STATE OF COLORADO

Musick - DNR, Jason <jason.musick@state.co.us>

Hayden Gulch 2016 AHR

1 message

Watterson, Brian <BWatterson@peabodyenergy.com> Thu, Mar 30, 2017 at 11:08 AM
To: "Musick - DNR, Jason <jason.musick@state.co.us> (jason.musick@state.co.us)" <jason.musick@state.co.us>

16_HGT_AHR_Final.pdf
1725K

Hayden Gulch Terminal, LLC
Peabody Energy
PO Box 670
36600 Routt County Road 27
Hayden, CO. 81639

February 17, 2017

Jason Musick
Colorado Division of Reclamation, Mining and Safety
1313 Sherman Street, Room 215
Denver, CO 80203-2273

RE: HGT AHR, Permit C-92-081

Dear Jason,

Enclosed is the 2016 Annual Hydrology Report (AHR) for the Hayden Gulch Terminal Loadout (HGT). This report contains a compilation and analysis of hydrologic data collected during the period extending from October 1, 2015 through September 30, 2016.

Please contact me with any comments and/or questions.

Sincerely,

Brian Watterson
Geologist

TNS/*tns*
Enclosure: HGT AHR

cc: Alan Boehms, OSMRE
Jennifer Maiolo, BLM

Hayden Gulch Terminal, LLC
Peabody Energy
PO Box 670
36600 Routt County Road 27
Hayden, CO. 81639

2016 WATER YEAR

ANNUAL HYDROLOGY REPORT

HAYDEN GULCH TERMINAL LOADOUT

PERMIT C-92-081

FEBRUARY 2017

2016

Annual Hydrology Report

Hayden Gulch Loadout

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List of Appendices

Introduction

The information assembled in this 2016 Annual Hydrology Report (AHR) includes data collected from all water monitoring sites at Hayden Gulch Terminal LLC's (HGT) Hayden Gulch Loadout (CDRMS Permit C-92-081) for the 2016 water year (October 2015-September 2016). Locations of water monitoring sites are depicted on Figure 1 (Appendix A).

In 2011, the tipple was scrapped. Topsoiling and reseeding of the tipple and coal storage areas were also completed in 2011. The office area and the rail line were left in place until 2013 when the offices were reclaimed. The rail line remains.

The Tie-Across Haul Road (formerly associated with the Seneca II-W Mine, CDRMS Permit C-82-057) was transferred to the Hayden Gulch Terminal on January 4, 2012.

Meteorological Data

Data from the National Climatic Data Center's (NCDC) Hayden Station are used to evaluate the precipitation trend. These data are provided in Appendix A1. Precipitation data are summarized on Table 2. For this year, 18.43 inches of precipitation was measured, which is 0.17 inch (1%) above the 1981-2015 average, 18.26 inches. All months except October, February, March, June, July, August, and September were above average. Snowpack runoff, as estimated by totaling November through March precipitation values, was 9.66 inches, which was 2.29 inches (31%) above the 1981-2015 average, 7.37 inches.

Water Sampling and Measurement Techniques

Field conductivity and pH meters were calibrated prior to each day of use. The conductivity meter is calibrated using a potassium chloride solution with an electrical conductivity in the 1,000 to 4,000 umhos/cm range. The pH meter is calibrated using NBS traceable buffers with pH values of 7 and 10. Water level measurements are taken with a water level indicator or directly from a steel tape.

Table 1 (Appendix A) lists the surface water parameters used for all stream sites. Table 2 (Appendix A) lists the ground water parameters used for all wells. ACZ Laboratory in Steamboat Springs, Colorado performs analyses by EPA or equivalent methods. Samples are delivered to the lab on the day of collection in an iced cooler.

Surface Water

There are two NPDES sites at the Loadout, 001 and 002 (aka NPDES1H and NPDES2H). NPDES water quality reports for 2016 are presented in Appendix B. Data provided include a water quality report for the 2016 water year, remarks, a flow hydrograph for all historic data, and a regression plot of historic total dissolved solids (TDS) data.

A new NPDES permit went into effect on July 10, 2008. The major changes in this new permit were: 1) monitoring frequency for most parameters is now twice a month (was weekly in the previous permit), 2) monitoring of total iron and total manganese was dropped and 3) monitoring of total recoverable iron was added. No NPDES effluent limits were exceeded this year.

Due to dry weather conditions, NPDES1H has no recorded discharge since 2011. This site displays a decreasing TDS trend, with the peak value occurring in May 1997.

Due to dry weather conditions, NPDES2H also did not discharge this year. This site displays a peak value occurring in June 2011 and a low value occurring in March 2015. The March 2015 sample was collected from the pond.

Surface water quality reports for 2016 are presented in Appendix B. Data provided include a water quality report for the 2016 water year, remarks, a flow hydrograph for all historic data, and a regression plot of historic total dissolved solids (TDS) data.

Site HGSD1 is upstream of the Loadout. This site is normally monitored twice a year, once in the spring and once in the fall. This site displays an increasing TDS trend, with the TDS peak occurring in October 2002.

Site HGSD3 is downstream of the Loadout. This site displays a slightly increasing TDS trend, with the peak TDS occurring in April 1995.

Table 4 provides a comparison of this year's surface water quality to CDPHE receiving stream standards for lower Dry Creek (Yampa Segment 13h, Regulation No. 33, January 2009). This table was generated from the Paradox database and does not include the units of concentration (mg/l or ug/l) for each parameter. The units used for each parameter are the same as those listed on the Surface Water Parameter List (Table 1) and are the same as those used in the water quality reports. The frequency column on Table 4 provides four values in the format 0/0/2/2. The first numeral represents the number of exceedances above the Method Detection Limit (MDL). The second numeral represents the number of exceedances between the MDL and the Practical Quantitation Level (PQL). The third numeral represents the number of sample values below the MDL but the MDL was higher than the standard. Moreover, the fourth numeral represents the total number of samples. A summary of the standards that were exceeded is presented below.

HGT analyzed selenium in three forms this year, dissolved, potentially dissolved and total recoverable, often on the same samples, to investigate the difference in the three methods of analysis. From a regulatory perspective, the potentially dissolved form is applicable to NPDES sites, while the dissolved form is applicable to stream sites. The total recoverable form was run only as a quality control check. The following discussion will focus only on potential dissolved selenium excursions at NPDES sites and dissolved selenium excursions at steam sites. There were no excursions at NPDES Sites this year.

The chronic selenium standard (4.6 ug/l) was exceeded twice at upstream Site HGSD1; 4.8 ug/l in March and 5.1 in May. Downstream Site HGSD3 exceeded the chronic standard once; 5.0 ug/l in May. The acute standard (18.4 ug/l) was not exceeded at either site this year. Irrigation return water from nearby hay fields is in part the cause of the excursions at these sites. This entire area is composed of topsoils derived from the Lewis Shale, which has naturally elevated concentrations of selenium and salts, which contribute to dissolved solids in local runoff. NPDES Sites

did not flow this year, so they are not responsible for the stream selenium exceedances.

The mercury Method Detection Limit (MDL) is 0.2 (or sometimes 0.4 ug/l). All test values this year were less than the MDL. The mercury standard is 0.01 ug/l.

The aquatic life ammonia standard is dependent on pH and temperature. The detection limit for ammonia is 0.05 mg/l. All values above detection limit are compared to table standards found on this website, page 87: http://www.epa.gov/waterscience/criteria/ammonia/99update.pdf
No ammonia excursions occurred this year.

The sulfide values provided in Table 4 differ from the values reported in Appendix B. The sulfide data presented in Appendix B are the total of both the ionized (S^-) and un-ionized (H_2S) forms of hydrogen sulfide. The un-ionized form is the potentially toxic form, and is the basis for the CDPHE water quality standard. A procedure for calculating the un-ionized form may be found on the website: http://www.mullalyengineering.com.au/images/product/file/Problem_of_Hydrogen_Sulphide_in_Sewers.pdf page 5, Table 1. The results of those calculations are presented in Table 4 of this AHR. This year, no sulfide excursions occurred.

Ground Water

Ground water quality reports for this year are presented in Appendix B. Data provided include a water quality report for the 2015 water year, a water level report, sampling remarks and a listing of a regression plot of historic TDS data.

Well HGDAL3 is downgradient of the Loadout. It was drilled in 1993. It displays a decreasing TDS trend; the peak TDS value occurred in June 1997.

Well HGDAL4 is upgradient of the Loadout. It was drilled in 2005. It displays an increasing TDS trend, with the peak TDS value occurring in May 2015.

This year's ground water quality was compared against CDPHE ground water agricultural use standards (CDPHE, Reg. 41, 2008). Results of those comparisons are presented in Table 5.

Well HGDAL3 exceeded the boron standard (750 ug/l) in September. According to the CDPHE, the 750 ug/l standard is set for sensitive crops (CDOH, Reg. 41, 2008), and that the limit otherwise is 5000 ug/l. None of the boron sensitive plant species are grown commercially in this area. This year, neither of the Loadout wells displayed a boron value higher than 800 ug/l.

The cadmium MDL is 30 ug/l (or sometimes 50 ug/l). All test values this year were less than the MDL. The cadmium standard is 10 ug/l.

The lead MDL is 200 ug/l (or sometimes 300 ug/l). All test values this year were less than the MDL. The lead standard is 100 ug/l.

Both wells exceeded the manganese standard (0.2 mg/l) in both May and September. It should be noted that, while the CDPHE uses a manganese standard of 0.2 mg/l, the EPA states that this standard is used to protect crops grown in soils with a pH value lower than 6.0. In January

2008, CDPHE revised their ground water agricultural standard to reflect this pH qualifier. In soils with a higher pH (as are found in the HGT region), a more appropriate standard would be 10 mg/l (EPA. 1976. "Quality Criteria for Water"). This year, neither of the Loadout wells displayed a manganese value higher than 6 mg/l.

In a letter dated June 5, 2008, Tom Kaldenbach of the CDRMS stated, “Groundwater points of compliance are unwarranted at the Hayden Gulch Loadout…”. He further concluded “… any leachate originating at the loadout would likely be of better quality than native groundwater in the Lewis Shale which has high concentrations of dissolved solids.” This letter was provided in the 2008 AHR, Figure 3 (Appendix A). Monitoring conducted this year at the Loadout continues to support these conclusions.

Summary

The Loadout appears to have little to no impact on the surface and ground water systems in the area. Irrigation return water upstream of the Loadout, which is in contact with topsoil derived from the Lewis Shale (which contribute to elevated concentrations of selenium and dissolved solids in local runoff), are dominate in determining the water quality in the vicinity.

APPENDIX A

Figures and Tables

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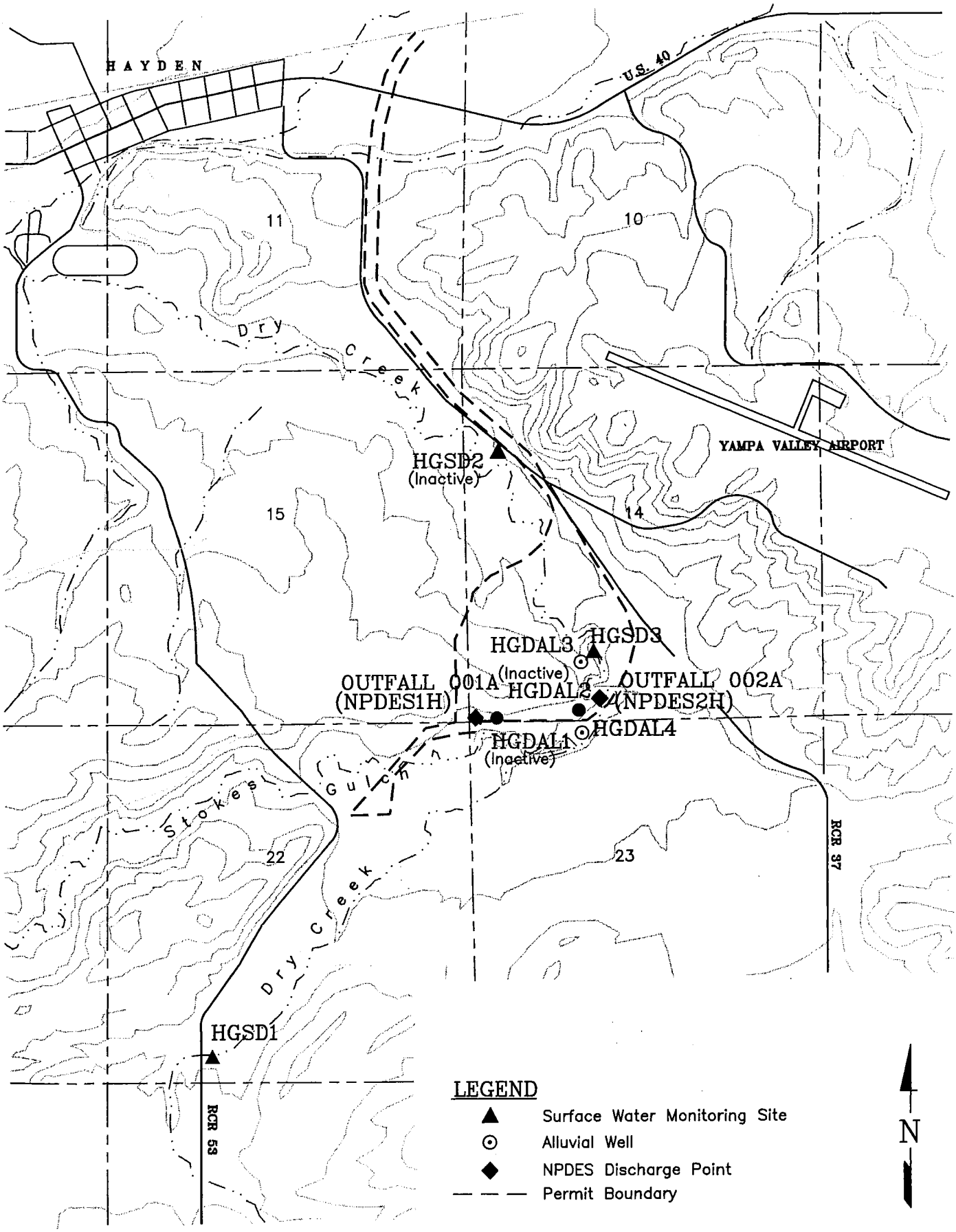

Title:	Monitoring Site Locations	Date:	03/07
Job Name:	Hayden Gulch Loadout 2006 Annual Hydrology Report	Job No.	04-6123
Client:	Hayden Gulch Terminal, Inc.	Figure	1

NWCC
North West Colorado Consultants, Inc
Geotechnical / Environmental Engineering - Materials Testing
(970)879-7688 - Fax (970)879-7891
2580 Copper Ridge Drive -P.O. Box 775226
Steamboat Springs, Colorado 80477

TABLE 1

Surface Water Parameter List

Parameter	Analysis Technique	Units
Field		
Conductivity	Direct Measurement	umhos/cm
pH	Direct Measurement	units
Temperature	Direct Measurement	•C
Laboratory		
Alkalinity as $CaCO_3$	Dissolved	mg/l
Arsenic	Total Recoverable	ug/l
Bicarbonate	Dissolved	mg/l
Boron	Dissolved	ug/l
Cadmium	Potentially Dissolved	ug/l
Calcium	Dissolved	mg/l
Carbonate	Dissolved	mg/l
Chloride	Dissolved	mg/l
Chromium	Potentially Dissolved (+3 & +6 valences)	ug/l
Conductivity at 25•C	Direct Measurement	umhos/cm
Copper	Potentially Dissolved	ug/l
Hardness as $CaCO_3$	Dissolved	mg/l
Iron	Total Recoverable	mg/l
Lead	Potentially Dissolved	ug/l
Magnesium	Dissolved	mg/l
Manganese	Potentially Dissolved	mg/l

TABLE 1 (Cont.)

