

Laser meter progress report 11/2019

General observations

- Overall observation is that laser meters installed show closer agreement between with the newest metering stations versus the stations of 1970's vintage
- Laser meters vs Ultrasonic - Traditional ultrasonic flow measurement is volumetric and controlled by flume dimensions and the registered sewage depth moving thru the flume. Laser meter does the same but also adds velocity as a component in its flow measurement.

Meter stations & flumes

- Original flume sizing due to peak flow issues – from inception when District and member community engineers spec'd out the meter station flumes it was necessary size them to cover peak flows due to I&I. (oversize) During wet weather events they still were not big enough and so a second area velocity meter was even added to capture flows when the flumes topped over and meter stations flooded. Overall, this resulted in flumes that are larger than desirable the majority of the time during normal flows/dry weather.
- MS 3 - flows come down the hill traveling at a velocity that is too fast for optimal flow measurement. If the station was rebuilt today it wouldn't be built like it is, there likely would be a drop manhole ahead of the meter station. This station remains unchanged from day 1 and is of 1970's vintage. Our existing flow metering technology does not account for velocity but new laser technology does.
- MS 6 - deposition of grit in flume and persistent H2S present at the station. The laser meter can be programmed to accommodate a stable grit layer but it's not ideal to have to do that and grit deposition points to inadequate flow velocity entering the meter station. H2S is a historical issue at this site – in the past persistent corrosion of the ventilation fan led to it being replaced and relocated. The H2S is a known safety issue for both HOV and City of Kaukauna staff.
- MS 5N - Construction of MS 5S rerouted sewage flow away from 5N station making an already large flume proportionally larger for the new flow amount being measured in 5N. The flow lines and a bend in piping at meter station are not ideal. The implications of 5S meter station being built did not result in changes or downsizing the flume installed in 5N.

Issues and concerns moving to new meters:

- Community treatment bills – there will be a change in bills and, in a few cases, it appears substantial with member community budgets for 2020 already set. Discussion on next steps and implementation date?

- Permit Compliance – mass based TMDL limits and the flow effect. Effluent TSS and phosphorus allocations/compliance are calculated on flow. Influent ultrasonic meter versus laser meter may impact mass discharged in the HOVMSD DMR reporting.
- Budget – much of the budget is based off loadings (pounds) for rate parameters especially BOD, TSS, phosphorus, and ammonia. The laser meter changeover is likely going to effect and change rate parameters in future budgets.
- HOVMSD Master planning efforts – Donohue project is ongoing. Total plant flow and organic load implications with plant capacities effected. Are we at 60% or 70% or 100% load?
- Sustainability / Clear water plan – average daily flows, peaking factors, sewer system flow response graphs and community progress appear to be impacted.

MONTH: OCTOBER

YEAR: 2019

DATE	(LASER) PLANT FLOW GALLONS	(ULTRASONIC) PLANT FLOW GALLONS	% DIFF
1	13,765,000	13,759,000	0.04
2	15,357,000	15,766,000	(2.66)
3	12,298,000	12,000,000	2.42
4	10,236,000	9,475,000	7.43
5	9,730,000	8,900,000	8.53
6	9,586,000	8,644,000	9.83
7	8,609,000	7,612,000	11.58
8	7,901,000	6,900,000	12.67
9	7,199,000	6,257,000	13.09
10	7,360,000	6,449,000	12.38
11	9,693,000	8,845,000	8.75
12	8,494,000	7,425,000	12.59
13	8,130,000	7,085,000	12.85
14	7,814,000	6,777,000	13.27
15	7,789,000	6,790,000	12.83
16	7,662,000	6,602,000	13.83
17	7,340,000	6,280,000	14.44
18	6,930,000	5,928,000	14.46
19	6,769,000	5,825,000	13.95
20	6,866,000	5,881,000	14.35
21	7,536,000	6,580,000	12.69
22	8,955,000	7,745,000	13.51
23	7,833,000	6,664,000	14.92
24	7,586,000	6,361,000	16.15
25	7,101,000	5,950,000	16.21
26	7,140,000	5,984,000	16.19
27	7,788,000	6,631,000	14.86
28	7,231,000	6,061,000	16.18
29	7,846,000	6,563,000	16.35
30	7,383,000	6,197,000	16.06
31	7,740,000	6,503,000	15.98

