

# Seasonal Progress Report #10

## SR431 Treatment Vault Effectiveness Monitoring

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**Agreement Number: P367-18-018**

**Submitted by: Tahoe Resource Conservation District**

**Submitted to: Nevada Department of Transportation**

**Water Year: 2019**

**Period: Spring Season, March 1, 2019 –May 31, 2019**

**Submission Date: July 10, 2019**

Two stormwater cartridge filter vaults, a Contech Media Filtration System (MFS) and a Jellyfish Filter, were installed by the Nevada Department of Transportation (NDOT) on State Highway 431 (SR431) above Incline Village, Nevada in 2013. Monitoring equipment was installed at the inflows and outflows of these two vaults. The Tahoe Resource Conservation District (Tahoe RCD) continued the effectiveness monitoring efforts of the Desert Research Institute (DRI) at the four monitoring stations on May 1, 2015 and will continue to monitor through the spring of water year 2020 (May 31, 2020) and beyond if funding allows. Tahoe RCD follows sampling protocols outlined in the Regional Stormwater Monitoring Program Framework and Implementation Guidance document (RSWMP FIG, Tahoe RCD et al 2015). A new agreement to continue monitoring for water year 2019 (WY19) and part of WY20 and complete the annual monitoring reports for WY18 and WY19 was fully executed in December 2018 for an 18-month term (January 1, 2019 - June 30, 2020). This new agreement is a continuation of agreement number P423-13-019 (November 12, 2013 – June 30, 2018) with a lapse in funding between June 30, 2018 and January 1, 2019. Despite the lapse in funding between these two grants, stormwater monitoring continued uninterrupted using funds from the Regional Stormwater Monitoring Program (RSWMP) Implementers' Monitoring Program (IMP) partnership. Tasks specific to this contract (outside of the scope of the partnership) did not continue. The Tahoe RCD appreciates the opportunity to provide these water quality monitoring services for NDOT and looks forward to continuing the partnership.

**Tasks and subtasks associated with this project and a summary of work completed to date are described below. Table 1 provides a summary of tasks, due dates and percent completion to date for the current agreement. RSWMP ASWMR refers to the RSWMP Annual Stormwater Monitoring Report submitted each year to the Nevada Division of Environmental Protection (NDEP) on March 15th as part of the RSWMP IMP partnership.**

Table 1: Summary of tasks, due dates, and percent completion to date.

Task	Description	Due Date	% Of Work Complete	Date Submitted
1	Project Administration			
1.1	Quarterly Invoices	4/30/19	ongoing	6/19/19
1.2	Seasonal Progress Reports	3/31/19, 6/30/19	ongoing	3/31/19, 7/10/19
2	Stormwater Monitoring			
2.1	Collect continuous flow and turbidity data at four monitoring stations	5/31/2019	ongoing	Available on Acuity
2.2	Collect stormwater runoff samples during eight events per year	5/31/2019	ongoing	NA
2.3	Collect three diurnal non-event snowmelt events if conditions allow	5/31/2019	NA	NA
2.4	Collect flow bypass data in both vaults	5/31/2019	ongoing	10/31/17
2.5	Provide precipitation data to date	5/31/2019	ongoing	3/31/19, 7/10/19
2.6	Provide hydrograph, turbidity, and sample distribution graphs to date	5/31/2019	ongoing	3/31/19, 7/10/19
3	Condition Assessments			
3.1	Estimate Road RAM score prior to eight sampled events	5/31/2019	ongoing	3/31/19, 7/10/19
3.2	Measure depth of sediment in both vaults after sampled events	5/31/2019	ongoing	3/31/19, 7/10/19
4	Final Report			
4.1	Provide raw data	3/15/2020	ongoing	Annual Stormwater Monitoring Report 3/15/19
4.2	Provide treatment effectiveness analysis	3/15/2020	ongoing	Annual Stormwater Monitoring Report 3/15/19
4.3	Correlate Road RAM score to pollutant concentration and load	3/15/2020	ongoing	Annual Stormwater Monitoring Report 3/15/19
4.4	Provide mass loading v. volume calculations for select events	6/30/2016	100%	3/31/16, 6/30/16

## Task 1: Project Administration

### 1. Invoices

Quarterly invoices will be submitted for this project covering the following periods:

- #1: January 1, 2019 - March 31, 2019 (due April 30, 2019)
- #2: April 1, 2019 - June 30, 2019 (due July 31, 2019)
- #3: July 1, 2019 - September 30, 2019 (due October 31, 2019)
- #4: October 1, 2019 - December 31, 2019 (due January 31, 2020)
- #5: January 1, 2020 - March 31, 2020 (due April 30, 2020)
- #6: April 1, 2020 - June 30, 2020 (due July 31, 2020)

### 2. Progress Reports

Progress reports are not concurrent with quarterly invoices. Three seasonal progress reports for WY19 and two for WY20 will be submitted for this project covering the following periods (report number is consistent with prior agreement's reports beginning May 2015):

- #9: Fall/winter: - October 1, 2018 - February 28, 2020 (due March 31, 2019)
- #10: Spring: March 1, 2019 - May 31, 2019 (due June 30, 2019)
- #11: Summer: June 1, 2019 - September 30, 2019 (due October 31, 2019)
- #12: Fall/winter: October 1, 2019 - February 29, 2020 (due March 31, 2020)
- #13: Spring: March 1, 2020 - May 31, 2020 (due June 30, 2020)

Please accept this report as seasonal progress report #10

## Task 2: Stormwater Monitoring

### 1. Maintain four stormwater monitoring stations to collect continuous flow and turbidity data.

The spring season of WY19 began on March 1, 2019 and ended May 31, 2019. Continuous flow was successfully monitored for the spring season. However, turbidimeters were buried in accumulated sediment beginning early February, so continuous turbidity data is not reliable for the months of February, March, April and May. The road surface of SR431 was very dirty throughout the season, and there was a substantial amount of sediment in the splitter vault (Figure 1 - 2). The road shoulders were covered in a snow berm until mid-April, making access to monitoring equipment difficult (Figure 3-4).



Figure 1: May 17, 2019 sediment in splitter vault up to the input pipe.



Figure 2: May 6, 2019 sediment on road.



Figure 3: April 18, 2019 berm on pullout and road. Access doors are under berm.



Figure 4: March 22, 2019 berm on pullout and road. Loader is removing snow to clear access doors under berm.

## **2. Collect stormwater runoff samples at four monitoring sites during eight runoff events per year.**

During the spring of water year 2019 two events were successfully sampled at all sites (two thunderstorm events on May 21, 2019 and May 25, 2019), and one rain event on May 15, 2019 was successfully sampled for CI, CO, and JO. Only one sample was successful at JI during this event due to a "fatal error" with the sampler, so CI data was substituted to calculate seasonal loads and BMP efficiency. The JI sampler head has been replaced and sent back to the manufacturer for repair. These events bring the water year total to seven events. Although the early spring of 2019 produced substantial amounts of precipitation, many storm events fell as snow and produced little to no runoff.

## **3. If conditions allow for non-event snowmelt sampling, analyze a rising and a falling limb composite during three diurnals (counts as one of the eight events).**

The spring snowmelt did not produce large enough flows for sampling this season.

## **4. Install a pressure transducer in each treatment vault to identify when there is bypass flow.**

New pressure transducers were installed in June 2016 and linked to the remote access data management system currently used at the SR431 monitoring site. Low flows tend to fill up the Contech MFS vault and keep it full. With low-flow snowmelt in the spring, it was in bypass for the majority of the season. Data indicate that during the spring of WY19 the Contech MFS cartridge filters were bypassed 5 times: March 1-5, 2019; March 10-11, 2019; March 15-17, 2019; May 1-24, 2019; and May 26-31, 2019 (Figure 5). During the spring of WY19 the Jellyfish filters bypassed 7 times: March 31-April 1, 2019; April 7-8, 2019; May 15-16, 2019; May 21, 2019; May 23, 2019; May 26-27, 2019; and May 29-30, 2019 (Figure 6).

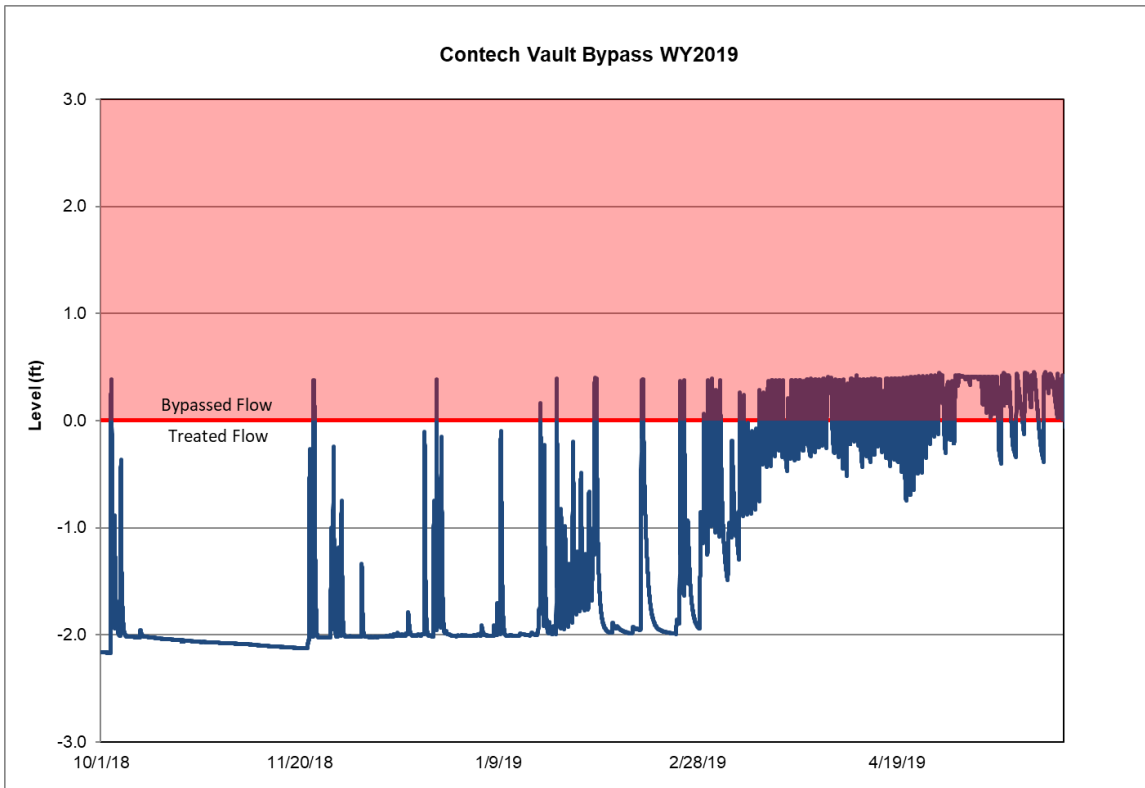


Figure 5: Bypassed flow in Contech MFS vault WY19 to date.