Surface Water Parameter List

Parameter	Analysis Technique	Units
Mercury	Total	ug/l
Nickel	Potentially Dissolved	ug/l
Nitrogen, Ammonia	Total	mg/l
Nitrogen, Nitrate	Dissolved	mg/l
Nitrogen, Nitrite	Dissolved	mg/l
pH	Direct Measurement	units
Potassium	Dissolved	mg/l
Selenium	Potentially Dissolved	ug/l
Silver	Potentially Dissolved	ug/l
Sodium	Dissolved	mg/l
Sodium Adsorption Ratio	Calculated	unitless
Sulfate	Dissolved	mg/l
Sulfide	Total	mg/l
Suspended Solids	Total	mg/l
Zinc	Potentially Dissolved	mg/l
Cation/Anion Balance	Calculated	percent
Total Dissolved Solids at 180•C	Dissolved	mg/l
Total Dissolved Solids Calculated	Calculated	mg/l

Table 2

Ground Water Parameter List

Parameter	Analysis Technique	Units
Field		
Conductivity	Direct Measurement	umhos/cm
pH	Direct Measurement	units
Temperature	Direct Measurement	°C
Laboratory		
Alkalinity as $CaCO_3$	Dissolved	mg/l
Aluminum	Dissolved	mg/l
Arsenic	Dissolved	ug/l
Bicarbonate	Dissolved	mg/l
Boron	Dissolved	ug/l
Cadmium	Dissolved	ug/l
Calcium	Dissolved	mg/l
Carbonate	Dissolved	mg/l
Chloride	Dissolved	mg/l
Chromium	Dissolved (+3 & +6 valences combined)	ug/l
Conductivity at 25°C	Direct Measurement	umhos/cm
Copper	Dissolved	ug/l
Fluoride	Dissolved	mg/l
Hardness as $CaCO_3$	Dissolved	mg/l
Iron	Dissolved	mg/l
Lead	Dissolved	ug/l
Magnesium	Dissolved	mg/l
Manganese	Dissolved	

Table 2 (Cont.)

Ground Water Parameter List

Parameter	Analysis Technique	Units
Mercury	Dissolved	ug/l
Nickel	Dissolved	ug/l
Nitrogen, Nitrate	Dissolved	mg/l
Nitrogen, Nitrite	Dissolved	mg/l
pH	Direct Measurement	units
Potassium	Dissolved	mg/l
Selenium	Dissolved	ug/l
Sodium	Dissolved	mg/l
Sodium Adsorption Ratio	Calculated	unitless
Sulfate	Dissolved	mg/l
Sulfide	Total	mg/l
Suspended Solids	Total	mg/l
Zinc	Dissolved	mg/l
Cation/Anion Balance	Calculated	percent
Total Dissolved Solids at 180°C	Dissolved	mg/l
Total Dissolved Solids Calculated	Calculated	mg/l

TABLE 3

CDOH Yampa Segment 13h (lower Dry Creek) Standards

FIELD PH	6.5 - 9.0
AMMONIA, NITROGEN, MG/L	0.05[A]
ARSENIC, TOTAL REC., UG/L	340.0 (acute)
ARSENIC, TOTAL REC., UG/L	7.6 (chronic)
BORON, DISSOLVED, UG/L	750.0
CADMIUM, UG/L	9.2 (acute)
CADMIUM, UG/L	1.2 (chronic)
CHROMIUM, UG/L	1773 (acute)
CHROMIUM, UG/L	231 (chronic)
COPPER, UG/L	50.0 (acute)
COPPER, UG/L	29.0 (chronic)
IRON, TOTAL REC., MG/L	1.0
LEAD, UG/L	281.0 (acute)
LEAD, UG/L	11.0 (chronic)
MANGANESE, MG/L	4.738 (acute)
MANGANESE, MG/L	2.618 (chronic)
MERCURY, TOTAL, UG/L	0.01[B]
NICKEL, UG/L	1513.0 (acute)
NICKEL, UG/L	168.0 (chronic)
NITRITE, NITROGEN, MG/L	0.05
NITRATE, NITROGEN, MG/L	100.0
SELENIUM, UG/L	18.4 (acute)
SELENIUM, UG/L	4.6[C] (chronic)
SULFIDE, MG/L	0.02[D]
SILVER, UG/L	22.0 (acute)
SILVER, UG/L	3.5 (chronic)
ZINC, MG/L	0.565 (acute)
ZINC, MG/L	0.428 (chronic)

Acute = one-day max., Chronic = 30-day average. These values were taken from Table IV, CDOH Reg. 31, using a mean hardness of 400 mg/l. All acute/chronic values are the 'dissolved' form.

TABLE 3 (cont.)

A = Detection limit is 0.05 mg/l. All values above detection limit are compared to table standards found on this website: http://nepis.epa.gov/Adobe/PDF/20003O3L.pdf

B = Detection limit for stream and spring sites is 0.2 ug/l.

C = Temporary Modification Se(ch): "current conditions" expires 12/31/18

D = Standard is 0.002 mg/l (un-ionized). Detection limit is 0.02 mg/l.

Table 4
COMPARISON OF SURFACE WATER STANDARDS TO SEGMENT 13h STREAM STANDARDS

Analyte	Standard	No. Sites	Sites	Frequency	Exceedence Date Range	Exceedence Value Range	Exceedence Median	
RECEIVING STREAM STANDARDS, 13H LO DRYCR JUNE 2014 DISS.STD								
Ammonia Nitrogen_N	0.0000 - 0.0500	0	none					
Arsenic, Total Rec.	0.0000 - 7.6000	0	none					
Arsenic, Total Rec.	0.0000 - 340.0000	0	none					
Boron, Dissolved	0.0000 - 750.0000	0	none					
Cadmium, Dissolved	0.0000 - 1.2000	0	none					
Cadmium, Dissolved	0.0000 - 9.2000	0	none					
Cadmium, Pot. Diss.	0.0000 - 1.2000	0	none					
Cadmium, Pot. Diss.	0.0000 - 9.2000	0	none					
Chromium, Dissolved	0.0000 - 231.0000	0	none					
Chromium, Dissolved	0.0000 - 1773.0000	0	none					
Chromium, Pot. Diss.	0.0000 - 231.0000	0	none					
Chromium, Pot. Diss.	0.0000 - 1773.0000	0	none					
Copper, Dissolved	0.0000 - 29.0000	0	none					
Copper, Dissolved	0.0000 - 50.0000	0	none					
Copper, Pot. Diss.	0.0000 - 29.0000	0	none					
Copper, Pot. Diss.	0.0000 - 50.0000	0	none					
Field Ph	6.5000 - 9.0000	0	none					
Iron, Total Rec.	0.0000 - 1.0000	1	HGSD1	1/0/0/2	09/07/16-09/07/16	2.0000 -	2.0000	2.0000
Lead, Dissolved	0.0000 - 11.0000	0	none					
Lead, Dissolved	0.0000 - 281.0000	0	none					
Lead, Pot. Diss.	0.0000 - 11.0000	0	none					
Lead, Pot. Diss.	0.0000 - 281.0000	0	none					
Manganese, Dissolved	0.0000 - 2.6180	0	none					
Manganese, Dissolved	0.0000 - 4.7380	0	none					
Manganese, Pot. Diss.	0.0000 - 2.6180	0	none					

Table 4
COMPARISON OF SURFACE WATER STANDARDS TO SEGMENT 13h STREAM STANDARDS

Analyte	Standard	No. Sites	Sites	Frequency	Exceedence Date Range	Exceedence Value Range	Exceedence Median	
Manganese, Pot. Diss.	0.0000 - 4.7380	0	none					
Mercury, Total	0.0000 - 0.0100	2	HGSD1	0/0/2/2	06/22/16-09/07/16(<)	0.2000 -	0.2000	0.2000
			HGSD3	0/0/1/1	06/22/16-06/22/16(<)	0.2000 -	0.2000	0.2000
Mercury, Total	0.0000 - 0.2000	0	none					
Nickel, Dissolved	0.0000 - 168.0000	0	none					
Nickel, Dissolved	0.0000 - 1513.0000	0	none					
Nickel, Pot. Diss.	0.0000 - 168.0000	0	none					
Nickel, Pot. Diss.	0.0000 - 1513.0000	0	none					
Nitrate Nitrogen_N	0.0000 - 100.0000	0	none					
Nitrite Nitrogen_N	0.0000 - 0.0500	0	none					
Selenium, Dissolved	0.0000 - 4.6000	2	HGSD1	2/0/0/2	06/22/16-09/07/16	4.8000 -	5.1000	4.9500
			HGSD3	1/0/0/1	06/22/16-06/22/16	5.0000 -	5.0000	5.0000
Selenium, Dissolved	0.0000 - 18.4000	0	none					
Selenium, Pot. Diss.	0.0000 - 4.6000	0	none					
Selenium, Pot. Diss.	0.0000 - 18.4000	0	none					
Selenium, Total Rec.	0.0000 - 4.6000	2	HGSD1	2/0/0/2	06/22/16-09/07/16	4.8000 -	5.2000	5.0000
			HGSD3	1/0/0/1	06/22/16-06/22/16	5.5000 -	5.5000	5.5000
Selenium, Total Rec.	0.0000 - 18.4000	0	none					
Silver, Dissolved	0.0000 - 3.5000	0	none					
Silver, Dissolved	0.0000 - 22.0000	0	none					
Silver, Pot. Diss.	0.0000 - 3.5000	0	none					
Silver, Pot. Diss.	0.0000 - 22.0000	0	none					
Sulfide	0.0000 - 0.0200	0	none					
Zinc, Dissolved	0.0000 - 0.4280	0	none					
Zinc, Dissolved	0.0000 - 0.5650	0	none					
Zinc, Pot. Diss.	0.0000 - 0.4280	0	none					
Zinc, Pot. Diss.	0.0000 - 0.5650	0	none					

Frequency = uncensored/between MDL&PQL/censored/no. samples, (B) = Between MDL&PQL range, (<) = Censored range

---- Water Use Summary Report ----

Site	RECEIVING
HGSD1	Iron, Total Rec.(1/2)
	Mercury, Total(2/4)
	Selenium, Dissolved(2/4)
	Selenium, Total Rec.(2/4)
HGSD3	Mercury, Total(1/2)
	Selenium, Dissolved(1/2)
	Selenium, Total Rec.(1/2)

Table 5
COMPARISON OF GROUND WATER STANDARDS TO AGRICULTURAL STANDARDS

Analyte	Standard	No. Sites	Sites	Frequency	Exceedence Date Range	Exceedence Value Range	Exceedence Median	
CDOH (5/08) AGRICULTURAL GROUNDWATER STANDARDS ONLY - AHRGW.STD								
Aluminum, Dissolved	0.0000 - 5.0000	0	none					
Arsenic, Dissolved	0.0000 - 100.0000	0	none					
Boron, Dissolved	0.0000 - 750.0000	1	HGDAL3	1/0/0/2	09/18/16-09/18/16	800.0000 -	800.0000	800.0000
Boron, Dissolved	0.0000 - 5000.0000	0	none					
Cadmium, Dissolved	0.0000 - 10.0000	2	HGDAL3	0/0/2/2	05/11/16-09/18/16(<)	30.0000 -	50.0000	40.0000
			HGDAL4	0/0/2/2	05/11/16-09/18/16(<)	30.0000 -	50.0000	40.0000
Chromium, Dissolved	0.0000 - 100.0000	0	none					
Copper, Dissolved	0.0000 - 200.0000	0	none					
Field Ph	6.5000 - 8.5000	0	none					
Fluoride	0.0000 - 2.0000	0	none					
Iron, Dissolved	0.0000 - 5.0000	0	none					
Lead, Dissolved	0.0000 - 100.0000	2	HGDAL3	0/0/2/2	05/11/16-09/18/16(<)	200.0000 -	300.0000	250.0000
			HGDAL4	0/0/2/2	05/11/16-09/18/16(<)	200.0000 -	300.0000	250.0000
Manganese, Dissolved	0.0000 - 0.2000	2	HGDAL3	2/0/0/2	05/11/16-09/18/16	4.3500 -	5.2600	4.8050
			HGDAL4	2/0/0/2	05/11/16-09/18/16	0.7700 -	1.4600	1.1150
Mercury, Dissolved	0.0000 - 10.0000	0	none					
Nickel, Dissolved	0.0000 - 200.0000	0	none					
Nitrate/Nitrite Nitrogen_N	0.0000 - 100.0000	0	none					
Nitrite Nitrogen_N	0.0000 - 10.0000	0	none					
Selenium, Dissolved	0.0000 - 20.0000	0	none					
Zinc, Dissolved	0.0000 - 2.0000	0	none					

Frequency = uncensored/between MDL&PQL/censored/no. samples, (B) = Between MDL&PQL range, (<) = Censored range

Table 5
COMPARISON OF GROUND WATER STANDARDS TO AGRICULTURAL STANDARDS

---- Water Use Summary Report ----

Site	CDOH
HGDAL3	Boron, Dissolved(1/4)
	Cadmium, Dissolved(2/2)
	Manganese, Dissolved(2/2)
	Lead, Dissolved(2/2)
HGDAL4	Cadmium, Dissolved(2/2)
	Manganese, Dissolved(2/2)
	Lead, Dissolved(2/2)

APPENDIX A1

HAYDEN NOAA WEATHER STATION DATA

APPENDIX A1

HAYDEN NOAA WEATER STATION DATA

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U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Record of Climatological Observations

These data are quality controlled and may not be identical to the original observations.
Generated on 02/08/2017

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Elev: 6467 ft. Lat: 40.493° N Lon: 107.255° W
Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2015	10	1	81	51	68	0.00		0.0		0.0								
	2015	10	2	80	44	55	0.00		0.0		0.0								
	2015	10	3	67	37	62	0.00		0.0		0.0								
	2015	10	4	76	37	66	0.00		0.0		0.0								
	2015	10	5	66	39	55	0.01		0.0		0.0								
	2015	10	6	64	42	55	0.00		0.0		0.0								
	2015	10	7	71	36	61	0.00		0.0		0.0								
	2015	10	8	70	33	62	0.00		0.0		0.0								
	2015	10	9	73	35	64	0.00		0.0		0.0								
	2015	10	10	78	37	70	0.00		0.0		0.0								
	2015	10	11	76	37	69	0.00		0.0		0.0								
	2015	10	12	72	31	65	0.00		0.0		0.0								
	2015	10	13	75	31	67	0.00		0.0		0.0								
	2015	10	14	76	32	69	0.00		0.0		0.0								
	2015	10	15	76	30	68	0.00		0.0		0.0								
	2015	10	16	73	32	65	0.00		0.0		0.0								
	2015	10	17	75	37	67	0.00		0.0		0.0								
	2015	10	18	67	48	59	T		0.0		0.0								
	2015	10	19	67	44	55	0.02		0.0		0.0								
	2015	10	20	62	39	52	0.05		0.0		0.0								
	2015	10	21	65	41	55	0.00		0.0		0.0								
	2015	10	22	55	32	42	0.47		0.0		0.0								
	2015	10	23	56	40	48	0.50		0.0		0.0								
	2015	10	24	59	30	55	0.00		0.0		0.0								
	2015	10	25	63	32	55	0.00		0.0		0.0								
	2015	10	26	59	43	50	0.15		0.0		0.0								
	2015	10	27	50	34	40	0.06		0.0		0.0								
	2015	10	28	53	23	46	0.00		0.0		0.0								
	2015	10	29	57	33	48	0.00		0.0		0.0								
	2015	10	30	48	36	41	0.13		0.0		0.0								
	2015	10	31	55	33	49	0.00		0.0		0.0								
			Summary	67	36		1.39		0.0										

