Evaluation of elevated fecal indicator bacteria at main Barton Springs

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Introduction

E. coli fecal indicator bacteria counts in the waters of main Barton Spring have been elevated above normal concentrations, and have been higher relative to the other two sampling locations in the pool (near the northern steps and at the downstream dam) based on *E. coli* samples collected by the Austin/Travis County Health and Human Services Department (ATCHHSD) (Figure 1, Figure 2). During drought without significant rainfall, *E. coli* bacteria concentrations are expected to be in the range of results currently seen from the northern steps and lower dam sampling locations based on historic data. Bacteria counts at main Barton Spring began to diverge from the other sampling locations in the pool around 06/06/2011. Although this phenomenon has occurred in the past during low flow conditions, the recent high counts are the longest near-consecutive duration ever recorded and the highest non-storm influenced counts in any year other than 2009, a similar low flow year.

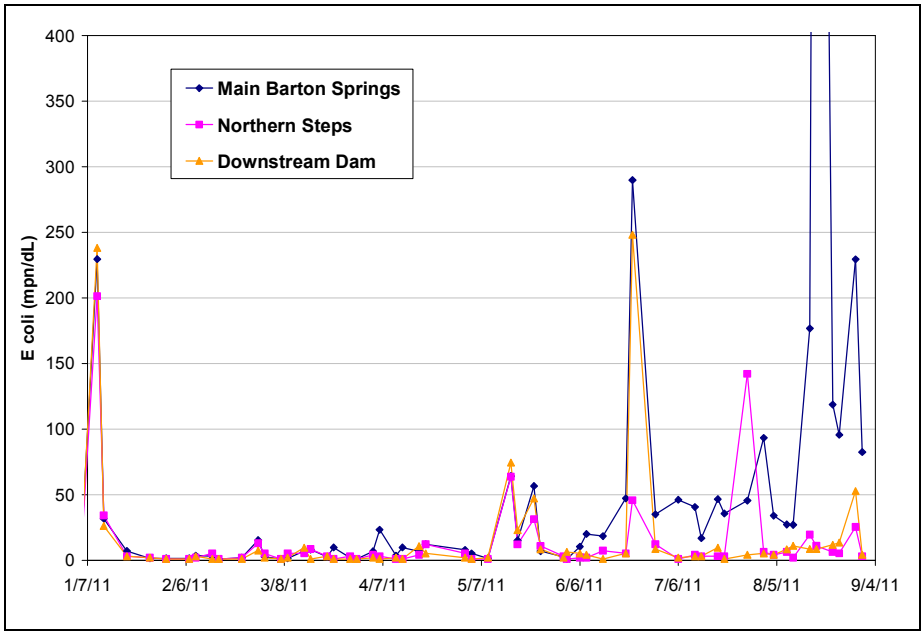

Figure 1. ATCHHSD E. coli counts since January 2011 at Barton Springs Pool.

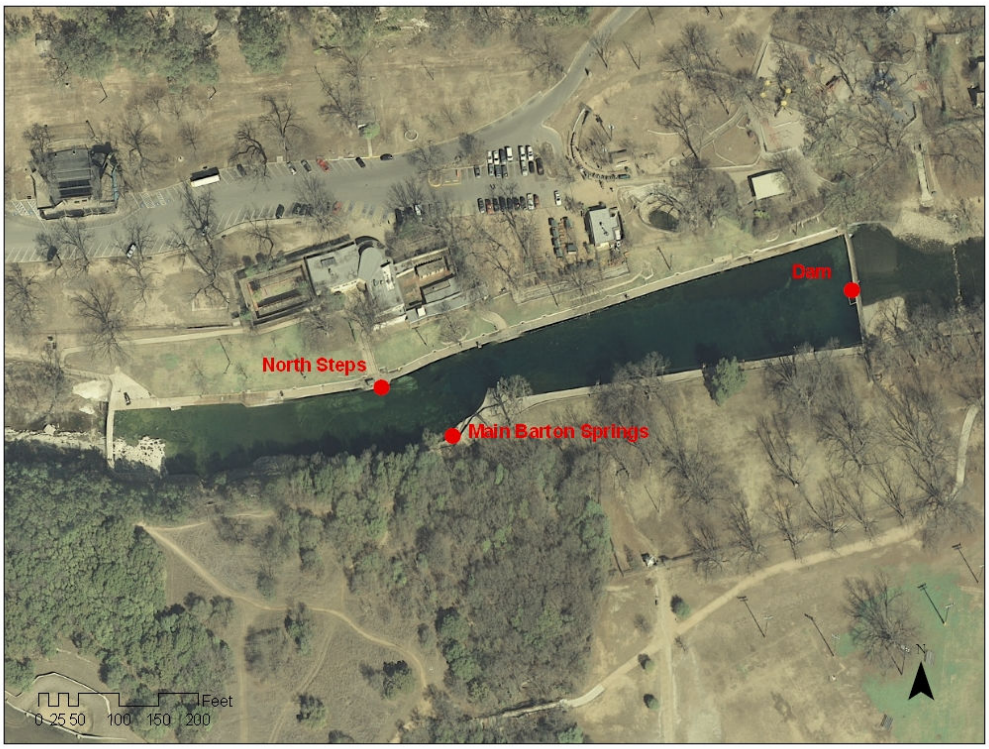

Figure 2. ATCHHSD sampling locations in Barton Springs Pool.

