SPF WATER ENGINEERING

TECHNICAL MEMORANDUM

PROFESSIONAL ENGINEER LICENSED 9193 8/10/15 STATE OF IDAHO CATHERINE GILLMOR COOPER

REGISTERED PROFESSIONAL GEOLOGIST TERRY M. SCANLAN 646 8/10/15 STATE OF IDAHO

DATE: August 10, 2015

TO: Mariel Platt, City of Hailey

FROM: Cathy Cooper, P.E., Terry Scanlan, P.E., P.G.

CC: Cole Balis, Roxanne Brown, Scott King, P.E.

RE: City of Hailey, Indian Creek Spring, Exploratory Drilling

Job: 330.0190

INTRODUCTION AND BACKGROUND

The City is interested in collecting additional water from their Indian Creek Spring facility. A cut-off wall was included in the last design drawings for the spring (dated 1986), but recent investigations by City staff find no evidence that the wall was actually installed. The cutoff wall was initially considered for installation just downstream of the existing spring collection facilities. However, it appears that additional flow could be captured by moving the cut-off wall further downstream within the spring site boundary.

The City holds a recorded easement for the area surrounding the Indian Creek Spring Facility, which lies on land owned by the Indian Creek Ranch Owner's Association (ICROA). The easement was recorded in 1994 and describes a 400-foot by 400-foot area encompassing the current facility, which appears to match the existing fence location.

More than 100 gpm of flow is visible in a channel that crosses the boundary fence near the southwest corner of the easement area. This flow and potentially unobserved subsurface flow might be captured by a cut-off wall and expanded infiltration gallery.

As an initial step in determining the potential effectiveness of a cutoff wall, exploratory drilling was conducted on August 5, 2015 to evaluate subsurface conditions at the project site. The purpose of the investigation was to determine the nature of the subsurface materials at the site. The nature of the subsurface materials provide insight into the most effective means to capture the flow that is currently leaving the site.

ACTIVITY

The drilling consisted of advancing four hollow-stem auger boreholes to depths of 20 to 25 feet. At the bottom of each borehole, a split-spoon sample was collected. R.P. Jones Drilling was the drilling contractor. Drilling was observed by Cathy Cooper, P.E., and Terry Scanlan, P.E., P.G., of SPF Water Engineering. Borehole locations are shown on Figure 1.

Materials penetrated by the boreholes at each site consisted of approximately 2 feet of topsoil, underlain by poorly-sorted clayey and silty sand and gravel of alluvial and colluvial origin. Although saturated, none of the materials appeared to be clean water-bearing sands or gravels that could be developed into productive wells. At borehole No. 4, bedrock was encountered at 19 feet; bedrock was not encountered in the other boreholes. Borehole logs are provided as Attachment A

In addition to drilling, the site was inspected to better understand spring hydrogeology. It was noted that groundwater was visibly discharging from the valley bottom southwest from the spring collection building and from the slope in the southwest portion of the site (Figure 1). Groundwater was also discharging from the slope a few feet above the valley bottom; this flow appeared to angle across the slope in strips.

ANALYSIS

Review of published geologic mapping (Batchelder and Hall, 1978) suggests that Indian Creek Spring occurs at the contact between the Wood River Formation and Challis Volcanic Group (Figure 2 and Attachment B). The Wood River Formation at this location is mapped as Unit 4, described as calcareous sandstone, sandy limestone, and micritic limestone of Late Pennsylvanian age. Locally, the rock is steeply dipping, with a northerly strike. The Challis Volcanic Group rock at this location consists of rhyodacite, dacite, and pyroxene andesite. At the spring, the bedrock units are shown as overlain by alluvium; glacial outwash overlies the bedrock south of the spring.

It is likely that groundwater can move through the Wood River formation rocks more freely than through the volcanic rock, so that at the contact between the Wood River Formation and the Challis Volcanic Group, the volcanic rocks form a semi-permeable dam forcing groundwater to the surface. The linear areas of spring discharge visible at the base of the slope near the southwest corner of spring fenced enclosure might be related to discharge of groundwater from permeable beds or fractures in the Wood River formation underlying the colluvium. Drilling in the spring vicinity indicates that the colluvial and alluvial sediments at the site are not highly permeable, which likely prevent a portion of the groundwater discharging from the bedrock from travelling downgradient as subsurface flow within the alluvial sediments along the creek.