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Asheville, North Carolina 28801

Elev: 6467 ft. Lat: 40.493° N Lon: 107.255° W
Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2015	11	1	62	28	51	0.00		0.0		0.0								
	2015	11	2	67	32	57	0.00		0.0		0.0								
	2015	11	3	65	29	55	0.00		0.0		0.0								
	2015	11	4	55	32	35	0.35		1.0		0.0								
	2015	11	5	36	28	29	0.19		2.0		1.0								
	2015	11	6	37	26	30	0.23		2.0		2.0								
	2015	11	7	39	16	29	0.00		0.0		1.0								
	2015	11	8	46	18	36	0.00		0.0		1.0								
	2015	11	9	53	24	42	0.00		0.0		0.0								
	2015	11	10	50	24	37	0.00		0.0		0.0								
	2015	11	11	37	25	26	0.28		2.0		2.0								
	2015	11	12	39	16	29	0.00		0.0		1.0								
	2015	11	13	43	15	34	0.00		0.0		1.0								
	2015	11	14	51	19	34	0.00		0.0		0.0								
	2015	11	15	54	22	35	0.00		0.0		0.0								
	2015	11	16	35	24	32	0.16		2.0		1.0								
	2015	11	17	34	24	29	0.00		0.0		1.0								
	2015	11	18	41	26	34	T		0.0		0.0								
	2015	11	19	40	27	37	0.00		0.0		0.0								
	2015	11	20	41	27	27	0.01		0.0		0.0								
	2015	11	21	36	8	27	0.00		0.0		0.0								
	2015	11	22	47	12	35	0.00		0.0		0.0								
	2015	11	23	50	19	33	0.00		0.0		0.0								
	2015	11	24	54	19	40	0.00		0.0		0.0								
	2015	11	25	46	27	36	0.00		0.0		0.0								
	2015	11	26	37	14	15	0.35		7.0		6.0								
	2015	11	27	18	5	11	T		0.5		6.0								
	2015	11	28	25	4	14	0.07		0.8		5.0								
	2015	11	29	25	8	16	0.16		2.0		6.0								
	2015	11	30	21	7	16	0.10		1.5		7.0								
			Summary	43	20		1.90		20.8										

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Elev: 6467 ft. Lat: 40.493° N Lon: 107.255° W
Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
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	2015	12	1	22	-2	12	0.02		0.3		7.0								
	2015	12	2	27	1	18	0.00		0.0		7.0								
	2015	12	3	39	17	24	0.00		0.0		6.0								
	2015	12	4	40	16	29	0.00		0.0		5.0								
	2015	12	5	34	21	21	T		T		5.0								
	2015	12	6	37	13	24	0.00		0.0		5.0								
	2015	12	7	37	11	28	0.00		0.0		5.0								
	2015	12	8	45	24	35	0.00		0.0		4.0								
	2015	12	9	40	21	31	0.00		0.0		4.0								
	2015	12	10	38	19	33	0.00		0.0		3.0								
	2015	12	11	35	22	24	0.54		7.0		10.0								
	2015	12	12	26	22	23	0.30		3.0		8.0								
	2015	12	13	24	2	13	0.00		0.0		8.0								
	2015	12	14	29	7	25	0.03		0.5		7.0								
	2015	12	15	26	16	16	0.25		3.5		9.0								
	2015	12	16	23	11	11	0.15		2.0		10.0								
	2015	12	17	23	7	7	0.14		2.0		11.0								
	2015	12	18	27	3	21	0.00		0.0		10.0								
	2015	12	19	26	8	18	0.00		0.0		10.0								
	2015	12	20	26	8	26	0.00		0.0		10.0								
	2015	12	21	34	25	29	0.13		2.0		10.0								
	2015	12	22	34	23	23	0.20		3.5		12.0								
	2015	12	23	25	15	15	0.46		10.0		16.0								
	2015	12	24	15	-4	4	0.00		0.0		16.0								
	2015	12	25	21	-1	15	0.13		2.0		18.0								
	2015	12	26	15	-2	-2	0.12		1.0		18.0								
	2015	12	27	-2	-23	-11	0.00		0.0		18.0								
	2015	12	28	4	-24	-1	0.00		0.0		17.0								
	2015	12	29	11	-4	5	T		T		17.0								
	2015	12	30	13	2	3	0.08		1.0		15.0								
	2015	12	31	4	-10	-5	0.00		0.0		15.0								
			Summary	26	8		2.55		37.8										

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Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	1	1	-5	-24	-14	0.00		0.0		15.0								
	2016	1	2	9	-21	-1	0.00		0.0		15.0								
	2016	1	3	14	-9	6	0.00		0.0		15.0								
	2016	1	4	16	-3	11	0.00		0.0		15.0								
	2016	1	5	28	2	24	0.00		0.0		15.0								
	2016	1	6	33	19	27	0.00		0.0		13.0								
	2016	1	7	34	24	28	0.22		2.0		14.0								
	2016	1	8	29	17	20	0.09		1.0		14.0								
	2016	1	9	23	13	15	0.05		1.0		15.0								
	2016	1	10	22	8	8	0.06		1.0		16.0								
	2016	1	11	13	-8	4	0.00		0.0		16.0								
	2016	1	12	15	-8	10	0.00		0.0		16.0								
	2016	1	13	22	-1	8	0.00		0.0		15.0								
	2016	1	14	23	-6	20	0.00		0.0		15.0								
	2016	1	15	27	13	22	0.10		2.6		16.0								
	2016	1	16	22	3	17	0.06		1.0		16.0								
	2016	1	17	33	17	19	0.69		12.0		24.0								
	2016	1	18	31	7	24	0.00		0.0		22.0								
	2016	1	19	35	7	17	0.20		2.0		22.0								
	2016	1	20	30	11	19	0.20		2.4		23.0								
	2016	1	21	27	11	11	0.03		1.5		23.0								
	2016	1	22	27	7	17	0.00		0.0		21.0								
	2016	1	23	28	6	19	0.00		0.0		21.0								
	2016	1	24	29	13	26	0.12		1.3		22.0								
	2016	1	25	27	14	14	0.19		3.3		24.0								
	2016	1	26	19	2	8	0.00		0.0		24.0								
	2016	1	27	25	2	14	0.00		0.0		23.0								
	2016	1	28	29	4	18	0.00		0.0		23.0								
	2016	1	29	34	9	27	0.17		2.5		22.0								
	2016	1	30	42	27	27	0.37		4.0		24.0								
	2016	1	31	27	11	19	0.10		2.5		27.0								
			Summary	25	5		2.65		40.1										

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Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	2	1	23	15	17	0.36		4.5		31.0								
	2016	2	2	23	11	15	0.11		1.4		31.0								
	2016	2	3	17	3	6	0.05		0.8		31.0								
	2016	2	4	15	-11	11	T		T		31.0								
	2016	2	5	24	8	11	0.23		5.5		34.0								
	2016	2	6	22	0	12	0.00		0.0		33.0								
	2016	2	7	26	4	15	0.00		0.0		31.0								
	2016	2	8	28	5	14	0.00		0.0		31.0								
	2016	2	9	30	7	21	0.00		0.0		29.0								
	2016	2	10	31	10	21	0.00		0.0		29.0								
	2016	2	11	34	8	25	0.00		0.0		28.0								
	2016	2	12	34	13	26	0.00		0.0		28.0								
	2016	2	13	35	12	25	0.00		0.0		28.0								
	2016	2	14	34	12	29	0.08		1.5		28.0								
	2016	2	15	42	28	38	0.01		T		26.0								
	2016	2	16	45	32	34	0.00		0.0		25.0								
	2016	2	17	40	21	35	0.00		0.0		25.0								
	2016	2	18	49	28	28	0.29		3.0		27.0								
	2016	2	19	31	12	26	T		0.0		27.0								
	2016	2	20	38	15	31	0.00		0.0		25.0								
	2016	2	21	36	12	27	0.00		0.0		24.0								
	2016	2	22	34	11	28	0.00		0.0		24.0								
	2016	2	23	33	21	23	0.00		0.0		24.0								
	2016	2	24	28	4	19	0.00		0.0		24.0								
	2016	2	25	35	8	25	0.00		0.0		24.0								
	2016	2	26	36	10	30	0.00		0.0		24.0								
	2016	2	27	44	14	40	0.00		0.0		24.0								
	2016	2	28	42	18	33	0.00		0.0		24.0								
	2016	2	29	39	17	34	0.03		T		23.0								
			Summary	33	12		1.16		16.7										

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Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	3	1	40	16	34	0.00		0.0		23.0								
	2016	3	2	46	26	39	0.02		0.0		23.0								
	2016	3	3	44	21	35	0.00		0.0		22.0								
	2016	3	4	44	22	35	0.00		0.0		22.0								
	2016	3	5	48	27	41	0.00		0.0		21.0								
	2016	3	6	43	26	36	0.02		0.0		21.0								
	2016	3	7	36	29	29	0.33		1.0		21.0								
	2016	3	8	37	22	29	0.05		0.5		21.0								
	2016	3	9	36	18	29	0.04		T		21.0								
	2016	3	10	47	16	40	0.00		0.0		20.0								
	2016	3	11	53	28	43	0.00		0.0		20.0								
	2016	3	12	52	33	42	0.00		0.0		19.0								
	2016	3	13	47	29	42	0.00		0.0		18.0								
	2016	3	14	46	29	30	0.10		0.5		16.0								
	2016	3	15	36	16	30	0.09		1.0		16.0								
	2016	3	16	35	19	32	0.01		T		15.0								
	2016	3	17	38	26	31	0.01		T		15.0								
	2016	3	18	35	14	30	0.00		0.0		15.0								
	2016	3	19	37	9	32	0.00		0.0		15.0								
	2016	3	20	48	13	42	0.00		0.0		12.0								
	2016	3	21	57	23	51	0.00		0.0		10.0								
	2016	3	22	56	30	30	T		T		8.0								
	2016	3	23	38	26	34	0.20		2.0		10.0								
	2016	3	24	41	22	40	0.00		0.0		10.0								
	2016	3	25	40	27	32	0.11		0.7		8.0								
	2016	3	26	41	15	35	0.00		0.0		4.0								
	2016	3	27	50	15	44	0.00		0.0		2.0								
	2016	3	28	59	27	50	0.00		0.0		T								
	2016	3	29	54	31	31	0.16		0.5		1.0								
	2016	3	30	41	23	30	0.09		0.5		0.0								
	2016	3	31	40	25	36	0.17		1.5		0.0								
			Summary	44	23		1.40		8.2										

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Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	4	1	43	20	39	0.00		0.0		0.0								
	2016	4	2	54	23	50	0.00		0.0		0.0								
	2016	4	3	60	26	54	0.00		0.0		0.0								
	2016	4	4	67	34	59	0.00		0.0		0.0								
	2016	4	5	59	34	44	T		T		0.0								
	2016	4	6	59	23	56	0.00		0.0		0.0								
	2016	4	7	64	29	58	0.00		0.0		0.0								
	2016	4	8	67	32	62	0.00		0.0		0.0								
	2016	4	9	62	34	49	T		0.0		0.0								
	2016	4	10	62	36	50	0.13		T		0.0								
	2016	4	11	61	37	57	0.05		0.0		0.0								
	2016	4	12	64	35	50	T		T		0.0								
	2016	4	13	67	40	53	0.03		0.0		0.0								
	2016	4	14	69	34	57	0.00		0.0		0.0								
	2016	4	15	57	29	34	1.27		12.0		6.0								
	2016	4	16	37	31	31	0.02		T		3.0								
	2016	4	17	34	27	32	0.10		T		0.0								
	2016	4	18	48	27	44	0.00		0.0		0.0								
	2016	4	19	47	25	40	T		0.0		0.0								
	2016	4	20	57	34	52	0.07		0.0		0.0								
	2016	4	21	66	31	63	0.00		0.0		0.0								
	2016	4	22	75	38	71	0.00		0.0		0.0								
	2016	4	23	71	37	38	0.16		0.0		0.0								
	2016	4	24	56	35	51	0.04		0.0		0.0								
	2016	4	25	65	33	51	0.00		0.0		0.0								
	2016	4	26	51	32	35	0.60		T		0.0								
	2016	4	27	48	31	44	0.12		T		0.0								
	2016	4	28	47	31	34	0.24		0.5		0.0								
	2016	4	29	45	32	41	0.08		0.0		0.0								
	2016	4	30	45	30	41	0.11		0.5		0.0								
			Summary	57	31		3.02		13.0										

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151 Patton Avenue
Asheville, North Carolina 28801

Elev: 6467 ft. Lat: 40.493° N Lon: 107.255° W
Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	5	1	54	29	52	0.00		0.0		0.0								
	2016	5	2	60	29	57	0.00		0.0		0.0								
	2016	5	3	68	28	65	0.00		0.0		0.0								
	2016	5	4	73	37	70	0.00		0.0		0.0								
	2016	5	5	78	40	73	0.00		0.0		0.0								
	2016	5	6	74	44	64	0.02		0.0		0.0								
	2016	5	7	64	38	39	0.30		0.0		0.0								
	2016	5	8	48	35	40	0.20		0.0		0.0								
	2016	5	9	56	33	55	0.74		0.5		0.0								
	2016	5	10	55	37	50	0.15		0.0		0.0								
	2016	5	11	55	29	52	0.00		0.0		0.0								
	2016	5	12	66	28	64	0.00		0.0		0.0								
	2016	5	13	74	32	71	0.00		0.0		0.0								
	2016	5	14	75	35	61	0.00		0.0		0.0								
	2016	5	15	63	44	53	0.23		T		0.0								
	2016	5	16	54	39	48	0.20		0.0		0.0								
	2016	5	17	63	34	56	0.02		0.0		0.0								
	2016	5	18	66	35	63	0.00		0.0		0.0								
	2016	5	19	69	42	63	0.00		0.0		0.0								
	2016	5	20	76	44	71	0.00		0.0		0.0								
	2016	5	21	73	42	67	0.00		0.0		0.0								
	2016	5	22	67	34	51	0.01		0.0		0.0								
	2016	5	23	65	28	58	0.00		0.0		0.0								
	2016	5	24	71	36	65	0.00		0.0		0.0								
	2016	5	25	67	39	63	0.00		0.0		0.0								
	2016	5	26	68	33	55	0.00		0.0		0.0								
	2016	5	27	66	35	47	0.03		0.0		0.0								
	2016	5	28	68	37	66	0.04		0.0		0.0								
	2016	5	29	72	38	66	0.00		0.0		0.0								
	2016	5	30	72	38	65	0.00		0.0		0.0								
	2016	5	31	70	38	69	0.00		0.0		0.0								
			Summary	66	36		1.94		0.5										

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151 Patton Avenue
Asheville, North Carolina 28801

