

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION

CASE NOS. 11,996 and 12,033
(Closing of Session for Deliberation)

ORIGINAL

TRANSCRIPT OF PROCEEDINGS

BEFORE: LORI WROTENBERY, CHAIRMAN
JAMI BAILEY, COMMISSIONER
ROBERT LEE, COMMISSIONER

OIL CONSERVATION COM.
00 MAR -9 PM 2:53

February 25th, 2000

Santa Fe, New Mexico

These matters came on for hearing before the Oil Conservation Commission, LORI WROTENBERY, Chairman, on Friday, February 25th, 2000, at the New Mexico Energy, Minerals and Natural Resources Department, Conference Room of the Office of the Secretary, 2040 South Pacheco, Santa Fe, New Mexico, Steven T. Brenner, Certified Court Reporter No. 7 for the State of New Mexico.

* * *

STEVEN T. BRENNER, CCR
(505) 989-9317

I N D E X

February 25th, 2000
Commission Hearing
CASE NOS. 11,996 and 12,033
(Closing of Session for Deliberation)

PAGE

REPORTER'S CERTIFICATE

5

* * *

A P P E A R A N C E S

FOR THE COMMISSION:

LYN S. HEBERT
Deputy General Counsel
Energy, Minerals and Natural Resources Department
2040 South Pacheco
Santa Fe, New Mexico 87505

* * *

STEVEN T. BRENNER, CCR
(505) 989-9317

1 WHEREUPON, the following proceedings were had at
2 12:23 p.m.:

3 CHAIRMAN WROTENBERY: And then we have two more
4 items to discuss today.

5 One is Case 11,996, the Application of Pendragon
6 Energy Partners, Inc., and J.K. Edwards Associates, Inc.,
7 to confirm production from the appropriate common source of
8 supply, San Juan County, New Mexico.

9 The other is Case 12,033, the Application of
10 Public Service Company of New Mexico for review of Oil
11 Conservation Division Directive dated March 13th, 1998,
12 directing Applicant to perform additional remediation for
13 hydrocarbon contamination, San Juan County, New Mexico.

14 The Commission will continue its deliberations on
15 these *de novo* cases. I will entertain a motion to close
16 the meeting for that purpose.

17 COMMISSIONER BAILEY: I move that we close the
18 meeting for that purpose.

19 COMMISSIONER LEE: Second.

20 CHAIRMAN WROTENBERY: All in favor say "aye".

21 COMMISSIONER BAILEY: Aye.

22 COMMISSIONER LEE: Aye.

23 CHAIRMAN WROTENBERY: Aye.

24 Thank you very much.

25 (Off the record at 12:23 p.m.)

1 (The following proceedings had at 12:44 p.m.)

2 CHAIRMAN WROTENBERY: Okay, we're back on the
3 record, and just like the record to reflect that we went
4 into closed session in order to discuss two cases, Case
5 11,996 and Case 12,033.

6 Those are the only matters that we discussed
7 while we were in closed session.

8 And I don't believe we have any further business
9 for today; is that right?

10 In that case, I'll take a motion to adjourn the
11 meeting.

12 COMMISSIONER BAILEY: I move we adjourn.

13 COMMISSIONER LEE: Second.

14 CHAIRMAN WROTENBERY: All in favor say "aye".

15 COMMISSIONER BAILEY: Aye.

16 COMMISSIONER LEE: Aye.

17 CHAIRMAN WROTENBERY: Thank you.

18 (Thereupon, these proceedings were concluded at
19 12:45 p.m.)

20 * * *

21

22

23

24

25

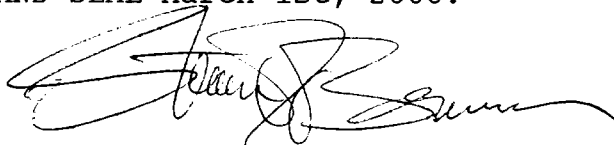
CERTIFICATE OF REPORTER

STATE OF NEW MEXICO)
) ss.
COUNTY OF SANTA FE)

I, Steven T. Brenner, Certified Court Reporter and Notary Public, HEREBY CERTIFY that the foregoing transcript of proceedings before the Oil Conservation Commission was reported by me; that I transcribed my notes; and that the foregoing is a true and accurate record of the proceedings.

I FURTHER CERTIFY that I am not a relative or employee of any of the parties or attorneys involved in this matter and that I have no personal interest in the final disposition of this matter.

WITNESS MY HAND AND SEAL March 1st, 2000.



STEVEN T. BRENNER
CCR No. 7

My commission expires: October 14, 2002

STEVEN T. BRENNER, CCR
(505) 989-9317

11/22

Judge recites history of cases

Hall:

6 efforts to enjoin proceedings
Whitey didn't file appeal - Jan., 2000 -
claiming that appeal was barred
"back door appeal"

Rule 1024, evidentiary showing
70-2-25 "appeal from OCC order"
(not exactly an appeal)

"knowingly and intentionally"
confirming order

"gamble" came mistaken in judgment
"motion to strike filed"
"collateral
attack" on OCC order -

geological findings
other findings
communication issues

consolidation: appeal + trial ^{trial? [OCC}
(not same parties) _{appeal [McE/Varh}

bellegos:

128 526 Golden Oil v. Bracer

Judge:

collateral attacks - not permissible
grant intervention - uphold ~~not~~ motions to strike
consolidation granted - ??? ~~not~~ OCCS decision

Geology / Pembagan Order:

take administrative notice of Case No. 11996

i^①: When machine reads outside into Fruitland Coal,
is it PC or Fruitland?

U:

P:

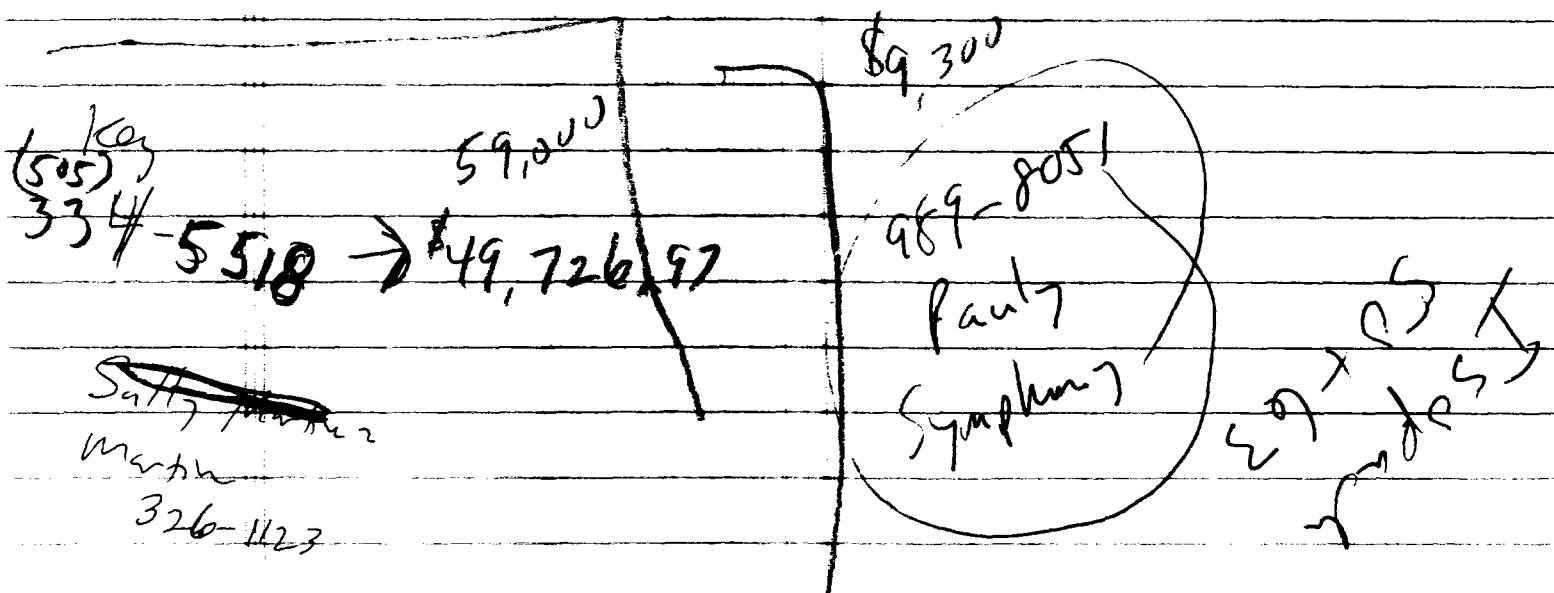
R: Industry practice, stds., establish that when
rock unit passes into another by intergrading or
interfingering... this is considered to be boundary

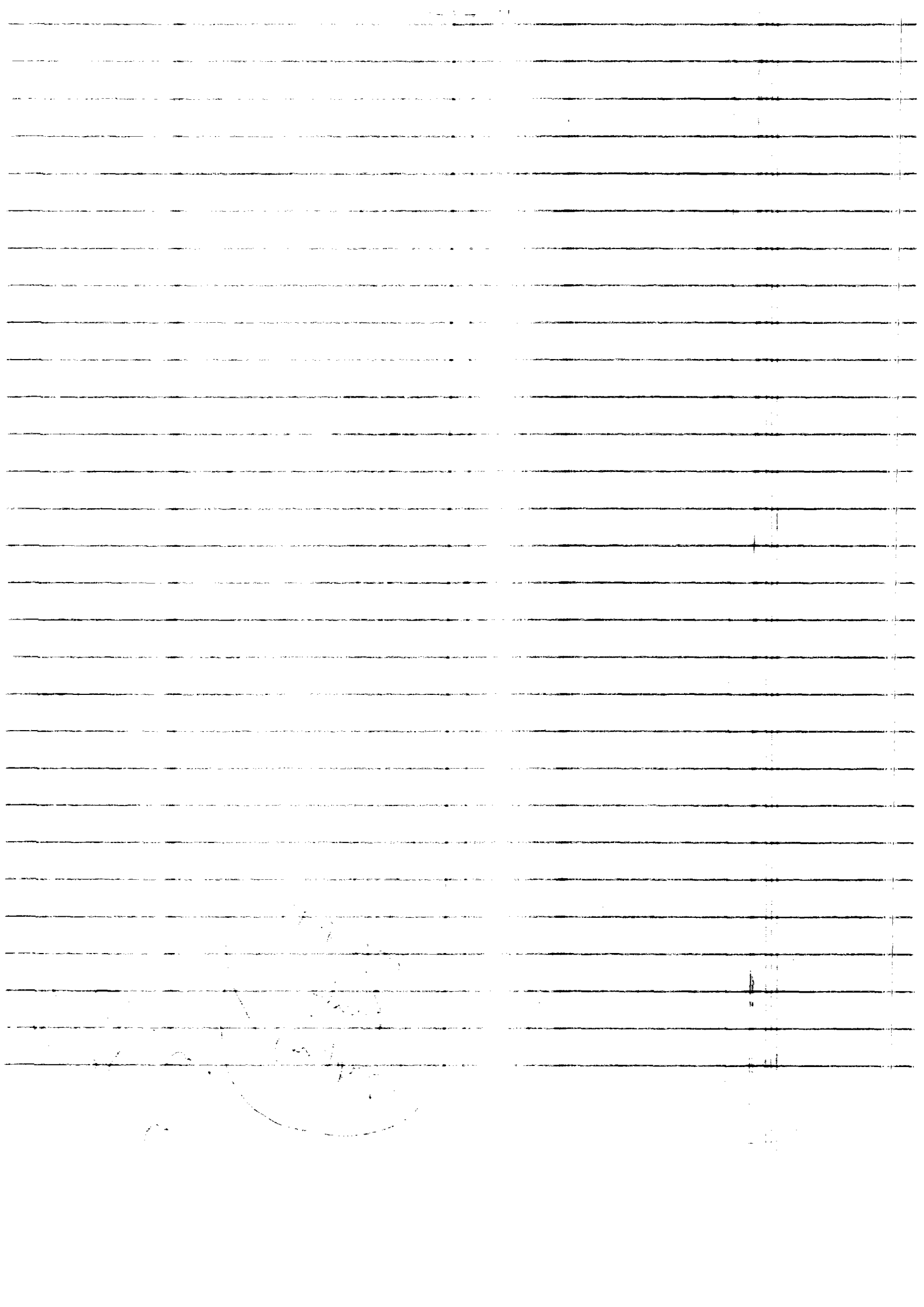
i^② pick: top of Pictured Cliffs:

① top of Upper Pictured Cliffs

② top of massive (or lower?) Pictured Cliffs

R: use method of deposition - if marine, then
Pictured Cliffs





(Petroson)
Whitehead

Agass
(Whiting)

Fruitland Coal

F

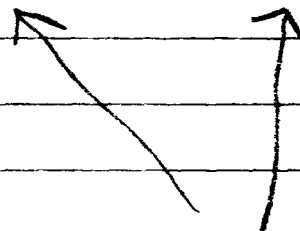
F

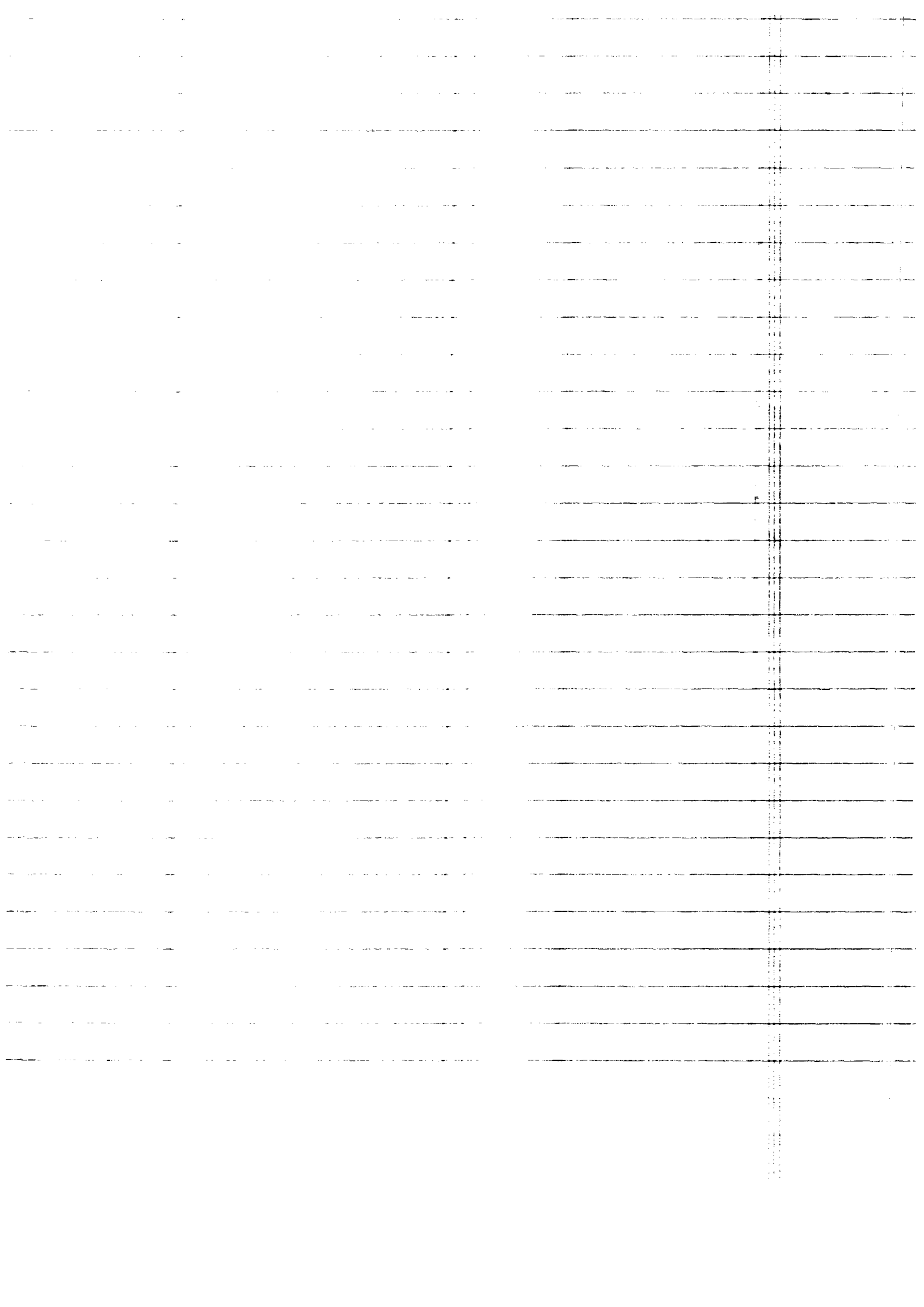
F

F

X

UPC





PENDRAGON de novo

SUBPOENAS ISSUED - LIST

2/17/99 at Pendragon's request: Halliburton Energy Services, Inc.
c/o C.T. Corp. System

B.J. Services Co., USA
c/o C.T. Corp. System

B.J. Services Co., USA
c/o f/k/a Smith Energy Services

Schlumberger Technology Corp,
f/k/a S.A. Holditch Associates, Inc.
(Bradley Robinson)

Schlumberger Technology Corp.
c/o C.T. Corp. System

2/25/99 at Pendragon's request: Maralex Resources, Inc.
c/o James R. Graves III

Maralex Resources, Inc.
C/o Michael J. Condon

Whiting Petroleum Corp.
C/o C.T.Corp. System

Whiting Petroleum Corp.
C/o Michael J. Condon

PENDRAGON - de novo

ORDERS FILE - Content

3/25/99 letter decision denying Pendragon's M for Partial Stay & W/M's Motion for Stay of Proceeding
letter decision also defers decision of W/M's M to Quash S.D.T. until after the prehearing conference

~~5/11/99~~ Scheduling Order

~~5/19/99~~ Order Allowing Reservoir Pressure Testing

PENDRAGON – *de novo*

PLEADINGS FILE - CONTENT

2/18/99 Pendragon's Application for Hearing de novo

2/23/99 Whiting/Maralex's Application for Hearing de novo as to Limited Issues

✓ ~~missing the Motion for Partial Stay of Order R-11133~~ 5/1/1999

~~3/16/99~~ W/M's Response in Opposition to Motion for Partial Stay of Order R-11133

(letter decision denying Motion dated 3/25/99)

~~4/22/99~~ Pendragon's Motion to Conduct Reservoir Pressure Tests

✓ ~~5/6/99~~ W/M's Response to Pendragon's Motion for Conduct Reservoir Pressure Tests

✓ ~~5/18/99~~ Pendragon's Reply pursuant to the Motion to Conduct Reservoir Pressure Tests

✓ ~~5/19/99~~ OCC's Order Allowing Pressure Testing)

✓ ~~6/1/99~~ W/M's Motion to Require Comprehensive & Fairly Designed Testing in
Connection w/ Reservoir Pressure Tests

✓ ~~6/3/99~~ Pendragon's Response to motion to Require Comprehensive etc.

