Working toward a Sustainable Water Supply

An ongoing series on IDWR water resource investigations working toward a Sustainable Water Supply ISSUE NO. 2

IDAHO DEPARTMENT OF WATER RESOURCES

IDWR Modeling and Monitoring of the Eastern Snake Plain Aquifer

Overview

The Eastern Snake Plain Aquifer (ESPA) is an important groundwater resource that underlies a vast landscape in southeastern Idaho. (Figure 1). The overlying Eastern Snake River Plain covers approximately 10,800 square miles, stretching from St. Anthony in the Upper Snake River Valley to Hagerman, a distance of about 225 miles.

The Eastern Snake River Plain has an arid to semi-arid climate, averaging between 8 to 14 inches of precipitation annually. Mountain snowpack in the tributary basins provides the majority of water supply to the plain.

In the Thousand Springs complex near Hagerman and Bliss, numerous freshwater springs pour crystal clear water from basalt canyon cliffs into the Snake River. The springs complex is the largest outlet for the ESPA and provides an average annual discharge of 4,650 cubic feet per second (cfs) to the Snake River.

Springs near American Falls Reservoir, in the Blackfoot to Minidoka reach of the Snake River, are another large discharge from the aquifer to the river.

The Challenge

The ESPA cumulative water-storage graph developed by IDWR and the U.S. Geological Survey (USGS) highlights changes in ESPA water volume over time in relation to the discharge estimates at the Thousand Springs complex (Figure 2, next page).

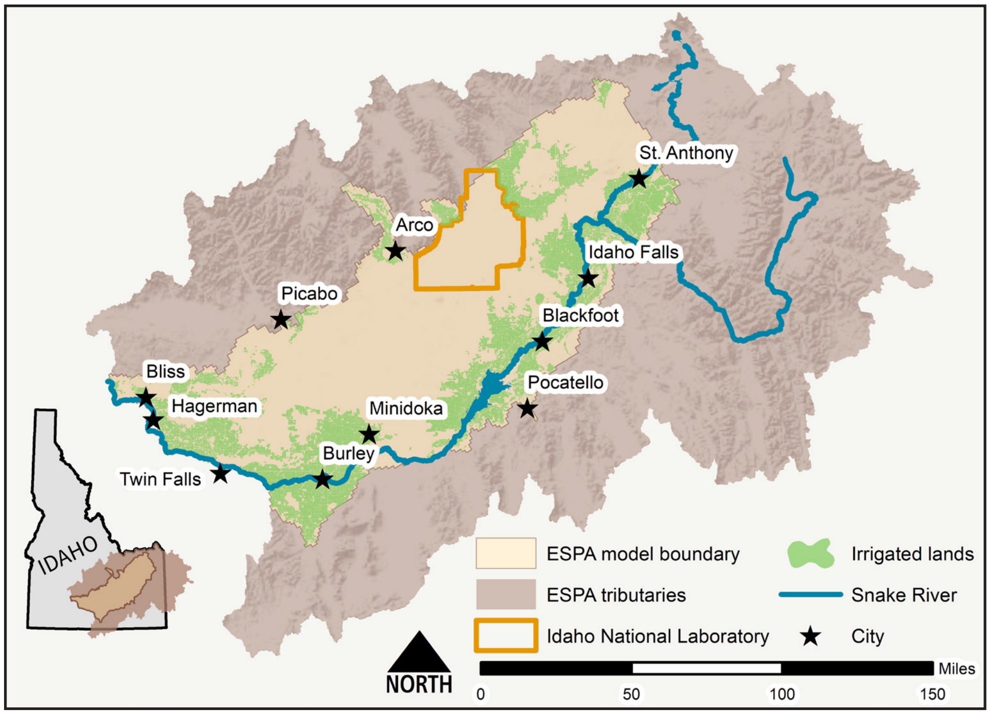


Figure 1: Location of the ESPA and selected communities that overlie the aquifer in Eastern Idaho.

- ***Project:*** Ongoing hydrologic investigations by IDWR and the Idaho Water Resource Board to track ESPA volume and discharge flows.
- ***Location:*** Eastern Snake Plain from St. Anthony to Hagerman

Seepage Builds the Aquifer

As irrigated farming grew in the early 1900s, seepage from irrigation canals significantly increased the amount of water being stored in the ESPA. Water stored in the aquifer increased by about 17 million acre-feet from 1912 to 1950. Flood irrigation at this time was the primary irrigation practice, resulting in excess water infiltrating the subsurface and contributing to aquifer recharge.

