GWIP

MBMG

Lolo Creek Project

Ground Water Investigations Program (GWIP)
Montana Bureau of Mines and Geology (MBMG)

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How does the stream go from wet to dry?

Low flow in summer, 2016

Same channel, dry, August, 2016

Looking down Lolo Creek channel below Highway 93

What are the roles of ***Groundwater, Precipitation, Surface water diversions, Groundwater pumping****?*
Is it possible to keep water flowing year round?

INTRODUCTION

Lolo Creek has historically been an important local water resource, aquatic habitat and fishery including a critical bull trout habitat. It is a perennial tributary to the Bitterroot River; connecting the mainstem to headwaters. However, intermittent late-summer dewatering (since the mid-1980s) of Lolo Creek has been documented between its confluence with the Bitterroot River and Highway 93 in several recent years. The dewatered reach has raised concerns about fish habitat and other riparian issues with water managers and local residents.

PURPOSE

The purpose of this GWIP project is to determine the cause(s) of changes in streamflow character that have occurred in the lowest reaches of Lolo Creek.

The project will identify groundwater/surface-water dynamics and quantify contributing factors to the dewatering such as: changes in precipitation, geomorphological changes that may separate the water table from the stream channel; surface water diversions and crop consumption; and general lowering of the water table because of land-use changes and/or groundwater withdrawals.

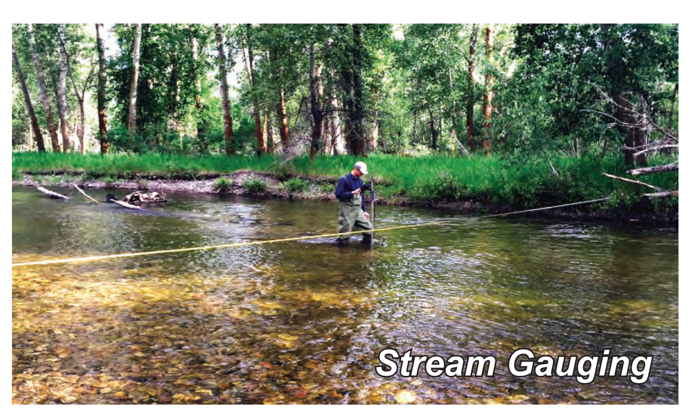
METHODS

Work began in April of 2016 in collaboration with watershed work conducted by the Montana Department of Natural Resources and Conservation (DNRC). Although the entire Lolo Creek watershed will be considered, the primary study area is the lowest 15 square miles (fig 1 & 2). The study focus area is the Lolo valley from a narrow part of the valley (pinch point) to the confluence with the Bitterroot River (fig 2). The pinch point provides an upstream gauging location where the water budget is fairly well constrained and can be quantified.

DATA COLLECTION

Surface Water

Staff gauges instrumented with continuous dataloggers along Lolo Creek and on the main ditch diversions (blue squares, fig. 2). This network is operated in conjunction with DNRC. Monthly manual discharge measurements document flow conditions and patterns and indicate points of net loss and gain.



Groundwater Use and Flow

Currently, 48 wells and piezometers are measured monthly across the watershed. Thirteen of these have been instrumented with dataloggers recording hourly water levels. Measured groundwater-level fluctuations (daily and seasonal), precipitation, and estimated use and evapotranspiration will be used to calculate and model a groundwater budget.

Groundwater / Surface-Water Interactions

Groundwater elevations matched with surface water elevations will confirm losing and gaining reaches; groundwater monitoring sites include wells across the study area plus shallow wells installed at four staff gauge sites. These piezometers are instrumented with temperature sensors. Isotopes have been collected at all stream sites and will be correlated with groundwater isotopes during synoptic sampling events.

Precipitation Data

Meteorological data are collected at two sites. These stations, installed by the Montana Climate Office, will provide inputs to water budget calculations.

