



July 31st, 2013
29321

Mike Petter
Brushy Creek M.U.D. General Manager
16318 Great Oaks Drive
Round Rock, TX 78681

RE: **REVISED** Technical Analysis of Water Demand in the Brushy Bend Park subdivision

Dear Mr. Petter:

Halff is pleased to present the results of our analysis of the Brushy Bend Park subdivision. This community is not within the limits of the Brushy Creek Municipal Utility District (BCMUD) CCN, though BCMUD provides water service to this area. Recently, one large parcel within Brushy Bend Park was replatted to create six individual lots. The additional water services for these new single family homes will increase the overall demand on this portion of BCMUD's system. If this development were to represent a trend towards smaller lots within Brushy Bend, there is cause for concern that service demand could increase beyond the capacity of the existing system infrastructure. Also, Brushy Bend Park customers have notified BCMUD that they experience periodic low water pressure in the subdivision, which could reflect existing problems within the Brushy Bend water system. For these reasons, Halff has investigated the potential for demand increase due to service unit growth within Brushy Bend Park, capacity limitations of the existing water system, and potential projects and costs to address these issues. System improvements have been identified to address specific service issues. Descriptions of these improvements are found on pages 5 & 6. Cost estimates for project construction are found at the back of this report as well as a map with project locations (Exhibit 2).

Subdivision Analysis

In order to determine the possible number of service units within the Brushy Bend Park subdivision, each parcel was evaluated and categorized by current service status and size. Halff graded the probability of an individual large parcel being subdivided to create new home sites based on parcel size, the length of street frontage, and location within the subdivision. With size as the predominant factor, the parcels are divided into three categories: plausible (easiest to subdivide), possible (large enough to subdivide, but may lack economic incentive), and improbable (subdivision would result in lots smaller than 1 acre or the exiting parcel has limited access). A criterion of this exercise was that all newly subdivided parcels are larger than 1.0 acre. This process is illustrated in Exhibit 1 at the back of this report. The table below shows the resulting number of possible new connections to the water system.

BRUSHY BEND PARCEL EVALUATION	
CURRENT CONNECTIONS	204
EXIST. LOTS WITHOUT METERS	13
POSSIBLE CONNECTIONS WITHOUT FURTHER SUBDIVISION	217
MAXIMUM NUMBER OF CONNECTIONS BY SUBDIVIDING PARCELS IN PLAUSIBLE CATEGORY	42
SUBTOTAL	259
MAXIMUM NUMBER OF CONNECTIONS BY SUBDIVIDING PARCELS IN POSSIBLE CATEGORY	45
MAXIMUM NUMBER OF SERVICE UNITS IN BRUSHY BEND (1.0 AC CRITERIA)	304

It should be noted that this table represents the most extreme scenario. Since the above growth requires the subdivision of previously developed properties, not raw land, any timeline for new home construction would not be based on typical population growth for the area and, therefore, uncertain. It is unlikely that Brushy Bend Park will ever quite attain 304 water services.

Tests on the WaterCAD model indicate that growth in the subdivision from the existing 204 meters up to 250 meters should not increase demand to the point that an issue with pressure loss is created. However, an existing low pressure issue that the WaterCAD model may not currently demonstrate would be exacerbated by this growth. This topic will be discussed further in the next section.

The Brushy Bend Park subdivision is connected to the BCMUD water system by a single, branch 6 inch diameter water main. Chapter 290.44.c of the TCEQ rules regulates the minimum line size per number of connections. The maximum number of customer connections allowed on a 6 inch main is 250. BCMUD will need to monitor the number of customer connections in Brushy Bend and anticipate the point at which the current main will need to be replaced with a larger line in order to continue service in this development and be in regulatory compliance. Project #1, which would enlarge the diameter of the water main connecting Brushy Bend Park to the BCMUD system, is described fully at the end of this report. Exhibit 2, also in the back of this report, illustrates the location and length of this project. After Project #1 is constructed, the main would be in compliance with TCEQ regulations indefinitely and would have capacity well in excess of the projected maximum number of possible service connections in Brushy Bend Park, i.e. 304 meters. As a result of this analysis, it became apparent that the 2" waterlines servicing Knollwood Circle and Vivian Drive currently exceed the allowable service unit capacity by rule. Replacement of these waterlines is included in the scope of Project #4, which replaces and upsizes waterlines in Brushy Bend that are not already improved by other projects. Replacement of this 2" pipe would likely improve overall service to the houses on these streets.

