"The Zone & the Box"

James L. Bullen, Attorney

Bryan S. Groves, Geologist

LAPL 2009 Spring Educational Seminar

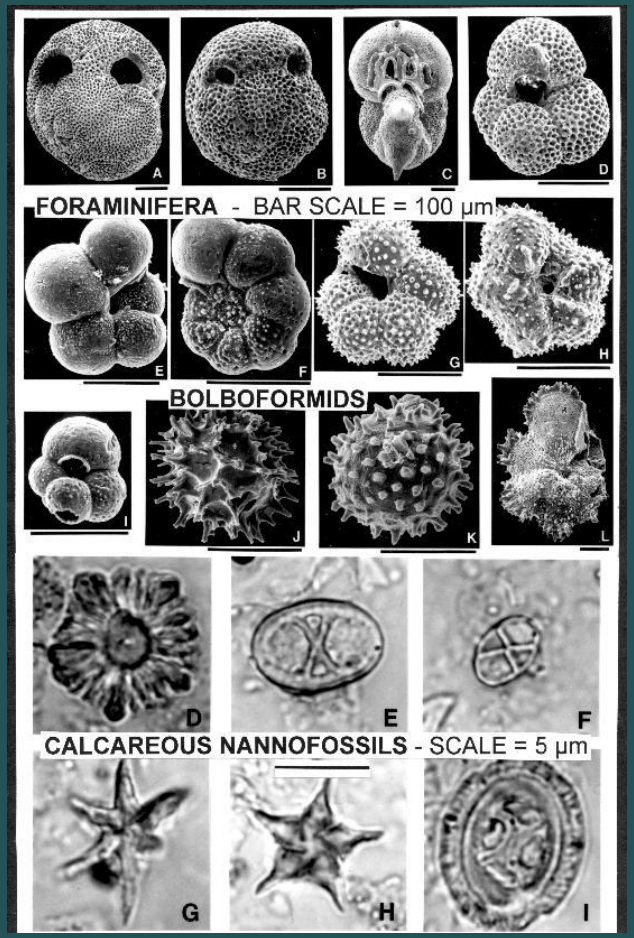
Friday, May 15, 2009

"The Zone & the Box"

OUTLINE

- Oil & gas geology 101
- Overview of unit types
- Unitization process
- Overview of interval definition types
- Sample case
- Conclusions
- Legal lagniappe

"The Zone & the Box"
GEOLOGY 101, MICROFOSSILS (NAMES)



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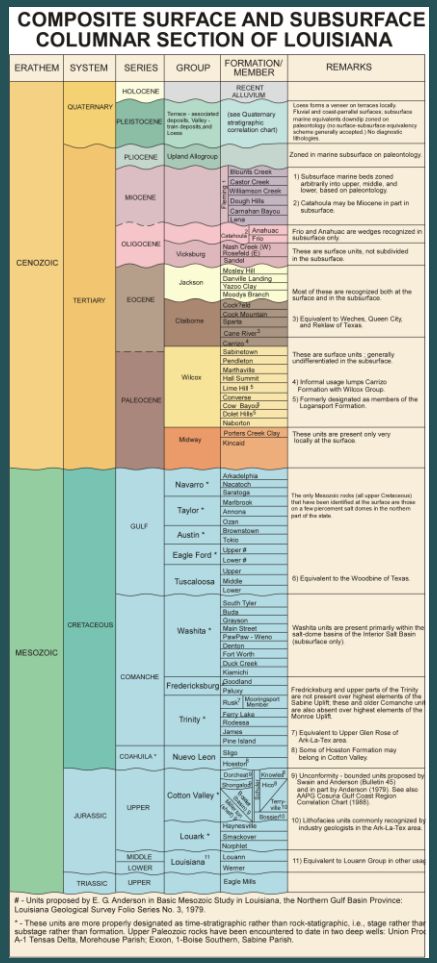
"The Zone & the Box"
GEOLOGY 101, STRATIGRAPHY (names)



COMPOSITE SURFACE AND SUBSURFACE COLUMNAR SECTION OF LOUISIANA

ERATHEM	SYSTEM	SERIES	GROUP	FORMATION/ MEMBER	REMARKS
CENOZOIC	QUATERNARY	HOLOCENE		RECENT ALLUVIUM	
		PLEISTOCENE	Terrace - associated deposits, Valley - train deposits,and Loess	(see Quaternary stratigraphic correlation chart)	Loess forms a veneer on terraces locally. Fluvial and coastal-parrallel surfaces; subsurface marine equivalents downdip zoned on paleontology (no surface-subsurface equivalency scheme generally accepted.) No diagnostic lithologies.
	TERTIARY	PLIOCENE	Upland Allogroup		Zoned in marine subsurface on paleontology
		MIOCENE		Pascagoula: Biloxi: Bioumis Creek, Castor Creek, Williamson Creek, Dough Hills, Carnahan Bayou, Lena	1) Subsurface marine beds zoned arbitrarily into upper, middle, and lower, based on paleontology 2) Catahoula may be Miocene in part in subsurface.
		OLIGOCENE	Vicksburg	Catahoula[2]: Anahuac, Frio; Nash Creek (W), Bosenfeld (E); Sandel	Frio and Anahuac are wedges recognized in subsurface only. These are surface units, not subdivided in the subsurface.
		EOCENE	Jackson	Mosley Hill, Danville Landing, Yazoo Clay, Moodys Branch	Most of these are recognized both at the surface and in the subsurface.
			Claiborne	Cook Mtn., Cook Mountain, Sparta, Cane River[3], Carrizo[4]	3) Equivalent to Weches, Queen City, and Reklaw of Texas.
		PALEOCENE	Wilcox	Sabinetown, Pendleton, Marthaville, Hall Summit, Lime Hill[5], Converse, Cow Bayou[5], Dolet Hills[5], Naborton	These are surface units : generally undifferentiated in the subsurface. 4) Informal usage lumps Carrizo Formation with Wilcox Group. 5) Formerly designated as members of the Logansport Formation.
			Midway	Porters Creek Clay, Kincaid	These units are present only very locally at the surface.
MESOZOIC	CRETACEOUS	GULF	Navarro *	Arkadelphia, Nacatoch, Saratoga	The only Mesozoic rocks (all upper Cretaceous) that have been identified at the surface are those on a few piercement salt domes in the northern part of the state.
			Taylor *	Marlbrook, Annona, Ozan	
			Austin *	Brownstown, Tokio	
			Eagle Ford *	Upper #, Lower #	
			Tuscaloosa	Upper, Middle, Lower	6) Equivalent to the Woodbine of Texas.
		COMANCHE	Washita *	South Tyler, Bells, Grayson, Main Street, PawPaw - Weno, Denton, Fort Worth, Duck Creek, Kiamichi	Washita units are present primarily within the salt-dome basins of the Interior Salt Basin (subsurface only).
			Fredericksburg	Goodland, Paluxy	Fredricksburg and upper parts of the Trinity are not present over highest elements of the Sabine Uplift; these and older Comanche units are also absent over highest elements of the Monroe Uplift.
			Trinity *	Rusk[7] / Mooringsport Member, Ferry Lake, Rodessa, James, Pine Island	7) Equivalent to Upper Glen Rose of Ark-La-Tex area.
		COAHUILA *	Nuevo Leon	Sligo, Hosston[8]	8) Some of Hosston Formation may belong in Cotton Valley
	JURASSIC	UPPER	Cotton Valley *	Dorcheat[9], Knowles, Bodcau[9], Hico[9], Buckner[9], Terryville[10], Bossier[10]	9) Unconformity - bounded units proposed by Swain and Anderson (Bulletin 45) and in part by Anderson (1979). See also AAPG Cotaurla Gulf Coast Region Correlation Chart (1988).
			Louark *	Haynesville, Smackover, Norphlet	10) Lithofacies units commonly recognized by industry geologists in the Ark-La-Tex area.
		MIDDLE	Louisiana [11]	Louann	11) Equivalent to Louann Group in other usage
		LOWER		Werner	
	TRIASSIC	UPPER		Eagle Mills	

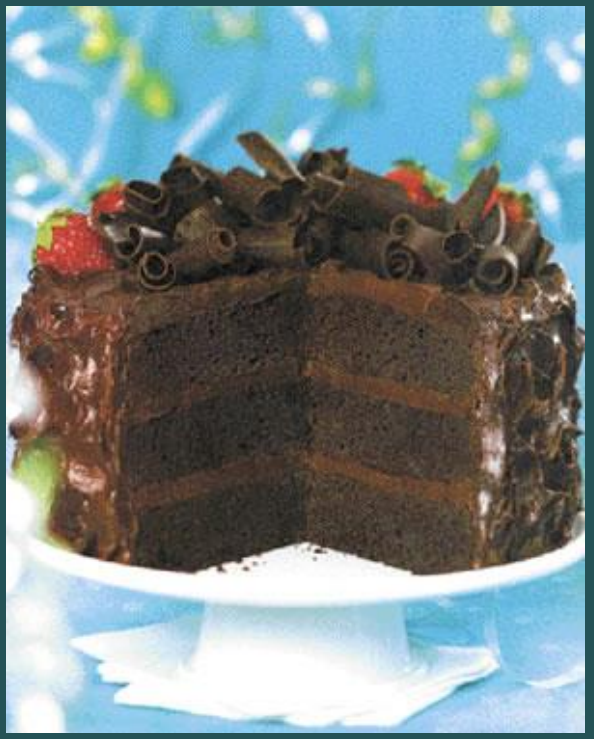
- Units proposed by E. G. Anderson in Basic Mesozoic Study in Louisiana, the Northern Gulf Basin Province: Louisiana Geological Survey Folio Series No. 3, 1979.

*- These units are more properly designated as time-stratigraphic rather than rock-statigraphic, i.e., stage rather than substage rather than formation. Upper Paleozoic rocks have been encountered to date in two deep wells: Union Prod A-1 Tensas Delta, Morehouse Parish; Exxon, 1-Boise Southern, Sabine Parish.

+/- 5 million years ago

+/- 62 million years ago

+/- 135 million years ago



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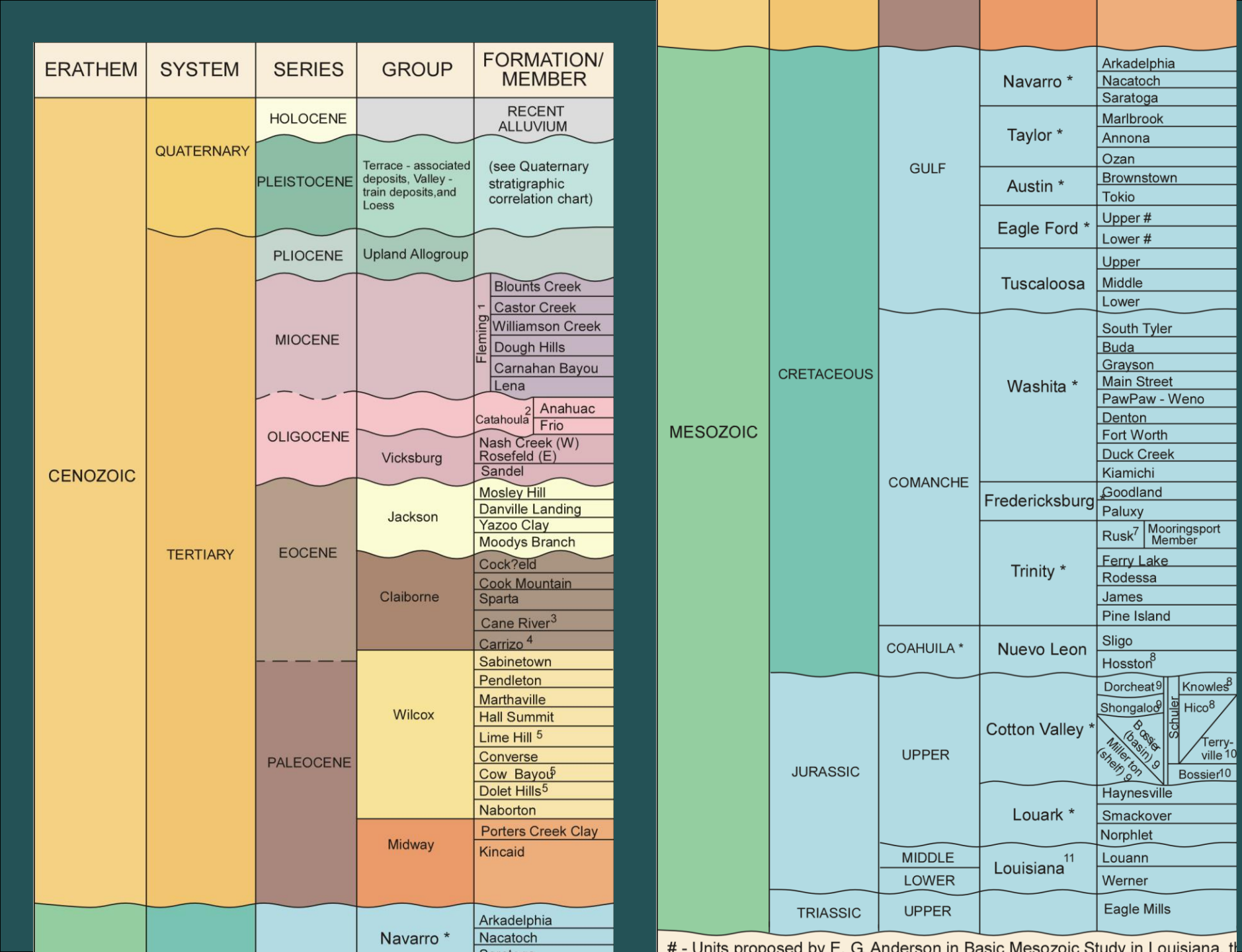
ERATHEM
SYSTEM
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FORMATION/ MEMBER
CENOZOIC
QUATERNARY
TERTIARY
HOLOCENE
PLEISTOCENE
PLIOCENE
MIOCENE
OLIGOCENE
EOCENE
PALEOCENE
RECENT ALLUVIUM
(see Quaternary stratigraphic correlation chart)
Terrace - associated deposits, Valley - train deposits,and Loess
Upland Allogroup
Fleming 1
Blounts Creek
Castor Creek
Williamson Creek
Dough Hills
Carnahan Bayou
Lena
Catahoula 2
Anahuac
Frio
Vicksburg
Nash Creek (W) Rosefeld (E)
Sandel
Jackson
Mosley Hill
Danville Landing
Yazoo Clay
Moodys Branch
Claiborne
Cock?eld
Cook Mountain
Sparta
Cane River 3
Carrizo 4
Wilcox
Sabinetown
Pendleton
Marthaville
Hall Summit
Lime Hill 5
Converse
Cow Bayou 5
Dolet Hills 5
Naborton
Midway
Porters Creek Clay
Kincaid
Navarro *
Arkadelphia
Nacatoch
MESOZOIC
CRETACEOUS
JURASSIC
TRIASSIC
GULF
COMANCHE
COAHUILA *
UPPER
MIDDLE
LOWER
UPPER
Navarro *
Arkadelphia
Nacatoch
Saratoga
Taylor *
Marlbrook
Annona
Ozan
Austin *
Brownstown
Tokio
Eagle Ford *
Upper #
Lower #
Tuscaloosa
Upper
Middle
Lower
Washita *
South Tyler
Buda
Grayson
Main Street
PawPaw - Weno
Denton
Fort Worth
Duck Creek
Kiamichi
Fredericksburg *
Goodland
Paluxy
Trinity *
Rusk 7
Mooringsport Member
Ferry Lake
Rodessa
James
Pine Island
Nuevo Leon
Sligo
Hosston 8
Cotton Valley *
Dorcheat 9
Shongaloo 9
Bossier (basin) 9
Millerton (shelf) 9
Schuler
Knowles 8
Hico 8
Terry-ville 10
Bossier 10
Louark *
Haynesville
Smackover
Norphlet
Louisiana 11
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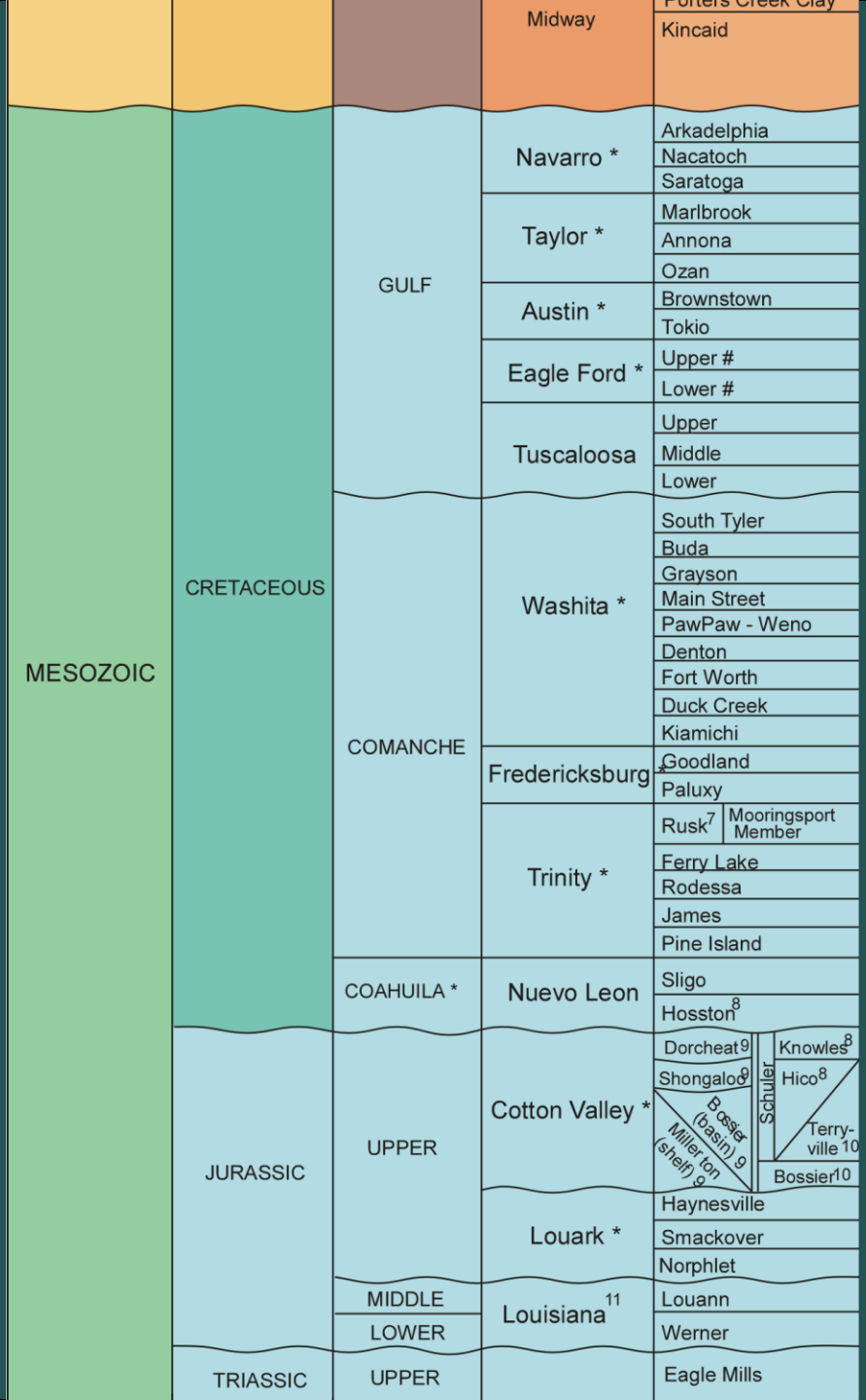

NORTH LOUISIANA

Austin (chalk)

Tuscaloosa

Paluxy

Rodessa

Sligo

Hosston

Cotton Valley

Haynesville

Smackover

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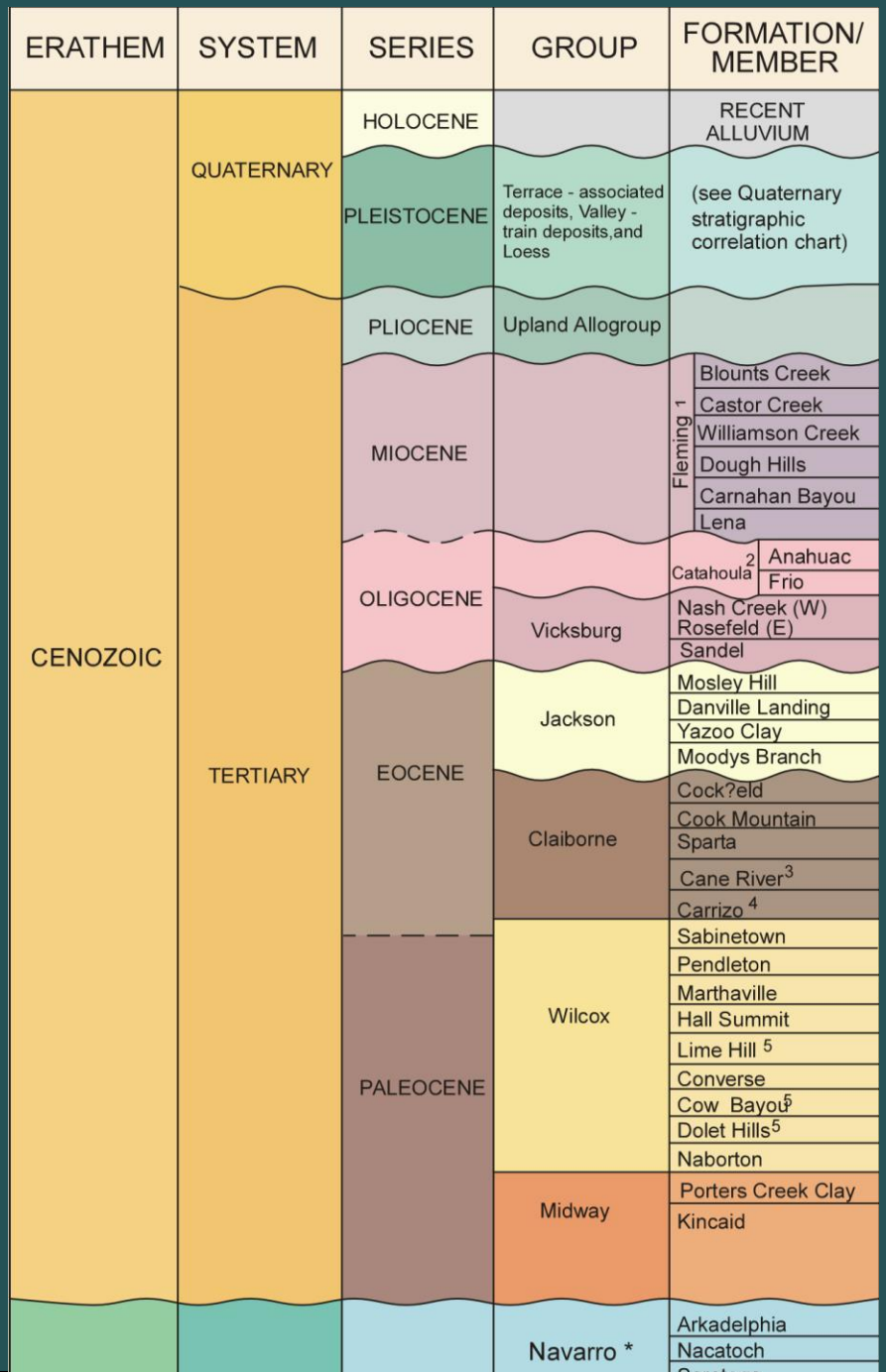

SOUTH LOUISIANA

Anahuac (fm.)

Frio (fm.)

