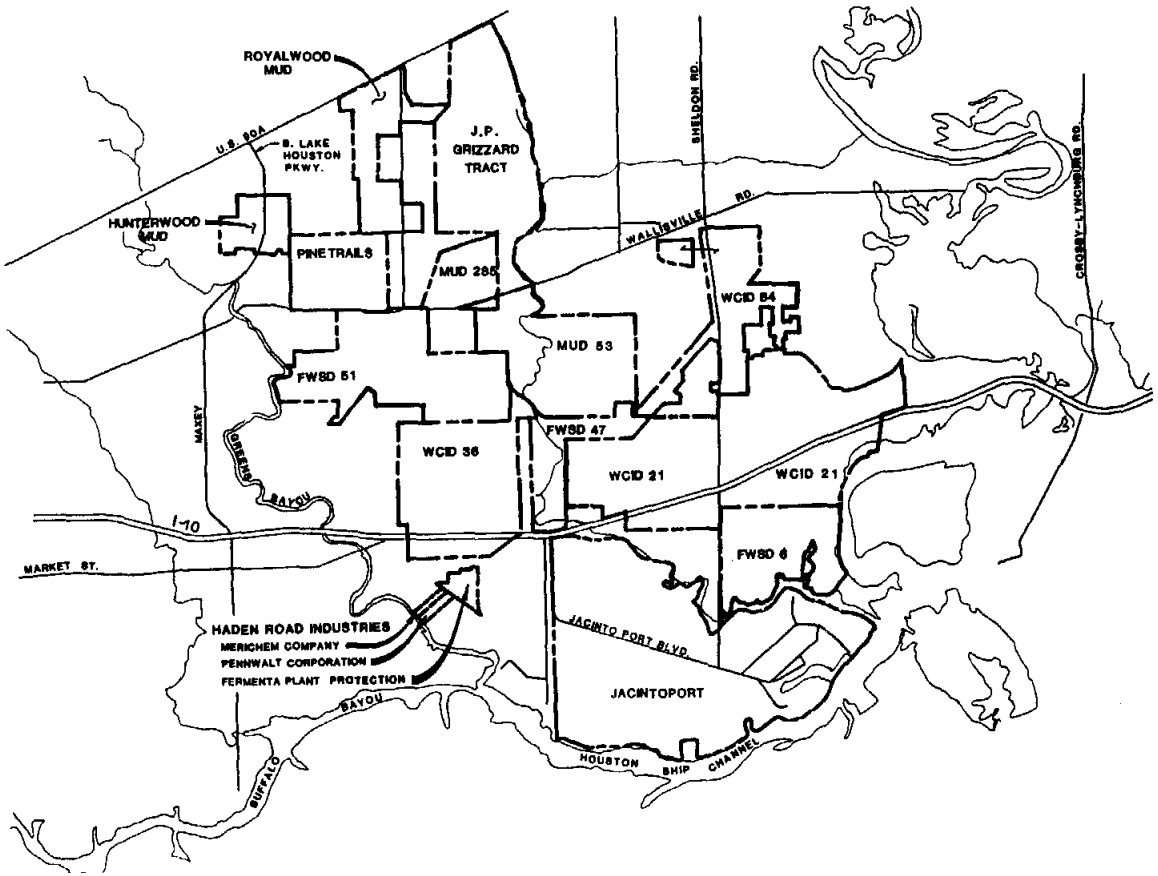
NORTH CHANNEL WATER SUPPLY CORPORATION
SURFACE WATER CONVERSION PLAN



SURFACE WATER CONVERSION PLAN
NORTH CHANNEL WATER SUPPLY CORPORATION

PREPARED BY:

PATE ENGINEERS, INC.
WITH MATCHING FUNDS PROVIDED BY
THE TEXAS WATER DEVELOPMENT BOARD

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SUMMARY

A long range, comprehensive plan was adopted by the Harris-Galveston Coastal Subsidence District in November 1985 which set goals and regulations for decreasing groundwater dependence through the year 2020. According to the plan, east Harris County groundwater consumers must begin the conversion to surface water by 1990. To address this requirement, sixteen public and private entities in the area bounded by the Houston Ship Channel to the south, the San Jacinto River to the east, U.S. 90A to the north, and Greens Bayou to the west have combined to form the North Channel Water Supply Corporation. The Corporation is to develop a plan for surface water conversion. In September, 1986, the Corporation's application for matching funds from the Texas Water Development Board was approved to aid in the cost of plan development.

Construction is nearing completion of a major expansion of the City of Houston's East Water Purification Plant which will provide the capability for expanded surface water service both within and outside the City of Houston. Based on this supply source, a plan has been developed to bring surface water to the North Channel Area in quantities sufficient to meet both 1990 targets and longer term requirements. The plan calls for construction of a supply network in the corporation planning area at an estimated total cost of $9.1 million. Phasing is proposed to minimize initial capital cost with a first phase project estimated to cost $6.9 million.

The plan incorporates the following principles:

- The plan is regional, addressing the combined requirements of the participant entities. This aspect permits phasing of facility construction such that some entities convert to exclusive use of surface water in the initial phases of implementation while others remain on groundwater. While conversion rates of individual entities vary, the implementation of the plan will permit all entities, taken as a whole, to satisfy HGCSD requirements.

- The plan is equitable in terms of cost. All entities share in the cost of increased surface water while benefitting equally from the cost reductions associated with reduced groundwater pumping. Also, entities pay only for capital improvements they will actually utilize.

- The plan is fundable. It is anticipated that a regional water authority will construct and operate the contemplated facilities. Under current programs and practices of the Texas Water Development Board, this Authority could sell revenue bonds at favorable terms, supported by contracts with participant entities.

Implementation of the proposed program will require formation of a regional financing and management entity. With approximately two years required for facility design and construction, it is important that a decision be made by the latter part of this year concerning the vehicle or entity to be used for project implementation.

SECTION I

INTRODUCTION

PURPOSE

Groundwater consumers in the North Channel Area face Harris-Galveston Coastal Subsidence District (HGCSD) mandates for substantial conversion to surface water use by 1990. Previous studies have shown the most logical source of surface water is the City of Houston's East Water Purification Plant, just to the east of the area. This report addresses the physical facilities required and an implementation plan to deliver surface water from a point near the City of Houston's East Water Purification Plant to the North Channel Area in a volume and timeframe to meet HGCSD targets.

AUTHORIZATION

This study was authorized by the North Channel Water Supply Corporation in a letter agreement dated December 18, 1986. Matching funds were provided by the Texas Water Development Board.

SCOPE

The scope of work is as follows:

- Define HGCSD conversion plan requirements.
- Update and detail local system information and collect pertinent facility and operating data.
- Define information, including projected water demand, necessary to conduct network analysis.
- Define surface water conveyance facilities and associated construction costs.
- Develop an implementation plan, including cost sharing formulas and projected water rates.

SECTION II

BACKGROUND CONSIDERATIONS

THE NORTH CHANNEL WATER SUPPLY CORPORATION

The North Channel Area is a developing, heavily populated unincorporated urban area in East Harris County. The area is generally defined as lying north of the Houston Ship Channel, east of Greens Bayou, south of U.S. 90 and west of the San Jacinto River. Residents and businesses in the area now depend solely on groundwater to meet their water needs.

Responding to significant subsidence in Harris and Galveston Counties, the 64th Legislature created the Harris-Galveston Coastal Subsidence District (HGCSD) to reduce subsidence which contributes to flooding through controlling and regulating ground water withdrawal in the two counties. In 1985, the HGCSD adopted a plan to abate subsidence which included a timetable of conversion to substantial surface water use. To implement this plan, the District has defined eight regulatory areas, each with its own timetable and conversion targets. The North Channel Area lies within two of the regulatory areas, and is required by the plan to begin the conversion to surface water by 1990.

Recognizing the need to plan for surface water conversion, sixteen districts and businesses ("entities") in the North Channel Area formed the North Channel Water Supply Corporation ("the Corporation") for the purpose of coordinating efforts to jointly define a plan for surface water conversion. Specifically, these entities include the following participants:

Fermenta Plant Projection
Merichem Company > Haden Road Industries
Pennwalt Corporation
Harris County Fresh Water Supply District No. 6
Harris County Fresh Water Supply District No. 47
Harris County Fresh Water Supply District No. 51
Harris County Municipal Utility District No. 53
Harris County Municipal Utility District No. 285

Harris County Water Control and Improvement District No. 21
Harris County Water Control and Improvement District No. 36
Harris County Water Control and Improvement District No. 84
Hunterwood Municipal Utility District
Industrial Utilities Services Incorporated (Jacinto Port)
Pine Trails Utility Company
Plantation Land Company (James P. Grizzard)
Royalwood Municipal Utility District

Exhibit No. 1 shows the location of these entities.

SURFACE WATER CONVERSION TARGETS

The entities represented by the North Channel Water Supply Corporation lie in HGCSD Regulatory Areas One and Two. Beginning in 1990, no more than 10% of the total water use in Area One is proposed to be from groundwater. In Area Two, groundwater withdrawals are reduced by 1990 such that no more than 20% of the total water use is from groundwater. Thereafter through 1998, increases in groundwater may be permitted so long as surface water use is not decreased. Then in 1999 groundwater withdrawal is again reduced so that no more than 20% of the total water use is from groundwater. Similar cycles of interim growth on groundwater ending with conversion to 80% surface water use occur in the 2000 to 2007 and the 2008 to 2015 time periods. Exhibit No. 2 shows the relationship of the Corporation entities to the HGCSD regulatory areas.

SURFACE WATER AVAILABILITY

The City of Houston's East Water Purification Plant on Federal Road, just south and west of the Corporation area was assumed as the source of treated surface water for service to the North Channel area. In the near future, an expansion of this plant to 310 million gallons per day (MGD) peak capacity will be completed, resulting in adequate capacity to provide service to the Corporation. An existing 90-inch high pressure water line extends from the plant northward along Federal Road to Market Street with a 48-inch stub at Federal Road and Market Street off of the 90-inch line for delivery of treated surface water to the east. Discussions with City of Houston Public Works Department personnel have indicated a willingness to sell sufficient treated surface water through this system to meet the Corporation's demands.

Two primary methods are provided for sales of this nature. The first is defined as providing constricted flow service ("CFS Method"). Under this method, per existing ordinances addressing City of Houston water sales to third parties, the rate paid by the customer per one thousand gallons is related to the ratio of peak demand to minimum demand, according to the following formula:

$$\$1.00 + ((P \div M) - 1) \times .23$$

"P" is the peak flow level defined by the customer in effect at the beginning of a month or portion thereof.
"M" is the minimum flow level defined by the customer in effect at the beginning of a month or portion thereof.

Constricted flow equipment essentially prevents flow greater than the peak from passing through the metering equipment. Provisions can be made for flows greater than peak at a cost of $4.49 per thousand gallons. The customer is billed for the minimum flow, even if the minimum flow quantity is not taken.

A second method is to sell undivided interests in water treatment plant capacity. Under this method, raw water costs and treatment plant operating expenses actually incurred are pro-rated among owners of capacity in proportion to water treated on their behalf. For example, if an entity owns a portion of a treatment plant and takes a percentage of the total volume of water treated at the plant, the entity's share of operating expense for a period is computed by multiplying total operating expense by the percentage of treated water taken by the entity. This second method ("participation method") requires a capital investment in plant capacity and related financing.

Water rates are not defined for the participation method. However, an effective rate can be developed. This rate is the sum of a participating entity's share of operating costs and the participating entity's cost of amortizing the capital cost required to purchase plant capacity, divided by actual water use. This rate will vary depending upon actual operating costs or financing costs.

The City has indicated a willingness to consider participation by the Corporation in the proposed Northeast Water Purification Plant, a new plant to be located near Lake Houston, when construction of this facility moves forward. The City plans to appropriate funds for construction of this plant by July, 1988. The City's long range plan calls for large, high capacity lines to link the two plants, thus addressing potential concerns about the East Plant's capacity to meet projected long term demand of the service area.

SECTION III

SURFACE WATER CONVERSION FACILITY PLAN

DEMAND PROJECTIONS

To define the required facilities to convey surface water, it is first necessary to project demands so as to compute the surface water requirements necessary to meet HGCSD targets. The North Channel Water Supply Corporation participant entities are diverse in terms of maturity of development and quantity of water use. Some of the entities are mature, primarily single family subdivisions, while others are newly created districts where development is beginning. Others are industrial developments or consumers.

To develop demand projections, no single source was utilized. District operators and engineers, developers, and industries were surveyed for data regarding area water demands. This material includes conceptual land plans, recorded plats, district creation reports, existing projections, prior studies, and participant industrial projections.

Industry participants generally provided projections of water demand. However, the following procedure was utilized to develop water demands for the District participant entities:

- A review of available information (land plans, creation reports, etc.) was made.
- Existing development was calibrated against actual pumping records on file with the HGCSD.
- A projection of ultimate land use based on this information was developed. Where such information was not available, a review of existing development and developable land based on aerial photographs was made to project ultimate land use.

- o Projected development was converted to equivalent single family connections (ESFC) generally assuming 5 ESFC per each single family acre and 10 ESFC per each commercial or multifamily acre.

- o A projection of demand based on 420 gallons per day (gpd) per ESFC was made. This factor is typical for primarily residential district water consumption planning.

A straight line water demand composite growth rate with ultimate demand at build out occurring in the year 2030 was assumed. This rate is in good conformance with growth rates experienced over the time frame 1980 to 1985.

The City of Houston is currently preparing a water supply master plan. As part of this effort, a population forecast by census tracts was performed which includes the area of the Corporation as well as a significant portion of the surrounding area. Census tracts are not directly correlateable to the Corporation's service area and sufficient data was not available regarding the City Water Master Plan projections to aggregate the projected demand for the Corporation area alone. Thus, for purposes of developing a surface water supply plan, the City of Houston projections could not be used. The approach described was confirmed above with City of Houston Public Works Department personnel.

Exhibit No. 3 graphically depicts the projected water demand growth in the area. Also on this exhibit is the surface water supply required to attain HGCSD targets. Appendix A includes data sheets on each corporation participant. These sheets describe growth rates, the source of data utilized in making projections for each entity and provide other information about each entity.

DESIGN CONSIDERATIONS

The design of a surface water supply system to serve the North Channel area must provide for minimal disruption in current systems operations, minimize the capital cost of surface water delivery system required, and maximize the use of the available groundwater while at the same time meeting HGCSD targets. This can be accomplished through a system which delivers treated surface water to existing entity ground storage

facilities which during peak demand periods is supplemented by existing wells.

This approach allows individual entity operation of water distribution systems to remain essentially unchanged. Additionally the use of existing storage facilities supplied by both existing wells and the proposed surface water conveyance system allows a downsizing of the surface water conveyance systems as well as a relatively constant use of treated surface water which minimizes the cost of this water under the CFS contract. Rather than sized to meet the projected peak day demand (approximately 1.7 times the average daily demand) the conveyance system design is proposed to supply at a maximum rate of flow equivalent to the average daily flow with peak demands supplied by wells.

This delivery rate was arrived at through an analysis of historical water use by corporation entities. Application of the HGCSD targets of 90% conversion of area 1 entity demand and 80% conversion of area 2 entity demand for the years 1983, 1984, and 1985, implies a weighted average of approximately 82% of the total water demand would be required to be met with surface water had these targets been in effect in those years. Over the three year period, a system capacity of approximately 6.8 MGD would be required to deliver the target volume of surface water. Groundwater pumpage would occur when total demand exceeded this rate. Figure 1 presents a graphical summary of water demand during the years 1983, 1984, 1985. The dashed line on extending across the graph is the rate necessary to deliver 82% surface water for the three year period.

