Report of Geotechnical Studies
Fault Evaluation Data

Volume 3
Appendix E-F

Volume 3

Report of Geotechnical Studies
Fault Evaluation Data
Appendix E through Appendix F
Proposed Newport Banning Ranch Development
City of Newport Beach/County of Orange

Prepared for:

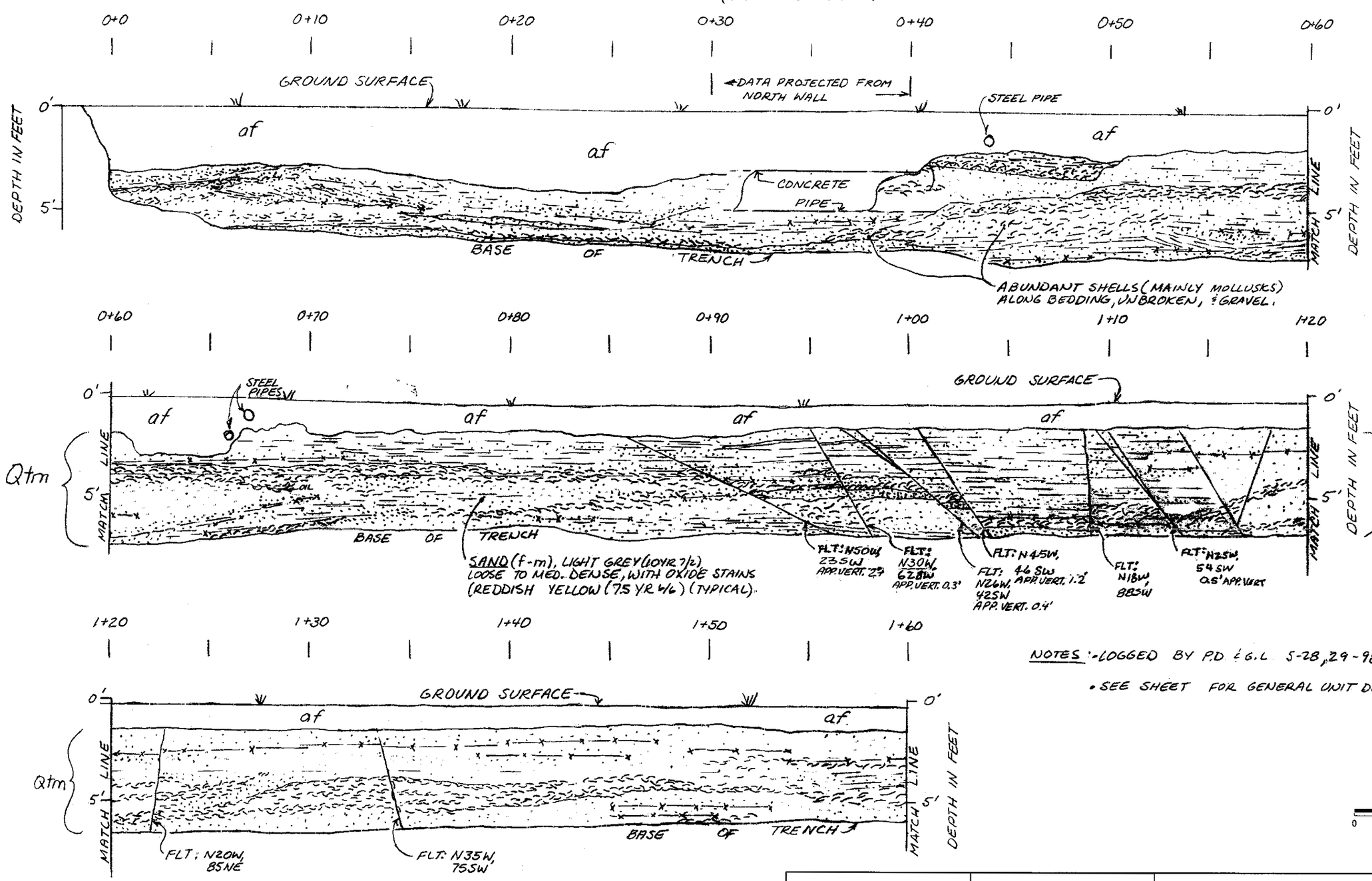
Newport Banning Ranch LLC

Prepared By:

GMU Geotechnical, Inc.

July 2011

TRENCH TR-1
(VIEW TO SOUTHEAST)



NOTES: - LOGGED BY P.D & G.L 5-28, 29-98

- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS

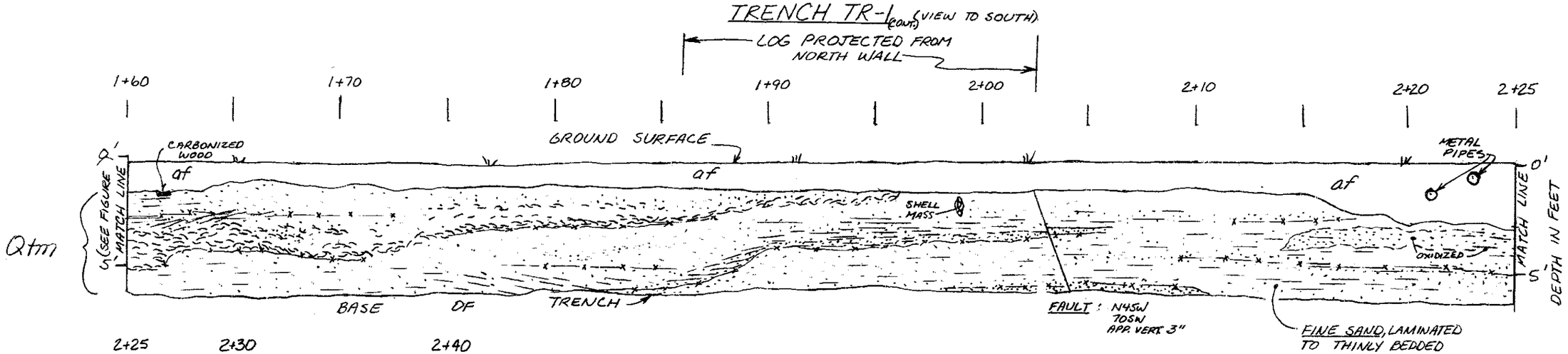
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

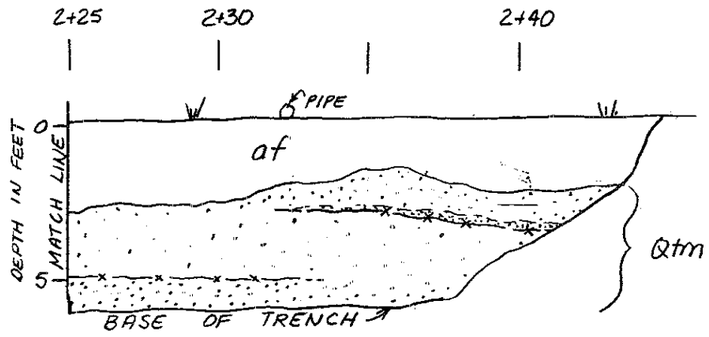
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

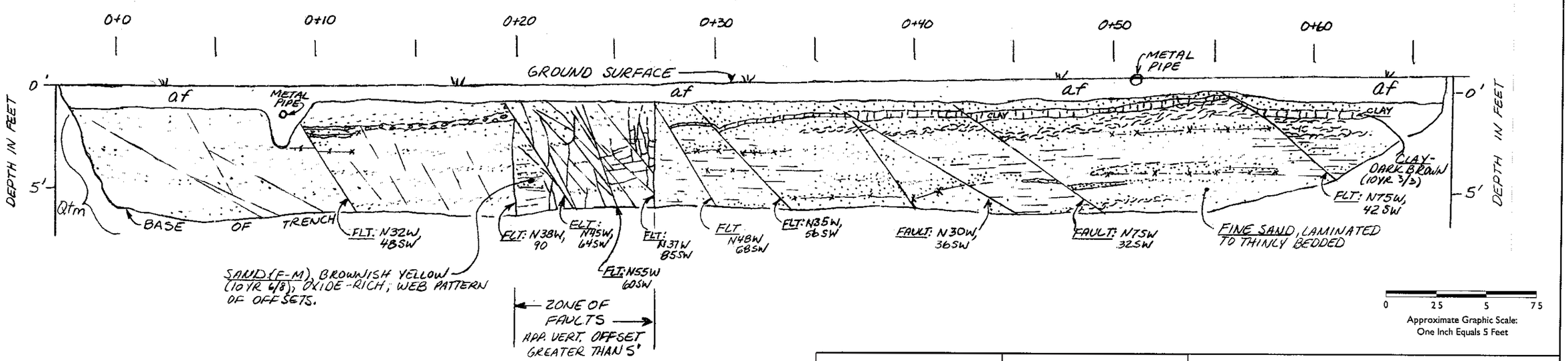
TRENCH TR-1
(Station Numbers 0+00 to 1+60)

TRENCH TR-1 (cont.) (VIEW TO SOUTH)





