BIOLOGICAL TREATMENT ALTERNATIVES EVALUATION

~ REQUEST FOR QUALIFICATIONS ~

The Metropolitan Sewerage District of Buncombe County, North Carolina (MSD) is soliciting Statements of Qualifications for Professional Engineering Services associated with the Biological Treatment Alternatives Evaluation. The study shall evaluate the existing biological treatment process and available footprint, and alternative technologies suitable for meeting future effluent goals per MSD's National Pollutant Discharge Elimination System (NPDES) permit.

General Background of Project

In 1967, MSD's French Broad River Water Reclamation Facility (WRF) was placed into service with a capacity of 25mgd. Originally an activated sludge facility, the biological treatment process was converted to Rotating Biological Contactors (RBCs) in 1988. The RBCs were retrofitted into the existing primary and secondary clarifier basins and activated sludge aeration tanks. In the same footprint, the 25mgd activated sludge plant was expanded to 40mgd using RBC technology. Today, the 40mgd WRF consists of the following treatment processes: coarse (1/2") and fine (1/4") screening, grit removal via forced vortex, high-rate chemically-enhanced primary clarification, biological treatment via RBCs, secondary clarification, cloth media disk filtration, and disinfection/dechlorination. Solids generated in the liquid train are thickened, dewatered via belt filter presses, and pumped into MSD's fluidizing bed incinerator (FBI).

The RBCs have performed well over the past 34 years, consistently achieving MSD's $CBOD_5$ discharge limitations (25.0 mg/L monthly avg., 40.0 mg/L weekly avg.). However, due to their age, condition, and obsolescence, as well as future regulatory requirements, the biological treatment process will be replaced with new technology capable of meeting ammonia limits and other anticipated nutrient limits.

In 2011, MSD's NPDES permit renewal required the WRF to submit an Ammonia Reduction Evaluation to the North Carolina Division of Water Resources (NCDWR) within 4.5 years of the permit effective date of April 1, 2011. The evaluation was to include the feasibility and costs for reducing ammonia-nitrogen by (1) optimizing the existing plant with operational improvements, and (2) upgrading the plant to meet a set of defined ammonia limits in summer and winter.

The evaluation's recommended initial improvements included replacing failed/idle RBC units, reducing grit and solids accumulation in the RBCs, reducing organic loading to the RBCs, and managing wet weather flows into the WRF. These recommendations would help optimize the RBC system, providing an appropriate treatment foundation for upgrading biological treatment. The evaluation also included the assessment of feasible treatment alternatives capable of meeting the ammonia reduction targets mentioned above. The short-listed alternatives included Activated Sludge, Moving Bed Biofilm Reactor (MBBR), Integrated Fixed Film Activated Sludge (IFAS), and Membrane Bioreactor (MBR).

NCDWR reviewed the recommendations of the Ammonia Reduction Evaluation and understood that the initial phases to address existing treatment challenges would be costly, complex, and require time to design, construct, and initiate operation. NCDWR developed a compliance schedule that included phased projects and milestone completion dates, culminating with the compliance of ammonia-nitrogen effluent limits by October 1, 2030. This compliance schedule is included in MSD's 2018 NPDES permit and consists of annual interim progress reports. The permit also includes the ammonia discharge limits defined below:

NH_3-N (April 1 – October 31)
- 14.0 mg/L (monthly average)
- 35.0 mg/L (weekly average)

NH_3-N (November 1 – March 31)
- 31.7 mg/L (monthly average)
- 35.0 mg/L (weekly average)

Compliance schedule milestones and requirements were readily achieved through 2021; however, inconsistent and inefficient operation of the new High Rate Primary Treatment (HRPT) process has delayed the 2-year performance testing defined in the permit schedule (completion date December 31, 2023). Due to these unforeseen difficulties, MSD requested a 5-year extension to the 2030 compliance deadline during its 2022 NPDES permit renewal process. To date, this request has not been accepted and MSD is moving forward based on the original compliance schedule. Accordingly, this Biological Treatment Alternatives Evaluation shall be submitted to NCDEQ by December 31, 2024 and is to include a selected treatment technology, design and construction timeline, and specific steps to be taken to achieve the ammonia-nitrogen limits.

