Curriculum Vitae

RYAN T. BAILEY

Assistant Professor
Civil & Environmental Engineering Department
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Summary of Experience and Qualifications

Dr. Ryan Bailey's research focuses on the sustainability of watershed management practices in regards to water quantity and water quality. Recent projects have focused on the development of process-based, dynamic numerical modeling codes to identify sustainable management practices within environmental systems, and have provided a foundation for ongoing and future research. Projects include the assessment of selenium and nitrogen reactive transport in agricultural groundwater systems through field, laboratory, and numerical modeling, assessing impacts of agricultural dry-up scenarios on watershed processes, linking watershed and groundwater flow and transport models to assess the movement of water and nutrients in watersheds, and investigating best-management practices for pollutant remediation. These projects have involved model development and application to large-scale systems in the western United States, and have afforded opportunities to mentor undergraduate and graduate students. He also has been involved with the assessment of groundwater resources of small oceanic islands using field and modeling methods and the analysis of small-island water supply during drought and extreme-climate events, with projects in the Federated States of Micronesia and the Republic of Maldives. Work in the western Pacific has offered opportunities to train local water resource managers in optimizing water supply for island communities. He has taught two undergraduate courses, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, and currently is teaching a graduate course entitled "Methods for Sustainable Water Supply", with a focus on designing water systems in rural areas and developing countries.

Education

PhD **Colorado State University, Fort Collins, CO, July 2012**
Civil & Environmental Engineering – Groundwater Hydrology & Water Quality
Dissertation: *Selenium and Nitrogen Cycling in Irrigated Agricultural Groundwater Systems: Conceptualization, Modeling, and Mitigation*

MS **University of Guam, Mangilao, GU, 2008**
Water & Environmental Research Institute of the Western Pacific – Environmental Science
Thesis: *Groundwater Resources of Atoll Islands: Observation, Modeling, and Management*

BS **Brigham Young University, Provo, UT 2006**
Civil & Environmental Engineering – Hydrology emphasis
Fundamentals of Engineering Exam: April 2006

Employment Summary

Assistant Professor, Colorado State University, Civil & Environmental Engineering Department
July 2013 - Present

Research Highlights

- Selenium and nitrogen reactive transport in groundwater and surface water in agricultural watersheds; assessment of best-management practices for remediation
- Water resources assessment (groundwater, rainwater catchment) for atoll island communities in Pacific and Indian Oceans
- Investigation of groundwater-surface water interaction and river riparian processes; Linkage of groundwater reactive transport model with stream solute transport model;
- Linkage of SWAT, MODFLOW, and RT3D (flow and solute transport in river basins)
- Investigation of impacts of agricultural dry-up scenarios on groundwater flow and stream flow patterns
- Data assimilation methods in groundwater-surface water models

Funded Research

Projects as Principal Investigator (Active Grants in **Bold**)

"Improved Assessment of Nitrogen and Phosphorus Fate and Transport for Irrigated Agricultural Watersheds in Semi-Arid Regions" (Acting PI) $489,180
Sponsor: USDA – National Institute of Food and Agriculture - Agricultural and Food Research Initiative (2013-2017)

"Modeling the Influence of Conjunctive Water Use onFlow Regimes in the South Platte River Basin Using the South Platte Decision Support System Groundwater Flow Model" $50,000
Sponsor – Colorado Water Conservation Board (2014-2015)

"Developing a Framework for Simulating the Fate and Transport of Salinity Species in the Lower Arkansas River Valley, Colorado" $10,000
Sponsor: CSU Water Center, Water Faculty Fellow (2014-2015)

"Sampling for Selenium Drainage Assessment" $7,420
Sponsor: James Valliant, AVID, LLC (2014-2015)

Projects as Co-Principal Investigator (Active Grants in **Bold**)

"Water Quality and Productivity Enhancement in an Irrigated River Basin Through Participatory Conservation Planning and Analysis" 659,954
Sponsor: USDA – National Institute of Food and Agriculture, NIWQP (2014-2017)
Principal Investigator: Dr. Timothy K. Gates