By visual estimate, between 100 and 200 gpm of spring flow was discharging through the fence line in the southwest corner of the spring site. This water could potentially be captured by creating a barrier at the fence line and installing infiltration pipes on the uphill side of the barrier. The barrier could consist of a cutoff wall or dike of compacted clayey materials excavated into the subsoils in the southwest corner of the site. Upstream from the dike, vegetation, top soil, and the upper few feet of subsoil should be stripped off. Infiltration pipes, bedded and covered with clean imported gravel, could extend to a collection point at the dike. The imported gravel within the site should be covered with geotextile. Topsoil could be replaced above the geotextile, to reclaim the site. We anticipate the cutoff wall would be approximately 6 feet deep, with pipes 3 to 6 feet deep. It will be important to pay attention during construction and shift the location of collection pipes if a particularly productive, wet area is located during digging.

The infiltration pipes could discharge into a collection box at the dike or cutoff wall. The box could overflow to the creek through the dike. A pipe could extend back from the collection box to the existing spring house. A survey is needed to determine available depths for gravity delivery to the spring house; it may be necessary to pump if the water surface in the spring house is above the anticipated water surface in the collection box. Figure 3 shows a potential configuration of a cut-off barrier and collection pipe system. This system would include 6 perforated lateral pipes (6-inch diameter) of approximately 150 feet each, 200 feet of solid 10-inch pipe, and a 72-inch diameter manhole for a spring collection box.

NEXT STEPS

The next steps are recommended.

1. Wetland Site Visit. Verify the steps that need to be taken to allow the contemplated improvements to be installed.
2. Site survey. Verify the easement boundary and survey elevations.
3. Prepare a Preliminary Engineering Report and Plans and Specifications for the collection system expansion. Submit these for Idaho Department of Environmental Quality (IDEQ) review and approval.
4. Bid and construct the collection system expansion.
5. Evaluate the need for additional collection and capture of spring flow, including the need for additional cutoff walls and/or additional laterals.

