Attachment 'D'

FUSS & O'NEILL

MEMORANDUM

TO: Ms. Marianne Brown
Newtown WSA Chair

FROM: Kurt A. Mailman, P.E. , Philip E. Forzley, P.E., LEED AP

DATE: March 10, 2015

RE: 79 Church Hill Road Proposed Development Review

The Newtown Water and Sewer Authority (WSA) solicited the services of Fuss & O'Neill to review documents related to a proposed development at 79 Church Hill Road in Newtown (hereinafter referred to as the "subject parcel") on February 12, 2015. A listing of the documents reviewed and results of the review follow:

The following documents were submitted to Fuss & O'Neill for review:

- *Second Request to the Water and Sewer Authority to Extend Authority's Sewer Service Area at 79 Church Hill Road, Newtown Map 38 Block 2 Lot 1; Request for Conditional Approval of Capacity and Connection* from Timothy S. Hollister, Shipman & Goodwin dated February 4, 2015.
- *Application for Preliminary Review by Newtown WSA*
- *Subsurface Sewage Disposal Feasibility Report Newtown Residential Development 79 Church Hill Road Newtown, Connecticut* dated February 4, 2014 prepared by Westcott and Mapes Inc. Consulting Engineers.
- *Conceptual Site Plan Subsurface Sewage Disposal System – Sheets SP-1,2,3,4,5* by Westcott and Mapes Inc. Consulting Engineers.

Review Comments:

<u>Second Request to the Water and Sewer Authority to Extend Authority's Sewer Service Area at 79 Church Hill Road, Newtown Map 38 Block 2 Lot 1; Request for Conditional Approval of Capacity and Connection</u> **<u>Dated February 4, 2015.</u>**

1. Basis for request (1) – There exist two (2) 6-inch laterals at the subject parcel as presented in **Exhibit 1** to service the subject parcel, not two 8-inch laterals as is asserted in the letter. Throughout the Newtown centralized sewer system the minimum pipe size for a service connection (a.k.a. lateral) is 6-inches in diameter for maintenance purposes and to minimize clogging, based on published literature (see **Exhibit 2** – "Metcalf and Eddy Wastewater Engineering: Collection and Pumping of Wastewater" p.109). Therefore there was no intent to promote development growth of the subject parcel, based on the size of the service connections provided. The minimum 6-inch lateral diameter is also presented on the Newtown DPW standard connection details Figures 1,2 for sewer connections as presented as in **Exhibit**

3 and the "Town of Newtown Preliminary Design Report Newtown Sewerage System, January 1994, 92-248" Design Criteria Section 8.A **Exhibit 4**. It is common practice to provide a minimum 8-inch sewer pipe, manhole and 8-inch minimum stub outside of the state right-of-way to provide public sewer connection for anticipated significant future development. If the intent was to sewer areas beyond the existing buildings, a minimum 8-inch pipe, manhole and minimum 8-inch stub would have been provided at the subject parcel.

2. With respect to the statement "the treatment plant has ample capacity"… it is misleading since the treatment plant capacity of 932,000 gallons per day is nearly completely reserved by the centralized municipal sewer service area (a maximum of approximately 23,400 gallons per day available remaining pursuant to the latest version of the "Newtown WSA Water Pollution Plan dated January 8, 2015" – **Exhibit 5**) and the State of Connecticut's reserved capacity (in the amount of 500,000 gallons per day). The Town is required to maintain the State's reserve capacity in the event that the State desires to discharge additional flows, despite the apparent treatment capacity available based upon the current average daily flows recorded at the treatment facility typically ranging from 300,000 to 800,000 gallons per day. (**Exhibit 6**) Upgrades to the wastewater treatment facility to expand the overall treatment capacity would be substantial, as Fuss & O'Neill concurs with the Plant Operations firm that the facility was designed for the current capacity. Additional capacity needs would facilitate significant upgrade; potentially including additional oxidation ditches, secondary clarifier tanks and flow splitters to evenly distribute the increased flows. Minor improvements to increase treatment capacity for this type of facility are not typically implementable without a significant reduction in water quality which could violate the NPDES discharge permit. The significant improvements required could conceivably cost several millions and up to greater than $10 million dollars to design, permit and construct.

3. We concur with the statement "the Sandy Hook Pump Station is at capacity but can be upgraded to accommodate greater flow". The collection system upstream of the Sandy Hook Pump Station is capable of transporting the design flows, however the pump station is currently reportedly overcycling (exceeding the recommended number of pump starts per hour), and isn't capable of pumping the proposed additional flows without surcharging. **Exhibit 7** presents the impact of the additional design flows on the Sandy Hook Pump Station. At a minimum, the existing 25 HP submersible pumps would need to be replaced with larger 40 horsepower pumps. In addition, the current start stop controls would need to be upgraded to variable frequency drives (VFDs) or soft starts/stops to reduce the increased inrush current associated with the larger pump horsepower. Additional improvements would likely be required including replacement of the existing electrical panel, standby generator and dunnage, and potential building expansion, with a potential upgrade cost to the pump station approaching $400,000 - $500,000.

<u>Application for Preliminary Review by Newtown WSA</u>

1. The peak hour flow of 6,350 Gallons/Day presented in the Application is incorrect. The ratio of extreme peak hourly flow to average daily flow is typically 4.0-5.6 times the average daily flow for wastewater generation, pursuant to Table 2-1 of "NEIWPCC Guides for the Design of Wastewater Treatment Works Technical Resource 16" (TR-16) 2011 Edition. (**Exhibit 8**) Based on an average daily flow of 43,750 gallons per day, the peak hour flow from the subject parcel with a peaking factor of 4.0 would be approximately 175,000 gallons per day, or 121 gallons per minute.

2. The number of units listed on the Application is listed as 350 units which conflicts with the 400 units presented on the drawing - *Conceptual Site Plan Subsurface Sewage Disposal System – Sheet SP-1* by Westcott and Mapes Inc. Consulting Engineers.

<u>Subsurface Sewage Disposal Feasibility Report Newtown Residential Development 79 Church Hill Road Newtown, Connecticut</u> **<u>dated February 4, 2014 prepared by Westcott and Mapes Inc. Consulting Engineers.</u>**

1. The calculation methods appear to be consistent with the DEEP Large Scale Onsite Wastewater Renovation Guidelines document dated 2006. However, we are unable to confirm the hydraulic and pollutant renovation capacity of the site, specifically the mounding analysis calculations and transport times for bacterial die off and virus inactivation, due to a lack of subsurface investigation (aka boring and test pit) logs in the report.

2. In report Section 7.10, Virus Removal - it is not clear how the "total separation at the leaching bed area" was calculated.

3. In report Section 7.30 Phosphorus Removal - there appear to be math errors that should be corrected.
   a. For all three leaching system segments the "Actual Depth of flow" calculations are incorrect.
   b. The width of flow in the Central Segment is indicated to be 520 feet, but in Section 5.10 of the report the width of flow in the Central Segment is indicated to be 230 feet. It appears the widths of flow or the Central and Northern and Southern Center Segments were transposed.

