Geologic Review

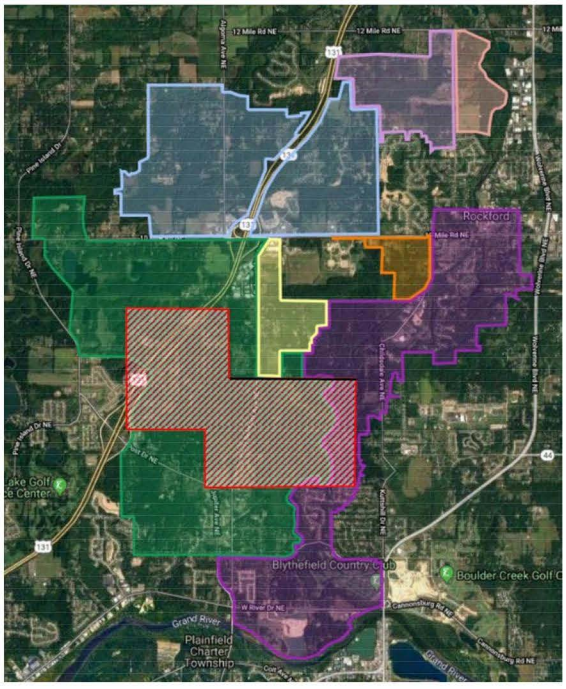
DEQ-RRD Grand Rapids District

Perfluoroalkyl and Polyfluoroalkyl Substances Evaluation of the Primary House Street Plume Area - March-2019

Note: This geologic review is based on the data available as of this report date and is subject to modification as other data becomes available. Additionally, this review is limited due to a lack of permanent monitor wells which are needed to better understand the multiple plumes that emanate from the House Street Disposal Site (the Site) both in an areal and vertical extent.

Introduction:

This evaluation of perfluoroalkyl and polyfluoroalkyl substance (PFAS) impact encompasses a portion of the area southeast of the House Street disposal area to the Belmont/Rogue River area. See Map Below**:**



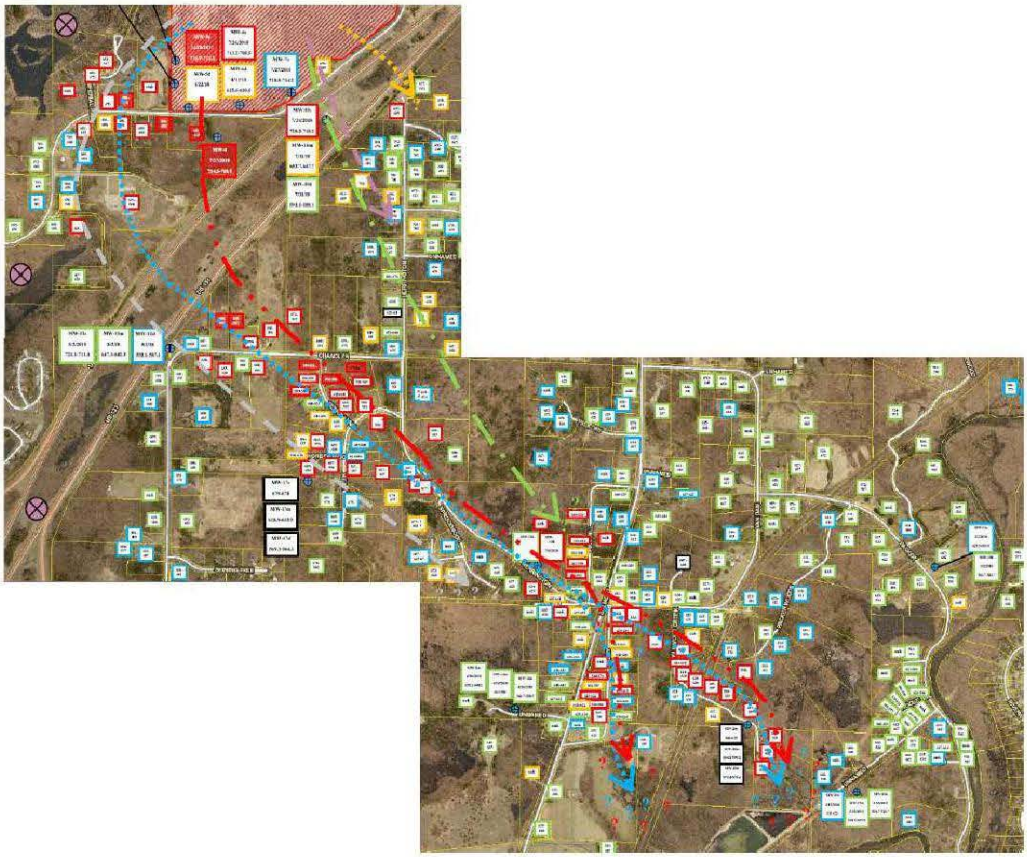
The outline of the analysis area is shown as a hatched red and white area.

This geologic review includes the primary House Street plume and uses residential well sample data collected by Wolverine World Wide (WWW) and all available WWW monitor wells. The DEQ analyzed the drinking water well sample results, screen elevation and surrounding geology to develop this preliminary hydrogeologic model. **Figures 1a and 1b** were created to detail the drinking water well screen elevations and monitoring well screen elevations compared to the total PFAS concentrations. These maps were then used to model the PFAS plumes. **Figures 2a**

and 2b were created to detail the drinking water well screen elevations and monitoring well screen elevations compared to combined PFOA and PFOS concentrations.

