



May 18, 2021

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SUBJECT: Conditional Approval of Groundwater Extraction and Treatment System (GETS)
Interim Remedial Action Design Report (RADR)
JCI/Tyco FTC PFAS, 2700 Industrial Parkway South, Marinette, WI
BRRTS #02-38-580694

Dear Mr. Danko and Mr. Wahl:

On February 26, 2021 the Wisconsin Department of Natural Resources (DNR) received the *Groundwater Extraction and Treatment System Interim Remedial Action Design Report* (GETS RADR) for the above-referenced site submitted by Arcadis U.S., Inc. (Arcadis), on behalf of Johnson Controls, Inc. and Tyco Fire Products LP (JCI/Tyco). The report was accompanied by the appropriate fee of \$1,050, required under Wisconsin Administrative Code (Wis. Adm. Code) § NR 749.04(1) for formal DNR review and response.

The DNR thanks JCI/Tyco for its plans to implement an interim action that is designed to remove per- and polyfluoroalkyl substances (PFAS) mass from the environment and reduce further spread PFAS from the site. The DNR expects that one or more actions may be needed to achieve the final remedial goals but finds the GETS interim action is designed to meet the remedial objectives it has provided in the GETS RADR. The DNR finds that JCI/Tyco's design for the GETS incorporates current proven technologies for PFAS remediation; is based on available site data; and can be adapted to future changes in technology and site conditions. In accordance with Wis. Adm. Code § NR 724.07, the DNR conditionally approves the GETS RADR. The DNR's conditional approval is specific to the requirements of ch. NR 724 Wis. Adm. Code and does not constitute an approval of the engineering design or approvals for other permits or permissions that JCI/Tyco must obtain for construction and/or operations of the GETS. The conditions of DNR's approval requires that JCI/Tyco complete several actions, which are described in this letter.

Background

JCI/Tyco is investigating and responding to the discharge PFAS to the environment at the JCI/Tyco Ansil Fire Technology Center (FTC), located at 2700 Industrial Parkway South in Marinette, Wisconsin (the "Site"). The discharge occurred as the result of fire suppressant training, testing, research and development of PFAS-containing aqueous film forming foams (AFFF) at the Site from the early 1960's through 2017.

Data collected to date by JCI/Tyco indicates PFAS contaminants have spread from the FTC and impacted private and public potable wells and surface water in the Town of Peshtigo, and surface water in the Bay of Green Bay in Lake Michigan. JCI/Tyco's site investigation into other transport pathways and into the degree and extent of contamination is still on-going.

Using the current available data, JCI/Tyco concluded that groundwater with PFAS concentrations greater than 10,000 part per trillion (ppt) is present beneath and to the east of the FTC property (see Figure B-8 from the GETS RADR provided in **Attachment A**). Some of the contaminated groundwater upwells and contributes to the PFAS contamination detected in surface water in Ditch B, which then flows into the Bay of Green Bay in Lake Michigan. Based on these findings JCI/Tyco proposed an interim remedial action to pump and treat areas of highly contaminated groundwater that are migrating east from the FTC towards Ditch B.

GETS RADR Summary

JCI/Tyco's proposed interim remedial action is described in detail in the GETS RADR. JCI/Tyco's proposed GETS includes the installation of nine vertical groundwater extraction wells and connected sub-grade piping that will pump and convey groundwater to a treatment building to be constructed on the northeastern corner of the FTC property. The proposed layout is shown on Figure 3-1 from GETS RADR (**Attachment A**). Groundwater treatment will include oxidation, filtration, granular activated carbon (GAC) and ion exchange resins to remove PFAS mass from groundwater. Treated water will be discharged into Ditch B at an outfall proposed near Pierce Avenue (south of Cleveland Ave); the discharge is expected to be monitored and regulated under a Wisconsin Pollutant Discharge Elimination System (WPDES) General Permit in accordance with Wis. Adm. Code § NR 205.08(1)(b), which JCI/Tyco will apply for separately from the GETS RADR submittal. JCI/Tyco incorporated flexibility into the design of the extraction, conveyance and treatment systems to allow for modification or added capacity, if needed in the future.

JCI/Tyco's GETS RADR includes a summary of the pre-design investigation, groundwater modeling simulations, a summary of permitting requirements and applicable standards for the proposed remedy and a wetlands delineation report for a portion of the project area. The GETS RADR also includes a conceptual layout for the proposed groundwater extraction and treatment system, preliminary engineering design drawings and specifications and an outline of an operation and maintenance plan to be completed after the system is constructed and operating parameters are defined. In accordance with the requirements outlined in DNR's January 21, 2021 response to JCI/Tyco's Pre-design Investigation Workplan, JCI/Tyco included its proposed Wis. Adm. Code § NR 724.17(3) long-term monitoring plan ("Monitoring Plan") for the GETS in Appendix G of the GETS RADR. The proposed monitoring network is shown on Figure 5-1 in the GETS RADR (**Attachment A**).

Objectives and Expectations for the GETS

JCI/Tyco's primary objectives for the GETS are: (1) reduce upwelling of PFAS-contaminated groundwater into Ditch B; (2) treat the recovered groundwater to reduce the PFAS concentration in the water; and (3) reduce PFAS-mass flux throughout groundwater plume.

In the GETS RADR, JCI/Tyco included estimates on percentage of PFAS mass to be removed, plume response and timeframes to achieve the remedial objectives of the GETS. At this time, the DNR considers these estimates to be preliminary. Refinements of these estimates are expected as more data are gathered during the site investigation and the long-term monitoring for the GETS, and future calibration of the groundwater model.

The following summarizes the general outcomes expected from operation of the GETS.

- While proposed as an interim remedial action, the GETS is expected to run for many years with regular performance monitoring, maintenance and pump replacement. (JCI/Tyco's estimates for PFAS mass removal from the GETS are based on model simulations for 30 years of operations.) JCI/Tyco will provide updates on operations in semi-annual progress reports submitted to the DNR.
- The GETS is expected to remove PFAS mass from the environment and reduce the migration of PFAS away from the FTC. JCI/Tyco will monitor the PFAS mass removed by the GETS and the hydraulic capture zone where migration is controlled.

- The GETS is expected to reduce the concentration of PFAS in groundwater in the remediation focus area; however, the reductions are not expected to achieve the Wisconsin Department of Health Services (DHS) Cycle 10 and 11 recommended groundwater standards for PFAS in the remediation focus area or the broader extent of the contaminant plume (see Figure B-8 in from the GETS RADR; **Attachment A**). JCI/Tyco will monitor the PFAS concentrations in groundwater over time in a defined network of Wis. Adm. Code ch. NR 141 groundwater monitoring wells.
- The GETS is expected to reduce the PFAS concentrations in surface water in Ditch B as shown on Figure B-15 in the GETS RADR (**Attachment A**). JCI/Tyco will monitor surface water concentrations in a defined monitoring network.
- The treated groundwater effluent is expected to be regulated under a WPDES General Permit; JCI/Tyco will monitor and report on the effluent discharge according to criteria established in a coverage letter that will be issued to JCI/Tyco for a WPDES permit.
- The GETS is expected to draw groundwater levels down approximately 3 feet near each extraction well. The drawdown will reduce with distance away from the extraction wells and minimal drawdown (less than 0.25 feet) is expected outside the area shown on Figures B-5 in the GETS RADR. JCI/Tyco will monitor the drawdown and adjust pumping rates as needed.
- The net effect of pumping groundwater and discharging the treated effluent into Ditch B is expected to increase the baseflow in Ditch B. JCI/Tyco will monitor the stage and flow in the ditch and adjust pumping rates as needed.
- The spent GAC from groundwater treatment is expected to be regenerated off-site and returned to the treatment system for re-use. Filters and spent ion exchange resins from the groundwater treatment system are expected to be disposed of off-site at approved facilities. JCI/Tyco will maintain records of materials handling for residuals from the groundwater treatment system.
- The GETS is not expected to capture all the PFAS in groundwater migrating eastward from the FTC.
- The GETS is not expected reduce the concentration of PFAS in impacted private wells or in groundwater outside the remediation focus area of the GETS (e.g., PFAS concentrations will not be reduced to the groundwater north and south of the FTC as shown on Figure B-8 from the GETS RADR; **Attachment A**). JCI/Tyco will be required to monitor groundwater outside the area of influence of the GETS as part of the on-going site investigation and future potential remedial actions.

DNR expects that one or more actions in addition to the GETS interim action may be needed to achieve the remedial goals at the Site. Data collected during operation and monitoring of the GETS may help develop other remedial options for areas not addressed by this interim action.

DNR Review

The DNR reviewed the GETS RADR and finds that the report meets the requirements of Wis. Adm. Code ch. NR 724. JCI/Tyco's design for the GETS incorporates current proven technologies for PFAS remediation; is based on the available site data; and aligns with the stated remedial objectives. JCI/Tyco has provided sufficient site data and analysis in the GETS RADR to proceed with the proposed interim action if certain conditions are met. **Based on this review the DNR conditionally approves the GETS RADR per Wis. Adm. Code § NR 724.07.** The DNR's conditional approval is specific to the requirements of ch. NR 724 Wis. Adm. Code and does not constitute an approval of the engineering design or approvals for other permits or permissions that JCI/Tyco must obtain for construction and/or operations of the GETS.

