Appendix L

Lawrence Street Equalization and Pump Station Planning

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Table L1
City of Lancaster
Phase II LTCP
Summary by Structure

OPINION OF PROBABLE COSTS AS OF (5/20/2014)							
ITEM	QUANTITIES		BARE COSTS				TOTAL
	AMOUNT	UNITS	MATERIA	LABOR	EQUIP.	TOTAL	
01- DIVERSION CHAMBER							
DIV 2 SITE WORK							$11,769
DIV 3 CONCRETE							$77,430
DIV 11 EQUIPMENT							$305,000
						TOTAL	**$394,199**
02 - WET WELL							
DIV 2 SITE WORK							$19,428
DIV 3 CONCRETE							$174,478
DIV 5 METALS							$4,700
DIV 11 EQUIPMENT							$1,791,383
Div 16 ELECTRICAL							$364,049
						TOTAL	**$2,354,037**
03 - INFLUENT SPLITTER TROUGH							
DIV 3 CONCRETE							$31,539
DIV 5 METALS							$5,500
DIV 11 EQUIPMENT							$150,000
						TOTAL	**$187,039**
04 - EQ TANKS WITHIN TF3 & TF4							
DIV 2 SITE WORK							$35,158
DIV 3 CONCRETE							$1,659,591
DIV 5 METALS							$500,000
						TOTAL	**$2,194,750**
05 - BLOWER BUILDING							
DIV 11 EQUIPMENT							$217,000
Div 16 ELECTRICAL							$160,883
							$377,883
SUBTOTAL							**$5,507,908**
Mobilization @ 2%							$275,395
Bonds @ 1%							$55,079
Insurance @ 2%							$110,158
Overhead @ 10%							$550,791
Profit @ 10%							$550,791
Contingency Allowance @ 30%							$1,652,373
TOTAL CONSTRUCTION COST							**$8,703,000**

Table L2
City of Lancaster
Phase II LTCP
Diversion Chamber

OPINION OF PROBABLE COSTS AS OF (05/20/2014)								
ITEM		QUANTITIES		BARE COSTS				TOTAL
		AMOUNT	UNITS	MATERIAL	LABOR	EQUIP.	TOTAL	
DIVISION 2 - SITE WORK								
Excavation	EXCAVATION (Whole Structure)	929	CY	$7			$7	$6,500
	BACKFILL	634	CY	$19			$19	$12,039
	MISC SITEWORK, GRADING, ETC	1	LS	$5,000			$5,000	$5,000
							TOTAL	**$11,769**
DIVISION 3 - CONCRETE								
03300 - CAST-IN-PLACE CONCRETE								
FOUNDATIC	FDN SLAB - 18 inch - EL 794.83	27	CY	$293	$153	$6	$452	$12,204
WALLS	12" Exterior Walls	54	CY	$352	$457	$10	$819	$44,226
	12" Trough Channel Walls	2	CY	$309	$438	$9	$756	$1,512
SLABS	12" Trough Elevated Slab at EL 800	5	CY	$557	$358	$14	$929	$4,645
	12" Top Slab at EL 815	15	CY	$430	$284	$13	$727	$10,905
STAIRS	Stairs From Grade to Top Slab	2	CY	$980	$603	$11	$1,594	$3,188
GROUT FILL	Floor Grout Slope	3	CY	$200	$50	$0	$250	$750
Sum of 03300 - CAST-IN-PLACE CONCRETE		108	CY	364	343	9	717	77430
							TOTAL	**$77,430**
DIVISION 11 - EQUIPMENT								
STATIC SCREEN		1	EA	$5,000.00	$100,000.00	$200,000.00	$305,000.00	$305,000
							$0.00	$0
							$0.00	$0
							$0.00	$0
							$0.00	$0
							$0.00	$0
							TOTAL	**$305,000**
GRAND TOTAL WITH BURDEN & WITH ALLOWANCE FOR SUBS								**$394,199**

Table L3
City of Lancaster
Phase II LTCP
Wet Well

OPINION OF PROBABLE COSTS AS OF (05/20/2014)							
ITEM	QUANTITIES		BARE COSTS				TOTAL
	AMOUNT	UNITS	MATERIAL	LABOR	EQUIP.	TOTAL	
DIVISION 2 - SITE WORK							
Excavation EXCAVATION (Whole Structure)	1810	CY	$7.00			$7.00	$12,670
BACKFILL	1115	CY	$19.00			$19.00	$21,185
MISC SITEWORK, GRADING, ETC	1	LS	$5,000.00			$5,000.00	$5,000
						TOTAL	**$19,428**
DIVISION 3 - CONCRETE							
03300 - CAST-IN-PLACE CONCRETE							
FOUNDATIC FDN SLAB - 24 inch - EL 790.50	77	CY	$242.00	$107.00	$6.00	$355.00	$27,178
WALLS 18" Exterior Walls	170	CY	$289.00	$316.00	$9.00	$614.00	$104,350
12" Baffle Wall	37	CY	$290.00	$429.00	$9.00	$728.00	$27,127
12" Trough - 2 - Walls	12	CY	$340.00	$451.00	$9.00	$800.00	$9,582
SLABS 12" Trough Bottom Slab at EL 826	5	CY	$406.00	$285.00	$12.00	$703.00	$3,646
GROUT FILL Floor Grout Slope and between pumps	10	CY	$200.00	$50.00	$0.00	$250.00	$2,595
Sum of 03300 - CAST-IN-PLACE CONCRETE	311	CY	$278.51	$273.94	$8.01	$560.46	$174,479
						TOTAL	**$174,478**
DIVISION 5 - METALS							
Dowels Wall Adhesive Dowels	94	EA	$25.00	$25.00		$50.00	$4,700
						TOTAL	**$4,700**
DIVISION 11 - Equipment							
Pumps CP 3400/735 3~1030	6	EA	$13,120.00	$26,338.75	$105,355.00	$144,813.75	$868,883
Plug Valves	6	EA		$10,000.00	$40,000.00	$50,000.00	$300,000
Check Valves	6	EA		$10,000.00	$75,000.00	$85,000.00	$510,000
VFD	6	EA		$3,750.00	$15,000.00	$18,750.00	$112,500
						TOTAL	**$1,791,383**
DIVISION 16 - Electrical							
Pump Controller	6	EA		$6,760.00	$13,520.00	$20,280.00	$121,680
MAS-711 Pump Monitoring with Base Unit and Oper	6	EA		$2,295.50	$4,591.00	$6,886.50	$41,319
MISC	1	LS	$50,000.00		$150,000.00	$200,000.00	$200,000
Startup and Training	1	EA		$1,050.00		$1,050.00	$1,050
						TOTAL	**$364,049**
GRAND TOTAL WITH BURDEN & WITH ALLOWANCE FOR SUBS							**$562,655**