Figure 1. Soil boring locations

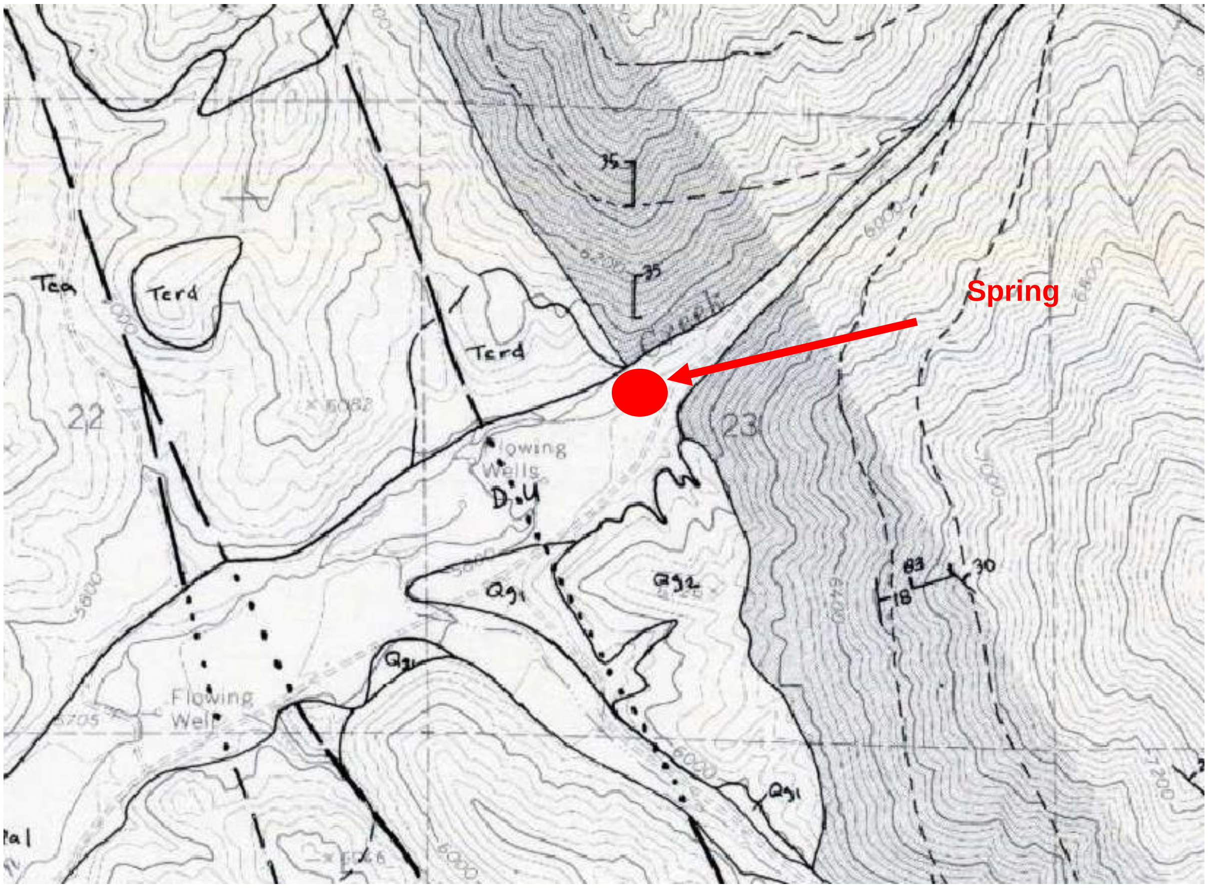

Figure 2 – Surface geology in Indian Creek Spring vicinity

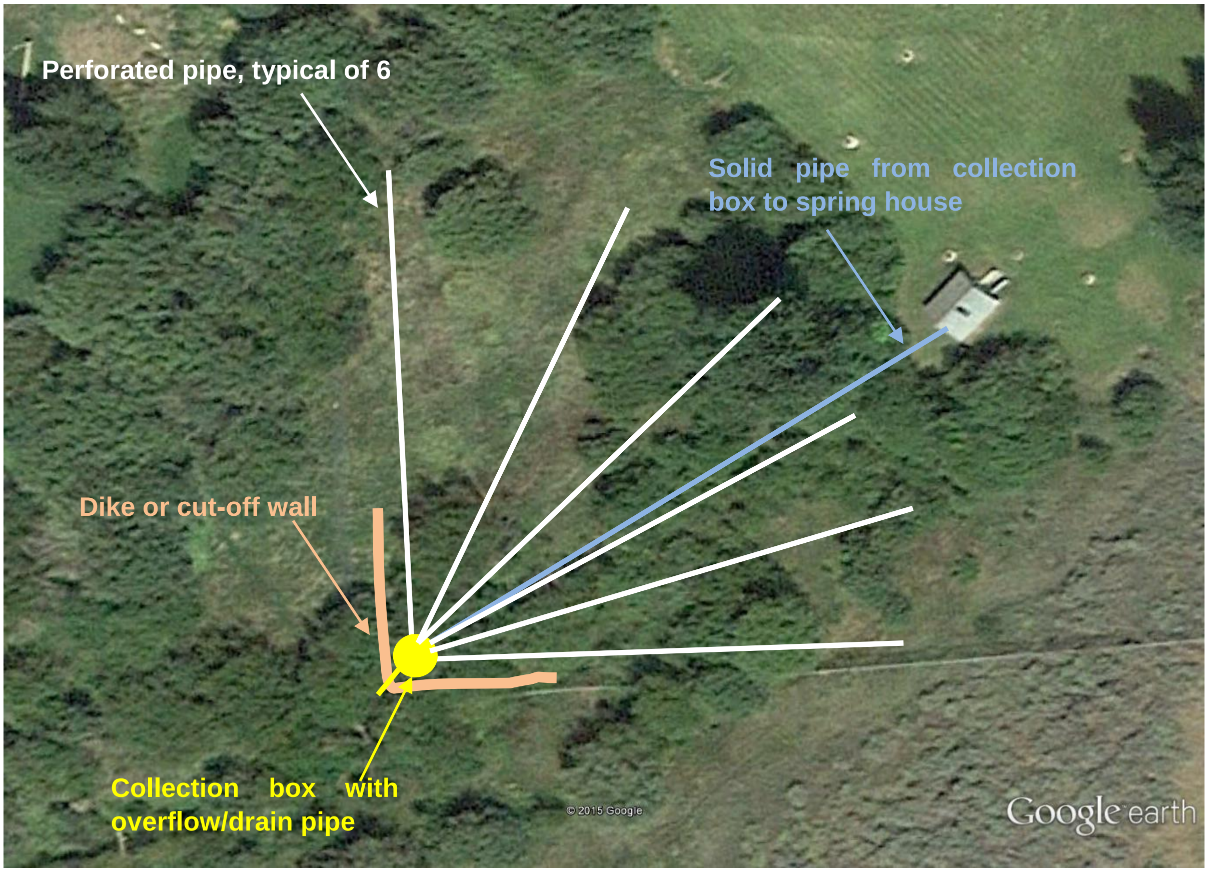

Figure 3 – Conceptual design of enhanced spring flow capture facilities

Attachment A

Soil Boring Logs

SPF Water Engineering Soil Boring Log

Project	Indian Creek Spring Improvements
Project No.	330.023
Boring No.	1 — on slope bove saturated area, 190 feet east of west fence, 20 feet north of south fence
Date:	8/5/2015
Location:	Indian Creek Spring
Driller:	RP Jones Drilling (Terry, Salvador, Chris)
Logged by:	Terry Scanlan and Cathy Cooper
Method:	Hollow Stem Auger
Weather:	Raining, 60F
Remarks:	Depth to water = 5.5 feet; hole seems wetter than others; ground surface approximately 4 feet higher than others

Depth (ft bgs)	
0–2	topsoil - dark brown to black
2–5	gravelly organic clay; black; rocky at 5 feet, otherwise drilling smooth
5–9	gravelly organic clay, rocky at 7 feet, grayer and more rock fragments below 7 feet
9–13	clayey gravelly sand, drills quickly, gray to green gray
13–25	As above, rocky at 17 feet, smooth drilling from 17.5 to 21 feet, harder at 22 feet, more gravelly from 22 to 25 feet
25–26.5	SPT 12/22/22; green brown silty gravel with dark gray rock fragments

SPF Water Engineering Soil Boring Log

Project	Indian Creek Spring Improvements	
Project No.	330.023	
Boring No.	2	at north edge of saturated area, 50 feet east of west fence, 75 feet north of south fence
Date:	8/5/2015	
Location:	Indian Creek Spring	
Driller:	RP Jones Drilling (Terry, Salvador, Chris)	
Logged by:	Terry Scanlan and Cathy Cooper	
Method:	Hollow Stem Auger	
Weather:	Overcast, 65F	
Remarks:	Depth to water = 2.25 feet; easier drilling than No. 3	

