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Civil
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Kent County Water Authority
Distribution Storage Tank Hydraulic Evaluation

Technical Memorandum No. 3A
Existing and Future System Demands
December 2006 (Finalized January18, 2007)

1.0 Purpose and Scope

The project has been divided into various sub tasks and each of which will be further detailed in a specific technical memorandum. The purpose of this technical memorandum is to describe the efforts and results associated with the task related to determining and establishing the existing (current) and future (20 year planning period) water demands for use in the evaluation. Also, to provide the diurnal flow curves for the various pressure zones that would be utilized in the model and specifically for use during extended period model simulations. It is intended that the information gathered as part of this task will be the basis for evaluation and analysis as part of this study and ultimately for development of recommendations in subsequent portions of this study. The following are the specific efforts associated with this task.

1. Establish water demands for the current (2006) and future (2026) planning period. These will be provided for the following demand scenarios.

    - Average Day Demand
    - Maximum Day Demand
    - Peak Hour Demands (during Maximum Day)

    Demands will be segregated and tabulated by Town / City and also by pressure zone. The future demands shall be entered into the model on a global basis. That is, the demand shall be proportionately assigned to the various junction nodes in the pressure zone in which the demand is projected to occur.

2. System Wide Diurnal Flow Curves – The diurnal water use graphs for each pressure zone that were developed as part of the original model shall be reviewed for use in this evaluation. The graphs are utilized to calculate a series of multipliers (peaking factors) that the model uses to adjust demands for each hour in a day.

    These diurnal flow patterns will then be available for use in the model for use in simulations for extended period simulation (EPS) analysis. It is critical that these diurnal flow curves are developed and that extended period simulations be completed in order to gauge how the overall water system responds to periods of increased demand especially during peak hour periods and under fire flow conditions. Most critical are their importance in evaluating the recovery rates of tanks as well as the existing pumping capability to adequately replenish distribution system storage tanks.

2.0 Current and Future Population

The data previously developed in Technical Memorandum 1 (TM 1) regarding current and future population projections for the various communities in the Authority's service territory were utilized for purposes of developing and allocating future water demands. These previously developed tables are repeated for reference in developing this TM 3A.

The current and projected changes in population vary from community to community throughout the service territory. The following tables represent the anticipated change in population up to the year 2020 from year 2000 Census data and projections of changes in population as prepared by Rhode Island Statewide Planning (RISWP). The City of Cranston and Town of Scituate were not included in this table, as the Authority has no designs on increasing its service area in these communities.

PROJECTED POPULATION CHANGE BY COMMUNITY 2000 - 2005

COMMUNITY	2000 (CENSUS) POPULATION	2005 (RISWP) POPULATION	CHANGE (VALUE) AND %
Warwick	85,808	85,803	(-5) – 0.0%
West Warwick	29,581	29,759	(+178) +0.6%
Coventry	33,668	34,590	(+922) +2.7%
West Greenwich	5,085	5,413	(+328) +6.5%
East Greenwich	12,948	13,340	(+392) +3.0%
TOTALS	**167,090**	**168,905**	**(+1,815) 1.1%**

PROJECTED POPULATION CHANGE BY COMMUNITY 2000 - 2020

COMMUNITY	2000 (CENSUS) POPULATION	2020 (RISWP) POPULATION	CHANGE (VALUE) AND %
Warwick	85,808	85,235	(-573) –0.7%
West Warwick	29,581	30,928	(+1,347) +4.6%
Coventry	33,668	37,789	(+4,121) +12.2%
West Greenwich	5,085	6,550	(+1,465) +28.8%
East Greenwich	12,948	14,656	(+1,708) +13.2%
TOTALS	**167,090**	**175,158**	**(+8,068) 4.8%**

A review of the Town and City Community Comprehensive Plans and consultation with the various Planning Directors was also completed as part of TM 1. The information provided in the Plans and available from Planning Directors was generally non-specific with regard to areas of expected growth for the twenty-year planning period. The general consensus was that the Statewide Planning projections were likely a "reasonable" projection of population change. The population projections as developed by Statewide Planning were therefore utilized as part of this evaluation.

The most recent Water Supply System Management Plan (WSSMP) of 2001 provided indication of service population by community premised upon year 2000 data. For the purpose of this evaluation, it will be assumed that any increase or decrease in the overall projected population for each community for the next twenty-year period in the service population will increase or decrease proportionately. For example, data for year 2000 indicates that approximately 59% (19,941 of 33,668) of the total population are served by the Authority. It is projected that the total population in Coventry will increase over the next twenty years by 4,121 persons. The service population would therefore be expected to increase by a proportional rate. Therefore, assuming 59% of the 4,121 increase would be served by the Authority, the projected service population of Coventry for 2020 would equate to 22,382 or an increase of 2,441 persons. A similar approach was applied to the remaining service communities.

KENT COUNTY WATER SERVICE POPULATION 2000 -2020

COMMUNITY	2000 SERVICE POPULATION	2020 SERVICE POPULATION	CHANGE (VALUE) AND %
Warwick	8,578	8,521	(-57) –0.7%
West Warwick	18,083	18,906	(+823) +4.6%
Coventry	19,941	22,382	(+2,441) +12.2%
West Greenwich	824	1,062	(+238) +28.8%
East Greenwich	9,262	10,484	(+1,222) +13.2%
Cranston	2,005	2,005	(0) +0.0%
North Kingstown	28	28	(0) +0.0%
Scituate	1,170	1,170	(0) +0.0%
TOTALS	**59,891**	**64,558**	**(+4,667) +7.8%**

The total system wide service population is therefore anticipated to increase by 7.8% based on the population projections.