Table L4
City of Lancaster
Phase II LTCP
Influent Splitter Trough

OPINION OF PROBABLE COSTS AS OF (05/20/2014)								
ITEM		QUANTITIES		BARE COSTS				TOTAL
		AMOUNT	UNITS	MATERIAL	LABOR	EQUIP.	TOTAL	
DIVISION 3 - CONCRETE								
03300 - CAST-IN-PLACE CONCRETE								
WALLS	12" Trough Channel Walls	14	CY	$332.00	$447.00	$9.00	$788.00	$10,799
SLABS	12" Trough Bottom Slab at EL 826	8	CY	$402.00	$281.00	$12.00	$695.00	$5,714
	12" Trough Top Slab at EL 831	8	CY	$402.00	$281.00	$12.00	$695.00	$5,714
STAIRS	Stairs From Grade to Top Slab	6	CY	$1,007.00	$534.00	$11.00	$1,552.00	$9,312
sum of 03300 - CAST-IN-PLACE CONCRETE		36	CY	$475.88	$385.92	$10.70	$872.50	$31,539
							TOTAL	**$31,539**
DIVISION 5 - METALS								
Dowels	Wall Adhesive Dowels	220	EA	$25.00			$25.00	$5,500
							TOTAL	**$5,500**
DIVISION 11 - EQUIPMENT								
SLIDE GATES		3	EA		$10,000.00	$40,000.00	$50,000.00	$150,000
							TOTAL	**$150,000**
GRAND TOTAL WITH BURDEN & WITH ALLOWANCE FOR SUBS								**$187,039**

Table L5
City of Lancaster
Phase II LTCP
New EQ Tank

OPINION OF PROBABLE COSTS AS OF (05/20/2014)							
ITEM	QUANTITIES		BARE COSTS				TOTAL
	AMOUNT	UNITS	MATERIAL	LABOR	EQUIP.	TOTAL	
DIVISION 2 - SITE WORK							
SELECT FIL Floor of 2 tanks	3447	CY	$5.00	$5.00	$10.00	$20.00	$68,946
Troughs - 2 tanks	69	CY	$5.00	$5.00	$10.00	$20.00	$1,370
						TOTAL	**$35,158**
DIVISION 3 - CONCRETE							
03300 - CAST-IN-PLACE CONCRETE							
WALLS 18" Exterior Walls - 2 tanks	1018	CY	$351.00	$321.00	$10.00	$682.00	$694,276
SLABS 12" Elevated Walkway Slab at EL 825 - 2 tanks	374	CY	$400.00	$400.00	$0.00	$800.00	$299,359
FOUNDATIC FOUNDATION - 2 tanks	1567	CY	$275.00	$125.00	$25.00	$425.00	$665,957
sum of 03300 - CAST-IN-PLACE CONCRETE	2959	CY	$316.95	$227.20	$16.68	$560.83	$1,659,591
						TOTAL	**$1,659,591**
DIVISION 11 - Equipment							
Jet Mixing System	2	EA		$50,000.00	$200,000.00	$250,000.00	$500,000
						TOTAL	**$500,000**
GRAND TOTAL WITH BURDEN & WITH ALLOWANCE FOR SUBS							**$2,194,750**

Table L6
City of Lancaster
Phase II LTCP
Blower Building

OPINION OF PROBABLE COSTS AS OF (05/20/2014)							
ITEM	QUANTITIES		BARE COSTS				TOTAL
	AMOUNT	UNITS	MATERIAL	LABOR	EQUIP.	TOTAL	
DIVISION 11 - Equipment							
Pumps Replace 5 existing pumps	5	EA	$2,400.00	$6,000.00	$26,500.00	$34,900.00	$174,500
VFD	5	EA		$1,700.00	$6,800.00	$8,500.00	$42,500
						TOTAL	**$217,000**
DIVISION 16 - Electrical							
Pump Controller	5	EA		$6,760.00	$13,520.00	$20,280.00	$101,400
MAS-711 Pump Monitoring with Base Unit and Operator	5	EA		$2,295.50	$4,591.00	$6,886.50	$34,433
MISC	1	LS	$6,000.00		$18,000.00	$24,000.00	$24,000
Startup and Training	1	EA		$1,050.00		$1,050.00	$1,050
						TOTAL	**$160,883**
GRAND TOTAL WITH BURDEN & WITH ALLOWANCE FOR SUBS							**$377,883**

ARCADIS

SUBJECT: LAWRENCE WPCF EQ
FLOW SCHEMATIC
JOB NO: 0 91066 . 0000

BY: WL DATE: 7/17/2014
CHKD: DATE:

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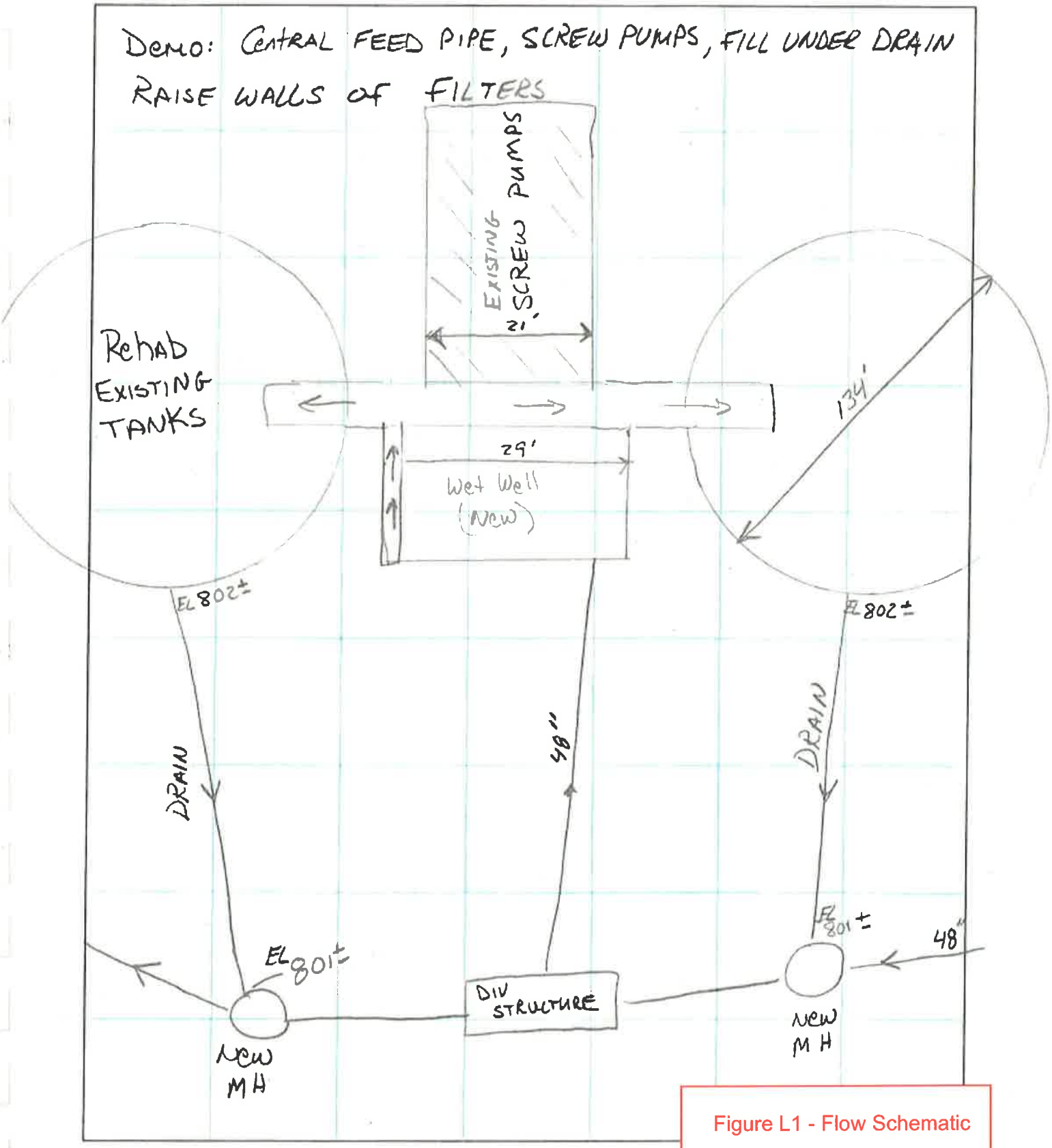

Figure L1 - Flow Schematic

Lawrence WPCF EQ

ARCADIS

SUBJECT: LANCASTER DIVISION STRUCTURE

JOB NO: 0491066.0000

BY: WL DATE: 5/20/2014

CHKD: DATE:

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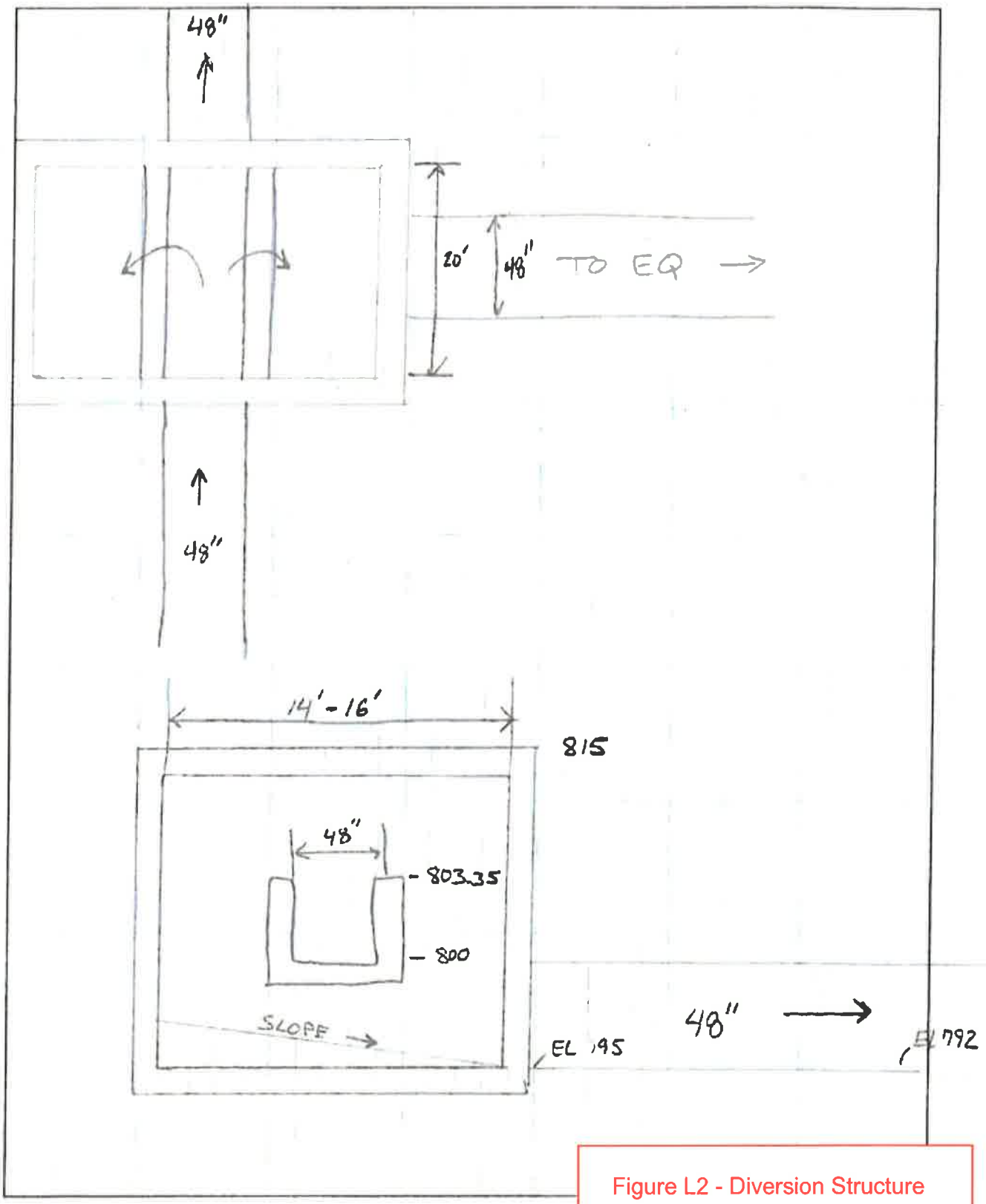

