McKIM&CREED

1365 Hamlet Ave Clearwater, FL 33756, (727) 442-7196

WORK ORDER INITIATION FORM
for the CITY OF CLEARWATER

Date:	**July 25, 2016**
Project Number:	**0992-0229**
City Project Number:	**16-0029-UT**

1. PROJECT TITLE:

Reverse Osmosis WTP#2 System Evaluation

2. SCOPE OF SERVICES:

The City of Clearwater (City) currently operates Reverse Osmosis Water Treatment Plant (ROWTP) #2, which was designed as a base load facility for the City's water supply system with a design capacity of 6.25 MGD. Since start-up, ROWTP #2 has been afflicted by operational issues, some of which are due to a decline in overall raw water quality from the 12 groundwater supply wells. One of the significant challenges for the City is that current treatment processes utilized to reduce hydrogen sulfide (natural groundwater constituent in the wellfield) result in bromate levels that exceed the regulatory compliance limit of 10 parts per billion (ppb). As a result, the City operates the facility at significantly lower flows to achieve regulatory compliance. Another issue is that total dissolved solids (TDS) in the groundwater have increased and the higher TDS supply is also preventing the facility from producing the potable water design capacity and this lower production results in negative financial impacts to the City.

The facility uses ozone to treat RO permeate for hydrogen sulfide removal. The groundwater supply contains bromide which reacts with ozone to form bromate, which is a regulated primary drinking water constituent. Ozone was selected to remove hydrogen sulfide since other methods (e.g., degasification and air scrubbing) can have negative impacts such as noise and odor. Along with the raw water TDS and bromate issues, there are several issues associated with the RO system that include cartridge filter system configuration, RO feed pump sizing, hydraulics, valves and other issues. These operational issues also have negatively impacted potable water production from the facility. Additionally, the staff is spending additional time and effort attempting to address these issues while keeping the plant operating.

To provide a fresh review of the current operational and plant performance issues, the City has requested McKim & Creed to provide professional engineering services to review these issues, evaluate improvement alternatives and provide prioritized recommendations to improve operations and increase potable water production capacity. The evaluation will conclude with a

summary report to include planning level costs and conceptual implementation schedules for the recommended alternatives.

The work included with this scope of services includes the following tasks:

Task 1 – Project Management, Project Meetings and Administration: Task includes project setup and project management plan, monthly progress reports and invoicing, coordination with City and kickoff meeting with City. Additionally, McKim & Creed will conduct periodic status meetings with City staff to provide updates on work effort and findings to date. It is anticipated that four (4) status meetings will be conducted with the City during the project and will be conducted concurrent with draft technical memoranda review meetings, when possible.

Task 2 – Data Collection and Review: Obtain and review data provided by the City which will include: Record Drawings, BODR, previous studies and reports; raw water, process treated water and finished water quality; flows, pressures, test results, and operational procedures. McKim & Creed will conduct a minimum of two (2) site visits that will include interviews with plant staff, obtain data, discuss current operations and discuss potential modifications. Additionally, the co-operative funding agreement and current financial/rate study report will be reviewed to understand implications that production rates, capital costs and O & M costs have on rate forecasts.

Task 3 – Improvement Alternatives and Recommendations: McKim & Creed will review current operations, identify and compare potential improvements and provide recommendations to address current and identifiable future operational issues as described in the following tasks:

Task 3.1 - Bromate Reduction Alternatives: Perform literature review for alternatives to: reduce bromate formation while utilizing ozone for hydrogen sulfide removal; utilize alternative hydrogen sulfide removal processes; and to remove bromate after formation from ozonation. Review existing operational procedures related to source water bromide levels, finished water bromate levels and existing treatment processes that have led to formation of bromate in excess of 10 ppb. Identify and compare potential improvement alternatives to address bromate regulatory issues. As part of this task, the following is a list of alternatives that will be investigated:

- Adjustment of ozone dosage and contact time
- Adjustment of sampling locations, techniques and testing laboratories
- RO membrane replacement
- Adjustment of RO recovery rate
- Alternative chemical treatment
- Adjust/modify source water blending
- Adjust/modify treated water blending
- Oxidation/filtration pre-treatment
- Permeate post-treatment with alternative chemical(s)
- Degasifier/scrubber for H2S removal and odor control
- Treatment at the well site(s)

- Bromate removal following ozonation using catalytically enhanced carbon, nanosorbents and other relevant technologies

The alternatives analyses will strive to maximize the use of existing infrastructure. In addition, current facility and site constraints will be considered for each treatment option. Along with the primary goal of increasing production capacity, the following criteria will be compared for viable alternatives:

- Ability to achieve regulatory compliance
- Ability to reduce hydrogen sulfide to acceptable levels
- Capital and operational costs
- Ability to utilize existing process equipment
- Implementation schedule
- Operational and maintenance requirements
- Site constraints

Results and recommendations from this Task will be summarized in a draft Technical Memorandum. Submit five (5) bound copies of the memo and e-mail copy to City (PDF format). Conduct draft Technical Memorandum review meeting with City staff and provide meeting minutes to attendees. Prepare final Technical Memorandum and combine with other memoranda for inclusion in in the Report described in Task 4.

