To: Tim Clear, VT DEC Water Quality TMDL Coordinator

Date: October 21, 2015

Project #: 57201.08

Memorandum

From: Robert Wildey, CPESC

Re: Jay Peak Supplemental Turbidity Monitoring Spring / Summer 2015 Results

VHB has prepared this memorandum to describe supplemental turbidity monitoring conducted during the 2015 monitoring year. The supplemental turbidity monitoring was conducted as required by the Jay Peak Resort 2014 Water Quality Remediation Plan Update ("WQRP"), as revised January 16, 2015.

Methodology

Supplemental turbidity samples were collected during or shortly after 11 rainfall events between June 21, 2015 and September 14, 2015. Turbidity data was collected in conjunction with rainfall events ranging from 0.12 inches to 1.41 inches in the 24 hours preceding the sample event (see Table 1). A total of 157 turbidity measurements were collected at 21 locations. A map of the supplemental turbidity monitoring stations is included on page 1 of the Attachment. Supplemental monitoring station P1-06 corresponds to WQRP monitoring station JB-T9-P1-0.1; station P2-07 corresponds to WQRP monitoring station JB-T9-P2-0.1; station T3-03 corresponds to WQRP monitoring station SMB-T3-0.5. Supplemental monitoring station T9-02 is approximately 200 feet upstream from WQRP monitoring station JB-T9-0.1 on Tributary 9.

Table 1. 2015 Monitoring Event Rainfall Depths

Monitoring Date	Depth (inches)
6/29/2015	1.00
7/1/2015	1.00
7/15/2015	0.46
7/20/2015	0.21
8/4/2015	0.50
8/5/2015	0.50
8/11/2015	1.41
8/13/2015	0.12
8/21/2015	0.54
8/27/2015	0.08
9/14/2015	1.14

Monitoring location P1-02 (Phase 1 Tributary Station 2) was dry on two occasions and could not be sampled on July 15 and August 4, 2015. Monitoring location P2-01 (Phase 2 Tributary Station 1) was dry on one occasion and could not be sampled on August 27, 2015. On July 1, 2015, a partial set of samples was collected which omitted monitoring stations P1-03, P1-04, P1-05, P1-06, P2-04, P2-05, P2-6, T9-02, and T9-03.

Results

Turbidity measurements ranged from a minimum of 0 NTU to a maximum of 352.5 NTU. The median turbidity value of all samples was 3.45 NTU and the mean was 12.43 NTU. A total of 26 samples exceeded the 25 NTU construction action level, all of which were collected following rainfall events of 0.5 inches or greater during the preceding 24 hours. Only 4 of these samples exceeded 100 NTU and none were greater than 352.5 NTU, which

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was reported during the 1.41 inch rain event on August 11, 2015. This result was reported at Station P2-01, which is located on the Queen's Highway ski trail near an iron seep. Station P1-01 is also located in the vicinity of this iron seep and reported a turbidity of 160 NTU during the August 11, 2015 event. Earth disturbance associated with the remediation of this iron seep had taken place prior to the monitoring event and is believed to be responsible for elevated turbidity at these two sites and at subsequent downstream locations during the monitoring event. Monitoring results from subsequent events indicate that this site has been properly stabilized and is not contributing excess sediment to the stream.

Table 2. Monitoring Station Statistics

Station ID	Maximum (NTU)	Minimum (NTU)	Mean (NTU)	Median (NTU)	# of Samples > 25 NTU	# of Samples > 100 NTU
JBT-01	12.5	0.0	3.6	2.0	-	-
JBT-02	12.0	0.0	4.0	2.8	-	-
P1-01	160.0	0.2	24.5	3.9	2	1
P1-02	110.0	0.4	20.0	4.4	2	1
P1-03	14.0	0.6	5.6	3.7	-	-
P1-04	30.0	0.4	6.2	3.0	1	-
P1-05	46.5	0.6	12.2	4.9	2	-
P1-06	37.5	0.1	11.9	8.2	1	-
P2-01	352.5	0.5	40.4	3.2	1	1
P2-02	70.0	0.0	16.4	4.5	2	-
P2-03	72.0	0.0	13.9	5.2	2	-
P2-04	75.0	0.1	15.6	4.5	2	-
P2-05	63.7	0.0	12.8	3.9	2	-
P2-06	48.5	0.0	10.1	4.5	1	-
P2-07	109.2	0.2	24.1	10.3	4	1
T9-01	50.5	0.0	8.8	2.8	1	-
T9-02	45.1	0.0	9.2	2.9	1	-
T9-03	15.0	0.0	4.3	3.3	-	-
T3-01	23.0	0.0	4.5	1.4	-	-
T3-02	15.0	0.0	4.3	1.9	-	-
T3-03	42.0	0.1	10.3	2.2	2	-

