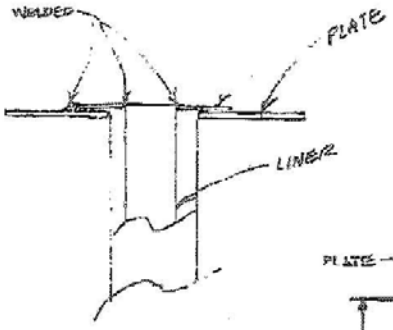
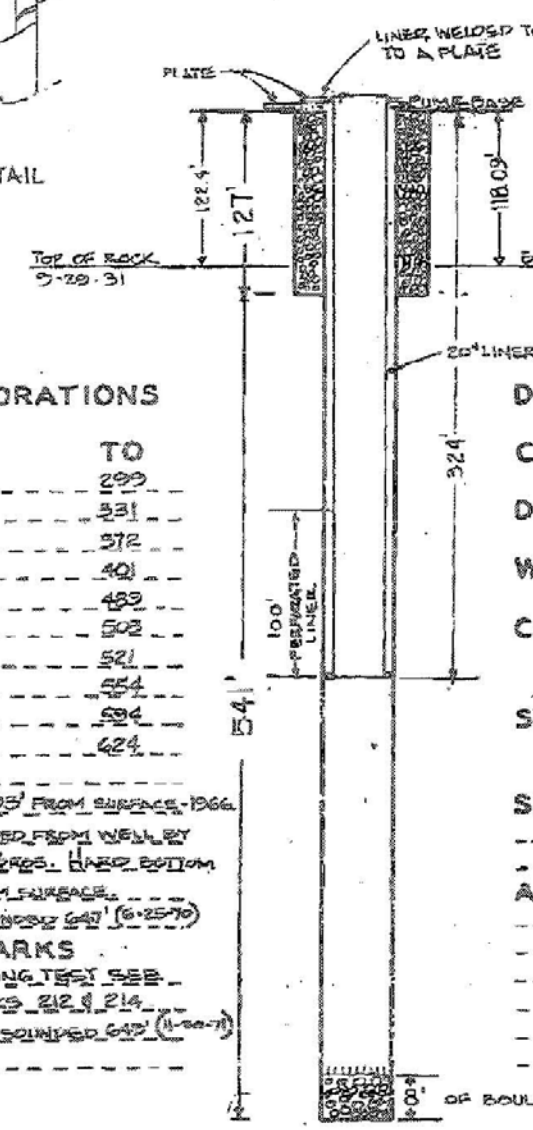
APPENDIX A
Production Well Boring Logs

PASADENA WATER DEPARTMENT
WELL ARROYO NO. 25



LINER DETAIL



324' OF NEW 20" LINER INSTALLED 10/75. BOTTOM 100 FEET PERFORATED.

CASING EXTENDED AND SHAFT FILLED WITH GRAVEL - 1967. WELL LINED - 10/75.

8' OF BOULDERS ADDED WHEN WELL WAS DRILLED.

PERFORATIONS

FROM	TO
127	299
306	331
367	372
398	401
457	489
498	502
505	521
538	554
568	594
598	624

SAND @ 595' FROM SURFACE - 1966.
SAND REMOVED FROM WELL BY SAUNDERS BROS. HARD BOTTOM @ 658' FROM SURFACE.
BOTTOM SOUNDED 647' (6-25-70)

REMARKS

FOR PUMPING TEST SEE FIELD BOOKS 212 & 214
BOTTOM SOUNDED 647' (11-20-71)

WELL

DRILLED BY Roscoe Moss Co.