***Conceptual Site Plan Subsurface Sewage Disposal System – Sheets SP-1,2,3,4,5* by Westcott and Mapes Inc. Consulting Engineers.**

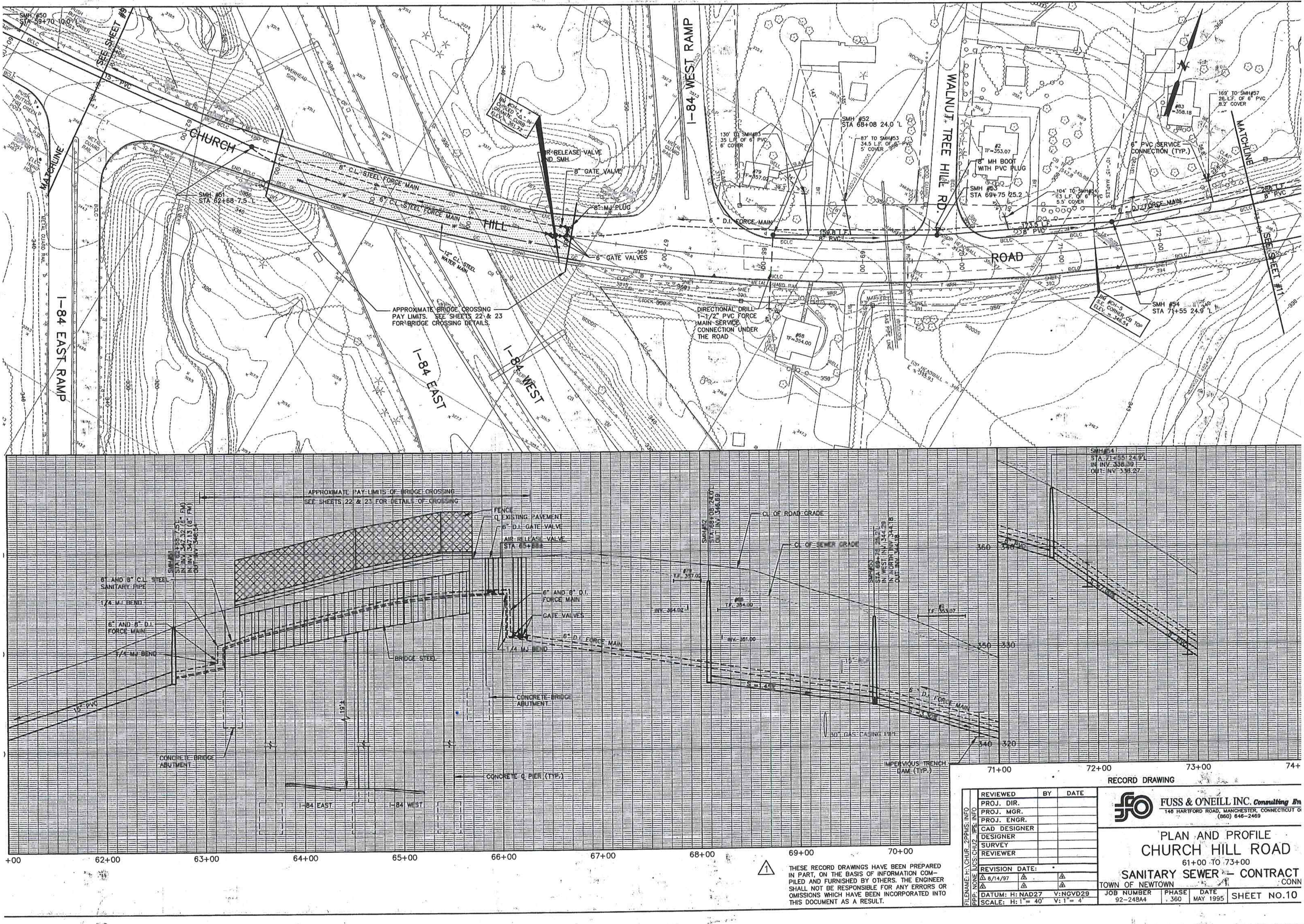
1. The dimensions of the leaching beds and extent of engineered fill locations are consistent with the dispersal area required for the 50,000 gallon per day flow listed on the plans. However, the depth of engineered fill depicted on the profiles on sheets 2-5 are unable to be reviewed due to the lack of subsurface investigation (boring and test pit) information provided.

2. A typical, dimensioned cross section that depicts the location of the leaching structures within the fill should be added to the drawings. The calculated depth of mounding between the leaching structures should be supported by the cross section.

3. The proposed decentralized onsite wastewater treatment facility (Amphidrome) presented appears to be capable of treating the design flow.

4. The building footprints depicted on the plans appear capable to provide 400 units on the basis that the units are a maximum of 600 square feet and predicated on a maximum building height of three stories (36 feet). Units greater than 600 square feet would require additional buildings on the subject parcel which may compromise the potential for onsite renovation for the design flow. See **Exhibit 9** for computations regarding the potential number of units at the subject parcel.

c: Fred Hurley – Newtown DPW Director
David Grogins Esq. – Cohen and Wolf



RECORD DRAWING
FUSS & O'NEILL INC. Consulting En
146 HARTFORD ROAD, MANCHESTER, CONNECTICUT
(860) 646-2469
PLAN AND PROFILE
CHURCH HILL ROAD
61+00 TO 73+00
SANITARY SEWER - CONTRACT
TOWN OF NEWTOWN
JOB NUMBER 92-248A4
PHASE .360
DATE MAY 1995
SHEET NO.10
DATUM: H: NAD27 V: NGVD29
SCALE: H: 1" = 40' V: 1" = 4'
REVISION DATE: 6/14/97
THESE RECORD DRAWINGS HAVE BEEN PREPARED IN PART, ON THE BASIS OF INFORMATION COMPILED AND FURNISHED BY OTHERS. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT.
WALNUT TREE HILL RD.
CHURCH HILL ROAD
I-84 WEST RAMP
I-84 EAST RAMP
I-84 EAST
I-84 WEST
APPROXIMATE BRIDGE CROSSING PAY LIMITS. SEE SHEETS 22 & 23 FOR BRIDGE CROSSING DETAILS.
DIRECTIONAL DRILL 1-1/2" PVC FORCE MAIN SERVICE CONNECTION UNDER THE ROAD
APPROXIMATE PAY LIMITS OF BRIDGE CROSSING SEE SHEETS 22 & 23 FOR DETAILS OF CROSSING

WASTEWATER ENGINEERING: COLLECTION AND PUMPING OF WASTEWATER

METCALF & EDDY, INC.

Written and edited by

GEORGE TCHOBANOGLOUS

Professor of Civil Engineering
University of California, Davis

McGraw-Hill, Inc.
New York St. Louis San Francisco Auckland Bogotá
Caracas Lisbon London Madrid Mexico City Milan
Montreal New Delhi San Juan Singapore
Sydney Tokyo Toronto

materials. Their standard lengths are longer than those of some of the older kinds of pipe. Therefore, some manufacturers have advocated smaller n values for plastic pipes ($n = 0.011$ or $n = 0.010$). But the number of building connections, manholes, and other flow-disturbing appurtenances in a given sewer remains the same, regardless of the pipe material. For this reason, and considering the uncertainties inherent in sewer design and construction, the value of n for sewer design should not be less than 0.013.

Sewer pipe materials and sizes. The principal sewer pipe materials are asbestos cement, ductile iron, reinforced concrete, prestressed concrete, polyvinyl chloride, and vitrified clay. The size ranges and information on the sewers made of these materials are presented in Table 4-4. Other sewer pipe materials include cast iron, corrugated metal, steel, nonreinforced concrete, and various plastics, either plain or reinforced with glass fibers.

In sewer design, a minimum size of sewer pipe must be established because large objects sometimes enter sewers, and clogging is less likely if sewers are not smaller than 200 mm (8 in). Obviously, the smallest sewers should be larger than the building sewer connections in general use, so that articles that pass through the building connections may as readily pass through the sewer. A minimum size of 200 mm (8 in) is recommended for gravity-flow sanitary sewers. The most common size of building connection is 150 mm (6 in), but connections of 125 and 100 mm (5 and 4 in) have been used successfully in some areas.

Minimum and maximum velocities. If wastewater flows for an extended time at low velocities, solids may be deposited in the sewer. Sufficient velocity should be developed regularly to flush out any solids that may have been deposited during low flow periods. The usual practice is to design the slopes for sanitary sewers to ensure a minimum velocity of 0.6 m/s (2.0 ft/s) with flow at one-half full or full depth. The velocity at less than one-half full depth will be less than 0.6 m/s; the velocity for depth between one-half full and full will be slightly greater than 0.6 m/s. Often, minimum and maximum velocities are specified in state and local standards.