Implementation of Initial Treatment Improvements

As mentioned above, the Ammonia Reduction Evaluation (completed in April 2015) described various treatment challenges that impacted performance in the RBC process. Addressing these issues was critical to improving biological treatment and recognizing the nitrification potential in the RBC process. Descriptions of the initial treatment improvements are below.

Out of Service RBCs

In 2014, thirty-eight (38) of the 152 RBC units were inoperable, removed, or had broken shafts and were not turning. Without these units in service, the total RBC surface area available for biological treatment was greatly reduced. MSD underwent an intensive search for replacement RBC units and by 2017 all inoperable units had been replaced. Since that time, additional units have failed and currently 11 units are inoperable with no replacement units in storage.

Grit/Solids Accumulation in RBCs

Poor grit removal and lack of primary clarification resulted in the collection of solids and grit throughout downstream processes. Settled solids in the RBC basins reduce residence time in the biological process while accumulating solids in the interstices of the RBC units increases operating weight and loads on the shafts, leading to failure. Additionally, solids and grit increase organic loading to the biological process. Because nitrification does not occur until most of the organic load has been oxidized, increased solids and grit loading reduces the likelihood of nitrification occurring in the RBC process.

Two major projects have been completed since 2015 which significantly reduce solids and grit loading. The first was the Plant Headworks Improvements project, placed online in 2019. This project included the replacement of existing ¾" bar screens with ½" bar screens, installation of new ¼" fine screens, and new vortex grit removal system. The project has helped reduce solids and grit loading into the biological process. Headworks performance testing was one of the initial phases of the Ammonia Schedule of Compliance and was completed in 2020.

The second major project was the installation of a chemically-enhanced, high-rate primary clarification process, referred to as the "HRPT". Installation was completed in accordance with the Ammonia Schedule of Compliance (by December 31, 2021); however, operation of the HRPT facility remains sporadic due to unanticipated difficulties (i.e. loss of sand ballast during operation). When the process is running, the facility removes $\geq$80% TSS and $\geq$60% particulate

BOD. Higher levels of treatment are possible with increased coagulant and polymer doses but the goal of the HRPT is to balance TSS removal rates while maintaining sufficient primary effluent ortho-P and CBOD to support downstream biological processes and enable the RBCs to achieve nitrification.

MSD continues to work with the HRPT vendor to come up with a permanent operational strategy that replicates the successful results achieved in the 2014 pilot study, and one that meets the specified design effluent parameters. It is worth noting that sludge production from the HRPT is greater than originally anticipated and outpaces the permitted burn rate of MSD's FBI. As a result, the HRPT system must be shut down periodically to effectively manage sludge inventory. When that occurs, influent quality to the biological system reverts to a pre-HRPT condition with high solids and organic loading. Until the HRPT operation becomes more consistent, the influent quality to the biological system will remain erratic.

Wet Weather Flows

Surge/flow equalization was recommended as a management strategy for trimming peak flows during wet weather operations and reducing adverse treatment process impacts such as loss of RBC biofilm and nitrifier washout. As part of the Plant Headworks Improvements, two (2) out-of-service anaerobic sludge digester tanks were converted into flow equalization storage. The tanks have a combined volume of 4.2 MG and are used to mitigate flows into the plant that exceed 65mgd, the design treatment capacity of the RBCs and other downstream processes. The tanks have been used approximately 6 times since 2019 and have proven successful in managing wet weather peaks and stabilizing flow through the WRF.

Existing Biological Treatment

MSD's WRF is said to be the largest RBC facility in the world with 152 treatment units. Each unit is 20ft. long x 10ft. diameter and provides approximately 2.5 acres of surface area for biofilm growth. RBC influent is normally conveyed from the HRPT process; however, a diversion structure upstream of the HRPT allows for bypass of the facility and direct discharge of de-gritted wastewater into the influent channel of RBC Basin No. 1. The RBC system is made up of three sequential basins and four parallel treatment trains in each basin. The RBC tankage was built as part of the original activated sludge plant in 1967 and was reconfigured into an RBC plant in 1988. This included filling the bottom of the basins with crushed stone and installing "false" floors to accommodate the shallow RBC treatment. The Biological Treatment

Alternatives Evaluation shall consider the removal of the false floors to regain original depth and treatment volume for alternative processes.

