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## Kent County Water Authority Distribution Storage Tank Hydraulic Evaluation

### Technical Memorandum No. 1 Data Collection, Review and Existing Water System Analysis August 2006

#### 1.0 Purpose and Scope

This project relates to utilizing the updated computerized hydraulic model of the Kent County Water Authority (Authority) water system to complete a detailed hydraulic study and evaluation of the entire supply and distribution system for the next twenty (20) year planning period. This evaluation is intended to consider system demand for both existing and the projected planning period and an evaluation of the ability of the water system infrastructure components to effectively meet these demands.

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 Data Collection, Review and Existing Water System Analysis. 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. Review the Authority's strategic plan and goals, the existing Water Supply System Management Plan and the Comprehensive Community Plans of all the Cities and Towns serviced by the Authority. The Community Plans shall be reviewed relative to planned or projected population changes and significant economic development.
  - a. Meet with local City and Town Planning Officials to determine if any significant changes are evident from the Community Plan.
2. Review the existing modeling studies that were previously completed by C&E to ensure that the conclusions and recommendations are still valid. These modeling studies include the following:
  - June 2004 Hydraulic Model Report
  - July 2004 High Pressure Gradient Model Evaluation (task order 2)
  - November 2004 High Pressure Gradient Model Evaluation (task order 3)
  - March 2006 Hydraulic Model Update Report
  - a. Review the existing 2002-2005 Capital Improvement Plan. Quantify the projects that have been completed to date, those that are currently in progress and those that have yet to be undertaken.
  - b. Collect data regarding the current planned improvements in an effort to assess whether they meet the strategic supply, storage and transmission goals of the Authority, its existing customers and comprehensive development plans of the cities and towns served.

3. Meet with the Authority staff to review current system operations including known or identified system problems and deficiencies, status of all infrastructure replacement and capital improvement projects. This meeting will also include a review of data collected from the previous tasks related to planned growth and development within the cities and towns served by the Authority.
  - a. Meet with Authority staff to discuss and outline any specific requirements for this project and to obtain any and all existing plans and information directly related to the work to be accomplished.
4. Prepare a technical memorandum summarizing the data collection efforts, meetings with city and town officials, Authority system operations and known system problems and/or identified constraints and identify information deficiencies that are readily evident.

## **2.0 Kent County Water Authority - Strategic Plan**

The Authority is committed to supplying a safe, reliable and adequate water supply to its service customers in Coventry, East Greenwich, West Greenwich, Warwick and West Warwick all of which comprise Kent County; and small isolated areas of Cranston, North Kingstown and Scituate. To this end, the Authority has developed a Strategic Plan, finalized December 14, 2005 that is directed at achieving and maintaining this objective. The Strategic Plan is divided into specific sections that identify objectives and all of which have defined goals with various milestones for the immediate, near term and long term. These objectives along with a brief narrative from the text of the Strategic Plan follow:

### **Objective 1 – Increase Supply and Distribution**

*As KCWA has experienced supply-related issues, an increase of water supply is a primary objective for us. Currently, the average daily demand is 10 MGD and the maximum daily demand is 19 MGD. KCWA has the ability to deliver 17 MGD daily from its various sources of supply (Clinton Ave. connection to Providence Water, Oaklawn connection to Providence Water, City of Warwick connection, East Greenwich well). Increase Supply to meet 20 MGD average day and 30 MGD maximum day.*

### **Objective 2 – Define Serviceable Area**

*KCWA's system continues to grow. Much of this growth is being driven by developers. It is important that KCWA prepare a plan that identifies the limits of our current system, as well as the limits with all of our planned improvements. This will be an invaluable planning tool that can be used to when planning system improvements and when assessing request for service.*

### **Objective 3 – Improve Efficiency of Local Operations**

*KCWA must have the proper tools to accomplish the required business activities and to conduct them in an efficient manner. The "tools" include both the facilities and the staff. This objective focuses on making improvements to administrative facilities, increasing staffing, providing training for staff, improving computer capabilities, gaining efficiencies in meter reading via radio read technology, and increasing the amount of infrastructure work accomplished annually.*

### **Objective 4 – Increase Public Awareness of Supply and Storage Needs**

*KCWA is faced with increasing water demand and a limited water supply. This places stress on the water system during the summer months. KCWA currently has a year round odd/even outdoor water use policy. At times, KCWA has had to implement an emergency full moratorium on outdoor water use. KCWA customers and the general public need to be better informed as to the underlying issues, the steps KCWA is taking, and the steps they can take to improve the situation.*

#### Objective 5 – Define Funding Sources

*Currently, KCWA receives 100% of its funding from the ratepayers. Major capital projects are financed with bonds, which are then paid through the water rates. In this objective KCWA will review other potential sources of funding. These sources may include both State and Federal Grants. In addition, we will review the possibility of assessing impact fees to new KCWA customers.*

#### Objective 6 – Improve Security in All Aspects

*Security has become a very important issue in the aftermath of September 11, 2001. Water utilities are potential targets as there is high potential of affecting a large group of people. It is important that KCWA identify vulnerabilities and implement measures to minimize the chance of event that attacks our facilities and/or personnel.*

The goal of this study as it relates to coordination with the Strategic Plan primarily relates to Objectives 1 - Increase Supply and Distribution and 2 – Define Serviceable Area. As this study is advanced consideration will be given to the specific goals and objectives in the Strategic Plan to ensure consistency with the specific goals and defined projects to which the Authority has committed.

### **3.0 Kent County Water Authority - Water Supply System Management Plan**

The Authority's Water Supply System Management Plan (WSSMP) was last updated in 2001 and is periodically updated every five years. The WSSMP is intended to address a multitude of aspects of the water system relating to supply, system demands, operations and management, preventive maintenance, conservation, emergency response, etc. The critical aspect in the WSSMP as it relates to the tank study is the section on current supply capacity and demand as well as projected future demands for the five and twenty year planning periods.

C&E examined the WSSMP as it related to available supply and current and future projected demands as part of Task Order 2 – High Service Gradient Evaluation, Subtask C. This Task Order that was completed in late 2005 was performed as part of an evaluation to assess the increase in overall water demands that were observed to be occurring within the High Service Gradient portion of the system. The following conclusions were noted as related to the WSSMP and Task Order 2 – Subtask C.

- The Authority's WSSMP which was updated in 2001 projected 20 year (year 2020) water demands of 16.4 MGD and 26.6 MGD, respectively for the average and maximum day demands. Current available source of supply is equal to 22.8 MGD, which is below the projected need.
- The majority of future growth and associated water demand is anticipated to occur within the 500-foot service gradient and within the Towns of East Greenwich, West Greenwich and Coventry.
- The current water demands of 10.46 MGD (average day) and 19.84 MGD (maximum day) are below the 5-year WSSMP projections of 14.0 MGD and 23.0 MGD respectively.
- The anticipated maximum day demand of 27.63 MGD is in excess of the 20-year projection for the year 2020 as presented in the WSSMP. This maximum day demand is a result of all existing and "known" developments that are expected to occur in the High Service Gradient.
- It was concluded that growth and the need for water is occurring at a greater rate than projected in the WSSMP and that the need to augment supply is critical to meeting the immediate and long term goals of the water system. This is most evident and critical in the High Service Gradient.
- As the High Service Gradient is currently dependant upon the Low Service Gradient for source of supply, it is critical that the Low Service be monitored to ensure that no adverse impacts are created in this portion of the system as the need to supply the High Service Gradient increases.

- It is recommended that the need to augment supply, including any associated capital improvement projects be continued and moved forward in order to meet anticipated future water demand. In addition, water demand projections in the WSSMP that are updated periodically, should be considered in the future planning of source supply for the water system.

The current study will provide additional emphasis on the potential for growth in the service of various communities and will take into consideration the current water demands as developed from the most recent model update in 2006. While the recent model update did not include a comprehensive update of system wide consumer system demands, it did consider the increase in demand associated with recent development in the High Service Gradient as well as any changes in the demand patterns of the large users on a system wide basis.