Analysis for fire flow was not included in the scope of this report, but it should be noted that the existing fire hydrants within the Brushy Bend Park development will not deliver a typical residential level of fire flow (500 gpm to 1500 gpm) under peak day demand conditions while the system

maintains required pressure levels. The construction of both Projects #1 & #2, which consists of 8” waterline installation on Walsh Dr. and Hightower Dr., would allow BCMUD to reliably provide the minimal level of fire protection (500 gpm) to the existing fire hydrants in Brushy Bend Park during all domestic demand conditions. In order to deliver fire protection elsewhere in this development, BCMUD should contemplate construction of Project #3, a system loop, and various portions of Project #4, depending on the desired location of new fire hydrants. Further analysis would be necessary to identify system improvements to guarantee fire protection in excess of 500 gpm.

Brushy Bend Park Water Demand and Pressure

Based on historical water production data for the years 2011 and 2012 provided by BCMUD, baselines for the average day and peak day water demand for both the Brushy Bend Park subdivision and the entire water system were determined. The results are tabulated below.

	BCMUD WATER SYSTEM	BRUSHY BEND SUBDIVISION
AVERAGE DAILY CONSUMPTION PER LUE (GAL)	514	488
PEAK DAY FACTOR	1.7	2.40
PEAK DAY CONSUMPTION PER LUE (GAL)	874	1,170
PEAK DAY FLOW RATE PER LUE (GPM)	0.61	0.81
EST. PEAK HOUR FLOW RATE PER LUE (GPM)	1.43	1.36

Halff updated the WaterCAD model to reflect these usage numbers. Test runs for peak day conditions, which also include peak hour demand within the 24 hour demand pattern, indicate several key points concerning demand and pressure within Brushy Bend Park.

- The Great Oaks North pressure reducing valve (PRV) on the west side of the water treatment plant (WTP) controls pressure to the 6 inch diameter main that is the only feed to the Brushy Bend Park subdivision. In every WaterCAD model scenario, the inlet pressure to this PRV exceeds the set point. In other words, the pump capacity at the WTP exceeds current peak demands and the system is able to maintain elevated storage at all times. Ideally, this indicates that low pressure experienced within Brushy Bend Park is not caused by a system wide issue, but rather is a localized issue related to high instantaneous/short term demand and pipe diameters.
- BCMUD staff recorded pressure readings at two locations on the Brushy Bend Park system to determine if Brushy Bend Park was impacted by water use in the Brushy Creek North development under real world conditions. In current configuration of the system, water must pass through two pressure reducing valves and the entirety of the Brushy Creek North Section 2 before it is distributed to Brushy Bend Park. These data logs demonstrated that

pressure to the Great Oaks North PRV is not maintained to the level predicted by the model. This suggests that water usage and system restrictions within Brushy Creek North Section 2 contribute to the low pressure experienced in Brushy Bend Park.

- Pressure loss to Brushy Bend Park appears to result from a combination of high dynamic losses due to pipe diameter, elevation differences, high peak system demand downstream of the Great Oaks North PRV, and pressure losses due to system parameters in Brushy Creek North Section 2. Based on the above table, peak hour flow in the 6 inch main that serves Brushy Bend Park is 284 gallons per minute (gpm). At this flow rate, dynamic friction losses reduce the pressure to a low of 43 psi to points along Hightower Drive and Vivian Drive. See attached graphs (Exhibits 3 & 4).

The lowest pressure demonstrated by the WaterCAD model in Brushy Bend Park does not include minor friction losses due to the diameter of customer plumbing systems. TCEQ rules mandate the pressure level to the point of service, i.e. the meter. According to the water model, BCMUD meets those requirements. Alternatively, two points stand out. The difference between 43 psi supplied at the point of service and 35 psi, the TCEQ mandated minimum, could easily be lost or dissipated by elevation changes on private property and minor friction losses within private water systems. Customers may experience pressure below 35 psi as “low pressure”. Furthermore, the WaterCAD scenarios were based on averaging data in an idealized situation. When dealing with personal irrigation systems on large lots, which is the case within Brushy Bend Park, it is a simple exercise to conceive of a scenario where demand in this subdivision exceeds 284 gpm. For example, if 50 homes in Brushy Bend Park were to turn on sprinkler irrigation systems at the same time, cumulative demand in the development could exceed 500 gpm. The chart below compares different flow rates in different pipe sizes and the resulting pressure losses to illustrate this point.

PRESSURE LOSS IN THE 3,580 LF APPROACH MAIN BETWEEN BRUSHY BEND PARK AND GREAT OAKS NORTH PRV		
	FLOW RATE (GPM)	
	284	500
VELOCITY IN 6 IN. PIPE (FT/S)	3.22	5.68
RESULTANT PRESSURE LOSS (PSI)	15.5	44.1
VELOCITY IN 8 IN. PIPE (FT/S)	1.81	3.19
RESULTANT PRESSURE LOSS (PSI)	3.8	10.9

The above table illustrates the amount of system pressure that could be conserved by increasing the diameter of the main between Brushy Creek North and Brushy Bend Park. The 3,580 linear feet in this table is only the distance between the Great Oaks North PRV and the first connection to the Brushy Bend Park system, not the entire length of Project #1, which would replace all of the 6 inch pipe along Sam Bass Road.

