San Joaquin, California – New Oil in an Old Basin:

Scotforth's DHM Exploration Steps in…..

1. Introduction: The San Joaquin Basin (**SJB**) is one of the world's oldest and most prolific multi-billion barrel oil and gas petroleum provinces. It measures 170 miles long by 65 miles wide and has over 18,000 feet of section in its depocentre. It has been explored for more than 140 years, had its first discovery in 1894, had produced 15.2 billion barrels of oil by the end of 2014 and despite its highly mature status is still producing over 400MBD from its numerous fields. Two valuable, comprehensive, public domain data sources to guide new investigations are:

- The California Oil and Gas Fields Atlas, (particularly) Volume I (1998) – Central California, of the California Department of Conservation, Division of Oil, Gas, and Geothermal Resources and
- U.S. Geological Survey Professional Paper 1713, Edited by Allegra Hosford Scheirer, 2007 - Petroleum Systems and Geologic Assessment of Oil and Gas in the San Joaquin Basin Province, California.

The former gives excellent summaries for each field, the latter a wonderful array of insightful technical assessments and a well-reasoned synthesis of the modelled petroleum resource potential for five Total Petroleum Systems. The USGS concludes that SJB has a mean 393 MMB of total undiscovered oil, about 332 MMBO (84%) in the five assessment units of the Miocene Total Petroleum System, and 46 MMBO (12%) estimated for the Eocene West Side Fold Belt Unit of the Eocene Composite Total Petroleum System. It estimates also 1.8 TCF of gas and 86 MMBNGL.

It further estimates that nearly 31%, or 121 MMB, of the total mean undiscovered oil resource in the SJB Province resides in the Central Basin Monterey Diagenetic Traps Unit. It suggests also that a further 4,000 MMB of oil reserves will be added to the reserves of existing fields from improved recoveries, including significantly from the diatomite reservoirs of the Monterey Formation.

The key question today is whether such a prolific, highly mature and often very heavy oil system is essentially just an "engineering enhanced recoveries" play or whether the basin's geological complexities and supreme petroleum endowment invite further exploration using new technologies such as Scotforth's Direct Hydrocarbon Mapping (DHM) to identify and discover totally new petroleum resources and reserves.

2. DHM in the SJB: Scotforth has recently researched whether it can see the proven SJB fields and those to the immediate south-west in the adjacent Cuyama Basin (**CB**) – in their various states of production, enhanced recovery and advanced depletion – using its **DHM (Direct Hydrocarbon Mapping) exploration surveying** technology, and if so, whether it sees an inventory of possible further analogous, untested prospective areas and specific leads of high confidence and perceived low exploration risk. If successful this could give weighting to the USGS modelled expectations or ***potentially provide a significantly different view***. Either way, it is expected to bring new exploration focus to a mature, classic petroleum province.

This first DHM pursuit of the SJB has involved the application of SFL's under-pinning RSDD-H processing of satellite imagery using a range of investigative processing algorithms it has come to trust world-wide in detecting surface areas with distinct anomalous **HLIs (Hydrocarbon Lead Indicators)** in many geological and geographical settings. These exhibit high coincidence with underlying proven oil and gas traps. Copious information on DHM as an exploration tool and numerous examples of its application across six continents is provided elsewhere on this website – www.scotforth.com .

DHM typically offers survey effectiveness in any particular survey area of between 50 and 70+% - a transforming agent for incisive pre-drill prospect generation and exploration risk reduction. Such findings provide an excellent complement to the conventional G&G prospect development toolkit. The following cameos of DHM examples in SJB suggest high DHM efficacy here also with an ability to:

- Observe many proven fields and pools
- Identify and map new prospects and additional field /pool extensions
- Define their predicted optimal / maximum net hydrocarbon pore volume centres and
- Set out their predicted peripheral margins and probable maximum gross size /areal extent.

Scotforth models such findings in terms of exploration risk and petroleum resource potential (PRP) giving a DHM–based prospect inventory under a selected range of assumptions. This leads to a stand-alone ranking of opportunities on both an unrisked gross and a risked net PRP basis which can then be considered against conventional prospectivity lead indicators / prospects in each case. The combined assessment is then well-placed to identify the optimal combined features, select them for progression and maximise exploration success.

3. The DHM Imagery Gallery:

This comprises a series of Scotforth processed satellite image examples of seven well-known SJB fields and their local surrounds in southern SJB, plus one of the South Cuyama oilfield, across the San Andreas Fault, in the adjacent Cuyama Basin (CB). ***These fields stand out "spectrally" after application of Scotforth's proprietary RSDD-H processing of raw imagery data.***

Most are large or giant in size and were mainly discovered around 80-120 years ago. Their DHM spectral expression is the consolidated impact of the integral of all of a field's subsurface pay zones – which here in SJB are often stacked and occur across wide depth ranges in some cases, are sometimes thick and on occasions pinch-out as part of a local trap condition. Accordingly, the DHM patterns represent a mix of structural, stratigraphic and combination traps.

Intensity of spectral expression is an indication of high net hydrocarbon pore volumes in the sub-surface, thus assisting in determination and ranking of field sub-areas and gross field limits.

It should be recognised for this Gallery, as always, that while any one display provides a general illustration of a field or discovery area a comprehensive set of processed images is used in commercial surveying to develop a final DHM prospectivity interpretation map.

In the examples, Iso-Photo Density processed image displays (IPDs) are provided in paired montage with field / well maps. These are semi-regional DHM survey spectral outputs (Play Fairway Series or PFS) targeted to recognise known accumulations and to identify new exploration focus areas (EFAs) and emerging leads, all mapped at 1:100,000 scale on the same images and under the same processing routines.