## **4.0 Town and City Comprehensive Community Plans**

### **General**

The Comprehensive Community Plans for each of the Towns and Cities within the Authority's service territory were reviewed as part of this study. This review primarily included the Comprehensive Plans prepared for Coventry, East Greenwich, West Greenwich, Warwick and West Warwick. Due to the fact that the Authority has no immediate or long term plans for expansion into areas of Cranston, North Kingstown and Scituate, these three (3) plans were reviewed for general information with less regard for potential of population growth and service area expansion.

C&E conducted interviews with personnel from the various Planning Departments from the primary five (5) communities served by the Authority. Personnel from the three (3) communities for which no expansion is anticipated were not consulted. These personnel were consulted regarding potential projects and growth that is anticipated to occur in the municipality and which may have a direct impact on future water use. This included interviews with the following representatives and a summary of which is included in the general discussion for each community below.

Warwick: Mark Carruolo, Director of Planning

West Warwick: Robert Malavick, Director of Planning

East Greenwich: Lee Whitaker, AICP, Director of Planning

West Greenwich: Jennifer Paquet, Town Planner

Coventry: Paul Sprague, Acting Director of Planning & Development

It is mandated that each municipality in the State prepare and periodically update a Comprehensive Plan in order to manage and plan for future population changes, environmental factors, community services and facilities, etc. These plans are to be updated at five-year intervals. It should be noted however that these updates are often not comprehensive and that particular sections may not be reevaluated during the update process. As such, some of the information may be dated.

The goal in reviewing these plans was to determine the municipality's policies and procedures with regard to water service as it relates to the Authority's water system in the particular municipality. Further, the plans were reviewed for projections in population changes and the corresponding affect that this may have on the Authority's water system for potential increase or decrease in water demand. In an effort to corroborate the population projections, Rhode Island Statewide Planning was consulted for population projections. Any discrepancies were so noted.

## **City of Warwick**

The City of Warwick Comprehensive Plan was last updated in 2005 and originally established in 1986. The Comprehensive Plan for the City depicts a population projection of 93,810 people for the year 2000. Rhode Island Statewide Planning projects a population of 85,235 people in the year 2020. Year 2000 Census data indicates a population of 85,808. The Comprehensive Plan prediction of 93,810 for year 2000 was apparently “high” given the 2000 Census number of 85,808.

The City of Warwick Comprehensive Plan serves to identify the overall goals and policies that will guide the future growth and development of the City. The intent of the Service and Facilities element of the Comprehensive Plan is to present the general goals and policies, which shape the Comprehensive Plan, and to guide the physical, social and economic development of the City. The Water Service element is contained within the Service and Facilities element of the Plan. The goal of the Water Service element in the City of Warwick Comprehensive Plan is as follows:

“Provide a plentiful supply of clean drinking water to meet current and future service requirements for the City’s residential and business communities.”

The policies of the Water Service element as depicted in the City of Warwick Comprehensive Plan are as follows:

1. Develop a policy program and eliminate dead end mains and pressure drops.
2. Promote and encourage water conservation efforts.
3. Protect the Hunt River aquifer from potential contamination.
4. Encourage the Kent County Water Authority to prepare a capital improvement program in order to implement necessary water delivery system improvements to meet current and future demand.”

### **Population Summary (RI Statewide Planning)**

2000: 85,808

2005: 85,803

Projected 2010: 85,620

Projected 2020: 85,235

### **Summary**

The City currently has two public sources of water supply with the Authority providing service to the southern section of the City and the City owned and maintained water system servicing the remainder of the City. The Authority operates its Low Service Gradient and Reduced Low Service Gradient in the City limits of Warwick. The goal indicated in the plan is to work with the Authority toward developing capital improvement programs that that would meet current and future demand. One such example is the recent negotiation for additional wholesale supply purchase from the City in order to upgrade the capacity of the Bald Hill Pump Station. The plan did not identify any specific limitations or problem areas (i.e. flow or pressure problems) related to water supply.

Original population projections in the plan for year 2000 were somewhat high. It is anticipated that the Statewide Planning projections out to year 2020 which show a population that is near unchanged to be most realistic. The effect would be that water use would remain fairly consistent with no marked increases or decreases.

Conversations with Mr. Mark Carruolo, Director of Planning were conducted as part of this review. Mr. Carruolo corroborated that the population projections in the Comprehensive Plan were somewhat high and that the current population of approximately 86,000 is more realistic. With regard to future growth in the area served by the Authority, which generally consists of the Appanoug area of the City, Mr. Carruolo indicated that it is expected to be near flat or unchanged for the foreseeable five to ten years. The development (predominately residential and commercial) that has occurred within the past five years at a somewhat moderate rate is not expected to be maintained. This is reflective in the slowdown of building permits and development proposals within the past six months. Mr. Carruolo indicated that any development that is expected to occur would mostly be in the form of “in fill” development as opposed to expansion of the service territory. The available area for in fill development is somewhat limited.

### **Town of West Warwick**

The Town of West Warwick Comprehensive Plan was established in 1992 and adjusted in March of 2005. The Comprehensive Plan for the Town indicates a projected population of 31,291 for the year 2000. Rhode Island Statewide Planning indicates a population projection of 30,928 people in the year 2020 for the Town. Year 2000 Census data indicates a population of 29,581.

The Water Service element is categorized under the Community Services and Facilities element of the Town of West Warwick Comprehensive Plan. The goals of the Community and Service Facilities element as stated in the Town’s Comprehensive Plan are as follows:

“To assure adequate water supply and pressure to all residents of West Warwick and to all businesses and industry sufficient to meet demand, for the protection and promotion of the public health, safety and welfare.”

The Town of West Warwick Comprehensive Plan states that the policies of the Community Services and Facilities element are:

“Recognize that the Kent County Water Authority has sole responsibility for water supply and distribution in the Town of West Warwick, and work with the Authority through the Planning Board, Town Planner, Town Engineer and other municipal officials as appropriate, to coordinate Town activities with the Water Authority’s efforts to maintain, improve and expand the water system throughout the Town.”

The Town of West Warwick is taking steps and coordinating closely with the Kent County Water Authority to implement the goals and policies stated in the Comprehensive Plan relating to Water Service. The Town is cooperating with the Kent County Water Authority on the following water system improvements:

- Campbell Farms – programs to correct for water pressure and volume are planned for this area. There are ongoing programs in place for the increase in pressure, supply and storage as well as equipment and line repair and replacement programs. *These programs have been completed.*
- Wakefield Hill and West Warwick Industrial Park – new water lines are planned and installation is under way to meet demands consistent with the Comprehensive Plan.
- Flushing program – an annual flushing program is planned and will be undertaken shortly.
- Natick area – plans for improvements to the system in the Natick area are under way associated with water pressure and volume. These are primarily related to infrastructure improvements (i.e. replacement of old mains) and are ongoing.

- West Street Tank – plans to refurbish the West Street Tank are under way, increasing water pressure and volume. *The tank has been rehabilitated. It remains off line pending resolution of issues related to tank circulation.*

**Population Summary (RI Statewide Planning)**

2000: 29,581  
 2005: 29,759  
 Projected 2010: 30,086  
 Projected 2020: 30,928

**Summary**

The Town currently receives all of its water supply from the Authority. The Authority operates both its Low Service Gradient in the central and northern sections of Town and the High Service Gradient in the southern section of Town. The goal indicated in the Comprehensive Plan is to cooperate with the Authority toward developing capital and infrastructure improvement programs in order to improve and meet current and future water demands.

The plan did identify specific projects and plans for improvement of water supply and several of which have been implemented as noted above. Potential development that may occur in the southern section of Town may be problematic depending upon timing for new sources of supply in the High Service Gradient. The remainder of Town which is served from the Low Service Gradient is not likely to have problems with regard to available water supply but must be evaluated on a case by case basis due to the possibility of old cast iron mains and their ability to adequately convey fire flows.