The schedule associated with these conditions of approval is provided in **Attachment C**. None of the DNR's conditions of approval or technical review comments provided herein should cause delay in JCI/Tyco's ability to proceed with proposed construction of the GETS.

Conditions of Approval of GETS RADR: As conditions of the DNR's approval, JCI/Tyco must complete the following:

- 1) Complete the pre-startup monitoring program described in the Wis. Adm. Code § NR 724.17 Monitoring Plan provided as Appendix G of the GETS RADR, including the revisions specified in **Attachment B**.
- 2) Submit a revised Wis. Adm. Code § NR 724.17 Monitoring Plan by **July 17, 2021** that includes a Commissioning Plan for the first 6 months of operations of the GETS and the other revisions specified in **Attachment B**.
- 3) Provide public notification prior to startup of the GETS that provides the remedial objectives, expected outcomes, and how the outcomes will be monitored and reported. The information provided to the public must align with the information in the approved GETS RADR per Wis. Adm. Code § NR 714.07.
- 4) Submit a final Wis. Adm. Code § NR 724.13(2) operation and maintenance (O&M) plan with the Wis. Adm. Code § NR 724.15 construction documentation report within 120 days after initial startup of the GETS. Include documentation and plans for the management of PFAS-impacted media generated during construction and operations of the GETS.

Information regarding the public notifications, revised Monitoring Plan, final O&M plan and construction documentation report are summarized below.

NR 714 Public Notifications: JCI/Tyco has shared its plans for the GETS with the public in presentations and in factsheets in which JCI/Tyco states the GETS “eliminates 95% of PFAS in the groundwater” and will provide “clean” water (e.g., JCI/Tyco's factsheet titled “Path to a Permanent PFAS Solution” currently posted to its website). These goals are not included in the GETS RADR and JCI/Tyco has not submitted to the DNR specific criteria and a monitoring program it would use to test these outcomes and the timeframe it would expect to achieve these results¹. **Prior to initial startup of the GETS, the DNR directs JCI/Tyco to revise its GETS factsheet(s) and host at least one public meeting to notify the public of what the GETS interim action will accomplish, consistent with the information that JCI/Tyco submitted to the DNR in the GETS RADR (Wis. Adm. Code § NR 714.07).** These and other public communications should explain:

- The objectives and expected outcomes from the GETS interim action (e.g., in the GETS RADR JCI/Tyco includes the “Objectives and Expectations for the GETS” listed above).
- The operations and timeframe that JCI/Tyco expects to achieve those results (e.g., in the GETS RADR JCI/Tyco contemplates 30 years of operations).
- A groundwater and surface water monitoring program will be done by JCI/Tyco to evaluate the performance of the GETS and that the monitoring results will be submitted to DNR semi-annually in Wis. Adm. Code § NR 724.13(3) progress reports, which will also be available to the public on BRRTS.

¹ There is one reference to a 95% reduction in the groundwater flow model simulations presented in Appendix B. JCI/Tyco predicts that if the Site was left as is for 30 years, then 32.5% of PFAS currently in groundwater would upwell into surface water (0.51% Ditch A + 6% Ditch B + 26% wetlands); whereas, if the proposed GETS operates for 30 years, then only 1.6% of the PFAS currently in groundwater would upwell into surface water (0.51% Ditch A + 0.39% Ditch B + 0.72% wetlands). In effect, JCI/Tyco's model simulations predict that operation of the GETS for 30 years will reduce the amount of total PFAS upwelling to surface water by 95% = $(32.5 - 1.6)/(32.5)$. JCI/Tyco's model simulations predict that over 40% of total PFAS currently present in groundwater will remain in groundwater following 30 years of operation of the GETS.

NR 724 Monitoring Plan: JCI/Tyco submitted its Monitoring Plan in Appendix G of the GETS RADR. The DNR finds that the Monitoring Plan was prepared in accordance with Wis. Adm. Code § NR 724.17; is designed to measure the effects the GETS has on groundwater and surface water at the Site; and provides a summary of proposed surface and groundwater monitoring locations, sampling parameters and frequency, general performance objectives and reporting schedule. To finalize the Monitoring Plan, the DNR requires that JCI/Tyco incorporate the updates specified in **Attachment B** and summarized below.

- *Include a Commissioning Plan:*
Include a Commissioning Plan to cover the first 6 months of operations of the GETS that describes JCI/Tyco's plans for sequencing the startup of the extraction wells and treatment system, the monitoring and decision framework for selecting the extraction well pumping rates and treatment parameters and any stop conditions or contingency plans based on monitoring results (Wis. Adm. Code § NR 724.13(2)).
- *Update the Monitoring Network, Sampling Frequency and Reporting Schedule:*
Incorporate the revisions to the monitoring network, sampling frequency and reporting schedule that are specified in Attachment B. **Following completion of the startup phase, the DNR approves JCI/Tyco's request to submit the Wis. Adm. Code § NR 724.17 long-term monitoring data with the Wis. Adm. Code § NR 724.13(3) semi-annual progress reports.** This approved reporting schedule is included in **Attachments B and C.**
- *Specify Parameters and Tools for Reporting Outcomes from the GETS:*
Specify the parameters and tools (e.g., calculations, figures, charts, tables) that will be used to document outcomes of the GETS in the semi-annual progress reports. These outcomes are specific to the changes in groundwater and surface water conditions that occur in response to the GETS interim action. (The parameters that JCI/Tyco must use to measure the performance of the treatment system will be defined in the WPDES Permit.) Examples that align with DNR's expectations for reporting changes to groundwater and surface water conditions are included in **Attachment B.**

NR 724 O&M Plan and Construction Documentation Report: JCI/Tyco included a preliminary outline for the O&M plan in the RADR in accordance with Wis. Adm. Code § NR 724.09(9). Because refinements to the system design and final O&M plan are expected to occur during construction and commissioning of the GETS and because the Commissioning Plan prescribed above is intended to cover the first 6 months of operations, the DNR allows JCI/Tyco to submit the final O&M plan (Wis. Adm. Code § NR 724.13(2)) with the construction documentation report (Wis. Adm. Code § NR 724.15) within 120 days after the initial startup of the GETS. (Note that 120 days is an extension from the 60-day deadline listed in Wis. Adm. Code § NR 724.15(1) and JCI/Tyco should submit these milestone reports sooner if the final as-built conditions and operations are ready to document prior to this deadline extension.) In these reports, JCI/Tyco must document the handling and disposal of PFAS-impacted media generated during construction and operations of the GETS.

Technical Review Comments on the Remedial Design

JCI/Tyco proposed installing nine extraction wells located between the northeastern section of the FTC property and Ditch B and set approximately 50 feet below ground surface (bgs) in the unconsolidated aquifer. In accordance with Wis. Adm. Code § NR 814.09(4)(a) and (b), JCI/Tyco must apply for and receive approval to construct and operate high capacity wells² for the nine proposed extraction wells. The review provided in this letter relates to the remedial objectives of the GETS and does not constitute approval of the high capacity wells. Review and approval of high capacity well applications are issued under separate cover by DNR's Bureau of Drinking and Groundwater - Water Use Section.

² <https://dnr.wi.gov/topic/Wells/HighCap/Apply.html>

JCI/Tyco completed an aquifer yield test during its pre-design investigation on extraction well (EX-1) at rates of 25 gallons per minute (gpm) or higher, and with predicted drawdowns typically less than 3 feet at each extraction well. The pump test indicates high well efficiencies and that the aquifer is transmissive (700-800 ft²/day). The findings support that the aquifer can sustain the design flow rate of 225 gpm averaged over the nine extraction wells. The drawdown and radius of influence will vary by location, duration and rate of pumping and seasonal influences, and JCI/Tyco will measure drawdown at the extraction wells and monitoring well network as part of its Monitoring Plan.

JCI/Tyco also used its groundwater flow model to predict the aquifer response to pumping from extraction wells and used its solute transport model to compare the fate and transport of PFAS 30 years into the future with and without operations of the GETS. While general predictions taken from model simulations can be useful in conceptual design and planning for a remedial action, any specific estimates JCI/Tyco made from its model are considered preliminary. JCI/Tyco will measure actual change in conditions at the Site and evaluate the performance of the GETS as part of its Monitoring Plan (Wis. Adm. Code § NR 724.17).