TOTAL:	263,667,000	227,936,000
AVERAGE:	8,505,387	7,597,867

KIMBERLY

Date	MS#1		% Diff
	Ultrasonic Gallons	Laser Gallons	
1	2,231,000	2,090,000	6.32
2	2,349,000	2,367,000	(0.77)
3	1,788,000	1,895,000	(5.98)
4	1,301,000	1,281,000	1.54
5	1,222,000	1,217,000	0.41
6	1,187,000	1,199,000	(1.01)
7	1,010,000	968,000	4.16
8	916,000	889,000	2.95
9	858,000	797,000	7.11
10	884,000	814,000	7.92
11	1,346,000	1,296,000	3.71
12	1,130,000	1,136,000	(0.53)
13	1,078,000	1,087,000	(0.83)
14	904,000	848,000	6.19
15	906,000	845,000	6.73
16	869,000	798,000	8.17
17	826,000	765,000	7.38
18	776,000	692,000	10.82
19	762,000	676,000	11.29
20	770,000	685,000	11.04
21	924,000	884,000	4.33
22	1,087,000	1,041,000	4.23
23	881,000	813,000	7.72
24	841,000	787,000	6.42
25	809,000	746,000	7.79
26	814,000	750,000	7.86
27	902,000	818,000	9.31
28	719,000	745,000	(3.62)
29	779,000	809,000	(3.85)
30	866,000	817,000	5.66
31	909,000	857,000	5.72
TOTAL	32,644,000	31,412,000	

Avg	Avg Daily	Avg	
1,053,032	DIFF	1,013,290	4.46
	39,742		

LITTLE CHUTE

MS#2			
Date	Ultrasonic Gallons	Laser Gallons	% Diff
1	1,664,000	1,453,000	12.680
2	1,979,000	1,789,000	9.601
3	1,506,000	1,433,000	4.847
4	1,223,000	1,100,000	10.057
5	1,149,000	1,045,000	9.051
6	1,116,000	1,030,000	7.706
7	937,000	866,000	7.577
8	849,000	794,000	6.478
9	793,000	758,000	4.414
10	818,000	774,000	5.379
11	1,181,000	1,073,000	9.145
12	991,000	940,000	5.146
13	946,000	900,000	4.863
14	875,000	815,000	6.857
15	875,000	813,000	7.086
16	889,000	830,000	6.637
17	845,000	796,000	5.799
18	805,000	759,000	5.714
19	791,000	742,000	6.195
20	799,000	752,000	5.882
21	898,000	704,000	21.604
22	1,058,000	829,000	21.645
23	844,000	604,000	28.436
24	806,000	584,000	27.543
25	775,000	494,000	36.258
26	780,000	497,000	36.282
27	864,000	542,000	37.269
28	771,000	520,000	32.555
29	835,000	565,000	32.335
30	794,000	567,000	28.589
31	834,000	595,000	28.657
TOTAL	30,290,000	25,963,000	

Avg	Avg Daily	Avg	
977,097	DIFF	837,516	15.235
	139,581		

MS#3			
Date	Ultrasonic Gallons	Laser Gallons	% Diff
1	1,973,000	3,304,000	(67.461)
2	2,351,000	3,700,000	(57.380)
3	1,789,000	2,963,000	(65.623)
4	1,508,000	2,737,000	(81.499)
5	1,416,000	2,601,000	(83.686)
6	1,376,000	2,563,000	(86.265)
7	1,219,000	2,544,000	(108.696)
8	1,105,000	2,335,000	(111.312)
9	974,000	2,096,000	(115.195)
10	1,004,000	2,142,000	(113.347)
11	1,413,000	2,801,000	(98.231)
12	1,186,000	2,455,000	(106.998)
13	1,132,000	2,350,000	(107.597)
14	1,108,000	2,342,000	(111.372)
15	1,108,000	2,334,000	(110.650)
16	1,315,000	2,241,000	(70.418)
17	1,250,000	2,146,000	(71.680)
18	862,000	1,879,000	(117.981)
19	847,000	1,835,000	(116.647)
20	855,000	1,862,000	(117.778)
21	1,135,000	2,316,000	(104.053)
22	1,335,000	2,726,000	(104.195)
23	1,164,000	2,443,000	(109.880)
24	1,112,000	2,366,000	(112.770)
25	951,000	2,128,000	(123.764)
26	957,000	2,140,000	(123.615)
27	1,060,000	2,334,000	(120.189)
28	998,000	2,144,000	(114.830)
29	1,081,000	2,327,000	(115.264)
30	1,050,000	2,215,000	(110.952)
31	1,101,000	2,323,000	(110.990)
TOTAL	37,735,000	74,692,000	