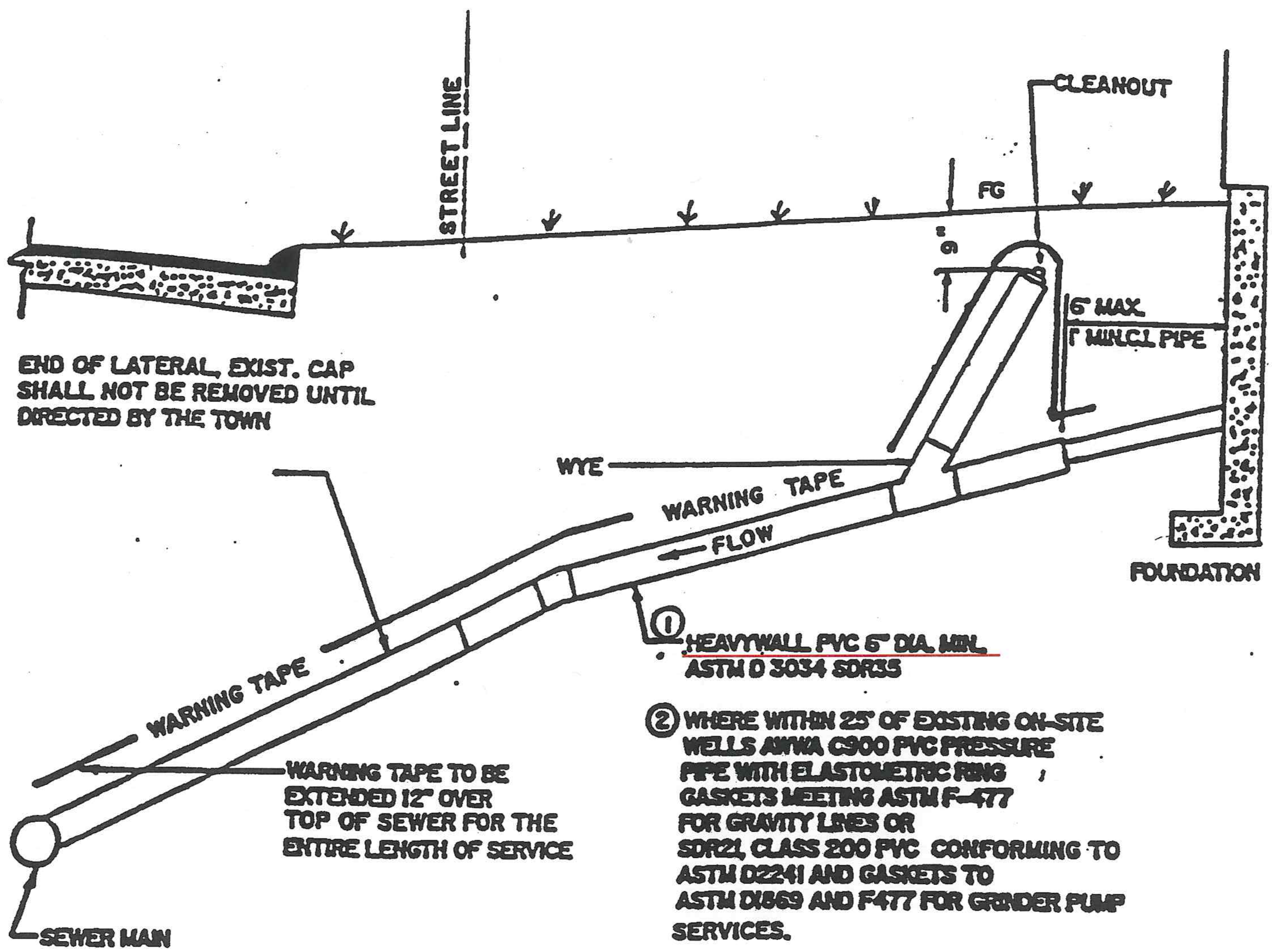
Although the velocity near the bottom of the sewer significantly affects how quickly the wastewater flows, a mean velocity of 0.3 m/s (1.0 ft/s) is usually sufficient to prevent the deposition of the organic solids in wastewater. To prevent deposition of mineral matter, such as sand and gravel, a mean velocity of 0.75 m/s (2.5 ft/s) is generally adequate in sanitary sewers. These are minimum figures. In depressed sewers (sometimes called *inverted siphons*), where access for cleaning is difficult, the minimum velocity should be about 1.0 m/s (3.0 ft/s) (see "Depressed Sewers," Chap. 5, Sec. 5-3). Slopes corresponding with mean velocities as low as 0.5 m/s (1.5 ft/s) have been used successfully in some special cases, but sewers at such slopes must be constructed with great care and will probably require frequent cleaning.

Repeated removal of deposited material from sewers is expensive and, if such deposits are not cleaned out, they may cause increasingly troublesome

NEWTOWN, CONNECTICUT 06470
(203) 270-4300

TOWN OF NEWTOWN
PUBLIC WORKS DEPARTMENT

FIGURE 1



4 TURKEY HILL ROAD
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PUBLIC WORKS DIRE

TOWN OF NEWTOWN
PUBLIC WORKS DEPARTMENT

Typical Sewer Lateral Trench & Bedding Requirements

1. Where "Form 815 / 814A " is used, it shall mean "State of Connecticut Department of Transportation Standard Specifications For Roads, Bridges and Incidental Construction, Form 815 / 814A, 1995".

2. Unusual soil conditions and or deep trench may require concrete encasement or extra depth or extra depth of pipe bedding.

3. Impervious dams of any suitable material are required to stop ground water flow into the sewer pipe bedding. The damming material shall be full width and depth of the stone bedding material and shall be located within the first pipe past the Town lateral.

4. Pipe bedding for 6" gravity service shall be crushed stone meeting the gradation requirements for 3/4" or 1/2" in Article M.01.01 of Form 815 / 814A. (Table 1).

5. All trenching shall require complete adherence to OSHA or other industry safety practices (whichever are more strict) including but not limited to hard hats, trench boxes, ladders etc. Hookup permits will be suspended if safety procedures are not followed.

4 TURKEY HILL ROAD
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PUBLIC WORKS DIRE

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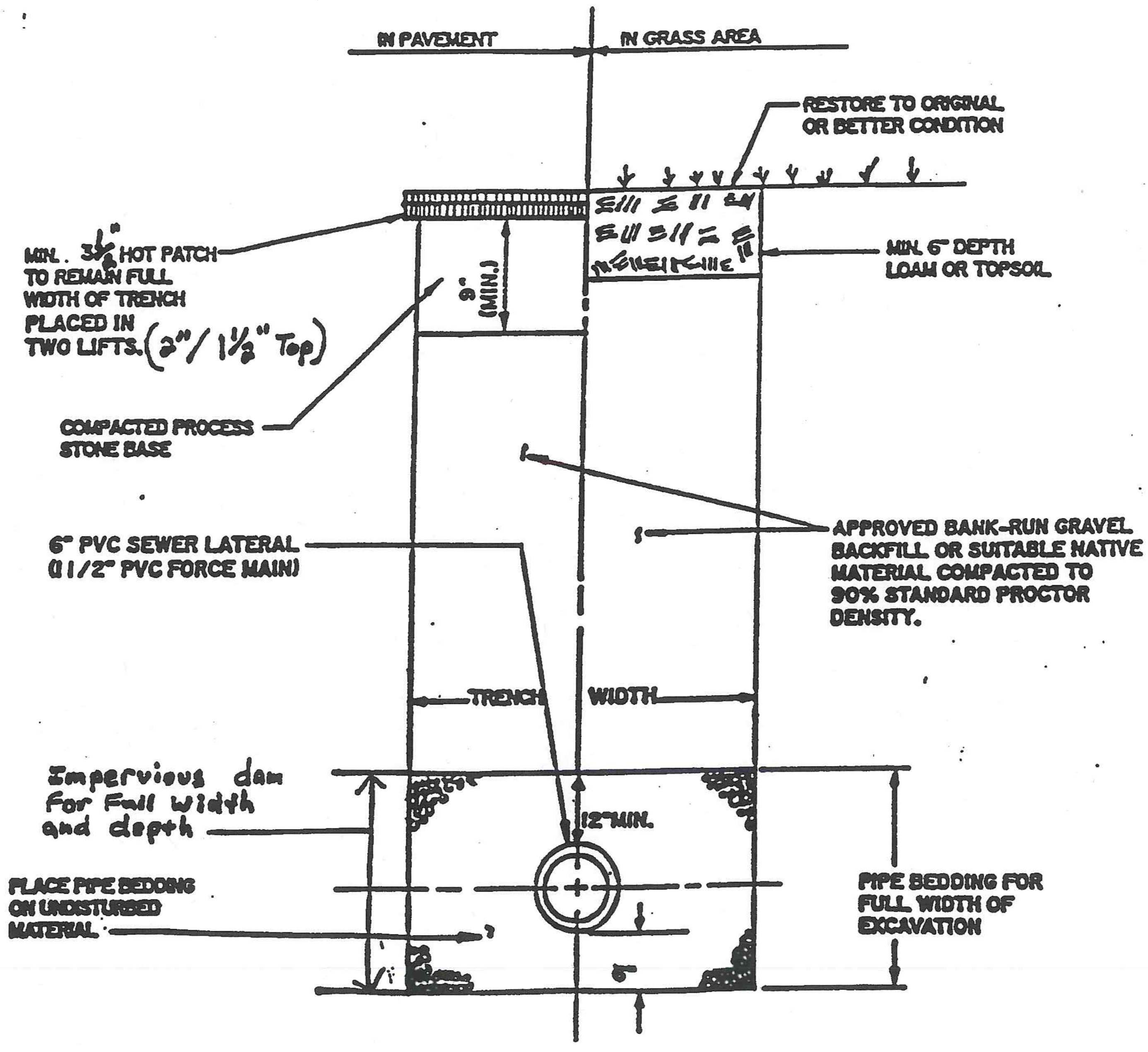
FIGURE 2



