Year of 2015 Chapter 94 Annual Report
Buckingham Township
Furlong WWTP
WQM Permit # 0911402 issued June 3, 2013, amended in January, 2015
Bucks County

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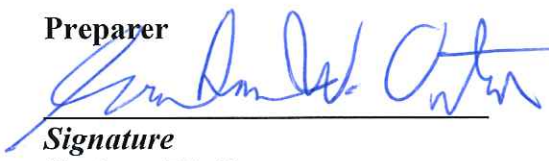

Signature
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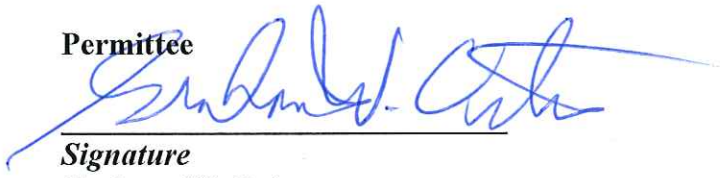
Permittee



Signature
Graham W. Orton
Buckingham Township

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INTRODUCTION

The Furlong WWTP serves several of the Furlong area developments. The service area is all in Buckingham Township and the Township is the sole operator but the system is still partly owned by the developers – primarily Toll Brothers.

The Kaplan Lagoon and Sprayfield were constructed in 1988-89 and Furlong Plant expansions occurred in 2000, 2004 and 2015 (under latest DEP permit 0911402). The plant consists of 4 sequential treatment lagoons (lagoon #1 is divided into two by a baffle) and two sprayfields.

HYDRAULIC AND ORGANIC LOADINGS

Line graphs showing 5-year past and projected Hydraulic and Organic loading are inserted between pages 9 and 10.

The permitted and constructed capacities of the Furlong WWTP (as of March, 2015):

Treatment Annual Average (AA) Capacity Permitted = 304,000 gpd (raw wastewater influent)
Spray Irrigation – with zones 5 & 6 constructed = 295,881 gpd (after 118,970 gpd from the Buckingham Village WWTP is deducted and the Yerkes unconstructed field is deducted)
Organic Design & Constructed Capacity = 1,001 lb/day (raw wastewater to the Furlong primary treatment lagoon)
Note that the seasonal discharge of treated wastewater from the Buckingham Village WWTP max ave of 0.236 MGD and 49 lbs/day to the Final Furlong lagoon is not counted in this study since it is fully treated and this load stacks on the 0.304 MGD and 1,001 lbs/day that is dedicated for the raw wastewater only.

Hydraulic Loading:

a. The calendar year's AA flow is less than the permitted and constructed AA capacity.

b. The Furlong WWTP has never exceeded the hydraulic design or permitted capacity nor is it expected to.

c. Neither a CAP nor CMP is required for this facility

d. A High Flow Maintenance Plan (HFMP) has not been prepared for the Furlong WWTP. This is a lagoon treatment plant which is not affected by short duration rain events. Very wet winters can cause the plant to enter the freeboard storage designed and constructed as a safety feature. The plant entered freeboard in February-March, 2014 because of the extreme winter weather and the Buckingham Village WWTP discharge was sent to Furlong pending completion of construction (BVWWTP flow normally goes to stream from

November through April). In the extremely unlikely event that the lagoons went well past the freeboard and threatened to overflow, the treated wastewater from the final lagoon would either be hauled or pumped (this is a reversal of the normal flow direction and is possible with the existing piping as long as the discharge from the Village Plant is well below the limit) to the Buckingham Village or other treatment plant or be chlorinated and discharged under less than ideal conditions on the sprayfields, rather than being allowed to spill over the lagoon banks. After the back-to-back storms Irene and Lee, the lagoons needed to be managed down and we were allowed to make up flow by spraying from the "bank" of flow not sprayed in previous months. We do not expect that we will need to do that again.

e. Table 1 below, in the DEP recommended format, provides tabular data of the historic 5-year hydraulic loading *(flows for June and August, 2012 will not be the same as reported on DMRs since we reported hard meter reads through July of 2014 then back to PLC meter reads from August, 2014 to match the DMR spreadsheet submissions. The difference between hard and PLC meters is always an insignificant +/- 2-4%).*

Table 1

	Hydraulic Loading (MGD)					**Rainfall (inches)**
Month	**2011**	**2012**	**2013**	**2014**	**2015**	**2015**
January	0.1549	0.1720	0.1738	0.1764	0.1851	4.99
February	0.1639	0.1655	0.1730	0.1843	0.1799	2.68
March	0.1675	0.1636	0.1719	0.1831	0.1930	6.43
April	0.1666	0.1645	0.1694	0.1823	0.1823	3.14
May	0.1697	0.1684	0.1596	0.1914	0.1837	1.28
June	0.1516	0.1571	0.1654	0.1830	0.1845	7.00
July	0.1482	0.1495	0.1664	0.1654	0.1694	3.60
August	0.1709	0.1629	0.1732	0.1627	0.1704	3.80
September	0.1816	0.1694	0.1550	0.1788	0.1755	3.08
October	0.1665	0.1723	0.1929	0.1794	0.1824	4.93
November	0.1743	0.1719	0.1749	0.1857	0.1801	1.95
December	0.1783	0.1790	0.1842	0.1926	0.1897	4.65
Annual Average (AA)	**0.1662**	**0.1663**	**0.1716**	**0.1804**	**0.1813**	
3 Month Max. Average	**.1741**	**0.1744**	**0.1840**	**0.1859**	**0.1863**	
Ratio (3 Month Max to AA ratio)	**1.05**	**1.05**	**1.07**	**1.03**	**1.03**	
5-Year Average Hydraulic Ratio = 1.05						

Organic loading of the Furlong WWTP:

f. Organic loadings at the Furlong WWTP were derived from a single grab sample per month pre-October, 2011 and two per month thereafter. The loading is coming from 100% domestic/office connections and, over a statistically significant (no less than three) number of samples, the loading average will not vary by more than 20 to 30% with peaks less than 150% of the 12-month average in virtually all cases. The true test of a WWTP's ability to treat influent organic loading is its performance as determined by the effluent parameters. This is especially true in a lagoon treatment system where the minimum retention volume is measured in weeks, not hours.

g. A minimum of three consecutive month grab samples will generate statistically significant values but a single grab sample will not. The single month peak of 919 lbs/day in March of 2011, based on a statistically insignificant grab sample, did exceed the then-permitted 772 lbs/day (now 1,001 lbs/day). The May, 2012 average of 2 values was 798 lbs/day which also exceeded the then-permitted loading. The single BOD_5 of 1618 on 11/20/2014 can not be considered statistically representative of actual loading but we are reporting it in conformance to DEP SERO requirements.

h. A lagoon treatment plant works on the principal of very long retention times and very low MLSS concentrations. It is, therefore, able to assimilate and treat wide organic loading variations that might occur. Although we believe that long-term grab sampling with averaging has been adequate to typify the WWTP's loading, we have taken steps to obtain more samples and have changed the way we calculate to the DEP-preferred instantaneous (single day) method which is flow-prorated by time if necessary.

i. Based on the historical method of measuring organic loading, there is no existing or projected organic overload condition. The SERO method predicted a higher projected value in the year 2014 report only due to the single month peak in 2014.

j. Sampling frequency, recommended as follows:

Recommended Sampling Frequency for Influent BOD_5	
Annual Average Capacity	**Minimum Sampling Frequency**
> 1.0 MGD	Once per week
0.050 to 1.0 MGD	Twice per month
<0.050 MGD	Once per month

k. Type of sample taken – once or twice-per-month grab samples tested for BOD_5, not $CBOD_5$.

l. The influent BOD_5 sample is taken from the influent pump station's wet well. This station takes the flow from 100% of the connections.

m. There is no septage hauled to this plant

n. Influent loadings are calculated using the sample day's time-prorated average flow and the single or twice monthly sample(s) result. In 2011, January through November flows were for a 7-day average, after that, we tried to get just the sample day's flow. Table 2 below, shows the calendar year's organic loading sampling data:

Table 2

Organic Loading Sampling Data

	A	B	C = A x B x 8.34	
Date of sample	**BOD5 (mg/l)**	**Flow (MGD) – week ave or day sampled**	**Weekly or daily BOD5 (lbs/day)**	**Monthly Average (lbs/day)**
1/8/15	321	0.1759	471	
1/15/15	542	0.1724	779	**625**
02/5/15	208	0.1755	304	
02/12/15	301	0.1749	439	**372**
03/5/15	214	0.2099	375	
03/12/15	189	0.2043	322	**349**
04/2/15	358	0.1714	512	
04/16/15	371	0.1710	529	**521**
05/7/15	215	0.1814	325	
05/21/15	292	0.1737	423	**374**
06/5/15	303	0.1823	461	
06/11/15	289	0.1820	439	**450**
07/9/15	269	0.1357	304	
07/23/15	265	0.1664	368	**336**
08/6/15	411	0.1625	557	
08/13/15	275	0.1610	369	**463**
09/3/15	573	0.1739	831	
09/18/15	272	0.1821	413	**622**
10/1/15	229	0.1753	335	
10/8/15	295	0.1689	416	**376**
11/5/15	374	0.1710	533	
11/12/15	217	0.1658	300	**417**
12/3/15	296	0.1834	453	
12/10/15	285	0.1703	405	**429**
Year 2015	**307**			**445**

Table 3 below shows the Furlong WWTP's historic 5-year organic loading data:

Table 3					
Organic Loading (lbs/day)					
Month	**2011**	**2012**	**2013**	**2014**	**2015**
January	380	449	339	275	625
February	272	362	391	482	372
March	919	367	403	393	349
April	247	365	488	392	521
May	375	798	487	499	374
June	448	330	569	309	450
July	273	312	353	354	336
August	341	268	327	496	463
September	331	371	415	434	622
October	297	275	551	556	376
November	542	389	376	1049	417
December	413	299	411	444	429
Annual Average	**403**	**382**	**426**	**474**	**445**
Ratio (Max Month to Annual Average Ratio)*	**2.28**	**2.09**	**1.34**	**2.21**	**1.40**
5-Year Average Organic Ratio = 1.86					

*While the hydraulic loading "peaking factor" is determined using the 3-Month-Max to AA ratio, the organic loading "peaking factor" is determined using the Maximum Month (i.e., the single highest monthly average in the calendar year) to AA ratio. However, based on Buckingham's historical sampling, the one month peak ratio of 1.40 may have less significance than the three month peak ratio of 1.07 in 2015.

5-YEAR HYDRAULIC AND ORGANIC LOADING PROJECTIONS

b. The Department has requested that flow projections be determined using a "5-year adjusted annual average flow," rather than a 5-year average or current calendar year AA flow. The guidance provided in the SERO template gives similar predictions for the Furlong WWTP to those we have made in the past using our original method, which method is quite similar to the SERO approach once a baseline average is computed. In our original method used to project annual averages, new EDUs are counted as if they were added mid-year. For this year's report original method, the 2016 base average flow is calculated using the 2015 flow as a base. To that we add ½ of the EDUs newly connected in 2015 (250 gpd/EDU) and ½ of the EDUs expected to be added in 2016. We use the same method

for the 3-month peak except we add the full expected peak EDU (1.2 x 250 = 300 gpd/peak EDU), rather than ½ the EDU for only the 2016 expected new EDUs. The graph is prepared showing this method as well as the DEP method. As expected, the difference between the two sets of predictions is small. Eventually we may switch to using just the DEP method once we are sure both methods reach essentially the same projection over several years.

c. Using the old method, average annual organic loading for the enclosed graph is calculated with the 2015 average becoming the 2016 base to which we add ½ of previous year and ½ of the current year EDU contribution. We show the results using the original method and the DEP SERO method on the organic loading graph. The difference between the two methods is significant (9.4%) but should decrease to near zero as time progresses. Our original method does not predict an organic overload since the 2013-issued phase 3 permit has 1001 lbs/day as the limit. It will be interesting to see which method is closest after 5 years.

d. To project organic loading, we use 0.17 pounds of BOD_5 per person per day and use 4 people per new EDU which is higher than the census data of 2.7 people per EDU. In the year 2018, when the Kaplan reserved commercial EDUs might come on line, we used 2 lbs/day/EDU (vs domestic of 0.68 lb/day/EDU) since some of the commercial space is likely to be devoted to food preparation.

e. No hydraulic (average and peak 3-month) or organic (average and peak one month) overload is projected at the Furlong WWTP through 2020.

f. Table 4 lists the organic projections we calculated using the SERO-recommended method. Our historic method yielded a one-month peak average of 854 lb/day in 2020 – lower than the SERO method for 1-month peak of 944 by 9.4%. Last year's difference was 18%

Table 4
Organic Loading Projections

Year	Annual Average BOD_5 Loading Projections[1] (lbs/day)	Maximum Monthly BOD_5 Loading Projections[2] (lbs/day)
2016	446	830
2017	447	831
2018	506	941
2019	507	943
2020	508	944

[1]AA projections = (Current report year's AA loadings) + (loadings from proposed EDUs)
[2] Max Month projections = (AA projection) x (5-year Average Organic Ratio)

Calculating the Five-Year Adjusted Annual Average For Chapter 94 Flow Projections

A. Determine the new flow in million gallons per day (MGD), which corresponds to the new EDUs connected for each calendar year. Note that there are 1227 ultimate EDU's (Watson Creek is removed) and 304,000 gpd full design which correlates to a design EDU of 248 gpd which is greater than the current observed EDU of about 160 gpd. As all the developments and systems age, flows per EDU will continue to increase. For this exercise we are using the DEP recommended 250 gpd/EDU:

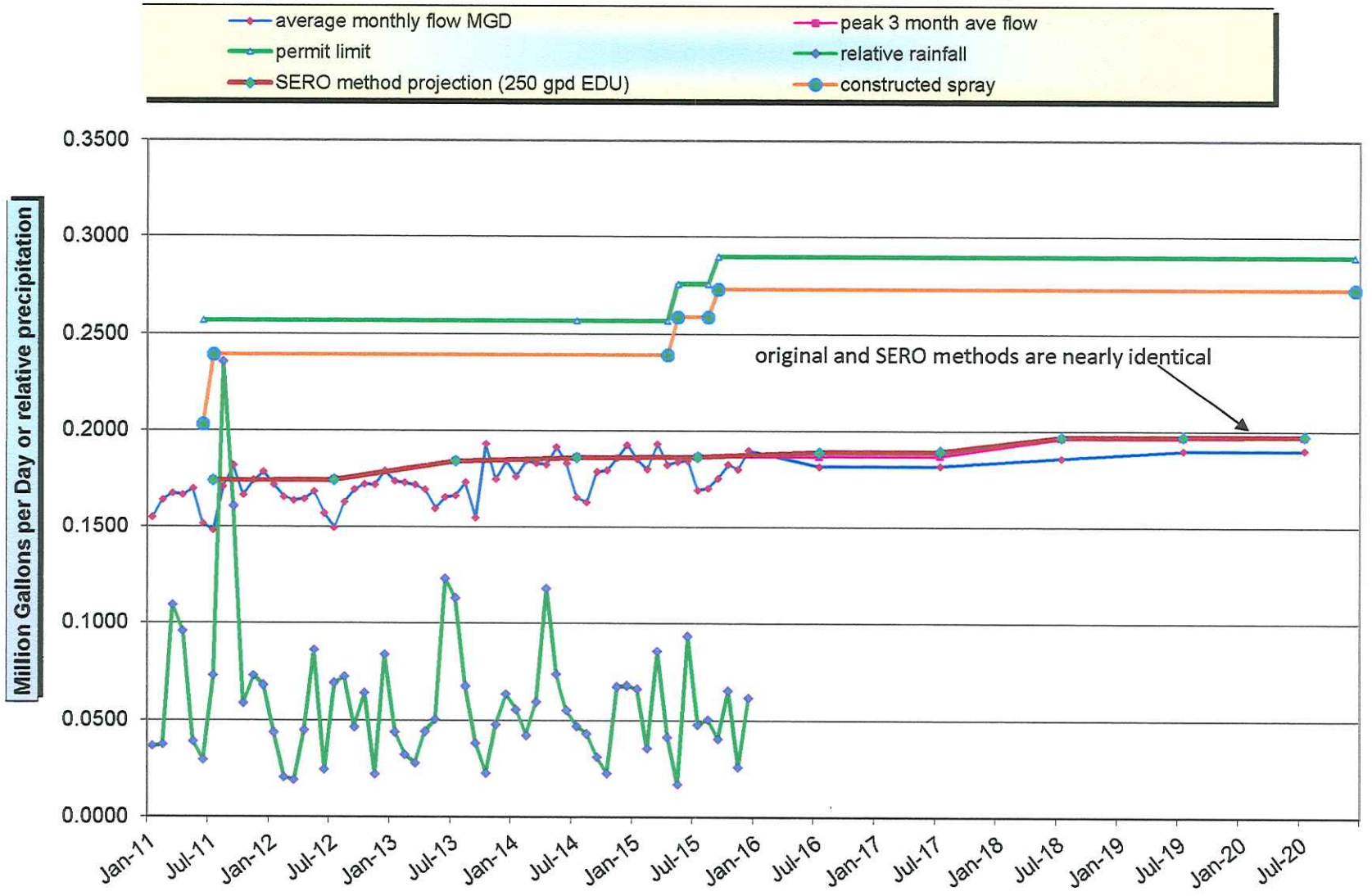
Table 5			
Year	**# of EDUs connected**	**gpd/EDU**	**New Flow (MGD)**
2011	41	250	0.01025
2012	26	250	0.00650
2013	25	250	0.00625
2014	17	250	0.00425
2015	0	250	0.00000

