



Big Hole Watershed Committee

Monthly Meeting Minutes

October 19, 2022 – 7:00 pm at the Divide Grange
Zoom option also provided

In Attendance

In-person: Pedro Marques, BHWC; Tana Nulph, BHWC; Ben LaPorte, BHWC; Tom Bowler, Resident; Betty Bowler, Resident; Roy Morris, GGTU; John Reinhardt, Rancher/BHWC; Charlie Ivor, Elkhorn Ranch; Dean Peterson, Rancher/BHWC; Howard Varner, Ranch; Matt Norberg, DNRC; Sean Claffey, TNC; Vanna Boccadori, MFWP; Jesse Newby, MFWP; Erik Kalsta, Ranch/BHWC; Matt Lacey, USFS; Scott Nagel, USFS; Jamie Tripp, USFS; Ron Breitmeyer, MBMG; Jenna Dohman, MBMG; Ann Hanson, MBMG; Jarrett Payne, MFWP; Jim Hagenbarth, Rancher/BHWC; and Diane Hutton, Resident/BHWC.

Zoom: None.

Meeting Minutes

BHWC monthly meetings are held at the Divide Grange with a virtual (Zoom) option provided thanks to Southern Montana Telephone Company, who donated the internet service. Meeting minutes and recordings are available at <https://bhwc.org/monthly-meetings/> (scroll down for meeting minutes archive). Printed copies are available during in-person meetings. Contact Tana Nulph, BHWC Associate Director, at tnulph@bhwc.org or (406) 267-3421 to suggest additions or corrections.

Reports

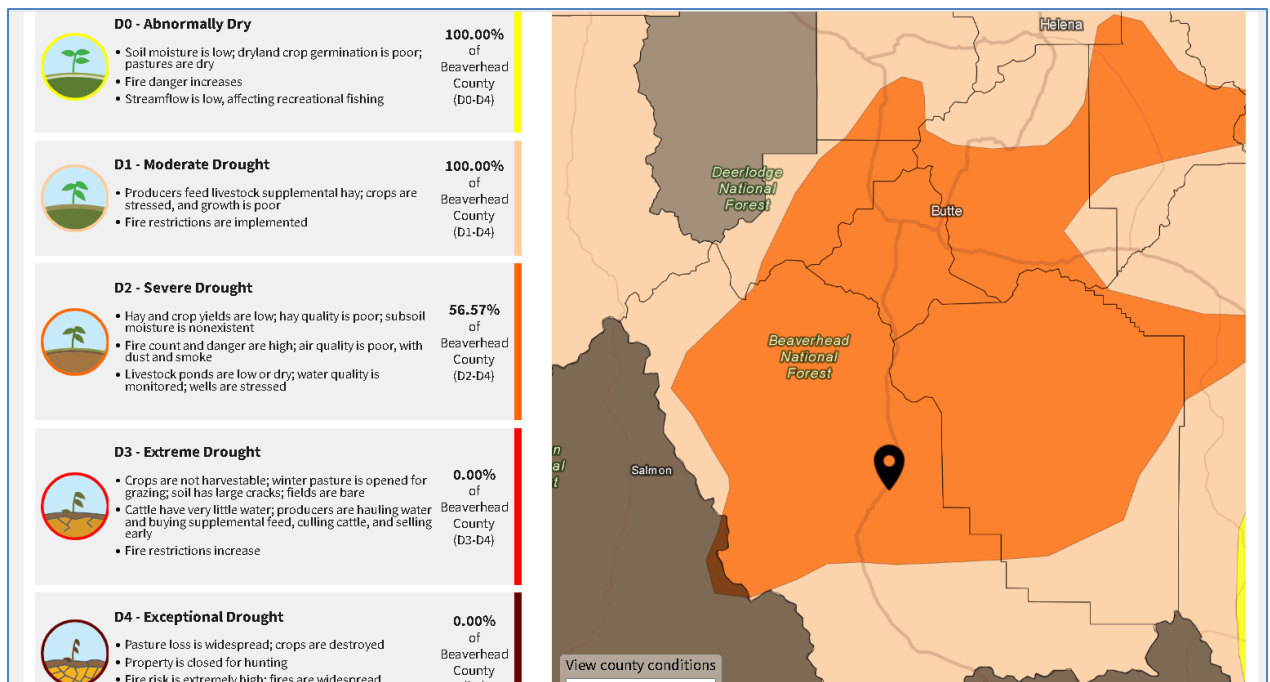
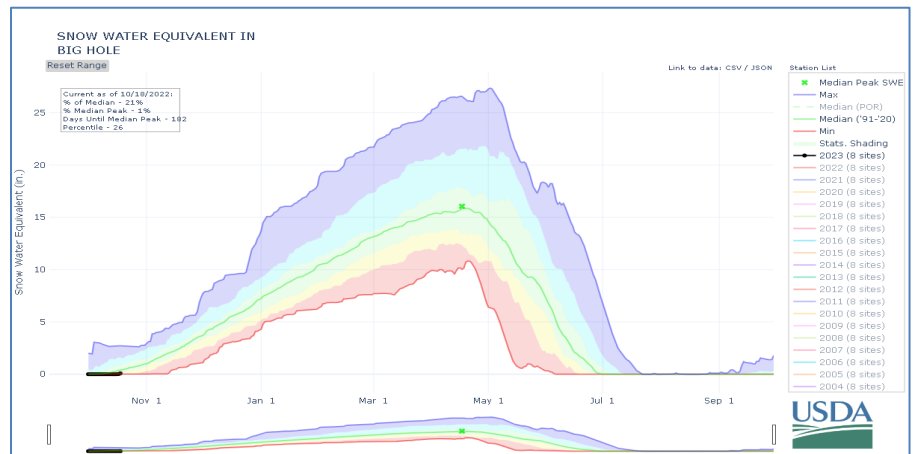
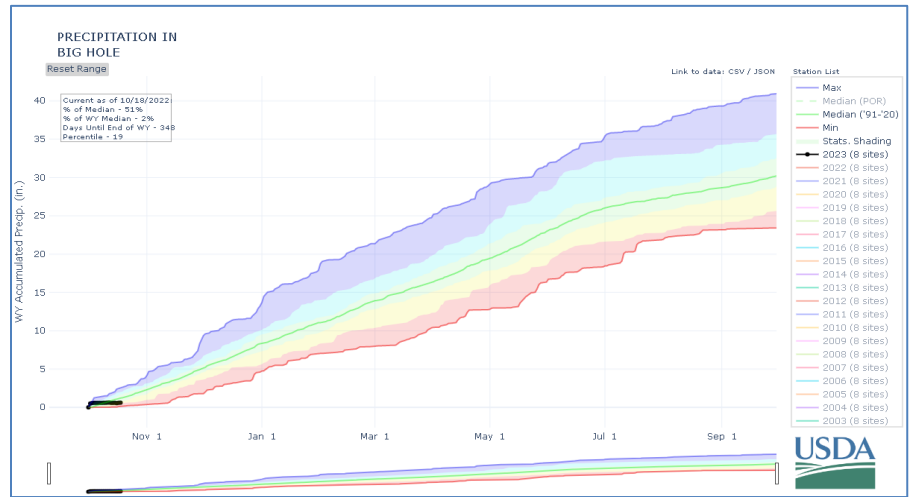
Streamflow and Snowpack Report – Matt Norberg, Department of Natural Resources and Conservation