8.0 DESIGN CRITERIA

NEWTOWN SEWERS
SEWER DESIGN CRITERIA

A. GRAVITY SEWERS

Sewer design criteria shall be as shown in Chapter 2 of the *Guide for the Design of Wastewater Treatment Works* (TR-16), prepared by the Technical Advisory Board of the New England Interstate Water Pollution Control Commission, supplemented as follows:

- Sewers will be designed to accommodate ultimate peak flows.
- Sewers will normally be installed in the middle of the road.
- Sewers will be located along the shoulders in state roads with concrete base pavement where possible. Crossings will be minimized. "Dual sewers" may be utilized.
- Sewer depth will be set with the goal of serving sanitary outlets by gravity. Where this would result in unusually deep sewers, an analysis will be prepared to compare the cost of the deep sewer versus pumping.
- A minimum slope for the furthest upstream reach of sewer will be 1% where possible to minimize depositions. Slopes of less than 0.5% will not be used.
- PVC SDR 35 sewer pipe will generally be used. Where ductile iron is necessary (such as force mains and within 25 feet of wells), it will be Class 52.
- Chimneys shall be precast units.
- Service laterals will be assumed as 6 inch at a minimum slope of 1% (2% preferred).
- Manholes will normally be 4 feet diameter. Increase diameter to 5 feet for sewers 18" through 24".
- Manholes will be precast concrete, waterproof, cored openings with rubber boots.
- Drop manholes will be avoided whenever possible. When drop manholes are unavoidable, inside drops will be used to facilitate maintenance. Drop pipes may be PVC.
- Manhole frames and covers will be Traffic Type 24 inch opening non-vented covers, with "Newtown Sewers" cast in the cover.
- Manhole covers on cross country runs will not be buried.

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Fred Hurley,
Director

TOWN OF NEWTOWN
1705
CONN.

TOWN OF NEWTOWN
WATER AND SEWER AUTHORITY

WATER POLLUTION CONTROL PLAN

Adopted 1/8/2015

I. Authority and Purpose

The Newtown Water Pollution Control Authority was established as an agency of the Town by Ordinance 56, adopted by the Legislative Council on May 7, 1980, in accordance with Chapter 103 of the Connecticut General Statutes and redesignated as the Water and Sewer Authority ("WSA") by Ordinance 56A adopted by the Legislative Council on April 7, 2004.

The WSA hereby establishes this Water Pollution Control Plan for the Town of Newtown. The purpose of the plan is to designate and delineate the boundaries of areas to be served by Town sewers and areas where sewers are to be avoided and to describe the policies and programs to be carried out to control surface and groundwater pollution control problems.

II. Facilities Plans

At a Town Meeting in March 1992, the Town accepted the recommendations for wastewater treatment as described in the "Town of Newtown, Connecticut Water Pollution Control Facilities Plan" dated September 1989, as amended by "Addendum #1" dated September 27, 1990 and "Addendum #2" dated October 10, 1991, prepared by Consulting Environmental Engineers, Inc. of West Hartford, CT.

The Town had rejected the original version of the Facilities Plan in 1989 and the first amended plan in 1990. Each of the two addenda scaled back the sewer service area based on lot-by-lot surveys undertaken by members of the Health Department and the WSA.

The plans for wastewater treatment were modified by the State/Town Intergovernmental Sewerage Agreement which calls for the discharge of sanitary sewage from State facilities into the Town plant. During design other plan improvements were made including the elimination of the need for four pump stations and a community treatment facility at Treadwell Park.

The wastewater treatment facility serves the central sewer service area consisting generally of the Borough, an area north of Taunton Pond, a portion of Sandy Hook, State-owned properties, and, as a result of the 2004 property transfer from the State to the Town, a portion of the Fairfield Hills campus.

Additional treatment capacity for economic development is available in the Hawleyville area as a result of interlocal agreements with Danbury and Bethel, CT. The Hawleyville Area Facility Plan prepared by Fuss & O'Neill Inc. Consulting Engineers of Manchester, CT was adopted by the WSA on November 12, 1998.

III. Sewer Avoidance

In January, 1978 the State Department of Environmental Protection published "A Report to the Joint Standing Committee on the Environment On the Establishment and Administration of a Municipal and Town Sewer Avoidance Program." The document served as a principal basis for the 1978 amendments to Section 7-246 of the Connecticut General Statutes that provided for the preparation of a Water Pollution Control Plan by municipalities. Sewer avoidance was recognized to be a desirable policy in rural communities where sewers do not exist and are not planned.

Based on Facilities Plan as amended, the WSA concludes that sewer avoidance is an appropriate policy for areas outside the sewer service areas as defined herein. The Town does not intend extend sewers to areas outside the sewer service areas and intends to control surface and groundwater pollution problems in these areas through aggressive administration of a sewer avoidance policy to the extent permitted by zoning regulations. This policy requires the support of all Town agencies to avoid future problems with onsite disposal.

IV. Policies and Objectives

In accordance with Town Policy, any new development outside a sewer service area shall not exceed the ability of the land on which it is located to support property subsurface wastewater disposal on site except where specifically permitted by zoning regulations. The design of such onsite disposal systems shall meet all current State and Town regulations, standards, and codes.

A sewer avoidance policy shall be adopted which shall promote the vigorous enforcement of technical standards for new and repaired disposal systems, the proper operation of disposal systems through public education, the monitoring of disposal systems and their effects on surface water and groundwater, and the identification of malfunctioning disposal systems and implementation of effective onsite repairs or alternative solutions.

The WSA adopted a priority matrix for the central sewer service area to ensure that the limited treatment plant capacity of 332,000 gallons per day ("gpd") can be allocated in a logical manner.

Priority	Allocation (gpd)	Type of development
1st priority	267,000	Existing average metered capacity usage as of 11/1/14
2nd priority	31,630	Previously allocated capacity to suspended existing usage (Sandy Hook School), paid commercial/industrial property assessment, existing and pending allocation requests
3rd priority	9,960	Reserve environmental capacity buffer of 3% of permitted capacity of 332,000 gpd
4th priority	23,410	Unallocated capacity available on a "first come, first serve" basis within the approved sewer service area

V. Designation and Delineation of Sewer Service Areas

The central sewer service area includes all properties that were determined to require sewer service during preparation of the Facilities Plan. The outline of the area generally follows that shown on Plate 1 "Recommended Plan," dated September 3, 1991 of the Facilities Plan but it has been modified during design and by subsequent additions. The WSA hereby adopts and incorporates in this plan the sewer service areas as delineated on the map entitled "Sewer Service Area, Newtown Sewerage System," dated May 11, 1994 and any revisions or additions to sewer service areas on maps subsequently approved by the WSA.

No Sewer Service Area has been established for the Hawleyville area. The Hawleyville Sewerage System serves individual properties and may be extended for economic development approved by the Town and WSA.