B. Adjust each calendar year by adding the flows from new connections to the annual average flow for each of the previous calendar years.

Table 6							
Year	**AA Flow in MGD**	**All projects connected (provide flows approved in planning modules or exemptions in MGD—include any connected projects that did not require planning)**					**Adjusted AA Flow**
		2011	2012	2013	2014	2015	
2011	0.1662		0.00650	0.00625	0.00425	0.00000	0.1832
2012	0.1663			0.00625	0.00425	0.00000	0.1768
2013	0.1716				0.00425	0.00000	0.1759
2014	0.1804					0.00000	0.1804
2015	0.1813						0.1813
Total	**0.8658**					**Total**	**0.8976**
5 Yr Avg	**0.1732**					**5 Yr Adj Avg**	**0.1795**

C. We next calculate the five-year flow projections starting with the five-year adjusted annual average flow. Each year's projection is based on the estimated number of new connections for that calendar year. The flow from the EDUs expected to connect in 2016 are added to the five-year adjusted annual average calculated above. Each year's projected annual average flow was then multiplied

Furlong WWTP Hydraulic Loading Graph



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Furlong WWTP Hydraulic Loading Graph (does not include treated wastewater from Buckingham Village WWTP)

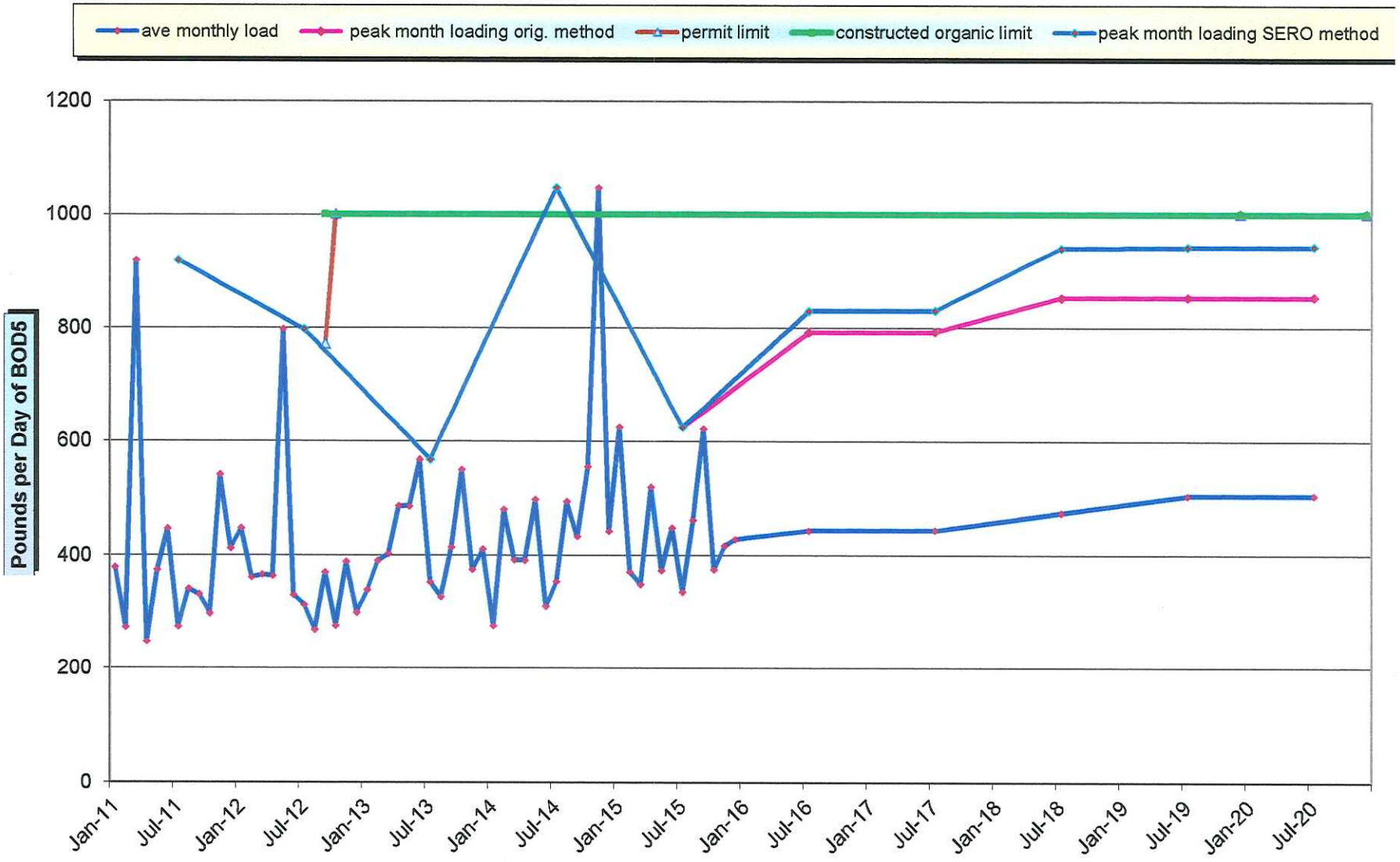
Table IA-1																
month	flow	3 month peak	3 month peak	3 month peak	annual	ratio 3-mo peak	ratio 1-mo peak	SERO proj	flow limit	flow limit	rainfall	relative	Comments	connected	Remaining	total
	MGD	flow MGD	flow MGD	SERO method	average	to average	to average	2011-2015	MGD	spray		rainfall	no BVWWTP	EDUs	committed EDUs	conn + res
		250 gpd edu		250 gpd edu					by permit	no BVWWTP			1/2 Coles			
				flow MGD						1/2 of Coles						
Jan-11	0.1549										2.76	0.037	using Code dept. records			
Feb-11	0.1639										2.82	0.038				
Mar-11	0.1675										8.22	0.110				
Apr-11	0.1666										7.16	0.095				
May-11	0.1697										2.95	0.039				
Jun-11	0.1516								0.2570	0.2030	2.22	0.030				
Jul-11	0.1482	0.1741	0.1741	0.1741	0.1662	1.0481	1.0931	0.1854		0.2394	5.48	0.073	added 41 EDUs in 2011			
Aug-11	0.1709										17.68	0.236				
Sep-11	0.1816										12.05	0.161				
Oct-11	0.1665										4.42	0.059				
Nov-11	0.1743										5.48	0.073	6 new commercial EDU's as of 12-31-2011			
Dec-11	0.1783										5.11	0.068	1100 homes connected as of 12-31-11	1,116	132	1,248
Jan-12	0.1720										3.30	0.044	using Water dept. records			
Feb-12	0.1655										1.56	0.021				
Mar-12	0.1636										1.45	0.019				
Apr-12	0.1645										3.38	0.045				
May-12	0.1684										6.47	0.086				
Jun-12	0.1571										1.85	0.025				
Jul-12	0.1495	0.1744	0.1744	0.1744	0.1663	1.0485	1.0760	0.1854			5.19	0.069	added 26 EDUs in 2012			
Aug-12	0.1629										5.45	0.073	1126 homes connected as of 12-31-12			
Sep-12	0.1694										3.50	0.047	16 commercial connected as of 12-31-12			
Oct-12	0.1723										4.83	0.064				
Nov-12	0.1719										1.68	0.022				
Dec-12	0.1790										6.29	0.084		1,142	106	1,248
Jan-13	0.1738										3.32	0.044				
Feb-13	0.1730										2.43	0.032				
Mar-13	0.1719										2.09	0.028				
Apr-13	0.1694										3.34	0.045				
May-13	0.1596										3.81	0.051				
Jun-13	0.1654										9.24	0.123				
Jul-13	0.1664	0.1840	0.1840	0.1840	0.1716	1.0719	1.1237	0.1854			8.49	0.113	added 25 EDUs in 2013			
Aug-13	0.1732										5.09	0.068	1151 homes connected as of 12-31-13			
Sep-13	0.1550										2.88	0.038	by Lynn's list it would be 1,149			
Oct-13	0.1929										1.72	0.023				
Nov-13	0.1749										3.60	0.048				
Dec-13	0.1842										4.79	0.064	removing coles from total to make 1227 EDUs	1,167	60	1,227
Jan-14	0.1764										4.19	0.056	***deducting Watson Creek 21 EDU - no longer will connect***			
Feb-14	0.1843										3.20	0.043	**this is the new final planning # 1227 EDU's**			
Mar-14	0.1831										4.48	0.060	***bookeeping catches up***			
Apr-14	0.1823										8.87	0.118	added 17 EDUs in 2014			
May-14	0.1914										5.54	0.074				
Jun-14	0.1830										4.16	0.055	hard meter to july, plc after that			
Jul-14	0.1654	0.1859	0.1859	0.1859	0.1804	1.0305	1.0675	0.2185	0.2570		3.53	0.047	added final residential EDUs in 2014			
Aug-14	0.1627										3.26	0.043				
Sep-14	0.1788										2.34	0.031	***added final Heritage commercial EDU's***			
Oct-14	0.1794										1.72	0.023	**this is the new final planning # 1227 EDU's**			
Nov-14	0.1857										5.08	0.068				
Dec-14	0.1926										5.11	0.068	***bookeeping catches up***	1,184	43	1,227
Jan-15	0.1851										4.99	0.067				
Feb-15	0.1799										2.68	0.036				
Mar-15	0.1930										6.43	0.086				
Apr-15	0.1823								0.2570	0.2394	3.14	0.042				
May-15	0.1837								0.2760	0.2590	1.28	0.017				
Jun-15	0.1845										7.00	0.093				
Jul-15	0.1694	0.1863	0.1863	0.1863	0.1813	1.0274	1.0641	0.2287			3.60	0.048	added 0 emergency EDUs in 2015			
Aug-15	0.1704								0.2760	0.2590	3.80	0.051				
Sep-15	0.1755								0.2900	0.2732	3.08	0.041	29 remaining 225 gpdEDUs for Kaplan commercial			
Oct-15	0.1824										4.93	0.066	Heritage comm fully occupied and < reservation			
Nov-15	0.1801										1.95	0.026				
Dec-15	0.1897										4.65	0.062		1,184	43	1,227
Jan-16																
Feb-16																
Mar-16																
Apr-16																
May-16																
Jun-16																

