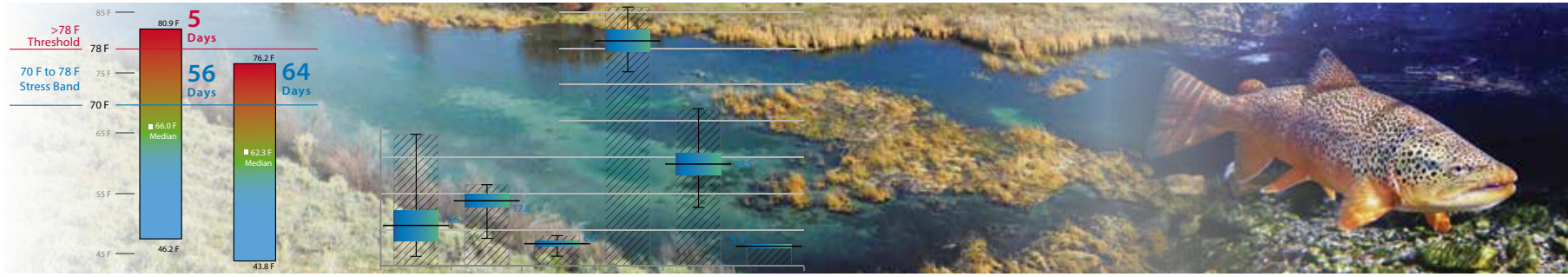
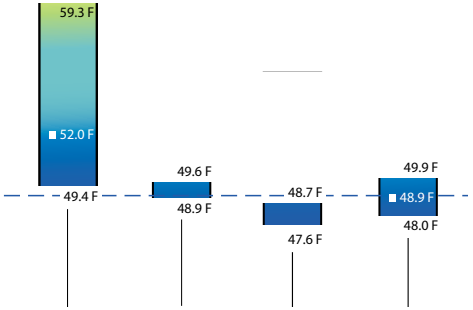
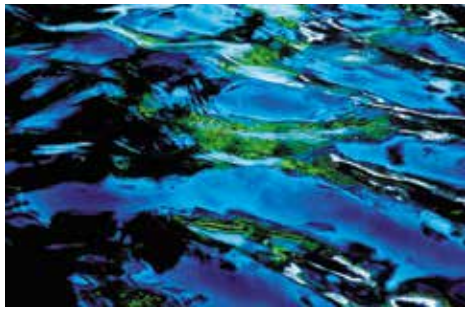
2013

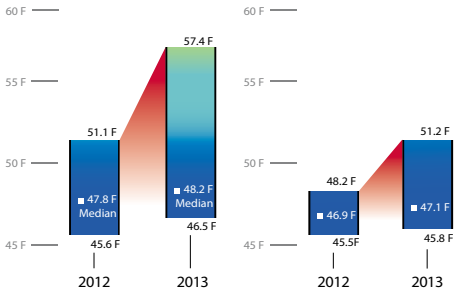
Silver Creek Annual Report

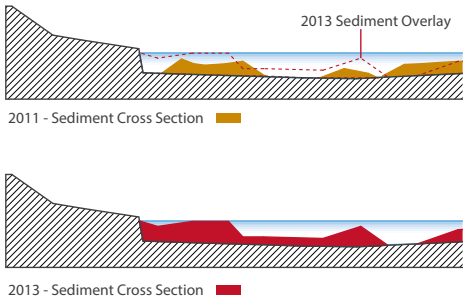
Ecosystem Sciences Foundation











Silver Creek Watershed

2013 Report

Since 2010, Ecosystem Sciences Foundation (ESF) has been engaged with monitoring and developing a better understanding of the Silver Creek Watershed. ESF developed a Restoration and Enhancement Strategy for the Silver Creek Watershed, in conjunction with The Nature Conservancy. The strategy identified numerous actions to be taken including filling critical data gaps on stream flow, temperature, and sediment conditions.

A logical outcome of the Silver Creek Watershed Enhancement Strategy was to implement monitoring to better understand the creeks and then develop effective management and restoration tools. Many of the numerous stream restoration projects which have been performed throughout the watershed have been on private land using private funds. This past year a significant effort to reconfigure the Kilpatrick Pond area was undertaken. Landowners want stream reaches on their property to support good fisheries, be ecologically functional, and to ensure that restoration investments already made are sustained. Additionally, landowners recognize that all of the streams in the watershed are maintained primarily by spring flows.

What We Learned

This report summarizes 2013 data for:

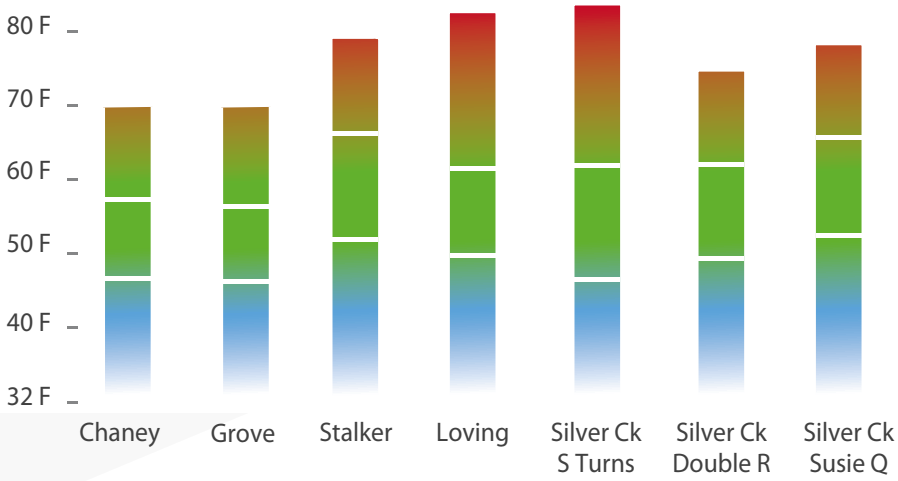
- **Spring Head Temperatures**
- **Stream Temperatures**
- **Groundwater Hydrology**
- **Sediment Accumulation**

The significant conclusions and findings from 2013 are:

- Some spring head temperatures rose significantly at the end of the summer with flows reduced to near zero.
- Several creeks exhibited high temperatures above the threshold for trout.
- A two year comparison of stream temperatures shows marked increases in some stream reaches.
- An analysis of groundwater data shows an overall decline in water level in several wells in the Wood River Aquifer.
- Stream sediment monitoring indicates an increase in accumulated sediments at selected transects in Lower Silver Creek.

For more details please visit: www.savesilvercreek.com

The information that is presented in this report reflects summarized analysis of all data. We are presenting the most important aspects of the past season's work in way that tells a story of the stream system and watershed. The raw and tabulated data that is used as the basis for the information presented here is detailed, scientifically rigourous, and reflects a considerable amount of field work to collect this important data. The website has more detailed information on programs in the watershed.