TRENCH TR-2 (VIEW TO



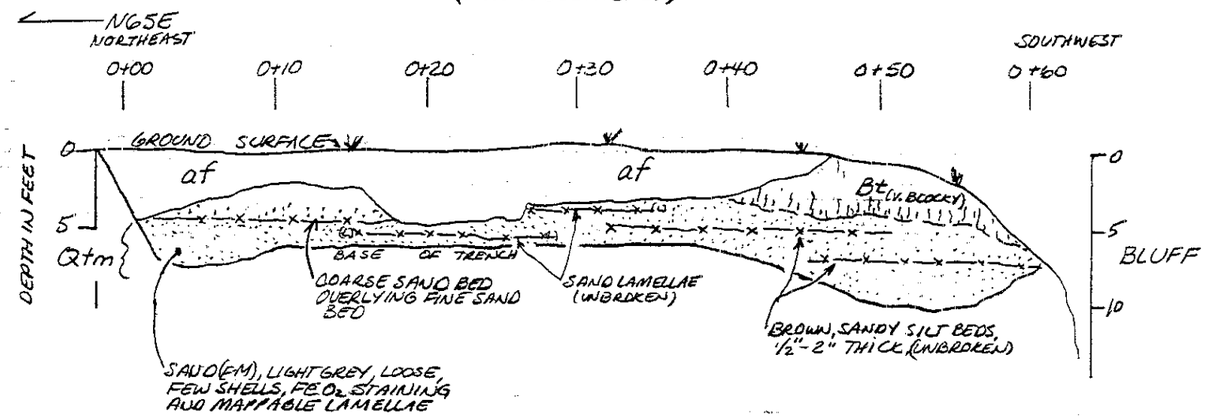
NOTES:
- LOGGED BY P.D & G.L., 5-29-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-1
(Station Numbers 1+60 to 2+25)
TRENCH TR-2
(Station Numbers 0+00 to 0+68)

TRENCH TR-1A
(VIEW TO SOUTHEAST)



NOTES:
- LOGGED BY P.D 10/14/98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS

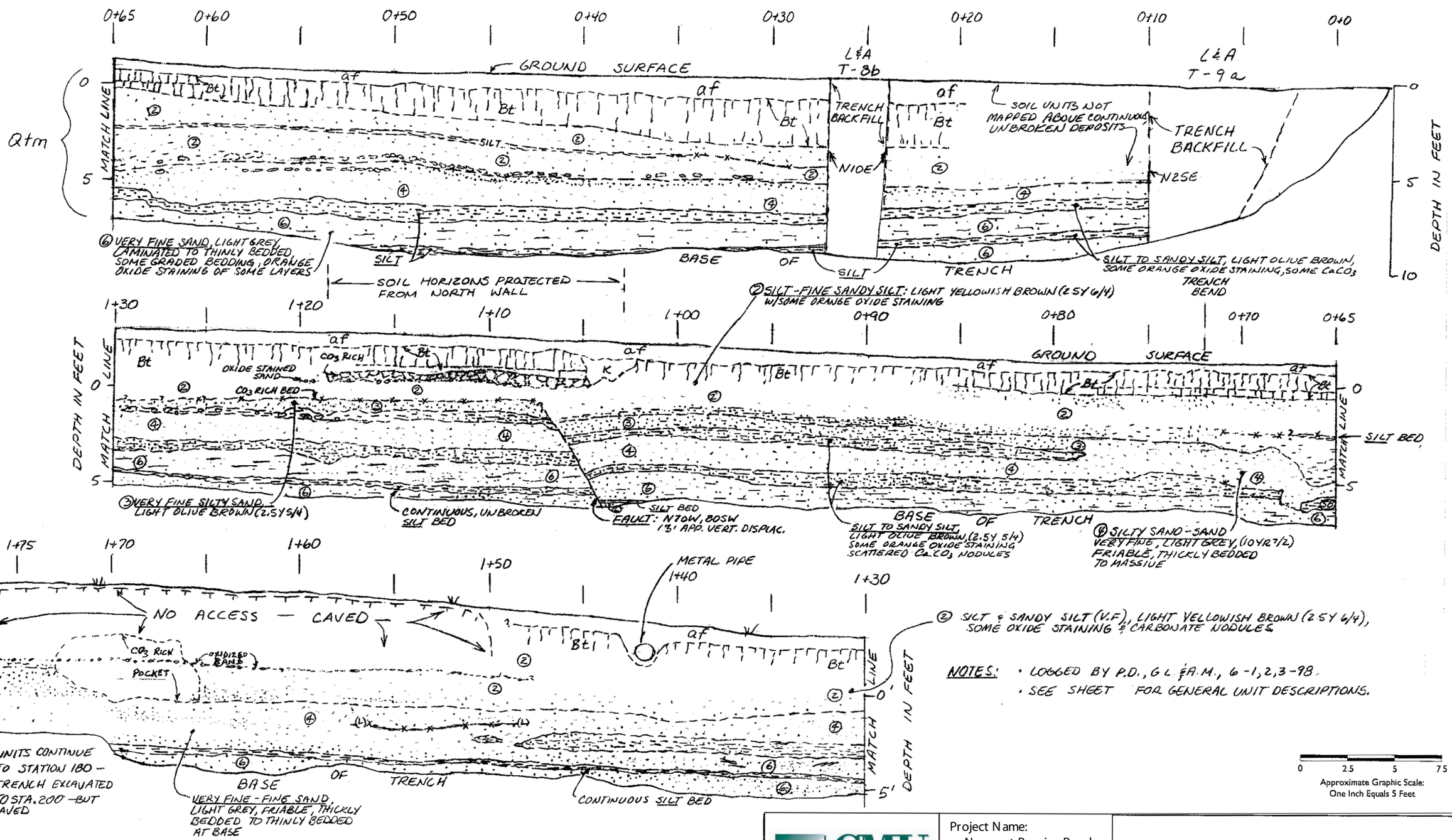
0 5 10 15
Approximate Graphic Scale:
One Inch Equals 10 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-1A
(Station Numbers 0+00 to 0+60)

TRENCH TR-3



NOTES:

- LOGGED BY P.D., G.L. & A.M., 6-1,2,3-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

Approximate Graphic Scale: One Inch Equals 5 Feet

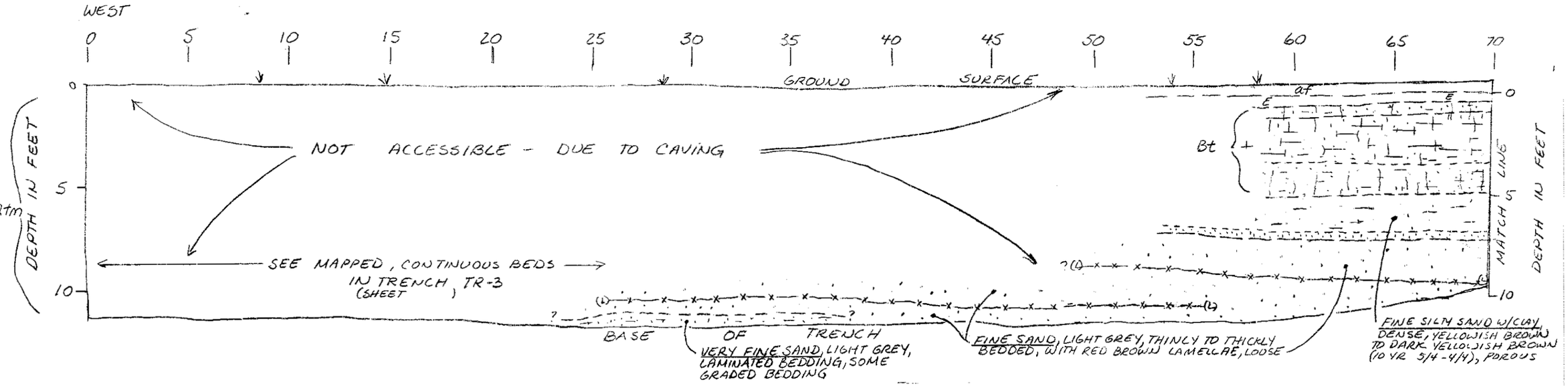
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-3
(Station Numbers 0+65 to 1+30)