Furlong WWTP Hydraulic Loading Graph (does not include treated wastewater from Buckingham Village WWTP)

Table IA-1

month	flow	3 month peak	3 month peak	3 month peak	annual	ratio 3-mo peak	ratio 1-mo peak	SERO proj	flow limit	flow limit	rainfall	relative	Comments	connected	Remaining	total
	MGD	flow MGD	flow MGD	SERO method	average	to average	to average	2011-2015	MGD	spray		rainfall	no BVWWTP	EDUs	committed EDUs	conn + res
		250 gpd edu		250 gpd edu					by permit	no BVWWTP			1/2 Coles			
				flow MGD						1/2 of Coles						
Jul-16	0.1814	0.1866	0.1866	0.1888	0.1814								add 1 emergency EDU in 2016			
Aug-16													using 2015 peak + 1.2 x added 2016 EDUs			
Sep-16																
Oct-16													29 remaining EDUs for Kaplan commercial			
Nov-16																
Dec-16														1,185	42	1,227
Jan-17																
Feb-17																
Mar-17																
Apr-17																
May-17																
Jun-17																
Jul-17	0.1817	0.1869	0.1869	0.1891	0.1817								add 1 emergency EDU in 2017			
Aug-17													using 2016 peak + 1.2 x added 2017 EDUs			
Sep-17																
Oct-17													29 remaining EDUs for Kaplan commercial			
Nov-17																
Dec-17														1,186	41	1,227
Jan-18																
Feb-18																
Mar-18																
Apr-18																
May-18																
Jun-18													*add 29 Kaplan commercial 225gpd EDUs in 2016 - 6,500 gpd for edu count*			
Jul-18	0.1857	0.1962	0.1962	0.1968	0.1857								add 2 emergency EDUs in 2018			
Aug-18													using 2017 peak + 1.2 x added 2018 EDUs			
Sep-18																
Oct-18																
Nov-18																
Dec-18														1,217	10	1,227
Jan-19																
Feb-19																
Mar-19																
Apr-19																
May-19																
Jun-19																
Jul-19	0.1897	0.1965	0.1965	0.1971	0.1897								add 1 emergency EDUs in 2019			
Aug-19													using 2018 peak + 1.2 x added 2019 EDUs			
Sep-19																
Oct-19																
Nov-19																
Dec-19														1,218	9	1,227
Jan-20																
Feb-20																
Mar-20																
Apr-20																
May-20																
Jun-20																
Jul-20	0.1899	0.1968	0.1968	0.1974	0.1899								add 1 emergency EDUs in 2020			
Aug-20													using 2019 peak + 1.2 x added 2020 EDUs			
Sep-20																
Oct-20																
Nov-20																
Dec-20									0.2900	0.2732				1,219	8	1,227

Furlong WWTP Organic Loading Graph



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Furlong WWTP Organic Loading Data

Table IA-2							
month	organic load	1 month peak	1 month peak	annual	organic limit	constructed	Comments
	# BOD/day	# BOD/day	SERO method	average	# BOD/day	organic limit	
Jan-11	380						
Feb-11	272						
Mar-11	919						
Apr-11	247						
May-11	375						
Jun-11	448						
Jul-11	273	919	919	403			1100 homes + 16 (10 old 6 new) commercial connected as of 12-31-11
Aug-11	341						using Code dept. records
Sep-11	331						3-month peak
Oct-11	297						524
Nov-11	542						
Dec-11	413						
Jan-12	449						
Feb-12	362						
Mar-12	367						
Apr-12	365						26 new homes in 2012
May-12	798						1126 homes + 16 commercial connected as of 12-31-12
Jun-12	330						using Code dept. records +2
Jul-12	312	798	798	382			3-month peak
Aug-12	268						510
Sep-12	371				772	1,001	
Oct-12	275				1,001		
Nov-12	389						
Dec-12	299						
Jan-13	339						
Feb-13	391						
Mar-13	403						
Apr-13	488						
May-13	487						
Jun-13	569						25 new homes in 2013
Jul-13	353	569	569	426			1151 homes + 16 commercial connected as of 12-31-13
Aug-13	327						3-month peak
Sep-13	415						515
Oct-13	551						3-month peak ratio
Nov-13	376						1.21
Dec-13	411						
Jan-14	275						
Feb-14	482						
Mar-14	393						
Apr-14	392						
May-14	499						
Jun-14	309						
Jul-14	354	1049	1049	474			17 new homes in 2014
Aug-14	496						3-month peak
Sep-14	434						683
Oct-14	556						3-month peak ratio
Nov-14	1049						1.44
Dec-14	444						
Jan-15	625						
Feb-15	372						
Mar-15	349						
Apr-15	521						DEP method
May-15	374						using DEP calculated base for 2016
Jun-15	450						using 1.86 average 5-year peak multiplier
Jul-15	336	625	625	445			0 new homes in 2015
Aug-15	463						3-month peak
Sep-15	622						474
Oct-15	376						3-month peak ratio
Nov-15	417						1.07
Dec-15	429						*1.41*
Jan-16							*1-month peak ratio*
Feb-16							

