NORTHERN SAN JOAQUIN BASIN PROJECT (NSJBP): REGIONAL CROSS SECTION GRID AND DATABASE

Offered for Multi-client Participation, by: QUANTSTRAT CALIFORNIA, LLC

Deliverables

- *Digital well header and correlated geological tops files for over 4,400 boreholes in the northern and central San Joaquin basin, California (T. 1-24 S. MDB&M; Figure 1). The database includes all known Miocene or older penetrations outside administrative field boundaries, a representative sampling of key wells (four or more per section) within oil fields producing from Miocene or older strata, and all known penetrations within shallow gas fields.*

- *Fifteen (15) regional stratigraphic cross sections were initially constructed in support of the database work (Figure 1). These sections incorporated more than 450 wells and provided the critical stratigraphic framework needed for iterative log correlation and tops work. Cross sections are available for licensing either individually, as a stand-alone package, or in combination with the database.*

- *The well header database is keyed to API number and includes 40 separate data fields (see pages 4-5). Unique header and tops files are provided for each known sidetrack, directional redrill, or deepening of a given well.*

- *The correlated tops database evolved by correlation (cluster loop-tying) to the regional cross section grid and has been extensively micropaleo- and seismic-tied over the past 30-plus years. Eighty-nine separate tops are supported, including 26 formation-level picks, encompassing the entire stratigraphic interval from "Top Miocene" to Basement (see pages 6-8).*

Formats

One (1) digital version of the header and tops database will be provided to each subscriber. The digital database is offered in either fixed-length or delimited ASCII, or CSV format. In order to simplify the data import process, a control file will be provided free-of-charge to all LMKR GeoGraphix users. Regional stratigraphic cross sections are available in either 24-inch or 36-inch hard copy print widths, or can be delivered digitally in various formats. Digital colorized versions of at least six (6) cross sections are now available at additional cost (please inquire about pricing).

Pricing

The database and cross section grid can be licensed separately or in combination. The current joint price is $78,500., which is payable in full upon subscription. Offers to license the database and/or cross section grid incrementally by area, or to license only specific parts of the database

(e.g., header or well spot data only), will be considered on an individual basis. In the past, "Gas Province" (T. 1-18 S.) and "Oil Province" (T. 15-24 S.) packages have been popular options. Incremental licensing of smaller subsets of the database or cross section grid is typically quoted on a "per well" or "per section" basis that is significantly more expensive compared to the same data purchased as part of a larger package. Please inquire about current pricing and specific deliverables for any requested subsets of the database and cross section grid.

Discounts

Discounts were offered to some initial subscribers for providing, or otherwise making available, certain data types to the project (e.g., hard copy well files, well logs, micropaleo data, seismic ties/checks, etc.). Because the cross section and correlation work has been completed, these discounts are generally no longer available, but could be granted in some cases—if interested, please make a proposal. Alternatively, companies can realize a significant savings by purchasing a license simultaneously with one or more joint venture partners or affiliates, as detailed below:

Initial License (Subscribing Company)…… $78,500
Second License (JV Partner/Affiliate #1)…… $65,500
Third License (JV Partner/Affiliate #2)……$52,500

In this scenario, the average price of $65,500 will be billed individually and a full, unrestricted license will be granted to all companies. Some form of documentation regarding the nature of working relationship or affiliation may be required to qualify for this discount.

Miscellaneous

- *The interpretations and data provided in this project represent the culmination of over 30 years of concerted effort in the northern and central San Joaquin basin by one experienced stratigrapher/petroleum geologist and one exceptional geotechnical assistant. This project was not completed "by committee."*

- *Currently there are 16 full or partial subscribers to the project.*

- *The header and tops databases will be maintained and quarterly updates made available to all current subscribers for a very reasonable annual fee. QuantStrat's update service was initiated in June, 2003 and has proved to be a valuable asset for tracking basin activity and maintaining up-to-date data resources. One (1) full year of quarterly updates will be provided free-of-charge to all new subscribers to the NSJBP that are licensed prior to June 15, 2017.*

- *In the future, several additional data sets may be compiled for each well/borehole, including well construction, directional survey, micropaleo, core/sidewall core, DST, and perforation/ production data. These "rock" and "fluids" data sets will be keyed to consistent formation- or member-level designations, resulting in the most comprehensive and reliable exploration database available for the northern and central San Joaquin basin. Pricing for the additional data sets will be determined upon completion, at which time all current NSJBP subscribers will be offered substantial discounts.*