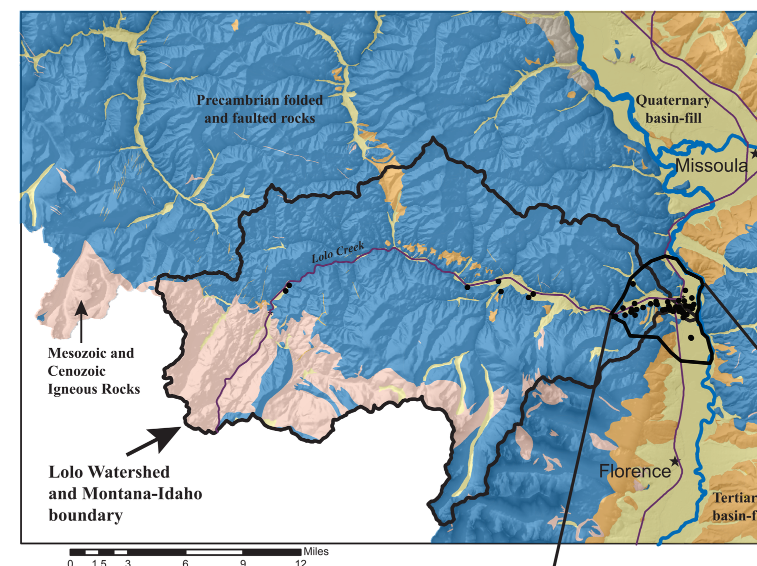


Figure 1. Lolo Watershed is located south of Missoula, Montana. The focus area is in the lower reach.

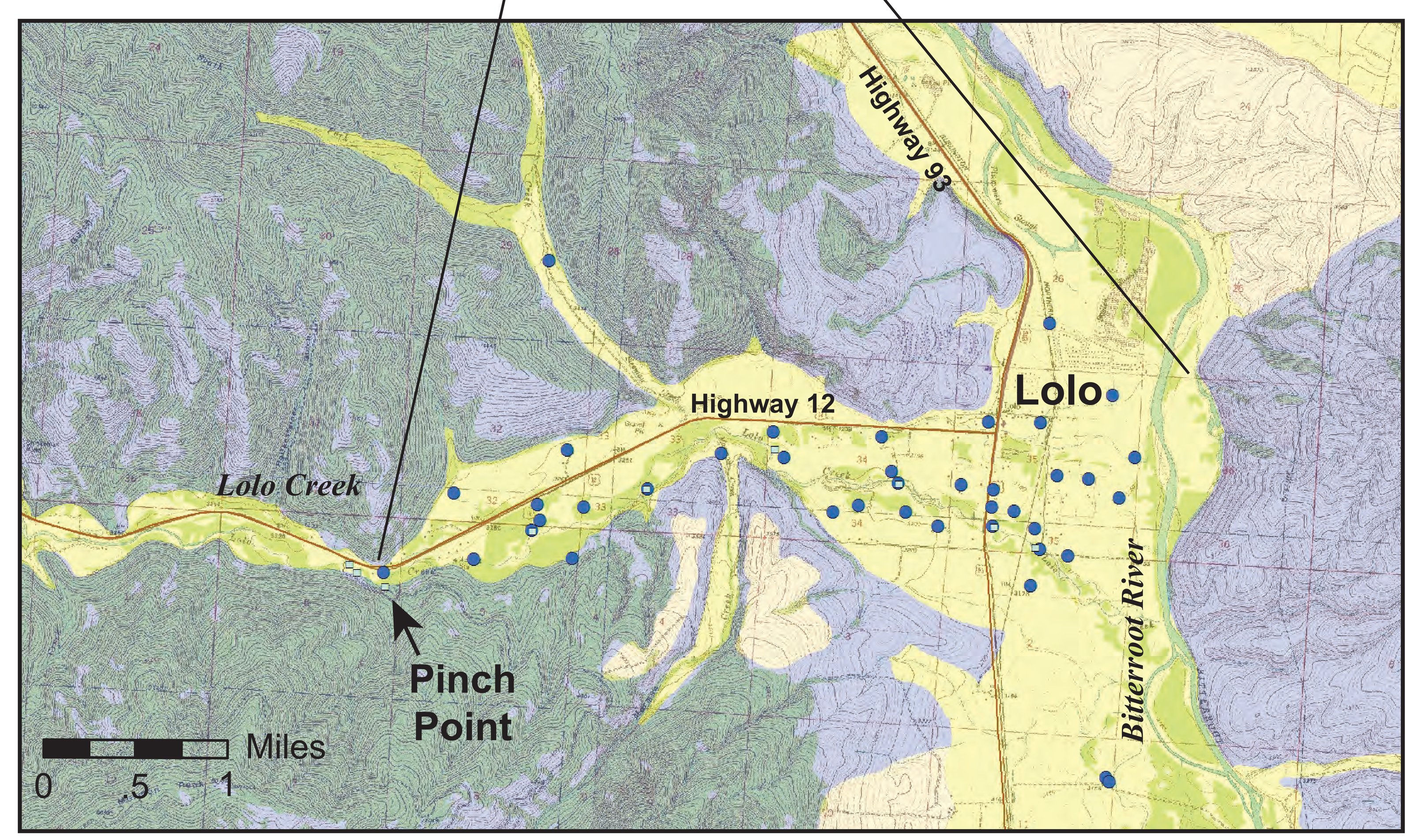
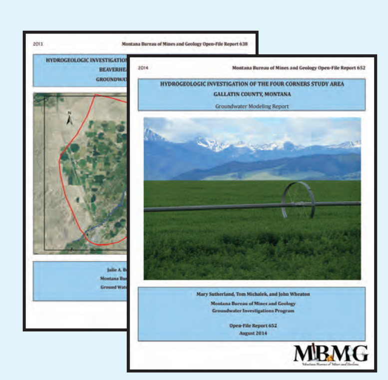


