TOWN OF ADDISON , TEXAS

CELESTIAL PUMP STATION IMPROVEMENTS

SUMMARY OF BIDS
9:00 a.m., February 17, 1998

	CONTRACTOR	Total Amount of Bid
1.	MEP Ventures, Inc. 212 N. Crockett, Suite C Sherman, Texas 75090-5996	$553,772.00
2.	Cajun Contractors, Inc. P. O. Box 59367 Dallas, Texas 75229	$621,000.00
3.	Control Specialist, Inc. P. O. Box 141 Roanoke, Texas 76262	$652,000.00
4.	Red River Construction Co. 1506 Capital Avenue, #200 Plano, Texas 75074	$726,600.00
5.	North Texas Municipal Construction Company, Inc. 5614 Dyer Street Dallas, Texas 75206	$748,499.99

	PUMP SUPPLIERS	Pump Manufacturer	Total Amount of Bid
1.	Paco/Johnston	Johnston	$39,620.00
2.	Jersey Equipment Company	SimpFlow	$39,671.00
3.	Smith Pump Company	Bryon Jackson	$45,450.00
4.	Oslin Nation	Ingersol-Dresser	$47,000.00
5.	Atlas Engineering, Inc.	Flow Way	$48,547.00
6.	J-Line Pump Company	J-Line	$59,572.00

TABULATION OF BIDS

DATE: February 17, 1998

PROJECT: TOWN OF ADDISON, TEXAS
Celestial Pump Station Additions - Pumps 2 & 4
and Emergency Generation

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS
Dallas, Texas

ITEM NO.	APPROXIMATE QUANTITIES	UNIT	DESCRIPTION	BID OF MEP Ventures, Inc. 212 N. Crockett, Suite C Sherman, Texas 75090-5996		BID OF Cajun Contractors, Inc. P. O. Box 59367 Dallas, Texas 75229		BID OF Control Specialist, Inc. P. O. Box 141 Roanoke, Texas 76262		BID OF Red River Construction Co. 1506 Capital Avenue, #200 Plano, Texas 75074	
				UNIT BID PRICE	EXTENSION	UNIT BID PRICE	EXTENSION	UNIT BID PRICE	EXTENSION	UNIT BID PRICE	EXTENSION
1*	1	Ea.	For Furnishing a 2,000 GPM Vertical Turbine Pump and 100 HP Motor	$28,000.00	$28,000.00	$28,000.00	$28,000.00	$28,000.00	$28,000.00	$28,000.00	$28,000.00
2*	1	Ea.	Furnishing a 3,500 GPM Vertical Turbine Pump & 200 HP Motor	$34,000.00	$34,000.00	$34,000.00	$34,000.00	$34,000.00	$34,000.00	$34,000.00	$34,000.00
3	1	Ea.	For Installing, Leveling & Making Operational a 2,000 GPM Pump & 100 HP Motor	$3,140.00	$3,140.00	$2,000.00	$2,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
4	1	Ea.	For Installing, Leveling and Making Operational a 3,500 GPM Pump and 200 HP Motor	$3,650.00	$3,650.00	$2,500.00	$2,500.00	$5,000.00	$5,000.00	$5,500.00	$5,500.00
5	1	Ea.	For Furnishing and Installing 14-Inch Butterfly Valves and Pump Check Control System	$6,391.00	$6,391.00	$6,000.00	$6,000.00	$8,000.00	$8,000.00	$7,500.00	$7,500.00
6	1	Ea.	For Furnishing and Installing 12-Inch Butterfly Valves and Pump Check Control System	$6,391.00	$6,391.00	$8,000.00	$8,000.00	$8,000.00	$8,000.00	$7,000.00	$7,000.00
7	1	Ea.	For Furnishing and Installing 3-Inch Air/Vacuum Valve	$766.00	$766.00	$750.00	$750.00	$2,000.00	$2,000.00	$1,200.00	$1,200.00
8	1	Ea.	For Furnishing and Installing 2-Inch Air/Vacuum Valve	$549.00	$549.00	$600.00	$600.00	$2,000.00	$2,000.00	$800.00	$800.00
9	1	L.S.	Furnish & Install Piping and appurtenances to Connect Pumps to Discharge Header	$16,779.00	$16,779.00	$16,000.00	$16,000.00	$17,000.00	$17,000.00	$30,000.00	$30,000.00
10	1	L.S.	For Furnishing and Installing Flow Transmitter	$4,399.00	$4,399.00	$20,000.00	$20,000.00	$21,000.00	$21,000.00	$17,000.00	$17,000.00
11	1	L.S.	Furnish & Install Motor Control Centers, including Multi-Lyns Protection Units	$74,856.00	$74,856.00	$90,000.00	$90,000.00	$100,000.00	$100,000.00	$85,000.00	$85,000.00
12	1	L.S.	For Furnishing and Installing Ventilation Modifications in Electrical Room	$3,000.00	$3,000.00	$5,000.00	$5,000.00	$7,000.00	$7,000.00	$15,000.00	$15,000.00
13	1	L.S.	For Furnishing and Installing Emergency Generator Set Inside Generator Set Building	$154,200.00	$154,200.00	$189,950.00	$189,950.00	$157,000.00	$157,000.00	$155,000.00	$155,000.00
14	1	L.S.	For Furnishing and Installing Emergency Generator Set Conduits, Conductors, Connections and all appurtenances to make Operational	$26,720.00	$26,720.00	$60,000.00	$60,000.00	$38,000.00	$38,000.00	$55,000.00	$55,000.00
15	1	L.S.	For Furnishing and Installing All necessary Conduits, Conductor, Connections and all appurtenances to make Electrical System Operational	$9,000.00	$9,000.00	$18,000.00	$18,000.00	$33,000.00	$33,000.00	$29,000.00	$29,000.00
16	1	L.S.	For Furnishing and Installing Emergency Generator Set Foundation and Screening Wall, including Excavation and Grading	See Item 21	$0.00	$75,000.00	$75,000.00	No Bid	$0.00	$0.00	$0.00
17	3	Ea.	For Furnishing, Installing and Making Operational Multi-Lyns Motor Protection in Existing Motor Control Centers	$23,562.00	$70,686.00	$13,000.00	$39,000.00	$11,000.00	$33,000.00	$35,000.00	$105,000.00
18	1	L.S.	For Restoring Disturbed Areas, including Establishing Solid Sod and Adjustments to Irrigation System	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$5,000.00	$5,000.00	$3,000.00	$3,000.00
19	1	L.S.	For Expanding Existing Driveway Area, including Saw Cut, Longitudinal Butt Joint, Curbs, Concrete and Subgrade Compaction	$6,400.00	$6,400.00	$1,200.00	$1,200.00	$5,000.00	$5,000.00	$8,000.00	$8,000.00
20	1	L.S.	For Preparing and Painting Steel Surfaces, including Electrical Conduits	$10,000.00	$10,000.00	$15,000.00	$15,000.00	$16,000.00	$16,000.00	$15,000.00	$15,000.00
21	1	L.S.	For Furnishing and Installing Emergency Generator Building, including Foundation, Electrical Sound Proofing and all appurtenances	$92,845.00	$92,845.00	$8,000.00	$8,000.00	$128,000.00	$128,000.00	$120,600.00	$120,600.00
			TOTAL AMOUNT BID (Items 1 through 21)		**$553,772.00**		**$621,000.00**		**$652,000.00**		**$726,600.00**

TABULATION OF BIDS

DATE: February 17, 1998

PROJECT: TOWN OF ADDISON, TEXAS
Celestial Pump Station Additions - Pumps 2 & 4
and Emergency Generation

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS
Dallas, Texas

BID OF

North Texas Municipal
Construction Company, Inc.
5614 Dyer Street
Dallas, Texas 75206

ITEM NO.	APPROXIMATE QUANTITIES	UNIT	DESCRIPTION	UNIT BID PRICE	EXTENSION
1*	1	Ea.	For Furnishing a 2,000 GPM Vertical Turbine Pump and 100 HP Motor	$28,000.00	$28,000.00
2*	1	Ea.	Furnishing a 3,500 GPM Vertical Turbine Pump & 200 HP Motor	$34,000.00	$34,000.00
3	1	Ea.	For Installing, Leveling & Making Operational a 2,000 GPM Pump & 100 HP Motor	$15,000.00	$15,000.00
4	1	Ea.	For Installing, Leveling and Making Operational a 3,500 GPM Pump and 200 HP Motor	$15,000.00	$15,000.00
5	1	Ea.	For Furnishing and Installing 14-Inch Butterfly Valves and Pump Check Control System	$6,000.00	$6,000.00
6	1	Ea.	For Furnishing and Installing 12-Inch Butterfly Valves and Pump Check Control System	$6,000.00	$6,000.00
7	1	Ea.	For Furnishing and Installing 3-Inch Air/Vacuum Valve	$700.00	$700.00
8	1	Ea.	For Furnishing and Installing 2-Inch Air/Vacuum Valve	$500.00	$500.00
9	1	L.S.	Furnish & Install Piping and appurtenances to Connect Pumps to Discharge Header	$30,000.00	$30,000.00
10	1	L.S.	For Furnishing and Installing Flow Transmitter	$15,000.00	$15,000.00
11	1	L.S.	Furnish & Install Motor Control Centers, including Multi-Lyns Protection Units	$100,000.00	$100,000.00
12	1	L.S.	For Furnishing and Installing Ventilation Modifications in Electrical Room	$2,000.00	$2,000.00
13	1	L.S.	For Furnishing and Installing Emergency Generator Set Inside Generator Set Building	$125,000.00	$125,000.00
14	1	L.S.	For Furnishing and Installing Emergency Generator Set Conduits, Conductors, Connections and all appurtenances to make Operational	$9,000.00	$9,000.00
15	1	L.S.	For Furnishing and Installing All necessary Conduits, Conductor, Connections and all appurtenances to make Electrical System Operational	$120,000.00	$120,000.00
16	1	L.S.	For Furnishing and Installing Emergency Generator Set Foundation and Screening Wall, including Excavation and Grading	See Item 21	$0.00
17	3	Ea.	For Furnishing, Installing and Making Operational Multi-Lyns Motor Protection in Existing Motor Control Centers	$33,333.33	$99,999.99
18	1	L.S.	For Restoring Disturbed Areas, including Establishing Solid Sod and Adjustments to Irrigation System	$1,300.00	$1,300.00
19	1	L.S.	For Expanding Existing Driveway Area, including Saw Cut, Longitudinal Butt Joint, Curbs, Concrete and Subgrade Compaction	$15,000.00	$15,000.00
20	1	L.S.	For Preparing and Painting Steel Surfaces, including Electrical Conduits	$15,000.00	$15,000.00
21	1	L.S.	For Furnishing and Installing Emergency Generator Building, including Foundation, Electrical Sound Proofing and all appurtenances	$111,000.00	$111,000.00
			TOTAL AMOUNT BID (Items 1 through 21)		**$748,499.99**

* Bid Allowance Item

TOWN OF

ADDISON PUBLIC WORKS

To: John Birkhoff

Company: Shimek, Jacobs . . .

FAX #: 214-361-0204

Date: 2-9-98

Re: Pratt Valves

# of pages (including cover): 6

From: James C. Pierce,Jr.,P.E.,DEE
Assistant City Engineer
Phone: 972/450-2879
FAX: 972/450-2837

16801 Westgrove
P.O. Box 144

Addison, TX 75001

☐ Original in mail ☐ Per your request ☒ FYI ☐ Call me

Comments:

Info on Henry Pratt Co from the Internet, including sales reps. Hope this helps.

Jim

Henry Pratt Company

Sales Representatives for Texas

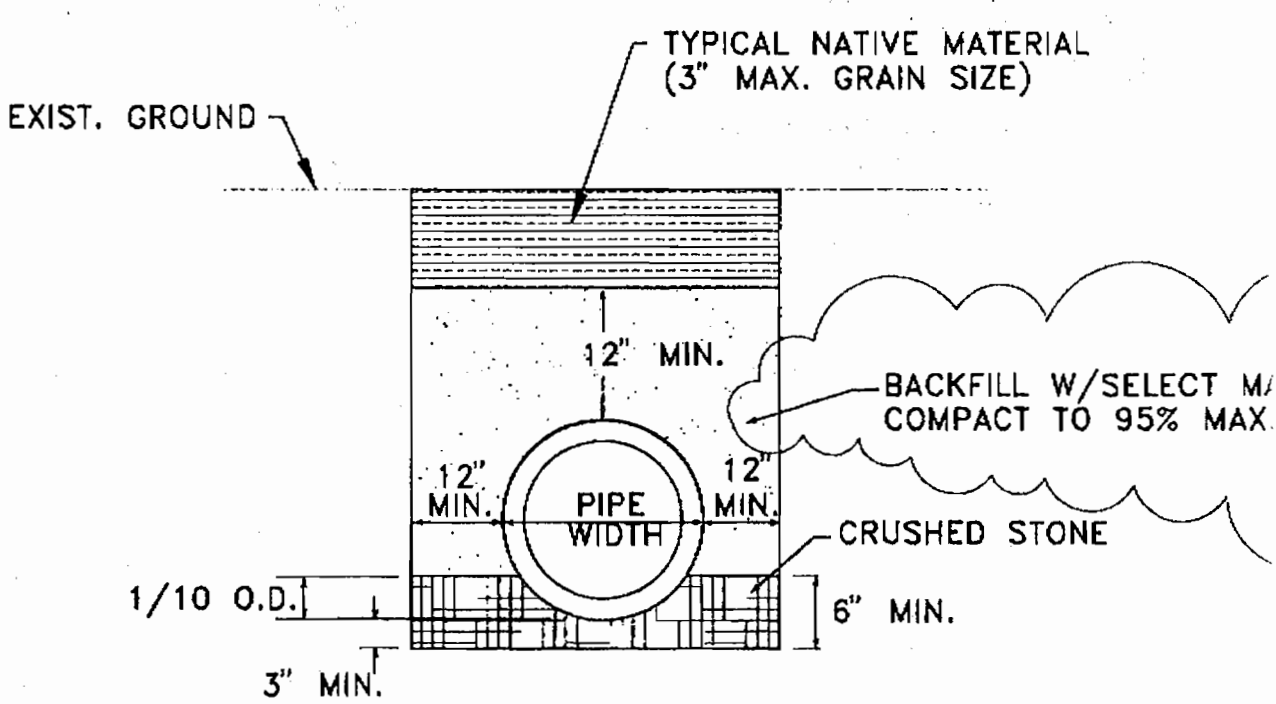
Company	Markets	
	Water Works	Power and Nuclear
Manufactured Valve Products,Inc. Garland, Texas Phone: 9726812200 Fax: 9726810066	✓	-
H*E Engineering Equipement Company Tulsa, Oklahoma Phone: 9182512121 Fax: 9182511051	✓	✓
Scruggs Company Houston, Texas Phone:7136492776 Fax: 7136491975	✓	-
Pipestone Industrial Co., Inc. Denver, Colorado Phone: 3037712300 Fax: 3037712396	✓	-

[Home] [Back]

Tyco International owns
Henry Pratt Co and
Mueller Co.

ADDISON AIRPORT
ADDENDUM NO. 1
PARTIAL DRAWING NO. 22

Ⓐ ADDED COMPACTION REQUIREMENTS
12/18/97



EMBEDMENT DETAIL FOR STORM SEWER
DETAIL NO. 1

N.T.S.

Henry Pratt Company

Products & Services

- All Product Details

- Model 2FII Bonded Seat Butterfly Valve
- Integrated Control Systems
- Groundhog Buried Service Rubber Seated Butterfly Valve
- Triton HP-250 Butterfly Valve
- HPX High Performance Butterfly Valve
- Indicating Butterfly Valve
- Series 8000 Industrial Butterfly Valve
- Metal Seated Ball Valve
- Monoflange MKII Bonded Seat Butterfly Valve
- N-Stamp Nuclear Butterfly Valve
- PIVA Post Indicating Valve Assembly
- AWWA Rubber Seated Ball Valve
- Rectangular Rubber Seated Butterfly Valves
- On-Site/Field/Factory Repair Services
- UL Listed Groundhog and Style G Indicator Post
- Venturi Flow Meters
- Triton XL Rubber Seated Butterfly Valve
- Triton XR-70 Rubber Seated Butterfly Valve

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Highlight the desired text and select "copy" from the Edit menu of your browser. Then paste the text into your word processor.

[Home] [Back]

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-Addison Svc Ctr -Upstairs-

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

FAX TRANSMISSION COVER SHEET

Fax Number: 72-450-2837 From: John W. Birkhoff, P.E.

Number of Pages Transmitted (including this one) **9** Date: February 6, 1998

To: **Mr. Jim Pierce**

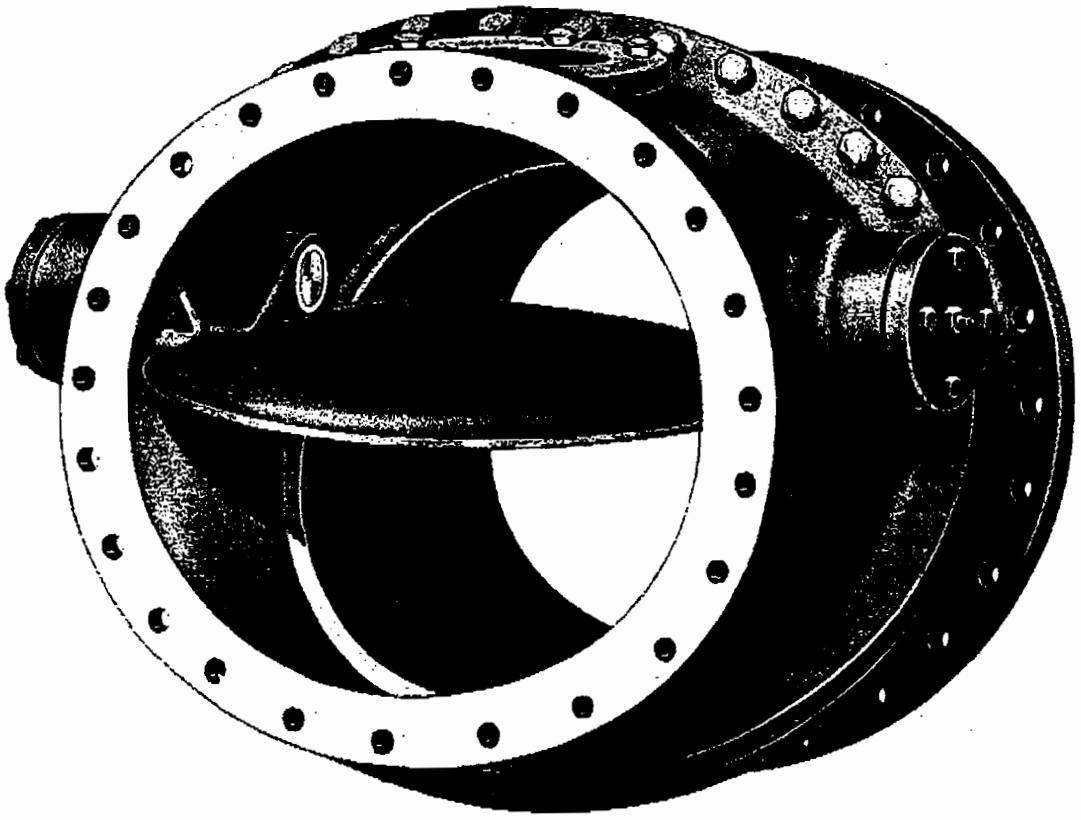
Information on Check Valve to go with soft start/stop motor control centers

BULLETIN
800
REVISED AND REPRINTED
1995

APCO®

SLANTING DISC CHECK VALVES

A NEW STANDARD OF EXCELLENCE



APCO® VALVE AND PRIMER CORPORATION
1420 S. WRIGHT BLVD. SCHAUMBURG, ILLINOIS 60193-4599
708/529-9000 • FAX: 708/529-9007 • 800/323-6969

APCO® SLANTING.

Setting New Standards.

SLANTING DISC CHECK VALVES . . . WITH 35 YEARS OF EXPERIENCE TO GUARANTEE REALIABILITY AND OUT-STANDING PERFORMANCE. RUGGEDLY DESIGNED—YET WITH MINIMAL HEAD LOSS AND MAXIMUM ANTI-HAMMER CHARACTERISTICS.

THE APCO SLANTING DISC CHECK VALVE, BECAUSE OF ITS VERY UNIQUE TWO PIECE BODY DESIGN AND SLANT DISC POSITION HAS SUPERIOR FLOW CHARACTERISTICS (LOWEST HEAD LOSS), WHEN COMPARED TO ANY HINGED DISC TYPE CHECK VALVE AVAILABLE "OUT TWO PIECE BODY DESIGN ALLOWS FOR A 40% EXPANDED CROSS SECTIONAL FLOW AREA WHERE THE DISC IS HINGED AND FLOWS OPEN". IN OTHER WORDS, THE FLOW AREA OCCUPIED BY THE MASS OF THE DISC IS MORE THAN COMPENSATED FOR BY THE EXPANDED FLOW AREA.

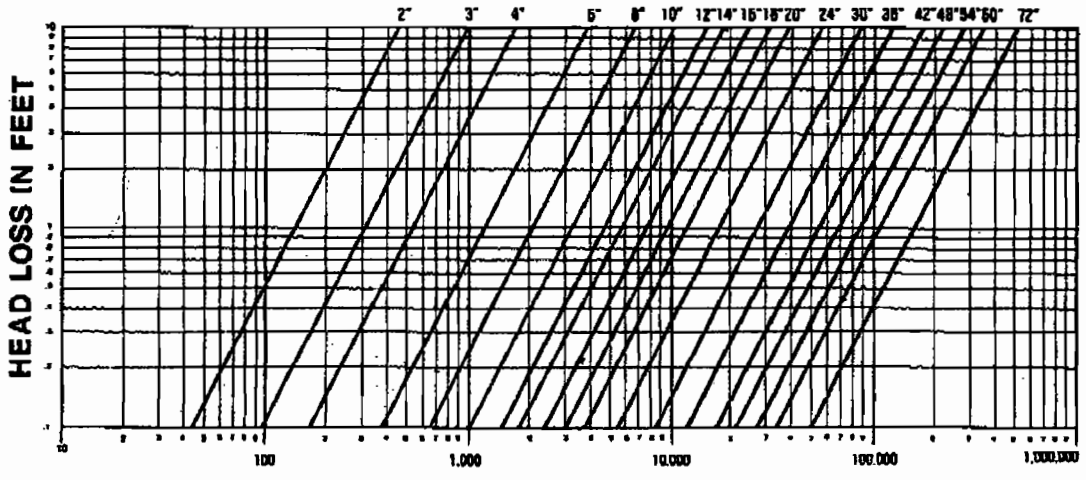
ALSO THE AEROFOIL DESIGN OF THE DISC, LIKE THE WING ON A PLANE, OFFERS MINIMAL RESISTANCE TO FLOW, WHILE LIFTING AND STABILIZING IN THE FULL OPEN POSITION. FLOW CHARACTERISTICS ARE FURTHER IMPROVED BECAUSE THE LONG LAYING LENGTH OF THE VALVE BODY ALLOWS WATER TO SMOOTHLY ENTER AND PASS THRU WITHOUT TURBULANCE, EDDYS OR CAVITATION.

THE "SLANTING DISC" FEATURE IS NOT A GIMMICK. "THE SLANT DISC POSITION IS THE MOST IMPORTANT FEATURE OF THIS VALVE. OFFERING MINIMUM RESISTANCE TO FLOW, WHILE MINIMIZING WATER COLUMN REVERSAL, AND SLAMMING ON SHUT DOWN, DUE TO THE SHORT DISTANCE, THE SLANT DISC TRAVELS TO SHUT-OFF POSITION.

THE OFF CENTER PIVOT OF THE SLANT DISC WORKS, TO YOUR ADVANTAGE, AS FOLLOWS: THE SURFACE DISC AREA ABOVE THE PIVOT POINT RESISTS CLOSING BECAUSE IT MUST CLOSE AGAINST THE REVERSING WATER COLUMN; THEREBY COUNTERACTING THE CLOSING FORCE TO THE DISC AREA BELOW THE PIVOT POINT". THE NET RESULT IS NO SLAM OR MINIMAL SLAM DEPENDING ON COLUMN REVERSAL VELOCITY.

THE UN-BALANCED WEIGHT (HEAVIER BELOW THE PIVOT POINT) CAUSES THE SLANT DISC TO FREE FALL INTO SHUT-OFF POSITION WITH MINIMAL REVERSE FLOW AND A SLIGHT PRESSURE DIFFERENTIAL WILL CAUSE THE SLANT DISC TO FLOW OPEN. HENCE, IT HAS THE LOWEST FRICTION HEAD LOSS OF ALL CONVENTIONAL SWING CHECK VALVES. DUE TO THIS VERY LOW HEAD LOSS THE APCO SLANTING DISC IS SUITABLE FOR HEAVY DUTY ROTARY AIR BLOWERS SERVICE WITH AN ALUMINUM DISC. SEE AIR FLOW HEAD LOSS CHART PAGE. APCO SLANTING DISC CHECK VALVE MAY COST MORE ON DATE OF PURCHASE, BUT IT PAYS FOR ITSELF MANY TIMES OVER IN REDUCED POWER CONSUMPTION AND GREATER PUMPING EFFICIENCY TO THE USER. SEE ENERGY SAVINGS BACK PAGE!

ACTUAL FLOW TEST FOR HEAD LOSS CHARACTERISTICS



FLOW IN GALLONS PER MINUTE

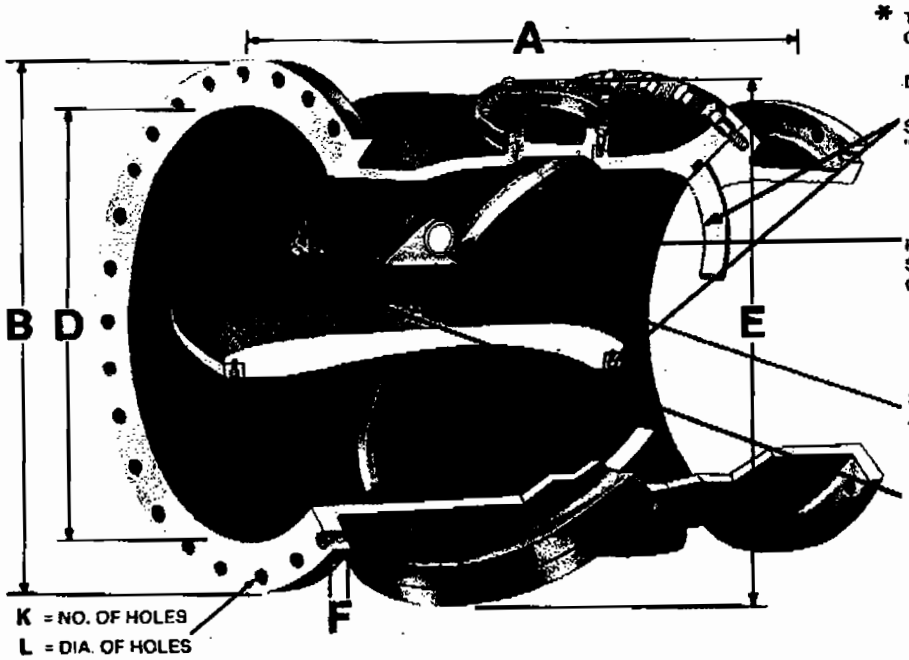
CERTIFIED FLOW TESTS CONDUCTED AT UTAH STATE UNIVERSITY WATER RESEARCH LABORATORY, LOGAN, UTAH, 1991.

FIGURES SHOWN ARE BASED ON CERTIFIED FLOW TESTS CONDUCTED AT UTAH STATE UNIVERSITY, WATER RESEARCH LABORATORY, REPORT NO. 299. VALVES SIZES 8" & 14". ACTUAL FIELD CONDITIONS MAY VARY FROM THESE CURVES.

NOTE: WHEN COMPARING SIMILAR COMPETITORS PUBLISHED DATA, ONLY USE CERTIFIED FLOW TEST DATA.

DISC CHECK VALVE

With These Features NO EXTRA COST!



K = NO. OF HOLES
L = DIA. OF HOLES
M = DIA. OF B.C.

* TWO ACCESSORY OPENINGS — ONE IN EACH BODY HALF!

DOUBLE O-RING SEALS — ONE EACH SIDE BODY SEAT

SEAT AND DISC RINGS HAND REPLACEABLE "WITHOUT MACHINING" IN THE FIELD.

PRECISE PIVOT CLEARANCE INSURES SELF-CENTERING. GUARANTEES AGAINST VALVE STICKING CLOSED! AND

• TIGHT SEATING PER AWWA C508-93.

STAINLESS STEEL PRESS FIT BUSHING & SPECIAL ALLOY PIVOT PIN — HIGHLY WEAR-RESISTANT.

DUCTILE IRON DISC . . . AND VALVE DISC POSITION INDICATOR — MOUNTED ON THE PIVOT PIN COVER — SEE PICTURE BELOW.

NO EXTRA COST!

INDICATOR SHOWS VALVE DISC POSITION MAY BE USED TO TRIP A MICRO SWITCH OR COUNTING DEVICE.

NOT AVAILABLE 2"-3" & 4" SIZES.

SERIES 800

	VALVE SIZE	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"	60"	72"
125 LB. FLANGE	MODEL No.	802	803	804	806	808	810	812	814	816	818	820	824	830	836	842	848	854	860	872
	A	9½	9½	11½	15	19½	24½	24	30	30	33	32	38	52	59½	62½	65	78	87	106
	B	6	7⅛	9	11	13½	16	19	21	23½	25	27½	32	38¾	46	53	59½	66¼	73	86½
	D	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	72
	E	7⅛	8½	9¾	13¼	15½	18	21	25	28	30	31½	36½	46½	51	58	67½	71	84	102
	F	⅝	¾	15/16	1	1⅛	1 1/16	1¼	1⅜	1 7/16	1 9/16	1 11/16	1⅞	2⅛	2⅜	2⅝	2¾	3	3⅛	3½
	G	8½	9	11	17½	22	25½	27	33	36	38	41	48	57	62½	63	72	77	90	125
	K	4	4	8	8	8	12	12	12	16	16	20	20	28	32	36	44	44	52	60
	L	⅝	¾	¾	⅞	⅞	1	1	1⅛	1⅛	1¼	1⅛	1⅜	1⅝	1⅝	1⅝	1⅞	2	2	2
	M	4¾	6	7½	9½	11¾	14¼	17	18¾	21¼	22¾	25	29½	36	42¾	48½	56	62¾	69¾	82½
	APPROX. WEIGHT	30	35	52	154	265	510	690	1044	1050	1535	1695	2650	3860	7500	9000	14500	18000	28241	44000
250 LB. FLANGE	A	9½	12½	11½	15	19½	24½	24	30	30	33	32	38	52	59½	62½	65	78	87	106
	B	6½	8¼	10	12½	15	17½	20½	23	25½	28	30½	36	43	50	57	65	*	*	*
	D	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	72
	E	7⅜	8½	9¾	13¾	15½	18	21	25	28	30	31½	36½	46½	51	58	67½	71	84	102
	F	⅞	1⅛	1⅜	1 7/16	1⅝	1⅞	2	2⅛	2¼	2⅝	2½	2¾	3	3⅜	3 11/16	4	*	*	*
	G	8½	9	11	17½	22	25½	27	33	36	38	41	48	57	62½	63	72	77	90	125
	K	8	8	8	12	12	16	16	20	20	24	24	24	28	32	36	40	*	*	*
	L	⅜	⅞	⅞	⅞	1	1⅛	1¼	1⅜	1⅜	1⅜	1⅜	1⅝	2	2¼	2¼	2½	*	*	*
	M	5	5⅝	7⅛	10¾	13	15¼	17½	20¼	22½	24¾	27	32	39¼	46	52¾	60¾	*	*	*
	APPROX. WEIGHT	33	65	93	199	357	573	893	1170	1600	1990	2100	3300	5800	8360	10500	18000	21000	34000	55000

* TO BE SUPPLIED BY CUSTOMER *

150# AND 300# CLASS DIMENSIONS SAME AS ABOVE — EXCEPT 12" A=27½" HIGHER PRESSURE CLASS PAGE 26.

* TWO ACCESSORY OPENINGS (1) EACH BODY HALF AND DUCTILE IRON DISC PERMITS SPECIFYING A CHECK VALVE WITH CONTROL FEATURES FOR YOUR PARTICULAR JOB NOW OR FOR FUTURE NEEDS.

OPTIONAL CONTROLS

1 FREE OPENING AND CONTROLLED CLOSING page 24

2 CONTROLLED OPENING AND CLOSING page 25

3 SIGNAL SWITCH page 25

4 FLOW BY-PASS page 25

• TIGHT SEATING PER AWWA C508-93.