Summer Stream Temperatures: The graph above indicate the maximum, average and minimum summer water temperatures on selected areas of Silver Creek over a five year period. This year 55 stream temperature loggers were monitored throughout Silver Creek and each tributary to record critical information and track changes in the system.

Stream Temperature

The stream temperature monitoring program was continued in 2013. Additional loggers were installed throughout the Silver Creek watershed in 2012 and were maintained by Save Silver Creek and TNC. The monitoring array collects water temperature data for most spring heads, every tributary stream within the watershed, and Silver Creek itself. In 2013, 55 stream temperature loggers collected data for the entire year.

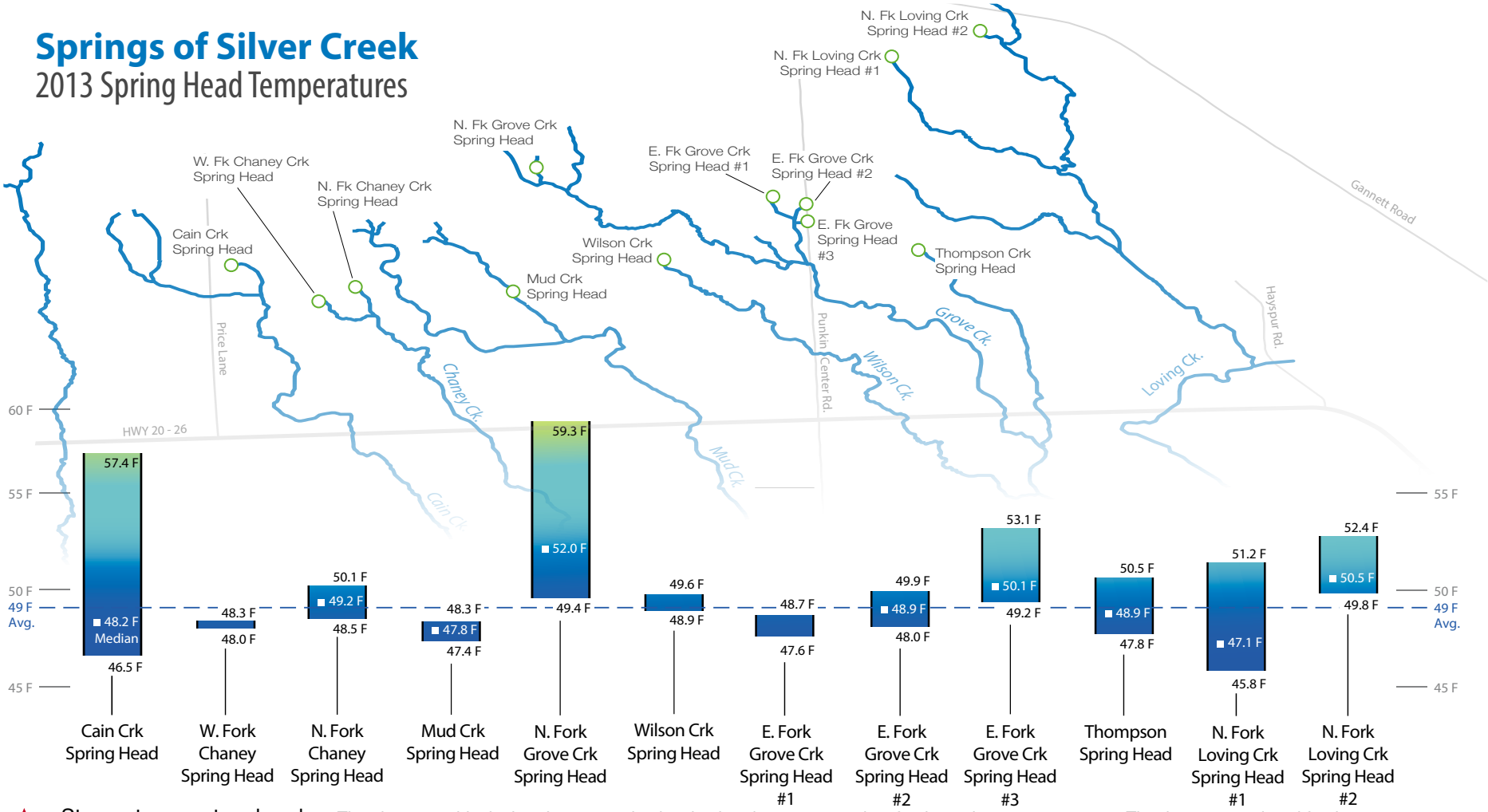
Temperature data is paramount to monitoring the overall health of the Silver Creek ecosystem. These data can aid in identifying potential reaches where elevated temperatures are problematic for fish and instream biota, or in assessing temperature responses to habitat restoration, changes in land use, or recovery from wildfire.

Spring Driven Ecosystem

Stream temperatures in a spring driven system, such as Silver Creek, should be relatively constant and not