The specific rate required to accomplish the split between surface water and groundwater will vary slightly from year to year. Total demand will grow in the future and the amplitude of seasonal fluctuations may change. Also, since there is an economic incentive to use the maximum amount of groundwater allowable under the plan, the delivery system should allow flexibility to adjust surface water consumption as actual demand changes. From this analysis of Corporation water use as well as our analysis of other similar systems in the metropolitan Houston area, the average daily demand was selected as the basis for design of the conveyance system. This design recommendation is consistent with similar projects in the Houston area where conjunctive use of groundwater and

MONTHLY GROUNDWATER PUMPAGE

1983-1985

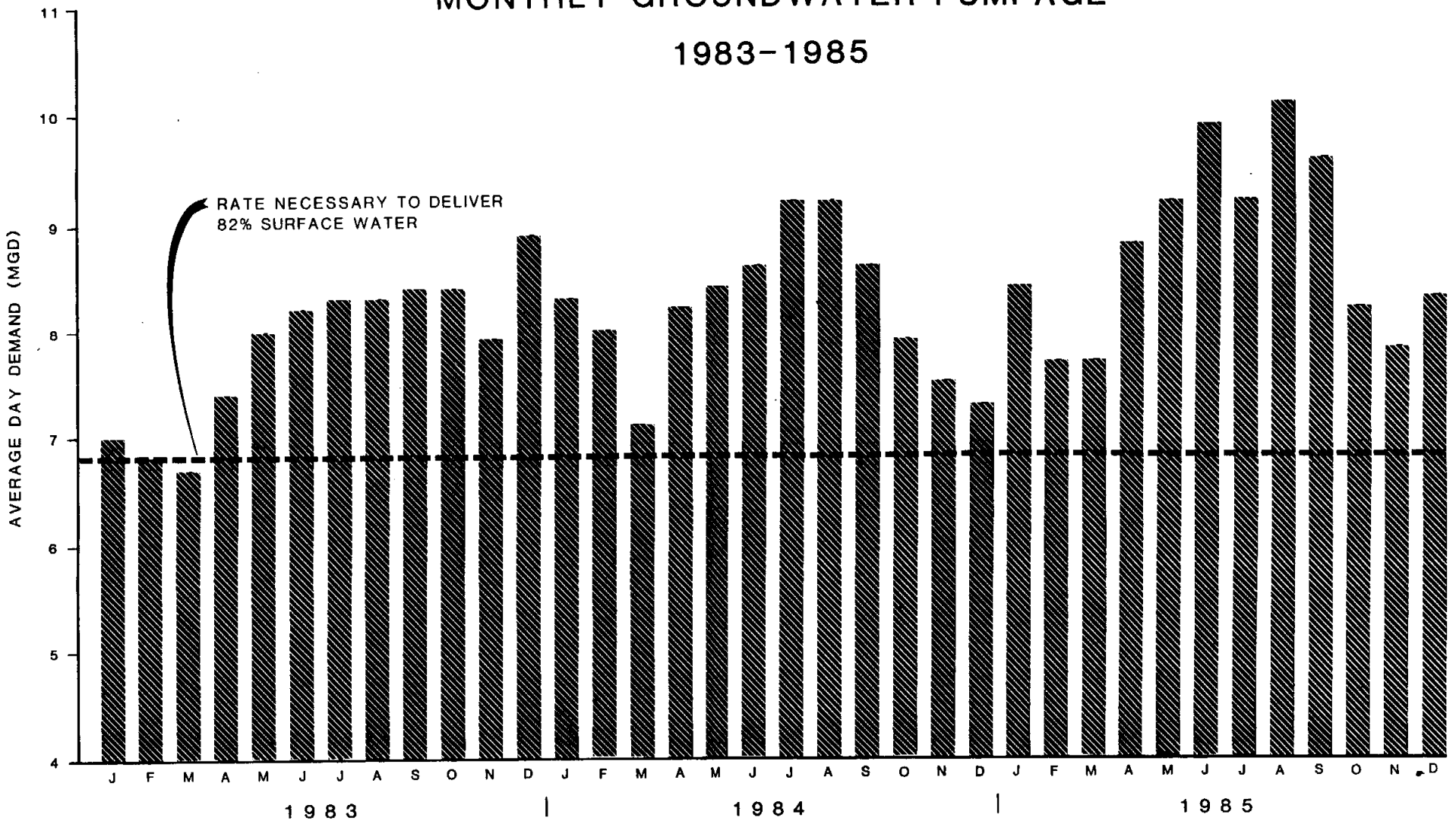


FIGURE NO. 1

surface water is anticipated and has been reviewed with and approved by City of Houston Public Works Department personnel.

The North Channel Area is located within the extra-territorial jurisdiction of the City of Houston and is, therefore, subject to the authority of the City in planning and constructing water supply facilities. The facilities proposed herein have been designed in accordance with applicable City of Houston standards and design criteria. In addition, the following is a summary of relevant specific design factors:

- Initial Pressure - In order to maintain pressures across the City system, the City will require the Corporation to reduce the pressure of the water supplied from the East Plant to 60 pounds per square inch (PSI) at the point of connection to the system.

- Velocities - A maximum design velocity of 6 feet per seconds (FPS) and minimum design velocity of 2 FPS was maintained.

- Right-of-Way - All water lines should be adjacent to public rights-of-way. In those cases where this is not possible, an exclusive water line easement 15 feet wide was assumed.

- Delivery Pressure - A minimum delivery pressure of 20 psi was maintained. This pressure will permit filling of existing ground storage facilities.

- "C" Values - The following C values were used:

Diameter	C Value
8"	150
12"	150
16" and larger	135

WATER SUPPLY NETWORK

The proposed water supply network sized to deliver quantities of surface water sufficient to meet projected Year 2020 requirements and HGCSD targets is shown on Exhibit No. 4. Treated surface water for corporation

entities is conveyed from the City of Houston 48-inch stub previously mentioned near Market Street Road and Federal Road through a 36-inch main eastward to the intersection of Uvalde and Market Street Road. At this point, flow is split between a northbound 30-inch line and an eastbound 24-inch line. Line diameters generally reduce from this point eastward as system demand is reduced by deliveries to participating entities.

The total cost of the fully developed surface water conveyance system is estimated at $9.1 million. This cost estimate is based on current prices for water line construction in the Houston area. In preparing the estimate, allowance has been made for special crossing under the City of Houston's West Canal, and crossings under Interstate 10 and Beltway 8. Right-of-way costs and engineering fees and contingencies are also included. Table No. 1 is a cost estimate of the network.

The system outlined herein is designed for service only to the participating entities. The City of Houston Water Master Plan, now under preparation, may call for a larger diameter trunk line extending eastward from Federal Road along the same alignment for service to the participating entities as well as others. Prior to initiation of final design, the project should be reviewed with the City of Houston to determine the potential for upsizing of this line in accordance with the Master Plan and pro-rata participation in design and construction by the City of Houston. This could result in cost savings for both the City and the Corporation.

CAPITAL COST SHARING

Based on the forecast Year 2020 (the final year of the current HGCSD plan), demands and the calculations derived from the network analysis described earlier, the capacity required to convey each entity's requirements in each line segment has been computed. This capacity has been compared to total capacity of each line segment to arrive at each entity's ownership capacity in each line segment. A cost estimate has been compared to total capacity in each line segment to arrive at each entity's ownership capacity in each line segment. A cost estimate has been prepared for each line segment, and, based on ownership capacity, each entity's share of the line cost has been computed.

To allocate this cost, each line segment was numbered as shown on Exhibit No. 5, a network schematic. The capacity owned by each entity in each line segment was used to allocate the entity's share. Table No. 2 shows each line segment, the diameter of that segment, the total cost of the segment, and each entity's capacity in the segment. Of course, these costs are estimates; actual cost allocation will be made on the basis of bids received. No participation by the City of Houston in construction of trunk lines has been assumed.

SURFACE WATER RATES

To develop the CFS rate, peak and minimum flow rates must be defined. Consideration of historical pumping rates and well known formulas suggest a peak-to-minimum flow rate ratio of 2 is appropriate. Utilizing this rate in the CFS formula results in a rate of $1.23 per thousand gallons. City projections indicate this rate can be expected to increase approximately 10% net of inflation in each of the next two years.

The effective rate associated with participation in the Northeast Treatment Plant is a function of the capital cost required and the actual operating cost. An analysis of recent Houston-area surface water treatment plant bids showed that $1.25 per gallon of required daily capacity is an appropriate figure for estimating construction costs. Amortizing this cost consistent with current municipal financing practices would result in an effective rate of approximately $.35 per thousand gallons. Added to this figure is an estimated $.65 per thousand gallons for raw water and operating costs, for a total of approximately $1.00 per thousand gallons. Increases in this rate would be limited to inflationary factors. If the Corporation chooses to participate in the construction of the Northeast Plant, the City has indicated a willingness to consider providing water at an interim rate of approximately $1.00 per thousand gallons, adjusted as necessary for inflation, prior to completion of the plant.

SECTION IV

SURFACE WATER CONVERSION IMPLEMENTATION PLAN

To implement surface water conversion, a plan was developed to address the issues of meeting HGCSD targets, minimizing initial capital cost, equitable cost sharing among participants, and providing flexibility to meet future demand growth. The implementation plan components include project phasing, institutional requirements, financial requirements, and schedule.

PROJECT PHASING

As previously discussed, the primary motivation for surface water conversion is regulatory pressure from the HGCSD. As promulgated, the plan calls for groundwater consumers in Regulatory Area 1 to convert to 90% surface water consumption by 1990 and consumers in Area 2 to convert to 80% surface water use by that time. Applying these targets to individual corporation entities would prohibit phasing, requiring construction of the entire system by 1990 at a cost of $9.1 million.

Discussions with HGCSD staff have indicated a willingness to support application of these guidelines on a regional basis rather than an entity-specific basis, permitting all corporation entities, at least in the near term, to conform to Area 2 targets. This concept allows phased construction of the network to convert those entities closer to the treated water source to a level in excess of the targets, thus offsetting groundwater use by entities not initially served. As long as the initial phase allows delivery of sufficient surface water so that, taken as a whole, the region meets HGCSD targets, plan compliance can be achieved. This strategy addresses the issues of meeting HGCSD targets and minimizing initial capital cost cited above.

Pursuing this strategy, a first phase project to fully convert entities whose combined projected 1990 demands total at least 80% of the Corporation's projected total demand was identified. This project will bring service to WCID No. 36, FWSD No. 51, Pine Trails, HCMUD No. 285, HCMUD No. 53, FWSD No. 47, WCID No. 84, WCID No. 21, and the Haden Road

Industries, which have a combined projected 1990 demand of 9 MGD compared to 11 MGD total. Those entities which are fully converted in the first phase will need to continue to maintain groundwater facilities to support future growth, as permitted by the plan. This maintenance will involve periodically exercising wells. The amount of this production is not considered material when considering plan compliance.

Addressing the issue of cost equitability, the allocation method of capital cost requirements has been previously discussed. Per this plan, each entity would be expected to defray the cost of any line in which it owns capacity when it is constructed. Thus, for example, all entities would be expected to pay the cost of the Market Street supply line in Phase I, since all entities own capacity in that line.

Equitability of water cost, however, must also be addressed. Those entities which fully convert to surface water are, in effect, consuming excess surface water on behalf of those entities which remain on groundwater so that the entire region can meet HGCSD targets. Entities which take excess surface water should not be financially penalized. Conversely, these entities will save the cost of groundwater production, while entities remaining on groundwater will continue to face this cost. To address this condition, it is proposed that all entities share the additional cost of surface water equally, and share the benefit of reduced groundwater cost equally.

Phasing the project in this way addresses the issue of flexibility. As stated, this plan is designed to serve participant entities only. Future phases can be modified depending on ultimate participation and/or actual demand growth. For example, at some future date, additional entities not included in the service area may request service. Future phase lines could be constructed at a larger size and an additional line could be constructed along other rights-of-way such as Beltway 8 to respond to this request. Conversely, if actual demand is less than projected, future phase lines might be down sized. Either case would likely require a reallocation of capital cost.

INSTITUTIONAL REQUIREMENTS

Implementation of this plan will require substantial management considerations. These will include arranging financing, negotiations

with the City of Houston, allocation of surface and groundwater cost among entities, payment of surface water cost to the City and system maintenance. Coordination and management of these functions would be almost overwhelming on an entity-by-entity basis. Further, in order to obtain HGCSD plan interpretation on a regional basis, regional coordination of data collection, communication and reporting is essential. For these reasons formation of a regional management and coordinating body is recommended to implement the plan and to operate the system in the future.

The wide scope of the functions related to financial matters required for plan implementation implies that this body will need to work very closely with participant entities. For example, this body will need an ability to verify quantities of water consumed and actual groundwater production costs. Texas law provides several potentially suitable institutional vehicles. The Corporation's attorney's are conducting a review of the various vehicles for suitability. For purposes of this report and the following analysis, the Corporation is assumed to provide the required management and coordination functions.

FINANCIAL REQUIREMENTS

Based on the concepts of regionalization, purchased and produced water cost equity, and capital cost sharing, a financial analysis of the plan was conducted. The primary assumptions on which this analysis is based are as follows:

- The North Channel Water Supply Corporation in the role of a regional water supplier purchases all surface water from the City of Houston on behalf of the Corporation entities and is responsible for conveyance of treated surface water to Corporation entity water plants.

- The Corporation participates in the construction of the Northeast Plant. For financial planning, a rate of $.62 per thousand gallons is assumed for the cost of raw water, plant operations and Corporation conveyance system operations. Each entity also has capital requirements for plant capacity.

Construction of the Northeast Plant is a part of the City's current capital investment program. Based on economic constraints, a change in the projected near-term level of demand for service from the plant or other factors, the City may decide to postpone plant construction. In that event, the City's willingness to execute an interim contract will require definition. If an interim contract cannot be executed and if participation is not possible, the higher CFS rate of $1.25, including system operating requirements, will apply. Of course, no capital is required in this event.

- Each Corporation entity provides the Corporation with enough funds to defray the cost of surface water in an amount equal to that entities share of the total water produced in the area. Thus, for example, if an entity consumes 10 percent of the total water consumption in the area, it will provide enough funds to defray 10% of the surface water cost incurred.

  In a parallel manner, the cost of groundwater production is shared by all entities. Groundwater production cost is assumed to be $.20 per thousand gallons of groundwater provided based on current experience.

- The Corporation constructs, owns, and operates the surface water conveyance network and owns the water treatment plant capacity.

- All capital requirements are met with bond funds developed by the Corporation. The Corporation contracts with participant entities to defray costs associated with their share of plant and conveyance line capacity. In actual practice, participants may choose to meet their requirements from surplus funds or their own financing.

  Discussions with the Corporation's financial advisor indicates that revenue bonds of this character would be eligible for consideration under the Texas Water Development Board Financial Assistance Program. This situation would result in more favorable financing terms than could be expected on the open market. These bonds include 12% non-construction costs such as capitalized interest and selling fees and carry an interest rate of 7% with a 25 year maturity, consistent with recently approved Texas Water Development Board financing.

The Texas Water Development Board prefers shorter term (20 year) bonds. If the shorter term bonds are issued, although interest payments will be less and payments will cease sooner, annual debt installments will be higher. Stated in terms of delivered treated surface water cost, the use of shorter term bonds would increase such costs in the initial phase by an average of $0.05 per thousand gallons. The term and interest rate of the bonds will be determined following applications.

Financial analyses were performed for the Phase I and ultimate systems. For purposes of this analysis, Phase I is assumed to be completed by 1990. Implementation of Phase II will depend on actual demand growth and may well be split into several phases. For purposes of this analysis, Phase II was assumed completed by 2015. This date was chosen because Phase I bonds would be fully amortized by that time, assuming the financing terms described.

A financial analysis was performed for each entity and is presented in the tables in this report. Table No. 3 shows the first phase capital and financing requirements for each entity. Displayed are amounts of capital, financing and annual costs to meet debt requirements for each entity. Treatment plant costs are based on capacity required to meet 80% of annual demand with surface water while conveyance line costs are based on the allocation of capacity previously discussed.

The cost of capital improvements and the cost of surface water purchases can be defrayed by increased water rates, maintenance taxes, use of surplus funds, or a combination. Each entity would need to review its powers and capabilities to define the best method. For purposes of this analysis, it is assumed that these cost would be met through increased water rates. Table No. 4 displays the impact on water rates of implementing the Phase I plan. Following is a line-by-line discussion of this table.

o Annual Demand

Based on demand projections included in Appendix A, estimated quantities of water required in 1990 for each entity are displayed.

- Surface Water Cost

  As previously discussed, the cost of meeting HGCSD targets are allocated to all entities on a pro-rata basis. This analysis assumes meeting 80% of the 1990 surface water demand with surface water. Thus the cost displayed on this line is arrived at by multiplying 80% of the demand by the Corporation's surface water price of $.67 per thousand gallons.

- Capital Cost

  This is the cost of amortizing debt for construction of each entity's share of the treatment plant and the conveyance system as computed from Table No. 3.

- Reduced Groundwater Cost

  This is the cost savings enjoyed by those entities which convert almost entirely to surface water. This cost is computed at $.20/thousand gallons.

- Groundwater Equalization

  As previously discussed, in order to equalize costs, entities which convert entirely to surface water should assist those entities remaining on groundwater sharing some of their savings due to reduced groundwater production. By making this adjustment, all entities have the financial requirements of 80% surface water and 20% groundwater, regardless of actual conversion rate. Entities converting in the first phase see a cost, while entities not converting receive a credit.

- Total Annual Cost

  This is the total net cost of conversion each entity will face annually. It is the net of the additional cost of surface water, reduced costs due to less groundwater pumping, and the annual payment to amortize debt associated with building the conveyance network.

- Water Rate Increase

  This line represents the increased cost of implementing the plan. It is computed by dividing the total annual cost for each entity by the total annual demand.

- New Single Family Rate

  This is an estimate of single family water rates, assuming the increase citied in the previous line, and assuming an average single family water consumption rate of 12,600 gallons per month. The base rate to which the increase is added was developed from a review of each entities' rate ordinance. For industrial entities, this line is omitted.

Table No. 5 is similar to Table No. 3, but is an allocation of capital costs for Phase II. Table No. 6 is similar to Table No. 4, but is a financial analysis of Phase II, assuming 2015 demands.

