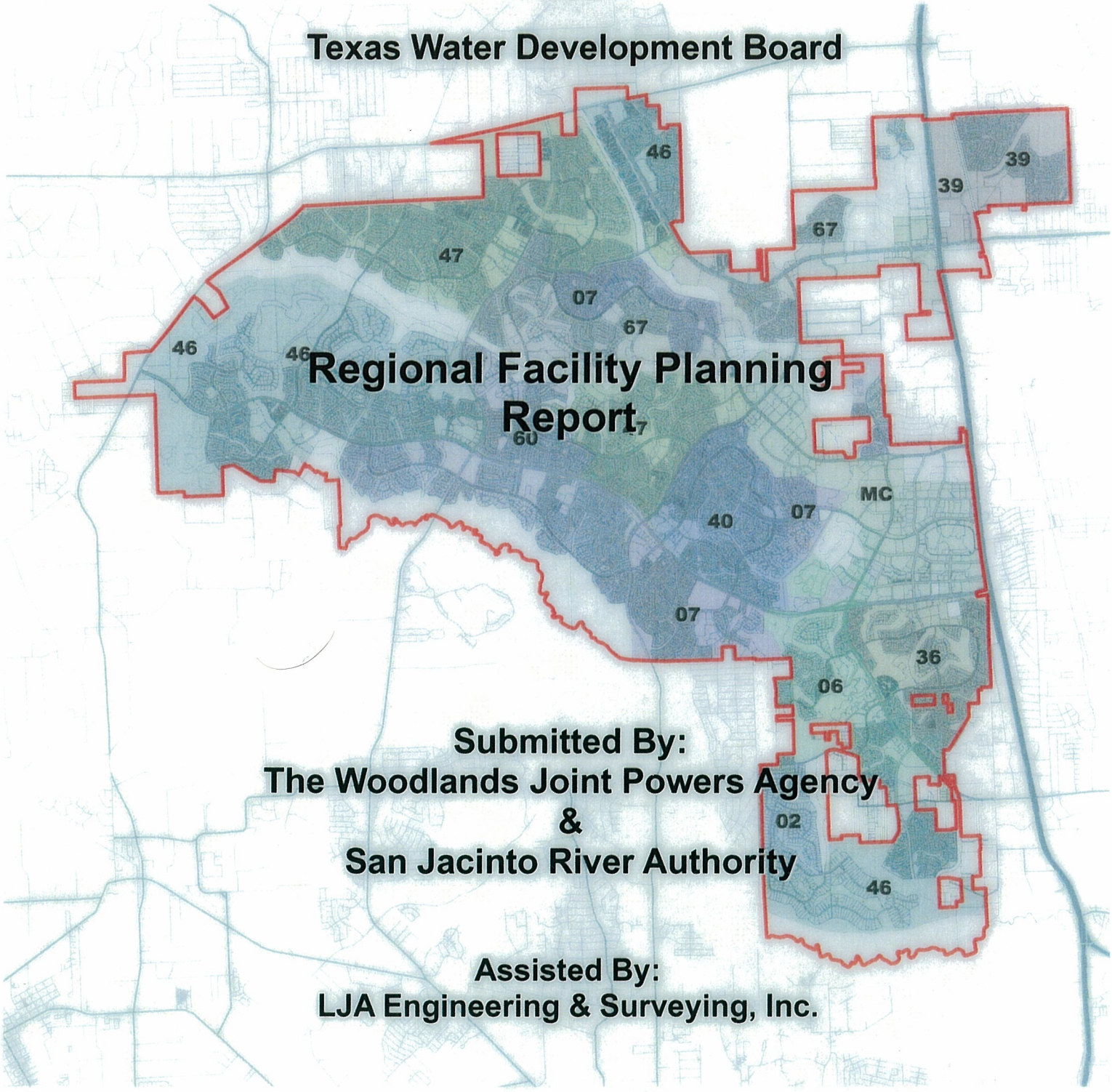
Texas Water Development Board

Regional Facility Planning Report



Submitted By:
The Woodlands Joint Powers Agency
&
San Jacinto River Authority

Assisted By:
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July 2007

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EXHIBITS

Reduced size exhibits are provided in this draft report. PDF files of the full size exhibits are provided on the enclosed CD.

WATER SUPPLY & DISTRIBUTION SYSTEM

The existing and ultimate development conditions for the Woodlands water supply & distribution system were analyzed using hydraulic models developed with KyPipe2000's 24-hour, extended period simulation (EPS) option. The existing system was verified to maintain pressures of at least 35 pounds per square inch (psi) during peak day and peak hour, and pressures greater than 20 psi during peak-day-plus-fire conditions. However to achieve the capacity needed for ultimate development conditions, some upgrades are required.

Two proposed water plants and eleven proposed water wells and one additional elevated storage tank are proposed to handle the projected demands for ultimate development.

Specific improvements to the existing system are better outlined in **Section 2**. The total cost for these improvements are approximately $17,781,770 (**Table 3.2**)

WASTEWATER TREATMENT & COLLECTION SYSTEM

The wastewater treatment and collection system was analyzed using Global Information Systems (GIS) to calculate the design flow of sanitary lines. Total average flow for year 2005 was 13.5 mgd. Average wastewater flows at ultimate development of The Woodlands are projected to be 16.5 mgd for all three wastewater treatment plants. A comparison of projected wastewater flow and actual annual average flow information indicates that the projected flows using the planning criteria are somewhat higher than those experienced today. A detailed analysis of the differences is beyond the scope of this study. The design capacity of any individual wastewater plant is dependent not only on the hydraulic capacity, but also organic loading to the facility. Should SJRA and WJPA elect to continue analysis of the system based on existing flow and quality data, the GIS model will prove an invaluable asset to the analysis.

From the analysis, only one lift station needs to be expanded to handle the projected design / ultimate peak wastewater flow, again however, more detailed analysis using actual flow data appears warranted. Based on current actual flow into each wastewater treatment plant, these plants appear to have capacity to serve The Woodlands without any further expansion, but additional study using actual organic loading and flow data and the GIS model can verify this assessment. The total estimated cost to expand the lift station is $300,000 (**Table 4.3).**

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WATER CONSERVATION AND DROUGHT CONTINGENCY PLAN

Section I

Adoption, Declaration of Policy, Purpose and Intent

In order to conserve the available water supply and protect the integrity of water supply facilities, with particular regard for domestic water use, sanitation, and fire protection, and to protect and preserve public health, welfare, and safety and minimize the adverse impacts of water supply shortage or other water supply emergency conditions, the Board of Directors of the District adopts the following rules, regulations, policies and restrictions concerning the delivery and consumption of water.

This Water Conservation and Drought Contingency Plan (this "Plan") shall be effective from and after the date of its adoption.

Water uses regulated or prohibited under this Plan are considered to be non-essential and continuation of such uses during times of water shortage or other emergency water supply condition are deemed to constitute a waste of water which subjects the offender(s) to penalties as defined in Section XI of this Plan.

Section II

Public Involvement

Opportunity for the public to provide input into the preparation of this Plan was provided by the District by means of holding a public meeting, for which proper notice was given, to accept input on this Plan.

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Section III
Public Education

The District will periodically provide or make available to the public information about this Plan, including information about the conditions under which each stage of this Plan is to be initiated or terminated and the drought response measures to be implemented in each stage. This information will be provided by various methods, as the Board of Directors deems appropriate from time to time, including but not limited to utility bill inserts.

Section IV
Coordination with Regional Water Planning Groups and the Texas Commission on Environmental Quality

The service area of the District is located within the Region H Regional Water Planning Group and the District will provide a copy of this Plan to such regional water planning group within ten (10) days following its adoption. Further, to the extent required by 30 TAC §288.30, the District shall submit this Plan to, or make it available for inspection by, the Executive Director of the Commission (as hereinafter defined) within ninety (90) days of its adoption, or sooner if required by 30 TAC §288.30. The District shall notify the Executive Director of the Commission within five (5) days of the implementation of any stage of this Plan, other than Stage 1.

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Section V
Authorization

The District's General Manager is hereby authorized and directed to implement the applicable provisions of this Plan upon determination that such implementation is necessary to protect public health, safety, and welfare. The District's General Manager shall have the authority to initiate or terminate drought or other water supply emergency response measures as described in this Plan.

Section VI
Application

To the extent that the District is a Retail Public Water Supplier, as that term is defined in Texas Administrative Code Title 30, Section 288.1(12), as amended from time to time, the applicable provisions of this Plan shall apply to all Retail Water Customers of the District. Additionally, to the extent that the District is a Wholesale Public Water Supplier, as that term is defined in Texas Administrative Code Title 30, Section 288.1(15), as amended from time to time, the applicable provisions of this Plan shall also apply to all Wholesale Water Customers of the District.

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Section VII
Definitions

For the purposes of this Plan, the following definitions shall apply:

The term "Aesthetic Water Use" shall mean water use for ornamental, decorative or recreational purposes such as fountains, amenity lakes, reflecting pools, swimming pools, hot tubs, fish ponds and water gardens.

The term "Commercial and Institutional Water Use" shall mean water use which is integral to the operations of commercial and non-profit establishments and governmental entities such as retail establishments, medical facilities, hotels and motels, restaurants, and office buildings.

The term "Commission" shall mean the Texas Commission on Environmental Quality, or its successor.

The term "Conservation" shall mean those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water or increase the recycling and reuse of water so that a supply is conserved and made available for future or alternative uses.

The term "Customers" shall mean all Retail Water Customers, if any, and all Wholesale Water Customers, if any.

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The term "Drought of Record" shall mean the historic period of record for the watershed in which the District is located, in which the lowest flows were known to have occurred based on naturalized stream flow.

The term "Domestic Water Use" shall mean water use for personal needs or for household or sanitary purposes such as drinking, bathing, heating, cooking, sanitation, or for cleaning a residence, business, industry, or institution.

The term "Even Numbered Address" shall mean street addresses, box numbers, or rural postal route numbers ending in 0, 2, 4, 6, or 8 and locations without addresses.

The term "Household" shall mean the residential premises served by the Retail Water Customer's meter.

The term "Industrial Water Use" shall mean the use of water in processes designed to convert materials of lower value into forms having greater usability and value.

The term "Landscape Irrigation Use" shall mean potable water used for the irrigation and maintenance of landscaped areas, whether publicly or privately owned, including residential and commercial lawns, gardens, golf courses, parks, and rights-of-way and medians.

The term "Non-essential Water Use" shall mean water uses that are not essential nor required for the protection of public, health, safety, and welfare, including but not limited to (a) Landscape Irrigation Use, except as otherwise provided under this Plan, (b)use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle, (c) use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas, (d) use of water to wash down buildings or structures for purposes other than immediate fire protection, (e) flushing gutters or permitting water to run or accumulate in

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any gutter or street, (f) Aesthetic Water Use, including, without limitation, use of water to fill, refill, or add to any indoor or outdoor swimming pools or hot tubs and use of water in a fountain, lake or pond for aesthetic or scenic purposes except where necessary to support aquatic life, (g) failure to repair a controllable leak(s) within a reasonable period after having actual knowledge of or having been given notice by the District directing the repair of such leak(s), and (h) use of water from hydrants for construction purposes or any other purposes other than fire fighting.

The term "Odd Numbered Address" shall mean street addresses, box numbers, or rural postal route numbers ending in 1, 3, 5, 7, or 9.

The term "Person" shall include individuals, corporations, partnerships, associations, and all other legal entities.

The term "Rate Order" shall mean the District's rules, regulations and policies concerning the provision of water supply services, as adopted and amended by the District's Board of Directors from time to time.

The term "Retail Water Customers" shall mean any Person using water supplied by the District except for Wholesale Water Customers.

The term "Wholesale Water Customers" shall mean any Person receiving water from the District for resale to the public, except said term shall not apply when the water is received through an emergency water interconnect between the District and another district which normally remains closed.

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Section VIII
Triggering Criteria for Initiation and Termination of Drought Response Stages

The District's General Manager shall monitor water supply and/or demand conditions on a daily basis and shall determine when conditions warrant initiation or termination of each stage of this Plan as set forth below. Public notification of the initiation or termination of drought response stages shall be by means of either publication in a newspaper of general circulation within the District, direct mail to each Customer, signs posted in the place or places within the District designated for posting notices of public meetings of the District or such other method as the District shall determine to be appropriate under the then existing circumstances.

The triggering criteria described below are based on an analysis performed by the District's General Manager concerning the vulnerability of the District's water source under Drought of Record conditions.

A. STAGE 1 – MILD WATER SHORTAGE CONDITIONS

1. Requirements for Initiation - The District will recognize that a mild water shortage condition exists when combined pumpage from the water plants supplying water to the District is in excess of 75% of production capacity for three (3) consecutive days.

2. Requirements for Termination - Stage 1 of this Plan may be rescinded when the condition listed as the triggering event has ceased to exist for a period of three (3) consecutive days. Upon the termination of Stage 1, District operations shall return to normal.

3. Reduction Goal – The goal for reduction in water use for Stage 1 of the Plan is to reduce the consumption by 10% to below 75% of the production capacity.

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B. STAGE 2 – MODERATE WATER SHORTAGE CONDITIONS

1. Requirements for Initiation – The District will recognize that a moderate water shortage condition exists when (i) combined pumpage from the water plants supplying water to the District is in excess of 85% of production capacity for three (3) consecutive days or 90% of production capacity for one (1) day, or (ii) pumpage from one water plant is in excess of 90% of production capacity for three (3) consecutive days, or (iii) when continually falling elevated storage tank or ground storage tank levels occur and storage cannot be replenished over 70% of maximum tank volume overnight.

2. Requirements for Termination – Stage 2 of this Plan may be rescinded when the condition listed as the triggering event has ceased to exist for a period of three (3) consecutive days. The District will notify its Customers of the termination of Stage 2 in any of the same manners as authorized for the notification of initiation of Stage 2 of this Plan. Upon the termination of Stage 2, Stage 1 becomes operative, if the condition listed as the triggering event exists for such stage.

3. Reduction Goal – The goal for reduction in water use for Stage 2 of the Plan is to reduce the consumption by 10 % to below 85% of the production capacity.

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C. STAGE 3 – SEVERE WATER SHORTAGE CONDITIONS

1. Requirements for Initiation – The District will recognize that a severe water shortage condition exists when (i) combined pumpage from the water plants supplying water to the District is in excess of 90% of production capacity for three (3) consecutive days or 95% of production capacity for one (1) day, or (ii) pumpage from one water plant is in excess of 95% of production capacity for three (3) consecutive days, or (iii) when continually falling elevated storage tank or ground storage tank levels occur and storage cannot be replenished over 50% of maximum tank volume overnight.

2. Requirements for Termination – Stage 3 of this Plan may be rescinded when all of the conditions listed as the triggering events have ceased to exist for a period of three (3) consecutive days. The District will notify its Customers of the termination of Stage 3 in any of the same manners as authorized for the notification of the initiation of Stage 3. Upon termination of Stage 3, Stage 2 or Stage 1, as applicable, becomes operative if the conditions listed as the triggering event exist for any such stage.

3. Reduction Goal – The goal for reduction in water use for Stage 2 of the Plan is to reduce the consumption by 5% to below 90% of the production capacity.

D. STAGE 4 - CRITICAL WATER SHORTAGE CONDITIONS

1. Requirements for Initiation – The District will recognize that a critical water shortage condition exists when (i) combined pumpage from the water plants supplying water to the District is in excess of 95% of production capacity for three (3) consecutive days or 100% of production capacity for one (1) day, or (ii) pumpage from one water plant is in excess of 100% of production capacity for three (3) consecutive days or (iii) a major line break or a pump or system failure occurs that causes pressures to drop significantly, or (iv) when there is a prolonged power outage.

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2. Requirements for Termination – Stage 4 of this Plan may be rescinded when all of the conditions listed as triggering events have ceased to exist for a period of three (3) consecutive days; provided, however, if the triggering event was attributable to a major water line break, pump failure, well failure, power failure or other water plant or water system failure which caused pressure to drop below 25 pounds per square inch, Stage 3 of this Plan shall be rescinded upon the completion of the required facility repairs and/or restoration of power.