Figure L2 - Diversion Structure

AGM Form 30 12-01 Q

ARCADIS

SUBJECT: LAWRENCE WPCF FQ PUMP REQUIREMENTS

JOB NO: 0491066.0000

BY: WJ DATE: 7/17/2014

CHKD: DATE:

PAGE

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RECOMMENDED ALTERNATIVE

$Q = 45$ MGD

$Q = 45{,}000{,}000 \frac{gal}{d} \frac{1d}{24hr} \frac{1hr}{60min} = 31{,}250$ GPM

ASSUME 5 PUMPS (4-DUTY, 1-STANDBY)

FLOW PER PUMP

$\frac{31{,}250 \text{ GPM}}{4 \text{ pumps}} = 7813$ gpm

STATIC HEAD

ELEV 792.50 FT@ PUMP

ELEV 832.00 FT@ HIGH POINT

DELEV = 39.50 FT

FRICTION

$C = 120$

$L = 42$ ft.

$Q = 7813$ gpm

$\Phi = 24$ in

$S = H_L$ ft H_2O / 100 ft. pipe

$F = 0.2083 \left(\frac{100}{C}\right)^{1.852} \frac{Q^{1.852}}{d_h^{4.8655}}$

$F = 0.2083 \left(\frac{100}{120}\right)^{1.852} \left[\frac{(7813)^{1.852}}{(24)^{4.8655}}\right]$

$F = 0.464$ ft/100ft

$42 \text{ ft} \frac{0.464}{100} = 0.195$ ft.

MINOR LOSS

$h_L = (\text{Coef.}) \frac{V^2}{2g}$

ASSUME 2-90° Bends

Figure L3 - Pump Requirements

ARCADIS

SUBJECT: LAWRENCE WPCF EQ
PUMP REQUIREMENTS

JOB NO: 0491066.0000

BY: WL DATE: 7/17/2014

CHKD: DATE:

PAGE

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COEF = 0.20 90° FLANGE

COEF = 2.0 SWING CHECK (NOT USED)

COEF = 1.0 PLUG VALVE (NOT USED)

$Q = 7813 \frac{gal}{min} = \frac{1044\ ft^3}{min} \frac{1\ min}{60\ SEC} = 17.4\ CFS$

$A = \frac{\pi D^2}{4} = \frac{\pi 2^2}{4} = \pi = 3.14\ ft^2$

$Q = AV \qquad V = \frac{Q}{A} = \frac{17.4}{3.14} = 5.54\ ft/s$

$h_L = (0.2)\frac{5.54^2}{2(32.2)} = 0.095$ ft. per 90° BEND

$2(0.095) =$ 0.19 ft

TOTAL HEAD LOSS

39.50	STATIC
0.195	FRICTION
6.190	MINOR
39.89	

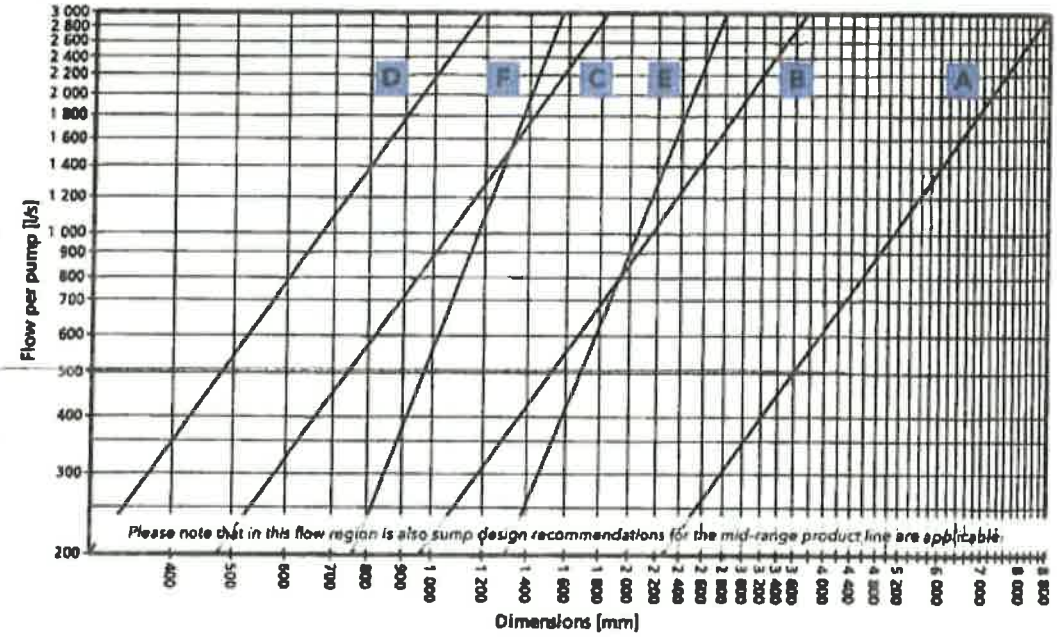
~40 ft = TDH WITHOUT VALVES

Figure L3 - Pump Requirements (cont.)