The table indicates that the municipalities such as Coventry, East Greenwich and West Greenwich are expected to grow at a moderate pace with the greatest increase in the number of persons identified in Coventry. West Greenwich is anticipated to grow at the fastest pace however the relative number of the increase in actual population is not as great as Coventry. Warwick and West Warwick are anticipated to experience a no change to a slight increase in population. None of the Planning Departments / Planning Officials made reference or had knowledge of any specific commercial or industrial project(s) that may

have a substantial direct impact to future water use. They did however indicate that there is always a possibility of such development occurring however, it is near impossible to project the volume of water that may be required.

It should be noted that the above are based on projections which can be subject to various factors including but not limited to the following: zoning and demographic changes, economic conditions, industrial development (most notably those employing wet processes which can utilize large volumes of water), conversion from single family to multifamily or commercial use, increase in fire service requirements, etc. The unpredictability of these various factors can serve to singly or in combination serve to increase or possibly decrease the future water volume requirements.

3.0 Current (2006) Water Demands

The following Tables represent the current (year 2006) water demands for each of the various demand scenarios as developed in the most recent hydraulic model update of March 2006. These are provided by both community and pressure zone.

CONSUMER DEMAND BY PRESSURE ZONE (2006)

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	5.393	10.237	11.844
Tiogue Tank (350') Gradient	0.086	0.176	0.200
Intermediate High (430') Gradient (RSHR)	0.397	0.811	0.924
High Service (500') Gradient	2.323	4.379	5.828
Low Service Reduced (334') Gradient	1.871	3.727	4.320
High Service (500') Reduced Gradient	0.528	1.035	1.274
Warwick Wholesale Interconnection (232') Gradient	0.006	0.010	0.011
Hope Road (510') Gradient	0.006	0.013	0.014
Oaklawn (231') Gradient	0.361	0.736	0.847
TOTALS	**11.0 MGD**	**21.1 MGD**	**25.3 MGD**

CONSUMER DEMAND BY COMMUNITY (2006)

COMMUNITY	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Warwick	1.866	3.594	4.153
West Warwick	2.916	5.751	6.804
Coventry	2.735	5.232	6.152
West Greenwich	1.064	1.765	2.361
East Greenwich	1.990	3.990	4.880
Cranston	0.303	0.592	0.686
Scituate	0.096	0.195	0.222
TOTALS	**11.0 MGD**	**21.1 MGD**	**25.3 MGD**

Note:

1. The maximum day and peak hour demands represented in the table above are premised upon an historical period (July 2002) when the system experienced its largest water use. Although the system does not experience a similar magnitude in water demand every year, it is prudent for planning purposes to consider that this peak demand can occur in the future.
2. The demands presented in the two tables above reflect the recent water reduction in water use by ON – Semiconductor (Low Service) and Amgen (High Service). The magnitude of these reductions is documented in Section 4.0.

4.0 Future Projected (2026) Water Demands

Water demands for the 20-year planning period were predicated upon a projection of population change to the year 2026 (20 years from current 2006). Due to the fact that population projection data was only available up to the year 2020 and there is an inherent "uncertainty" in the accuracy of these numbers, this evaluation inferred that the 2020 population projections would be used up through the planning period of 2026.

The following summarizes the significant assertions and basis as to the method by which future demands were developed and allocated in the model. This also includes significant changes in system operation, which are anticipated to occur within the planning period.

Demand Calculation and Allocation in Model

- The High Service "Board Approved" developments have already been incorporated into the most recent 2006 model update. These were not reconsidered as part of future projections and have already been allocated to specific areas in the system in which they are expected to occur.

- All "known" development projects in the High Service Gradient which have yet to be approved (but have been modeled) will be added to the model demand database as these would likely be approved and constructed once sufficient supply exists to service this area.

  - A spreadsheet, which provides specific development projects, which are "Board Approved" and "Known But Not Approved", is provided as Attachment No. 1. This spreadsheet was developed as part of Task Order No. 3 – High Pressure Gradient Model Evaluation, December 2004 and updated through February 26, 2007. Of particular note to the adjustments are the reduction in flow from Amgen and the elimination of the casino project. These adjustments serve to increase the available water supply in the High Service. Currently, with all developments, both approved and not approved there exists a surplus maximum day capacity of 36,978 gallons per day (26 gpm).

  - It should also be noted that the Task Order 3 Technical Memorandum included potential demands in the High Service Gradient that were associated with substantial future development that was projected to occur (commercial and residential) in the Centre of New England. A tabular summary of these developments is provided as Attachment No. 2. The cumulative demands from the development at full grow out would total 2.62 MGD.

    Since preparation of Task Order 3, it has become known that that there are plans currently in place to construct a private water system to service these aforementioned developments at Centre of New England. If so, and if it is designed to accommodate all projected flows, then these projected demands would not necessarily need to be considered in this evaluation. At this time, the demands have been removed from the projected future demands in the High Service Gradient hence the reduction of projected flows previously presented in Task Order 3 and those presented herein. In the event that additional information becomes available regarding the disposition of this private water system, it may be necessary to adjust projected flows accordingly in the future.

- Based on the anticipated increase in service population by community previously developed, the water demand will be proportionally increased by this amount. For example, the (service) population is expected to increase by 4.6% in West Warwick for the planning period. Therefore, demands are projected to increase in West Warwick by an equal amount within this area of the service territory. A similar approach was applied to the remaining communities with the Authority service territory.

- Due to the fact that the specific area of future development and growth is unknown, the future anticipated consumer demands would be distributed globally across the particular community in which they are projected to occur.