✓ ~~6/4/99~~ Motion to Schedule Witness Presentation

✓ ~~6/4/99~~ Applicant's Witness List

✓ ~~6/7/99~~ Opponent's Witness List

✓ ~~6/10/99~~ Pendragon's Motion in Limine

✓ ~~6/17/99~~ W/M's Response in Opposition to Pendragon's Motion in Limine

✓ ~~6/28/99~~ W/M's Exhibit List for De Novo Commission Hearing

✓ ~~8/6/99~~ letter from Hall adding material: insert to be placed between pages 96 and 97 of
Nicol's testimony; addition for Exhibit N-16 raw shut-in pressure data

✓ ~~8/9/99~~ Pendragon's Objections & Motion to Strike Testimony

✓ ~~8/8/99~~ Pendragon's Prehearing Statement

✓ 8/9/99 W/M's Prehearing Statement

✓ 8/10/99 Stipulation of Fact

✓ ~~8/11/99~~ W/M's Response to Pendragon's Objections & in Opposition to Motion to Strike Testimony

✓ ~~8/11/99~~ W/M's Motion to Strike Exhibit 1 of Alan B. Nicol Testimony

✓ ~~8/11/99~~ letter from Hall w/ replacements for Exhibit N-8 & M-9

8/12/99 W/M's Revised Exhibit List for De Novo Commission Hearing

CONDUCTING A PREHEARING CONFERENCE

Judge Reana K Sloniger

I. BASIC TYPES OF PREHEARING CONFERENCES

- A. "Regular," *i.e.*, to narrow and simplify factual and legal issues to be heard and expedite the hearing
- B. Combined "regular" and "settlement," *i.e.*, to assist parties to explore settlement

II. ADDITIONAL REASONS TO HOLD PREHEARING CONFERENCES

- A. Amend pleadings
- B. Limit the number of witnesses, particularly of experts
- C. Provide opportunity to obtain admissions of fact and of documents to avoid unnecessary proof
- D. Consider preliminary motions/objections
- E. Schedule discovery and resolve discovery issues
- F. Identify burden of proof and establish order of presentation
- G. Identify novel legal issues and require prefiled legal memoranda
- H. Consider subpoena requests
- I. Consider intervention requests
- J. Consider consolidation of hearings
- K. Require use of prefiled documents

- L. Limit number of exhibits
- M. Determine length of hearing and type of facility needed
- N. Eliminate surprise at hearing
- O. Review hearing procedure
- P. Identify matters agreed upon and issues remaining in dispute
- Q. Identify any applicable sanctions for a party who fails to prepare for, appear at, or participate in a prehearing conference or to abide by ALJ orders, without good reason

III. INITIATION OF PREHEARING CONFERENCE

- A. At party's request
- B. On ALJ's own motion and order
- C. As a routine matter in practically all hearings, unless
 - 1. Waived by agreement of the parties
 - 2. Determined to be unnecessary by ALJ with reasons stated on record

IV. TIMING OF PREHEARING CONFERENCE

- A. Shortly after pleadings complete (*i.e.*, application and any response)
- B. After completion of discovery and necessary preparation

V. PARTIES' PREPARATION FOR PREHEARING CONFERENCE

(Place these points in order scheduling prehearing conference)

- A. Learn procedures used by ALJ when conducting prehearing conference
- B. Know the case

- C. Depending on timing, have completed discovery and gathered all documents, photographs, and other physical evidence; copy to other parties
- D. Interview witnesses
- E. Complete research of all reasonably anticipated legal issues
- F. Be prepared to discuss case, argue motions, and make stipulations or admissions where appropriate
- G. Have full authority to take all necessary steps and make all necessary decisions
- H. Be prepared to aid ALJ in preparing prehearing order to reflect agreements made and orders given

VI. PROCEDURE TO SCHEDULE PREHEARING CONFERENCE

- A. Send order/notice scheduling prehearing conference to all parties, stating
 - 1. Date, time, anticipated duration, and place of the conference with any necessary directions
 - 2. If by telephone, numbers and who will initiate the call
 - 3. Persons who must appear, particularly representative who will represent the party at the hearing
 - 4. Purposes for the conference
 - 5. Procedures to be followed at the conference and deadlines to be set
 - 6. Required preparation for the conference
- B. Require prefiled statements, joint or separate (and attach suggested form to be used to the order/notice), covering
 - 1. Nature of the case

2. Agreed or admitted matters
3. If applicable, inability to agree upon settlement
4. Remaining discovery procedures and reason for failure to complete them as ordered, with remaining time lines
5. Remaining motion matters
6. Unserved witnesses
7. Estimate hearing time
8. Statement of legal and factual issues and legal and factual contentions remaining in dispute
9. Warning that resulting prehearing order supersedes the pleadings and controls the hearing absent good cause

VII. TYPICAL PROCEDURE AT TIME OF PREHEARING CONFERENCE

- A. Record the conference
 1. If any *pro per/pro se* party involved
 2. If good faith conduct of any party or representative is at issue
 3. At request of a party
 4. Upon stipulation
 5. If members of the public or media are present
- B. Conduct the conference in this order
 1. Parties present prehearing statement if not prefiled
 2. Each party states substance of its case

3. ALJ attempts to find additional issues that can be resolved
4. ALJ arranges any necessary amendments to pleadings
5. ALJ considers and, if possible, disposes of law and motion matters
6. ALJ asks about exhibits to be used and attempts to secure agreements regarding authenticity and admissibility
7. ALJ asks about witnesses to be used and attempts to secure agreements regarding order and number to be called
8. ALJ sets deadlines for any remaining prehearing actions
9. If applicable, ALJ explores possibility of settlement
10. ALJ issues prehearing order incorporating results of conference, either orally for the record or in writing

VIII. POSSIBLE SANCTIONS RELATING TO PREHEARING MATTERS

- A. If appellant, place case at end of calendar
- B. If allowed by law or within discretion of ALJ
 1. If appellant, dismiss case
 2. Assess fines for contempt
 3. Refer to court for contempt
 4. Assess costs to date against representative personally
- C. If a witness is not disclosed or exhibit is not presented, preclude unless good reason

ORDER SCHEDULING PREHEARING CONFERENCE

(Form-Case Heading deleted)

A PREHEARING CONFERENCE, (as authorized by A.C.R.R. R9-1-118) (upon the Administrative Law Judge's own motion), is scheduled in this matter at (time) o'clock, M.S.T. on (date) before (name of ALJ). The conference will be held at (address); parking is available at (location).

The prehearing conference will include at least all of the following:

1. Simplification and reduction of issues, thereby amending pleadings and notices as appropriate;
2. Presentation and consideration of preliminary legal issues;
3. Stipulations to facts that are not contested by the parties;
4. Stipulations to the admission of evidence to avoid unnecessary proof;
5. Identification of documentary or other physical evidence, disposing of questions of authenticity;
6. Identification and reduction of the number of witnesses;
7. Consideration of any other matters~~x~~ which will aid in the expeditious conduct of the hearing.

Accordingly,

IT IS ORDERED, prior to the conference, through counsel or representative if any, the parties are to confer with each other and:

1. Exchange lists containing names and addresses of each witness each party expects to call at the hearing, and identify for each the issue of fact to which the testimony will be directed and the expected testimony in general;
2. Exchange lists of additional documentary (and physical) evidence each party intends to offer at the hearing; each list is to be accompanied by a

copy of documentary exhibits unless the originals, or copies thereof, are in the possession of all other parties. Such lists should not include those documents already a part of the case file;

3. Attempt to reach agreement on each factual and legal issue involved in the case;
4. Prepare for submission to the Administrative Law Judge at or before the conference a joint statement of any matters agreed upon, and joint or separate statements of factual and legal issues remaining in dispute.

IT IS FURTHER ORDERED each counsel or representative attending the prehearing conference is required to have a thorough knowledge of the case, be prepared to discuss it and to make stipulations or admissions where appropriate, and to argue any pending motions. Each counsel or representative must have full authority from the party represented and any law firm with which associated to take such action as may be necessary to comply with this Order.

IT IS FURTHER ORDERED, at the conclusion of the conference, either orally for the record or by separate writing, an Order will be entered which recites any action taken and agreements reached by parties. The Order will take the place of all that has gone before and will control the subsequent course of the hearing unless modified to prevent manifest injustice.

DATED:

(Name and title of ALJ)

*to the
order
parties
order*

PREHEARING CONFERENCES

[NOTE: Although agency procedural provisions may vary, prehearing conferences where allowed are substantially similar to pretrial conferences in techniques, strategy, and procedures.]

For your bookshelf and other aids

4 AM JUR, TRIAL, "Pretrial Conference," pg. 659

Failure of party or his attorney to appear at pretrial conference. 55 ALR3d 303

Procedure, of issues not fixed for trial in pretrial order. 11 ALRDed 786

Lubet and Schoenfield, Trial Preparation: A Systematic Approach. 1 *American Journal of Trial Advocacy* 229 (Spring 1978)

53 AM JUR, TRIAL (1st ed. §11) Rules for pretrial conference; pretrial procedure generally

DRAFT

**STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT**

BEFORE THE NEW MEXICO OIL CONSERVATION COMMISSION

IN THE MATTER OF:

**APPLICATION OF PENDRAGON ENERGY
PARTNERS, INC., PENDRAGON RESOURCES, L.P.,
And J.K. EDWARDS ASSOCIATES, INC TO CONFIRM
PRODUCTION FROM THE APPROPRIATE COMMON
SOURCE OF SUPPLY, SAN JUAN COUNTY, NEW MEXICO**

**CASE NO. 11996
ORDER NO. R-11133**

ORDER OF PARTIAL STAY

THIS MATTER, having come before the Division pursuant to the Motion For Partial Stay Of Order R-11133 filed by the Applicant, Pendragon Energy Partners, Inc., et al., and the Division, being duly advised,

FINDS THAT:

(1) Pressure and production data obtained since the examiner hearing in July, 1998, as well as decline curve analyses, clearly establish that the Gallegos Fed. 26-12-6 No. 2 and the Gallegos Fed. 26-13-12 No. 1 are draining Pictured Cliffs gas reserves.

(2) Order No. R-11133 found the existence of communication between the Basin-Fruitland Coal Gas Pool and the WAW Fruitland Sand Pictured Cliffs Gas Pool. However, Order No. R-11133 did not conclusively determine either (1) the areal extent of such communication and any resulting drainage, or (2) the cause of such communication.

(3) The provisions of Order No. R-11133 requiring the shut-in of the subject Pictured Cliffs wells, while not requiring the simultaneous shut-in of the subject Fruitland Coal wells, results in waste and gross negative consequences to the owners of the Pictured Cliffs gas reserves.

(4) The subject Fruitland Coal wells should be shut-in pending the hearing **de novo** in this matter, or as otherwise ordered by the Division or the Commission.

(5) Correlative rights are not at issue in this proceeding. Correspondingly, the finding at paragraph 51 of Order No. R-11133 is an incorrect basis for administrative action in this case and is otherwise unnecessary.

(6) The findings at paragraph 54 and 55 and decretal paragraph 3 of Order No. R-11133 suggest that further proceedings before the Division on any proposed methods of future production from the subject Pictured Cliffs wells are subject to the approval of Whiting Petroleum Corporation. To the extent these provisions of the Order do so, they should be stayed.

IT IS THEREFORE ORDERED THAT:

(1) The following Basin-Fruitland Coal Gas Pool producing wells shall be immediately shut-in:

Gallegos Federal 26-12-6 No. 2	W ½, Section 6, T26N, R12W
Gallegos Federal 26-12-7 No. 1	W ½, Section 7, T26N, R12W
Gallegos Federal 26-13-1 No. 1	E ½, Section 1, T26N, R13W
Gallegos Federal 26-13-1 No. 2	W ½, Section 1, T26N, R13W
Gallegos Federal 26-13-12 No. 1	N ½, Section 12, T26N, R13W

(2) Finding paragraph 51 of Order No. R-11133 is stayed.

(3) To the extent finding paragraphs 54 and 55, and decretal paragraph 3 of Order No. R-11133 may be construed to make the Division's acceptance of a proposed method for the continued production from the WAW Fruitland Sand-Pictured Cliffs Gas Pool producing wells subject to the approval of Whiting Petroleum Corporation, those provisions are stayed.

DONE at Santa Fe, New Mexico, on the day and year herein designated.

STATE OF NEW MEXICO
OIL CONSERVATION DIVISION

Lori Wrotenbery, Director
Oil Conservation Division, and Chairman,
Oil Conservation Commission

**STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION**

**IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION FOR THE PURPOSE OF
CONSIDERING:**

**De Novo
Case No. 11996
Order No. R-11133-A**

**APPLICATION OF PENDRAGON ENERGY PARTNERS, INC.
AND J. K. EDWARDS ASSOCIATES, INC.
TO CONFIRM PRODUCTION FROM
THE APPROPRIATE COMMON SOURCE OF SUPPLY,
SAN JUAN COUNTY, NEW MEXICO.**

ORDER OF THE COMMISSION

BY THE COMMISSION:

This case came on for hearing at 9:00 a.m. on August 12, 1999, at Santa Fe, New Mexico, before the New Mexico Oil Conservation Commission ("Commission") and continued on August 13, 19, 20 and 21, 1999.

NOW, on this ____ day of _____, 2000, the Commission, a quorum being present and having considered the record,

FINDS THAT:

- (1) Due public notice has been given and the Commission has jurisdiction of this case and its subject matter.
- (2) The applicants, Pendragon Energy Partners, Inc. and J. K. Edwards Associates, Inc. ("Pendragon"), pursuant to Rule (3) of the Special Rules and

CASE NO. 11996

Order No. R-11133-A

Page 2

Regulations for the Basin-Fruitland Coal Gas Pool set forth in Oil Conservation Division ("Division") Order No. R-8768, as amended, seek an order confirming that the following described wells, completed within the vertical limits of the WAW Fruitland Sand-Pictured Cliffs Gas Pool ("Pendragon Chaco Wells") or the Basin-Fruitland Coal Gas Pool ("Whiting Fruitland Coal Wells") are producing from the appropriate common source of supply and for such further relief as the Commission deems necessary:

Pendragon Chaco Wells

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Pendragon Energy Partners, Inc.	Chaco No. 1 (API No. 30-045-22309)	1846' FNL & 1806' FWL, Unit F, Section 18, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 2R (API No. 30-045-23691)	1850' FSL & 1850' FWL, Unit K, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 4 (API No. 30-045-22410)	790' FNL & 790' FWL, Unit D, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 5 (API No. 30-045-22411)	790' FSL & 790' FEL, Unit P, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J (API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J (API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, Section 1, T-26N, R-13W

Whiting Fruitland Coal Wells

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

(3) Whiting Petroleum Corporation and Maralex Resources, Inc. (hereinafter referred to as "Whiting") appeared at the hearing in opposition to the application. Whiting claimed that the Pendragon Chaco Wells are producing:

- a) gas from a sandstone interval located within the Fruitland formation;
and
 - b) coal gas from the Basin-Fruitland Coal Gas Pool because of the establishment of communication between the Basin-Fruitland Coal and WAW Fruitland Sand-Pictured Cliffs Gas Pools.
- (4) All eleven wells that are the subject of this application are located within an

CASE NO. 11996

Order No. R-11133-A

Page 4

area (hereinafter referred to as the "Subject Area") that comprises:

TOWNSHIP 26 NORTH, RANGE 12 WEST, NMPM

Section 6: W/2

Section 7: W/2

Section 18: NW/4

TOWNSHIP 26 NORTH, RANGE 13 WEST, NMPM,

Section 1: All

Section 12: N/2

(5) The Subject Area is located within the horizontal boundaries of the Basin-Fruitland Coal Gas Pool created by Division Order No. R-8768 dated October 17, 1988. The vertical limits of this pool, as defined by Ordering Paragraph (1) of Order No. R-8768, encompasses:

... all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2,450 feet to 2,880 feet as shown on the Gamma Ray/Bulk Density log from Amoco Production Company's Schneider Gas Com "B" Well No. 1 located 1110 feet from the South line and 1185 feet from the West line of Section 28, Township 32 North, Range 10 West, NMPM, San Juan County, New Mexico.

<(6) Order No. R-8768 also established Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool, including provisions for standard 320-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the proration unit nor closer than 130 feet from any quarter section line nor closer than 10 feet from any quarter-quarter section line or subdivision inner boundary. In addition, wells are to be located in the NE/4 or SW/4 of a single governmental section.>

(7) The Subject Area is also located within the horizontal boundaries of the WAW Fruitland Sand-Pictured Cliffs Gas Pool. The vertical limits of this pool encompass all of the Pictured Cliffs formation (Order No. R-4260 dated February 22, 1972) and all the sandstone intervals of the Fruitland formation (Order No. R-8769 dated October 17, 1988). <The WAW Fruitland Sand-Pictured Cliffs Gas Pool is currently governed by Division Rule 104.C., which requires standard 160-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the spacing unit nor closer than 130 feet from any quarter-quarter section line or subdivision inner boundary.>

(8) Pendragon and Whiting received assignments of oil and gas leases in the Subject Area from common grantors, Robert Bayless ("Bayless") and Merrion Oil and Gas Corporation ("Merrion"), during the period from 1992 through 1994.