APCO Slanting Disc Check Valves close with slight clearance around pivot pins, insuring 360° seating between the concentric disc ring and body seat ring. These rings are precisely machined and move together or apart with minimum rubbing, thus eliminating wear and leakage for many years of service. This movement allows "tight" seating to meet AWWA standards for metal to metal seated valves.

1 SERIES 800B - with BOTTOM MOUNTED BUFFER (FREE OPENING AND **CONTROLLED** CLOSING)

THIS UNIQUE BUFFER ARRANGEMENT ALLOWS THE VALVE DISC **10** TO OPEN FULLY WITHOUT INTERFERENCE AND TO CLOSE FREELY FOR APPROX. 90% OF ITS STROKE. AFTER THE DISC IS 90% CLOSED, IT THEN COMES IN CONTACT WITH THE BUFFER ROD **33**, AT THIS POINT, FINAL CONTROL SPEED OF CLOSING THRU THE LAST 10% OF CLOSING IS ESTABLISHED.

THE FLOW CONTROL VALVE **41** ON THE CYLINDER **39**, IS EASILY ADJUSTED TO ALLOW TIME ADJUSTMENT. TO SUIT PIPELINE FLOW CONDITIONS, POSITIVELY PREVENTING SLAMMING AND GREATLY REDUCING PRESSURE SURGES.

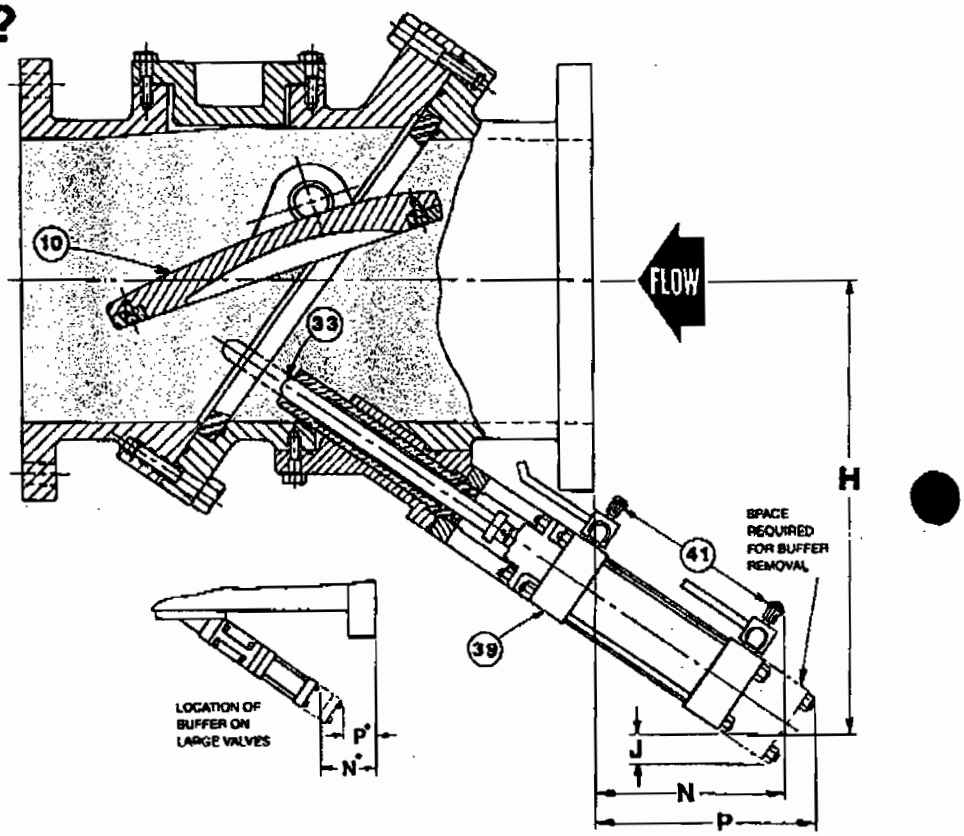
DID YOU KNOW?

ANY APCO CONTROLLED MOVEMENT VALVE CAN BE MODIFIED IN THE FIELD TO SUITE UNUSUAL CONDITIONS.

GOOD PUMP STATION DESIGN REQUIRES AT LEAST 3 PIPE DIAMETERS OF STRAIGHT PIPE DOWN STREAM SIDE OF A CHECK VALVE AND IN SOME CASES THE UPSTREAM SIDE.

THE APCO BUFFER MAY BE ADDED TO A VALVE IN THE FIELD.

APCO OFFERS ONLY FACTORY TRAINED ENGINEERS FOR FIELD START UP.



ABOUT THE BUFFER

Bottom Mounted Buffers have been used successfully for many years to eliminate slamming of the valve disc and resultant water hammer.

Recommended where instantaneous flow reversal caused by a Hydro-pneumatic Surge Tank or Open Line Discharge is so fast a free closing check valve cannot shut prior to reverse flow and therefore slams. Alternately, the Buffer will stop the disc at 90%, approximately (adjustable) of closure and control close the disc to shut-off without slamming and with minimal pressure rise.

VALVE DIMENSIONS FOR S-800B (BOTTOM MOUNTED BUFFER) & S-800T (TOP MOUNTED DASHPOT)

	VALVE SIZE	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"	36"	42"	48"	54"	60"	72"
800T	G	21⅜	28⅝	30⅝	31⅞	35⅞	43½	44⅞	48¼	60⅞	69⅝	79³⁄₁₆	91	102	122	124	147
800B	H	13⅜	14¾	16½	17⅞	19¾	21⅝	23½	26¼	28⅜	34½	39¼	46½	50	60	62½	73
	N	8⅝	7¾	5	7⅛	4¾	4⅝	2⅞	5¼	1¹¹⁄₁₆ X	2¹⁄₁₆	8¾ X	9¾	½ X	3¼ X	11⅜ X	8 X
	J	2¾	3⅝	4⅛	5⅛	5⅜	5¼	5½	7⅛	8	8¼	7¾	3½	2½	7	8	3½
	P	11½	11	9	11	9	9	7	12	3	5	2 X	2 X	2	¾ X	4 X	3

2 SERIES 800T - with TOP MOUNTED OIL DASHPOT (SLOW OPENING & **CONTROLLED** CLOSING)

The Top Mounted Oil Dashpot System is highly recommended when slow open and full control closure of the disc **10** is essential. Slow Gradual Opening and Control Closing of the valve disc will prevent or greatly reduce surge pressures (water hammer) that can cause damage to the pipeline each time the pump starts & stops or power failure.

The system shown below works as follows:

1. **SLOW GRADUAL OPENING**
   Slow Gradual Opening in the upper chamber of the cylinder **59** as the piston inside the cylinder moves upwards.
2. **FULL CONTROL CLOSING TWO (2) STAGES**
   1st Stage: Closing control occurs in the lower chamber of the cylinder **59** as the piston moves downward, then
   2nd Stage: Final control stage occurs as the piston reaches the bottom of the cylinder and enters the internal cushion chamber, built into the cap of the cylinder.

By simply regulating each flow control valve **64**, a slow gradual opening of the disc **10** can be achieved as well as variable control closing of the disc. Closing time adjustments can be made in the field to best suit your installations. This is a desirable feature because times for opening and closing computed, during design of a pump station and pipeline may not coincide with actual field conditions.

Once correct open & close times have been set, the flow control valves can be locked in position to prevent tampering.

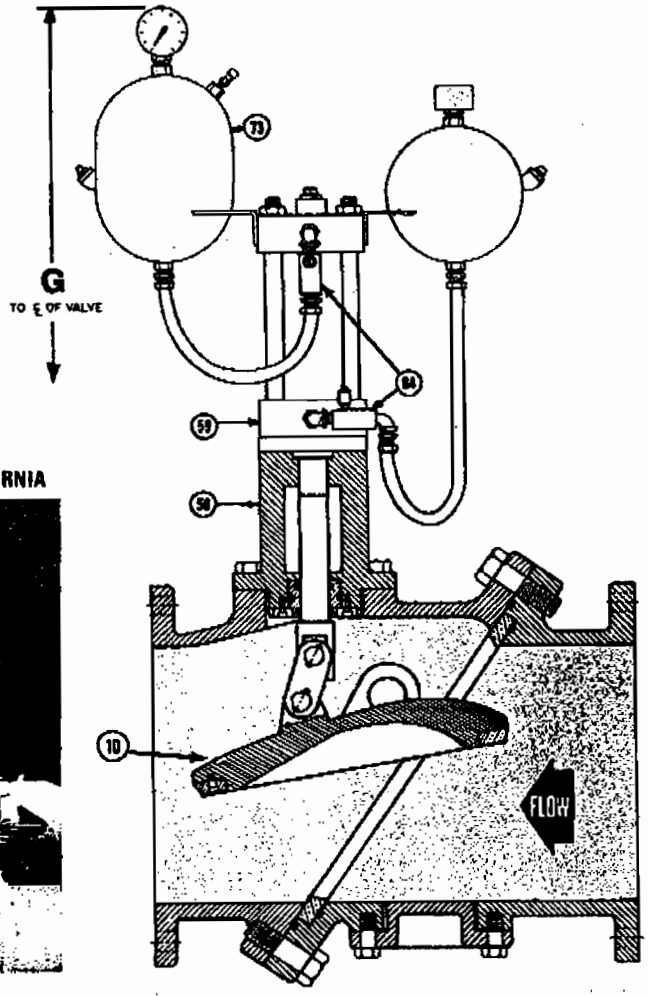
The slightly pressurized hydro-pneumatic tank **73** serves as power to start the disc closing immediately when pumping stops.

OIL DASHPOT SYSTEM

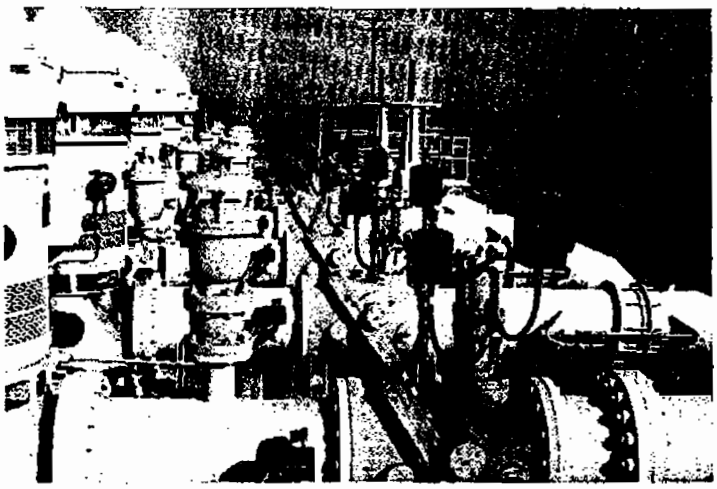
The system described above is oil operated and thirty 30 years of experience we have found the oil system to be trouble free and easier to maintain than water dashpot systems.

Oil is used here in a manner to create an independent and closed system, completely divorced from the main line media by a positive air gap spacer **56**.

Therefore, risk of oil contaminating potable water in the main line is eliminated. Oil also prevents problems such as corrosion, electrolysis, silt or mineral deposits from fouling up the cylinder and controls, as is the risk, when water is used.



TYPICAL PUMPING STATION — KERN TULARE WATER DISTRICT CALIFORNIA



3 SIGNAL SWITCH

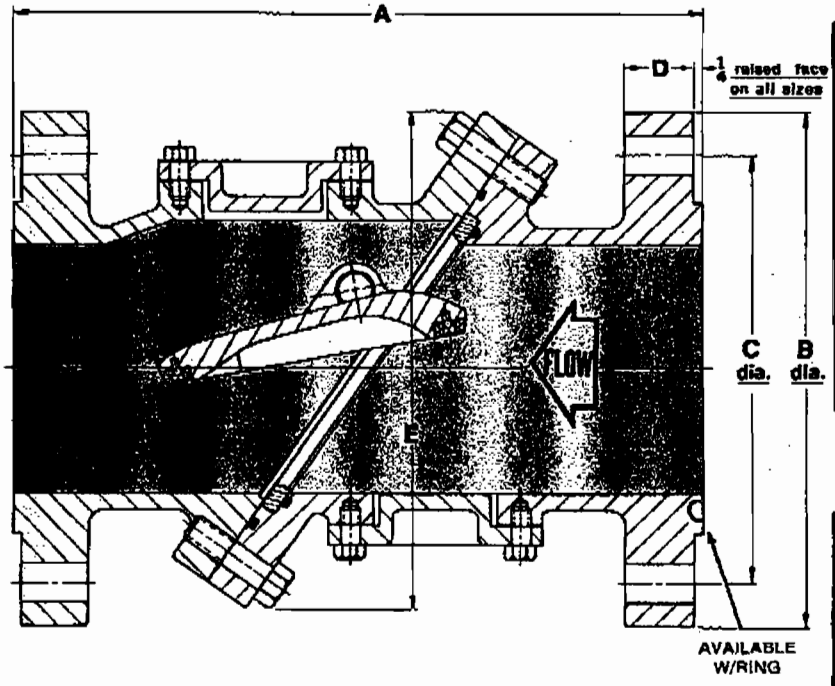
ELECTRICAL SIGNAL SWITCHES ARE AVAILABLE MOUNTED ON THE INDICATOR COVER TO GIVE A LOCAL OR REMOTE SIGNAL, THUS VALVE DISC IS OPEN OR CLOSED.

4 FLOW BY-PASS

BY-PASS PIPING WITH MANUAL SHUT-OFF READILY AVAILABLE, TO PERMIT FLOW AROUND THE DISC, WHEN THE CHECK VALVE IS CLOSED, IE: - TO DRAIN SYSTEM.

SERIES 800-HIGH PRESSURE

CAST STEEL CONSTRUCTION FOR HIGHER PRESSURE CLASS



DIMENSIONS FOR 400# CLASS VALVES

SIZE	A	B	C	D	E	WEIGHT
3"	16	8¼	6⅝	1½	11	125
4"	16¾	10	7⅞	1⅝	12	150
6"	16¾	12⅛	10⅜	1⅞	16	275
8"	21½	15	13	2⅛	16½	450
10"	24½	17½	15¼	2⅜	21½	675
12"	29¼	20½	17¾	2½	24½	825
14"	33¾	23	20¼	2⅝	29	1400
16"	35	25½	22½	2⅝	32	1700
18"	36¾	28	24¾	2⅞	34½	2250
20"	42½	30½	27	3	35	2550
24"	44	36	32	3⅛	42	3700

DIMENSIONS FOR 600# CLASS VALVES

SIZE	A	B	C	D	E	WEIGHT
3"	16	8¼	6⅝	1½	11	175
4"	17	10¾	8½	1⅝	12	200
6"	17¼	14	11½	2⅛	16	325
8"	22¼	16½	13¾	2⅞	16½	525
10"	25½	20	17	2¾	21½	750
12"	30	22	19¼	2⅞	24½	925
14"	34	23¾	20¾	3	29	1600
16"	36	27	23¼	3¼	32	1950
18"	38	29¼	25⅜	3½	34½	2500
20"	40	32	28½	3¾	35	2900
24"	46	37	33	4¼	42	4000

MATERIALS*

BODIES — CAST STEEL ASTM A216 WCB
DISC (2" THRU 10") — STAINLESS STEEL ASTM A351 CF8M
(12" AND UP) — CAST STEEL ASTM A216 WCB
BODY SEAT RING — STAINLESS STEEL ASTM A351 CF8M
DISC SEAT RING (12" AND UP) — STAINLESS STEEL ASTM A351 CF8M
PIVOT PIN — STAINLESS STEEL ASTM A582 T303
PIVOT PIN BUSHING (12" AND UP) — STAINLESS STEEL ASTM A269 T304
*OR TO SUIT PRESSURE-TEMPERATURE APPLICATION

NOTE: DIMENSIONS FOR BUTT WELD END VALVES AND PRESSURES UP TO 2500# VALVES CLASS READILY AVAILABLE FROM APCO ENGINEERING DEPARTMENT.

APCO PRESSURE-TEMPERATURE RATINGS

TEMP. °F	MAXIMUM NON-SHOCK SERVICE PRESSURE, P.S.I.																						
	CAST IRON ASTM A126 CL B						DUCTILE IRON ASTM A395		CARBON STEEL ASTM A216 GR WCB							STAINLESS STEEL ASTM A351 CF 8M							
	CLASS 125			CLASS 250			PRESSURE CLASS		PRESSURE CLASS							PRESSURE CLASS							
	1" - 12"	14" - 24"	30" - UP	1" - 12"	14" - 24"	30" - UP	150	300	150	300	400	600	900	1500	2500	150	300	400	600	900	1500	2500
0 to 150																							
-20 to 100							250	640	285	740	990	1480	2220	3705	6170	275	720	960	1440	2160	3600	6000
-20 to 150	200	150	150	500	300	300	242	620	272	707	945	1415	2122	3540	5897	257	670	892	1340	2010	3347	5580
200	190	135	115	460	280	250	235	600	260	675	900	1350	2025	3375	5625	240	620	825	1240	1860	3095	5160
250	175	125	85	415	260	200	225	582	245	665	887	1332	1997	3327	5547	227	590	785	1180	1770	2945	4910
300	165	110	50	375	240	150	215	565	230	655	875	1315	1970	3280	5470	215	560	745	1120	1680	2795	4660
SEAT TEST PSI	200	150	150	500	300	300	275	720	315	815	1090	1630	2445	4075	6790	305	795	1060	1585	2380	3960	6600
SHELL TEST PSI	300	230	230	750	450	450	400	975	450	1125	1500	2225	3350	5575	9275	425	1100	1450	2175	3250	5400	9000

CONVERSION OF FLOW FROM G.P.M. TO F.P.S. FOR VARIOUS PIPE SIZES

Size of Pipe		3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54	60	72
Area Sq. In.		7.07	12.57	28.27	50.27	78.54	113.1	153.9	201.1	254.5	314.2	452.4	706.9	1017.9	1385.4	1809.6	2290.2	2827.4	4071.5
Area Sq. Ft.		.0491	.0873	.1964	.3491	.5454	.785	1.069	1.396	1.767	2.182	3.142	4.909	7.069	9.621	12.566	15.904	19.63	28.27
U.S. G.P.M.	C.F.S.	VELOCITY FT./SEC.																	
60	.13	2.7	1.5	0.7	0.4														
120	.27	5.4	3.1	1.4	0.8	0.5													
240	.53	10.9	6.1	2.7	1.5	1.0	0.7												
360	.80	16.3	9.2	4.1	2.3	1.5	1.02	0.8											
480	1.07	21.8	12.3	5.5	3.1	2.0	1.4	1.0											
600	1.34	27.2	15.3	6.8	3.8	2.5	1.7	1.3	1.0										
900	2.01		23.0	10.2	5.7	3.7	2.6	1.9	1.4	1.1									
1,200	2.76		30.6	13.6	7.7	4.9	3.4	2.5	1.9	1.5	1.2								
1,800	4.01			20.4	11.5	7.4	5.1	3.8	2.9	2.3	1.8	1.3							
2,400	5.35			27.2	15.3	9.8	6.8	5.0	3.8	3.0	2.5	1.7							
3,000	6.69			34.0	19.2	12.3	8.5	6.3	4.8	3.8	3.1	2.1							
3,600	8.02				23.0	14.7	10.2	7.5	5.7	4.5	3.7	2.5							
4,200	9.36				26.8	17.2	11.9	8.8	6.7	5.3	4.3	3.0							
4,800	10.70				30.6	19.6	13.6	10.0	7.7	6.1	4.9	3.4							
5,400	12.03					22.1	15.3	11.3	8.6	6.8	5.5	3.8							
6,000	13.37					24.5	17.0	12.5	9.6	7.6	6.1	4.3							
7,200	16.05					29.4	20.4	15.0	11.5	9.1	7.4	5.1							
8,400	18.72					34.3	23.8	17.5	13.4	10.6	8.6	6.0							
9,600	21.39						27.2	20.0	15.3	12.1	9.8	6.8							
10,800	24.07						30.6	22.5	17.2	13.6	11.0	7.7							
12,000	26.74						34.1	25.0	19.2	15.1	12.3	8.5							
16,000	40.11							37.5	28.7	22.7	18.4	12.8							
24,000	53.49								38.3	30.3	24.5	17.0							
30,000	66.86									37.8	30.6	21.3							
36,000	80.23										36.8	25.5							
42,000	94.0																		
48,000	108.0																		
54,000	130.0																		
60,000	133.6																		

SPECIFICATIONS

SERIES 800 SLANTING DISC CHECK VALVES

The **BODY** shall be heavy **TWO PIECE** cast iron, not fabricated steel. The two (2) body halves and body seat shall be O-ring **SEALED** and bolted together in a manner to sandwich the body seat on a 55° angle. Each body half must have an **ACCESS COVERED HOLE** for internal inspection and each **BODY HALF** and **DISC** fully machined to accept future attachment of a Bottom Buffer or Top Mounted Oil Dash Pot. The **SEAT RING** and **DISC RING** must be of the design that permits replaceability in the field without need for special tools or machining. The **PIVOT PINS** in the body and the **BUSHINGS**, in the disc lugs, must be stainless steel, but of different hardnesses to prevent galling. The **BUSHINGS** shall be **PRESS FIT** to prevent wear. An **INDICATOR** shall be provided to show the position of the disc. The area throughout the valve body must be equal to full pipe area. The area thru the seat section shall be 40% larger than the inlet and outlet of the valve to achieve lowest head loss.

Valve materials shall be certified conforming to following A.S.T.M. specifications:

Bodies	Cast Iron	ASTM A126 GR. B
Disc (2" thru 10")	Bronze	ASTM B584 C83600
Disc (12" & Larger)	Ductile iron	ASTM A536
Seat Ring & Disc Ring	Bronze	ASTM B271 C92200
*Pivot Pins (2" thru 10")	Aluminum bronze	ASTM B150 Alloy 2
Pivot Pins (12" & Larger)	Stainless steel	ASTM A582 T303
Pivot Pin Bushings	Stainless steel	ASTM A269 T304
Exterior Paint	Phenolic Primer Red Oxide	FDA Approved for Potable Water Contact

Valve to be APCO Series 800 Slanting Disc Check Valve, per Bulletin 800, as manufactured by Valve & Primer Corporation, Schaumburg, Illinois, U.S.A.

OPTIONAL PAGE 24—SERIES 800B WITH BOTTOM MOUNTED BUFFER

FOR FREE OPEN AND POSITIVE NON-SLAM CLOSING, the valve must be a bottom mounted buffer. The buffer shall be designed to contact the disc during the last 10% of closure and control the final closing of the valve to prevent water hammer; rate of closure externally adjustable and variable. The line media to the buffer must be separated by a combination pressure sensing device, oil-water separator to protect the buffer cylinder against corrosive build-up from the media.

OPTIONAL PAGE 25—SERIES 800T WITH TOP MOUNTED DASHPOT

FOR SLOW OPEN AND NON-SLAM CLOSING, a top mounted oil dashpot must be provided with slow opening and control closing cycle of the valve, to prevent surge and water hammer. Dashpot must have (2) control flow rates. (1) 90% rapid rate (2) 10% slow rate during shut-down. Each rate infinitely and independently adjustable. The dashpot must be a self contained oil system, separate and independent from the water line media. The oil reservoir for closing cycle shall be open to atmosphere with an air breather cap to prevent dust and other media from contaminating the oil. The oil reservoir for opening cycle must be hermetically sealed to contain pressure if necessary (air over oil) and be equipped with a pressure gauge and pneumatic air valve.

ENERGY COST SAVINGS COMPARISONS (1992)

Check Valves . . . generally, essential pipeline components . . . but inherently, definite flow obstruction in pipelines — measured as head loss in feet of water — create wasteful energy cost. Hence, each time pumps run, check valve(s) continually waste energy. Therefore, check valve(s) merely selected for lowest initial purchase cost, can quickly become an extremely expensive choice, compared to Slanting Disc Check Valve(s) which have lowest head loss.

ENERGY COST SAVINGS EVALUATION

1) A 24" size pipeline, to deliver water (Sp. Gr.–1) by pump with combined motor & pump efficiency (Ec) of 72% . . . first year average delivery is 15,000 GPM and average energy cost is $0.08 per Kilowatt/Hour (cost may vary accordingly to local Utility Rates).
2) Using a conventional Swing Check Valve, head loss (HL at 15,000 GPM is 3 feet of water.
3) Using an APCO Slanting Disc Check Valve, head loss (HL) at 15,000 GPM is 0.718 feet of water [Certified Tests conducted at Utah State University, (Logan) Utah Water Research Laboratory].

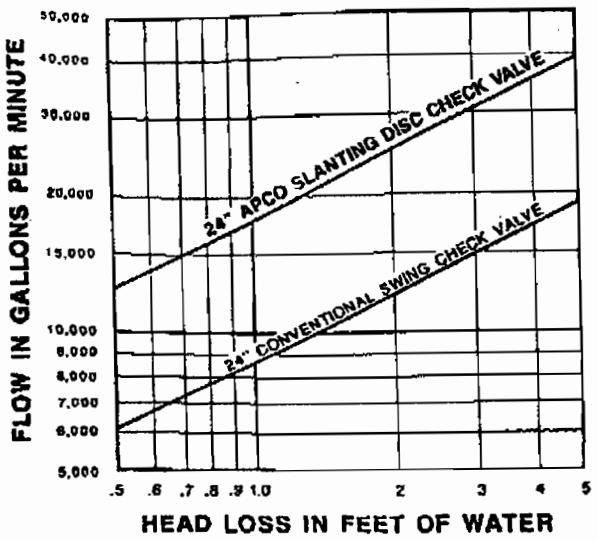
Energy cost dispensed for first year of check valve (Py) is:

$$Py = \frac{GPM \times HL \times Sp.\ Gr. \times .746 \times Cost}{3960 \times Ec} \times 24\ Hour \times 365\ Days\ KW\text{-}Hr.$$

Since GPM, Sp. Gr., cost/KW-Hr, Ec, other figures are common in determination of Py for both valves.

$$Py = 2750.404 \times HL$$

COMPARISON HEAD LOSS THROUGH 24" CHECK VALVE



Energy cost using Conventional Swing Check Valve end of first year = $8,251.21

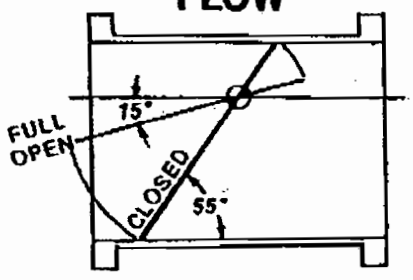
Energy cost using APCO Slanting Disc Check Valve end of first year = $1,974.76

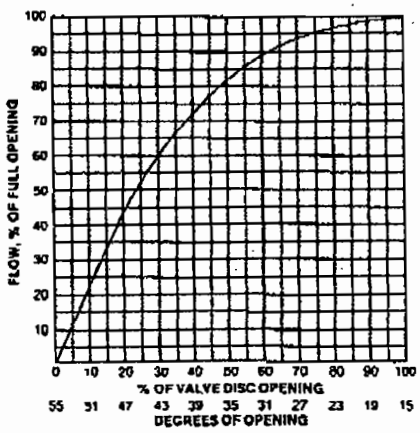
Energy cost saving using APCO Slanting Disc Check Valve end of first year = $6,276.45

Average service life for APCO Valve is 30 years and projecting 2% future increase for water demand and energy cost, will reflect estimated savings as follows:

YEAR	YEARLY SAVINGS	CUMULATIVE SAVINGS
1st	$ 6,276.45	$ 6,276.45
5th	6,793.80	32,662.75
10th	7,500.91	68,725.07
20th	9,143.56	152,500.55
30th	11,145.95	254,622.39

DISC OPENING VS FLOW





2-6-98

John Birkhoff

No mfr from Pratt
hi performance butterfly valve
Soft Start & Stop
Slant disc check valve

Aurora Ill

Pratt
"Check Mate" Butterfly valve

Mueller Rep

Water Hammer Causes

Pump Start-up

Pump Power failure

Valve Operation

Improper operation of Surge Protection Devices

Celestial 1-22-98

H_L thru pump control valve (5 mgd pump) & 10" valve = 18.4 feet (from design memo)

H_L thru a 14" butterfly valve:

$K = 0.45$

$\frac{3500 \text{ gpm}}{450} = 7.778 \text{ cfs}$ $\quad Q = AV$

$\frac{7.778 \text{ cfs}}{1.07 \text{ ft}^2} = 7.27 \text{ fps}$

$h_L = 0.45 \frac{V^2}{2g} = 0.45 \frac{(7.27)^2}{64.4} = 0.37 \text{ feet}$

say 0.4 feet

$18.4' - 0.4' = 18.0'$ difference in amt of head lost

Bhp reqd for this h_L = $\frac{3500 \text{ gpm} \times 18 \text{ ft} \times 1}{3960 \times 0.85} = 18.7$

↑ eff of pump

Kw input = $\frac{3500 \times 18 \times 1 \times 0.746}{3960 \times 0.85 \times 0.90} = 15.5$

↑ motor effiency

↑ pump effiency

assume pump runs 18 hrs per day, 300 days/yr

Elec cost = $15.5 \text{ Kw} \times 18 \frac{\text{hrs}}{\text{day}} \times 300 \frac{\text{days}}{\text{yr}} \times \$0.08 \frac{}{\text{KwH}}$

Elec cost = $\$6695$/year "wasted" energy

Losses thru decreaser & increaser not included

6156.99 / 84,000 = 0.0733 ¢/KWH

TOWN OF ADDISON PAST DUE DATE: 01/16/98
MUNICIPAL WATER PUMPING

DESCRIPTION: 5510,CELESTIAL.@PUMP ACCT #: 116 5819 99 4
ADDRESS: 5510 CELESTIAL RD CITY: ADDISON
METER 079146652GE PREV RDG 02786 PRES RDG 02821 WH MULT 2,400 KWH 84,000
DEM RDG 14.28 DEM MULT 24 A/KW 343 B/KW 0
FROM 11/11/97 TO 12/12/97 RATE MS
ELECTRIC SERV AMT 6,156.99 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00000700- PER KWH TOTAL AMT DUE 6,156.99

DESCRIPTION: BELTLINE & ADDISON ACCT #: 133 2661 99 8
ADDRESS: BELTLINE & ADDISON CITY: ADDISON
METER 062014508WE PREV RDG 03800 PRES RDG 03800 WH MULT 1 KWH 0
FROM 11/10/97 TO 12/12/97 RATE MP
ELECTRIC SERV AMT 14.00 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00000700- PER KWH TOTAL AMT DUE 14.00

DESCRIPTION: 15130,SURVEYOR ACCT #: 194 6027 99 0
ADDRESS: 15130 SURVEYOR BLVD CITY: ADDISON
METER 081162357WE PREV RDG 31272 PRES RDG 31711 WH MULT 45 KWH 19,755
DEM RDG 4.67 DEM MULT 45 A/KW 210 B/KW 0
FROM 11/10/97 TO 12/11/97 RATE MS
ELECTRIC SERV AMT 1,459.46 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00000700- PER KWH TOTAL AMT DUE 1,459.46

DESCRIPTION: WATER TOWER ACCT #: 830 7227 99 4
ADDRESS: 4949 MILDRED ST CITY: ADDISON
METER 043265399LG PREV RDG 16758 PRES RDG 18768 WH MULT 1 KWH 2,010
FROM 11/10/97 TO 12/12/97 RATE GT
ELECTRIC SERV AMT 190.73 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00000400- PER KWH TOTAL AMT DUE 190.73

SUBTOTAL OF MUNICIPAL WATER PUMPING $7,821.18

$9,659.40 / 108,000 KWH = $0.0894/KWH

OFFICE
FARMERS BRANCH

TU ELECTRIC
SUMMARY BILLING DETAIL

DATE: 07/28/97

TOWN OF ADDISON
MUNICIPAL WATER PUMPING

PAST DUE DATE: 08/14/97

DESCRIPTION: 5510,CELESTIAL.@PUMP — ACCT #: 116 5819 99 4
ADDRESS: 5510 CELESTIAL RD — CITY: ADDISON
METER 079146652GE PREV RDG 02526 PRES RDG 02571 WH MULT 2,400 KWH 108,000
DEM RDG 13.96 DEM MULT 24 A/KW 335 B/KW 0
FROM 06/11/97 TO 07/11/97 RATE MS
ELECTRIC SERV AMT 9,659.40 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00002600- PER KWH — TOTAL AMT DUE 9,659.40

DESCRIPTION: BELTLINE & ADDISON — ACCT #: 133 2661 99 8
ADDRESS: BELTLINE & ADDISON — CITY: ADDISON
METER 062014508WE PREV RDG 03800 PRES RDG 03800 WH MULT 1 KWH 0
FROM 06/10/97 TO 07/11/97 RATE MP
ELECTRIC SERV AMT 14.00 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00002600- PER KWH — TOTAL AMT DUE 14.00

DESCRIPTION: 15130,SURVEYOR — ACCT #: 194 6027 99 0
ADDRESS: 15130 SURVEYOR BLVD — CITY: ADDISON
METER 081162357WE PREV RDG 28770 PRES RDG 29115 WH MULT 45 KWH 15,525
DEM RDG 4.44 DEM MULT 45 A/KW 200 B/KW 0
FROM 06/10/97 TO 07/11/97 RATE MS
ELECTRIC SERV AMT 1,401.39 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00002600- PER KWH — TOTAL AMT DUE 1,401.39

DESCRIPTION: WATER TOWER — ACCT #: 830 7227 99 4
ADDRESS: 4949 MILDRED ST — CITY: ADDISON
METER 043265399LG PREV RDG 13549 PRES RDG 14188 WH MULT 1 KWH 639
FROM 06/10/97 TO 07/11/97 RATE GT
ELECTRIC SERV AMT 71.13 GUARD LIGHT 0.00 MISC AMT 0.00
ADJT AMOUNT 0.00 TAX AMOUNT 0.00

COGENERATION POWER COST $.00001300- PER KWH — TOTAL AMT DUE 71.13

SUBTOTAL OF MUNICIPAL WATER PUMPING $11,145.92

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS
8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

DESIGN MEMORANDUM

Date: January 13, 1998

Subject: Celestial Pump Station Improvements with 3 and 5 mgd Pumps

Pump Selection, Pump Control Valve Selection and Air & Vacuum Valve Selection

A. Pump Selection

The Celestial Pump Station Improvements include the addition of two high service pumps. Pumps are needed for winter month demands, to replace a deficiency in elevated storage and to run concurrently with one existing pump during the summer months. In order to determine the amount of discharge needed from the pumps during low demand periods, pumping records for the months of January through March were obtained from the City. The records indicated a flowrate of approximately 5 million gallons per day (MGD) occurred during this period. Pumps with flowrates of 5 MGD and 3 MGD were selected by the City to meet this demand and the above stated criteria.