Elev: 6467 ft. Lat: 40.493° N Lon: 107.255° W
Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	6	1	75	37	71	0.00		0.0		0.0								
	2016	6	2	79	37	75	0.00		0.0		0.0								
	2016	6	3	78	41	74	0.00		0.0		0.0								
	2016	6	4	83	43	79	0.00		0.0		0.0								
	2016	6	5	85	46	82	0.00		0.0		0.0								
	2016	6	6	87	51	70	0.00		0.0		0.0								
	2016	6	7	83	49	68	0.00		0.0		0.0								
	2016	6	8	80	47	68	0.00		0.0		0.0								
	2016	6	9	85	50	75	0.00		0.0		0.0								
	2016	6	10	88	50	82	0.00		0.0		0.0								
	2016	6	11	85	52	67	0.00		0.0		0.0								
	2016	6	12	78	46	70	0.07		0.0		0.0								
	2016	6	13	72	45	65	0.01		0.0		0.0								
	2016	6	14	75	39	70	0.00		0.0		0.0								
	2016	6	15	85	46	80	0.00		0.0		0.0								
	2016	6	16	82	40	78	0.00		0.0		0.0								
	2016	6	17	87	47	82	0.00		0.0		0.0								
	2016	6	18	89	45	85	0.00		0.0		0.0								
	2016	6	19	88	48	82	0.00		0.0		0.0								
	2016	6	20	94	45	90	0.00		0.0		0.0								
	2016	6	21	96	52	90	0.00		0.0		0.0								
	2016	6	22	90	48	72	0.07		T		0.0								
	2016	6	23	82	54	79	0.00		0.0		0.0								
	2016	6	24	91	54	81	0.06		0.0		0.0								
	2016	6	25	82	52	78	0.00		0.0		0.0								
	2016	6	26	85	40	82	0.00		0.0		0.0								
	2016	6	27	89	45	82	0.00		0.0		0.0								
	2016	6	28	93	50	80	0.00		0.0		0.0								
	2016	6	29	90	49	72	0.02		0.0		0.0								
	2016	6	30	74	53	62	0.17		0.0		0.0								
			Summary	84	47		0.40		0.0										

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Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	7	1	74	55	65	0.07		0.0		0.0								
	2016	7	2	77	53	61	0.34		0.0		0.0								
	2016	7	3	82	50	72	0.06		0.0		0.0								
	2016	7	4	84	50	77	0.00		0.0		0.0								
	2016	7	5	82	54	68	0.16		T		0.0								
	2016	7	6	85	51	82	0.04		0.0		0.0								
	2016	7	7	85	45	83	0.00		0.0		0.0								
	2016	7	8	87	46	83	0.00		0.0		0.0								
	2016	7	9	88	49	83	0.00		0.0		0.0								
	2016	7	10	87	52	85	0.00		0.0		0.0								
	2016	7	11	85	44	77	0.00		0.0		0.0								
	2016	7	12	84	36	80	0.00		0.0		0.0								
	2016	7	13	85	43	82	0.00		0.0		0.0								
	2016	7	14	85	40	83	0.00		0.0		0.0								
	2016	7	15	87	43	83	0.00		0.0		0.0								
	2016	7	16	86	56	81	0.00		0.0		0.0								
	2016	7	17	89	53	87	0.00		0.0		0.0								
	2016	7	18	87	58	71	T		0.0		0.0								
	2016	7	19	85	58	81	0.00		0.0		0.0								
	2016	7	20	83	53	75	0.00		0.0		0.0								
	2016	7	21	84	58	70	0.00		0.0		0.0								
	2016	7	22	89	51	79	0.00		0.0		0.0								
	2016	7	23	88	53	83	0.00		0.0		0.0								
	2016	7	24	89	56	79	0.00		0.0		0.0								
	2016	7	25	91	48	86	0.00		0.0		0.0								
	2016	7	26	91	53	73	0.02		0.0		0.0								
	2016	7	27	91	51	89	0.00		0.0		0.0								
	2016	7	28	90	45	82	0.00		0.0		0.0								
	2016	7	29	88	46	81	0.00		0.0		0.0								
	2016	7	30	90	47	81	0.00		0.0		0.0								
	2016	7	31	83	51	65	0.12		0.0		0.0								
			Summary	86	50		0.81		0.0										

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Station: **HAYDEN, CO US GHCND:USC00053867**

Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	8	1	88	50	83	0.00		0.0		0.0								
	2016	8	2	89	51	84	0.00		0.0		0.0								
	2016	8	3	89	53	73	0.00		0.0		0.0								
	2016	8	4	76	55	65	0.00		0.0		0.0								
	2016	8	5	84	53	75	0.00		0.0		0.0								
	2016	8	6	80	54	70	0.02		0.0		0.0								
	2016	8	7	85	50	79	0.00		0.0		0.0								
	2016	8	8	83	53	80	0.09		0.0		0.0								
	2016	8	9	88	56	85	0.00		0.0		0.0								
	2016	8	10	85	51	78	T		0.0		0.0								
	2016	8	11	80	48	71	0.00		0.0		0.0								
	2016	8	12	79	43	73	0.00		0.0		0.0								
	2016	8	13	83	41	79	0.00		0.0		0.0								
	2016	8	14	85	43	84	0.00		0.0		0.0								
	2016	8	15	86	47	77	0.00		0.0		0.0								
	2016	8	16	87	46	82	0.00		0.0		0.0								
	2016	8	17	84	51	74	0.00		0.0		0.0								
	2016	8	18	81	48	68	0.03		0.0		0.0								
	2016	8	19	81	44	74	0.00		0.0		0.0								
	2016	8	20	78	39	75	0.00		0.0		0.0								
	2016	8	21	85	41	80	0.00		0.0		0.0								
	2016	8	22	81	45	68	0.00		0.0		0.0								
	2016	8	23	80	43	73	0.00		0.0		0.0								
	2016	8	24	78	47	71	0.04		0.0		0.0								
	2016	8	25	71	39	65	0.00		0.0		0.0								
	2016	8	26	75	41	68	0.00		0.0		0.0								
	2016	8	27	78	42	73	0.01		0.0		0.0								
	2016	8	28	83	43	75	0.00		0.0		0.0								
	2016	8	29	80	45	74	0.00		0.0		0.0								
	2016	8	30	85	45	77	0.00		0.0		0.0								
	2016	8	31	87	52	83	0.00		0.0		0.0								
			Summary	82	47		0.19		0.0										

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Observation Time Temperature: 1800 Observation Time Precipitation: 1800

Preliminary	Year	Month	Day	Temperature (F)			Precipitation					Evaporation		Soil Temperature (F)					
				24 hrs. ending at observation time		at Observation	24 Hour Amounts ending at observation time				At Obs Time			4 in depth			8 in depth		
				Max.	Min.		Rain, melted snow, etc. (in)	Flag	Snow, ice pellets, hail (in)	Flag	Snow, ice pellets, hail, ice on ground (in)	24 Hour Wind Movement (mi)	Amount of Evap. (in)	Ground Cover (see *)	Max.	Min.	Ground Cover (see *)	Max.	Min.
	2016	9	1	85	49	76	0.00		0.0		0.0								
	2016	9	2	80	55	75	0.03		0.0		0.0								
	2016	9	3	79	54	60	0.04		0.0		0.0								
	2016	9	4	73	47	72	0.15		0.0		0.0								
	2016	9	5	79	41	75	0.00		0.0		0.0								
	2016	9	6	80	37	77	0.00		0.0		0.0								
	2016	9	7	77	39	72	0.00		0.0		0.0								
	2016	9	8	78	38	75	0.00		0.0		0.0								
	2016	9	9	75	38	65	0.00		0.0		0.0								
	2016	9	10	77	35	75	0.00		0.0		0.0								
	2016	9	11	83	33	75	0.00		0.0		0.0								
	2016	9	12	79	50	71	0.00		0.0		0.0								
	2016	9	13	78	43	69	0.01		0.0		0.0								
	2016	9	14	73	48	60	0.01		0.0		0.0								
	2016	9	15	63	37	60	0.01		0.0		0.0								
	2016	9	16	68	32	63	0.00		0.0		0.0								
	2016	9	17	71	32	67	0.00		0.0		0.0								
	2016	9	18	79	35	74	0.00		0.0		0.0								
	2016	9	19	85	39	78	0.00		0.0		0.0								
	2016	9	20	82	44	73	0.00		0.0		0.0								
	2016	9	21	73	49	63	0.01		0.0		0.0								
	2016	9	22	83	52	65	0.03		0.0		0.0								
	2016	9	23	65	41	45	0.32		0.0		0.0								
	2016	9	24	48	37	44	0.16		0.0		0.0								
	2016	9	25	62	32	57	0.10		0.0		0.0								
	2016	9	26	71	34	65	0.00		0.0		0.0								
	2016	9	27	76	36	70	0.00		0.0		0.0								
	2016	9	28	81	40	73	0.00		0.0		0.0								
	2016	9	29	73	42	58	0.00		0.0		0.0								
	2016	9	30	69	50	60	0.15		0.0		0.0								
			Summary	75	41		1.02		0.0										

The '*' flags in Preliminary indicate the data have not completed processing and qualitycontrol and may not be identical to the original observation
Empty, or blank, cells indicate that a data observation was not reported.
***Ground Cover: 1=Grass; 2=Fallow; 3=Bare Ground; 4=Brome grass; 5=Sod; 6=Straw mulch; 7=Grass muck; 8=Bare muck; 0=Unknown**
"s" This data value failed one of NCDC's quality control tests.
"T" values in the Precipitation category above indicate a TRACE value was recorded.
"A" values in the Precipitation Flag or the Snow Flag column indicate a multiday total, accumulated since last measurement, is being used.
Data value inconsistency may be present due to rounding calculations during the conversion process from SI metric units to standard imperial units.

APPENDIX B

Water Quality Reports

Table of Contents

Instantaneous Flow Measurements Report
NPDES1H - NPDES 001 (HGLO)
10/01/2015-00:00 to 09/30/2016-23:59

Date	Time	Instrument	Type	Flag	Begin/End	Stage	CFS	GPM	MGD
10/12/2015	16:10:00	MANF	INS				0.00	0.00	0.00
11/03/2015	09:55:00	MANF	INS				0.00	0.00	0.00
12/09/2015	16:10:00	MANF	INS				0.00	0.00	0.00
01/11/2016	16:00:00	MANF	INS				0.00	0.00	0.00
02/04/2016	09:35:00	MANF	INS				0.00	0.00	0.00
03/03/2016	16:20:00	MANF	INS				0.00	0.00	0.00
04/20/2016	15:10:00	MANF	INS				0.00	0.00	0.00
05/04/2016	07:20:00	MANF	INS				0.00	0.00	0.00
06/22/2016	14:30:00	MANF	INS				0.00	0.00	0.00
07/06/2016	08:45:00	MANF	INS				0.00	0.00	0.00
08/04/2016	08:50:00	MANF	INS				0.00	0.00	0.00
09/07/2016	12:30:00	MANF	INS				0.00	0.00	0.00

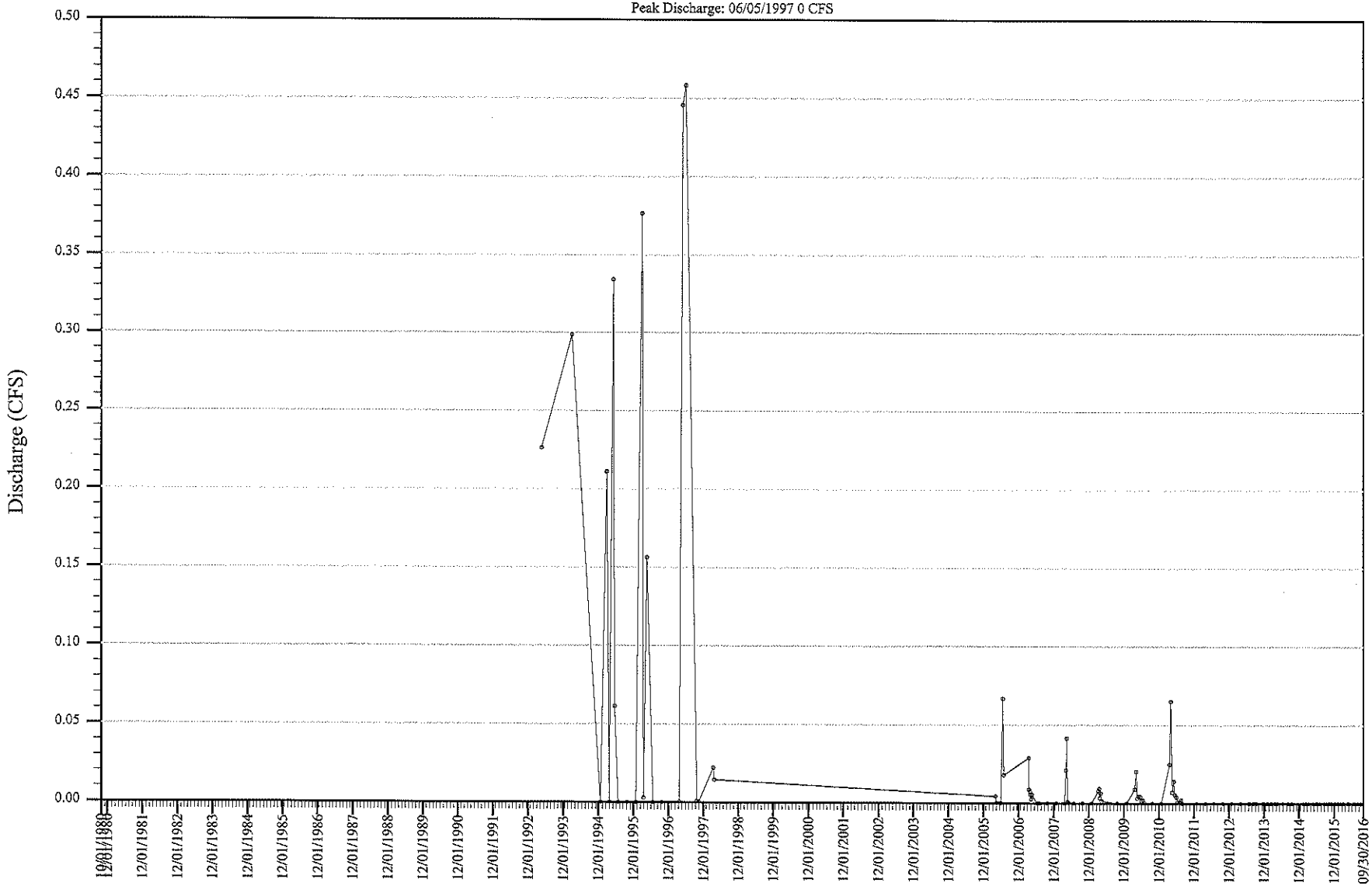
NPDES1H Sample Remarks

10/01/2015 to 09/30/2016

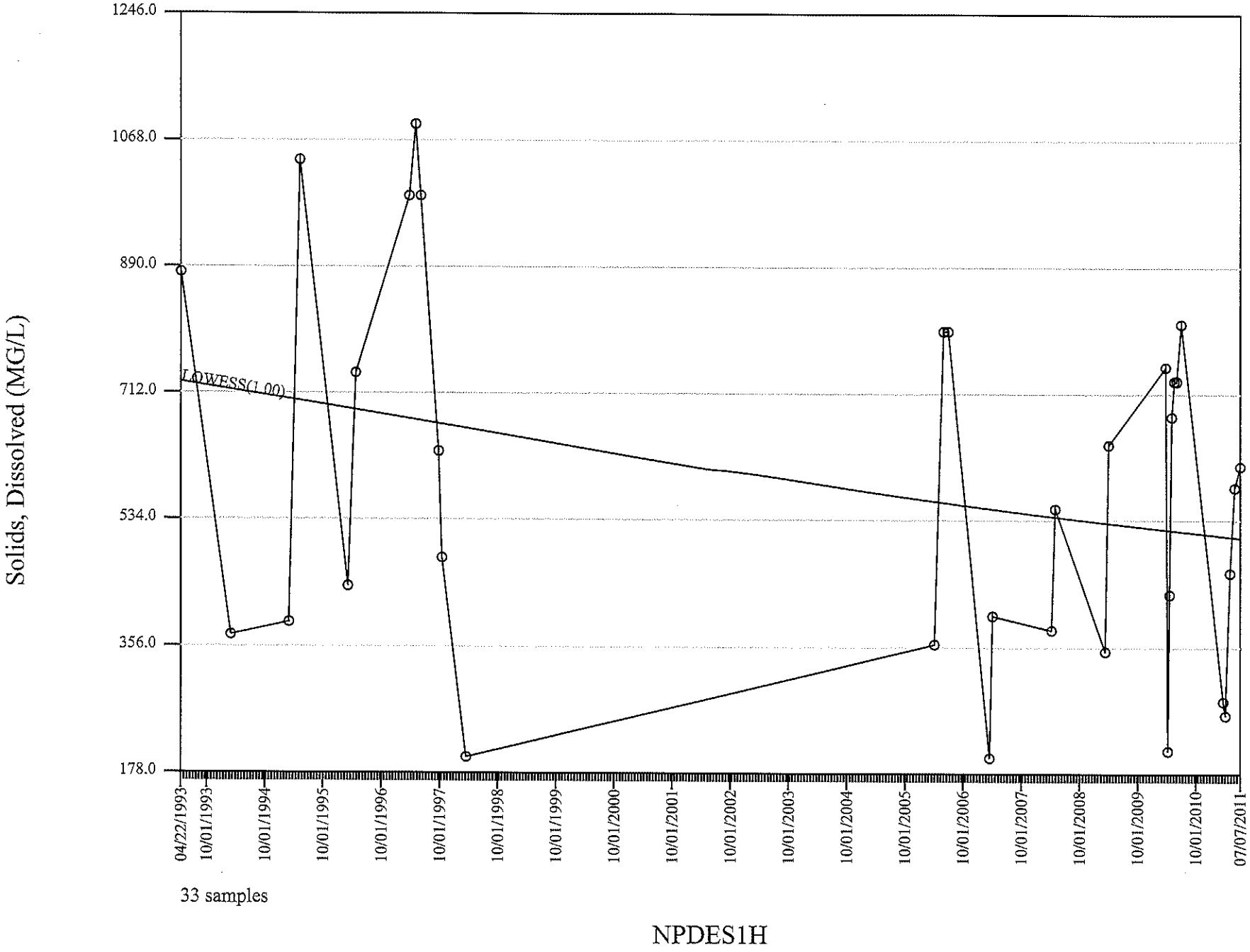
Remark Date-Time	Remark
05/04/2016-07:20	NO FLOW
06/22/2016-14:30	NO FLOW
07/06/2016-08:45	NO FLOW
08/04/2016-08:50	NO FLOW
09/07/2016-12:30	NO FLOW

Discharge Hydrograph

Peak Discharge: 06/05/1997 0 CFS



NPDES1H


Solids, Dissolved (MG/L)
1246.0
1068.0
890.0
712.0
534.0
356.0
178.0
LOWESS(1.00)
04/22/1993
10/01/1993
10/01/1994
10/01/1995
10/01/1996
10/01/1997
10/01/1998
10/01/1999
10/01/2000
10/01/2001
10/01/2002
10/01/2003
10/01/2004
10/01/2005
10/01/2006
10/01/2007
10/01/2008
10/01/2009
10/01/2010
07/07/2011
33 samples
NPDES1H

Instantaneous Flow Measurements Report
NPDES2H - NPDES 002 (HGLO)
10/01/2015-00:00 to 09/30/2016-23:59

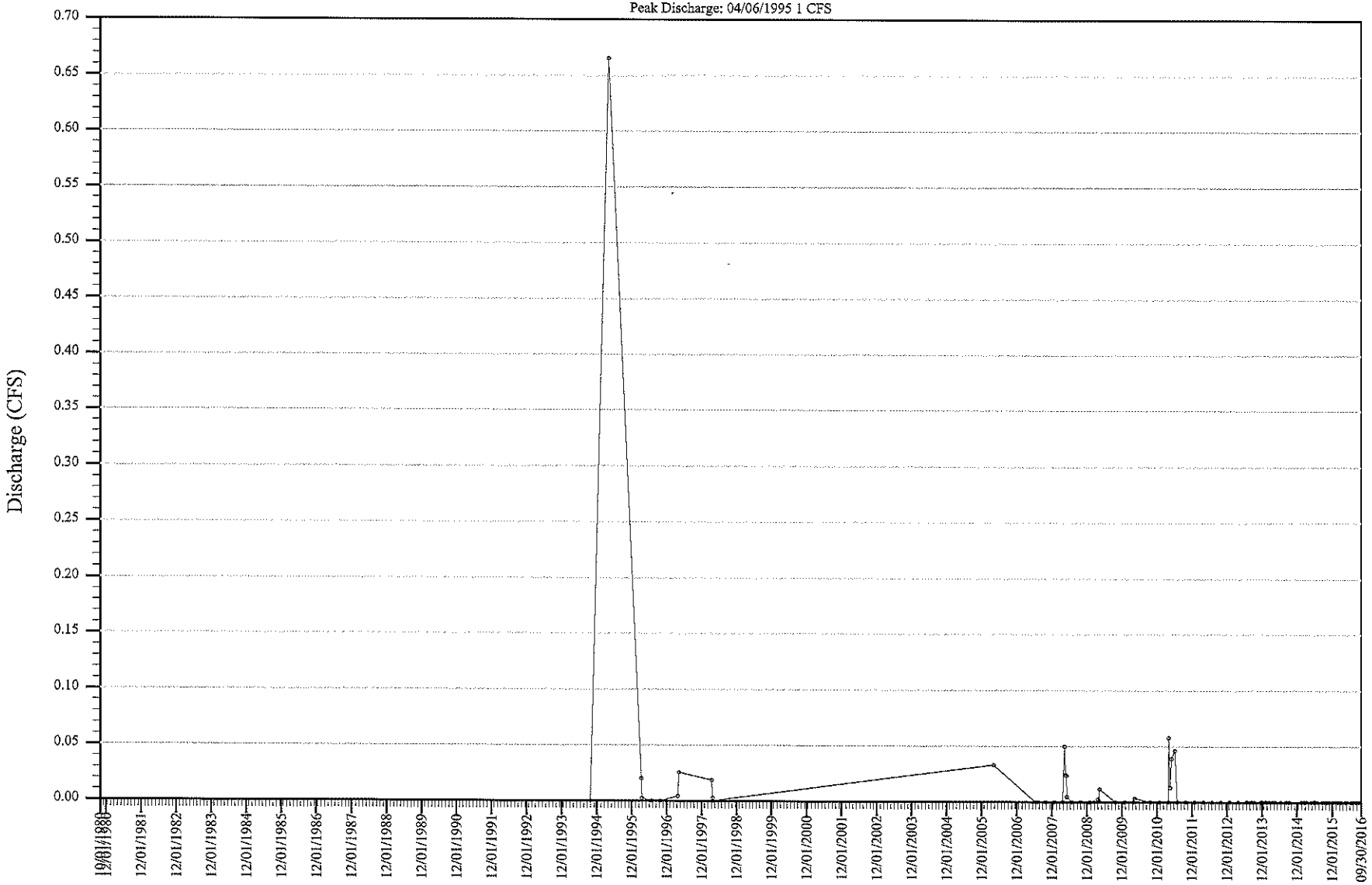
Date	Time	Instrument	Type	Flag	Begin/End	Stage	CFS	GPM	MGD
10/12/2015	16:25:00	MANF	INS				0.00	0.00	0.00
11/03/2015	10:10:00	MANF	INS				0.00	0.00	0.00
12/09/2015	16:15:00	MANF	INS				0.00	0.00	0.00
01/11/2016	16:05:00	MANF	INS				0.00	0.00	0.00
02/04/2016	09:40:00	MANF	INS				0.00	0.00	0.00
03/03/2016	16:30:00	MANF	INS				0.00	0.00	0.00
04/20/2016	15:05:00	MANF	INS				0.00	0.00	0.00
05/04/2016	07:00:00	MANF	INS				0.00	0.00	0.00
06/22/2016	14:35:00	MANF	INS				0.00	0.00	0.00
07/06/2016	08:55:00	MANF	INS				0.00	0.00	0.00
08/04/2016	09:00:00	MANF	INS				0.00	0.00	0.00
09/07/2016	12:40:00	MANF	INS				0.00	0.00	0.00

NPDES2H Sample Remarks
10/01/2015 to 09/30/2016

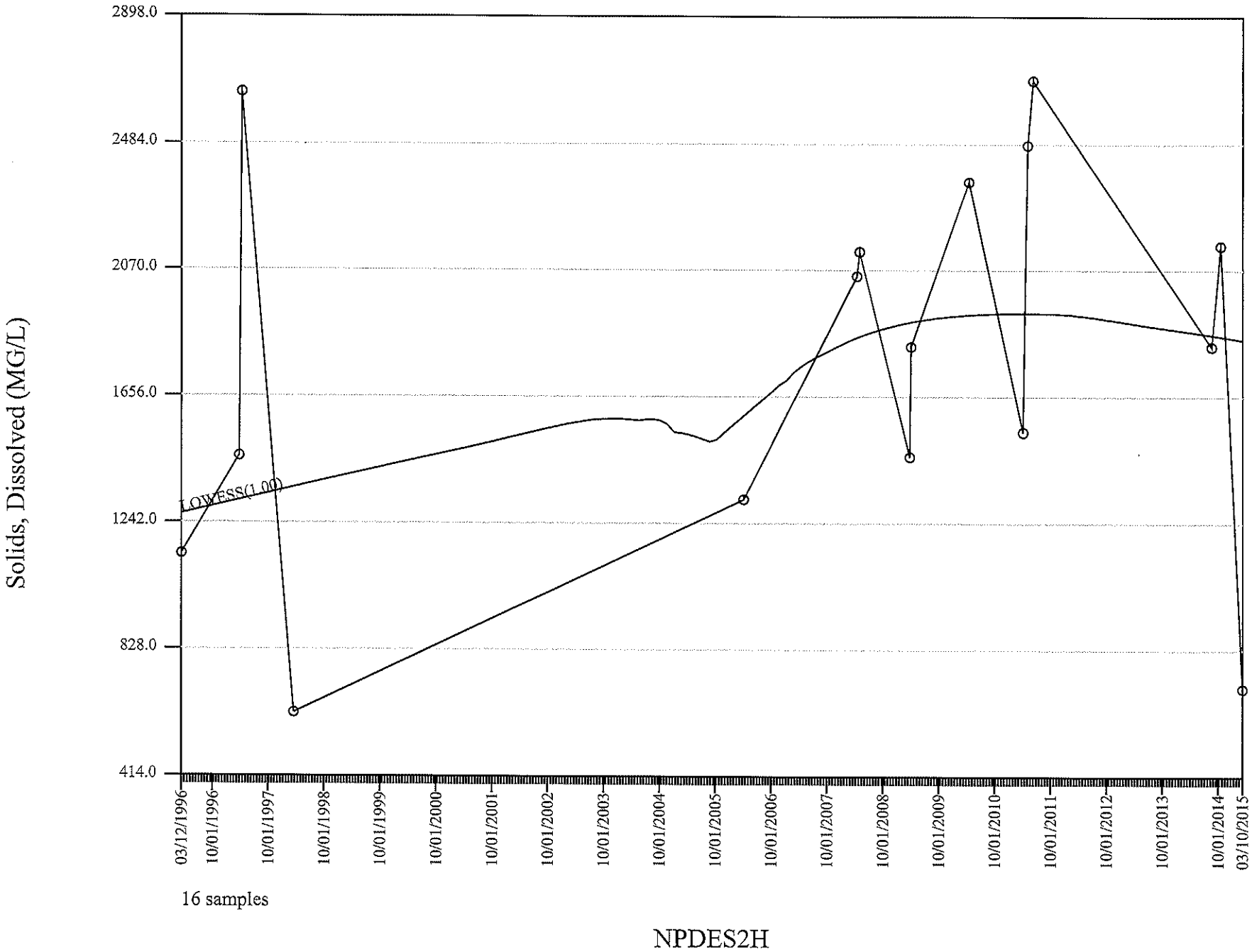
Remark Date-Time	Remark
05/04/2016-07:00	NO FLOW
06/22/2016-14:35	NO FLOW
07/06/2016-08:55	NO FLOW
08/04/2016-09:00	NO FLOW
09/07/2016-12:40	NO FLOW

Discharge Hydrograph

Peak Discharge: 04/06/1995 1 CFS



NPDES2H


Solids, Dissolved (MG/L)
2898.0
2484.0
2070.0
1656.0
1242.0
828.0
414.0
LOWESS(1.00)
03/12/1996
10/01/1996
10/01/1997
10/01/1998
10/01/1999
10/01/2000
10/01/2001
10/01/2002
10/01/2003
10/01/2004
10/01/2005
10/01/2006
10/01/2007
10/01/2008
10/01/2009
10/01/2010
10/01/2011
10/01/2012
10/01/2013
10/01/2014
03/10/2015
16 samples
NPDES2H

Extended Water Quality Report
HGSD1 - HGLO UPSTM
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	06/22/2016 10:30	09/07/2016 07:40
Field Parameters			
Field Ph	S.U.	7.5400	7.8800
Temperature	C	19.3000	10.9000
Field Conductivity	UMHOS/CM	3560.0000	4910.0000
Flow	CFS	2.2013	0.0064
Laboratory Parameters			
Alk As CaCO3, Ph 4.5	MG/L	334.0000	538.0000
Alk, Bicarb As CaCO3	MG/L	323.0000	538.0000
Alk, Carb As CaCO3	MG/L	B 11.3000	< 2.0000
Alk, Hydrox As CaCO3	MG/L	< 2.0000	< 2.0000
Boron, Dissolved	UG/L	160.0000	400.0000
Cadmium, Dissolved	UG/L	< 0.2000	< 0.5000
Calcium, Dissolved	MG/L	118.0000	214.0000
Chloride	MG/L	46.7000	77.8000
Chromium, Dissolved	UG/L	< 1.0000	< 3.0000
Conductivity	UMS/CM2	3180.0000	4570.0000
Copper, Dissolved	UG/L	< 1.0000	< 3.0000
Hardness As CaCO3	MG/L	1220.0000	1930.0000
Lead, Dissolved	UG/L	< 0.2000	< 0.5000
Magnesium, Dissolved	MG/L	225.0000	340.0000
Manganese, Dissolved	MG/L	0.0800	B 0.1000
Mercury, Total	UG/L	< 0.2000	< 0.2000
Nickel, Dissolved	UG/L	< 20.0000	< 40.0000
Ammonia Nitrogen_N	MG/L	< 0.0500	< 0.0500
Nitrate Nitrogen_N	MG/L	B 0.0500	0.2400
Nitrite Nitrogen_N	MG/L	< 0.0100	< 0.0100
Nitrate/Nitrite Nitrogen_N	MG/L	B 0.0500	0.2400
Ph At 25 Deg. Cent.	S.U.	8.4000	8.3000
Potassium, Dissolved	MG/L	10.0000	7.0000
Selenium, Dissolved	UG/L	4.8000	5.1000
Silver, Dissolved	UG/L	< 0.1000	< 0.3000
Sodium, Dissolved	MG/L	356.0000	517.0000
Solids, Dissolved	MG/L	2990.0000	4440.0000
Solids, Suspended	MG/L	B 11.0000	57.0000
Sulfate	MG/L	1670.0000	2530.0000
Sulfide	MG/L	< 0.0200	< 0.0200
Zinc, Dissolved	MG/L	< 0.0200	< 0.0500
Bicarbonate As HCO3	MG/L	394.0000	656.0000
Carbonate As CO3	MG/L	B 6.8000	< 2.0000
Hydroxide As OH	MG/L	< 2.0000	< 2.0000
Cation_Anion Balance	PERCENT	< -3.6000	< -3.1000
Sar	RATIO	4.5000	5.2000
Solids, Diss. (Calc)	MG/L	2630.0000	4020.0000