- a) The assignments of rights, in pertinent part, to Whiting are as follows:

Operating rights from the surface of the earth to the base of the Fruitland (Coal Gas) Formation subject to the terms and provisions of that certain Farmout Agreement dated December 7, 1992 by and between Merrion Oil & Gas et al., Robert L. Bayless, Pitco Production Company, and Maralex Resources, Inc.

- b) The assignment of rights to Pendragon, in pertinent part, are as follows:

Leases and lands from the base of the Fruitland Coal formation to the base of the Pictured Cliffs formation.

- (9) A brief history of the Pendragon Chaco Wells follows:

- a) The Chaco Well No. 1 was drilled by Merrion and Bayless in February, 1977 to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,113' to 1,139'. The well initially tested in this interval at a rate of approximately 342 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, J. K. Edwards & Associates, Inc. ("Edwards") became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.

- b) The Chaco Well No. 2R was drilled by Merrion and Bayless in October, 1979 to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,132' to 1,142'. The well initially tested in this interval at a rate of approximately 150 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.

- c) The Chaco Well No. 4 was drilled by Merrion and Bayless in April, 1977 to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,163' to 1,189'. The well was initially tested in this interval at a rate of approximately 480 MCFGD, 0 BOPD, and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In May, 1995, the well was re-perforated in the interval from 1,163' to 1,189' and fracture stimulated in this interval. In January, 1996, Pendragon became operator of the well.
- d) The Chaco Well No. 5 was drilled by Merrion and Bayless in April, 1977, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,165' to 1,192'. The well initially tested in this interval at a rate of approximately 1029 MCFGD, 0 BOPD and 0 BWPD. In May, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was re-perforated in the interval from 1,165' to 1,192' and was fracture stimulated in this interval. In January, 1996, Pendragon became operator of the well.
- e) The Chaco Limited Well No. 1J was drilled by Merrion and Bayless in April, 1982 to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,200' to 1,209'. The well initially tested in this interval at a rate of approximately 10 MCFGD, 0 BOPD and a trace of water. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In

January, 1996, Pendragon became operator of the well.

- f) The Chaco Limited Well No. 2J was drilled by Merriam and Bayless in September, 1979 to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,186' to 1,202'. The well initially tested in this interval at a rate of approximately 208 MCFGD, 0 BOPD and 4 BWPD. In October, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January, 1996, Pendragon became operator of the well.

- (10) A brief history of the Whiting Fruitland Coal Wells follows:



- a) The Gallegos Federal 26-12-6 No. 2 was drilled by Maralex in December, 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,138' to 1,157'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well.
- b) The Gallegos Federal 26-12-7 No. 1 was drilled by Maralex in December, 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,131' to 1,150'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well.

Engineering Issue

(56) Whiting, the owners and operators of the Whiting Fruitland Coal Wells on the one hand, and Pendragon, the owner and operator of the Pendragon Chaco Wells on the other, each contend that the other's well stimulation treatments caused their separately owned formations to become communicated. Both parties contend that their wells are experiencing interference and that gas is being produced out of zone as a result.

(57) The Fruitland Coal formation became communicated with the Pictured Cliffs formation as a result of the fracture stimulation treatments performed on both the Pendragon Chaco Wells by Pendragon and the Whiting Fruitland Coal Wells by Whiting.

(58) The stimulation work on Whiting Fruitland Coal Wells in 1992, created communication channels near the wellbore region between the Fruitland Coal and Picture Cliffs formations. At the time, the gas in the Picture Cliffs formation was nearly depleted and very little gas could escape to the Fruitland Coal formation, unless the Whiting Fruitland Coal Wells were operated under extremely low pressures. On the other hand, the adsorbed gas in the Fruitland Coal formation stayed within the coal matrices before pressure became low enough for gas to be desorbed by the dewatering process.

(59) After the dewatering process, substantial amounts of adsorbed gas escaped from the coal matrices, especially in the near wellbore region where pressure was low. As a result, the Whiting Fruitland Coal Wells began their gas productions economically. The desorbed gas moving toward the Whiting Fruitland Coal Wells may move to the Picture Cliffs formation through the communication channels near the Whiting Fruitland Coal Wells if the local pressure in the Picture Cliffs formation is lower than that in the Fruitland Coal formation. It is possible that gas in the Picture Cliffs formation may have migrated to the Fruitland Coal formation through the communication channels if the production pressures at the Whiting Fruitland Coal Wells were low. However, these possible gas migrations were

not significant, evidenced by steady gas production from the Pendragon Chaco Wells.

(60) In 1995, after three years of the dewatering process, the gas bubble near the Whiting Fruitland Coal Wells was extended. This gas bubble is moving toward the Pendragon Chaco Wells. In addition to the gas migration near the communication channels, at the edge of the bubble, the gas pressure in the Fruitland Coal formation is believed to be higher than the adjacent pressure in the lower Picture Cliffs formation. It is possible that, at the area of this relatively high pressure contrast (gas pressure differences between adjacent Fruitland Coal and Picture Cliffs formation), the thin capillary barrier might be broken, allowing gas migration between two zones. Some unexplainable pressure readings in the Picture Cliffs formation might occur.

(61) By analyzing the post-treatment gas productions of the Pendragon Chaco Wells, it is seen that the stimulation work performed by Pendragon was successful in breaking in some high pressure gas compartments. One possibility is that the hydraulic fractures were extended upward to the Fruitland Coal formation and generated a gas highway to the gas bubble. Pendragon's experts have vigorously denied this possibility. Instead, they concluded that an additional gas compartment, the so-called "third bench" below the Picture Cliffs, was assumed to exist. This assumption is believed to be untrue, based upon the following reasons:

- (a) no "third bench" was reported throughout the San Juan region;
- (b) no geological evidence exists of this kind of formation;
- (c) no scientific reason exists to explain why the hydraulic fracture moved only downward; and
- (d) the upward-moving gases that evolved from the source rock needed geological time to recharge the Picture Cliffs formation.

Therefore, the most reasonable explanation of these sudden significant increases of the fracturing treatment was that the hydraulic fractures penetrated into the gas bubble

established in the Fruitland Coal formation.

(62) Both Pendragon and Whiting presented volumetric and material balance calculations. Although the calculation procedure is well documented in many textbooks, the procedure used in their calculations and arguments failed to adequately describe the dynamics of the continuous communications between two zones and the water movements.

(63) Many Picture Cliffs wells reported significant gas increases after fracturing. It should be noted in most cases the owners of the Picture Cliffs formation are the same as the owners of the Fruitland Coal formation. Also, spacing for a Picture Cliffs well is 160 acres while spacing for a Fruitland Coal well is 320 acres.

(64) As the original Picture Cliffs gas was relatively dry, it is hard to believe that the four Pendragon Chaco Wells suffered from the same magnitude of damage due to (a) scale precipitation, (b) water blockage and (c) migration of clay fines.

(65) Experts of hydraulic fracturing for both Pendragon and Whiting presented their own simulation results. Each result was in favor of their own theories. Many input values of key parameters are questionable. Both simulators used have good reputation in assisting in designing a fracturing job but it is easy to manipulate them incorrectly. In a case like this, their results were too exaggerated to be adopted by this Commission.

(66) In the BTU analysis, Whiting showed that gas contents of the Pendragon Chaco Wells were slightly diluted from 1988 to 1995 and were significantly reduced from 1995 to 1997. Perhaps, the two zones communicated with each other long before Pendragon's actions in 1995. It should be noted that some BTU values reported for a Picture Cliffs well in the San Juan region must be considered as values for a highly fractured Picture Cliffs well.

CASE NO. 11996
Order No. R-11133-A
Page 33

IT IS THEREFORE ORDERED:

11996 de novo. doc

**STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION**

**IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION FOR THE PURPOSE OF
CONSIDERING:**

**De Novo
Case No. 11996
Order No. R-11133-A**

**APPLICATION OF PENDRAGON ENERGY PARTNERS, INC.
AND J. K. EDWARDS ASSOCIATES, INC.
TO CONFIRM PRODUCTION FROM
THE APPROPRIATE COMMON SOURCE OF SUPPLY,
SAN JUAN COUNTY, NEW MEXICO.**

ORDER OF THE COMMISSION

BY THE COMMISSION:

This case came on for hearing at 9:00 a.m. on August 12, 1999, at Santa Fe, New Mexico, before the New Mexico Oil Conservation Commission ("Commission") and continued on August 13, 19, 20 and 21, 1999.

NOW, on this ____ day of _____, 2000, the Commission, a quorum being present and having considered the record,

FINDS THAT:

- (1) Due public notice has been given and the Commission has jurisdiction of this case and its subject matter.
- (2) The applicants, Pendragon Energy Partners, Inc. and J. K. Edwards Associates, Inc. ("Pendragon"), pursuant to Rule (3) of the Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool set forth in Oil Conservation Division ("Division") Order No. R-8768, as amended, seek an order confirming that the following described wells, completed within the vertical limits of the WAW Fruitland Sand-Pictured Cliffs Gas Pool ("Pendragon Chaco and Chaco Limited Wells") or the Basin-Fruitland Coal Gas Pool ("Whiting Fruitland Coal Wells"), are producing from the appropriate common source of supply and for such further relief as the Commission deems necessary:

Pendragon Chaco Wells

Operator

**Well Name &
API Number**

Well Location

CASE NO. 11996
Order No. R-11133-A
Page 2

Pendragon Energy Partners, Inc.	Chaco No. 1 (API No. 30-045-22309)	1846' FNL & 1806' FWL, Unit F, Section 18, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 2R (API No. 30-045-23691)	1850' FSL & 1850' FWL, Unit K, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 4 (API No. 30-045-22410)	790' FNL & 790' FWL, Unit D, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 5 (API No. 30-045-22411)	790' FSL & 790' FEL, Unit P, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J (API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J (API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, Section 1, T-26N, R-13W

Whiting Fruitland Coal Wells

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

(3) Whiting Petroleum Corporation and Maralex Resources, Inc. (hereinafter referred to as "Whiting") appeared at the hearing in opposition to the application. Whiting claimed that the Pendragon Chaco and Chaco Limited Wells are producing:

- a) gas from a sandstone interval located within the Fruitland Formation; and
- b) coal gas from the Basin-Fruitland Coal Gas Pool because of the establishment

of communication between the Basin-Fruitland Coal and WAW Fruitland Sand-Pictured Cliffs Gas Pools.

(4) All eleven wells that are the subject of this application are located within an area (hereinafter referred to as the "Subject Area") that comprises:

TOWNSHIP 26 NORTH, RANGE 12 WEST, NMPM

Section 6: W/2
Section 7: W/2
Section 18: NW/4

TOWNSHIP 26 NORTH, RANGE 13 WEST, NMPM,

Section 1: All
Section 12: N/2

(5) The Subject Area is located within the horizontal boundaries of the Basin-Fruitland Coal Gas Pool created by Division Order No. R-8768 dated October 17, 1988. The vertical limits of this pool, as defined by Ordering Paragraph (1) of Order No. R-8768, encompasses:

... all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2,450 feet to 2,880 feet as shown on the Gamma Ray/Bulk Density log from Amoco Production Company's Schneider Gas Com "B" Well No. 1 located 1110 feet from the South line and 1185 feet from the West line of Section 28, Township 32 North, Range 10 West, NMPM, San Juan County, New Mexico.

(6) The Subject Area is also located within the horizontal boundaries of the WAW Fruitland Sand-Pictured Cliffs Gas Pool. The vertical limits of this pool encompass all of the Pictured Cliffs Formation (Order No. R-4260 dated February 22, 1972) and all the sandstone intervals of the Fruitland Formation (Order No. R-8769 dated October 17, 1988).

(7) Pendragon and Whiting received assignments of oil and gas leases in the Subject Area from common grantors, Robert Bayless ("Bayless") and Merrion Oil and Gas Corporation ("Merrion"), during the period from 1992 through 1994.

a) The assignments of rights, in pertinent part, to Whiting are as follows:

Operating rights from the surface of the earth to the base of the Fruitland (Coal Gas) Formation subject to the terms and provisions of that certain Farmout Agreement dated December 7, 1992 by and between Merrion Oil & Gas et al., Robert L. Bayless, Pitco Production Company, and Maralex Resources, Inc.

at the Oil Conservation Division (hereafter referred to as "the Division")

- b) The assignment of rights to Pendragon, in pertinent part, are as follows:

Leases and lands from the base of the Fruitland Coal Formation to the base of the Pictured Cliffs Formation.

- (8) A brief history of the Pendragon Chaco Wells follows:

- a) The Chaco Well No. 1 was drilled by Merrion and Bayless in February, 1977 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,113' to 1,139'. The well initially tested in this interval at a rate of approximately 342 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, J. K. Edwards & Associates, Inc. ("Edwards") became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.
- b) The Chaco Well No. 2R was drilled by Merrion and Bayless in October, 1979 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,132' to 1,142'. The well initially tested in this interval at a rate of approximately 150 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.
- c) The Chaco Well No. 4 was drilled by Merrion and Bayless in April, 1977 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,163' to 1,189'. The well was initially tested in this interval at a rate of approximately 480 MCFGD, 0 BOPD, and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In May, 1995, the well was re-perforated in the interval from 1,163' to 1,189' and fracture stimulated in this interval. In January 1996, Pendragon became operator of the well.
- d) Merrion and Bayless drilled the Chaco Well No. 5 in April 1977, to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,165' to 1,192'. The well initially tested in this interval at a rate of approximately 1029 MCFGD, 0 BOPD and 0 BWPD. In May 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January 1995, the well was re-perforated in the interval from 1,165' to

1,192' and was fracture stimulated in this interval. In January 1996, Pendragon became operator of the well.

- e) The Chaco Limited Well No. 1J was drilled by Merriam and Bayless in April 1982 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,200' to 1,209'. The well initially tested in this interval at a rate of approximately 10 MCFGD, 0 BOPD and a trace of water. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January 1996, Pendragon became operator of the well.
- f) The Chaco Limited Well No. 2J was drilled by Merriam and Bayless in September 1979 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,186' to 1,202'. The well initially tested in this interval at a rate of approximately 208 MCFGD, 0 BOPD and 4 BWPD. In October, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January, 1996, Pendragon became operator of the well.

(9) A brief history of the Whiting Fruitland Coal Wells follows:

- a) Maralex drilled the Gallegos Federal 26-12-6 No. 2 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,138' to 1,157'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- b) Maralex drilled the Gallegos Federal 26-12-7 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,131' to 1,150'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- c) Maralex drilled the Gallegos Federal 26-13-1 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,158' to 1,177'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.

- d) Maralex drilled the Gallegos Federal 26-13-1 No. 2 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,047' to 1,208'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- e) Maralex drilled the Gallegos Federal 26-13-12 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,178' to 1,197'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.

Geologic Issues
Fruitland Sand vs. Pictured Cliffs Sand

(10) Related geologic issues are raised by the application: the proper means for determining the limits of the pools and Formations at issue, and the effect on this analysis, if any, of integration or interfingering of different rock types. ✓

(11) In its Chaco Wells No. 1, 4 and 5 and its Chaco Limited Well No. 2J, Pendragon is producing from two separate sandstone intervals, hereinafter referred to as the "Upper Sandstone" and "Lower Sandstone" intervals. In its Chaco Well No. 2R and Chaco Limited Well No. 1J, Pendragon is producing only from the "Lower Sandstone" interval. It is the position of Pendragon that the top of the Pictured Cliffs Formation occurs at or above the top of the Upper Sandstone.

(12) The perforated intervals in each of the Pendragon Chaco Wells are as follows:

<u>Well Name & Number</u>	<u>"Upper Sandstone"</u> <u>Perforations</u>	<u>"Lower Sandstone"</u> <u>Perforations</u>
Chaco Well No. 1	1,113'-1,119'	1,134'-1,139'
Chaco Well No. 4	1,163'-1,166'	1,173'-1,189'
Chaco Well No. 5	1,165'-1,169'	1,174'-1,192'
Chaco Limited Well No. 2J	1,186'-1,188'	1,200'-1,202'
Chaco Well No. 2R	None	1,132'-1,142'
Chaco Limited Well No. 1J	None	1,200'-1,209'

(13) Whiting agrees that the "Lower Sandstone" interval is within the Pictured Cliffs Formation; however, it contends that the top of the Pictured Cliffs Formation is the top of the "Lower Sandstone" interval and the Upper Sandstone is within the Fruitland Coal Formation. It is on this basis that Whiting contends that Pendragon is producing from perforations in the Fruitland Coal Formation in its Chaco Wells Nos. 1, 4 and 5 and its Chaco Limited Well No. 2J. ✓

(14) The parties have stipulated that the Pictured Cliffs Formation was deposited in a marine environment and the Fruitland Coal Formation was deposited in a non-marine or terrestrial environment.

(15) In the late Cretaceous period in what was to become the San Juan Basin, sediments were deposited contemporaneously in various environments. The Kirtland Formation accumulated in an alluvial plain, the Fruitland Formation accumulated on a coastal plain with swamps and bogs, the Pictured Cliffs Formation accumulated in primarily a barrier beach setting, while the Lewis Shale represents muds and storm-carried sands offshore of the Pictured Cliffs barrier beach trend.

(16) ~~(16)(17)~~ Pendragon's isopach map of the Upper Sandstone, Exhibits ____, shows this barrier-bar marine littoral environment with the Pictured Cliffs sandstone along the ancient shoreline trending in a northwest to a southeast direction. Pendragon's exhibits ____ also shows that the Upper Sandstone occurs in a continuous sheet that coalesces into the main body or bench of the Pictured Cliffs Formation as it trends from the shoreline environment on the southwest toward the center of the San Juan basin to the northeast.

(17) As the ~~Pictured Cliffs~~ shoreline moved to the northeast, each of the environments of deposition shifted. At a single location a well bore presents the familiar vertical sequence of Formations.