In order to determine the ability of the pumps to operate in different demand conditions and in combination with one of the existing pumps, a Cybernet Extended Period Simulation (EPS) was created. Select output was recorded and is shown on the enclosed EPS pump sizing worksheet (Exhibit 1). The data generated from the EPS shows the amount of pump head required to refill the 1 MG elevated storage tank, while overcoming the static head (Hydraulic Gradient at the Elevated Storage Tank Minus the Elevation of the Pumps; 605.5-feet) and the total dynamic head (Static Head Plus the Head Loss in the Distribution system).

System curves were generated with the calculation of the static head and the total dynamic head at various flow rates. Table 1 shows the static head in the water distribution system when the elevated storage tank is at the maximum condition (High Water Level Elevation = 777) and the minimum condition (Low Water Level Elevation = 737).

Table 1 - Maximum and Minimum Static Head

Maximum Static Head (feet)	Minimum Static Head (feet)
171.5	131.5

The head loss at various pump rates were calculated and added to the static head to provide the total dynamic head. Table 2 shows a summary of the total dynamic head for the condition when one existing pump and the two proposed pumps are running at the same time.

Table 2 - Maximum and Minimum Total Dynamic Head

Flowrate (MGD)	Total Dynamic Head at Minimum Condition in Feet (Static Head +Head Loss)	Total Dynamic Head at Minimum Condition in Feet (Static Head +Head Loss)
0	171.50	131.50
2	172.09	132.09
4	173.62	133.62
6	176.00	136.00
8	179.17	139.17
10	183.09	143.09
12	187.75	147.75
14	193.12	153.12
15	196.06	156.06
16	199.18	159.18
17	202.47	162.47
18	205.93	165.93
20	213.35	173.35

The data generated from the tables above are shown on the attached system curve graph (Exhibit 2) and are labeled as Maximum and Minimum. Once the system curves are plotted, the pump curves for each pump and the additive pump curves for different pump combinations were plotted. When one existing pump is operating with the two proposed pumps, the operating point must fall in the area between the maximum and minimum condition system curves. As shown in the EPS worksheet (Exhibit 1) at hour 27, one existing pump and two proposed pumps operating in a condition following a period of maximum hourly demand, produce a pump head of approximately 190-feet of head with a total pump rate of 17.15 MGD. Plotting these two points on the pump curve labeled Pumps 1+2+4, show the pumps are operating within the system curves.

Once the pump sizes were selected, the next phase of the design consisted of determining the size of the pump column and lineshaft for each pump. When checking the size the pump column based on the velocity, the friction loss in the column becomes important. Generally a friction loss no greater than 5-feet per 100-feet is acceptable. The friction loss per 100-feet for Pump 2 (5 mgd) with a 14-inch column and a 1-1/2-inch 416 stainless steel lineshaft is 2.38 feet. The friction loss per 100-feet for Pump 4 (3 mgd) with a 12-inch column and a 1-1/2-inch 416 stainless steel lineshaft is 1.89 feet. Therefore, the friction loss and velocity in a 14-inch pump column (Pump 2) and a 12-inch pump column (Pump 4) are in an acceptable range. The size of the lineshaft selected for each pump is 1-1/2-inch. A 1-1/2-inch lineshaft of this size provides a maximum horse power rating of 212. Since the lineshaft is 416 stainless steel, a correction factor (1.5) can be applied to the horse power rating. The correction factor multiplied to the rated horse power (212*1.5) provides a maximum horse power rating of 318. The 200 hp and 125 hp pumps and motors are well below the 318 hp maximum rating. Therefore, the size of the lineshaft is adequate.

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

EXHIBIT 2 - EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - 3.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	762				C	769				C	770				775.03	776.00	39.00	-6.06	6.60	0.00
1	C					O	773	4.95	191.04	7.17	O	775	2.70	192.08	5.31	771.20	768.14	31.14	1.10	6.55	7.65
2	C					O		4.93	191.43	7.14	O		2.68	192.48	5.28	772.00	769.56	32.56	-2.82	10.43	7.61
3	C					O		5.05	189.17	7.31	O		2.81	190.28	5.53	766.62	765.89	28.89	-8.94	16.80	7.86
4	O	767	8.81	206.15	6.25	O		4.99	190.24	7.22	O		2.75	191.90	5.41	787.47	754.30	17.30	8.24	8.31	16.55
5	O		8.23	212.04	5.84	O		4.78	198.67	6.92	O		2.52	196.07	4.96	793.33	765.01	28.01	5.28	10.25	15.53
6	C	762				O		4.82	194.71	6.98	O		2.55	195.24	5.03	774.49	771.84	34.84	-0.57	7.94	7.37
7	C					O		4.84	194.20	7.00	O		2.57	194.86	5.06	773.88	771.10	34.10	0.19	7.22	7.41
8	C					O		4.83	194.54	6.99	O		2.56	195.12	5.04	774.45	771.35	34.35	2.42	4.97	7.39
9	C					C	769				O		2.61	193.90	5.15	772.26	774.49	37.49	-10.91	13.52	2.61
10	O	767	8.47	209.76	6.00	O	773	5.07	188.85	7.34	O		2.61	193.97	5.14	790.42	760.33	23.33	5.42	10.73	16.15
11	C	762				O		4.91	192.19	7.10	O		2.65	193.21	5.21	770.54	767.37	30.37	2.21	5.34	7.56
12	C					O		4.85	193.97	7.01	O		2.58	194.69	5.08	773.37	770.24	33.24	2.45	4.97	7.43
13	C					C	769				O		2.58	194.76	5.07	773.55	773.43	36.43	-2.64	5.22	2.58
14	C					O	773	4.95	191.12	7.16	O		2.69	192.23	5.30	769.79	770.00	33.00	-10.98	18.62	7.64
15	O	767	8.80	206.34	6.24	O		4.97	190.54	7.20	O		2.73	192.30	5.38	785.94	755.75	18.75	2.07	14.43	16.50
16	O		8.27	211.62	5.87	O		4.80	198.10	6.94	O		2.54	195.66	4.99	791.03	758.43	21.43	13.06	2.55	15.61
17	C	762				C	769				C	770				775.28	775.37	38.37	-1.70	1.70	0.00
18	C					C					C					772.89	773.18	36.18	-3.21	3.21	0.00
19	C					O	773	4.89	192.53	7.08	O	775	2.63	193.52	5.18	772.27	769.02	32.02	2.67	4.85	7.52
20	C					O		4.82	194.82	6.98	O		2.55	195.32	5.02	775.72	772.48	35.48	3.13	4.24	7.37
21	C					C	769				C	770				771.27	776.53	39.53	-15.22	15.22	0.00
22	O	767	8.51	209.36	6.03	O	773	4.88	192.87	7.06	O	775	2.64	193.39	5.20	791.24	756.77	19.77	13.30	2.73	16.03
23	C	762				C	769				O		2.59	194.40	5.10	774.06	774.04	37.04	-3.29	5.88	2.59
24	C					C					O		2.71	192.66	5.35	769.91	769.77	32.77	-2.74	5.46	2.71
25	C					O	773	5.01	189.84	7.25	O		2.75	191.70	5.43	769.14	766.20	29.20	-0.30	8.07	7.76
26	C					O		5.10	189.33	7.38	O		2.86	188.72	5.63	764.72	765.81	28.81	-13.15	21.10	7.96
27	O	767	9.16	202.21	6.49	O		5.11	189.20	7.39	O		2.88	188.04	5.67	782.94	747.85	10.85	8.35	8.79	17.15
28	O		8.53	209.08	6.05	O		4.89	192.60	7.08	O		2.64	193.38	5.20	789.83	759.59	22.59	5.03	11.04	16.06
29	O		8.11	213.13	5.75	O		4.74	200.08	6.86	O		2.47	197.10	4.87	793.51	766.10	29.10	5.25	10.07	15.32
30	C	762				C	769				O		2.58	194.78	5.07	772.40	772.94	35.94	-6.10	8.67	2.58
31	C					O	773	4.97	190.68	7.19	O		2.71	192.82	5.33	767.83	765.03	28.03	-0.82	8.49	7.68
32	C					O		5.00	189.96	7.24	O		2.75	191.72	5.42	765.96	763.97	26.97	-4.86	12.61	7.75
33	O	767	8.59	208.57	6.09	O		4.90	192.30	7.09	O		2.65	193.12	5.22	787.55	757.65	20.65	4.80	11.34	16.14
34	O		8.05	213.61	5.71	O		4.72	200.75	6.83	O		2.45	197.62	4.82	792.47	763.89	26.89	8.67	6.55	15.22
35	C	762				C	769				C	770				774.26	775.12	38.12	-5.70	5.70	0.00
36	C					O	773	4.87	193.11	7.05	O	775	2.61	194.02	5.14	770.80	767.74	30.74	1.90	5.58	7.48
37	C					O		4.82	194.75	6.98	O		2.55	195.27	5.03	773.21	770.21	33.21	1.98	5.40	7.37
38	C					O		4.77	199.09	6.90	O		2.50	196.55	4.91	775.69	772.78	35.78	1.87	5.40	7.27
39	C					C	769				C	770				774.51	775.19	38.19	-5.03	5.03	0.00
40	C					O	773	4.89	192.74	7.07	O	775	2.65	193.05	5.23	771.90	768.67	31.67	2.63	4.91	7.54
41	C					O		4.86	193.57	7.03	O		2.59	194.37	5.11	773.25	772.07	35.07	-6.98	14.43	7.45
42	C					O		5.00	190.09	7.23	O		2.75	191.90	5.41	766.92	763.01	26.01	5.19	2.55	7.75
43	C					O		4.86	193.55	7.03	O		2.59	194.36	5.11	773.45	769.76	32.76	4.66	2.79	7.45
44	C					C	769				C	770				770.91	775.80	38.80	-14.65	14.61	0.00
45	O	767	8.57	208.71	6.08	O	773	4.90	192.24	7.10	O	775	2.67	192.74	5.25	789.87	756.83	19.83	10.38	5.76	16.14
46	C	762				O		4.86	193.44	7.04	O		2.60	194.28	5.12	773.31	770.31	33.31	1.58	5.88	7.46
47	C					O		4.82	194.79	6.98	O		2.55	195.30	5.03	775.28	772.36	35.36	1.43	5.94	7.37

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

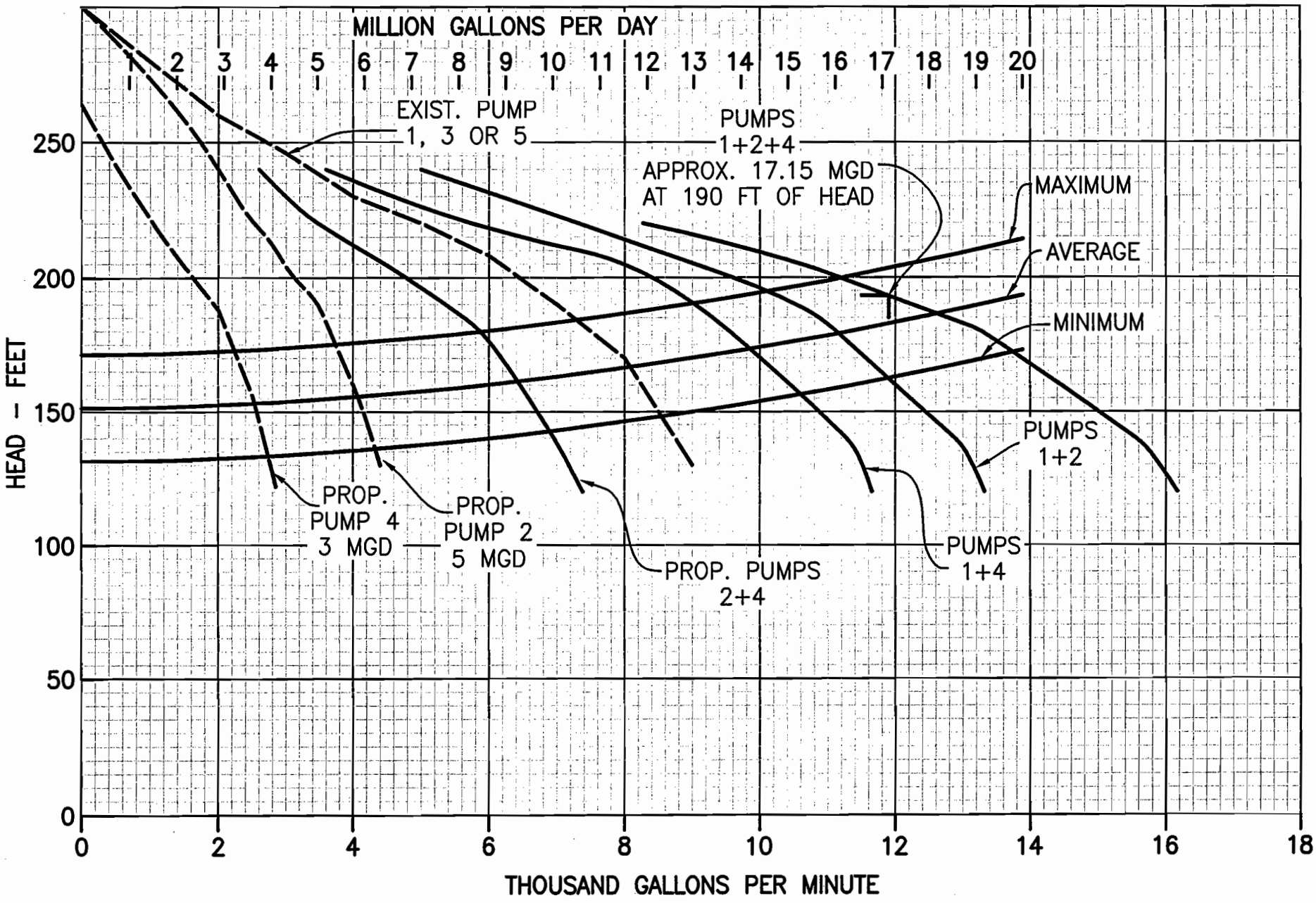
Runs 12 hrs

Runs 36 hrs

Runs 41 hrs

all 3 pumps running together for 12 hours

DSN_MEM.DWG



PAGE 4

TOWN OF ADDISON
CELESTIAL ROAD PUMP STATION
EXHIBIT 2

SHIMEK, JACOBS & FINKLEA
CONSULTING ENGINEERS
Dallas, Texas

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

ROSS L. JACOBS, P.E.
RONALD V. CONWAY, P.E.
JOHN W. BIRKHOFF, P.E.
JOE R. CARTER, P.E.
GARY C. HENDRICKS, P.E.
I. C. FINKLEA, P.E.

December 12, 1997

Mr. James Pierce Jr., P.E., DEE
Town of Addison
Post Office Box 144
Addison, Texas 75001-0144

Re: Celestial Pump Station Improvements
Pump Size Selection

Dear Mr. Pierce:

During the design phase of the Celestial Pump Station Improvements, various Cybernet Extend Period Simulation water models were analyzed to assist in the sizing of pumps. The following combinations of pump sizes were modeled:

- Scenario 1 1-Existing 9.5 mgd Pump, 1-Proposed 3 mgd Pump and 1- Proposed 2 mgd Pump
- Scenario 2 1-Existing 9.5 mgd Pump, 1-Proposed 5 mgd Pump and 1- Proposed 3 mgd Pump
- Scenario 3 1-Existing 9.5 mgd Pump and 1-Proposed 5 mgd Pump

The results of the different pump combinations were summarized on the pump sizing data sheets discussed during our meeting on December 11, 1997. It is our understanding Addison has selected a 5 mgd pump and a 3 mgd pump to be installed in the two available slots at Celestial Pump Station. We are moving forward on developing a revised system curve for the selected pumps and the completion of the construction plans and specifications for this project.

We are available to discuss the Celestial Pump Station Improvements further at your convenience.

Sincerely,

John W. Birkhoff, P.E.

cc: Mr. Jeff Markiewicz

B. Pump Control Valves

The Celestial Pump Station Improvements include the addition of a 5 mgd (million gallons per day) and a 3 mgd vertical turbine pump. In order for the pumps to operate properly, the correct Pump Control Valve (PCV) size must be selected to prevent surges caused by the starting and stopping of the pumps. A key element to the design of a PCV is not to oversize the valve and nullify its ability prevent surges. In order to determine the proper size of the PCV for a 5 mgd and 3 mgd pump, the pressure drop (Head Loss) across the valves at the desired flow rates must be calculated. With the discharge pipe out of the proposed 5 mgd pump set at 14-inches and the 3 mgd pump set to 12-inches, various PCV sizes are possible (14-inch, 12-inch, 10-inch or 8-inch Valves. The following tables and exhibits summarize the calculation process used to size the PCV's.

Table 3 - Pump Control Valve Sizing for a 5 mgd (3,500 gpm) Pump

Valve Size (In)	V=Q/A (fps)	Globe Valve Pattern Minor Loss Coeff. (K) Exhibit 5	Head Loss (H_L) $H_L=K(V^2/2*32.2)$ (ft)	Pressure Drop Across Valve (psi) $\frac{(H_L*62.4\ lbs/ft^3)}{144\ in^2/ft^2}$	Valve Capacity (mgd) Exhibit 6 Max. Cont. Flow
14	7.4	5.0	4.251	1.84	12.2
12	9.8	6.1	9.097	3.94	10.1
10	14.3	5.8	18.417	7.98	7.1
8	22.2	6.1	46.682	20.22	4.5

The results in Table 3 indicate that a 10-inch PCV will provide a maximum continuous flow of 7.1 mgd with a pressure drop across the valve greater than 5 psi. The desired pressure drop across a PCV should be greater than 4.5 to 5 psi to prevent oversizing. The size of the PCV is verified by Exhibit 3 with a pressure drop of approximately 8 psi at 5.0 mgd (3,500 gpm).

Exhibit 3 - Pump Control Valve Sizing for 5 MGD Pump (From CLA-VAL Catalog, Model 60-19)

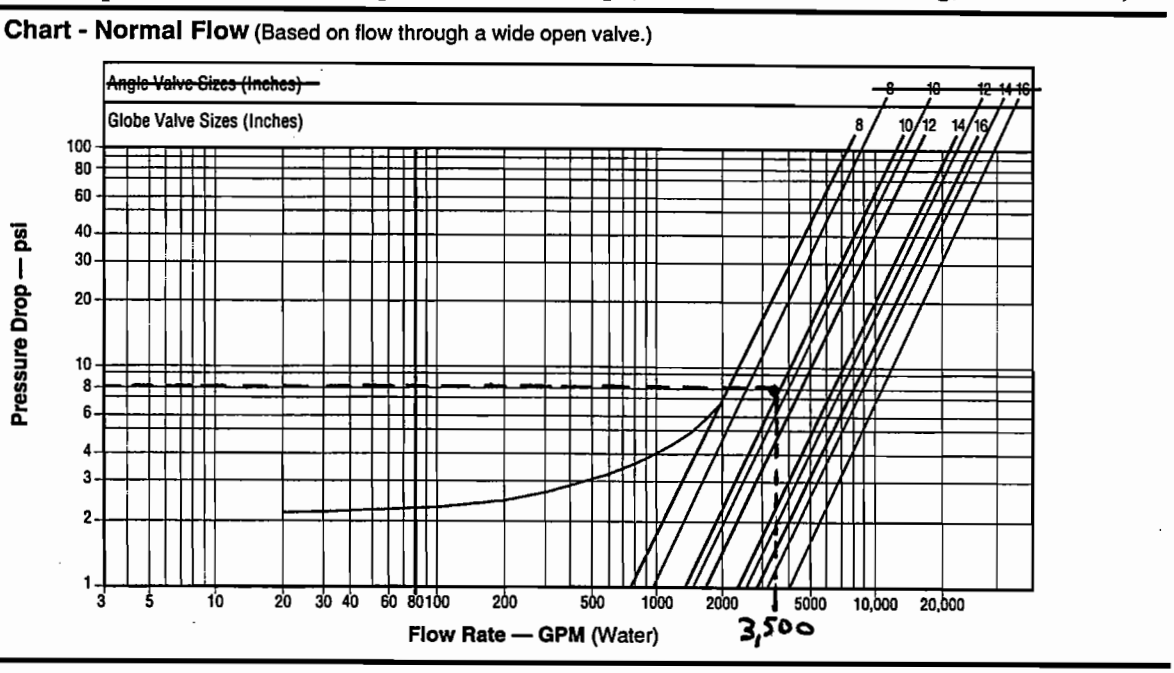


Table 4 - Pump Control Valve Sizing for a 3 mgd (2,100 gpm) Pump

Valve Size (In)	V=Q/A (fps)	Globe Valve Pattern Minor Loss Coeff. (K) Exhibit 5	Head Loss (H_L) $H_L=K(V^2/2*32.2)$ (ft)	Pressure Drop Across Valve (psi) $\frac{(H_L*62.4\ lbs/ft^3)}{144\ in^2/ft^2}$	Valve Capacity (mgd) Exhibit 6 Max. Cont. Flow
12	5.7	6.1	3.077	1.33	10.1
10	8.2	5.8	6.056	2.62	7.1
8	13.5	6.1	17.263	7.48	4.5

The results in Table 4 indicate that an 8-inch PCV will provide a maximum continuous flow rate of 4.5 mgd and a pressure drop across the valve greater than 5 psi. The size of the PCV is verified in Exhibit 4 with a pressure drop of approximately 7.5 psi at 3.0 mgd (2,100 gpm).

Exhibit 4 - Pump Control Valve Sizing for 3 MGD Pump (From CLA-VAL Catalog, Model 60-19)

Flow Chart - Normal Flow (Based on flow through a wide open valve.)

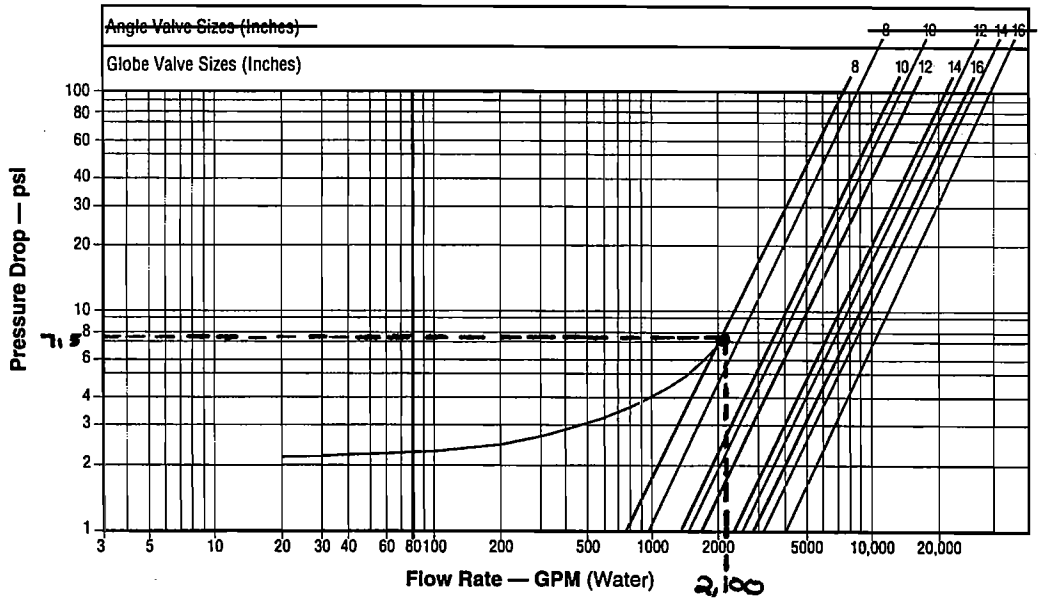


Exhibit 5 - Minor Loss Coefficient (K) - Globe Valve Pattern (CLA-VAL Catalog, Basic Model 100-03)

Functional Data — **Model 100 - 03**

Valve Size		Inches	2 ½	3	4	6	8	10	12	14	16
		mm	65	80	100	150	200	250	300	350	400
C_V Factor	Globe Pattern	Gal/Min	85	115	200	460	770	1245	1725	2300	2940
		Litres/Sec	5.36	7.25	12.62	29.02	48.57	78.54	108.82	145.09	185.47
	Angle Pattern	Gal/Min	101	139	240	541	990	1575	2500	3060	4200
		Litres/Sec	6.37	8.77	15.14	34.13	62.45	99.36	157.71	193.04	264.95
Equivalent Length of Pipe	Globe Pattern	Feet	44	74	102	163	240	304	393	363	448
		Meters	13.41	22.55	31.09	49.68	73.15	92.65	119.78	110.64	136.54
	Angle	Feet	31.8	52.7	74	123	154	197	194	213	226
		Meters	9.69	16.1	22.55	37.49	46.93	60.04	59.13	64.92	68.88
K Factor	Globe Pattern		4.6	6.0	5.8	5.7	6.1	5.8	6.1	5.0	5.2
	~~Angle Pattern~~		~~5.2~~	~~4.1~~	~~4.1~~	~~4.1~~	~~5.7~~	~~6.0~~	~~2.9~~	~~2.6~~	~~2.8~~
Liquid Displaced from Diaphragm Chamber When Valve Opens		Fl. Oz	—	—	—	—	—	—	—	—	—
		US Gal	0.043	0.08	0.169	0.531	1.26	2.51	4.0	6.5	9.57
		ml	162.7	302.8	639.7	—	—	—	—	—	—
		L	—	—	—	2.0	4.8	9.5	15.1	24.6	36.2

*Estimated

Exhibit 6 - Maximum Continuous Flow through Valve (From CLA-VAL Catalog, Model 60-19)

Valve Selection — These Symbols ▲ and ▲ Indicate Available Sizes

			Size	8"	10"	12"	14"	16"	20"	24"
			End Details	Flanged						
Model 60-19	Basic Valve 100-03		Globe	▲	▲	▲	▲	▲		
			Angle	▲	▲	▲	▲	▲		
	Suggested Flow-GPM	Max. Continuous		3100	4900	7000	8500	11000		
		Max. Intermittent		3900	6150	8720	10340	13770		
Model 660-19	Basic Valve 100-22		Globe		▲	▲		▲	▲	▲
			Angle							
	Suggested Flow-GPM	Max. Continuous			4100	6900		9230	16500	16500

Refer to the 100-03 or the 100-22 Technical Data Sheet for complete basic valve specifications and dimensions.
Max. Continuous Flow based on 20fps (100-03), 25fps (100-22)
Max. Intermittent Flow based on 25fps (100-03)

C. Air and Vacuum Valve

Air and Vacuum Valves prevent surges and water hammer by venting entrapped air from the pump suction column to the atmosphere with each pump start-up and shut-down. Design of air and vacuum valves are related to the pump capacity at no head and the following table.

Table 5 - Air and Vacuum Valve Sizing (From APCO Valve Catalog - Bulletin 586)

Pump Capacity (gpm)	Valve Size (In)
Up to 1,000	1/2
1,001 to 1,550	1
1,551 to 3,200	2
3,201 to 6,300	3

The flow rate at no head for the proposed 5 mgd pump is approximately 4,800 gpm. Table 5 shows that a 3-inch air and vacuum valve is necessary for a 4,800 gpm flow rate. The flow rate at no head for the 3 mgd pump is approximately 2,850 gpm. Table 5 shows that a 2-inch air and vacuum valve is necessary for a 2,850 gpm flow rate.

Celestial Plan Review 1-13-98

Check Specs for

Saddle Support

Pump & Piping disinfection procedure

Pressure Gage, Gate Valve, Diaphragm

~~10" Pump Control Valve~~

3" Gate Valve

~~3" Air & Vac Relief Valve~~

~~Pump(s)~~

~~Motor(s)~~

Flex Coupling

Generator

Transformer

System Start-up, Shut down & emergency power op.

O & M manuals for all equip furnished

Spare Parts

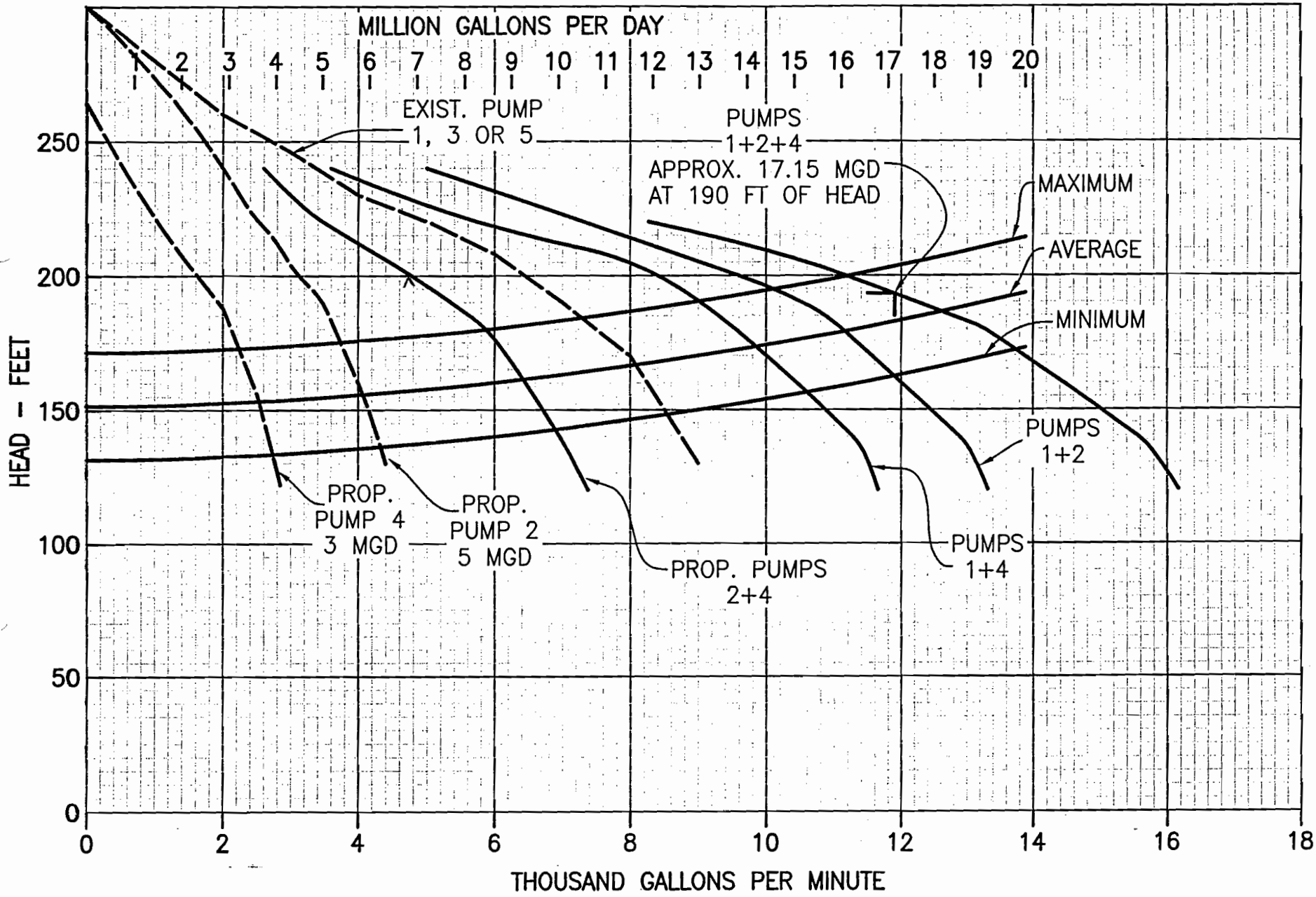
~~Painting system~~

Disposal of excess dirt

J.P.

Video Site "Before"

As-Builts



TOWN OF ADDISON
CELESTIAL ROAD PUMP STATION

SHIMEK, JACOBS & FINKLEA
CONSULTING ENGINEERS
Dallas, Texas

1-8-98

Celestial Generator Set

3 purposes

1) Screen against noise

2) Screen against sight

3) Allow for adequate ventilation

Suggestion – Cut into bank and lower generator

Direction of Air Flow through unit?

Minimum Dimensions needed for proper Ventilation/cooling –

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

FAX TRANSMISSION COVER SHEET

Fax Number: 972-450-2837 From: John W. Birkhoff, P.E.

Number of Pages Transmitted (including this one) **3** Date: January 7, 1998

To: **Mr. Jim Pierce, P.E.**

Celestial Pump Station

Long enclosure for generator set 29 feet by 7 feet Height 10 feet

Short enclosure for generator set 24 feet by 7 feet Height 10 feet

Separate Switch Box 6 feet by 6.5 feet

Screening wall will need to be approximately 13 feet tall

Joe Kotrola informed us that the long enclosure will cost $10,000.00 more. The reason is the added sound material to include the switch gear. Switch gear does not need sound enclosure.

Cross section of generator set location

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

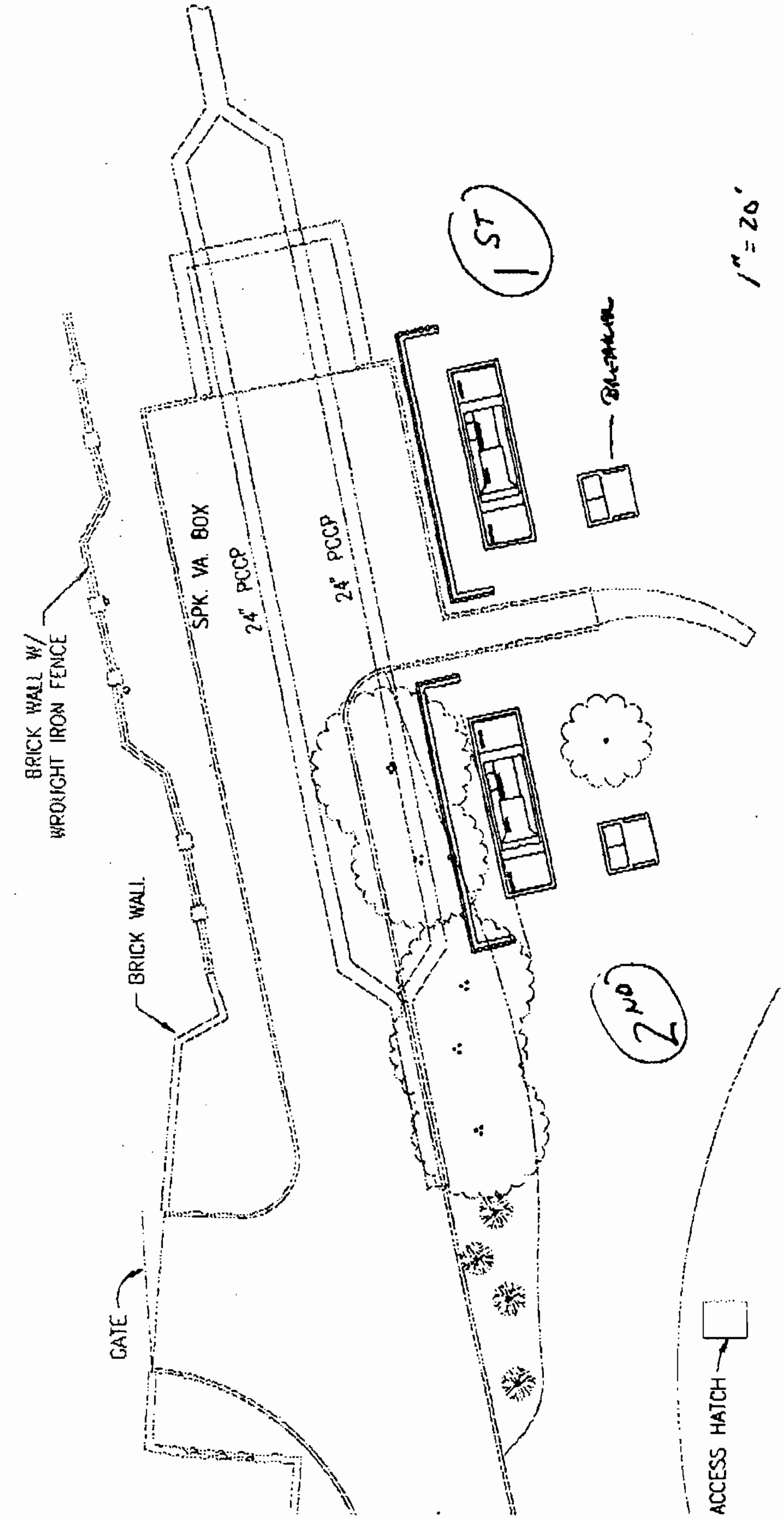
FAX TRANSMISSION COVER SHEET

Fax Number: 972-450-2837 From: John W. Birkhoff, P.E.

Number of Pages Transmitted (including this one) **3** Date: January 6, 1998

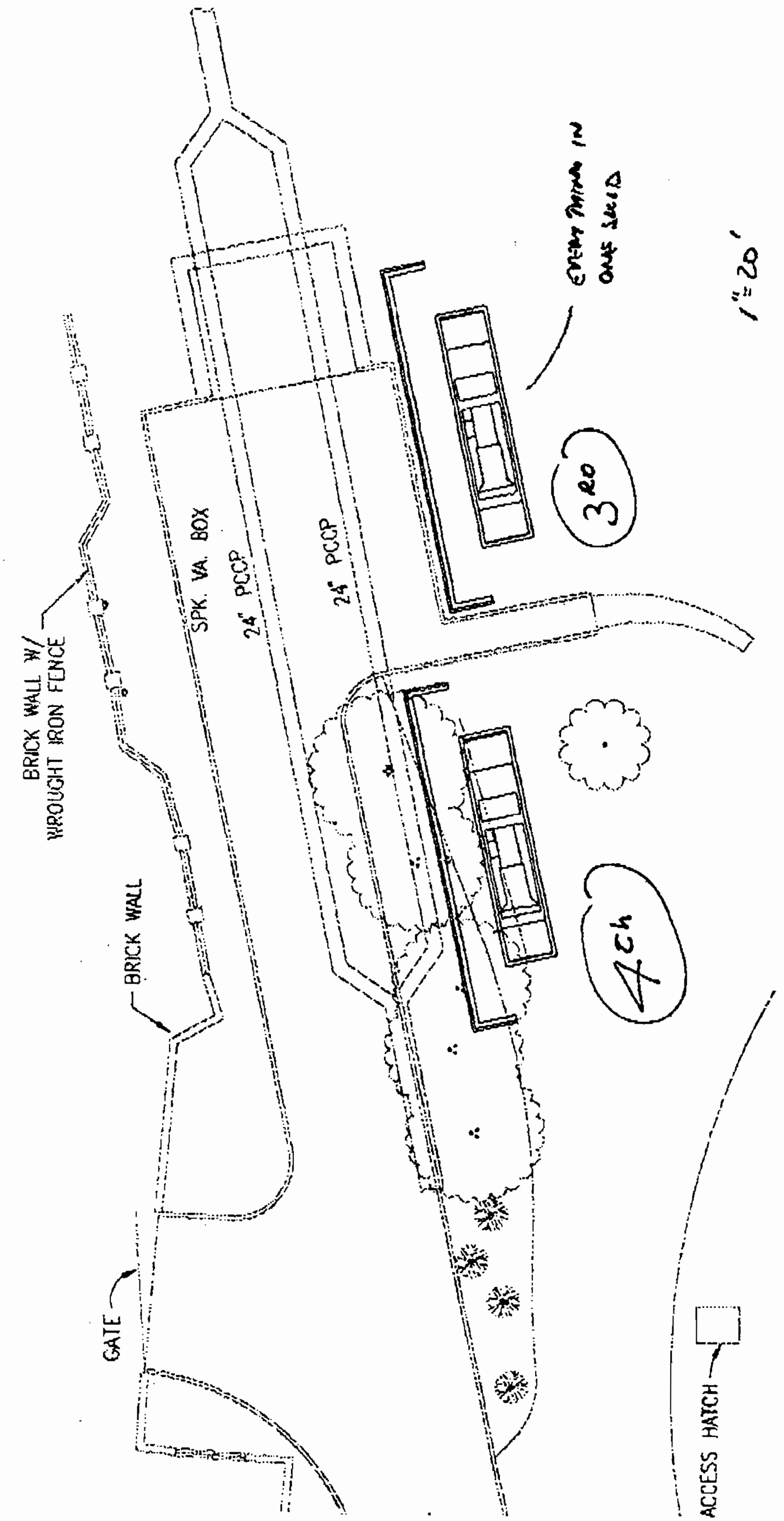
To: **Mr. Jim Pierce, P.E.**

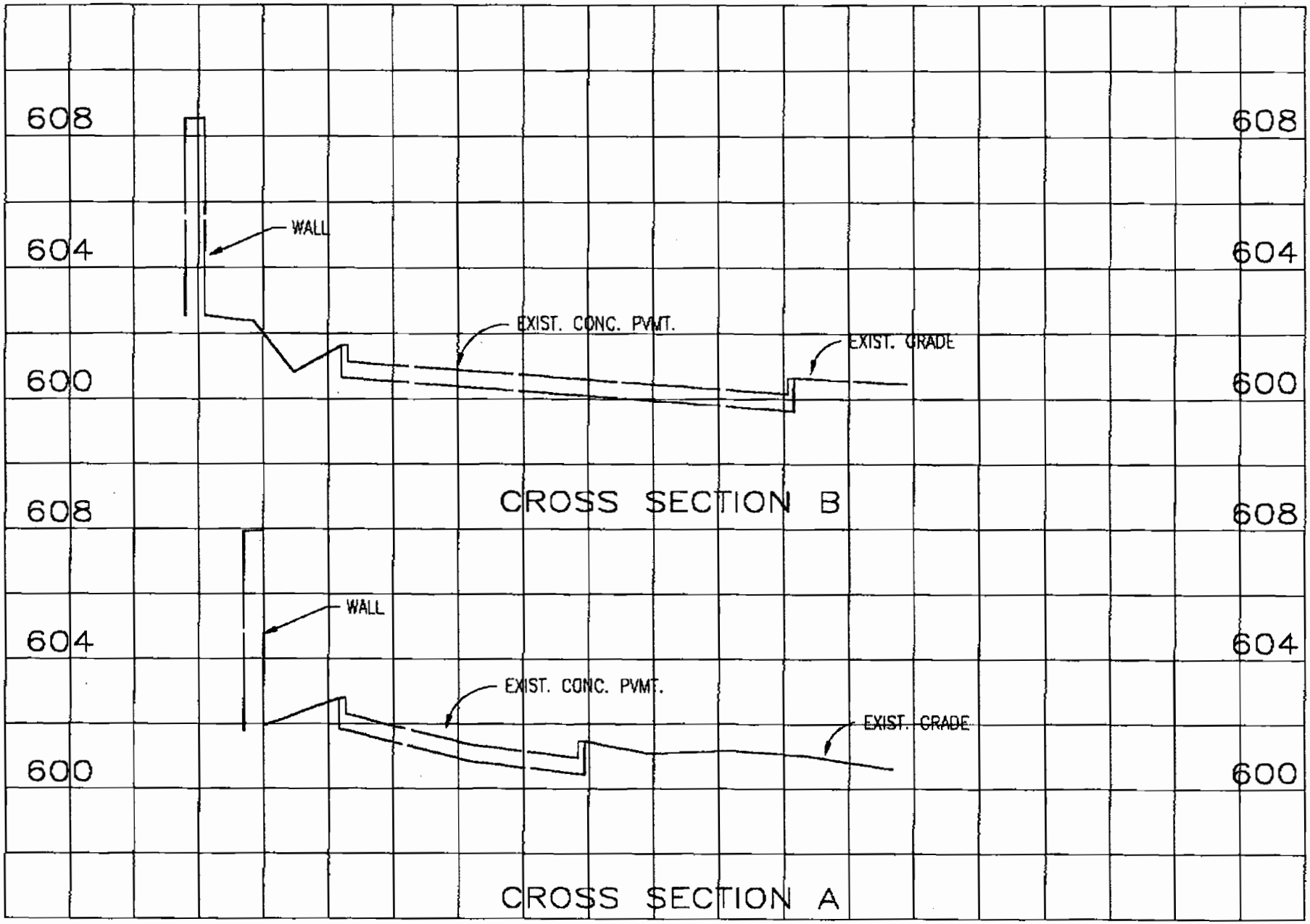
Celestial Pump Station Emergency Generator Set location for your review and comment.



BRICK WALL W/
WROUGHT IRON FENCE
BRICK WALL
GATE
SPK. VA. BOX
24" PCCP
24" PCCP
1ST
2ND
1" = 20'
ACCESS HATCH

FAX: JOE [illegible]
2 PAGES





TOWN OF ADDISON, TEXAS
CELESTIAL PUMP STATION
JAN. 7,1998
SHIMEK, JACOBS & FINKLEA. L.L.P.

I:PROJECTS\ADDISON\97180\SURVEY\EXHA-SEC.DWG

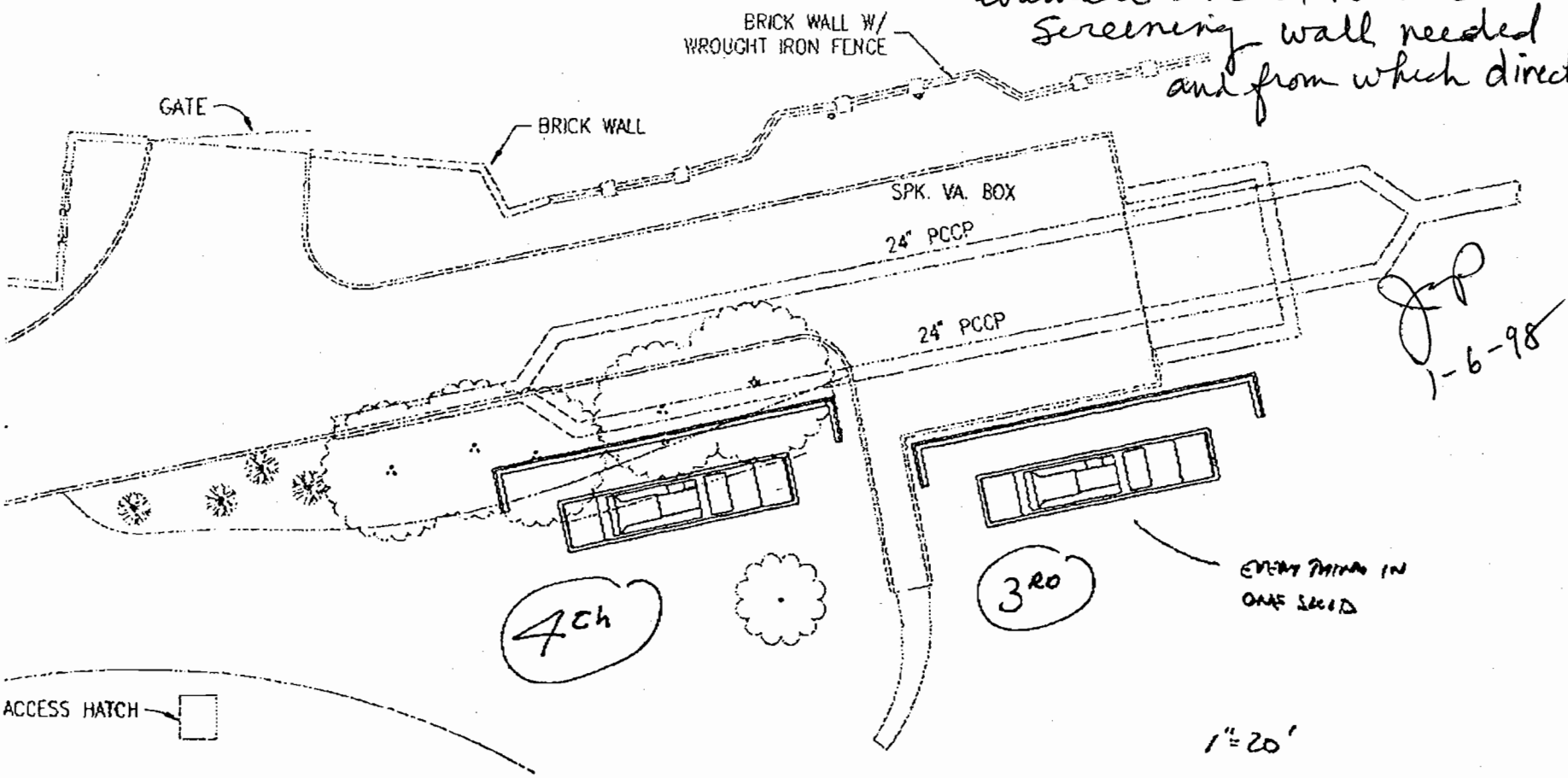
Post-it® Fax Note 7671

To John Birkhoff	Date 1-6-98 # of pages ▶ 1
Co./Dept.	From Jim Pierce
Phone #	Co.
Fax # 214-361-0204	Phone # 972-450-2879
	Fax #

① Prefer 4th layout except as follows:

a) Move generator set 5' to the South — we want to preserve screen planting

b) Furnish overall dimensions above grade — we want to evaluate the extent of screening wall needed and from which directions



J.P. 1-6-98

JAN- 5-98 MON 17:37

01/06/1998 08:23 214-361-0204 SPIEKER, JACOBSEN PAGE 03/03

MODE = TRANSMISSION START=01-06 04:30PM END=01-06 04:30PM

NO.	COM	SPEED	NO	STATION NAME/ TELEPHONE NO.	PAGES
001	OK			92143610204	001

-Addison Svc Ctr -Upstairs-

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

ROSS L. JACOBS, P.E.
RONALD V. CONWAY, P.E.
JOHN W. BIRKHOFF, P.E.
JOE R. CARTER, P.E.
GARY C. HENDRICKS, P.E.
I. C. FINKLEA, P.E.

December 12, 1997

Mr. James Pierce Jr., P.E., DEE
Town of Addison
Post Office Box 144
Addison, Texas 75001-0144

Re: Celestial Pump Station Improvements
Pump Size Selection

Dear Mr. Pierce:

During the design phase of the Celestial Pump Station Improvements, various Cybernet Extend Period Simulation water models were analyzed to assist in the sizing of pumps. The following combinations of pump sizes were modeled:

- Scenario 1 1-Existing 9.5 mgd Pump, 1-Proposed 3 mgd Pump and 1- Proposed 2 mgd Pump
- Scenario 2 1-Existing 9.5 mgd Pump, 1-Proposed 5 mgd Pump and 1- Proposed 3 mgd Pump
- Scenario 3 1-Existing 9.5 mgd Pump and 1-Proposed 5 mgd Pump

The results of the different pump combinations were summarized on the pump sizing data sheets discussed during our meeting on December 11, 1997. It is our understanding Addison has selected a 5 mgd pump and a 3 mgd pump to be installed in the two available slots at Celestial Pump Station. We are moving forward on developing a revised system curve for the selected pumps and the completion of the construction plans and specifications for this project.

We are available to discuss the Celestial Pump Station Improvements further at your convenience.

Sincerely,

John W. Birkhoff, P.E.

cc: Mr. Jeff Markiewicz

J:\Addison\97-180\Letters\Corres\Pumpsel.Doc

Celestial - Meeting with John, Matt
Jeff & Jeff & Joe Kotrola 12-1-97

5 MGD Pump @ 480 volts vs 4160 volts
1½% more power due to transformer loss
Metered on secondary side of transformer

Step down to 480 for smaller pumps
Controllers will cost more @ 4160 volts

Run generator @ 4160 volts
113K 76" X 245" inside housing
84" X 353 outside w sound deadening -

Advertize Jan ~~16th~~ 9th 1st ad 2nd on 16th
Bids ~~23rd~~ 30th
Rec award Feb 2nd
agenda 3rd
council 10th

SCADA - Separate from contract

GT with a 3 mgd & 5 mgd pump

Looked @ Site and selected Gen Set location
Discussed Transformer location issues. Will
use spare vacuum breaker for Gen set. Transfer
will be automatic

TOWN OF ADDISON

CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET
ADDING 1 - 5 MGD PUMP

Job No.: 97180
Date: 12/04/97

EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - No Pump					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	762				C	770									775.03	776.00	39.00	-6.06	6.06	0.00
1	C					O	775	4.99	190.17	7.22						769.30	768.14	31.14	-1.56	6.55	4.99
2	C					O		5.06	189.03	7.32						766.55	766.10	29.10	-5.37	10.43	5.06
3	O	767	8.99	204.23	6.37	O		5.05	189.21	7.30						785.99	759.14	22.14	-2.27	16.80	14.04
4	O		9.00	204.11	6.38	O		5.05	189.15	7.31						784.79	755.56	18.56	5.74	8.31	14.05
5	O		8.57	208.75	6.08	O		4.90	192.28	7.09						789.48	763.00	26.00	3.22	10.25	13.47
6	C	762				O		4.97	190.52	7.20						768.10	767.18	30.18	-2.97	7.94	4.97
7	C					O		5.06	188.99	7.33						764.44	763.33	26.33	-2.15	7.22	5.06
8	O	767	8.60	208.43	3.10	O		4.91	191.98	7.11						789.16	760.52	23.52	8.54	4.97	13.51
9	C	762				O		4.91	191.98	7.11						771.03	771.61	34.61	-8.61	13.52	4.91
10	O	767	8.71	207.31	6.17	O		4.95	191.05	7.16						787.36	760.43	23.43	2.92	10.73	13.66
11	O		8.33	211.09	5.91	O		4.82	194.88	6.97						791.09	764.24	27.24	7.81	5.34	13.15
12	C	762				O		4.79	198.57	6.93						775.59	774.37	37.37	-0.19	4.97	4.79
13	C					O		4.80	197.97	6.95						775.34	774.12	37.12	-0.41	5.22	4.80
14	C					O		4.91	192.14	7.10						771.08	773.59	36.59	-13.71	18.62	4.91
15	O	767	8.98	204.25	6.37	O		5.05	189.22	7.30						783.36	755.80	18.80	-0.40	14.43	14.03
16	O		8.72	207.13	6.19	O		4.96	190.92	7.17						785.86	755.28	18.28	11.13	2.55	13.68
17	C	762				O		4.87	193.29	7.04						771.46	769.73	32.73	3.17	1.70	4.87
18	C					O		4.80	198.21	6.94						775.25	773.84	36.84	1.58	3.21	4.80
19	C					C	770									775.25	775.88	38.88	-4.58	4.85	0.00
20	C					O	775	4.93	191.52	7.14						770.98	769.60	32.60	0.69	4.24	4.93
21	C					O		4.98	190.50	7.20						769.40	770.48	33.48	-10.25	15.22	4.98
22	O	767	8.75	206.78	6.21	O		4.97	190.67	7.19						787.99	757.48	20.18	10.99	2.73	13.72
23	C	762				O		4.90	192.43	7.09						772.65	771.45	34.45	-0.99	5.88	4.90
24	C					O		4.93	191.16	7.14						771.45	770.17	33.17	-0.52	5.46	4.93
25	C					O		4.97	190.68	7.19						770.40	769.50	32.50	-3.10	8.07	4.97
26	C					O		5.16	188.37	7.47						761.66	765.47	28.47	-15.94	21.10	5.16
27	O	767	9.85	193.64	6.99	O		5.34	183.55	7.73						772.98	740.70	3.70	6.40	8.79	15.19
28	O		9.16	202.21	6.49	O		5.11	189.20	7.39						782.21	753.08	16.08	3.23	11.04	14.27
29	O		8.86	205.63	6.10	O		5.00	189.91	7.24						785.32	757.27	20.27	3.80	10.07	13.86
30	O		8.52	209.28	6.04	O		4.88	192.77	7.07						788.83	762.20	25.20	4.73	8.67	13.40
31	C	762				O		4.92	191.68	7.13						769.14	768.35	31.35	-3.57	8.49	4.92
32	C					O		5.05	189.12	7.31						763.57	763.72	26.72	-7.56	12.62	5.05
33	O	767	9.02	203.82	6.30	O		5.06	189.03	7.32						782.19	753.91	16.91	2.74	11.34	14.08
34	O		8.67	207.65	6.15	O		4.94	191.32	7.15						785.86	757.46	20.46	7.06	6.55	13.61
35	O		8.11	213.12	5.75	O		4.74	200.03	6.86						791.74	766.62	29.62	7.15	5.70	12.85
36	C	762				C	770									775.08	775.91	28.91	-5.58	5.58	0.00
37	C					O	775	4.90	192.38	7.09						769.93	768.68	31.68	-0.50	5.40	4.90
38	C					O		4.92	191.73	7.12						769.29	768.03	31.03	-0.47	5.40	4.92
39	C					O		4.95	191.14	7.16						768.72	767.41	30.41	-0.09	5.03	4.95
40	C					O		4.96	190.84	7.18						768.63	767.29	30.29	0.05	4.91	4.96
41	C					O		5.02	189.72	7.26						766.52	767.36	30.36	-9.42	14.43	5.02
42	O	767	8.80	206.25	6.24	O		4.98	190.30	7.21						786.34	755.14	18.14	11.24	2.55	13.78
43	C	762				O		4.90	192.21	7.10						771.29	769.73	32.73	2.11	2.79	4.90
44	C					O		4.91	192.08	7.10						771.57	772.47	35.47	-9.71	14.61	4.91
45	O	767	8.66	207.79	6.14	O		4.93	191.43	7.14						788.33	759.87	22.87	7.83	5.76	13.59
46	C	762				O		4.91	192.13	7.10						771.25	770.04	33.04	0.97	5.88	4.91
47	C					O		4.94	191.18	7.16						770.01	768.79	31.79	-1.00	5.94	4.94

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

TOWN OF ADDISON

CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET
ADDING 1 - 5 MGD PUMP

Job No.: 97180
Date: 12/04/97

EXTENDED PERIOD SIMULATION - WINTER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - No Pump					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	762				C	770									775.32	776.00	39.00	-5.01	5.01	0.00
1	C					O	775	4.94	191.23	7.15						770.83	769.51	32.51	0.93	4.01	4.94
2	C					O		4.92	191.84	7.12						771.77	770.71	33.71	-1.50	6.42	4.92
3	C					O		4.97	190.69	7.19						769.36	768.78	31.78	-4.26	9.22	4.97
4	C					O		5.06	188.96	7.33						765.54	763.25	26.25	-0.05	5.11	5.06
5	C					O		5.27	185.86	7.62						764.46	763.18	26.18	-1.05	6.31	5.27
6	O	767	8.69	193.53	7.43	O		4.86	193.45	7.04						772.86	761.82	24.82	8.64	4.91	13.55
7	C	762				O		4.79	198.23	6.94						774.25	773.04	36.04	0.33	4.46	4.79
8	C					O		4.80	198.16	6.94						774.84	773.47	36.47	1.74	3.06	4.80
9	C					C	770									773.98	775.72	38.72	-8.32	8.32	0.00
10	C					O	775	5.00	190.01	7.24						766.02	764.95	27.95	-1.62	6.62	5.00
11	C					O		5.03	189.46	7.28						764.30	762.83	25.83	1.77	3.26	5.03
12	C					O		4.98	190.43	7.21						766.63	765.15	28.15	1.92	3.06	4.98
13	C					O		4.92	191.71	7.13						769.05	767.63	30.63	1.72	3.21	4.92
14	C					O		4.89	192.59	7.08						770.44	769.86	32.86	-4.13	9.02	4.89
15	C					O		5.00	190.01	7.24						765.18	764.51	27.51	-3.87	8.87	5.00
16	O	767	8.61	194.87	6.10	O		4.82	194.82	6.98						772.17	759.47	22.47	11.87	1.55	13.43
17	C	762				C	770									774.83	774.87	37.87	-1.05	1.05	0.00
18	C					C										773.39	773.52	36.52	-2.00	2.00	0.00
19	C					C										770.64	770.91	33.91	-3.01	3.01	0.00
20	C					O	775	4.93	191.44	7.14						768.53	767.01	30.01	2.33	2.61	4.93
21	C					O		4.88	192.77	7.07						770.61	770.03	33.03	-4.14	9.02	4.88
22	C					O		5.03	189.54	7.27						766.44	764.67	27.67	3.23	1.70	5.03
23	C					O		4.88	192.78	7.07						770.33	768.98	31.98	1.28	3.61	4.88
24	C					O		4.85	193.97	7.01						771.98	770.63	33.63	1.49	3.36	4.85
25	C					O		4.80	197.91	6.95						773.72	772.56	35.56	-0.16	4.96	4.80
26	C					O		4.82	194.85	6.97						772.89	772.36	35.36	-4.20	9.02	4.82
27	C					O		4.92	191.79	7.12						768.07	766.90	29.90	-0.49	5.41	4.92
28	C					O		4.93	191.44	7.14						767.27	766.25	29.25	-1.83	6.77	4.93
29	C					O		5.04	189.33	7.29						765.05	763.89	26.89	-1.13	6.16	5.04
30	C					O		5.09	189.35	7.37						763.70	762.42	25.42	-0.27	5.36	5.09
31	C					O		5.01	189.87	7.25						763.32	762.07	25.07	-0.21	5.21	5.01
32	O	767	8.57	195.43	6.08	O		4.82	194.79	6.98						771.32	761.80	24.80	5.63	7.77	13.39
33	C	762				O		4.81	195.27	6.96						770.03	769.12	32.12	-2.16	6.97	4.81
34	C					O		4.87	193.09	7.05						767.59	766.30	29.30	0.86	4.01	4.87
35	C					O		4.85	193.97	7.01						768.75	767.43	30.43	1.34	3.51	4.85
36	C					O		4.80	197.89	6.95						770.49	769.17	32.17	1.35	3.46	4.80
37	C					O		4.76	199.32	6.89						772.21	770.90	33.90	1.46	3.31	4.76
38	C					O		4.72	200.79	6.83						774.09	772.81	35.81	1.41	3.31	4.72
39	C					O		4.68	202.14	6.77						775.91	774.62	37.62	1.62	3.06	4.68
40	C					C	770									776.47	776.73	39.73	-3.01	3.01	0.00
41	C					C										770.87	772.83	35.83	-8.87	8.87	0.00
42	O	767	8.39	198.36	5.95	O	775	4.78	198.65	6.92						773.53	761.30	24.30	11.62	1.55	13.17
43	C	762				C	770									776.30	776.39	39.39	-1.70	1.70	0.00
44	C					C										772.18	774.18	37.18	-8.97	8.97	0.00
45	C					O	775	4.96	190.81	7.18						763.93	762.54	25.54	1.40	3.56	4.96
46	C					O		4.92	191.84	7.12						765.72	764.37	27.37	1.31	3.61	4.92
47	C					O		4.88	192.95	7.06						767.43	766.05	29.05	1.57	3.31	4.88

