Alcoa USA Corp.

Operating Permit Amendment Application

(POSGCD Drilling and Operating Permit No. 0148)

May 2021

Alcoa USA Corp.
Energy Division
3990 John D. Harper Road
PO Box 1491
Rockdale, TX 76567-1491 USA

May 17, 2021

Mr. Gary Westbrook, General Manager, and
Members of the Board of Directors
Post Oak Savannah Groundwater Conservation District
P. O. Box 92
Milano, Texas 76556

RE: Alcoa USA Corp.
Application to Amend Alcoa's Existing 25,000 af/yr Simsboro Drilling and Operating Permit No. 0148; and associated Application for Transport Permit

Dear Mr. Westbrook and Members of the Board:

Alcoa USA Corp. (Alcoa) is submitting today the two applications referenced above. Each of the two applications is being submitted with a cover letter addressed to the General Manager that identifies that application and the attachments to it, and that transmits the check for fees that accompanies the application.

This letter is intended to provide the General Manager and the Board an overall picture of the two applications and the April 26, 2021 Letter of Intent between Alcoa and EPCOR USA Inc. (EPCOR). Copies of this letter and the Letter of Intent are included under Section 1 of each of the two applications.

The first application is an Application to Amend Alcoa's existing 25,000 af/yr Simsboro Drilling and Operating Permit No. 0148 to authorize use of the water for municipal use in addition to industrial use, and to authorize use of the water anywhere within Milam County (which is within the District), and anywhere within Williamson County and the adjacent Counties of Lee, Travis and Bell (each of which is outside the District). The 56 wells that will produce the water are the same 56 wells that are currently authorized under the operating permit. No increase in either the authorized aggregate annual production or the rate of production from any well is requested.

The second application is an Application for a Transport Permit authorizing transport of up to 25,000 af/yr of the water produced under the amended operating permit out of the District for use in Williamson County and the three other out-of-District counties.

Alcoa owns nearly 32,000 acres of land and groundwater rights in Milam and Lee Counties known as Sandow Lakes Ranch. Alcoa currently is marketing the property to prospective buyers and, at the same time, entering into long-term leases and water supply contracts with new tenants on the property. Alcoa's objectives include significant long-term economic development within Sandow Lakes Ranch and nearby areas in the two counties. However, Alcoa believes it is also

important that it promote, facilitate and assist in the economic development of the fast growing region between Alcoa's property and the I-35 corridor, because the economic health of that region is critical to the economic development of Milam and Lee Counties. The amended Drilling and Operating Permit No. 0148 and the associated Transport Permit are needed for the desired economic development.

In furtherance of its objectives, Alcoa has entered into the Letter of Intent with EPCOR regarding the supply of this 25,000 AFY of water for use in Milam County, Williamson County, and the adjacent counties of Lee, Travis and Bell.

The project currently envisioned by EPCOR and Alcoa involves phased infrastructure development that will ultimately deliver up to 44,800 acre-feet of groundwater per year. Phase 1 would include an initial 11,200 af/yr of groundwater from EPCOR's existing 130 Project delivered via a pipeline extension from the 130 Project. Phase 2 would include an additional supply of up to 33,600 af/yr of Sandow Lakes Ranch groundwater delivered by a new adjacent pipeline project. Groundwater in addition to the 25,000 af/yr of Simsboro groundwater authorized under Alcoa's amended Operating Permit No. 0148 could come from the Hooper. Interconnections between the 130 Project and the new pipeline would provide significant flexibility and redundancy in water supply to the users.

Please call me at (512) 430-0669 if you have any questions or need any additional information.

Respectfully,

Tommy E. Hodges

Tommy E. Hodges, P.E.
Authorized Representative,
Alcoa USA Corp.

Letter of Intent
Regarding Groundwater from Alcoa's Sandow Lakes Ranch
by and between
Alcoa USA Corp. and
EPCOR USA Inc.

This Letter of Intent (LOI) regarding Groundwater from Alcoa's Sandow Lakes Ranch is entered into as of the 26th day of April 2021, by and between and Alcoa USA Corp. (Alcoa) and EPCOR USA Inc. (EPCOR).

Background

Alcoa owns over 30,000 acres of land and groundwater rights in Milam and Lee Counties, Texas known as Sandow Lakes Ranch, of which nearly 25,000 acres are in Milam County.

EPCOR is a utility company that builds, owns and operates water and wastewater treatment facilities, water transmission pipelines, and natural gas distribution systems. Today, EPCOR is the largest private water provider in the Southwestern United States, owning and operating more than 249 groundwater production wells, 71 water treatment plants, 63 pump stations, 2,860 miles of water distribution pipeline, and 292 miles of natural gas distribution pipeline. In all, EPCOR delivers reliable water and wastewater service to a population of more than 780,000.

In Texas, EPCOR has ownership interest in and operational responsibility for two water supply projects: the Vista Ridge Project and the 130 Project. See Figure 1, below:

Figure 1: EPCOR's Vista Ridge Project and its 130 Project

EPCOR and Alcoa have agreed to work together to make water from Sandow Lakes Ranch available to users in Williamson and adjacent counties in conjunction with EPCOR's 130 Project. Consistent with the understanding between EPCOR and Alcoa, EPCOR by this LOI confirms its immediate

need to secure from Alcoa the supply of 25,000 acre-feet per year (AFY) or more of Sandow Lakes Ranch groundwater. The project currently envisioned by EPCOR and Alcoa involves phased infrastructure development that will ultimately deliver up to 44,800 AFY. Phase 1 would include an initial 11,200 AFY of groundwater from the 130 Project delivered via a pipeline extension from the 130 Project. Phase 2 would include an additional supply of up to 33,600 AFY from Sandow Lakes Ranch groundwater delivered by a new pipeline project. Interconnections between the 130 Project and proposed new pipeline would provide significant flexibility and redundancy in water supplied to the users.

Alcoa's objectives include significant long-term economic development of Alcoa's Sandow Lakes Ranch and nearby areas in Milam and Lee Counties. However, Alcoa believes it is also important that it promote, facilitate and assist in the economic development of the fast growing I-35 and Highway 130 corridors and areas between them and Sandow Lakes Ranch, because the economic health of that region is critical to the economic development of Milam and Lee Counties.

Among its other currently permitted groundwater production rights at its Sandow Lake Ranch, Alcoa holds Operating Permit No. 0148 issued by the Post Oak Savannah Groundwater Conservation District (the "District") authorizing the production of 25,000 AFY of groundwater annually from Alcoa's lands in Milam County and the use of that water for industrial purposes at Alcoa's Milam County property. Alcoa is in the process of seeking from the District amendments to that Operating Permit, as well as a Transport Permit, to authorize use of the water for municipal use in addition to industrial use, use of the water anywhere within Milam County, which is within the District, and transport of the water out of District and use of the water anywhere within Williamson and the adjacent Counties of Lee, Williamson, Travis and Bell. Based on the acreage of groundwater rights that it owns, Alcoa also has additional rights for future additional groundwater production permits at its Sandow Lakes Ranch.

Water Needs of Municipalities and Other Water Suppliers in the Region

In September 2019, the City of Round Rock, Texas issued a Request for Information ("RFI") to identify potential water suppliers and determine basic costs for potential projects. In the RFI, the City asked potential suppliers how the following two alternative firm annual supply volumes and delivery capacities can be provided:

i. 11,200 AFY (10 million gallons per day (mgd), with a delivery capacity of 10 mgd (no peaking capacity); and
ii. 16,800 AFY (15 mgd) with a delivery capacity of 30 mgd.

As reflected in the recently submitted final 2021 Brazos G Regional Water Plan, the City of Round Rock is projected to begin experiencing water supply shortages in the near future, and the 16,800 acft/yr specified in item ii, above, is the City's currently projected 2070 water supply shortage. Based on the initial responses to the RFI, the City is now also considering larger supply volumes with one or more regional partners, having executed a Memorandum of Understanding (MOU) to this effect with the City of Georgetown and the Brazos River Authority. In December 2020, the MOU participants followed up with additional RFI questions, the first of which asked for a description of the potential for each proposed groundwater supply project to provide additional supply volumes beyond those specified in the RFI.

Given the rate of sustained regional population growth in Central Texas, it is prudent for municipalities to secure needed additional water supplies quickly, and to consider securing larger volumes to provide margins of error in the events that shortages will begin to occur even earlier than currently forecasted and future growth in demand will exceed current projections, and to provide for diversification of supply by incorporating drought-proof groundwater conjunctively with surface water supplies. Such larger regional projects will benefit from economies of scale in common production and delivery

infrastructure, and the economy of the entire region would benefit because of the greater long-term security of the region that would result from more water providers having firm water supplies in volumes that will be adequate to avoid shortages for many years into the future. Based on the 2021 Region G Regional Water Plan, the total projected 2070 water supply shortage in Williamson County alone exceeds 25,000 AFY.

Alcoa's and EPCOR's Intent

For the reasons summarized above, Alcoa and EPCOR intend to initiate formal negotiations for an agreement for the reservation and supply of Alcoa's Sandow Lakes Ranch groundwater immediately upon the District acting on Alcoa's applications for the amendment of Operating Permit No. 0148 and the associated Transport Permit. This expression of intent and this LOI are non-binding on both parties in all respects, and either one of the parties may terminate this LOI at any time by giving written notice of termination to the other.

Alcoa USA Corp.

By 

EPCOR USA Inc.

By 

Alcoa USA Corp.
Energy Division
3990 John D. Harper Road
PO Box 1491
Rockdale, TX 76567-1491 USA

May 17, 2021

Mr. Gary Westbrook, General Manager
Post Oak Savannah Groundwater Conservation District
310 East Avenue C
Milano, Texas 76556

RE: Alcoa USA Corp. – Application to Amend Alcoa's Existing 25,000 af/yr Simsboro Drilling and Operating Permit No. 0148

Dear Mr. Westbrook:

Submitted herewith are 3 copies of the Application of Alcoa USA Corp. (Alcoa) to Amend Alcoa's existing 25,000 af/yr Simsboro Drilling and Operating Permit No. 0148 to authorize municipal use in addition to industrial use, and to authorize use of water anywhere within Milam County (which is in the District) and anywhere within Williamson County and the adjacent Counties of Lee, Travis and Bell (each of which is outside of the District). A separate transport permit application is being submitted for the transport of the water to the four out of district counties.

Each copy of the Application to Amend Drilling and Operating Permit No. 0148 is compiled in a single notebook consisting of five sections, corresponding to tabs in the notebook. As described in the table below, Section 1 consists of the completed application form and certain attachments to the application form, and the remaining sections consist of additional attachments to the application form.

As indicated in the table below, the first attachment to the completed application form is a copy of a letter from Tommy Hodges to you and the Members of the Board discussing both applications and the April 26, 2021 Letter of Intent between Alcoa and EPCOR USA Inc.

Section	Descriptions of Materials in each Section
1	The completed application form and the following attachments to the completed application form: • Letter from Tommy Hodges to Gary Westbrook and the Board of Directors summarizing this Application to Amend Drilling and Operating Permit No. 0148, the associated application for a transport permit, and the April 26, 2021 Letter of Intent between Alcoa and EPCOR USA Inc. • April 26, 2021 Letter of Intent between Alcoa and EPCOR USA Inc. • Summary of Amendment Application, Responses to POSGCD Rule 7.4, and Response to the District's Request for a Description of Flow Measurements
2	• Land Ownership Information
3	• Water Conservation Plan and Drought Contingency Plan
4	• Aquifer Impact Study
5	• Production Well Information

Also enclosed is a check in the amount of $5,600 for the District's processing of the application.

Finally, also enclosed is a flash drive containing a digital copy of the application and the groundwater models associated with the Aquifer Impact Study.

Please call Tommy Hodges at (512) 430-0669 if you have any questions or need any additional information.

Respectfully,

Robyn L. Gross
Director Asset Management Americas
Alcoa USA Corp.

Enclosures

Section 1

Application Information

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT (POSGCD)
Permit Application to Drill or Alter and Operate a Non-Exempt Well

Return this completed form to: POSGCD, PO Box 92 (310 East Ave. C), Milano, TX 76556
Phone: 512-455-9900 **FAX:** 512-455-9909 **Email:** admin@posgcd.org
Please type or print legibly. Incomplete applications will be returned to applicant.

Application Date: _____ Well Number: _____
Date received by POSGCD Assigned by POSGCD

Is the property where this well is or will be located within a subdivision or city? Yes (No)

If yes, please write the name of the subdivision or city: _____

PURPOSE FOR THIS APPLICATION (*Choose one*)

New well

Replacement well; if selected, please briefly explain: _____

Alter an existing well; if selected, please briefly explain: _____

Operate an existing well

Other; if selected, please briefly explain: See Summary of Application in Section 1 - Application Information

SECTION 1: APPLICANT

Name: Alcoa USA Corp. Phone: (512) 430-0669
(First, Middle, Last)

Address: P.O. Box 1491 Email: Tommy.Hodges2@alcoa.com

City: Rockdale State: TX Zip: 76567

Are you requesting an exemption under Post Oak Savannah GCD Rule 7.10? Yes (No)

If yes, please cite applicable rule, or explain: _____

SECTION 2: FEE REQUIRED

If the applicant intends to drill a new well, increase the size of an existing well, increase the size of a pump on an existing well, or replace a permitted well, then a **$100 NON-REFUNDABLE FEE PER EXISTING, OR PROPOSED WELL** must accompany this application. The applicant may be required to submit any additional information identified by the board during the permitting process as reasonably required or beneficial to the Districts' decision. Additional funds may be required from the applicant if necessary to complete the District's cost of processing the application.

A charge of $25.00 will be assessed for all "returned" checks.

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT (POSGCD)
Permit Application to Drill or Alter and Operate a Non-Exempt Well

SECTION 3: AUTHORIZATION TO DRILL

Has any part of the water rights of the property for this well been leased, sold, or transferred? Yes (No)

If yes, or if the name and address of the property owner is different than the person shown in Section 1, please complete this section and attach proof of authorization to drill and produce groundwater:

Name: _____ Phone: _____
(First, Middle, Last)

Address: _____ Email: _____

City: _____ State: _____ Zip: _____

Is a copy of authorization to drill on property attached according to Rule 7.4.4? Yes No

SECTION 4: MAP & SPACING

You must answer yes to each of the following for this application to be complete:

Is map of area accoring to Rule 7.4.4 attached? (Yes)

Is proof of satisfaction of spacing requirements according to Rule 4.1 attached? (Yes)

SECTION 5: PURPOSE FOR WATER USE

Type of well (Check one): Domestic (Municipal) Irrigation (Other)

If other, please explain: Industrial

List proposed usage of water produced from well and the amount of usage, including conjunctive use.

Use: Aggregated maximum amount of Amount Used: 25,000 acre-feet/yr [redacted]

Use: _____ Amount Used: _____ gallons/day.

Use: _____ Amount Used: _____ gallons/day.

Total Amount to be used: _____ gallons/day.

Location of water usage: within Milam, Williamson, Lee, Travis, or Bell Counties

Proposed rate at which water will be withdrawn: No change in approved maximum well rates requested [redacted]

Aquifer & Formation water is to be drawn from: Simsboro

The total number of acres that overlies the aquifer and formation listed above that is contiguous to the well listed and located above (Rule 7.4.4): 24,282.41 (in Milam Co.) total acres.

Total amount of water requested per year: maximum aggregate of 25,000 acre feet (1 acre foot = 325,851 gallons)

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT (POSGCD)
Permit Application to Drill or Alter and Operate a Non-Exempt Well

SECTION 6: PLANS

Please attach copies of the following studies or plans, or indicate:

Well Closure Plan Alternative Supply Plan Conservation Plan Drought Contingency Plan

Aquifer Impact Study: See attached Section 4 - Response to Rule 7.4.5 - Aquifer Impact Study

Declaration to abide by all Rules and the Management Plan of the District (found in Section 8).
*** In lieu of submitting these plans, the applicant may declare that he/she will abide by the District's Rules and Management Plan as they pertain to these items.*

SECTION 7: Well Information (*POSGCD can assist with this Section*)

Well location (*directions to well site from nearest state or federal highway*): **See Note Below**

Begin at _____ and then go _____

and then go _____ and then go _____

and then go _____ and then go _____

Well is located in: Milam County Burleson County

Well coordinates: Latitude: _____ Longitude: _____

Please attach copies of the following schedules or logs, if available:

Driller's Schedule Driller's Log/Report Electric Log

Date well drilled:	Driller's name:	Driller's license number:
Well depth (feet):	Diameter of hole (inches):	Diameter of pipe (inches):
Pump set at (depth of lift in feet):	Depth to water (feet):	Pump size (horse power):
Well capacity (gallons/minute):	Pump power source:	Type of pump:

Request for well to be aggregate with other wells? Yes No If yes, list wells below:

No change in the approved Operating Permit wells is requested. The 56 approved wells are listed in Table 1-1 contained in Section 1 - Application Information of this permit amendment.

POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT (POSGCD)
Permit Application to Drill or Alter and Operate a Non-Exempt Well

SECTION 8: Attachments

Please list all items attached to this permit:

(Map of location showing spacing (REQUIRED)) (Unique property description (REQUIRED))

Other: Section 1 - Application Information including Summary of Application and Responses to Rule 7.4, Section 2 - Land Ownership, Section 3 - Water Conservation Plan and Drought Contingency Plan, Section 4 - Response to Rule 7.4.5 - Aquifer Impact Statement, Section 5 - Production Well Information

SECTION 9: Affirmation and Execution

I certify that all statements and information in this application are true and correct. If the name and address in Section 3 of this application is different than that in Section 1, I also certify that I have authorization to act on behalf of the person(s) in Section 2 and that I also have authorization to produce groundwater from this well. I further declare that all groundwater withdrawn will be put to beneficial use at all times. If I have chosen the Declaration option in Section 6, I here by declare that I will abide by all Rules and the Management Plan of the District according to the District's Rule 7.4.4 D, F, G, and H concerning these items.

Robyn Gross
Signature of Applicant

THE STATE OF ~~TEXAS~~ Pennsylvania
COUNTY OF Allegheny

This instrument was acknowledged before me on (date) May 13, 2021

by (applicant) Alcoa USA Corp., by Robyn Gross, Director .

Commonwealth of Pennsylvania - Notary Seal
Julie Perez, Notary Public
Allegheny County
My commission expires March 18, 2023
Commission number 1197517
(NOTARY SEAL)
Member, Pennsylvania Association of Notaries

Julie Perez
Notary Signature

Can be notarized in the presence of any Notary of your choice. There is a Notary at the POSGCD office.

FOR OFFICE USE ONLY

Has appropriate fee been paid to District to process this application?	Yes	No	Amount Paid:
Is Applicant current with District Rules?	Yes	No	
Is application administratevely complete?	Yes	No	

Date of hearing (if applicable): _____

Notes: _____

Letter of Intent
Regarding Groundwater from Alcoa's Sandow Lakes Ranch
by and between
Alcoa USA Corp. and
EPCOR USA Inc.

This Letter of Intent (LOI) regarding Groundwater from Alcoa's Sandow Lakes Ranch is entered into as of the 26th day of April 2021, by and between and Alcoa USA Corp. (Alcoa) and EPCOR USA Inc. (EPCOR).

Background

Alcoa owns over 30,000 acres of land and groundwater rights in Milam and Lee Counties, Texas known as Sandow Lakes Ranch, of which nearly 25,000 acres are in Milam County.

EPCOR is a utility company that builds, owns and operates water and wastewater treatment facilities, water transmission pipelines, and natural gas distribution systems. Today, EPCOR is the largest private water provider in the Southwestern United States, owning and operating more than 249 groundwater production wells, 71 water treatment plants, 63 pump stations, 2,860 miles of water distribution pipeline, and 292 miles of natural gas distribution pipeline. In all, EPCOR delivers reliable water and wastewater service to a population of more than 780,000.

In Texas, EPCOR has ownership interest in and operational responsibility for two water supply projects: the Vista Ridge Project and the 130 Project. See Figure 1, below:

Figure 1: EPCOR's Vista Ridge Project and its 130 Project

EPCOR and Alcoa have agreed to work together to make water from Sandow Lakes Ranch available to users in Williamson and adjacent counties in conjunction with EPCOR's 130 Project. Consistent with the understanding between EPCOR and Alcoa, EPCOR by this LOI confirms its immediate

need to secure from Alcoa the supply of 25,000 acre-feet per year (AFY) or more of Sandow Lakes Ranch groundwater. The project currently envisioned by EPCOR and Alcoa involves phased infrastructure development that will ultimately deliver up to 44,800 AFY. Phase 1 would include an initial 11,200 AFY of groundwater from the 130 Project delivered via a pipeline extension from the 130 Project. Phase 2 would include an additional supply of up to 33,600 AFY from Sandow Lakes Ranch groundwater delivered by a new pipeline project. Interconnections between the 130 Project and proposed new pipeline would provide significant flexibility and redundancy in water supplied to the users.

Alcoa's objectives include significant long-term economic development of Alcoa's Sandow Lakes Ranch and nearby areas in Milam and Lee Counties. However, Alcoa believes it is also important that it promote, facilitate and assist in the economic development of the fast growing I-35 and Highway 130 corridors and areas between them and Sandow Lakes Ranch, because the economic health of that region is critical to the economic development of Milam and Lee Counties.

Among its other currently permitted groundwater production rights at its Sandow Lake Ranch, Alcoa holds Operating Permit No. 0148 issued by the Post Oak Savannah Groundwater Conservation District (the "District") authorizing the production of 25,000 AFY of groundwater annually from Alcoa's lands in Milam County and the use of that water for industrial purposes at Alcoa's Milam County property. Alcoa is in the process of seeking from the District amendments to that Operating Permit, as well as a Transport Permit, to authorize use of the water for municipal use in addition to industrial use, use of the water anywhere within Milam County, which is within the District, and transport of the water out of District and use of the water anywhere within Williamson and the adjacent Counties of Lee, Williamson, Travis and Bell. Based on the acreage of groundwater rights that it owns, Alcoa also has additional rights for future additional groundwater production permits at its Sandow Lakes Ranch.

Water Needs of Municipalities and Other Water Suppliers in the Region

In September 2019, the City of Round Rock, Texas issued a Request for Information ("RFI") to identify potential water suppliers and determine basic costs for potential projects. In the RFI, the City asked potential suppliers how the following two alternative firm annual supply volumes and delivery capacities can be provided:

i. 11,200 AFY (10 million gallons per day (mgd), with a delivery capacity of 10 mgd (no peaking capacity); and
ii. 16,800 AFY (15 mgd) with a delivery capacity of 30 mgd.

As reflected in the recently submitted final 2021 Brazos G Regional Water Plan, the City of Round Rock is projected to begin experiencing water supply shortages in the near future, and the 16,800 acft/yr specified in item ii, above, is the City's currently projected 2070 water supply shortage. Based on the initial responses to the RFI, the City is now also considering larger supply volumes with one or more regional partners, having executed a Memorandum of Understanding (MOU) to this effect with the City of Georgetown and the Brazos River Authority. In December 2020, the MOU participants followed up with additional RFI questions, the first of which asked for a description of the potential for each proposed groundwater supply project to provide additional supply volumes beyond those specified in the RFI.

Given the rate of sustained regional population growth in Central Texas, it is prudent for municipalities to secure needed additional water supplies quickly, and to consider securing larger volumes to provide margins of error in the events that shortages will begin to occur even earlier than currently forecasted and future growth in demand will exceed current projections, and to provide for diversification of supply by incorporating drought-proof groundwater conjunctively with surface water supplies. Such larger regional projects will benefit from economies of scale in common production and delivery

infrastructure, and the economy of the entire region would benefit because of the greater long-term security of the region that would result from more water providers having firm water supplies in volumes that will be adequate to avoid shortages for many years into the future. Based on the 2021 Region G Regional Water Plan, the total projected 2070 water supply shortage in Williamson County alone exceeds 25,000 AFY.

Alcoa's and EPCOR's Intent

For the reasons summarized above, Alcoa and EPCOR intend to initiate formal negotiations for an agreement for the reservation and supply of Alcoa's Sandow Lakes Ranch groundwater immediately upon the District acting on Alcoa's applications for the amendment of Operating Permit No. 0148 and the associated Transport Permit. This expression of intent and this LOI are non-binding on both parties in all respects, and either one of the parties may terminate this LOI at any time by giving written notice of termination to the other.

Alcoa USA Corp.

By 

EPCOR USA Inc.

By 

Summary of Amendment Application, Responses to Post Oak Savannah Rule 7.4, and Response to the District's Request for a Description of Flow Measurements

Alcoa USA Corp.

Application to Amend
POSGCD Drilling and Operating Permit No. 0148

Currently Authorized Production of 25,000 af/yr from the Simsboro

SUMMARY OF AMENDMENT APPLICATION:

Alcoa USA Corp. (Alcoa) holds POSGCD Drilling and Operating Permit No. 0148 (sometimes referred to as "Operating Permit No. 0148"), which authorizes the production of 25,000 acre-feet per year (af/yr) of water from the Simsboro formation by means of a system of 56 wells located on the nearly 25,000 acres of land that Alcoa owns in Milam County. The water is authorized to be used for industrial use on that land. The 56 wells consist of 24 permitted but not yet constructed wells and 32 of the 61 existing wells permitted under Alcoa's Historic Use Permit No. 0330.

Alcoa seeks an amendment to its Operating Permit No. 0148 to authorize use of the water for municipal use in addition to industrial use, and to authorize use of the water anywhere within Milam County (which is within the District), and anywhere within Williamson County and the adjacent Counties of Lee, Travis and Bell (each of which is outside the District). No changes in the currently permitted well locations or currently permitted well rates are requested. By separate application, Alcoa is also seeking a transport permit to authorize the transport of the water for use outside the District. .

As part of the proposed permit amendment, Alcoa is requesting that the term of the permit be extended to a date that is 40 years from the date of issuance of the amendment. The permit currently has a term that ends November 13, 2052. Alcoa is requesting the same 40-year term for the transport permit.

Alcoa owns nearly 32,000 acres of land and groundwater rights in Milam and Lee Counties known as Sandow Lakes Ranch. Alcoa currently is marketing the property to prospective buyers and, at the same time, entering into long-term leases and water supply contracts with new tenants on the property. Alcoa's objectives include significant long-term economic development within the property and nearby areas in the two counties. However, Alcoa believes it is also important for it

to promote, facilitate and assist in the economic development of the fast growing region between Alcoa's property and the I-35 corridor, because the economic health of that region is critical to the economic development of Milam and Lee Counties. The amended operating permit and the associated transport permit are needed for the desired economic development.

In furtherance of its objectives, Alcoa has entered into a Letter of Intent dated as of April 26, 2021 with EPCOR USA Inc. (EPCOR) regarding the supply of this 25,000 af/yr of water for use in Milam County, Williamson County, and the adjacent counties of Lee, Travis and Bell. The project currently envisioned by EPCOR and Alcoa involves phased infrastructure development that will ultimately deliver up to 44,800 af/yr. Phase 1 would include an initial 11,200 af/yr of groundwater from EPCOR's existing 130 Project delivered via a pipeline extension from the 130 Project. Phase 2 would include an additional supply of up to 33,600 af/yr from Sandow Lakes Ranch groundwater delivered by a new pipeline project. Interconnections between the 130 Project and proposed new pipeline would provide significant flexibility and redundancy in water supply to the users. A copy of the Letter of Intent is included under Section 1 of this Application.

RESPONSES TO RULE 7.4. APPLICATION REQUIREMENTS FOR ALL PERMITS.

1. Each original application for a drilling permit, historic use permit, operating permit, transport permit, permit review or renewal, or permit amendment shall be on the form or forms required by the District. The forms will be furnished to the applicant upon request.

2. All permits are granted in accordance with the rules, and acceptance of a permit constitutes an acknowledgment of receipt of the rules and agreement that the permit holder will comply with all of the rules.

3. The application for a permit shall be in writing and sworn to.

   The POSGCD application form included in Section 1 includes a sworn statement, and the application is in writing.

4. The following shall be included in the permit application:

   a. the name and mailing address of the applicant and the owner of the land on which the well is or will be located;

      Alcoa USA Corp.
      PO Box 1491
      Rockdale, Texas 76567

   b. documentation establishing ownership of the land on which the well is or will be located; and, if the applicant is other than the owner of the property or if the water rights have been sold or leased, documentation establishing the applicable authority to construct and operate a well on such property for the proposed use; the documentation must be one or more documents recorded in the real property records of the County in which the land is located;

      See Table 1-1 in Section 1 for individual well location, unique property description, and maximum pumping rate for each approved well. In Section 2, see Figure 2-1 for a map of property Alcoa USA Corp (Alcoa) owns in support of this application and Table 2-1 for property descriptions. See Figure 5-1 in Section 5 for a map of the location of each approved well in relation to Alcoa property utilized in support of this application.

   c. a statement of the nature and purpose of the proposed use and the amount of groundwater to be used for each purpose, including, as applicable, any proposed conjunctive use;

      Alcoa seeks an amendment to its Drilling and Operating Permit No. 0148 to authorize use of the water for municipal use in addition to industrial use. The amount of water to be used for each purpose is dependent on end user needs over the duration of the permit term. The total aggregate amount is limited to 25,000 af/yr.

Within the new requested place of use, there are over 100 individual public water supply systems. Numerous systems currently use surface water and groundwater in a conjunctive approach. The Draft 2022 State Water Plan also includes increases in conjunctive use for entities located in the requested receiving area.

d. a water conservation plan or a declaration that the applicant will comply with the management plan;

See Section 3 for this information. All water will be used beneficially and consistent with the District management plan.

e. the maximum rate at which groundwater is proposed to be withdrawn from each well and a map showing the location of the well and the property owned or controlled by the applicant for the production of water; [Amended July 2, 2019]

The 56 wells that are currently permitted under Drilling and Operating Permit No. 0148 consist of 24 permitted but not yet constructed wells and 32 of the 61 existing wells permitted under Alcoa's Historic Use Permit No. 0330. See Table 1-1 in Section 1 for the individual well's approved location and production rate, and unique property information. See Figure 5-1 in Section 5 for a map of the location of each well and Alcoa property utilized in support of this application.

For every well location, no part of the water rights has been leased, sold, or transferred. Alcoa owns all rights to the surface estate and groundwater rights for the location of every permitted well.

No exemption under POSGCD rule 7.10 is requested for any well.

f. a water well closure plan or a declaration that the applicant will comply with well plugging guidelines and report closure to the District;

Alcoa's water well closure plan includes compliance with all TCEQ, Texas Department of Licensing and Regulation, and District closure and well plugging guidelines. Alcoa will also furnish well plugging records to the District.

g. a drought contingency plan if required by state law;

See Section 3 for this information.

h. an alternative supply plan if required by state law or District Rule;

See Section 4 of the Transport Permit Application for this information.

i. a statement by the applicant that the groundwater withdrawn under the permit will be put to beneficial use at all times;

The groundwater will be put to beneficial use at all times.

j. the location of the use of the groundwater from the well;

Alcoa is requesting authorization to use the groundwater anywhere within Milam County (which is in the District), and anywhere within Williamson County and the adjacent Counties of Lee, Travis and Bell (each of which is outside of the District). Alcoa is also seeking a transport permit to authorize the transport of water outside of the District.

k. the aquifer and formation or proposed depth from which the applicant intends to produce groundwater;

The production will be from the Simsboro Formation. See Table 1-2 for location and estimated depths for the 24 permitted but not yet constructed wells, and location and existing depth information for the 32 existing wells. Existing construction records for existing wells are included in Section 5, Appendix A.

Each of the 32 existing wells will undergo investigation and well testing prior to being used for municipal use. These investigations may include pulling pumping equipment for inspection and TV survey to inspect the condition of the well. Additional work may also be conducted including well cleaning and rehabilitation, and other work required to obtain approval from TCEQ for municipal use of the well. Results of all work conducted and copies of TCEQ submittals will be provided to POSGCD.

Upon drilling, completing and testing of each of the 24 permitted but not yet constructed wells, within 90 days Alcoa will submit to the POSGCD the following:

1. **TDLR State Well Report**
2. **Geophysical Log**
3. **Results of Water Quality Testing**
4. **Results of Pump Testing**

l. the total acreage that overlies the aquifer and formation listed under (k) above, from which the applicant has the right to produce groundwater;

Summary of Alcoa property ownership in Milam County overlying the Simsboro Formation:

Full Ownership in Milam County Overlying Simsboro	Groundwater Rights Only in Milam County Overlying Simsboro	Total of Full Ownership plus Groundwater Rights in Milam County Overlying Simsboro
23,681.35 acres	904.6 acres	24,585.95 acres

See Figure 2-1 in Section 2 for a map of these Milam County properties.

m. the total number of acres that overlies the aquifer and formation listed under (k) above and that is contiguous to the well(s) listed and located under (e) above; [Amended September 5, 2017]

Summary of Alcoa contiguous ownership in Milam County overlying the Simsboro Formation:

Full Ownership and Contiguous in Milam County Overlying Simsboro	Groundwater Rights Only and Contiguous in Milam County Overlying Simsboro	Total of Full Ownership plus Groundwater Rights and Contiguous in Milam County Overlying Simsboro
23,377.81 acres	904.6 acres	24,282.41 acres

5. Applications for permits for wells that will have a maximum pumping rate that equals or exceeds 500 gpm shall include:

a. Predictions of pumping impacts on water levels over the next 30 years within a radial distance of 5 miles of the newly permitted well.

See Section 4 for this information. Although all wells are currently permitted (i.e., there will be no newly permitted wells) and no changes in the permitted amount or production rates are requested, Alcoa at the District's request submits an Aquifer Impact Study in Section 4.

b. The predictions will be based on the newly permitted well pumping its fully permitted amount and will be submitted in report form that describes the assumptions used in the model run.

See Section 4 for this information. Again, all wells are currently permitted (i.e., there are no requests for new permitted wells) and no changes in the permitted amount or production rates are requested.

c. If a MAG exists for the aquifer from which water will be produced, then the predictions will include results based on using the Groundwater Availability Model run used to establish the MAG for the aquifer. [Amended July 2, 2019]

At the request of the District, a new Carrizo-Wilcox, Queen City, Sparta GAM was utilized to simulate the operating permit production. See the Aquifer Impact Study in Section 4 for the assumptions used in the model runs.

d. Predictions made using models other than the GAMs will be accepted by the district.

N/A.

e. Prior to submitting the report, the applicant will meet with POSGCD to agree to the modeling assumptions and the required deliverables.

See the Aquifer Impact Study in Section 4 for a summary of the actions and efforts of Alcoa and the District to arrive at the modeling assumptions and the deliverables.

f. Following submittal of the report, POSGCD will review and provide comments on the report and the well owner shall provide written responses to all comments.

g. Wells producing from the Brazos or Little River Alluviums, or wells used for seasonal irrigation (or less than 180 days per year) are exempt from this rule 7.4.5.

6. Payment by the permittee of the appropriate application fee.

A check for the application fee of $5,600 accompanies this application.

RESPONSE TO THE DISTRICT'S REQUEST FOR A DESCRIPTION OF FLOW MEASUREMENTS.

In addition to the deliverables requested by the District to be included in the Aquifer Impact Study (submitted under Section 4), the District also requested that the application include a description of how production from each of Alcoa's wells will be metered and how the flow meter data will be analyzed so that the correct volumes will be reported for the amounts produced from each well under each of Alcoa's production permits. The requested description is set forth below:

(1) Alcoa holds Historic Use Permit No. 0330 authorizing production of 15,000 af/yr from 61 existing wells. The water produced under the permit is authorized to be used for industrial use within the boundaries of Alcoa's Milam County property.

(2) Alcoa also holds Operating Permit No. 0148 authorizing production of 25,000 af/yr from a total of 56 wells, 32 of which are existing wells included in the 61 existing wells authorized under HU Permit no. 0330, and 24 of which are not yet constructed. Thus, Alcoa is authorized to pump water under either permit from any of the 32 dual-use wells.

(3) Currently, the water produced under OP No. 0148 is authorized to be used for industrial use within the boundaries of Alcoa's Milam County property. Alcoa is asking the District to amend OP No. 0148 and issue Alcoa a Transport Permit so that the water produced under OP No. 0148 will be authorized to be used for municipal use in addition to industrial use, anywhere within Milam County (which is within the District), and anywhere within Williamson County and the adjacent Counties of Lee, Travis and Bell (all of which are outside the District).

(4) The flow from each producing well will be metered. For each well other than the 32 dual-use wells, one meter is all that is needed to be able to assign the amount produced from that well to a particular permit.

(5) Additional meters will be added at appropriate points as necessary to determine the amount of water produced from any producing 32 dual-use wells to be assigned to each permit. For example, if all of the flow from a single, isolated producing dual-use well is being used only under HU No. 0330 for industrial use within Alcoa's Milam County property, then no additional meter is needed for that well. If some of the water produced from a single, isolated producing dual-use well is being used under HU No. 0330 for industrial use within Alcoa's Milam County property and some is being used under OP No. 0148 for municipal use in any of the four counties, then an additional meter would be added for that well. One of the two meters for that well will measure the amount of water produced under one of the permits and, depending on

how the two meters are arranged, the other meter will measure either the total amount of water produced from the well or the amount produced under the other permit. If one of the meters measures the total amount of water produced from the well, then the amount measured by the other meter is the amount produced under one of the permits, and the difference between the two measured amounts is the amount produced under the other permit. If one of the meters measures the amount of water produced under one of the permits and the other meter measures the amount produced under the other permit, then the sum of the two measured amounts is the total amount produced from the well. If a number of dual-use wells are operated as a well field to produce water used under both permits, then only one additional meter is needed for that well field, to measure the total amount produced by the well field under one of the permits; the sum of the metered amounts produced from each well in the well field is the total amount produced from the well field, and the difference between that sum and the measured amount produced by the well field under one of the permits is the amount produced under the other permit; and the amount produced by each well under each permit would be assigned proportionally. If that well field is operated to produce water used under only one of the permits, then no additional meter is needed for that well field.

(6) One or more additional meters will be added at appropriate points to measure the amount of water produced under OP No. 0148 that is transported for use outside the District.

(7) If the District desires that the amounts of water produced under OP No 0148 for each of the two authorized purposes of use be reported separately (instead of allowing all use under OP No. 0148 to be reported as "municipal or industrial"), the approach used to arrive at the amounts to be separately reported will depend upon various factors, including the number of customers or end users of each use and the amount of water used by each. If, as currently expected, all or most of the water supplied under OP No. 0148 is treated and there are relatively few customers or end users of that water that fall in the industrial category, then the most logical approach likely will turn out to be as follows: Identify those particular end users that fall in the industrial category; the metered amounts of water supplied to those end users would be assigned industrial use and subtracted from the total production under OP No 0148 to arrive at the amount assigned municipal use.

Table 1-1. Summary of Approved Operating Permit Wells

Approved Operating Permit Wells (to be constructed)

Well Name	Latitude	Longitude	Approved Maximum Withdrawal Rate (gpm)	Well Location – Milam County Appraisal District Property ID
OP-1	30.6217298	-97.003762	1,000	10354
OP-2	30.6051961	-97.008376	1,000	10354
OP-3	30.5988499	-97.008832	1,000	10354
OP-4	30.5814542	-97.011233	1,000	10354
OP-5	30.5750311	-97.011456	1,000	20519037
OP-6	30.5590547	-97.018725	1,000	20519037
OP-7	30.5542342	-97.01588	1,000	20519037
OP-8	30.5511811	-97.024434	1,000	20519037
OP-9	30.5450588	-97.031084	1,000	20519037
OP-10	30.5422235	-97.029208	1,000	20519037
OP-11	30.5394868	-97.028175	1,000	20519037
OP-12	30.5367041	-97.02784	1,000	20519037
OP-13	30.5354732	-97.031413	1,000	20519037
OP-14	30.5331892	-97.033489	1,000	20519037
OP-15	30.5315937	-97.038386	1,000	20519037
OP-16	30.5252656	-97.048067	1,000	20519037
OP-17	30.5174972	-97.05115	1,000	20519037
OP-18	30.5046506	-97.0717	1,000	20519037
OP-19	30.4985799	-97.078782	1,000	20519037
OP-20	30.4957154	-97.084374	1,000	20519037
OP-21	30.4938185	-97.091286	1,000	11598
OP-22	30.4901527	-97.095187	1,000	11598
OP-23	30.4859395	-97.103281	1,000	11598
OP-24	30.4843084	-97.106346	1,000	11598

Note: All wells are located on tracts owned fully by Alcoa. See Table 2-1 for more information.

Table 1-1. Summary of Approved Operating Permit Wells (con't)

Historic Use Wells Approved For Dual Use With Operating Permit and Designated for Dual Use Operating Permit Amendment

Well Name	Latitude	Longitude	Approved Maximum Withdrawal Rate (gpm)	Well Location – Milam County Appraisal District Property ID
58-32-502	30.560556	-97.072222	500	10354
58-32-503	30.561667	-97.066112	500	10354
E-1/A-9-4	30.588348	-97.019437	1,000	20519037
AT-1 / AX(10)5	30.54111	-97.05764	500	20520844
C4052A	30.57223	-97.02831	300	20519037
C4245	30.57988	-97.02349	240	20519037
C4246	30.57911	-97.02407	250	20519037
C4247	30.57784	-97.02452	240	20519037
C4248A	30.57674	-97.02479	230	20519037
C4250A	30.57393	-97.02559	290	20519037
C5245B	30.57941	-97.00878	410	10354
C-9-12	30.56138	-97.02401	440	20519037
C-9-13	30.56657	-97.01864	320	20519037
C-9-14	30.56227	-97.02189	420	20519037
C-9-20	30.56734	-97.01604	450	20519037
DP-S-A-3	30.57033	-97.03935	250	20519037
DP-S-A-4	30.56881	-97.04432	250	20519037
DP-S-A-5	30.56458	-97.04714	250	10354
DP-S-A-6	30.56225	-97.04861	250	10354
DP-S-A-7	30.55998	-97.05018	250	10354
F10 Sims	30.52283	-97.06630	250	20519037
F11 Sims	30.52264	-97.06762	250	20519037
F12 Sims	30.51527	-97.07801	250	20519037
F13 Sims	30.51867	-97.07272	250	20519037
F14 Sims	30.51614	-97.07222	250	20519037
F15 Sims	30.51738	-97.07004	250	20519037
F2 Sims	30.51536	-97.07445	250	20519037
F4 Sims	30.51329	-97.07452	250	20519037
F6 Sims	30.51804	-97.06758	250	20519037
F8 Sims	30.51959	-97.06777	250	20519037
F9 Sims	30.52120	-97.06688	250	20519037
P-5	30.58484	-97.01220	500	10354

Note: All wells are located on tracts owned fully by Alcoa. See Table 2-1 for more information.

Table 1-2. Construction Summary for Operating Permit Wells

Well Name	Latitude	Longitude	Ground Level (ft, amsl)	Estimated Depth	
				Top of Screen (ft, bgl)	Bottom of Screen (ft, bgl)
OP-1	30.6217298	-97.003762	407	200	400
OP-2	30.6051961	-97.008376	442	250	600
OP-3	30.5988499	-97.008832	419	300	600
OP-4	30.5814542	-97.011233	397	350	700
OP-5	30.5750311	-97.011456	445	400	800
OP-6	30.5590547	-97.018725	461	450	900
OP-7	30.5542342	-97.01588	472	450	1000
OP-8	30.5511811	-97.024434	477	450	900
OP-9	30.5450588	-97.031084	483	500	900
OP-10	30.5422235	-97.029208	485	550	1000
OP-11	30.5394868	-97.028175	467	550	1000
OP-12	30.5367041	-97.02784	460	550	1000
OP-13	30.5354732	-97.031413	436	550	1000
OP-14	30.5331892	-97.033489	452	550	1000
OP-15	30.5315937	-97.038386	444	550	1000
OP-16	30.5252656	-97.048067	451	500	900
OP-17	30.5174972	-97.05115	462	550	1000
OP-18	30.5046506	-97.0717	493	500	1000
OP-19	30.4985799	-97.078782	530	500	1000
OP-20	30.4957154	-97.084374	515	500	1000
OP-21	30.4938185	-97.091286	488	400	900
OP-22	30.4901527	-97.095187	476	400	900
OP-23	30.4859395	-97.103281	453	300	800
OP-24	30.4843084	-97.106346	441	300	700

Note: Screen interval is estimated based on interpolation of regional data. Actual depths to be determined based on site-specific test drilling.

Table 1-2. Construction Summary for Operating Permit Wells (con't)

Well Name	Latitude	Longitude	Ground Level (ft, amsl)	Reported Depth	
				Top of Screen (ft, bgl)	Bottom of Screen (ft, bgl)
58-32-502	30.560556	-97.072222	480	117	190
58-32-503	30.561667	-97.066112	480	120	170
E-1/A-9-4	30.588348	-97.019437	427	197	317
AT-1 / AX(10)5	30.54111	-97.05764	507	236	383
C4052A	30.57223	-97.02831	407	238	438
C4245	30.57988	-97.02349	430	238	438
C4246	30.57911	-97.02407	426	258	458
C4247	30.57784	-97.02452	423	238	448
C4248A	30.57674	-97.02479	416	258	478
C4250A	30.57393	-97.02559	401	238	398
C5245B	30.57941	-97.00878	413	358	458
C-9-12	30.56138	-97.02401	467	388	568
C-9-13	30.56657	-97.01864	451	358	538
C-9-14	30.56227	-97.02189	466	348	548
C-9-20	30.56734	-97.01604	425	348	608
DP-S-A-3	30.57033	-97.03935	461	218	370
DP-S-A-4	30.56881	-97.04432	473	238	385
DP-S-A-5	30.56458	-97.04714	469	210	330
DP-S-A-6	30.56225	-97.04861	467	198	318
DP-S-A-7	30.55998	-97.05018	463	178	316
F10 Sims	30.52283	-97.06630	487	225	430
F11 Sims	30.52264	-97.06762	505	275	430
F12 Sims	30.51527	-97.07801	491	285	395
F13 Sims	30.51867	-97.07272	484	235	405
F14 Sims	30.51614	-97.07222	491	278	478
F15 Sims	30.51738	-97.07004	478	298	458
F2 Sims	30.51536	-97.07445	488	245	405
F4 Sims	30.51329	-97.07452	502	265	360
F6 Sims	30.51804	-97.06758	499	310	470
F8 Sims	30.51959	-97.06777	481	250	410
F9 Sims	30.52120	-97.06688	489	250	400
P-5	30.58484	-97.01220	389	234	422

Table 1-3. Well Spacing Information for Approved Operating Permit Wells

Well Name	Maximum Permitted Pumping Rate (gpm)	Distance to Closest Well (ft)	Closest Well Name	Closest Well Permitted Pumping Rate (gpm)	Distance to Property Boundary (ft)
58-32-502	500	1,155	58-32-505	500	7,578
58-32-503	500	606	58-32-504	500	9,081
A-9-4	1000	2,254	A-9-2	540	3,037
AT-1	500	1,637	E-4	1000	4,133
C4052A	300	1,055	C4250A	290	4,010
C4245	240	335	C4246	250	4,004
C4246	250	335	C4245	240	3,980
C4247	240	410	C4248A	230	3,861
C4248A	230	410	C4247	240	3,770
C4250A	290	1,055	C4248A	230	3,739
C5245B	410	510	C-9-31	450	394
C-9-12	440	741	C-9-14	420	2,145
C-9-13	320	864	C-9-20	450	457
C-9-14	420	698	AT-2	500	1,409
C-9-20	450	864	C-9-13	320	421
DP-S-A-3	250	1,656	DP-S-A-4	250	6,029
DP-S-A-4	250	1,656	DP-S-A-3	250	6,046
DP-S-A-5	250	967	DP-S-A-6	250	4,983
DP-S-A-6	250	963	DP-S-A-7	250	4,562
DP-S-A-7	250	963	DP-S-A-6	250	4,357
F2 Sims	250	343	F3 Sims	250	2,442
F4 Sims	250	413	F3 Sims	250	2,034
F6 Sims	250	568	F8 Sims	250	875
F8 Sims	250	568	F6 Sims	250	1,186
F9 Sims	250	574	F11Sims	250	1,350
F10 Sims	250	421	F11Sims	250	1,793
F11Sims	250	421	F10 Sims	250	1,915
F12 Sims	250	1,119	F2 Sims	250	3,347

Table 1-3. Well Spacing Information for Approved Operating Permit Wells – (con't)

Well Name	Proposed Maximum Permitted Pumping Rate (gpm)	Distance to Closest Well (ft)	Closest Well Name	Closest Well Permitted Pumping Rate (gpm)	Distance to Property Boundary (ft)
F13 Sims	250	935	F14 Sims	250	2,417
F14 Sims	250	756	F2 Sims	250	1,858
F15 Sims	250	810	F6 Sims	250	1,453
P-5	500	512	C-9-27	500	1,526
OP-1	1000	6,198	OP-2	1000	675
OP-2	1000	2,317	OP-3	1000	521
OP-3	1000	2,317	OP-2	1000	522
OP-4	1000	940	C-9-31	450	1,184
OP-5	1000	981	C-9-17	260	712
OP-6	1000	1,537	C-9-14	420	585
OP-7	1000	1,971	OP-6	1000	640
OP-8	1000	2,908	OP-7	1000	715
OP-9	1000	1,190	OP-10	1000	577
OP-10	1000	1,049	OP-11	1000	599
OP-11	1000	1,020	OP-12	1000	624
OP-12	1000	1,020	OP-11	1000	671
OP-13	1000	1,057	OP-14	1000	708
OP-14	1000	1,057	OP-13	1000	560
OP-15	1000	1,645	OP-14	1000	547
OP-16	1000	2,992	OP-17	1000	656
OP-17	1000	2,992	OP-16	1000	517
OP-18	1000	3,139	OP-19	1000	549
OP-19	1000	2,044	OP-20	1000	1,205
OP-20	1000	2,044	OP-19	1000	2,126
OP-21	1000	1,813	OP-22	1000	540
OP-22	1000	1,813	OP-21	1000	543
OP-23	1000	1,132	OP-24	1000	3,446
OP-24	1000	1,132	OP-23	1000	3,501

Note: * designates wells that currently have permitted, maximum pumping rates of 1,000 gpm and do not meet the new POSGCD well spacing regulations. The listed rate reflects new proposed revision to the individual well pumping rate limit.

Land Ownership

Table 2-1. Alcoa Property Ownership
Overlying the Simsboro Formation

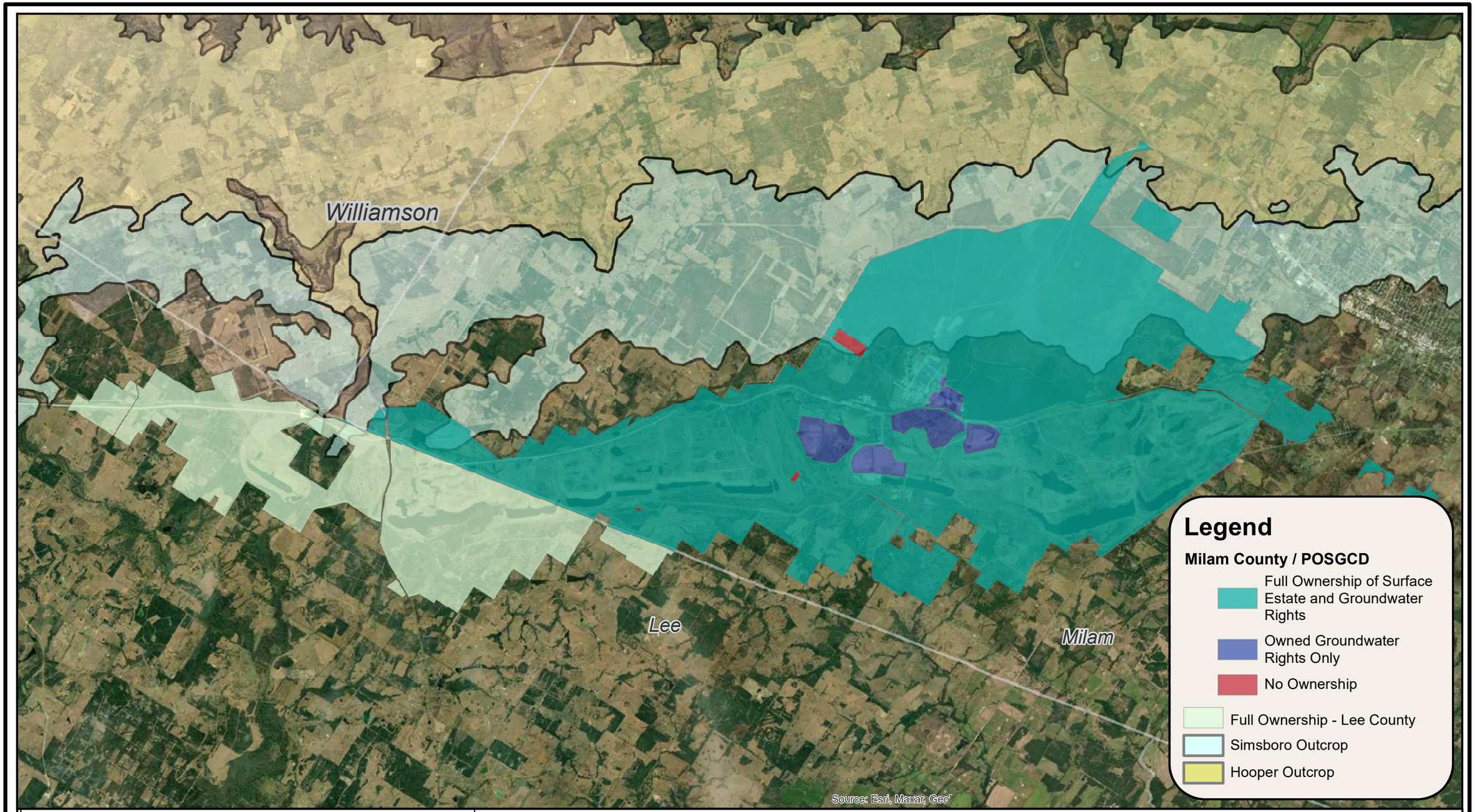
Milam County Appraisal District Property ID	Milam County Appraisal District Geographic_ID	Alcoa Ownership Type
10354	A207-321-001-00	Full Ownership
11236	A369-317-007-00	Full Ownership
11598	A414-318-002-00	Full Ownership
12630	A223-293-051-00	Full Ownership
14414	A378-304-014-00	Full Ownership
14547	A265-321-002-00	GW Rights Only
15510	A196-295-018-00	Full Ownership
17115	A228-321-001-00	GW Rights Only
19675	A340-295-001-00	Full Ownership
20126	A089-320-004-00	Full Ownership
25057	A288-302-001-00	Full Ownership
27832	A087-238-003-00	Full Ownership
20501277	A089-320-006-50	Full Ownership
20512490	A369-317-005-00	Full Ownership
20519037	A207-321-001-02	Full Ownership
20519071	A207-321-001-03	Full Ownership
20519072	A207-321-001-04	Full Ownership
20519948	A207-321-001-05	GW Rights Only
20519949	A207-321-001-06	GW Rights Only
20519950	A207-321-001-07	GW Rights Only
20519951	A207-321-001-08	GW Rights Only
20520283	A207-321-001-00	GW Rights Only
20520445	A207-321-001-09	GW Rights Only
20520844	A207-321-001-10	Full Ownership
20520847	A207-321-001-05	Full Ownership
20520848	A207-321-001-05	Full Ownership
20520849	A207-321-001-11	Full Ownership
20520850	A207-321-001-12	Full Ownership
20520851	A207-321-001-13	Full Ownership

Groundwater rights overlying the Simsboro Formation

Total Acres in Milam County: 24,585.95

Total Contiguous Acres in Milam County: 24,282.41

Note: Property acreages based on survey conducted for Alcoa by:
Bruce L. Bryan RPLS No. 4249
Bryan Technical Services, Inc. TBPLS Firm No. 10128500



Notes:
1. Alcoa owns 24,585.95 acres of property located within the POSGCD boundary and also overlie the Simsboro Formation. Of these lands, 24,282.41 acres are contiguous to the property with Operating Permit well locations.
2, Location of Simsboro outcrop based on Bureau of Economic Geology maps

Alcoa Property Ownership Map
Lee and Milam County, Texas

Alcoa

Figure 2-1

0 2,000 4,000 8,000
Feet

Water Conservation Drought Contingency

Section 3

SECTION 3. - WATER CONSERVATION PLAN AND DROUGHT CONTINGENCY PLAN

For many decades, Alcoa USA Corp. (Alcoa) and its predecessor entities have utilized and conserved groundwater resources underlying the nearly 32,000 acres of land and groundwater rights owned by Alcoa in Milam and Lee Counties, of which nearly 25,000 acres is in Milam County. Groundwater use has been primarily in conjunction with lignite mining operations in both counties and industrial operations and power generation in Milam County.

Looking forward with respect to Alcoa's Milam County lands, groundwater will be produced under amended and new permits issued by the Post Oak Savanah Groundwater Conservation District (POSGCD, or District) and used for both municipal and industrial (including manufacturing and commercial) uses where Alcoa may not be the end user of the produced groundwater. Future groundwater use may involve the sale of groundwater to a wholesale water supplier and then the resale to one or more retail water utilities or industrial users, or the direct sale to one or more retail water utilities or industrial users. In each case, the wholesale water supplier, retail water utility, or industrial user should have water conservation plans and drought contingency plans as required by Texas Administrative Code Title 30, Chapter 288.

Groundwater production should be monitored individually at each well head and at primary pump stations associated with any groundwater delivery contract. Groundwater production will be reported to POSGCD. Ultimately, produced groundwater may be delivered to retail water utilities or industries located within, or outside, the boundaries of the POSGCD. The counties that groundwater would be delivered to are Milam County inside the District, and Williamson County and the adjacent Counties of Lee, Travis and Bell outside of the District. A transport permit will be sought for the transport of any groundwater outside of the POSGCD boundaries.

After execution of a water supply contract, the applicable water conservation plans and drought contingency plans of a wholesale water provider, retail public utility or industrial user (as applicable) will be provided to the POSGCD. Per current requirements of Administrative Code Title 30, Chapter 288, these plans should have specific and quantified five-year and ten-year targets for water savings including, where appropriate, target goals for municipal use in gallons per capita per day for the delivery service area, maximum acceptable water loss, and the basis for the development of these goals. Any industrial user should have a process design to minimize or reduce water use for the industrial application. Where applicable, these plans will include details of conjunctive use of alternative supplies to optimize water savings and hopefully reduce water shortages during droughts.

Typically, the retail water utilities employ a stage-based drought contingency plan commensurate with the intensity and duration of drought conditions. Many of these drought contingency plans are triggered based on public health and safety concerns that arise when reductions in storage of surface water occur due to drought. When invoked, the stage-based restrictions can include specific water days for landscape irrigation, restrictions on filling of swimming pools, etc., and more heightened stage restrictions can include restriction on additional landscape plantings, vehicle washings, restaurant serving of water only on request and other restrictions.

A retail water utility that ultimately receives groundwater produced under Alcoa permits issued by the POSGCD should have a record management system capable of reporting water use by residential, single and multi-family, commercial, institutional, industrial, and wholesale categories. The retail water utility should utilize a water rate structure that is not promotional and does not encourage the excessive use of water. For any retail public water utility that serves a current population of 5,000 or more and/or a projected population of 5,000 or more within the next ten years subsequent to the effective date of its water conservation plan, the utility should have a program of leak detection, repair and water loss accounting for the water transmission, delivery, and distribution system. The utility's water conservation plan should also address, as applicable or as required by the Texas Commission of Environmental Quality, conservation-oriented water rates and water rate structures, the adoption of ordinances, plumbing codes, and/or rules requiring water-conserving fixtures; the reuse or recycling of wastewater or graywater; a program and/or ordinance(s) for landscape water management; and a program for pressure control and/or reduction in the distribution system and/or customer connections.

As applicable, an industrial water user should have a description of how the water is utilized, and the estimated quantity of water consumed in the production process and therefore not available for reuse or discharge. Water metering requirements should be identified, as well as a leak detection, repair and accounting for water loss in water distribution system. If applicable, the water conservation plan should describe the application of state-of-the-art equipment and/or process modifications to improve water efficiency.

Each wholesale water provider, retail public water utility, or industrial water user should review and update its water conservation and drought contingency plans (as applicable) every five years to coincide with regional water planning. These updated plans will be submitted to POSGCD for the life of the operating permit.

Groundwater would be provided to one or more public water suppliers or industrial users who may engage in conjunctive use. Opportunities for conjunctive use appear to be favorable, as groundwater from the Carrizo-Wilcox is a drought resistant supply that likely would reduce risk of water shortages during droughts for entities that currently rely solely on surface water. Implementation of these conjunctive use opportunities will likely require coordination and cooperation of different entities – both public water suppliers and wholesale water providers. These conjunctive use opportunities are long-term investments for improving safety and reliability of public water systems and management of water resources.

Response to POSGCD Rule 7.4.5 Aquifer Impact Study

Section 4

Response to Post Oak Savannah Rule 7.4.5 - Aquifer Impact Study

Alcoa USA Corp.

Application to Amend

POSGCD Drilling and Operating Permit No. 0148

(Currently Authorized Production of 25,000 af/yr
from the Simsboro Formation)

Prepared by:

HARDEN
HYDROLOGY &
ENGINEERING

May 10, 2021

STATE OF TEXAS
ROBERT HARDEN
79290
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Bob Harden

The seal appearing on this document was authorized
by Robert Harden, P.E. 79290
on May 10, 2021.
Firm Registration Number: F-19082

Response to Rule 7.4.5 - Aquifer Impact Study

Alcoa USA Corp.
Application to Amend
POSGCD Drilling and Operating Permit No. 0148

(Currently Authorized Production of 25,000 af/yr
from the Simsboro Formation)

Alcoa USA Corp. (Alcoa) holds Drilling and Operating Permit No. 0148 (sometimes referred to as Operating Permit No. 0148), issued by the Post Oak Savanah Groundwater Conservation District (POSGCD, or District), which authorizes the production of 25,000 acre-feet per year (af/yr) of water from the Simsboro Formation by means of a system of 56 wells located on the nearly 25,000 acres of land that Alcoa owns in Milam County. The 56 wells consist of 24 permitted but not yet constructed wells and 32 of the 61 existing wells permitted under Alcoa's Historic Use Permit No. 0330.

Alcoa requests that its Operating Permit No. 0148 be amended to authorize use of the water for municipal use in addition to industrial use, and to authorize use of the water anywhere within five counties: Milam County (which is within the District), and Williamson County and the adjacent Counties of Lee, Travis and Bell (each of which is outside the District). No changes in the currently permitted well locations or currently permitted well rates are requested. By separate application, Alcoa is also seeking a transport permit to authorize the transport of the water for use outside the District.

Alcoa also requests that the term of the permit be extended to a date that is 40 years from the date of issuance of the amended permit. The permit currently has a term that ends November 13, 2052. Assuming the amended permit is issued in 2021, the extension of the term would be about 9 years, covering the time period from November 14, 2052 to a date that is 40 years from the date of issuance of the amended permit. Alcoa is requesting the same 40-year term for the transport permit.

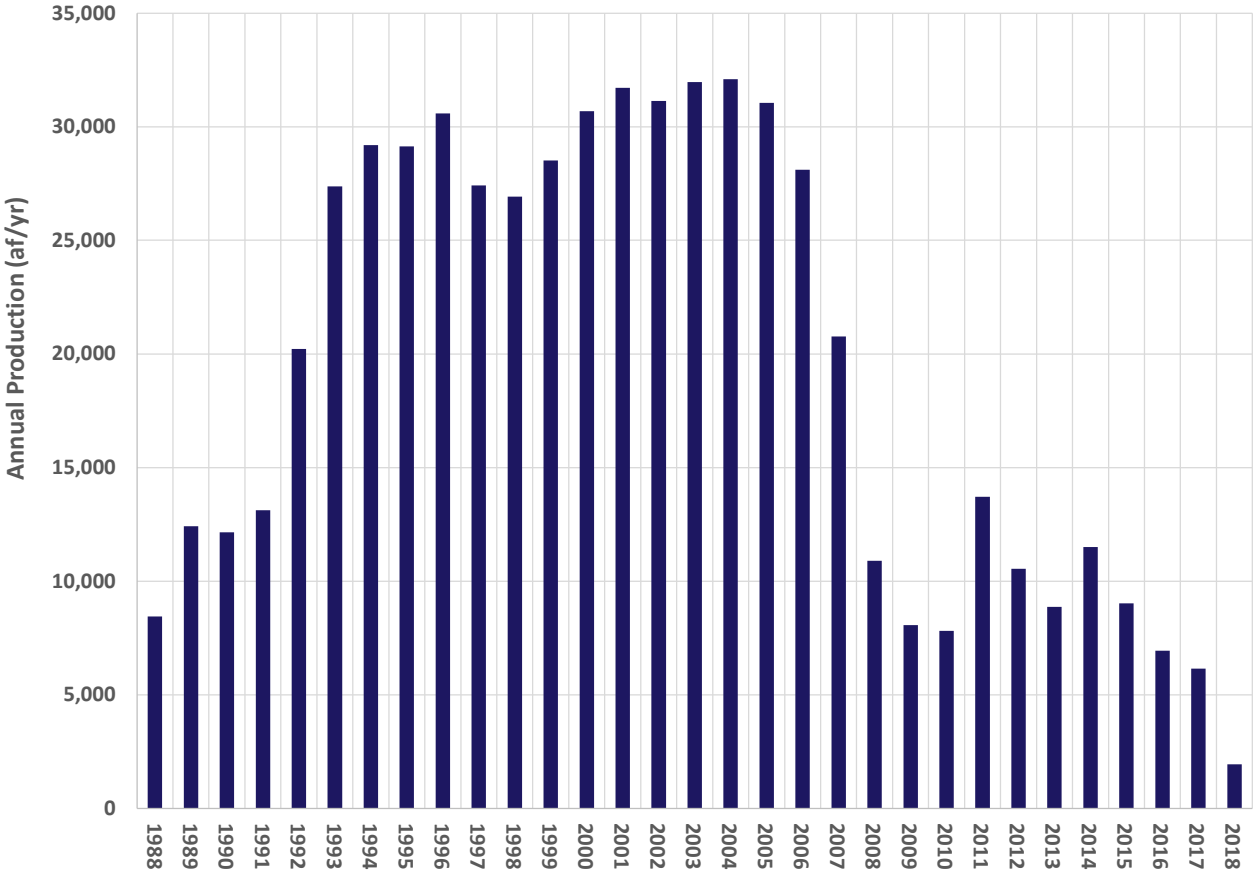
This report presents information provided by Alcoa regarding Alcoa's historical Simsboro production at its Sandow Mine and Rockdale Operations, as well as past well mitigation activities conducted by Alcoa in compliance with mining regulations. This report also presents the results of modeling projections of future groundwater conditions through the requested 40-year term of the amended Operating Permit in response to District Rule 7.4.5 and as requested by the District.

Alcoa Historical Simsboro Production

Alcoa began producing Simsboro aquifer groundwater in significant quantities in the 1980s, in large part to depressurize the Simsboro aquifer for safe mining of lignite to fuel the electric generation units located at Alcoa's Rockdale Operations. Before then and thereafter, Simsboro water was also used for cooling and industrial processes. Figure 4-1 shows Alcoa's annual

Simsboro production from wells located at the Sandow Mine during the period from 1988 through 2018. As shown, withdrawals during the late 1980s and early 1990s averaged about 12,000 af/yr. Average production increased as mining progressed at Sandow, where an average production rate of about 30,000 af/yr was maintained for about 14 years, peaking at about 33,000 af/yr. Simsboro production from the Sandow mine area started decreasing in 2007 as primary mining operations were transferred to the neighboring Three Oaks Mine. Reclamation activities at Sandow mine continued for 10+ years with total use of about 10,000 af/yr. Most recently, after the closure of Alcoa's primary aluminum smelter and the cessation of power generation at Alcoa's Rockdale Operations, groundwater use has declined further.

Figure 4-1. Estimated Historical Simsboro Production at Sandow Mine



Note: Simsboro production shown in Figure 4-1 reflects all industrial pumping from Simsboro Formation wells associated with the Sandow Mine in Milam and Lee Counties.

Modeling Assumptions and Deliverables

Four different model runs, and ten specific deliverables, were prepared for this application. The model runs and their assumptions, and the deliverables, are listed below in Table 1.

Item	List of Assumptions for Groundwater Model Runs
A-1	The baseline GAM simulation will be GMA 12 Pumping Scenario #10 (PS-10). This simulation will be called GAM A-1 (or GAM Run A-1).
A-2	A modified GAM A-1 simulation that includes no pumping after Dec 31, 2020 under Alcoa's 25,000 AFY permit at the 56 wells associated with Alcoa's current 25,000 AFY permit. This simulation will be called GAM B-2 (or GAM Run B-2).
A-3	A modified GAM B-2 simulation that includes pumping 25,000 AFY under Alcoa's 25,000 AFY permit at the 56 wells from Jan 1, 2024 to Dec 31, 2052. This simulation will be called GAM B-3 (or GAM Run B-3). Jan 1, 2024 is chosen as a conservative date that construction activities could be accomplished for the transport facilities.
A-4	A modified GAM B-2 simulation that includes pumping under Alcoa's 25,000 AFY permit at the 56 wells from Jan 1, 2024 to Dec 31, 2061. This simulation will be called GAM B-4 (or GAM Run B-4).
	List of Deliverables for Groundwater Model Runs
D-1	A table that contains the following information for the 32 historical wells: (1) latitude; (2) longitude; (3) current ground elevation; (4) depth of top of well screen below current ground elevation; and (5) depth of bottom of screen below current ground elevation. Similar information for the 24 approved wells to be drilled.
D-2	Documentation, as available, that the well screen information in Item D-1 is valid for the historical wells (e.g. driller report, geophysical log, and/or well setting report).
D-3	A table that lists the maximum pumping rate and the distance to the nearest well in the Simsboro Aquifer for the 56 wells.
D-4	A table that lists the average drawdown for the entire Simsboro Aquifer within POSGCD for GAM Runs A-1,B-2, B-3, and B-4 for time periods: 2010 to 2020, 2010 to 2030, 2010 to 2040, 2010 to 2050, 2010 to 2060, and 2010 to 2070.
D-5	Electronic files for model inputs and outputs for GAM Runs A-1, B-2, B-3, and B-4. A spreadsheet list of the annual pumping rates assigned to the 56 wells from Jan 1, 2024 to December 31, 2069 for GAM Runs A-1, B-2, B-3, and B-4.
D-6	A table that includes the average drawdown that occurs in model layer 1 for the Simsboro Aquifer outcrop and for entire Carrizo-Wilcox Aquifer (combined Hooper, Simsboro, Calvert Bluff and Carrizo) outcrop for GAM Runs A-1, B-2, B-3, and B-4. For each GAM Run, provide the average drawdowns for the two outcrop sections for: 2010 to 2020, 2010 to 2030, 2010 to 2040, 2010 to 2050, 2010 to 2060, and 2010 to 2070.
D-7	A table that includes differences between GAM Runs B-3 and B-4.
D-8	Contours of predicted drawdown in the Hooper, Simsboro, and Calvert Bluff aquifers from January 1, 2021 to December 31, 2052 and from January 1, 2021 to December 31, 2061 for GAM Runs B-3 and B-4. In addition, a third set of contours that show the difference in drawdowns between GAM Runs B-3 and B-4 in the Hooper, Simsboro, and Calvert Bluff aquifers. Registered wells within five miles of any Alcoa production well should be shown in the figures.
D-9	An assessment of changes in land subsidence that will occur from the difference in drawdown between GAM Runs B-3 and B-4. The assessment needs to discuss the applicability of the recent TWDB tool for estimating risk associated with land subsidence.
D-10	An assessment of changes in surface water -groundwater interaction that will occur from the difference in drawdown between GAM Runs B-3 and B-4.

Set forth below is a summary of actions and efforts by Alcoa and the District to arrive at these modeling assumptions and deliverables:

- Alcoa representatives met with District representatives on February 14, 2020 to discuss modeling assumptions and deliverables for reports for two of five then-pending applications. The first of the two applications was an application for a new operating permit that Alcoa is not seeking at this time, and the second was an application to amend Operating Permit 0148 that Alcoa is now re-filing.
- The District's geohydrologic consultant provided by letter dated February 19, 2020 to the District General Manager an itemized list of requested modeling assumptions and deliverables for each of the two applications discussed at the meeting on February 14, 2020.
- By letter dated March 19, 2020, Alcoa advised the District's General Manager that Alcoa, in response to the worsening world-wide Coronavirus emergency, had elected to temporarily cease work on the five pending applications, and requested that POSGCD abate further processing of the applications until further notice from Alcoa.
- By letter dated March 26, 2020, the General Manager advised Alcoa that, under Rules 7.5.1 and 7.9, the only response he is able to give Alcoa is that the District will accept Alcoa's request for abatement of the applications as a request to withdraw the applications. The General Manager stated that the District understands the work and discussions which have taken place to date have value for the applicant and much of that work may be applicable to any future applications filed by Alcoa, however any work in the future should be handled as new applications. The General Manager advised that since there has been work performed by consultants of the District to evaluate the applications and provide comment and direction to the applicant, any expenses incurred by the District in those efforts will need to be paid by Alcoa.
- Alcoa subsequently received, and paid, the District's bill for the services of the District's consultants referred to in the General Manager's March 26, 2020 letter.
- In early January, 2021, Alcoa advised the District that it intended to re-file the application to amend Operating Permit No. 0148 and the associated transport permit application, and was told that Alcoa should use the new Carrizo-Wilcox, Queen City, Sparta GAM for the model runs but that there was uncertainty regarding the best GMA 12 Model Run to use.
- By email dated January 22, 2021, Alcoa's geohydrologic consultant asked the District's geohydrologic consultant about the availability of the updated GAM. The District's geohydrologic consultant replied by email dated January 23, 2021, advising that GMA 12 Run PS-10 should be used for the Alcoa permit, and providing the link at which Run PS-10 can be found. The District's geohydrologic consultant then stated that the delay in sending the file was partly attributed to concerns about what will be the final DFC run for GMA 12, that POSGCD thought that Run PS-10 would likely be the final DFC run but it may not be based on discussions from the last GMA 12 meeting, but that nonetheless, he believes it represents the best GMA Run for the Alcoa permit.

- In a video conference call on May 4, 2021 attended by representatives of the District and Alcoa, Alcoa's geohydrologic consultant summarized the two applications that Alcoa intended to file (the application to amend Operating Permit No. 0148 and the associated transport permit application), and stated that the modeling assumptions and deliverables proposed to be used for the report were in substance those requested by the District's geohydrologic consultant for the application to amend Operating Permit No. 0148 as set forth in his letter dated February 19, 2020, updated by using Run PS-10 of the updated GAM as previously directed by the District's geohydrologic consultant.
- Following the conference call, Alcoa's geohydrologic consultant on May 4, 2021 sent an email to the District's geohydrologic consultant again summarizing the two applications that Alcoa intended to file and the updated modeling assumptions and deliverables, and asking the District's geohydrologic consultant to advise if the assumptions are acceptable for the technical part of the application. The District's geohydrologic consultant responded by email the same day by saying he appreciated Alcoa's geohydrologic consultant providing the summary and that he "will review and provide comments after the new permits have been submitted." The quoted language is consistent with Rule 7.4.5.f, which provides as follows: "Following submittal of the report, POSGCD will review and provide comments on the report and the well owner shall provide written responses to all comments."
- The modeling assumptions and deliverables listed in Table 1 are those set forth in the May 4, 2021 email sent by Alcoa's geohydrologic consultant with edits for simplification, accuracy and clarity.

Pumping Input Specific to Sandow Lakes Property

The first step in preparing the model runs was to inspect the A-1 model run and identify the amount of assumed Alcoa pumping in the model simulation that could be attributed to the Milam County portion of Alcoa's Sandow Lakes Ranch. This work effort indicates that assumed pumping of approximately 23,250 af/yr is assigned in the model nodes associated with Alcoa's Milam County property.[1] Table 2 is a summary of the assumed Alcoa pumping by decade assigned in these model nodes for Alcoa's Milam County property.

Alcoa's Milam County property (which consists of nearly 25,000 acres) supports currently permitted production of 40,000 af/yr (15,000 af/yr under Alcoa's Historic Use Permit and 25,000 af/yr under the Operating Permit). Because the assumed Alcoa future pumping in Model Run A-1 (23,250 af/yr) is less than Alcoa's currently permitted production (40,000 af/yr), the next step in producing the requested deliverables is to determine what portion of the assumed model pumping should be assumed as pumping under the Historic Use Permit and what portion should be assumed as pumping under the Operating Permit. For purposes of this report, the first 15,000 af/yr of the assumed Alcoa pumping of 23,250 af/yr is assumed as pumping under Alcoa's Historic Use Permit, and the remaining 8,250 af/yr is assumed as pumping under the Operating Permit. As discussed below, this assumption results in modeling that assumes pumping from Alcoa's Milam County property equal to the currently permitted 40,000 af/yr.

To construct Model Run B-2 pumping input, 8,250 af/yr is removed from Model Run A-1 within the Sandow Lakes property in Milam County. Table 3 is a summary by decade of pumping input for Model Run B-2 in the Milam Sandow Lake property model grid nodes that assumes no Operating Permit pumping.[2]

To construct Model Runs B-3 and B-4, the full amount of Operating Permit pumping is added to the Model Run B-2 pumping. This creates a pumping file equal to Alcoa's currently permitted 40,000 af/yr. Table 4 is a listing of the permitted maximum, instantaneous well rates, and the assumed long-term average pumping rate by well for Model Runs B-3 and B-4. For these simulations, pumping was assumed for a number of wells that could be used for water delivery in a Transport Permit. It is assumed that actual wells and pumping rates used for developing the supply may vary some from these assumptions, yet any individual well's pumping rate would not exceed the permitted, maximum instantaneous pumping rate of the well, and the total production limit of 25,000 af/yr would never be exceeded.

Table 5 is a summary by decade of pumping input for Model Runs B-3 and B-4 for the Alcoa Sandow Lakes property in Milam County. It is assumed the Operating Permit pumping would

[1] Based on permitted well locations, it also appears there is about 400 – 500 af/yr of other assumed pumping placed in the model in nodes 156238, 156239, 156888, and 157595. It is unknown what the pumping in nodes 156238 and 156239 represents, and it is assumed pumping in nodes 156888 and 157595 are small amounts of exempt use.

[2] And excluding the pumping in model nodes 156238 and 156239. See footnote 1.

begin in Year 2024 based on a conservative assumption, from a modeling perspective, for construction of the required collection, treatment, and transportation facilities.

Table 2. Pumping by Decade for Model Nodes Associated with Sandow Lakes Property in Milam County Model Run A-1

Model Node	MODEL A-1 PUMPING BY DECADE (af/yr)				
	2020	2030	2040	2050	2060
156215		394.79	394.79	394.79	394.79
156217		394.79	394.79	394.79	394.79
156222		394.79	394.79	394.79	394.79
156225		789.58	789.58	789.58	789.58
156226		394.79	394.79	394.79	394.79
156238	22.62	22.33	24.31	26.29	28.26
156239	22.62	22.33	24.31	26.29	28.26
156888	1.53	1.69	1.87	2.06	2.28
156889					
156890		789.58	789.58	789.58	789.58
156892		394.79	394.79	394.79	394.79
156894		789.58	789.58	789.58	789.58
156898		394.79	394.79	394.79	394.79
156901		689.87	689.87	689.87	689.87
156902		789.58	789.58	789.58	789.58
156916					
157595	1.53	1.69	1.87	2.06	2.28
157596					
157597		3,947.88	3,947.88	3,947.88	3,947.88
157598		1,579.15	1,579.15	1,579.15	1,579.15
157599		394.79	394.79	394.79	394.79
157601		789.58	789.58	789.58	789.58
157604		394.79	394.79	394.79	394.79
157607		789.58	789.58	789.58	789.58
157608		394.79	394.79	394.79	394.79
157609		1,973.94	1,973.94	1,973.94	1,973.94
157610		1,184.36	1,184.36	1,184.36	1,184.36
157612		394.79	394.79	394.79	394.79
157613					
157614		394.79	394.79	394.79	394.79
157615		1,973.94	1,973.94	1,973.94	1,973.94
157617					
158242					
158243					
158244					
158245					
158246					
158247		789.58	789.58	789.58	789.58
158248		1,973.94	1,973.94	1,973.94	1,973.94
Totals:	48.30	23,240.83	23,245.13	23,249.48	23,253.86

Table 3. Pumping by Decade for Model Nodes Associated with Sandow Lakes Property in Milam County Model Run B-2

Model Node	MODEL B-2 PUMPING BY DECADE (af/yr)				
	2020	2030	2040	2050	2060
156215		400.06	400.06	400.06	400.06
156217		400.06	400.06	400.06	400.06
156222		400.06	400.06	400.06	400.06
156225		964.15	964.15	964.15	964.15
156226		164.03	164.03	164.03	164.03
156238	22.62				
156239	22.62				
156888	1.53	1.69	1.87	2.06	2.28
156889					
156890		567.70	567.70	567.70	567.70
156892		206.38	206.38	206.38	206.38
156894		2,362.26	2,362.26	2,362.26	2,362.26
156898		88.36	88.36	88.36	88.36
156901		176.73	176.73	176.73	176.73
156902		176.73	176.73	176.73	176.73
156916					
157595	1.53	1.69	1.87	2.06	2.28
157596					
157597		1,477.85	1,477.85	1,477.85	1,477.85
157598		471.47	471.47	471.47	471.47
157599		88.36	88.36	88.36	88.36
157601		595.08	595.08	595.08	595.08
157604					
157607		285.68	285.68	285.68	285.68
157608		103.50	103.50	103.50	103.50
157609		441.82	441.82	441.82	441.82
157610		611.66	611.66	611.66	611.66
157612		353.58	353.58	353.58	353.58
157613		787.46	787.46	787.46	787.46
157614		330.34	330.34	330.34	330.34
157615		1,593.96	1,593.96	1,593.96	1,593.96
157617					
158242					
158243					
158244					
158245					
158246					
158247		355.27	355.27	355.27	355.27
158248		1,597.45	1,597.45	1,597.45	1,597.45
Totals:	48.30	15,003.38	15,003.73	15,004.13	15,004.56

Table 4. Assumed Pumping Rate by Well for Model Runs B-3 and B-4

Well Designation	Approved Permit	Model Node	Approved Permit Pumping Rate (GPM)	Assumed Rate for Model Runs B-3/B-4 (gpm)	(ft3/day)
58-32-502	Dual HUP - OP	156226	500	290	55,825.00
58-32-503	Dual HUP - OP	156225	500	290	55,825.00
A-9-4	Dual HUP - OP	157604	1,000	580	111,649.99
AT-1	Dual HUP - OP	157599	500	290	55,825.00
C4052A	Dual HUP - OP	157608	300	174	33,495.00
C4245	Dual HUP - OP	157609	240	140	26,950.00
C4246	Dual HUP - OP	157609	250	145	27,912.50
C4247	Dual HUP - OP	157609	240	139	26,757.50
C4248A	Dual HUP - OP	157609	230	133	25,602.50
C4250A	Dual HUP - OP	157609	290	168	32,340.00
C5245B	Dual HUP - OP	157614	410	238	45,815.00
C-9-12	Dual HUP - OP	157607	440	256	49,280.00
C-9-13	Dual HUP - OP	157610	320	186	35,805.00
C-9-14	Dual HUP - OP	157607	420	245	47,162.50
C-9-20	Dual HUP - OP	158247	450	261	50,242.50
DP-S-A-3	Dual HUP - OP	156902	250	145	27,912.50
DP-S-A-4	Dual HUP - OP	156902	250	145	27,912.50
DP-S-A-5	Dual HUP - OP	156901	250	145	27,912.50
DP-S-A-6	Dual HUP - OP	156901	250	145	27,912.50
DP-S-A-7	Dual HUP - OP	156898	250	145	27,912.50
F2 Sims	Dual HUP - OP	157597	250	145	27,912.50
F4 Sims	Dual HUP - OP	157597	250	145	27,912.50
F6 Sims	Dual HUP - OP	157597	250	145	27,912.50
F8 Sims	Dual HUP - OP	157598	250	145	27,912.50
F9 Sims	Dual HUP - OP	157598	250	145	27,912.50
F10 Sims	Dual HUP - OP	157598	250	145	27,912.50
F11 Sims	Dual HUP - OP	157598	250	145	27,912.50
F12 Sims	Dual HUP - OP	156892	250	145	27,912.50
F13 Sims	Dual HUP - OP	157597	250	145	27,912.50
F14 Sims	Dual HUP - OP	157597	250	145	27,912.50
F15 Sims	Dual HUP - OP	157597	250	145	27,912.50
OP-1	OP	156916	1,000	120	23,100.00
OP-2	OP	157617	1,000	160	30,800.00
OP-3	OP	157617	1,000	180	34,650.00
OP-4	OP	157614	1,000	250	48,125.00
OP-5	OP	158248	1,000	265	51,012.50
OP-6	OP	158246	1,000	500	96,249.99
OP-7	OP	158246	1,000	500	96,249.99
OP-8	OP	158246	1,000	500	96,249.99
OP-9	OP	158245	1,000	500	96,249.99
OP-10	OP	158245	1,000	500	96,249.99
OP-11	OP	158245	1,000	500	96,249.99
OP-12	OP	158245	1,000	500	96,249.99
OP-13	OP	158245	1,000	500	96,249.99
OP-14	OP	158244	1,000	500	96,249.99
OP-15	OP	158244	1,000	500	96,249.99
OP-16	OP	158244	1,000	500	96,249.99
OP-17	OP	158243	1,000	500	96,249.99
OP-18	OP	157597	1,000	420	80,849.99
OP-19	OP	157596	1,000	350	67,375.00
OP-20	OP	157596	1,000	325	62,562.50
OP-21	OP	157595	1,000	325	62,562.50
OP-22	OP	157595	1,000	325	62,562.50
OP-23	OP	156889	1,000	325	62,562.50
OP-24	OP	156889	1,000	300	57,750.00
P-5	Dual HUP - OP	157615	500	288	55,519.71

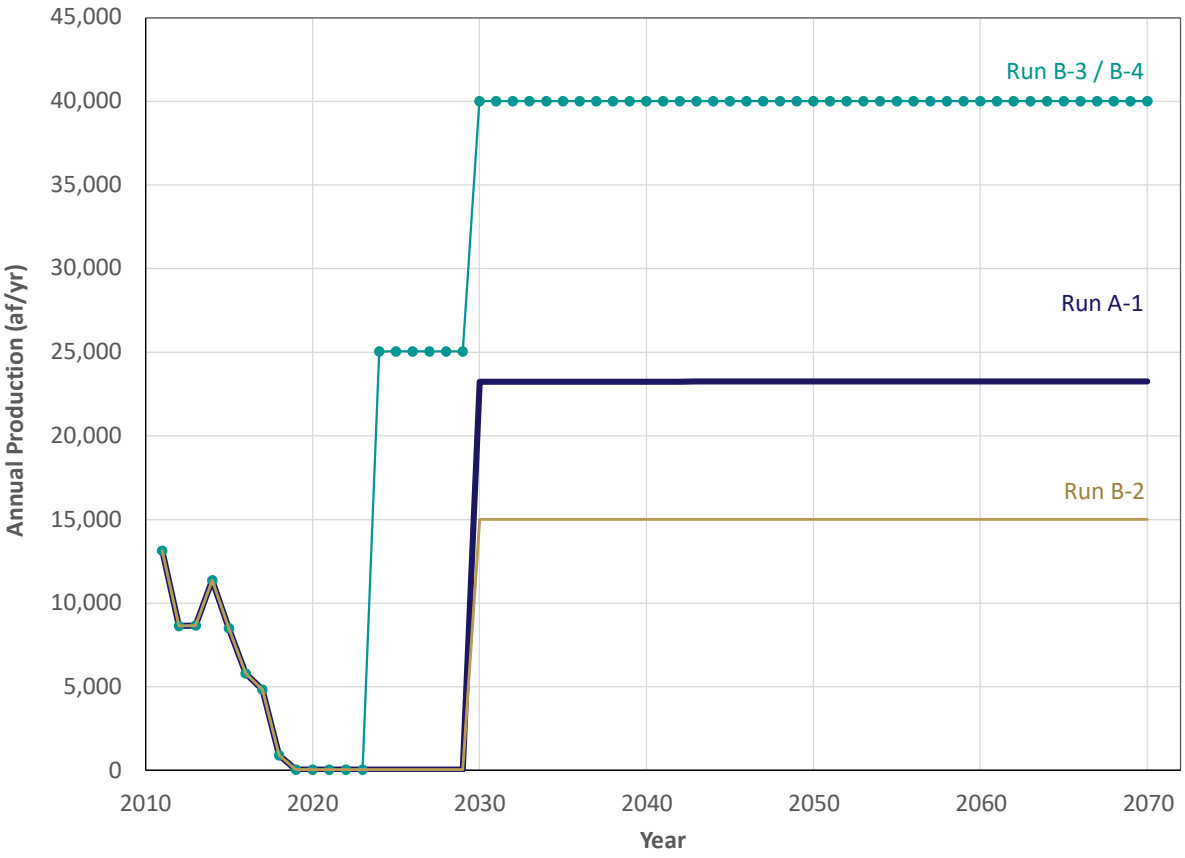
Table 5. Pumping by Decade for Model Nodes Associated with Sandow Lakes Property in Milam County - Model Runs B-3 and B-4

Model Node	MODEL B-3 / B-4 PUMPING BY DECADE (af/yr)					
	2020	2024	2030	2040	2050	2060
156215			400.06	400.06	400.06	400.06
156217			400.06	400.06	400.06	400.06
156222			400.06	400.06	400.06	400.06
156225		468.09	1,432.24	1,432.24	1,432.24	1,432.24
156226		468.09	632.12	632.12	632.12	632.12
156238	22.62	21.15				
156239	22.62	21.15				
156888	1.53	1.59	1.69	1.87	2.06	2.28
156889		1,008.82	1,008.82	1,008.82	1,008.82	1,008.82
156890			567.70	567.70	567.70	567.70
156892		234.05	440.43	440.43	440.43	440.43
156894			2,362.26	2,362.26	2,362.26	2,362.26
156898		234.05	322.41	322.41	322.41	322.41
156901		468.09	644.82	644.82	644.82	644.82
156902		468.09	644.82	644.82	644.82	644.82
156916		193.69	193.69	193.69	193.69	193.69
157595	1.53	1,050.76	1,050.86	1,051.04	1,051.23	1,051.45
157596		1,089.52	1,089.52	1,089.52	1,089.52	1,089.52
157597		2,082.20	3,560.05	3,560.05	3,560.05	3,560.05
157598		936.18	1,407.66	1,407.66	1,407.66	1,407.66
157599		468.09	556.46	556.46	556.46	556.46
157601			595.08	595.08	595.08	595.08
157604		936.18	936.18	936.18	936.18	936.18
157607		808.67	1,094.35	1,094.35	1,094.35	1,094.35
157608		280.86	384.35	384.35	384.35	384.35
157609		1,170.23	1,612.05	1,612.05	1,612.05	1,612.05
157610		300.22	911.88	911.88	911.88	911.88
157612			353.58	353.58	353.58	353.58
157613			787.46	787.46	787.46	787.46
157614		787.69	1,118.02	1,118.02	1,118.02	1,118.02
157615		465.53	2,059.50	2,059.50	2,059.50	2,059.50
157617		548.80	548.80	548.80	548.80	548.80
158242						
158243		807.05	807.05	807.05	807.05	807.05
158244		2,421.16	2,421.16	2,421.16	2,421.16	2,421.16
158245		4,035.27	4,035.27	4,035.27	4,035.27	4,035.27
158246		2,421.16	2,421.16	2,421.16	2,421.16	2,421.16
158247		421.28	776.56	776.56	776.56	776.56
158248		427.74	2,025.19	2,025.19	2,025.19	2,025.19
Totals:	**48.30**	**25,045.48**	**40,003.38**	**40,003.73**	**40,004.13**	**40,004.56**

Note: Model Run B-3 starts in 2024 and stops in Year 2052. Model Run B-4 stops in 2070.

Figure 4-2 shows the timing and magnitude of the pumping input for GAM Run A-1, GAM Run B-2, and GAM Run B-3/B-4.

Figure 4-2. Sandow Lakes Milam County Pumping by Model Run



Regional Pumping in GAM Run A-1

As stated earlier in this report, GAM Run A-1 is a model run scenario that was developed during the current GMA 12 Joint Planning activities. GAM Run A-1 contains the base regional pumping assumptions that are carried forward into the Operating Permit specific runs (GAM model runs B-3 and B-4). GAM Run A-1 contains increases in future pumping distributed within Bastrop, Lee, Milam, Burleson, Brazos, and Robertson counties. Table 6 presents the GAM Run A-1 total Simsboro pumping in the Brazos Valley Groundwater Conservation District (BVGCD), the Lost Pines Groundwater Conservation District (LPGCD), and the POSGCD.

Table 6. Simsboro Aquifer Pumping for Model Run A-1 by Decade for Lost Pines, Post Oak Savanah, and Brazos Valley Groundwater Conservation Districts (af/yr)

GCD	2020	2030	2040	2050	2060	2070
BVGCD	71,500	86,650	101,799	116,948	132,097	147,246
LPGCD	24,242	106,402	111,276	116,161	121,059	125,971
POSGCD	29,955	65,541	74,833	78,744	79,076	79,436

Table 7 presents the assumed pumping in GAM Runs B-3 and B-4 for the Simsboro aquifer totaled by groundwater conservation district.

Table 7. Simsboro Aquifer Pumping for Model Runs B-3/B-4 by Decade for Lost Pines, Post Oak Savanah, and Brazos Valley Groundwater Conservation Districts (af/yr)

GCD	2020	2030	2040	2050	2060	2070
BVGCD	71,500	86,650	101,799	116,948	132,097	147,246
LPGCD	24,242	106,402	111,276	116,161	121,059	125,971
POSGCD	29,955	82,303	91,592	95,499	95,827	96,182

In tabulating Tables 6 and Table 7, pumping in model nodes 156889, 156890, 157595, 157596, 157597, 158243, and 158244 was attributed to Milam County where the Operating Permit wells reside.

Model Simulations

New GAM for Carrizo-Wilcox Aquifer

Groundwater Management Area 12 (GMA 12) originally adopted a new groundwater availability model (GAM) for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers for use in the third round of joint planning activities (Ewing, Jigmond, Jones & Young, 2018). This model was updated in October 2020 (D.B. Stephens, et al). Rule 7.4.5.c of the POSGCD states "if a MAG exists for the aquifer from which the water will be produced, then the predictions will include results based on using the Groundwater Availability Model run used to establish the MAG for the aquifer". POSGCD has requested for purposes of this report, that the new updated GAM be used to simulate the required analysis using the model runs A-1, B-2, B-3 and B-4, previously described.

Required Deliverables

As shown in Table 1, POSGCD has requested a series of contour maps and tables be provided to satisfy the requirements of District Rule 7.4.5. One series of maps reflect the changes in water levels (drawdown) for the period January 1, 2021 through December 31, 2052 (Model Run B-3).

For naming simplicity, these maps are designated as declines in piezometric surface from Year 2020 to Year 2052, and are intended to demonstrate effects over the current Operating Permit term. Another set of maps are for the period January 1, 2021 through December 31, 2061 (Model Run B-4), and represent the current permit term plus an assumed 9-year permit term amendment. These maps are labeled with the descriptive timeframe of Year 2020 to Year 2061. A third set of maps represents only the period of the extension of the Operating Permit term, and these maps are labeled as Year 2052 to Year 2061.

