CHANGING FOCUS

FROM LEAKS TO APPS

MAINLINE LEAKS

- IN 2010 PWD REPAIRED 866 LEAKS.
- IN 2016 PWD REPAIRED 243 LEAKS.
- TO DATE IN 2017 PWD HAS REPAIRED 70 LEAKS.

RE-ALIGNING RESOURCES

- REDUCED LEAKS MEANS MORE RESOURCES TO MAINTAIN OTHER ASSETS.
- STAFF EVALUATED AND REPRIORITIZED MAINTENANCE EFFORTS.

FLUSHING

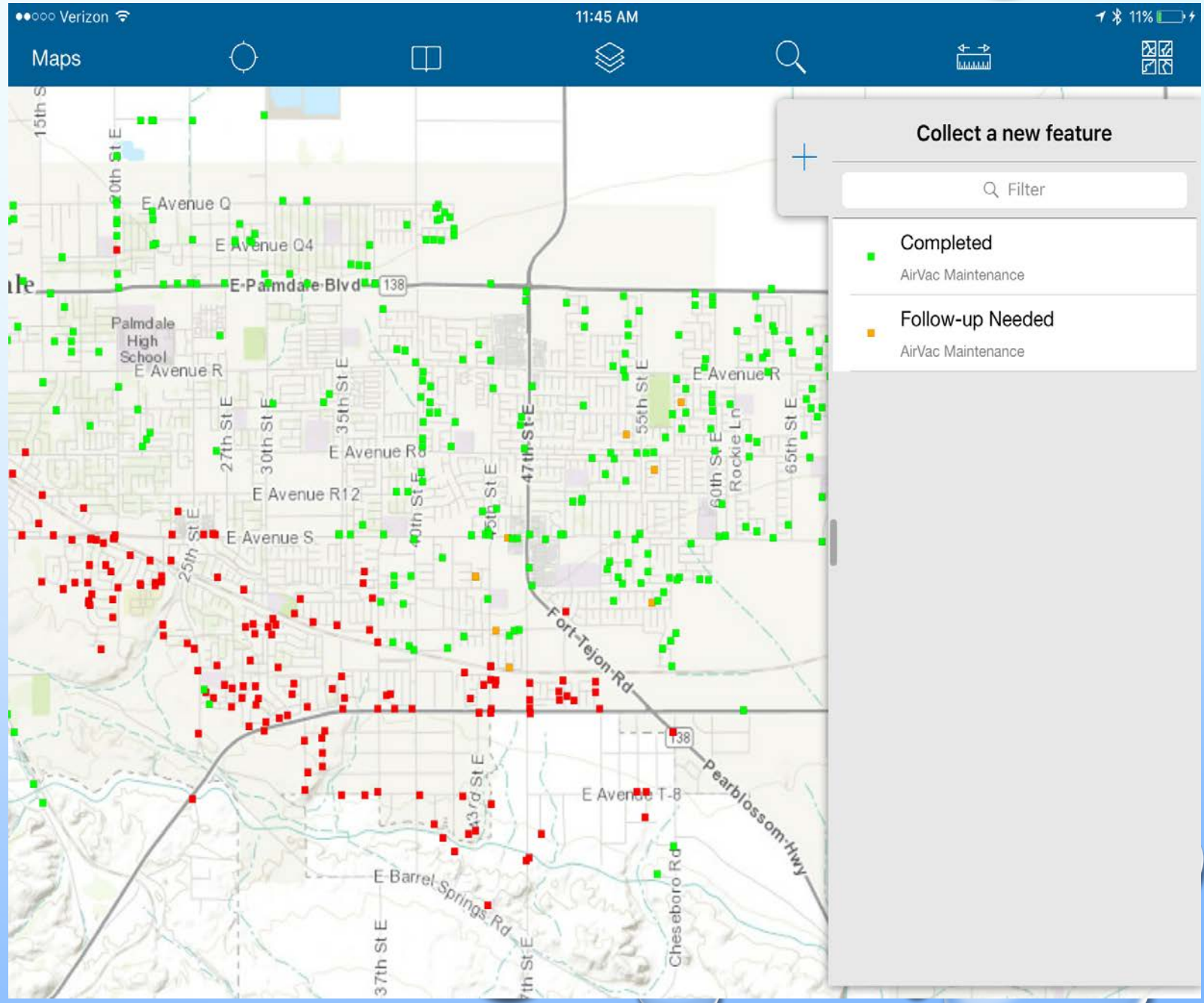
- PWD HAS 340 SITES SHOULD BE FLUSHED AT LEAST ANNUALLY.
- THE IMPROVED FLUSHING PROGRAM IMPROVES WATER QUALITY.

LARGE METER MAINTENANCE

- PWD HAS 88 LARGE METER VAULTS
- 2017 ASSESSMENTS AND REPAIRS ARE UNDERWAY
- FIRST INSTALLATION OF “OCTAVE METERS”

AIR VACS

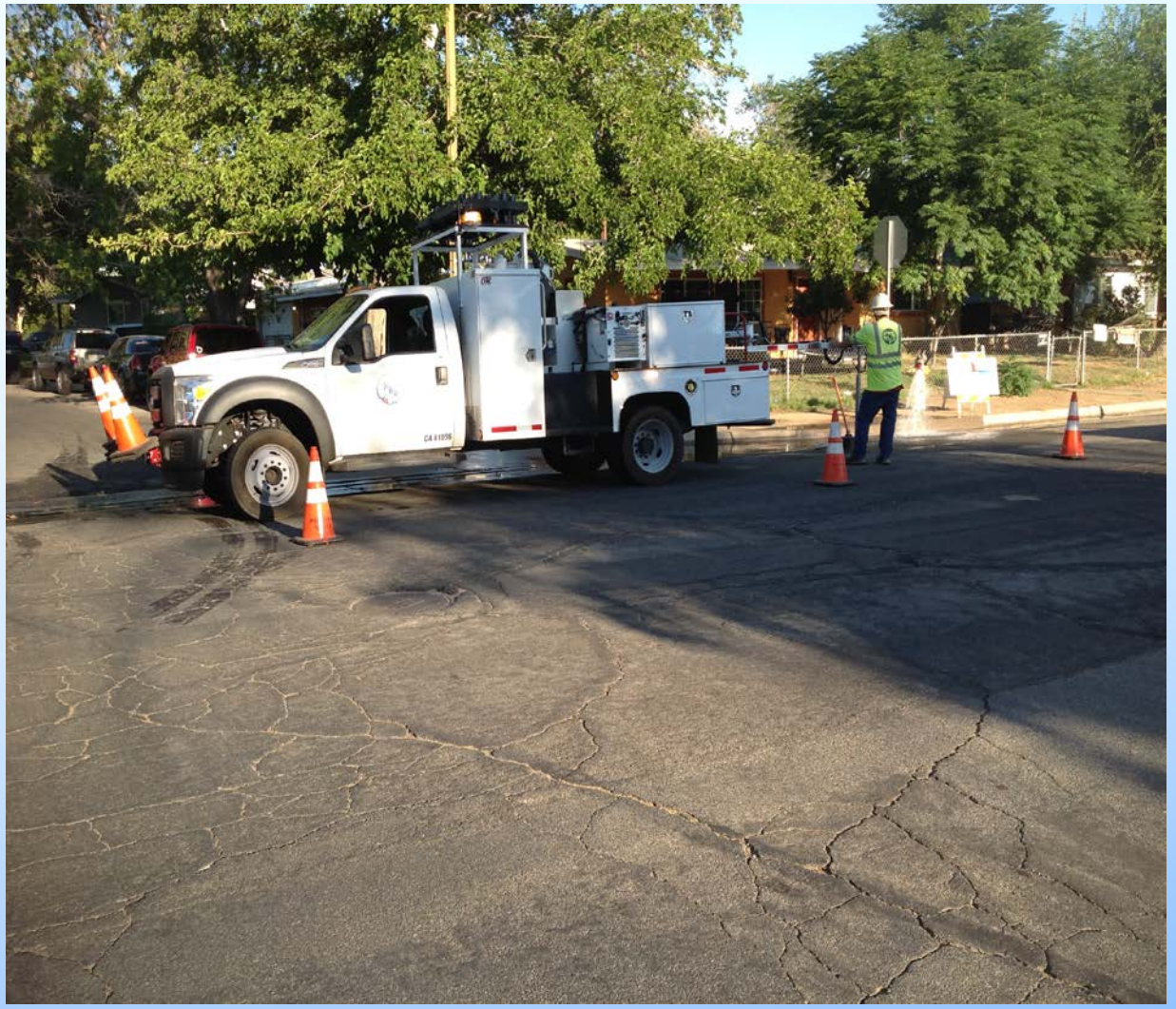
IN THE PROCESS OF REPLACING 567 OLD STEEL AIR VACS.



