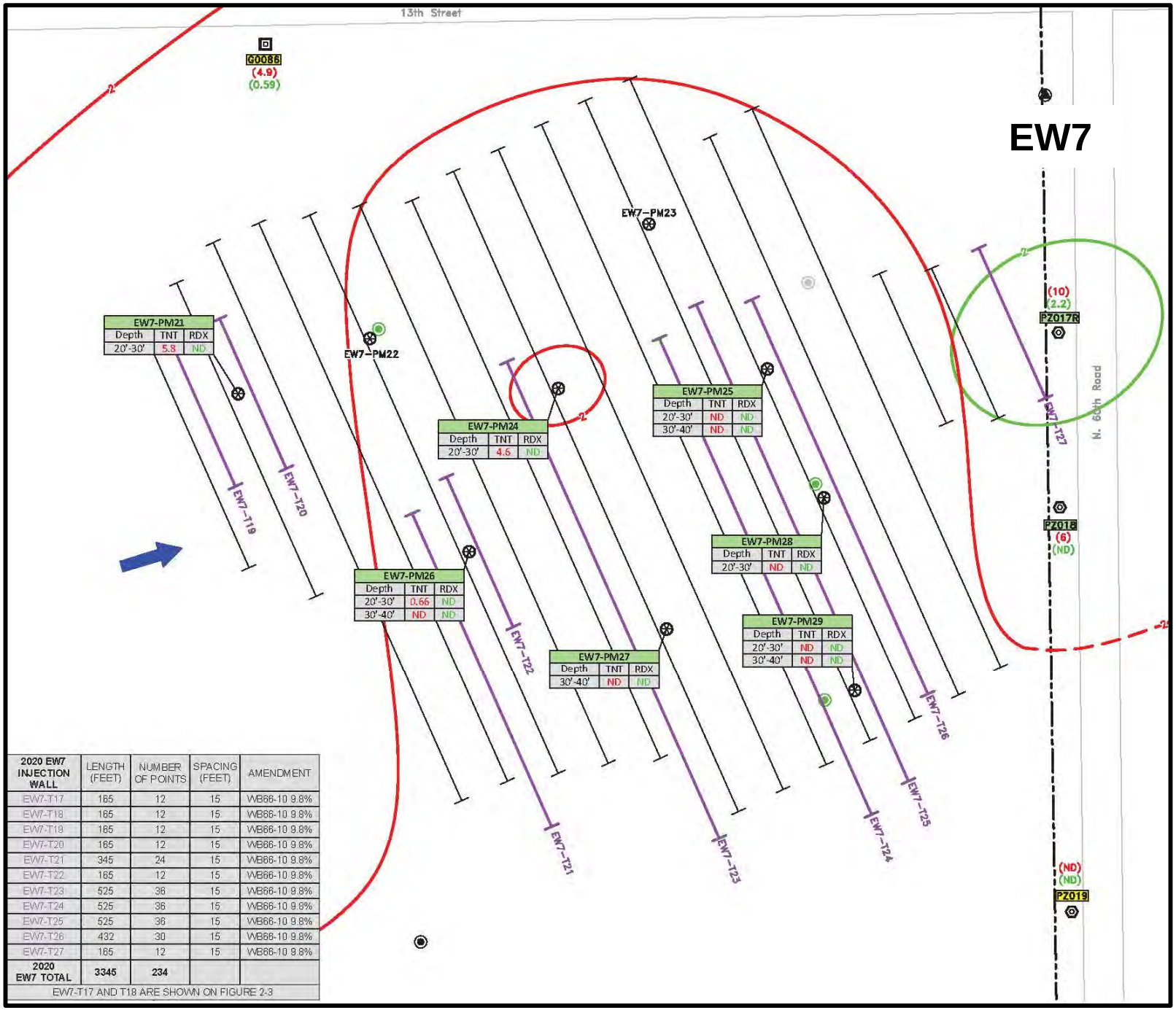
- Concentrations have been substantially reduced within the subsurface injection area
- No PM wells above RDX HAL
- Strong anaerobic geochemical conditions persist

