



**WATER UTILITIES DEPARTMENT
EASTERN HILLSBORO ASR SYSTEM
CYCLE TESTS - TECHNICAL MEMORANDUM**

EHILL-ASR

DATE: August 23, 2005

TO: Bevin Beaudet, P.E, Director of PBCWUD
Leisha Pica, P.E, Deputy Director of PBCWUD
Brian Shields, P.E., Director of Engineering
Steve McGrew, P.E, Manager of Water Design
Jim Shamblin, Director of O & M
Vincent Munn, WTP 9 Plant Superintendent
Hassan Hadjimiri, Director of Regulatory Compliance
Juan Guevarez, P.E., Manager of Regulatory Compliance
Jaya Navani, Manager of NELAP

Tom LeFevre, PBCHD



Rick Nevulis, P.G., SFWMD
Peter J. Kwiatkowski, P.G., SFWMD
Steven Anderson, SFWMD

Joseph R. May, P.G., FDEP Program Administrator
Heidi Vandor, P.G., FDEP UIC Permitting
Len Fishkin, P.G., FDEP UIC Permitting
Richard Deuerling, FDEP
Bart Bibler, P.E., FDEP Chief, Bureau of Water Programs/HSEW
Tim Powell, FDEP
Paul Sze, FDEP

Ron Reese, USGS

Nancy Marsh, USEPA Permitting, Region IV

File

FROM: Nick Panayides, Process/Design Engineer 
Tom Uram, P.G., Hydrologist 
Engineering Division

RE: Hillsboro ASR Cycle Test No.2

FILE: Hillsboro ASR System Cycle Tests
Project No. WUD 98-66B





WATER UTILITIES DEPARTMENT EASTERN HILLSBORO ASR SYSTEM CYCLE TESTS - TECHNICAL MEMORANDUM

The Eastern Hillsboro Aquifer Storage and Recovery (ASR) System, WUD Project No. 98-66 B, was conducted through a cooperative agreement (No. R99-839D; C-10801) between Palm Beach County Water Utilities Department (PBCWUD) and the South Florida Water Management District (SFWMD). Construction began on March 26, 2001 and completed in June 2003. The total project cost was \$2,773,680.00 out of which \$1,526,300.00 was from the SFWMD cooperative agreement. The Eastern Hillsboro ASR System was designed and permitted for recharge (injection) and recovery, at a flow rate of 3,500 gpm (5 MGD). The well is permitted to recharge raw water from the surficial aquifer that meets primary and secondary drinking water standards with a Water Quality Criteria Exception for Color and a Variance for pH. This ASR Well is permitted to discharge to the Hillsboro Canal and WTP 9. The operating permit application was submitted to the Florida Department of Environmental Protection (FDEP) on May 3, 2005.

The cycle tests defined by PBCWUD in the operational testing protocol as a requirement of the FDEP construction/operational permit No. 0172069-005 UC for the Eastern Hillsboro ASR System were successfully completed on June 27, 2005. The first cycle test had a recovery efficiency of 10% (49.5 MG raw water recovered out of 470 MG recharged). Cycle test No.2 had a recovery efficiency of 38% (178 MG raw water recovered out of 308 MG recharged). The cycle tests ended based on the following conditions:

- End recovery cycle to the Hillsboro Canal when chlorides = 250 mg/L or when specific conductance = 1,275 as/cm
- End recovery cycle to WTP 9 when chlorides = 250 mg/L

Appendix A presents the recharge, storage, and recovery charts for conductivity, TDS, and chlorides for the two cycle tests for both the ASR well and FAMW well (data was plotted from the MOR reports). Appendix B, presents the recharge, storage, and recovery charts for cycle test 2 as recorded by the ASR online instruments and as retrieved from the historian database for conductivity, TDS, dissolved oxygen (DO), residual chlorides (correlation based on conductivity lab data) and flow rate. Appendix C, presents the operating protocol as modified during the two





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cycle tests to include the process flow diagrams with the exact percentage open/close for the three flow control valves (FCV's 1, 2, & 3). Also, in Appendix C is attached a GIS vicinity map, process photo description of the ASR vaults, instruments and equipment, an Intellution HMI screen from WTP 9 SCADA system, and the process flow diagram (P & ID). The following table presents a summary of the two cycle tests.

Cycle Tests Summary

	Cycle Test No.1	Cycle Test No.2
Recharge Period (Days)	97 days From 10/13/2004 to 01/18/2005	91 days From 02/16/2005 to 05/18/2005
Storage Period (Days)	13 days From 01/18/2005 to 02/01/2005	6 days From 05/18/2005 to 05/24/2005
Recovery Period (Days)	10 days From 02/01/2005 to 02/10/2005	35 days From 05/24/2005 to 06/27/2005
Percent Recovery (%)	10	38
Recharge Volume (MG)	470	308
Recharge Average Flow Rate (gpm)	3,367	3,288
Recovery Volume (MG)	49.5	178
Recovery Average Flow Rate (gpm)	3,431	3,435
Cycle Ended at Chlorides (mg/L)	252	242

The data and information presented herein is for your review and evaluation. PBCWUD plans to start cycle test No.3 at the end of August, 2005. Cycle test No. 3 will be the same as the two previous cycle tests:

- Recharge for 90 days at a flow rate up to 3,500 gpm ,
- Storage for 1 to 7 days,
- Recovery to WTP 9 at a flow rate up to 3,500 gpm until chlorides = 250 mg/L)





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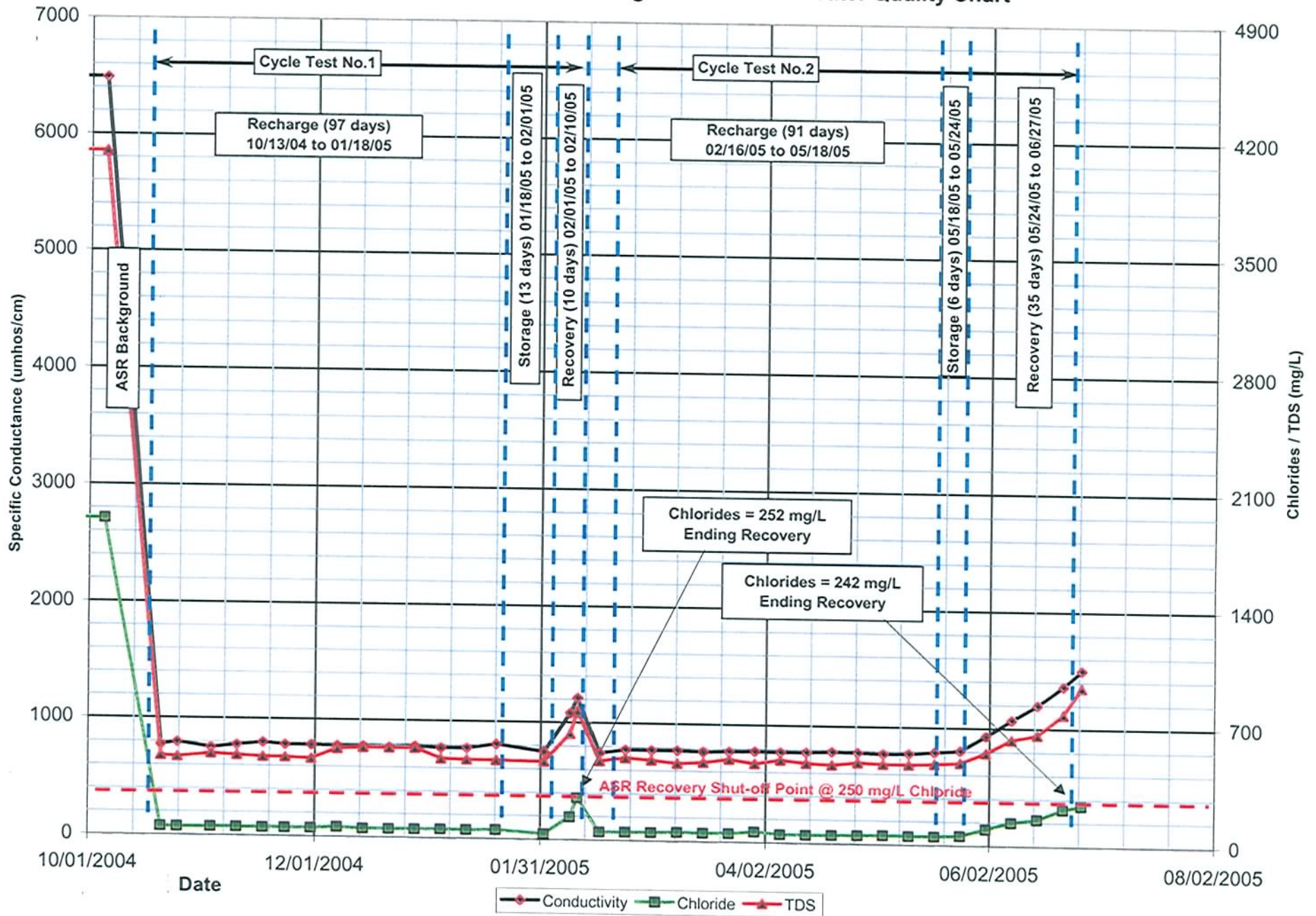
APPENDIX A

PBCWUD Hillsboro ASR and FAMW Cycle Tests
Recharge, Storage & Recovery MOR Conductivity, TDS and Chloride Charts



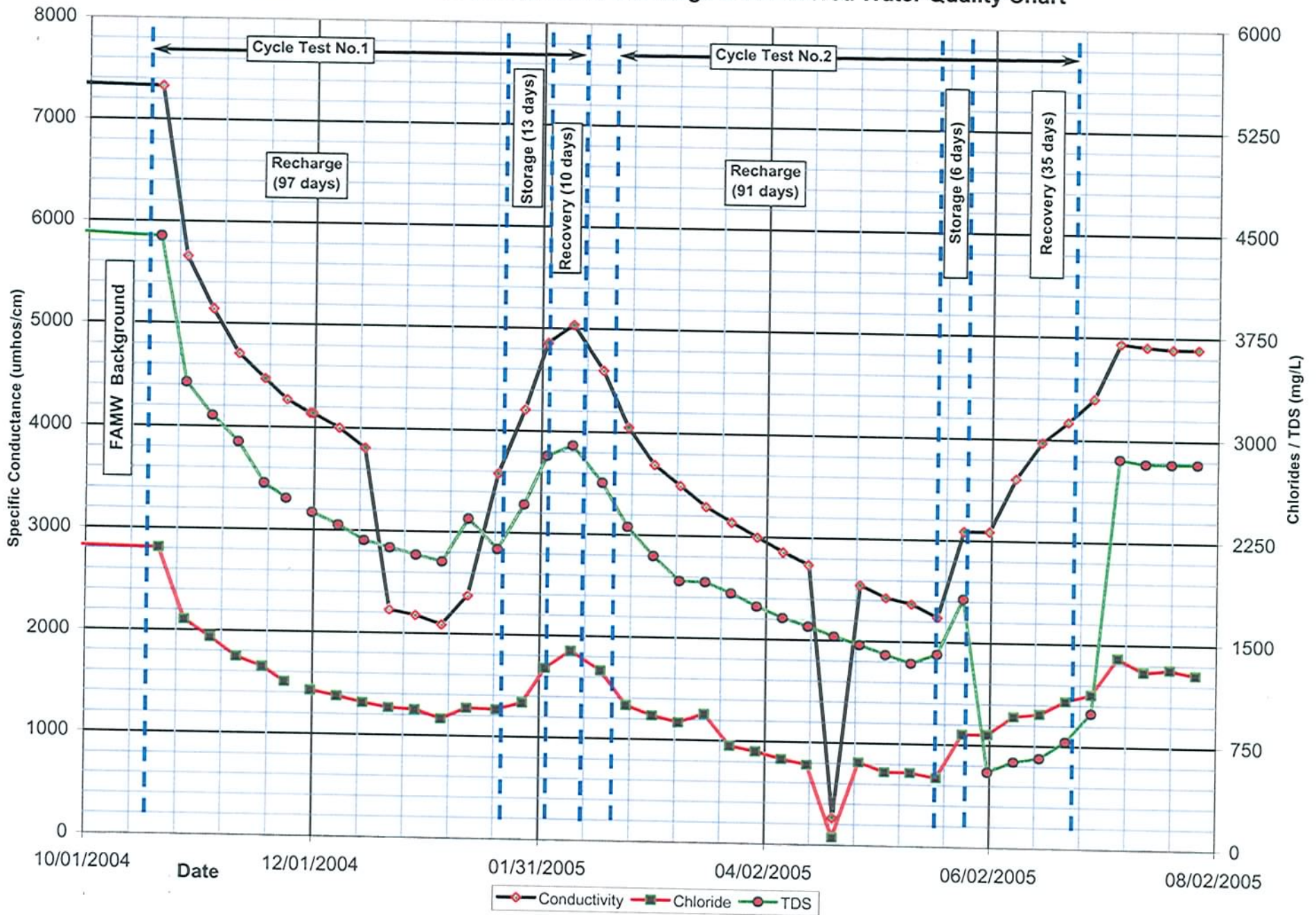
Easter Hillsboro ASR System - Cycle Tests

ASR Well Background, Recharge & Recovered Water Quality Chart



Eastern Hillsboro ASR System - Cycle Tests

FAMW Monitor Well Background, Recharge & Recovered Water Quality Chart





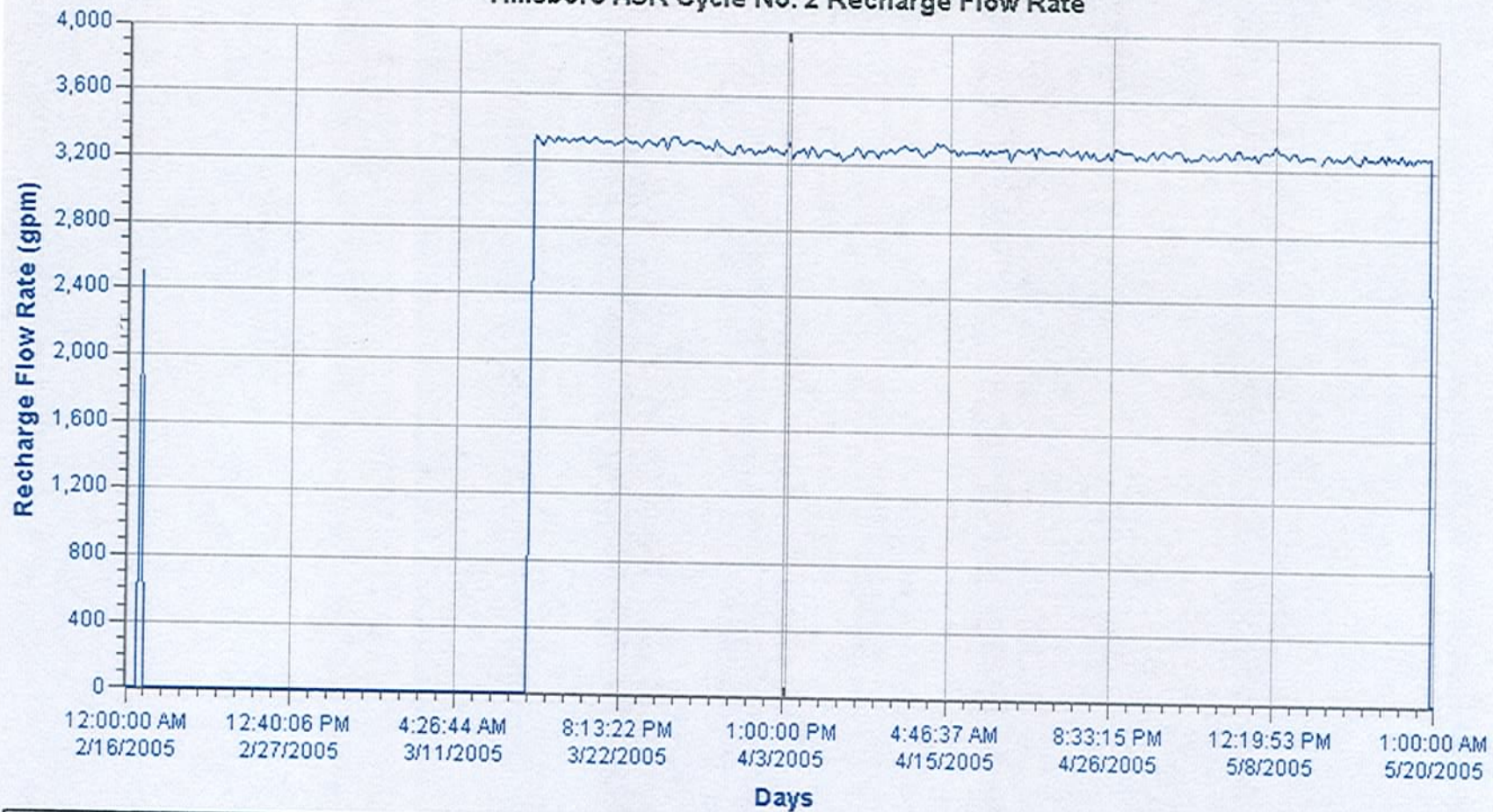
WATER UTILITIES DEPARTMENT
EASTERN HILLSBORO ASR SYSTEM
CYCLE TESTS - TECHNICAL MEMORANDUM