VALVE TURNING

PWD HAS 9,436 VALVES THAT MUST BE EXERCISED.

IN 2017 STAFF WILL EXERCISE AN ESTIMATED 4,000 VALVES.



COLLECTOR APP

- PWD STAFF DEVELOPED IN HOUSE APPS FOR EACH OF THESE AREAS OF MAINTENANCE.
- ALLOWS STAFF TO INSTANTLY DOCUMENT AND REPORT MAINTENANCE ACTIVITIES FROM THE FIELD
- IMPROVES EFFICIENCY, PRODUCTIVITY AND ORGANIZATION

Vehicle Fleet and Heavy Equipment

List of Vehicles and Equipment

281	YEAR	MAKE	MODEL	DESCRIPTION	LOCATION	ASSIGNED:	DEPARTMENT	
3	2000	CAT	416C	Backhoe	5604 hrs	Crew	Construction	year 2/3
4	1991	FORD	F800	Dumptruck	72,515	Crew	Construction	year 2/3
7	2002	FORD	F150	1/2 T P/U	111,397	Pool	WTP	2018
11			TRI STATE INDUSTRIES, INC	Trailer	Facilities	Crew	Construction	
	1978	MILLER	MILLER	Welder 47	67 hrs	Crew	Construction	
16		Signal		Arrowboard	Facilities	Crew	Construction	
17	1995	FORD	F350	Utility	69,215	Maint Worker	Facilities	year 2/3
22	1996	FORD	F150	1/2 T P/U	98,570	Pool	WTP	2018
24	1988	FORD	F8000	Crane	18,023	Facilities	Facilities	year 2/3
25	1992	SOUTHWEST	VAN TRAILER	HAZ MAT TRAILER	WTP	Pool	WTP	
033	2000	CHEV	C30	Utility	131,025	Scott Mahoney	Operations	
035	2002	FORD	F150	1/2 T P/U	107,110	Audel Narez	Lab	year 2/3
038		IR		Air Compressor	Facilities	Crew	Construction	
040	2002	BUICK	LeSabre	Car	87,265	Pool	Facilities	year 2/3
043	1990	GMC	C30	Flatbed	46,119	Pool	Construction	year 2/3
044		SPCNS		Utility Trailer	Facilities	Crew	Construction	
046		SHPBLT	4Axle	Trailer	Facilities	Crew	Construction	
50		Vermeer		Woodchipper	Facilities	Crew	Construction	
057	1993	Trailking	2Axle	Trailer	Facilities	Crew	Construction	
058	1988	HMDE	2Axle	Trailer, Water	Facilities	Crew	Construction	
059	1996	Gregor		Pontoon Boat	WTP	Pool	WTP	
	2000	Honda	BF50A	Outboard Motor-48	WTP	Pool	WTP	
			2Axle	Boat Trailer	WTP	Pool	WTP	
060	1998	GMC	C30	Utility	98,292	Fleet Techicians	Facilities	year 2/3
061	1998	Trailking	2Axle	Trailer	Facilities	Crew	Construction	year 2/3
066	1989	JD	644G	Loader	5068	Pool	WTP	
067	1999	CHEV	C7500	Water truck	51,699	Crew	Construction	year 2/3
068	1999	CHEV	C20	Utility	85,838	Pool	Facilities	year 2/3

Budget Impact

- Total of 81 – Vehicles, Heavy Equipment and small equipment.
- Each year the replacement should include 1 to 2 pieces of heavy equipment. (tractors, loader, dump trucks, large service trucks with cranes)
- Each year the replacement for vehicles and small service trucks should include 4 to 5.
- The Leasing program has been a benefit for our vehicles and small trucks.
- It is not a benefit to lease heavy equipment. The monthly cost for a backhoe =$ 24,000.00

Compound Meters

88 TOTAL IN OUR SYSTEM

Compound meters supply high flow rates when necessary, but also measure low flow . Accuracy is essential to account for all water delivered to our customers and prevent water loss in our system

Testing for Accuracy

- It is vital to test our meters annually. Our meters are tested through an independent contractor. To ensure our meters are recording and measuring water flow for accurate billing.

It is essential to maintain and update our meters through: replacement/ new technology retro fit existing assemblies. maintenance of existing valves and piping

- All compound meters are below ground level in vaults. The environment is harsh with constant moisture, water runoff, dirt and silt build up. Maintenance is important to rebuild and replace piping to ensure durability and longevity

Corrosion is our biggest culprit that causes leaks and failure

Budget Impacts

Our existing budget for compound meters include:	Annual testing $12,500.00	Maintenance and Repair $20,000.00
To upgrade and restore compound meters these line items to be increased by at least 75%	Testing to $20,000	Maintenance to $35,000.00

Return on Investment

Well maintained Compound Meters will:

- Reduce unaccounted for water sales
- Improve water sale revenue

Pressure Reducing Valves

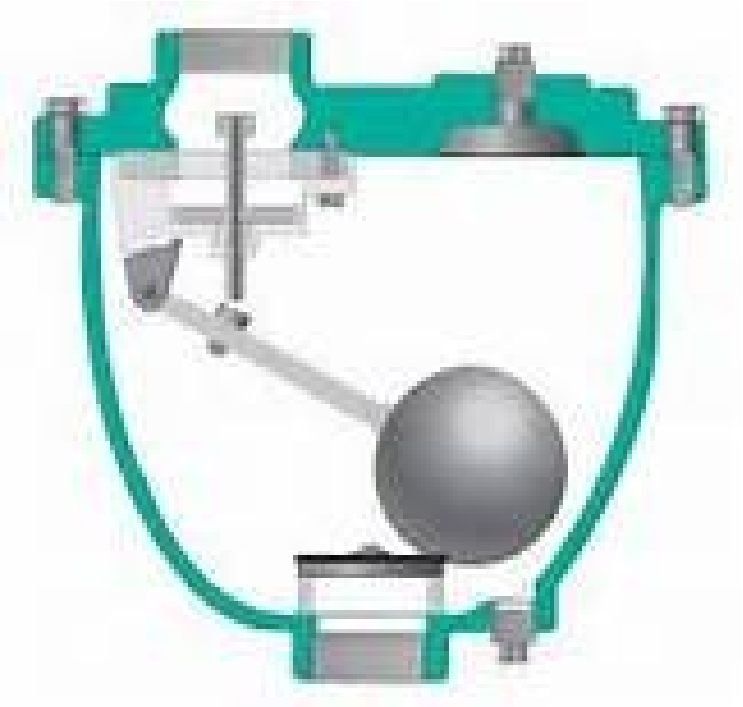
- Pressure reducing valves separate all our pressure zones.
- There is a total of (14) pressure regulating stations
- 12 out 14 of our stations are over 23 years of age.
- Aging valves and piping lead to leaks, corrosion and failure that would put customers out of service.

Pipe Corrosion

Recently the Construction Crew and Operations Crew installed a complete P.R.V on 47th st. E. and Ave. S-10. The cost to replace this assembly = $27,563.00

Cycled Maintenance

- A Five year cycle-Pressure Reducing Valve Program would cost approximately $51,000.00 per year.
- Engineering recently approved using concrete coated and mortar lined pipe in all our PRV assemblies increasing durability and longevity.



AIR VAC's combination air release / vacuum valves

PRIMARY FUNCTION OF AN AIR VAC IS TO EXHAUST AIR FROM PRESSURED PIPE.

IT ALSO ALLOWS AIR TO RE-ENTER WHEN WATER LEVELS DROP.

PRESSURE ZONES

- There are (7) pressure zones in our system. All at different elevations.
- 2800 ‘
- 2850 ‘
- 2950’
- 3000’
- 3200’
- 3250’
- 3400 +

Air Vac's play a very important role to help keep our infrastructure functioning properly.

