City of Austin WATERSHED PROTECTION

USING BARTON CREEK FLOW GAUGES TO EVALUATE POTENTIAL FLOODING OF BARTON SPRINGS POOL

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Barton Springs Pool is at the downstream end of a 120 mi^2 watershed. Rainfall in the watershed can generate runoff in the creek, which can overwhelm the bypass around the pool. Because the bypass has a capacity of about 500 ft^3/s (cfs), large storm events can flood the pool. There are four flow gauges on Barton Creek and all should be used in evaluating flooding potential for the pool. Flow at all four creek gauges can be accessed through the U.S. Geological Survey (USGS) webpage. The following link shows all the stream flow gauges in Texas:
http://waterdata.usgs.gov/tx/nwis/current/?type=flow

The pool will typically flood at creek flows greater than 500 cfs or when the Barton Creek Above Barton Springs Pool USGS gauge height exceeds 8 feet. The creek channel upstream of the pool can recharge a relatively large volume of water into the aquifer, perhaps up to 70-100 cfs. Therefore, it is possible that flows of 500 cfs at the Barton Creek at Lost Creek gauge will decrease downstream as some of the water recharges in the creek bottom and will not flood the pool. However, 1,500 cfs of stream flow moving downstream from Barton Creek at Highway 71 will flood the pool even with aquifer recharge downstream. Depending on where rain falls in the watershed, there can be multiple flow or hydrograph peaks on the gages. For example, heavy regional rain can produce peak flows at each gauge that then moves downstream to create multiple hydrograph peaks at each consecutive downstream gauge.

There are several factors that influence a creek hydrograph. When there is no flow in the creeks over the recharge zone it typically takes around three inches of rain to produce runoff that will cause the creek to flow across the recharge zone. This amount of rain may or may not flood the pool. If the ground is already wet from a previous rain, a downpour of less than 2 inches can produce enough runoff to flood the pool. In this situation, the creeks are often, but not always, already flowing. A flood after a long period of no creek flow can carry a large amount of debris which can pile up on the on the bypass inlet grate and reduce the ability of the grate to pass water. If the bypass grate gets clogged with too much debris, the pool can flood at flows below 500 cfs but the gauge height will still rise to over eight feet. Antecedent conditions and rainfall intensity also influences how quickly the flood pulse moves downstream.

Figure 1 shows the hydrograph stage height of all the Barton Creek gauges from November 2014 to March 2015. Gauge height at the gauge "Barton Creek Above Barton Springs Pool" is typically higher than upstream gauges because the creek channel and floodplain are narrower. Figure 2 shows creek hydrographs from a rain event in November 2014. Each flood pulse can be traced downstream. This figure illustrates how one flood pulse can stop overtopping the upstream pool dam but a flood pulse from further upstream can cause renewed pool flooding. Figure 3 shows creek hydrographs from a relatively simple rain event whose flood pulse can the easily tracked downstream. This event did not flood the pool.

Barton Creek at Highway 71:
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08155200&PARAmeter_cd=00065,00060

This is the most upstream Barton Creek gauge but still has almost 90 mi^2 of drainage area upstream. Heavy rain in the Dripping Springs area can take several hours to reach this gauge and most large rain events generate flood waters from upstream of this gauge as well as downstream. Now that Bee Caves is mostly urbanized there can also be large volumes of local runoff generated from impervious cover that enter the creek through Little Barton Creek, which is upstream of this gauge. Travel time from this gage to Barton Springs is about 7-8 hours but can be as little as 6 hours (Figures 2 and 3).

Barton Creek at Lost Creek:
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08155240&PARAmeter_cd=00065,00060

Because this gauge is the last gauge upstream of the recharge zone, flows at this gauge that appear to flood the pool may not because 70-100 cfs can be lost to recharge in the channel downstream of this gauge. Travel time from this gage to Barton Springs is about 3-4 hours (Figure 2 and 3).

Barton Creek at Loop 360:
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08155300&PARAmeter_cd=00065,00060