Vicksburg

Jackson

Wilcox

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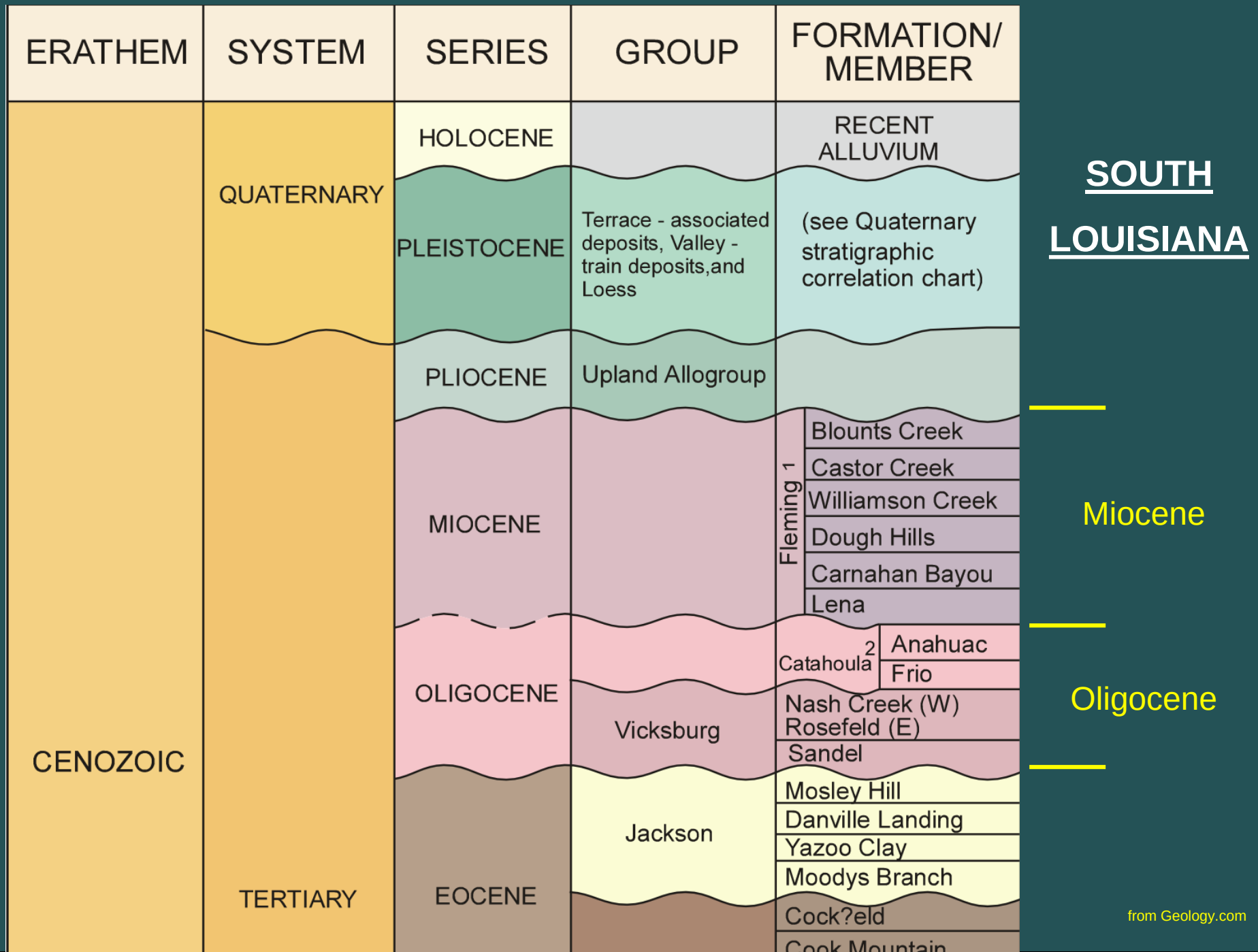
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Yazoo Clay
Moodys Branch
Cock?eld
Cook Mountain
SOUTH LOUISIANA
Miocene
Oligocene
from Geology.com

Microfossils

REGIONAL FOSSIL ZONES IN GULF COAST TERTIARY

– CONFIDENTIAL –

	AGE	TEXAS GULF COAST AND OFFSHORE	SW LOUISIANA AND OFFSHORE	SE LOUISIANA AND OFFSHORE
MIOCENE	UPPER MIOCENE	Cristellaria (M) Bigenerina (A) Discorbis (12) Textularia (L) Bigenerina (2)/Cibicides carstensi	Cristellaria (M) Bigenerina (A) Bigenerina (B)/Discorbis (12) Textularia (L) Bigenerina (2)/Cibicides carstensi	Cristellaria (M) = Rob E Bigenerina (A) Amphistegina (E)/Cristellaria (K) Timbalier Bay fauna Bigenerina (B)/Discorbis (12) Textularia (L) Bigenerina (2)/Cibicides carstensi
	MIDDLE MIOCENE	Textularia (W) Bigenerina (3) Discorbis sp. (Onshore) Bigenerina (4) (Onshore) Cibicides opima Harang fauna Amphistegina (B) (Onshore)/ Robulus (L)	Textularia (W) Bigenerina (3) Cristellaria (I) Planulina (D) Cibicides opima Harang fauna Amphistegina (B)/Robulus (L)	Textularia (W) Bigenerina (3) Cristellaria (I) Planulina (D) Cibicides opima Harang fauna Amphistegina (B)/Robulus (L)
	LOWER MIOCENE	Discorbis bolivarensis Siphonina davisi Planulina palmerae	Eponides (E) Gyroidina sp. (ornate) Cristellaria cf. (A) Discorbis bolivarensis Lower Discorbis (B) fauna Basal Freshwater Bayou fauna Siphonina davisi Planulina palmerae Caldwell fauna Broussard fauna Abbeville assemblage	Camerina (1) Discorbis bolivarensis Lower Discorbis (B) fauna Siphonina davisi Planulina palmerae Caldwell fauna Abbeville assemblage
OLIGOCENE	UPPER OLIGOCENE ANAHUAC	Discorbis nomada Discorbis restricta Heterostegina sp. Marginulina idiomorpha Marginulina vaginata Marginulina howei	Discorbis nomada Discorbis restricta Heterostegina sp. Bolivina perca Marginulina idiomorpha Marginulina vaginata Marginulina howei Miogypsinoides (A)	Discorbis restricta Bolivina perca Marginulina idiomorpha Marginulina vaginata Marginulina howei Miogypsinoides (A)
	MIDDLE OLIGOCENE FRIO	Cibicides hazzardi Marginulina texana Bolivina (A) Hackberry assemblage Bolivina alazanensis Nonion struma Nodosaria blanpiedi Discorbis (D) Textularia seligi Anomalina bilateralis Cibicides (10) Textularia (2) Nonion (4) Discorbis (6)	Cibicides hazzardi Cristellaria (H) Marginulina texana Bolivina (A) Hackberry assemblage Bolivina alazanensis Nonion struma Nodosaria blanpiedi Discorbis (D)	Cibicides hazzardi Marginulina texana Bolivina (A) Hackberry assemblage Nonion struma Nodosaria blanpiedi Discorbis (D)
	LOWER OLIGOCENE	Textularia warreni or Vicksburg assemblage or Loxostoma (B) (downdip)	Vicksburg assemblage or Loxostoma (B) (downdip)	Vicksburg assemblage
	JACKSON	Discorbis cocoaensis Uvigerina cocoaensis or	Discorbis cocoaensis Uvigerina cocoaensis or	Discorbis cocoaensis Uvigerina cocoaensis or

Tex "L"

Amph. B

Siph. dav.

Planulina

Het.

Marg. howei

Cib. hazz.

Marg. tex.

Bol. mex.

N. s.

Nod. blan.

"The Zone & the Box"
GEOLOGY 101, STRATIGRAPHY (STRATA)

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"The Zone & the Box"
GEOLOGY 101, STRATA

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"The Zone & the Box"
GEOLOGY 101, ORIGIN OF FAULTS

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GEOLOGY 101, ORIGIN OF FAULTS

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GEOLOGY 101, ORIGIN OF FAULTS

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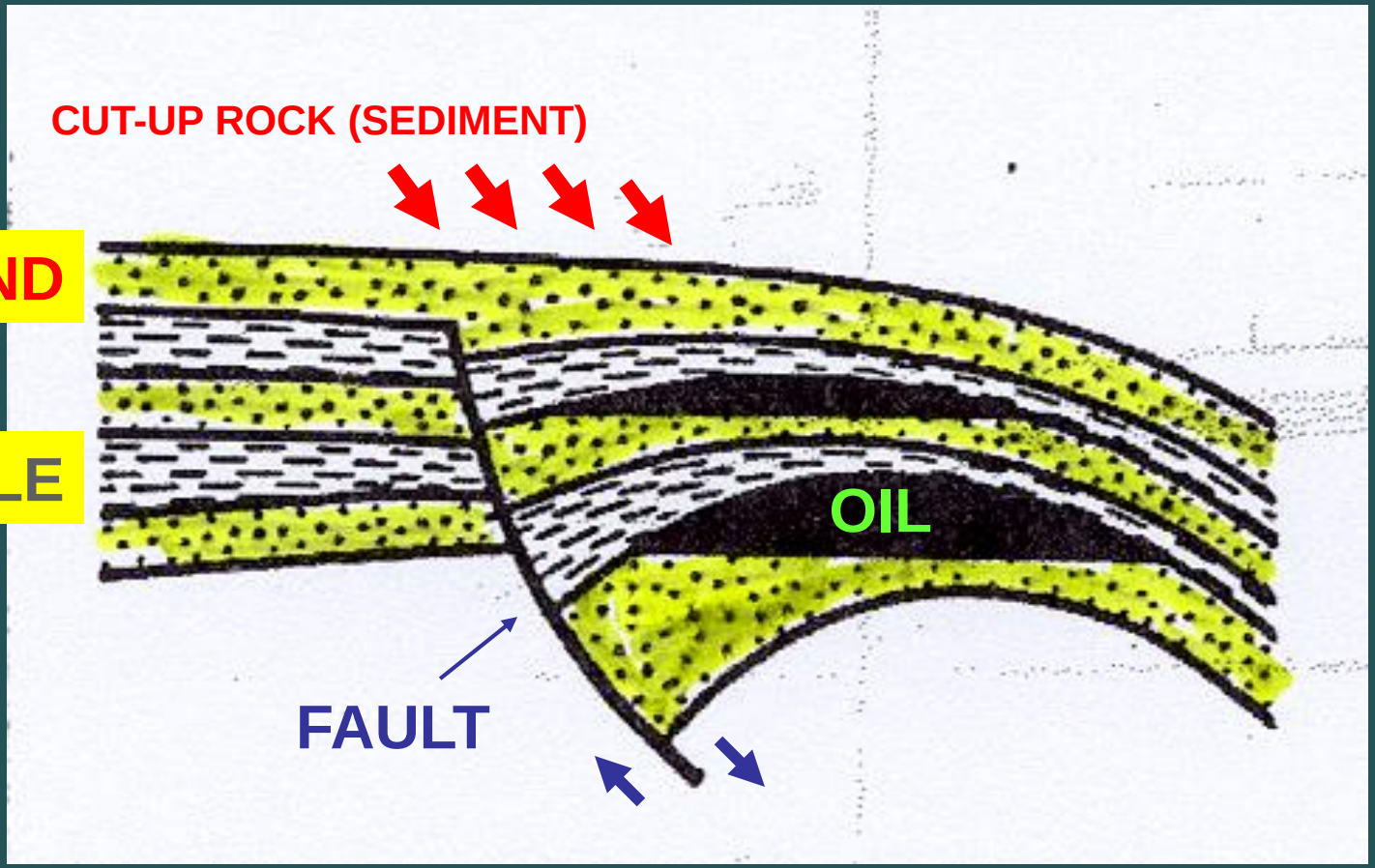
GEOLOGY 101, FAULTING



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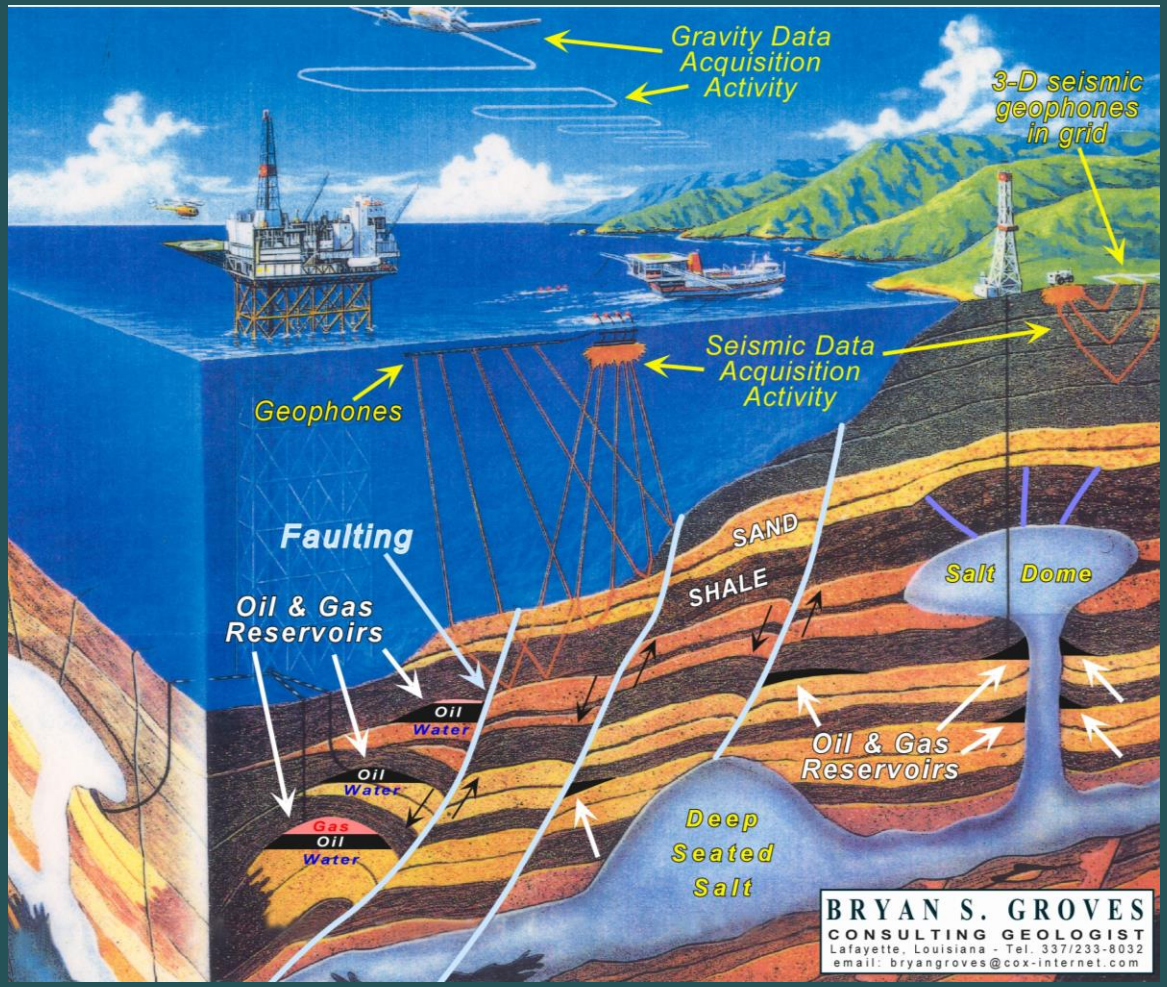
GEOLOGY 101, STRATA & FAULTS, ETC.



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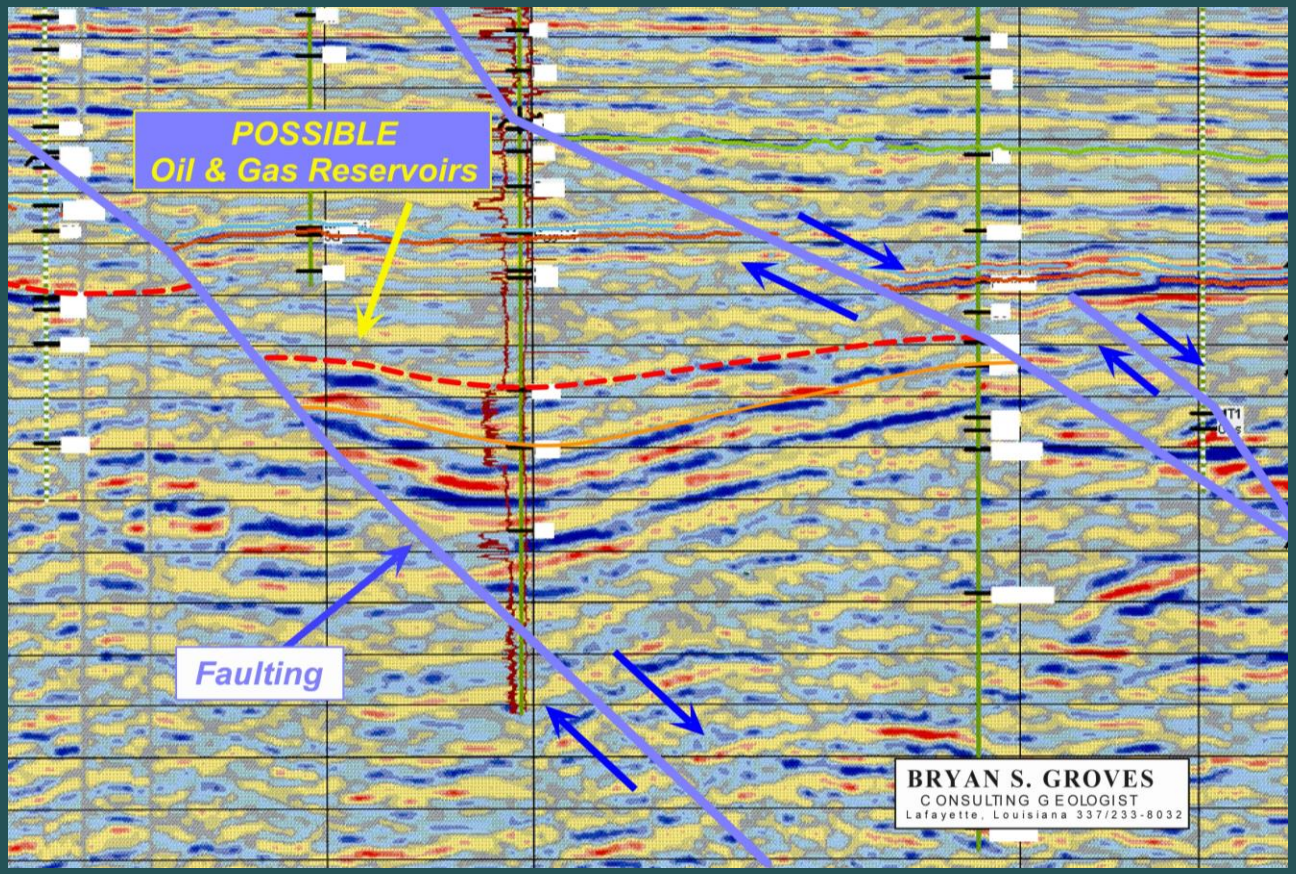
"The Zone & the Box"
SEISMIC DATA - VERTICAL SLICE



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"The Zone & the Box"
WHERE IS THE OIL?

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OIL AND GAS FLOAT ON WATER

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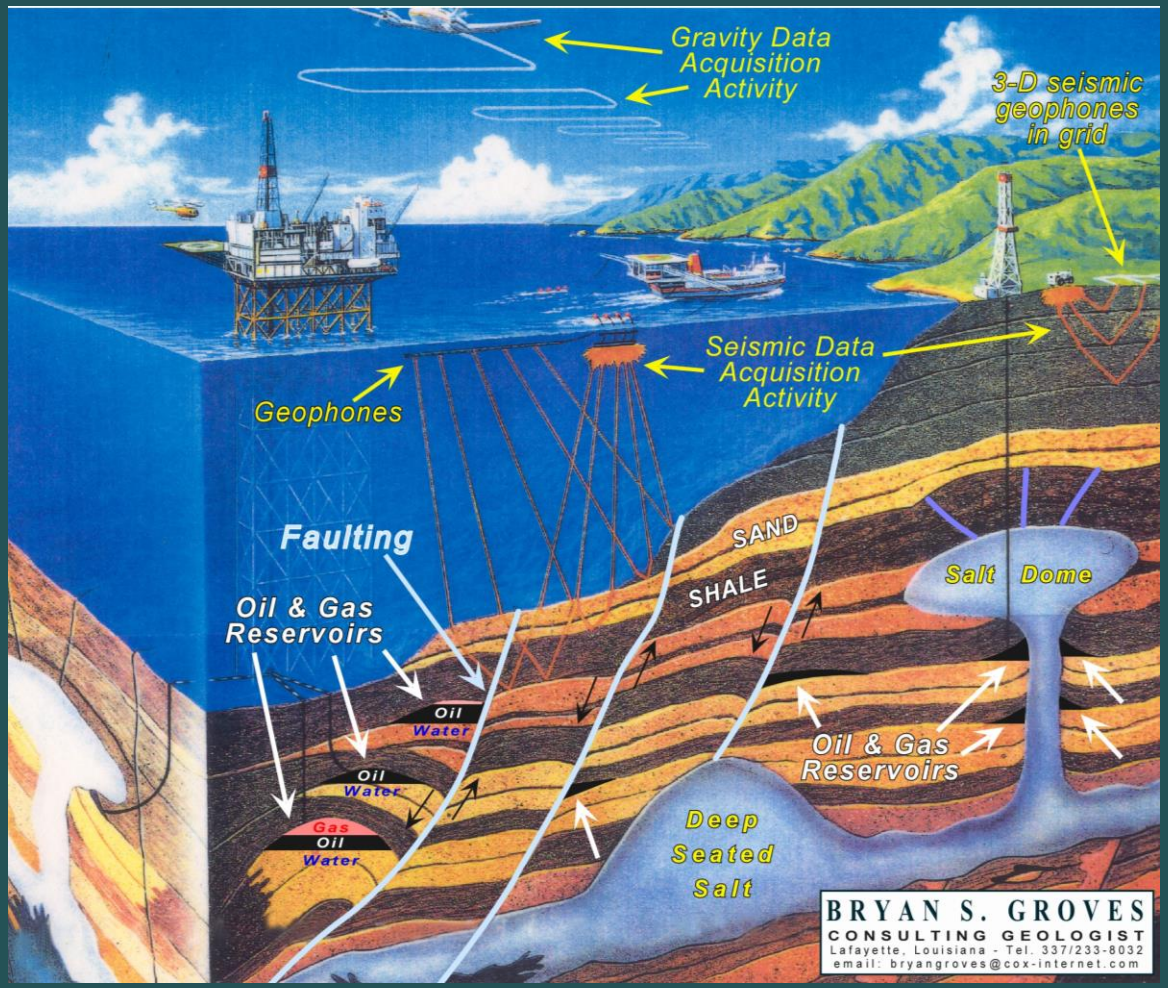
"The Zone & the Box"
RESERVOIR LIMITS



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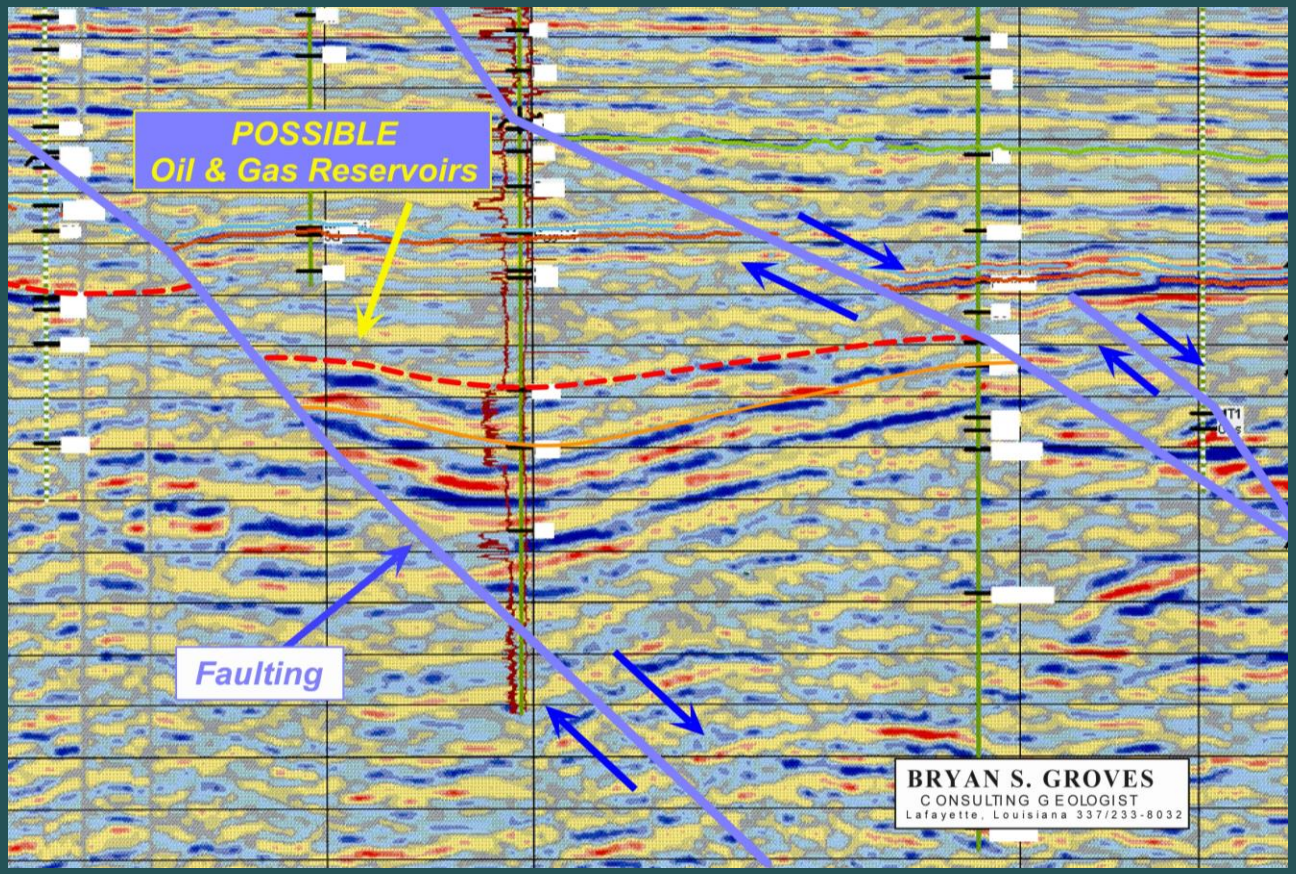

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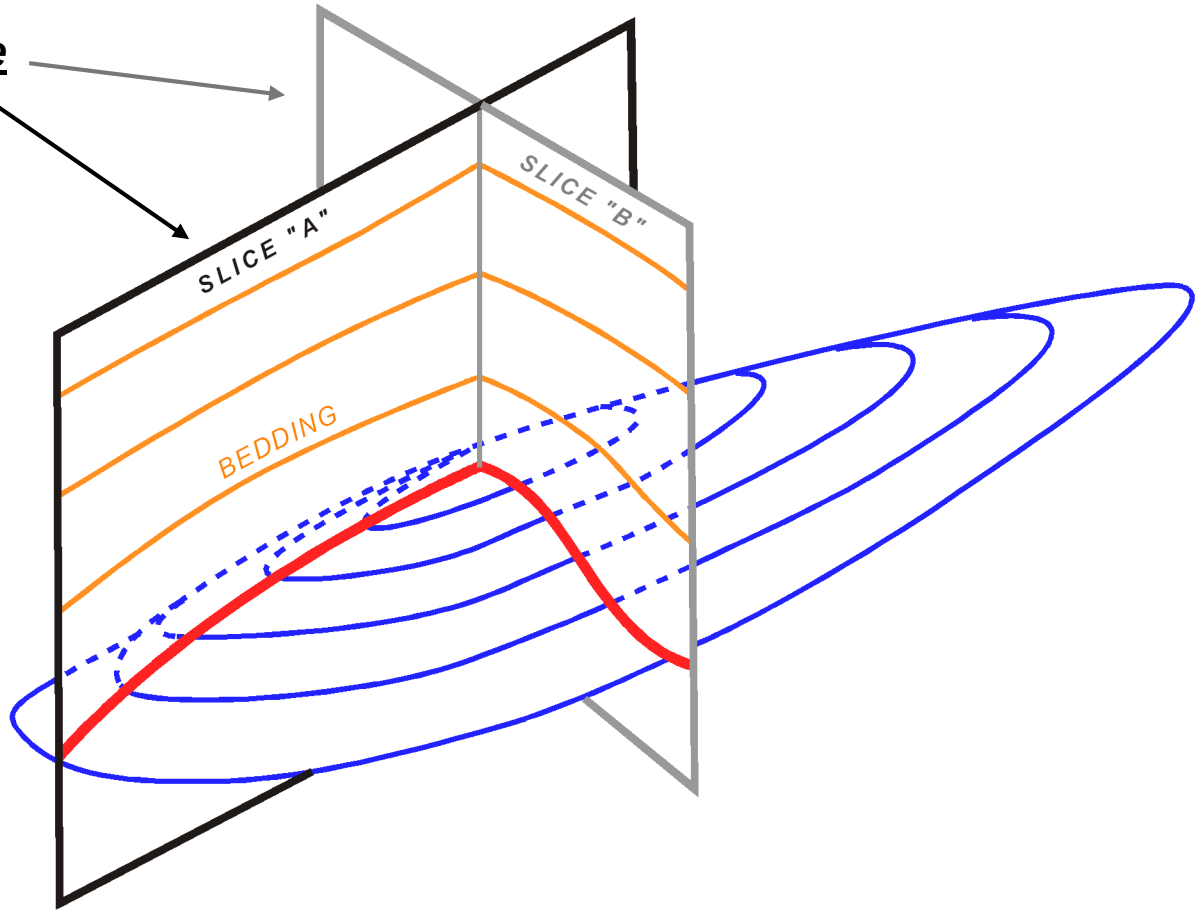
"The Zone & the Box"
RESERVOIR LIMITS

. . . the vertical slice

is the

seismic line . . .