A few examples are also displayed in spectral intensity prospect contour map format ("Relative Brightness Units" or "RBU" value maps). These typically provide, in addition to the overall gross DHM prospectivity pattern of the IPDs, a more definitive internal spectral characterisation pattern that can be used to consider / map core focus areas and prospect zonations for the identified feature.

Such mapped prospects can then be measured, risked and modelled for PRP volumetrics in rather conventional prospect analysis terms - then rated and ranked for possible progression and drilling/ testing with formulated guidance of locations suitable for optimal, effective early well tests - and similarly of where to NOT locate a first test.

Historic well inventories are indicated in the examples by current status as far as possible – producers, injectors, D&As and idle.

3.1 Greater Poso Creek / Mount Poso Oilfield District

This major field complex is very old, very large (>500MMbbls), yet still being developed further today by CRC using modern drilling, completion and enhanced recovery technologies. The two primary accumulations are Poso Creek itself and nearby Mount Poso. Both are shown in conventional field profile geological terms, in the California Department of Conservation's Atlas of SJB fields Volume I (Central California).

Under DHM their northern parts display strongly as spectral anomalies in close alignment with the inventory of total wells there and with the structural – stratigraphic evidence of the traps in the Atlas. Interestingly too, the DHM spectral pattern suggests that despite its long history there are further significant prospects still remaining there in undrilled sub-areas. These clearly merit more detailed attention and prospect development.

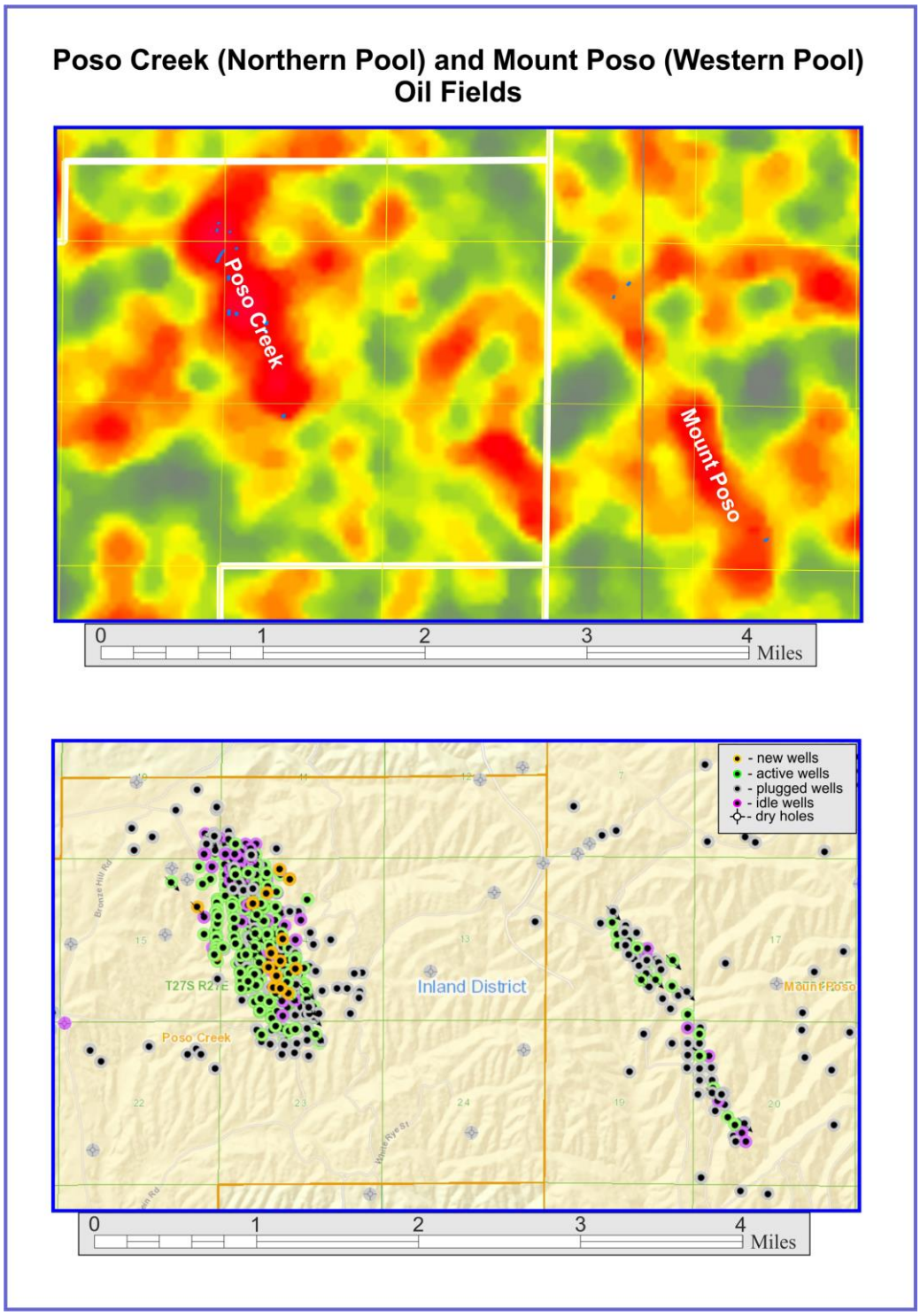

Figure 1: Greater Poso Creek /Mount Poso Field District (Discovered 1920-1926)

Strong IPD anomalies exist over the two main pools in this northern part of the Poso Creek / Mount Poso Field District. The known geological complexity and observed additional HLI response areas here strongly suggest further pools and deeper pays await discovery. Commercial DHM surveying is now required to provide more definitive prospect development, risk reduction, opportunity ranking and optimisation of new well locations.