(18) In the Subject Area, tongues of Pictured Cliffs sandstone thin in a landward direction and thicken in a seaward direction and ultimately merge with the main body of the Pictured Cliffs Formation. These tongues ~~[occasionally]~~ "interfinger" or integrate with other rock types in the Subject Area, forming the Upper Sandstone and the Lower Sandstone.

As noted earlier, the Division
(20) ~~(14)~~ In its Order No. R-8768, the Oil Conservation Division defined the vertical limits of the Basin Fruitland Coal Gas Pool as all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2450 feet to 2880 feet as shown on the well log from the Amoco Schneider Gas Com "B" Well No. 1. The pick for the base of the pool in Order No. R-8768 is the top of the Pictured Cliffs Formation. The pick is also the break between marine and non-marine sediments. It is undisputed that the coal or shale layers occurring below the stratigraphic pick set forth in Order No. R-8768 would not be included in the Basin Fruitland Coal Gas Pool or in the Fruitland Coal Formation.

(21) The term "stratigraphic equivalent" is a legal term commonly used in oil and gas leases, ~~which~~ ^{and} is used to describe the formation occurring at a stated numerical depth beneath the surface in a reference well in order to ensure that a productive reservoir is not split. Thus, in the case of Order No. R-8768, the Basin Fruitland Coal Gas Pool includes the coals and rocks that are stratigraphically equivalent to the coals in the interval from approximately 2,450 to 2,880 feet

beneath the surface in the Amoco Schneider Gas Com "B" Well No. 1.

this interval is the
(23) <(15)> In its cross section C-C', Pendragon identified the stratigraphic equivalent *of* as that term is used in Order No. R-8768 and reflected on the well log for the Amoco Schneider Gas Com "B" Well No. 1 as the Upper Sandstone, the first marine sandstone below the Fruitland Coal Formation.

(22) <(48)> The interval between the top of the Upper Sandstone and the top of the main body of the Pictured Cliffs is composed of a variety of rock types including marine sandstones, silt stones, shales, and thin coals. It has been the long-standing and accepted custom and practice of industry and the various regulatory agencies, including the Oil Conservation Division in Order No. R-8768, to place this entire interval within the Pictured Cliffs Formation. This industry and regulatory agency practice conforms to the standards of the North American Stratigraphic Code and the International Stratigraphic Guide *that state*, "where a rock unit passes into another by integrating or interfingering of two or more kinds of rock...the boundary is necessarily arbitrary and should be selected on the basis of practicality.">

(24) <(39)> The evidence presented by Pendragon establishes that over the years approximately 34 wells within approximately 2.5 miles of the Pendragon Chaco Wells were actually perforated in the Upper Sandstone in conjunction with other Pictured Cliffs intervals and reported by the numerous different operators of those wells as Pictured Cliffs completions, consistent with the picks for the top of the Pictured Cliffs for the Chaco Plant No. 1 and the Pendragon Chaco Wells (Exhibit N-61). The evidence also establishes that those reported completions were accepted by the Division and the Bureau of Land Management and that industry and geologists have placed substantial reliance on those reported completions as Pictured Cliffs completions for nearly thirty years.

(25) <(42)> In a written statement provided to the Division in conjunction with its hearing in Case No. 11996, Merrion, the assignor of the interests in both the Fruitland Coal Formation to Whiting and Pictured Cliffs Formation to Pendragon, indicated it concurred with Pendragon in its identification of the Upper Sandstone interval and the historic recognition of that interval as Pictured Cliffs by Merrion and other operators in the area. (Exhibit N-43.) Merrion further stated that the Pendragon Chaco Wells are appropriately perforated in the Pictured Cliffs Formation and that it had no intention of conveying to Pendragon wells that were perforated in other zones. Merrion also stated that it never intended to farm-out to Whiting the rights to zones where the Pendragon Chaco Wells were perforated. *check was this admitted?*

(26) <(50)> Thus, the identification and utilization of the Upper Sandstone tongues to establish the vertical boundaries of the Pictured Cliffs Formation by industry, governmental regulatory agencies [and the parties or their successors-in-interest] is a long-established custom and practice. Such custom and practice is to be accorded significant weight.

(28)<(25)> Whiting asserted during the hearing of this matter that the Upper Sandstone interval was deposited in a non-marine, crevasse-splay deposit, resulting from a large, sediment-laden river breaking through its natural boundaries during a flood stage and spreading clean, well-sorted sand over an area more than sixteen-miles long and up to three-miles wide parallel to the shoreline. Whiting contended that peat-forming coals occur only at distances significantly inland of the beach and shore-face sands of the Pictured Cliffs Formation and therefore the Upper Sandstone in the Subject Area was most likely the product of non-marine sediments. However, the witness's cross-section exhibit, Exhibit WA-3, showed that coals were also formed or deposited within the Pictured Cliffs Formation.

(29)<(34)> Whiting's expert geologist testified that it was also possible that the disputed interval was deposited as a washover fan. However, the washover fan depositional mechanism involves wave-dominated action, consistent with the accepted geologic definitions of a marine depositional mechanism. Such a theory also supports a conclusion that the Upper Sandstone was deposited in a marine environment.

(30)<(27)> Pendragon presented aerial photographs of modern deposits of sands comparable in mode of deposition and areal extent to the Upper Sandstone located in the marine lagoonal areas behind barrier islands, thus demonstrating the validity of the depositional model. Pendragon demonstrated using these exhibits that these sands are wave and tidal-current dominated deposits, and further showed that the seaward beach of a barrier island is not to be confused with the true ocean shoreline which lies behind the island.

(32)<(28)> The core analysis for the Lansdale Federal No. 1 located in the SE/4 of Sec. 7, T-26-N, R-12-W establishes that grain size and sorting throughout the Upper Sandstone is uniform, consistent with a marine depositional environment. The physical descriptions of the sand appearing in the Upper Sandstone and the Lower Sandstone are grey, fine-grained with little variation in clay content, consistent with a marine sand that has been laterally transported by currents and waves to the point where the energy available sorts the sand into uniform size. Sand-sorting characteristics of this sort are not consistent with a fluvial deposit with graded bedding coarsening downward. This evidence further supports the conclusion that the upper tongue is Pictured Cliffs sandstone.

(34)<(31)> There is no evidence that the Upper Sandstone in the Subject Area is associated with any stream channels or down cutting as would be the case in a fluvial environment. Rather, the deposition of a sand with the consistency in geometry of the Upper Sandstone requires a marine setting with a flat, stable base and a source of sand with consistent grain size spread by tidal or wave energy. Such conditions do not occur behind the shoreline.

(27)<(35)> Pendragon presented evidence that the Spontaneous Potential ("SP") readings on electrical logs are much greater in the Pictured Cliffs Formation, which was deposited in a

marine setting, than in the Fruitland sands, which were deposited in a fluvial, fresh water environment. Pendragon [demonstrated] ~~<then showed>~~ that the SP readings for the Upper Sandstone were comparable or identical to those of the Lower Sandstone and were much greater than those of the Fruitland sands. Examples of this fact were found on the geological cross-section prepared by Whiting's expert geologist. See Exhibit No. ____.

(36) The SP map of the Pictured Cliffs introduced by Whiting, Exhibit WA-9, showed 40 to 80 millivolt SP development in the Chaco area. The cross-section exhibit demonstrated that the disputed interval also showed 40 to 80 millivolts SP, even though it was interpreted by Whiting's expert geologist to be Fruitland sandstone, and all other Fruitland sands on his cross-section showed only zero to less than 10 millivolts. Additional testimony established that 40 to 80 millivolts is a significantly higher range than is typically associated with SP development in a fresh-water depositional environment and is more characteristic of the SP development in the Pictured Cliffs intervals observed on the well logs and cross-sections for the Pendragon Chaco Wells. The geologic evidence also established that Pictured Cliffs sandstones have higher SP development because they are deposited in a more saline, marine environment. This evidence further supports the conclusion that the disputed interval is Pictured Cliffs sandstone that was deposited in a marine environment.

(37)~~(32)~~ [Thus,] Whiting failed to establish by a preponderance of the evidence the existence of any crevasse splay or any depositional materials indicative of a sand-laden flood. Moreover, there is no evidence of the transporting river or river channel, the thinning of sand deposits in both directions at right angles to the river, adjacent deltaic deposits or any other non-marine mechanism with the capability of forming the thin, but areally extensive, sand of the dimensions seen in the Upper Sandstone. Available core analysis data showed no characteristics consistent with fluvial depositional materials or mechanics.

(38)~~(40)(43)~~ Whiting contends that the top of the first "massive" sandstone below the lowermost coal of the Fruitland Coal Formation should be the basis for picking the top of the Pictured Cliffs Formation. Whiting presented testimony and an exhibit to support its contention that the operators of approximately one hundred additional wells outside the Subject Area had identified the top of the massive Pictured Cliffs Sandstone as the vertical boundary between the Pictured Cliffs and Fruitland Coal Formations. However, Whiting failed to present any additional evidence establishing whether the Upper Sandstone interval was present in any of the wells identified. Similarly, Whiting failed to show that any operator identified the top of the Pictured Cliffs sandstone as the massive sand in those areas where tongues of the Pictured Cliffs are known to exist. The geologic testimony and evidence shows that such a definition has little support in the geologic literature and that the arbitrary and undefined term "massive" makes its application impractical. ~~<The geologic literature for the area and industry practice indicates that~~ [It appears that] it is more common to place the contact between the Fruitland and Pictured Cliffs Formations at the top of the highest ophiomorpha-major bearing sandstone. Consequently, the more widely accepted technical definition of Pictured Cliffs sandstone concerns whether the

Formation is of marine deposition.

(41)<(53)> The preponderance of the geologic evidence establishes that the Pendragon Chaco and Chaco Limited Wells are producing from a zone that is stratigraphically equivalent to an interval below the base of the Basin Fruitland Coal Gas Pool.

(42) The preponderance of the geologic evidence establishes that the Pendragon Chaco Wells are completed in the Pictured Cliffs Formation sandstone intervals.

Engineering Issue

(44)<(56)> Whiting, the owners and operators of the Whiting Fruitland Coal Wells, and Pendragon, the owner and operator of the Pendragon Chaco Wells and Chaco Limited Wells, each contend that the other's well stimulation treatments established communication between their separately owned formations. Both parties contend that, as a result, their wells are experiencing interference and that gas is being produced out of zone. ✓

(45)<(57)> The production history of the Pendragon Chaco and Chaco Limited Wells is summarized as follows:

<u>Well No.</u>	<u>Initial Production</u> <u>(Original Completion)</u>	<u>Pre-Acidization or</u> <u>Fracture Stimulation</u> <u>Production</u>	<u>Post-Acidization or</u> <u>Fracture Stimulation</u> <u>Production</u>	<u>Current</u> <u>Production</u>
Chaco No. 1	80 MCF/D	0 MCF/D	250 MCF/D	165 MCF/D
Chaco No. 2R	70 MCF/D	0-15 MCF/D	90 MCF/D	120 MCF/D
Chaco No. 4	200 MCF/D	0 MCF/D	425 MCF/D	200 MCF/D
Chaco No. 5	190 MCF/D	0 MCF/D	370 MCF/D	210 MCF/D
Chaco Ltd. 1J	11 MCF/D	0-10 MCF/D	0-10 MCF/D	0-10 MCF/D
Chaco Ltd. 2J	30 MCF/D	0-10 MCF/D	0-10 MCF/D	0-10 MCF/D

(46)<(58)> The production history of the Whiting Fruitland Coal Wells is summarized as follows:

<u>Well No.</u>	<u>Date of Initial</u> <u>Production</u>	<u>Initial Production</u> <u>Rate</u>	<u>Current Production</u> <u>Rate</u>
26-12-6 No. 2	12/93	85 MCF/D	733 MCF/D
26-12-7 No. 1	12/93	124 MCF/D	700 MCF/D
26-13-1 No. 1	12/93	26 MCF/D	383 MCF/D
26-13-1 No. 2	7/93	51 MCF/D	150 MCF/D
26-13-12 No. 1	1/94	195 MCF/D	350 MCF/D

(47)<(59)> The fracture stimulation treatments performed on both the Pendragon Chaco Wells by Pendragon and the Whiting Fruitland Coal Wells by Whiting established

communication between the Fruitland Coal Formation and the Pictured Cliffs Formation.

(48)<(60)> The stimulation work on Whiting Fruitland Coal Wells in 1992 created near-wellbore communication channels between the Fruitland Coal and Pictured Cliffs Formations. At the time, the gas in the Pictured Cliffs Formation was nearly depleted and very little gas could escape to the Fruitland Coal Formation, unless the Whiting Fruitland Coal Wells were operated under extremely low pressures. On the other hand, the adsorbed gas in the Fruitland Coal Formation stayed within the coal matrices before [until?] the pressure was lowered enough through the dewatering process for the gas to be desorbed.

(49)<(61)> After the dewatering process, substantial amounts of adsorbed gas escaped from the coal matrices, especially in the near-wellbore region where pressure was low. As a result, the Whiting Fruitland Coal Wells began their commercial gas production. The desorbed gas moving toward the Whiting Fruitland Coal Wells may have migrated to the Pictured Cliffs Formation through the communication channels near the Whiting Fruitland Coal Wells if the local pressure in the Pictured Cliffs Formation was lower than that in the Fruitland Coal Formation. Gas in the Pictured Cliffs Formation may have migrated to the Fruitland Coal Formation through the communication channels if the production pressures at the Whiting Fruitland Coal Wells were low. However, these possible gas migrations were not significant, as evidenced by steady gas production from the Pendragon Chaco Wells.

(50)<(62)> In 1995, after three years of the dewatering process, the gas [near the Whiting Fruitland Gas Wells exhibited its usual pressure increase as a result of the dewatering and, with the increase of pressure, moved] <bubble [EXPLAIN THIS TERM]> near the Whiting Fruitland Coal Wells was growing toward the Pendragon Chaco Wells. At the edge of the [resulting gas] bubble, the gas pressure in the Fruitland Coal Formation was probably higher than the adjacent pressure in the Lower Sandstone. In the area of this relatively high pressure contrast, it is possible [it appears?] that the thin capillary barrier was broken, allowing gas migration between the two zones that might explain some [which explains the?] unusual pressure readings in the Pictured Cliffs Formation.

(51)<(63)> Pendragon performed fracture stimulation treatments on the Pendragon Chaco Wells in 1995. The post-treatment gas production from the Pendragon Chaco Wells indicates that the stimulation work performed by Pendragon successfully broke into some high-pressure gas compartments.

(52)<(64)> One possibility is that the hydraulic fractures were extended upward to the Fruitland Coal Formation and generated a gas highway to the gas bubble. Pendragon's experts vigorously denied this possibility. Instead, they asserted that an additional gas compartment, the so-called "third bench," exists below the perforations in the Pendragon Chaco Wells. The evidence does not support this assertion. No "third bench" has been reported previously throughout the San Juan region, and there is no geological evidence of this kind of Formation.

Furthermore, there is no scientific basis for believing that fractures moved downward into the "third Bench" but not upward into the Fruitland Coal Formation. Therefore, the most reasonable explanation of the sudden significant increases in production following the fracture stimulation treatments was that the hydraulic fractures penetrated into the gas bubble established in the Fruitland Coal Formation.

(53)<(65)> Pendragon also asserted that the fracture stimulation treatments increased production in the Pendragon Chaco Wells by counteracting the effects of reservoir damage caused by (a) scale precipitation, (b) water blockage, and (c) migration of clay fines. As the original Pictured Cliffs gas was relatively dry, however, it is unlikely that the Pendragon Chaco Wells suffered from significant reservoir damage of this type.

(54)<(66)> The BTU analysis of the gas from the Pendragon Chaco Wells supports the conclusion that the fracture stimulation treatments of these wells in 1995 established communication with the Fruitland Coal Formation. Whiting showed that hydrocarbon liquids content of the gas from the Pendragon Chaco Wells was slightly reduced from 1988 to 1995 and was significantly reduced from 1995 to 1997.

(55)<(67)> Both Pendragon and Whiting presented volumetric and material balance calculations. Although the calculation procedure is well documented in many textbooks, the procedure used in their calculations and arguments failed to adequately describe the dynamics of the continuous communications between the two zones and the water movements.

(56)<(68)> Expert witnesses for both Pendragon and Whiting presented their own opinions on the effects of the fracture stimulation treatments in the Whiting Fruitland Coal Wells and the Pendragon Chaco Wells based on their own theories and models. Many input values for key parameters were questionable. Both simulators <used> have a good reputation for assisting in the design of fracturing jobs, but it is easy to manipulate them incorrectly. In a case like this, their results are too exaggerated to be reliable.

(57)<(69)> The acid stimulation treatments performed by Pendragon on the Chaco Limited Wells No. 1J and 2J in 1995 did not alter these wells' rates of production. These treatments did not establish communication between the Pictured Cliffs Formation and the Fruitland Coal Formation.

(58)<(70)> The gas now capable of production from the Pendragon Chaco Wells No. 1, 2R, 4, and 5 is: (1) gas originally in place in the Pictured Cliffs Formation; (2) gas from the Fruitland Coal Formation that has migrated to the Pictured Cliffs Formation through fractures around the Pendragon Chaco Wells; and (3) gas produced from the Fruitland Coal Formation through fractures around the Whiting Fruitland Coal Wells.

(59)<(71)> The Pendragon Chaco Wells depleted the Pictured Cliffs Formation prior to

the fracture stimulation treatments performed on the wells in 1995.

(60)<(72)> Pendragon Chaco Wells No. 1, 2R, 4, and 5 have already produced their fair share of the gas in the Pictured Cliffs Formation.