3. Reduction Goal – The goal for reduction in water use for Stage 2 of the Plan is to reduce the consumption by 5% to below 95% of the production capacity.

E. ADDITIONAL TRIGGERING EVENTS

Further, to the extent that at least Stage 1 of this Plan is not otherwise triggered, then the appropriate stage, as determined by the District's General Manager, shall be triggered upon the District having received notice from the county in which the District is located, in accordance with Texas Water Code, Section 16.055(g)(2)(B), as amended, that a state of disaster in such county has been declared.

Section IX

Drought Response Stages

The District's General Manager shall, in accordance with the triggering criteria set forth in Section VIII of this Plan above, implement the following actions upon the giving of notice as set forth in Section VIII.

A. STAGE 1 – MILD WATER SHORTAGE CONDITIONS

1. Supply Management Measures – The District's General Manager shall (a) request by any appropriate means Customers to voluntarily limit the amount of water used, (b) increase monitoring

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of water supply versus water demand, (c) increase leak detection and repair efforts, and (d) undertake any actions which it deems necessary, including reducing system pressure and/or reducing interconnection with another water system.

B. STAGE 2 - MODERATE WATER SHORTAGE CONDITIONS

1. Supply Management Measures – The District's General Manager shall undertake any actions that it deems necessary, including reducing system pressure, interconnection with another water system and/or a pro-rata curtailment of water supply to Customers.

2. Voluntary Water Use Restrictions Applicable to Retail Water Customers – The following voluntary water use restrictions shall apply to all Retail Water Customers:

(a) Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems shall be voluntarily limited to Sundays and Thursdays for Retail Water Customers with an Even Numbered Address and Retail Water Customers responsible for watering common areas such as esplanades and sports fields, and to Saturdays and Wednesdays for Retail Water Customers with an Odd Numbered Address, and irrigation of said areas is further voluntarily limited to the hours designated in the notice of initiation of Stage 2.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle shall be voluntarily limited to the days and hours designated in the notice of initiation of Stage 2. Such washing, when allowed, should be done with a hand-held bucket or a hand-held hose equipped with a positive shutoff nozzle for quick rinses. Vehicle washing may be done at any time on the immediate premises of a commercial car wash or commercial service station.

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(c) Use of water to fill, refill, or add to any Aesthetic Water Use should be voluntarily limited to the days and hours designated in the notice of initiation of Stage 2.

(d) Operation of any ornamental fountain or pond for aesthetic or scenic purposes shall be voluntarily limited to the days and hours designated in the notice of initiation of Stage 2.

(e) Use of water from hydrants should be limited to fire fighting, related activities, or other activities necessary to maintain public health, safety, and welfare, except that use of water from designated fire hydrants for construction purposes may be allowed under special permit from the District.

(f) Use of water for the irrigation of golf course greens, tees, and fairways should be voluntarily limited to the days and hours designated in the notice of initiation of Stage 2. However, if the golf course utilizes a water source for irrigation other than that provided by the District's potable water supply system, the golf course shall not be subject to this restriction.

(g) All restaurants are encouraged to refrain from serving water except upon request.

(h) To the extent not otherwise provided or otherwise in conflict with any of the above, all other Non-essential Water Uses should be voluntarily limited to the days and hours designated in the notice of initiation of Stage 2.

(i)

C. STAGE 3 – SEVERE WATER SHORTAGE CONDITIONS

1. Supply Management Measures – The District's General Manager shall undertake any actions which he deems necessary, including reducing system pressure, interconnection with another water system and/or a pro-rata curtailment of water supply to Customers.

2. Water Use Restrictions Applicable to Retail Water Customers – All water use restrictions for Stage 2 shall remain in effect during Stage 3, except as further restricted below,and shall be mandatory. First time violators will receive a warning. Repeat violators shall be subject to the penalties set forth in Section XI of this Plan:

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(a) Irrigation of landscaped areas shall be limited to twice per week based on the following schedule: Sundays and Thursdays for Retail Water Customers with an Even Numbered Address and Saturdays and Wednesdays for Retail Customers with an Odd Numbered Address during the hours designated in the notice of initiation of Stage 3.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle not occurring on the premises of a commercial car wash or commercial service station is prohibited. Further, such washing may be granted a variance from this restriction in accordance with Section XII of this Plan if the health, safety, and welfare of the public is contingent upon frequent vehicle cleansing, such as garbage trucks and vehicles used to transport food and perishables. Such vehicle washing at commercial car washes and commercial service stations shall be allowed only during the hours designated in the notice of initiation of Stage 3.

(c) The filling, refilling, or adding of water to any Aesthetic Water Use is prohibited.

D. STAGE 4 – CRITICAL WATER SHORTAGE CONDITIONS

1. Supply Management Measures – The District's General Manager shall undertake any actions which he deems necessary, including reducing system pressure, interconnection with another water system and/or a pro-rata curtailment of water supply to Customers.

2. Water Use Restrictions Applicable to Retail Water Customers – All water use restrictions for Stage 3 shall remain in effect during Stage 4 except as further restricted below. All violators shall be subject to the penalties set forth in Section XI of this Plan:

(a) Irrigation of landscaped areas shall be prohibited at all times.

(b) Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is prohibited at all times. Further, such washing may be granted a variance from this restriction in accordance with Section XII of this Plan if the health, safety and welfare of the public is

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contingent upon frequent vehicle cleansing, such as garbage trucks and vehicles used to transport food and perishables. Such vehicle washing shall be permitted at commercial car washes and commercial service stations only and shall be allowed only during the hours designated in the notice of initiation of Stage 4.

(c) No applications for new, additional, expanded, or increased-in-size water service connections, meters, service lines, pipeline extensions, mains, or water service facilities of any kind shall be allowed or approved.

Section X
Emergency Water Allocation and Surcharges

This Section Reserved for emergency water allocations for future wholesale customers, if any, as the District does not currently supply wholesale water to any entity.

Section XI
Enforcement and Penalties

The District's General Manager will administer and enforce the Plan, and will oversee and be responsible for the execution and implementation of all elements of the Plan. The General Manager shall keep adequate records for Plan verification. The District's operator shall report to the Board of the District, at meetings of the Board, regarding actions taken and which need to be taken under the Plan.

A. Retail Water Customers. The following shall apply to Retail Water Customers.

1. No Retail Water Customer shall knowingly or intentionally allow the use of water supplied by the District through the Retail Water Customer's meter for any purpose in a manner contrary to any provision of this Plan, or in an amount in excess of that permitted by the drought response stage in

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effect at the time pursuant to action taken by District's General Manager, in accordance with provisions of this Plan.

2. Any Person who, after receipt of a warning of violation of this Plan, again violates this Plan during the same triggering event, commits an offense punishable by a fine of not less than fifty dollars ($50.00) and not more than two hundred dollars ($200.00) for each offense. Each day that one or more of the provisions in this Plan is violated shall constitute a separate offense. If, after receipt of a warning of violation of this Plan, three or more additional violations of this Plan occur at the same premises to which the District supplies water, the District's General Manager shall, upon due notice to the Retail Water Customer, as set forth for termination of service in the Rate Order, be authorized to discontinue water service to the premises where such violations occurred. Services discontinued under such circumstances shall be restored only upon payment of a re-connection charge, as established by the District's Rate Order, plus all outstanding water and sewer service charges pursuant to the Rate Order and surcharges pursuant to this Plan, any other costs incurred by the District in discontinuing service, and all fines imposed hereunder. In addition, suitable assurance must be given to the District's General Manager that no further violations of this Plan will occur at said premises while any stage of this Plan is in effect. Compliance with this Plan may also be sought through injunctive relief or any other legal or equitable remedies.

3. For the purposes of imposing the fines and penalties set forth in Section XI (A)(2) above, any Person, including a person classified as a Retail Water Customer of the District, in apparent control of the property where a violation occurs or originates shall be presumed to be the violator, and proof that the violation occurred on the Person's property shall constitute a rebuttable presumption that the Person in apparent control of the property committed the violation, but any such Person shall have the right to show that such person did not commit the violation by the presentation of objective evidence to the satisfaction of the Board of Directors of the District. For the purposes of imposing the fines and penalties set forth in Section XI (A)(2) above, parents shall be presumed to be responsible

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for violations of their minor children and proof that a violation committed by a child occurred on property within the parents' control shall constitute a rebuttable presumption that the parent committed the violation, but any such parent may be excused if the parent proves to the satisfaction of the Board of Directors of the District, that the parent had previously directed the child not to use the water as it was used in violation of this Plan and that the parent could not have reasonably known of or prevented the violation.

4. Any appeal of fines, surcharges, penalties and/or termination of service imposed pursuant to this Plan shall be implemented in accordance with the procedure for appeals of District charges as set forth in the Rate Order.

Unless a different time is designated by the District's Board of Directors, the surcharges described herein shall commence on the first day and shall terminate on the last day of the billing cycle during the calendar month Stage 2 or Stage 3, as appropriate, has been initiated or terminated, as applicable.

Section XII
Variances

The District's General Manager may, in writing, grant a temporary variance for a period not to exceed seven (7) days for a specific existing water use otherwise prohibited under this Plan if it is determined by objective evidence, to the satisfaction of the District's General Manager, that failure to grant such variance would cause an emergency condition adversely affecting the health, safety, sanitation, fire protection or welfare of the public or the Customer requesting such variance and if one or both of the following conditions are met:

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(a) Compliance with this Plan cannot, in the Board of Directors determination, reasonably be accomplished during the duration of the applicable stage for which this Plan is in effect or would violate applicable laws or regulations related to the health, safety or welfare of the public.

(b) Alternative methods can be implemented which will achieve the same level of reduction in water use.

Customers requesting a variance from this Plan, including Customers to which a temporary variance has been granted as set forth above, shall file a petition for the variance with the District's Board of Directors at the District's administrative offices within five (5) days after this Plan or a particular drought response stage (as applicable to the variance requested) has been invoked. All petitions for variances shall be reviewed by the District's Board of Directors as set forth below, and shall include the following:

(a) Name and address of the petitioner(s).

(b) Purpose of water use.

(c) Specific provision(s) of this Plan from which the petitioner is requesting relief.

(d) Detailed statement as to why this Plan cannot be technically accomplished or how the specific provision of this Plan adversely affects the petitioner or what damage or harm will occur to the petitioner or others if petitioner complies with this Plan, including, if applicable, the specific law or regulation which may be violated by compliance with this Plan.

(e) Description of the relief requested.

(f) Period of time for which the variance is sought.

(g) Alternative water use restrictions or other measures the petitioner is taking or proposes to take to meet the requirements of this Plan and the compliance date.

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(h) Other pertinent information and other information specifically requested by the District's Board of Directors.

The District's Board of Directors shall consider the petition at the first meeting held following receipt of the petition and shall provide the petitioner with notice of the date, time and place of the meeting and an opportunity to address the Board of Directors at said meeting. The District's Board of Directors may elect, in its sole and absolute discretion, not to impose any penalties for violations of this Plan which occur following the date the petition is filed and before the date a final determination is made by the District's Board of Directors with respect to the granting or denial of the variance.

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Variances granted by the District's Board of Directors shall be subject to the following conditions, unless waived or modified by the District:

(a) Variances granted shall include a timetable for compliance.

(b) Variances granted shall expire at the earlier of their specified termination date or when this Plan is no longer in effect unless the District's Board of Directors determines, in its sole discretion, to continue a variance under a new or amended Plan; provided, however, if the petitioner has failed to meet requirements specified in the variance, the variance may be immediately revoked by the Board of Directors of the District.

No variance shall be retroactive or otherwise justify any violation of this Plan occurring prior to the issuance of the variance, unless specifically agreed to by the District's Board of Directors, in its sole discretion.

Section XIII
Service Area

Profile data for the District water utility is provided in Appendix "A". Appendix "A" includes data on the District's service area, including population and customer data, water use data, water supply system data and wastewater data. Appendix "A" shall hereafter be updated at least once every five years.

Section XIV
Five Year and Ten Year Targets

The District shall use reasonable efforts to reduce water loss and municipal use of water. In doing so, the District has identified the following goals for water savings:

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(a) "Five-year Target": By December 31, 2010, the District shall attempt to reduce the average daily municipal use of water in the District's service area to 175 gallons per capita daily and to keep the unaccounted water in the system below 10% annually.

(b) "Ten-year Target": By December 31, 2015, the District shall attempt to reduce the average daily municipal use of water in the District's service area to 170 gallons per capita daily and to keep the unaccounted water in the system below 10% annually.

Notwithstanding the targets identified above, the District shall not be obligated to achieve any water savings in its service area, and the District's failure to do so shall not subject the District to any liability whatsoever.

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Section XV
Metering Devices

The District will meter all water delivered by the District, and all such metering devices will be calibrated regularly to ensure reasonable accuracy.

Section XVI
Unaccounted Water Usage

The District authorizes the District's operator to implement any reasonable program to determine unaccounted-for uses of water and to make recommendations to the District regarding measures to control such unaccounted-for uses of water. Such measures may include periodic visual inspections along distribution lines, annual or monthly audits of the water system to determine illegal connections, and investigation of abandoned services. The District's operator shall also continue the existing programs of leak detection, repair, and water loss accounting for the water storage, delivery, and distribution system in order to control unaccounted-for uses of water.

Section XVII
Continuing Public Education and Information

The District hereby institutes an educational program, to be implemented immediately, to promote the Plan by the general public which may include any of the following:

(a) Publications of articles in a newspaper or newsletter of general circulation in the District's service area, providing information regarding water conservation; and

(b) Direct distributions to customers of the District of educational and informational material regarding water conservation; and

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(c) Additional educational activities consisting of (i) conducting an informational school program in a school attended by students within the District's service area, or (ii) conducting an educational program for users at a public place within or accessible to residents within the service area of the District, or (iii) conducting or engaging in such other informational or educational activity designed to further water conservation measures as, in the discretion of the Board, may be consistent with the purposes and policies of this Plan, or (iv) any combination of the foregoing.

Section XVIII

Cost-based Rate Structure

The District hereby acknowledges that it has adopted an increasing block water rate structure, as reflected in its Rate Order that is intended to encourage water conservation and discourage excessive use and waste of water.

Section XIX

Reservoir Systems Operations Plan

The District does not own any reservoirs within a common watershed or river basin and is not required to establish a reservoir systems operation plan.

Section XX

Record Management

The District authorizes the District's operator to establish a record management system to record water pumped, water delivery, water sales, and water losses, and which allows for the desegregation of water sales and uses into residential, commercial, public and institutional, and industrial user classes.

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Section XXI
Wholesale Water Customers

The District shall require that each successive wholesale customer, if any, develop and implement a water conservation plan or water conservation measures in compliance with all applicable rules of the Texas Commission on Environmental Quality. This requirement will also extend to each successive wholesale customer in the resale of water.

Section XXII
Five-year Review

The District shall review *and* update the Plan every five years, or more frequently, as appropriate, based on an assessment of previous five-year and ten-year targets and any other new or updated information.

Section XXIII
Water Conservation Plan

The Water Conservation Plan set forth and attached as Exhibit "A" hereto is hereby adopted as the water conservation plan of The Woodlands Districts.

Section XXIV
Severability, Amendment and Revocation of Prior Plan

It is hereby declared to be the intention of the District that the sections, paragraphs, sentences, clauses, and phrases of this Plan are severable and, if any phrase, clause, sentence, paragraph, or section of this Plan shall be declared invalid, unenforceable or unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such invalidity, unenforceability, or unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this Plan, which shall be enforceable as if the same had been enacted by the District without the incorporation into this

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Plan of any such invalid, unenforceable or unconstitutional phrase, clause, sentence, paragraph, or section.

The District has and specifically reserves the right to change, alter or amend any provision of this Plan at any time. The District shall renew and update, as appropriate, this Plan at least every five (5) years, based on new or updated information, such as adoption or revision of any applicable regional water plan.