3.2 Kettleman North Dome

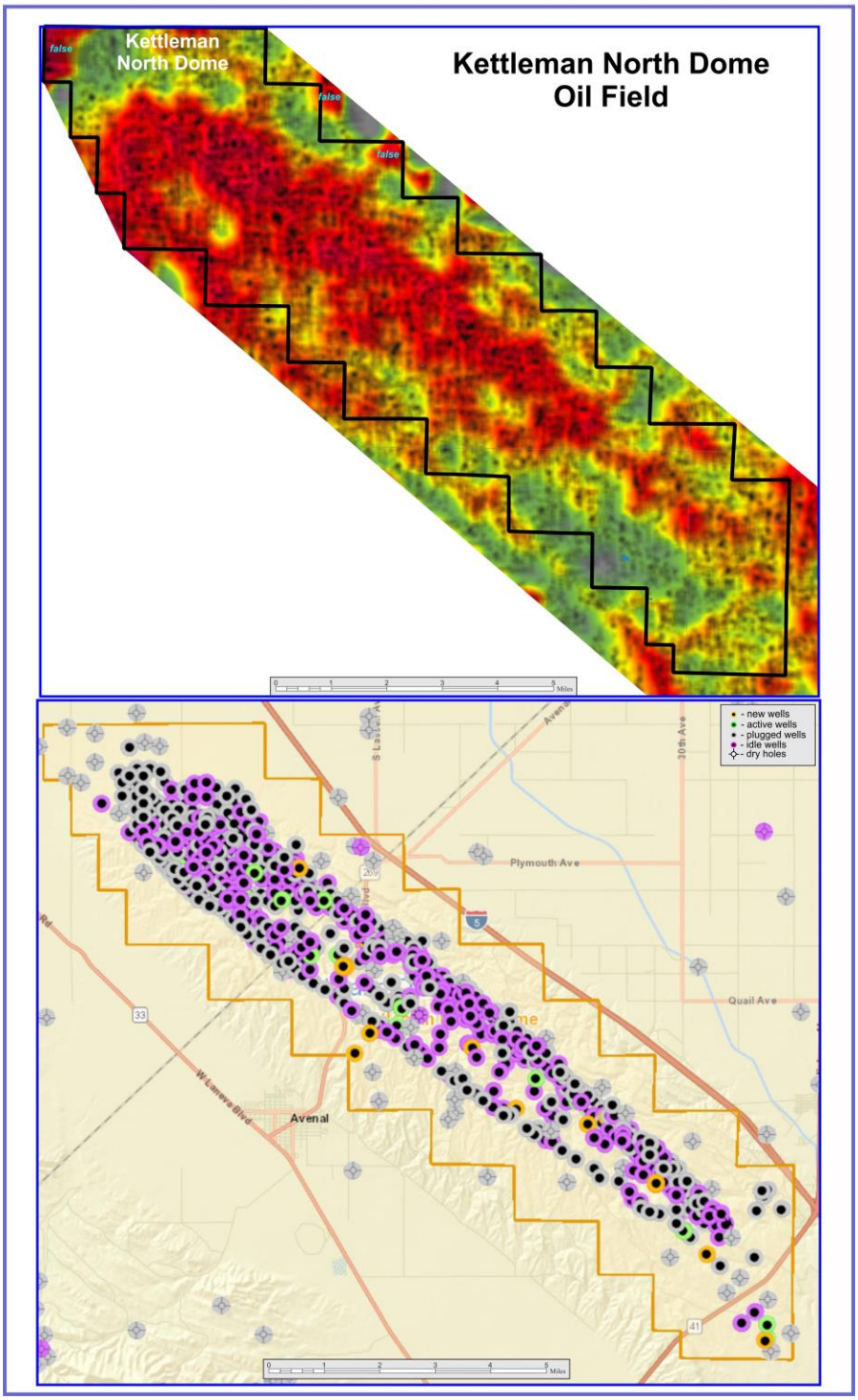

Figure 2: Kettleman North Dome (1928) - strong IPD anomaly over this super-giant field (1928), 20+ sq. mile, 4-way closure with >4,000´ stacked reservoir pays and 3.5-5.0 original BOE in place. Many idle wells but still scope for reserves growth and extensions. Being pursued today by CRC using multiple modern development / recovery technologies and exploration of untested deep exploration targets. EUR now seems likely to be in excess of 1BOE.