Recommendations

- BCMUD should replace the 6" diameter pipe parallel to Sam Bass Rd. with 8" diameter waterline. As part of this improvement, the Great Oaks North PRV should be relocated so that the Brushy Bend Park water system is supplied by a main more directly connected to both the North elevated storage tank (EST) and the water treatment facility, bypassing the smaller diameter lines contained in the Brushy Creek North Section 2 water system. The scope of Project 1 (see below) encompasses this recommended construction.
- If BCMUD determines that fire protection within Brushy Bend Park is a consideration, then Halff recommends the construction of Project #2 (full description below) in conjunction with Project #1 and that the size of the replacement mains be determined by the desired level of fire flow.
- BCMUD should consider construction that would loop the Brushy Bend Park system to the overall BCMUD system. This would increase service reliability to the development by ensuring a secondary feed during shut downs for maintenance emergencies and operations. A looped system also performs better during peak usage and fire demand scenarios. One example of how this may be accomplished is described in Project #3.

Project Descriptions

Project #1 - Beginning at the 12" diameter main on the east side of the BCMUD water treatment plant that supplies the North EST, install approximately 5,430 linear feet of 8 inch PVC main, with necessary appurtenances and encasement, to the intersection of Mayfield Drive and Sam Bass Road. Reconnect existing services, reconnect existing Brushy Bend Park bulk meter, and abandon existing 6 inch pipe material in place. This project would greatly reduce pressure loss due to friction during high instantaneous/short term demand Brushy Bend Park and eliminate losses due to the Brushy Creek North Section 2 water system. This project assumes the relocation of the Great Oaks North PRV. Estimated construction cost = \$411,920.

Project #2 - Replace approximately 4,000 linear feet of 4 inch waterline with 8" PVC from the intersection of Walsh Drive and Sam Bass Road to the intersection of Hightower Drive and Mayfield Drive. Diameter of new pipe material should be determined by specified level of fire flow. This project would continue the pressure loss reduction started by Project #1 and would allow for the possibility of fire flow in the neighborhood. Estimated construction cost for new 8 inch PVC pipe = \$371,600.

Project #3 - Install approximately 4,150 linear feet of 8" PVC pipe parallel to Oak Ridge Dr. and Walsh Dr., abandon existing PRV, and interconnect the Brushy Bend system to the 24" main at Oak Ridge and Great Oaks. This would provide a secondary feed to the Brushy Bend Park development, improving overall service and reliability. Estimated construction cost = \$269,860.



Project #4 – Replace all existing waterlines in Brushy Bend Park that are not included in any of the previously listed projects. This would consist of approximately 14,000 linear feet of 8” diameter PVC and associated appurtenances. Pipe diameters could be reduced in some locations at BCMUD’s discretion. Estimated construction cost = \$846,890.

Thank you for this opportunity. We look forward to working with BCMUD in the future.