Contour maps of the declines in piezometric surface are provided for the model layers corresponding to the confined portions of the Simsboro, Hooper, and Calvert Bluff aquifers, as well as the shallow portion of the Simsboro, and the combined outcrop areas of the Carrizo-Wilcox group which comprise portions of model layer 2. Figures 4-3 through 4-7 show these maps for the period of Year 2020 to Year 2052 (Model Run B-3), and Figures 4-8 through 4-12 depict the simulations results from Year 2020 to Year 2061. Figures 4-13 through 4-17 portray the changes in piezometric surface from the Year 2052 to 2061, and for the confined portions of the Simsboro, Hooper, and Calvert Bluff aquifers, as well as the shallow portion of the Simsboro, and the combined outcrop areas of the Carrizo-Wilcox group.

Table 8 lists the average drawdown for Model Layer 9 (the confined portion) of the Simsboro aquifer within POSGCD, for GAM model runs A-1, B-2, B-3, and B-4 and for time periods: 2010 to 2020, 2010 to 2030, 2010 to 2040, 2010 to 2050, 2010 to 2060, and 2010 to 2070.

Table 8. Average Drawdown in Model Layer 9 (confined portion) of the Simsboro Aquifer (feet)

Area	GAM Model Scenario	2010 to 2020	2010 to 2030	2010 to 2040	2010 to 2050	2010 to 2060	2010 to 2070
POSGCD	A-1	55	199	266	309	340	370
POSGCD	B-2	55	197	262	304	334	362
POSGCD	B-3/B-4	55	208	276	322	355	386

Table 9 lists the average drawdown for Model Layer 2 (the outcrop portion) of the Simsboro aquifer within POSGCD, for GAM model runs A-1, B-2, B-3, and B-4 and for time periods: 2010 to 2020, 2010 to 2030, 2010 to 2040, 2010 to 2050, 2010 to 2060, and 2010 to 2070.

Table 9. Average Drawdown in Model Layer 2 (outcrop portion) of the Simsboro Aquifer (feet)

Area	GAM Model Scenario	2010 to 2020	2010 to 2030	2010 to 2040	2010 to 2050	2010 to 2060	2010 to 2070
POSGCD	A-1	3	6	12	19	25	31
POSGCD	B-2	3	6	12	18	24	30
POSGCD	B-3/B-4	3	7	13	21	28	34

Table 10 lists the average drawdown for Model Layer 2 for the entire Carrizo-Wilcox Aquifer (combined Hooper, Simsboro, Calvert Bluff, and Carrizo) outcrop within POSGCD, for GAM model runs A-1, B-2, B-3, and B-4 and for time periods: 2010 to 2020, 2010 to 2030, 2010 to 2040, 2010 to 2050, 2010 to 2060, and 2010 to 2070.

Table 10. Average Drawdown in Model Layer 2 for the Entire Carrizo-Wilcox Aquifer Outcrop (feet)

Area	GAM Model Scenario	2010 to 2020	2010 to 2030	2010 to 2040	2010 to 2050	2010 to 2060	2010 to 2070
POSGCD	A-1	6	12	18	24	30	41
POSGCD	B-2	6	11	17	23	28	39
POSGCD	B-3/B-4	6	13	20	26	34	44

Discussion of Modeling Results

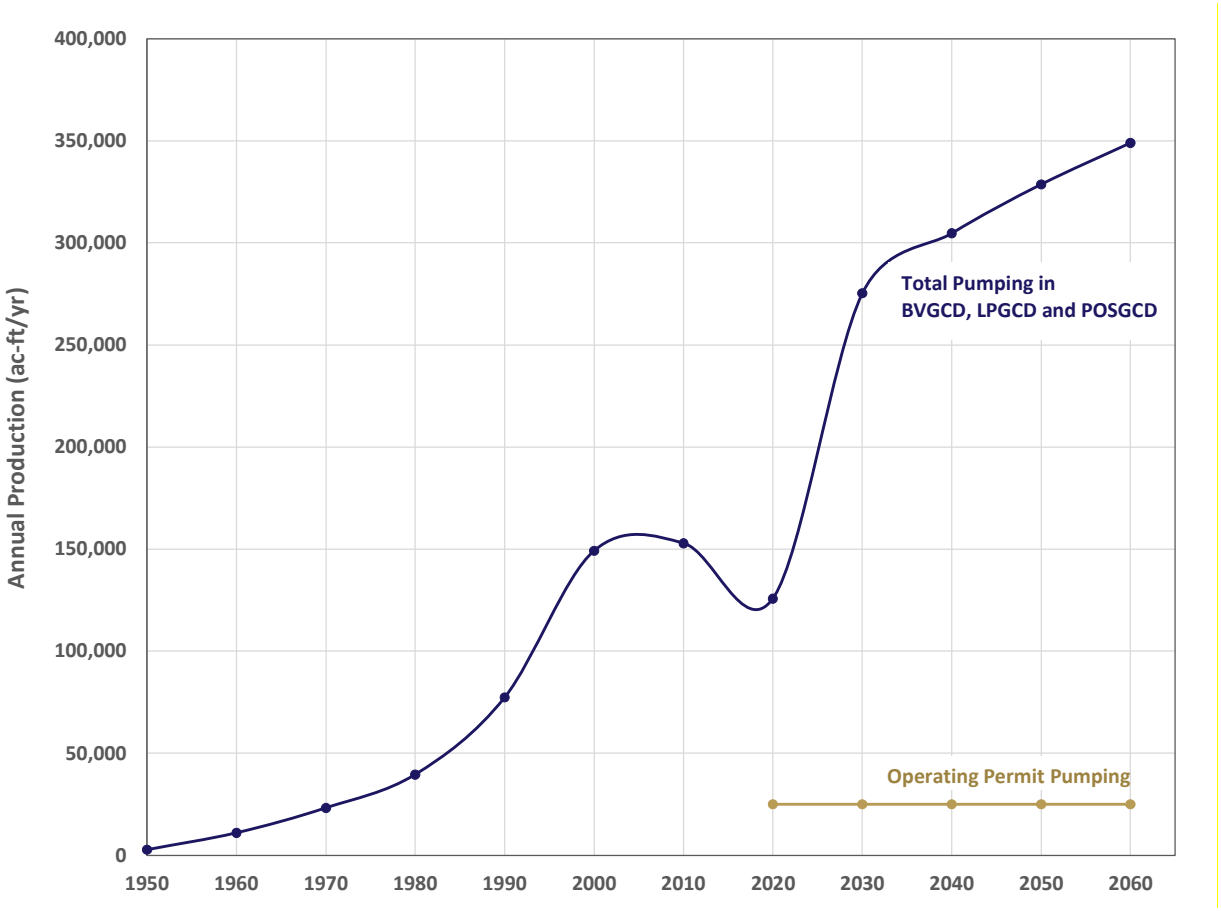
The model results indicate the regional effects of pumping on reductions in artesian pressure and water table decline. Model results shown on Figures 4-3 through 4-12 are largely changes in artesian pressure, and in some cases (GAM Layer 2) smaller changes in water table decline. These predicted changes are the result of: 1) the assumed continuation of regional existing pumping, 2) assumed increases in regional future pumping largely in the LPGCD and the BVGCD, and 3) the additional assumed pumping by Alcoa as discussed above under Pumping Input Specific to Sandow Lakes Property. The future increases in pumping are largely within the LPGCD and BVGCD (see Table 6 and Table 7).

Conversely, the changes depicted on Figures 4-13 through 4-17 represent the combined effects of all modeled regional pumpage for the 9 additional years concurrent with the permit term extension. Much smaller effects are simulated over this period. Thus, the predicted effects of the amendment of the permit term are minor compared to the longer term, regional cumulative effects.

Figure 4-18 shows the total historical and future pumping assumed in the model through 2060 for the POSGCD, the LPGCD and the BVGCD. Also shown are the groundwater pumping

amounts and duration associated with this Operating Permit. It demonstrates that the Operating Permit pumping is small compared to both the historical pumping that has occurred regionally, and the total future production rates assumed in GAM Run A-1 in the LPGCD, BVGCD, and the POSGCD.

Figure 4-18. Estimated Historical and Future Simulated Simsboro Production in BVGCD, LPGCD, and POGCD - GAM Run B-4



Actual future changes in aquifer conditions will likely be of less magnitude and slower to occur then simulated, as future regional pumping is likely to be less than assumed by GMA 12 in GAM Run A-1 (and carried forward into Run B-3 and B-4). Future increases in pumping will cause regional effects that are primarily reductions in artesian pressure, and as these pressure reductions propagate to the shallower zones of the Simsboro outcrop, then subsequent reductions in the water table can occur. The degree and magnitude of these responses is largely dependent on the aquifer's vertical hydraulic conductivity, recharge rates, the amount of groundwater that is naturally discharged via direct evaporation, transpiration by plants, and seeps and springs, and the degree of capture of the natural discharge that occurs in response to aquifer pumping. Each of these components of the groundwater system are difficult to measure directly. Nevertheless, the subsequent response of the capture of recharge will naturally occur, and this can reduce

wasteful discharge to the extent it is occurring, and will increase the sustainability of water supplies.

Experience has shown that any reductions in the water table zones will be very slow to occur or will occur in a very gradual, mostly unnoticeable manner. For example, groundwater pumping from the Carrizo aquifer in the Wintergarden Area occurred for many decades with total pumping rates between 200,000 to over 300,000 af/yr. Long-term water level records in shallow, water table wells exhibited little or relatively small response. Similar experience has been documented over the past century of pumping in the Northern Trinity aquifer and the Gulf Coast aquifer, as well.

Analysis of Potential for Land-Surface Subsidence

Land-surface subsidence is known to occur in some groundwater settings. Groundwater pumping from sand and gravel zones can cause seepage of water from adjacent clay or silt zones. The loss of pore water pressure in the clay or silt reduces the load bearing capacity of the clays or silts, and the overbearing weight of soil, groundwater and buildings causes the clay or silt zones to compact. This compaction occurs at the depth of the clays or silts, and some amount of this compaction can translate into subsidence at land surface.

In Texas, subsidence is documented to have occurred in the greater Houston area (Gabrysch, 1984). Near Pecos, Texas (Chi and Reilinger, 1984), and in the area of El Paso, Texas (Land and Armstrong, 1985).

TWDB Subsidence Risk Study

In 2016, the TWDB contracted with LRE Water, LLC "to identify and characterize areas within Texas' major and minor aquifers that are susceptible to land subsidence related to groundwater pumping" (TWDB, 2020). In 2017, a report was issued and titled "Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping", and an EXCEL analytical model was released for assigning a risk factor for subsidence based on lithologic, geotechnical, water level change and other factors (Furnans et al. 2017).

Based on the risk methodology employed, the authors state that of the 9 major aquifers in Texas, 5 of these aquifers are classified with a "high subsidence risk over large areas of the aquifer" (Furnans, 2017). The major aquifers of Texas with a high-risk subsidence rating are the Gulf Coast, Pecos Valley, Hueco-Mesilla Bolson, Ogallala, and Carrizo-Wilcox aquifers. Two minor aquifers, the Yegua-Jackson, and the Brazos River Alluvium are ranked as high risk for subsidence.

It is helpful to look at the underlying technique and data the authors used to determine the subsidence risk rating for an aquifer. The factors used to calculate the subsidence risk are saturated clay thickness, an estimate of clay compressibility, the assumed type of aquifer lithology, historic water levels compared to current water levels (pre-consolidation water level),

and the potential of for future water level declines. Of these factors, the authors state they were unable to gather actual geotechnical data on clays, and instead relied on generalized values of clay compressibility based on aquifer lithology.

Factors not considered in the study are the permeability, depth, age, or lateral continuity of the clays, nor the degree of compaction at depth that may translate to actual land surface subsidence. The study also does not try to calibrate the methodology utilized in the report with known data on clay thickness, water level change, and measured subsidence.

Past Experience in the Carrizo-Wilcox

As addressed previously, Alcoa has conducted groundwater pumping in Milam County for the safe mining of lignite reserves, and for power generation and industrial processes. The largest amounts of this pumpage were related to depressurization of the Simsboro aquifer for mining operations. Pressure declines in the Simsboro occurred over a multi-decade period with maximum pressure decline of about 200 feet occurring. Numerous high-capacity wells were originally constructed prior to this depressurization pumping, and the construction included cementing of steel casing and stainless steel screen at the depths of the Simsboro aquifer. If land-surface subsidence had occurred due to compaction of overlying sediments, then the well casings and foundations would have been noticeably higher relative to adjoining ground level. No land-surface subsidence was ever detected or revealed as a result of the Alcoa pumping.

Groundwater pumping has also occurred in the Carrizo-Wilcox aquifer in Texas for many decades. Production has historically occurred in the Wintergarden Area of Southwest Texas, the Tyler area of Northeast Texas, and the Bryan-College Station area in Central Texas. Numerous Texas Water Development Board (TWDB) groundwater availability reports from early 1960 to the near present and spanning the extents of the Carrizo-Wilcox in Texas have studied the groundwater conditions, and/or effects of groundwater pumping (Ex: Reports 4, 032, 109, 110, 150, 160, 210, 327, 332). No concerns of land-surface subsidence resulting from pumping groundwater from the Carrizo-Wilcox are presented in these historical reports.

The Explanatory Report developed by GMA 12 during the second round of joint planning (Ewing et al., 2017) states subsidence has not been detected anywhere within GMA 12 despite large-scale pumping and associated drawdowns, and concluded the risk for land-surface subsidence is negligible.

The TWDB GAM for the Gulf Coast aquifer in southeast Texas, known as the Houston Area Groundwater Model (HAGM), was developed for an area of Texas where land-surface subsidence is a known issue. The HAGM specifically includes a subsidence modeling package for purposes of simulating land-surface subsidence due to groundwater pumping (Kasmarek, 2012). In contrast, the new GAM for the Central Portion of the Sparta, Queen City, and Carrizo-Wilcox Aquifers does not include a subsidence modeling package (Ewing et al., 2018). Similarly, other historic and current GAMs of the Carrizo-Wilcox, including all Southern, Central and Northern portion models, have not included a subsidence modeling package. This is

empirical evidence that across the State of Texas, subsidence has not been a concern in the Carrizo-Wilcox over the many decades of actual groundwater development experience.

The natural conditions of the Carrizo-Wilcox, and past experience with development and documented long-term effects, support the position there are little concerns for subsidence being a factor in limiting development of the resource.

Analysis of Effect on Surface and Groundwater Interaction

POSGCD Rule 7.6(3) requires consideration of what impact a permit application will have on surface water resources. As described by C.V. Theis, the source of the produced water from a well follows a natural dynamic from 1) a reduction of artesian storage to the extent artesian conditions exist at the well site, 2) subsequent propagation of the cone of depression laterally and possibly vertically until the cone of influence encounters water table conditions, at which time pore water storage is reduced, 3) the reduction of pore water storage causes a redirection towards the pumping well of groundwater that previously was discharged naturally through evaporation, transpiration, seepage, or larger springflow (Theis, 1940). This natural, dynamic response to pumping has been occurring in the Carrizo-Wilcox for many decades.

Alcoa, in conjunction with its prior mining operations at both the Sandow Mine and the Three Oaks Mine near Elgin, Texas, conducted numerous surveys related to surface and groundwater interaction. Both surface water resources and groundwater resources were surveyed and studied. Studies included aerial surveys stretching from the Colorado River to the Brazos River, ground surveys along creek beds to identify areas of groundwater seepage and springflow prior to mining, as well as surface water flow monitoring in area creeks to identify the nature of rainfall-runoff and baseflow characteristics of local drainages.

These studies indicate there were no large springs present in eastern Bastrop, Lee or Milam Counties, and no State parks are designated throughout this area to recognize culturally or environmentally important springflows. Area streams are classified as intermittent yet with the headwaters classified as ephemeral where the stream channel is above the local water table. Areas of seepage and wet, muddy locations were observed in low-lying areas, of the intermittent streams, and many of which would be dry in summer months. Additionally, many stock ponds have been built throughout the area. All of these features increase discharge of groundwater via transpiration plants and/or direct evaporation.

Due to the location of historic and likely future pumping in combination with the regional transmissivity and artesian pressure conditions, a regional response spanning many counties and GCDs will occur. Figure 4-3 and Figure 4-8 indicate any effects of Simsboro groundwater pumping on surface water resources in the Central portions of GMA 12 will be attributable to groundwater production in numerous counties including groundwater production located in the LPGCD, the POSGCD, and the BVGCD. This includes both any affects which have occurred to date, and any long-term effects into the future.

Most importantly for review of this permit application, any effects on surface water resources due to the extension of Alcoa's existing, Operating Permit term from 2052 to 2061 would necessarily be small considering the past history of Alcoa production, the comparatively low amount of operating permit pumping compared to total regional aquifer pumping, the regional response of pumping that can span across many counties of GMA 12, and the short timeframe of the extension in the permit term requested in the amendment application.

Past Mitigation Activities of Alcoa

A large part of Alcoa's historical Simsboro pumping levels shown in Figure 4-1 were necessary to safely and successfully mine the lignite reserves at the Sandow mine. Alcoa historically produced up to 33,000 af/yr from the Simsboro and demonstrated the aquifer response and groundwater availability characteristics of this production. Groundwater production associated with mining operations at the Sandow Mine was permitted and regulated by the Railroad Commission of Texas, which required monitoring of the ongoing, regional impacts associated with that pumpage and mitigation of any affected water supplies. The monitoring and mitigation program was conducted for more than 20 years and included:

- Conducting field inventories/assessments of over 1,600 well sites in order to document both pre-mining, active-mining, and post-mining hydrogeologic conditions,
- Monitoring of an extensive network of both Alcoa and private wells specifically to document and establish mitigation responsibility under the regulations of the Railroad Commission,
- Lowering of pumps or other modifications in more than 360 wells in which water level declines due mining-related pumping were observed or predicted to occur, and
- Construction of over 125 deeper, replacement wells for landowners whose original wells were completed in the shallowest, upper portions of the Simsboro Formation.

The locations of past well mitigations are coincident with the area of primary effects from the approved operating permit production of 25,000 af/yr. Consequently, many existing users in the area are uniquely protected from adverse hydrologic impacts due to past mitigations efforts of Alcoa. In addition, since cessation of mine reclamation and monitoring activities, Alcoa has assisted the POSGCD to convert Alcoa's regional monitoring well program to be incorporated into the POSGCD monitoring well network.

Summary

The amended Operating Permit production will largely replicate the historic pumping conducted by Alcoa for mining operations beginning in 1988. The primary effect of this production is the reduction of artesian pressure, and the amount of reduction is largely related to the peak pumping rate. Alcoa mining production reached a peak rate of about 33,000 af/yr, and the same type of effects associated with this past pumping will re-occur upon a return to this pumping rate. Unique to this area, Alcoa has also conducted extensive mitigation efforts to address these effects, and the benefit of these past efforts will continue into the future.

Operating Permit production is much smaller than known, existing, and potential future pumping located in Bastrop, Lee, Burleson, Robertson, and Brazos Counties. Cumulative hydrologic effects will occur throughout a large part of GMA 12 due to current and future collective pumping primarily in LPGCD, POSGCD, and BVGCD, and the regional, continuous extent of the sands of the Simsboro. The effects of pumping are primarily reductions in artesian pressure, with subsequent reductions in the water table. Any effects on the water table will be very slow and gradual compared to the changes in artesian pressure, and the water table effects will be small compared to aquifer storage.

Overall, it is most likely that further development of the groundwater resources will occur, and in some cases modifications to existing wells will be required to sustain the supplies in the region. As demonstrated by Alcoa, this is very feasible to conduct, and the Post Oak Savanah Groundwater District is one of the few groundwater districts in Texas with an established mitigation program. From a State Water planning perspective, the Operating Permit amendment's requested change in use to include municipal and the requested change in place of use can provide meaningful, drought-proof groundwater supplies useful for increasing conjunctive use, reducing supply risk, and enhancing supply reliability for a growing area of the State.

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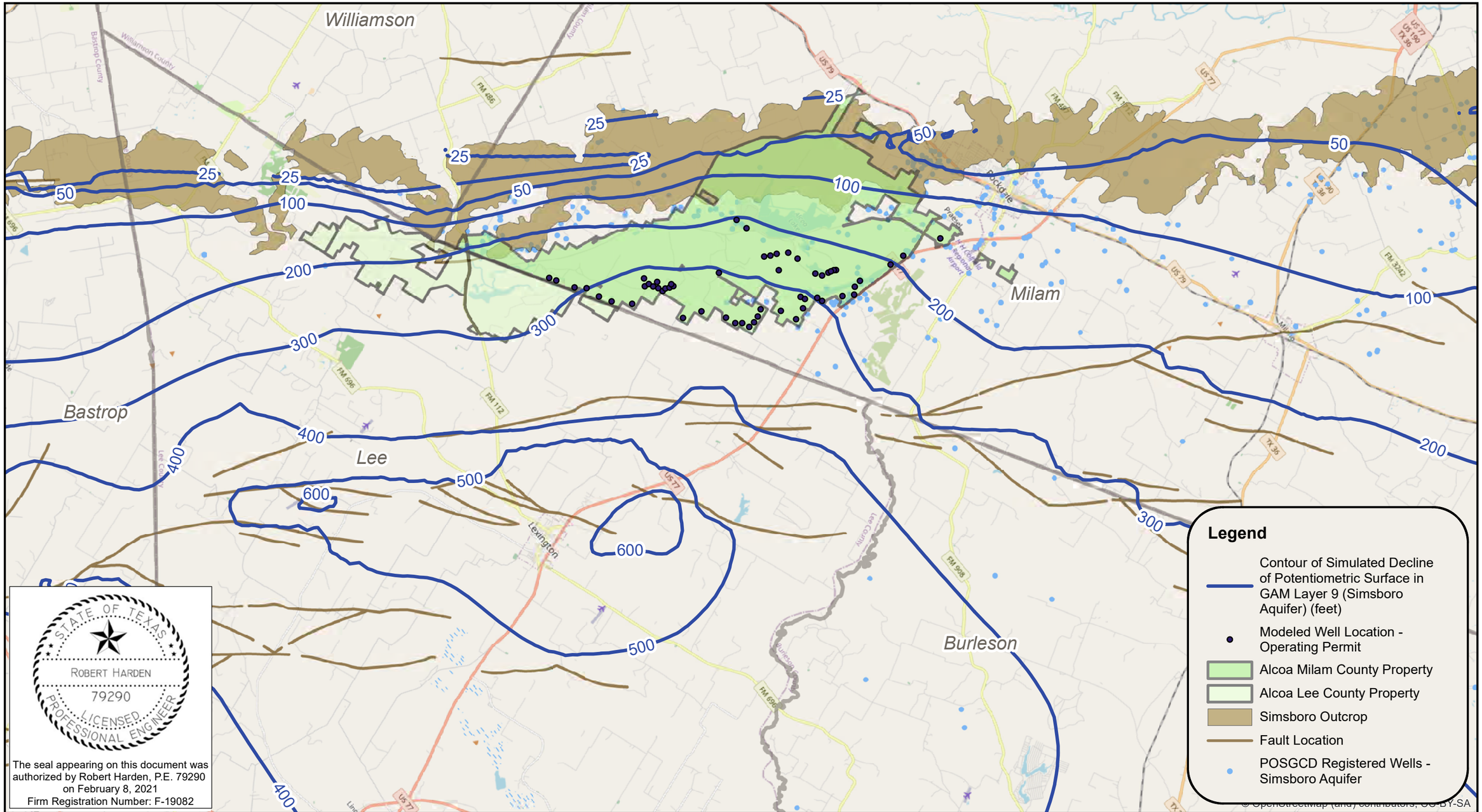
William F. Guyton & Associates, (1970), Report No. 150 Ground-Water Conditions in Anderson, Cherokee, Freestone, and Henderson Counties, Texas; Texas Water Development Board.

William F. Guyton & Associates, (1970), Report No. 110 Ground-Water Conditions in Angelina and Nacogdoches Counties, Texas; Texas Water Development Board.



STATE OF TEXAS
ROBERT HARDEN
79290
LICENSED
PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by Robert Harden, P.E. 79290 on February 8, 2021
Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 9 (Simsboro aquifer) for GAM Run B-3, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2052
2. Locations of faults and Simsboro outrop based on Bureau of Economic Geology geologic maps

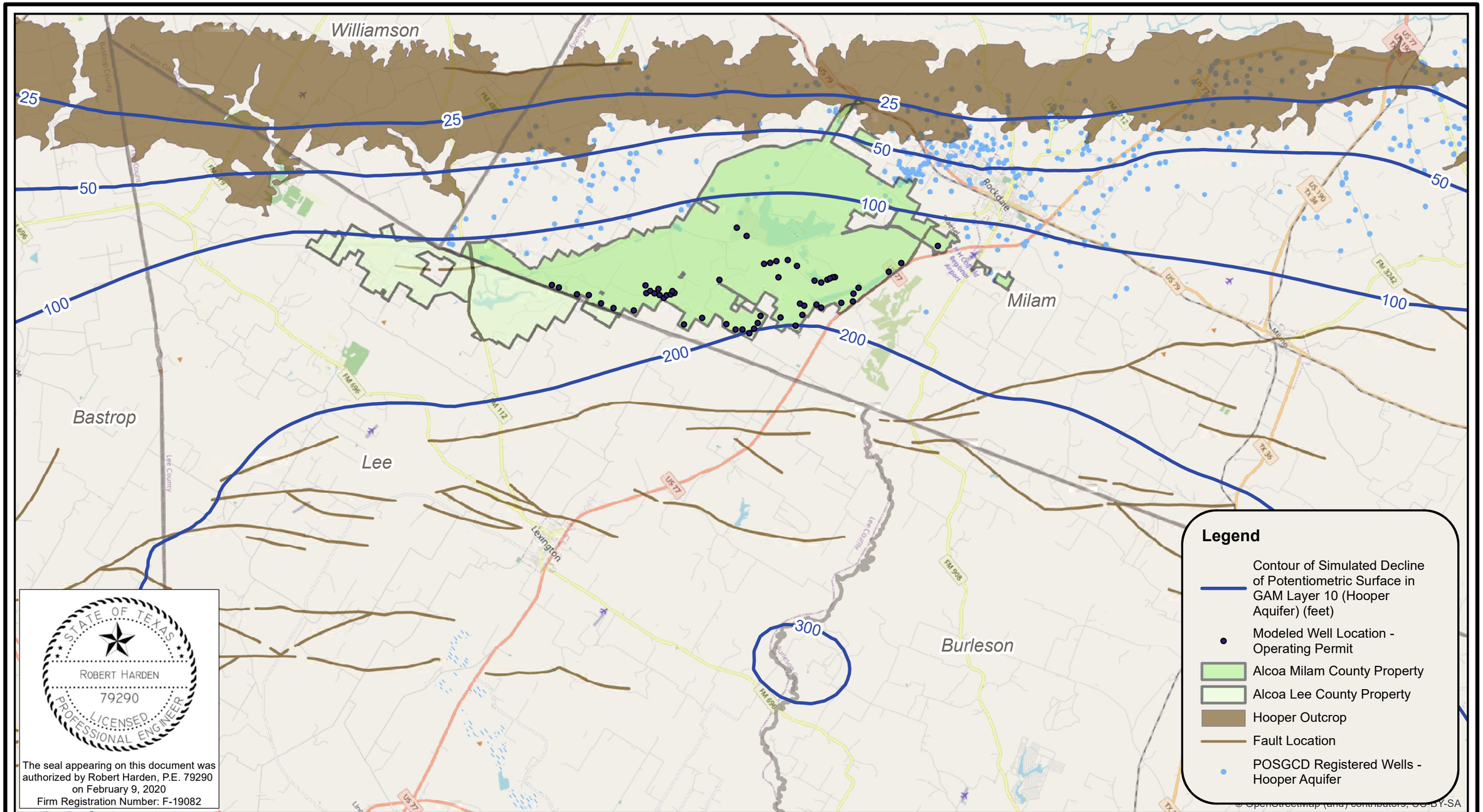
Simulated Decline of Potentiometric Surface in GAM Layer 9 (Simsboro Aquifer) from Year 2020 to Year 2052 (GAM Run B-3)

Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-3

0 1.25 2.5 5
Miles



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ROBERT HARDEN
79290
LICENSED PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by Robert Harden, P.E. 79290 on February 9, 2020
Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 10 (Hooper aquifer) for GAM Run B-3, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2052
2. Locations of faults and Hooper outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 10 (Hooper Aquifer) from Year 2020 to Year 2052 (GAM Run B-3)

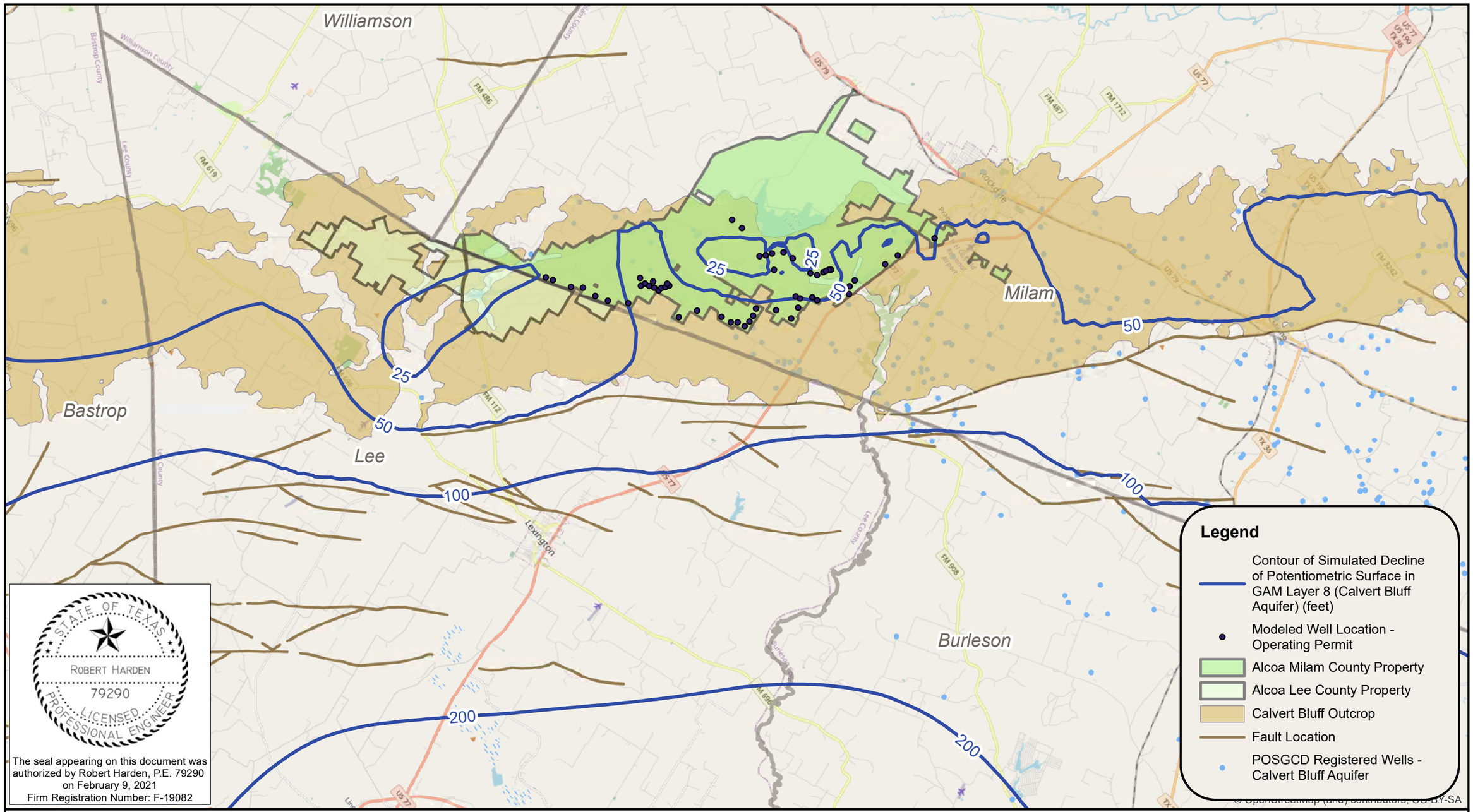
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-4

N

0 1.25 2.5 5
Miles



STATE OF TEXAS
ROBERT HARDEN
79290
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PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by Robert Harden, P.E. 79290 on February 9, 2021
Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 8 (Calvert Bluff aquifer) for GAM Run B-3, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2052
2. Locations of faults and Calvert Bluff outrop based on Bureau of Economic Geology geologic maps

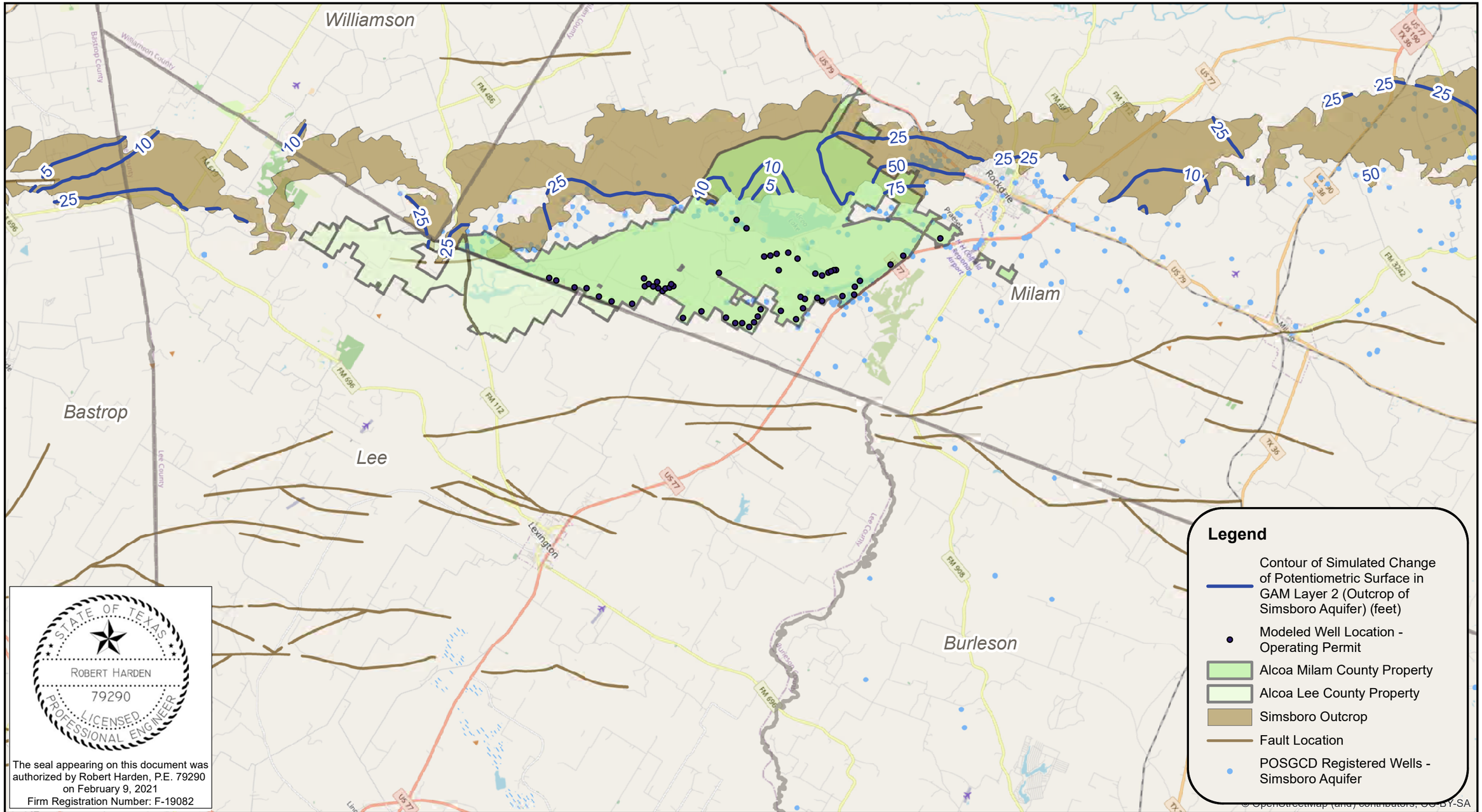
Simulated Decline of Potentiometric Surface in GAM Layer 8 (Calvert Bluff Aquifer) from Year 2020 to Year 2052 (GAM Run B-3)

Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-5

0 1.25 2.5 5
Miles



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79290
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PROFESSIONAL ENGINEER

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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Simsboro aquifer) for GAM Run B-3, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2052
2. Locations of faults and Simsboro aquifer outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 2 (Outcrop of Simsboro Aquifer) from Year 2020 to Year 2052 (GAM Run B-3)

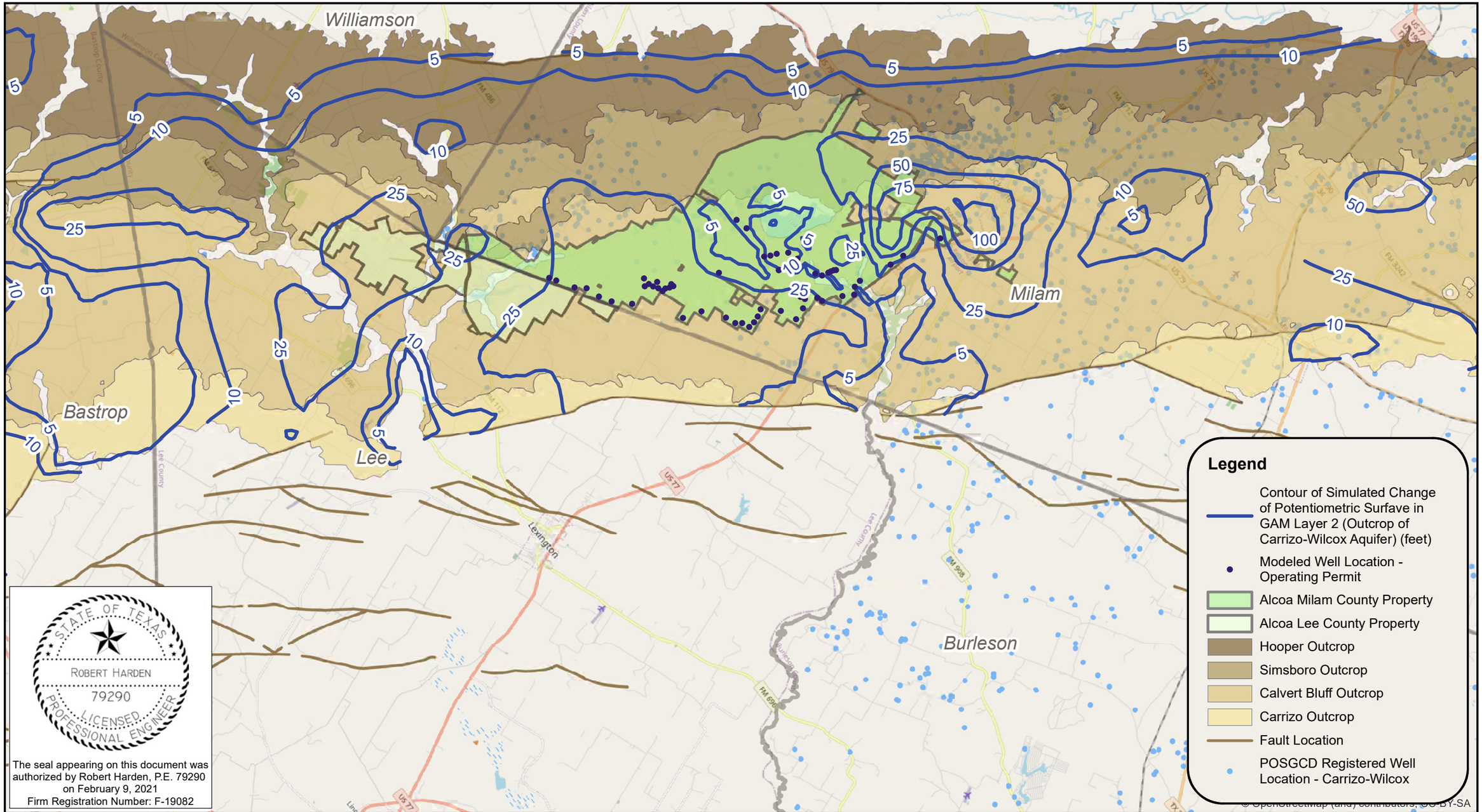
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-6

N

0 1.25 2.5 5
Miles



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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Carrizo-Wilcox aquifer) for GAM Run B-3, which includes Operating Permit production of 25,000 ac-ft/yr in Simsboro aquifer from 2024 to 2052
2. Locations of faults and Carrizo-Wilcox aquifer outrops based on Bureau of Economic Geology geologic maps

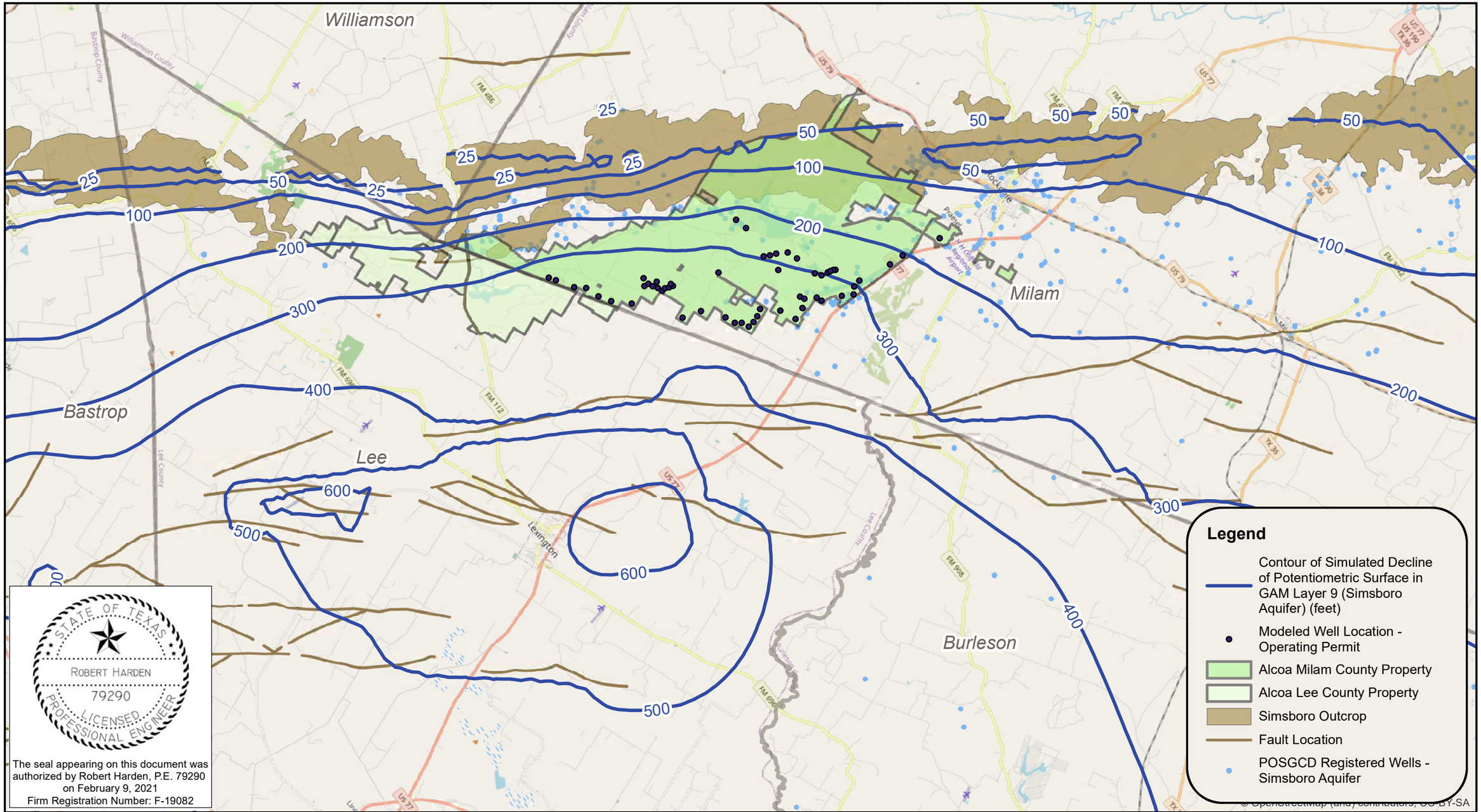
Simulated Decline of Potentiometric Surface in GAM Layer 2 (Outcrop of Carrizo-Wilcox Aquifer) from Year 2020 to Year 2052 (GAM Run B-3)

Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-7

0 1.25 2.5 5
Miles



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Notes:
1. Simulated decline of potentiometric suface in GAM Layer 9 (Simsboro aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 ac-ft/yr in Simsboro aquifer from 2024 to 2061
2. Locations of faults and Simsboro outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 9 (Simsboro Aquifer) from Year 2020 to Year 2061 (GAM Run B-4)

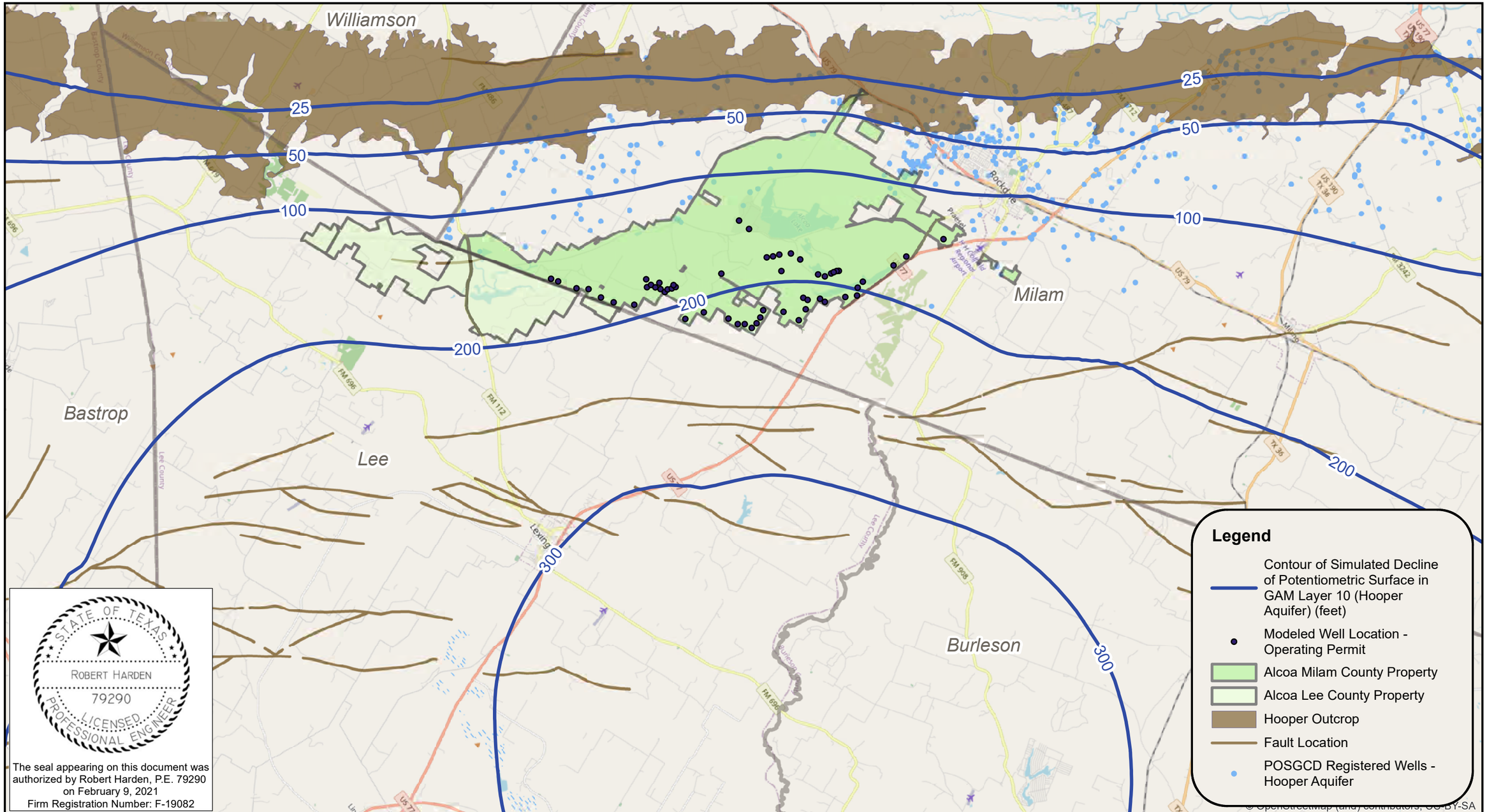
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-8

N

0 1.25 2.5 5
Miles



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Notes:
1. Simulated decline of potentiometric suface in GAM Layer 10 (Hooper aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2061
2. Locations of faults and Simsboro outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 10 (Hooper Aquifer) from Year 2020 to Year 2061 (GAM Run B-4)

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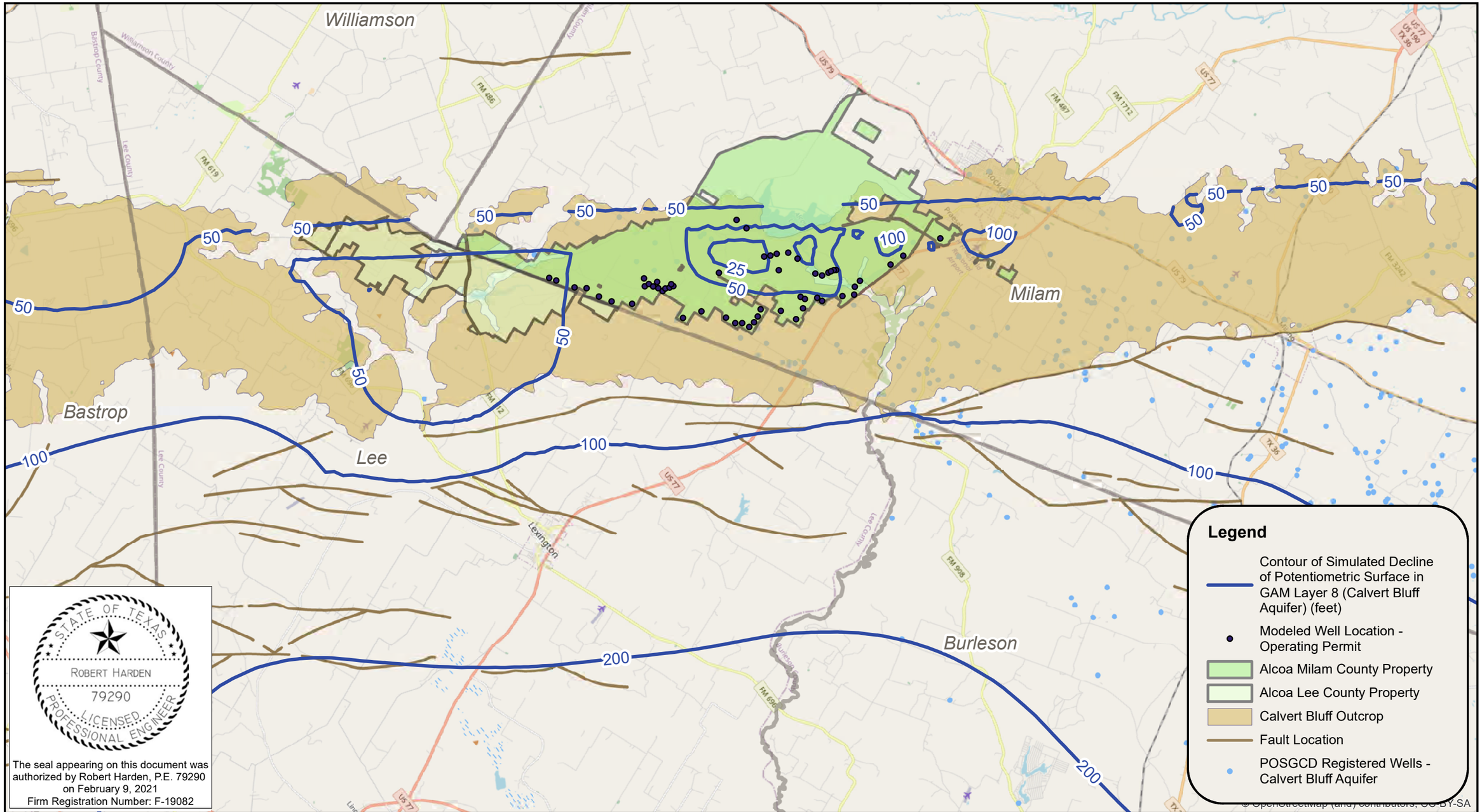
HARDEN HYDROLOGY & ENGINEERING

Figure 4-9

N

0 1.25 2.5 5
Miles



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Notes:
1. Simulated decline of potentiometric suface in GAM Layer 8 (Calvert Bluff aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2024 to 2061
2. Locations of faults and Calvert Bluff outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 8 (Calvert Bluff Aquifer) from Year 2020 to Year 2061 (GAM Run B-4)

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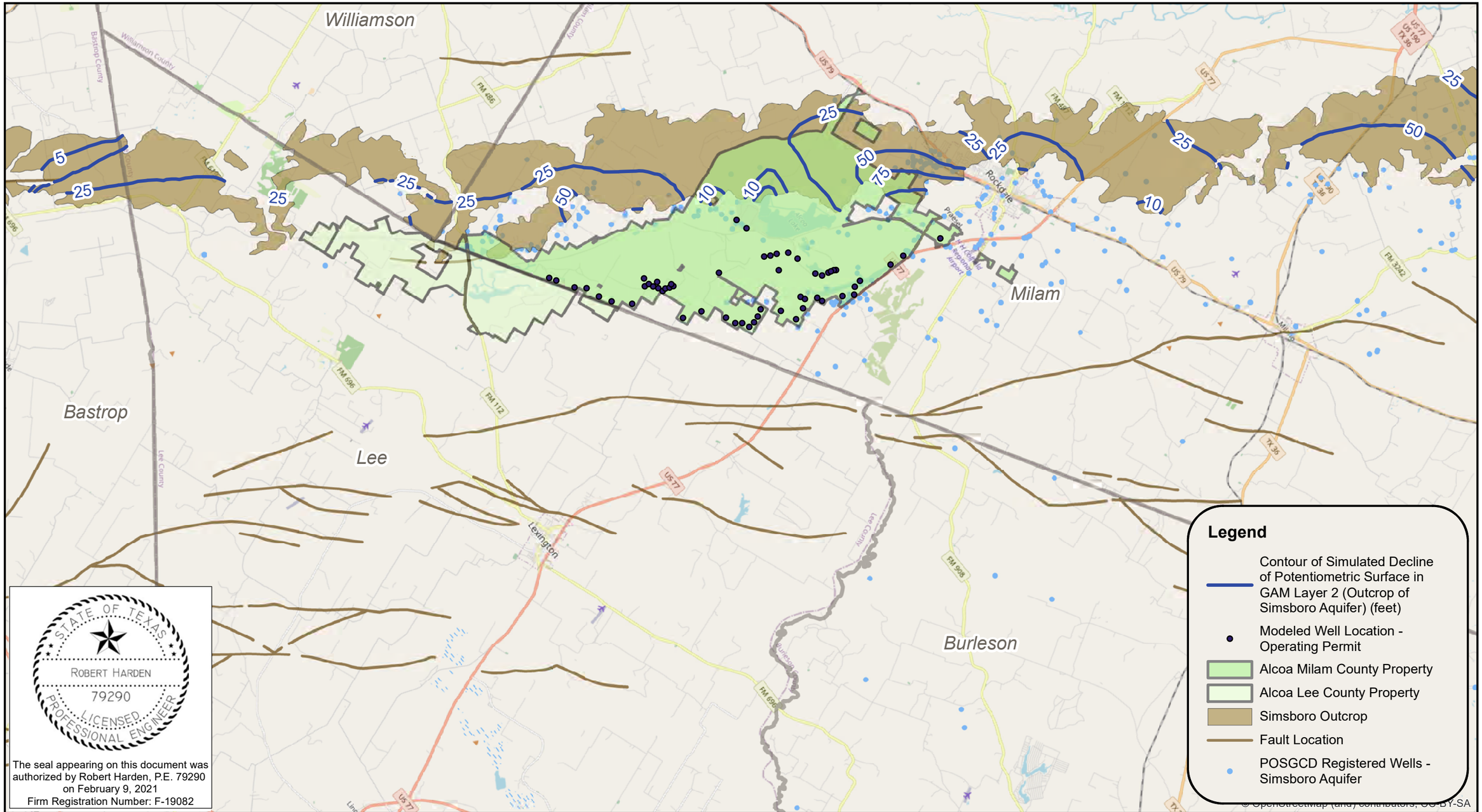
HARDEN HYDROLOGY & ENGINEERING

Figure 4-10

N

0 1.25 2.5 5
Miles



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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Simsboro aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in in Simsboro aquifer from 2024 to 2061
2. Locations of faults and Simsboro aquifer outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 2 (Outcrop of Simsboro Aquifer) from Year 2020 to Year 2061 (GAM Run B-4)

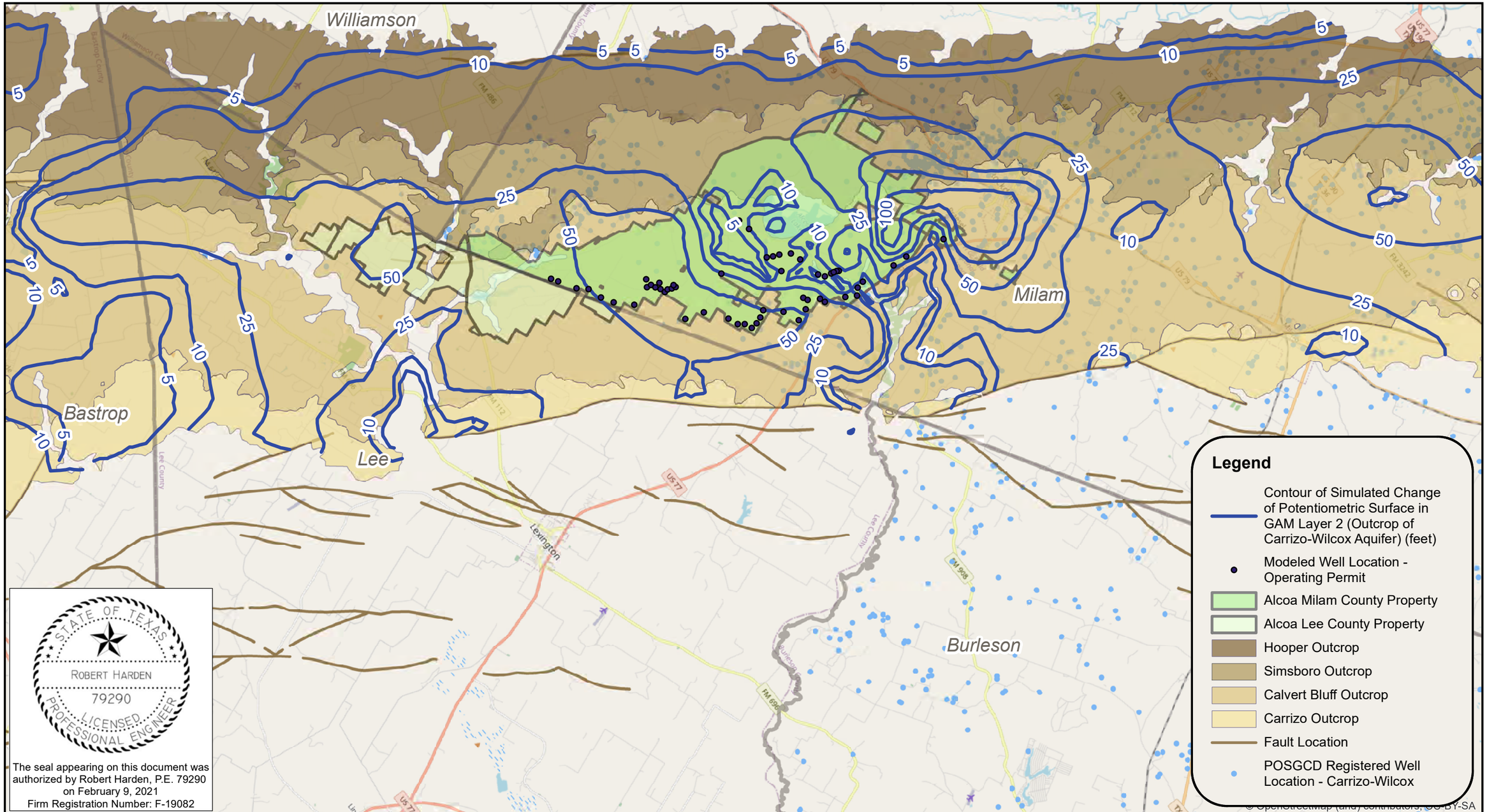
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-11

N

0 1.25 2.5 5
Miles



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ROBERT HARDEN
79290
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PROFESSIONAL ENGINEER

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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Carrizo-Wilcox aquifer), for GAM Run B-4, which includes Operating Permit production of 25,000 ac-ft/yr in Simsboro aquifer from 2024 to 2061
2. Locations of faults and Carrizo-Wilcox aquifer outrops based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 2 (Outcrop of Carrizo-Wilcox Aquifer) from Year 2020 to Year 2061 (GAM Run B-4)

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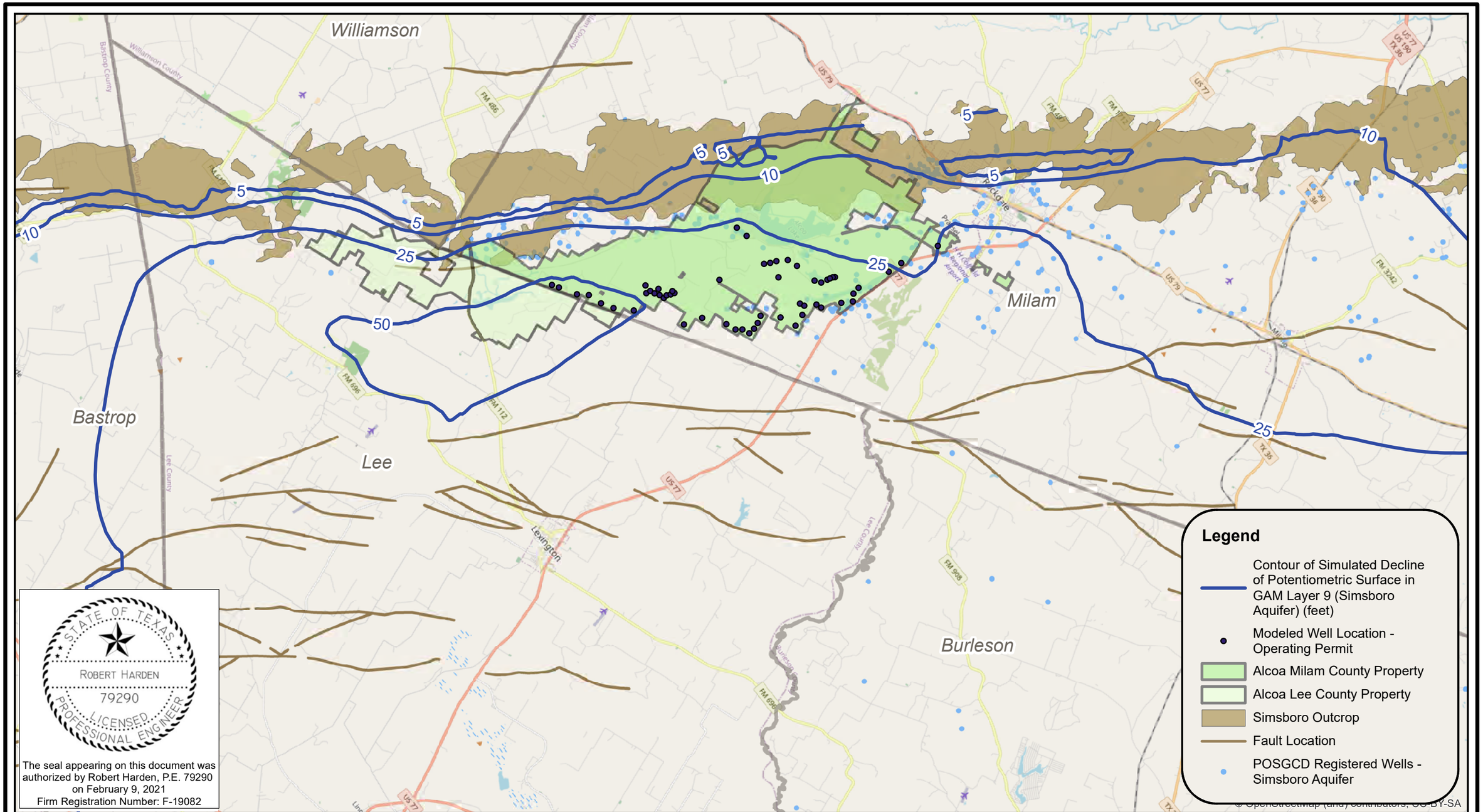
HARDEN HYDROLOGY & ENGINEERING

Figure 4-12

N

0 1.25 2.5 5
Miles



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Notes:
1. Simulated decline of potentiometric suface in GAM Layer 9 (Simsboro aquifer), for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in Simsboro aqufier from 2052 to 2061
2. Locations of faults and Simsboro outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 9 (Simsboro Aquifer) from Year 2052 to Year 2061 (GAM Run B-4)

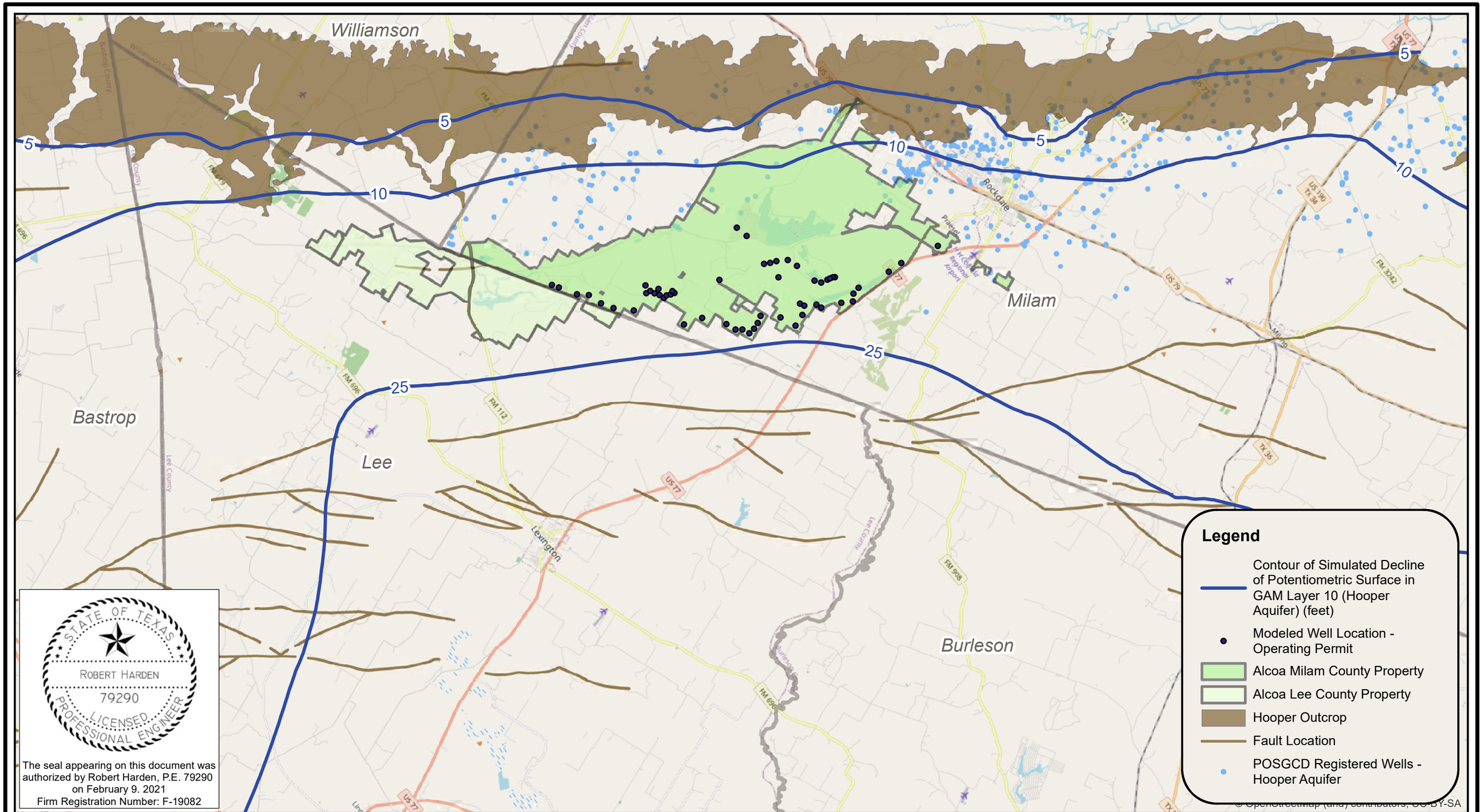
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-13

N

0 1.25 2.5 5
Miles



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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 10 (Hooper aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from Year 2052 to Year 2061
2. Locations of faults and Simsboro outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 10 (Hooper Aquifer) from Year 2052 to Year 2061 (GAM Run B-4)

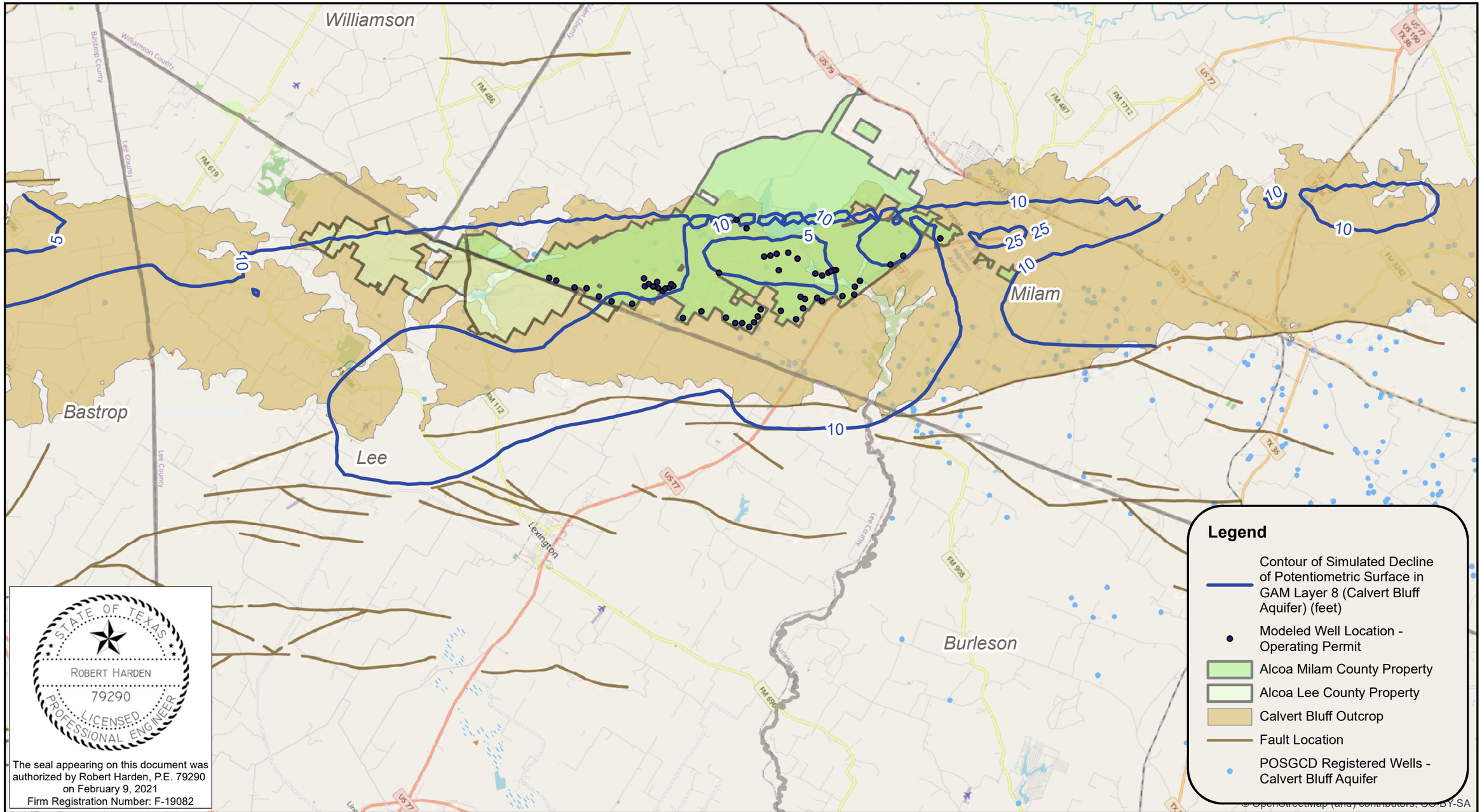
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-14

N

0 1.25 2.5 5
Miles



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Firm Registration Number: F-19082

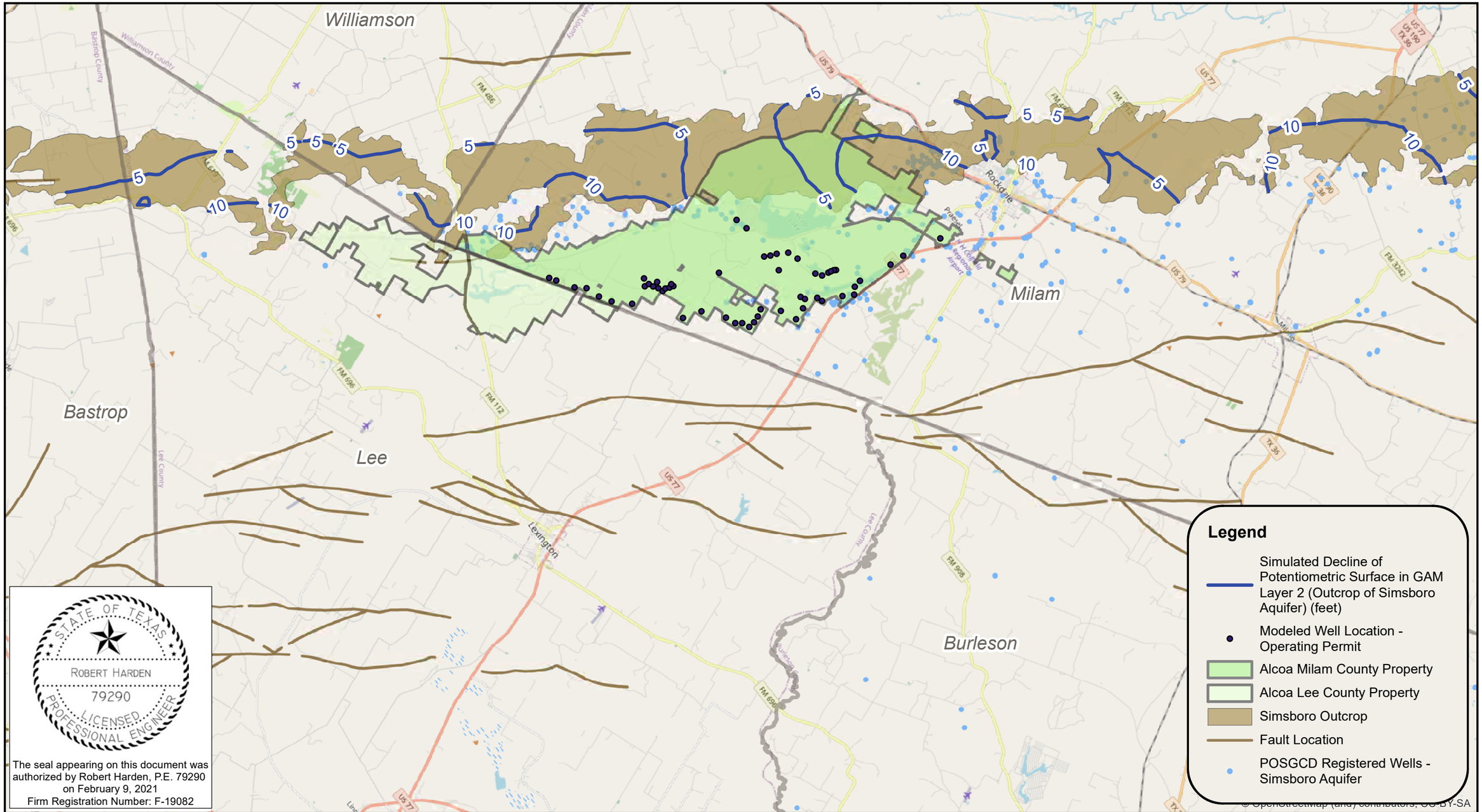
Notes:
1. Simulated decline of potentiometric suface in GAM Layer 8 (Hooper aquifer) for GAM Run B-4, which inlcudes Operating Permit production of 25,000 af/yr in Simsboro aquifer from 2052 to 2061
2. Locations of faults and Calvert Bluff outrop based on Bureau of Economic Geology geologic maps

Simulated Decline of Potentiometric Surface in GAM Layer 8 (Calvert Bluff Aquifer) from Year 2052 to Year 2061 (GAM Run B-4)

Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-15



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Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Simsboro aquifer) for GAM Run B-4, which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from end of 2052 through 2061
2. Locations of faults and Simsboro aquifer outrop based on Bureau of Economic Geology geologic maps

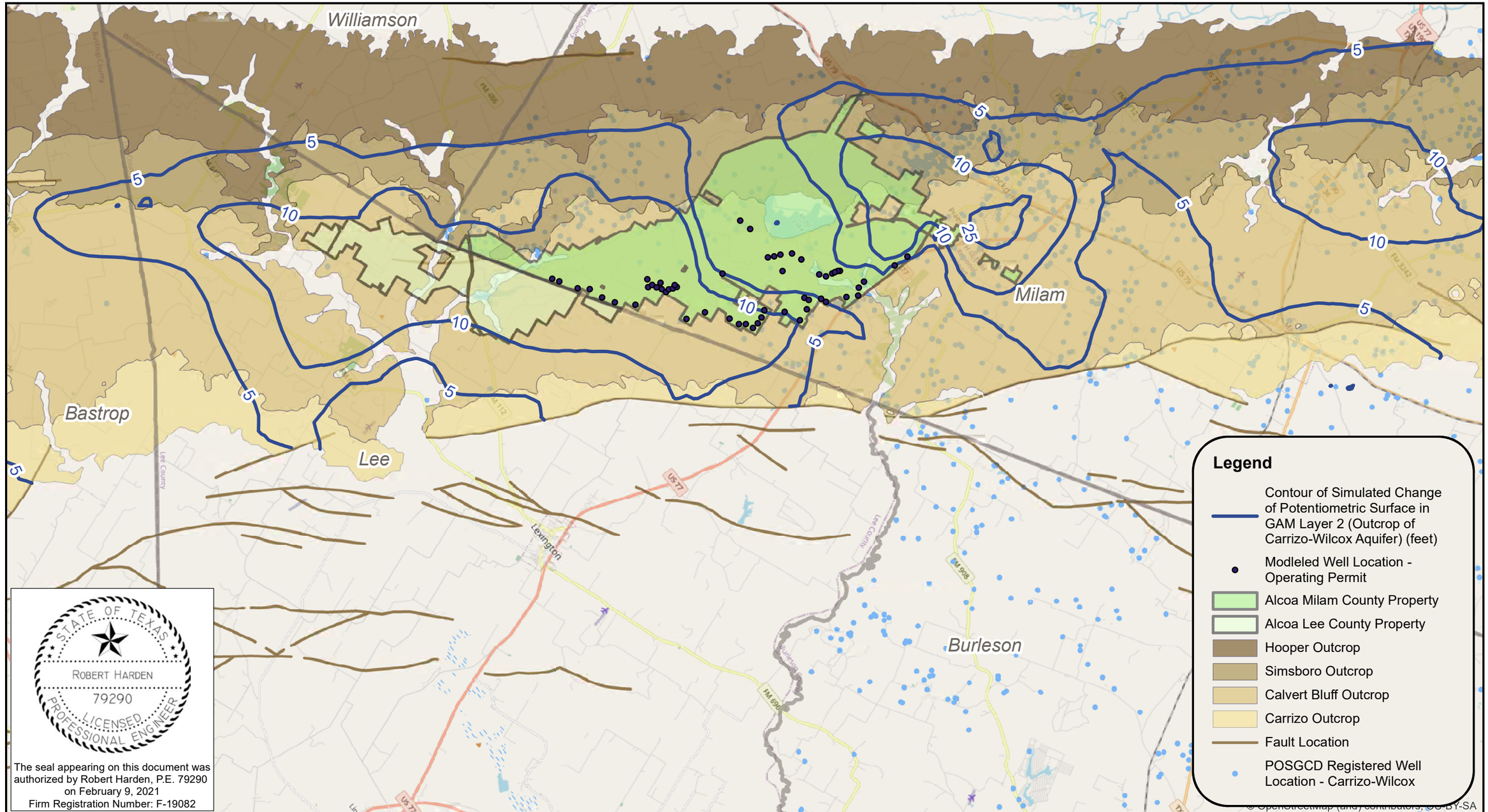
Simulated Decline of Potentiometric Surface in GAM Layer 2 (Outcrop of Simsboro Aquifer) From End of Year 2052 Through Year 2061 (GAM Run B-4)

Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-16

0 1.25 2.5 5
Miles



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79290
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PROFESSIONAL ENGINEER

The seal appearing on this document was authorized by Robert Harden, P.E. 79290 on February 9, 2021
Firm Registration Number: F-19082

Notes:
1. Simulated decline of potentiometric suface in GAM Layer 2 (outcrop of Carrizo-Wilcox aquifer) for GAM Run B-4 which includes Operating Permit production of 25,000 af/yr in Simsboro aquifer from the end of 2052 through 2061
2. Locations of faults and the Hooper, Simsboro, Calvert Bluff, and Carrizo aquifer outrops based on Bureau of Economic Geology geologic maps

Simulated Change of Potentiometric Surface in GAM Layer 2 (Outcrop of Carrizo-Wilcox Aquifer) From End of Year 2052 Through Year 2061 (GAM Run B-4)

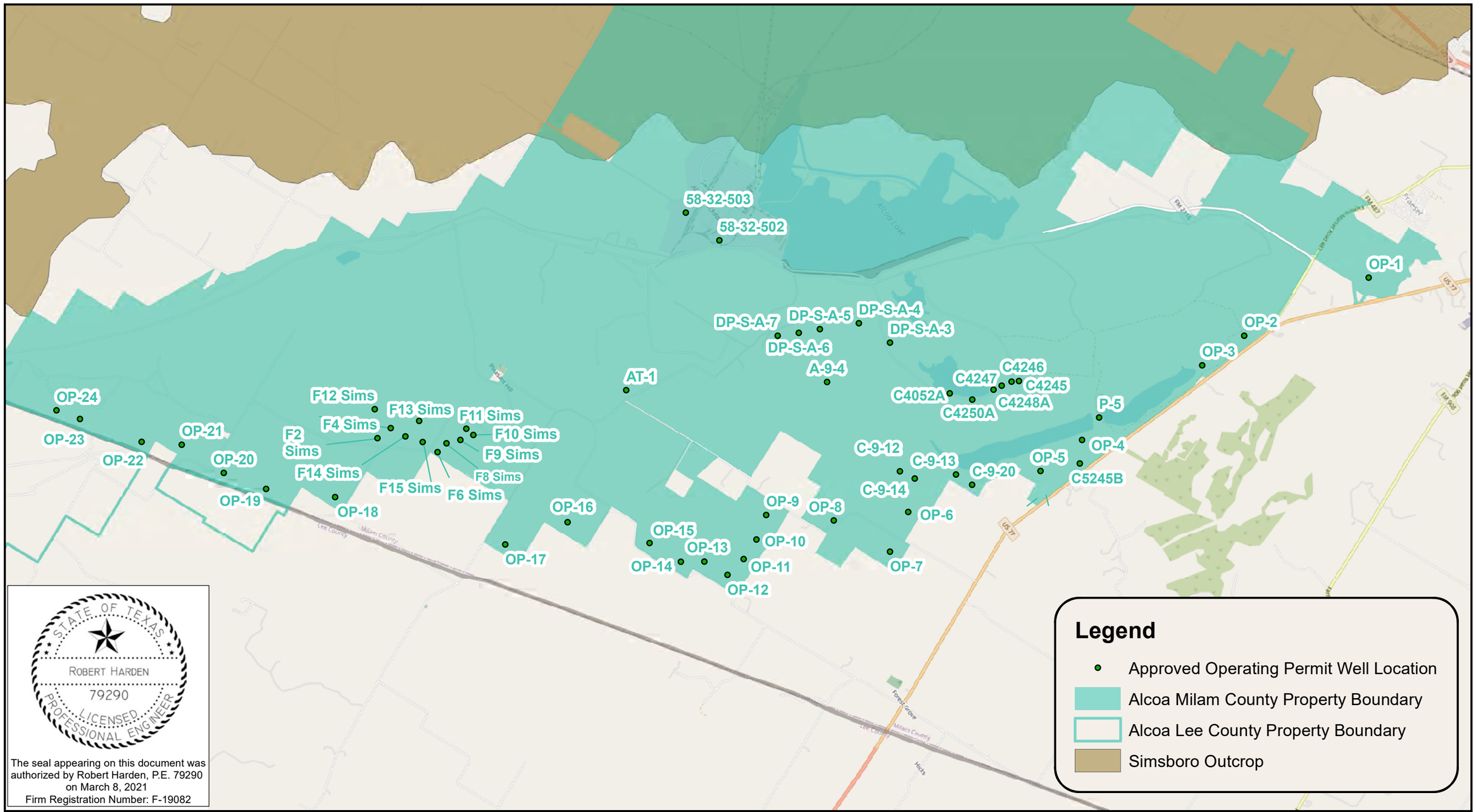
Alcoa

HARDEN HYDROLOGY & ENGINEERING

Figure 4-17

0 1.25 2.5 5
Miles

Production Well Information


58-32-503
58-32-502
DP-S-A-7
DP-S-A-5
DP-S-A-4
DP-S-A-3
DP-S-A-6
A-9-4
AT-1
OP-1
OP-2
OP-3
C4246
C4247
C4245
C4052A
C4248A
C4250A
P-5
OP-4
OP-5
C5245B
C-9-12
C-9-13
C-9-20
C-9-14
OP-6
OP-7
OP-8
OP-9
OP-10
OP-11
OP-12
OP-13
OP-14
OP-15
OP-16
OP-17
OP-18
OP-19
OP-20
OP-21
OP-22
OP-23
OP-24
F12 Sims
F13 Sims
F11 Sims
F4 Sims
F2 Sims
F10 Sims
F9 Sims
F8 Sims
F14 Sims
F15 Sims
F6 Sims
Alcoa Milam County Property Boundary
Alcoa Lee County Property Boundary
Simsboro Outcrop
Approved Operating Permit Well Location
Legend
STATE OF TEXAS
ROBERT HARDEN
79290
LICENSED
PROFESSIONAL ENGINEER
The seal appearing on this document was authorized by Robert Harden, P.E. 79290 on March 8, 2021
Firm Registration Number: F-19082
Notes:
1. Well locations previously approved under Operating Permit
Approved Well Locations
Operating Permit
Alcoa
HARDEN HYDROLOGY & ENGINEERING
Figure 5-1
0 0.25 0.5 1
Miles

APPENDIX A

Existing Operating Permit Wells Construction Documentation

Available Construction Documentation

for Approved Operating Permit Well

58-32-502

GW 1

TEXAS WATER DEVELOPMENT BOARD

Lat 30°33'34"/Long 97°04'03"

WELL SCHEDULE

Aquifer Wilcox - Simsboro Field No. State Well No. TK 58-32-502

Owner's Well No. #2 County Milam

1. Location: 1/4, 1/4 Sec., Block, Survey

2. Owner: Aluminum Company of America Address:

Tenant: Rockdale Plant Address: Rockdale, Texas

Driller: Layne - Texas Address: Houston, Texas

3. Elevation of is 480 ft. above msl, determined by

4. Drilled: 7 1952; Dug, Cable Tool, (Rotary)

5. Depth: Rept. 200 ft. Meas. ft.

6. Completion: Open Hole, Straight Wall, (Underreamed), (Gravel Packed)

7. Pump: Mfgr. Layne - Texas Type T

No. Stages, Bowls Diam. in., Setting ft.

Column Diam. in., Length Tailpipe ft.

8. Motor: Fuel E Make & Model HP. 15

9. Yield: Flow gpm, Pump gpm, Meas., Rept., Est.

10. Performance Test: Date Length of Test 34 Made by L-T

Static Level ? ft. Pumping Level 104 ft. Drawdown ft.

Production 723 gpm Specific Capacity gpm/ft.

CASING & BLANK PIPE

Cemented From ft. to ft.

Diam. (in.)	Type	Setting, ft. from	to
18	Steel	0	90.5
10		0	200

11. Water Level: ft. rept. meas. 19 above/below which is ft. above/below surface.

ft. rept. meas. 19 above/below which is ft. above/below surface.

ft. rept. meas. 19 above/below which is ft. above/below surface.

ft. rept. meas. 19 above/below which is ft. above/below surface.

12. Use: Dom., Stock, Public Supply, (Ind.), Irr., Waterflooding, Observation, Not Used,

13. Quality: (Remarks on taste, odor, color, etc.)

Temp. 73 °F, Date sampled for analysis 7-23-52 Laboratory Curtis Labs

Temp. °F, Date sampled for analysis Laboratory

Temp. °F, Date sampled for analysis Laboratory

WELL SCREEN

Screen Openings #7 Shutton

Diam. (in.)	Type	Setting, ft. from	to
10	Screel	117	142
10	do	165	190

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log, Formation Samples, Pumping Test,

15. Record by: R. Preston Date 19

Source of Data obs, USGS well Schedule, Mr. Hutton

16. Remarks:

Spec. cap. = 14.2 (34 hr. test) & 20.7 (8 hr. test)

CRF

TWDBE-GW-49

(Sketch)

LAT 30°33'34"/LONG 97°04'03"

9-185—July 1935
Revised

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

WELL SCHEDULE

Date 11-28, 1960 Field No.

Record by CRF Office No.

Source of data [illegible] TX-58 32 502

1. *Location:* State Tex County Milam

Map

¼ ¼ sec. T N/S R E/W

2. *Owner:* Aluminum Company of Am

Tenant Rockdale Plant Address

Driller L-T Address

3. *Topography*

4. *Elevation* 450 ft. above/below

5. *Type:* Dug, drilled, driven, bored, jetted 7 1952

6. *Depth:* Rept. 200 ft. Meas. ft.

7. *Casing:* Diam. 10 in., to in., Type S

Depth 200 ft., Finish [illegible] 117-142 and [illegible]

8. *Chief Aquifer* Wilcox [illegible] From ft. to ft.

Others [illegible]

9. *Water level* 46.65 ft. rept./meas. 7-21 1952 above/below

([illegible]) which is ft. above/below surface

10. *Pump:* Type T Capacity G. M.

Power: Kind E Horsepower

11. *Yield:* Flow G. M., Pump G. M., Meas., Rept. Est.

Drawdown 134 ft. after 34 hours pumping 723 G. M.

12. *Use:* Dom., Stock, PS., RR., Ind., Irr., Obs.

Adequacy, permanence

13. *Quality* Temp 78 °F.

Taste, odor, color Sample Yes/No [illegible] 7/23/52

Unfit for

14. *Remarks:* (Log, Analyses, etc.) [illegible]

[illegible] 34 [illegible]

[illegible] 20 [illegible]

Available Construction Documentation

for Approved Operating Permit Well

58-32-503

GW 1

TEXAS WATER DEVELOPMENT BOARD

WELL SCHEDULE

Aquifer Wilcox - Simsboro Field No. _____ State Well No. TK 58-32-503

Lat 30°33'23" / Long 97°04'16" Owner's Well No. #3 County Milam

1. Location: ___ 1/4, ___ 1/4 Sec. _____, Block _____ Survey _____

2. Owner: Aluminum Company of America Address: _____

Tenant: Rockdale Plant Address: _____

Driller: Layne-Texas Company Address: Houston, Texas

3. Elevation of ? is 480 ft. above msl, determined by _____

4. Drilled: 8 1952; Dug, Cable Tool, (Rotary)

5. Depth: Rept. 182 ft. Meas. _____ ft.

6. Completion: Open Hole, Straight Wall, (Underreamed) (Gravel Packed)

7. Pump: Mfgr. Layne-Texas Type T

No. Stages _____, Bowls Diam. ___ in., Setting _____ ft.

Column Diam. _____ in., Length Tailpipe _____ ft.

8. Motor: Fuel E Make & Model _____ HP. 15

9. Yield: Flow ___ gpm, Pump _____ gpm, Meas., Rept., Est.

10. Performance Test: Date ? Length of Test 24 Made by _____

Static Level ? ft. Pumping Level 117 ft. Drawdown ? ft.

Production 200 gpm Specific Capacity _____ gpm/ft.

11. Water Level: 39.5 ft. (rept) meas. 8-9 1952 above (below) 3 (Bob Markey) land surface which is at ft. above (below) surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

_____ ft. rept. meas. _____ 19__ above below _____ which is _____ ft. above below surface.

12. Use: Dom., Stock, Public Supply, (Ind.) Irr., Waterflooding, Observation, Not Used, _____

13. Quality: (Remarks on taste, odor, color, etc.) _____

Temp. ✓ °F, Date sampled for analysis 8-8-52 Laboratory Curtis Labs.

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

Temp. ___ °F, Date sampled for analysis _____ Laboratory _____

14. Other data available as circled: Driller's Log, Radioactivity Log, Electric Log,

Formation Samples, Pumping Test, _____

15. Record by: R. Preston Date _____ 19__

Source of Data copied USGS Schedule — obs, & Mr. Hutton

16. Remarks: _____

CASING & BLANK PIPE

Cemented From ___ ft. to ___ ft.

Diam. (in.)	Type	Setting, ft. from	to
18		0	100.7
10		0	182

WELL SCREEN

Screen Openings #4 Shutter

Diam. (in.)	Type	Setting, ft. from	to
10	Screen	120	170

CRF

TWDBE-GW-49

(Sketch)

9-185—July 1935
Revised

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH LAT 30°33'23"/LONG 97°04'18"

WELL SCHEDULE

Date 11-28, 1960 Field No. ________

Record by CRF Office No. ________

Source of data JH Baugh TK-58-32-503

1. *Location:* State Tex County Milam
Map ________
____ ½ ____ ¼ sec. ____ T ____ N/S R ____ E/W

2. *Owner:* Aluminum Company of America Address ________
#3 Tenant ________ Address ________
Driller L-T Address ________

3. *Topography* ________

4. *Elevation* 480 ft. above/below ________

5. *Type:* Dug, drilled, driven, bored, jetted ____ 1952

6. *Depth:* Rept. 182 ft. Meas. ________ ft.

7. *Casing:* Diam. 10 in., to ____ in., Type ____
Depth 182 ft., Finish Screen 120-170 ________

8. *Chief Aquifer* Wilcox From ____ ft. to ____ ft.
Others underreamed to 30", gravel-packed

9. *Water level* 39.5 ft. rept./meas. 7-9 1952 above/below ?
(Reh...) which is ____ ft. above/below surface

10. *Pump:* Type T Capacity ____ G. M.
Power: Kind E Horsepower ________

11. *Yield:* Flow ____ G. M., Pump ____ G. M., Meas., Rept. Est. ____
Drawdown 117 ft. after 24 hours pumping 700 G. M.