Inspection of the tables show that, if the Phase I program is financed by the Corporation and obligations are met through water rates, the increase due to the application of Corporation rates applied to total entity consumption can be expected to range from $.73 per thousand gallons to $1.42 per thousand gallons. Assuming an average single family water consumption of 12,600 gallons per month, this increase results in a higher water bill of $9.20 to $18.02 per month. Of the twelve non-industrial entities, only three would be expected to see increases of over $1.00 per thousand gallons.

This rate increase consists of two components. The first is the higher net cost of surface water compared to groundwater. Because the increased cost of surface water as well as the savings due to reduced groundwater pumping is shared equally by all participant entities, this component is $.64 per thousand gallons of demand for all entities. The second component is the cost of amortizing debt incurred for conveyance line construction. This second component will vary among entities, depending on conveyance capacity and length of line required.

SCHEDULE

Attaining HGCSD targets by 1990 will require aggressive action by the Corporation. It is estimated that approximately six months will be required to design the described facilities with about one and one-half years required for construction. To meet the conversion target deadline, the Corporation should move forward to select an institutional vehicle and negotiate financing arrangements so that design can be initiated by January 1988.

SECTION V

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The construction of a major expansion of the City of Houston's East Water Purification is nearing completion. This facility will make available significant amounts of additional surface water for expanded service to the City of Houston as well as the North Channel Water Supply Corporation. The delivery of this treated surface water to all participating entities of the Corporation will require the construction of a conveyance system estimated to cost approximately $9.1 million.

A regional implementation approach would allow a phased program of construction reducing initial project cost to $6.9 million and providing flexibility in the phasing and sizing of future system components. Any plan for conversion to surface water will result in increased cost to the consumer in one form or another. The cost of development and treatment of surface water is three to four times the cost of groundwater. If the cost of this plan is to be recovered in water rates, first phase water rates for corporation participants would increase from about $.75 per thousand gallons to about $1.45 per thousand gallons of water demand.

The cost basis of treated surface water is sensitive to the peak demand required. This is true whether the Corporation purchases treated water from the City of Houston (because of the application of the CFS Formula) or the Corporation purchases capacity in a water plant (because facility capacity must be purchased to meet peak demand). A program of water conservation to reduce peak demands will tend to reduce the cost of surface water to Corporation customers.

RECOMMENDATIONS

From this analysis of the requirements for surface water conversion for the North Channel Area, the following specific recommendations are made:

1. The implementation plan proposed in this report should be adopted by the North Harris County Water Supply Corporation.

2. Once adopted by the Corporation, the plan should be submitted to the Harris-Galveston Coastal Subsidence District for approval.

3. The Corporation should begin immediately to evaluate the institutional vehicles available for use in program implementation including but not limited to continuing to use a non-profit water supply corporation or the creation of a regional services district.

4. Authorize the attorney for the Corporation to define the contractual requirements necessary between the selected regional entity and the individual participating entities for program implementation.

5. Initiate discussions with the Texas Water Development Board regarding the potential for financial assistance in connection with financing of the engineering and construction of the initial project.

6. Initiate detailed engineering design of the project by January, 1988 in order to insure surface water delivery to the North Channel Area by 1990.

7. As the surface water conversion program moves forward, the Corporation should work with its customers to encourage water conservation.

TABLES

TABLE NO. 1

ESTIMATED CAPITAL COSTS
ULTIMATE SYSTEM

	ITEM	QUANTITY	UNIT	UNIT COST	TOTAL COST
1.	36" Waterline	8,700	L.F.	$ 138.00	$1,200,600
2.	30" Waterline	7,800	L.F.	109.00	850,200
3.	24" Waterline	9,900	L.F.	50.00	495,000
4.	20" Waterline	28,300	L.F.	35.00	990,500
5.	16" Waterline	26,100	L.F.	25.00	652,500
6.	12" Waterline	31,900	L.F.	20.00	638,000
7.	8" Waterline	16,300	L.F.	14.00	228,200
Appurtenances (30%)					1,516,500
ROW & Crossings					985,830
	Subtotal				$7,557,330
Contingencies (10%)					755,730
Engineering (10%)					831,300
	Total Construction Cost				$9,144,360

TABLE NO. 2

NORTH CHANNEL WATER SUPPLY CORPORATION
PRELIMINARY COST ESTIMATE - ULTIMATE SYSTEM

LINE SEGMENT	TOTAL COST	CAPACITY OWNED (MGD)						
		WCID 36	FWSD 51	PINE TRAILS	ROYALWOOD	HCMUD 285	GRIZZARD	HCMUD 53
A-1	$2,192,400	2.2	2.6	0.8	1.8	0.7	3.3	2.2
B-1	455,400	2.2	2.6	0.8	1.8	0.7	3.3	2.2
*	108,000	2.2						
B-2	1,089,000		2.6	0.8	1.8	0.7	3.3	2.2
B-3	220,500		1.3	0.8	1.8	0.7	0.9	
*	5,040		1.3					
B-4	132,300			0.8	1.8	0.7	0.9	
F-2	273,600			0.8				
F-1	88,200							
B-5	346,500				1.8			
*	90,000				1.8			
F-3	126,000					0.7	0.9	
*	50,400					0.7		
F-4	97,200						0.9	
E-3	99,000						2.4	
*	25,200							1.1
E-2	63,000						2.4	1.1
*	85,680							1.1
E-1	220,500						2.4	2.2
D-1	288,000		1.3				2.4	2.2
*	36,000		1.3					
D-2	468,000						2.4	2.2
D-3	238,500							
*	5,040							
D-4	283,500							
C-4	151,200							
*	30,240							
C-3	64,800							
*	9,000							
C-2	85,500							
C-1	112,500							
*	120,960							
A-4	630,000							
*	54,000							
A-3	516,600							
*	147,600							
A-2	135,000							
	$9,144,360							

*Service Lines

TABLE NO. 2 - CONTINUED

NORTH CHANNEL WATER SUPPLY CORPORATION
PRELIMINARY COST ESTIMATE - ULTIMATE SYSTEM

LINE SEGMENT	CAPACITY OWNED (MGD)							
	FWSD 47	WCID 84	WCID 21	FWSD 6	JACINTOPORT	HADEN ROAD	HUNTERWOOD MUD	TOTAL
A-1	0.9	1.1	3.1	0.5	2.2	1.6	0.5	23.5
B-1	0.9	1.1	0.2				0.5	16.3
*								2.2
B-2	0.9	1.1	0.2				0.5	14.1
B-3							0.5	6.0
*								1.3
B-4							0.5	4.7
F-2							0.5	1.3
F-1							0.5	0.5
B-5								1.8
*								1.8
F-3								1.6
*								0.7
F-4								0.9
E-3								2.4
*								1.1
E-2								3.5
*								1.1
E-1								4.6
D-1	0.9	1.1	0.2					8.1
*								1.3
D-2	0.9	1.1	0.2					6.8
D-3	0.9	1.1	0.2					2.2
*	0.9							0.9
D-4		1.1	0.2					1.3
C-4		1.1						1.1
*		1.1						1.1
C-3			0.2					0.2
*			3.1					3.1
C-2			2.9					2.9
C-1			2.9					2.9
*				0.5				0.5
A-4			2.9	0.5				3.4
*					2.2			2.2
A-3			2.9	0.5	2.2			5.6
*						1.6		1.6
A-2			2.9	0.5	2.2	1.6		7.2

*Service Lines

TABLE NO. 3

PHASE I CAPITAL COST ALLOCATION

	WCID 36	FWSD 51	PINE TRAILS	ROYALWOOD	HCMUD 285	GRIZZARD	HCMUD 53
Capital Cost							
Treatment Plant	$1,200,000	$2,100,000	$ 600,000	$ 400,000	$ 100,000	$ 500,000	$1,100,000
Conveyance Lines	374,412	651,050	379,062	474,058	289,880	1,192,975	902,397
Financed Cost							
Treatment Plant	1,363,636	2,386,364	681,818	454,545	113,636	568,182	1,250,000
Conveyance lines	425,468	739,830	430,752	538,702	329,409	1,355,655	1,025,451
Annual Capital Cost							
Treatment Plant	117,014	204,775	58,507	39,005	9,751	48,756	107,263
Conveyance Lines	36,510	63,485	36,963	46,226	28,267	116,329	87,994

TABLE NO. 3 - CONTINUED

PHASE I CAPITAL COST ALLOCATION

	FWSD 47	WCID 84	WCID 21	FWSD 6	JACINTOPORT	HADEN ROAD	HUNTERWOOD MUD	TOTAL
Capital Cost								
Treatment Plant	$ 600,000	$ 500,000	$1,500,000	$ 200,000	$ 700,000	$1,300,000	$ 200,000	$11,000,000
Conveyance Lines	375,170	873,704	524,593	56,022	246,496	326,869	236,911	6,903,600
Financed Cost								
Treatment Plant	681,818	568,182	1,704,545	227,273	795,455	1,477,273	227,273	12,500,000
Conveyance Lines	426,330	992,845	596,128	63,661	280,109	371,442	269,217	7,845,000
Annual Capital Cost								
Treatment Plant	58,507	48,756	146,268	19,502	68,258	126,766	19,502	1,072,631
Conveyance Lines	36,584	85,197	51,154	5,463	24,036	31,874	23,102	673,184

TABLE NO. 4

PHASE I FINANCIAL ANALYSIS

	WCID 36	FWSD 51	PINE TRAILS	ROYALWOOD	HCMUD 285	GRIZZARD	HCMUD 53
Demand (MGD)	1.2	2.1	0.6	0.4	0.1	0.5	1.1
Surface Water Cost (80% of Demand)	$ 234,768	$ 410,844	$ 117,384	$ 78,256	$ 19,564	$ 97,820	$ 215,204
Capital Cost							
Treatment Plant	117,014	204,775	58,507	39,005	9,751	48,756	107,263
Conveyance Lines	36,510	63,485	36,963	46,226	28,267	116,329	87,994
Reduced Groundwater Cost (98% of Surface Water Supplied Entity Demand)	(85,653)	(149,893)	(42,827)	-0-	(7,138)	-0-	(78,516)
Groundwater Equalization							
Cost	15,573	27,253	7,787	-0-	1,298	-0-	14,276
Credit	-0-	-0-	-0-	(23,360)	-0-	(29,200)	-0-
Total Annual Cost	$ 318,212	$ 556,464	$ 177,814	$ 140,127	$ 51,742	$ 233,705	$ 346,221
Water Rate Increase Over Current Rates ($ per 1,000 gallons)	$0.73	$0.73	$0.81	$0.96	$1.42	$1.28	$0.86
New Single Family Rate* ($ per 1,000 gallons)	$1.79	$1.57	$1.94	$1.96	$2.74	-	$2.05

*Based on 12,600 gallons per month

TABLE NO. 4 - CONTINUED

PHASE I FINANCIAL ANALYSIS

	FWSD 47	WCID 84	WCID 21	FWSD 6	JACINTOPORT	HADEN ROAD	HUNTERWOOD MUD	TOTAL
Annual Demand (MGD)	0.6	0.5	1.5	0.2	0.7	1.3	0.2	11.0
Surface Water Cost (80% of Demand)	$ 117,384	$ 97,820	$ 293,460	$ 39,128	$ 136,948	$ 254,332	$ 39,128	$ 2,152,040
Capital Cost								
Treatment Plant	58,507	48,756	146,268	19,502	68,258	126,766	19,502	1,072,631
Conveyance Lines	36,584	85,197	51,154	5,463	24,036	31,874	23,102	673,184
Reduced Groundwater Cost (98% of Surface Water-Supplied Entity Demand)	(42,827)	(35,689)	(107,067)	-0-	-0-	(92,791)	-0-	($ 642,400)
Groundwater Equalization								
Cost	7,787	6,489	19,467	-0-	-0-	16,871	-0-	$ 116,800
Credit	-0-	-0-	-0-	(11,680)	(40,880)	-0-	(11,680)	(116,800)
Total Annual Cost	$ 177,435	$ 202,573	$ 403,282	$ 52,413	$ 188,362	$ 337,052	$ 70,052	$ 3,255,455
Water Rate Increase Over Current Rates ($ per 1,000 gallons)	$0.81	$1.11	$0.74	$0.72	$0.74	$0.71	$0.96	
New Single Family Rate* ($ per 1,000 gallons)	$1.82	$2.05	$2.05	$2.07	-	-	$2.51	-

*Based on 12,600 gallons per month

TABLE NO. 5

PHASE II CAPITAL COST ALLOCATION

	WCID 36	FWSD 51	PINE TRAILS	ROYALWOOD	HCMUD 285	GRIZZARD	HCMUD 53
Capital Cost							
Treatment Plant	$ 800,000	$ 400,000	$ 200,000	$1,200,000	$ 500,000	$2,300,000	$ 900,000
Conveyance Lines	-0-	-0-	-0-	436,500	-0-	196,200	-0-
Financed Cost							
Treatment Plant	909,091	454,545	227,273	1,363,636	568,182	2,613,636	1,022,727
Conveyance Lines	-0-	-0-	-0-	496,023	-0-	222,955	-0-
Annual Capital Cost							
Treatment Plant	78,101	39,005	19,502	117,014	48,756	224,277	87,761
Conveyance Lines	-0-	-0-	-0-	42,564	-0-	19,132	-0-

TABLE NO. 5 - CONTINUED

PHASE II CAPITAL COST ALLOCATION

	FWSD 47	WCID 84	WCID 21	FWSD 6	JACINTOPORT	HADEN ROAD	HUNTERWOOD MUD	TOTAL
Capital Cost								
Treatment Plant	$ 200,000	$ 500,000	$1,300,000	$ 300,000	$1,300,000	$ 300,000	$ 200,000	$10,400,000
Conveyance Lines	-0-	-0-	1,002,877	259,732	256,950	-0-	88,201	2,240,460
Financed Cost								
Treatment Plant	227,273	568,182	1,477,273	340,909	1,477,273	340,909	227,273	11,818,182
Conveyance Lines	-0-	-0-	1,139,633	295,150	291,989	-0-	100,228	2,545,977
Annual Capital Cost								
Treatment Plant	19,502	48,756	126,766	29,254	126,766	29,254	19,502	1,014,216
Conveyance Lines	-0-	-0-	97,792	25,327	25,056	-0-	8,601	218,472

TABLE NO. 6

PHASE II FINANCIAL ANALYSIS

	WCID 36	FWSD 51	PINE TRAILS	ROYALWOOD	HCMUD 285	GRIZZARD	HCMUD 53
Annual Demand (MGD)	2.0	2.5	0.8	1.6	0.6	2.8	2.0
Surface Water Cost	$ 391,280	$ 489,100	$ 156,512	$ 313,024	$ 117,384	$ 547,792	$ 391,280
Amortization Cost							
Treatment Plant	78,101	39,005	19,502	117,014	48,756	224,277	87,761
Conveyance Lines	-0-	-0-	-0-	42,564	-0-	19,132	-0-
Reduced Groundwater Cost	(116,800)	(146,000)	(46,720)	(93,440)	(35,040)	(163,520)	(116,800)
Groundwater Equalization							
Cost	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Credit	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Total Annual Cost	$ 352,581	$ 382,105	$ 129,294	$ 379,162	$ 131,100	$ 627,681	$ 362,241
Water Rate Increase Over Current Rates ($ per 1,000 gallons)	$0.48	$0.42	$0.44	$0.65	$0.60	$0.61	$0.50
New Single Family Rate* ($ per 1,000 gallons)	$1.54	$1.26	$1.57	$1.65	$1.92	-	$1.69

