

## Montana Bureau of Mines and Geology (MBMG) – Groundwater Investigation Program (GWIP) Helena Area GWIP Projects, North Hills and Scratchgravel Hills – Update December, 2010

There are two GWIP projects in the Helena area, the North Hills project (GWIP Project Number 12) and Scratchgravel Hills project (GWIP Project Number 13). For the general descriptions of these projects, please see the Fact Sheets at the MBMG GWIP website. The link to the website is:

<http://www.mbm.mtech.edu/gwip/gwip-projects.asp>

Scroll down to projects 12 and 13, and near the top of each is a hyperlink for the Fact Sheet for that particular area.

This update lists contracts for both Helena area projects, followed by activities completed or underway for the each project.

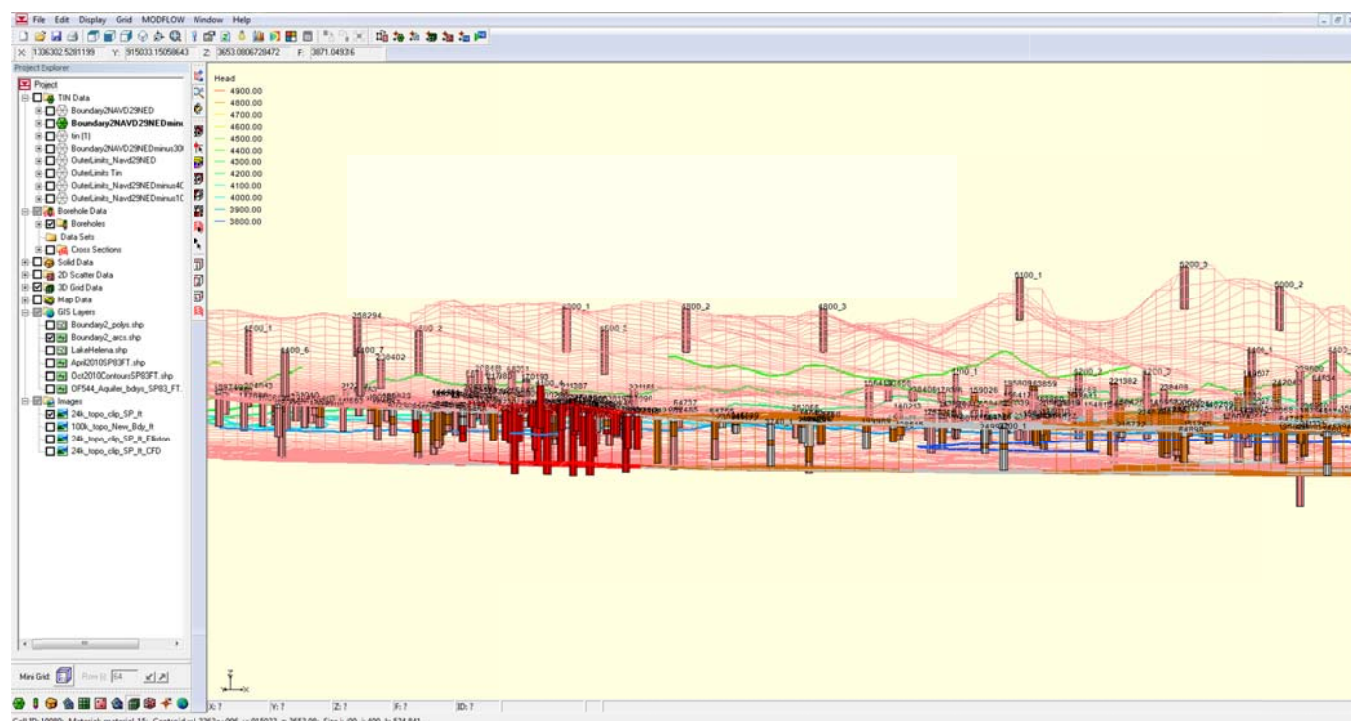


Figure 1. Groundwater Modeling System (GMS) software is being used to develop input files for the US Geological Survey's numerical groundwater flow model MODFLOW 2000. This image shows the model grid as viewed from the south, with the North Hills in the background. The colored bars represent well log data from deeper wells in the study area, except for those along the ridge which were control points added to map bedrock materials in that part of the model. Digital elevation data from the US Geological Survey was used to develop the upper surface of the model.