- In order to account for unanticipated growth (i.e. growth that would result in water demand increase), a conservative estimate of a 10% increase in water demand was allocated across the entire service territory for the planning period. This 10% increase in water demand also included the communities of Cranston, North Kingstown and Scituate for which the Authority has no immediate plans for expansion as a measure to account for "infill" development.

  - This 10% factor for unanticipated growth has been reduced from the 20% factor that was previously factored into the calculations for maximum day demand as presented in Task Order 3. The rational behind this approach is such that a comprehensive evaluation was completed for each City and Town in the service area as part of this study to account for projected increases in population for the next twenty years. These population projections were unknown at the time of preparation of Task Order 3. As such, the water demands that would be associated with the population increases were added to the projected flows in this study. It was concluded that a 10%

factor for unknown anticipated growth is a reasonable and conservative estimate given the available information that has been derived and accounted for through projected planning population numbers.

- It should also be noted that the various factors and recent available information as discussed herein have had the overall effect of reducing the maximum day projected demand of 30.72 MGD as presented in Task Order to 24.7 MGD as provided in this study. The most significant cause of the reduction is attributed to the following.

  Reduced flows from Amgen (0.9 MGD) and ON-Semiconductor (0.425 MGD)
  Removal of Center of New England Development (2.6 MGD) and Casino (0.4 MGD)
  Decrease in the overall system wide unanticipated growth factor from 20 to 10 percent

- The future demands for Amgen and ON Semiconductor were also considered in this study and both of which have been significantly reduced. The demands for each of these facilities were readjusted in the model database as follows.

  - An average day demand of 10.42 gpm (5,000 gallons per day) was utilized for ON-Semiconductor. This demand has decreased from 299.34 gpm (431,050 gallons per day) or by over 95% in the Low Service Gradient.

  - Based upon recent correspondence from Amgen dated January 4, 2007, detailing forecasted water use through year 2008 overall water demands have decreased for all demand scenarios. June 2008 is the projected point at full grow out for the facility. These adjusted demands will have an impact on the operation of the water system in the High Service Pressure Gradient. The demands are significantly lower than those provided in 2002 as can be seen below.

MODEL SCENARIO	2002 AMGEN DEMANDS	2008 AMGEN DEMANDS	OVERALL DECREASE IN FORECAST
Average Day	833 gpm (1.2 MGD)	556 gpm (0.80 MGD)	277 gpm (0.40 MGD)
Maximum Day	1,500 gpm (2.16 MGD)	833 gpm (1.20 MGD)	667 gpm (0.96 MGD)
Peak Hour	1,500 gpm (2.16 MGD	1,084 gpm (1.56 MGD)	416 gpm (0.60 MGD)

- The future water demands were calculated for the entire system based on the aforementioned data and were proportionately applied to each of the various junction nodes within each of the service communities.

Significant changes / modifications to system operations:

- The existing Tiogue Tank (350') Gradient will be served and become part of the High Service (500') Gradient.

- The Bald Hill Booster Pump Station will be upgraded in capacity to 10.0 MGD. This will include installation of significant water main infrastructure such that the pump station will have the ability to

pump directly to the High Service 500 Foot Gradient. The breakdown is anticipated as follows: 2.0 MGD to High Service Gradient and 8.0 MGD to Low Service Gradient.

- The new Read School House Road Tank will be in service and the pressure zone increased from 430 feet to 500 feet. This will include the activation of the 3.0 MGD High Service Pumps at Clinton Avenue Pump Station.

- The existing Knotty Oak Pump Station will be deactivated (replaced by pumps at Clinton Avenue).

- The new Read School House Gradient and the existing High Service Gradient will be interconnected by new water main infrastructure and will operate as one Gradient.

- The Mishnock Well Field and treatment facility will be activated with a total production capacity of approximately 3.0 MGD with the ability to pump into either the Low or High Service Gradient.

- East Greenwich and Spring Lake Well upgrade in pumping capacity.

- Installation of a new interconnection to Providence Water in vicinity to Wakefield Street with the ability to pump up to 6 MGD into the Low Service Gradient and 2 MGD into the High Service Gradient.

- Installation of new water main infrastructure at Harding Street, Main Street, Pleasant Street, etc. in West Warwick.

CONSUMER DEMAND BY PRESSURE ZONE (2026)

PRESSURE ZONE	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Low Service (334') Gradient	6.272	11.896	13.766
New (500') Read School House Gradient	0.485	0.990	1.129
High Service (500') Gradient*	2.752	5.279	7.010
Low Service Reduced (334') Gradient	2.211	4.404	5.107
High Service (500') Reduced Gradient	0.659	1.292	1.588
Warwick Wholesale Interconnection (232') Gradient	0.006	0.011	0.013
Hope Road (510') Gradient	0.007	0.014	0.016
Oaklawn (231') Gradient	0.402	0.821	0.944
TOTALS	**12.8 MGD**	**24.7 MGD**	**29.6 MGD**

*In the future, the Tiogue Tank (350') Gradient will become part of the High Service (500') Gradient.

CONSUMER DEMAND BY COMMUNITY (2026)

COMMUNITY	AVERAGE DAY DEMAND (MGD)	MAXIMUM DAY DEMAND (MGD)	PEAK HOUR DEMAND (MGD)
Warwick	2.052	3.954	4.569
West Warwick	3.342	6.590	7.798
Coventry	3.346	6.399	7.523
West Greenwich	1.165	1.983	2.672
East Greenwich	2.451	4.916	6.012
Cranston	0.333	0.651	0.755
Scituate	0.105	0.215	0.245
TOTALS	**12.8 MGD**	**24.7 MGD**	**29.6 MGD**

In summary, the total system demand for the planning period for all three demand scenarios is anticipated to increase by approximately 20%. The most significant increase is expected to occur within the existing 500 Foot High Service Gradient (34%). The communities with the greatest increase in demand by percentage include Coventry (22%), West Greenwich (39%) and East Greenwich (23%). In terms of overall greatest volume increase, the Low Service is anticipated to increase by approximately 0.9 MGD or roughly 16%.

