



February 11, 2026

Anjuman, A. Islam
Executive Director
Racine Water Utility
100 Hubbard Street
Racine, Wisconsin 53402

Subject: Letter Proposal for Raw Water Treatment Efficiency Study

Dear Anjuman,

CDM Smith Inc. (CDM Smith) is pleased to submit this proposal to conduct a study-phase evaluation of the effectiveness of current and potentially proposed treatment practices in addressing PFAS contamination and taste and odor (T&O) concerns, utilizing powdered activated carbon (PAC) and potassium permanganate (KMnO₄ or permanganate). Contractually, this scope would serve as an amendment to Contract No. 310549, the Chlorine Conversion Study.

Project Understanding

The Racine Water Utility (RWU) currently employs conventional and advanced treatment processes to produce safe drinking water from Lake Michigan, including coagulation, flocculation, sedimentation, dual-media filtration, ultrafiltration membranes, and disinfection with free gaseous chlorine. RWU also introduces fluoride for dental health and phosphate for corrosion control, while continuously monitoring water quality to comply with federal and state regulations.

However, emerging contaminants such as PFAS (per- and polyfluoroalkyl substances) and periodic T&O issues present challenges that may not be fully addressed by existing treatment practices. RWU currently feeds permanganate to the raw water to control T&O. A powdered activated carbon (PAC) system was installed, started up and commissioned following significant T&O issues experienced in the late 1990's, though these issues did not return for over 20 years and the system was never regularly activated due to infrequent recurring T&O issues. However, significant T&O issues occurred in summer 2025 for the first time since installation of the PAC system. The effectiveness of PFAS removal from RWU source water using PAC has not been previously evaluated as the original system was designed and constructed based on typical T&O values and concentrations for Lake Michigan.

To ensure continued compliance, public health protection, and customer satisfaction, RWU is requesting a review of its existing T&O treatment processes, as well as complete a demonstrative study to evaluate the performance of currently installed technologies to reduce PFAS contamination and T&O concerns. The findings will inform potential process improvements and guide future investments.

The previous PAC system design was conducted based upon the performance observed during pilot testing of PAC added directly to the membrane system for the control of T&O compounds. While encouraged by membrane system suppliers at the time, this method of operation with PAC feed directly to the membranes is no longer encouraged. The previous testing did not consider the feed of PAC to the raw water. The previous testing also did not consider the removal of PFAS, as the levels of PFAS in Lake Michigan are below the levels of detection that were available at the time. We understand that the PAC system was not utilized after commissioning due to improved water quality in Lake Michigan which limited the occurrence of seasonal T&O events that previously had occurred frequently. The PAC Human-Machine Interface (HMI) was previously removed, but RWU has reached out



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to the manufacturer for a potential replacement. RWU desires an implementable solution for T&O concerns for summer 2026 while the PFAS PAC solution could have a longer implementation timeframe.

In addition, RWU plans to install a raw water monitoring system, where it would monitor Total Organic Carbon (TOC), Chlorophyll A, and pH. The system would be located at the permanganate distribution location at Bunker Hill. The raw water monitoring system would not be part of this proposed Study.

CDM Smith is currently performing a study to evaluate options to upgrade the chlorination process at RWU. Given the process relationships between these chemical additions, outcomes from the Chlorine Conversion Study will be considered and incorporated into this study. In addition, the future design and construction implementation project will address the recommended chlorine, PAC, permanganate, and PFAS treatment system upgrades. The design and construction of all recommendations under a single project will be the most efficient means of implementation. A task to review, assess, and achieve operational functionality, including potential relocation of the PAC injection point, will be completed prior to summer 2026 to immediately address potential T&O concerns.

Scope of Work

Task 1 – Project Management and Meetings

CDM Smith will facilitate an in-person kickoff meeting to discuss existing treatment capabilities, current status, required information, and to concur on overall study objectives including the intended bench-scale testing program. Ongoing project management activities will include project communications, submittal of monthly invoices and progress reports, as well as updates to project scheduling and team coordination.

Task 2 – Review of Current Practices

CDM Smith will conduct a comprehensive review of RWU's existing raw water quality and evaluate existing permanganate and PAC treatment capabilities and injection points for reducing T&O compounds as well as PAC for addressing PFAS contamination.

CDM Smith understands that RWU has a fair amount of historical data regarding PFAS and T&O concerns that will be provided and leveraged, based on the initial PAC concentration and injection point. CDM Smith will also leverage our PAC industry knowledge and expertise in recommending a potential revised concentration and injection point.

The review will begin with benchmarking RWU's current treatment practices against industry standards and best practices for PFAS removal and T&O control; focused on the existing permanganate and PAC systems.

- Permanganate: Analyze historical dosing data, sampling protocols, test results, online analyzer performance, and reporting practices.
- PAC: Examine the previously designed capacity and delivery concentrations, current condition of PAC systems, application points, and operational effectiveness.
- Water treatment operations: Evaluate any seasonal operational processes (e.g., flushing or recycle processes).

Additionally, CDM Smith will assess the existing application points for permanganate to optimize treatment effectiveness and provide recommendations for any modifications or adjustments. Physical and chemical limitations of permanganate and PAC will be considered and incorporated into this evaluation.