Possible causes of the elevated *E. coli* bacteria counts are wastewater contamination of the aquifer, localized influences from wildlife occupying the area around the fault or interactions with the algae mats near the main spring. Possible commensalistic relationships between coliform bacteria and algae have been previously documented in waters uncontaminated by fecal pollution (McFeters et al 1978. Englebert et al. 2008).

Methods and Results

The Watershed Protection Department (WPD) conducted concurrent sampling with ATCHHSD on three recent sampling events (Table 1). WPD collected at several additional sampling locations, including from inside the fault and underwater inside the cave approximately 15 ft from the waters surface at the bottom of the pool. These locations should be less influenced by surface activities in the immediate pool area and more representative of overall aquifer conditions. On 08/31/2011, WPD also collected a sample from the same location as routine ATCHHSD sample collected at the main springs near the fault but agitated the mats of green filamentous algae near the site prior to sample collection.

Table 1. Recent concurrent WPD and ATCHHSD (Health) *E. coli* samples. Blank cells indicate no sample from that location.

	8/31/2011		8/24/2011		8/15/2011	
E. coli (mpn/dL)	**WPD**	**Health**	**WPD**	**Health**	**WPD**	**Health**
Barton Springs	488.4	82.5	.	95.7	4	176.8
BS-S	6.3	3.1	19.9	5.2	.	19.5
BS-D	2	4.1	11.9	13.4	.	8.6
Barton Springs-cave	4.1	.	10.9	.	.	.
Barton Springs-fault	4.1	.	3.1	.	.	.
agitated algae near fault	727	.	.	.	.	.

The lack of elevated concentrations at all sample locations within the Barton Springs swimming pool do not support the hypothesis of wastewater contamination of the aquifer. If the aquifer was contaminated concentrations at all sample locations would be expected to be elevated given the short hydraulic residence time of the pool. The samples from within the fault and at the cave further suggest that there is no large-scale fecal contamination of groundwater emanating from the aquifer at Barton Springs. More likely than fecal contamination of the aquifer is a localized fecal source contribution from wildlife around the main spring sample location or some interaction between the bacteria and the algae mats clustered around the main spring sample location. A small wildlife source around the main spring sample location would be diluted in the larger pool water volume. During sampling at the main spring location, the only ATCHHSD sample location where large mats of algae are typically observed, bacteria associated with the mats could be disturbed into the water column.

A raccoon was observed in the fault on 08/31/2011 (Figure 2) but not on previous sampling days, and raccoons have been observed at other locations at various times around Barton Springs according to pool lifeguards. Birds have been observed on the algae mats around the fault and their waste may accumulate in the algal mats.


Figure 2. Raccoon observed inside Barton Springs fault on 08/31/2011.

The WPD sample collected on 08/31/2011 after agitation of the floating algae mats near the fault yielded high *E. coli* counts, suggesting some interaction between algae and bacteria could influence samples from this location. Algal mats are not typically observed at the other sample locations within the pool which have not exhibited elevated indicator bacteria counts.

Conclusions

There does not appear to be any recent large-scale wastewater contamination of the aquifer based on fecal indicator bacteria results from the springs and pool. Barton Springs Pool still fully supports contact recreation based on Texas Commission on Environmental Quality contact recreation standards.

Local wildlife seeking shelter in the fault, birds or other animals resting or feeding on the algal mats or some possible interaction between the bacteria and algae mats near the main Barton Springs sampling location may be the source of elevated bacteria counts. WPD suggests that routine water samples be collected from within the fault to avoid any influence of the surface algae mats near the fault exit. Additionally, WPD suggests inspecting the fault prior to sampling for the presence of a raccoon or other animal. Because the raccoon appears to be present intermittently, no action to remove it is necessary now. However, if high counts continue at main Barton Springs while sampling within the fault and a raccoon is consistently observed, some removal or screening of the fault may be necessary but should be done in cooperation with WPD, ATCHHSD animal control and Parks and Recreation Department pool staff.

References

McFeters, G.A., Stuart, S. A., and S.B. Olson. (1978). Growth of heterotrophic bacteria and algal extracellular products in oligotrophic waters. Applied and Environmental Microbiology 35(2): 383-391.

Englebert, E.T., McDermott, G.T., and Kleinheinz, C. (2008). Impact of alga *Cladophora* on the survival of *E. coli*, *Salmonella*, and *Shigella* in laboratory microcosm. Journal of Great Lakes Research. 34:377-382.