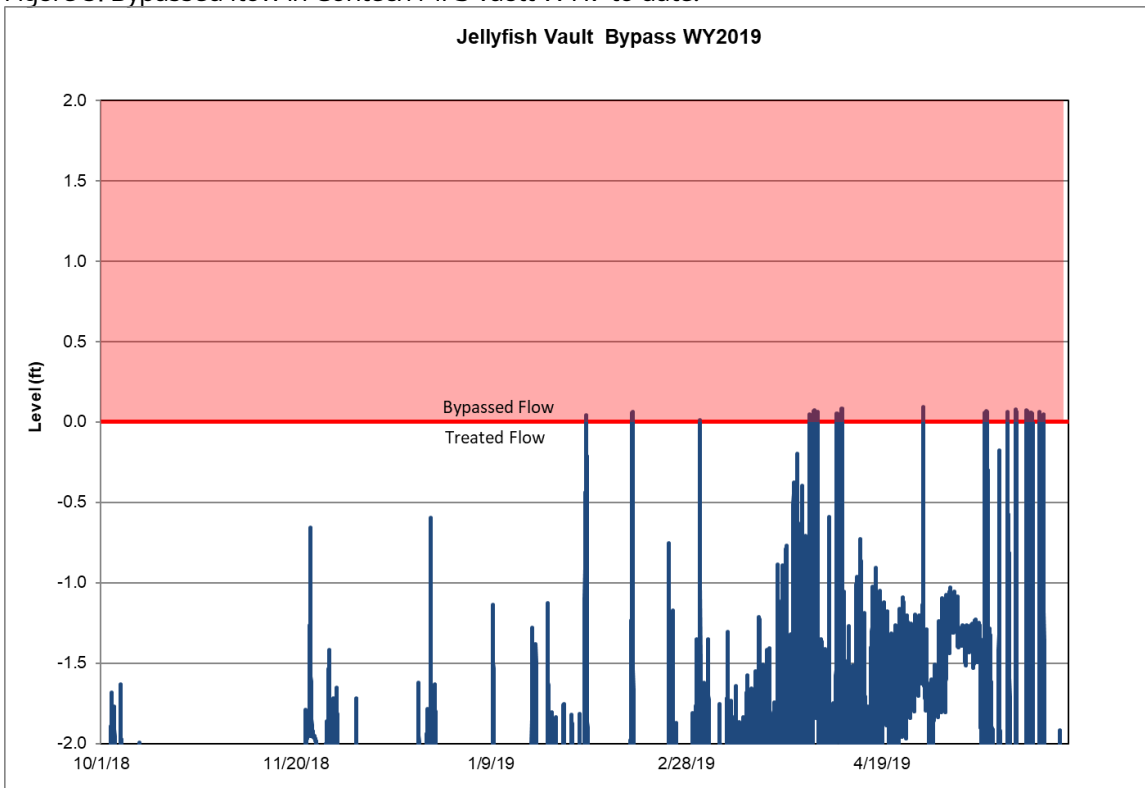


Figure 6: Bypassed flow in Jellyfish vault WY19 to date.

**5. Provide precipitation data to date.**

Table 2 provides summary data for all 41 fall/winter precipitation events recorded at the NDOT and TERC2 meteorological stations including event start and end dates, total precipitation, peak precipitation, minimum and maximum temperature, and precipitation type. Events highlighted in pink were sampled for water quality.

Because of its high elevation, precipitation often falls in the form of snow during fall/winter and spring and thus does not always generate sufficient runoff for sampling. The NDOT tipping bucket became non-functional on January 20, 2019 due to damage from snow blowers. Between February 25, 2019 and March 14, 2019 all other sensors became buried due to excessive snow accumulation. The NDOT tipping bucket was replaced on April 19, 2019. Meteorological data from the TERC2 weather station located on the roof of the Sierra Nevada College Tahoe Center for Environmental Science building in Incline Village was substituted for this period.

Table 2: Summary of fall/winter and spring precipitation events at SR431 for WY19. Highlighted rows indicate events that were sampled.

Station ID	Precip Event (#)	Precipitation event start (PST)	Event end (PST)	Event duration (days)	Interevent duration (days)	Event precipitation (inches)	Event peak precipitation (inch/5min)	Event minimum temp (°C)	Event maximum temp (°C)	Type of Precipitation
NDOT	--	--	7/31/2018 7:40	--	--	--	--	--	--	--
NDOT	NDOT-17-01	10/3/2018 9:05	10/4/2018 12:35	1.1	64.1	0.41	0.023	4	10	Rain
NDOT	NDOT-17-02	10/5/2018 20:55	10/6/2018 18:55	0.9	1.3	0.1000	0.008	1	9.47	Rain
NDOT	NDOT-17-03	10/10/2018 20:40	10/11/2018 6:10	0.4	4.1	0.028	0.012	1	3.628	Rain
NDOT	NDOT-17-04	11/21/2018 19:30	11/23/2018 23:20	2.2	41.6	1.3840	0.016	-3	2	Rain
NDOT	NDOT-17-05	11/27/2018 13:15	12/2/2018 4:15	4.6	3.6	1.5080	0.016	-9	3	Rain on Snow
NDOT	NDOT-17-06	12/5/2018 0:25	12/5/2018 10:05	0.4	2.8	0.068	0.008	-5	-0.81	Snow
NDOT	NDOT-17-07	12/10/2018 15:40	12/10/2018 15:40	0.0	5.2	0.004	0.004	0	-0.098	Snow
NDOT	NDOT-17-08	12/17/2018 1:15	12/17/2018 7:10	0.2	6.4	0.056	0.004	-2	-0.284	Snow
NDOT	NDOT-17-09	12/21/2018 0:25	12/21/2018 10:10	0.4	3.7	0.1120	0.008	-1	1	Rain on Snow
NDOT	NDOT-17-10	12/23/2018 12:35	12/26/2018 11:15	2.9	2.1	1.1400	0.016	-9	2	Rain, Snow
NDOT	NDOT-17-11	12/27/2018 21:35	12/27/2018 21:35	0.0	1.4	0.0040	0.004	-9	-9	Other
NDOT	NDOT-17-12	1/5/2019 16:10	1/7/2019 18:05	2.1	8.8	1.1120	0.016	-7	-1	Snow, Rain
NDOT	NDOT-17-13	1/9/2019 3:00	1/9/2019 16:15	0.6	1.4	0.1640	0.016	-1	1	Rain on Snow
NDOT	NDOT-17-14	1/14/2019 21:45	1/18/2019 6:20	3.4	5.2	2.5720	0.133	0	0	Snow, Rain, Snow, Rain
TERC2	NDOT-17-15	1/20/2019 8:45	1/21/2019 11:55	1.1	2.1	0.7920	0.016	0	0	Rain, Snow
TERC2	NDOT-17-16	2/2/2019 0:25	2/5/2019 16:55	3.7	11.5	2.3760	0.024	0	0	Rain, Snow
TERC2	NDOT-17-17	2/9/2019 4:25	2/10/2019 13:40	1.4	3.5	0.7320	0.012	0	0	Rain, Snow
TERC2	NDOT-17-18	2/13/2019 0:00	2/17/2019 15:55	4.7	2.4	4.4280	0.032	-9	2	Rain, Snow
TERC2	NDOT-17-19	2/20/2019 14:30	2/20/2019 14:30	0.0	2.9	0.0040	0.004	-7	-7	Snow
TERC2	NDOT-17-20	2/25/2019 14:50	2/28/2019 9:05	2.8	5.0	1.4880	0.012	-4	6	Rain/Snow
TERC2	NDOT-17-21	3/2/2019 4:50	3/3/2019 18:20	1.6	1.8	0.5160	0.012	-18	6	Rain/Snow
TERC2	NDOT-17-22	3/5/2019 13:10	3/6/2019 21:25	1.3	1.8	1.1400	0.028	0	4	Rain/Snow
TERC2	NDOT-17-23	3/10/2019 3:05	3/10/2019 18:50	0.7	3.2	0.1760	0.008	-5	3	Snow
TERC2	NDOT-17-24	3/12/2019 14:50	3/12/2019 19:00	0.2	1.8	0.0200	0.008	-3	3	Snow
TERC2	NDOT-17-25	3/20/2019 2:15	3/21/2019 7:00	1.2	7.3	0.2600	0.024	-4	4	Rain/Snow
TERC2	NDOT-17-26	3/23/2019 0:05	3/23/2019 9:20	0.4	1.7	0.3360	0.008	-2	-1	Snow
TERC2	NDOT-17-27	3/27/2019 5:55	3/28/2019 12:25	1.3	3.9	0.5440	0.024	-9	2	Rain/Snow
TERC2	NDOT-17-28	4/1/2019 16:00	4/2/2019 13:45	0.9	4.1	0.7280	0.024	-1	3	Rain/Snow
TERC2	NDOT-17-29	4/5/2019 13:35	4/5/2019 14:25	0.0	3.0	0.0160	0.004	-1	-1	Rain/Snow
TERC2	NDOT-17-30	4/8/2019 20:20	4/8/2019 23:30	0.1	3.2	0.1120	0.012	2	3	Rain/Snow
TERC2	NDOT-17-31	4/16/2019 6:25	4/16/2019 9:00	0.1	7.3	0.0080	0.004	-3	0	Rain/Snow
TERC2	NDOT-17-32	4/20/2019 12:20	4/20/2019 12:20	0.0	4.1	0.0040	0.004	4	4	Rain
TERC2	NDOT-17-33	4/29/2019 17:45	4/30/2019 11:45	0.8	9.2	0.0440	0.008	0	7	Rain/Snow
TERC2	NDOT-17-34	5/15/2019 8:15	5/17/2019 4:50	1.9	14.9	0.2800	0.012	-3	6	Rain, Snow
TERC2	NDOT-17-35	5/19/2019 0:45	5/19/2019 6:15	0.2	1.8	0.0760	0.008	-2	-1	Rain, Snow
TERC2	NDOT-17-36	5/21/2019 1:35	5/23/2019 17:45	2.7	1.8	0.4780	0.023	-4	8	Snow, Rain
TERC2	NDOT-17-37	5/24/2019 19:20	5/24/2019 19:55	0.0	1.1	0.0080	0.004	4	4	Rain
TERC2	NDOT-17-38	5/26/2019 1:35	5/28/2019 4:45	2.1	1.2	0.9460	0.031	-2	9	Snow, Rain
TERC2	NDOT-17-39	5/29/2019 11:55	5/29/2019 12:20	0.0	1.3	0.0860	0.039	6	10	Thunderstorm
TERC2	NDOT-17-40	5/30/2019 15:00	5/30/2019 17:25	0.1	1.1	0.1120	0.016	5	6	Thunderstorm
TERC2	NDOT-17-41	6/3/2019 17:30	6/3/2019 17:50	0.0	4.0	0.0240	0.008	11	13	Thunderstorm

## 6. Provide hydrograph, continuous turbidity, and sample distribution graphs for each sampled event.

See Figures 8-19 at the end of this report for hydrographs, continuous turbidity, and sample distributions for the events sampled in the spring season.