TRENCH TR-3a

TRENCH TREND N82W



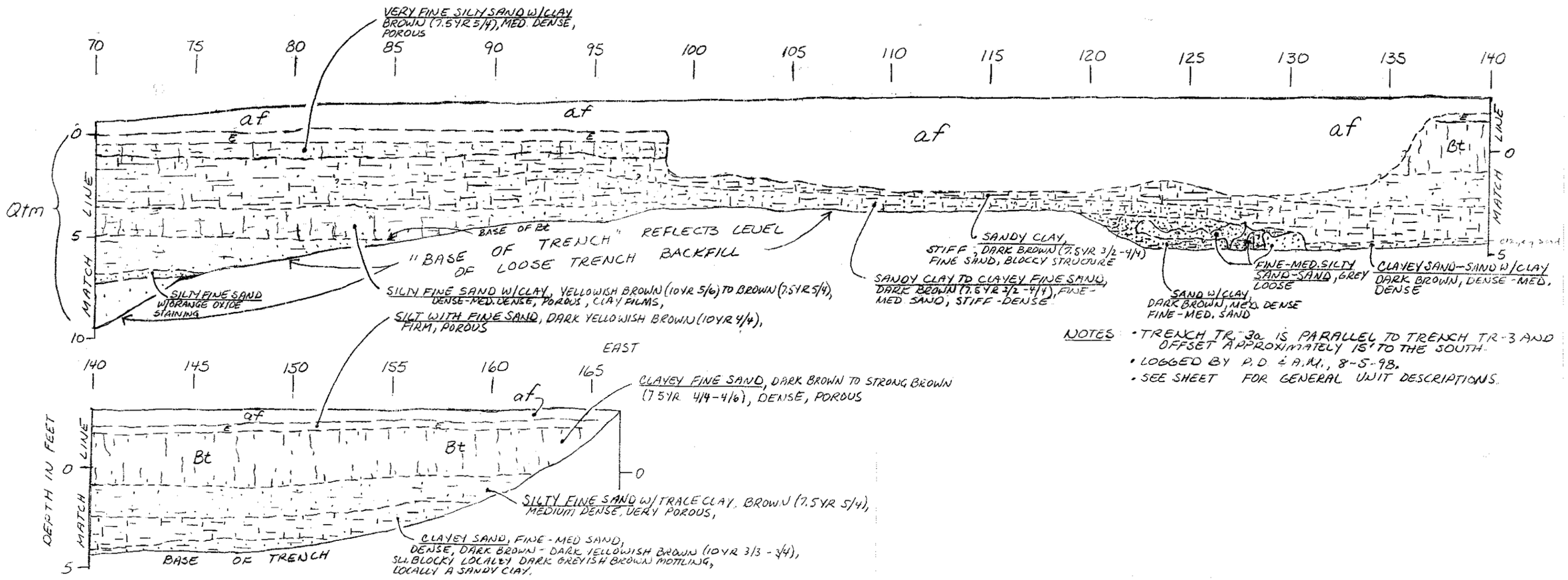
0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-3A
(Station Numbers 0+00 to 70+00)



NOTES
- TRENCH TR-3a IS PARALLEL TO TRENCH TR-3 AND OFFSET APPROXIMATELY 15' TO THE SOUTH.
- LOGGED BY P.D. & A.M., 8-5-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

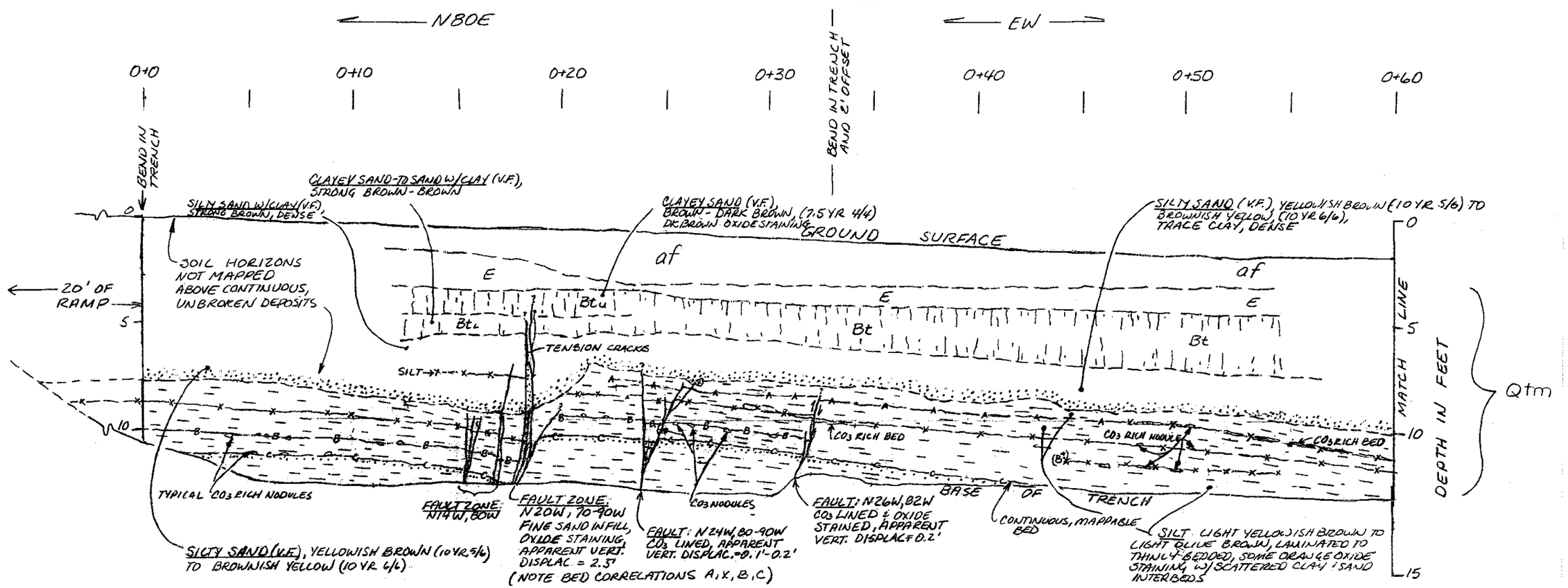
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-3A
(Station Numbers 70+00 to 165+00)

TRENCH TR-4



NOTES:

- LOGGED BY P.D, G.L & A.M. 6-2,3,4-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

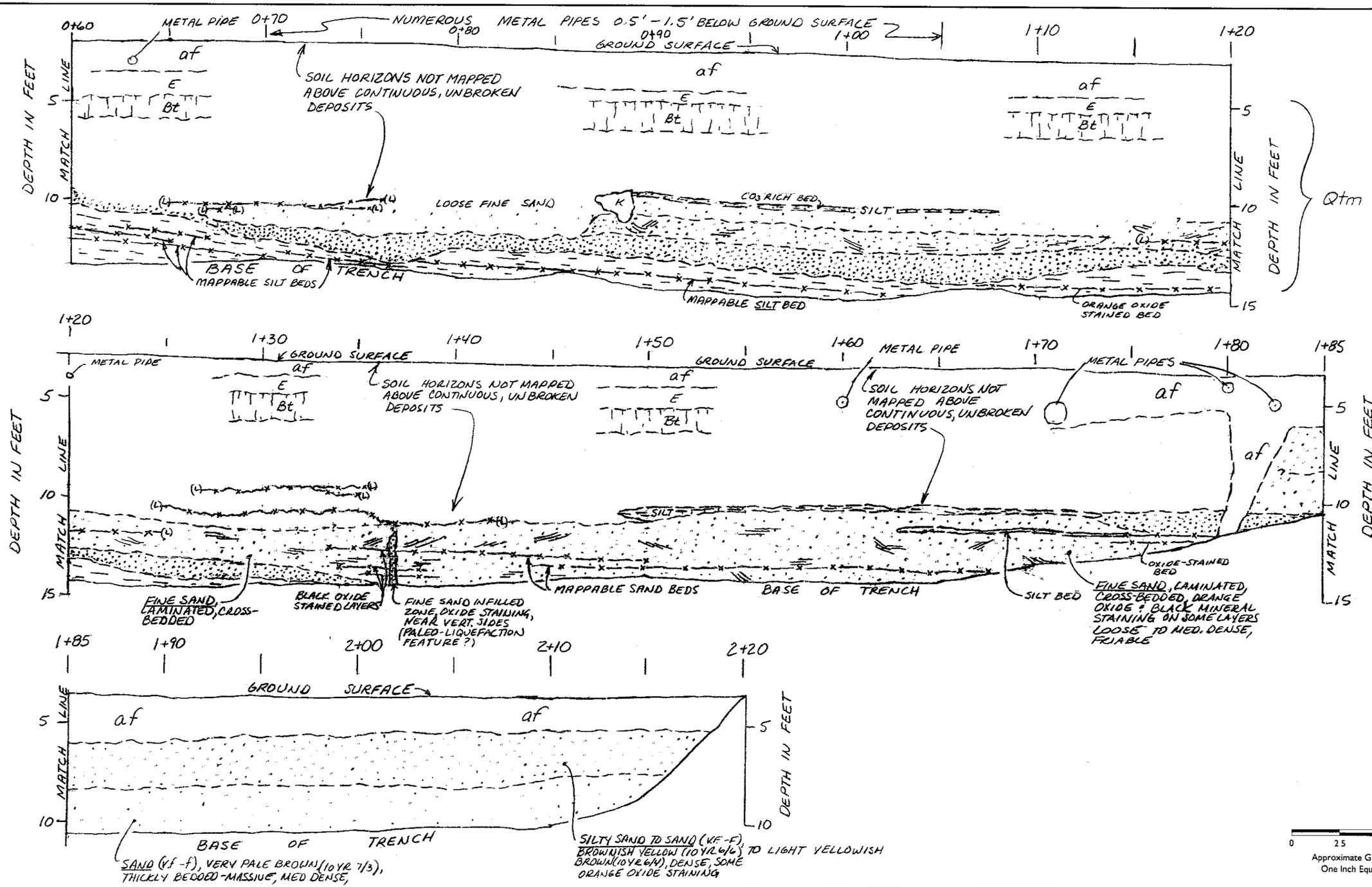
0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-4
(Station Numbers 0+00 to 0+60)