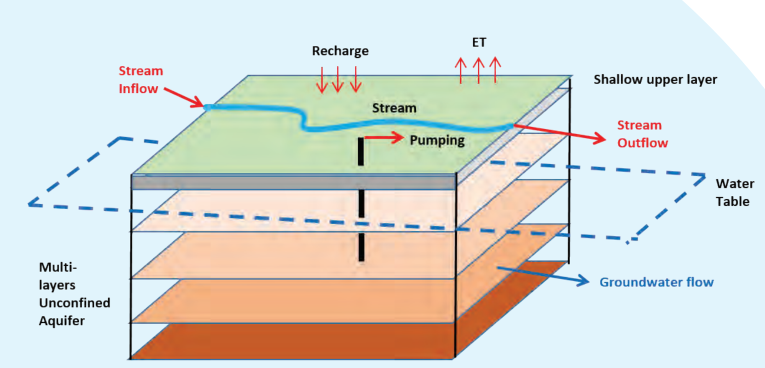
Figure 2. The current data collection sites within the focus area.

EXPECTED PRODUCTS



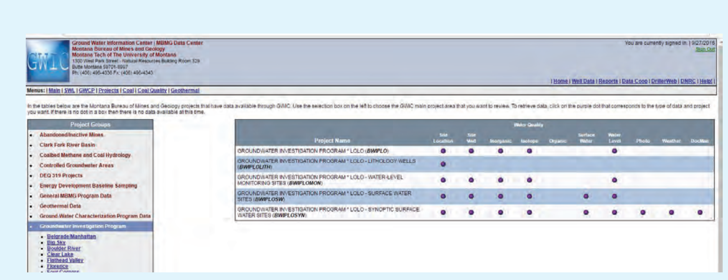
Interpretative Technical Report

Groundwater/Surface-water Interaction description; Correlate stream flow with water uses, climate patterns, changes in irrigation in the study area and population related stresses.



Numerical Groundwater Model

Future users will be able to evaluate how changes of groundwater and surface water parameters may impact Lolo Creek flow. The model files and supporting documentation will be published.



Comprehensive Data Set in GWIC

http://mbmggwic.mtech.edu/sqlserver/v11/menus/menuProject
.asp?mygroup=GWIP&myroot=BWIPLO&ord=1&