### Task 3: Condition Assessments

#### 1. Estimate Road RAM score prior to monitored runoff events.

This task was initiated in November 2015 following a meeting between Tahoe RCD and NDOT where it was decided that determining a Road RAM score prior to runoff events was valuable. This procedure is expected to help establish a site-specific relationship between road condition and inflow FSP concentration in runoff. However, Figure 7 indicates that no significant relationship can be established with the data collected to date.

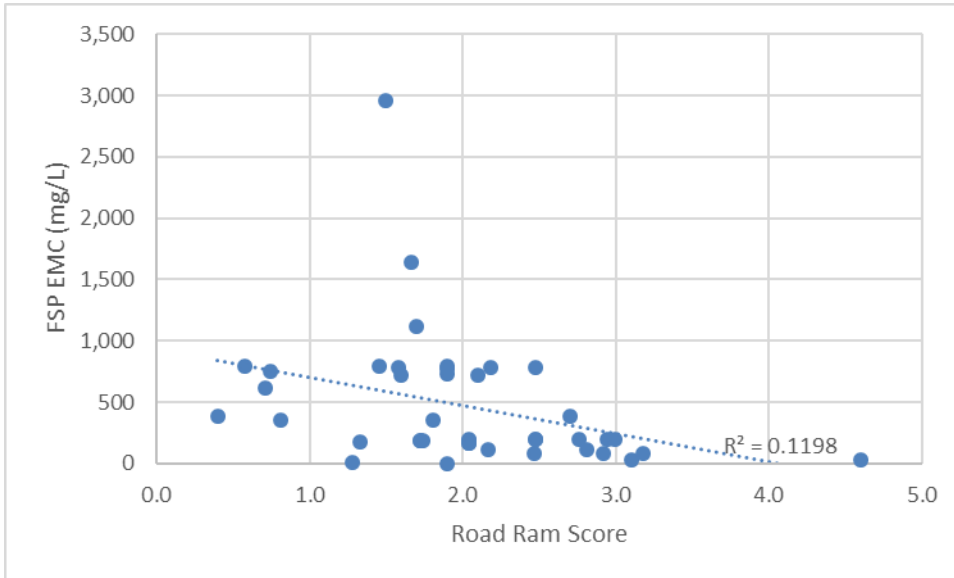


Figure 7: Relationship between Road Ram Score and inflow FSP EMC; very low R2 indicates no significant relationship.

Since November 2015, 41 Road RAM scores have been determined. Road RAM scores assess road condition and are expressed on a scale from 0 to 5. A score of 0 indicates road conditions that present a high risk to downslope water quality, while a score of 5 indicates road conditions with minimal risk to downslope water quality (2NDNATURE et al 2015). Road RAM was conducted September 2018 through November 2018, but not December 2018 through March 2019 because the road surface was consistently too wet (Road RAM is not possible on wet roads). Road RAM measurements resumed in April 2019. Road RAM scores correspond to an estimated FSP concentration range that can be expected in runoff events as outlined in the Road RAM Technical Document (2NDNATURE et al 2015). Efforts are made to take Road RAM scores close to the beginning of sampled runoff events, but this cannot always occur. Observed Road RAM scores thus far cover nearly the full range of possible measurements (0.4 to 4.6); however, the majority of scores indicate that the roads were relatively dirty prior to most runoff events (Table 3 - sorted from dirtiest to cleanest Road RAM scores.) Table 3 summarizes the Road RAM scores, days between RAM determination and runoff event, the expected FSP concentrations associated with that score, actual inflow FSP concentrations (an average of the event mean concentrations (EMCs) measured at the Contech MFS inflow and the Jellyfish inflow), and the percent difference between the expected FSP based on RAM score and the measured FSP concentration. The worst scores tend to occur in the spring (March - May), and the best scores tend to occur in the fall (October - November).

Table 3: Summary of Road RAM scores and FSP concentrations WY16, WY17, WY18, and WY19 to date.

Road RAM date	Runoff event date	Days between RAM and runoff event	Road RAM Score	Expected FSP concentration* (mg/L)	Average JI&CI inflow FSP EMC (mg/L)	FSP Percent Difference (%)
4/8/16	5/5/16	27	0.4	1133	387	-98%
5/6/19	5/15/19	9	0.6	977	791	-21%
4/11/17	4/16/17	6	0.7	872	612	-35%
3/15/17	4/6/17	23	0.7	847	746	-13%
5/1/17	5/6/17	6	0.8	802	352	-78%
5/12/17	5/19/17	7	1.3	537	13	-191%
4/20/18	5/16/18	26	1.3	516	177	-98%
4/18/19	5/15/19	27	1.5	463	791	52%
2/24/16	3/4/16	8	1.5	445	2,955	148%
12/27/17	3/20/18	83	1.6	415	783	62%
12/2/15	12/10/15	8	1.6	409	722	55%
3/29/18	4/6/18	8	1.7	388	1,639	123%
1/28/15	1/29/16	1	1.7	375	1,118	99%
7/5/17	8/19/17	46	1.7	367	186	-65%
7/20/17	8/19/17	31	1.7	367	186	-65%
6/5/17	8/19/17	76	1.7	363	186	-64%
5/5/17	5/6/17	2	1.8	343	352	3%
12/7/16	12/8/16	1	1.9	317	774	84%
5/13/19	5/15/19	2	1.9	316	791	86%
5/13/19	5/21/19	8	1.9	316	726	79%
5/13/19	5/26/19	13	1.9	316	na	na
8/7/17	8/19/17	13	2.0	281	186	-41%
8/25/17	9/21/17	27	2.0	281	167	-51%
8/25/17	9/21/17	27	2.0	281	167	-51%
10/5/17	11/16/17	42	2.0	281	201	-33%
12/8/15	12/10/15	2	2.1	267	722	92%
5/30/18	7/22/18	53	2.2	252	114	-75%
1/13/18	3/20/18	66	2.2	248	783	104%
9/18/18	10/3/18	15	2.5	195	82	-81%
10/19/17	11/16/17	28	2.5	195	201	3%
11/1/17	11/16/17	15	2.5	195	201	3%
12/14/17	3/20/18	96	2.5	195	783	120%
5/4/16	5/5/16	1	2.7	160	387	83%
11/16/18	11/23/18	7	2.8	152	192	23%
6/20/18	7/22/18	32	2.8	147	114	-25%
7/26/18	10/3/18	69	2.9	134	82	-48%
11/11/17	11/16/17	5	2.9	130	201	43%
10/12/18	11/23/18	42	3.0	124	192	43%
10/12/16	10/27/16	15	3.1	114	34	-109%
8/16/18	10/3/18	48	3.2	107	82	-26%
10/11/16	10/27/16	16	4.6	32	34	6%

\*FSP concentrations expected with particular RAM score (from PLRM Road Methodology nhc et al. 2009)



According to the Road RAM Technical Document scores between 0 and 1.0 are considered "poor" and expected FSP concentrations in runoff from roads in this category range from 680-1,592 mg/L. Actual average inflow FSP EMCs were less than expected FSP concentrations in all cases for poor scores. Poor scores constitute 12% of scores determined to date and all occurred in the spring.

Road RAM scores greater than 1.0 and less than or equal to 2.0 fall into the "degraded" category. The range of FSP concentrations that can be expected in runoff from roads in this condition is 291-679 mg/L. However, the actual average inflow FSP EMCs from runoff events within this score range tended to be higher than the expected FSP concentrations for Road RAM estimations made in the fall/winter and spring seasons and lower for estimations made in the summer season for this category of scores. This may indicate a seasonal influence on the dependability of Road RAM to predict actual concentrations. Degraded scores constitute 49% of scores determined to date.

Road RAM scores greater than 2.0 and less than or equal to 3.0 fall into the "fair" category where the range of expected FSP concentrations in runoff is 124-290 mg/L. The actual average inflow FSP EMCs from runoff events within this score range tended to fall within that range in the fall, above that range in the winter, and within or below that range in the summer. Fair scores constitute 32% of scores determined to date.

Road RAM scores greater than 3.0 and less than or equal to 4.0 are considered "acceptable" and expected FSP concentrations range from 53-123 mg/L. To date, three measurements had a score between 3.0 and 4.0; for these measurements one of actual average inflow FSP EMCs from runoff events within the estimated FSP concentration range, one was less than 53mg/L, and one was greater than 123mg/L. Acceptable scores constitute 5% of scores determined to date and occurred between August and October.

Road RAM scores greater than 4.0 are considered "desired" and expected FSP concentrations range from 23-53mg/L. Only one measurement was greater than 4.0, and the actual average inflow FSP EMC fell within the estimated FSP concentration range. Desired scores constitute 2% of scores determined to date and occurred in October.