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Results of the review will be summarized in a **Technical Memo – Review of Current Practices** and discussed with RWU in a workshop meeting.

Task 3 – PAC System Operation and Injection Point Relocation

CDM Smith will determine requirements to achieve operational status for the existing PAC system, recommend relocation of the PAC injection point, and design any required PAC system operational improvements including relocation of the injection point. This effort may include coordination with the PAC system vendor to achieve operational status of the system. While the existing PAC system has been permitted for operation by the Wisconsin Department of Natural Resources (WDNR), the system has not been routinely operated since implementation, and the injection point will need to be relocated due to revised industry recommendations for PAC dosage upstream of membrane filters. CDM Smith will summarize this work in a **Technical Memo – PAC System Recommendations** and meet with RWU to discuss and confirm approach in a workshop meeting.

CDM Smith will coordinate with WDNR regarding any requirements for permit compliance for the reactivation of the PAC system, including the injection point relocation.

CDM Smith will coordinate with RWU for public bidding, utilizing an existing RWU Contractor agreement, or performing the PAC reutilization work with Utility staff. As stated previously, timing is critical as this work must be completed prior to summer 2026. This proposal does not include costs associated with vendor engagement or system rehabilitation.

Task 4 – Bench Scale Testing

CDM Smith will design and perform bench-scale testing scenarios to evaluate treatment performance for PFAS and T&O concerns. These tests will simulate site-specific conditions, capture summer parameters, and provide data to optimize treatment strategies before full-scale implementation. The benchmarking requires standardization of the water quality data and confirmation of concentration data so that the permanganate and PAC design can adequately perform across all Lake Michigan influent water conditions. All experiments will include QA/QC through duplicate experimental test conditions to ensure reproducibility and statistical confidence.

Baseline Water Quality Evaluation

CDM Smith will establish a comprehensive water quality profile to define initial conditions for treatment optimization. For example, total and dissolved organic carbon (TOC and DOC) are important parameters to monitor because they will influence both permanganate oxidant demand and competition for adsorptive sites on PAC. Data collected will guide PAC dosing and permanganate optimization strategies.

- One sample location will be investigated (WTP influent).
- One sampling event (Spring) will be evaluated to provide optimized treatment before the summer.
- Analyses will include PFAS, T&O, TOC, DOC, UV254, pH, temperature, alkalinity, hardness, total/dissolved manganese.
- Permanganate may only address T&O concerns whereas PAC may address both T&O as well as PFAS concerns

Confirmational Taste and Odor Treatment with Powder Activated Carbon

CDM Smith will validate PAC effectiveness for T&O control as a secondary or primary treatment option. Higher PAC doses required for PFAS removal may also provide T&O control, potentially reducing the reliance on permanganate

or offering dual treatment capabilities. T&O evaluation will be conducted separately from the PFAS testing because T&O spiking solutions contain methanol, which interferes with PFAS adsorption.

- One sample location will be investigated (WTP influent).
- One sampling event will be evaluated.
- Two contact times will be tested based on the historical average and high flow rates through the water treatment plant to reflect operational variability.
- One T&O spike level will be investigated (i.e., 100 ng/L MIB and geosmin or historical high T&O levels seen in the summer).
- Three different PAC types will be evaluated (current plant PAC, wood-based Ingevity AquaNuchar, and coal-based Calgon WPH 1000).
- Two PAC doses will be evaluated (10, and 20 mg/L).
- One temperature condition will be tested (20°C).
- Analyses include T&O, pH, and temperature.
- One control test condition spiked with T&O compounds and treated through the jar testing process with coagulant and polymer but not treated with PAC to evaluate any potential losses of volatile T&O compounds during the experimental process.
- All experimental test conditions will be performed in duplicate to evaluate experimental reproducibility.

Taste and Odor Treatment Optimization with Potassium Permanganate

CDM Smith will determine the optimal permanganate dose and contact time for effective oxidation of T&O compounds (MIB and Geosmin) under worst-case seasonal conditions. Permanganate is currently used for T&O control. This testing evaluation will confirm dose-response relationships and assess whether higher dosing will be required during episodic T&O events. Higher TOC and algal activity increase oxidant demand and testing ensure reliable control during peak events without exceeding the manganese secondary Maximum Contaminant Level (MCL). A treatment goal of 90-95% T&O removal will be used to evaluate treatment performance, as sensitive populations can detect T&O compounds at very low levels.

- One sample location will be investigated (WTP influent).
- One sampling event will be evaluated.
- Two contact times will be tested based on the historical average and high flow rates through the water treatment plant to reflect operational variability.
- One T&O spike level will be investigated (i.e., 100 ng/L MIB and geosmin or historical high T&O levels seen in the summer).
- Three permanganate doses will be evaluated (current operational permanganate dose and two higher doses to model T&O treatment performance).
- One temperature condition will be tested (20°C).
- Analyses include T&O, residual permanganate, pH, temperature, and dissolved manganese (secondary MCL of 0.05 mg/L).