CONTRACT NO. Inc. 63

DATE August 1930

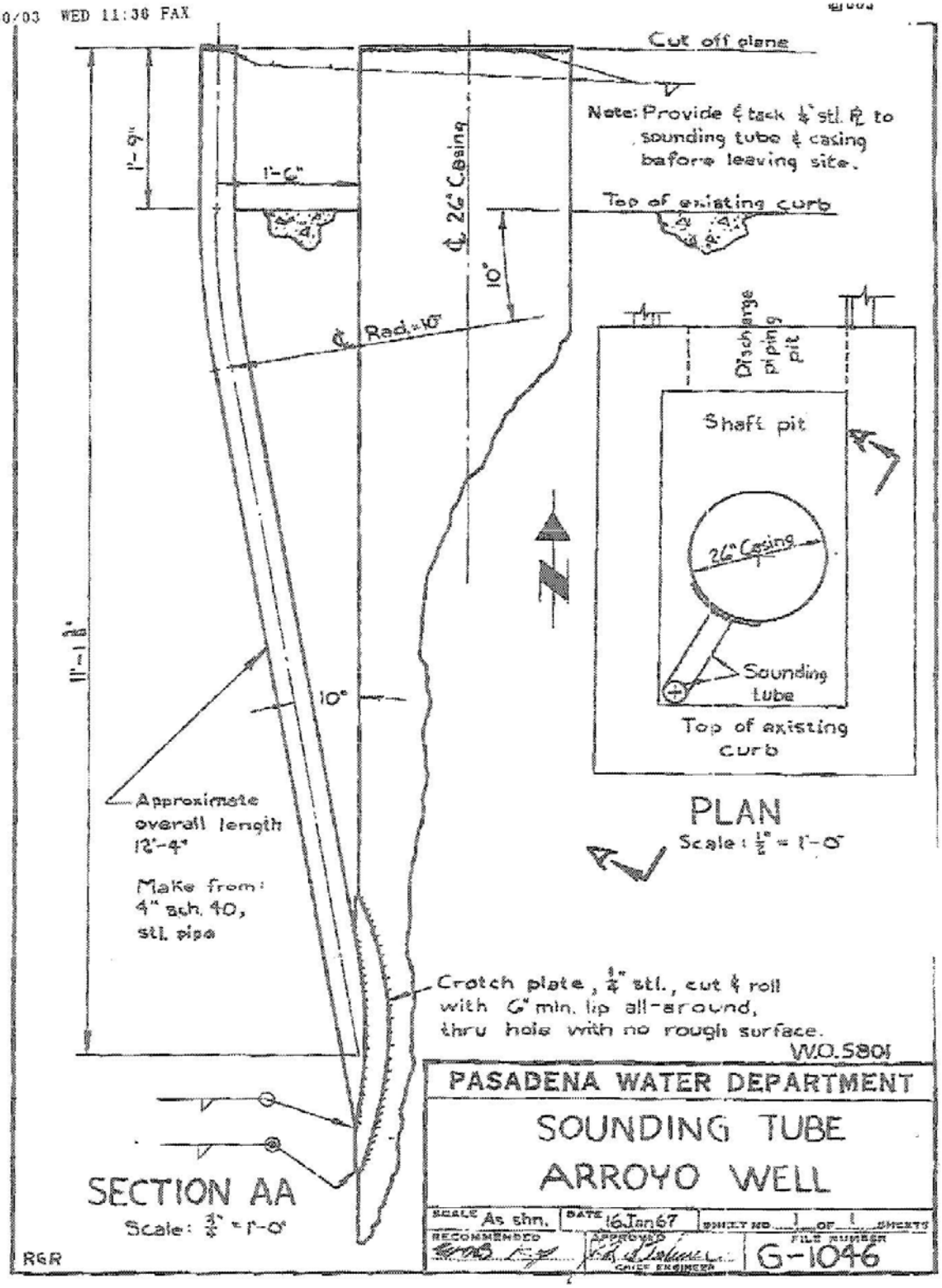
WORK ORDER 2511

CASING 26 IN NO. 8 GUAGE

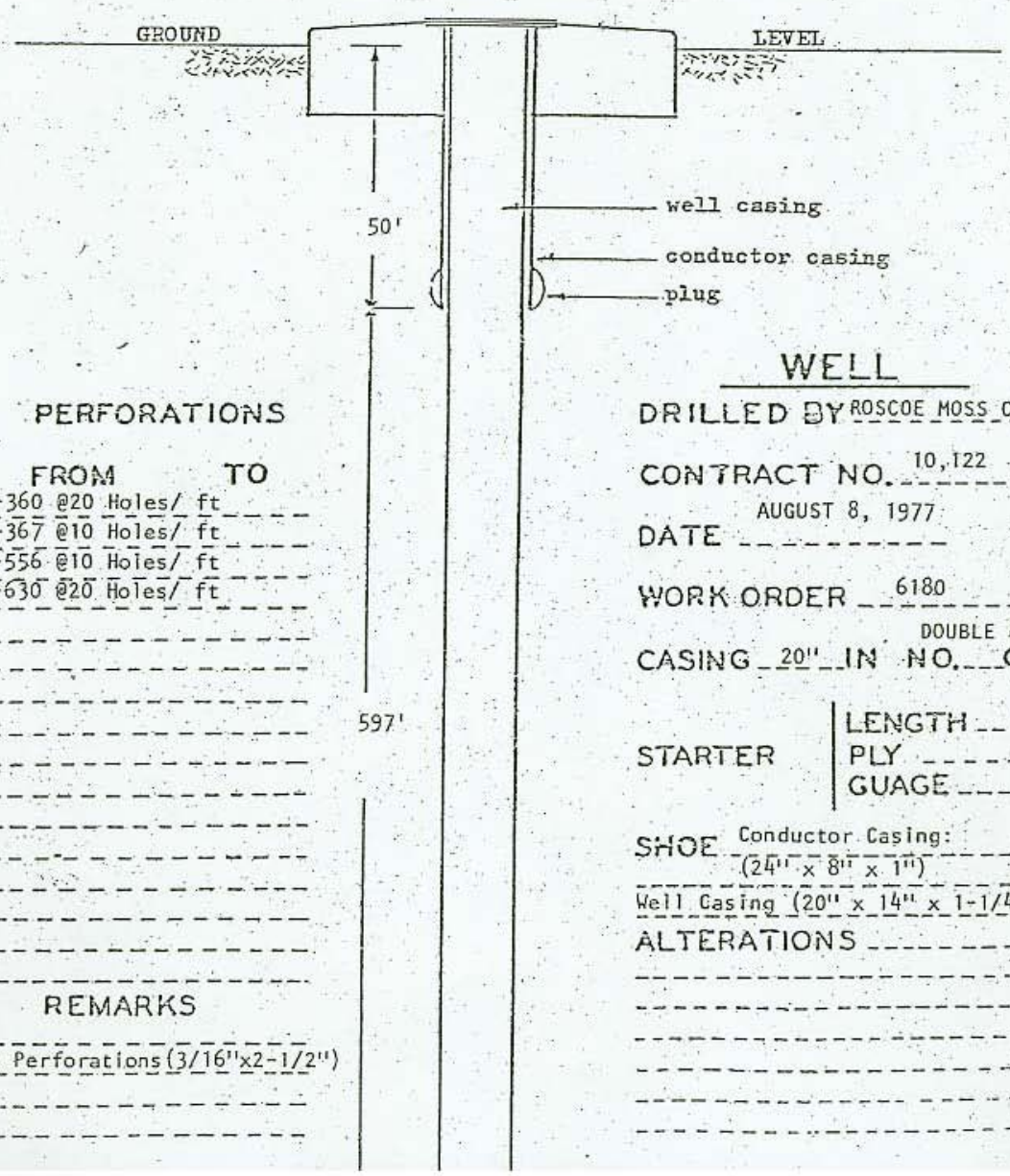
STARTER | LENGTH 30' | PLY 4 | GUAGE 8

SHOE 26" X [illegible]"

ALTERATIONS


Cut off plane
Note: Provide & tack ½" stl. PL to sounding tube & casing before leaving site.
Top of existing curb
1'-9"
1'-6"
℄ 26" Casing
10°
℄ Rad. = 10'
11'-1½"
10°
Approximate overall length 12'-4"
Make from: 4" sch. 40, stl. pipe
Discharge piping pit
Shaft pit
26" Casing
Sounding tube
Top of existing curb
PLAN
Scale: ½" = 1'-0"
Crotch plate, ¼" stl., cut & roll with 6" min. lip all-around, thru hole with no rough surface.
W.O. 5801
PASADENA WATER DEPARTMENT
SOUNDING TUBE
ARROYO WELL
SCALE As shn.
DATE 16 Jan 67
SHEET NO. 1 OF 1 SHEETS
RECOMMENDED
APPROVED
CHIEF ENGINEER
FILE NUMBER
G-1046
SECTION AA
Scale: ¾" = 1'-0"
RGR

PASADENA WATER DEPARTMENT
WELL NO. 52



PERFORATIONS

FROM	TO
250-360 @20 Holes/ ft	
360-367 @10 Holes/ ft	
372-556 @10 Holes/ ft	
556-630 @20 Holes/ ft	

REMARKS

Size Perforations (3/16"x2-1/2")

WELL

DRILLED BY ROSCOE MOSS COMPANY

CONTRACT NO. 10,122

DATE AUGUST 8, 1977

WORK ORDER 6180

CASING 20" IN DOUBLE 8 NO. GUAGE

STARTER
- LENGTH 23'
- PLY 3
- GUAGE 8'

SHOE Conductor Casing: (24" x 8" x 1")

Well Casing (20" x 14" x 1-1/4")

ALTERATIONS

PASADENA WATER DIVISION

WELL VENTURA NO. 21

Depth to Sand

Date	Depth
11/65	426
11/66	429
3/71	419
7/71	424
12/71	473

Floor Level

473'

PERFORATIONS

FROM	TO
102	141
164	218
241	311
410	468

REMARKS

(1) Casing looks bigger than double 8

WELL

DRILLED BY Roscoe Moss Co.