## **2. Measure depth of sediment in vaults after eight monitored runoff events.**

This task was initiated November 2015 following the meeting between Tahoe RCD and NDOT mentioned above where it was determined that post event sediment depth was valuable information. The depths shown in Table 4 represent the average depth in each vault in feet. All clean-outs restored sediment depth in the respective vaults to near zero. Summer and fall of WY18 was dry and minimal sediment accumulation occurred by January of 2019 (~0.1 feet for both the Contech MFS and the Jellyfish). No sediment accumulation measurements were conducted during the lapse of funding that occurred July 2018-December 2018. February 2019 was the snowiest month on record for many areas in the Tahoe basin, and therefore it was not possible to conduct sediment accumulation until May due to lack of access to the vaults. By May substantial sediment had entered the system and a cleanout was scheduled.

Table 4: Average depth of sediment in vaults.

Date Time	Contech MFS (ft)	Jellyfish (ft)
12/30/2015	0.33	0.92
3/16/2016	0.58	1.14
4/15/2016	0.61	na
4/22/2016	0.56	na
6/3/2016	0.75	2.17
8/3/2016	1.10	2.05
10/20/2016	na	1.92
12/30/2016	0.10	0.05
4/3/2016	1.00	2.30
4/20/2017	1.90	2.85
5/1/2017	0.10	0.43
5/18/2017	0.08	0.37
5/22/2017	0.10	0.46
6/19/2017	0.12	0.38
8/19/2017	0.00	0.00
9/21/2017	0.01	0.10
10/5/2017	0.03	0.15
10/24/2017	0.00	0.04
11/14/2017	0.10	1.19
11/17/2017	0.00	0.10
2/2/2018	0.17	0.30
4/7/2018	0.00	0.05
5/17/2018	0.08	0.36
1/2/2019	0.10	0.09
5/8/2019	0.25	0.38

## Task 4: Final Report

### 1. Provide raw data.

Final reporting for each water year is provided as part of the Annual Stormwater Monitoring Report (due March 15th of each year), but raw data can be viewed at any time on Acuity.

### 2. Provide treatment effectiveness analysis following formats outlined in the RSWMP FIG.

Final reporting for each water year is provided as part of the Annual Stormwater Monitoring Report (due March 15th of each year) which includes treatment effectiveness evaluations for FSP, TN, and TP on a seasonal and annual basis as well as for sampled events. However, treatment effectiveness for FSP for spring of WY19 is provided for all events for the Contech MFS in Table 5 and the Jellyfish in Table 6. Removal efficiencies highlighted in pink indicate that FSP was flushed from the system or that outflow turbidity sensors were inundated with accumulated sediment. Removal efficiencies highlighted in yellow indicate unreliable data due to turbidity sensors being inundated in accumulated sediment. Lab turbidities were substituted for continuous turbidity beginning 5/23/19. A removal efficiency of 100% with no highlight indicates no outflow from the filter vault.

Table 5: Contech MFS FSP removal efficiency for each event of spring WY19.

CONTECH MFS WY19 Spring: March 1, 2019 - May 31, 2019								
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent Effluent		Influent FSP (lbs)	Effluent FSP (lbs)	Removal Efficiency
				Volume (cf)	Volume (cf)			
10/3/18 10:05	10/3/18 19:05	rain	9:00	754	450	4.33	1.73	60%
10/4/18 10:35	10/4/18 11:45	rain	1:10	49	0	0.24	0.00	100%
10/5/18 23:50	10/6/18 1:45	rain	1:55	90	0	0.39	0.00	100%
11/22/18 10:50	11/22/18 13:50	rain, snow	3:00	163	41	2.15	0.19	91%
11/23/18 10:10	11/23/18 18:30	rain, snow	8:20	791	469	10.40	4.00	62%
11/27/18 18:55	11/28/18 14:00	rain, snow	19:05	174	0	2.30	0.00	100%
11/29/18 13:25	11/29/18 16:35	snowmelt	3:10	27	0	0.34	0.00	100%
11/30/18 9:50	11/30/18 12:25	snowmelt	2:35	66	0	0.42	0.00	100%
12/5/18 11:25	12/5/18 13:00	event snowmelt	1:35	26	0	0.90	0.00	100%
12/21/18 8:05	12/21/18 11:05	rain	3:00	108	21	2.54	0.14	94%
12/23/18 12:55	12/23/18 18:00	event snowmelt	5:05	50	0	0.64	0.00	100%
12/24/18 9:55	12/24/18 11:55	event snowmelt	2:00	153	55	2.56	0.18	93%
12/25/18 13:05	12/25/18 16:20	event snowmelt	3:15	97	6	0.59	0.01	99%
1/9/19 10:55	1/9/19 15:30	rain	4:35	150	16	4.26	0.04	99%
1/19/19 9:50	1/19/19 16:15	snowmelt	6:25	225	79	3.97	0.07	98%
1/20/19 9:35	1/20/19 11:20	rain	1:45	64	0	0.66	0.00	100%
1/23/19 11:35	1/23/19 17:15	snowmelt	5:40	243	97	4.29	0.30	93%
1/24/19 12:50	1/24/19 15:45	snowmelt	2:55	23	0	0.04	0.00	100%
1/25/19 13:55	1/25/19 15:40	snowmelt	1:45	11	0	0.02	0.00	100%
1/27/19 13:15	1/27/19 17:05	snowmelt	3:50	56	0	0.04	0.00	100%
1/29/19 11:35	1/29/19 16:15	snowmelt	4:40	19	0	0.00	0.00	100%
1/31/19 14:40	1/31/19 16:45	snowmelt	2:05	8	0	0.00	0.00	100%
2/1/19 23:50	2/2/19 16:30	rain	16:40	1,018	722	8.02	1.36	83%
2/13/19 18:25	2/14/19 11:10	rain	16:45	1,657	1,431	7.92	0.91	89%
2/23/19 11:45	2/23/19 17:15	snowmelt	5:30	344	183	4.99	0.31	94%
2/24/19 13:35	2/24/19 16:40	snowmelt	3:05	169	55	2.04	0.08	96%
2/25/19 11:00	2/25/19 11:30	event snowmelt	0:30	6	0	0.03	0.00	100%
3/1/19 11:55	3/1/19 14:30	snowmelt	2:35	22	0	0.12	0.00	100%
3/2/19 12:30	3/2/19 19:25	rain/snow	6:55	178	64	0.87	0.05	94%
3/3/19 10:55	3/3/19 18:55	rain/snow	8:00	436	277	4.29	0.27	94%
3/4/19 10:10	3/4/19 15:15	snowmelt	5:05	112	22	0.70	0.01	99%
3/5/19 10:25	3/5/19 19:25	rain/snow	9:00	119	28	0.82	0.01	98%
3/8/19 13:25	3/8/19 14:30	event snowmelt	1:05	10	0	0.05	0.00	100%
3/10/19 10:45	3/10/19 16:40	event snowmelt	5:55	52	0	0.20	0.00	100%
3/11/19 11:15	3/11/19 13:30	snowmelt	2:15	32	0	0.07	0.00	100%
3/12/19 14:05	3/12/19 15:35	snowmelt	1:30	12	0	0.03	0.00	100%
3/15/19 12:20	3/15/19 15:55	snowmelt	3:35	65	10	0.04	0.00	99%
3/16/19 12:05	3/16/19 22:10	snowmelt	10:05	174	66	0.04	0.00	96%
3/17/19 14:40	3/17/19 22:15	snowmelt	7:35	128	67	0.03	0.00	93%
3/18/19 12:45	3/18/19 22:05	snowmelt	9:20	343	207	0.08	0.01	92%
3/19/19 12:00	3/19/19 20:15	snowmelt	8:15	221	118	0.04	0.00	90%
3/20/19 9:35	3/21/19 10:00	rain/snow	24:25	274	102	0.06	0.00	94%
3/22/19 14:05	3/22/19 16:15	snowmelt	2:10	12	0	0.00	0.00	100%
3/23/19 9:55	3/23/19 17:10	event snowmelt	7:15	337	181	0.08	0.01	92%
3/24/19 11:30	3/24/19 17:40	snowmelt	6:10	311	178	0.06	0.01	89%
3/25/19 11:50	3/25/19 18:35	snowmelt	6:45	397	243	0.08	0.01	84%
3/26/19 13:20	3/26/19 20:10	snowmelt	6:50	85	14	0.01	0.00	96%
3/27/19 4:15	3/28/19 12:25	rain/snow	32:10	295	318	0.07	0.04	46%

Table 5 continued.

CONTECH MFS WY19 Spring: March 1, 209 - May 31, 2019								
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent Effluent		Influent FSP (lbs)	Effluent FSP (lbs)	Removal Efficiency
				Volume (cf)	Volume (cf)			
3/28/19 9:50	3/28/19 19:15	snowmelt	9:25	478	206	0.09	0.03	70%
3/29/19 11:25	3/29/19 18:35	snowmelt	7:10	387	267	0.06	0.03	49%
3/30/19 11:35	3/30/19 18:35	snowmelt	7:00	338	207	0.04	0.01	63%
3/31/19 11:10	3/31/19 21:15	snowmelt	10:05	801	617	0.12	0.08	39%
4/1/19 11:00	4/1/19 16:00	snowmelt	5:00	195	112	0.02	0.01	70%
4/1/19 16:00	4/2/19 16:00	rain/snow	24:00	2,179	1,579	0.66	0.39	41%
4/3/19 12:40	4/3/19 18:20	snowmelt	5:40	154	80	0.02	0.01	69%
4/4/19 11:40	4/4/19 18:45	snowmelt	7:05	166	80	0.01	0.00	73%
4/5/19 13:40	4/5/19 16:55	rain/snow	3:15	184	99	0.03	0.01	50%
4/7/19 9:30	4/7/19 20:30	snowmelt	11:00	936	840	0.15	0.08	47%
4/8/19 9:35	4/9/19 3:40	rain/snow	18:05	1,166	1,004	0.25	0.10	59%
4/9/19 10:40	4/9/19 14:15	snowmelt	3:35	41	16	0.01	0.00	93%
4/10/19 12:05	4/10/19 18:30	snowmelt	6:25	151	87	0.01	0.00	83%
4/11/19 14:15	4/11/19 16:35	snowmelt	2:20	33	11	0.00	0.00	90%
4/12/19 11:40	4/12/19 19:30	snowmelt	7:50	269	173	0.02	0.00	79%
4/13/19 10:45	4/13/19 19:50	snowmelt	9:05	388	262	0.03	0.01	79%
4/14/19 10:50	4/14/19 15:55	snowmelt	5:05	136	78	0.01	0.00	83%
4/16/19 8:20	4/16/19 9:40	rain/snow	1:20	15	1	0.00	0.00	99%
4/16/19 13:40	4/16/19 19:00	snowmelt	5:20	162	102	0.01	0.00	79%
4/17/19 11:25	4/17/19 17:35	snowmelt	6:10	162	108	0.01	0.00	77%
4/18/19 10:45	4/18/19 17:45	snowmelt	7:00	183	131	0.00	0.00	65%
4/19/19 11:55	4/19/19 17:15	snowmelt	5:20	97	67	0.00	0.00	27%
4/20/19 12:30	4/20/19 15:25	snowmelt	2:55	11	1	0.00	0.00	97%
4/21/19 14:20	4/21/19 15:10	snowmelt	0:50	8	3	0.00	0.00	-571%
4/22/19 13:55	4/22/19 16:30	snowmelt	2:35	26	21	0.00	0.00	-1211%
4/23/19 12:50	4/23/19 17:10	snowmelt	4:20	53	54	0.00	0.00	57%
4/24/19 12:35	4/24/19 16:45	snowmelt	4:10	48	63	0.00	0.00	100%
4/25/19 14:25	4/25/19 14:35	snowmelt	0:10	1	0	0.00	0.00	na
4/29/19 17:40	4/29/19 19:15	snowmelt	1:35	78	0	17.61	0.00	100%
4/30/19 7:10	4/30/19 7:30	snowmelt	0:20	2	0	0.00	0.00	100%
4/30/19 11:20	4/30/19 11:45	snowmelt	0:25	4	0	0.00	0.00	100%
5/5/19 19:20	5/5/19 19:35	thunderstorm	0:15	1	0	0.00	0.00	100%
5/15/19 9:35	5/16/19 6:20	rain	20:45	433	482	0.50	0.00	99%
5/16/19 17:35	5/17/19 0:05	rain	6:30	61	53	0.01	0.00	95%
5/19/19 3:15	5/19/19 7:10	rain	3:55	90	88	0.32	0.21	32%
5/21/19 8:10	5/21/19 21:45	rain	13:35	668	656	5.10	0.01	100%
5/22/19 19:40	5/22/19 23:45	rain	4:05	57	56	0.69	0.00	100%
5/23/19 7:20	5/23/19 16:30	rain	9:10	345	336	5.33	4.52	15%
5/26/19 1:40	5/26/19 14:10	rain	12:30	551	514	9.60	7.31	24%
5/27/19 6:05	5/27/19 22:05	rain	16:00	351	342	4.48	2.46	45%

Table 6: Jellyfish FSP removal efficiency for each event of spring WY19.

JELLYFISH WY19 Spring: March 1, 2019 - May 31, 2019								
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent Effluent		Influent FSP (lbs)	Effluent FSP (lbs)	Removal Efficiency
				Volume (cf)	Volume (cf)			
10/3/18 10:05	10/3/18 19:15	rain	9:10	738	691	3.86	2.15	44%
10/4/18 10:35	10/4/18 12:05	rain	1:30	49	49	0.28	0.13	55%
10/6/18 0:00	10/6/18 2:15	rain	2:15	97	96	0.17	0.21	-24%
11/22/18 10:50	11/22/18 15:50	rain, snow	5:00	165	143	2.06	0.16	92%
11/23/18 10:05	11/24/18 3:40	rain, snow	17:35	1,104	995	10.73	8.13	24%
11/27/18 18:30	11/28/18 15:40	rain, snow	21:10	263	85	2.55	0.37	86%
11/29/18 12:35	11/29/18 21:35	snowmelt	9:00	129	5	1.20	0.04	97%
11/30/18 9:45	11/30/18 15:50	snowmelt	6:05	147	42	0.73	0.30	60%
12/5/18 11:25	12/5/18 12:50	event snowmelt	1:25	27	8	0.93	0.01	99%
12/17/18 4:50	12/17/18 5:10	event snowmelt	0:20	2	0	0.01	0.00	100%
12/21/18 8:05	12/21/18 11:25	rain	3:20	91	46	2.04	0.50	75%
12/23/18 12:55	12/23/18 18:00	event snowmelt	5:05	45	1	0.56	0.01	98%
12/24/18 9:50	12/24/18 11:55	event snowmelt	2:05	152	114	2.56	1.09	57%
12/25/18 12:10	12/25/18 16:40	event snowmelt	4:30	115	72	0.67	0.54	19%
1/9/19 10:55	1/9/19 17:30	rain	6:35	168	135	4.73	1.88	60%
1/19/19 9:45	1/19/19 16:55	snowmelt	7:10	244	219	4.26	1.05	75%
1/20/19 9:35	1/20/19 11:25	rain	1:50	69	59	0.72	0.15	79%
1/23/19 11:35	1/23/19 18:05	snowmelt	6:30	261	245	4.33	0.62	86%
1/24/19 12:50	1/24/19 15:50	snowmelt	3:00	34	11	0.05	0.02	67%
1/25/19 13:20	1/25/19 16:10	snowmelt	2:50	22	9	0.01	0.01	-55%
1/27/19 12:50	1/27/19 17:45	snowmelt	4:55	73	51	0.05	0.08	-81%
1/29/19 11:25	1/29/19 16:40	snowmelt	5:15	40	22	0.00	0.03	-7304%
1/31/19 14:05	1/31/19 17:05	snowmelt	3:00	22	12	0.00	0.02	-1601%
2/1/19 23:45	2/2/19 16:05	rain	16:20	1,051	935	8.24	0.44	95%
2/13/19 18:25	2/14/19 11:10	rain	16:45	1,764	1,762	8.66	0.96	89%
2/23/19 11:45	2/23/19 16:55	snowmelt	5:10	367	363	5.24	0.28	95%
2/24/19 13:35	2/24/19 16:30	snowmelt	2:55	174	165	2.02	0.07	97%
2/25/19 10:55	2/25/19 12:15	event snowmelt	1:20	10	4	0.03	0.00	94%
3/1/19 12:30	3/1/19 14:55	snowmelt	2:25	24	19	0.12	0.01	89%
3/2/19 12:30	3/2/19 20:00	rain/snow	7:30	189	177	0.87	0.09	90%
3/3/19 10:55	3/3/19 19:35	rain/snow	8:40	505	498	4.43	0.19	96%
3/4/19 10:05	3/4/19 16:45	snowmelt	6:40	139	135	0.84	0.06	93%
3/5/19 10:15	3/5/19 19:25	rain/snow	9:10	141	139	0.81	0.05	94%
3/8/19 13:25	3/8/19 14:35	event snowmelt	1:10	14	11	0.08	0.00	93%
3/10/19 10:40	3/10/19 16:45	event snowmelt	6:05	61	54	0.18	0.01	92%
3/11/19 10:50	3/11/19 13:50	snowmelt	3:00	46	42	0.06	0.01	77%
3/12/19 14:00	3/12/19 15:45	snowmelt	1:45	18	8	0.03	0.00	90%
3/13/19 12:00	3/13/19 13:30	snowmelt	1:30	7	3	0.01	0.00	89%
3/14/19 13:55	3/14/19 16:05	snowmelt	2:10	10	7	0.01	0.00	51%
3/15/19 11:50	3/15/19 18:40	snowmelt	6:50	105	103	0.06	0.03	40%
3/16/19 11:45	3/16/19 23:45	snowmelt	12:00	224	216	0.04	0.06	-57%
3/17/19 12:05	3/17/19 23:45	snowmelt	11:40	186	181	0.03	0.04	-68%
3/18/19 11:45	3/18/19 22:45	snowmelt	11:00	360	349	0.08	0.06	21%
3/19/19 11:10	3/19/19 22:35	snowmelt	11:25	274	263	0.05	0.05	-18%
3/20/19 9:25	3/21/19 10:30	rain/snow	25:05	327	321	0.07	0.05	23%
3/22/19 13:40	3/22/19 23:05	snowmelt	9:25	37	32	0.00	0.01	-257%
3/23/19 9:55	3/23/19 18:50	event snowmelt	8:55	340	330	0.08	0.03	59%
3/24/19 11:15	3/24/19 18:50	snowmelt	7:35	308	305	0.05	0.03	54%

Table 6 continued.

JELLYFISH WY19 Spring: March 1, 209 - May 31, 2019								
Runoff Start Date Time	Runoff End Date Time	Runoff Type	Event Duration	Influent	Effluent	Influent FSP (lbs)	Effluent FSP (lbs)	Removal Efficiency
				Volume (cf)	Volume (cf)			
3/25/19 11:30	3/25/19 20:10	snowmelt	8:40	385	382	0.07	0.03	57%
3/26/19 12:40	3/26/19 21:10	snowmelt	8:30	151	150	0.01	0.01	-130%
3/27/19 2:35	3/27/19 15:45	rain/snow	13:10	300	295	0.07	0.03	62%
3/28/19 9:50	3/28/19 20:10	snowmelt	10:20	532	528	0.10	0.04	65%
3/29/19 11:00	3/29/19 19:40	snowmelt	8:40	399	396	0.06	0.02	61%
3/30/19 11:05	3/30/19 20:00	snowmelt	8:55	337	331	0.04	0.02	53%
3/31/19 10:45	3/31/19 22:25	snowmelt	11:40	857	827	0.13	0.04	66%
4/1/19 10:45	4/1/19 16:00	snowmelt	5:15	200	197	0.02	0.01	48%
4/1/19 16:00	4/2/19 18:00	rain/snow	26:00	1,821	1,808	0.53	0.07	87%
4/3/19 8:10	4/3/19 20:00	snowmelt	11:50	2	182	0.00	0.01	-6058%
4/3/19 12:05	4/3/19 19:55	snowmelt	7:50	182	0	0.02	0.00	100%
4/4/19 10:55	4/4/19 20:50	snowmelt	9:55	200	196	0.01	0.01	54%
4/5/19 13:35	4/5/19 17:20	rain/snow	3:45	168	167	0.03	0.01	79%
4/6/19 14:10	4/6/19 17:30	snowmelt	3:20	8	8	0.00	0.00	-99%
4/7/19 9:10	4/7/19 22:40	snowmelt	13:30	1,034	1,012	0.15	0.03	80%
4/8/19 8:55	4/9/19 4:15	rain/snow	19:20	1,191	1,176	0.24	0.03	86%
4/9/19 8:55	4/9/19 18:55	snowmelt	10:00	113	101	0.01	0.00	76%
4/10/19 10:10	4/10/19 20:25	snowmelt	10:15	205	201	0.01	0.00	66%
4/11/19 12:30	4/11/19 18:35	snowmelt	6:05	76	73	0.00	0.00	46%
4/12/19 10:05	4/12/19 21:50	snowmelt	11:45	308	304	0.02	0.01	64%
4/13/19 9:05	4/13/19 22:25	snowmelt	13:20	408	402	0.03	0.01	64%
4/14/19 9:45	4/14/19 20:00	snowmelt	10:15	191	189	0.01	0.00	43%
4/15/19 8:55	4/15/19 20:30	snowmelt	11:35	18	6	0.00	0.00	na
4/16/19 7:40	4/16/19 10:10	rain/snow	2:30	33	32	0.00	0.00	44%
4/16/19 10:35	4/16/19 21:05	snowmelt	10:30	220	219	0.01	0.00	43%
4/17/19 9:05	4/17/19 19:30	snowmelt	10:25	224	221	0.01	0.00	32%
4/18/19 8:35	4/18/19 20:00	snowmelt	11:25	264	263	0.00	0.01	-2%
4/19/19 8:25	4/19/19 19:55	snowmelt	11:30	207	204	0.00	0.00	-194%
4/20/19 9:50	4/20/19 17:50	snowmelt	8:00	96	95	0.00	0.00	-274%
4/21/19 10:35	4/21/19 18:05	snowmelt	7:30	100	99	0.00	0.00	-413%
4/22/19 10:40	4/22/19 18:20	snowmelt	7:40	107	106	0.00	0.00	-112%
4/23/19 10:05	4/23/19 19:00	snowmelt	8:55	136	135	0.00	0.00	-50%
4/24/19 9:45	4/24/19 19:50	snowmelt	10:05	143	142	0.00	0.00	-5250%
4/25/19 10:45	4/25/19 20:50	snowmelt	10:05	96	94	0.00	0.00	na
4/26/19 11:35	4/26/19 21:35	snowmelt	10:00	57	55	0.00	0.00	na
4/27/19 12:30	4/28/19 4:40	snowmelt	16:10	112	109	0.00	0.00	na
4/28/19 12:45	4/29/19 5:30	snowmelt	16:45	124	117	0.00	0.00	na
4/29/19 12:25	4/30/19 3:10	snowmelt	14:45	167	164	27.55	0.00	100%
4/30/19 7:30	4/30/19 8:25	snowmelt	0:55	6	5	0.00	0.00	62%
4/30/19 10:45	4/30/19 12:35	snowmelt	1:50	8	7	0.00	0.00	-54%
5/3/19 18:10	5/4/19 2:30	snowmelt	8:20	51	47	0.00	0.00	na
5/4/19 12:50	5/5/19 0:20	snowmelt	11:30	69	67	0.00	0.00	na
5/5/19 11:30	5/10/19 9:15	thunderstorm	117:45	788	777	0.00	0.01	-87434%
5/15/19 8:30	5/16/19 6:30	rain	22:00	238	235	0.31	0.00	99%
5/16/19 17:25	5/17/19 3:05	rain	9:40	47	30	0.00	0.00	91%
5/19/19 2:25	5/19/19 7:10	rain	4:45	133	131	0.01	0.32	-3123%
5/21/19 8:10	5/21/19 20:45	rain	12:35	277	272	2.28	0.00	100%
5/23/19 11:25	5/23/19 16:35	rain	5:10	260	215	4.46	3.81	15%
5/26/19 1:40	5/26/19 14:55	rain	13:15	487	485	8.52	6.50	24%
5/27/19 5:45	5/27/19 21:10	rain	15:25	355	351	4.90	2.84	42%

### **3. Correlate Road RAM score to pollutant concentration and load.**

This task has been initiated, see task 3.1.

### **4. Provide mass loading v. volume calculations for select events.**

Seasonal Progress Report #3 provides this analysis for events that occurred in the fall/winter and spring of water year 2016. Seasonal Progress Report #1 included a similar study based on four events that occurred in the late spring and early summer of water year 2015. Analyses have consistently shown that in general, turbidities (and thus FSP) mirror the flow and therefore no first flush phenomenon exists at SR431 with respect to FSP. This may indicate that the primary road serves as a constant source of sediment. Due to consistent results this analysis has not been repeated since Seasonal Progress Report #3. This analysis can be repeated upon request.

Figures 8-19

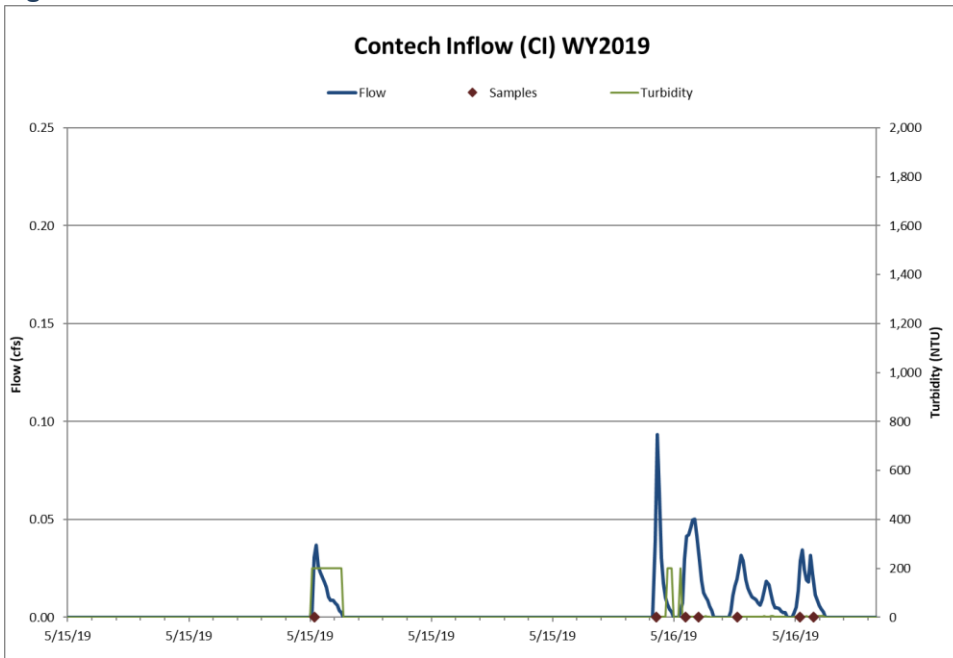


Figure 8: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Inflow for the 5/15/19 rain event.

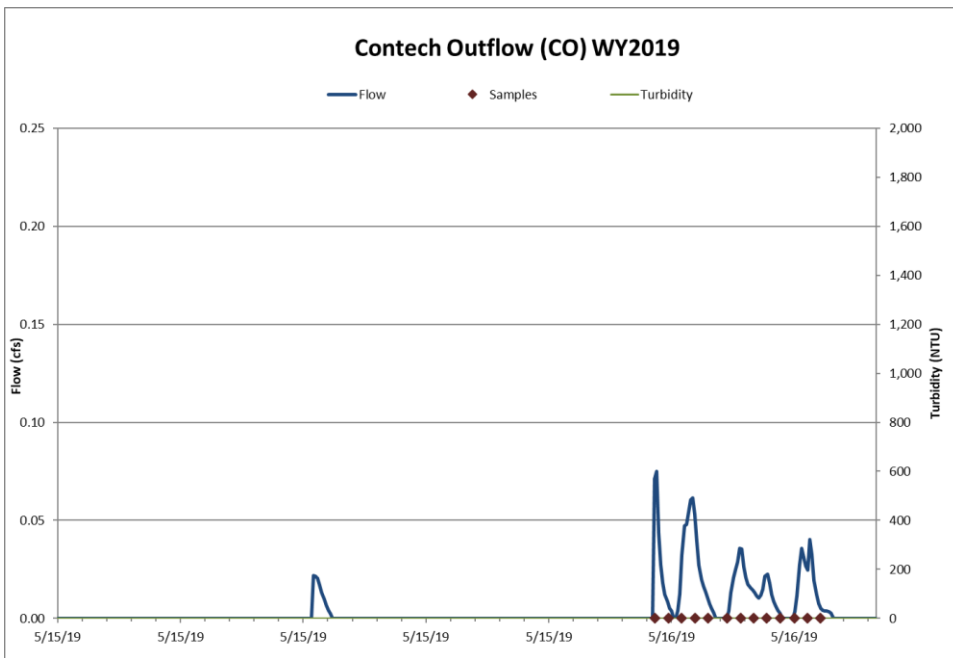


Figure 9: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Outflow for the 5/15/19 rain event.



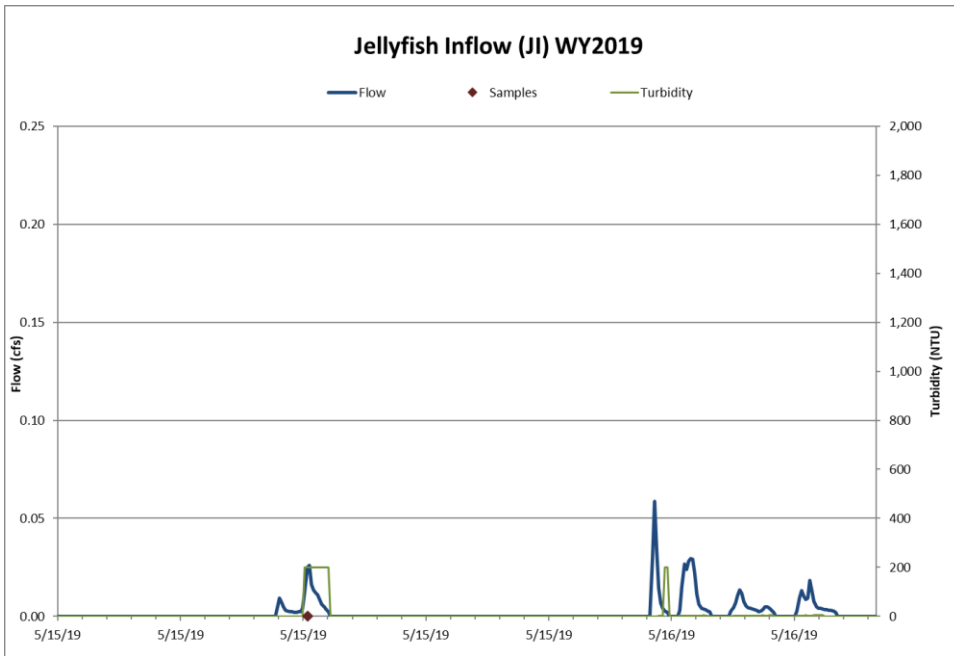


Figure 10: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Inflow for the 5/15/19 rain event. Only one sample was successful for JI, so CI data was substituted in to calculate seasonal loads.

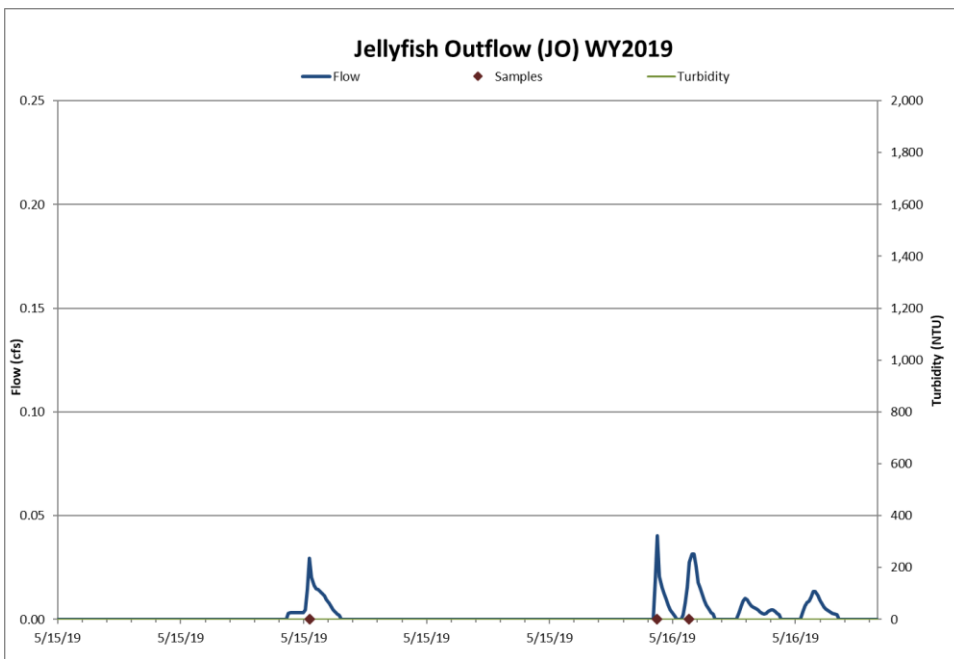


Figure 11: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Outflow for the 5/15/19 rain event.

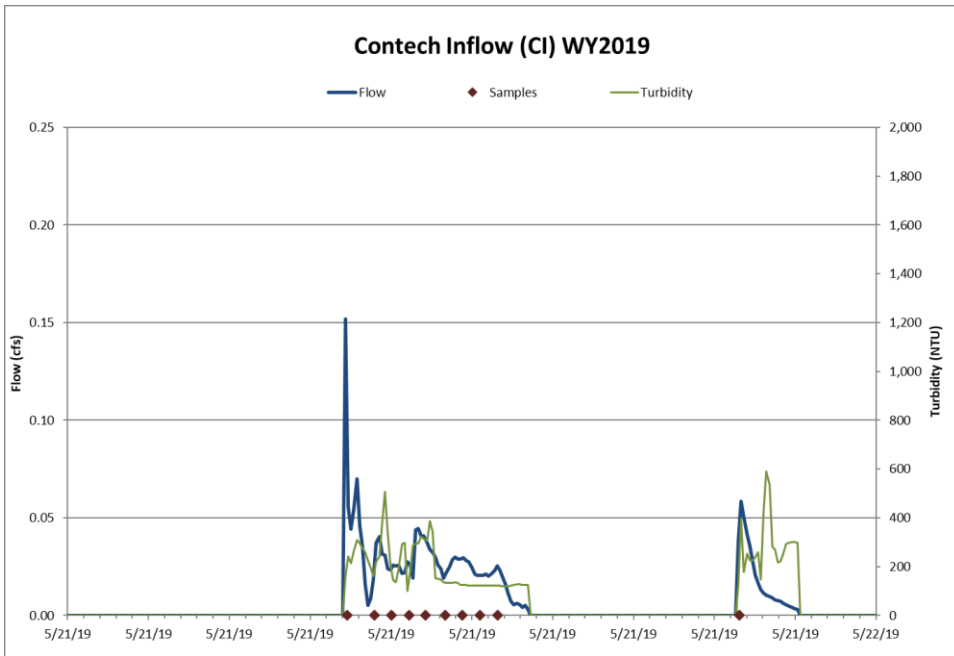


Figure 12: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Inflow for the 5/21/19 thunderstorm event.

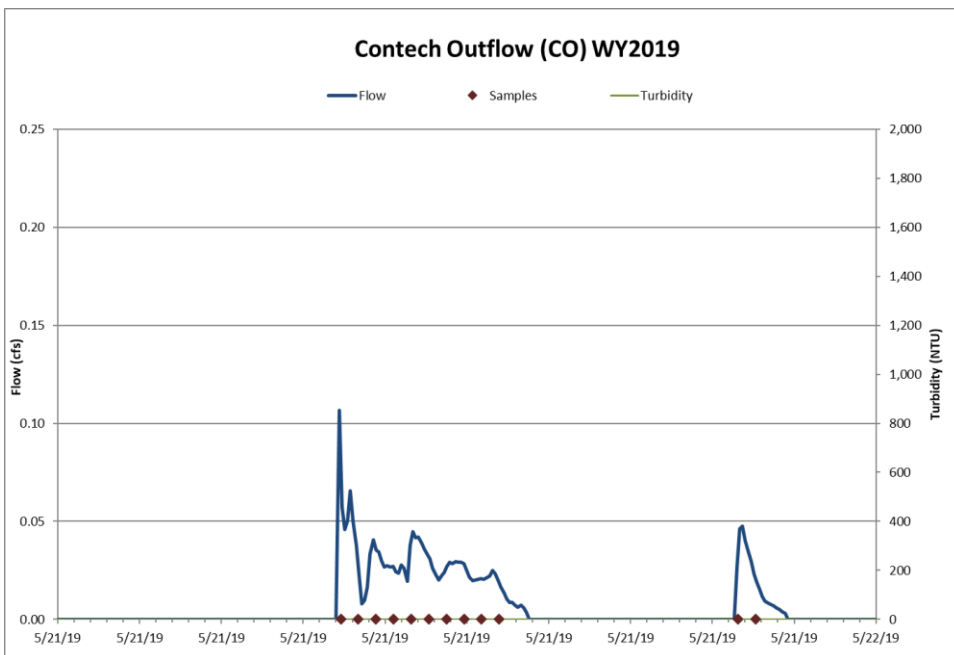


Figure 13: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Outflow for the 5/21/19 thunderstorm event.

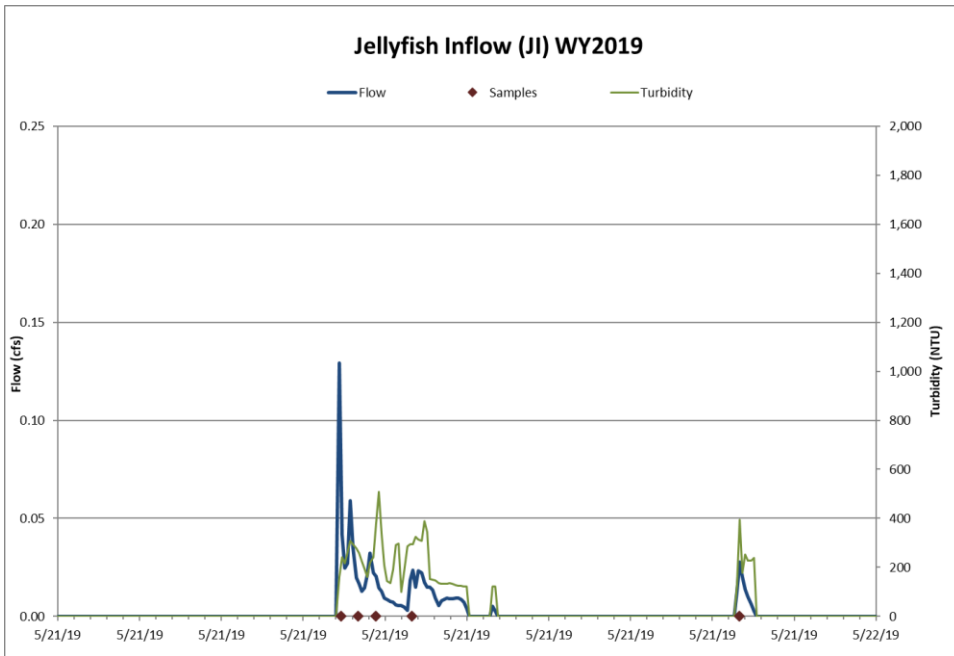


Figure 14: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Inflow for the 5/21/19 thunderstorm event.

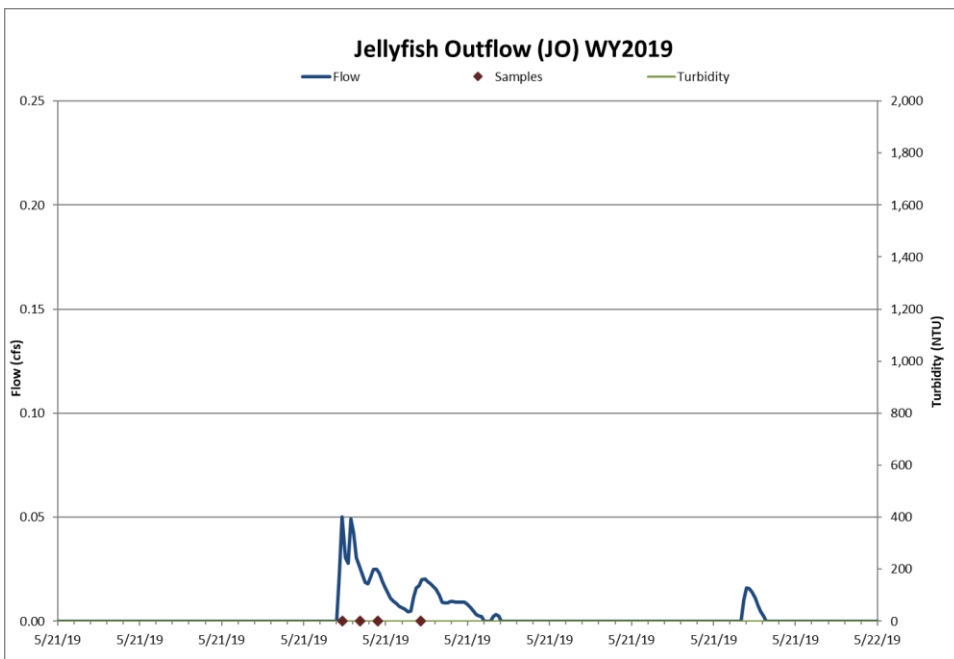


Figure 15: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Outflow for the 5/21/19 thunderstorm event.

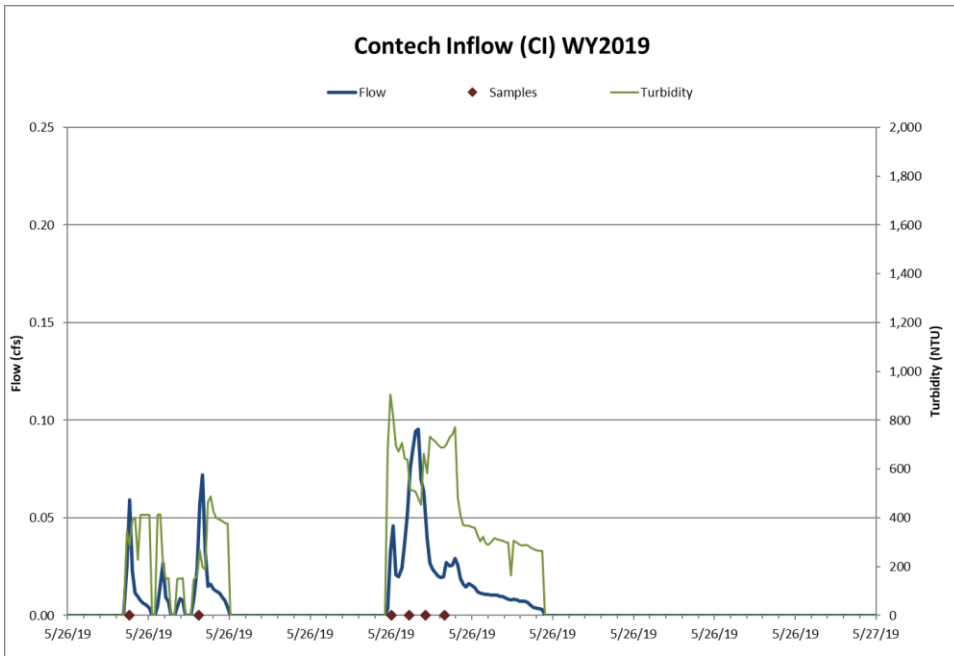


Figure 16: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Inflow for the 5/26/19 thunderstorm event.

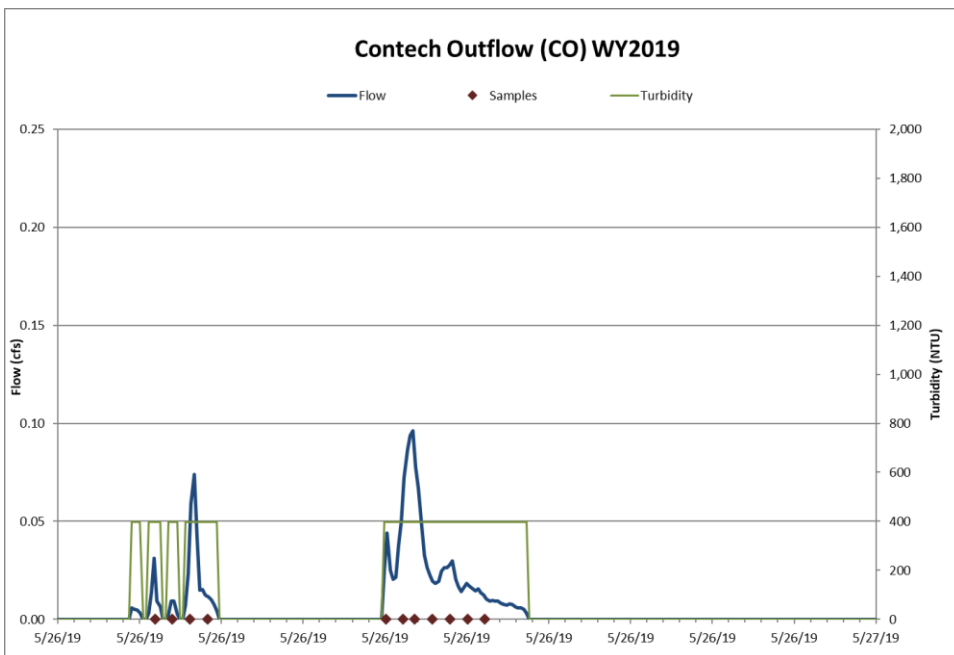


Figure 17: Hydrograph, continuous turbidity and sample distribution at the Contech MFS Outflow for the 5/26/19 thunderstorm event.

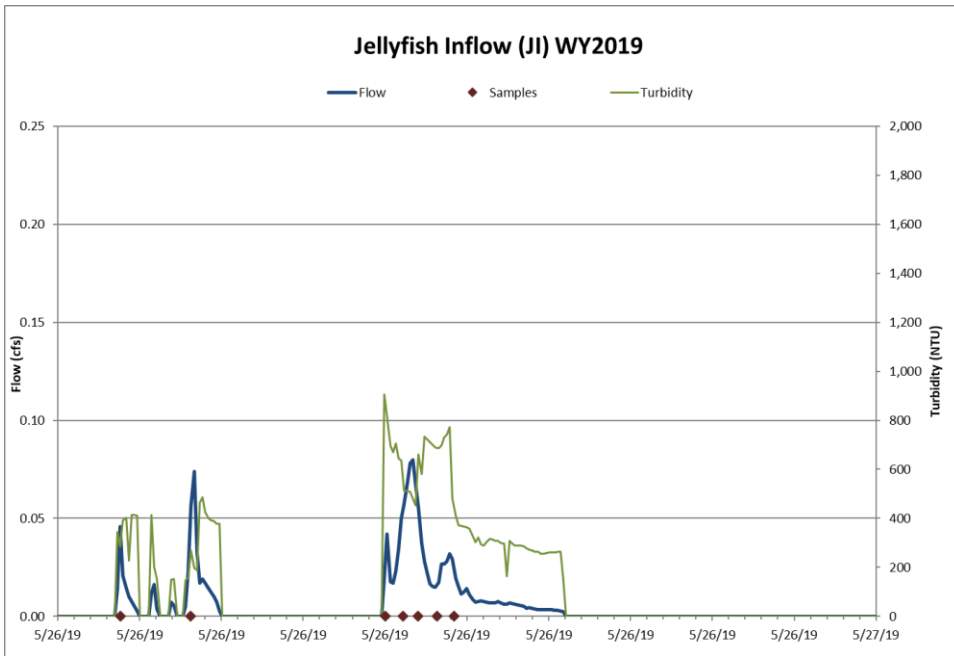


Figure 18: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Inflow for the 5/26/19 thunderstorm event.

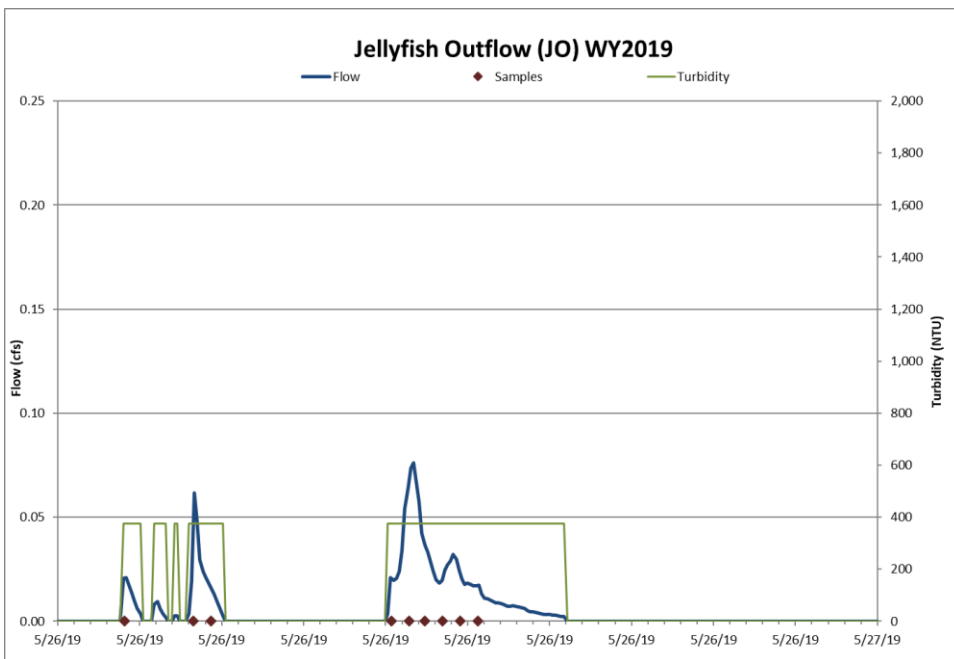


Figure 19: Hydrograph, continuous turbidity and sample distribution at the Jellyfish Outflow for the 5/26/19 thunderstorm event.

## References

2NDNATURE LLC, Northwest Hydraulic Consultants, Environmental Incentives, 2015. *Road Rapid Assessment Methodology (Road RAM) User Manual v2, Tahoe Basin. Final Document*. Prepared for the Nevada Division of Environmental Protection and Lahontan Regional Water Quality Control Board. May 2015.

PLRM Model Development Document 2009. NHC, Geosyntec, and 2ndNature.

Tahoe Resource Conservation District, 2NDNATURE, Desert Research Institute, Northwest Hydraulic Consultants. 2015. *RSWMP Framework and Implementation Guidance Document*. Submitted the California State Water Board. March 30, 2015.