"Building and Assessing an Accounting Tool for Water from Lease Fallowing in Colorado's Lower Arkansas River Valley - Phase 4" 24,702
Sponsor: Upper Arkansas Water Conservancy District (2015)
Principal Investigator: Dr. Timothy K. Gates

"Identifying Arkansas River Selenium and Nitrogen Best Management practices" $256,620
Sponsor: Colorado Department of Public Health and Environment (2012-2015)
Principal Investigator: Dr. Timothy K. Gates

Enhancement of "Identifying Arkansas River Selenium and Nitrogen Best Management practices", *Sponsor*: Water Quality Improvement Fund, Colorado Department of Public Health and Environment, 2013-2014. $59,462
Principal Investigator: Dr. Timothy K. Gates

Building and Assessing an Accounting Tool for Water from Lease-Fallowing in Colorado's Lower Arkansas River Valley, *Sponsor:* Upper Arkansas Valley Water Conservancy District, 2012 – 2014, $227,551.
Principal Investigator: Dr. Timothy K. Gates

Contracts outside of Colorado State University

"Sustainable Conjunctive use of Groundwater and Rain Catchment Water under Variable Climatic Scenarios for Atoll Island Communities" $10,000
Sponsor: United States of Geologic Survey (by way of University of Guam) (2014-2015)

"Combined Use of Surface Water and Groundwater for Sustainability of Atoll Island Water Supply" $7,000
Sponsor: United States of Geologic Survey (by way of University of Guam) (2012-2013)
Principal Investigator: Dr. John W. Jenson

"Groundwater Resources Analysis for the Maldives (Maldives Water Scarcity)" $5,700
Sponsor: World Bank (2012-2013)

Teaching/Training Experience

Undergraduate Courses
CIVE 260 Engineering Mechanics: Statics
CIVE 261 Engineering Mechanics: Dynamics
CIVE 423 Groundwater Engineering

Graduate Courses
CIVE 580-A9 Methods of Sustainable Water Supply

Participation in Teacher Training Workshops
Participation in American Society of Civil Engineers ExCEEd (Excellence in Civil Engineering Education Teaching Workshop), Colorado State University (2011)

Training Courses / Public Outreach

- "Assessment of future water supply for Micronesian atoll island communities" (Pohnpei State, Federated States of Micronesia; October 2014)
- **"**Conjunctive use of rain catchment water and groundwater for atoll island communities" (Yap State, Federated States of Micronesia; October 2012)
- **"**Sustainability of Water Supply on Atoll Islands: Water Resources, Education, and Future Needs" (Chuuk State, Federated States of Micronesia; October 2011)
- "Groundwater Resources of Atoll Islands: Threats, Prediction, and Management" (Pohnpei State, Federated States of Micronesia, October 2010)
- "Groundwater Management for Atoll Islands" (Yap and Pohnpei States, Federated States of Micronesia; August 2009)

Professional Publications and Talks

Refereed Journal Articles *(published or in press)*

Published *(in order of publication)*:
(underlined authors indicate advised graduate student)

1. **Bailey, R.T.**, Jenson, J.W., and Olsen, A.E. (2009), Numerical modeling of atoll island hydrogeology. *Ground Water* 47(2), 184-196.

2. Gates, T.K., Cody, B.M., Donnelly, J.P., Herting, A.W., **Bailey, R.T.**, and Mueller.-Price, J. (2009), Assessing selenium contamination in the irrigated stream-aquifer system of the Arkansas River, Colorado. *Journal of Environmental Quality* 38, 1-13.

3. **Bailey, R.T.**, Jenson, J.W., and Olsen, A.E. (2010), Estimating the ground water resources of atoll islands. *Water* 2(1), 1-27.

4. **Bailey, R.T.** and Baù, D. (2010), Ensemble smoother assimilation of hydraulic head and return flow data to estimate hydraulic conductivity distribution, *Water Resources Research*, 46, W12543, doi:10.1029/2010WR009147.

5. **Bailey, R.T.** and Baù, D. (2011), Estimating spatially-variable first-order rate constants in groundwater reactive transport systems, *Journal of Contaminant Hydrology*, 122, 104-121.