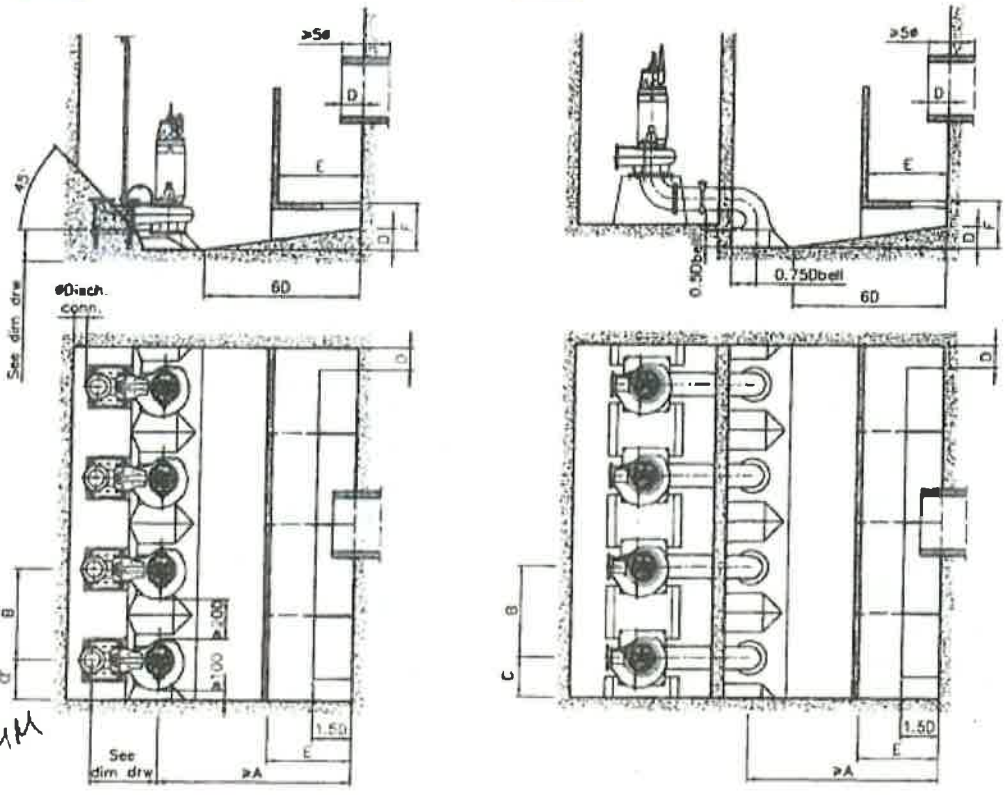
AGM Form 30 12-01

Sump dimensions

The sizing diagram is valid for pumping stations up to four pumps, which may all be duty pumps. Tolerances of ±10% on the sump dimensions shown in the table below are acceptable provided that the combined effect of the departures does not lead to velocities significantly higher than those for the standard sump.
Flow per pump refers to one pump duty point for maximum total flow (in a common pressure pipe).



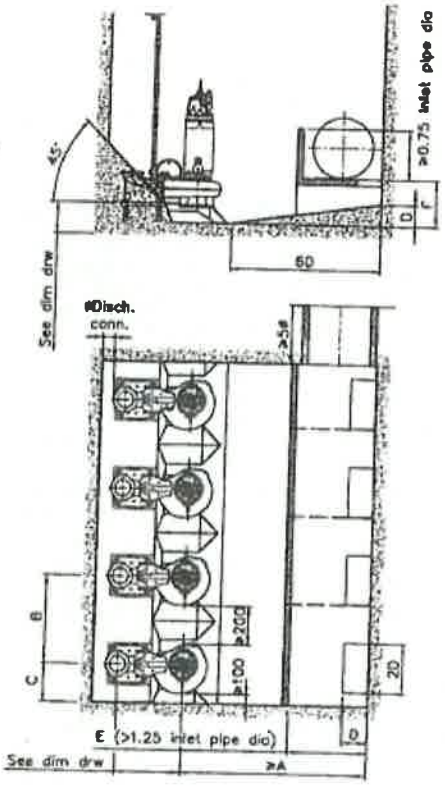
Submerged **Dry**



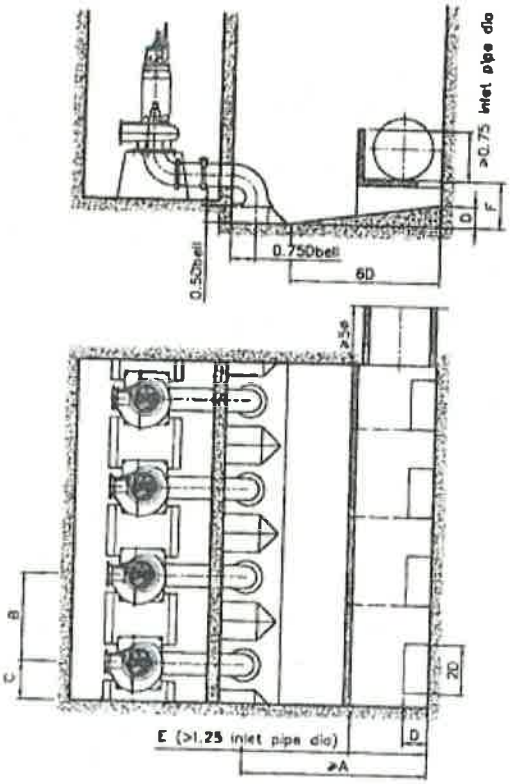
F = 980MM
D = 490 MM
C = 740 MM
E = 1700 MM
B = 1520 MM
A = 3600MM