The House Street Disposal Site (the Site) sits on a groundwater divide where PFAS groundwater plumes migrate off-site in multiple directions. This review is of the area southeast of the site along what has been described as the primary House Street PFAS groundwater plume. A bedrock high sits to the northeast of the Site and likely in part controls the groundwater direction of flow to the Rogue River. Based on the current data there could be at least seven or eight distinct PFAS plumes migrating to the southeast of the Site from a lateral perspective; an assessment of the number of plumes vertically cannot be completed at this time without the addition of a significant number of additional nested sets of monitor wells. The plumes are identified differently based on their lateral distribution and will be described from west to east on the attached figures and differentiated on the map by different colored arrows. Based on the boring logs for MW-10d, MW-11d and MW-17d the lithology is primarily sand to bedrock with occasional clay-silt stringers. This geologic depositional setting changes to the northeast in the vicinity of the MW-9 nested set (clay and silt occurs at this location in significantly higher amounts) . The extent of the geologic setting in other directions is currently unknown.

The PFAS Plumes:



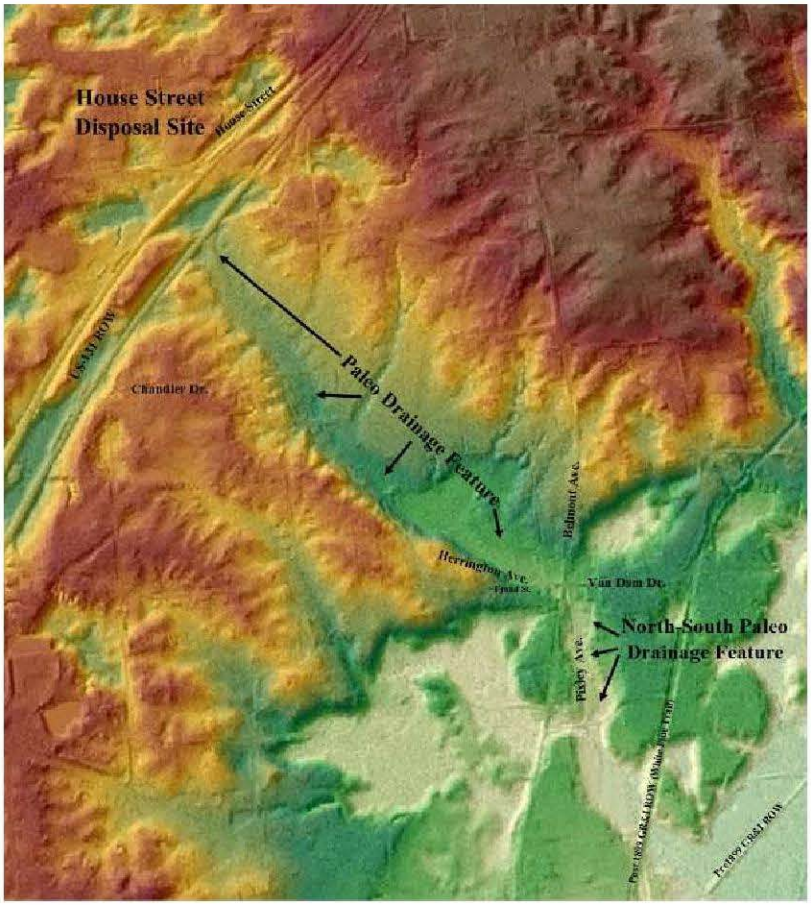
Combined Total PFAS Plume Figures 3a and 3b for the area southeast of House Street.

Gray Plume:

The Gray Plume on attached **Figures 3a and 3b**, appears to migrate from the western boundary of the Site looping then to the southeast and exists at least to the Sprucewood neighborhood area, however, the end of the plume is currently undelineated. This plume appears to occur from approximately 655 feet to 585 feet and is marked by a unique ratio of PFOA/PFOS to total PFAS concentrations (unlike other areas of the study area, this plume has very low levels of PFOS & PFOA and high levels of other PFAS compounds). This relationship is illustrated by the results from 1580 House St. NE, 7422 Chandler Dr. NE, 7410 Chandler Dr. NE, 2055 Korban Woods NE, 2042 Korban Woods NE, 2075 Korban Woods NE, 2066 Meek Dr. NE and 2072 Meek Dr. NE. The vertical and horizontal extent of this plume is currently unknown, and a significant number of monitor wells are still necessary to evaluate the environmental impacts from this plume.

Red and Blue Plumes

Although the Red Plume and the Blue Plume as identified on attached **Figures 3a and 3b**, emanate from different locations on the Site, they may merge offsite and be part of one large plume or separate plumes. Additional characterization and installation of monitoring wells would be necessary to make a determination. These plumes emanate from the west side and south side of the Site and contain the highest known impacted groundwater emanating from the Site. These plumes loops to the southeast from the Site and parallels or mirrors the paleo-stream channel visible on LIDAR (see below) and clearly present in the field. Near the intersection of Herrington Avenue, Belmont Avenue, Frond Street, Van Dam Drive and Pixley Avenue, the plume or plumes appear to separate into a plume to the south and a separate plume to the east. On LIDAR this area is the location of a paleo-stream channel oriented to the south from the above-mentioned channel. This location is annotated on the LIDAR image below. This plume or plumes exist from at least 715 feet to 565 feet. It is currently unclear if this impact is throughout the full extent of the 150 feet or if the PFAS plumes are laminated vertically through distinct elevations. The vertical and horizontal extent of this plume is currently unknown, and a significant number of monitor wells are still necessary to evaluate the environmental impacts from these plumes.



Annotated LIDAR image illustrating paleo drainage features southeast of the Site (LIDAR image from Kent County).