Precipitation - Streamflow - Groundwater Interaction

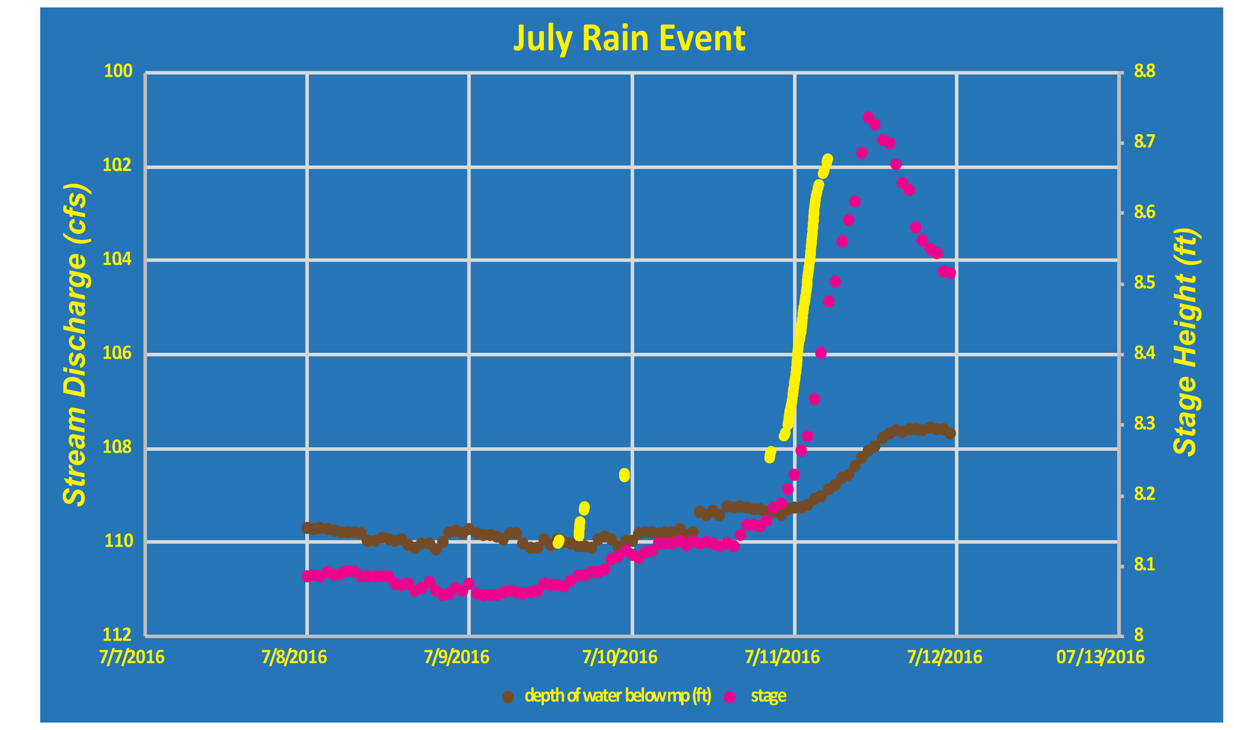
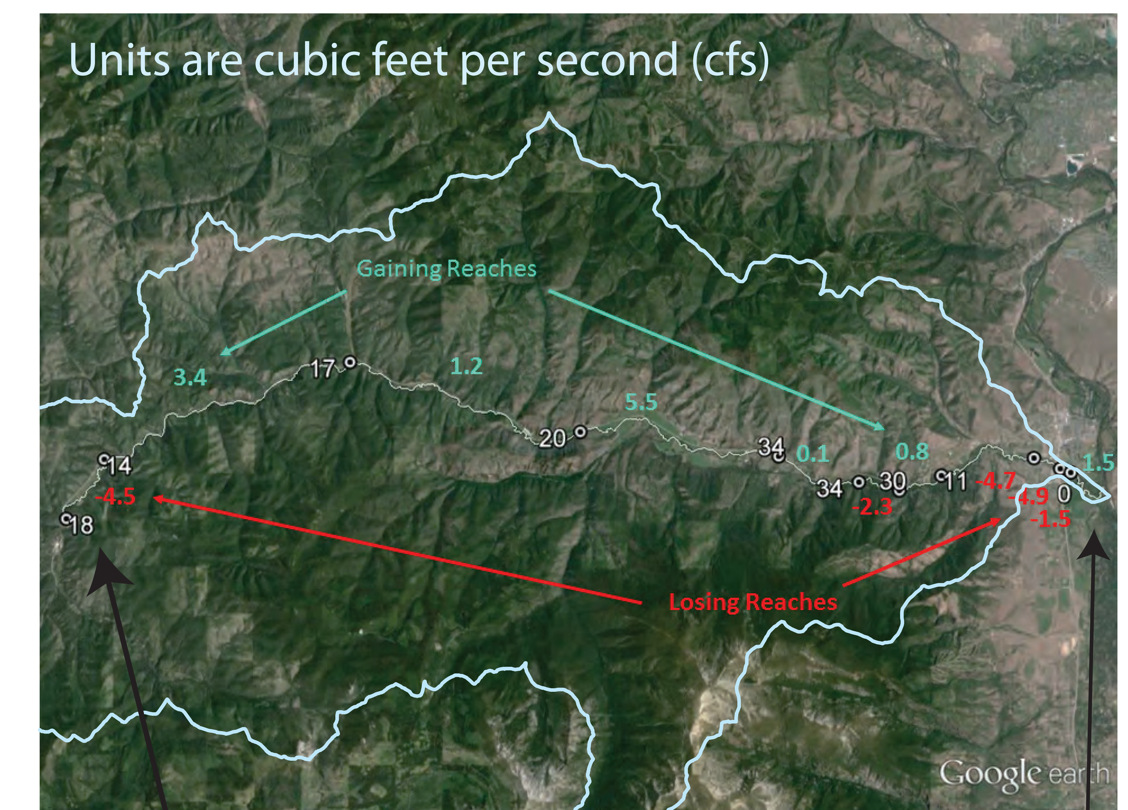