4.0 System-Wide Diurnal Flow Curves

The system-wide diurnal flow curves were developed from hourly water production and tank level data that is representative of the maximum day water use patterns of the pressure zones of the Authority system. A review of past records indicated that the maximum water demand period occurred during July 2, 2002. Although this demand has not been experienced since, it is considered to be representative of a time period of maximum water use and when the system has been most "stressed".

Due to the fact that Amgen has such a significant water demand in the High Service Pressure Gradient accounting for over 30% of the total demand, an individual diurnal flow curve was created for this facility. The recent information supplied by Amgen was utilized to develop this curve.

These diurnal flow curves are still considered to be most accurate with regard to extreme maximum day conditions and would be utilized during the evaluation through the planning period. The various diurnal patterns were entered into the model and assigned to all the junction demand nodes. The diurnal flow curves for the various Pressure Gradients of the system are provided as Attachment No. 3.

Attachment No. 1 – High Service Pressure Gradient Demand Worksheet

HIGH SERVICE DEVELOPMENTS AS OF FEBRUARY 26, 2007

BOARD APPROVED & KNOWN BUT NOT BOARD APPROVED

Number	Development	Street	Description	Avg. Day (gpm)	Max Day Multiplier	Max Day (gpm)	Date Approved
1	Signal Ridge	EG Re-service	Residential	141.1	2.3	324.5	1/1/2001
2	Rose Farm	Frenchtown Rd., EG	Residential	1.11	2.3	2.6	5/4/2001
3	Birchwood Glen	Kulus Rd., WW	Residential	2.78	2.3	6.4	11/20/2001
4	Middle Woods	Middle Rd., EG	Residential	27.8	2.3	63.9	11/27/2001
5	Shippeetown Road Sub.	Shippeetown Rd., EG	Residential	6.67	2.3	15.3	12/10/2001
6	Amgen	Technology Way, WG	Industrial	556.0	*	833.0	2/8/2002
7	Sandra Court	Reservoir Rd., COV	Residential	1.81	2.3	4.2	5/20/2002
8	Chole Court	Clark Rd., COV	Residential	2.08	2.3	4.8	7/19/2002
9	Hawk Crest Est.	Hill Farm Rd., COV	Residential	12.2	2.3	28.1	4/4/2003
10	Crystal Creek	Middle Rd., EG	Residential	9.58	2.3	22.0	4/10/2003
11	Long Meadow	Frenchtown Rd., EG	Residential	8.33	2.3	19.2	4/10/2003
12	Middle Hollow	Middle Rd., EG	Residential	2.78	2.3	6.4	5/14/2003
13	Blueberry Hill	Shippeetown Rd., EG	Residential	7.78	2.3	17.9	8/26/2003
14	Hidden Ridge	Shippeetown Rd., EG	Residential	8.89	2.3	20.4	10/29/2003
15	Green Farm	Squirrel Ln./Tillinghast Rd., EG	Residential	6.67	2.0	13.3	1/12/2004
16	Dunkin Donuts	New London Turnpike	Commercial	1.3	1.5	2.0	2/9/2004
17	Chiropractic Center	Nooseneck Hill Rd., WG	Commercial	0.63	1.5	0.9	7/24/2004
18	Randolph Bank	Center of New England, COV	Commercial	1.0	1.5	1.5	11/11/2004
19	Leisure Condo	Nooseneck Hill Rd., COV	Condominiums	13.9	2.0	27.8	11/12/2004
20	Coventry Lumber	Nooseneck Hill Rd., COV	Commercial	1.0	1.5	1.5	11/16/2004
21	Santo Lombardi	Sharon Dr., COV	1 Residence	0.4	2.3	0.9	11/18/2004
22	Home Depot	Center of New England, COV	Commercial	1.7	1.5	2.6	12/6/2004
23	Debra Zarrella	Frenchtown Rd., EG	1 Residence	0.4	2.3	0.9	3/16/2005
24	Arlington RV	Division Rd., WG	Commercial	3.5	1.5	5.3	3/16/2005
25	Brooks Pharmacy	Division Rd., EG	Commercial	10.4	1.5	15.6	3/16/2005
26	Pine Ridge	Hopkins Hill Rd., COV	Residential	28.8	2.3	66.2	3/16/2005
27	Westwood Apartments	Reservoir Rd., COV	Apartments	4.9	2.0	9.8	3/16/2005
28	Dawn Santilli	68 Surrey Ln., WW	1 Residence	0.4	2.3	0.9	3/22/2005
29	Maurice Cooney	949 Tillinghast Rd., EG	1 Residence	0.4	2.3	0.9	4/21/2005
30	Wingate Hotel	CNE Universal Blvd., COV	Hotel	2.0	2.0	4.0	5/2/2005
31	Wal-Mart	CNE Boulevard, COV	Commercial	1.7	1.5	2.6	5/2/2005
32	Paul & Tanya Rossi	53 Mohawk Tr., WG	1 Residence	0.4	2.3	0.9	5/18/2005
33	George Olney	22 Marion Dr., COV	1 Residence	0.4	2.3	0.9	5/18/2005
34	Mojtaba Rajaee	1627 Middle Rd., EG	1 Residence	0.4	2.3	0.9	5/18/2005
35	John Assalone	Valerie Dr., Parcel 1(a), WG	1 Residence	0.4	2.3	0.9	5/18/2005
36	John Assalone	Valerie Dr., Parcel 1(b), WG	1 Residence	0.4	2.3	0.9	5/18/2005
37	Peter Suorsa	12 Island Dr., COV	1 Residence	0.4	2.3	0.9	6/15/2005
38	Dana Carlow	Rejane St., COV	1 Residence	0.4	2.3	0.9	6/15/2005
39	Dunkin Donuts	Hopkins Hill Rd., WG	Commercial	1.3	1.5	2.0	6/15/2005
40	Andrew Potvin	Hopkins Hill Rd., COV	1 Residence	0.4	2.3	0.9	7/1/2005
41	Matthew L. Tucci	59 Club House Rd., WG	1 Residence	0.4	2.3	0.9	7/1/2005
42	Caren Bourque	Veronica Ct., COV	1 Residence	0.4	2.3	0.9	7/1/2005