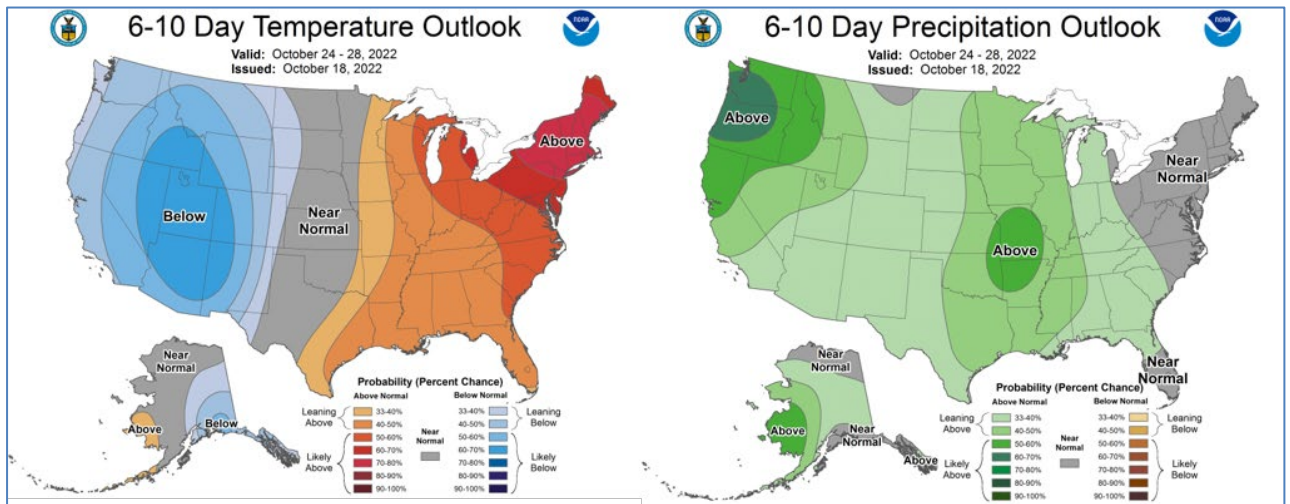
- *Streamflows:* Streamflows in the Big Hole River watershed are still below to well below average for this time of year. Lack of precipitation and warmer than average air temperatures this fall have not replenished water availability throughout the watershed. Hopefully, the upcoming weekend storm and cooler temperatures will start to elevate streamflows in the Big Hole.

Big Hole Stream Gages							
Station Number	Station name	Date/Time	Gage height, feet	Dis-charge, ft ³ /s	Long-term median flow 5/18	Temperature, water, deg C	
■ UPPER MISSOURI RIVER BASIN							
06024450	Big Hole River bl Big Lake Cr at Wisdom MT	10/18 19:45 MDT	1.99	31.8	73.0	9.5	
06024540	Big Hole River bl Mudd Cr nr Wisdom MT	10/18 19:30 MDT	2.64	50.9	203	--	
06024580	Big Hole River near Wise River MT	10/18 19:45 MDT	--	--	---	7.5	
06025250	Big Hole River at Maiden Rock nr Divide MT	10/18 19:45 MDT	2.72	--	---	Ssn	
		10/18 18:45 MDT	--	234	459	--	
06025500	Big Hole River near Melrose MT	10/18 19:15 MDT	1.42	282	462	10.0	
06026210	Big Hole River near Glen MT	10/18 19:30 MDT	2.32	305	558	Ssn	
06026420	Big Hole R bl Hamilton Ditch nr Twin Bridges, MT	10/18 19:30 MDT	0.810	183	427	11.2	