IT IS THEREFORE ORDERED THAT:

(1) Pursuant to the application of Pendragon Energy Partners, Inc., and J. K. Edwards Associates, Inc., it is determined that the following described wells are perforated within the Pictured Cliffs Formation, WAW Fruitland Sand-Pictured Cliffs Gas Pool. It is further determined that the following described wells are [also?] producing from the WAW Fruitland Sand-Pictured Cliffs Gas Pool and the Basin-Fruitland Coal Gas Pool, San Juan County, New Mexico:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Pendragon Energy Partners, Inc.	Chaco No. 1 (API No. 30-045-22309)	1846' FNL & 1806' FWL, Unit F, Section 18, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 2R (API No. 30-045-23691)	1850' FSL & 1850' FWL, Unit K, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 4 (API No. 30-045-22410)	790' FNL & 790' FWL, Unit D, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 5 (API No. 30-045-22411)	790' FSL & 790' FEL, Unit P, Section 1, T-26N, R-13W

(2) It is further determined that the following described wells are perforated within and producing solely from the Pictured Cliffs Formation, WAW Fruitland Sand-Pictured Cliffs Gas Pool:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J (API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J (API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, Section 1, T-26N, R-13W

(3) It is further determined that the following described wells are producing from the Basin-Fruitland Coal Gas Pool and the WAW Fruitland Sand-Pictured Cliffs Gas Pool:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

(4) Pendragon is hereby ordered to shut-in its Chaco Wells No. 1, 2R, 4 and 5 until such time as the Division approves a method for either putting them back into production or plugging them.

(5) Inasmuch as Whiting's wells are producing from the already depleted WAW Fruitland Sand-Pictured Cliffs Gas Pool as well as the Basin-Fruitland Coal Gas Pool, Whiting's wells are not to be shut-in.

(6) Jurisdiction is hereby retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION

JAMI BAILEY, Member

ROBERT LEE, Member

CASE NO. 11996
Order No. R-11133-A
Page 16

LORI WROTENBERY, Chairman

S E A L

CASE NO. 11996

Order No. R-11133-A

Page 17

<(6) Order No. R-8768 also established Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool, including provisions for standard 320-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the proration unit nor closer than 130 feet from any quarter section line nor closer than 10 feet from any quarter-quarter section line or subdivision inner boundary. In addition, wells are to be located in the NE/4 or SW/4 of a single governmental section.>

<(7/end>The WAW Fruitland Sand-Pictured Cliffs Gas Pool is currently governed by Division Rule 104.C., which requires standard 160-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the spacing unit nor closer than 130 feet from any quarter-quarter section line or subdivision inner boundary.>

<delete><(19) In the Subject Area, the Upper Sandstone appears as a classic shoreline or Chenier-type sand grading from 0 to approximately 13 feet toward the northeast where it coalesces into the main body of the Pictured Cliffs Formation and where the thin underlying shale stringers are not present. The Upper Sandstone in the Subject Area cannot be differentiated from the main body of the Pictured Cliffs Formation.>

<delete><(21)The geologic testimony and literature establishes that the pick for the top of the Pictured Cliffs Formation is often at the base of the basal Fruitland Coal, but the Fruitland Formation is the non-marine facies tract consisting of inter-bedded sandstone, mudstone, and coal beds deposited landward of the marine facies tract of the Pictured Cliffs Formation.>

<delete><(18) The geologic evidence presented by Pendragon also establishes that the Fruitland sands were deposited in channels trending from the southwest to the northeast and that the sands thin toward the northeast.>

delete><(20) The preponderance of the evidence, including the geologic literature and cross-sections, shows that the marine Pictured Cliffs sandstone abruptly wedges out and is replaced by chrono-stratigraphically correlative coals. In Exhibit W-9, the wedge out of the Pictured Cliffs sandstone and its replacement with Coal B occurs across an interval of less than 1.4 miles. In Exhibit W-10, the wedge-out <of the Pictured Cliffs sandstone and replacement by Fruitland Formation inter-bedded coals and non-coals> occurs across an interval of less than 0.88 mile. Thus, the marine Pictured Cliffs sandstone and thick basal Fruitland Coals occur in close proximity to each other.>

< < delete><(22) The evidence established that directly beneath the Basin Fruitland Coal throughout this portion of the San Juan Basin is a shale, or "underclay," deposited directly upon the Pictured Cliffs sandstone. The underclay is continuous over a large area, thinning to the northeast and is usually highly conductive on electrical logs. It appears in a uniform deposit on a marine platform and is not cut by channels or downward coarsening sands. There is no sand body

or separately identifiable shale in the several hundred feet above the base of the basal Fruitland Coal that demonstrates anything near the areal extent or uniformity of this underclay shale. It is correspondingly different from Fruitland deposits. The Pictured Cliffs section immediately below the underclay thickens towards the northeast, indicative of a time of subsidence, which caused the deposition of the Upper Sandstone interval. Conversely, a non-marine sand-shale-sand sequence can be expected to thin out to the northeast and should trend from the northeast to the southwest instead of the northwest to the southeast. >

<delete><(23) Whiting's expert geologist defined a "marine" environment as that which is influenced by the sea and the action of the sea. While the witness acknowledged that lagoons are under a marine influence, he excluded lagoonal environments from the definition of "marine" environments.>

<delete><(24) Lagoons may be described as "...of, belonging to, or caused by the sea" in conformity with the definition of "marine" as set forth in the AGI Dictionary of Geological Terms.>

Formation and wells in the Subject Area in 1994, he did not check the perforated intervals or otherwise question the identification of the top of the Formation at the Upper Pictured Cliffs sandstone.>

<delete><(37) In a number of instances, Whiting's expert geologist misidentified shales as sandstones on his cross-section exhibit or otherwise failed to distinguish between the two types of rock where they occur adjacent to one another. As a consequence, the witness similarly failed to distinguish between the two in his discussion of core sample and well log response characteristics.>

<delete><(41) Whiting's president testified that when he evaluated the Pictured Cliffs

<delete><(49) The boundary between the Fruitland Formation and the Pictured Cliffs sandstone has been placed by industry and accepted by regulatory agencies to be at the top of the "upper Pictured Cliffs sand" as that interval has been referred to in these proceedings. The "upper Pictured Cliffs sand" is marine and as such, conforms to the Fassett and Hinds (1971) definition of the top of the Pictured Cliffs as marked by the highest marine sandstone. The boundary placed by industry also meets the test of practicality, and as such, fully conforms to the dictates of the North American Stratigraphic Code and the International Stratigraphic Guide.><redundant>

<delete><(51) The vertical boundary between the Fruitland Formation and Upper Pictured Cliffs sandstone in the Subject Area conforms to the base of the "Fruitland (coal gas) Formation" in the assignment from Bayless and Merrion to Whiting and with the base of the "Fruitland Coal Formation" in the assignment from Bayless and Merrion to Pendragon. This Formational boundary also conforms to accepted industry and regulatory interpretation. It conforms to the intentions of the parties: Whiting to produce from the "Coal Gas Formation"; and of Merrion to sell Pictured

CASE NO. 11996

Order No. R-11133-A

Page 19

Cliffs producing wells.><redundant>

<delete><(52) In defining the vertical limits of the basin Fruitland Coal gas pool, the Division's Order No. R-8768 utilizes the phrase "all coal seams within the equivalent of the stratigraphic interval" to the rock occurring at a specified depth in the well log for the Amoco Production Company Snyder Gas Com B well No. 1. The term "equivalent" means that one can determine at geographically separated stations that the rocks in question are the same. Accordingly, the use of the phrase "stratigraphic equivalent" means "lithostratigraphic" equivalent. From the definition in Order No. R-8768, the vertical limits of the basin-Fruitland Coal gas pool are the coals in rocks which are lithostratigraphically equivalent with the Fruitland Formation. In the Subject Area, rocks downward from the top of the "upper Pictured Cliffs sand" mapped by Pendragon are part of the Pictured Cliffs sandstone and are not a lithostratigraphic equivalent to the Fruitland Formation. Accordingly, the interval in question is not part of the Basin Fruitland Coal gas pool or the WAW Fruitland sand.><redundant>

Sheet
of
shps.

STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION

IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION FOR THE PURPOSE OF
CONSIDERING:

De Novo
Case No. 11996
Order No. R-11133-A

APPLICATION OF PENDRAGON ENERGY PARTNERS, INC.
AND J. K. EDWARDS ASSOCIATES, INC.
TO CONFIRM PRODUCTION FROM
THE APPROPRIATE COMMON SOURCE OF SUPPLY,
SAN JUAN COUNTY, NEW MEXICO.

ORDER OF THE COMMISSION

BY THE COMMISSION:

This case came on for hearing at 9:00 a.m. on August 12, 1999, at Santa Fe, New Mexico, before the New Mexico Oil Conservation Commission ("Commission") and continued on August 13, 19, 20 and 21, 1999.

NOW, on this ____ day of _____, 2000, the Commission, a quorum being present and having considered the record,

FINDS THAT:

- (1) Due public notice has been given and the Commission has jurisdiction of this case and its subject matter.
- (2) The applicants, Pendragon Energy Partners, Inc. and J. K. Edwards Associates, Inc. ("Pendragon"), pursuant to Rule (3) of the Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool set forth in Oil Conservation Division ("Division") Order No. R-8768, as amended, seek an order confirming that the following described wells, completed within the vertical limits of the WAW Fruitland Sand-Pictured Cliffs Gas Pool ("Pendragon Chaco and Chaco Limited Wells") or the Basin-Fruitland Coal Gas Pool ("Whiting Fruitland Coal Wells"), are producing from the appropriate common source of supply and for such further relief as the Commission deems necessary:

Pendragon Chaco Wells

Operator

**Well Name &
API Number**

Well Location

hereinafter
referred to
as

hereinafter
referred
to as "the

Pendragon Energy Partners, Inc.	Chaco No. 1 (API No. 30-045-22309)	1846' FNL & 1806' FWL, Unit F, Section 18, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 2R (API No. 30-045-23691)	1850' FSL & 1850' FWL, Unit K, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 4 (API No. 30-045-22410)	790' FNL & 790' FWL, Unit D, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 5 (API No. 30-045-22411)	790' FSL & 790' FEL, Unit P, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J (API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J (API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, Section 1, T-26N, R-13W

Whiting Fruitland Coal Wells

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

(3) Whiting Petroleum Corporation and Maralex Resources, Inc. (hereinafter referred to as "Whiting") appeared at the hearing in opposition to the application. Whiting claimed that the Pendragon Chaco and Chaco Limited Wells are producing:

- a) gas from a sandstone interval located within the Fruitland Formation; and
- b) coal gas from the Basin-Fruitland Coal Gas Pool because of the establishment

Coal 7.

of communication between the Basin-Fruitland Coal and WAW Fruitland Sand-Pictured Cliffs Gas Pools.

(4) All eleven wells that are the subject of this application are located within an area (hereinafter referred to as the "Subject Area") that comprises:

TOWNSHIP 26 NORTH, RANGE 12 WEST, NMPM

Section 6: W/2
Section 7: W/2
Section 18: NW/4

TOWNSHIP 26 NORTH, RANGE 13 WEST, NMPM,

Section 1: All
Section 12: N/2

(5) The Subject Area is located within the horizontal boundaries of the Basin-Fruitland Coal Gas Pool created by Division Order No. R-8768 ~~of the Oil Conservation Division (hereinafter referred to as "the Division")~~ dated October 17, 1988. The vertical limits of this pool, as defined by Ordering Paragraph (1) of Order No. R-8768, encompasses:

... all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2,450 feet to 2,880 feet as shown on the Gamma Ray/Bulk Density log from Amoco Production Company's Schneider Gas Com "B" Well No. 1 located 1110 feet from the South line and 1185 feet from the West line of Section 28, Township 32 North, Range 10 West, NMPM, San Juan County, New Mexico.

(6) The Subject Area is also located within the horizontal boundaries of the WAW Fruitland Sand-Pictured Cliffs Gas Pool. The vertical limits of this pool encompass all of the Pictured Cliffs Formation (Order No. R-4260 dated February 22, 1972) and all the sandstone intervals of the Fruitland Formation (Order No. R-8769 dated October 17, 1988).

(7) Pendragon and Whiting received assignments of oil and gas leases in the Subject Area from common grantors, Robert Bayless ("Bayless") and Merrion Oil and Gas Corporation ("Merrion"), during the period from 1992 through 1994.

a) The assignments of rights, in pertinent part, to Whiting are as follows:

Operating rights from the surface of the earth to the base of the Fruitland (Coal Gas) Formation subject to the terms and provisions of that certain Farmout Agreement dated December 7, 1992 by and between Merrion Oil & Gas et al., Robert L. Bayless, Pitco Production Company, and Maralex

Resources, Inc.

- b) The assignment of rights to Pendragon, in pertinent part, are as follows:

Leases and lands from the base of the Fruitland Coal Formation to the base of the Pictured Cliffs Formation.

- (8) A brief history of the Pendragon Chaco Wells follows:

- a) The Chaco Well No. 1 was drilled by Merrion and Bayless in February 1977 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,113' to 1,139'. The well initially tested in this interval at a rate of approximately 342 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, J. K. Edwards & Associates, Inc. ("Edwards") became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.
- b) The Chaco Well No. 2R was drilled by Merrion and Bayless in October 1979 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,132' to 1,142'. The well initially tested in this interval at a rate of approximately 150 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.
- c) The Chaco Well No. 4 was drilled by Merrion and Bayless in April 1977 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,163' to 1,189'. The well was initially tested in this interval at a rate of approximately 480 MCFGD, 0 BOPD, and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In May, 1995, the well was re-perforated in the interval from 1,163' to 1,189' and fracture stimulated in this interval. In January 1996, Pendragon became operator of the well.
- d) Merrion and Bayless drilled the Chaco Well No. 5 in April 1977 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,165' to 1,192'. The well initially tested in this interval at a rate of approximately 1029 MCFGD, 0 BOPD and 0 BWPD. In May 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In

January 1995, the well was re-perforated in the interval from 1,165' to 1,192' and was fracture stimulated in this interval. In January 1996, Pendragon became operator of the well.

- e) The Chaco Limited Well No. 1J was drilled by Merrion and Bayless in April 1982 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,200' to 1,209'. The well initially tested in this interval at a rate of approximately 10 MCFGD, 0 BOPD and a trace of water. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January 1996, Pendragon became operator of the well.
- f) The Chaco Limited Well No. 2J was drilled by Merrion and Bayless in September 1979 to test the Pictured Cliffs Formation. The well was perforated and completed in the Pictured Cliffs Formation from a depth of 1,186' to 1,202'. The well initially tested in this interval at a rate of approximately 208 MCFGD, 0 BOPD and 4 BWPD. In October, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January, 1996, Pendragon became operator of the well.

(9) A brief history of the Whiting Fruitland Coal Wells follows:

- a) Maralex drilled the Gallegos Federal 26-12-6 No. 2 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal ^{Formation} from a depth of 1,138' to 1,157'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- b) Maralex drilled the Gallegos Federal 26-12-7 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal ^{Formation} from a depth of 1,131' to 1,150'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- c) Maralex drilled the Gallegos Federal 26-13-1 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal ^{Formation} from a depth of 1,158' to 1,177'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.

- d) Maralex drilled the Gallegos Federal 26-13-1 No. 2 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal ^{Formation} from a depth of 1,047' to 1,208'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.
- e) Maralex drilled the Gallegos Federal 26-13-12 No. 1 in December 1992 to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal ^{Formation} from a depth of 1,178' to 1,197'. The well was subsequently fracture stimulated in this interval. In September 1995, Whiting became operator of the well.

Geologic Issues
Fruitland Sand vs. Pictured Cliffs Sand

(10) Related geologic issues are raised by the application: the proper means for determining the limits of the pools and formations at issue, and the effect on this analysis, if any, of integration or interfingering of different rock types.

(11) In its Chaco Wells No. 1, 4 and 5 and its Chaco Limited Well No. 2J, Pendragon is producing from two separate sandstone intervals, hereinafter referred to as the "Upper Sandstone" and "Lower Sandstone" intervals. In its Chaco Well No. 2R and Chaco Limited Well No. 1J, Pendragon is producing only from the "Lower Sandstone" interval. It is the position of Pendragon that the top of the Pictured Cliffs Formation occurs at or above the top of the "Upper Sandstone."

(12) The perforated intervals in each of the Pendragon Chaco Wells are as follows:

<u>Well Name & Number</u>	<u>"Upper Sandstone" Perforations</u>	<u>"Lower Sandstone" Perforations</u>
Chaco Well No. 1	1,113'-1,119'	1,134'-1,139'
Chaco Well No. 4	1,163'-1,166'	1,173'-1,189'
Chaco Well No. 5	1,165'-1,169'	1,174'-1,192'
Chaco Limited Well No. 2J	1,186'-1,188'	1,200'-1,202'
Chaco Well No. 2R	None	1,132'-1,142'
Chaco Limited Well No. 1J	None	1,200'-1,209'

??
 search
 and
 place?

(13) Whiting agrees that the "Lower Sandstone" interval is within the Pictured Cliffs Formation; however, it contends that the top of the Pictured Cliffs Formation is the top of the "Lower Sandstone" interval and the "Upper Sandstone" is within the Fruitland Coal Formation. It is on this basis that Whiting contends that Pendragon is producing from perforations in the

??

Fruitland Coal Formation in its Chaco Wells Nos. 1, 4 and 5 and its Chaco Limited Well No. 2J.

(14) The parties have stipulated that the Pictured Cliffs Formation was deposited in a marine environment and the Fruitland Coal Formation was deposited in a non-marine or terrestrial environment.

(15) < (21) >

16 (15) For the reasons set forth below, we find that the preponderance of the geologic evidence establishes that the Pendragon Chaco and Chaco Limited Wells are completed in the Pictured Cliffs Formation ~~and producing from the appropriate common source of supply.~~

17 (16) The preponderance of the geologic evidence also establishes that the ~~Lower and Upper Sandstone is~~ ^{is a} marine ~~deposit~~ ^{in the} and thus appropriately considered a part of the Pictured Cliffs Formation. ~~In the Subject Area, the Upper Sandstone appears as a classic marine shoreline sand grading from 0 to approximately 13 feet toward the northeast where it coalesces into the main body of the Pictured Cliffs Formation. The Upper Sandstone in the Subject Area cannot be differentiated from the main body of the Pictured Cliffs Formation.~~

18 (17) In the late Cretaceous period in what was to become the San Juan Basin, sediments were deposited contemporaneously in various environments. The Kirtland Formation accumulated in an alluvial plain, the Fruitland Formation accumulated on a coastal plain with swamps and bogs, the Pictured Cliffs Formation accumulated in primarily a barrier beach setting, while the Lewis Shale represents muds and storm-carried sands offshore of the Pictured Cliffs barrier beach trend.