NOTES

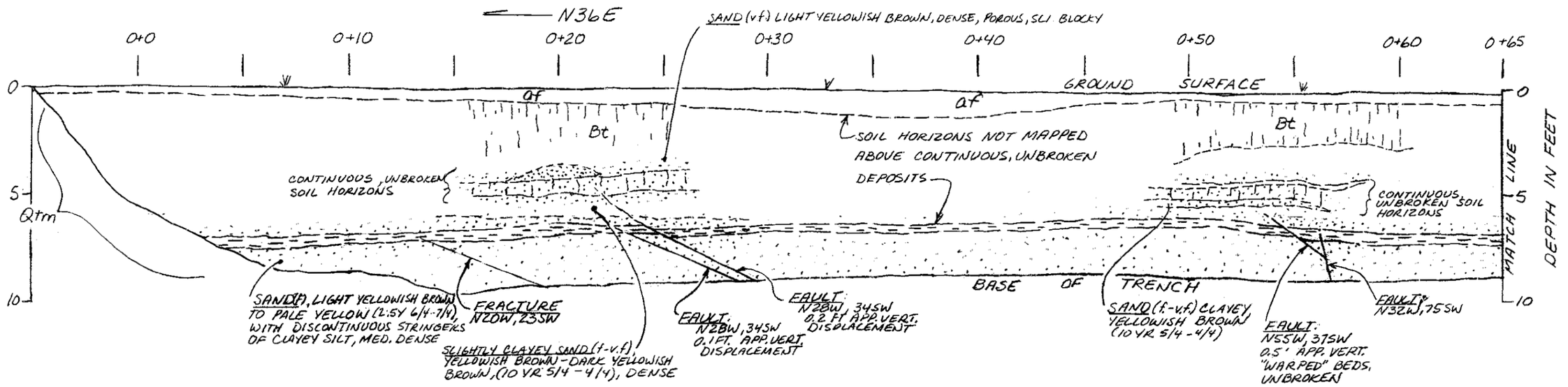
- LOGGED BY P.D., G.L. & A.M. 6-2, 3, 4-98
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

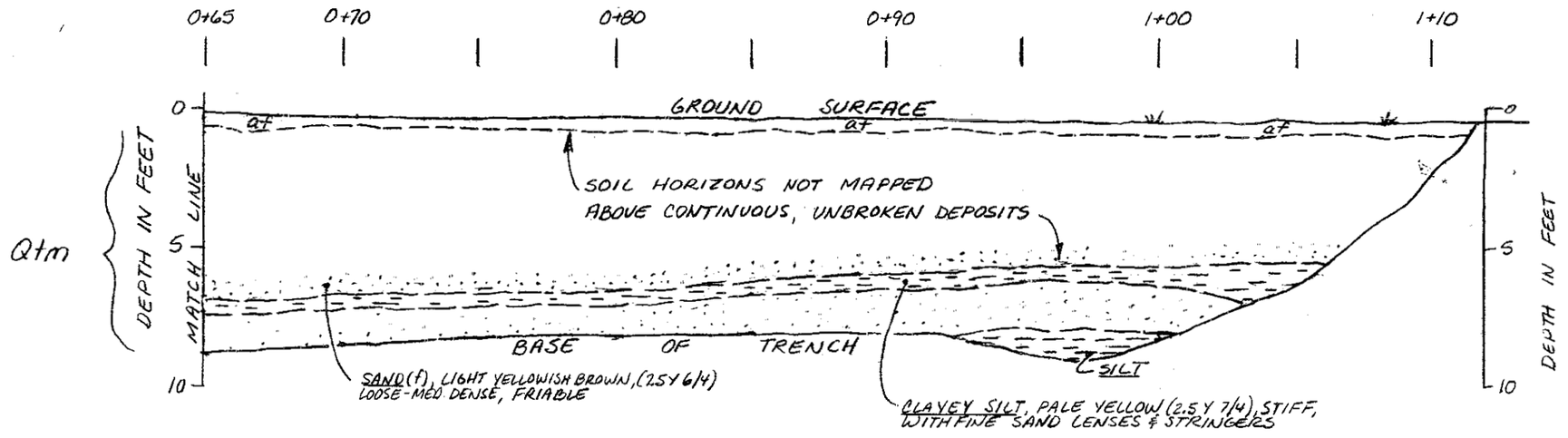
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-4
(Station Numbers 0+60 to 2+20)

TRENCH TR-5





NOTES.
- LOGGED BY P.D & G.L. 6-8,9,10-98
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

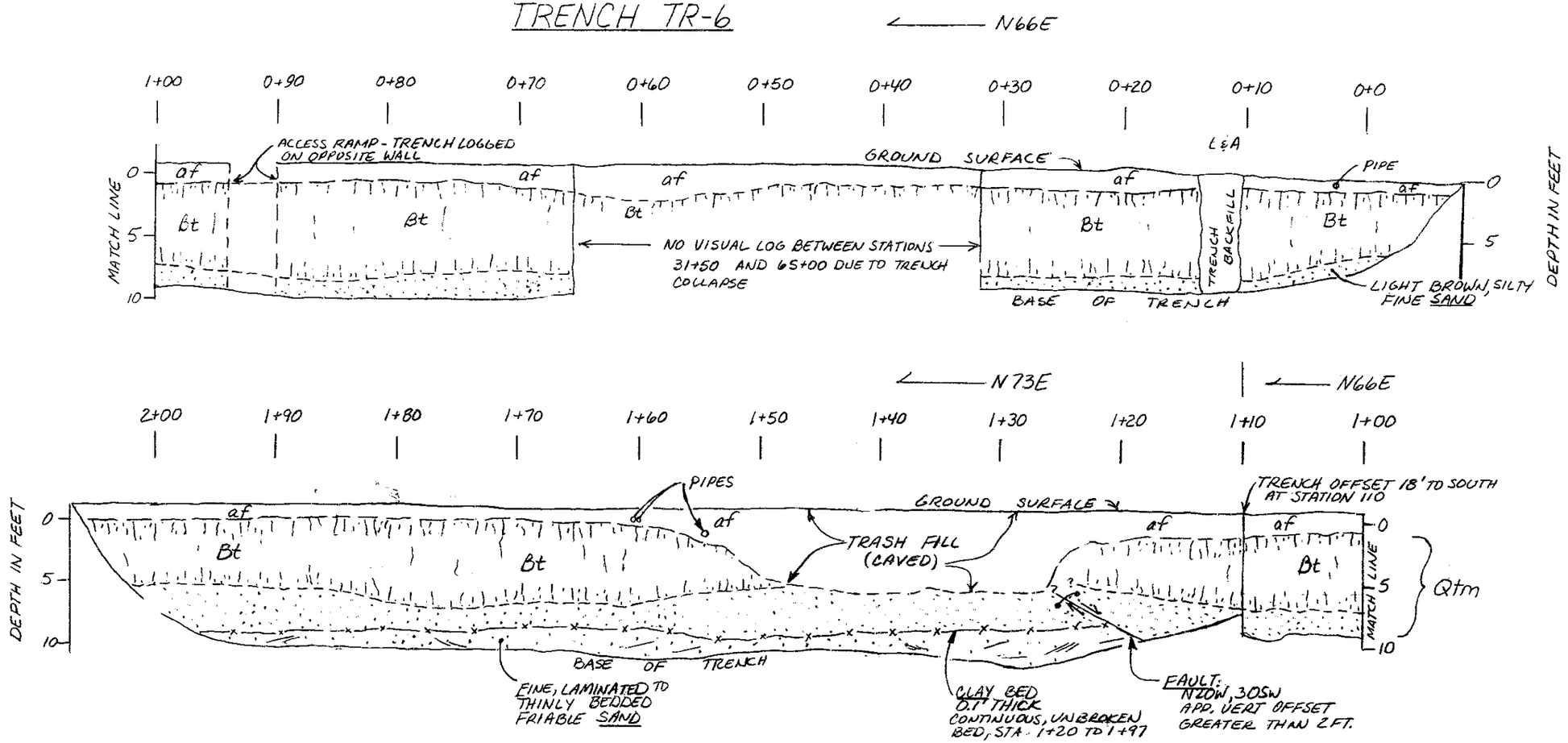
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-5
(Station Numbers 0+00 to 1+10)