12. *Use:* Dom., Stock, PS., RR., (Ind.) Irr., Obs. ________
Adequacy, permanence ________

13. *Quality* ________ Temp. ____ °F.
Taste, odor, color ________ Sample No. 9-7-52 ...
Unfit for ________

14. *Remarks:* (Log, Analyses, etc.) [illegible]
[illegible]
[illegible]

Available Construction Documentation

for Approved Operating Permit Well

A-9-4

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 7/24/96
Mine Area A
Well Number 2
Site Number SPA-9-1 A(9)4

Driller _____ Company MHC
Slimhole / Piezometer / Depressurization Well
Ground Level Elevation _____
TOC Elevation _____
Northing _____
Easting _____

DRILLING/CONSTRUCTION (MHC)

Date _____
Mud Type _____ No. Bags _____
Bit Size _____
Depth Drilled, Ft. BGL _____
Casing Diameter and Type _____
Cased Interval, Ft. BGL _____
Screen Diameter and Type _____
Screen Guage _____
Screened Interval, Ft. BGL _____
Amount of Gravel Used, Sacks _____
Gravel Type _____
Gravel Setting, Ft. BGL _____
Length of Gravel Tremmie, Ft. _____
Depth to Top of Gravel, Ft. BGL _____
Cement Type _____. Lbs Per Sack _____
Sacks of Cement Used _____
Sacks of Bentonite Used _____
Amount of Water Used, Gals. _____
Length of Cement Tremmie, Ft. _____

NOTES/CONSTRUCTION PROBLEMS

DEVELOPMENT (MHC)

Start, Time/Date _____
Finish, Time/Date _____
Total Time Jetted _____
Stable Water-Level Measured
After Development (ft. BTOC) _____

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL _____
After Jetting (Date), Ft. BGL _____
Rate Jetted (Meas./Est.), gpm _____

PUMP/MOTOR (MHC)

Motor H.P. _____
Length of Column Pipe (ft.) _____
Diameter of Column Pipe (in.) _____
Column Pipe Type _____

INSPECTION COMPLETION (ALCOA)

Date _____ Time _____
Measuring Point Description _____

Which is _____ Ft. A.G.L.
Depth to Water, Ft. B.T.O.C. _____

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well	
Casing	+2 - 220
	340 - 350
Screen	220 - 340
Gravel	180 - 350
Cement	0 - 10
	150 - 180
Pump Column Length	220 ft
Measuring Pipe	
Casing	
Screen	N/A

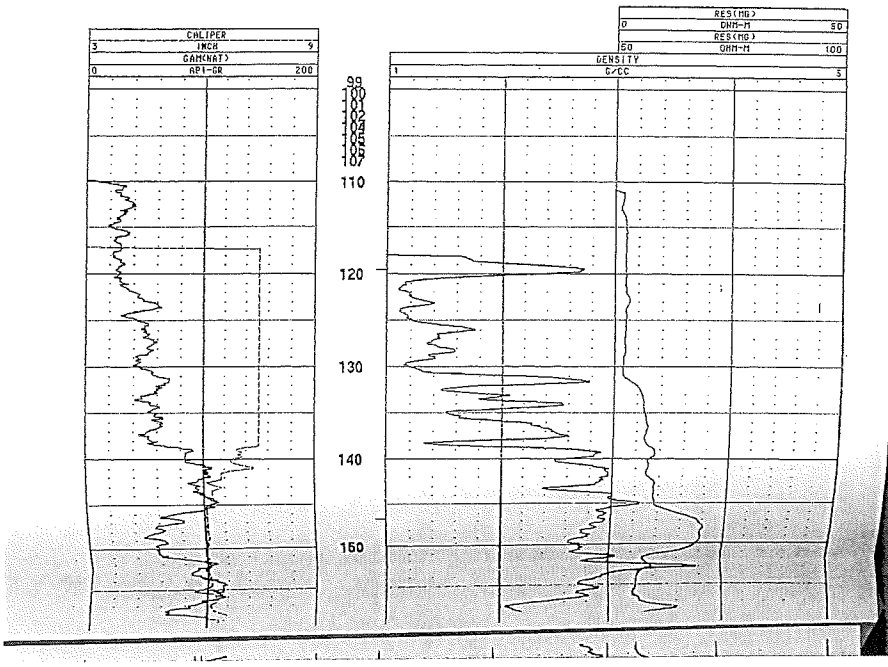
Century GEOPHYSICAL CORP.

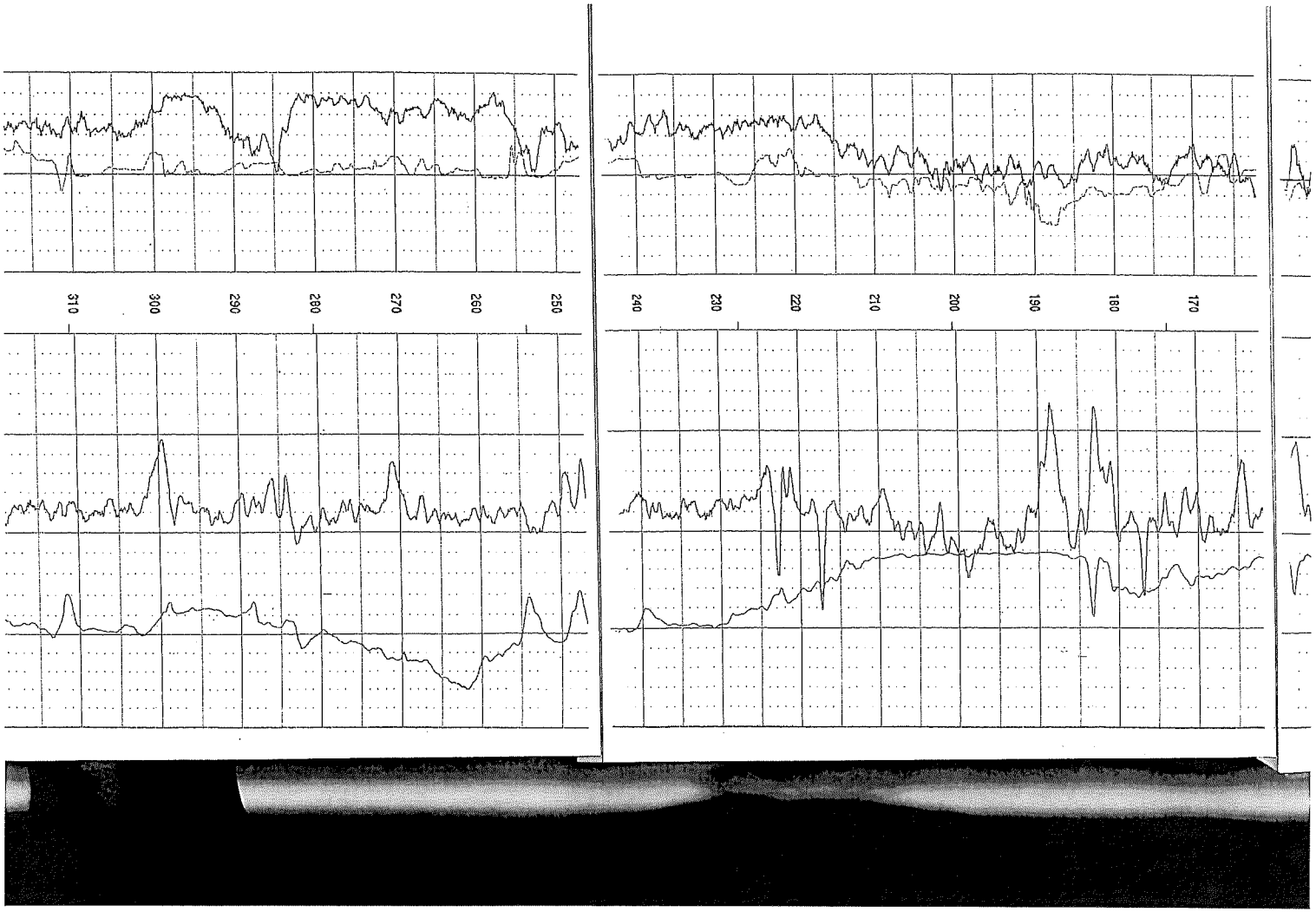
DPA-9-4

DP A-9-4

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: SPA-9-1				
LOCATION/FIELD	: AREA A				
COUNTY	: MILAM				
STATE	: TEXAS				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 07/23/96	PERMANENT DATUM	: G.L.	ELEVATIONS	
DEPTH DRILLER	: 395 T.W.	ELEV. PERM. DATUM:		KB	:
LOG BOTTOM	: 331.80	LOG MEASURED FROM:	G.L.	DF	:
LOG TOP	: 119.20	DRL MEASURED FROM:	G.L.	GL	:
CASING DRILLER	: 140	LOGGING UNIT	: 9606		
CASING TYPE	: STEEL	FIELD OFFICE	: TULSA, OK.		
CASING THICKNESS:	.25	RECORDED BY	: B.C. LILES		
BIT SIZE	: 6.62	BOREHOLE FLUID	: H/20	FILE	: ORIGINAL
MAGNETIC DECL.	: 8.5	RM	:	TYPE	: 9830AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 5
FLUID DENSITY	:	MATRIX DELTA T	:	PLOT	: 9830AA 6
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	:	THRESH:	580000
REMARKS	:				

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

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170

Available Construction Documentation

for Approved Operating Permit Well

AT-1 / AX(10)5

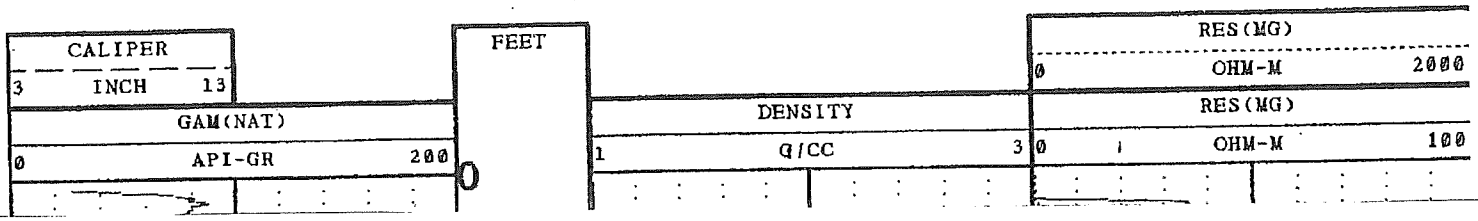
ALCOA INC.

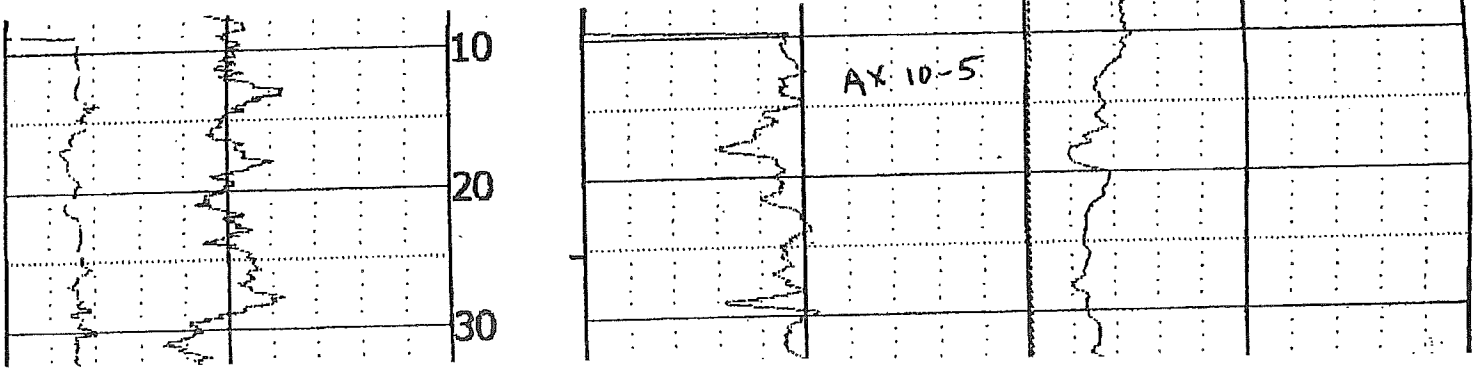
AX10-5 PILOT

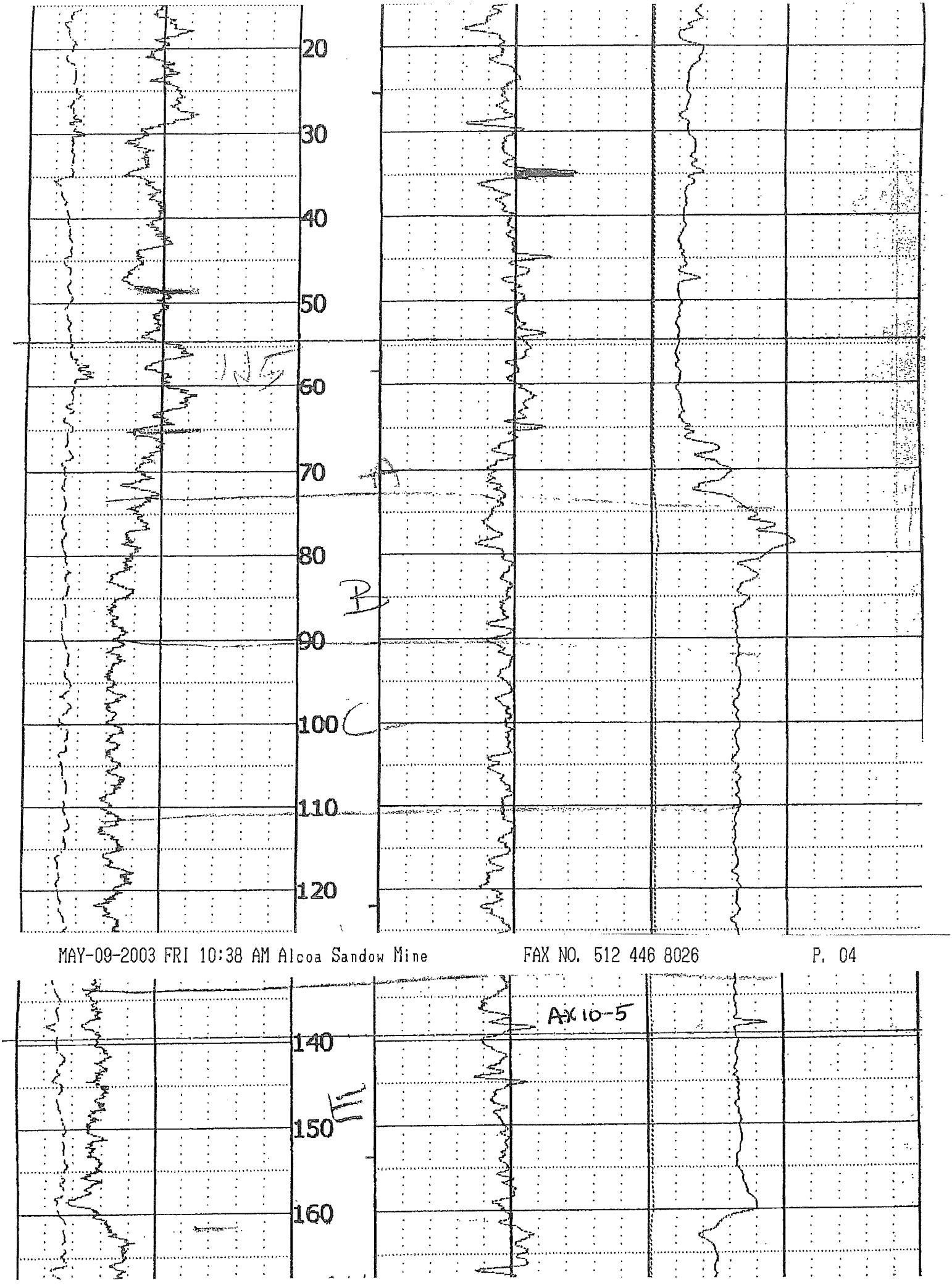
COMPANY	: ALCOA	OTHER SERVICES:	
WELL	: AX10-5 PILOT		
LOCATION/FIELD	: AX		
COUNTY	: MILAM		
STATE	: Tx.		
SECTION	:	TOWNSHIP :	RANGE :
DATE	: 05/08/03	PERMANENT DATUM :	
DEPTH DRILLER	: 460 H.O		KB :
LOG BOTTOM	: 459.00	LOG MEASURED FROM: G.L.	DF :
LOG TOP	: 0.70	DRL MEASURED FROM:	GL :
CASING DIAMETER	: 0	LOGGING UNIT : 703	
CASING TYPE	:	FIELD OFFICE :	
CASING THICKNESS	: 0	RECORDED BY : J. Wren	
BIT SIZE	: 6.75"	BOREHOLE FLUID : water	FILE : ORIGINAL
MAGNETIC DECL	: 0	RM : 0	TYPE : 9034AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE : 0	
NEUTRON MATRIX	: Sandstone	MATRIX DELTA T : 49	THRESH: 10000

PILOT

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



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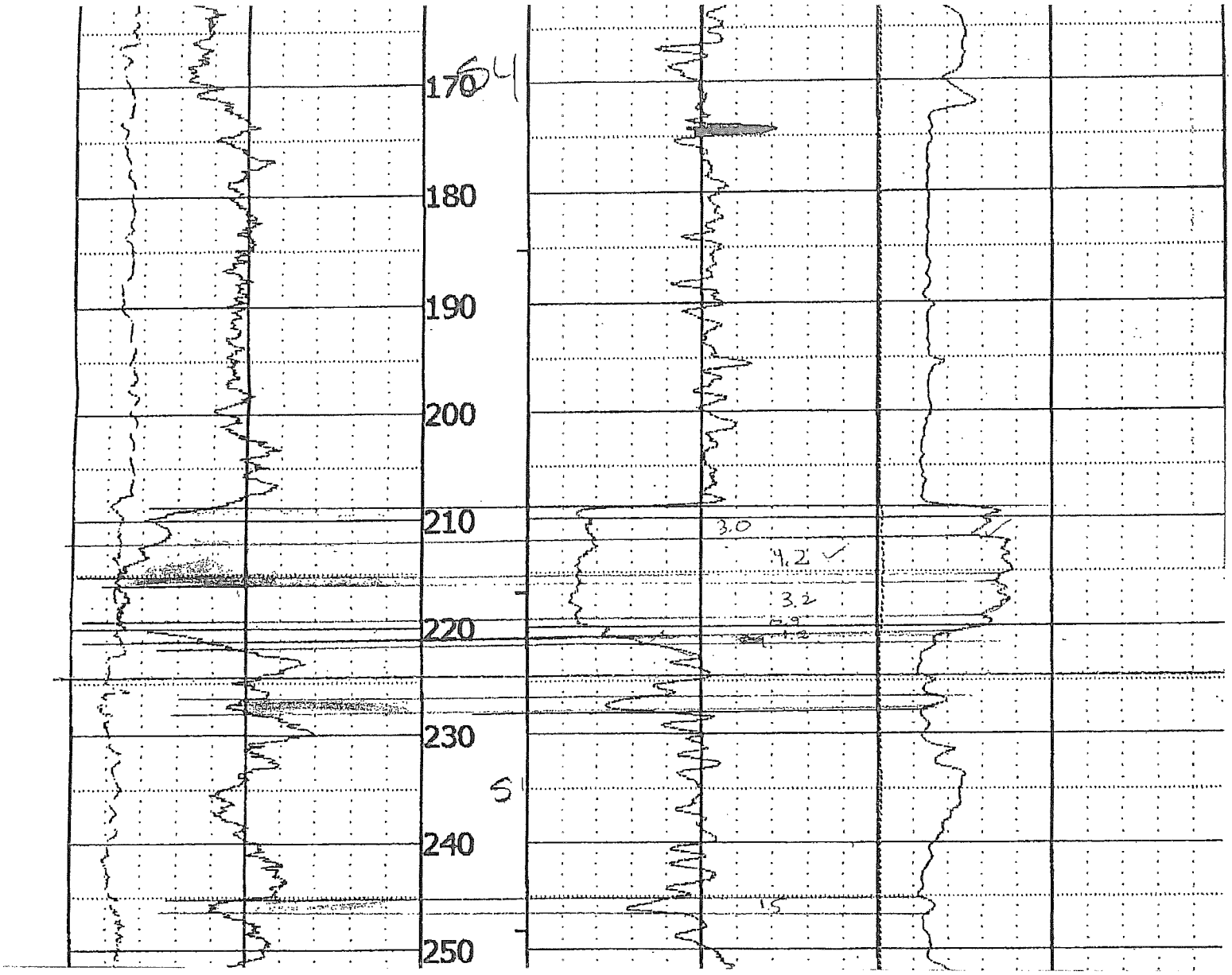
AX10-5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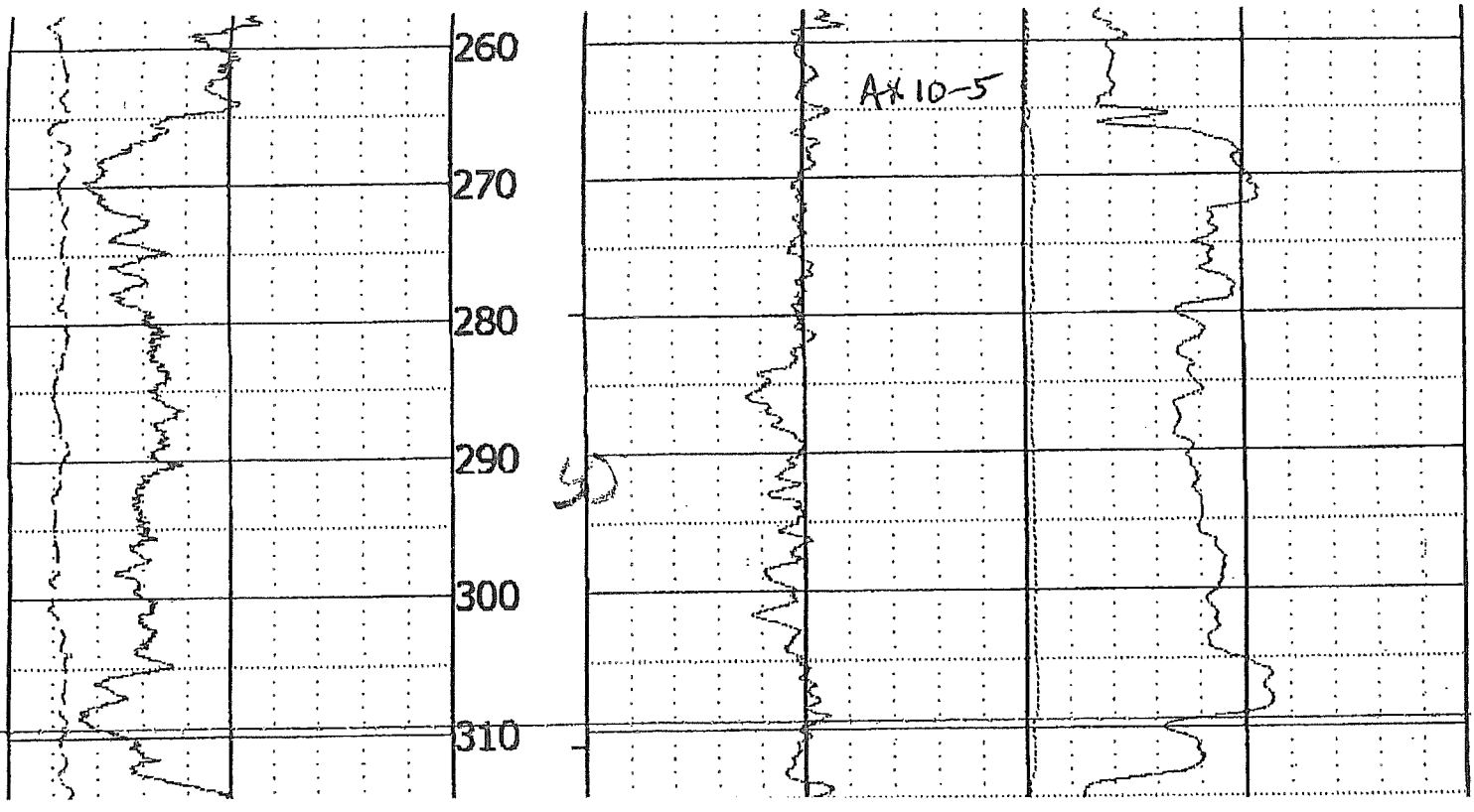
4.2
3.2
1.5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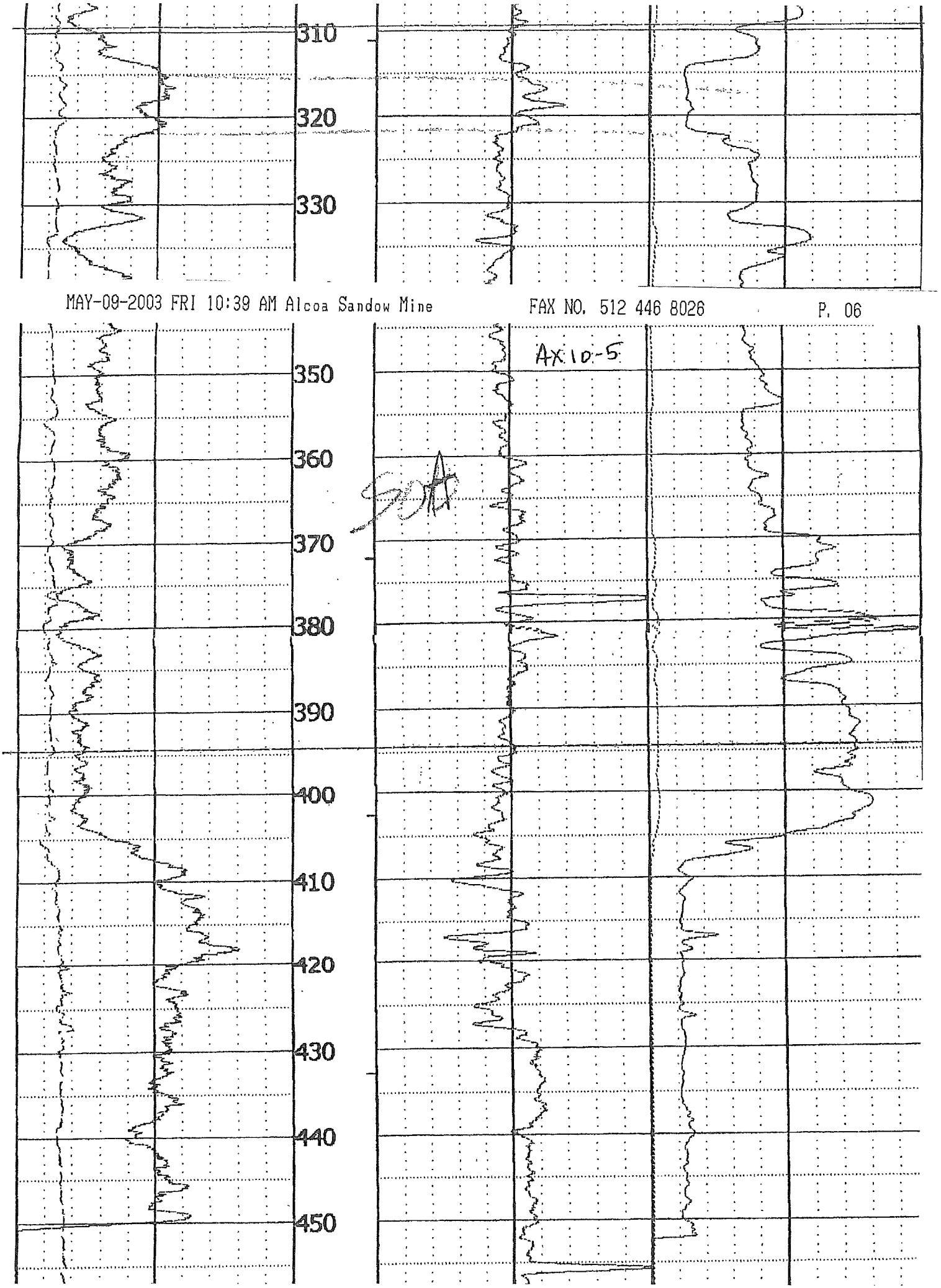
AX10-5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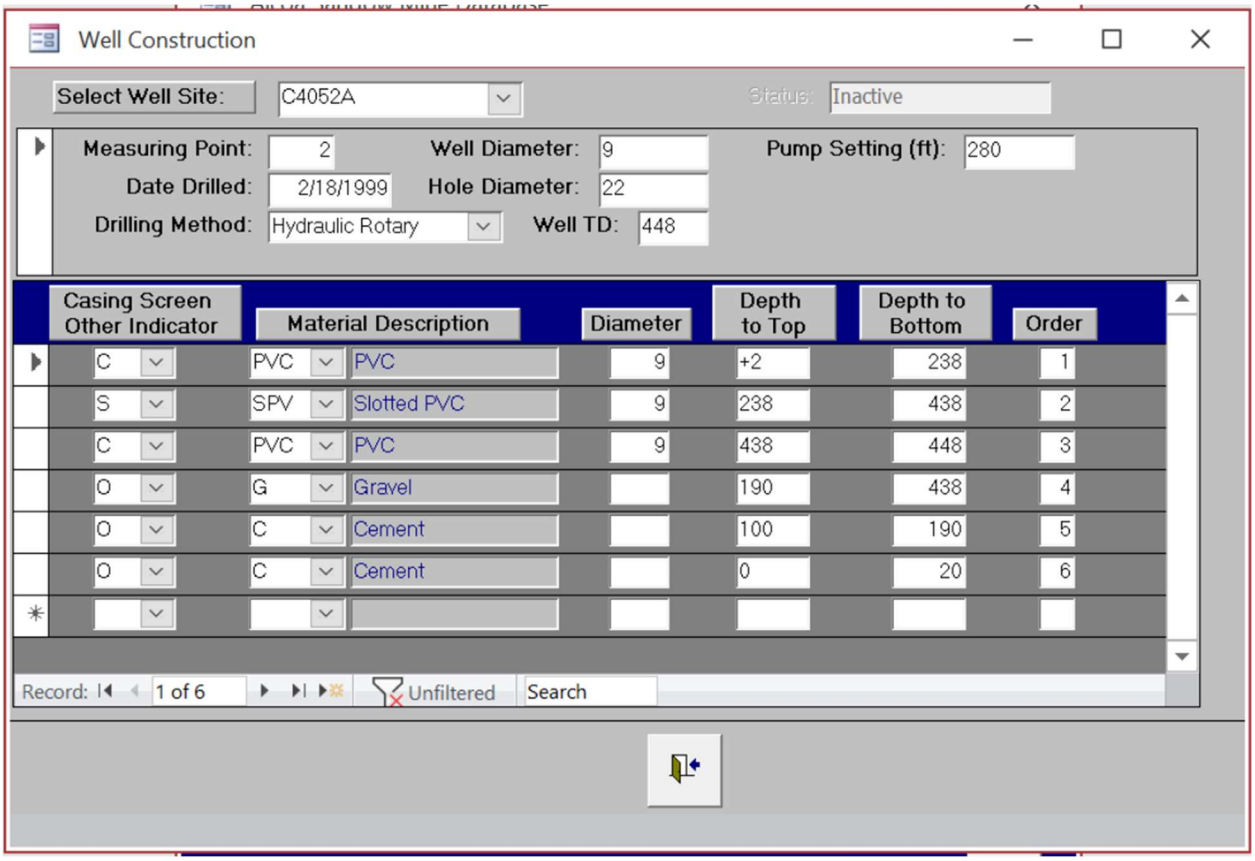
AX10-5

Available Construction Documentation

for Approved Operating Permit Well

C4052A


Well Construction
Select Well Site:
C4052A
Status:
Inactive
Measuring Point:
2
Well Diameter:
9
Pump Setting (ft):
280
Date Drilled:
2/18/1999
Hole Diameter:
22
Drilling Method:
Hydraulic Rotary
Well TD:
448
Casing Screen Other Indicator
Material Description
Diameter
Depth to Top
Depth to Bottom
Order
C PVC PVC 9 +2 238 1
S SPV Slotted PVC 9 238 438 2
C PVC PVC 9 438 448 3
O G Gravel 190 438 4
O C Cement 100 190 5
O C Cement 0 20 6
Record: 1 of 6
Unfiltered
Search

Available Construction Documentation

for Approved Operating Permit Well

C4245

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 5/28/98
Mine Area C
Well Number C4245
Site Number C4245

Driller _____ Company _____
Slimhole / Piezometer / Depressurization Well
Ground Level Elevation _____
TOC Elevation _____
Northing _____
Easting _____

DRILLING/CONSTRUCTION (MHC)

Date _____
Mud Type _____ No. Bags _____
Bit Size _____
Depth Drilled, Ft. BGL _____
Casing Diameter and Type _____
Cased Interval, Ft. BGL _____
Screen Diameter and Type _____
Screen Guage _____
Screened Interval, Ft. BGL _____
Amount of Gravel Used, Sacks _____
Gravel Type _____
Gravel Setting, Ft. BGL _____
Length of Gravel Tremmie, Ft. _____
Depth to Top of Gravel, Ft. BGL _____
Cement Type _____. Lbs Per Sack _____
Sacks of Cement Used _____
Sacks of Bentonite Used _____
Amount of Water Used, Gals. _____
Length of Cement Tremmie, Ft. _____

NOTES/CONSTRUCTION PROBLEMS

GRAVEL 285 CU FT
CEMENT 90'-200' = 121 FT³
0 - 20 = 22 FT³
TOTAL = 143 FT³ @ 110 SKS
plus 20% = 130 SKS

DEVELOPMENT (MHC)

Start, Time/Date _____
Finish, Time/Date _____
Total Time Jetted _____
Static Water-Level Measured
After Devolopment _____

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL _____
After Jetting (Date), Ft. BGL _____
Rate Jetted (Meas./Est.), gpm _____

PUMP/MOTOR (MHC)

Motor H.P. _____
Length of Column Pipe (ft.) _____

INSPECTION COMPLETION (ALCOA)

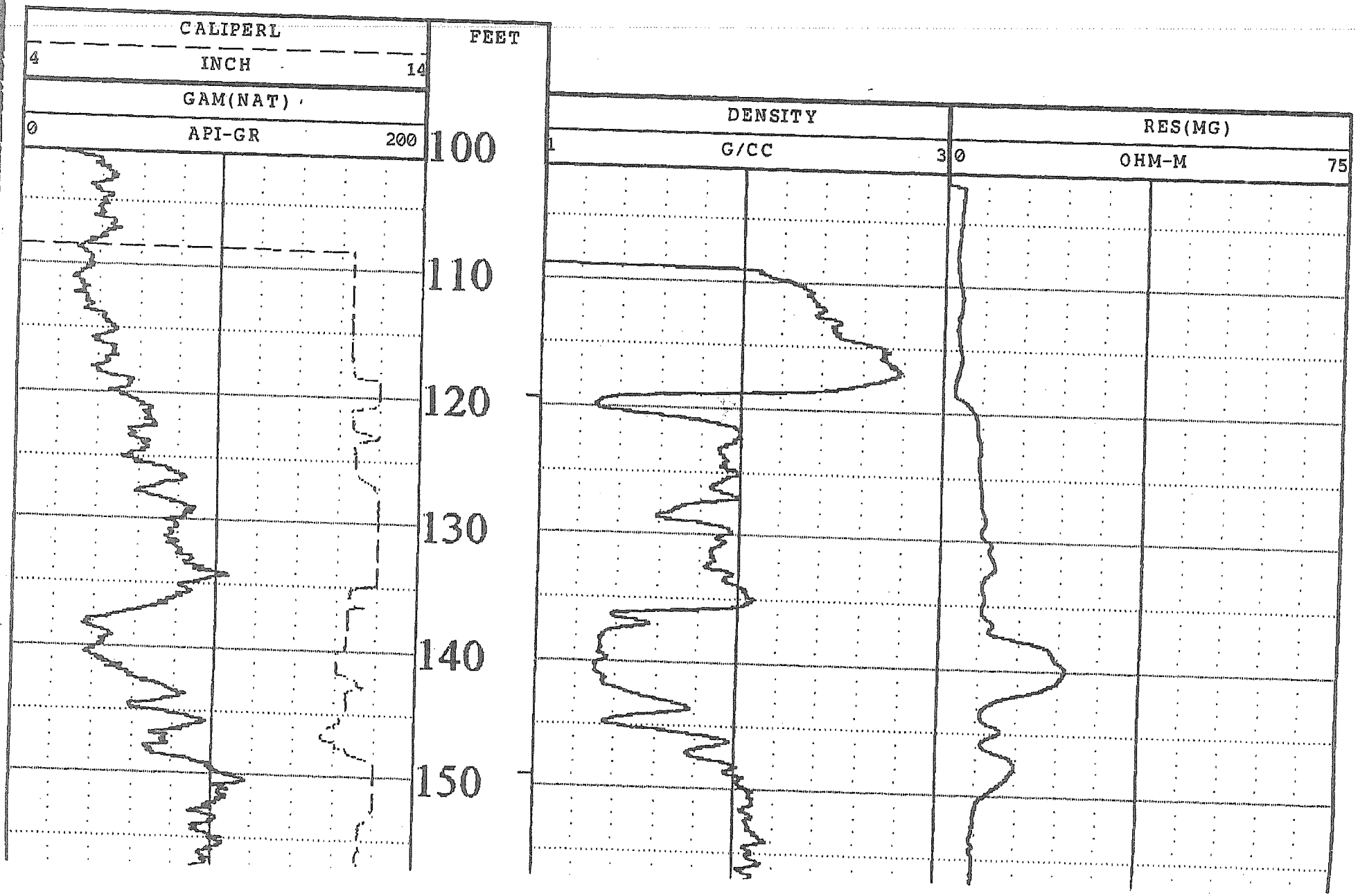
Date _____ Time _____
Measuring Point Description _____
_____
Which is _____ Ft. A.G.L.
Depth to Water, Ft. B.T.O.C. _____

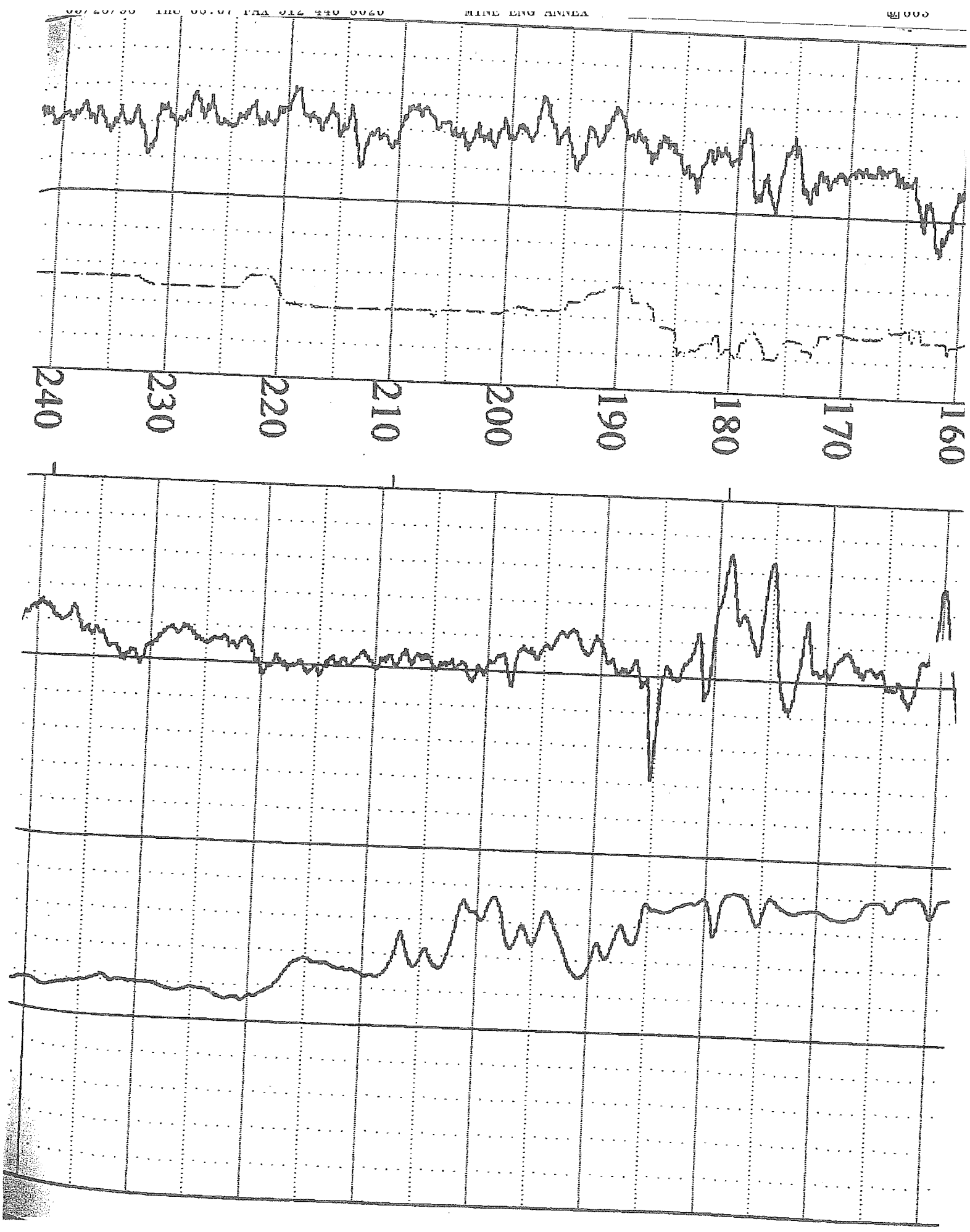
MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well Casing	+2 - 238 ~~448 - 458~~
Screen	238 - ~~448~~ 438
Gravel	200 - ~~458~~ 438
Cement	125 ~~80~~ - 200 ~~0 - 20~~
Pump Column Length	~~260~~
Measuring Pipe Casing	
Measuring Pipe Screen	

DP2

C4245 05/28/98 958 cond 1055

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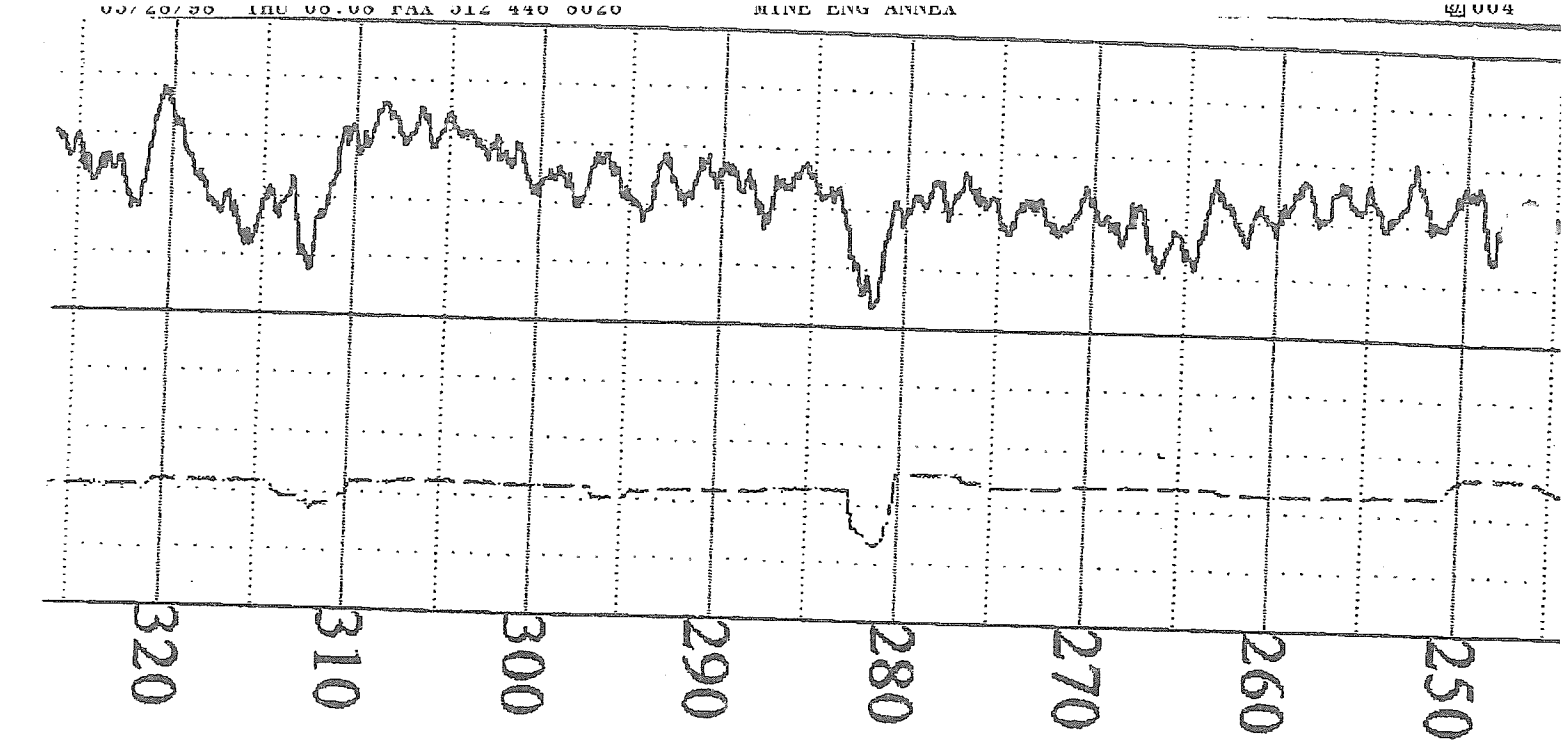
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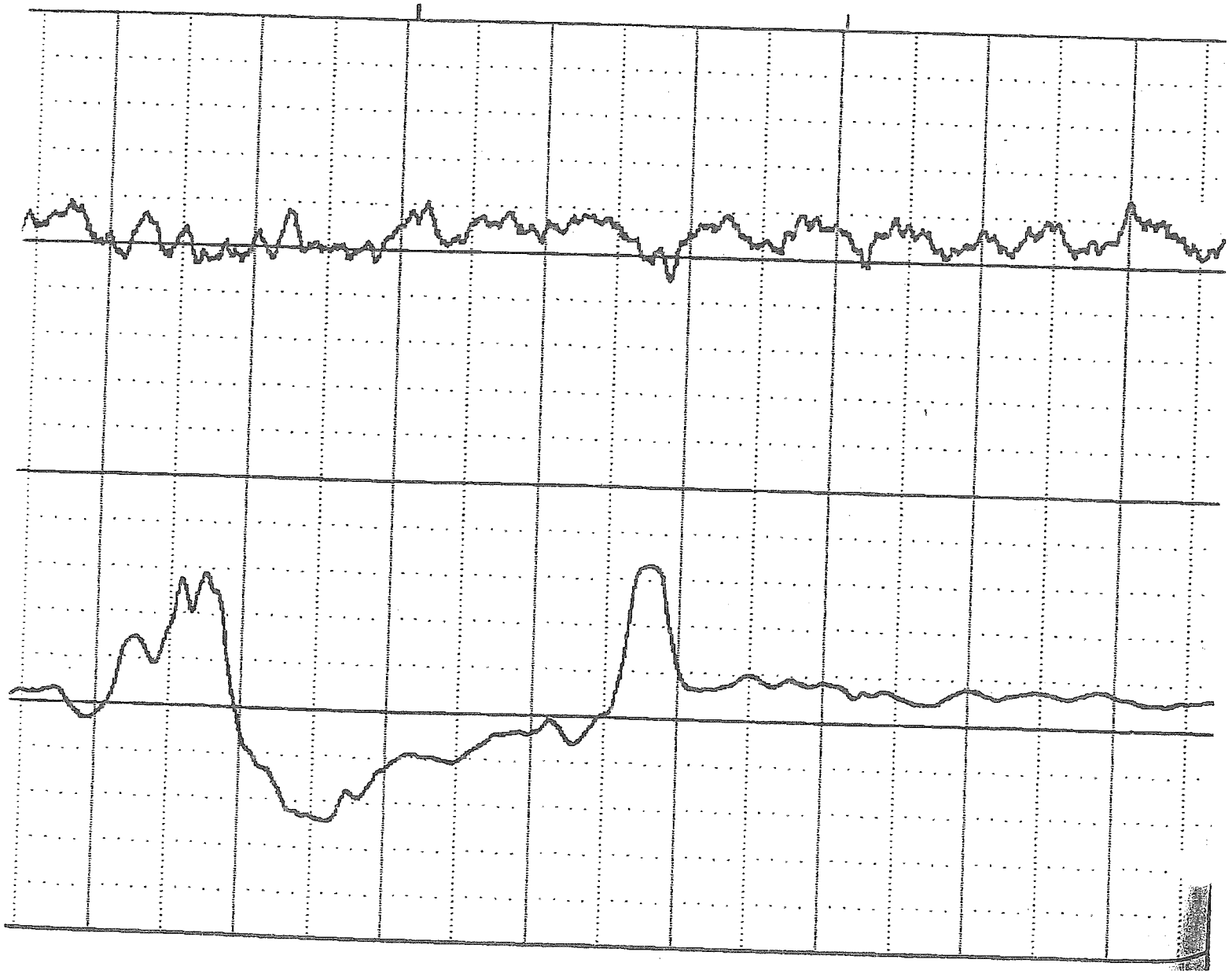

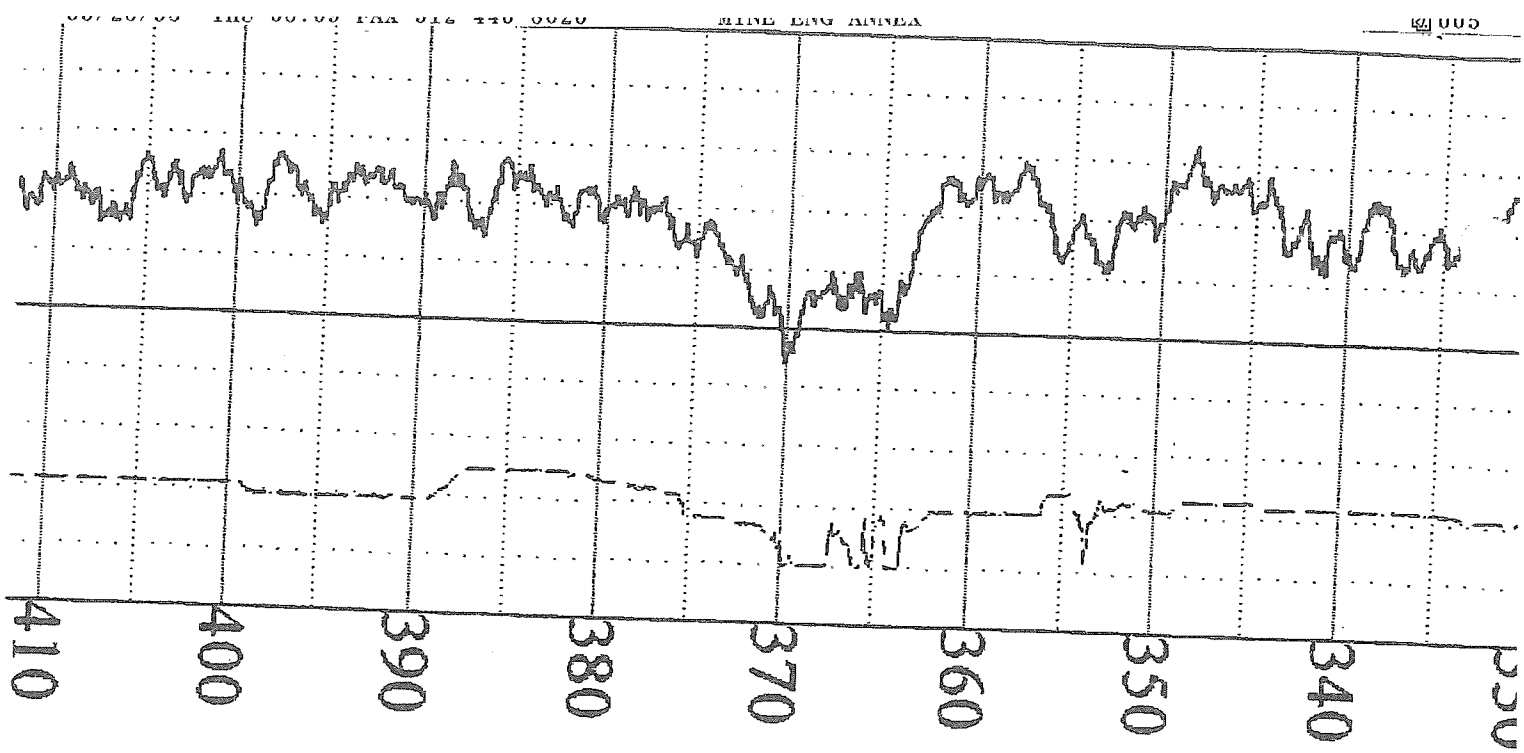
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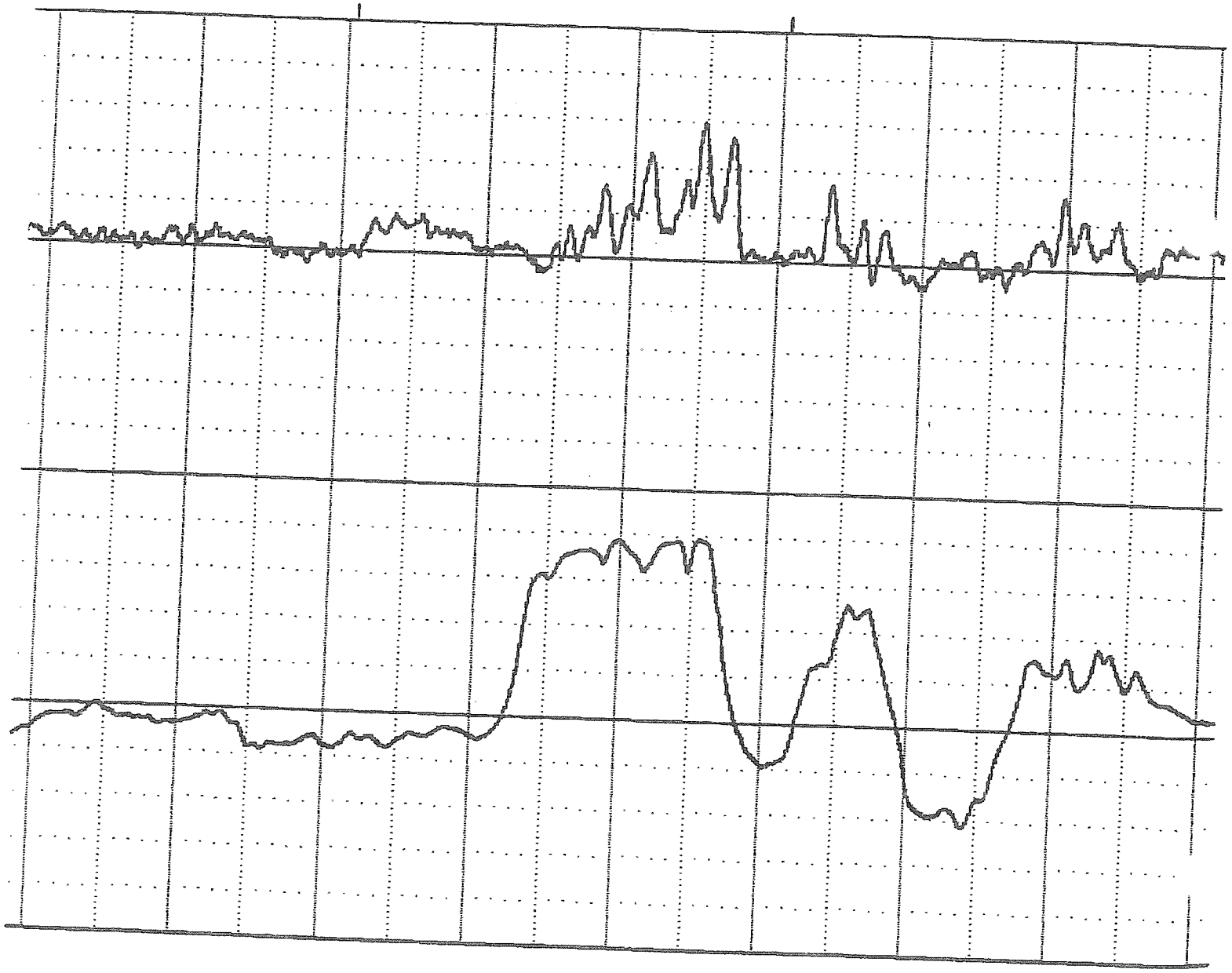


Available Construction Documentation

for Approved Operating Permit Well

C4246

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date C4246 5/6/98
Mine Area C
Well Number
Site Number C4246

Driller _____ Company _____
Slimhole / Piezometer / Depressurization Well
Ground Level Elevation _____
TOC Elevation _____
Northing _____
Easting _____

DRILLING/CONSTRUCTION (MHC)

Date _____
Mud Type _____ No. Bags _____
Bit Size _____
Depth Drilled, Ft. BGL _____
Casing Diameter and Type _____
Cased Interval, Ft. BGL _____
Screen Diameter and Type _____
Screen Guage _____
Screened Interval, Ft. BGL _____
Amount of Gravel Used, Sacks _____
Gravel Type _____
Gravel Setting, Ft. BGL _____
Length of Gravel Tremmie, Ft. _____
Depth to Top of Gravel, Ft. BGL _____
Cement Type _____. Lbs Per Sack _____
Sacks of Cement Used _____
Sacks of Bentonite Used _____
Amount of Water Used, Gals. _____
Length of Cement Tremmie, Ft. _____

NOTES/CONSTRUCTION PROBLEMS

GRAVEL 342 FT3

CEMENT 0-20' 4.2 SKS

95-~~210~~ 210 14.1 SKS

TOTAL CEMENT 18.3 SKS

DEVELOPMENT (MHC)

Start, Time/Date _____
Finish, Time/Date _____
Total Time Jetted _____
Static Water-Level Measured
After Devolopment _____

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL _____
After Jetting (Date), Ft. BGL _____
Rate Jetted (Meas./Est.), gpm _____

PUMP/MOTOR (MHC)

Motor H.P. _____
Length of Column Pipe (ft.) _____

INSPECTION COMPLETION (ALCOA)

Date _____ Time _____
Measuring Point Description _____
_____
Which is _____ Ft. A.G.L.
Depth to Water, Ft. B.T.O.C. _____

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well Casing	+2-258
	458-468
Screen	258-458
Gravel	210-468
Cement	0-20
	95-210
Pump Column Length	300'
Measuring Pipe Casing	
Measuring Pipe Screen	

Aluminum Company of America

Sanderson Mine

Brackettville, Texas

C AREA DPZ

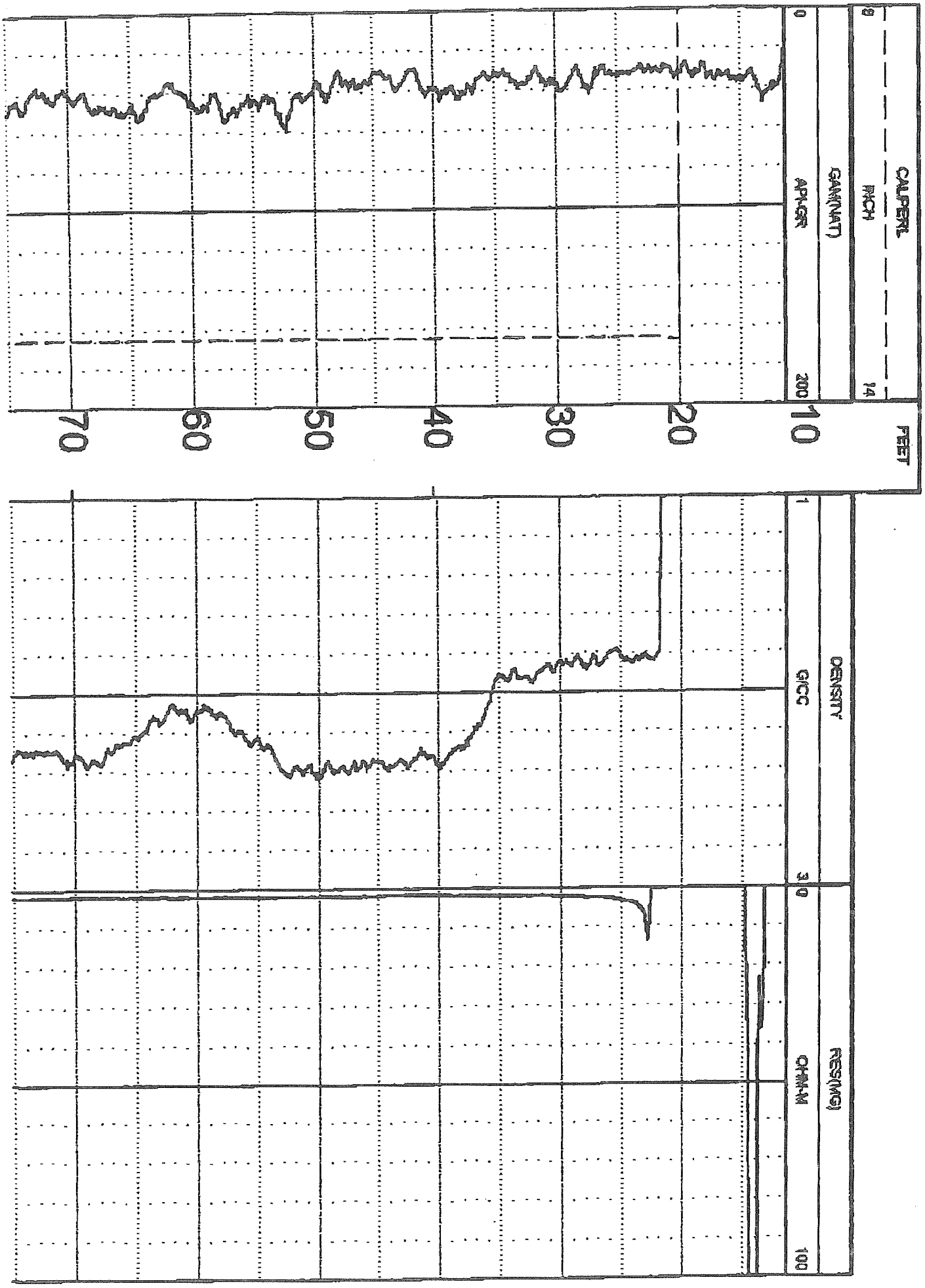
COND - 702

C4246

OTHER SERVICES:

COMPANY	: ALCOA				
WELL	: C AREA DPZ				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/06/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 520			KB	:
LOG BOTTOM	: 518.40	LOG MEASURED FROM	: GL	DF	:
LOG TOP	: 11.50	DRL MEASURED FROM	: GL	GL	:
CASING DIAMETER	: 0	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS	: 0	RECORDED BY	: COLDIRON		
BIT SIZE	: 12 1/4	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL	: 8	RM	: 0	TYPE	: 9034AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49	THRESH	: 30000

DPZ HOLE


CALIPER1
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INCH
14
GAMMA(NAT)
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API-GR
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FEET
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DENSITY
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G/CC
3
RES(MG)
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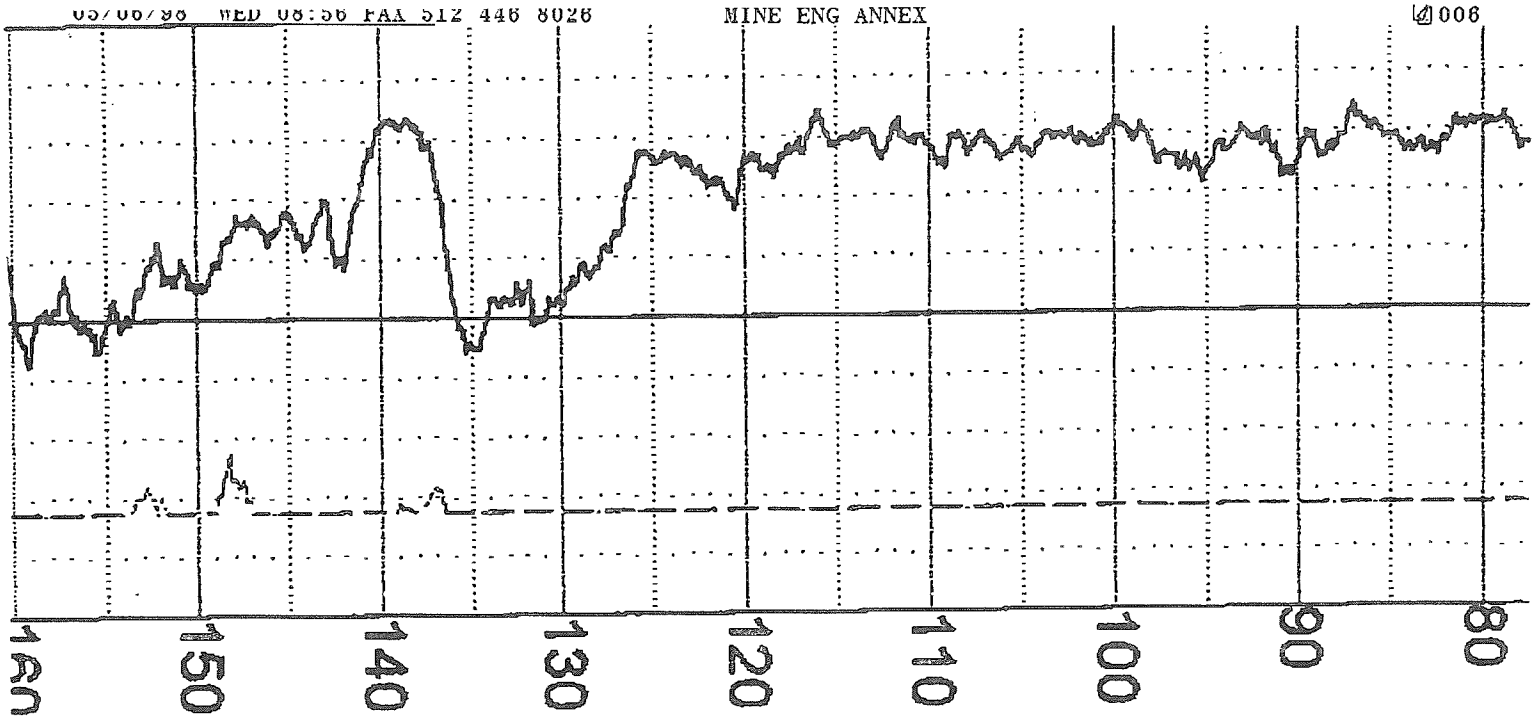
OHM-M
100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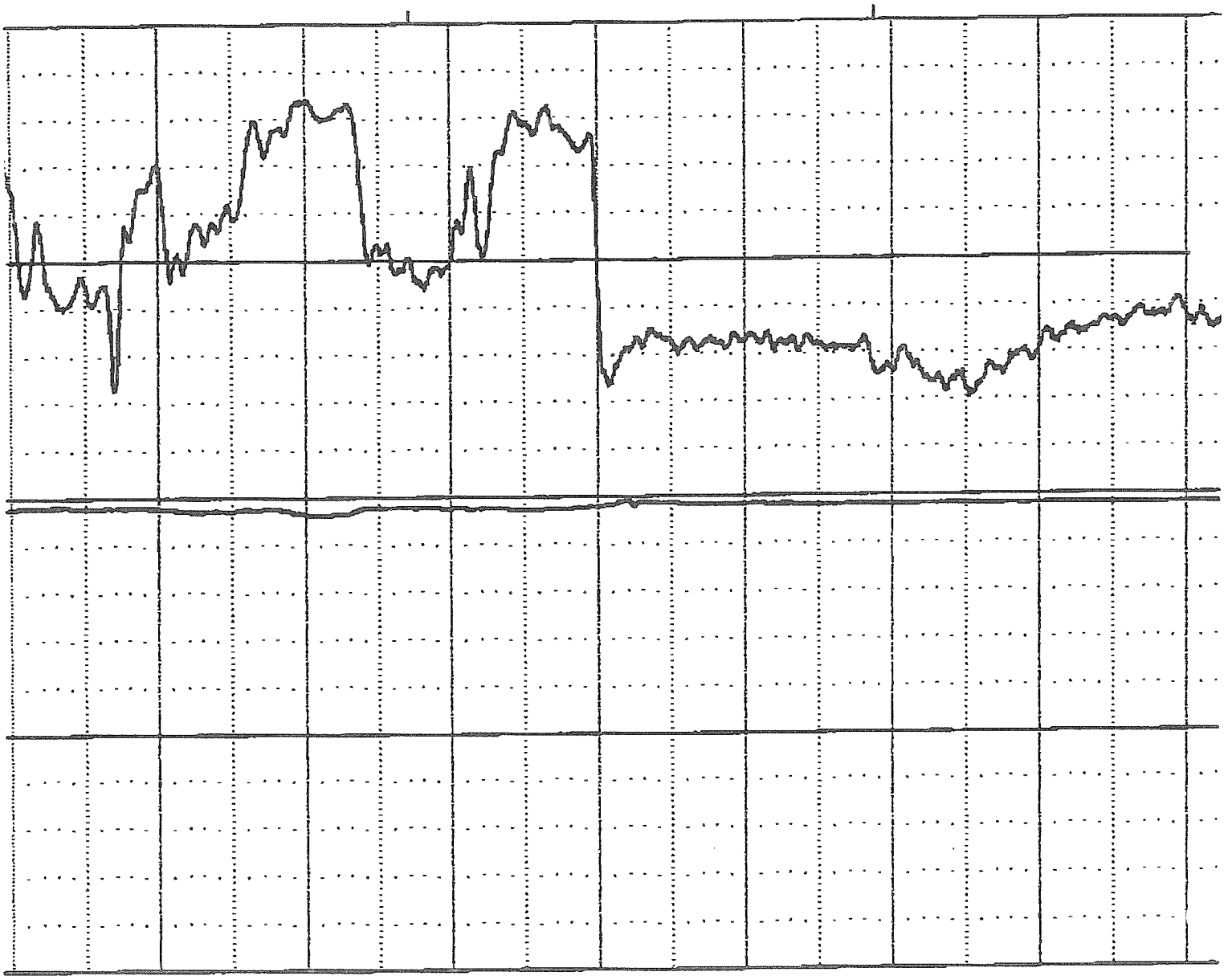

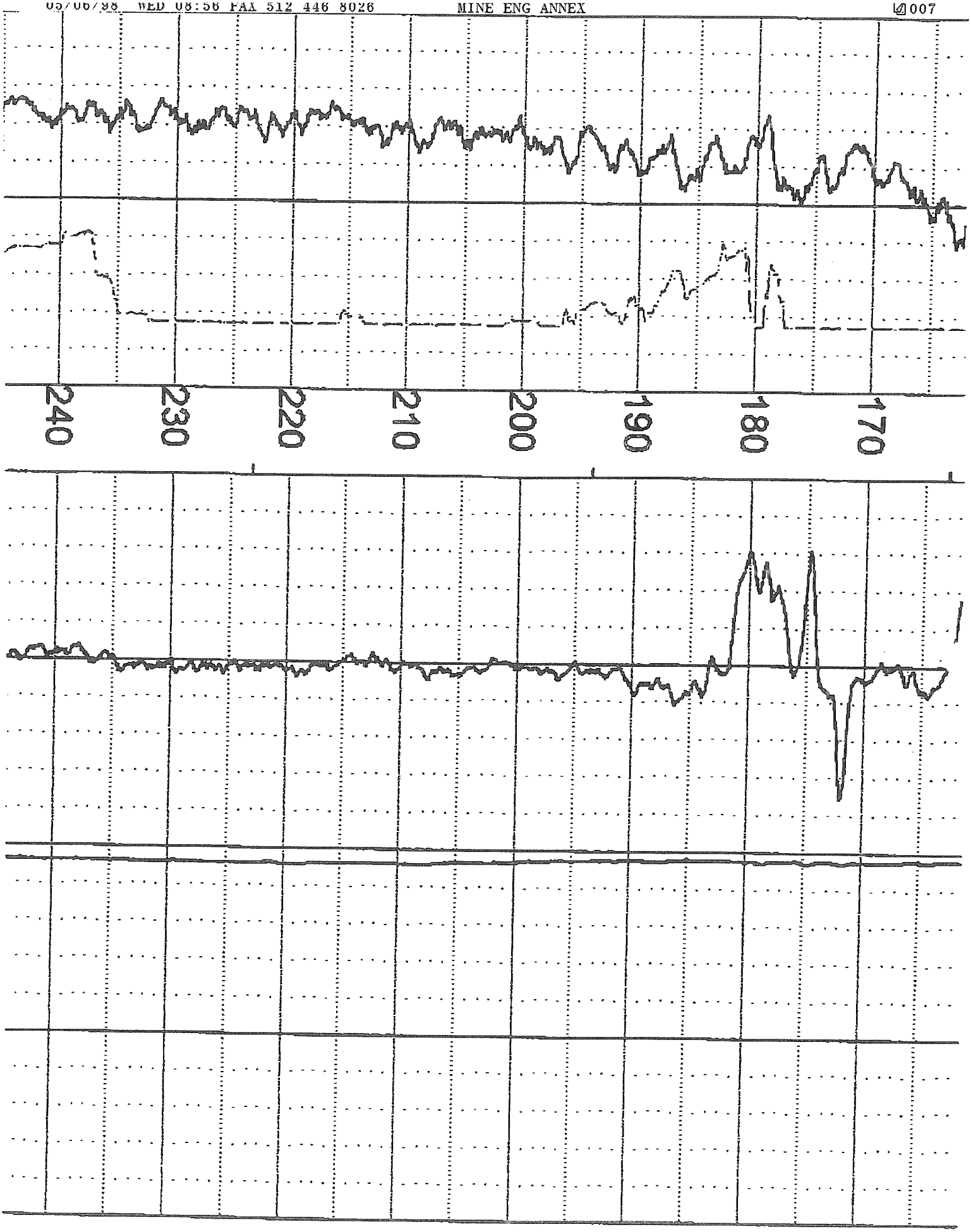
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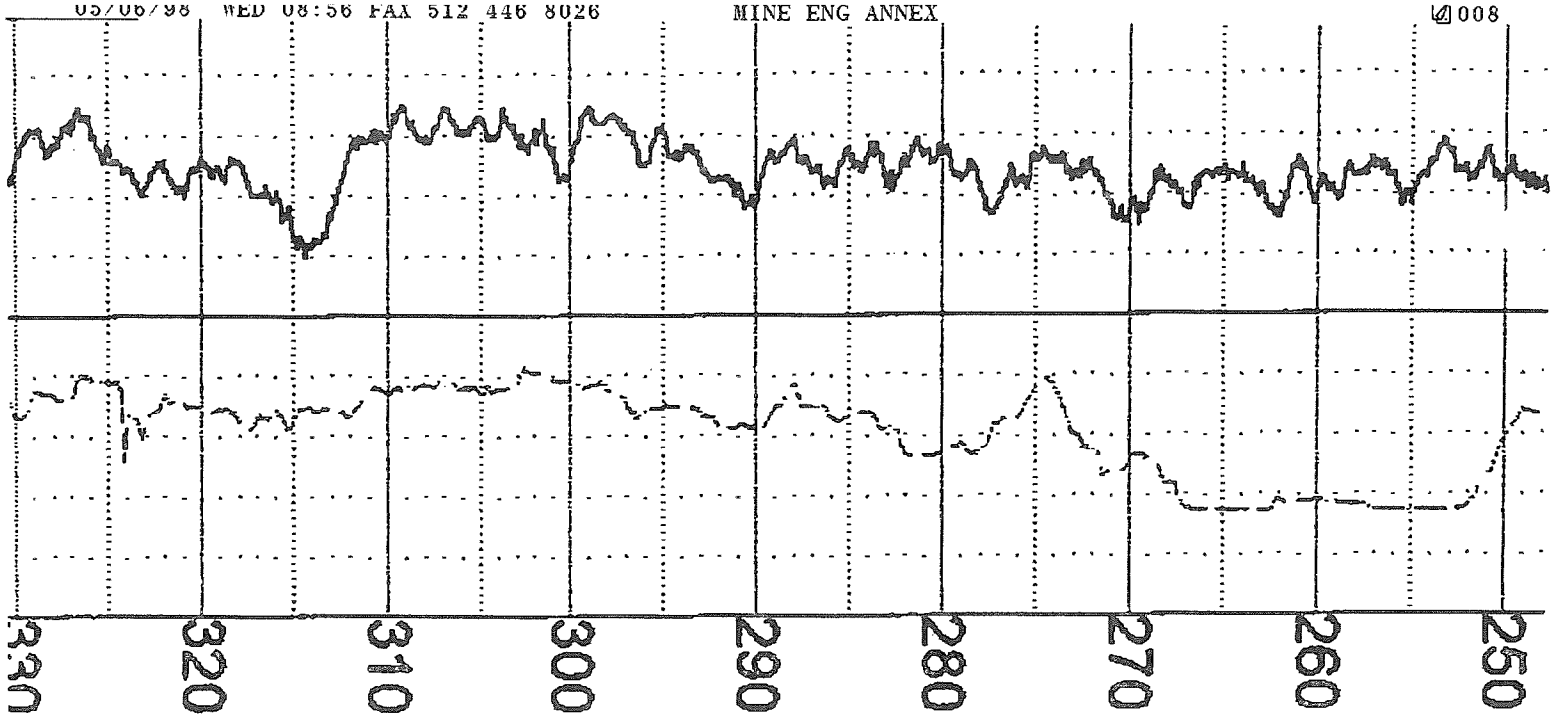
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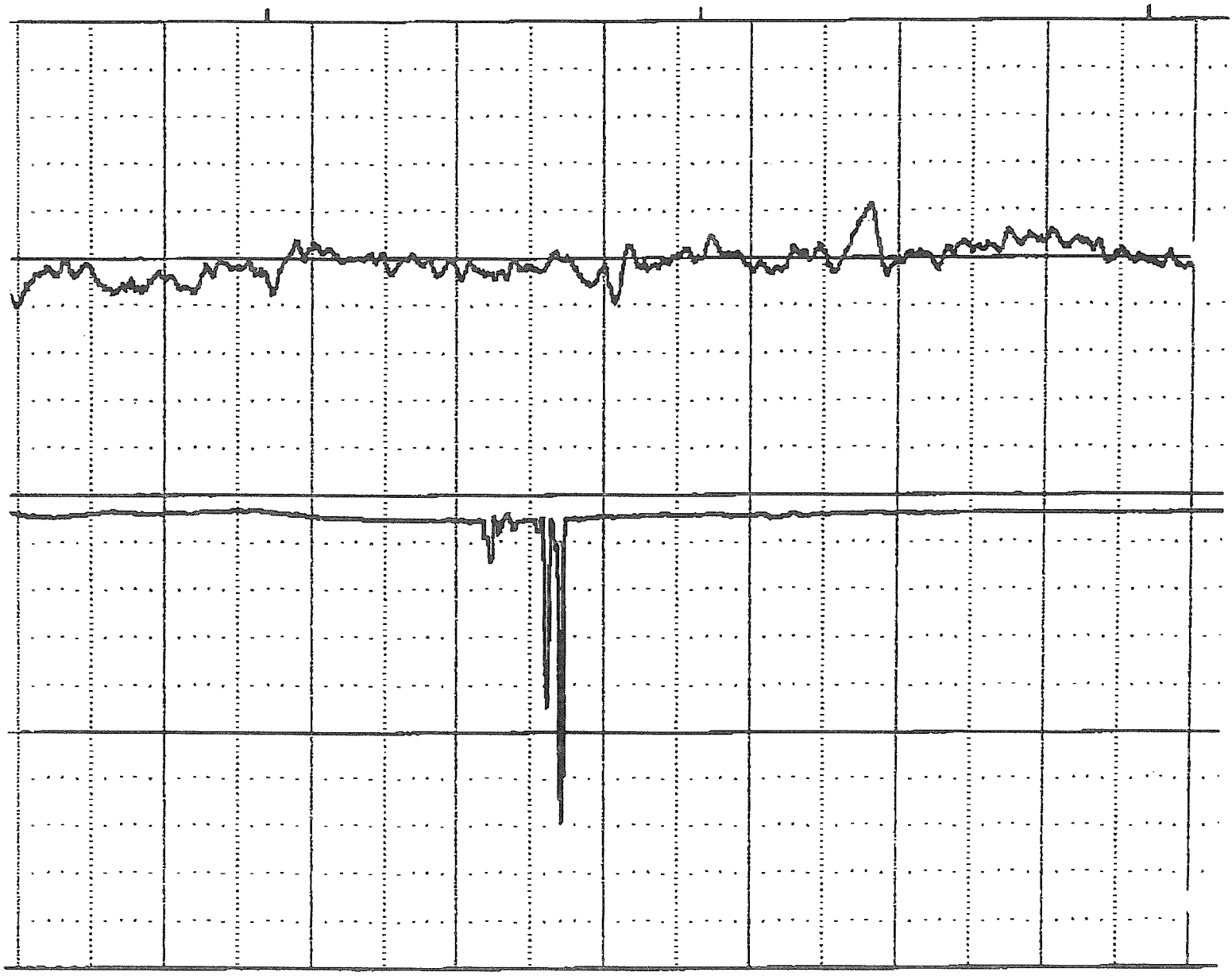

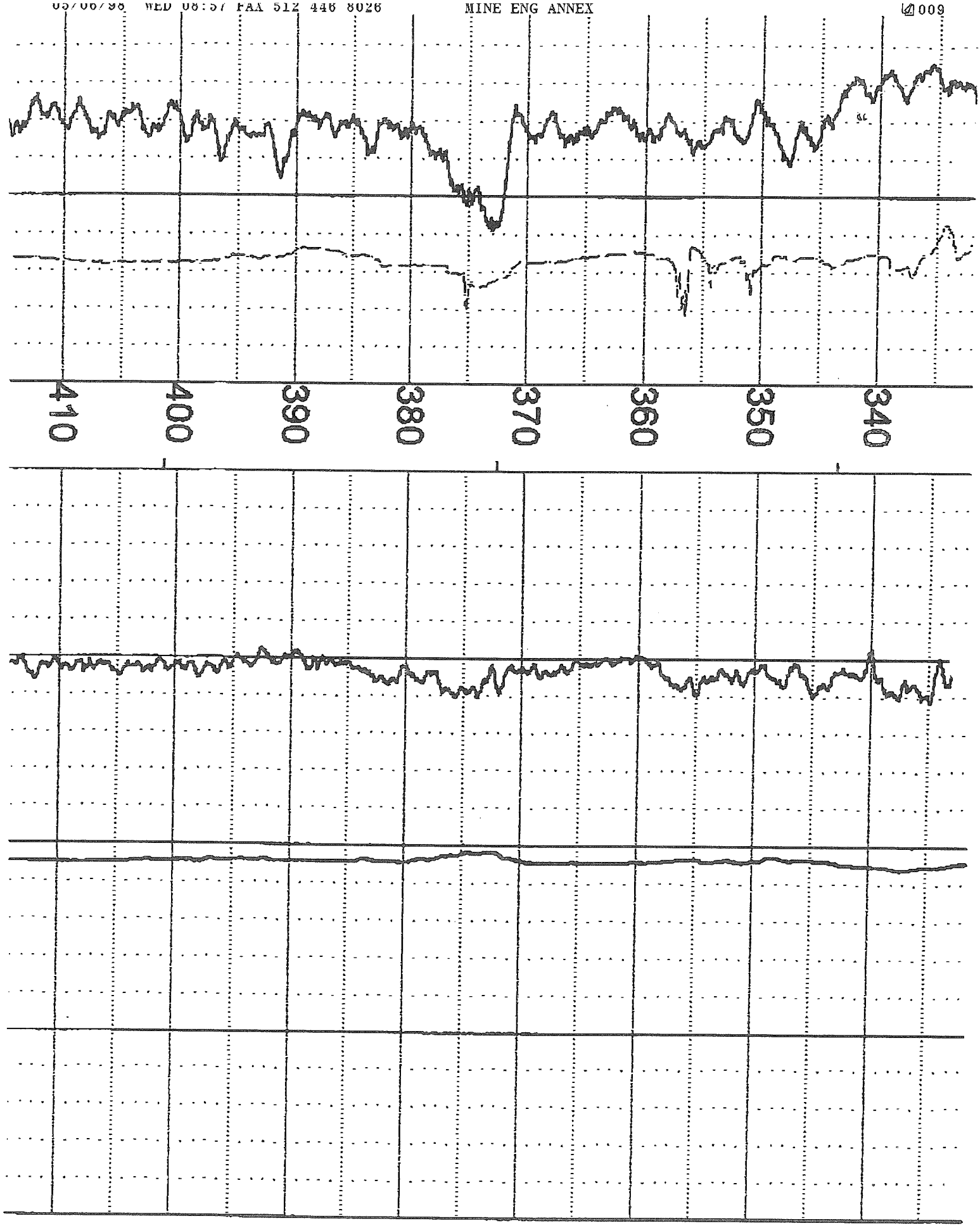
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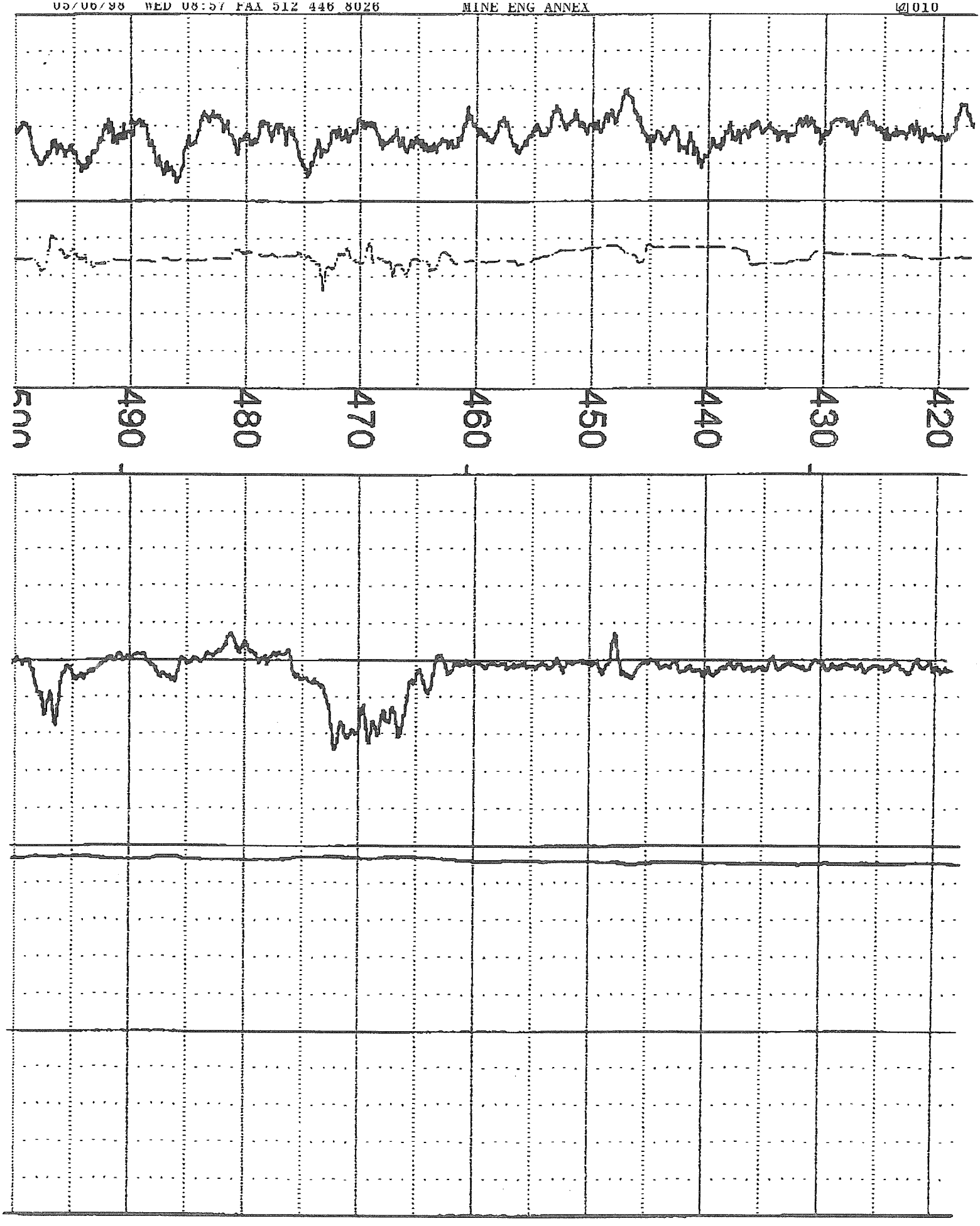
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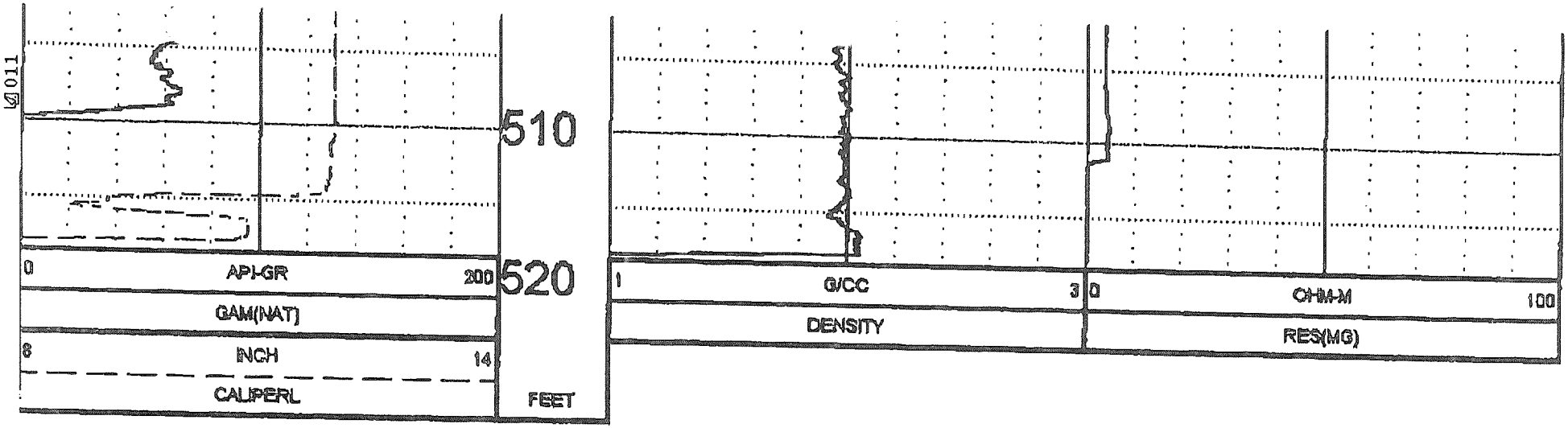


TOOL CALIBRATION C AREA DPZ 05/06/98 01:04
TOOL 9034AA1
SERIAL NUMBER 474

	DATE	TIME	SENSOR	STANDARD	RESPONSE
1	Apr28,98	12:38:51	GAM(NAT)	Default [API-GR]	Default [CPS]
	Apr28,98	12:38:51	GAM(NAT)	Default [API-GR]	Default [CPS]
2	Apr28,98	12:46:25	DENSITY	1.106 [G/CC]	9180 [CPS]
	Apr28,98	12:46:25	DENSITY	2.612 [G/CC]	2020 [CPS]
3	Apr28,98	12:38:51	RES(MG)	Default [OHM-M]	Default [CPS]
	Apr28,98	12:38:51	RES(MG)	Default [OHM-M]	Default [CPS]
4	Apr28,98	16:04:03	CALIPER	4.000 [INCH]	59005 [CPS]
	Apr28,98	16:04:03	CALIPER	6.000 [INCH]	83580 [CPS]
5	Apr28,98	12:38:51	DENSITYH	Default [G/CC]	Default [CPS]
	Apr28,98	12:38:51	DENSITYH	Default [G/CC]	Default [CPS]
6	May04,98	17:31:39	CALIPERL	4.000 [INCH]	47322 [CPS]
	May04,98	17:31:39	CALIPERL	6.000 [INCH]	57900 [CPS]

Available Construction Documentation

for Approved Operating Permit Well

C4247

Well/Piezometer Record

Site (Alcoa)

Date: 12-15-97
Mine Area: C (SPOIL WELL)
Well Number: C4247
Site Number:
Driller:
Company:
Slimhole / Piezometer / DP Well / DW Well / Test Well
Ground Level Elevation:
TOC Elevation:
Northing:
Easting:

Proposed Settings (RWH&A)

Material		Depth Interval (ft. BGL)			
9"	Casing	+2 - 238			
		438 - 448			
	Screen	238 - 438			
	Gravel	200 - 448			
	Cement	0-10	=	14	sacks
		100 - 200	=	115	sacks

Gravel Volume (ft^3): 330 ft3
Pump Column Length: 220

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured
After Development (ft. BMP):
Total Depth Inside Casing
Before Jetting (ft. BMP):
After Jetting (ft. BMP):
Rate Jetted (meas/estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC -- STEEL - Other

Drilling/Construction (Driller)

Date: 12-16-97
Mud Type: No. of bags:
Bit Size(s): 17.5"
Depth Drilled (ft. BGL): 443
Casing Dia. and Type: 9.05"$_{OD}$ PVC
Cased Interval (ft. BGL): +2-238
Screen Dia. and Type: 9.05"$_{OD}$ PVC
Screen Gauge: 0.010
Screened Interval (ft. BGL): 238'—448'
Gravel Volume (ft^3): ~350
Gravel Type:
Gravel Setting (ft. BGL): 198'-448'
Length of Gravel Tremie (ft.): 420
Depth to Top of Gravel (ft. BGL): ~200
Cement Type: PORTLAND NEAT
Cement Volume (sacks): 115
Volume of Water per Sack: ~7 GALS.
Length of Cement Tremie (ft.): 190'
Bentonite Volume (sacks): — ?