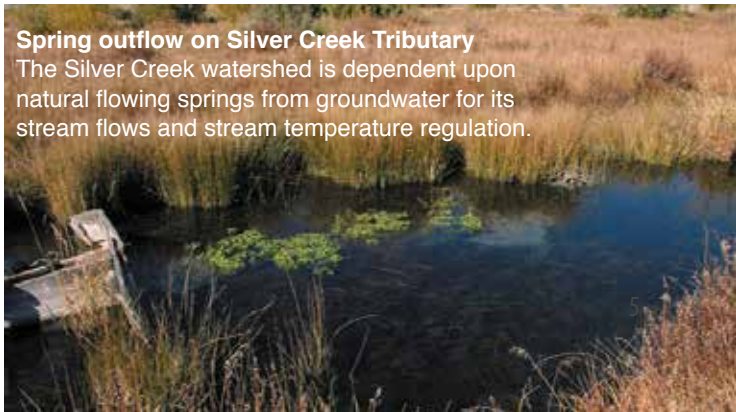
Springs of Silver Creek

2013 Spring Head Temperatures



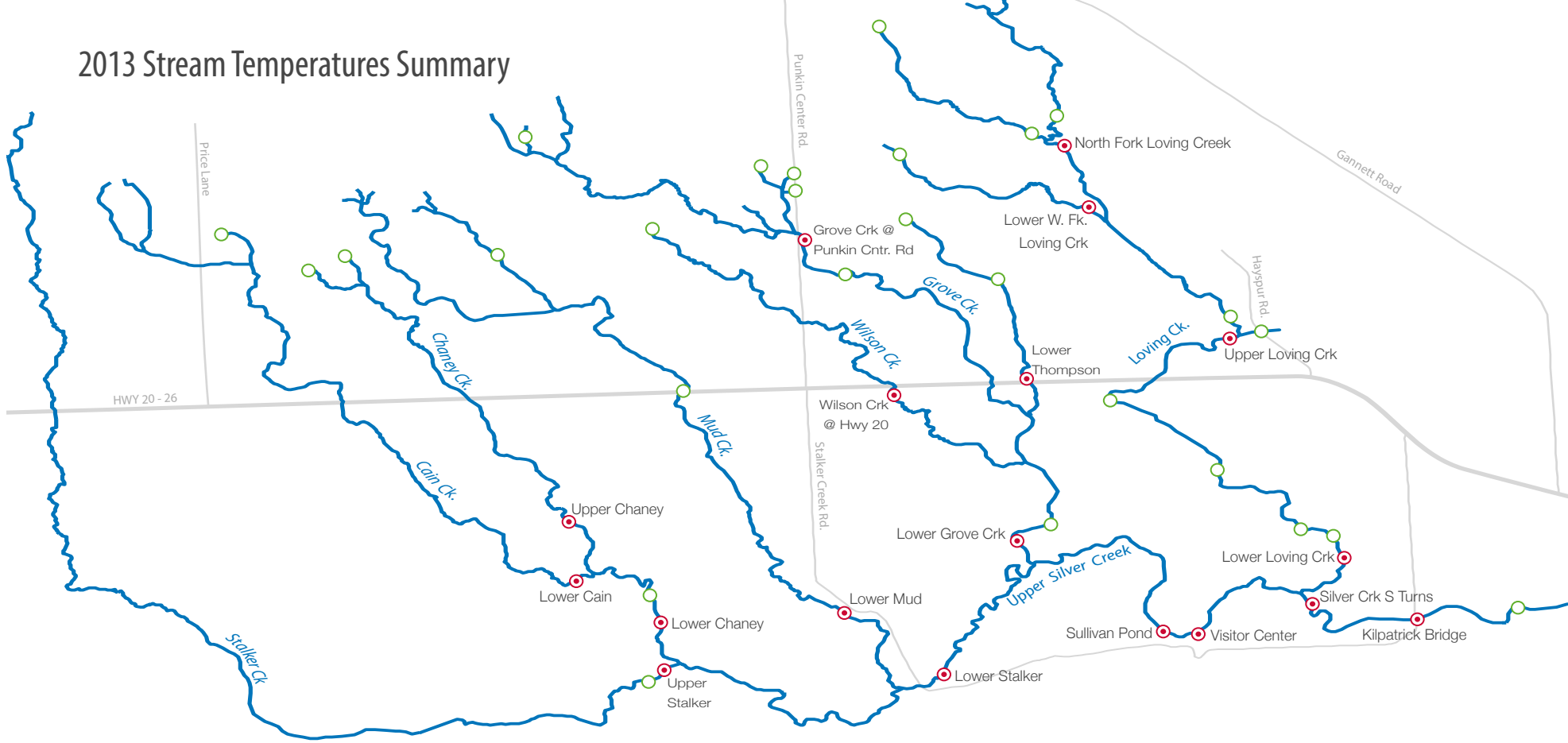
Stream temperature bands The above graphic depicts the summarized spring head temperature data for the entire summer season. The data was analyzed for the summer season to illustrate the spring temperatures that occurred for the period of June through September 2013. Each graph displays the total temperature range for the period of record; the absolute high and low temperatures are given and the median water temperature is shown for that particular spring.

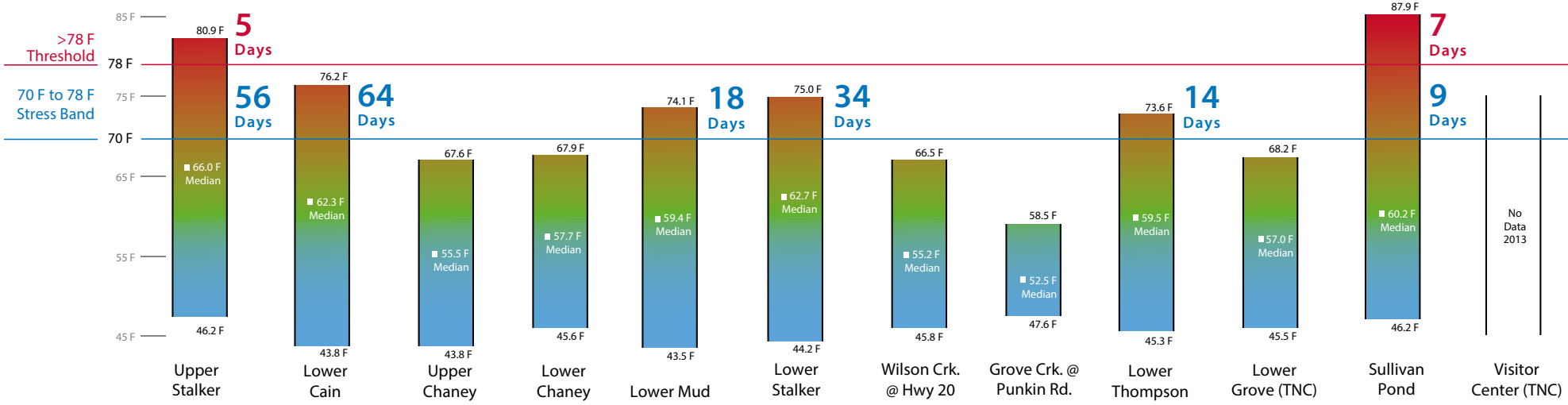
fluctuate greatly with changes in air temperature or climatic conditions. Long periods of warm weather accompanied by clear sunny skies (high solar input) could elevate stream temperatures in a spring system. In 2013, spring head temperature loggers were placed in 12 springs throughout the watershed. Monitoring data shows the average spring head temperature was 49F with a range between 45.8 to 59.3F •



Spring outflow on Silver Creek Tributary
The Silver Creek watershed is dependent upon natural flowing springs from groundwater for its stream flows and stream temperature regulation.