19 (18) Pendragon's isopach map of the Upper Sandstone, Exhibits ____, shows this barrier-bar marine littoral environment with sandstone along the ancient shoreline trending in a northwest to a southeast direction. Pendragon's Exhibits ____ also show that the Upper Sandstone occurs in a continuous sheet that coalesces into the main body ~~of the~~ of the Pictured Cliffs Formation as it trends from the shoreline environment on the southwest toward the center of the San Juan basin to the northeast.

20 (19) As the ancient shoreline moved to the northeast, each of the environments of deposition shifted. At a single location a well bore presents the familiar vertical sequence of Formations.

(20) In the Subject Area, tongues of Pictured Cliffs sandstone thin in a landward direction and thicken in a seaward direction and ultimately merge with the main body of the Pictured Cliffs Formation. These tongues "interfinger" or integrate with other rock types in the Subject Area, ~~forming the Upper Sandstone and the Lower Sandstone.~~

CASE NO. 11996

Order No. R-11133-A

Page 8
15

(21) In its Order No. R-8768, the Division defined the vertical limits of the Basin Fruitland Coal Gas Pool as all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2450 feet to 2880 feet as shown on the well log from the Amoco Schneider Gas Com "B" Well No. 1. The pick for the base of the pool in Order No. R-8768 is the top of the Pictured Cliffs Formation. The pick is also the break between marine and non-marine sediments. It is undisputed that the coal or shale layers occurring below the stratigraphic pick set forth in Order No. R-8768 would not be included in the Basin Fruitland Coal Gas Pool or in the Fruitland Coal Formation.

(21) (22) The interval between the top of the Upper Sandstone and the top of the main body of the Pictured Cliffs is composed of a variety of rock types including marine sandstones, silt stones, shales, and thin coals. It has been the long-standing and accepted custom and practice of industry and the various regulatory agencies, including the Division in Order No. R-8768, to place this entire interval within the Pictured Cliffs Formation. This industry and regulatory agency practice conforms to the standards of the North American Stratigraphic Code and the International Stratigraphic Guide.

(22) (23) The evidence presented by Pendragon establishes that over the years approximately 34 wells within approximately 2.5 miles of the Pendragon Chaco Wells were actually perforated in the Upper Sandstone in conjunction with other Pictured Cliffs intervals and reported by the numerous different operators of those wells as Pictured Cliffs completions, consistent with the picks for the top of the Pictured Cliffs for the Chaco Plant No. 1 and the Pendragon Chaco Wells (Exhibit N-61). The evidence also establishes that those reported completions were accepted by the Division and the Bureau of Land Management and that industry and geologists have placed substantial reliance on those reported completions as Pictured Cliffs completions for nearly thirty years.

(23) (24) In a written statement provided to the Division in conjunction with its hearing in Case No. 11996, Merrion, the assignor of the interests in both the Fruitland Coal Formation to Whiting and Pictured Cliffs Formation to Pendragon, indicated it concurred with Pendragon in its identification of the Upper Sandstone interval and the historic recognition of that interval as Pictured Cliffs by Merrion and other operators in the area. (Exhibit N-43.) Merrion further stated that the Pendragon Chaco Wells are appropriately perforated in the Pictured Cliffs Formation and that it had no intention of conveying to Pendragon wells that were perforated in other zones. Merrion also stated that it never intended to farm-out to Whiting the rights to zones where the Pendragon Chaco Wells were perforated. ~~check - was this admitted?~~

24 (25) Thus, the identification and utilization of the Upper Sandstone tongues to establish the vertical boundaries of the Pictured Cliffs Formation by industry, governmental regulatory agencies and the parties or their successors-in-interest is a long-established custom and practice. Such custom and practice is to be accorded significant weight.

(25) (26) Whiting asserted during the hearing of this matter that the Upper Sandstone interval was deposited in a non-marine, crevasse-splay deposit, resulting from a large, sediment-laden river breaking through its natural boundaries during a flood stage and spreading clean, well-sorted sand over an area more than sixteen-miles long and up to three-miles wide parallel to the shoreline. Whiting contended that peat-forming coals occur only at distances significantly inland of the beach and shore-face sands of the Pictured Cliffs Formation and therefore the Upper Sandstone in the Subject Area was most likely the product of non-marine sediments. However, the witness's cross-section exhibit, Exhibit WA-3, showed that coals were also formed or deposited within the Pictured Cliffs Formation.

(27) Whiting's expert geologist testified that it was also possible that the disputed interval was deposited as a washover fan. However, the washover fan depositional mechanism involves wave-dominated action, consistent with the accepted geologic definitions of a marine depositional mechanism. Such a theory also supports a conclusion that the Upper Sandstone was deposited in a marine environment.

(28) Pendragon presented aerial photographs of modern deposits of sands comparable in mode of deposition and areal extent to the Upper Sandstone located in the marine lagoonal areas behind barrier islands, thus demonstrating the validity of the depositional model. Pendragon demonstrated using these exhibits that these sands are wave and tidal-current dominated deposits, and further showed that the seaward beach of a barrier island is not to be confused with the true ~~ocean~~ ^{marine} shoreline which lies behind the island.

(29) The core analysis for the Lansdale Federal No. 1 located in the SE/4 of Sec. 7, T-26-N, R-12-W establishes that grain size and sorting throughout the Upper Sandstone is uniform, consistent with a marine depositional environment. The physical descriptions of the sand appearing in the Upper Sandstone and the Lower Sandstone are grey, fine-grained with little variation in clay content, consistent with a marine sand that has been laterally transported by currents and waves to the point where the energy available sorts the sand into uniform size. Sand-sorting characteristics of this sort are not consistent with a fluvial deposit with graded bedding coarsening downward. ~~This evidence further supports the conclusion that the upper tongue is Pictured Cliffs sandstone.~~

(30) Pendragon presented evidence that the Spontaneous Potential ("SP") readings on electrical logs are much greater in the Pictured Cliffs Formation, which was deposited in a marine setting, than in the Fruitland sands, which were deposited in a fluvial, fresh water environment. Pendragon demonstrated that the SP readings for the Upper Sandstone were comparable or identical to those of the Lower Sandstone and were much greater than those of the Fruitland sands. Examples of this fact were found on the geological cross-section prepared by Whiting's expert geologist. See Exhibit No. .

(31) The SP map of the Pictured Cliffs ^{Formation} introduced by Whiting, Exhibit WA-9, showed

40 to 80 millivolt SP development in the Chaco area. The cross-section exhibit demonstrated that the disputed interval also showed 40 to 80 millivolts SP, even though it was interpreted by Whiting's expert geologist to be Fruitland sandstone, and all other Fruitland sands on his cross-section showed only zero to less than 10 millivolts. Additional testimony established that 40 to 80 millivolts is a significantly higher range than is typically associated with SP development in a fresh-water depositional environment and is more characteristic of the SP development in the Pictured Cliffs intervals observed on the well logs and cross-sections for the Pendragon Chaco Wells. ~~The geologic evidence also established that Pictured Cliffs sandstones have higher SP development because they are deposited in a more saline, marine environment. This evidence further supports the conclusion that the disputed interval is Pictured Cliffs sandstone that was deposited in a marine environment.~~

What is this?

(25) However,
(32) Thus, Whiting failed to establish by a preponderance of the evidence the existence of any crevasse splay or any depositional materials indicative of a sand-laden flood. Moreover, there is no evidence of the transporting river or river channel, the thinning of sand deposits in both directions at right angles to the river, adjacent deltaic deposits or any other non-marine mechanism with the capability of forming the thin, but areally extensive, sand of the dimensions seen in the Upper Sandstone. ~~Available core analysis data showed no characteristics consistent with fluvial depositional materials or mechanics.~~

(32) (33) Whiting contends that the top of the first "massive" sandstone below the lowermost coal of the Fruitland Coal Formation should be the basis for picking the top of the Pictured Cliffs Formation. Whiting presented testimony and an exhibit to support its contention that the operators of approximately one hundred additional wells outside the Subject Area had identified the top of the massive Pictured Cliffs Sandstone as the vertical boundary between the Pictured Cliffs and Fruitland Coal Formations. However, Whiting failed to present ~~any~~ additional evidence establishing whether the Upper Sandstone interval was present in any of the wells identified. Similarly, Whiting failed to show that any operator identified the top of the Pictured Cliffs sandstone as the massive sand in those areas where tongues of the Pictured Cliffs are known to exist. The geologic testimony and evidence shows that such a definition has little support in the geologic literature and that the arbitrary and undefined term "massive" makes its application impractical. ~~It appears that it is more common to place the contact between the Fruitland and Pictured Cliffs Formations at the top of the highest ophiomorpha-major bearing sandstone. Consequently, the more widely accepted technical definition of Pictured Cliffs sandstone concerns whether the Formation is of marine deposition.~~

no

already stipulated

Engineering Issue

(34) Whiting, the owners and operators of the Whiting Fruitland Coal Wells, and Pendragon, the owner and operator of the Pendragon Chaco ~~Wells~~ and Chaco Limited Wells, each contend that the other's well stimulation treatments established communication between their separately owned Formations. Both parties contend that, as a result, their wells are

experiencing interference and that gas is being produced out of zone.

(35) The production history of the Pendragon Chaco and Chaco Limited Wells is summarized as follows:

Well No.	Initial Production (Original Completion)	Pre-Acidization or Fracture Stimulation Production	Post-Acidization or Fracture Stimulation Production	^{Last} Current Production
Chaco No. 1	80 MCF/D	0 MCF/D	250 MCF/D	165 MCF/D
Chaco No. 2R	70 MCF/D	0-15 MCF/D	90 MCF/D	120 MCF/D
Chaco No. 4	200 MCF/D	0 MCF/D	425 MCF/D	200 MCF/D
Chaco No. 5	190 MCF/D	0 MCF/D	370 MCF/D	210 MCF/D
Chaco Ltd. 1J	11 MCF/D	0-10 MCF/D	0-10 MCF/D	0-10 MCF/D
Chaco Ltd. 2J	30 MCF/D	0-10 MCF/D	0-10 MCF/D	0-10 MCF/D

~~(36) The production history of the Whiting Fruitland Coal Wells is summarized as follows:~~

Well No.	Date of Initial Production	Initial Production Rate	Current Production Rate
26-12-6 No. 2	12/93	85 MCF/D	733 MCF/D
26-12-7 No. 1	12/93	124 MCF/D	700 MCF/D
26-13-1 No. 1	12/93	26 MCF/D	383 MCF/D
26-13-1 No. 2	7/93	51 MCF/D	150 MCF/D
26-13-12 No. 1	1/94	195 MCF/D	350 MCF/D

(37) The fracture stimulation treatments performed on both the Pendragon Chaco Wells by Pendragon and the Whiting Fruitland Coal Wells by Whiting established communication between the Fruitland Coal Formation and the Pictured Cliffs Formation.

~~Fracture stimulation~~ ^{treatments performed on the} Whiting Fruitland Coal Wells in 1992 created near-wellbore communication channels between the Fruitland Coal and Pictured Cliffs Formations. At the time, the gas in the Pictured Cliffs Formation was nearly depleted and very little gas could escape to the Fruitland Coal Formation, unless the Whiting Fruitland Coal Wells were operated under extremely low pressures. On the other hand, the adsorbed gas in the Fruitland Coal Formation stayed within the coal matrices until the pressure was lowered enough through the dewatering process for the gas to ~~be~~ desorb.

(39) After the dewatering process, substantial amounts of adsorbed gas escaped from the coal matrices, especially in the near-wellbore region where pressure was low. As a result, the Whiting Fruitland Coal Wells began their commercial gas production. The desorbed gas moving toward the Whiting Fruitland Coal Wells may have migrated to the Pictured Cliffs Formation through the communication channels near the Whiting Fruitland Coal Wells if the local pressure

verified - part of stimulation?

purpose of the engineering ordered established that the

after they were drilled

in the Pictured Cliffs Formation was lower than that in the Fruitland Coal Formation. Gas in the Pictured Cliffs Formation may have migrated to the Fruitland Coal Formation through the communication channels if the production pressures at the Whiting Fruitland Coal Wells were low. However, these possible gas migrations were not significant, as evidenced by steady gas production from the Pendragon Chaco Wells.

Coal
matrices

region in which
decreased pressures
allowed gas to
desorb from the

region
area of gas desorption

(40) In 1995, after three years of the dewatering process, the gas near the Whiting Fruitland Gas Wells exhibited its usual pressure increase as a result of the dewatering and, with the increased pressure, moved toward the Pendragon Chaco Wells. At the edge of the resulting gas bubble, the gas pressure in the Fruitland Coal Formation was probably higher than the adjacent pressure in the Lower Sandstone. In the area of this relatively high pressure contrast, it appears that the thin capillary barrier was broken, allowing gas migration between the two zones which explains the unusual pressure readings in the Pictured Cliffs Formation.

had grown

Pictured Cliffs Formation
may have been

(41) Pendragon performed fracture stimulation treatments on the Pendragon Chaco Wells in 1995. The post-treatment gas production from the Pendragon Chaco Wells indicates that the stimulation work performed by Pendragon successfully broke into some high-pressure gas compartments.

more 35 here

(42) One possibility is that the hydraulic fractures were extended upward to the Fruitland Coal Formation and generated a gas highway to the gas bubble. Pendragon's experts vigorously denied this possibility. Instead, they asserted that an additional gas compartment, the so-called "third bench," exists below the perforations in the Pendragon Chaco Wells. The evidence does not support this assertion. No "third bench" has been reported previously throughout the San Juan region, and there is no geological evidence of this kind of formation. Furthermore, there is no scientific basis for believing that fractures moved downward into the "third bench" but not upward into the Fruitland Coal Formation. Therefore, the most reasonable explanation of the sudden significant increases in production following the fracture stimulation treatments was that the hydraulic fractures penetrated into the gas bubble established in the Fruitland Coal Formation.

(43) Pendragon also asserted that the fracture stimulation treatments increased production in the Pendragon Chaco Wells by counteracting the effects of reservoir damage caused by (a) scale precipitation, (b) water blockage, and (c) migration of clay fines. As the original Pictured Cliffs gas was relatively dry, however, it is unlikely that the Pendragon Chaco Wells suffered from significant reservoir damage of this type.

on the
Pendragon
Chaco
Wells

(44) The BTU analysis of the gas from the Pendragon Chaco Wells supports the conclusion that the fracture stimulation treatments of these wells in 1995 established communication with the Fruitland Coal Formation. Whiting showed that hydrocarbon liquids content of the gas from the Pendragon Chaco Wells was slightly reduced from 1988 to 1995 and was significantly reduced from 1995 to 1997.

(45) Both Pendragon and Whiting presented volumetric and material balance calculations. Although the calculation procedure is well documented in many textbooks, the *use of* procedure ~~used in their calculations and arguments~~ failed to adequately describe the dynamics of the continuous communications between the two zones ~~and the water movements~~.

(46) Expert witnesses for both Pendragon and Whiting presented their own opinions on the effects of the fracture stimulation treatments in the Whiting Fruitland Coal Wells and the Pendragon Chaco Wells based on their own theories and models. Many input values for key parameters were questionable. Both ~~simulators~~ *used in their testimony* have a good reputation for assisting in the design of fracturing jobs, but it is easy to manipulate them incorrectly. In a case like this, their results are too exaggerated to be reliable.

(47) The acid stimulation treatments performed by Pendragon on the Chaco Limited Wells No. 1J and 2J in 1995 did not alter these wells' rates of production. These treatments did not establish communication between the Pictured Cliffs Formation and the Fruitland Coal Formation.

(48) The gas now capable of production from the Pendragon Chaco Wells No. 1, 2R, 4, and 5 is: (1) gas originally in place in the Pictured Cliffs Formation; (2) gas from the Fruitland Coal Formation that has migrated to the Pictured Cliffs Formation through fractures around the Pendragon Chaco Wells; and (3) gas ~~produced~~ from the Fruitland Coal Formation through fractures around the Whiting Fruitland Coal Wells.

(49) The Pendragon Chaco Wells depleted the Pictured Cliffs Formation prior to the fracture stimulation treatments performed on the wells in 1995.

(50) Pendragon Chaco Wells No. 1, 2R, 4, and 5 have already produced their fair share of the gas in the Pictured Cliffs Formation.

IT IS THEREFORE ORDERED THAT:

(1) Pursuant to the application of Pendragon Energy Partners, Inc., and J. K. Edwards Associates, Inc., it is determined that the following described wells are perforated within the Pictured Cliffs Formation, WAW Fruitland Sand-Pictured Cliffs Gas Pool. It is further determined that the following described wells are ~~also~~ *both* producing from the WAW Fruitland Sand-Pictured Cliffs Gas Pool and the Basin-Fruitland Coal Gas Pool, San Juan County, New Mexico:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Pendragon Energy Partners, Inc.	Chaco No. 1	← 1846' FNL & 1806' FWL, Unit F,

←(API No. 30-045-22309) ← Section 18, T-26N, R-12W

Pendragon Energy Partners, Inc. Chaco No. 2R 1850' FSL & 1850' FWL, Unit K,
 ←(API No. 30-045-23691) ← Section 7, T-26N, R-12W

Pendragon Energy Partners, Inc. Chaco No. 4 790' FNL & 790' FWL, Unit D,
 ←(API No. 30-045-22410) ← Section 7, T-26N, R-12W

Pendragon Energy Partners, Inc. Chaco No. 5 790' FSL & 790' FEL, Unit P,
 ←(API No. 30-045-22411) ← Section 1, T-26N, R-13W

(2) It is further determined that the following described wells are perforated within and producing solely from the Pictured Cliffs Formation, WAW Fruitland Sand-Pictured Cliffs Gas Pool:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J →(API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J ←(API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, ←Section 1, T-26N, R-13W

(3) It is further determined that the following described wells are producing from ^{both} the Basin-Fruitland Coal Gas Pool and the WAW Fruitland Sand-Pictured Cliffs Gas Pool:

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	← 886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

CASE NO. 11996

Order No. R-11133-A

Page 15

(4) Pendragon is hereby ordered to shut-in its Chaco Wells No. 1, 2R, 4 and 5 until such time as the Division approves a method for either putting them back into production or plugging them.