6. **Bailey, R.T.**, and Baù, D. (2012), Estimating geostatistical parameters and spatially-variable hydraulic conductivity within a catchment system using an ensemble smoother. *Hydrology and Earth System Sciences*, 16, 287-304.

7. **Bailey, R.T.**, Hunter, W.J., and Gates, T.K. (2012), The influence of nitrate on selenium in irrigated agricultural groundwater systems. *Journal of Environmental Quality,* 41, 783-792.

8. **Bailey, R.T.**, Baù, D., and Gates, T.K. (2012), Estimating spatially-variable rate constants of denitrification in an irrigated agricultural groundwater system using an Ensemble Smoother. *Journal of Hydrology*, 468-469, 188-202.

9. Morway, E.D., Niswonger, R., Langevin, C., **Bailey**, **R.T.**, and Healy, R. (2013), Modeling variably saturated subsurface solute transport with MODFLOW-UZF and MT3DMS. *Groundwater*, 51(2), 237-251.

10. **Bailey, R.T.**, Jenson, J.W., and Taborosi, D. (2013), Estimating the freshwater lens thickness of atoll islands in the Federated States of Micronesia. *Hydrogeology Journal*, 21(2), 441-457.

11. **Bailey, R.T.**, Gates, T.K., and Halvorson, A.D. (2013) Simulating variably-saturated reactive transport of selenium and nitrogen in agricultural groundwater systems. *Journal of Contaminant Hydrology*, 149, 27-45.

12. **Bailey, R.T.**, Morway, E.D., Niswonger, R., and Gates, T.K. (2013), Modeling variably saturated multispecies reactive groundwater solute transport with MODFLOW-UZF and RT3D. *Groundwater*, 51(5), 752-761.

13. **Bailey, R.T.** and Jenson, J.W. (2013), Effects of marine overwash for atoll island aquifers: environmental and human factors. *Groundwater*, 52(5), 694-704.

14. **Bailey, R.T.** and M. Ahmadi (2014), Spatial and Temporal Variability of In-Stream Water Quality Parameter Influence on Dissolved Oxygen and Nitrate within a Regional Stream Network. *Ecological Modelling* 277, 87-96.

15. **Bailey, R.T.**, Gates, T.K., and M. Ahmadi (2014), Simulating reactive transport of selenium coupled with nitrogen in a regional-scale irrigated groundwater system. *Journal of Hydrology* 515, 29-46.

16. **Bailey, R.T.**, Khalil, A., and V. Chatikavanij (2014), Estimating Transient Freshwater Lens Dynamics for Atoll Islands of the Maldives. *Journal of Hydrology* 515, 247-256.

17. Yen, H., **Bailey, R.T.**, Arabi, M., Ahmadi, M., White, M., and Arnold, J. (2014), The role of interior watershed processes in improving parameter estimating and performance of watershed models. *Journal of Environmental Quality*, doi:10.2134/jeq2013.03.0110.

18. **Bailey, R.T.**, Khalil, A., and V. Chatikavanij (2014), Estimating Current and Future Groundwater Resources of the Maldives. *Journal of the American Water Resources Association*, doi: 10.1111/jawr.12236.

19. Wallace, C.D. and **R.T. Bailey** (2014), Sustainable rainwater catchment systems for Micronesian atoll communities. *Journal of the American Water Resources Association*, doi: 10.1111/jawr.12244.

20. **Bailey, R.T.**, Romero, E.C., and T.K. Gates (2015), Assessing best management practices for remediation of selenium loading in groundwater to streams in an irrigated region. J. Hydrol. 521:341-359.

21. Foy, C., Arabi, M, Yen, H, Gironás, J., and **R.T. Bailey** (2015), Multisite assessment of hydrologic processes in snow-dominated mountainous river basins in Colorado using a watershed model. *Journal of Hydrologic Engineering*. doi: 10.1061/(ASCE)HE.1943-5584.0001130.