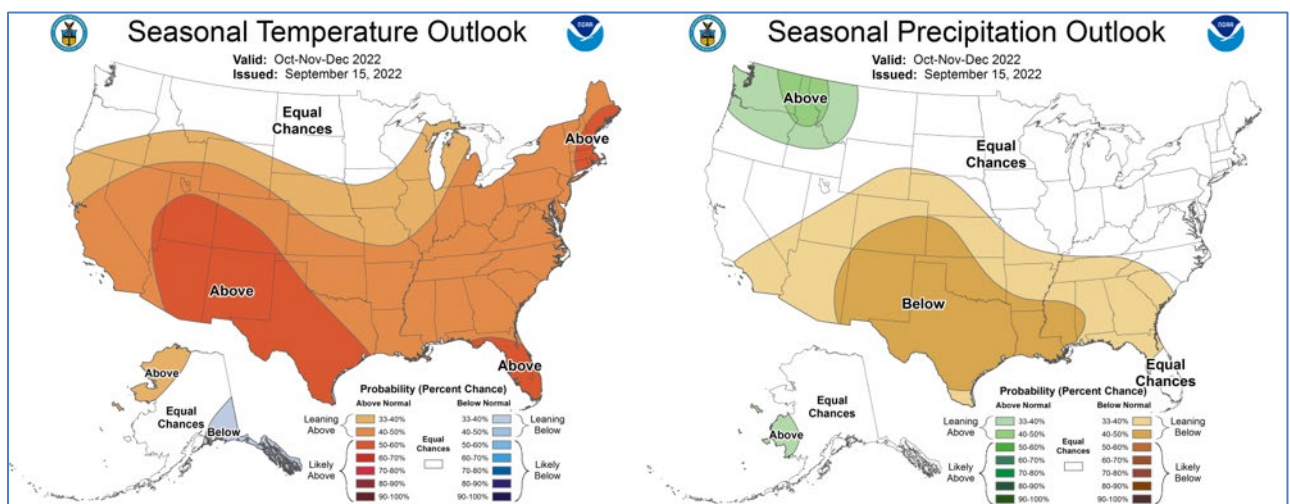
41D 01000	Big Hole River abv Jackson, MT	Upper Missouri Basin	10/18/2022, 7:45 PM	12.80	0.79	6.84
41D 02000	Big Hole River abv Spring Cr nr Jackson, MT	Upper Missouri Basin	10/18/2022, 7:45 PM	17.18	1.45	8.14
41D 05000	Big Hole River at Miner Creek nr Jackson, MT	Upper Missouri Basin	10/18/2022, 7:45 PM	31.74	0.88	8.67
41D 08000	Big Hole River near Wise River, MT	Upper Missouri Basin	10/18/2022, 7:45 PM	125.90	2.47	7.50

- **Precipitation:** October 1st started the new Water Year (2023). Precipitation in the Big Hole is currently 51% of the median and Snowpack is currently 21% of median values. The only SnoTel sites reporting measurable snow are the Mule Creek and Saddle Mtn sites. Obviously, its still very early in the water year, but some fall storms would sure be nice. Its dry and crunchy out there!!
- **Drought Status:** Drought conditions in the Big Hole remain in the D1 to D2 category. Hot and dry weather from the summer months continued through October.
- **Outlook:** The 6-10 day outlook predicts below average temperatures and above average precipitation!

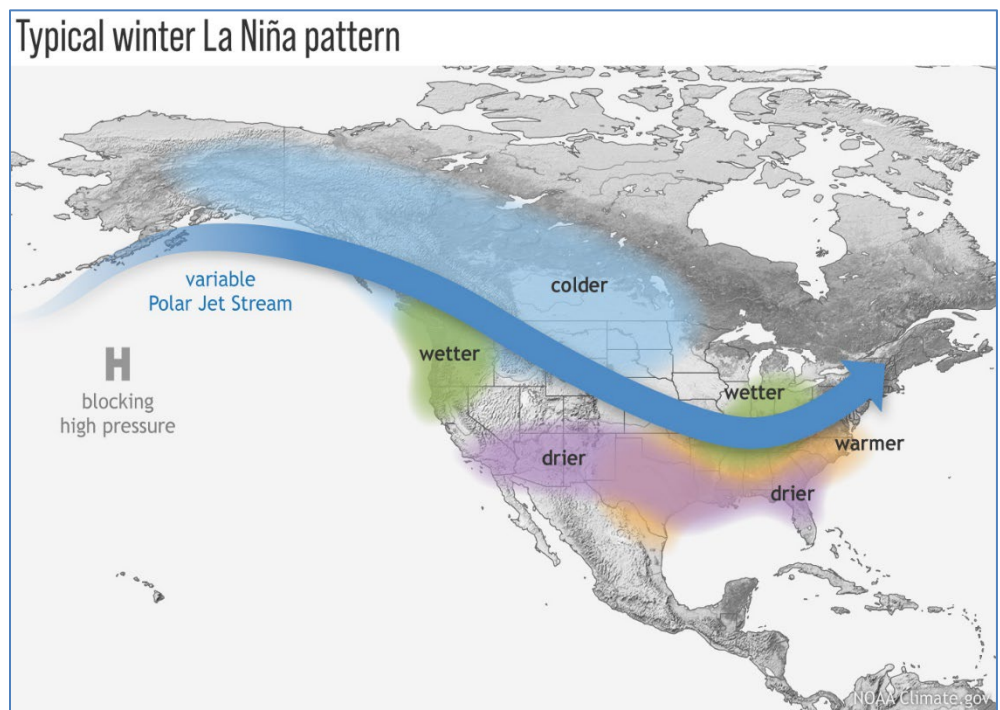




- **Seasonal Outlook:** The three-month outlook is more favorable than previous months. Equal chances of normal temperatures and equal to slightly above normal chances for average precipitation.