CONTRACT NO. 1034

DATE 4/25/1924

WORK ORDER 1390

CASING 26 IN NO. 8 (1) GUAGE

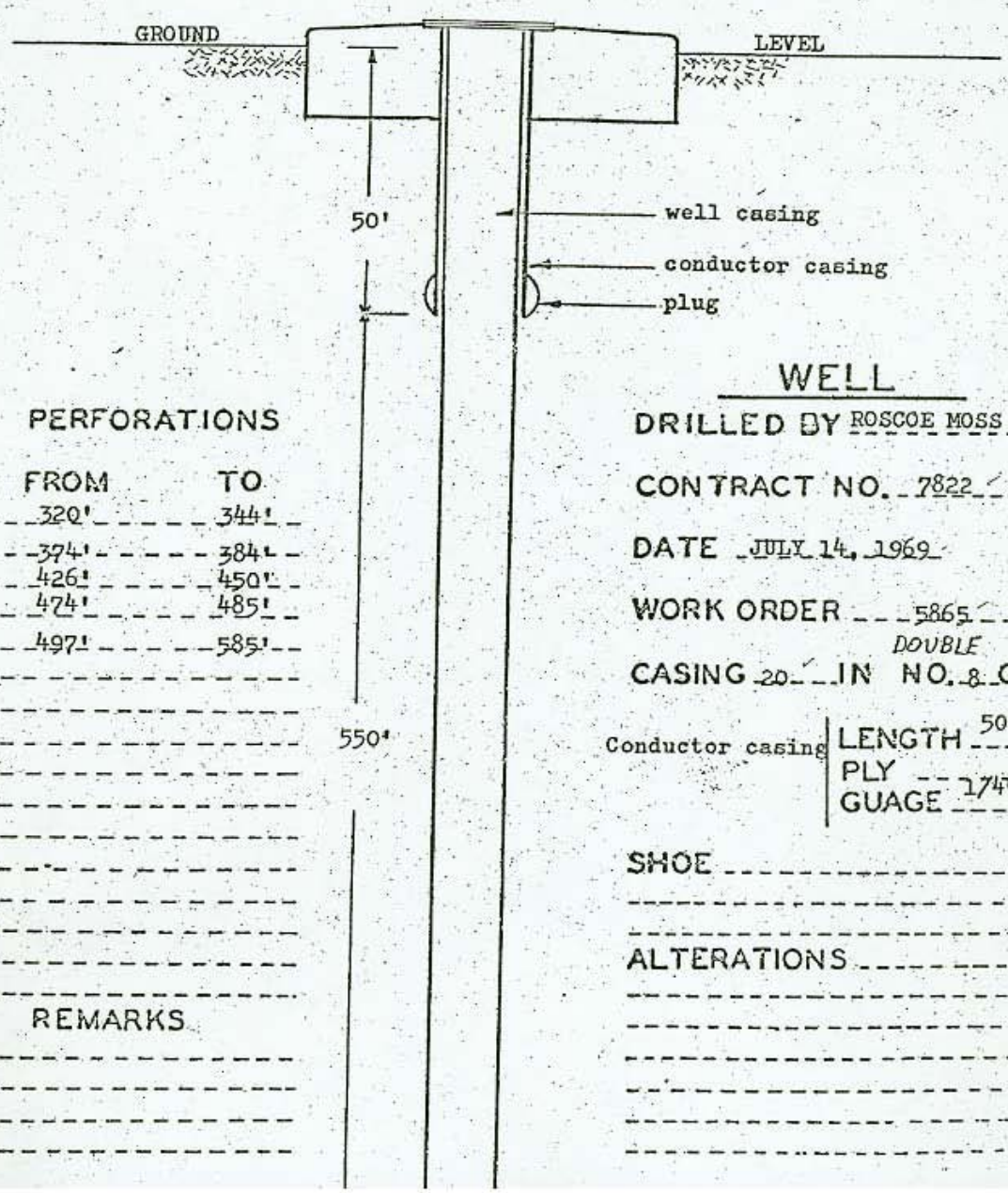
STARTER: LENGTH 30' PLY Double 1/4" GUAGE

SHOE 26" x 12" x 1 1/2"

ALTERATIONS

PASADENA WATER DEPARTMENT

WELL WINDSOR NO. 48



PERFORATIONS

FROM	TO
320'	344'
374'	384'
426'	450'
474'	485'
497'	585'

REMARKS

WELL

DRILLED BY ROSCOE MOSS CO.

CONTRACT NO. 7822

DATE JULY 14, 1969

WORK ORDER 5865

CASING 20" IN DOUBLE NO. 8 GUAGE

Conductor casing
LENGTH 50'
PLY
GUAGE 174"

SHOE

ALTERATIONS

APPENDIX B
Windsor Well Layout Evaluation

Technical Memorandum

Evaluation for Operating Scenarios for the Windsor Well, City of Pasadena Monk Hill Treatment System

National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California

Draft April 2008

INTRODUCTION

This technical memorandum provides a cost analysis for two potential operating scenarios associated with the Windsor Well. The Windsor Well, located on the Windsor Reservoir site, is one of four existing production wells that would supply water to the proposed City of Pasadena Monk Hill Treatment System (MHTS), which is currently in the design and permitting stage. The proposed MHTS would remove volatile organic compounds (VOCs) and perchlorate from groundwater extracted from the production wells[1] and would be implemented as a remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program at the National Aeronautics and Space Administration's (NASA's) Jet Propulsion Laboratory (JPL).

The initial design utilizes the existing pipeline, which directs extracted groundwater from the Windsor Well downhill to the former air stripping system sump. At the sump, groundwater from Windsor Well would be combined with groundwater extracted from three other wells and pumped back uphill to the MHTS. An analysis was performed to evaluate whether it would be more cost-effective to pump groundwater from the Windsor Well directly to the MHTS.

SUMMARY OF RECOMMENDATIONS AND CONCLUSIONS

Based on the cost analysis documented in this technical memorandum, *it is recommended that the initial MHTS design be modified so that Windsor Well pumps directly to the treatment system*. While additional capital costs (as much as $327,000) may be incurred with this approach, power savings would result in an estimated payback timeframe of 4 to 7 years.

CAPITAL COST EVALUATION OF WINDSOR WELL SCENARIOS

Windsor Well is located adjacent to the Windsor Reservoir. Figure 1 shows the locations of the production wells, sump and booster pumps, proposed MHTS location, and the Windsor Reservoir. The initial design involves pumping 1,400 gallons per minute (gpm) of water from Windsor Well through the existing pipeline to the sump, located 1,500 feet away and at an elevation of approximately 75 feet lower. Three booster pumps sized at 350 horsepower each are included in the initial design to pump water through the MHTS and into the Windsor Reservoir. The estimated booster pump station capital cost is $1,359,300.

If groundwater from Windsor Well is pumped directly to the MHTS, bypassing the sump, the maximum flow rate requirement of the booster pumps would be reduced from 7,000 gpm to 5,600 gpm. In this case, 300 horsepower booster pumps would be required instead of 350 horsepower, and there would be less friction loss in the 16-inch pipe (pipe efficiency improves from 71% to 80% under maximum flow conditions) resulting in a significant decrease in the energy demand of the booster pumps. However, under this scenario, a larger pump would be required at the Windsor Well and possibly a unit to remove particulates from the groundwater. The estimated capital cost for installing a new well pump in Windsor Well, and three smaller (300 horsepower) booster pumps is $1,686,300.

[1] NASA. 2007. *Final Interim Record of Decision for Operable Unit 3, Off-Facility Groundwater*. National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, CA. August.