(5) Inasmuch as Whiting's wells are producing from the already depleted WAW Fruitland Sand-Pictured Cliffs Gas Pool *only minor amounts of gas* ~~as well as the Basin-Fruitland Coal Gas Pool~~ Whiting's wells are not to be shut-in.

(6) Jurisdiction is hereby retained for the entry of such further orders as the Commission may deem necessary.

DONE at Santa Fe, New Mexico, on the day and year hereinabove designated.

**STATE OF NEW MEXICO
OIL CONSERVATION COMMISSION**

JAMI BAILEY, Member

ROBERT LEE, Member

LORI WROTENBERY, Chairman

S E A L

**STATE OF NEW MEXICO
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT
OIL CONSERVATION COMMISSION**

**IN THE MATTER OF THE HEARING
CALLED BY THE OIL CONSERVATION
COMMISSION FOR THE PURPOSE OF
CONSIDERING:**

**De Novo
Case No. 11996
Order No. R-11133-A**

**APPLICATION OF PENDRAGON ENERGY PARTNERS, INC.
AND J. K. EDWARDS ASSOCIATES, INC.
TO CONFIRM PRODUCTION FROM
THE APPROPRIATE COMMON SOURCE OF SUPPLY,
SAN JUAN COUNTY, NEW MEXICO.**

ORDER OF THE COMMISSION

BY THE COMMISSION:

This case came on for hearing at 9:00 a.m. on August 12, 1999, at Santa Fe, New Mexico, before the New Mexico Oil Conservation Commission ("Commission") and continued on August 13, 19, 20 and 21, 1999.

NOW, on this ____ day of _____, 2000, the Commission, a quorum being present and having considered the record,

FINDS THAT:

(1) Due public notice has been given and the Commission has jurisdiction of this case and its subject matter.

(2) The applicants, Pendragon Energy Partners, Inc. and J. K. Edwards Associates, Inc. ("Pendragon"), pursuant to Rule (3) of the Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool set forth in Oil Conservation Division ("Division") Order No. R-8768, as amended, seek an order confirming that the following described wells, completed within the vertical limits of the WAW Fruitland Sand-Pictured Cliffs Gas Pool ("Pendragon Chaco Wells") or the Basin-Fruitland Coal Gas Pool ("Whiting Fruitland Coal Wells") are producing from the appropriate common source of supply and ~~providing~~ further relief as the Commission deems necessary:

Pendragon Chaco Wells

Operator

**Well Name &
API Number**

Well Location

Pendragon Energy Partners, Inc.

Chaco No. 1
(API No. 30-045-22309)

1846' FNL & 1806' FWL, Unit F,
Section 18, T-26N, R-12W

- net.
form

CASE NO. 11996

Order No. R-11133-A

Page 2

extra return?

Pendragon Energy Partners, Inc.	Chaco No. 2R (API No. 30-045-23691)	1850' FSL & 1850' FWL, Unit K, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 4 (API No. 30-045-22410)	790' FNL & 790' FWL, Unit D, Section 7, T-26N, R-12W
Pendragon Energy Partners, Inc.	Chaco No. 5 (API No. 30-045-22411)	790' FSL & 790' FEL, Unit P, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 1J (API No. 30-045-25134)	1850' FSL & 1750' FWL, Unit K, Section 1, T-26N, R-13W
Pendragon Energy Partners, Inc.	Chaco Limited No. 2J (API No. 30-045-23593)	790' FNL & 1850' FEL, Unit B, Section 1, T-26N, R-13W

?

Whiting Fruitland Coal Wells

<u>Operator</u>	<u>Well Name & API Number</u>	<u>Well Location</u>
Whiting Petroleum Corp.	Gallegos Fed 26-12-6 No. 2 (API No. 30-045-28898)	886' FSL & 1457' FWL, Unit N, Section 6, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-12-7 No. 1 (API No. 30-045-28899)	2482' FSL & 1413' FWL, Unit K, Section 7, T-26N, R-12W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 1 (API No. 30-045-28881)	828' FNL & 1674' FEL, Unit B, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-1 No. 2 (API No. 30-045-28882)	1275' FSL & 1823' FWL, Unit N, Section 1, T-26N, R-13W
Whiting Petroleum Corp.	Gallegos Fed. 26-13-12 No. 1 (API No. 30-045-28903)	1719' FNL & 1021' FEL, Unit H, Section 12, T-26N, R-13W

(3) Whiting Petroleum Corporation and Maralex Resources, Inc. ("Whiting"), interest owners and operators of the Gallegos Federal 26-12-6 No. 2, 26-12-7 No. 1, 26-13-1 No. 1, 26-13-1 No. 2 and 26-13-12 No. 1 ("Whiting Fruitland Coal Wells"), appeared at the hearing in opposition to the application ~~and to present evidence to support their position~~ that the Pendragon Chaco Wells are producing. *Whiting claims*

- gas*
- from a sandstone interval located within the Fruitland formation; and
 - coal gas from the Basin-Fruitland Coal Gas Pool because of the establishment of communication between the Basin-Fruitland Coal

and WAW Fruitland Sand-Pictured Cliffs Gas Pools [within the
Pendragon Chaco Wells/wellbores.]

(4) All eleven wells that are the subject of this application are located within an area (hereinafter referred to as the "Subject Area") that comprises:

TOWNSHIP 26 NORTH, RANGE 12 WEST, NMPM

Section 6: W/2
Section 7: W/2
Section 18: NW/4

TOWNSHIP 26 NORTH, RANGE 13 WEST, NMPM,

Section 1: All
Section 12: N/2

(5) The Subject Area is located within the horizontal boundaries of the Basin-Fruitland Coal Gas Pool created by ~~the~~ Division Order No. R-8768 dated October 17, 1988. The vertical limits of this pool, as defined by Ordering Paragraph (1) of Order No. R-8768, ~~are as follows:~~
enclosed:

...all coal seams within the equivalent of the stratigraphic interval from a depth of approximately 2,450 feet to 2,880 feet as shown on the Gamma Ray/Bulk Density log from Amoco Production Company's Schneider Gas Com "B" Well No. 1 located 1110 feet from the South line and 1185 feet from the West line of Section 28, Township 32 North, Range 10 West, NMPM, San Juan County, New Mexico.

(6) Order No. R-8768 also established Special Rules and Regulations for the Basin-Fruitland Coal Gas Pool, including provisions for standard 320-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the proration unit nor closer than 130 feet from any quarter section line nor closer than 10 feet from any quarter-quarter section line or subdivision inner boundary. In addition, wells are to be located in the NE/4 or SW/4 of a single governmental section.

(7) The Subject Area is also located within the horizontal boundaries of the WAW Fruitland Sand-Pictured Cliffs Gas Pool. The vertical limits of this pool comprise ~~all~~ *enclosed?* the Pictured Cliffs formation (Order No. R-4260 dated February 22, 1972) and all the sandstone intervals of the Fruitland formation (Order No. R-8769 dated October 17, 1988). [The WAW Fruitland Sand-Pictured Cliffs Gas Pool is currently governed by Division Rule 104.C., which requires standard 160-acre gas spacing and proration units with wells to be located no closer than 790 feet from the outer boundary of the spacing unit nor closer than 130 feet from any quarter-quarter section line or subdivision inner boundary.]

(8) [The evidence presented by the parties in this case is generally in agreement that] Pendragon and Whiting received assignments of oil and gas leases in the Subject Area from common grantors, Robert Bayless ("Bayless") and Merrion Oil and Gas Corporation ("Merrion"), during the period from 1992 through 1994.

- a) The assignments of rights, in pertinent part, to Whiting are as follows:

Operating rights from the surface of the earth to the base of the Fruitland (Coal Gas) Formation subject to the terms and provisions of that certain Farmout Agreement dated December 7, 1992 by and between Merrion Oil & Gas et al., Robert L. Bayless, Pitco Production Company, and Maralex Resources, Inc.

- b) The assignment of rights to Pendragon, in pertinent part, are as follows:

Leases and lands from the base of the Fruitland Coal formation to the base of the Pictured Cliffs formation.

- (9) A brief history of the Pendragon Chaco Wells ~~is described as follows:~~

?

- a) [The Chaco Well No. 1 was drilled by Merrion and Bayless in February, 1977, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,113' to 1,139'. The well initially tested in this interval at a rate of approximately 342 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, J. K. Edwards & Associates, Inc. ("Edwards") became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.]

?

- b) [The Chaco Well No. 2R was drilled by Merrion and Bayless in October, 1979, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,132' to 1,142'. The well initially tested in this interval at a rate of approximately 150 MCFGD, 0 BOPD and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was fracture stimulated in the perforated interval. In January, 1996, Pendragon became operator of the well.]





- c) The Chaco Well No. 4 was drilled by Merrion and Bayless in April, 1977, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,163' to 1,189'. The well was initially tested in this interval at a rate of approximately 480 MCFGD, 0 BOPD, and 0 BWPD. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In May, 1995, the well was re-perforated in the interval from 1,163' to 1,189' and fracture stimulated in this interval. In January, 1996, Pendragon became operator of the well.
- d) The Chaco Well No. 5 was drilled by Merrion and Bayless in April, 1977, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,165' to 1,192'. The well initially tested in this interval at a rate of approximately 1029 MCFGD, 0 BOPD and 0 BWPD. In May, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was re-perforated in the interval from 1,165' to 1,192' and was fracture stimulated in this interval. In January, 1996, Pendragon became operator of the well.
- e) The Chaco Limited Well No. 1J was drilled by Merrion and Bayless in April, 1982, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,200' to 1,209'. The well initially tested in this interval at a rate of approximately 10 MCFGD, 0 BOPD and a trace of water. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January, 1996, Pendragon became operator of the well, and
- f) The Chaco Limited Well No. 2J was drilled by Merrion and Bayless in September, 1979, to test the Pictured Cliffs formation. The well was perforated and completed in the Pictured Cliffs formation from a depth of 1,186' to 1,202'. The well initially tested in this interval at a rate of approximately 208 MCFGD, 0 BOPD and 4 BWPD. In October, 1979, the well was fracture stimulated in this interval. In January, 1995, Edwards became operator of the well. In January, 1995, the well was acidized with 500 gallons 7 ½ percent HCl. In January, 1996, Pendragon became operator of the well.

(10) A brief history of the Whiting Fruitland Coal Wells is described as follows:

CASE NO. 11996

Order No. R-11133-A

Page 6

- a) ~~T~~he Gallegos Federal 26-12-6 No. 2 was drilled by Maralex in December, 1992, to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,138' to 1,157'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well. ~~X~~ 
- b) ~~T~~he Gallegos Federal 26-12-7 No. 1 was drilled by Maralex in December, 1992, to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,131' to 1,150'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well. ~~X~~ 
- c) ~~T~~he Gallegos Federal 26-13-1 No. 1 was drilled by Maralex in December, 1992, to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,158' to 1,177'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well. ~~X~~ 
- d) ~~T~~he Gallegos Federal 26-13-1 No. 2 was drilled by Maralex in December, 1992, to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,047' to 1,208'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well. ~~X~~ 
- e) ~~T~~he Gallegos Federal 26-13-12 No. 1 was drilled by Maralex in December, 1992, to test the Basin-Fruitland Coal Gas Pool. The well was perforated and completed in the Fruitland Coal from a depth of 1,178' to 1,197'. The well was subsequently fracture stimulated in this interval. In September, 1995, Whiting became operator of the well.

1. Exhibit No. W7 + W8

CASE NO. 11996
Order No. R-11133-A
Page 8

is this the same as the "Upper Sandstone" referenced in (11)?

isn't there a difference between chenier & barrier sands?

(16) Pendragon's isopach of the Upper Pictured Cliffs sand shows the occurrence of that sandstone along the shoreline trending from a northwest to southeast direction in a barrier-bar marine littoral environment. Pendragon's exhibit also establishes that the Upper Pictured Cliffs sand occurs in a continuous sheet that coalesces into the main body or bench of the Pictured Cliffs formation as the sand trends from the shoreline environment on the southwest toward the center of the San Juan basin to the northeast. The

(17) The Upper Pictured Cliffs sand coalesces into thicker and undifferentiated Pictured Cliffs sands to the east, northeast and north indicating that it is part of the same depositional environment. The Upper Pictured Cliffs sand also correlates and is continuous in character over a large area covering portions of four townships.

(18) The geologic evidence presented by Pendragon also establishes that the Fruitland sands are deposited along a trend from the southwest to the northeast on a channelized basis and that those sands thin toward the northeast to the edge of the Pictured Cliffs sandstone body.

(19) In the area of the subject lands, the Upper Pictured Cliffs sand appears as a classic shoreline or chenier-type sand grading from 0 to approximately 13 feet toward the northeast where it coalesces into the main body of the Pictured Cliffs where the thin underlying shale stringers are not present. The Upper Pictured Cliffs sand cannot be differentiated from the main body of the Pictured Cliffs formation.

(20) The preponderance of the evidence, including the geologic literature and cross-sections, shows that the Pictured Cliffs marine sandstone abruptly wedges out and is replaced by chrono-stratigraphically correlative coals. In Exhibit W-9, the pinch-out of the Pictured Cliffs sandstone and replacement with Coal B occurs across an interval of less than 1.4 miles. In Exhibit W-10, the stratigraphic wedge-out of the Pictured Cliffs sandstone and replacement by Fruitland formation interbedded coals and non-coals occurs across an interval of less than 0.88 mile. Thus, marine Pictured Cliffs sandstone contemporaneous with thick basal Fruitland coals occur in close proximity to each other.

(21) The geologic testimony and literature further establishes that Fruitland sands are consistently recognized as non-marine or continental deposits such as fluvial channels, deltaic-distributary channels and other landward deposits. Additionally, the geologic literature indicates that the pick for the top of the Pictured Cliffs formation is often at the base of the basal Fruitland Coal. The Fruitland formation is the non-marine facies tract consisting of interbedded sandstone, mudstone, and coal beds deposited landward of the marine facies tract of the Pictured Cliffs sandstone.

why the quotes

what does this formation add?

Fruitland formation?

what is the basal Fruitland coal?

combine

combine with (16) & (17)?

(13)

combine with (18)?

(22) The evidence established that directly beneath the Basin Fruitland Coal throughout this portion of the San Juan Basin is a shale, or "underclay," deposited directly upon the Pictured Cliffs sandstone. The underclay is continuous over a large area, thinning to the northeast and is usually highly conductive on electrical logs. It appears in a uniform deposit on a marine platform and is not cut by channels or downward coarsening sands. There is no sand body or separately identifiable shale in the several hundred feet above the base of the basal Fruitland Coal that demonstrates anything near the areal extent or uniformity of this underclay shale. It is correspondingly different from Fruitland deposits. The Pictured Cliffs section immediately below the underclay thickens towards the northeast, indicative of a time of subsidence, which caused the deposition of the upper Pictured Cliffs sandstone interval. Conversely, a non-marine sand-shale-sand sequence can be expected to thin out to the northeast ~~and should trend from the northeast to the southwest instead of the northwest to the southeast.~~

(23) Whiting's expert geologist defined a "marine" environment as that ^{one} which is influenced by the sea and the action of the sea. ^{Although} the witness acknowledged that lagoons are under ~~a~~ marine influence, he excluded lagoonal environments from the definition of "marine" environments.

(24) Lagoons may be described as "...of, belonging to, or caused by the sea" ^{which} in conformity with the definition of "marine" as set forth in the AGI Dictionary of Geological Terms.

(25) Whiting asserted that the disputed upper Pictured Cliffs sandstone interval was deposited in a non-marine, crevasse-splay deposit, resulting from a large, sediment-laden river breaking through its natural boundaries during ~~a~~ flood stage and spreading ~~clean~~, well-sorted sand over an area more than sixteen miles long and up to three miles wide parallel to the shoreline. ^{JB}

(26) Whiting contended that peat-forming coals occur only at distances significantly inland of the beach and shore-face sands of the Pictured Cliffs, and therefore, the "upper Pictured Cliffs sand" in the ~~area of the subject well~~ ^{Area} was most likely the product of non-marine sediments deposited by a crevasse-splay mechanism that formed far inland from the beach and shore-face sediments of the Pictured Cliffs sandstone. ^{formation} However, the witness' ~~x~~ cross-section exhibit, Exhibit WA-3, showed that coals were also formed or deposited within the Pictured Cliffs formation.

(27) Pendragon presented aerial photographs of modern-day deposits of sands comparable in mode of deposition and areal extent to the Upper Pictured Cliffs sand located in the marine lagoonal areas behind barrier islands, thus demonstrating both the validity of the depositional model and the opportunity for muds and coal-forming organic materials to be deposited in this environment. Pendragon demonstrated in these exhibits that these sands are wave and tidal current dominated deposits, and further showed that the seaward beach of a barrier island is not to be confused with the true ocean shoreline which lies behind the island.

Photographs
do it all
of this

(28) The core analysis for the Lansdale Federal No. 1 located in the SE/4 of Sec. 7, T-26-N, R-12-W establishes the average permeability and porosity for the Upper Pictured Cliffs sand and that grain size and sorting throughout the Upper Pictured Cliffs sand are uniform, consistent with a marine depositional environment. The physical descriptions of the sand appearing in the Upper Pictured Cliffs bench and the two lower benches are gray, fine-grained with little variation in clay content, consistent with a marine sand that has been laterally transported to the point where the energy available sorts the sand into uniform size. Sand sorting characteristics of this sort are not consistent with a fluvial deposit with graded bedding and coarsening downward.

redundant

(29) The descriptions for the disputed sandstone upper tongue interval and the main body of the Pictured Cliffs sandstone on the core analysis of the nearby Lansdale Federal No. 1 well are identical. The uniform description for both as gray, fine-grained with some clay content is consistent with marine sand, which was sorted and deposited by currents and waves. This evidence further supports the conclusion that the upper tongue is Pictured Cliffs sandstone.