Sincerely,

HALFF ASSOCIATES, INC.
TBPE FIRM #312

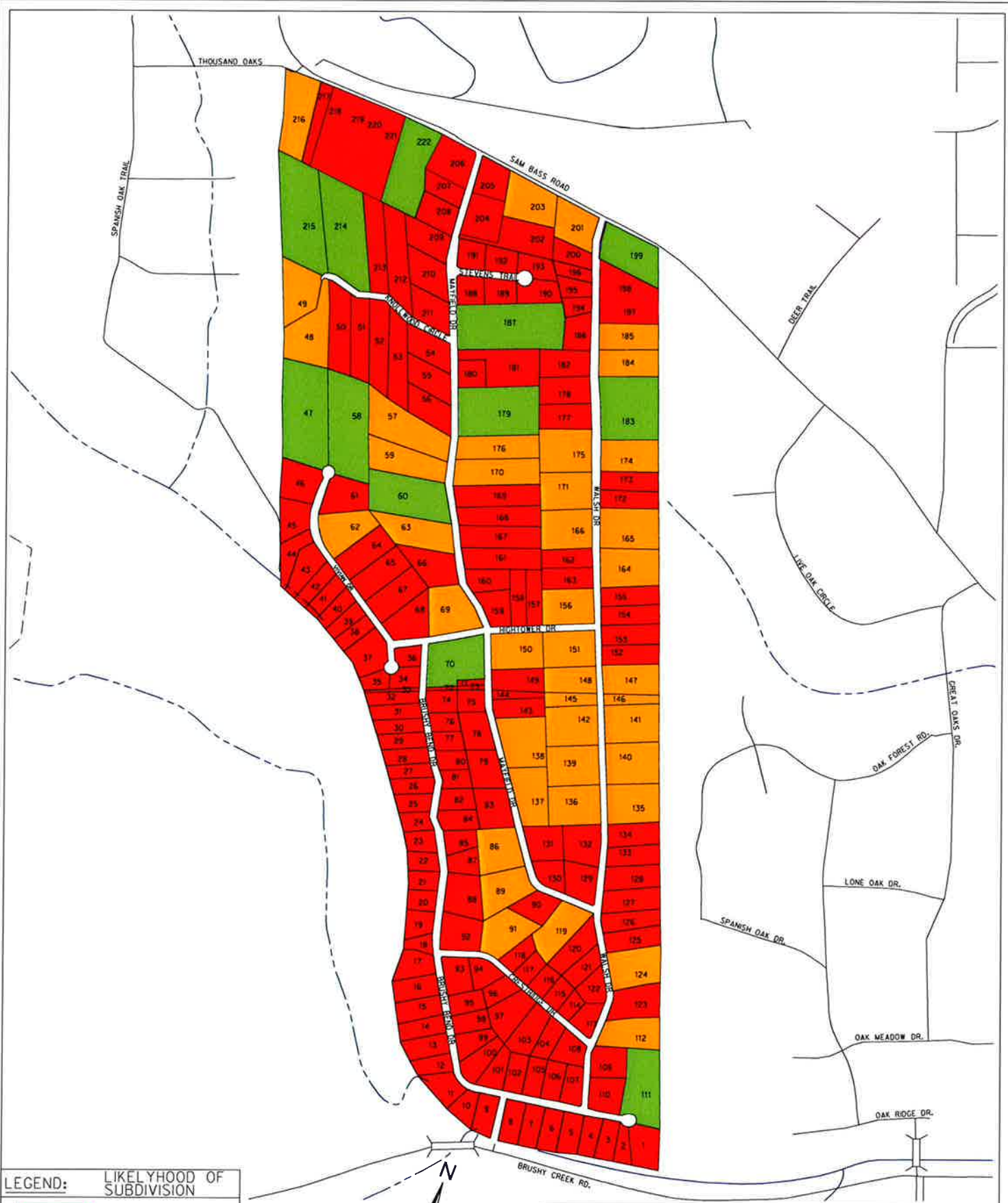
A handwritten signature in black ink, appearing to read "Noah Shaffer".

Noah Shaffer, P.E.
Project Engineer

C:



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LEGEND: LIKELYHOOD OF SUBDIVISION

- IMPROBABLE
- POSSIBLE
- PLAUSIBLE

BRUSHY BEND WATER SYSTEM STUDY
PARCEL CATEGORIZATION BY SIZE

AVO: 29321	DATE: 7/31/2013
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HALFFSM
TBPE FIRM NO.: 312