(continued from Page 1)

Aquifer Storage Declines

Since the 1950s, ESPA storage has decreased by approximately 14 million acre-feet of water. Beginning in the 1950s, additional acres of land in the ESPA began to be irrigated as groundwater pumping increased. Over time, canals have been lined to prevent leakage, and many farmers have converted from flood to sprinkler irrigation, greatly reducing the amount of seepage into the aquifer.

Along with the decline in storage, discharge from the Thousand Springs complex has declined from 6,750 cfs in the 1950s to 4,650 cfs today. Aquifer discharge into the Blackfoot to Minidoka reach of the Snake River – known locally as “reach gains” – also has been dropping since the 1980s.

The Director of IDWR issued a moratorium on ESPA groundwater development for irrigation in 1992.

ESPA Water Modeling Begins

In 1998, IDWR began moving toward managing surface water and groundwater together as one water source, a practice known as “conjunctive administration.” At the same time, hydrologists from IDWR and the USGS formed a committee to develop the first Eastern Snake Plain Aquifer Model (ESPAM). Although there were previous hydrologic models of the ESPA, this IDWR-led modeling effort had the goal of building a tool to perform conjunctive administration, and sought to quantify the impacts of groundwater pumping on:

- Surface water flows in the Snake River
- Blackfoot to Minidoka reach gains
- ESPA discharge at Thousand Springs

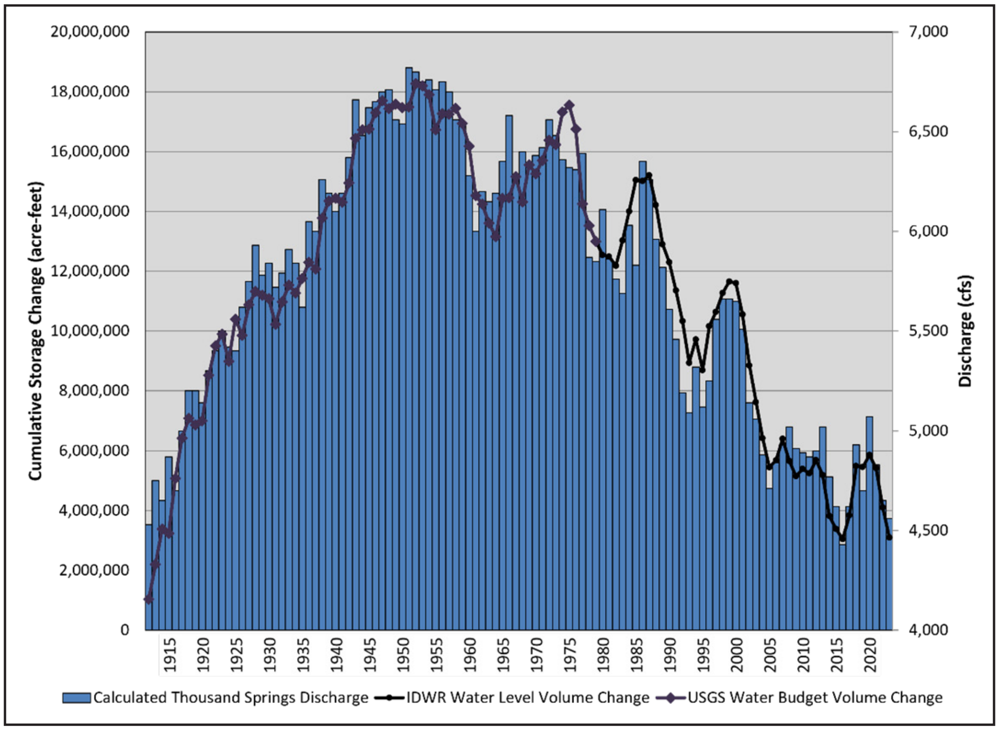


Figure 2: ESPA storage volume change (black line) and discharge from the Thousand Springs complex (blue bars) from 1912-2023.

The first version of ESPAM was published in 2006. IDWR has completed four updates to the model (versions 1.1, 2.0, 2.1, and 2.2) over the last 20 years in consultation with a broader group of stakeholder representatives known as the Eastern Snake Hydrologic Modeling Committee.