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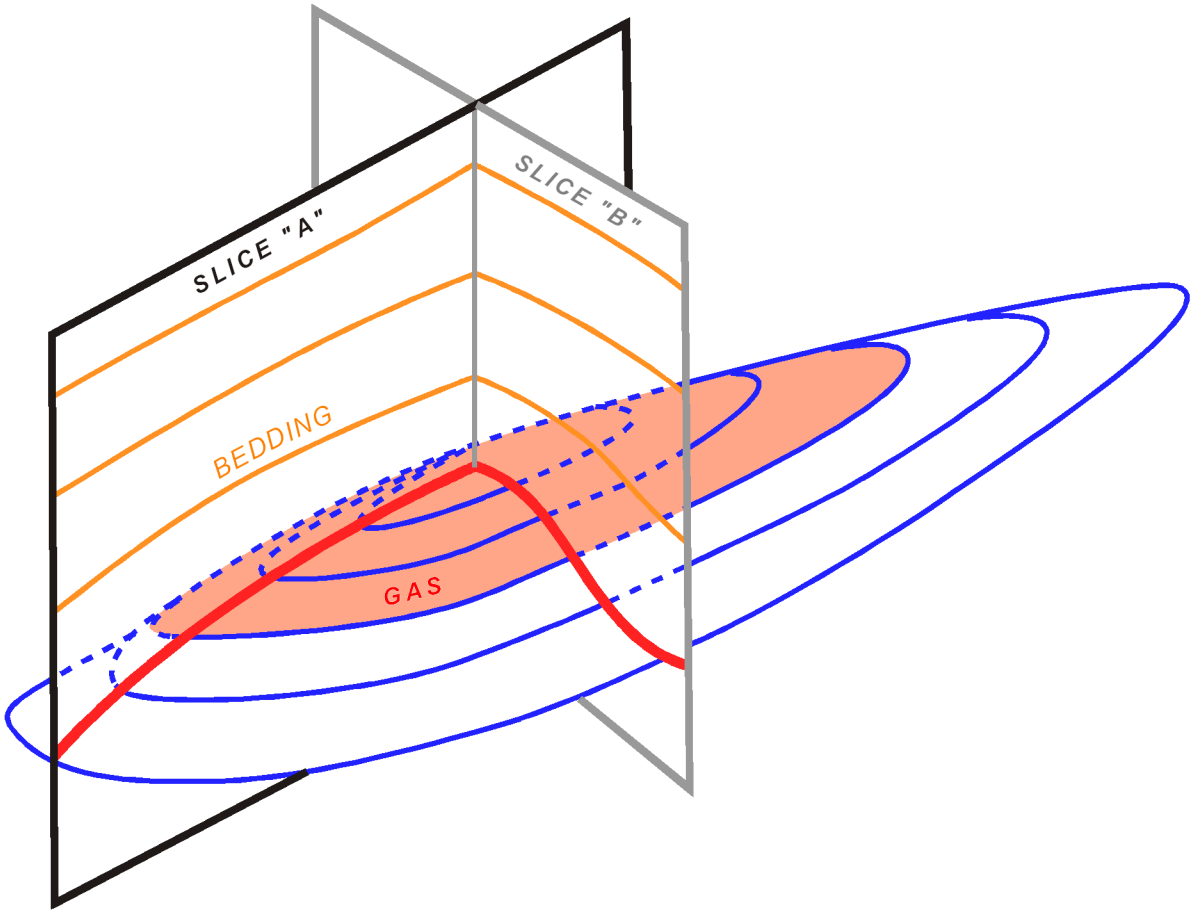

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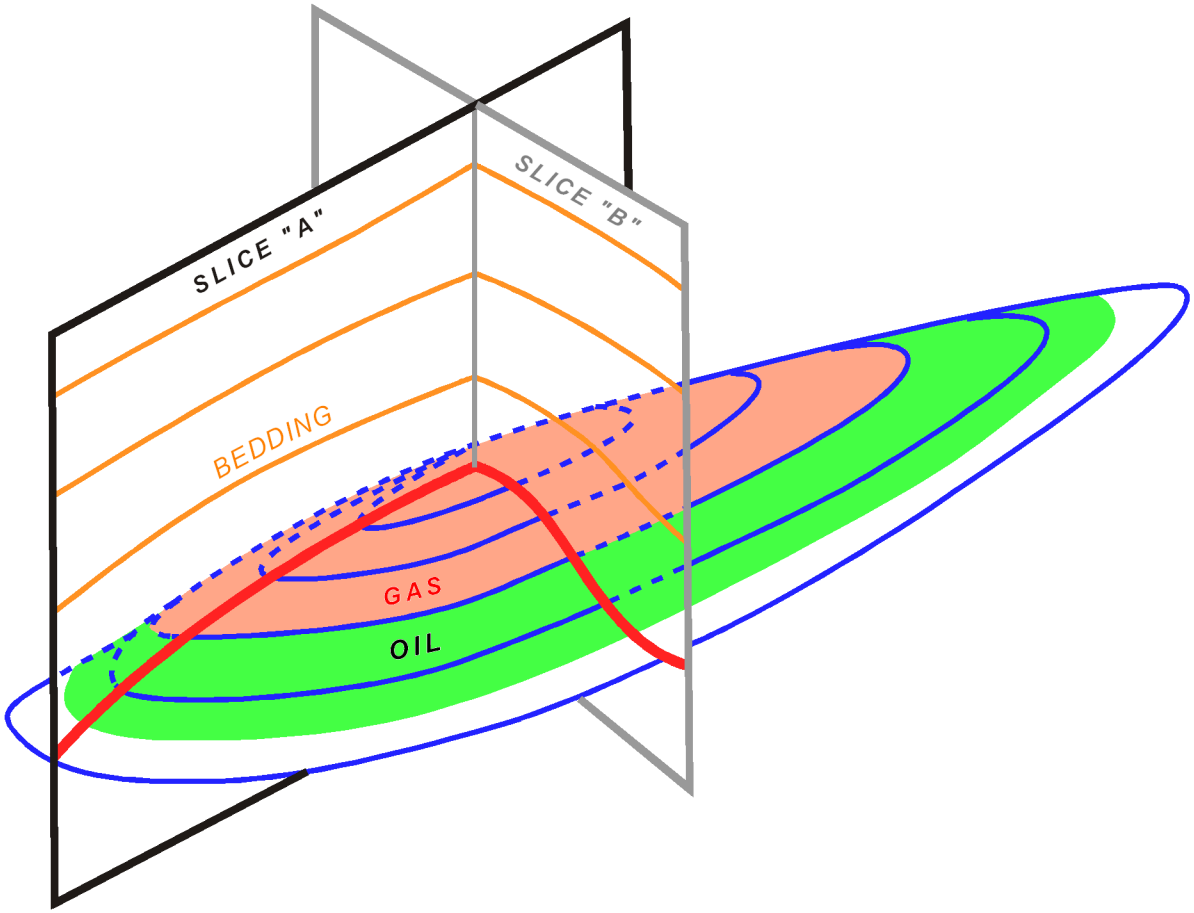

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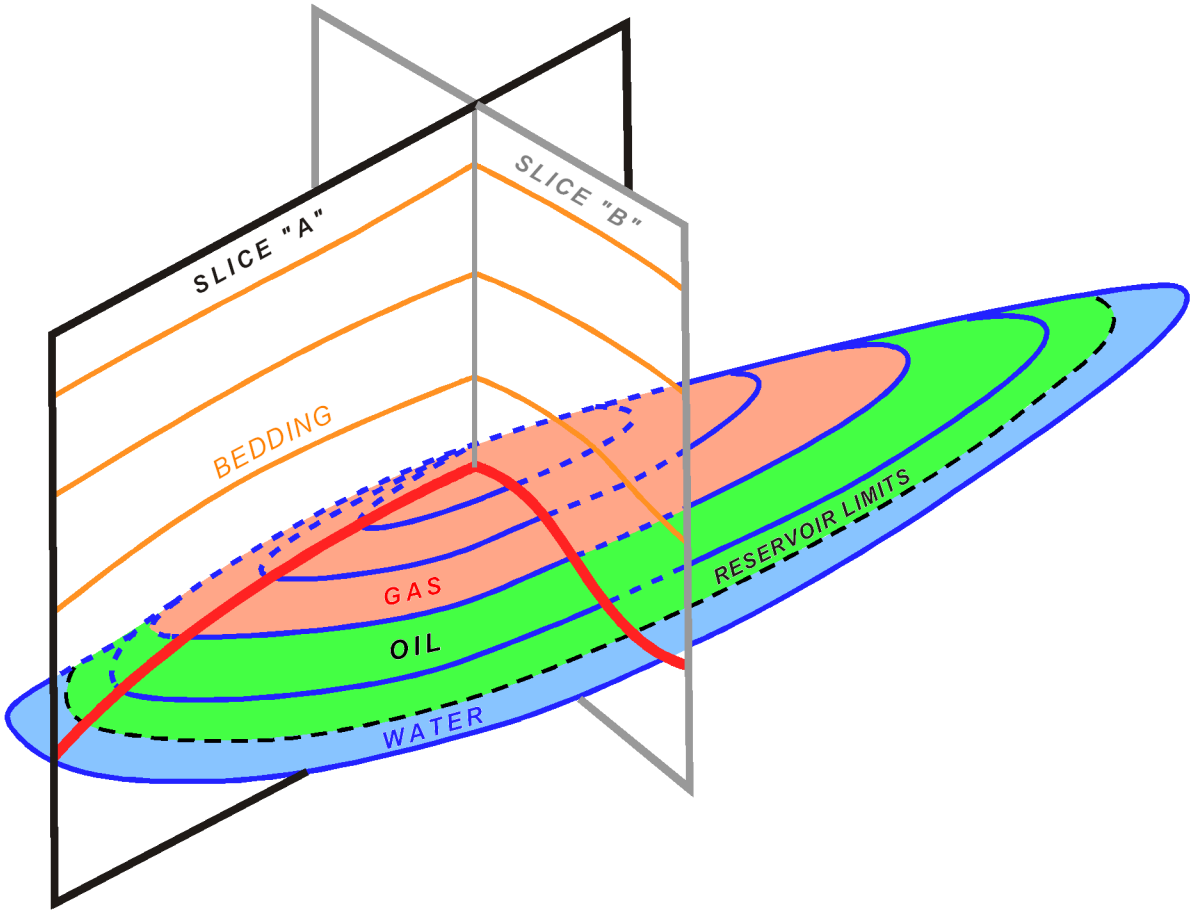

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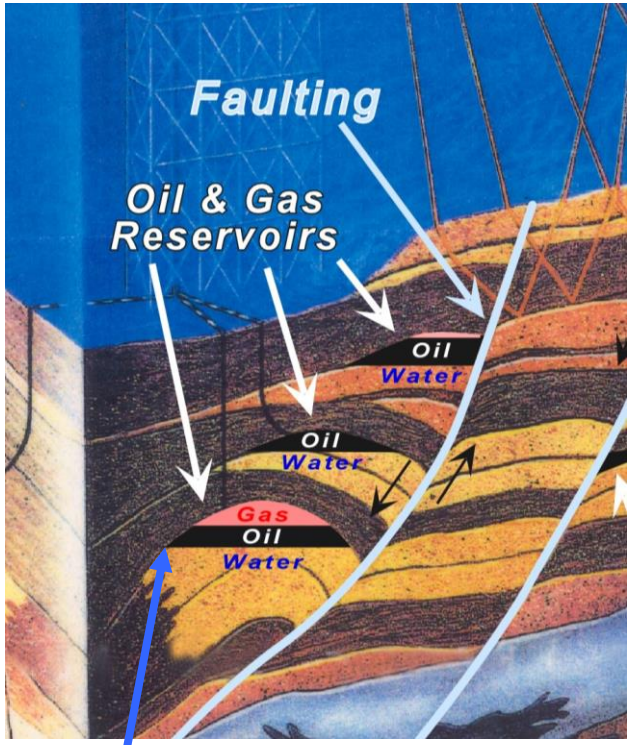
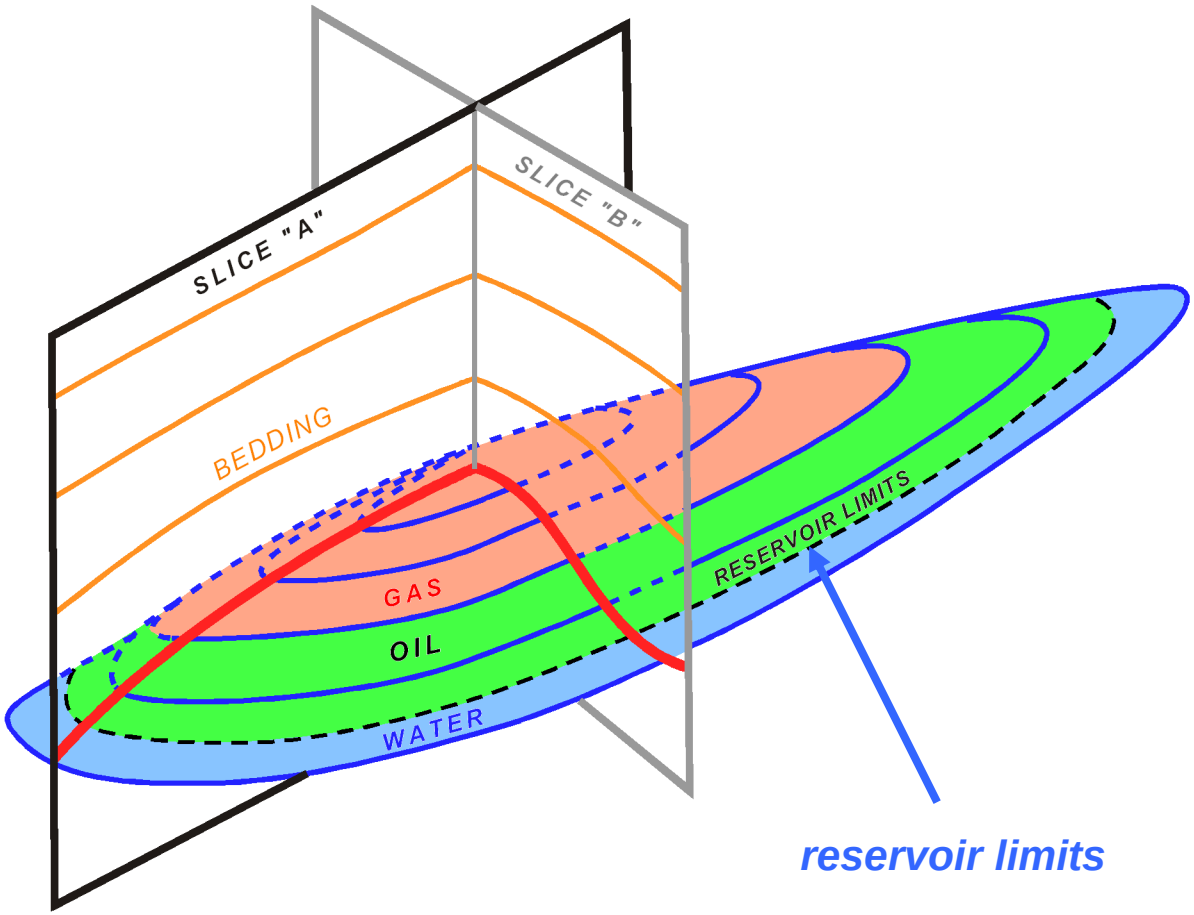


reservoir limits



reservoir limits

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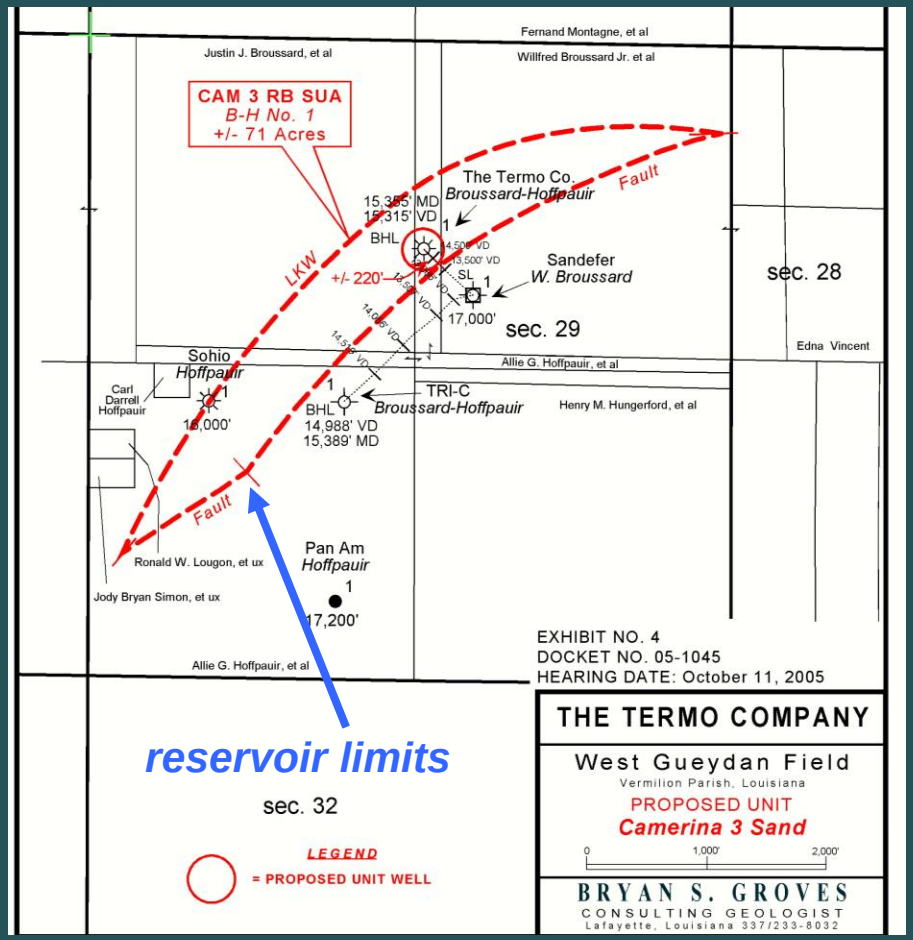
RESERVOIR LIMITS




Types of Units

"The Zone & the Box"
TYPES OF UNITS

- Voluntary: geographic per agreement
- Declared: per lease provisions
- Conservation: geologic or geographic per State

"The Zone & the Box"
TYPES OF UNITS

- Voluntary: geographic per agreement
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PRE-DRILL


Unitization Process

"The Zone & the Box"
UNITIZATION PROCESS, LDNR
(Rules of Procedure)

- Pre-Application Conference **Notice Letter**
- Pre-Application **Conference** (informal meeting to discuss proposed unit plans)
- **Application Letter** (docketed for hearing)
- **Hearing** (in Baton Rouge, LA)
- **Unit Order** signed by Commissioner of Conservation

"The Zone & the Box"
UNITIZATION PROCESS, LDNR

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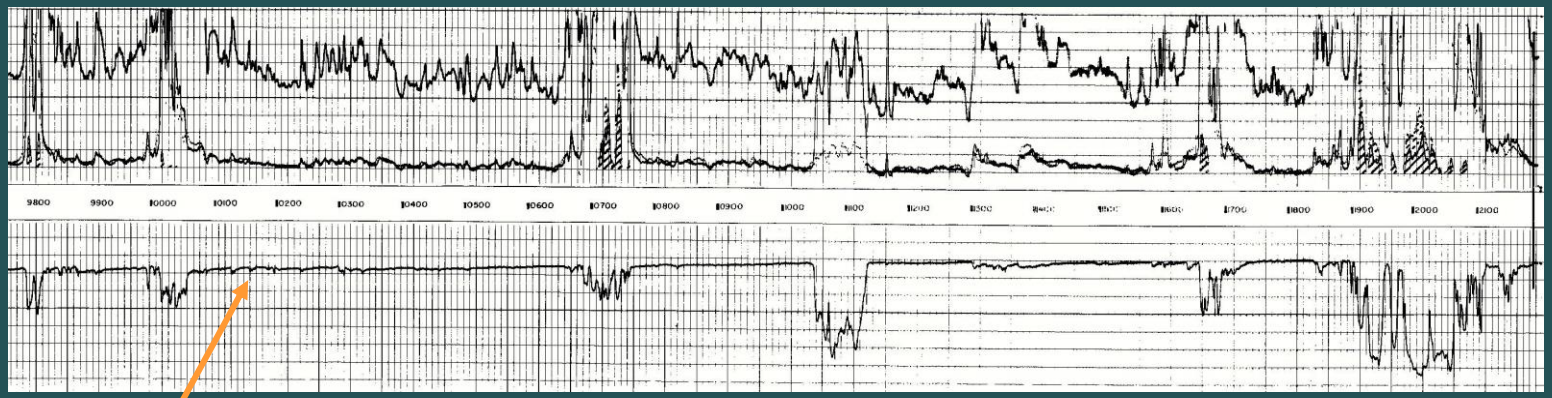
ENTIRE PROCESS TAKES APPROXIMATELY 90-120 DAYS


Logs

"The Zone & the Box"
ELECTRIC LOGS 101



SP CURVE
exhibits sand & shale

Sand
SP CURVE ↓

Shale
SP CURVE ↑


Types of Interval Definitions

"The Zone & the Box"
UNITIZATION, INTERVAL DEFINITION TYPES

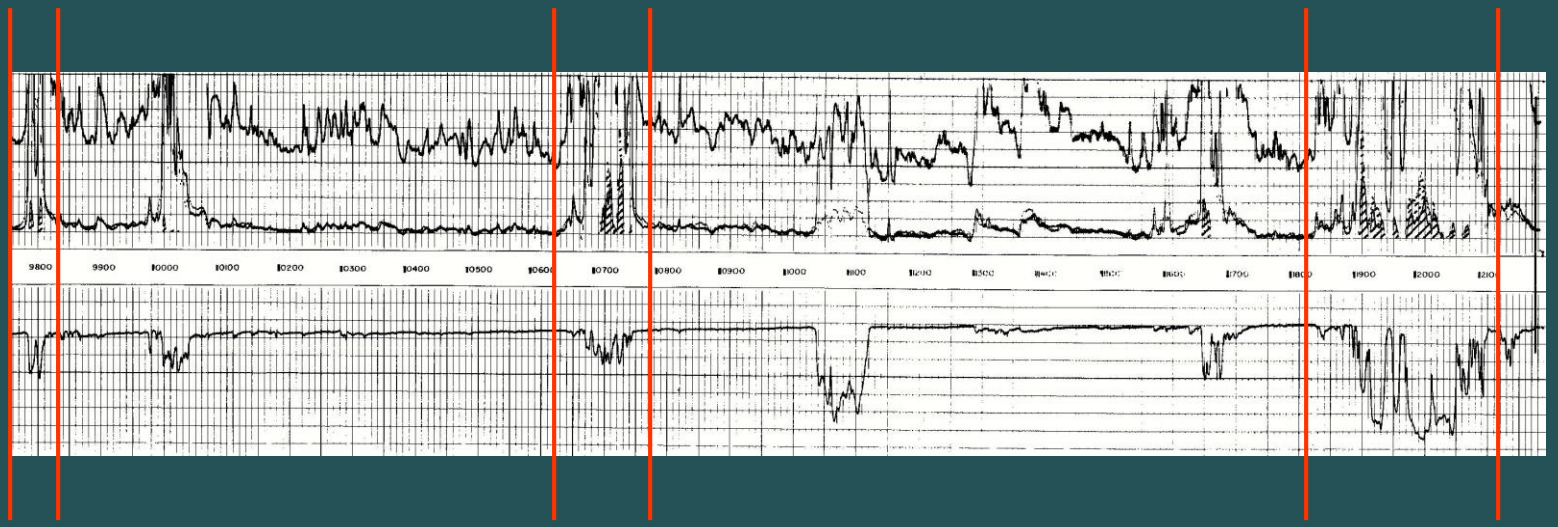
- Sand definition: includes one sand body

- Zone definition: includes more than one sand body

"The Zone & the Box"

UNITIZATION, INTERVAL DEFINITION TYPES

Sand definition: includes one sand body



"The Zone & the Box"
UNITIZATION, INTERVAL DEFINITION TYPES

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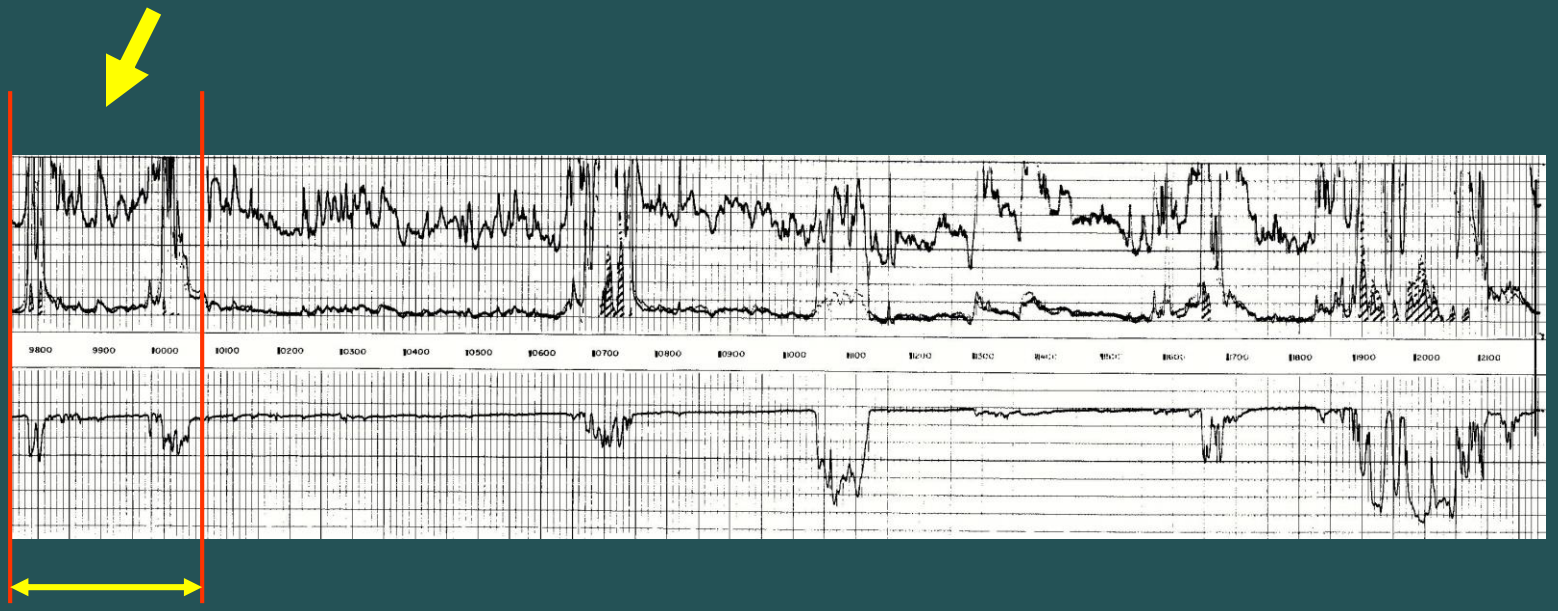
- **Zone definition**: includes **more than one sand body**

"The Zone & the Box"

UNITIZATION, INTERVAL DEFINITION TYPES

Zone definition: includes more than one sand body

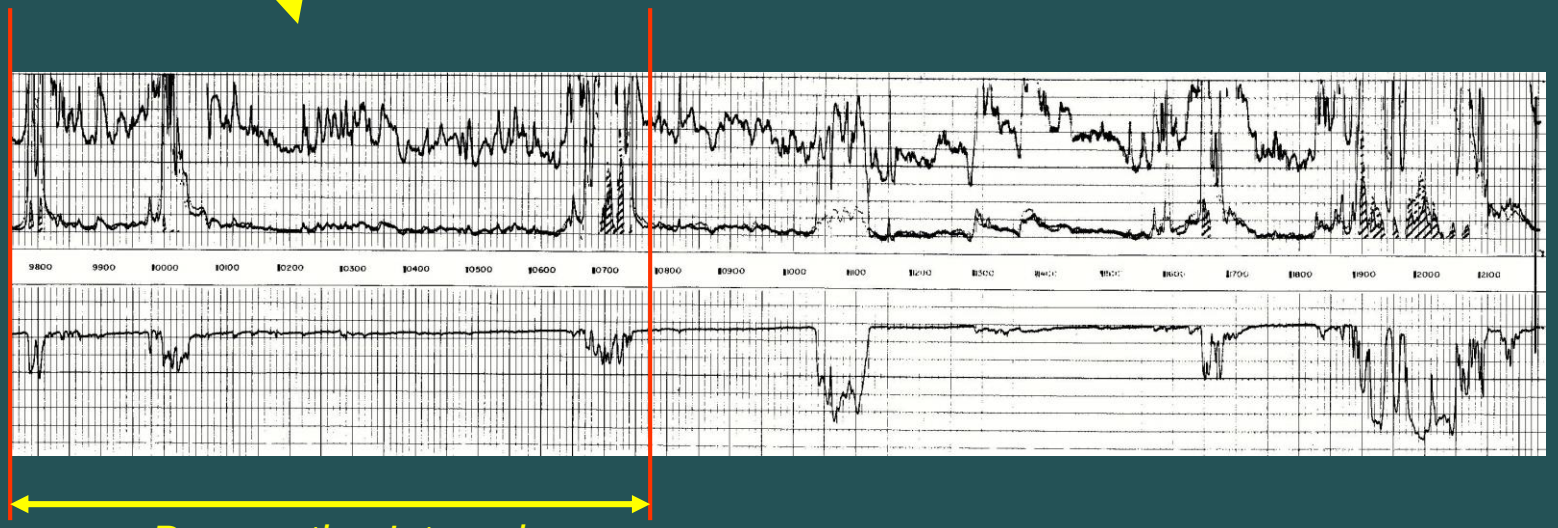


Prospective Interval

"The Zone & the Box"

UNITIZATION, INTERVAL DEFINITION TYPES

Zone definition: includes more than one sand body



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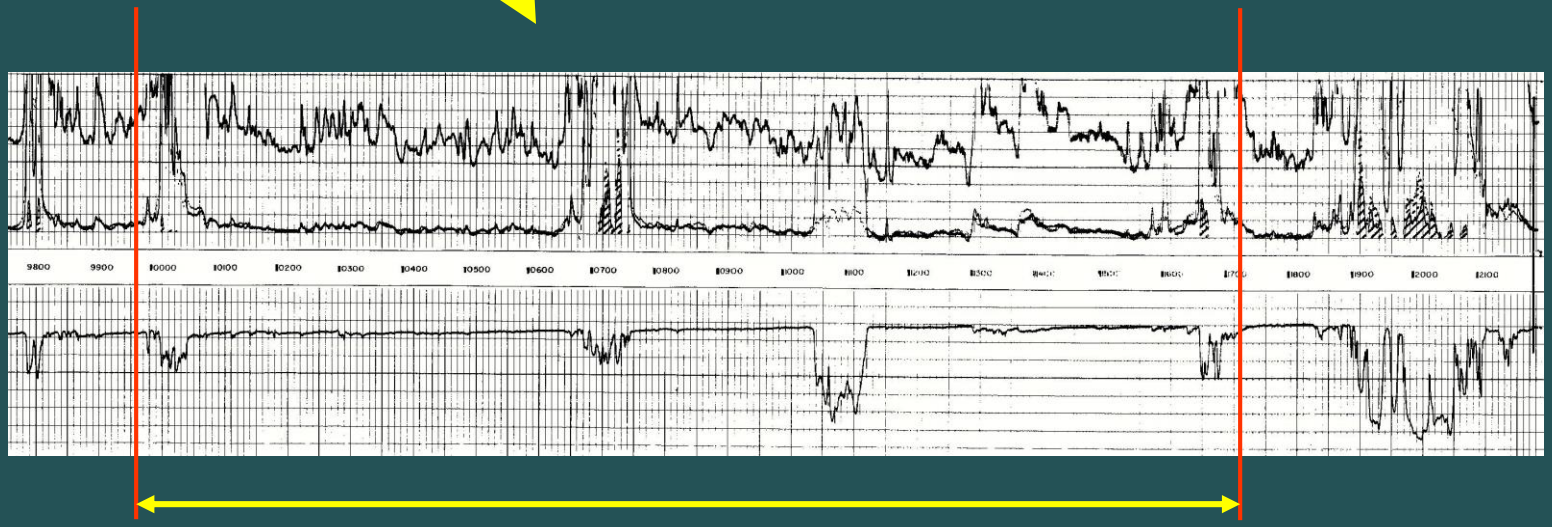
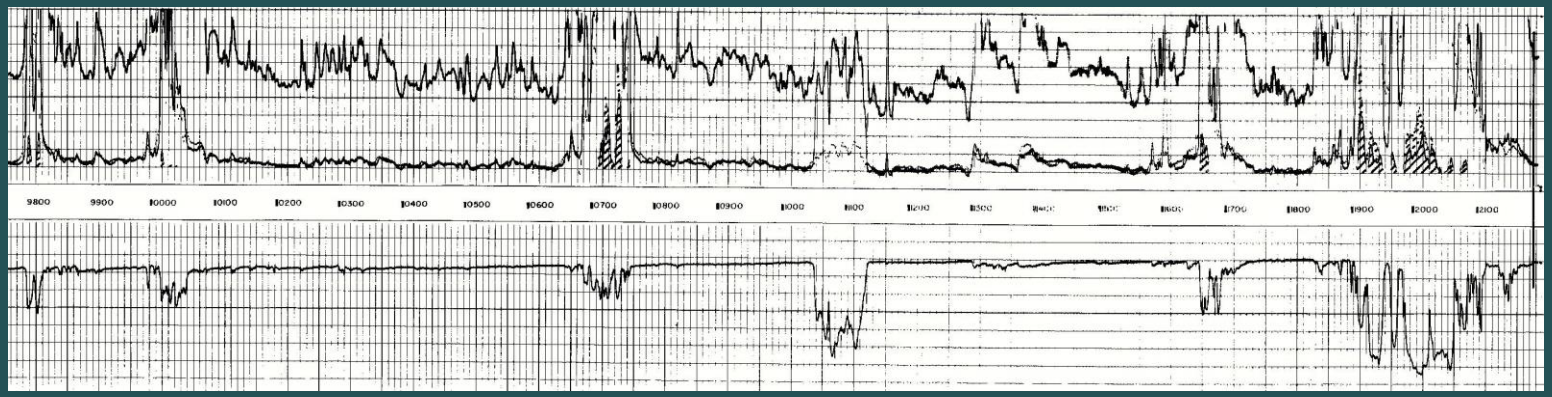


Prospective Interval

"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE



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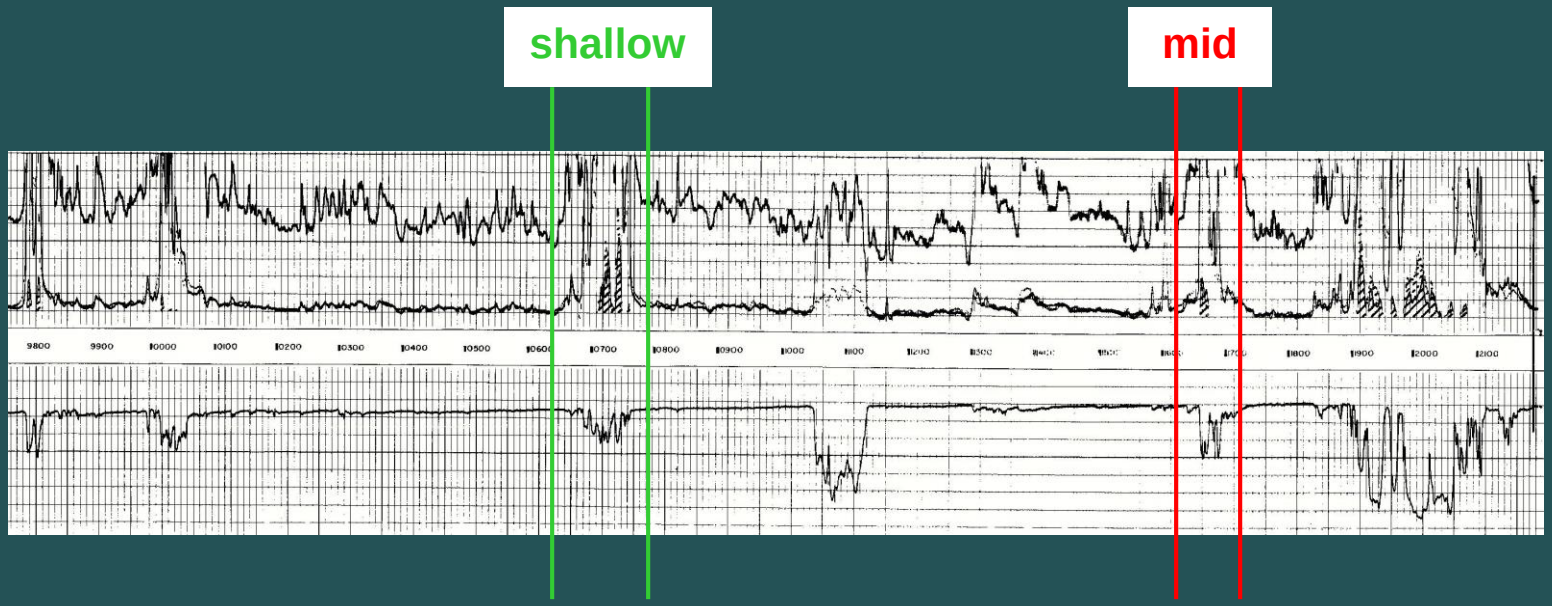
"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE

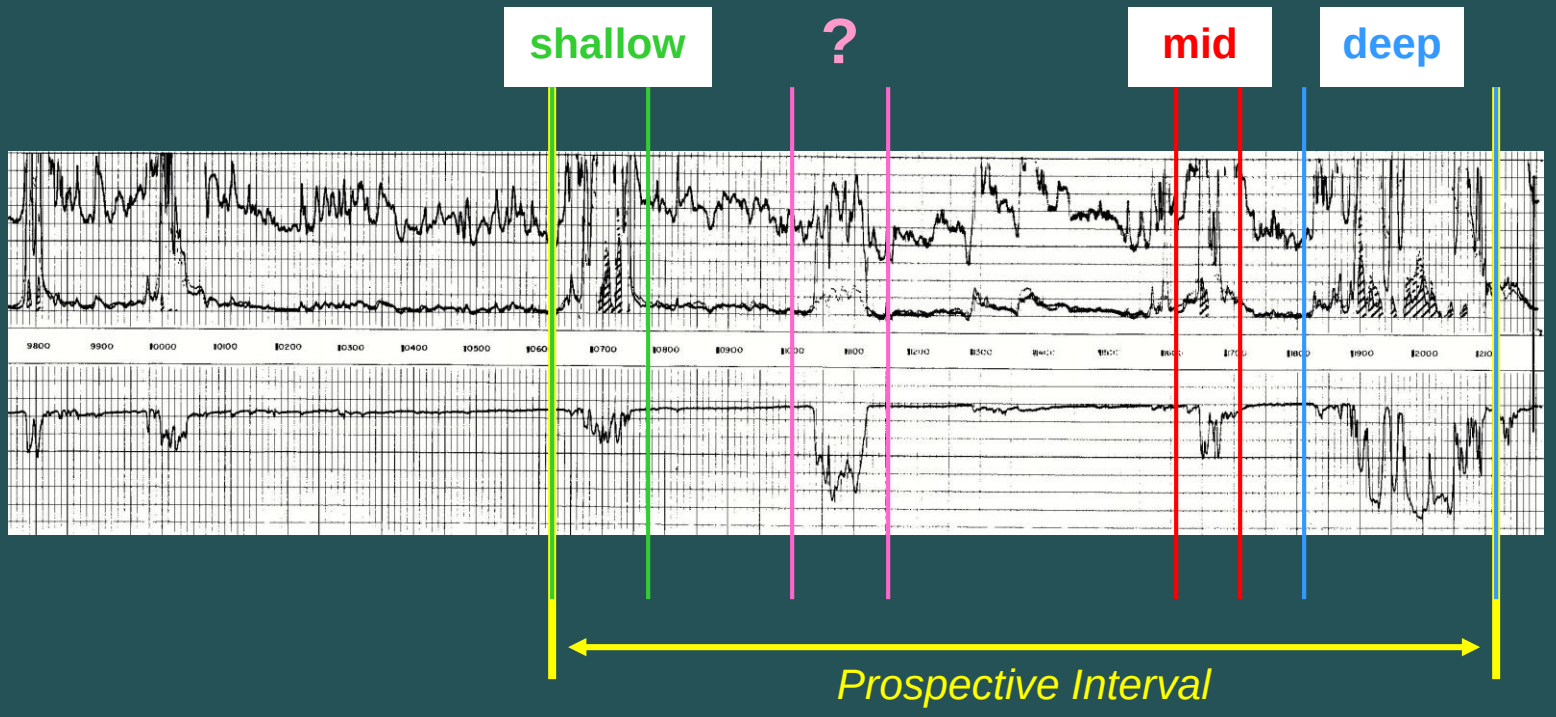
"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE



"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE

"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE

"The Zone & the Box"
UNITIZATION, ZONE DEFINITION
SAMPLE CASE

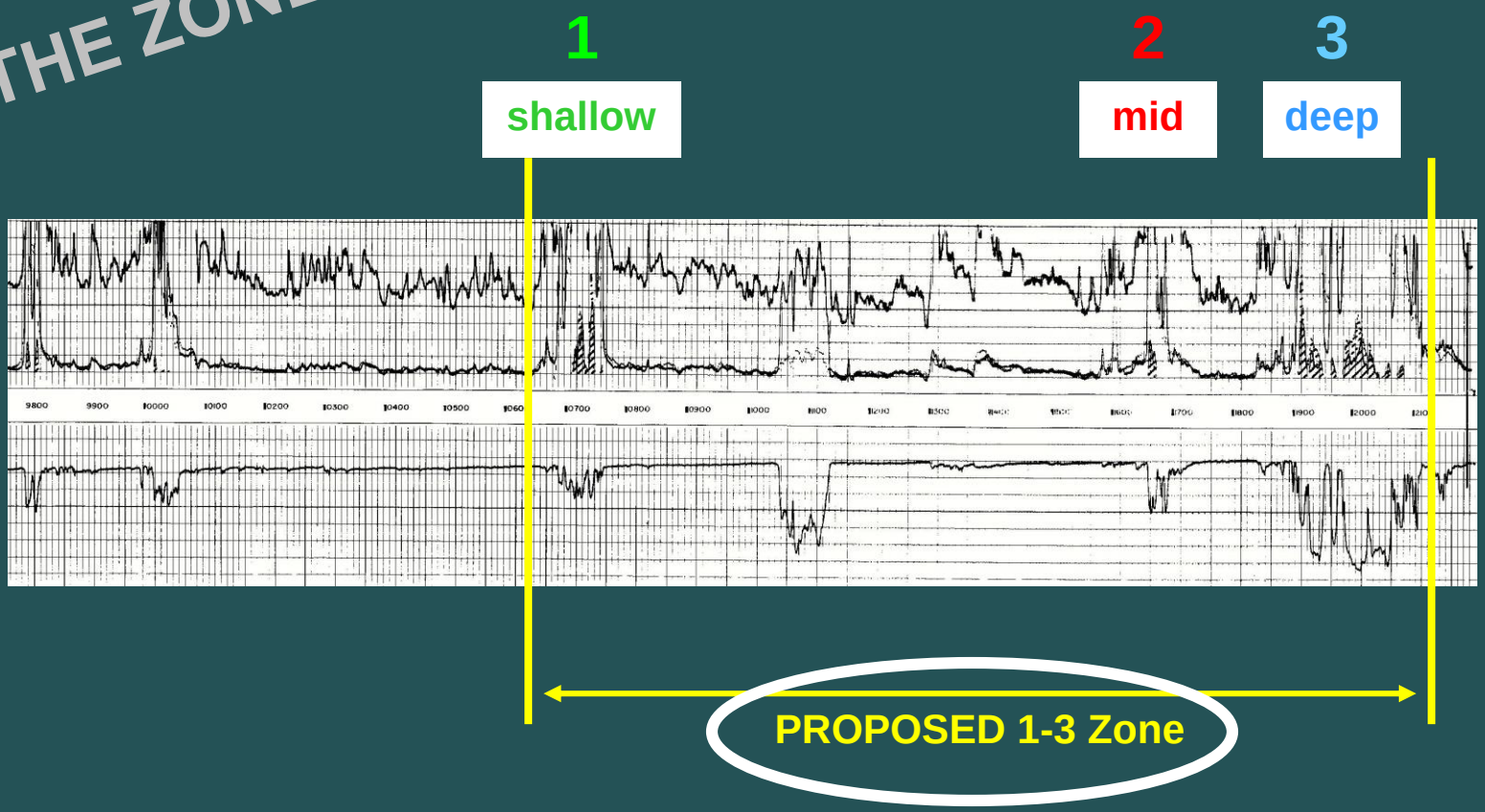


"The Zone & the Box"

UNITIZATION, ZONE DEFINITION

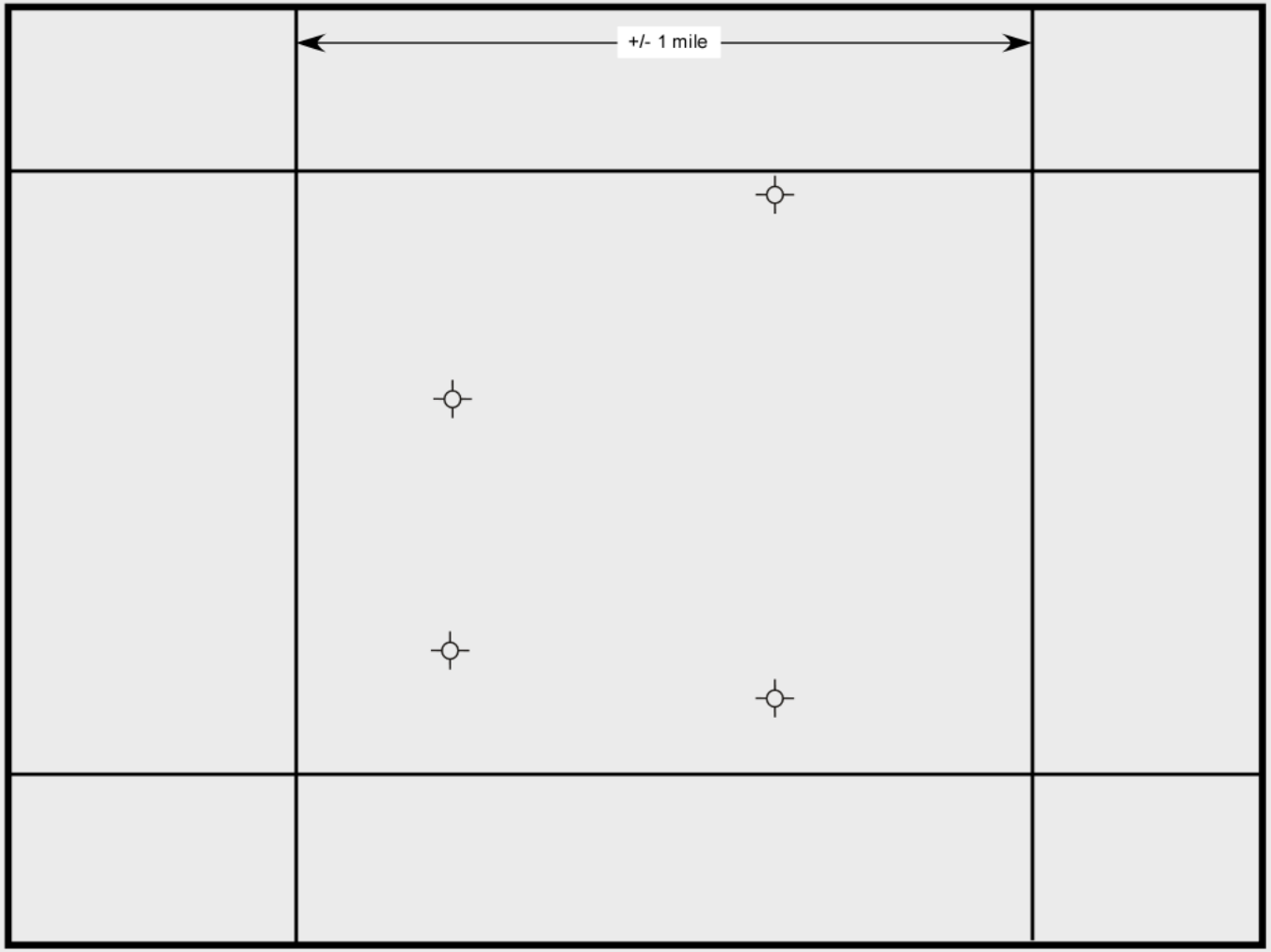
SAMPLE CASE

"THE ZONE"