TRENCH TR-6



0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

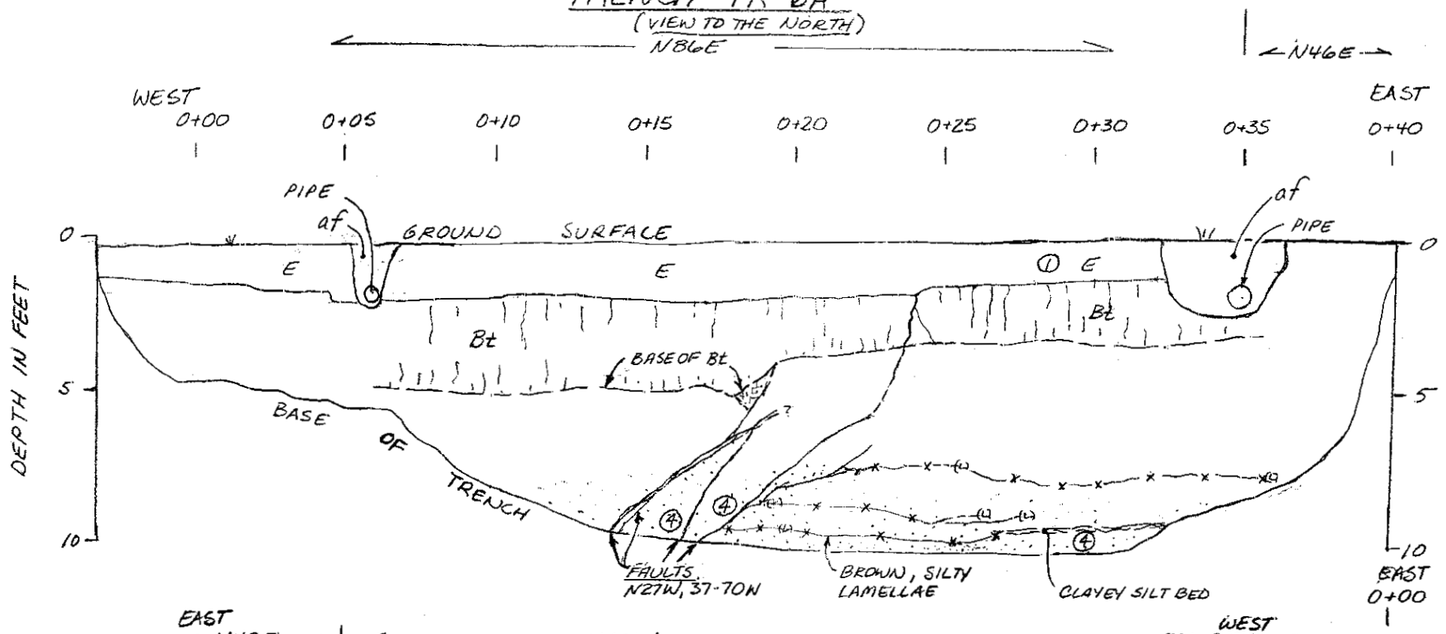
NOTES.
- LOGGED BY P.D. & G.L. 6-10-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

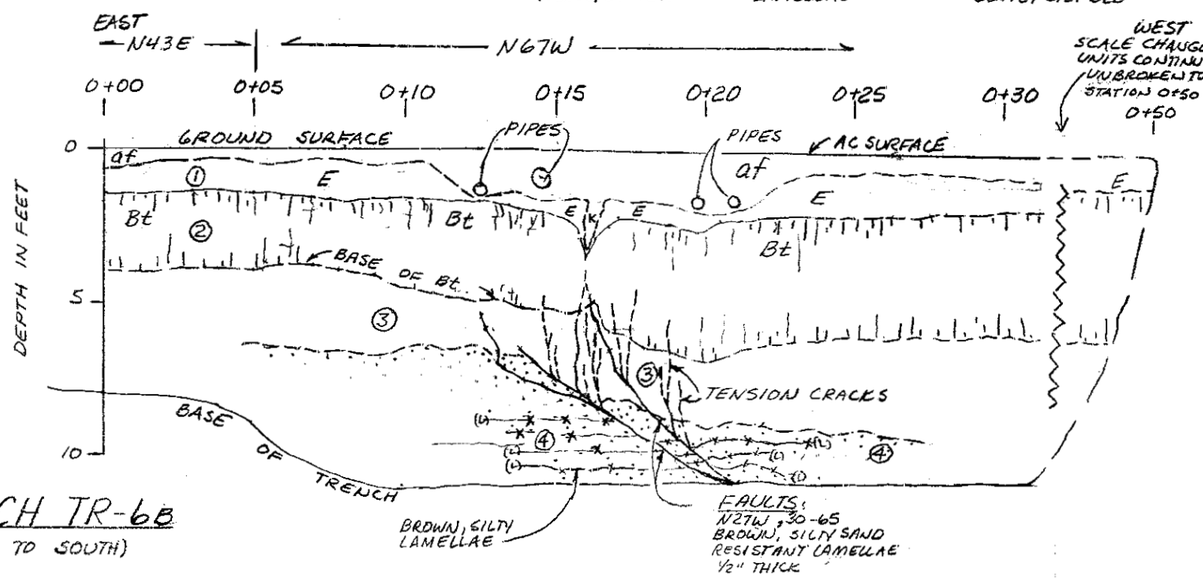
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-6
(Station Numbers 0+00 to 2+00)

TRENCH TR-6A
(VIEW TO THE NORTH)





TRENCH TR-6B
(VIEW TO SOUTH)

UNIT DESCRIPTIONS

1 "E" HORIZON, SANDY SILT - CLAYEY SILT (F-VF), FIRM-STIFF, DRY, BROWN (10YR 5/3) TO DARK BROWN (10YR 4/3) TO YELLOWISH BROWN (10YR 5/4), SLI POROUS.

1A. FINE SANDY SILT, STIFF, DRY, YELLOW BROWN (10YR 5/4) SLI. CLAYEY, NUM TINY POREHOLES.

2. "Bt" HORIZON, CLAYEY SAND TO SANDY CLAY (F), DENSE, SLI MOIST, DARK BROWN (7.5YR 4/4) TO DARK YELLOWISH BROWN (10YR 4/4) W/ DARK MINERAL STAINING (10YR 2/2), BLOCKY, SLI. POROUS.

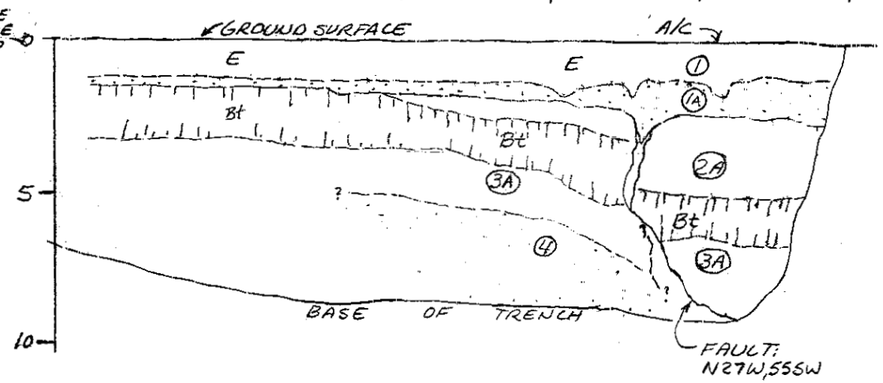
2A CLAYEY FINE SAND, DENSE, DRY, BROWN (7.5YR 5/4), SOME DARK MINERAL STAINING, POROUS.

3. CLAYEY FINE SAND, DENSE, DRY, YELLOWISH BROWN (10YR 5/4), POROUS, SLIGHT DK MINERAL STAINING ALONG PORES.

3A CLAYEY SILTY FINE SAND, DENSE, DRY, YELLOWISH BROWN - BROWN (10YR 5/4 - 7.5YR 5/4), W/ DK. MINERAL STAINING, POROUS.

4. SAND TO SAND W/ SILT (F-M), MED. DENSE, DRY-SLI. MOIST, LIGHT YELLOWISH BROWN (10YR 6/4), TYPICALLY FRIABLE, W/ BROWN SILTY SAND LAMELLAE, THINLY TO THICKLY BEDDED.

TRENCH TR-6C
(VIEW TO SOUTH)



0 2.5 5 7.5
Approximate Graphic Scale: One Inch Equals 5 Feet

NOTES: TRENCH TR-6A LOGGED BY
TRENCH TR-6B LOGGED BY
TRENCH TR-6C LOGGED BY

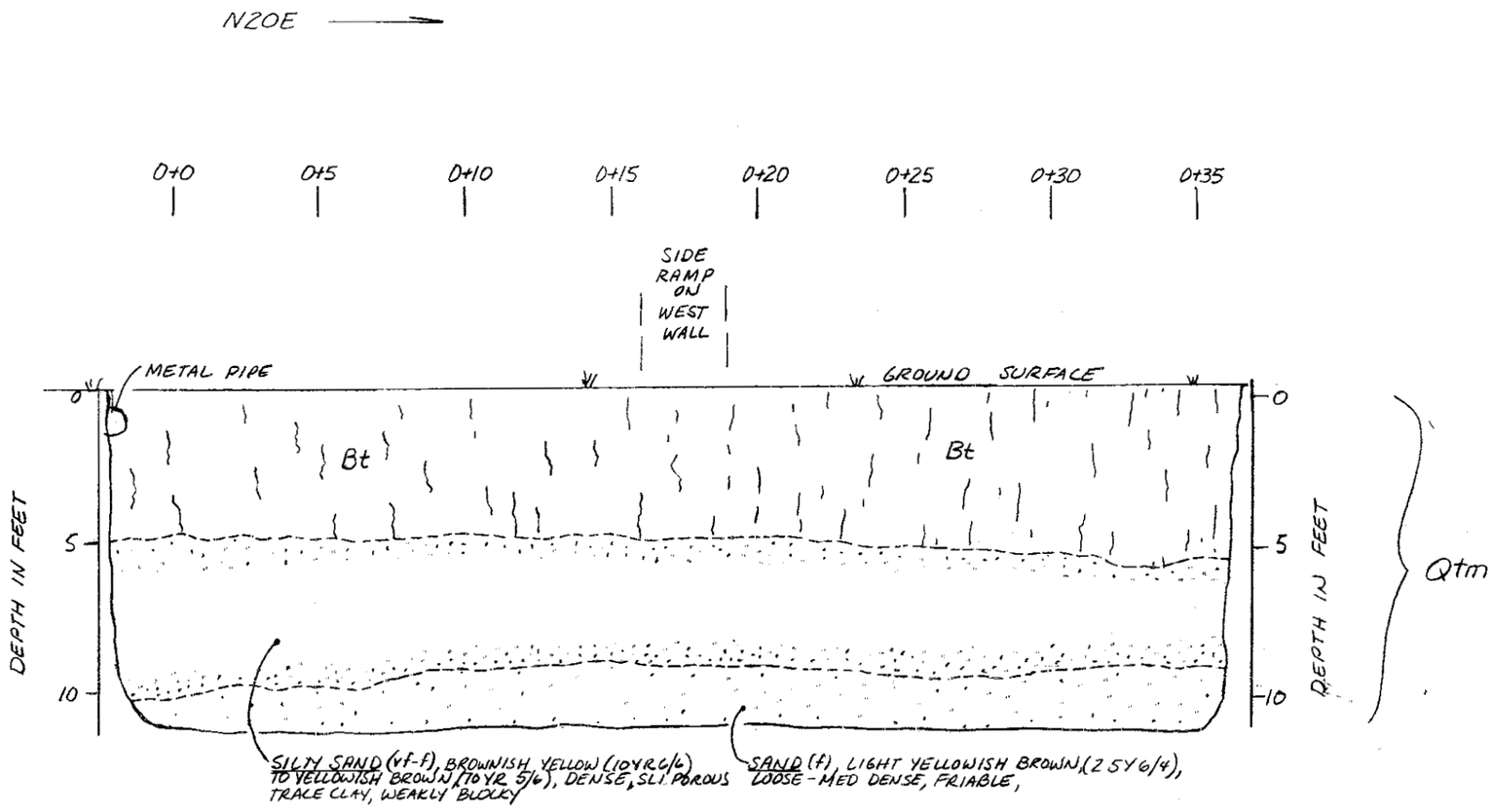
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-6a (Station Number 0+00 to 0+40)
TR-6b (Station Number 0+00 to 0+50) and
TRENCH TR-6c
(Station Number 0+00 to 0+25)

TRENCH TR-7



NOTES:

- LOGGED BY P.D & G.L. 6-15-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS

0 2.5 5 7.5

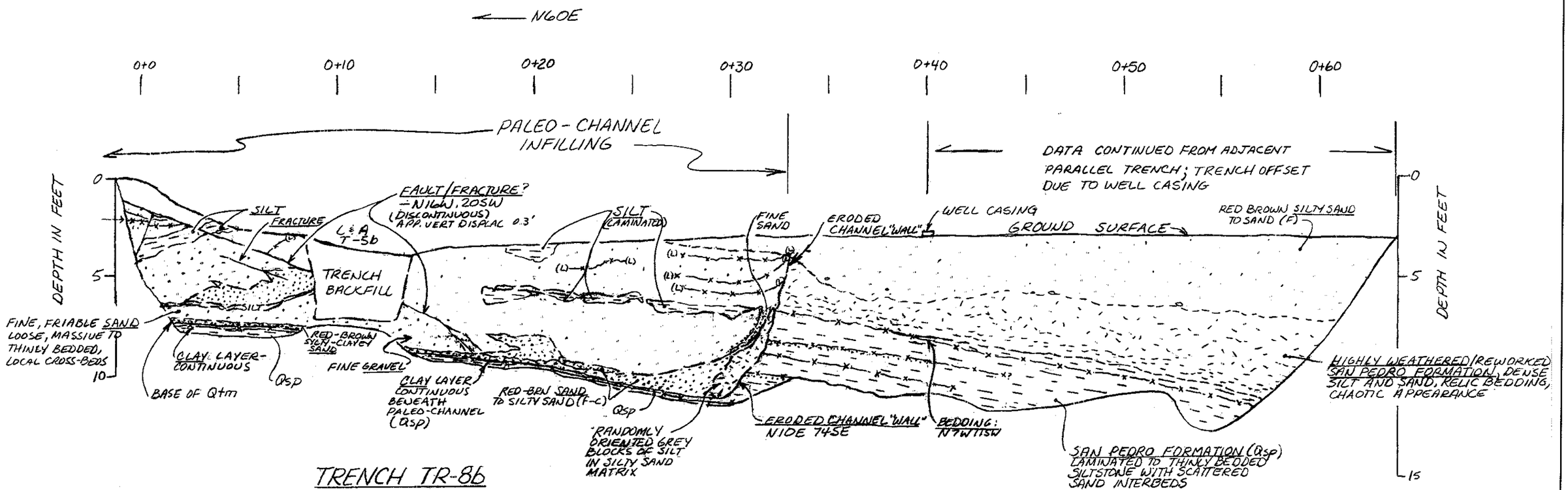
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

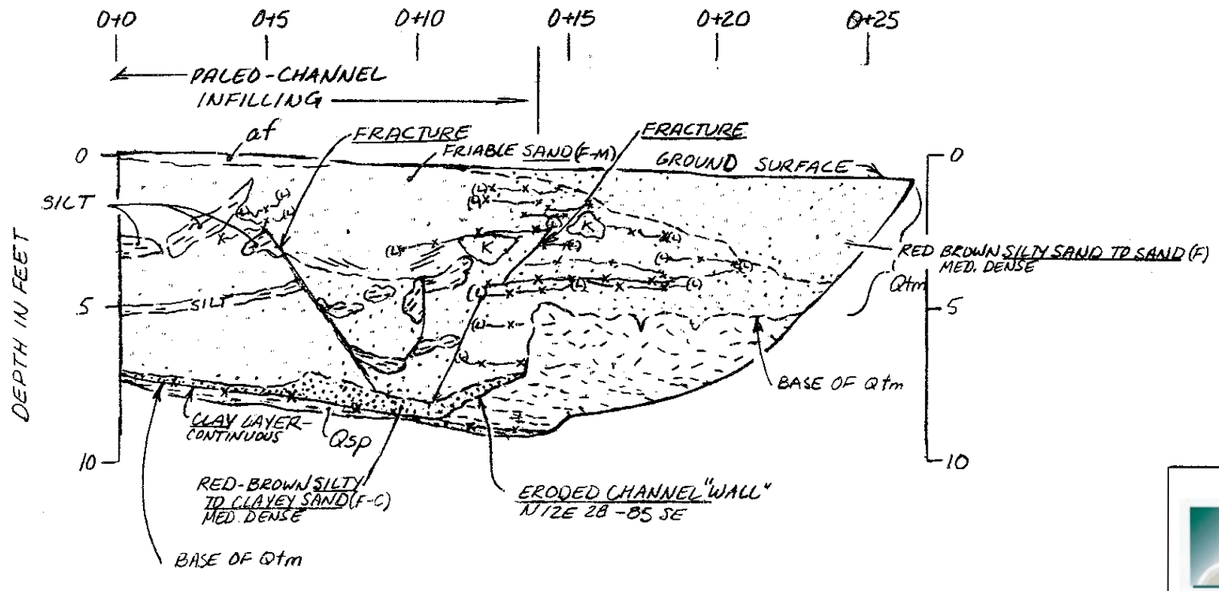
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-7
(Station Numbers 0+00 to 0+35)

TRENCH TR-8a



TRENCH TR-86



NOTES:

- UNITS FOR TRENCHES TR-8a AND TR-86 ARE VERY SIMILAR, SYMBOLS ARE THE SAME FOR BOTH TRENCHES.
- LOGGED BY P.D., G.L., & A.M. 6-5, 9, 10-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