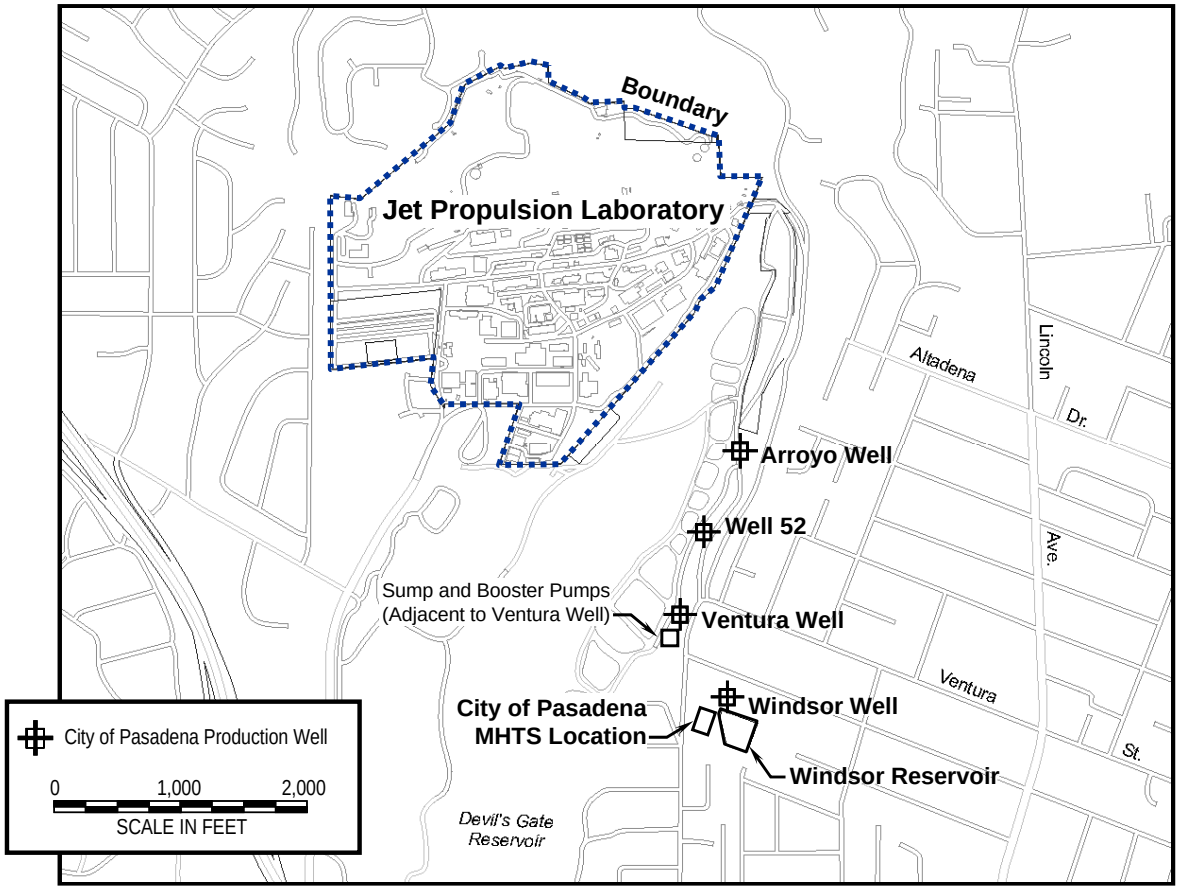


Figure 1. Map Depicting the Location of the Windsor Reservoir, the City of Pasadena Production Wells, and the Proposed MHTS

Table 1 summarizes the capital costs associated with each scenario. The total capital cost for pumping from Windsor Well directly to the MHTS is approximately $327,000 more than pumping to the sump. This includes a savings of $155,800 associated with installing smaller booster pumps, but an added cost of $482,800 for installing a new pump and desanding equipment for Windsor Well.

The costs provided in Table 1 are believed to represent a conservative estimate of anticipated capital costs associated with pumping Windsor Well directly to the MHTS. Results of well rehabilitation and pump testing activities may indicate that desanding equipment is not needed, which would reduce the estimated capital cost by approximately $34,500.

Table 1. Capital Cost Estimates for Windsor Well Scenarios

Item	Booster Pump Station	Windsor Well Modifications	Total
Windsor Well to Sump			
Structural	$122,700		
Mechanical	$594,200		
Electrical	$642,400		
Subtotal	*$1,359,300*	*$0*	*$1,359,300*
Windsor Well to MHTS			
Site Work		$6,500	
Concrete		$10,500	
Structural	$122,700		
Mechanical	$497,400	$356,900	
Electrical	$583,400	$108,900	
Subtotal	*$1,203,500*	*$482,800*	*$1,686,300*

OPERATING COST EVALUATION OF WINDSOR WELL SCENARIOS

Two potential operating schedules have been proposed for the MHTS. The first schedule includes continuous operation of all four production wells, including Windsor Well, for six months per year. The second operation schedule includes year-round operation of the MHTS, with Windsor Well only operating from July through September, or three months per year.

Power costs were estimated for each operating schedule under both Windsor Well scenarios. Pasadena Water and Power (PWP) has published rate schedules (tariffs) for various classes of customers. The booster pumps near Ventura Well would be subject to PWP's large commercial and industrial (C&I) rate schedule L-1 and the Windsor Well would be subject to PWP's medium C&I rate schedule M-1 (see Table 2). Table 3 summarizes the estimated energy costs for both operating schedules, as well as the estimated annual savings realized by pumping the Windsor Well directly to the MHTS.

Table 2. PWP Rates (effective October 1, 2007) for Three-Phase General Service (Schedule L-1 and M-1)[2]

Charge	Rate for Schedule L-1 (Booster Pumps)	Rate for Schedule M-1 (Windsor Well)
Customer/Meter Charge ($/Month)	$160.21	$60.22
Distribution Charge ($/kW)	$10.07	$10.07
Transmission Charge[(a)] ($/kWh)	$0.00802	$0.00802
Energy Service Charge ($/kWh)		
Summer Peak[(b)] (Noon to 8PM)	$0.10394	$0.10218
Summer Off-Peak[(b)] (8PM to Noon)	$0.05843	$0.06063
Winter Peak[(c)] (6AM to 10PM)	$0.06579	$0.06578
Winter Off-Peak[(c)] (10PM to 6AM)	$0.05659	$0.05785
Power Cost Adjustment	$0.01000	$0.01000
Public Benefit Charge[(d)]	$0.00830	$0.00830

Note: Customers that run electric motors exceeding 50 horsepower can be subjected to special provisions at the demand of PWP. The minimum monthly charges for schedule L-1 and M-1 are $3,181.21 and $362.32, respectively.

(a) The transmission charge is calculated by PWP on a quarterly basis (see §13.04.170 of the Light and Power Rate Ordinance).
(b) Summer months are defined as June through September. Weekend and holiday hours are all off-peak.
(c) Winter months are defined as October through May. Weekend and holiday hours are all off-peak.
(d) Other taxes, including the State Environmental Charge, Utility Users Tax, Streetlights and Traffic Signals Tax, and Underground Surtax, do not apply to PWP systems.