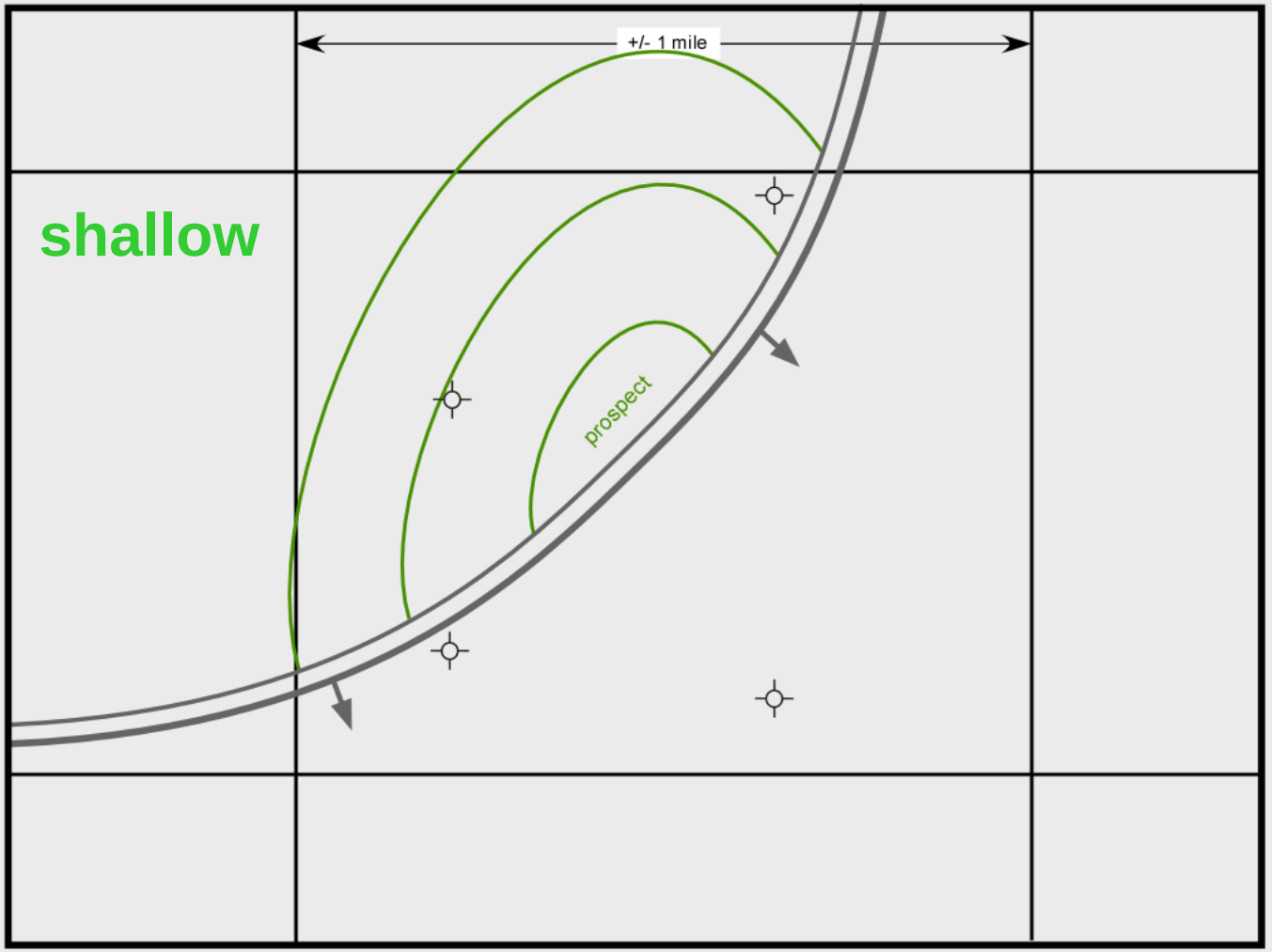



Sample case, map view

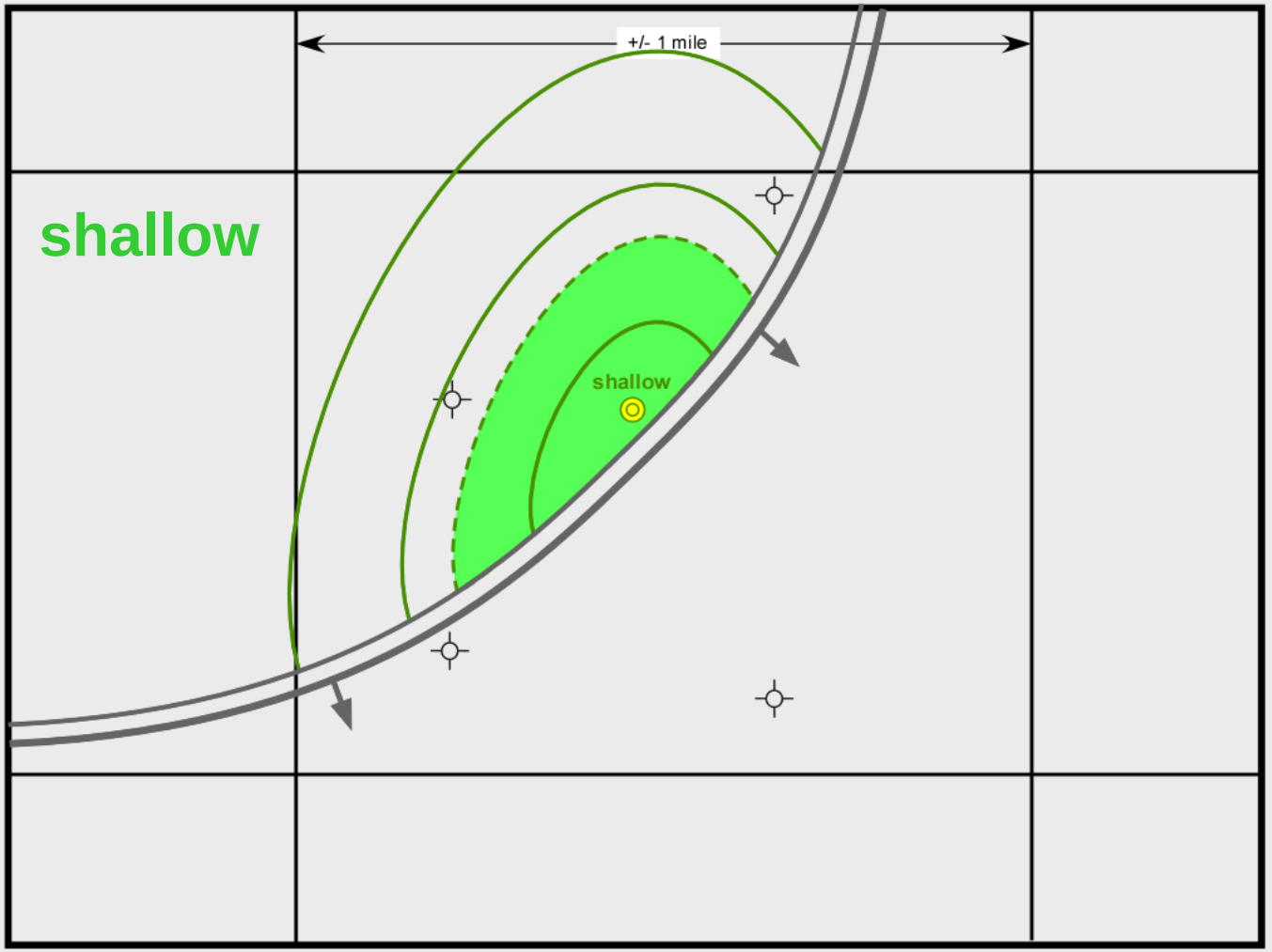
Sample Case



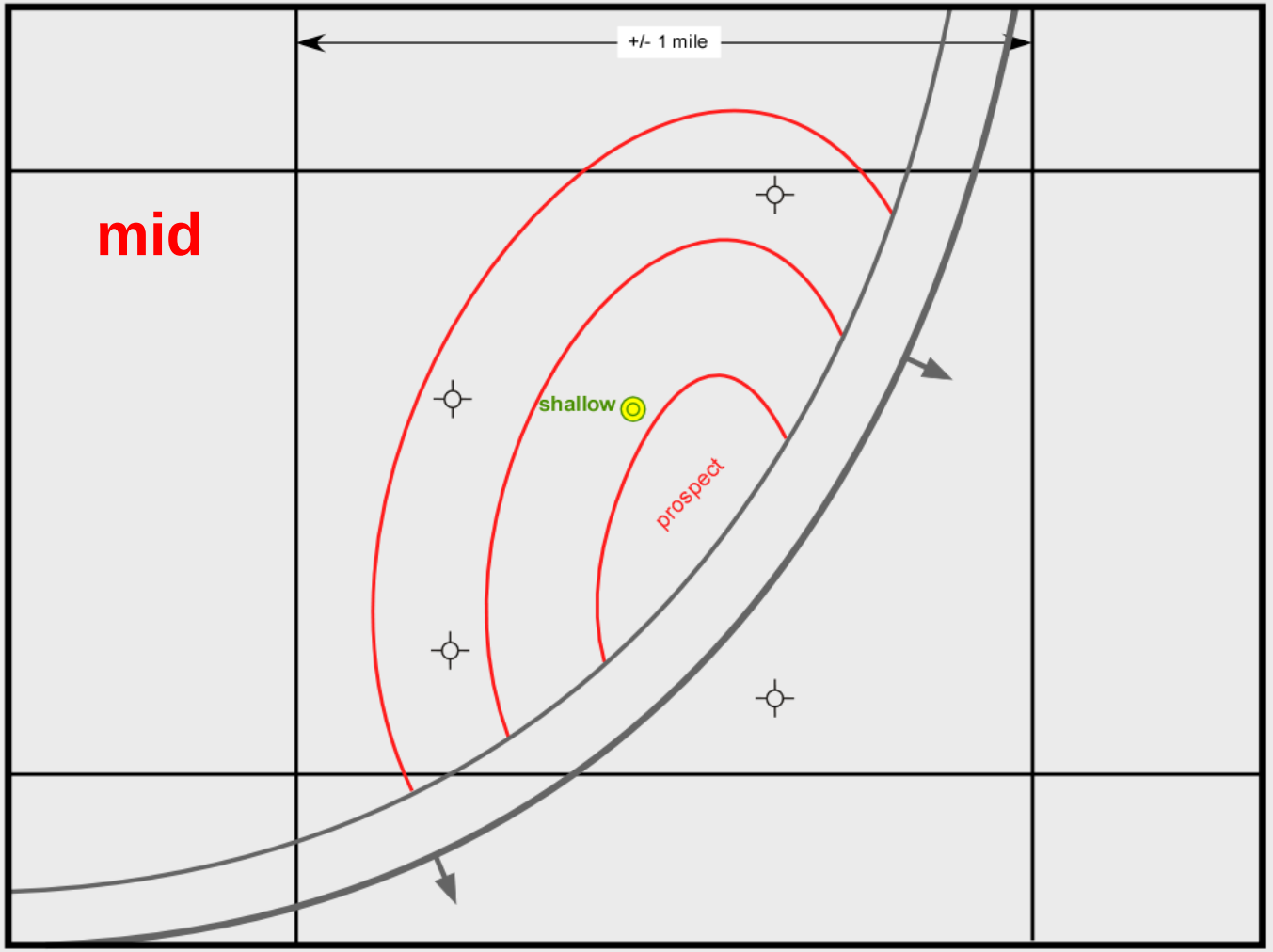
Sample Case



Sample Case



Sample Case



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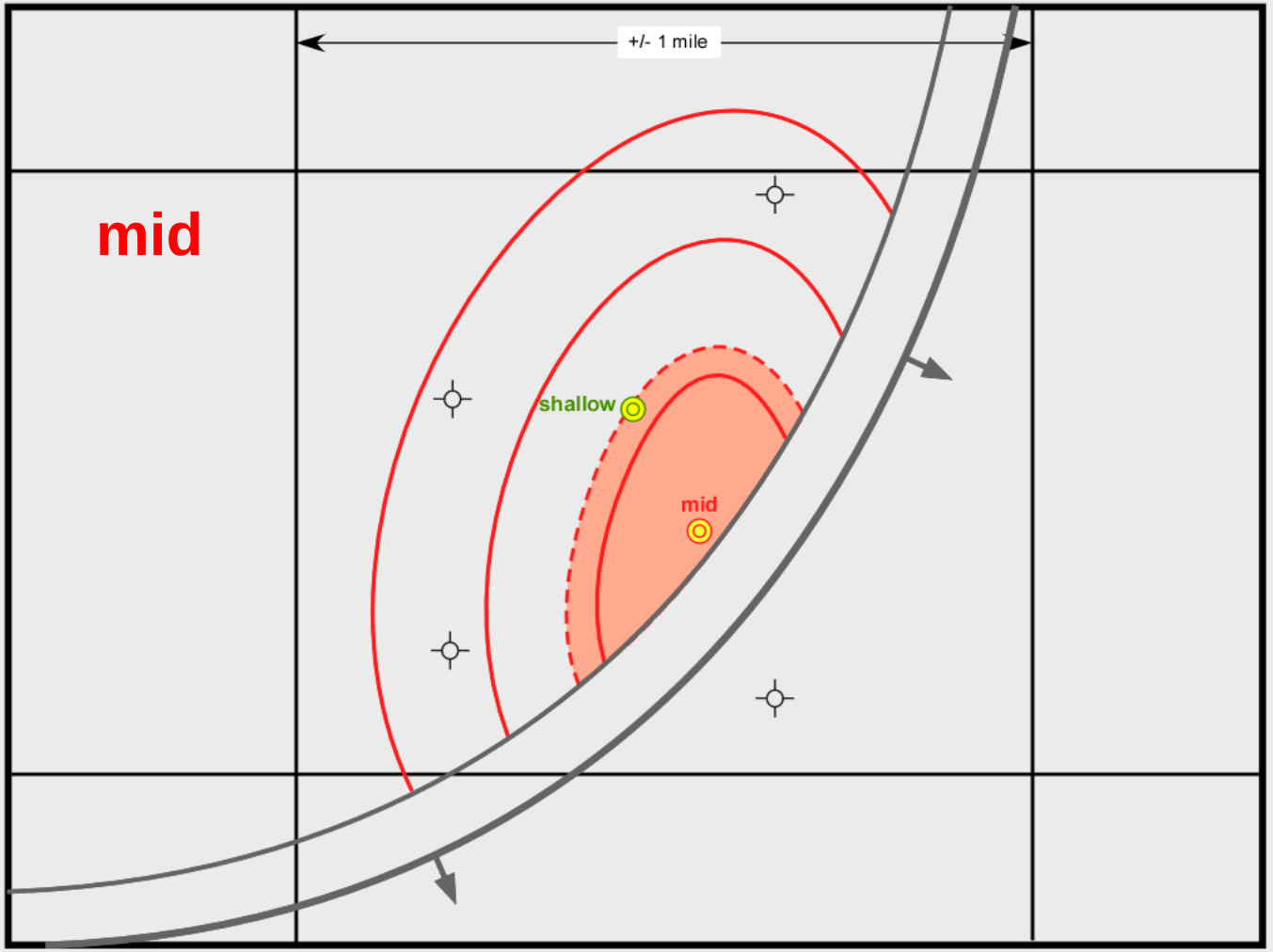
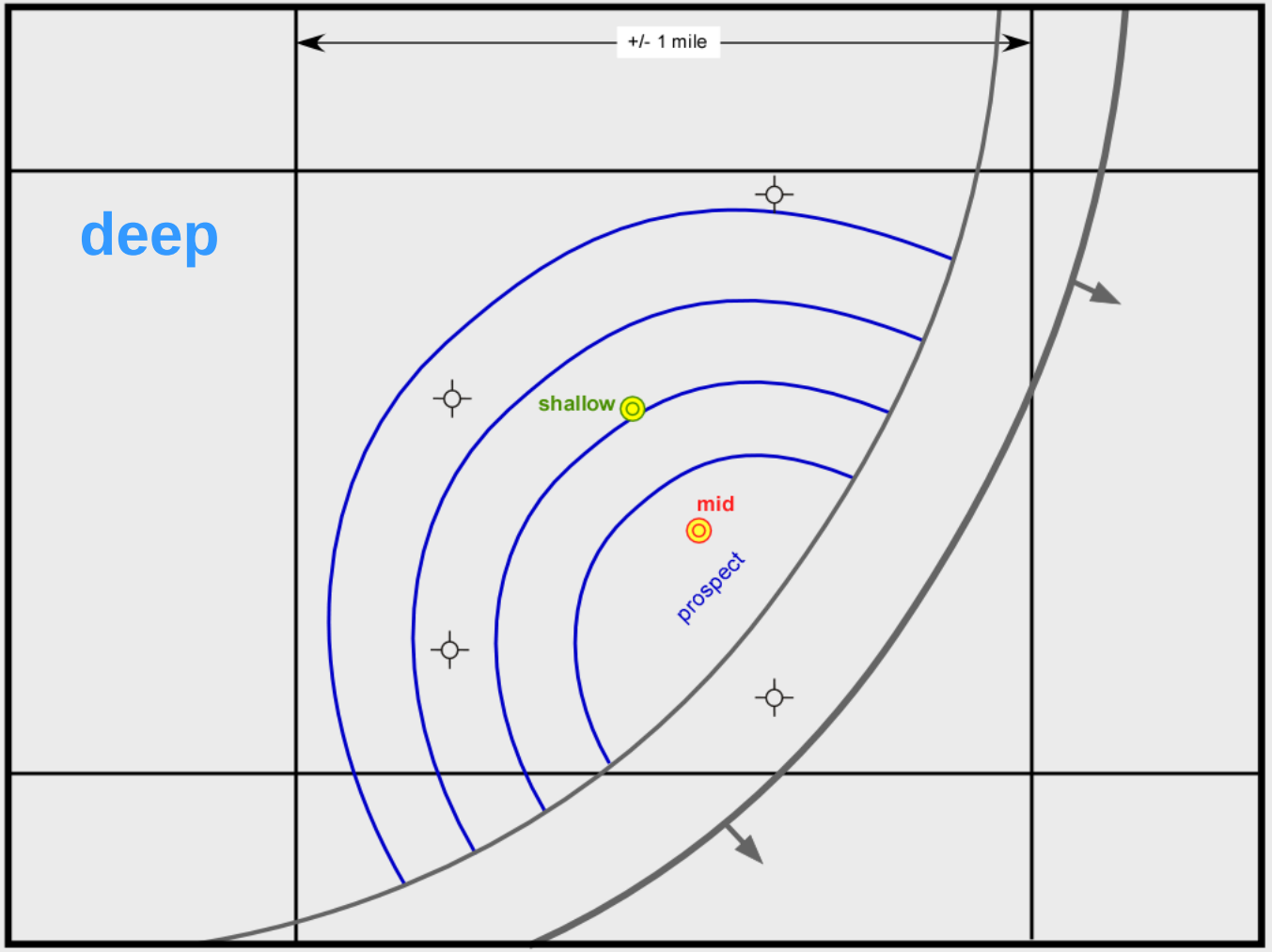


Sample Case



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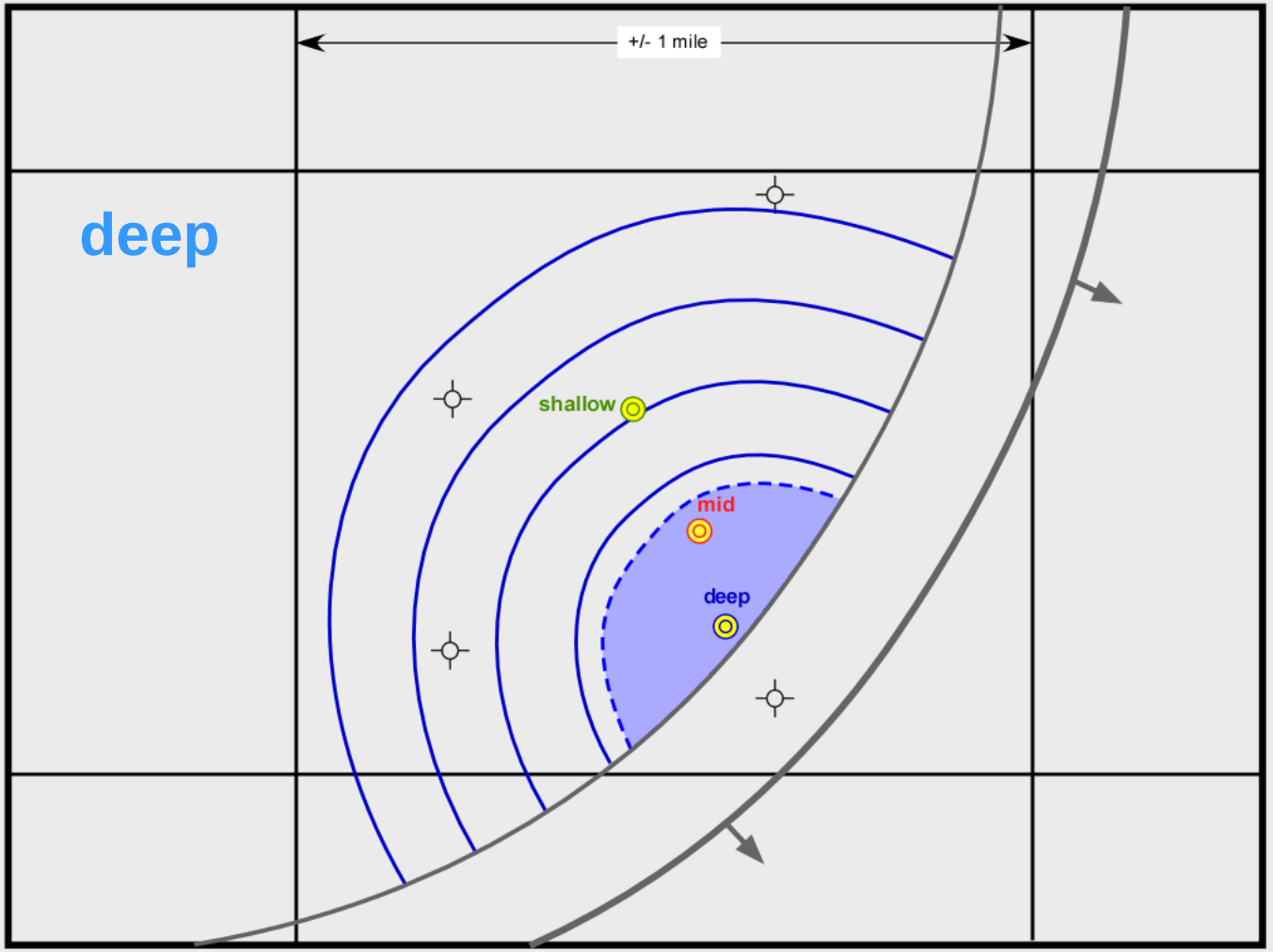

