RESEARCH AGREEMENT

No. 1800736

BY AND BETWEEN

City of Sparks

AND

The Board of Regents of the Nevada System of Higher Education obo University of Nevada, Reno

This Research Agreement ("Agreement") is entered into and is effective as of as of the date of last signature by the Parties hereto, by and between City of Sparks, a municipal corporation, having its principal place of business at 431 Prater Way, Sparks, NV 89431, ("Sparks") and the Board of Regents of the Nevada System of Higher Education (NSHE), obo the University of Nevada, Reno, an institution of higher education of the State of Nevada, ("University") having its principal place of business at 1664 North Virginia Street, Reno, NV 89557 (Sparks and University each to be referred to as "Party" or together as "Parties") .

RECITALS

WHEREAS, Sparks, with City of Reno, own the Truckee Meadows Water Reclamation Facility ("TMWRF");

WHEREAS, Sparks desires to evaluate process and treatment performance at the TMWRF through a comprehensive collection of flow and loading data over the course of one year;

WHEREAS, University has prepared a proposal Entitled *Development of a TMWRF Process Model and Evaluation of Combined CNP Treatment Alternatives* and Sparks and University wish to have the research project performed in accordance with the scope of work and budget outlined in this Agreement;

WHEREAS, the performance of such research is consistent, compatible and beneficial to the academic role and mission of University as an institution of higher education; and

WHEREAS, University is qualified to conduct the research associated with such project.

AGREEMENT

NOW, THEREFORE, for and in consideration of the mutual covenants, conditions and undertakings herein set forth, the parties agree as follows:

1. Scope of Work. University agrees to perform for Sparks certain research ("Research")

described in the Scope of Work and provide the deliverables set forth in Appendix A, which is attached hereto and incorporated herein by this reference. Principal Investigator may select other University employees to participate in the Research (including but not limited to, University technicians, undergraduate and graduate students, post-doctural fellows, or faculty members).

2. Period of Performance. The Project period under this Agreement is intended to commence upon execution of this Agreement by both parties and continue for eighteen (18) months from the date of commencement. This Agreement may be extended for additional periods of performance beyond the Initial Term, upon written approval by Sparks and University.

3. Compensation and Payment.

3.1. Compensation. Sparks shall pay to University a total not to exceed One Hundred Twenty-six Thousand Dollars ($126,000.00) ("Compensation") for performance of the Research under this Agreement. A budget itemizing the costs for providing the Research is set forth in Appendix A.

3.2. Payment. Monthly cost reimbursable payments shall be made by Sparks to University based upon monthly invoices submitted by University. Invoices submitted to Sparks shall be paid by Sparks within thirty (30) days of receipt. The monthly invoices for services performed shall identify the direct and facility and administrative costs. Final payment shall be made upon completion of the Research.

3.3. Invoicing.
Invoices shall be delivered to:

Michael Drinkwater
Truckee Meadows Water Reclamation Facility
8500 Clean Water Way
Reno, NV 89502

Compensation checks shall reference the appropriate UNR account number and be payable to "Board of Regents, NSHE obo the University of Nevada, Reno" and shall be delivered to:

University of Nevada, Reno
Controller's Office
Mail Stop 124
Reno, NV 89557-0025

4. Technical Supervision

4.1. Supervision by Sparks. The person with primary responsibility for supervision of the performance of the Research on behalf of Sparks shall be Michael Drinkwater, Treatment Plant

Manager, or such other person as may be designated by Sparks, who shall have primary responsibility for technical supervision of the Project.

4.2. Supervision by University. The person with primary responsibility for supervision of the performance of the Research on behalf of University shall be Eric Marchand. No other person shall replace or substitute for him/her in the supervisory responsibilities hereunder without the prior written approval of University, which may be granted or withheld at University's sole discretion.

5. Reporting Requirements. University shall provide written reports to Sparks on the progress of the performance of Research as outlined or required in the Scope of Work. A final written report shall be furnished to Sparks upon completion of the Research within 60 days of the last day of the project period and after the final payment has been received.

6. Equipment. All equipment, instruments and materials purchased or used by University in connection with performance of the Research shall at all times remain under the sole control and ownership of University.