Table 3. Estimated Annual Energy Costs Associated with the Windsor Well Scenarios

Description	Schedule 1[(a)] Annual Cost	Schedule 2[(b)] Annual Cost
Booster Pumps, Including Windsor Well[(c)]	$334,326	$280,897
Booster Pumps, Excluding Windsor Well[(d)]	$230,451	$211,960
Windsor Well, Pumping to Sump	$50,102	$33,468
Windsor Well, Pumping to MHTS	$78,659	$52,405
Power Cost Paid by NASA, With Windsor Pumping to Sump	$334,326	$280,897
Power Cost Paid by NASA, With Windsor Pumping to MHTS[(e)]	$259,007	$230,897
Estimated Annual Cost Savings, With Windsor Pumping to MHTS	**$75,319**	**$50,000**

(a) Scenario 1 includes all four wells operating for 6 months per year (May through October).
(b) Scenario 2 includes year-round operation of the MHTS, with all four wells operating from July to September, Arroyo Well operating from October to April, and Well 52 operating May to June.
(c) Power cost includes operation of two, 350 horsepower booster pumps.
(d) Power cost includes operation of two, 300 horsepower booster pumps.
(e) Power Cost Paid by NASA = [Booster Pumps, Excluding Windsor Well] + [Windsor Well, Pumping to MHTS] – [Windsor Well, Pumping to Sump].

[2] Pasadena Water and Power. 2006. Light and Power Rate Ordinance (In Accordance with Chapter 13.04 of the Pasadena Municipal Code). Revised July 1.

Under the existing agreement between NASA and the City of Pasadena,[3] NASA would pay for energy costs associated with the booster pumps, site lighting, security, and feed pumps. The City of Pasadena would pay for the energy costs associated with the production well pumps. However, as reflected in Table 3, for the operating scenario where Windsor Well pumps directly to the MHTS, it was assumed that NASA would pay the incremental energy costs associated with running the larger well pump needed for Windsor Well.

Under the year-round operating schedule, the total annual power cost to be paid by NASA when Windsor Well pumps to the sump would be $280,897 and $230,897 when Windsor Well pumps directly to the MHTS. Therefore, an annual savings of approximately $50,000 would be realized by Windsor Well pumping directly to the sump. Assuming simple payback (i.e., capital investment ÷ annual savings), the payback period for the additional $327,000 in capital costs associated with pumping the Windsor Well to the MHTS would be approximately 6.5 years. Under the six month operating schedule, the total annual power cost savings would be approximately $75,319 and the payback period would be 4.3 years.

It is estimated that the MHTS will be operational for at least 10 years. Therefore, it is recommended that the MHTS design be modified so that Windsor Well pumps directly to the treatment system.

[3] NASA. 2006. Monk Hill Treatment System Agreement. Parties to the agreement are the City of Pasadena and the California Institute of Technology (Caltech). The agreement is available on the JPL CERCLA Program Web site: http://jplwater.nasa.gov/NMOWeb/AdminRecord/docs/NAS710386.PDF. January.

APPENDIX C
Pipeline Inspection and Testing Report

General Civil, Municipal, Water and Wastewater Engineering, Planning,
Construction Management and Surveying
Monrovia Prescott Phoenix Kingman

February 05, 2008

Battelle Institute
Jet Propulsion Laboratory
4800 Oak Grove Drive Building 180, Room 8008
Pasadena, CA 91109

Attention: Carolyn Scala

Subject: Monk Hill Treatment System CCTV Pipeline Investigation-Rev1

Dear Ms Scala:

Background

CIVILTEC engineering, inc. (***Civiltec***) has performed and completed a review of the Closed Circuit Television (CCTV) videos on the Monk Hill Treatment System. The videos were captured in order to assess the condition of the existing pipelines and determine if they will be suitable for continued use. There are six (6) existing pipes a 12-inch Transite, 12-inch Ductile Iron, 12-inch Steel, 16-inch Steel, 24-inch Cast Iron and 30-inch Hume. Overall the pipes are in good condition; however there are a few segments within some of the pipe alignments that will require some attention; please refer to Exhibit A for details on specific sections.

12" Transite Pipe (ACP)

This segment of pipe extends approximately 163' from the intersection of Ventura Street and Windsor Ave. The video log (m0101008) indicated that the pipe length was generally in good repair. This pipe serves as the final segment of pipe that connects the Windsor well to the sump located near the Ventura Well. It is recommended to pressure test this segment of pipe per the procedures set forth in the Pressure Testing Work Plan.

12" Ductile Iron Pipe (DIP)

DIP connects the ACP pipe described previously to the Windsor Well. The pipe alignment is generally situated on the eastern side of Windsor Ave, entering the Windsor reservoir site at its north western corner. The pipe is approximately 996' long. Video logs BETTELLE-JPL.mpg, ___071707_1431.mpg, m101009.mpg, and OPEN CUT_UP STRM__120307_1139.mpg signify that the pipe is generally good condition. Video m101009.mpg revealed that a segment of the pipe alignment at Station 46'-00" had become disjointed. PWP confirmed that this condition was normal, due to the transition from PVC to DIP at this location. The remaining portions of pipe appeared to be in good repair and should be pressure tested.

16" Steel Pipe Post Sump

This stretch of 16-inch pipe is in good condition. Video logs for this pipe are as follows; MPEG_A_11012007_2_6i, MPEG_A_11012007_1154_4_13i, 16inNORTH_OPEN TRENCH__072007_1002, 16inSOUTH_OPEN TRENCH__072007_1008, SOUTH 730' FROM WELL 52 and ___071707_1006. The pipe extends from the sand box of the Windsor reservoir approximately 1,175' to the sump located adjacent to the Ventura well.

A portion of this pipe will be utilized as the main feed to the monk hill treatment system (MHTS). The remaining portions specifically video segments listed under the following file names will not be utilized.

- 16inSOUTH_OPEN TRENCH__072007_1008,
- ___071707_1006.

This segment of pipe is approximately 215' in length. It is recommended that this pipe segment be capped and abandoned in place in accordance with Pasadena Water and Power (PWP) requirements. Pipe that will serve as the main feed to the MHTS should be pressure tested.

16" Steel & 12" Steel Pipe Pre Sump

These two pipe segments connect the Arroyo well to the far north and Well #52 to the sump located near the Ventura Well. Generally the 12" pipe extends from the Arroyo well to Well #52. The 16" pipe segment combines the flow from both wells and discharges it to the sump. The entire length of pipe is approximately 1486' long. Of that length approximately 1,136' was video logged. Video logs for this pipe are named as follows;

- open_cut_south__071207_1025,
- north_cont__071207_1164,
- north_after_wash__071207_1142,
- 16ineast,
- 16inwest,
- jpl.
- North Slope (01)
- North Slope (02)

Pipe segments represented in files 16inwest and jpl are in very poor condition and will need to be replaced. This constitutes approximately 42' of 12" pipe. The remaining portions of pipe appear to be in good repair. This pipe will direct flow from the Arroyo well and Well # 52 to the sump. As this pipe does not show severe signs of deterioration, considering its low pressure operation, and relative proximity of use (5 years ago) it is recommended that pipe operation be monitored. Subsequent video analysis performed on these pipe segments will detail whether additional measured need to be taken on this pipe.

30" Hume Line

A segment of the existing 30" hume line extends from the sand box of the Windsor Reservoir to the Arroyo well. The alignment of the pipe generally follows Windsor Avenue down the access road to the JPL east campus parking lot. The line will ultimately be modified to discharge water

from the MHTS to spreading basin no. 5. The pipe generally is in good repair and it is expected that the pipe will operate under low pressure or gravity conditions. The pipe segment being analyzed for use in conjunction with the MHTS is approximately 2,504' in length. Approximately 2080' of this pipe was video logged. The file names of the video segments of this pipe are as follows:

- UP STRM STAT_DWN STRM STA__111307_0758,
- ___071707_1250.