2013 Stream Temperatures Summary





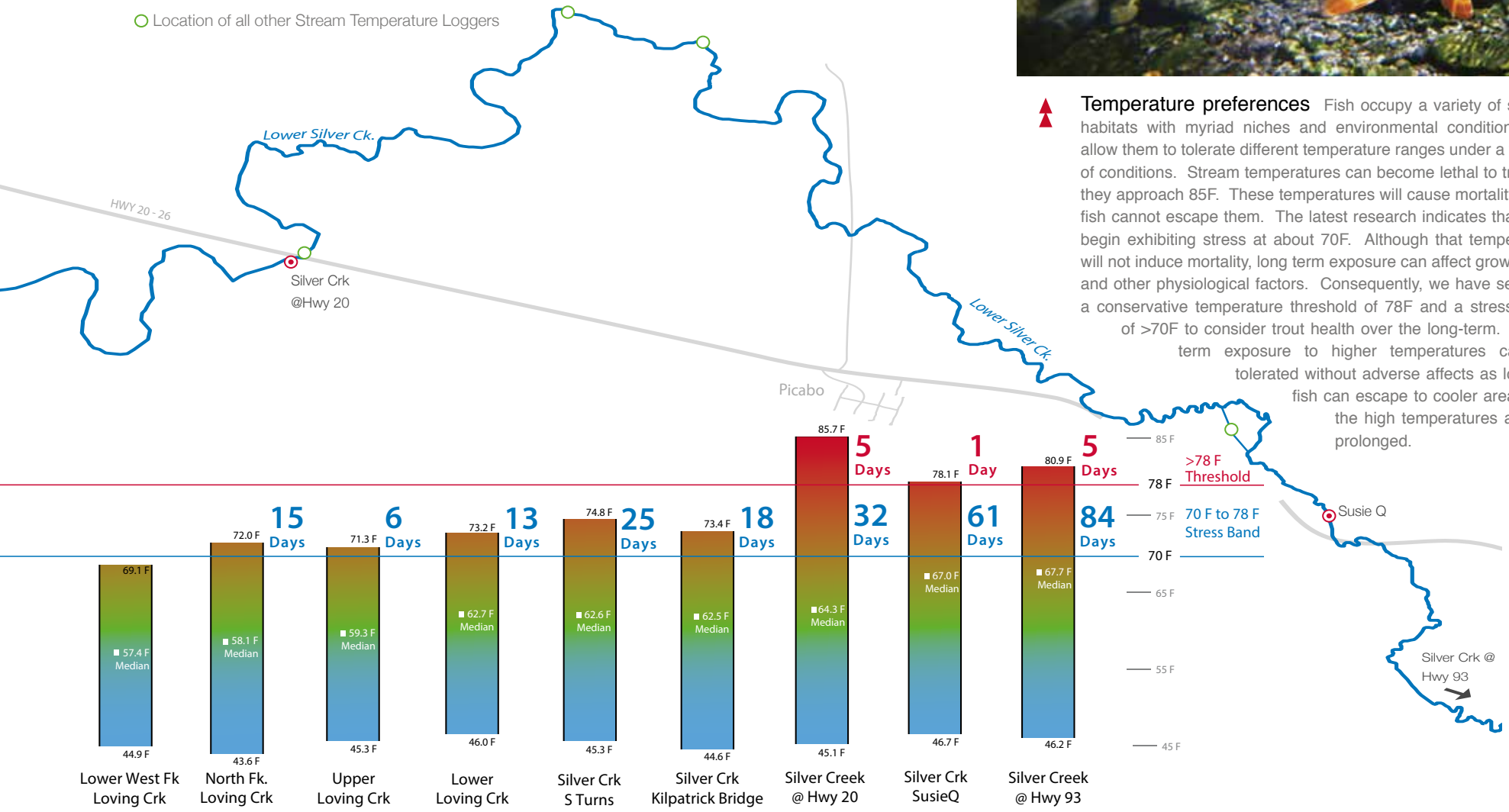
Stream temperature bands The above graphic depicts the summarized stream temperature data for the entire summer season for a selected group of data loggers and locations. The data were analyzed for the summer season to illustrate the high temperatures that occurred throughout the stream system for the period of June through the end of September, 2013. Each graph displays the total temperature range for the period of record; the absolute high and low temperatures are given and the median stream temperature is shown for that particular stream.

Locations of Stream Temperature Logger Array

The map illustrates the Silver Creek stream and tributary system with the locations of the stream temperature loggers. The temperature loggers are expressed in two categories for discussion and analysis purposes:

- Location of Stream Temperature Loggers illustrated in bottom graphic of seasonal temperatures
- Location of all other Stream Temperature Loggers

Stream temperatures are logged at one hour intervals over a twenty four hour period for as long as the logger is left in place. The array of stream temperature loggers in the Silver Creek system is designed to capture temperature differences for each stream and tributary segment, from the spring source through to Lower Silver Creek at the Highway 93 crossing.



Temperature preferences Fish occupy a variety of stream habitats with myriad niches and environmental conditions that allow them to tolerate different temperature ranges under a variety of conditions. Stream temperatures can become lethal to trout as they approach 85F. These temperatures will cause mortality if the fish cannot escape them. The latest research indicates that trout begin exhibiting stress at about 70F. Although that temperature will not induce mortality, long term exposure can affect growth rate and other physiological factors. Consequently, we have selected a conservative temperature threshold of 78F and a stress band of >70F to consider trout health over the long-term. Short-term exposure to higher temperatures can be tolerated without adverse affects as long as fish can escape to cooler areas and the high temperatures are not prolonged.

The overall average temperatures between night and day, throughout the summer, in all streams were well within the preference range for trout (around 55-60 degrees). Chaney, Grove and Wilson creeks' temperatures never entered the stress range. However, several streams did show temperatures exceeding the threshold of 78 degrees for several days (particularly Upper Stalker and Lower Silver Creek), and temperatures in most streams fell within the stress range for many days.

Temperature Comparison

Heating Up

As a spring-driven system, temperatures within Silver Creek and its tributaries should remain relatively constant throughout the year and between years. For this reason, it is important to monitor temperatures over time to detect any major shifts in the system and to monitor the overall health of the Silver Creek Watershed. While median temperatures remained relatively stable over three years of monitoring, there was an increase in the number of days that temperatures exceeded the 78°F threshold for trout health in 2013; extended periods above this threshold could result in fish mortality.

Our monitoring indicated that three spring heads dried up (flow was reduced to 0) at the end of August for the first time since monitoring began in 2011. This left the remaining stagnant water to warm considerably, up to 10 degrees warmer than the previous year. Whether this is due to an overall decrease/change in the groundwater system or land use changes in near-surface water-bearing zones (e.g. a localized cone of depression resulting from groundwater extraction) is not yet clear.

Notably, some of the spring heads in close proximity did not dry up and matched the temperature profiles measured in 2011 and 2012.

An increased understanding of the hydrogeologic relationship between surface water and groundwater in the Silver Creek watershed is needed in order to explain these changes in flow and temperature, and to develop appropriate strategies for future management and enhancement efforts. The following section outlines our current understanding of the groundwater system underlying Silver Creek.