A combination of aluminum and stainless steel slide gates route flow through the RBC system and allow any train in any basin to be isolated and drained. Basin No. 1 has aluminum gates that were installed in 1988 and appear to be in good condition. MSD initiated a project earlier this year to replace the gates in Basins 2 and 3 with stainless steel gates. This project is anticipated to be completed in the summer of 2023. The ability to isolate flow for a phased biological upgrade will be critical to maintenance of plant operations.

The RBCs are air-driven and are actuated by submerged air piping underneath each RBC. Air is supplied to a combination of ductile iron and stainless steel air headers from five (5) 450 HP blowers, each supplying approximately 10,000cfm.

RBC effluent is conveyed to the intermediate clarifiers for settling and capture of waste solids from the RBC process. An intermediate pump station conveys RBC effluent from the end of RBC Basin No. 3 to the intermediate clarifiers. The pumps are required because the intermediate clarifier surface water elevation is approximately 10 feet higher than the RBC surface water elevation. The biological treatment upgrade shall be designed to eliminate the need for intermediate pumping. Upstream processes (i.e. Headworks and HRPT) were designed and constructed with this in mind and increased the hydraulic grade line at the head of the WRF.

Special Project Considerations

Small Footprint and Capacity Expansion. The WRF site is constrained on all sides and cannot easily be expanded without major rock removal. Rock encompasses the north and east sides of the plant. Riverside Dr. (NC 251) and the French Broad River lie to the west, and a Duke Energy electrical sub-station to the south. One objective of this study is to identify treatment alternatives that work within the existing biological treatment tanks (Basins 1, 2 and 3) due to these conflicts and the presence of hard rock beneath the existing tankage.

MSD's Headworks and HRPT facilities are designed to treat 80mgd (the hydraulic capacity of the WRF's 66-inch influent interceptor) and pass up to 100mgd to accommodate future peak flow events. Ideally, the capacity of the new biological upgrade shall match that of upstream processes; however, many challenges exist with constructing inside the existing, confined

footprint.

Maintenance of Plant Operations (MOPO). Perhaps the most challenging aspect of the biological upgrade will be maintaining effluent compliance with portions of the existing plant offline and under construction. Not only is the site footprint extremely tight, but existing underground utilities consume many of the corridors and roadways between treatment tankage. Active and abandoned utilities exist from over five decades of improvements and replacements, so designing around these will require thorough investigation and careful planning. Complex bypass systems as well as innovative aerial conveyance may be required for a successful biological conversion.

Each technology considered in the Alternatives Evaluation shall be fully vetted for constructability while maintaining existing plant operations. The study shall identify the selected technology and provide specific details on phasing of construction as it pertains to MOPO. Access around the site and safety of personnel is of utmost importance during the upgrade and is essential for operation and maintenance of the existing plant.

Technology Selection. The biological replacement project will be the largest capital expenditure in MSD's history. This Alternatives Evaluation shall carefully vet all feasible treatment options and shall give proper consideration to the aspects listed below. Items are not necessarily in order of priority or importance. The selected technology shall be characterized by:

- Ease of operation and maintenance for plant personnel
- Ability to easily meet effluent objectives
    - NH_3-N (April 1 – Oct. 31) - 14.0mg/L (monthly)/35.0mg/L (weekly)
    - NH_3-N (Nov. 1 – March 31) – 31.7mg/L (monthly)/35.0mg/L (weekly)
- Upgradable to achieve potential future TN/TP limits
- Cost effective technology and good value for MSD's rate payers
- Proven technology with successful full-scale installations similar in size to MSD
- Energy efficient
- Ease of added capacity (e.g. modular by design)

Due to the inconsistency of biological influent quality, lack of HRPT performance data, and magnitude of capital outlay required for the biological upgrade, pilot testing shall be completed as part of the evaluation, prior to final process selection. Pilot test data will be used to verify design criteria, characterize process performance, and establish operating conditions at the

operating equivalent of 80mgd. The firm responsible for completing the Alternatives Evaluation shall also prepare a pilot test plan with specified test conditions and sampling schedule.

Impacts to Solids Handling and other WRF Systems and Processes. MSD is in the process of completing a Solids Handling Study to evaluate its existing facilities and recommend upgrades for future solids generation. While these two studies will be performed independently, it is important that the Biological Treatment Alternatives Evaluation quantify the volume of solids anticipated from each biological process considered, and define the sludge characteristics of each. This information will be critical to appropriately designing future solids handling infrastructure.