Task 3.2 – Wellfield Expansion Alternatives: Based on preliminary information from the City, it appears that additional groundwater wells are needed to provide additional supply, rotational ability, operational flexibility and redundancy. Work included for this task includes:

- Review existing wellfield data; including pumpage, water quality and drawdown
- Review current wellfield operational procedures and protocol under relevant ROWTP #2 operational scenarios
- Obtain current water quality and future water quality projections to be provided by the City from SDI for the existing wells and potential future wells from the City
- Develop blending analysis to include flows and relevant constituent levels for the twelve existing wells, ROWTP #1 concentrate, existing WTP No 2 fresh water wells, County potable water, and identified future wells

Conceptual locations identified in previous well siting studies will be reviewed and cost estimates for development will be updated and compared with cost to purchase water from Pinellas County. The City's existing wellfield operations / management plan will be reviewed and comments will be provided to the City's hydrogeologist for use in an updated wellfield operations plan. For this Task, McKim & Creed will rely on information from the City for potential future well sites.

Results and recommendations from this Task will be summarized in a draft Technical Memorandum. Submit five (5) bound copies of the memo and e-mail copy to City (PDF format). Conduct draft Technical Memorandum review meeting with City staff and provide meeting

minutes to attendees. Prepare final Technical Memorandum and combine with other memoranda for inclusion in in the Report described in Task 4.

Task 3.3 – RO Treatment Process Improvements: This Task includes a review of current issues directly associated with the RO treatment process that result in reduced production capacity from the RO process and increased operational complexity. Based on initial discussions with City staff, these issues include:

- Undersized RO feed pumps
- Sand in RO feedwater / high silt density index (SDI)
- RO system piping, valving and hydraulics
- Reduced flux balance
- Cavitation of RO permeate backpressure valves

McKim & Creed will evaluate the existing RO process in the interest of developing solutions to restore production capacity and improve the operation and efficiency of the RO treatment process. Information and data will be obtained from equipment suppliers as appropriate. Potential improvements to be evaluated will include:

- RO system design modifications
- RO feed pump retrofit or replacement
- Install inter-stage boost pumps
- Install energy recovery turbine
- Install orifice plates and/or replace existing permeate backpressure valves
- Skid modifications to accommodate improvements
- Modify RO system piping and valving to improve hydraulics
- Utilize alternative RO membranes
- Implement alternative RO membrane system array
- Install sand separator

Potential RO system improvements will be compared and prioritized based on input from the City during the project. Recommendations will be provided with conceptual costs and implementation schedules. Results and recommendations from this Task will be summarized in a draft Technical Memorandum. Submit five (5) bound copies of the memo and e-mail copy to City (PDF format). Conduct draft Technical Memorandum review meeting with City staff and provide meeting minutes to attendees. Prepare final Technical Memorandum and combine with other memoranda for inclusion in in the Report outlined in Task 4.

Task 3.4 – Ancillary Improvements: This Task includes ancillary RO WTP components and processes that impact operations, but have less of an impact on production capacity. These items include:

- Antiscalant pipe routing
- Operation of 8-inch pressure sustaining valve
- Cartridge filter system
- RO skid permeate and concentrate check valves
- 10-inch flow meter on bypass line

- RO bypass piping sizing
- Caustic storage and transfer pumping systems
- Clean-in-place pump and hydraulics
- Plant storage tank hydraulic balancing

These items will be summarized and potential improvements will be investigated, evaluated and compared. Recommendations, costs and schedules for feasible improvements will be summarized in a draft Technical Memorandum. Submit five (5) bound copies of the memo and e-mail copy to City (PDF format). Conduct Technical Memorandum review meeting with City staff and provide meeting minutes to attendees. Prepare final Technical Memorandum and combine with other memoranda for inclusion in in the Report summarized in Task 4.

Task 4 – ROWTP #2 Improvements Summary Report:

Task 4.1 – Draft Summary Report: Assemble final Technical Memoranda from previous tasks and update to include:

- Updates based on City comments from draft memoranda
- Overall executive summary with prioritized recommendations
- Summary of existing operational issues and challenges
- Summary of Recommendations
- Capital, O&M and present worth costs
- Modified process schematics/process flow diagrams for recommended alternatives
- Aerial (Google Earth or similar) exhibit with potential future well sites and conceptual pipe routing (used for determining approximate pipe lengths only)
- Conceptual implementation schedule
- Permitting considerations
- Constructability / maintenance of operations discussion

Task 4.2 – Draft Summary Report Review Meeting: Attend review meeting with City staff to discuss draft Report results and recommendations. Prepare and distribute meeting minutes to attendees.

Task 4.3 – Final Summary Report: Incorporate comments from City staff and from draft Summary Report review meeting and prepare final ROWTP #2 Summary Report. Submit five (5) bound, signed & sealed copies and a CD-ROM with an electronic PDF of Report.

Additional Information

- Preliminary and final engineering design, permitting, bidding and construction phase services that may be needed for recommended improvements will be included as part of a separate phase or scope of work.
- City will provide all required current and future projected water quality data for existing wells and potential future well sites.
- McKim & Creed will rely on Record Drawings, observable site conditions, staff interviews and other information provided by the City for the evaluations included in the project.

- Additional tasks, such as: future well siting studies, hydrogeological testing, field testing, laboratory testing, sampling and permitting may need to be performed during preliminary design of recommended alternatives and are not included in this phase of the Project.
- If pilot testing is indicated, a separate work scope and fees will be provided at such time.
- City will coordinate with testing lab(s) and will issue payment for testing fees, if necessary.

3. PROJECT GOALS:

The main goal project goal is to identify and recommend cost-effective and feasible alternatives to increase the production capacity of WTP #2 while complying with regulatory bromate limits. Other goals are generally associated with improving the overall plant operations, redundancy and operational flexibility. Deliverables for the project will include:

- Five (5) copies of draft Technical Memoranda for Tasks 3.1 to 3.4 and e-mail copy in PDF format
- Five (5) bound, copies of draft Summary Report Memorandum; e-mail copy in PDF format
- Five (5) bound, signed and sealed copies of draft Summary Report Memorandum; e-mail copy in PDF format; one (1) CD-ROM in PDF format
- Meeting minutes for kickoff, status and review meetings

4. BUDGET:

See attachment "B"

This price includes all labor and expenses anticipated to be incurred by McKim & Creed, Inc. for the completion of these tasks in accordance with Professional Services Method "B" – Lump Sum – Percentage of Completion by Task, **for a fee not to exceed One Hundred Fifty-Seven Thousand Four Hundred Nineteen Dollars ($157,419.00)**.

SCHEDULE:

Project schedule will commence upon receipt of written authorization from the City. The project is to be completed within **240 calendar days** from issuance of notice-to-proceed. The project shall be phased as follows:

Project Kickoff Meeting	**14 calendar days**
Data Collection & Review	**30 calendar days**
Status Meeting No. 1	**75 calendar days**
Status Meeting No. 2	**100 calendar days**
Status Meeting No. 3	**120 calendar days**
Status Meeting No. 4	**150 calendar days**
Draft Report	**180 calendar days**

Draft Report Review Meeting	**210 calendar days**
Final Report	**240 calendar days**

5. STAFF ASSIGNMENT (Consultant):

Street Lee, PE – Principal-in-Charge
Phil Locke, PE – Project Manager / Lead Engineer

6. CORRESPONDENCE/REPORTING PROCEDURES:

Engineer's project correspondence shall be directed to:
Phil Locke, PE

All City project correspondence shall be directed to:
Rob Fahey, PE with copies to others as may be appropriate.

7. INVOICING/FUNDING PROCEDURES:

For work performed, invoices shall be submitted monthly to the City of Clearwater, Engineering Department, Attn.: Veronica Josef, Senior Staff Assistant, PO Box 4748, Clearwater, Florida 33758-4748.

City Invoicing Code: **0315-96767-561300-533-000-0000**

8. INVOICING PROCEDURES

At a minimum, in addition to the invoice amount(s) the following information shall be provided on all invoices submitted on the Work Order:

A. Purchase Order Number and Contract Amount.
B. The time period (begin and end date) covered by the invoice.
C. A short narrative summary of activities completed in the time period
D. Contract billing method – Lump Sum or Cost Times Multiplier
E. If Lump Sum, the percent completion, amount due, previous amount earned and total earned to date for all tasks (direct costs, if any, shall be included in lump sum amount).
F. If Cost Times Multiplier, hours, hourly rates, names of individuals being billed, amount due, previous amount earned, total earned to date for each task and other direct costs (receipts will be required for any single item with a cost of $50 or greater or cumulative monthly expenses greater than $100).
G. If the Work Order is funded by multiple funding codes, an itemization of tasks and invoice amounts by funding code.