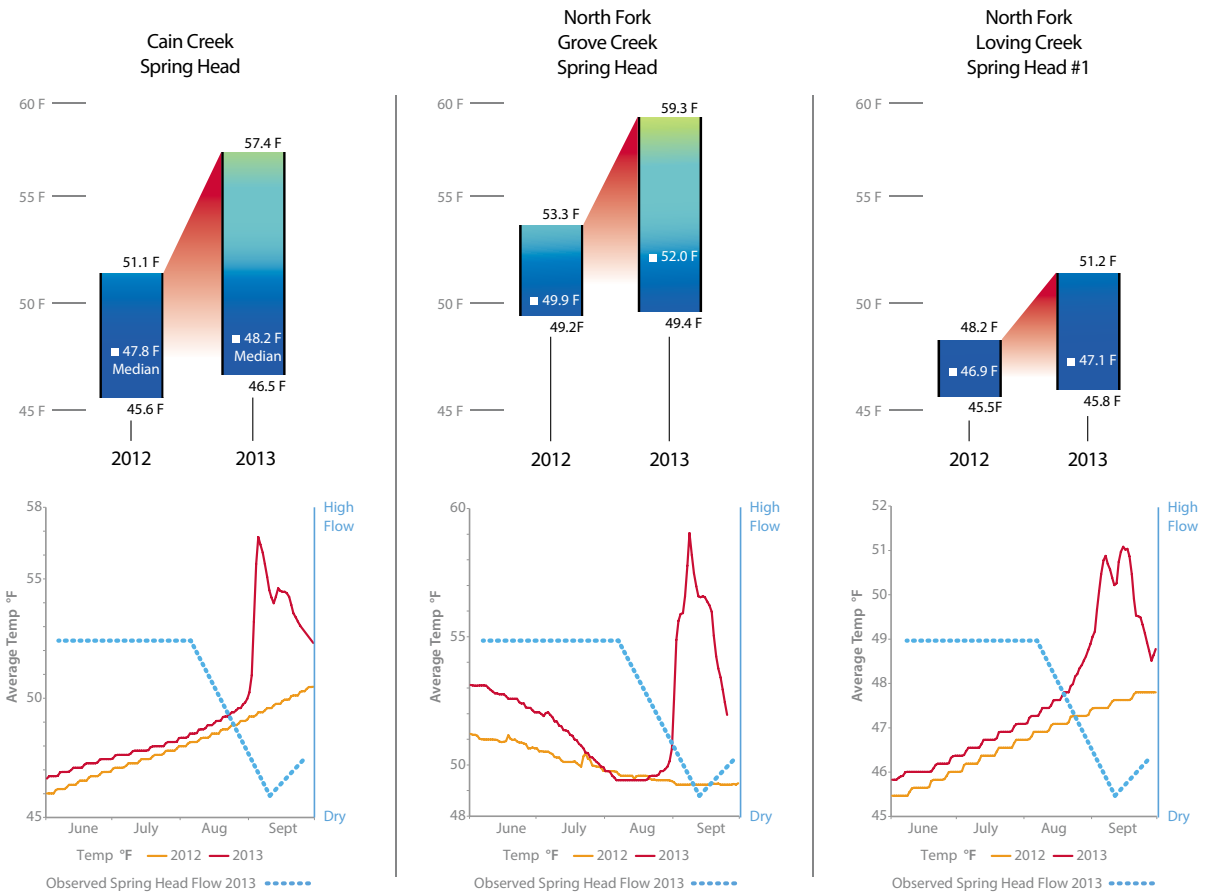
Temperature Spikes, 2013

The temperature comparisons on this page display three spring heads and three stream temperature records that indicate large changes or anomalies over the past two years.

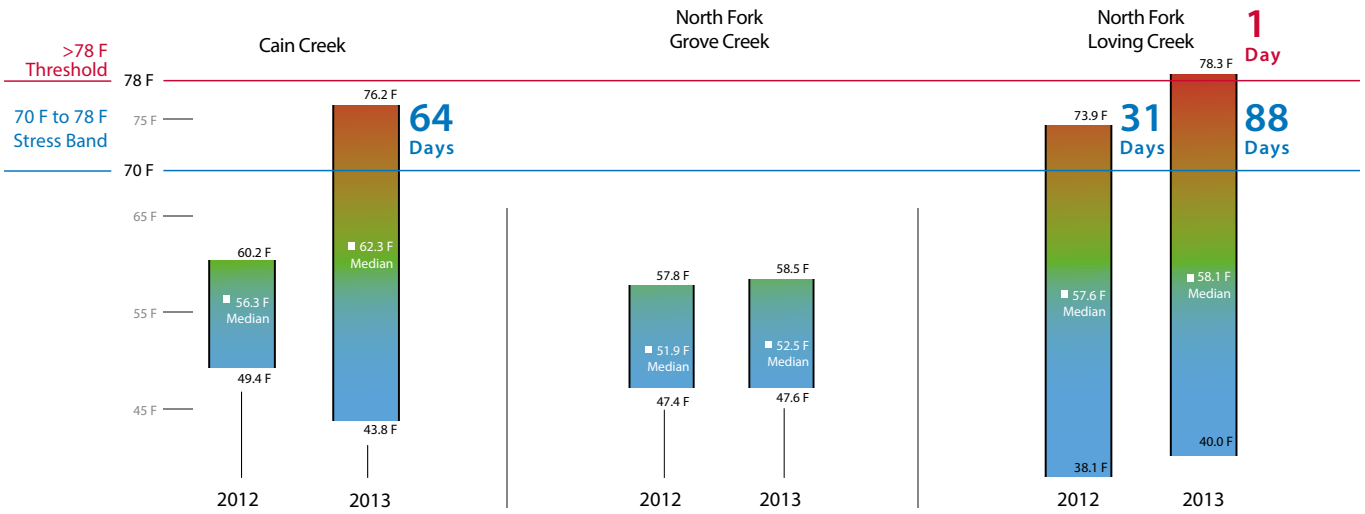
These three spring heads all had a dramatic increase in temperature in late August to early September - corresponding with a period of spring flows diminishing and drying up.

The temperature profile of the North Fork Grove Creek spring head is notable based on its declining temperature throughout the summer. In contrast, most spring head temperatures rise throughout the summer. This suggests that the North Fork Grove Creek spring head water upwells from a cold subterranean source; this cold water is critical to the health of Silver Creek, as Grove Creek water supplies large volumes of cold water that are vital to the health of the main stem of Silver Creek.

2012 / 2013 Spring Head Temperatures Comparison



2012 / 2013 Creek Temperatures Comparison



Groundwater Hydrology

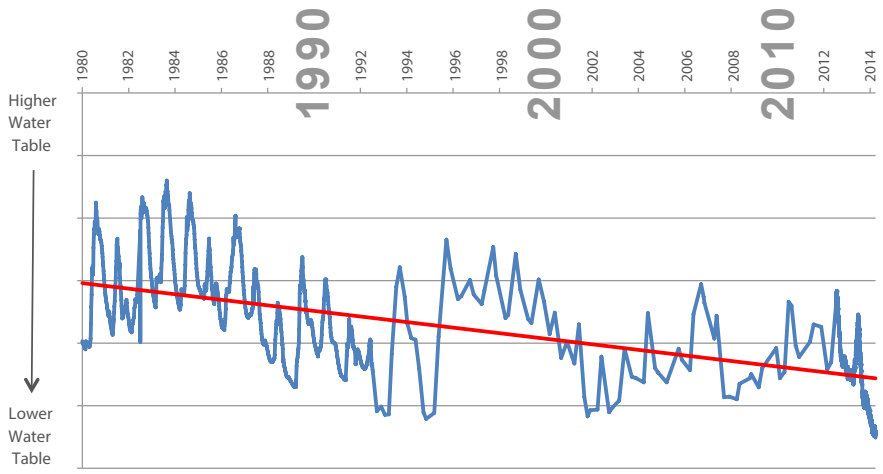
Silver Creek depends on the Wood River Valley aquifer system to feed its springs and streams. Without this groundwater, Silver Creek will cease to flow cold and clear and the system that we know and love will disappear. Groundwater levels and consequently stream flows have been declining over the last 30 years in the system (see the 2012 Annual Report). To better understand and manage this trend, the USGS and IDWR are collaborating to construct a groundwater flow model to simulate potential anthropomorphic and climatic effects on groundwater and surface water resources.