APPENDIX B

PBCWUD Hillsboro ASR System Cycle Tests
Recharged & Recovered Continuous Data Charts
From the Online ASR Instruments

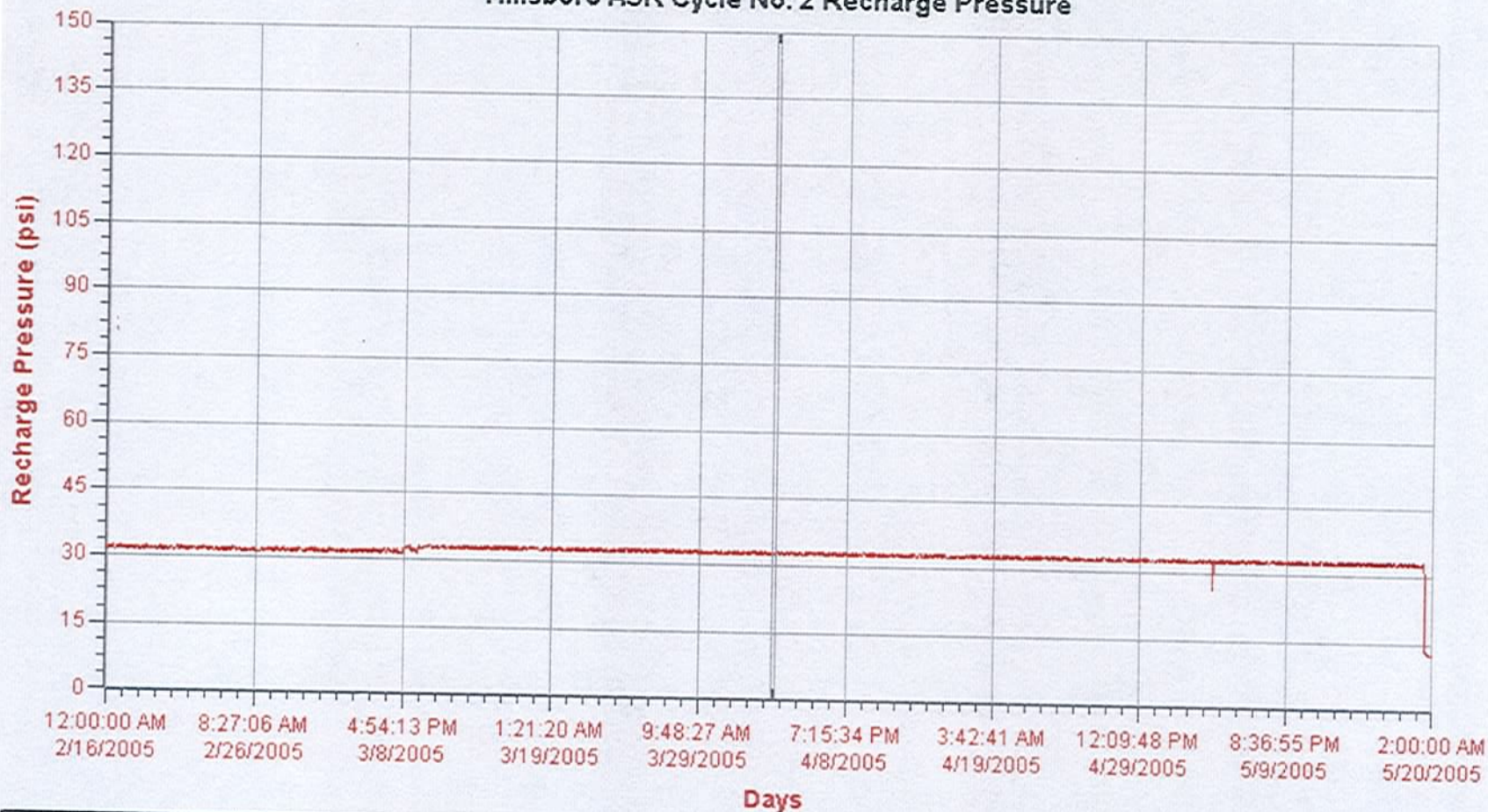


Hillsboro ASR Cycle No. 2 Recharge Flow Rate



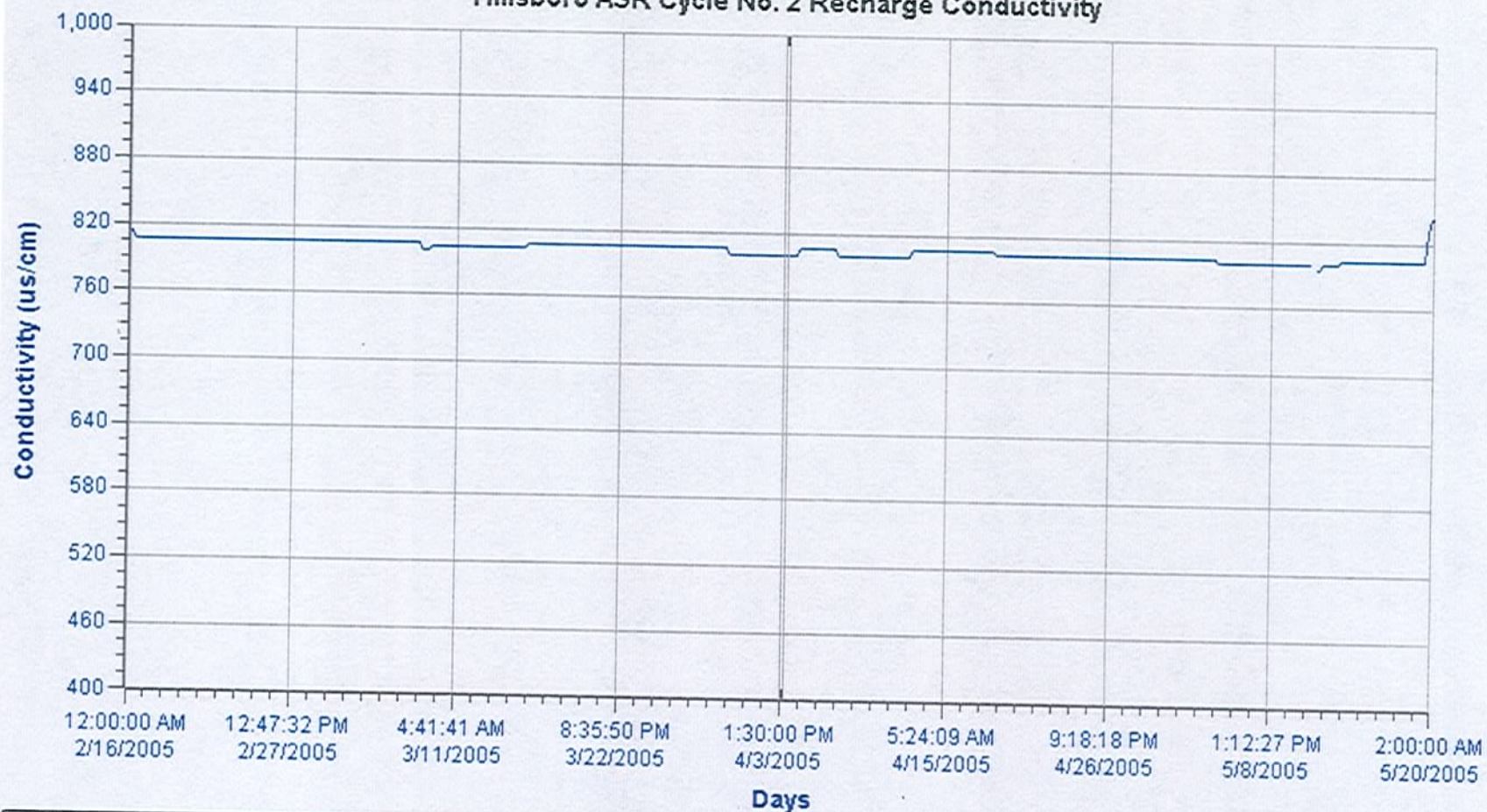
Pen Name	Description	Value
WP09SN1.WP9_ASR_FLOW1.F_CV	ASR-xxx Flow (F_CV)	3,325

Hillsboro ASR Cycle No. 2 Recharge Pressure



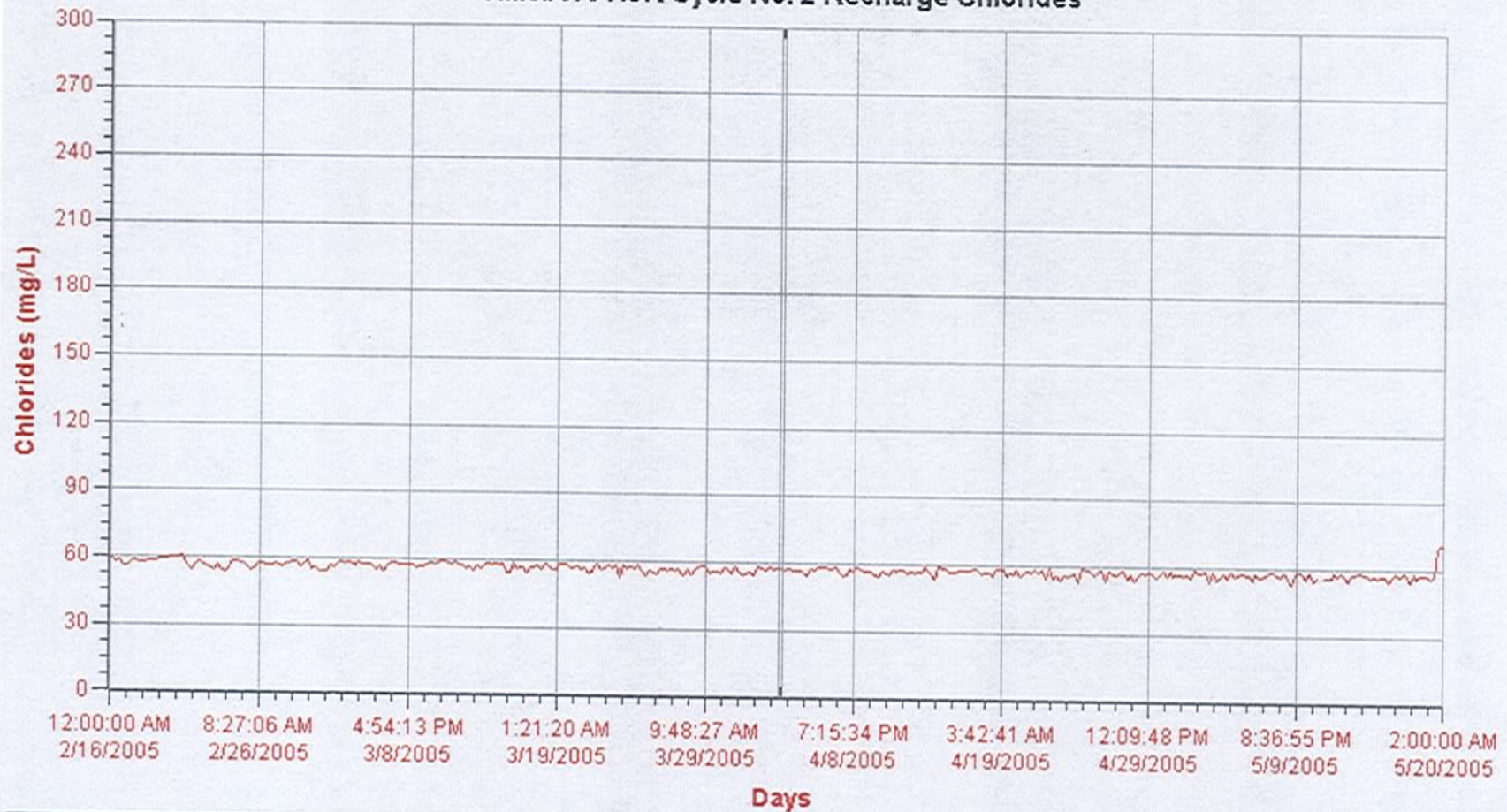
Pen Name	Description	Value
WP09SN1.WP9_ASR_RECHG_PSI.F_CV	ASR-Recharge Pressure (F_CV)	32