Original population projections in the plan for the year 2000 were slightly high. It is anticipated that the Statewide Planning projections out to year 2020 which show a population that is slightly higher to be most realistic. The effect would be that water use would remain fairly consistent with possible slight increases and most likely in the southern section of Town in vicinity to the West Warwick Business / Industrial Park.

Conversations with Mr. Robert Malavick, Director of Planning were conducted as part of this review. Mr. Malavick indicated that particular sections of the Comprehensive Plan, specifically related to water supply, contain information that is up to fifteen years old and needs to be updated. Mr. Malavick corroborated that the population projections in the Comprehensive Plan and from State Wide Planning were likely accurate however there has been some recent development(s) both underway and in the planning stages which may increase these numbers in the next several years. Several of these projects include:

- An overall tendency to convert existing one to two acre parcels with single-family dwellings to condominium developments with 12 – 15 units each. No exact number of these conversions was available. There has been a recent slowdown of this type of conversion.
- It is anticipated that up to 1,000 new residential apartment / condominium units coming on line within a year as a result of textile mill conversions. Most notably these include the Royal and Crompton Mills. These developments would be located on the Low Service Gradient in vicinity to Providence Street and East Main Street. On this basis it is anticipated that population could increase by approximately 1,500 persons. This would increase overall population by approximately five percent assuming that the persons were from out of Town and not relocations.
- Tentative plans to construct an indoor / outdoor water park in the south section of Town off of James P. Murphy Industrial Highway. This would require tie in to the High Service Gradient. There is no information with regard to potential water use at this time.

- Potential for development of a casino in the south section of Town off of James P. Murphy Industrial Highway. This would require tie in to the High Service Gradient. There is no information with regard to potential water use at this time and the likelihood of development is undeterminable at this time.

Mr. Malavick indicated that new non-residential development in the Town is however limited due to the lack of available land. Similar to Warwick, there is the potential for “in-fill” development however this is not anticipated to amount to any significant increase in total population. There are few undeveloped areas in West Warwick that are zoned for commercial or industrial activity and these are primarily located in the southern section of Town. Development in this area would require connection to the High Service Gradient portion of the water system.

### **Town of Coventry**

The Town of Coventry Comprehensive Plan was established in 1992 and amended in June of 2000 and the Town is looking to update the Plan within the next year. As of the year 2000, the population of the Town was 33,668 as indicated by Rhode Island Statewide Planning (2000 Census). Rhode Island Statewide Planning has projected a population of 37,789 for the year 2020.

The Kent County Water Authority (KCWA) provides water service to the Town of Coventry. The KCWA works closely with the Town of Coventry to implement Capital Improvement and water service extension projects to ensure that infrastructure extensions and improvements are consistent with the Town’s plans for future growth.

The Town of Coventry cooperates with the KCWA toward implementing improvements. The Comprehensive Plan identified four (4) areas of concern with regard to the water system. These four (4) areas of concern are as follows:

1. Pressure and supply deficiencies in the Oak Haven area of Town.
2. Pressure and supply deficiencies in the Wood Estates area of Town.
3. Pressure and supply deficiencies in the vicinity of Read School House Road.
4. Protection of the KCWA drinking water sources located within the Town of Coventry.

In conversation with the Authority, items 1 and 3 above are primarily related to pressure problems and not supply. They will be rectified through the projects involving the construction of the new Read School House Road tank and associated infrastructure as well as increasing the hydraulic gradient and expansion of the service territory in this area. There is no known pressure and / or supply deficiencies associated with the Wood Estates area of Town.

Additionally, improvements to these areas of concern are addressed in the KCWA’s Capital Improvement Program. The improvements, which are outlined in the KCWA Capital Improvement Program, provide prerequisite planning to improve existing deficiencies of the KCWA water system located within the Town of Coventry. The Town of Coventry Comprehensive Plan indicates that the Town works with the KCWA to implement improvement projects in conjunction with ongoing street improvements and sewer installation projects. The Town’s Comprehensive Plan also states:

“New projects to extend water service to portions of western Coventry must be coordinated with the Town of Coventry to assure that infrastructure extensions are consistent with the Town’s plans for future growth.”

The Town of Coventry protects the water quality of the KCWA’s wells (Spring Lake and Mishnock wells) through the implementation of a Watershed Protection Overlay District.

**Population Summary (RI Statewide Planning)**

2000: 33,668

2005: 34,590

Projected 2010: 35,357

Projected 2020: 37,789

**Summary**

The Town currently receives all its public water supply from the Authority. Due to large variations of elevations in Town, the Authority operates multiple pressure gradients in Town including the Read School House Gradient (430 feet), Low Service Gradient (334 feet), High Service Gradient (500 feet) and the Reduced High Service Gradient (470 feet). The Authority services approximately one third of the Town and predominately the eastern portion in locations east of Flat River Reservoir. Development extending beyond the current service area will likely be limited due to service elevations and the ability of the Authority to provide adequate pressure and water supply to these areas with existing system and currently planned improvements.

The Plan did identify specific projects and plans for improvement of water supply and several of which have been implemented. The new Read School House Road Pressure Gradient will likely solve current areas of low pressure. The remainder of the Town which is currently served from the Low Service Gradient is not likely to have problems with regard to available water supply but must be evaluated on a case by case basis due to the possibility of old cast iron mains and their ability to adequately convey fire flows.

Conversations with Mr. Paul Sprague Acting Director of Planning and Development were conducted as part of this review. Mr. Sprague indicated that residential growth is encouraged in Town and that the Town would work with the Authority for expansion of water service and infrastructure replacement projects. Ultimately, it would be the decision of the Authority to provide determination if additional growth and expansion relating to an increase in water service could be supported by the water system.

There also exists several hundred acres of land located in the southeast corner of Coventry (vicinity of Center of New England complex), which is either under development or planned for future development. It is uncertain to what extent this development will rely on public water supply as there are indications that a portion of the development is being considered for private water supply. In addition, a portion of the complex is dedicated to various retail, service, office and light industrial development. A number of these developments have been reviewed and approved for water service by the Authority and include a bank, Home Depot, Wal-Mart, Hotel, and a commercial “retail pad”.

The Town is expected to grow at a moderate pace for the next twenty years with a projected overall increase in population of 12%. The area of potential growth (outside of Center of New England) is not well quantified and it is likely that a larger percentage may occur in areas in which public service (sewer and water supply) are currently available or easily extended.

In addition, it would be expected that increasing the pressure gradient as proposed for the Read School House Zone with the provision for additional infrastructure to connect to the existing High Service Gradient to the south would likely further add to the potential for increase in service population and water demand. The ability to meet these demands would be a function on the timing of these developments in relation to having additional sources of supply in these High Service Gradients.

### **Town of West Greenwich**

The Town of West Greenwich Comprehensive Plan was established in 1995 and amended in May of 2006. The population of the Town as indicated by Rhode Island Statewide Planning (2000 Census) was 5,085 as of the year 2000. Rhode Island Statewide Planning has indicated a projected population of 6,550 for the year 2020.

According to the Comprehensive Plan the areas in West Greenwich serviced by the Kent County Water Authority (KCWA) include the Mishnock residential area, the commercial areas north of Interstate 95 on Nooseneck Hill Road, Hopkins Hill Road and Technology Park. The KCWA also maintains a 1.5 million gallon elevated steel tank within Technology Park, a 3.0 million gallon reservoir style tank located off Carrs Pond Road and watershed areas north of Mishnock Road within the Town of West Greenwich.

The Comprehensive Plan of the Town of West Greenwich states the following goal with regard for public water supply:

“Protect and enhance local water supply quantity and quality.”

The Town of West Greenwich Comprehensive Plan states the following policy regarding public water supply:

“The Town shall work cooperatively with the Kent County Water Authority and RIDEM.”

### **Population Summary (RI Statewide Planning)**

2000: 5,085

2005: 5,413

Projected 2010: 5,685

Projected 2020: 6,550

### **Summary**

The Town currently receives all its public water supply from the Authority. This includes a relatively small portion of Town in the north – northeast corner and includes a mix of residential, commercial and industrial development. Due to the high elevations in this area, it is required that West Greenwich be serviced from the High Service Gradient (500 feet) and Reduced High Pressure Gradient (470 feet). Expansion of the KCWA water system in these areas will be limited by available water supply in this Gradient.

In speaking with Ms. Jennifer Paquet, Town Planner the potential for future growth and expansion as related to water supply is somewhat limited in Town. The existing service area is constrained to the extreme northeast area of Town and is generally defined by Nooseneck Hill Road to the west, Interstate 95 to the south and the Towns of Coventry and East Greenwich to the north and east respectively. A transmission main was run across Interstate 95, which connects the High Service Gradient to the Carrs Pond water storage tank to the south of Interstate 95. Any development would likely be limited to further growth within this defined area, which is somewhat limited as recent expansion and development in the area of the Amgen facility have occupied much of the remaining developable land.

In addition, Ms. Paquet indicated that expansion of the water system is hampered by the current Town zoning which has a two (2) acre minimum requirement in place. It is anticipated that with this zoning requirement in place it is likely that future residential development in West Greenwich would be serviced primarily by individual lot private wells. Extension of public water service would likely be cost prohibitive unless large-scale subdivisions are considered.

In addition to the two-acre minimum zoning requirement which would likely limit expansion of the water system, there are additional physical barriers to expansion. This includes the Big River Watershed Protection area to the west and the higher elevations to the south and in the remainder of Town. It is unlikely that development of the water system would extend beyond the areas currently serviced however it is possible that additional subdivisions and water service could be extended to streets within the existing service territory.

The Town is expected to grow at a rapid pace for the next twenty years with a projected overall increase in population of near 30% which is 1,465 persons or roughly 600 households. This area of potential growth is not well quantified and it is probable that a larger percentage will occur in the area to the south and west outside of the existing water service territory.

It is more probable that any additional water use that may be required in the commercial / industrial area corridor north of Interstate 95 in proximity to the Technology Park Tank. There exists some undeveloped land area, which could be utilized, or for potential expansion of existing facilities both of which would increase water demand. Ms Paquet did not provide any indication at this time as to the nature of any planned development in this area. The ability to meet these potential demands would be a function on the timing of these developments in relation to having additional source of supply in the High Service Gradient.

### **Town of East Greenwich**

The Town of East Greenwich Comprehensive Plan was last updated in 2005 and initially prepared in 1988. It should be noted that, Section 4.1.7 - Water, of the Comprehensive Plan was not reorganized as part of the 2005 update and as such much of the information is dated. As of the year 2000, the population of the Town as indicated by Rhode Island Statewide Planning (2000 Census) was 12,948.

The goal of the East Greenwich Comprehensive Plan with regards to water service is to ensure protection of environmental resources. The Plan indicated the following:

The Kent County Water Authority (KCWA) has exclusive rights to provide water to the Town of East Greenwich. Approximately 75% of the Town is serviced by the KCWA, which accounts for 95% of the population of East Greenwich. The most recent KCWA water service extensions in East Greenwich have been installed by land developers.

The areas that are not serviced by the KCWA are predominantly located in the western and southeastern portions of the Town.

It should be noted that since the establishment of the original East Greenwich Comprehensive Plan in 1988, the KCWA water system has provided service expansion in East Greenwich to include the 334' Service Gradient as well as the 500' Service Gradient. In addition, the Reduced Low Service Gradient was also established to reduce pressures in areas of Town along the coastline.

### **Population Summary (RI Statewide Planning)**

2000: 12,948

2005: 13,330

Projected 2010: 13,648

Projected 2020: 14,656

#### **Summary**

The Town currently receives all of its public water supply from the Authority. Due to large variations of elevations in Town, the Authority operates multiple pressure gradients in Town including the Low Service Gradient (334 feet), Reduced Low Service Gradient (270 feet) and the High Service Gradient (500 feet). There are likely areas for development to the south in Town, which would likely require expansion of the High Service Gradient. Development in these areas will be dependant upon the Authority's ability to allow for further expansion of the High Service Gradient.

Rhode Island Statewide Planning has projected a population of 14,656 people for the year 2020 or an increase of 1,708 or 13%. This increase would likely occur in the south and be residential in nature. There exists the potential for a moderate increase in demand from this development.

Conversations with Mr. Lee Whitaker, Director of Planning were conducted as part of this review. Mr. Whitaker indicated that the Town has seen much development within the past five years and is beginning to experience a gradual slowdown. The particular sections of the Comprehensive Plan, specifically related to water supply, contain information that is somewhat obsolete and needs to be updated. Mr. Whitaker corroborated that the population projections in the Comprehensive Plan and from State Wide Planning were likely accurate. There are several development projects both underway and in the planning stages, which may impact these numbers in the future. Several of these projects include:

- Development of the Rocky Hill Fairgrounds area. There have been several development proposals for the property and it is likely that some a mix of commercial and residential development will take place within the next five years.
- Potential for future development of the commercial area along Route 2. There are still several remaining areas along this corridor that will likely be developed. The type and density of the development is unknown but likely commercial / retail in nature.
- Wellington Woods a proposed residential subdivision located off of Division Road has been proposed however it has yet to gain formal approval and could be downsized. It is currently proposed for construction of 429 units.
- Additional residential development will take place predominately in the south and western portions of Town where there is available vacant land. Issues relating to pressure and serving higher elevations above 275 - 280 feet have been a concern in this area. It would likely be required that any expansion in this area would require connection to the Low Service Gradient with booster pumps or connection to the High Service Gradient.
- The remainder of Town is largely built up and near saturation development. It is likely that any development in this area would consist of "in fill" development consistent with the current zoning designation of a particular area.

#### **City of Cranston**

The City of Cranston Comprehensive Plan was established in 1992 and last updated in 2005. The population of Cranston as indicated in the Comprehensive Plan was 76,269 in 2000 (2000 Census). Rhode Island Statewide Planning has projected a population of 83,811 people in the year 2020 for the City.

The Authority has a limited service area defined as the Oaklawn Pressure Zone that is supplied from a master meter connection with Providence Water. This area operates at a pressure gradient of 231 feet and is limited to a small isolated section of Cranston (Oaklawn). The Authority does not envision expansion of this current developed area into additional areas of Cranston. The majority of the City that is supplied with potable water is from Providence Water.

In addition, the Authority also services a small number of residences (approximately 15) off of Hope Road east of the intersection with Seven Mile Road via a small booster pump station. This facility is designed to service this limited area only and no expansion capability is provided in this pump station.

The Comprehensive Plan as it relates to water service primarily relates to water service from Providence Water. Water service falls under the element of Services and Facilities in the City of Cranston Comprehensive Plan. The policy of the Service and Facilities element as it relates to water service as indicated in the Comprehensive Plan is to adopt water conservation measures for residential and industrial users.

The City of Cranston seeks to restrict the expansion of private and public utility systems. As a means to restrict the expansion of water systems, the City placed limits on future service areas as a means to better manage the expansion of the water systems. To achieve this restriction on water system expansions the City implemented low density zoning to preserve well water sources in the western portion of Cranston.

The Kent County Water Authority (KCWA) services a small area of Cranston. The Comprehensive Plan indicates that water system expansion is problematic in western Cranston due to the fact that elevations are over 400 feet in this area.

**Population Summary (RI Statewide Planning)**

2000: 79,269

2005: 80,285

Projected 2010: 81,131

Projected 2020: 83,811

**Summary**

As previously indicated the Authority serves a defined portion of the City of Cranston and at such time no further expansion is envisioned outside of this existing service territory. All unserved areas in Cranston would be considered for service through Providence Water. There exists little room for additional expansion within the limits of the existing service territory however it may be likely that several additional water services could be required in the future from development of single available lots.

**Town of Scituate**

The Town of Scituate Comprehensive Plan was established in August 1994 and updated in June 2003. As of the year 2000 (2000 Census) the population of Scituate was 10,324 people as depicted by Rhode Island Statewide Planning. Rhode Island Statewide Planning has indicated a population of 11,522 people for the year 2020 or an increase of 12%.

The Kent County Water Authority (KCWA) provides water to a portion of the Hope area in Scituate, which is located in the southeast portion of Town. This includes the Low Service Gradient, which has the ability to marginally service these higher elevation areas in Town. The KCWA is currently the only public water service provider in the Town of Scituate. The KCWA does not at this time have plans to expand its service area in Scituate.

In addition, the Authority maintains its primary wholesale connection with Providence Water at the location of the Clinton Avenue Pump Station off of Hope Road. This facility, which was recently upgraded provides for upwards of 70% of the total system demand.

Agreements with Providence Water and the KCWA allow limited water service expansion in the Hope area of Town with the goal being to eliminate problems associated with contaminated wells rather than inducing growth in undeveloped areas. The Town of Scituate Comprehensive Plan states:

“Any expansion of the Kent County Water Authority system would require the concurrence of the Providence Water Supply Board.”

The water service element is categorized under the Services and Facilities element in the Scituate Comprehensive Plan. The goals of the water service portion of the Services and Facilities element as stated in the Comprehensive Plan are as follows:

“Pursue the installation of sewer and the extension of water service to provide for the health and safety of residents.”

The policies of the Services and Facilities element with regards to water service is indicated in the Comprehensive Plan as follows:

“Expand water system to service needs in contaminated areas. Water service shall not be used to induce growth.”

#### **Population Summary (RI Statewide Planning)**

2000: 10,324

2005: 10,592

Projected 2010: 10,815

Projected 2020: 11,522

#### **Summary**

As previously indicated the Authority serves a defined portion of the Town of Scituate (Hope Village) and at such time no further expansion is envisioned outside of this existing service territory. The remainder of Town does not have public water however Providence Water, the largest water purveyor in the State, maintains all of its water resources in the form of surface water in the Town of Scituate.

## **5.0 Review of Previous Modeling Studies and Assessment**

A review of previous studies conducted for the Authority that was either directly or partially related to current available and future water supply sources, current and future consumer demands and rate of change in consumer demands in the last five years was completed. This included the following reports / studies: June 2004 Hydraulic Model Report; July 2004 High Pressure Gradient Model Evaluation (task order 2); November 2004 High Pressure Gradient Model Evaluation (task order 3) and the March 2006 Hydraulic Model Update Report.

These reports and studies are critical in that the consumer demand data and supply capabilities for each pressure gradient will be a determining factor when evaluating the total available storage capacity in a particular gradient.

2004 Model Report and 2006 Model Report Update

The original model report that was completed in 2004 utilized consumer demand records from year 2002. The system wide consumer demands associated with the original model included an average day of 10.4 MGD, a maximum day of 19.5 MGD and a peak hour of 22.1 MGD. These demand rates were developed from an accounting of the consumer demand data records as well as supply / production records and includes an allowance for unaccounted water demand.

The hydraulic model update consisted of modifying the 2004 model geometry to represent changes in the water system infrastructure and changes in operation of the water system, updating the consumer demand data for the large water users and including the consumer demands of all the developments that were approved by the Authority Board. It should be noted that the system wide consumer demands were not updated at this time however all Board approved developments and changes in the large users were incorporated. Generally, system wide consumer demands are updated at five year intervals.

The following table summarizes the water system demand for the updated hydraulic model compared to the water system demands contained in the original model.

**CHANGE IN CONSUMER DEMAND (2004 – 2006)**

| <b>MODELING SCENARIO</b>  | <b>2004 MODEL</b> | <b>2006 MODEL UPDATE</b> | <b>% CHANGE +/-</b> |
|---------------------------|-------------------|--------------------------|---------------------|
| Average Day System Demand | 10.4 MGD          | 11.6 MGD                 | +10.3%              |
| Maximum Day System Demand | 19.5 MGD          | 22.2 MGD                 | +12.4%              |
| Peak Hour System Demand   | 22.1 MGD          | 25.9 MGD                 | +14.7%              |

The results of the updated model indicate that the Authority’s overall water system demand has increased rather significantly under all of the demand scenarios (average day, maximum day, peak hour) within the past three years. On average this increase is 12.5%. The following table summarizes the consumer demand for each pressure zone under the various demand scenarios.

**CONSUMER DEMAND BY PRESSURE ZONE (2006)**

| <b>PRESSURE ZONE</b>              | <b>DEMAND SCENARIO</b> | <b>DEMAND (MGD)</b> |
|-----------------------------------|------------------------|---------------------|
| Low Service (334’) Gradient       | Average Day            | 5.818               |
|                                   | Maximum Day            | 10.741              |
|                                   | Peak Hour              | 12.460              |
| Tiogue Tank (350’) Gradient       | Average Day            | 0.086               |
|                                   | Maximum Day            | 0.176               |
|                                   | Peak Hour              | 0.200               |
| Intermediate High (430’) Gradient | Average Day            | 0.397               |
|                                   | Maximum Day            | 0.811               |
|                                   | Peak Hour              | 0.924               |

|   |             |       |
|---|-------------|-------|
| High Service (500') Gradient                      | Average Day | 2.553 |
|   | Maximum Day | 5.021 |
|   | Peak Hour   | 5.813 |
| Low Service Reduced (334') Gradient               | Average Day | 1.871 |
|   | Maximum Day | 3.727 |
|   | Peak Hour   | 4.320 |
| High Service (500') Reduced Gradient              | Average Day | 0.528 |
|   | Maximum Day | 1.035 |
|   | Peak Hour   | 1.274 |
| Warwick Wholesale Interconnection (232') Gradient | Average Day | 0.006 |
|   | Maximum Day | 0.010 |
|   | Peak Hour   | 0.011 |
| Hope Road (510') Gradient                         | Average Day | 0.006 |
|   | Maximum Day | 0.013 |
|   | Peak Hour   | 0.014 |
| Oaklawn (231') Gradient                           | Average Day | 0.361 |
|   | Maximum Day | 0.736 |
|   | Peak Hour   | 0.847 |

Further, the following table illustrates the average day demand in each of the pressure zones as a percentage of the entire system demand.

### PERCENTAGE OF CONSUMER DEMAND BY PRESSURE ZONE (2006)

| PRESSURE ZONE                           | PERCENTAGE OF SYSTEM DEMAND |
|---|-----------------------------|
| Low Service (334') Gradient             | 50.0                        |
| Tiogue Tank (350') Gradient             | 0.7                         |
| Intermediate High (430') Gradient       | 3.4                         |
| High Service (500') Gradient            | 22.0                        |
| Low Service Reduced (334') Gradient     | 16.1                        |
| High Service (500') Reduced Gradient    | 4.5                         |
| Warwick Interconnection (232') Gradient | < 0.1                       |
| Hope Road (510') Gradient               | < 0.1                       |
| Oaklawn (231') Gradient                 | 3.1                         |

2004 High Pressure Gradient Model Evaluation and November 2004 High Pressure Gradient Model Evaluation

These studies concentrated on the growth that was occurring in the High Service 500 foot Gradient portion of the system and specifically on the ability to effectively provide water supply to this area. These studies were critical in that the majority of new demand is occurring within this portion of the distribution system, which has a defined supply limitation. Currently there are no sources of supply to this gradient and supply is afforded from a combination of booster pump stations (Johnson Boulevard, West Warwick Industrial Park and Setian Lane). All of these booster pump stations are fed directly from the Low Service 334 foot gradient. The primary concern is related to limitations in supply during peak (maximum day) demand periods and the ability to supply adequate pressure and volume to this area.

The conclusions that were developed from these studies are summarized below.

- The High Service Gradient in November 2004 had an available supply capacity of 3.17 MGD and was determined capable of supplying existing and approved development projects, which totaled 3.01 MGD.
- There existed additional as yet unapproved development projects which if approved could greatly exceed the supply capacity of the High Service Gradient. Source augmentation was necessary in order to meet this potential future demand.
- In November 2004, the High Service Gradient had a theoretical surplus capacity to meet maximum day demands of 0.16 MGD.
- In October 2005, the list of all approved developments (as per the September 2005 approvals of the Board) was updated which included an accounting of all single and multi family residences as well as approved developments since November 2004 was updated. The maximum day consumer demand from all approved developments was calculated at 3.46 MGD, which is above the November 2004 available surplus capacity of 3.17 MGD.
- This demonstrated a supply deficit in capacity to meet the maximum day demands of the High Service Gradient of approximately 0.29 MGD.

It was concluded that without supply augmentation, further approvals of development(s) relating to increasing water demand within the High Service Gradient would further increase the deficit of water supply to meet maximum day demands. This would also further exacerbate the supply deficit and increase risk of the water system not possessing the ability to meet overall consumer demands. Supply deficits during maximum day demand periods would result with possible service interruptions for existing customers and an inability to maintain critical levels in the water storage tanks for adequate pressure and fire service protection.

2002 – 2005 Updated Capital Improvement Program, March 2001

In 2000 the Authority commissioned an update of their existing Capital Improvement Program (CIP) to prioritize water system needs over the next four years (2002 –2005). This CIP detailed numerous water infrastructure projects including water main replacements and installation as well as projects directed at increasing overall supply capacities either through new or rehabilitation of facilities. The projects were prioritized by fiscal year and are further detailed in the Updated CIP. The projects are as follows.

| <u>PROJECTS</u>                               | <u>STATUS</u>         |
|---|-----------------------|
| Fiscal Year 2002 Improvements                 |                       |
| Project 1 - Mishnock Well Field Expansion     | Ongoing – Pilot Study |
| Project 1a – Mishnock Well Field Improvements | Pending               |
| Project 1b – Mishnock Transmission Mains      | Pending               |

|  |                  |
|--|------------------|
| Project 1c – Mishnock Water Treatment Plant  | Pending          |
| Project 2 – East Greenwich Well Upgrade  | Pending          |
| Project 3 – New Kent County Water Authority Facility                                     | Pending          |
| Fiscal Year 2003 Improvements  |                  |
| Project 4 – Black Rock Road Transmission Main  | Complete         |
| Project 5 – Knotty Oak Road Transmission Main  | Complete         |
| Project 6 – Watercress Court Transmission Main   | Pending          |
| Project 7 – New Read School House Road High Service Area                                 |                  |
| Project 7a – Clinton Avenue Pump Station Modifications                                   | Complete         |
| Project 7b – New Read School House Road Storage Tank                                     | Design Phase     |
| Project 7c – New Read School House Road Transmission<br>Main South of New Storage Tank   | Design Complete  |
| Project 7d – Flat River Road 20 – Inch Transmission Main                                 | Design Complete  |
| Fiscal Year 2004 Improvements  |                  |
| Project 8 – Additional Read School House Road Transmission Mains                         |                  |
| Project 8a – Flat River Road 16-Inch Transmission Main                                   | Design Complete  |
| Project 8b – Read School House Road Transmission Main North of<br>New Storage Tank       | Future - Pending |
| Project 8c – Hope Furnace Road Transmission Main   | Future - Pending |
| Project 9 – Extension of High Service to the Oak Haven Manor Area                        |                  |
| Project 9a – Boston Street Area Water Main Improvements                                  | Future - Pending |
| Project 9b – Laurel Avenue Water Main  | Future - Pending |
| Project 9c – Pilgrim Avenue Water Main   | Future - Pending |
| Project 9d – Sandy Bottom Road Transmission Main   | Future - Pending |
| Project 10 – East Greenwich Transmission Mains   |                  |
| Project 10a – Division Road Transmission Main  | Future - Pending |
| Project 10b – Shippeetown Road Water Main  | Future - Pending |
| Project 10c – Middle Road Water Main from Mawney Brook to<br>Tillinghast Road            | Future - Pending |
| Project 10d – Middle Road Water Main between Westfield Drive<br>and Moosehorn Road       | Future - Pending |
| Fiscal Year 2005 Improvements  |                  |
| Project 11- West Street Tank Area Transmission Mains                                     |                  |
| Project 11a – Green Street Area Water Mains  | Future - Pending |
| Project 11b – Main Street Transmission Main  | Future - Pending |
| Project 11c – Ames Street Water Main   | Future - Pending |
| Project 11d – Low Service Area Storage Analysis  | Future - Pending |
| Project 12 – Read School House Road and Technology Park High<br>Service Areas Connection |                  |
| Project 12a – Flat River Reservoir Dam Crossing  | Future - Pending |
| Project 12b – Reservoir Road Transmission Mains  | Future - Pending |
| Project 12c – Nooseneck Hill Road 20-Inch Transmission Main                              | Future - Pending |
| Project 12d – Nooseneck Hill Road 20-Inch Transmission Main                              | Future - Pending |
| Project 13 – General   |                  |
| Project 13a – Bald Hill Road Area Transmission Mains                                     | Future - Pending |
| Project 13b – West Warwick Industrial Park Tank Demolition                               | Future - Pending |
| Project 13c – Read School House Road Tank Demolition                                     | Future - Pending |

The projects identified above have been bond funded up through Project 7d – Flat River Road 20 – Inch Transmission Main including Project 8a – Flat River Road 16-Inch Transmission Main less Project 3 – New Kent County Water Authority Facility and Project – 6 Watercress Court Transmission Main. A number of these projects have been completed, are in the design and construction phase or are in the planning stages.

The remaining projects identified as 8 through 13 (except 8a) do not as of yet have secured bonding revenue. It is anticipated that the Authority will following completion of this Tank Study revisit the CIP and the merit of each of these projects. It is intended that the CIP Update will be performed in Spring 2007.

May 31, 2006 Five Year Build Out Report

The following are a summary of significant infrastructure improvements that are proposed by the Authority for the next five-year planning period. These projects are in varied stages from being near completion and operational to conceptual and preliminary in nature. Those projects that are not well defined will require further determination and evaluation and would likely be included in the next update of the CIP. The following is a brief overview of each of the projects, some of which are included in the 2001 Updated CIP.

- Clinton Avenue Booster Pump Station Upgrade

This facility is the Authority's primary wholesale source of supply that is derived from Providence Water and has historically provided upwards of 70% of the total system demand. The facility has been designed for complete rehabilitation in order to increase pumping capacity to the Low Service Gradient from an available 12 MGD to 22 MGD. Additionally, the facility has been redesigned to have the ability to pump 3.0 MGD directly to the new Read School House Road Gradient (500 feet) that is currently at a 430 foot Intermediate Gradient. This will necessitate the construction of a new storage tank that is anticipated to be completed by 2008 and will allow for the Knotty Oak Pump Station to be taken off line. Total upgraded station capacity will be 25 MGD.

Construction of the facility occurred during 2005 / 2006 and the facility is now substantially complete and operational. Funding for this upgrade has already been secured through issuance of a bond. The High Service portion of the facility is expected to be in service in 2008.

- Bald Hill Road Pumping Station Upgrade

This facility currently provides wholesale water from the City of Warwick and indirectly from Providence Water (Warwick purchases all water from Providence). The Authority has negotiated an increase in supply for this facility from Warwick, which will require an upgrade of this facility. It is anticipated that the capacity will be increased from 4.6 MGD to 10 MGD. Initially, the station will be upgraded to provide a service capacity of 8.0 MGD to the Low Service Gradient as existing water transmission main infrastructure is in place. This is considered to be the first phase of the project and will be funded through the Authority's Infrastructure Replacement Fund.

The second phase of this project which is currently unfunded includes the installation of pump(s) for the High Service Gradient and significant length of transmission main designed to connect the facility to the High service Gradient.

The project is in the preliminary design stages and it is anticipated that construction of the first phase could be conducted in late 2007. The timing for the second phase is as yet undetermined.

- Proposed New Wholesale Supply Interconnection

This project involves an additional wholesale connection to the Providence Water system at the existing 102-inch diameter aqueduct for a supply of up to 7.0 MGD. At this juncture the project is in the preliminary stages and requires further refinement with regard to site location, connection location, funding and required level of infrastructure. Initially, this project was envisioned as a temporary backup to the Clinton Avenue pump station and would permit Clinton Avenue to be temporarily shut down in order that Providence Water may perform required maintenance on the 78-inch diameter aqueduct.

Ultimately, the facility would be permanent such that up to 5.0 MGD could be supplied to the Low Service and up to 2.0 MGD could be supplied to the High Service. No cost has been developed due to the conceptual and preliminary nature of the project.

- Mishnock Well Field Upgrade

The Mishnock Well Field is currently being piloted for treatment technology for removal of iron and manganese that have historically plagued this source of supply. Once the treatment system has been selected and installed the well field will yield a capacity of 2.4 MGD for use in both the Low Service Gradients. This project along with the necessary transmission and storage facilities are funded under the 2001 CIP program and bond funding has been secured. Following the piloting program, final siting and design can commence. It is anticipated that the supply will be divided and shifted to either the Low or High Service Gradient based on need with final construction and activation anticipated for 2008.

- East Greenwich Well Field Upgrade

This well is located on the Warwick/East Greenwich line and supplies 1.0 MGD to the Low Service Gradient. It is envisioned that this facility be fitted with treatment technology for mineral removal (iron and manganese) which will allow an increase in capacity to 2.0 MGD. The treatment technology will be similar in nature to that selected for the Mishnock Well Field. This supply will be utilized to offset supply from the Bald Hill Pump Station. Upgrade of this facility is currently funded under the 2001 CIP program and bond funding has been secured.

- Spring Lake Well Field Upgrade

This well is currently off line and will require treatment for mineral removal (iron and manganese) for future reactivation. The well yield is relatively low at 0.5 MGD and supplies the Low Service Gradient. At this time, it is anticipated that treatment and reactivation would occur only after Mishnock and East Greenwich wells are placed back into service.

- Johnson's Boulevard Pumping Station

Constructed in 1990 and designed to pump from the Low Service to the High Service Gradient with a rated capacity of 5.04 MGD. No current upgrades are planned however infrastructure improvements to the suction side transmission mains are required to eliminate low pressure and allow full pumping capacity during peak demand periods. Part of this study will include identifying those infrastructure projects that would alleviate the low pressure problems and subsequently permit the pump station to be utilized to full capacity.

- Setian Lane Booster Pumping Station

Constructed in 2004 and designed to pump directly from the Setian Lane Tank (Low Service Gradient) into the High Service Gradient with a rated capacity of 1.1 MGD. No current improvements are proposed for this facility however the planned upgrade to the Bald Hill Pump

Station will provide an additional source of supply to this facility such that the rated capacity can be increased. It is anticipated that Bald Hill Pump Station upgrade will allow operation of the second 1.1. MGD pump at the facility thus providing a total rated capacity of 2.2 MGD without compromise to the storage capacity (tank level) in the Setian Lane storage tank.

- West Warwick Business Park Booster Pumping Station

Constructed in 2003 and designed to pump from the Low Service Gradient to supply the High Service Gradient and specifically to accommodate the additional demand required by Amgen. The facility has a rated capacity of 1.1 MGD. No current improvements are proposed for this facility however the planned upgrade to the Bald Hill Pump Station will provide an increased source of supply to this facility.

## 6.0 System Overview and Identified Deficiencies

### Population Projections

The projected changes in population vary from municipality to municipality throughout the service territory. The following table represents the anticipated change in population out to 2020 from year 2000 Census data. 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)<br>POPULATION | 2005 (RIEDC)<br>POPULATION | CHANGE<br>(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%            |
| <b>TOTALS</b>  | <b>167,090</b>              | <b>168,905</b>             | <b>(+1,815) 1.1%</b>    |

### PROJECTED POPULATION CHANGE BY COMMUNITY 2000 - 2020

| COMMUNITY    | 2000 (CENSUS)<br>POPULATION | 2020 (RIEDC)<br>POPULATION | CHANGE<br>(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          | (+1,456) +28.8%      |
| East Greenwich | 12,948         | 14,656         | (+1,708) +13.2%      |
| <b>TOTALS</b>  | <b>167,090</b> | <b>175,158</b> | <b>(+8,059) 4.8%</b> |

The most recent Water Supply System Management Plan (WSSMP) of 2001 provided indication of service population by community based on year 2000 data. For the purpose of this study, it will be assumed that any increase or decrease in the overall projected population for each community for the next twenty-year period that 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 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**

| <b>COMMUNITY</b> | <b>2000 SERVICE POPULATION</b> | <b>2020 SERVICE POPULATION</b> | <b>CHANGE (VALUE) AND %</b> |
|------------------|--------------------------------|--------------------------------|-----------------------------|
| Warwick          | 8,578                          | 8,521                          | (-573) -0.7%                |
| West Warwick     | 18,083                         | 18,906                         | (+1,347) +4.6%              |
| Coventry         | 19,941                         | 22,382                         | (+4,121) +12.2%             |
| West Greenwich   | 824                            | 1,062                          | (+1,456) +28.8%             |
| East Greenwich   | 9,262                          | 10,484                         | (+1,708) +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%                   |
| <b>TOTALS</b>    | <b>59,891</b>                  | <b>64,558</b>                  | <b>(+4,667) +7.8%</b>       |

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

The table indicates that the municipalities that 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 no change to a slight increase. 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.

Task Order No. 6 & 7 – Review and Discussion

Task Order No. - 6 High Pressure Gradient Demand Evaluation – October 2005

C&E in November 2004 presented Project Task Orders No. 2 and 3 to the Kent County Water Authority (Authority). These Task Orders consisted of evaluating the available water supply capacity related to the High Service Gradient portion of the Authority's system and included identifying potential surplus supply capacity for future growth within this area of the service territory.

The results of this evaluation identified an existing maximum day system demand within the High Service Gradient of 2,197 gpm (3.17 MGD). The current water supply capacity of the High Service Gradient was determined to be 4,400 gpm (6.34 MGD) which is the supply output capacity of the three (3) booster pump stations that service this pressure gradient. The theoretical surplus supply capacity was determined to be equal to 2,203 gpm (3.17 MGD).

The evaluation determined that the High Service Gradient portion of the water system was capable of accommodating a defined increase in the maximum day water demand associated with additional growth and development that was expected to occur within this portion of the system. This defined increase is associated with projects for which the Authority had granted formal approval of supply. At the time (November 2004), the maximum day demand associated with approved projects was equal to 3.01 MGD as finalized in Task Order 3. As the existing High Service Gradient had an identified surplus capacity of 3.17 MGD, it was determined to be sufficient to meet the maximum day demand associated with these approved projects.

Task Order 3 evaluation concluded that there existed a surplus capacity to serve additional growth in the High Service Gradient equal to 0.16 MGD or approximately 160,000 gallons per day. It was also concluded that there were potential projects which were yet unapproved for water supply by the Authority which would further tax the ability of the High Service Gradient to effectively meet the overall supply of water to this portion of the system. The total maximum day water demand from all potential projects was well in excess of the available supply capacity to the High Service Gradient. The conclusion of the evaluation was that there was a shortage of overall water supply in the High Service Gradient to meet current existing demand coupled with all known potential development project(s).

The current pace of proposed development was also reviewed in the context of the projections contained in the Authority's Water Supply System Management Plan (WSSMP). It was concluded that the rate of growth and development and the associated need for water is apparently occurring in the High Service Gradient at a rate greater than that projected in the WSSMP. The immediate concern was that the potential for water demand in the very near future is likely to be in excess of the 20-year demand projection contained in the WSSMP.