JCI/Tyco used its groundwater flow model to predict the effect that the GETS will have on the water balance, groundwater-surface water interactions and surface water flow in Ditch B. There is uncertainty with the predictions of the model, and while many of these uncertainties can be addressed by physical monitoring after startup of the GETS, additional work could be done with the groundwater flow model prior to startup to improve the understanding of these surface water interactions and to refine final design and initial operating parameters for the GETS. (**Refer to DNR's letter dated April 9, 2021 for technical review comments on the Groundwater Flow and Solute Transport Model report.**) Suggestions and comments on the groundwater flow model for this application are as follows:

- Provide an explicit discussion of the water balance in Ditch B (a diagram would be helpful) and simulate seasonal changes in baseflow in the ditch with the model.
- JCI/Tyco used the existing regional-scale model to address local-scale questions without refinements to the focus area (e.g., grid resolution, lithology, recharge rates). Consider refining the model near the proposed extraction area or speak to the limitations of the model simulations without these refinements.
- Clarify if pump test results from extraction well EX-1 and the lack of drawdown observed in piezometer PZ-17S during pumping were used to further calibrate the model.
- Define the modeling assumptions for the connected linear network (CLN) used to simulate Ditch B. Explain whether surface waters from Ditch B were allowed to drain to the groundwater under the extraction scenarios, or whether the CLN module was configured to simply receive groundwater and route flows along the ditch, without drainage to the aquifer. These settings may be important for assessing capture and changes to groundwater flux in Ditch.

The remainder of DNR's technical review comments are organized based on JCI/Tyco's objectives for the GETS.

Objective: Reduce PFAS-mass flux throughout groundwater plume

JCI/Tyco's site investigation and pre-design investigation identified groundwater containing PFAS at concentrations greater than 10,000 ppt beneath the FTC, extending east toward Ditch B and to depths of approximately 50 feet bgs (e.g., perfluorooctanoic acid [PFOA] = 72,000 ppt in piezometer PZ-31 at 40 feet bgs).

JCI/Tyco's plan to construct groundwater extraction wells at the proposed locations to depths around 50 feet bgs is expected to remove PFAS mass from the groundwater and reduce the migration of PFAS in groundwater flowing eastward from the FTC. JCI/Tyco's long-term monitoring plan includes a network of monitoring wells

that will measure the groundwater capture zone and changes to PFAS concentrations over time in groundwater within the area of influence of the GETS.

The following are technical review comments for JCI/Tyco to consider in the final design and/or future modifications of the GETS. JCI/Tyco's design for the extraction wells and conveyance piping for the GETS appears flexible and able to adapt to future changes if required to optimize remedial outcomes.

- Extraction wells placed on the FTC property between the Outdoor Training Area and the north and eastern property boundaries could potentially remove more PFAS mass than the proposed extraction wells; however, adding more extraction wells in the current design may overwhelm the capabilities of treatment system, and moving extraction wells away from Ditch B would likely delay the response and improvement in surface water quality in the ditch. It is possible that the GETS operations will eventually reduce PFAS flux to Ditch B such that in the future pumping could be reduced along Ditch B and extraction wells could be added to address other areas of high concentrations of PFAS in groundwater on or around the FTC; potentially, this could be accomplished without the need to expand the treatment system.
- Extraction wells placed near the southern property boundary of the FTC could reduce migration of PFAS in this portion of the groundwater plume, but would likely remove less PFAS mass and have minimal if any improvement on Ditch B. It is possible that the GETS operations will eventually reduce PFAS flux to Ditch B such that wells along the southern side of the FTC could be added to control PFAS-mass flux in the southern section of the groundwater plume.
- Migration of PFAS in groundwater may be focused in preferential flow paths in the unconsolidated aquifer or near the weathered bedrock surface. Monitoring of groundwater flow conditions after startup of the GETS may determine that one or more extraction wells screened or focused in a preferential flow path are needed to achieve stable to decreasing concentration trends in the groundwater within the expected area of influence of the GETS.

Objective: Reduce upwelling of PFAS-contaminated groundwater into Ditch B

JCI/Tyco's pre-design investigation to characterize the groundwater-surface water interactions along Ditch B demonstrated that Ditch B is primarily a gaining stream, PFAS is present in the shallow groundwater (~ 3 feet bgs) below Ditch B (e.g., PFOA = 15,000 ppt in temporary piezometer GW-U03) and that the concentrations of PFAS increase significantly in the surface water between the upper and mid-reach sections of the ditch northeast of the FTC. These findings support JCI/Tyco's use of groundwater pumping near Ditch B between the upper and mid-reach sections of the ditch to reduce the upwelling of groundwater into the ditch. JCI/Tyco proposed the location of the extraction wells along the stretch of Ditch B where most of the upwelling of PFAS-contaminated groundwater was observed and included long-term monitoring to evaluate the groundwater flux and the PFAS concentrations in the surface water of Ditch B.

JCI/Tyco proposed to discharge the treated water into Ditch B at approximately 225 gpm at one outfall located near Pierce Avenue. The return of treated water into Ditch B near Pierce Avenue is expected to off-set reductions to water levels and flow in Ditch B that could occur when groundwater upwelling is reduced by the pumping from the extraction wells. JCI/Tyco's long-term monitoring program will measure the surface water flow and stage in Ditch B at fixed monitoring points, and adjustments to pumping and effluent discharge rates can be made as needed to minimize changes to flow conditions in the ditch.

The following are technical review comments for JCI/Tyco to consider in the final design and/or future modifications of the GETS. JCI/Tyco's extraction well pumping rate and system appears flexible and able to adapt to future changes if required to optimize remedial outcomes.

- The groundwater-surface water interactions in Ditch B may be subject to seasonal variations that were not observable during the fall pre-design study. JCI/Tyco plans to collect additional data in Ditch B in 2021 as part of its pre-startup monitoring and this data should be factored into the final design and operations of the GETS as needed to optimize remedial outcomes.
- Groundwater upwelling into Ditch B may not be the only source of PFAS to surface water in the ditch. PFAS may also enter surface water flowing in Ditch B from wetland and stormwater runoff, sediment loads and shallow seeps in the hyporheic zone. If these other potential contributions are significant sources of PFAS, then the GETS may not reduce the PFAS concentrations in Ditch B to achieve target concentrations that would allow the operations of downstream Ditch B treatment system to cease, as proposed in the GETS RADR. Modifications to the GETS and/or additional response actions may be needed to further reduce the concentrations of PFAS in Ditch B.
- The extraction wells that are screened at approximately 50 feet bgs may not reduce upwelling along the full extent of Ditch B in the anticipated capture zone. For example, the lack of drawdown in piezometer PZ-17S observed during the pump test may indicate a low permeability zone in the shallow soils that could limit the ability for the deeper extraction wells to control the shallow groundwater flux in Ditch B at some locations. Modifications or shallower extraction wells may be needed if upwelling into the ditch cannot be consistently controlled by pumping from the proposed extraction wells.

Objective: Treat the recovered groundwater to reduce concentration of PFAS

JCI/Tyco proposed to treat the PFAS contaminated groundwater in a building to be constructed on the FTC property and to discharge the treated effluent to Ditch B. The treatment design and the monitoring of the treated effluent will be regulated under a WPDES General Permit³ in accordance with Wis. Adm. Code § NR 205.08(1)(b). The review provided herein does not constitute an approval of the treatment design or a permit for discharge of treated groundwater; these will be issued by DNR's Water Quality Program based on JCI/Tyco's application for coverage under the General Permit for Treatment of Contaminated Groundwater. The discharge criteria and monitoring requirements for the treated effluent will be defined in the coverage letter for the WPDES permit.

JCI/Tyco included the groundwater treatment plans in the GETS RADR as required under Wis. Adm. Code ch. NR 724 to document all components of the remedial design and to demonstrate its intent to comply with all applicable laws and standards for the interim action. The DNR's review of the GETS RADR finds that JCI/Tyco selected technologies proven to be successful for PFAS removal from groundwater and designed an advanced groundwater treatment system appropriate for the scale of the proposed GETS application.

JCI/Tyco incorporated some flexibility into the design of the treatment system that will allow for future modifications if needed to optimize performance and/or incorporate advancements in treatment technologies. Because the available technologies for PFAS remediation may improve in the future and because the current approach to groundwater treatment will require frequent changeout and disposal/regeneration of spent materials, JCI/Tyco must continue to evaluate best available technologies as new treatments for PFAS emerge to determine if modifications to the current treatment system are needed to optimize performance and/or sustainability (Wis. Adm. Code § NR 722.09).

³ When applying for the WPDES permit, JCI/Tyco is reminded to list all the petroleum volatile organic compounds (PVOCs) and chlorinated volatile organic compounds (CVOCs) in groundwater (BRRTS 03-38-001345) extending from the FTC, which are comingled with the PFAS in the groundwater within the capture zone of the proposed extraction wells.

Next Steps and Conclusions:

The DNR thanks JCI/Tyco for its submittal of the GETS RADR and its plans to implement an interim action designed to reduce the migration of PFAS in groundwater and surface water from the FTC and to remove PFAS mass from the environment at the Site. **JCI/Tyco may proceed with the implementation of the GETS interim action subject to the conditions of approval presented in this letter, including the required revisions to the Monitoring Plan in Attachment B and the schedule provided in Attachment C.**

JCI/Tyco is reminded that it must complete the site investigation per Wis. Adm. Code ch. NR 716 and develop remedial goals for the Site per Wis. Adm. Code ch. NR 722. One or more actions (in addition to the GETS) may be needed to achieve the remedial goals at the Site. Closure under Wis. Adm. Code ch. NR 726 is not achievable while active remedies like the GETS require operation and maintenance.