3.3 Paloma

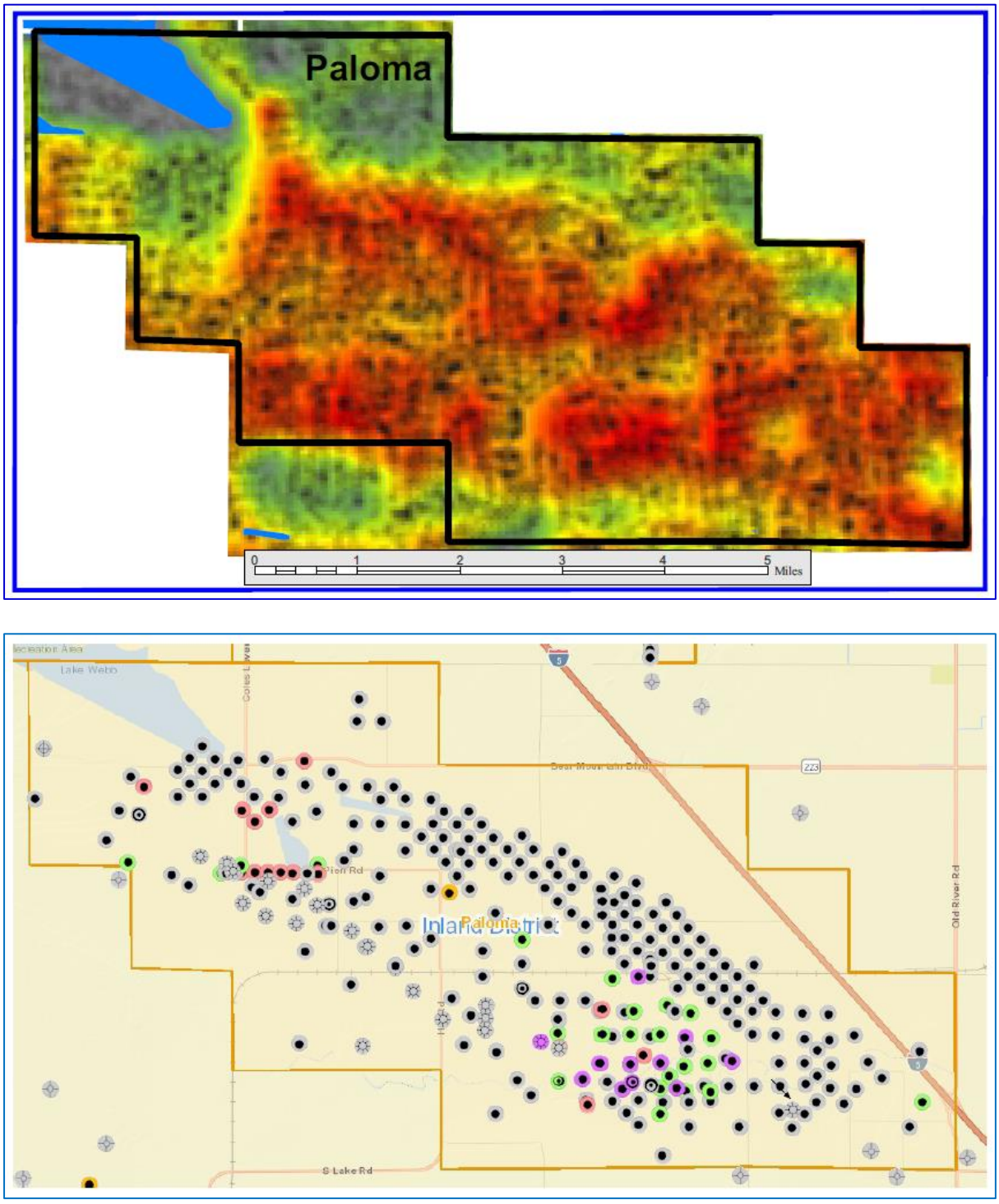

Figure 3: Paloma (1934). 62 MMBBL and 433 BCF Multi-zone complex across more than 4,355 acres. Strong IPD HLI surrounded by Low Prospectivity peripheries. Internal complexities suggested by spectral heterogeneities.