BUDGET IMPACT

There are 566 air vac's throughout the (7) elevation zones in our system.

The cost to replace and repair equals $86,000.00

That amount would allow us to to replace every air vac in two years or less.

After replacement an annual maintenance cycle would allow us to repair as needed for a cost per year of $10,000.00

Return on Investment

- Well maintained Air Vacs will:
  - Maintain operation efficiency
  - Reduce leaks
  - Extend the life of mainlines

Palmdale Water District

INFRASTRUCTURE ASSET MANAGEMENT- PIPELINES

In 2015, the district had reported a total of 409.7 miles of pipeline installed.

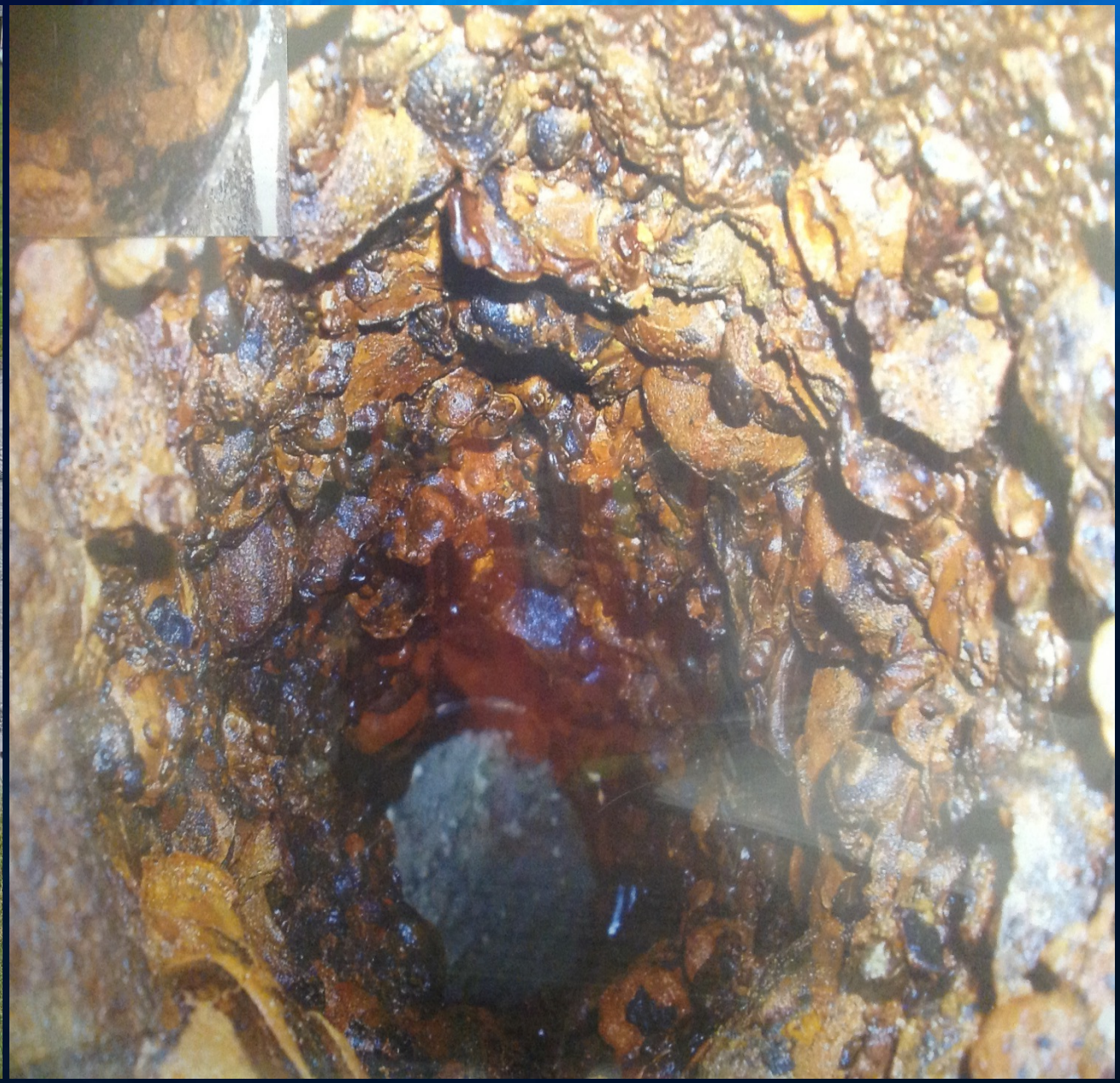
Length of Pipe (ft) by Year Constructed Source: GIS MainLine feature class data as of Sept 2, 2014 (Year Constructed has been corrected or estimated for 29.4 miles of pipe previously classified as Unknown)																	$/in-dia 17.00
Pipe Diameter (in)	1945-1949 (69 - 65)	1950-1954 (64 - 60)	1955-1959 (59 - 55)	1960-1964 (54 - 50)	1965-1969 (49 - 45)	1970-1974 (44 - 40)	1975-1979 (39 - 35)	1980-1984 (34 - 30)	1985-1989 (29 - 25)	1990-1994 (24 - 20)	1995-1999 (19 - 15)	2000-2004 (14 - 10)	2005-2009 (9 - 5)	2010-2014 (5 - Current)	Unknown N/A	Total Length (ft)	Replacement Cost ($)
4	-	855	2,718	1,851	188	3,291	3,024	5,231	6,277	2,550	1,556	562	7	-	2,662	30,772	$ 2,092,496
5	-	850	-	-	-	-	-	-	-	-	-	-	-	-		850	72,250
6	-	4,249	19,917	3,824	29,769	9,022	18,721	25,448	75,325	82,933	4,479	32,744	26,668	21,452	1,326	355,877	36,299,454
8	-	3,184	480	3,225	13,083	16,078	14,114	70,200	307,809	222,103	40,038	72,315	74,113	25,616	2,413	864,771	117,608,856
10	-	-	-	99	697	3,572	-	20,082	60,276	24,613	20	46	69	-	490	109,964	18,693,880
12	-	151	20,787	25,559	35,955	11,321	2,425	25,504	97,537	90,628	34,268	37,100	35,276	18,694	1,683	436,888	89,125,152
14	-	-	-	425	-	123	-	3,165	11,595	3,395	-	3	-	-	35	18,741	4,460,358
16	-	-	-	33	2,986	4,889	-	33,299	52,166	46,699	7,683	9,767	10,580	2,119	3,012	173,233	47,119,376
18	-	1,234	-	10	10	-	-	5,480	4,331	-	24	241	-	-	873	12,203	3,734,118
20	-	-	-	-	5,257	-	-	-	48,174	35,300	-	-	2,920	3,127	2,199	96,977	32,972,180
24	-	-	-	91	9,883	-	2,659	-	29,235	383	-	-	14,248	-	355	56,854	23,196,432
30	-	-	-	-	-	-	-	-	1,650	-	625	-	304	-		2,579	1,315,290
36	-	-	-	-	-	-	-	-	-	-	1,073	-	-	-		1,073	656,676
42	-	-	-	-	-	-	-	-	1,452	-	639	-	-	-	115	2,206	1,575,084
48	-	-	-	-	-	-	-	-	-	-	441	-	-	-		441	359,856
Totals (LF)	0	10,523	43,902	35,117	97,828	48,296	40,943	188,409	695,827	508,604	90,846	152,778	164,185	71,008	15,163	2,163,429	$ 379,281,458
Totals (Miles)	0.0	2.0	8.3	6.7	18.5	9.1	7.8	35.7	131.8	96.3	17.2	28.9	31.1	13.4	2.9	409.7	
Cumulative (LF)	0	10,523	54,425	89,542	187,370	235,666	276,609	465,018	1,160,845	1,669,449	1,760,295	1,913,073	2,077,258	2,148,266	2,163,429		
Cumulative (Miles)	0	2	10	17	36	45	52	88	220	316	333	362	393	407	410		
Replacement Cost ($)	$ -	$ 1,405,220	$ 6,522,186	$ 6,335,696	$ 18,916,716	$ 7,606,446	$ 5,614,250	$ 32,602,838	$ 128,575,794	$ 87,179,298	$ 16,890,554	$ 23,520,248	$ 29,846,798	$ 11,125,004	$ 3,140,410	$ 379,281,458	
Cumulative Replacement Cost ($)	$ -	$ 1,405,220	$ 7,927,406	$ 14,263,102	$ 33,179,818	$ 40,786,264	$ 46,400,514	$ 79,003,352	$ 207,579,146	$ 294,758,444	$ 311,648,998	$ 335,169,246	$ 365,016,044	$ 376,141,048	$ 379,281,458		