HIGH SERVICE DEVELOPMENTS AS OF FEBRUARY 26, 2007

BOARD APPROVED & KNOWN BUT NOT BOARD APPROVED

Number	Development	Street	Description	Avg. Day (gpm)	Max Day Multiplier	Max Day (gpm)	Date Approved
43	Peter Rosiello	Pond View Ct., WG	1 Residence	0.4	2.3	0.9	7/1/2005
44	Albert/Barbara LaPlume	307 Shippeetown Rd., EG	1 Residence	0.4	2.3	0.9	7/20/2005
45	Arthur L. Larsson	298 Shippeetown Rd., EG	1 Residence	0.4	2.3	0.9	7/20/2005
46	Frederick Schultz	58 Crompton Rd., EG	1 Residence	0.4	2.3	0.9	8/11/2005
47	Richard Todisco	61 Island Dr., COV	1 Residence	0.4	2.3	0.9	8/17/2005
48	Maple Root Center	Nooseneck Hill Rd., COV	Commercial	1.7	1.5	2.6	8/17/2005
49	Deer Run	Carr Pond Rd., WG	Residential	13.0	2.3	29.9	8/17/2005
50	Gentry Glen Condos	Crompton Rd., WW	Condominiums	13.0	2.0	25.8	9/21/2005
51	Carriage House Condos	Reservoir Rd., COV	Condominiums	3.3	2.0	6.7	9/21/2005
52	Retail Pad A	Center of New England, COV	Commercial	1.3	1.5	2.0	9/21/2005
53	GrandVille @ Greenwich	Center of New England, WG	300 Apts/Condos	31.1	2.5	77.8	9/21/2005
54	Kenneth Hendrickson	335 Shippeetown Rd., EG	1 Residence	0.4	2.3	0.9	9/21/2005
55	Jane Revkin	385 Moosehorn Rd., EG	1 Residence	0.4	2.3	0.9	9/21/2005
56	Howard M. Dulude	20 Marion Dr., COV	1 Residence	0.4	2.3	0.9	9/21/2005
57	Larry Lachance	58 Robin Ln., WW	1 Residence	0.4	2.3	0.9	9/21/2005
58	184 Homes	Maude Ave., COV	Residential	19.7	2.3	45.3	9/21/2005
59	Karen Carlow	7 Rejane St., COV	1 Residence	0.4	2.3	0.9	10/19/2005
60	Scott Tierney	Spencer's Grant Dr. & Stone Carry Way	Residential	4.8	2.3	11.0	10/19/2005
61	Sarah Wye	129 East Greenwich Ave.	1 Residence	0.4	2.3	0.9	11/16/2005
62	John Brunero	East Greenwich Ave., AP 12-2, Lot 241	2 Residences	0.8	2.3	1.8	11/16/2005
63	John Brunero	199 East Greenwich Ave.	1 Residence	0.4	2.3	0.9	11/16/2005
64	Retail Pad B	Center of New England, COV	Commercial	1.3	1.5	2.0	10/19/2006
65	Arthur Brown	183 Greenbush Rd.	1 Residence	0.4	2.3	0.9	12/15/2005
66	Clark R. Smith	2594 Division Rd., EG	1 Residence	0.4	2.3	0.9	4/19/2006
67	Scott and Maria Brown	47 Clark Mill Rd., COV	1 Residence	0.4	2.3	0.9	6/26/2006
68	Peter Nolan	5 Hidden Ln., EG	Irrigation	2.4	1.0	2.4	6/21/2006
69	Peter Nolan	35 Hidden Ln., EG	Irrigation	2.4	1.0	2.4	6/21/2006
70	Peter Nolan	45 Hidden Ln., EG	Irrigation	2.4	1.0	2.4	6/21/2006
71	Kenneth Parris and Janet Hillier	65 Clark Mill Rd., COV	1 Residence	0.4	2.3	0.9	6/21/2006
72	Peter Nolan	40 Hidden Ln., EG	Irrigation	2.4	1.0	2.4	7/19/2006
73	Peter Nolan	55 Hidden Ln., EG	Irrigation	2.4	1.0	2.4	7/19/2006
74	Peter Nolan	5 Secret Ln., EG	Irrigation	2.4	1.0	2.4	7/19/2006
75	Charles Hawkins	368 Hopkins Hill Rd.	1 Residence	0.4	2.3	0.9	7/21/2006
76	Matthew and Yadira Gilchrest	420 East Greenwich Ave., WW	1 Residence	0.4	2.3	0.9	8/16/2006
77	K. Joseph Shekarchi	Herb Chambers, Rte. 2	Commercial	0.4	1.5	0.6	8/16/2006
78	Alfred & Linda Colucci	2271 Middle Rd., EG	1 Residence	0.4	2.3	0.9	10/18/2006
79	Stacy B. Ferrara, P.C.	21 Sharon Dr., COV	1 Residence	0.4	2.3	0.9	10/18/2006
80	Robert T. Chito	42 Deer Run, WG	1 Residence	0.4	2.3	0.9	11/16/2006
81	Brian Ascoli	17 Cambio Ct., WG	1 Residence	0.4	2.3	0.9	11/16/2006
82	Robert Mellor	74 Tiffany Rd., COV	2 Residences	0.8	2.3	1.8	12/14/2006