Long Term Well Data

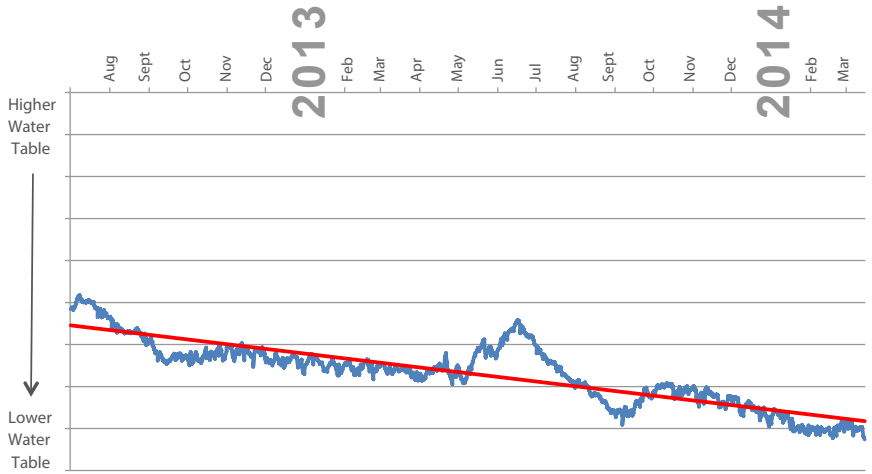
Depth to groundwater has declined since 1980 at two wells with long term data recorded by USGS and IDWR (Upper Grove and Stanton Crossing graphs to the right). The graphs depict water levels in two wells in the Silver Creek area of the Big Wood River Aquifer. Since 1980, groundwater levels have declined at both locations. A linear regression trend line (shown in red) has been fitted to the data. The Stanton Crossing well, located near HWY 75, is an artesian well that flows from water pressure found within the confined aquifer. The pressure has decreased by roughly 50% over this time period. The well west of Gannet, in the upper Grove Creek watershed, is a well within the unconfined aquifer where water levels have dropped between 5-10 feet over the same time period.

Recent Well Data

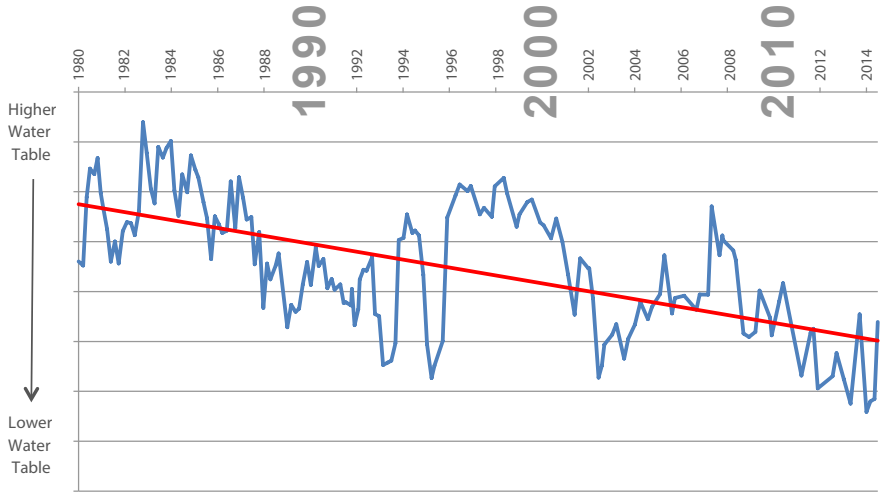
Depth to groundwater has declined since 2012 at two wells recorded by USGS and IDWR (Gannet and Upper Stalker graphs to the right). The graphs depict water levels in two wells in the Silver Creek area of the Big Wood River Aquifer. Since summer 2012, groundwater levels have declined at both locations. A linear regression trend line has been fitted to the data (red line). Both graphs show a rise in groundwater that coincides with the snowmelt run-off in spring to early summer. At the Upper Stalker well, groundwater levels have dropped from about 10 feet to 20 feet over this time period. The Gannet well shows a smaller decline.



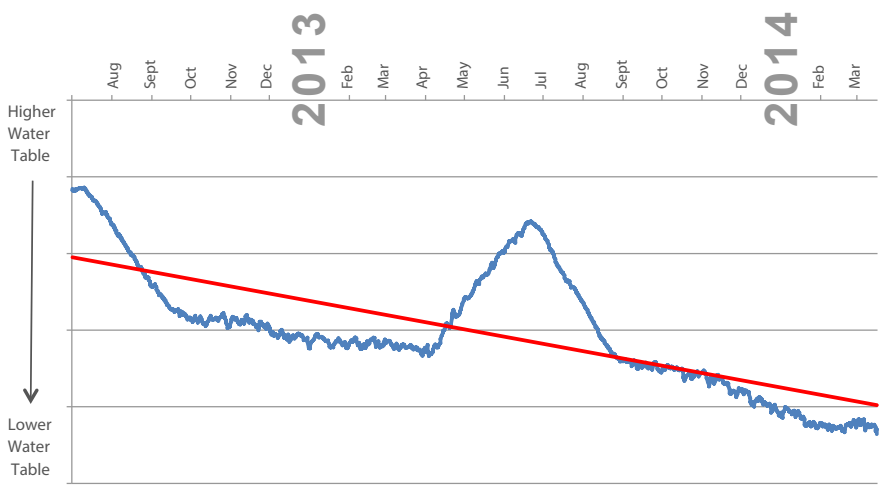
Upper Grove



Gannet



Stanton Crossing



Upper Stalker

Well Data - Depth to Groundwater Graphs. These graphs display well data at four locations throughout the Silver Creek area. Each graph shows the depth to groundwater for the period of record. Upper Grove and Stanton Crossing show data for the past 34 years. Gannet and Upper Stalker are most recent and show data over the past two years. All graphs indicate a decline in groundwater.

*Well data acquired from Hydro Online: http://www.idwr.idaho.gov/hydro.online/gwl/gwl.html. Accessed 4/24/2014.