Figure L4 - Sump Dimensions

Submerged



Dry



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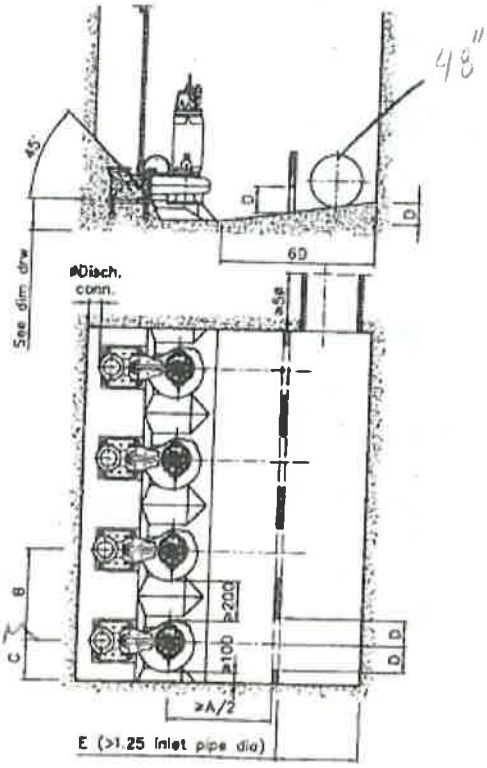

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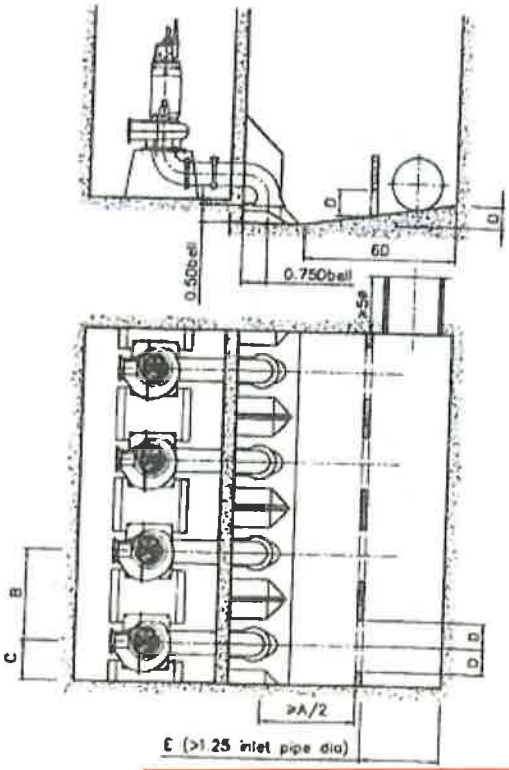

Figure L4 - Sump Dimensions (cont.)

Lawrence WPCF EQ

ARCADIS

SUBJECT: LANCASTER
WET WELL

JOB NO: 0491066.0000

BY: WL DATE: 5/16/14

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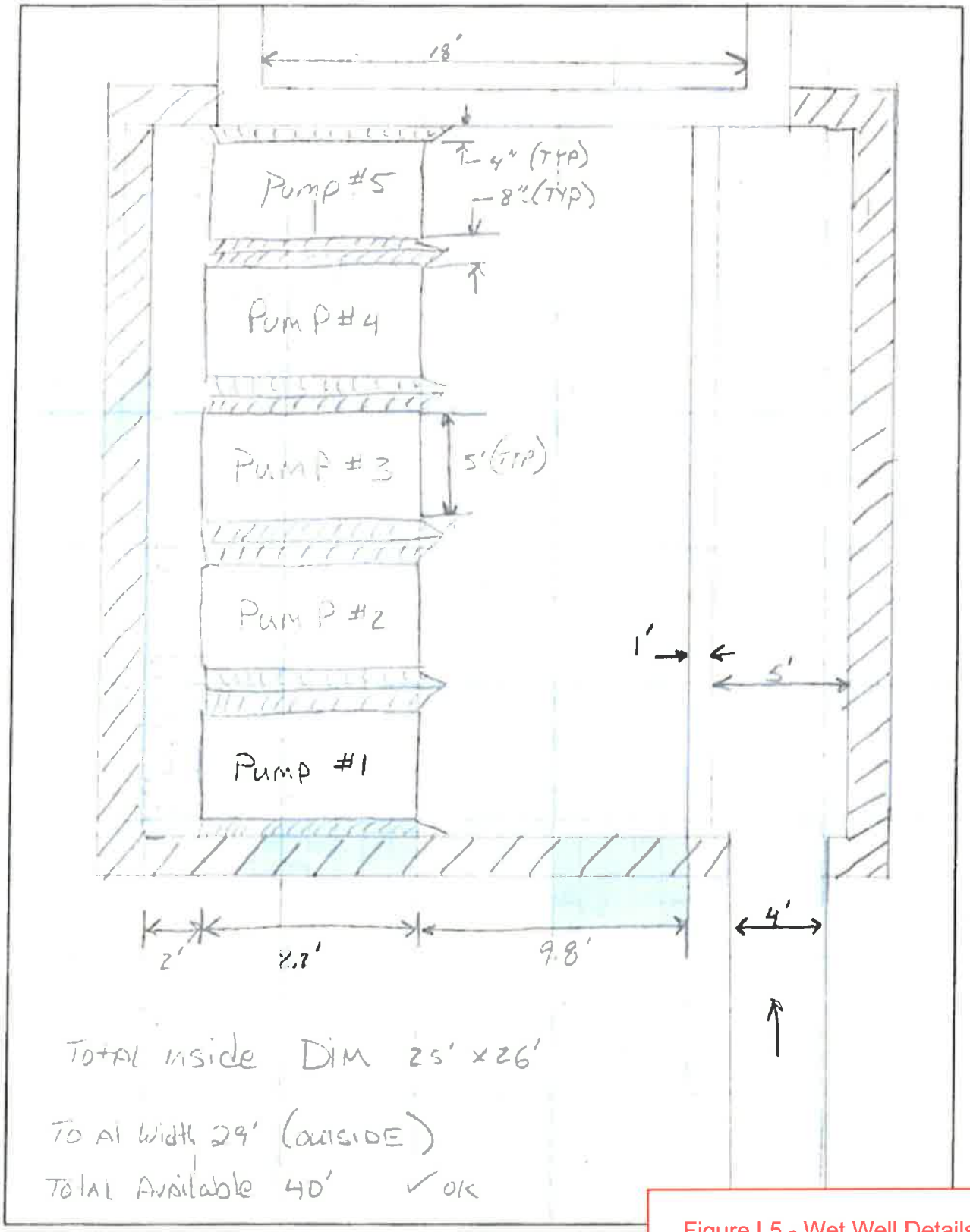

Figure L5 - Wet Well Details

ARCADIS

SUBJECT: LAWRENCE WPCT EQ
EQ TANK SIZE CALC.