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:
Which is ft. AGL
Depth to Water (ft. BMP):

Notes/Construction Problems

SURFACE CASING 0' - 128 (20")

Aluminum Company of America

Sandow Mine

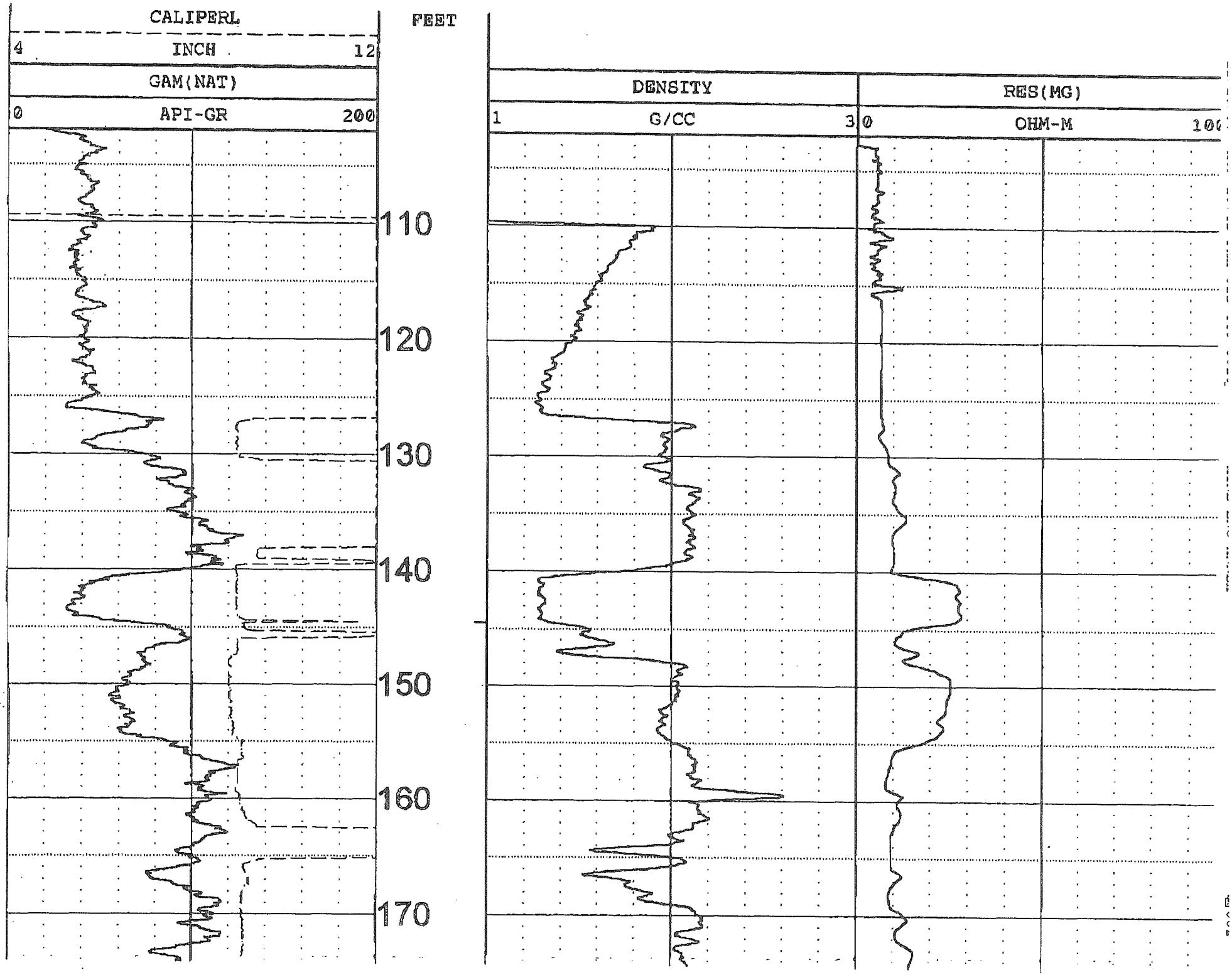
ALCOA Rockdale, Texas

~~C4245~~ C4247

Post-it® Fax Note 7671			
To KIRBY KAISER		Date 12/15/97	# of pages ▶ 4
Co./Dept. T		From RICKEY G	
Phone # (512) 345-3379		Co. ALCOA	
Fax # (512) 338-9372		Phone # (512) 448-8748	
		Fax # (512) 448-8620	

COMPANY	: ALCOA		OTHER SERVICES:		
WELL	: C4245				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 12/15/97	PERMANENT DATUM	:		
DEPTH DRILLER	: 540			KB	:
LOG BOTTOM	: 526.80	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 102.00	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	: 703		
CASING TYPE	:	FIELD OFFICE	: DL OPERATIO		
CASING THICKNESS:		RECORDED BY	: COLDIRON		
BIT SIZE	: 8 3/4	BOREHOLE FLUID	: 0	FILE	: ORIGINAL
MAGNETIC DECL.	: 0	RM	: 0	TYPE	: 9030AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: Dolomite	MATRIX DELTA T	: 54	THRESH:	2600

CS-3 DPZ
COND 1414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12
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API-GR
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FEET
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DENSITY
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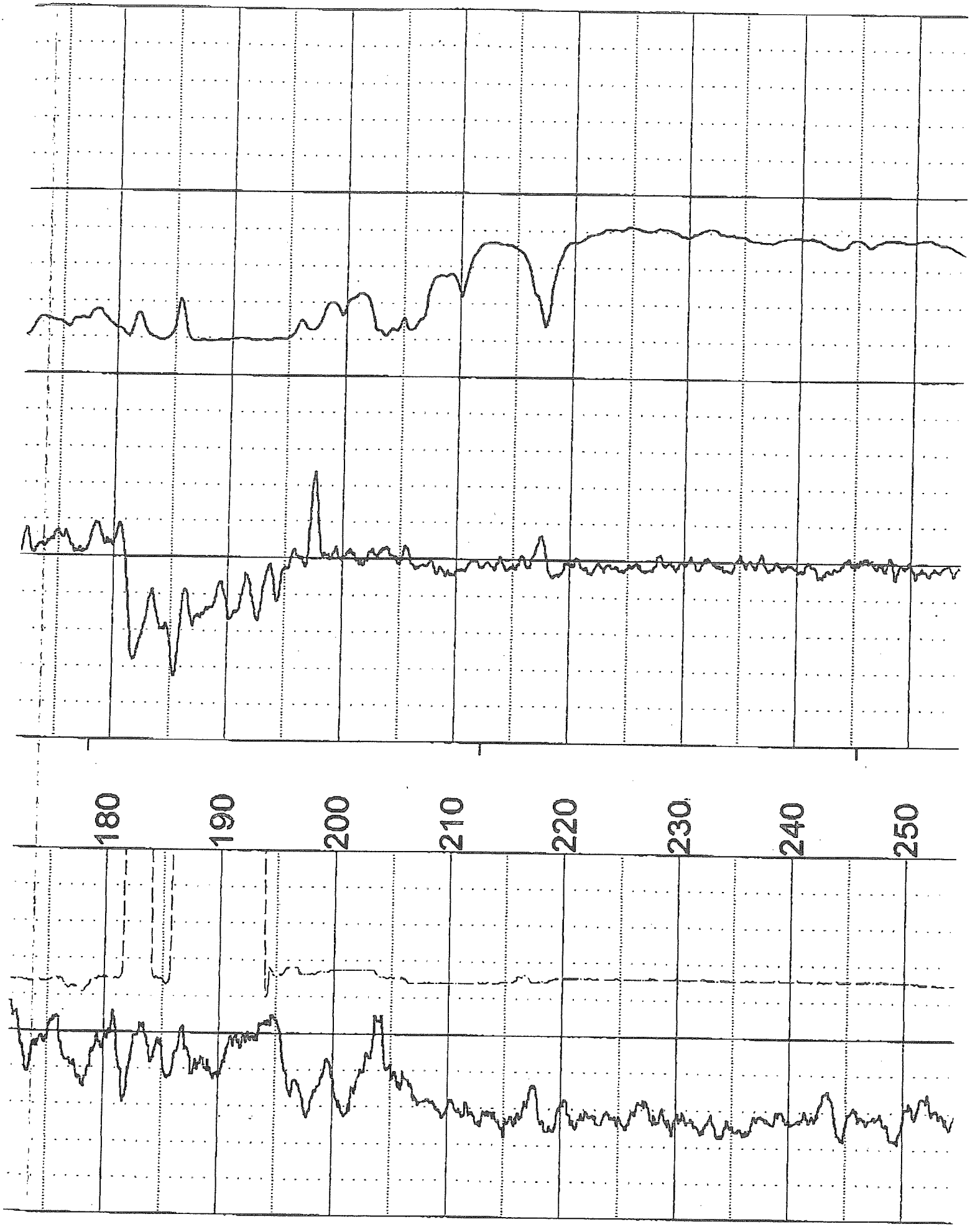
G/CC
3
RES(MG)
0
OHM-M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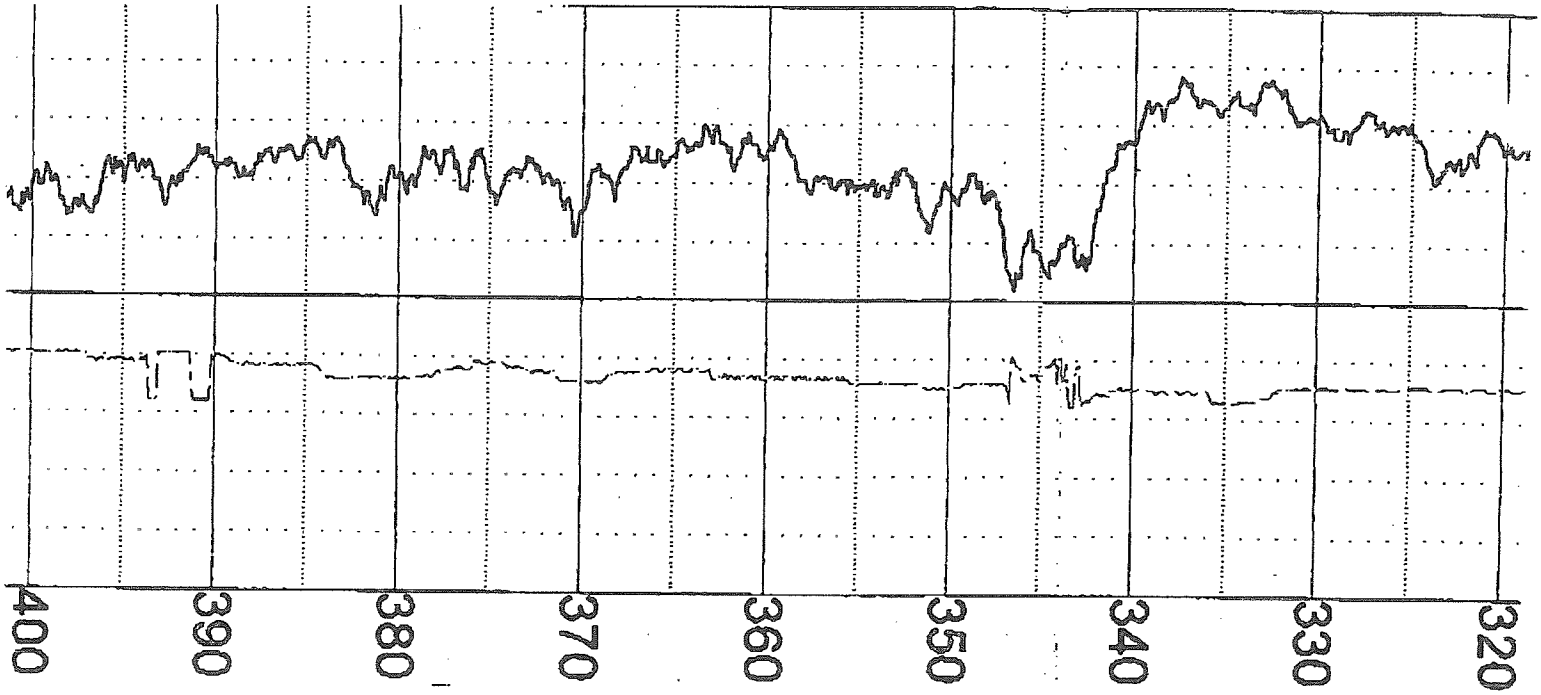
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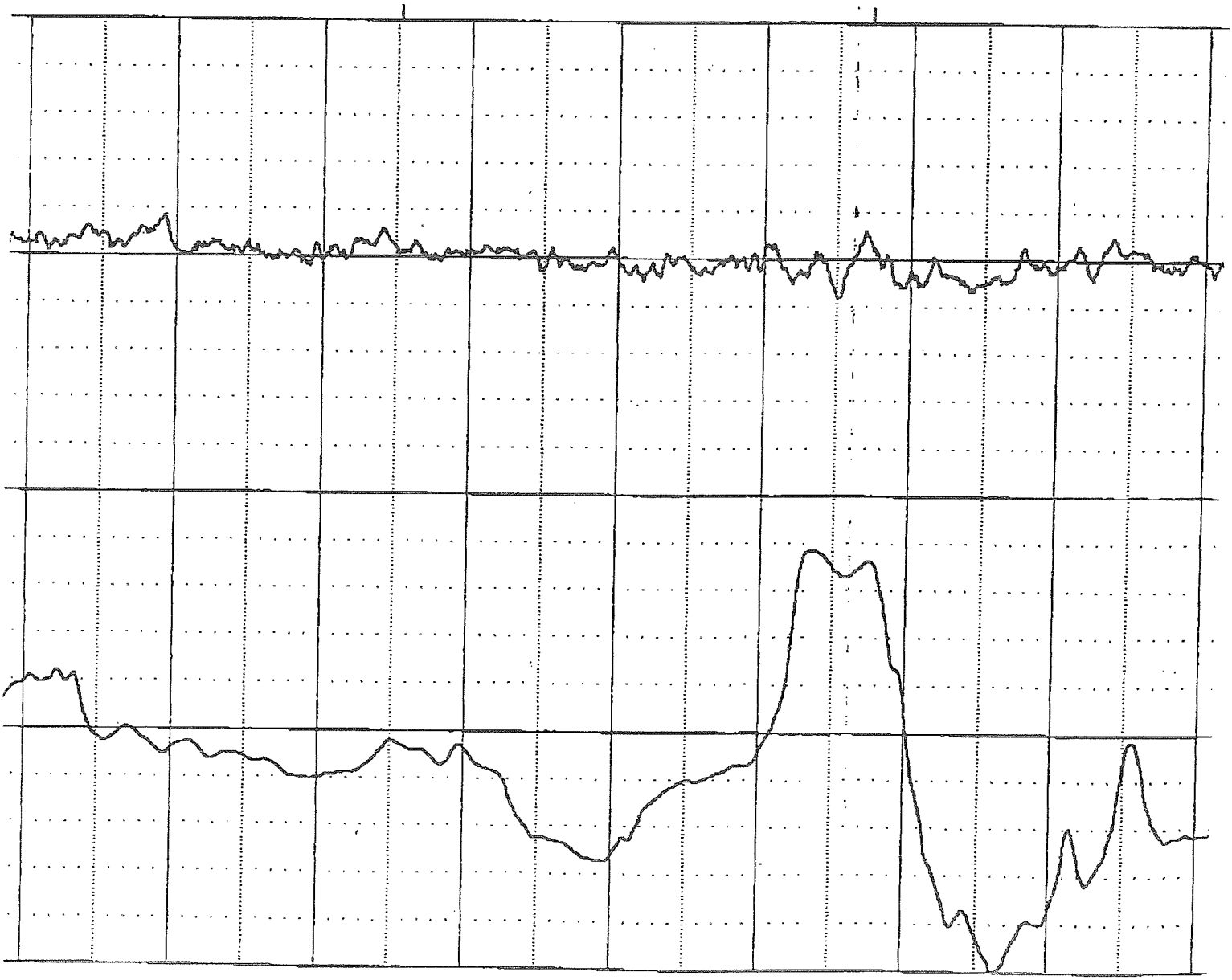
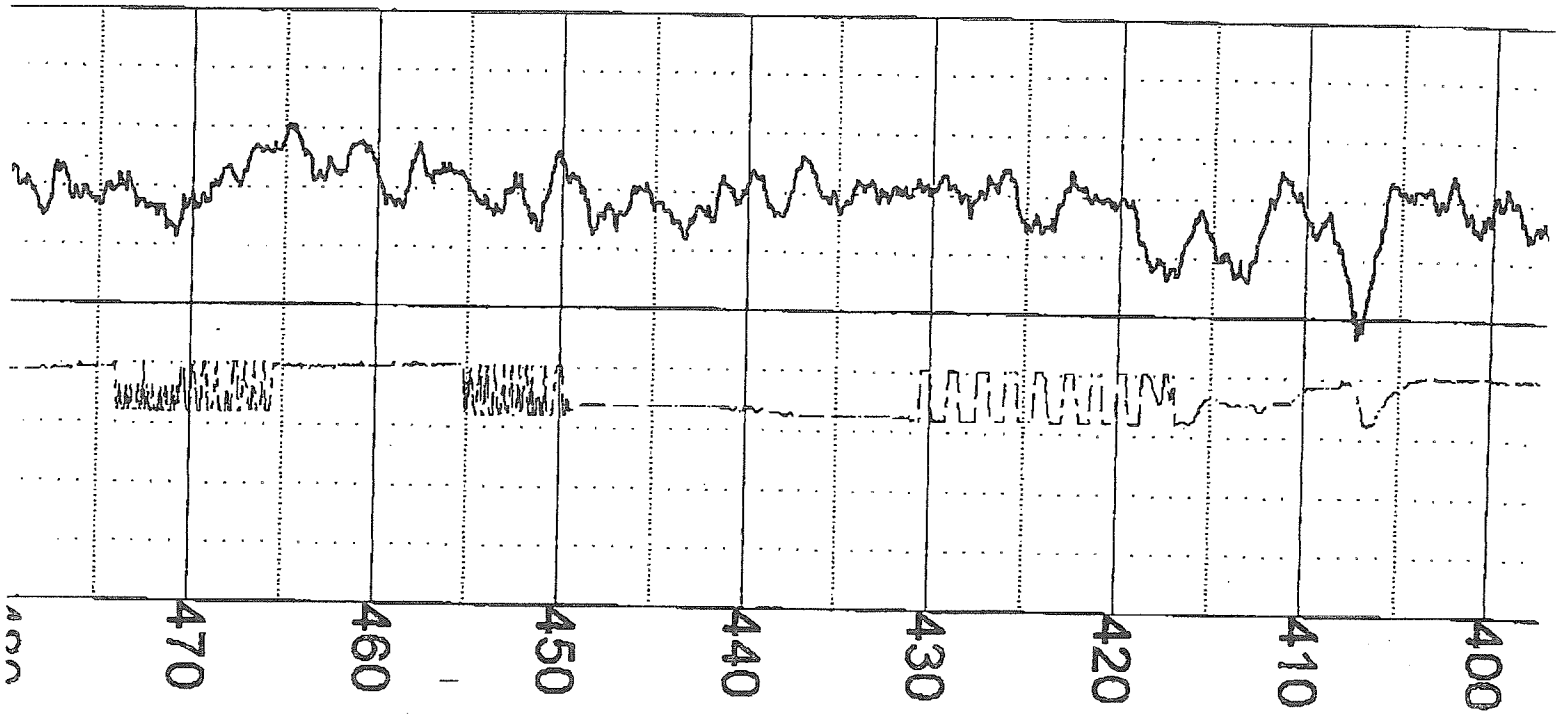
320

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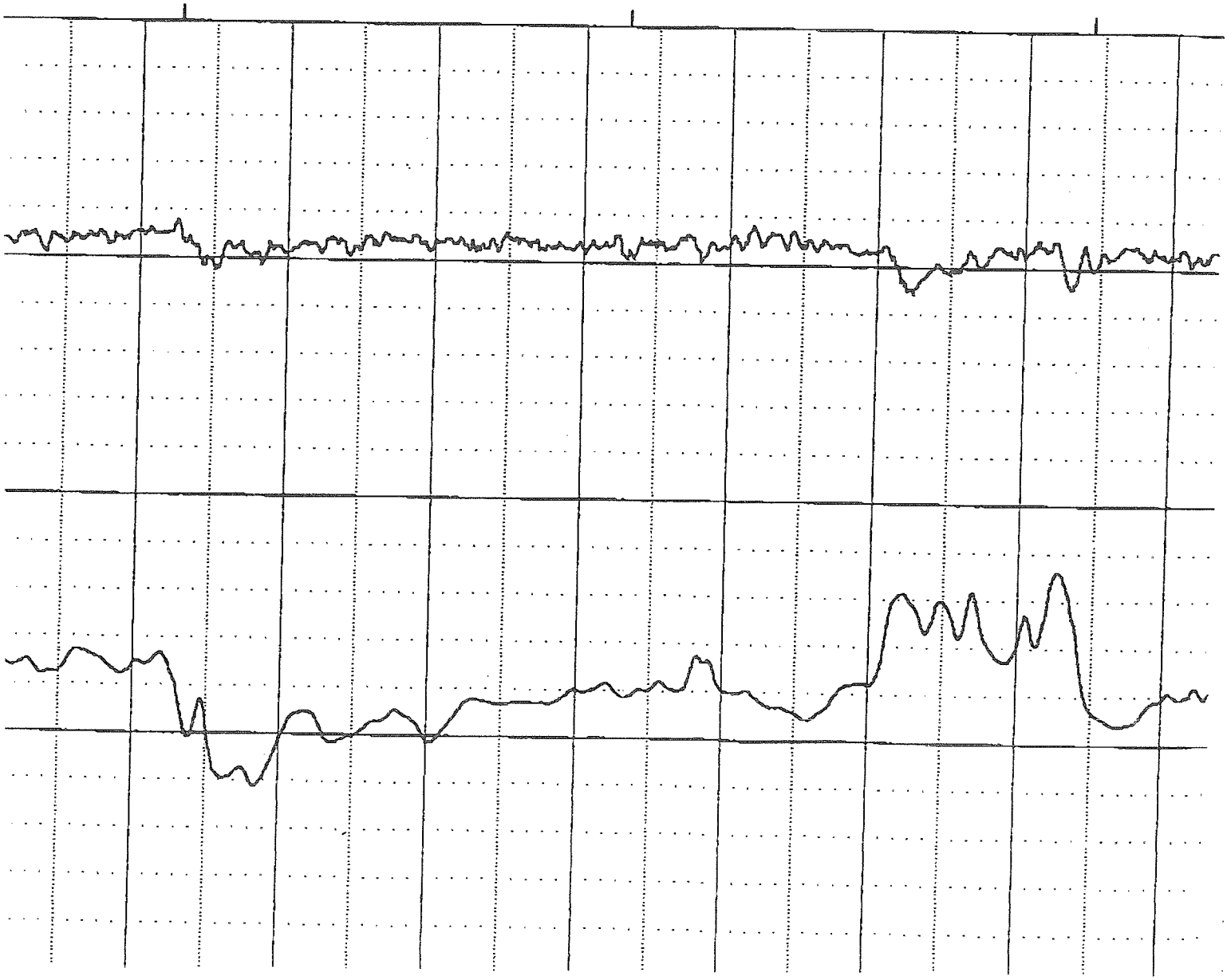
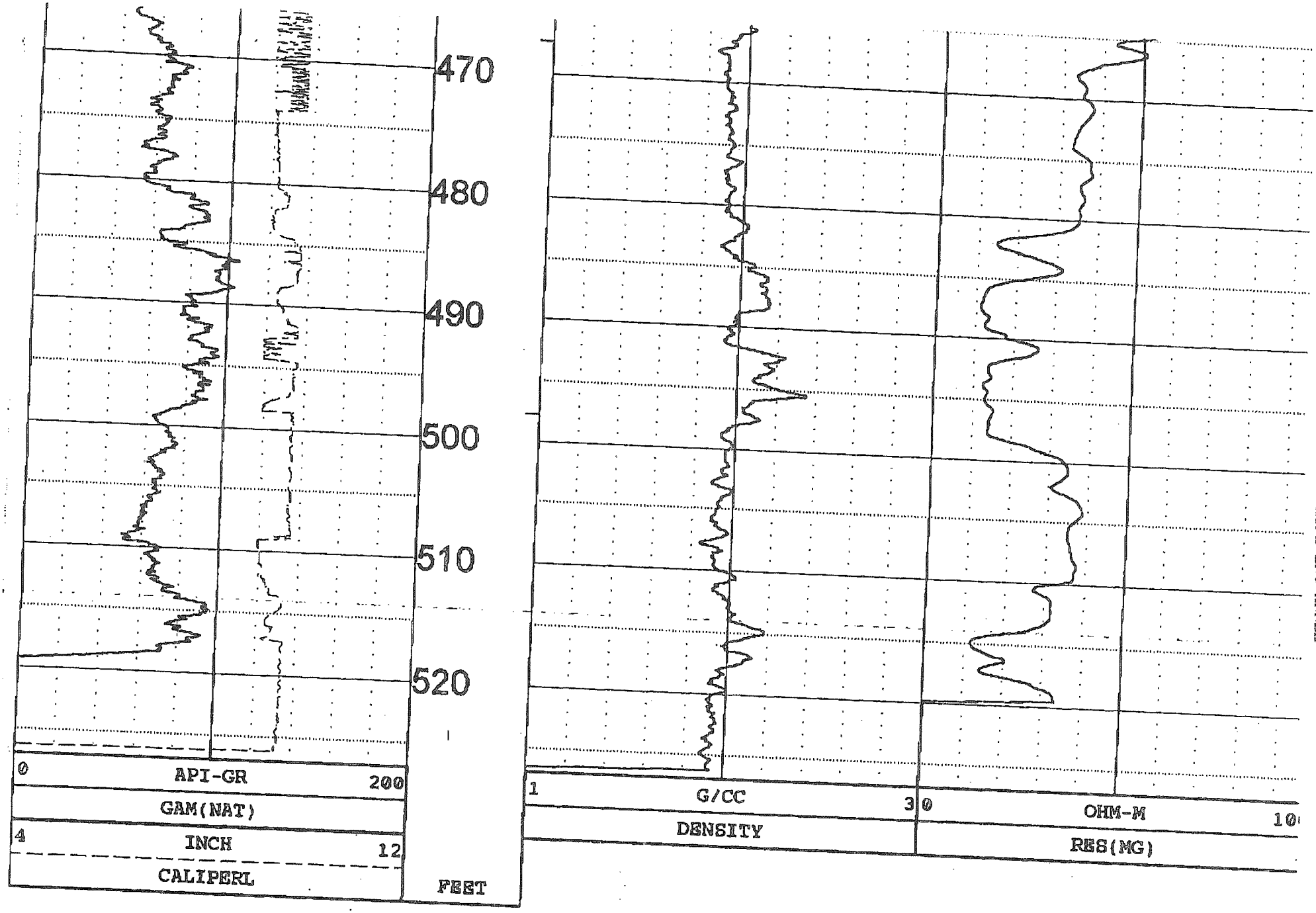
410
400




470
480
490
500
510
520
0
API-GR
200
GAM(NAT)
4
INCH
12
CALIPERL
FEET
1
G/CC
3
DENSITY
0
OHM-M
RES(MG)

Available Construction Documentation

for Approved Operating Permit Well

C4248A

Well/Piezometer Record

Site (Alcoa)

Date: 12-16-97
Mine Area: C-SPOIL
Well Number: C4248A
Site Number:
Driller: PETE
Company: MAC XPLORATION
Slimhole / Piezometer / (DP Well) / DW Well / Test Well
Ground Level Elevation:
TOC Elevation:
Northing:
Easting:

Proposed Settings (RWH&A)

Material		Depth Interval (ft. BGL)			
9.05	Casing	+2-258			
		478-488			
	Screen	258-478			
	Gravel	220-488			
	Cement	0-10	=	14	sacks
		95-220	=	140	sacks

Gravel Volume (ft^3): 361
Pump Column Length: 260

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured
After Development (ft. BMP):
Total Depth Inside Casing
Before Jetting (ft. BMP):
After Jetting (ft. BMP):
Rate Jetted (meas/estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC - STEEL - Other

Drilling/Construction (Driller)

Date: 12-17-97
Mud Type: Poly Gel No. of bags: ?
Bit Size(s): 17 1/2
Depth Drilled (ft. BGL): 488'
Casing Dia. and Type: 9.05
Cased Interval (ft. BGL): +2-258
Screen Dia. and Type: 9.05
Screen Gauge: 0.010
Screened Interval (ft. BGL): 258-478
Gravel Volume (ft^3): ≈ 380 cu. ft.
Gravel Type:
Gravel Setting (ft. BGL): 217'-488'
Length of Gravel Tremie (ft.): 421'
Depth to Top of Gravel (ft. BGL): 217'
Cement Type: PORTLAND NEAT
Cement Volume (sacks): 140
Volume of Water per Sack: .7 cu. ft
Length of Cement Tremie (ft.): 210'
Bentonite Volume (sacks): ?

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:

Which is ft. AGL
Depth to Water (ft. BMP):

Notes/Construction Problems

CASING COLLAPSED @ 115'

Available Construction Documentation

for Approved Operating Permit Well

C4250A

446-8026

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 12/31/98

Mine Area C

Well Number CS-5 G4280A

Site Number CS-5

Driller ________ Company MHC

Slimhole / Piezometer / (Depressurization Well)

Ground Level Elevation ________

TOC Elevation ________

Northing ________

Easting ________

DRILLING/CONSTRUCTION (MHC)

Date ________

Mud Type ________ No. Bags ________

Bit Size ________

Depth Drilled, Ft. BGL ________

Casing Diameter and Type ________

Cased Interval, Ft. BGL ________

Screen Diameter and Type ________

Screen Guage ________

Screened Interval, Ft. BGL ________

Amount of Gravel Used, Sacks ________

Gravel Type ________

Gravel Setting, Ft. BGL ________

Length of Gravel Tremmie, Ft. ________

Depth to Top of Gravel, Ft. BGL ________

Cement Type ________. Lbs Per Sack ________

Sacks of Cement Used ________

Sacks of Bentonite Used ________

Amount of Water Used, Gals. ________

Length of Cement Tremmie, Ft. ________

NOTES/CONSTRUCTION PROBLEMS

GRAVEL 216 FT^3

CEMENT 0-20 = 16 SKS

120-200 = 60 SKS

USE STEEL CASING +2-238

DEVELOPMENT (MHC)

Start, Time/Date ________

Finish, Time/Date ________

Total Time Jetted ________

Static Water-Level Measured

After Devolopment ________

Total Depth Inside Casing (Measured)

Before Jetting (Date), Ft. BGL ________

After Jetting (Date), Ft. BGL ________

Rate Jetted (Meas./Est.), gpm ________

PUMP/MOTOR (MHC)

Motor H.P. ________

Length of Column Pipe (ft.) ________

INSPECTION COMPLETION (ALCOA)

Date ________ Time ________

Measuring Point Description ________

Which is ________ Ft. A.G.L.

Depth to Water, Ft. B.T.O.C. ________

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well Casing	+2-238
	398-408
Screen	238-398
Gravel	200-408
Cement	0-20, 120-200

Pump Column Length 300

Measuring Pipe

Casing ________

Screen ________

ALCOA

Aluminum Company of America

Southern Mines

Rockdale, Texas

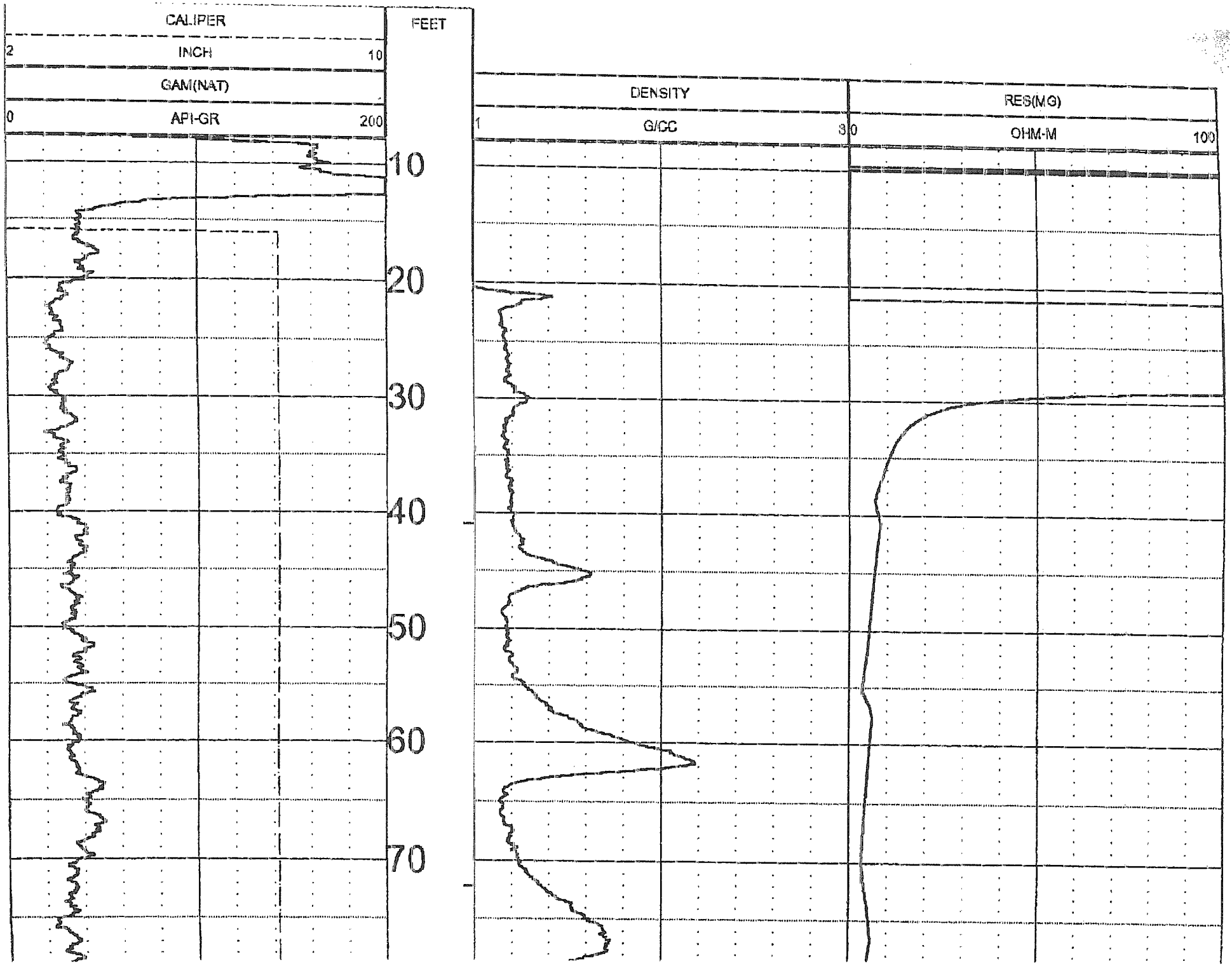
C4250A

CS-5

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: CS-5				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 12/31/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 480			KB	:
LOG BOTTOM	: 467.80	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 7.80	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS:	0	RECORDED BY	: COLDIRON		
BIT SIZE	: 8.5	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9034AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH:	30000

DPZ

: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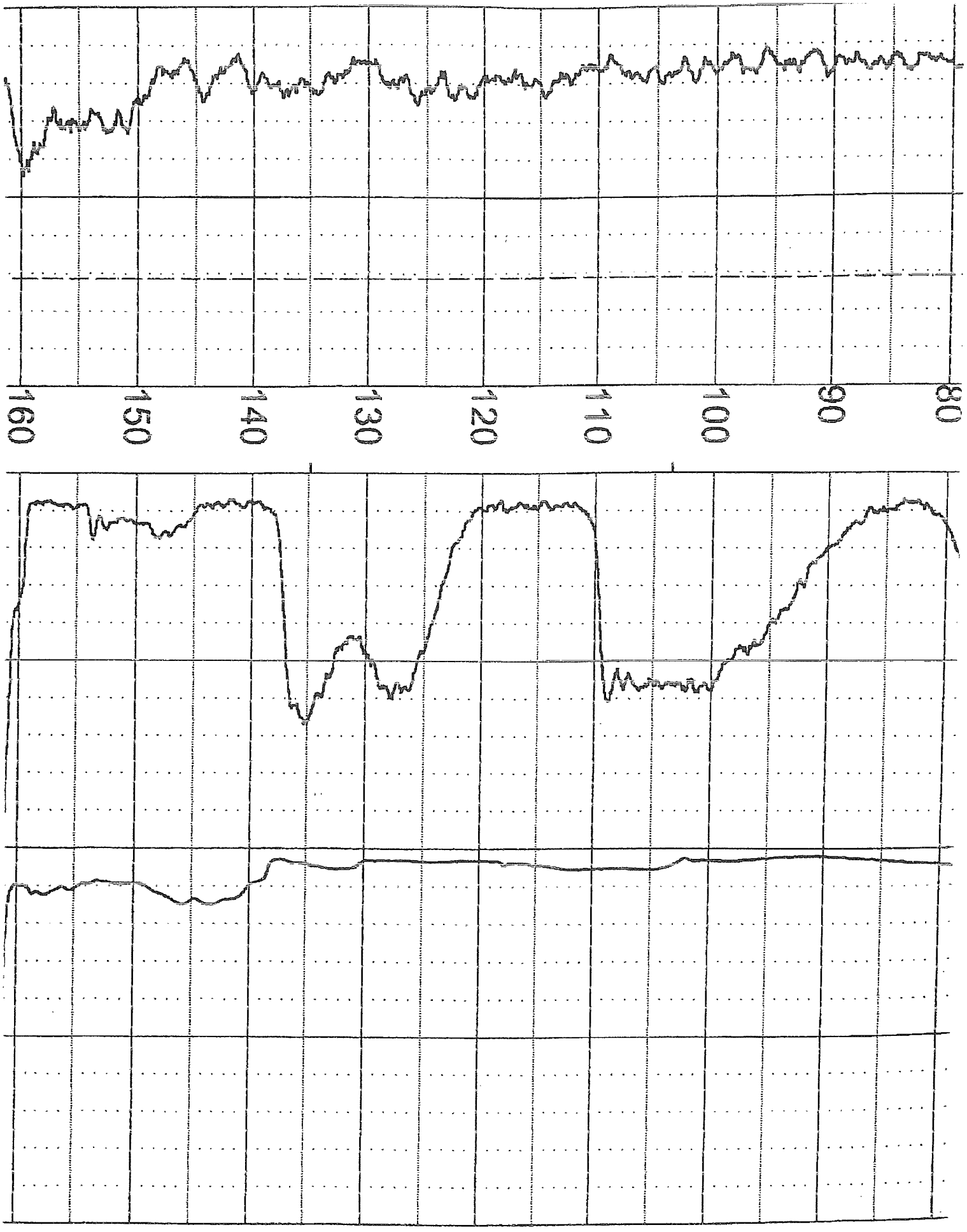
2
INCH
10
GAM(NAT)
0
API-GR
200
FEET
10
20
30
40
50
60
70
DENSITY
1
G/CC
3
RES(MG)
0
OHM-M
100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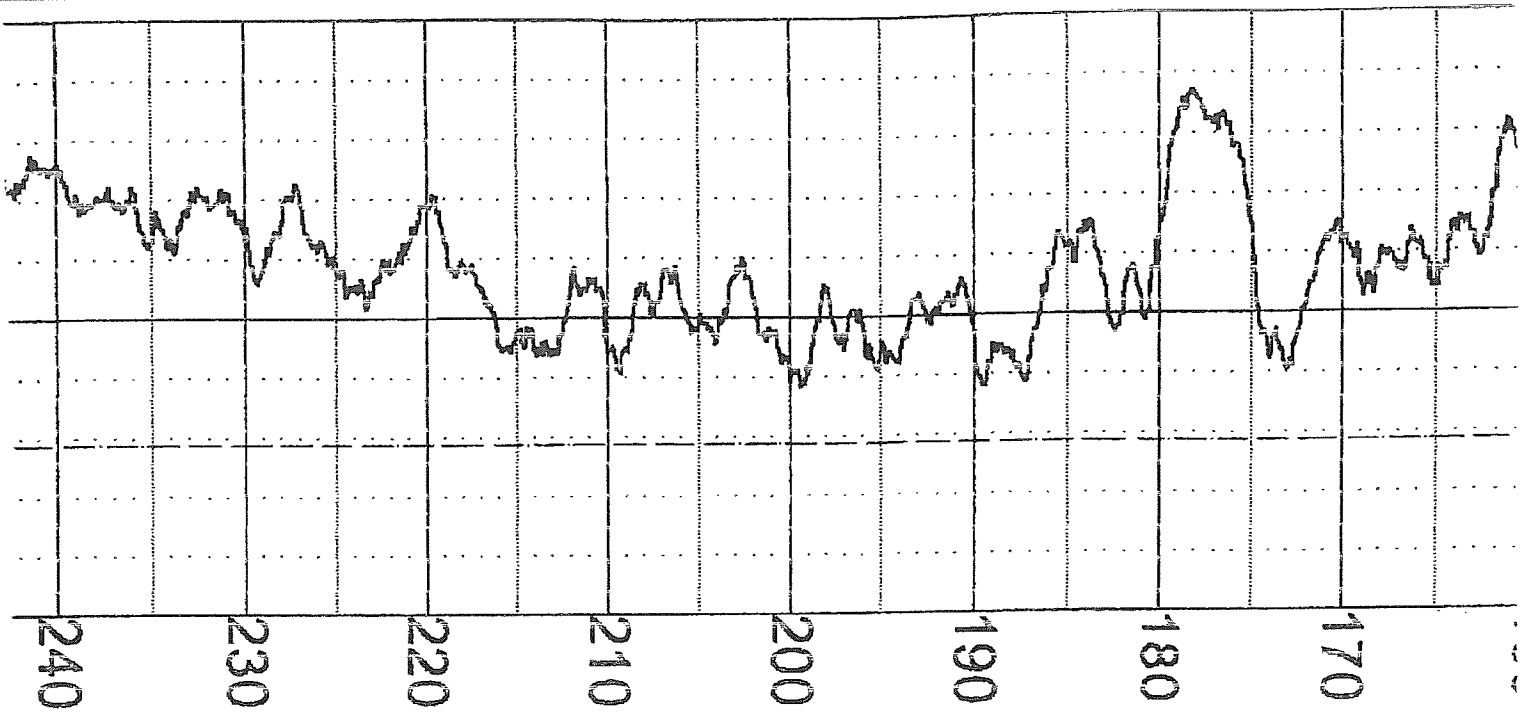
110
100
90
80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220
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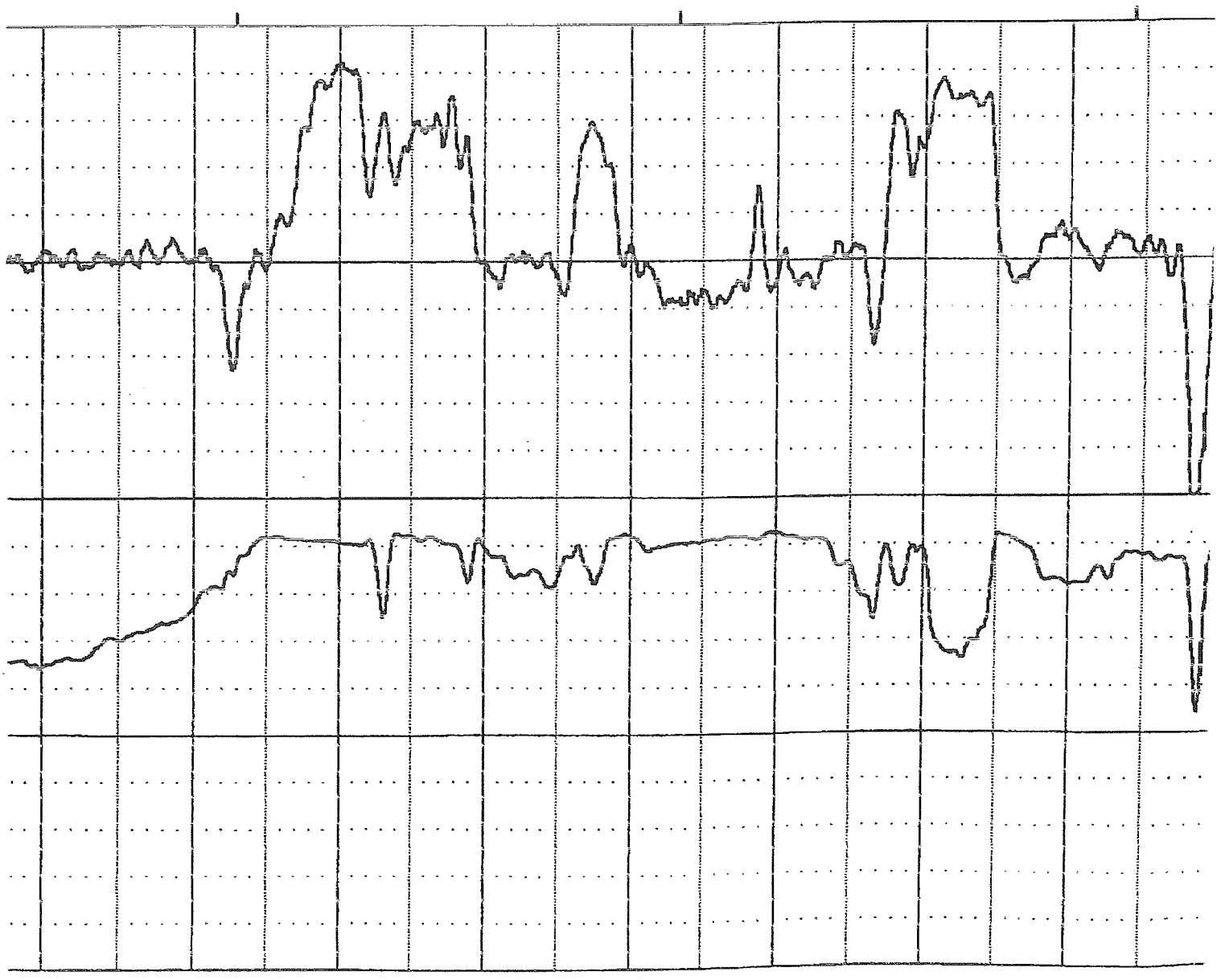
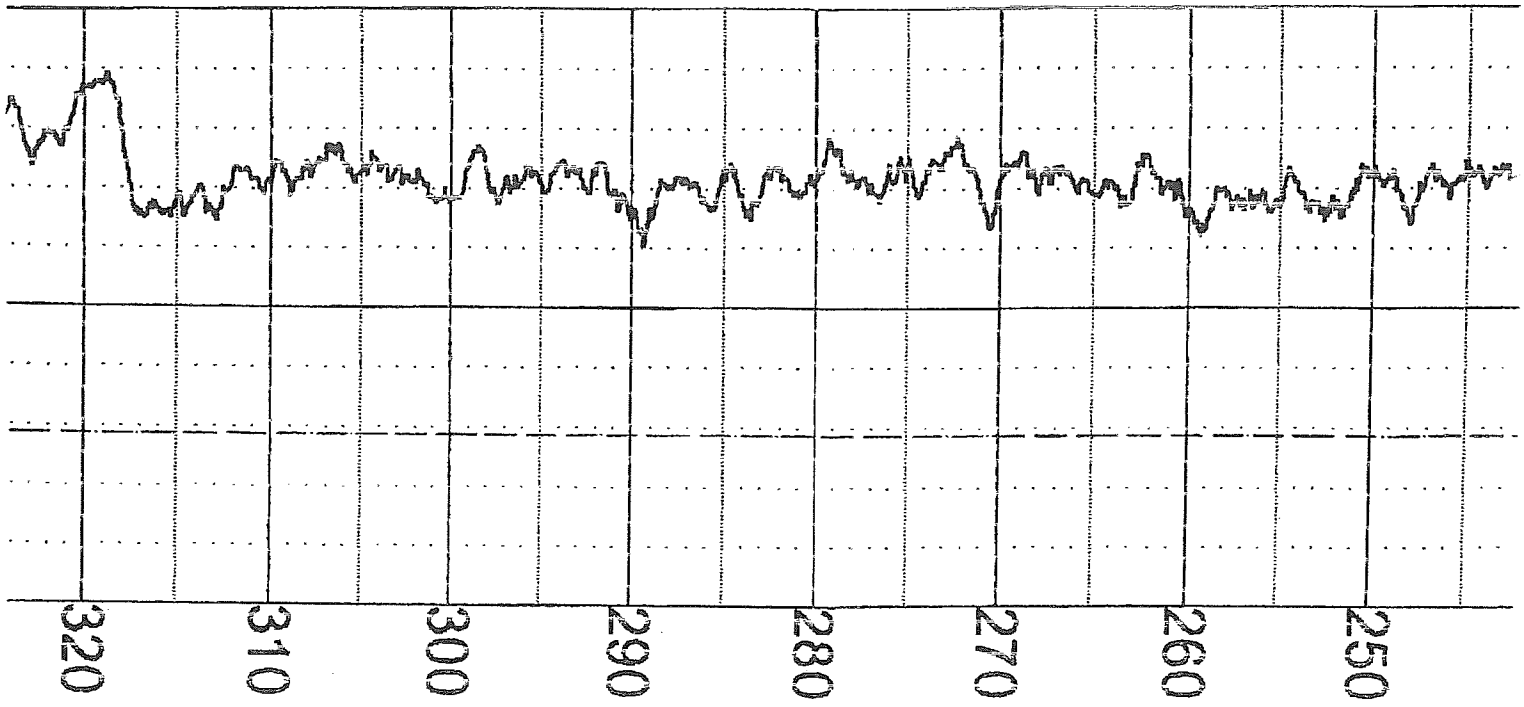
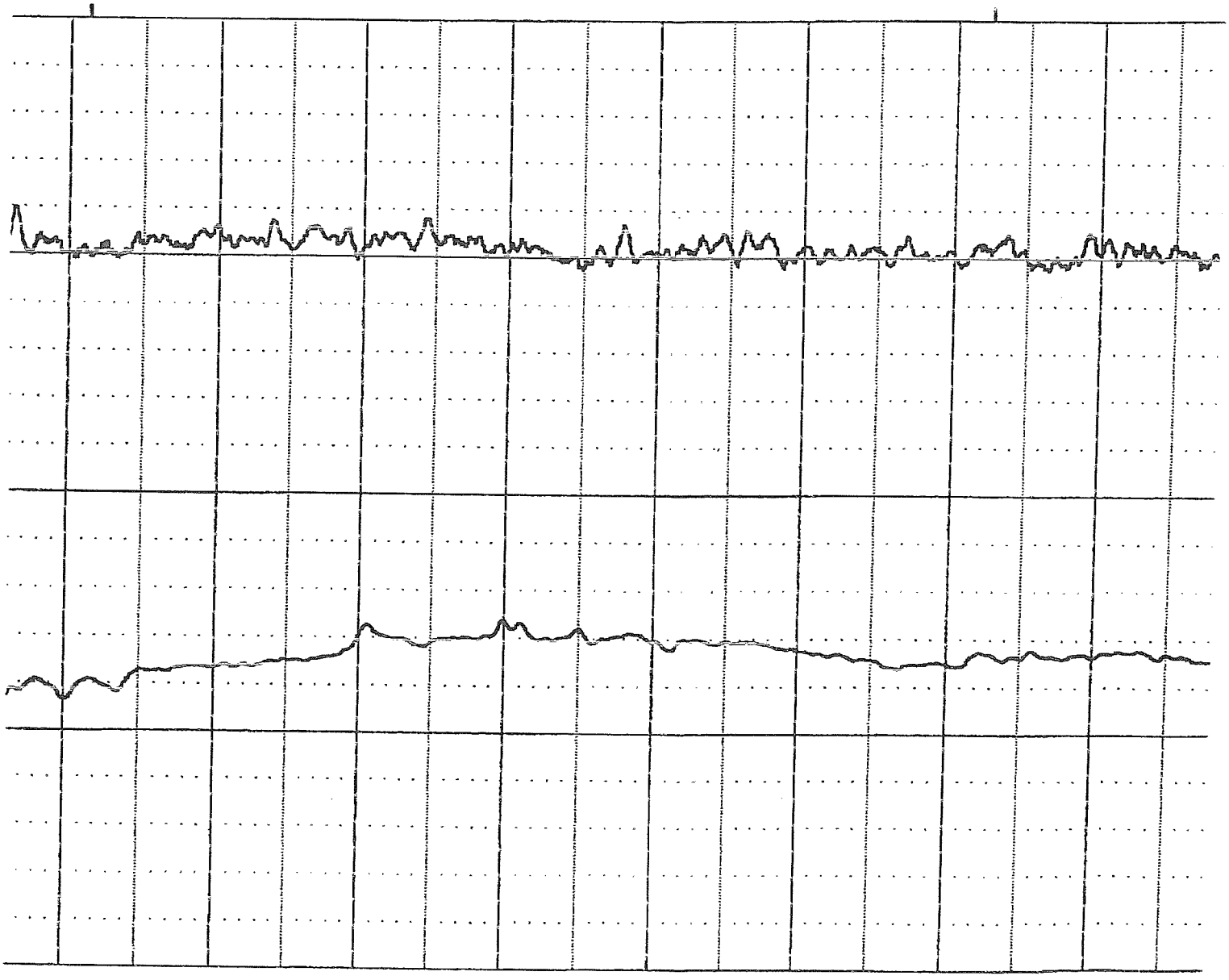
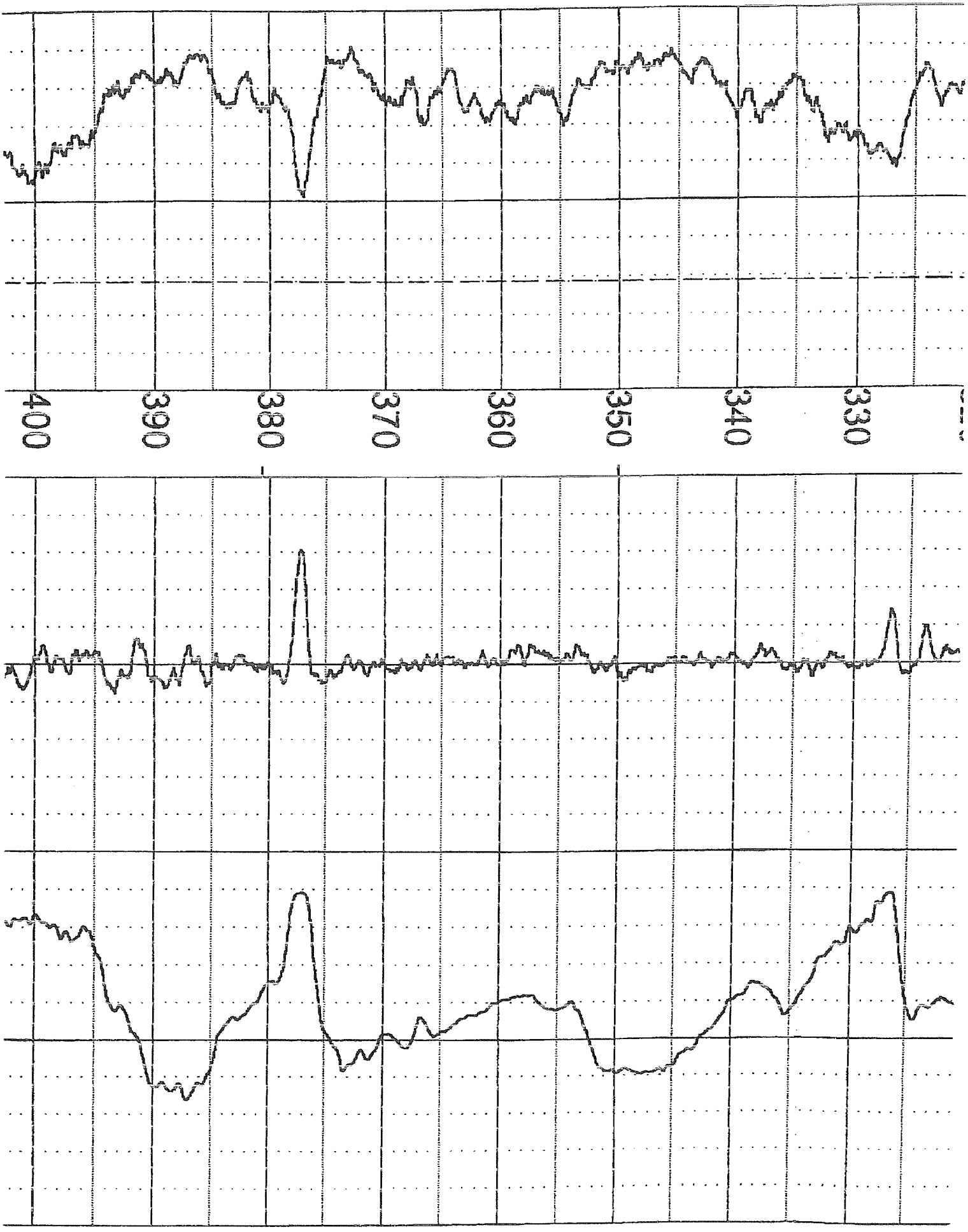
200
190
180
170




320
310
300
290
280
270
260
250

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390
380
370
360
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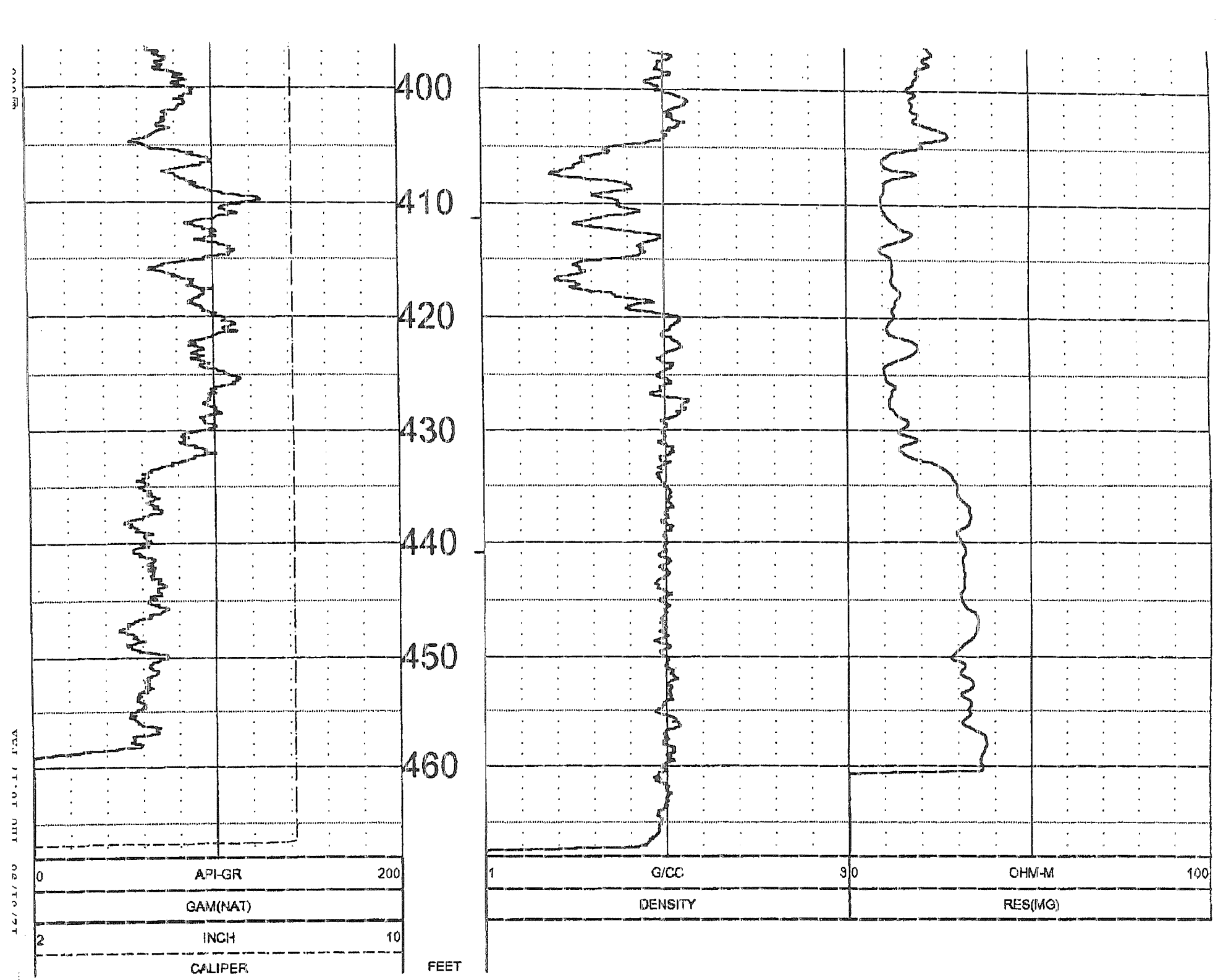
340
330


400
410
420
430
440
450
460
0
API-GR
200
GAM(NAT)
2
INCH
10
CALIPER
FEET
1
G/CC
3
DENSITY
0
OHM-M
100
RES(MG)

Available Construction Documentation

for Approved Operating Permit Well

C5245B

Well/Piezometer Record

Site (Alcoa)

Date: 8-27-98
Mine Area: C
Well Number: C 52458
Site Number: C-9-11
Driller:
Company: MHC
Slimhole / Piezometer / (DP Well) / DW Well / Test Well
Ground Level Elevation:
TOC Elevation:
Northing:
Easting:

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)		
Casing	+2 - 358		
	458 - 468		
Screen	358 - 458		
Gravel	320 - 468		
Cement	130 - 320	= 171	sacks
	0 - 20	= 18	sacks

Gravel Volume (ft^3): 196
Pump Column Length: 358

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured
After Development (ft. BMP):
Total Depth Inside Casing
Before Jetting (ft. BMP):
After Jetting (ft. BMP):
Rate Jetted (meas/estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC - STEEL - Other

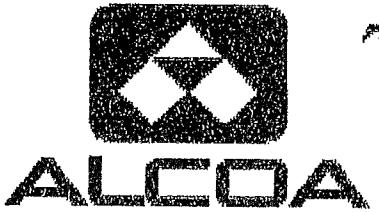
Drilling/Construction (Driller)

Date:
Mud Type: No. of bags:
Bit Size(s):
Depth Drilled (ft. BGL):
Casing Dia. and Type:
Cased Interval (ft. BGL):
Screen Dia. and Type:
Screen Gauge:
Screened Interval (ft. BGL):
Gravel Volume (ft^3):
Gravel Type:
Gravel Setting (ft. BGL):
Length of Gravel Tremie (ft.):
Depth to Top of Gravel (ft. BGL):
Cement Type:
Cement Volume (sacks):
Volume of Water per Sack:
Length of Cement Tremie (ft.):
Bentonite Volume (sacks):

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:
Which is ft. AGL
Depth to Water (ft. BMP):

Notes/Construction Problems



Aluminum Company of America

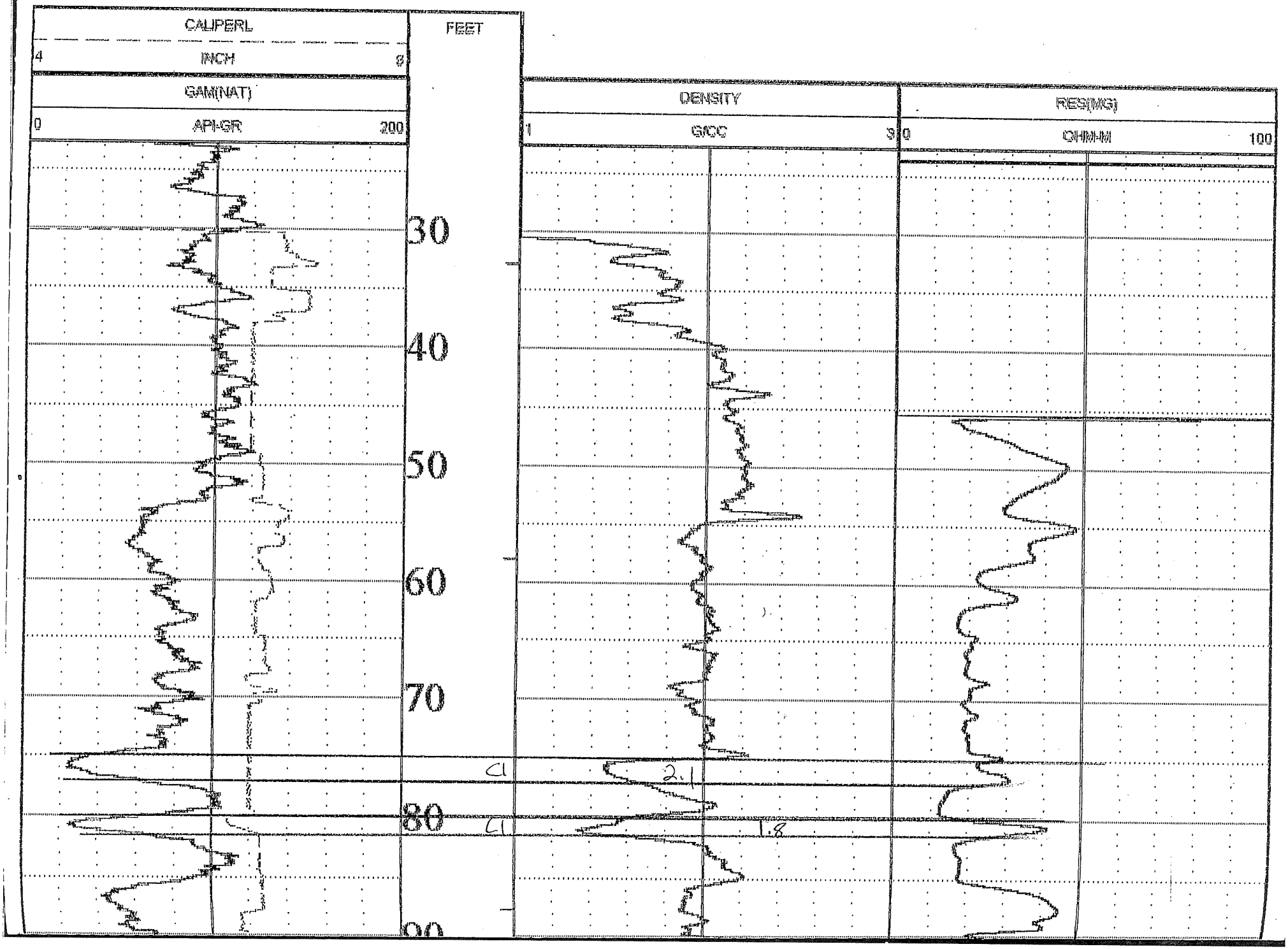
Sandow Mine

Rockdale, Texas

C(9)-11 C5245B

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: C(9)-11				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 08/26/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 520			KB	:
LOG BOTTOM	: 509.30	LOG MEASURED FROM	: GL	DF	:
LOG TOP	: 22.70	DRL MEASURED FROM	: GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS	: 0	RECORDED BY	: COLDIRON		
BIT SIZE	: 6"	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9033AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH	: 30000

DPZ HOLE
COND: 424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GAM(NAT)
0 API-GR 200
FEET
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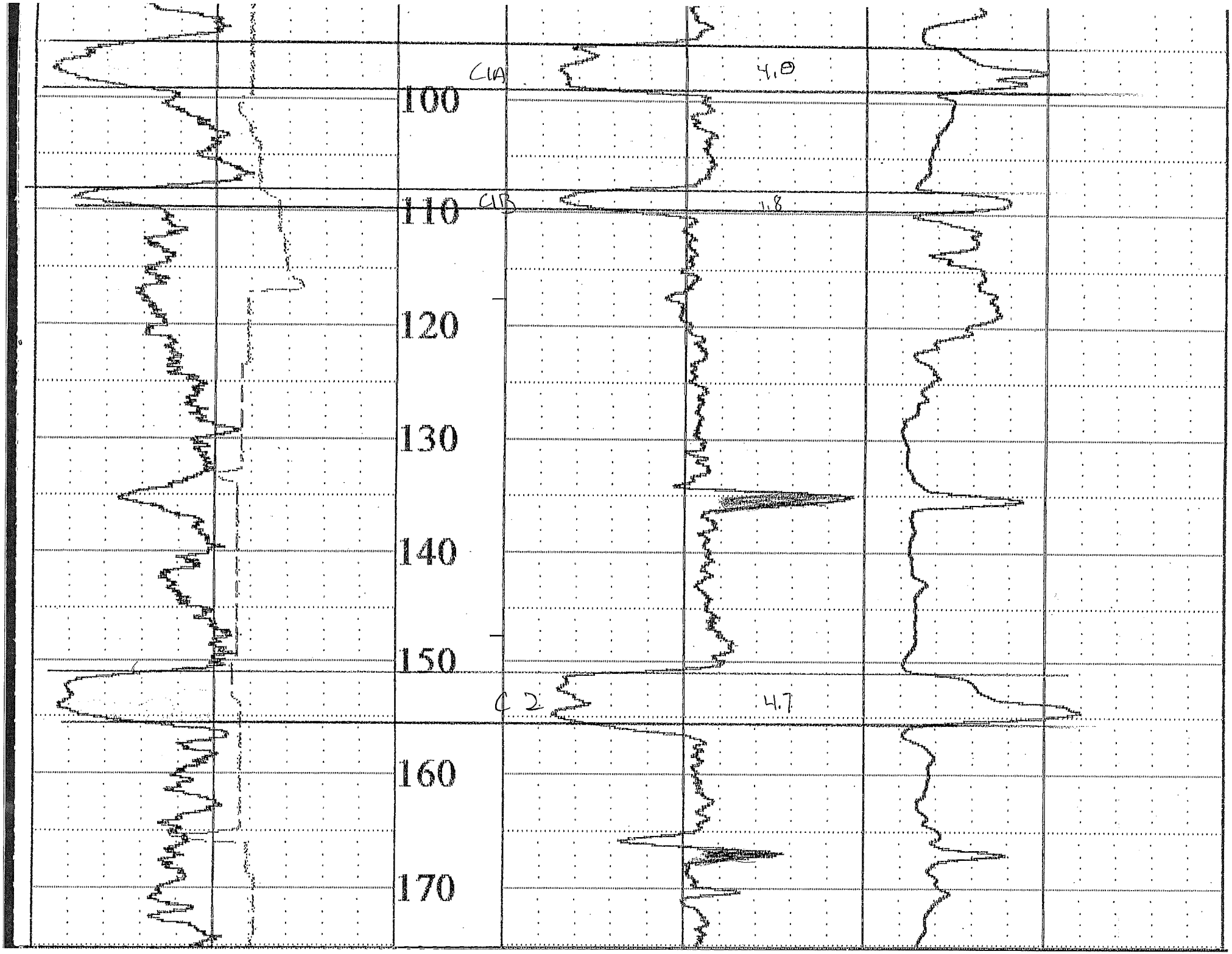
40
50
60
70
80
90
DENSITY
1 G/CC 3
2.1
1.8
RES(MG)
0 OHM-M 100


C1A
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C1B
1.8
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C2
4.7
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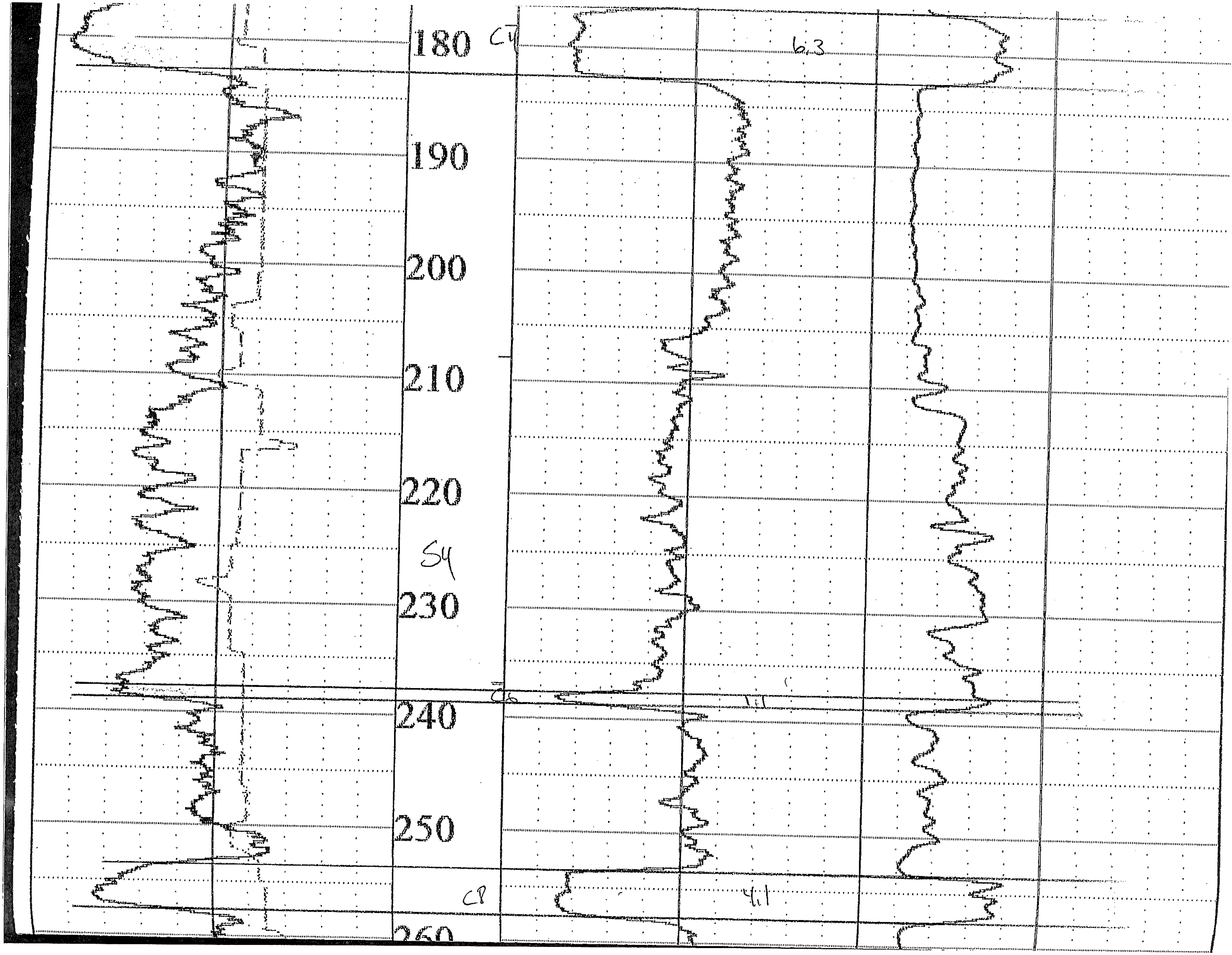
170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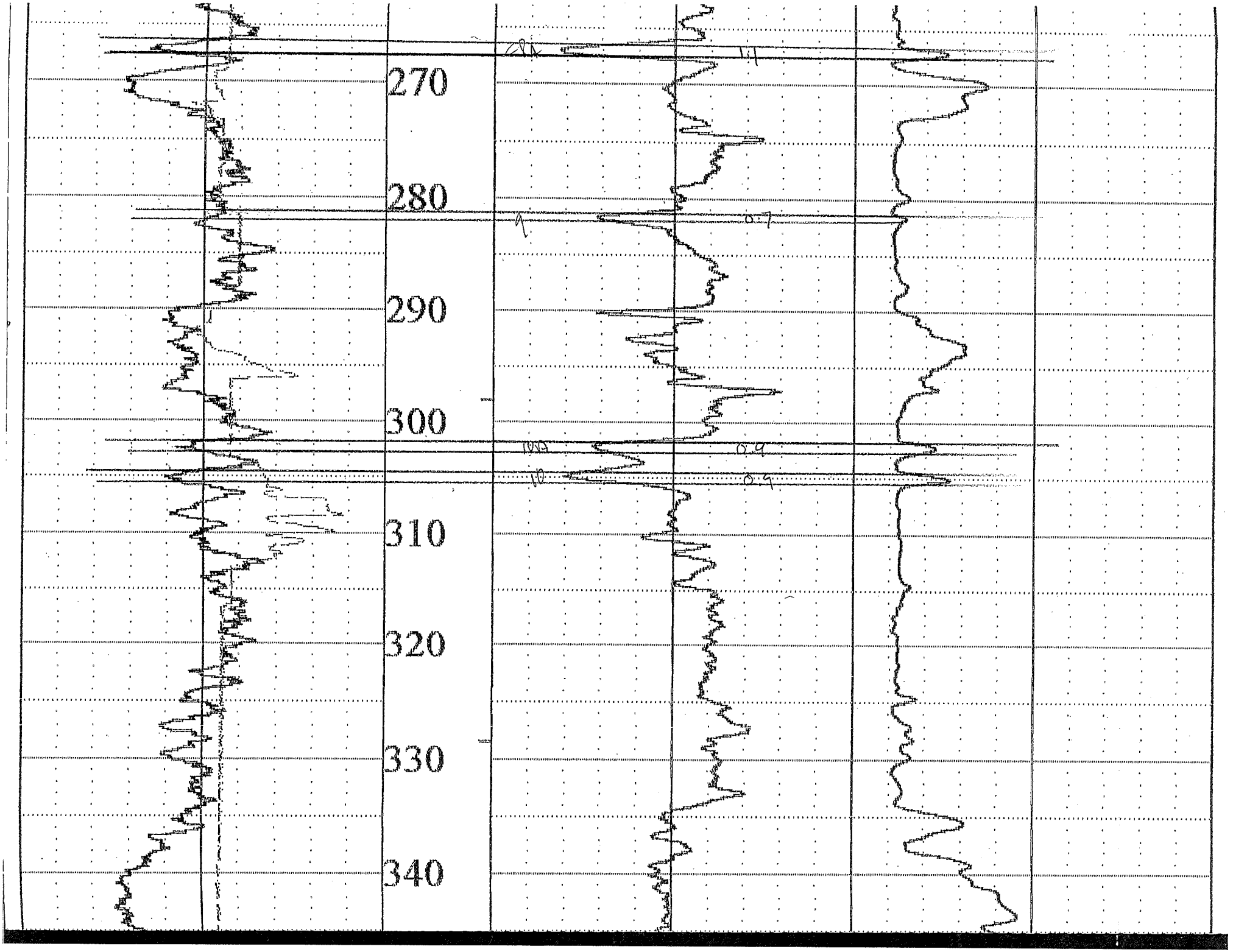
S4
230
C6
240
250
C8
260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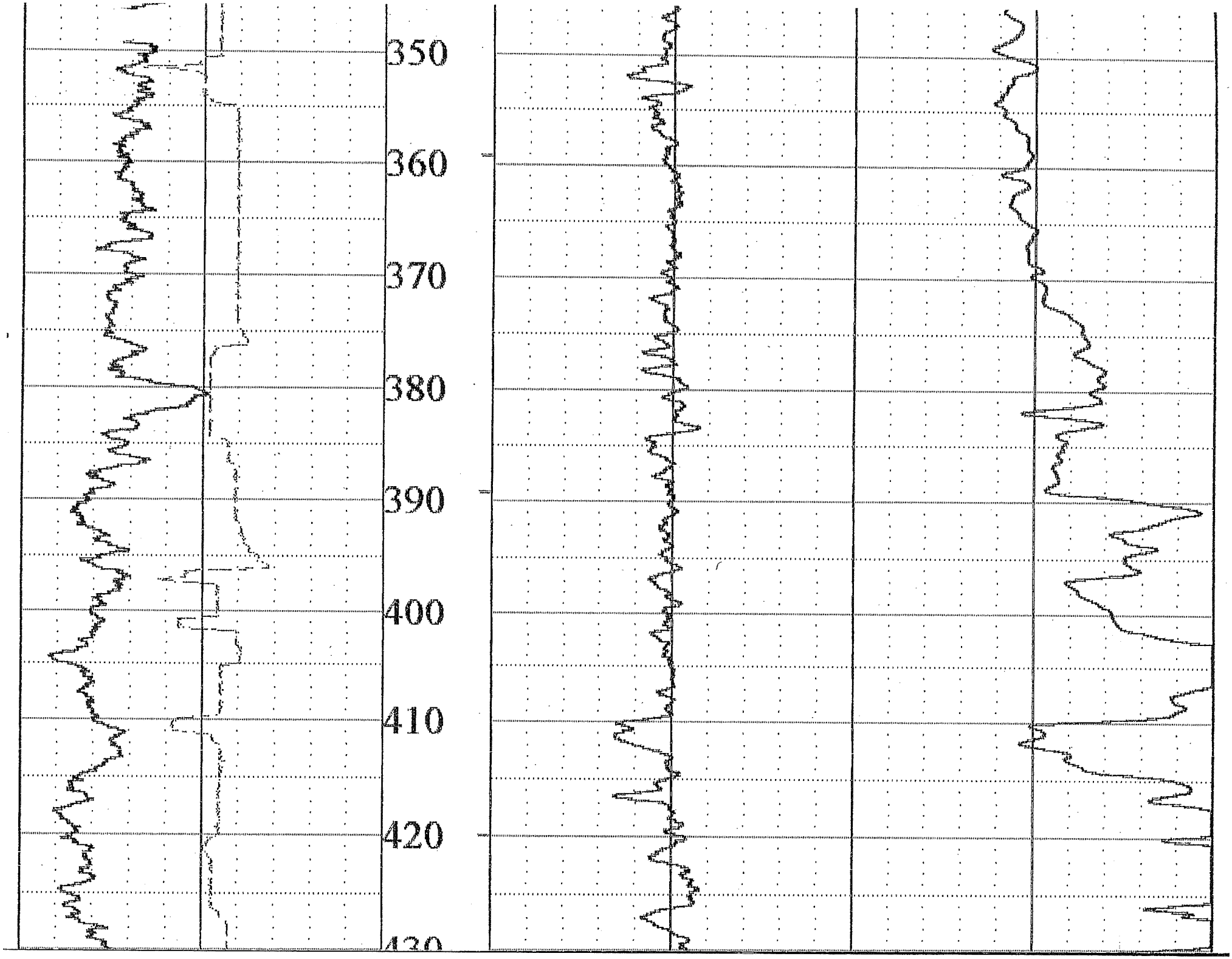
300
310
320
330
340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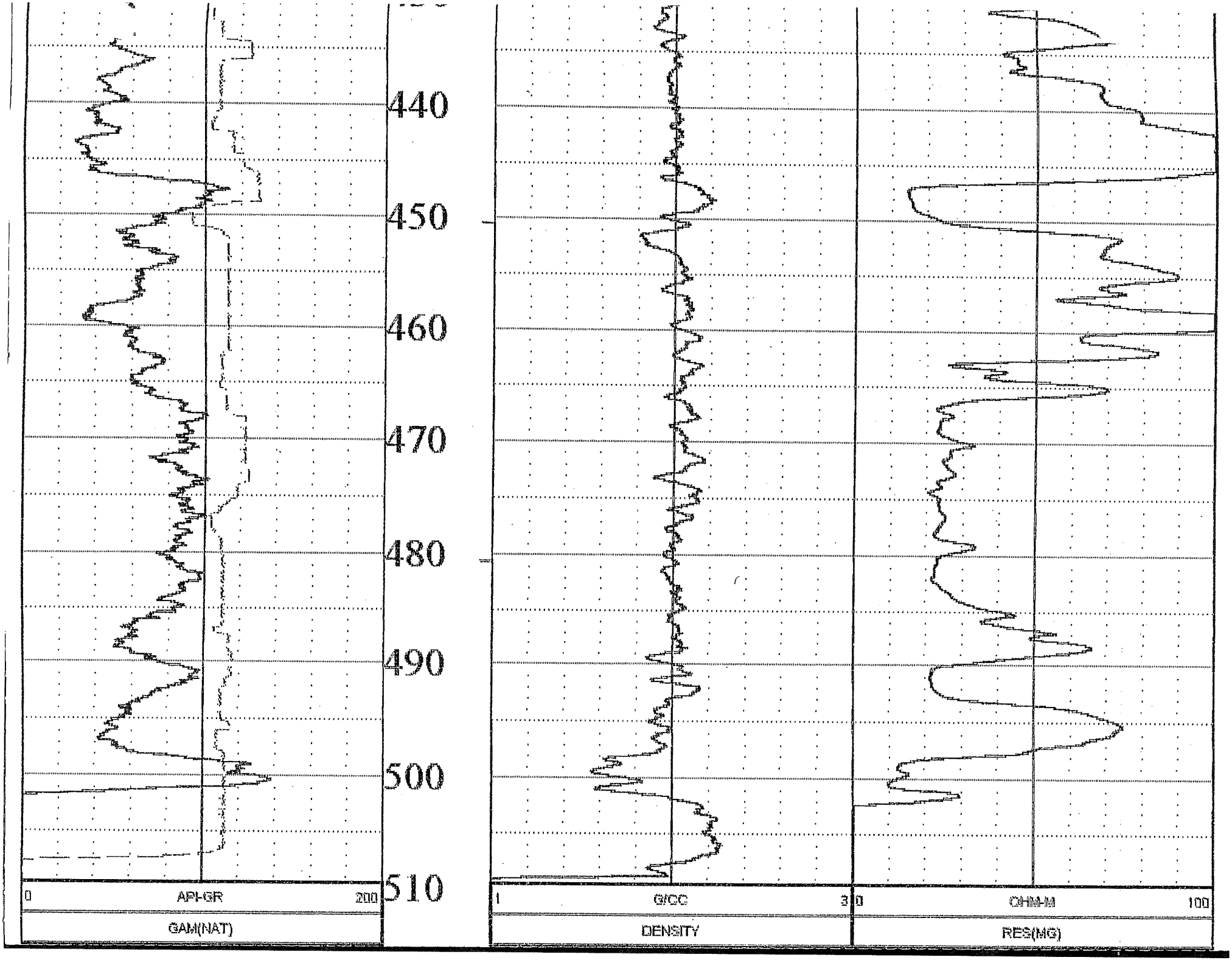
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450
460
470
480
490
500
510
0
API-GR
200
GAM(NAT)
1
G/CC
3
DENSITY
0
OHM-M
100
RES(MG)

4	INCH	8	
	CALIPERL		FEET

TOOL CALIBRATION C(9)-11 09/26/98 16:01
TOOL 9033AA1
SERIAL NUMBER 958

	DATE	TIME	SENSOR	STANDARD	RESPONSE
1	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
2	May07,98	10:12:25	DENSITY	1.106 [G/CC]	6123 [CPS]
	May07,98	10:12:25	DENSITY	2.612 [G/CC]	1347 [CPS]
3	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
4	May07,98	10:05:11	CALIPER	4.000 [INCH]	625 [CPS]
	May07,98	10:05:11	CALIPER	6.000 [INCH]	1487 [CPS]
5	May07,98	09:55:36	DENSITYH	Default [G/CC]	Default [CPS]
	May07,98	09:55:36	DENSITYH	Default [G/CC]	Default [CPS]
6	May27,98	14:39:50	CALIPERL	4.000 [INCH]	250 [CPS]
	May27,98	14:39:50	CALIPERL	6.000 [INCH]	643 [CPS]

Available Construction Documentation

for Approved Operating Permit Well

C-9-12

Well/Piezometer Record

Site (Alcoa)

Date: 10-30-98
Mine Area: C
Well Number: C(9)-12
Site Number: C(9)-12
Driller: Pete
Company: MHC
Slimhole / Piezometer / DP Well (circled) / DW Well / Test Well
Ground Level Elevation: 466
TOC Elevation:
Northing: 340815 R. C.
Easting: 2041497

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)
Casing	+2 - 388
	568 - 578
Screen	388 - 568
Gravel	350 - 578
Cement	230 - 350 = 125 sacks
	0 - 20 = 20 sacks

Gravel Volume (ft^3): 300
Pump Column Length: 430 feet

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured
After Development (ft. BMP):
Total Depth Inside Casing
Before Jetting (ft. BMP):
After Jetting (ft. BMP):
Rate Jetted (meas/estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC - STEEL - Other

Drilling/Construction (Driller)

Date: 10-30-98
Mud Type: No. of bags:
Bit Size(s): 5 5/8, 12 1/4, 18
Depth Drilled (ft. BGL): 580 ft
Casing Dia. and Type: 9.05 CL
Cased Interval (ft. BGL): +2-388
Screen Dia. and Type: 9.05, CL
Screen Gauge:
Screened Interval (ft. BGL): 388 - 568
Gravel Volume (ft^3):
Gravel Type: Texblast
Gravel Setting (ft. BGL): 350 - 580
Length of Gravel Tremie (ft.): 32 ft
Depth to Top of Gravel (ft. BGL): 0 - 345
Cement Type: Portland
Cement Volume (sacks): 125
Volume of Water per Sack:
Length of Cement Tremie (ft.): 32 ft
Bentonite Volume (sacks):

Inspection Completion (Alcoa)

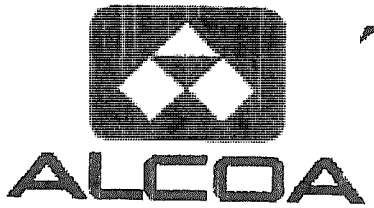
Date:
Time:
Measuring Point Description:
Which is ft. AGL
Depth to Water (ft. BMP):

Notes/Construction Problems

10 foot of blank casing from 568 - 578.

More C-hole needed.