As a reminder, this Site is subject to an enforcement action and therefore all submittals to the DNR under Wis. Adm. Code chs. NR 700-799 and submittals directed by the DNR must be accompanied by an Wis. Adm. Code ch. NR 749 fee per Wis. Stat. § 292.94. These fees are not pro-ratable or refundable per Wis. Adm. Code § NR 749.04(1). If you have any questions about whether to include a fee with a submittal, please contact DNR staff prior to submitting a document without a fee.

The DNR appreciates your efforts to investigate and remediate this Site. If you have any questions about this letter, please contact me, the DNR Project Manager, at (608) 622-8606 or Alyssa.Sellwood@wisconsin.gov.

Sincerely,



Alyssa Sellwood, PE
Complex Sites Project Manager
Remediation & Redevelopment Program

Attachments: Attachment A: Figures Referenced from the GETS RADR
Attachment B: Required Revisions to the GETS Long-term Monitoring Plan
Attachment C: Schedule and Submittal Summary

cc: Scott Potter, Arcadis (via email: Scott.Potter@arcadis.com)
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Jodie Peotter, DNR (via email: Jodie.Peotter@wisconsin.gov)

Attachment A: Response to GETS RADR
BRRTS #02-38-580694

Figures Referenced from JCI/Tyco's GETS RADR

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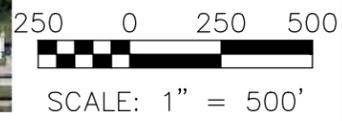
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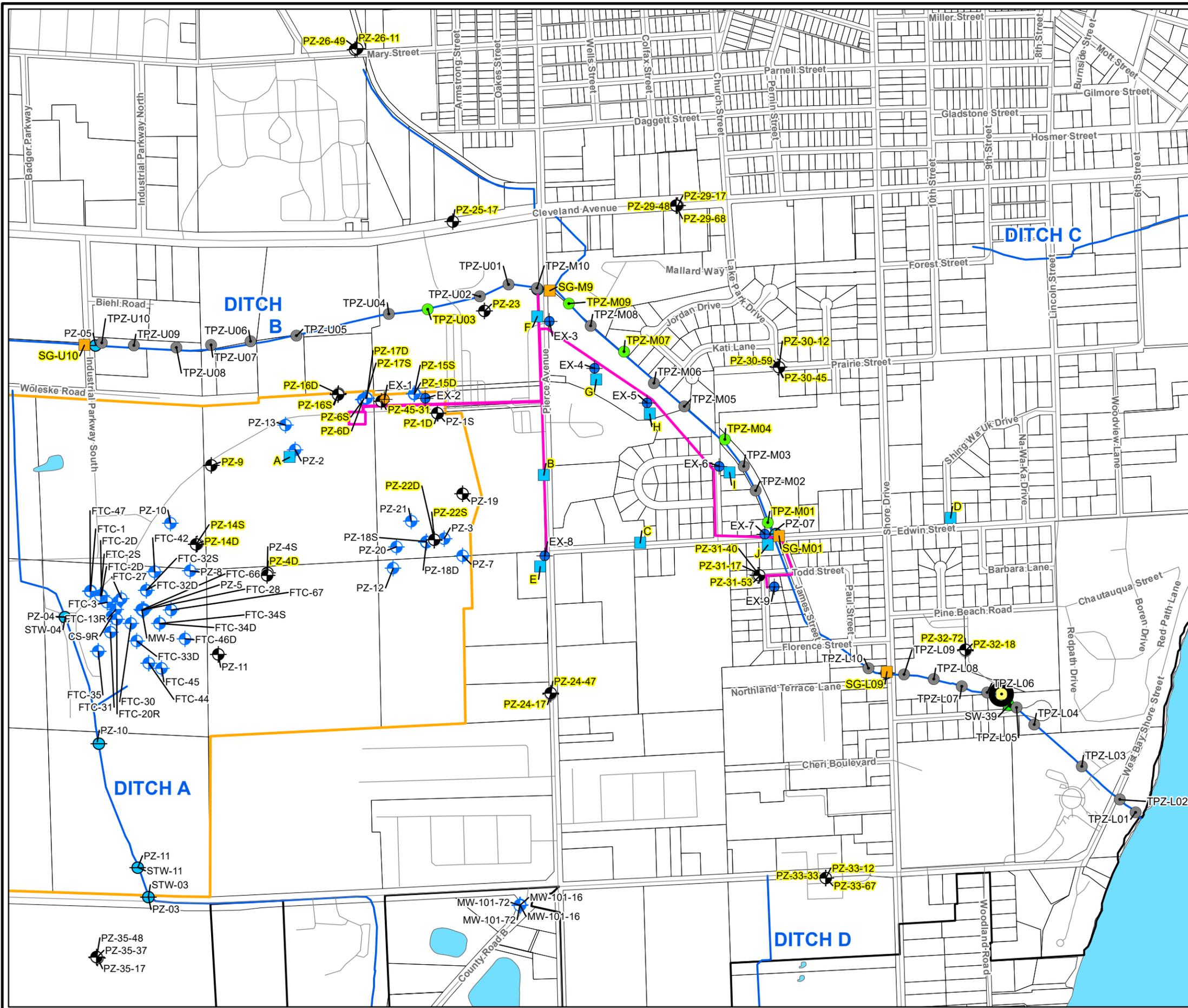
-  EXTRACTION WELL
-  BELOW-GRADE GROUNDWATER EXTRACTION UTILITY INFRASTRUCTURE ROUTE
-  BELOW-GRADE TREATED EFFLUENT DISCHARGE LINE ROUTE
-  APPROXIMATE LIMITS OF DITCH B

NOTE:
AERIAL MAPPING SOURCE ©2020 MICROSOFT CORPORATION, NAD83 WISCONSIN STATE PLANES, CENTRAL ZONE, US FEET.

TYCO FIRE TECHNOLOGY CENTER
MARINETTE, WISCONSIN

GROUNDWATER EXTRACTION AND TREATMENT SYSTEM (GETS) INTERIM REMEDIAL ACTION SITE PLAN





LEGEND:

- PROPOSED STAFF GAUGE LOCATION
- PROPOSED PIEZOMETER LOCATION
- OBSERVATION WELL LOCATION
- MONITORING WELL
- PROPOSED MINI-PIEZOMETER LOCATION
- FORMER TEMPORARY PIEZOMETER
- EXISTING EXTRACTION WELL
- PROPOSED EXTRACTION WELL
- APPROXIMATE SITE PROPERTY BOUNDARY
- APPROXIMATE MARINETTE CITY BOUNDARY
- PARCEL BOUNDARY
- ROAD
- DITCH/STREAM
- GROUNDWATER EXTRACTION TREATMENT SYSTEM
- WATERBODY
- DITCH B TREATMENT SYSTEM
- CONTINUOUS STAGE/FLOW (INFLUENT DITCH B TREATMENT SYSTEM)

PZ-29-68 = PROPOSED GROUNDWATER OR SURFACE WATER GAUGING LOCATION

- NOTES:**
1. CITY BOUNDARY DATA SOURCE: WISCONSIN LEGISLATIVE TECHNOLOGY SERVICES BUREAU, WISCONSIN COUNTY CLERKS AND LAND INFORMATION OFFICES, ACCESSED FALL 2017.
 2. DITCH/STREAM AND WATERBODY DATA SOURCE: U.S. GEOLOGICAL SURVEY NATIONAL HYDROGRAPHY DATASET, ACCESSED FALL 2017.
 3. ROAD DATA SOURCE: OPEN STREET MAP, ACCESSED FALL 2017.
 4. TPZ-U10 AND TPZ-L10 WILL BE SAMPLED AS A SURFACE WATER LOCATION ONLY. THE MINI-PIEZOMETER WILL NOT BE SAMPLED.