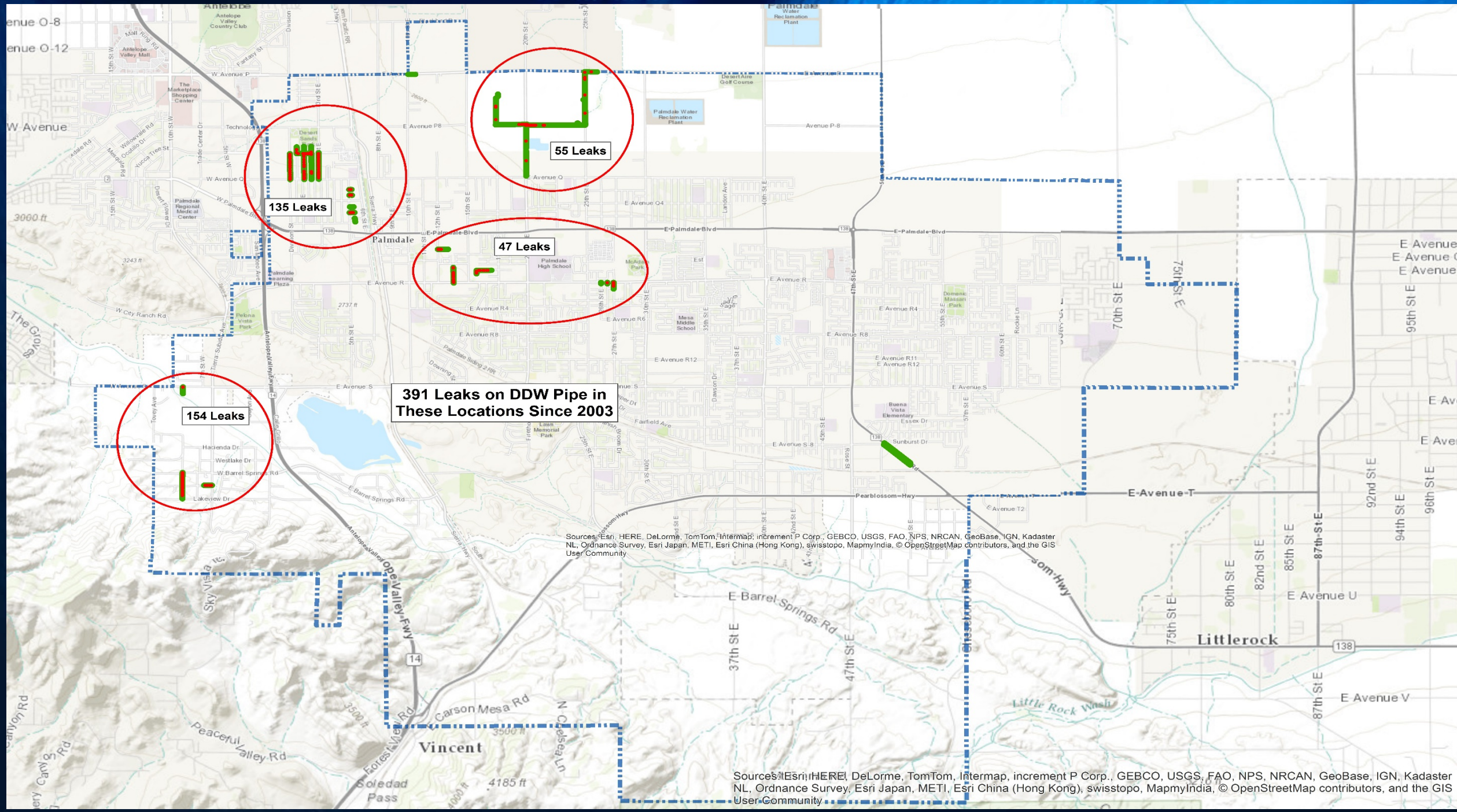
Note: Totals include +/- 19,400 LF of vintage 1950's steel DDW pipe that was cleaned and lined "in place" with cement mortar lining in 1992 and 1994.

With a total replacement cost of $379,281,458.00

There are 3 very high priority pipelines, that will need to be address as soon as possible. The failures in these areas will have a major impact to these sites.

And there’s another 14 high priority sites.



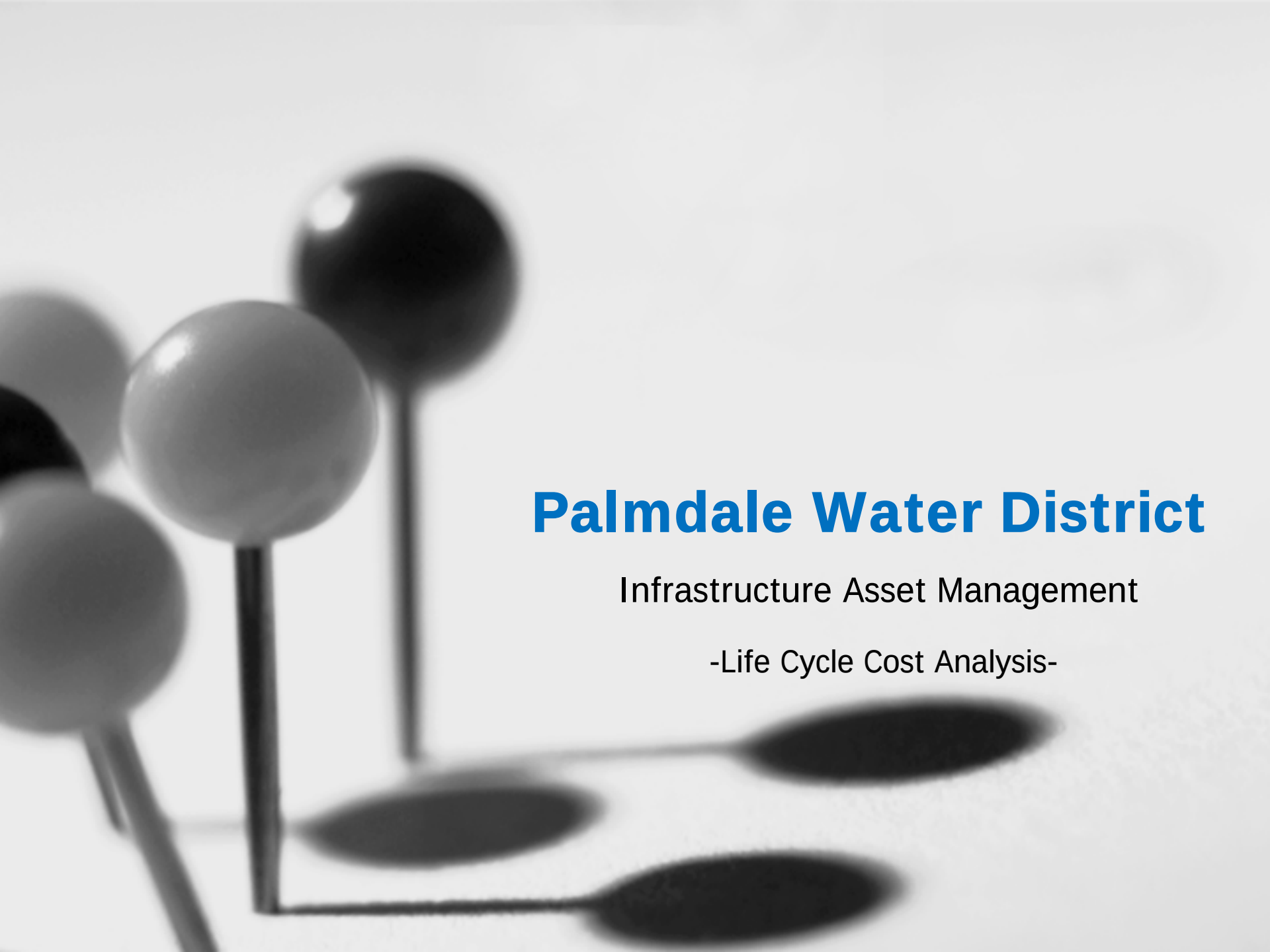


Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

The current needs of the district are;