32	14	32	33	104
9	32	14	15	
288	28	128	163	
	42	32	33 / 495	
	448	448		
	350	350		
32	98	34 98		
	96	96		
	2	2		



Aluminum Company of America

Sandow Mine

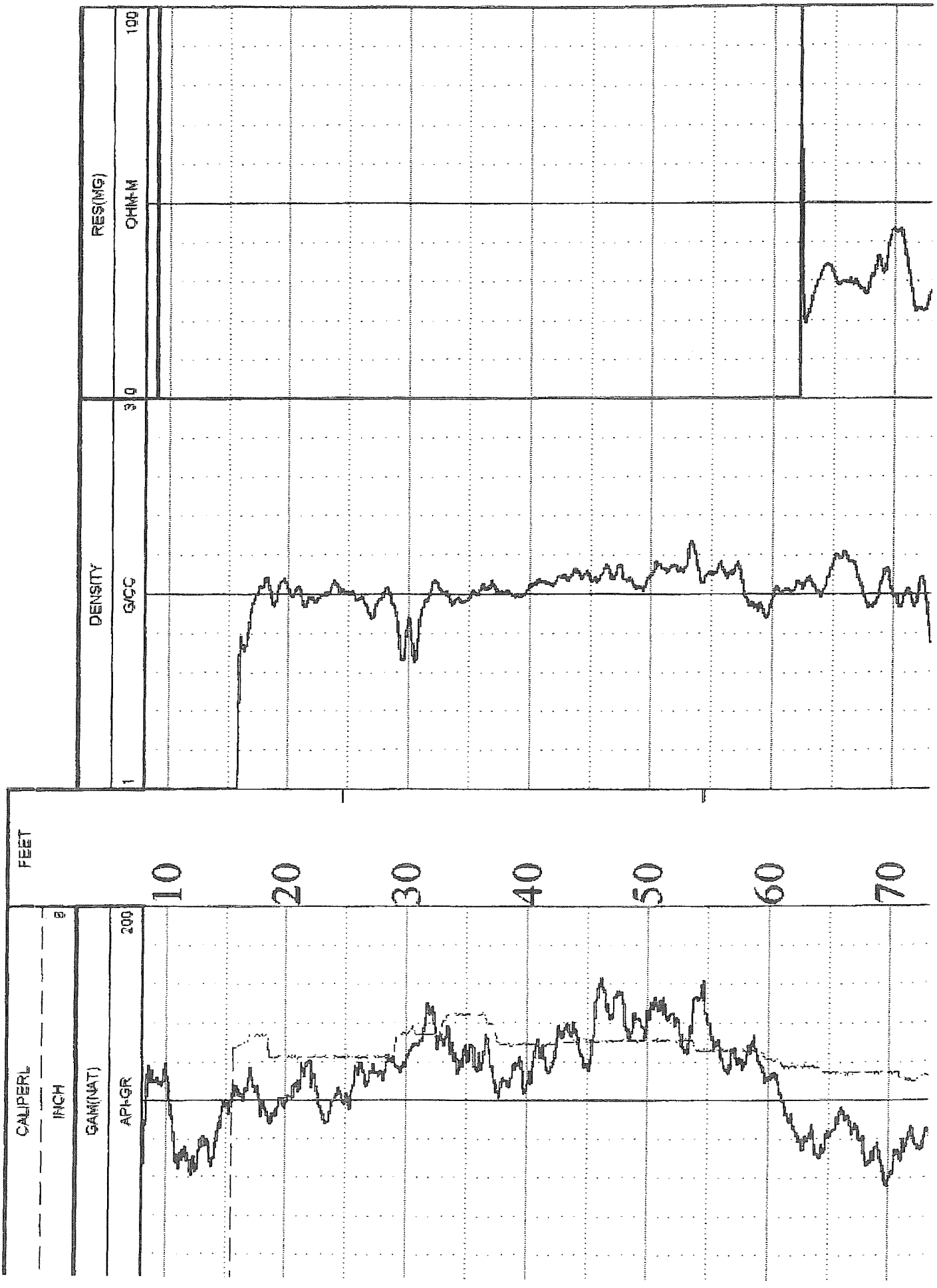
Rockdale, Texas

C(9)-12

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: C(9)-12				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 10/30/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 580			KB	:
LOG BOTTOM	: 568.30	LOG MEASURED FROM	: GL	DF	:
LOG TOP	: 8.00	DRL MEASURED FROM	: GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS	: 0	RECORDED BY	: COLDIRON		
BIT SIZE	: 5 5/8	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9033AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH	: 30000

DPZ
ELEV.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS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DENSITY
G/CC
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FEET
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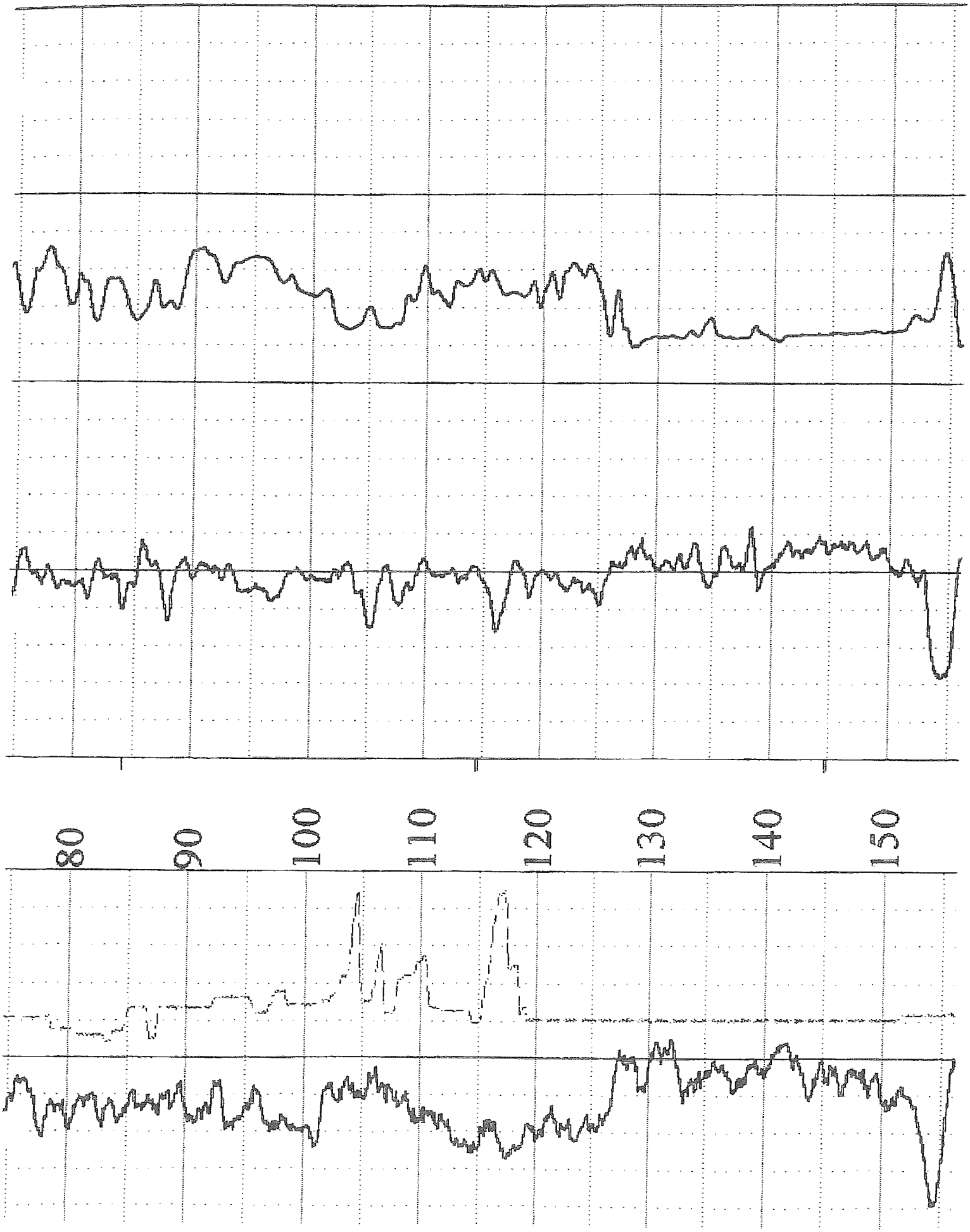
CALIPERL
INCH
8
GAM(NAT)
API-GR
200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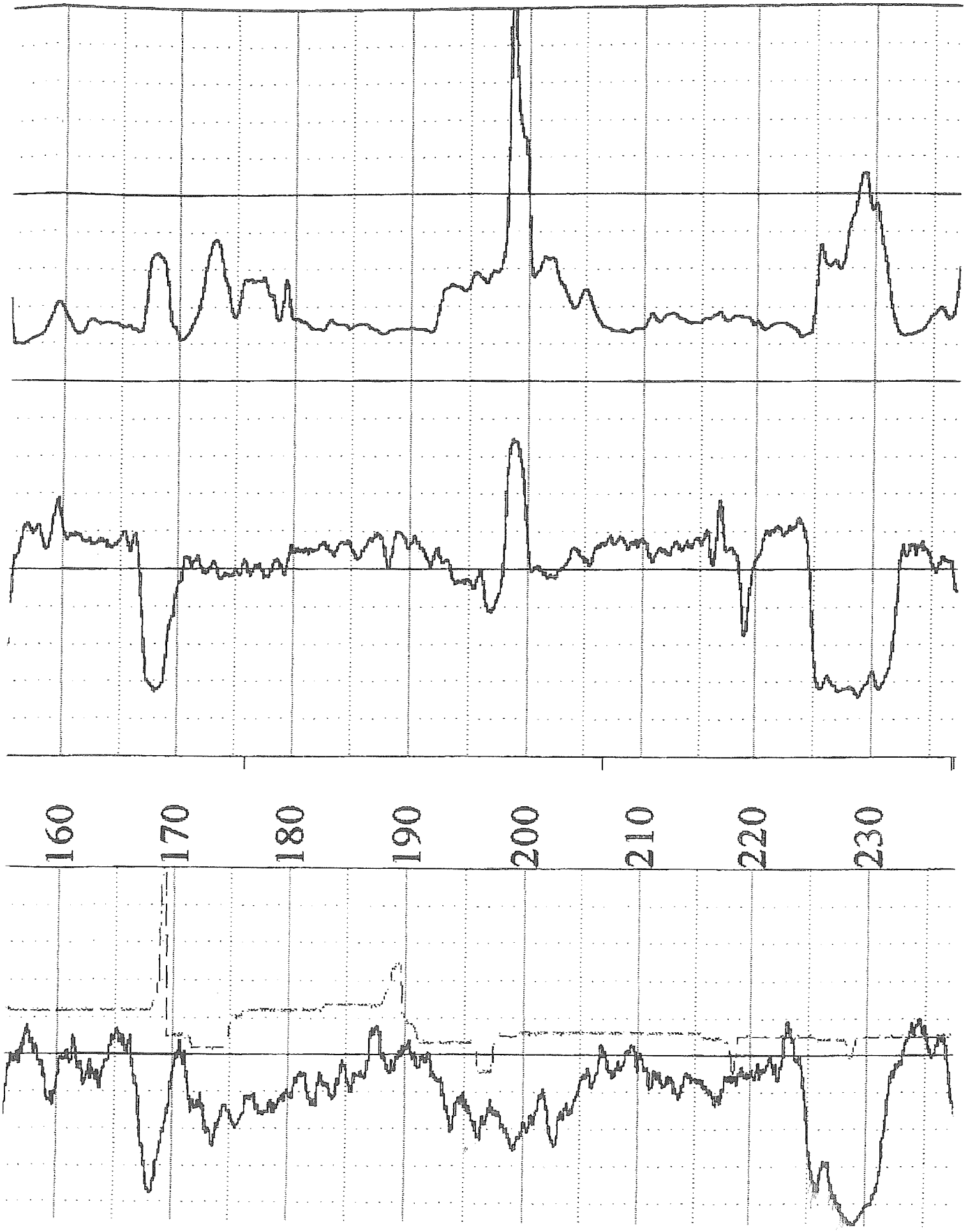
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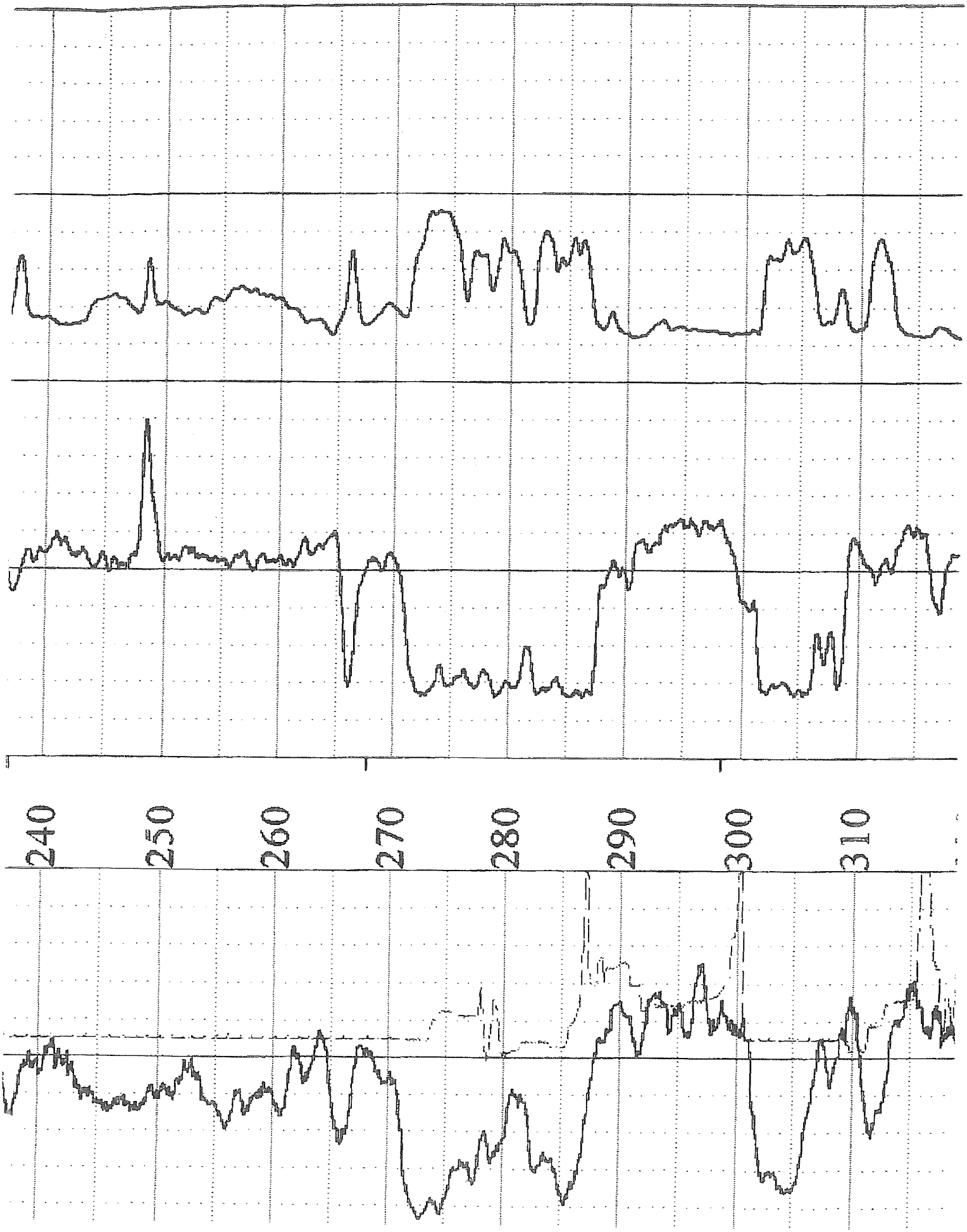
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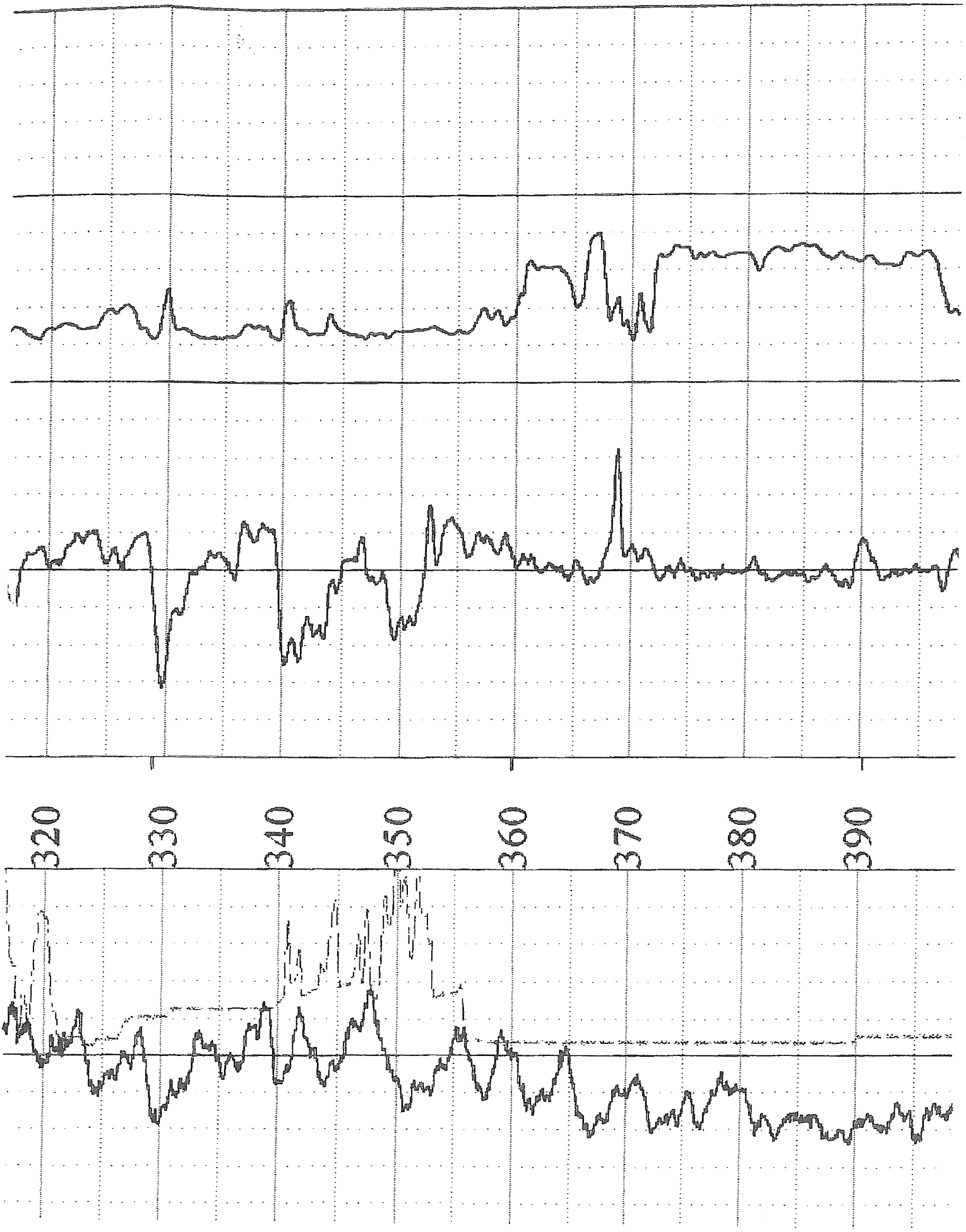
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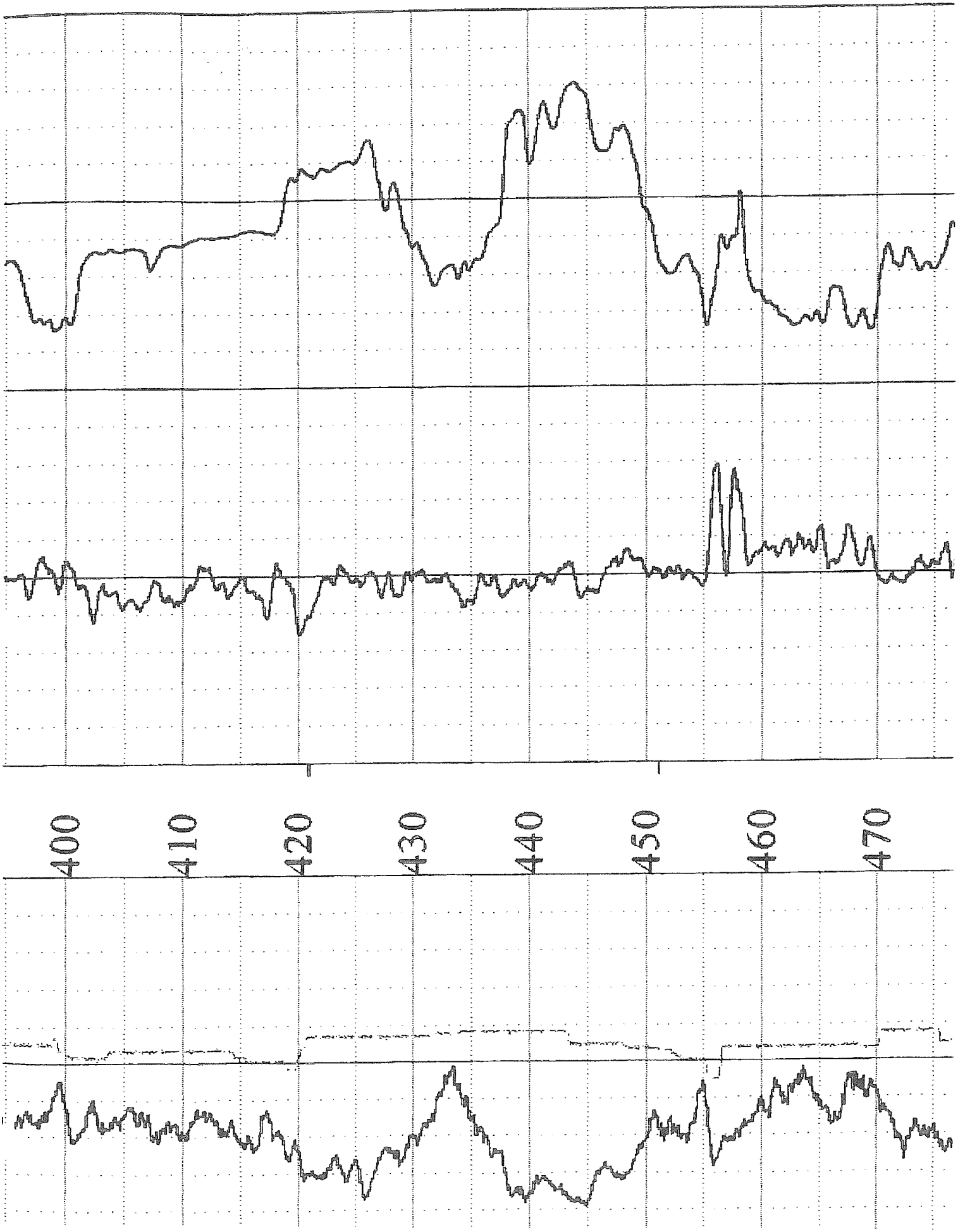
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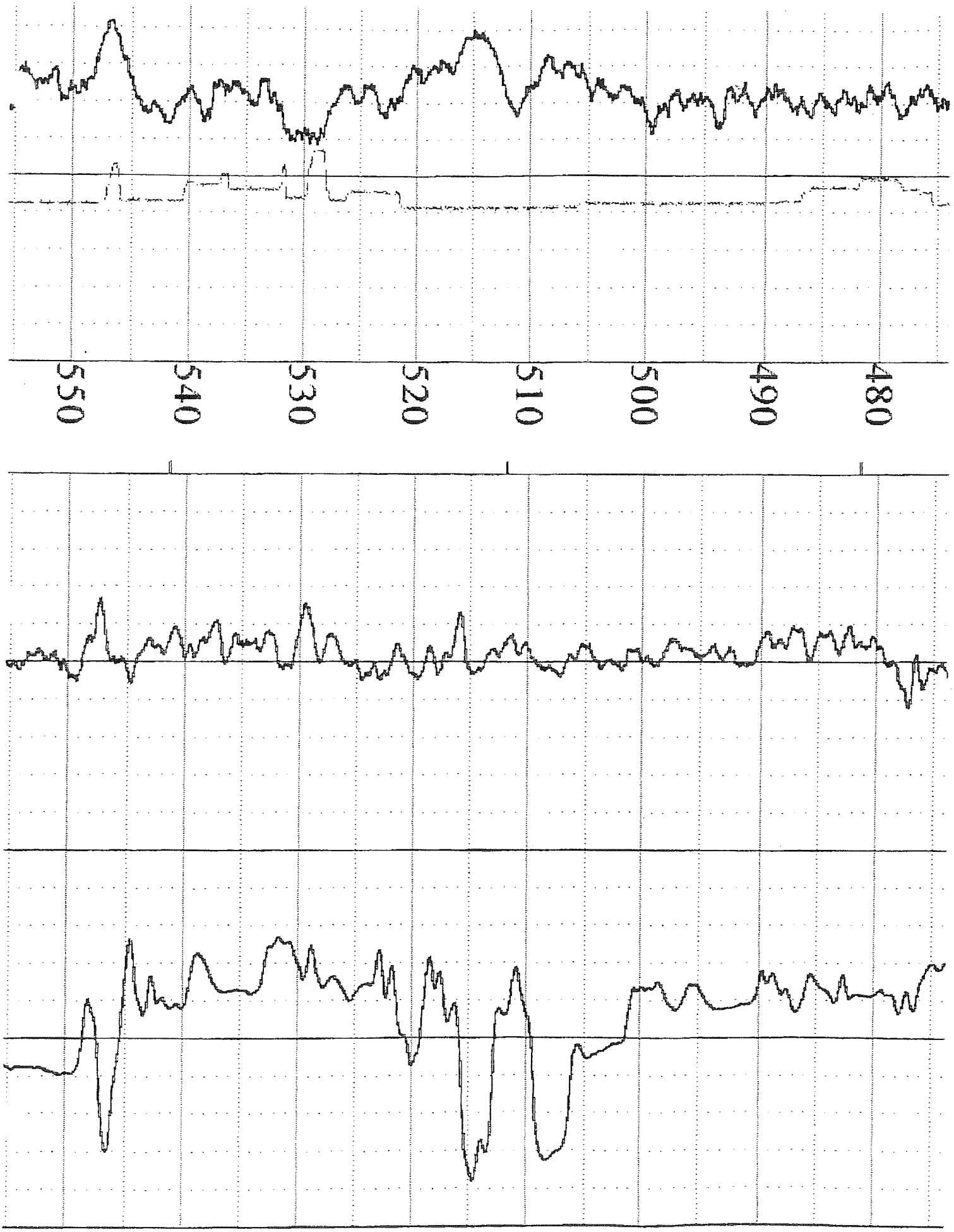
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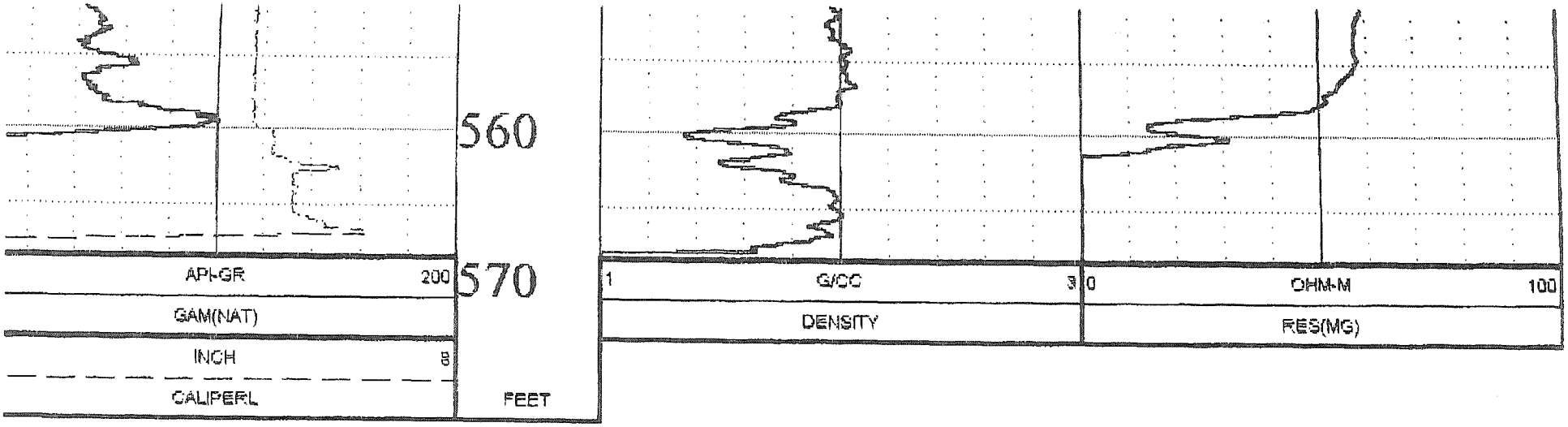


TOOL CALIBRATION C(9)-12 10/30/98 13:33
TOOL 9033AA1
SERIAL NUMBER 958

	DATE	TIME	SENSOR	STANDARD	RESPONSE
1	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
2	May07,98	10:12:25	DENSITY	1.106 [G/CC]	6123 [CPS]
	May07,98	10:12:25	DENSITY	2.612 [G/CC]	1347 [CPS]
3	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
4	May07,98	10:05:11	CALIPER	4.000 [INCH]	625 [CPS]
	May07,98	10:05:11	CALIPER	6.000 [INCH]	1487 [CPS]
5	May07,98	09:55:36	DENSITYH	Default [G/CC]	Default [CPS]
	May07,98	09:55:36	DENSITYH	Default [G/CC]	Default [CPS]
6	May27,98	14:39:50	CALIPERL	4.000 [INCH]	250 [CPS]
	May27,98	14:39:50	CALIPERL	6.000 [INCH]	643 [CPS]

Available Construction Documentation

for Approved Operating Permit Well

C-9-13

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 4/21/98
Mine Area C
Well Number C(9)-13
Site Number [redacted]

Driller _____ Company MHC
Slimhole / Piezometer / (Depressurization Well)
Ground Level Elevation _____
TOC Elevation _____
Northing _____
Easting _____

DRILLING/CONSTRUCTION (MHC)

Date _____
Mud Type _____ No. Bags _____
Bit Size _____
Depth Drilled, Ft. BGL _____
Casing Diameter and Type _____
Cased Interval, Ft. BGL _____
Screen Diameter and Type _____
Screen Guage _____
Screened Interval, Ft. BGL _____
Amount of Gravel Used, Sacks _____
Gravel Type _____
Gravel Setting, Ft. BGL _____
Length of Gravel Tremmie, Ft. _____
Depth to Top of Gravel, Ft. BGL _____
Cement Type _____. Lbs Per Sack _____
Sacks of Cement Used _____
Sacks of Bentonite Used _____
Amount of Water Used, Gals. _____
Length of Cement Tremmie, Ft. _____

NOTES/CONSTRUCTION PROBLEMS

GRAVEL ≈ 280 FT³

CEMENT:

0'-20' ≈ 17 SACKS

210'-320' ≈ 92 SACKS

ASSUMES 17½" hole

DEVELOPMENT (MHC)

Start, Time/Date _____
Finish, Time/Date _____
Total Time Jetted _____
Static Water-Level Measured
After Devolopment _____

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL _____
After Jetting (Date), Ft. BGL _____
Rate Jetted (Meas./Est.), gpm _____

PUMP/MOTOR (MHC)

Motor H.P. _____
Length of Column Pipe (ft.) _____

INSPECTION COMPLETION (ALCOA)

Date _____ Time _____
Measuring Point Description _____

Which is _____ Ft. A.G.L.
Depth to Water, Ft. B.T.O.C. _____

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well Casing	+2 - 358
	538 - 548
Screen	358 - 538
Gravel	320 - 548
Cement	210 - 320
	0 - 20
Pump Column Length	368
Measuring Pipe Casing	N/A
Screen	

Aluminum Company of America

Sandow Mine

ALCOA Rockdale, Texas

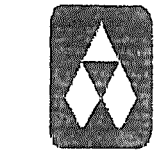
C(9)-13

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: C(9)-13				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 11/21/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 540			KB	:
LOG BOTTOM	: 536.60	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 7.00	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS:	0	RECORDED BY	: COLDIRON		
BIT SIZE	: 12"	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9033AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH:	30000

DPZ

: ELEV.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS



Aluminum Company of America

Sandow Mine

Rockdale, Texas

C(9)-13

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: C(9)-13				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 11/21/98	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 540			KB	:
LOG BOTTOM	: 536.60	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 7.00	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS:	0	RECORDED BY	: COLDIRON		
BIT SIZE	: 12"	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9033AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH:	30000

DPZ

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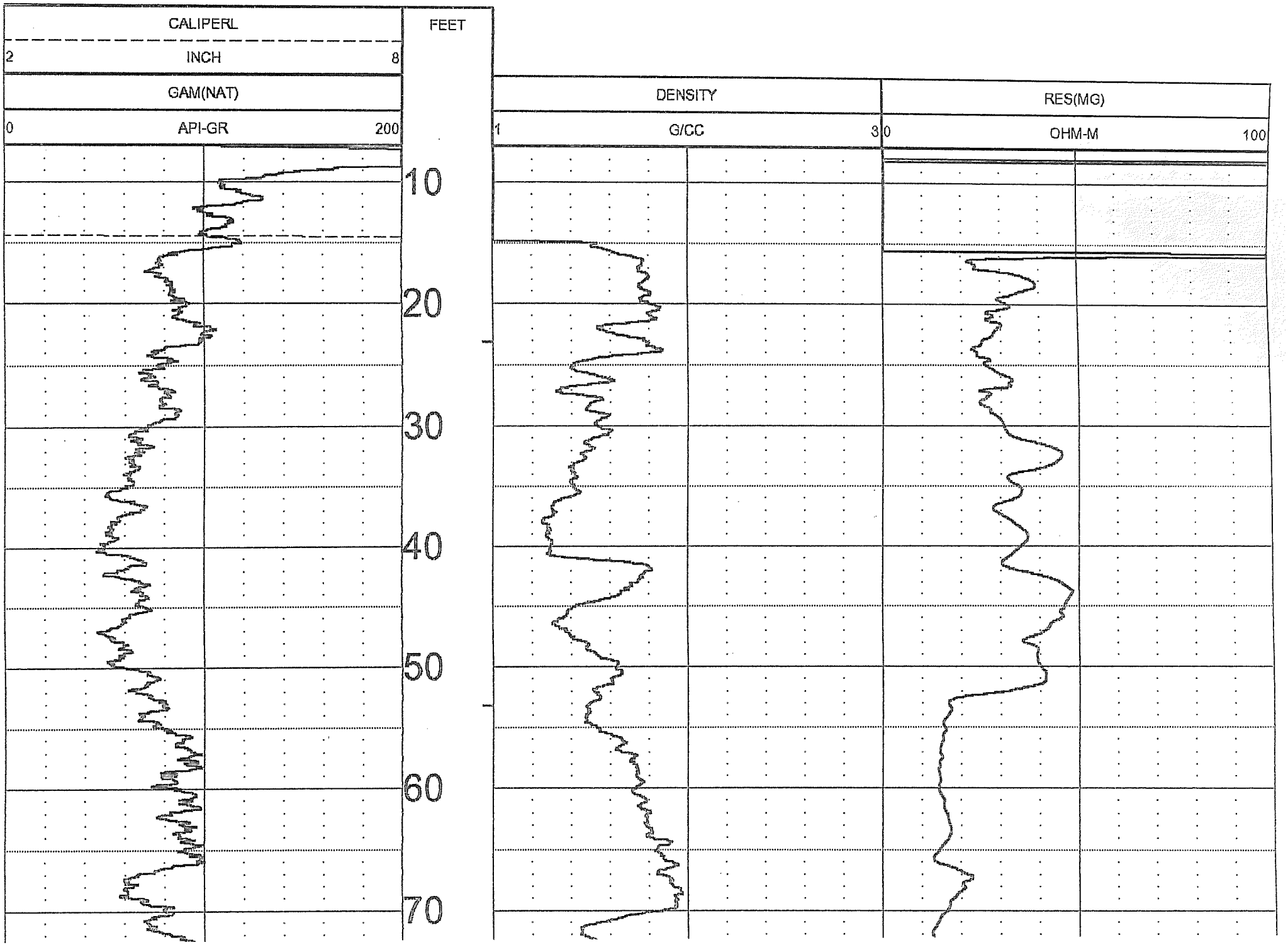
: ELEV.

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


CALIPERL
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INCH
8
GAM(NAT)
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API-GR
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FEET
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DENSITY
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G/CC
3
RES(MG)
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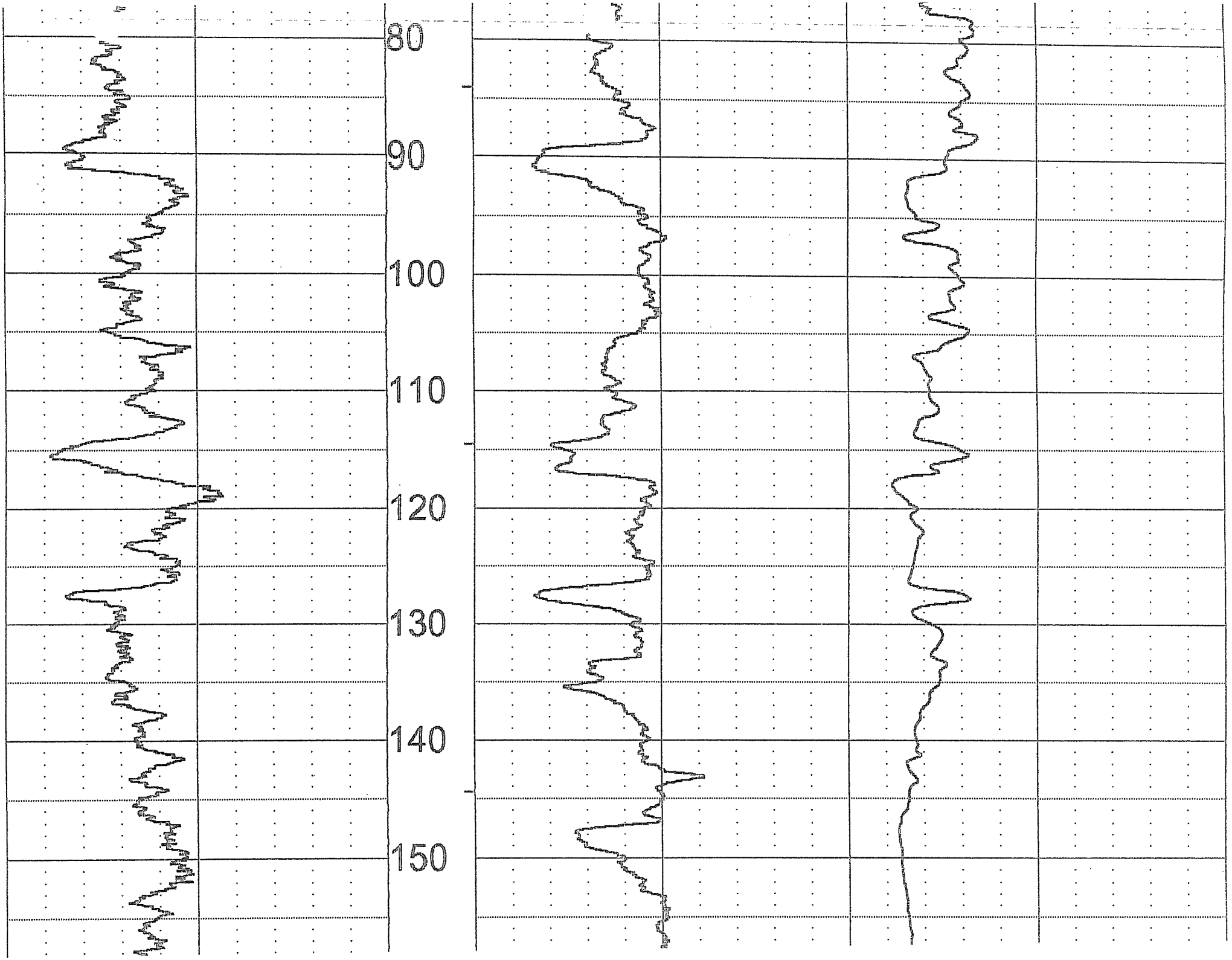
OHM-M
100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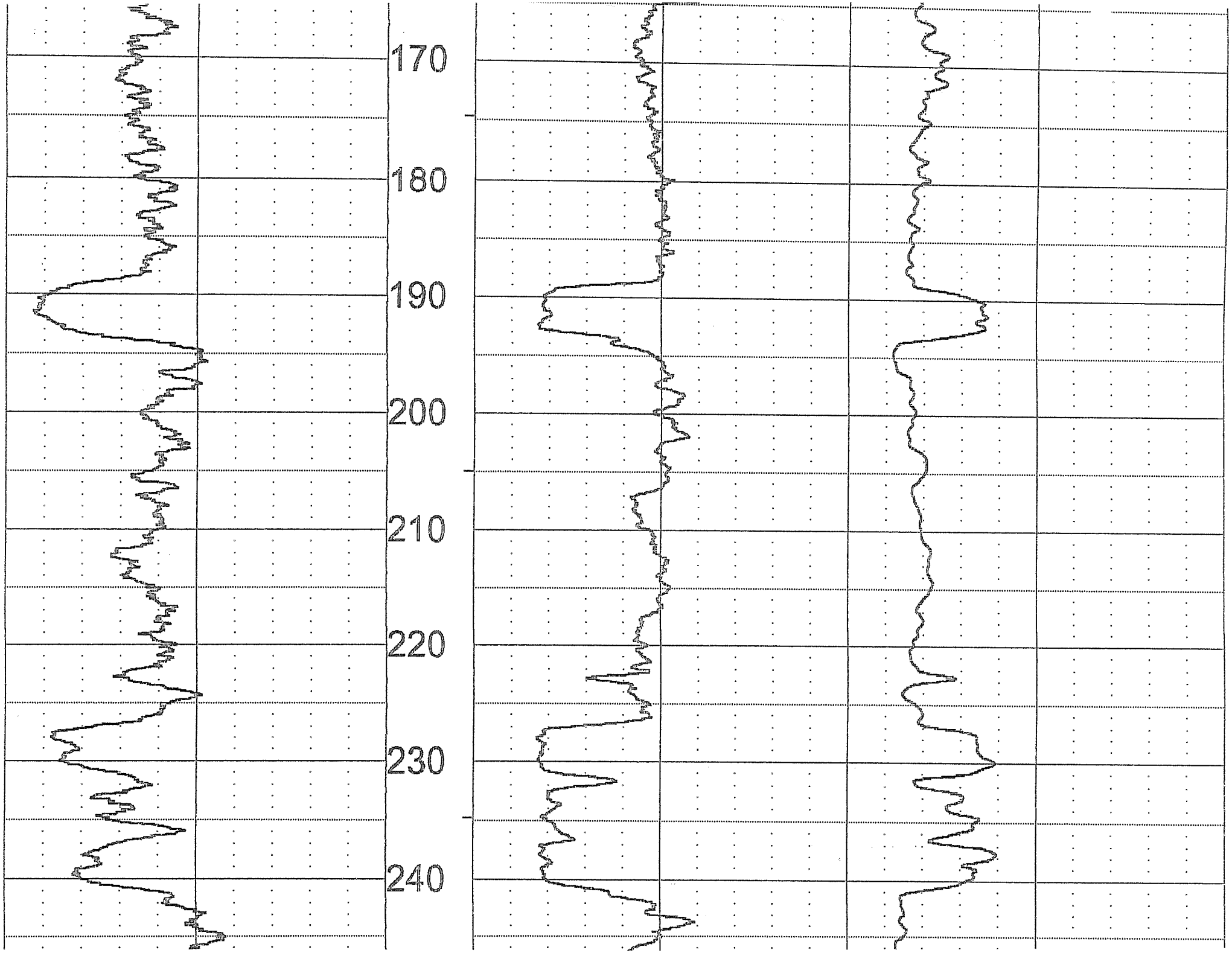
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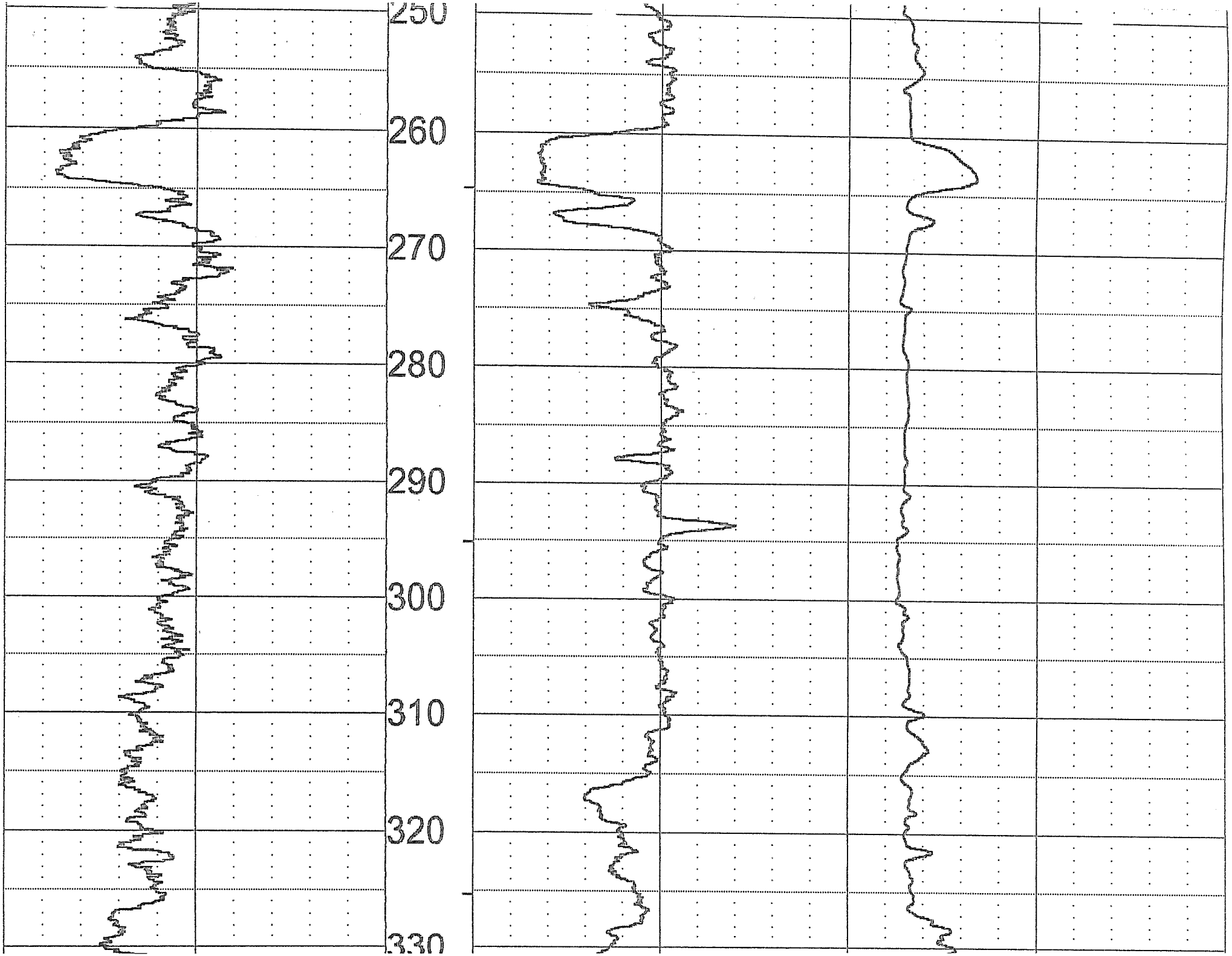
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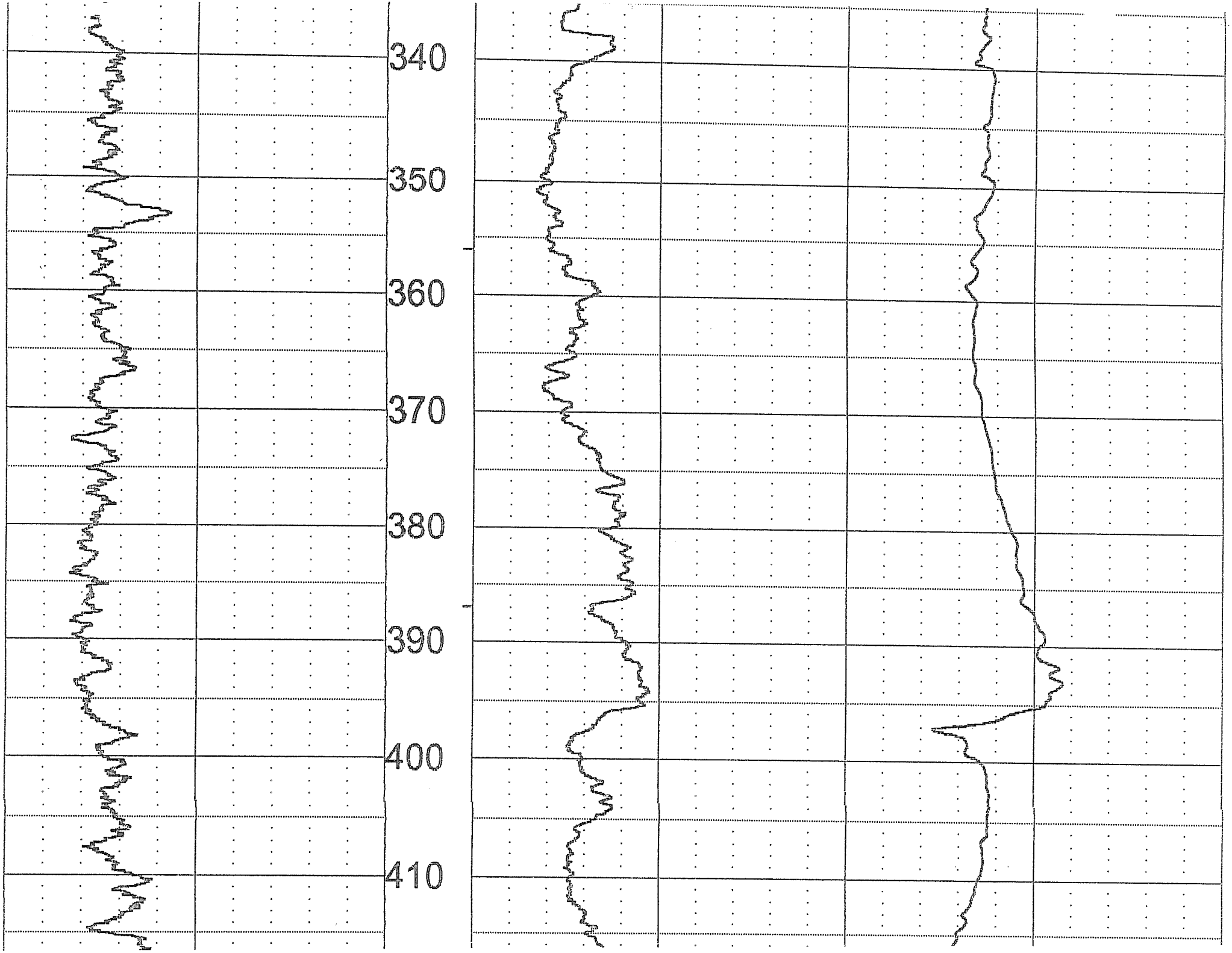
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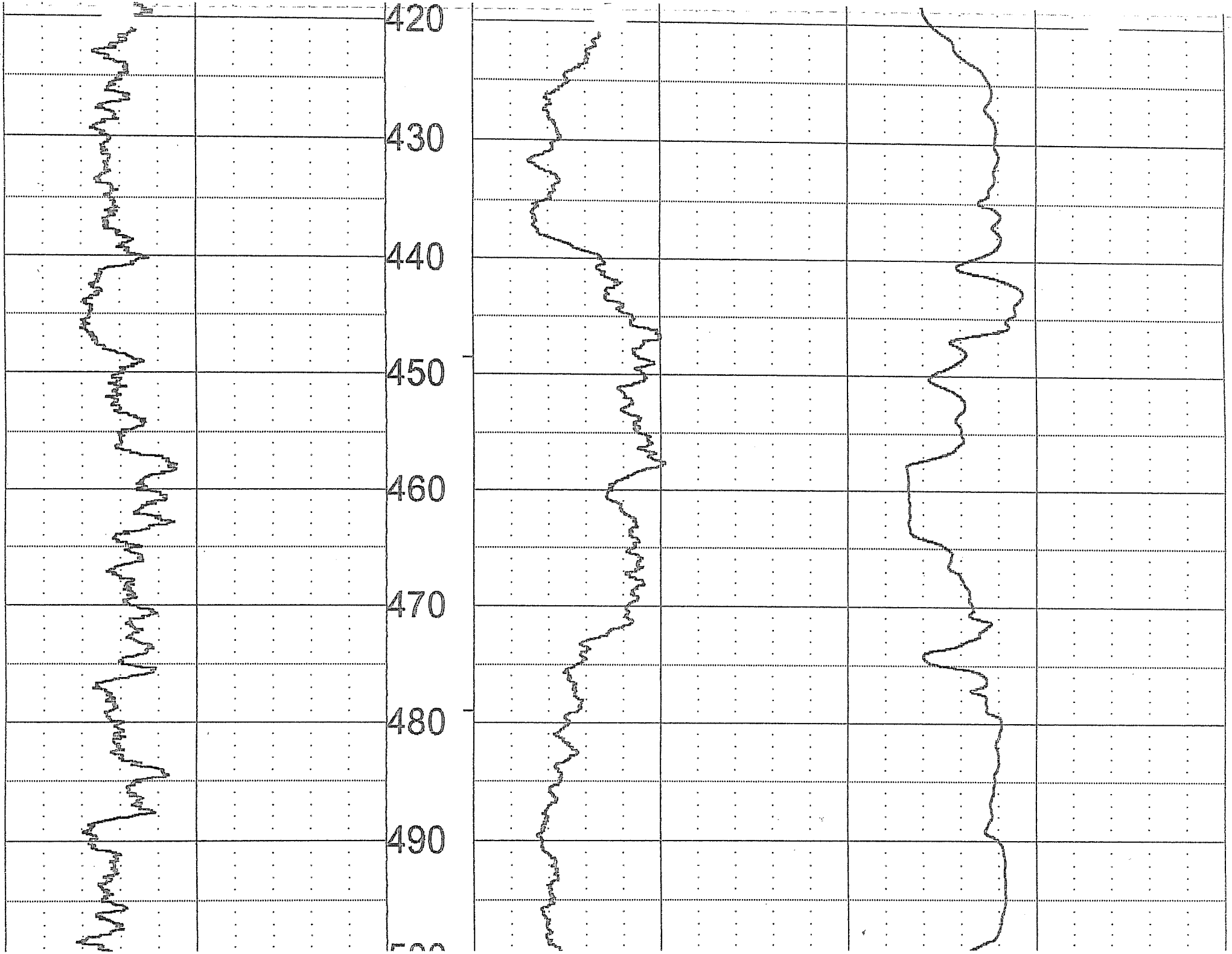
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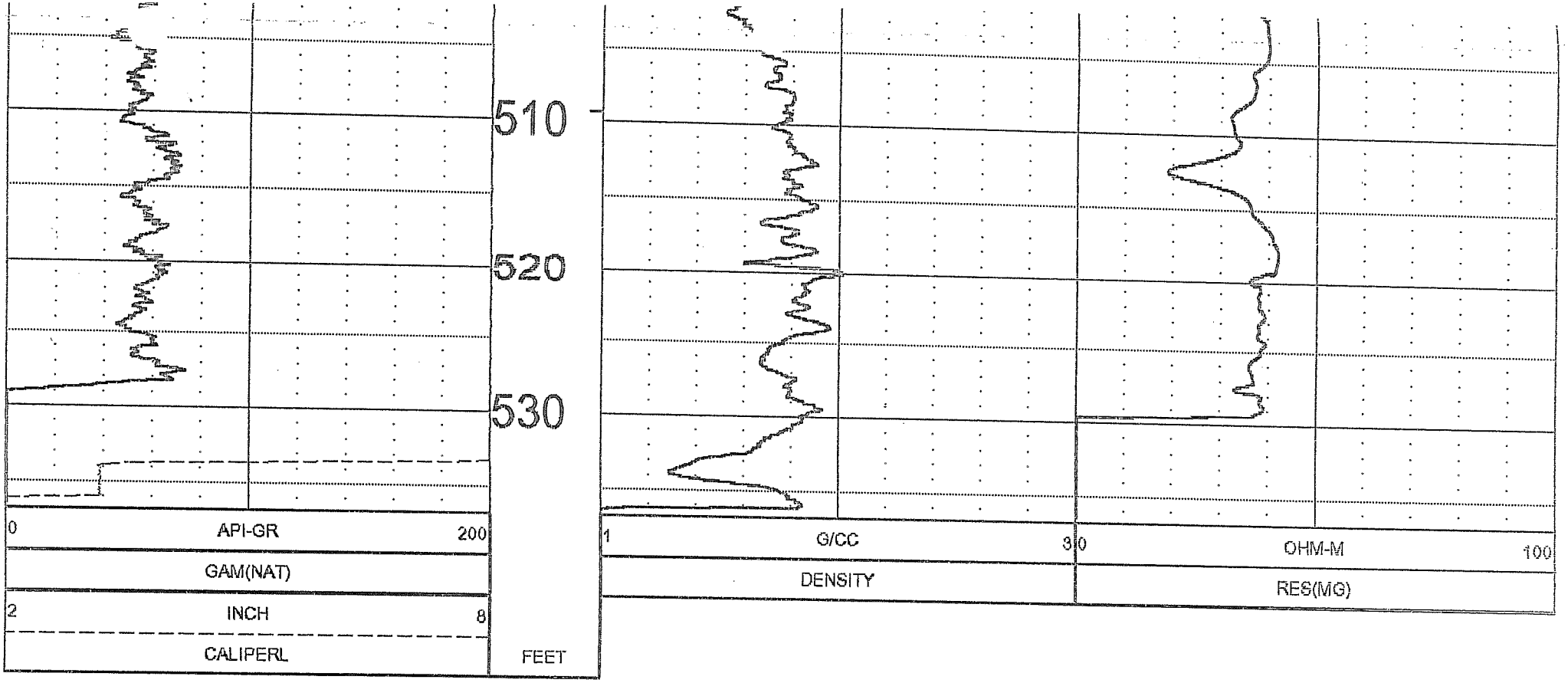


TOOL CALIBRATION C(9)-13 11/21/98 08:39
TOOL 9033AA1
SERIAL NUMBER 958

	DATE	TIME	SENSOR	STANDARD	RESPONSE
1	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
	May07,98	09:55:36	GAM(NAT)	Default [API-GR]	Default [CPS]
2	May07,98	10:12:25	DENSITY	1.106 [G/CC]	6123 [CPS]
	May07,98	10:12:25	DENSITY	2.612 [G/CC]	1347 [CPS]
3	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
	May07,98	09:55:36	RES(MG)	Default [OHM-M]	Default [CPS]
4	May07,98	10:05:11	CALIPER	4.000 [INCH]	625 [CPS]
	May07,98	10:05:11	CALIPER	6.000 [INCH]	1487 [CPS]

Available Construction Documentation

for Approved Operating Permit Well

C-9-14

Well/Piezometer Record

Site (Alcoa)

Date 1-9-99
Mine Area C
Well Number C-9-14
Site Number
Driller
Company MHC
Slimhole / Piezometer / (DP Well) / DW Well / Test Well
Ground Level Elevation
TOC Elevation
Northing
Easting

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)		
Casing	+2-348		
	548-558		
Screen	348-548		
Gravel	310-558		
Cement	220-310	= 91	sacks
	0-20	= 18	sacks

Gravel Volume (ft^3) 328
Pump Column Length 358

Development (Driller)

Start, Time/Date
Finish, Time/Date
Total Time Jetted
Static Water-Level Measured
After Development (ft. BMP)
Total Depth Inside Casing
Before Jetting (ft. BMP)
After Jetting (ft. BMP)
Rate Jetted (meas/estimated) (gpm)

Pump/Motor (Driller)

Motor H.P.
Pump Model No.
Length of Column Pipe (ft.)
Type Column Pipe: PVC - STEEL - Other

Drilling/Construction (Driller)

Date
Mud Type No. of bags
Bit Size(s)
Depth Drilled (ft. BGL)
Casing Dia. and Type
Cased Interval (ft. BGL)
Screen Dia. and Type
Screen Gauge
Screened Interval (ft. BGL)
Gravel Volume (ft^3)
Gravel Type
Gravel Setting (ft. BGL)
Length of Gravel Tremie (ft.)
Depth to Top of Gravel (ft. BGL)
Cement Type
Cement Volume (sacks)
Volume of Water per Sack
Length of Cement Tremie (ft.)
Bentonite Volume (sacks)

Inspection Completion (Alcoa)

Date
Time
Measuring Point Description
Which is ft. AGL
Depth to Water (ft. BMP)

Notes/Construction Problems

more pathole needed

Aluminum Company of America

Sandow Mine

ALCOA Rockdale, Texas

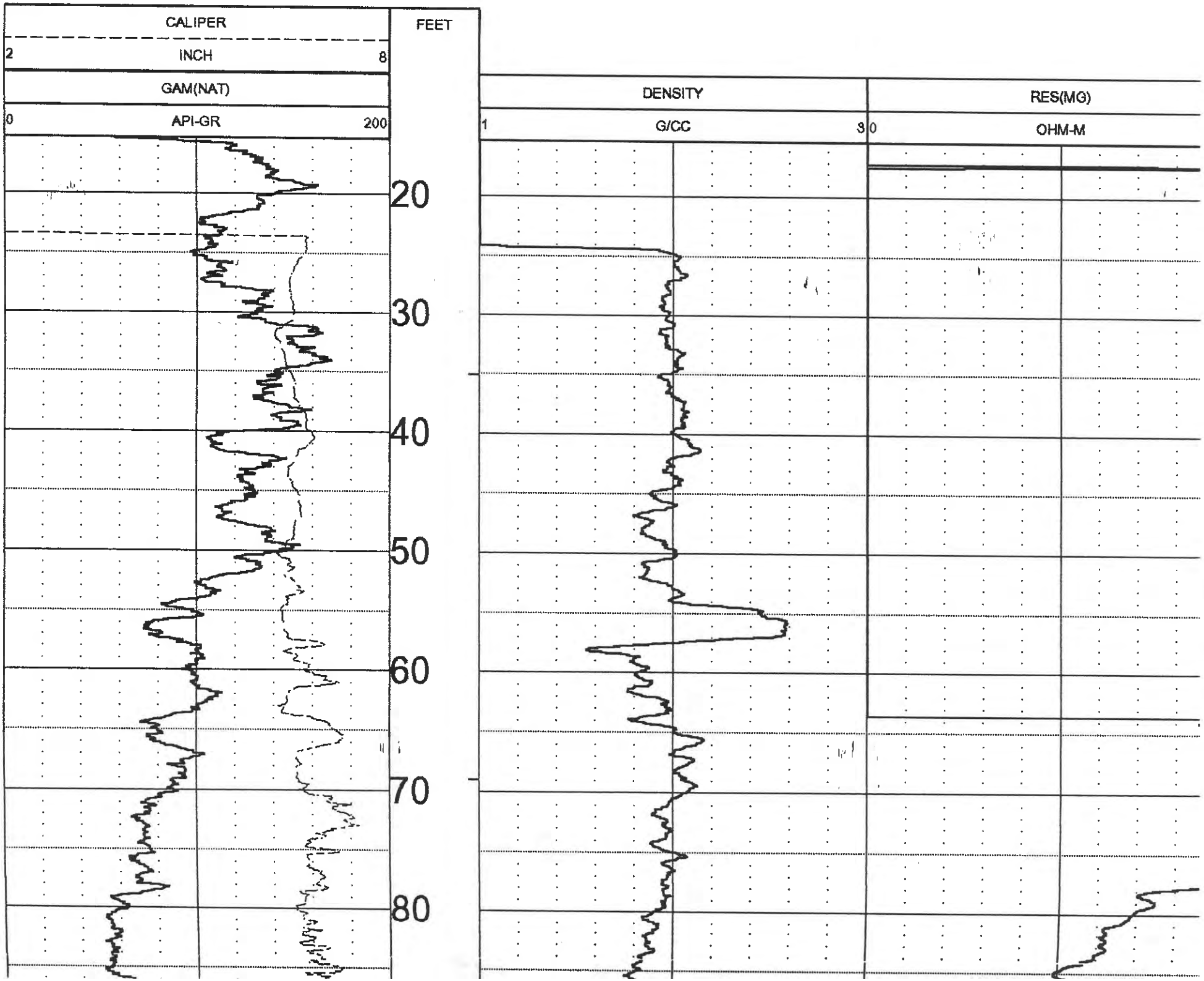
C9-14

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: C9-14				
LOCATION/FIELD	: C AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 01/09/99	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 560			KB	:
LOG BOTTOM	: 547.70	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 15.30	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	:		
CASING TYPE	:	FIELD OFFICE	:		
CASING THICKNESS:	0	RECORDED BY	: COLDIRON		
BIT SIZE	: 6"	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 8	RM	: 0	TYPE	: 9034AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	: 0		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 49		
				THRESH:	30000

DPZ

:

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS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G/CC
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RES(MG)
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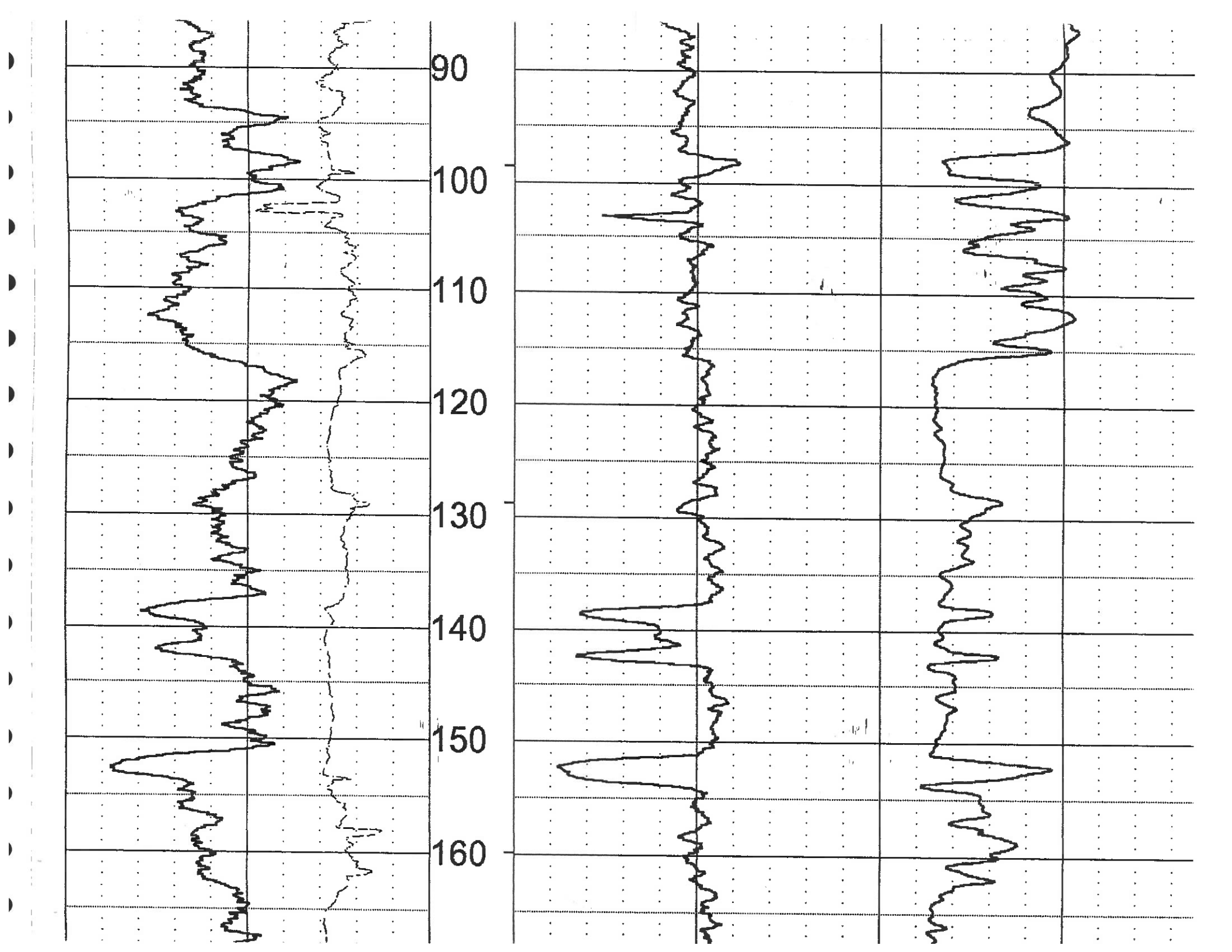
OHM-M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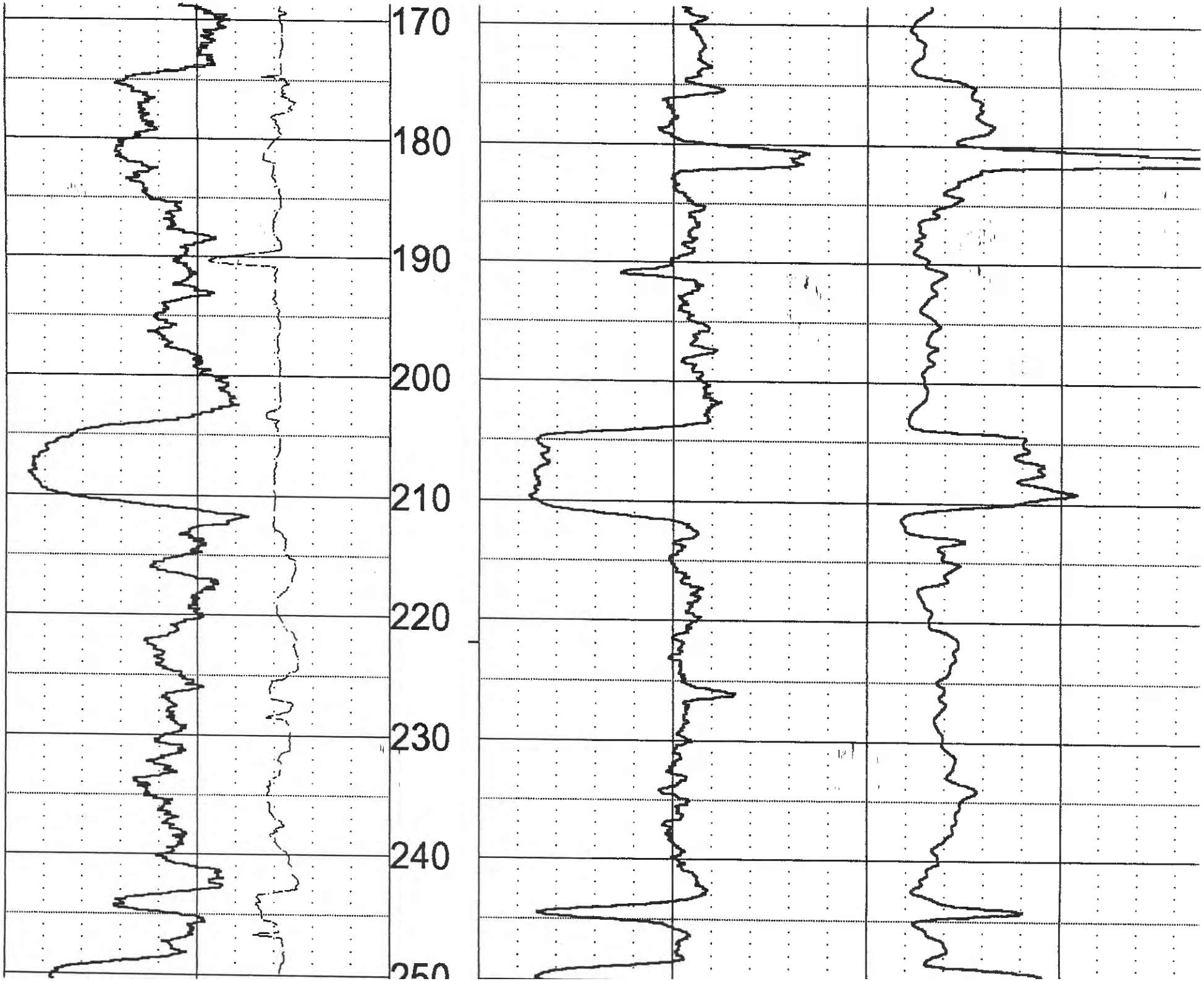
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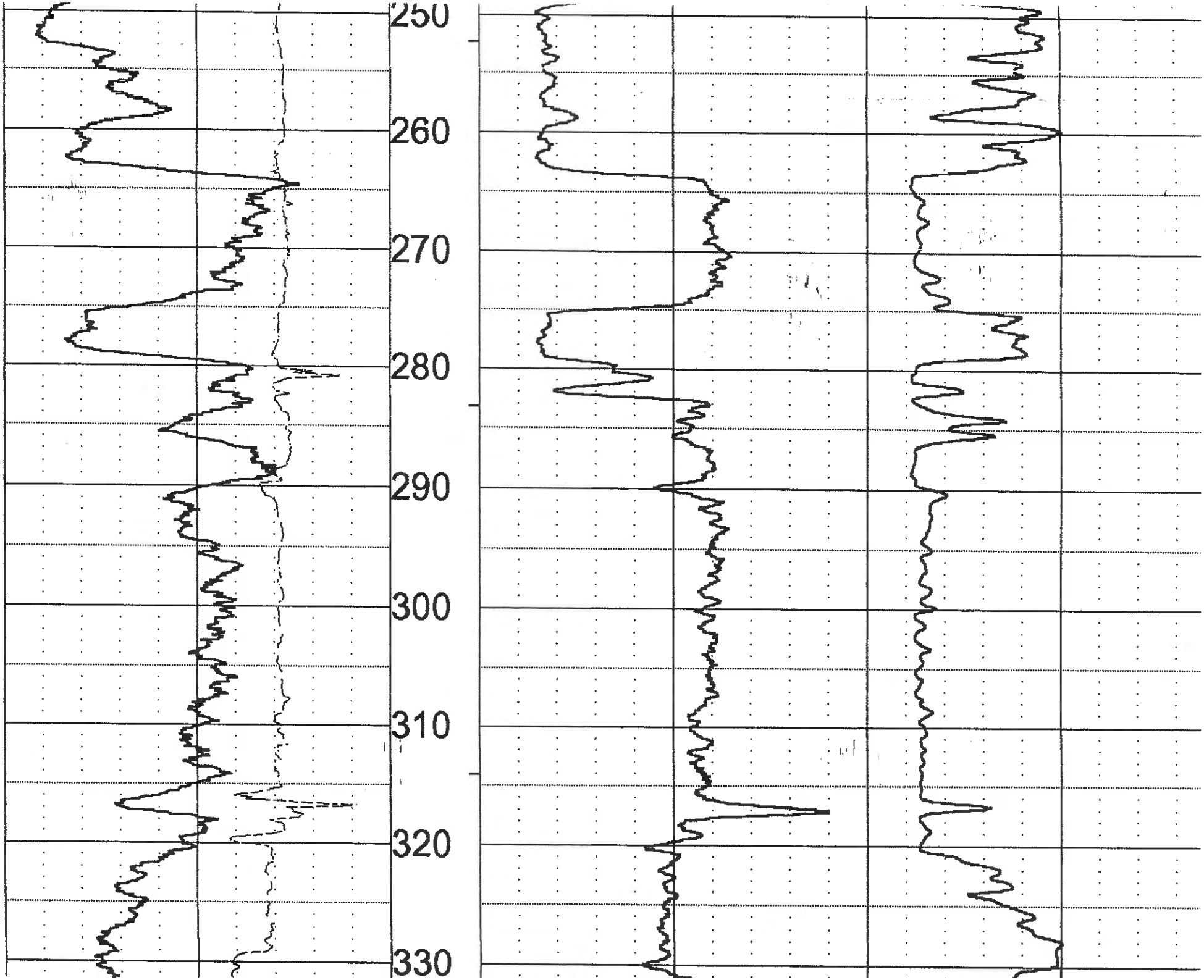
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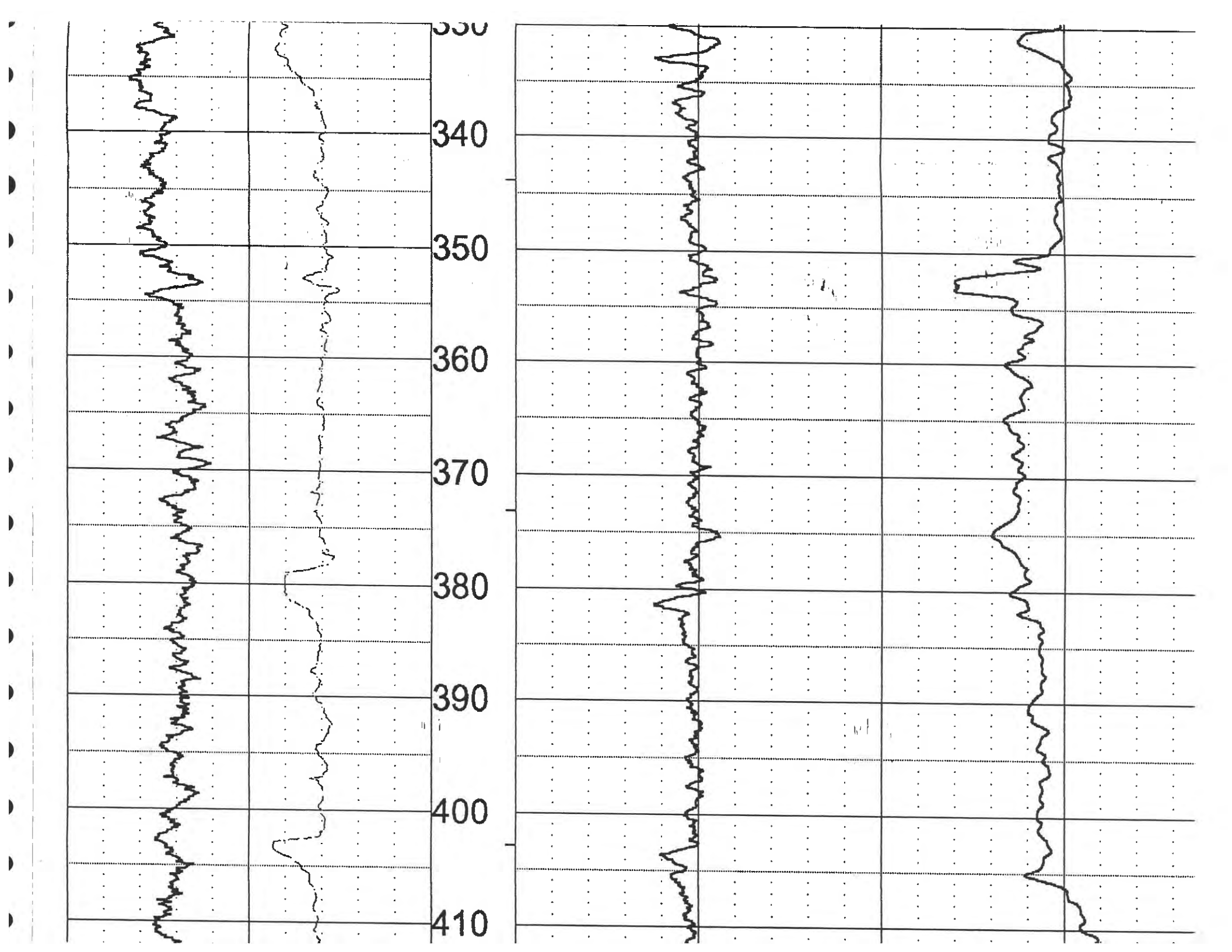
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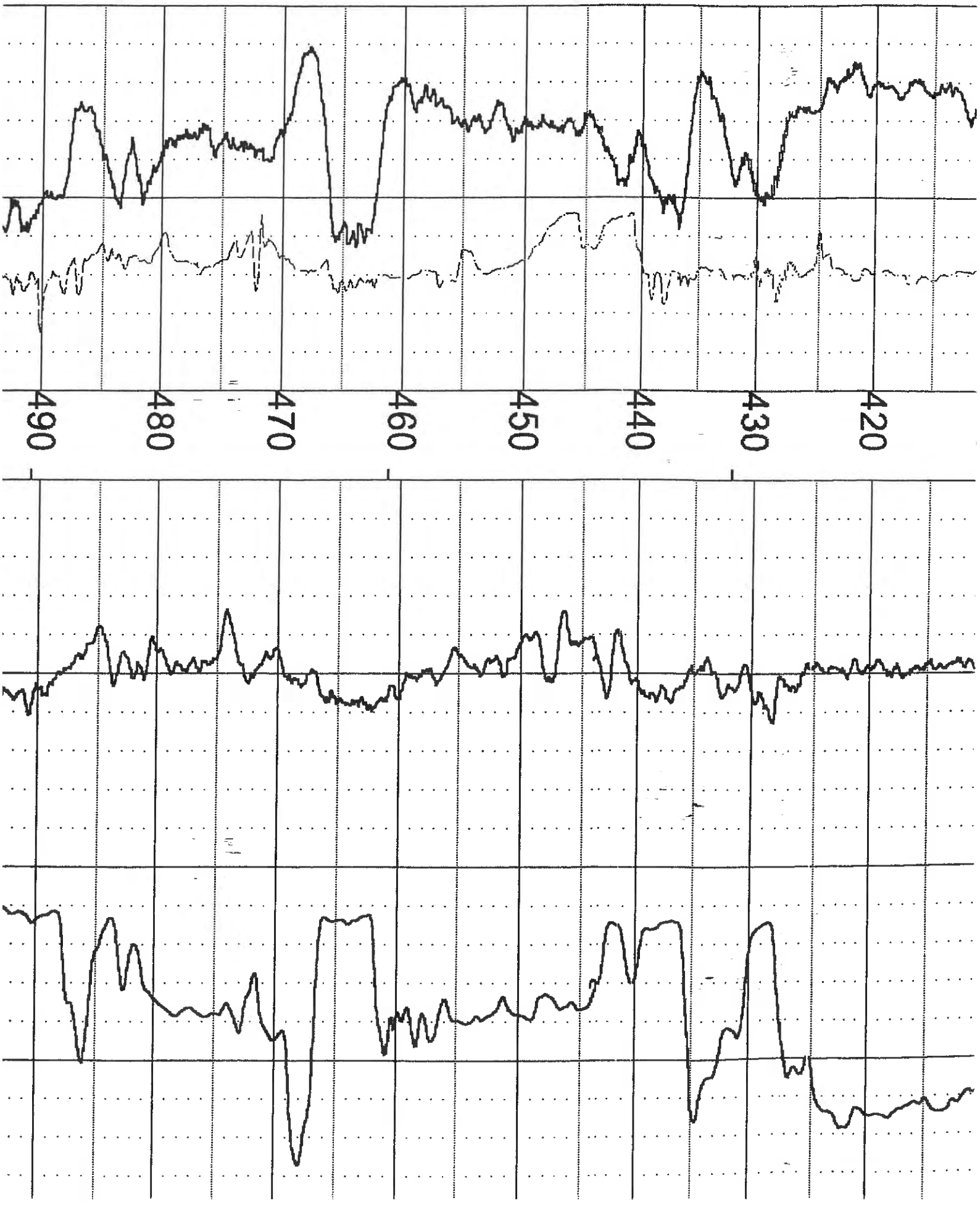
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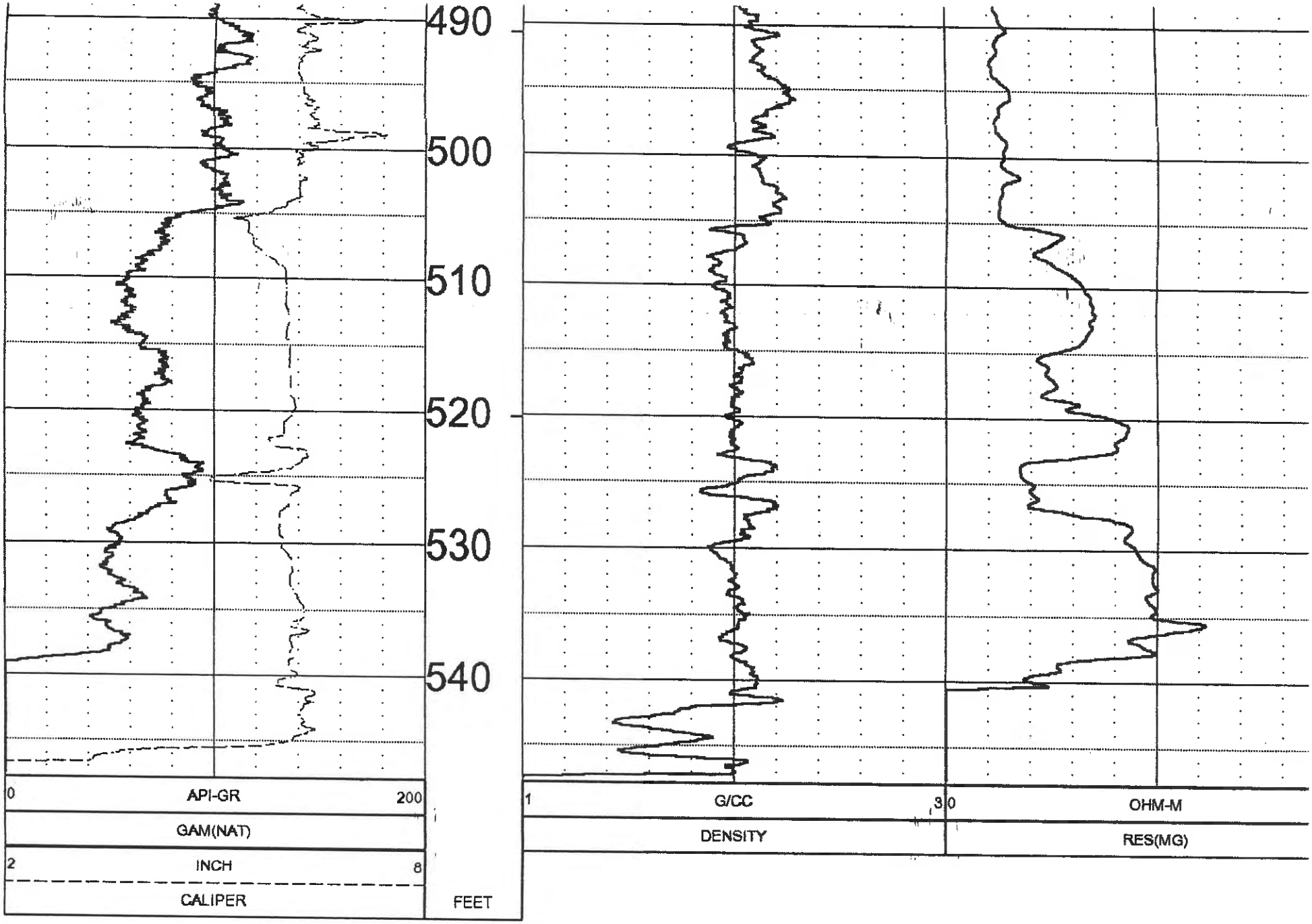


TOOL CALIBRATION C9-14 01/09/99 16:42

Available Construction Documentation

for Approved Operating Permit Well

C-9-20

Well Construction Record

Site Information

Owner: Alcoa Inc.
Well Number: C9-20
Well Use: Depressurization
Ground Level Elevation (Ft. AMSL): 425
Measuring Point
Description: Attached to well casing
Elevation (Ft. AMSL): AMSL+2
Northing (Ft.): 343058
Easting (Ft.): 3043941

Drilling

Drilling Company: MHC X-ploration Corporation
Driller's License No.: 4977WWDPMP
Date Drilled: 8/6/99
Drilling Method: Rotary-Mud
Bit Size and Type: 8.5"rock-pilot; 18"rock-ream
Drilling Fluid: Water-natural mud (see note 1)
Depth Drilled (Ft. Below Ground Level): 620, 830

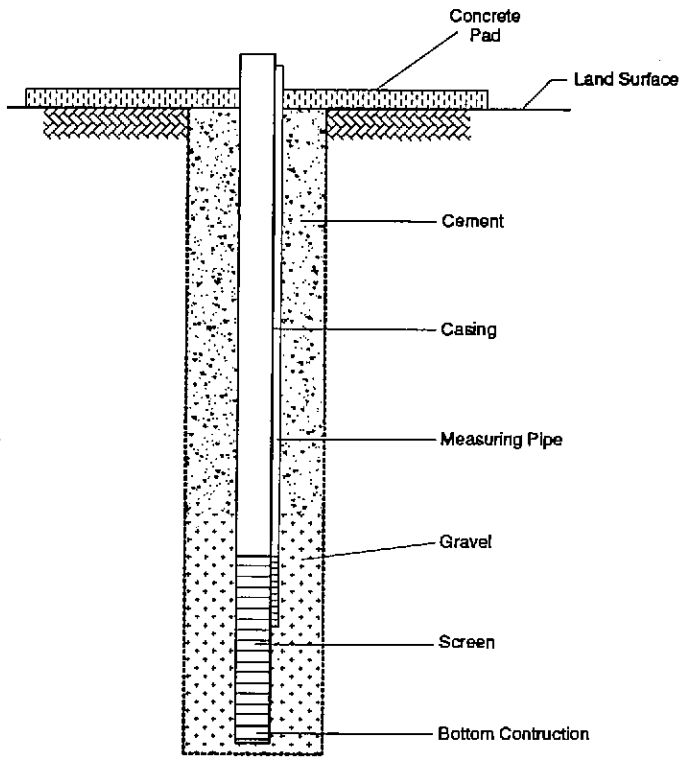
Construction

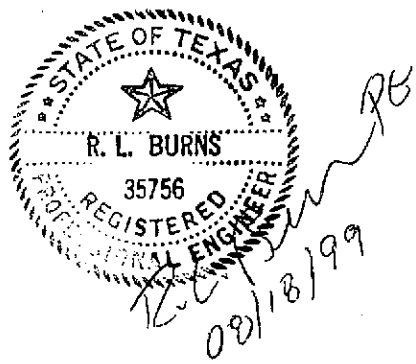
Date / Time of Construction: 8/12/99
Casing
Casing Type, Size, and Weight: Certain Teed Certalok PVC SDR 17 9.05 inch OD
Casing Interval (Ft. From Ground Level):
Top of Casing: +2
Bottom of Casing: 618
Screen
Screen Type, Size, Weight, and Opening Gauge:
Certain Teed Certalok PVC SDR 17 9.05 inch OD
Supplied with 0.030" mill manufactured slots
Screen Interval (Ft. Below Ground Level):
Top of Screen: 348
Bottom of Screen: 608
Bottom Construction: PVC End Cap
Bottom of Well (Ft. Below Ground Level): 620
Measuring Pipe
Measuring Pipe Type, Size, and Weight: 1 ¼ " PVC-Sch40
Measuring Point Interval (Ft. From Ground Level)
Top of Measuring Pipe: +2
Bottom of Measuring Pipe: 378
Gravel Pack
Gravel Type: 12/20 Brady Sand (see note 2)
Gravel Volume: 420 ft3
Gravel Setting (Ft. Below Ground Level)
Top of Gravel: 300
Bottom of Gravel Pack: 618
Placement Method: 1 ¼ " Tremie Pipe
Cement Grout Seal
Cement Type: Standard Class A –13.1 lb/gal (see note 3)
Cement Volume: 248 sacks
Cement Setting (Ft. Below Ground Level)
Top of Cement: Surface
Bottom of Cement: 300
Placement Method: 1 ¼ " Tremie Pipe (see note 4)

Geophysical Log

Date and Time of Log: 8/5/99
Logging Company: Alcoa Inc.
Logger: Rodney Coldiron
Depth Logged: 817.6

Well Construction Schematic





Development

Date / Time of Development: 08/16/99
Method of Development: Air Jetting
Date / Time of Development: 40 hours
Method of Development: Air Jetting

Notes

1-Drilling fluids chlorinated with calcium hypochlorite minimum of 0.5 mg/L chlorine; ec less than 1000umhos
2- Gravel placed with 5 mg/L chlorinated water
3- Centralizers installed
4. Cementing by Halliburton Energy Services

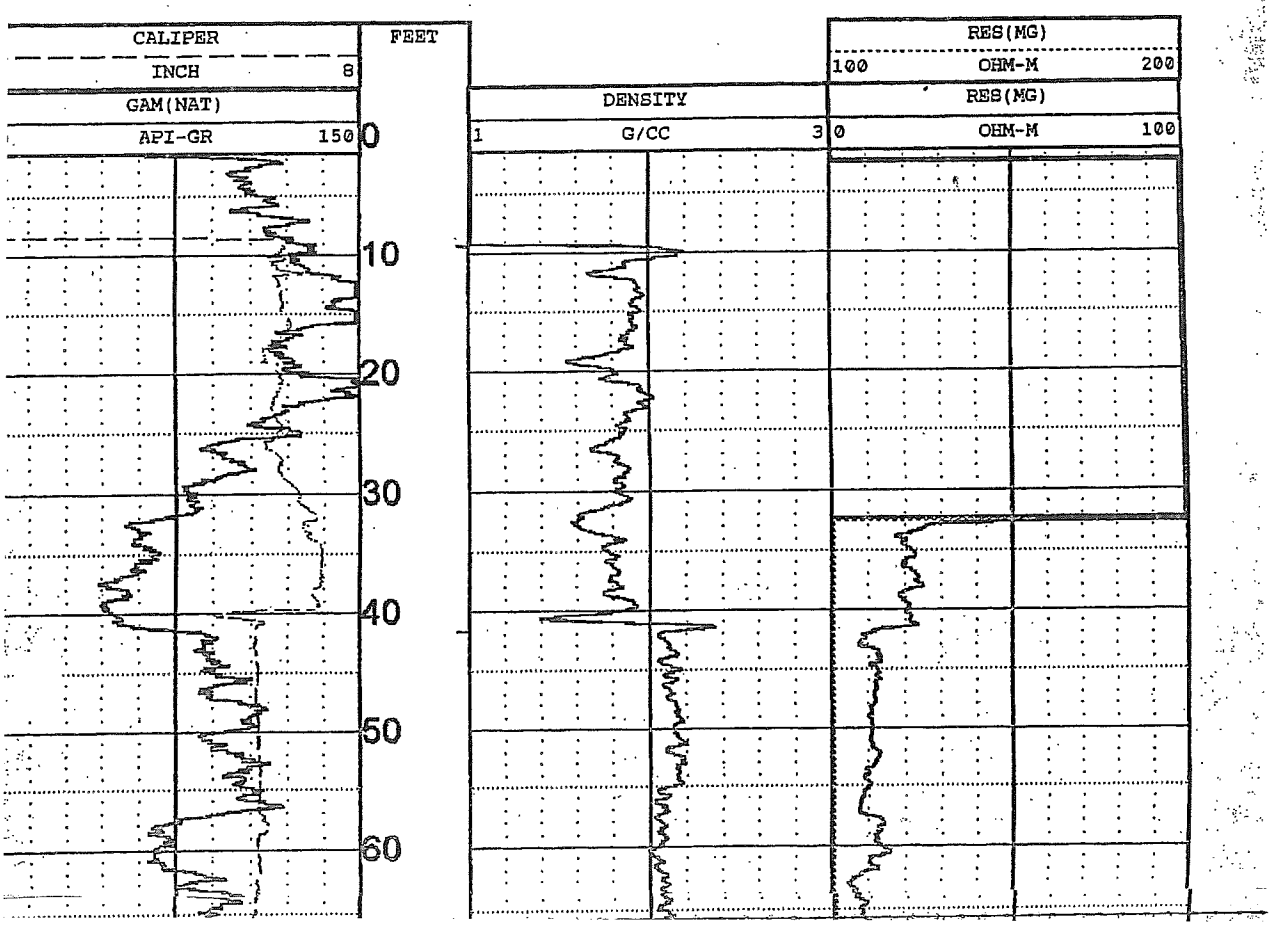
Engineer's Name Richard L. Burns Signature Richard L. Burns PE Date 08/18/99
Professional Engineering Registration Number TX35756

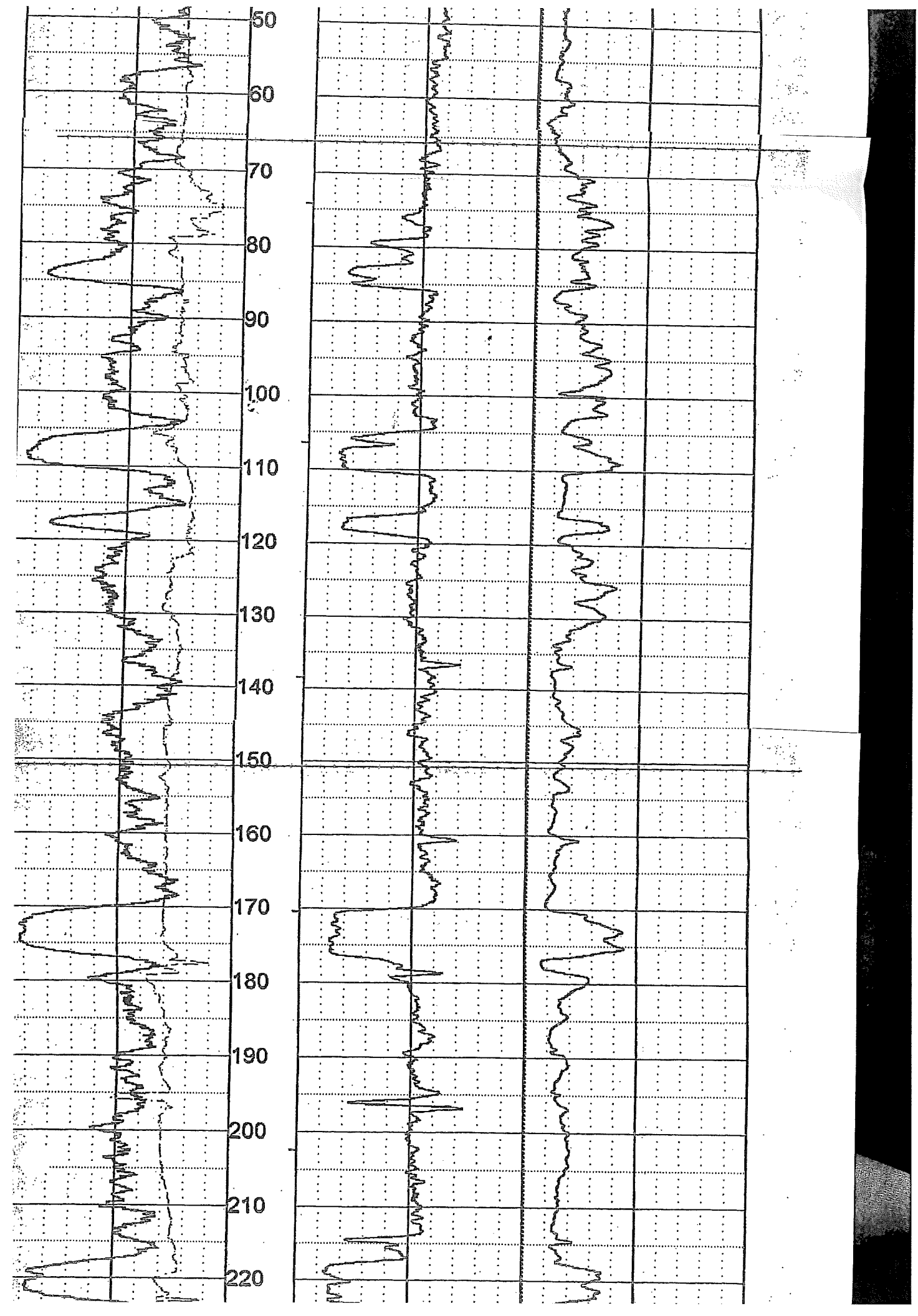
Century GEOPHYSICAL CORP.

C9-20

COMPANY	: MFG, INC.			OTHER SERVICES:	
WELL	: C9-20				
LOCATION/FIELD	: ALCOA E-AREA				
COUNTY	: MILAM				
STATE	: TX				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 08/05/99	PERMANENT DATUM	: GL		
DEPTH DRILLER	: 820			KB	:
LOG BOTTOM	: 817.60	LOG MEASURED FROM:	GL	DF	:
LOG TOP	: 1.50	DRL MEASURED FROM:	GL	GL	:
CASING DIAMETER	:	LOGGING UNIT	: 9611		
CASING TYPE	:	FIELD OFFICE	: TULSA		
CASING THICKNESS:		RECORDED BY	: BARAHONA		
BIT SIZE	: 6	BOREHOLE FLUID	: WATER	FILE	: ORIGINAL
MAGNETIC DECL.	: 7.0	RM	:	TYPE	: 9030AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:		
NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 54		
				THRESH:	20000

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

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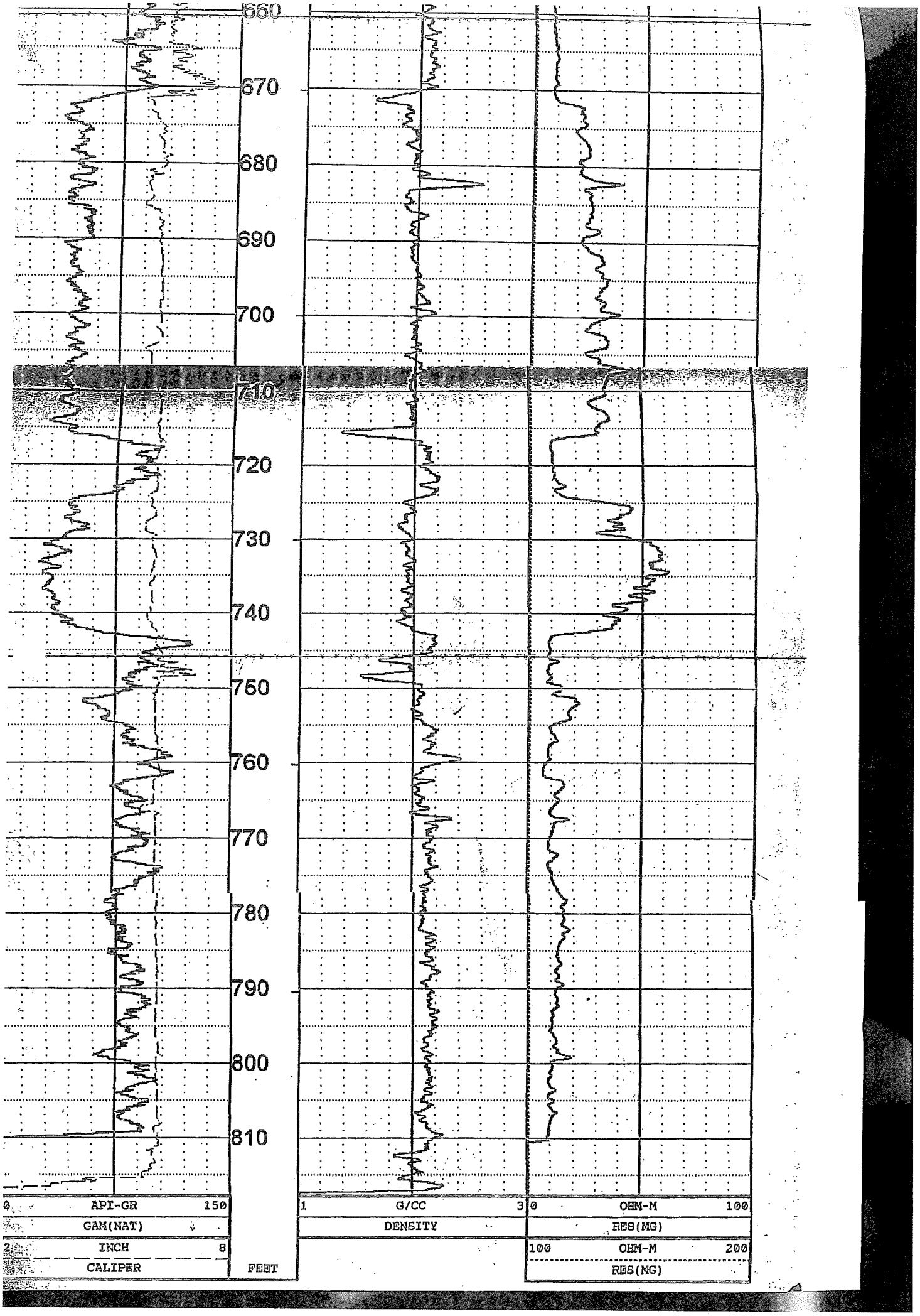
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GAM(NAT)
2 INCH 8
CALIPER
FEET
1 G/CC 3
DENSITY
0 OHM-M 100
RES(MG)
100 OHM-M 200
RES(MG)

Available Construction Documentation

for Approved Operating Permit Well

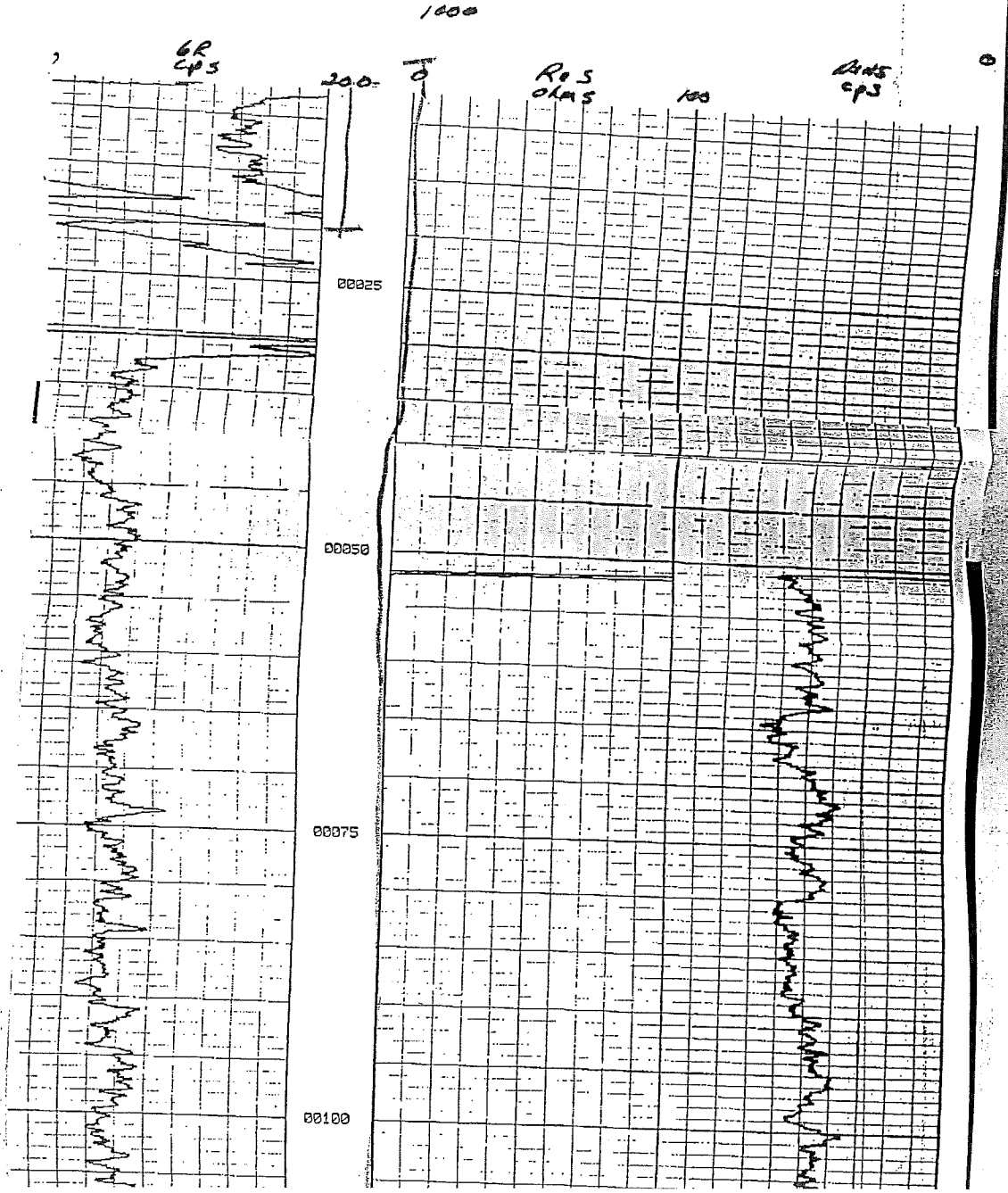
DP-S-A-3

To Ridge Kaiser

From: Rickey Gaines

DP-5A-3

2/18/93



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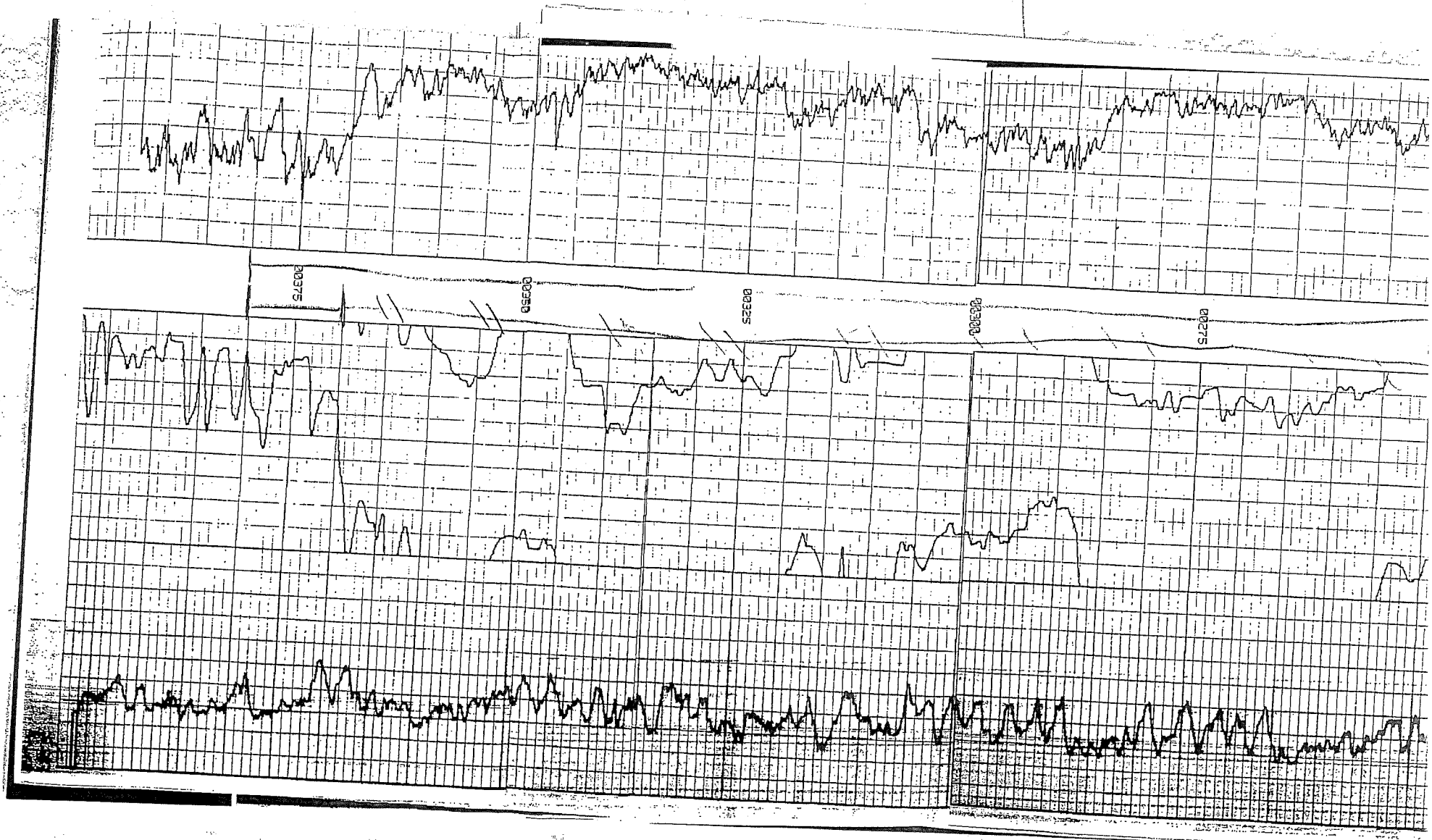
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Available Construction Documentation

for Approved Operating Permit Well

DP-S-A-4

A Area

SA 4

SA-4

1-06-92

Post-it™ brand fax transmittal memo 7671 | # of pages ▸

To RIDGE KAISER | From R. GAINES

Co. RHA | Co.

Dept. | Phone # (512) 446-8748

Fax # (512) 338-9272 | Fax # -8614

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RES ohms 0 100

MNS cps 0

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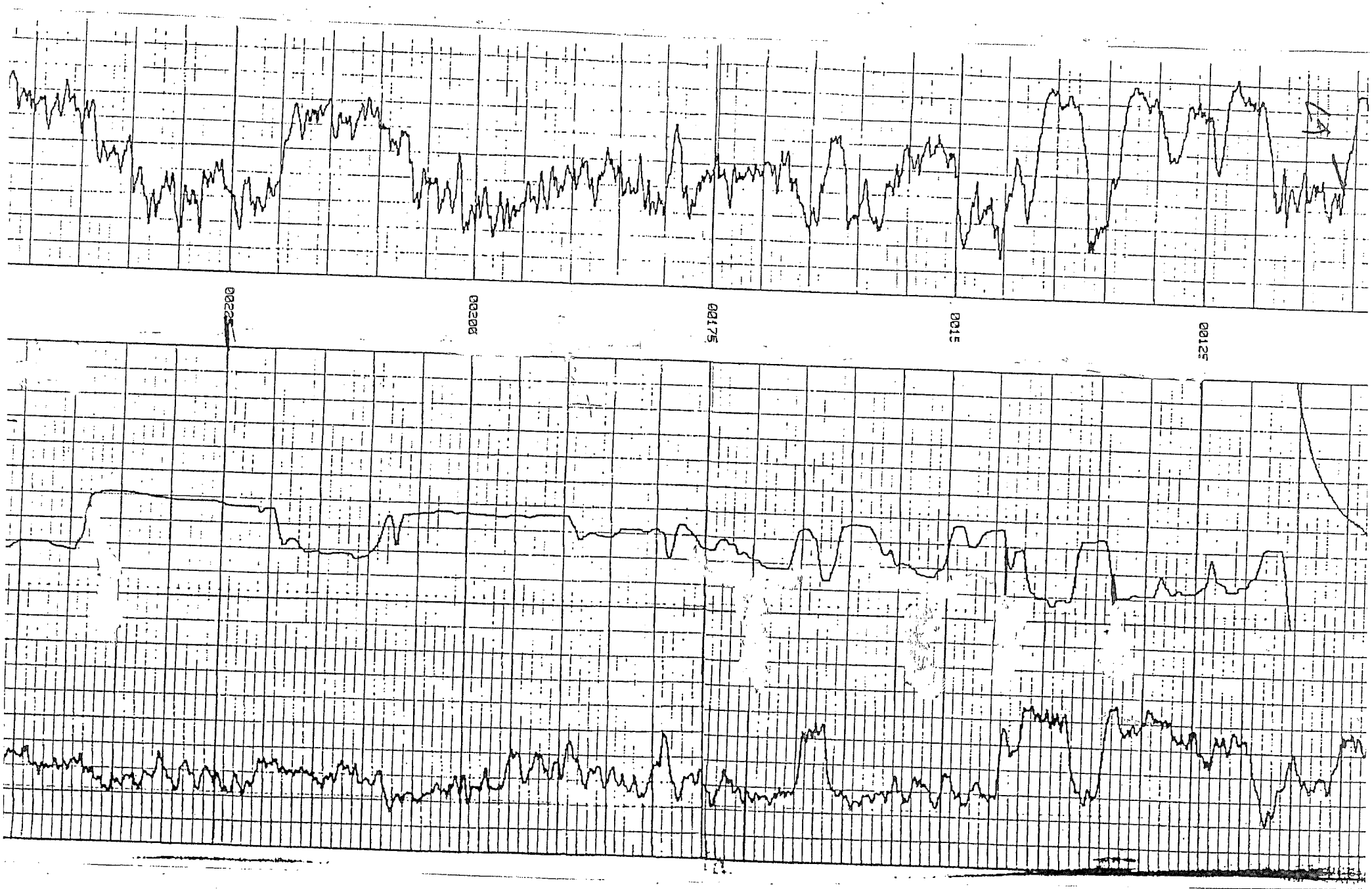
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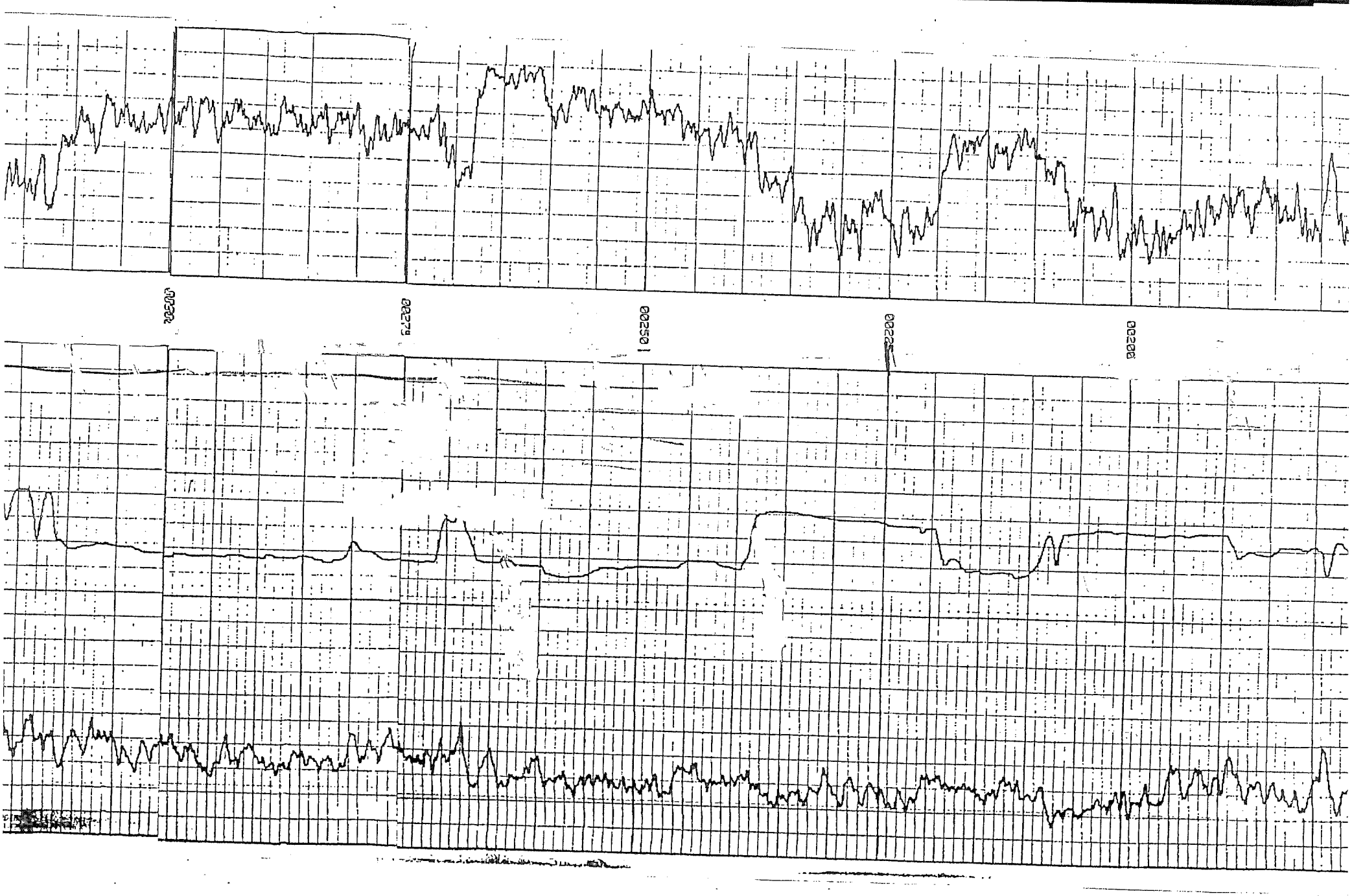
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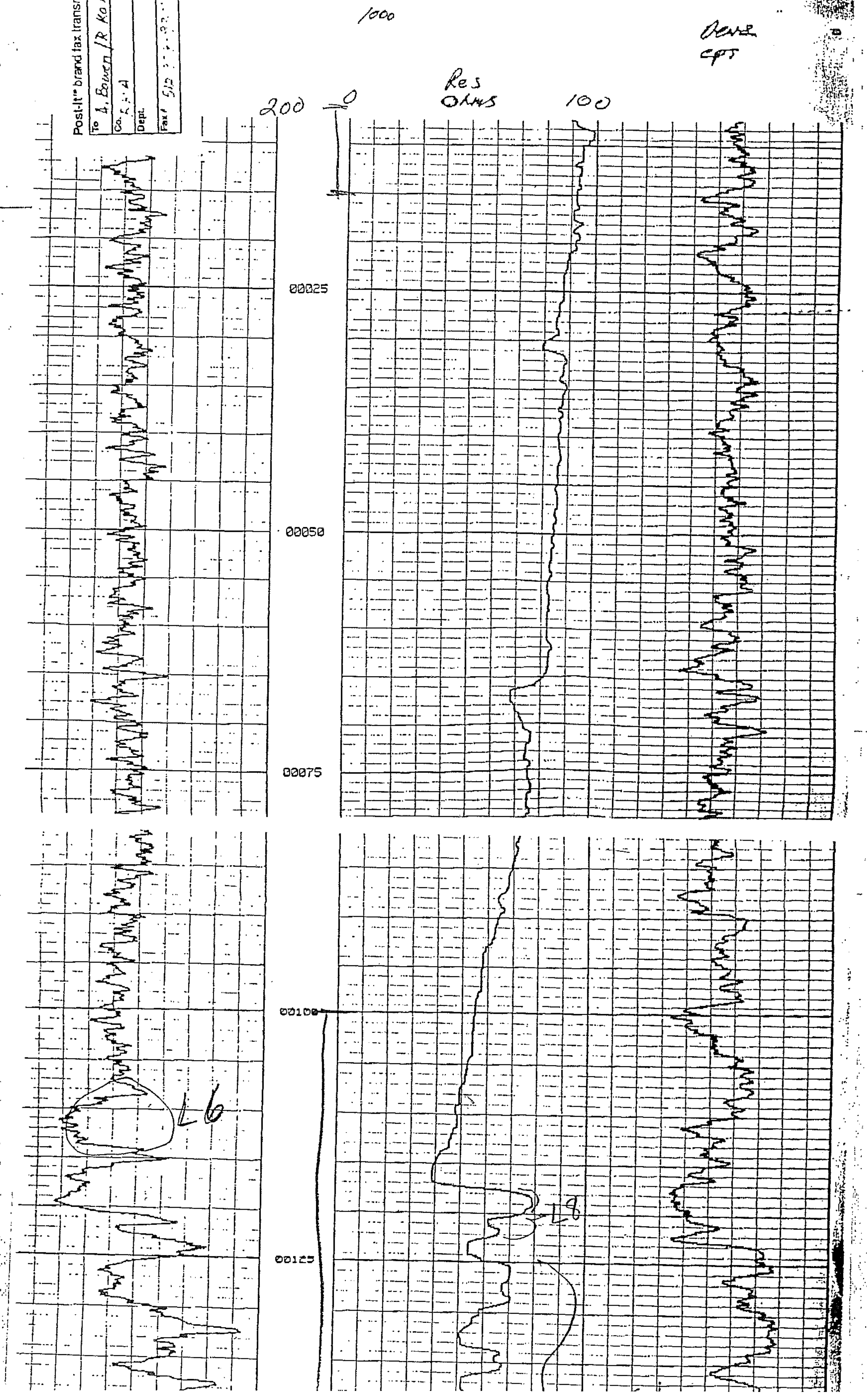
Available Construction Documentation

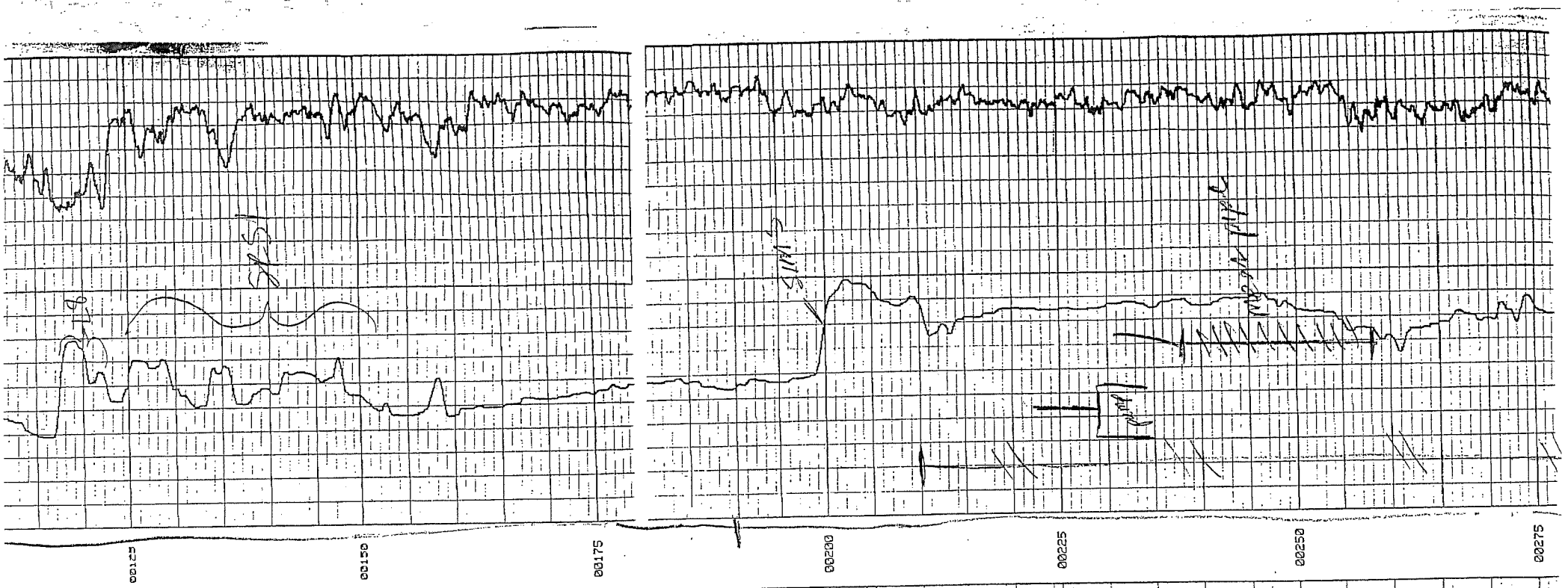
for Approved Operating Permit Well

DP-S-A-5

SA-5
1/14/93

Post-it™ brand fax transmittal memo 7671 | # of pages ▸
To A. Bowen / R Kaiser | From R.

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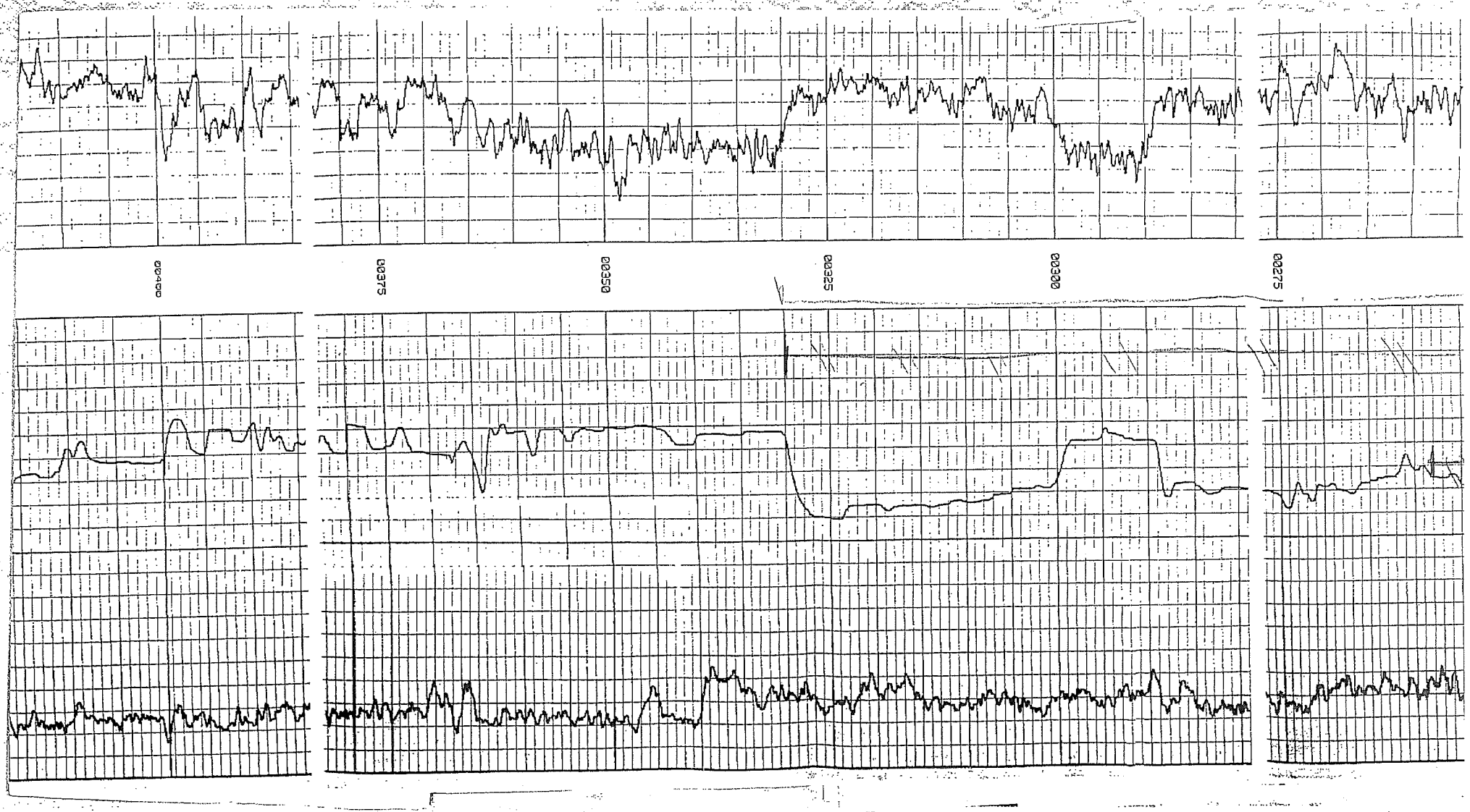
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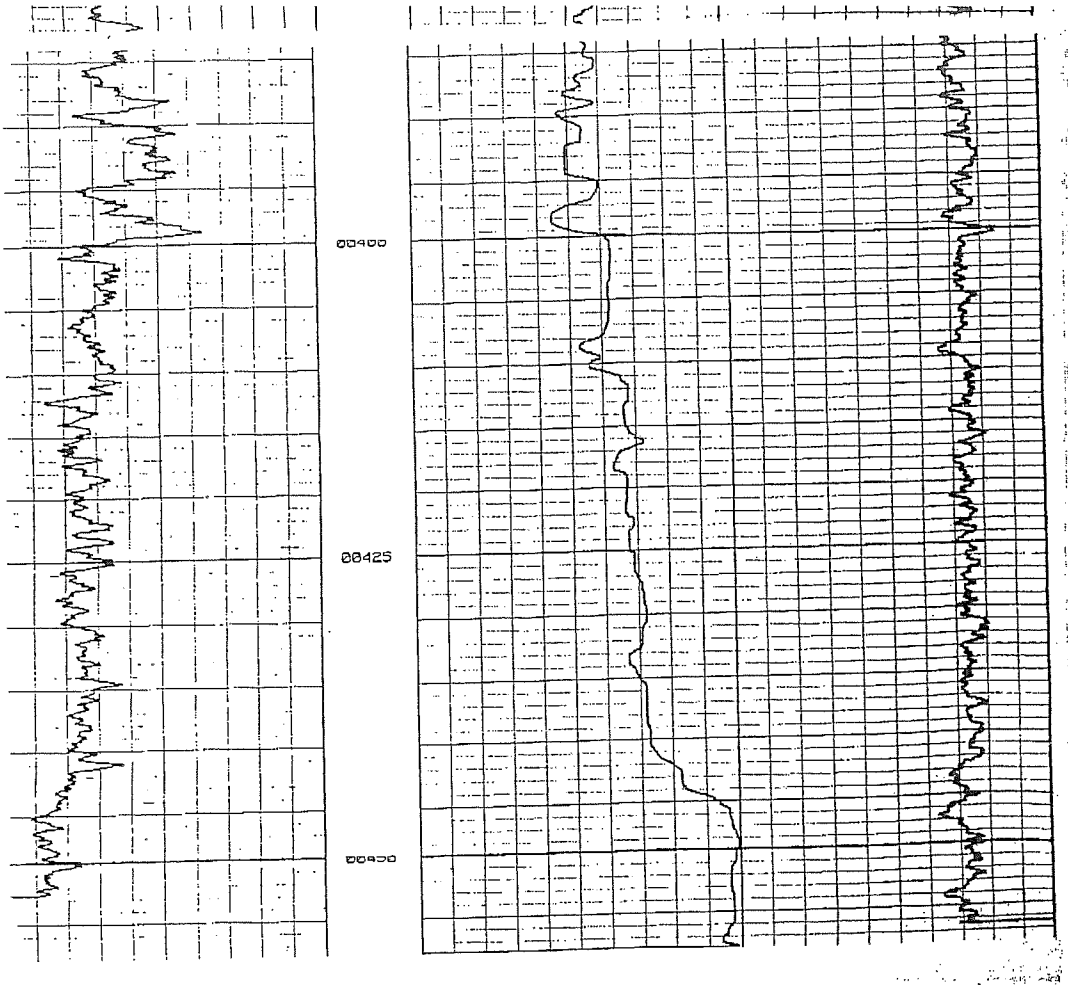
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Available Construction Documentation

for Approved Operating Permit Well

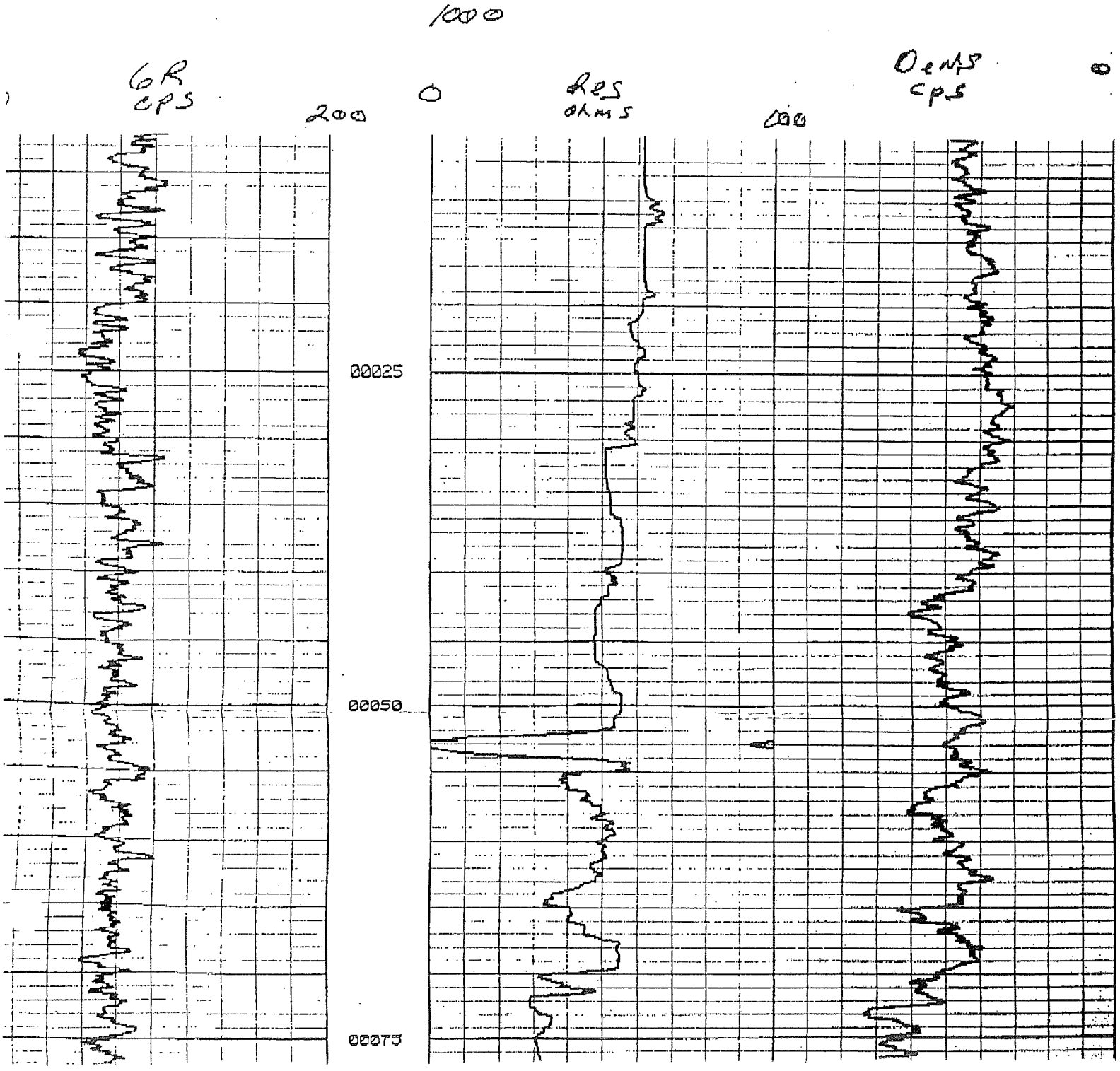
DP-S-A-6

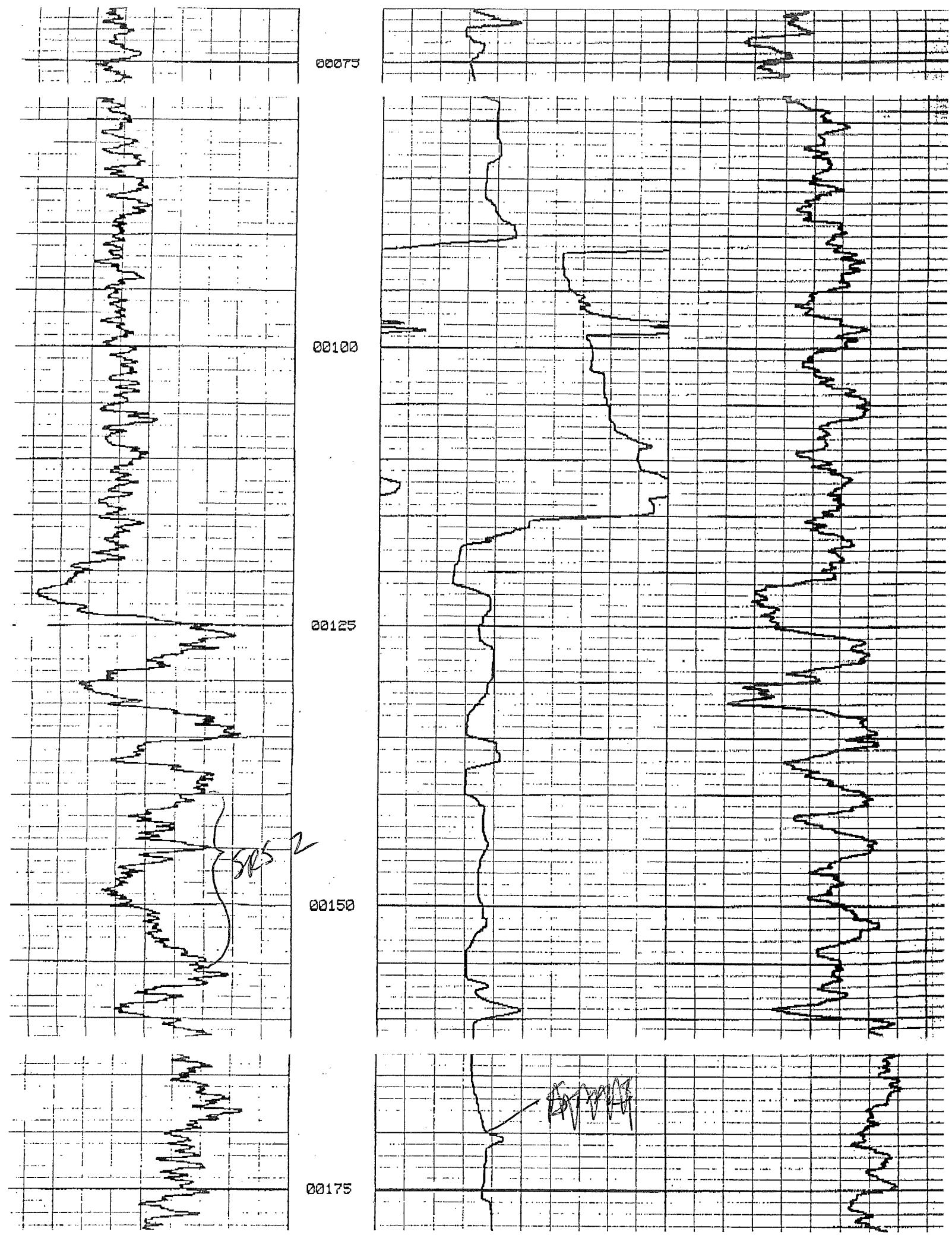
To: Ridge Kaiser

From: Rickey Gaines

SA-6

1/18/93

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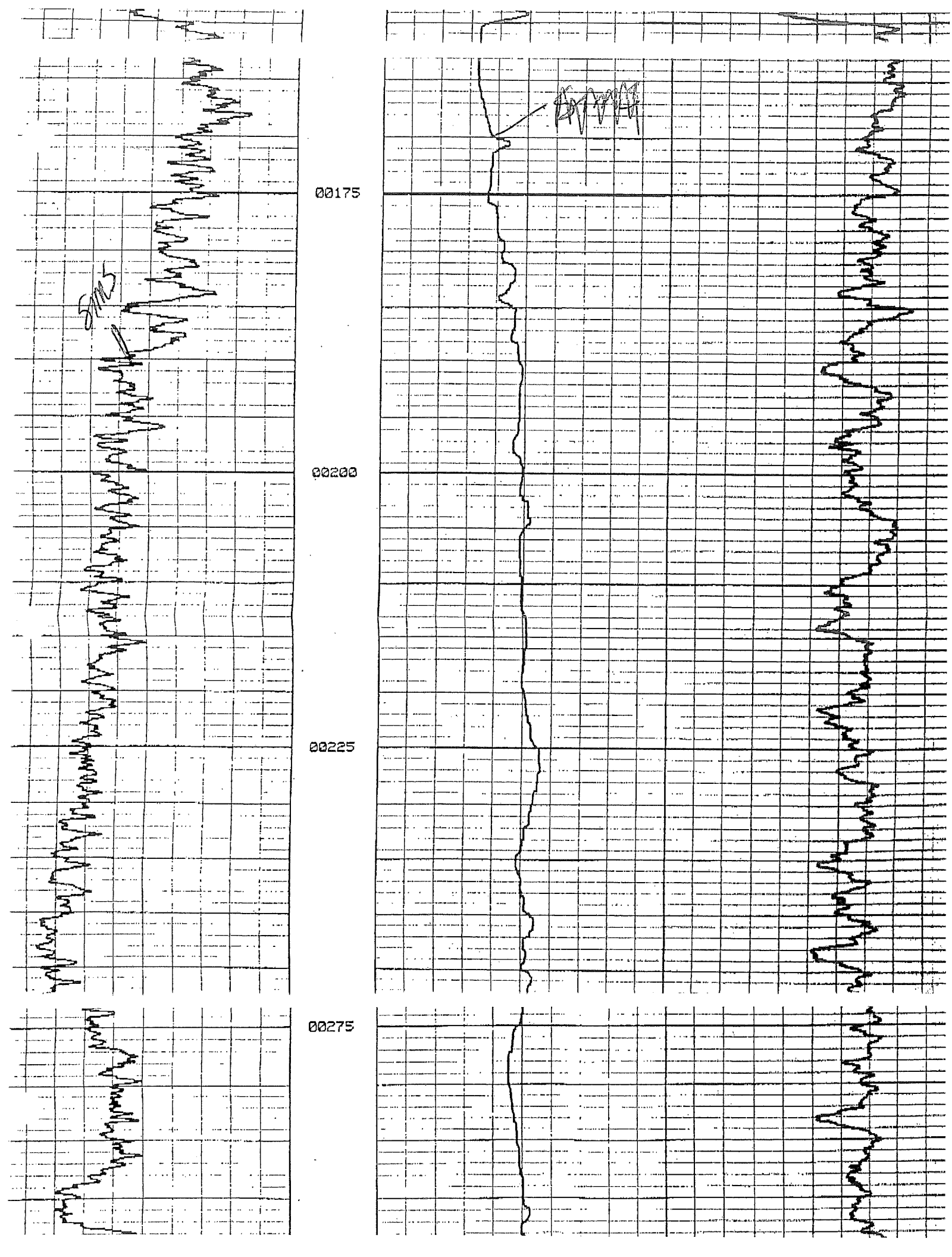
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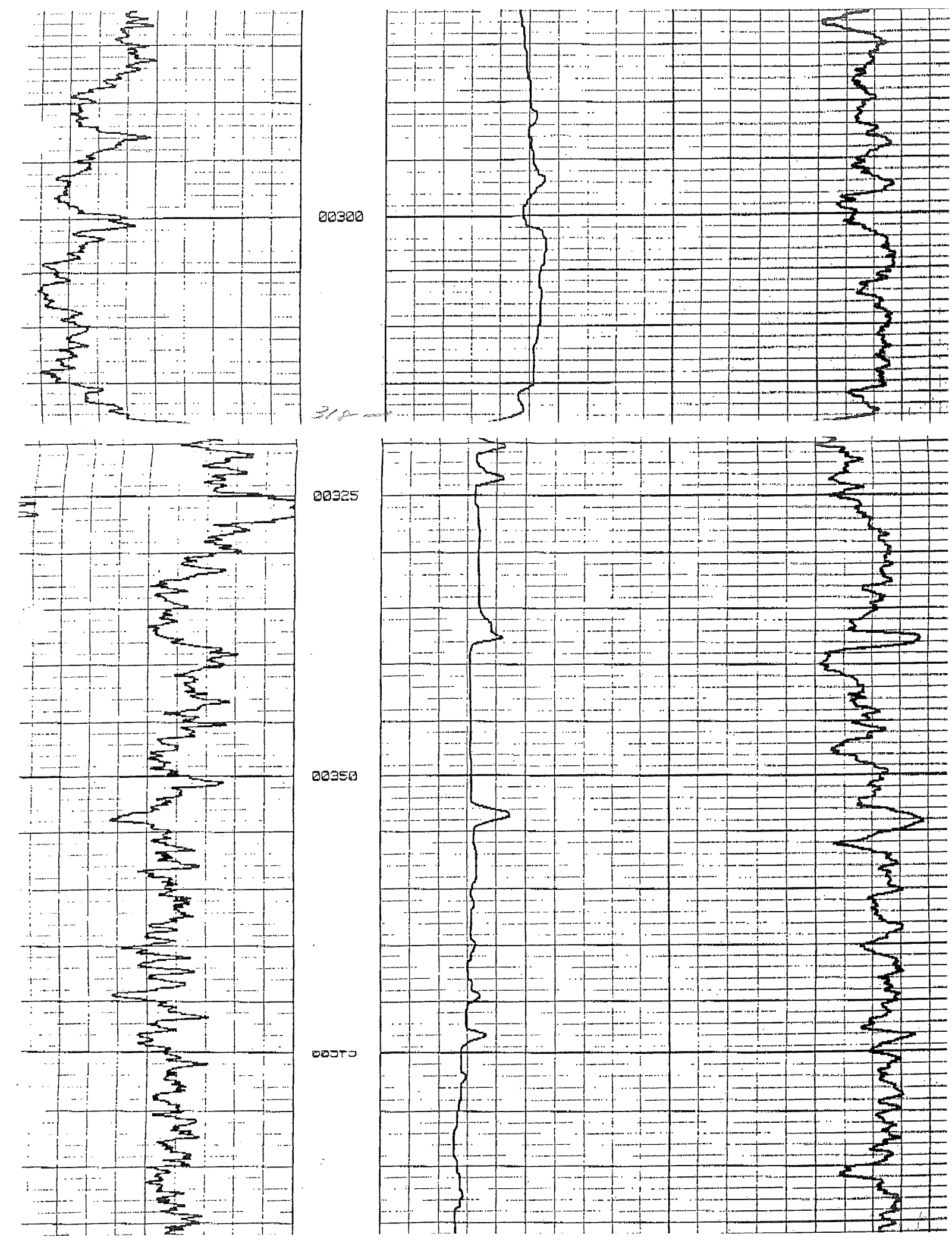
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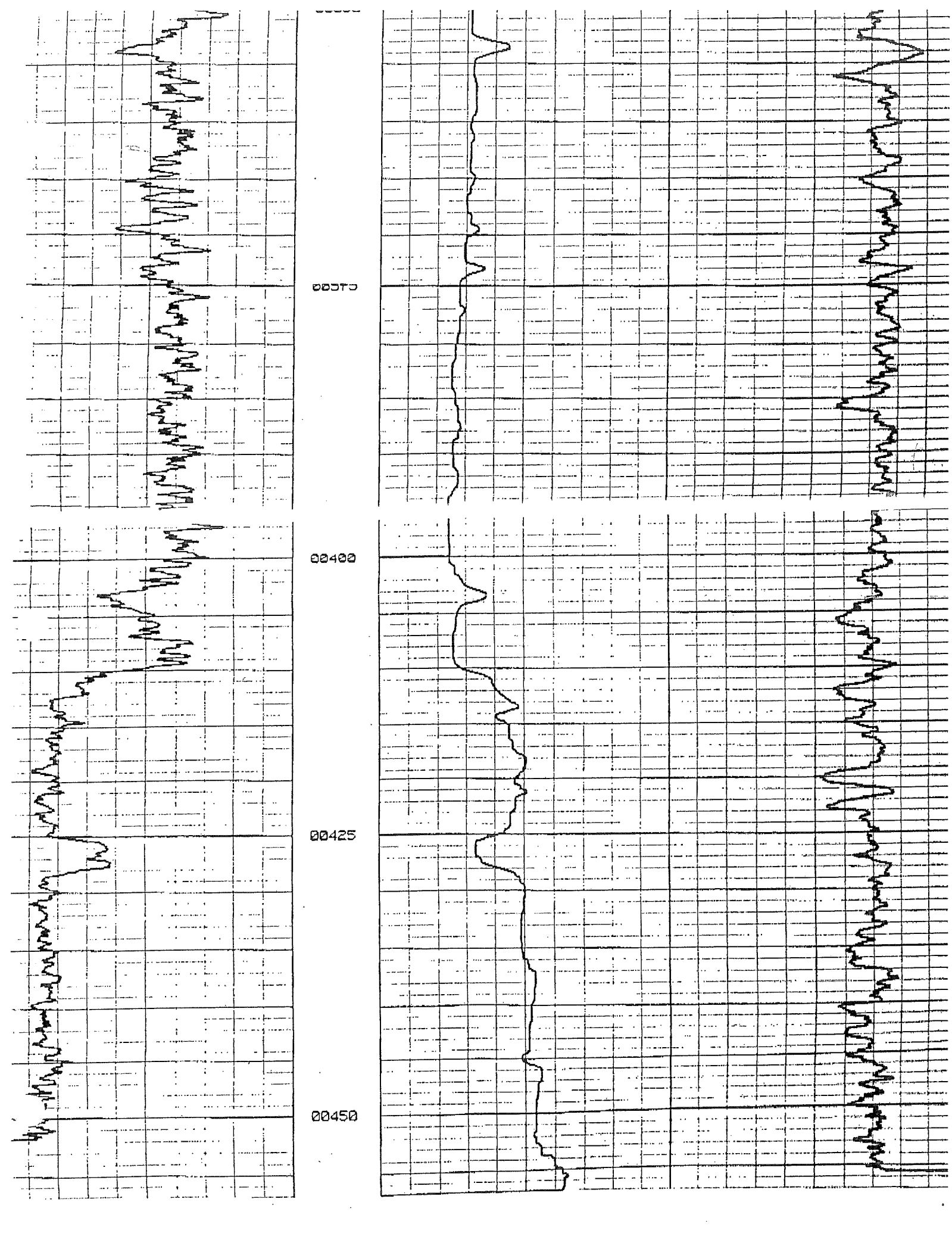
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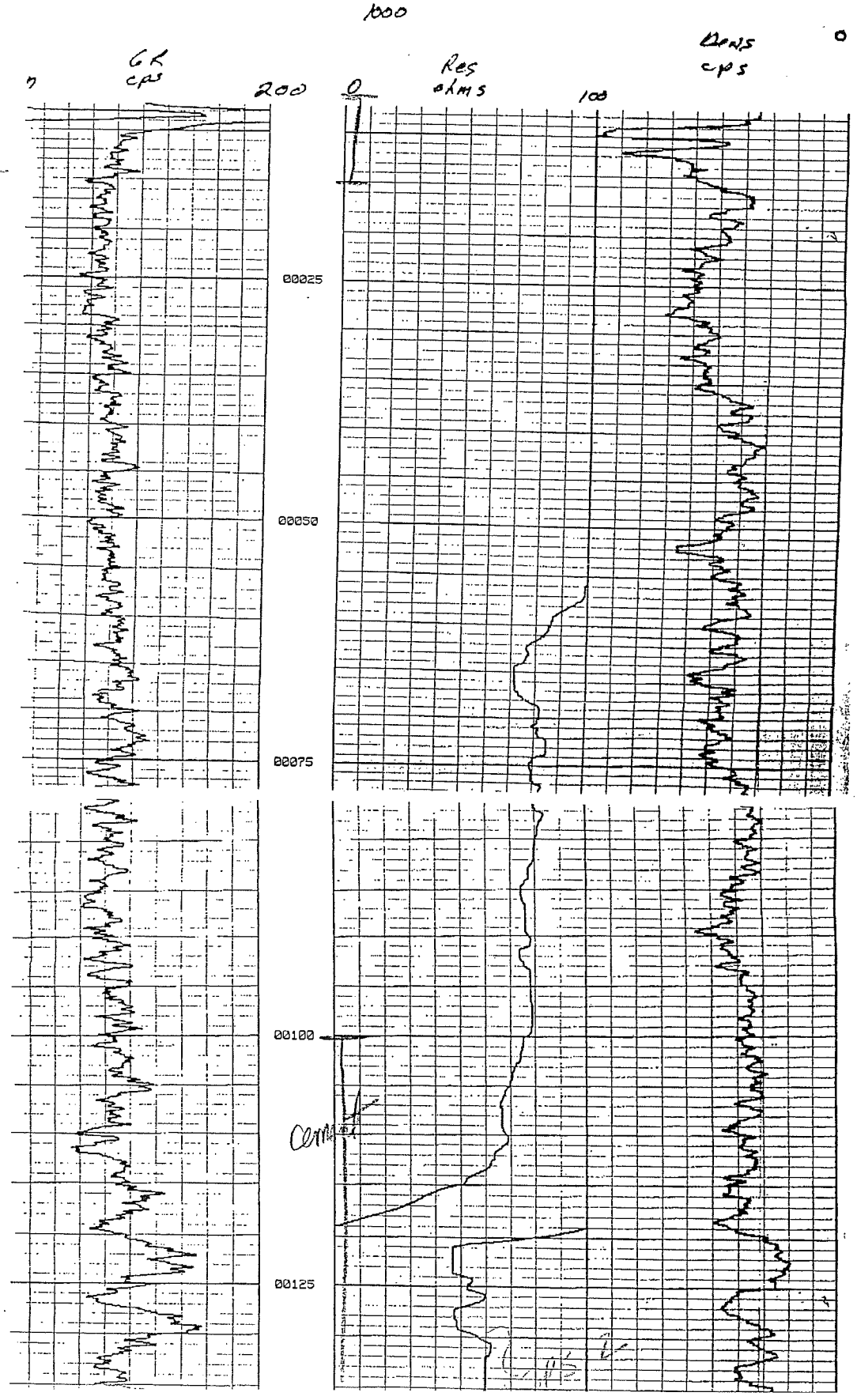
Available Construction Documentation

for Approved Operating Permit Well

DP-S-A-7

5A-7

1-25-93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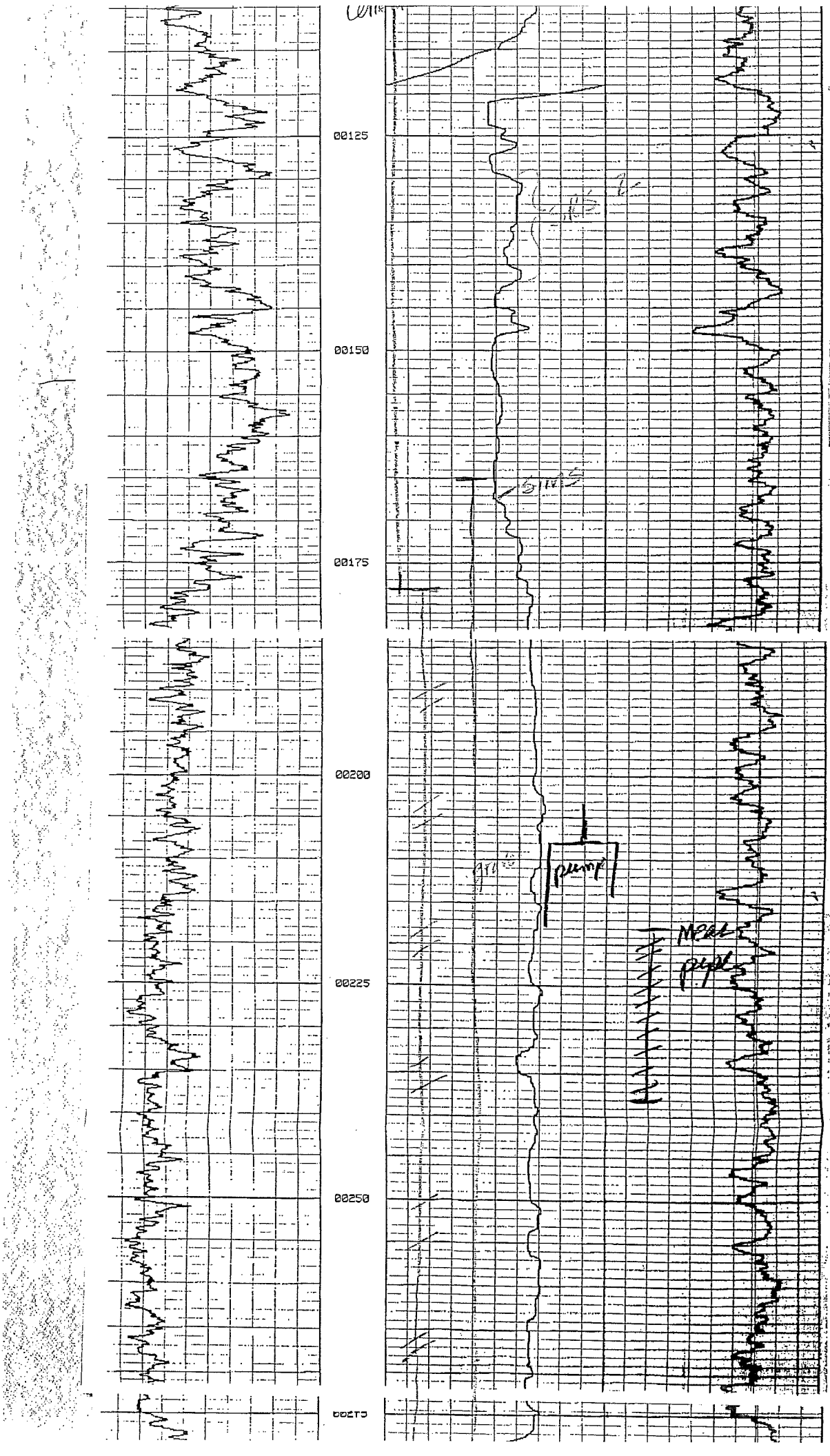
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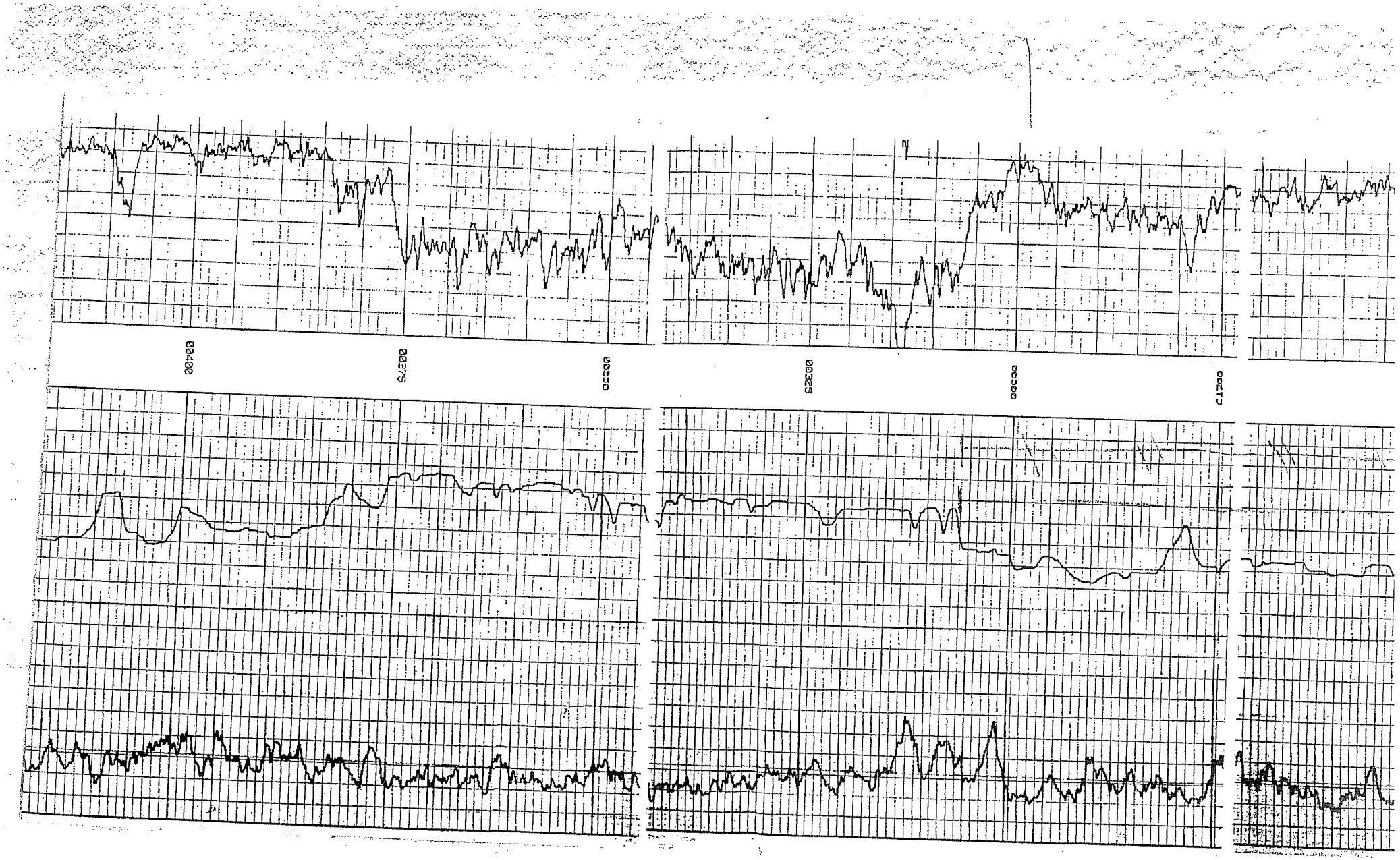
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Available Construction Documentation

for Approved Operating Permit Well

F2 Sims

SEPARATION = 132' x 1.76 = 232.3'

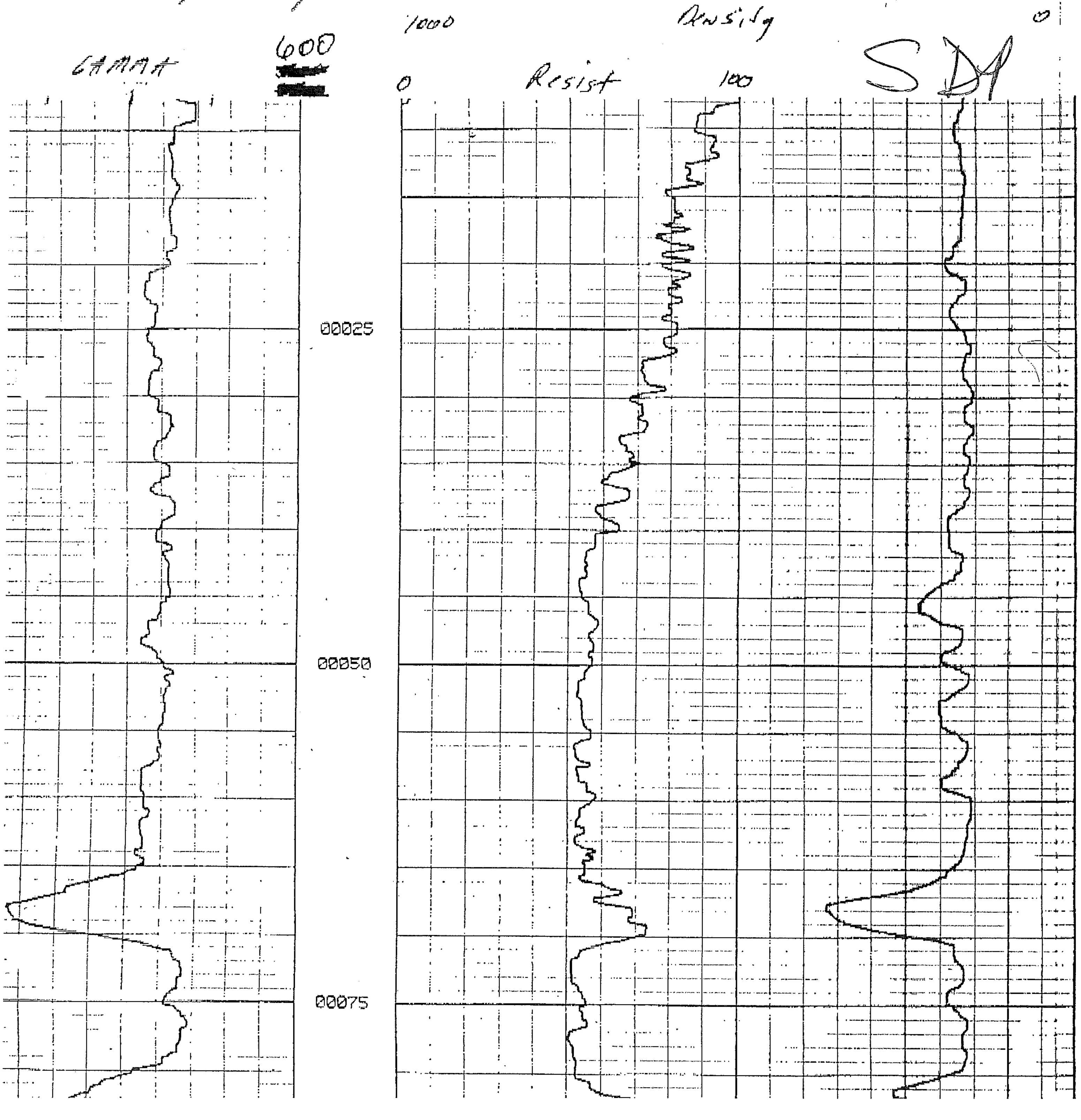
Top Sims 385

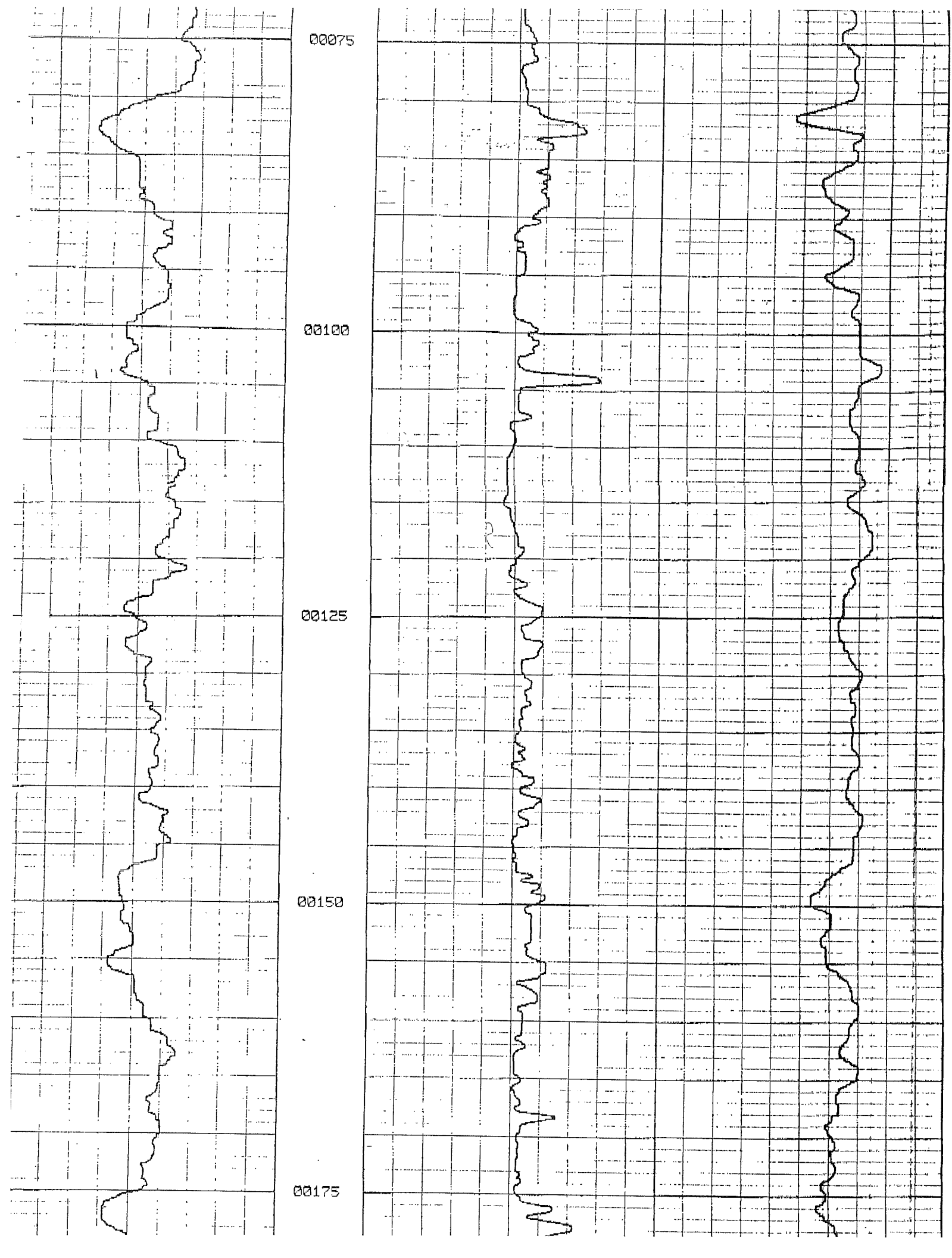
1.76 overpress elev. = 379.'

F.2 1/14/92

Site no good for depress well

APPROX F/BW 537

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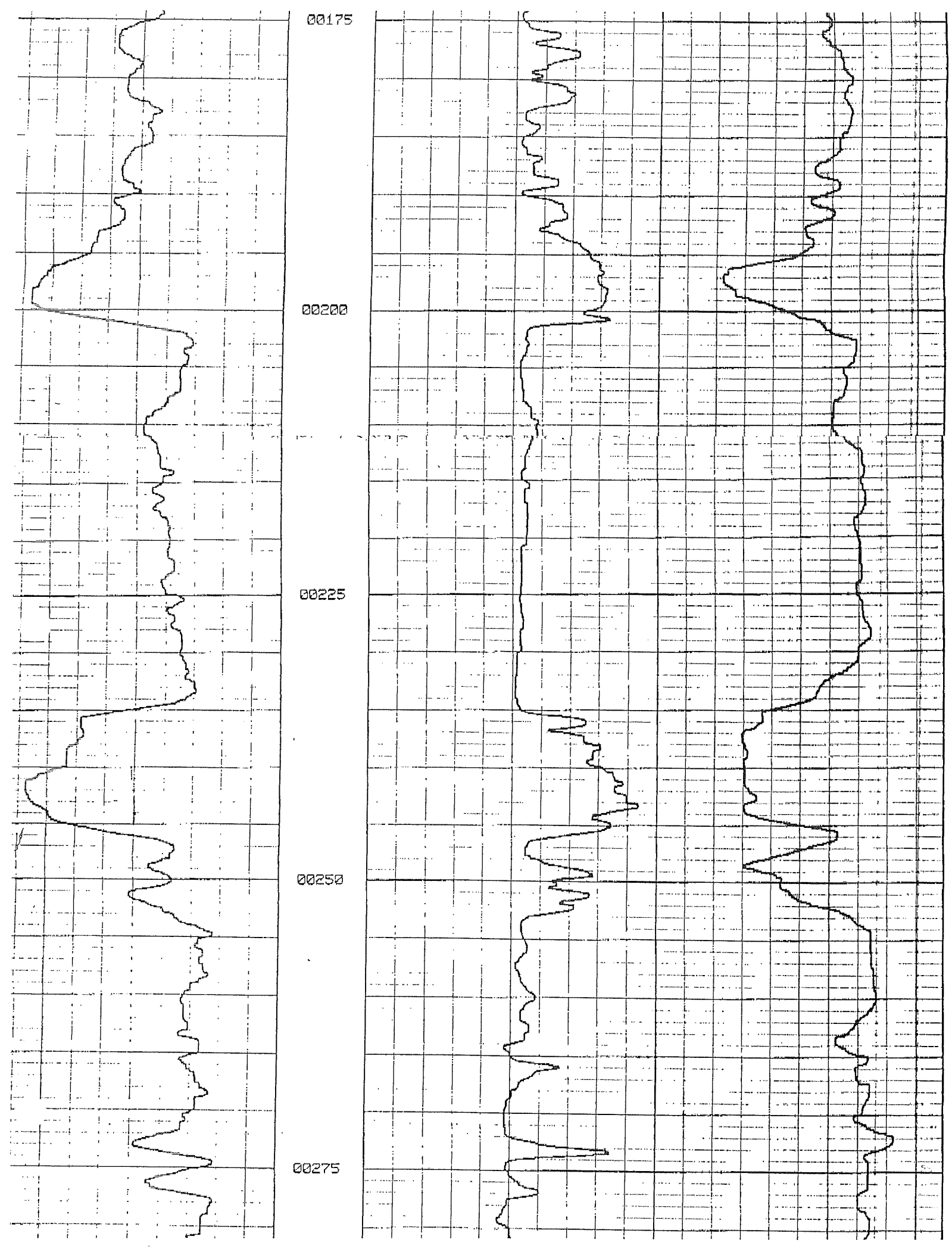
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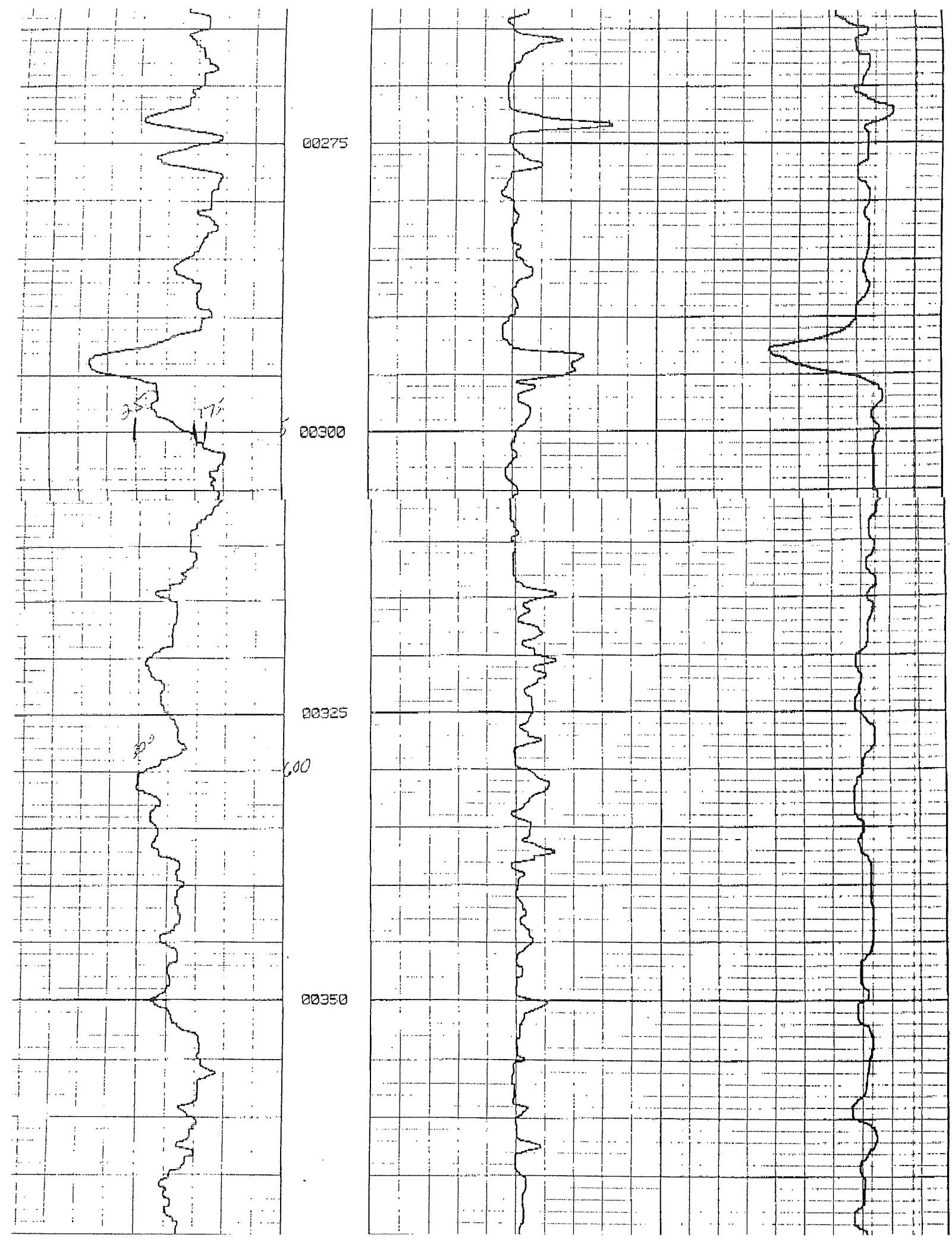
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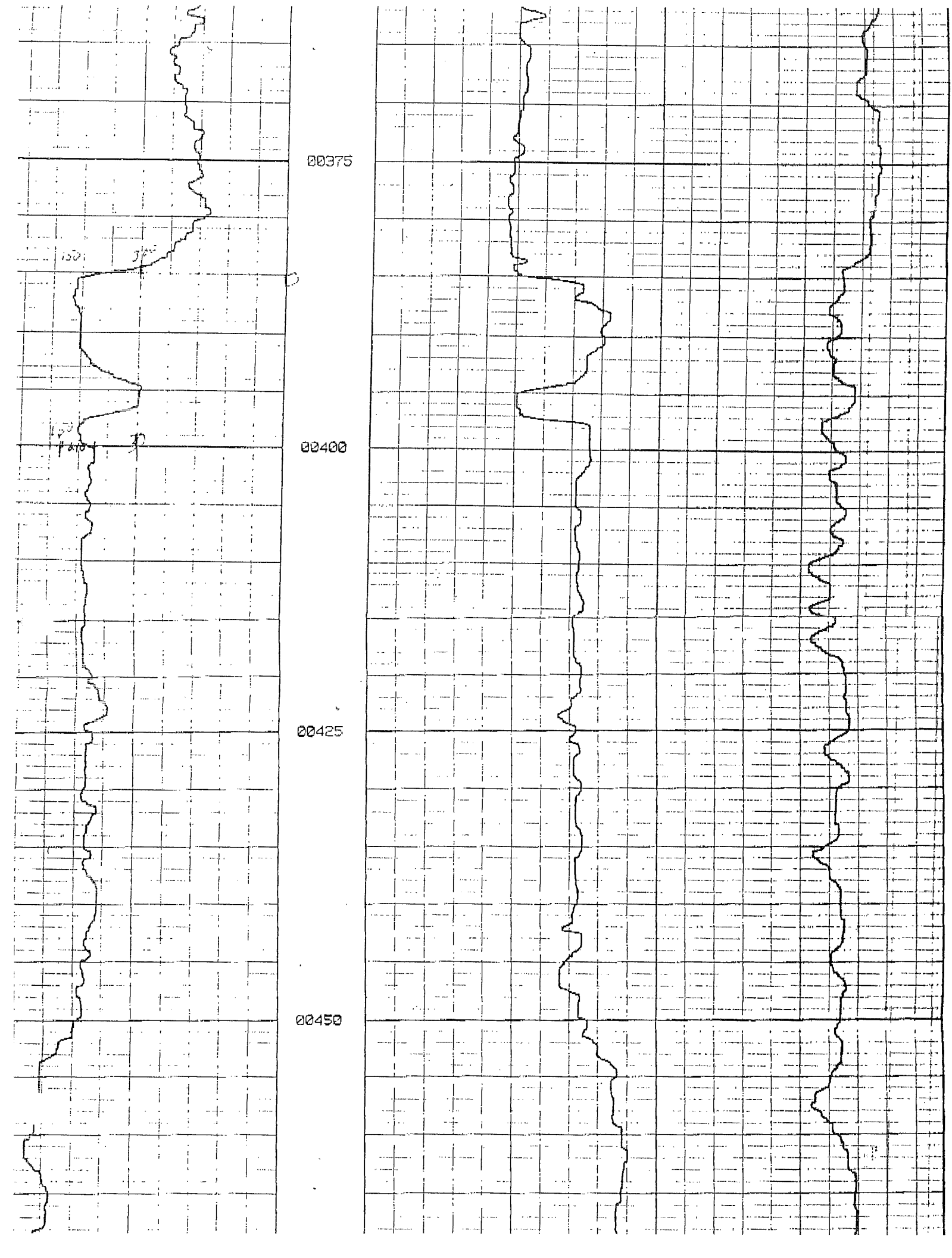
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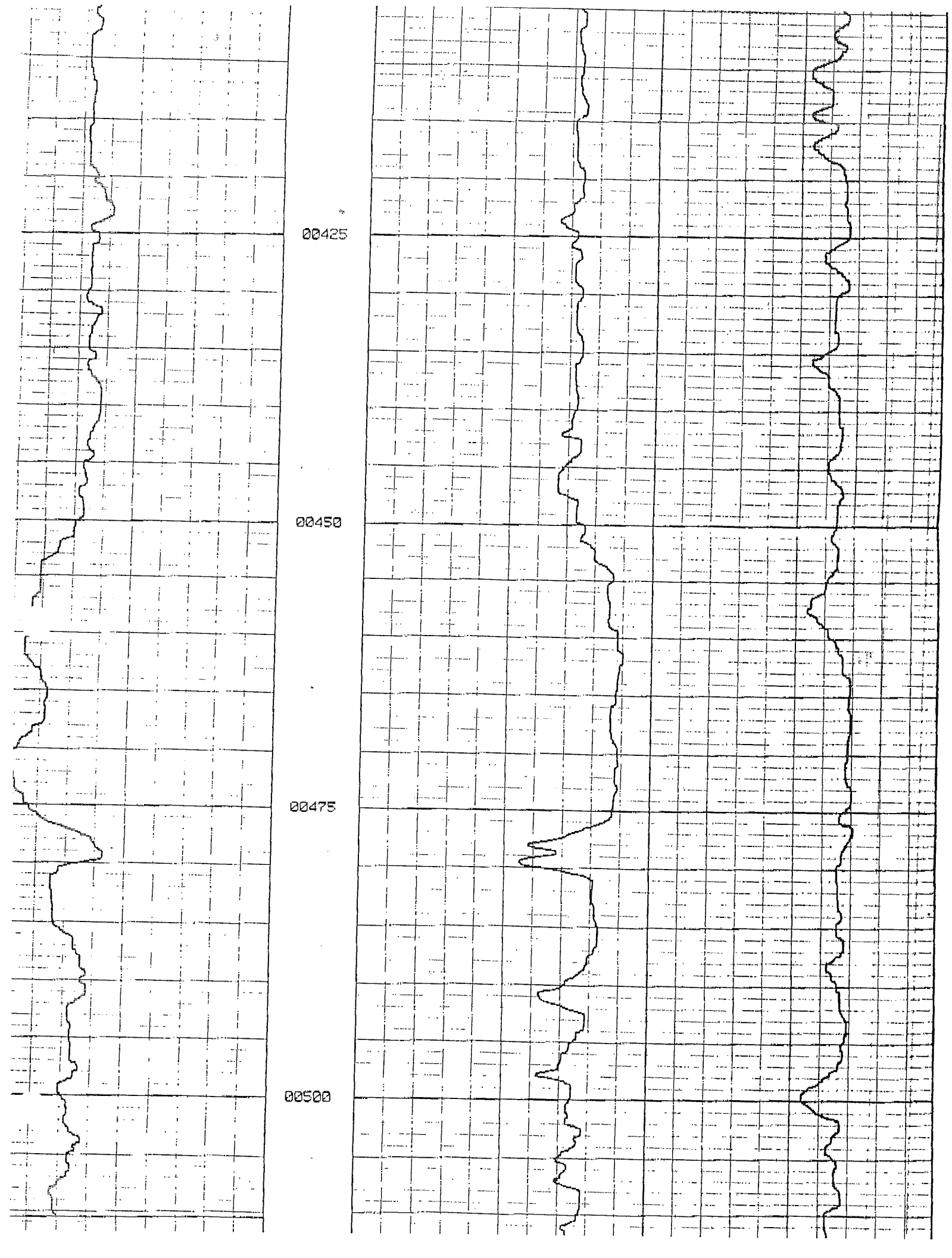
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Available Construction Documentation

for Approved Operating Permit Well

F4 Sims

F-4

COMPANY ALUMINUM COMPANY OF AMERICA

WELL F-4

FIELD F AREA

COUNTY MILAM STATE TEXAS COUNTRY USA

LOCATION 47+18.84 S X 87+48.61 E

322859.20 N X 3026121.91 E

SECTION ____ TOWNSHIP ____ RANGE ____ API NUM ____

Permanent Datum ____ ; Elevation 504.00 Elev.: K.B. ____

Log Measured From GL ____, ____ Above Perm. Datum D.F. ____

Drilling Meas From GL G.L. ____

	1	2	3
Date	11\17-92		
Depth - Driller	520		
Depth - Logger	514		
Btm Log Interval			
Top Log Interval			
Casing - Driller	MHC		
Casing - Logger	ALCOA		
Bitsize	43\4		
Type Fluid in Hole	H20		
Dens. / Visc.	/	/	/
pH / Fluid Loss	/	/	/
Source of Sample			
Rm @ Meas. Temp	@	@	@
Rmf @ Meas. Temp	@	@	@
Rmc @ Meas. Temp	@	@	@
Rm @ BHT	@	@	@
Max. Rec. Temp.			

Rm @ BHT	@	@	@
Max. Rec. Temp.			

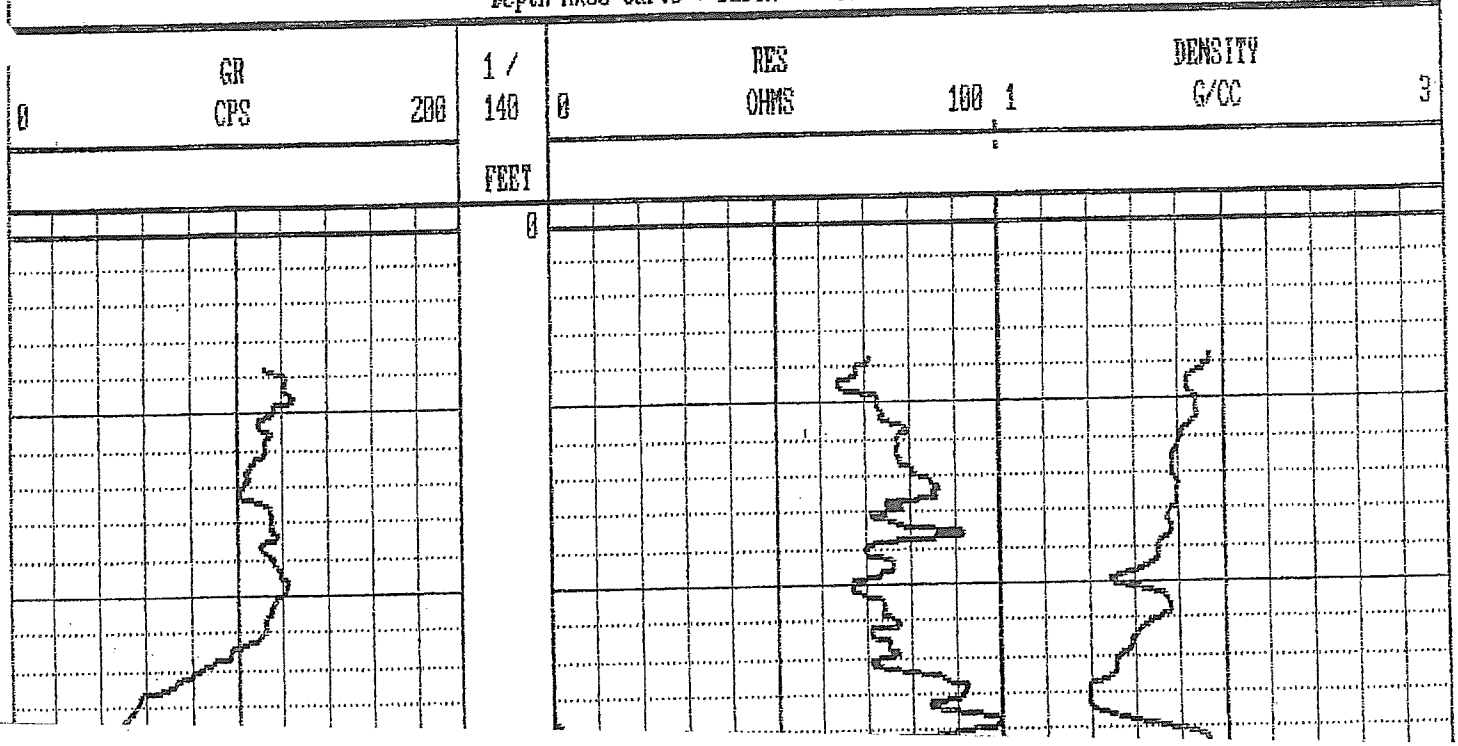
REMARKS :

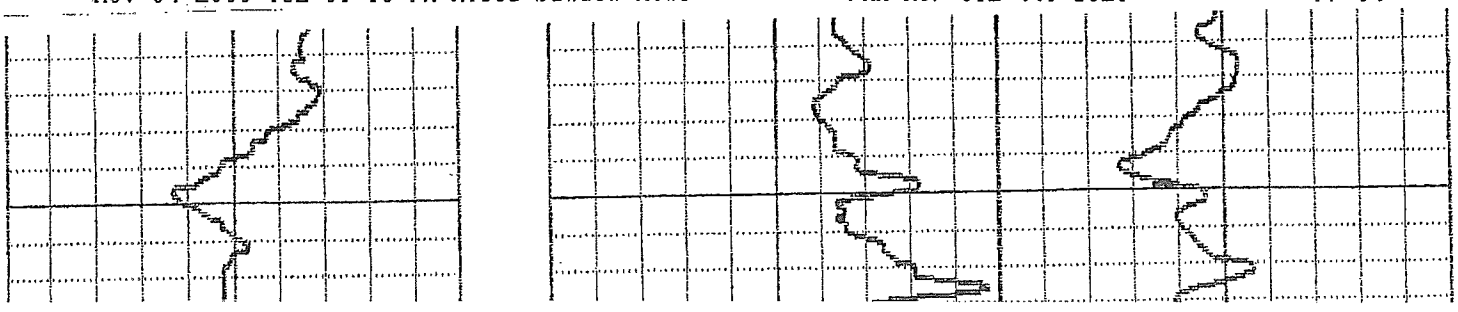
SOURCE USED: CS-137-.125mCI
SERIAL NUMBER: V-402

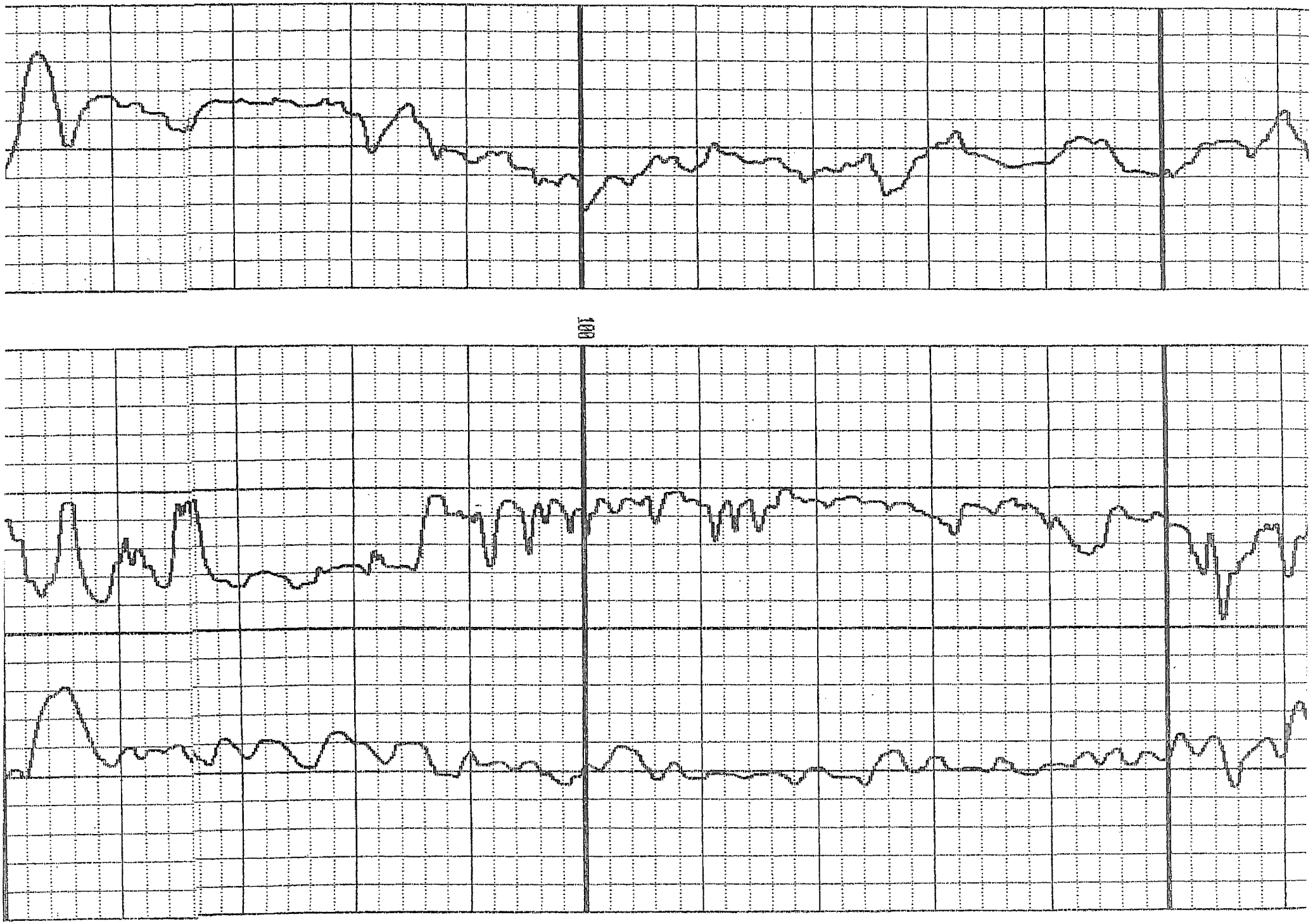
OUTPUT CURVE DEFINITIONS

GR : GAMMA RAY CPS
RES : SINGLE POINT RESISTANCE OHMS
DENSITY : G\CC

F-4
1-JUL-93 @ 10:13:26
Depth Axes Curve : DEPTH Units : FT





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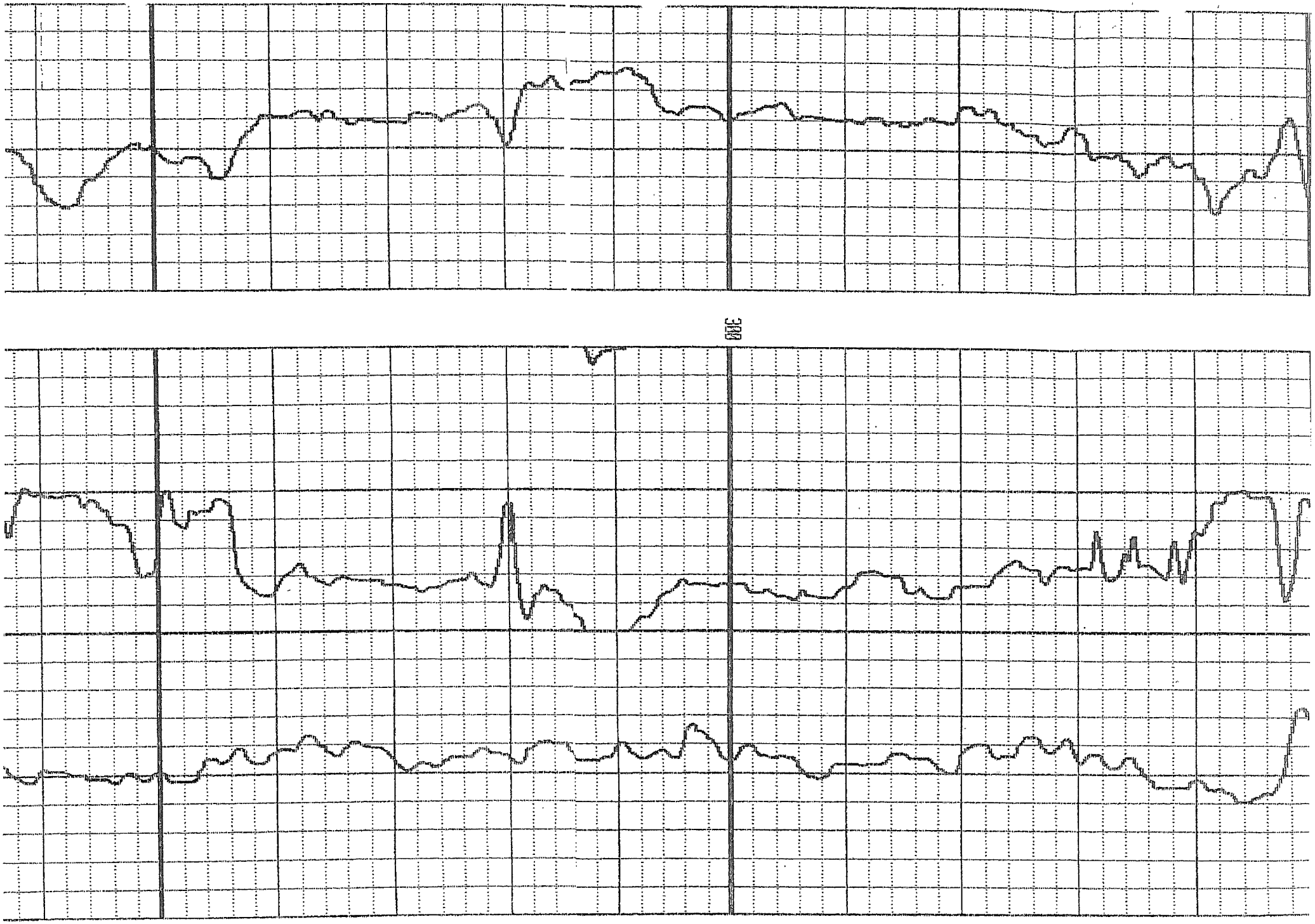

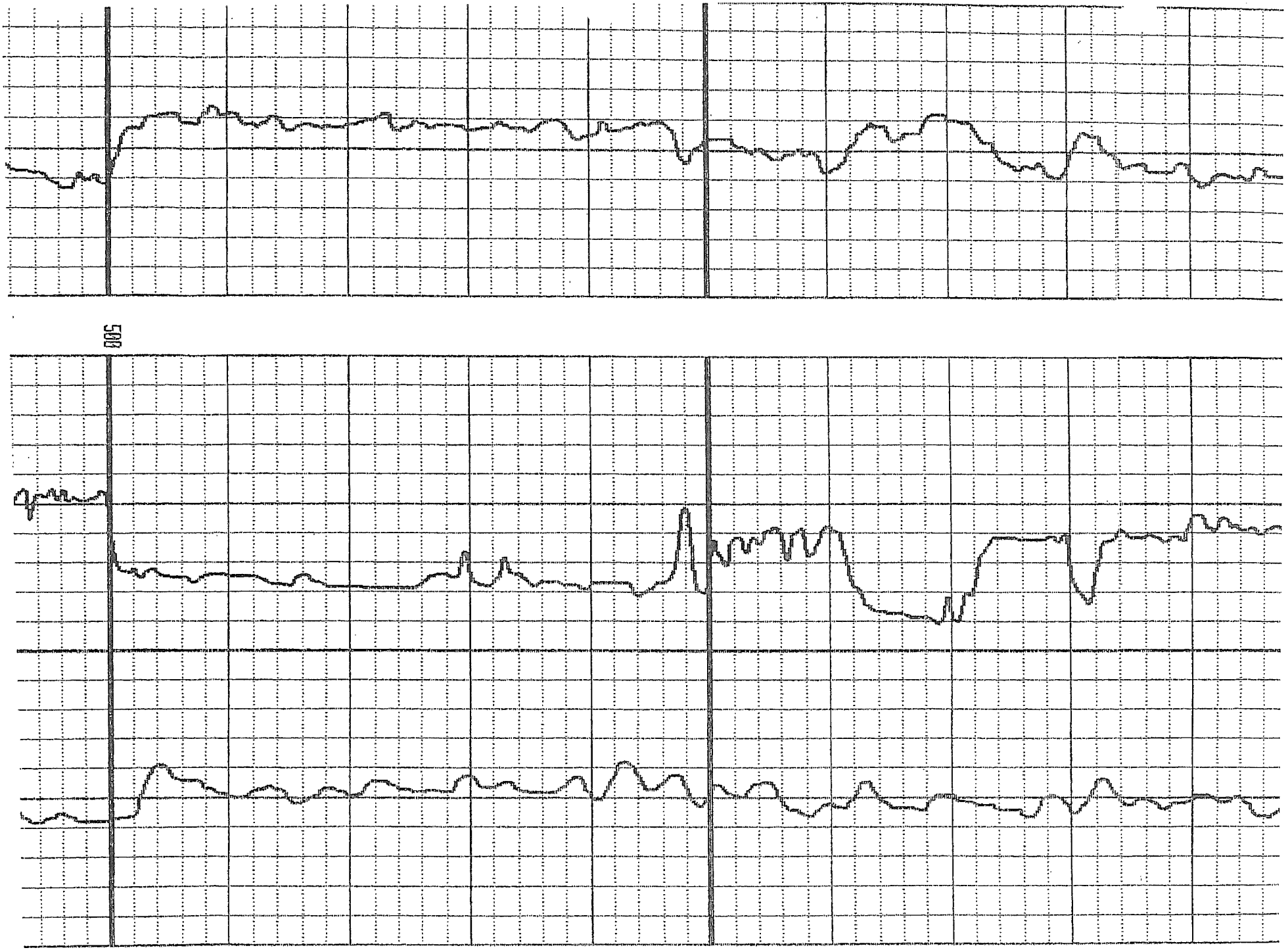
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Available Construction Documentation

for Approved Operating Permit Well

F6 Sims

MEMORANDUM

SDP

TO: Rickey Gaines
FROM: Ridge Kaiser
DATE: 7/22/92
SUBJECT: Material Settings for E Area E well

The following provides material settings for piezometer/depressurization well E.