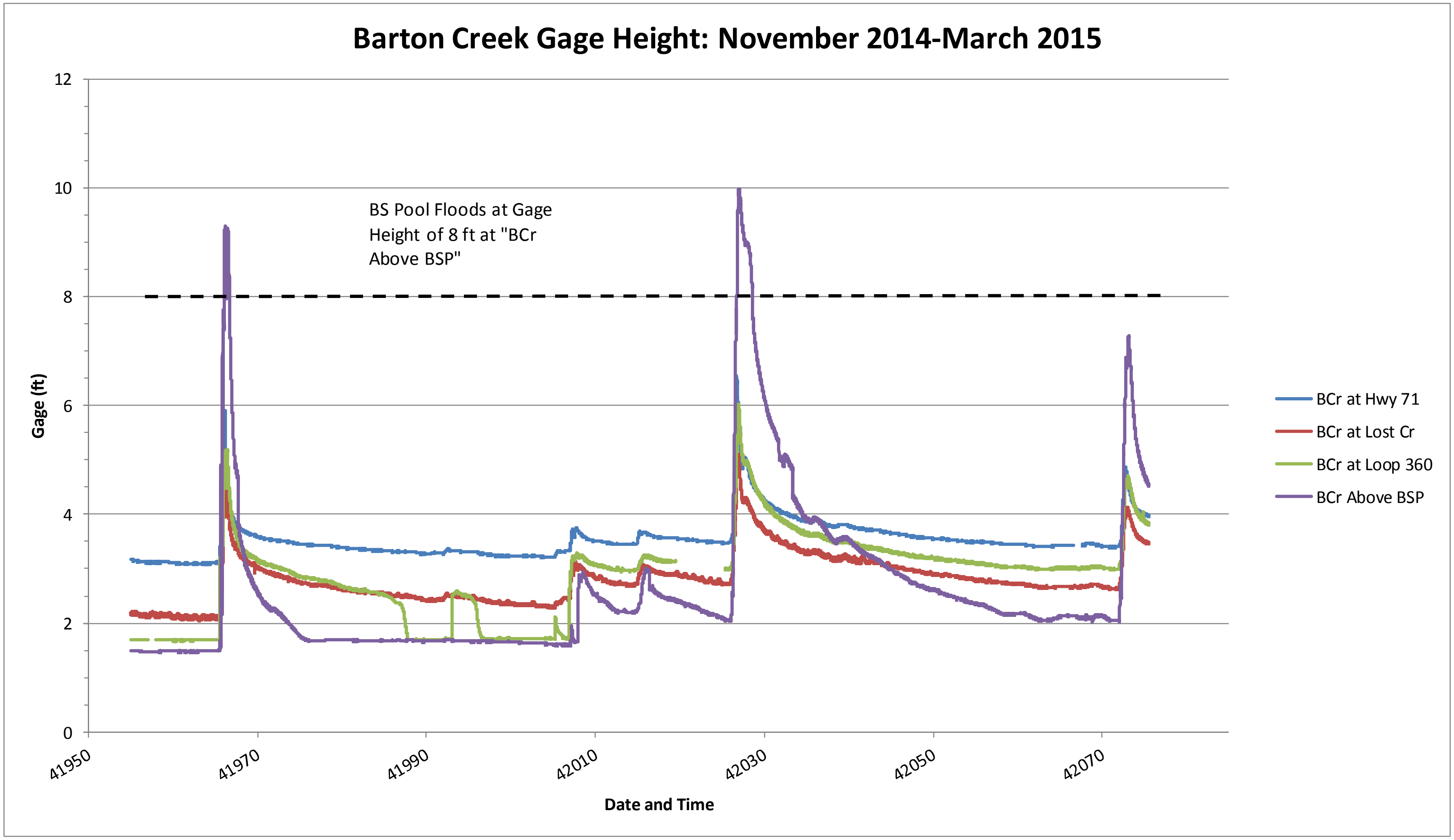
There is a lot of local runoff that reaches this gauge from Barton Creek Mall and the Sunset Valley area (via Gaines Creek). Many pool flood events have been from rainfall in this lower basin area not seen in the two upstream gauges. Floods generated from this area tend to be short-lived but "dirty" containing high suspended sediment loads. Travel time from this gage to Barton Springs is about 1-2 hours (Figures 2 and 3).

Barton Creek Above Barton Springs Pool;
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08155400&PARAmeter_cd=00065,00060

This is the most downstream creek gauge and is located immediately upstream of the upper Barton Springs pool dam. This gauge is very useful to determine if the pool is actually flooding. The pool will flood at a gauge height of about 8 ft or about 500 cfs.

Barton Springs:
http://waterdata.usgs.gov/tx/nwis/uv/?site_no=08155500&PARAmeter_cd=00065,00060

In cases where the gauge just upstream of the pool is around 8 feet, you can determine if water is actually overtopping the dam by accessing the sampling depth parameter on this webpage. This data is from the multi-probe sonde in the cave at the bottom of the pool that the USGS maintains under a contract with the City of Austin. Typically, water depth is 13-14 ft. Apparent depth measured by the sonde will vary slowly and slightly due to changes in atmospheric pressure. If water is overtopping the upstream dam, the water depth will rise quickly. If the downstream dam gates are opened to prepare the pool for flooding, however, pool water levels may start to drop before the upstream dam is overtopped by flood water.