Stream Sediment

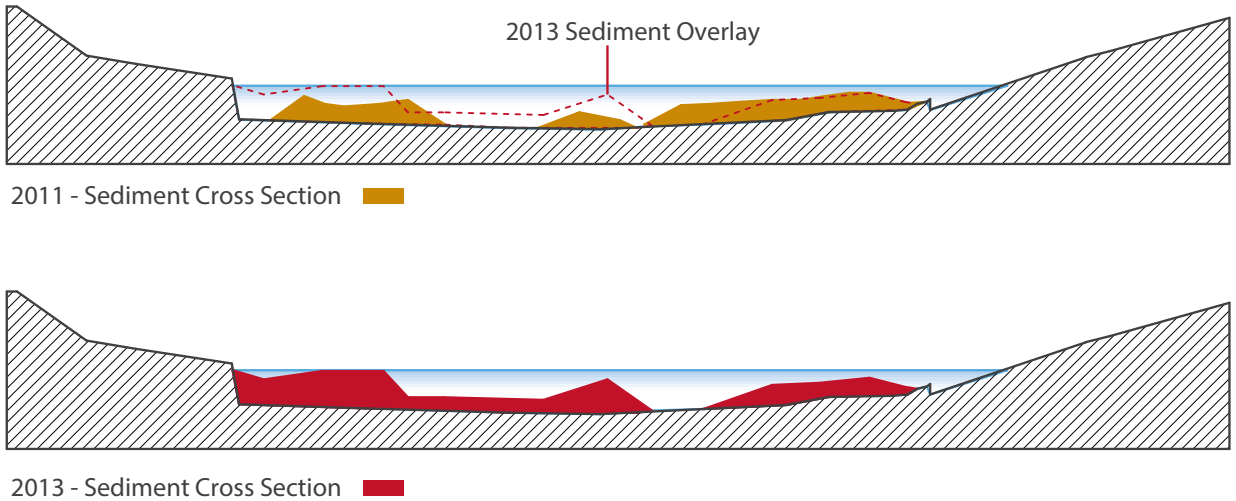
In 2013, sediment monitoring focused on Lower Silver Creek. Seven transects were surveyed to determine the depth and extent of sediment in the river channel of Lower Silver Creek. Five of the seven transects were initially surveyed in 2011 and were revisited in 2013. Two new sites were established in 2013. The map on the facing page shows the sites that were monitored in 2011 (green), those resurveyed in 2013 (red) and two new sites established in 2013 (blue).

The reasoning for the 2013 sediment monitoring focus on Lower Silver Creek was two-fold; Lower Silver Creek had the highest sediment load of all creeks based on the 2011 monitoring and the need for baseline data for pre Kilpatrick Pond Restoration Project conditions. In 2011, Lower Silver Creek retained the highest sediment load of all streams in the Silver Creek system, with an average of over 33 sq.ft. per transect. Of the nine transects surveyed in 2011, six retained a high (>22 sq. ft.) sediment load. For these reasons, Lower Silver Creek was resurveyed in 2013 to determine the sediment conditions; does Lower Silver Creek retain a high sediment load, has sediment decreased in the reach, or has it stayed the same?

Lastly, the Kilpatrick Pond Restoration Project constitutes a major change for the Silver Creek system. The restoration project sits at the upstream end of the Lower Silver Creek reach. The 2013 survey will serve as a baseline dataset from which to monitor sediment conditions post restoration.

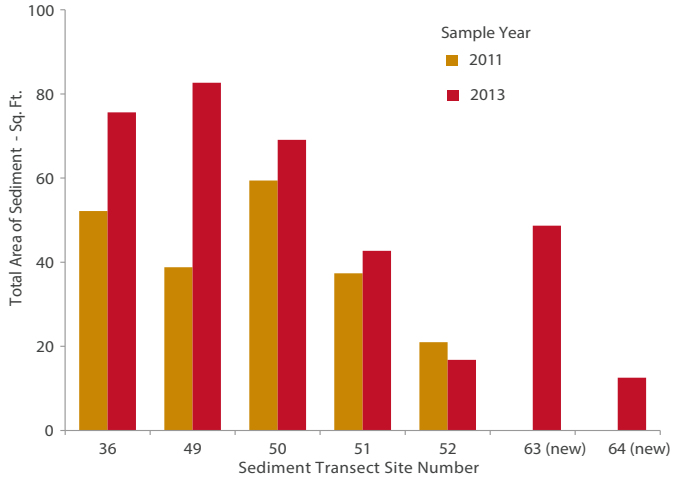
Cross Channel Sediment Transect Comparison

The graphic below depicts a cross-channel view of transect 36, which was surveyed in 2011 and 2013. The graphic demonstrates the additional sediment surveyed in 2013, where approximately 23.5 sq. ft. of new sediment was documented.



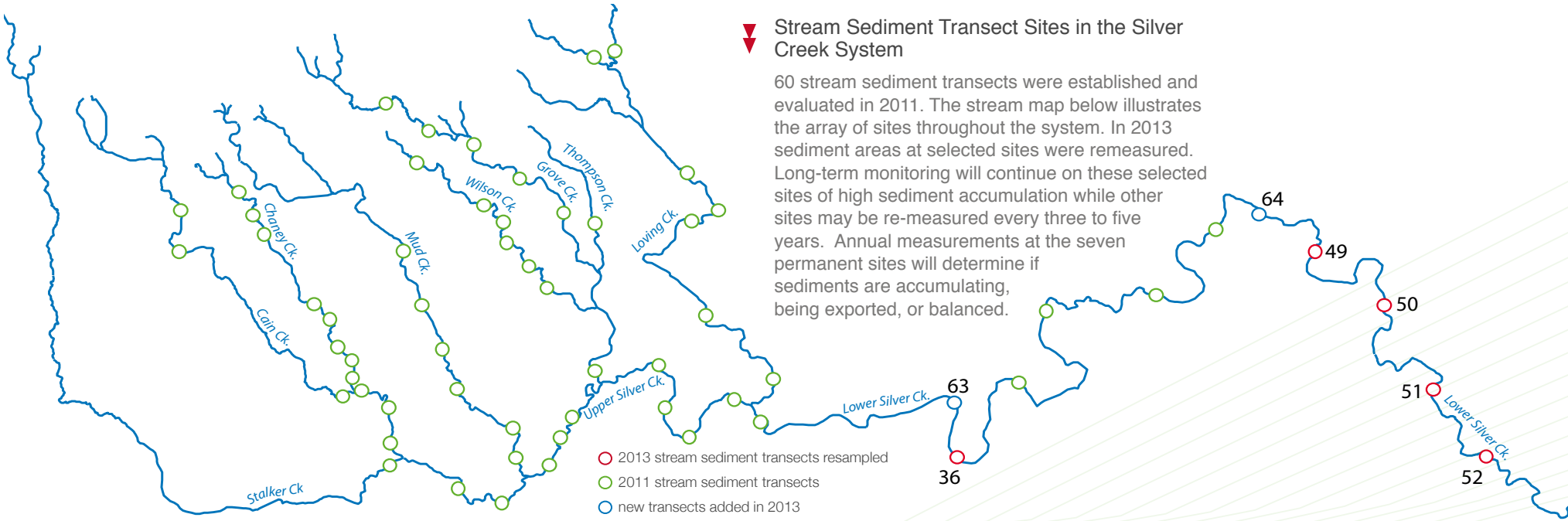
Sediment Comparison 2011 - 2013

The graph below demonstrates that four of the five sites that were resurveyed in 2013 had more sediment than in 2011. Two of the four transects (36 and 49) had a significant sediment increase over 2011 conditions. Lower Silver Creek exhibits a higher average sediment load per transect in 2013 compared to 2011.