7. Confidentiality. The parties acknowledge that they are both governmental entities and thus subject to the Nevada Open Records Act, NRS Code 239.005 to 239.011. Pursuant to the Act, this Agreement, any confidential information provided pursuant hereto, may be subject to public disclosure. Any person who provides either party with records that such person believes should be protected from disclosure for business reasons must indicate the confidentiality of such records upon disclosure.

8. Data Ownership. University shall retain ownership of all data and information generated as a result of conducting the Research. University grants Sparks the right to use the data for its purposes in connection with the TMWRF.

9. Publication. Sparks recognizes that the results of University's involvement in the Research must be publishable or otherwise available for public dissemination, and agrees that University has the right to present at international, national or regional professional meetings or symposia, and to publish in journals, theses, or dissertations, or otherwise of their own choosing, methods, information and data resulting from or gained in pursuing the Research in connection with this Agreement.

10. Intellectual Property. It is not anticipated that any Intellectual Property will be developed as a result of the research.

10.1. University Intellectual Property. Intellectual property independently conceived or reduced to practice or writing by University prior to entering into this Agreement with no facilities, contribution, involvement or support by Sparks, as to its conception or reduction to practice, shall remain the sole and exclusive property of University, and Sparks shall have no title or claim to such intellectual property.

10.2. Sparks Intellectual Property. Intellectual property independently conceived or reduced to practice or writing by Sparks prior to entering into this Agreement with no facilities, contribution, involvement or support by University, as to its conception or reduction to practice, shall remain the sole and exclusive property of Sparks, and the University shall have no title or claim to such intellectual property.

11. Compliance With Laws. In performance of the Research, Sparks and University shall comply with all applicable federal, state and local laws, codes, regulations, rules and orders.

12. Relationship of Parties. In assuming and performing the obligations of this Agreement, University and Sparks are each acting as independent parties and neither shall be considered or represent itself as a joint venturer, partner, agent or employee of the other. Neither party shall use the name or any trademark of the other party in any advertising, sales promotion or other publicity matter without the prior written approval of the other party.

13. Termination and Survival.

13.1. Termination. This Agreement may be terminated by either party at any time, by giving written notice thereof to the other party. Such termination shall be effective thirty (30) days after receipt of such notice. Termination shall not relieve either party of any obligation or liability accrued hereunder prior to such termination, or rescind or give rise to any right to rescind any payments made prior to the time of such termination.

13.2. Survival. Termination of this Agreement by either party, for any reason, shall not affect the rights and obligations of the parties accrued prior to the effective date of termination of this Agreement. No termination of this Agreement, however effectuated, shall affect the parties' rights and obligations under Paragraphs 7, 8, 9, and 10 of this Agreement.

14. Uncontrollable Forces. Neither Sparks nor University shall be considered to be in default of this Agreement if delays in or failure of performance shall be due to uncontrollable forces the effect of which, by the exercise of reasonable diligence, the nonperforming party could not avoid. The term "uncontrollable forces" shall mean any event which results in the prevention or delay of performance by a party of its obligations under this Agreement and which is beyond the control of the nonperforming party. It includes, but is not limited to, fire, flood, earthquakes, storms, lightning, epidemic, war, riot, civil disturbance, sabotage, inability to procure permits, licenses, or authorizations from any state, local, or federal agency or person for any of the supplies, materials, accesses, or services required to be provided by either Sparks or University under this Agreement, strikes, work slowdowns or other labor disturbances, and judicial restraint.

15. Miscellaneous.

15.1. Assignment. Neither party shall assign or transfer any interest in this Agreement, nor assign any claims for money due or to become due under this Agreement, without the prior written consent of the other party.

15.2. Entire Agreement. This Agreement, with its attachments, constitutes the entire agreement between the parties regarding the subject matter hereof and supersedes any other written or oral understanding of the parties. This Agreement may not be modified except by written instrument executed by both parties.

15.3. Successors and Assigns. This Agreement shall be binding upon and inure to the benefit of the parties, their successors and permitted assigns.

15.4. Notices. Except as provided in Section 3 hereof regarding payment of invoices, any notice or other communication required or permitted to be given to either party hereto shall be in writing and shall be deemed to have been properly given and effective: (a) on the date of delivery if delivered in person during recipient's normal business hours; or (b) on the date of delivery if delivered by courier, express mail service or first-class mail, registered or certified, return receipt requested. Such notice shall be sent or delivered to the respective addresses given below, or to such other address as either party shall designate by written notice given to the other party as follows:

To University

Attn: Charlene Hart
Office of Sponsored Projects
University of Nevada, Reno
204 Ross Hall MS 325
Reno, NV 89557

To Sparks:

Attn: Michael Drinkwater
Truckee Meadows Water Reclamation Facility
8500 Clean Water Way
Reno, NV 89502

15.5. Order of Precedence. In the event of any conflict, inconsistency or discrepancy amount, the Agreement and any other documents listed below shall be resolved by giving precedence in the following order.

(a) This Agreement including the Exhibits hereto

(b) Purchase Order issued by Sparks. In the event a purchase order is issued under this Agreement and such purchase order contains standardized terms and conditions, the terms and conditions of this Agreement shall supercede and replace all such purchase order standardized terms and conditions.

15.6. Governing Law and Disputes. This Agreement shall be interpreted and construed in accordance with the laws of the State of Nevada, without application of any principles of choice of laws. Disputes that cannot be resolved by Sparks and University shall be determined by a court of competent jurisdiction in the State of Nevada.

15.7. Nonwaiver. A waiver by either party of any breach of this Agreement shall not be binding upon the waiving party unless such waiver is in writing. In the event of a written waiver, such a waiver shall not affect the waiving party's rights with respect to any other or further breach.

15.8. Use of Name. Neither party shall use the name of the other party in any news release or advertising or any publications directed to the general public without written approval of the other party.

15.9. Attorney Fees. The prevailing Party in any action or suit to enforce the terms or conditions of this Agreement shall be entitled to recover its costs of court and reasonable attorneys' fees incurred in enforcing the terms or conditions of this Agreement.

15.10. Counterparts and Facsimile Signatures. This Agreement may be executed in one or more counterparts each of which shall be deemed an original but all of which together shall constitute one and the same instrument. Signed signature pages may be transmitted by facsimile, and any such signature shall have the same legal effect as an original.

15.11. Severability. If any provision of this Agreement is held void or unenforceable, the remaining provisions shall nevertheless be effective, the intent being to effectuate this Agreement to the fullest extent possible.

This space left blank intentionally. Signature page follows.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed by their duly authorized representatives effective as of the day and year first written above.

CITY OF SPARKS	**BOARD OF REGENTS, NSHE OBO UNIVERSITY OF NEVADA, RENO**
"Sparks"	"University"
By: _____ Signature	By: _____ Signature
Name: Geno R. Martini (Please print)	Name: Charlene Hart
Title: Mayor, City of Sparks Nevada	Title: Assistant Vice President for Research Administration
Date: _____	Date: _____

PROJECT PROPOSAL

1. Project Title: **Development of a TMWRF Process Model and Evaluation of Combined CNP Treatment Alternatives**

2. Principal Investigators: **Eric Marchand, Ph.D., P.E., Associate Professor**
Krishna Pagilla, Ph.D., P.E., Professor
University of Nevada, Reno
Department of Civil and Environmental Engineering
Phone: 775-784-6817; E-mail: marchand@unr.edu

3. Project Manager: **Michael Drinkwater, P.E.**
Manager
Truckee Meadows Water Reclamation Facility
8500 Clean Water Way
Reno, Nevada 89502
Phone: 775-861-4100
E-mail: mdrinkwater@cityofsparks.us

4. Statement of Work: See attached

5. Duration of the Project: June 1, 2018 to December 31, 2019 (19 months)

6. Deliverables: As described in the Statement of Work

7. Equipment: As described in the Statement of Work

8. Budget and Description: Attached

4. Statement of Work

A. Purpose of Project

The purpose of this project is to evaluate process and treatment performance at the Truckee Meadows Water Reclamation Facility through a comprehensive collection of flow and loading data over the course of one year. Based on the data collection process, UNR researchers, with input from TMWRF technical and laboratory personnel, will develop a BioWin process model of the current facility and evaluate potential future scenarios (e.g., changes in flow, concentration, process configuration, etc.). Following development of the process model and evaluation of different configurations, UNR researchers will develop a preliminary conceptual analysis and research plan for a pilot-scale investigation into converting TMWRF's System 3 secondary treatment train to a CNP removal configuration.

B. Scope of Services

The scope of services for this project includes the following tasks:

1. Review and confirm through additional sampling existing plant data regarding flows and concentrations of key water quality parameters and flows necessary to develop a process model. Based on the data analysis, UNR researchers will prepare a detailed sampling plan in conjunction with TMWRF laboratory personnel and facility stakeholders.
2. Develop a BioWin process model for appropriate biological, chemical, and physical units based on water quality and flow data collected. Provide staff training on BioWin use and recommendations and guidance to TMWRF regarding the BioWin process model.
3. Investigate alternative process configurations for combined carbon-nitrogen-phosphorus treatment at the facility using the calibrated BioWin model. Develop a preliminary conceptual analysis and evaluation of alternative treatment options using BioWin.
4. Plan for conducting a pilot-scale investigation of a CNP treatment train at TMWRF and develop a research plan for studying CNP removal on-site at the pilot-scale using System 3.
5. Provide recommendations and guidance to TMWRF regarding the BioWin process model, alternative treatment options, and a research plan for studying CNP removal on-site at the pilot-scale in System 3.

C. Project Tasks

In order to achieve the overall project objectives and specific goals identified above, researchers at the University of Nevada, Reno (UNR) will perform the following tasks during this project. The tasks are further outlined below to describe the scope of the study.

Task 1 – Review and confirm existing plant data regarding flows and concentrations of key water quality parameters and flows necessary to develop a process model. Based on the data analysis, UNR researchers will prepare a detailed sampling plan in conjunction with TMWRF laboratory personnel and facility stakeholders

Some data have already been collected and reviewed by UNR researchers in conjunction with TMWRF stakeholders. Historical data will be organized and long-term trends will be developed to better understand variations in plant flow, water quality parameters, and process effluent levels on an annual and seasonal basis. Based on the data collection and review, UNR researchers will develop a comprehensive list of parameters and sampling locations to complement existing data and provide necessary information to develop and calibrate a TMWRF process model. It is proposed that TMWRF laboratory personnel conduct standard analyses (e.g., TSS, VSS, COD, nitrogen species, phosphorus species, DO, pH, etc.) to ensure consistency of data. UNR researchers will perform complimentary analyses necessary to develop and calibrate the model. This will include identifying specific constituent fractions necessary to build and calibrate the model. Examples include, but are not limited to the following: readily biodegradable COD, slowly biodegradable COD, unbiodegradable COD, particulate unbiodegradable COD, and filtered and flocculated COD.

- Deliverables include the following:

  (1) Develop and provide a detailed sampling plan to TMWRF
  (2) Provide a summary of water quality data and trends, develop seasonal and annual metrics for process performance, and provide a summary of relevant data for modeling process.

- Task Duration: 1-year (June 1, 2018 – May 31, 2019)

Task 2 – Develop a BioWin process model for appropriate biological, chemical, and physical units based on water quality and flow data collected. Provide staff training on BioWin use and recommendations and guidance to TMWRF regarding the BioWin process model.

Preliminary water quality data have been collected for TMWRF and reviewed by the UNR researchers and TMWRF personnel. The data collected during the Task 1 phase will provide

the sufficient basis for initial development of the BioWin process model. The UNR team will begin process model development after the first quarter of water quality data have been collected. Further refinement to the model will take place as more data are collected during the year-long data collection period.

- Deliverables:

  (1) Development of a BioWin process model based on steady-state performance of TMWRF.
  (2) UNR researchers will conduct a 2-day training for TMWRF process engineers and staff on operation of a TMWRF-purchased model platform.

- Task Duration: 1 year (September 1, 2018 – August 31, 2019)

Task 3 – Investigate alternative process configurations for combined carbon-nitrogen-phosphorus treatment at the facility using the calibrated BioWin model. Develop a preliminary conceptual analysis and evaluation of alternative treatment options using BioWin.