F-6

Material	Depth Interval (feet BGL)
Casing	+2 - 310
Screen	310 - 470
Casing	NA
Gravel	260 - 470
Cement	150 - 260
	0 - 30
Pump Setting	305

Remarks: _____

RK/lpg/230/set-orig.doc

MEMORANDUM

SDP

TO: Rickey Gaines
FROM: Ridge Kaiser
DATE: 7/22/92
SUBJECT: Material Settings for F Area E well

The following provides material settings for piezometer/depressurization well E.

F-6

Material	Depth Interval (feet BGL)
Casing	+2 - 310
Screen	310 - 470
Casing	NA
Gravel	260 - 470
Cement	150 - 260
	0 - 30
Pump Setting	305

Remarks: _____

RK/lpg/230/set-orig.doc

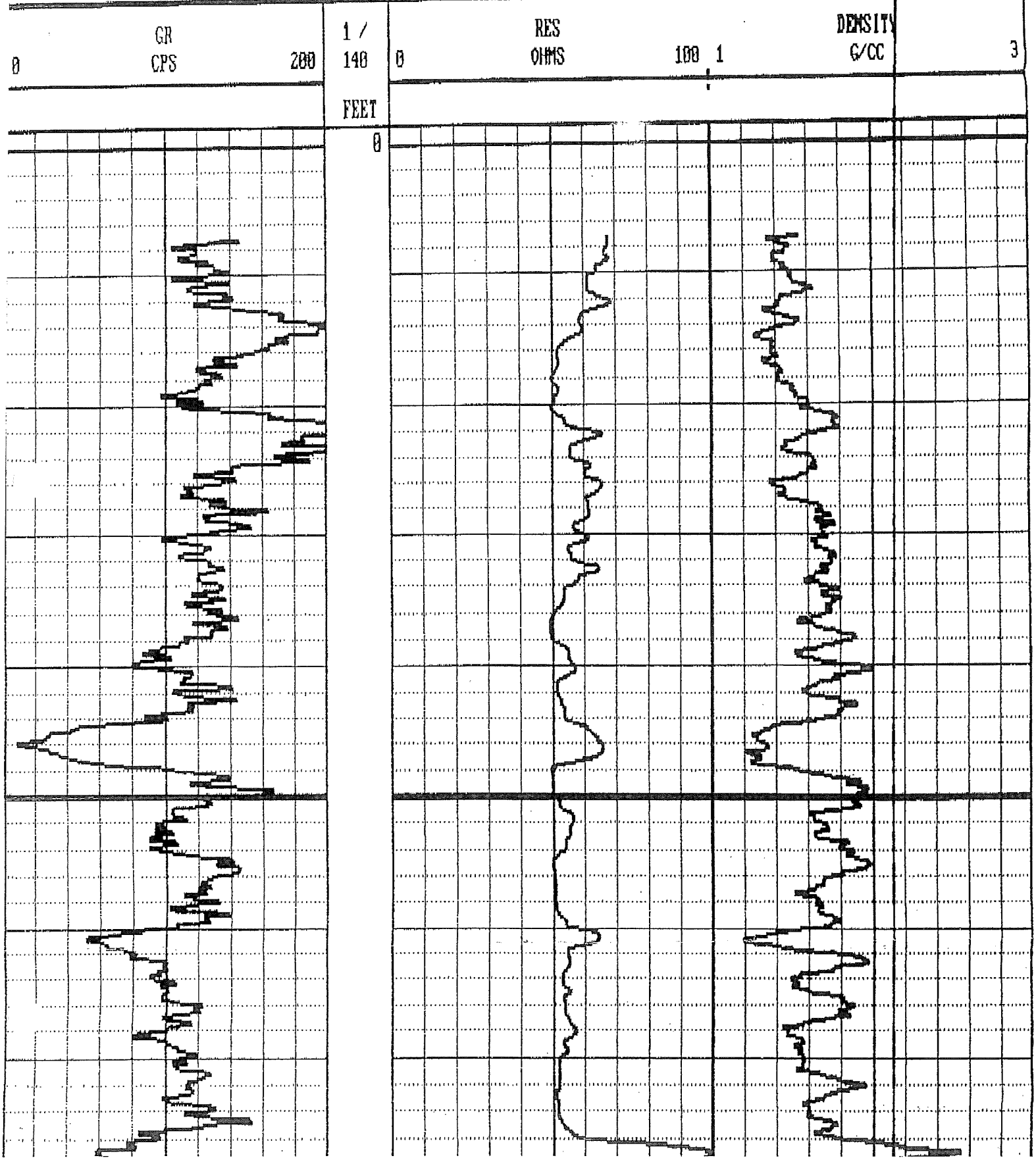
F6 (Sims)

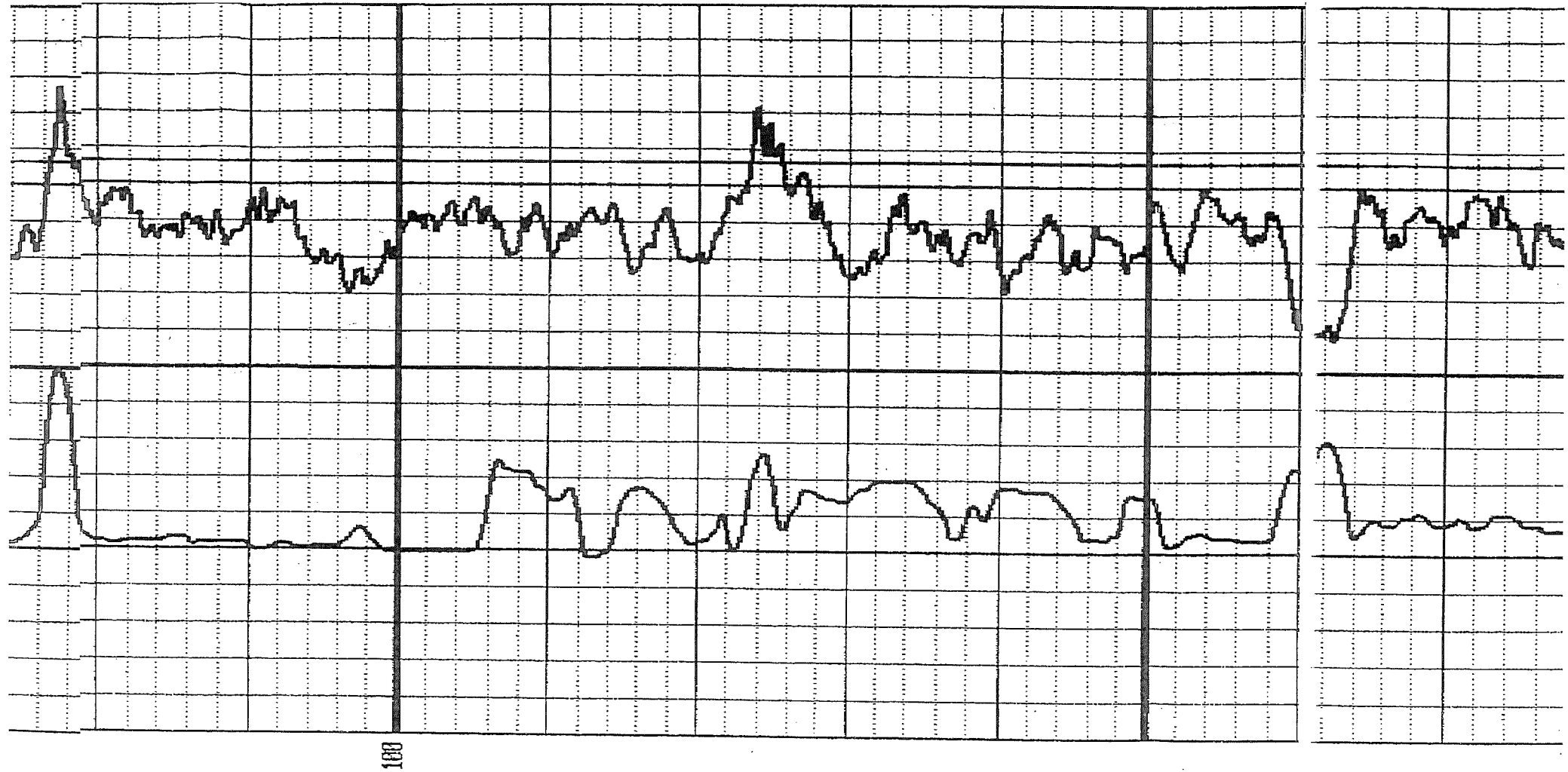
07/22/92 11:20 ALCOA SANDOW MINE 002

E-WELL

21-JUL-92 @ 15:17:36

Depth Axes Curve : DEPTH Units : FT

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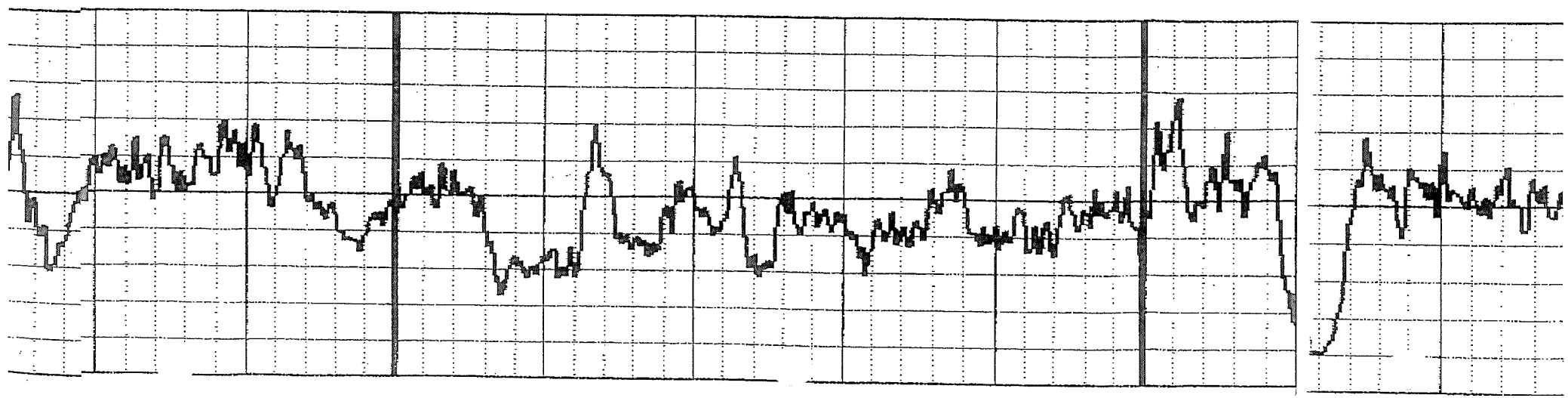

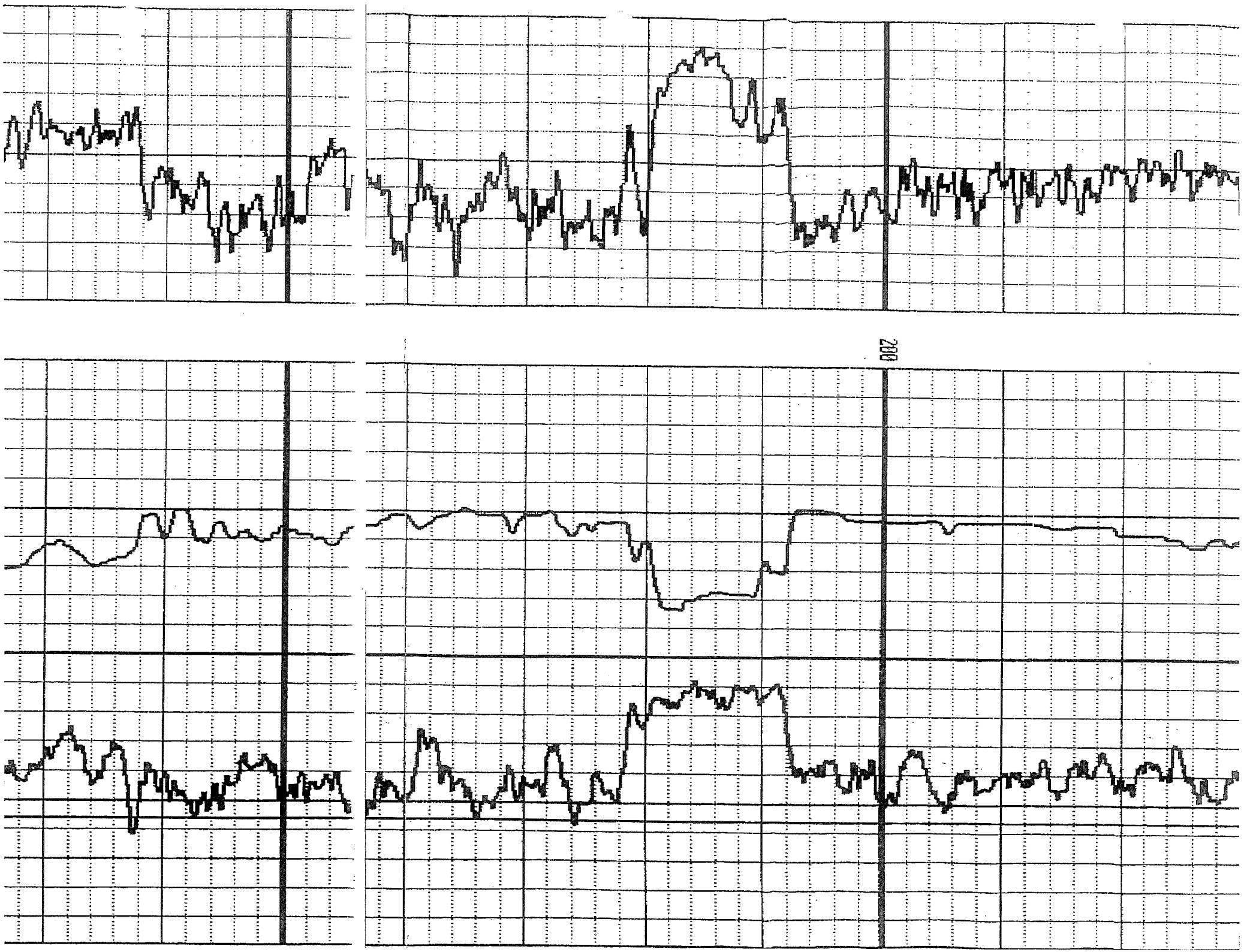
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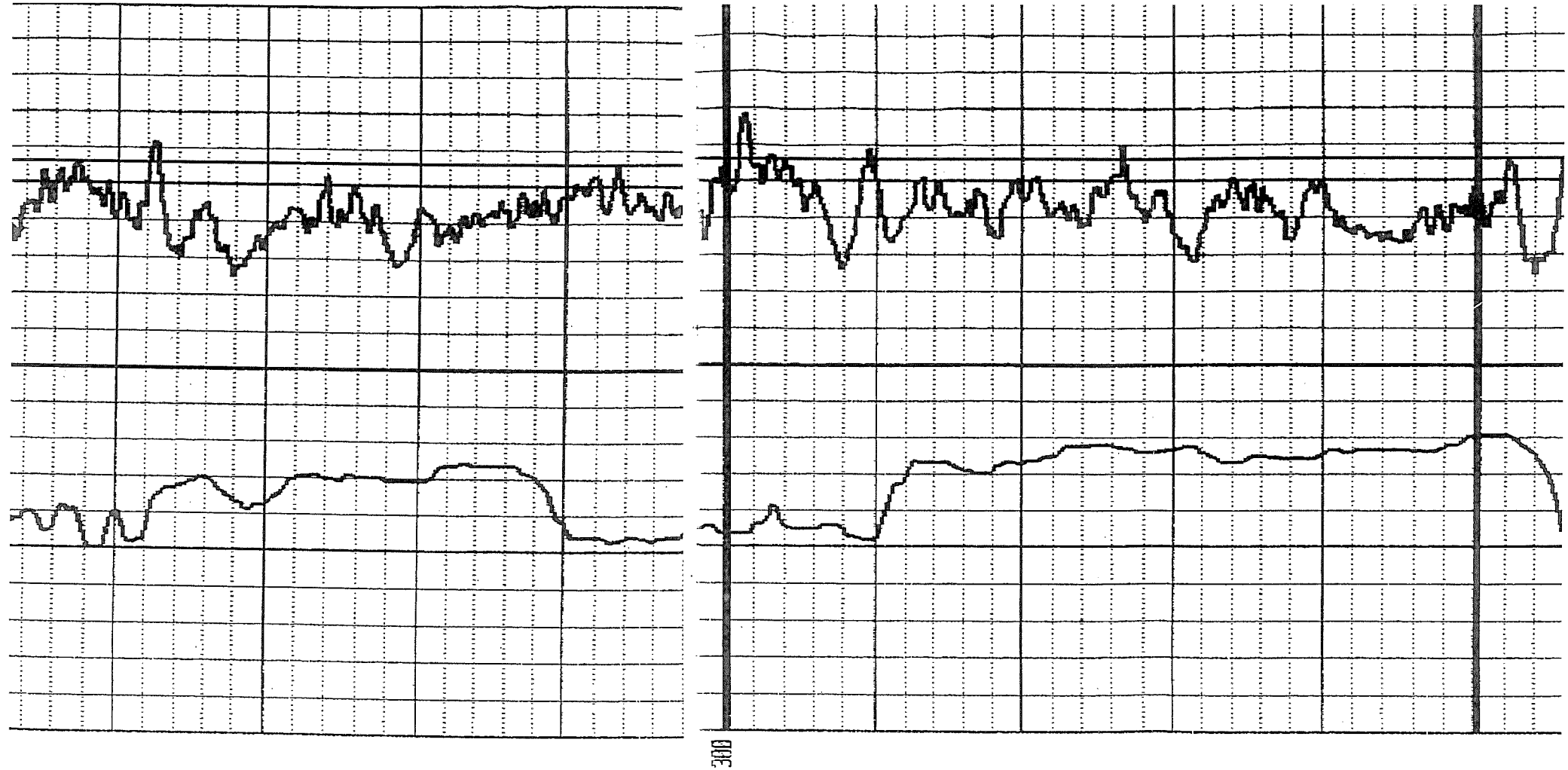

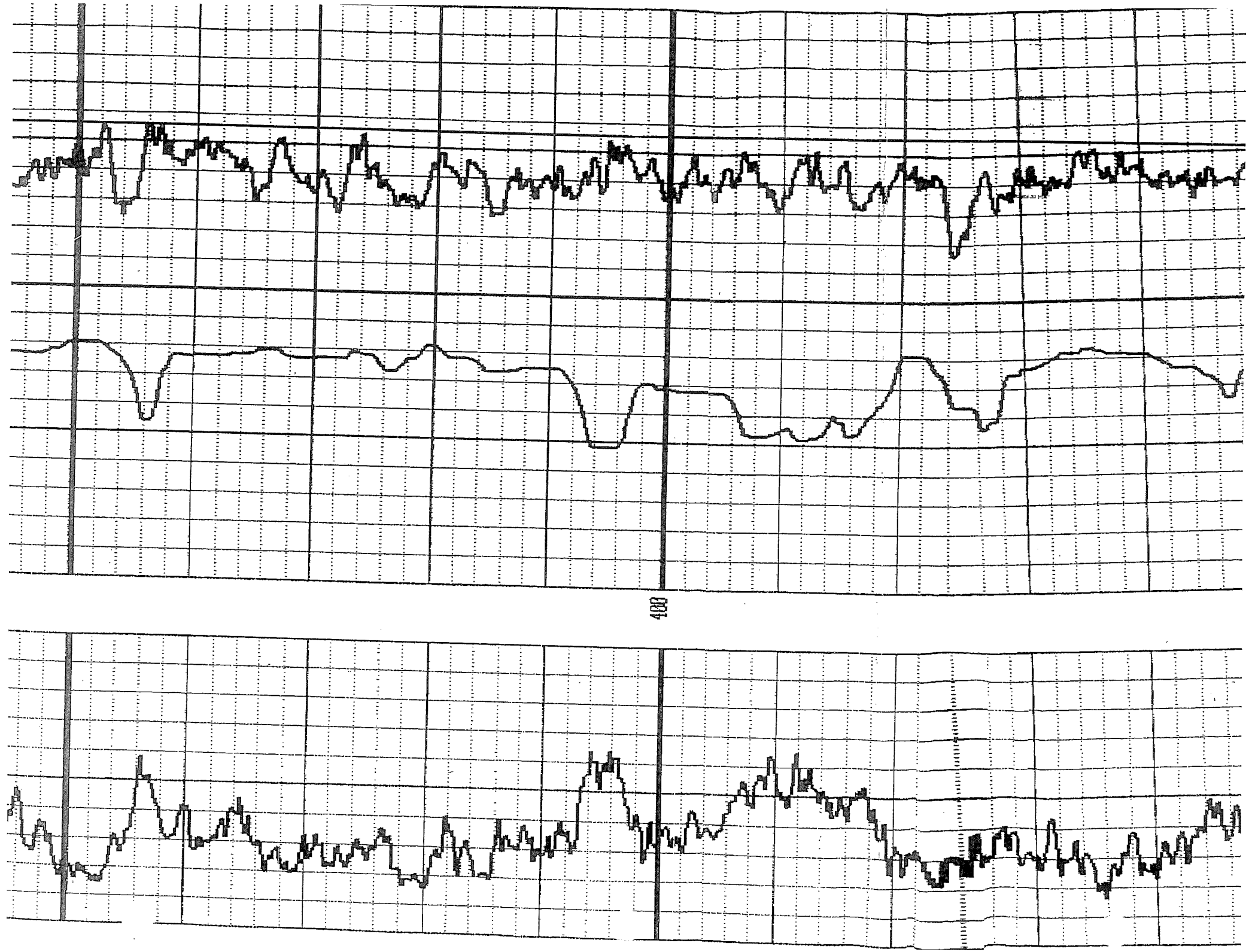

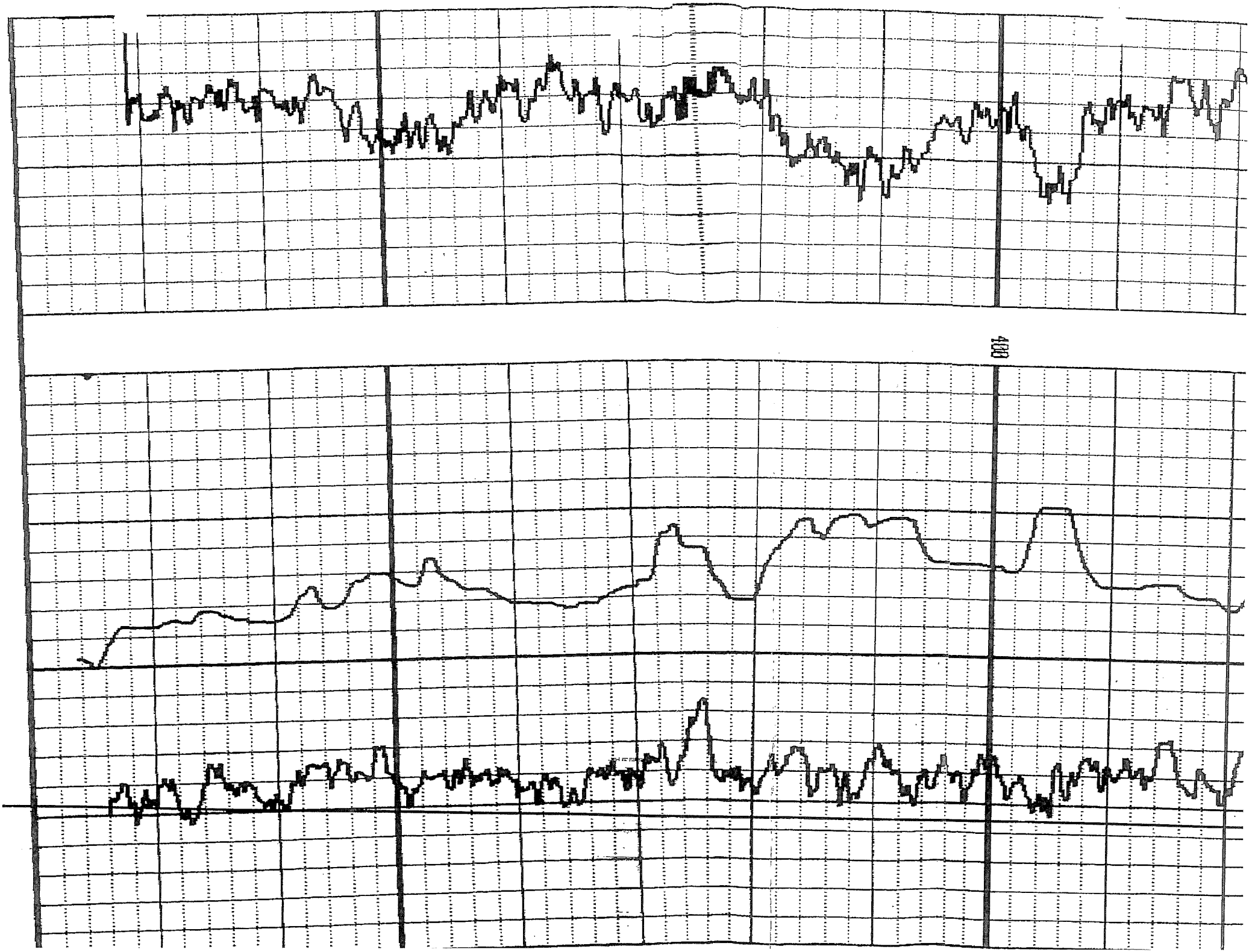
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Available Construction Documentation

for Approved Operating Permit Well

F8 Sims

3409 Executive Center Drive
Suite 226
Austin, Texas 78731

512/345-2379
FAX 512/338-9372

R. W. Harden & Associates, Inc.
Consulting Hydrologists and Geologists

MEMORANDUM

TO: Rickey Gaines
FROM: Ridge Kaiser
DATE: February 4, 1992
SUBJECT: Material Settings for F-8

The following provides material settings for depressurization well F-8. The material settings are based on the use of SDR-21 PVC not Schedule 40.

F-8

Material	Depth Interval (feet BGL)
Casing	+2 - 250
Screen	250 - 410
Casing	410 - 415
Gravel	220 - 415
Cement	0 - 30
	175 - 220
Pump Setting	240

RK/lpg/214/matset.doc

Well/Piezometer Record

Site (Alcoa)

Date: 2-4-1992
Mine Area: Sandow
Well Number: F-8
Site Number:
Driller:
Drilling Company:
Hole Type: SDP
Ground Level Elevation: 485
Northing:
Easting:

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)	
Casing	to	
	to	
Screen	to	
	to	
Gravel	to	ft^3
Cement Contractor	MHC	
Cement	0 to 20	sacks
	175 to 220	sacks

Pump Column Length (ft): 300

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured After Development:
Total Depth Inside Casing
- Before Jetting (ft. BMP):
- After Jetting (ft. BMP):

Rate Jetted (meas / estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Make/Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC / Steel / Other:

Drilling/Construction (Driller)

Date:
Mud Type: No. of Bags:
Bit Size(s):
Depth Drilled (ft. BGL): 415'
Casing Diam. and Type: PVC
Cased Interval (ft. BGL): +2 - 250
Screen Diam. and Type: slotted PVC
Screen Gauge:
Screened Interval (ft. BGL): 250 - 410
Gravel Volume (ft^3):
Gravel Type:
Gravel Setting (ft. BGL): 220'
Length of Gravel Tremie (ft):
Depth to Top of Gravel: 220'
Cement Type:
Volume of Water per Sack:
Length of Cement Tremie (ft.):
Bentonite Volume (sacks):

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:
Measuring Point Elevation Above Ground Level:
Depth to Water (ft. BMP):

Notes/Construction Problems

Continued on back

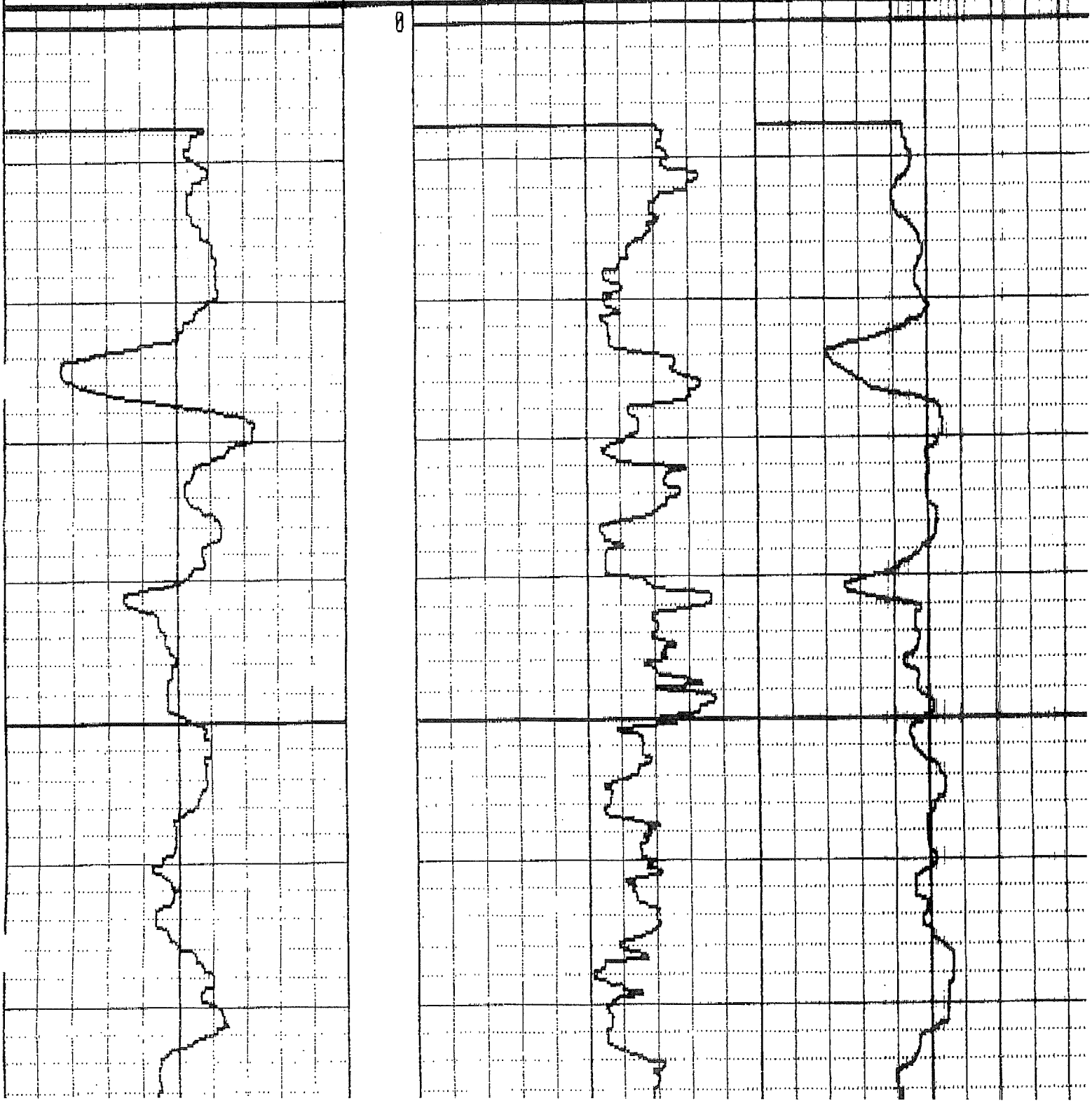
F8 (Sims) 02/04/92 09:12 ALCOA SANDOW MINE 002

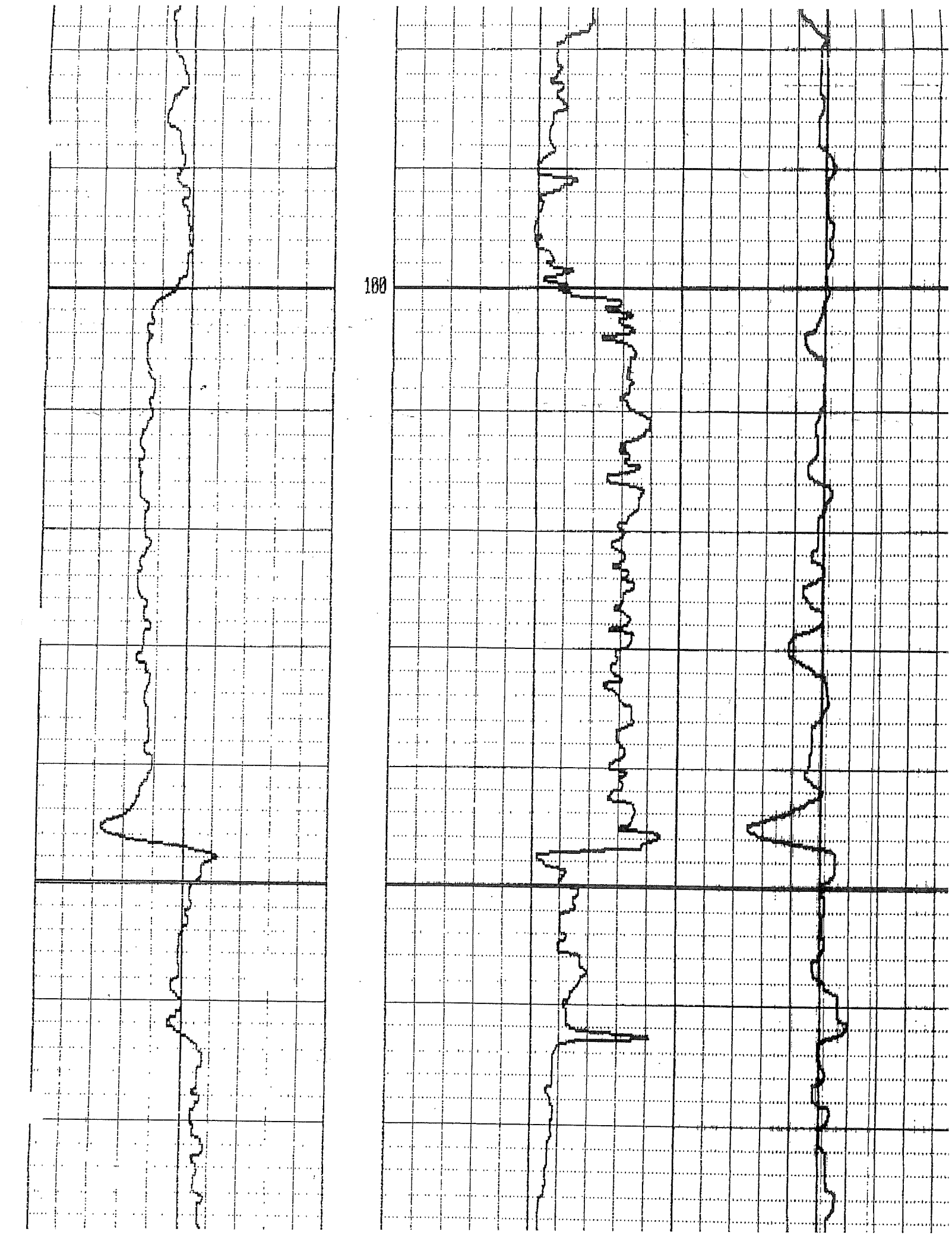
F-8

17-DEC-91 @ 12:21:25

SDP

GR CPS	1 / 140	RES OHMS	DENSITY G/CC
0 200	FEET	0 100 1	3
	0		

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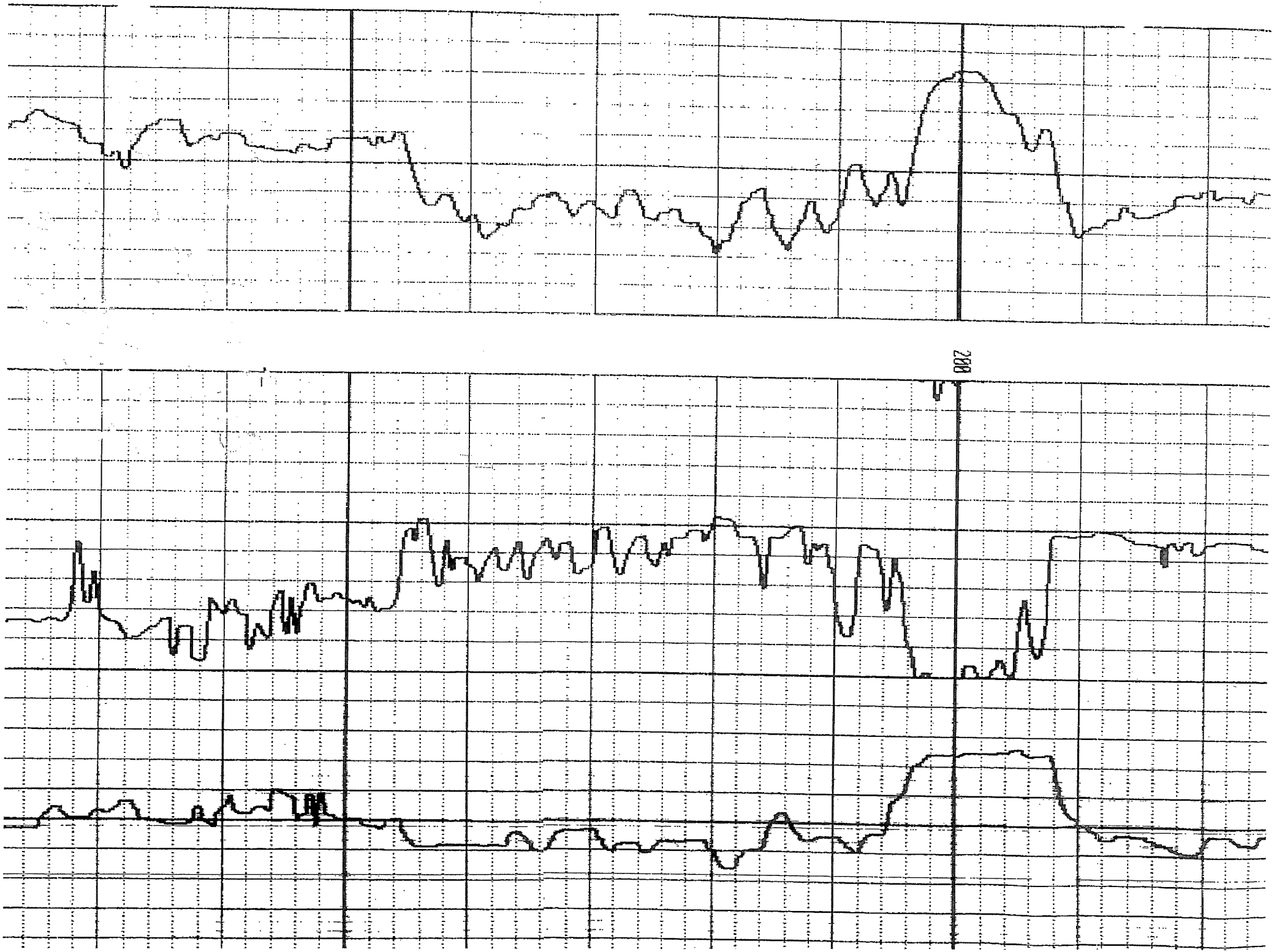
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400

Available Construction Documentation

for Approved Operating Permit Well

F9 Sims

P-9

COMPANY ALUMINUM COMPANY OF AMERICA

WELL P-9

FIELD P AREA

COUNTY MILAM STATE TEXAS COUNTRY

LOCATION 9+98.68 S X 91+68.81 E

325809.84 N X 3028448.14 E

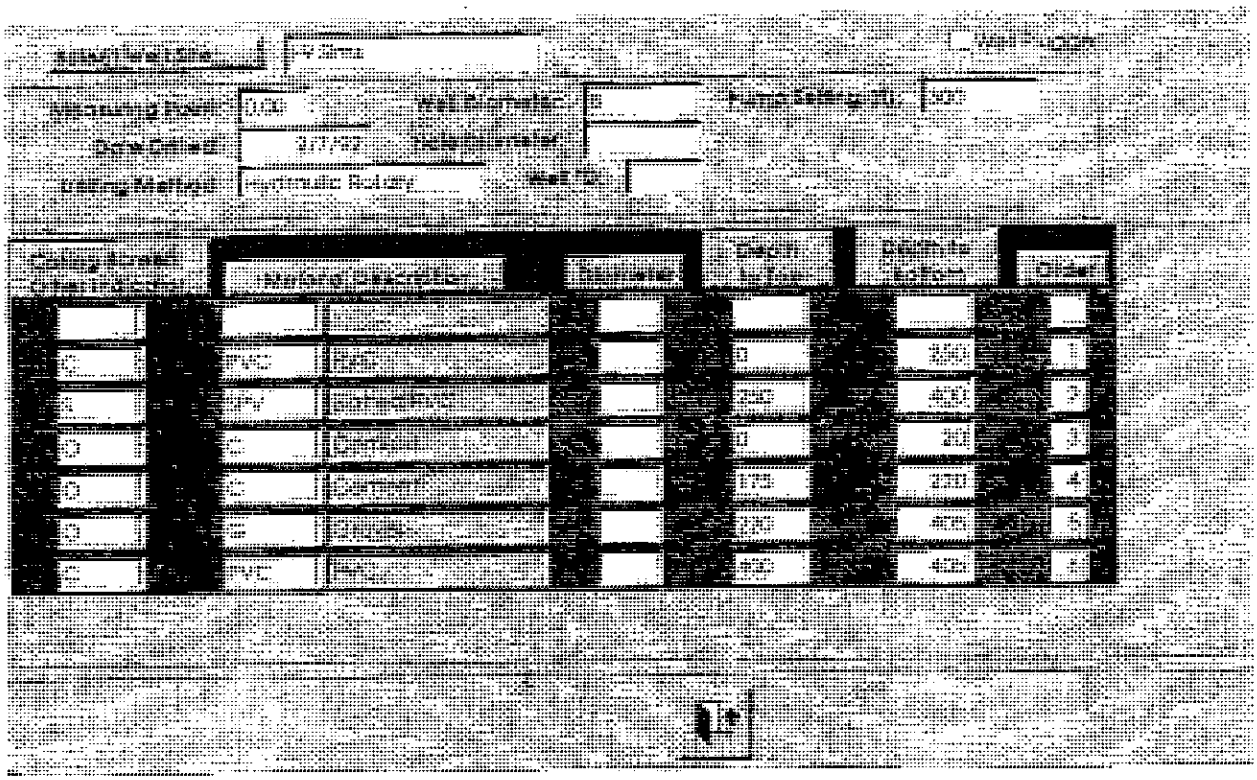
SECTION TOWNSHIP RANGE API NUM

Permanent Datum ; Elevation 498.4 Elev.: K.B.

Log Measured From GL , Above Perm. Datum D.F.

Drilling Meas From GL G.L.

	1	2	3
Date	2NOV92	GLB-498.54	
Depth - Driller	488	TOC-491.66	
Depth - Logger	476		
Btm Log Interval			
Top Log Interval			
Casing - Driller	MMC		
Casing - Logger	ALCOA		
Bitsize	43/4		
Type Fluid in Hole	H2O MUD		
Dens. / Visc.	/	/	/
pH / Fluid Loss	/	/	/
Source of Sample			
Rm @ Meas. Temp	@	@	@
Rmf @ Meas. Temp	@	@	@
Rmc @ Meas. Temp	@	@	@

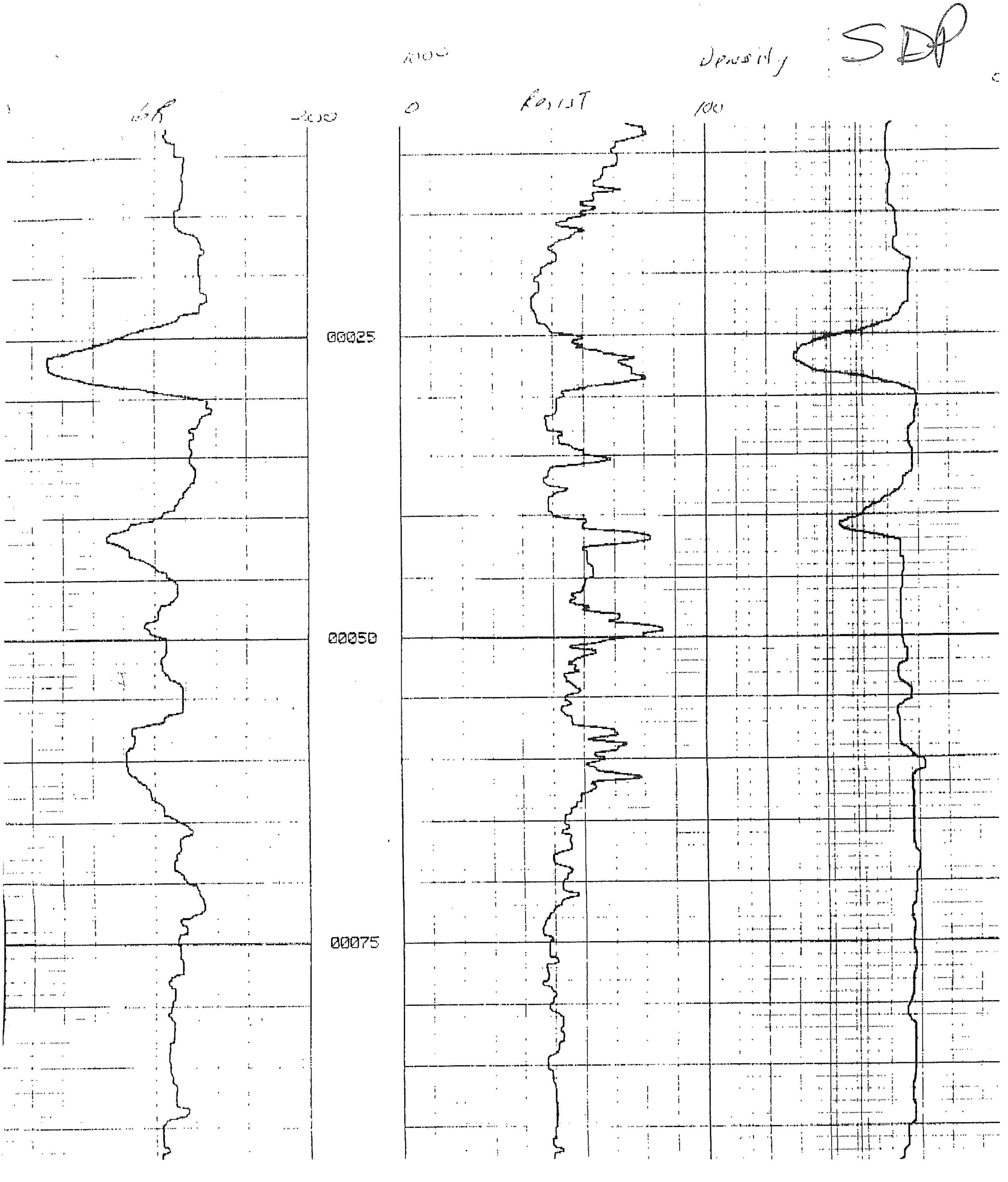


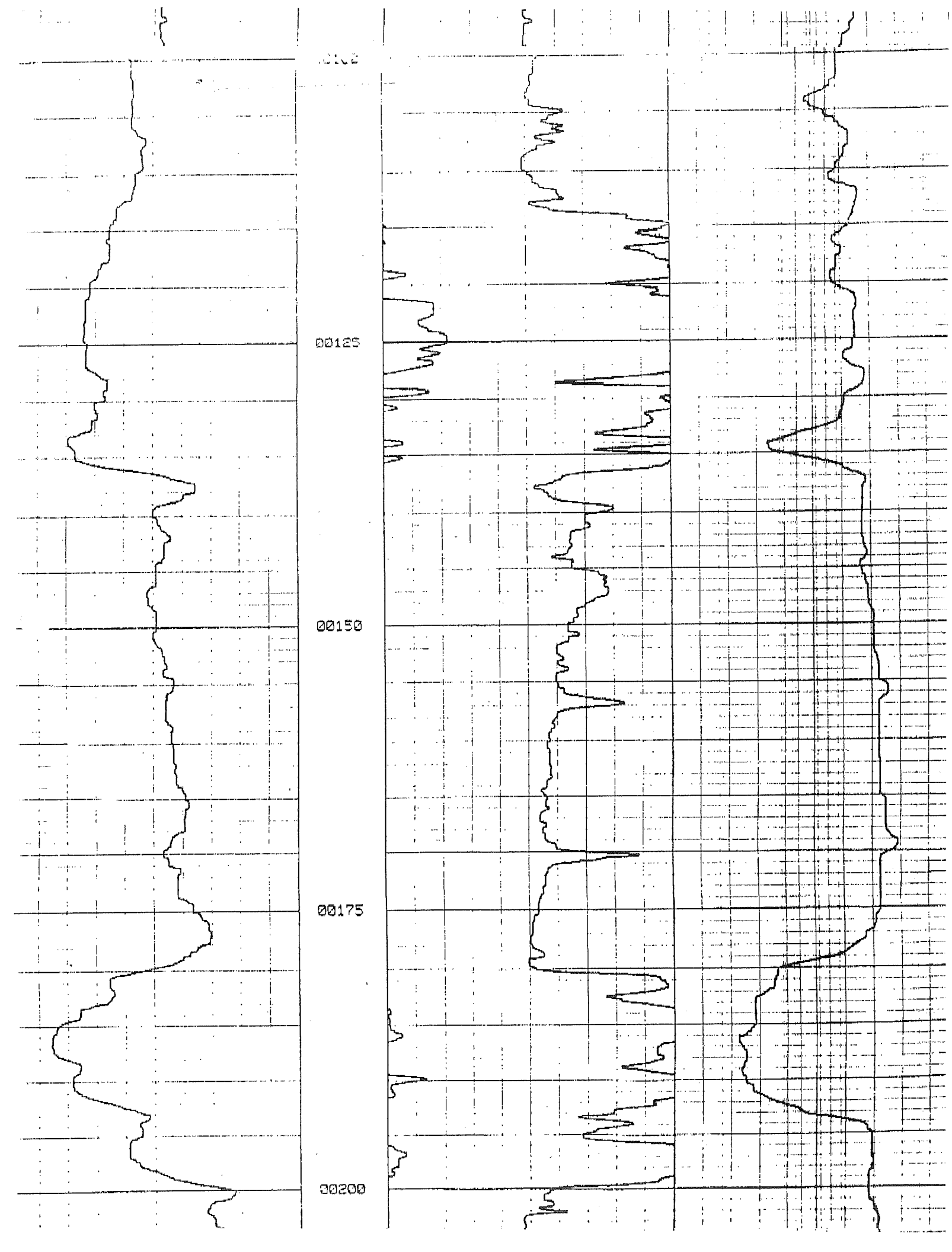
#9 (Sims)

02/07/92 14:49 ALCOA SANDOW MINE 002

F-9

2/07/92

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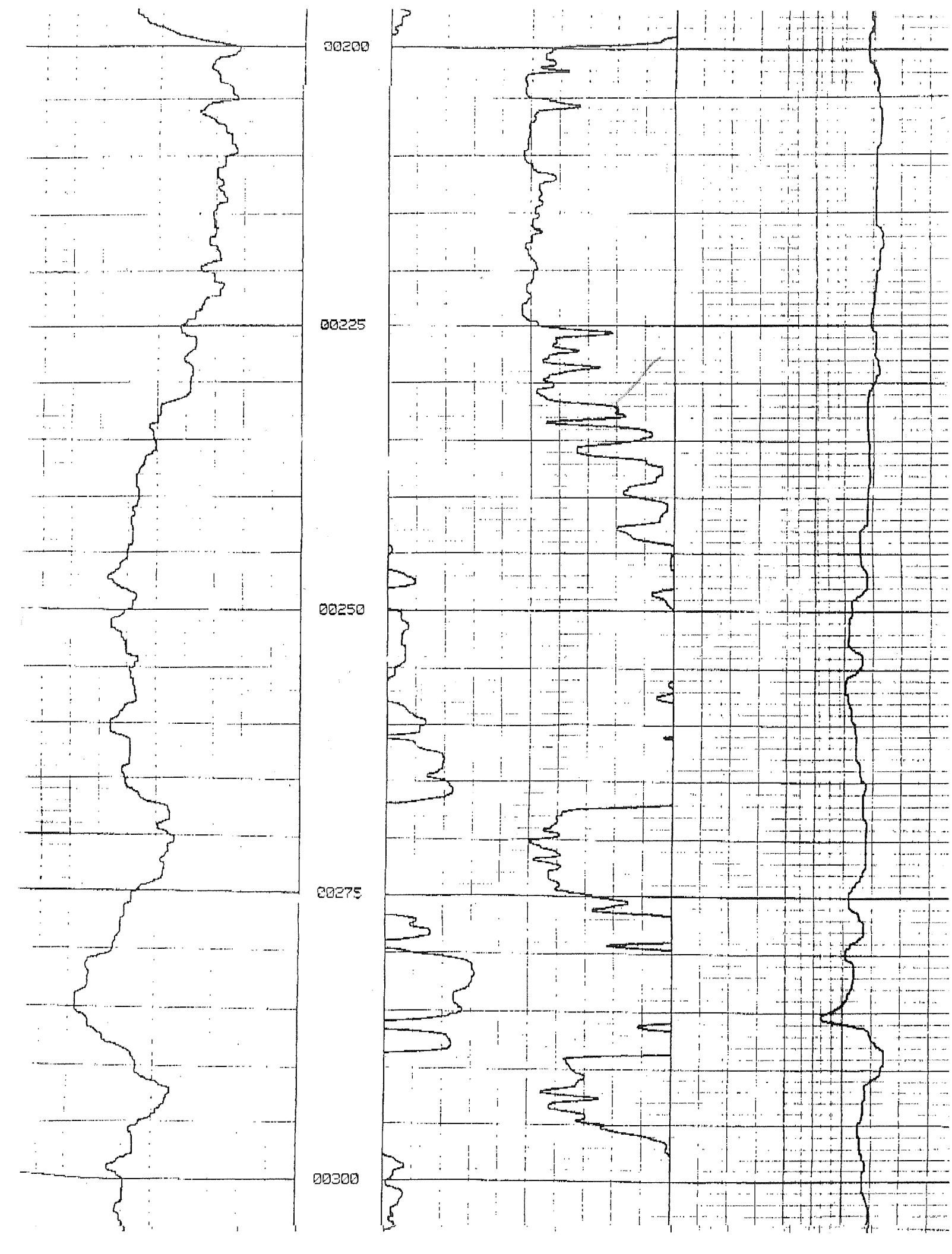
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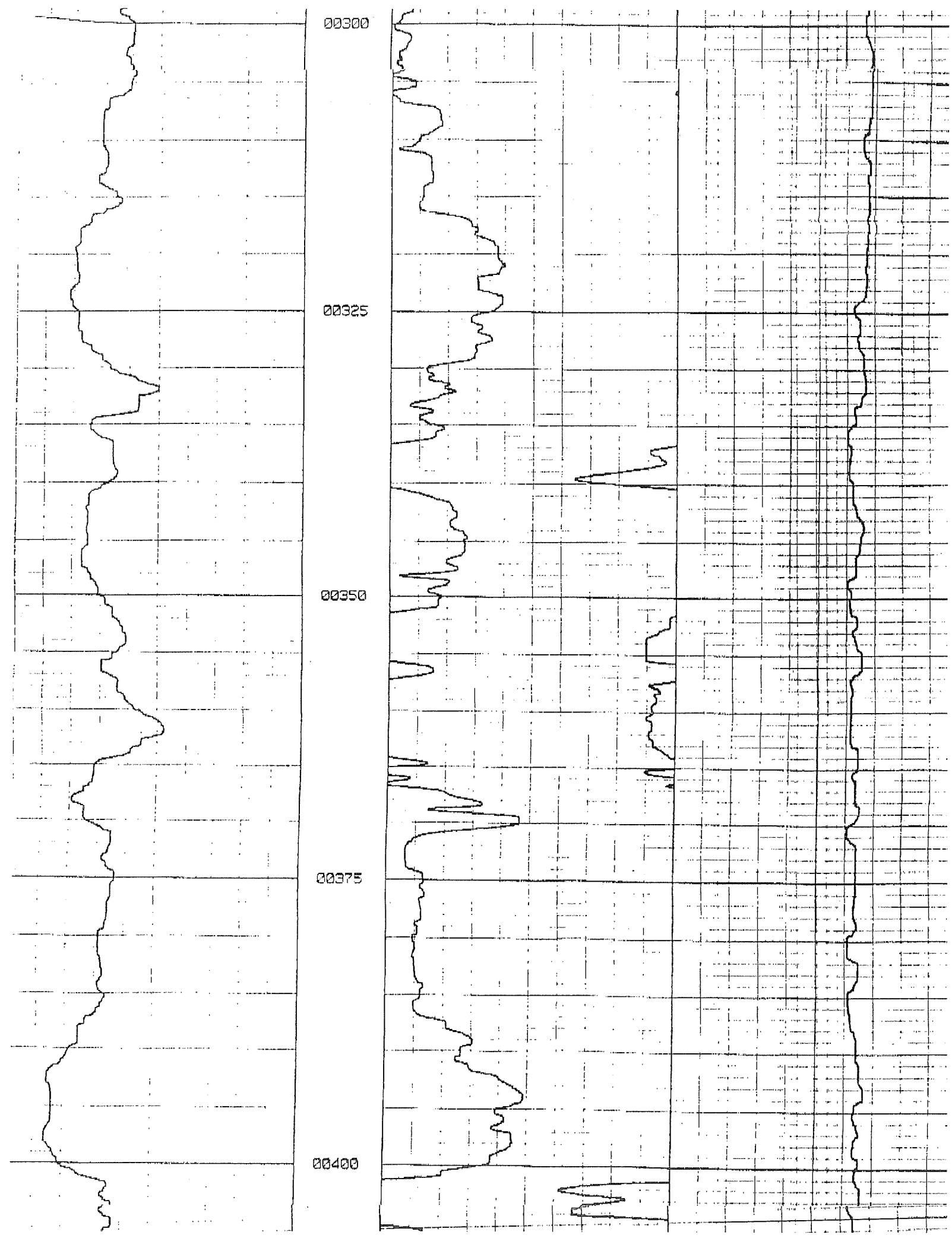
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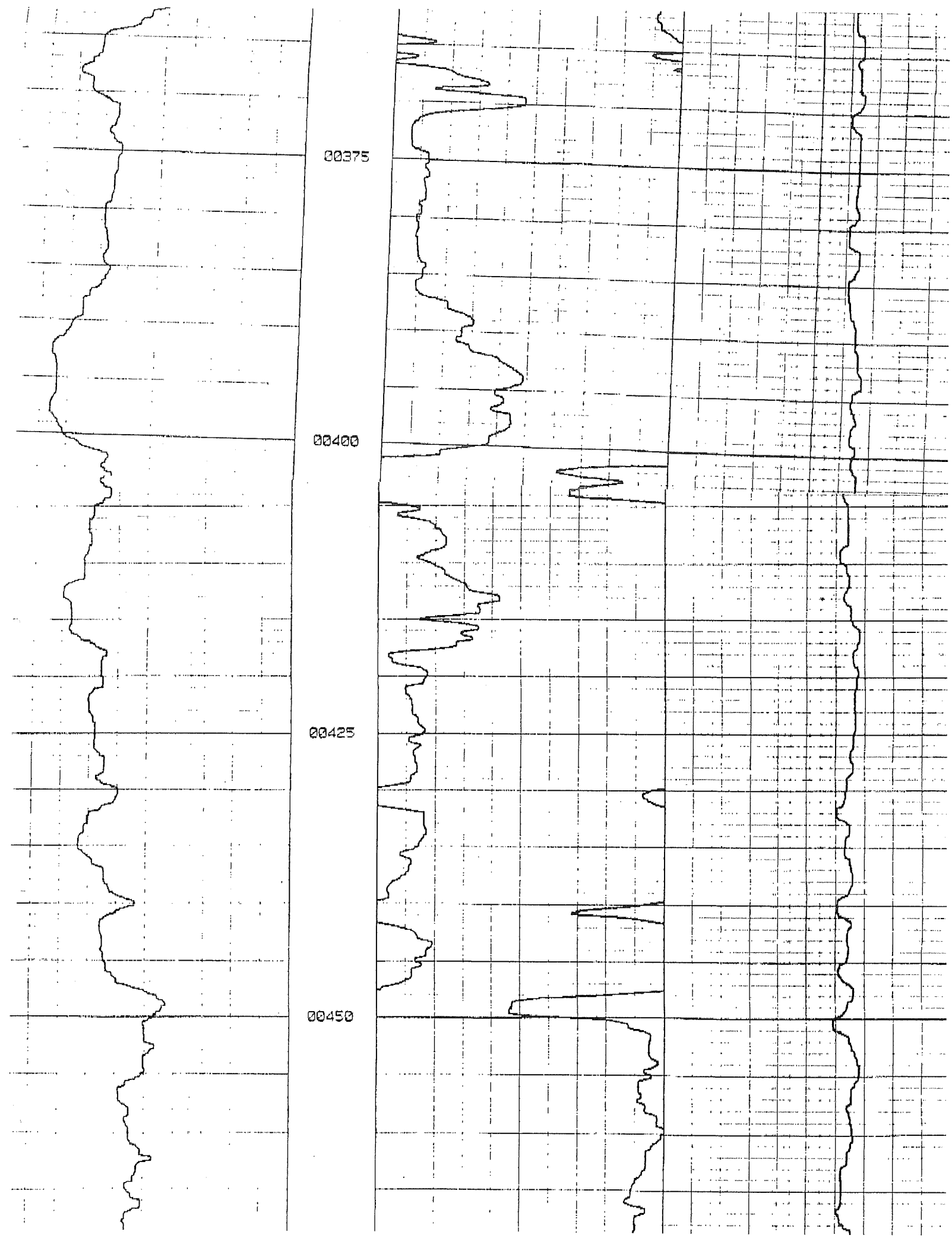
00400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00400
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00450

Available Construction Documentation

for Approved Operating Permit Well

F10 Sims

Well/Piezometer Record

Site (Alcoa)

Date: 2/20/92
Mine Area: Sandow
Well Number: F-10
Site Number:
Driller:
Drilling Company:
Hole Type: Sdp
Ground Level Elevation: 474
Northing:
Easting:

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)	
Casing	to	
	to	
Screen	to	
	to	
Gravel	to	ft^3

Cement Contractor

Cement	0 to 30		sacks
	175 to 190		sacks

Pump Column Length (ft): 300'

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured After Development:
Total Depth Inside Casing
- Before Jetting (ft. BMP):
- After Jetting (ft. BMP):

Rate Jetted (meas / estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Make/Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC / Steel / Other:

Drilling/Construction (Driller)

Date:
Mud Type: No. of Bags:
Bit Size(s):
Depth Drilled (ft. BGL): 435
Casing Diam. and Type: PVC
Cased Interval (ft. BGL): +2 - 225
Screen Diam. and Type: Slotted PVC
Screen Gauge:
Screened Interval (ft. BGL): 225 - 430
Gravel Volume (ft^3):
Gravel Type:
Gravel Setting (ft. BGL): 190
Length of Gravel Tremie (ft):
Depth to Top of Gravel: 190
Cement Type:
Volume of Water per Sack:
Length of Cement Tremie (ft.):
Bentonite Volume (sacks):

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:
Measuring Point Elevation Above Ground Level:
Depth to Water (ft. BMP):

Notes/Construction Problems

Continued on back

3409 Executive Center Drive
Suite 226
Austin, Texas 78731

512/345-2379
FAX 512/338-9372

R. W. Harden & Associates, Inc.
Consulting Hydrologists and Geologists

MEMORANDUM

TO: Rickey Gaines
FROM: Ridge Kaiser
DATE: February 20, 1992
SUBJECT: Material Settings for F-10

The following provides material settings for depressurization well F-10. The material settings are based on the use of SDR-21 PVC.

F-10

Material	Depth Interval (feet BGL)
Casing	+2 - 225
Screen	225 - 430
Casing	430 - 435
Gravel	190 - 435
Cement	0 - 30
	shallower than 175 - 190
Pump Setting	220

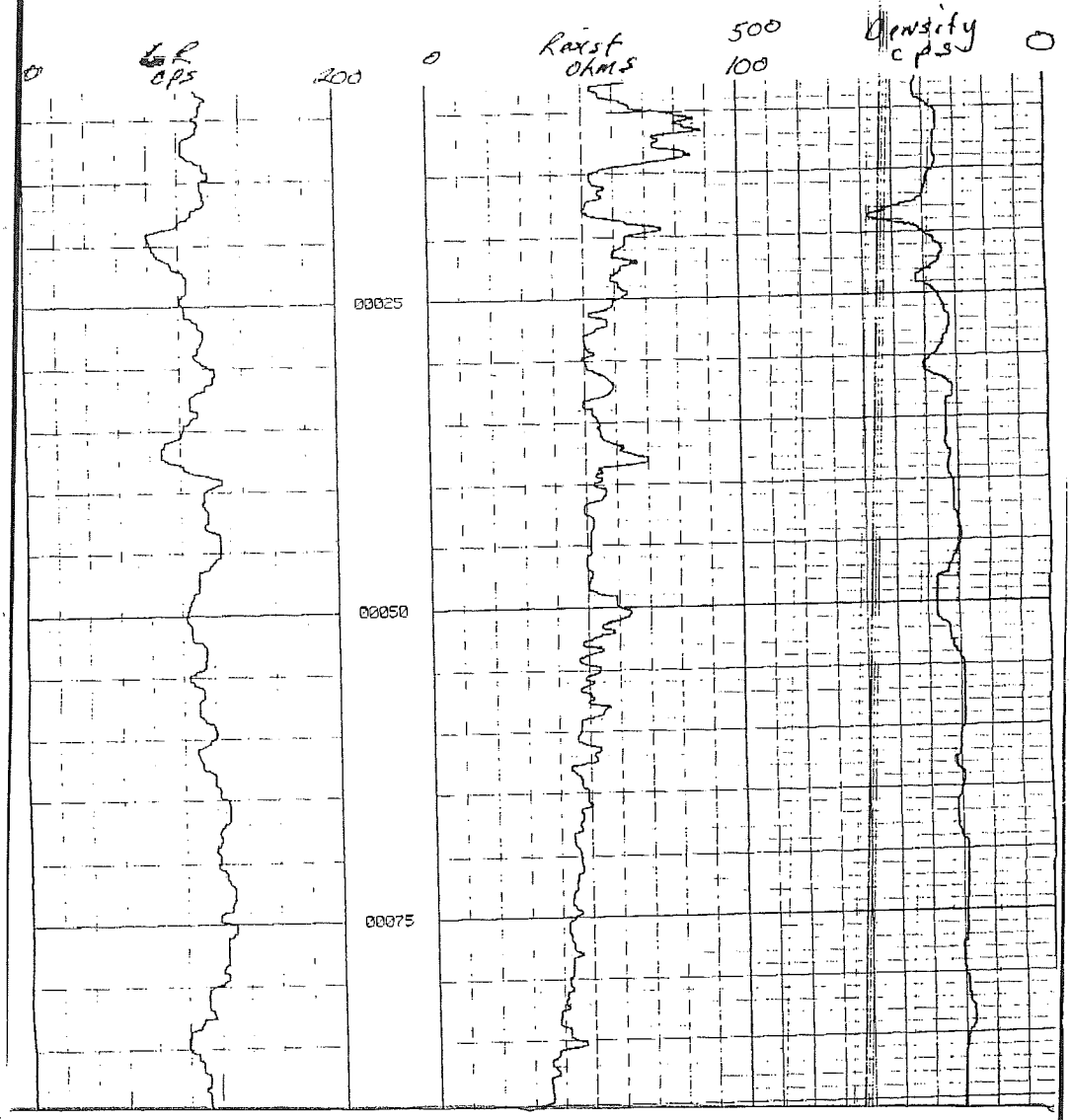
Note: 25 feet of blank pipe may be placed between depths of 250 and 275 feet below ground level.

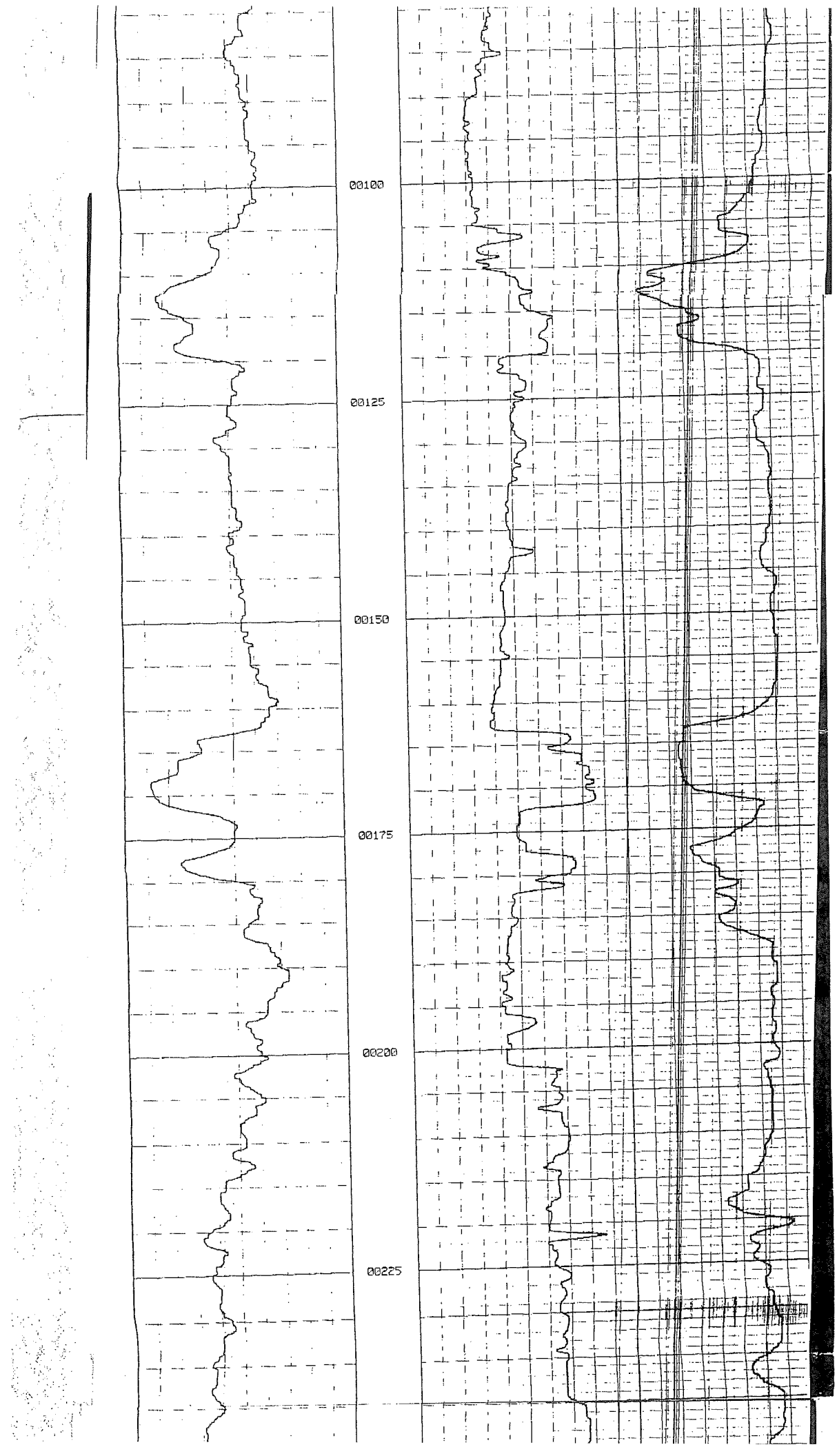
RK/lpg/214/matset2.doc

02/19/92 15:42 ALCOA SANDOW MINE 001

2/19/92

To: Ridge Kaiser F-10 S DP

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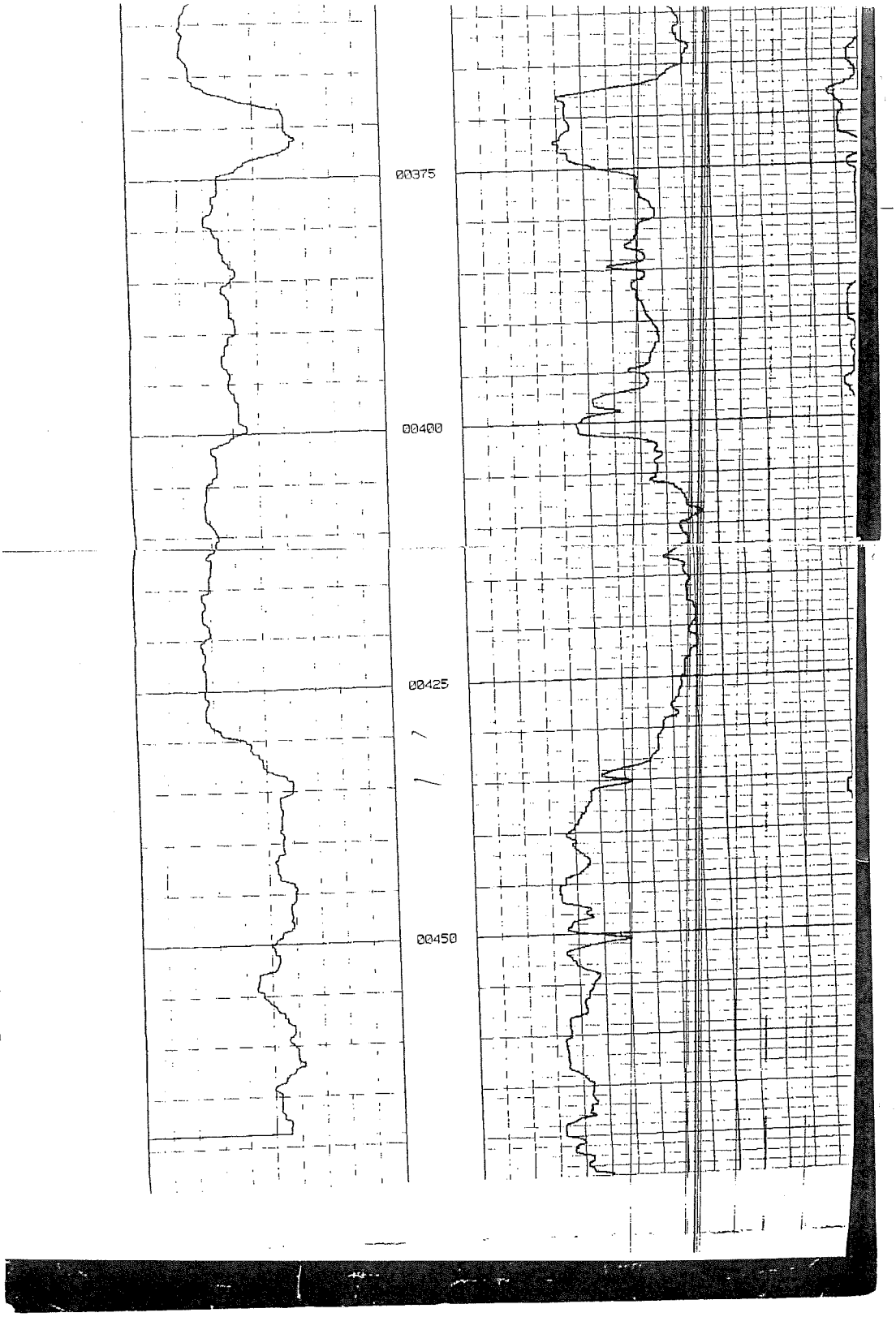
00375
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00450

Available Construction Documentation

for Approved Operating Permit Well

F11 Sims

Well/Piezometer Record

Site (Alcoa)

Date: March 2, 1992
Mine Area: Sandow
Well Number: F-11
Site Number:
Driller:
Drilling Company:
Hole Type: Sdp
Ground Level Elevation: 480'
Northing:
Easting:

Proposed Settings (RWH&A)

Material	Depth Interval (ft. BGL)	
Casing	to	
	to	
Screen	to	
	to	
Gravel	to	ft³

Cement Contractor:

Cement	0 to 30		sacks
	175 to 225		sacks

Pump Column Length (ft): 280'

Development (Driller)

Start, Time/Date:
Finish, Time/Date:
Total Time Jetted:
Static Water-Level Measured After Development:
Total Depth Inside Casing
- Before Jetting (ft. BMP):
- After Jetting (ft. BMP):

Rate Jetted (meas / estimated) (gpm):

Pump/Motor (Driller)

Motor H.P.:
Pump Make/Model No.:
Length of Column Pipe (ft.):
Type Column Pipe: PVC / Steel / Other:

Drilling/Construction (Driller)

Date:
Mud Type: No. of Bags:
Bit Size(s):
Depth Drilled (ft. BGL): 435
Casing Diam. and Type: PVC
Cased Interval (ft. BGL): +2-275
Screen Diam. and Type: Slot PVC
Screen Gauge:
Screened Interval (ft. BGL): 275-430
Gravel Volume (ft³):
Gravel Type:
Gravel Setting (ft. BGL): 225'
Length of Gravel Tremie (ft):
Depth to Top of Gravel:
Cement Type:
Volume of Water per Sack:
Length of Cement Tremie (ft.):
Bentonite Volume (sacks):

Inspection Completion (Alcoa)

Date:
Time:
Measuring Point Description:
Measuring Point Elevation Above Ground Level:
Depth to Water (ft. BMP):

Notes/Construction Problems

Continued on back

F-11

COMPANY ALCOA SANDOW MINE

WELL F-11

FIELD F AREA

COUNTY MILAM STATE TEXAS COUNTRY U. S. A.

LOCATION 6+80.26 S X 86+86.12 E

326326.90 N X 3828192.92 E

SECTION ____ TOWNSHIP ____ RANGE ____ API NUM ____

Permanent Datum ____ ; Elevation 490.44 Elev.: K.B. ____

Log Measured From GL ____, ____ Above Perm. Datum D.F. ____

Drilling Meas From GL G.L. ____

	1	2	3
Date	3\02\92	GLE-488.44	
Depth - Driller	460	TOC-481.05	
Depth - Logger	458		
Btm Log Interval			
Top Log Interval			
Casing - Driller	MAC		
Casing - Logger	ALCOA		
Bitsize	4 3\4		
Type Fluid in Hole	H20 MUD		
Dens. / Visc.	/	/	/
pH / Fluid Loss	/	/	/
Source of Sample			
Rm @ Meas. Temp	@	@	@
Rmf @ Meas. Temp	@	@	@
Rmc @ Meas. Temp	@	@	@

REMARKS :

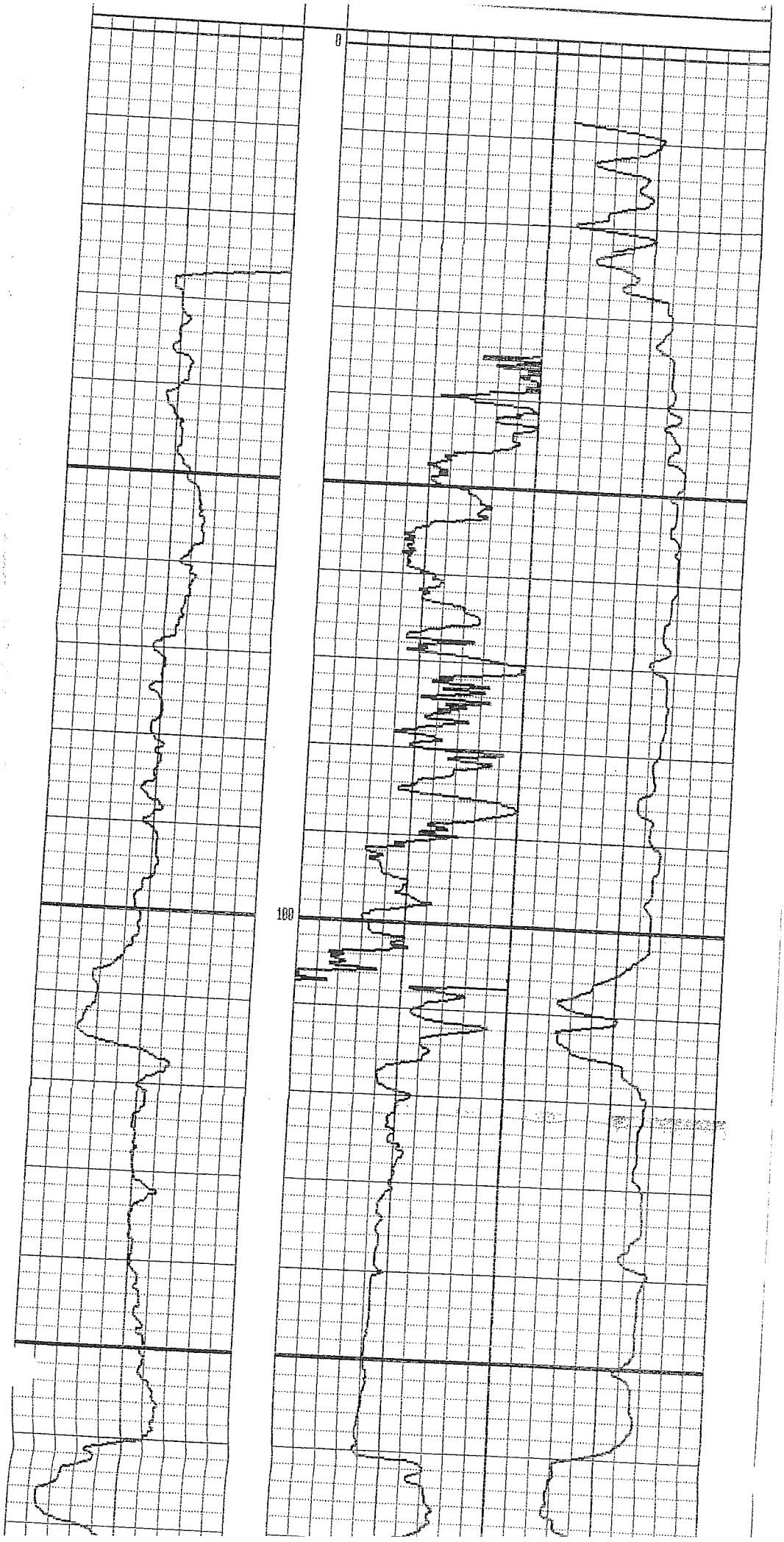
SOURCE USED: CS-137-.125mCi
SERIAL NUMBER: V-482

OUTPUT CURVE DEFINITIONS

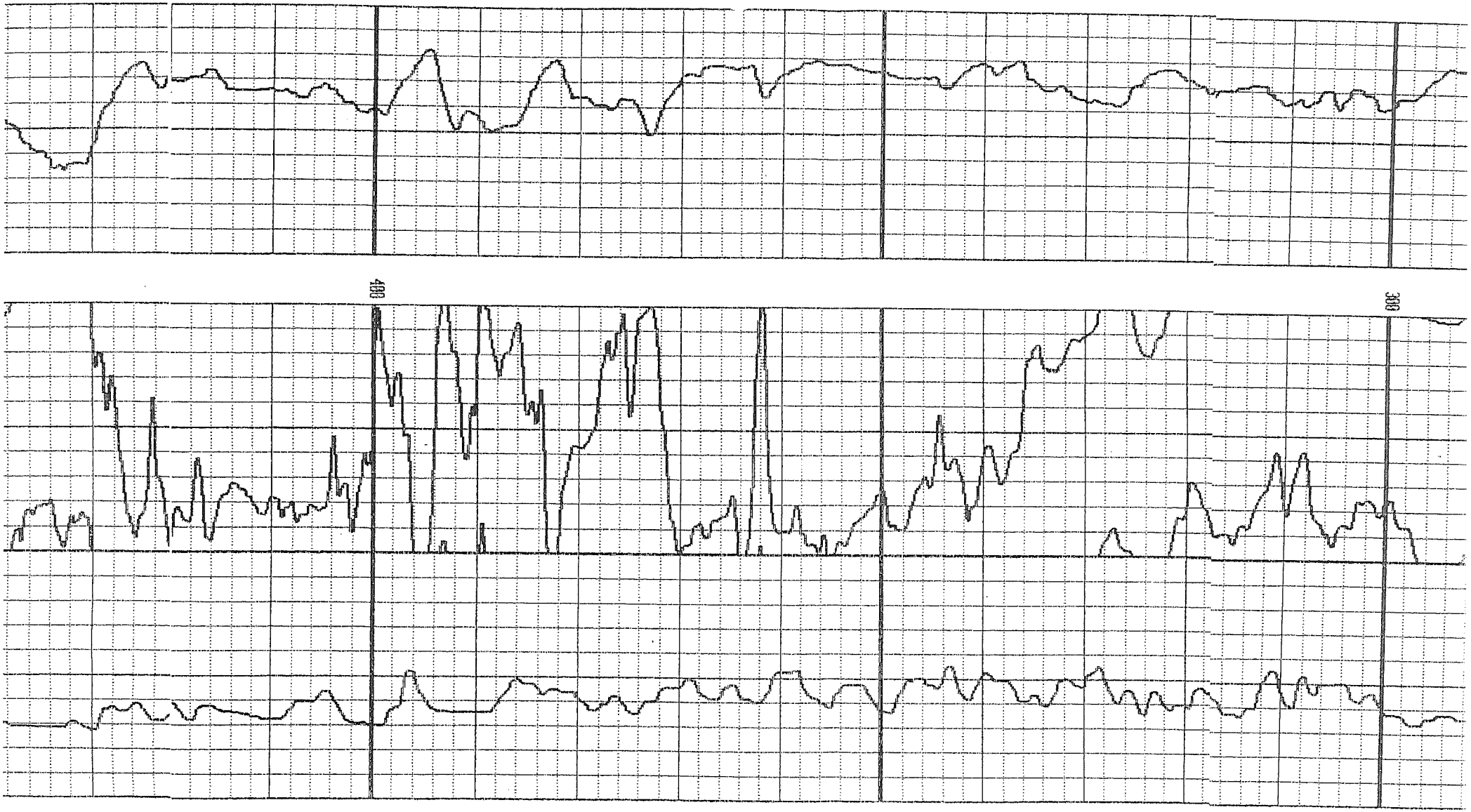
GR : GAMMA RAY CPS
RES : SINGLE POINT RESISTANCE OHMS
DENS : BULK DENSITY CPS

F-11
1-JUL-93 @ 11:11:21
Depth Axes Curve : DEPTH Units : FT

GR	1 /	RES
0 CPS 200	140	0 OHMS 100
	FEET	DENS


0
100


300
200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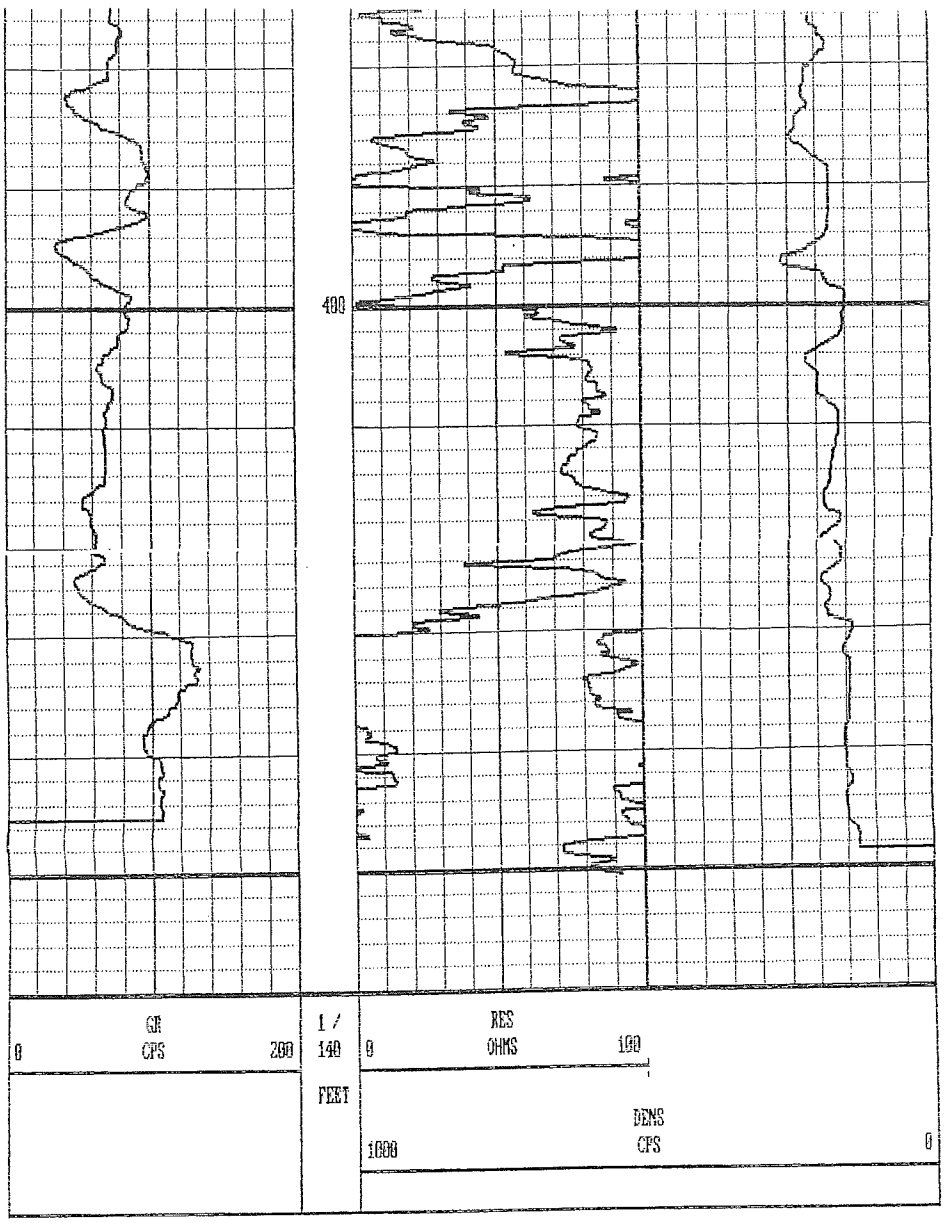
300


400
GR
0
CPS
200
1 /
140
FEET
RES
0
OHMS
100
DENS
1000
CPS
0

Available Construction Documentation

for Approved Operating Permit Well

F12 Sims

F-12

COMPANY ALCOA SANDOW MINE

WELL F-12

FIELD F AREA

COUNTY MILAM STATE TEXAS COUNTRY U.S.A.