*Based on 12,000 gallons per month

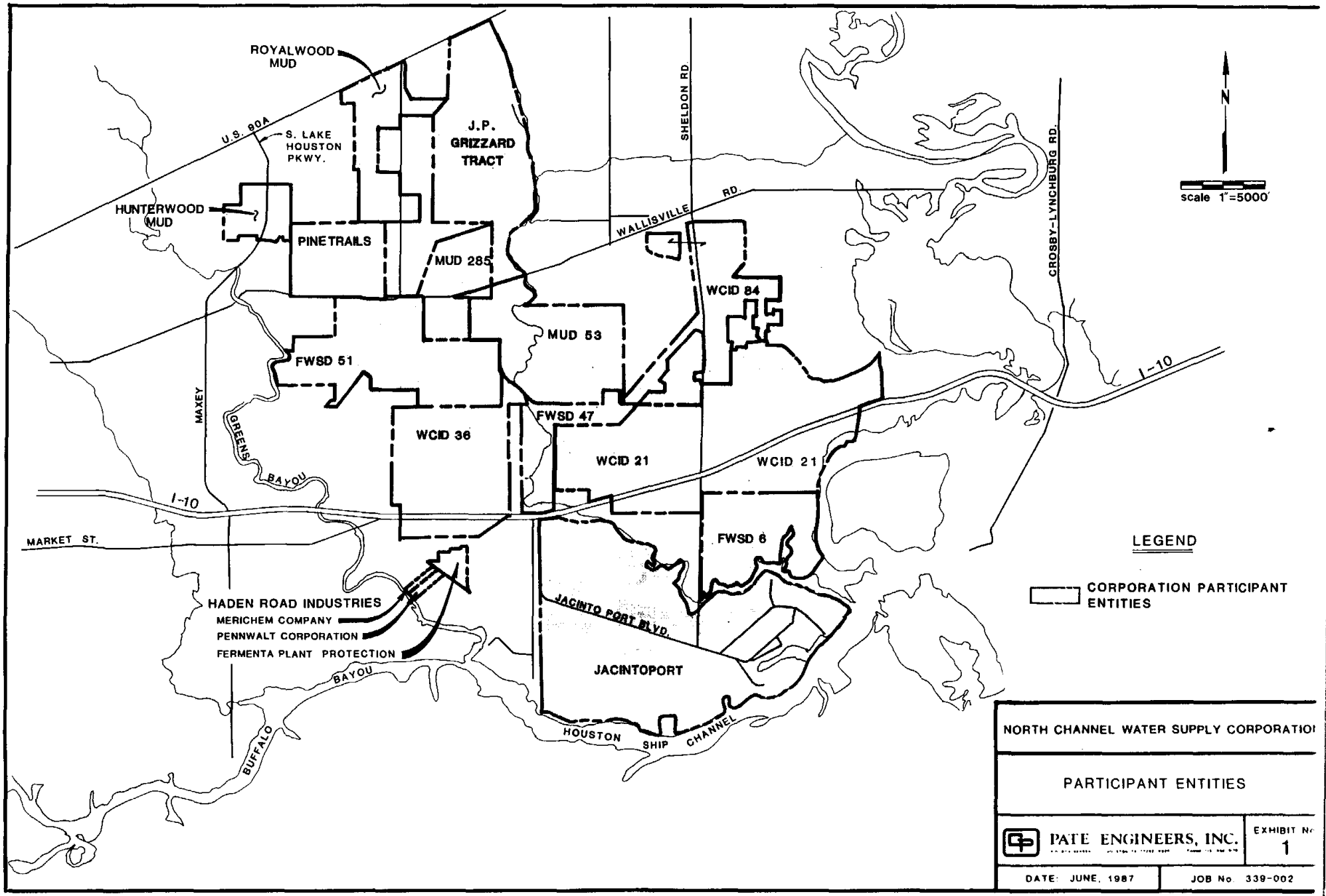
TABLE NO. 6 - CONTINUED

PHASE II FINANCIAL ANALYSIS

	FWSD 47	WCID 84	WCID 21	FWSD 6	JACINTOPORT	HADEN ROAD	HUNTERWOOD MUD	TOTAL
Annual Demand (MGD)	0.8	1.0	2.8	0.5	2.0	1.6	0.4	21.4
Surface Water Cost	$ 156,512	$ 195,640	$ 547,792	$ 97,820	$ 391,280	$ 313,024	$ 78,256	$4,186,696
Amortization Cost								
Treatment Plant	19,502	48,756	126,766	29,254	126,766	29,254	19,502	1,014,216
Conveyance Lines	-0-	-0-	97,792	25,327	25,056	-0-	8,601	218,472
Reduced Ground-Water Cost	(46,720)	(58,400)	(163,520)	(29,200)	(116,800)	(93,440)	(23,360)	(1,249,760)
Groundwater Equalization								
Cost	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Credit	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Total Annual Cost	$ 129,294	$ 185,996	$ 608,830	$ 123,201	$ 426,302	$ 248,838	$ 82,999	$4,169,624
Water Rate Increase Over Current Rates ($ per 1,000 gallons)	$0.44	$0.51	$0.60	$0.68	$0.58	$0.43	$0.57	
New Single Family Rate* ($ per 1,000 gallons)	$1.45	$1.45	$1.91	$2.03	-	-	$2.12	

*Based on 12,600 gallons per month

EXHIBITS



NORTH CHANNEL WATER SUPPLY CORPORATIO

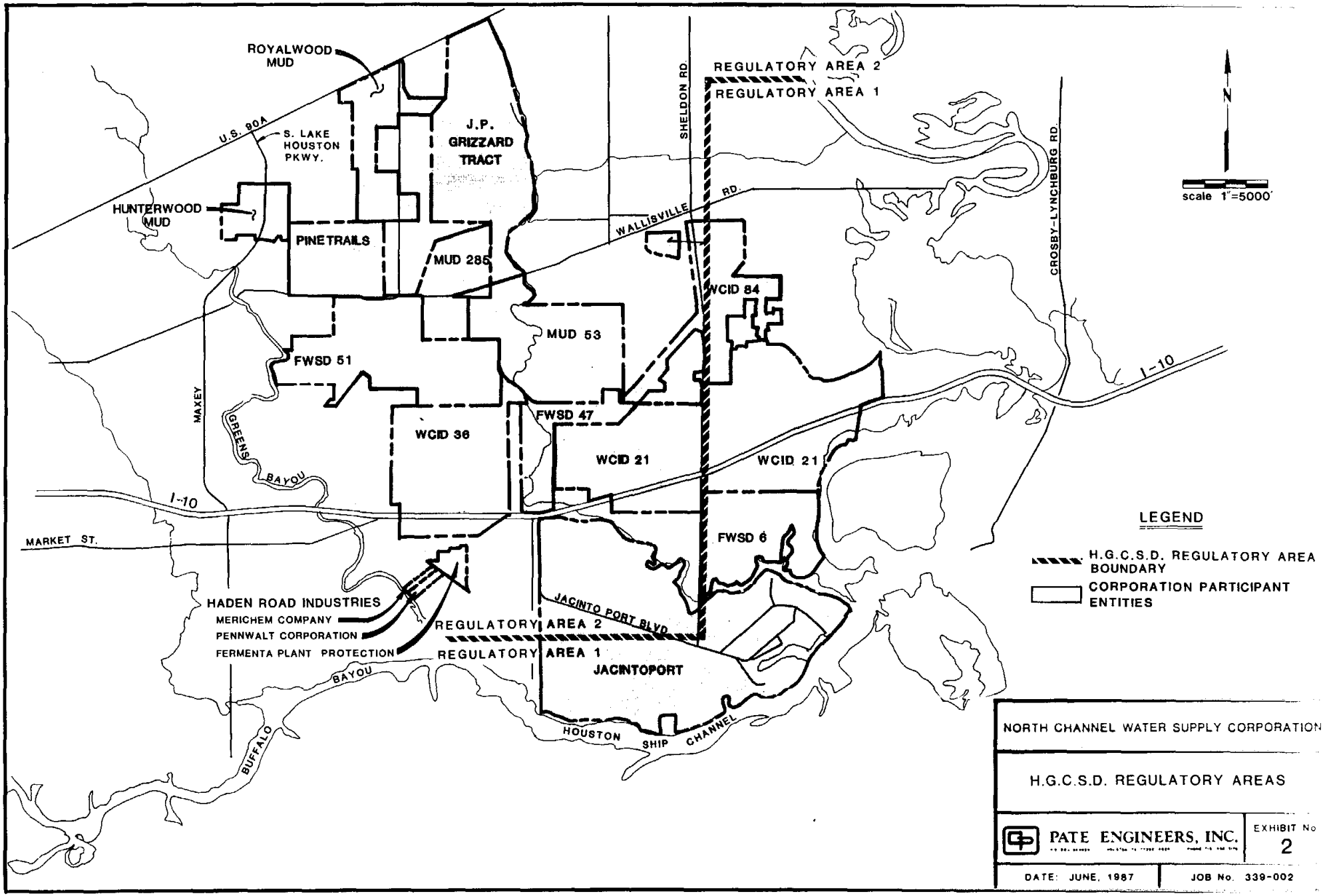
PARTICIPANT ENTITIES

PATE ENGINEERS, INC.

EXHIBIT No. 1

DATE: JUNE, 1987

JOB No. 339-002



NORTH CHANNEL WATER SUPPLY CORPORATION

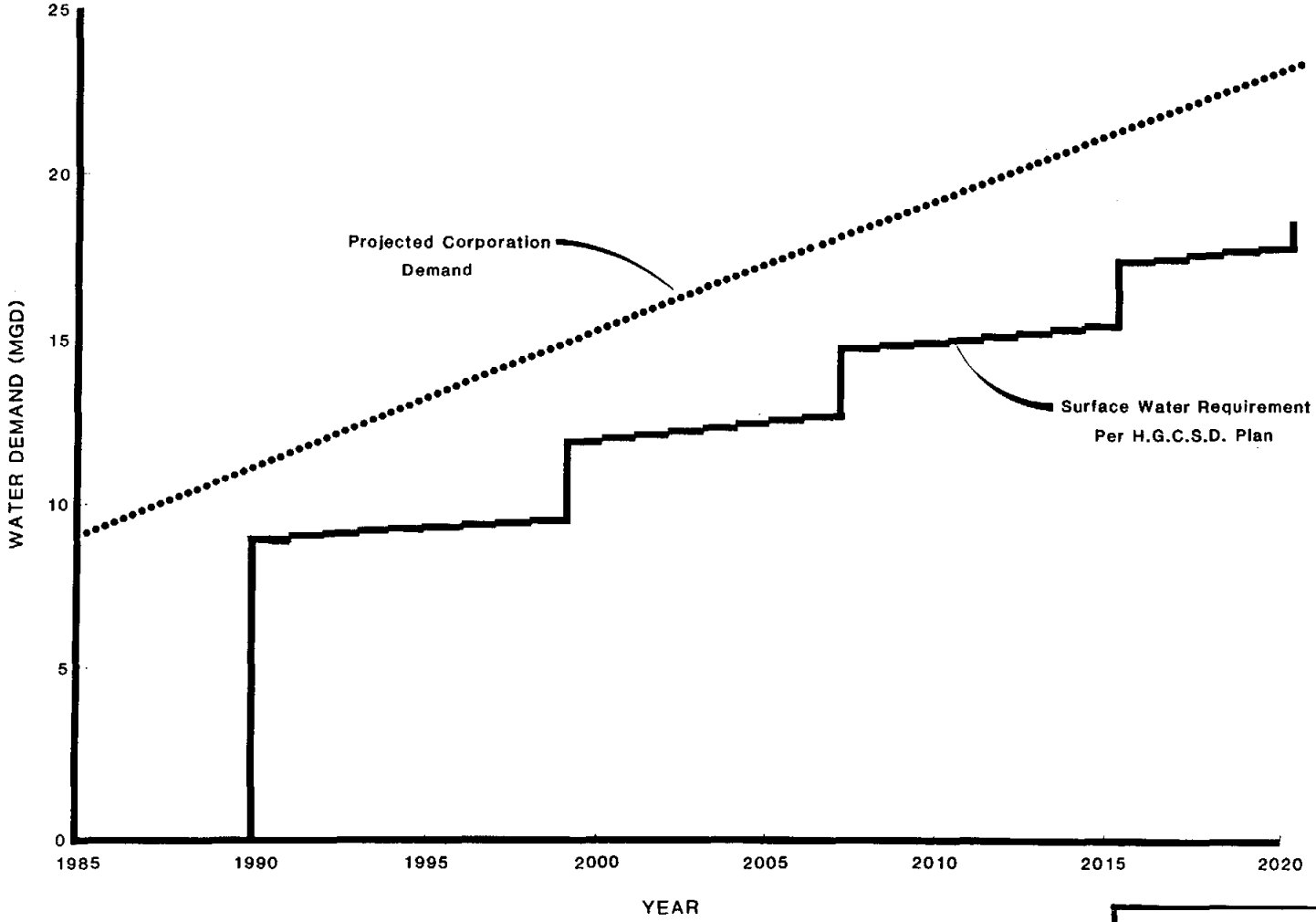
H.G.C.S.D. REGULATORY AREAS

PATE ENGINEERS, INC.

EXHIBIT No 2

DATE: JUNE, 1987

JOB No. 339-002



NORTH CHANNEL WATER SUPPLY CORPORATION

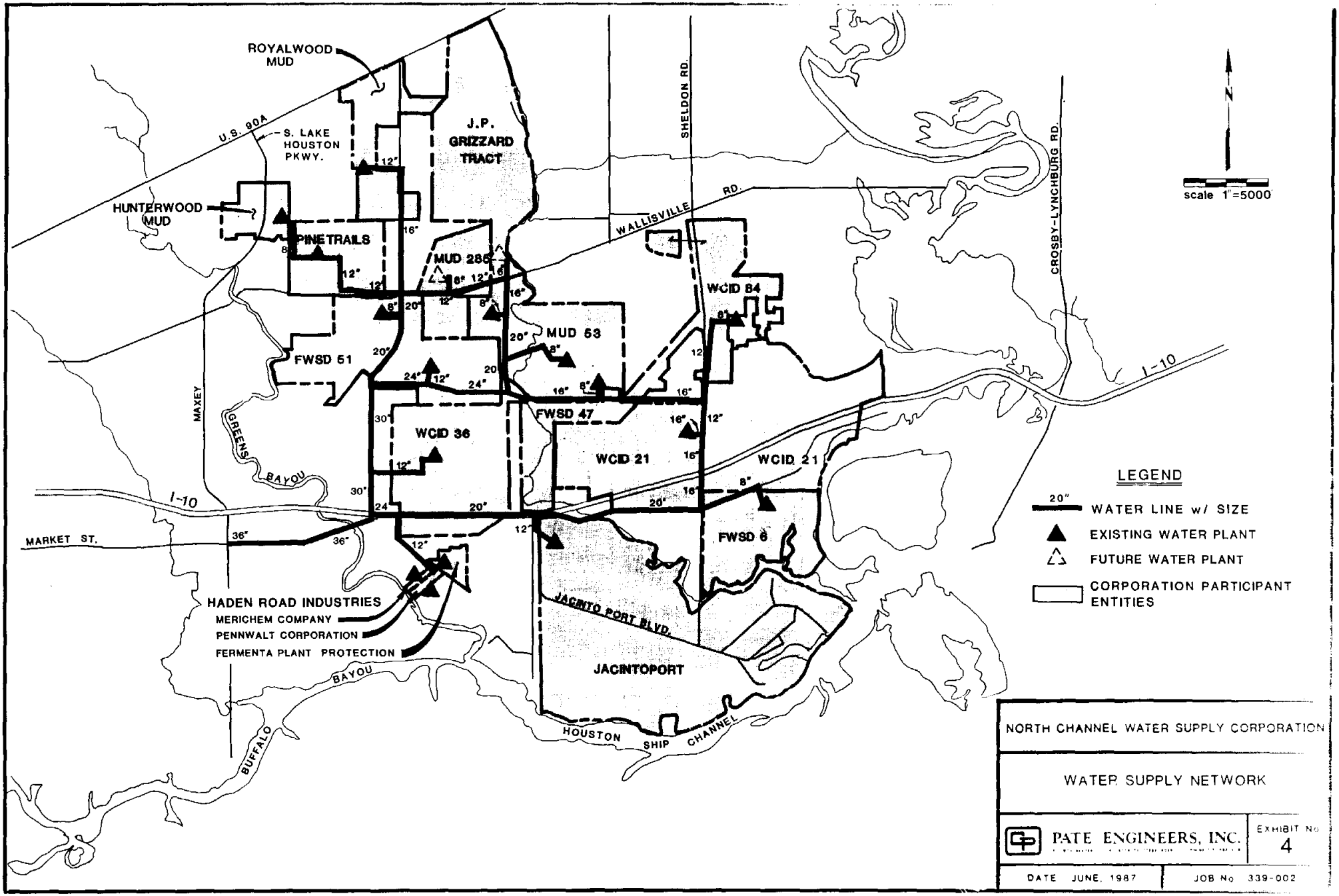
PROJECTED WATER DEMAND
COMPARED TO
H.G.C.S.D. CONVERSION REQUIREMENTS

PATE ENGINEERS, INC.