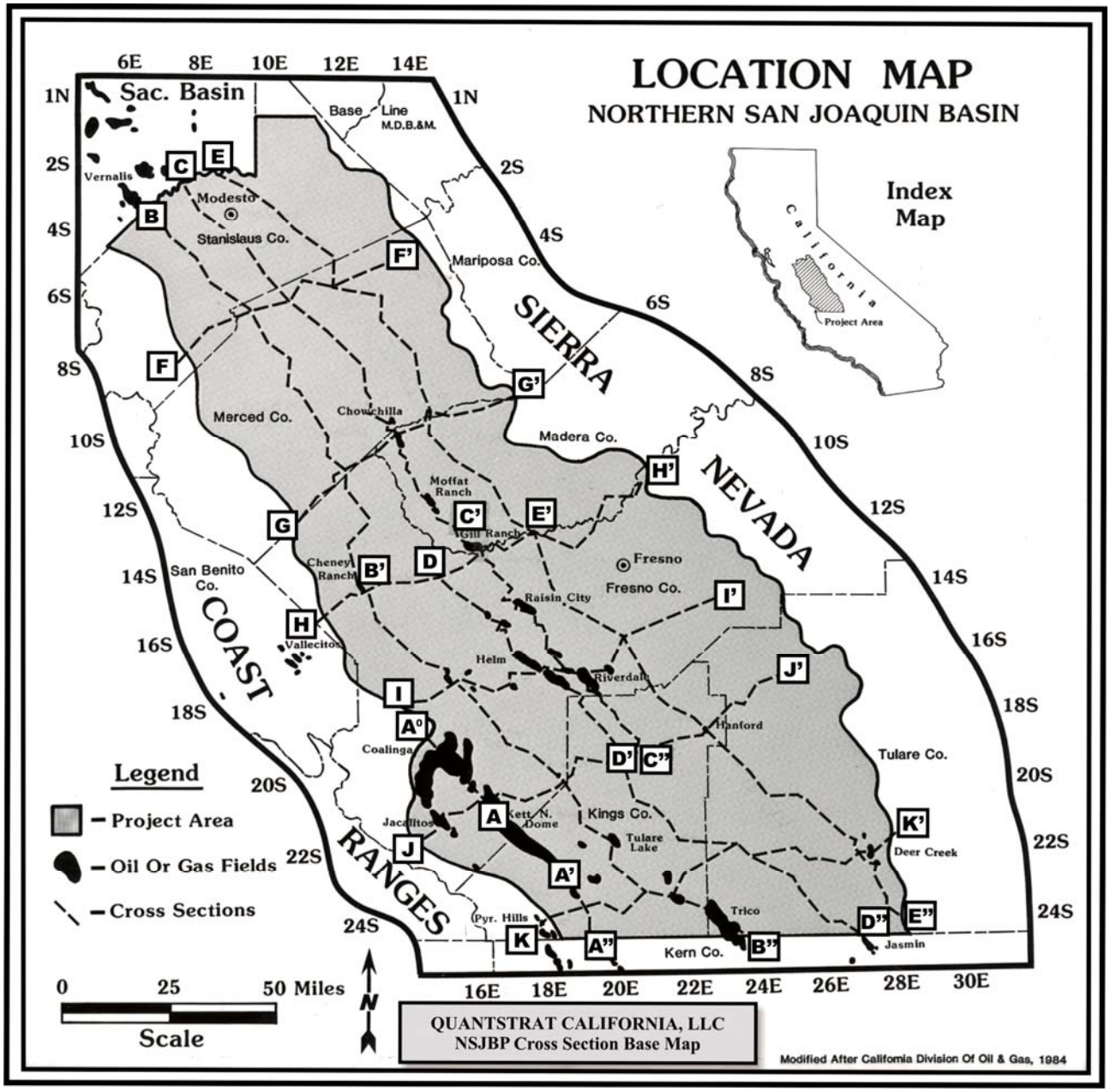

Figure 1
NSJBP Focus Area and Regional Cross Section Grid

NORTHERN SAN JOAQUIN BASIN PROJECT
Digital Well Header & Correlated Tops Database (T. 1-24 S. MDB&M)