All prior drought contingency plans, including any such plan related to Wholesale Water Customers, as herein defined, or water conservation plans adopted by the District shall be revoked and no longer in force and effect as of said date.

Appendix A

Water Conservation Plan

The Woodlands Joint Powers Agency
Water Conservation Plan

Overview

The Woodlands in Montgomery County is made up of eleven individual Municipal Utility Districts ("The Woodlands Districts") that operate as a single entity through The Woodlands Joint Powers Agency (WJPA). The WJPA provides retail water and wastewater service to The Woodlands community. The Woodlands is 19,000+ acre master-planned community located primarily in southern Montgomery County, Texas on IH-45, just north of the Harris County line. The district serves approximately 34,436 connections, supplying water to approximately 81,596 people. The WJPA purchases all of its water from the San Jacinto River Authority. Several factors contribute to the desirability of establishing a Water Conservation Plan. The primary driving factor being a statutory obligation when accessing state money for loans or grants, but also to provide for the long term water resource for the Woodlands community.

1. Purpose

Purpose is to identify and establish principles, practices, and standards to effectively conserve and efficiently use available water supplies and water distribution system capacity.

2. Location

The WJPA provides retail water and wastewater service to the Woodlands community. The Woodlands is 19,000+ acre master-planned community located in southern Montgomery County, Texas on IH-45, just north of the Harris County line. The Woodlands Districts serve approximately 34,436 connections, supplying water to approximately 81,596 people. The Woodlands Districts purchase all of their wholesale water and wastewater treatment services from the San Jacinto River Authority.

3. Customer Data

A full description of The Woodlands Districts customer information can be found in Attachment A, the Water Utility Profile. A summary of the data is presented as:

Population and Service Area Data

- The Woodlands encompasses 29.86 square miles and provides all the water and wastewater service to that area. Additionally, the SJRA provides all of the treatment for wastewater collected in all eleven districts which serve the Woodlands Community.
- The December 2006 population for The Woodlands is approximately 81,596 persons.

- The Woodlands Districts provide water and wastewater service to each residence and establishment within their boundaries.
- There has been growth in the population over the last five years. The population has increased 18% over the last five years.
- There is expected growth projected through 2030 at a rate of about 2.8% until the final build-out population of 119,300.

Active Connections

- The WJPA meters all of its connections, currently serving 34,436 total connections of which 33,998 connections are single family or multi family residences and 438 are commercial connections.
- There have been 4,774 new connections added over the last three years.

High Volume Customers

- The five highest volume retail accounts all belong to commercial customers
  - — Lexicon Genetics
  - — Grogans Landing Apartments
  - — The Woodlands Waterway Marriot
  - — Hughes Christensen Company
  - — The Park at Research Forest

4. Water Use Data

A full description of the district's water use information can be found in Attachment A, the Water Utility Profile. A summary of the data is presented as:

Water Accounting Data

- In the years 2002 to 2006, the SJRA produced an average of 448.3 million gallons per month for use within The Woodlands Districts.
- During the period of 2002 to 2006, 77% of the water was used by residential customers. Commercial use accounted for 23%.
- The WJPA has taken steps to account for as much water as possible through accurate metering, leak detection and repair programs. Unaccounted for water in The Woodlands for the last 5 years has averaged less than 6%.
- The average annual peak-to-average daily use ratio for the last five years is 1.99.

- The average per capita daily water use over the last five years is 195.7 gpcd.
- The average seasonal water use for the last five years is 134 gpcd. The highest seasonal water use occurred in 2005 at 155 gpcd.

Projected Water Demands

- The Woodlands Districts are not yet built out and project increases in water demand due to growth in population to a projected maximum of 28,330 acre-ft/year in year 2030. The 2006 Region H plan projects that from 2030 to 2050, the water use will drop to 28,063 acre-ft/year in 2050.

5. Water Supply System

A full description of the district's water supply information can be found in Attachment A, the Water Utility Profile. A summary of the data is presented as:

Water Supply Sources

- The Woodlands districts purchase of all its water from the San Jacinto River Authority through a wholesale purchase. Water is provided under direct pressure from the SJRA.
- The SJRA is planning sufficient well production capacity, storage, and service pump capacity to supply the anticipated future growth of the Woodlands.

6. Wastewater Utility System

Neither the WJPA nor any of The Woodlands Districts provide wastewater treatment. All wastewater treatment is provided by SJRA.

Wastewater Data for Service Area

- 100% percent of the customers within The Woodlands Districts are provided with wastewater service.
- The average monthly volume treated for is 218.6 MG for the previous three years.
- The average ratio of treated water pumped to wastewater flow is approximately 2.14:1.

7. Utility Operating Data

The Woodlands Districts have adopted water rates which promote conservation. Water and wastewater rates for residential and non residential uses are listed in the following table.

Residential Bimonthly Billing Rate Structure

	Water				Sewer	
			Block Rate Structure			
District	Minimum Usage	$ per 1,000 Gallons	Usage Above	$ per 1,000 Gallons	Minimum Usage	$ per 1,000 Gallons
2	NONE	1.40	300,000	2.00	NONE	2.00
6	10,000	1.33	200,000	2.00	10,000	1.86
7	10,000	1.28	200,000	2.00	10,000	1.81
36	10,000	1.28	100,000	2.00	10,000	1.81
39	10,000	1.33	100,000	2.00	10,000	1.86
40	10,000	1.08	300,000	2.00	10,000	1.55
46	10,000	1.28	300,000	2.00	10,000	1.81
47	10,000	1.28	200,000	2.00	10,000	1.81
60	10,000	1.25	200,000	2.00	10,000	1.76
67	10,000	1.28	200,000	2.00	10,000	1.81

Commercial Billing Rate Structure

	Water				Sewer	
			Block Rate Structure			
District	Minimum Usage	$ per 1,000 Gallons	Usage Above	$ per 1,000 Gallons	Minimum Usage	$ per 1,000 Gallons
2	NONE	1.40	NA	NA	NONE	2.00
6	5,000	1.33	NA	NA	5,000	1.86
7	5,000	1.28	NA	NA	5,000	1.81
36	5,000	1.28	NA	NA	5,000	1.81
39	5,000	1.73	NA	NA	5,000	2.22
40	5,000	1.08	NA	NA	5,000	1.55
46	5,000	1.28	NA	NA	5,000	1.81
47	5,000	1.28	NA	NA	5,000	1.81
60	5,000	1.25	NA	NA	5,000	1.76
67	5,000	1.28	NA	NA	5,000	1.81
Metro	10,000	1.70	NA	NA	10,000	1.70

8. Water Conservation Goals

The WJPA proposes five-year and ten-year targets that are driven by the targets of the State of Texas. The state wide target is 140 GPCD. Data gathered from the WJPA operating reports indicate that the average for the last five years is 195.7 GPCD. To meet the state goals by 2015, the Districts would have to reduce consumption by greater than 3% per year. The Districts believe setting such a goal is unrealistic and proposes a reduction goal of just over 2.5% per year through 2010. This 2.5% percent reduction goal sets a per capita usage by December 31, 2010 at 175 GPCD. The proposed target for December 31, 2015 is 170 GPCD.

Estimation for reducing per capita water use:

- Reduction in unaccounted-for uses 0.1% per year.
- Reduction in indoor water use due to water-conserving plumbing fixtures 0.5% per year.
- Reduction in seasonal use 1.5% per year.
- Reduction in water use due to public education program 0.4% per year.

9. Water Conservation Plan Elements –Best Management Plans (BMPs) and Other Programs

To track the effectiveness of the instituted BMPs, the WJPA will compile the necessary metering data so that ongoing water usage can be compared to historical usage.

Metering Program

- All water sold to The Woodlands Districts retail customers is metered.
- The WJPA is committed to a program of universal metering, which includes metering of water for use in common areas of The Woodlands Districts. This includes a program to test, repair, and periodically replace water meters. The WJPA is committed to a program of accurate metering, which includes a goal of accuracy for metering devices of plus or minus five percent. The WJPA maintains a program to identify meters which may be functioning outside those parameters and to take steps to insure accuracy on an ongoing basis.

Measures to Determine and Control Unaccounted for Water

- The WJPA is committed to measures to determine and control unaccounted-for uses of water through periodic, visual inspections along distribution lines and ongoing audits of the water system to determine illegal connections, abandoned services, etc.

Leak Detection and Repair

- The WJPA is committed to a program of leak detection and repair. Staff has been instructed to address reports of leaks in a manner to limit the loss of un-billable water.

Reservoir System Operating Plan

- The WJPA does not own or operate any reservoirs.

Education Programs

- Media Campaign – The WJPA has made use of its water bill letter to convey messages about water conservation. The district also has a website at http://www.wjpa.net, where the WJPA posts information and educational material on water conservation.

- School Programs – The WJPA and The Woodlands Districts support water conservation programs in schools within The Woodlands community.

Water Rate Structure

- The district has adopted a rate schedule that minimally promotes water use efficiency. A complete breakdown is found in Item 7, Utility Operating Data. The WJPA will undertake efforts in the next two years to examine the water rate structure and evaluate rate structures which may promote a higher level of water conservation.

Water Use BMPs

- Voluntary Water Use Restrictions Applicable to Retail Water Customers – The water levels of the Gulf Coast Aquifer in the vicinity of The Woodlands are projected to fall at rates which will limit the capacity of the existing wells. Although not a drought related event, the WJPA may initiate voluntary water use restrictions for established landscapes. Irrigation of landscaped areas with hose-end sprinklers or automatic irrigation systems will be voluntarily limited to Sundays and Thursdays for Retail Water Customers with an Even Numbered Address and Retail Water Customers responsible for watering common areas, such as esplanades and sports fields, and to Saturdays and Wednesdays for Retail Water Customers with an Odd Numbered Address.

- Toilet Replacement/Rebates – The Water Conservation BMP guidance document and information provided to the Region H Regional Water Planning Group by the TWDB indicates that for each high volume flush toilet that is replaced with a low volume flush toilet a savings of 10.5 GPCD can be achieved. The Woodlands development has been in existence for better than 30 years. During that time, newly constructed houses have been equipped with both high and low volume toilets. Additionally, over this period of time, some percentage of the high volume toilets have been replaced with low volume toilets. While some savings could undoubtedly be achieved through a toilet replacement program, the conservation target for this BMP cannot be established without better information on which to base the percentages of high volume toilets still in use within The Woodlands. The WJPA will initiate an effort to determine the potential saving from a toilet replacement program. The results of such an effort

will be used as material to determine if this BMP would significantly help The Woodlands Districts meet their water conservation goals.

- Efficient Irrigation Rebate – The Water Conservation BMP guidance document and information provided to the Region H Regional Water Planning Group by the TWDB indicates that for each residential irrigation audit that is performed, a savings of 18.0 GPCD can be achieved. Through the WJPA educational programs, homeowners are encouraged to be conservation conscious in the use of water for irrigation purposes. The WJPA will also consider initiating an education plan that sells the concept of water audits using the potential water savings and costs savings to the homeowner as the driving factor. The WJPA will initiate an effort to determine the potential saving from a water audit program. The results of such an effort will be used as material to determine if this BMP would significantly help The Woodlands Districts meet their water conservation goals.

- Residential Irrigation Rain Shut Off Rebate – The Woodlands Districts recognize the importance of efficient irrigation in the conservation of water. One Woodlands District has initiated a rebate program for the installation of rain shut offs on irrigation systems. This serves as a pilot program for the other Woodlands Districts. Based on the findings of the pilot program, this strategy may be expanded to other areas of The Woodlands.

- Reuse and Recycling of Wastewater and Graywater – The WJPA currently provides no reclaimed water from the SJRA treatment plants. The WJPA will commit to investigating reclaimed water usage to common areas.

10. Schedule for Implementing the Plan to Achieve Targets and Goals

The WJPA will adhere to the following schedule, to achieve the targets and goals for water conservation:

- Calibrations of large meters for all treated water deliveries are conducted semi-annually.
- The WJPA meter replacement program is as follows:
  - — Meters will continue to be monitored for accuracy annually and replaced on a fifteen-year cycle.
- Water audits are conducted annually:
  - — Real water losses are identified and corrected.
  - — Real water losses are minimized by replacement of deteriorating water mains and appurtenances by WJPA staff on an on-going basis.

- The WJPA will mail out materials developed by the staff, the TWDB, the TCEQ and other sources semi-annually (once in the spring and once in the summer) to all customers.
- The leak detection program described in the plan is currently in use which reduces real water losses:
  - — Intermittent night-flow measurements are conducted annually.
  - — Pressure is controlled to just above the standard-of-service level by use of SCADA system.
  - — Pressure zones are operated based on the topography.
  - — Surges in pressure are limited by control valves.
  - — Nighttime pressure is reduced by control valves when feasible.

Tracking Targets and Goals

The staff shall track targets and goals by utilizing the following procedures:

- Logs shall be maintained for meter calibration, meter testing, and meter replacement programs
- Annual water audits shall be documented and kept in the Utility Department files
- Staff shall keep a record of the number of mail-outs distributed semi-annually
- Rates are tracked by means of ordinances adopted

11. Regional Water Planning and Coordination

A copy of this plan has been provided to the Region H Regional Water Planning Group since The Woodlands area is located within the boundaries of Region H. A copy of this plan has also been provided to the TCEQ and TWDB.

12. Authority and Adoption

- This Water Conservation Plan has been adopted by action of the Boards of Directors of The Woodlands Districts.

Attachment A

Water Utility Profile

Texas Commission on Environmental Quality*

UTILITY PROFILE & WATER CONSERVATION PLAN REQUIREMENTS FOR MUNICIPAL WATER USE BY PUBLIC WATER SUPPLIERS

This form is provided to assist entities in water conservation plan development for municipal water use by a retail public water supplier. Information from this form should be included within a water conservation plan for municipal use. If you need assistance in completing this form or in developing your plan, please contact the conservation staff of the Resource Protection Team in the Water Supply Division at (512) 239-4691.

*This form has been revised to include items included in the TWDB utility profile

Name of Entity: The Woodlands Joint Powers Agency

Address & Zip: 2455 Lake Robbins Drive, The Woodlands, Texas 77380-1027

Telephone Number: (281) 367-1271 **Fax:** (281)367-6517

Form Completed By: Anthony E. Bennett, RS

Title: Technical Director, Natural Resource Planning, TCB Inc.

Signature: **Date:** May 16, 2007

Name and Phone Number of Person/Department responsible for implementing a water conservation program: Mr. Mike Mooney, The Woodlands JPA, 281-367-1271

UTILITY PROFILE

I. POPULATION AND CUSTOMER DATA

A. Population and Service Area Data

1. Attach a copy of your service-area map and, if applicable, a copy of your Certificate of Convenience and Necessity (CCN).

2. Service area size (square miles): 29.86

3. Current population of service area: 81,596

4. Current population served:

a. water 81,596
b. wastewater 81,596

5. Population served by water utility for the previous five years:

Year	Population
2002	68,790
2003	72,072
2004	75,398
2005	78,436
2006	81,596

6. Projected population for service area in the following decades:

Year	Population
2010	93,038
2020	111,470
2030	119,300
2040	119,300
2050	119,300

7. List source/method for the calculation of current and projected population:

Based on projections of the Region H Regional Water Planning Group.