VI. Effective Date

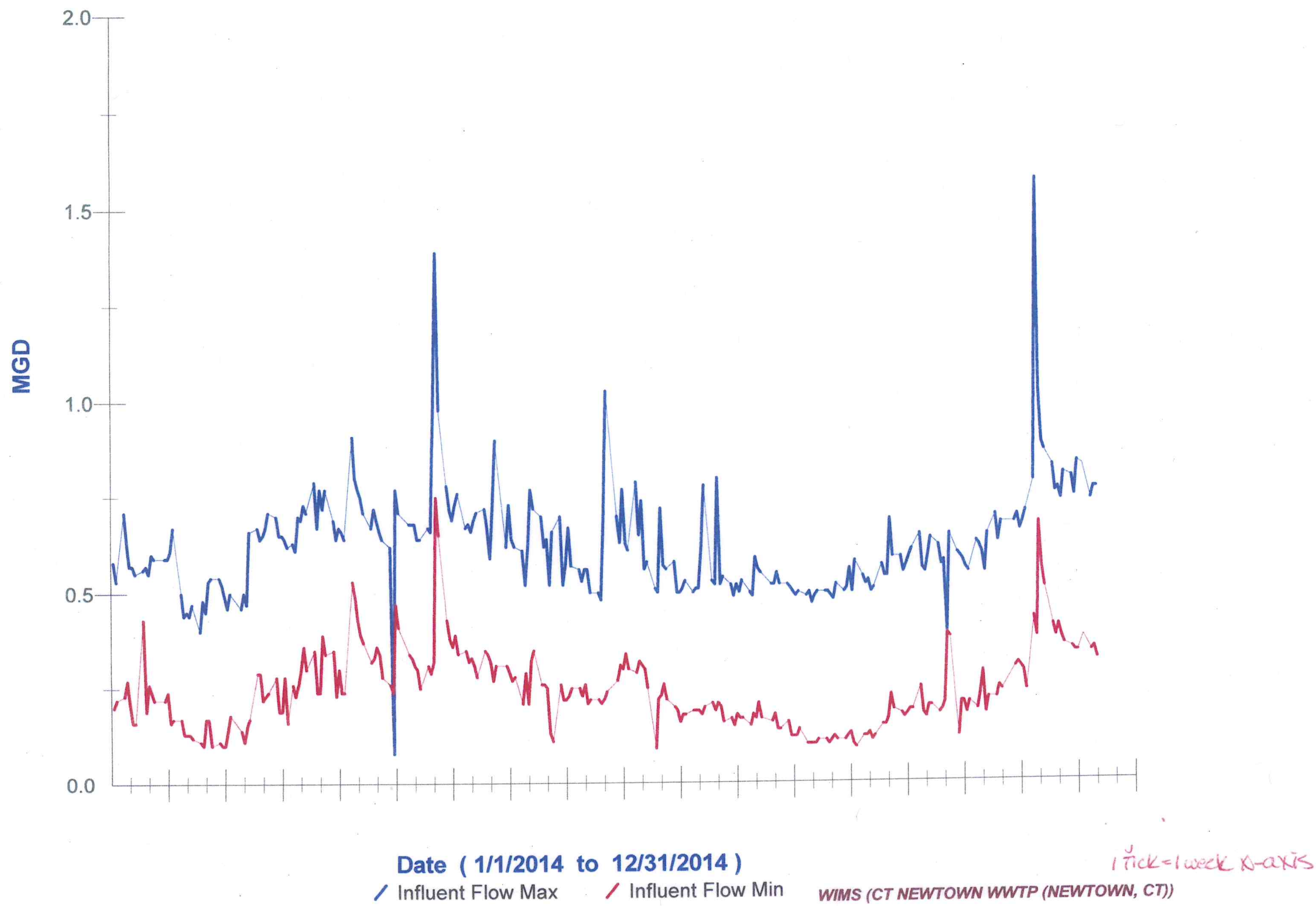
The date of adoption shall be deemed the effective date of this Water Pollution Control Plan. This plan may be amended by the WSA with the approval of the Board of Selectmen. A copy of this plan and any updates shall be filed with the State Commissioner of Environmental Protection.

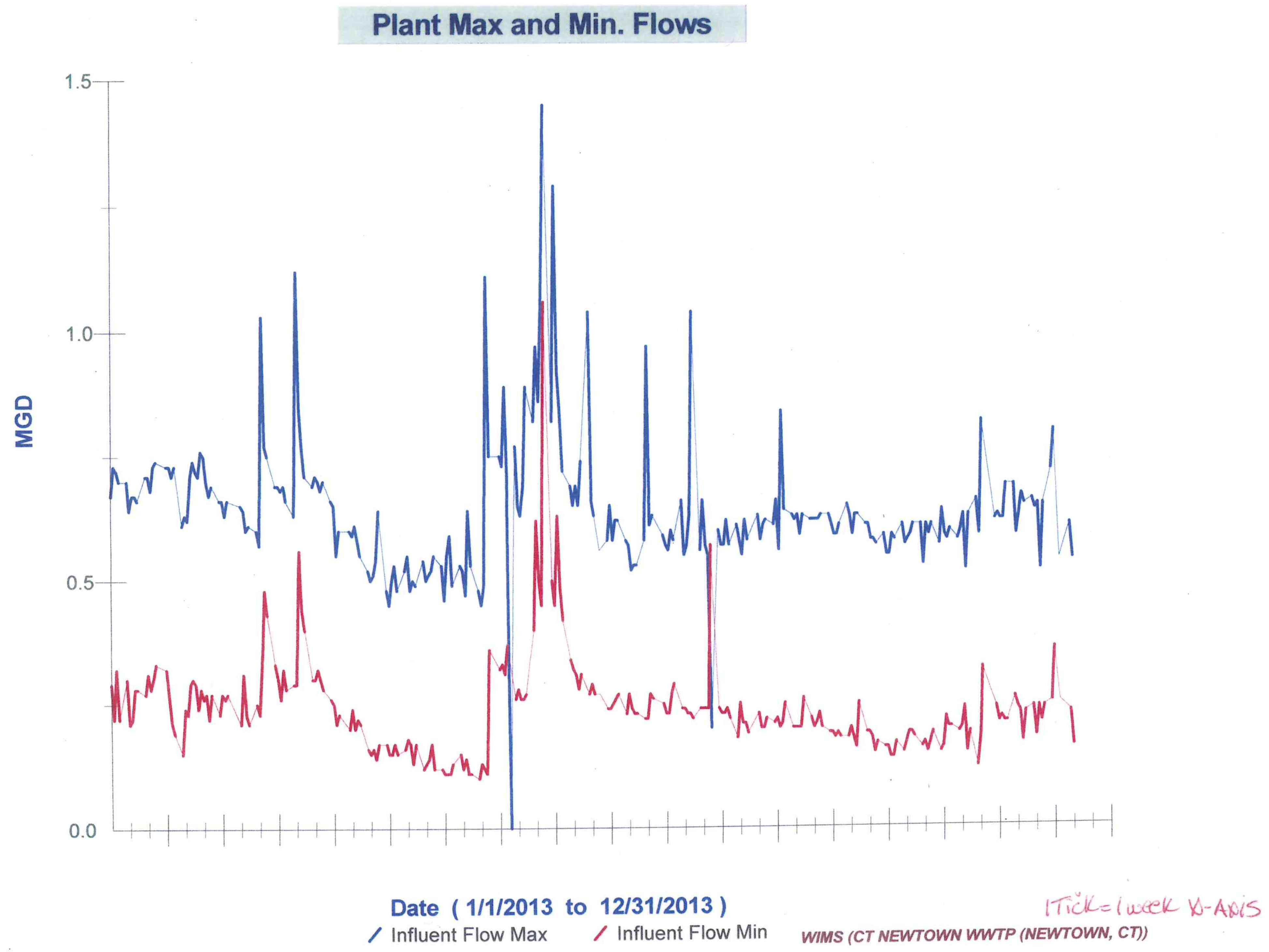
The original Water Pollution Plan was adopted on February 9, 1995 and previously amended on June 24, 1999 and August 13, 2009.