3.4 South Coles Levee

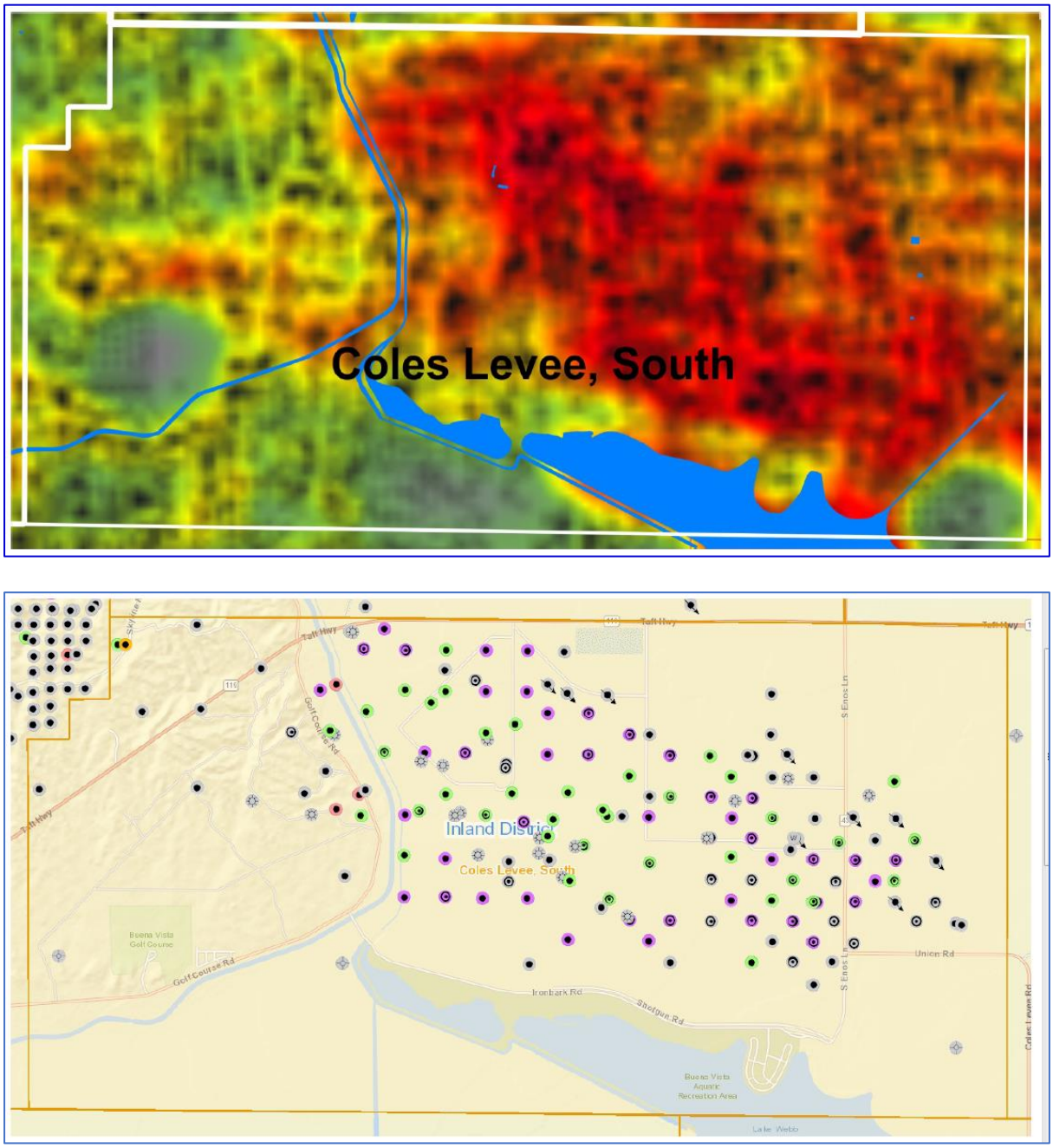

Figure 4: South Coles Levee (1938) - structural closure but stratigraphic trapping elements too. Original discovery of Stevens Zone pay. Modest field (60+MMBbls) but strong HLI suggests possible deeper pays.