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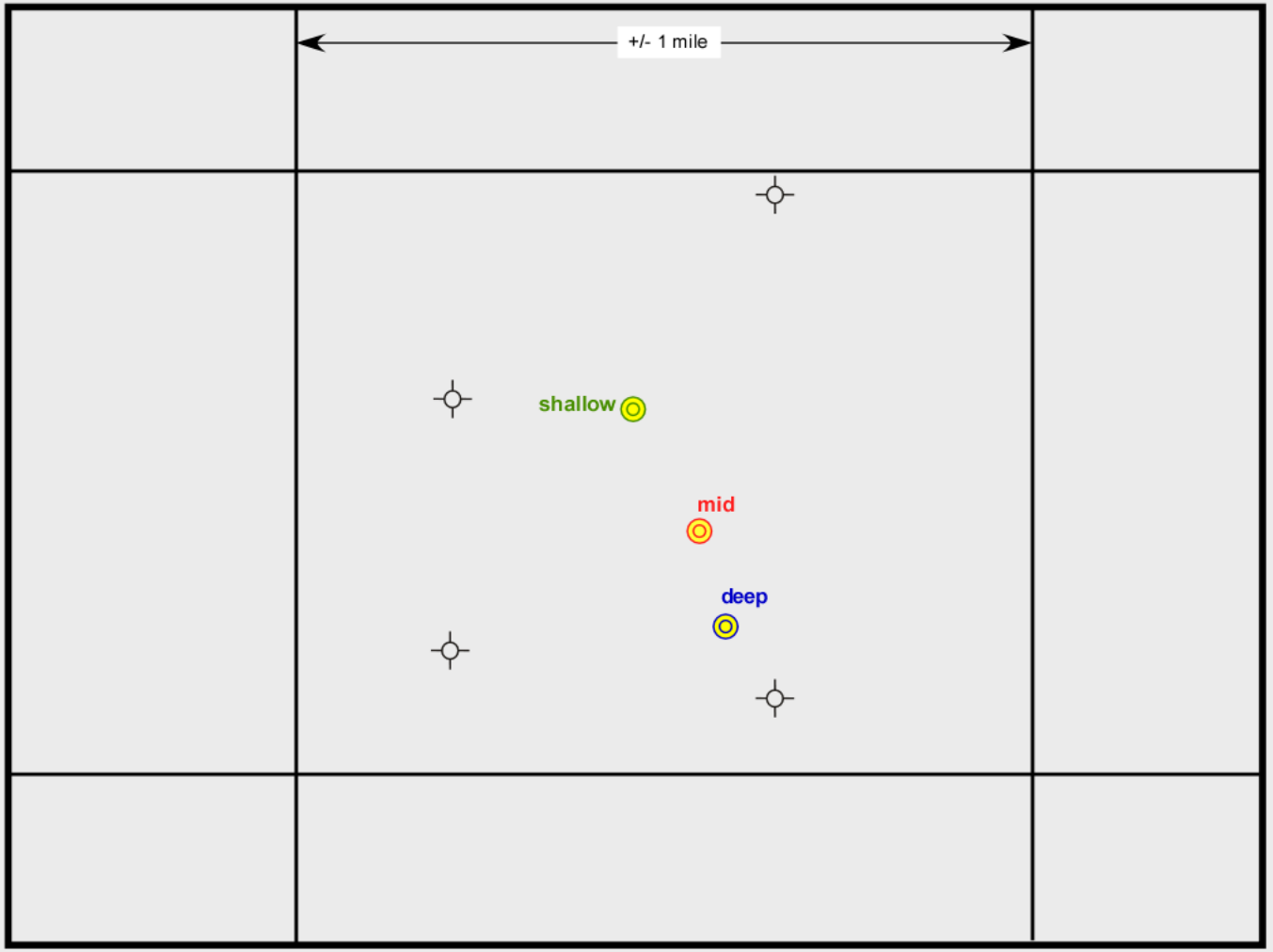

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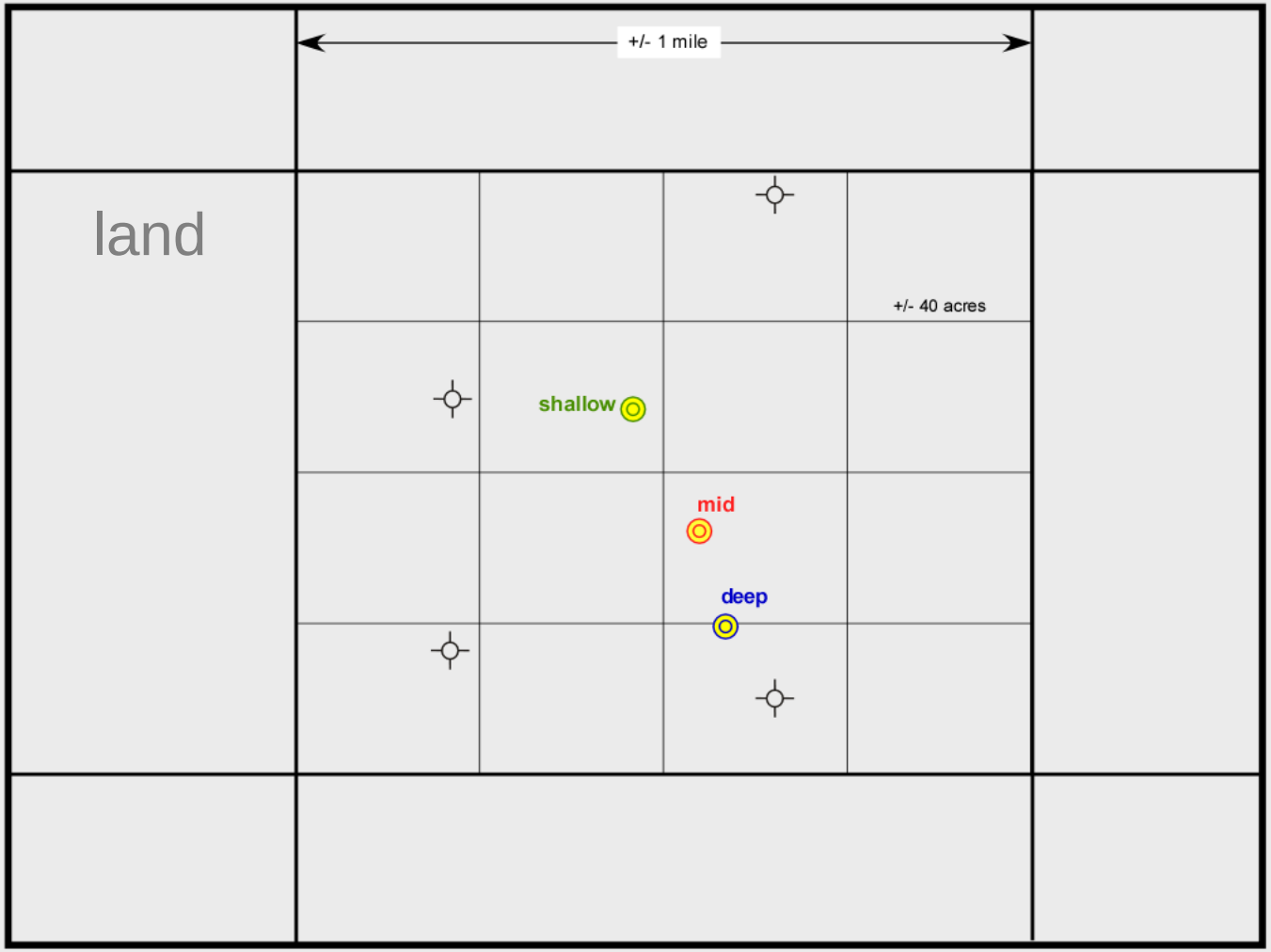

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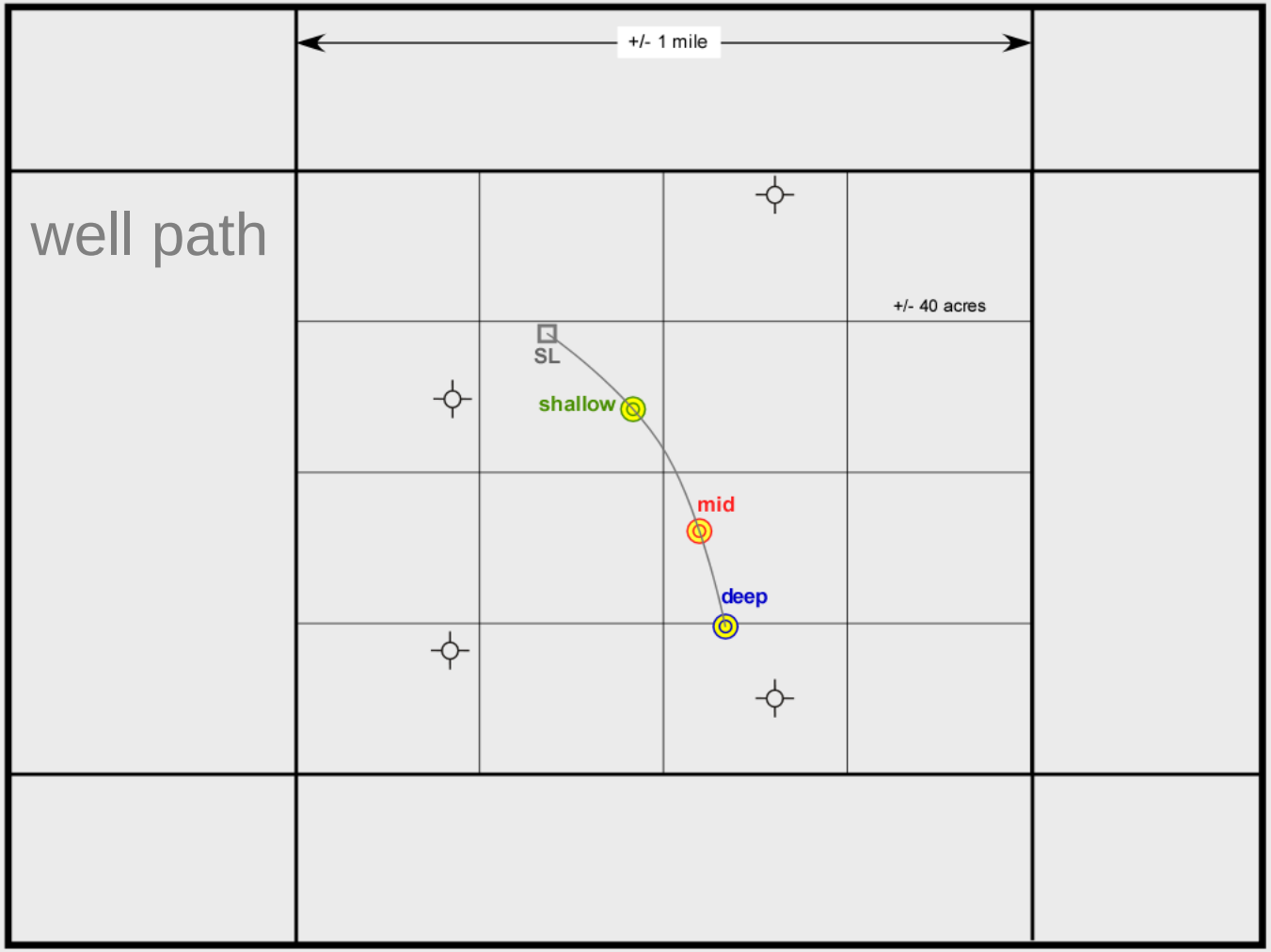

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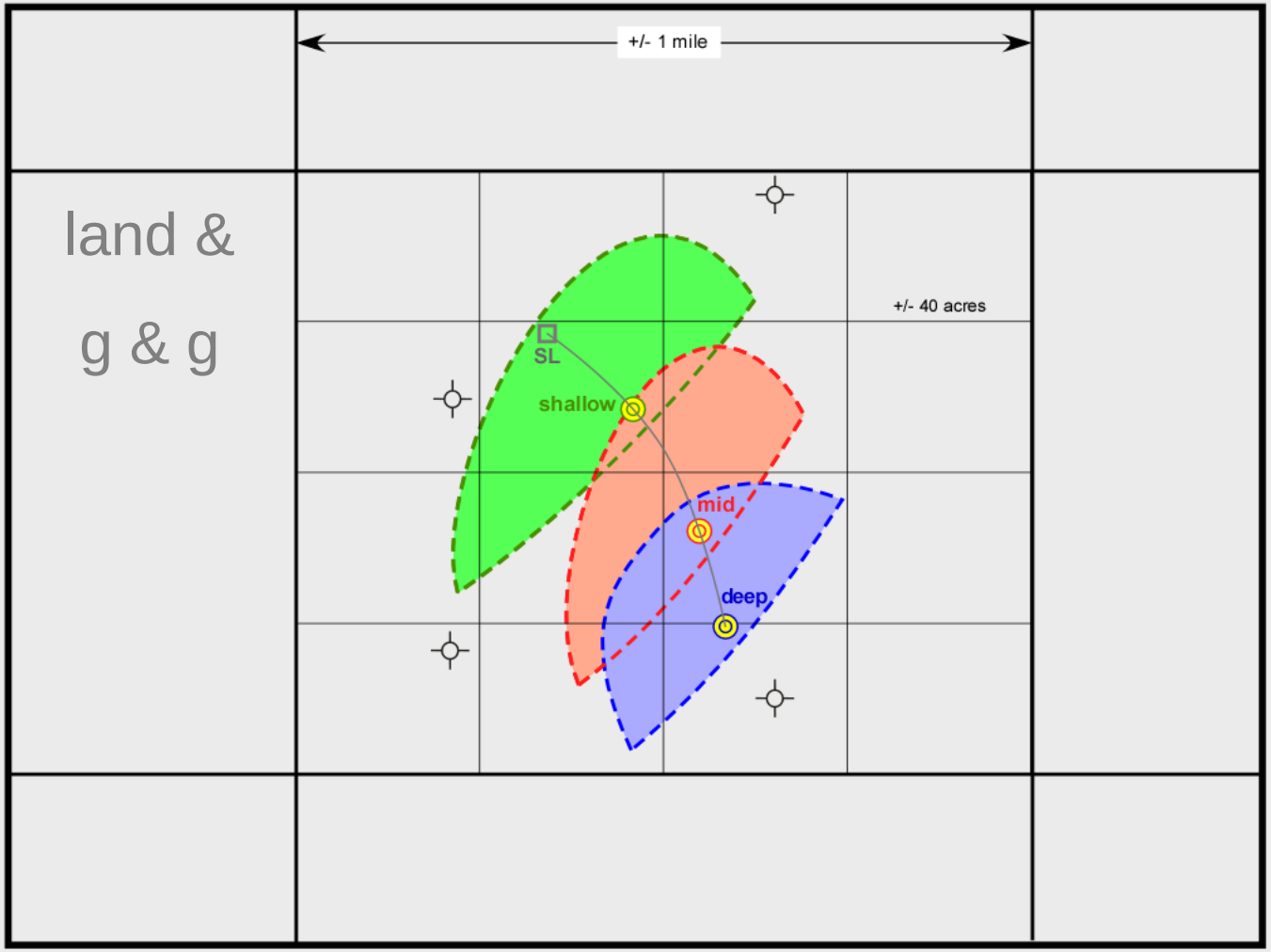

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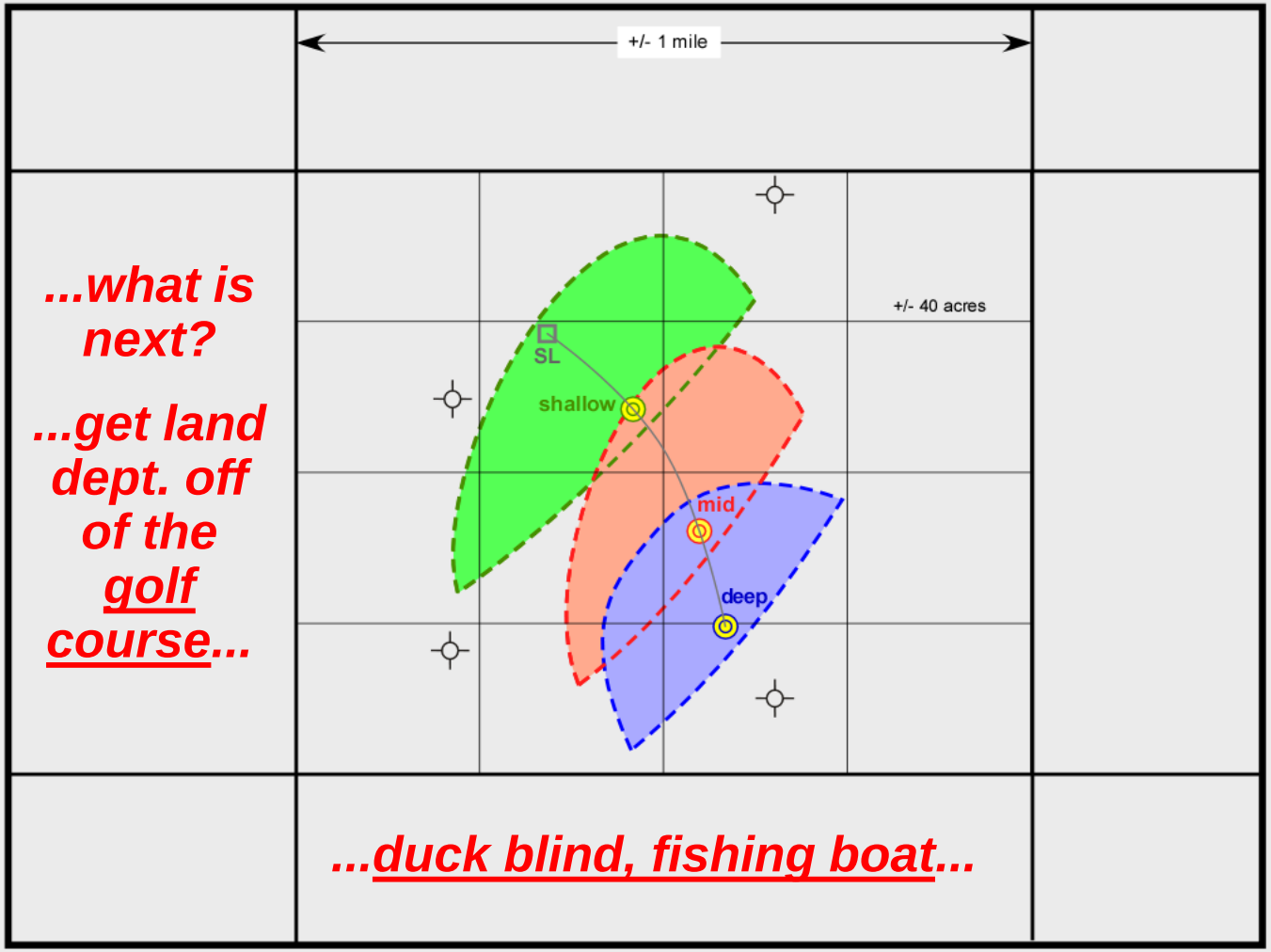
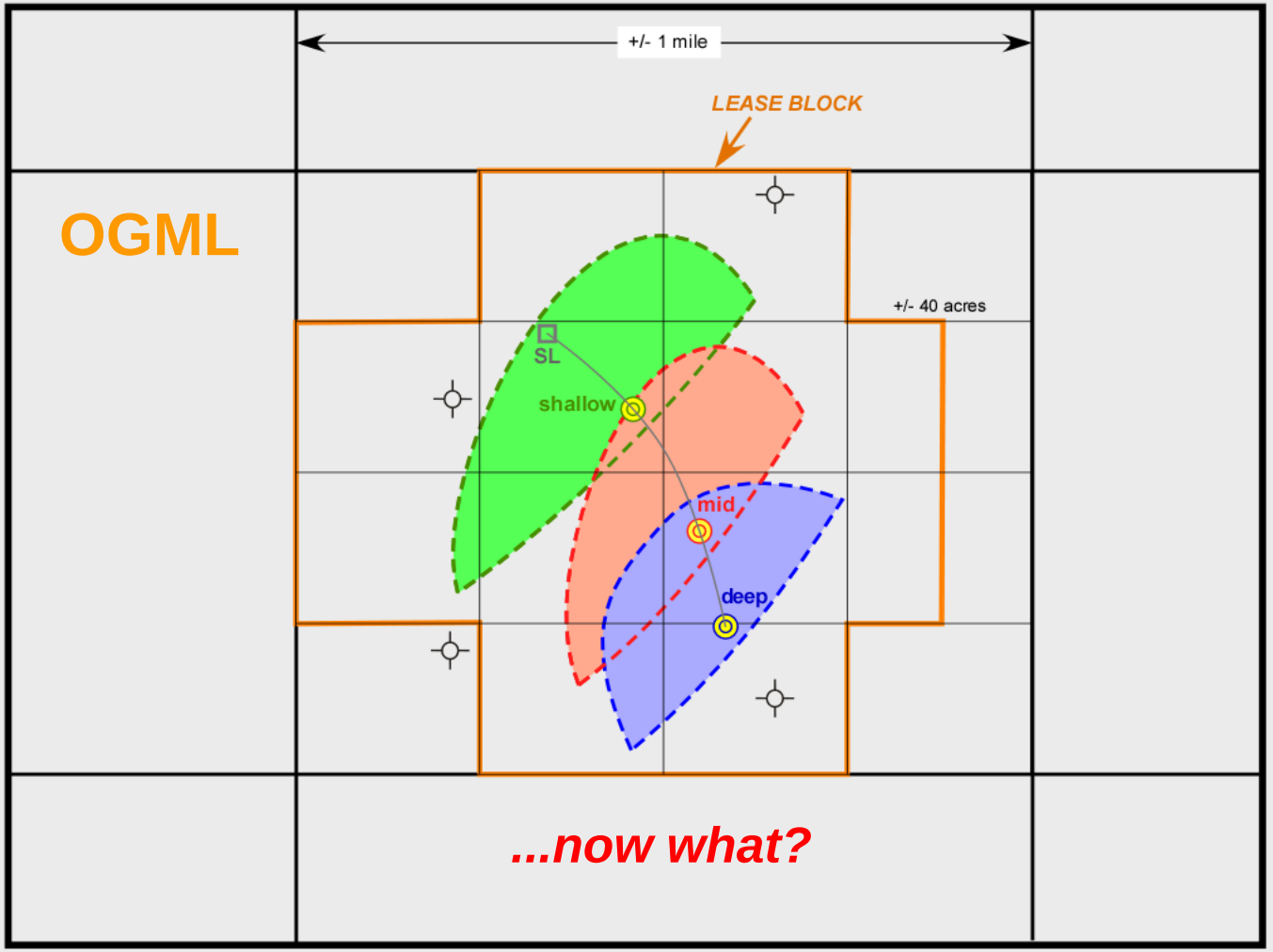


...what is next?

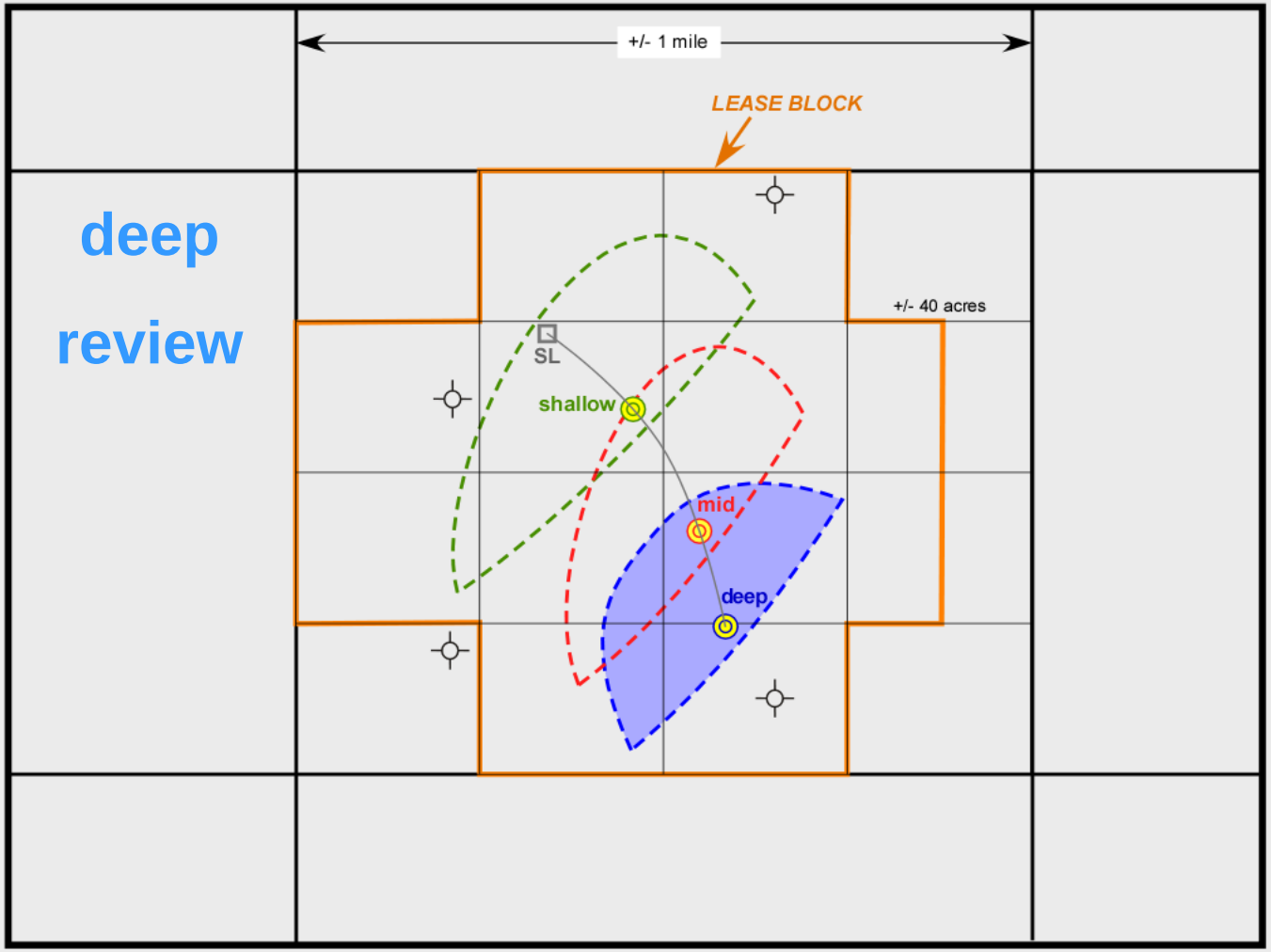
...get land dept. off of the golf course...

...duck blind, fishing boat...

