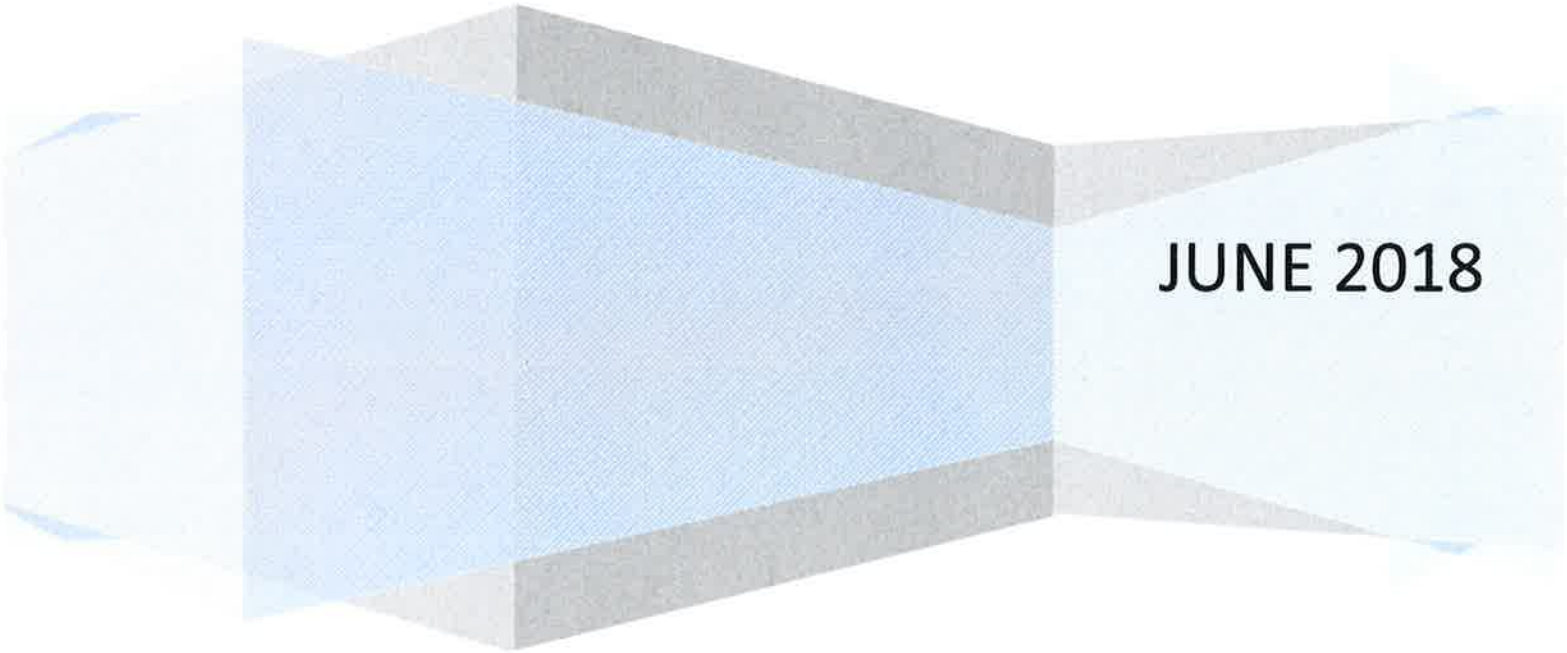
MIDDLESEX COUNTY UTILITIES AUTHORITY

NJPDES PERMIT NO. NJ0020141

SYSTEM CHARACTERIZATION REPORT

HEYDEN GRAVITY SEWER SYSTEM



JUNE 2018

Middlesex County Utilities Authority - Certification

Without prejudice to any objections timely made to permit conditions, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information.

Joseph P. Cryan — Date 6/28/18

Executive Director, Middlesex County Utilities Authority

City of Perth Amboy - Certification

I certify under penalty of law that this document and all attachments were prepared as part of a cooperative effort by members of a hydraulically connected system, as is required under the NJPDES Permit, to provide the information requested. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly, or negligently submitting false information.

Luis Perez-Jimenez /AC — Date 6/28/18

Director of Operations, City of Perth Amboy, Water and Sewer Department

Introduction

The Middlesex County Utilities Authority (Authority) owns, operates and maintains the Heyden Gravity Sewer, Edison Pump Station and Edison Relief Force Mains that receive wastewater flows from the Borough of Carteret, Woodbridge Township, City of Perth Amboy and portions of Edison Township. The City of Perth Amboy's Main Pumping Station, Force Main and gravity sewer connects into the Township of Woodbridge's Keasby Interceptor. Carteret's connection is further upstream. Woodbridge's pumping station connects between Carteret's and Perth Amboy's connections. Woodbridge's Keasby Interceptor flows into the Authority's Heyden Gravity sewer. The Authority's Heyden Gravity Sewer also receives flow from Edison Township (see Figure 1).

The Authority monitors wastewater flows from the City of Perth Amboy's Main Pumping Station through the Authority's Perth Amboy meter chamber located on Florida Grove Road in Woodbridge Township. The Authority also monitors wastewater flow from Woodbridge's Keasby Interceptor prior to reaching the Authority's Heyden Gravity Sewer through the Authority's Woodbridge meter chamber located along Crows Mill Road in Woodbridge Township. The Authority's Heyden Gravity Sewer conveys wastewater flow to the Edison Pump Station that pumps directly to the Authority's Central Treatment Plant (CTP) via one and/or two 60 inch force mains.

Since the Authority does not own/operate any Combined Sewer Overflows (CSOs) or CSO Outfalls, references are made to the applicable sections of the City of Perth Amboy's System Characterization Report. The Authority is cooperating with the City of Perth Amboy in developing each of its own System Characterization Reports. Each entity is responsible for their owned/operated infrastructure. The Authority has prepared the necessary information for the portion of its owned/operated wastewater collection system that conveys wastewater flows from the City of Perth Amboy to the Authority's Central Treatment Plant; and has provided this information to the City of Perth Amboy. The Authority will continue working together with the City of Perth Amboy to develop a single, coordinated Long Term Control Plan (LTCP). The LTCP will address each of the nine LTCP elements in accordance with Part IV CSM Section G of the Authority (NJ0020141) and the City of Perth Amboy (NJ0156132) respective permits.