### Helena area projects contracts:

Completed contracts:

- Phil Farnes – precipitation maps and consulting
- Patrick Faber – summaries of aquifer testing in the North Hills area
- MSE – installation of shallow piezometers along Silver Creek and Sevenmile Creek
- H and L Drilling – Aquifer test site drilling and well installation (Valley Excavating site)

- Diamond M Drilling: Exploratory drilling and aquifer tests at three wells along the Helena Valley Fault (Diamond Hill property)
- H and L Drilling – Aquifer test site drilling and well installation (Head Lane site on private land)
- Lindsay Drilling – Exploration and monitoring well installation at four in the North Hills area
- Lindsay Drilling – Exploration, monitoring, and aquifer test site well installations at two aquifer test sites in the Scratchgravel Hills on US Bureau of Land Management property
- Lindsay Drilling – Deep exploratory and test wells at two sites near the crest of the North Hills on state-owned land
- Isotech Laboratories – stable oxygen, hydrogen, sulfur, and nitrogen isotope analyses for water samples from area wells, streams, canals, and drain ditches

Contracts underway:

- University of Idaho METRIC evapo-transpiration calculations.
- Lewis and Clark County Water Quality Protection District (LCWQPD) – ¼ FTE Hydrogeologist and technician for monthly groundwater level monitoring

Future contracts:

- Survey project wells
- Endocrine disrupter water quality sampling event

### **North Hills Project Activities:**

Began or re-instated monthly groundwater level monitoring at 26 wells, increased Lewis and Clark County Water Quality Protection District (LCWQPD) monitoring from quarterly to monthly at 4 wells, and collect monthly data for another 21 wells monitored monthly by LCWQPD. Seven wells instrumented with continuous recorders

Drilled replacement monitoring wells for the county at two locations and installed a deep and shallow well pair near the north end of Glass Drive. Drilled and completed two sets of wells on state-owned land up near the divide, one near Interstate 15 and one in the hills northwest of Diamond Springs Gulch.

Installed a pumping well and four observation wells for aquifer testing near the Valley Excavating rock quarry and conducted a 5-day aquifer test at the test site

Installed three wells near the Helena Valley Fault to examine hydrogeologic conditions in the subsurface in the vicinity of the fault and conducted numerous well and aquifer tests

Conducted a 6-day aquifer test with existing, unused wells at the Panoramic Subdivision site north of Lake Helena, and another test at the

Monitored and assisted with two privately conducted aquifer tests at a subdivision

Montana Tech Geophysics Department has conducted several resistivity surveys and a seismic survey on state and private land near and on both sides of Interstate 15 and completed gravity and magnetic surveys along Applegate Drive, Montana Avenue, and Prairie Road

Three sites along Silver Creek have been established for stream flow monitoring, and have been instrumented with data recorders, staff gages and shallow monitoring wells

Monitoring of stream flow at drains began in March at numerous sites, augmenting surface water flows measured by LCWQPD in Prickly Pear Creek, Ten Mile Creek, and Drain D2

Three major water quality sampling events were conducted in April and August, in cooperation with LCWQPD. GWIC project samples are being analyzed by the MBMG laboratory. Isotopes of certain elements are being analyzed by Isotech Laboratories, Inc.

Crest gages have been installed with buried temperature recorder buttons in four sites in the North Hills area to measure the depth and durations of intermittent flows in selected drainages, and two rain gages are collecting precipitation data

Snow and water samples were collected in March for stable oxygen and hydrogen isotope analyses at various elevations

Aquifer test data from DNRC water rights records, the GWIC database, and from a summary from Helena area consultant Pat Faber have been compiled

Area maps, aerial photos, and digital elevation models have been projected into the groundwater model coordinate system, which will be the Montana State Plane system, North American Datum 1983, in feet

Well log data for hundreds of wells over 200 feet deep have been processed for display in a 3D graphics format in Groundwater Modeling System for use in developing the aquifer geometry for the groundwater model

Groundwater modeling is now underway. The conceptual model has been written, and the groundwater model grid has been built. The next step is to prepare water level data and water budget information to operate the model and begin the model calibration process.