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

Runs 4 hrs

Runs 39 hrs

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 10/28/97

EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 3.00 MGD					Proposed Pump 4 - 2.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	766	0.00			O	772	2.88	187.76	5.68	O	775	1.88	186.82	5.34	772.06	771.00	34.00	1.30	6.06	4.76
1	C		0.00			O		2.94	185.80	5.79	O		1.92	184.84	5.45	770.38	769.33	32.33	1.69	6.55	4.86
2	C		9.04	187.77	6.41	O		3.03	182.08	5.96	O		1.98	181.81	5.63	767.51	767.13	30.13	5.42	10.43	14.05
3	O	771	9.05	187.62	6.42	O		3.01	183.29	5.94	O		1.98	181.94	5.62	768.58	760.09	23.09	2.76	16.80	14.04
4	O		8.69	193.50	6.16	O		3.02	183.14	5.94	O		1.98	181.87	5.62	767.36	756.51	19.51	-5.74	8.31	13.69
5	O		8.43	197.70	5.98	O		2.84	189.03	5.60	O		1.85	188.46	5.24	773.11	763.97	26.97	-3.13	10.25	13.12
6	O		0.00			O		2.62	192.98	5.17	O		1.75	192.15	4.97	777.03	768.03	31.03	-4.86	7.94	4.37
7	C	766	0.00			C	768				O		1.79	190.28	5.09	773.81	774.33	37.33	5.42	7.22	1.79
8	C		0.00			O	772	2.94	185.71	5.80	O		1.92	187.74	5.46	768.54	767.30	30.30	0.10	4.97	4.86
9	C		0.00			O		3.01	183.56	5.92	O		1.97	182.58	5.58	766.64	767.16	30.16	8.55	13.52	4.98
10	O	771	9.08	187.17	6.44	O		3.09	182.68	5.97	O		1.99	181.48	5.65	766.17	756.07	19.07	-3.37	10.73	14.16
11	O		8.74	192.77	6.20	O		2.86	188.31	5.64	O		1.88	187.11	5.54	771.59	760.43	23.43	-8.14	5.34	13.48
12	C	766	0.00			O		2.82	189.64	5.56	O		1.84	188.73	5.22	772.12	771.00	34.00	0.31	4.97	4.66
13	C		0.00			O		2.85	188.80	5.61	O		1.86	187.87	5.27	771.72	770.60	33.60	0.51	5.22	4.71
14	C		0.00			O		2.98	184.38	5.87	O		1.95	183.40	5.54	767.24	769.94	32.94	13.68	18.62	4.93
15	O	771	9.28	183.71	6.15	O		3.12	179.14	6.15	O		2.06	177.85	5.85	761.83	752.10	15.10	0.03	14.43	14.46
16	O		9.02	188.07	6.40	O		3.00	183.60	5.92	O		1.97	182.33	5.60	765.76	752.14	15.14	-11.45	2.55	13.99
17	O		8.27	200.04	5.87	O		2.75	191.73	5.41	O		1.67	195.70	4.75	778.78	767.09	30.09	-10.99	1.70	12.69
18	C	766	0.00			C	768				C	773				766.02	776.32	39.32	3.21	3.21	0
19	C		0.00			C					O	775	1.86	188.03	5.26	772.08	772.15	35.15	3.00	4.85	1.86
20	C		0.00			C					O		1.95	183.75	5.52	768.03	768.27	31.27	2.30	4.24	1.95
21	O	771	8.74	192.67	6.20	O	772	2.87	188.26	5.64	O		1.88	187.06	5.32	773.41	765.28	28.28	1.74	15.22	13.49
22	O		8.60	194.94	6.10	O		2.79	190.53	5.50	O		1.83	189.39	5.18	775.08	763.03	26.03	-10.49	2.73	13.22
23	C	766	0.00			C	768				C	773				775.73	776.64	39.64	5.88	5.88	0
24	C		0.00			C					O	775	1.94	183.76	5.52	768.89	769.02	32.02	3.51	5.46	1.94
25	O	771	8.72	193.04	6.18	O	772	2.86	188.55	5.63	O		1.87	187.39	5.50	774.42	764.46	27.46	-5.38	8.07	13.45
26	C	766	0.00			O		3.01	183.29	5.93	O		1.97	182.30	5.60	767.37	771.43	34.43	16.12	21.10	4.98
27	O	771	9.36	182.47	6.63	O		3.15	177.86	6.21	O		2.09	176.58	5.92	761.76	750.17	13.17	-5.80	8.79	14.6
28	O		8.99	188.68	6.37	O		2.99	184.21	5.88	O		1.96	182.88	5.57	767.81	758.04	21.04	-2.90	11.04	13.94
29	O		8.75	192.49	6.21	O		2.87	188.03	5.66	O		1.88	186.82	5.34	777.19	761.80	24.80	-3.44	10.07	13.5
30	O		8.48	196.89	6.02	O		2.72	192.44	5.36	O		1.77	191.29	5.02	775.28	766.28	29.27	-4.30	8.67	12.97
31	C	766	0.00			O		2.78	190.72	5.48	O		1.82	189.84	5.15	772.42	771.86	34.86	3.89	8.49	4.6
32	C		0.00			O		2.96	185.07	5.84	O		1.94	184.10	5.91	766.52	766.81	29.81	7.71	12.61	4.9
33	O	771	8.97	188.98	6.36	O		2.98	184.52	5.87	O		1.96	183.20	5.55	766.43	756.80	19.80	-2.56	11.34	13.91
34	O		8.70	193.46	6.17	O		2.84	188.99	5.60	O		1.85	188.41	5.24	770.59	760.13	23.10	-6.84	6.55	13.39
35	O		8.23	200.90	5.84	O		2.50	196.15	4.92	O		1.68	195.45	4.76	778.24	769.01	32.01	-6.71	5.70	12.41
36	C	766	0.00			C	768				C	773				775.56	776.39	39.39	5.58	5.58	0
37	C		0.00			C					O	775	1.88	186.88	5.33	769.02	769.16	32.16	3.52	5.40	1.88
38	O	771	8.51	196.44	6.03	O	772	2.74	192.03	5.39	O		1.78	190.86	5.05	774.97	764.60	27.60	-7.63	5.40	13.03
39	C	766	0.00			C	768				O		1.77	191.36	5.02	774.37	774.48	37.88	3.26	5.03	1.77
40	C		0.00			C					O		1.88	186.78	5.34	770.19	770.25	33.25	3.03	4.91	1.88
41	O		8.61	194.75	6.11	O	772	2.80	190.35	5.51	O		1.83	189.20	5.19	774.29	766.31	29.30	1.19	14.43	13.24
42	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.72	5.00	776.29	764.79	27.79	-10.31	2.55	12.86
43	C	766	0.00			C	768				C	773				776.48	776.71	39.71	2.79	2.79	0
44	C		0.00			C					O	775	1.91	185.64	5.41	769.79	773.09	36.09	12.71	14.61	1.91
45	O	771	8.98	188.83	6.37	O	772	2.98	184.37	5.88	O		1.96	183.12	5.55	768.32	756.59	19.59	-8.16	13.92	13.92
46	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.71	5.00	777.06	767.18	30.18	-6.98	5.88	12.86
47	C	766	0.00			C	768				C	773				775.30	776.23	39.23	5.94	5.94	0

* (-) Represents Elevated Storage Refill Rate
(+) Represents Elevated Storage Flow into the Distribution System

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

777 – 40' – Tank Full

Job No.: 97180
Date: 11/22/97

EXTENDED PERIOD SIMULATION - WINTER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 3.00 MGD					Proposed Pump 4 - 2.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	757				C	767				C	769				775.32	776.00	39.00	-5.01	5.01	0.00
1	C					C					C					769.05	769.51	32.51	-4.01	4.01	0.00
2	C					O	772	2.83	189.48	5.58	O	775	1.94	189.72	3.82	765.30	764.31	27.31	-1.64	6.42	4.77
3	C					O		2.89	187.66	5.69	O		1.98	187.02	3.90	762.70	762.16	25.16	-4.35	9.22	4.87
4	O ✓	767	9.04	187.82	6.41	O		2.76	191.52	5.44	O		1.89	192.51	3.73	767.77	756.50	19.50	8.58	5.11	13.69
5	C	757				O		2.71	192.71	5.34	O		1.85	194.69	3.65	768.54	767.64	30.64	-1.75	6.31	4.56
6	C					O		2.76	191.61	5.43	O		1.88	192.94	3.71	766.48	765.38	28.38	-0.27	4.91	4.64
7	C					O		2.76	191.50	5.44	O		1.89	192.77	3.72	766.18	765.03	28.03	0.19	4.46	4.65
8	C					O		2.75	191.79	5.42	O		1.88	193.22	3.70	766.56	765.27	28.27	1.57	3.06	4.63
9	C					O		2.72	192.60	5.61	O		1.86	194.48	3.65	767.86	767.30	30.30	-3.75	8.32	4.58
10	C					O		2.82	189.89	5.55	O		1.93	190.34	3.80	763.39	762.44	25.44	-1.87	6.62	4.75
11	C					O		2.86	188.55	5.64	O		1.96	188.33	3.86	761.38	760.01	23.01	1.56	3.26	4.82
12	C					O		2.81	190.07	6.01	O		1.92	190.62	3.79	763.39	762.04	25.04	1.68	3.06	4.73
13	C					O		2.76	191.52	5.44	O		1.89	192.82	3.71	765.51	764.24	27.24	1.44	3.21	4.65
14	C					O		2.73	192.19	5.39	O		1.87	193.84	3.68	766.52	766.09	29.09	-4.42	9.02	4.60
15	C					O		2.86	188.54	5.64	O		1.96	188.37	3.86	760.95	760.35	23.25	-4.05	8.87	4.82
16	O ✓	767	8.90	190.16	6.31	O		2.69	192.21	5.30	O		1.84	195.24	3.63	767.53	755.11	18.11	11.87	1.55	13.43
17	C	757				O		2.56	195.09	5.04	O		1.75	199.36	3.44	771.94	770.51	33.51	3.24	1.05	4.31
18	C					C	767				O		1.69	201.04	3.34	774.89	774.73	37.73	-0.31	2.00	1.69
19	C					C					O		1.71	200.60	3.37	774.43	774.33	37.33	-1.30	3.01	1.71
20	C					C					O		1.74	199.43	3.43	772.80	772.66	35.66	-0.86	2.61	1.74
21	C					C					O		1.79	197.65	3.52	770.51	771.53	34.53	-7.23	9.02	1.79
22	C					O	772	2.80	190.35	5.52	O		1.91	191.53	3.76	763.70	762.14	25.14	3.01	1.70	4.71
23	C					O		2.71	192.85	5.33	O		1.85	194.88	3.64	767.21	766.04	29.04	0.95	3.61	4.56
24	C					O		2.68	192.55	5.27	O		1.83	195.97	3.60	768.45	767.28	30.28	1.14	3.36	4.51
25	C					O		2.64	193.29	5.20	O		1.80	197.06	3.55	769.76	768.77	31.77	-0.52	4.96	4.44
26	C					O		2.67	192.64	5.26	O		1.82	196.11	3.59	768.46	768.09	31.09	-4.53	9.02	4.49
27	C					O		2.79	190.72	5.50	O		1.91	191.59	3.76	763.29	762.21	25.21	-0.71	5.41	4.70
28	C					O		2.81	190.08	5.54	O		1.92	190.62	3.79	762.20	761.27	24.27	-2.03	6.77	4.73
29	C					O		2.87	188.40	5.65	O		1.96	188.12	3.86	759.73	758.65	21.65	-1.33	6.16	4.83
30	O ✓	767	8.85	190.97		O		2.68	192.55	5.27	O		1.83	195.74	3.61	767.48	756.91	19.91	7.99	5.36	13.36
31	C	757				O		2.63	193.62	5.24	O		1.79	197.53	3.53	768.24	767.29	30.29	-0.79	5.21	4.42
32	C					O		2.66	192.94	5.24	O		1.81	196.56	3.57	766.85	766.25	29.25	-3.30	7.77	4.47
33	C					O		2.75	191.76	5.42	O		1.88	193.20	3.70	762.81	761.97	24.97	-2.34	6.97	4.63
34	C					O		2.81	190.18	5.99	O		1.92	190.77	3.78	760.19	758.95	21.95	0.72	4.01	4.73
35	C					O		2.79	190.89	5.49	O		1.90	191.84	3.75	761.14	759.88	22.88	1.88	3.51	4.69
36	C					O		2.75	191.88	5.41	O		1.88	193.37	3.70	762.64	761.40	24.40	1.17	3.46	4.63
37	C					O		2.71	192.79	5.34	O		1.85	194.79	3.64	764.14	762.93	25.93	1.25	3.31	4.56
38	C					O		2.67	192.69	5.26	O		1.82	196.18	3.59	765.73	764.56	27.56	1.18	3.31	4.49
39	C					O		2.63	193.53	5.18	O		1.79	197.39	3.53	767.24	766.07	29.07	1.37	3.06	4.42
40	C					O		2.59	194.51	5.10	O		1.76	198.66	3.47	768.99	767.86	30.86	1.34	3.01	4.35
41	C					O		2.56	195.04	5.05	O		1.75	199.29	3.44	769.91	769.61	32.61	-4.56	8.87	4.31
42	C					O		2.68	192.49	5.44	O		1.83	195.88	3.60	765.08	763.69	26.69	2.95	1.55	4.51
43	C					O		2.59	194.52	5.09	O		1.76	198.69	3.47	768.84	767.52	30.52	2.65	1.70	4.35
44	C					O		2.53	195.84	4.98	O		1.72	200.16	2.25	771.18	770.94	33.94	-4.72	8.97	4.25
45	C					O		2.65	193.05	5.23	O		1.81	196.72	3.56	765.95	764.84	27.84	0.90	3.56	4.46
46	C					O		2.62	193.70	5.23	O		1.79	197.61	3.52	767.08	765.99	28.99	0.80	3.61	4.41
47	C					O		2.60	194.30	5.12	O		1.77	198.40	3.49	768.14	767.04	30.04	1.06	3.31	4.37

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

2 AM

Runs 3 hrs

Runs 38 hrs

Runs 46 hrs

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - 3.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	762				C	769				C	770				775.03	776.00	39.00	-6.06	6.60	0.00
1	C					O	773	4.95	191.04	7.17	O	775	2.70	192.08	5.31	771.20	768.14	31.14	1.10	6.55	7.65
2	C					O		4.93	191.43	7.14	O		2.68	192.48	5.28	772.00	769.56	32.56	-2.82	10.43	7.61
3	C					O		5.05	189.17	7.31	O		2.81	190.28	5.53	766.62	765.89	28.89	-8.94	16.80	7.86
4	O	767	8.81	206.15	6.25	O		4.99	190.24	7.22	O		2.75	191.90	5.41	787.47	754.30	17.30	8.24	8.31	16.55
5	O		8.23	212.04	5.84	O		4.78	198.67	6.92	O		2.52	196.07	4.96	793.33	765.01	28.01	5.28	10.25	15.53
6	C	762				O		4.82	194.71	6.98	O		2.55	195.24	5.03	774.49	771.84	34.84	-0.57	7.94	7.37
7	C					O		4.84	194.20	7.00	O		2.57	194.86	5.06	773.88	771.10	34.10	0.19	7.22	7.41
8	C					O		4.83	194.54	6.99	O		2.56	195.12	5.04	774.45	771.35	34.35	2.42	4.97	7.39
9	C					C	769				O		2.61	193.90	5.15	772.26	774.49	37.49	-10.91	13.52	2.61
10	O	767	8.47	209.76	6.00	O	773	5.07	188.85	7.34	O		2.61	193.97	5.14	790.42	760.33	23.33	5.42	10.73	16.15
11	C	762				O		4.91	192.19	7.10	O		2.65	193.21	5.21	770.54	767.37	30.37	2.21	5.34	7.56
12	C					O		4.85	193.97	7.01	O		2.58	194.69	5.08	773.37	770.24	33.24	2.45	4.97	7.43
13	C					C	769				O		2.58	194.76	5.07	773.55	773.43	36.43	-2.64	5.22	2.58
14	C					O	773	4.95	191.12	7.16	O		2.69	192.23	5.30	769.79	770.00	33.00	-10.98	18.62	7.64
15	O	767	8.80	206.34	6.24	O		4.97	190.54	7.20	O		2.73	192.30	5.38	785.94	755.75	18.75	2.07	14.43	16.50
16	O		8.27	211.62	5.87	O		4.80	198.10	6.94	O		2.54	195.66	4.99	791.03	758.43	21.43	13.06	2.55	15.61
17	C	762				C	769				C	770				775.28	775.37	38.37	-1.70	1.70	0.00
18	C					C					C					772.89	773.18	36.18	-3.21	3.21	0.00
19	C					O	773	4.89	192.53	7.08	O	775	2.63	193.52	5.18	772.27	769.02	32.02	2.67	4.85	7.52
20	C					O		4.82	194.82	6.98	O		2.55	195.32	5.02	775.72	772.48	35.48	3.13	4.24	7.37
21	C					C	769				C	770				771.27	776.53	39.53	-15.22	15.22	0.00
22	O	767	8.51	209.36	6.03	O	773	4.88	192.87	7.06	O	775	2.64	193.39	5.20	791.24	756.77	19.77	13.30	2.73	16.03
23	C	762				C	769				O		2.59	194.40	5.10	774.06	774.04	37.04	-3.29	5.88	2.59
24	C					C					O		2.71	192.66	5.35	769.91	769.77	32.77	-2.74	5.46	2.71
25	C					O	773	5.01	189.84	7.25	O		2.75	191.70	5.43	769.14	766.20	29.20	-0.30	8.07	7.76
26	C					O		5.10	189.33	7.38	O		2.86	188.72	5.63	764.72	765.81	28.81	-13.15	21.10	7.96
27	O	767	9.16	202.21	6.49	O		5.11	189.20	7.39	O		2.88	188.04	5.67	782.94	747.85	10.85	8.35	8.79	17.15
28	O		8.53	209.08	6.05	O		4.89	192.60	7.08	O		2.64	193.38	5.20	789.83	759.59	22.59	5.03	11.04	16.06
29	O		8.11	213.13	5.75	O		4.74	200.08	6.86	O		2.47	197.10	4.87	793.51	766.10	29.10	5.25	10.07	15.32
30	C	762				C	769				O		2.58	194.78	5.07	772.40	772.94	35.94	-6.10	8.67	2.58
31	C					O	773	4.97	190.68	7.19	O		2.71	192.82	5.33	767.83	765.03	28.03	-0.82	8.49	7.68
32	C					O		5.00	189.96	7.24	O		2.75	191.72	5.42	765.96	763.97	26.97	-4.86	12.61	7.75
33	O	767	8.59	208.57	6.09	O		4.90	192.30	7.09	O		2.65	193.12	5.22	787.55	757.65	20.65	4.80	11.34	16.14
34	O		8.05	213.61	5.71	O		4.72	200.75	6.83	O		2.45	197.62	4.82	792.47	763.89	26.89	8.67	6.55	15.22
35	C	762				C	769				C	770				774.26	775.12	38.12	-5.70	5.70	0.00
36	C					O	773	4.87	193.11	7.05	O	775	2.61	194.02	5.14	770.80	767.74	30.74	1.90	5.58	7.48
37	C					O		4.82	194.75	6.98	O		2.55	195.27	5.03	773.21	770.21	33.21	1.98	5.40	7.37
38	C					O		4.77	199.09	6.90	O		2.50	196.55	4.91	775.69	772.78	35.78	1.87	5.40	7.27
39	C					C	769				C	770				774.51	775.19	38.19	-5.03	5.03	0.00
40	C					O	773	4.89	192.74	7.07	O	775	2.65	193.05	5.23	771.90	768.67	31.67	2.63	4.91	7.54
41	C					O		4.86	193.57	7.03	O		2.59	194.37	5.11	773.25	772.07	35.07	-6.98	14.43	7.45
42	C					O		5.00	190.09	7.23	O		2.75	191.90	5.41	766.92	763.01	26.01	5.19	2.55	7.75
43	C					O		4.86	193.55	7.03	O		2.59	194.36	5.11	773.45	769.76	32.76	4.66	2.79	7.45
44	C					C	769				C	770				770.91	775.80	38.80	-14.65	14.61	0.00
45	O	767	8.57	208.71	6.08	O	773	4.90	192.24	7.10	O	775	2.67	192.74	5.25	789.87	756.83	19.83	10.38	5.76	16.14
46	C	762				O		4.86	193.44	7.04	O		2.60	194.28	5.12	773.31	770.31	33.31	1.58	5.88	7.46
47	C					O		4.82	194.79	6.98	O		2.55	195.30	5.03	775.28	772.36	35.36	1.43	5.94	7.37

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

EXTENDED PERIOD SIMULATION - WINTER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - 3.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	757				C	767				C	769				775.32	776.00	39.00	-5.01	5.01	0.00
1	C					C					C					769.05	769.51	32.51	-4.01	4.01	0.00
2	C					O	772	5.19	187.82	7.52	O	775	3.00	183.61	5.91	767.83	764.31	27.31	1.78	6.42	8.19
3	C					O		5.03	189.48	7.28	O		2.97	184.87	5.84	769.52	766.60	29.60	-1.23	9.22	8.00
4	C					O		5.04	189.34	7.29	O		2.97	184.71	5.85	768.64	765.03	28.03	2.90	5.11	8.01
5	C					O		4.89	192.53	7.08	O		2.63	193.51	5.18	771.73	768.87	31.78	1.21	6.31	7.52
6	C					O		4.82	194.66	6.98	O		2.81	190.32	5.53	773.63	770.34	33.34	2.72	4.91	7.63
7	C					C	767				O		2.77	191.30	5.46	774.17	773.87	36.87	-1.69	4.46	2.77
8	C					C					O		2.60	194.22	5.12	772.04	771.67	34.67	-0.46	3.06	2.60
9	C					C					O		2.88	188.00	5.67	770.78	771.08	34.08	-5.44	8.32	2.88
10	C					O	772	5.04	189.34	7.29	O		2.97	184.71	5.85	767.36	764.03	27.03	1.39	6.62	8.01
11	C					O		4.92	191.85	7.12	O		2.89	187.52	5.70	769.72	765.82	28.82	4.55	3.26	7.81
12	C					O		4.75	199.80	6.87	O		2.67	192.72	5.26	775.29	771.74	34.74	4.36	3.06	7.42
13	C					C	767				C	769				776.42	776.71	39.71	-3.21	3.21	0.00
14	C					C					C					770.53	772.55	35.55	-9.02	9.02	0.00
15	C					O	772	5.21	187.26	7.55	O	775	3.03	182.24	5.97	764.03	760.83	23.83	-0.63	8.87	8.24
16	C					O		5.16	188.44	7.46	O		3.00	183.60	5.91	764.88	760.02	23.02	6.60	1.55	8.16
17	C					O		4.82	194.95	6.97	O		2.55	195.41	5.02	772.74	768.61	31.61	6.31	1.05	7.37
18	C					C	767				C	769				776.67	776.79	39.79	-2.00	2.00	0.00
19	C					C					C					773.92	774.18	37.18	-3.01	3.01	0.00
20	C					C					C					770.08	770.28	33.28	-2.61	2.61	0.00
21	C					O	772	4.93	191.61	7.13	O	775	2.90	187.23	5.72	767.71	766.90	29.90	-1.19	9.02	7.83
22	C					O		4.90	192.20	7.10	O		2.88	187.88	5.68	769.74	765.36	28.36	6.08	1.70	7.78
23	C					C	767				O		2.75	191.81	5.42	773.63	773.26	36.26	-0.86	3.61	2.75
24	C					C					O		2.79	190.68	5.50	772.55	772.14	35.14	-0.57	3.36	2.79
25	C					C					O		2.83	189.74	5.57	771.66	771.40	34.40	-2.14	4.96	2.83
26	C					C					O		2.92	186.53	5.76	768.20	768.64	31.64	-6.10	9.02	2.92
27	C					O	772	5.19	187.90	7.50	O		2.99	183.80	5.90	764.42	760.70	23.70	2.77	5.41	8.18
28	C					O		4.94	191.30	7.15	O		2.68	192.35	5.29	767.29	764.32	27.32	0.86	6.77	7.62
29	C					O		4.90	192.27	7.09	O		2.88	187.95	5.68	768.62	765.42	28.42	1.62	6.16	7.78
30	C					O		4.82	194.67	6.98	O		2.80	190.33	5.53	770.72	767.52	30.52	2.27	5.36	7.62
31	C					O		4.80	198.01	6.95	O		2.65	193.10	5.22	773.53	770.46	33.46	2.24	5.21	7.45
32	C					C	767				O		2.64	193.23	5.21	773.09	773.37	36.37	-5.21	7.77	2.64
33	C					O	772	4.83	194.62	6.98	O		2.81	190.28	5.53	769.66	766.71	29.71	0.67	6.97	7.64
34	C					O		4.77	198.98	6.91	O		2.75	191.93	5.41	770.98	767.58	30.58	3.51	4.01	7.52
35	C					C	767				O		2.63	193.55	5.18	772.48	772.14	35.14	-0.88	3.51	2.63
36	C					C					O		2.68	192.41	5.28	771.35	770.99	33.99	-0.78	3.46	2.68
37	C					C					O		2.76	191.57	5.44	770.40	769.99	32.99	-0.55	3.31	2.76
38	C					C					O		2.79	190.77	5.49	769.70	769.29	32.29	-0.52	3.31	2.79
39	C					C					O		2.81	190.04	5.54	769.05	768.61	31.61	-0.24	3.06	2.81
40	C					C					O		2.83	189.60	5.57	768.74	768.30	31.30	-0.18	3.01	2.83
41	C					C					O		2.87	188.47	5.65	767.64	768.06	31.06	-6.01	8.87	2.87
42	C					O	772	4.99	190.28	7.22	C		2.94	185.75	5.80	764.85	760.26	23.26	6.38	1.55	7.93
43	C					O		4.74	199.96	6.87	O		2.66	192.90	5.24	772.50	768.55	31.55	5.70	1.70	7.40
44	C					C	767				C	769				773.93	775.94	38.94	-8.97	8.97	0.00
45	C					O	772	4.86	193.45	7.04	O	775	2.84	189.14	5.60	768.01	764.31	27.31	4.15	3.56	7.70
46	C					O		4.78	198.78	6.92	O		2.62	193.82	5.16	773.06	769.86	32.68	3.79	3.61	7.40
47	C					C	767				O		2.53	195.86	4.98	774.94	774.59	37.59	-0.78	3.31	2.53

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

Does not Run

Runs 24 hrs

Runs 39 hrs

A typical characteristic curve of a centrifugal pump is shown in Fig. 13 and Fig. 14. It will be observed that both charts have plotted on them several head capacity curves with lines of constant efficiency and Hp superimposed on them. In Fig. 13 the impeller diameter is held constant and the speed varies whereas in Fig. 14 the speed is held constant and the impeller diameter varies. The mathematical relationships between these several variables are known as the affinity laws and can be expressed as follows:

With impeller diameter held constant		With speed held constant	
$\frac{Q_1}{Q_2}=\frac{N_1}{N_2}$	Law 1a	$\frac{Q_1}{Q_2}=\frac{D_1}{D_2}$	Law 2a
$\frac{H_1}{H_2}=\left(\frac{N_1}{N_2}\right)^2$	Law 1b	$\frac{H_1}{H_2}=\left(\frac{D_1}{D_2}\right)^2$	Law 2b
$\frac{\text{Bhp}_1}{\text{Bhp}_2}=\left(\frac{N_1}{N_2}\right)^3$	Law 1c	$\frac{\text{Bhp}_1}{\text{Bhp}_2}=\left(\frac{D_1}{D_2}\right)^3$	Law 2c

Where

Q_1 = Capacity and H_1 = head at N_1 rpm or with impeller dia. D_1

Q_2 = Capacity and H_2 = head at N_2 rpm or with impeller dia. D_2

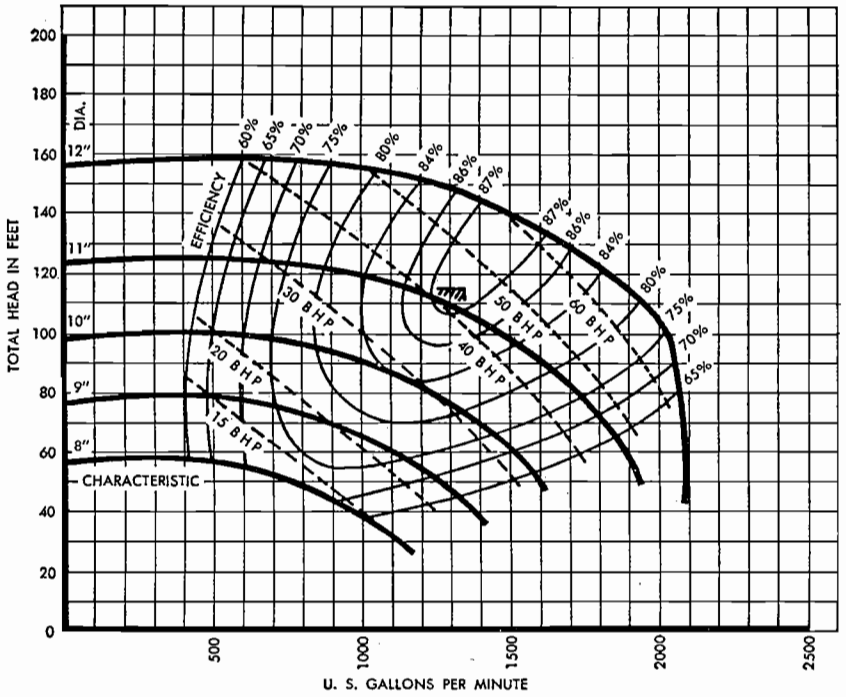


FIG. 14. Typical performance curve of a centrifugal pump at 1750

These relations are graphically shown on Fig. 15.

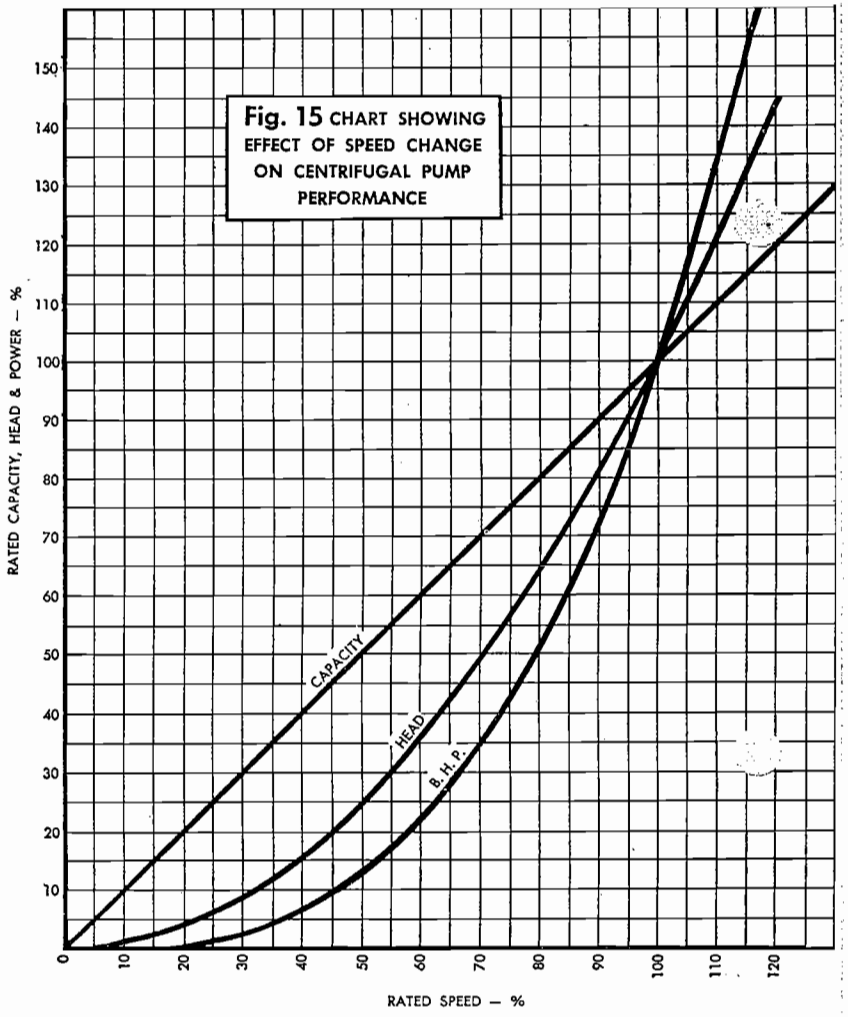


FIG. 15. Chart showing effect of speed change on centrifugal pump performance.

Where complete rating charts such as those shown in Figures 13 and 14, secured by actual test of the pump, are available, it is always best to use them to estimate intermediate points by interpolation. However, many field problems will arise where these data are not available and then approximations can be made by calculation, using

SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

ROSS L. JACOBS, P.E.
RONALD V. CONWAY, P.E.
JOHN W. BIRKHOFF, P.E.
JOE R. CARTER, P.E.
GARY C. HENDRICKS, P.E.
I. C. FINKLEA, P.E.

December 5, 1997

Mr. James Pierce Jr., P.E., DEE
Town of Addison
Post Office Box 144
Addison, Texas 75001-0144

Re: Celestial Pump Station Improvements

Dear Mr. Pierce:

We are enclosing the results of a third Cybernet Extended Period Simulation (EPS) scenario with a 5 MGD pump placed at Celestial Pump Station. The results are recorded on a worksheet similar to the previous summary sheets discussed during our meeting in November. The water distribution system was modeled under a summer and winter demand condition.

We currently have a meeting scheduled at the Service Center on December 11, 1997, to discuss the Celestial Pump Station Improvements. If you have any questions regarding the EPS models or the data summary sheets, please do not hesitate to contact our office.

Sincerely,

Matt Hickey

Matt Hickey, E.I.T.

Enclosure
cc: Mr. Jeff Markiewicz

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SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS

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GARY C. HENDRICKS, P.E.
I. C. FINKLEA, P.E.