22. **Bailey, R.T.** (2015), Quantifying transient post-overwash aquifer recovery for atoll islands in the Western Pacific. *Hydrological Processes*. doi: 10.1002/hyp.10512.

23. **Bailey, R.T.**, Gates, T.K., and E.C. Romero (2015), Assessing the effectiveness of land and water management practices on nonpoint source nitrate levels in an alluvial stream-aquifer system. *Journal of Contaminant Hydrology*. 179, 102-115.

24. Wallace, C.D., **Bailey, R.T.**, and M. Arabi (2015), Rainwater catchment system design using simulated future climate data. *Journal of Hydrology. In press*.

Conference Proceedings

***invited talk*

1. **Bailey, R.T.**, Jenson, J.W. and Olsen, A.E. (2008), "Atoll Island Freshwater Lens Alebraic Model". In: *Proceedings of the 14th Symposium on the Geology of the Bahamas and other Carbonate Regions,* Gerace Research Centre, 12-16 June, 2008, San Salvador, Bahamas.
2. **Bailey, R.T.**, Jenson, J.W. and Olsen, A.E. (2008), "Numerical Modeling of Atoll Island Hydrogeology". In: *Proceedings of the 14th Symposium on the Geology of the Bahamas and other Carbonate Regions,* Gerace Research Centre, 12-16 June, 2008, San Salvador, Bahamas.
3. **Bailey, R.T.**, Cody, B.M., and Gates, T.K. (2009). "Mobilization and reactive transport of selenium in a stream-aquifer system: From field monitoring toward remediation modeling". In J. Ramirez, Proceedings of the *XXIX American Geophysical Union Hydrology Days*, Fort Collins, CO.
4. **Bailey, R.T.** and Baù, D. (2010). "Assimilating water table elevation data into a catchment hydrology modeling framework to estimate hydraulic conductivity". In J. Ramirez, Proceedings of the *XXX American Geophysical Union Hydrology Days*, Fort Collins, CO.
5. ***Bailey, R.T.** and Baù, D. (2010), "Inverse modeling of hydraulic conductivity distribution by assimilation of return flow data". In J. Carrera (Ed), Proceedings of the *XVIII International Conference on Computational Methods in Water Resources*, CIMNE, Barcelona, Spain. **peer-reviewed paper*
6. **Bailey, R.T.** and Baù, D. (2011). "Estimating the spatial distribution of a first-order solute decay constant in groundwater systems". In J. Ramirez, Proceedings of the *XXXI American Geophysical Union Hydrology Days*, Fort Collins, CO.
7. Morway, E., Niswonger, R., and **Bailey, R.T.**, 2011. "Modeling variable saturated transport with MODFLOW-UZF and MT3DMS", extended abstract, in Proceedings of *MODFLOW and More 2011: Integrated Hydrologic Modeling*, Volume1, p. 715, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado.
8. **Bailey, R.T.**, Gates, T.K., Niswonger, R., and Morway, E.D. 2011. "Multi-species reactive transport in agricultural groundwater systems", extended abstract, in Proceedings of *MODFLOW and More 2011: Integrated Hydrologic Modeling*, Volume1, p. 721-723, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, 80401.
9. **Bailey, R.T.**, and Baù, D. 2011. "Data assimilation of water table and stream flow data to estimate uncertain spatial distribution of hydraulic conductivity in catchment hydrology systems", extended abstract, in Proceedings of *MODFLOW and More 2011: Integrated Hydrologic Modeling*, Volume 1, p. 421-422, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado.
10. **Bailey, R.T.** and Jenson, J.W. (2011), "Analysis of groundwater resources of atoll islands in the Federated States of Micronesia", *Water Resource Sustainability Issues on Tropical Islands Conference*, Honolulu, HI. Nov. 14-16, 2011.
11. ****Bailey, R.T.** and Gates, T.K. (2011), "Simulating the reactive transport of nitrogen species in a regional irrigated agricultural groundwater system", Abstract H51O-01, presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec.
12. **Bailey, R.T.**, Baù, D., and Gates, T.K. (2011), "Using data assimilation methodology to estimate spatially-variable denitrification rate constants in an irrigated agricultural aquifer system", Abstract A33A-0180, presented at 2011 Fall Meeting, AGU, San Francisco, Calif., 5-9 Dec, Poster.
13. **Bailey, R.T.** and Jenson, J.W. (2012). "Estimating the spatial distribution of a first-order solute decay constant in groundwater systems". In J. Ramirez, abstract in: Proceedings of the *XXXII American Geophysical Union Hydrology Days*, Fort Collins, CO.