B. Active Connections

1. Current number of active connections. Check whether multi-family service is counted as Residential X or Commercial _____

Treated water users:	Metered	Not-metered	Total
Residential*	33,998	0	33,998
Commercial	438	0	438
Industrial			
Other			

* Residential connections includes all single family units plus individual apartment units

2. List the net number of new connections per year for most recent three years:

Year	2004	2005	2006
Residential	1,418	1,635	1,662
Commercial	25	10	24
Industrial	0	0	0
Other	0	0	0

C. High Volume Customers

List annual water use for the five highest volume customers
(indicate if treated or raw water delivery)

	Customer	Use (1,000gal./yr.)	Treated/Raw Water
(1)	Lexicon Genetics	30,025	Treated
(2)	Grogans Landing Apts	23,811	Treated
(3)	Waterway Marriot	22,336	Treated
(4)	Hughes Christensen	19,993	Treated
(5)	Park at Research Forest	13,356	Treated

II. WATER USE DATA FOR SERVICE AREA

A. Water Accounting Data

1. Amount of water use for previous five years (in 1,000 gal.):
Please indicate: Diverted Water
Treated Water

Month	2002	2003	2004	2005	2006
January	259,131	271,400	268,371	274,476	373,603
February	251,454	229,123	253,171	230,517	291,030
March	337,932	282,955	303,175	301,939	435,679
April	428,870	439,674	368,374	476,236	549,156
May	616,601	682,301	418,270	612,434	560,272
June	573,094	609,027	426,194	751,764	563,407
July	507,757	492,357	566,857	646,064	591,320
August	560,338	690,115	611,833	602,247	749,783
September	429,785	410,399	566,230	642,487	618,838
October	388,057	411,214	511,442	660,622	463,676
November	295,900	330,102	337,070	463,894	395,051
December	265,288	295,573	268,016	356,864	329,499
Total	4,914,207	5,144,240	4,899,003	6,019,544	5,921,314

Water Usage was determined from master meters at each well operated by SJRA.

2. Amount of water (in 1,000 gallons) delivered (sold) as recorded by the following account types for the past five years.

Year	Residential	Commercial	Industrial	Wholesale	Other	Total
2002	3,661,463	1,025,255				4,686,718
2003	3,681,798	1,095,362				4,777,160
2004	3,477,492	1,074,503				4,551,995
2005	4,359,720	1,283,554				5,643,274
2006	4,517,771	1,311,864				5,829,635

3. List previous five years records for water loss (the difference between water diverted (or treated) and water delivered (or sold))

Year	Amount (1000 gal.)	%
2002	227,489	4.6
2003	367,080	7.1
2004	347,008	7.1
2005	376,270	6.3
2006	91,679	1.5

4. Municipal water use for previous five years:

Year	Population	Total Water produced or purchased (1,000 gal.)	Per Capita (gpcd)
2002	68,790	4,914,207	195.7
2003	72,072	5,144,240	195.6
2004	75,398	4,899,003	178.0
2005	78,436	6,019,544	210.3
2006	81,596	5,921,314	198.8

5. List previous 5 year records for annual peak-to-daily use ratio

Year	Average MGD	Peak MGD	Ratio
2002	13.464	26.209	1.95
2003	14.094	31.273	2.22
2004	13.385	26.799	2.00
2005	16.492	31.821	1.93
2006	16.223	30.285	1.87

6. Seasonal Water Use for the previous five years (in gallons per person per day)

Year	Population	Base per capita	Summer per capita
2002	68,790	125	259
2003	72,072	123	270
2004	75,398	116	231
2005	78,436	122	277
2006	81,596	135	254

B. Projected Water Demands

The district is not yet built out and projects increases in water demand due to growth in population to a projected maximum of 28,330 acre-ft/year in year 2030. The 2006 Region H plan projects that from 2030 to 2050, the water use will drop to 28,063 acre-ft/years in 2050.

III. WATER SUPPLY SYSTEM DATA

A. Water Supply Sources

List all current water supply sources and the amounts authorized with each:

	Source	Amount Authorized	
Surface Water:	_____	_____	acre-feet
Groundwater:	_____	_____	acre-feet
Contracts:	Groundwater via SJRA	**	acre-feet
Other:	_____		acre-feet

** no specified maximum amount in the contract with SJRA

B. Treatment and Distribution System

All production treatment and storage is provided by the SJRA as described below

1. Design daily capacity of system: 35.4 MGD (based on total well production)

2. Storage Capacity: Elevated 4.5 MG, Ground 13.6 MG

3. If surface water, do you recycle filter backwash to the head of the plant? NA Yes _____ No _____. If yes, approximately _____ MGD.

4. Water System Description

   The Woodlands districts purchase of all its water from the San Jacinto River Authority through a wholesale purchase agreement. The SJRA facilities provide water under direct pressure to the districts at multiple points.

IV. WASTEWATER SYSTEM DATA

A. Wastewater System Data

1. Design capacity of wastewater treatment plant(s): 12.77 MGD

2. Is treated effluent used for irrigation on-site No, off-site No, plant washdown No, or chlorination/dechlorination No?
   If yes, approximately NA million gallons per month.

3. Wastewater collected in the WJPA service area flows to plants owned and Operated by the San Jacinto River Authority by the SJRA.

B. Wastewater Data for Service Area

All wastewater treatment is provided by the SJRA

1. Percent of water service area served by wastewater system: 100 %

2. Monthly volume treated for previous three years (in 1,000,000 gallons):

Year	2004	2005	2006
January	210.8	218.054	218.922
February	196.196	210.924	197.568
March	208.816	220.875	216.659
April	205.38	207.9	213.24
May	227.075	217.465	228.749
June	218.43	211.5	223.35
July	215.109	223.603	232.841
August	223.634	232.624	238.08
September	210.893	229.741	227.261
October	204.33	213.12	243.69
November	225.277	223.045	227.509
December	209.82	212.7	223.86
Total	2555.76	2621.551	2691.729

Flow Data provided by the SJRA

Attachment B

Definitions of Commonly Used Terms

Definitions of Commonly Used Terms

Conservation - Those practices, techniques, and technologies that reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future or alternative uses.

Industrial use - The use of water in processes designed to convert materials of a lower order of value into forms having greater usability and commercial value, commercial fish production, and the development of power by means other than hydroelectric, but does not include agricultural use.

Irrigation - The agricultural use of water for the irrigation of crops, trees, and pastureland, including, but not limited to, golf courses and parks which do not receive water through a municipal distribution system.

Municipal per capita water use - The sum total of water diverted into a water supply system for residential, commercial, and public and institutional uses divided by actual population served.

Municipal use - The use of potable water within or outside a municipality and its environs whether supplied by a person, privately owned utility, political subdivision, or other entity as well as the use of sewage effluent for certain purposes, including the use of treated water for domestic purposes, fighting fires, sprinkling streets, flushing sewers and drains, watering parks and parkways, and recreational purposes, including public and private swimming pools, the use of potable water in industrial and commercial enterprises supplied by a municipal distribution system without special construction to meet its demands, and for the watering of lawns and family gardens.

Municipal use in gallons per capita per day - The total average daily amount of water diverted or pumped for treatment for potable use by a public water supply system. The calculation is made by dividing the water diverted or pumped for treatment for potable use by population served. Indirect reuse volumes shall be credited against total diversion volumes for the purpose of calculating gallons per capita per day for targets and goals.

Peak-day to average-day ratio – The value calculated by dividing the maximum daily pumpage (in million gallons per day) by the average daily pumpage. Average daily pumpage is the total pumpage for the year (as reported in Section IIA1, p. 4) divided by 365 and expressed in million gallons per day.

Pollution - The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to the public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose.

Public water supplier - An individual or entity that supplies water to the public for human consumption.

Regional water planning group - A group established by the Texas Water Development Board to prepare a regional water plan under Texas Water Code, ' 16.053.

Retail public water supplier - An individual or entity that for compensation supplies water to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants when that water is not resold to or used by others.

Reuse - The authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water.

Seasonal water use - The difference between base (winter) daily per capita use and summer daily per capita use. To calculate **the base daily per capita use**, average the monthly diversions for December, January, and February, and divide this average by 30. Then divide this figure by the population. To calculate the **summer daily per capita use**, use the months of June, July, and August.

Water conservation plan - A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water. A water conservation plan may be a separate document identified as such or may be contained within another water management document(s).

Water loss - The difference between water diverted or treated and water delivered (sold). Water loss can result from:

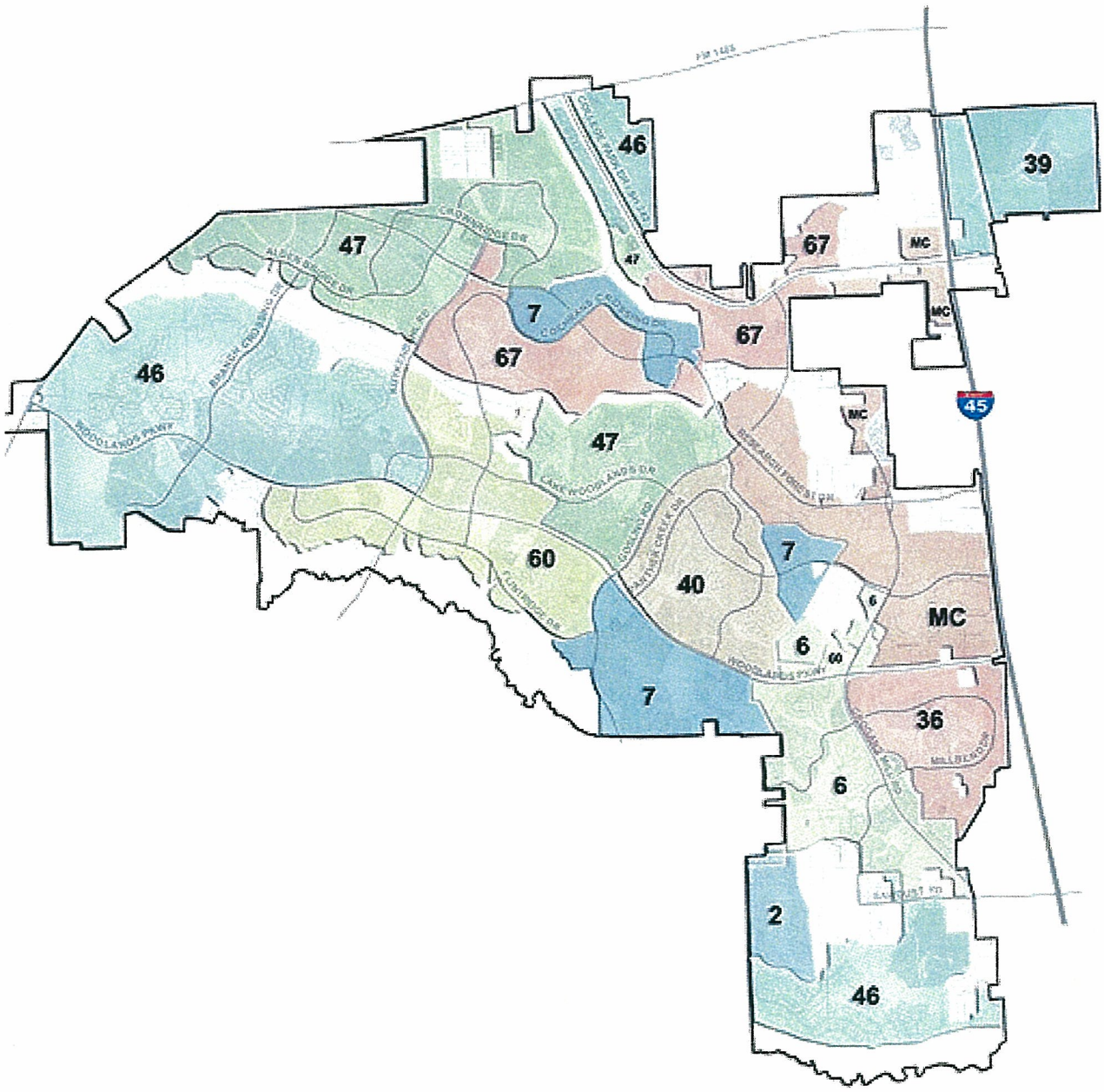
1. inaccurate or incomplete record keeping;
2. meter error;
3. unmetered uses such as firefighting, line flushing, and water for public buildings and water treatment plants;
4. leaks; and
5. water theft and unauthorized use.

Wholesale public water supplier. An individual or entity that for compensation supplies water to another for resale to the public for human consumption. The term does not include an individual or entity that supplies water to itself or its employees or tenants as an incident of that employee service or tenancy when that water is not resold to or used by others, or an individual or entity that conveys water to another individual or entity, but does not own the right to the water which is conveyed, whether or not for a delivery fee.

Attachment C

Service Area Map

The Woodlands
Service Area Map



1.0 BACKGROUND

The Woodlands is a master planned community encompassing approximately 25,000 acres located about 25 miles north of the City of Houston in Montgomery County. Predominant land uses are single and multi-family residential, office, commercial and institutional. A majority of the non-residential development is contained within a centrally located Town Center and along a research-oriented corridor. The Woodlands community began development in the early 1970's and the current residential population within the community area is approximately 81,000 with about 21,700 active connections. The ultimate population is projected to reach approximately 90,000 to 100,000 people within the next 10 to 15 years. (**Table 1.1 summarizes existing and projected land uses.)**

Eleven municipal utility districts (MUDs) comprise The Woodland's community – Montgomery County MUD Nos. 6, 7, 36, 39, 40, 46, 47, 60, 67, The Woodlands MUD No. 2, and Metro Center MUD. **Exhibit 1.1** shows the planning area and the MUD boundaries. The districts provide retail wastewater collection, drainage facilities and retail water distribution to customers within their own political boundaries. The Woodlands Joint Powers Agency (WJPA) is an agency created by the MUDs to manage the common affairs of the districts. The agency is comprised of representatives from each MUD, headed by a common General Manager with an employed staff.

TABLE 1.1 - Projected Land Use (2005)

	ultimate[1]	2005[1]	2006[1]	2007[1]	2008[1]	2009[1]	2010[1]	2011[1]	2012[1]	2013[1]	2014[1]	2015[1]
Commercial/Retail Space Total	4,058	2,886	3,247	3,446	3,500	3,703	3,705	3,927	3,832	3,866	3,866	4,058
Community Activity Space Total	368	289	344	348	348	368	368	368	368	368	361	360
Church Site Total	2,031	1,005	1,594	1,860	1,962	1,962	1,962	2,031	2,031	2,031	2,031	2,031
Retirement Apartment Total	490	490	490	490	490	490	490	490	490	490	490	490
Lodging Total	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234	1,234
Multi-Family Dwelling Unit Total	5,914	4,593	5,332	5,560	5,688	5,791	5,859	5,870	5,902	5,902	5,902	5,902
Office Space Total	5,789	3,292	4,169	4,483	4,524	4,875	5,176	5,308	5,453	5,654	5,801	5,789
School Site Total	2,361	2,179	2,361	2,361	2,361	2,361	2,362	2,179	2,179	2,362	2,361	2,361
Single Family Dwelling Unit Total	29,040	26,038	27,566	28,344	28,629	28,738	28,853	29,038	29,047	29,047	29,047	29,047
Industrial/Warehouse Site Total	198	198	198	198	198	198	198	198	198	198	198	198
Grand Total:	51,482	42,204	46,535	48,324	48,934	49,719	50,206	50,642	50,732	51,151	51,289	51,469

[1]Equilivalent single family dwelling unit, based on 3.2 persons per unit as determined by design criteria.

The WJPA manages the local retail systems of the water and wastewater utilities including maintenance of all sanitary sewer lines 12 inches or smaller in diameter and all water lines 8 inches or smaller in diameter. The San Jacinto River Authority (SJRA), through contractual agreements with each MUD, provides wholesale water supply and transmission and wastewater collection and treatment to each MUD within the Woodlands. The SJRA owns, operates and maintains all sanitary sewer lines 15-inches or larger, and all water lines 12-inches or larger. In addition, SJRA owns, operates and maintains all water supply components (water wells, storage tanks, and pumping stations) and all wastewater treatment plants.

1.1 STUDY PURPOSE

The water system which currently serves The Woodlands consists of 3 water pumping plants, 26 groundwater wells, approximately 10 miles of water well collection lines, 6 elevated storage tanks and approximately 360 miles of water distribution lines. Additional water wells, storage tanks and pumping stations are planned to meet the needs of the growing population. Wastewater treatment is provided by three regional wastewater treatment plants. Wastewater is transported to the plants via a network of 420 miles of gravity sewer lines and 29 lift stations. Due to their age, the water and wastewater systems are beginning to require expected repairs and rehabilitation and the WJPA and SJRA have a growing need to efficiently track the extent and cost of repairs to the systems. There is some evidence that suggests that older sections of the wastewater collection system may be experiencing increased infiltration and inflow (I&I). The WJPA and SJRA need a program to identify I&I sources in a systematic manner and a plan for repairs and improvements of facilities in order to control potentially excessive flows and minimize future wastewater treatment and collection issues and related costs.