by QuantStrat California, LLC
May 1, 2017

Example Fixed Length ASCII Format for NSJBP Well Headers and Tops

Two different record types are provided for in the data template: headers and tops. All records pertaining to a particular borehole are grouped together (i.e., each header record is followed by up to 89 tops records that correspond to that borehole). Each record is terminated with standard carriage return and line-feed control characters (ASCII 13, 10). Fields within a record are one of three types: character (char), numeric (num), or date. Dates will always be in the format MM/DD/YYYY. Numeric fields have no leading zeros and are right-justified; character fields are left-justified.

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NSJBP Header Record Layout

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Positions	*Length*	*Type*	*Description*
1 - 3	*3*	*char*	*Header Record Code = "HSJ"*
4 - 5	*2*	*num*	*Database Format Version Number = 1*
6 - 19	*14*	*char*	*API Number*
20 - 61	*42*	*char*	*Operator*
62 - 95	*34*	*char*	*Well Name*
96 - 101	*6*	*char*	*Well Number*
102 - 105	*4*	*num*	*Meridian Code = 16 (Mount Diablo B&M)*
106 - 107	*2*	*num*	*Township Number*
108	*1*	*char*	*Township Direction*
109 - 110	*2*	*num*	*Range Number*
111	*1*	*char*	*Range Direction*
112 - 113	*2*	*num*	*Section Number*
114 - 143	*30*	*char*	*Reference Location*
144 - 150	*7*	*char*	*Footage Location 1*
151 - 157	*7*	*char*	*Footage Location 2*
158 - 159	*2*	*char*	*Reference Quarter*
160 - 169	*10*	*num*	*Longitude (data not supplied)*
170 - 179	*10*	*num*	*Latitude (data not supplied)*
180	*1*	*char*	*Original Hole? (Y/N/U)*
181	*1*	*char*	*Directional Well? (Y/N/U)*
182 - 187	*6*	*char*	*Bottom Hole Offset N/S (if directional & known)*
188 - 193	*6*	*char*	*Bottom Hole Offset E/W (if directional & known)*
194 - 197	*4*	*num*	*Ground Elevation*

198 - 199	*2*	*char*	*Datum Description*
200 - 204	*5*	*num*	*Datum Elevation*
205 - 214	*10*	*date*	*Spud Date*
215 - 224	*10*	*date*	*Completion Date*
225 - 234	*10*	*date*	*Production Date*
235 - 244	*10*	*date*	*Abandonment Date*
245 - 264	*20*	*char*	*Historical ("running") Well Status*
265 - 266	*2*	*num*	*Map Status Code:*
			0 = P&A
			1 = OIL
			2 = GAS
			3 = OG (capable of both oil & dry gas production)
			4 = OIL/P&A
			5 = GAS/P&A
			6 = OG/P&A
			7 = SUSP (includes SI, TA & IDLE)
			8 = INJ (water, steam, gas, etc.)
			9 = UNK
			10 = OTHER (includes LOC & DR)
267	*1*	*char*	*Well Reworked? (Y/N/U)*
268 - 272	*5*	*num*	*Total Depth*
273 - 277	*5*	*num*	*Bottom Hole TVD (if directional & known)*
278 - 283	*6*	*char*	*Series/Formation at TD (code)*
284	*1*	*char*	*Logged? (Y/N/U)*
285	*1*	*char*	*Casing Set? (Y/N/U)*
286	*1*	*char*	*Cores Taken? (Y/N/U)*
287	*1*	*char*	*Core Shows? (Y/N/U)*
288	*1*	*char*	*Sidewall Cores Taken? (Y/N/U)*
289	*1*	*char*	*Sidewall Core Shows? (Y/N/U)*
290	*1*	*char*	*DST's Made? (Y/N/U)*
291	*1*	*char*	*DST Shows? (Y/N/U)*
292	*1*	*char*	*Well Productive? (Y/N/U)*
293 - 338	*46*	*char*	*Comments*
339 - 384	*46*	*char*	*Comments*
385 - 430	*46*	*char*	*Comments*
431	*1*	*char*	*Units = E (English)*
432	*1*	*char*	*Record Has Been Manually Updated? (Y/N)*
433 - 442	*10*	*date*	*Date This Record Was Last Changed (MM/DD/YYYY)*
443 - 447	*5*	*char*	*Time This Record Was Last Changed (HH:MM)*