- **ENSO Alert System Status (from NOAA):** La Niña Advisory
 - **Synopsis:** There is a 75% chance of La Niña during the Northern Hemisphere winter (December-February) 2022-23, with a 54% chance for ENSO-neutral in February-April 2023.
 - **La Niña three-peat?** La Niña conditions are

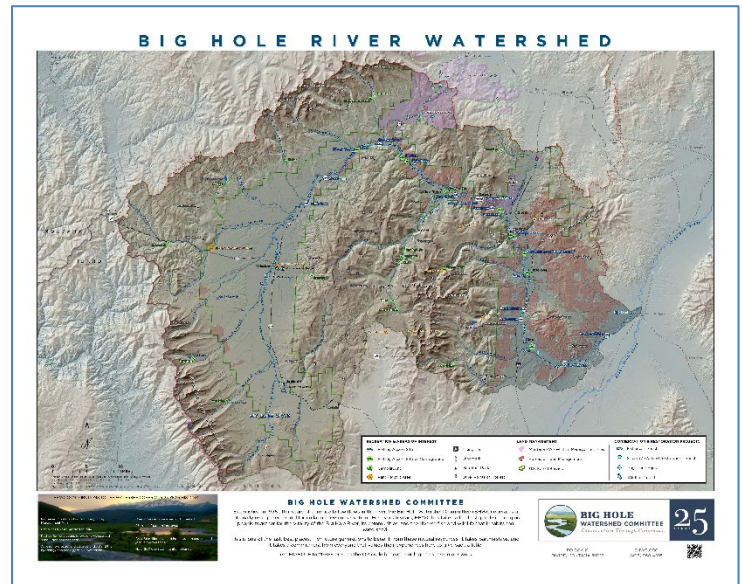


expected to persist through early winter and potentially through February and gradually transition to neutral conditions. This is only the second time a three-peat La Niña has occurred in the period of record (73 years).

- What does this mean for the Big Hole? The answer is...we don't know! La Niña conditions in Montana typically mean colder and wetter winters, but the past two years have not played out like that. Does this mean that the La Niña trend is changing for MT? Possibly, but until more data is available, we won't really know, it's still early to be making solid predictions for our upcoming snowpack. The general climatic trend is showing warmer and drier conditions in general with shorter more intense storms. SW Montana has been in shortage the last couple of years especially in late summer. Current long-term predictions do not show this trend changing.

Director's Report – Pedro Marques, Executive Director

- Wise River measurement and irrigation
- Fishing regulation change proposal
- Madison County floodplain permit
- Speaking engagements
 - USFS- Partners dinner and Leadership Team
 - National Adaptation Conference
 - Albany County, WY Stockgrowers
- BHWC map – for sale for \$25 minimum donation at monthly meetings or \$30 online (includes shipping). [Get yours here!](#)
 - Proceeds support Big Hole Conservation Fund.



Steering Committee Report – Jim Hagenbarth, Vice-Chair; Roy Morris, Secretary

- The steering committee had nothing to report.

Wildlife Report – Tana Nulph, Associate Director; Jim Hagenbarth, Rancher; Dean Peterson, Rancher

- 2022 Range Rider program season summary:
 - Season: July 1 – Sept. 30
 - Wolves, black bears, grizzly bears, mountain lions on the landscape (tracks, game camera photos)
 - Found 3 calf carcasses (none confirmed by Wildlife Serv.)
 - At least 1 confirmed loss to grizzly depredation nearby
 - Helped locate missing cattle at end of season
 - Warned campers/hunters about grizzly bears

Restoration Report – Ben LaPorte, Program Manager

- *Upper Oregon Creek:*
 - October 18
 - Helicopter seeding (25 acres)
 - 70.2 acres of aspen enhancement
 - 27,000 feet of gully erosion control
 - Up next:

- Fall photo points
 - 2023 maintenance/additions
- *French Gulch Fish Passage:*
 - Low-tech steep slope/bank stabilization with Montana Conservation Corps
- *Other Happenings:*
 - Monthly Wise River monitoring continued – one last round of data collection scheduled before winter
 - Montana BioAgriculture, Inc. (MBAI) Elkhorn Biofiltration – installed larger, on-site pilot columns under 1,000 ft adit
 - The filter seemed like it worked better than the last time and they were able to process 500 gallons of AMD.
 - Ran the column system with 2 different fungal strains in 2 columns each for 2 hours per strain. Approximately 30 lbs. of corn cob fungal mix per column.
 - Wetland delineation training with Geum Environmental Consulting
 - Future project planning