An additional need of the agencies is to catalog, organize, and compile information pertinent to the water and wastewater systems into a comprehensive planning tool. By developing a dynamic model of both the water and sanitary sewer systems, the WJPA and SJRA will have a tool that will aid in developing schedules for maintenance and replacement and will better be able to serve the public. With the ability to provide continued tracking of problem areas, the WJPA and SJRA can efficiently perform an overall review of its water and wastewater facility needs and schedule maintenance and repairs accordingly. Development of the sanitary sewer system model is of particular interest to address TCEQ's Sanitary Sewer Overflow Initiative Program and EPA's

proposed Capacity Management, Operation, and Maintenance (CMOM) Program. These regulatory programs would require a computerized approach in managing the planning area's sanitary sewer system.

Finally, facility needs, that is, the sizes or capacities of individual water and wastewater system components, have been estimated during the development years of The Woodlands using established design criteria. Shown in **Exhibit 1.2**. This system of estimating future facilities needs has worked well as the community has grown and there were additional areas to be served. As the development matures, however, there is no longer the luxury of providing facilities larger than might be required because they could be utilized by future planned growth. Instead, there is a need to fine tune the criteria by utilizing actual data gathered from WJPA and SJRA records. Development and implementation of a Geographical Information System (GIS) model is the perfect tool for WJPA and SJRA to fill these needs.

1.2 STUDY FUNDING

In November of 2002, the Woodlands Joint Powers Agency submitted a Regional Facility Planning Grant Application to the Texas Water Development Board. Shortly there after, The WJPA received notice that the application was approved and they were awarded a grant in the amount of $525,000 for this study. This grant was planned to be used to develop a GIS model of both the water and wastewater networks of The Woodlands. As stated above, implementing this plan will help the WJPA and SJRA use budget dollars more efficiently for maintenance and repairs, organize and compile existing system information, and better plan for the final stages of development. The grant supplied by the Water Development Board will help fund the cost of preparation and start up of the GIS program. The GIS program is a valuable source of information that will be used and updated for years to come.

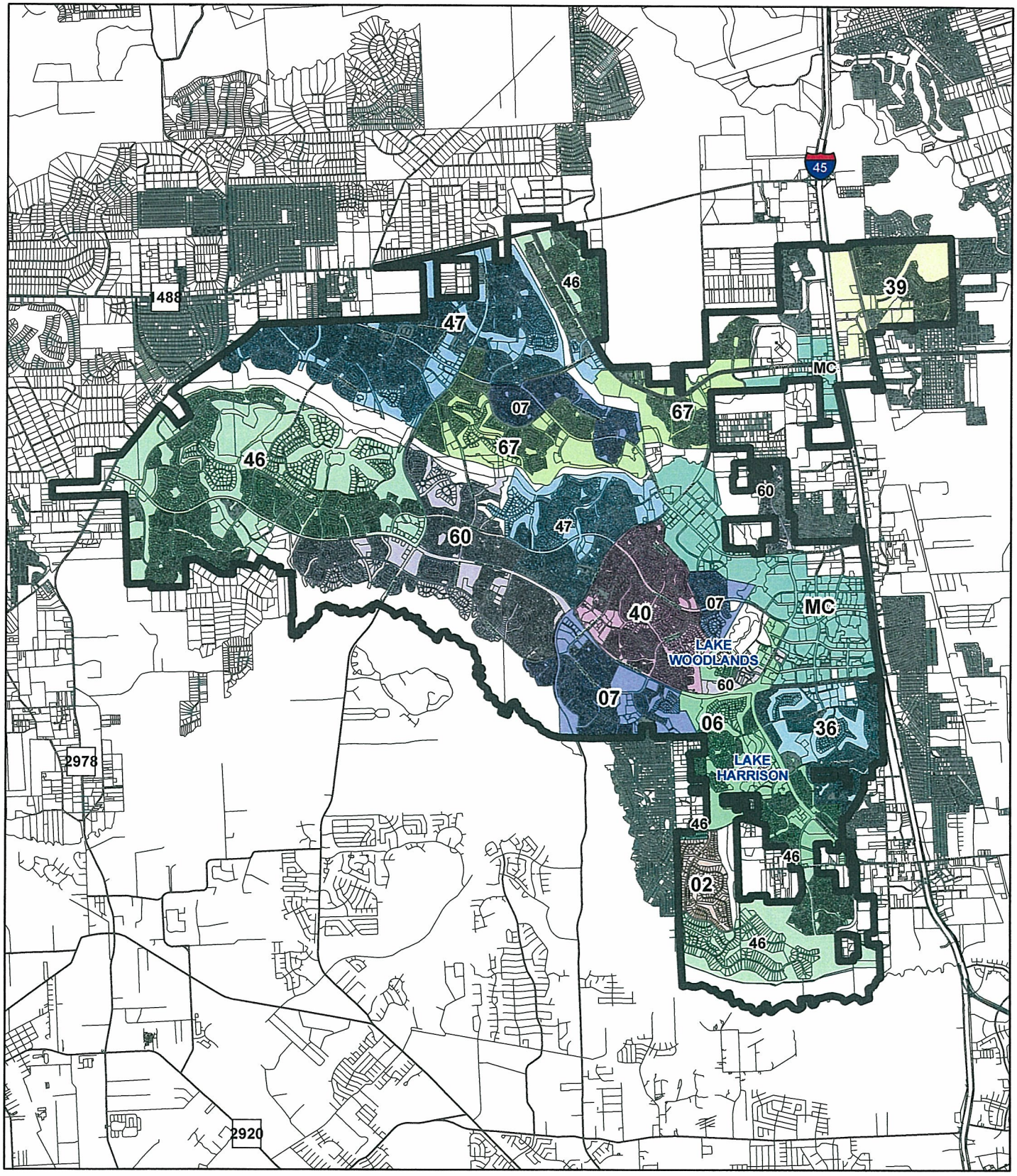


EXHIBIT 1.1

MUNICIPAL UTILITY DISTRICTS

N

W E

S

8,000 4,000 0 8,000

Feet

SCALE : 1"= 8,000 FEET

NOVEMBER 2006

LJA ENGINEERING

Exhibit 1.2
POTABLE WATER SUPPLY and WASTEWATER TREATMENT PLANNING / DESIGN CRITERIA

PARAMETER	CODE	DEMAND CONVERSION CRITERIA
POPULATION DENSITY		
Single Family Dwelling Unit	SFD	= **3.2** people per SFD
Multi-Family Dwelling Unit	MFD	= **2.5** people per MFD
Retirement Apartment Unit	ELD	= **1.1** people per ELD
AVERAGE POTABLE WATER USE		
Per-Capita-Per-Day Use		= **130** gpcd
Single Family Dwelling Unit	SFD	3.2 people x 130 gpcd = **416** gpd
Multi-Family Dwelling Unit	MFD	2.5 people x 130 gpcd = **325** gpd
Retirement Apartment Unit	ELD	1.1 people x 130 gpcd = **143** gpd
Office Space	OFF	= **0.169** gpd per sf
Commercial/Retail Space	C/R	= **0.143** gpd per sf
Community Activity Space	CA	= **0.143** gpd per sf
Lodging	LOD	= **325** gpd per room
Retirement Home	ELD	= **130** gpd per bed
Institutional (School/Church) Site	SCH / CH	= **1953** gpd per acre
Industrial/Warehouse Site	I/W	= **0.065** gpd per sf
AVERAGE WASTEWATER DISCHARGE		
Per-Capita-Per-Day Use		= **100** gpcd
Single Family Dwelling Unit	SFD	3.2 people x 100 gpcd = **320** gpd
Multi-Family Dwelling Unit	MFD	2.5 people x 100 gpcd = **250** gpd
Retirement Apartment Unit	ELD	1.1 people x 100 gpcd = **110** gpd
Office Space	OFF	= **0.13** gpd per sf
Commercial/Retail Space	C/R	= **0.11** gpd per sf
Community Activity Space	CA	= **0.11** gpd per sf
Lodging	LOD	= **250** gpd per room
Retirement Home	ELD	= **100** gpd per bed
Institutional (School/Church) Site	SCH / CH	= **1502** gpd per acre
Industrial/Warehouse Site	I/W	= **0.05** gpd per sf
SFDU EQUIVALENTS		
Single Family Dwelling Unit		1 sfdue = **1.00** SFD
Multi-Family Dwelling Unit		1 sfdue = **1.28** MFD
Retirement Apartment Unit		1 sfdue = **2.91** ELD
Office Space		1 sfdue = **2461** sf
Commercial/Retail Space		1 sfdue = **2909** sf
Community Activity Space		1 sfdue = **2909** sf
Lodging		1 sfdue = **1.28** rooms
Retirement Home		1 sfdue = **3.20** beds
Institutional (School/Church) Site		1 sfdue = **0.213** acre
Industrial/Warehouse Site		1 sfdue = **6400** sf
POTABLE WATER CAPACITIES		
Average Daily Rate		= **0.289** gpm per 1 sfdue
Well Supply		= **0.693** gpm max-daily-rate per 1 sfdue
Water Plant Pumping Capacity		= **0.693** gpm max-daily-rate per 1 sfdue
Ground Storage Tank Capacity		= **100** gal per person (320 gal/sfdue)
Elevated Storage Tank Capacity		= **55** gal per person (176 gal/sfdue)
Peaking Factors:	Average Daily Use	= **1.0**
	Maximum Daily Use	= **2.4** (x Ave. Daily Use)
	Peak Hourly Use	= **3.6** (x Ave. Daily Use)
Fire Demand Factors:	for SFD	= **1000** gpm per 2-hour period
	for MFD	= **3000** gpm per 2-hour period
	for ELD	= **1500** gpm per 2-hour period
	for OFF	= **3500** gpm per 2-hour period
	for C/R	= **3500** gpm per 2-hour period
	for CA	= **3500** gpm per 2-hour period
	for LOD	= **1500** gpm per 2-hour period
	for SCH / CH	= **3500** gpm per 2-hour period
	for I/W	= **3000** gpm per 2-hour period
Conservation Factors:	for SFD	= **1.0** (x Ave. Daily Use)
	for MFD	=
	for ELD	=
	for OFF	=
	for C/R	=
	for CA	=
	for LOD	=
	for SCH / CH	=
	for I/W	=
WASTEWATER FLOW CAPACITIES		
Wet Weather Peak Flow Factor		= **4.0** (x Ave. Annual Flow)
Wastewater Treatment Plant Capacity		= **320** gpd per 1 sfdue

2.0 OVERVIEW

The GIS platform provides a central location for utility information, easing the operator's role of information retrieval and in field transmittals. Over 4 million linear feet of sanitary water lines are mapped in a digital format which includes such information as size, material, date of construction, carrying capacities and current user load. This information is available to the operator, engineer, developers, etc.

The utility information is available as an inner office tool but also has the capability to be integrated in a mobile GIS platform allowing the information to be viewed or updated in the field. This provides the operators access to the utility information and ultimately leads to data verification and correction if needed. In addition, maintenance and work order management is also supported with an extension of mobile GIS. As work or maintenance is being performed, data can be collected and assigned to the particular line or feature that is being addressed. Analysis and/or trend comparisons of the existing network can then be made.

With a central GIS available to the engineer, existing / proposed utility conditions are easily acquired. As a result design is much more efficient. In addition, to the extensive information, the engineer also has a geometric network with line capacities to insure that line capacities are available for new development.

With the approach of building the utility infrastructure in a geodatabase format and implementing the geometric network, planners and developers now have the capability to alter development types (single family dwellings vs. multiple tenants vs. commercial / retail) based on water availability or lift station / treatment plant capacities. The ability to plan for residential expansion and relate this to the capacity of the existing infrastructure can help facilitate financial and planning decisions.

2.1 DATA COLLECTION AND ENTRY

The data provided by the WJPA and SJRA, for this project was predominately provided in a CAD format. This is the basis on which the GIS data was spatially created and attribute information populated. The digital designed plans were created using the Texas South Central NAD 27 coordinate system throughout The Woodlands development. Where digital plans are not available, GIS data was created from scanned, then geo-rectified, construction plans.

2.2 DATA DELIVERY

Delivered Data consists of four geodatabases and scanned imagery which is listed below.

A. Community Data –*Communitydata.mdb*

Layers
The Woodlands boundary
MUD Districts
MoCAD Parcels
Aerial Photography
Section Boundaries
Street Centerlines
General Land Use Map 2005

B. Sanitary – spatial and attribute information, existing and proposed– *Sanitary.mdb (feature class)*

Layers
Lines – size, material, age
Manholes – construction plan ID's
Plant facilities WWTP – boundaries or point locations with name (ID)
Lift Stations – boundary and point locations with name (ID)
Service Areas
CAD and /or scanned and rectified images where available

C. Water – spatial and attribute information, existing and proposed – *Water.mdb (feature class)*

Layers
Lines - Size, Material and age
Valves, fittings – type
Water Supply Plant – boundary and associated point locations with name (ID)
- *Capacity, ground elevation, max elevation, minimum elevation, initial elevation*
  Elevated Storage tanks – boundary and associated point locations with name (ID)
- *Capacity, ground elevation, max elevation, minimum elevation, initial elevation*
- *Water wells – associated point locations with name and flow rate.*
  Pressure maintenance facilities – boundary and associated point locations with name (ID)
  Service Areas
  CAD and /or scanned and rectified images where available

D. KyPipe – database containing arcs and nodes used for KY Pipe analysis – *KyPIPE.mdb (feature class)*

Layers
Lines - Size, Material
Valves, fittings – type
Water Supply Plant – boundary and associated point locations with name (ID)
- *Capacity, ground elevation, max elevation, minimum elevation, initial elevation*
  Elevated Storage tanks – boundary and associated point locations with name (ID)
- *Capacity, ground elevation, max elevation, minimum elevation, initial elevation*
- *Water wells – associated point locations with name and flow rate.*
  Pressure maintenance facilities – boundary and associated point locations with name (ID)

E. Scanned Plans and Maps All available construction plans and recorded plats.
- *Scanned and rectified (geographically and spatially adjusted) construction base maps when used for digitizing of network data.*
- *Control Map – 1 – 2004, rectified in map format.*
  - *Control Map – September 2005, non-rectified not in map format*

2.3 WASTEWATER SYSTEM ANALYSIS

One of the main deliverables in this project is an analysis tool for the sanitary network. The district needed a tool that will analyze any pipe, at any time, showing carrying capacities and the current amount of flow in that particular pipe.

The initial tool was a basic calculation tool based on a defined area. The user could draw a polygon around a section or neighborhood and a returned value of equivalent connections (equivalent connections based on existing flows or projections prepared by the developer) would be posted on a pop up window. The allowed the user to determine how many connections where flowing from that section into the main collector pipe. This information was entered into the attribute for that pipe and compared to the designed capacity.

The next step was to implement network tracing, and to incorporate this as an ArcServer application. This application allows the user to click on a sanitary line at any location and again return the equivalent connection values at that point and automatically populate the database with the returned value. The process allowed the analyst to interpret the system at any location. In addition to the ArcServer functionality we have also incorporated an ArcMap application that populates every sanitary line with equivalent connection values (utilizing tracing functionality) and design capacities, creating a percentage comparison between the two. The process follows the tracing route and accumulates connection values as it progresses down the network, summing as it reaches each manhole. The result is an added attribute to each line of all connections at that given manhole. Again, this is a powerful planning and engineering tool.

Exhibit 2.1 is a sample of the water distribution system layers.