Hillsboro ASR Cycle No. 2 Recharge Conductivity



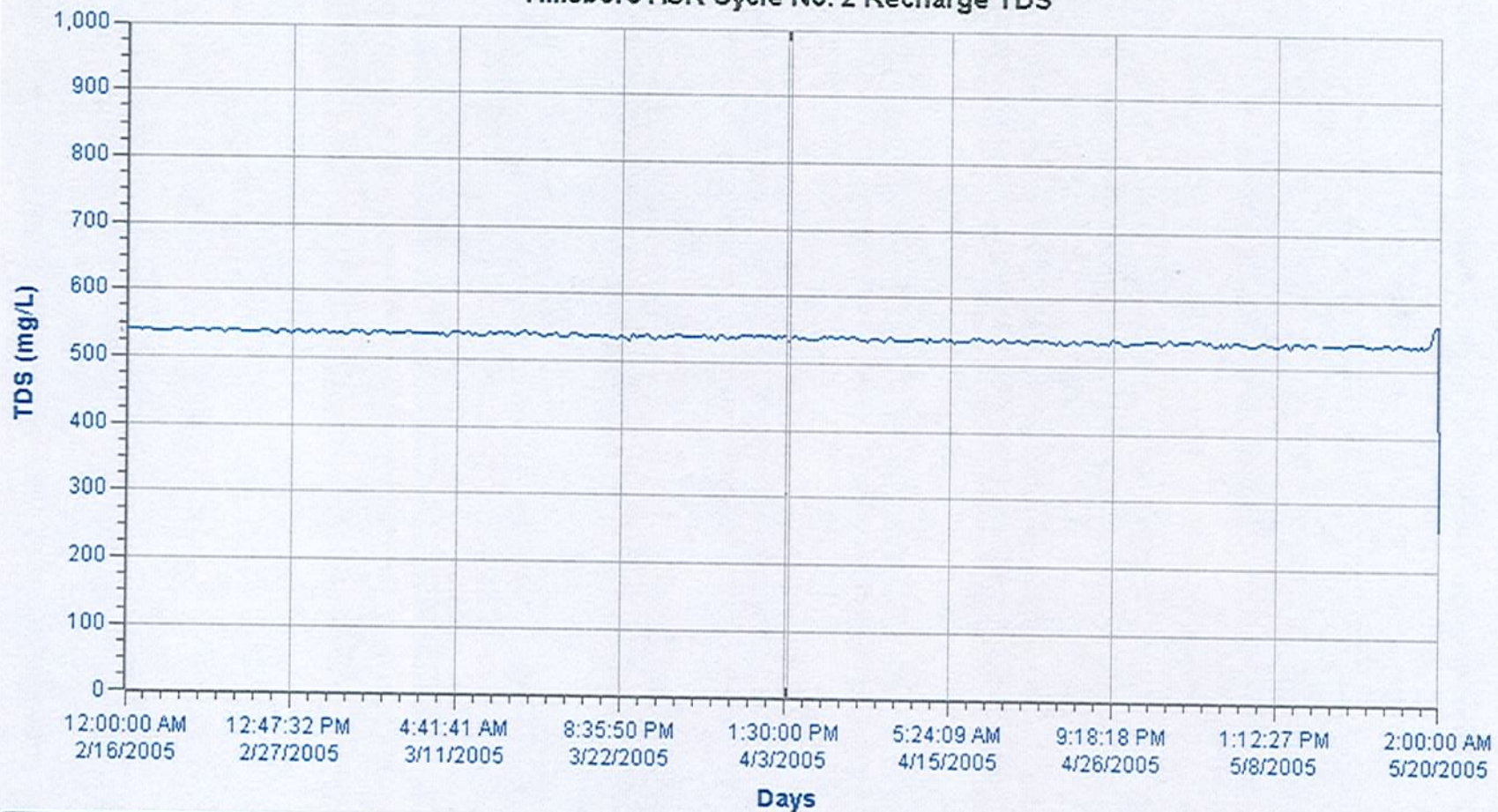
Pen Name	Description	Value
— WP09SN1.WP9_ASR_COND.F_CV	ASR-Conductivity (F_CV)	800

Hillsboro ASR Cycle No. 2 Recharge Chlorides



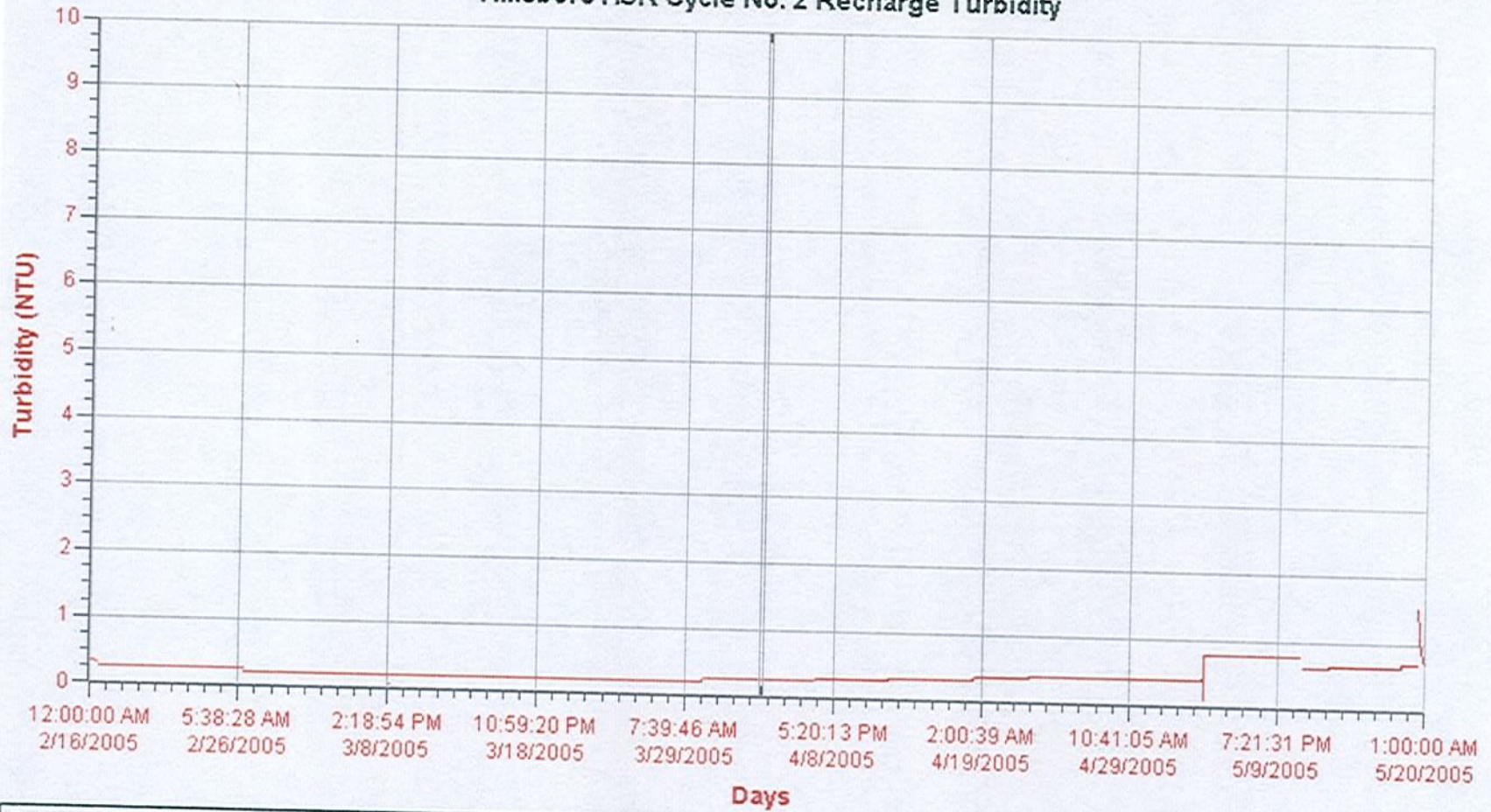
Pen Name	Description	Value
WP09SN1.WP9_ASR_CL_CAF_CV	ASR Chloride Calculation (F_CV)	57

Hillsboro ASR Cycle No. 2 Recharge TDS



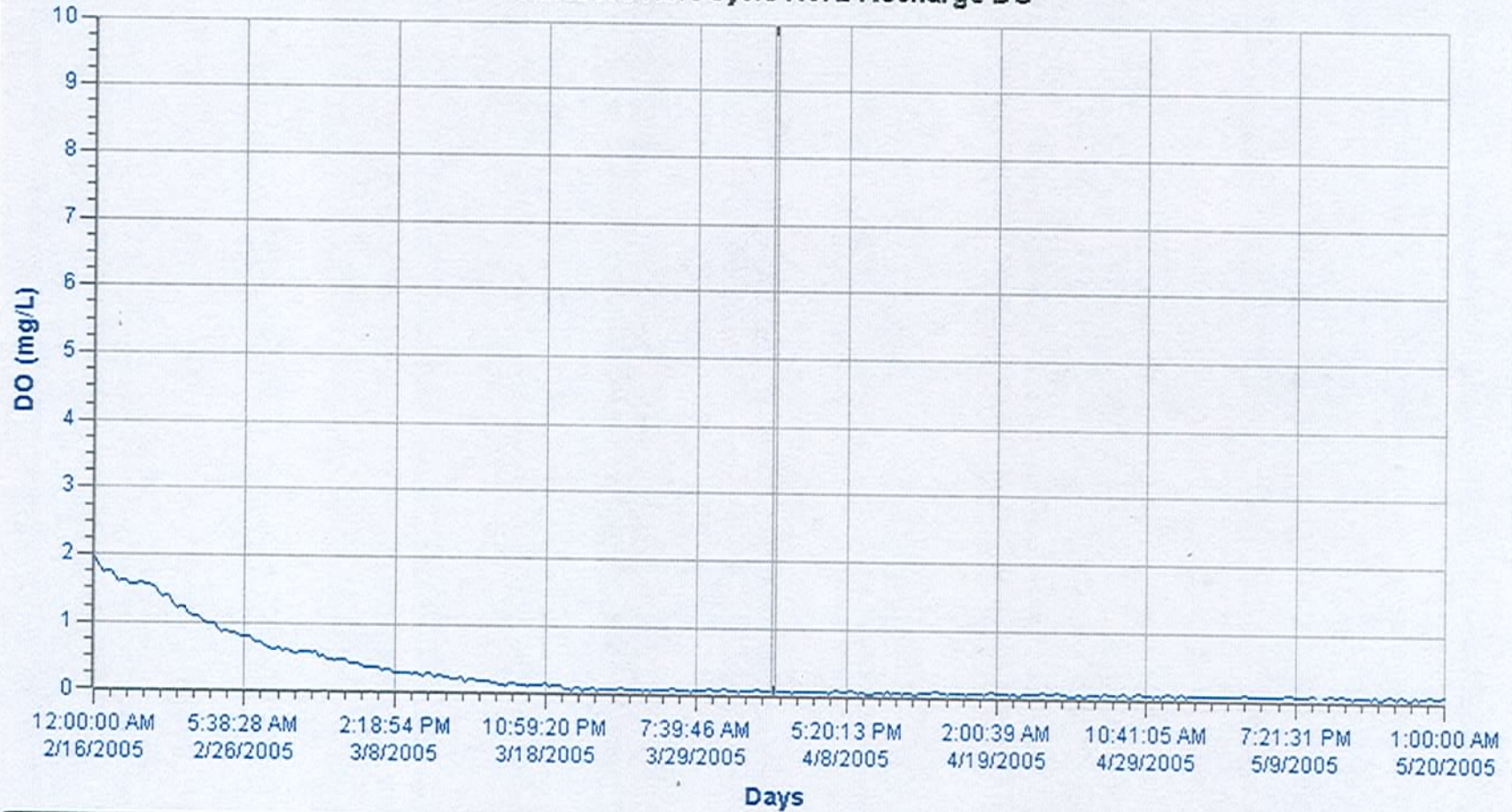
Pen Name	Description	Value
WP09SN1.WP9_ASR_TDS_CAF_CV	TDS Calculation (F_CV)	532

Hillsboro ASR Cycle No. 2 Recharge Turbidity



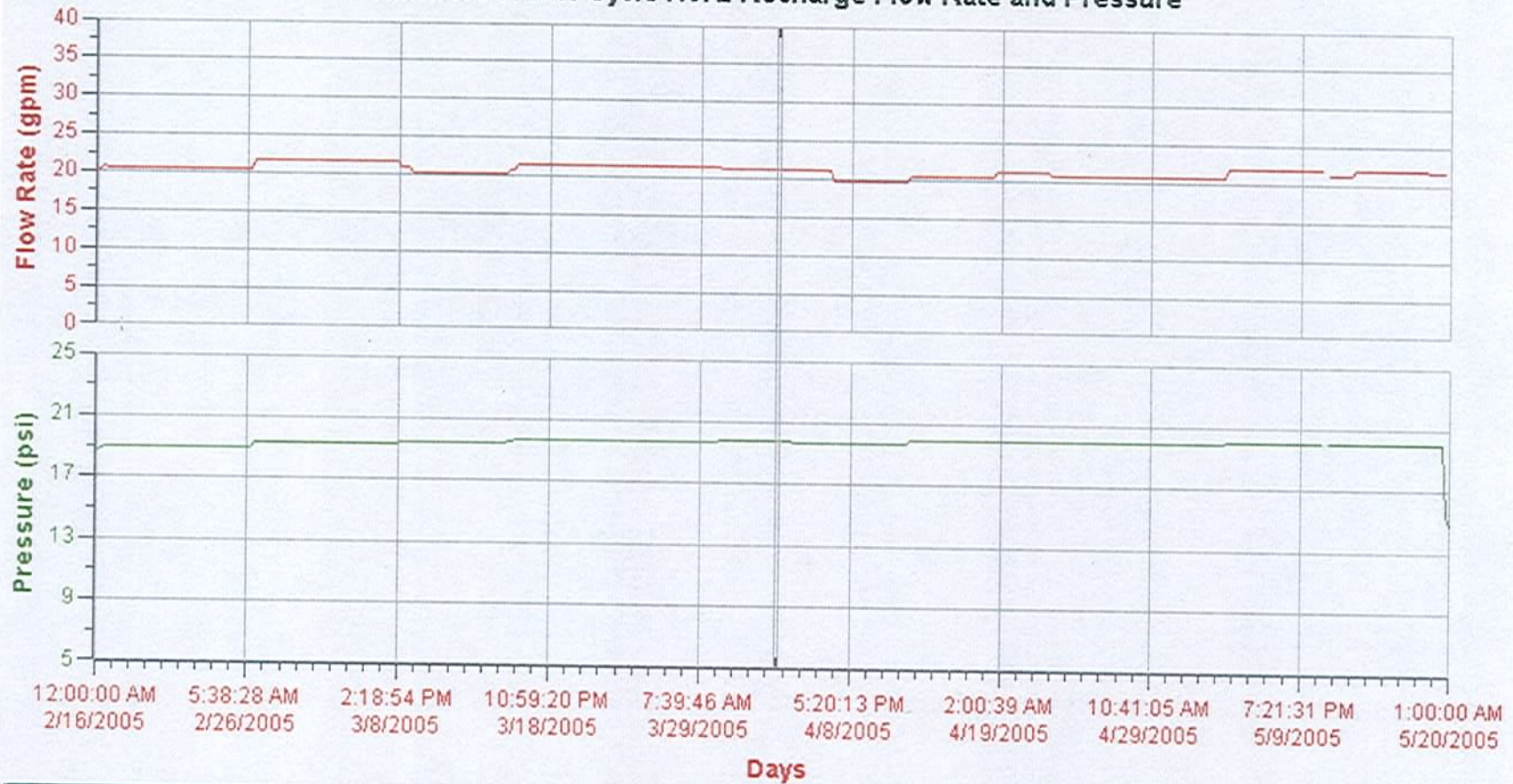
Pen Name	Description	Value
WP09SN1.WP9_ASR_TURB.F_CV	ASR-Turbidity to Canal (F_CV)	0