Green Plume:

The Green Plume (illustrated on attached **Figures 3a and 3b**) emanates from the southeast side of the Site and migrates to the southeast in the vicinity of monitor well MW-10 nested set. This plume follows the northwest to southeast paleo-stream channel noted on the above LIDAR image and migrates to at least the Pine Hill Neighborhood. This impact found from 667 to 588 feet although it is unclear if the aquifer is impacted throughout the entire 79 feet or the PFAS impact is vertically stratified. The vertical and horizontal extent of this plume is currently unknown, and a significant number of monitor wells are still necessary to evaluate the environmental impacts from this plume.

Purple Plume:

The Purple Plume (as illustrated on **Figure 3a**) follows the same path as the Green Plume but may not migrate past Herrington Avenue and exists at shallower depths (728 feet to 685 feet). Again, several monitor wells are necessary to fully evaluate the environmental impacts from this plume both in an areal and vertical extent.

Orange Plume:

The Orange Plume (as illustrated on **Figure 3a**) leaves the Site from the southeast side and may be short in length and data is very limited. This plume appears to be migrating to the southeast of the Site at depths from 695 feet to 672 feet. Additional drilling is necessary to assess the environmental impacts from this plume.

Existing Wolverine World Wide Monitor Well Analysis:

The MW-8 location, directly south of the Site in an area of high PFAS concentration, currently exists as only one well. Additional wells should be installed to evaluate the aquifer(s) to at least 565 feet (150 feet deeper then the current screen interval) and especially the depths of 625 to 610 feet, the screened interval of a highly impacted adjacent drinking water well.

At the MW-10 location, there is nearby PFAS impact at elevations that are not vetted by the current nested set of monitor wells. The boring log for MW-10d indicates a saturated sand from 717 feet to 652 feet, which is in an area of the aquifer that is not currently being evaluated by this nested set of monitor wells.

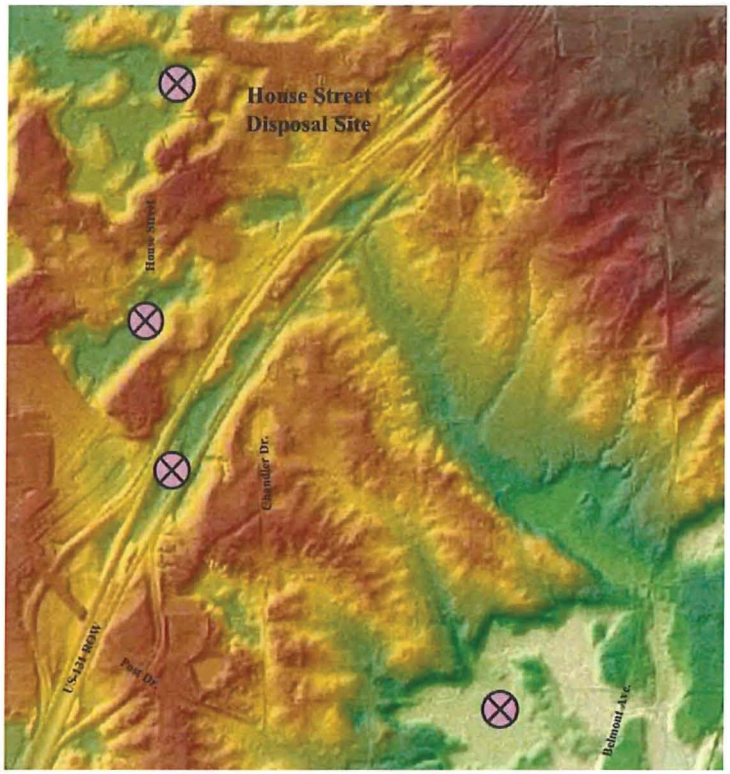
At the MW-11 location, the four closest PFAS detections higher then 70part per trillion (ppt) are at elevations where the nested set does not have a well screened. These nearby drinking water wells are screened at 638-633 feet, 655-650 feet, 668-664 feet and 688-683 feet; the boring log for this location does indicate there are saturated sands at these elevations.

At the MW-17 location, additional monitor wells screened between 613 and 569 feet (the lithology between the existing shallow well and the existing intermediate well) would be beneficial to fully assess the aquifer.

At the MW-20 location, additional monitor wells screened between 639 and 605 feet (the lithology between the existing shallow well and the existing intermediate well) would be beneficial to fully assess the aquifer.

Other Possible Plumes:

On the attached **Figures 3a and 3b** there are four locations annotated with a purple circle-x that based on LIDAR could present pathways for PFAS plume migration to areas where there are no existing drinking wells or environmental wells. The groundwater in these areas should be vetted via vertical aquifer profiling or installation of nested well sets in order to evaluate current risks or future risks associated with potential land development (assuming no municipal water is available). These locations are shown on the below LIDAR image.



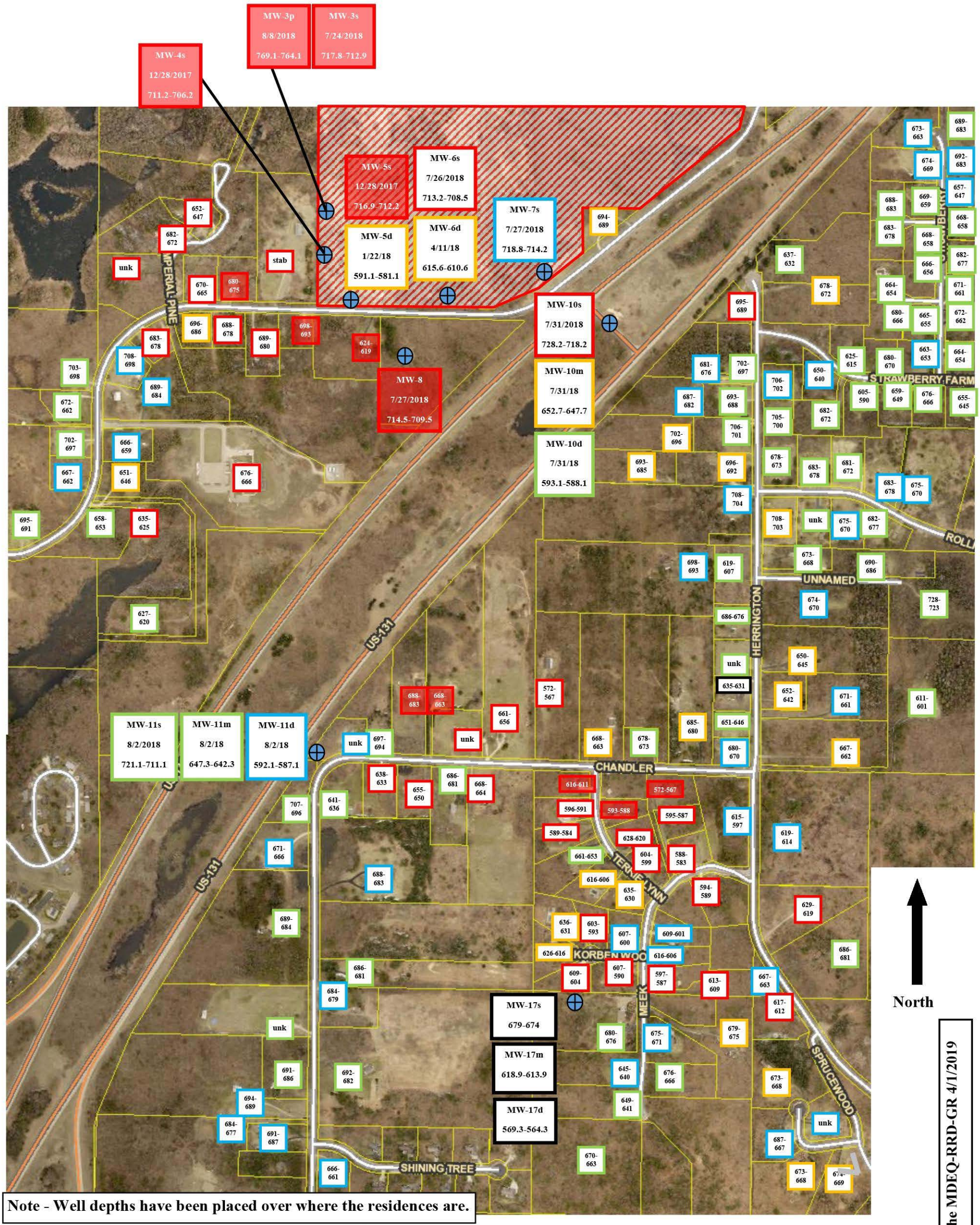
Annotated LIDAR image illustrating areas of groundwater concern (LIDAR image from Kent County).

Attachments:

- Figure 1a – Total PFAS – Analysis of Drinking Water Well Results of the Main House Street Plume – West
- Figure 1b – Total PFAS – Analysis of Drinking Water Well Results of the Main House Street Plume – East
- Figure 2a – PFOS/PFOA – Analysis of Drinking Water Well Results of the Main House Street Plume – West
- Figure 2b – PFOS/PFOA – Analysis of Drinking Water Well Results of the Main House Street Plume – East
- Figure 3a - Total PFAS with Plumes– Analysis of Drinking Water Well Results of the Main House Street Plume – West
- Figure 3b - Total PFAS with Plumes– Analysis of Drinking Water Well Results of the Main House Street Plume – East

Geologist Signature: _____ Date: 4-2-19

Mark Worrall, District Geologist



Note - Well depths have been placed over where the residences are.

House Street Disposal Area

Below Method Detection Level

Total PFAS: <20ppt

Total PFAS: 20 to 70ppt

Total PFAS: >70ppt

Total PFAS: >1,000ppt

WWW Monitor Well Location

Elevation of Well Screen (Top of Screen-Bottom of Screen)

Well Screen Information Unknown

Exact Well Location Unknown

MW-11m — WWW Monitor Well Name
8/2/18 — Sample Date Used
647.3-642.3 — Screen Elevation

Updated by the MDEQ-RRD-GR 4/1/2019

Figure 1a—Total PFAS

Analysis of Drinking Water Well Results of the Main House Street Plume - West

Plainfield Township MI

North

663-658 **Elevation of Well Screen** (Top of Screen-Bottom of Screen)