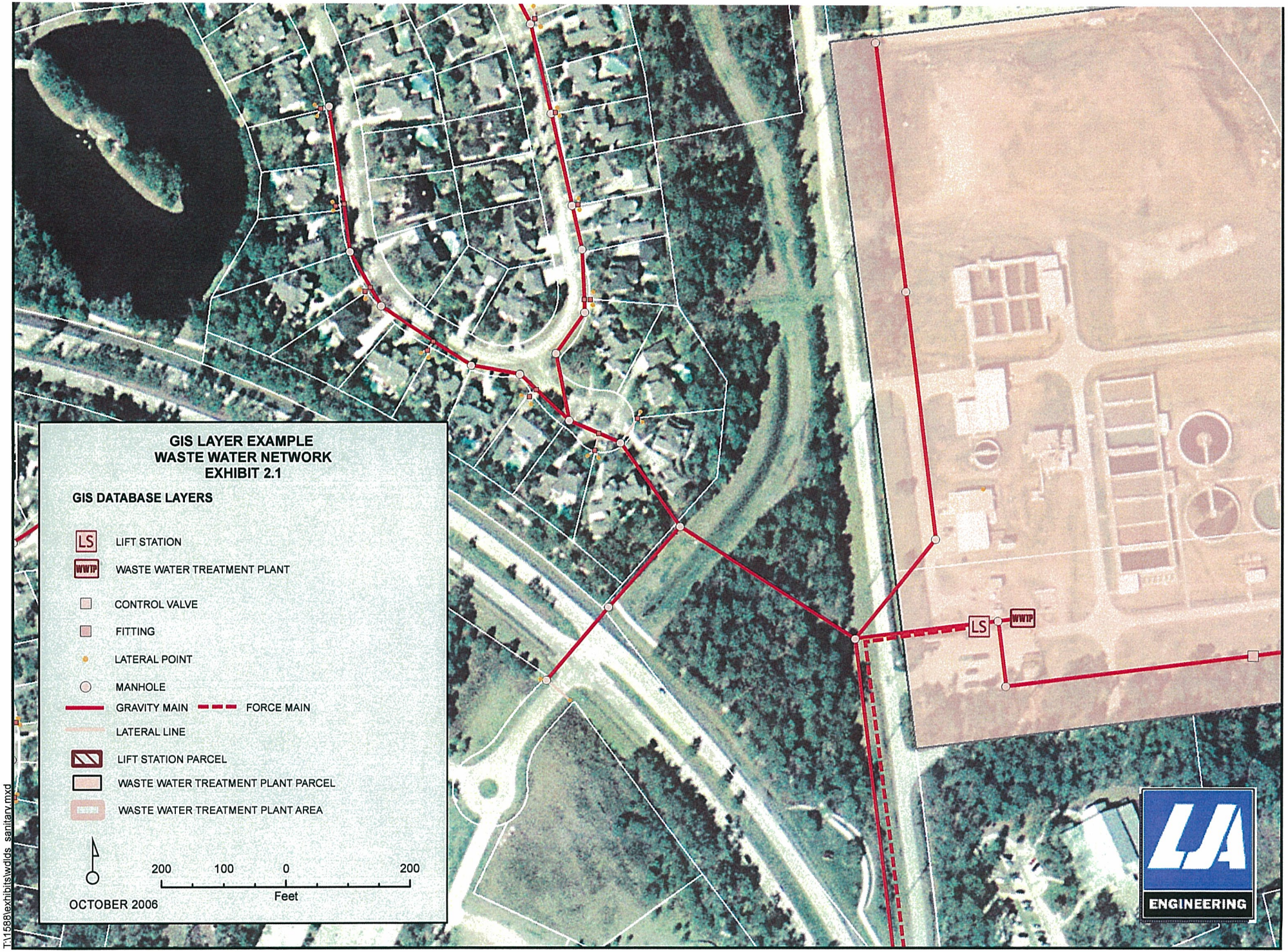
2.4 WATER ANALYSIS

The second portion of The Woodlands project is associated with the water network and the demands placed on the water lines. Again we are dealing with projected development and the ability of the current water distribution network to carry and provide the demand. This ArcServer application is focused on data entry and integrity for an ultimate interface with KyPipe 2000 (the utilized water modeling software package).

A water network was created with listed points (nodes) for associated demand on the lines. These nodes are placed to simulate the water usage demand at that location on the pipe. Once this process is finalized the collected and derived information is then input into a water modeling package (KyPipe2000) for further analysis. An interface was created

allowing data collection and database population to be created, and the connection to KyPipe2000 is a seamless process of GIS data export.

Exhibit 2.2 is a sample of the water distribution system layers.



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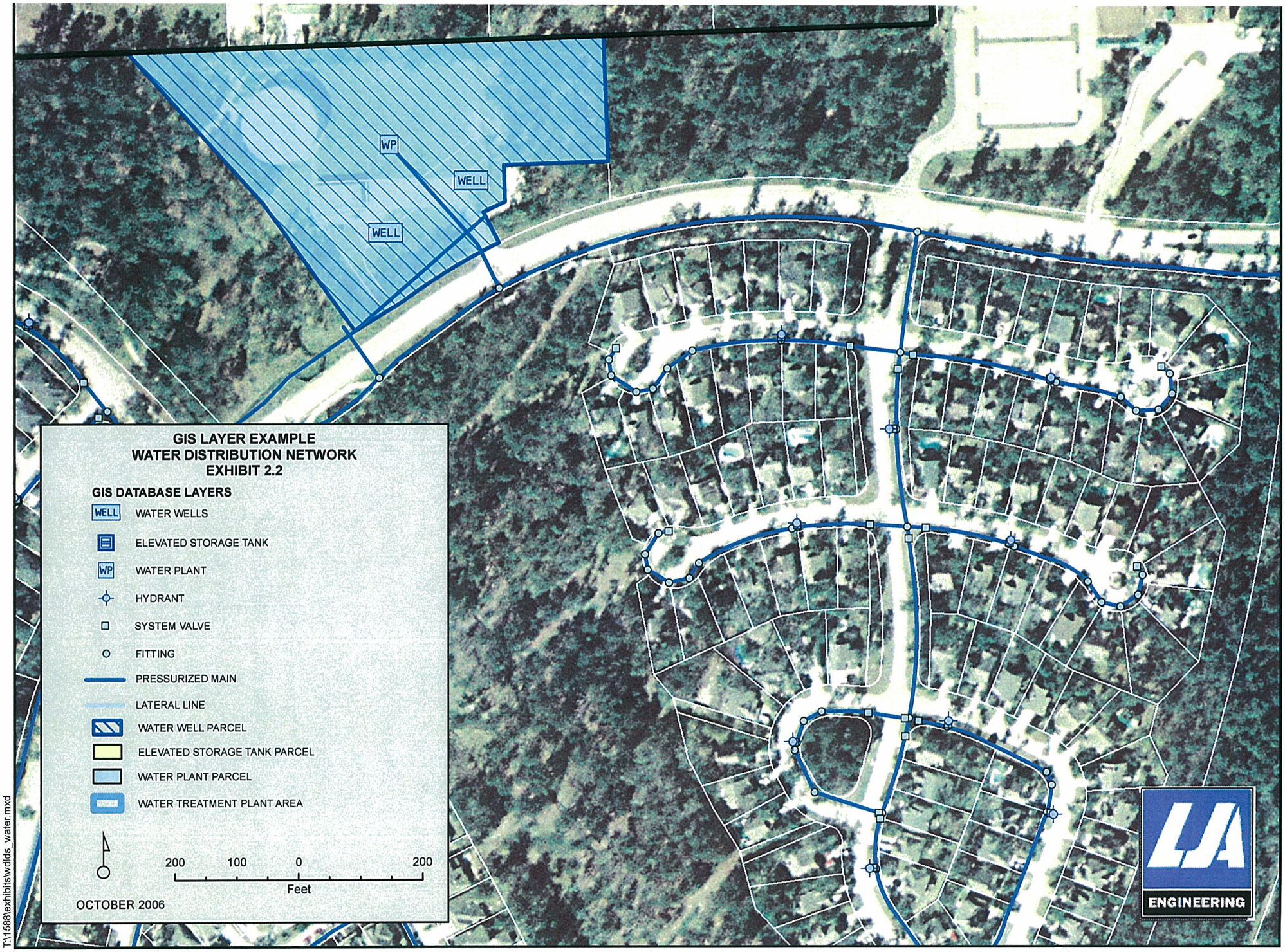

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3.0 INTRODUCTION

Significant differences in elevation exist between the northern and southern portions of The Woodlands. The service area is divided into two separate pressure planes to provide adequate service under these conditions. The division between the upper and lower pressure planes was established roughly along the 155 ft elevation contour through the installation of pressure reducing valves (PRVs) on major water lines. As a result, the system is capable of maintaining adequate pressures in the higher elevations of the service area without providing excessive pressures to connections in the lower elevations of the service area.

Water system components were sized so that demands in each of the pressure planes are satisfied primarily by facilities in that plane. Water can transfer readily from the upper pressure plane to the lower pressure plane through the pressure reducing valves, if required. Water will not normally transfer from the lower pressure plane to the upper pressure plane except under low demand or emergency low pressure conditions in the upper pressure plane. This transfer has been successfully accomplished under low demand conditions during system maintenance and repair operations.

3.1 EXISTING SYSTEM

Two water plants (WP) currently operate in the Woodlands lower pressure plane. WP I is located in the southeastern portion of the service area in the Village of Grogan's Mill, while WP 2 is more centrally located in the Village of Cochran's Crossing. Water is supplied to WP I by two on-site wells and four remote wells and WP 2 is supplied by two on-site wells and eight remote wells. WP 3, in the Village of Alden Bridge, is currently the only water plant in the upper pressure plane with two on-site water wells and four remote wells. Water is transferred from the remote wells to the plants through designated well collection lines. The facilities at each plant are summarized in **Exhibits 3.1** and **3.2**. In addition to the three water plants, there are also six elevated storage tanks (ESTs) located in the project area. ESTs 1, 2, 4, and 7 are located in the lower pressure plane, and ESTs 3 and 5 are located in the upper pressure plane. The capacities of these six tanks are shown in **Exhibit 3.3**. Water is supplied to ESTs 3 and 5 directly from two wells and to EST 7 from one well. The water distribution system consists of line sizes from 8" to 24" diameter pipe that interconnects the water plants and elevated storage tanks. A layout of the water system is shown in **Exhibit 3.4**.

3.2 Groundwater Supply

The Woodlands' potable water demands presently are met entirely through groundwater obtained from the Jasper and the Evangeline aquifers. The Evangeline is the shallower of the two aquifers, while the Jasper is deeper and more productive. Two wells are constructed at each well site as a means of maximizing production from the aquifer systems. One well is drilled into each aquifer, with the deeper well being installed first.

In recent years, William F. Guyton Associates, Inc. (Guyton), groundwater hydrologists, has performed studies for the SJRA to determine well performance of existing wells. The studies have found that water levels in the aquifers are declining at a rate of eight to twelve feet per year. The studies concluded that as the water level in the aquifer system continues to decline, productivity of the wells will also decline. Maintenance costs to restore or increase pumping rates can be significant. More recently, a new groundwater conservation district, The Lonestar Groundwater Conservation District (LSGCD) was created by the Texas Legislature to collect data and evaluate groundwater supplies for Montgomery County and to develop appropriate groundwater strategies for the region.

In May 2004, the LSGCD completed a regional planning study for Montgomery County. The study was jointly funded by SJRA, LSGCD, and a regional planning grant from the Texas Water Development Board. The study recommends the eventual conversion from purely groundwater to a combination of groundwater and surface water for water supply. While the conversion of the planning area to surface water is beyond the scope of this study, the water system model developed for The Woodlands system will be invaluable in planning for future surface water supply achieving this goal. A second study, with the same participants and funding sources, began in early 2006 to analyze potential surface water sources, surface water plant location, routing of surface water supply lines, and possible recipients of surface water. The Woodlands and southern Montgomery County are expected to be among the first to partially convert to surface water.

3.3 FUTURE SYSTEM

3.3.1 Calculation of Demands

Exhibit 1.2 following Section 1 presented the planning criteria used in this study. These criteria were developed in previous planning studies and have subsequently been used for planning purposes. **Table 3.1** summarizes water demands throughout the planning period by water plant service area based on land use projections presented in the schedule for development.

The peak day demands for each of these planning years are estimated at 37.5 mgd and 50.9 mgd, while the peak hour demands are estimated at 56.2 mgd and 76.3 mgd.

One of the goals of this study was to initiate the use of radio read meters at selected areas in The Woodlands to accumulate accurate data for input into the GIS and KyPipe models. With accumulation of the data, it was hoped to define realistic peak-day and peak-hour factors for the various types of development, i.e., high-, medium-, and low-density residential, commercial, and institutional categories. To be successful and provide meaningful results, it is necessary that

TABLE 3.1 - Water Plant Demand Summary

	2005 Average (gpm)	Max Day (gpm)	Peak Hour (gpm)	**Ultimate** Average (gpm)	Max Day (gpm)	Peak Hour (gpm)
Service Area 1	2,764.0	6,633.5	9,950.2	3,961.0	9,506.3	14,259.5
Service Area 2	3,956.6	9,495.8	14,243.7	4,379.0	10,509.5	15,764.3
Service Area 5	1,119.1	2,685.8	4,028.6	1,753.9	4,209.4	6,314.0
Service Area 3	2,321.2	5,570.9	8,356.4	2,630.3	6,312.7	9,469.0
Service Area 4	675.6	1,621.4	2,432.2	1,997.4	4,793.8	7,190.7
Subtotal (LPP)	7,839.6	18,815.0	28,222.5	10,093.8	24,225.2	36,337.8
Subtotal (UPP)	2,996.8	7,192.3	10,788.5	4,627.7	11,106.5	16,659.7
Total	**10,836.4**	**26,007.4**	**39,011.1**	**14,721.5**	**35,331.7**	**52,997.5**
Total (mgd)	**15.6**	**37.5**	**56.2**	**21.2**	**50.9**	**76.3**

As shown in this table, the calculated average day demands during the planning period are 15.6 mgd and 21.1mgd for existing (2005) and ultimate development.

data be collected for a reasonable time period and include, at a minimum, an actual peak-day period. Implementation of a radio-read system is an ambitious undertaking and it soon became evident that this task could not be accomplished within the time frame of this study. For this reason, the historical peak-day and peak-hour factors of 2.4 and 3.6 times the average demand, respectively, were used for the system analysis.

In the inception of this study, the WJPA did evaluate the Neptune T-10 Residential water meter, which included the R-900 radio read option (used in Metro Center 45 and Market Street). On this particular model, the radio antenna is mounted to the meter box and is connected to the meter through dual wires. They quickly found that during construction, these antennas were disconnected from the meters rendering the units inoperable. Neptune has since changed their design of this model and the re-designed R-900i has an internal antenna which is contained within the meter box. These meters are currently under evaluation in the residential areas of Town Center on a trial basis, but all information so far points to the continued use of these meters.

3.4 ANALYSIS OF SYSTEM

A dynamic computer program developed by the University of Kentucky, KyPipe 2000, was used to model the water system and determine the adequacy and efficiency of the system. KyPipe2000 has an established history of use throughout the engineering industry and across the United States. Existing construction plans, waterline sizes, gate valves, flushing valves, water plants, water wells, and elevated storage tanks were input into the GIS data base and used as a basis for the model.

Hydraulic models were developed for both existing and ultimate development conditions using KyPipe2000's 24-hour, extended period simulation (EPS) option. The EPS option allows input of hourly adjustment factors to simulate actual diurnal demand patterns. For this study, the existing and proposed condition models were executed for peak-day-plus-fire conditions using a demand pattern provided by SJRA. Sizes of existing and proposed system waterlines were analyzed to verify that maximum velocities of 5 feet per second and a maximum head loss of 5 feet per 1,000 feet were not exceeded under normal operating conditions. In addition, the system was verified to maintain pressures of at least 35 pounds per square inch (psi) during peak day and peak hour, and pressures greater than 20 psi during peak-day-plus-fire conditions.

3.5 PROPOSED IMPROVEMENTS

Water system supply component sizes were based on criteria that either meet or exceed TCEQ minimum system criteria and satisfy criteria developed for The Woodlands. Although these criteria were used for preliminary sizing, the actual facility sizes are based on results obtained from the hydraulic modeling of the proposed system. As a result, the required facilities, in some cases, exceed the design criteria in order to ensure a reliable supply and distribution system.

Specific system components include:

- Expansion of the existing Water Plant No. 1 system by adding two (2) wells, the associated well collection lines, ground storage and two (2) high service booster pumps;
- Expansion of existing Water Plant No. 2 system by adding two (2) wells and the associated well collection line;
- Expansion of existing Water Plant No. 3 system by adding one (1) booster pump and an elevated storage tank.

TABLE 3.2 - Water Facilities Estimated Construction Cost

ITEM	DESCRIPTION	UNIT	QUAN.	UNIT PRICE	TOTAL COST
1.	WATER TREATMENT PLANT NO. 4 (includes 2 water wells)	LS	1	$3,681,770.00	$3,681,770.00
2.	WATER TREATMENT PLANT NO. 5 (includes 2 water wells)	LS	1	$3,100,000.00	$3,100,000.00
3.	PROPOSED WATER WELLS				
A.	WELL NO. 31 & 32- (Water Plant No. 1)	EA	1	$700,000.00	$700,000.00
B.	WELL NO. 33 - (Elevated Storage Tank No. 7)	EA	1	$700,000.00	$700,000.00
C.	WELL NO. 35 & 36 - (Water Plant No. 2)	EA	1	$1,400,000.00	$1,400,000.00
D.	WELL NO. 37 & 38- (Water Plant No. 4)	EA	1	$1,400,000.00	$1,400,000.00
E.	WELL NO. 39 & 40 - (Water Plant No. 4)	EA	1	$1,400,000.00	$1,400,000.00
F.	WELL NO. 41 & 42 - (Water Plant No. 4)	EA	1	$1,400,000.00	$1,400,000.00
4.	WATER WELL COLLECTION LINES	EA	5	$350,000.00	$1,750,000.00
5.	GROUND STORAGE TANK (Water Plant No. 2)	EA	1	$1,000,000.00	$1,000,000.00
6.	MISC. PUMP ADDITIONS	EA	1	$250,000.00	$250,000.00
7.	ELEVATED STORAGE TANK NO. 6	EA	1	$1,000,000.00	$1,000,000.00
TOTAL - WATER SUPPLY SYSTEM					**$17,781,770.00**

From the results of the water model, it is necessary for two proposed water plants and eleven proposed water wells, (listed in **Exhibits 3.1** and **3.2**),
and one additional elevated storage tank be online to handle the projected demands for ultimate development.
The location of the water plants, the elevated storage tank, and water wells are shown in **Exhibit 3.5**. The cost for each is summarized in **Table 3.2**.

- Construction of the Water Plant No. 4 system including a booster pump station building with a motor control center, chlorination facility, four (4) booster pumps, a ground storage tank, two (2) on-site wells and six (6) off-site wells with the associated well collection line (may be surface water), and;
- Construction of the Water Plant No. 5 system including a booster pump station building with a motor control center, chlorination facility, three (3) booster pumps, a ground storage tank and two (2) on-site wells.

3.6 PHASED PLANNING OF IMPROVEMENTS

As development continues to grow, the planned expansions and new construction will be required. **Table 3.3** shows the projected time table for the proposed water facilities within The Woodlands.

TABLE 3.3 - Phased Planning of Water Facilities

Improvements	2005	2006	2007	2008	2009	2010
Water Plant No. 4	D		C			
Water Plant No. 5	D		C			
2 Wells at Water Plant No. 4	D					
2 Wells at Water Plant No. 5	D		C			
2 Wells to Water Plant No. 1 at Grogan's Mill Rd.	D	C				
Well Collection Line in Grogan's Mill Rd.	D	C				
2 Wells to Water Plant No. 2 at Gosling Rd.	D	C				
Well Collection Line in Gosling Rd.	D	C				
1 Booster Pump at Water Plant No. 3		D, C				
2.0 mg Ground Storage Tank at Water Plant No. 1			D	C		
1.0 mg Elevated Storage (No. 6) to Water Plant No. 3	D	C				
1 Booster Pump at Water Plant No. 1		D, C				
2 Wells to Water Plant No. 4, Branch Crossing		D	C			
Well Collection Line in Branch Crossing		D	C			
1 Booster Pump at Water Plant No. 1				D, C		
1 Booster Pump at Water Plant No. 3		D	C			
2 Booster Pumps at Water Plant No. 4			D	C		
Water Wells or Surface Water to WP No. 4						D

Notes:
D = Design
C = Completion of Construction
E = Existing
* = Construction phased across multiple years

Exhibit 3.1- Booster Pump Capacities: Upper and Lower Pressure Planes

Lower Pressure Plane

Service Area No. 1		Flowrate (gpm)					
Water Plant No. 1		Existing		2005		Ultimate	
Existing Pump	Proposed Pump	@65 psi	@52 psi	@65 psi	@52 psi	@65 psi	@52 psi
PUMP1-WP1		1600	2025	1600	2025	1600	2025
PUMP2-WP1		1000	1160	1000	1160	1000	1160
PUMP3-WP1		1600	2050	1600	2050	3350	4500
PUMP4-WP1		2750	3650	2750	3650	3350	4500
PUMP5-WP1		2750	3650	2750	3650	3350	4500

Total Pump Capacity for Service Area No. 1	12535.0	16685.0
Firm Pump Capacity for Service Area No. 1	8885.0	12185.0
Firm Well Capacity for Service Area No. 1	5799.0	5799.0
Max Day Demand for Service Area No. 1	6633.5	9506.3
Peak Hour Demand for Service Area No. 1	9950.2	14259.5

Service Area No. 2		Flowrate (gpm)					
Water Plant No. 2		Existing		2005		Ultimate	
Existing Pump	Proposed Pump	@65 psi	@52 psi	@65 psi	@52 psi	@65 psi	@52 psi
PUMP1-WP2		3350	4500	4600	5100	4600	5100
PUMP2-WP2		3350	4500	4600	5100	4600	5100
PUMP3-WP2		3350	4500	3350	4500	3350	4500
PUMP4-WP2		1000	1600	1000	1600	1000	1600

Total Pump Capacity for Service Area No. 2	16300.0	16300.0
Firm Pump Capacity for Service Area No. 2	11200.0	11200.0
Firm Well Capacity for Service Area No. 2	10424.0	10424.0
Max Day Demand for Service Area No. 2	9495.8	10509.5
Peak Hour Demand for Service Area No. 2	14243.7	15764.3

Service Area No. 5		Flowrate (gpm)					
Water Plant No. 5		Existing		2005		Ultimate	
Existing Pump	Proposed Pump	@65 psi	@52 psi	@65 psi	@52 psi	@65 psi	@52 psi
WW34			861		861		861
	WW33				1000		1000
	PUMP1-WP5			1000	1160	1000	1160
	PUMP2-WP5			1000	1160	1000	1160
	PUMP3-WP5			1600	2050	2750	3650
	PUMP4-WP5					2750	3650
	PUMP5-WP5						

Total Pump Capacity for Service Area No. 5	6231.0	11481.0
Firm Pump Capacity for Service Area No. 5	4181.0	7831.0
Firm Well Capacity for Service Area No. 5	2561.0	7661.0
Max Day Demand for Service Area No. 5	2685.8	4209.4
Peak Hour Demand for Service Area No. 5	4028.6	6314.0

Lower Pressure Plane Total	35066.0	44466.0
Firm Cap. for Total Lower Pressure Plane	29966.0	39366.0
Lower Pressure Plane Peak Hour Demand	28222.5	36337.8

Firm Capacity for Total Lower Pressure Plane (Lower Pressure Plane Total Minus One Largest Pump)	29966.0	39366.0
Total of Firm Well Capacities in Service Areas 1, 2, 5	18784.0	23884.0
Total Max Day for LPP	18815.0	24225.2

Exhibit 3.1 (continued)

Upper Pressure Plane

Service Area No. 3		Flowrate (gpm)					
Water Plant No. 3		Existing		2005		Ultimate	
Existing Pump	Proposed Pump	@65 psi	@52 psi	@65 psi	@52 psi	@65 psi	@52 psi
PUMP1-WP3		3350	4625	3350	4625	3350	4625
PUMP2-WP3		3350	4050	3350	4050	3350	4050
PUMP3-WP3		1000	1750	1000	1750	1000	1750
WW9			1363		1363		1363
WW10			779		779		779
	PUMP4-WP3					1000	1160
Total Pump Capacity for Service Area No. 3					12567.0		13727.0
Firm Pump Capacity for Service Area No. 3					7942.0		9102.0
Firm Well Capacity for Service Area No. 3					6993.0		6993.0
Max Day Demand for Service Area No. 3					5570.9		6312.7
Peak Hour Demand for Service Area No. 3					8356.4		9469.0

Service Area No. 4		Flowrate (gpm)					
Water Plant No. 4		Existing		2005		Ultimate	
Existing Pump	Proposed Pump	@65 psi	@52 psi	@65 psi	@52 psi	@65 psi	@52 psi
WW25			1199		1199		1199
WW26			875		875		875
	PUMP1-WP4			1000	1160	1000	1160
	PUMP2-WP4			1000	1160	1000	1160
	PUMP3-WP4			2250	3500	2250	3500
	PUMP4-WP4					1000	1160
	PUMP5-WP4					1000	1160
Total Pump Capacity for Service Area No. 4					7894.0		10214.0
Firm Pump Capacity for Service Area No. 4					4394.0		6714.0
Firm Well Capacity for Service Area No. 4					2575.0		4275.0
Max Day Demand for Service Area No. 4					1621.4		4793.8
Peak Hour Demand for Service Area No. 4					2432.2		7190.7

Upper Pressure Plane Total	20461.0	23941.0
Firm Cap. for Total Upper Pressure Plane	15836.0	19316.0
Upper Pressure Plane Peak Hour Demand	10788.5	16659.7

Total of Firm Well Capacities in Service Areas 3, 4	9568.0	11268.0
Total Max Day for UPP	7192.3	11106.5

Exhibit 3.2- Water Well Capacities: Upper and Lower Pressure Planes

Lower Pressure Plane

Service Area No. 1		Flowrate (gpm)	
Water Plant No. 1			
Existing Well	Proposed Well	2005	Ultimate
WW1		566.0	566.0
WW2		1285.0	1285.0
WW3		1113.0	1113.0
WW4 (Abandon)			
WW17		1286.0	1286.0
WW18		1135.0	1135.0
	WW35	1000.0	1000.0
	WW36	700.0	700.0
Total Well Capacity for Service Area No. 1		7085.0	7085.0
Firm Well Capacity for Service Area No. 1		5799.0	5799.0
Max. Day Demand for Service Area No. 1		6633.5	9506.3

Service Area No. 2		Flowrate (gpm)	
Water Plant No. 2			
Existing Well	Proposed Well	2005	Ultimate
WW5		1212.0	1212.0
WW6		728.0	728.0
WW7		1135.0	1135.0
WW8		667.0	667.0
WW11		913.0	913.0
WW12		766.0	766.0
WW15		1279.0	1279.0
WW16		1093.0	1093.0
WW21		1301.0	1301.0
WW22		931.0	931.0
	WW31	1000.0	1000.0
	WW32	700.0	700.0
Total Well Capacity for Service Area No. 2		11725.0	11725.0
Firm Well Capacity for Service Area No. 2		10424.0	10424.0
Max. Day Demand for Service Area No. 2		9495.8	10509.5

Service Area No. 5		Flowrate (gpm)	
Water Plant No. 5			
Existing Well	Proposed Well	2005	Ultimate
WW34		861.0	861.0
	WW27	1000.0	1000.0
	WW28	700.0	700.0
	WW33 @ ET-7	1000.0	1000.0
	WW37		1000.0
	WW38		700.0
	WW39		1000.0
	WW40		700.0
	WW41		1000.0
	WW42		700.0
Total Well Capacity for Service Area No. 5		41142.8	45251.5
Firm Well Capacity for Service Area No. 5		2561.0	7661.0
Max. Day Demand for Service Area No. 5		2685.8	4209.4

Lower Pressure Plane Total	59952.8	64061.5
Firm Cap. for Total Lower Pressure Plane	48227.8	52336.5
Lower Pressure Plane Max. Day Demand	18815.0	24225.2

Exhibit 3.2 (continued)

Upper Pressure Plane

Service Area No. 3		Flowrate (gpm)	
Water Plant No. 3			
Existing Well	Proposed Well	2005	Ultimate
WW9		1363.0	1363.0
WW10		779.0	779.0
WW13		1382.0	1382.0
WW14		743.0	743.0
WW19		773.0	773.0
WW20		1017.0	1017.0
WW23		1406.0	1406.0
WW24		936.0	936.0
Total Well Capacity for Service Area No. 3		8399.0	8399.0
Firm Well Capacity for Service Area No. 3		6993.0	6993.0
Max. Day Demand for Service Area No. 3		0.0	0.0

Service Area No. 4		Flowrate (gpm)	
Water Plant No. 4			
Existing Well	Proposed Well	2005	Ultimate
WW25		1199.0	1199.0
WW26		875.0	875.0
	WW29	1000.0	1000.0
	WW30	700.0	700.0
	WW43		1000.0
	WW44		700.0
Total Well Capacity for Service Area No. 4		3774.0	5474.0
Firm Well Capacity for Service Area No. 4		2575.0	4275.0
Max. Day Demand for Service Area No. 4		5570.9	6312.7

Upper Pressure Plane Total	12173.0	13873.0
Firm Cap. for Total Upper Pressure Plane	10767.0	12467.0
Upper Pressure Plane Max. Day Demand	5570.9	6312.7

Exhibit 3.3 - Water Storage Tank Capacities

Lower Pressure Plane

Storage		Capacity (million gallons)		Node			
Ground Storage	Elevated Storage	2005	Ultimate	Elevation	Maximum Elev.	Minimum Elev.	Initial Elev.
GST-WP1		4	4	137.5	160.93	140.81	160
GST-WP2		5	5	154.5	177.5	156.5	177
GST-WP5		2	2	132	152	132	151
	ET-1	0.5	0.5	150	290	252.5	289.5
	ET-2	1	1	145	285.5	245.5	285
	ET-4	0.75	0.75	165	290	250.33	289
	ET-7	0.5	0.5	128	290	260.6	289.5
Total		13.75	13.75				

Upper Pressure Plane

Storage		Capacity (million gallons)		Node			
Ground Storage	Elevated Storage	2005	Ultimate	Elevation	Maximum Elev.	Minimum Elev.	Initial Elev.
GST-WP3		2	2	176	197.5	176	197
GST-WP4		2	4	180	200	180	199
	ET-3	0.75	0.75	192	342	302	341.5
	ET-5	1	1	180	342	302	341
	ET-6	1	1	190	342	302	340
Total		6.75	8.75				

AERIAL PHOTOGRAPH MARCH 2006

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LEGEND

WATER LINES

WATER PLANT SERVICE AREAS

- WATER PLANT SERVICE AREA 1
- WATER PLANT SERVICE AREA 2
- WATER PLANT SERVICE AREA 3
- WATER PLANT SERVICE AREA 4
- WATER PLANT SERVICE AREA 5