Hillsboro ASR Cycle No. 2 Recharge DO



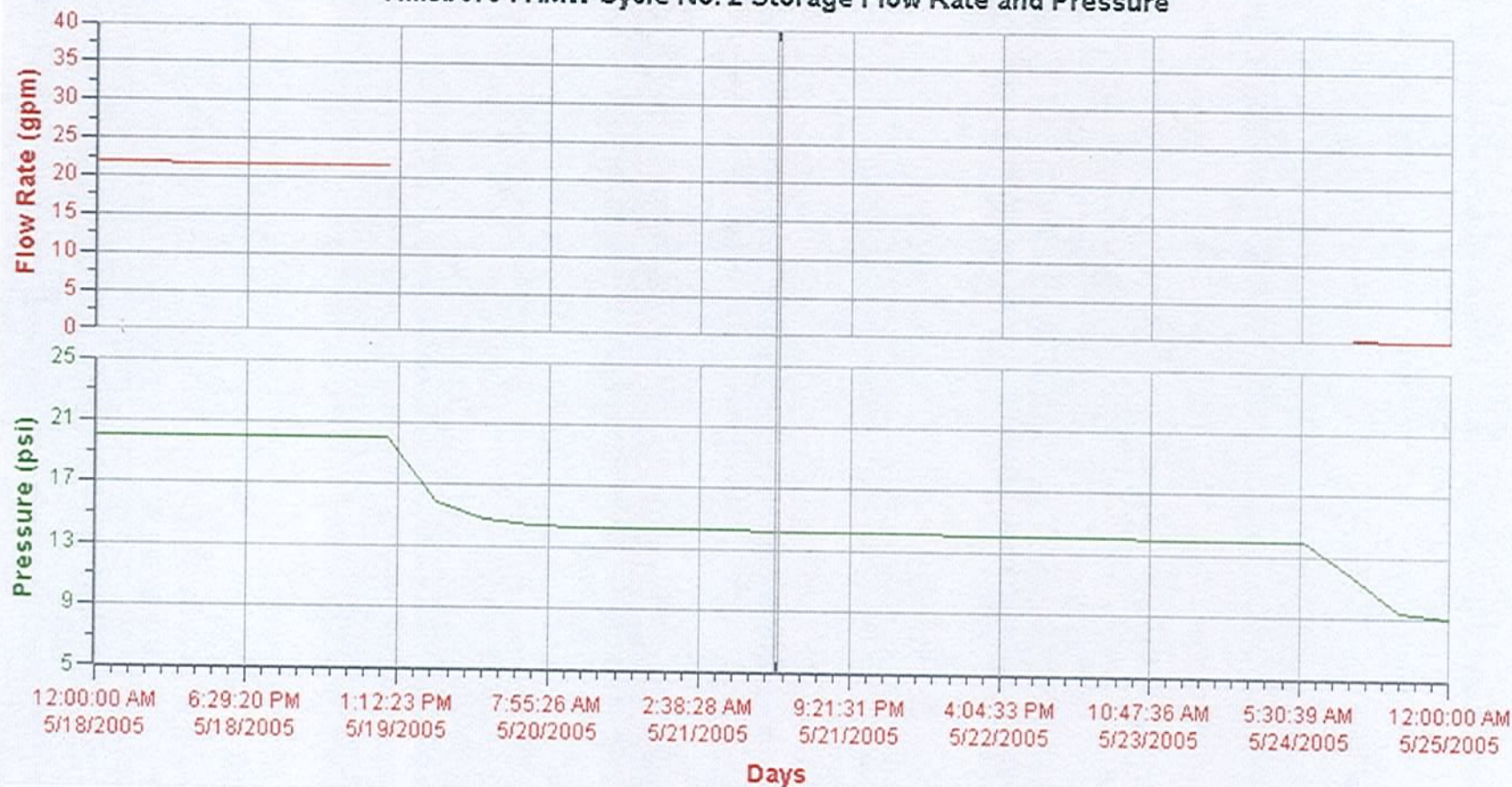
Pen Name	Description	Value
WP09SN1.WP9_ASR_DO.F_CV	ASR-Dissolved Oxygen (F_CV)	0

Hillsboro FAMW Cycle No. 2 Recharge Flow Rate and Pressure



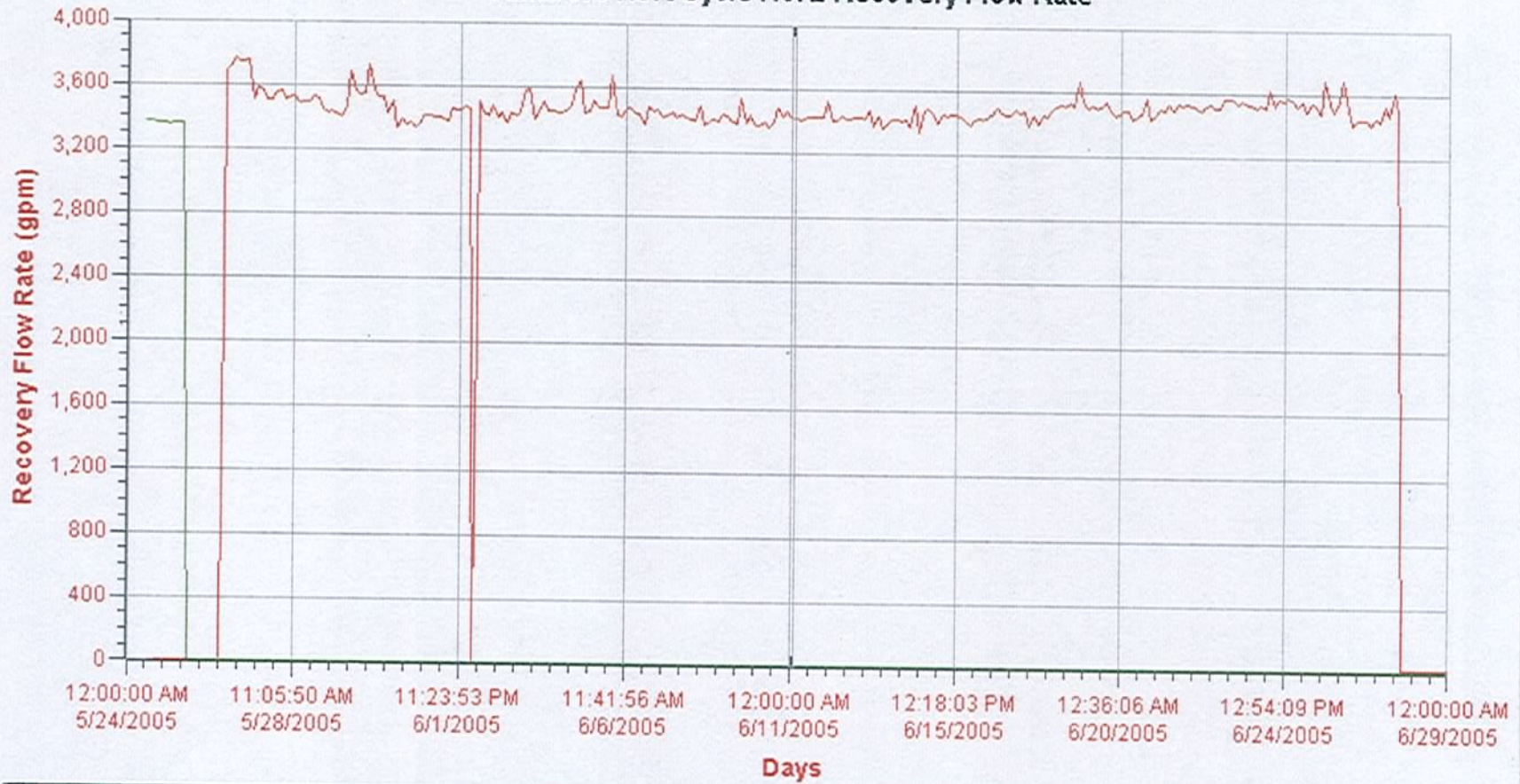
Pen Name	Description	Value
WP09SN1.WP9_ASR_MW_FLOW.F_CV	ASR Monitoring Well Flow (F_CV)	21
WP09SN1.WP9_ASR_MW_PSI.F_CV	ASR Monitoring Well Pressure (F_CV)	20

Hillsboro FAMW Cycle No. 2 Storage Flow Rate and Pressure



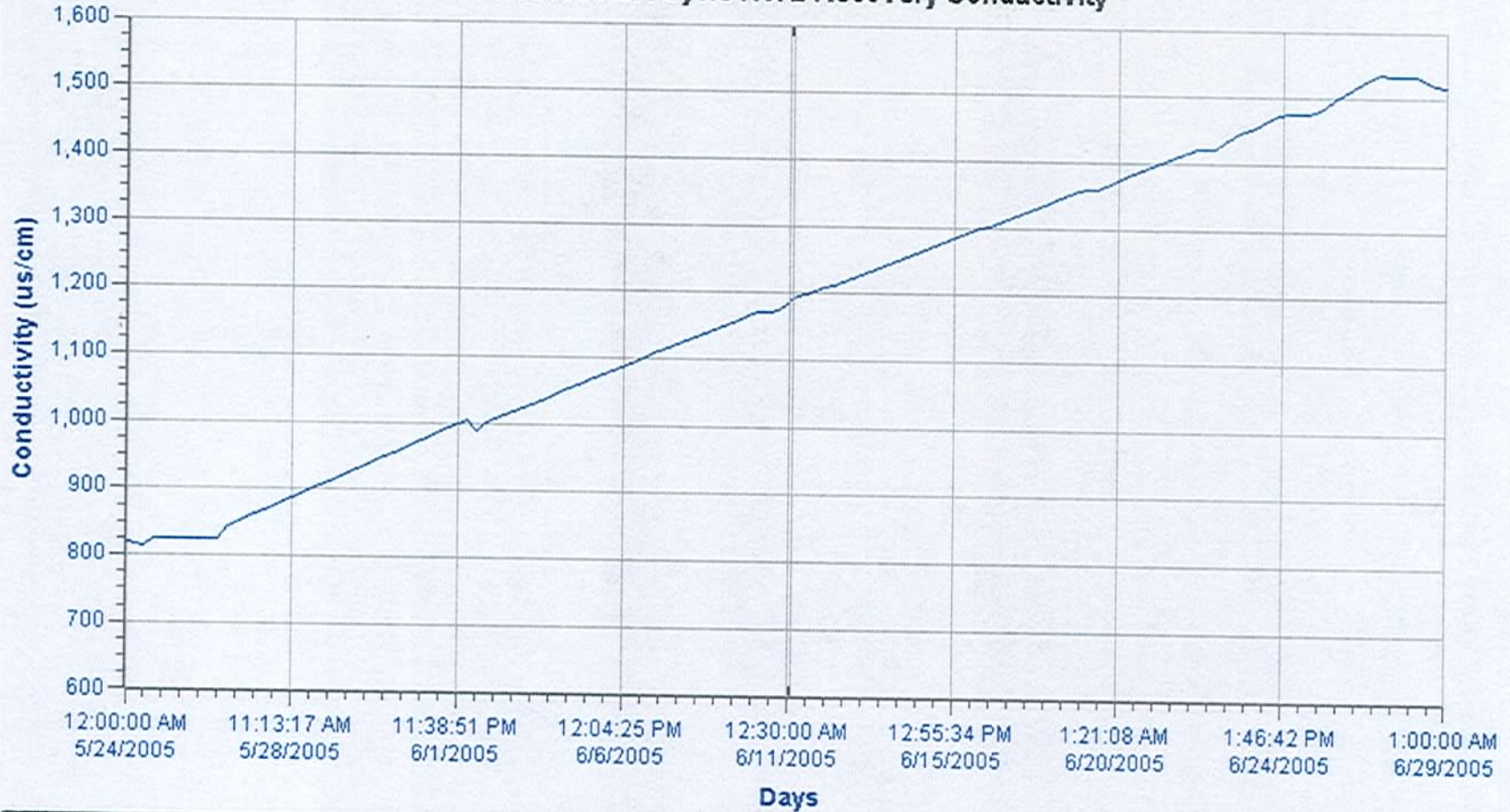
Pen Name	Description	Value
WP09SN1.WP9_ASR_MW_FLOW.F_CV	ASR Monitoring Well Flow (F_CV)	<No Data>
WP09SN1.WP9_ASR_MW_PSI.F_CV	ASR Monitoring Well Pressure (F_CV)	14

Hillsboro ASR Cycle No. 2 Recovery Flow Rate



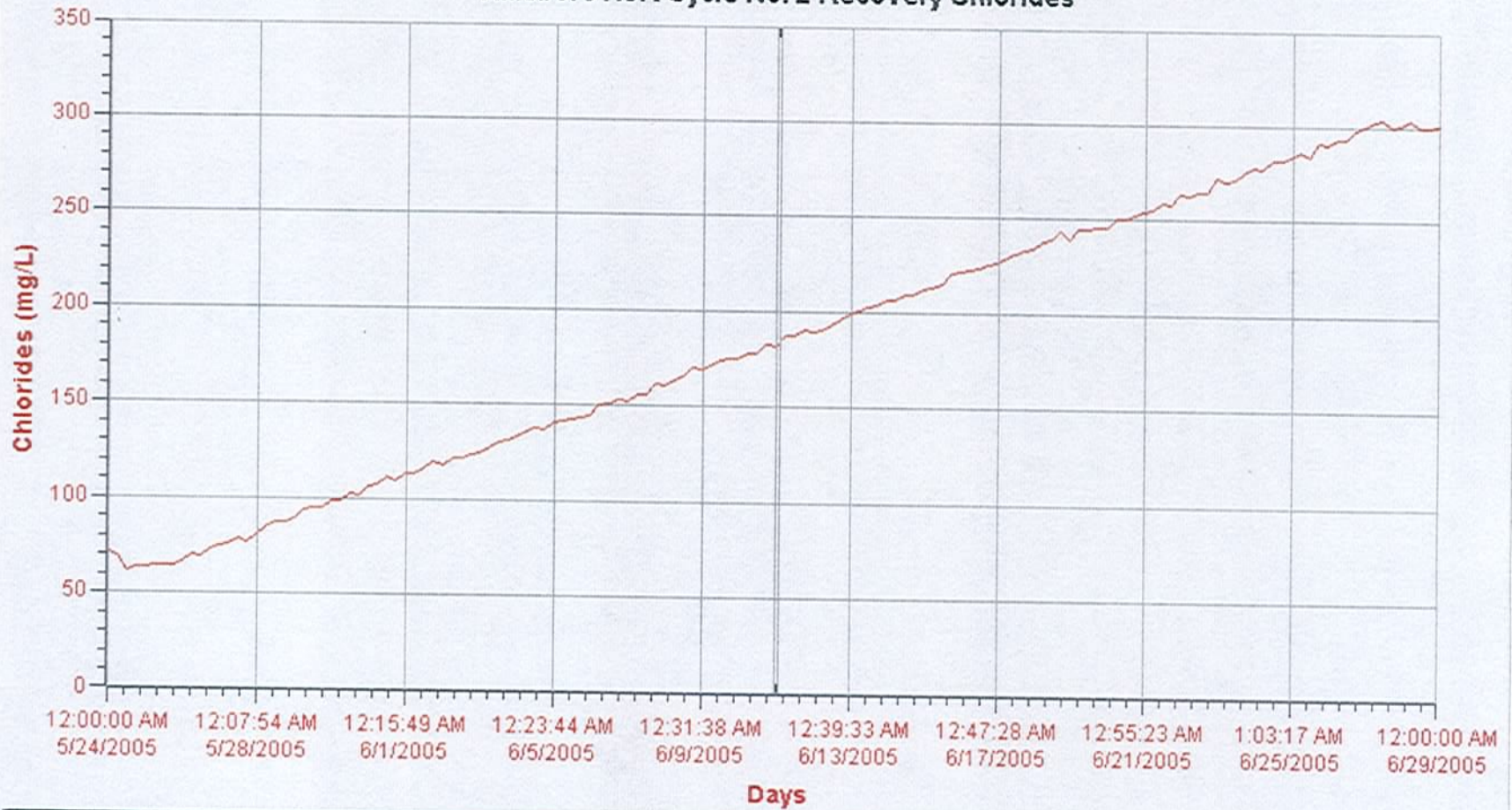
Pen Name	Description	Value
WP09SN1.WP9_ASR_FLOW2.F_CV	ASR-xxx Flow (F_CV)	3,407
WP09SN1.WP9_ASR_FLOW3.F_CV	ASR-xxx Flow (F_CV)	0