DDW WATER MAINS

LOCATION	SIZE (IN)	FTG	COST DIA-IN-FT	COST	PRIORTY	BUDGET STATUS	YEAR
DIV TO 3RD Q TO P-12	6	6280	21.25	$800,700.00	H	DEFERRED	1956-1957
"	12	1330	21.25	$339,150.00	H	DEFERRED	1956-1957
P-8 @ 20TH	16	1420	18.00	$408,960.00	H	DEFERRED	1961
Q-1,2,4,5, 5TH PL	4	860	21.25	$73,100.00	H	DEFERRED	1951
Q-10 @ 12TH	4	470	21.25	$39,950.00	H	DEFERRED	1955
13TH FR Q-13 TO R	8	1000	21.25	$170,000.00	H	DEFERRED	1963
Q-14 @15TH	6	880	18.00	$95,040.00	H	DEFERRED	1950
26TH, RUDALL, 27TH @ R	6	140	21.25	$17,850.00	H		1964
"	8	350	21.25	$59,500.00	H		1964
CAMARES FR LAGO LINDO TO LKVW	8	1335	9.00	$96,120.00	H	DEFERRED	1963
S-14 W/O TIERRA SUBIDA	6	390	9.00	$21,060.00	H	DEFERRED	1965
V-5 W/O 47TH	6	50	9.00	$2,700.00	H	DEFERRED	UNKNOWN
"	4	668	9.00	$24,048.00	H	DEFERRED	UNKNOWN
"	2	958	9.00	$17,244.00	H	DEFERRED	UNKNOWN
P FR 25TH TO 500' ELY (FAA)	12	500	21.25	$127,500.00	H*	DEFERRED	1961
P @ 10TH (LOCKHEED)	14	440	21.25	$130,900.00	H*		1960
"	12	80	21.25	$20,400.00	H*		1960
25TH FR P TO P-8	12	2750	21.25	$701,250.00	M	DEFERRED	1961
20TH FR P-8 TO Q	12	2700	21.25	$688,500.00	L		1961
17TH FR P-4 TO P-8	12	1360	18.00	$293,760.00	L		1958
WELL 17 YARD PIPING	12	280	18.00	$60,480.00	L		1958
CAMARES @ S	6	350	21.25	$44,625.00	L		1957
FT TEJON	6	3130	21.25	$399,075.00	L		UNKNOWN
		5.25	MILES				
HIGH PRIORITY REPLACEMENT COSTS				**$2,444,222.00**			
MED. PRIORITY REPLACEMENT COSTS				**$701,250.00**			
LOW PRIORITY REPLACEMENT COSTS				**$1,486,440.00**			
TOTAL REPLACEMENT COSTS				**$4,631,912.00**			



Palmdale Water District

Infrastructure Asset Management

-Life Cycle Cost Analysis-

Asset management is a systematic process of deploying, operating, maintaining, upgrading, and disposing of assets cost-effectively, to maintain the quality of life in society and efficiency in the economy.

Pumping Plant Name	Test Date	Pump Location	CSS Service Acct #	Motor HP	kWh / Year	kWh / Acre Ft.	kW	Annual Acre Ft.	Avg $ / Acre Ft.	Annual Cost	Test Eff. %	Impr. Eff %	kWh Annual Savings	*kW Savings	Impr. Annual Cost	Est. $ Annual Savings
T-8 BOOSTER 1	9/20/2016	4228 E AVENUE T8, PALMDALE, CA 93552-6221	1099981	15	12048	225.32	11.7	53	$41	$2,169	54%	61%	1,446	1	$1,908	$260
T-8 BOOSTER 2	9/20/2016	4228 E AVENUE T8, PALMDALE, CA 93552-6221	1099981	15	9600	264.75	11.7	36	$48	$1,728	46%	61%	2,368	3	$1,302	$426
PWD BOOSTER 14A	9/6/2016	39401 20TH ST E, PALMDALE, CA 93550-2167	13175353	75	214500	348.24	56.3	616	$31	$19,305	66%	72%	19,271	5	$17,571	$1,734
PWD WELL 14A	4/26/2017	39401 20TH ST E, PALMDALE, CA 93550-2167	13175353	250	571392	1144.27	193	499	$114	$57,139	54%	69%	128,283	43	$44,311	$12,828
PWD WELL 8	4/27/2017	2200 E AVENUE P, PALMDALE, CA 93551-2338	1388874	600	919992	1104.41	387.6	833	$99	$82,799	70%					
PWD WELL 7	4/25/2017	39395 25TH ST E, PALMDALE, CA 93550	1388875	500	980088	1437.48	272.1	682	$144	$98,009	55%	72%	226,038	63	$75,405	$22,604
HILLTOP Booster	9/21/2016	35609 CHESEBORO	1388885	10	3336	436.11	10.6	8	$224	$1,715	33%	58%	1,423	5	$983	$731
PALMDALE HILLS BOOSTER	9/22/2016	4640 BARREL SPRINGS ROAD, PALMDALE, CA 93550	1388887	10	5148	392.53	7.3	13	$90	$1,177	35%	58%	2,071	3	$703	$473
PWD WELL 18	5/9/2017	4640 BARREL SPRINGS ROAD, PALMDALE, CA 93550	1388887	3	1332	199.76	3.2	7	$45	$301	35%	47%	336	1	$225	$76
PWD WELL 19	5/9/2017	4640 BARREL SPRINGS ROAD, PALMDALE, CA 93550	1388887	7.5	3444	320.91	6.5	11	$73	$778	43%	50%	470	1	$672	$106
V-5 BOOSTER	9/22/2016	4640 BARREL SPRINGS ROAD, PALMDALE, CA 93550	1388887	15	7956	682.34	14.7	12	$156	$1,819	60%					
							0.6	6	$138	$830	60%	65%	150	3	$760	$70
							0.6	6	$140	$814	59%	65%	161	3	$738	$75
							36.3	641	$36	$23,057	68%	75%	20,982	10	$20,959	$2,098
							32.9	656	$37	$24,294	65%	75%	30,795	13	$21,215	$3,079
							105	1113	$38	$42,044	64%	75%	60,985	15	$35,946	$6,099
							71	550	$15	$8,312	63%	74%	12,575	11	$7,055	$1,258
							3.5	627	$14	$9,024	67%	74%	8,793	8	$8,145	$879
							66	847	$15	$13,028	61%	74%	23,217	12	$10,707	$2,322

SCE Hydraulic / Industrial Services
Customer: Palmdale Water District

Cost Analysis Summary

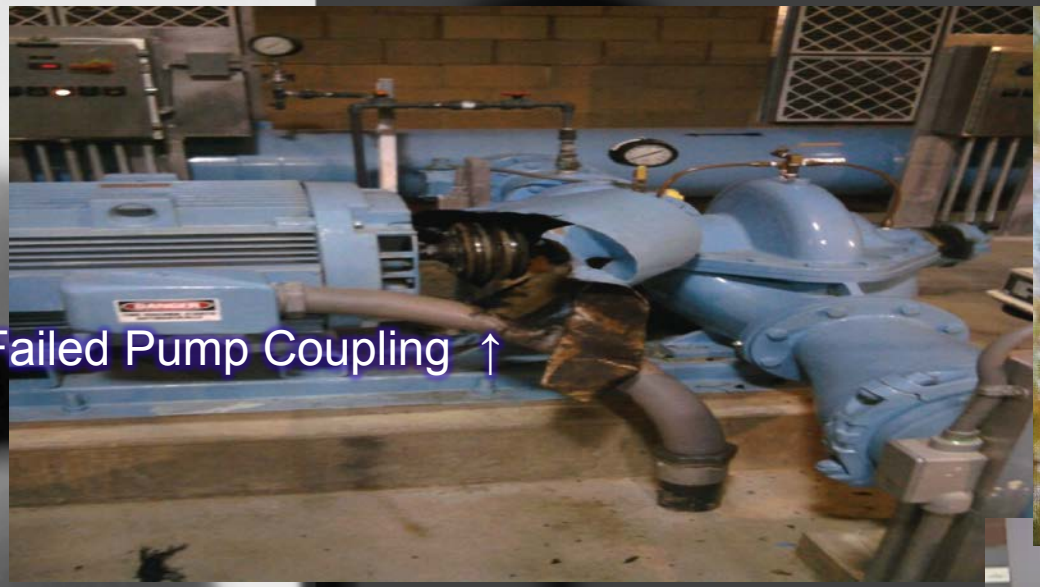
SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

*The kW on-peak activity factor represents how the kW impacts the SCE system during on-peak periods as determined by SCE's agricultural and water pumping customers' average load profiles.
The savings used for incentive calculations is calculated based on pump kW usage during DEER on-peak days. Actual kW savings may vary at time of application validation.