N

0 3,500 7,000 14,000 21,000

Feet

SCALE : 1"= 7,000 Feet

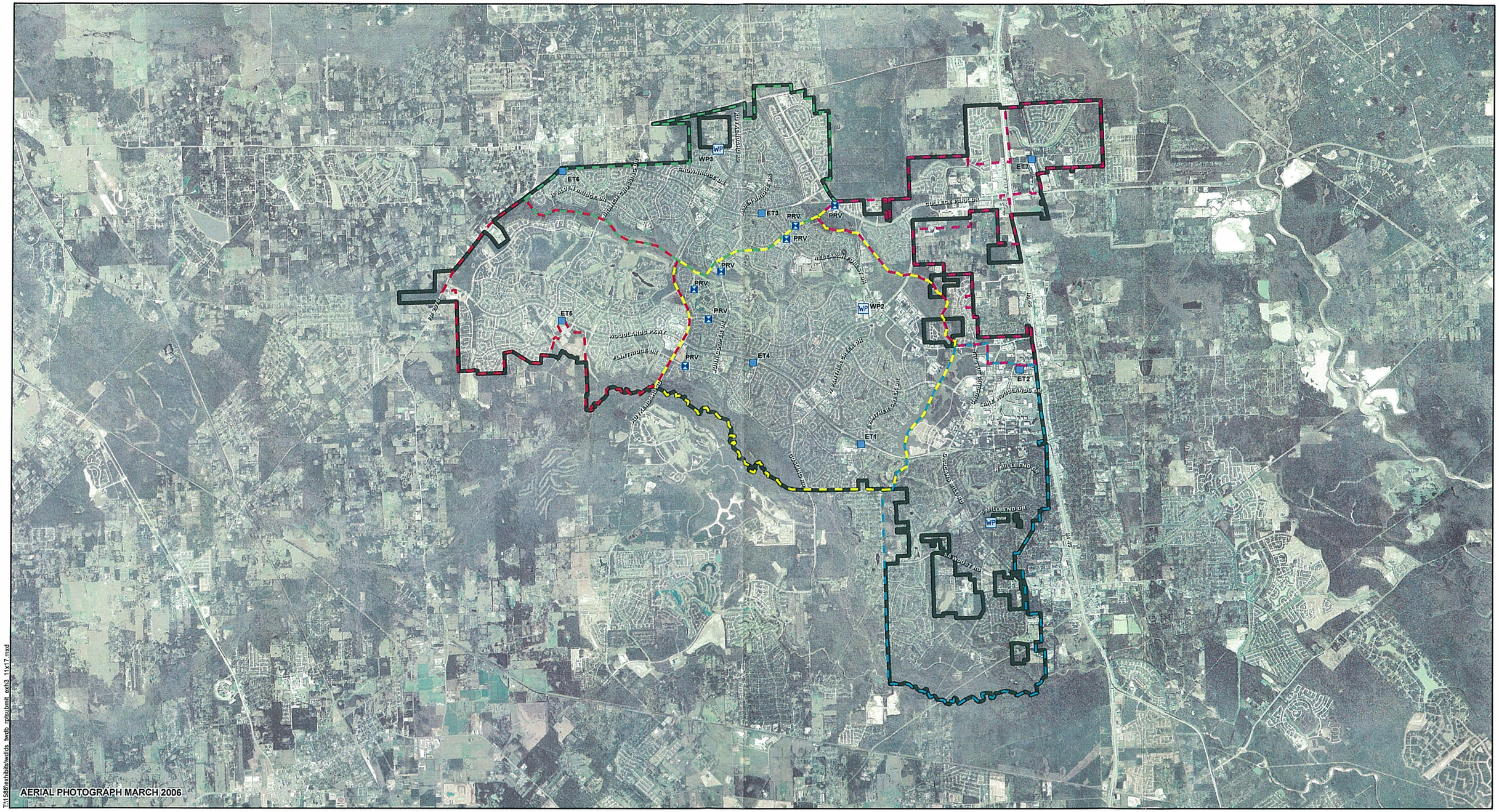
LJA Engineering & Surveying, Inc.

EXHIBIT 3.4

WATER DISTRIBUTION SYSTEM

WATER LINES
&
WATER SYSTEM SERVICE AREAS

NOVEMBER 2006



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LEGEND

- ELEVATED STORAGE TANK
- PRESSURE RELEASE VALVE
- WP — WATER PLANT

N

0 3,500 7,000 14,000 21,000

Feet

SCALE : 1"= 7,000 Feet

LJA Engineering & Surveying, Inc.

EXHIBIT 3.5

WATER DISTRIBUTION SYSTEM

WATER FACILITIES

november 2006

4.0 INTRODUCTION

The second of the two models created for this study is the wastewater network model. This model includes all lateral lines, trunk lines, lift stations and treatment plants. Much like the water network, the wastewater network is a tool that allows the WJPA and SJRA to better serve the public. It will also allow the WJPA and SJRA to evaluate the capacity in each line and develop around the needs and abilities of the existing wastewater network.

4.1 EXISTING SYSTEM

The Woodlands wastewater system has 3 wastewater service areas. Centralized collection system and treatment plants serve each service area. Wastewater Treatment Plant (WWTP) Nos. 1 and 2 utilize the activated sludge treatment process with advanced nutrient removal. WWTP No. 1 has a TCEQ permitted capacity of 7.8 mgd, WWTP No. 2 has an existing permitted capacity of 6.0 mgd, and WWTP No. 3 is permitted for an interim capacity of 0.77 mgd and 0.88 mgd final permitted capacity. All of the existing wastewater treatment facilities have been permitted and constructed in accordance with local, state, and federal regulations.

The wastewater collection systems consist of a combination of gravity sanitary sewer lines varying from 8" to 54" in diameter and 29 lift stations with force mains to convey wastewater flows to the respective WWTPs. As discussed earlier, the service area and the projected number of connections were reevaluated in 2005 and is the best information available at this time. The service areas can be seen in **Exhibit 4.1**. The Woodlands system is somewhat unique in that WWTP No. 2 has a diversion system in place that allows up to 2.5 mgd diversion of wastewater flow to WWTP No. 1. The system was constructed several years ago to delay construction of WWTP No. 2, but remains operable.

4.2 ANALYSIS OF SYSTEM

The sanitary sewer system was analyzed using GIS to calculate the design flow of sanitary lines based on given slopes of line size taken from the construction plans. Wastewater flows for each sewer line segment were estimated by calculating wastewater contribution for each type of land use based on unit factors for each land use classification and compared to the design flow capacity. Residential wastewater flows are based on an average flow factor of 100 gallons per capita per day (gpcd) and 3.2

TABLE 4.1 - Analysis of Wastewater Treatment Plant Capacities				
Wastewater Plant No.	Permitted Capacity (MGD)	Calculated Capacity (MGD) Year 2005	Ultimate	Annual Average Flow (MGD)*
1	7.8	3.30	7.78	3.74
2	6	4.59	7.78	3.02
3	0.9	0.87	0.92	0.42
Totals	**14.7**	**8.76**	**16.47**	**7.18**

* Flow to WWTP No. 1 includes some diversion from WWTP No. 2

persons per single family dwelling unit or 2 persons per multi-family dwelling unit. Non-residential flow factors are based on unit factors specific to each type of land use. Peak system flow (wet-weather) was estimated using a peaking factor of 4 for the collection system and 3 for the wastewater treatment plants. A lower factor for the plants is warranted due to the dampening effect of the collection system and analysis of historical plant flows.

Projected average wastewater flows using the planning criteria for each of the wastewater plant service areas are shown in **Table 4.1**. Total average flow for year 2005 was 13.5 mgd, based on the planning criteria. Average wastewater flows at ultimate development of The Woodlands are projected to be 16.5 mgd for all three wastewater treatment plants using the planning criteria. A comparison of projected wastewater flow and actual annual average flow information indicates that the projected flows using the planning criteria are somewhat higher than those experienced today. A detailed analysis of the differences is beyond the scope of this study. The design capacity of any individual wastewater plant is dependent not only on the hydraulic capacity, but also organic loading to the facility. Should SJRA and WJPA elect to continue analysis of the system based on existing flow and quality data, the GIS model will prove an invaluable asset to the analysis.

4.3 PROPOSED IMPROVEMENTS

Table 4.2 shows the design flows, average daily flows, size of existing lift stations (based on existing pumping capacity) and projected wastewater flows for the lift stations.

From this analysis, it appears that only one lift station needs to be expanded to handle the projected design / ultimate peak wastewater flow. Again, more detailed analysis using actual flow data appears warranted. **Table 4.3** shows the construction costs for the lift station.

TABLE 4.2 - Lift Station Capacities Analysis				
	2004 Avg.Flow G.P.D.	2005 Avg.Flow G.P.D.	G.I.S. Modeled Flow G.P.D.	Design Capacity G.P.D.
Lift Station No.1	29,607	25,929	62,400	93,150
Lift Station No.2	42,161	37,425	36,480	100,800
Lift Station No.3	57,848	61,262	22,400	243,360
Lift Station No.4	429,433	385,368	430,080	1,188,000
Lift Station No.5	2,676,128	2,431,236	3,177,280	2,177,910
Lift Station No.6	2,079	2,224	238,080	212,400
Lift Station No.7	78,934	70,584	178,880	249,480
Lift Station No.8	42,397	40,877	17,920	65,520
Lift Station No.9	418	409	182,720	324,720
Lift Station No.10	212,422	187,565	300,160	380,520
Lift Station No.11	286,298	258,948	263,040	394,200
Lift Station No.12	609,298	641,161	1,065,600	1,008,000
Lift Station No.13	267,024	216,297	263,040	356,400
Lift Station No.14	289,323	334,339	386,560	406,080
Lift Station No.15	1,201,276	109,112	0	1,008,000
Lift Station No.16	48,598	46,085	196,800	252,000
Lift Station No.17	159,923	259,368	100,160	1,008,000
Lift Station No.18	14,741	10,356	8,960	72,000
Lift Station No.19	10,989	9,424	14,080	64,800
Lift Station No.20	2,227	1,387	0	43,200
Lift Station No.21	13,679	14,385	0	118,080
Lift Station No.22	72,455	72,329	53,440	90,000
Lift Station No.23	14,700	19,728	0	47,160
Lift Station No.24	303,423	410,104	1,442,880	216,000
Lift Station No.25	123,565	175,088	344,960	356,400
Lift Station No.27	20,648	30,523	23,360	118,080
Lift Station No.28	131,769	95,958	0	356,400
Lift Station No.29	0	9,036	257,600	394,200

[(1)]Lift station No. 15 is a relief facility for the over flow of Wastewater Treatment Plant No.2, therefore flows for this area are not modeled.

TABLE 4.3 - Wastewater Facilities Estimated Construction Cost					
ITEM	DESCRIPTION	UNIT	QUAN.	UNIT PRICE	TOTAL COST
SANITARY SEWER COLLECTION SYSTEM					
1.	LIFT STATION IMPROVEMENTS				
A.	NO. 5	LS	1	$300,000.00	$300,000.00
TOTAL - SANITARY SEWER COLLECTION SYSTEM					**$300,000.00**

Based on current actual flow into each wastewater treatment plant, as shown in **Table 4.3**, these plants appear to have capacity to serve The Woodlands without any further expansion, but additional study using actual organic loading and flow data and the GIS model can verify this assessment. These sanitary sewer facilities are shown on **Exhibit 4.2**.

4.4 PHASED PLANNING OF IMPROVEMENTS

As development continues to expand in The Woodlands, proposed construction is currently underway.

WASTE WATER TREATMENT PLANT 03
LIFT STATION 16
LIFT STATION 25
WASTE WATER TREATMENT PLANT 02
LIFT STATION 15
LIFT STATION 11
LIFT STATION 29
LIFT STATION 24
LIFT STATION 06
LIFT STATION 23
LIFT STATION 14
LIFT STATION 13
LIFT STATION 12
LIFT STATION 09
LIFT STATION 01
LIFT STATION 07
LIFT STATION 05
LIFT STATION 02
LIFT STATION 22
LIFT STATION 03
LIFT STATION 19
LIFT STATION 18
WASTE WATER TREATMENT PLANT 01
LIFT STATION 04
LIFT STATION 28
LIFT STATION 21
LIFT STATION 08
LIFT STATION 20
LIFT STATION 17
LIFT STATION 10
LIFT STATION 27
AERIAL PHOTOGRAPH MARCH 2006

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LEGEND

LS — LIFT STATION

WWTP — WASTE WATER TREATMENT PLANT

N

0 3,500 7,000 14,000 21,000

Feet

SCALE : 1"= 7,000 Feet

LJA Engineering & Surveying, Inc.

EXHIBIT 4.2

SANITARY SEWER COLLECTION SYSTEM

SANITARY FACILITIES

NOVEMBER 2006

AERIAL PHOTOGRAPH MARCH 2006

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LEGEND

- GRAVITY MAINS
- FORCE MAIN
- WASTE WATER TREATMENT PLANT SERVICE AREA 1
- WASTE WATER TREATMENT PLANT SERVICE AREA 2
- WASTE WATER TREATMENT PLANT SERVICE AREA 3

N

0 3,500 7,000 14,000 21,000

Feet

SCALE : 1"= 7,000 Feet

LJA Engineering & Surveying, Inc.

EXHIBIT 4.1

SANITARY SEWER COLLECTION SYSTEM

SANITARY SEWER LINES
&
SANITARY SYSTEM SERVICE AREAS

NOVEMBER 2006

5.0 WATER SYSTEM AUDIT

One of the tasks of this study was to analyze water pumping and billing records to determine if there were significant unaccounted water losses that could be identified and rectified as a means of conserving water supply. **Exhibit 5.1** presents a water audit for each of the MUDs for calendar year 2005. Realistically, the MUDs have no practical way of quantifying with great accuracy certain components of the water audit, i.e. water theft and customer service line breaks, because these losses cannot be metered. For this reason, percentage estimates for these two items were used. Assuming that the assigned percentages are reasonable estimates, the analysis indicates that water uses are well accounted in the system. The estimate for water theft (4%) may appear high, but The Woodlands remains in an active growth phase with new construction of both water lines and homes. Water used for flushing and construction of new lines is not generally metered and probably contributes significantly to the amount of apparent water loss. It is expected that this amount will diminish considerably as development slows.

5.1 WATER CONSERVATION PLAN

The Woodlands currently has in place a plan for water reuse for irrigation systems proposed within The Woodlands. Attached are two permits to reuse surface water from existing Lake Harrison and Lake Woodlands. These plans were implemented to assist in water conservation. The Lake Harrison Permit (Certificate No. 10-3960A) was granted in December 2002, and shows that two existing dams and reservoirs are impounding 20 acre-feet in the upper reservoir and 90 acre-feet in the lower reservoir. On an annual basis 310 acre-feet of water can be used to irrigate 200 acres of land out of a 335 acre tract in The Woodlands. Plans are underway to supplement water to Lake Harrison with treated wastewater effluent from SJRA's WWTP No. 1. A 20-inch force main is in place connecting the wastewater plant and headwaters of the lake. New pumping facilities are being planned.

The Lake Woodlands Permit (Certificate No. 10-3959A) was granted in March 2004 and outlines that an existing dam and reservoir impounds 1460 acre-feet of water. On an annual basis 515 acre-feet of water can be used to irrigate 500 acres in the Woodlands and 215 acre-feet of water can be used for recreational purposes in the Woodlands Waterway. Treated wastewater effluent from SJRA's WWTP No. 2 supplies flows to Lake

Woodlands via Bear Branch. Through an agreement with SJRA and the developer, SJRA has agreed to replenish the lake's volume with effluent in lieu of the developer providing a new groundwater well for replenishment.

In addition to the measures, The MUDs comprising The Woodlands have adopted a State approved Water Conservation Plan that addresses various methods of conserving potable water supplies and provides for specific goals. A copy of the plan is included.

5.2 DROUGHT CONTINGENCY PLAN

Currently the WJPA and SJRA have a drought contingency plan based on the rules outlined by the State. Attached is a copy of the current drought contingency plan that is in place.

5.3 SURFACE WATER

As an alternative to the current drought contingency plan, the WJPA and SJRA have looked at utilizing surface water to alleviate some of the stress put on the system. In January of 2006, the SJRA issued a Regulatory Study and Facilities Implementation plan for Lone Star Groundwater Conservation District and San Jacinto River Authority. Through their studies, they have found that for the short term, it is unfeasible to utilize this method because of shear time restraints. The earliest a surface water facility could be constructed and online is early 2013.