Graphs showing the turbidity results for each storm event are included on pages 2 through 4 of the Attachment. Graphs showing the results for each station have been uploaded to the Jay Peak web map, available online at: http://gis.vhb.com/Apps/JayPeakResort_SedimentSourceTracking/

Discussion

During 2014 and 2015 monitoring events, turbidity measurements within the unnamed tributary to Jay Branch (monitoring stations JBT-01 and JBT-02) have never exceeded the 25 NTU construction discharge action level. Based on these results, it would appear that this tributary is not contributing excess sediment to the Jay Branch watershed. The parking lot near the snow making building and chair barn is within the JBT-02 watershed; however, this lot was paved during 2014 and does not appear to be a significant source of sediment. The majority of the watershed consists of ski trails and forested areas, with a relatively small amount of developed area and little evidence of in-stream instability.

The watersheds of both the Phase 1 and Phase 2 tributaries (corresponding to sites P1-01 through P1-06 and P2-01 through P2-07) are relatively developed with residential structures, gravel roads, and ski trails. Turbidity measurements at some stations within these watersheds have been periodically observed to exceed the 25 NTU construction discharge action level, in particular during several storm events with greater than 0.5 inches of rain in the preceding 24 hours. Stormwater treatment practices ("STPs") provide treatment and control for the developed areas of these watersheds and discharge treated stormwater to the sampled reaches of the Phase 1 and Phase 2 tributaries. As part of the Resort's operations and maintenance activities, turbidity measurements were collected from these STPs for many of the same storm events. A review of this turbidity data indicates that the practices appear to be functioning as designed and are not contributing excess turbidity to the stream channels. As has been observed previously, there are some minor areas of bank erosion within the Phase 1 and Phase 2 tributaries that may be contributing sediment to the channels. The Tributary 9 main stem exhibits generally lower turbidity measurements than the contributing Phase 1 and Phase 2, which provides some evidence that settling and filtration is occurring within the stream reach within the golf course and adjacent forested areas.

ATTACHMENT

Jay Peak Resort
Jay, Vermont
Sediment Reduction Assessment
Supplemental Turbidity Monitoring Locations

Last Revised: June 30, 2014

500 250 0 500 1,000 Feet

Legend

- Culvert
- Stream (VHD)
- Stream Center (VHB)
- Stream (Historic VHB)
- Wetlands Delineated (VHB)
- Wetland Restoration/Creation
- Stormwater Treatment Practice
- Existing WQM Stations
- TurbidityStations

Sources:Background image OpenStreetMap (2014); Roads by VTrans (2009), VHD Streams (2008) modified by VHB (2012); VHB Streams and Wetlands, and watersheds by VHB (2009-2012)

VHB Vanasse Hangen Brustlin, Inc.

Site ID	Description
JBT-01	Harmony Lane at Ullr's Dream culvert
JBT-02	West Bowl Road downstream from Tram Haus Bridge
P1-01	Phase 1 trib at Queen's Highway culvert; behind 117-120
P1-02	Phase 1 trib at North Village Road culvert, opposite VSF4
P1-03	Phase 1 trib at Slopeside Road
P1-04	Phase 1 trib between 301-308 and parking garage
P1-05	Phase 1 trib upstream from Treatment System 3
P1-06	Phase 1 trib at Jay Peak Road
P2-01	Phase 2 trib at Queen's highway workroad crossing
P2-02	Phase 2 trib at Raccoon Run, behind 129-132
P2-03	Phase 2 trib at Raccon Run, behind 125-128
P2-04	Phase 2 trib at Raccon Run, behind 153-156
P2-05	Phase 2 trib, behind 351-358
P2-06	Phase 2 trib at Grammy Jay crossing
P2-07	Phase 2 trib at Jay Peak Road
T3-01	Trib 3 at Powerliner Trail bridge
T3-02	Trib 3 at work road to Jet Triple Lift
T3-03	Trib 3 at Rt. 242
T9-01	Trib 9 at GC Hole 9 bridge
T9-02	Trib 9 at GC Hole 3 bridge
T9-03	Downtream from GMS2 basin, upstream from Trib 9 confluence