- One control test condition spiked with T&O compounds but not treated with permanganate to evaluate any potential losses of volatile T&O compounds during the experimental process.
- All experimental test conditions will be performed in duplicate to evaluate experimental reproducibility.

PFAS Treatment Optimization with Powder Activated Carbon (PAC)

CDM Smith will evaluate PAC adsorption performance for PFAS removal under site-specific conditions such as competitive adsorption, PAC doses, and contact times. PAC has been shown to provide some PFAS removal capabilities, and this testing will generate kinetic data for full-scale design. A treatment goal will target 50% of MCL levels for regulated compounds.

- One sample location will be investigated (WTP influent).
- One sampling event will be evaluated.
- Two contact times will be tested based on the historical average and high flow rates through the water treatment plant to reflect operational variability.
- One PFAS spike level will be investigated (i.e., 3 to 5 times baseline concentrations to ensure measurable removal over analytical reporting limits).
- Three different PAC types will be evaluated (current plant PAC, wood-based Ingevity AquaNuchar, and coal-based Calgon WPH 1000).
- Three PAC doses will be evaluated (10, 20 and 40 mg/L). Current system dosing range is estimated to be 1.8 to 18 mg/L (to be confirmed based on additional review of plant schematics).
- One temperature condition will be tested (20°C). Worst-case kinetics at higher temperature with literature showing minimal temperature effect on long-chain PFAS adsorption but slight effect on short-chain PFAS.
- One coagulation/flocculation/sedimentation condition will be evaluated. Coagulant doses will be based on plant conditions during sample collection. Jar testing protocols will be developed based on current plant operation conditions (i.e., flash mixing, slow mix contact time, and settling time).
- Analyses include PFAS, TOC, DOC, UV254, pH, temperature, and arsenic (on highest PAC dose and highest contact time condition only). Arsenic has been shown to demobilize from activated carbon so only the highest PAC dose with the longest contact time will be evaluated for arsenic demobilization.
- One control test condition spiked with PFAS compounds and treated through the jar testing process with coagulant and polymer but not treated with PAC to evaluate any potential losses of PFAS compounds during the experimental process.
- All experimental test conditions will be performed in duplicate to evaluate experimental reproducibility.

Results and interpretation of testing will be summarized in **Technical Memo –Bench Scale Testing** and discussed with RWU in a **Workshop**.

Task 5– Alternatives Analysis and Recommendations

Based on the results of the review and bench-scale testing, CDM Smith will work with RWU to define solutions for alternative approaches or process enhancements to permanganate and PAC treatment schemes. A qualitative



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alternatives analysis defining key advantages and considerations will be performed to determine recommended solutions. This Task will confirm the required dosages of permanganate and PAC to address T&O and PFAS concerns.

Outcomes of the alternatives analysis, including estimated capital and operation & maintenance costs for recommended solutions, will be documented in the **Raw Water Treatment Efficiency Report**.

Assumptions and Requirements

CDM Smith will require additional historical operational information from RWU, which will include but not limited to:

- Permanganate dosage information (previously received annual information, requesting daily if available)
- Coagulant and coagulant aid dosage
- PFAS data (specifically PFOA, PFOS)
- TOC and DOC data and/or UV254
- T&O data (Geosmin, MIB), anecdotal evidence and customer complaints of T&O events

Schedule

Tasks 2 and 3 will be initiated in Q1 2026 and completed prior to the anticipated potential occurrence of T&O issues, i.e., mid-summer 2026. Task 4 will be initiated in Q1 2026, and the jar testing associated with concurrent T&O and PFAS bench scale testing and analysis, through a single sampling event, is proposed for this Study. T&O analysis will be prioritized over that of PFAS to ensure implementable results are available for Summer 2026. The overall duration of the project will span 6-8 months, to be completed by Q4 2026.

Fee

For the services listed in the above base Scope of Work, CDM Smith shall be paid on a time and material basis with an upper limit not to exceed a cost of \$261,800. Work will be invoiced monthly as completed.

This above fee assumes that RWU staff will obtain the required totes, collect the desired water samples, and ship them to the CDM Smith laboratory in Bellevue, Washington. Alternatively, if desired by RWU staff, CDM Smith could complete these tasks for a fee of \$5,000.

Task	Hours	Budget
1 – Project Management	110	\$16,600
2 – Review Current Practices	112	\$19,700
3 – PAC System Operation and Injection Point Relocation	66	\$14,400
4 – Bench Scale Study	757	\$164,700
5 – Alternatives Analysis and Recommendations	255	\$46,400
TOTAL	1,300	\$261,800



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Next Steps

We appreciate this opportunity to support the Racine Water Utility to perform professional services to review raw water quality and treatment capabilities. Should you have any questions or suggested edits to the scope, please contact me at 414-203-4004 or bednarskimj@cdmsmith.com.

Additional qualifications or resumes of key staff are available upon request.

Sincerely,

A handwritten signature in blue ink that reads "Matt Bednarski". The signature is stylized and includes a long horizontal line extending to the right.

Matt Bednarski, P.E.
Client Service Leader
CDM Smith Inc.

cc: Joel Brunner