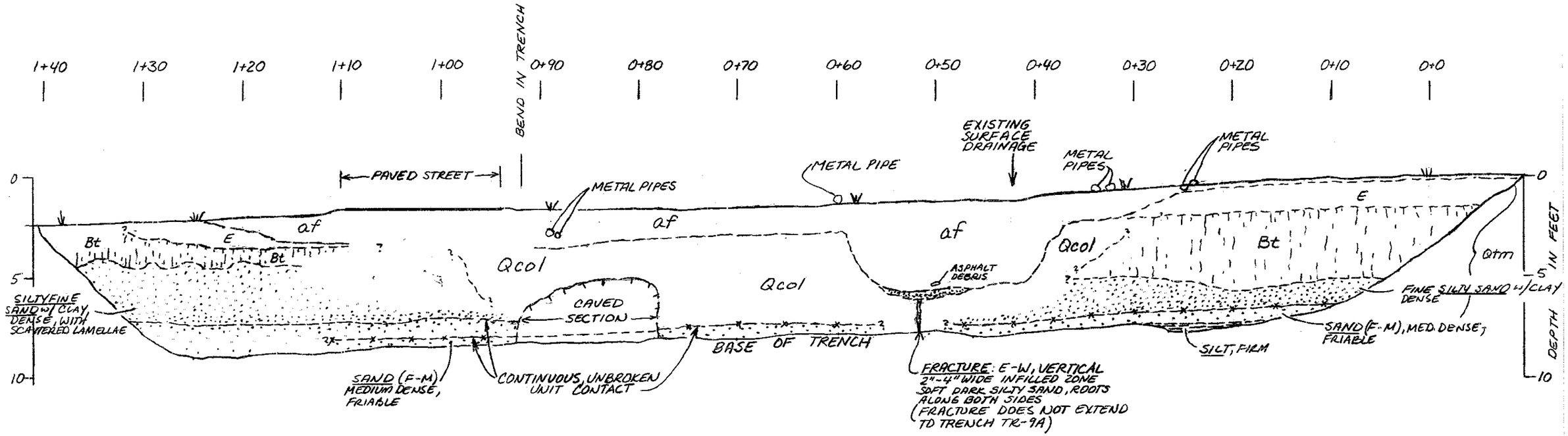
Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-8a
(Station Numbers 0+00 to 0+60)
AND TRENCH 8b
(Station Numbers 0+00 to 0+25)

TRENCH TR-9



NOTES:

- LOGGED BY P.D. & G.L. 6-5-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

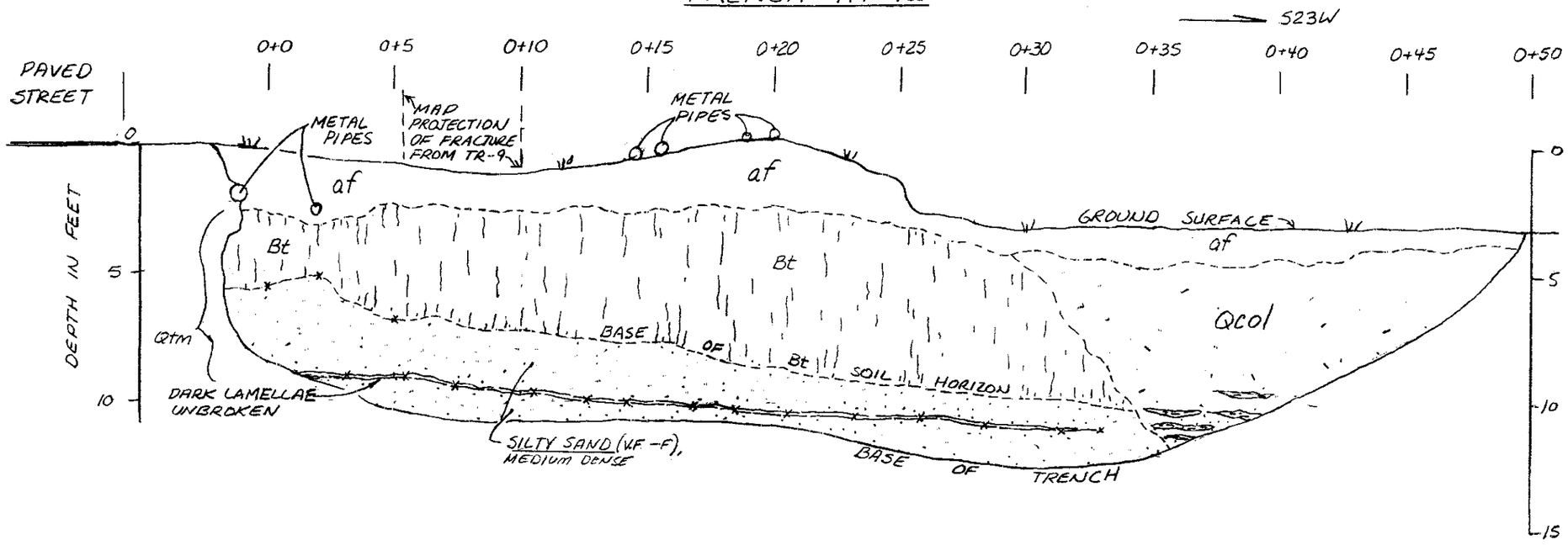
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-9
(Station Numbers 0+00 to 1+40)

TRENCH TR-9a



NOTES:
- LOGGED BY P.D. & G.L., 6-12-98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTION.

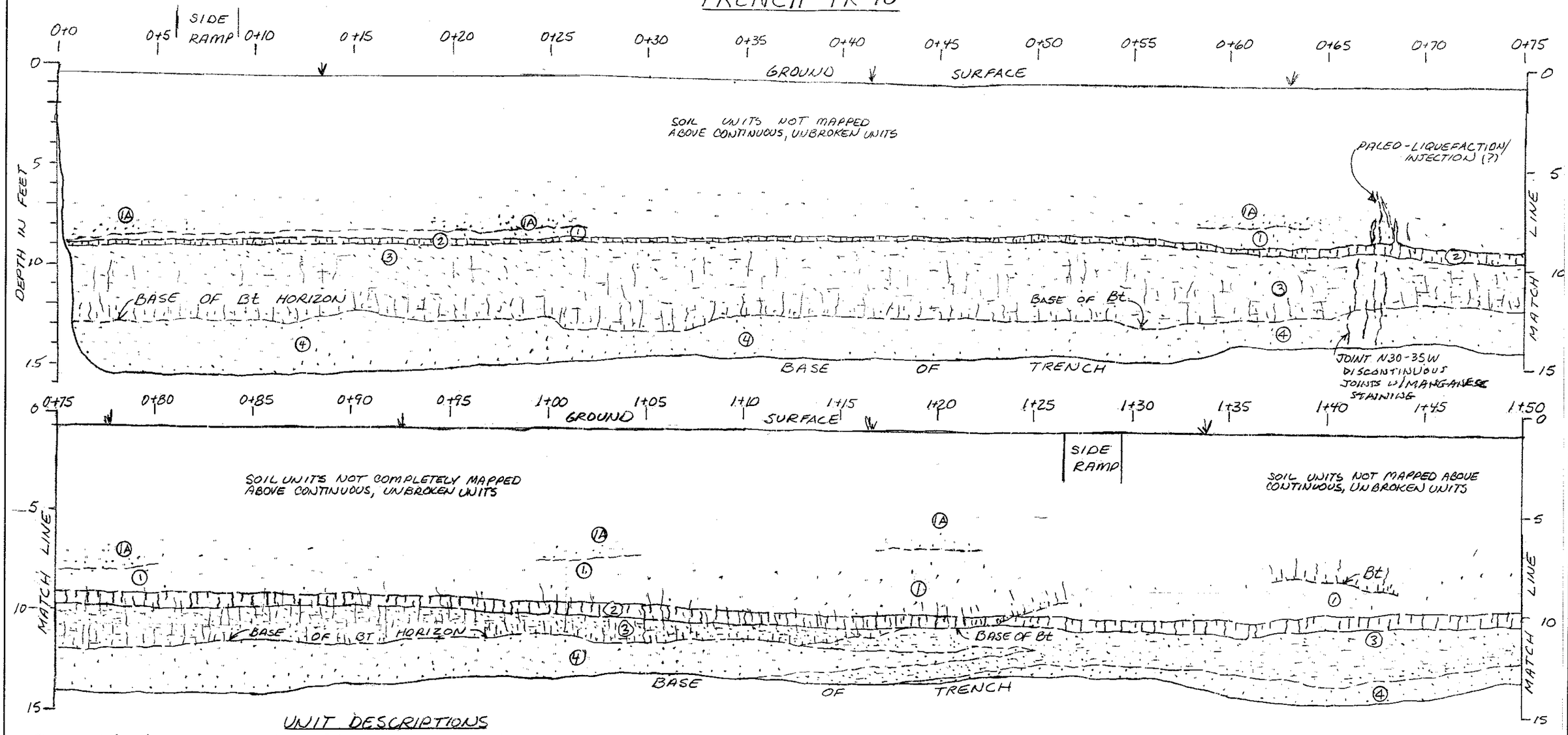
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-9a
(Station Numbers 0+00 to 0+50)

TRENCH TR-10



UNIT DESCRIPTIONS

(1A) SAND (M-C), DENSE, BROWN (7.5YR 5/4) TO STRONG BROWN (7.5YR 5/6), CLAYEY EAST OF STA 0+90'.