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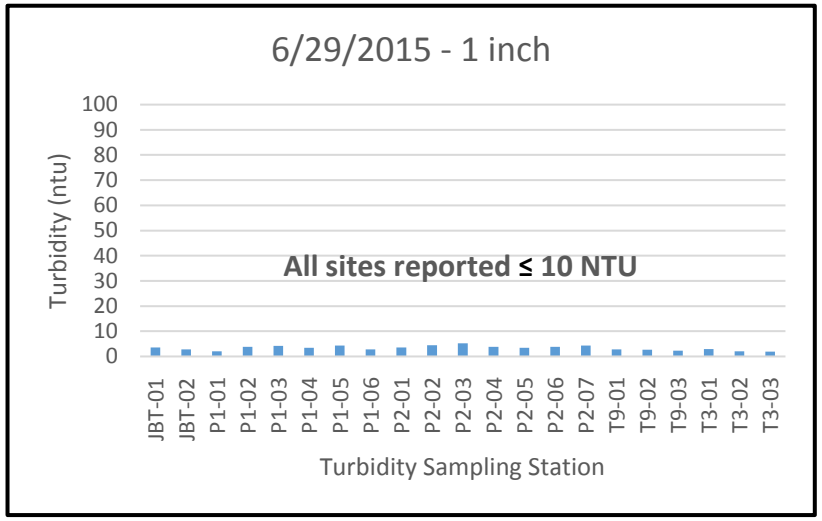
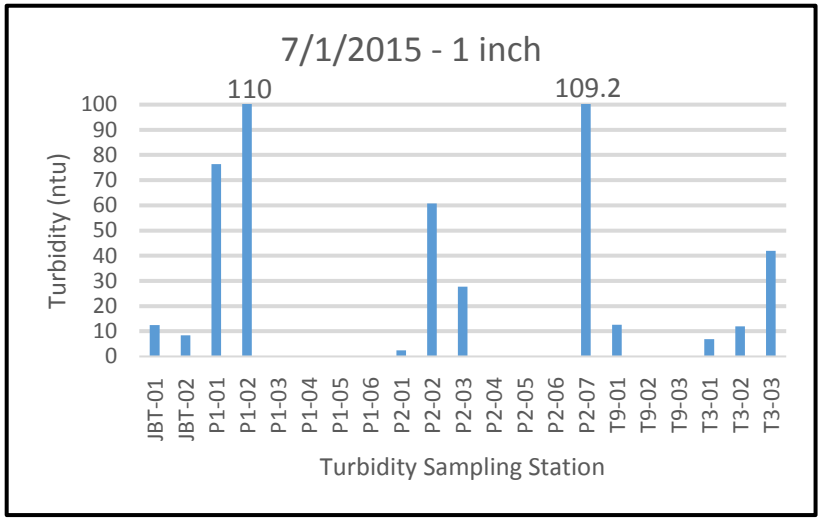
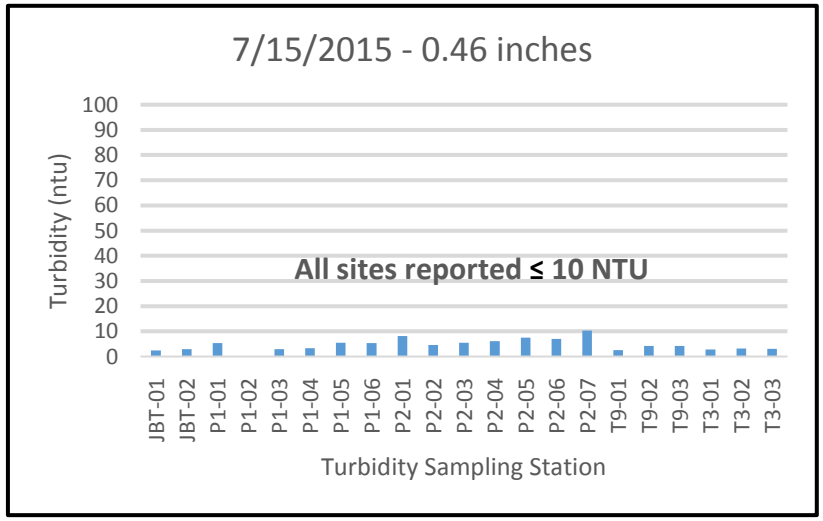
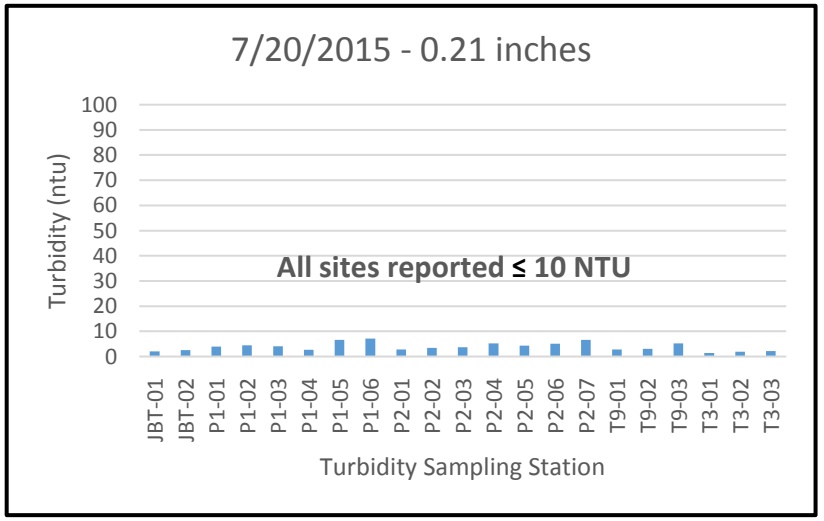
Jay Peak Resort
Supplemental Turbidity Monitoring Results
Spring / Summer 2015 Rainfall Events









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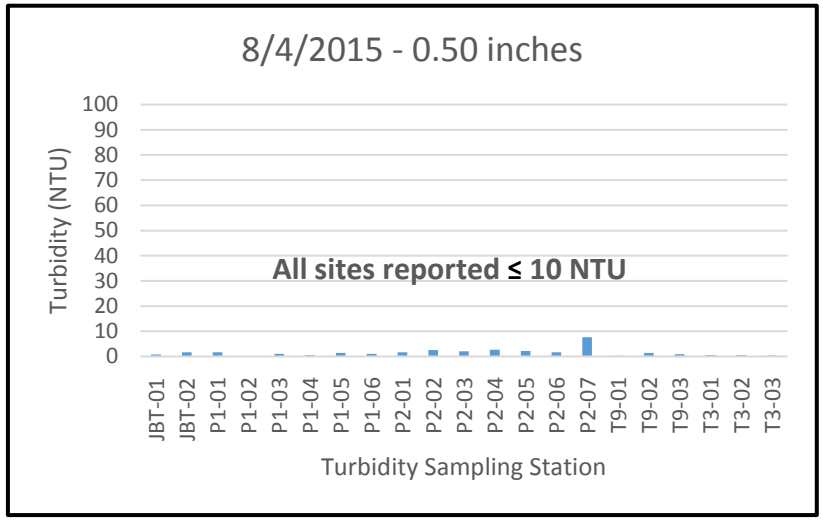