Depth (ft bgs)	Description
0–2	Topsoil - dark brown
2–6	gravelly clayey sand ; saturated at 6 feet
6–13	silty sand, greenish gray brown
13–17	As above, lighter color
17–19	As above, more gravelly
19–20	As above, smoother drilling
20–21.5	SPT 6/17/7; silty to clayey sand and gravel; colluvial?

SPF Water Engineering Soil Boring Log

Project	Indian Creek Spring Improvements	
Project No.	330.023	
Boring No.	3	30 feet east of west fence, 130 feet north of south fence
Date:	8/5/2015	
Location:	Indian Creek Spring	
Driller:	RP Jones Drilling (Terry, Salvador, Chris)	
Logged by:	Terry Scanlan and Cathy Cooper	
Method:	Hollow Stem Auger	
Weather:	Overcast, 65F	
Remarks:	Depth to water = 2.5 feet; rocky drilling	

Depth (ft bgs)	
0–2	Topsoil - dark brown
2–4	gravelly clay - brown
4–5	clayey sand and gravel, softer
5–7.5	clay, light brown; rock at 7.5 feet
7.5–10	clay with rock fragments, greenish grayish brown; gravelly at 10 feet
10–13	clay with minor gravel; green-brown; rock at 13.5
13–16	clay and gravel; more gravelly at 15 feet
16–20	As above, smoother drilling; alluvial?
20–21.5	SPT 5/15/21; sandy silty gravel, angular black to brown

SPF Water Engineering Soil Boring Log

Project	Indian Creek Spring Improvements
Project No.	330.023
Boring No.	4 — 20 feet east of west fence, 225 feet north of south fence
Date:	8/5/2015
Location:	Indian Creek Spring
Driller:	RP Jones Drilling (Terry, Salvador, Chris)
Logged by:	Terry Scanlan and Cathy Cooper
Method:	Hollow Stem Auger
Weather:	Overcast, 65F; slight drizzle
Remarks:	Depth to water = 9 feet after 30 minutes; bottom of the borehole was visible after drilling (through hollow stem) with water trickling in.