EXHIBIT No
3

DATE: JUNE, 1987

JOB No. 339-002



NORTH CHANNEL WATER SUPPLY CORPORATION

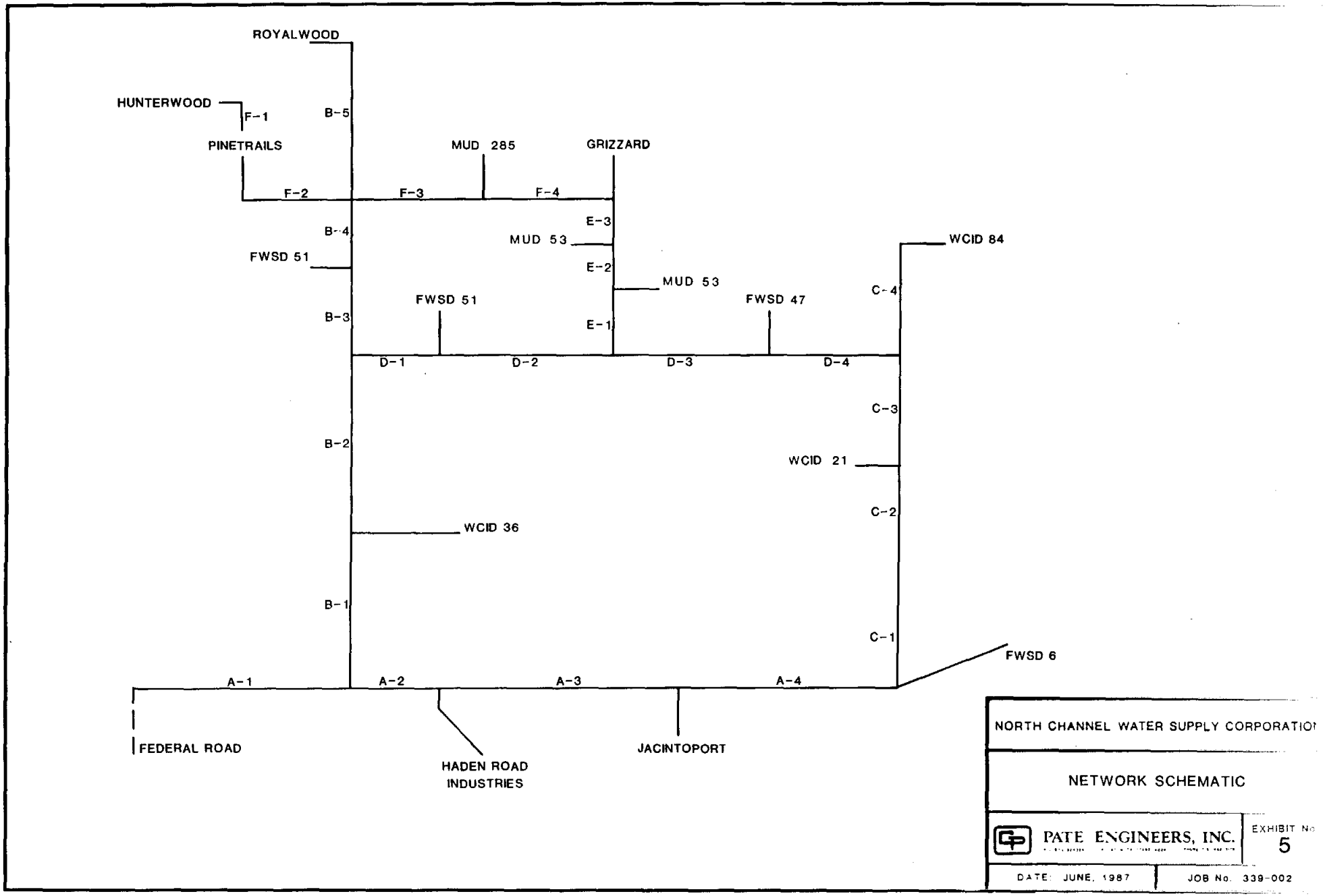
WATER SUPPLY NETWORK

PATE ENGINEERS, INC.

EXHIBIT No. 4

DATE JUNE, 1987

JOB No. 339-002



NORTH CHANNEL WATER SUPPLY CORPORATION

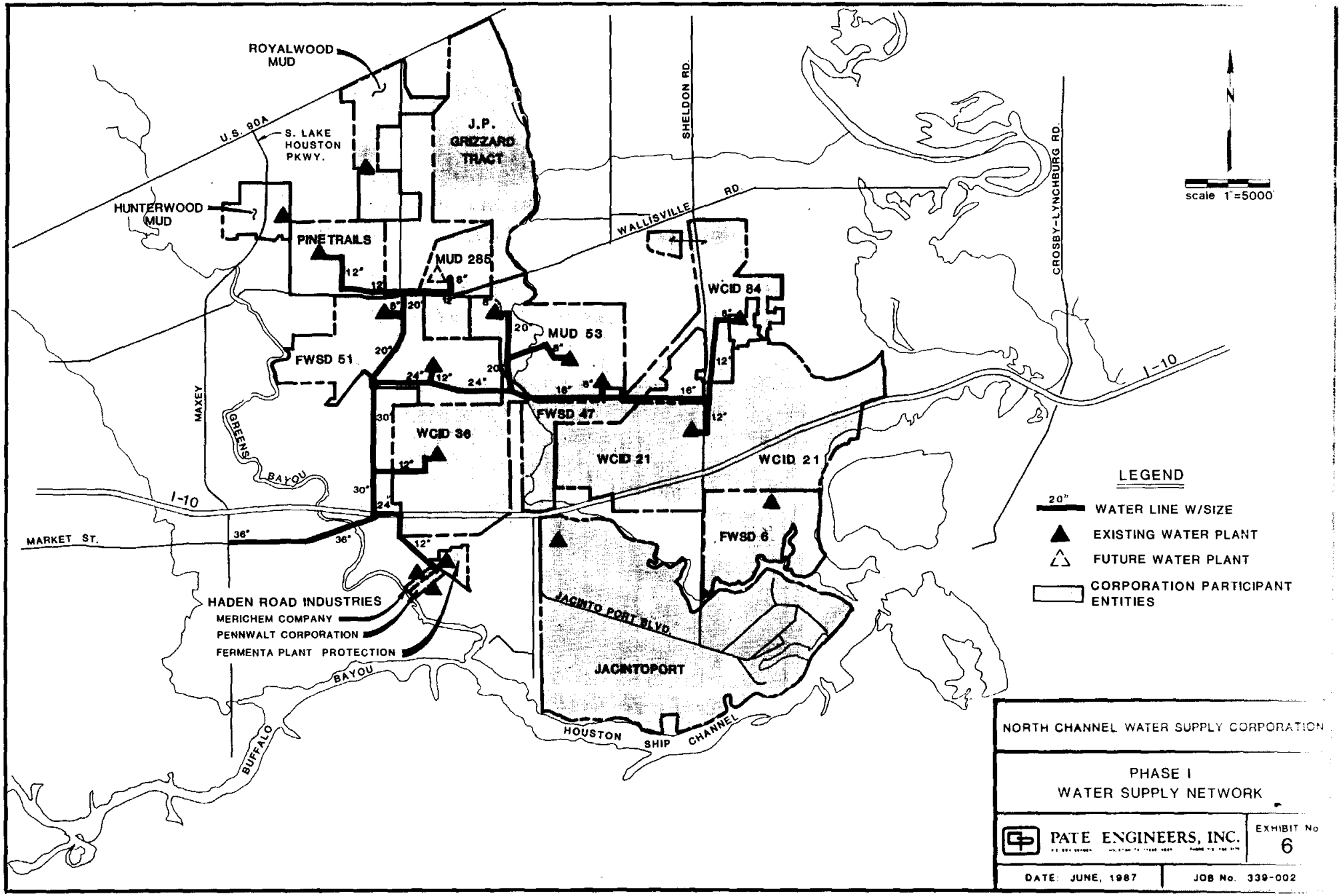
NETWORK SCHEMATIC

PATE ENGINEERS, INC.

EXHIBIT No. 5

DATE: JUNE, 1987

JOB No. 339-002



NORTH CHANNEL WATER SUPPLY CORPORATION

PHASE I
WATER SUPPLY NETWORK

PATE ENGINEERS, INC.

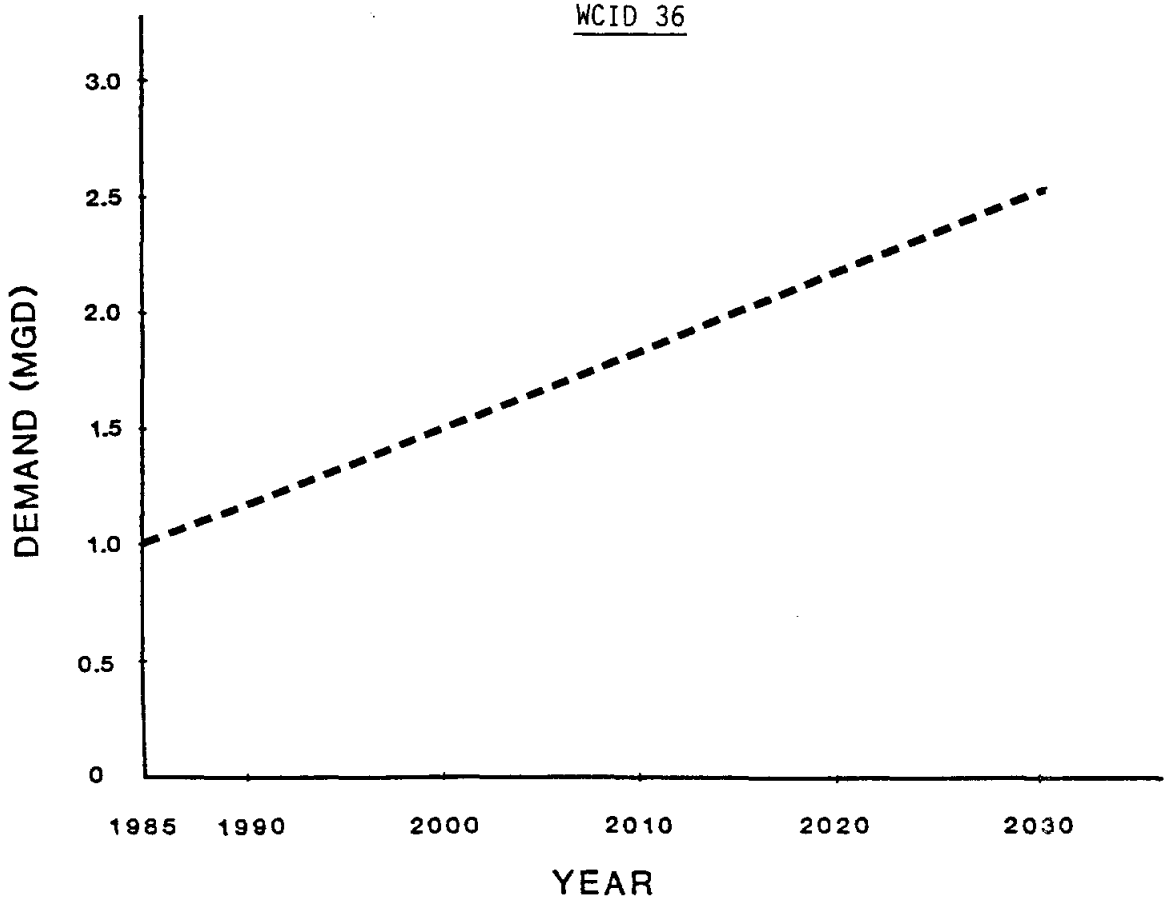
EXHIBIT No 6

DATE: JUNE, 1987

JOB No. 339-002

APPENDIX A

WCID 36



GENERAL DESCRIPTION: Residential/Mixed-Use Commercial
Approx. 1100 Ac.

1985 PUMPAGE: 1.0 MGD

BUILT OUT DEMAND PROJECTION:

based on aerial photographs

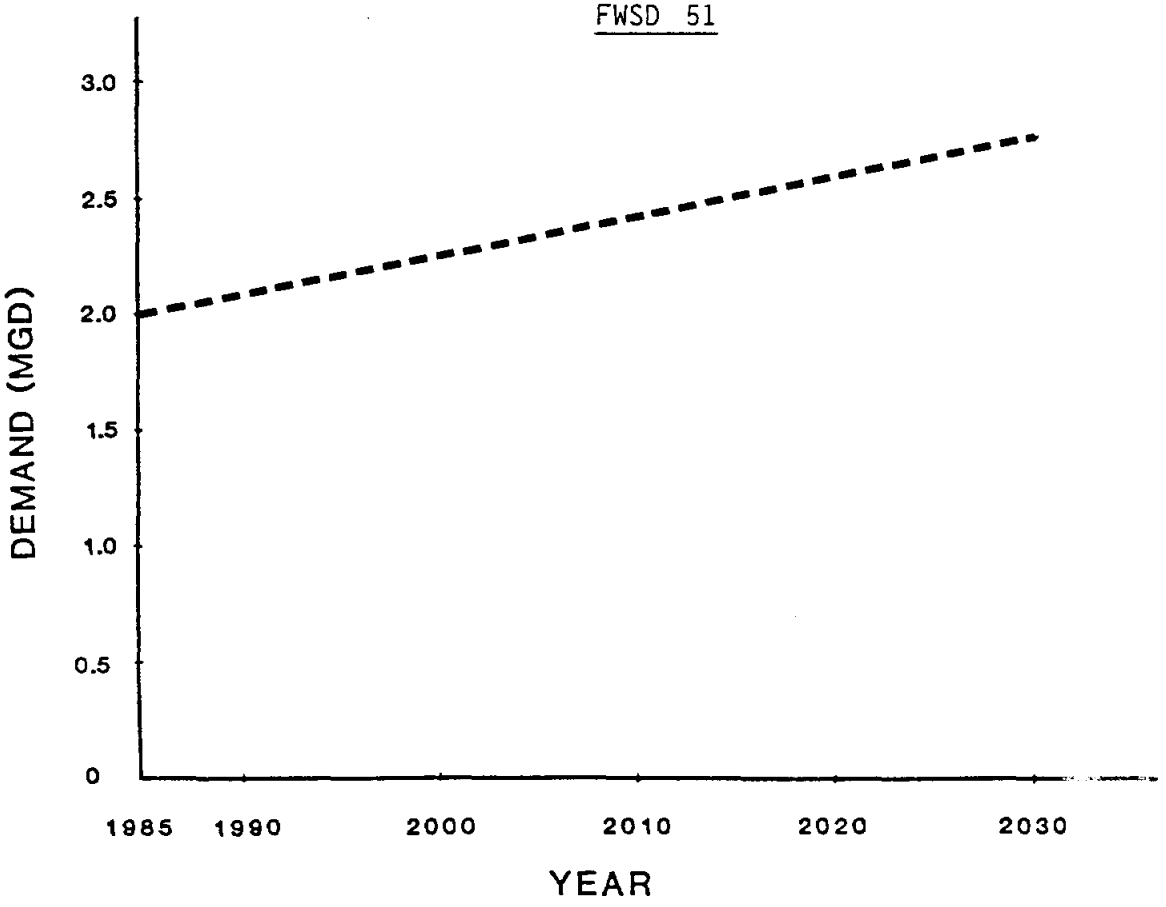
(1100 Ac.) (90%) Residential	@ 5 ESFC/Ac.	4950	
(1100 Ac.) (10%) Commercial	@ 10 ESFC/Ac.	1100	
		6050	ESFC

(6050) ESFC (420) gpd/ESFC = 2.6 MGD

ULT. STORAGE PER TDH = (6050) ESFC (200) = 1.21 MG

EXIST. STORAGE = Approx. 1.2 MG

FWSD 51



GENERAL DESCRIPTION: Residential and Mixed-Use Commercial
Approx. 1200 Ac.

1985 PUMPAGE: 2.0 MGD

BUILT OUT DEMAND PROJECTION:

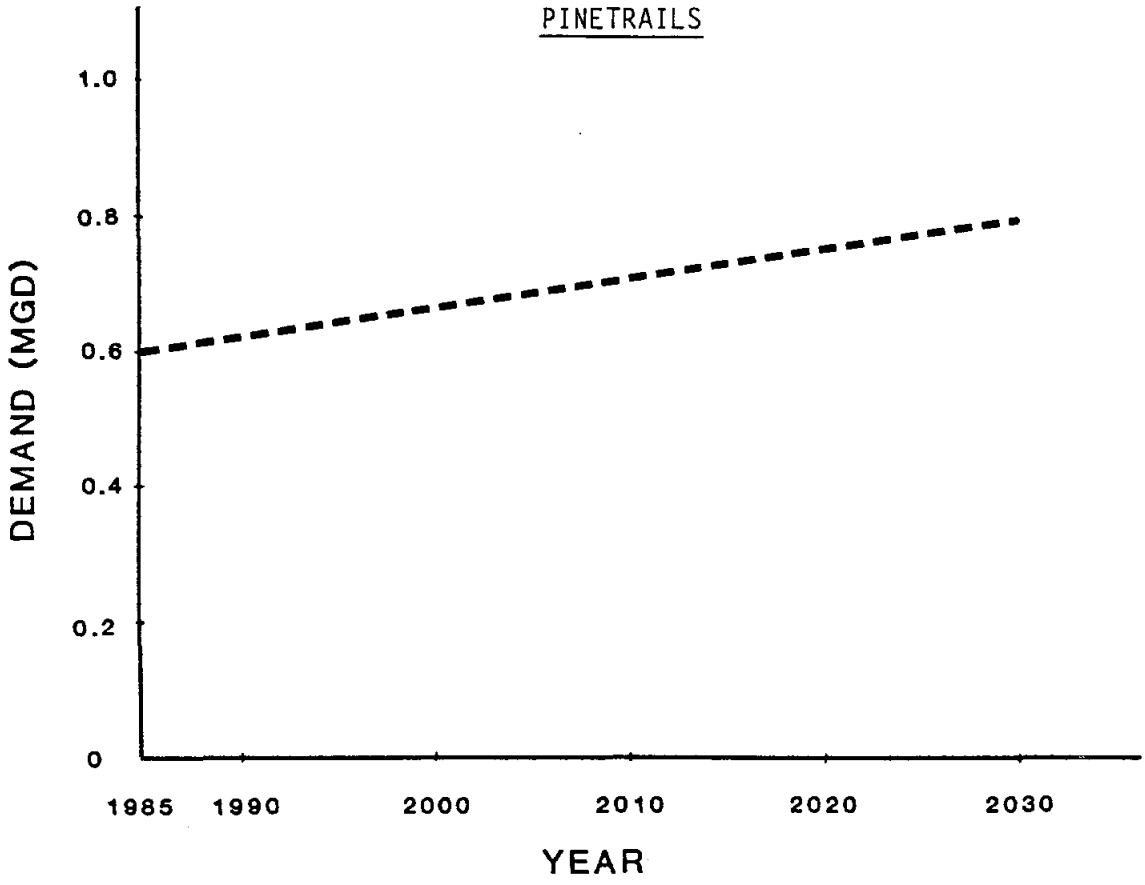
based on land plan

926.4 Ac. Residential	@ 5 ESFC/Ac.	4632	
185.2 Ac. Commercial	@ 10 ESFC/Ac.	1852	
9.2 Ac. Multi-Family	@ 15 ESFC/Ac.	138	
19.8 Ac. School	@ 2 ESFC/Ac.	40	
46.4 Ac. Park	@ 0 ESFC/Ac.	0	
		6662	ESFC

(6662) ESFC (420) gpd/ESFC = 2.8 MGD

ULT. STORAGE PER TDH = (6662) ESFC (200) = 1.33 MG

EXIST. STORAGE = 2.1 MG



GENERAL DESCRIPTION: Predominantly Single Family, nearly built out
Approx. 550 Ac.