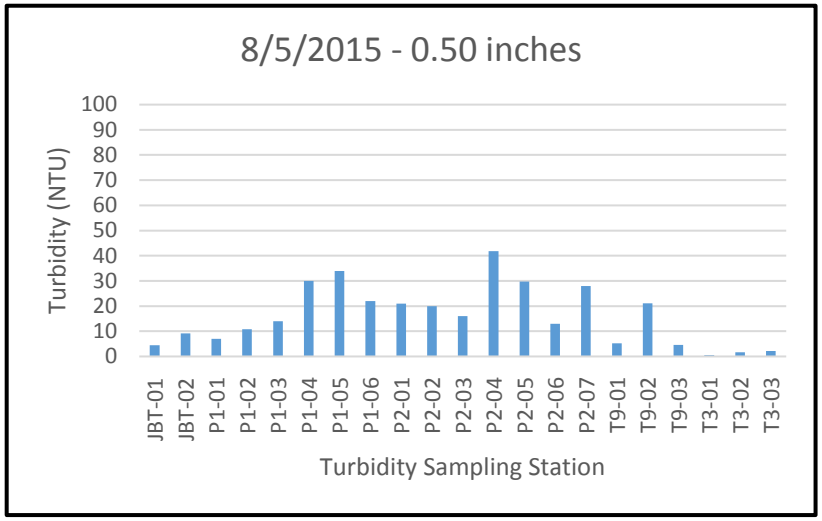

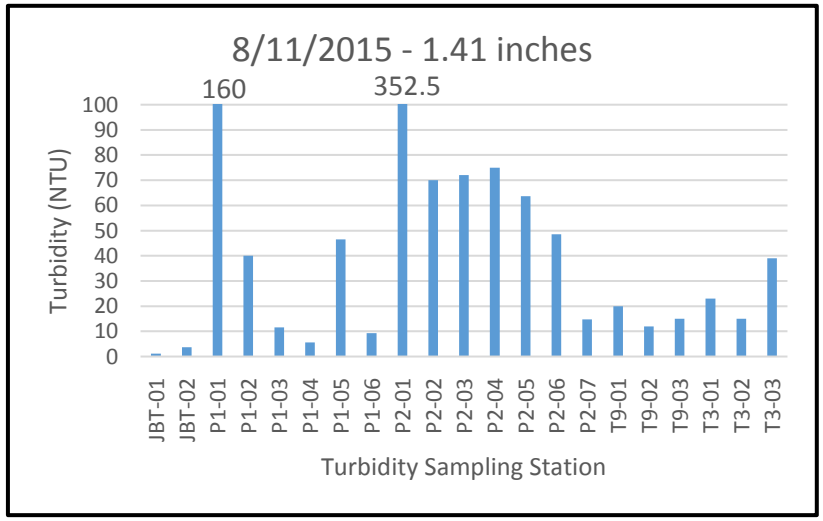

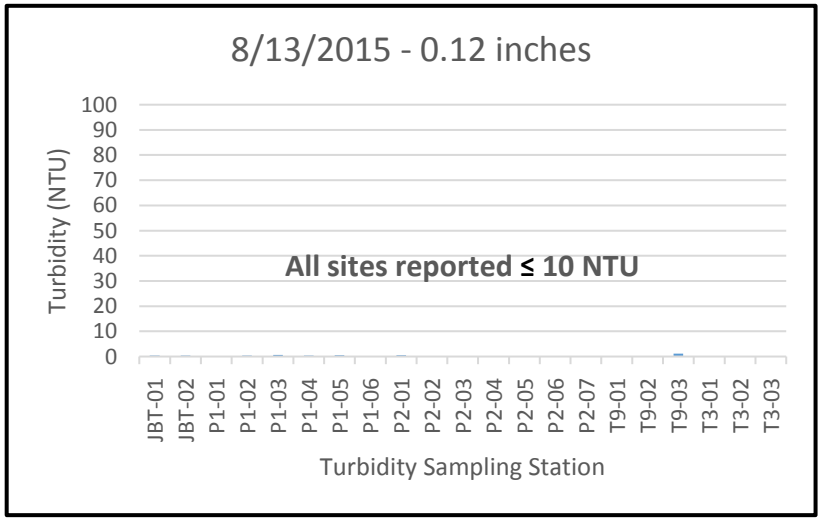

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