14. **Bailey, R.T.** and Gates, T.K. (2012). "Groundwater analysis of atoll islands in the Federated States of Micronesia: Observations, Modeling, and Training". In J. Ramirez, abstract in: Proceedings of the *XXXII American Geophysical Union Hydrology Days*, Fort Collins, CO.
15. **Bailey, R.T.** and Gates, T.K. (2012), "Simulating the reactive transport of selenium in a regional irrigated agricultural groundwater system", *XIX International Conference on Computational Methods in Water Resources* (CMWR 2012), Urbana, Illinois, 17-21 June 2012.
16. **Bailey, R.T.** and Baù, D. (2012), "Estimating geostatistical parameters of hydraulic conductivity using an iterative Ensemble Smoother scheme", *XIX International Conference on Computational Methods in Water Resources* (CMWR 2012), Urbana, Illinois, 17-21 June 2012.
17. Romero, E.C., **Bailey, R.T.**, and T.K. Gates (2013), "Modeling selenium and nitrate reactive transport in the Arkansas River in southeastern Colorado using OTIS-MULTI." In J. Ramirez, abstract in: Proceedings of the *XXXIII American Geophysical Union Hydrology Days*, Fort Collins, CO.
18. Mages, C., **Bailey, R.T.**, and T.K. Gates (2013), "Evaluation of the Glover Solution for Estimating Stream Depletion due to Fallowing in the Lower Arkansas River Valley, Colorado." In J. Ramirez, abstract in: Proceedings of the *XXXIII American Geophysical Union Hydrology Days*, Fort Collins, CO.
19. **Bailey, R.T.**, Arabi, M., Wible, T., Ditty, J., and R. Records (2013), "Comprehensive simulation of hydrologic and water quality processes in watershed systems by linking SWAT, MODFLOW, and RT3D", extended abstract, in Proceedings of *MODFLOW and More 2013: Translating Science into Practices*, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, 80401.
20. **Bailey, R.T.**, Romero, E.C., and T.K. Gates (2013), "Simulating the reactive transport of multiple chemical species in groundwater and surface water in irrigated stream-aquifer systems", extended abstract, in Proceedings of *MODFLOW and More 2013: Translating Science into Practices*, International Ground Water Modeling Center, Colorado School of Mines, Golden, Colorado, 80401.
21. Wible, T., Ditty, J., **Bailey, R.T.**, Arabi, M. (2013), "Spatial integration of SWAT, MODFLOW, and RT3D for simulation of hydrologic and water quality processes in irrigated agricultural watersheds", abstract in Proceedings of SWAT 2013, Toulouse France.
22. **Bailey, R.T.** and T.K. Gates (2013), "Influence of Irrigation Management Scenarios on Nitrate and Selenium Mass Loading to the Arkansas River, Colorado", abstract, in Proceedings of the United States Committee on Irrigation and Drainage annual meeting, Denver, CO, 22-25 October 2013.
23. ****Bailey, R.T.** (2013), "Recent enhancements of the OTIS model to simulate multi-species reactive transport in stream-aquifer systems", abstract, in Proceedings of the GSA Annual Meeting & Exposition, Denver, CO, 27-30 October 2013.
24. **Bailey, R.T.**, Khalil, A., and V. Chatikavanij (2013), "Estimating Current and Future Groundwater Resources of the Republic of the Maldives", abstract, in Proceedings of the American Water Resources Association Annual Water Resources Conference, Portland, OR, 4-7 November 2013.
25. Romero, E.C., **Bailey, R.T.**, Gates, T.K., Sharp, M.D., and D.L. Hoag (2013), "Exploring Best Management Practices for Decreasing Selenium in the Stream-Aquifer System of Colorado's Lower Arkansas River Valley", abstract, in Proceedings of the American Water Resources Association Annual Water Resources Conference, Portland, OR, 4-7 November 2013.
26. Sharp, M.D., Hoag, D.L., Romero, E.C., Gates, T.K., and **R.T. Bailey** (2013), "Institutional and Economic Complications of River Basin Management: The Case of Selenium in the Lower Arkansas River Valley", abstract, in Proceedings of the American Water Resources Association Annual Water Resources Conference, Portland, OR, 4-7 November 2013.
27. Wallace, C.D., and **R.T. Bailey** (2014), "Rainwater catchment analysis to assess existing and potential water supply for Micronesian Atoll Islands" In J. Ramirez, abstract in: Proceedings of the *XXXIV American Geophysical Union Hydrology Days*, Fort Collins, CO.