November 5, 1997

F41

Mr. Jeff Markiewicz
Town of Addison
Post Office Box 144
Addison, Texas 75001-0144

Re: Celestial Pump Station
Pumps 2 & 4

Dear Mr. Markiewicz:

We are enclosing three sets of preliminary specifications and contract documents for the bidding of Pumps 2 and 4 at the Celestial Pump Station for your review and comment. Also enclosed is the design memo which outlines the sizing of the pumps for your system. Delivery time on the pumps and motors is approximately 10 to 12 weeks. It is our understanding that the Town desires to bid the pumps and motors separate of the construction contract to install them.

Prior to these specifications being finalized the bottom elevation of the pump cans needs to be determined. We have been unable to locate in the record drawings the depth of the cans. It appears that the station will need to be shut down and valved off from the system. The flange will need to be removed and a measure down taken. Our survey crew is available to assist the Town in this effort.

We are continuing to complete the design of the improvements and will provide those documents to you shortly. We are available at your convenience to discuss any questions you may have with the enclosed documents.

Sincerely,

John W. Birkhoff, P.E.

Enclosures

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SHIMEK, JACOBS & FINKLEA, L.L.P.
CONSULTING ENGINEERS
8333 Douglas Avenue, #820 Dallas, Texas 75225-5816 Fax (214) 361-0204 Phone (214) 361-7900

DESIGN MEMORANDUM

Pumps should be designed to keep elevated tank full

To: Mr. Jeff Markiewicz

From: John W. Birkhoff, P.E.

Date: November 5, 1997

Subject: Celestial Pump Station Improvements

The Celestial Pump Station Improvements include the addition of two high service pumps. These pumps will be used for winter months demands, replace a deficiency in elevated storage and to run concurrently with one existing pump during the summer months. In order to determine the amount of discharge needed from the pumps during low demand periods, pumping records for the months of January through March were obtained from the City. The records indicated a flowrate of approximately 5 million gallons per day (MGD) occurred during this period. Pumps with flowrates of 3 MGD and 2 MGD were selected to meet this demand.

currently 3- 9.5 MGD pumps

this will increase

In order to determine the ability of the pumps to operate in different demand conditions and in combination with one of the existing pumps, a Cybernet Extended Period Simulation (EPS) was created. Select output was recorded and is shown on the enclosed EPS pump sizing worksheet. The data generated from the EPS shows the amount of pump head required to refill the 1 MG elevated storage tank, while overcoming the static head (Hydraulic Gradient at the Elevated Storage Tank Minus the Elevation of the Pumps; 605.5-feet) and the total dynamic head (Static Head Plus the Head Loss in the Distribution system).

System curves were generated with the calculation of the static head and the total dynamic head at various flow rates. The following table shows the static head in the water distribution system when the elevated storage tank is at the maximum condition (High Water Level Elevation = 777) and the minimum condition (Low Water Level Elevation = 737):

Maximum Static Head (feet)	Minimum Static Head (feet)
171.5	131.5

The head loss at various pump rates were calculated and added to the static head to provide the total dynamic head. The following table shows a summary of the total dynamic head for the condition when one existing pump and the two proposed pumps are running at the same time:

Does model include use out of the distribution system?

Flowrate (MGD)	Total Dynamic Head at Minimum Condition in Feet (Static Head +Head Loss)	Total Dynamic Head at Minimum Condition in Feet (Static Head +Head Loss)
0	171.50	131.50
2	172.18	132.18
4	174.04	134.04
6	176.81	136.81
8	180.63	140.63
10	184.66	144.66
12	191.03	151.03
13	194.00	154.00
14	196.97	156.97
15	199.94	159.94
18	211.82	171.82

The data generated from the tables above are shown on the attached system curve graph and are labeled as Maximum and Minimum. Once the system curves are plotted, the pump curves for each pump and the additive pump curves for different pump combinations were plotted. When one existing pump is operating with the two proposed pumps, the operating point must fall in the area between the maximum and minimum condition system curves. As shown in the EPS worksheet, one existing pump and two proposed pumps operating in a condition following a period of maximum hourly demand, produce a pump head of approximately 190-feet of head with a total pump rate of 13.5 MGD. Plotting these two points on the pump curve labeled Pumps 1+2+4, show the pumps are operating within the system curves.

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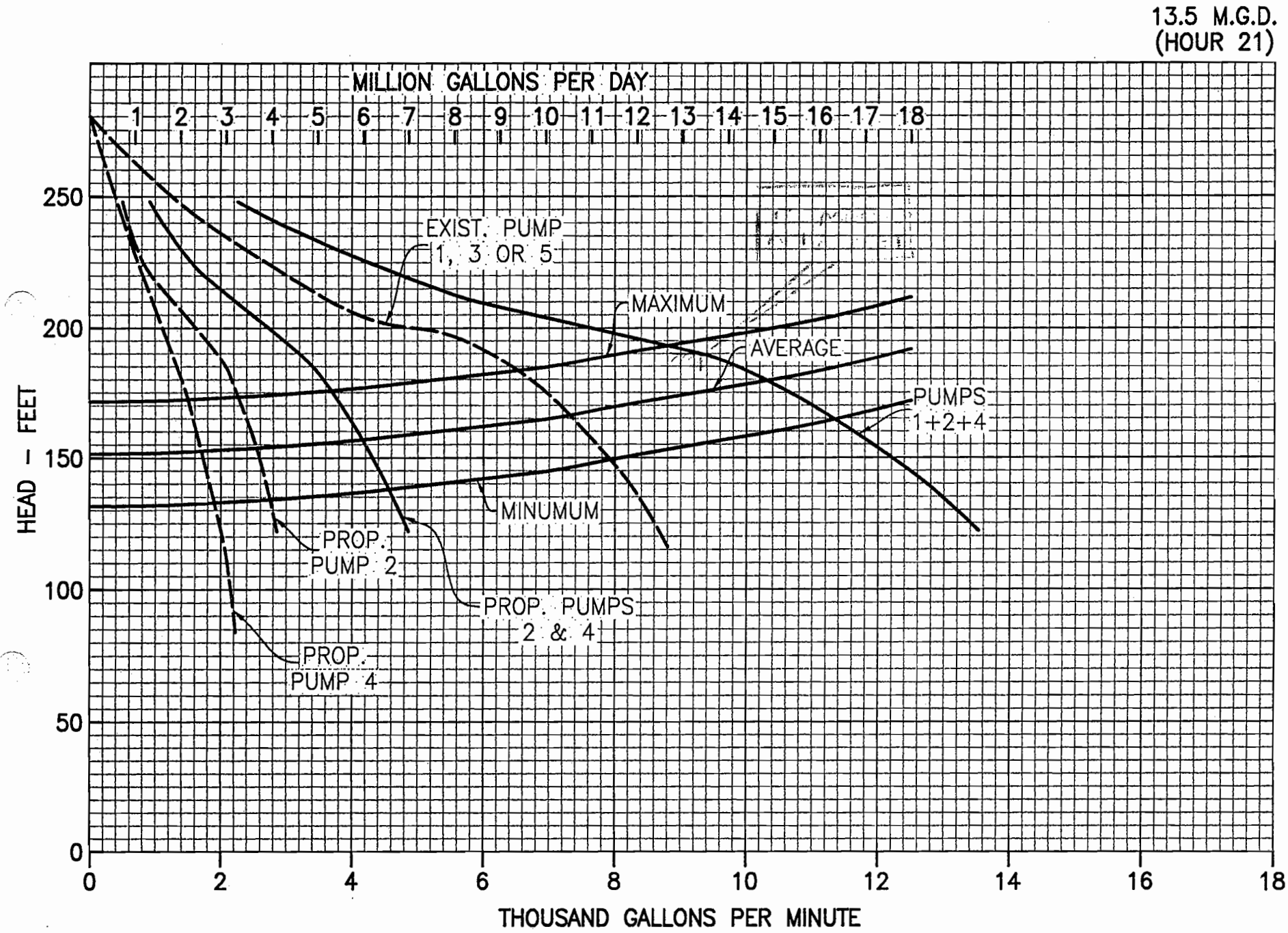


TOWN OF ADDISON

CELESTIAL ROAD PUMP STATION

SHIMEK, JACOBS & FINKLEA
CONSULTING ENGINEERS
Dallas, Texas

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 10/28/97

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 3.00 MGD					Proposed Pump 4 - 2.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	766	0.00			O	772	2.88	187.76	5.68	O	775	1.88	186.82	5.34	772.06	771.00	34.00	1.30	6.06	4.76
1	C		0.00			O		2.94	185.80	5.79	O		1.92	184.84	5.45	770.38	769.33	32.33	1.69	6.55	4.86
2	C		9.04	187.77	6.41	O		3.03	182.08	5.96	O		1.98	181.81	5.63	767.51	767.13	30.13	5.42	10.43	14.05
3	O	771	9.05	187.62	6.42	O		3.01	183.29	5.94	O		1.98	181.94	5.62	768.58	760.09	23.09	2.76	16.80	14.04
4	O		8.69	193.50	6.16	O		3.02	183.14	5.94	O		1.98	181.87	5.62	767.36	756.51	19.51	-5.74	8.31	13.69
5	O		8.43	197.70	5.98	O		2.84	189.03	5.60	O		1.85	188.46	5.24	773.11	763.97	26.97	-3.13	10.25	13.12
6	O		0.00			O		2.62	192.98	5.17	O		1.75	192.15	4.97	777.03	768.03	31.03	-4.86	7.94	4.37
7	C	766	0.00			C	768				O		1.79	190.28	5.09	773.81	774.33	37.33	5.42	7.22	1.79
8	C		0.00			O	772	2.94	185.71	5.80	O		1.92	187.74	5.46	768.54	767.30	30.30	0.10	4.97	4.86
9	C		0.00			O		3.01	183.56	5.92	O		1.97	182.58	5.58	766.64	767.16	30.16	8.55	13.52	4.98
10	O	771	9.08	187.17	6.44	O		3.09	182.68	5.97	O		1.99	181.48	5.65	766.17	756.07	19.07	-3.37	10.73	14.16
11	O		8.74	192.77	6.20	O		2.86	188.31	5.64	O		1.88	187.11	5.54	771.59	760.43	23.43	-8.14	5.34	13.48
12	C	766	0.00			O		2.82	189.64	5.56	O		1.84	188.73	5.22	772.12	771.00	34.00	0.31	4.97	4.66
13	C		0.00			O		2.85	188.80	5.61	O		1.86	187.87	5.27	771.72	770.60	33.60	0.51	5.22	4.71
14	C		0.00			O		2.98	184.38	5.87	O		1.95	183.40	5.54	767.24	769.94	32.94	13.68	18.62	4.93
15	O	771	9.28	183.71	6.15	O		3.12	179.14	6.15	O		2.06	177.85	5.85	761.83	752.10	15.10	0.03	14.43	14.46
16	O		9.02	188.07	6.40	O		3.00	183.60	5.92	O		1.97	182.33	5.60	765.76	752.14	15.14	-11.45	2.55	13.99
17	O		8.27	200.04	5.87	O		2.75	191.73	5.41	O		1.67	195.70	4.75	778.78	767.09	30.09	-10.99	1.70	12.69
18	C	766	0.00			C	768				C	773				766.02	776.32	39.32	3.21	3.21	0
19	C		0.00			C					O	775	1.86	188.03	5.26	772.08	772.15	35.15	3.00	4.85	1.86
20	C		0.00			C					O		1.95	183.75	5.52	768.03	768.27	31.27	2.30	4.24	1.95
21	O	771	8.74	192.67	6.20	O	772	2.87	188.26	5.64	O		1.88	187.06	5.32	773.41	765.28	28.28	1.74	15.22	13.49
22	O		8.60	194.94	6.10	O		2.79	190.53	5.50	O		1.83	189.39	5.18	775.08	763.03	26.03	-10.49	2.73	13.22
23	C	766	0.00			C	768				C	773				775.73	776.64	39.64	5.88	5.88	0
24	C		0.00			C					O	775	1.94	183.76	5.52	768.89	769.02	32.02	3.51	5.46	1.94
25	O	771	8.72	193.04	6.18	O	772	2.86	188.55	5.63	O		1.87	187.39	5.50	774.42	764.46	27.46	-5.38	8.07	13.45
26	C	766	0.00			O		3.01	183.29	5.93	O		1.97	182.30	5.60	767.37	771.43	34.43	16.12	21.10	4.98
27	O	771	9.36	182.47	6.63	O		3.15	177.86	6.21	O		2.09	176.58	5.92	761.76	750.17	13.17	-5.80	8.79	14.6
28	O		8.99	188.68	6.37	O		2.99	184.21	5.88	O		1.96	182.88	5.57	767.81	758.04	21.04	-2.90	11.04	13.94
29	O		8.75	192.49	6.21	O		2.87	188.03	5.66	O		1.88	186.82	5.34	777.19	761.80	24.80	-3.44	10.07	13.5
30	O		8.48	196.89	6.02	O		2.72	192.44	5.36	O		1.77	191.29	5.02	775.28	766.28	29.27	-4.30	8.67	12.97
31	C	766	0.00			O		2.78	190.72	5.48	O		1.82	189.84	5.15	772.42	771.86	34.86	3.89	8.49	4.6
32	C		0.00			O		2.96	185.07	5.84	O		1.94	184.10	5.91	766.52	766.81	29.81	7.71	12.61	4.9
33	O	771	8.97	188.98	6.36	O		2.98	184.52	5.87	O		1.96	183.20	5.55	766.43	756.80	19.80	-2.56	11.34	13.91
34	O		8.70	193.46	6.17	O		2.84	188.99	5.60	O		1.85	188.41	5.24	770.59	760.13	23.10	-6.84	6.55	13.39
35	O		8.23	200.90	5.84	O		2.50	196.15	4.92	O		1.68	195.45	4.76	778.24	769.01	32.01	-6.71	5.70	12.41
36	C	766	0.00			C	768				C	773				775.56	776.39	39.39	5.58	5.58	0
37	C		0.00			C					O	775	1.88	186.88	5.33	769.02	769.16	32.16	3.52	5.40	1.88
38	O	771	8.51	196.44	6.03	O	772	2.74	192.03	5.39	O		1.78	190.86	5.05	774.97	764.60	27.60	-7.63	5.40	13.03
39	C	766	0.00			C	768				O		1.77	191.36	5.02	774.37	774.48	37.88	3.26	5.03	1.77
40	C		0.00			C					O		1.88	186.78	5.34	770.19	770.25	33.25	3.03	4.91	1.88
41	O		8.61	194.75	6.11	O	772	2.80	190.35	5.51	O		1.83	189.20	5.19	774.29	766.31	29.30	1.19	14.43	13.24
42	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.72	5.00	776.29	764.79	27.79	-10.31	2.55	12.86
43	C	766	0.00			C	768				C	773				776.48	776.71	39.71	2.79	2.79	0
44	C		0.00			C					O	775	1.91	185.64	5.41	769.79	773.09	36.09	12.71	14.61	1.91
45	O	771	8.98	188.83	6.37	O	772	2.98	184.37	5.88	O		1.96	183.12	5.55	768.32	756.59	19.59	-8.16	13.92	13.92
46	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.71	5.00	777.06	767.18	30.18	-6.98	5.88	12.86
47	C	766	0.00			C	768				C	773				775.30	776.23	39.23	5.94	5.94	0

* (-) Represents Elevated Storage Refill Rate
(+) Represents Elevated Storage Flow into the Distribution System

TOWN OF
ADDISON PUBLIC WORKS

To: MATT HICKEY

From: Jeff Markiewicz

Company: S, J & F

Phone: 972/ 450-2871
FAX: 972/450-2837

FAX #: 214-361-0204

Date: Oct. 16, 1997

16801 Westgrove
P.O. Box 144
Addison, TX 75001

# of pages (including cover): 5

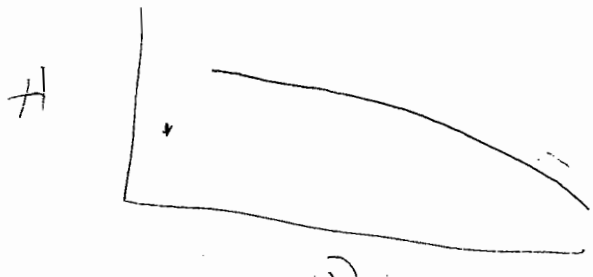
☐ Original in mail ☑ Per your request ☐ FYI ☐ Call me

Comments:

CELESTIAL ROF DEC-MARCH

MONTHLY WATER REPORT JANUARY
DECEMBER 13, 1996 THROUGH JANUARY 14, 1997

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
12/13	1,055,000	2,405,000	3,460,000
12/14	1,055,000	3,692,000	4,747,000
12/15	285,000	2,803,000	3,088,000
12/16	202,000	2,879,000	3,081,000
12/17	0	3,394,000	3,394,000
12/18	710,000	2,915,000	3,625,000
12/19	92,000	3,270,000	3,362,000
12/20	933,000	2,847,000	3,780,000
12/21	0	3,098,000	3,098,000
12/22	944,000	2,554,000	3,498,000
12/23	324,000	2,854,000	3,178,000
12/24	920,000	2,757,000	3,677,000
12/25	98,000	2,721,000	2,819,000
12/26	1,057,000	1,592,000	2,649,000
12/27	7,000	3,057,000	3,064,000
12/28	955,000	2,757,000	3,712,000
12/29	248,000	2,415,000	2,663,000
12/30	870,000	2,491,000	3,361,000
12/31	94,000	4,129,000	4,223,000
SUBTOTAL	9,849,000	54,630,000	64,479,000
1/1	1,029,000	2,840,000	3,869,000
1/2	120,000	3,578,000	3,698,000
1/3	866,000	2,673,000	3,539,000
1/4	149,000	4,268,000	4,417,000
1/5	891,000	3,385,000	4,276,000
1/6	0	2,886,000	2,886,000
1/7	1,095,000	1,499,000	2,594,000
1/8	573,000	2,930,000	3,503,000
1/9	899,000	2,510,000	3,409,000
1/10	235,000	3,064,000	3,299,000
1/11	867,000	2,787,000	3,654,000
1/12	172,000	2,983,000	3,155,000
1/13	549,000	1,027,000	1,576,000
1/14	512,000	3,652,000	4,164,000
SUBTOTAL	7,957,000	40,082,000	48,039,000
TOTALS	17,806,000	94,712,000	112,518,000
MINIMUM	0	1,027,000	1,576,000
MAXIMUM	1,095,000	4,268,000	4,747,000
AVERAGE	539,576	2,870,061	3,409,636



MONTHLY WATER R ORT DECEMBER
NOVEMBER 15, 1996 THROUGH DECEMBER 12, 1996

	SURVEYOR ROF	CELESTIAL ROF	TOTALS
11-15-96	1,056,000	3,361,000	4,417,000
	809,000	2,986,000	3,795,000
	1,118,000	2,333,000	3,451,000
	794,000	3,690,000	4,484,000
	1,008,000	3,002,000	4,010,000
	27,000	4,175,000	4,202,000
	1,026,000	2,940,000	3,966,000
	243,000	4,410,000	4,653,000
	594,000	3,057,000	3,651,000
	841,000	3,588,000	4,429,000
	0	2,802,000	2,802,000
	613,000	2,832,000	3,445,000
	0	2,952,000	2,952,000
	987,000	2,696,000	3,683,000
	215,000	1,799,000	2,014,000
11-30-96	1,092,000	2,558,000	3,650,000
	10,423,000	49,181,000	59,604,000
12-1-96	267,000	2,888,000	3,155,000
	931,000	2,597,000	3,528,000
	0	3,004,000	3,004,000
	946,000	2,862,000	3,808,000
	199,000	3,113,000	3,312,000
	1,030,000	2,993,000	4,023,000
	281,000	3,767,000	4,048,000
	1,095,000	2,737,000	3,832,000
	30,000	3,051,000	3,081,000
	877,000	3,394,000	4,271,000
	30,000	3,748,000	3,778,000
12-12-96	123,000	5,108,000	5,231,000
TOTAL	5,809,000	39,262,000	45,071,000
TALS	16,232,000	88,443,000	104,675,000
MUM	0	1,799,000	2,014,000
MUM	1,118,000	5,108,000	5,231,000
AGE	601,185	3,275,667	3,876,852

MONTHLY WATER REPORT FEBRUARY
JANUARY 15, 1997 THROUGH FEBRUARY 13, 1997

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
1/15	513,000	2,456,000	2,969,000
1/16	840,000	3,526,000	4,366,000
1/17	663,000	1,980,000	2,643,000
1/18	708,000	3,712,000	4,420,000
1/19	634,000	2,292,000	2,926,000
1/20	523,000	3,626,000	4,149,000
1/21	666,000	2,240,000	2,906,000
1/22	712,000	3,976,000	4,688,000
1/23	535,000	2,212,000	2,747,000
1/24	623,000	4,392,000	5,015,000
1/25	702,000	2,368,000	3,070,000
1/26	966,000	4,760,000	5,726,000
1/27	731,000	2,440,000	3,171,000
1/28	453,000	4,020,000	4,473,000
1/29	519,000	1,560,000	2,079,000
1/30	909,000	4,180,000	5,089,000
1/31	678,000	2,104,000	2,782,000
			0
			0
SUBTOTAL	11,375,000	51,844,000	63,219,000
2/1	630,000	4,876,000	5,506,000
2/2	652,000	2,160,000	2,812,000
2/3	634,000	4,252,000	4,886,000
2/4	654,000	2,288,000	2,942,000
2/5	774,000	4,160,000	4,934,000
2/6	690,000	2,604,000	3,294,000
2/7	761,000	3,748,000	4,509,000
2/8	523,000	2,720,000	3,243,000
2/9	483,000	3,608,000	4,091,000
2/10	594,000	2,160,000	2,754,000
2/11	683,000	3,892,000	4,575,000
2/12	574,000	2,080,000	2,654,000
2/13	629,000	3,888,000	4,517,000
SUBTOTAL	8,281,000	42,436,000	50,717,000
TOTALS	19,656,000	94,280,000	113,936,000
MINIMUM	453,000	1,560,000	2,079,000
MAXIMUM	966,000	4,876,000	5,726,000
AVERAGE	655,200	3,142,667	3,797,867

MONTHLY WATER REPORT MARCH
FEBRUARY 14, 1997 THROUGH MARCH 13, 1997

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
2/14	611,000	2,388,000	2,999,000
2/15	630,000	3,864,000	4,494,000
2/16	617,000	2,408,000	3,025,000
2/17	381,000	3,712,000	4,093,000
2/18	487,000	2,628,000	3,115,000
2/19	622,000	3,924,000	4,546,000
2/20	595,000	2,000,000	2,595,000
2/21	738,000	3,872,000	4,610,000
2/22	542,000	2,008,000	2,550,000
2/23	506,000	3,336,000	3,842,000
2/24	563,000	2,220,000	2,783,000
2/25	618,000	3,252,000	3,870,000
2/26	510,000	2,384,000	2,894,000
2/27	557,000	3,652,000	4,209,000
2/28	502,000	2,000,000	2,502,000
SUBTOTAL	8,479,000	43,648,000	52,127,000
3/1	509,000	3,504,000	4,013,000
3/2	1,022,000	4,131,000	5,153,000
3/3	0	1,889,000	1,889,000
3/4	532,000	1,896,000	2,428,000
3/5	569,000	3,892,000	4,461,000
3/6	0	4,068,000	4,068,000
3/7	683,000	1,824,000	2,507,000
3/8	675,000	2,988,000	3,663,000
3/9	690,000	2,408,000	3,098,000
3/10	288,000	3,632,000	3,920,000
3/11	473,000	2,372,000	2,845,000
3/12	387,000	3,928,000	4,315,000
3/13	581,000	1,932,000	2,513,000
SUBTOTAL	6,409,000	38,464,000	44,873,000
TOTALS	14,888,000	82,112,000	97,000,000
MINIMUM	0	1,824,000	1,889,000
MAXIMUM	1,022,000	4,131,000	5,153,000
AVERAGE	531,714	2,932,571	3,464,286

MONTHLY WATER REPORT SEPTEMBER
SEPTEMBER 1 - 30

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
09/01	1,099,000	5,805,000	6,904,000
09/02	956,000	5,449,000	6,405,000
09/03	1,133,000	5,308,000	6,441,000
09/04	1,192,000	5,872,000	7,064,000
09/05	1,122,000	5,441,000	6,563,000
09/06	1,076,000	5,791,000	6,867,000
09/07	1,064,000	6,064,000	7,128,000
09/08	1,131,000	5,070,000	6,201,000
09/09	1,063,000	5,341,000	6,404,000
09/10	1,050,000	5,534,000	6,584,000
09/11	1,128,000	5,001,000	6,129,000
09/12	1,162,000	5,535,000	6,697,000
09/13	1,001,000	5,123,000	6,124,000
09/14	1,178,000	4,905,000	6,083,000
09/15	1,080,000	4,630,000	5,710,000
SUBTOTAL	16,435,000	80,869,000	97,304,000
09/16	1,019,000	4,404,000	5,423,000
09/17	1,157,000	5,350,000	6,507,000
09/18	1,127,000	4,393,000	5,520,000
09/19	1,009,000	4,669,000	5,678,000
09/20	1,037,000	4,161,000	5,198,000
09/21	1,094,000	4,318,000	5,412,000
09/22	1,074,000	4,186,000	5,260,000
09/23	919,000	3,472,000	4,391,000
09/24	827,000	5,000,000	5,827,000
09/25	801,000	3,919,000	4,720,000
09/26	1,063,000	2,729,000	3,792,000
09/27	1,079,000	4,380,000	5,459,000
09/28	24,000	5,782,000	5,806,000
09/29	834,000	5,506,000	6,340,000
09/30	934,000	4,555,000	5,489,000
SUBTOTAL	13,998,000	66,824,000	80,822,000
TOTALS	30,433,000	147,693,000	178,126,000
MINIMUM	24,000	2,729,000	3,792,000
MAXIMUM	1,192,000	6,064,000	7,128,000
AVERAGE	1,014,433	4,923,100	5,937,533

MONTHLY WATER REPORT
JULY 1995

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
07/01	998,000	4,624,000	5,622,000
07/02	986,000	4,308,000	5,294,000
07/03	782,000	4,234,000	5,016,000
07/04	985,000	3,981,000	4,966,000
07/05	1,121,000	4,191,000	5,312,000
07/06	1,068,000	3,809,000	4,877,000
07/07	1,042,000	4,188,000	5,230,000
07/08	1,101,000	3,952,000	5,053,000
07/09	1,088,000	3,939,000	5,027,000
07/10	439,000	5,496,000	5,935,000
07/11	995,000	4,385,000	5,380,000
07/12	1,090,000	4,916,000	6,006,000
07/13	1,103,000	5,186,000	6,289,000
07/14	1,108,000	4,909,000	6,017,000
07/15	997,000	4,516,000	5,513,000
SUBTOTAL	14,903,000	66,634,000	81,537,000
07/16	1,107,000	4,963,000	6,070,000
07/17	1,208,000	4,732,000	5,940,000
07/18	1,069,000	4,756,000	5,825,000
07/19	1,094,000	5,091,000	6,185,000
07/20	1,119,000	4,969,000	6,088,000
07/21	1,008,000	4,649,000	5,657,000
07/22	1,093,000	5,352,000	6,445,000
07/23	1,093,000	5,740,000	6,833,000
07/24	1,109,000	5,033,000	6,142,000
07/25	1,110,000	4,707,000	5,817,000
07/26	1,020,000	5,611,000	6,631,000
07/27	1,096,000	5,142,000	6,238,000
07/28	1,124,000	5,688,000	6,812,000
07/29	1,071,000	5,558,000	6,629,000
07/30	1,056,000	5,674,000	6,730,000
07/31	1,130,000	5,829,000	6,959,000
SUBTOTAL	17,507,000	83,494,000	101,001,000
TOTALS	32,410,000	150,128,000	182,538,000
MINIMUM	439,000	3,809,000	4,877,000
MAXIMUM	1,208,000	5,829,000	6,959,000
AVERAGE	1,045,484	4,842,839	5,888,323

MONTHLY WATER REPORT AUGUST

DATE	SURVEYOR ROF	CELESTIAL ROF	TOTALS
08/01	1,104,000	4,630,000	5,734,000
08/02	1,102,000	4,682,000	5,784,000
08/03	1,112,000	3,976,000	5,088,000
08/04	1,085,000	3,810,000	4,895,000
08/05	1,037,000	4,411,000	5,448,000
08/06	1,049,000	4,821,000	5,870,000
08/07	1,075,000	5,402,000	6,477,000
08/08	1,004,000	4,703,000	5,707,000
08/09	958,000	6,059,000	7,017,000
08/10	1,027,000	5,285,000	6,312,000
08/11	1,087,000	5,470,000	6,557,000
08/12	1,012,000	5,456,000	6,468,000
08/13	1,104,000	5,744,000	6,848,000
08/14	1,207,000	5,479,000	6,686,000
08/15	1,030,000	4,859,000	5,889,000
SUBTOTAL	15,993,000	74,787,000	90,780,000
08/16	1,045,000	5,835,000	6,880,000
08/17	1,196,000	5,584,000	6,780,000
08/18	1,015,000	5,616,000	6,631,000
08/19	1,035,000	5,178,000	6,213,000
08/20	1,098,000	5,615,000	6,713,000
08/21	1,218,000	5,827,000	7,045,000
08/22	1,096,000	5,256,000	6,352,000
08/23	1,021,000	5,679,000	6,700,000
08/24	1,183,000	5,646,000	6,829,000
08/25	1,119,000	5,575,000	6,694,000
08/26	981,000	5,093,000	6,074,000
08/27	1,103,000	5,471,000	6,574,000
08/28	1,210,000	6,312,000	7,522,000
08/29	1,060,000	6,287,000	7,347,000
08/30	1,042,000	5,515,000	6,557,000
08/31	1,154,000	5,507,000	6,661,000
SUBTOTAL	17,576,000	89,996,000	107,572,000
TOTALS	33,569,000	164,783,000	198,352,000
MINIMUM	958,000	3,810,000	4,895,000
MAXIMUM	1,218,000	6,312,000	7,522,000
AVERAGE	1,082,871	5,315,581	6,398,452

The following demands are utilized in this report:

Land Use	Maximum Day	Maximum Hour
High Density Single Family (3.2 persons/unit)	350 gpcd	700 gpcd
Low Density Single Family (1.8 homes/acre)	500 gpcd	1,000 gpcd
Apartments	3,000 gpad	6,000 gpad
Quorum Circle & Northern Undeveloped Areas	5,000 gpad	10,000 gpad
Tollway Corridor	7,000 gpad	10,500 gpad
Midway Road Office/Commercial	3,000 gpad	4,500 gpad
Commercial Retail	3,000 gpad	4,500 gpad
Industrial	3,000 gpad	4,500 gpad
Schools/Recreation Centers	3,000 gpad	4,500 gpad

gpcd = gallons per capital per day
gpad = gallons per acre per day

The calculated demands for various land uses results in the following overall system demands:

Land Use	Maximum Day (MGD)	Maximum Hour (MGD)
High Density Single Family (3.2 persons/unit)	1.13	2.27
Low Density Single Family (1.8 homes/acre)	0.26	0.51
Apartments	0.76	1.52
Quorum Circle & Northern Undeveloped Areas	1.37	2.75
Tollway Corridor	2.55	3.83
Midway Road Office/Commercial	0.24	0.37
Commercial Retail	1.37	2.05
Industrial	1.70	2.55
Schools/Recreation Centers	0.36	0.57
	9.74 (mgd)	**16.42 (mgd)**

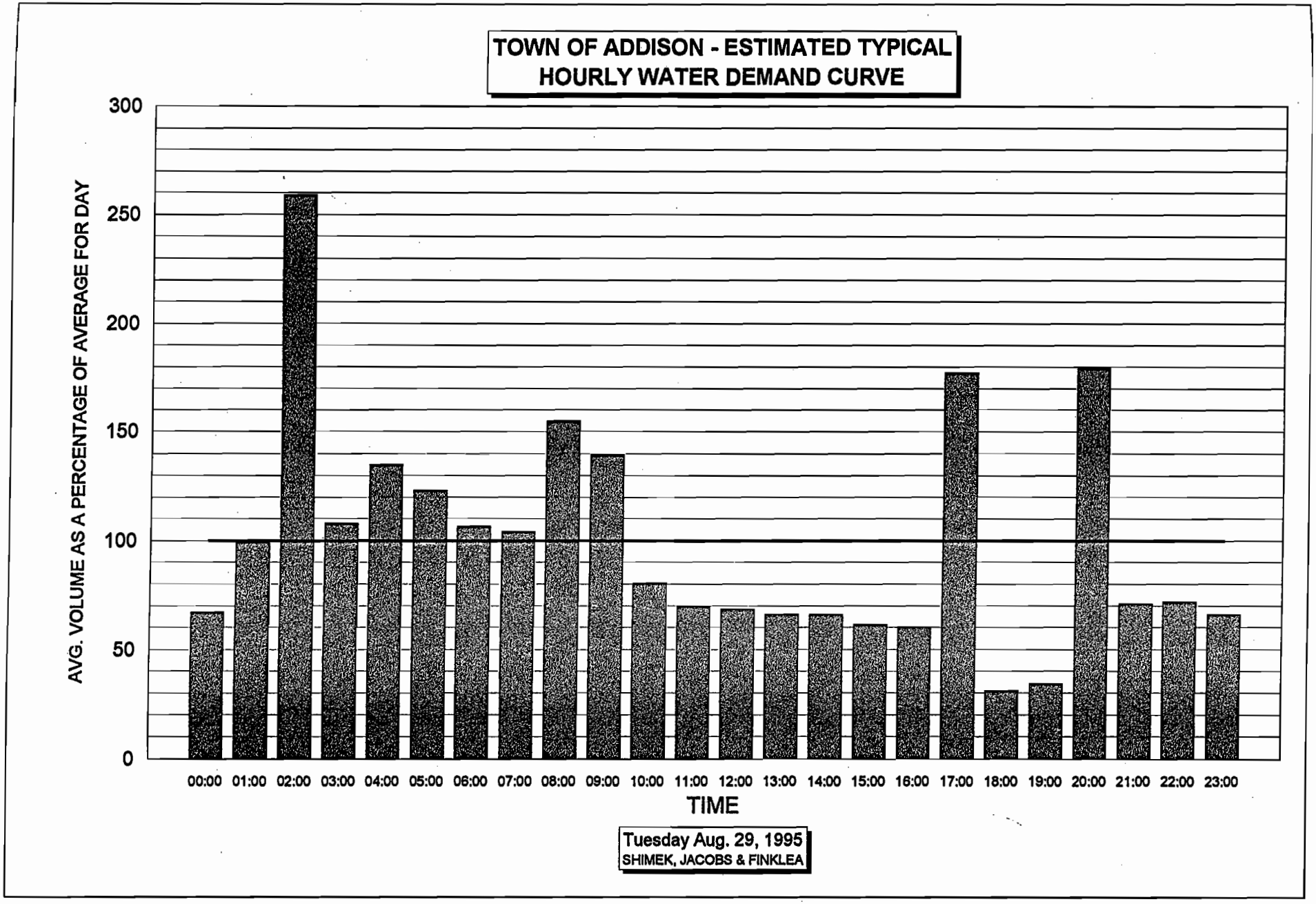

TOWN OF ADDISON - ESTIMATED TYPICAL HOURLY WATER DEMAND CURVE
AVG. VOLUME AS A PERCENTAGE OF AVERAGE FOR DAY
300
250
200
150
100
50
0
00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00
TIME
Tuesday Aug. 29, 1995
SHIMEK, JACOBS & FINKLEA

Figure 1

Surveyor 25tt 6.5. Head Range.