Depth (ft bgs)	Description
0–3	topsoil - gravelly, dry
3–5	damp clayey gravel
5–11	saturated clayey gravel, gray-gren; large rock at 6 feet, smooth 7 to 10 feet
11–13	clayey gravel, dark gray, drills hard, rocky from 12 to 13 fet
13–16	green-brown clayey silty gravelly sand; saturated; drills slow but smooth (2 to 3" per minute); no return at below 16 feet
16–19	drilling slightly faster; not many rocks
19	bedrock at 19 feet, SPT 50 for 1 inch; no return

Attachment B

Geologic Mapping and Description of Map Units

(from Batchelder, J.N., and W.E. Hall, 1978, Preliminary Geologic Map of the Hailey 7 ½-Minute Quadrangle, Idaho, USGS Open File Report 78-546, Plate 1)

DESCRIPTION OF MAP UNITS

Qal	ALLUVIAL DEPOSITS - Includes unconsolidated silt, sand and gravel along rivers and tributary streams, alluvial fans, and talus (Holocene).
Ql	LANDSLIDE DEPOSITS - Unconsolidated landslide deposits (Holocene).
Qt_1	LOW TERRACE DEPOSITS - Includes terraces 10 to 20 feet above recent stream deposits in the Big Wood River Valley and tributary streams (Holocene).
Qt_2	HIGH TERRACE DEPOSITS - Sand and gravel in eroded valley side terraces 30 to 40 feet above recent stream deposits in the Big Wood River Valley (Pleistocene).
Qg_1	GLACIAL OUTWASH - Characterized by abundant float of large rounded white quartzite boulders exotic to the Wood River Valley. Deposits are localized on the east side of the Wood River graben in the vicinity of Ohio Gulch (Pleistocene).
Qg_2	GLACIAL OUTWASH Characterized by abundant float of large rounded white quartzite boulders exotic to the Wood River Valley. Occurs in erosion remnants 200 to 400 feet above present stream drainages (Pleistocene).

CHALLIS VOLCANICS (EOCENE)

Tcrd	RHYODACITE AND DACITE - Gray or pinkish-gray porphyritic thick flows with prominent phenocrysts of plagioclase, biotite, hornblende as much as 6 mm long and some with minor quartz or augite in an aphanitic or glassy groundmass. Includes some undifferentiated crystal tuff and breccia. Tops of flows commonly amygdaloidal and silicified or filled with chalcedony.
Tcrp	RHYODACITE AND DACITE PYROCLASTICS - Agglomerate, crystal tuff, and breccia of rhyodacite and dacite.
Tca	PYROXENE ANDESITE - Dark-gray porphyritic rock with an aphanitic groundmass. Phenocrysts of plagioclase, pyroxene, and amphibole 1- to 2-mm long in a microcrystalline groundmass with a pilotaxitic texture. Locally the andesite is highly altered to celadonite.
Tcap	ANDESITE PYROCLASTICS - Consists of agglomerate, lapilli tuff, fine ash that is commonly silicified, and breccias of andesitic composition.
Tct	TUFF - White or light greenish-gray epiclastic tuff beds and lenses interbedded mostly in pyroxene andesite flows. The beds are poorly consolidated and are susceptible to plastic flow.
$\mathbb{P}w_4$	UNIT 4 (LATE PENNSYLVANIAN) - Light- to medium gray, fine-grained calcareous sandstone, sandy limestone, and micritic limestone that weathers dark brown to grayish-brown. Cross-bedding is present locally. The age is Virgilian (Late Pennsylvanian) on the basis of fusulinid determinations by Douglass (in Hall, Batchelder, and Douglass, 1974). The thickness is 212 m.

Contact--Short dash between units in the Wood River Formation

Fault--Dashed where approximately located; dotted where concealed. U, upthrown; D, downthrown side. Arrows show relative movement

Thrust fault, dashed where approximately located. Sawteeth on upper plate

Overturned thrust fault, sawteeth in direction of dip; bar on side of tectonically higher plate

Anticline

Overturned anticline

Syncline

Overturned syncline

Strike and dip of beds

Strike of vertical beds

Strike and dip of overturned beds

Horizontal beds

Strike and dip of fracture cleavage

Strike of vertical fracture cleavage

Strike and dip of flow banding

Contact metamorphosed rock

Shattered rock

Spring