Date: 1/28/15 Amended: Marianne Brown
Marianne Brown, WSA Chairman

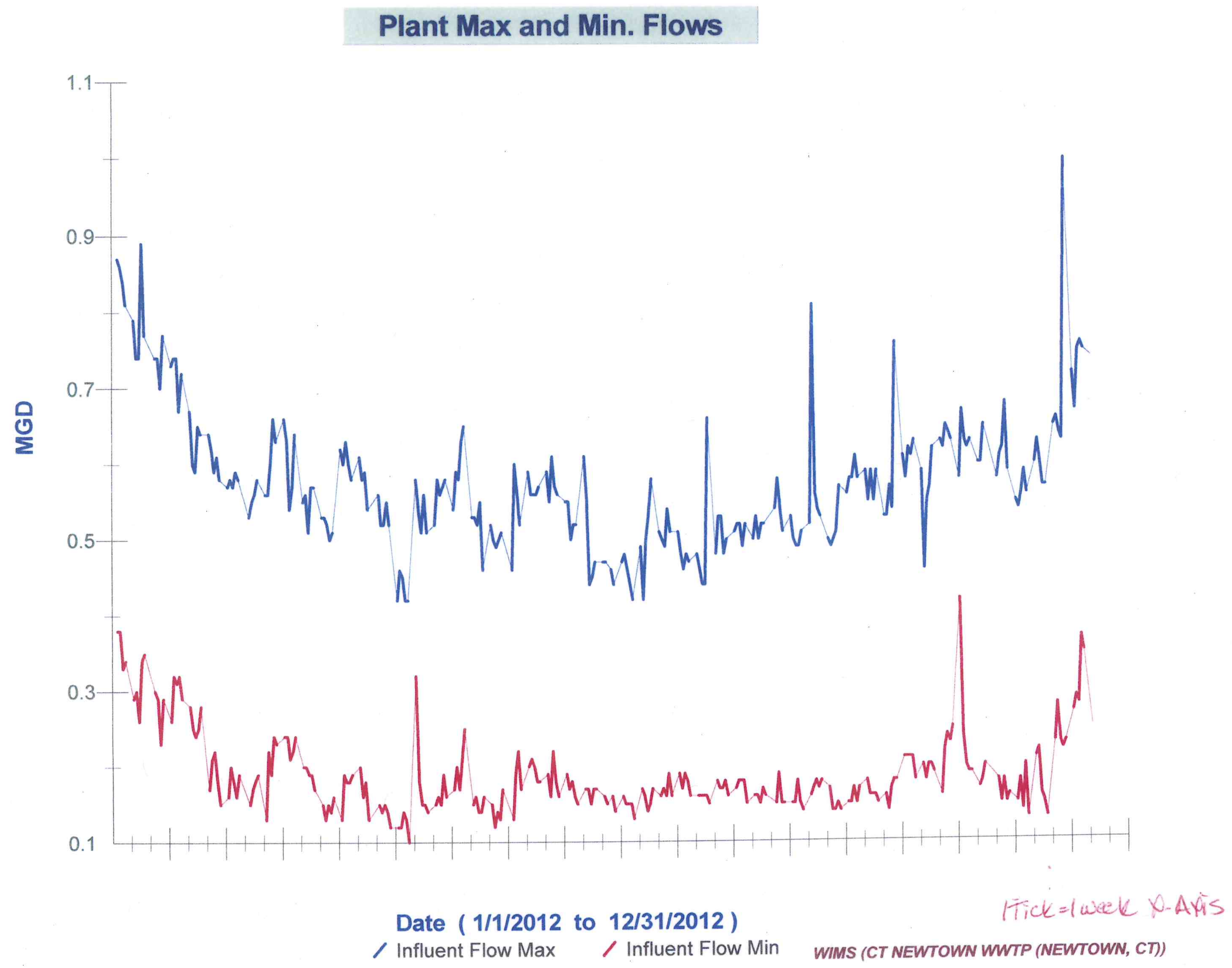
Date: 1/28/15 Approved: E. Patricia Llodra
E Patricia Llodra, First Selectman

Plant Max and Min. Flows



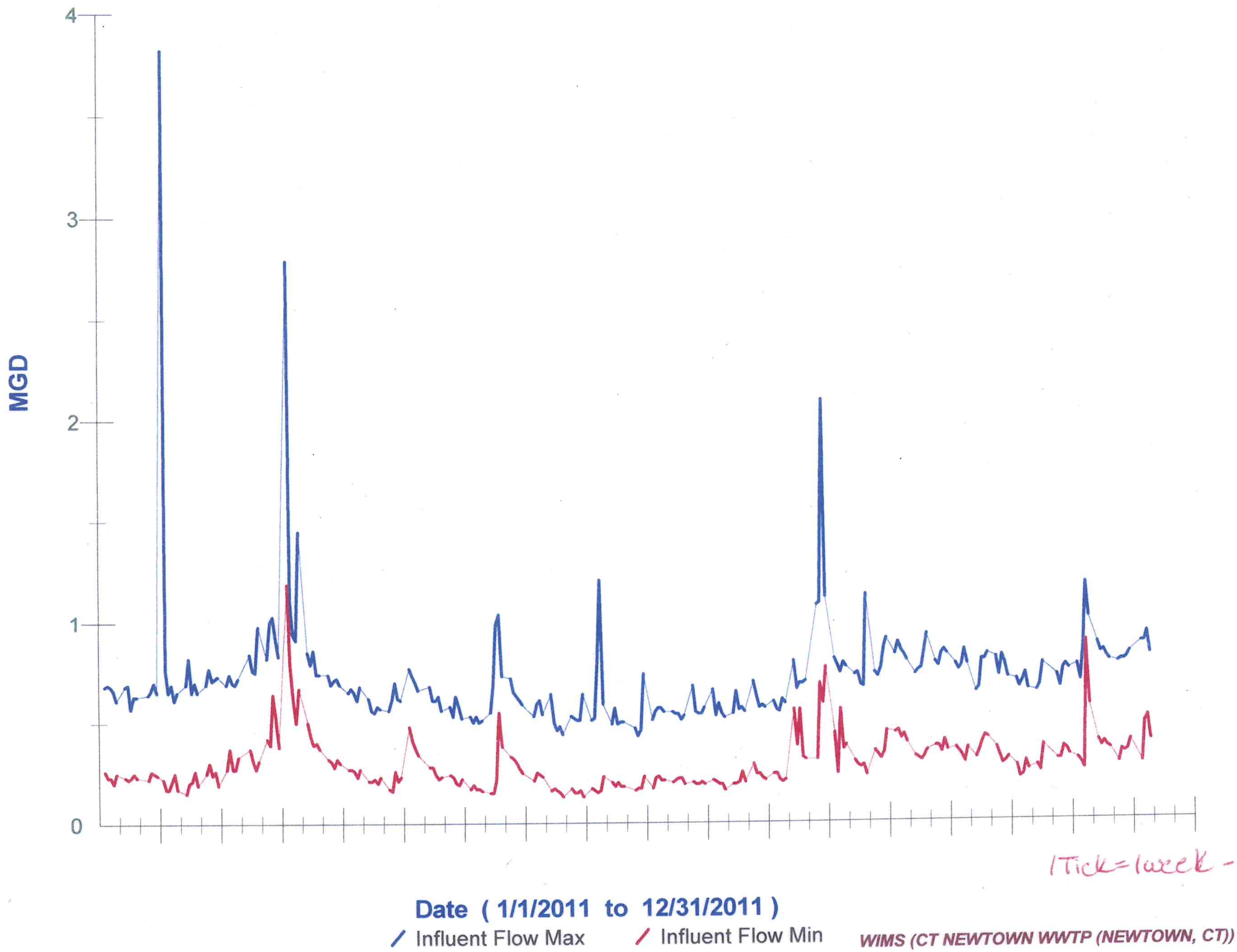


Plant Max and Min. Flows
MGD
1.5
1.0
0.5
0.0
Date (1/1/2013 to 12/31/2013)
Influent Flow Max
Influent Flow Min
WIMS (CT NEWTOWN WWTP (NEWTOWN, CT))
1 Tick = 1 week X-Axis



Plant Max and Min. Flows
MGD
1.1
0.9
0.7
0.5
0.3
0.1
Date (1/1/2012 to 12/31/2012)
Influent Flow Max
Influent Flow Min
WIMS (CT NEWTOWN WWTP (NEWTOWN, CT))
1Tick=1week X-Axis