Hillsboro ASR Cycle No. 2 Recovery Conductivity



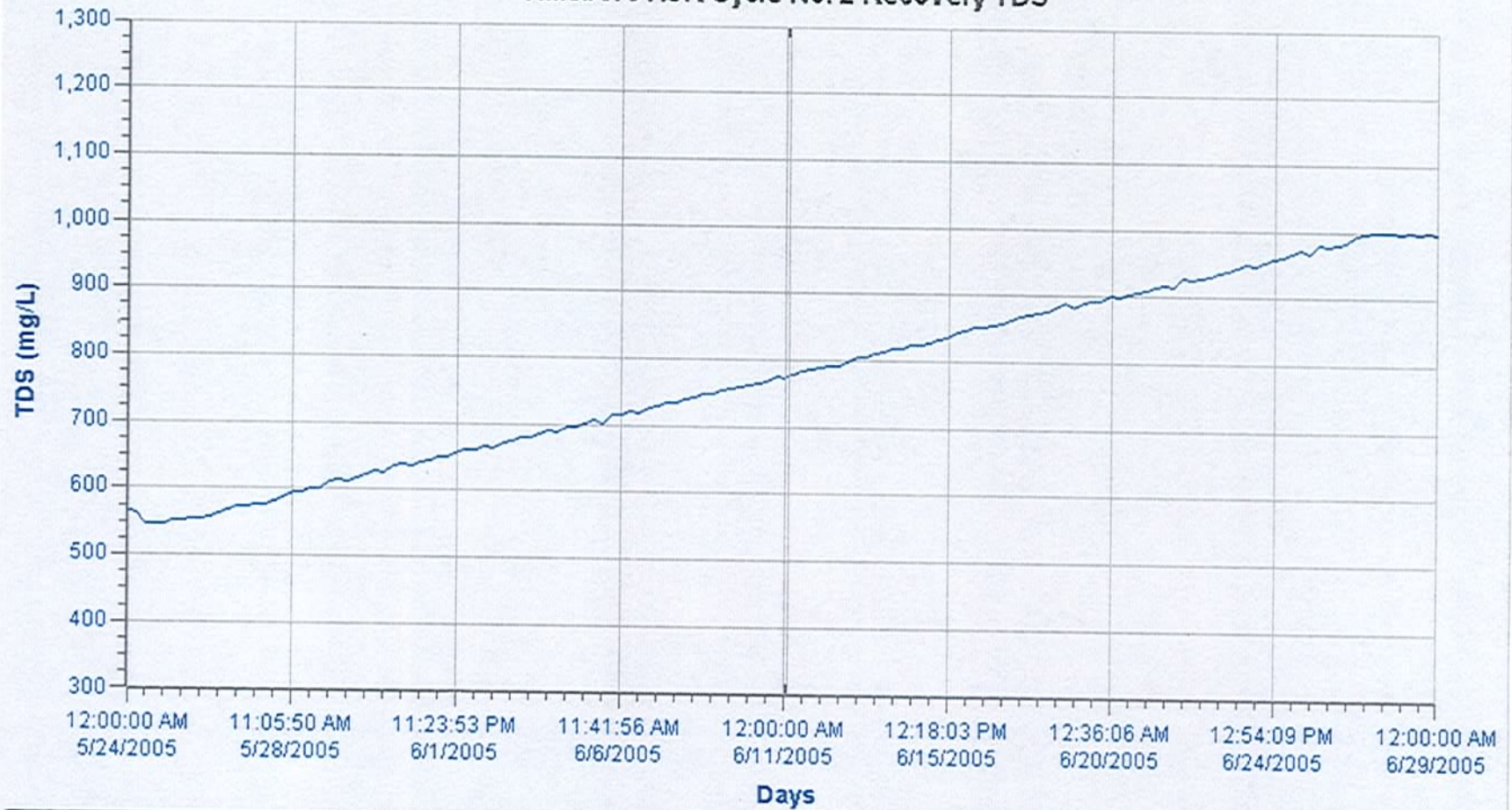
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Hillsboro ASR Cycle No. 2 Recovery Chlorides



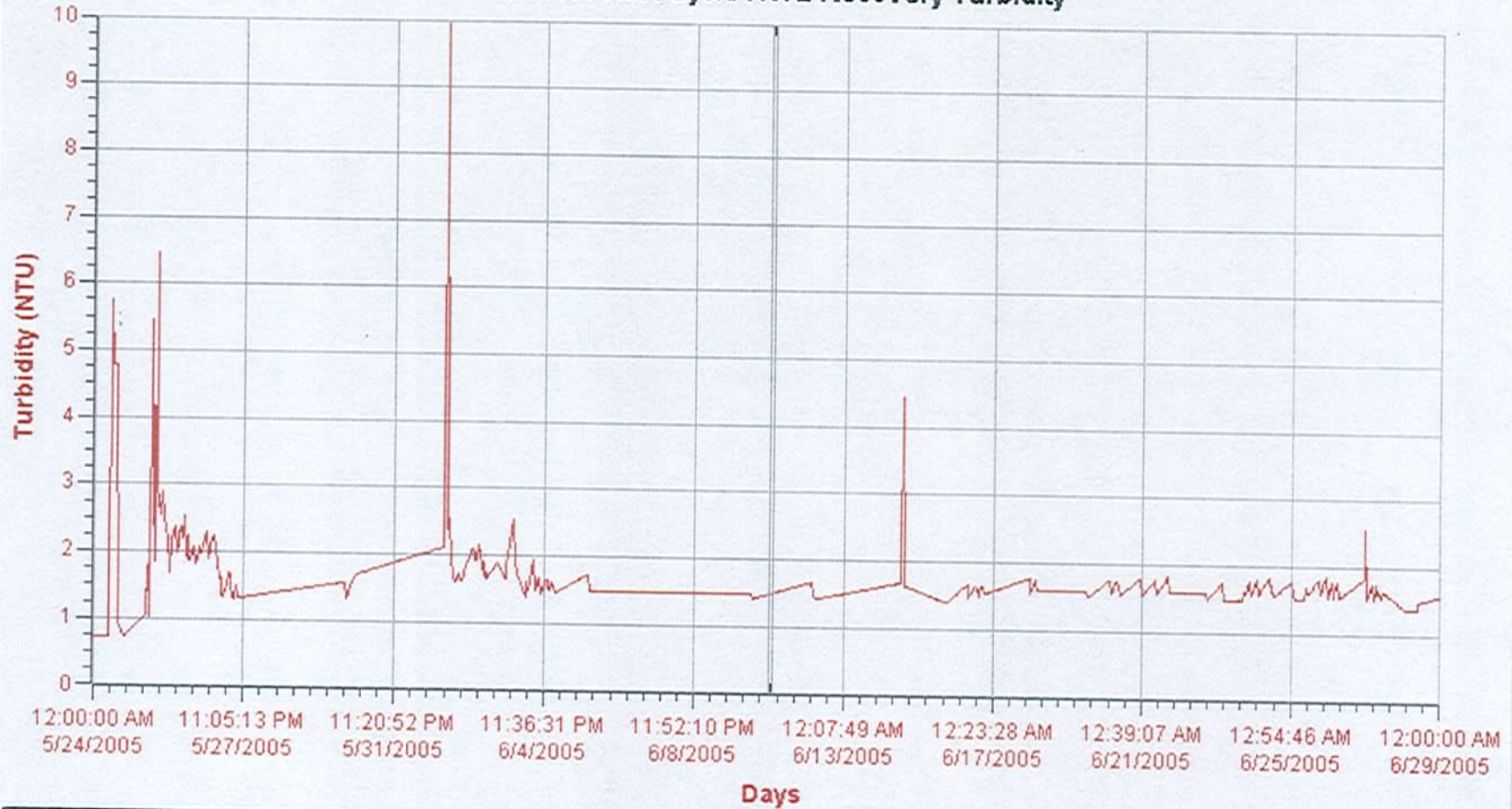
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WP09SN1.WP9_ASR_CL_CA.F_CV	ASR Chloride Calculation (F_CV)	182

Hillsboro ASR Cycle No. 2 Recovery TDS



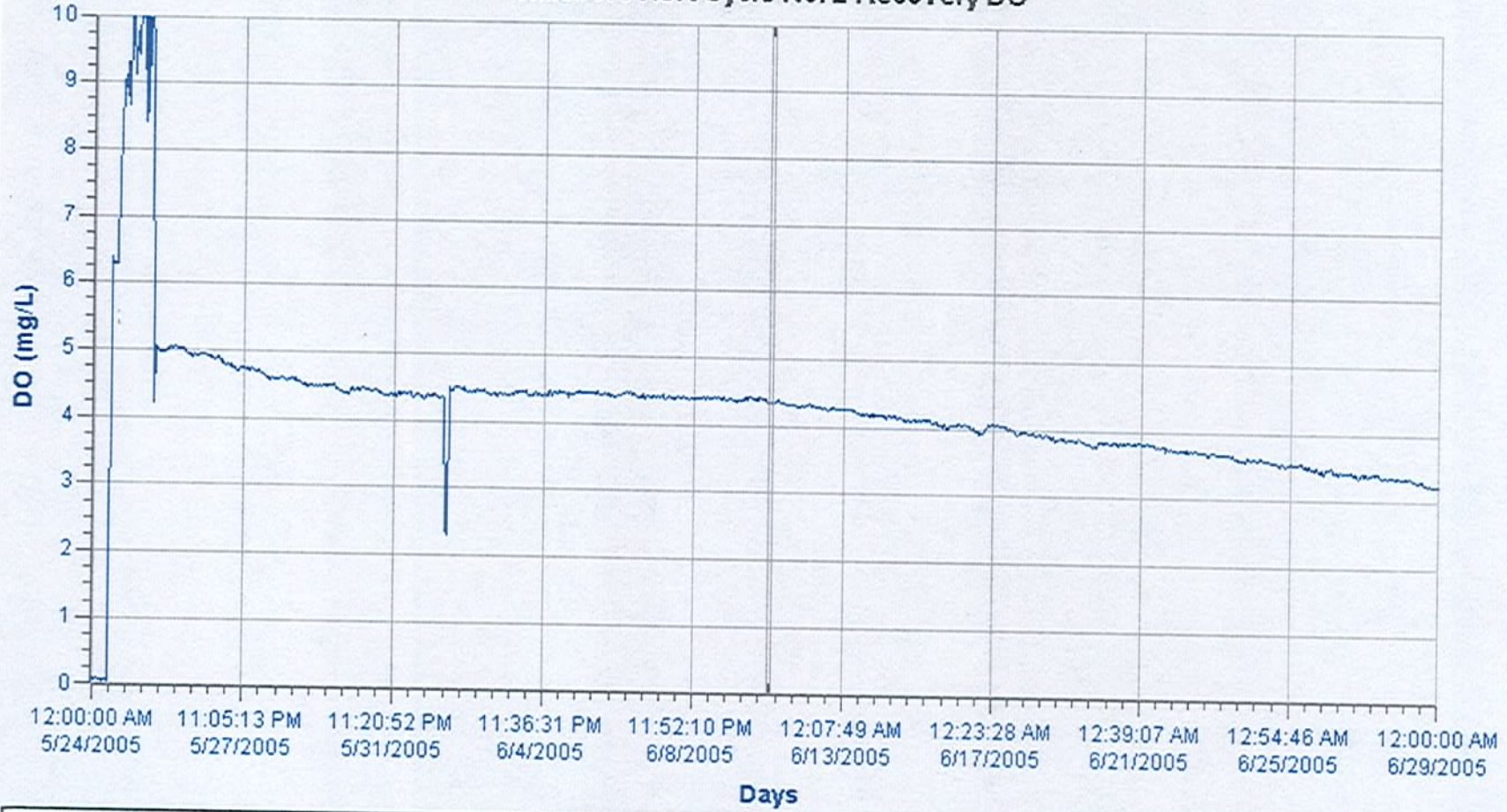
Pen Name	Description	Value
WP09SN1.WP9_ASR_TDS_CA.F_CV	TDS Calculation (F_CV)	772

Hillsboro ASR Cycle No. 2 Recovery Turbidity



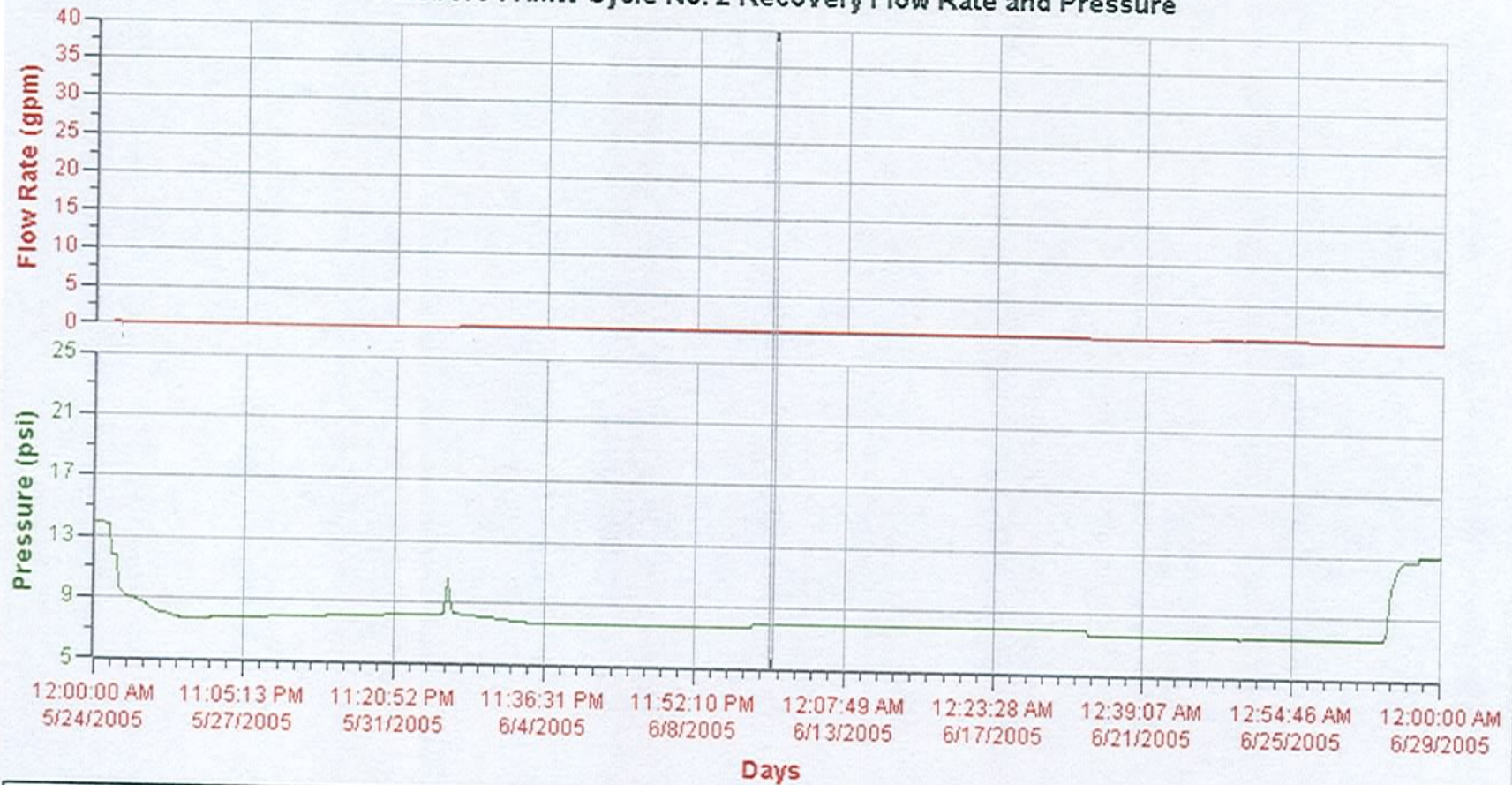
Pen Name	Description	Value
— WP09SN1.WP9_ASR_TURB.F_CV	ASR-Turbidity to Canal (F_CV)	1