"B" -- Between MDL and PQL, "<" -- Less than detection limit

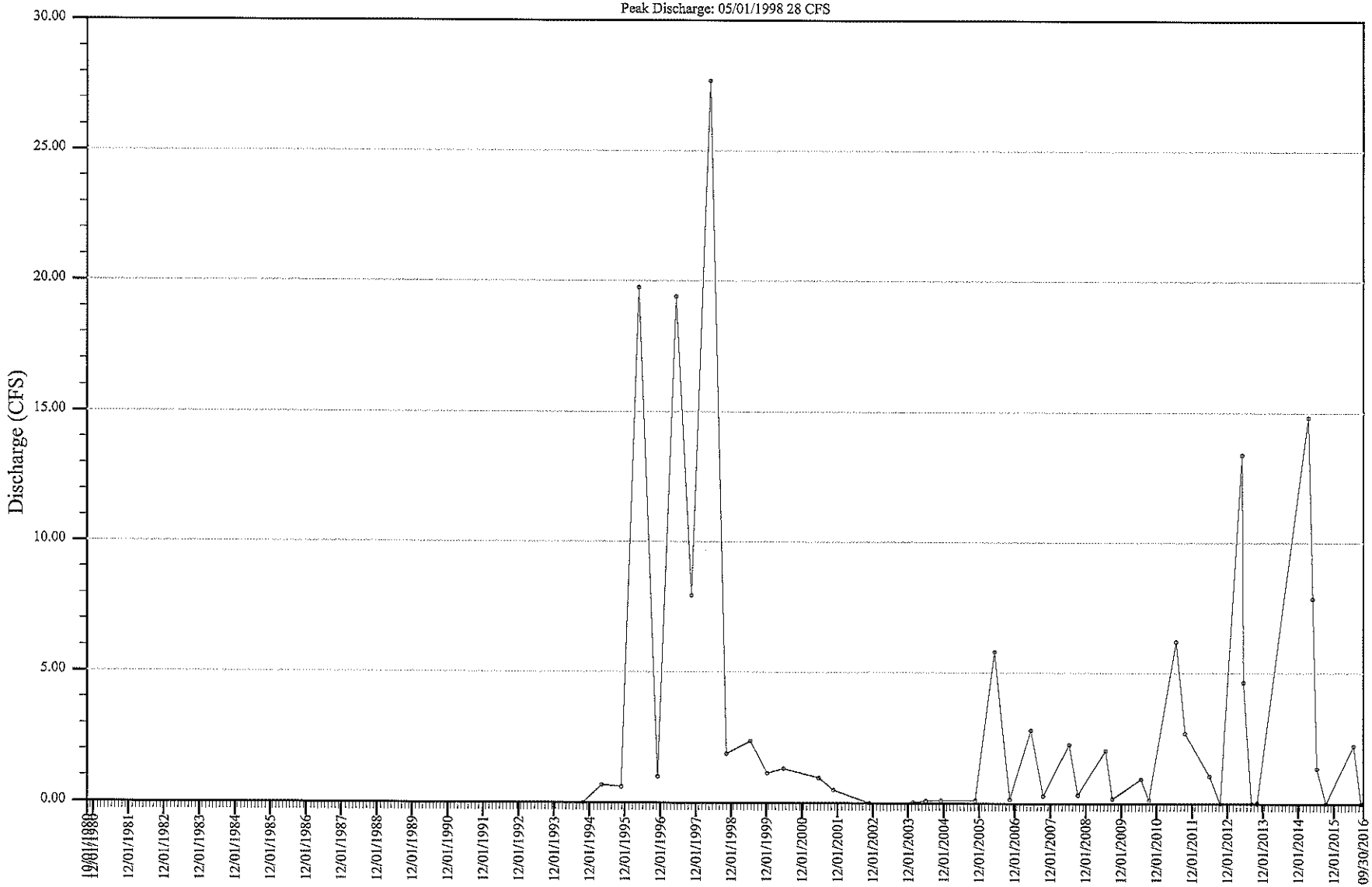
Extended Water Quality Report
HGSD1 - HGLO UPSTM
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	06/22/2016 10:30	09/07/2016 07:40
Laboratory Parameters			
Sum Of Anions	MEQ/L	43.0000	66.0000
Sum Of Cations	MEQ/L	40.0000	62.0000
Arsenic, Total Rec.	UG/L	3.2000	B 3.0000
Iron, Total Rec.	MG/L	0.2400	2.0000
Selenium, Total Rec.	UG/L	5.2000	4.8000
Tds Ratio	ANAL/CALC	1.1400	1.1000

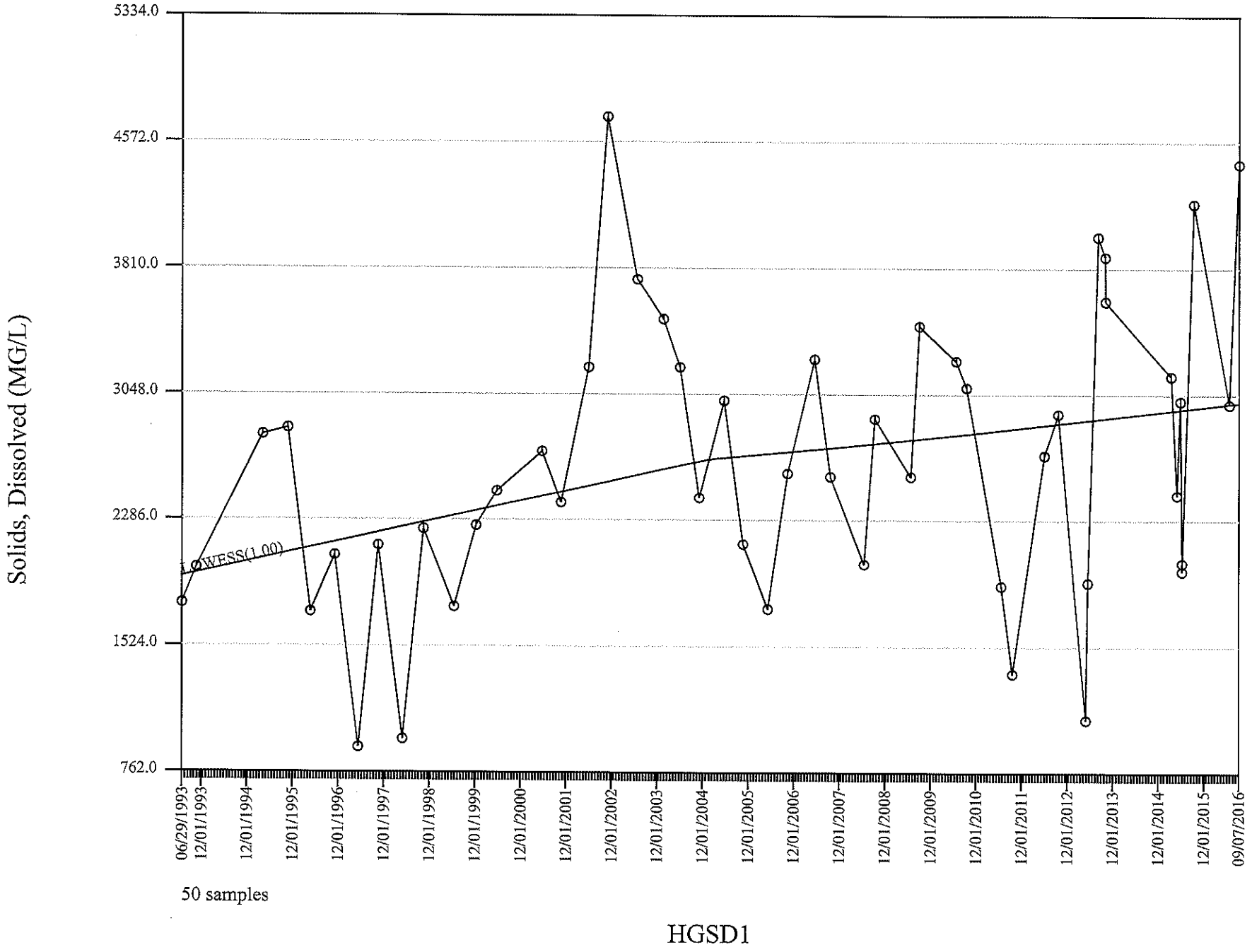
"B" -- Between MDL and PQL, "<" -- Less than detection limit

Discharge Hydrograph

Peak Discharge: 05/01/1998 28 CFS



HGSD1


Solids, Dissolved (MG/L)
5334.0
4572.0
3810.0
3048.0
2286.0
1524.0
762.0
LOWESS(1.00)
06/29/1993
12/01/1993
12/01/1994
12/01/1995
12/01/1996
12/01/1997
12/01/1998
12/01/1999
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
09/07/2016
50 samples
HGSD1

Extended Water Quality Report
HGSD3 - HGLO DNSTM-2
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	06/22/2016 10:10
Field Parameters		
Field Ph	S.U.	7.5600
Temperature	C	20.2000
Field Conductivity	UMHOS/CM	3730.0000
Flow	CFS	1.7958
Laboratory Parameters		
Alk As CaCO3, Ph 4.5	MG/L	351.0000
Alk, Bicarb As CaCO3	MG/L	337.0000
Alk, Carb As CaCO3	MG/L	B 14.1000
Alk, Hydrox As CaCO3	MG/L	< 2.0000
Boron, Dissolved	UG/L	230.0000
Cadmium, Dissolved	UG/L	< 0.2000
Calcium, Dissolved	MG/L	132.0000
Chloride	MG/L	50.4000
Chromium, Dissolved	UG/L	< 1.0000
Conductivity	UMS/CM2	3350.0000
Copper, Dissolved	UG/L	< 1.0000
Hardness As CaCO3	MG/L	1280.0000
Lead, Dissolved	UG/L	< 0.2000
Magnesium, Dissolved	MG/L	232.0000
Manganese, Dissolved	MG/L	0.1000
Mercury, Total	UG/L	< 0.2000
Nickel, Dissolved	UG/L	< 20.0000
Ammonia Nitrogen_N	MG/L	< 0.0500
Nitrate Nitrogen_N	MG/L	< 0.0200
Nitrite Nitrogen_N	MG/L	< 0.0100
Nitrate/Nitrite Nitrogen_N	MG/L	< 0.0200
Ph At 25 Deg. Cent.	S.U.	8.4000
Potassium, Dissolved	MG/L	10.7000
Selenium, Dissolved	UG/L	5.0000
Silver, Dissolved	UG/L	< 0.1000
Sodium, Dissolved	MG/L	373.0000
Solids, Dissolved	MG/L	3170.0000
Solids, Suspended	MG/L	B 19.0000
Sulfate	MG/L	1740.0000
Sulfide	MG/L	< 0.0200
Zinc, Dissolved	MG/L	B 0.1000
Bicarbonate As HCO3	MG/L	411.0000
Carbonate As CO3	MG/L	B 8.5000
Hydroxide As OH	MG/L	< 2.0000
Cation_Anion Balance	PERCENT	< -3.4000
Sar	RATIO	4.6000
Solids, Diss. (Calc)	MG/L	2750.0000

"B" -- Between MDL and PQL, "<" -- Less than detection limit

Parameters	Units	06/22/2016 10:10
Laboratory Parameters		
Sum Of Anions	MEQ/L	45.0000
Sum Of Cations	MEQ/L	42.0000
Arsenic, Total Rec.	UG/L	4.6000
Iron, Total Rec.	MG/L	0.8200
Selenium, Total Rec.	UG/L	5.5000
Tds Ratio	ANAL/CALC	1.1500