Stream Sediment Transect Sites in the Silver Creek System

60 stream sediment transects were established and evaluated in 2011. The stream map below illustrates the array of sites throughout the system. In 2013 sediment areas at selected sites were remeasured. Long-term monitoring will continue on these selected sites of high sediment accumulation while other sites may be re-measured every three to five years. Annual measurements at the seven permanent sites will determine if sediments are accumulating, being exported, or balanced.



Next Steps

Surface Hydrology and Temperature Monitoring

After three years of monitoring, it is clear that the hydrology and temperature monitoring must continue on Silver Creek. As we build the database, we will continue to understand the system better and be able to detect data trends that indicate problems with the system. As an example, if flows continue to decrease and temperatures rise, stress on fish will increase.

Unfortunately, in 2013 funding was insufficient to continue the surface monitoring of Silver Creek tributaries. Monitoring is a long-term scientific tool that must be done consistently over time. For this reason, we must find the resources to continue our existing monitoring efforts.

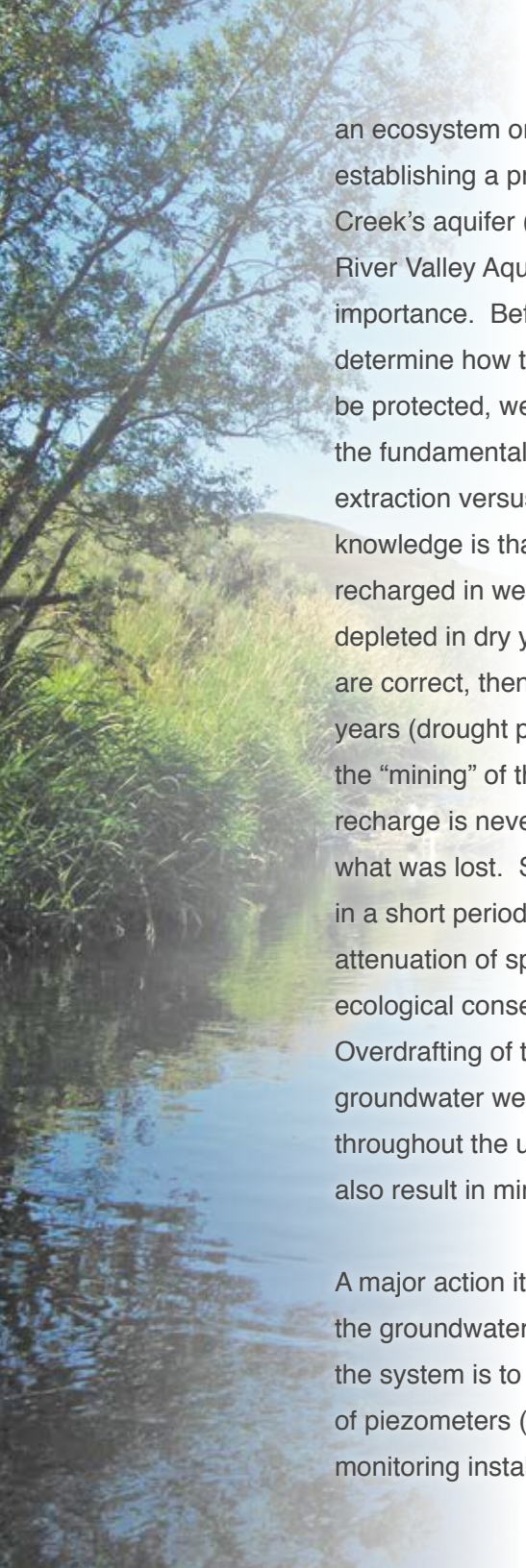
Buffers

Riparian buffers are streamside vegetation that "buffer" the stream from the upland landscape. They are critical ecosystem components that provide shade, sediment and nutrient filters, and habitat for fish and wildlife. However, not all buffers are created equal. Width, height and species composition all influence the functionality and value of a riparian buffer. We are seeking willing landowners to create a case study. We will evaluate the current riparian buffers on the property, assess the site specific conditions, and make recommendations as to how riparian buffers can be improved for temperature, sediment or erosion control, nutrients, habitat and ecosystem values.

Groundwater Protection

All of the surface water in all of the tributaries to Silver Creek originates, for the most part, in headwater springs. Thus, groundwater is the ecological driver for the entire watershed.

If groundwater levels drop such that spring flows are diminished or stopped, the ecosystem faces collapse. The 2013 spring head monitoring indicates that some springs temporarily dried up. While temperature thresholds and sedimentation are critical parameters that influence the health of the ecosystem, it is groundwater which determines whether there is



an ecosystem or not. Consequently, establishing a program to protect Silver Creek's aquifer (part of the Wood River Valley Aquifer) is of paramount importance. Before landowners can determine how the groundwater can be protected, we need to understand the fundamental dynamics of extraction versus recharge. Our current knowledge is that aquifers may be recharged in wet years, and may be depleted in dry years. If these 'maybes' are correct, then a succession of dry years (drought periods) could result in the "mining" of the aquifers in which recharge is never able to replace what was lost. Severe drought could, in a short period of time, lead to the attenuation of spring flows with adverse ecological consequences to follow. Overdrafting of the aquifer as more groundwater wells go into production throughout the upper watershed can also result in mining.

A major action item to understand the groundwater dynamics within the system is to establish an array of piezometers (small groundwater monitoring installations) that will measure the change in depth to groundwater over time. Ideally, these piezometers will be spread systematically throughout the watershed. This is our long-term goal. In the short term, setting up piezometers along one or two creeks in select locations would set the foundation for our understanding of the groundwater dynamics. The cooperative effort between the USGS and IDWR to create a groundwater model for the Wood River Valley Aquifer will be a key tool to understand the greater aquifer dynamics; however, local dynamics will only be understood by implementing shallow monitoring of groundwater on a finer scale.

Fish Habitat Mapping

Fish habitat mapping would delineate trout spawning areas, early rearing and nursery areas within Silver Creek and in side channels, pools (deep and shallow), undercut banks, resting and feeding zones, sediment conditions, beaver ponds, riparian vegetation and stream bank conditions, areas of reed canary grass growth, channel constrictions, and over-widened reaches. Also, fish population sampling can be an important part of any monitoring program. Fish are one of the treasured resources in Silver Creek and they should be understood and protected.

Watershed Health

The critical environmental issues throughout the Silver Creek Watershed are temperature, sediments, and flow. These parameters are indicators of the health of the watershed much like checking our own body temperature and circulatory system. Consequently it is important to maintain our temperature logger arrays throughout the streams and measure flows seasonally in all the streams to alert us to changes that indicate a serious issue with the functioning of the ecosystem. Sediment tracking requires less intensive work now that we have defined conditions for Silver Creek and the tributaries.

Funding

In order to continue this important work and increase our understanding of the Silver Creek system requires funding. Please consider a donation to continue this important program.

2013

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