Hillsboro ASR Cycle No. 2 Recovery DO



Pen Name	Description	Value
— WP09SN1.WP9_ASR_DO.F_CV	ASR-Dissolved Oxygen (F_CV)	4

Hillsboro FAMW Cycle No. 2 Recovery Flow Rate and Pressure



Pen Name	Description	Value
WP09SN1.WP9_ASR_MW_FLOW.F_CV	ASR Monitoring Well Flow (F_CV)	0
WP09SN1.WP9_ASR_MW_PSI.F_CV	ASR Monitoring Well Pressure (F_CV)	8



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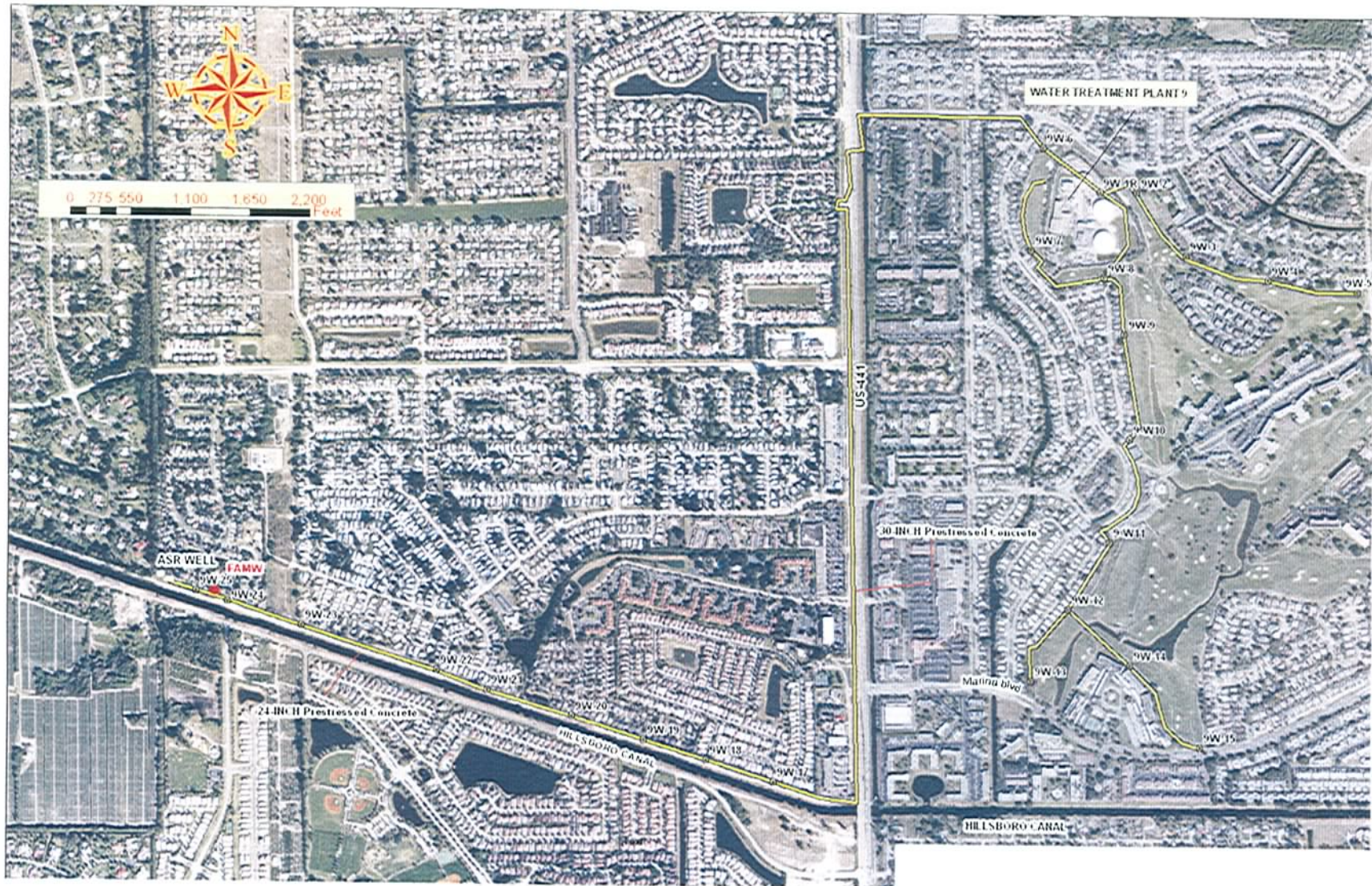
APPENDIX C

Operating Protocol





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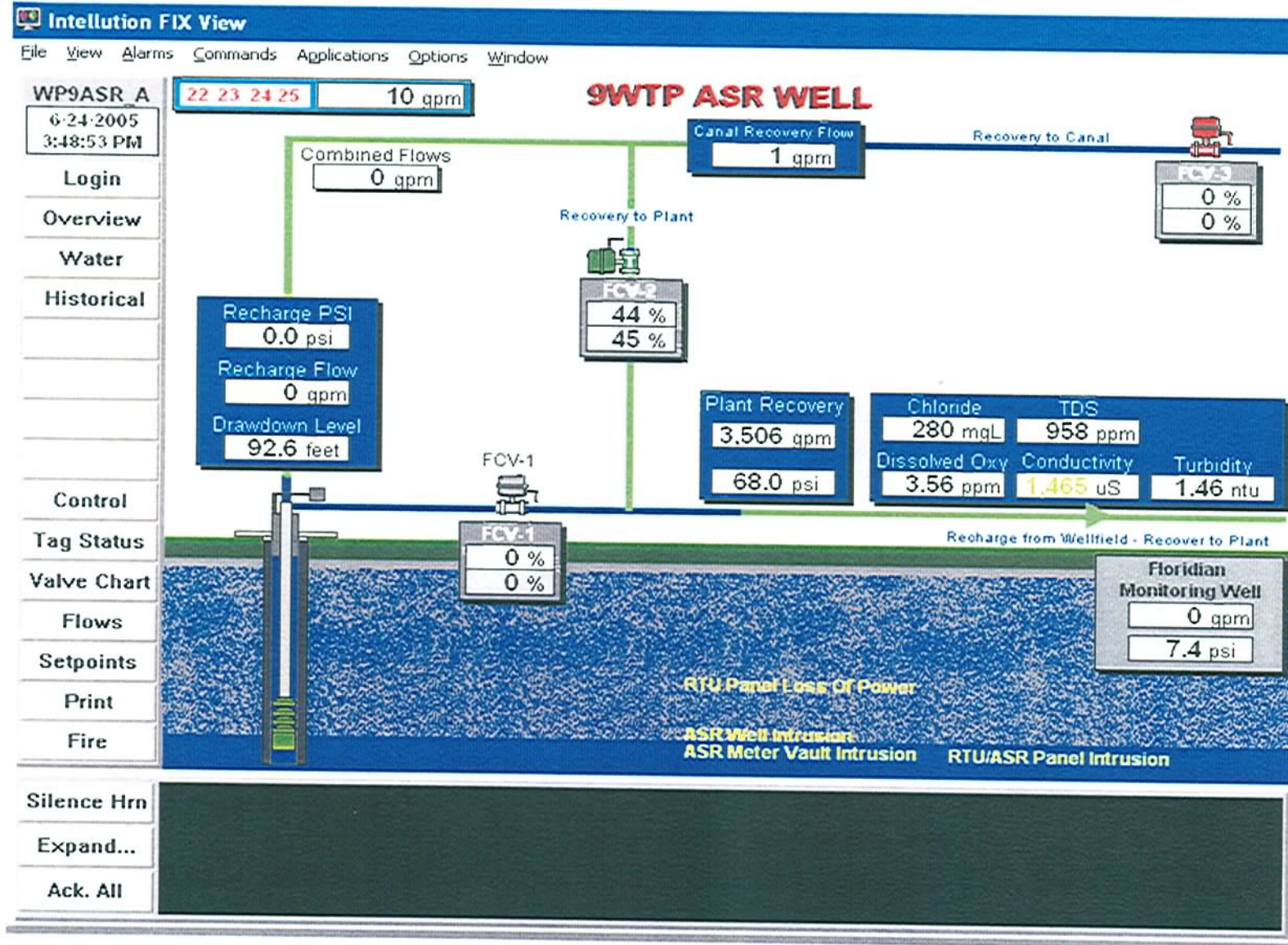


Eastern Hillsboro Canal Wellfield & WTP 9 Wellfield GIS Map Location



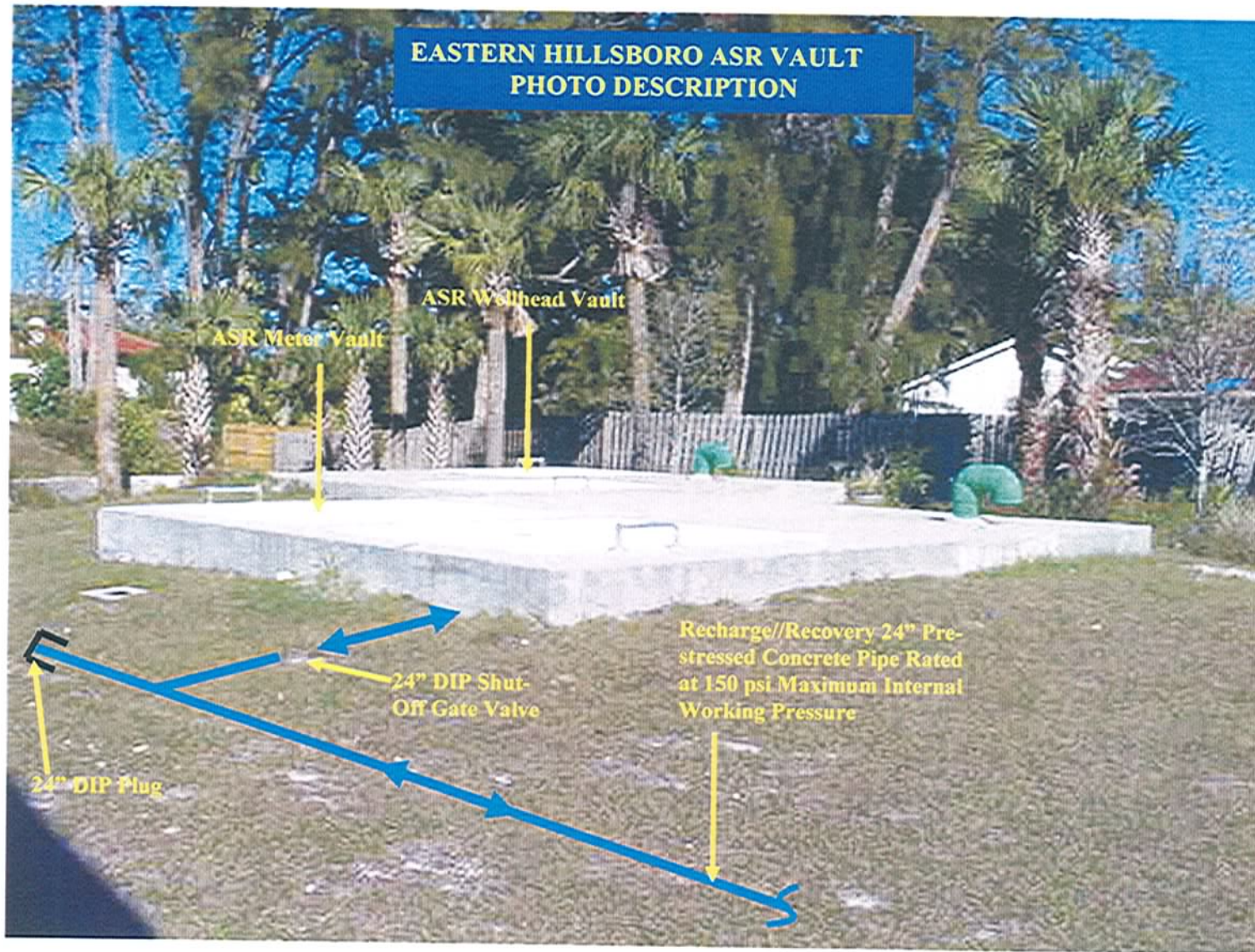


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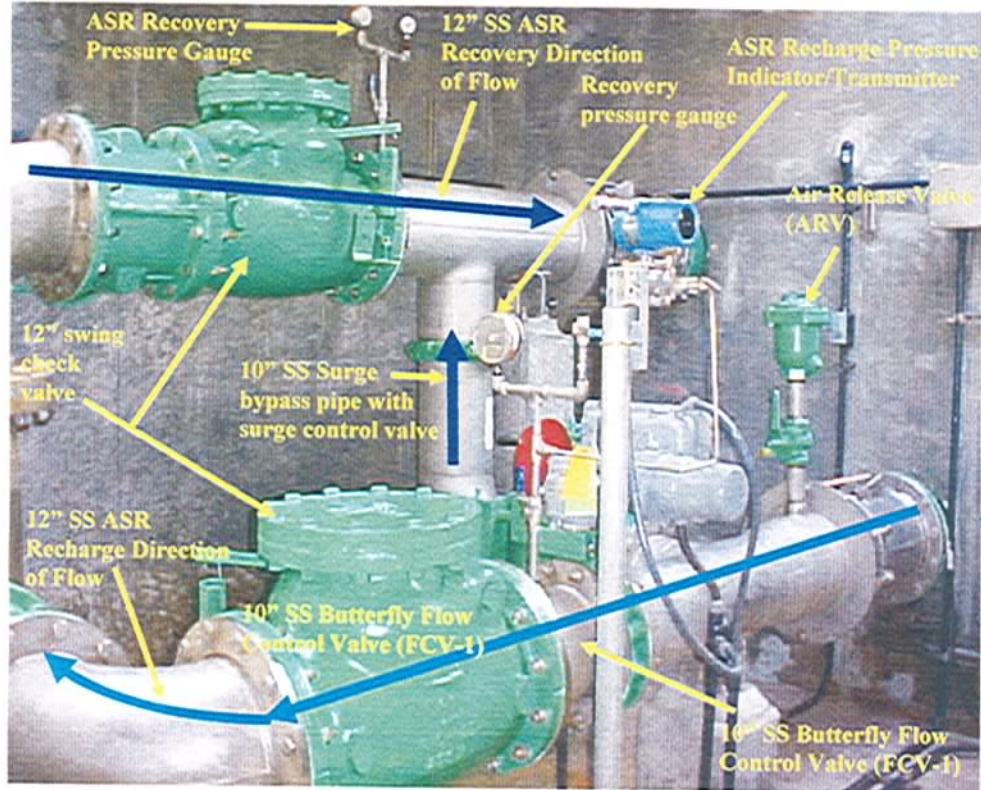