Legend

- TNT >2 µg/L (Oct 2020)
- 2020 Injections
- 2019 Injections
- Groundwater Flow Direction

Note: Health Advisory Level (HAL) for TNT and RDX = 2 µg/L

Feb 2021 (Q5) Plume Core – Near EW7



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2020 EW7 TOTAL	3345	234		

EW7-T17 AND T18 ARE SHOWN ON FIGURE 2-3

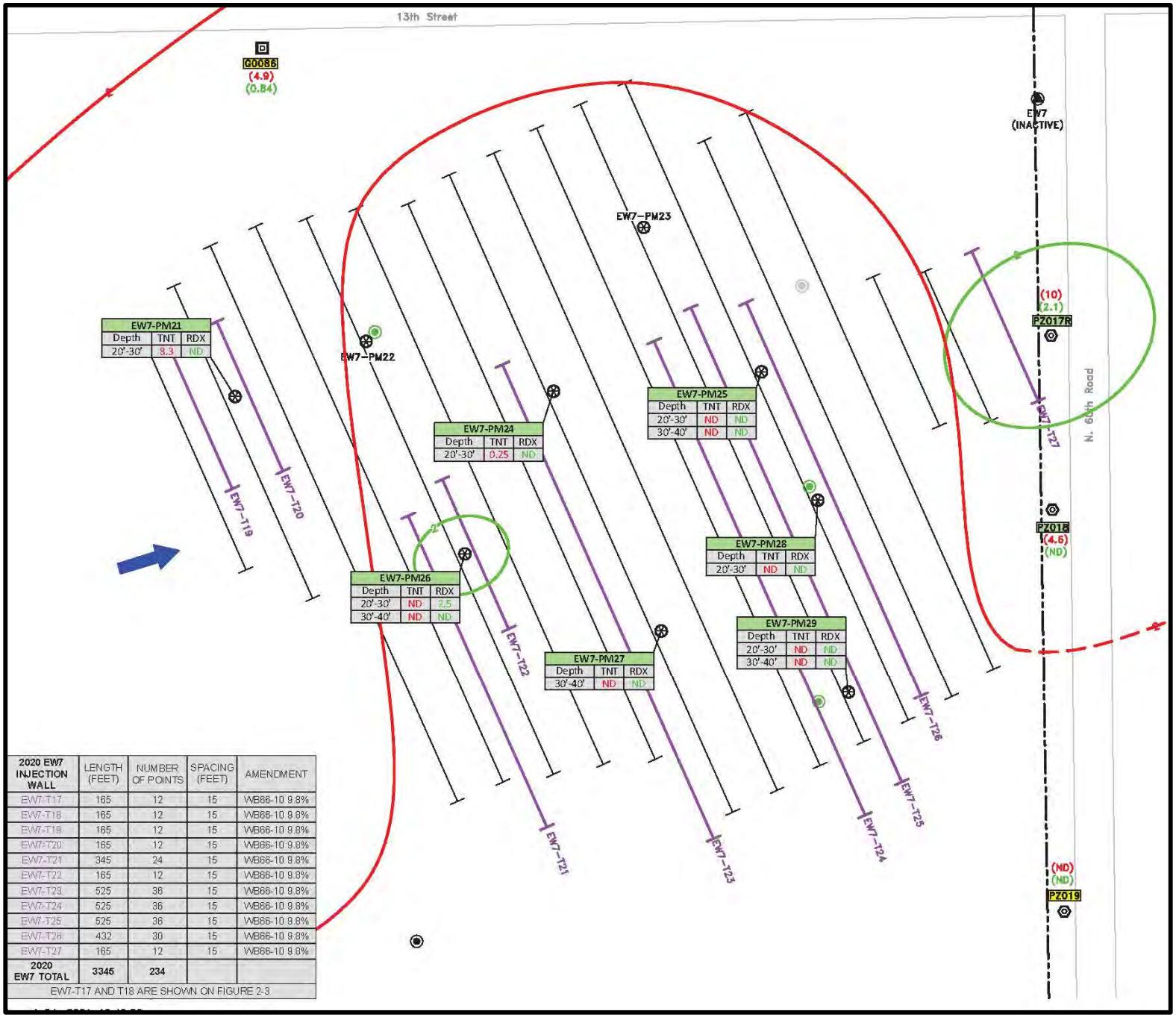
Observations

- Significant TNT decreases at 5 wells with 9 of 13 wells below HAL
- RDX increased at 1 well (to above the HAL) due to mobilization of RDX as result of injections (expected)
- Persistence of highly anaerobic conditions conducive to explosives biodegradation

Legend

- TNT >2 µg/L
- RDX >2 µg/L
- 2020 Injections
- 2019 Injections
- GW Flow