Barton Creek Gage Height: November 2014-March 2015
BS Pool Floods at Gage Height of 8 ft at "BCr Above BSP"
Gage (ft)
Date and Time
0
2
4
6
8
10
12
41950
41970
41990
42010
42030
42050
42070
BCr at Hwy 71
BCr at Lost Cr
BCr at Loop 360
BCr Above BSP

Figure 1.

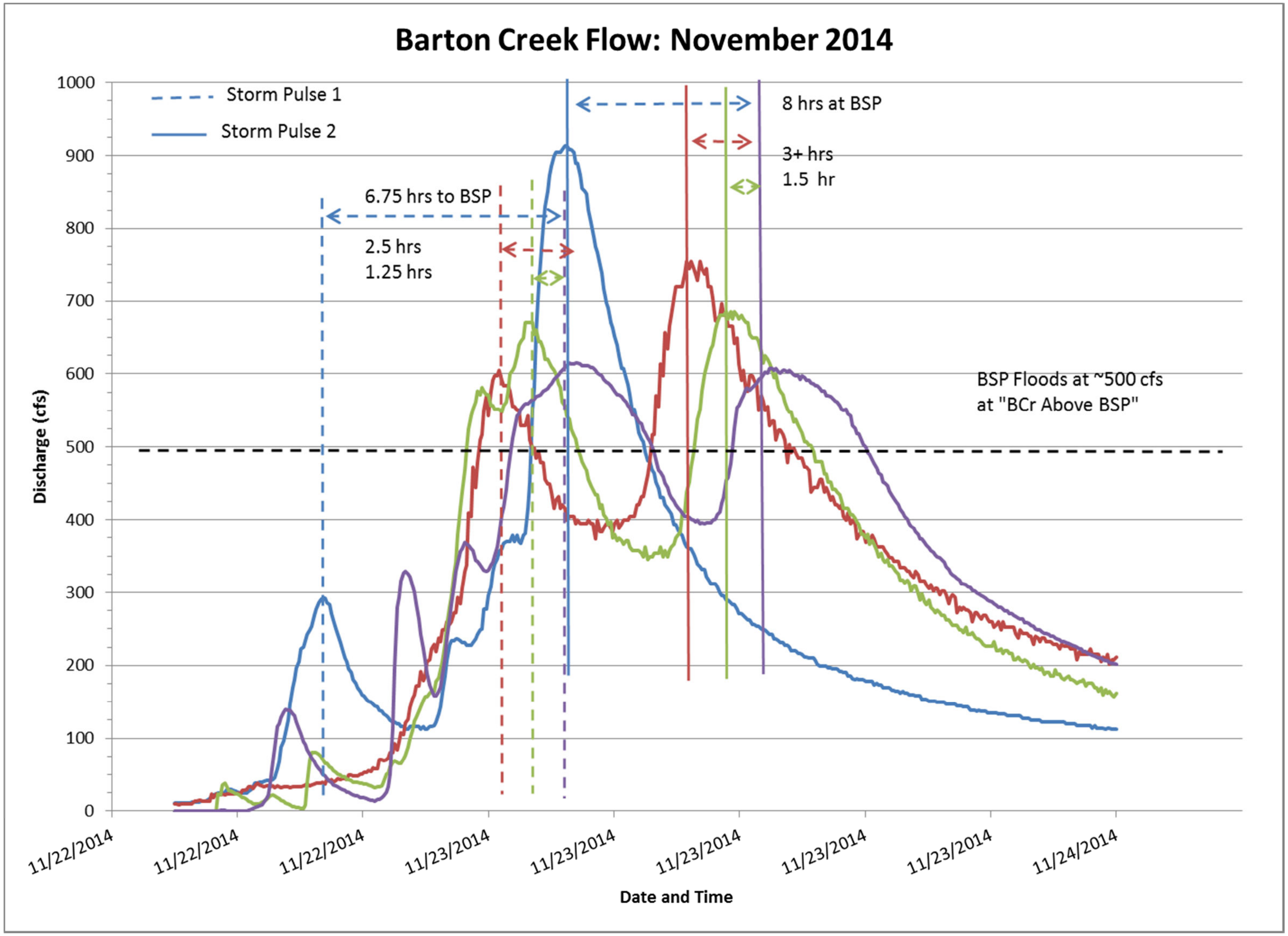
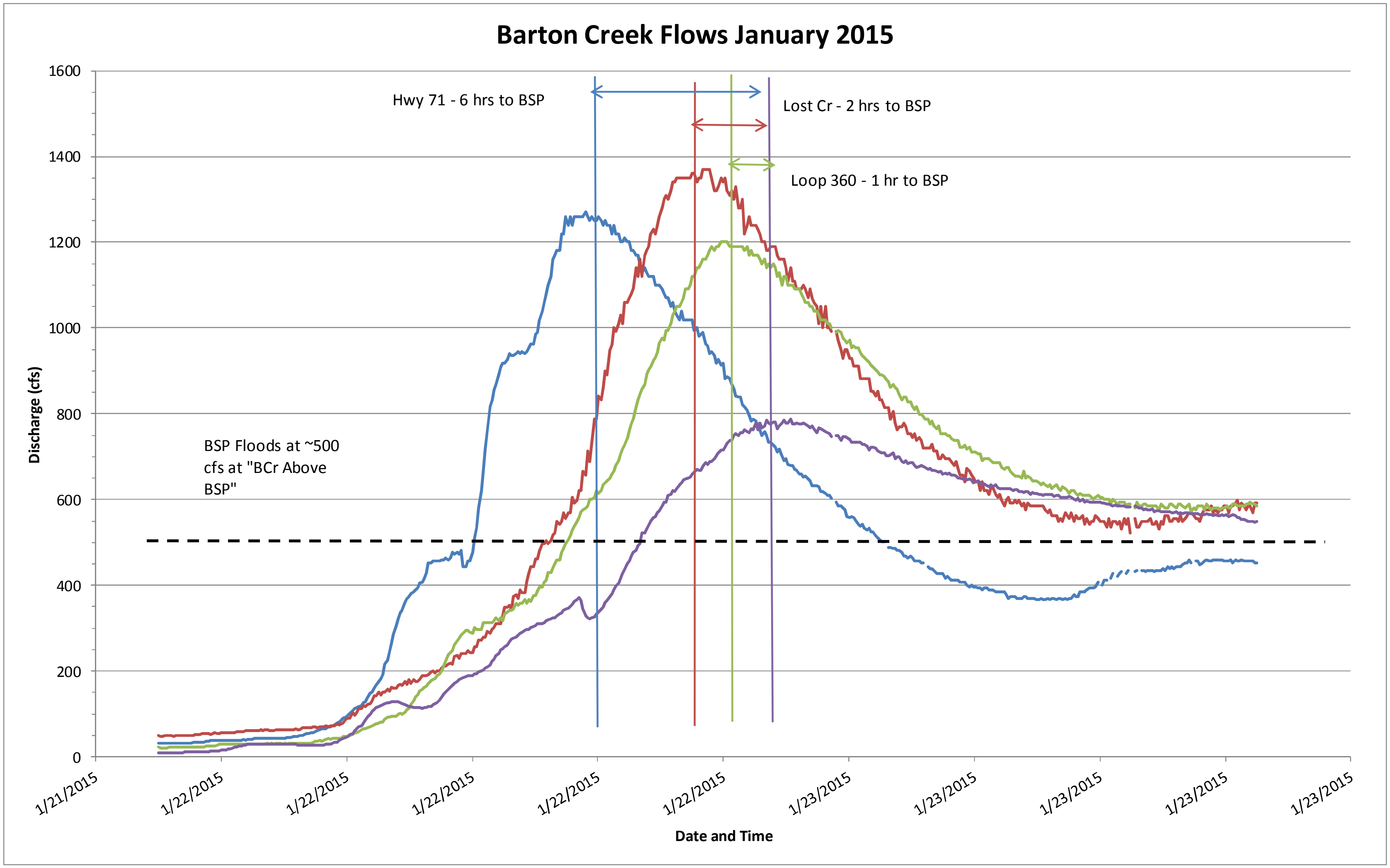

Barton Creek Flow: November 2014
Storm Pulse 1
Storm Pulse 2
6.75 hrs to BSP
2.5 hrs
1.25 hrs
8 hrs at BSP
3+ hrs
1.5 hr
BSP Floods at ~500 cfs
at "BCr Above BSP"
Discharge (cfs)
Date and Time
0
100
200
300
400
500
600
700
800
900
1000
11/22/2014
11/22/2014
11/22/2014
11/23/2014
11/23/2014
11/23/2014
11/23/2014
11/23/2014
11/24/2014

Figure 2.



Barton Creek Flows January 2015
1600
1400
1200
1000
800
600
400
200
0
Discharge (cfs)
Hwy 71 - 6 hrs to BSP
Lost Cr - 2 hrs to BSP
Loop 360 - 1 hr to BSP
BSP Floods at ~500 cfs at "BCr Above BSP"
1/21/2015
1/22/2015
1/22/2015
1/22/2015
1/22/2015
1/22/2015
1/23/2015
1/23/2015
1/23/2015
1/23/2015
1/23/2015
Date and Time

Figure 3.