The Alternatives Evaluation shall also consider impacts the biological upgrade will have on existing plant systems and processes (e.g. electrical system, disinfection capacity, etc), and provide innovative approaches to maximizing the utilization of other plant processes (e.g. HRPT, secondary clarifiers, cloth media disk filters).

General Scope of Work

The firm selected shall generate a preliminary engineering report that is comprehensive, organized and integrated into a series of technical memorandums providing a framework for expansion and phasing of future biological improvements to the WRF. The study shall identify operating parameters, anticipate permit conditions and discharge limits, evaluate alternatives and ultimately select a preferred biological treatment technology, and recommend solutions for implementing the expansion and technology conversion. The study shall include preliminary design and planning level cost estimates for the work which will be incorporated into MSD's Capital Improvement Program. The study shall be complete in its entirety by September 2024, ahead of the December 2024 NPDES compliance schedule deadline.

In addition to the Project Considerations described above, the selected firm shall include the following tasks in the Scope of Work.

- Condition assessment of existing biological treatment facility (for purposes of reusing concrete tankage).
- Review and update Regulatory Assessment (see Facilities Plan Update, 2015)
- Review and update influent flow and load projections (see Facilities Plan Update, 2015)

- Engineering and professional services to support pilot test programs

Additional Resources Being Provided:

- 2018 HRPT Conformed Construction Drawings (CDM Smith) – Proj. No. 2015054
- 2018 NPDES Permit NC0024911
- 2015 Ammonia Reduction Evaluation (HDR)
- 2015 Facilities Plan Update (HDR)
- 2013 Final Microscreen Replacement Record Drawings (Black & Veatch) – Proj. No. 2007026
- 2011 NPDES Permit NC0024911
- 1994 Intermediate Clarifier Record Drawings (Hendon Engineering Assoc) – Proj. No. 1990001
- 1964 Original Plant Record Drawings (Harry Hendon and Assoc.) – Proj. No. 1964002
- 1987 RBC Upgrade Record Drawings (Hendon Engineering Assoc) – Proj. No. 1984001
- Map of operational/failed RBC units

Submittal Requirements

NOTE: **Qualifications shall not exceed fifteen (15) pages in length.** Brevity, clarity, and conciseness are strongly encouraged.

1. Transmittal cover letter. The cover letter will designate the firm's contact person with phone number, mailing address, fax number and email address.

2. Project team and sub-consultants. Identify the project manager and describe their experience related to this project. Identify other project team members and sub-consultants and their relative experience. Discuss the role of key team members. Specify the location of the offices and the percentage and type of work that will be performed at each location. Discuss the experience of the project manager with the other members of the project team.

3. Firm Qualifications. Discuss the firm's work on projects similar in size and complexity. Firm must have extensive knowledge and expertise in wastewater treatment. Firm must have completed **no less than 10** similar alternatives evaluations. Indicate firm's history of meeting established schedules and budgets.

4. References. Provide references of other clients (including contact name, phone number and address) for other projects similar in scope.

Evaluation of Statement of Qualifications

The selection committee will develop a short list of firms for the project. Short listed firms may be asked to participate in a presentation/interview process.

The selection committee will choose a firm for the proposed project based in part on the following criteria:

1. Experience on projects of similar type and magnitude, and the firm's ability to adequately address and evaluate the items described above, within the specified timeframe.
2. Qualifications and experience of the proposed team and location of team members.
3. Completeness of the submittal.
4. Ingenuity and conceptual approaches to addressing the problem at hand.
5. Any other experience or criteria deemed applicable to the project.

To Respond

If your firm is interested in this project and qualified based on the requirements above, please submit an electronic copy of the Statement of Qualification to Hunter Carson, P.E. before 2:00 P.M on Friday, February 10, 2023 to:

MSD of Buncombe County, N.C.
Mull Building
2028 Riverside Drive
Asheville, N.C. 28804

For questions regarding the process or to review information, please contact Hunter Carson directly at (828) 225-8241, or e-mail hcarson@msdbc.org.

The anticipated selection process timeline will be as follows:

- SOQ Submittal Deadline – Feb. 10, 2023
- SOQ Review and Shortlisting – Feb. 13 – March 3, 2023
- Consultant Interviews – March 6-17, 2023
- MSD Board Approval – April 19, 2023

The Metropolitan Sewerage District reserves the right to reject any and all Statements of Qualifications.