3.5 McKittrick

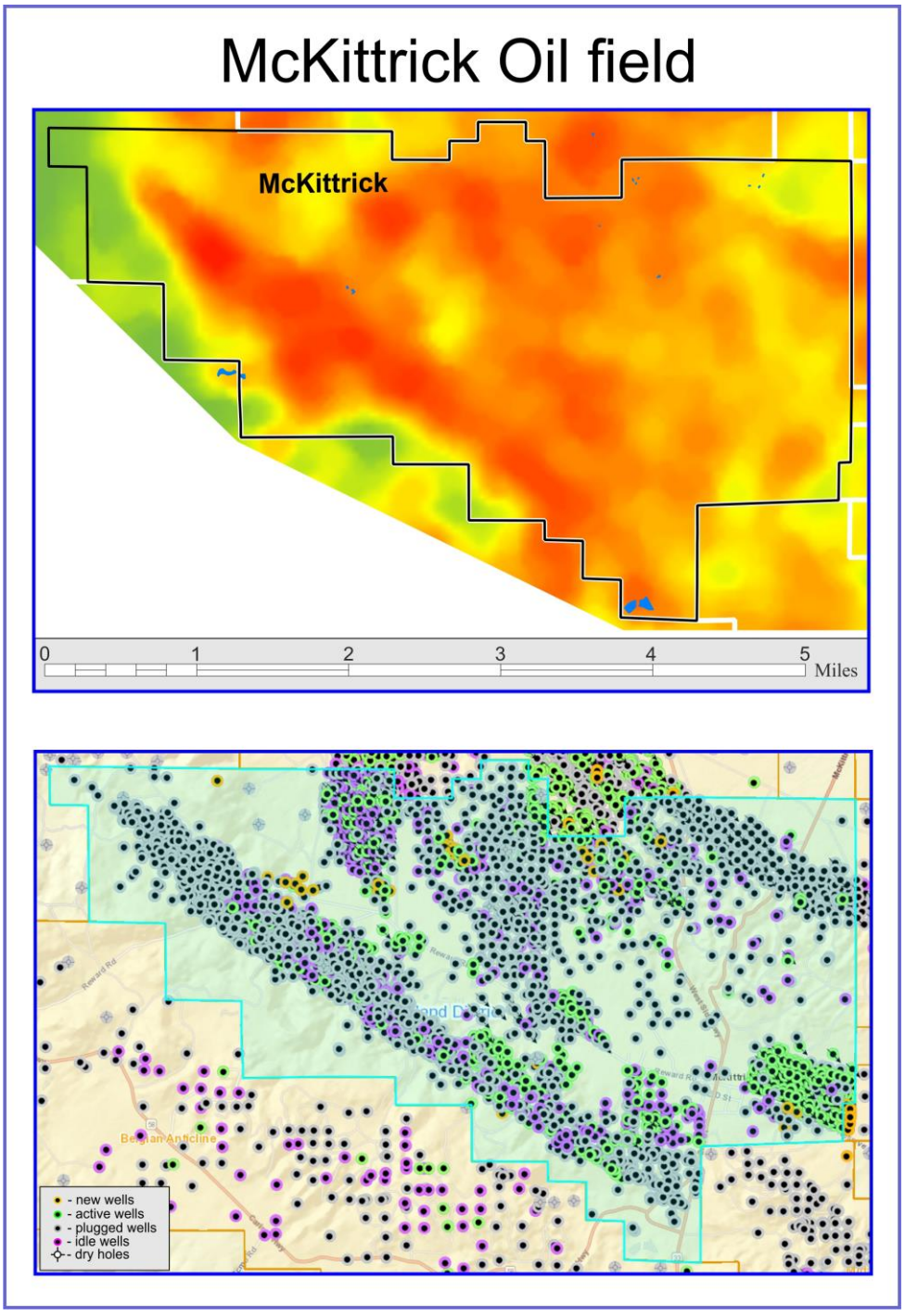

Figure 5: McKittrick Field (ca. 1896) - a very early SJB giant (325MMBBL and 247BCF). Strongly elongate NW-SE IPD anomaly aligns with field's "Main Area" - a well-developed high amplitude thrust fault closure. Broader sub-ovoid NE and SE pools also display. Impact of depletion apparent in weakening of some sub-area responses but there is general good coincidence of stronger core HLI areas with still producing areas.

3.6 Tule Elk

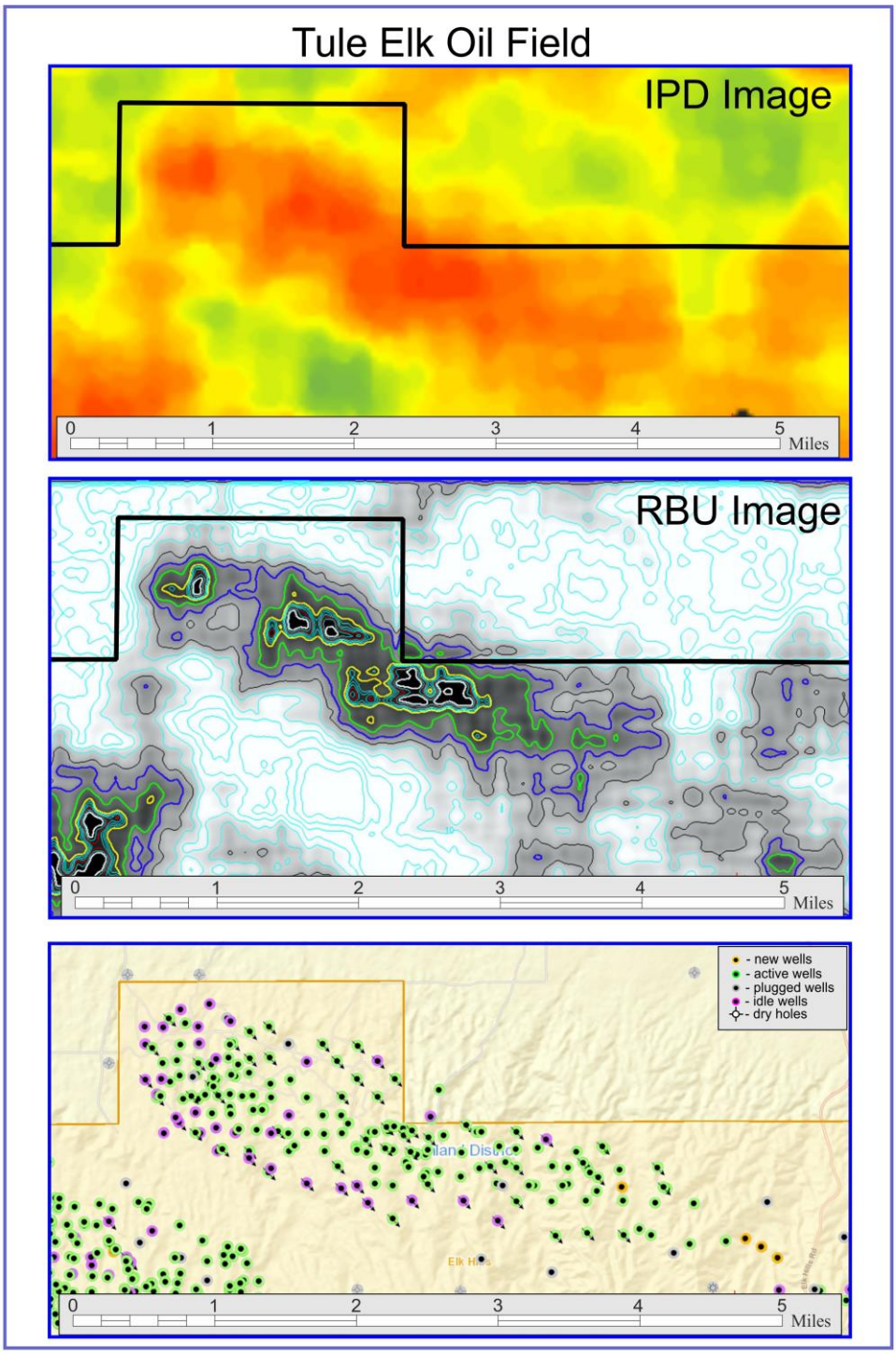

Figure 6. Tule Elk Field - two good, clean IPD anomalies over the producing field. Peripheral Injector and Idle wells in weaker HLI marginal positions. Originally developed on a 20 acre spacing pattern on the NE flank of the western anticline of the Elk Hills uplift. The RBU pane illustrates DHM's capacity to discern internal field / prospect "hydrocarbon geometries" and perceived high Net Hydrocarbon Pore Volume (NHPV) sub-areas – an effective, probabilistic surrogate of high reserves yield sweetspots or "core areas".