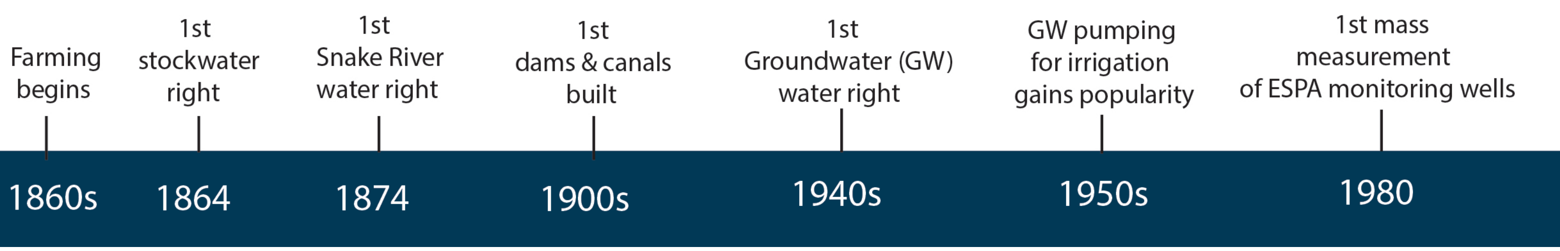
In 2023, ESPAM 2.2 was used to gauge the impacts of water consumption by all users in the ESPA region and continues to be used to calculate water budgets and examine impacts of groundwater pumping.

An immense amount of hydrologic data is collected by IDWR and partner agencies to calibrate the model and understand the status of the aquifer.

IDWR Increases Water Monitoring

From the late 2000s to present day, the Idaho Legislature has increased funding for the collection of hydrologic data to enhance understanding of the ESPA and improve model accuracy. In the early 2000s, IDWR monitored water levels in 215 wells; that number more than doubled to over 551 wells in 2022 (Figure 3). Additionally, IDWR has installed dataloggers in almost half the monitoring wells. These dataloggers record daily values of water levels, allowing the ability to observe water level fluctuations throughout the year.

About 15 IDWR staff collect manual water level measurements and download dataloggers in these wells twice a year, once in the spring prior to the irrigation season and again in the fall after the irrigation season



concludes. There is generally a higher concentration of wells monitored in areas with more groundwater development; however, IDWR in recent years has been expanding its network by drilling dedicated monitoring wells in areas where more data are needed.

Through grant funding from the Department of Energy (DOE), IDWR installed 23 new ESPA monitoring wells to fill model calibration data gaps. These wells were drilled and instrumented with dataloggers from 2018-2022 at a cost of approximately $1.35 million. Also through DOE grant funding, IDWR oversaw the drilling of 22 wells in the Big Lost River Basin, a significant tributary to the ESPA.

Approximately every five years, IDWR partners with the USGS to perform a mass measurement event of water levels in the ESPA region. These measurements took place in the spring over a two-week period in 1980, 2001, 2002, 2008, 2013, 2018, and 2023.

During these events, IDWR measures its normal network of wells and the USGS measures approximately 700 additional wells. These data provide for more detailed analysis of water level trends. The next mass measurement event is scheduled for spring 2028.