May 2021 (Q6) Plume Core – Near EW7



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2020 EW7 TOTAL	3345	234		
EW7-T17 AND T18 ARE SHOWN ON FIGURE 2-3				

Observations

- Continued decreasing concentrations of TNT; 10 of 13 wells remain below HAL
- RDX decreased at 1 well and increased at 1 well. Only 2 wells above HAL (max concentration only 2.5 µg/L)
- Strong anaerobic conditions continue to persist

Legend

- TNT >2 µg/L
- RDX >2 µg/L
- 2020 Injections
- 2019 Injections
- GW Flow

Oct 2020 (Q4) Plumes – Load Lines

Observations

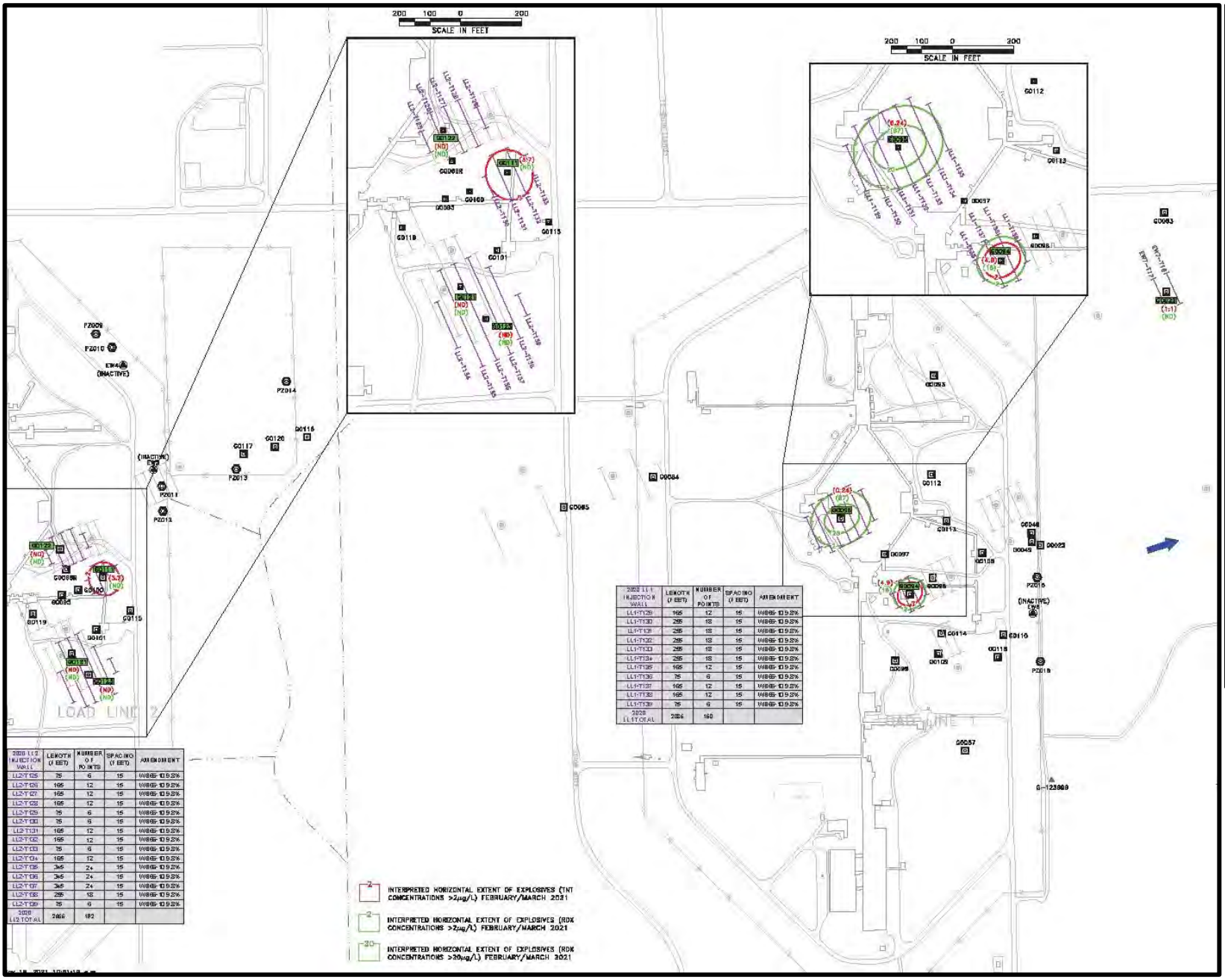
- Small isolated plumes remain in the Load Lines, primarily near former source areas
- No injections since 2016, anerobic geochemical conditions have diminished