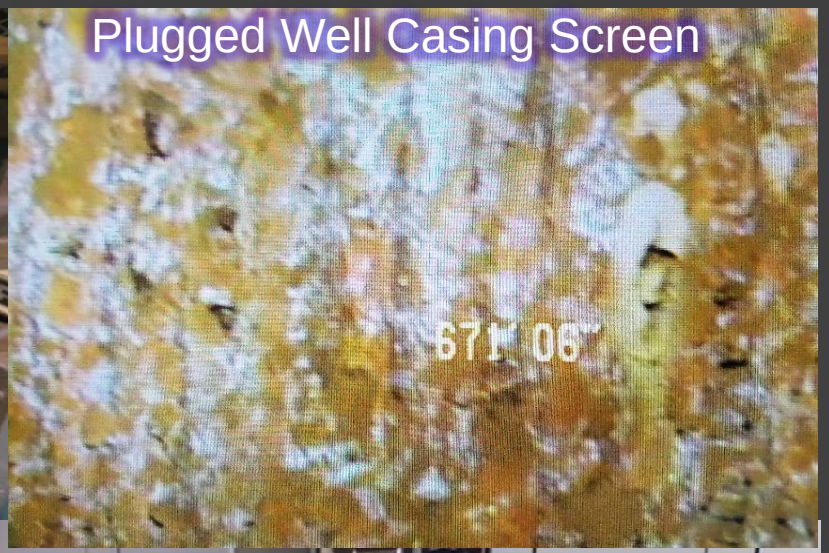
Pumping Plant Name	Test Date	Pump Location	CSS Service Account #	Motor HP	kWh / Year	kWh / Acre Ft.	kW	Annual Acre Ft.	Avg $ / Acre Ft.	Annual Cost	Test Eff. %	Impr. Eff %	kWh Annual Savings	*kW Savings	Impr. Annual Cost	Est. $ Annual Savings
PWD WELL 7	4/25/2017	39395 25TH ST E, PALMDALE, CA 93550	1388875	500	980088	1437.485	272.1	682	$144	$98,009	55%	72%	226,038	63	$75,405	$22,604
PWD WELL 14A	4/26/2017	39401 20TH ST E, PALMDALE, CA 93550-2167	13175353	250	571392	1144.273	193	499	$114	$57,139	54%	69%	128,283	43	$44,311	$12,828
PWD WELL 2	4/25/2017	PALMDALE, CA 93550-	1683701	400	1102032	1287.596	303	856	$116	$99,183	62%	69%	104,803	29	$89,750	$9,433
PWD WELL 35	5/8/2017	36549 60TH ST E, PALMDALE, CA 93550	3134242	75	209544	1182.649	76	177	$154	$27,241	44%	65%	69,256	25	$18,237	$9,003
PWD WELL 3	4/27/2017	2160 E AVENUE P8, PALMDALE, CA 93551-	4736309	500	853704	1216.719	233	702	$122	$85,370	65%	70%	60,254	16	$79,345	$6,025
PWD WELL 16	5/8/2017	4125 E AVENUE S4, PALMDALE, CA 93552	3134242	40	78168	1307.249	27.2	60	$172	$10,274	36%	61%	32,538	11	$5,997	$4,276
PWD WELL 6	4/26/2017	PALMDALE, CA 93550-	1388901	100	236136	1435.169	80.6	165	$172	$28,336	56%	65%	30,884	11	$24,630	$3,706
PWD WELL 33	5/1/2017	7160 E AVENUE R, PALMDALE, CA 93550	2437025	75	123708	918.2056	82	135	$147	$19,793	50%	65%	29,031	19	$15,148	$4,645
PWD WELL 30	5/1/2017	7392 E AVENUE R LITLERCK, CA 93543	1388891	150	141300	735.1896	70.8	192	$103	$19,782	58%	67%	18,920	9	$17,133	$2,649
PWD WELL 32	4/26/2017	PALMDALE, CA 93550-	7347323	60	101316	788.4958	34.7	128	$103	$13,171	56%	65%	13,418	5	$11,427	$1,744
PWD WELL 23	4/27/2017	2202 E AVENUE P-8, PALMDALE, CA 93551	18788643	250	667848	1168.121	179.6	572	$117	$66,785	69%	70%	12,669	3	$65,518	$1,267
PWD WELL 22	5/8/2017	AVE S/55TH ST E, PALMDALE, CA 93550	600887	75	119076	517.6069	36.6	230	$62	$14,289	61%	65%	7,852	3	$13,347	$942
PWD WELL 29	5/2/2017	PALMDALE, CA 93552-	28881173	40	78024	701.7642	31.4	111	$98	$10,923	58%	62%	4,678	2	$10,269	$655
UNDERGROUND 40	8/4/2017	PALMDALE, CA 93551-	8470783	40	19596	463.5726	30.9	42	$83	$3,527	52%	65%	3,802	6	$2,843	$684
PWD WELL 19	5/9/2017	ROAD, PALMDALE, CA	1388887	7.5	3444	320.9139	6.5	11	$73	$778	43%	50%	470	1	$672	$106
PWD WELL 18	5/9/2017	ROAD, PALMDALE, CA	1388887	3	1332	199.7554	3.2	7	$45	$301	35%	47%	336	1	$225	$76
PWD WELL 8	4/27/2017	2200 E AVENUE P, PALMDALE, CA 93551-	1388874	600	919992	1104.406	387.6	833	$99	$82,799	70%					
PWD WELL 26	5/1/2017	PALMDALE, CA 93552-	4955413	50	73488	711.6286	45.6	103	$107	$11,023	62%					
PWD WELL 25	5/2/2017	37520 70TH ST E, PALMDALE, CA 93550	14349879	75	114744	683.8848	68	168	$103	$17,212	68%					
PWD WELL 21	5/2/2017	36525 N 52NDSTE, PALMDALE, CA 93550	17439425	30	94860	672.7769	33.2	141	$79	$11,098	66%					
												Totals:	743,232			$80,644

In Asset Management, Deferred Maintenance is?

- Reactive maintenance,
  - > Is a Component failure which Leads to Multiple Component failures.



Failed Pump Coupling ↑

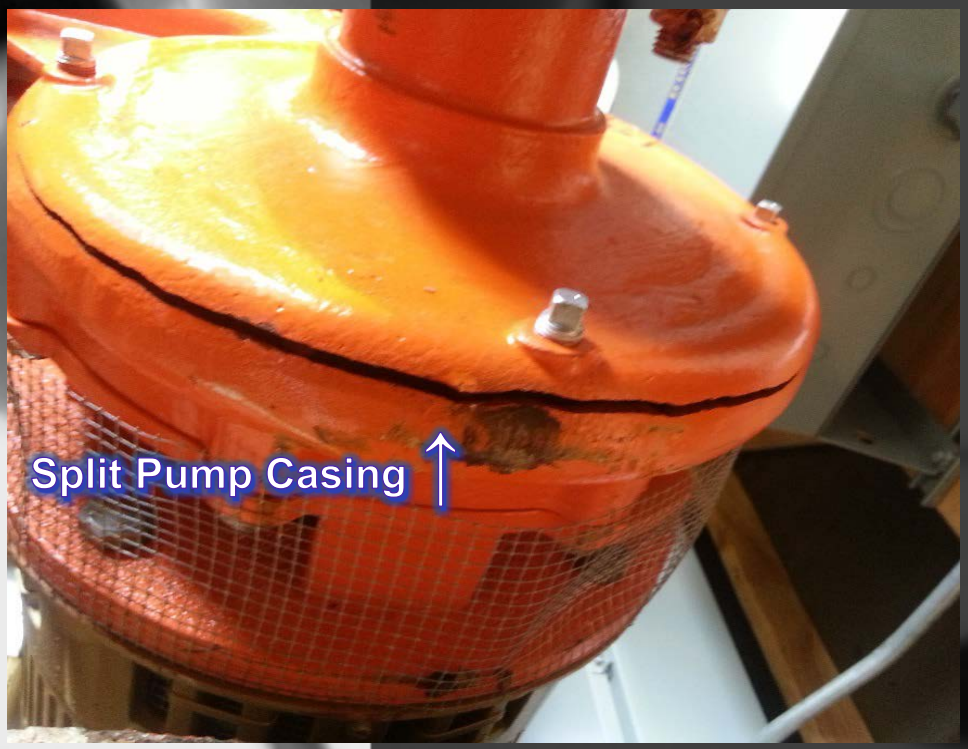


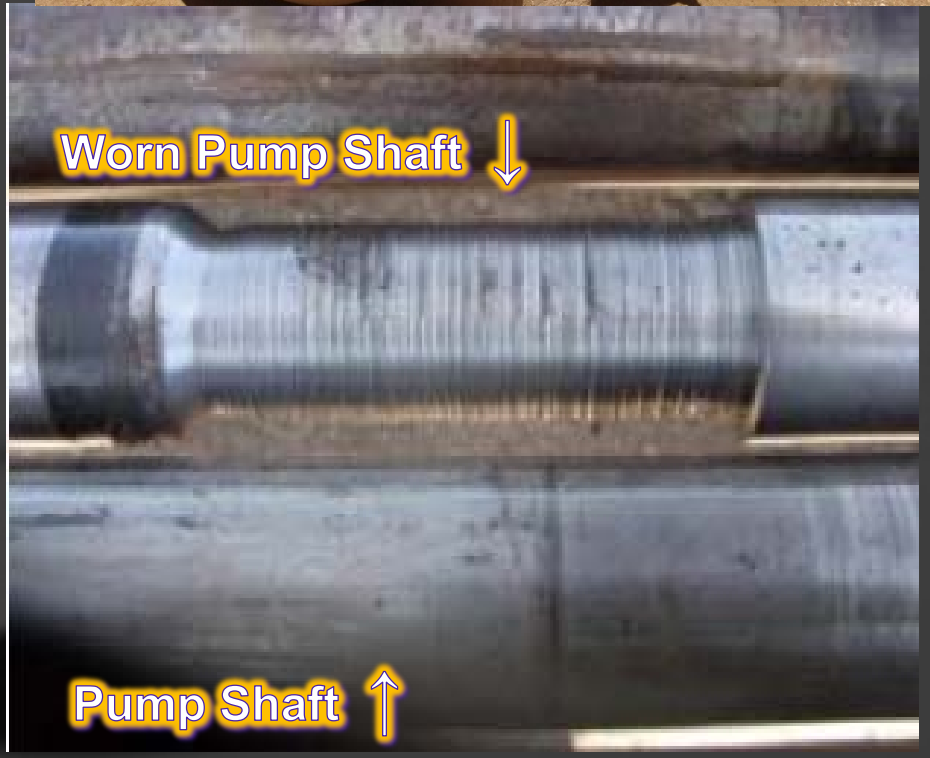
Plugged Well Casing Screen

Plugged Well Casing Screen

↑ Failed Motor Soft Start

Other Deferred Maintenance Issues are;





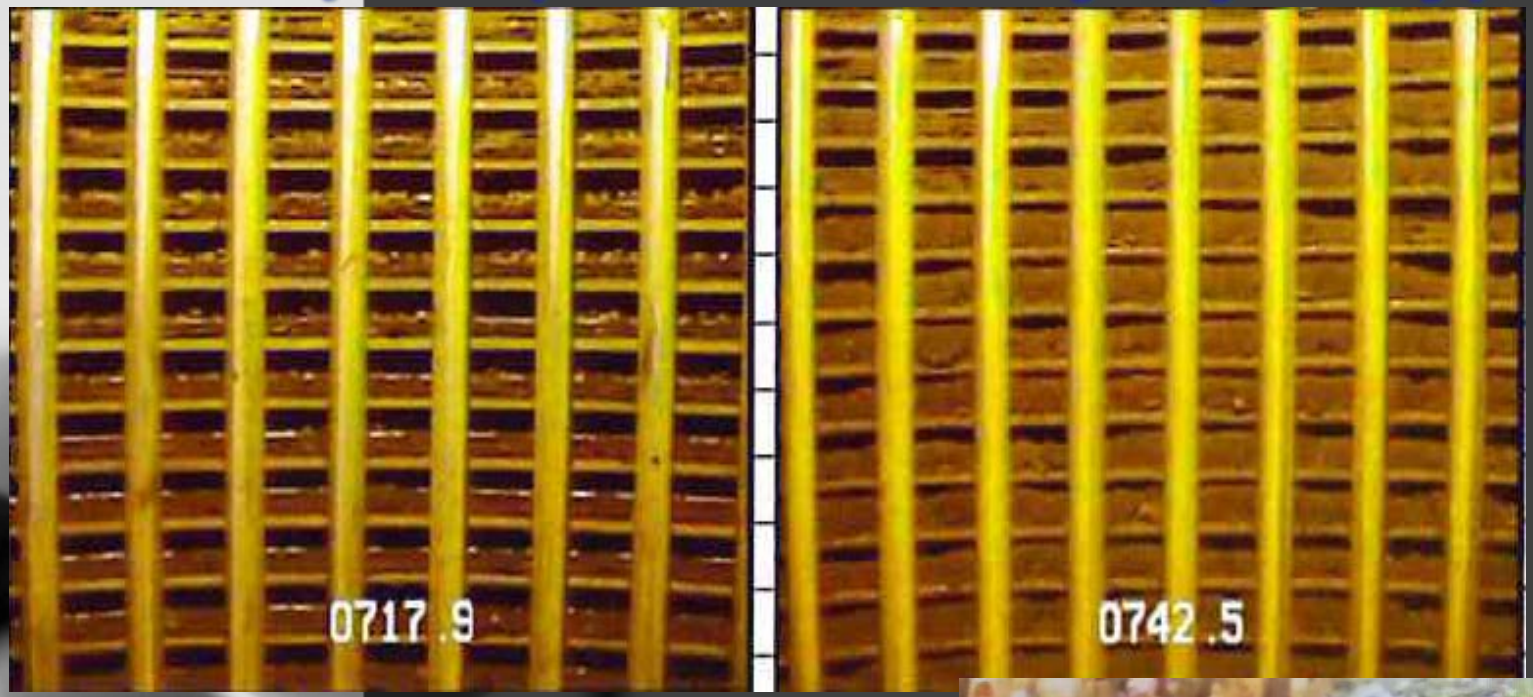
Horizontal Split Case Pump

Split Case Pump Impeller (New)

Split Case Pump Impeller (Run to Fail)

When it's run to fail, the complete Pump needs replacing.

Well Screens, clean ↓ After a 7 year cycle / dirty ↓



And RUN – TO – FAIL →

System weaknesses exist.

And we have a plan to address them!

What is Life Cycle Cost Analysis (LCCA)?

- The LCCA is a basic formula for calculating life cycle costs.
- It helps managers and board members prioritize asset investments.
- Prioritizes the needs of the district by using a Cost/Benefit look of its initial costs and the potential benefit to the organization.
- ✓ Such as downtime reduction, maintenance utilization, and proactive maintenance hours versus reactive maintenance hours.

The Life cycle formula is,

(I) + (Repl) – (Res) + (L) + (O/M & R) = LCC

The initial cost of the unit (I) +

The replacement cost of the unit (Repl) –

The resale or residual value of the unit (Res) +

The desired useful life in years (L) +

The operating & maintenance costs or repairs (O/M & R)

= Life Cycle Costs (LCC)

In reality, what matters are the systems in place and the strategies to properly support the systems. If managers do not clearly define these strategies, all technology will do is speed up their mistakes.

-Andrew Gager, CMRP, CPIM, Director of the Marshall Institute.
Author of the LCCA formula.