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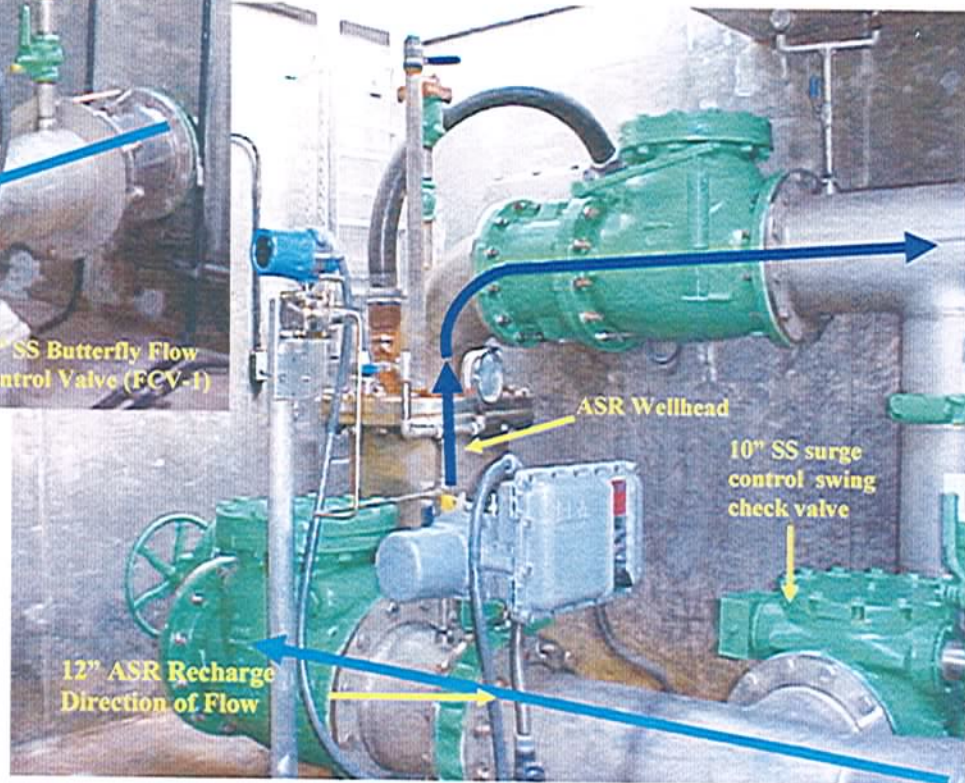




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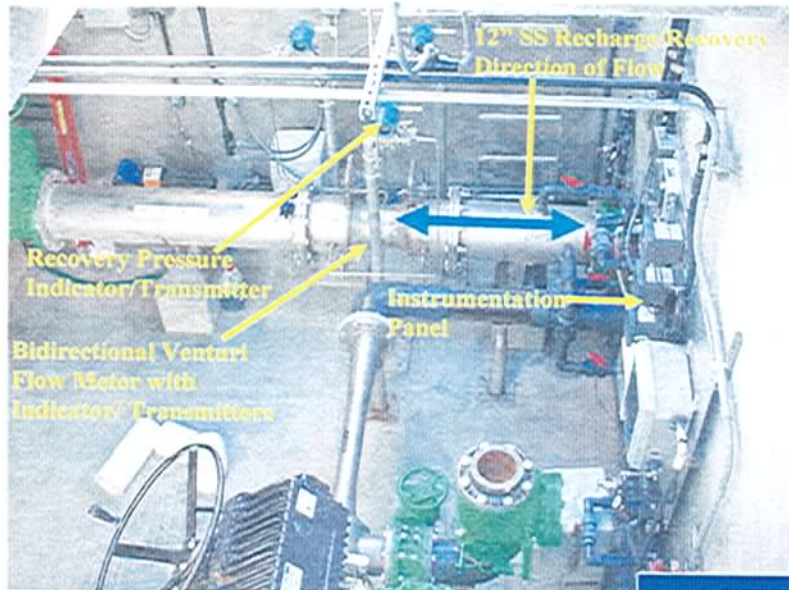


WELLHEAD VAULT PHOTO DESCRIPTION

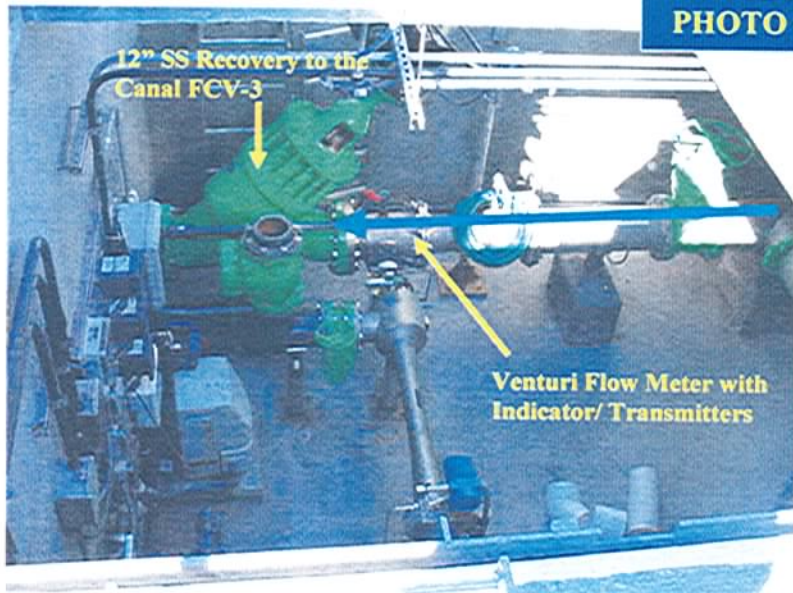




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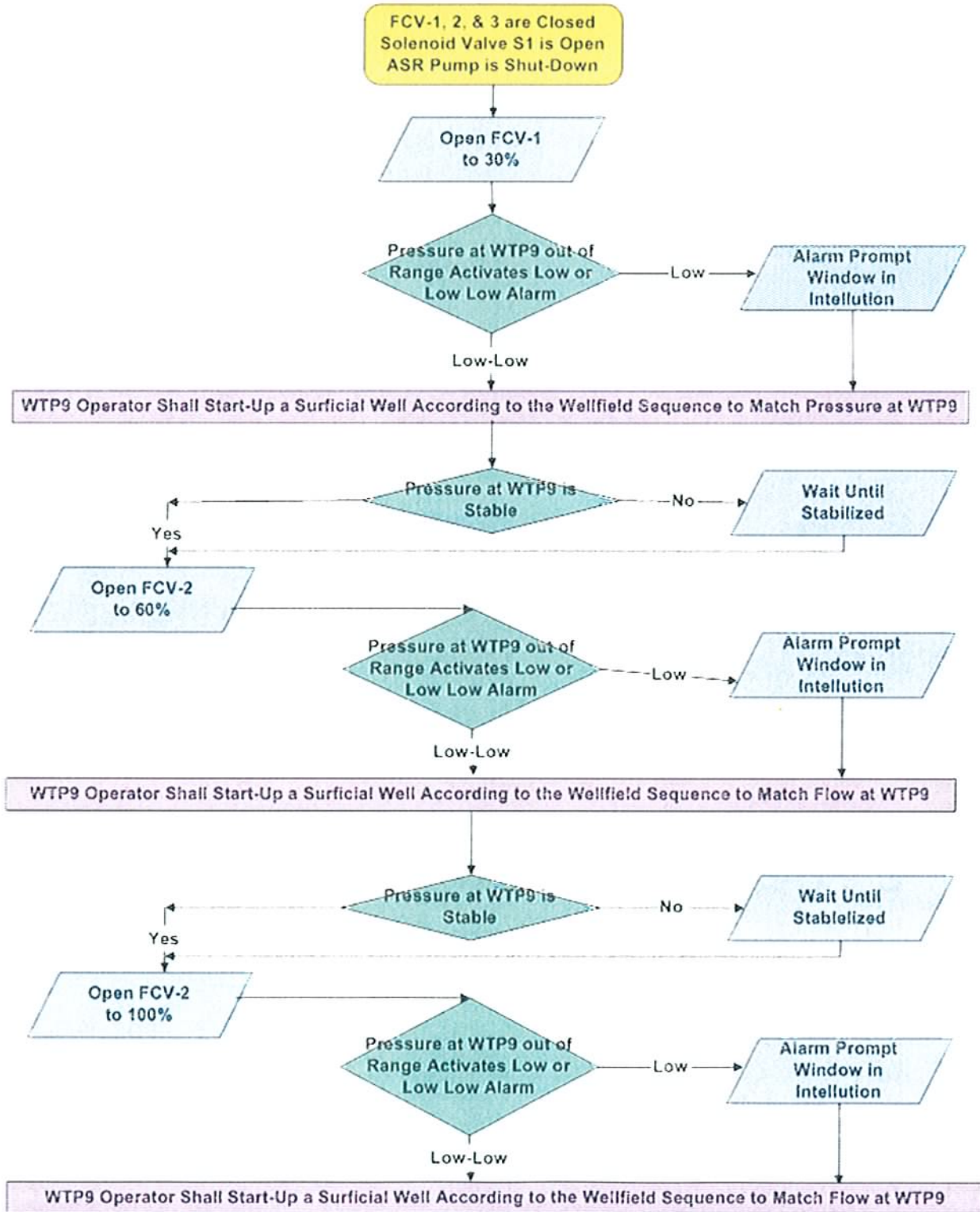
METER VAULT PHOTO DESCRIPTION





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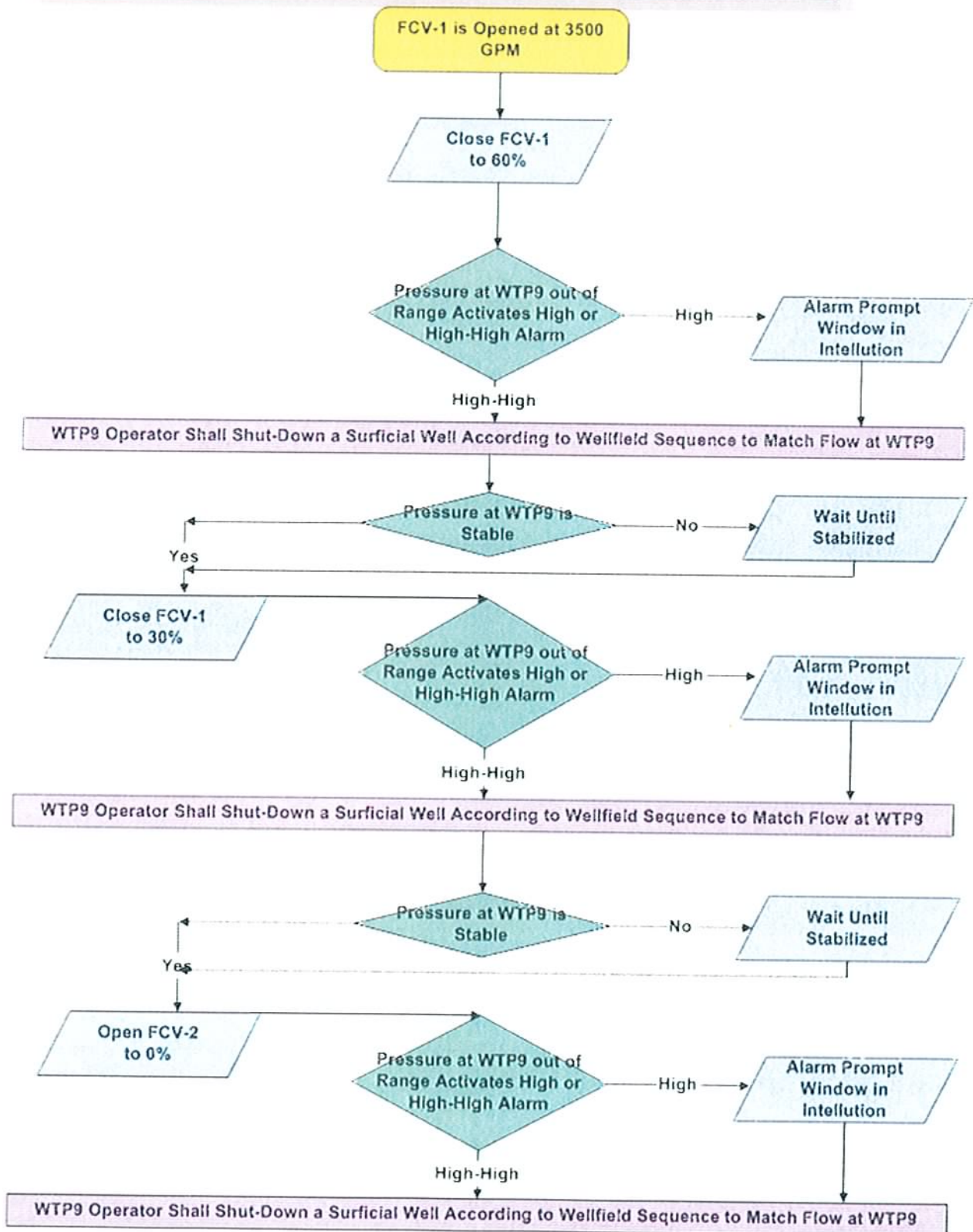
HILLSBORO ASR RECHARGE START-UP OPERATIONS FLOW CHART