The videos did not indicate serious pipe problems. It is recommended that the pipe be monitored during operation.

24" Cast Iron

The cast iron lines were generally observed to be in poor condition. It is recommended that these lines be pressure tested.

Conclusion

Please contact Mr. Shem Hawes if you should have any question at (626) 357-0588 or by way of e-mail at shawes@civiltec.com.

Very truly yours,

CIVILTEC engineering, inc.

C. Shem Hawes, P.E.
Project Manager

Battelle Institute
Carolyn Scala
Monk Hill Treatment System CCTV Pipeline Investigation
January 25, 2007
Exhibit A

Exhibit A

File Name	Pipe Material	Pipe Size (in)	Start Station ID	End Station ID	Start Station/Time	End Station/Time	Pipe Station/Time	Pipe Station Comments	Recommendations
MPEG_A_11012007_2_6i	STL	16	C	D	0'-00"	465'-01"	379'-04"	Coating Defects. No visible Steel.	Pressure test to determine pipe integrity
MPEG_A_11012007_1154_4_13i	STL	16			0'-00"	93'-0"		Video segment does not describe pipe location type or size.	Pressure test to determine pipe integrity
MPEG_A_11012007_0912_1_1i	STL	16	A	B	0'-00"	18'02"	14'04"	Connector Pipe Corroded	Pressure test to determine pipe integrity
MPEG_A_11012007_0912_1_1i	STL	16	A	B	0'-00"	18'02"	12'10"	Concrete lining chipped at certain locations	Pressure test to determine pipe integrity
OPENING_EAST__112107_0908	ACP	12			0'-00"	2'-0"		Staging only no video taken	
OPENING_WEST__112107_0859	ACP	12	MH Opening	MH West	0'-00"	27'-09"	13'-09"	Coating Defects.	Pressure test to determine pipe integrity
OPENING_WEST__112107_0859	ACP	12	MH Opening	MH West	0'-00"	27'-09"	27'-01"	Apx 1 foot section extremely deteriorated.	Pressure test to determine pipe integrity
RESEVOIR_BTTRFL VALVE__112107_0753	Cast iron	24	Reservoir	Butterfly	0'-00"	64'-03"		Majority of the pipe has Rust and some deterioration	Pressure test to determine pipe integrity
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	52'-08"	Small Defect at the top of pipe	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	179'-08"	Lateral Pipe Corroded.	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	463'-05"	Fine Roots inside pipe, Approx 30'	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	476'-01"	Large Root throught seal	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	508'-00"	Fine Roots inside pipe	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	534'-00"	Roots Through Seal	Monitor Pipe During operation
UP STRM STAT_DWN STRM STA__111307_0758	Hume	30	Up Stream	Down Stream	5'-05"	1372'-07"	783'-08"	Deformation in Pipe	Monitor Pipe During operation
___071707_0936	Ductile Iron	12	Pump Station	Ukn	0'-00"	330'-01"	329'-05"	Deterioration of Pipe	Pressure test to determine pipe integrity
___071707_1006	STL	16	Pumpstation	Valve	8'-00"	74'-07"	62'-07"	Disfiguration.	Pressure test to determine pipe integrity
___071707_1250	Hume	30	Pumpstation	Ukn	8'-00"	708'-01"	17'-05"	Chunk of Pipe wall missing.	Monitor Pipe During operation
___071707_1250	Hume	30	Pumpstation	Ukn	8'-00"	708'-01"	387'-00"	Pipe Corroded/Deteriorated from beginning to 387'	Monitor Pipe During operation
	Hume	30	Pumpstation	Ukn	8'-00"	708'-01"	400'-5"	Prefabed Stub	Monitor Pipe During operation
___071707_1250	Hume	30	Pumpstation	Ukn	8'-00"	708'-01"		End Due to Plug in Pipe	Plug Has Been Removed
___071707_1431	Ductile Iron	12	Pumpstation	Ukn	10'-00"	331'-03"	330'-02"	Pipe Deteriorated.	Pressure test to determine pipe integrity
16inNORTH_OPEN TRENCH__072007_1002	STL	16	North Open Trench		7'-00"	93'-11"	17'-04"	Disfiguration in Pipe	Abandon pipe segment.
16inNORTH_OPEN TRENCH__072007_1002	STL	16	North Open Trench		7'-00"	93'-11"	23'-11"	Grout Splatter at Joint	Abandon pipe segment.
16inNORTH_OPEN TRENCH__072007_1002	STL	16	North Open Trench		7'-00"	93'-11"	34'-10"	Defect at top of Pipe	Abandon pipe segment.
16inSOUTH_OPEN TRENCH__072007_1008	STL	16	South Open Trench		7'-00"	144'-10"	106'-00"	Begin Crack in top of pipe	Abandon pipe segment.
16inSOUTH_OPEN TRENCH__072007_1008	STL	16	South Open Trench		7'-00"	144'-10"	120'-00"	End Crack in top of pipe	Abandon pipe segment.
24inNORTH_IN BUILDING__072007_1039	Cast Iron	24	North In Building		0'-00"	50'-0""	Total	Pipe Severely Corroded/Deteriorated	Pressure test to determine pipe integrity
12LINE_TOPSIDE__072007_0925	Ukn	12	Top Side		7'-00"	271'-10"		Pipe Integrity looks good.	No Recommendation
16ineast	STL	12	East		5'-00"	43'-00"	39'-00"	Minor corrosion	No Recommendation
16inwest	STL	12	West		0'-00"	34'-00"		Majority of pipe deteriorated	Replace or Abandon entire pipe segment.
jpl	STL	12	Pump Station		0'-00"	8'-00"	Total	Majority of Pipe rusted/deteriorated.	Replace or Abandon entire pipe segment.
m0101004	Ukn	Ukn	0 min	10min	0'-00"	31'-00"	9'-00"	Section of pipe deteriorated	No Recommendations
m0101004	Ukn	Ukn	10min	22min	0'-00"	55'-00"			
m101008		Ukn			0'-00"	153'-00"	26'-00"	Section of pipe (elbow) deteriorated	No recommendations
m101009	ACP	12	Opening Heading East		0'-00"		46'-00"	Uneven Section at Joint, Downstream section appears to have shifted	Typical PVC to DIP Joint