Legend

- TNT >2 µg/L (Oct 2020)
- RDX >2 µg/L (Oct 2020)
- 2020 Injections
- 2016 Injections
- Groundwater Flow Direction

Note: Health Advisory Level (HAL) for TNT and RDX = 2 µg/L

Feb 2021 (Q5) Plumes – Load Lines



Observations

- TNT concentrations decreased or remained ND at all 6 wells
- RDX decreased at 3 locations (all below HAL)
- RDX increased at 2 locations at LL1 due to mobilization of RDX as result of injections (expected)

Legend

- TNT >2 µg/L
- RDX >2 µg/L
- 2020 Injections
- 2016 Injections
- Groundwater Flow Direction

May 2021 (Q6) Plumes – Load Lines

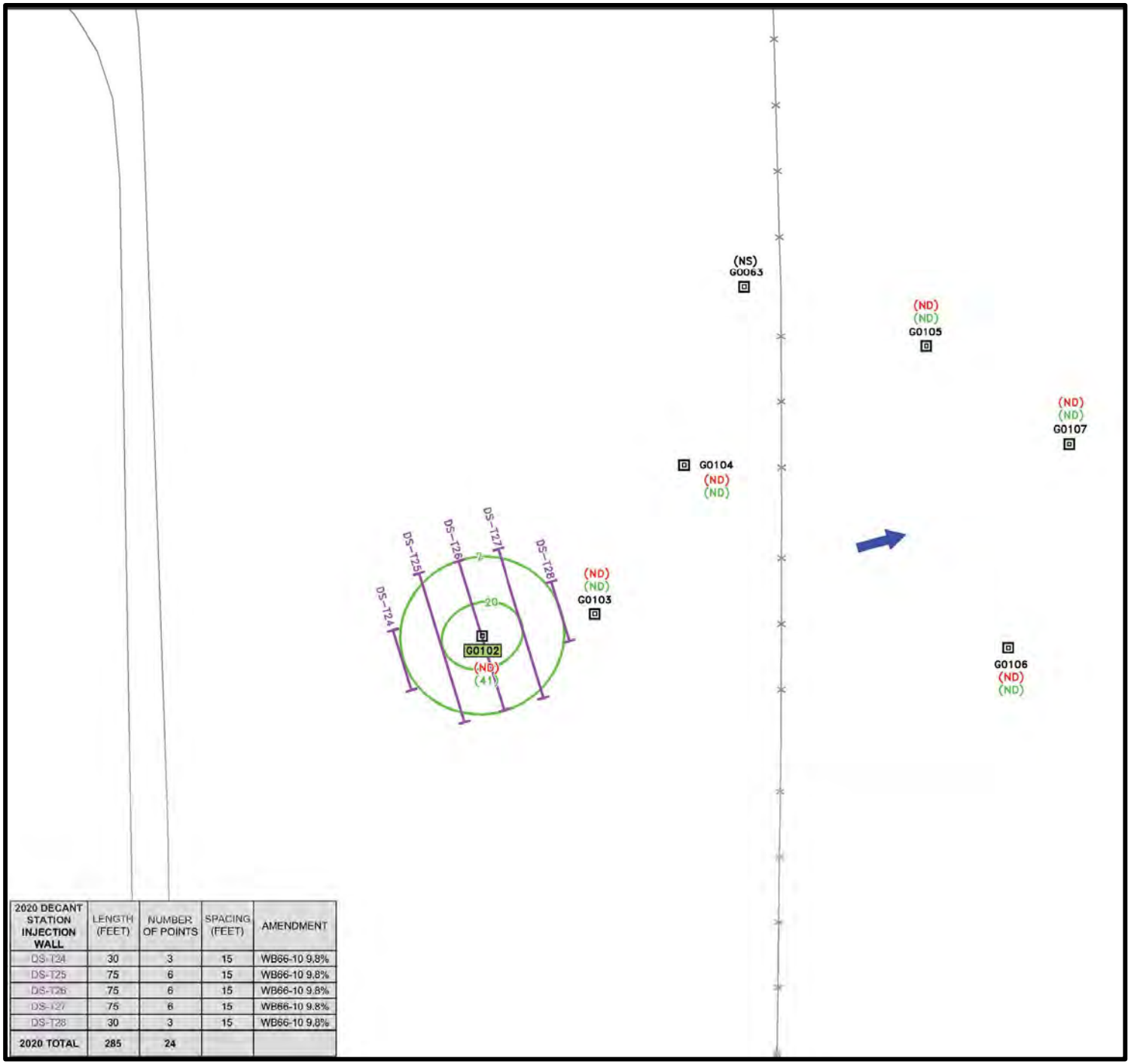
Observations

- TNT increased slightly at 3 wells and 3 wells remained ND
- RDX decreased at 2 wells, increased at 2 wells, and 2 wells remained ND
- Anaerobic conditions expected to reduce RDX and TNT mobilized from injections

Legend

- TNT >2 µg/L
- RDX >2 µg/L
- 2020 Injections
- 2016 Injections
- Groundwater Flow Direction

Oct 2020 (Q4) Plume – Decant Station



2020 DECANT STATION INJECTION WALL	LENGTH (FEET)	NUMBER OF POINTS	SPACING (FEET)	AMENDMENT
DS-T24	30	3	15	WB66-10 9.8%
DS-T25	75	6	15	WB66-10 9.8%
DS-T26	75	6	15	WB66-10 9.8%
DS-T27	75	6	15	WB66-10 9.8%
DS-T28	30	3	15	WB66-10 9.8%
2020 TOTAL	285	24		

Observations

- One small RDX isolated plume remains at the Decant Station, with all downgradient wells ND