Major Elements of the System Characterization Report

1. Rainfall Records (CSM Part IV.G.1.d.i)

The Authority maintains a rain gage (Novalynx Corp Model 260-2510 Standard Rain & Snow Gage) at its Central Treatment Plant (CTP) located outside the operations control building with readings taken at midnight each day and recorded in the shift supervisor's log book. On occasion, such as snowfall events, the Authority may use rainfall data from the Office of the New Jersey State Climatologist located at Rutgers University New Brunswick (ONJSC website http://climate.rutgers.edu/stateclim/). Every month the daily rainfall data is entered into the monthly operations spreadsheet.

The Authority reviewed CTP historical rainfall records from 1999 up to the current year obtained at its Central Treatment Plant (CTP) and Rutgers University New Brunswick (as applicable). The quantity of rainfall (inches per month and inches per year) was compared to the average along with the number of instances outside 68.27% of the mean of a normal distribution. The frequency of rainfall events per month was recorded in the same manner as the rainfall quantity above and the year with the lowest number of instances outside 68.27% of the mean was selected. Year 2000 was initially selected as most representative of the average rainfall quantity and frequency, although it had below average total rainfall. This was then compared with rainfall data recorded at JFK Airport Rain Station 94789 for 1988 (see Table 1).

The Authority reviewed the rainfall data recorded at Newark Liberty Airport Station GHCND:USW00014734 from 2004 and compared it with the Table 1 averages. The 2004 Newark rainfall data was much closer to the CTP rainfall quantity and frequency than the 1988 JFK data (see Table 2). The Authority reviewed the Typical Hydrologic Year Report prepared on behalf of the NJ CSO Group Permittees, dated May 2018 and accepted by the NJDEP. The Typical Hydrologic Year Report contained a very discreet and detailed analysis that also considered ratio of the receiving water body average flow to total annual rainfall from mid May to mid September. Since the Passaic River and Raritan River had very similar flows in 2004 and the ratio of river flow to rainfall was the closest of any other year (see Table 3), the daily precipitation data of 2004 from Newark Liberty International Airport selected by the NJ CSO Group was jointly chosen with the City of Perth Amboy for the "Typical Hydrological Year". Also, refer to the Rainfall Records Analysis as conducted by Perth Amboy and described in Section 3 of the Perth Amboy System Characterization Report.

2. Combined Sewer System Characterization (CSM Part IV.G.1.d.ii)

All flows contributory to MCUA's Edison Pump Station are included to properly characterize this collection system (see Figure 1). Specifically, the MCUA's Borough of Carteret, City of Perth Amboy, Woodbridge Township, Edison/Clara Barton, Edison/Raritan Center, Hatco, Woodbridge/CPV-Shore (WCPV), Edison/Pershing Avenue Meter Chambers, the Heyden Gravity Sewer and the Edison Pump Station are included in the System Characterization Report (see Table 4). MCUA' s Perth Amboy meter chamber is capable of measuring up to 21.4 MGD and receives flow from the City of Perth Amboy's Second Street pump station via 24-inch diameter force main (see Figure 2) before combining with flows from Woodbridge Township and the Borough of Carteret. MCUA's Woodbridge Meter Chamber with a non-surge capacity of 67 MGD records flow from Woodbridge Township, Borough of Carteret and the City of Perth Amboy's Second Street Pump Station. The combined sewer flows through Woodbridge Township's Keasby Interceptor and connects with MCUA's Heyden Gravity Sewer (see Figure 3).

There are five meter chambers that convey flow to MCUA's 60-inch Heyden Gravity Sewer (Upper Heyden) identified as Edison/Clara Barton, Edison/Raritan Center, Hatco, Woodbridge/CPV-Shore (WCPV) and Woodbridge/CPV-Keasby (future). Recorded flows from 2004 were modified with 2017 flows from WCPV that became active in 2016. It is expected that Woodbridge/CPV-Keasby (future) will have flows similar to that of WCPV ; therefore, 2017 flows for WCPV were also included for Woodbridge/CPV-Keasby (future). The 2004 modified flows to the Upper Heyden was 7.50 MGD (see Table 4). The Upper Heyden has a capacity of 26.3 MGD at its flattest section.

Woodbridge Township's Keasby Interceptor connects at the junction of the Upper Heyden and 66-inch Heyden Gravity (Lower Heyden). The Edison/Pershing Avenue meter chamber discharges into the Lower Heyden 70 feet before the Edison Pump Station. The previously prepared report entitled "MCUA Central Treatment Plant Conveyence and Capacity Analysis Cost and Performance Analysis Report" prepared by CDM, dated August 2007 (2007 MCUA Report) and improvements to the Edison Pump Station at the time of the report were used to describe the system capacity of the Authority's owned/operated infrastructure located downstream of the City of Perth Amboy's force main connection (see Table 5).

The Authority does not own/operate CSO Outfalls, tide gates, Solids/floatables Control, regulators or specific locations with historical issues. This information has been provided to the City of Perth Amboy for the aforementioned infrastructure. Please refer to Section 2 of the Perth Amboy System Characterization Report which details the Characterization of the Perth Amboy Combined Sewer System.

The following identifies the Significant Industrial Users (SIU) issued a Non-Domestic Wastewater Discharge Permit by the Authority which are located within the City of Perth Amboy service area indicating name of Authority Permittee, Permit No., City of Perth Amboy CSO Outfall No., Location, and Receiving Waters:

Authority Permittee/Permit No.	CSO Outfall No.	Location	Receiving Waters
Chemtura/31093	CSO 02	Rudyk Park	Arthur Kill
Englert/31116	CSO 02	Rudyk Park	Arthur Kill
Med-Apparel/31185	CSO 05	Commerce Street	Arthur Kill

3. Combined Sewer Overflow (CSO) Monitoring (CSM Part IV.G.1.d.iii)

The Authority does not own/operate any CSOs. Please refer to Section 4 of the Perth Amboy System Characterization Report which details Perth Amboy's CSO monitoring program.