"B" -- Between MDL and PQL, "<" -- Less than detection limit

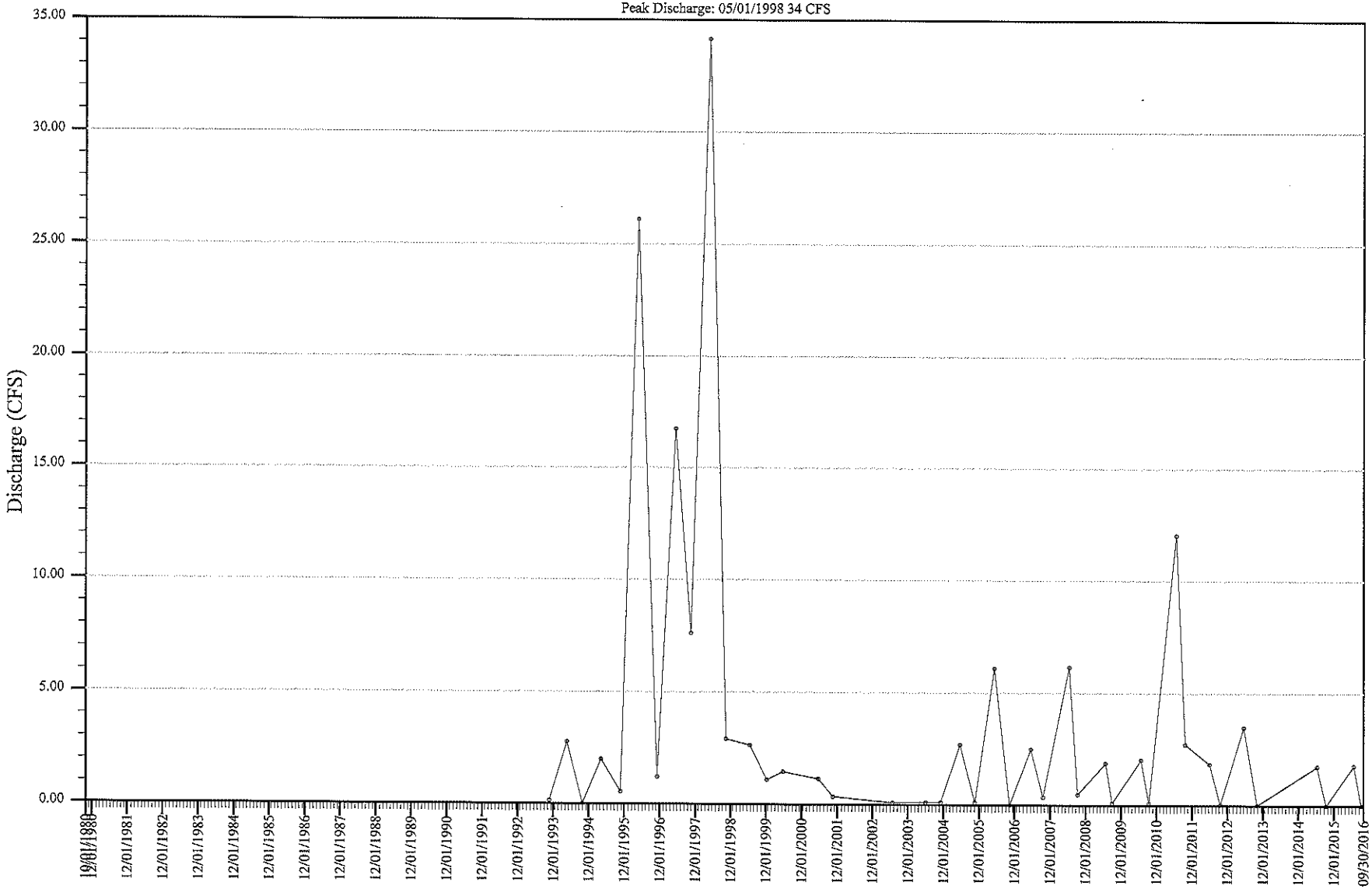
HGSD3 Sample Remarks

10/01/2015 to 09/30/2016

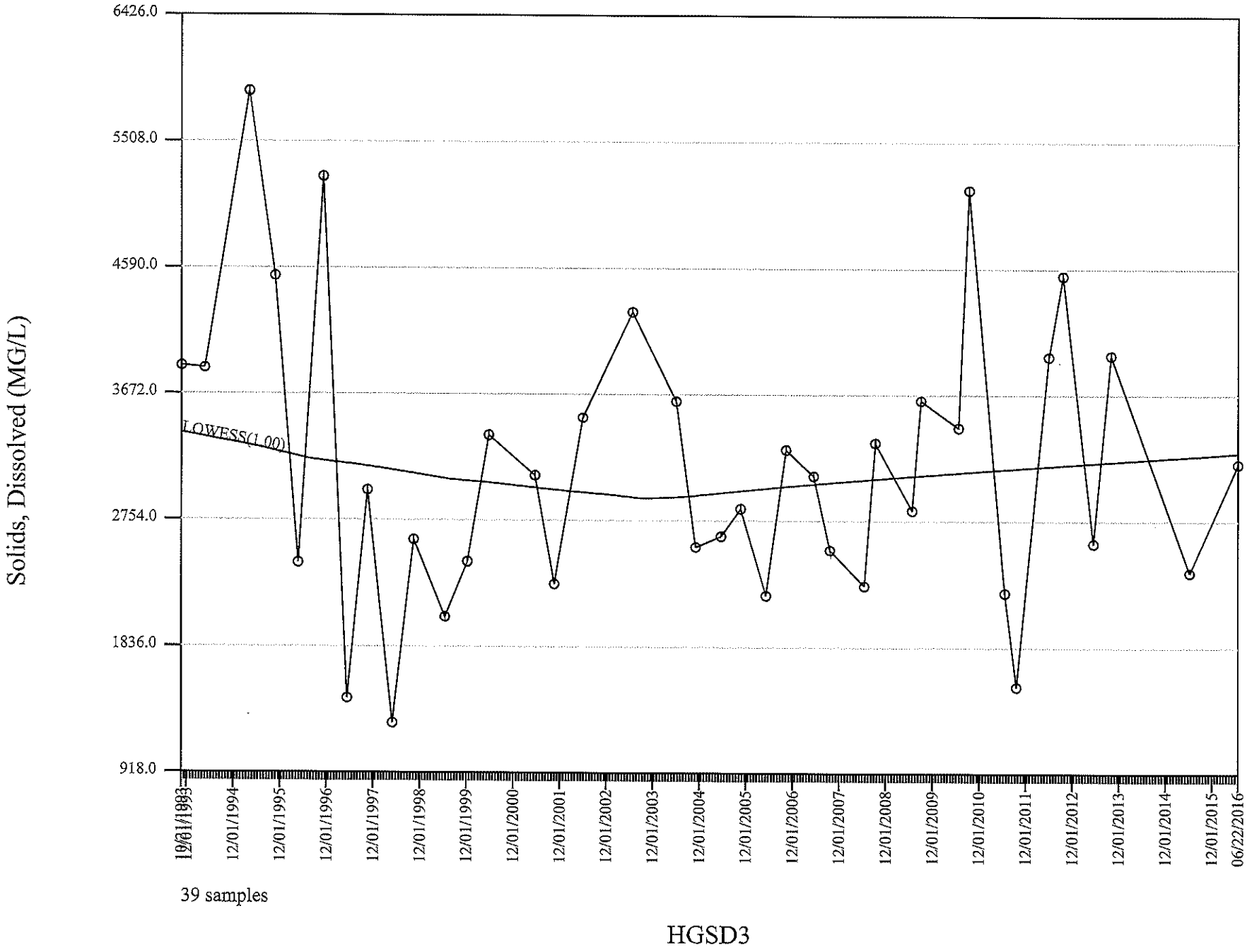
Remark Date-Time	Remark
09/07/2016-07:20	NO FLOW

Discharge Hydrograph

Peak Discharge: 05/01/1998 34 CFS



HGSD3


Solids, Dissolved (MG/L)
6426.0
5508.0
4590.0
3672.0
2754.0
1836.0
918.0
LOWESS(1.00)
12/01/1993
12/01/1994
12/01/1995
12/01/1996
12/01/1997
12/01/1998
12/01/1999
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
06/22/2016
39 samples
HGSD3

Water Quality Report
HGDAL3 - HGLO NEW DOWNDIP
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	05/11/2016 09:10	09/18/2016 07:35
Field Parameters			
Field Ph	S.U.	7.3900	7.0300
Temperature	C	6.6000	11.4000
Field Conductivity	UMHOS/CM	14170.0000	14410.0000
Laboratory Parameters			
Alk As CaCO3, Ph 4.5	MG/L	820.0000	825.0000
Alk, Bicarb As CaCO3	MG/L	820.0000	825.0000
Alk, Carb As CaCO3	MG/L	< 2.0000	< 2.0000
Alk, Hydrox As CaCO3	MG/L	< 2.0000	< 2.0000
Aluminum, Dissolved	MG/L	< 0.2000	< 0.3000
Arsenic, Dissolved	UG/L	< 2.0000	< 2.0000
Boron, Dissolved	UG/L	620.0000	800.0000
Cadmium, Dissolved	UG/L	< 30.0000	< 50.0000
Calcium, Dissolved	MG/L	440.0000	464.0000
Chloride	MG/L	573.0000	651.0000
Chromium, Dissolved	UG/L	< 50.0000	< 100.0000
Conductivity	UMS/CM2	14100.0000	14000.0000
Copper, Dissolved	UG/L	< 50.0000	< 100.0000
Fluoride	MG/L	B 0.2100	B 0.2000
Hardness As CaCO3	MG/L	5790.0000	5850.0000
Iron, Dissolved	MG/L	B 0.3000	0.7000
Lead, Dissolved	UG/L	< 200.0000	< 300.0000
Magnesium, Dissolved	MG/L	1140.0000	1140.0000
Manganese, Dissolved	MG/L	4.3500	5.2600
Mercury, Dissolved	UG/L	< 0.2000	< 0.2000
Nickel, Dissolved	UG/L	< 40.0000	< 80.0000
Nitrate Nitrogen_N	MG/L	B 0.0400	0.2300
Nitrite Nitrogen_N	MG/L	< 0.0100	< 0.0100
Nitrate/Nitrite Nitrogen_N	MG/L	B 0.0400	0.2300
Ph At 25 Deg. Cent.	S.U.	7.9000	7.9000
Potassium, Dissolved	MG/L	12.0000	14.0000
Selenium, Dissolved	UG/L	B 1.6000	< 1.0000
Sodium, Dissolved	MG/L	2580.0000	2670.0000
Solids, Dissolved	MG/L	16500.0000	17100.0000
Solids, Suspended	MG/L	39.0000	39.0000
Sulfate	MG/L	9630.0000	9960.0000
Sulfide	MG/L	< 0.0200	< 0.0200
Zinc, Dissolved	MG/L	B 0.0700	< 0.1000
Bicarbonate As HCO3	MG/L	1000.0000	1010.0000
Carbonate As CO3	MG/L	< 2.0000	< 2.0000
Hydroxide As OH	MG/L	< 2.0000	< 2.0000
Cation_Anion Balance	PERCENT	< -1.1000	< -1.9000
Sar	RATIO	15.0000	15.0000

"B" -- Between MDL and PQL, "<" -- Less than detection limit

Water Quality Report
HGDAL3 - HGLO NEW DOWNDIP
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	05/11/2016 09:10	09/18/2016 07:35
Laboratory Parameters			
Solids, Diss. (Calc)	MG/L	14900.0000	15400.0000
Sum Of Anions	MEQ/L	235.0000	244.0000
Sum Of Cations	MEQ/L	230.0000	235.0000
Tds Ratio	ANAL/CALC	1.1100	1.1100

"B" -- Between MDL and PQL, "<" -- Less than detection limit

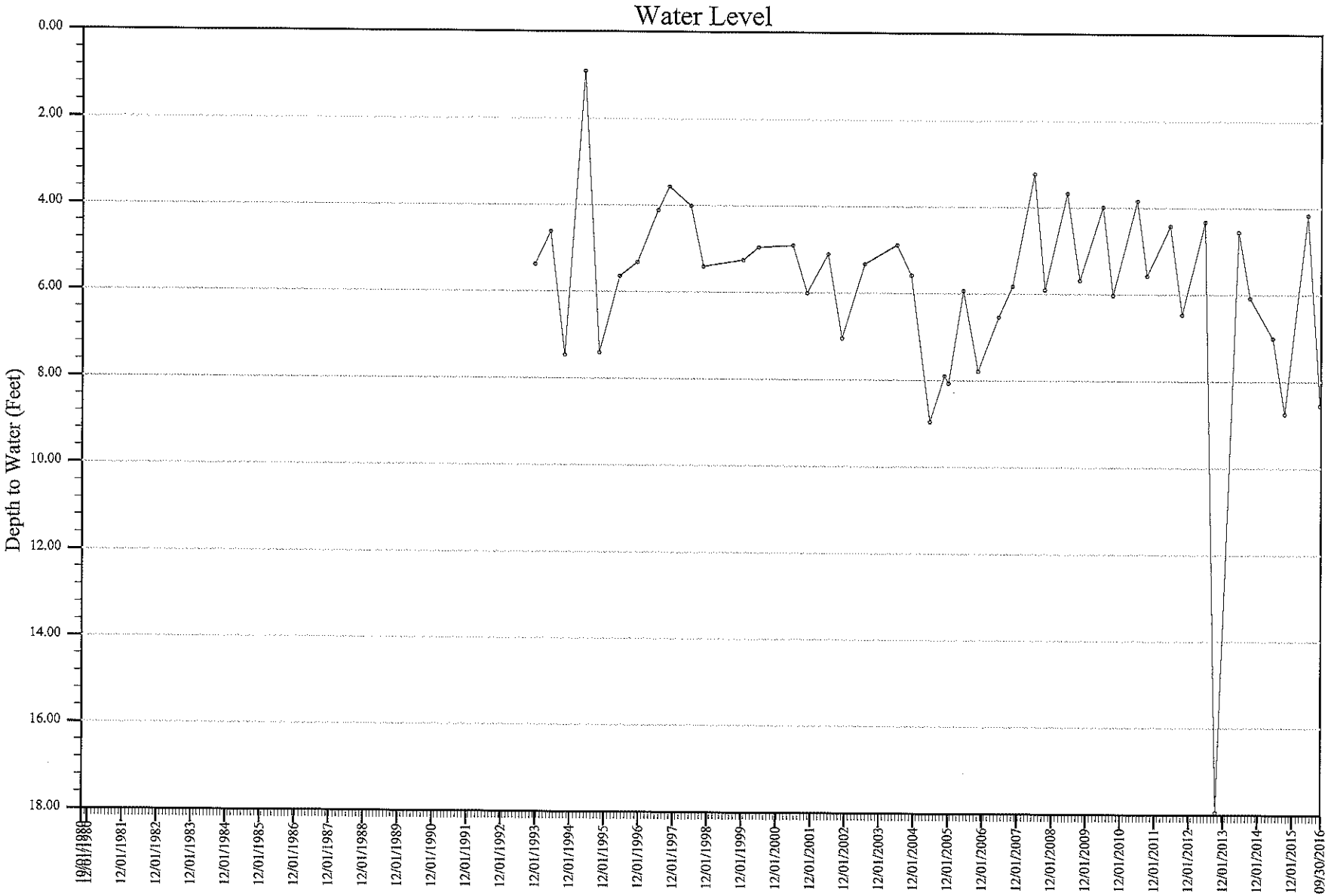
Water Level Report
HGDAL3 - HGLO NEW DOWNDIP
10/01/2015-00:00 to 09/30/2016-23:59

Date	Time	Instrument	Water Level	Elevation	Correction	Status
05/11/2016	09:10:00	MANF	4.17	6376.22	0.00	
09/18/2016	07:35:00	MANF	8.56	6371.83	0.00	

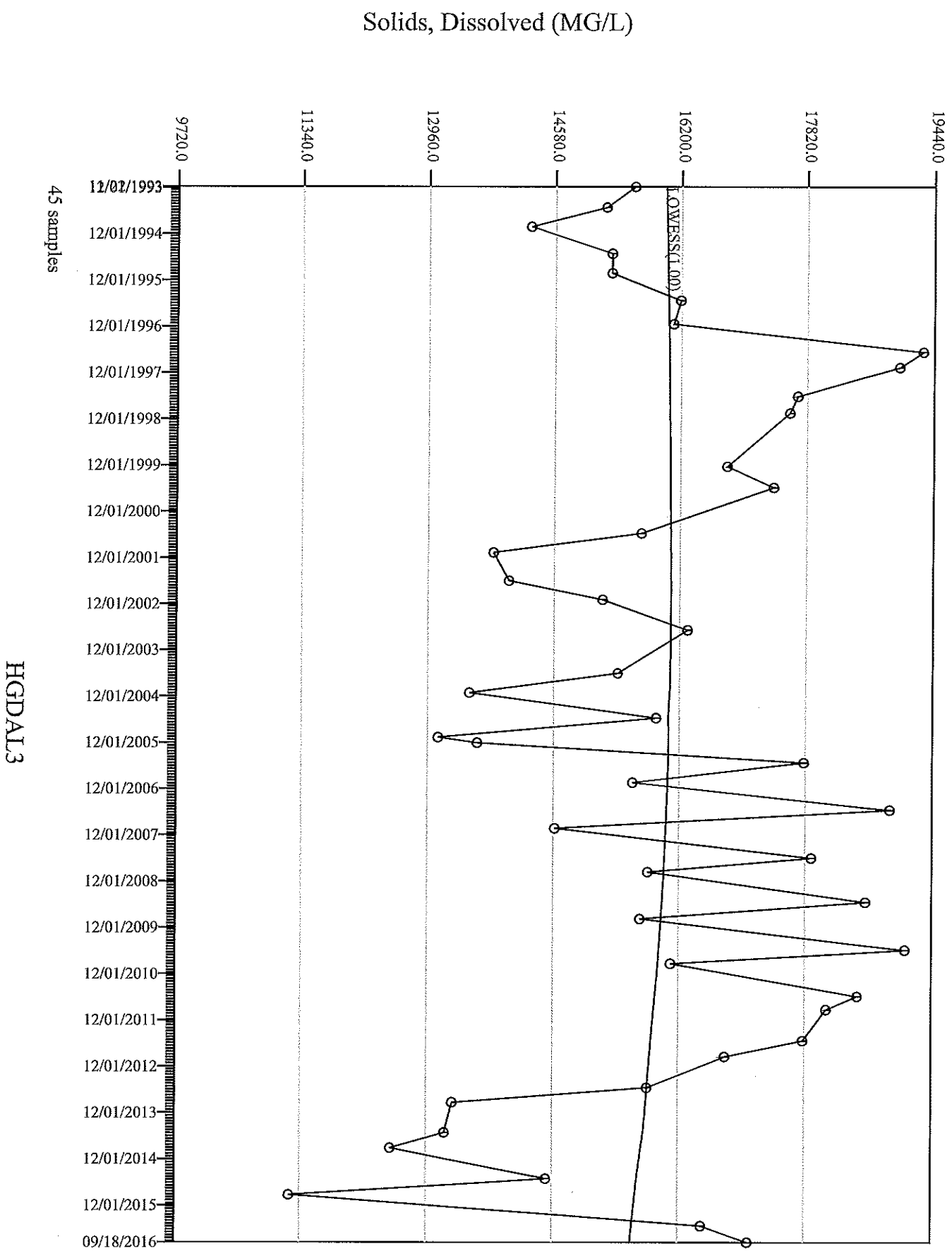
Average water level = 6.37 feet
Minimum water level 4.17 feet at 05/11/2016-09:10:00
Maximum water level 8.56 feet at 09/18/2016-07:35:00