WATER UTILITIES DEPARTMENT EASTERN HILLSBORO ASR SYSTEM CYCLE TESTS - TECHNICAL MEMORANDUM

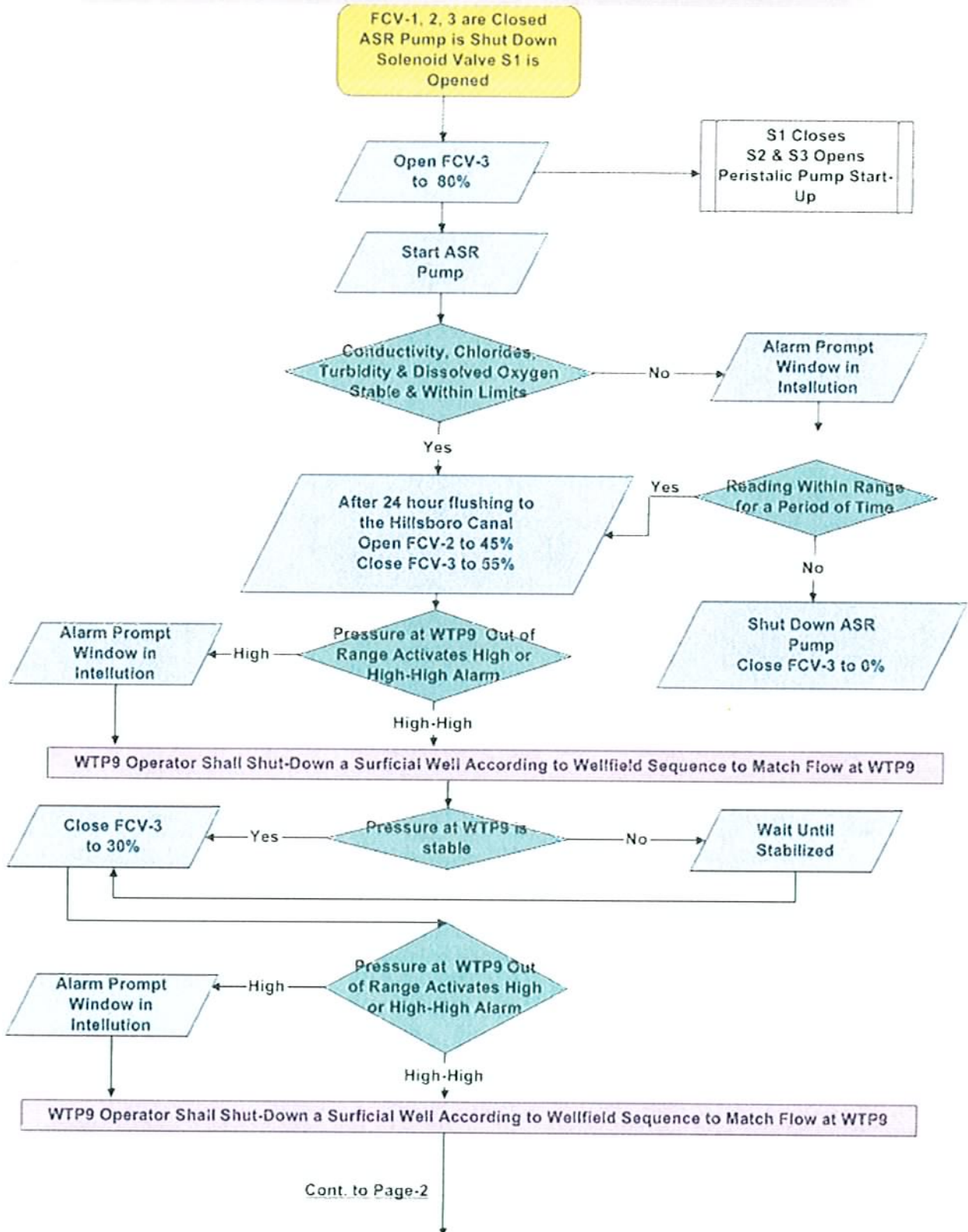
HILLSBORO ASR RECHARGE SHUT DOWN FLOW CHART





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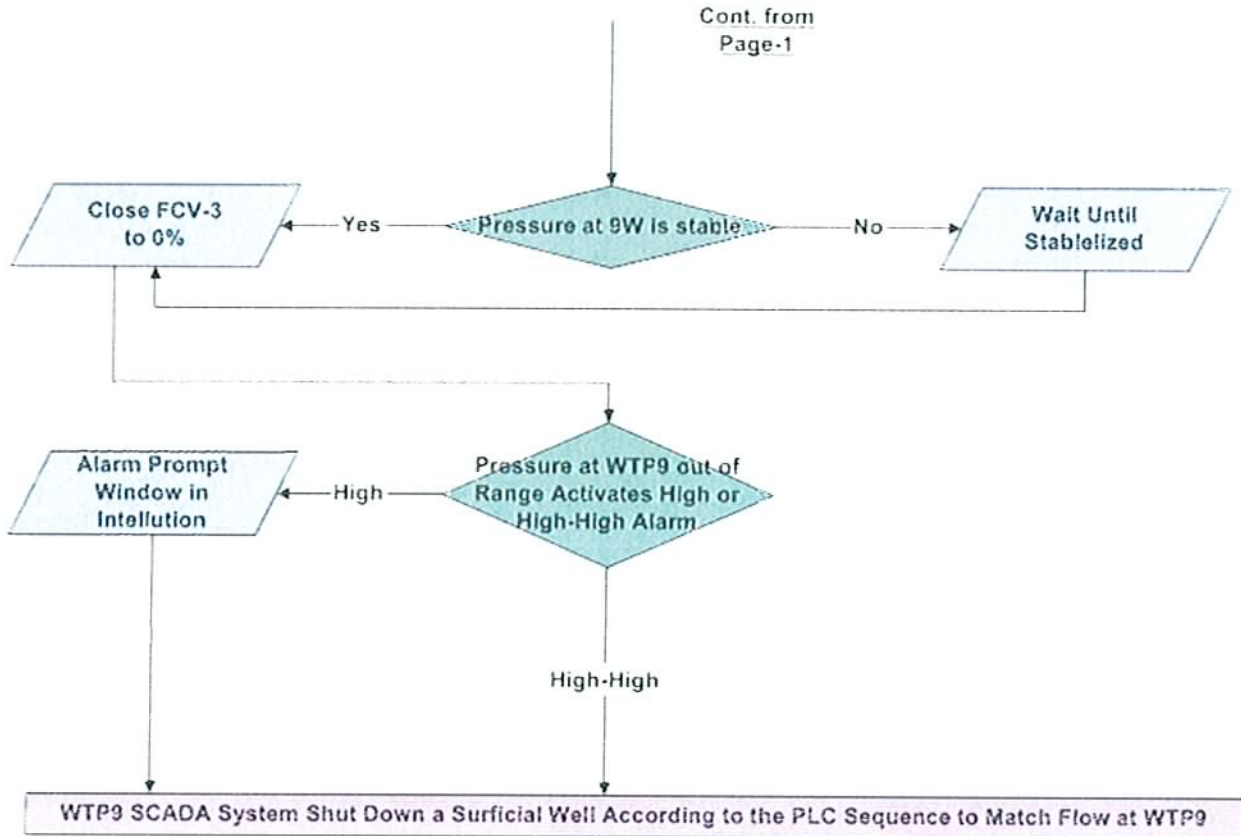
HILLSBORO ASR RECOVERY RAW WATER TO WTP9 OR HILLSBORO CANAL START-UP OPERATIONS FLOW CHART





WATER UTILITIES DEPARTMENT EASTERN HILLSBORO ASR SYSTEM CYCLE TESTS - TECHNICAL MEMORANDUM

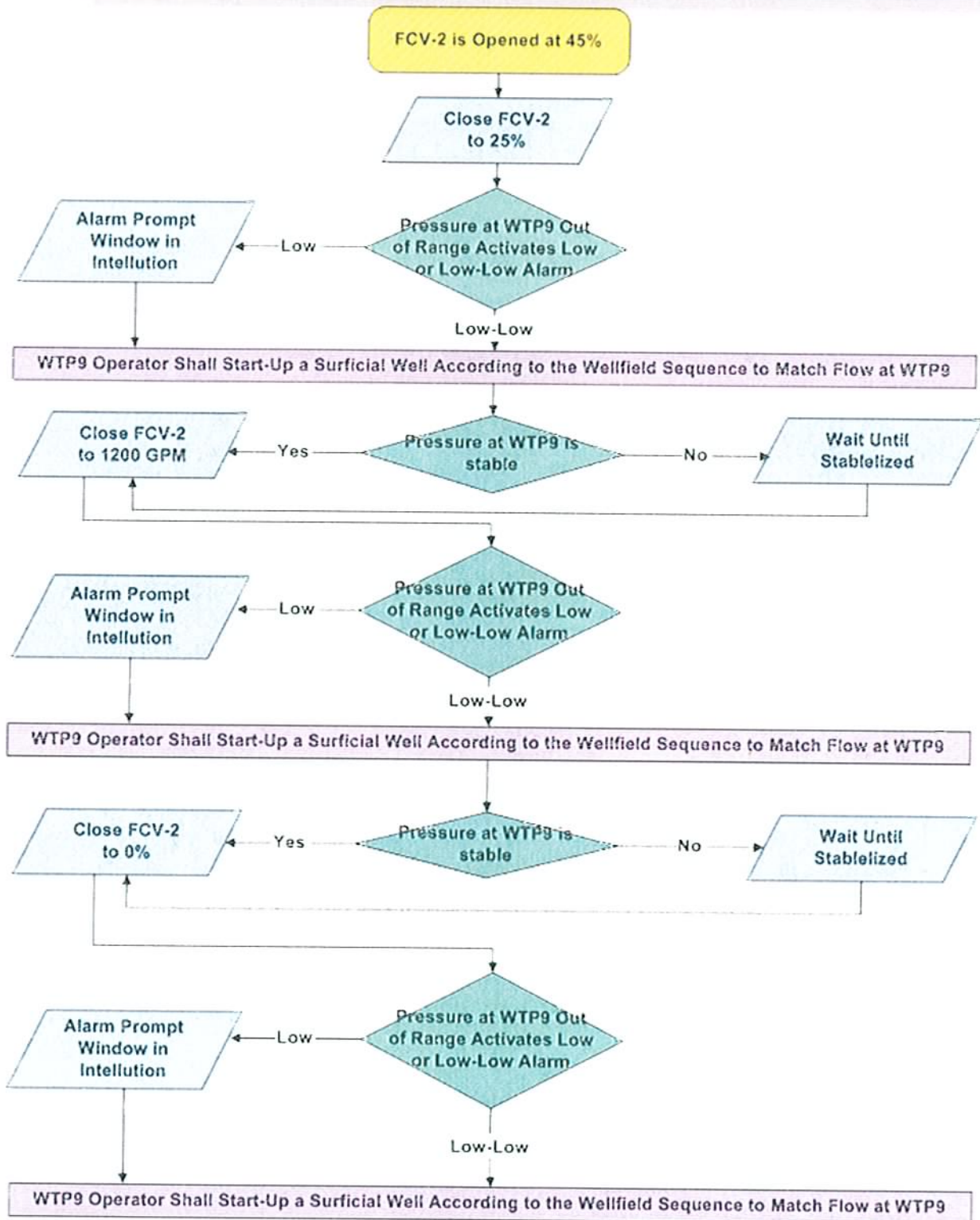
HILLSBORO ASR RECOVERY RAW WATER TO WTP9 OR HILLSBORO CANAL START-UP OPERATIONS FLOW CHART



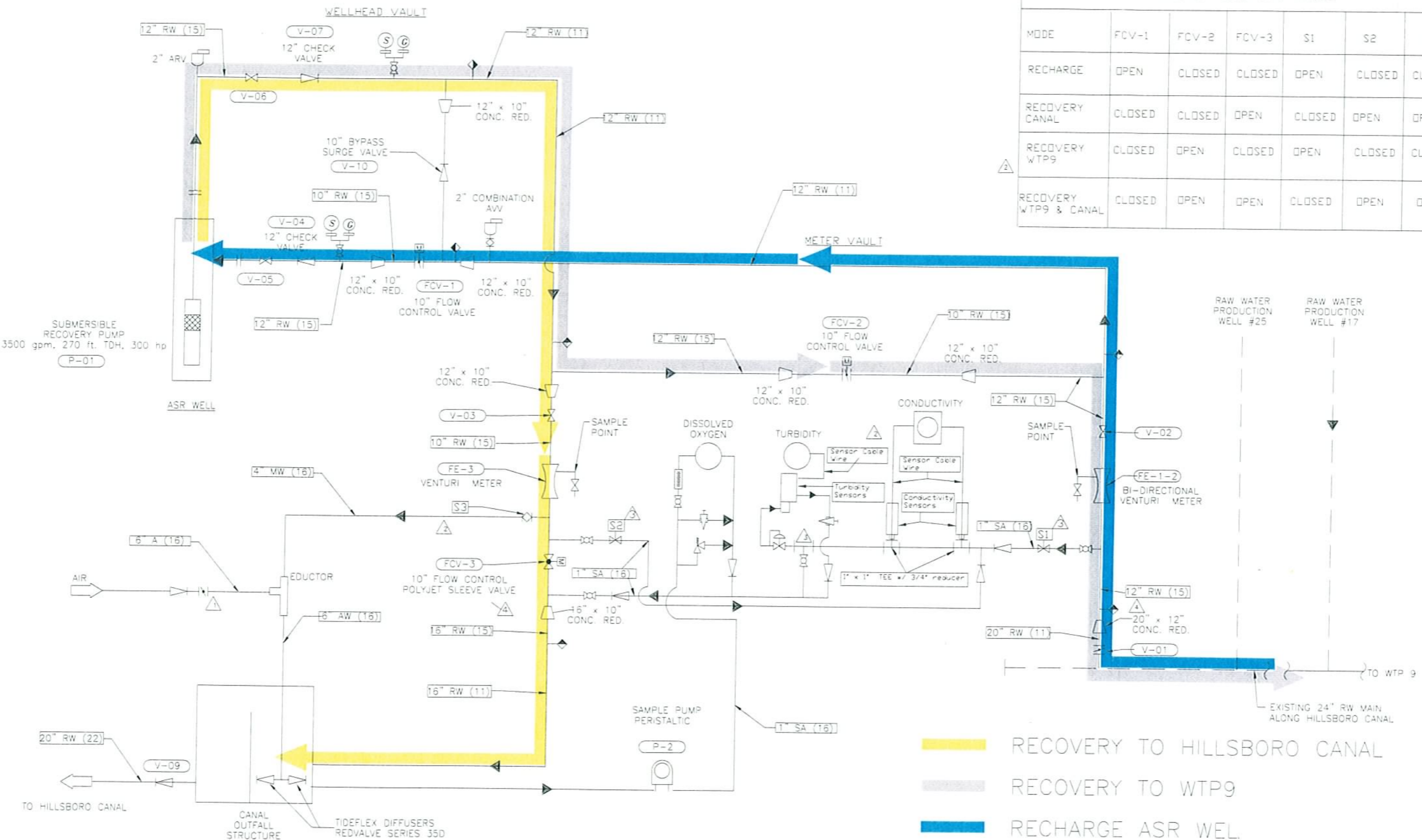


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HILLSBORO ASR RECOVERY RAW WATER TO WTP9 SHUT-DOWN OPERATIONS FLOW CHART



PROCESS FLOW DIAGRAM (PFD) - ASR WELL



MODE	FCV-1	FCV-2	FCV-3	S1	S2	S3
RECHARGE	OPEN	CLOSED	CLOSED	OPEN	CLOSED	CLOSED
RECOVERY CANAL	CLOSED	CLOSED	OPEN	CLOSED	OPEN	OPEN
RECOVERY WTP9	CLOSED	OPEN	CLOSED	OPEN	CLOSED	CLOSED
RECOVERY WTP9 & CANAL	CLOSED	OPEN	OPEN	CLOSED	OPEN	OPEN

RECOVERY TO HILLSBORO CANAL
 RECOVERY TO WTP9
 RECHARGE ASR WEL.

C:\Documents and Settings\jpanayides\Desktop\198-060_g07\mod007_ProcessFlow.dwg (Model) Last Modified: Mon, Apr 18, 2005 - 2:42pm

REV	DATE	BY	DESCRIPTION
1	3/7/01	JAZ	AERATION MODIFICATIONS PER NPDES PERMIT
2			Sample Lines, Solenoid Valves, Valve chart
3			Drawn, Ball Valve, Added recovery mode
4			RECORD DRAWING

WARNING
 0 1/2 1
 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED: J. McMahon
 DRAWN: J. ZARAGOZA
 CHECKED: G. HART
 Kimley-Horn and Associates, Inc.
 4431 Embrocadero Dr
 West Palm Beach, Florida 33407
 Certificate of Authorization Number 696

MONTGOMERY WATSON
 490 SANDRASS CORPORATE PARKWAY
 SUITE 300 SUNRISE, FLORIDA 33325
 Certificate of Authorization Number 6773

Palm Beach County
 Water Utilities Department

PALM BEACH COUNTY
 HILLSBORO ASR WELL
 SHEET
G-7
 PROCESS FLOW DIAGRAM - ASR WELL