4. Modeling (CSM Part IV.G.1.d.iv)

Since the Authority does not own/operate any CSOs, the Authority has opted to utilize the 2007 MCUA Report which previously modeled the capacity of Heyden Gravity Sewer using SWMM 5 software. The Authority plotted the actual Perth Amboy flows, MCUA CTP flows and rainfall data for the Typical Hydrologic Year 2004 (see Figure 4). Please refer to Section 5 of the Perth Amboy System Characterization Work Plan which details System Hydrologic and Hydraulic Modeling for the Perth Amboy owned/operated CSS/CSO's.

5. Sensitive Areas (CSM Part IV.G.1.d.v)

The Authority does not own/operate/maintain any CSO outfalls that would directly impact Sensitive Areas. Please refer to the Identification of Sensitive Areas Report/CSO Long Term Control Plan dated May 2018 submitted to the NJDEP by the Passaic Valley Sewerage Authority on behalf of the New Jersey CSO Group.

6. Conclusions

The following conclusions are based on the analysis documented within this System Characterization Report.

1. Preliminary results of the Baseline Compliance Monitoring Report dated June 30,2018 submitted to the NJDEP by PVSC on behalf of the NJCSO Group indicated the following:

    a. The larger waterbodies (including the Arthur Kill) appear to meet existing water quality criteria.

    b. The Raritan River may have attainment issues related to pathogen standards for its designation.

2. The Authority utilized 2004 Newark rainfall data as the typical hydrologic year for system characterization purposes. This is consistent with the NJCSO Group choice.

3. Based upon the average daily flows recorded by the MCUA on April 26, 2004 at its meter chambers conveying flow to the Heyden Gravity Sewer and Edison Pump Station conveying flow to the MCUA Central Treatment Plant, system flows were at 28% of the capacity for the Upper Heyden Gravity Sewer, 45% of the capacity for MCUA's Perth Amboy meter chamber, 42% of the capacity for MCUA's Woodbridge Township meter chamber, 39% of the capacity for Lower Heyden Gravity Sewer and 43% of the capacity for Edison Pump Station.

TABLE 1

Rainfall Records Comparison of JFK and MCUA's Central Treatment Plant

Rainfall Inches per month (Quantity)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Instances above+, below() avg±stdev
***1988**	**3.13**	**3.85**	**2.38**	**2.01**	**5.07**	**1.53**	**6.69**	**2.01**	**2.86**	**3.39**	**6.65**	**1.08**	**+4,(2)**
1999	6.63	3.51	4.15	2.31	3.26	1.02	1.30	3.88	10.87	2.67	2.25	3.02	+2,(2)
2000	2.73	2.09	3.73	2.84	4.81	2.68	5.38	5.10	5.17	0.74	2.93	2.97	(1)
2001	3.23	2.30	8.13	1.97	3.25	4.34	2.41	4.05	2.55	0.16	1.14	2.35	+1,(3)
2002	2.55	0.29	4.61	2.71	5.22	4.37	2.35	6.70	5.12	6.98	5.18	5.12	+2,(1)
2003	3.53	4.87	4.06	2.68	4.66	8.35	4.24	3.97	4.92	3.75	5.87	4.71	+3
2004	1.54	2.75	3.70	5.28	5.21	2.53	10.12	4.20	7.14	1.92	4.58	3.96	+3,(1)
2005	4.27	2.49	4.27	3.98	2.03	2.54	4.89	0.65	0.48	13.01	4.13	3.16	+1,(3)
2006	5.07	1.57	0.93	3.43	2.78	8.30	5.22	2.96	4.85	7.36	6.81	1.93	+4,(2)
2007	3.70	1.00	5.39	10.37	2.42	4.84	5.91	4.36	1.40	4.23	1.98	5.62	+2,(2)
2008	2.80	5.44	3.71	3.00	6.10	4.05	3.19	2.23	9.23	4.27	3.45	6.66	+4
2009	3.01	0.58	1.69	3.80	5.07	6.67	5.45	5.88	2.41	5.27	1.55	6.51	+3,(2)
2010	1.94	4.00	11.19	3.24	2.84	2.57	4.18	1.93	3.89	3.19	1.85	3.65	+2
2011	1.91	2.95	5.32	5.54	4.11	2.75	2.51	15.58	4.67	5.63	2.55	3.90	+1
2012	2.37	1.07	1.74	1.93	4.04	4.10	3.43	4.64	2.76	3.41	0.82	3.77	(1)
2013	2.27	1.83	1.89	1.47	2.53	6.63	4.31	2.19	3.61	0.55	1.86	3.70	+1,(2)
2014	2.00	2.02	2.74	4.76	2.33	3.32	6.96	1.66	1.47	2.81	3.36	3.61	+1,(2)
2015	3.95	1.41	4.19	1.82	2.58	5.71	2.49	1.09	2.51	3.83	1.15	4.40	(1)
	3.15	2.36	4.20	3.60	3.72	4.40	4.37	4.18	4.30	4.10	3.03	4.06	average
	1.30	1.44	2.48	2.11	1.26	2.12	2.12	3.38	2.76	3.08	1.76	1.32	std dev
	1.85	0.92	1.72	1.48	2.46	2.28	2.25	0.80	1.54	1.03	1.26	2.74	avg-stdev
	4.45	3.81	6.68	5.71	4.98	6.51	6.49	7.56	7.05	7.18	4.79	5.38	avg+stdev

* Rainfall data recorded at JFK Airport RainSation 94789, in 1988

TABLE 1 (Cont.)