HIGH SERVICE DEVELOPMENTS AS OF FEBRUARY 26, 2007

BOARD APPROVED & KNOWN BUT NOT BOARD APPROVED

Number	Development	Street	Description	Avg. Day (gpm)	Max Day Multiplier	Max Day (gpm)	Date Approved
83	Francis Belanger	45 Deer Run, WG	1 Residence	0.4	2.3	0.9	12/14/2006
84	Charles Hirsch	30 Deer Run, WG	1 Residence	0.4	2.3	0.9	12/14/2006
85	Keith White	Lot 22, AP 50 Lot A Reservoir Rd.	1 Residence	0.4	2.3	0.9	10/21/2004
86	Keith White	136 Reservoir Rd., COV	1 Residence	0.4	2.3	0.9	10/21/2004
87	Peter Suorsa	13 Island Dr., COV	1 Residence	0.4	2.3	0.9	6/15/2005
88	Oak Haven Tiogue Reduced			60		123.0	11/16/2006
89	Royal Hatheway Heights	East Greenwich Ave., WW	Residential	6.25	2.3	14.38	
90	Shipwreck Falls Lodge Indoor Water Park	99 James P. Murphy Industrial Hwy., WW	Commercial	83.6	2.0	167.2	2/15/2007
91	Woods at Fox Ridge	Mallard Way, EG	Residential	2.78	2.3	6.39	
92	Cedar Hill Farm	Frenchtown Rd., EG	Residential	5.56	2.3	12.79	
93	Coventry Crossing	New London Turnpike, COV & EG	Commercial	1.69	1.5	2.6	2/15/2007
94	Village on Green	1646 Division St., EG	Condominiums	13.6	2.0	27.2	2/15/2007
95	Rocky Hill Commons	Division St., EG	Comm./Res.	18.8	2.0	38.0	2/15/2007
96	Margery S. Ordog	1823 Frenchtown Rd., EG	1 Residence	0.4	2.3	0.9	2/15/2007
97	James and Jeanne Rotatori	340 Moosehorn Rd., EG	1 Residence	0.4	2.3	0.9	2/15/2007
		TOTALS GPM		**1182.82**		**2175.71**	
		TOTALS MGD		**1.70**		**3.13**	

*Maximum day flow demand based on correspondence received from Amgen to KCWA dated January 4, 2007.
Note: All flows for developments received from the Kent County Water Authority records.

Supply/Pumping Capacity (MGD) (-) Current Demand (MGD) (-) Future Demand = Surplus / Defecit

6.34 (-) 3.17 (-) 3.13 = 36978 Gal / Day

Attachment No. 2 – Center of New England Projected Flows for 2005 - 2009, as Prepared 3/16/04

Projected Flows – Task Order 3, Dec. 2004.

Center of New England Proposed Development Scenario

Number	Development	Year	Description	Avg. Day (gpm)	Max Day Multiplier	Max Day (gpm)
24	CNE	2005	Retail / Comm. - 400,000 sf	27.8	1.5	41.7
			Restaurant	12.7	2.3	29.21
			Hotel	9.1	2.0	18.2
			300 Homes	87.5	2.3	201.25
			337 Apartments	91.3	2.0	182.6
			120 Age Rest. Apts	26.7	2.0	53.4
			Subtotal	**255.1**		**526.36**
		2006	Retail / Comm. - 400,000 sf	27.8	1.5	41.7
			Restaurant	12.7	2.3	29.21
			Hotel	8.3	2.0	16.6
			300 Homes	87.5	2.3	201.25
			Subtotal	**136.3**		**288.76**
		2007	300 Homes	87.5	2.3	201.25
			Subtotal	**87.5**		**201.25**
		2008	300 Homes	87.5	2.3	201.25
			900 Asst. Living Units	100.0	2.0	200
			Subtotal	**187.5**		**401.25**
		2009	300 Homes	87.5	2.3	201.25
			900 Asst. Living Units	100.0	2.0	200
			Subtotal	**187.5**		**401.25**