The significant conclusions of Task Order 6 were as follows:

- The High Service Gradient in November of 2004 had an available supply capacity of 3.17 MGD and was determined capable of supplying existing and approved development projects, which totaled 3.01 MGD.
- There existed additional as yet unapproved development projects which if approved would greatly exceed the supply capacity of the High Service Gradient. Source augmentation was necessary in order to meet this potential future demand.
- In November 2004, the High Service Gradient had a theoretical surplus capacity to meet maximum day demands of 0.16 MGD.
- In October 2005, the list of all approved developments (as per the September 2005 approvals of the Board) was updated which included an accounting of all single and multi family residences as well as approved developments since November 2004 was updated. The maximum day consumer

demand from all approved developments is now calculated at 3.46 MGD, which is above the November 2004 available surplus capacity of 3.17 MGD.

- This demonstrates that there is a supply deficit in capacity to meet the maximum day demands of the High Service Gradient of approximately 0.29 MGD.
- Without additional supply augmentation, additional approvals of development(s) relating to increasing water demand within the High Service Gradient will further increase the deficit of water supply to meet maximum day demands. This would also further exacerbate the supply deficit and increase risk of the water system not possessing the ability to meet overall consumer demands. Supply deficits during maximum day demand periods will result with possible service interruptions for existing customers and an inability to maintain critical levels in the water storage tanks for adequate pressure and fire service protection.

**Task Order No. 7 – Hydraulic Model Update – February 2006**

In February 2006, C&E updated the computerized hydraulic model of the Authority’s water supply and distribution system. One of the key elements of this update was to incorporate the “known” consumer demands associated with recent development in the High Service Gradient and as detailed in Task Orders 2, 3 and 6. The results were a significant increase in the overall system demand of 12.5%. This increase was however more significant and in the range of 50% in the High Service Gradient portion of the water system. The model now accurately reflects all Board approved development projects.

**System Consumer Demand Allocation**

In order to account for future demands for purpose of this study the following approach will be adopted.

- The High Service Board approved developments have already been incorporated into the most recent model update. These do not need to be reconsidered as part of future projections and are already allocated to specific areas in the system to which they are expected to occur.
- All “known” development projects in the High Service Gradient which have yet to be approved will be added to the model demand database as they would likely be approved and constructed once sufficient supply exists to service this area.
- Based on the anticipated increase in service population by community, increase the demand for the twenty-year planning period by an equal amount. Due to the fact that the area of future development is unknown, the additional anticipated consumer demands would be distributed globally across the particular community. The following table represents the percentage modification in consumer demands by service community, based on anticipated population changes, that will be used for the study in the twenty-year planning period.

**SERVICE POPULATION TABLE ALLOCATION 2000 -2020**

| <b>COMMUNITY</b> | <b>2000 SERVICE POPULATION</b> | <b>2020 SERVICE POPULATION</b> | <b>CHANGE (VALUE) AND %</b> |
|------------------|--------------------------------|--------------------------------|-----------------------------|
| Warwick          | 8,578                          | 8,521                          | (-573) -0.7%                |
| West Warwick     | 18,083                         | 18,906                         | (+1,347) +4.6%              |
| Coventry         | 19,941                         | 22,382                         | (+4,121) +12.2%             |
| West Greenwich   | 824                            | 1,062                          | (+1,456) +28.8%             |
| East Greenwich   | 9,262                          | 10,484                         | (+1,708) +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%             |
| <b>TOTALS</b>   | <b>59,891</b> | <b>64,558</b> | <b>(+4,667) +7.8%</b> |

- As a conservative estimate for unanticipated growth, allocate a system wide growth rate of 10%. This would also include communities including Cranston, North Kingstown and Scituate for which the Authority has no immediate plans for expansion. This will account for the potential of “in-fill” growth that is likely to occur.

#### System Overview

Through conversations with Authority personnel and review of Comprehensive Community Plans, an identification of system deficiencies and problematic areas within the Kent County Water Authority (KCWA) water system have been identified. Those that are identified are intended to be specific rather than general in nature (i.e. eliminate dead ends, loop water mains, frequency of hydrant flushing, etc.).

Included in this assessment will be the Clinton Avenue Pump Station. Currently, the station operates on a near 24 / 7 basis to supply system demand. Periodically, during the winter months the station will shut down during off-hour periods (i.e. early morning hours of midnight to 5:00 AM). Currently, the pump station must remain in near constant operation in order to provide adequate pressures to localized areas in the service territory. Generally, these are at elevations in the vicinity of 300 feet. This study will include an investigation of these specific locations and provide potential alternatives to solving this problem. The goal would be to provide the ability to shut down pumps at the station without compromising the service pressure at other locations within the distribution system.

Additional deficiencies and problematic areas that have been preliminarily are listed by city or town below.

#### City of Warwick

The City of Warwick did not identify any specific areas of concern in the Comprehensive Plan. The areas of concern indicated in the Warwick Comprehensive Plan were general in nature (i.e. goal of eliminating dead end mains and pressure drops, water conservation efforts, etc.).

There were no specific areas of concern identified through meeting with Authority staff.

#### Town of West Warwick

The Town of West Warwick identified the following problematic areas regarding low pressures and water volume in the Comprehensive Plan:

- Campbell Farms (these problems have been corrected)
- Wakefield Hill and West Warwick Industrial Park (i.e. average day demand pressures ranging from 29 psi to 38 psi) – (note that these problems have been corrected as a result of reservicing the area to the High Service Gradient)
- Natick area
- West Street Tank – refurbishment of the tank is complete but not in service (This study is directed at alternatives to reactivating this tank)

There were no specific areas of concern identified through meeting with Authority staff.

#### Town of Coventry

The Town of Coventry identified the following problematic areas relating to pressure and supply deficiencies within the Town in the Comprehensive Plan:

- Oak Haven
- Wood Estates (Note based on review of model results and conversation with Authority personnel there are no known pressure or supply deficiencies associated with this area of Town)
- Read School House Road (i.e. average day pressures of approximately 11 psi) in proximity to storage tank

In meeting with Authority personnel and through hydraulic model simulations the following areas of low pressures have been identified within the Town of Coventry:

- Crest of Knotty Oak Road (i.e. average day pressures ranging from 29 psi to 38 psi)
- Tiogue Hill / Oak Haven (i.e. average day pressures ranging from 19 psi to 45 psi)
- Crest of Arnold Road (i.e. average day pressures from 32 psi to 37 psi)
- Suction side of Johnson Boulevard Pump Station (i.e. average day pressures ranging from 28 psi to 33 psi)
- Crest of Route 3 (Woodland Manor) (i.e. average day pressures ranging from 37 psi to 38 psi)

#### Town of West Greenwich

The Town of West Greenwich Comprehensive Plan did not identify any system deficiencies or areas of concern within the KCWA water system.

There were no specific areas of concern identified through meeting with Authority staff.

#### Town of East Greenwich

The Comprehensive Plan for the Town of East Greenwich did not identify any problematic areas within the KCWA water system.

In meeting with Authority personnel and through hydraulic model simulations the following areas of low pressures have been identified within the Town of East Greenwich:

- Watch Hill/Signal Ridge (i.e. average day pressures ranging from 30 psi to 38 psi). Note: the top of Watch Hill that is currently not serviced however water main is in place (11 psi)

#### Town of Scituate

The Town of Scituate Comprehensive Plan did not indicate any areas of concern.

In meeting with Authority personnel and through hydraulic model simulations the following areas of low pressures have been identified within the Town of Scituate:

- Seven Mile Road in vicinity to Fiskeville storage tanks (i.e. average day pressures of approximately 22 psi)

City of Cranston

The City of Cranston has not identified any water system deficiencies or areas of concern in the Comprehensive Plan.

There were no specific areas of concern identified through meeting with Authority staff.