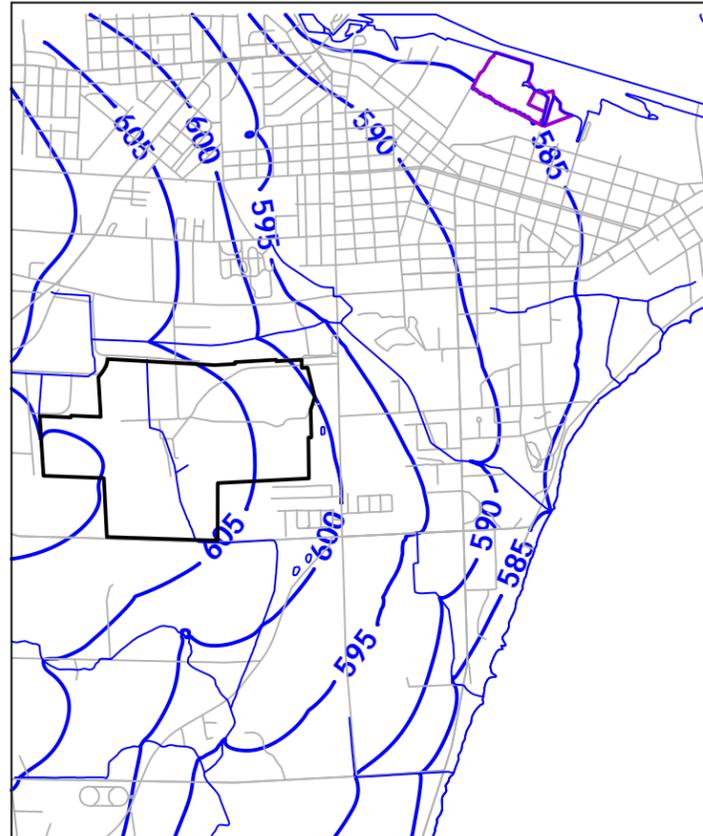


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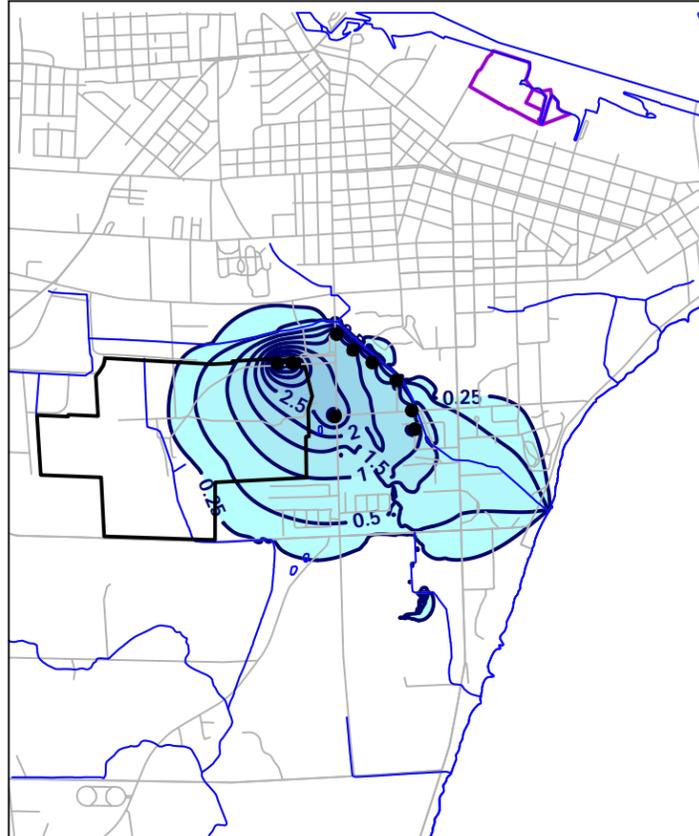
GETS MONITORING LOCATIONS

FIGURE
5-1

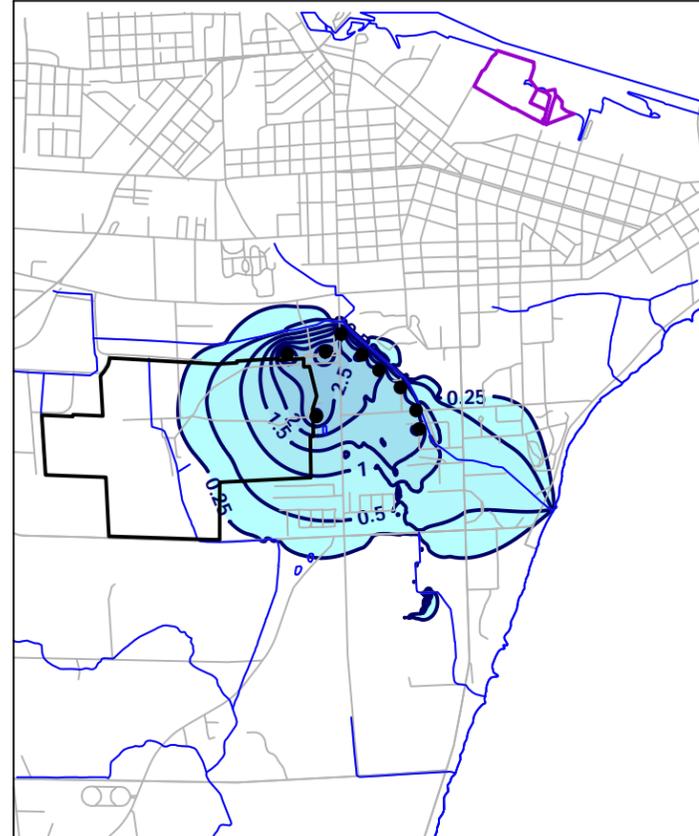
**Baseline
(No Active Groundwater Remediation)**



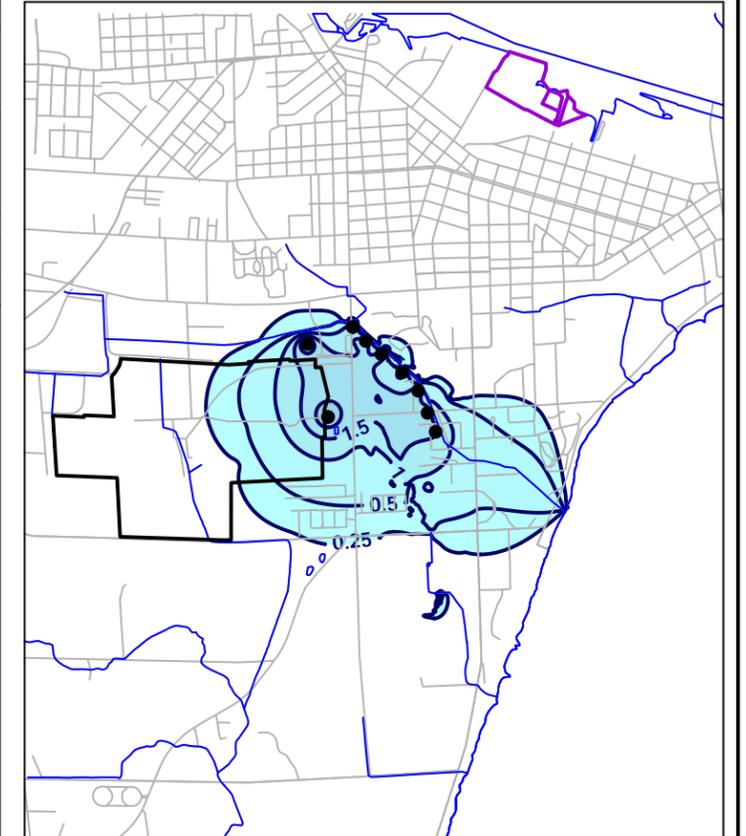
Design A Drawdown



Design B Drawdown



Design C Drawdown

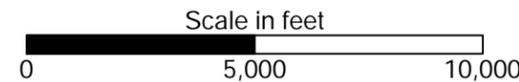


Legend

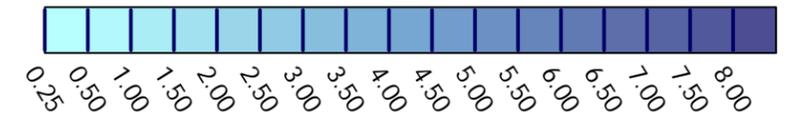
- FTC Site Area
- Stanton St. Site Barrier Walls
- Ditches/Streams
- Groundwater Extraction Well
- 585- Simulated Groundwater Elevation (ft NAVD88)

Notes:

1. ft = feet elevation
2. Each panel is a zoom in of a portion of the study area.
3. Water table drawdown is relative to baseline.