1985 PUMPAGE: 0.6 MGD

BUILT OUT DEMAND PROJECTION:

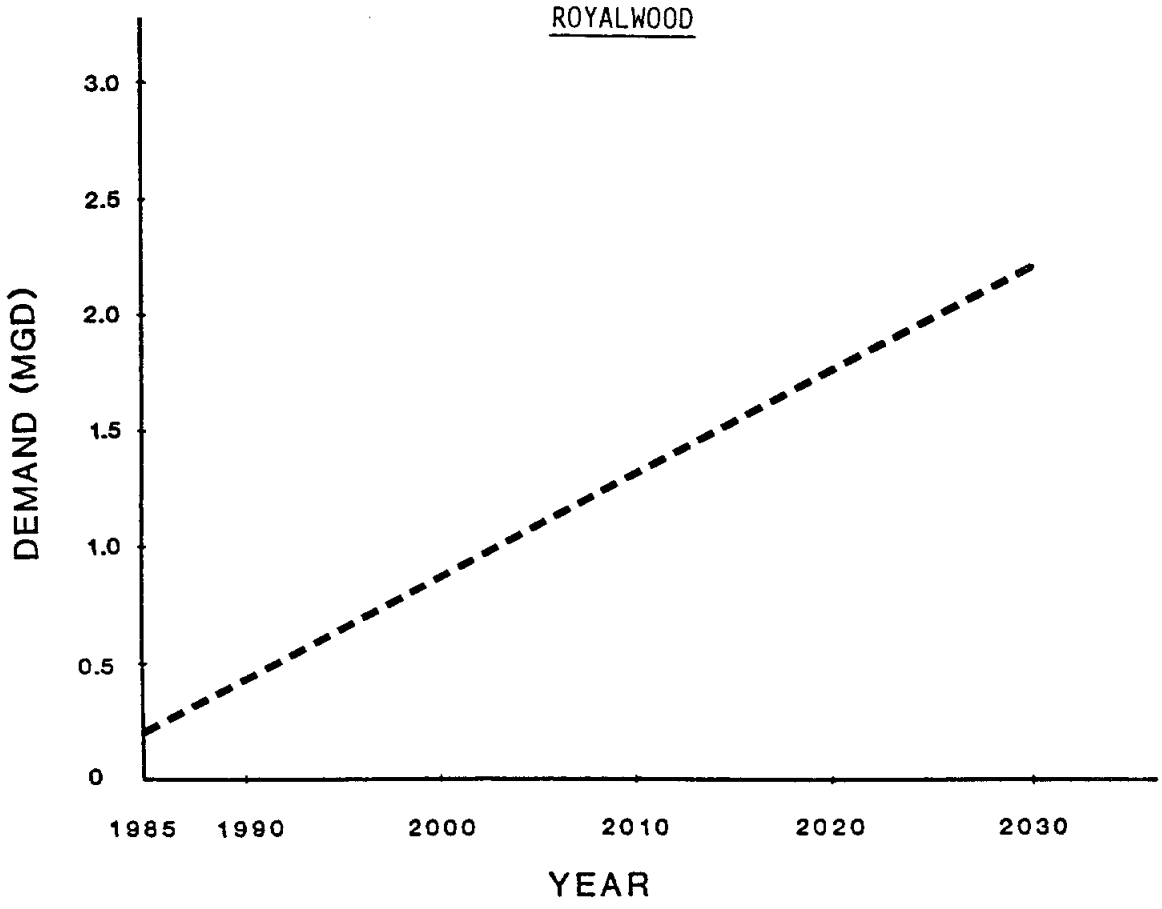
based on

Existing use plus 30% built out increase

= 0.8 MGD

ULT. STORAGE PER TDH = (1905) ESFC (200) = 0.38 MG

EXIST. STORAGE = 0.5 MG



GENERAL DESCRIPTION: Existing Residential Approx. 100 Ac.
Proposed Mixed-Use Commercial Approx. 480 Ac.

1985 PUMPAGE: 0.2 MGD

BUILT OUT DEMAND PROJECTION:

based on conceptual land plan

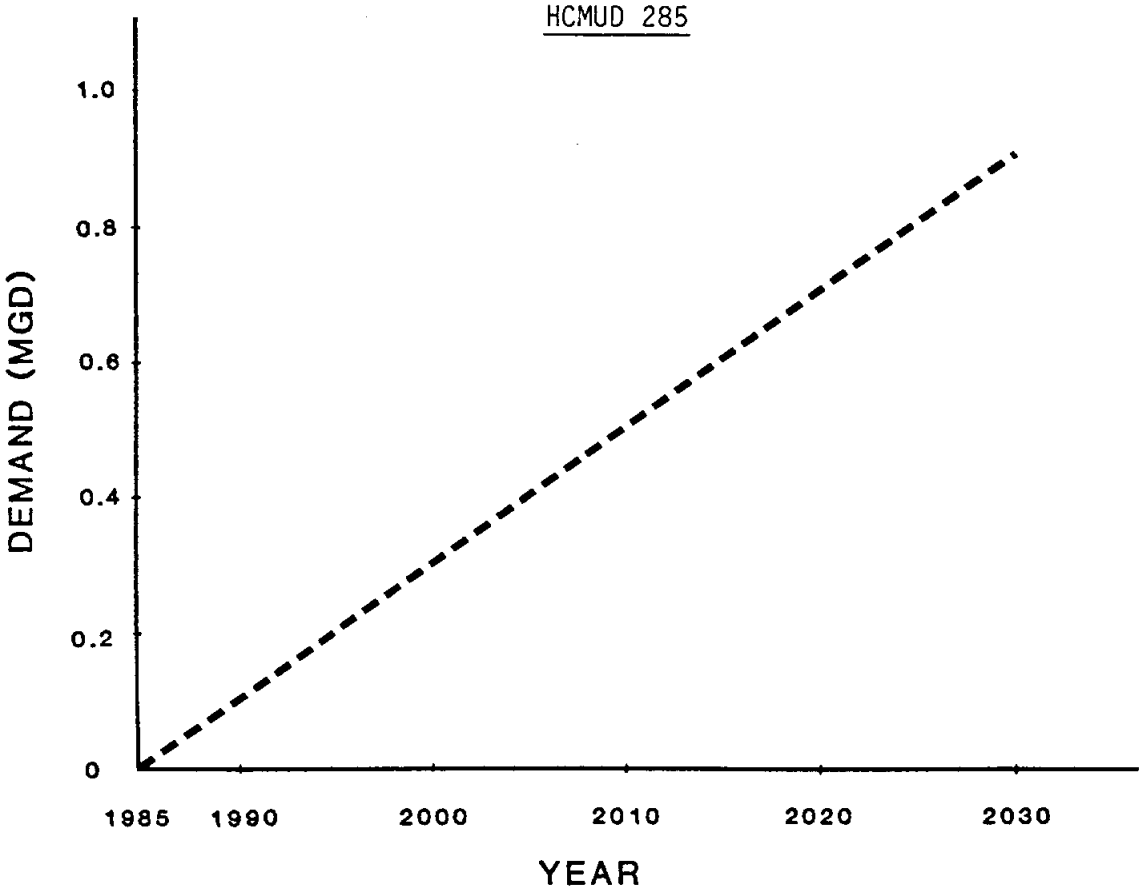
100 Ac. Residential	@ 5 ESFC/Ac.	500	
480 Ac. Commercial	@ 10 ESFC/Ac.	4800	
		5300	ESFC

(5300) ESFC (420) gpd/ESFC = 2.2 MGD

ULT. STORAGE PER TDH = (5300) ESFC (200) = 1.06 MG

EXIST. STORAGE = 1.68 MG

HCMUD 285



GENERAL DESCRIPTION: Approx. 367 Ac. currently undeveloped

1985 PUMPAGE: -0-

BUILT OUT DEMAND PROJECTION:

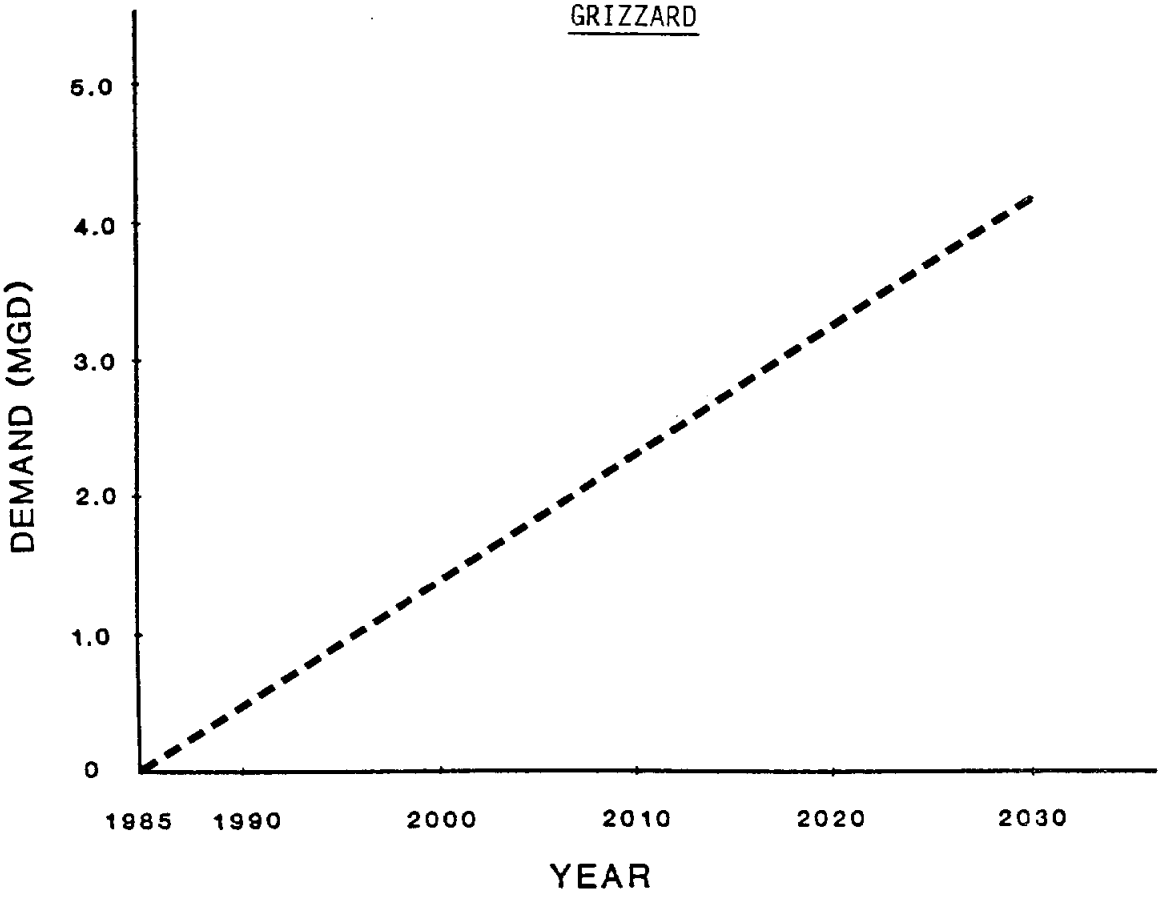
based on creation plan

254.4 Ac. Residential	@ 5 ESFC/Ac.	1272	
72.6 Ac. Commercial	@ 10 ESFC/Ac.	726	
40.0 Ac. School	@ 2 ESFC/Ac.	80	
		2078	ESFC

(2078) ESFC (420) gpd/ESFC = 0.9 MGD

ULT. STORAGE PER TDH = (2078) ESFC (200) = 0.42 MG

EXIST. STORAGE = -0-



GENERAL DESCRIPTION: Approx. 1,000 Ac. currently undeveloped

1985 PUMPAGE: -0-

BUILT OUT DEMAND PROJECTION:

based on Developer's projection of mixed-use commercial

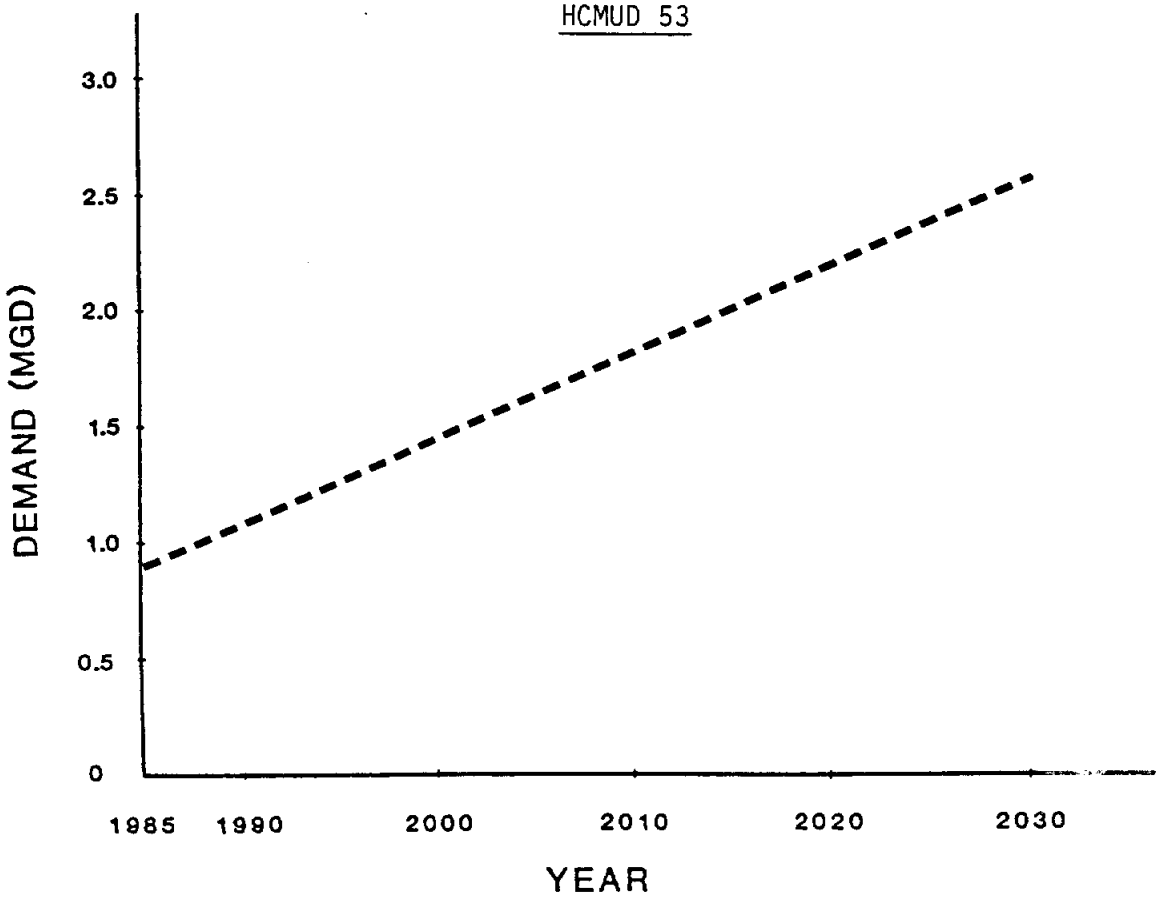
1,000 Ac. Commercial @ 10.0 ESFC/Ac. 10,000 ESFC

(10,000) ESFC (420) gpd/ESFC = 4.2 MGD

ULT. STORAGE PER TDH = (10,000) ESFC (200) = 2.0 MG

EXIST. STORAGE = -0-

HCMUD 53



GENERAL DESCRIPTION: Residential and Mixed-Use Commercial
Approx. 1100 Ac.