Legend

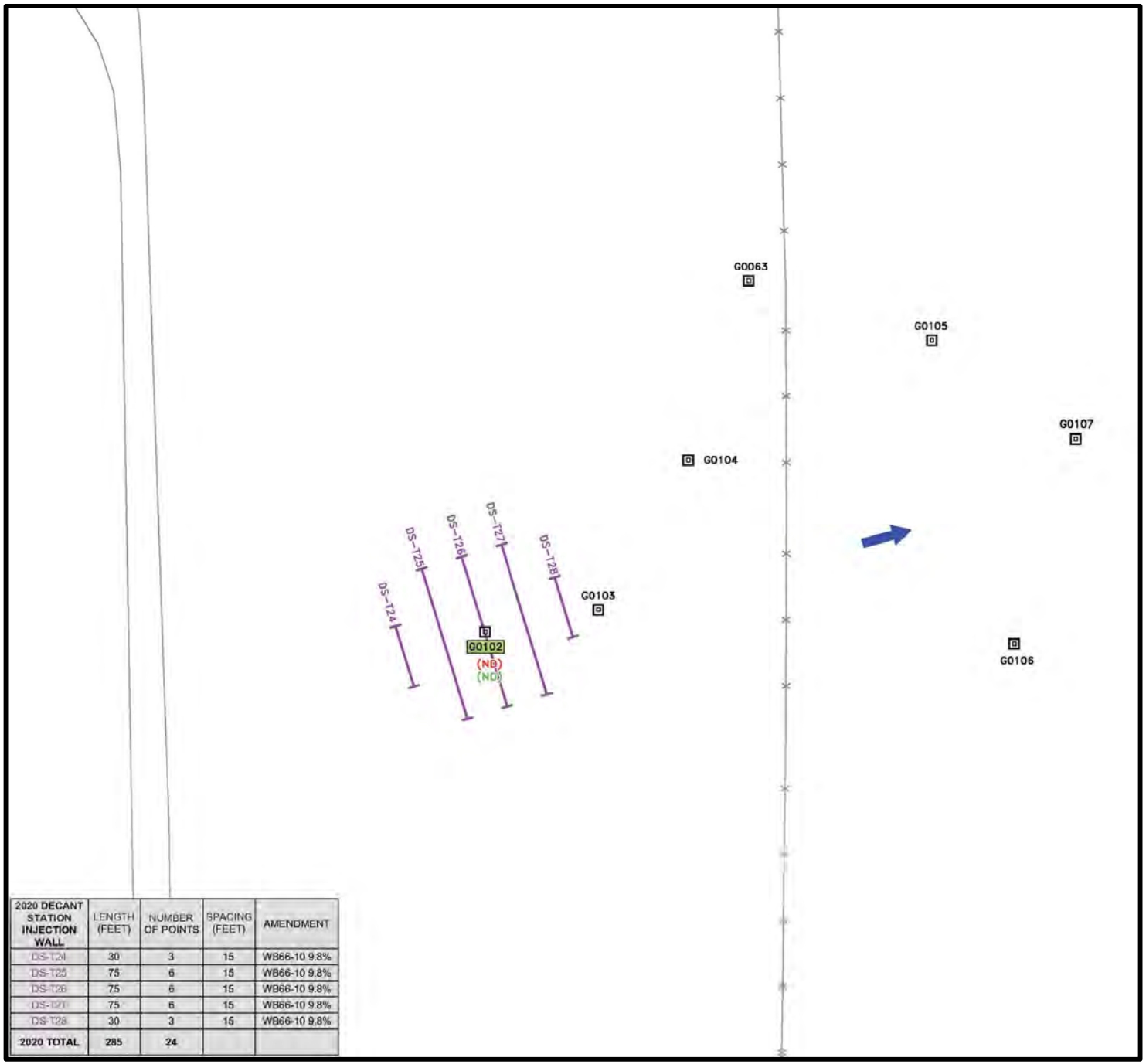
RDX >2 µg/L (Oct 2020)

2020 Injections

Groundwater Flow Direction

Note: Health Advisory Level (HAL) for TNT and RDX = 2 µg/L

Feb 2021 (Q5) Plume – Decant Station



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DS-T27	75	6	15	WB66-10 9.8%
DS-T28	30	3	15	WB66-10 9.8%
2020 TOTAL	285	24		