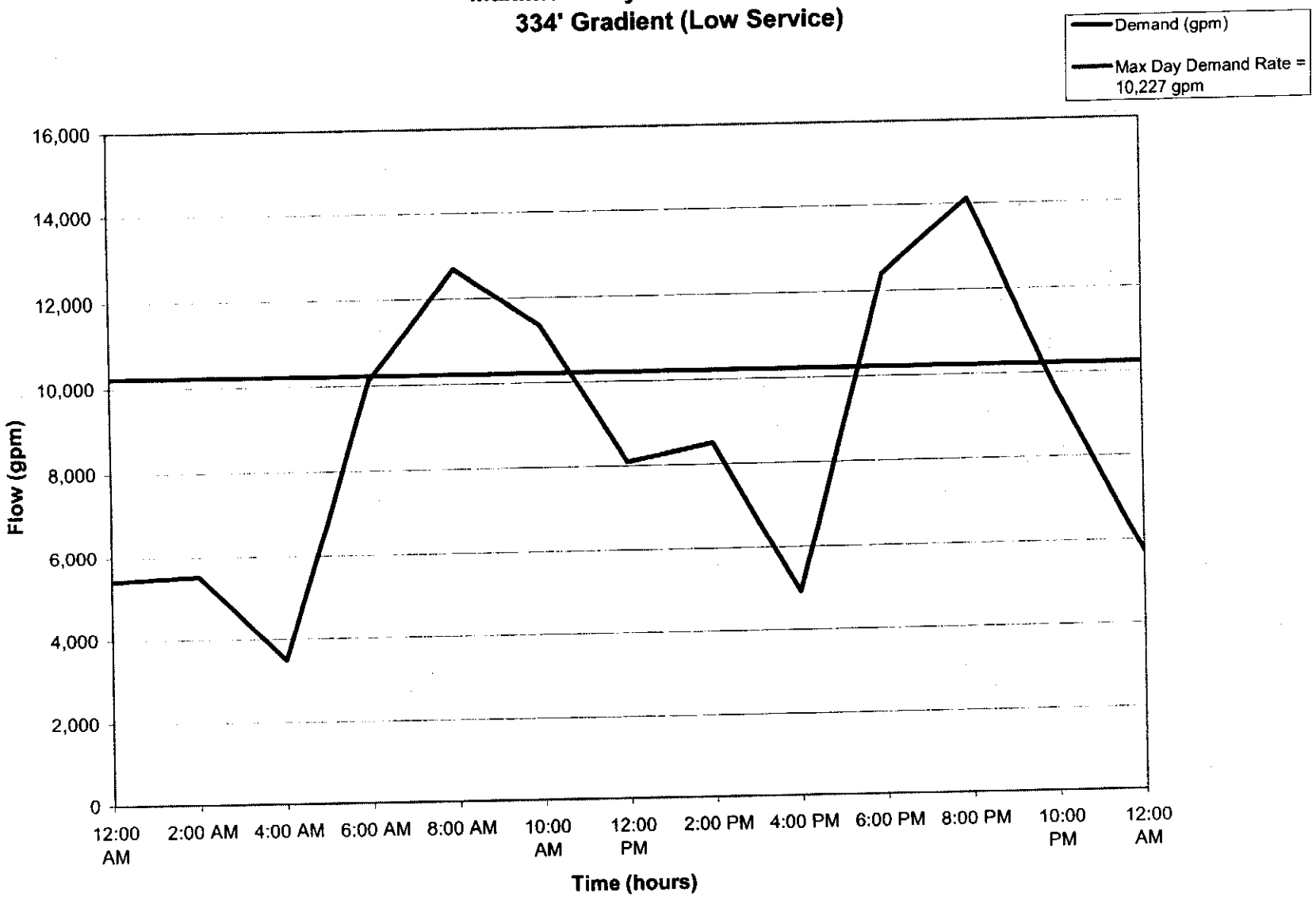
Note: All flows and development time tables premised upon information contained in data supplied by John P. Catio Corporation (dated 3/16/04).

year	demand - max day
2005	526.36
2006	288.76
2007	201.25
2008	401.25
2009	401.25
	1818.87 gpm

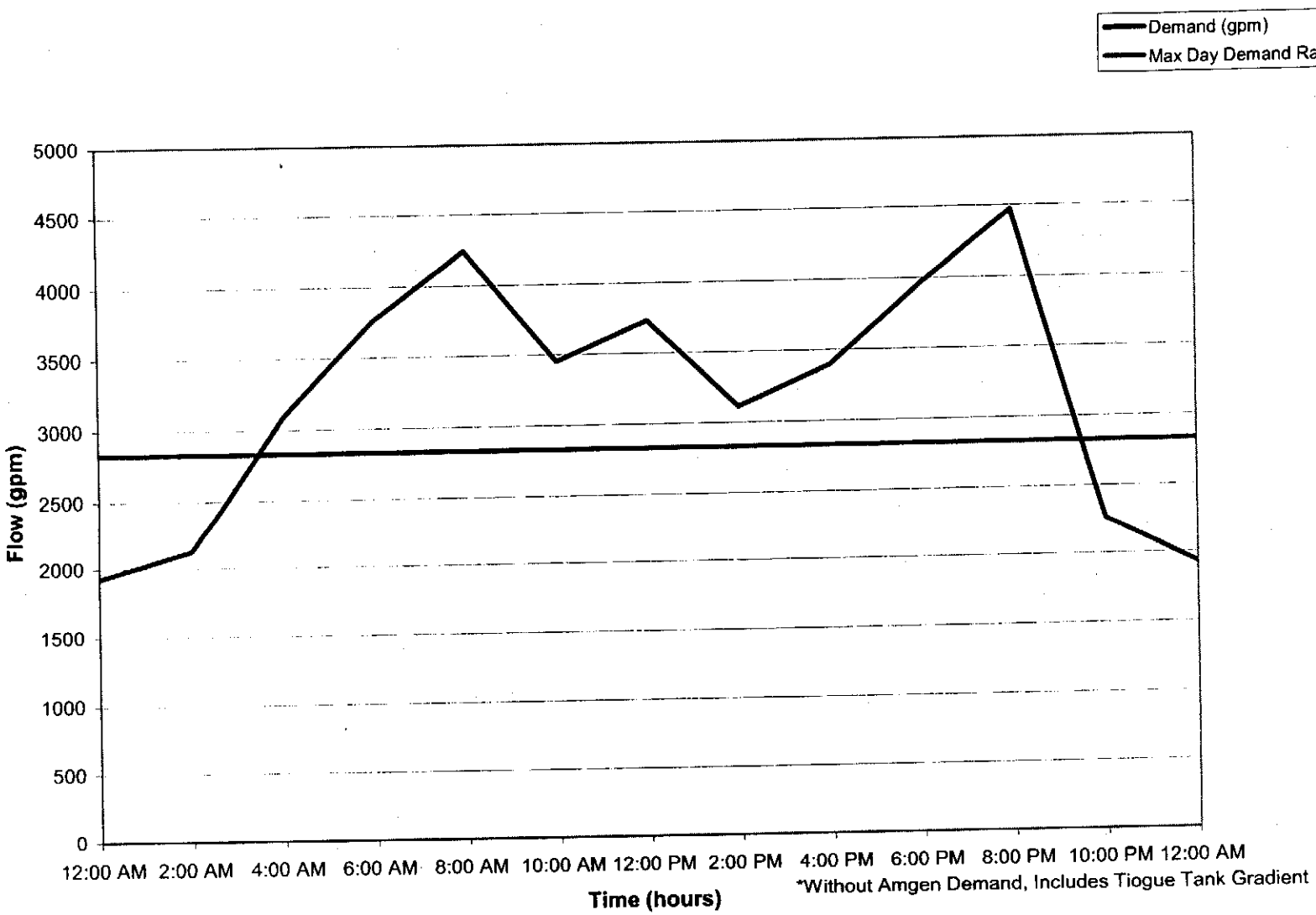
(2.62 MGD)