1985 PUMPAGE: 0.9 MGD

BUILT OUT DEMAND PROJECTION:

based on District Engineer's projections

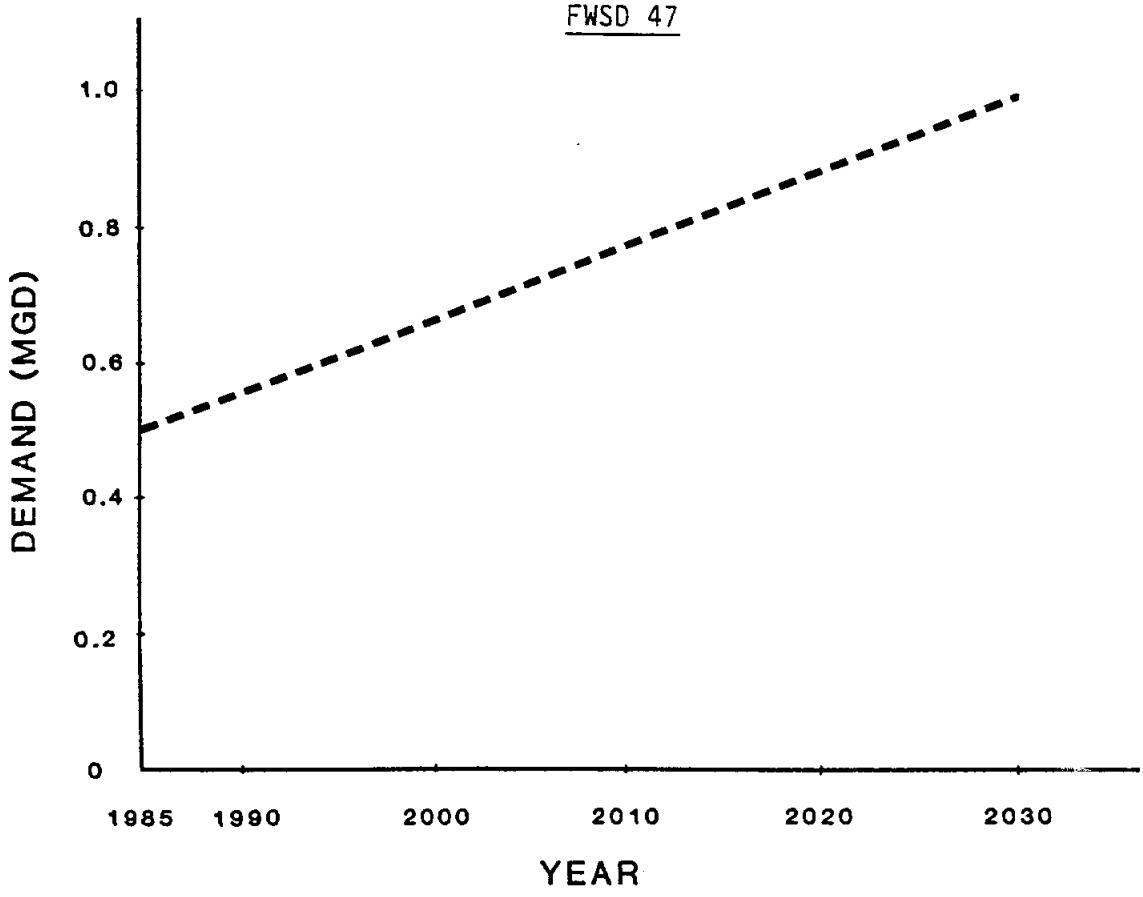
805 Ac. Residential	@ 5 ESFC/Ac.	4025	
95 Ac. Commercial	@ 10 ESFC/Ac.	950	
75 Ac. Multi-Family	@ 15 ESFC/Ac.	1125	
		6100	ESFC

(6100) ESFC (420) gpd/ESFC = 2.6 MGD

ULT. STORAGE PER TDH = (6115) ESFC (200) = 1.22 MG

EXIST. STORAGE = 1.59 MG

FWSD 47



GENERAL DESCRIPTION: Residential/Mixed-Use Commercial
Approx. 500 Ac.

1985 PUMPAGE: 0.5 MGD

BUILT OUT DEMAND PROJECTION:

based on aerial photographs

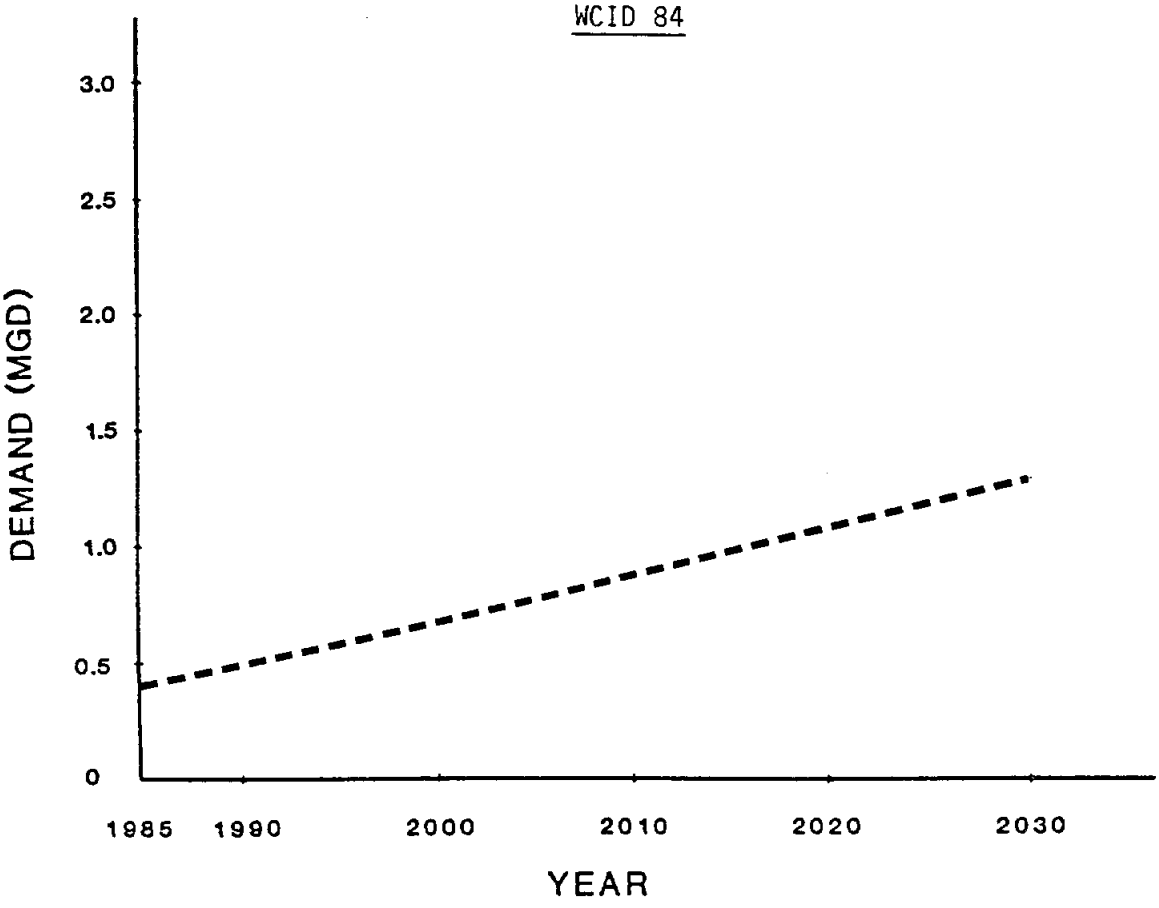
435 Ac. Residential	@ 5 ESFC/Ac.	2175
20 Ac. Commercial	@ 10 ESFC/Ac.	200
		2375 ESFC

(2375) ESFC (420) gpd/ESFC = 1.0 MGD

ULT. STORAGE PER TDH = (2375) ESFC (200) = 0.48 MG

EXIST. STORAGE = 1.0 MG

WCID 84



GENERAL DESCRIPTION: Residential/Mixed Use Commercial
Approx. 730 Ac.

1985 PUMPAGE: 0.4 MGD

BUILT OUT DEMAND PROJECTION:

based on District Engineer's projections

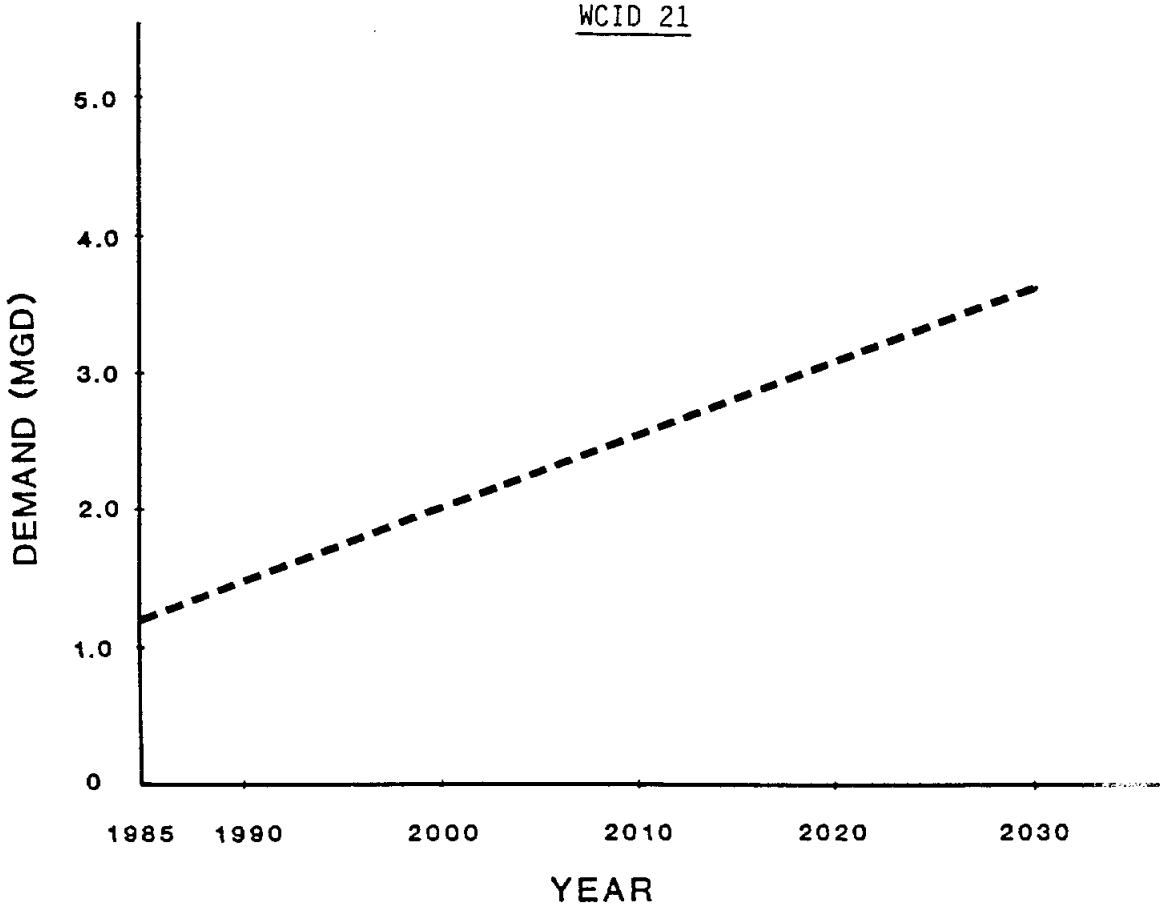
136 Ac. Residential	@ 5 ESFC/Ac.	680	
213 Ac. Commercial	@ 18 ESFC/Ac.	1704	
347 Ac. Industrial	@ 1.85 ESFC/Ac.	642	
		3026	ESFC

(3026) ESFC (420) gpd/ESFC = 1.3 MGD

ULT. STORAGE PER TDH = (3026) ESFC (200) = 0.61 MG

EXIST. STORAGE = 0.40 MG

WCID 21



GENERAL DESCRIPTION: Low Density Residential/Light Industrial
Approx. 2750 Ac.

1985 PUMPAGE: 1.2 MGD

BUILT OUT DEMAND PROJECTION:

based on aerial photographs

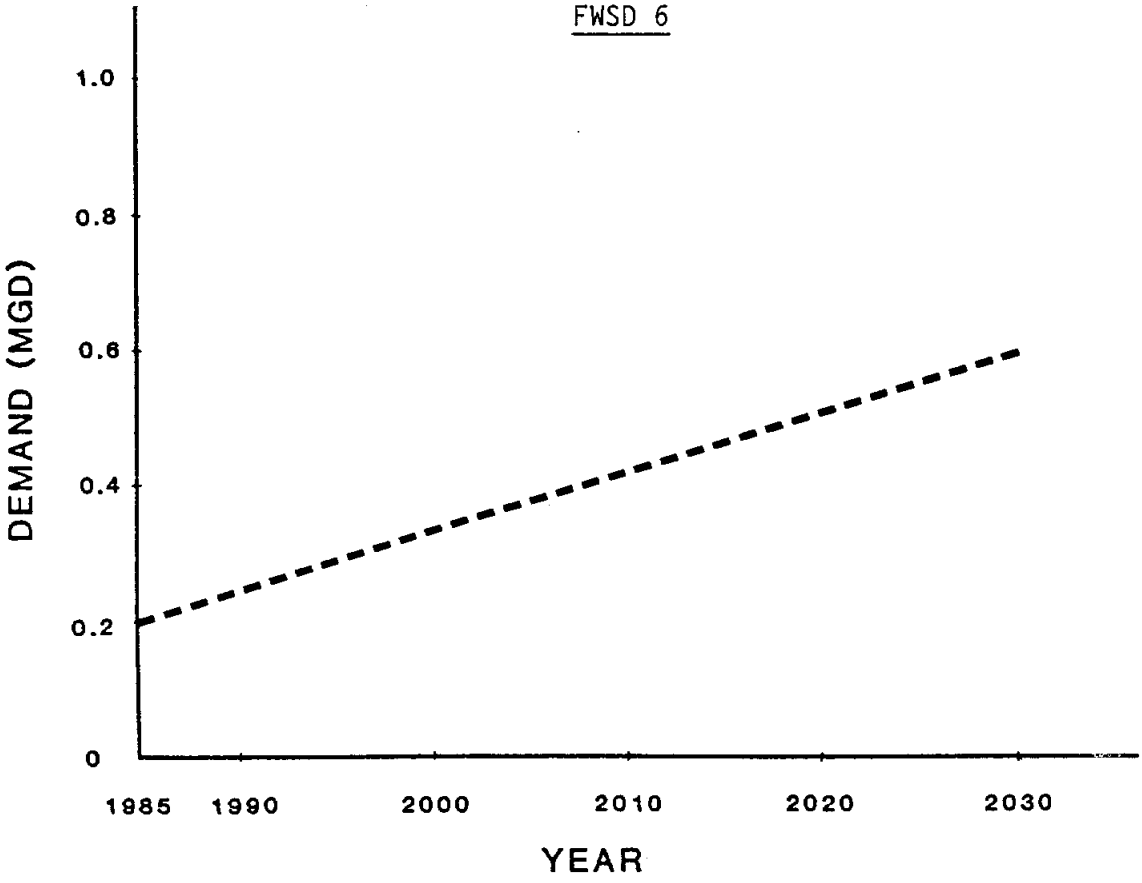
2510 Ac. Low Density Res.	@ 2.5 ESFC/Ac.	6275
240 Ac. Light Industrial	@ 10.0 ESFC/Ac.	2400
		8675 ESFC

(8675) ESFC (420) gpd/ESFC = 3.6 MGD

ULT. STORAGE PER TDH = (8675) ESFC (200) = 1.74 MG

EXIST. STORAGE = Approx. 2.0 MG

FWSD 6



GENERAL DESCRIPTION: Low Density Residential/Light Industrial
Approx. 850 Ac.