Plant Max and Min. Flows



1 Tick = 1 week - X-AXIS

Wastewater Flows

FUSS & O'NEILL

Town of Newtown
March 3, 2015

Flow Node E (E3, E4)	Average (gpd)	Average (gpm)	Peak Factor [1] (gpd)	Infiltration & Inflow (I/I) (gpd)	Total Peak Hour Flow Plus I/I (gpd)	Total Peak Hour Flow Plus I/I (gpm)	Pump #1 Capacity [4] (gpm)	Pump #2 Capacity [4] (gpm)
Initial (Table 9-2 PDR)	29,970	21	120,180	21,318	141,498	98	215	180
79 Church Hill Rd.[2]	43,750	30	152,250	1,464	153,714	107		
Total	73,720	51	272,430	22,782	295,212	**205**	OK	**Not OK**
Based on Actual in 2011[3]	61,468	43	246,487		246,487	171	215	180
79 Church Hill Rd.[2]	43,750	30	152,250	1,464	153,714	107		
Total	105,218	73	398,737		400,201	**278**	**Not OK**	**Not OK**
Ultimate (Table 9-3 PDR)	341,880	237	1,111,110	596,636	1,707,746	1,186	215	180
79 Church Hill Rd.[2]	43,750	30	152,250	1,464	153,714	107		
Total	385,630	268	1,263,360	598,100	1,861,460	**1,293**	**Not OK**	**Not OK**

Notes:

1- Following peaking factors have been used :
   - Initial Flow — 4.01 - Table 9-2 PDR dated 04/20/94 by F&O
   - 79 Church Hill Rd — 3.48 - Shipman & Goodwin Letter dated February 4, 2015
   - Ultimate Flow — 3.25 - Table 9-3 PDR dated 04/20/94 by F&O

2- Assumed 0.61 mile of sewer within the 79 Church Hill Development area 300 - gpd/in.dia./mile
Minimal I/I allowance for the gravity sewer calculated based on a 250 - 500 gpd/in.dia./mile of sewer. (TR-16)

3- Recorded 2011 flow data at Sandy Hook Pump Station utilized to capture ADF from Sandy Hook School which was vacated in 2012 and is projected to be reconnected to the system upstream of Sandy Hook Pump Station

4- Existing pumps can not handle the 107 gpm additional flow from the proposed development at 79 Church Hill Road

FUSS & O'NEILL
Disciplines to Deliver

Newtown - Force Main Hydraulic alculations - Actual Flow

Sandy Hook Pump Station

Description	Value	Units
Pump Rate	278	gpm
C Factor	**120**	*Old D.I.*
Force Main Length (6")	3,120	*feet*
Pump Discharge (LL Alarm, H)	210.2	*feet*
Force Main highest Elevation	357.0	*feet*
Force Main Discharge Elev. at P.S.	226.5	
Force Main Length (4")	40	
Pump Rate		*gpm*
Static Head	147	*feet*

Church Hill Rd L =	2,524	ft
Under Pootatuck River =	396	
To Dry Pit	200	
Total	3,120	

Mechanical Friction Head

Type of Fitting	Quantity	K Factor	# × (K ÷ 2g) P.S. (4")	# × (K ÷ 2g) Force Main (6")
Entrance	1	0.50	0.0078	
90 Degree Bend (Standard Radius)	2	0.90		0.0280
90 Degree Bend (Long Radius)	5	0.60		0.0466
45 Degree Bend	4	0.42		0.0261
11.5 Degree Bend	6	0.20		0.0186
Wye Increaser	1	0.90	0.0140	
Cross	1	0.30	0.0047	
Branch	0	0.90		
Swing Check Valve	1	2.30	0.0357	
Gate Valve	1	0.19	0.0030	
Increaser	1	0.30		0.0047
Air Release/Vacuum Valve	1	0.80		0.0124
Cleanout	0	0.90		
Flow Meter	1	0.10	0.0016	
Exit	1	1.00		0.0155
Mechanical Friction Head = 0.0667 x (v^2)		**Subtotal**	0.0667	0.1520

Total Dynamic Head

Pipe Diameter	Flow	Velocity	Friction Head *(feet)*		Static Head	Total Dynamic Head	Maximum Pressure	
inches	*gpm*	*fps*	Pipe	Mechanical	*feet*	*feet*	*psi*	
4	278	7.10	2.3	3.4	16	**22**	10	P.S.
6	278	**3.15**	25.3	1.5	131	**157**	68	FM
Total			27.7	4.9	147	**179**	78	

(Using Hazen-Williams Equation)

Newtown - Force Main Hydraulic Calculations - Ultimate Flow

FUSS & O'NEILL
Disciplines to Deliver

Sandy Hook Pump Station

Description	Value	Units
Pump Rate	1,293	gpm
C Factor	120	*Old D.I.*
Force Main Length (6")	3,120	*feet*
Pump Discharge (LL Alarm, H)	210.2	*feet*
Force Main highest Elevation	357.0	*feet*
Force Main Discharge Elev. at P.S.	226.5	
Force Main Length (4")	40	
Pump Rate		*gpm*
Static Head	147	*feet*

Church Hill Rd L =	2,524	ft
Under Pootatuck River =	396	
To Dry Pit	200	
Total	3,120	

Mechanical Friction Head

Type of Fitting	Quantity	K Factor	# × (K ÷ 2g) P.S. (4")	# × (K ÷ 2g) Force Main (6")
Entrance	1	0.50	0.0078	
90 Degree Bend (Standard Radius)	2	0.90		0.0280
90 Degree Bend (Long Radius)	5	0.60		0.0466
45 Degree Bend	4	0.42		0.0261
11.5 Degree Bend	6	0.20		0.0186
Wye Increaser	1	0.90	0.0140	
Cross	1	0.30	0.0047	
Branch	0	0.90		
Swing Check Valve	1	2.30	0.0357	
Gate Valve	1	0.19	0.0030	
Increaser	1	0.30		0.0047
Air Release/Vacuum Valve	1	0.80		0.0124
Cleanout	0	0.90		
Flow Meter	1	0.10	0.0016	
Exit	1	1.00		0.0155
Mechanical Friction Head = 0.0667 x (v^2)		**Subtotal**	0.0667	0.1520

Total Dynamic Head

Pipe Diameter	Flow	Velocity	Friction Head *(feet)*		Static Head	Total Dynamic Head	Maximum Pressure	
inches	*gpm*	*fps*	Pipe	Mechanical	*feet*	*feet*	*psi*	
4	1,293	33.01	40.2	72.7	16	129	56	P.S.
6	1,293	14.67	434.9	32.7	131	598	259	FM
Total			475.0	105.4	147	727	315	**High Velocity, High Head**

(Using Hazen-Williams Equation)

Fairbanks Morse
Pump Corporation

SUBMITTAL CURVE

THIS CURVE IS BASED ON ACTUAL TEST PERFORMANCE OF A SIMILAR PUMP. ONLY THE INDICATED POINT(S) IS GUARANTEED.	NO. STAGES ONE	SIZE-MODEL 4-D5435MV	
	REFERENCE 74935	IMPELLER DES. T4E1E	
	PLOTTED BY JCM	IMPELLER DIA. 12.60"	
	DATE 2/4/97	RPM(S) 1766	