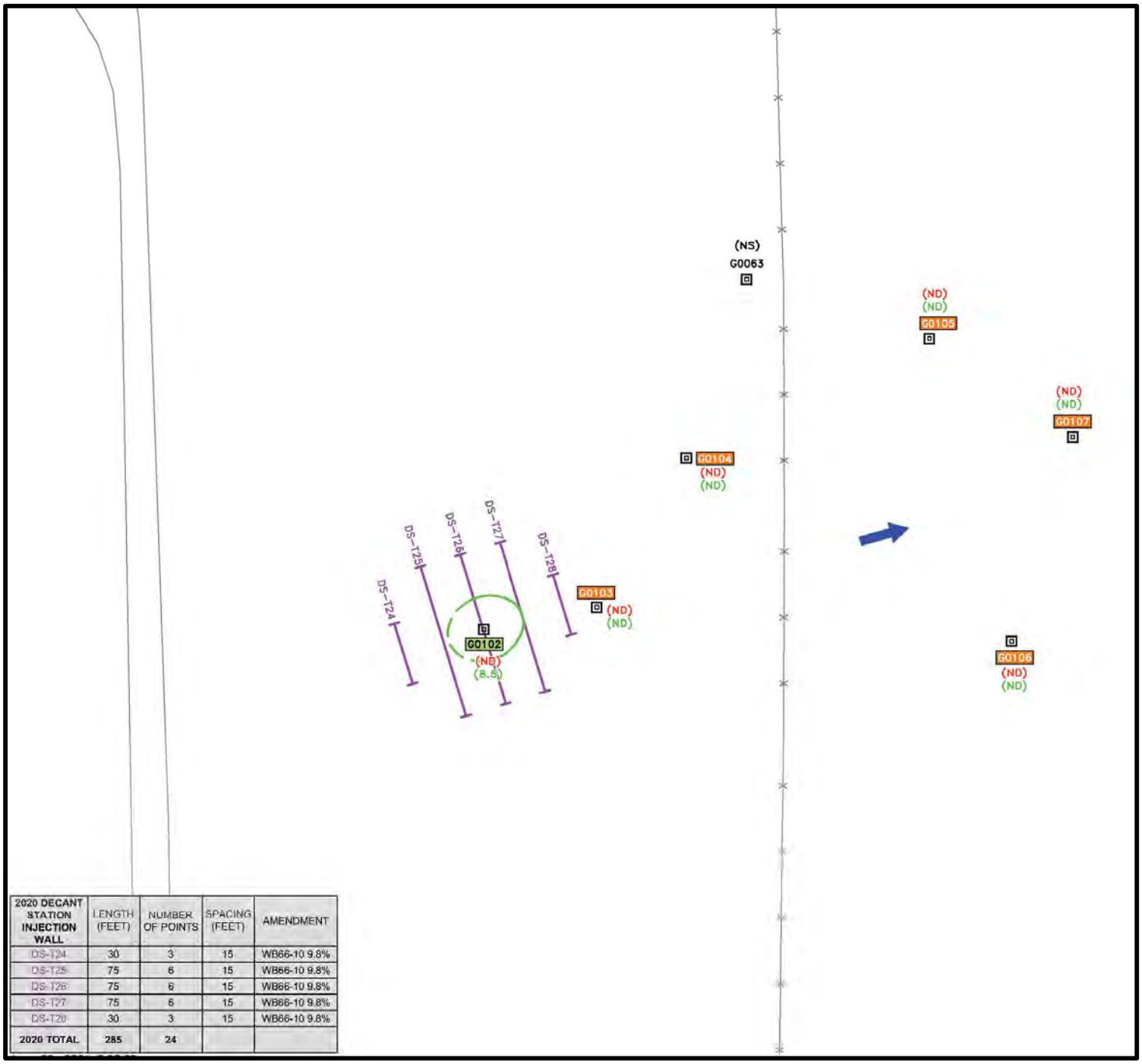
Observations

- RDX concentration at G0102 reduced from 41 µg/L to ND
- Strong anaerobic conditions observed

Legend

- RDX >2 µg/L
- 2020 Injections
- Groundwater Flow Direction

May 2021 (Q6) Plume – Decant Station



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DS-T27	75	6	15	WB66-10 9.8%
DS-T28	30	3	15	WB66-10 9.8%
2020 TOTAL	285	24		

Observations

- RDX concentration at G0102 increased, however, anaerobic conditions expected to reduce RDX mobilized during injections
- All downgradient wells remain ND for RDX