Furlong WWTP Organic Loading Data

Table IA-2							
month	organic load	1 month peak	1 month peak	annual	organic limit	constructed	Comments
	# BOD/day	# BOD/day	SERO method	average	# BOD/day	organic limit	
Mar-16							
Apr-16							
May-16							
Jun-16							
Jul-16	445	793	830	445			add 1 EDU @ pop. 4 x 0.17lb/person
Aug-16							
Sep-16							
Oct-16							
Nov-16							
Dec-16							
Jan-17							
Feb-17							
Mar-17							
Apr-17							
May-17							
Jun-17							
Jul-17	446	793	831	446			add 1 EDU @ pop. 4 x 0.17lb/person
Aug-17							
Sep-17							
Oct-17							
Nov-17							
Dec-17							
Jan-18							
Feb-18							
Mar-18							adding 58 lbs load
Apr-18							*assuming restaurant use*
May-18							these are the Kaplan shopping ctr EDU's
Jun-18							add 29 commercial EDU @ est 2lb/EDU
Jul-18	476	853	941	476			add 2 EDU @ pop. 4 x 0.17lb/person
Aug-18							
Sep-18							
Oct-18							
Nov-18							
Dec-18							
Jan-19							
Feb-19							
Mar-19							
Apr-19							
May-19							
Jun-19							
Jul-19	506	853	943	506			add 1 EDU @ pop. 4 x 0.17lb/person
Aug-19							
Sep-19							
Oct-19							
Nov-19							
Dec-19					1,001	1,001	
Jan-20							
Feb-20							
Mar-20							
Apr-20							
May-20							
Jun-20							
Jul-20	506	854	944	506			add 1 EDU @ pop. 4 x 0.17lb/person
Aug-20							
Sep-20							
Oct-20							
Nov-20							
Dec-20					1,001	1,001	

by the five-year average hydraulic ratio (or peaking factor of 1.05) to determine the projected three-month maximum flow.

Table 7

Adjusted Projections

Year	Previous Year's Annual Average Flow[1]	New EDUs[5]	Increased Flow[2] (MGD)	Projected Annual Average Flow[3] (MGD)	Projected Max 3-Month Flow[4] (MGD)
2016	0.1795	1	0.00025	0.1798	0.1888
2017	0.1798	1	0.00025	0.1801	0.1891
2018	0.1801	29	0.00725	0.1874	0.1968
2019	0.1874	1	0.00025	0.1877	0.1971
2020	0.1877	1	0.00025	0.1880	0.1974

[1] The first year's projection (2015 in this example) starts with the 5-year adjusted annual average that was calculated in A through B, above.
[2] Increased Flow = (New EDUs x 250 gpd/EDU)/1,000,000
[3] Projected Annual Average Flow = Previous Year's AA Flow + Increased flow
[4] Projected Max 3-Month = Projected Annual Avg. Flow x 5-year average hydraulic ratio as calculated in table 1.
[5] With the exception of two possible emergency EDU connection, the 2018 EDUs are commercial and related to a flow limit of 6,500 gpd or 26.1 (rounded up to 27) EDUs with DEP's 250 gpd/EDU vs the old method's 29 EDUs.

D. Considerations on projection figures:

Future connections to the Furlong WWTP are shown in the 5-year planning window. With the possible exception of one or two emergency connections, any other connections could not be made before the plant is expanded. I & I is not a major problem in this system with a 3-month peak hydraulic multiplier of less than 1.05. The SERO method for projecting hydraulic loading generates predicted flows about the same as using the Buckingham historical method. The results of using both methods are plotted on the hydraulic loading graph. Neither method predicts a hydraulic overload. The Township is currently reviewing all the planning numbers and recalculating rainfall into lagoons, etc. now that occupancy is complete except for the reserved 6,500 gpd for the Kaplan commercial tract.

SEWER EXTENSIONS

a. There were no sewer extensions in 2015.
b. There were no sewer extensions approved or exempted in the past year in accordance with the PA Sewage Facilities Act (35 P.S. §§ 750.1—750.20)

and Chapter 71 (relating to administration of the sewage facilities program), but not yet constructed;

c. There is one known proposed project in the Furlong area that would require public sewers – preliminary discussions are underway. A 21 home development to the West of York Road known as Watson Creek was approved under Act 537 but it has been changed to a 3-home development with OLDS, removed from the planning numbers and recently withdrawn.

PROGRAM FOR SANITARY SEWER MONITORING, MAINTENANCE, AND REPAIR

a. Monitoring – none except manholes are spot checked
b. Maintenance – routine cleaning of PS #16 gravity interceptor.
c. Repair – PS #16 gravity interceptor in early 2012
d. Rehabilitation - manhole receiving discharge from PS #17 was relined due to H_2SO_4 degradation caused by the oxidation of reduced sulfur in the raw wastewater under anaerobic conditions that occur in the long force main.
e. Routine and special activities – pump station #17 flow study is completed and recommendations made but not constructed.
f. Personnel and equipment used – three certified wastewater operators inspect
g. Sampling frequency - none
h. Quality assurance - none
i. Data analyses - none
j. Infiltration/inflow (I/I) monitoring – none except at pump stations
k. Maintenance and control of combined sewer regulators during the past year: not applicable

The sewer system is relatively new – constructed between 2000 and 2008. I & I is very low. A 5-year average/peak flow ratio of 1.05 and two most recent year's ratio of 1.03 does not warrant sub-basin studies.

CONDITION OF THE SEWER SYSTEM

l. Bypassing - none
m. Combined sewer overflows – not applicable
n. Sanitary sewer overflows – none in 2015
o. Excessive infiltration – none
p. Other system problems – three manholes receiving flow from PS 14, 15 and 16 were acid-damaged by forcemain anoxic discharges and were relined in 2013.

<u>Discussion of available existing and future capacity</u>.

q. The age of the sewer system is 7 to 16 years
r. 100% PVC pipe is used
s. All sewer capacities were analyzed for peaking during the design and permitting stages with a minimum peak factor of 4.

Discuss any portions of the sewer system in which surcharging occurs:

t. There is no known system surcharging

u. There were no dry or wet weather SSO's during the report year.

v. Flows are monitored at the main pump station that transfers all flow from the collection system to the WWTP. The system is about 21% gravity to the WWTP and 79% pumped to the main pump

w. All sewers were designed with very high peak-conveyance capacity and there is relatively low I & I in this system.