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NSJBP Tops Record Layout

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Positions	*Length*	*Type*	*Description*
1 - 3	*3*	*char*	*Tops Record Code = "TSJ"*
4 - 11	*8*	*char*	*Formation Code*
12 - 16	*5*	*char*	*Top Value (drilled depth)*

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NSJBP Tops Sequence and Codes

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Sequence #	*Ser/Fm Code*	*Full Code*	*Formation, Member or Surface*
1	*MSM*	*MSMRG*	*MIOCENE SANTA MARGARITA FM.*
2	*MRR*	*MRRDG*	*MIOCENE REEF RIDGE FM.*
3	*MM*	*MMTRY*	*MIOCENE MONTEREY FM.*
4	*MM*	*MCLSH*	*McLure Shale*
5	*MM*	*FTVLSH*	*Fruitvale Shale (SE)*
6	*MM*	*MCVSD*	*McVan Sand (SE)*
7	*MUT*	*MUTMB*	*MIOCENE "UPPER" TEMBLOR FM.*
8	*MZ*	*MZILCH*	*MIOCENE ZILCH FM. (N)*
9	*MUT*	*1STSD*	*First Sand (SW)*
10	*MRM*	*MRMTN*	*MIOCENE ROUND MTN. FM. (SE)*
11	*MUT*	*UVGTSH*	*Upper Variegated Shale (SW)*
12	*MUT*	*2NDSD*	*Second Sand (SW)*
13	*MUT*	*600FTSH*	*600 Foot Shale (SW)*
14	*MOL*	*MOLC*	*MIOCENE OLCESE FM. (SE)*
15	*MUT*	*3RDSD*	*Third Sand (SW)*
16	*MUT*	*800FTSH*	*800 Foot Shale (SW)*
17	*MFJ*	*MFJWT*	*MIOCENE FREEMAN-JEWETT FM. (SE)*
18	*MUT*	*4THSD*	*Fourth Sand (SW)*
19	*MUT*	*LVGTSH*	*Lower Variegated Shale (SW)*
20	*MUT*	*5THSD*	*Fifth Sand (SW)*
21	*OMLT*	*OMLTMB*	*OLIG./MIO. "LOWER" TEMBLOR FM.*
22	*MFJ*	*PYRHLSD*	*Pyramid Hill Sand (SE)*
23	*OMLT*	*FLXSLT*	*Felix Silt (SW)*
24	*OVD*	*OVDR*	*OLIGOCENE VEDDER FM. (SE)*
25	*OMLT*	*BRBKSD*	*Burbank Sand (SW)*
26	*OVQ*	*OVQR*	*OLIGOCENE "VAQUEROS" FM. (S)*
27	*OVQ*	*WPLYSH*	*Whepley Shale (S)*
28	*OVQ*	*ALSNSD*	*Allison Sand (S)*
29	*OVQ*	*UVQRSD*	*Upper Vaqueros Sand (S)*
30	*OVQ*	*LVQRSD*	*Lower Vaqueros Sand (S)*