IMPELLER DIAMETER 16.625"

5-5-76 E-7854

Curves show approximately the characteristics when pumping clear water with specific gravity of 1.0. No guarantee is made except for the rated point.

CURVE A-7854-1 | PUMP 12 X 10 X 17 8000 SERIES | SPEED 1770 RPM

IMPELLER DATA

IMP. NO. 08-1361 | NO. OF VANES 7

MAX. DIA. 17.5" | MIN. DIA. 10.0"

MAX. SPHERE 1.36" | INLET AREA 86.4 □"

OP-3 KEY-6

19.0" REFERENCE DIAMETER TO CUT WATER

17.5" 250 HP

16.7" 200 HP

15.0" 150 HP

13.8" 125 HP

12.4" 100 HP

89 74 79 81 84 85 87 85 84 81 79

PERFORMANCE FOR NON OVERLOADING WITH A 1.15 S.F.

MOTOR HP	IMP. DIA.
250	17.5
200	16.7
150	15.0
125	13.8
100	12.4

Elm Fork Construction Co.
P.O. 28-10
S.O. 27380-1
Tag: Pump Station 6 Water Lines
3850 GPM @ 197 T.D.H.

NPSH REQ'D (FT) 15 20 23

SUCT. LIFT (FT) 18 13 10

A-7854-1

0 1000 2000 3000 4000 5000

U.S. GALLONS PER MINUTE

ALLIS-CHALMERS

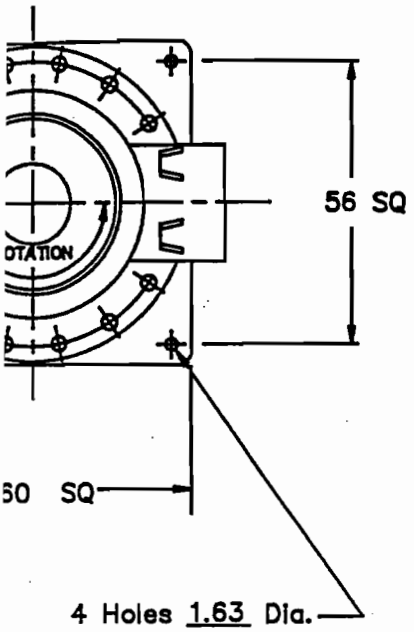
VERTICAL PUMPS

INGERSOLL-RAND PUMPS

392-0739.

Tues.

CAN BOLTING –
D STUDS WITH NUTS



D VIEW

R BOLTING–
A307 "L" TYPE
N. EMBEDMENT

ING:

06

MOTOR

500 H.P. Vertical SOLID Shaft
1200 R.P.M. 3 Phase 60 Cycle 4160 Volts
WP–2 Enclosure Mfg. U.S. Motors

DISCHARGE HEAD – Type LF

20LF Discharge Head
20 Plain End Discharge Nozzle

Shaft Seal PACKED BOX

BARREL

.375 Wall With 24" Plain End Suction Pipe

PUMP

2 Stage 23LK Bowl Type M Impeller
7000 USGPM 190 Ft. Total Head

MATERIALS

Bowls	A48–CL30	Barrel	A36/A53–GR.B
Impellers	B584–C86500	Head	A36/A53–GR.B
Pump Shaft	A276–GR416	Column	A36
Bowl Bearings	B505–C84400	Lineshaft	A276–GR416
Bearing Retainer	A36	Lineshaft Brg.	BURA–S
		Lineshaft Slv.	304 S.S.

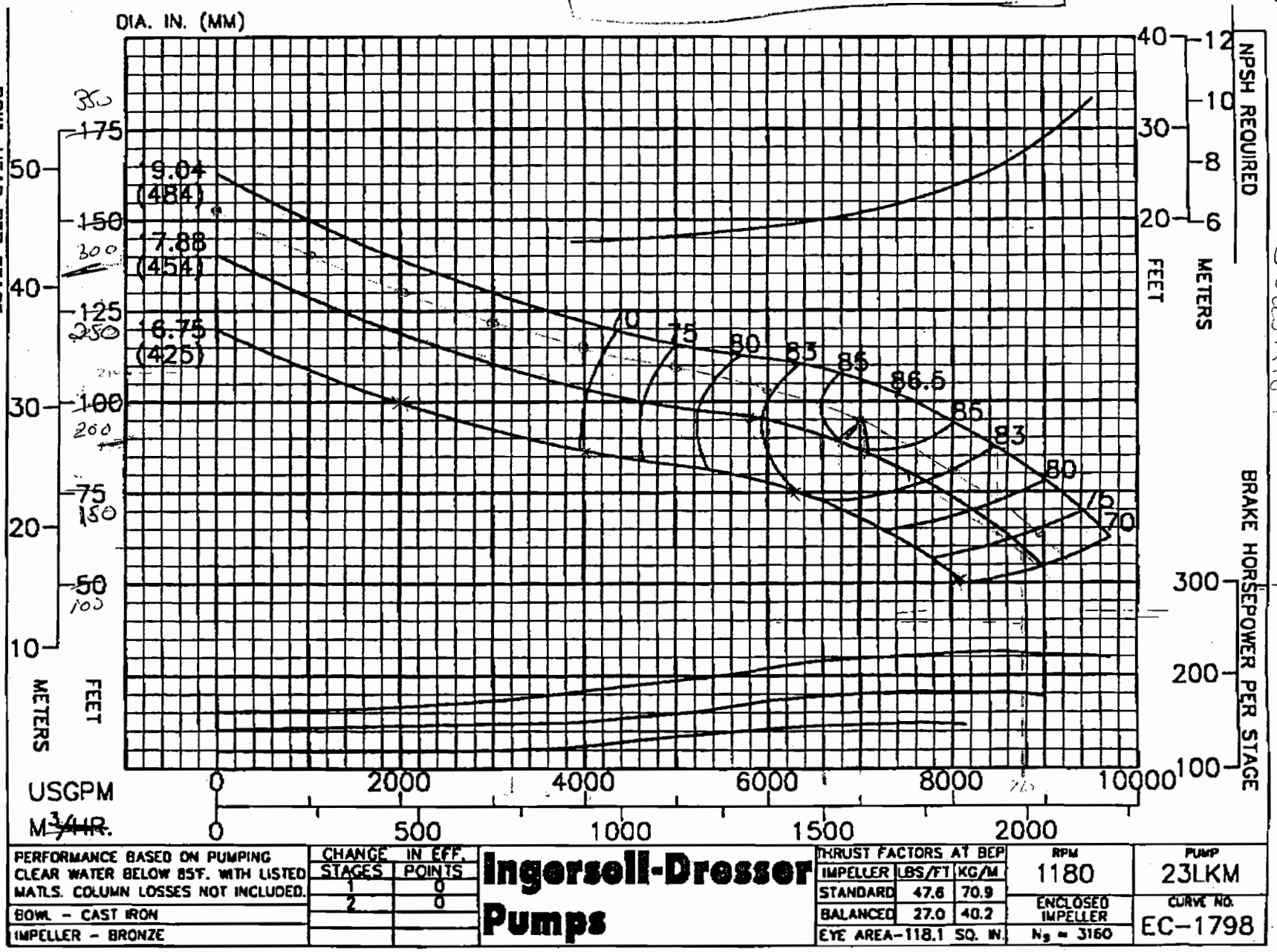
Driver Weight 4400 lb. Pump Weight 21200 lb.
Pump will be shipped UNASSEMBLED

SUBMITTAL

GES IN THIS DRAWING WILL
SHIPPING DELAYS
ADDITIONS

BAR CONSTRUCTORS
CITY OF ADDISON, TX.
CELESTIAL ROAD PUMP STATION

Date: 8–24–87
Drawn By: V.A.H.
Drg. No.: 871232GA REV. 2



TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

12AM

EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

Hour	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - 3.00 MGD					Hydraulic Grade at PumpStation	Elevated Storage				TOTAL PUMPAGE (MGD)
	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)		Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	
0	C	762				C	769				C	770				775.03	776.00	39.00	-6.06	6.60	0.00
1	C					O	773	4.95	191.04	7.17	O	775	2.70	192.08	5.31	771.20	768.14	31.14	1.10	6.55	7.65
2	C					O		4.93	191.43	7.14	O		2.68	192.48	5.28	772.00	769.56	32.56	-2.82	10.43	7.61
3	C					O		5.05	189.17	7.31	O		2.81	190.28	5.53	766.62	765.89	28.89	-8.94	16.80	7.86
4	O	767	8.81	206.15	6.25	O		4.99	190.24	7.22	O		2.75	191.90	5.41	787.47	754.30	17.30	8.24	8.31	16.55
5	O		8.23	212.04	5.84	O		4.78	198.67	6.92	O		2.52	196.07	4.96	793.33	765.01	28.01	5.28	10.25	15.53
6	C	762				O		4.82	194.71	6.98	O		2.55	195.24	5.03	774.49	771.84	34.84	-0.57	7.94	7.37
7	C					O		4.84	194.20	7.00	O		2.57	194.86	5.06	773.88	771.10	34.10	0.19	7.22	7.41
8	C					O		4.83	194.54	6.99	O		2.56	195.12	5.04	774.45	771.35	34.35	2.42	4.97	7.39
9	C					C	769				O		2.61	193.90	5.15	772.26	774.49	37.49	-10.91	13.52	2.61
10	O	767	8.47	209.76	6.00	O	773	5.07	188.85	7.34	O		2.61	193.97	5.14	790.42	760.33	23.33	5.42	10.73	16.15
11	C	762				O		4.91	192.19	7.10	O		2.65	193.21	5.21	770.54	767.37	30.37	2.21	5.34	7.56
12	C					O		4.85	193.97	7.01	O		2.58	194.69	5.08	773.37	770.24	33.24	2.45	4.97	7.43
13	C					C	769				O		2.58	194.76	5.07	773.55	773.43	36.43	-2.64	5.22	2.58
14	C					O	773	4.95	191.12	7.16	O		2.69	192.23	5.30	769.79	770.00	33.00	-10.98	18.62	7.64
15	O	767	8.80	206.34	6.24	O		4.97	190.54	7.20	O		2.73	192.30	5.38	785.94	755.75	18.75	2.07	14.43	16.50
16	O		8.27	211.62	5.87	O		4.80	198.10	6.94	O		2.54	195.66	4.99	791.03	758.43	21.43	13.06	2.55	15.61
17	C	762				C	769				C	770				775.28	775.37	38.37	-1.70	1.70	0.00
18	C					C					C					772.89	773.18	36.18	-3.21	3.21	0.00
19	C					O	773	4.89	192.53	7.08	O	775	2.63	193.52	5.18	772.27	769.02	32.02	2.67	4.85	7.52
20	C					O		4.82	194.82	6.98	O		2.55	195.32	5.02	775.72	772.48	35.48	3.13	4.24	7.37
21	C					C	769				C	770				771.27	776.53	39.53	-15.22	15.22	0.00
22	O	767	8.51	209.36	6.03	O	773	4.88	192.87	7.06	O	775	2.64	193.39	5.20	791.24	756.77	19.77	13.30	2.73	16.03
23	C	762				C	769				O		2.59	194.40	5.10	774.06	774.04	37.04	-3.29	5.88	2.59
24	C					C					O		2.71	192.66	5.35	769.91	769.77	32.77	-2.74	5.46	2.71
25	C					O	773	5.01	189.84	7.25	O		2.75	191.70	5.43	769.14	766.20	29.20	-0.30	8.07	7.76
26	C					O		5.10	189.33	7.38	O		2.86	188.72	5.63	764.72	765.81	28.81	-13.15	21.10	7.96
27	O	767	9.16	202.21	6.49	O		5.11	189.20	7.39	O		2.88	188.04	5.67	782.94	747.85	10.85	8.35	8.79	17.15
28	O		8.53	209.08	6.05	O		4.89	192.60	7.08	O		2.64	193.38	5.20	789.83	759.59	22.59	5.03	11.04	16.06
29	O		8.11	213.13	5.75	O		4.74	200.08	6.86	O		2.47	197.10	4.87	793.51	766.10	29.10	5.25	10.07	15.32
30	C	762				C	769				O		2.58	194.78	5.07	772.40	772.94	35.94	-6.10	8.67	2.58
31	C					O	773	4.97	190.68	7.19	O		2.71	192.82	5.33	767.83	765.03	28.03	-0.82	8.49	7.68
32	C					O		5.00	189.96	7.24	O		2.75	191.72	5.42	765.96	763.97	26.97	-4.86	12.61	7.75
33	O	767	8.59	208.57	6.09	O		4.90	192.30	7.09	O		2.65	193.12	5.22	787.55	757.65	20.65	4.80	11.34	16.14
34	O		8.05	213.61	5.71	O		4.72	200.75	6.83	O		2.45	197.62	4.82	792.47	763.89	26.89	8.67	6.55	15.22
35	C	762				C	769				C	770				774.26	775.12	38.12	-5.70	5.70	0.00
36	C					O	773	4.87	193.11	7.05	O	775	2.61	194.02	5.14	770.80	767.74	30.74	1.90	5.58	7.48
37	C					O		4.82	194.75	6.98	O		2.55	195.27	5.03	773.21	770.21	33.21	1.98	5.40	7.37
38	C					O		4.77	199.09	6.90	O		2.50	196.55	4.91	775.69	772.78	35.78	1.87	5.40	7.27
39	C					C	769				C	770				774.51	775.19	38.19	-5.03	5.03	0.00
40	C					O	773	4.89	192.74	7.07	O	775	2.65	193.05	5.23	771.90	768.67	31.67	2.63	4.91	7.54
41	C					O		4.86	193.57	7.03	O		2.59	194.37	5.11	773.25	772.07	35.07	-6.98	14.43	7.45
42	C					O		5.00	190.09	7.23	O		2.75	191.90	5.41	766.92	763.01	26.01	5.19	2.55	7.75
43	C					O		4.86	193.55	7.03	O		2.59	194.36	5.11	773.45	769.76	32.76	4.66	2.79	7.45
44	C					C	769				C	770				770.91	775.80	38.80	-14.65	14.61	0.00
45	O	767	8.57	208.71	6.08	O	773	4.90	192.24	7.10	O	775	2.67	192.74	5.25	789.87	756.83	19.83	10.38	5.76	16.14
46	C	762				O		4.86	193.44	7.04	O		2.60	194.28	5.12	773.31	770.31	33.31	1.58	5.88	7.46
47	C					O		4.82	194.79	6.98	O		2.55	195.30	5.03	775.28	772.36	35.36	1.43	5.94	7.37

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

System Demand

EXTENDED PERIOD SIMULATION - WINTER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 5.00 MGD					Proposed Pump 4 - 3.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	757				C	767				C	769				775.32	776.00	39.00	-5.01	5.01	0.00
1	C					C					C					769.05	769.51	32.51	-4.01	4.01	0.00
2	C					O	772	5.19	187.82	7.52	O	775	3.00	183.61	5.91	767.83	764.31	27.31	1.78	6.42	8.19
3	C					O		5.03	189.48	7.28	O		2.97	184.87	5.84	769.52	766.60	29.60	-1.23	9.22	8.00
4	C					O		5.04	189.34	7.29	O		2.97	184.71	5.85	768.64	765.03	28.03	2.90	5.11	8.01
5	C					O		4.89	192.53	7.08	O		2.63	193.51	5.18	771.73	768.87	31.78	1.21	6.31	7.52
6	C					O		4.82	194.66	6.98	O		2.81	190.32	5.53	773.63	770.34	33.34	2.72	4.91	7.63
7	C					C	767				O		2.77	191.30	5.46	774.17	773.87	36.87	-1.69	4.46	2.77
8	C					C					O		2.60	194.22	5.12	772.04	771.67	34.67	-0.46	3.06	2.60
9	C					C					O		2.88	188.00	5.67	770.78	771.08	34.08	-5.44	8.32	2.88
10	C					O	772	5.04	189.34	7.29	O		2.97	184.71	5.85	767.36	764.03	27.03	1.39	6.62	8.01
11	C					O		4.92	191.85	7.12	O		2.89	187.52	5.70	769.72	765.82	28.82	4.55	3.26	7.81
12	C					O		4.75	199.80	6.87	O		2.67	192.72	5.26	775.29	771.74	34.74	4.36	3.06	7.42
13	C					C	767				C	769				776.42	776.71	39.71	-3.21	3.21	0.00
14	C					C					C					770.53	772.55	35.55	-9.02	9.02	0.00
15	C					O	772	5.21	187.26	7.55	O	775	3.03	182.24	5.97	764.03	760.83	23.83	-0.63	8.87	8.24
16	C					O		5.16	188.44	7.46	O		3.00	183.60	5.91	764.88	760.02	23.02	6.60	1.55	8.16
17	C					O		4.82	194.95	6.97	O		2.55	195.41	5.02	772.74	768.61	31.61	6.31	1.05	7.37
18	C					C	767				C	769				776.67	776.79	39.79	-2.00	2.00	0.00
19	C					C					C					773.92	774.18	37.18	-3.01	3.01	0.00
20	C					C					C					770.08	770.28	33.28	-2.61	2.61	0.00
21	C					O	772	4.93	191.61	7.13	O	775	2.90	187.23	5.72	767.71	766.90	29.90	-1.19	9.02	7.83
22	C					O		4.90	192.20	7.10	O		2.88	187.88	5.68	769.74	765.36	28.36	6.08	1.70	7.78
23	C					C	767				O		2.75	191.81	5.42	773.63	773.26	36.26	-0.86	3.61	2.75
24	C					C					O		2.79	190.68	5.50	772.55	772.14	35.14	-0.57	3.36	2.79
25	C					C					O		2.83	189.74	5.57	771.66	771.40	34.40	-2.14	4.96	2.83
26	C					C					O		2.92	186.53	5.76	768.20	768.64	31.64	-6.10	9.02	2.92
27	C					O	772	5.19	187.90	7.50	O		2.99	183.80	5.90	764.42	760.70	23.70	2.77	5.41	8.18
28	C					O		4.94	191.30	7.15	O		2.68	192.35	5.29	767.29	764.32	27.32	0.86	6.77	7.62
29	C					O		4.90	192.27	7.09	O		2.88	187.95	5.68	768.62	765.42	28.42	1.62	6.16	7.78
30	C					O		4.82	194.67	6.98	O		2.80	190.33	5.53	770.72	767.52	30.52	2.27	5.36	7.62
31	C					O		4.80	198.01	6.95	O		2.65	193.10	5.22	773.53	770.46	33.46	2.24	5.21	7.45
32	C					C	767				O		2.64	193.23	5.21	773.09	773.37	36.37	-5.21	7.77	2.64
33	C					O	772	4.83	194.62	6.98	O		2.81	190.28	5.53	769.66	766.71	29.71	0.67	6.97	7.64
34	C					O		4.77	198.98	6.91	O		2.75	191.93	5.41	770.98	767.58	30.58	3.51	4.01	7.52
35	C					C	767				O		2.63	193.55	5.18	772.48	772.14	35.14	-0.88	3.51	2.63
36	C					C					O		2.68	192.41	5.28	771.35	770.99	33.99	-0.78	3.46	2.68
37	C					C					O		2.76	191.57	5.44	770.40	769.99	32.99	-0.55	3.31	2.76
38	C					C					O		2.79	190.77	5.49	769.70	769.29	32.29	-0.52	3.31	2.79
39	C					C					O		2.81	190.04	5.54	769.05	768.61	31.61	-0.24	3.06	2.81
40	C					C					O		2.83	189.60	5.57	768.74	768.30	31.30	-0.18	3.01	2.83
41	C					C					O		2.87	188.47	5.65	767.64	768.06	31.06	-6.01	8.87	2.87
42	C					O	772	4.99	190.28	7.22	C		2.94	185.75	5.80	764.85	760.26	23.26	6.38	1.55	7.93
43	C					O		4.74	199.96	6.87	O		2.66	192.90	5.24	772.50	768.55	31.55	5.70	1.70	7.40
44	C					C	767				C	769				773.93	775.94	38.94	-8.97	8.97	0.00
45	C					O	772	4.86	193.45	7.04	O	775	2.84	189.14	5.60	768.01	764.31	27.31	4.15	3.56	7.70
46	C					O		4.78	198.78	6.92	O		2.62	193.82	5.16	773.06	769.86	32.68	3.79	3.61	7.40
47	C					C	767				O		2.53	195.86	4.98	774.94	774.59	37.59	-0.78	3.31	2.53

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

5 MGD

Fire flows are included but spread out over the System

777 tank Full
737 Low water — Bowl Empty
Drives Model

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 10/28/97

EXTENDED PERIOD SIMULATION - SUMMER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 3.00 MGD					Proposed Pump 4 - 2.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	766	0.00			O	772	2.88	187.76	5.68	O	775	1.88	186.82	5.34	772.06	771.00	34.00	1.30	6.06	4.76
1	C		0.00			O		2.94	185.80	5.79	O		1.92	184.84	5.45	770.38	769.33	32.33	1.69	6.55	4.86
2	C		9.04	187.77	6.41	O		3.03	182.08	5.96	O		1.98	181.81	5.63	767.51	767.13	30.13	5.42	10.43	14.05
3	O	771	9.05	187.62	6.42	O		3.01	183.29	5.94	O		1.98	181.94	5.62	768.58	760.09	23.09	2.76	16.80	14.04
4	O		8.69	193.50	6.16	O		3.02	183.14	5.94	O		1.98	181.87	5.62	767.36	756.51	19.51	-5.74	8.31	13.69
5	O		8.43	197.70	5.98	O		2.84	189.03	5.60	O		1.85	188.46	5.24	773.11	763.97	26.97	-3.13	10.25	13.12
6	O		0.00			O		2.62	192.98	5.17	O		1.75	192.15	4.97	777.03	768.03	31.03	-4.86	7.94	4.37
7	C	766	0.00			C	768				O		1.79	190.28	5.09	773.81	774.33	37.33	5.42	7.22	1.79
8	C		0.00			O	772	2.94	185.71	5.80	O		1.92	187.74	5.46	768.54	767.30	30.30	0.10	4.97	4.86
9	C		0.00			O		3.01	183.56	5.92	O		1.97	182.58	5.58	766.64	767.16	30.16	8.55	13.52	4.98
10	O	771	9.08	187.17	6.44	O		3.09	182.68	5.97	O		1.99	181.48	5.65	766.17	756.07	19.07	-3.37	10.73	14.16
11	O		8.74	192.77	6.20	O		2.86	188.31	5.64	O		1.88	187.11	5.54	771.59	760.43	23.43	-8.14	5.34	13.48
12	C	766	0.00			O		2.82	189.64	5.56	O		1.84	188.73	5.22	772.12	771.00	34.00	0.31	4.97	4.66
13	C		0.00			O		2.85	188.80	5.61	O		1.86	187.87	5.27	771.72	770.60	33.60	0.51	5.22	4.71
14	C		0.00			O		2.98	184.38	5.87	O		1.95	183.40	5.54	767.24	769.94	32.94	13.68	18.62	4.93
15	O	771	9.28	183.71	6.15	O		3.12	179.14	6.15	O		2.06	177.85	5.85	761.83	752.10	15.10	0.03	14.43	14.46
16	O		9.02	188.07	6.40	O		3.00	183.60	5.92	O		1.97	182.33	5.60	765.76	752.14	15.14	-11.45	2.55	13.99
17	O		8.27	200.04	5.87	O		2.75	191.73	5.41	O		1.67	195.70	4.75	778.78	767.09	30.09	-10.99	1.70	12.69
18	C	766	0.00			C	768				C	773				766.02	776.32	39.32	3.21	3.21	0
19	C		0.00			C					O	775	1.86	188.03	5.26	772.08	772.15	35.15	3.00	4.85	1.86
20	C		0.00			C					O		1.95	183.75	5.52	768.03	768.27	31.27	2.30	4.24	1.95
21	O	771	8.74	192.67	6.20	O	772	2.87	188.26	5.64	O		1.88	187.06	5.32	773.41	765.28	28.28	1.74	15.22	13.49
22	O		8.60	194.94	6.10	O		2.79	190.53	5.50	O		1.83	189.39	5.18	775.08	763.03	26.03	-10.49	2.73	13.22
23	C	766	0.00			C	768				C	773				775.73	776.64	39.64	5.88	5.88	0
24	C		0.00			C					O	775	1.94	183.76	5.52	768.89	769.02	32.02	3.51	5.46	1.94
25	O	771	8.72	193.04	6.18	O	772	2.86	188.55	5.63	O		1.87	187.39	5.50	774.42	764.46	27.46	-5.38	8.07	13.45
26	C	766	0.00			O		3.01	183.29	5.93	O		1.97	182.30	5.60	767.37	771.43	34.43	16.12	21.10	4.98
27	O	771	9.36	182.47	6.63	O		3.15	177.86	6.21	O		2.09	176.58	5.92	761.76	750.17	13.17	-5.80	8.79	14.6
28	O		8.99	188.68	6.37	O		2.99	184.21	5.88	O		1.96	182.88	5.57	767.81	758.04	21.04	-2.90	11.04	13.94
29	O		8.75	192.49	6.21	O		2.87	188.03	5.66	O		1.88	186.82	5.34	777.19	761.80	24.80	-3.44	10.07	13.5
30	O		8.48	196.89	6.02	O		2.72	192.44	5.36	O		1.77	191.29	5.02	775.28	766.28	29.27	-4.30	8.67	12.97
31	C	766	0.00			O		2.78	190.72	5.48	O		1.82	189.84	5.15	772.42	771.86	34.86	3.89	8.49	4.6
32	C		0.00			O		2.96	185.07	5.84	O		1.94	184.10	5.91	766.52	766.81	29.81	7.71	12.61	4.9
33	O	771	8.97	188.98	6.36	O		2.98	184.52	5.87	O		1.96	183.20	5.55	766.43	756.80	19.80	-2.56	11.34	13.91
34	O		8.70	193.46	6.17	O		2.84	188.99	5.60	O		1.85	188.41	5.24	770.59	760.13	23.10	-6.84	6.55	13.39
35	O		8.23	200.90	5.84	O		2.50	196.15	4.92	O		1.68	195.45	4.76	778.24	769.01	32.01	-6.71	5.70	12.41
36	C	766	0.00			C	768				C	773				775.56	776.39	39.39	5.58	5.58	0
37	C		0.00			C					O	775	1.88	186.88	5.33	769.02	769.16	32.16	3.52	5.40	1.88
38	O	771	8.51	196.44	6.03	O	772	2.74	192.03	5.39	O		1.78	190.86	5.05	774.97	764.60	27.60	-7.63	5.40	13.03
39	C	766	0.00			C	768				O		1.77	191.36	5.02	774.37	774.48	37.88	3.26	5.03	1.77
40	C		0.00			C					O		1.88	186.78	5.34	770.19	770.25	33.25	3.03	4.91	1.88
41	O		8.61	194.75	6.11	O	772	2.80	190.35	5.51	O		1.83	189.20	5.19	774.29	766.31	29.30	1.19	14.43	13.24
42	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.72	5.00	776.29	764.79	27.79	-10.31	2.55	12.86
43	C	766	0.00			C	768				C	773				776.48	776.71	39.71	2.79	2.79	0
44	C		0.00			C					O	775	1.91	185.64	5.41	769.79	773.09	36.09	12.71	14.61	1.91
45	O	771	8.98	188.83	6.37	O	772	2.98	184.37	5.88	O		1.96	183.12	5.55	768.32	756.59	19.59	-8.16	13.92	13.92
46	O		8.46	197.28	6.00	O		2.64	192.56	5.20	O		1.76	191.71	5.00	777.06	767.18	30.18	-6.98	5.88	12.86
47	C	766	0.00			C	768				C	773				775.30	776.23	39.23	5.94	5.94	0

* (-) Represents Elevated Storage Refill Rate
(+) Represents Elevated Storage Flow into the Distribution System