SEWAGE PUMPING STATIONS

x. "Maximum pump rate" is the permitted hydraulic design capacity of the station, which excludes the capacity of the backup pump.

y. "Present maximum flows" are estimated (PS 14 & 15) or metered (PS 16 & 17) - peak instantaneous flow data is not available for the pump stations. The stations were all designed to handle peaks as dictated by DEP design criteria with only one pump in service. The second pump is redundant but may also operate in tandem ("lag") with the lead pump if the lead pump is partly blocked or in extreme high flow conditions. Because of the desire to keep the 2-hour fill time for the stations, the lag pump is set to start at a point far below where it would need to come on to pump extra in order to keep the stations from potentially overflowing. Partly blocked pumps evidence themselves when pumping hours are analyzed and are immediately serviced. If both pumps at a pump station fail, the station is designed to hold at least two hours of flow with no pumping. An alarm notifies the operators of high wet well level – set a few inches above the station's normal HWL. The Township's pump stations are all listed with Sanders Power Equipment who can supply the correct temporary generator or pump within an hour or two from notification of the need. Gary's Septic, Clemens Septic and Norbill Disposal are on-call to provide transient emergency pumping and hauling if the station is completely out of service. Response time has been adequate to avoid station overflows in nearly every imaginable situation, including multiple stations being completely out of service. Pump Station #16 was problematical – partly due to electrical and control malfunctions and partly due to the original slope of the final gravity sewer into the station. The electrical problems have been addressed with no subsequent problems. The influent gravity sewer was replaced and the slope increased early in 2012 and that seems to have solved the problem. PS 17 forcemain was thought to have a partial blockage but the developer's contractor investigated, found none but will provide a solution in 2016. PS 14 and 15 will be getting meters and generators during the Township's comprehensive pump station program – contract has been awarded and work will occur in 2016.

Table 8						
Pump Stations						
Pump Station Name	**Number of Pumps**	**Permitted Capacities**		**Present Flows**		**Projected Flows**
		AA Permitted Capacity (gpd)	**Hydraulic Design Capacity (*w/o backup pump*) (min gpm)**	**2015 Annual Average Flows (gpd)**	**2015 Peak 3-Day Flow (gpd)**	**2-Year Projected Maximum[1] Flow (gpd)**
PS No. 14	2	40,725	108	35,147	43,560	54,780
PS No. 15	2	8,100	78	6,717	9,920	12,240
PS No. 16	2	208,000	370	58,815	67,950	116,500
PS No. 17	2	32,550	90	21,158	30,170	35,532

[1] 0 new projected 300 gpd (1.2 x 250 gpd ave EDU) connections were added to the 3-day peak 2013 flow of 54,780 gpd for PS 14. ***Timers may over-record flow as pumps wear will be metered in 2016***
0 new projected 300 gpd (1.2 x 250 gpd ave EDU) connections were added to the 3-day peak 2013 flow of 12,240 gpd for PS 15. ***Timers may over-record flow as pumps wear will be metered in 2016***
0 new projected 300 gpd (1.2 x 250 gpd ave EDU connections were added to the 3-day peak 2011 flow of 116,500 gpd for PS 16. ***2014 peak was 92,960 gpd***
0 new projected 300 gpd (1.2 x 250 gpd ave EDU) connections were added to the 3-day peak 2012 flow of 35,532 gpd for PS 17. ***2014 peak was 30,617 gpd***

INDUSTRIAL WASTES

There are no industrial wastes or significant users.

CORRECTIVE ACTION PLAN

A Corrective Action Plan is not needed.

CALIBRATION REPORTS

All Furlong meters were calibrated in November of 2015 and the reports are attached after page 13. The PS 16 and 17 meters were also certified and those reports are attached.

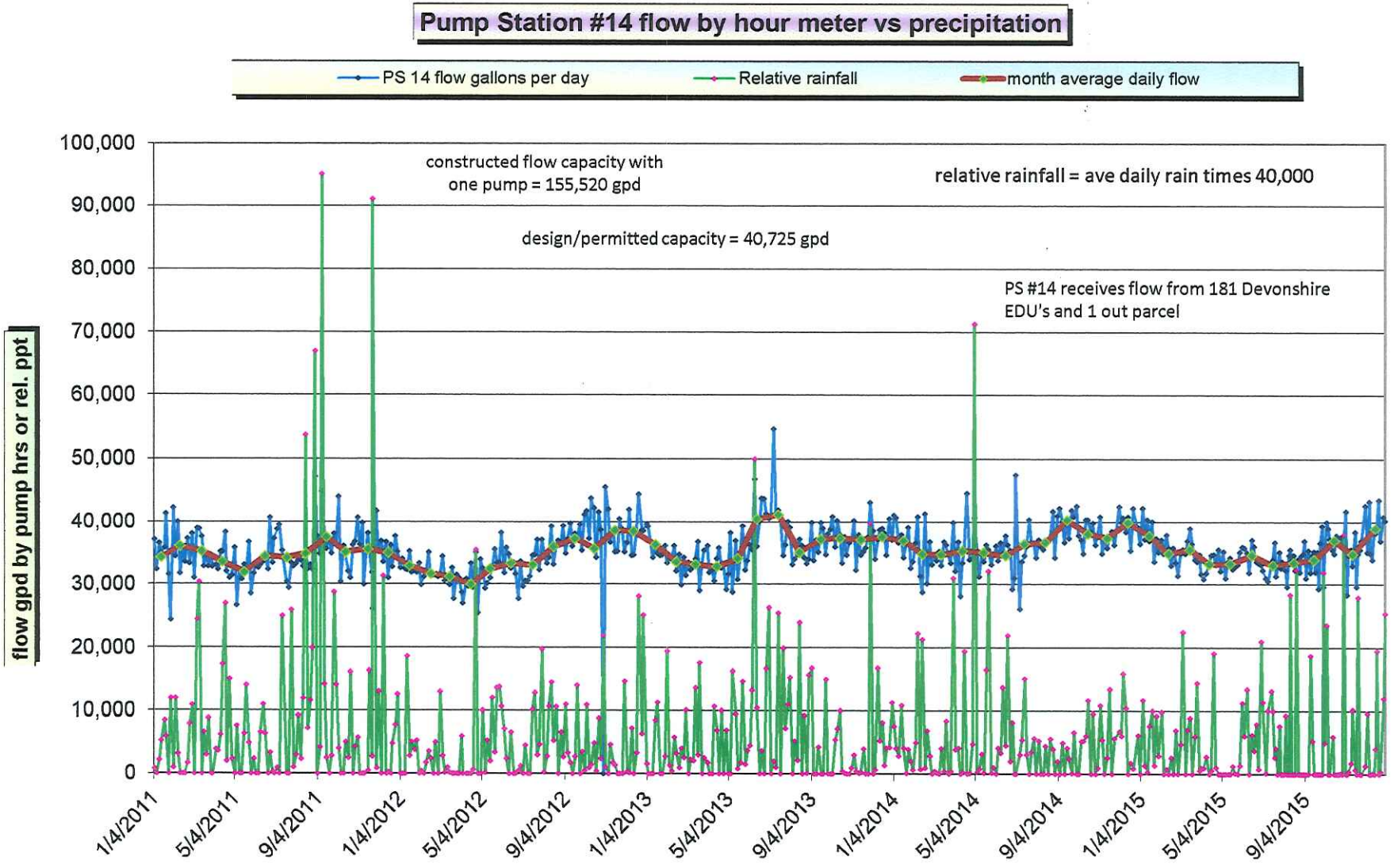
TRIBUTARY MUNICIPALITY REPORTS

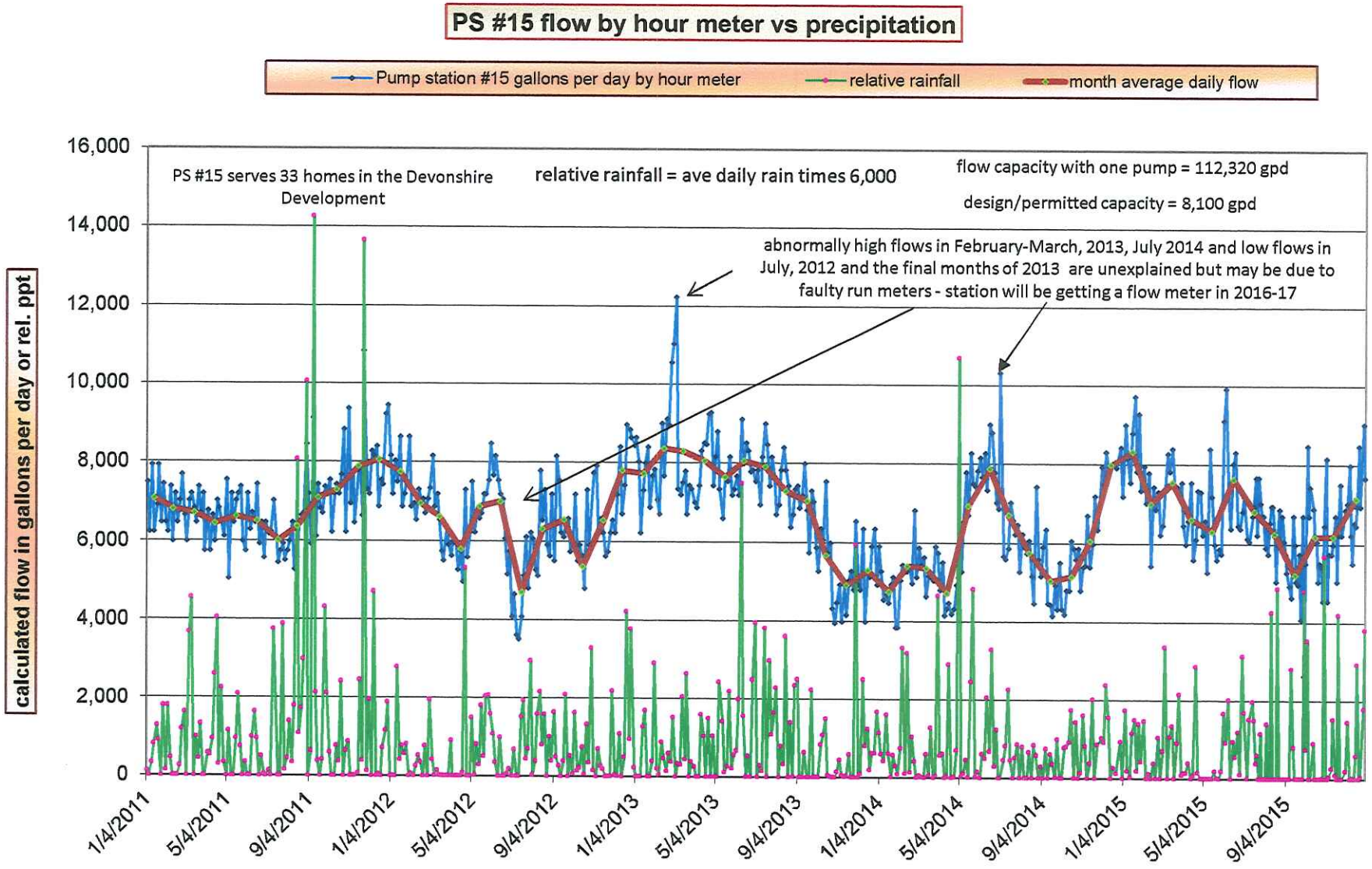
Not applicable

ATTACHMENTS

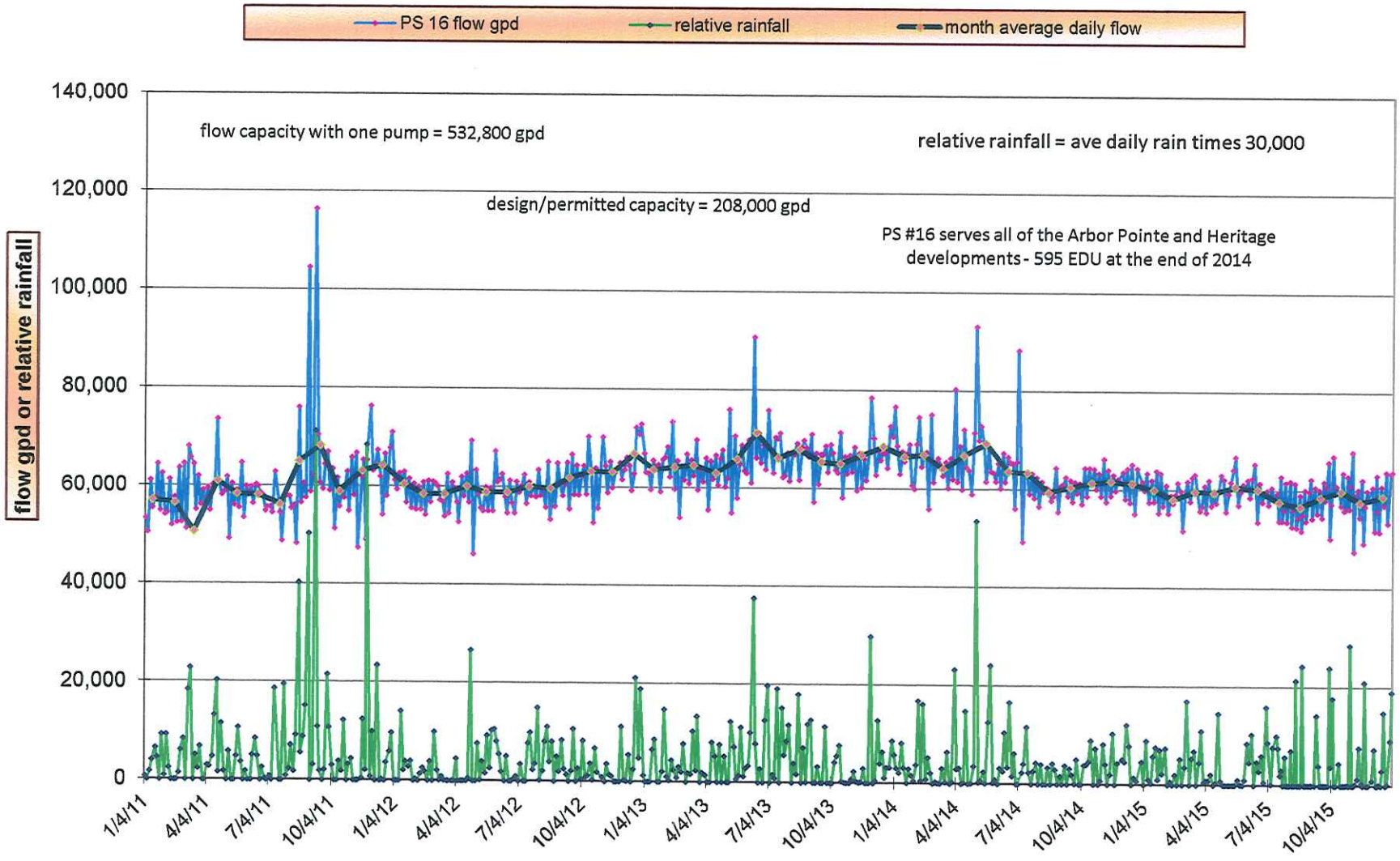
Meter Calibration reports

Pump Station graphs showing 5-year history.


Pump Station #14 flow by hour meter vs precipitation
PS 14 flow gallons per day
Relative rainfall
month average daily flow
flow gpd by pump hrs or rel. ppt
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
constructed flow capacity with one pump = 155,520 gpd
design/permitted capacity = 40,725 gpd
relative rainfall = ave daily rain times 40,000
PS #14 receives flow from 181 Devonshire EDU's and 1 out parcel
1/4/2011
5/4/2011
9/4/2011
1/4/2012
5/4/2012
9/4/2012
1/4/2013
5/4/2013
9/4/2013
1/4/2014
5/4/2014
9/4/2014
1/4/2015
5/4/2015
9/4/2015