Rainfall Records Comparison of JFK and MCUA's Central Treatment Plant

Rain Days per month (Frequency)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total rain days	Total Annual Rainfall (in)	Instances above+, below() avg±stdev	Overall deviations per 26 categories
***1988**	**9**	**10**	**8**	**9**	**13**	**7**	**15**	**5**	**6**	**8**	**9**	**5**	**104**	**40.65**	**+1,(5)**	**+5,(7)**
1999	12	7	12	13	9	6	5	9	12	9	7	7	108	44.87	(3)	+2,(5)
2000	9	10	11	11	11	12	13	17	12	3	6	8	123	41.17	+1,(1)	+1,(2)
2001	9	15	16	14	11	8	8	9	10	4	8	7	119	35.88	+2,(2)	+3,(5)
2002	10	5	12	15	8	8	5	10	6	12	16	9	116	51.2	+1,(2)	+3,(3)
2003	10	12	12	16	19	13	13	11	13	10	11	9	149	55.61	+5	+8
2004	7	5	17	16	15	11	14	12	9	11	9	12	138	52.93	+5,(1)	+8,(2)
2005	13	11	12	10	10	9	11	7	4	14	11	10	122	45.901	+2,(1)	+3,(4)
2006	12	8	5	10	7	15	12	11	10	10	8	8	116	51.21	(2)	+4,(4)
2007	13	8	12	13	10	14	9	7	4	10	10	18	128	51.22	+1,(1)	+3,(3)
2008	14	13	12	11	14	14	11	6	9	7	9	15	135	54.126	+4	+8
2009	7	7	12	11	12	19	13	10	8	13	13	10	135	47.89	+3	+6,(2)
2010	6	12	12	8	11	7	8	7	9	8	7	5	100	44.47	(5)	+2,(5)
2011	5	7	9	15	10	10	7	16	12	10	7	9	117	57.42	+2,(1)	+3,(1)
2012	9	9	12	7	16	12	9	11	11	12	5	18	131	34.08	+2,(3)	+2,(4)
2013	7	10	10	9	10	17	12	10	8	7	7	10	117	32.84	+1,(1)	+2,(3)
2014	10	10	7	11	11	7	10	9	6	10	11	13	115	37.04	(3)	+1,(5)
2015	11	8	16	12	8	15	10	4	4	7	9	14	118	35.13	+1,(3)	+1,(4)
	10	9	12	12	11	12	10	10	9	9	9	11	123	45.47	average	
	2.64	2.77	3.00	2.71	3.12	3.79	2.76	3.29	2.98	2.97	2.75	3.77	12	8.14	std dev	
	7	6	9	9	8	8	7	6	6	6	6	7	111	37.33	avg-stdev	
	12	12	15	15	14	15	13	13	12	12	12	14	135	53.61	avg+stdev	

* Rainfall data recorded at JFK Airport RainSation 94789, in 1988

TABLE 2

Rainfall Records Comparison of Newark and MCUA's Central Treatment Plant

Rainfall Inches per month (Quantity)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Instances above+, below() avg±stdev
***2004**	**1.89**	**2.44**	**3.07**	**4.85**	**4.60**	**2.95**	**8.39**	**3.70**	**8.01**	**0.89**	**4.21**	**3.37**	**+2,(1)**
1999	6.63	3.51	4.15	2.31	3.26	1.02	1.30	3.88	10.87	2.67	2.25	3.02	+2,(2)
2000	2.73	2.09	3.73	2.84	4.81	2.68	5.38	5.10	5.17	0.74	2.93	2.97	(1)
2001	3.23	2.30	8.13	1.97	3.25	4.34	2.41	4.05	2.55	0.16	1.14	2.35	+1,(3)
2002	2.55	0.29	4.61	2.71	5.22	4.37	2.35	6.70	5.12	6.98	5.18	5.12	+2,(1)
2003	3.53	4.87	4.06	2.68	4.66	8.35	4.24	3.97	4.92	3.75	5.87	4.71	+3
2004	1.54	2.75	3.70	5.28	5.21	2.53	10.12	4.20	7.14	1.92	4.58	3.96	+3,(1)
2005	4.27	2.49	4.27	3.98	2.03	2.54	4.89	0.65	0.48	13.01	4.13	3.16	+1,(3)
2006	5.07	1.57	0.93	3.43	2.78	8.30	5.22	2.96	4.85	7.36	6.81	1.93	+4,(2)
2007	3.70	1.00	5.39	10.37	2.42	4.84	5.91	4.36	1.40	4.23	1.98	5.62	+2,(2)
2008	2.80	5.44	3.71	3.00	6.10	4.05	3.19	2.23	9.23	4.27	3.45	6.66	+4
2009	3.01	0.58	1.69	3.80	5.07	6.67	5.45	5.88	2.41	5.27	1.55	6.51	+3,(2)
2010	1.94	4.00	11.19	3.24	2.84	2.57	4.18	1.93	3.89	3.19	1.85	3.65	+2
2011	1.91	2.95	5.32	5.54	4.11	2.75	2.51	15.58	4.67	5.63	2.55	3.90	+1
2012	2.37	1.07	1.74	1.93	4.04	4.10	3.43	4.64	2.76	3.41	0.82	3.77	(1)
2013	2.27	1.83	1.89	1.47	2.53	6.63	4.31	2.19	3.61	0.55	1.86	3.70	+1,(2)
2014	2.00	2.02	2.74	4.76	2.33	3.32	6.96	1.66	1.47	2.81	3.36	3.61	+1,(2)
2015	3.95	1.41	4.19	1.82	2.58	5.71	2.49	1.09	2.51	3.83	1.15	4.40	(1)
	3.15	2.36	4.20	3.60	3.72	4.40	4.37	4.18	4.30	4.10	3.03	4.06	average
	1.30	1.44	2.48	2.11	1.26	2.12	2.12	3.38	2.76	3.08	1.76	1.32	std dev
	1.85	0.92	1.72	1.48	2.46	2.28	2.25	0.80	1.54	1.03	1.26	2.74	avg-stdev
	4.45	3.81	6.68	5.71	4.98	6.51	6.49	7.56	7.05	7.18	4.79	5.38	avg+stdev

* Rainfall data recorded at Newark Liberty Airport Station GHCND:USW00014734 (2004 Typical Hydrologic Year)

TABLE 2 (Cont.)

Rainfall Records Comparison of Newark and MCUA's Central Treatment Plant

Rain Days per month (Frequency)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total rain days	Total Annual Rainfall (in)	Instances above+, below() avg±stdev	Overall deviations per 26 categories
***2004**	**10**	**5**	**15**	**14**	**16**	**11**	**11**	**12**	**9**	**8**	**8**	**11**	**130**	**48.37**	**+1,(1)**	**+3,(2)**
1999	12	7	12	13	9	6	5	9	12	9	7	7	108	44.87	(3)	+2,(5)
2000	9	10	11	11	11	12	13	17	12	3	6	8	123	41.17	+1,(1)	+1,(2)
2001	9	15	16	14	11	8	8	9	10	4	8	7	119	35.88	+2,(2)	+3,(5)
2002	10	5	12	15	8	8	5	10	6	12	16	9	116	51.2	+1,(2)	+3,(3)
2003	10	12	12	16	19	13	13	11	13	10	11	9	149	55.61	+5	+8
2004	7	5	17	16	15	11	14	12	9	11	9	12	138	52.93	+5,(1)	+8,(2)
2005	13	11	12	10	10	9	11	7	4	14	11	10	122	45.901	+2,(1)	+3,(4)
2006	12	8	5	10	7	15	12	11	10	10	8	8	116	51.21	(2)	+4,(4)
2007	13	8	12	13	10	14	9	7	4	10	10	18	128	51.22	+1,(1)	+3,(3)
2008	14	13	12	11	14	14	11	6	9	7	9	15	135	54.126	+4	+8
2009	7	7	12	11	12	19	13	10	8	13	13	10	135	47.89	+3	+6,(2)
2010	6	12	12	8	11	7	8	7	9	8	7	5	100	44.47	(5)	+2,(5)
2011	5	7	9	15	10	10	7	16	12	10	7	9	117	57.42	+2,(1)	+3,(1)
2012	9	9	12	7	16	12	9	11	11	12	5	18	131	34.08	+2,(3)	+2,(4)
2013	7	10	10	9	10	17	12	10	8	7	7	10	117	32.84	+1,(1)	+2,(3)
2014	10	10	7	11	11	7	10	9	6	10	11	13	115	37.04	(3)	+1,(5)
2015	11	8	16	12	8	15	10	4	4	7	9	14	118	35.13	+1,(3)	+1,(4)
	10	9	12	12	11	12	10	10	9	9	9	11	123	45.47	average	
	2.64	2.77	3.00	2.71	3.12	3.79	2.76	3.29	2.98	2.97	2.75	3.77	12	8.14	std dev	
	7.0	6.5	8.7	9.2	8.2	7.8	7.2	6.5	5.7	6.3	6.3	6.9	111	37.33	avg-stdev	
	12.3	12.0	14.7	14.6	14.4	15.4	12.8	13.1	11.6	12.2	11.8	14.5	135	53.61	avg+stdev	

* Rainfall data recorded at Newark Liberty Airport Station GHCND:USW00014734 (2004 Typical Hydrologic Year)

TABLE 3

Rainfall vs River Flow Records Comparison of Newark/Passaic River and MCUA/Raritan River

Year	Annual Rainfall (in)	May 15-Sep 15 Rainfall (in)	May 15-Sep 15 Passaic (cfs)	May 15-Sep 15 Raritan (cfs)	Ratio Riverflow / rainfall
***2004**	**48.37**	**19.85**	**850**		**42.8**
1999	44.87	13.40		306	22.8
2000	41.17	19.49		849	43.6
2001	35.88	15.24		764	50.1
2002	51.20	18.54		462	24.9
2003	55.61	23.37		1524	65.2
2004	52.93	21.32		882	41.4
2005	45.90	9.75		333	34.2
2006	51.21	22.96		1031	44.9
2007	51.22	17.38		445	25.6
2008	54.13	17.73		524	29.6
2009	47.89	20.19		1321	65.4
2010	44.47	10.64		331	31.1
2011	57.42	27.87		2529	90.7
2012	34.08	15.80		483	30.6
2013	32.84	17.30		1463	84.5
2014	37.04	14.25		671	47.1
2015	35.13	12.91		345	26.7
	10%	5%		5%	10%
average	45.47	17.54		839	44.6

* Rainfall data recorded at Newark Liberty Airport Station GHCND:USW00014734 (2004 Typical Hydrologic Year)

TABLE 4

2004 Flows vs. Capacity

Meter Chamber/Element Name	Flow* (MGD)	Capacity (MGD)	% of Capacity
Hatco	0.50		
Edison/Clara Barton	5.15		
Woodbridge/CPV-Shore	0.71		
Woodbridge/CPV-Keasby	0.71		
Edison/Raritan Center	0.42		
Upper Heyden (60")	7.49	26.3**	28%
Borough of Carteret	7.16		
City of Perth Amboy	9.54	21.4***	45%
Woodbridge Township	28.30	67***	42%
Lower Heyden (66")	35.79	92***	39%
Edison/Pershing Ave	3.01		
Edison Pump Station	38.80	89.9***	43%

* Flow from April 26, 2004, 5th largest storm event of Typical Hydrologic Year

** See Table 5

*** MCUA Central Treatment Plant Conveyance and Capacity Analysis Cost and Performance Analysis Report, 2007

Table 5

MCUA Owned/Operated Collection System Characterization Downstream of the City of Perth Amboy

Gravity Sewers	Dia. (in)	Length (ft)	Material	Upstream Connection	Downstream Connection	Capacity* (MGD)	Flow for Typical** Year 2004 (MGD)	Reserve Capacity (MGD)	Age (yrs)
Heyden Gravity Sewer (upper)	60	1896	RCP	Raritan Center, Clara Barton, Hatco, WCPV	Heyden Gravity Sewer (lower)	26	7.5	18.5	49
Heyden Gravity Sewer (lower)	66	3434	RCP	Heyden Gravity Sewer (upper), Woodbridge Township's Keasby Interceptor	Edison Pump Station	92	35.8	56.2	49
Edison Pump Station				Heyden Gravity Sewer (lower)	Edison Force Main	89.9	38.8	51.1	49
Force Mains	Dia. (in)	Length (ft)	Material	Upstream Connection	Downstream Connection	Capacity (MGD)			Age (yrs)
Edison Force Main No. 1	60	3988	FRPM	Edison Pump Station	Central Treatment Plant	95	38.8	56.2	9
Edison Force Main No. 2	60	4108	FRPM	Edison Pump Station	Central Treatment Plant	95	0	95	9

* Capacity of the Heyden Gravity Sewer (lower), Edison Pump Station and Edison Force Mains obtained from report entitled " *MCUA Central Treatment Plant Conveyance and Capacity Analysis, Cost Performance Analysis Report NJPDES Permit No. NJ0020141, prepared by CDM, dated August 2007 " (2007 MCUA Report)*

** Actual 2004 Flows for 5th Largest Storm April 26, 2004 plus 2017 WCPV & future 2020 CPV-Keasby flows.

FIGURE 1 - MIDDLESEX COUNTY UTILITIES AUTHORITY'S HEYDEN GRAVITY COLLECTION SYSTEM DIAGRAM

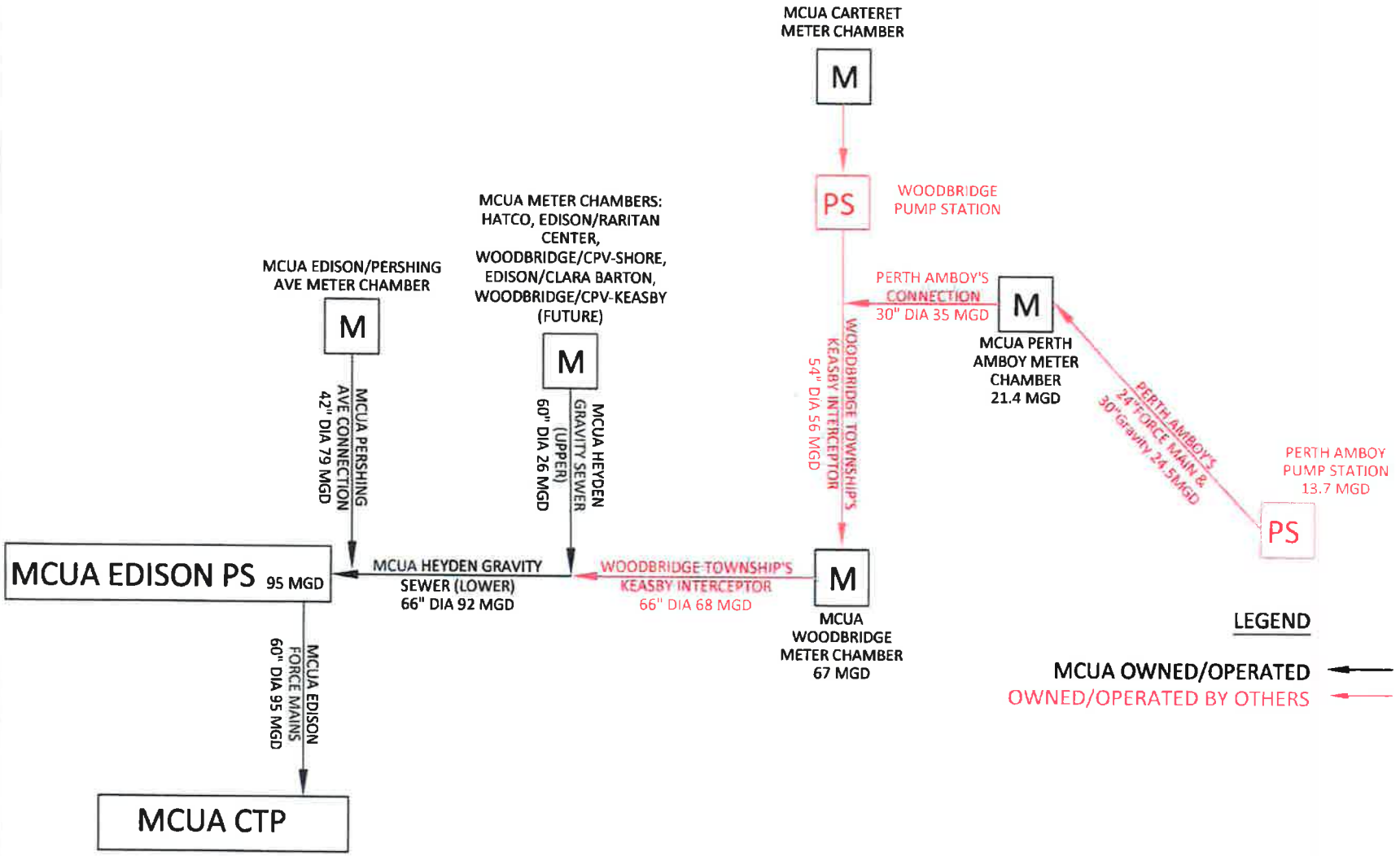
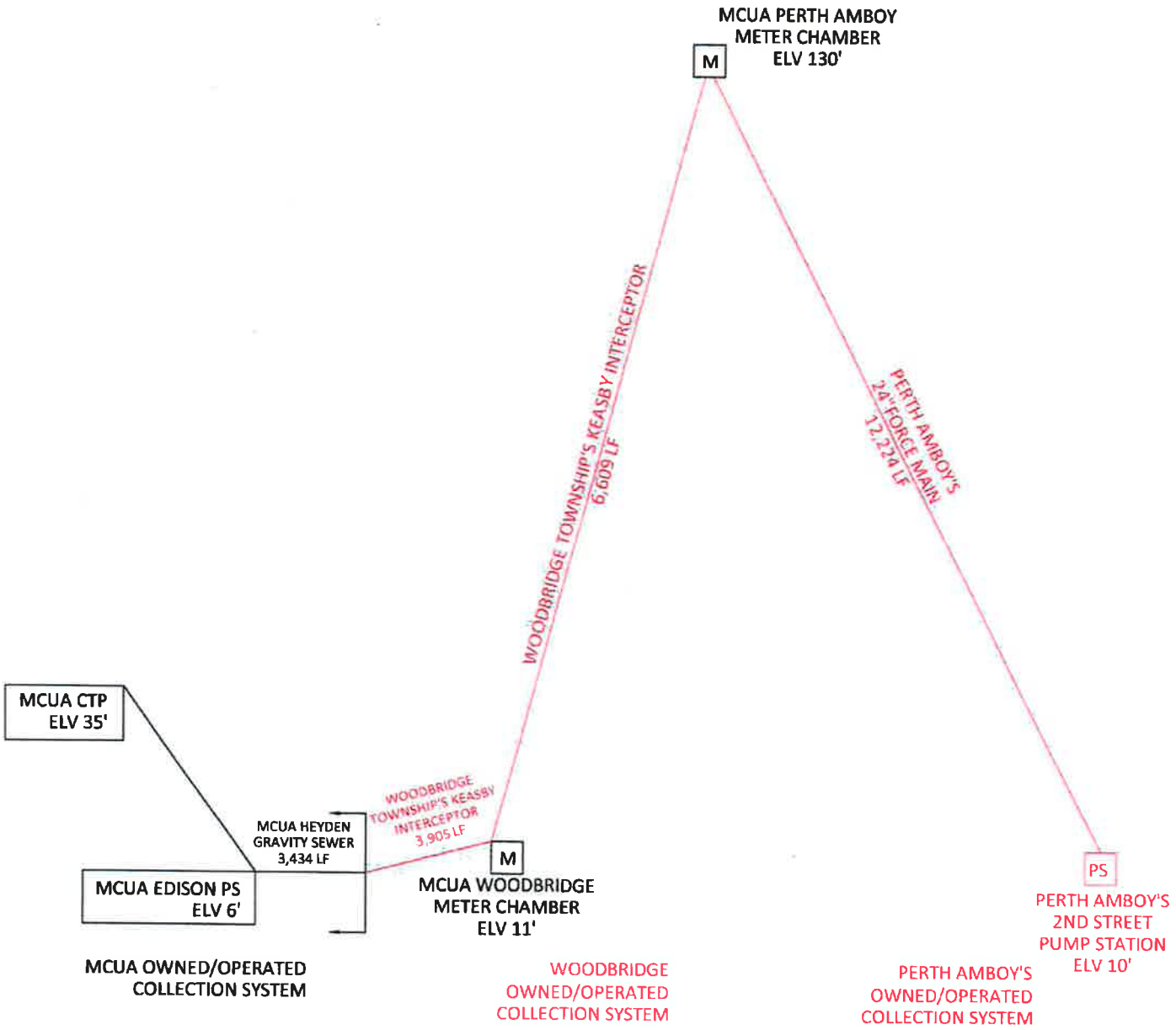


FIGURE 2 - HYDRAULIC PROFILE



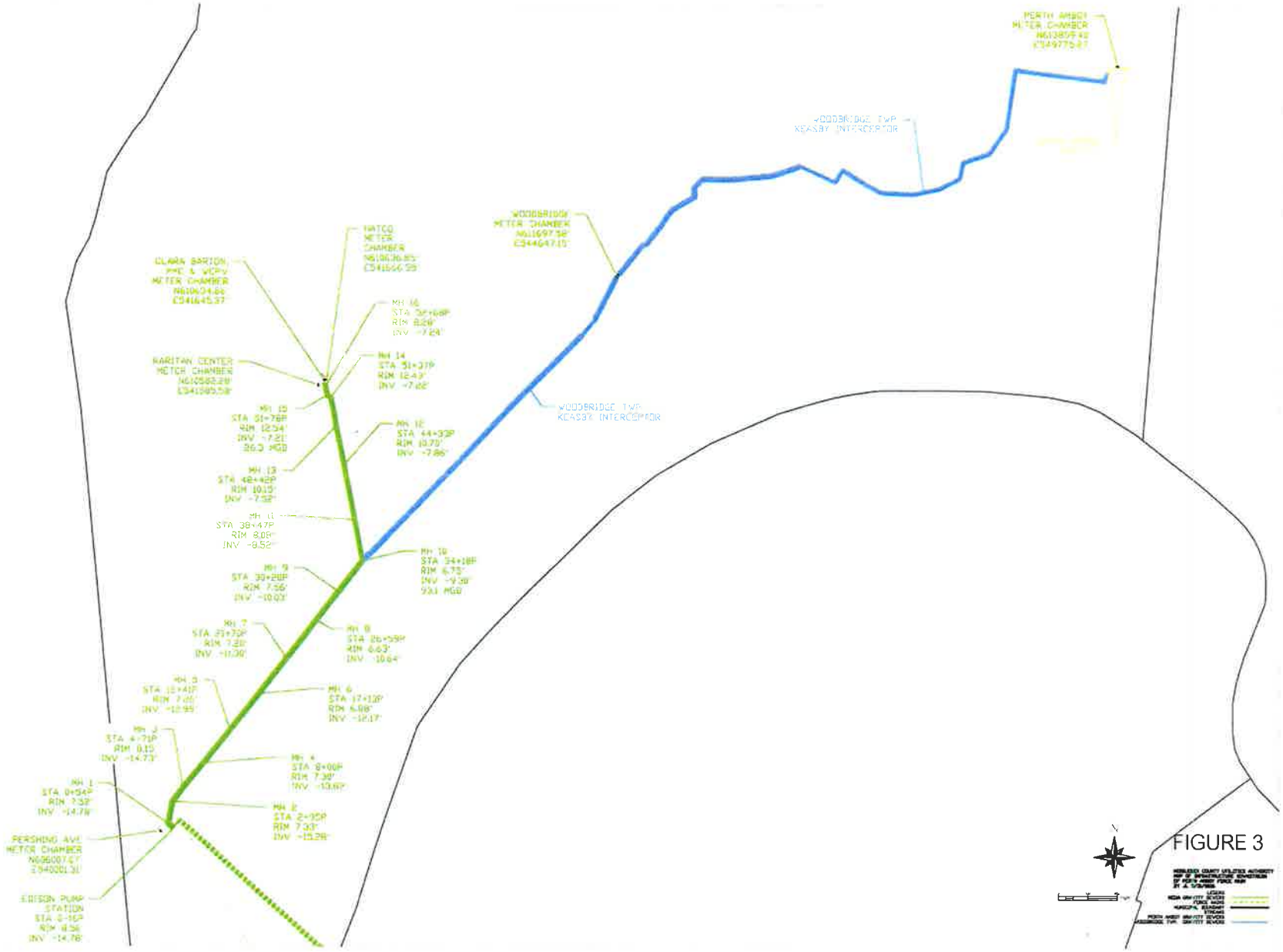
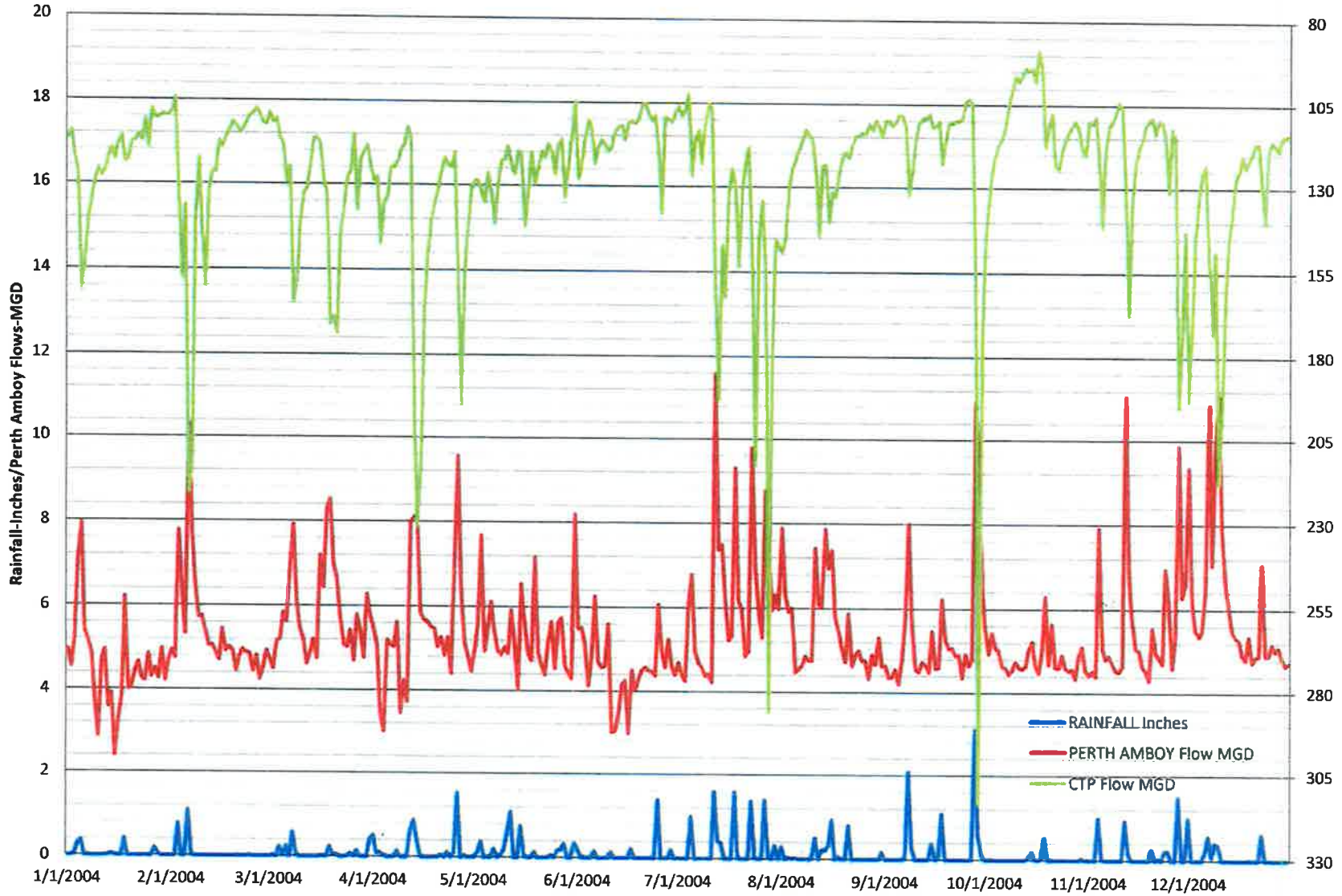

PERTH AMBOY
METER CHAMBER
WOODBRIDGE TWP
KEASBY INTERCEPTOR
WOODBRIDGE
METER CHAMBER
WOODBRIDGE TWP
KEASBY INTERCEPTOR
HATCO
METER
CHAMBER
CLARA BARTON
PRC & WCPV
METER CHAMBER
RARITAN CENTER
METER CHAMBER
MH 16
MH 14
MH 15
MH 12
MH 13
MH 11
MH 10
MH 9
MH 8
MH 7
MH 6
MH 5
MH 4
MH 3
MH 2
MH 1
PERSHING AVE
METER CHAMBER
EDISON PUMP
STATION
N
FIGURE 3

Figure 4-MCUA CTP vs Perth Amboy Flows During Rainfall Events



Rainfall from Typical Hydrologic Year 2004 at Newark Liberty International Airport
Flows are Actual 2004 MCUA Measured Data