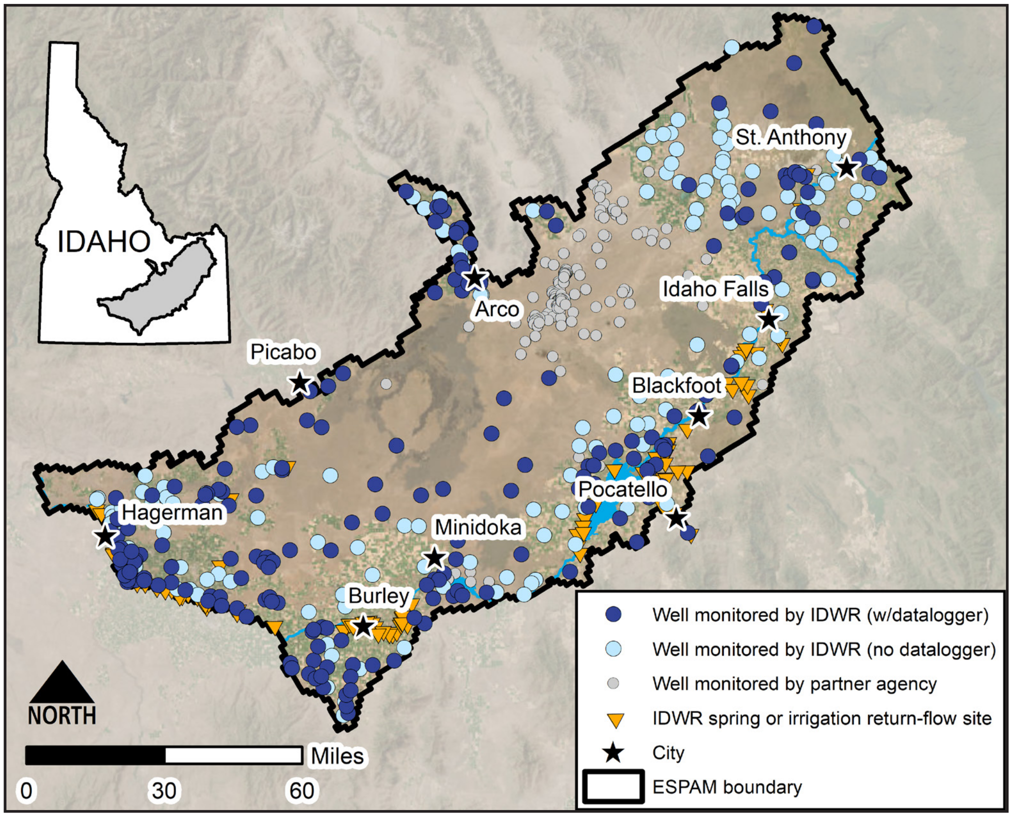


Figure 4: Locations of wells routinely monitored by IDWR and partner agencies, along with spring and irrigation return-flow sites within the ESPAM boundary.

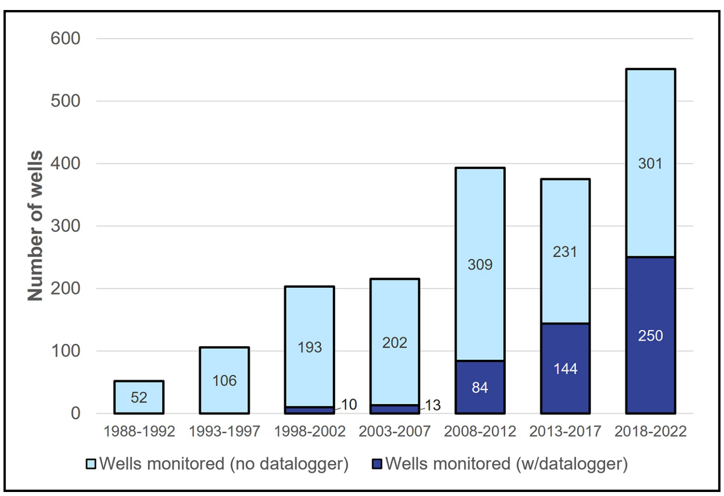


Figure 3: Number of wells monitored by IDWR over time within the ESPAM boundary.

The groundwater data that IDWR collects are rigorously reviewed and publicly available. The IDWR groundwater portal can be accessed at: [https://idwr-groundwater-data.idaho.gov/.](https://idwr-groundwater-data.idaho.gov/)

IDWR also maintains over 100 spring or irrigation return-flow monitoring sites (Figure 4). These surface water sites measure water flowing into the river and allow for better model calibration in ESPAM. Data collected at these sites can be accessed at [https://research.idwr.idaho.gov/apps/hydrologic/aquainfo.](https://research.idwr.idaho.gov/apps/hydrologic/aquainfo)

IDWR continues to recalibrate ESPAM and develop newer versions of the model with input from the Eastern Snake Hydrologic Modeling Committee. A new version of the model is expected to be released in 2026. All model files are available to the public but require sophisticated software recommended to be run by trained and experienced professionals.

For more information, go to: [http://idwr.idaho.gov/water-data/projects/espam/.](http://idwr.idaho.gov/water-data/projects/espam/)

1st ESPA GW Model created by USGS

1st Moratorium on new ESPA GW wells

1992

1st Snake River Water Delivery Call

1993

Conjunctive management of Snake River begins

1994

1st IDWR ESPA GW Model Released (ESPAM)

1998-99

Working toward a Sustainable Water Supply

The ESPA: A Vital Resource

The ESPA contains an estimated 200-300 million acre-feet of groundwater. An acre-foot is the amount of water it takes to flood one acre to the depth of one foot.

It is a sole-source aquifer that provides the only safe drinking water available to more than 400,000 Idaho residents. The Eastern Snake River Plain contains approximately two million acres of irrigated farmland; approximately half of them are irrigated by groundwater from the ESPA. The ESPA region produces about 21% of all goods and services within the State of Idaho with an estimated annual value of $10 billion.

Sustainability Goal: The Idaho Department of Water Resources is responsible for implementing the ESPA Comprehensive Aquifer Management Plan (CAMP) and managing the ESPA water balance (consumption and supply) to sustain Idaho's economy, ecosystems and resulting quality of life.

IDWR hydrology staff routinely measure water levels in approximately 550 ESPA wells two times a year (IDWR photo).

2005	2006	2012	2018	2020	2022
Surface Water Coalition (SWC) Water Delivery Call	ESPAM 1.1 GW Model released	ESPAM 2.0 GW Model released	Resolution of Spring Users Delivery Calls	ESPAM 2.1 GW Model released	ESPAM 2.2 GW Model released