Simulated Water Table Drawdown (ft)



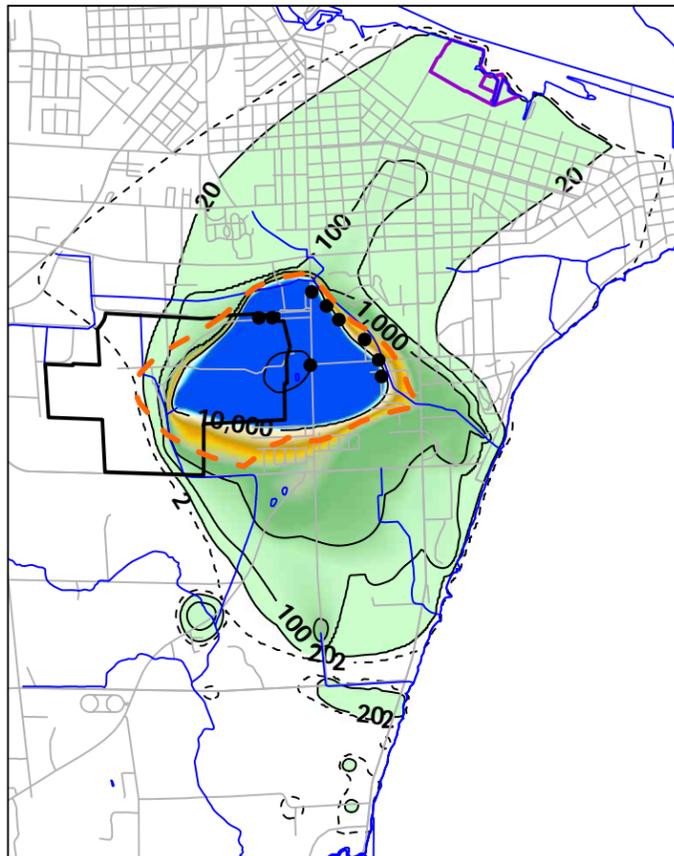
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CHANGES IN SIMULATED WATER TABLE
ELEVATIONS FOR EACH DESIGN

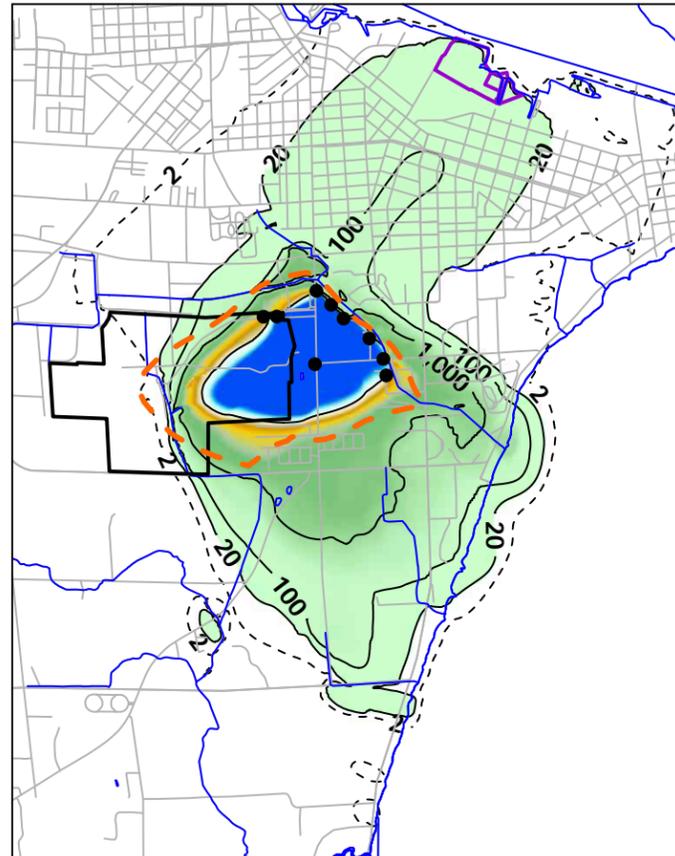


FIGURE
B-5

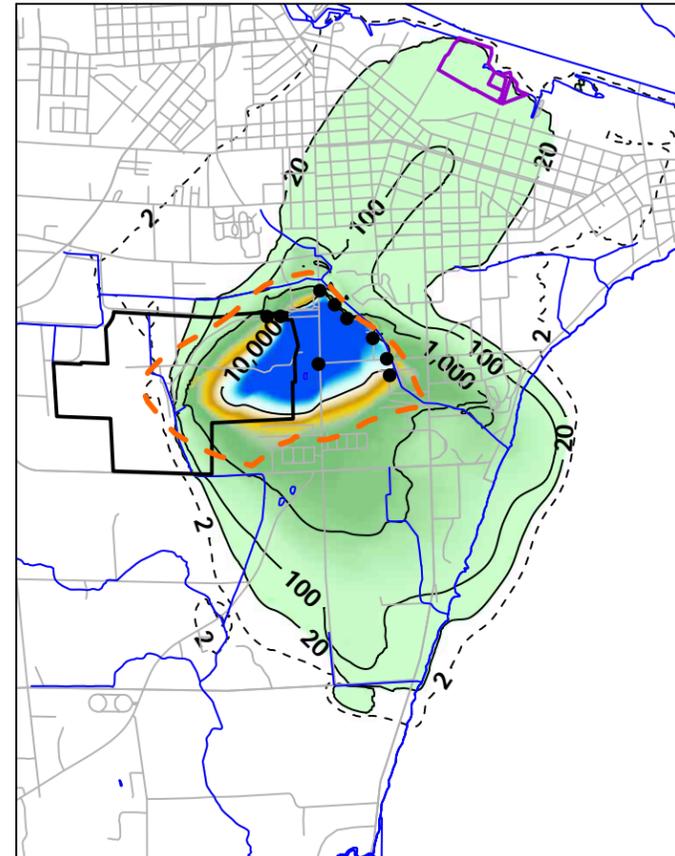
Year 0



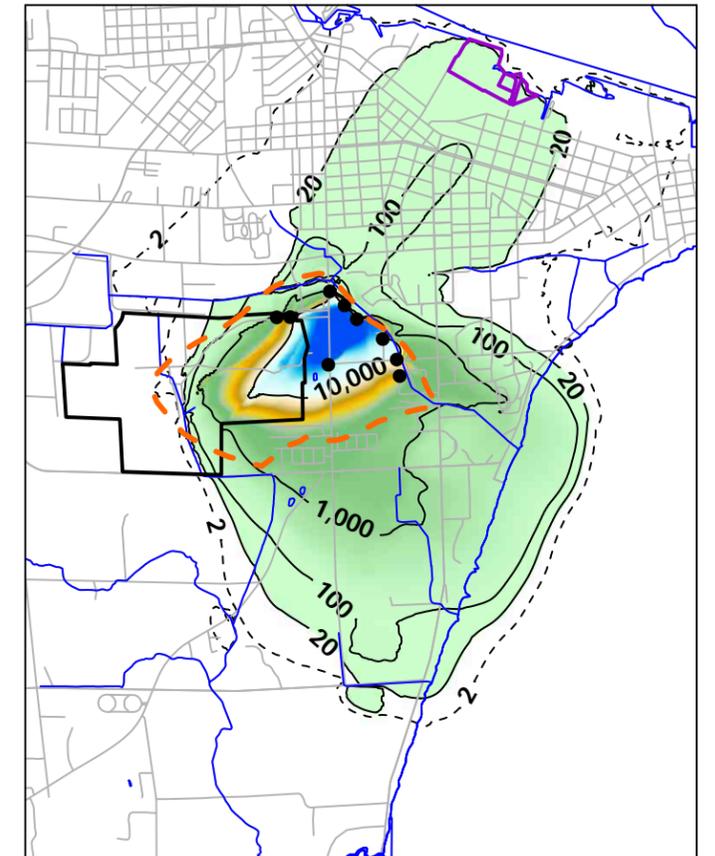
Year 10



Year 20



Year 30



Legend

- FTC Site Area
- Stanton St. Site Barrier Walls
- Ditches/Streams
- Groundwater Extraction Well
- Remediation Focus Area

Notes:

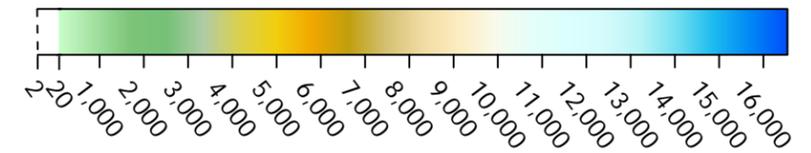
1. PFOA = perfluorooctanoic acid
2. PFOS = perfluorooctanesulfonic acid
3. ng/L = nanograms per liter
4. ft = feet elevation
5. Each panel is a zoom in of a portion of the study area.
6. The PFOA + PFOS concentration for each panel represents the maximum concentration for all model layers.