JOB NO: 0491066.0000

BY: WJ DATE: 7/17/2014

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REQUIRED EQ TANK SIZE

4.25 MG Capacity

$4{,}250{,}000 \text{ gal} \times \frac{0.133 \text{ ft}^3}{1 \text{ gal}} = 568142 \text{ ft}^3$

DIAMETER = 134 ft.
- 3 ft (new wall thickness)
131 ft.

ASSUMED GROUND ELEV 802 ft.

$\text{AREA} = 2\left(\frac{\pi D^2}{4}\right) = 2\,\frac{\pi (131)^2}{4} = 26956 \text{ ft}^2$

$\frac{565250 \text{ ft}^3}{26956 \text{ ft}^2} = 20.96 \text{ ft}$

Add 2 ft FB = 23 ft. (WALL HEIGHT)

802' + 23' = 825 ft.

ELEVATION OF TANK WALL = 825 ft

Figure L6 - EQ Tank Sizing Calculations

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ARCADIS

SUBJECT: LAWRENCE WPCF EQ TROUGH CALCULATIONS

JOB NO: 0491066.0000

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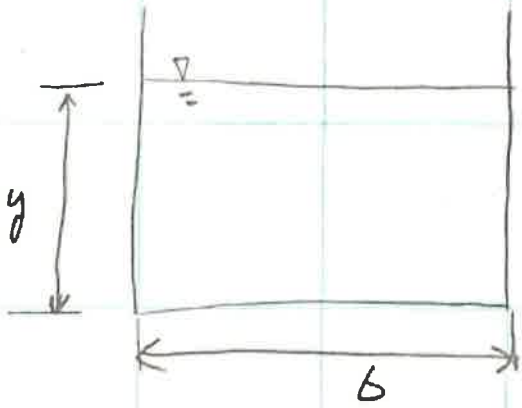

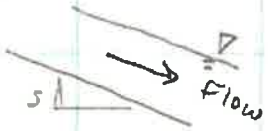

$Q = VA \qquad V = \frac{K}{n} R^{2/3} S^{1/2} \qquad R = \frac{A}{P} \qquad A = yb \qquad P = 2y + b$

$Q = 45$ MGD

$Q = 45{,}000{,}000 \frac{gal}{d} \frac{0.133 ft^3}{1 gal} \frac{1d}{24hr} \frac{1hr}{60min} \frac{1min}{60sec} = 69.3$ cfs

$A = \frac{Q}{V}$ Assume 6 ft/s

$A = \frac{69.3}{6} = 11.55 ft^2$

$\frac{11.55}{4} = 2.89 = y$

$b = 4 \qquad y = 2.89$

$R = \frac{11.55}{(2)(2.89) + 4}$

$R = 1.18$

$6 = \frac{1.49}{0.013} (1.18)^{0.667} (S)^{.5}$

$S = 0.002$ ft/ft

~ 30 ft long

Figure L7 - Trough Calculations

ARCADIS

SUBJECT: LAWRENCE WPCF EQ
WET WELL PIPING TYP.
JOB NO: 0491066.0000

BY: WJ DATE: 7/17/2014
CHKD: DATE:

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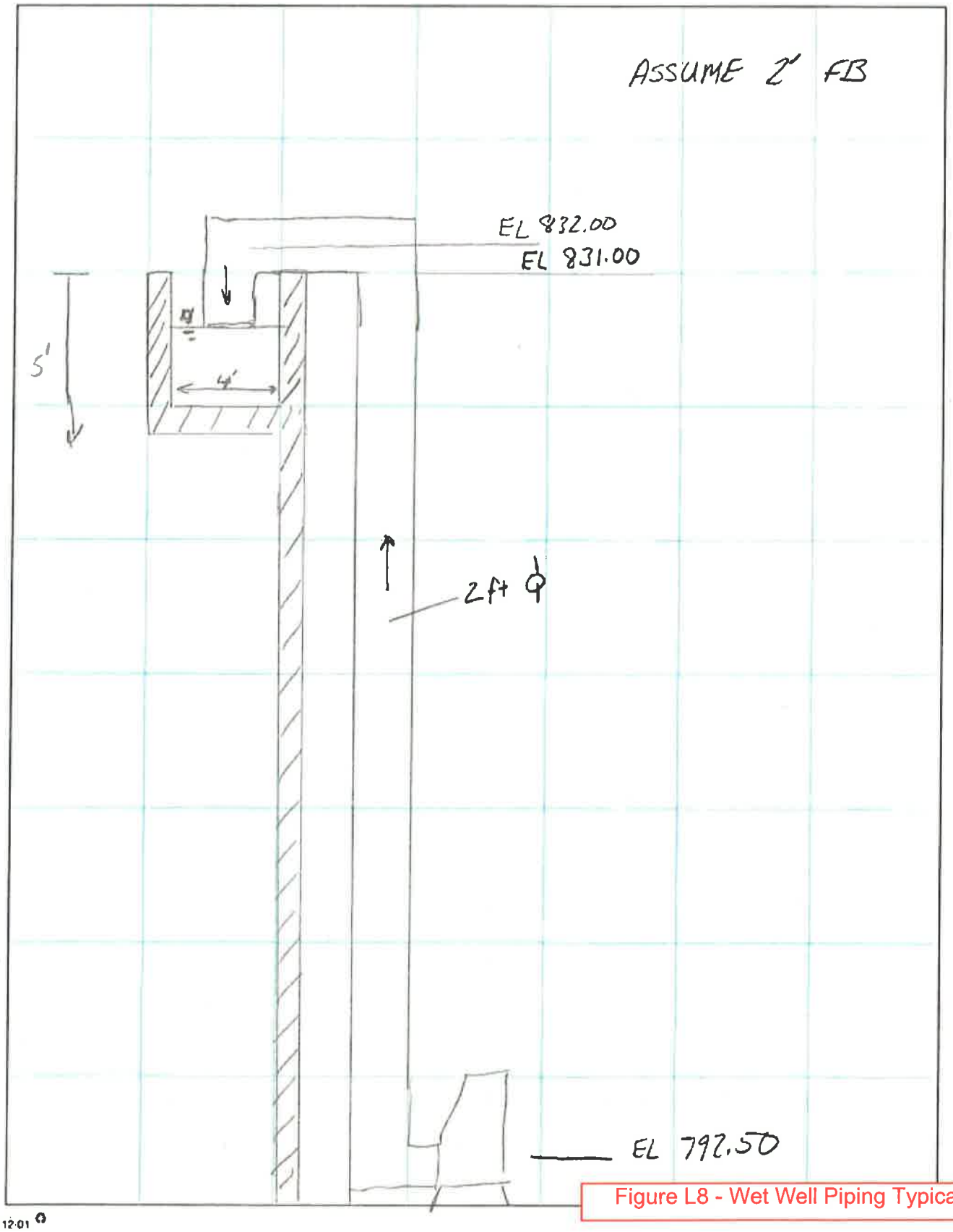