Life Cycle Cost Analysis

- Helps project a 6 year snapshot of the districts assets and of the facility needs for operations and maintenance.
- It also helps make informed investments decisions that drive budget distribution.

The LCCA spreadsheets also has data for Deferred Maintenance (DM).

The deferred maintenance formula is,

5(L+M) X 3(G+O+P) X C X D = DM

05/30/08

Department of the Interior

Policy on Deferred Maintenance, Current Replacement Value and Facility Condition Index in Life-Cycle Cost Management

Item	DM Project or CRV Costs ≤ $1,000,000	DM Project or CRV Costs > $1,000,000
General Requirements (G)	15%	10%
Overhead (O)	15%	10%
Profit (P)	10%	10%
Design Fee (D)	15%	10%
Estimating Contingency (C)	20%	15%

CRV Estimate (CRV) Calculated As:
In the below formula, the capital letters correspond to the items in the above table. The percentages shown in the table should be summed and used as decimals.
CRV is the sum of the following items:

(Labor + Materials) multiplied by LAF (local adjustment factor)
+ (Labor + Materials) multiplied by (G+O+P)
+ {(Labor + Materials) + (Labor + Materials) multiplied by (G+O+P)} multiplied by C
+ {(Labor + Materials) + (Labor + Materials) multiplied by (G+O+P)} multiplied by D

= CRV Estimate Total

Note that the same equation is used to create a DM estimate.

Deferred Maintenance formula is courtesy of The Department of Interior.

The LCCA spreadsheets data is a calculation of,

Asset & Rate Type	Edison Feed / Transformer Incoming Voltage / Impendence / Outgoing Voltage / Size				Estimated Costs (Replacement)	Deferred Costs	Motor Control Center (MCC)	Motor Starters	Estimated Costs Replacement	Estimated Costs Repairs	Deferred Costs	Automatic Switch Gear	Estimated Costs Replacement	Estimated Costs Repair	Deferred Costs
Well No. 2A / TOU-PA-SOP-1-I	12KV	1.4	277 / 480 / 3PH	500KVA PDMNT	$35,000.00	$120,575.00	Power Control Inc. (PCI)	Allen Bradley - Soft Start	$23,000.00	$13,000.00	$44,785.00	Murphy Panel	$8,500.00	$4,500.00	$15,502.50
Well No. 2A / GS-1	12KV	1	120 / 240/ 1PH	25KVA PDMNT	$12,000.00	$41,340.00	Westinghouse	Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 3A / TOU-PA-SOP-1-I	12KV	1.4	277 / 480 / 3PH	500KVA PDMNT	$35,000.00	$120,575.00	Power Control Inc. (PCI)	Westinghouse Soft Start	$23,000.00	$13,000.00	$44,785.00	Asco ATS 800 Amp / 480 V 3 PH	$12,000.00	$4,500.00	$15,502.50
Well No. 4A / TOU-PA-SOP-1-I	12KV	1.1	277 / 480 / 3PH	300KVA PDMNT	$25,000.00	$86,125.00	Westinghouse	Soft Start	$23,000.00	$13,000.00	$44,785.00		$0.00	$0.00	$0.00
Well No. 4A / GS1	12KV	1	120 / 240/ 1PH	10KVA OH	$4,600.00	$15,847.00	Westinghouse	Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 5 / PA-2	12KV	1.1	277 / 480 / 3PH	3-75KVA OH BANK	$18,000.00	$62,010.00	Square D	Across the line starter	$12,000.00	$2,500.00	$8,612.50		$0.00	$0.00	$0.00
Well No. 6A / PA-2	12KV	1.1	277 / 480 / 3PH	3-75KVA OH BANK	$18,000.00	$62,010.00	Square D	Soft Start	$23,000.00	$13,000.00	$44,785.00		$0.00	$0.00	$0.00
Well No. 7A / TOU-PA-SOP-1-I	12KV	1.4	277 / 480 / 3PH	500KVA PDMNT	$35,000.00	$120,575.00	Square D	Soft Start	$23,000.00	$13,000.00	$44,785.00	Asco ATS 800 Amp / 480 V 3 PH	$12,000.00	$4,500.00	$15,502.50
Well No. 7A / GS-1	12KV	1	120 / 240/ 1PH	10KVA OH	$4,600.00	$15,847.00		Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 8A / TOU-PA-SOP-1-I	12KV	5.5	4160/2.4X12.Y/7.	750KVA PDMNT	$40,000.00	$137,800.00	Square D	Toshiba - Soft Start	$43,000.00	$21,000.00	$72,345.00		$0.00	$0.00	$0.00
Well No. 8A / GS-1	12KV	5.5	120 / 240 / 1PH	750KVA PDMNT	$0.00	$0.00		Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 10 / TOU-PA-SOP-1-I	12KV	1.1	277 / 480 / 3PH	3-50KVA OH BANK	$16,000.00	$55,120.00	Square D	Soft Start	$12,000.00	$2,500.00	$8,612.50		$0.00	$0.00	$0.00
Well No. 11A /GS-1	12KV	1	120 / 240/ 1PH	10KVA OH	$4,600.00	$15,847.00		Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 14A / TOU-PA-SOP-1-I	12KV	1.1	480 / 3PH / 3W	3-100KVA OH BANK	$19,000.00	$65,455.00	General Electric	Soft Start	$23,000.00	$13,000.00	$44,785.00	Asco ATS 800 Amp / 480 V 3 PH	$12,000.00	$4,500.00	$15,502.50
Well No. 15 / GS-1	12KV	1	120 / 240/ 1PH	15KVA OH	$6,600.00	$22,737.00		Knife Switch	$2,300.00	$1,300.00	$4,478.50		$0.00	$0.00	$0.00
Well No. 16 / TOU-PA-B	12KV	1.1	480 / 3PH / 3W	3-15KVA OH BANK	$6,600.00	$22,737.00	Square D	Across the line starter	$12,000.00	$2,500.00	$8,612.50		$0.00	$0.00	$0.00

Well Nc

	Replacement	*Repair*	*Deferred*	*Life Cycle Costs*
Overall Electrical components total costs;	*$1,845,200.00*	*$567,900.00*	*$3,741,959.00*	*$3,261,790.95*
Overall Electrical components costs per year;	*$307,533.33*	*$366,074.24*	*$623,659.83*	*$709,736.82*

	Replacement	*Repairs*	*Deferred*	*Life Cycle Costs*	
Combined Totals of Elect., Mech., Struct. & Civil;	*$5,447,534.58*	*$996,620.00*	*$6,160,710.48*	*$10,645,208.96*	*<<<<<< Total Costs*
Combined Totals of Elect., Mech., Struct. & Civil;	*$907,922.43*	*$436,027.58*	*$1,026,785.08*	*$1,940,306.49*	*<<<<<< Costs Per Year*
					(All Pages Combined)

Scheduled Rehabilitations Per Year

Current Schedule >	*2017 (or before)*	*2018*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*2025*
(Total Costs) >	*$460,000.00*	*$320,000.00*	*$0.00*	*$330,000.00*	*$175,000.00*	*$380,000.00*	*$0.00*	*$215,000.00*	*$485,000.00*
Wells >	*7, 16, 29, 33, 35*	*2, 6, 22*	*0*	*3, 23*	*19, 21, 32*	*11, 14*	*0*	*25, 26, 30*	*8, 10, 15, 18*
Wells >	*2, 7, 29, 35*		*3, 6, 16, 33*	*14, 19, 23*	*11, 21, 32*	*15, 22, 25*	*8, 10, 26*	*7, 29, 30,*	*2, 18, 35*
(Total Costs) >	*$500,000.00*		*$395,000.00*	*$375,000.00*	*$330,000.00*	*$330,000.00*	*$310,000.00*	*$320,000.00*	*$295,000.00*
New Schedule >	*Preliminary Cycle Start*		*<<*			*6 to 7 Year Cycle*			*>>*
	(2017 to 2018)		*$330,000.00*			*$336,428.67*	*< Yearly Average*		*$360,000.00*
			↑ If Well 16 is moved to 2025 after this rehab.						*↑ with Well 16 added.*

Actual purchase prices of equipment.

Competitive bid pricing (averaged)

Years of useful service

Repair costs (averaged)