unk **Well Screen Information Unknown**

unk **Exact Well Location Unknown**

709-704 **Below Method Detection Level**

736-731 **Total PFAS: <20ppt**

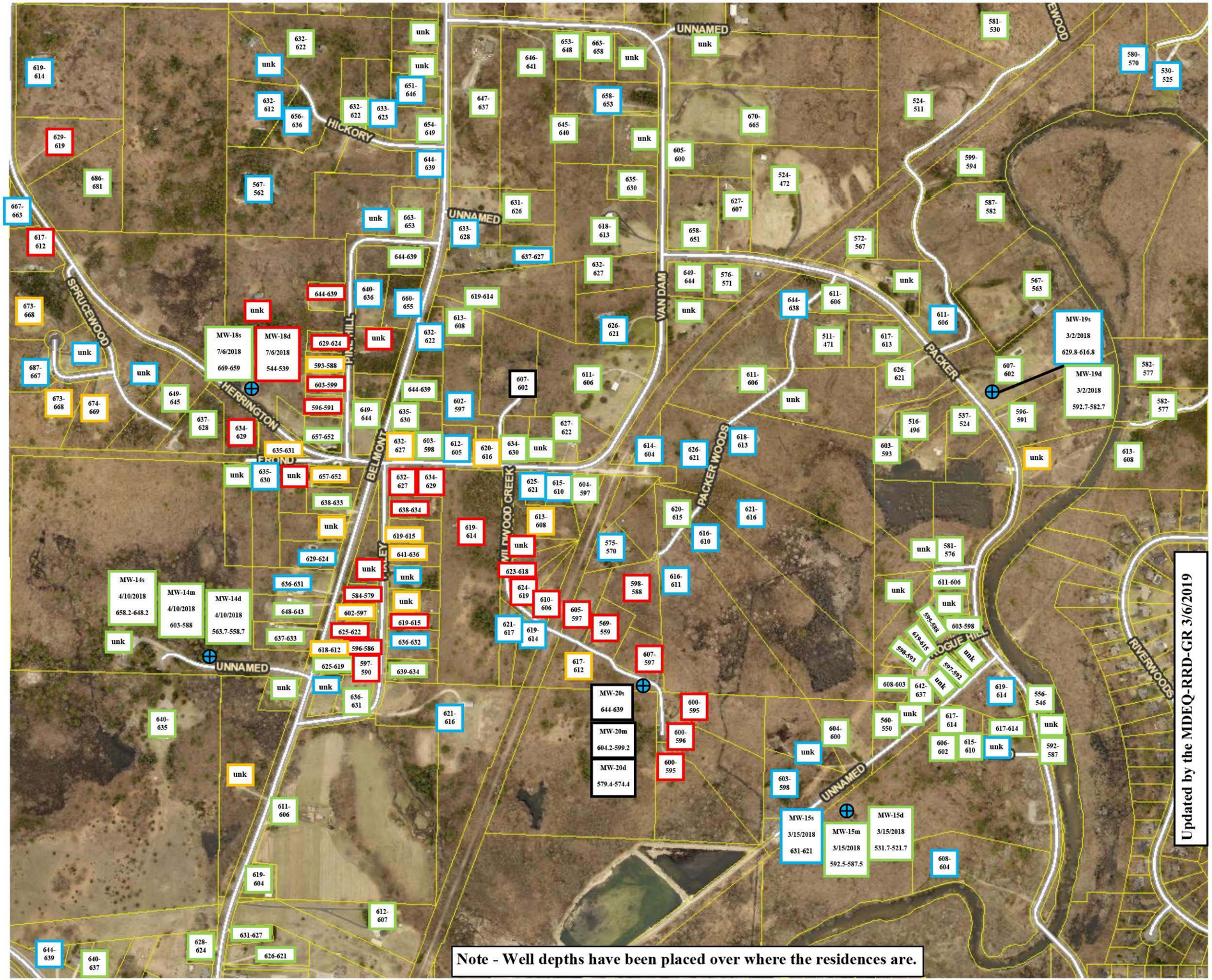
703-693 **Total PFAS: 20 to 70ppt**

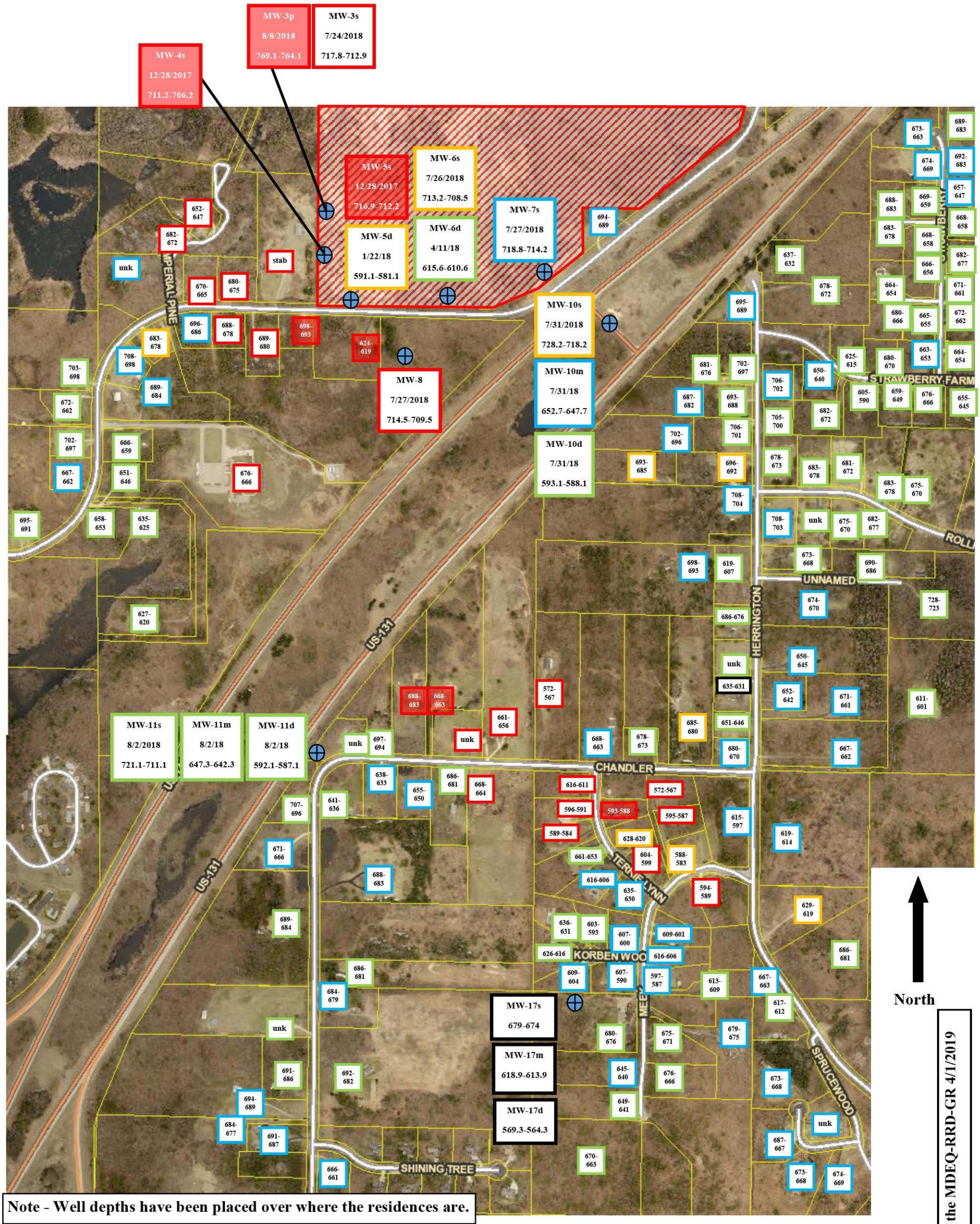
704-695 **Total PFAS: >70ppt**

MW-11m — WWW Monitor Well Name
8/2/18 — Sample Date Used
647.3-642.3 — Screen Elevation

⊕ **WWW Monitor Well Location**

Figure 1b—Total PFAS
Analysis of Drinking Water Well Results of the Main House Street Plume - East
Plainfield Township MI





Note - Well depths have been placed over where the residences are.

House Street Disposal Area

WWW Monitor Well Location

709-704 Below Method Detection Level

736-731 PFOS & PFOA: <20ppt

703-693 PFOS & PFOA: 20 to 70ppt

704-695 PFOS & PFOA: >70ppt

704-695 PFOS & PFOA: >1,000ppt

663-658 Elevation of Well Screen (Top of Screen-Bottom of Screen)

unk Well Screen Information Unknown

unk Exact Well Location Unknown

MW-11m — WWW Monitor Well Name
8/2/18 — Sample Date Used
647.3-642.3 — Screen Elevation

Updated by the MDEQ-RRD-GR 4/1/2019

Figure 2a—PFOA/PFOS

Analysis of Drinking Water Well Results of the Main House Street Plume - West

Plainfield Township MI

North

663-658 **Elevation of Well Screen** (Top of Screen-Bottom of Screen)