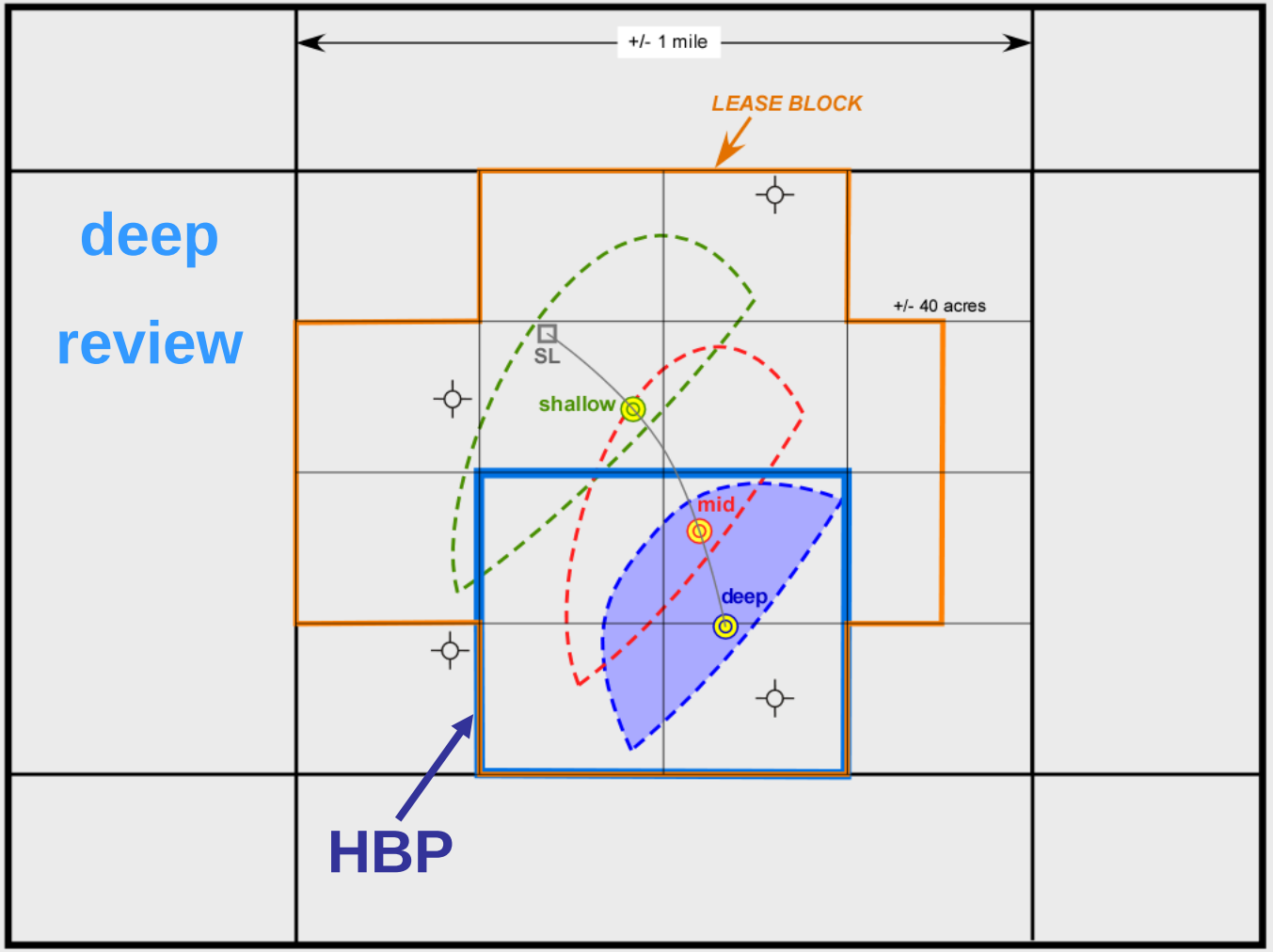
Sample Case



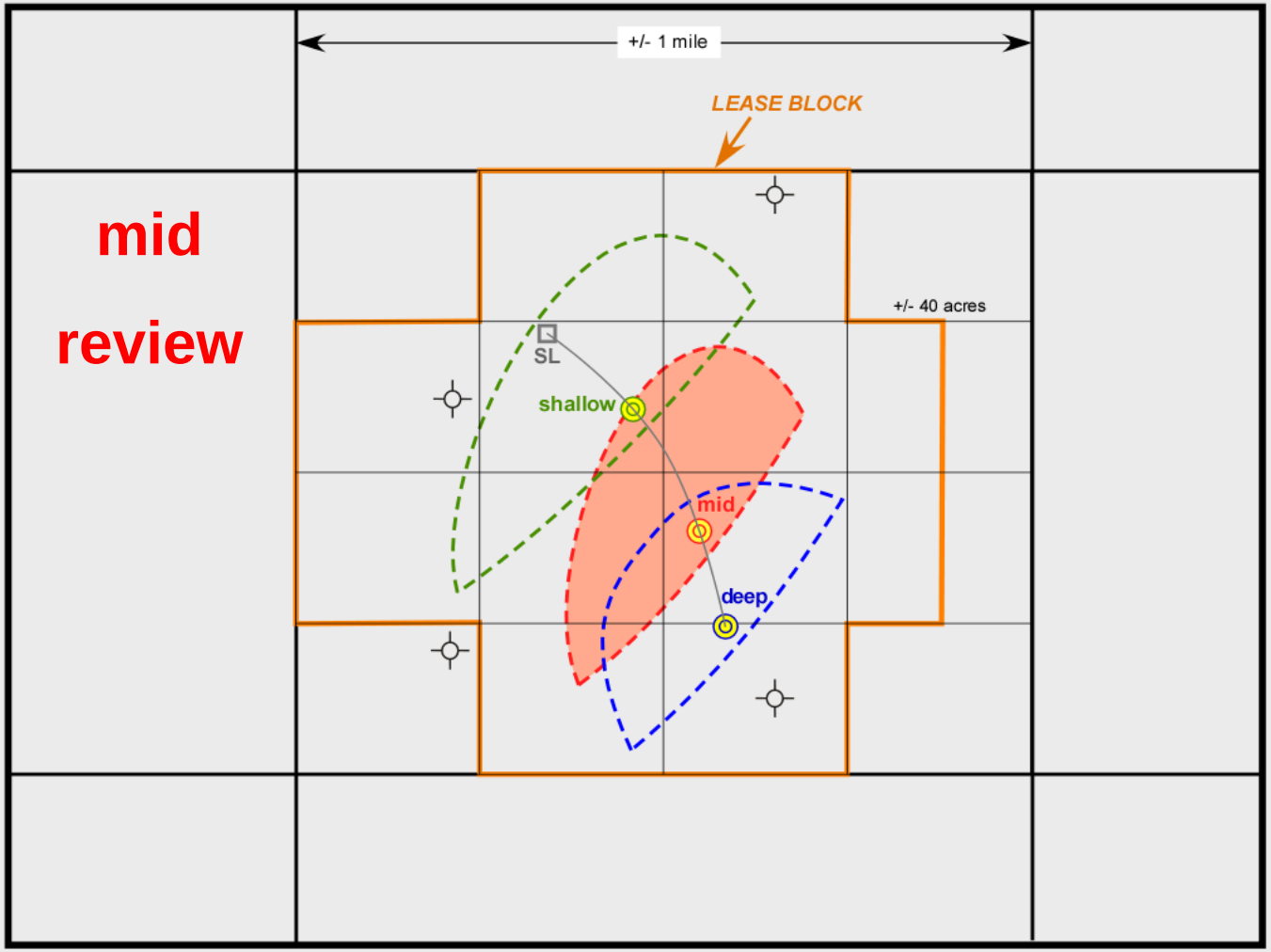
Sample Case



Sample Case


+/- 1 mile
LEASE BLOCK
deep
review
+/- 40 acres
SL
shallow
mid
deep
HBP

Sample Case



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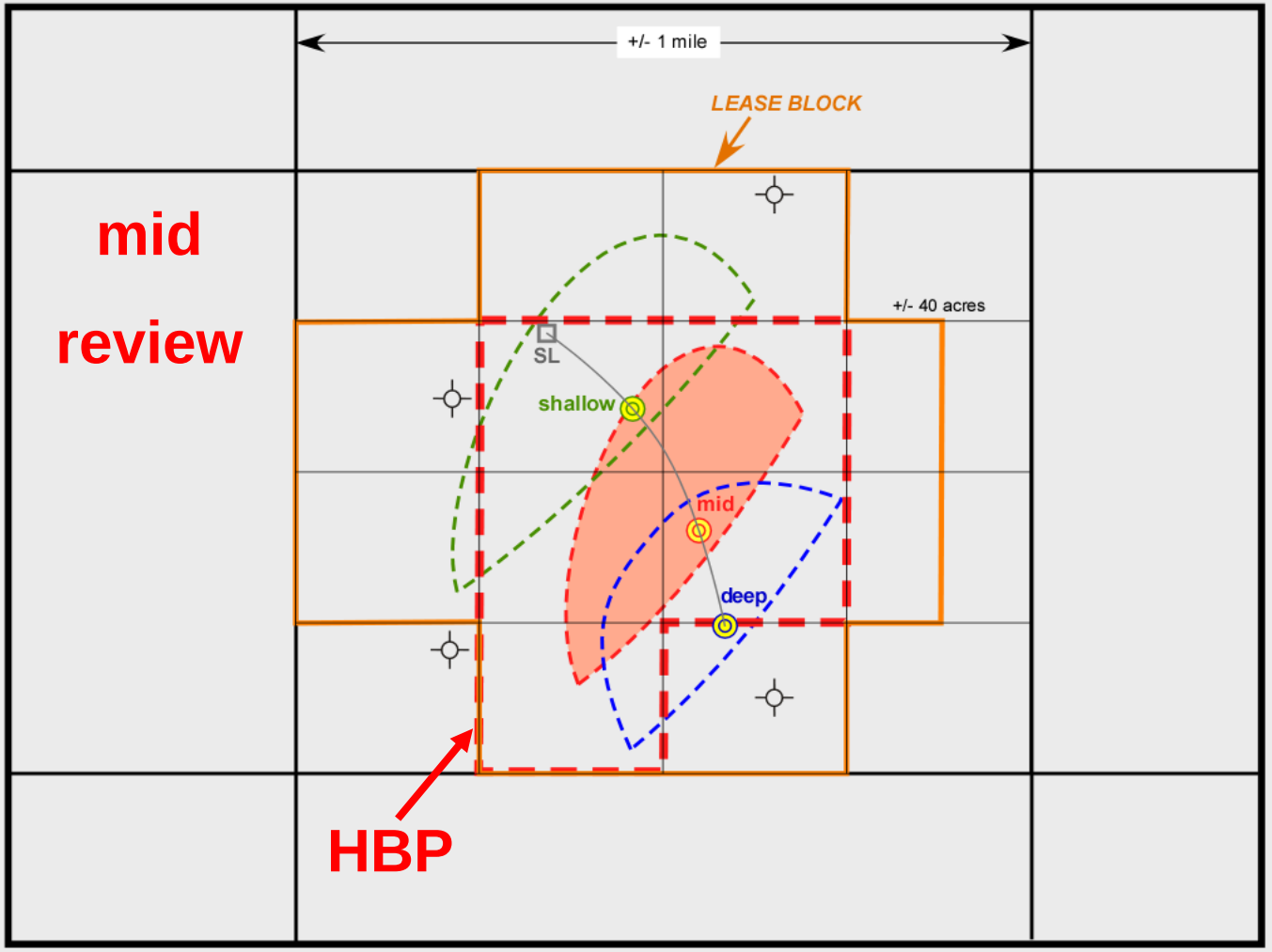
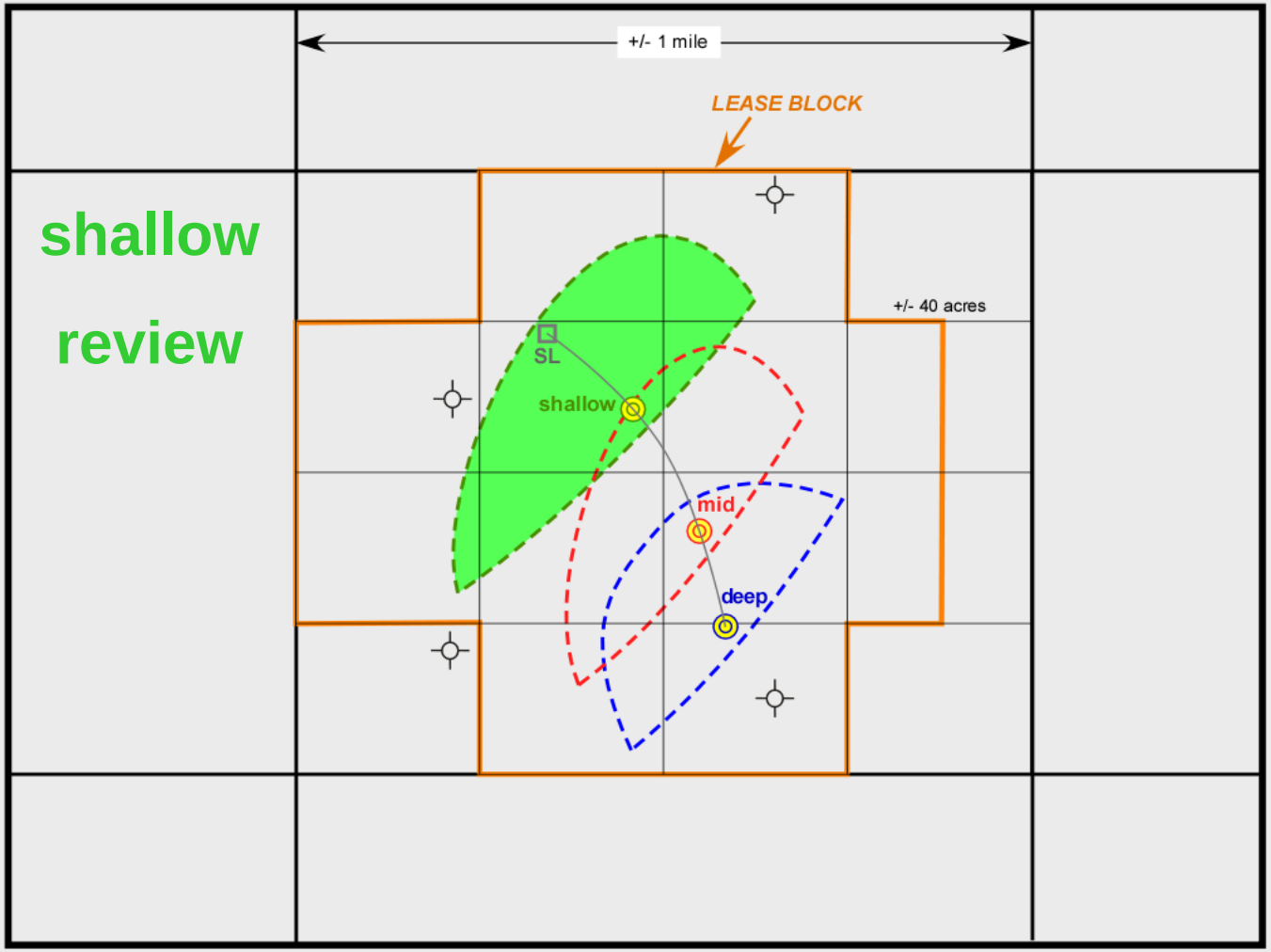
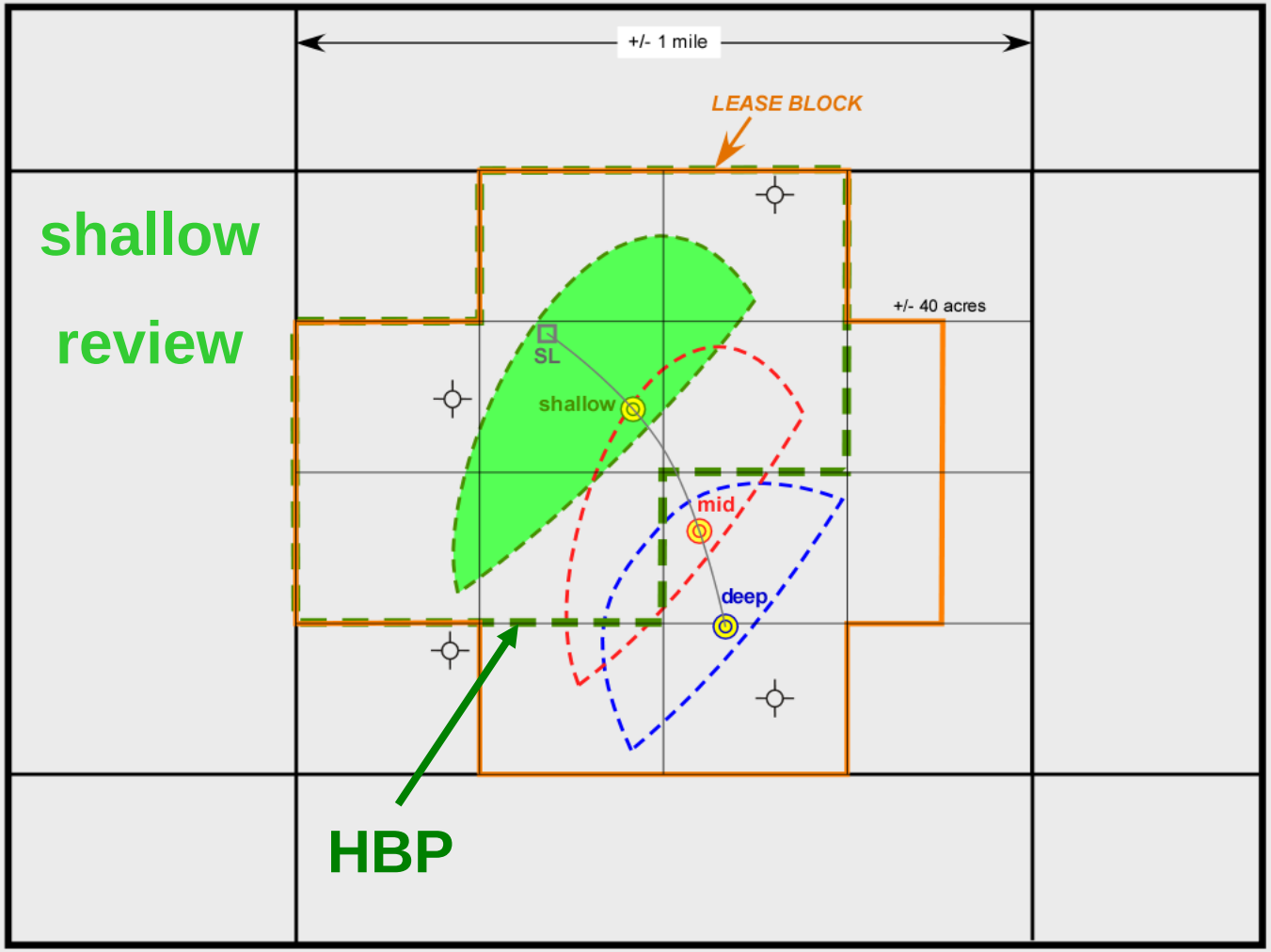