New Business

Break – 10 minutes

Meeting Topic: Sage Grouse and Wildlife Update

Presented by: Vanna Boccadori and Jesse Newby, Montana Fish, Wildlife and Parks

Dillon Area Updates – Jesse Newby, Montana Fish, Wildlife and Parks – Dillon area

Season setting process for the 2022-2023 Biennium

- Biologists were directed this year to simplify hunting regulations by:
 - Combining hunting districts where biologically feasible
 - Reducing license/permit types
 - Eliminating hunting district portions
 - Eliminating split seasons
- HDs 328 and 329:
 - Combine west half of HD 328 with HD 329 into a new “HD 329”
 - Elk B-license 321-00 no longer valid in northwest portion of HD 329.
- HD 331 and 332:
 - Combine HDs 331 and 332 into a new “HD 331”
 - General elk license brow-tined bull only during 5-week general season
 - Antlerless harvest allowed on private lands
 - Eliminate 399-00 elk B license in district
 - Add elk B license 331-00 (quota of 400)
 - Make white-tailed deer B license 399-00 valid for antlerless whitetails in HD 331

Elk Management Plan

- Pioneer Elk Management Unit: HD 329 and HD 331

- Objective: Manage elk populations within biological and social tolerances and cooperate with public and private land managers/landowners in the management of elk habitat with an emphasis on maximizing hunter opportunity to harvest all age classes of bulls in a backcountry setting.
- Management Goal
- Habitat Objectives:
 - Habitat Management Strategies
 - Game Damage Strategies
 - Access Strategies
- Population Objectives:
 - Objectives for elk counted in winter surveys:
 - HD 329: 1,125 (long-term), 760-900 (current)
 - HD 331: 1,545 (long-term), 1,940-2,300 (current)
 - Objectives for bull: cow ratio
 - Current objective: 10 bulls: 100 cows
 - HD 329: 10 BTB: 100 cows
 - 12 yearling bulls: 100 cows
 - HD 331: 6 BTB: 100 cows
 - 7 yearling bulls: 100 cows
- Population Counts (2022):
 - HD 329:
 - Former HD 329: 813 total elk
 - New HD 329 average: 1,125 elk (Note boundary change now includes west side of upper horse prairie. Numbers reflect 12% increase (or 113 elk). This is not reflected in objectives. Adding in old HD 328 objective would increase it approximately 77-98 elk.)
 - HD 331:
 - New HD 331: 1,263 total elk
 - Former HD 331: 810 elk
 - Old HD 332: 453 elk
- Harvest (2021):
 - HD 329: 411 total (176 bulls, 235 antlerless)
 - HD 331: 421 total (214 bulls, 207 antlerless)
- Brucellosis Monitoring:
 - Current estimated brucellosis prevalence by hunt district
 - Number of cow elk sampled for *B. abortus*
 - 2013 West Pioneer Brucellosis monitoring (due for monitoring again in next few years)
 - 100 cow elk captured
 - No cows seropositive for *Brucella abortus*
 - 30 cows collared with GPS collars
 - Monitored up to 23 months
 - Locations every ½ hour
 - 2023 East Pioneer Brucellosis monitoring
 - 100-150 elk targeted
 - Sampled for *Brucella abortus*
 - 30-60 cows collared with GPS collars

Mule Deer Harvest (2021)

- HD 329: 119 total (72 bucks, 47 antlerless)
- HD 331: 295 total (210 bucks, 85 antlerless)
 - HD 332 (now part of HD 331): 33 bucks, 1 antlerless

Moose Study Update

- Methods:
 - Focus on adult females (30/area)
 - Areas: Cabinet Mountains, Big Hole Valley, Rocky Mountain Front
 - N = 229 capture
 - 63 moose on air
 - Adult female survival
 - Reproduction
 - Calf survival
- Monitoring:
 - Calibrate existing data
 - Evaluate alternative monitoring strategies
 - Moose PAM (hunter sightings from phone surveys)
 - ~5 years (2012-2016)
 - ~45,000 hunters/year
 - ~4,000 observations/year
 - \$14,000/year
- Research:
 - Vital rates and limiting factors (impacted by predation, disease, nutrition, temperature, harvest)
 - Fecundity
 - Calf survival
 - Adult female survival
- Results:
 - Adult female survival similar in all study areas
 - *E. schneideri* worm parasite may be a factor in mortalities.
 - Calf survival similar in all study areas, but there is more variability in observed parturition (number of calves born).
 - Fecundity (number of calves/female) is higher in the Rocky Mountain Front, likely due to their diet.
 - Big Hole moose use 10 shrubs (6 willows) throughout the year. Rocky Mountain Front moose use 23 shrubs (16 willows) throughout the year.
- Take home: Populations are different, but all stable to increasing.

Butte Area Updates – Vanna Boccadori, Montana Fish, Wildlife and Parks

Sage Grouse Study Update

- Mission: proactive collaborative approach to sage grouse conservation in a sustainable working landscape.
- Collaring females and using data to track movement, lekking activity, etc.
- In 5th and final year – final report coming winter 2023!
- Applied research – lessons learned will help inform sagebrush conservation actions:
 - Identify previously unknown leks

- Conservation easements
- Habitat and fencing projects
- USFWS + MFWP + many partners:
 - Big Hole Watershed Committee
 - Big Hole landowners
 - Vigilante Electric Cooperative
 - BLM
 - USFS
 - DNRC
 - TNC

Pronghorn Movement and Population Ecology Study

- Big Hole is one of 8 study areas throughout Montana
- Objective: Identify potential conservation concerns within seasonal ranges or along movement corridors.
- In the 3rd and final year of collaring (goal is to keep 60 collared does online each year):
 - 89 GPS collared does 2022-2023:
 - 33 mortalities
 - 4 malfunctions
 - 52 on the air
 - GPS collars collect locations every hour, so researchers can see if antelope are getting stopped by fences
- Results:
 - 31% non-migratory
 - 69% migratory (movement back and forth: Argenta, Bannack Bench, Horse Prairie, Frying Pan)
 - 56% of migratory go through the Big Hole (Polaris, Hairpin area, Highlands, Upper Big Hole/Battlefield area, Mount Haggin)
- Applicability:
 - Using this data to identify barriers to movement. Working with TNC, Wildlife Federation, USFS, BLM and private landowners to do fence modifications to make fences more permeable to antelope and other wildlife.
 - Simon Buzzard, Project Coordinator
 - Removed/modified ~15 miles of fences in last 2 summers, identified additional ~15 miles to treat next summer
 - Identified woven wire fence along Highway 324 that is currently separating 2 populations of antelope that were likely historically connected. Removing/modifying the fence should reconnect these two populations.
 - A lot of similarity in habitat/movements between antelope and sage grouse (it's where the sagebrush is).
 - This is a working landscape with multiple uses, but also highly important for a variety of wildlife species. Where we can find common ground to do habitat/connectivity improvement projects in sagebrush habitats, they should be a high priority.

Big Hole Grizzly DNA Study Update

- Grizzly Bear meeting in Wisdom on October 11th
- Last year, 2 grizzly bears photographed in the Big Hole:

- Part of the purpose of this study is to see if they can document a breeding female in the Bitterroot Recovery Area.
- Want to know where the Big Hole grizzlies are coming from (Yellowstone population or Northern Continental Divide population).
- MFWP is not trying to saturate the Big Hole with grizzlies. The goal is to understand what is there (in the Big Hole) and to work with communities to “make place” for those grizzlies to move through.
- Remember to please report potential sighting of grizzly bears to a biologist so it can be verified (can send to Jesse or Vanna and they will FWD to the bear experts). This allows them to show up as a dot on the map showing grizzly bear present and movement.

Deer & Elk

- Season Setting Changes:
 - 321 and 334 combined into one district: HD 321
- HD 319:
 - Elk:
 - Population (2021): 835
 - Harvest (2021): 211 total (136 males, 75 females)
 - Mule Deer:
 - Population (2018): 336
 - Harvest (2020): 66 (51 males, 15 females)
- HD 321:
 - Population (2022): 1,524
 - Harvest (2021): 207 total (80 males, 119 females)
- HD 334:
 - Population (2022): 834
 - Harvest (2021): 87 total (22 males, 57 females)
- HD 340:
 - Elk:
 - Population (2022): 830
 - Harvest (2021): 319 total (136 males, 176 females)
 - Mule Deer:
 - Population (2022): 153
 - Harvest (2021): 355 (261 males, 94 females)
 - 2018: General license either-sex, no B licenses (drove population down)
 - Expected doe harvest to not change. This was not the case, female harvest shot up in 2018. Has dropped slightly since then but not to the level it was before. Experienced overall increase in harvest.
 - Now back to buck only on the general license in this district.

Highlands Bighorn Sheep Project

- In year 1 of a 5-year project.
- Objective: to better understand the pneumonia that seems to inhibit lamb survival and keep population from growing.
- This winter:
 - Captured ~32 ewes
 - Sampled for pneumonia and *Mycoplasma pneumoniae* (precursor to pneumonia).

- Collared
- Will go back in the spring and capture/collar lambs from known ewes
- Will resample the ewes
- Years 1-2: Establish baseline understanding of disease prevalence. 5 sub-herds in the Highland population
- Years 3-4: Will have an idea of who the chronic carriers are and will remove them.
- Years 5-6: Will assess potential increases to ewe/lamb survival.

Upcoming Meetings

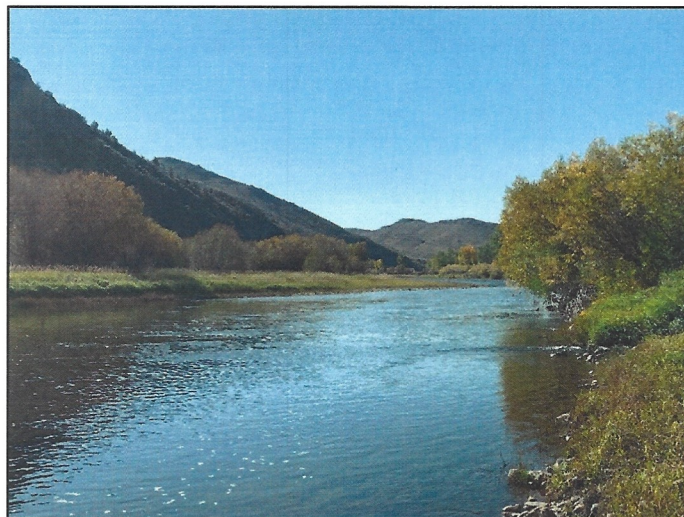
- November 16, 2022: **Montana Bureau of Mines and Geology Groundwater Study @ Melrose**
 - 6:00* pm at the Divide Grange/Zoom
 - *Note the time change from 7:00 to 6:00 pm to account for the shorter winter days!*

Adjourn

BACKGROUND AND PURPOSE

The Big Hole River is a blue-ribbon trout fishery and an important water resource for the Glen area agricultural economy. Low river flows are detrimental for both agriculture and the fishery, decreasing the amount of water available for irrigation. Coupled with high water temperatures, low flows may trigger partial or full river fishing closure by wildlife management officials.

In response to these challenges, changes to irrigation practice and/or improvements to conveyance and diversion infrastructure have occurred or may be planned with the goal of using water more efficiently. However, these changes may alter aquifer recharge and affect interaction between groundwater and the Big Hole River.



The Ground Water Investigation Program (GWIP) of the Montana Bureau of Mines and Geology (MBMG) will conduct a study over the next two years to answer the following question:

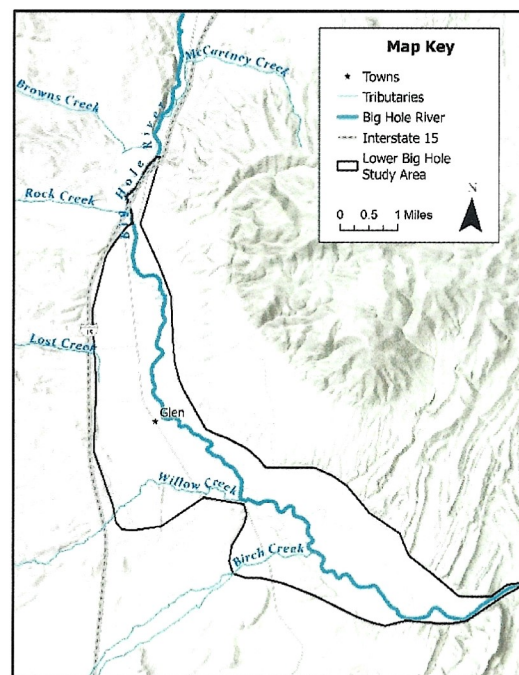
How would changes in irrigation practice and infrastructure affect water resources in the Big Hole River near Glen?

FIELD DATA COLLECTION

- ❖ **Groundwater levels** from existing wells and wells installed for this project
- ❖ **Stream flow** measurements on the Big Hole River, its tributaries, and canals
- ❖ **Water chemistry** samples of surface and groundwater
- ❖ **Temperature** monitoring of surface water and groundwater

PROJECT OUTCOMES

- ❖ **Published report** presenting hydrologic interpretations of the data
- ❖ **Water budget and hydrologic model** of the Glen Valley
- ❖ **Project methodology and results** could be used in other watersheds with similar concerns to more effectively manage their water resources



GWIP CONTACTS

Ron Breitmeyer
Team Leader/Hydrogeologist
406.496.4866
rbreitmeyer@mtech.edu

Jenna Dohman
Professional Scientist
406.496.4379
jdohman@mtech.edu

Ann Hanson
Professional Scientist
406.496.4653
ahanson4@mtech.edu

Montana Bureau of Mines and Geology
Ground Water Investigation Program

MBMG

June 2022



PUBLICLY AVAILABLE RESULTS INCLUDE

- ⇒ Detailed, peer-reviewed MBMG published reports, with more in review.
- ⇒ Computer models of site-specific groundwater flow are available for use.
- ⇒ Each project's scientific teams answer public inquiries regarding the hydrogeology of GWIP areas.
- ⇒ Comprehensive sets of hydrogeologic data for each investigation are publicly available in GWIC database.
- ⇒ Presentations to stakeholders and other interest groups.

The **Ground Water Investigation Program (GWIP)** answers locally identified, site-specific questions prioritized by the Montana Ground Water Steering Committee (MCA 85-2-525). As mandated by the Montana Legislature, GWIP conducts research on the most urgent water issues in the state.

FOR MORE INFORMATION CONTACT:
GINETTE ABDO (PROGRAM MANAGER)
(406) 496-4152
gabdo@mtech.edu
www.mbmgs.mtech.edu/WaterEnvironment/GWIP/main.asp

PUBLISHED REPORTS (2021-2022)

An investigation of spring sources and potential alternative water supplies near Virginia City, Montana, 2022, Report of Investigations, RI 30

Hydrogeology and groundwater availability at Big Sky, Montana, 2022, Open-File MBMG 747

Hydrogeologic investigation of the Upper Jefferson River Valley, Madison and Jefferson Counties, Montana: Waterloo groundwater modeling report, 2021, Report of Investigations, RI 29

Hydrogeologic investigation of the Upper Jefferson Valley, Montana-Interpretive report, 2021, Report of Investigations, RI 28

West Crane aquifer test summaries, Richland County, 2021, Open-File MBMG 737

Hydrology and water management of the Clear Lake aquifer, 2021, Open-File MBMG 738

Aquifer tests completed in the Bitterroot Valley, Hamilton area, 2021, Open-File MBMG 739

Groundwater model of the Meadow Village aquifer at Big Sky, 2021, Open-File MBMG 742

PROJECTS STARTING 2022

Big Hole Beaverhead, Madison, and Silver Bow Counties

Purpose: Investigate the effects of irrigation return flows on the Big Hole River in the Melrose area. The project will focus on measurement and modeling of the groundwater surface-water interactions with special consideration to temperature effects on the river.

Status: Meetings with stakeholders and an initial field visit have been conducted. Data compilation and project planning is in progress. The monitoring network will be established this year.

Personnel: Ron Breitmeyer, Principal Investigator

Eureka Lincoln County

Purpose: Understand how groundwater development will affect the availability of groundwater and surface water in the Tobacco Valley, Eureka.

Status: Meetings with stakeholders and an initial field visit have been conducted. Data compilation and project planning is in progress. The monitoring network will be established this year.

Personnel: Andy Bobst, Principal Investigator

Irrigation Recharge Carbon and Beaverhead Counties

Purpose: Quantify the infiltration of groundwater beneath fields subjected to flood and pivot irrigation. The project will focus on direct measurement of infiltration through the vadose zone to determine the potential for irrigation-derived groundwater recharge under different operational conditions.

Status: Meetings with stakeholders and an initial field visit have been conducted. Data compilation and project planning is in progress. The monitoring network will be established this year.

Personnel: Ron Breitmeyer, Principal Investigator

West Billings Yellowstone County

Purpose: Identify and quantify recharge sources and controls on groundwater quantity and quality in the Billings area to support future development decisions.

Status: Meetings with stakeholders and an initial field visit have been conducted. Data compilation and project planning is in progress. Monitoring sites are currently being established.

Personnel: Liddi Meredith, Principal Investigator

ACTIVE PROJECTS

East Flathead Valley Flathead County

Purpose: Determine the connection between the shallow aquifer, deep alluvial aquifer and surface water. This information will be used to evaluate the effects of pumping on these aquifers and on surface water.

Status: Data collection is complete, including drilling and aquifer testing. Groundwater model development is underway. A draft interpretive report and model report are in preparation.

Personnel: Andy Bobst, Principal Investigator

Ennis Area Madison County

Purpose: Investigate the effects of increased residential development and groundwater withdrawals in the bedrock aquifer on the west side of the Ennis Valley. Implications for increased withdrawals on adjacent aquifers will be considered.

Status: Data collection is complete. Data interpretation and report preparation will commence in 2022.

Personnel: Mary Sutherland, Principal Investigator

Lolo Creek Missoula County

Purpose: Determine the cause of changes in streamflow character that occur in the lowest reaches of Lolo Creek, resulting in the channel occasionally being dry.

Status: Groundwater model development and report preparation are underway. The geologic framework, water budget, and model calibration are complete. The model will help quantify the water budget and the effects of hydrologic stresses on Lolo Creek. A draft report is in preparation.

Personnel: Ali Gebriel, Principal Investigator

Upper Gallatin Gallatin County

Purpose: Evaluate the effects of existing and future residential/commercial development in the Upper Gallatin Valley on water quantity and quality.

Status: Groundwater and surface-water monitoring is complete, including aquifer testing. Data interpretation and groundwater model development is underway to predict groundwater availability and quality from increased residential development. A draft interpretive report and modeling report are in preparation.

Personnel: James Rose, Principal Investigator



Developing the hydrogeologic framework, monitoring, and communicating results to the public.

IN REVIEW

Belgrade/Manhattan Gallatin County

Purpose: Assess the effects of pumping from high capacity wells for a municipality or subdivision on groundwater and surface-water resources.

Results: The valley geology dictates the ideal location of a high yield water supply. Thick sediments in the central valley are conducive to development with the distance to surface water and the timing of mitigation considered for minimizing effects.

Personnel: Mary Sutherland, Principal Investigator

Flathead Valley Flathead County

Purpose: Determine whether withdrawals from the deep aquifer affect surface-water resources; and if current stresses are creating declining water-level trends.

Results: Pumping has created water-level declines in some areas, but not valley-wide. The deep sand and gravel aquifer is overlain by a confining layer over most of the valley. A 3-D hydrostratigraphic model (MGMG Open-File 703) allows access to lithologic information for any location in the valley.

Personnel: James Rose, Principal Investigator

Hamilton Area Ravalli County

Purpose: Provide detailed hydrogeologic information that can be used to examine the effects of land use changes on groundwater and surface-water. Evaluate nitrate concentrations as an indication of residential growth and associated increase in septic systems.

Results: Irrigation-related recharge to groundwater accounts for one-third of the groundwater budget inflows. Nitrate concentrations varied throughout the study area and were less than the 10 mg/L EPA maximum contaminant level.

Personnel: Todd Myse, Principal Investigator

Musselshell River Musselshell County

Purpose: Determine the sources of salinity in the lower Musselshell River from Roundup to Melstone. High salinity irrigation water can result in crop yield loss and degraded soils.

Results: The high salinity of the Musselshell River in spring is driven by natural increases in groundwater elevation causing an increase in movement of naturally high salinity groundwater to the river. Irrigation mobilized salinity to the river is evident in the late summer and early fall when the river salinity tends to be at its lowest point.

Personnel: Liddi Meredith, Principal Investigator

Sidney Area-West Crane Buried Valley Aquifer Richland County

Purpose: Determine the availability of water from the buried channel aquifer in the Sidney area and the aquifer's ability to meet the needs for future municipal, irrigation, and oil and gas development.

Results: Test drilling defined the extent of the West Crane Aquifer, a buried river valley near Sidney, Montana. The aquifer supports well yields of up to 1,300 gpm. Annual groundwater recharge is highly variable depending on local climatic and seasonal conditions.

Personnel: Jon Reiten, Principal Investigator