(30) The Upper Pictured Cliffs sand is elongated along a northwest to southeast strike parallel to the ancient shoreline. The sand thickens consistently to the northeast, which is not consistent with a fluvial or crevasse splay deposit.

(31) There is no evidence that the upper Pictured Cliffs sandstone in the area of the subject wells is associated with any stream channels or down-cutting as would be the case in a fluvial environment. Rather, the deposition of a sand with the consistency in geometry of the upper Pictured Cliffs sand requires a marine setting with a flat, stable base and a source of sand with consistent grain size spread by tidal or wave energy. Such conditions do not occur onshore and behind the shoreline.

Subject

See
(16) &
(17)

(32) Whiting failed to establish by a preponderance of the evidence the existence of any crevasse splay or any depositional materials indicative of a sand-laden flood of ~~tremendous velocity scouring or cutting down through the area where the sand would have been deposited.~~ Moreover, there is no evidence of the transporting river or river channel or the thinning of sand deposits in both directions at right angles to the river, adjacent deltaic deposits or any other non-marine mechanism with the capability of forming the thin, but areally extensive sand of the dimensions seen in the upper Pictured Cliffs sandstone. The available core analysis data showed none of the characteristics consistent with the fluvial depositional materials or mechanics.

(33) Whiting presented an isopach of the Upper Sandstone that at its northern edge, implies the sand is lying directly upon the marine, thick Pictured Cliffs sand. Additional evidence established that it is not a geologically credible possibility that such a deposition would occur as a result of a crevasse splay.

(34) Whiting's expert geologist testified that it was also possible that the disputed interval was deposited by a washover fan mechanism. The washover fan depositional mechanism includes ~~oceanfront, storm and wave-dominated action, all of which are~~ consistent with the accepted geologic definitions of a marine depositional mechanism. Such a theory also supports a conclusion that the Upper Pictured Cliffs sandstone was deposited in a marine environment.

(35) Pendragon presented evidence that the Spontaneous Potential ("SP") readings on electrical logs are much greater in the Pictured Cliffs formation ~~which was deposited in a marine setting than are those of the Fruitland sands that were deposited in a fluvial, fresh water environment.~~ Pendragon then showed that the SP readings for the Upper Sandstone were comparable or identical to those of the Lower Pictured Cliffs and were much greater than those of the Fruitland sands above the Basal Coal. Examples of this fact were found on the geological cross-section prepared by Whiting's expert geologist.

(36) The SP map of the Pictured Cliffs introduced by Whiting, Exhibit WA-9, showed 40 to 80 millivolt SP development in the Chaco area. The cross-section exhibit demonstrated that the disputed interval also showed 40 to 80 millivolts SP, even though it was interpreted by Whiting's expert geologist to be Fruitland sandstone, and all other Fruitland sands on his cross-section showed only zero to less than 10 millivolts. Additional testimony established that 40 to 80 millivolts is a significantly higher range than is typically associated with SP development in a fresh-water depositional environment and is more characteristic with the SP development in the Pictured Cliffs intervals observed on the well logs and cross-sections for the Pendragon Chaco Wells. The geologic evidence also established that Pictured Cliffs sandstones have higher SP development because they are deposited in a more saline, marine environment. This evidence further supports the conclusion that the disputed interval is Pictured Cliffs sandstone that was deposited in a marine environment.

(37) In a number of instances, Whiting's expert geologist misidentified shales as sandstones on his cross-section exhibit or otherwise failed to distinguish between the two types of rock where they occur adjacent to one another. As a consequence, the witness similarly failed to distinguish between the two in his discussion of core sample and well log response characteristics.

delete
JB

(38) The geologic evidence shows that the upper Pictured Cliffs sandstone tongues are widespread and occur in the southern portion of the San Juan Basin, including the Subject Area.

(39) The evidence presented by Pendragon establishes that over the years approximately 34 wells within approximately 2.5 miles of the Pendragon Chaco Wells were actually perforated in the Upper Pictured Cliffs sand in conjunction with other Pictured Cliffs intervals and reported by the numerous different operators of those wells as Pictured Cliffs completions, consistent with the picks for the top of the Pictured Cliffs for the Chaco Plant No. 1 and the Pendragon Chaco Wells (Exhibit N-61). The evidence also establishes that those reported completions were accepted by the Division and the Bureau of Land Management and that industry and geologists have placed substantial reliance on those reported completions as Pictured Cliffs completions for nearly thirty years.

12
not
referred
elsewhere

(40) Whiting presented testimony and an exhibit to support its contention that the operators of approximately one hundred additional wells outside Subject Area had identified the top of the Pictured Cliffs sandstone "massive" as the boundary between the Pictured Cliffs and Fruitland formation. However, Whiting failed to present any additional evidence establishing whether the upper Pictured Cliffs interval was present in any of the wells identified. Similarly, Whiting failed to present any evidence tending to show that any operator identified the top of the Pictured Cliffs sandstone as the massive sand in those areas where tongues of the Pictured Cliffs are known to exist.

JB
12

(41) Whiting's president testified that when he evaluated the Pictured Cliffs formation and wells in the Subject Area in 1994, he did not check the perforated intervals or otherwise question the identification of the top of the formation at the Upper Pictured Cliffs sandstone.

12

(42) In a written statement provided to the Division in conjunction with its hearing in Case No. 11996, Merrion, the assignor of the interests in the Fruitland Coal formation to Whiting and Pictured Cliffs formation to Pendragon indicated its concurrence with Pendragon's identification of the upper Pictured Cliffs interval and the historic recognition of that interval as Pictured Cliffs by Merrion and other operators in the area. (Exhibit N-43.) Merrion further stated its belief that the Pendragon Chaco Wells are appropriately perforated in the Pictured Cliffs formation and that it had no intention of conveying to Pendragon wells that were perforated in other zones. Merrion also stated that it never intended to farm-out to Whiting the rights to zones where the Pendragon Chaco Wells were perforated.

is this
part of
de novo
record?

12

(38)



CASE NO. 11996
Order No. R-11133-A
Page 13

(43) Whiting contends that the top of the first "massive" sandstone below the lowermost coal of the Fruitland formation should be the ~~definitional~~ basis for picking the top of the Pictured Cliffs formation. The geologic testimony and evidence shows that such a definition has little support in the geologic literature and that the arbitrary and undefined term ~~of~~ "massive" makes its application impractical. The geologic literature for the area and industry practice indicates that it is more common to place the contact between the Fruitland and Pictured Cliffs formations at the top of the highest ophiomorpha-major bearing sandstone. Consequently, the more widely accepted technical definition of a Pictured Cliffs sandstone ~~is~~ ^{concerns} whether the formation is of marine deposition, ~~such as shoreline, wave-dominated, delta-front chenier, barrier bar and tidal channel-type environments.~~ In addition, the use of the "massive" definition would ~~also~~ ^{basin} conflict with Order No. R-8768, establishing the equivalent stratigraphic interval designated as the Fruitland Coal gas pool. ^{See Fruitland (52)}

how?

(44) The evidence and testimony of the geologists established that the definition of "massive" utilized in the AGI Glossary of Geology includes beds that are more than ten centimeters (four inches) in thickness or more than 1.8 meters (six feet) in thickness. Accordingly, under this definition, the Upper Pictured Cliffs sandstone tongues would be considered as "massive" sands.

(45) Whiting's expert geologist advocated the use of a twenty-foot cut-off for defining the boundaries of Pictured Cliffs sandstone tongues and urged the Commission to disregard any deposits thinner than twenty feet. The witness testified the twenty-foot cut-off was used in a mapping study over a very wide area in the northern part of the San Juan Basin. However, Whiting's expert geologist acknowledged that the cut-off is a product of a "good average" and that Pictured Cliffs sandstone tongues less than twenty feet thick do exist. Additional geological literature evidence documents the occurrence of the Upper Pictured Cliffs sandstone in the WAW field in tongues from fifteen feet to three feet in thickness. Consequently, while the selection of a twenty-foot cut-off may be appropriate for a broad, academic geological study, its use by the Commission in this proceeding would lead to an ~~unnecessarily~~ arbitrary result.

(46) The testimony further established that the use of a twenty-foot cut-off for mapping the extent of Pictured Cliffs tongues is not practical and would cause significant Pictured Cliffs gas reserves to be arbitrarily disregarded.

(47) A 1994 type log published by ~~the~~ Whiting's expert geologist (Exhibit W-4) reflects a tongue of the Pictured Cliffs ~~within~~ ^{formation} the Fruitland formation above the so-called the "massive" sand of the main body of the Pictured Cliffs sandstone. This tongue is referred to by the author as UPI, which the author explains stands for "upper Pictured Cliffs sandstones or upper Pictured Cliffs tongues." This interpretation of Whiting's expert geologist supports that of Pendragon's.

doesn't the WAW field occur above the top of the PC?

12

12

12

12

12

JB

(48) The interval from the top of the "upper Pictured Cliffs sandstone," as mapped by Pendragon, to the top of the main body of the Pictured Cliffs is composed of a variety of rock types including marine sandstones, silt stones, shales, and thin coals. It has been the long-standing and accepted custom and practice of industry and the various regulatory agencies to place this entire interval within the Pictured Cliffs sandstone. This industry and regulatory agency practice conforms to the standards of the North American Stratigraphic Code and the International Stratigraphic Guide, which state, "where a rock unit passes into another by integrating or interfingering of two or more kinds of rock...the boundary is necessarily arbitrary and should be selected on the basis of practicality."

(49) The boundary between the Fruitland formation and the Pictured Cliffs sandstone has been placed by industry and accepted by regulatory agencies to be at the top of the "upper Pictured Cliffs sand" as that interval has been referred to in these proceedings. The "upper Pictured Cliffs sand" is marine and as such, conforms to the Fassett and Hinds (1971) definition of the top of the Pictured Cliffs as marked by the highest marine sandstone. The boundary placed by industry also meets the test of practicality and as such, fully conforms to the dictates of the North American Stratigraphic Code and the International Stratigraphic Guide.

(50) The identification and utilization of the Upper Pictured cliffs sandstone tongue to establish the ~~vertical boundaries~~ ^{top} of the Pictured Cliffs formation by industry and the governmental regulatory agencies is a long-established custom and practice. Such custom and practice is to be accorded significant weight.

(51) The ~~vertical~~ boundary between the Fruitland formation and Upper Pictured Cliffs sandstone in the Subject Area conforms to the base of the "Fruitland (coal gas) formation" in the assignment from Bayless and Merriion to Whiting and with the base of the "Fruitland Coal formation" in the assignment from Bayless and Merriion to Pendragon. ~~This formational boundary also conforms to accepted industry and regulatory interpretation. It conforms to the intentions of the parties: Whiting to produce from the "Coal Gas Formation"; and Merriion to sell Pictured Cliffs producing wells.~~

some of this is
redundant —
see (14) & (15)

Can we really equate the pool to the formation??

(52) In defining the vertical limits of the Basin Fruitland Coal gas pool, the Division's Order No. R-8768 utilizes the phrase "all coal seams within the equivalent of the stratigraphic interval" ~~of the rock occurring at a specified depth in the well log for the Amoco Production Company Snyder Gas Com B Well No. 1.~~ ^{refers to} The term "equivalent" means that one can determine at geographically separated stations that the rocks in question are the same. ^{includes that} Accordingly, the use of the phrase "stratigraphic equivalent" means "lithostratigraphic equivalent." From the definition in Order No. R-8768, the vertical limits of the Basin Fruitland Coal gas pool ^{to the} are the coals in rocks which are lithostratigraphically equivalent with the Fruitland formation. In the Subject Area, rocks downward from the top of the "upper Pictured Cliffs sand" mapped by Pendragon are part of the Pictured Cliffs sandstone and are not a lithostratigraphic equivalent to the Fruitland formation. ^{to the reference interval in the well log for Amoco well} Accordingly, the interval in question is not part of the Basin Fruitland Coal gas pool or the WAW Fruitland sand.

7
4

(53) The preponderance of the geologic evidence establishes that the Pendragon Chaco Wells are producing from a zone that is stratigraphically equivalent to an interval below the base of the Basin Fruitland Coal gas pool. Moreover, the classification of the upper sandstone interval as Pictured Cliffs is supported by a preponderance of the geologic evidence and is consistent with the interpretation by the larger scientific community, by industry and by governmental agencies.

(54) The preponderance of the geologic evidence establishes that the Pendragon Chaco Wells are completed in and are producing from the Pictured Cliffs formation sandstone intervals and from their appropriate common source of supply.

(55) Whiting's request that the Commission establish the base of the Fruitland formation in the subject area at the top of the "massive" sandstone below the lowermost continuous coal should be denied.

Engineering Issue

(56) Whiting, the owners and operators of the Whiting Fruitland Coal Wells on the one hand, and Pendragon, the owner and operator of the Pendragon Chaco Wells on the other, each contend that the other's well stimulation treatments caused their separately owned formations to become communicated. Both parties contend that their wells are experiencing interference and that gas is being produced out of zone as a result.

(57) The Fruitland Coal formation became communicated with the Pictured Cliffs formation as a result of the fracture stimulation treatments performed on both the Pendragon Chaco Wells by Pendragon and the Whiting Fruitland Coal Wells by Whiting.

(58) The stimulation work on Whiting Fruitland Coal Wells in 1992 created communication channels near the wellbore region between the Fruitland Coal and Pictured

Cliffs formations. At the time, the gas in the Picture Cliffs formation was nearly depleted and very little gas could escape to the Fruitland Coal formation, unless the Whiting Fruitland Coal Wells were operated under extremely low pressures. On the other hand, the adsorbed gas in the Fruitland Coal formation stayed within the coal matrices before pressure became low enough for gas to be desorbed by the dewatering process.

(59) After the dewatering process, substantial amounts of adsorbed gas escaped from the coal matrices, especially in the near wellbore region where pressure was low. As a result, the Whiting Fruitland Coal Wells began their gas productions economically. The desorbed gas moving toward the Whiting Fruitland Coal Wells may move to the Picture Cliffs formation through the communication channels near the Whiting Fruitland Coal Wells if the local pressure in the Picture Cliffs formation is lower than that in the Fruitland Coal formation. It is possible that gas in the Picture Cliffs formation may have migrated to the Fruitland Coal formation through the communication channels if the production pressures at the Whiting Fruitland Coal Wells were low. However, these possible gas migrations were not significant, evidenced by steady gas production from the Pendragon Chaco Wells.

(60) In 1995, after three years of the dewatering process, the gas bubble near the Whiting Fruitland Coal Wells was extended. This gas bubble is moving toward the Pendragon Chaco Wells. In addition to the gas migration near the communication channels, at the edge of the bubble, the gas pressure in the Fruitland Coal formation is believed to be higher than the adjacent pressure in the lower Picture Cliffs formation. It is possible that, at the area of this relatively high pressure contrast (gas pressure differences between adjacent Fruitland Coal and Picture Cliffs formation), the thin capillary barrier might be broken, allowing gas migration between two zones. Some unexplainable pressure readings in the Picture Cliffs formation might occur.

(61) By analyzing the post-treatment gas productions of the Pendragon Chaco Wells, it is seen that the stimulation work performed by Pendragon was successful in breaking into some high pressure gas compartments. One possibility is that the hydraulic fractures were extended upward to the Fruitland Coal formation and generated a gas highway to the gas bubble. This possibility has been vigorously denied by Pendragon's experts. Instead, they concluded that an additional gas compartment, the so-called "third bench" below the Picture Cliffs, was assumed to exist. This assumption is believed to be untrue, based upon the following reasons:

- (a) no "third bench" was reported throughout the San Juan region;
- (b) no geological evidence exists of this kind of formation;
- (c) no scientific reason exists to explain why the hydraulic fracture moved only downward; and
- (d) the upward-moving gases that evolved from the source rock needed geological time to recharge the Picture Cliffs formation.

Therefore, the most reasonable explanation of these sudden significant increases of the fracturing treatment was that the hydraulic fractures penetrated into the gas bubble

established in the Fruitland Coal formation.

(62) Both Pendragon and Whiting presented volumetric and material balance calculations. Although the calculation procedure is well documented in many textbooks, the procedure used in their calculations and arguments failed to adequately describe the dynamics of the continuous communications between two zones and the water movements.

e
(63) Many Picture Cliffs wells reported significant gas increases after fracturing. It should be noted in most cases the owners of the Picture Cliffs formation are the same as the owners of the Fruitland Coal formation. Also, spacing for a Picture Cliffs well is 160 acres while spacing for a Fruitland Coal well is 320 acres.

(64) As the original Picture Cliffs gas was relatively dry, it is *unlike* hard to believe that the four Pendragon Chaco Wells suffered from the same magnitude of damage due to (a) scale precipitation, (b) water blockage and (c) migration of clay fines.

The (65) Experts of hydraulic fracturing for both Pendragon and Whiting presented their own simulation results. Each result was in favor of their own theories. Many input values of key parameters are questionable. Both simulators used have good reputation in assisting in designing a fracturing job but it is easy to manipulate *input values of parameters* them incorrectly. *in this case* [In a case like this,] their results were too exaggerated to be adopted by this Commission.

(66) In the BTU analysis, Whiting showed that gas contents of the Pendragon Chaco Wells were slightly diluted from 1988 to 1995 and were significantly reduced from 1995 to 1997. Perhaps, the two zones communicated with each other long before Pendragon's actions in 1995. It should be noted that some BTU values reported for a Picture Cliffs well in the San Juan region must be considered as values for a highly fractured Picture Cliffs well.

the

IT IS THEREFORE ORDERED: