



PROJECT PROPOSAL

- 1. Project Title:** Strategies to Improve Water Quality, Treatment Capacity and Operations for Water Reuse
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- 4. Statement of Work:** See attached
- 5. Duration of the Project:** Feb 1, 2026 to January 31, 2029 (36 months)
- 6. Deliverables:** As described in the Statement of Work
- 7. Equipment:** None
- 8. Budget and Description:** As described in the Statement of Work

4. Statement of Work

Section I. Background and Statement of Needs

Washoe County Community Services Department (WCCSD) owns and operates the South Truckee Meadows Water Reclamation Facility (STMWRF), Cold Springs Water Reclamation Facility (CSWRF), and Lemmon Valley Water Reclamation Facility (LVWRF). The facilities produce reclaimed water which is beneficially used for various non-potable applications in Washoe County, increasing the water resiliency of the region. However, the WRFs are experiencing either capacity constraints due to operational challenges and/or recent improvements (such as at STMWRF) which need to be integrated into existing plant operations and processes. Furthermore, there are critical improvements that can be made to solids handling and reservoir operations at STMWRF to enhance operations and costs, and explore more opportunities for reclaimed water use. Therefore, WCCSD has requested the Nevada Water Innovation Institute (NWII) at the University of Nevada, Reno (UNR) to assist, and conduct process and development tasks to alleviate the problems and challenges, and improve operations in the WRFs and auxiliary facilities. The NWII will provide subject matter expertise and conduct tasks in coordination with WCCSD to address the same. The proposal presented here lists and describes the specific projects, tasks, deliverables, and a schedule to be followed in the next 3 years. Based on discussions between Washoe County CSD and UNR's NWII, the following projects have been identified of need for the County to address during the next 3 years.

Table 1: List of projects to be investigated and priority of completion during the proposal period.

Priority List	Project (Abbreviated Title)	Comments
1	Bardenpho Integration Technical Support to CSD at STMWRF	Field scale operations support to achieve steady state operation through process monitoring and real time optimization at STMWRF
2a	Sludge Dewatering Improvements at STMWRF	Conduct bench scale and full scale investigations across the entire sludge treatment train at STMWRF and conduct pilot scale investigations solar drying
2b	Feasibility of Solar Drying of Dewatered Sludge at STMWRF	Conduct feasibility analysis of solar drying of sludge to reduce volume of cake to landfill and select appropriate solar dryer for pilot scale testing. Conduct pilot testing to determine cost-benefits
3a	Lemmon Valley WRF Debottlenecking and Performance Upgrading	Conduct performance assessment and capacity evaluation of Lemmon Valley WRF to determine feasibility of capacity upgrading
3b	Lemmon Valley WRF Effluent Effects or Lack thereof on Lake Water and Groundwater	Conduct desktop study to determine the interactions of reclaimed water with surface and ground water in the region and potential impacts, both positive and negative

4	Algae Growth in Huffaker Reservoir and pH Control	Minimize algae growth through water quality improvements strategies
5	Minimize Arsenic/Boron in STMWRF Effluent	Review existing data to assess arsenic/boron in reclaimed water and develop strategies for reducing arsenic/boron inputs into wastewater and in reclaimed water
6	As needed services at WRFs, reclaimed water systems for landscape irrigation, and sewers	Assist Washoe County CSD in investigating and solving any problems or opportunities that arise during the project period

Section II. Scope of Projects

Project 1: Bardenpho Process Evaluation and Integration Support at STMWRF

Why and What: STMWRF has just expanded the facility to include a new Bardenpho treatment train to increase capacity. Integration of the same into overall plant process and improving water quality of the effluent is critical to realize the potential of the new addition. NWII can provide support, subject matter expertise and strategies to facilitate the same in collaboration with County staff.

Tasks

- Review process data from routine operations to determine if the Bardenpho process is working as per design and maintains water quality desired.
- Conduct sampling and analysis of N and P profiles through the various zones of the Bardenpho process to determine optimum operating conditions at varying flow rates and influent wastewater conditions
- Develop future online and sampling and analytical strategies to monitor the process to produce high quality reclaimed water for reuse.

Deliverables

- Quarterly reports to convey the findings of the investigations and their implications for Washoe County CSD in operating STMWRF
- Monthly Teams/Zoom meetings to discuss the results and changes to operations based on the results
- Guidance document on Bardenpho process operating conditions and monitoring/sampling/analytical procedures at the end of the project period

Proposed Period

Feb 1, 2026 – January 31, 2027

Project 2a: Sludge Dewatering Improvements at STMWRF

Why and What: STMWRF digests sludge from WRF in aerobic digestion followed by dewatering prior to landfill. However, the final total solids (TS) % in the dewatered product sludge cake is lower at about 15% TS due to various reasons including sludge characteristics, dewatering conditions, and sludge conditioning. STMWRF would like to reduce final sludge volume for landfill disposal and transport by enhancing final product total solids. Hence, careful analysis of bottlenecks in sludge processing system to increase cake solids in the final product is needed. A technical study of each process (thickening, digestion, and dewatering) and together as a system is needed including chemical addition optimization. NWII will conduct such a study and make recommendations for operational or physical modifications needed to WCCSD.

Tasks

- Review of existing historical data on waste activated sludge (WAS), thickening process and thickened sludge, aerobic digestion process and digested sludge, and dewatering process including polymer use to determine the bottlenecks in achieving higher cake solids.
- Design and investigate the bottleneck step(s) by bench scale and limited full scale modifications to improve cake solids
- Determine the costs and benefits associated with operational and process level modifications to achieve higher cake solids for transport and disposal

Deliverables

- Preliminary report on identification of bottlenecks within the solids processing system following the completion of the existing information review. This includes plans for bench scale and full scale investigations
- Quarterly reports and in-person meetings with Washoe County CSD to discuss the results from investigations including real-time recommendations to improve sludge processing operations
- End of the project report to summarize findings and recommendations for modifications to the solids processing operations based on cost-benefit analyses

Proposed Period

April 1, 2026 – March 31, 2027

Project 2b. Assess Feasibility of Solar Dryer to Reduce Sludge Cake Volume to Landfill from STMWRF

Why and What: Sludge from STMWRF is being transported to a landfill by trucks incurring significant operating costs and traffic nuisance to the neighbors. Increase the % TS in dewatered cake through further enhancements in sludge processing (item 3 above) and exploring solar dryer for reducing moisture in the final sludge cake can reduce number of trucks to transport the sludge to landfill and landfill disposal costs. NWII can conduct investigations to determine the feasibility of such a strategy and

explore various solar drying options including potential odor control options, if needed. A pilot scale investigation with a selected commercial solar dryer to determine the costs-benefits of solar drying application for STMWRF provide the answers needed to evaluate the feasibility of solar drying for STMWRF and for other regional agencies.

Tasks

- Conduct a thorough review of solar drying applications in other WRFs in the country to determine best practices and a short list of solar drying equipment for consideration
- Assist Washoe County CSD in procuring and operating a pilot solar drying unit and collect data necessary to make the costs-benefits analysis for STMWRF application.

Deliverables

- A technical memo at the conclusion of existing information review regarding pros and cons of exploring solar drying at STMWRF and appropriate system to pilot test at STMWRF
- Quarterly report to summarize the findings from pilot scale solar dryer operation and any upstream (solids processing) modifications needed to make the drying operations feasible
- A costs-benefits report to show energy needs, reduction in transportation and disposal costs, and operational aspects of solar drying at STMWRF

Proposed Period

April 1, 2026 – March 31, 2027

Project 3a: Lemmon Valley WRF - Capacity Recovery through Debottlenecking (from 120,000 gpd to 2,00,000 gpd (permitted))

Why and What: Lemmon Valley WRF is operating at a treatment capacity of 120,000 gpd although it is permitted to treat 2,00,000 gpd. The facility may be able to treat up to its permitted capacity if various constraints and bottlenecks can be identified and removed. NWII can conduct debottlenecking studies and potential optimization options to determine the increase in capacity of the facility. Individual unit operations and processes will be evaluated for increase in capacity and then the integrated WRF is assessed for practical treatment capacity. Strategies including flow equalization and base flow operations will be assessed to increase seasonal capacity and base flow treatment capacity of the WRF. The detailed methods outlined in the book “Integrated Methods for Wastewater Treatment Plant Upgrading and Optimization” by Drs. Movva Reddy and Krishna Pagilla (2010) and steady state process modeling using Biowin will be employed to conduct this project.

Tasks

- Conduct review of existing information and determine the capacity of the WRF vis-à-vis the current operating capacity of the facility by means of a desktop study
- Use upgrading and optimization protocols including use of process modeling tool, Biowin, to determine the operational modifications needed to increase the capacity of Lemmon Valley WRF
- Identify and recommend any operational and capital improvements needed to the existing treatment units and hydraulic structures to increase the WRF's capacity

Deliverables

- A technical memo to detail and summarize the assessment of the units and WRF for capacity enhancement including operational and capital improvement modifications needed. A preliminary cost-benefit analysis to be included in the technical memo to guide Washoe County CSD in undertaking capacity enhancement implementation.

Proposed Period

July 1, 2026 – June 1, 2027

Project 3b: Lemmon Valley WRF – Water Quality, Lake Water/Ground Water/Reclaimed Water Interactions

Why and What: Based on the discussions with WCCSD, it seems that there are concerns that the reclaimed water from Lemmon Valley WRF and its quality may be interacting with the surrounding lake water and ground water, and causing some concerns regarding NDEP requirements. NWII can provide technical expertise and support to determine if such effluent/lake water/ground water interactions are taking place or not, and if yes, what and how those effects can be mitigated.

Tasks

- A desktop study utilizing existing information and on-the-ground conditions at Lemmon Valley WRF will be conducted to determine the fate and transport of reclaimed water and its influences on the local water quality

Deliverables

- A technical memo describing the conditions and implications of Lemmon Valley WRF operations on local ground water and surface water and potential effects, if any.
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Proposed Period

April 1, 2027 – November 30, 2027 – This project can be conducted concurrently with other projects described above depending on the needs and requirements of Washoe County CSD

Project 4: Algae Growth in Huffaker Reservoir and Implications for Reclaimed Water Quality for Reuse

Why and What: The reclaimed water from Huffaker reservoir undergoes wide fluctuations in pH due to photosynthesis by algae during the day and respiration at night. This results in high pH during day and low pH during night and has implications for conveyance and reuse of reclaimed water. Reduction in algae production as in (1) would reduce the diurnal variations in pH. Algae in reclaimed water requires re-filtration and disinfection prior to supply to the reuse customers. This can add to filter load and capacity utilization. The implementation of new Bardenpho process which can provide higher water quality can aid in reducing algae production, if optimized correctly. Additional strategies including blending ratios (reservoir water:plant effluent) and chemical addition strategies need to be explored for unrestricted reuse of the reclaimed water and minimize any adverse effects. NWII can conduct preliminary studies to determine the strategies and feasibility of the same for practical implementation.

Tasks

- Conduct desktop study to determine the changes in water quality in the reservoir during a calendar year and during reclaimed water reuse period to determine the extent of the problem and its relationship to effluent water quality
- Develop mitigation strategies to minimize algae production based on best practices in the literature and make recommendations for implementation
- Conduct limited bench scale studies, if necessary, to assess intervention strategies such as chemical control and blending to improve reclaimed water quality.

Deliverables

- Preliminary technical memo on desktop study findings including potential mitigation strategies to any identified causes of algae growth in the reservoir
- Technical report on bench scale studies, if needed, at the end of the project period

Proposed Period

June 1, 2027 – December 31, 2028 (The project period is long to consider seasonal variations over at least one year)

Project 5: Strategies to Address Arsenic/Boron in STMWRF's Reclaimed Water

Why and What: Arsenic and boron are present in STMWRF's wastewater due to infiltration of native groundwater into the collection systems. Although considerable progress has been made in reducing infiltration through sewer and manhole rehabilitation, both constituents continue to be present in the wastewater and hence the reclaimed water. Arsenic and boron have adverse effects on landscape growth at elevated concentrations and under certain conditions. NWII will further investigate previous

efforts to develop prioritized strategies to minimize arsenic and boron to well below various reuse requirements.

Tasks

- Conduct review of data and reports from studies and prior efforts to determine the current situation with respect to levels of arsenic and boron in the influent wastewater and reclaimed water
- Develop operational strategies to undertake both in the collections systems and at STMWRF, if the Arsenic and Boron levels are above all reuse requirements
- Conduct bench scale and/or pilot scale studies, if necessary, to further reduce Boron and Arsenic levels in the reclaimed water.

Deliverables

- Technical memo to describe and summarize findings from existing data, prior efforts, and identify future strategies
- Quarterly reports to convey progress from operational strategies and bench/pilot scale studies
- End of the project report to summarize and implement findings of the reviews and studies

Proposed Period

July 1, 2027 – December 31, 2028

Project 6: As-needed Investigations and Studies to Address Emerging Issues in Sewer Systems, WRFs, and Reclaimed Water Systems

Why and What: In addition to the well-defined projects described above, Washoe County CSD faces certain needs which are not well defined, but need to be addressed when they arise. Example issues identified in the past and present include odor issues in collection systems, reclaimed water quality concerns or perceptions at end-user facilities, and specific challenges at WRFs.

Tasks

- Conduct as-needed tasks to address emerging issues, as requested by Washoe County CSD

Deliverables

- Technical memos to describe and summarize findings from as-needed investigations and assist Washoe County CSD in consultations with external stakeholders and public.

Proposed Period

February 1, 2026 – January 31, 2029

Section III. Project Management

Dr. Krishna Pagilla will be the Project Manager and Principal Investigator of the proposed projects. He will be the point of contact for all communications and deliverables, and will work with Washoe County CSD Project Manager(s) in successfully conducting the described projects. Dr. Eric Marchand will be Co-Principal Investigator and task lead for multiple projects. Dr. Lin Li and Dr. Laura Haak will conduct day-to-day efforts and studies at UNR and at Washoe County CSD facilities. Additionally, one graduate student and one or more undergraduate students will be involved in bench scale and pilot scale studies. UNR/NWII will also include, as needed, other UNR personnel and Washoe County staff and interns in conduct of studies and project efforts.

Project invoicing will be conducted by UNR Sponsored Research Office at least once a quarter, but no more frequent than once a month during the project period.

Project Team

The UNR project team will consist of the Principal Investigator, Dr. Krishna Pagilla, PE, Professor and Director, NWII; Dr. Eric Marchand, PE, Professor and Associate Director, NWII; Dr. Meena Ejjada, Post-Doctoral Scholar; Dr. Laura Haak, Research Scientist; Graduate and Undergraduate Student Assistants. Additional faculty and staff at UNR will be engaged for unique and supplementary tasks as needed with approval from Washoe County.

Project and Task Schedule

The project schedule will extend over a period of 36 months starting on February 1, 2026 and ending on January 31, 2029. A project-specific schedule outlining the exact dates of each task for each project described above will be developed during the first month of each project in consultation with Washoe County.

Project Costs

The budget requested will be proportional to the anticipated time and materials needed for the project efforts. The anticipated budget has been developed in consultation with Washoe County CSD.

8. PROJECT BUDGET AND EXPLANATION

Total Budget Requested: \$777,169 (for 3 years)

Based on the project tasks involved and UNR personnel involvement, the budget explanation is as follows:

Personnel: Dr. Krishna Pagilla will be the lead Principal Investigator (PI) for this project. His role will include project management, communications with the team and with Washoe County CSD, research supervision and project reporting to Washoe County. He is budgeted at 1.0 calendar month of salary per year for three years.

Dr. Eric Marchand will be the Co-Principal Investigator (Co-PI) for this project. His role will include research supervision and direction, draft report preparation, and schedule compliance. He is budgeted at 1.0 calendar month of salary per year for three years.

Drs. Lin Li and Laura Haak will be the principal Research Scientists of the project. They develop methods, coordinate project activities, and conduct bench scale and full scale studies during the project as proposed. Dr. Li and Dr. Haak are budgeted at 2 calendar months and 1 calendar months per year for the three years of project.

In addition, one graduate student is budgeted at 50% FTE in all three years of the project. An undergraduate student assistant is budgeted to be hired as hourly worker for up to 500 hours per year of the project.

Fringe Benefits: Fringe benefits are determined based on variable rates for senior personnel and students. The fringe benefits are budgeted at 32.5% for the PIs and Research Scientists, 12.9% for graduate students, and 2.5% for hourly worker.

Travel: We anticipate local travel to plants and Washoe County sites for sample collection, study monitoring, and project meetings by the UNR team members. A fixed budget of \$2000 is estimated for car mileage in each year of the project.

Materials and Supplies: An anticipated budget of \$12,000 in Year 1, \$10,000 in Year 2, and \$9,457 in Year 3 is allocated for lab supplies, lab scale and pilot scale studies, analytical supplies, and replacement parts for analytical instruments. This budget includes consumables such as gases, tubing, and reagents for analytical equipment. No equipment is budgeted in UNR budget and will be procured by Washoe County as needed.

Services: We anticipate some external lab services for QA/QC and testing and hence have budgeted \$10000 per year for 3 years. This budget will also be used for any additional UNR personnel's efforts or expertise that is not included in the project team.

Tuition and Fees: As per UNR policies, graduate students are paid tuition and fees from projects in which they serve as graduate assistants. We have budgeted tuition and fees for one graduate student in all three years of the project.

Equipment: No equipment has been budgeted for this project work. Any large field equipment for pilot scale work will be requested from Washoe County as needed. UNR has all the necessary analytical instrumentation for lab work needed in these projects described above.

Facilities and Administration Costs (Indirect Costs): Indirect costs are calculated at 47% of the modified total direct costs (total direct costs minus student tuition and fees) as per UNR policies. The indirect costs support the lab space needed for the project studies, and administrative functions not budgeted as direct costs.

Requested Budget Table

Category	Year 1	Year 2	Year 3	Total 3 Years
Personnel	\$114,725	\$119,927	\$125,225	\$359,877
Fringe Benefits	\$29,006	\$29,920	\$30,860	\$89,786
Travel	\$2,000	\$2,000	\$2,000	\$6,000
Materials and Supplies	\$12,000	\$10, 000	\$9,457	\$31,457
Services	\$10,000	\$10,000	\$10,000	\$30,000
Tuition and Fees	\$5,448	\$5,664	\$5,892	\$17,004
F&A Costs	\$78,834	\$80,768	\$83,444	\$243,046
Total Budget	\$250,013	\$258,279	\$266,877	\$777,169