1985 PUMPAGE: 0.2 MGD

BUILT OUT DEMAND PROJECTION:

based on aerial photographs

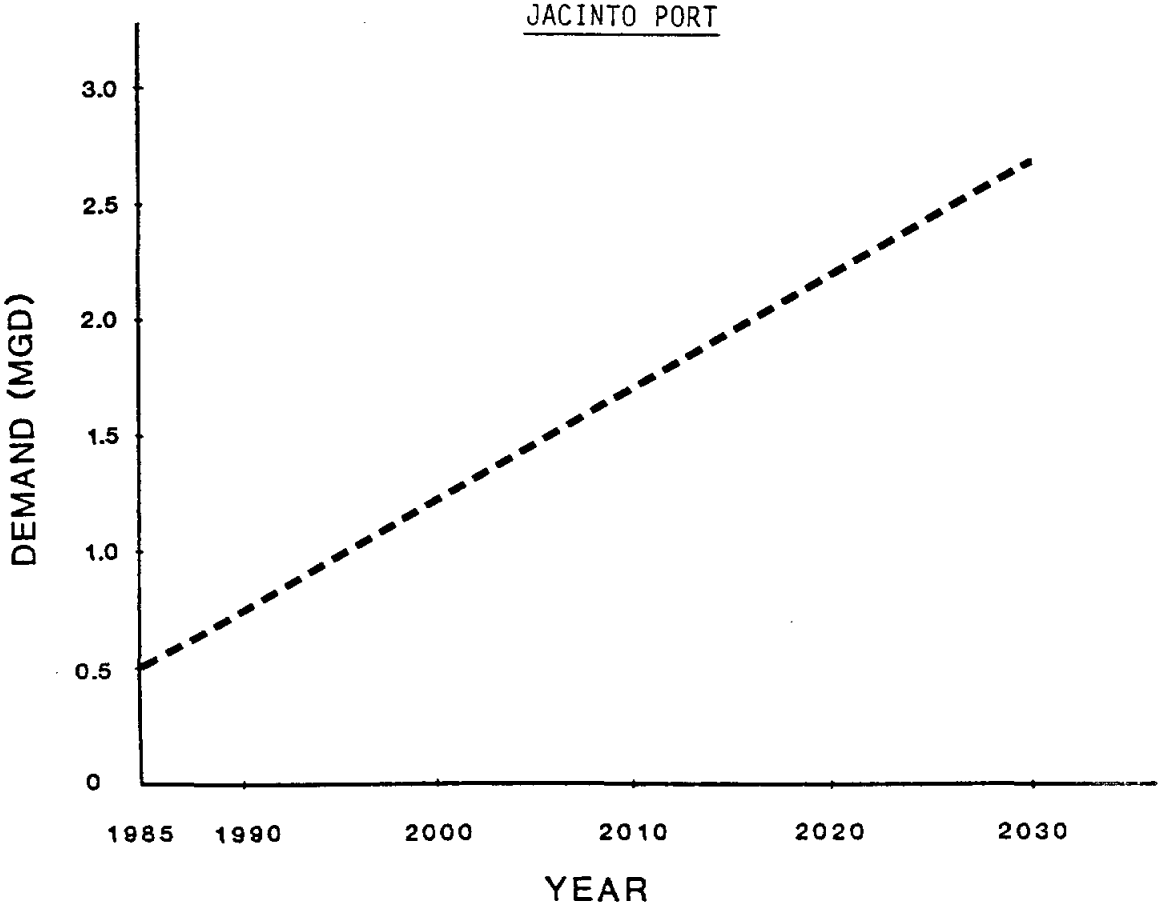
405 Ac. Residential	@	2 ESFC/Ac.	810
45 Ac. Commercial	@	5 ESFC/Ac.	225
400 Ac. Industrial	@	1 ESFC/Ac.	400
			1435 ESFC

(1435) ESFC (420) gpd/ESFC = 0.6 MGD

ULT. STORAGE PER TDH = (1435) ESFC (200) = 0.29 MG

EXIST. STORAGE = 0.26 MG

JACINTO PORT



GENERAL DESCRIPTION: Industrial
Approx. 3575 Ac.

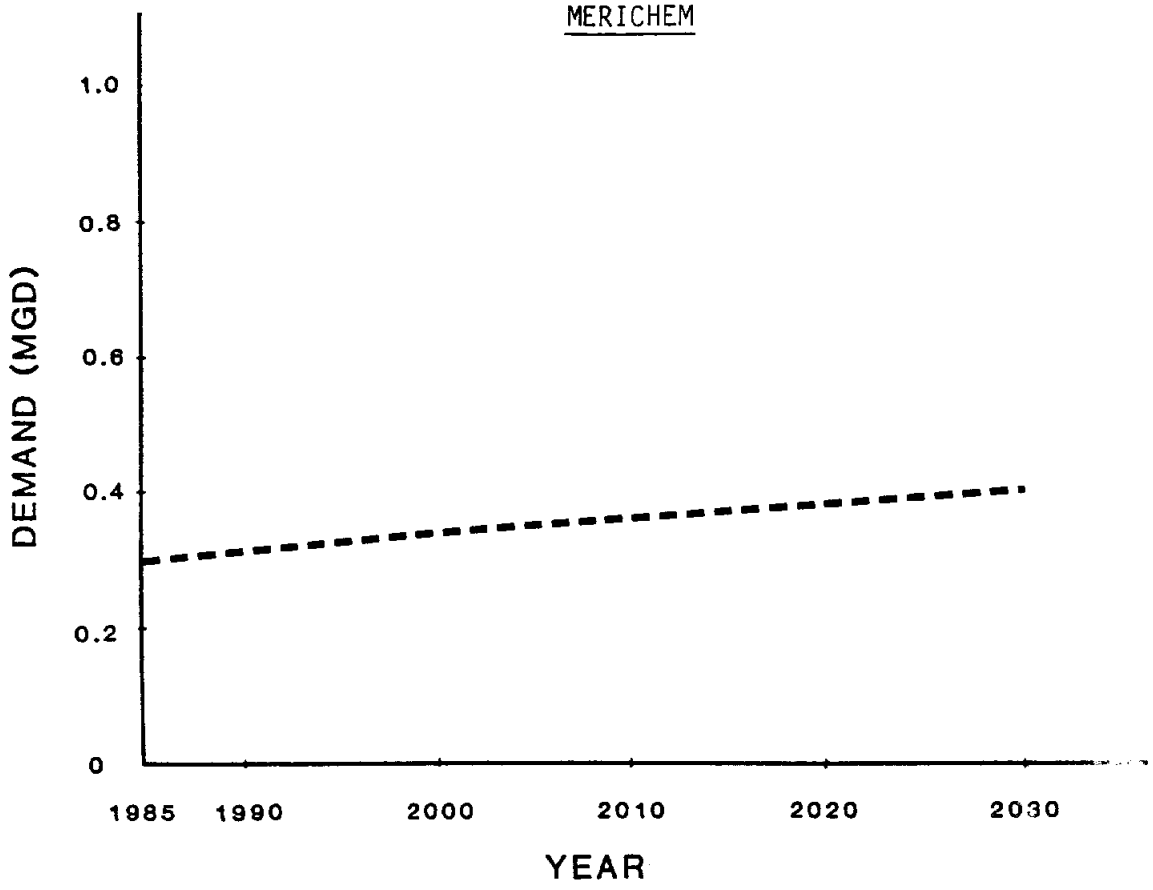
1985 PUMPAGE: 0.5 MGD

BUILT OUT DEMAND PROJECTION:

based on industrial development

3500 Ac.	@ 1.85 ESFC/Ac.	6475 ESFC
	(6475) ESFC (420) gpd/ESFC =	2.7 MGD

MERICHEM



GENERAL DESCRIPTION: Industrial

1985 PUMPAGE: 0.3 MGD

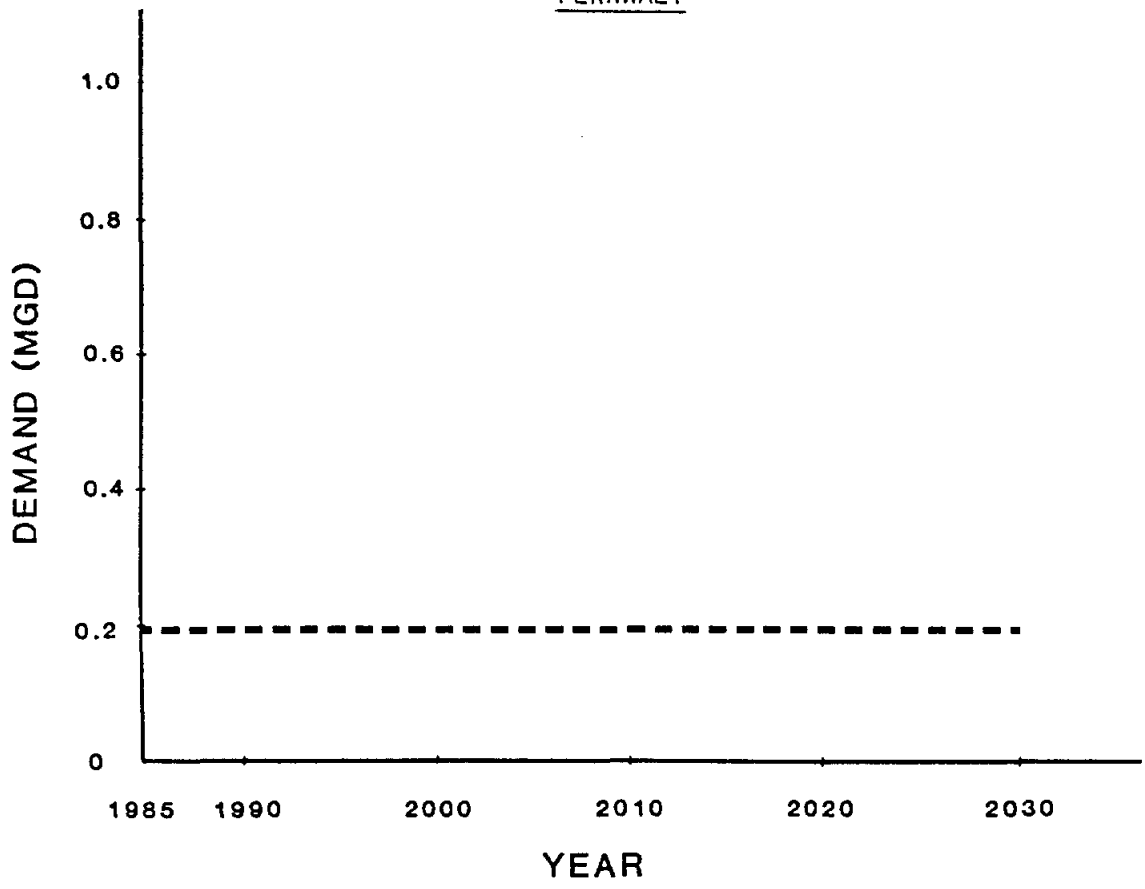
BUILT OUT DEMAND PROJECTION:

based on Plant Engineer's request

Minimum of 250 gpm
or existing use with 30% safety factor

0.4 MGD

PENNWALT



GENERAL DESCRIPTION: Industrial

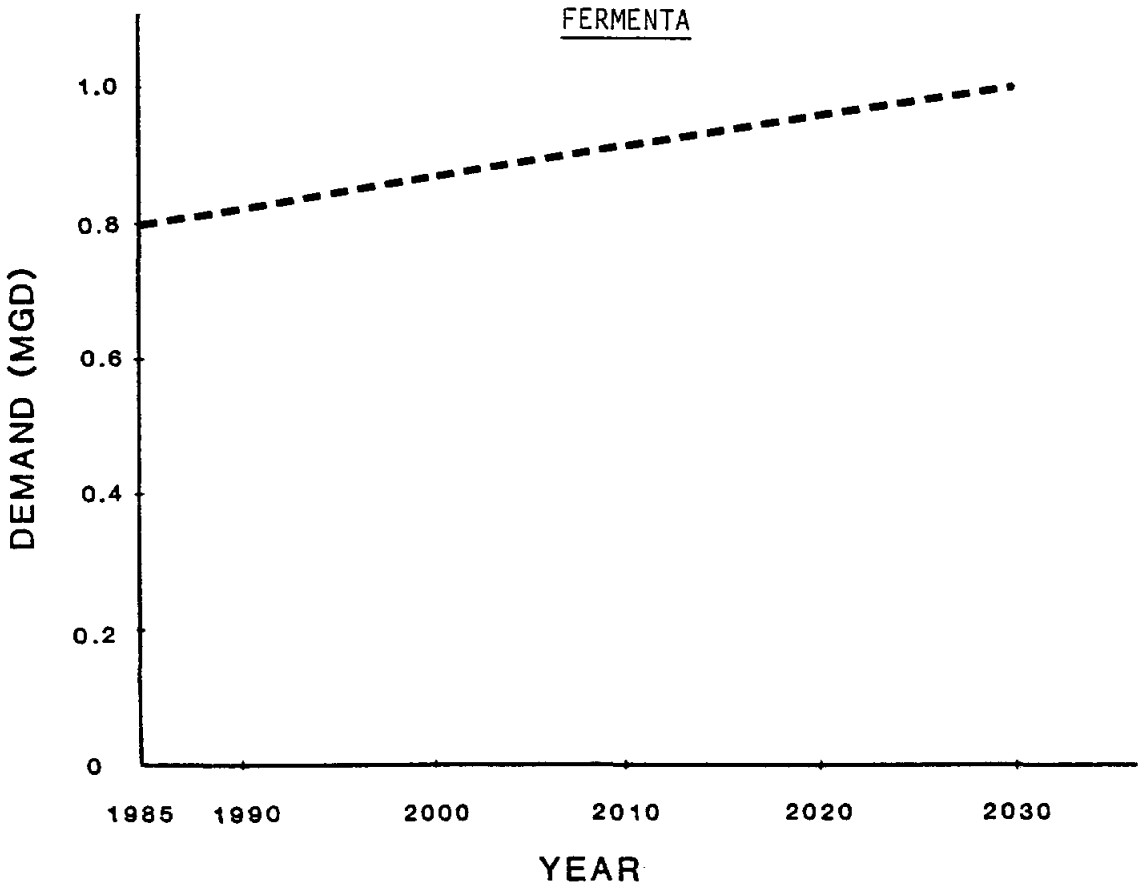
1985 PUMPAGE: 0.2 MGD

BUILT OUT DEMAND PROJECTION:

based on Plant Engineer's request

Peak demand of 150 gpm

0.2 MGD



GENERAL DESCRIPTION: Industrial
Approx. 200 Ac.

1985 PUMPAGE: 0.8 MGD

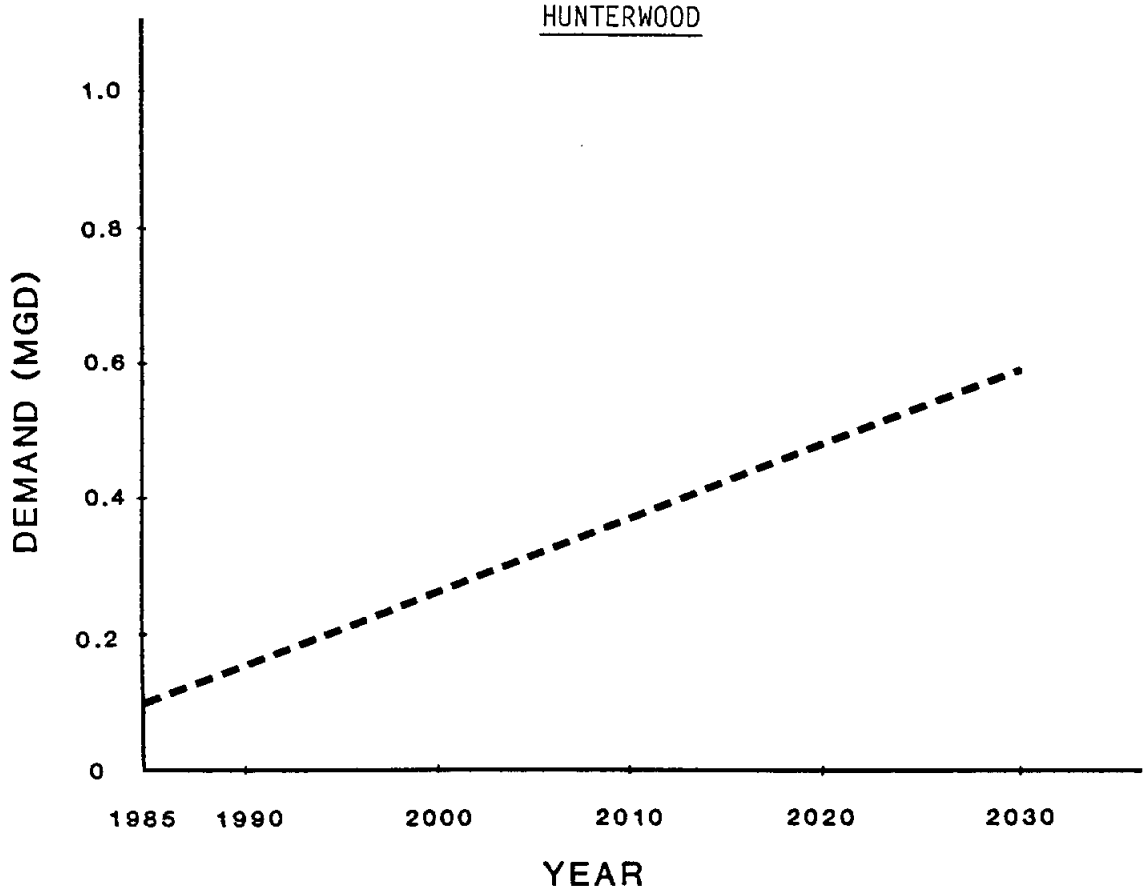
BUILT OUT DEMAND PROJECTION:

based on Plant Engineer's request

Max. Hour demand of 682 gpm

1.0 MGD

HUNTERWOOD



GENERAL DESCRIPTION: Residential/Mixed Use Commercial
Approx. 280 Ac.

1985 PUMPAGE: 0.1 MGD

BUILT OUT DEMAND PROJECTION:

based on landplan

120 Ac. Residential	@	5 ESFC/Ac.	600
74 Ac. Commercial	@	10 ESFC/Ac.	740

(1340) ESFC (420) gpd/ESFC = 0.6 MGD

ULT. STORAGE PER TDH = (1340) ESFC (200) = 0.27 MG

EXIST. STORAGE = 0.21 MG