File Name	Pipe Material	Pipe Size (in)	Start Station ID	End Station ID	Start Station/Time	End Station/Time	Pipe Station/Time	Pipe Station Comments	Recommendations
OPEN CUT_UP STRM__120307_1139	DIP	12	Open Cut	Up Strm	0'-00"	193'-02"		Pipe Integrity looks good.	
BETTELLE-JPL	DIP	12			0'-00"	318'-00"		Pipe Integrity looks good.	
north_after_wash__071207_1142	STL	12			0'-00"	92'-06"	17'-00"	Deterioration of the WYE	Monitor Operation
north_after_wash__071207_1143	STL	12			0'-00"	92'-06"	57'-11"	Disfiguration of the Joint. Stub out corroded.	Monitor Operation
north_after_wash__071207_1144	STL	12			0'-00"	92'-06"	83'-02"	Stub out corroded.	Monitor Operation
north_after_wash__071207_1145	STL	12			0'-00"	92'-06"	87'-04"	Deterioration of T-intersection	Monitor Operation
north_cont__071207_1156	STL	12			92'-06"	531'-05"	92'-06"	Corrosion of pipe around valve joints.	Monitor Operation
north_cont__071207_1157	STL	12			92'-06"	531'-05"	132'-08"-140'-11"	Discoloration of pipe.	Monitor Operation
north_cont__071207_1158	STL	12			92'-06"	531'-05"	145'-05"-184'-11"	Discoloration of pipe.	Monitor Operation
north_cont__071207_1159	STL	12			92'-06"	531'-05"	218'-00"-232'-00"	Discoloration of pipe	Monitor Operation
north_cont__071207_1160	STL	12			92'-06"	531'-05"	320'-00"-328'-00"	Discoloration of pipe	Monitor Operation
north_cont__071207_1161	STL	12			92'-06"	531'-05"	343'-10"	Discoloration of pipe	Monitor Operation
north_cont__071207_1162	STL	12			92'-06"	531'-05"	373'-00"-383'-00"	Discoloration of pipe	Monitor Operation
north_cont__071207_1163	STL	12			92'-06"	531'-05"	403'-00"-420'-00"	Discoloration of pipe	Monitor Operation
north_cont__071207_1164	STL	12			92'-06"	531'-05"	426'-00"	Discoloration of pipe	Monitor Operation
open_cut_south__071207_1025	STL	12			0'-00"	605'-05"		Pipe Integrity looks good.	Monitor Operation
North Slope (01)	STL	12			0:00	1:04:45	12:20	Discoloration of Pipe	Monitor Operation
North Slope (01)	STL	12			0:00	1:04:45	19:27	Discoloration of Pipe	Monitor Operation
North Slope (01)	STL	12			0:00	1:04:45	30:47:00	Discoloration of Pipe	Monitor Operation
North Slope (01)	STL	12			0:00	1:04:45	33:05:00	Discoloration of Pipe	Monitor Operation
North Slope (01)	STL	12			0:00	1:04:45	33:29:00	Discoloration of Pipe	Monitor Operation
North Slope (02)	STL	12			0:00	55:16:00			
South 730' From Well 52	STL	16			0:00	50:01:00	35:51:00	Hole in pipe. Looks to be a small diameter "wye".	Monitor Operation
South 730' From Well 52	STL	16			0:00	50:01:00	43:07:00	Continuing Pipe Severely Deteriorated	Monitor Operation

Pressure Testing Work Plan Ventura Sump Discharge Line

Date ~~4/18/08~~ 4/23/08

Pipe Size (in)	16		Testing Standard	M11
Pipe Material	STL		Test Pressure (psi)[a]	128
Pipe Length (ft)	1100		Allowable leakage (gal)	6.94
Operating Pressure (psi)	95		Test Length (hr)	2
Reservoir Volume (gal)				
Reservoir Dimension (ftxft)	15' R 17" H			
Test Location				

Time	Pressure	Water Level (in)*	Comments
9:45	130	17	TESTING STARTS
9:55	130	17	
10: ~~xxx~~ 05	130	17	
10: 15	130	17	
10: 25	130	16.5	
10: 35	130	16.5	
10: 45	130	16.0	
10: 55	130	16.0	
11: 05	130	16.0	
11: 15	130	16.0	
11: 25	130	16.00	
11: 35	130	16.0	
11: 45	130	16	
			DS
			PASS

[a]Make up water is to be added at +/- 2 psi of test pressure

*Water level is inches above reservoir bottom

LEAK ON BUCKET

Pressure Testing Work Plan Ventura Sump Discharge Line
Date 4/18/08

Pipe Size (in)	16	Testing Standard	M11
Pipe Material	STL	Test Pressure (psi)[a]	128
Pipe Length (ft)	1100	Allowable leakage (gal)	6.94
Operating Pressure (psi)	95	Test Length (hr)	2
Reservoir Volume (gal)	2 ft³ = 14.96 gal		
Reservoir Dimension (ftxft)	16"Ø X 16.5" = .87 gal/in		
Test Location			

Time	Pressure	Water Level (in)*	Comments
9:31	130	16	
9:42	128	16	
9:51	128	16	
9:53	125	16	> 4" x .87 gal/in = 3.48
9:55	129	12	
9:56	129	16	
10:02	129	16	
10:08	128	15.25	> 5" x .87 gal/in = 4.35
10:09	130	10.25	
10:11	130	16.25	
10:17	129	15.75	
10:25	127	15	
10:28	125	14.9	
10:27	125	14	> 5" x .87 gal/in = 4.35
10:29	130	9	
10:29	130	16	12.2 gal
10:45	128	16	
10:52	123	16	12.2 gal/hr >> 3.5 gal/hr
			∴ PIPE DOES
			NOT PASS
			GM 4/18/08

[a]Make up water is to be added at +/- 2 psi of test pressure

*Water level is inches above reservoir bottom

Pressure Testing Work Plan Windsor Well Discharge Line
Date 4/18/08

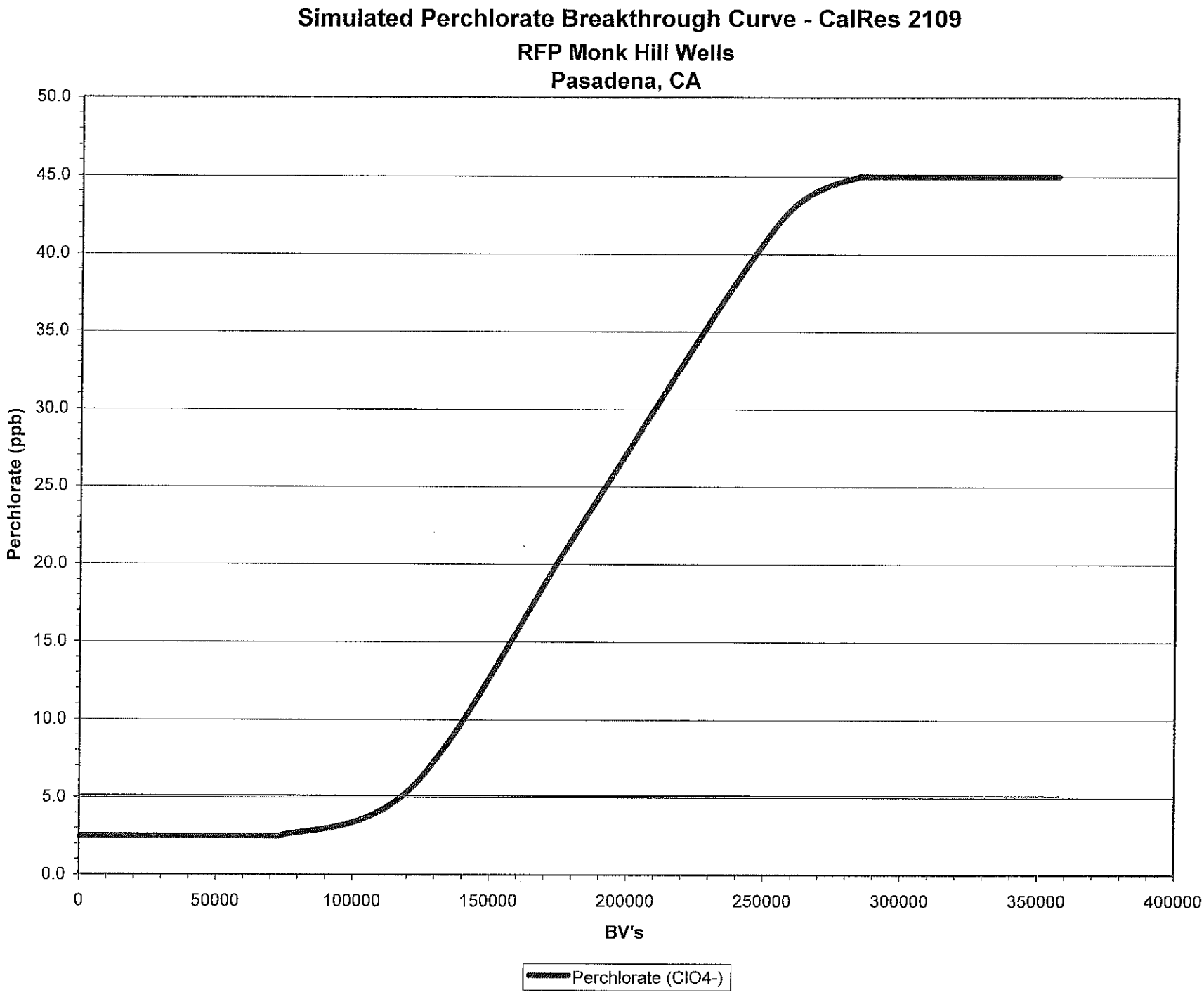
Pipe Size (in)	12	Testing Standard	AWWA C600
Pipe Material	DIP	Test Pressure (psi)[a]	150
Pipe Length (ft)	255	Allowable leakage (gal/hr)	0.25
Operating Pressure (psi)	100	Test Length (hr)	2
Reservoir Volume ~~(gal)~~ LITER 2.5			
Reservoir Dimension (ftxft)			
Test Location			