Scale in feet



PFOA+PFOS Concentration (ng/L)



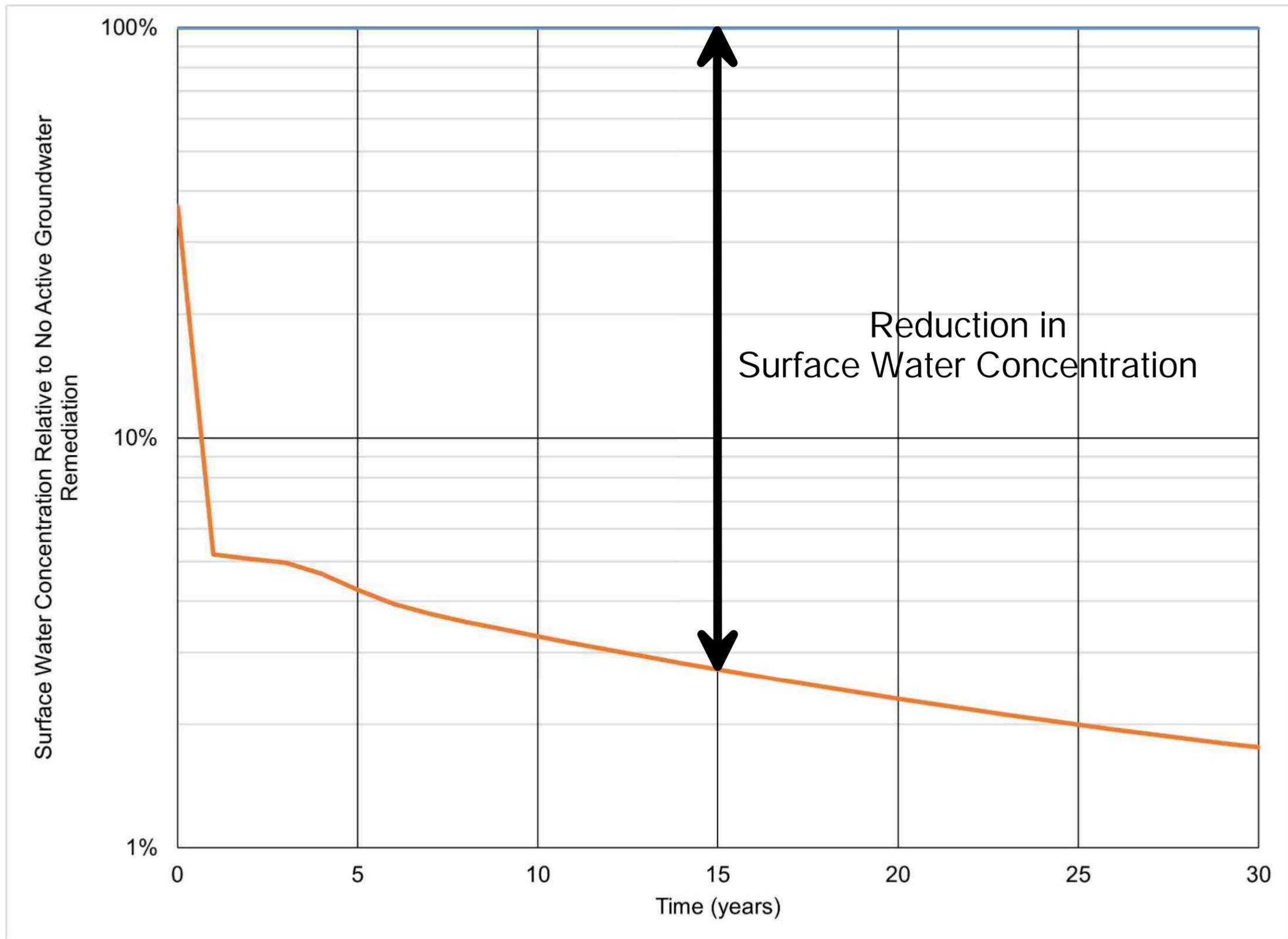
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MARINETTE, WISCONSIN

TOTAL PFOA AND PFOS PLUME EVOLUTION
OVER TIME: DESIGN A

DRAFT - Privileged and Confidential/Attorney Client Communication Prepared Under Direction of Counsel



FIGURE
B-8



- No Active Groundwater Remediation (Baseline)
- Design A

TYCO FIRE TECHNOLOGY CENTER MARINETTE, WISCONSIN	
PFOA + PFOS SURFACE WATER CONCENTRATION RELATIVE TO NO ACTIVE GROUNDWATER REMEDIATION (BASELINE)	
ARCADIS <small>Design & Consultancy for natural and built assets</small>	FIGURE B-15

Required Revisions to the GETS Monitoring Plan

JCI/Tyco submitted a Long-Term Monitoring Plan (Monitoring Plan) for the GETS as Appendix G in the GETS RADR in accordance with Wis. Adm. Code § NR 724.17. The Monitoring Plan provides a detailed summary of proposed surface water and groundwater monitoring locations, sampling parameters and frequency, general performance objectives and a reporting schedule.

The Monitoring Plan is separated into four phases.

- **Pre-Startup:** Establish baseline conditions and evaluate seasonal changes in Ditch B; includes all sampling and reporting described above.
- **Startup Phase** (first 6 months of operation): Evaluate, troubleshoot, and optimize system operations; includes all sampling and reporting described above.
- **Short-Term Phase** (6 months to 2 years after initial startup): Evaluate performance of the interim action relative to remedial objectives and optimize operations; includes all sampling and reporting described above.
- **Long-Term Phase** (remaining years of operations of the GETS): Evaluate performance relative to remedial objectives and optimize operations, with less frequent monitoring and/or a revised monitoring program. (The long-term plan is designed to cover the lifespan of the GETS, but modifications are anticipated in the future based on the short-term monitoring results).

The Monitoring Plan is designed to test the following conditions to evaluate effects of the interim action:

- **Ditch B:** PFAS concentrations in surface water; stream flow; stream stage; and groundwater levels beneath the stream bed.
- **Extraction Wells:** PFAS concentrations, pumping rates, and groundwater levels in each well.
- **NR 141 Monitoring Wells:** PFAS concentrations, water quality parameters, and groundwater levels.

JCI/Tyco proposed to report the results from the testing completed under the Monitoring Plan with the semi-annual Operation and Maintenance (O&M) progress reports submitted under Wis. Adm. Code § NR 724.13(3).

Revision Required to the GETS Monitoring Plan

The DNR reviewed the GETS Monitoring Plan and agrees with the phased-monitoring approach, broad objectives and much of the monitoring network and parameters proposed. The revisions listed below are required as a condition of DNR's approval of the GETS RADR.

Once the revisions are made, submit the revised Monitoring Plan to the DNR for review and approval. The Monitoring should be submitted as a Wis. Adm. Code § NR 724.17 long-term monitoring plan with the associated review fee per Wis. Adm. Code ch. NR 749. For clarity, the DNR recommends naming the plan something like "*GETS Monitoring Plan: Startup through Initial Years of Operation*".

Revision 1: Include a Commissioning Plan:

JCI/Tyco suggested that it intends to phase-in pumping from each of the extraction wells to allow time to refine the treatment system and to optimize groundwater pumping rates. The DNR agrees with this concept as it is likely to improve outcomes and performance of the GETS during the initial operations. Although the DNR understands this to be JCI/Tyco's intended plan, the phased startup to groundwater extraction and evaluation of the treatment system are not explicitly described in the GETS RADR, the GETS Monitoring Plan or the preliminary O&M plan.

Required Revisions to the GETS Monitoring Plan

Include a Commissioning Plan in the GETS Monitoring Plan to cover the commissioning through first 6 months of operations of the GETS and that incorporates elements from Wis. Adm. Code § NR 724.13, including:

- Plans for sequencing the startup of the extraction wells and treatment system,
- A monitoring and decision framework for selecting the extraction well pumping rates and treatment parameters and any stop conditions or contingency plans based on monitoring results.
- Decision criteria based on monitoring of the influent and effluent from the treatment system and the response measured in the surface water and groundwater monitoring network.

The Commissioning Plan is an addition or supplement to the startup phase of monitoring for groundwater and surface water that JCI/Tyco has included in the Monitoring Plan.

Revision 2: Update the Monitoring Well Network:

The required updates to the groundwater monitoring network are as follows:

- Construct a new well near piezometer PZ-22S/-22D to a depth of approximately 52 ft bgs with a 5-foot well screen; include as part of sampling plans for water level gauging and baseline and semi-annual PFAS sampling.
- Add existing monitoring wells PZ-1S and PZ-15S into the baseline and quarterly PFAS sampling. Include both wells in the water-level gauging.
- Collect groundwater samples for PFAS from the five temporary piezometers proposed for Ditch B (TPZ-U03, TPZ-M09, TPZ-M07, TPX-M04, and TPZ-M01). Collect the samples concurrent with the surface water samples and the water-level measurements at these locations.

Revision 3: Update the Sampling Frequency:

The required updates to the sampling frequency schedule are as follows:

- ***Pre-Startup:*** No changes.
- ***Startup Phase:*** Incorporate two changes to the sampling frequency during this phase.
 - Increase the PFAS sampling frequency to monthly for each extraction well after pumping is initiated in that well.
 - Add a contingency plan to gauge water-levels in the mini-piezometers and sample groundwater and surface water in Ditch B when groundwater pumping from the GETS is stopped for 24-hours or more. The contingency sampling must be done in addition to the sampling scheduled to occur when the GETS is operating. (If multiple stoppages are needed in a month, only one contingency sample event is required for that monthly period.)
- ***Short-Term Phase:*** For wells scheduled to be sampled annually for PFAS, increase the sampling frequency to semi-annually.
- ***Long-Term Phase:*** Because modifications to this phase of monitoring are expected in the future, no comments are provided to the sampling frequency in the long-term phase as this time. (See below for the requirement to submit a revised long-term monitoring plan following completion of the short-term phase.)

Required Revisions to the GETS Monitoring Plan

Revision 4: Update the Reporting Schedule:

The required updates to the reporting schedule are described below and are also summarized in **Attachment C**.