Once the preliminary BioWin model has being developed and calibrated for TMWRF water quality over different seasons, the model will be used to identify whether alternative process configurations are feasible. It is proposed to utilize the TMWRF BioWin model in steady-state operation mode as the basis for an expanded model that can incorporate additional, single stream processes such as simultaneous carbon-nitrogen-phosphorus removal schemes. It is expected that water quality and energy considerations will be evaluated for these different process configurations in addition to process footprint, reactor configuration aspects, treatment capacity, and required chemical addition. Data collected from this phase of the research will provide much needed information regarding the potential feasibility and efficacy of alternate treatment configurations.

- Deliverables:

  (1) TM with alternate TMWRF BioWin process configuration models to evaluate water quality, facility energy usage, and chemical needs, results of CNP in system 3, plant capacity in terms of flow, and load (BOD, N, P).
  (2) Provide preliminary recommendations for a pilot study if the model showed promising results.

- Task Duration: 6 months (March 1, 2019 – August 31, 2019)

Task 4 – Plan for conducting a pilot-scale investigation of a CNP treatment train at TMWRF and develop a research plan for studying CNP removal on-site at the pilot-scale using System 3.

Following Task 3 research, UNR researchers will work in conjunction with TMWRF technical and operations personnel to evaluate and prepare preliminary design for conducting a pilot-scale study of the CNP process scheme selected based on previous research. This task will specifically focus on the equipment needed, field modifications needed, and preliminary cost estimate to experimentally assess potential CNP configurations using the System 3 train at TMWRF.

- Deliverables:

    (1) UNR researchers will identify experimental needs to develop and test an optimum CNP configuration using TMWRF's System 3 treatment train in parallel with existing processes operating in a conventional treatment mode.
    (2) Provide a TM with pilot study plan including system 3 modifications, sample and data collection plan, and preliminary cost estimate.

- Task Duration: 4 months (September 1, 2019 – December 31, 2019)

Task 5 – Provide recommendations and guidance to TMWRF regarding the BioWin process model, alternative treatment options, and a research plan for studying CNP removal on-site at the pilot-scale.

- Deliverables:

    (1) Throughout the project, UNR researchers will conduct quarterly meetings with TMWRF stakeholders to discuss project results, identify whether the project scope needs modification or adjustment, and obtain input on treatment alternatives. Specific deliverables will be quarterly project update presentations and summary process data.
    (2) A TM will be developed identifying the performance of the modified treatment schematic and preliminary scaling calculations will be performed to assess the required scale to achieve full treatment.

- Task Duration: 19 months (throughout the project)

D. Reporting and Meetings

a. Throughout the project, UNR researchers will conduct quarterly meetings with TMWRF stakeholders to discuss project results, identify whether the project scope needs modification or adjustment, and obtain input on treatment alternatives. Specific deliverables will be quarterly project update presentations and summary process data.
b. UNR will provide written reports related to progress on the project tasks on a quarterly basis.
c. A final draft report and a final report will be prepared at the end of the project by UNR. The final report will include all TMs and an executive summary.
d. UNR will also prepare publications and presentations for conferences and journals, with the approval of regional team.

Deliverables: Progress reports, meeting minutes, final draft report, final report, and presentations and publications.

Task Period: Continuous throughout the duration of the project

E. Project Team

The team of UNR researchers will consist of the Principal Investigators Dr. Eric Marchand, P.E., Dr. Krishna Pagilla, P.E., one Ph.D. student, and one undergraduate student assistant.

F. Project Schedule

The proposed project schedule will extend over a period of 19 months from June 1, 2018 through December 31, 2019.

G. Other Provisions

The following items are related to the project described above but are not part of the scope of work for UNR researchers.

a. Sample collection and analysis for standard water quality parameters already analyzed by the TMWRF Water Quality Laboratory (e.g., TSS, VSS, COD, nitrogen species, phosphorus species, DO, pH, etc.).
b. Installation of any equipment or sampling devices (although UNR will assist during installation) and provision of site utilities (water, power, etc.)
c. Any additional tasks that need to be conducted will be undertaken only after approval from TMWRF stakeholders and the UNR project team.

d. TMWRF will procure the BioWin software license or lease the software for use by UNR and will be turned over to TMWRF after development of the plant model.

8. Budget and Description

Proposed Project Budget

The proposed project budget and specific categories are shown in the table below. The proposed total budget for the 19-month project is $126,000. A description and justification of each item follows.

Category	Proposed Budget		
	Year 1	Year 2	TOTAL
A. Professional Summer w/o Retirement	$16,567.60	$8,615.15	**$25,182.75**
B. Graduate Research Assistant	$24,000.00	$14,700.00	**$38,700.00**
C. Undergraduate Student - Hourly	$3,000.00	$400.00	**$3,400.00**
Total Salaries	$43,567.60	$23,715.15	**$67,282.75**
D. Fringe Benefits	$4,562.70	$2,704.61	**$7,267.31**
Total Salaries and Fringe Benefits	$48,130.30	$26,419.76	**$74,550.06**
E. Travel	$1,600.00	$500.00	**$2,100.00**
F. Operating	$6,000.00	$2,000.00	**$8,000.00**
G. Tuition & Fees	$2,748.37	$1,355.54	**$4,103.91**
Total Direct Costs	$58,478.67	$30,275.30	**$88,753.97**
Indirect Cost Rate (Fraction of MTDC)	0.44	0.44	**0.44**
Modified Total Direct Costs (MTDC)	$55,730.30	$28,919.76	**$84,650.06**
H. Indirect Costs - Facilities & Admin Costs (F&A)	$24,521.33	$12,724.70	**$37,246.03**
Total	$83,000	$43,000	**$126,000**

Description

The CEE Department at the University of Nevada, Reno operates on a 8-month academic and 4-month summer calendar schedule.

The team of UNR researchers will consist of the following investigators: Dr. Eric Marchand, P.E. (PI) and Dr. Krishna Pagilla, P.E. (Co-PI), one Ph.D. graduate student, and one undergraduate student assistant. Additional faculty and staff at UNR will participate in supplementary tasks as needed.

A. Senior Personnel - $25,182.75

Funding is requested for summer salary each year for PI Eric Marchand (20 days in year #1 and 10 days in year #2) and Co-PI Krishna Pagilla (4 days in year #1 and 2 days in year #2). A 4%

increase has been budgeted for year #2 The proposed level of commitment for this proposal is appropriate for the scope of work and is required in order to fulfill the objectives of this project within the proposed timeframe.

B. Graduate Research Assistant - $38,700

This project will provide 12-months of support each year for a Ph.D. graduate research assistant throughout the 19-month duration of the project. The graduate assistant salary has a projected salary increase of $100 per month during the second year of the project. The graduate assistant will support the PIs of the project in data collection, coordination with TMWRF laboratory personnel and engineers, development of the BioWin model, analysis of different facility configurations, evaluation of needs for pilot-scale investigation of CNP treatment, and assistance in preparation of draft reports and presentations.

C. Undergraduate Student Assistant. $3,400. One undergraduate student assistant has been budgeted at 340 hours over the course of the project at an hourly rate of $10/hour. The undergraduate student assistant will assist the graduate assistant and senior personnel of the project with major tasks during the project.

D. Fringe Benefits - $7,267.31

The fringe rate for faculty salaries is 4% (summer overload without retirement benefits). The fringe rate for the graduate research assistant is 16%. The fringe rate for the undergraduate student assistant is 2%.

E. Travel - $2,100

An amount of $2,100 has been requested for domestic and local travel for sample collection, project meetings, and conference travel for faculty and students over the duration of the project.

F. Operating Costs - $8,000

An amount of $8,000 has been requested for operating costs associated with materials, chemicals, supplies, and laboratory consumables required for the project.

G. Tuition and Fees Costs - $4,103.91

A total of $4,103.91 is requested to provide tuition and fees benefits to the graduate research assistant throughout the duration of the project. These funds support 13 credits in year #1 and 6 credits in year #2.

H. Indirect Costs (F&A Costs) - $37,246.03

Indirect costs are requested at the rate of 44.0% of the modified total direct costs (MTDC). The modified direct costs are calculated as the net total of total direct costs minus graduate student tuition and fees. The MTDC base is $84,650.06.

TOTAL PROJECT COSTS REQUESTED – $126,000