28. **Bailey, R.T.**, Gates, T.K., and S. Tavakoli (2014), "Simulating the fate and transport of salinity in a regional irrigated agricultural groundwater system" Salinity Forum 2014, Riverside, CA.
29. Wallace, C.D., and **R.T. Bailey** (2014), "Estimation of future freshwater lens thickness of Micronesian atoll islands using simulated climate data" 2014 AWRA Annual Water Resources Conference, Tysons Corner, VA.

Technical Reports

1. **Bailey, R.T.**, Jenson, J.W., Rubinstein, D., and A.E. Olsen (2008), "Groundwater resources of atoll islands: Observations, Modeling, and Management". Water and Environmental Research Institute of the Western Pacific, University of Guam. Technical Report No. 119.
2. **Bailey, R.T.**, Jenson, J.W., Rubinstein, D., and A.E. Olsen (2008), "An atoll freshwater lens algebraic model for groundwater management in the Caroline Islands". Water and Environmental Research Institute of the Western Pacific, University of Guam. Technical Report No. 120.
3. **Bailey, R.T.**, and J.W. Jenson (2011), "Groundwater resources analysis of atoll islands in the Federated States of Micronesia using an Algebraic Model". Water and Environmental Research Institute of the Western Pacific, University of Guam. Technical Report No. 134.
4. **Bailey, R.T.** (2012), "Groundwater Resources Analysis for the Maldives: Addressing current climate conditions, drought conditions, and the effects of sea-level rise", Final Draft submitted to The World Bank, Washington, D.C.

Invited Talks

1. 2015 Governors Forum on Colo Agriculture (Feb 26 – Denver), "Water Quality in the Lower Arkansas River Valley: Salinity, Nitrate, & Selenium".

Peer-Review Activity

Journals

- *Advances in Water Resources* (2012 – present)
- *Applied Geochemistry* (2014 – present)
- *Chemosphere* (2013 – present)
- *Groundwater* (National Ground Water Association) (2009 – present)
- *Hydrogeology Journal* (2014 – present)
- *Hydrologic Processes* (2013 – present)
- *Hydrology and Earth System Sciences* (2014 – present)
- *Journal of Contaminant Hydrology* (2013 – present)
- *Journal of Environmental Quality* (2012 – present)
- *Journal of Hydrology* (2013 – present)
- *Marine Pollution Bulletin* (2014 – present)
- *Science of the Total Environment* (2012 – present)
- *Water* (2014 – present)

Model Development

- UZF-RT3D: linkage between MODFLOW-UZF and RT3D for reactive transport of solute in variably saturated soil and aquifer systems
- UZF-RT3DAG: groundwater solute transport model that accounts for the fate and transport of selenium and nitrogen species in agricultural-influenced groundwater systems
- Coupled SWAT – MODFLOW - RT3D to simulate flow and transport in watershed systems
- OTIS-MULTI: modified version of OTIS, to simulate reactive transport of multiple interacting species in stream networks
- RT3D-OTIS: reactive solute transport in coupled groundwater-surface water system

Professional Affiliation and Activities

American Society of Civil Engineers (ASCE)
American Water Resources Association (AWRA)
American Geophysical Union (AGU)