3.7 McDonald Anticline Field

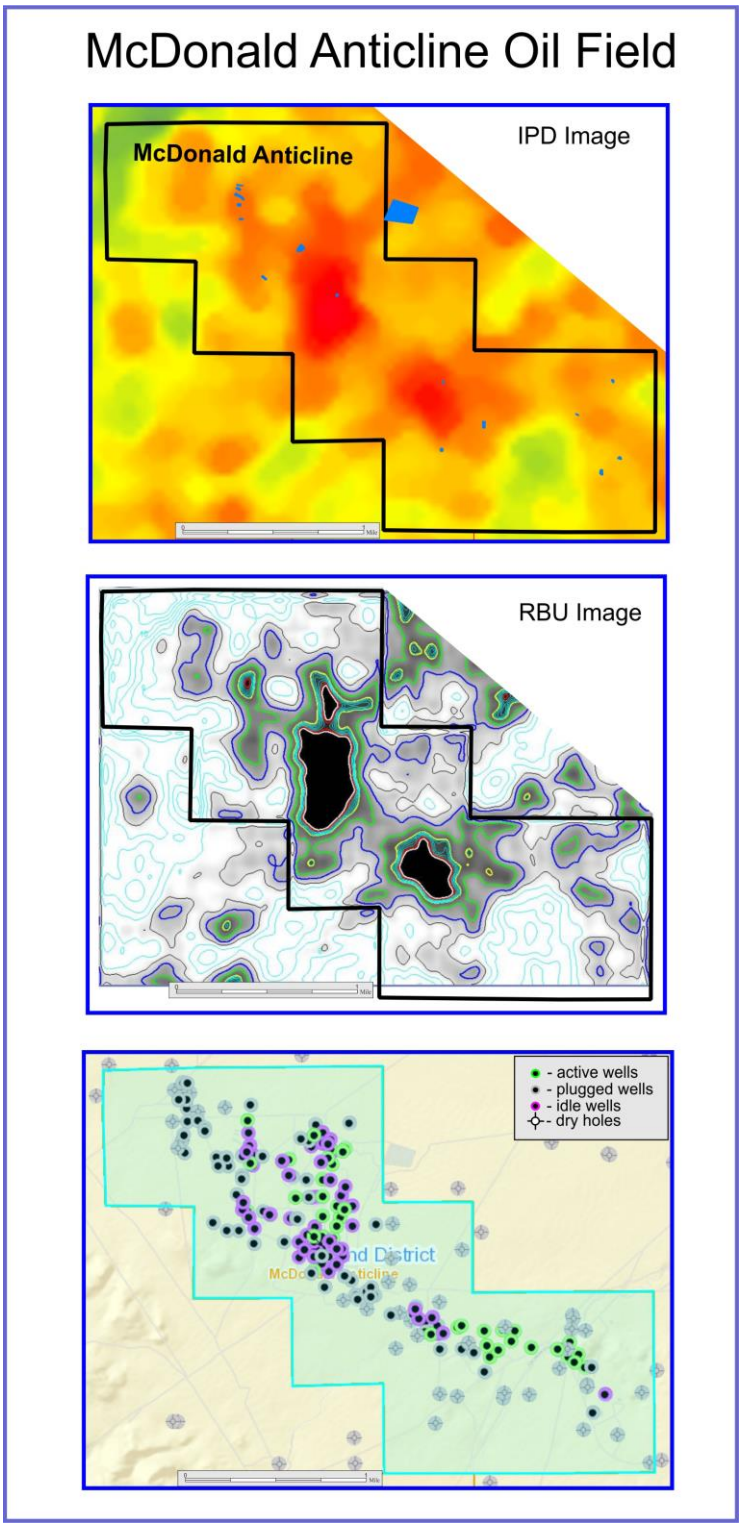

Figure 7. McDonald Anticline Field (1945) - the gross field area and key reserves sub-areas of McDonald Anticline field display clearly and strongly in DHM (IPD & RBU images) even after many decades of production. There is a notable absence of HLIs in the surrounding dry hole or undrilled terrains.

3.8 South Cuyama – Cuyama Basin

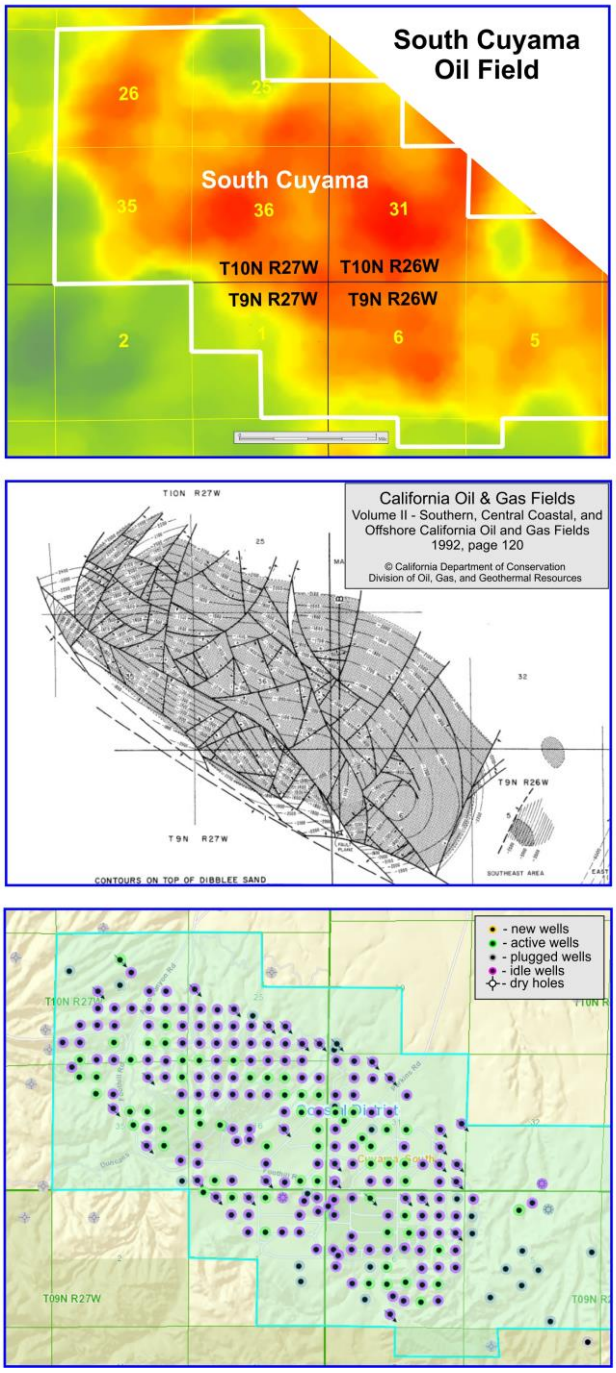

Figure 8. HLI (IPD) – CLI montage of the 250 million barrel South Cuyama Field in the Cuyama Basin immediately SW of the SJB. The strong IPD response aligns closely with the field's geologically mapped geometry. (Well and conventional geological displays courtesy of California Department of Conservation, Division of Oil, Gas and Geothermal Resources).

Nearby in this Cuyama Basin play fairway, the Russell Ranch oilfield (70 million barrels) also displays strongly under equivalent RSDD-H processing. Analogous new undrilled DHM prospects are similarly emerging.

4. Surveying and DHM Considerations:

Topography: The San Joaquin Valley floor itself, the bounding western Temblor ranges and the foothills of the Sierra Nevada in the east provide a wide array of topographic conditions for the SJB. DHM is observing known oil in all of these terrains and surface geomorphological situations. It appears that the HLI signals of this prolific habitat consistently outweigh the interference tendencies of the local terrains – including in nearby Cuyama.

Land Use: The arid ecosystem and open grasslands are clearly not a problem for DHM here but the intensive, irrigated agriculture in parts of the valley floor add complexity and require extra processing efforts to mitigate local interferences.

Vintage of Imagery v Depletion Status: The vast majority of SJB main fields were discovered in the first half of the 20th Century, many in its first quarter and some even earlier. Few genuine discoveries of note have been made recently. By normal standards this province would be considered fully mature with many fields now depleted or requiring new advanced technologies to keep them producing. This is however happening, in part due to the mainly heavy, very heavy and ultra-heavy nature of SJB crudes. Fields such as Mount Poso are seeing re-activation through a combination of such advanced drilling and completion and Secondary and Tertiary recovery schemes.

This technological evolution is increasingly accessing the very large percentages of Initial In Place volumes still present in many fields. Thus, by the time of capture and availability of first series satellite imagery in the last quarter of the 20th Century most fields were still displaying quite well on RSDD-H processing. It is nevertheless recognised that the cameos presented here are typically covering fields from which there has been a further long period of production and recovery. Each field case needs considered on its own merits versus its production history and more recent late life development schemes.

5. High Resolution Detailed DHM New Prospect Mapping and Commercial Surveys:

Having now observed and mapped at the general level many of SJB's well-known oilfields in this research project the case for the general effectiveness of DHM as an exploration tool in SJB is considered proven – as in many petroleum provinces world-wide. In part this is corroborated by the general absence of good HLIs in most of the dry hole terrains and undrilled low prospectivity surrounds (as deemed by industry). This current assessment indicates the ability of DHM and RSDD-H to map hydrocarbon-driven prospectivity in the SJB with good expectations.

There is therefore a high probability that analogous good HLIs in SJB / CB represent genuine new field outliers, deeper, still untested reservoir targets and/or completely new low risk exploration prospects. The next challenge is to undertake comprehensive and high resolution DHM surveys in defined areas of new interest for prospect development both in the SJB and in the adjacent CB.

Such a DHM prospect inventory can then be mapped, measured and assessed for PRP magnitude and Probabilities of Discovery taking not account the conventional exploration understanding of these areas.

Where Conventional Lead Indicators exist in parallel or seem possible then it is highly likely that the DHM results are effecting major new prospect inventory opportunity, significant exploration risk reduction and first time prediction of the likely extent of areal hydrocarbon entrapment in each mapped feature.

Scotforth has already identified an opening inventory of strong new DHM leads in field outlier, expected deeper pays and new exploration locations. It is considered probable that these will mature with comprehensive DHM surveying into low risk, high confidence, drillable prospects.

Once integrated with CLI studies, it is predicted that new discoveries and field extensions will follow from drilling and new reserves additions will exceed the recent USGS PRP prediction. ***It is considered that the ultimate petroleum reserves of this petroleum province will comfortably extend towards and quite possibly beyond 20 billion barrels.*** Truly, a remarkable basin!

Scotforth can guide and assist in building, capturing and delivering this new potential - and at an accelerated rate and reduced finding cost through:

- New DHM-based Field Studies
- District / Lease-wide DHM Exploration Surveys
- Acreage Drop Assessments
- Provision of developed DHM-led Prospects.

Should this opportunity set provide serious interest for development of business collaboration / commercial engagement between us, then please let us know. We can discuss and develop:

opportunities@scotforth.com

SFL 01 March 2019