9. SPECIAL CONSIDERATIONS:

A. The consultant named above is required to comply with Section 119.0701, Florida Statutes (2013) where applicable.
B. City will provide all required current and future projected water quality data for existing wells and potential future well sites.

C. Preliminary and final engineering design, permitting, bidding and construction phase services that may be needed for recommended improvements will be included as part of a separate scope of work.
D. McKim & Creed will rely on Record Drawings, observable site conditions, staff interviews and other information provided by the City for the evaluations included in the project.
E. Additional tasks, such as: future well siting studies, hydrogeological testing, field testing, laboratory testing, sampling and permitting may need to be performed during preliminary design of recommended alternatives and are not included in this phase of the Project.
F. If pilot testing is indicated, a separate work scope and fees will be provided at such time.
G. City will coordinate with testing lab(s) and will issue payment for testing fees, if necessary.

PREPARED BY:

Aubrey Haudricout, PE
Project Manager
McKim & Creed, Inc.

7/26/16
Date

APPROVED BY:

Michael D. Quillen, PE
City Engineer
City of Clearwater

8-4-16
Date

BRIGHT AND BEAUTIFUL BAY TO BEACH

CITY OF CLEARWATER
ENGINEERING DEPARTMENT

WORK ORDER INITIATION FORM
CITY DELIVERABLES

1. FORMAT

The design plans shall be compiled utilizing the following methods:

1. City of Clearwater CAD standards.
2. Datum: Horizontal and Vertical datum shall be referenced to North American Vertical Datum of 1988 (vertical) and North American Datum of 1983/90 (horizontal). The unit of measurement shall be the United States Foot. Any deviation from this datum will not be accepted unless reviewed by City of Clearwater Engineering/Geographic Technology Division.

2. DELIVERABLES

The design plans shall be produced on bond material, 24" x 36" at a scale of 1" = 20' unless approved otherwise. Upon completion the consultant shall deliver all drawing files in digital format with all project data in Autodesk Civil 3D file format. If not available Land Desktop files are still acceptable, however the City or Clearwater is currently phasing out Land Desktop.

NOTE: If approved deviation from Clearwater CAD standards are used the Consultant shall include all necessary information to aid in manipulating the drawings including either PCP, CTB file or pen schedule for plotting. The drawing file shall include only authorized fonts, shapes, line types or other attributes contained in the standard release of Autodesk, Inc. software. All block references and references contained within the drawing file shall be included. Please address any questions regarding format to Mr. Tom Mahony, at (727) 562 4762 or email address Tom.Mahony@myClearwater.com.

All electronic files (CAD and Specification files) must be delivered upon completion of project or with 100% plan submittal to City of Clearwater.

Reverse Osmosis WTP2 Operational Study and Improvements

McKim & Creed, Inc.

WORK ORDER INITIATION FORM
PROJECT BUDGET

Task	Description	Subconsultant Services	Labor	Total
1.0	**Project Management, Project Meetings and Administration**			
1.1	Project Management Plan		$473	$473
1.2	Progress Reports		$1,002	$1,002
1.3	Coordination/General Correspondence		$595	$595
1.4	Meetings		$6,161	$6,161
1.5	Task Allowance (10%)		$823	$823
				$9,054
2.0	**Data Collection & Review**			
2.1	Wellfield Data		$419	$419
2.2	Original Basis of Design Report		$529	$529
2.3	Record Drawings		$397	$397
2.4	Bromide and Water Quality Data		$198	$198
2.5	Bromate Control Documentation		$482	$482
2.6	City Reports of Issues		$778	$778
2.7	Financial/Rate Study Reports		$605	$605
2.8	Task Allowance (10%)		$341	$341
				$3,749
3.0	**Improvement Alternatives and Recommendations**			
3.1	Bromate Reduction Alternatives	$10,000	$25,682	$35,682
3.2	Wellfield Expansion Alternatives		$20,585	$20,585
3.3	RO Treatment Process Improvements	$10,000	$30,029	$40,029
3.4	Ancillary Improvements		$15,788	$15,788
3.5	Task Allowance (10%)		$11,208	$11,208
				$123,292
4.0	**RO WTP #2 Improvements Summary Report**			
4.1	Draft Report		$13,262	$13,262
4.2	Draft Report Review Meeting		$1,411	$1,411
4.3	Final Report		$4,712	$4,712
4.4	Task Allowance (10%)		$1,939	$1,939
				$21,324
Grand Total				**$157,419**