Figure 3. Preciptitation events (yellow) are quickly manisfested as increased surface-water flow (pink) followed by rises in shallow groundwater levels (brown).

Where are the gains and losses?



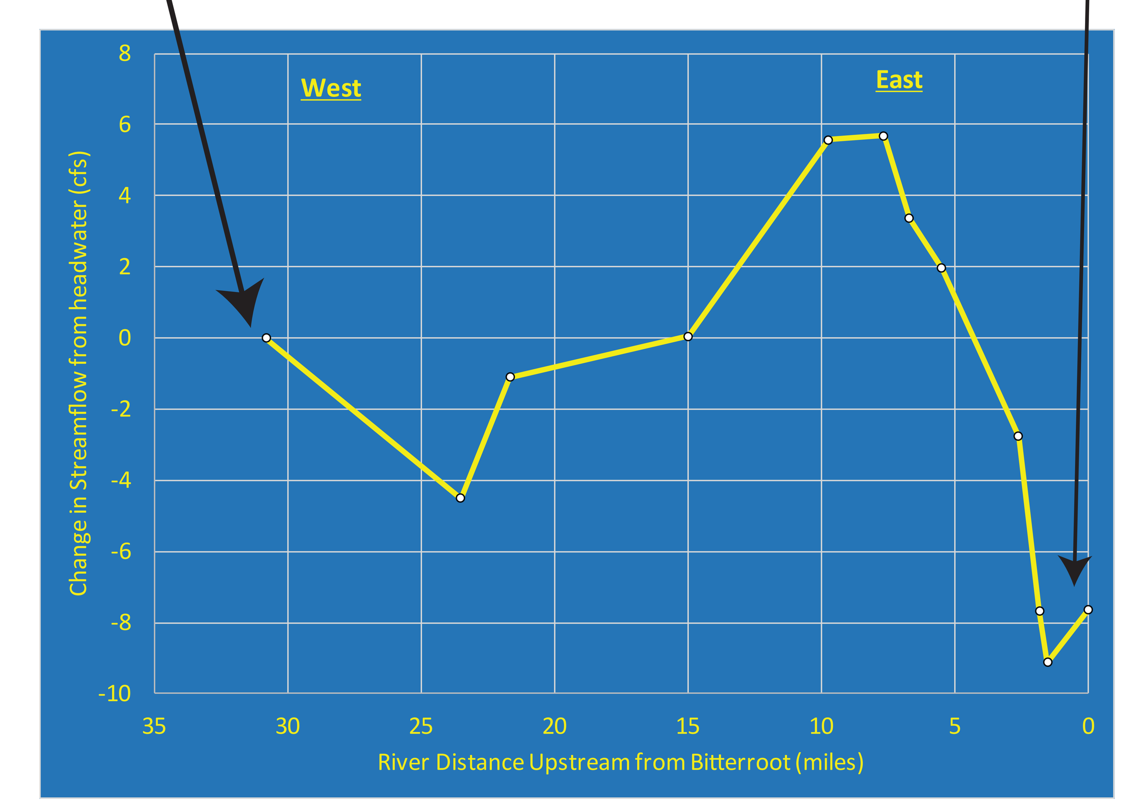


Figure 4. August synoptic run values from the headwaters of Lolo Creek to the last measurement site show increasing discharge until after the pinch point.

Data from a synoptic run in August, 2016 are shown on these two plots. The map image shows the locations of gaining (green) and lossing (red) reaches. Gains and losses have been adjusted for surface tributary inflows and irrigation diversions.

Figure 4 illustrates the magnitude of exchange between Lolo Creek and the groundwater. Lolo Creek gains through the middle reaches, likely due to mountain front recharge adding groundwater to the alluvial system. Losses from the creek to shallow groundwater in the lower reaches occur as the stream leaves the constrained mountain valley and enters the Bitterroot valley.

The reasons for these losses are the primary drivers for this project.