#### Scratchgravel Hills Project Activities:

Began or re-instated monthly groundwater level monitoring at 38 wells in cooperation with Lewis and Clark County Water Quality Protection District (LCWQPD). Eight wells instrumented with continuous recorders

Four stream flow and shallow groundwater monitoring sites have been constructed and are being monitored by routine flow and water level measurements and various data logging instruments.

Installed two wells to augment two existing unused wells for an aquifer test near the intersection of Head Lane and Franklin Mine Road, and conducted a 5-day aquifer test

Complex geology in the vicinity of mapped faults was evaluated by a geologist from the Bureau's State Geologic Mapping program to ascertain conditions before drilling exploration and test wells .

Six exploration and test wells at three sites were recently installed on US Bureau of Land Management (BLM) land in the Scratchgravel Hills

Two constant rate aquifer tests have been conducted, one near the intersection of Head Lane and Franklin Mine Road, and one on BLM land north of the Head Lane area.

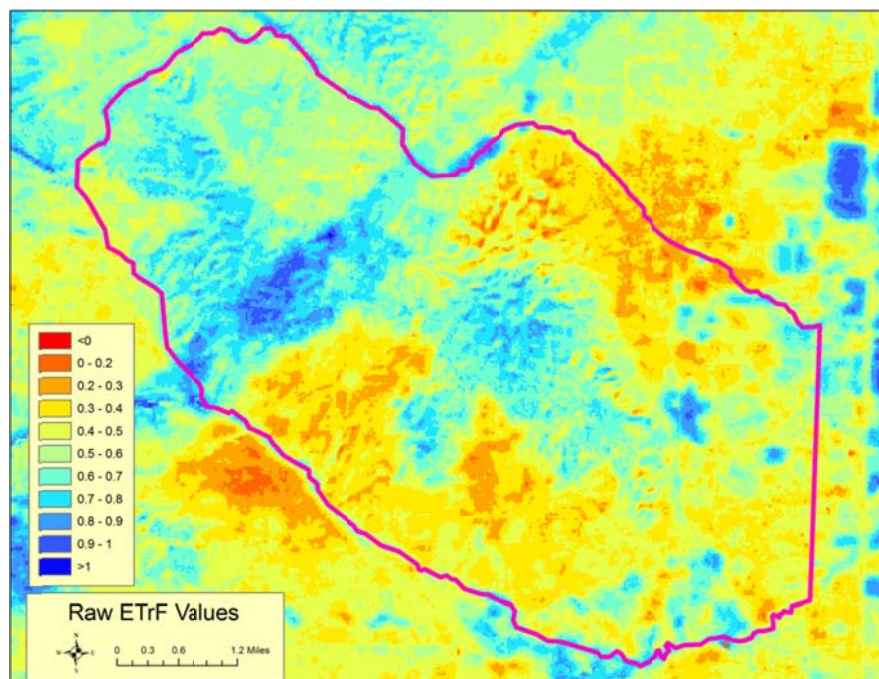
Three major water quality sampling events were conducted in April and August, in cooperation with LCWQPD; GWIC project samples are being analyzed by the MBMG laboratory. Isotopes of certain elements are being analyzed by Isotech Laboratories, Inc.

Crest gages have been installed with buried temperature recorder buttons in numerous sites in the Scratchgravel Hills area, and a rain gage is collecting precipitation data

Aquifer test data from DNRC water rights records, the GWIC database, and from a summary from Helena area consultant Pat Faber have been compiled

Area maps, aerial photos, and digital elevation models have been projected into the groundwater model coordinate system, which will be the Montana State Plane system, North American Datum 1983, in feet.

The groundwater conceptual model is being developed, and planning is underway for the groundwater model grid and boundary conditions.



*Figure 2. This map image of the Scratchgravel project area shows raw evapotranspiration data that is referenced to a maximum evapotranspiration value of 1 for an irrigated alfalfa field. This data is being further processed by the University of Idaho to develop estimates of actual evapotranspiration from Landsat thermal imagery and data from nearby AgriMet weather stations. The Landsat Program is a series of Earth-observing satellite missions jointly managed by NASA and the U.S. Geological Survey. AgriMet, a conjunction of the words "agricultural" and "meteorology", is a satellite-based network of automated agricultural weather stations operated and maintained by the Bureau of Reclamation. This information will be used in our process of determining reasonable estimates of recharge from local precipitation.*