Avg	Avg Daily	Avg	
1,217,258	DIFF	2,409,419	(102.268)
	(1,192,161)		

COMBINED LOCKS

Date	MS#4		% Diff
	Ultrasonic Gallons	Laser Gallons	
1	922,000	882,000	4.338
2	1,064,000	1,011,000	4.981
3	809,000	809,000	-
4	664,000	626,000	5.723
5	624,000	595,000	4.647
6	606,000	586,000	3.300
7	515,000	498,000	3.301
8	467,000	458,000	1.927
9	403,000	407,000	(0.993)
10	415,000	416,000	(0.241)
11	624,000	588,000	5.769
12	524,000	515,000	1.718
13	500,000	493,000	1.400
14	452,000	446,000	1.327
15	452,000	444,000	1.770
16	435,000	434,000	0.230
17	413,000	415,000	(0.484)
18	384,000	398,000	(3.646)
19	377,000	389,000	(3.183)
20	381,000	394,000	(3.412)
21	409,000	410,000	(0.244)
22	482,000	482,000	-
23	423,000	413,000	2.364
24	404,000	399,000	1.238
25	387,000	378,000	2.326
26	390,000	380,000	2.564
27	432,000	415,000	3.935
28	388,000	372,000	4.124
29	421,000	404,000	4.038
30	406,000	394,000	2.956
31	426,000	413,000	3.052
TOTAL	15,599,000	15,264,000	

Avg	Avg Daily	Avg	
503,194	DIFF	492,387	1.769
	10,806		

DARBOY

Date	MS#7		% Diff
	Ultrasonic Gallons	Laser Gallons	
1	1,584,000	1,438,000	9.217
2	1,510,000	1,398,000	7.417
3	1,150,000	1,120,000	2.609
4	1,134,000	1,068,000	5.820
5	1,065,000	1,015,000	4.695
6	1,035,000	1,000,000	3.382
7	1,002,000	921,000	8.084
8	908,000	846,000	6.828
9	858,000	781,000	8.974
10	885,000	798,000	9.831
11	1,155,000	1,080,000	6.494
12	970,000	947,000	2.371
13	926,000	906,000	2.160
14	897,000	831,000	7.358
15	898,000	828,000	7.795
16	914,000	856,000	6.346
17	870,000	820,000	3.333
18	918,000	841,000	8.388
19	902,000	822,000	8.869
20	911,000	834,000	8.452
21	846,000	759,000	10.284
22	995,000	894,000	10.151
23	911,000	795,000	12.733
24	869,000	770,000	11.392
25	896,000	844,000	5.804
26	901,000	848,000	5.882
27	999,000	925,000	7.407
28	852,000	836,000	1.878
29	923,000	908,000	1.625
30	849,000	766,000	9.776
31	890,000	803,000	9.775
TOTAL	30,423,000	28,298,000	

Avg	Avg Daily	Avg	
981,387	DIFF	912,839	6.845
	68,548		

KAUKAUNA

Date	MS#5N		% Diff
	Ultrasonic Gallons	Laser Gallons	
1	282,000	821,000	(191.135)
2	294,000	858,000	(191.837)
3	223,000	687,000	(208.072)
4	224,000	656,000	(192.857)
5	230,000	624,000	(171.304)
6	223,000	615,000	(175.785)
7	206,000	566,000	(174.757)
8	186,000	519,000	(179.032)
9	177,000	475,000	(168.362)
10	183,000	485,000	(165.027)
11	221,000	600,000	(171.493)
12	186,000	526,000	(182.796)
13	177,000	503,000	(184.181)
14	149,000	485,000	(225.503)
15	150,000	483,000	(222.000)
16	162,000	476,000	(193.827)
17	155,000	456,000	(194.194)
18	163,000	453,000	(177.914)
19	161,000	443,000	(175.155)
20	162,000	449,000	(177.160)
21	109,000	443,000	(306.422)
22	129,000	521,000	(303.876)
23	114,000	434,000	(280.702)
24	109,000	421,000	(286.239)
25	120,000	396,000	(230.000)
26	121,000	399,000	(229.752)
27	134,000	435,000	(224.627)
28	120,000	383,000	(219.167)
29	129,000	416,000	(222.481)
30	149,000	424,000	(184.564)
31	157,000	444,000	(182.803)
TOTAL	5,305,000	15,896,000	

Avg	Avg Daily	Avg	
171,129	DIFF	512,774	(206.227)
	(341,645)		

KAUKAUNA

Date	MS#5s		% Diff
	Ultrasonic Gallons	Laser Gallons	
1	3,601,000	3,146,000	12.635
2	4,146,000	3,557,000	14.206
3	3,155,000	2,848,000	9.731
4	2,503,000	2,189,000	12.545
5	2,351,000	2,081,000	11.484
6	2,284,000	2,050,000	10.245
7	1,997,000	1,783,000	10.716
8	1,810,000	1,636,000	9.613
9	1,612,000	1,470,000	8.809
10	1,662,000	1,503,000	9.567
11	2,236,000	1,997,000	10.689
12	1,877,000	1,750,000	6.766
13	1,791,000	1,675,000	6.477
14	1,770,000	1,581,000	10.678
15	1,773,000	1,575,000	11.168
16	1,750,000	1,530,000	12.571
17	1,664,000	1,465,000	11.959
18	1,546,000	1,330,000	13.972
19	1,519,000	1,302,000	14.286
20	1,533,000	1,321,000	13.829
21	1,715,000	1,467,000	14.461
22	2,019,000	1,727,000	14.463
23	1,781,000	1,512,000	15.104
24	1,700,000	1,465,000	13.824
25	1,595,000	1,386,000	13.103
26	1,605,000	1,394,000	13.146
27	1,778,000	1,521,000	14.454
28	1,633,000	1,419,000	13.105
29	1,769,000	1,539,000	13.002
30	1,707,000	1,475,000	13.591
31	1,792,000	1,547,000	13.672
TOTAL	61,674,000	54,241,000	

Avg	Avg Daily	Avg	
1,989,484	DIFF	1,749,710	12.060
	239,774		

KAUKAUNA

MS#6			
Date	Ultrasonic Gallons	Laser Gallons	% Diff
1	1,052,000	800,000	23.954
2	1,088,000	977,000	10.202
3	828,000	782,000	5.556
4	656,000	724,000	(10.366)
5	616,000	688,000	(11.688)
6	599,000	678,000	(13.189)
7	572,000	656,000	(14.685)
8	519,000	603,000	(16.185)
9	482,000	500,000	(3.734)
10	496,000	512,000	(3.226)
11	612,000	595,000	2.778
12	514,000	521,000	(1.362)
13	491,000	499,000	(1.629)
14	508,000	500,000	1.575
15	508,000	498,000	1.969
16	527,000	511,000	3.036
17	501,000	490,000	2.196
18	461,000	431,000	6.508
19	453,000	421,000	7.064
20	457,000	427,000	6.565
21	493,000	399,000	19.067
22	581,000	469,000	19.277
23	521,000	408,000	21.689
24	498,000	396,000	20.482
25	437,000	318,000	27.231
26	440,000	320,000	27.273
27	488,000	349,000	28.484
28	458,000	331,000	27.729
29	496,000	360,000	27.419
30	470,000	188,000	60.000
31	493,000	197,000	60.041
TOTAL	17,315,000	15,548,000	

Avg	Avg Daily DIFF	Avg	% Diff
558,548	57,000	501,548	10.775

MS#10			
Date	Ultrasonic Gallons	Laser Gallons	% Diff
1	1,158,000	883,000	23.748
2	1,262,000	995,000	21.157
3	961,000	797,000	17.066
4	732,000	692,000	5.464
5	687,000	658,000	4.221
6	667,000	648,000	2.849
7	557,000	536,000	3.770
8	504,000	491,000	2.579
9	425,000	407,000	4.235
10	438,000	417,000	4.795
11	652,000	579,000	11.196
12	547,000	508,000	7.130
13	522,000	486,000	6.897
14	474,000	433,000	8.650
15	474,000	431,000	9.072
16	432,000	387,000	10.417
17	410,000	370,000	9.756
18	402,000	349,000	13.184
19	395,000	341,000	13.671
20	399,000	346,000	13.283
21	464,000	403,000	13.147
22	547,000	475,000	13.163
23	421,000	361,000	14.252
24	402,000	349,000	13.184
25	421,000	366,000	13.064
26	424,000	368,000	13.208
27	470,000	401,000	14.681
28	430,000	365,000	15.116
29	465,000	396,000	14.839
30	449,000	378,000	15.813
31	471,000	396,000	15.924
TOTAL	17,062,000	15,012,000	

Avg	Avg Daily DIFF	Avg	% Diff
550,387	63,187	487,200	11.275