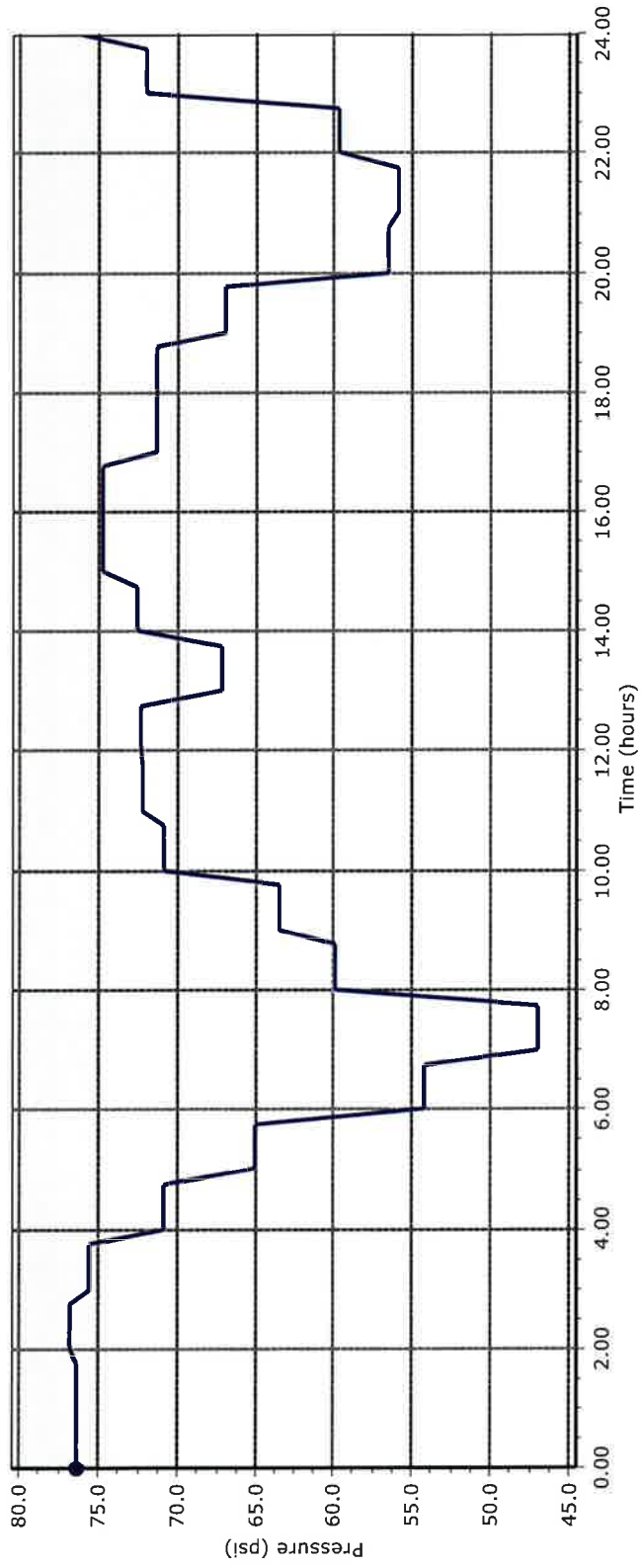


Brushy Creek
Municipal Utility District

EXHIBIT

1

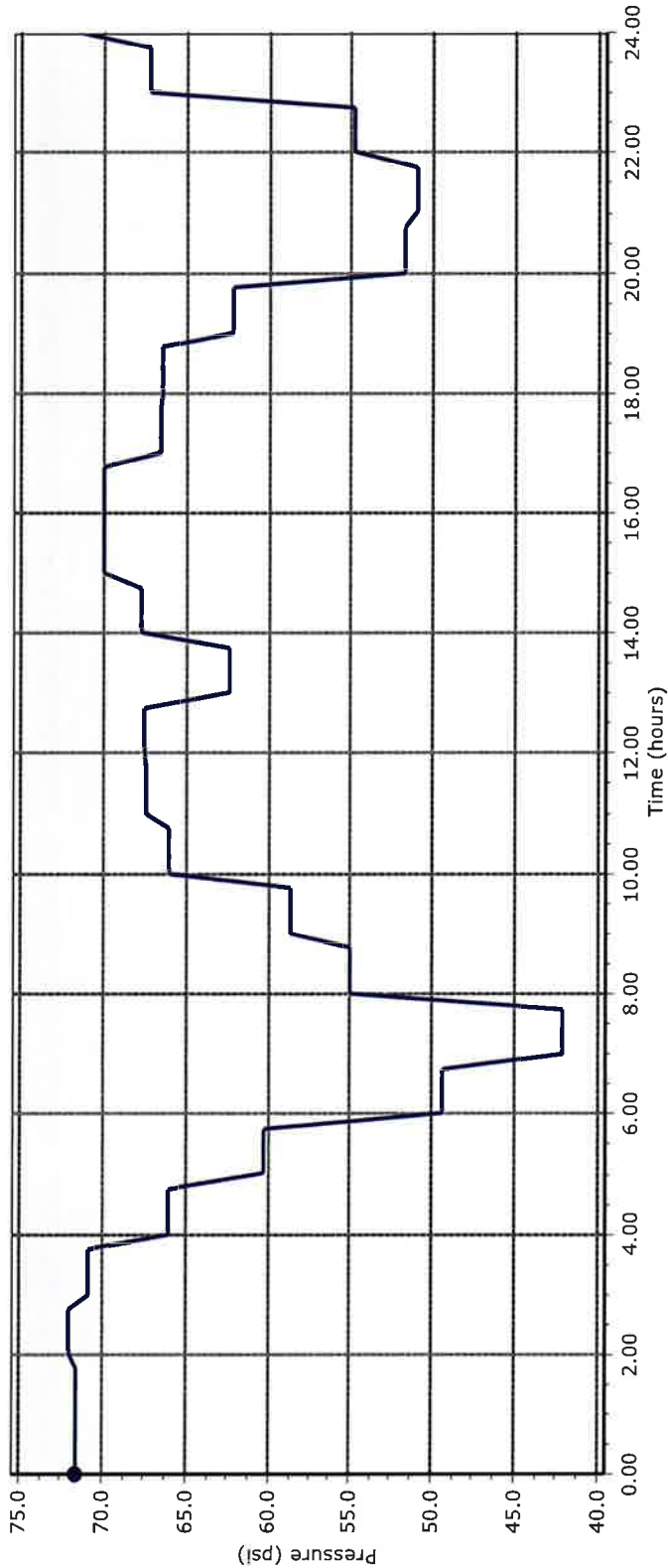
PEAK DAY PRESSURE
WALSH AND HIGHTOWER



J-2064 - Brushy Bend - Pressure

EXHIBIT 3

PEAK DAY PRESSURE
MAYFIELD AND HIGHTOWER



— J-45 - Brushy Bend - Pressure

EXHIBIT 4

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS
Brushy Creek M.U.D.

Project #1 Brushy Bend Park Improvements - 8" Water Main at Sam Bass Road & PRV Relocation

DATE: 7/31/2013
 PREPARED BY: NS
 HA AVO: 29321

PAY ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COSTS	SUB-TOTALS	% OF TOTAL COSTS
1	PREPARING ROW	STA	42	\$80.00	\$3,360	\$3,360	0.82%
2	CUT & REPAIR CONC. DRIVEWAYS	SY	139	\$75.00	\$10,425	\$10,425	2.53%
3	CUT & REPAIR ASPHALT (MATCH EX. THICKNESS)	SY	111	\$250.00	\$27,750	\$27,750	6.74%
4	WET CONNECTIONS	EA	4	\$1,000.00	\$4,000	\$4,000	0.97%
5	INSTALL PRECAST CONCRETE PRV VAULT	EA	1	\$10,000.00	\$10,000	\$10,000	281.45%
6	INSTALL 16" STEEL ENCASEMENT BY BORE	LF	60	\$225.00	\$13,500	\$13,500	3.28%
7	INSTALL 16" STEEL ENCASEMENT BY OPEN CUT	LF	450	\$125.00	\$56,250	\$56,250	13.66%
8	TRENCH EXCAVATION SAFETY SYSTEMS	LF	5,370	\$1.25	\$6,713	\$6,713	1.63%
9	8" DIA. PVC PIPE, C900, DR-18, INC. TRACER WIRE	LF	5,430	\$26.00	\$141,180	\$141,180	34.27%
10	DUCTILE IRON FITTINGS (8")	TON	1.3	\$7,000.00	\$9,100	\$9,100	2.21%
11	GATE VALVE (8")	EA	5	\$1,200.00	\$6,000	\$6,000	1.46%
12	GATE VALVE (6")	EA	2	\$900.00	\$1,800	\$1,800	0.44%
13	INSTALL FIRE HYDRANT, NOT INC. GATE VALVE	EA	2	\$2,500.00	\$5,000	\$5,000	1.21%
14	INSTALL FULL BODY TAP. SLEEVE W/ VALVE	EA	1	\$3,800.00	\$3,800	\$3,800	105.56%
15	RELOCATE EXIST. PRV ASSEMBLY TO NEW VAULT	EA	1	\$3,000.00	\$3,000	\$3,000	83.33%
16	RECONNECT EXIST. WATER SERVICES	EA	3	\$1,200.00	\$3,600	\$3,600	0.87%
17	MOBILIZATION	LS	1	\$22,000.00	\$22,000	\$22,000	5.34%
18	NATIVE SEEDING FOR EROSION CONTROL	SY	5,467	\$0.65	\$3,553	\$3,553	0.86%
19	SILT FENCE	LF	4,920	\$2.00	\$9,840	\$9,840	2.39%
20	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	2	\$1,200.00	\$2,400	\$2,400	0.58%
SUB TOTAL						\$343,270	
CONTINGENCY (20%)						\$68,650	
GRAND TOTAL						\$411,920	

UNIT PRICES ARE ENGINEER'S ESTIMATE BASED ON ENGINEER'S PREVIOUS EXPERIENCE AND QUALIFICATIONS WHICH REPRESENTS THE ENGINEER'S JUDGEMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. QUANTITIES IDENTIFIED IN THIS ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS HAVE BEEN ESTIMATED BY HALFF ASSOCIATES, INC. THE ENGINEER NEITHER MAKES REPRESENTATION NOR ACCEPTS RESPONSIBILITY AS TO THE ACCURACY OF THESE QUANTITIES AS STATED ABOVE. THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT THE PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM THESE ESTIMATES OF PROBABLE COSTS PREPARED FOR THE OWNER OR THE INTENDED RECIPIENT OF THIS DOCUMENT.

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Brushy Creek M.U.D.

Project #2 Brushy Bend Park Improvements - 4" Waterline Replacement in Brushy Bend Park

DATE: 7/31/2013
 PREPARED BY: NS
 HA AVO: 29321

PAY ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COSTS	SUB-TOTALS	% OF TOTAL COSTS
1	PREPARING ROW	STA	40.0	\$75.00	\$3,000	\$3,000	0.81%
2	CUT & REPAIR CONC. DRIVEWAYS	SY	400.0	\$75.00	\$30,000	\$30,000	8.07%
3	CUT & REPAIR ASPHALT (MATCH EX. THICKNESS)	SY	188.9	\$250.00	\$47,222	\$47,222	12.71%
4	WET CONNECTIONS	EA	3	\$2,000.00	\$6,000	\$6,000	1.61%
5	INSTALL 1" PVC SERVICE MATERIAL	LF	420	\$15.00	\$6,300	\$6,300	1.70%
6	TRENCH EXCAVATION SAFETY SYSTEMS	LF	4,000	\$1.25	\$5,000	\$5,000	1.35%
7	8" DIA. PVC PIPE, C900, DR-18, INC. TRACER WIRE	LF	4,000	\$26.00	\$104,000	\$104,000	27.99%
8	DUCTILE IRON FITTINGS (8")	TON	0.7	\$7,000.00	\$4,900	\$4,900	1.32%
9	GATE VALVE (8")	EA	4	\$1,200.00	\$4,800	\$4,800	1.29%
10	GATE VALVE (6")	EA	6	\$900.00	\$5,400	\$5,400	1.45%
11	INSTALL FIRE HYDRANT, NOT INC. GATE VALVE	EA	6	\$2,500.00	\$15,000	\$15,000	4.04%
12	RECONNECT EXIST. WATER SERVICES	EA	31	\$1,200.00	\$37,200	\$37,200	10.01%
13	MOBILIZATION	EA	1	\$18,000.00	\$18,000	\$18,000	4.84%
14	ABANDON EXIST. 4" WATERLINE	LS	1	\$6,000.00	\$6,000	\$6,000	1.61%
15	NATIVE SEEDING FOR EROSION CONTROL	SY	4,378	\$0.65	\$2,846	\$2,846	0.77%
16	SILT FENCE	LF	4,000	\$2.00	\$8,000	\$8,000	2.15%
17	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	2	\$3,000.00	\$6,000	\$6,000	1.61%
				SUB TOTAL		\$309,670	
				CONTINGENCY (20%)		\$61,930	
				GRAND TOTAL		\$371,600	

UNIT PRICES ARE ENGINEER'S ESTIMATE BASED ON ENGINEER'S PREVIOUS EXPERIENCE AND QUALIFICATIONS WHICH REPRESENTS THE ENGINEER'S JUDGEMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. QUANTITIES IDENTIFIED IN THIS ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS HAVE BEEN ESTIMATED BY HALFF ASSOCIATES, INC. THE ENGINEER NEITHER MAKES REPRESENTATION NOR ACCEPTS RESPONSIBILITY AS TO THE ACCURACY OF THESE QUANTITIES AS STATED ABOVE. THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT THE PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM THESE ESTIMATES OF PROBABLE COSTS PREPARED FOR THE OWNER OR THE INTENDED RECIPIENT OF THIS DOCUMENT.

ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Brushy Creek M.U.D.

Project #3 Brushy Bend Park Improvements - 8" Loop on Oak Ridge Dr. & Walsh Dr.

DATE: 7/31/2013
 PREPARED BY: NS
 HA AVO: 29321

PAY ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COSTS	SUB-TOTALS	% OF TOTAL COSTS
1	PREPARING ROW	STA	40.0	\$75.00	\$3,000	\$3,000	1.1%
2	CUT & REPAIR CONC. DRIVEWAYS	SY	140.0	\$75.00	\$10,500	\$10,500	3.9%
3	CUT & REPAIR ASPHALT (MATCH EX. THICKNESS)	SY	12.0	\$250.00	\$3,000	\$3,000	1.1%
4	WET CONNECTIONS	EA	2	\$2,500.00	\$5,000	\$5,000	1.9%
5	TRENCH EXCAVATION SAFETY SYSTEMS	LF	4,150	\$1.25	\$5,188	\$5,188	1.9%
6	8" DIA. PVC PIPE, C900, DR-18, INC. TRACER WIRE	LF	4,150	\$26.00	\$107,900	\$107,900	40.0%
7	DUCTILE IRON FITTINGS (8")	TON	0.7	\$7,000.00	\$4,900	\$4,900	1.8%
8	GATE VALVE (8")	EA	4	\$1,200.00	\$4,800	\$4,800	1.8%
9	INSTALL 4" PRV. INC. VAULT & BYPASS	EA	1	\$16,000.00	\$16,000	\$16,000	5.9%
10	RECONNECT EXIST. WATER SERVICES	EA	18	\$1,200.00	\$21,600	\$21,600	8.0%
11	MOBILIZATION	EA	1	\$12,000.00	\$12,000	\$12,000	4.4%
12	ABANDON EXIST. 3" WATERLINE, VALVES & PRV	LS	1	\$7,000.00	\$7,000	\$7,000	2.6%
13	NATIVE SEEDING FOR EROSION CONTROL	SY	4,322	\$0.65	\$2,809	\$2,809	1.0%
14	SILT FENCE	LF	3,890	\$2.00	\$7,780	\$7,780	2.9%
15	EASEMENTS	AC	0.5	\$15,000.00	\$7,400	\$7,400	2.7%
16	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	2	\$3,000.00	\$6,000	\$6,000	2.2%
				SUB TOTAL		\$224,880	
				CONTINGENCY (20%)		\$44,980	
				GRAND TOTAL		\$269,860	

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ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS

Brushy Creek M.U.D.

Project #4 Brushy Bend Park Improvements - Replace Remainder of Brushy Bend Park WL

DATE: 7/31/2013
 PREPARED BY: NS
 HA AVO: 29321

PAY ITEM NO	DESCRIPTION	UNITS	QUANTITY	UNIT PRICE	ITEM COSTS	SUB-TOTALS	% OF TOTAL COSTS
1	PREPARING ROW	STA	140.0	\$75.00	\$10,500	\$10,500	1.2%
2	CUT & REPAIR CONC. DRIVEWAYS	SY	500.0	\$75.00	\$37,500	\$37,500	4.4%
3	CUT & REPAIR ASPHALT (MATCH EX. THICKNESS)	SY	75.0	\$250.00	\$18,750	\$18,750	2.2%
4	WET CONNECTIONS	EA	5	\$2,500.00	\$12,500	\$12,500	1.5%
5	TRENCH EXCAVATION SAFETY SYSTEMS	LF	14,000	\$1.25	\$17,500	\$17,500	2.1%
6	8" DIA. PVC PIPE, C900, DR-18, INC. TRACER WIRE	LF	14,000	\$26.00	\$364,000	\$364,000	43.0%
7	DUCTILE IRON FITTINGS (8")	TON	3.8	\$7,000.00	\$26,600	\$26,600	3.1%
8	GATE VALVE (8")	EA	10	\$1,200.00	\$12,000	\$12,000	1.4%
9	RECONNECT EXIST. WATER SERVICES	EA	95	\$1,200.00	\$114,000	\$114,000	13.5%
10	MOBILIZATION	EA	1	\$20,000.00	\$20,000	\$20,000	2.4%
11	ABANDON EXIST. WATERLINES, VALVES & PRV	LS	1	\$22,000.00	\$22,000	\$22,000	2.6%
12	NATIVE SEEDING FOR EROSION CONTROL	SY	14,444	\$0.65	\$9,389	\$9,389	1.1%
13	SILT FENCE	LF	13,000	\$2.00	\$26,000	\$26,000	3.1%
14	BARRICADES, SIGNS AND TRAFFIC HANDLING	MO	5	\$3,000.00	\$15,000	\$15,000	1.8%
SUB TOTAL						\$705,740	
					CONTINGENCY (20%)	\$141,150	
GRAND TOTAL						\$846,890	

UNIT PRICES ARE ENGINEER'S ESTIMATE BASED ON ENGINEER'S PREVIOUS EXPERIENCE AND QUALIFICATIONS WHICH REPRESENTS THE ENGINEER'S JUDGEMENT AS A DESIGN PROFESSIONAL FAMILIAR WITH THE CONSTRUCTION INDUSTRY. QUANTITIES IDENTIFIED IN THIS ENGINEER'S ESTIMATE OF PROBABLE CONSTRUCTION COSTS HAVE BEEN ESTIMATED BY HALFF ASSOCIATES, INC. THE ENGINEER NEITHER MAKES REPRESENTATION NOR ACCEPTS RESPONSIBILITY AS TO THE ACCURACY OF THESE QUANTITIES AS STATED ABOVE. THE ENGINEER CANNOT AND DOES NOT GUARANTEE THAT THE PROPOSALS, BIDS, OR ACTUAL CONSTRUCTION COSTS WILL NOT VARY FROM THESE ESTIMATES OF PROBABLE COSTS PREPARED FOR THE OWNER OR THE INTENDED RECIPIENT OF THIS DOCUMENT.