Time	~~(psi)~~ Pressure	Water Level ~~(in)~~ L*	Comments
9:10:30	150	2.84	TEST BEGINS
9:25:00	150	2.54	
9:45:00	145	2.4 >1.4	START PUMP
9:46	148	1.0	2 ~~2.10~~ in = .69 gal
9:47	148	3.0 >1.8	
9:48	150	1.7	
9:52	150	1.8	SLIGHT LEAK IN CAP @ WELDED COUPLING
10:15	150	1.8	NEAR WINDSOR WELL
10:24	149	1.8	NO ACTION
10:35	147	1.8	
10:45	147	1.8	
11:00	147	1.8	
~~11:10~~			
11:11	147	1.8	END TEST
			PASS
			GM 04/18/08

[a]Make up water is to be added at +/- 5 psi of test pressure

*~~Water level is inches above reservoir bottom~~

APPENDIX D
Ion Exchange Resin Breakthrough Curves


Simulated Perchlorate Breakthrough Curve - CalRes 2109
RFP Monk Hill Wells
Pasadena, CA
Perchlorate (ppb)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
0
50000
100000
150000
200000
250000
300000
350000
400000
BV's
Perchlorate (ClO4-)

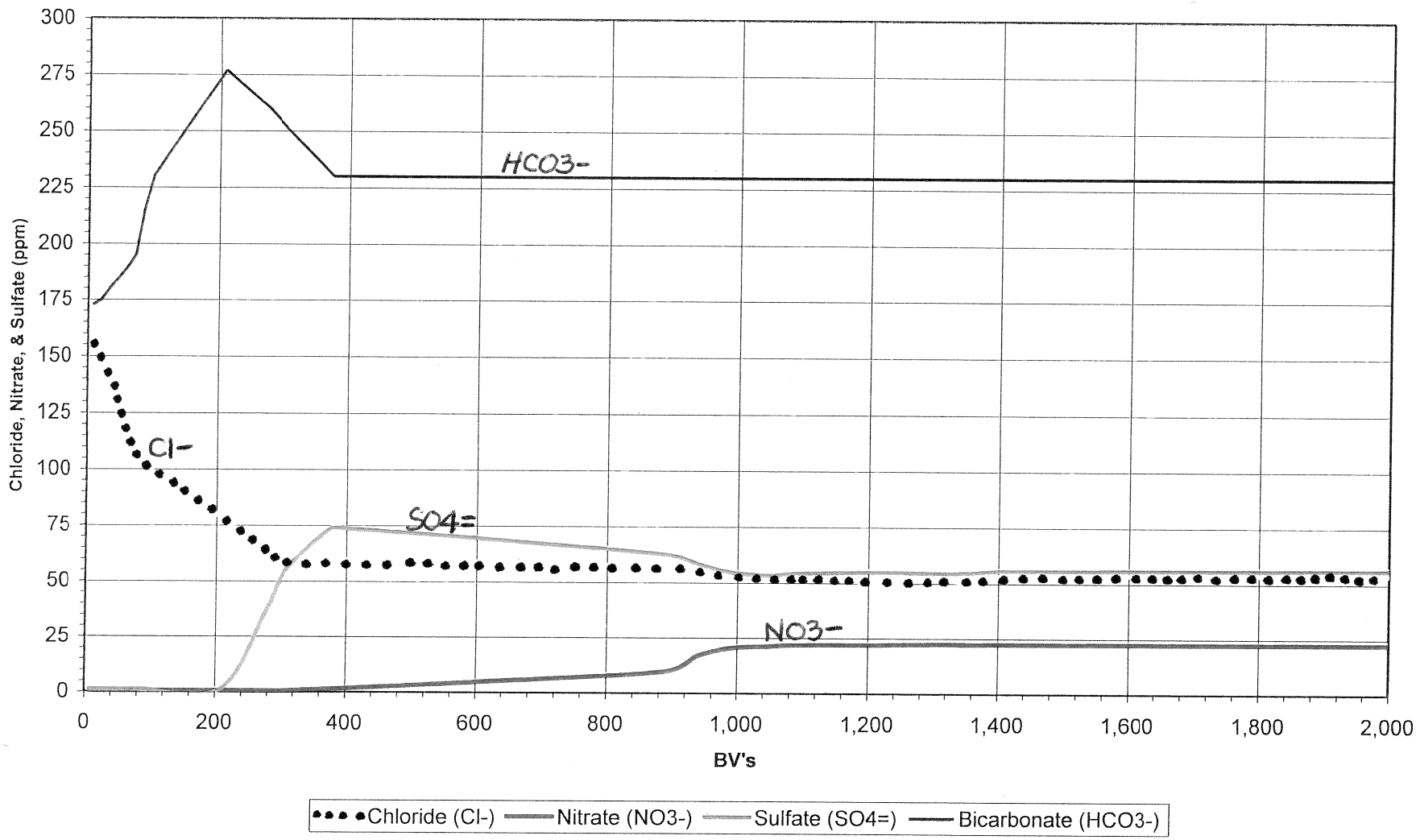



Figure 1: Simulated Breakthrough Curves - CalRes 2109
RFP Monk Hill Wells
Pasadena, CA