unk **Well Screen Information Unknown**

unk **Exact Well Location Unknown**

709-704 **Below Method Detection Level**

736-731 **PFOA & PFOS: <20ppt**

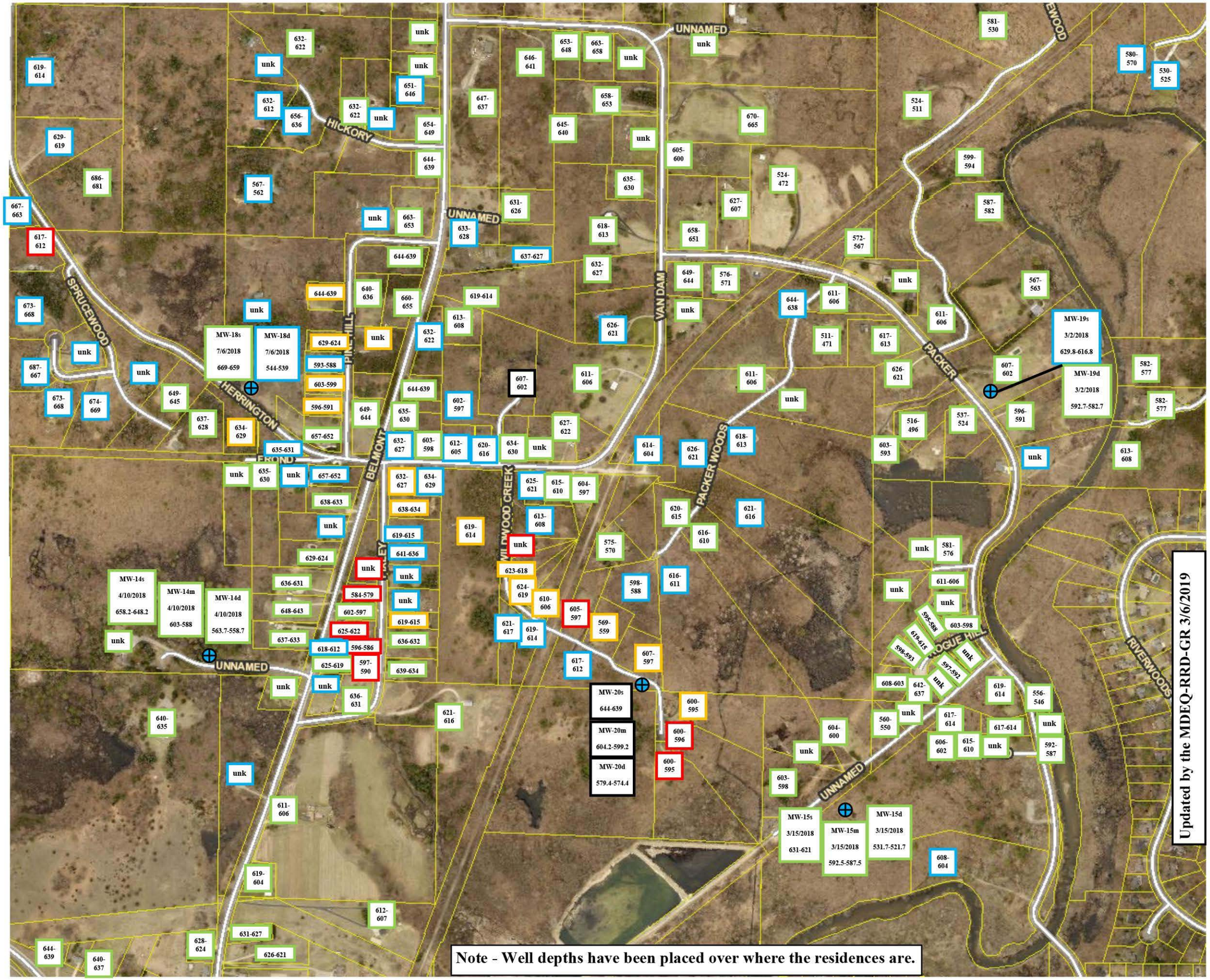
703-693 **PFOA & PFOS: 20 to 70ppt**

704-695 **PFOA & PFOS: >70ppt**

MW-11m — WWW Monitor Well Name
8/2/18 — Sample Date Used
647.3-642.3 — Screen Elevation

⊕ **WWW Monitor Well Location**

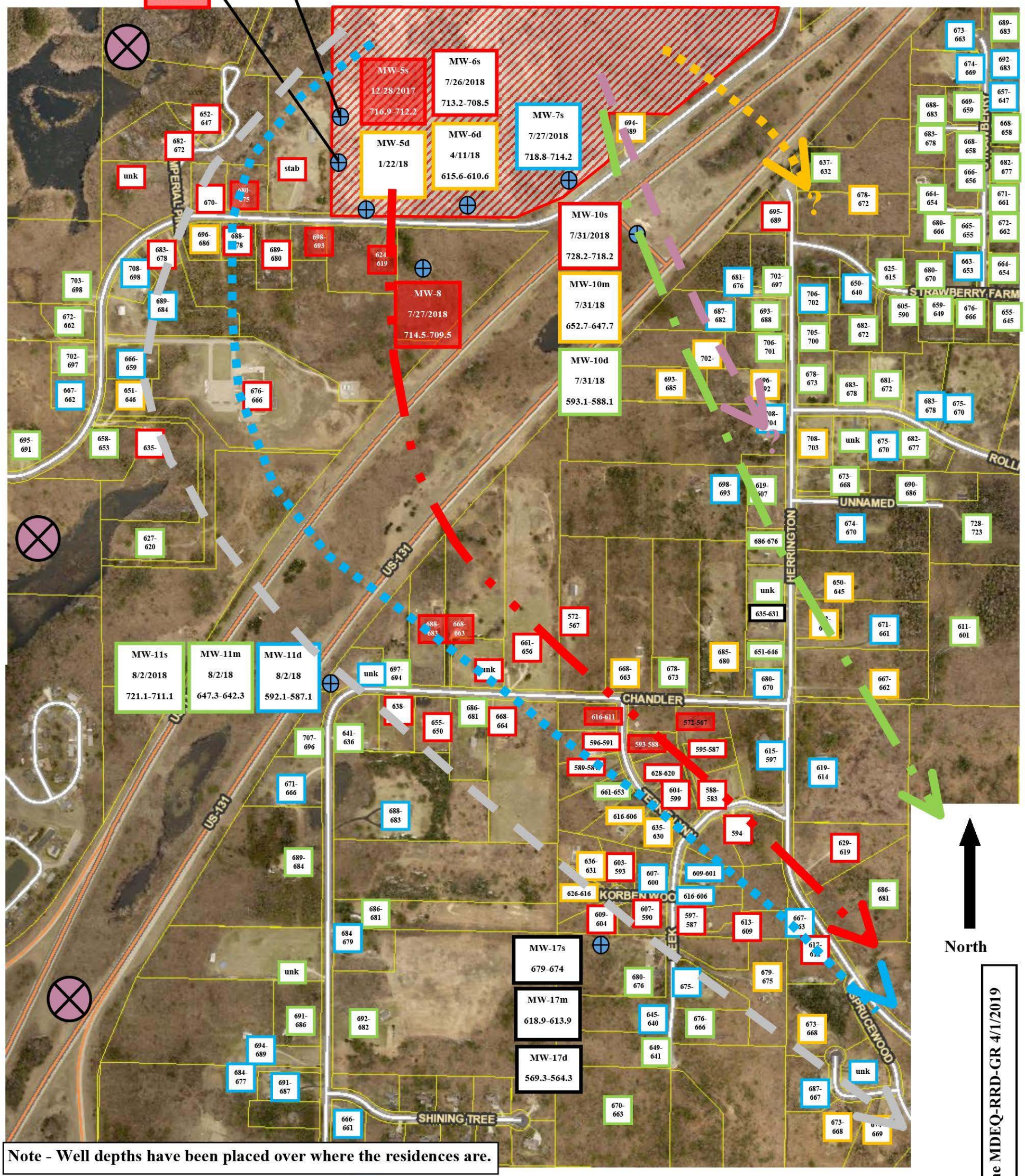
Figure 2b—PFOA & PFOS
Analysis of Drinking Water Well Results of the Main House Street Plume - East
Plainfield Township MI



PFAS Groundwater plumes:

Gray Plume
Blue Plume
Red Plume
Orange Plume
Purple Plume
Green Plume

PFAS plumes are represented by dashed lines and the locations are approximate based on the data currently available.