LOCATION 323548 N X 3025883 E

SECTION ____ TOWNSHIP ____ RANGE ____ API NUM ____

Permanent Datum ____ ; Elevation 507.1 Elev.: K.B. ____

Log Measured From GL ____, ____ Above Perm. Datum D.F. ____

Drilling Meas From GL G.L. ____

	1	2	3
Date	3\93		
Depth - Driller	420		
Depth - Logger	418		
Btm Log Interval			
Top Log Interval			
Casing - Driller	MMC		
Casing - Logger	ALCOA		
Bitsize	43\4		
Type Fluid in Hole	H20		
Dens. / Visc.	/	/	/
pH / Fluid Loss	/	/	/
Source of Sample			
Rm @ Meas. Temp	@	@	@
Rmf @ Meas. Temp	@	@	@
Rmc @ Meas. Temp	@	@	@

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 1-29-93
Mine Area F
Well Number
Site Number F-12

Driller Company MHC
Slimhole / Piezometer / Depressurization Well
Ground Level Elevation
TOC Elevation
Northing
Easting

DRILLING/CONSTRUCTION (MHC)

Date 2-8-93
Mud Type No. Bags 170
Bit Size 18 inch
Depth Drilled, Ft. BGL 405
Casing Diameter and Type 8 inch
Cased Interval, Ft. BGL 280'
Screen Diameter and Type 8 inch
Screen Guage #0
Screened Interval, Ft. BGL 285 to 405
Amount of Gravel Used, Sacks 170
Gravel Type #1
Gravel Setting, Ft. BGL 243 to 405
Length of Gravel Tremmie, Ft.
Depth to Top of Gravel, Ft. BGL 243
Cement Type 1 Lbs Per Sack
Sacks of Cement Used 30'
Sacks of Bentonite Used 25#
Amount of Water Used, Gals.
Length of Cement Tremmie, Ft.

NOTES/CONSTRUCTION PROBLEMS

[redacted]

Vw - 298 1½ inch

Vw 20' 2 inch

DEVELOPMENT (MHC)

Start, Time/Date
Finish, Time/Date
Total Time Jetted
Static Water-Level Measured
After Development

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL
After Jetting (Date), Ft. BGL
Rate Jetted (Meas./Est.), gpm

PUMP/MOTOR (MHC)

Motor H.P.
Length of Column Pipe (ft.)

INSPECTION COMPLETION (ALCOA)

Date Time
Measuring Point Description

Which Is Ft. A.G.L.
Depth to Water, Ft. B.T.O.C.

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well	
Casing	+2-285
	395-405
Screen	285-395
Gravel	245-405
Cement	0-15 / 175-245
Pump Column Length	273
Measuring Pipe	
Casing	+2-298
Screen	298-318

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 1-29-93
Mine Area F
Well Number
Site Number F-12

Driller Company MHC
Slimhole / Piezometer / Depressurization Well
Ground Level Elevation
TOC Elevation
Northing
Easting

DRILLING/CONSTRUCTION (MHC)

Date 2-8-93
Mud Type No. Bags 170
Bit Size 18 inch
Depth Drilled, Ft. BGL 405
Casing Diameter and Type 8 inch
Cased Interval, Ft. BGL 280'
Screen Diameter and Type 8 inch
Screen Guage #10
Screened Interval, Ft. BGL 285 to 405
Amount of Gravel Used, Sacks 170'
Gravel Type #1
Gravel Setting, Ft. BGL 243 to 405
Length of Gravel Tremmie, Ft.
Depth to Top of Gravel, Ft. BGL 243
Cement Type I Lbs Per Sack
Sacks of Cement Used 30'
Sacks of Bentonite Used 25#
Amount of Water Used, Gals.
Length of Cement Tremmie, Ft.

NOTES/CONSTRUCTION PROBLEMS

[redacted]

Use - 298 1½ inch

Use 20' 2 inch

DEVELOPMENT (MHC)

Start, Time/Date
Finish, Time/Date
Total Time Jetted
Static Water-Level Measured
After Development

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL
After Jetting (Date), Ft. BGL
Rate Jetted (Meas./Est.), gpm

PUMP/MOTOR (MHC)

Motor H.P.
Length of Column Pipe (ft.)

INSPECTION COMPLETION (ALCOA)

Date Time
Measuring Point Description

Which Is Ft. A.G.L.
Depth to Water, Ft. B.T.O.C.

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Well	
Casing	+2-265
	395-405
Screen	285-395
Gravel	245-405
Cement	0-15 / 175-245

Pump Column Length 273

Measuring Pipe

Casing	+2-298
Screen	298-318

D-WELL

5-AUG-92 @ 13:04:23

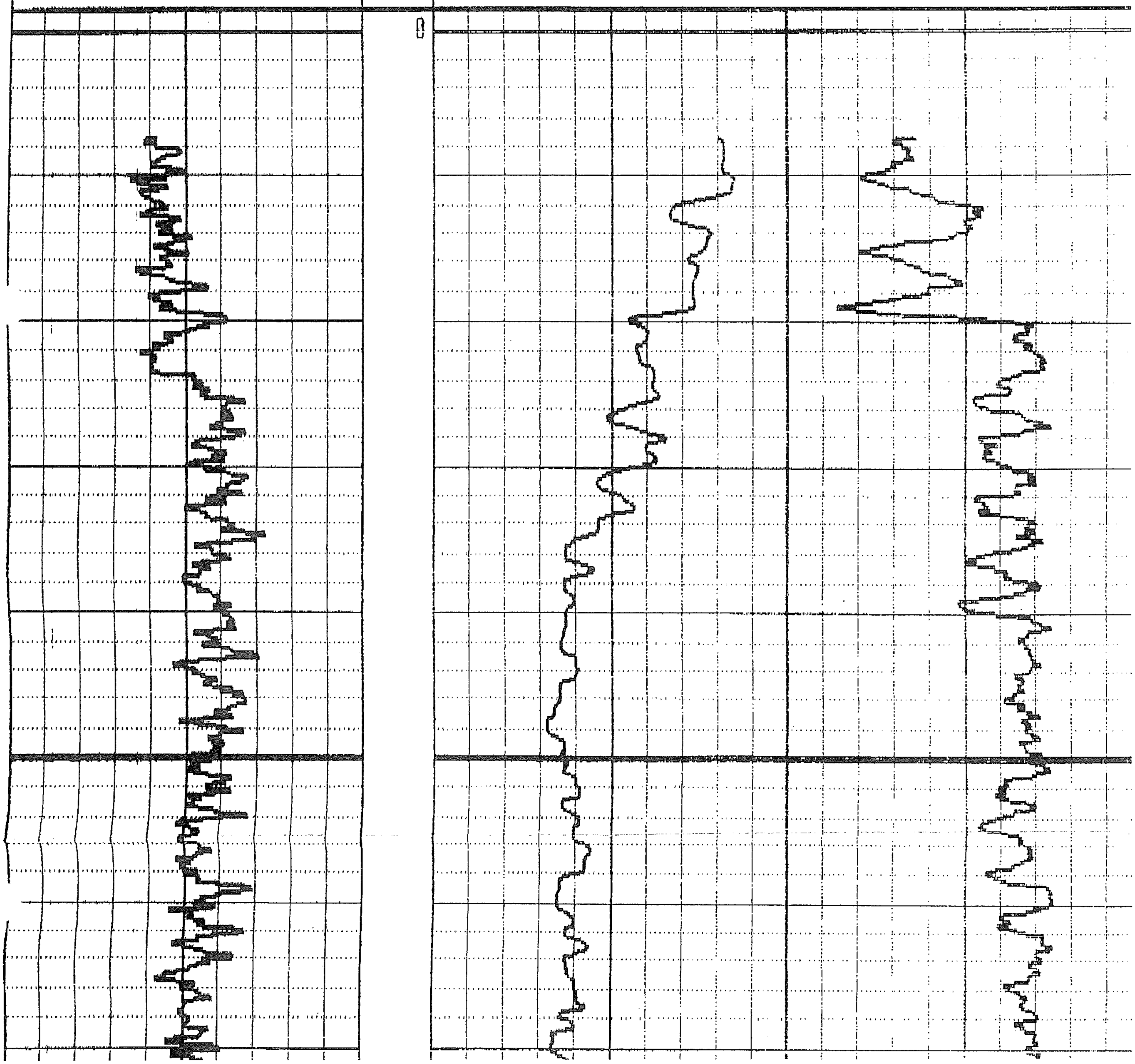
Depth Axes Curve : DEPTH   Units : FT

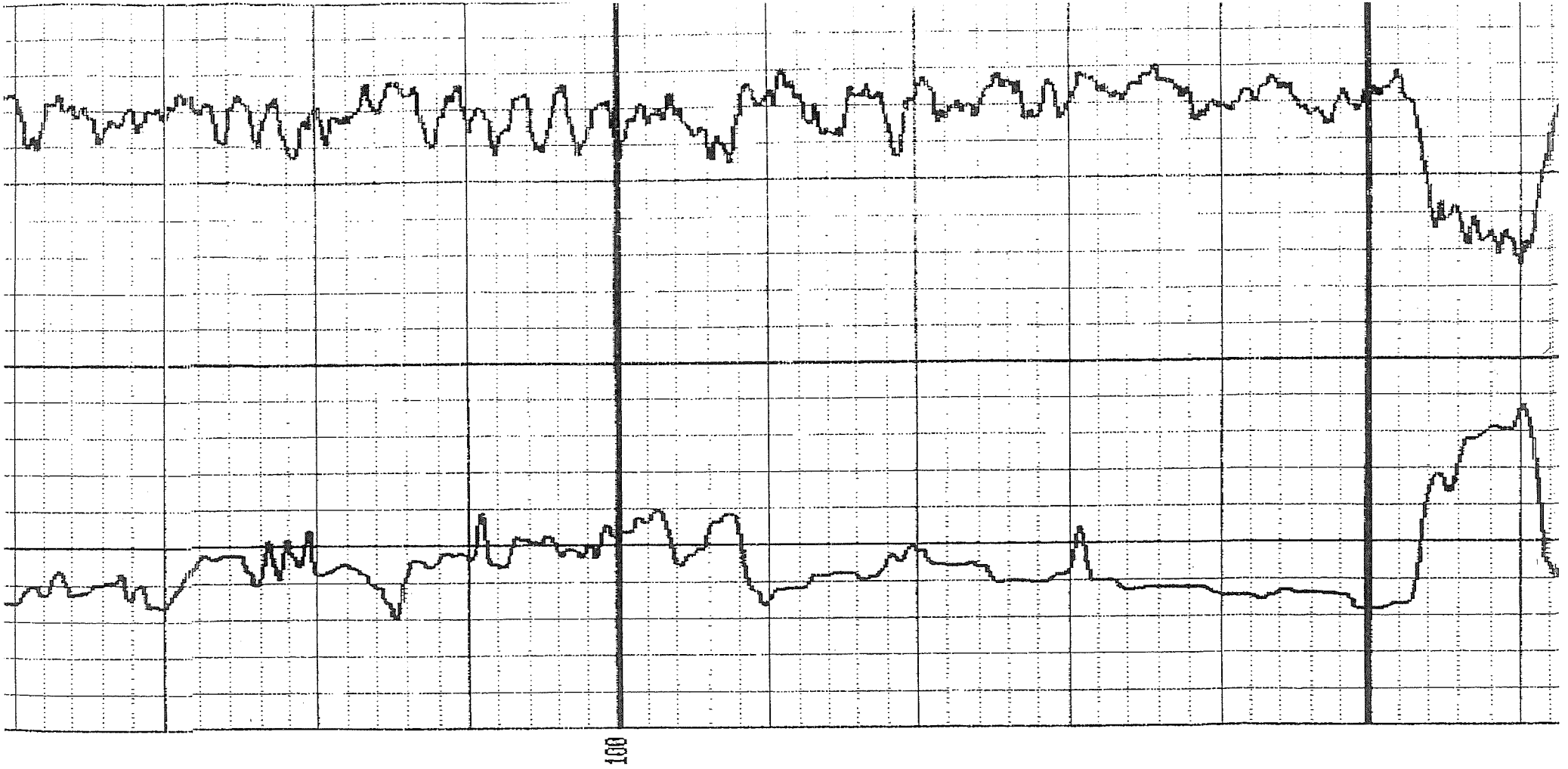
F Area

F-12

North

GR	1 /	RES
0 CPS 200	140	0 OHMS 100
	FEET	DENS
		1000 CPS 0

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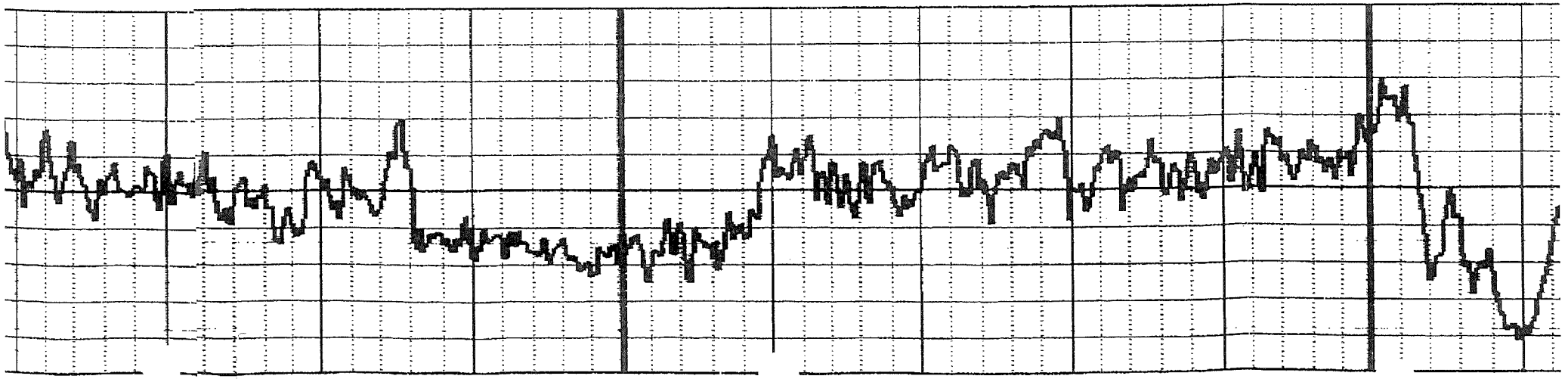

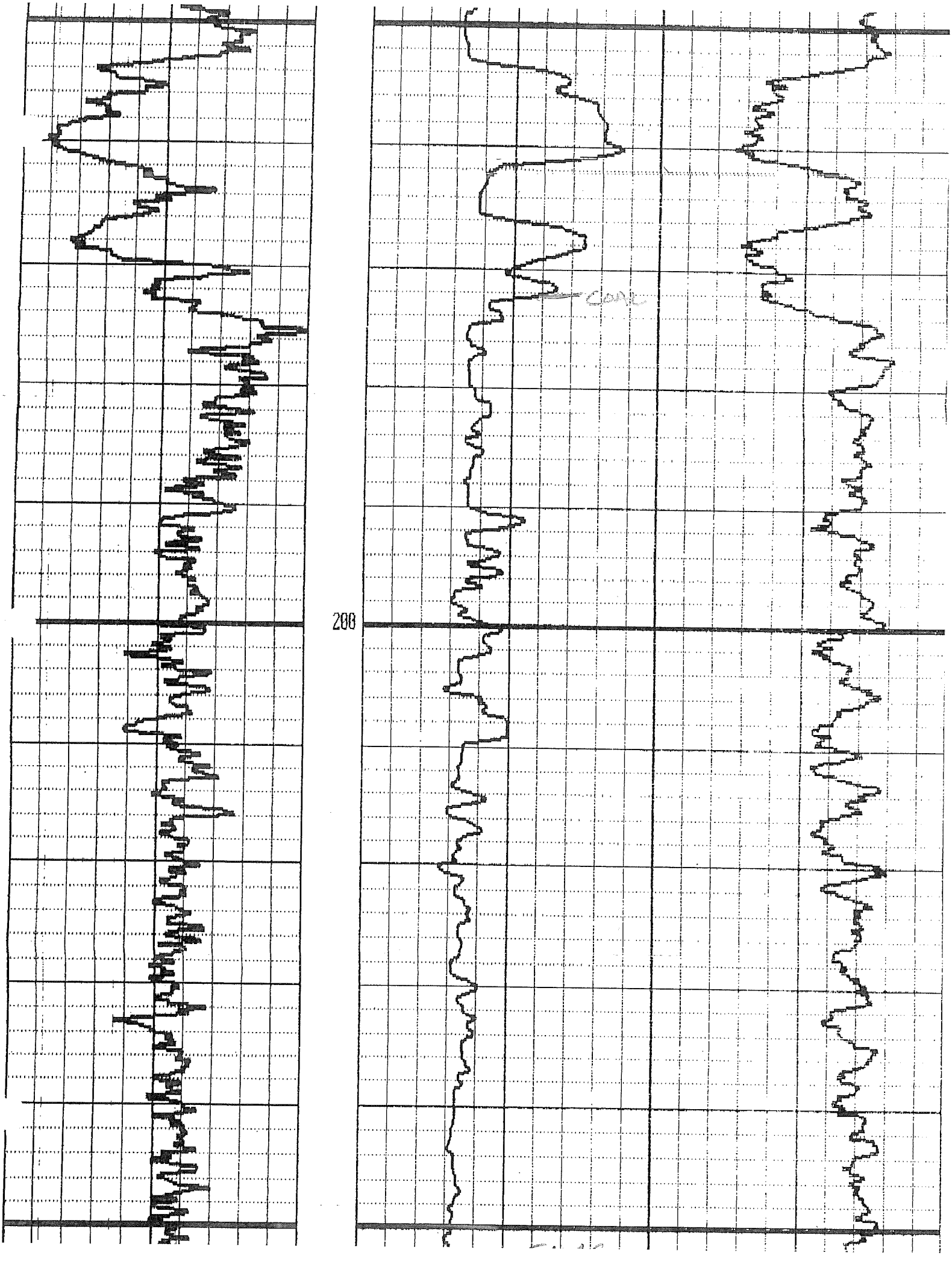
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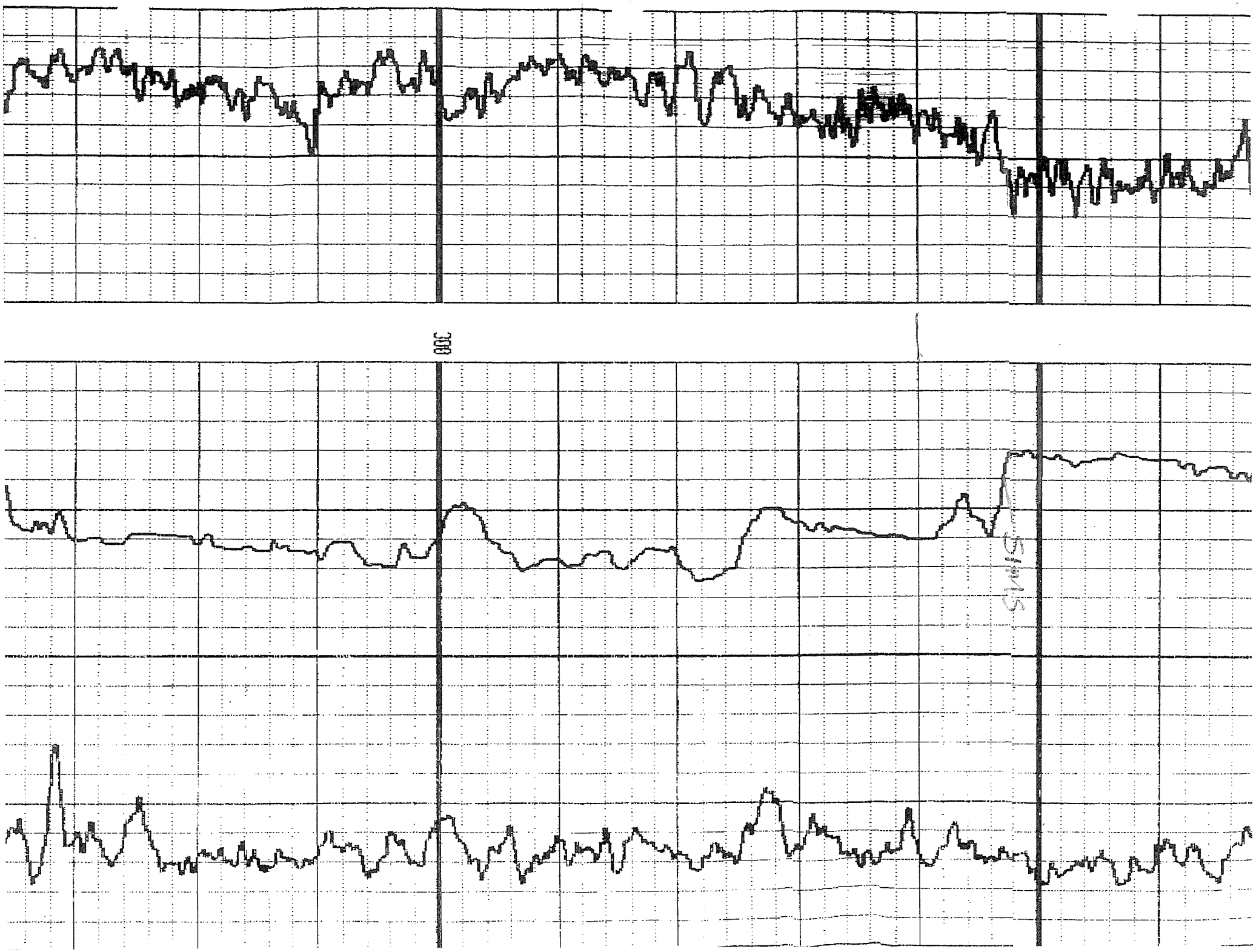

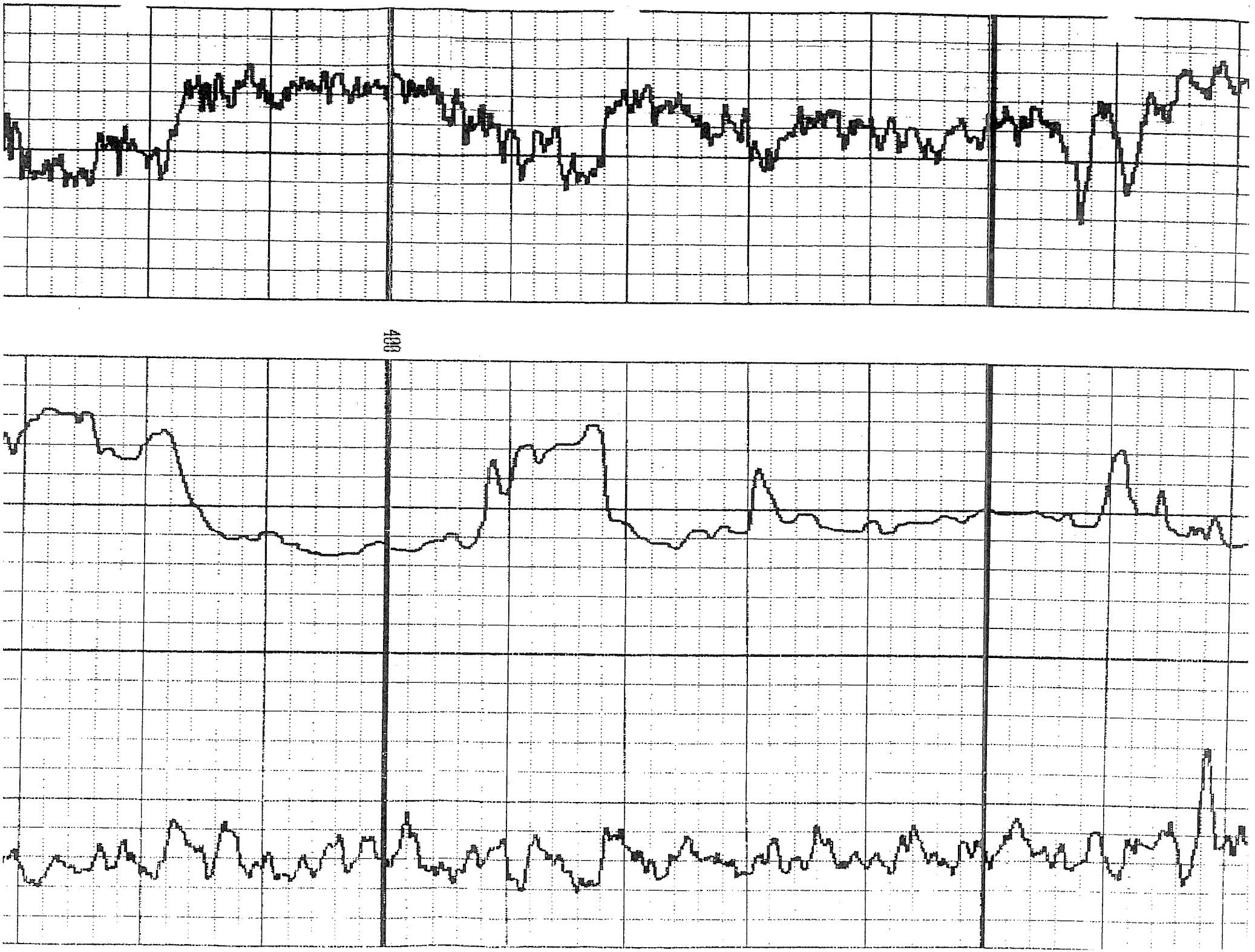
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Available Construction Documentation

for Approved Operating Permit Well

F13 Sims

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 3-25-93
Mine Area F-
Well Number F-13 offset
Site Number

Driller R. Shupp Company M.H.C.
Slimhole or Piezometer Depress.
Ground Level Elevation
TOC Elevation
Northing
Easting

MATERIAL SETTINGS (RWH&A)

Material	Depth Interval(s) (ft BGL)
Casing	+2'-235'
	405'-415'
Screen	235'-405'
Gravel	265'-415'
Cement	125'-205'
	0-15'
Pump Setting	273'

DRILLING/CONSTRUCTION (MHC)

Date 3-25-93
Mud Type Drill Lube No. Bags 14 gal
Bit Size 12 3/4
Depth Drilled, Ft. BGL 415
Casing Diameter and Type 8" P.V.C. Sch 80
Cased Interval, Ft. BGL +2'-235' 405-415'
Screen Diameter and Type 8" P.V.C. - 40
Screen Guage
Screened Interval, Ft. BGL 235-405'
Amount of Gravel Used, Sacks 281
Gravel Type Sand
Gravel Setting, Ft. BGL 205-415
Length of Gravel Tremmie, Ft.
Depth to Top of Gravel, Ft. BGL 205
Cement Type Port. Lbs Per Sack 96
Sacks of Cement Used 20
Sacks of Bentonite Used
Amount of Water Used, Gals.
Length of Cement Tremmie, Ft.

DEVELOPMENT (MHC)

Start, Time/Date 9:00 3-26-93
Finish, Time/Date 3:00 " "
Total Time Jetted 6 hr.
Static Water-Level Meesured
After Devolopment

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL
After Jetting (Date), Ft. BGL
Rate Jetted (Meas./Est.), gpm

PUMP/MOTOR (MHC)

Motor H.P. 30 H.P.
Length of Column Pipe (ft.) 273

INSPECTION COMPLETION (ALCOA)

Date Time
Measuring Point Description

Which Is Ft. A.G.L.
Depth to Water, Ft. B.T.O.C.

NOTES/CONSTRUCTION PROBLEMS

F Area

Post-it™ brand fax transmittal memo 7671	# of pages ▸
To R. KAISER	From R. GAINES
Co. RHA	Co. ALCOA
Dept.	Phone # [redacted]
Fax # 512 338-9372	Fax # [redacted]

.13

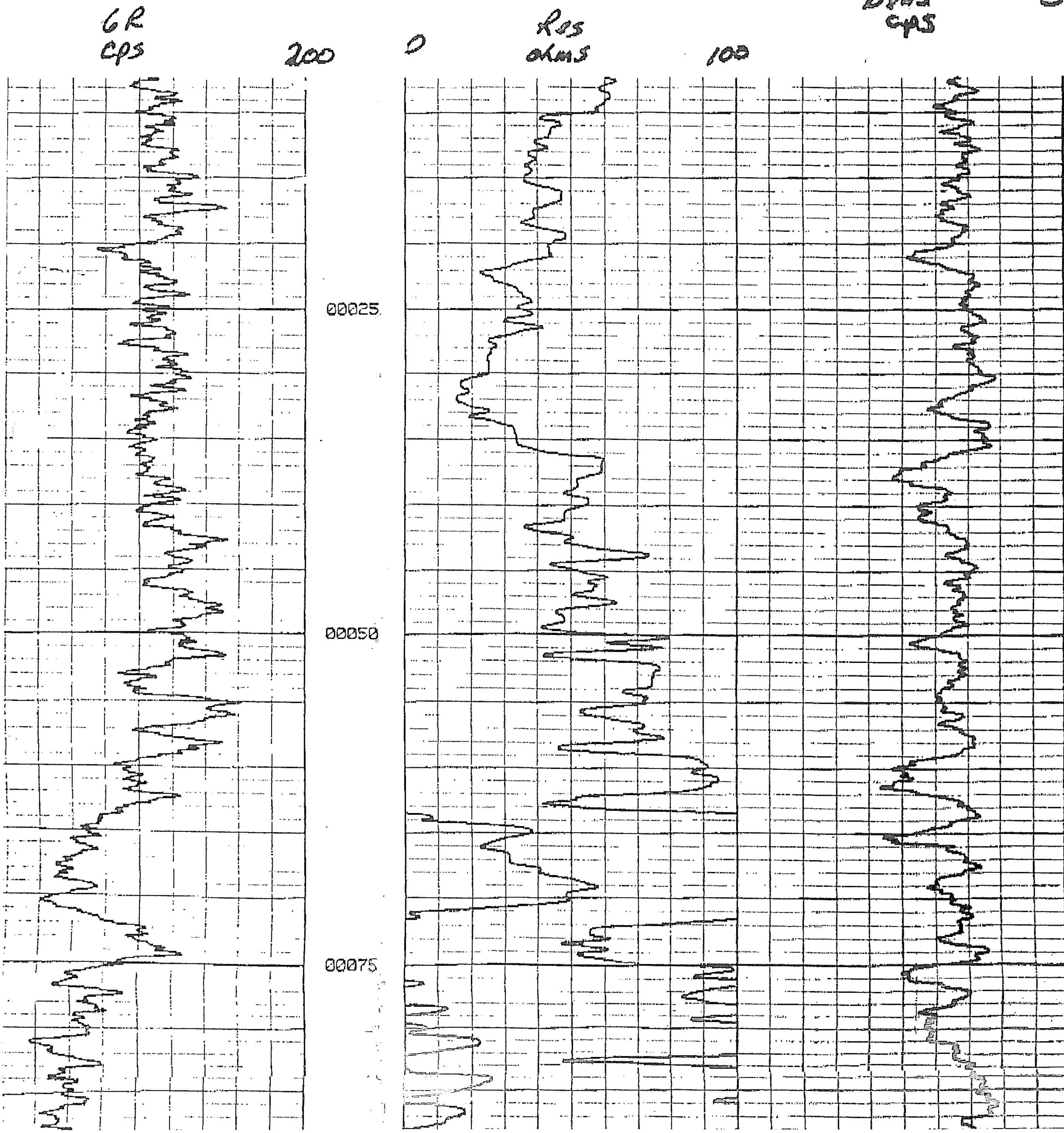
INSIDE [illegible] Block

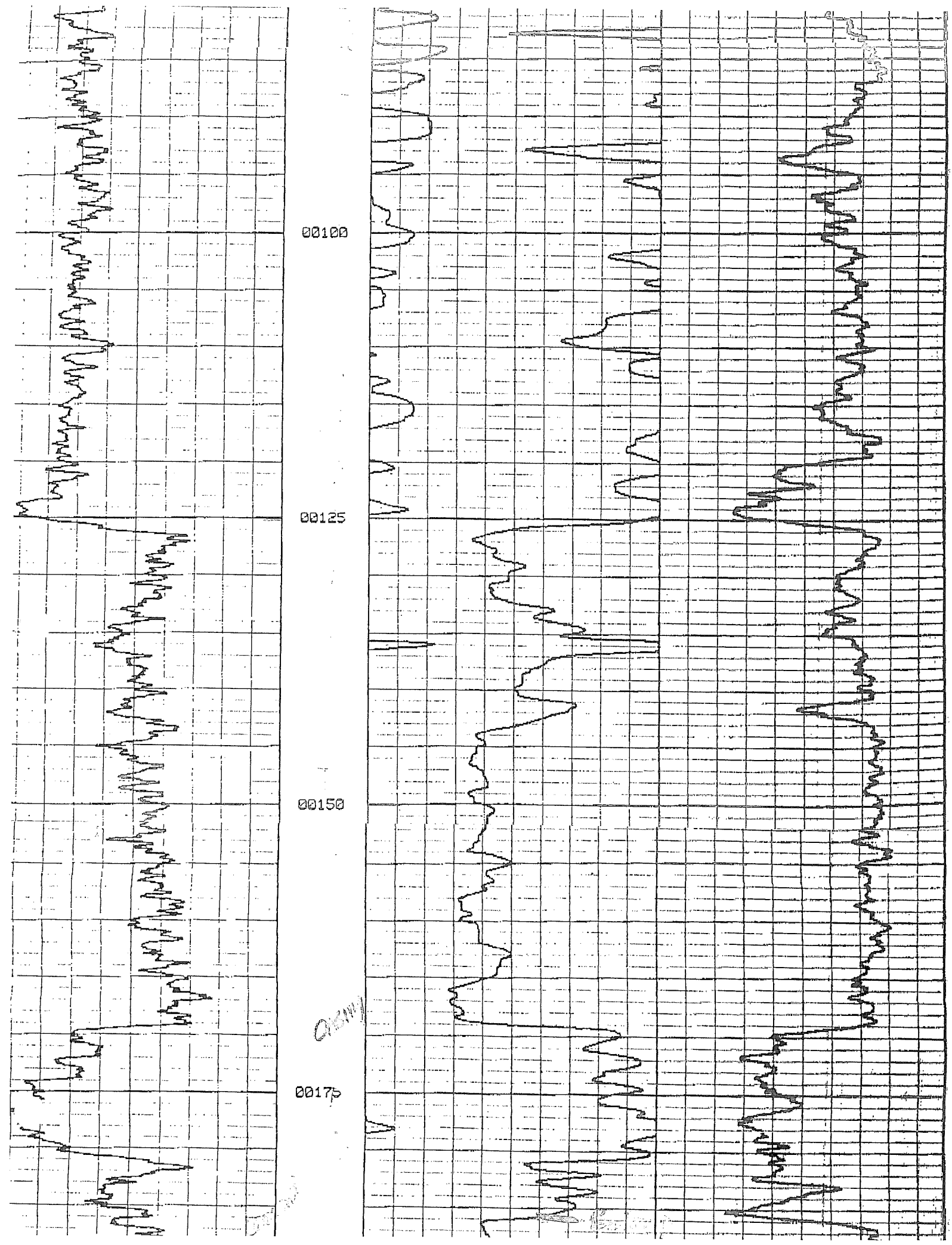
F-13 North

WAITING

5/19/93

F13

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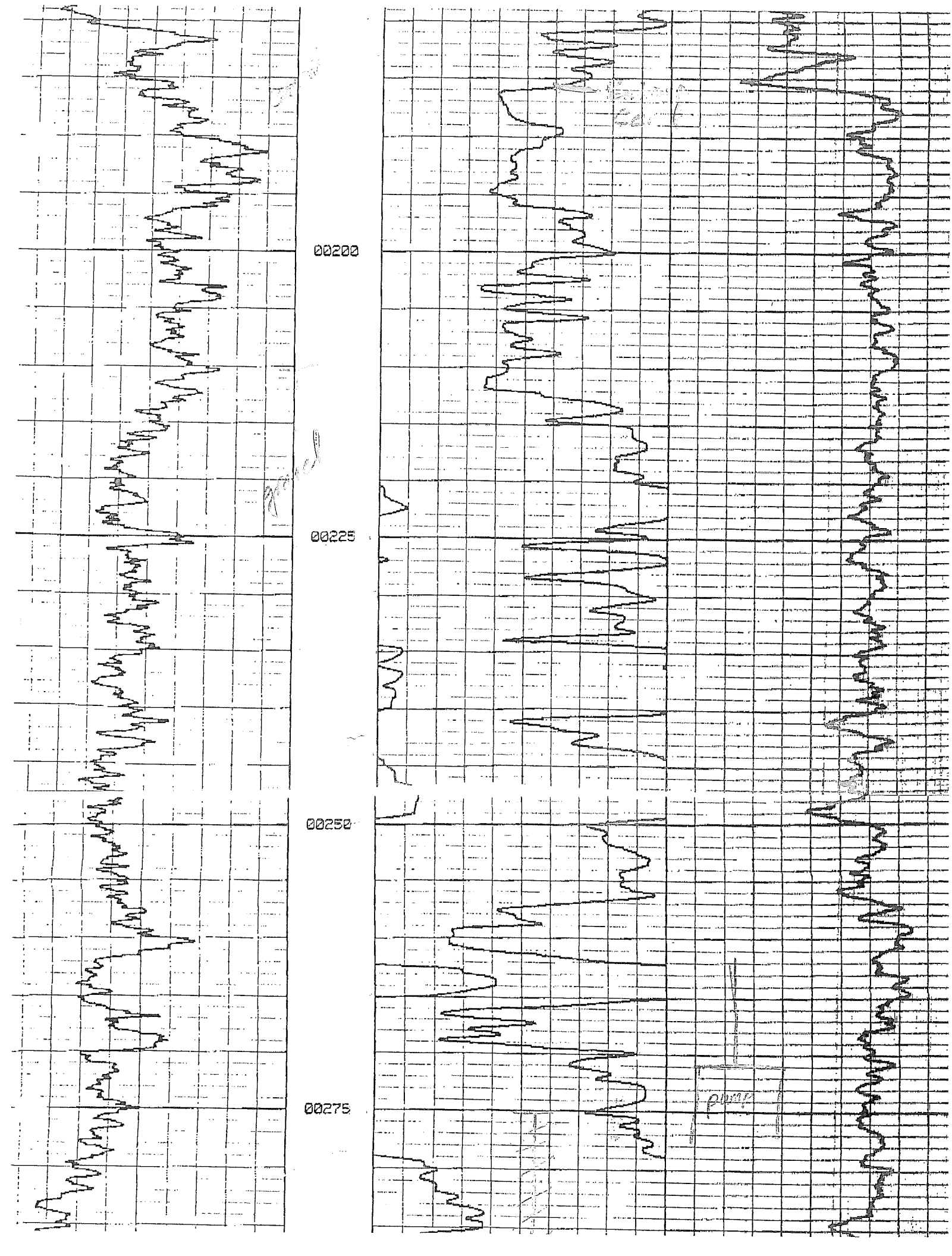
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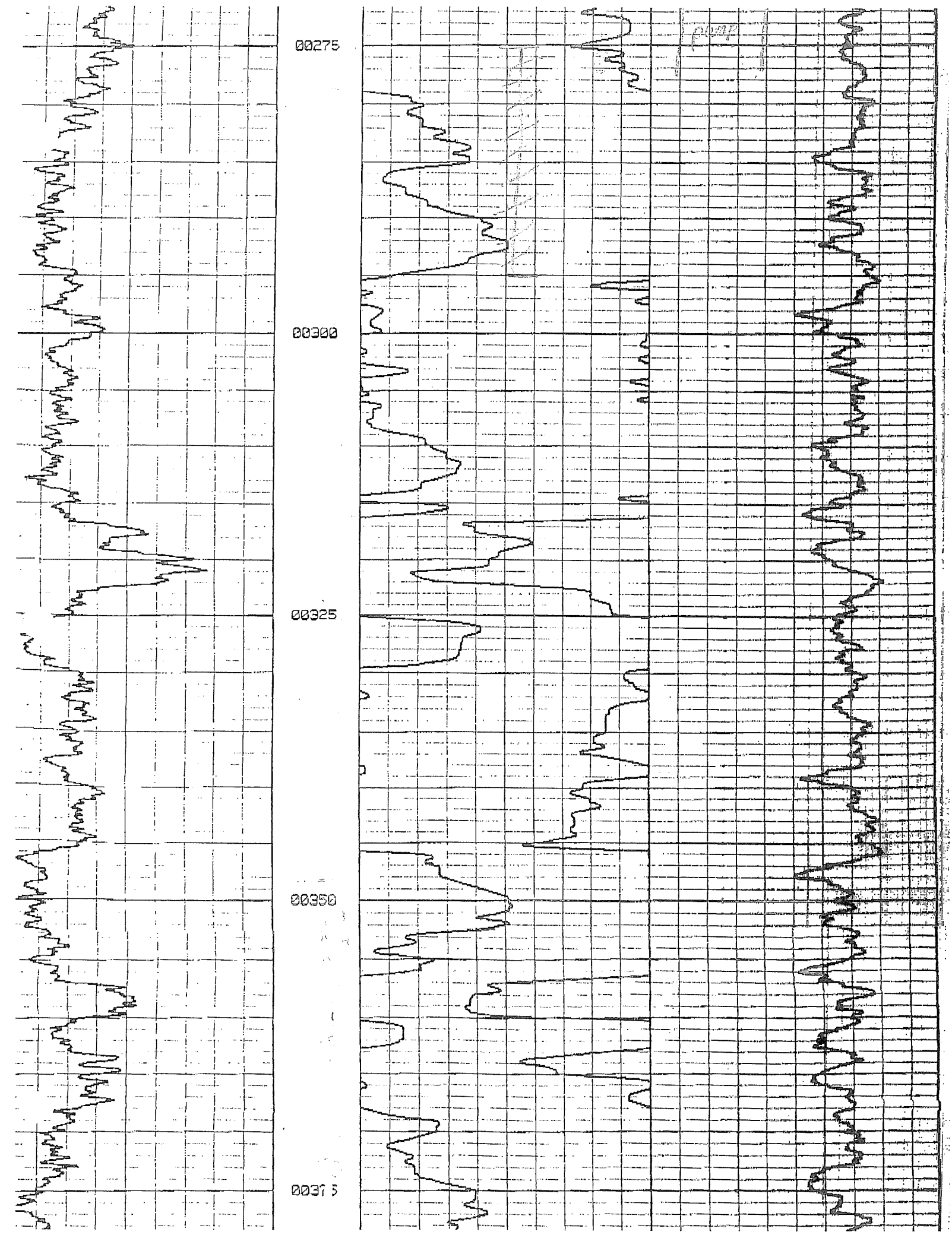
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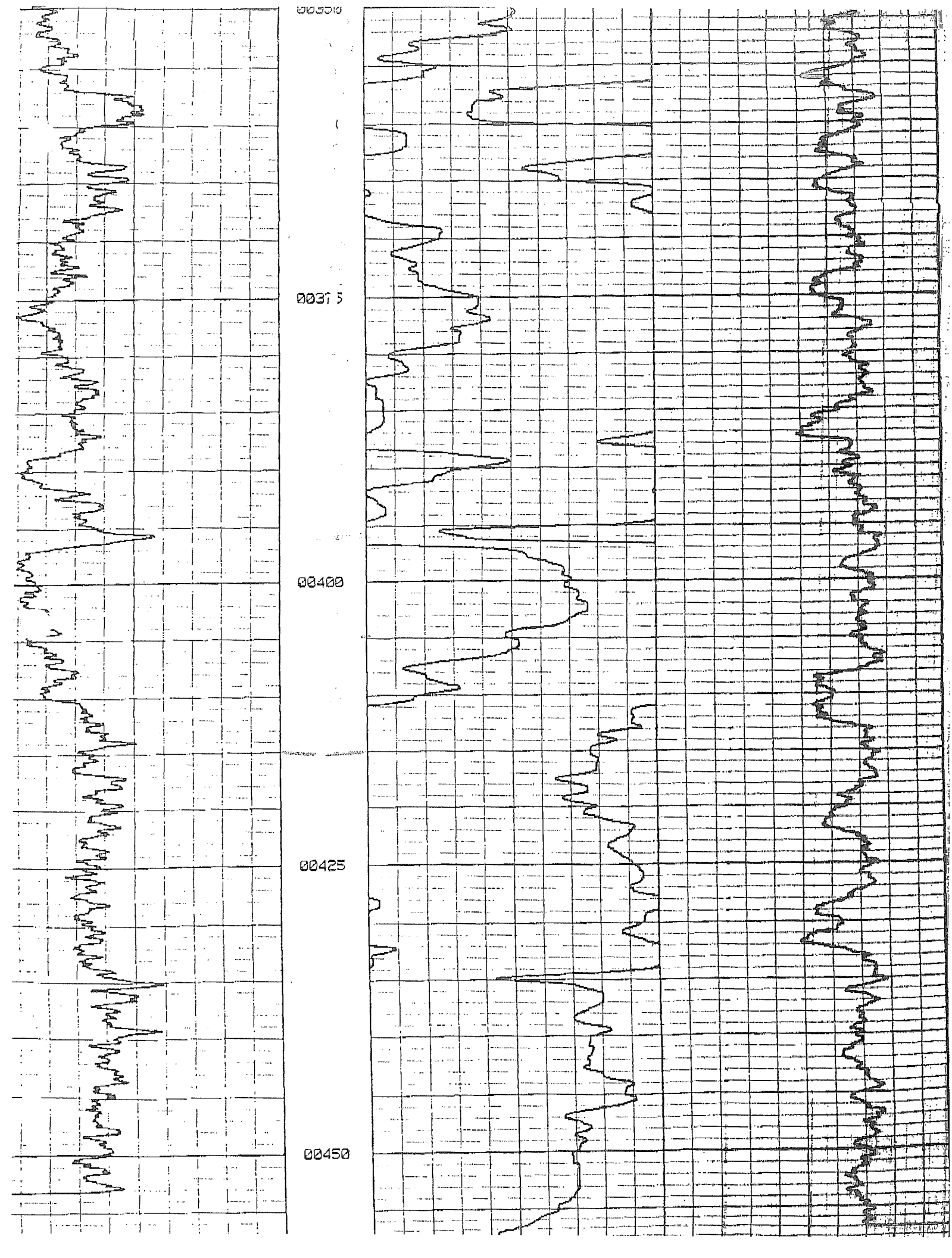
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Available Construction Documentation

for Approved Operating Permit Well

F14 Sims

DRILLERS WELL/PIEZOMETER RECORD

SITE (ALCOA)

Date 4/20/93
Mine Area F
Well Number F-14
Site Number F-14

Driller ______ Company MHC-X
Slimhole / Piezometer / (Depressurization Well)
Ground Level Elevation ______
TOC Elevation ______
Northing ______
Easting ______

DRILLING/CONSTRUCTION (MHC)

Date ______
Mud Type ______ No. Bags ______
Bit Size ______
Depth Drilled, Ft. BGL ______
Casing Diameter and Type ______
Cased Interval, Ft. BGL ______
Screen Diameter and Type ______
Screen Guage ______
Screened Interval, Ft. BGL ______
Amount of Gravel Used, Sacks ______
Gravel Type ______
Gravel Setting, Ft. BGL ______
Length of Gravel Tremmie, Ft. ______
Depth to Top of Gravel, Ft. BGL ______
Cement Type ______. Lbs Per Sack ______
Sacks of Cement Used ______
Sacks of Bentonite Used ______
Amount of Water Used, Gals. ______
Length of Cement Tremmie, Ft. ______

NOTES/CONSTRUCTION PROBLEMS

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 1

To Ricky Gaines	From Rick Kaiser
Co. ALCOA	Co. RWH&A
Dept.	Phone # 3452379
Fax # 4468614	Fax # 3389372

DEVELOPMENT (MHC)

Start, Time/Date ______
Finish, Time/Date ______
Total Time Jetted ______
Static Water-Level Measured
After Devolopment ______

Total Depth Inside Casing (Measured)
Before Jetting (Date), Ft. BGL ______
After Jetting (Date), Ft. BGL ______
Rate Jetted (Meas./Est.), gpm ______

PUMP/MOTOR (MHC)

Motor H.P. ______
Length of Column Pipe (ft.) ______

INSPECTION COMPLETION (ALCOA)

Date ______ Time ______
Measuring Point Description ______

Which is ______ Ft. A.G.L.
Depth to Water, Ft. B.T.O.C. ______

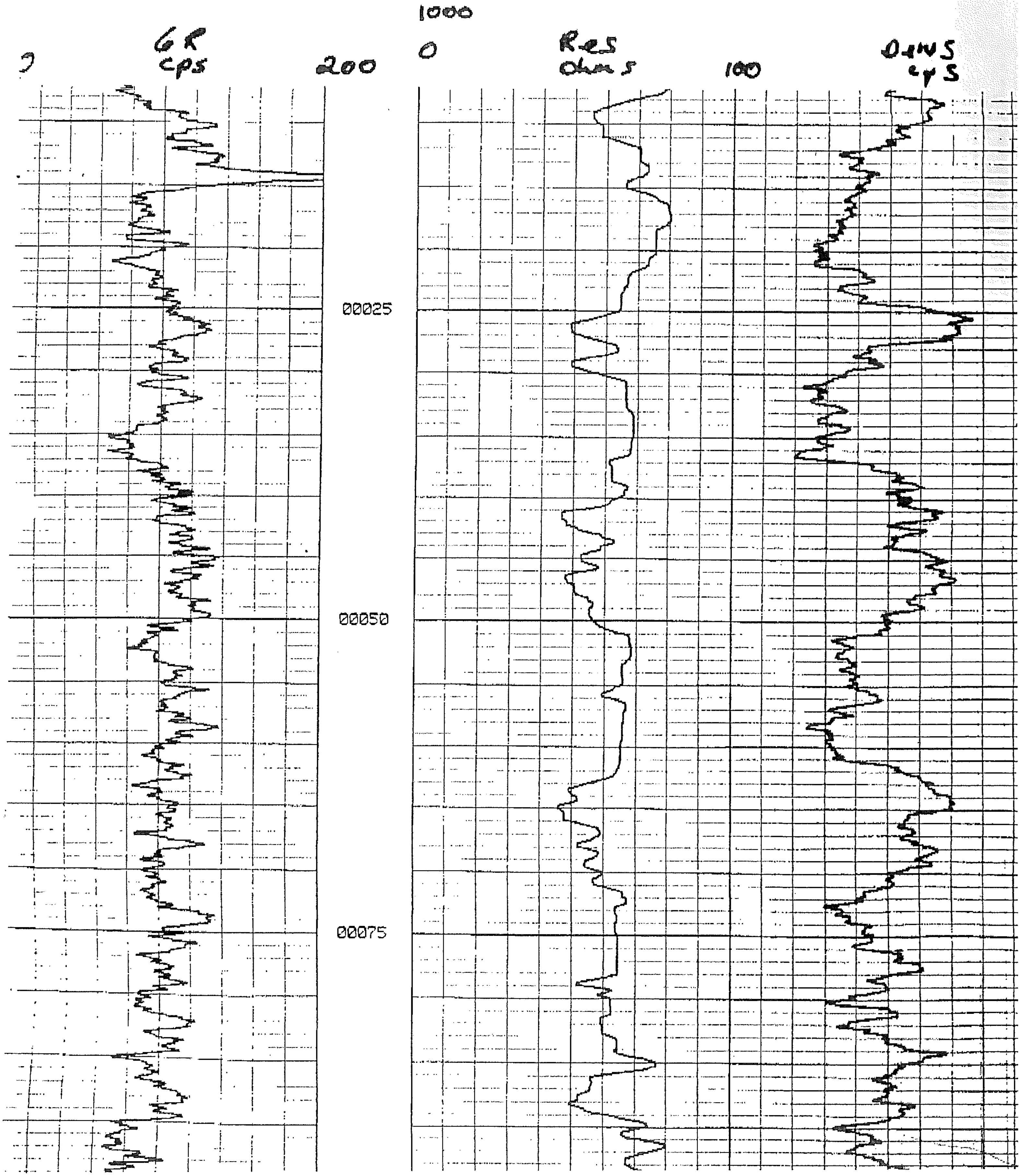
MATERIAL SETTINGS (RWH&A)

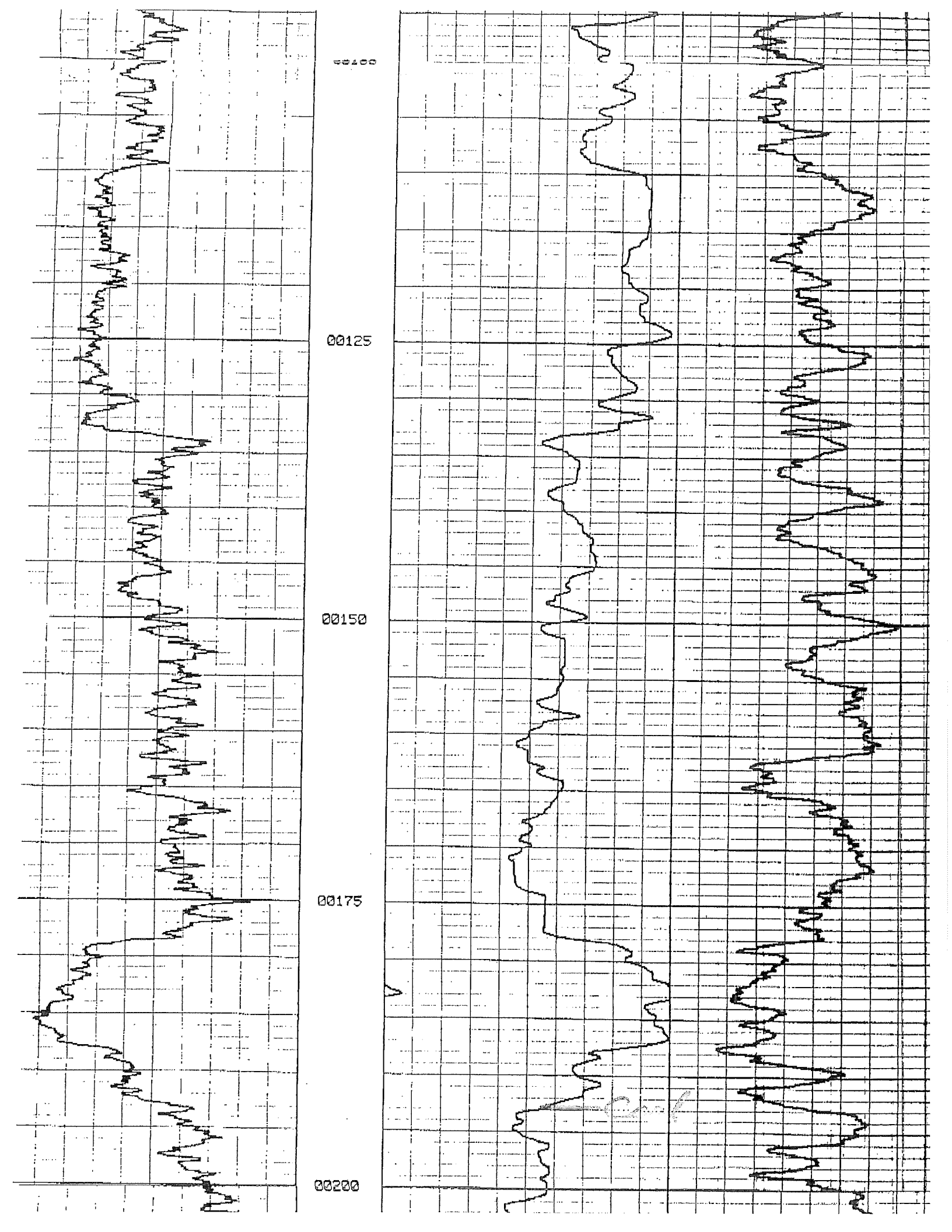
Material	Depth Interval(s) (ft BGL)
Well	
Casing	+2 - 278
	478 - 488
Screen	278 - 478
Gravel	240 - 488
Cement	125 - 240
	0 - 15
Pump Column Length	223
Measuring Pipe	
Casing	+2 - 298
Screen	298 - 318

RK 4/20/93

14

4/19/93

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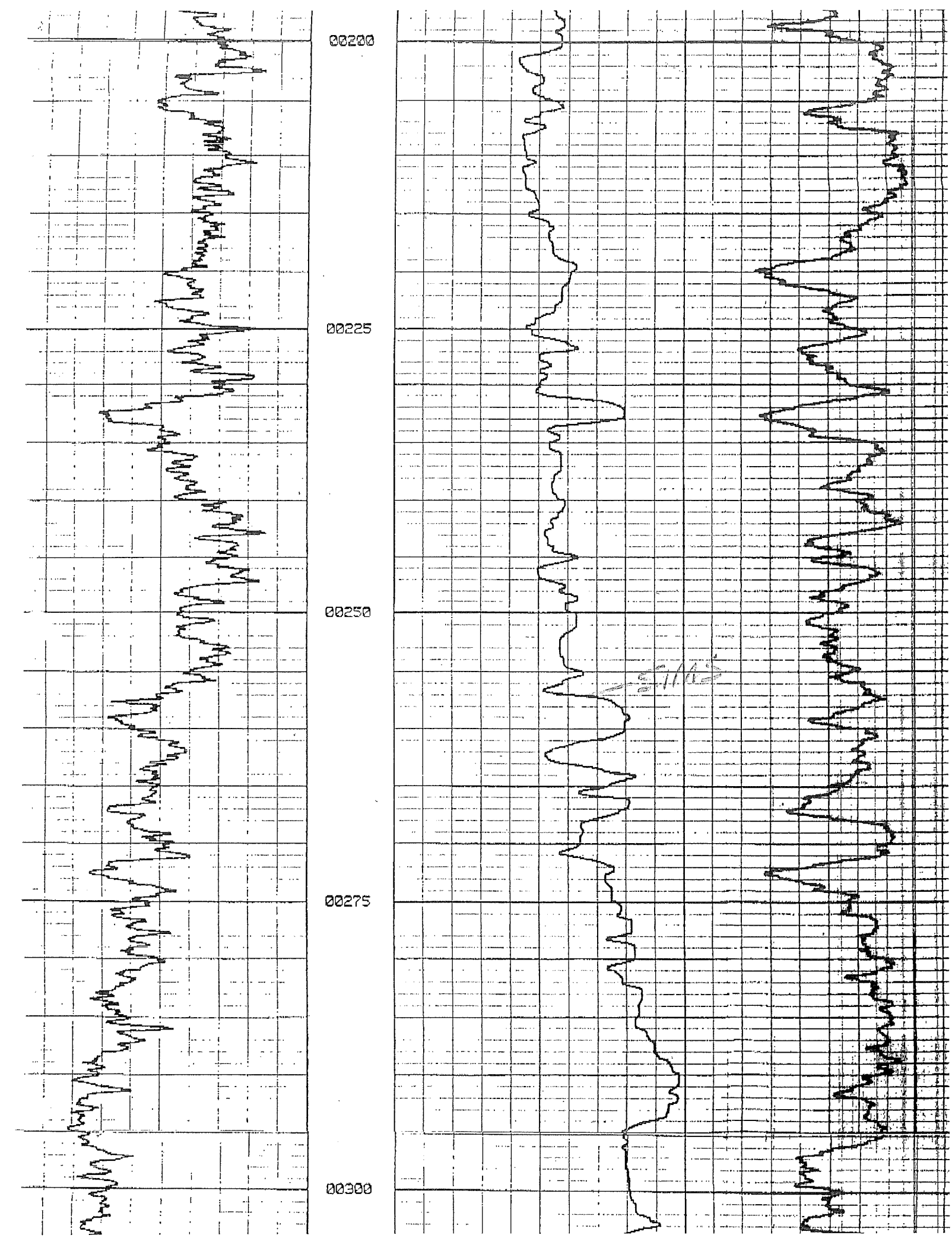
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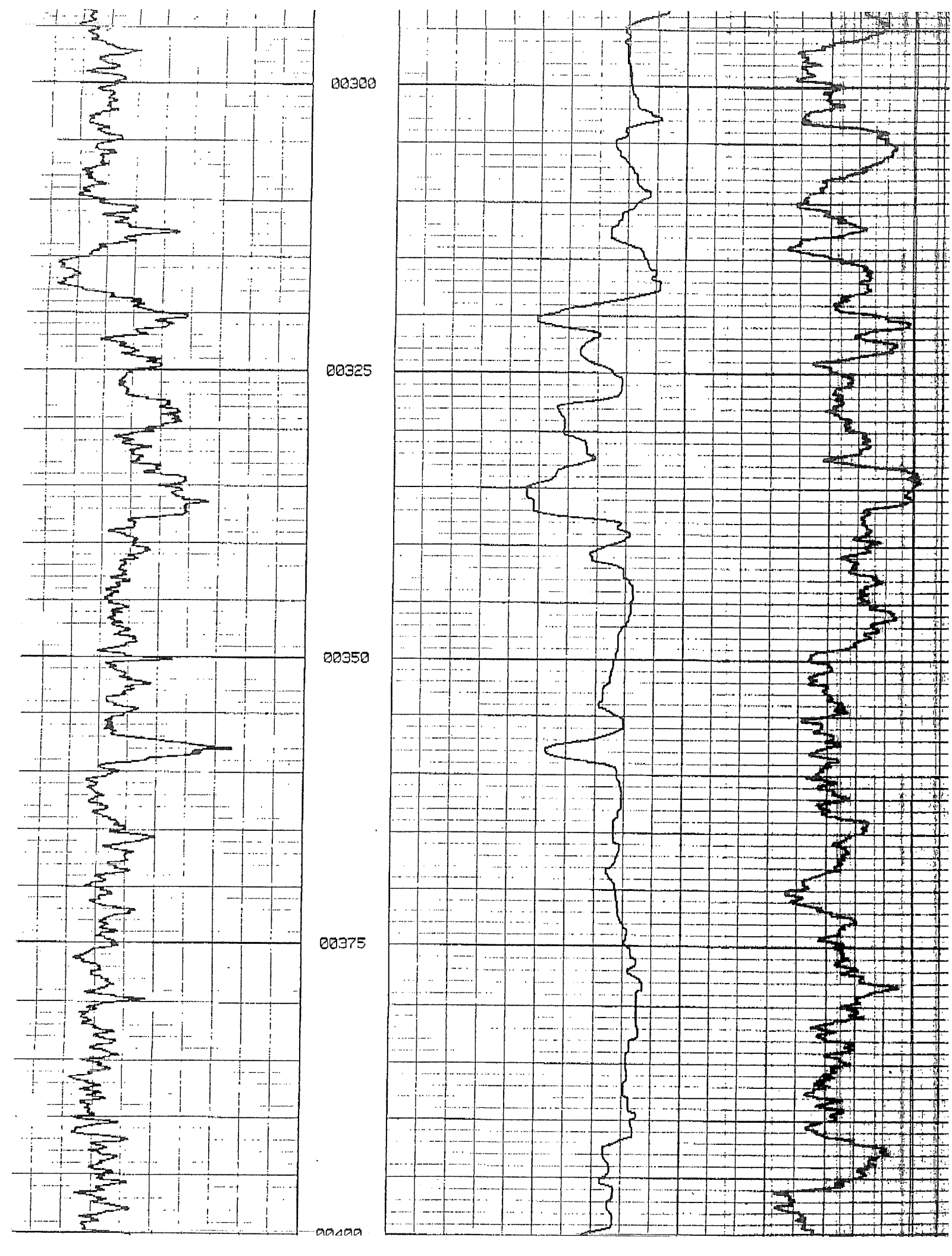
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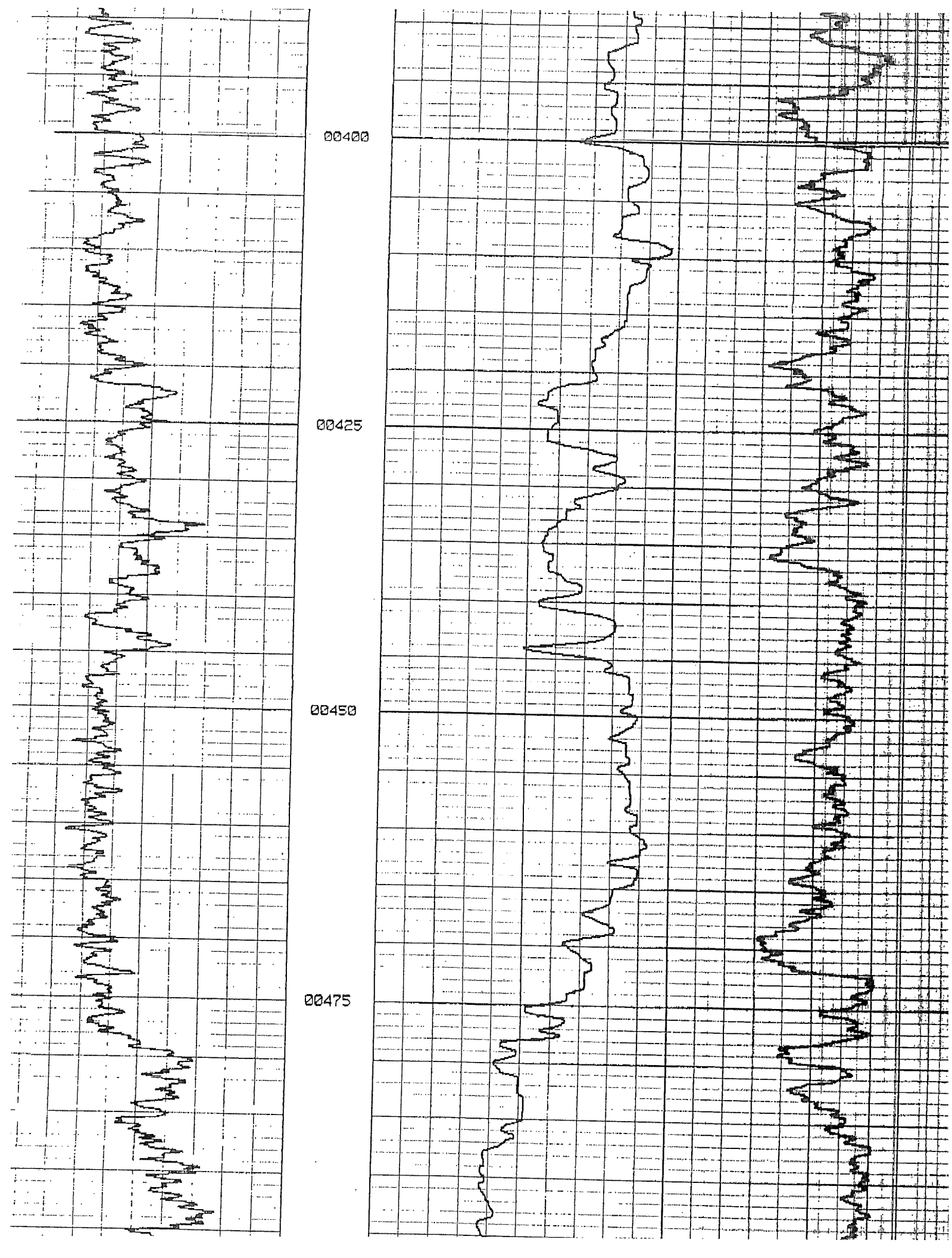
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Available Construction Documentation

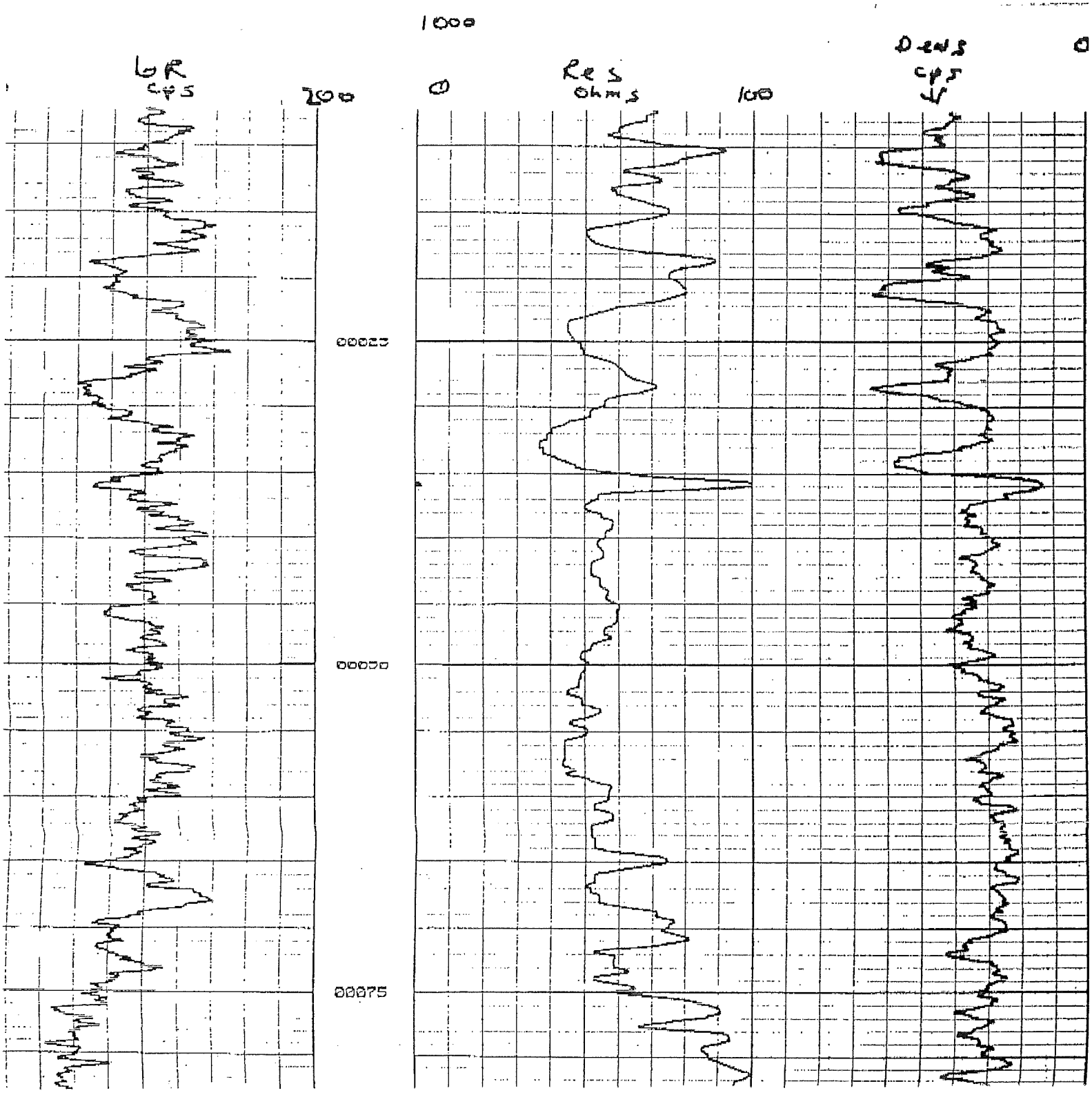
for Approved Operating Permit Well

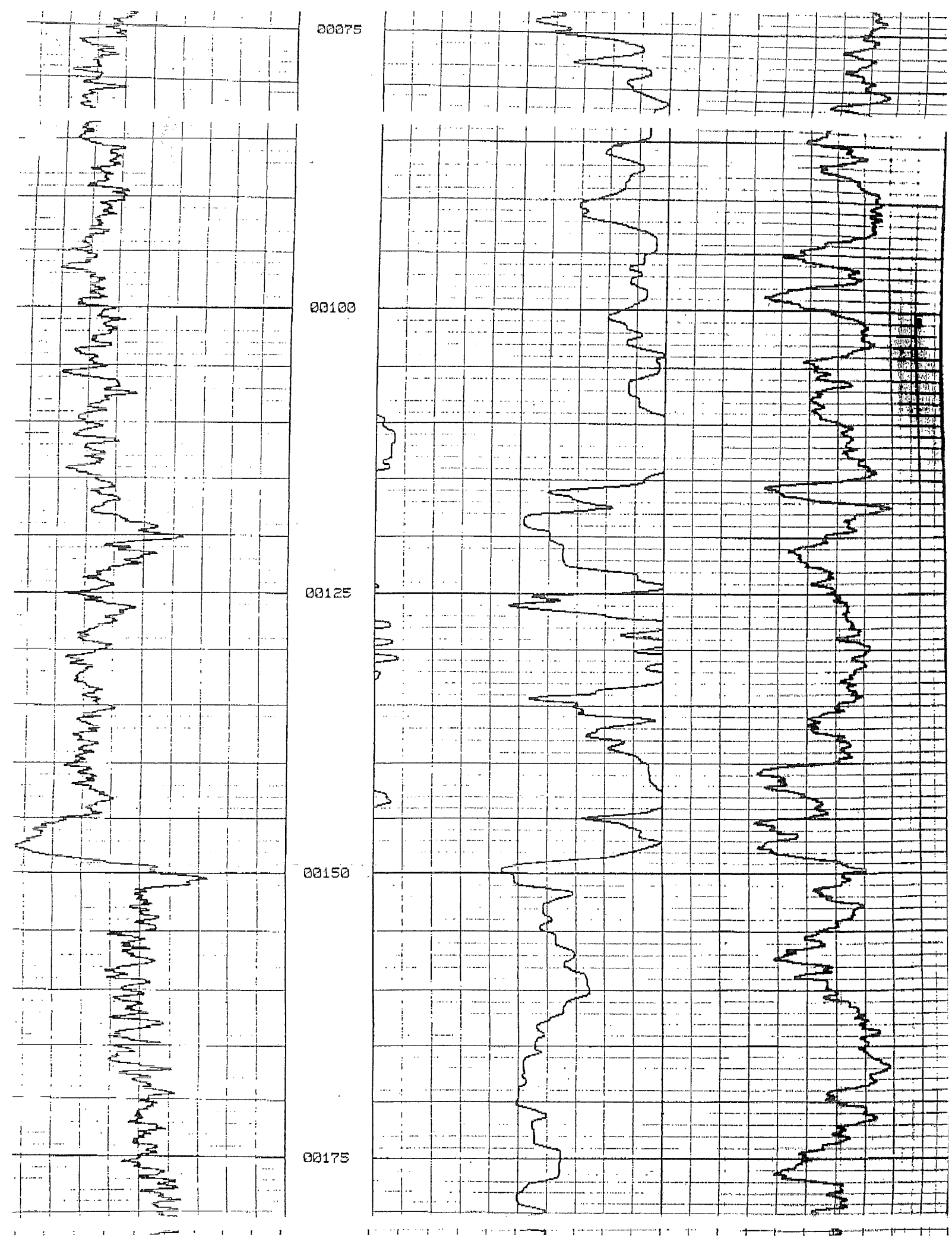
F15 Sims

To: Ridge Kaiser

F-15
4/06/93

From: R. Gaines

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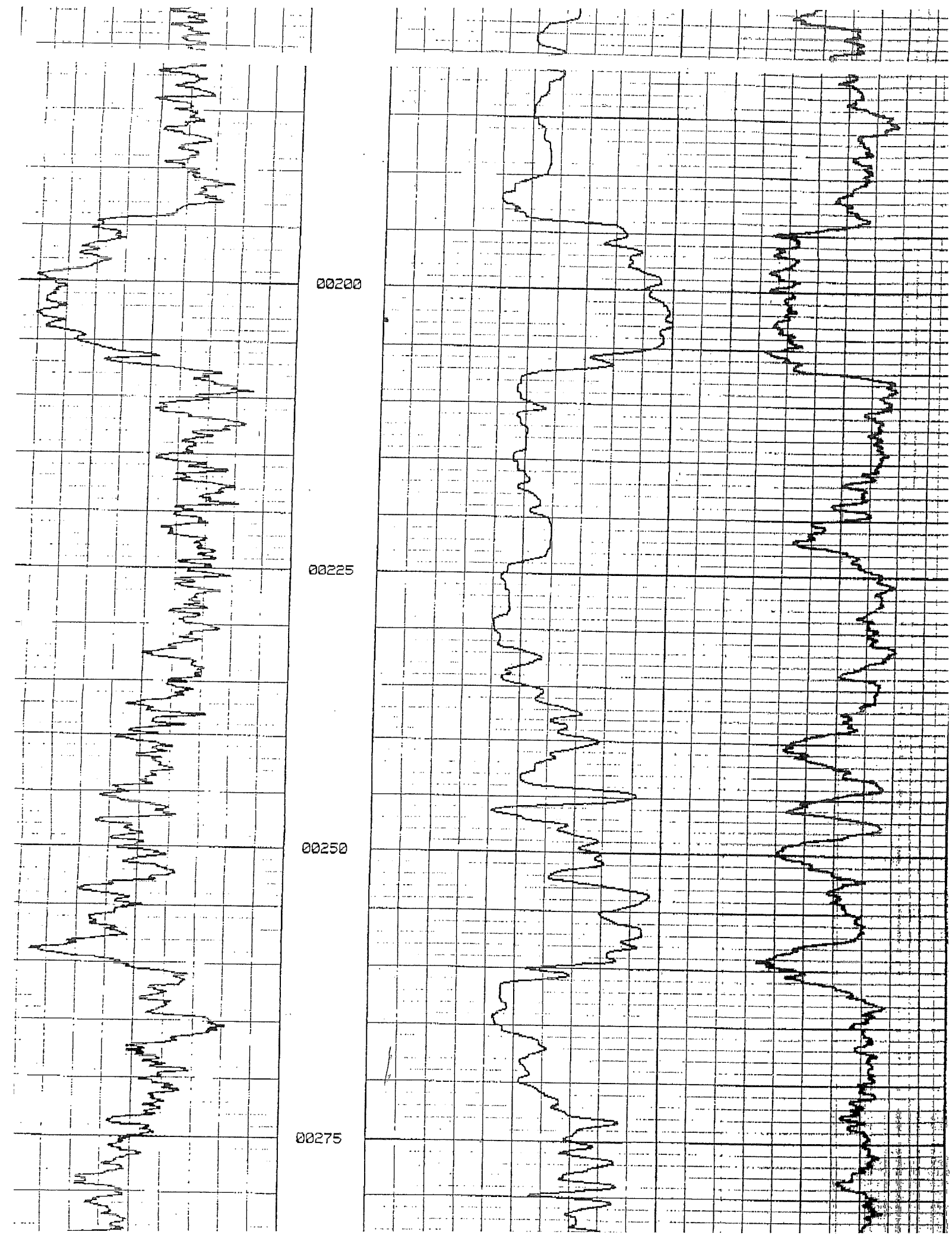
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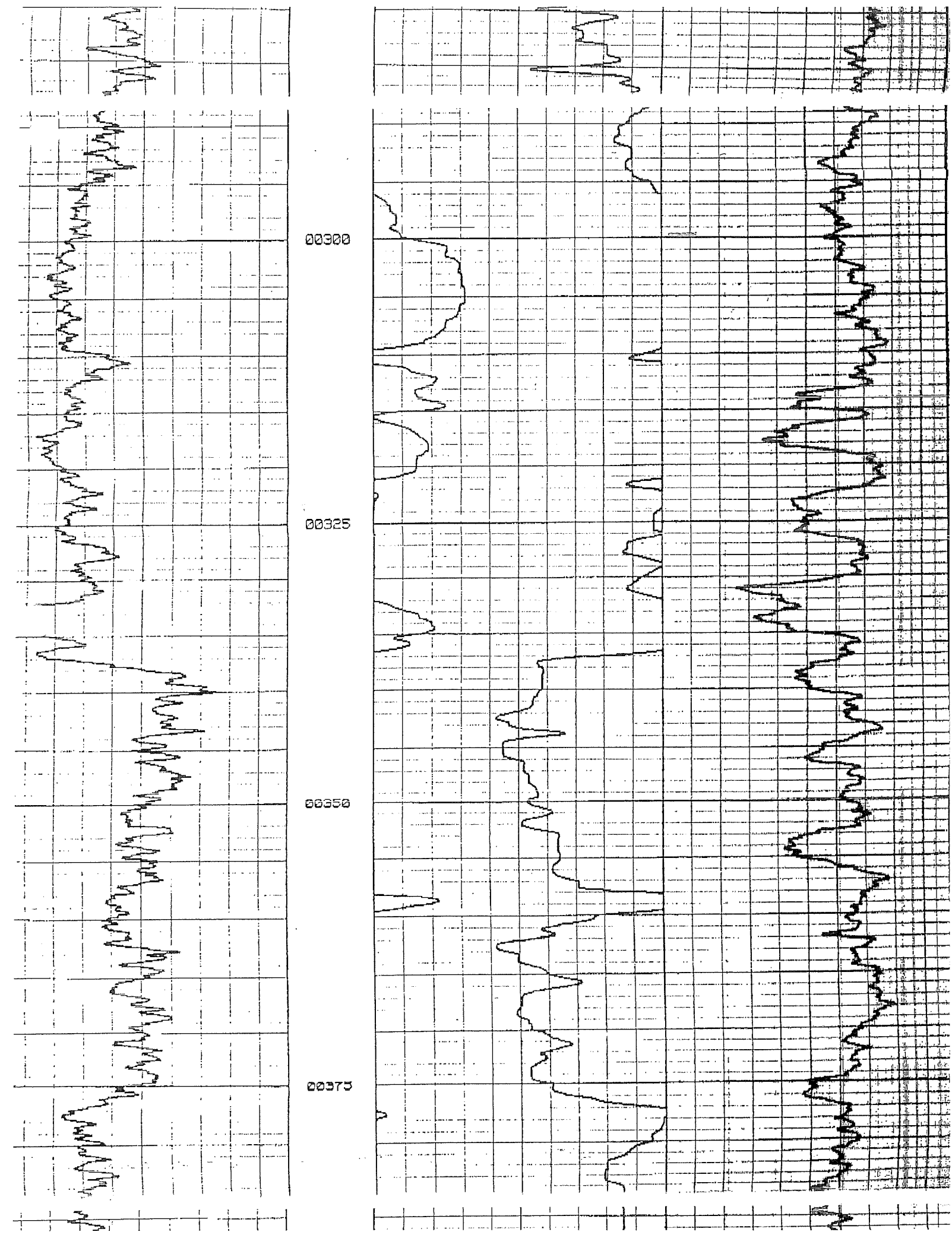
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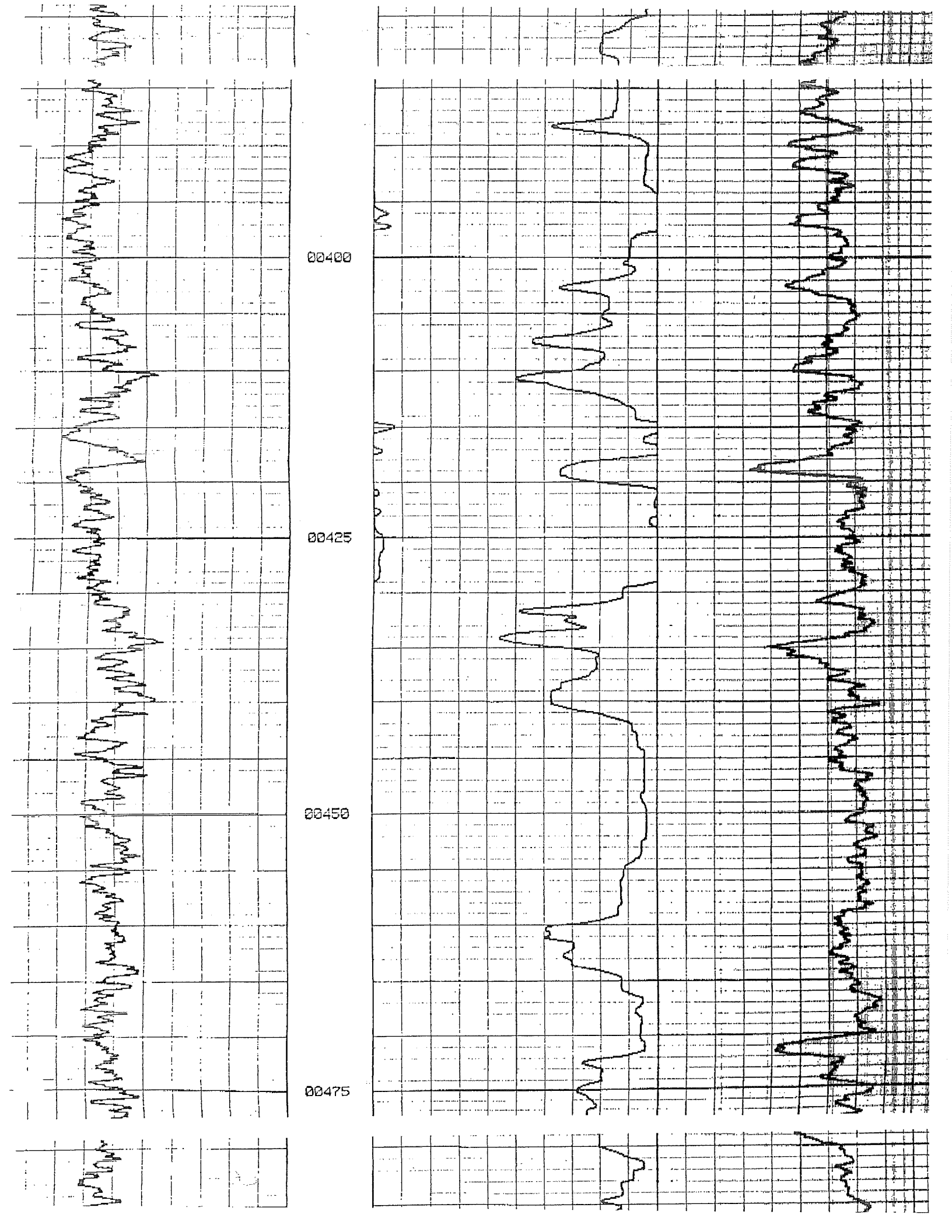
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Available Construction Documentation

for Approved Operating Permit Well

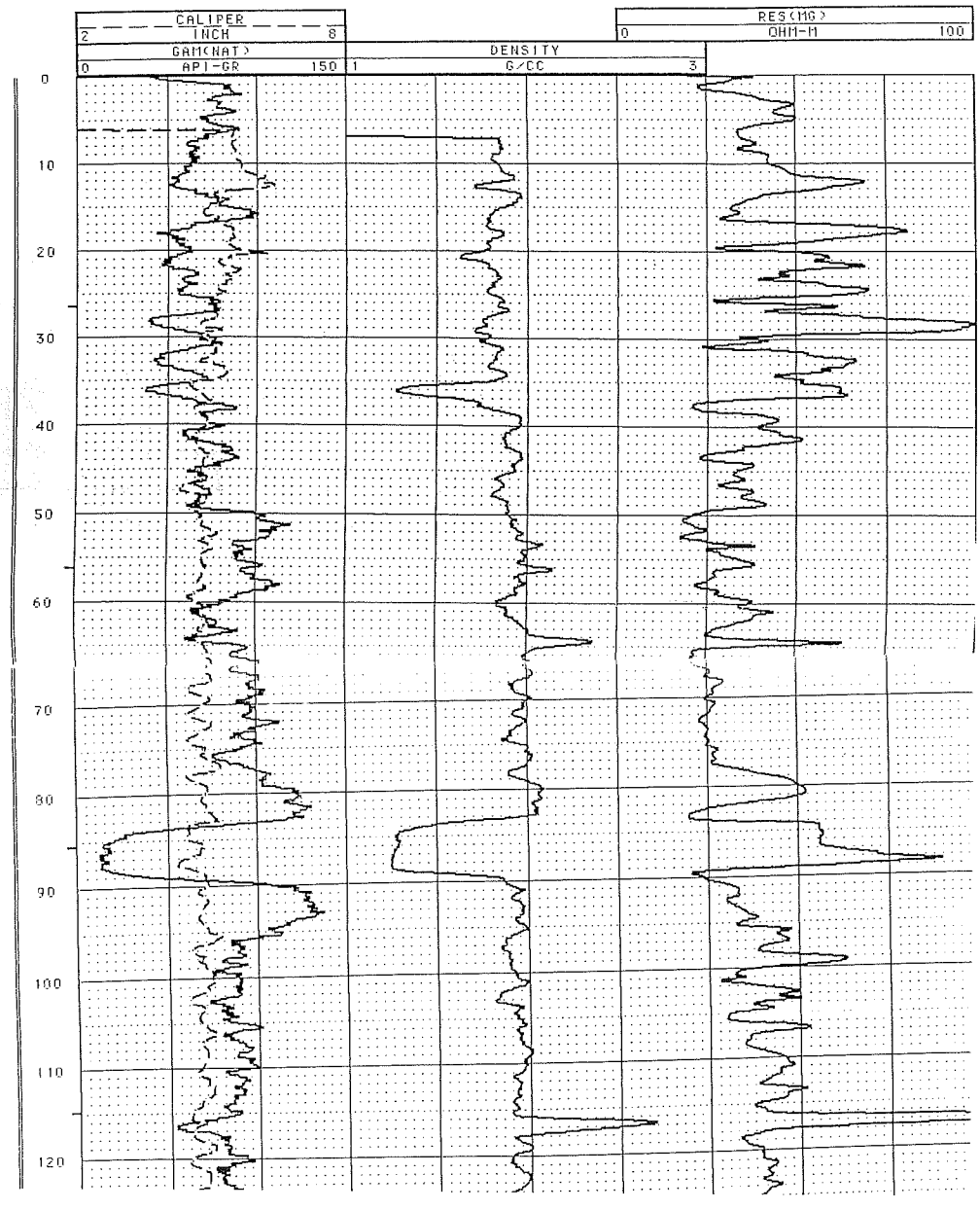
P-5

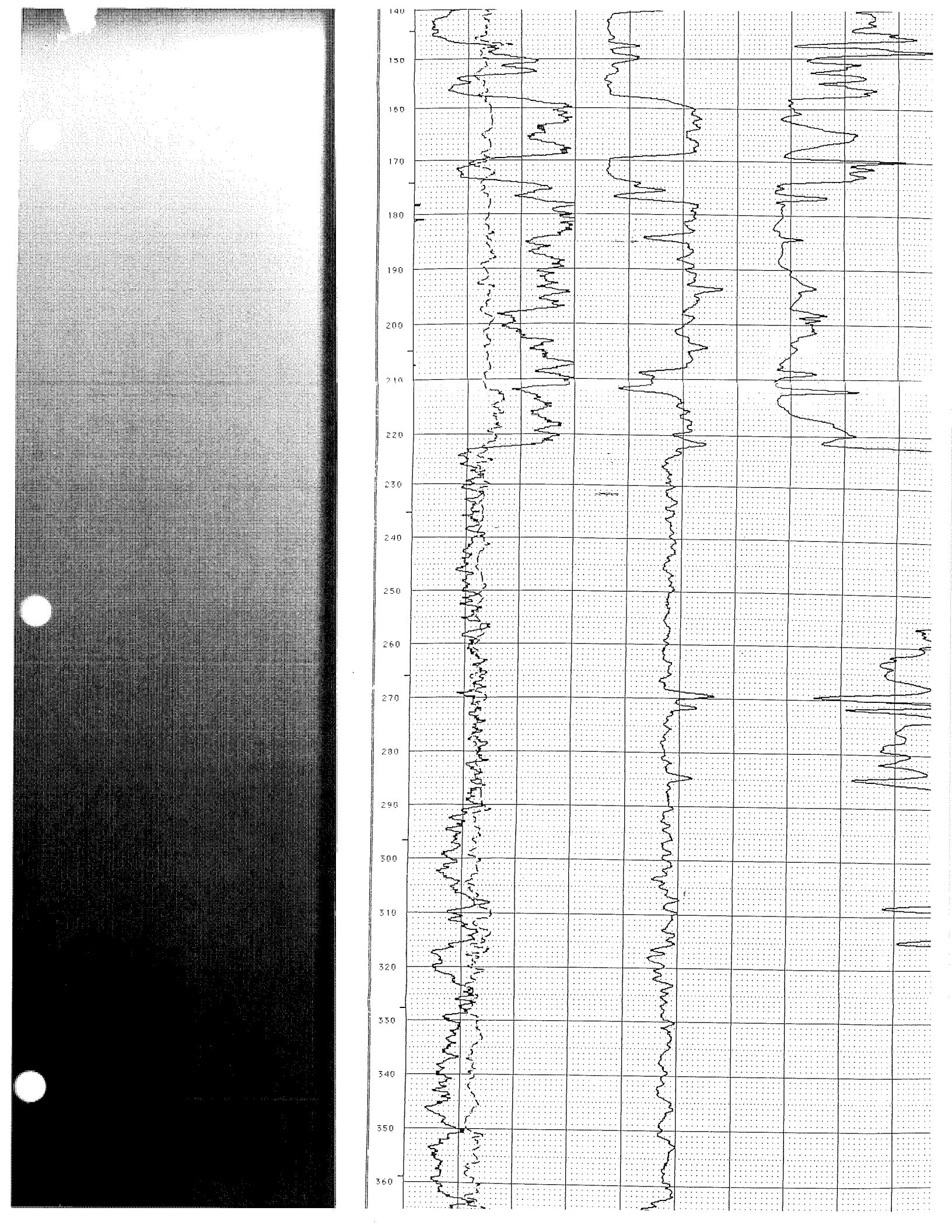
CGC **Century**

P-5

COMPANY	: ALCOA			OTHER SERVICES:	
WELL	: P-5B				
LOCATION/FIELD	: SANDOW MINE AREA E				
COUNTY	: MILIAM				
STATE	: TEXAS				
SECTION	:	TOWNSHIP	:	RANGE	:
DATE	: 05/25/91	PERMANENT DATUM	: GL	ELEVATIONS	
DEPTH DRILLER	: 440 E.J.	ELEV. PERM. DATUM	: GL	KB	:
LOG BOTTOM	: 440.80	LOG MEASURED FROM	: GL	DF	: GL
LOG TOP	: -.70	DRL MEASURED FROM	: GL	GL	: GL
CASING DRILLER	: 00	LOGGING UNIT	: 8911		
CASING TYPE	: 00	FIELD OFFICE	: TULSA,OK.		
CASING THICKNESS	: 00	RECORDED BY	: I.F.ALANIZ		
BIT SIZE	: 4.75	BOREHOLE FLUID	: H/20	FILE	: ORIGINAL
MAGNETIC DECL.	: 7.5	RM	:	TYPE	: 9030AA
MATRIX DENSITY	: 2.65	RM TEMPERATURE	:	LOG	: 8
FLUID DENSITY	: 1.0	MATRIX DELTA T	: 57	PLOT	: COAL 0
NEUTRON MATRIX	: SANDSTONE	FLUID DELTA T	: 210	THRESH	: 50000

REMARKS :
PROBE 9030A #404)(SOURCE CZ.137 .125 MI.#UL-1-239)
SURVEY METER LULDUM # 3 SR.#15719 CAL.DATE TUE.05/07/91

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380
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400
410
420
430
441
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API-GR
150
GAM(NAT)
1
G/CC
3
DENSITY
2
INCH
8
CALIPER
0
OHM-M
RES(MG)