TOWN OF ADDISON
CELESTIAL PUMP STATION IMPROVEMENTS
EXTENDED PERIOD SIMULATION (EPS) - PUMP SIZING WORK SHEET

Job No.: 97180
Date: 11/22/97

EXTENDED PERIOD SIMULATION - WINTER DEMAND SCENARIO

	Existing Pump 1 - 9.75 MGD					Proposed Pump 2 - 3.00 MGD					Proposed Pump 4 - 2.00 MGD					Hydraulic	Elevated Storage				TOTAL
Hour	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Status (O/C)	Next Switch Grade (ft)	Pump Flowrate (mgd)	Pump Head (ft)	Discharge Velocity (fps)	Grade at PumpStation	Elevated Storage Water Elevation	Elevated Storage Tank Depth	*Elevated Storage Flow (mgd)	Net Demand (mgd)	PUMPAGE (MGD)
0	C	757				C	767				C	769				775.32	776.00	39.00	-5.01	5.01	0.00
1	C					C					C					769.05	769.51	32.51	-4.01	4.01	0.00
2	C					O	772	2.83	189.48	5.58	O	775	1.94	189.72	3.82	765.30	764.31	27.31	-1.64	6.42	4.77
3	C					O		2.89	187.66	5.69	O		1.98	187.02	3.90	762.70	762.16	25.16	-4.35	9.22	4.87
4	O	767	9.04	187.82	6.41	O		2.76	191.52	5.44	O		1.89	192.51	3.73	767.77	756.50	19.50	8.58	5.11	13.69
5	C	757				O		2.71	192.71	5.34	O		1.85	194.69	3.65	768.54	767.64	30.64	-1.75	6.31	4.56
6	C					O		2.76	191.61	5.43	O		1.88	192.94	3.71	766.48	765.38	28.38	-0.27	4.91	4.64
7	C					O		2.76	191.50	5.44	O		1.89	192.77	3.72	766.18	765.03	28.03	0.19	4.46	4.65
8	C					O		2.75	191.79	5.42	O		1.88	193.22	3.70	766.56	765.27	28.27	1.57	3.06	4.63
9	C					O		2.72	192.60	5.61	O		1.86	194.48	3.65	767.86	767.30	30.30	-3.75	8.32	4.58
10	C					O		2.82	189.89	5.55	O		1.93	190.34	3.80	763.39	762.44	25.44	-1.87	6.62	4.75
11	C					O		2.86	188.55	5.64	O		1.96	188.33	3.86	761.38	760.01	23.01	1.56	3.26	4.82
12	C					O		2.81	190.07	6.01	O		1.92	190.62	3.79	763.39	762.04	25.04	1.68	3.06	4.73
13	C					O		2.76	191.52	5.44	O		1.89	192.82	3.71	765.51	764.24	27.24	1.44	3.21	4.65
14	C					O		2.73	192.19	5.39	O		1.87	193.84	3.68	766.52	766.09	29.09	-4.42	9.02	4.60
15	C					O		2.86	188.54	5.64	O		1.96	188.37	3.86	760.95	760.35	23.25	-4.05	8.87	4.82
16	O	767	8.90	190.16	6.31	O		2.69	192.21	5.30	O		1.84	195.24	3.63	767.53	755.11	18.11	11.87	1.55	13.43
17	C	757				O		2.56	195.09	5.04	O		1.75	199.36	3.44	771.94	770.51	33.51	3.24	1.05	4.31
18	C					C	767				O		1.69	201.04	3.34	774.89	774.73	37.73	-0.31	2.00	1.69
19	C					C					O		1.71	200.60	3.37	774.43	774.33	37.33	-1.30	3.01	1.71
20	C					C					O		1.74	199.43	3.43	772.80	772.66	35.66	-0.86	2.61	1.74
21	C					C					O		1.79	197.65	3.52	770.51	771.53	34.53	-7.23	9.02	1.79
22	C					O	772	2.80	190.35	5.52	O		1.91	191.53	3.76	763.70	762.14	25.14	3.01	1.70	4.71
23	C					O		2.71	192.85	5.33	O		1.85	194.88	3.64	767.21	766.04	29.04	0.95	3.61	4.56
24	C					O		2.68	192.55	5.27	O		1.83	195.97	3.60	768.45	767.28	30.28	1.14	3.36	4.51
25	C					O		2.64	193.29	5.20	O		1.80	197.06	3.55	769.76	768.77	31.77	-0.52	4.96	4.44
26	C					O		2.67	192.64	5.26	O		1.82	196.11	3.59	768.46	768.09	31.09	-4.53	9.02	4.49
27	C					O		2.79	190.72	5.50	O		1.91	191.59	3.76	763.29	762.21	25.21	-0.71	5.41	4.70
28	C					O		2.81	190.08	5.54	O		1.92	190.62	3.79	762.20	761.27	24.27	-2.03	6.77	4.73
29	C					O		2.87	188.40	5.65	O		1.96	188.12	3.86	759.73	758.65	21.65	-1.33	6.16	4.83
30	O	767	8.85	190.97		O		2.68	192.55	5.27	O		1.83	195.74	3.61	767.48	756.91	19.91	7.99	5.36	13.36
31	C	757				O		2.63	193.62	5.24	O		1.79	197.53	3.53	768.24	767.29	30.29	-0.79	5.21	4.42
32	C					O		2.66	192.94	5.24	O		1.81	196.56	3.57	766.85	766.25	29.25	-3.30	7.77	4.47
33	C					O		2.75	191.76	5.42	O		1.88	193.20	3.70	762.81	761.97	24.97	-2.34	6.97	4.63
34	C					O		2.81	190.18	5.99	O		1.92	190.77	3.78	760.19	758.95	21.95	0.72	4.01	4.73
35	C					O		2.79	190.89	5.49	O		1.90	191.84	3.75	761.14	759.88	22.88	1.88	3.51	4.69
36	C					O		2.75	191.88	5.41	O		1.88	193.37	3.70	762.64	761.40	24.40	1.17	3.46	4.63
37	C					O		2.71	192.79	5.34	O		1.85	194.79	3.64	764.14	762.93	25.93	1.25	3.31	4.56
38	C					O		2.67	192.69	5.26	O		1.82	196.18	3.59	765.73	764.56	27.56	1.18	3.31	4.49
39	C					O		2.63	193.53	5.18	O		1.79	197.39	3.53	767.24	766.07	29.07	1.37	3.06	4.42
40	C					O		2.59	194.51	5.10	O		1.76	198.66	3.47	768.99	767.86	30.86	1.34	3.01	4.35
41	C					O		2.56	195.04	5.05	O		1.75	199.29	3.44	769.91	769.61	32.61	-4.56	8.87	4.31
42	C					O		2.68	192.49	5.44	O		1.83	195.88	3.60	765.08	763.69	26.69	2.95	1.55	4.51
43	C					O		2.59	194.52	5.09	O		1.76	198.69	3.47	768.84	767.52	30.52	2.65	1.70	4.35
44	C					O		2.53	195.84	4.98	O		1.72	200.16	2.25	771.18	770.94	33.94	-4.72	8.97	4.25
45	C					O		2.65	193.05	5.23	O		1.81	196.72	3.56	765.95	764.84	27.84	0.90	3.56	4.46
46	C					O		2.62	193.70	5.23	O		1.79	197.61	3.52	767.08	765.99	28.99	0.80	3.61	4.41
47	C					O		2.60	194.30	5.12	O		1.77	198.40	3.49	768.14	767.04	30.04	1.06	3.31	4.37

* (+) Represents Elevated Storage Refill Rate
(-) Represents Elevated Storage Flow into the Distribution System

Addison 1MM Elevated Storage

CBI

GAGING TABLE FOR 1MM GAL FLUTED COL ELEVATED TANK W/42" ACCESS TUBE
DIA=74'-0", CONE SLOPE=45 DEG, BTM HD RAD=34.4102', BCL 37" ABV TR BTM

DEPTH	6	1 7	2 8	3 9	4 10	5 11
		CAPACITIES IN US GALLONS				
0'-0	0.	402.	814.	1237.	1669.	2112.
	2565.	3028.	3500.	3983.	4476.	4979.
1'-0	5492.	6014.	6547.	7089.	7641.	8203.
	8775.	9356.	9948.	10549.	11159.	11779.
2'-0	12409.	13048.	13697.	14355.	15023.	15701.
	16387.	17083.	17789.	18504.	19228.	19962.
3'-0	20704.	21456.	22218.	22988.	23768.	24557.
	25354.	26161.	26977.	27802.	28636.	29479.
4'-0	30331.	31336.	32503.	33678.	34861.	36053.
	37252.	38459.	39675.	40899.	42130.	43370.
5'-0	44619.	45875.	47140.	48413.	49695.	50984.
	52283.	53589.	54904.	56228.	57560.	58901.
6'-0	60250.	61607.	62974.	64349.	65732.	67125.
	68526.	69935.	71354.	72781.	74217.	75662.
7'-0	77116.	78579.	80051.	81531.	83021.	84520.
	86028.	87544.	89070.	90605.	92149.	93703.
8'-0	95265.	96837.	98418.	100009.	101608.	103217.
	104836.	106463.	108101.	109747.	111403.	113069.
9'-0	114744.	116429.	118123.	119827.	121541.	123264.
	124997.	126739.	128492.	130254.	132026.	133808.
10'-0	135600.	137401.	139213.	141034.	142865.	144707.
	146558.	148420.	150291.	152173.	154064.	155966.
11'-0	157878.	159801.	161733.	163676.	165629.	167593.
	169567.	171551.	173545.	175550.	177566.	179592.
12'-0	181628.	183675.	185733.	187801.	189880.	191969.
	194069.	196180.	198301.	200434.	202577.	204731.
13'-0	206895.	209071.	211257.	213455.	215663.	217882.
	220113.	222354.	224606.	226870.	229144.	231430.
14'-0	233727.	236035.	238354.	240685.	243027.	245380.
	247744.	250120.	252507.	254906.	257316.	259737.
15'-0	262170.	264615.	267071.	269539.	272018.	274509.
	277011.	279525.	282051.	284589.	287138.	289699.
16'-0	292272.	294857.	297454.	300063.	302683.	305316.
	307960.	310617.	313285.	315962.	318637.	321312.
17'-0	323987.	326662.	329337.	332012.	334687.	337362.
	340037.	342712.	345387.	348062.	350737.	353412.
18'-0	356087.	358762.	361437.	364112.	366787.	369463.
	372138.	374813.	377488.	380163.	382838.	385513.
19'-0	388188.	390863.	393538.	396213.	398888.	401563.
	404238.	406913.	409588.	412263.	414938.	417613.
20'-0	420288.	422963.	425638.	428314.	430989.	433664.
	436339.	439014.	441689.	444364.	447039.	449714.
21'-0	452389.	455064.	457739.	460414.	463089.	465764.
	468439.	471114.	473789.	476464.	479139.	481814.
22'-0	484489.	487165.	489840.	492515.	495190.	497865.
	500540.	503215.	505890.	508565.	511240.	513915.
23'-0	516590.	519265.	521940.	524615.	527290.	529965.
	532640.	535315.	537990.	540665.	543340.	546016.
24'-0	548691.	551366.	554041.	556716.	559391.	562066.
	564741.	567416.	570091.	572766.	575441.	578116.

GAGING TABLE FOR 1MM GAL FLUTED COL ELEVATED TANK W/42" ACCESS TUBE
DIA=74'-0", CONE SLOPE=45 DEG, BTM HD RAD=34.4102', BCL 37" ABV TK BTM

DEPTH	6	1 7	2 8	3 9	4 10	5 11
		CAPACITIES IN US GALLONS				
25'-0	580791.	583466.	586141.	588816.	591491.	594166.
	596841.	599516.	602191.	604867.	607542.	610217.
26'-0	612892.	615567.	618242.	620917.	623592.	626267.
	628942.	631617.	634292.	636967.	639642.	642317.
27'-0	644992.	647667.	650342.	653017.	655692.	658367.
	661043.	663718.	666393.	669068.	671743.	674418.
28'-0	677093.	679768.	682443.	685118.	687793.	690468.
	693143.	695818.	698493.	701168.	703843.	706518.
29'-0	709193.	711868.	714543.	717218.	719894.	722569.
	725244.	727919.	730594.	733269.	735944.	738619.
30'-0	741294.	743969.	746644.	749319.	751994.	754669.
	757344.	760019.	762694.	765369.	768044.	770719.
31'-0	773394.	776069.	778745.	781420.	784095.	786770.
	789445.	792120.	794795.	797470.	800145.	802820.
32'-0	805495.	808170.	810845.	813520.	816195.	818870.
	821545.	824220.	826895.	829570.	832245.	834920.
33'-0	837596.	840271.	842946.	845621.	848296.	850971.
	853646.	856321.	858996.	861671.	864346.	867021.
34'-0	869696.	872371.	875046.	877721.	880396.	883071.
	885746.	888421.	891096.	893772.	896447.	899122.
35'-0	901797.	904472.	907147.	909822.	912497.	915172.
	917847.	920522.	923197.	925872.	928547.	931222.
36'-0	933897.	936572.	939247.	941922.	944597.	947272.
	949947.	952623.	955298.	957973.	960648.	963323.
37'-0	965998.	968673.	971348.	974023.	976698.	979373.
	982048.	984723.	987398.	990073.	992748.	995423.
38'-0	998098.	1000773.	1003448.	1006123.	1008798.	1011474.
	1014149.	1016824.	1019499.	1022174.	1024849.	1027524.
39'-0	1030199.	1032874.	1035549.	1038224.	1040899.	1043574.
	1046249.	1048924.	1051599.	1054274.	1056949.	1059624.
40'-0	1062299.					

TOTAL CAPACITY= 1062299.: FOR HD RANGE= 40.000 FT
DEAD WATER = 7458.

GEOTECHNICAL INVESTIGATION

WATER STORAGE RESERVOIR

ADDISON, TEXAS

INTRODUCTION

This report presents the results of a geotechnical investigation performed at the site of the proposed Water Storage Reservoir to be located on the west side of Celestial Road in Addison, Texas. The purpose of this investigation was to determine the subsurface soil and limestone strata present at the site, evaluate the bearing capacity and plasticity characteristics of the various strata and to make recommendations concerning the design of the foundation system for this project.

FIELD EXPLORATION

The core borings were drilled at the locations shown on Plate No. 1 by means of a truck-mounted rotary core drilling rig. Undisturbed samples of the cohesive soils were obtained by means of thin-walled Shelby tube samplers. The underlying limestone formation was cored continuously by means of a double tube core barrel equipped with a saw-tooth bit. The various soil and limestone strata encountered are shown on the attached Boring Logs. The results of the pocket penetrometer tests performed in the laboratory on the cohesive soils are also shown on the Boring Logs. Upon completion of the borings, the holes were bailed of drilling fluid to the depths indicated and water observations were made. The results of these water observations are reported on the Boring Logs. The elevations reported on the Boring Logs are estimates based on the topographic survey provided our firm.

LABORATORY TESTS

All samples were sealed in plastic to prevent moisture loss, placed in core boxes and transported to the soils laboratory for further examination and testing. In the laboratory, representative samples of the cohesive soils were tested to determine their Atterberg Limits and existing moisture contents. These results are reported on Plate No. 2. Representative samples of the unweathered limestone were tested to evaluate their unconfined compressive strength characteristics. The results of these laboratory tests are presented on Plate No. 3.

SITE CONDITIONS

Based on the test borings, the site was found to be underlain by moderately active CL and CH clay soils to depths ranging from about 0.5 to 6 feet. These clay soils have a plasticity index (PI) of about 16 to 24. At their present high moisture content, the existing clay soils are considered to have only a slight potential for future swell.

These overburden soils are underlain by the Austin Chalk Limestone Formation. In its unweathered state, the limestone is gray in color and firm but contains some tan fractured limestone bands, shale bands and some fractured zones. The gray unweathered limestone stratum was encountered at depths ranging from about 3 to 12 feet. The elevation of the firm gray unweathered limestone stratum was found to range from about 571 to 574 feet at Boring Nos. 3 and 4 to about 590 to 595 feet at Boring Nos. 2 and 6. The upper layer of weathered limestone is tan in color, fractured to varying degrees and soft to firm.

Based on the water observations, it appears that ground water is present in the area of Boring No. 4 (drilled nearest the creek) at depths of about 6 feet. Ground water encountered in this area should be in the form of seepage

through the fractures present in the tan weathered limestone. Water from the adjacent creek is apparently flowing through the fractured upper layer of weathered limestone.

DESIGN REQUIREMENTS

Based on the topographic survey provided our firm, it appears that the site slopes toward the creek (located about 50 to 100 feet east of the west property line) with a fall of about 40 feet. It is understood that the base of the water storage reservoir and the floor of the pump house are to be situated at about Elevation 567 feet. It therefore appears that cuts ranging from about 10 to 30 feet will be required in the water storage reservoir area while cuts of about 30 to 33 feet will be required in the area of the pump house. Based on the results of the core borings, it appears that the water storage reservoir will be founded about 4 to 23 feet below the surface of the firm gray unweathered limestone stratum. The pump house will be founded about 28 feet below the surface of the firm gray unweathered limestone stratum. The excavation for the reservoir will be performed to limits of about 6 feet outside the edge of the perimeter footing in order to allow for construction of the circular wall.

RECOMMENDATIONS

Foundation Design

It is understood that spread footings are proposed for use at this project site. The perimeter footing and the floor of the reservoir will be placed on about 6 inches of clean compacted crushed Chico limestone. The perimeter footing will be founded 15 inches below the top of the reservoir floor. The interior footings will be placed directly on the floor of the reservoir. All footings should be designed for a maximum end bearing pressure of 10,000 psf

and should be subject to only slight settlements of less than one-quarter inch. Prior to placement of the crushed Chico limestone, the entire base of the excavation should be cleaned of all loose soil and rock fragments so that all Chico limestone is placed on undisturbed solid rock. The crushed Chico limestone should be placed just prior to placement of the reservoir slab. All crushed Chico limestone should conform to City of Dallas Specification M 3:40, Grade 3. This Chico limestone should be compacted using a heavy vibratory compactor.

Another foundation system would be the use of auger-excavated, cast-in-place concrete, straight shaft piers founded in the firm gray unweathered limestone. The perimeter wall could be supported by a pier supported grade while the interior column supports could be supported by individual pier foundations. Since the grade beam excavations will apparently terminate in limestone, void boxes should not be required beneath the grade beams. All piers should be designed for a maximum end bearing pressure of 25 tons per square foot and a maximum skin friction value of 8 tons per square foot for that portion of the pier shaft in direct contact with the firm gray unweathered limestone. Regardless of pier loads, all piers should penetrate the firm gray limestone a minimum of 7 feet and the upper 4 feet of gray limestone should not be counted on for skin friction load transfer. Since the unweathered firm gray limestone stratum will apparently be exposed throughout the entire base of the excavation, it appears that the piers will only be about 7 to 8 feet deep (assuming that the minimum pier penetrations are specified). Of course, if a fractured limestone layer or a shale band is encountered at the bottom of any pier hole, those piers should be deepened until firm gray unweathered and unfractured limestone is again encountered. These foundations should be subject to negligible settlements. It is believed that only slight ground water seepage, if any, should be encountered in these pier holes. If slight ground water

seepage is encountered in some piers, those piers should be concreted immediately on completion of drilling and proper cleaning of each pier. In any event, all piers should be concreted within 8 hours after the limestone bearing stratum has been penetrated.

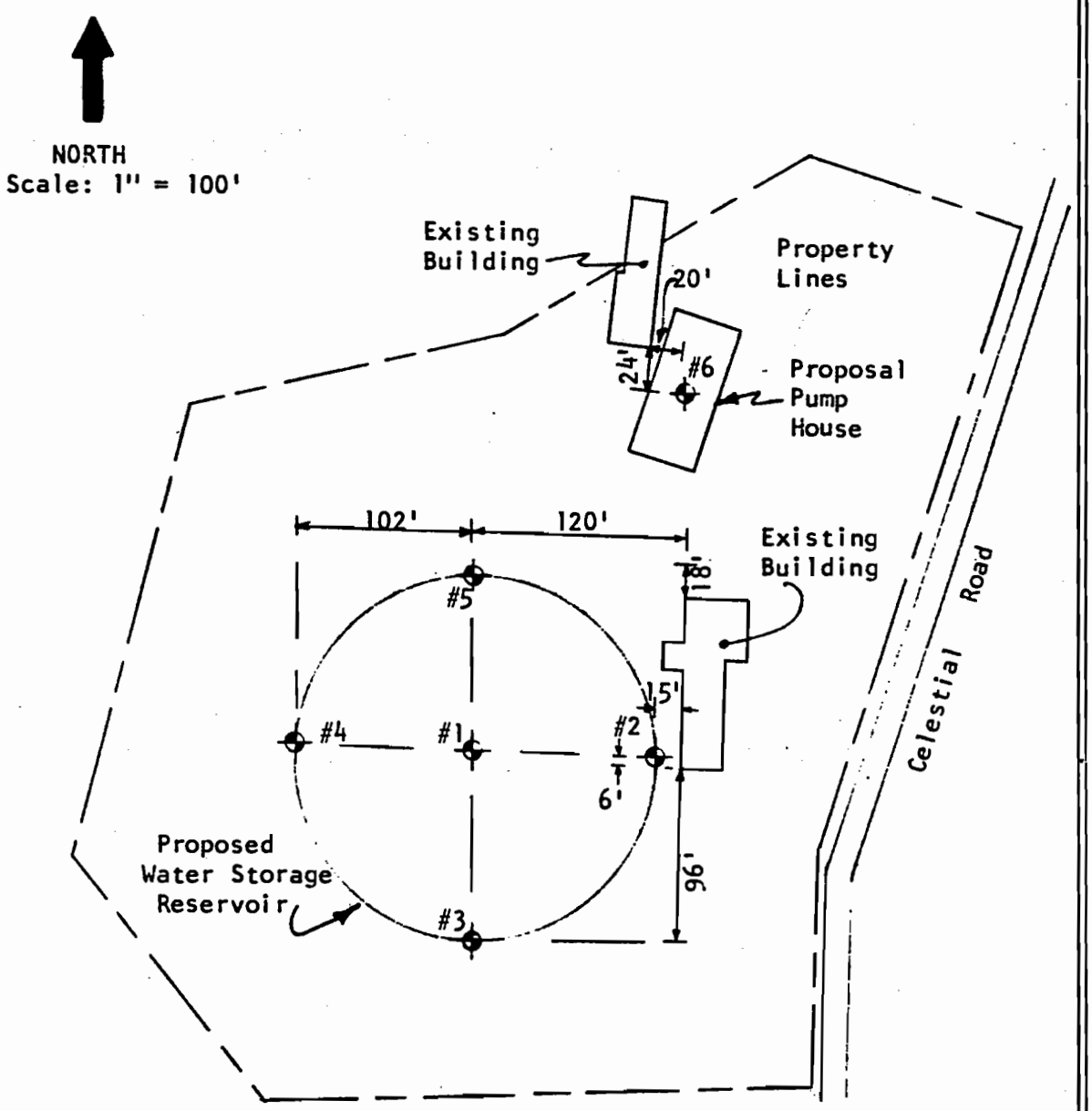
Basement Wall Design

The excavation for the basement walls should be cut so that the walls can be backfilled with select material in a wedge extending from the surface of the moderately firm to firm tan weathered limestone stratum to the ground surface on a maximum angle of 45 degrees. A steeper cut could be made in the moderately firm to firm tan and gray limestone strata. These cut slopes are based solely on lateral earth pressure considerations and should be cut flatter if required for safety. In this regard (for safety), it should be noted that the tan weathered limestone mass is fractured to varying degrees and that fractured zones were also encountered throughout the firm gray unweathered limestone stratum. If steep cuts are made in the rock, rock anchors should be used. All basement walls should be backfilled to a minimum width of 24 inches with free draining granular material. In addition, a perforated drain pipe should be installed below the basement level excavation so that water collected in the granular material will be rapidly removed from the structure area. It should be anticipated that this drain line will receive ground water seepage through weathered and fractured limestone strata. All other backfill beyond the 24 inches of granular material should consist of select fill (clayey sand or sandy clay) with a PI of 3 to 10. This material should be compacted to a minimum of 95% Standard Proctor density. To prevent surface water infiltration, the area surrounding the structures should be sloped away from the structure and the upper 18 inches of backfill should consist of sandy clay having a PI of 15 to 22. If the walls are backfilled in this manner, they may be designed for a lateral

pressure equal to that of a fluid weighing 40 pounds per cubic foot. Traffic live loads should also be considered in the design of these walls.

In lieu of low PI select fill, broken gray limestone (obtained from the deep excavations) could be used beyond the 24 inches of free draining granular material. If broken limestone is used as backfill, the free draining granular material should consist of clean crushed Chico limestone (to prevent finer material from filtering through the voids in the broken rock fill). All broken rock fill should be broken into pieces having a diameter of less than 8 inches prior to placement. This rock should be placed in maximum 16 inch lifts and tamped. If this broken rock and Chico limestone is used as backfill behind the walls, a construction fabric (such as a Mirafi or Petromat fabric designed for this purpose) should be placed below the upper 18 inches of sandy clay fill.

If provisions are not made for draining the wall backfill, the walls should be designed for an equivalent fluid pressure of 85 pcf. If the reservoir will ever be emptied, provisions would have to be made to prevent flotation of the reservoir due to its buoyant nature.



Location of Borings

Water Storage Reservoir
Addison, Texas

Water Storage Reservoir
Addison, Texas

Atterberg Limit and Moistue Content Tests

Boring No.	Depth (ft.)	Liquid Limit(%)	Plastic Limit (%)	Plasticity Index(PI)	Moisture Content(%)
2	0.0-1.4	48.8	26.2	22.6	24.8
3	0.0-1.0	39.6	24.1	15.5	18.7
4	0.0-1.5	52.9	28.6	24.3	28.5

Water Storage Reservoir
Addison, Texas

Unconfined Compression Tests

Boring No.	Depth (ft.)	Max. Compressive Strength(tsf)
1	8.0-8.6	104.8
	19.1-19.5	128.3
	22.1-22.9	122.3
	25.4-26.0	122.3
	28.4-28.9	170.3
2	25.4-26.0	158.3
	29.0-29.7	137.9
	30.4-31.2	136.0
	34.8-35.4	166.7
	37.7-38.3	48.0(1)
3	19.1-19.7	120.9
	21.9-22.5	110.6
	25.3-26.1	69.6(2)
	28.7-29.3	159.3
4	10.7-11.5	168.1
	14.2-15.0	152.8
	17.7-18.4	109.2
	23.0-23.8	32.9(3)
5	18.8-19.4	168.9
	20.6-21.3	136.6
	24.2-24.9	117.9
	27.4-28.3	30.6(3)
	32.7-33.6	171.1
6	6.8-7.5	89.1
	18.2-18.9	120.6
	29.1-29.6	143.2
	31.2-32.0	126.6
	34.6-35.6	123.3
	37.5-38.2	161.5

Footnotes:
(1) Test sample contained shaly limestone band.
(2) Test sample contained healed high angle fracture.
(3) Test sample contained shale band.

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir

Addison, Texas

Job No. 2882

Date 4/6/85

Boring No. 1

Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	ELEVATION FEET
					Brown clay (CL)	588
					Limestone, tan, severely weathered, with clay bands and clay filled fractures, soft to moderately firm	
5					Limestone, tan, weathered, slightly fractured, moderately firm	
			5.0	5.0		580.2
					8.0-iron-stained fracture	
					9.1'-2" tan fractured limestone band	
10					11.2'-1" tan fractured limestone band	
					Limestone, gray, firm	
15			10.0	10.0		
					16.3'-1" dark gray shale band	
20					Proposed Base of Reservoir	567
					21.0'-1" shale band	
					24.5'-24.8'-thin shale bands	
25			10.0	10.0	Total Depth = 30.0 feet	
					Upon completion, hole bailed to 28.8 feet. 10 minutes later, water measured at 24.0 feet. 2 days later, water measured at 19.4 feet and hole blocked at 30.0 feet.	
30						

FIELD TESTS

Pocket Penetrometer Readings, Tons per Sq. Ft. - X
Standard Penetration Tests, Blows per Foot (BPF) - ⊗

X · 1 · ⊗ · 10 | 2 · 20 | 3 · 30 | 4 · 40 | 4.5+ · 50 | 4.5++ · 60

Geotechnical Engineers

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Sheet 1 of 2

Job No. 2882

Boring No. 2

Date 4/6/85

Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS (Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗)	ELEVATION FEET
					Dark brown and brown clay with some limestone fragments-stiff(CL)(fill)		596
					1.4'-sand seam Brown clay-stiff(CL)		
					Limestone, tan, weathered, fractured, moderately firm to firm		590.5
			5.0	5.0	← 6.5'-iron-stained fracture 7.0'-2" tan fracture limestone band		
			10.0	9.8	←10.9'-thin tan fractured limestone band ←12.8'-2" tan fractured limestone band ←16.1'-thin shale band ← 17.8-2" zone with iron-stained fracture		
			10.0	10.0	Limestone, gray, firm ←26.0'-thin-shale band ←28.0'-1" shale band		
					Proposed Base of Reservoir		567

Geotechnical Engineers

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Job No. 2682

Boring No. 2

Date 4/6/85

Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS: Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗ (X ⊗ · 1 · 10 · 2 · 20 · 3 · 30 · 4 · 40 · 4.5 + · 50 · 4.5 + + · 60)	ELEVATION FEET
					←31.9'-1" fractured shale band		
35			10.0	10.0	Limestone, gray, firm		
40					Total Depth = 40.0 feet Upon completion, hole bailed to 38.5 feet. 10 minutes later, water measured at 36.3 feet. 2 days later, water measured at 35.4 feet and hole blocked at 40.0 feet.		

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Job No. 2882
Date 4/6/85
Boring No. 3
Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS (Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗)	ELEVATION FEET
					Brown silty clay with some limestone fragments-hard(CL)		586
					Limestone, severely weathered to weathered, severely fractured, soft to moderately firm		
5			5.0	5.0	Limestone, tan, weathered, slightly fractured, with some 3" to 6" gray limestone bands, moderately firm to firm		
10					Limestone, gray, with some 1" to 7" tan fractured limestone bands, weathered, firm		574.5
					←12.7'-1" shale band		
					← 13.8'-2" tan fractured limestone band		
15			10.0	10.0	← 14.8'-1" tan fractured limestone band		
					Limestone, gray, firm		
					Proposed Base of Reservoir		567
20					Limestone, gray, with some healed fractures and calcite filled fractures, firm		
					21.2'-6" fracture zone		
					Limestone, gray, firm		
					24.1' to 25.0'-vertical fracture		
25			10.0	10.0	25.0'12" zone with healed high angle fractures		
					Total Depth = 30.0 feet		
					Upon completion, hole bailed to 28.8 feet. 10 minutes later, water measured at 19.2 feet. 2 days later, water measured at 18.6 feet and hole blocked at 30.0 feet.		
30							

Geotechnical Engineers

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Job No. 2882 Boring No. 4

Date 4/6/85 Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	ELEVATION FEET
					Dark grayish brown clay-stiff(CH)	579
5					Light brown and tan clay with trace limestone fragments-medium stiff(CL)	
					Water Level 4/8/85	573.1
					Limestone, tan, severely weathered, severely fractured, soft to moderately firm	571.4
10			5.0	5.0		
					Limestone, gray, firm	
					Proposed Base of Reservoir	567
15			10.0	10.0	←17.4'-1" shale band	
20						
			3.0	3.0		
25					Total Depth = 25.0 feet	
					Upon completion, hole bailed to 23.8 feet. 10 minutes later, water measured at 22.1 feet. 2 days later, water at 5.9 feet and hole blocked at 25.0 feet.	

FIELD TESTS

Pocket Penetrometer Readings, Tons per Sq. Ft. - X
Standard Penetration Tests, Blows per Foot (BPF) - ⊗

X - 1 2 3 4 4.5+ 4.5++
⊗ - 10 20 30 40 50 60

Geotechnical Engineers

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Sheet 1 of 2

Job No. 2882

Boring No. 5

Date 4/5/85

Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS: Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗	ELEVATION FEET
					Dark brown clay with trace limestone particles-stiff(CL)	X ⊗ 1 10 2 20 3 30 4 40 4.5 + 50 4.5 ++ 60	588 ±
					Limestone, tan, severely weathered, severely fractured, soft to moderately firm		583.8
5					← 5.6'-2" tan fractured limestone band		
			5.0	5.0	← 7.7'-4" tan fractured limestone band		
10					Limestone, gray, firm		
			10.0	10.0			
15							
20						Proposed Base of Reservior	567
					Limestone, gray, with trace thin shale bands, firm		
25			10.0	10.0			
30							

Geotechnical Engineers

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Job No. 2882
Date 4/5/85
Boring No. 5
Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE: DRILLED	CORE: RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS: Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗	ELEVATION FEET
			5.0	5.0	Limestone, gray, with trace thin shale bands, firm	X ⊗ · 1 10 2 20 3 30 4 40 4.5 + 50 4.5 + + 60	
35					Total Depth = 35.0 feet Upon completion, hole bailed to 33.8 feet. 10 minutes later, water measured at 31.0 feet. 3 days later, water measured at 30.1 feet and hole blocked at 34.5 feet.		

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Water Storage Reservoir
Addison, Texas

Sheet 1 of 2

Job No. 2882

Boring No. 6

Date 4/3/85

Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	ELEVATION FEET
					Gray clay with some limestone fragments-soft(CL)	598 +/-
					Limestone, tan, severely weathered, with clay bands, severely fractured, soft to moderately firm	595.2
5					←5.9'-1½" tan fractured limestone band	
			5.0	5.0		
10					Limestone, gray, firm	
					←14.0'-1" zone with iron-stained fracture	
15			10.0	10.0		
20						
25			10.0	10.0		
					←29.0'-1" shale band	
30					← 3-.8'-1" dark gray shale band	
					Proposed Base of Reservoir	567

FIELD TESTS

Pocket Penetrometer Readings, Tons per Sq. Ft. - X
Standard Penetration Tests, Blows per Foot (BPF) - ⊗

X - 1 | 2 | 3 | 4 | 4.5 + | 4.5 ++
⊗ - 10 | 20 | 30 | 40 | 50 | 60

JOHN H. HAYNES & ASSOCIATES, INC.

BORING LOG

Sheet 2 of 2

Water Storage Reservoir
Addison, Texas

Job No. 2882
Date 4/3/85
Boring No. 6
Location See Plate 1

DEPTH, FEET	DESCRIPTIVE SYMBOL	SAMPLES	CORE DRILLED	CORE RECOVERED	DESCRIPTION OF STRATA	FIELD TESTS: Pocket Penetrometer Readings, Tons per Sq. Ft. - X; Standard Penetration Tests, Blows per Foot (BPF) - ⊗ (X · 1 · 10; 2 20; 3 30; 4 40; 4.5 + 50; 4.5 + + 60)	ELEVATION FEET
					←30.8'-1" dark gray shale band		
					←32.8'-1" dark gray shale band		
35			10.0	10.0	Limestone, gray, firm		
40					Total Depth = 40.0 feet Upon completion, hole bailed to 38.7 feet. 10 minutes later, water measured at 32.6 feet. 5 days later, water measured 27.6 feet and hole blocked at 38.5 feet.		

Geotechnical Engineers