Note - Well depths have been placed over where the residences are.

House Street Disposal Area

Below Method Detection Level

Total PFAS: <20ppt

Total PFAS: 20 to 70ppt

Total PFAS: >70ppt

Total PFAS: >1,000ppt

WWW Monitor Well Location

Location where aquifer needs to be assessed-see Geologic Review

Elevation of Well Screen (Top of Screen -Bottom of Screen)

unk Well Screen Information Unknown

unk Exact Well Location Unknown

MW-11m WWW Monitor Well Name
8/2/18 Sample Date Used
647.3-642.3 Screen Elevation

Figure 3a—Total PFAS-with Plumes

Analysis of Drinking Water Well Results of the Main House Street Plume - West

Plainfield Township MI

Updated by the MDEQ-RRD-GR 4/1/2019

663-658 **Elevation of Well Screen** (Top of Screen-Bottom of Screen)

unk **Well Screen Information Unknown**

unk **Exact Well Location Unknown**

Location where aquifer needs to be assessed-see Geologic Review

North

MW-11m — **WWW Monitor Well Name**

8/2/18 — **Sample Date Used**

647.3-642.3 — **Screen Elevation**

PFAS Groundwater plumes:

- **Gray Plume**
- **Blue Plume**
- **Red Plume**
- **Green Plume**

PFAS plumes are represented by dashed lines and the locations are approximate based on the data currently available.

709-704 **Below Method Detection Level**

736-731 **Total PFAS: <20ppt**

703-693 **Total PFAS: 20 to 70ppt**

704-695 **Total PFAS: >70ppt**

⊕ **WWW Monitor Well Location**

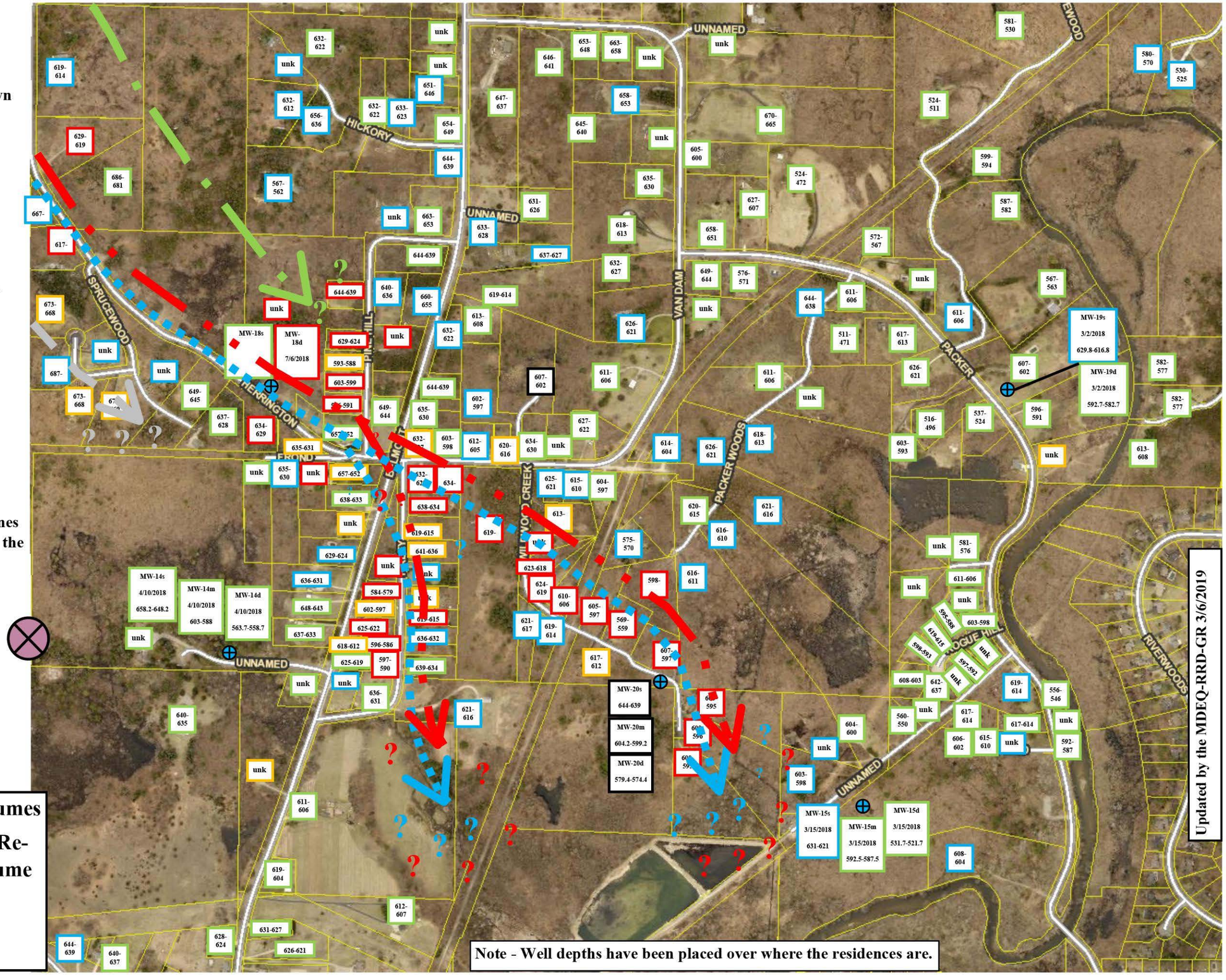


Figure 3b—Total PFAS—with Plumes

Analysis of Drinking Water Well Results of the Main House Street Plume - East

Plainfield Township MI