

APPENDIX E

City of Pearland Water Model  
Update

December 2013







TBPE Firm Registration No. F-3043

## Memorandum

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*Date: March 19, 2013*

*Subject: City of Pearland Water Model Update*

Due to changes in current and expected future economic and population growth and source water cost, the City of Pearland (City) identified the need to update their water model and associated water master plan last updated in April 2007. The City has a need for future water at the west side of the City currently served by the Shadow Creek surface water connection. The current Capital Improvements Plan (CIP) includes future transmission from the Alice Street Water Plant across the City to the west to supplement future demand in conjunction with a plan for a west side surface water treatment plant. The City has recently constructed a surface water connection with the City of Houston Water System at the City of Pearland Alice Water Plant. The project includes the expansion of the existing Alice Street Water Plant Facility to a 10 MGD surface water pump station, with a future expansion to 15MGD, and allows the City to purchase City of Houston Southeast Purification Plant water at a cost of \$0.55 per one thousand gallons/ The City of Pearland's existing surface water connection with the City of Houston at the Shadow Creek Water Plant has the capacity to take 6 MGD and purchases water from the City of Houston at a cost of \$2.513 per thousand gallons plus a surcharge of \$0.623 per one thousand gallons for a flow that exceeds the minimum of 40 million gallons per month or 1.33 MGD. Because of the significant cost difference in the City of Houston water at Shadow Creek versus City of Houston SEWPP water at the Alice Street Pump Station, the City would like to review the options for expediting the McHard Road waterline currently in the CIP for 2015 to take more Alice Street Pump Station water to the west to reduce the purchase of City of Houston water at Shadow Creek. Additionally the City would like to review the timing associated with the new west side surface water treatment plant identified in the current CIP.

In order to clearly define the McHard Road waterline project, review the Shadow Creek connection, and timing associated with the new surface water plant a project specific update to the water model and master plan development is necessary. The updated model developed in the recent McHard Road Waterline Technical Memorandum will be utilized as a base for this scope of work. In the McHard Road Waterline Technical Memorandum the Year 2015 demand scenario was updated to include completed projects and revised to exclude projects not expected to be complete by Year 2015.

The City of Pearland contracted CDM Smith to update the City's water demand for scenario years 2012 (existing), 2015, 2022 and 2042 (buildout) as well as to review the timing of 2 proposed CIP projects; the Lower Kirby ET and the new west side surface water plant. Additionally the scope includes a re-review of the expedited McHard Road Waterline Project with the updated demands. This contract follows a model update done in 2011 to analyze the size of the McHard Water Line project. The first project analyzed in this model update is a proposed 2.0 MG elevated tank (ET) in the Lower Kirby development on the northwest side of the City. This project was proposed to be constructed by 2010 in the 2007 Water Model Update. Due to slower than anticipated growth, the City has asked if the new ET is required by 2015 or if it can be pushed to a future demand year. The second project, the proposed new west side surface water plant, timing and capacity will depend on the updated system demand projections as well as the effectiveness of other source water options analyzed as part of this update.

## **Task 1 – Update Demand Allocation and Growth Projections**

### **Historical Data**

The City of Pearland water distribution system model that was updated during the 2011 McHard Water Line Update was used as the basis of this analysis, utilizing the software H2OMAP Water by Innovyze. CDM Smith was provided with the following data from the City and ETJ communities to update the model:

- Water billing data from January, 2010 to December, 2011
- Water production data from January, 2010 to September, 2012
- Water facility target discharge pressures
- Updated population projections and estimated years for annexing ETJ areas
- Updated land use data for buildout
- Capacity information for existing Savannah water system (MUDs 21 and 22)

### **Assumptions**

A number of assumptions were made to complete the development of the scenarios. These general assumptions are listed below:

- The Old City Hall water plant, Alice well and Green Tee surface water interconnections will be eliminated between the existing and 2015 scenarios.
- All ETJ water facilities were incorporated into the City's water system based on the City's current projected schedule. If these facilities cannot or will not be used by the City, the City's future water facilities need to be reevaluated.
- Allocation for new demand in the interim scenarios (years 2015 and 2022) was based on direction from the City, discussed further in the **Demand Allocation** subsection.



- Since manufacturers' pump curves are unavailable for the City's wells, the pump design points were taken from the 2007 Water Model Update and the discharge pressure was limited to less than 60 psi based on anecdotal information provided by City water operations.
- The Shadow Creek surface water interconnection with the City of Houston does not receive the fully contracted 6 MGD on high demand days. To simulate this, for MDD scenarios Shadow Creek is limited to 2.8 MGD unless a project is completed to improve the interconnection's capacity.
- In future scenarios, the pump controls at well pump stations have been adjusted when necessary to ensure that the well capacity is utilized.

During the McHard Water Line Update project done in 2011, the City provided updated GIS data that was compared against the water model to look for recently completed projects and changes in pipe diameter. These GIS changes were incorporated into the model for the Year 2015 along with the below list of projects provided by the City which have already been constructed or are anticipated to be completed by 2015. All other projects included for 2015 in the 2007 Water Model Update were determined to be complete by Year 2022.

- Cullen Pkwy, 12-inch line - Cullen Plant to McHard Rd
- City of Houston interconnect, 30-inch line - Fuqua to Alice Street Plant
- Old Alvin Rd, 20-inch line - Alice Street to John Lizer Rd
- SH35, 16-inch line - John Lizer Rd to Prancer (Pearland High School)
- SH35, 16-inch line- FM518 to John Lizer Rd
- Pearland Pkwy, 12-inch line – Shadycrest Dr to Dixie Farm Rd
- Tom Bass Park, 12-inch line – Beltway 8 to Lakes of Country Place Community
- Bellavita Loop, 12-inch line - Dixie Farm Rd to San Conero Dr and N Rivera Cir
- Future Street (Barry Rose Rd), 12-inch line - Pearland Pkwy to City Limits
- Northeast City Limit, 12-inch line – Barry Rose Rd to Country Club Dr
- Business Center Dr, 12-inch line - Broadway St to CR59

As confirmed in the McHard Water Line update project, the proposed McHard Road water line crosses several roads with existing or future water lines. In the revised model, the proposed McHard Road water line from N Main St to Business Center Dr intersects only north-south water lines along Max Rd, Cullen Blvd and County Rd 94.

### **Study Area**

The City of Pearland, Texas is located just south of Houston Metroplex in northern Brazoria County. The City is located approximately 24 miles southeast of downtown Houston with State Highway

288 cutting through the western portion of the City, State Highway 35 cutting through the eastern portion of the City, and FM 518 cutting through the center of the City running in an east to west direction. The City provides water service to local customers only. The service area consists of mostly residential and commercial developments, some limited industrial developments, and open space such as parks and golf courses. Commercial areas are concentrated along State Highway 288 and FM 518. A large proposed mixed use commercial and residential development is in the currently undeveloped area between lower Kirby Road and State Highway 288 on the east and west boundaries and between Beltway 8 and Clear Creek on the north and south boundaries. The planned development as represented in the “Lower Kirby Urban Center Master Plan and Implementation Strategy” provided by the City planning department was incorporated into the updated future water demand scenarios. Figure 1 shows the project study area.

### **Population Projections**

The City’s population estimates through buildout were provided by City planning staff and included City plus expected ETJ development and annexation. The information contained yearly growth estimates through 2040 planning year or the expected City buildout year. Table 1 shows the population projections used as the basis for the development of the water demand scenarios.

### **Land Use**

Future land use in this study is based on information provided by the City planning department. The City’s future land use planning data identifies areas of the City that are projected to undergo redevelopment, new development or maintain the same type of development through buildout. The identification of future land use planning zones is shown in Figure 2, as provided by the planning department.

### **Water Usage Data**

The City obtains the majority of its source water from groundwater wells and two surface water connections with City of Houston; Shadow Creek Water Plant and Alice Water Plant. Water from both surface water connections is contractually provided by City of Houston. Other source water includes a small surface water connection with Clear Creek MUD at the Green Tee facility.

The existing demand alternatives were created using two sources of information: the meter billing data and the total daily water consumption provided by water operations staff. The water consumption data indicated how much water was taken from each surface water take point and the groundwater wells. Figure 3 shows the 2010/ 2011 average metered water usage data. The annual average demand was created for each meter by averaging all available data.

### **Demand and Source Water Projections**

**Table 1** shows the projected maximum day demand (MDD) and source water supply for the updated population projections and 2010-2012 billing data.

**Table 1 – Updated Water Demand and Current Supply**

Year	Population	MDD (MGD) <sup>1</sup>	City Wells & Green Tee (MGD)	Shadow Creek (MGD) <sup>2</sup>	Alice Surface Water (MGD)	Total Water Supply (MGD)	Excess Water Supply (MGD)
2012	94,100	21.8	17.7	2.8	10.0	30.5	8.7
2015 <sup>3</sup>	110,400	26.3	15.5	6.0	10.0	31.5	5.2
2020	125,900	30.7	15.5	6.0	10.0	31.5	0.9
2022	132,100	32.4	15.5	6.0	10.0	31.5	-0.9 <sup>b</sup>
2025 <sup>4</sup>	160,680	40.3	24.9	6.0	10.0	40.9	0.6
2030 <sup>5</sup>	187,200	47.7	28.1	6.0	10.0	44.1	-3.6 <sup>b</sup>
2035	204,200	52.5	28.1	6.0	10.0	44.1	-8.4 <sup>b</sup>
2040	224,600	58.1	28.1	6.0	10.0	44.1	-14.0 <sup>b</sup>

Notes:

1. MDD for 2012 was taken from city-wide production data for January, 2010 to September, 2012. All increases in MDD assume that residential use is constant per capita and non-residential use was adjusted linearly based on population to arrive at the buildout projections.
2. Pearland is contracted to receive 6 MGD from the City of Houston at Shadow Creek but is only able to rely on a maximum of 2.8 MGD with the current connection on high demand days. The City of Houston will remedy this with a CIP waterline project by 2015.
3. Alice well, Old City Hall well and Green Tee surface water connections to be eliminated.
4. Assumes all ETJ excluding Savannah will be added to Pearland water system by 2025.
5. Assumes Savannah will be added to Pearland water system by 2030.
6. Additional source water can come from 2 potential projects: (1) Increase capacity of Alice connection from the City of Houston; or (2) Build new surface water plant.

**Table 2** shows the comparison of projected water demand and supply for the updated population projections and billing data with the projections from the 2007 Water Model Update. The buildout MDD is approximately the same for both projections, although buildout is now projected to be reached in 2040 rather than 2025.

**Table 2 – Water Demand and Supply for 2007 Report and Current Update**

Year	2007 Model Update MDD Projections (MGD)	Current MDD Projections (MGD)
2015	38.6	26.3
2020	48.9	30.7
2025	59.4 (buildout)	40.3
2030		47.7
2035		52.5
2040		58.1 (buildout)

**Peaking Factors**

The peaking factor established for converting average day demand (ADD) to summer average demand is 1.21. The summer average day peaking factor was calculated by comparing production data provided by the City for May through September of 2010 and 2011 to the production data for

all of 2010 and 2011. The data from 2012 was not included in the determination of the ADD since the entire year's data was not yet available.

The peaking factor established for converting ADD to MDD is 1.86. This is similar to the peaking factor used in the 2007 Water Model Update of 1.9. The maximum day peaking factor was calculated by determining the MDD from the almost 3 years of data provided by the City, identified as 21.81 MGD on June 12, 2011, and comparing it to the ADD from 2010 and 2011.

The peaking factor established for converting MDD to maximum hour demand is 1.68. This is the peak of the diurnal curve taken from the 2007 Water Model Update.

**Table 3** shows a summary of the demands for planning years evaluated in this update.

**Table 3 – Water Demand Summary for Planning Years**

Year	Estimated Population	Average Day Demand (MGD) <sup>1</sup>	Average Summer Demand (MGD) <sup>2</sup>	Maximum Day Demand (MGD) <sup>3</sup>	Maximum Hour Demand (MGD) <sup>4</sup>
2012	94,100	11.73	14.14	21.81	36.64
2015	110,400	14.17	17.08	26.35	44.26
2022	132,100	17.42	20.99	32.39	54.41
Buildout	224,600	31.27	37.69	58.14	97.67

Notes:

1. ADD for 2012 was taken as the average from city-wide production data for January, 2010 to December 2011. All increases assume that residential use is constant per capita and non-residential use was adjusted linearly based on population to arrive at the buildout projections.
2. Average Summer Demand for 2012 was taken as the average from city-wide production data for May through September, 2010 and May through September 2011, excluding August, 2011 for which production data was not provided. The ratio of Average Summer Demand to ADD for 2012 was used to project future demand.
3. MDD for 2012 was taken as the maximum from city-wide production data for January, 2010 through September, 2012, excluding August, 2011 for which production data was not provided. The MDD was determined to have taken place on June 12, 2011. The ratio of MDD to ADD for 2012 was used to project future demand.
4. Maximum Hour Demand for 2012 was calculated as the MDD multiplied by the maximum peaking factor of 1.68 from the diurnal curve used in the 2007 water model update.

**Unaccounted For Water (UFW)**

A comparison of the City's water production data to the billing data for 2010 and 2011 determined that the UFW in the water distribution system is 10.9% of the total water production. To account for this UFW in the existing system demand in the model, 10.9% was applied to all billing demands in the system to distribute the UFW citywide. Since the demand projections for 2015, 2022 and buildout are all based on the water production data, this UFW is already incorporated and no additional factor was required.

## Demand Allocation

Demand scenarios were created for the years 2012 (existing), 2015, 2022 and 2042 (buildout). For the existing scenario, the billing data was used to allocate the demand after adjusting for UFW. While the City provided annual population projections through the end of 2040 to reach the currently estimated buildout population as well as buildout land use, there was no detailed geographic information provided for growth in the interim planning years. This was addressed differently for each planning year as described below.

For the 2015 demand scenario, additional demand was added to the existing demand scenario to account for the growth between the scenarios. Given the short time frame and limited information on where additional development would take place, the additional demand was spread proportionally across the existing demands by applying a factor to each demand to increase the citywide ADD to 14.17 MGD as shown above in **Table 3**.

For the 2022 demand scenario, additional demand was added to the 2015 demand scenario for the projected areas of growth. The specific amount of growth for commercial or industrial areas is unknown, so the projected population was used to estimate the total demand. The proportion of the population added between 2012 and buildout is the same proportion of demand that was included in the 2022 demand scenario, determined to be a total ADD of 17.42 MGD. The additional demand added between 2015 and 2022 was allocated based on direction from the City. The area between FM 521 and Cullen Blvd (western Pearland) was allocated 60% of the new growth, spread evenly across the undeveloped areas within City limits. Similarly, the area between Cullen Blvd and Main St (central Pearland) as well as the area east of Main St (eastern Pearland) were each allocated 20% of the new growth.

For the buildout demand scenario, the future land use plan data provided by the City was used. The water duty factors shown in **Table 4** were applied to each land use category at buildout to determine the total demand and its distribution. These water duty factors were taken directly from the 2007 Water Model Update and verified against the recent water billing data provided by the City

**Table 4 – Water Duty Factors for Demand Projections**

Land Use Type	Land Use Category	Assumed Average Day Water Duty Factor (gpm/acre)
A-1/2 Ac. Lots	Residential	0.48
B-15,000 sf Lots	Residential	0.48
Business Commercial	Commercial	0.34
Business Park	Commercial	0.34
C-12,000 sf Lots	Residential	0.48
Cullen Mixed Use District	Commercial	0.34
D-10,000 sf Lots	Residential	0.48

**Table 4 – Water Duty Factors for Demand Projections**

Land Use Type	Land Use Category	Assumed Average Day Water Duty Factor (gpm/acre)
Garden/O' Day Mixed Use District	Commercial	0.34
High Density Residential	Multi-unit	2.95
Industrial	Commercial	0.34
Light Industrial	Commercial	0.34
Low Density Residential	Residential	0.48
Medium Density Residential	Residential	0.48
Mixed Use Business Park	Commercial	0.34
Offices	Commercial	0.34
Parks	Residential	0.48
Public/Semi-public	Commercial	0.34
Retail, Offices, and Services	Commercial	0.34
Village District	Multi-unit	2.95

## Task 2 – Verification

To verify that a model is serving its purpose by reasonably representing its real world counterpart, it is important to accurate date on the existing system configuration and operation. For the GIS data, it is important to verify that there are no inaccuracies created during the import process. All crossing connections, any isolation valve locations and valve positions, and water facility layouts were verified with City of Pearland water operations staff. The results for facility operations were reviewed to ensure that the water system model was performing similarly to conditions observed during high demand times. All stations were originally assumed to operate as in the 2007 Water Model Update and facility operations verified against water facility sketches provided by the water operations staff to review overall facility layout and valve locations. Target system pressures just outside each facility were also provided by water operations staff and used to verify existing system base scenario model results for average annual, summer average and maximum demand days were reviewed by the City.

Based on additional information provided from the City at a meeting on November 8, 2012, the existing well pump stations were adjusted to limit discharge head to a maximum of 60 psi. Also, the City is currently unable to receive the full contracted 6 MGD from the City of Houston at the surface water connection at the Shadow Creek pump station on high demand days. Because of this, the Shadow Creek pump station was manually limited to 3.2 MGD for the MDD, based on a typical flow received on high demand days as seen in the historical production data. The pressures seen after incorporating these changes were confirmed as accurate for the existing system by City staff at a meeting on December 13, 2012. **Figure 4** shows the existing water system including facility capacities. **Table 5** below shows the target pressure values provided by water operations staff utilize to verify base scenario mode results.

**Table 5 – Target Pressure Validation**

Facility	Target Pressure (psi)
Shadow creek WTP	55
Liberty WTP	58
Old City Hall	57
Southeast WTP	61.3
Mclean WTP	57
Garden WTP	57.5
Southdown WTP	59
Magnolia WTP	57.9
Cullen WTP	56

**Figure 5** shows citywide pressure during the ADD's peak hour. **Figure 6** shows citywide pressure during the summer ADD's peak hour. **Figure 7** shows citywide pressure during the MDD's peak hour, also referred to as the maximum hour.

### **Task 3 – Project Analysis**

#### **System Requirements**

The Texas Commission on Environmental Quality (TCEQ) has specific minimum requirements in 30 TAC Chapter 290.45 for water distribution systems with more than 250 connections. The capacity requirements are defined by the number of connections that the system has. When the specific number of connections served is not known, the TCEQ states that the population divided by 3 will be used for the determination of the capacity requirements. The relevant TCEQ requirements for this project are:

- Source water capacity of 0.47 gpm / connection (per the City regarding the approved alternative capacity in lieu of the standard 0.60 gpm / connection requirement)
- Total storage of 200 gal / connection
- Elevated storage capacity of 100 gal / connection
- System pressure must remain at or above 35 psi for all connections at all times, with the exception of fire events in which case pressures must be 20 psi or higher.

The City's source water will be discussed later in this section. A summary of the total TCEQ storage requirement and existing storage is shown in **Table 6**, indicating that the City far exceeds the TCEQ requirements based on the current schedule of ETJ annexation provided by the City that is referenced in **Table 1** above.

**Table 6 – TCEQ Storage Requirement**

Year	Population	Approximate Connections <sup>1</sup>	TCEQ Required Total Storage (MG)	Existing Storage in System (MG) <sup>2</sup>	Excess Storage (MG)
Existing	94,100	31,367	6.27	14.64	8.37
2015	110,400	36,800	7.36	18.10	10.74
2022	132,100	44,033	8.81	18.10	9.29
2042 (Buildout)	224,600	74,867	14.97	22.74	7.77

Notes:

1. Based on the TCEQ directive to divide population by 3 when not enough information is available.
2. Includes only the existing elevated and ground storage tanks based on when they will be added to the City's water system.

Often, more conservative planning criteria are used based on local codes, engineering judgment, accepted industry standards and input from City staff. **Table 7** shows the planning criteria used in to analyze the specific projects under this scope to ensure that the City will still have adequate infrastructure in place in the future.

**Table 7 – Planning Criteria Summary**

Description	Planning Criteria
Minimum System Pressure	35 psi, with a goal of 50 psi on transmission pipelines
Maximum System Pressure	80 psi, with a goal of 65 psi
Maximum Water Pipeline Velocity	8 fps
Recommended Storage Capacities:	
Operational Storage	25% of MDD
Fire Storage	1.00 MG (4 hours @ 4,000 gpm)
Emergency Storage	ADD

Based on these recommendations for storage, **Table 8** summarizes the total recommended storage for each planning year evaluated using the updated ADD and MDD values.

**Table 8 – Recommended Storage Summary**

Year	ADD (MGD)	MDD (MGD)	Operational Storage (MG)	Fire Storage (MG)	Emergency Storage (MG)	Total Recommended Storage (MG)
Existing	11.73	21.81	5.45	1.00	11.73	18.18
2015	14.17	26.35	6.59	1.00	14.17	21.76
2022	17.42	32.39	8.10	1.00	17.42	26.52
2042 (Buildout)	31.27	58.14	14.54	1.00	31.27	46.81



Since the timing of the annexation of ETJ areas has changed since the 2007 Water Model Update, **Table 8** shows an updated comparison of the total recommended storage based on the planning criteria and the projected storage with all proposed projects included. No storage projects were eliminated, however the capacities of completed projects were updated and the timings of proposed projects were updated based on input from the City.

**Table 8 – Proposed Storage Comparison Summary**

Year	Total Recommended Storage (MG)	Existing Storage in System (MG)	Proposed Storage (MG)	Total Storage Including Proposed (MG)	Excess Storage (MG)
Existing	18.18	14.64	N/A	14.64	-3.54
2015	21.76	18.10 <sup>1</sup>	2.00 <sup>2</sup>	20.10	-1.66 <sup>3</sup>
2022	26.52	18.10	10.00 <sup>4</sup>	28.10	1.58
2042 (Buildout)	46.81	22.74 <sup>5</sup>	25.60 <sup>6</sup>	48.34	1.54

Notes:

1. Includes the addition of the 5.0 MG ground storage at Alice and subtraction of the 1.0 MG ground storage at the Alice well, 0.21 MG ground storage at Green Tee and 0.33 MG ground storage at Old City Hall.
2. Assumes new 2.0 MG ET near Mary's Creek to be completed by 2015.
3. If the City wishes to meet the total storage recommendations for 2015 then the new 2.0 MG Lower Kirby ET needs to be completed by 2015.
4. Assumes new 2.0 MG Lower Kirby ET and 6.0 MG of ground storage at the new surface water plant to be completed by 2022 in addition to 2015 improvements.
5. Includes the addition of 0.5 MG ground storage at MUD 1, 1.2 MG ground storage at MUD 2, 1.24 MG ground storage and 0.7 MG ET at MUD 3, 0.5 MG ground storage at MUD 4 and 0.5 MG ground storage at Savannah.
6. Assumes new 0.6 MG ground storage and 2.0 MG ET at new well near Penny Wayne Ln and West Field Ln, new 5.0 MG ground storage at Alice, and new 2.0 MG ET near Savannah to be completed by buildout in addition to 2022 improvements.

### Timing of Lower Kirby ET

The necessity for the new 2.0 MG Lower Kirby ET was evaluated for various conditions in the 2015 demand year. The following outlines the scenarios that were each analyzed both with and without the Lower Kirby ET:

- Scenario 1 – Demand Year 2015 - Analysis on break point for Shadow Creek flow for ADD with 16-inch McHard Road water line
- Scenario 2 – Demand Year 2015 - Analysis on break point for Shadow Creek flow MDD with 16-inch McHard Road water line
- Scenario 3 – Demand Year 2015 - Analysis on break point for Shadow Creek flow for ADD with 24-inch McHard Road water line
- Scenario 4 – Demand Year 2015 - Analysis on break point for Shadow Creek flow for MDD with 24-inch McHard Road water line

The analysis for each scenario evaluated the resulting conditions with and without the new Lower Kirby ET, with the results summarized in **Table 10**. For all scenarios, the pressures at the peak hour meet the minimum requirement of 35 psi so the ET could be pushed back to a later year for

construction. Maximum line velocities in the system are also all less than 8 fps. In this case, the City would not be meeting the minimum recommended storage shown above in **Table 9**, although the City would still exceed TCEQ requirements in 2015. The ET should be completed by 2022. For scenario 2 without the ET, some pressures in the Shadow Creek area are between 35 and 40 psi when the output from Shadow Creek is limited to 2.8 MGD, which is close to violating TCEQ requirements. If reducing the City’s reliance on Shadow Creek in the short term is desirable, Scenario 4 showed that with the new ET in place, pumping water from Shadow Creek is not necessary to meet the MDD. If an occurrence of consecutive days of MDD were encountered and the ET was unable to refill, water from Shadow Creek would be required.

**Table 10 – Lower Kirby ET Analysis Results Summary**

Scenario	Demand	McHard Size	Lower Kirby ET Included?	Shadow Creek Output (MGD)	Alice Output (MGD)	McHard Avg Flow (MGD)	McHard Peak Flow (MGD)
1	ADD - 14.2 MGD	16"	No	0	6.0	0.7	1.2
			Yes	0	6.0	0.6	0.9
2	MDD - 26.3 MGD	16"	No	2.8	8.6	0.9	1.4
			Yes	2.6	8.2	0.5	1.1
3	ADD - 14.2 MGD	24"	No	0	6.5	1.8	2.9
			Yes	0	6.0	1.2	2.0
4	MDD - 26.3 MGD	24"	No	2.9	9.4	1.8	3.1
			Yes	0	9.9	2.1	2.9

**Timing of New West Side Surface Water Treatment Plant**

The City will need to secure additional source water before reaching the buildout population. **Table 11** shows a summary of the source water needed and planned for the planning years evaluated in this update.

**Table 11 – Source Water Summary for Planning Years**

Year	Population	Approximate Connections <sup>1</sup>	TCEQ Required Source Water (MGD)	Maximum Day Demand (MGD)	Source Water (MGD) <sup>2</sup>	Excess Source Water (MGD) <sup>3</sup>
Existing	94,100	31,367	21.23	21.81	30.55	8.74
2015	110,400	36,800	24.91	26.35	31.53	5.18
2022	132,100	44,033	29.80	32.39	31.53	-0.86
2042 (Buildout)	224,600	74,867	50.67	58.14	44.09	-14.05

Notes:

1. Based on TCEQ, computed as 3 people/connection when not available.
2. Including all currently contracted source water and currently planned ETJ well annexation.
3. The amount of source water over either the TCEQ or MDD requirement. A negative value indicates that the City needs to secure additional source water by that time by adding capacity at Alice or constructing a new surface water plant.

As shown, the City will need to have additional source water in place by at least 2022. An analysis was done to weigh the options available to the City: (1) obtain an additional 5 MGD from the City of Houston at Alice and/or (2) build a new surface water plant. Since 14 MGD is needed by buildout, increasing the capacity of the Alice plant would still require the construction of a new, smaller surface water plant.

Per the City, the City of Houston will be constructing a project by 2015 that will enable the Shadow Creek facility to receive the fully contracted 6 MGD on high demand days. Including this, the City is projected to have an excess source water capacity of 5 MGD by 2015.

In the next modeled year of 2022, additional source water will be needed. **Figure 8** shows the pressures at the maximum hour if 5 MGD of source water is added at a new surface water plant in 2022. The other option in 2022 is to add 5 MGD at Alice instead, with the maximum hour pressures shown in **Figure 9**. Although pressures and line velocities are in the acceptable range for both options with little difference between them, adding source water at Alice does not convey additional water from Alice down the McHard line due to the downstream hydrologic conditions along the McHard line. The water from Alice feeds the east and central areas of the City and slightly reduces the production of the wells. The dissemination of water from Alice in the system after 24 hours is shown in **Figure 10** (. If trying to direct flow from Alice down the McHard line by simulating isolation valves, the high head loss through the system actually reduces the Alice plant output to less than 10 MGD. Although the Alice plant was shown to be successful at feeding water down the McHard line in 2015 above and in the 2011 McHard Water Line Update, by 2022 the flows are high enough to limit Alice to the east and central areas of the City.

The City is currently planning to reach a buildout population by the year 2042. Similar to 2022, there are 2 options to obtain additional source water by buildout. If an additional 5 MGD is obtained at Alice, then a surface water plant capacity of approximately 10 MGD is needed. The pressures at

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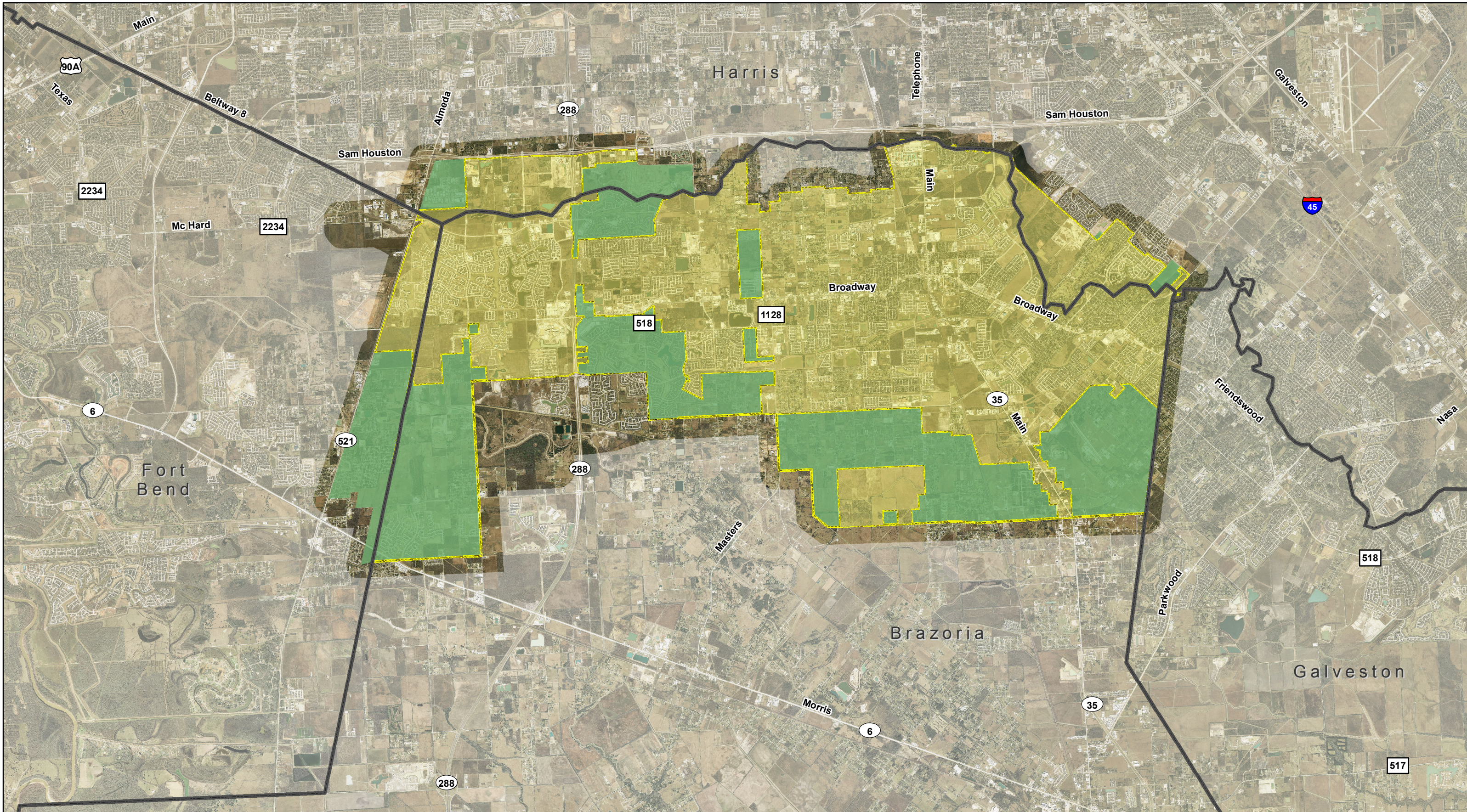
the maximum hour demand are shown in **Figure 11**. If no additional water is obtained from the City of Houston at the Alice connection, then a surface water plant with a total capacity of 15 MGD is needed. Pressures for the maximum hour of this scenario are shown in **Figure 12**. Again, both scenarios show pressures and line velocities falling in the acceptable range.

## **Conclusions**

Based on the City of Pearland's current and projected water demand and the assumption that the City of Houston will complete a waterline project allowing the Shadow Creek facility to operate at the designed 6 MGD during peak demand times, the City will be required to have additional source water capacity operational by the Year 2022. This additional source water capacity may be implemented at the existing Alice Water Plant or the future surface water plant; however for optimal operation of the City's water system and based on location of the Year 2022 demand growth it is recommended that the Year 2022 additional source water capacity be implemented by the construction of a 5 MGD surface water plant located in the southwest area of the City.

cc: File  
Chris Canonico, P.E., CDM Smith





**Legend**

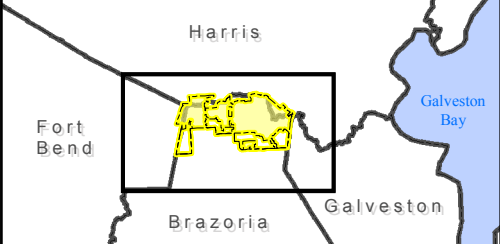
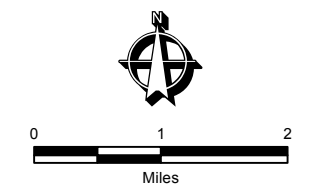
**Jurisdiction**

- ETJ
- Pearland City Limit
- County Boundary

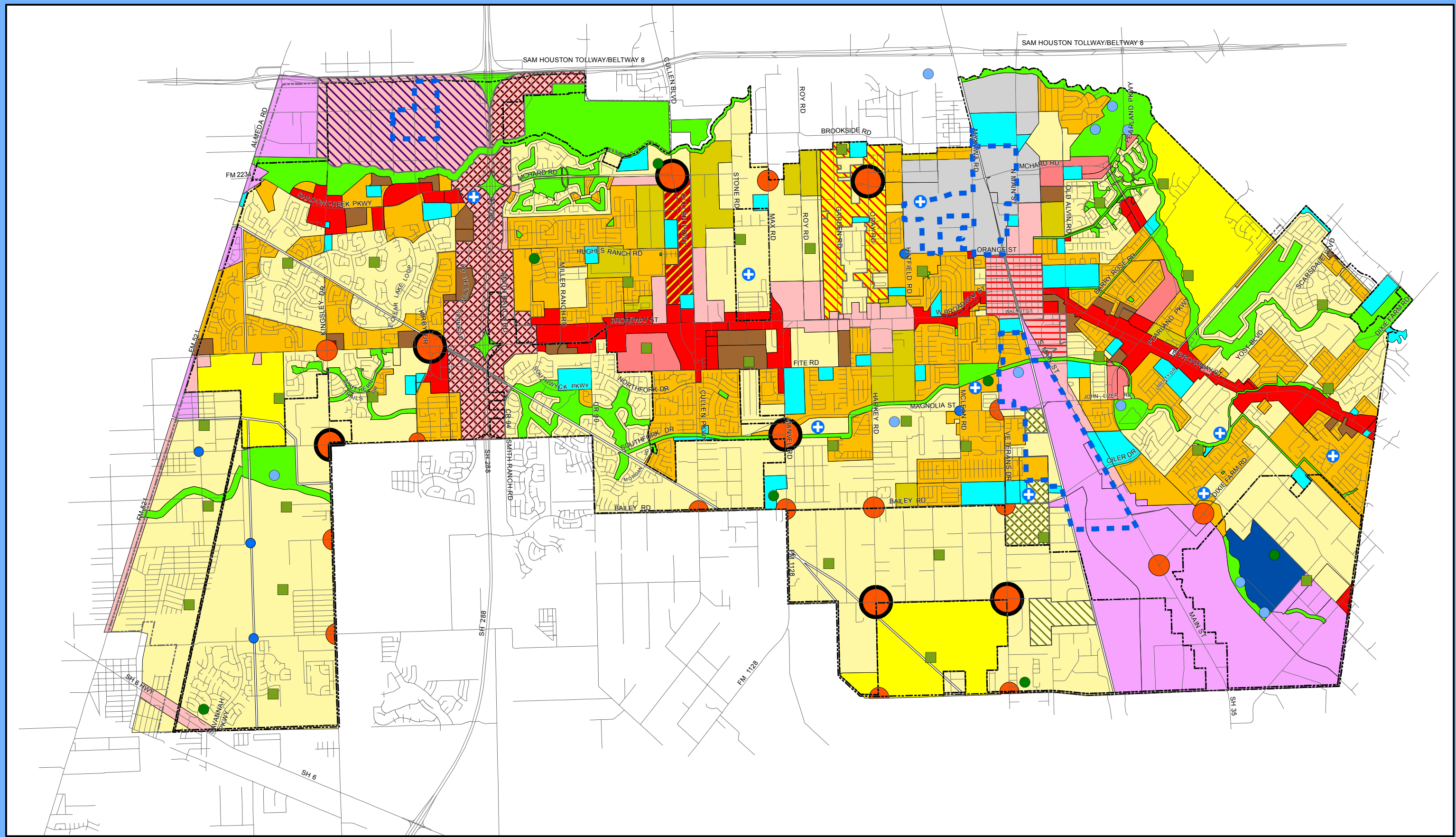


**Figure 1**  
**Study Area**

February 2013



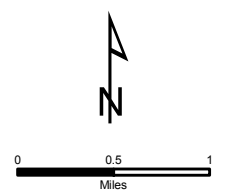




# City of Pearland Land Use Plan

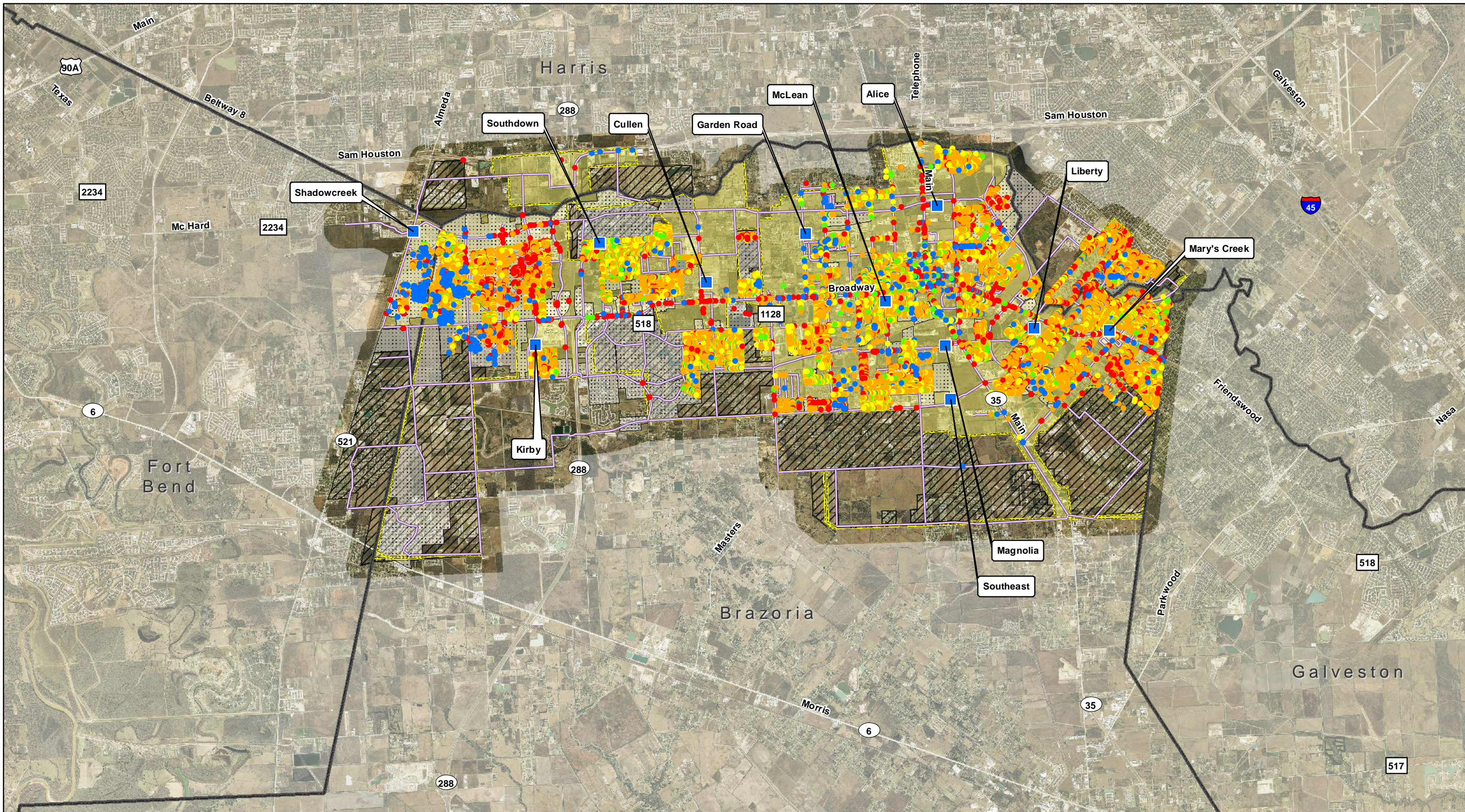
**NOTE:**  
A comprehensive plan shall not constitute zoning regulations or establish zoning district boundaries.

- |                                   |                            |                              |                                 |                                   |                                     |
|-----------------------------------|----------------------------|------------------------------|---------------------------------|-----------------------------------|-------------------------------------|
| A - 1/2 Acre Lots (Suburban Res)  | Medium Density Residential | Retail, Offices and Services | Garden/O'Day Mixed Use District | Foreign Trade Zone                | City of Pearland Detention Site     |
| B - 15,000 SF Lots (Suburban Res) | High Density Residential   | Village District             | Light Industrial                | Major Retail Node (50 acres)      | Community Park Site                 |
| C - 12,000 SF Lots (Suburban Res) | Offices                    | Spectrum District            | Industrial                      | Minor Retail Node (25 acres)      | Neighborhood Park Site              |
| D - 10,000 SF Lots (Suburban Res) | Parks                      | Business Park                | Business Commercial             | Residential Retail Node (5 acres) | Restaurant & Entertainment District |
| Low Density Residential           | Public / Semi-Public       | Cullen Mixed Use District    | Airport                         | David L. Smith Project            | B.D.D #4 Proposed Detention Site    |



This product is for informational purposes and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries.  
MAP PREPARED ON: DEC 2012 (GIS)  
View online maps at [www.cityofpearland.com](http://www.cityofpearland.com)





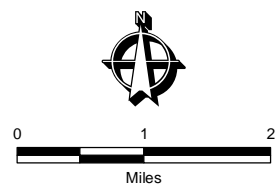
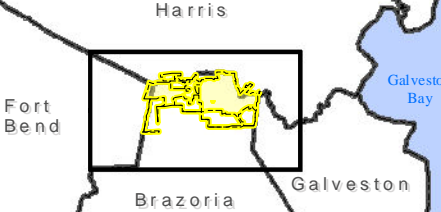


**Legend**

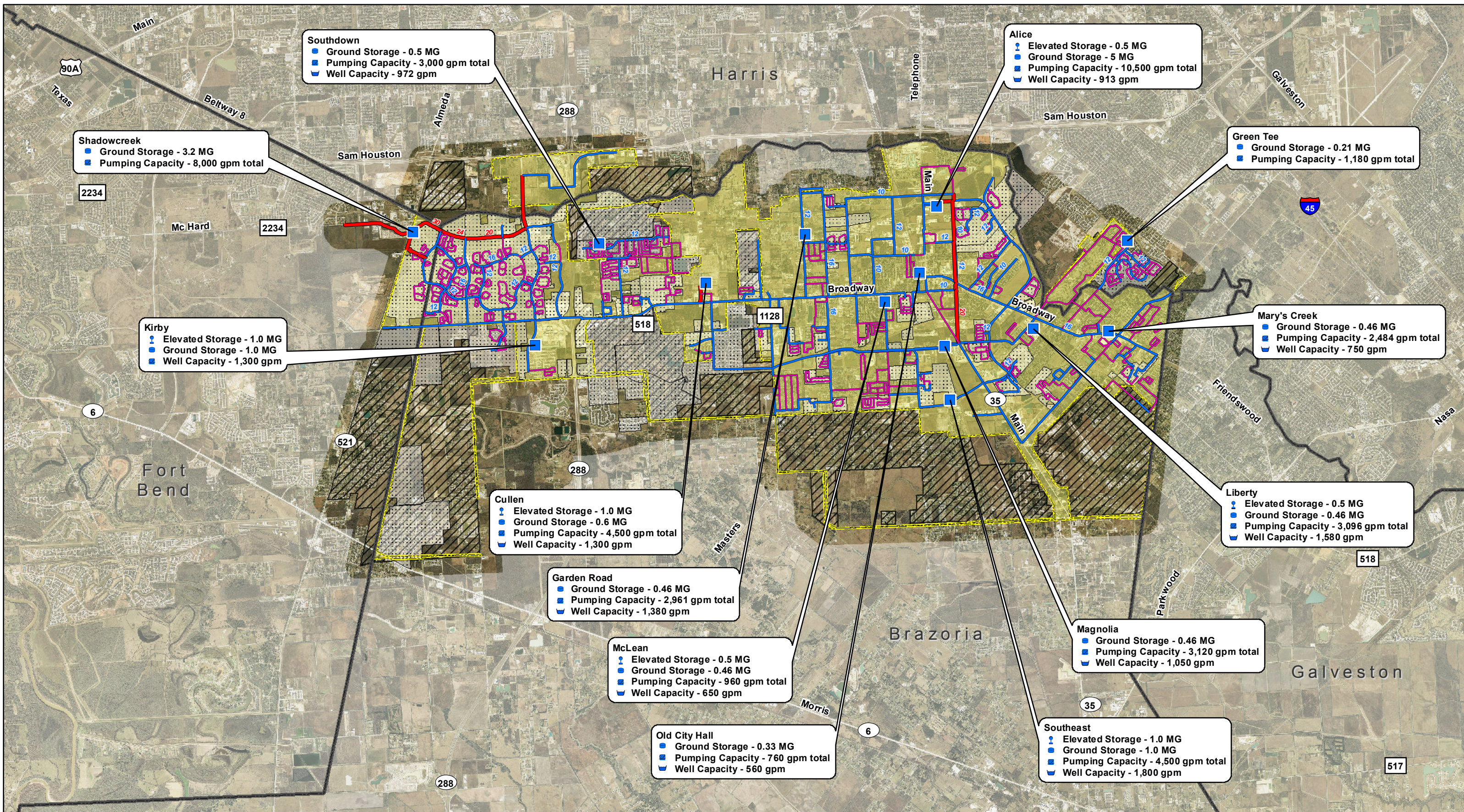
<b>Water System</b>	<b>Average Daily Usage</b>	<b>Jurisdiction</b>
Water Facility	0 - 70 gpd	MUD
Water Line	71 - 120 gpd	ETJ
	121 - 200 gpd	Pearland City Limit
	201 - 500 gpd	County Boundary
	> 500 gpd	

**Figure 3**  
**Average Water Usage**  
**2010 - 2011**

February 2013







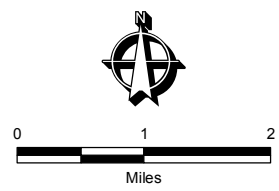
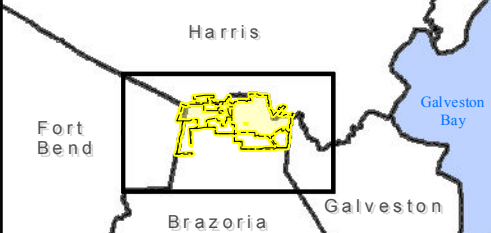
**Legend**

<b>Water System</b>	<b>Water Line</b>	<b>Jurisdiction</b>
Water Facility	> 18"	MUD
Elevated Storage Tank	10" - 18"	ETJ
Ground Storage Tank	< 10"	Pearland City Limit
Pump		County Boundary
Well		

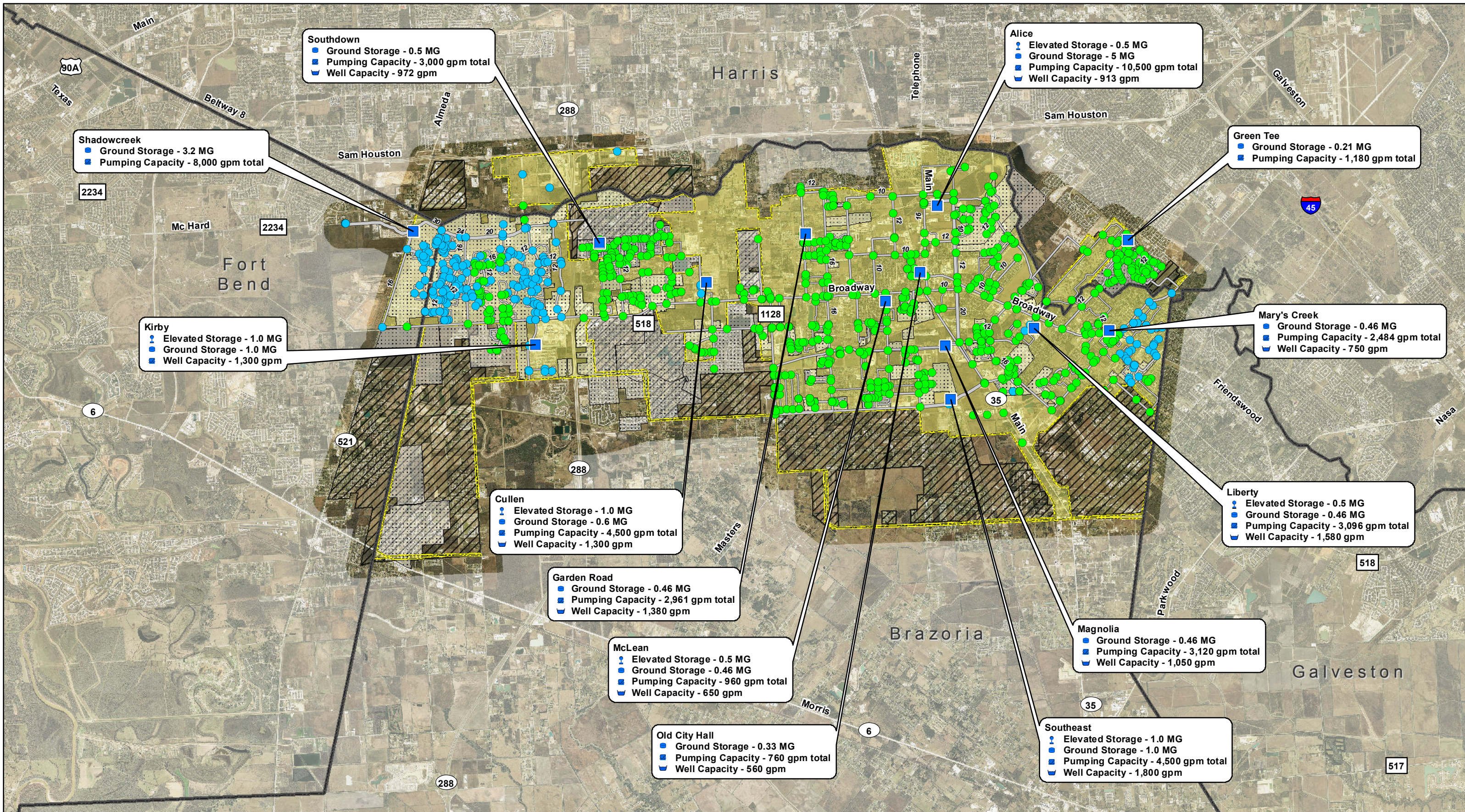
**Figure 4**

**Pearland Existing Water System**

February 2013





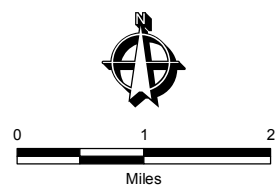
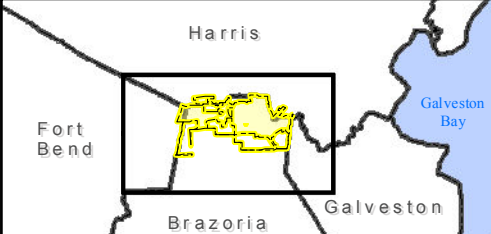


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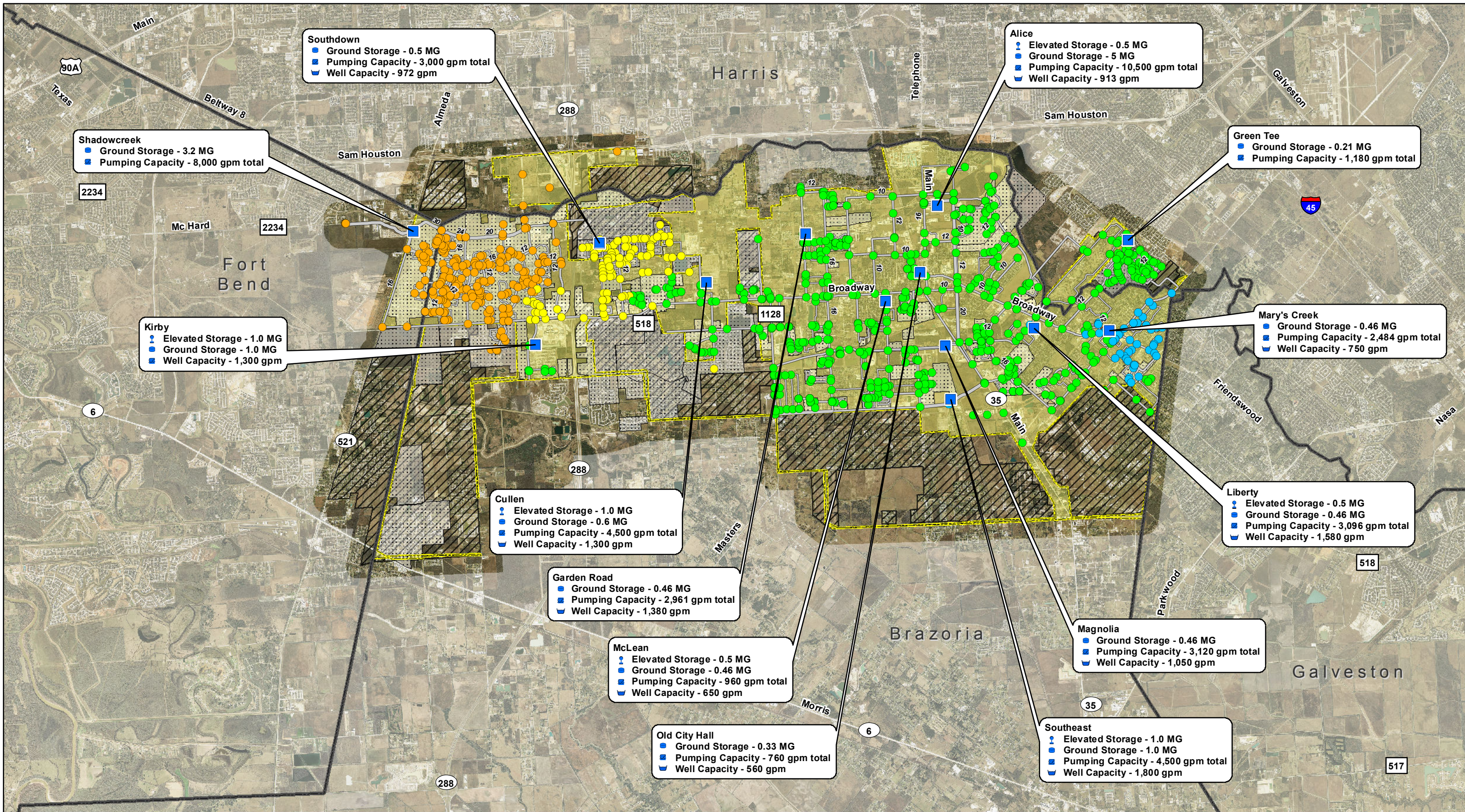
<b>Facility</b>	<b>Pressure</b>	<b>Jurisdiction</b>
■ Water Facility	● < 35 psi	☐ MUD
⬮ Elevated Storage Tank	● 35 - 45 psi	☐ ETJ
● Ground Storage Tank	● 46 - 50 psi	☐ Pearland City Limit
⬮ Pump	● 51 - 55 psi	☐ County Boundary
⬮ Well	● 56 - 60 psi	
— Water Line	● > 60 psi	

**Figure 5**  
**Average Day Demand Pressure**

February 2013





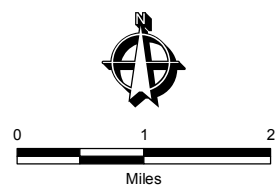
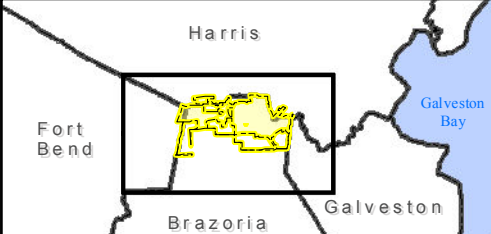


**Legend**

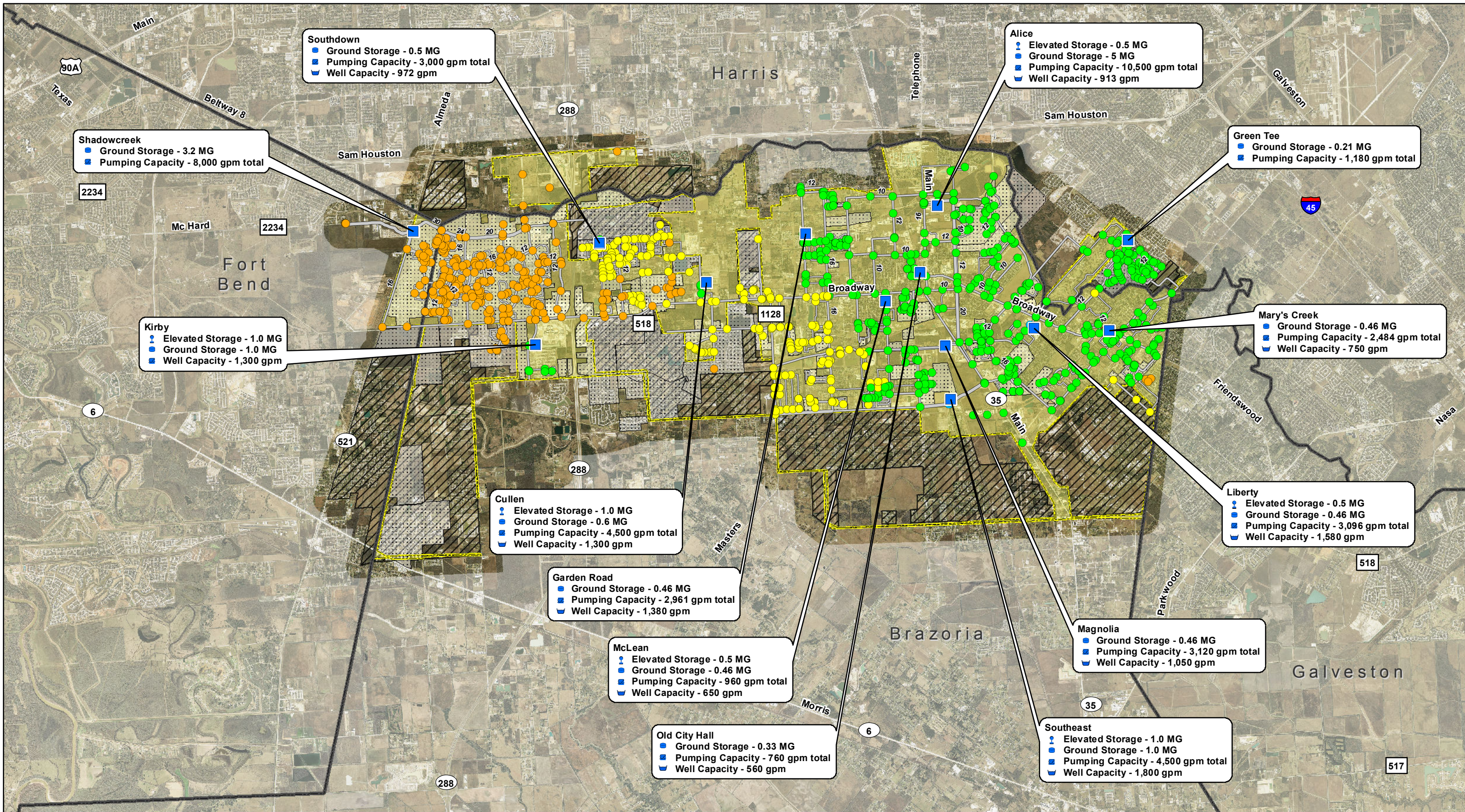
<b>Facility</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Elevated Storage Tank	35 - 45 psi	ETJ
Ground Storage Tank	46 - 50 psi	Pearland City Limit
Pump	51 - 55 psi	County Boundary
Well	56 - 60 psi	
Water Line	> 60 psi	

**Figure 6**  
**Average Summer Demand Pressure**

February 2013





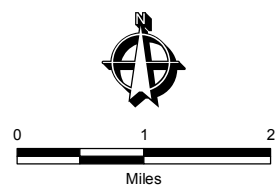
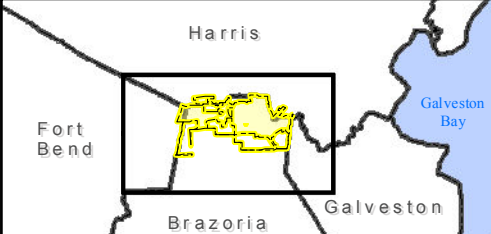


**Legend**

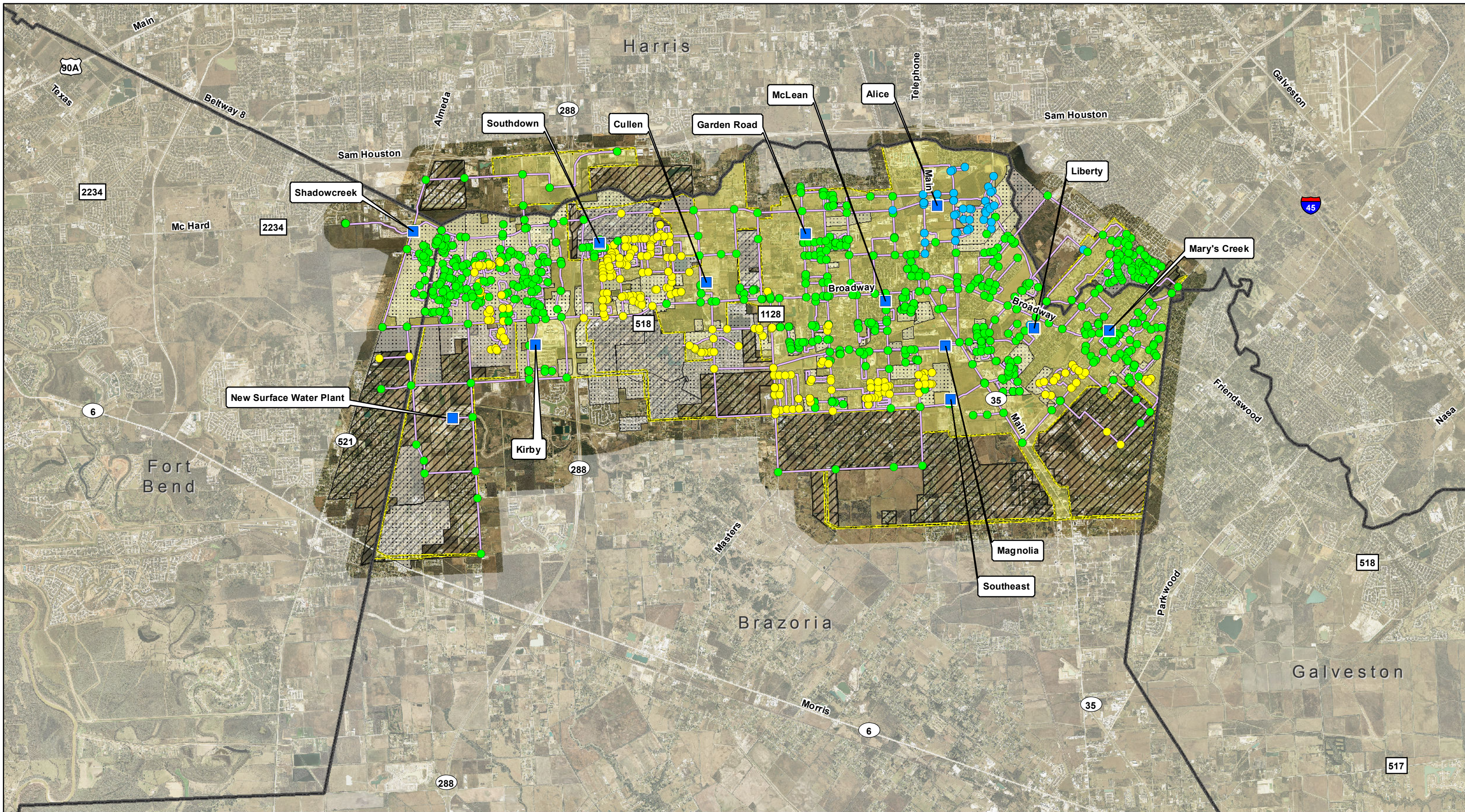
<b>Facility</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	Red circle: < 35 psi	MUD
Elevated Storage Tank	Orange circle: 35 - 45 psi	ETJ
Ground Storage Tank	Yellow circle: 46 - 50 psi	Pearland City Limit
Pump	Green circle: 51 - 55 psi	County Boundary
Well	Light Blue circle: 56 - 60 psi	
Water Line	Dark Blue circle: > 60 psi	

**Figure 7**  
**Peak Hour Demand Pressure**

February 2013





**Legend**



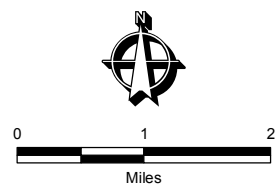
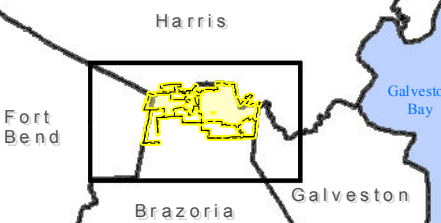
<b>Water System</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Water Line	35 - 45 psi	ETJ
	46 - 50 psi	Pearlland City Limit
	51 - 55 psi	County Boundary
	56 - 60 psi	
	> 60 psi	

**Figure 8**

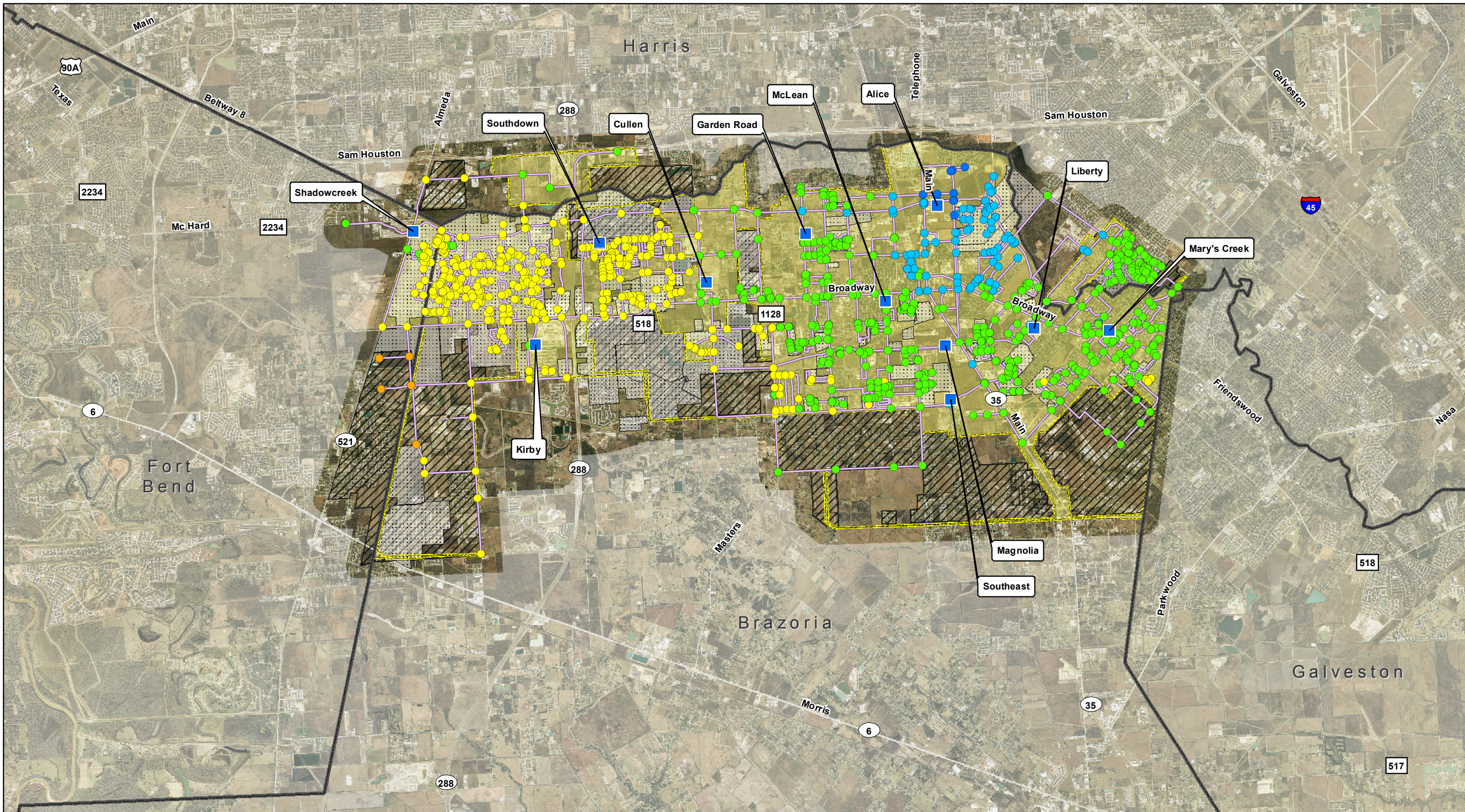
**Demand Year 2022**

**5 MGD Surface Water Plant**

February 2013





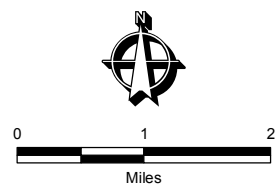
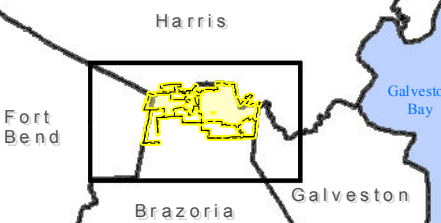
**Legend**

<b>Water System</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Water Line	35 - 45 psi	ETJ
	46 - 50 psi	Pearlland City Limit
	51 - 55 psi	County Boundary
	56 - 60 psi	
	> 60 psi	

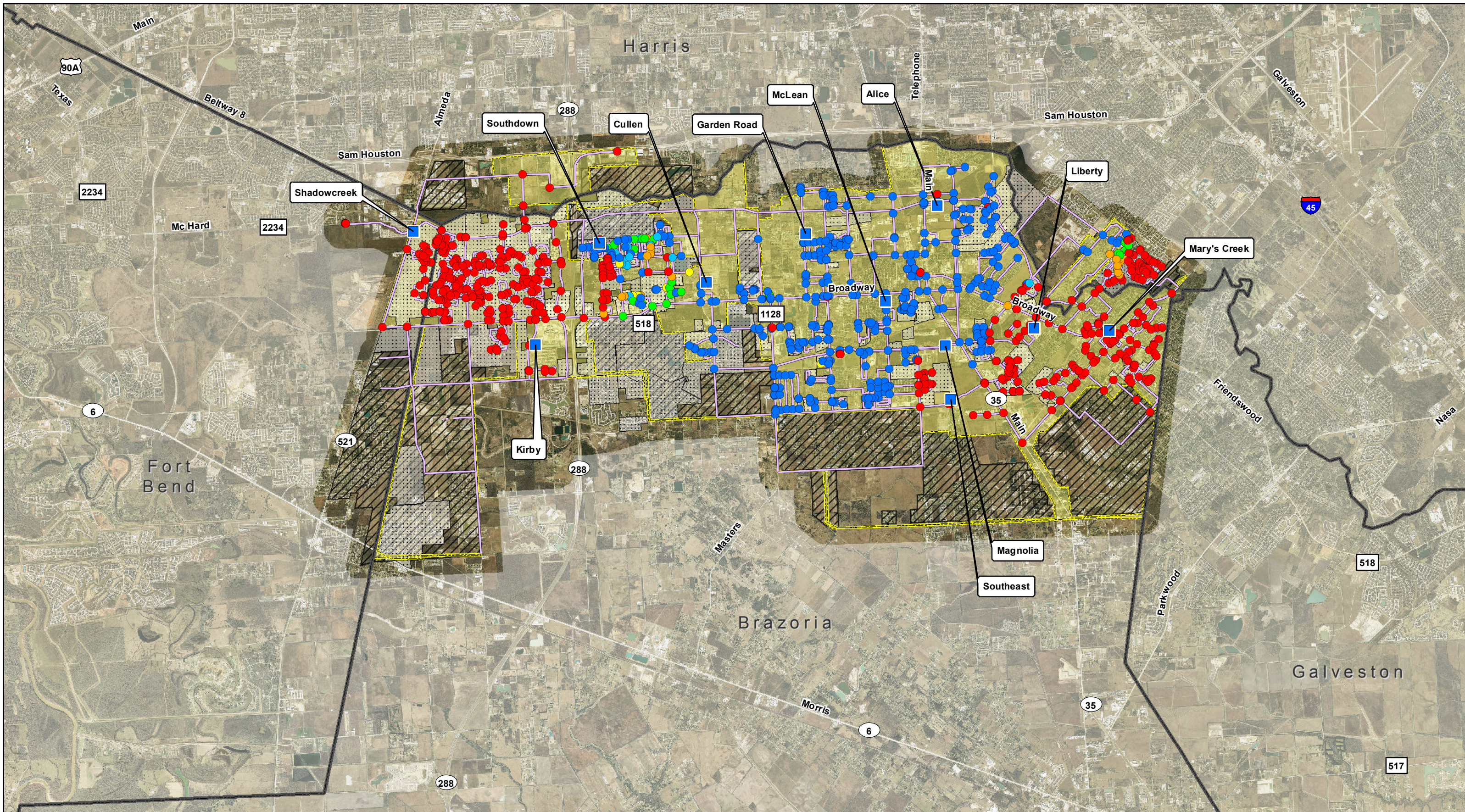
**Figure 9**  
**Demand Year 2022**  
**Additional 5 MGD Alice Water Plant**

February 2013





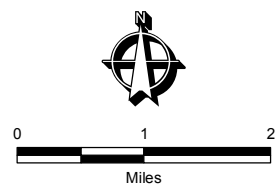
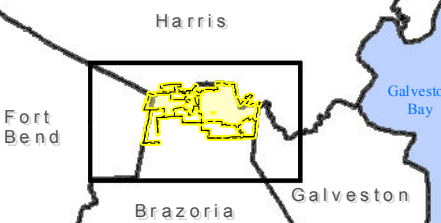


**Legend**

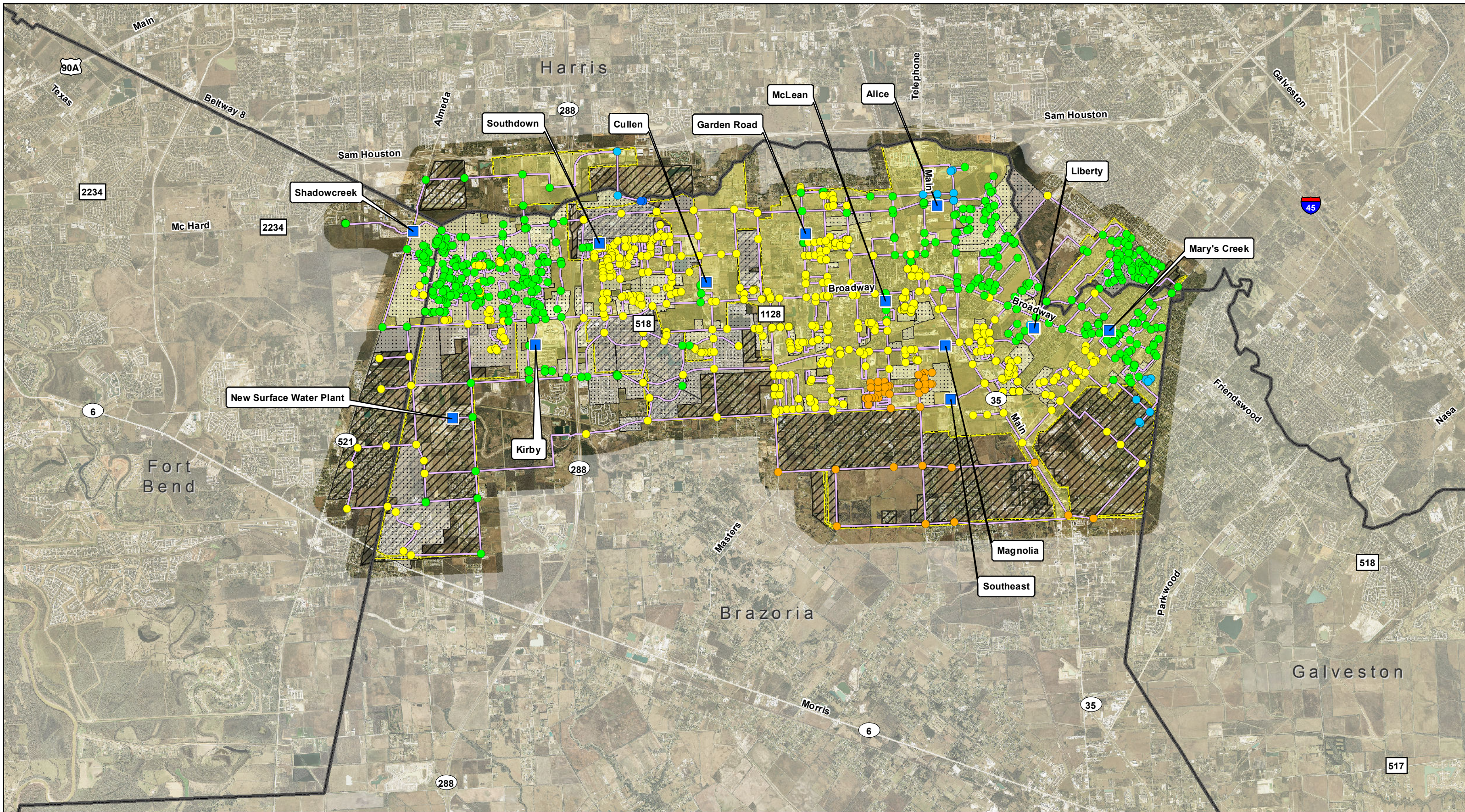
<b>Water System</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Water Line	35 - 45 psi	ETJ
	46 - 50 psi	Pearlland City Limit
	51 - 55 psi	County Boundary
	56 - 60 psi	
	> 60 psi	

**Figure 10**  
**Demand Year 2022**  
**Additional 5 MGD Alice Water Plant**  
**Trace Results**  
 February 2013







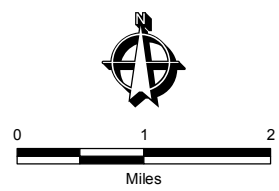
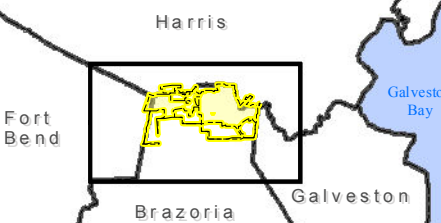


**Legend**

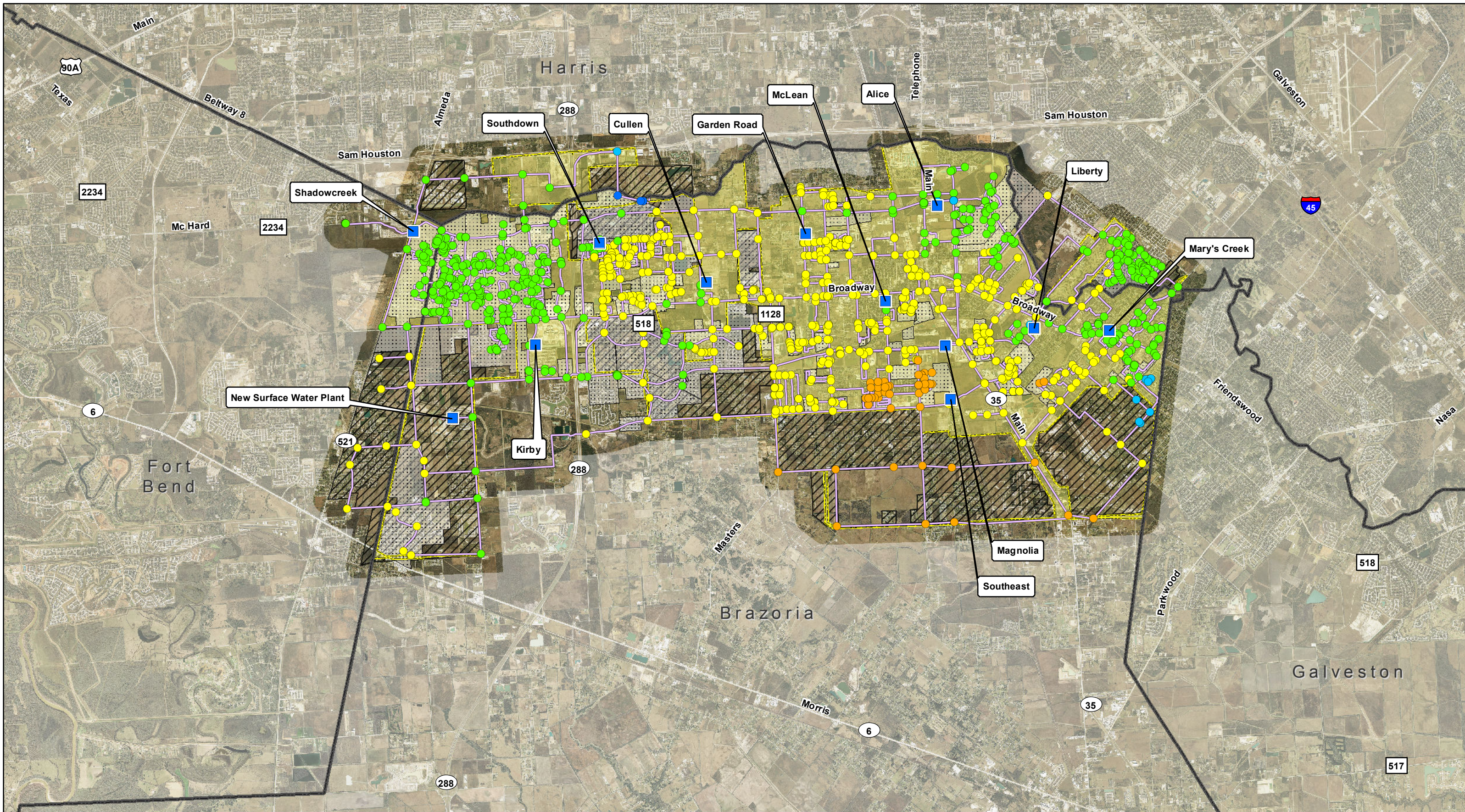
<b>Water System</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Water Line	35 - 45 psi	ETJ
	46 - 50 psi	Pearland City Limit
	51 - 55 psi	County Boundary
	56 - 60 psi	
	> 60 psi	

**Figure 11**  
**Additional 5 MGD Alice Water Plant**  
**and 10 MGD Surface Water Plant**

February 2013





**Legend**

<b>Water System</b>	<b>Pressure</b>	<b>Jurisdiction</b>
Water Facility	< 35 psi	MUD
Water Line	35 - 45 psi	ETJ
	46 - 50 psi	Pearland City Limit
	51 - 55 psi	County Boundary
	56 - 60 psi	
	> 60 psi	

**Figure 12**

**Demand Year 2042**

**15 MGD Surface Water Plant**

February 2013