- **Pre-Startup:** Provide the DNR with a data package of the pre-startup monitoring results at least 15-days prior to initiating operations of the GETS. Include a summary of the flow and stage measurements for Ditch B in the submittal. Present the data in summary tables that can be updated with future monitoring data. Describe how results affect the basis of design or proposed operations for the GETS and use the data as baseline data from which to compare the monitoring results collected after startup of the GETS.
- **Startup Phase:** Provide the DNR with startup progress reports during the Startup Phase. Submit **weekly** for the first 8 weeks and **monthly** thereafter through the end of the Startup Phase (anticipated to end 6 months after initiating operations of the GETS). Include a summary of the O&M; any operational challenges, modifications or contingency actions taken during the reporting period; and any monitoring data collected/received during the reporting period. The startup progress reports do not require a Wis. Adm. Code ch. NR 749 review fee, and separate data notifications to DNR are not required if the data is included in the startup progress reports.
- **Short-Term Phase:** After completion of the Startup Phase, **the DNR approves JCI/Tyco's request to submit the Wis. Adm. Code § NR 724.17 long-term monitoring data with the semi-annual O&M progress reports per Wis. Adm. Code § NR 724.13(3)**. JCI/Tyco should number the semi-annual progress reports sequentially starting with #1 for the first semi-annual report. JCI/Tyco is not required to use Form 4400-194 for the progress reports. The semi-annual progress reports must include the performance parameters approved for use in reporting outcomes from GETS (see below).
- **Long-Term Phase:** It is likely that modifications to the monitoring program and some performance metrics will be needed based on the results from the short-term phase monitoring. **At the completion of the short-term phase, submit an updated Monitoring Plan specific to the long-term phase of the monitoring.** Continue to complete the short-term phase of the plan until the DNR reviews and approves the updates to the long-term monitoring plan.

Revision 5: Specify Performance Parameters and Tools for Reporting Outcomes from the GETS:

Specify the parameters and tools (e.g., calculations, figures, charts, tables) that will be used to document outcomes of the GETS in the semi-annual progress reports. These outcomes are specific to the changes in groundwater and surface water conditions that occur in response to the GETS interim action. (The parameters that JCI/Tyco must use to measure the performance of the treatment system will be defined in the WPDES Permit.) At the end of the short-term phase of monitoring, JCI/Tyco may propose revisions to the parameters and tools used to document outcomes when it submits the revised long-term monitoring plan.

Examples that align with the DNR's minimum expectations are as follows:

- Document reductions in groundwater upwelling in the upper, middle and lower reaches of Ditch B.
 - Summarize the head differential in groundwater and surface water at each mini-piezometer and include the average effluent discharge rate and stream flow rate recorded on the day measurements were collected.
 - Summarize the daily average total flow rate in Ditch B together with the daily average effluent discharge rate and stream gauge measurements (when available).
 - Identify locations or conditions contributing to any observed upwelling in Ditch B.

Required Revisions to the GETS Monitoring Plan

- Monitor and assess groundwater migration from the FTC.
 - Summarize water levels measured in the monitoring well and surface water monitoring networks.
 - Include figure(s) showing measured groundwater levels and capture zones.
 - Include at least one cross-section through Ditch B that shows extraction well(s), measured groundwater levels and the extent of the capture zone.

- Document where PFAS concentrations in surface water in Ditch B are reduced.
 - Summarize the groundwater and surface water concentrations for all PFAS analyzed at each mini-piezometer location.
 - Summarize the perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) concentrations and flow rate measured in surface water and the PFOA and PFOS concentrations and flow rate measured in the treated effluent on or about the same day.
 - Include a figure with one or more sets of measurements of surface water flow rates and concentrations of PFOA and PFOS and include the treated effluent measurements from or about the same day.
 - Include trend plot(s) of the stream flow rate and PFOA and PFOS concentrations measured at the influent downstream Ditch B Treatment System location for the reporting period.
 - Identify locations or situations contributing to potential increases observed in PFAS concentrations in Ditch B.

- Document whether PFAS concentrations in groundwater are stable to decreasing.
 - Provide a table summarizing PFAS concentrations over time in each monitoring well.
 - Provide trend plots for concentrations of certain PFAS in each monitoring well. Suggested PFAS include: PFOA, PFOS, perfluorohexanoic acid (PFHxA), 6:2 fluorotelomer sulfonic acid (FTSA).
 - Include an isoconcentration map and a cross-section through the capture zone with the most recent available data. These may be limited to PFOA for the semi-annual progress reports.

- Track PFAS mass¹ removal over time in each extraction well (as needed to make decisions on system optimization and sustainability).
 - Summarize the average operating flow rate, run time, and volume of groundwater removed per month in each extraction well.
 - Calculate an estimate of PFAS mass extracted from each well for the reporting period based on total volume removed and measured PFAS concentration(s) in each well. Include a running total of the cumulative estimated mass of PFAS extracted from each well since startup.
 - Provide trend plots of the cumulative mass of PFAS pumped from each well since startup.

- Track PFAS mass¹ of captured and removed by the GETS (as needed to make decisions on system optimization and sustainability).
 - Summarize the volume of groundwater captured by the GETS and discharged by the GETS per reporting period and cumulative total volume treated since startup.
 - Summarize the influent and effluent concentrations from the GETS treatment system during the reporting period.

¹ PFAS mass = Sum of all PFAS detected or mass per detected compound for laboratory analysis for 36 PFAS.

Required Revisions to the GETS Monitoring Plan

- Calculate an estimate of PFAS mass captured and removed by the GETS during the reporting period and a cumulative total of PFAS mass captured and removed since startup.
- Provide a trend plot of the cumulative of PFAS captured and removed by the GETS since startup.
- Provide an estimate of PFAS mass remaining in the groundwater at the Site.
- Evaluate sustainability of the GETS operations in accordance with Wis. Adm. Code § NR 722.09(2m).
 - Summarize the run time and downtime of the GETS during the reporting period.
 - Include estimate of energy use by GETS per reporting period and cumulative total.
 - Include summary of carbon regeneration volume/mass per reporting period and cumulative total.
 - Include summary of disposal volume/mass for filters and ion exchange resin per reporting period and cumulative totals.

Schedule and Submittal Summary

The following table summarizes the schedule of certain requirements identified in the DNR’s conditions of approval of the GETS RADR and is organized based on the phases of monitoring that JCI/Tyco identified in its Wis. Adm. Code § NR 724.17 Long-Term Monitoring Plan (“Monitoring Plan”) for the GETS.

Action Item	Schedule	NR 749 Fee?
<u>Pre-Startup Phase</u>		
Implement Pre-Startup monitoring	Spring 2021 – Fall 2021	
Submit a revised Monitoring Plan (Wis. Adm. Code § NR 724.17) <i>Incorporate a Commissioning Plan and the revisions specified in Attachment B</i>	Due July 17, 2021	✓
Host a public meeting and update the GETS factsheets to share objectives, expected outcomes and monitoring that align with the information presented in the GETS RADR (Wis. Adm. Code § NR 714.07)	At least 30 days prior to Startup Phase	
Submit Pre-Startup monitoring data	At least 15 days prior to Startup Phase	
<u>Startup Phase¹</u>		
Start operations of the GETS	After JCI/Tyco has obtained all necessary permits and approvals and construction is complete.	
Implement the Commissioning Plan and complete the Startup Phase of monitoring	Duration of at least 6 months after starting operations of the GETS ¹	
Submit startup phase progress reports ² <i>Include a brief summary of the O&M and any data collected/received during the reporting period.</i>	Weekly for 8 weeks, then monthly until Startup Phase is complete ¹	
Submit a final O&M plan (Wis. Adm. Code § NR 724.13) with the construction documentation report (Wis. Adm. Code § NR 724.15)	120 Days after starting operations of the GETS	✓
<u>Short-Term Phase</u>		
Implement the Short-Term Phase of monitoring	Initiate after Startup Phase is complete ¹	
Submit NR 724.13(3) progress reports ² <i>Include summary of the O&M and the parameters approved to document outcomes of the GETS from the Monitoring Plan</i>	Semi-Annually (Submit progress report #1 approximately 6 months after starting operations of the GETS)	✓
Submit a revised Monitoring Plan (Wis. Adm. Code § NR 724.17) specific the Long-Term Phase of monitoring	Approximately 2 years after starting operations of the GETS and following progress report #4	✓
<u>Long-Term Phase</u>		
Implement the Long-Term Phase of monitoring	After the revised Monitoring Plan is approved	
Submit NR 724.13(3) progress reports ² <i>Include summary of the O&M and the parameters approved to document outcomes of the GETS from the revised Monitoring Plan</i>	Semi-Annually	✓

Footnotes:

¹ The Startup Phase is not to be less than 6 months but could be longer if JCI/Tyco is still implementing its Commissioning Plan to refine operations of the GETS.

² The progress reports do not require use of Form 4400-194.