HGDAL3 Sample Remarks
10/01/2015 to 09/30/2016

Remark Date-Time	Remark
05/11/2016-09:10	PUMP GAL/GPM: 10/5
09/18/2016-07:35	PUMP GAL/GPM: 10/.5


Water Level
Depth to Water (Feet)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
12/01/1980
12/01/1981
12/01/1982
12/01/1983
12/01/1984
12/01/1985
12/01/1986
12/01/1987
12/01/1988
12/01/1989
12/01/1990
12/01/1991
12/01/1992
12/01/1993
12/01/1994
12/01/1995
12/01/1996
12/01/1997
12/01/1998
12/01/1999
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
09/30/2016

HGDAL3


Solids, Dissolved (MG/L)
9720.0
11340.0
12960.0
14580.0
16200.0
17820.0
19440.0
LOWESS(1.00)
45 samples
12/01/1993
12/01/1994
12/01/1995
12/01/1996
12/01/1997
12/01/1998
12/01/1999
12/01/2000
12/01/2001
12/01/2002
12/01/2003
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
09/18/2016
HGDAL3

Water Quality Report
HGDAL4 - NEW UPDIP WELL
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	05/11/2016 08:30	09/18/2016 07:55
Field Parameters			
Field Ph	S.U.	7.4600	7.4400
Temperature	C	6.1000	11.2000
Field Conductivity	UMHOS/CM	11560.0000	9290.0000
Laboratory Parameters			
Alk As CaCO3, Ph 4.5	MG/L	698.0000	628.0000
Alk, Bicarb As CaCO3	MG/L	698.0000	628.0000
Alk, Carb As CaCO3	MG/L	< 2.0000	< 2.0000
Alk, Hydrox As CaCO3	MG/L	< 2.0000	< 2.0000
Aluminum, Dissolved	MG/L	< 0.2000	< 0.3000
Arsenic, Dissolved	UG/L	< 2.0000	< 2.0000
Boron, Dissolved	UG/L	520.0000	700.0000
Cadmium, Dissolved	UG/L	< 30.0000	< 50.0000
Calcium, Dissolved	MG/L	412.0000	352.0000
Chloride	MG/L	276.0000	222.0000
Chromium, Dissolved	UG/L	< 50.0000	< 100.0000
Conductivity	UMS/CM2	10100.0000	8970.0000
Copper, Dissolved	UG/L	< 50.0000	< 100.0000
Fluoride	MG/L	B 0.3000	0.3300
Hardness As CaCO3	MG/L	4620.0000	3860.0000
Iron, Dissolved	MG/L	< 0.1000	< 0.2000
Lead, Dissolved	UG/L	< 200.0000	< 300.0000
Magnesium, Dissolved	MG/L	872.0000	723.0000
Manganese, Dissolved	MG/L	0.7700	1.4600
Mercury, Dissolved	UG/L	< 0.2000	< 0.2000
Nickel, Dissolved	UG/L	B 70.0000	< 80.0000
Nitrate Nitrogen_N	MG/L	< 0.0200	< 0.0200
Nitrite Nitrogen_N	MG/L	< 0.0100	< 0.0100
Nitrate/Nitrite Nitrogen_N	MG/L	< 0.0200	< 0.0200
Ph At 25 Deg. Cent.	S.U.	8.1000	8.1000
Potassium, Dissolved	MG/L	B 4.0000	B 4.0000
Selenium, Dissolved	UG/L	< 1.0000	< 1.0000
Sodium, Dissolved	MG/L	1750.0000	1500.0000
Solids, Dissolved	MG/L	10900.0000	10200.0000
Solids, Suspended	MG/L	410.0000	708.0000
Sulfate	MG/L	7000.0000	5990.0000
Sulfide	MG/L	< 0.0200	< 0.2000
Zinc, Dissolved	MG/L	< 0.0500	B 0.2000
Bicarbonate As HCO3	MG/L	852.0000	766.0000
Carbonate As CO3	MG/L	< 2.0000	< 2.0000
Hydroxide As OH	MG/L	< 2.0000	< 2.0000
Cation_Anion Balance	PERCENT	< 0.0000	< -0.7000
Sar	RATIO	11.0000	11.0000

"B" -- Between MDL and PQL, "<" -- Less than detection limit

Water Quality Report
HGDAL4 - NEW UPDIP WELL
10/01/2015-00:00 to 09/30/2016-23:59

Parameters	Units	05/11/2016 08:30	09/18/2016 07:55
Laboratory Parameters			
Solids, Diss. (Calc)	MG/L	10700.0000	9180.0000
Sum Of Anions	MEQ/L	169.0000	145.0000
Sum Of Cations	MEQ/L	169.0000	143.0000
Tds Ratio	ANAL/CALC	1.0200	1.1100

"B" -- Between MDL and PQL, "<" -- Less than detection limit

Water Level Report
HGDAL4 - NEW UPDIP WELL
10/01/2015-00:00 to 09/30/2016-23:59

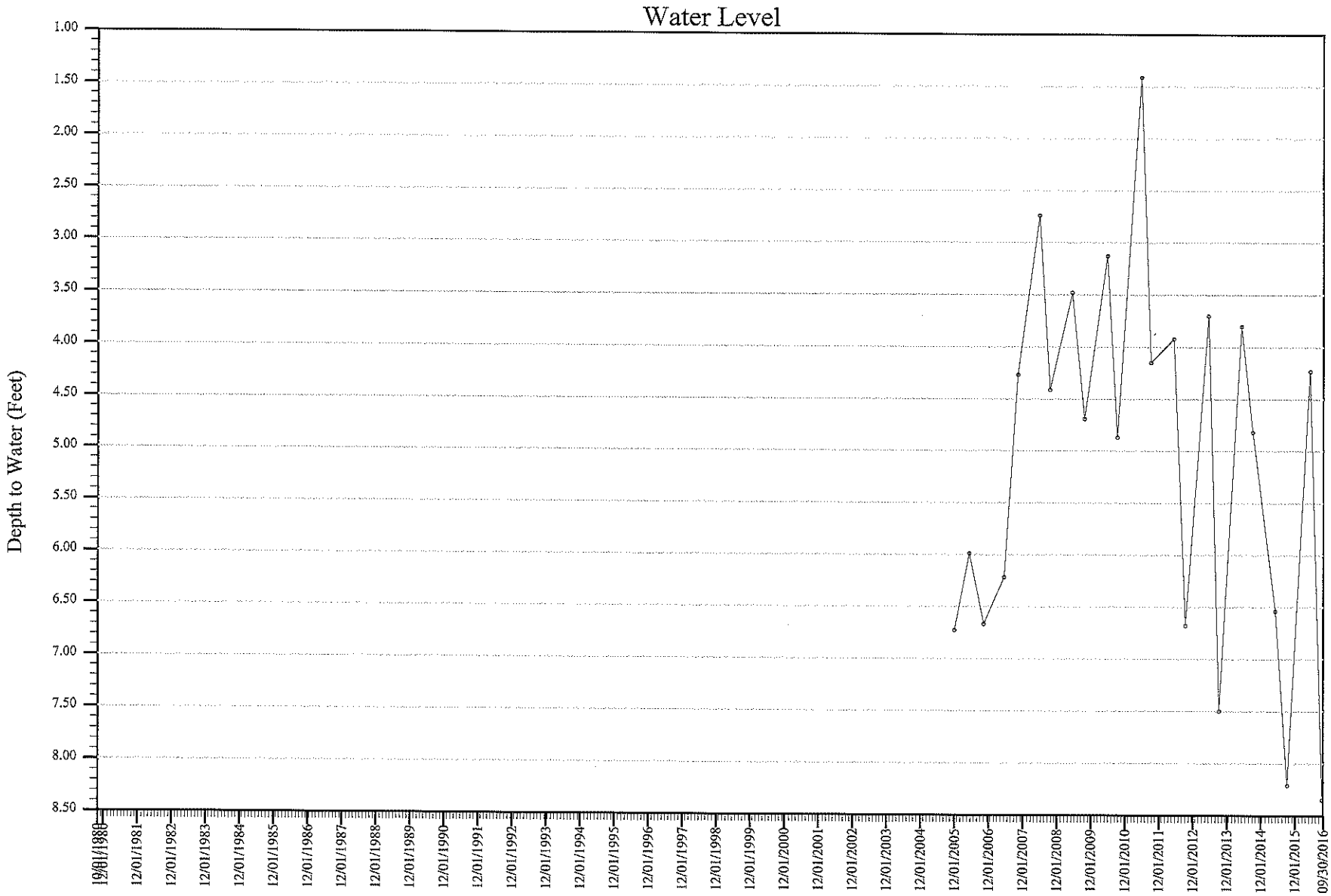
Date	Time	Instrument	Water Level	Elevation	Correction	Status
05/11/2016	08:30:00	MANF	4.23	6379.18	0.00	
09/18/2016	07:55:00	MANF	8.35	6375.06	0.00	

Average water level = 6.29 feet
Minimum water level 4.23 feet at 05/11/2016-08:30:00
Maximum water level 8.35 feet at 09/18/2016-07:55:00

HGDAL4 Sample Remarks

10/01/2015 to 09/30/2016

Remark Date-Time	Remark
05/11/2016-08:30	PUMP GAL/GPM: 4/.5
09/18/2016-07:55	PUMP GAL/GPM: 5/.5


Water Level
Depth to Water (Feet)
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
8.50
12/01/1980
12/01/1981
12/01/1982
12/01/1983
12/01/1984
12/01/1985
12/01/1986
12/01/1987
12/01/1988
12/01/1989
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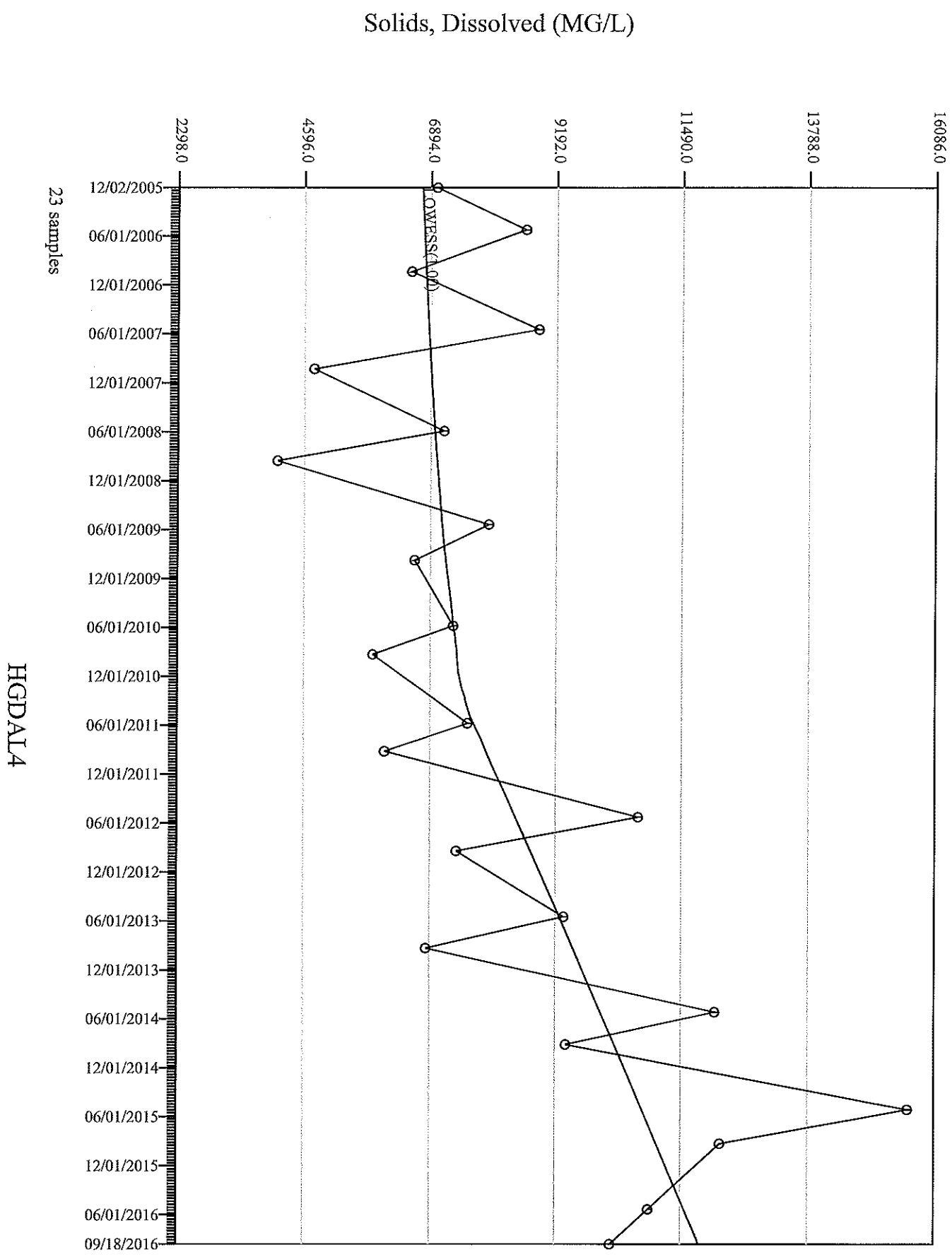
12/01/2004
12/01/2005
12/01/2006
12/01/2007
12/01/2008
12/01/2009
12/01/2010
12/01/2011
12/01/2012
12/01/2013
12/01/2014
12/01/2015
09/30/2016

HGDAL4


Solids, Dissolved (MG/L)
2298.0
4596.0
6894.0
9192.0
11490.0
13788.0
16086.0
LOWESS(1.0f)
23 samples
12/02/2005
06/01/2006
12/01/2006
06/01/2007
12/01/2007
06/01/2008
12/01/2008
06/01/2009
12/01/2009
06/01/2010
12/01/2010
06/01/2011
12/01/2011
06/01/2012
12/01/2012
06/01/2013
12/01/2013
06/01/2014
12/01/2014
06/01/2015
12/01/2015
06/01/2016
09/18/2016
HGDAL4