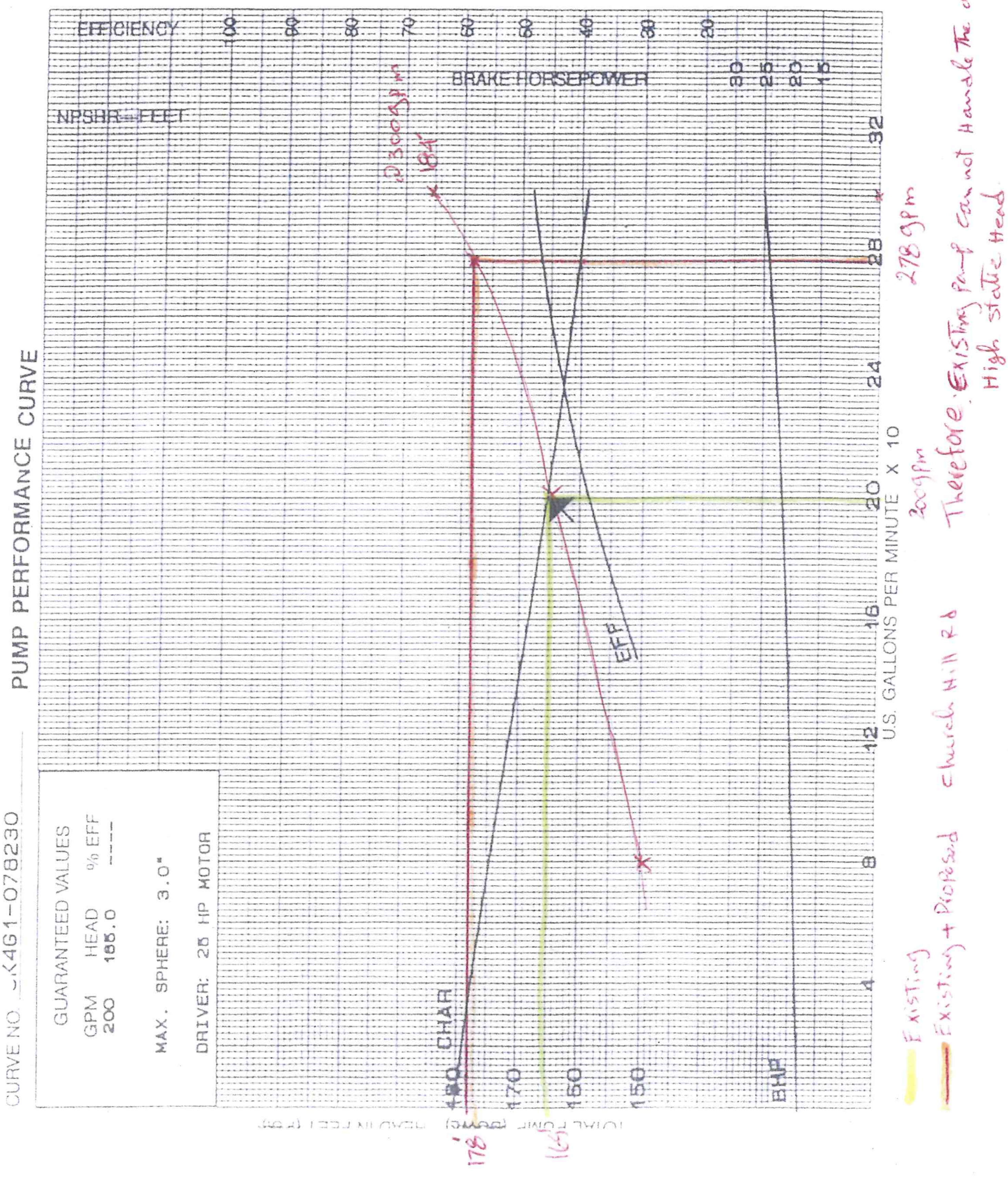
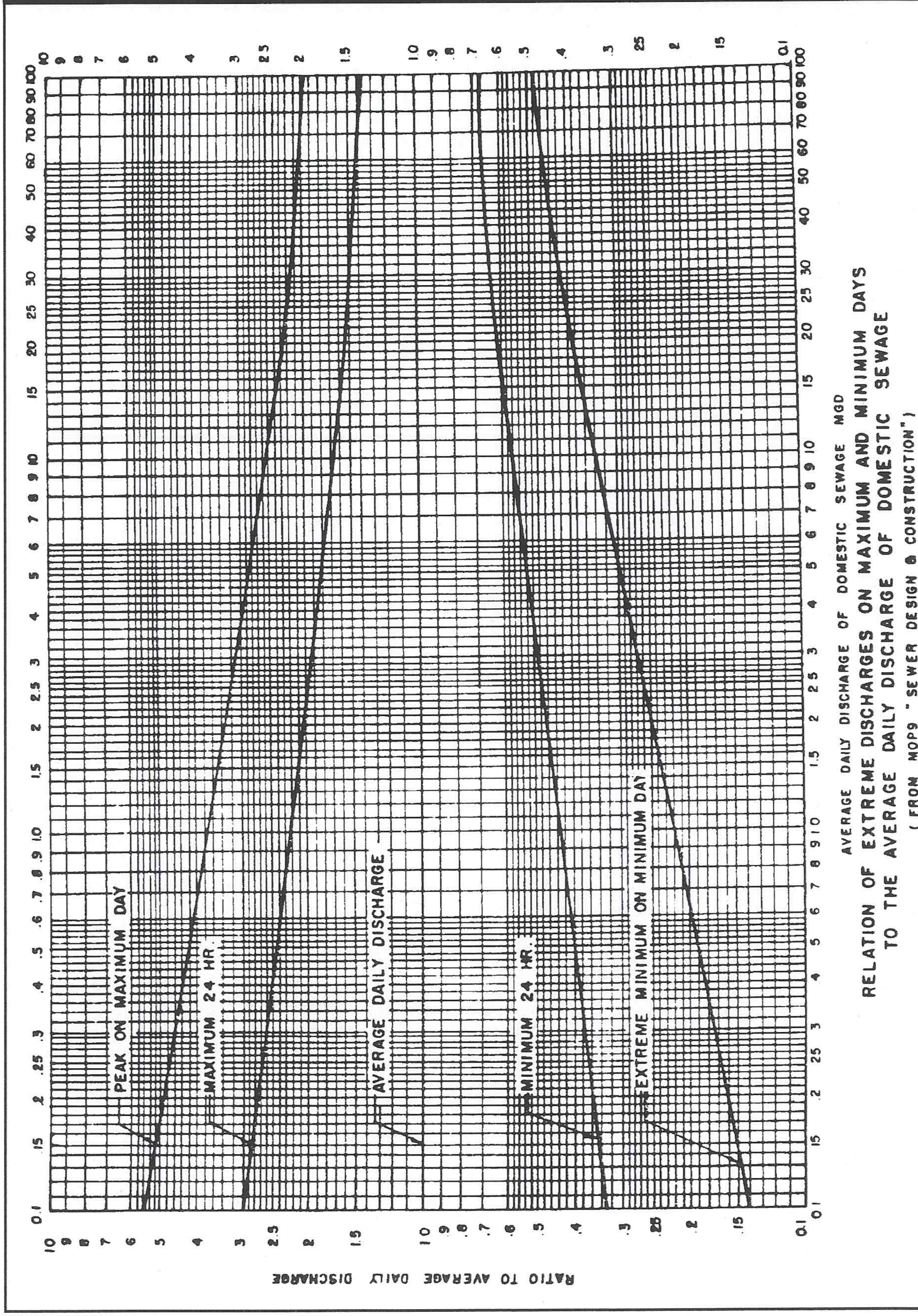


Figure 2-1 **Ratio of Extreme Flow to Average Daily Flow**



FUSS & O'NEILL

MEMORANDUM

TO:

FROM: Eric Bernardin

DATE: February 25, 2015

RE: Newtown Residential Development Feasibility

Building Foot Print A – 6 Typical (230' X 65')	15,000 SQ. FT.
Common Space Assumed hallway entire length of building, stairs and elevators, and lobby,	3,000 SQ. FT.
Usable space left for apartments	12,000 SQ. FT.
Average size of one-bedroom apartment	600 SQ. FT.
Number of units per floor	20 Units
Floors per building	3 Floors
Units per building	60 Units per Building
Total Building at 15,000 SQ. FT	6 Buildings
Number of units in 6 Buildings	360 Units

Building Foot Print B – 1 Typical (150' X 65')	9,800 SQ. FT.
Common Space Assumed hallway entire length of building, stairs and elevators, and lobby,	2,000 SQ. FT.
Usable space left for apartments	7,800 SQ. FT.
Average size of one-bedroom apartment	600 SQ. FT.
Number of units per floor	12 Units
Floors per building	3 Floors
Units per building	36 Units per Building
Total Building at 9,800 SQ. FT	1 Building
Number of units in 1 Buildings	36 Units

Total Units for all seven (7) proposed buildings = 396 Units