Legend

- RDX >2 µg/L
- 2020 Injections
- Groundwater Flow Direction

Overall Results

- **On-post**
  - Pervasive anaerobic conditions established in injection zones
  - TNT concentrations significantly decreased
  - Some RDX concentration increases due to mobilization resulting from injections
  - Anaerobic conditions expected to reduce RDX mobilized from injections
  - Permanent and temporary wells generally show decreasing or stable trends

Overall Results

- **Off-post**
  - All permanent off-post wells sampled as part of the OU1 Rebound Study remain below HALs
  - Direct-push samples downgradient of EW7/south of feedlot (OS001, OS002, OS003, NW050R) collected as part of OU1 Rebound Study:
    - TNT concentrations above HALs at only OS001
    - RDX detected at only OS001, but below the HAL
      - Q4 RDX = 1.8 µg/L
      - Q5 RDX = 0.82 µg/L
      - Q6 RDX = 0.40 µg/L
    - No evidence of plume mobilization and the plume is attenuating
    - Monitoring will continue

Year in Review – OU1 and OU3 Annual Groundwater Monitoring (LTM)

OU1 and OU3 Groundwater Monitoring Program

- **May 2021 Annual Sampling Event**
  - Site-wide (OU1 and OU3) groundwater level measurements (102 wells)
  - OU1: Groundwater sampling at 75 on-post and 12 off-post wells concurrent with OU1 Rebound Study Q6 sampling event
  - OU3: Groundwater sampling at 2 Shop Area wells

OU1 and OU3 Groundwater Monitoring Program

- **OU1 Results**
  - Off-post:
    - TNT and RDX in all off-post annual LTM permanent wells below HALs (2 µg/L); have been below HALs since 2014
    - Note that TNT is above HAL in 1 off-post direct-push location (OS001) near the facility boundary associated with OU1 Rebound Study
  - On-post: TNT and RDX concentrations generally continued decreasing trends or remain below HALs
    - 13 of 75 wells above HALs in May 2021
  - Maximum concentrations in May 2021
    - TNT = 19 µg/L at G0094 at LL1 (historic high at G0094, 156 µg/L in 2011)
    - RDX = 97 µg/L at G0099 at LL1 (historic high at G0099, 183 µg/L in 2012)
      - Both wells are located near recent injections - continued degradation expected
    - Max concentrations near EW7 are TNT = 10 µg/L and RDX = 2.1 µg/L

OU1 and OU3 Groundwater Monitoring Program

- **OU3 Results**
  - VOC concentrations (1,1,2-TCA, 1,2-DCA) have, overall, decreased over time, but do fluctuate above/below maximum contaminant levels (MCLs) (5 µg/L)
    - Well SHGW02: VOCs below MCLs in May 2021 (above MCLs in 2018, 2016, 2014, 2013, 2010 and prior)
    - Well SHGW03: VOCs above MCLs in May 2021 (1,1,2-TCA: 11 µg/L), above MCLs in May 2020, but below prior
    - Downgradient wells (on 3-year sampling frequency) indicate VOCs remain isolated at SHGW02 and SHGW03, with no downward migration
- **Sitewide Observation**
  - Groundwater levels decreased ~2 feet since 2020, but there has been an overall increasing trend since 2014 (~11 feet overall)

Up Next – October 2021 through October 2022

Up Next – October 2021 through October 2022

- **Annual OU1 and OU3 Groundwater Monitoring (June)**

- **OU1 Rebound Study**
  - Maintain shutdown of EW7 and GWTF
  - Continue Quarterly Monitoring until February 2022 (eighth and final round of quarterly monitoring)

- **OU1 Post Rebound Study**
  - Rebound Study results to date indicate the plume core is shrinking, concentrations are declining, and there has been no further plume migration downgradient (further off-post)
  - Starting to take the necessary next steps to modify the current on-post remedy from Groundwater Extraction and Treatment to Monitored Natural Attenuation with Institutional Controls
  - Next round of documents to modify remedy will include a Focused Feasibility Study, Proposed Plan, and Record of Decision Amendment
  - Following final approval of the Record of Decision Amendment, Long-Term Monitoring and Institutional Control reviews would continue annually site wide

Questions?