Attachment No. 3 - Water System Diurnal Flow Curves

Maximum Day - Diurnal Flow Curve
334' Gradient (Low Service)

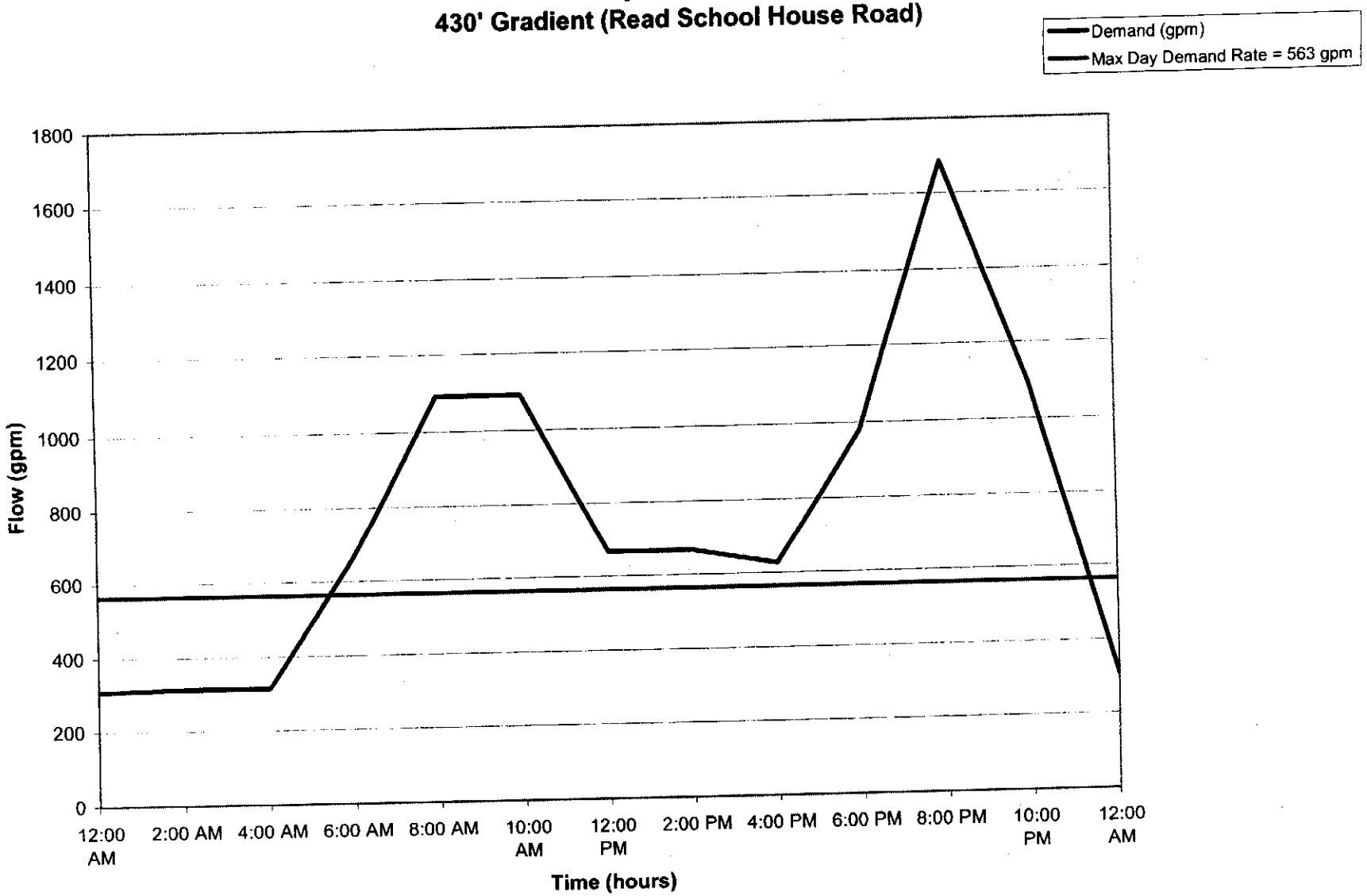


Maximum Day - Diurnal Flow Curve
500' Gradient (High Service)



*Without Amgen Demand, Includes Tiogue Tank Gradient

Maximum Day - Diurnal Flow Curve
430' Gradient (Read School House Road)



Maximum Day - Diurnal Flow Curve
Amgen