+/- 1 mile
LEASE BLOCK
mid
review
+/- 40 acres
SL
shallow
mid
deep
HBP

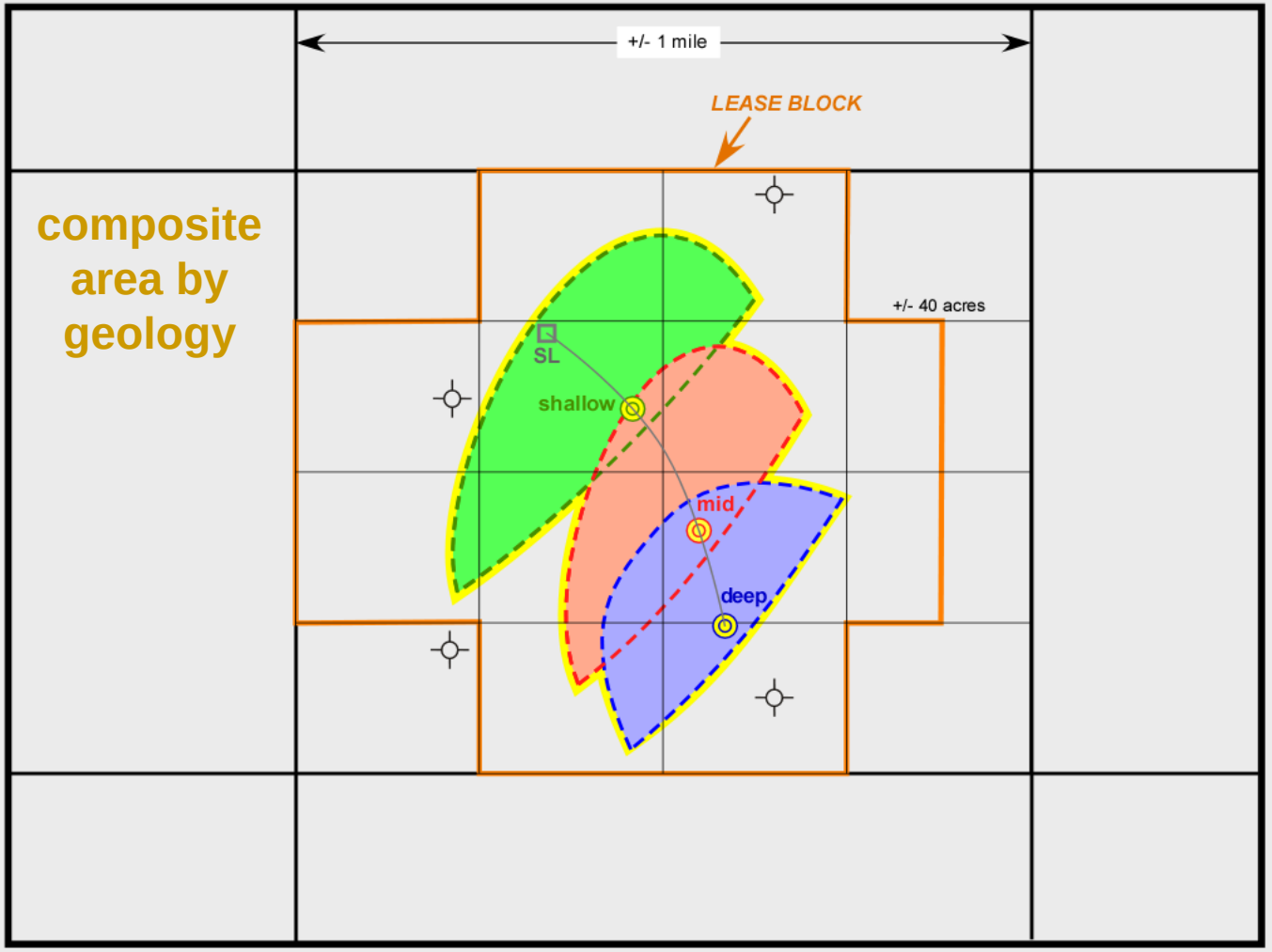
Sample Case


+/- 1 mile
LEASE BLOCK
shallow
review
+/- 40 acres
SL
shallow
mid
deep

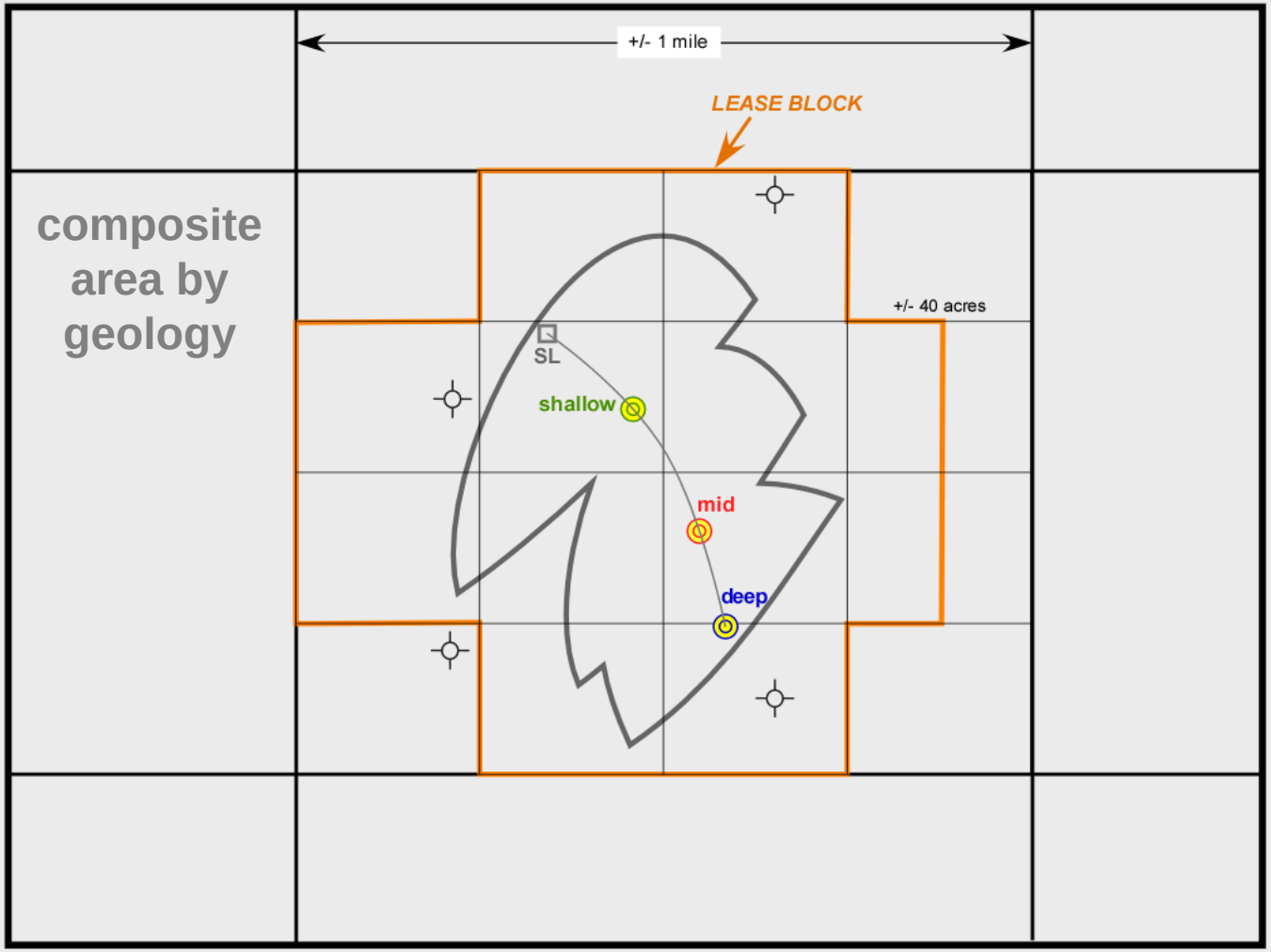
Sample Case


+/- 1 mile
LEASE BLOCK
shallow
review
+/- 40 acres
SL
shallow
mid
deep
HBP

Sample Case

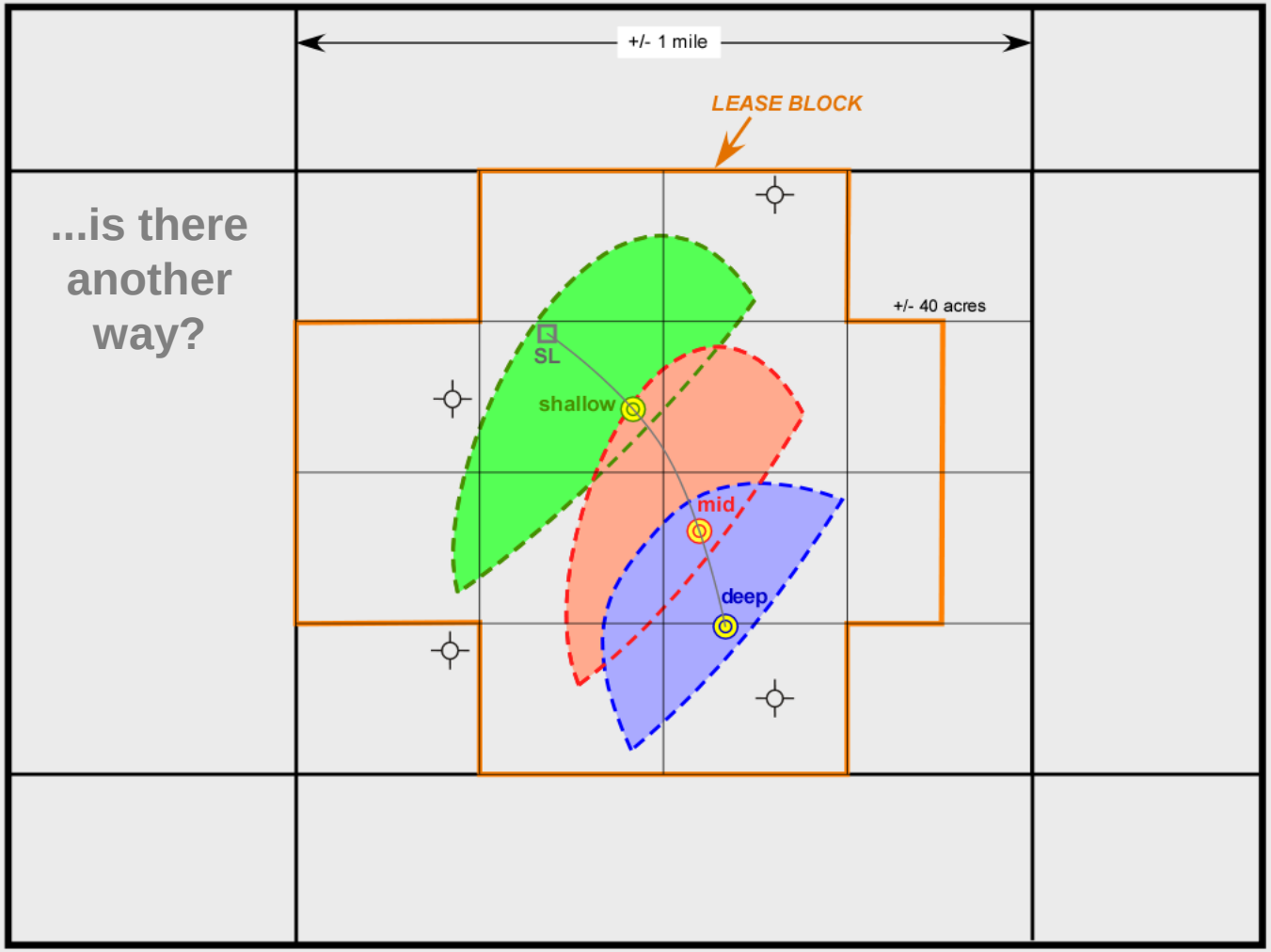

+/- 1 mile
LEASE BLOCK
composite area by geology
+/- 40 acres
SL
shallow
mid
deep

Sample Case


+/- 1 mile
LEASE BLOCK
composite area by geology
+/- 40 acres
SL
shallow
mid
deep

Sample Case

...is there another way?



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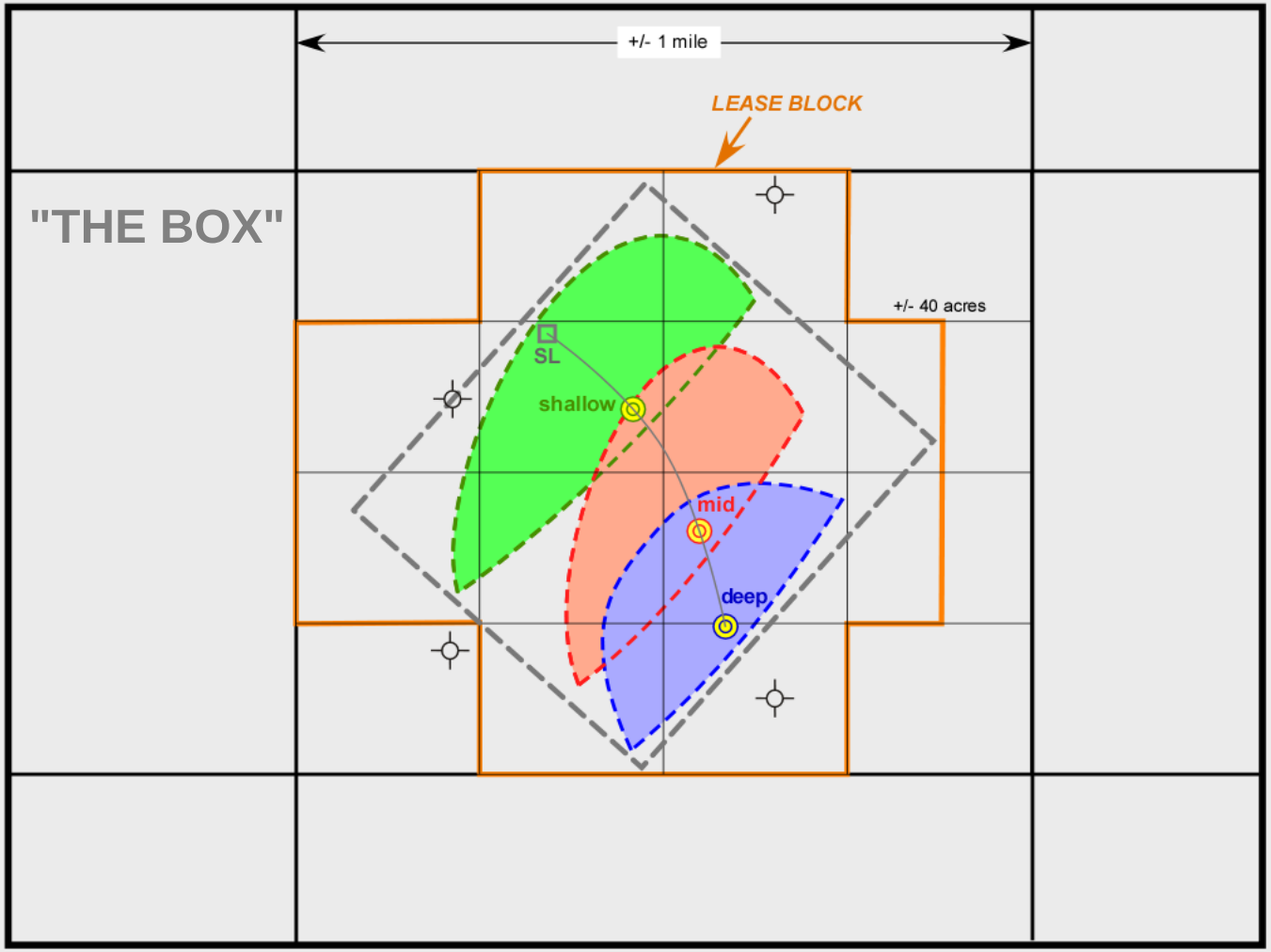

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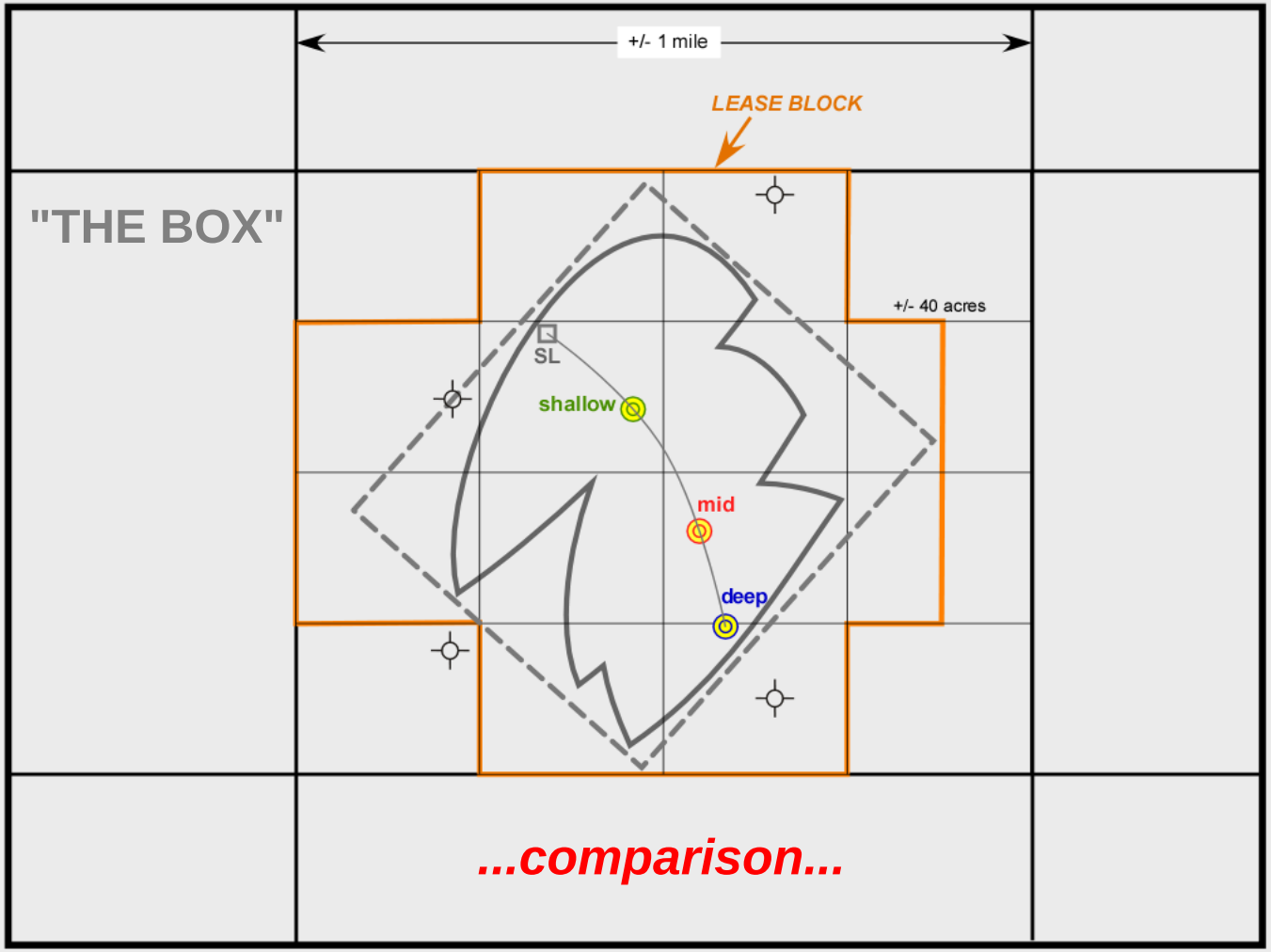
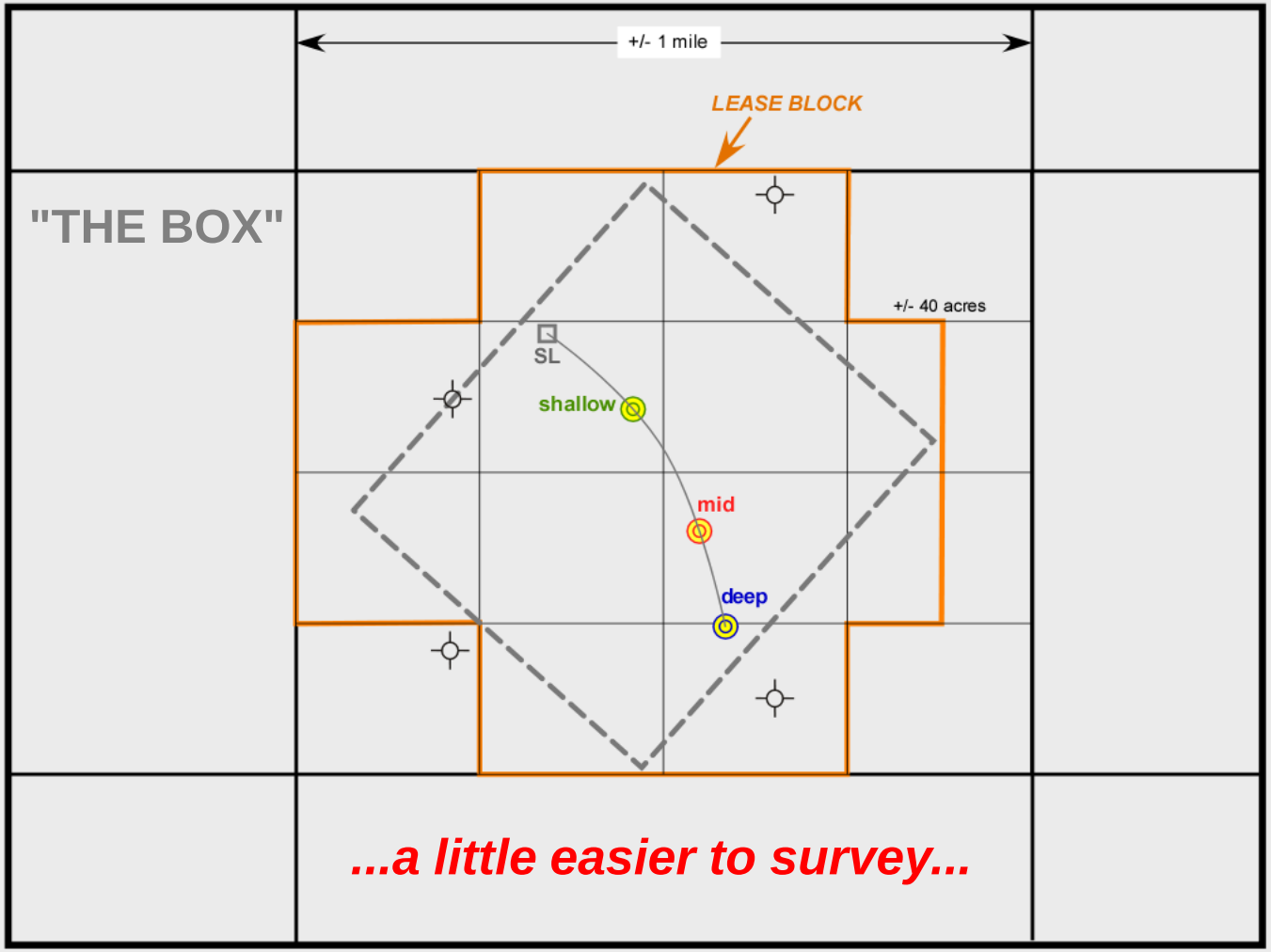
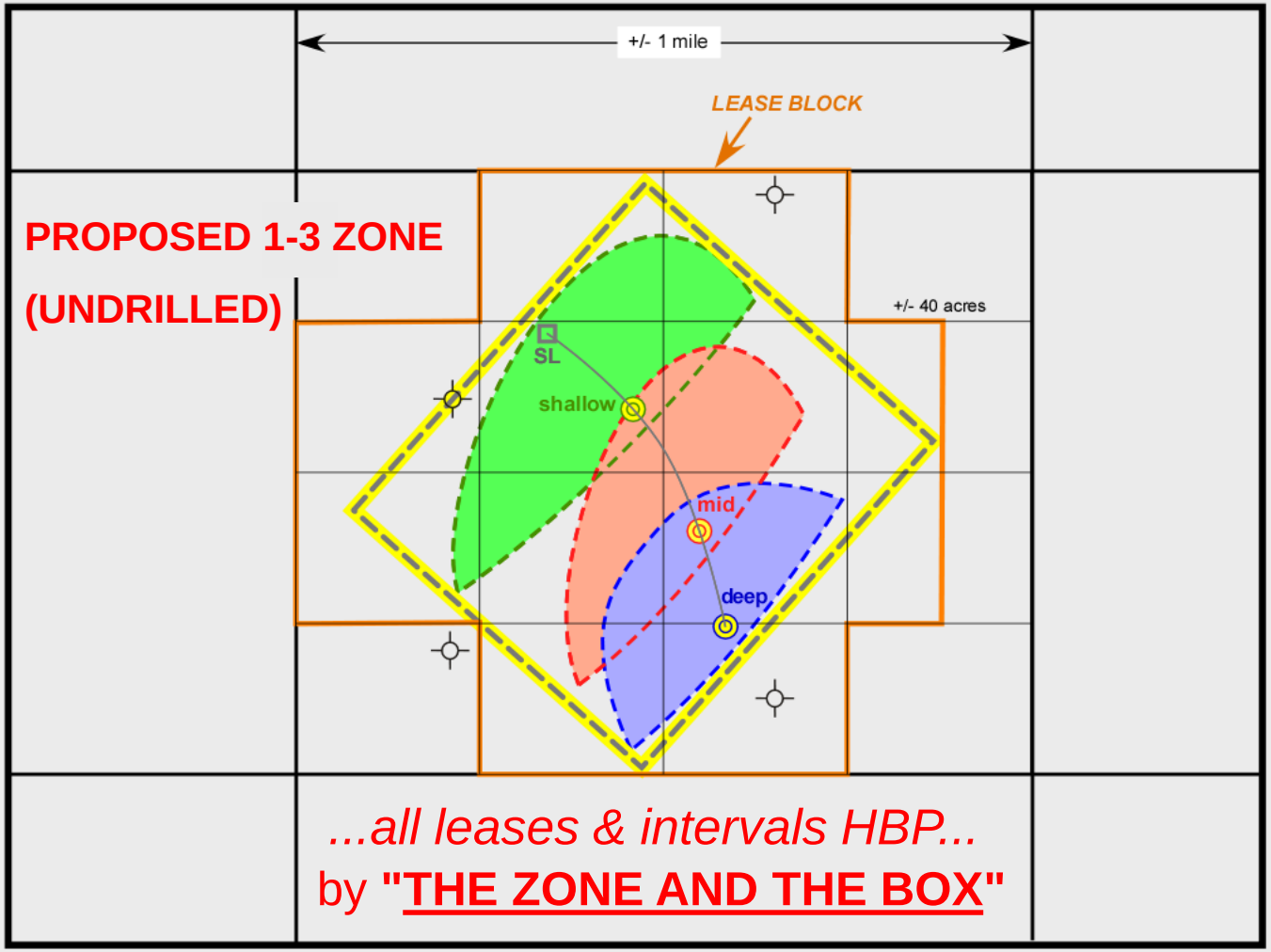

+/- 1 mile
LEASE BLOCK
"THE BOX"
+/- 40 acres
SL
shallow
mid
deep
...comparison...

Sample Case


+/- 1 mile
LEASE BLOCK
"THE BOX"
+/- 40 acres
SL
shallow
mid
deep
...a little easier to survey...

Sample Case


+/- 1 mile
LEASE BLOCK
PROPOSED 1-3 ZONE
(UNDRILLED)
+/- 40 acres
SL
shallow
mid
deep
...all leases & intervals HBP...
by "THE ZONE AND THE BOX"


Conclusions

"The Zone & the Box"
CONCLUSIONS

- Geographical holds more acreage than geological
- Accommodates multiple horizons and tracts
- "Lock-in" N.R.I. on prospect lease block
- "Risk fee" non-operator lessees
- Can dilute non-operator held interests
- Simplifies land issues in regards to future operations
- Save costs on unitization, surveying and legal
- Protects entire unitized leasehold

"The Zone & the Box"

...IS A TOTAL PACKAGE!

James L. Bullen, Attorney

Bryan S. Groves, Geologist

LAPL 2009 Spring Educational Seminar

Friday, May 15, 2009

"The Zone & the Box"
LEGAL LAGNIAPPE

- Bath form 14-BRI 2A pooling clause comments
- Article 75 of the mineral code
- Article 11 of the mineral code
- Mineral Code table of contents

LOUISIANA MINERAL CODE
TABLE OF CONTENTS

CHAPTER

(The Louisiana Mineral Code contains a total of 217 Articles.)

"The Zone & the Box"

Acknowledgements

OUR THANKS TO THE

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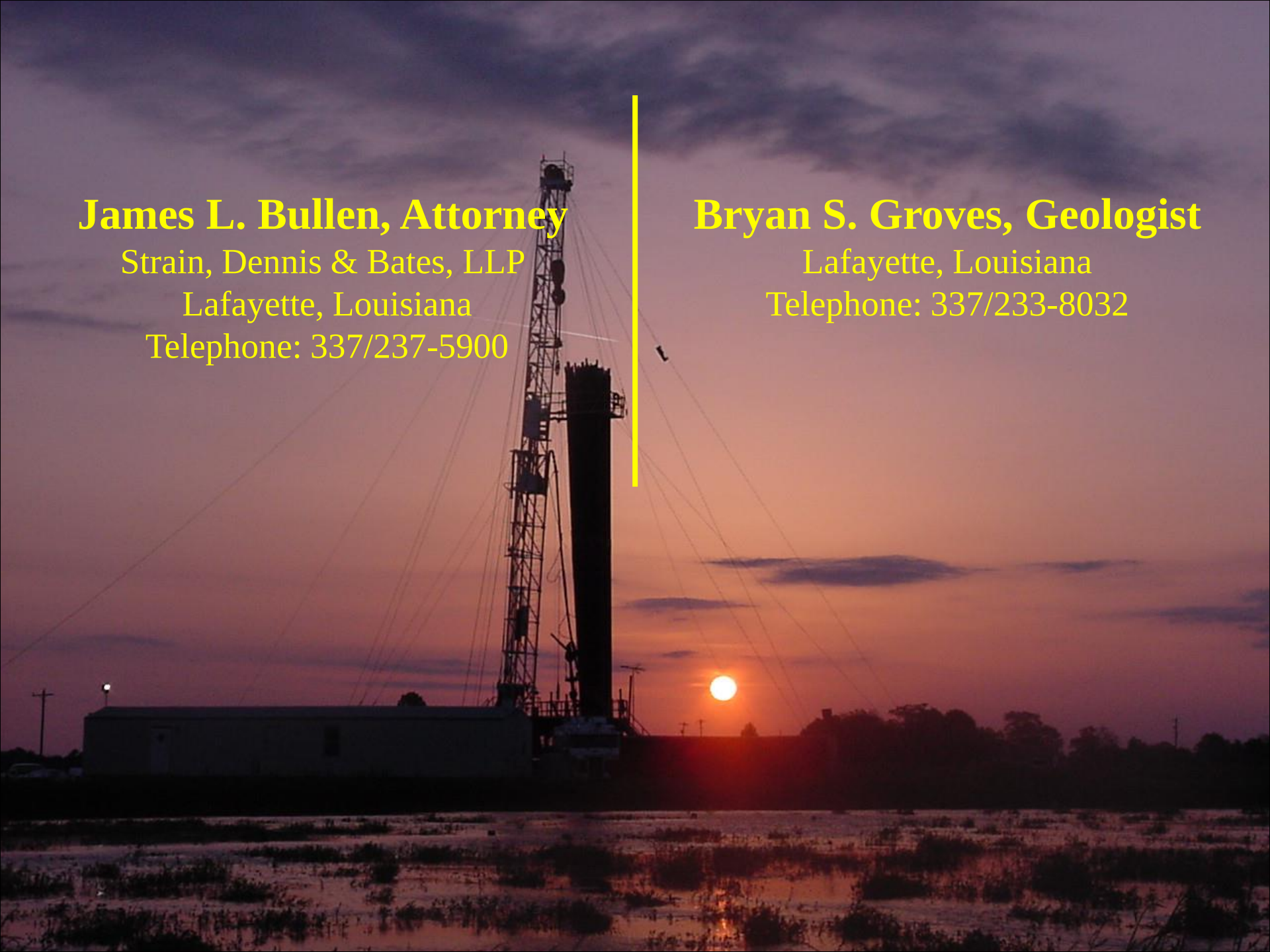

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