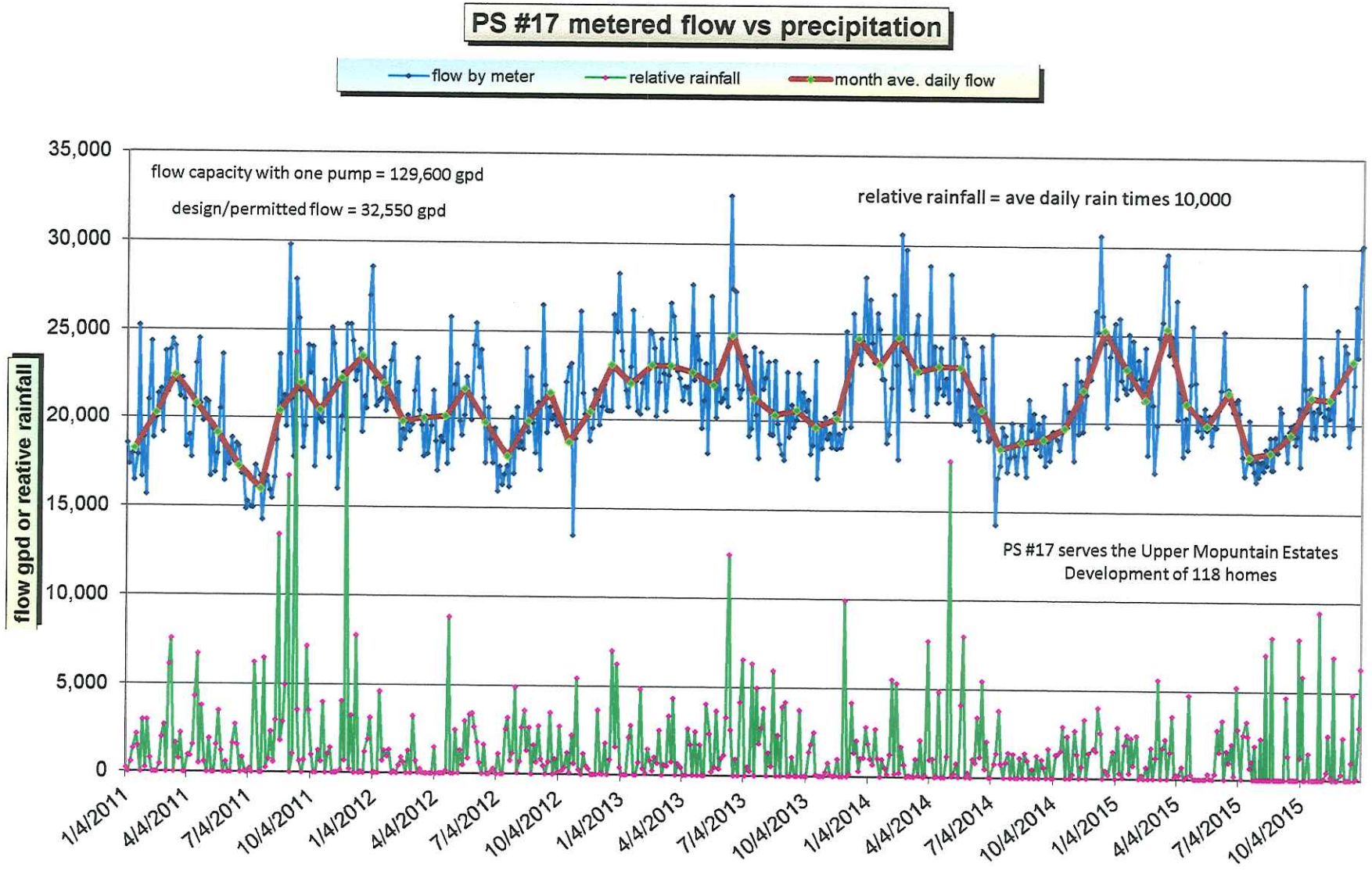

PS #15 flow by hour meter vs precipitation
Pump station #15 gallons per day by hour meter
relative rainfall
month average daily flow
calculated flow in gallons per day or rel. ppt
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
PS #15 serves 33 homes in the Devonshire Development
relative rainfall = ave daily rain times 6,000
flow capacity with one pump = 112,320 gpd
design/permitted capacity = 8,100 gpd
abnormally high flows in February-March, 2013, July 2014 and low flows in July, 2012 and the final months of 2013 are unexplained but may be due to faulty run meters - station will be getting a flow meter in 2016-17
1/4/2011
5/4/2011
9/4/2011
1/4/2012
5/4/2012
9/4/2012
1/4/2013
5/4/2013
9/4/2013
1/4/2014
5/4/2014
9/4/2014
1/4/2015
5/4/2015
9/4/2015

Pump Station #16 metered flow vs precipitation



H:\EXCEL\Wastewater Pump Stations\Pump Stations Master 2003-16 & graphs.xls

PS #17 metered flow vs precipitation



ESSEX SERVICE CORPORATION
82 DOE RUN DRIVE
HOLLAND, PA 18966
T/A TREATMENT INSTRUMENTATION SPECIALIST

FIELD SERVICE REPORT November 24-25,28 2015

Township of Buckingham
P.O. Box 413
Buckingham, PA 18912

Attention: Graham Orton

Trip required for verification of calibration of Kaplan influent flow meter located at Furlong WWTP.

Influent Flow Meter

1. Sparling model Tiger Mag; Serial No. M109834306.

    a. Calibration 0 - 2000 gpm. Primary Element 6" Mag Meter.

The following parameters are programmed as follows:

Forward - Normal, 0 Return OFF, System dampening 5 second, K Factor 92.606, Low cutoff 100 gpm, Empty pipe detection ON, Failsafe Low.

Unit checked and calibrated at the following:

As found settings:	Adjusted settings:
0% in - out = 4.000 Madc	None
50% in - out = 11.999 Madc	None
100% in - out = 19.99 Madc	None

Note: All units checked and calibrated in accordance with manufacturers' specifications as set forth in their instruction manuals.

Next calibration due December 2016.

If you have any questions or comments please feel free to call.

ESSEX SERVICE CORPORATION

William K. Weissman

ESSEX SERVICE CORPORATION
82 DOE RUN DRIVE
HOLLAND, PA 18966
T/A TREATMENT INSTRUMENTATION SPECIALIST

FIELD SERVICE REPORT November 24-25,28 2015

Township of Buckingham
P.O. Box 413
Buckingham, PA 18912

Attention: Graham Orton

Trip required for verification of calibration of Coles Return flow meter located at Furlong WWTP Lindquist.

Treated Influent Flow Meter

1. McCrometer model Mainline; Serial No. E0501197.

    a. Calibration 0 - 2000 gpm. Primary Element 6" Tube.

Unit checked and calibrated at the following:

As found settings:	Adjusted settings:
0% in - out = n/a	None
50% in - out = n/a	None
100% in - out = n/a	None

Note: All units checked and calibrated in accordance with manufacturers' specifications as set forth in their instruction manuals.

Next calibration due December, 2016.

If you have any questions or comments please feel free to call.

ESSEX SERVICE CORPORATION

William K. Weissman

ESSEX SERVICE CORPORATION
82 DOE RUN DRIVE
HOLLAND, PA 18966
T/A TREATMENT INSTRUMENTATION SPECIALIST

FIELD SERVICE REPORT November 24-25,28 2015

Township of Buckingham
P.O. Box 413
Buckingham, PA 18912

Attention: Graham Orton

Trip required for verification of calibration of effluent flow meter located at Furlong WWTP Kaplan.

Effluent Flow Meter

1. McCrometer model Mainline; Serial No. E0501193.

   a. Calibration 0 - 4500 gpm. Primary Element 12" Tube.

Unit checked and calibrated at the following:

As found settings:	Adjusted settings:
0% in - out = n/a	None
50% in - out = n/a	None
100% in - out = n/a	None

Note: All units checked and calibrated in accordance with manufacturers' specifications as set forth in their instruction manuals.

Next calibration due December, 2016.

If you have any questions or comments please feel free to call.

ESSEX SERVICE CORPORATION

William K. Weissman

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82 DOE RUN DRIVE
HOLLAND, PA 18966
T/A TREATMENT INSTRUMENTATION SPECIALIST

FIELD SERVICE REPORT November 24-25,28 2015

Township of Buckingham
P.O. Box 413
Buckingham, PA 18912

Attention: Graham Orton

Trip required for verification of calibration of effluent flow meter located at Furlong WWTP Lindquist.

Effluent Flow Meter

1. McCrometer model Mainline; Serial No. E0501195.

    a. Calibration 0 - 3500 gpm. Primary Element 10" Tube.

Unit checked and calibrated at the following:

As found settings:	Adjusted settings:
0% in - out = n/a	None
50% in - out = n/a	None
100% in - out = n/a	None

Note: All units checked and calibrated in accordance with manufacturers' specifications as set forth in their instruction manuals.

Next calibration due December, 2016.

If you have any questions or comments please feel free to call.

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William K. Weissman