GALLATIN VALLEY WATER EXCHANGE

A market-based approach to sustainable water management in Western Montana

KAREN ASKELAND | JAMES BAGLIA | RIA BONER
LEAH FINE | DAVID GRUEN | RACHEL O'CONNOR
FACULTY ADVISOR: THOMAS DUNNE

BREN SCHOOL

INTRODUCTION

Gallatin Valley, Montana is experiencing rapid population growth. This new development depends on groundwater withdrawals and has placed increasing pressure on local water resources. From 2007 to 2016, over 118,000 groundwater wells were drilled in the state. In the Gallatin Valley, surface and groundwater are closely connected, and this significant groundwater pumping reduces streamflow in nearby rivers.

Streamflow is important not only for freshwater ecosystems, but also for agricultural and water-based recreational industries. Recognizing this, the State of Montana developed regulations that new water users must follow in order to minimize harm to streams and existing water users. Under these rules, new water users must offset— or mitigate— their impact to surface streams by purchasing and retiring existing water rights. This process is complex, time-consuming and costly. The difficulty of meeting mitigation requirements threatens the future of sustainable water management in Montana.

Project study area.

PROJECT OBJECTIVE

Create a management plan for a new institution, the Gallatin Valley Water Exchange (GVWE), to facilitate water transactions for mitigating new groundwater use. This allows new groundwater users to meet Montana's water-use laws while balancing water needs for both the environment and the economy.

- Secure existing water rights
- Complete regulatory change-of-use process
- **Mitigation Credit**
- Market mitigation to new water users
- Recharge water and/or leave instream
- Offset adverse impacts to streamflow
- Long-term agricultural, urban, and environmental sustainability

Groundwater@lists.bren.ucsb.edu
www.montanagroundwater.weebly.com

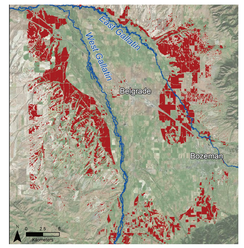
HYDROGEOLOGY

In order to meet Montana's mitigation requirements and offset stream depletion throughout the year, water must be diverted during the summer irrigation season and infiltrated into the groundwater aquifer, delaying its flow back to rivers and streams GVWE will need to construct managed aquifer recharge sites to conduct this infiltration, but only certain locations are suitable for recharge. Suitable parcels are relatively flat, undeveloped and overlie permeable soils and coarse geology. In addition, there must be sufficient depth between the land surface and the underlying groundwater, in order to provide enough space to store the recharged water.

A valley-wide site suitability analysis was conducted to inform GVWE's selection of recharge locations (see table for criteria).

CRITERION	THRESHOLD VALUE
Surficial Geology	Quaternary Alluvium or Tertiary Sediments
Slope	< 3%
Soil Type	Hydrologic Groups A & B
Land Use	Undeveloped, Agriculture
Land Ownership	Private or City of Bozeman Property
Depth to Groundwater	> 6 m

Suitability criteria for recharge site selection.



Recommended areas for recharge suitability investigation.

The final selected parcels are suitable under all six criteria. The results of the analysis show three general suitable areas: the southern portion of the valley, the raised bench west of the West Gallatin River, and areas north of Bozeman bordering the East Gallatin River. Depth to groundwater was found to be a limiting factor for the lower portions of the valley located in between the East and West Gallatin Rivers.

A basin-wide hydrologic model must be completed to find suitable recharge sites and understand the stream depletion resulting from new groundwater pumping.

Due to the close connection between surface water and groundwater, efficient siting of recharge projects will be needed to offset stream depletions caused by new pumping.

SUPPLY & DEMAND

Supply: GVWE will need to repurpose existing water rights, likely those formerly used for irrigation, to use for mitigation. The volume of water in Gallatin County available for acquisition was calculated based on historic consumptive use, priority date and location of water rights.

Agricultural surveys suggest that a maximum of 89,243 to 122,538 acre feet (AF) per year of water in the Valley has historically been used consumptively, indicating that GVWE will require roughly 7-10% of the total available agricultural water. However factors, such as finding a willing seller, may limit the supply.

To be successful, GVWE may need to use water rights with a later priority date as part of a mitigation portfolio. Furthermore, leadership from the agricultural community is essential for the development of GVWE from concept to implementation.

Demand: Census data and per capita water use from regional planning documents indicate that future water demand in Gallatin County cannot be met by current supplies. The volume of water demanded from GVWE was estimated based on how much of this future demand is met by new wells that are large enough to require permits and the adverse impact to surface streams caused by the pumping.

Mitigation water demand in Gallatin County, MT.

City of Bozeman (90%)

Non-municipal (10%)

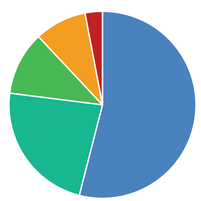
Under a moderate demand scenario, GVWE would supply nearly 6,000 AF of mitigation per year by 2050. The majority of this demand will come from the City of Bozeman, which has expressed interest in finding mitigation options for future high-capacity wells to serve its growing population.

VIABILITY

The costs for operating GVWE will determine the necessary price of a mitigation credit in order to break-even. For GVWE to be successful, this price will need to be comparable or lower than other methods of mitigation.

Informational interviews were conducted with other water banks to gain a better understanding of costs. Water rights acquisition and aquifer recharge were found to be the most substantial.

Under the most cost-effective model, GVWE would use a mitigation portfolio for its customers, including instream transfers and managed aquifer recharge. Additionally, GVWE would act as an intermediary between water rights holders and new water users to avoid the substantial costs associated with purchasing a water right.



Total operational costs from 2016-2048 by category.

- 54% *Water Rights Acquisition*
- 23% *Aquifer Recharge & Conveyance*
- 11% *Operations & Administration*
- 9% *Change of Use Process*
- 3% *Hydrologic Modeling*

Under the cost-effective model, administering transactions and providing mitigation would range from $2,500 to $3,500 per AF. New water users would pay between $5,000 and $7,500 per AF for a complete mitigation credit, including the cost of obtaining a water right. However, these prices do not include the cost of operating into perpetuity, which will be a necessary feature of GVWE.

Currently, only new users pumping more than 10 AF per year are required to mitigate. Lowering this exemption would create a much larger customer base for GVWE and help protect water resources.

Success of GVWE will depend on a few key factors: 1) the participation of the City of Bozeman, 2) the willingness of senior rights holders to sell, 3) the ability of GVWE to operate under the cost-effective model.

STAKEHOLDER BENEFITS

- Senior water users are protected from harm caused by new, unmitigated groundwater pumping.
- New water users have a simplified way to offset their impact on rivers and streams.
- Gallatin Valley economy is supported by sustainable water use for agriculture, recreational fisheries, and residential development.
- The environment is protected through mitigation requirements that maintain streamflow.
- Water resources practitioners have an example of successful, sustainable management of surface water and groundwater.

Acknowledgements:
This project would not have been possible without the generous support of many individuals. We would like to thank our clients Laura Ziemer at Trout Unlimited and Eloise Kendy at The Nature Conservancy, our faculty advisor Thomas Dunne, our PhD Mentor Andrew Ayres, our external advisors Deborah Stephenson, Bruce Aylward and Robert Barwin, as well as many professionals who shared their expertise and experiences with us providing essential knowledge and guidance for our project.