31	*OET*	*OETMY*	*EOC./OLIG. TUMEY FM.*
32	*OET*	*STCRKSH*	*Salt Creek Shale (SW)*
33	*OET*	*LEDASD*	*Leda Sand (SW)*
34	*OET/EK*	*OET/EK*	*TUMEY/KREYENHAGEN FM. UNDIFF.*
35	*EK*	*EKREY*	*EOCENE KREYENHAGEN FM.*
36	*EK*	*KRE*	*Kreyenhagen "E" Point (Kre)*
37	*EK*	*TSRFSD*	*Top Surfluh Sand (EC)*
38	*EK*	*TNRTSD*	*Top Nortonville Sand (EC)*
39	*EF*	*EFAM*	*FAMOSO SAND/C.T.U. (SE)*
40	*ED*	*EDOM*	*EOCENE DOMENGINE FM.*
41	*ED*	*BDOMUC*	*Base Domengine Unconformity*
42	*EKUW*	*EKUWKR*	*EOC.-U. CRET. WALKER FM. (SE)*
43	*ED*	*YKTLOSD*	*Yokut/Loescher Sand (SC)*
44	*EL*	*ELODO*	*EOCENE LODO FM. (S)*
45	*EL*	*UMCADMSD*	*Upper McAdams Sand (SW)*
46	*EL*	*UAHNDSH*	*U. Arroyo Hondo Shale (SW)*
47	*EL*	*GTCHLSD*	*Gatchell Sand (SC)*
48	*EL*	*LMCADMSD*	*Lower McAdams Sand (SW)*
49	*EL*	*LAHNDSH*	*L. Arroyo Hondo Shale (SW)*
50	*EL*	*TCNTSD*	*Top Cantua Sand (WC)*
51	*EL*	*BCNTSD*	*Base Cantua Sand (WC)*
52	*PEMART*	*PEMART*	*PALEOCENE MARTINEZ FM.*
53	*PEMART*	*MARTSD*	*Martinez Sand*
54	*PEMOR*	*PEMOR*	*PALEOCENE MORENO FM.*
55	*PEMOR*	*TDSPLS*	*Top Dos Palos Sand/Shale (W)*
56	*PEMOR*	*CIMASD*	*Cima Sand (W)*
57	*PEMOR*	*UMORSH*	*"Upper" Moreno Shale (S)*
58	*KUM*	*KUMOR*	*U. CRETACEOUS MORENO FM.*
59	*KUM*	*HALLSH*	*Hall Shale (N)*
60	*KUM*	*GRZSD*	*Garzas Sand (N)*
61	*KUM*	*WTVLSD*	*Wheatville Sand (NC)*
62	*KUM*	*LMORSH*	*"Lower" Moreno Shale (N)*
63	*KUM*	*TAZVSD*	*Top Azevedo Sand (N)*
64	*KUM*	*BAZVSD*	*Base Azevedo Sand (N)*
65	*KUB*	*KUBLWT*	*U. CRETACEOUS BLEWETT FM. (W)*
66	*KUB*	*TBLWTSD*	*Top Blewett Sand (W)*
67	*KUB*	*BBLWTSD*	*Base Blewett Sand (W)*
68	*KUB*	*RVSLT*	*Ragged Valley Silt (N)*
69	*KUS*	*KUSTRK*	*U. CRETACEOUS STARKEY FM. (E)*
70	*KUS*	*STRKSD1*	*First Starkey Sand (E)*
71	*KUT*	*KUTRCY*	*U. CRETACEOUS TRACY FM. (NW)*
72	*KUT*	*BTRCYSD*	*Base Tracy Sand (NW)*
73	*KUS/KUT*	*SWTHMK*	*Sawtooth Marker (N)*
74	*KUS*	*STRKSD2*	*Second Starkey Sand (E)*
75	*KUS/KUT*	*SWTHSH*	*Sawtooth Shale (N)*
76	*KUW*	*KUWNT*	*U. CRETACEOUS WINTERS FM. (NW)*
77	*KUW*	*BWNTSD*	*Base Winters Sand (NW)*
78	*KUS*	*STRKSD3*	*Third Starkey Sand (E)*

79	*KUS/KUW*	*TESH*	*Top "E" Zone Shale Undiff. (N)*
80	*KUL*	*KULRP*	*U. CRETACEOUS LATHROP FM. (W)*
81	*KUL*	*TLRPSD*	*Top Lathrop Sand (W)*
82	*KUL*	*BLRPSD*	*Base Lathrop Sand (W)*
83	*KUL*	*TLWLRP*	*Top Lower Lathrop (N)*
84	*KUS/KUL*	*TESD*	*Top "E" Zone Sand Undiff. (NC)*
85	*KUL*	*SACSH*	*Sacramento Shale (N)*
86	*KUF*	*KUFRBS*	*U. CRETACEOUS FORBES FM. (N)*
87	*KUF*	*TFRBSD*	*Top Forbes Sand (N)*
88	*KUF*	*BFRBSD*	*Base Forbes Sand (N)*
89	*BSMT*	*BSMT*	*BASEMENT UNDIFF.*

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Questions regarding content, format or pricing regarding our NSJBP Regional Cross Section Grid and Database can be directed to J. Scott Lewis (QuantStrat California, LLC) at 303-766-9677, or by e-mail at jslewis@quantstrat.com