Figure L8 - Wet Well Piping Typical

ARCADIS

SUBJECT: Lawrence WPCF EQ
LANCASTER
JOB NO: 0491066.0000

BY: WL DATE: 5/20/2014
CHKD: DATE:

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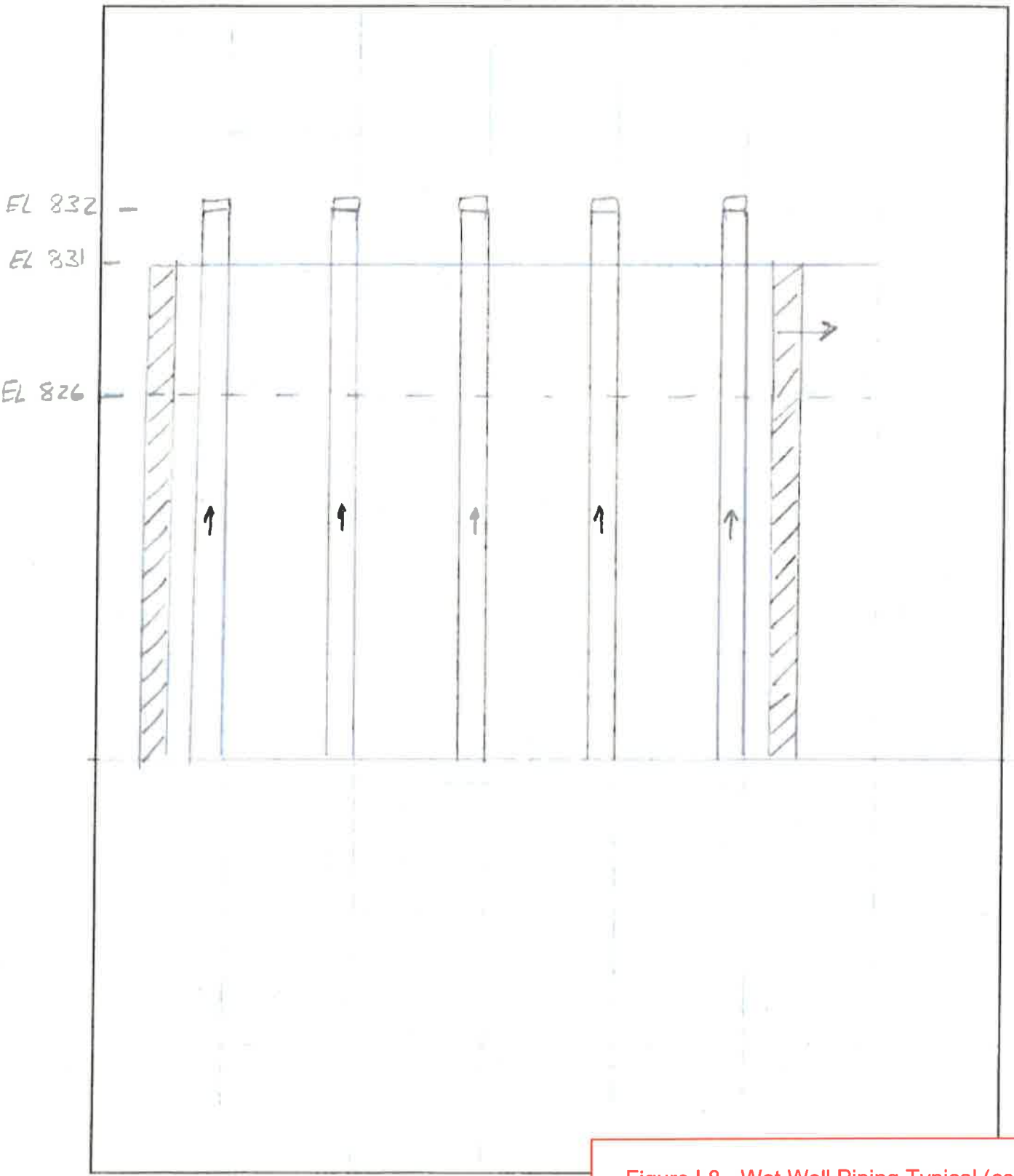

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Figure L8 - Wet Well Piping Typical (cont.)

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