(1) SANDY CLAY, VERY STIFF, BROWN TO DARK BROWN (10YR 4/3) TO MOTTLED WITH CLAY SEAMS AND FILMS, AND MANGANESE STAINING, POROUS.

(2) CLAY, VERY STIFF, YELLOWISH BROWN (10YR 5/4), VERY STICKY, PLASTIC.

(3) SILTY SAND W/SANDY SILT, DENSE, YELLOWISH BROWN (10YR 5/4), SLIGHTLY POROUS, LOCAL THIN SAND INFILLING.

(4) SAND, (FINE) MED. DENSE, LIGHT OLIVE BROWN (2.5Y 5/6).

(4a) SAND, (FINE-MEDIUM), MEDIUM DENSE, BROWN (7.5YR 5/4), FRIABLE, SLIGHTLY-CEMENTED - "RIB FORMING".

(5) SAND, (FINE TO COARSE), VERY DENSE, BROWN (7.5YR 5/4), NON-POROUS, (BASAL EROSIONAL CONTACT).

NOTES:
- LOGGED BY P.D., 7-23 & 7/28 98.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS

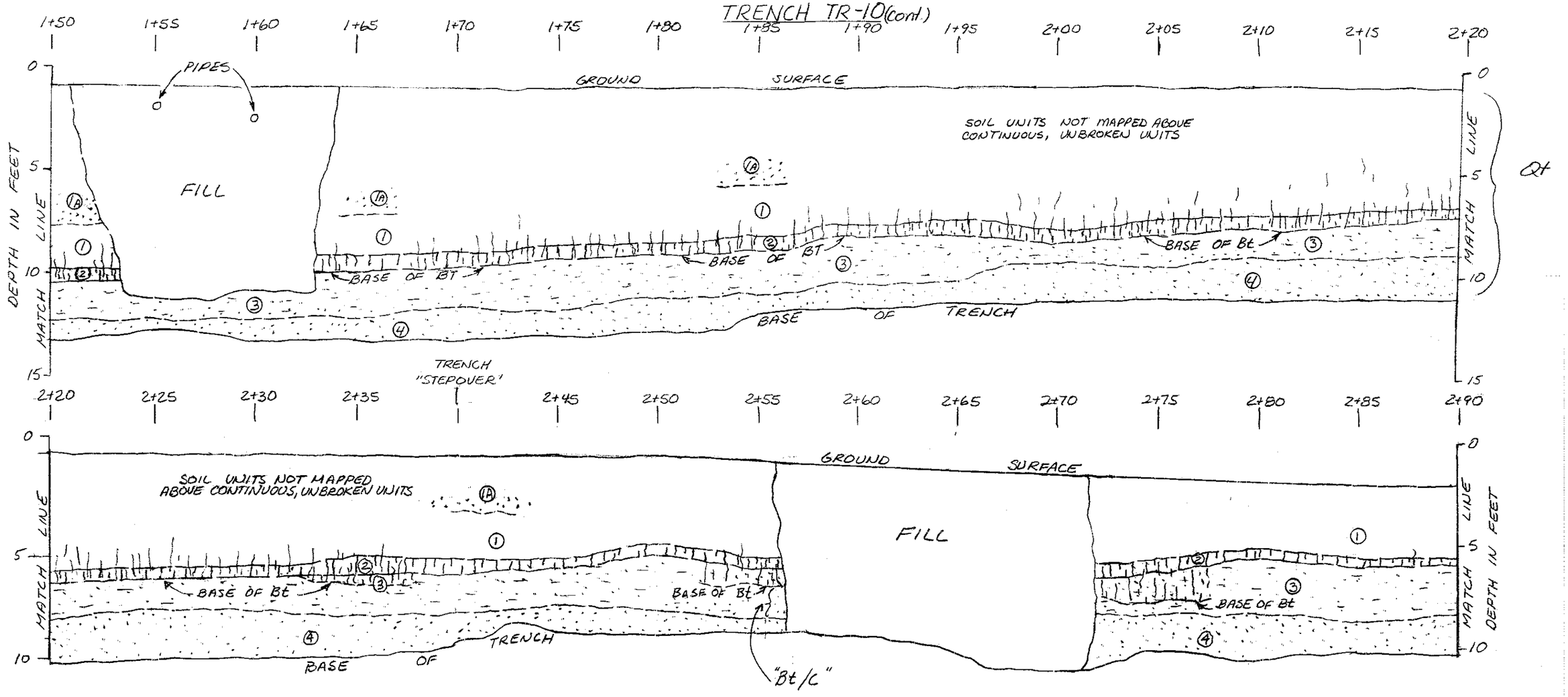
0 2.5 5 7.5
Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-10
(Station Number 0+00 to 1+50)

TRENCH TR-10 (cont.)



NOTES: • UNIT DESIGNATIONS SHOWN ON FIGURE.

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

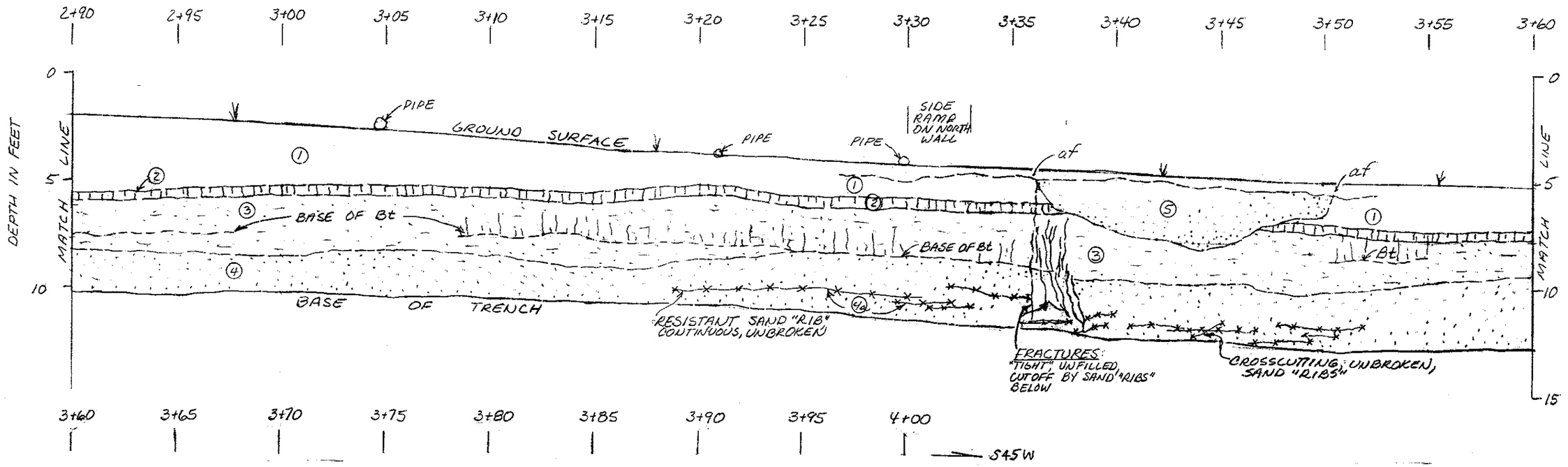
GMU GEOTECHNICAL, INC.

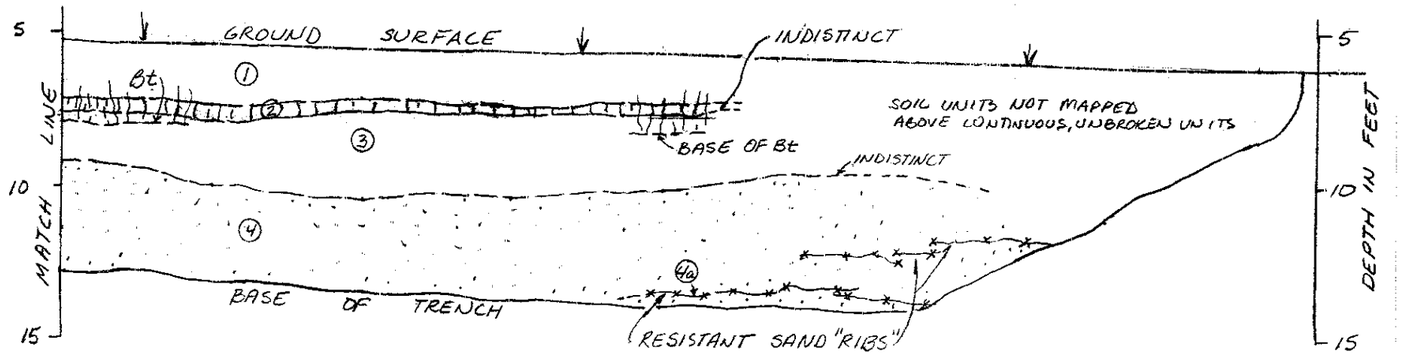
Project Name: Newport Banning Ranch	**TRENCH TR-10** (Station Numbers 1+50 to 2+90)
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-10 (CONT.)

(STATIONS 290 - 401)

—— TREND S45W ——→





0 2.5 5 7.5

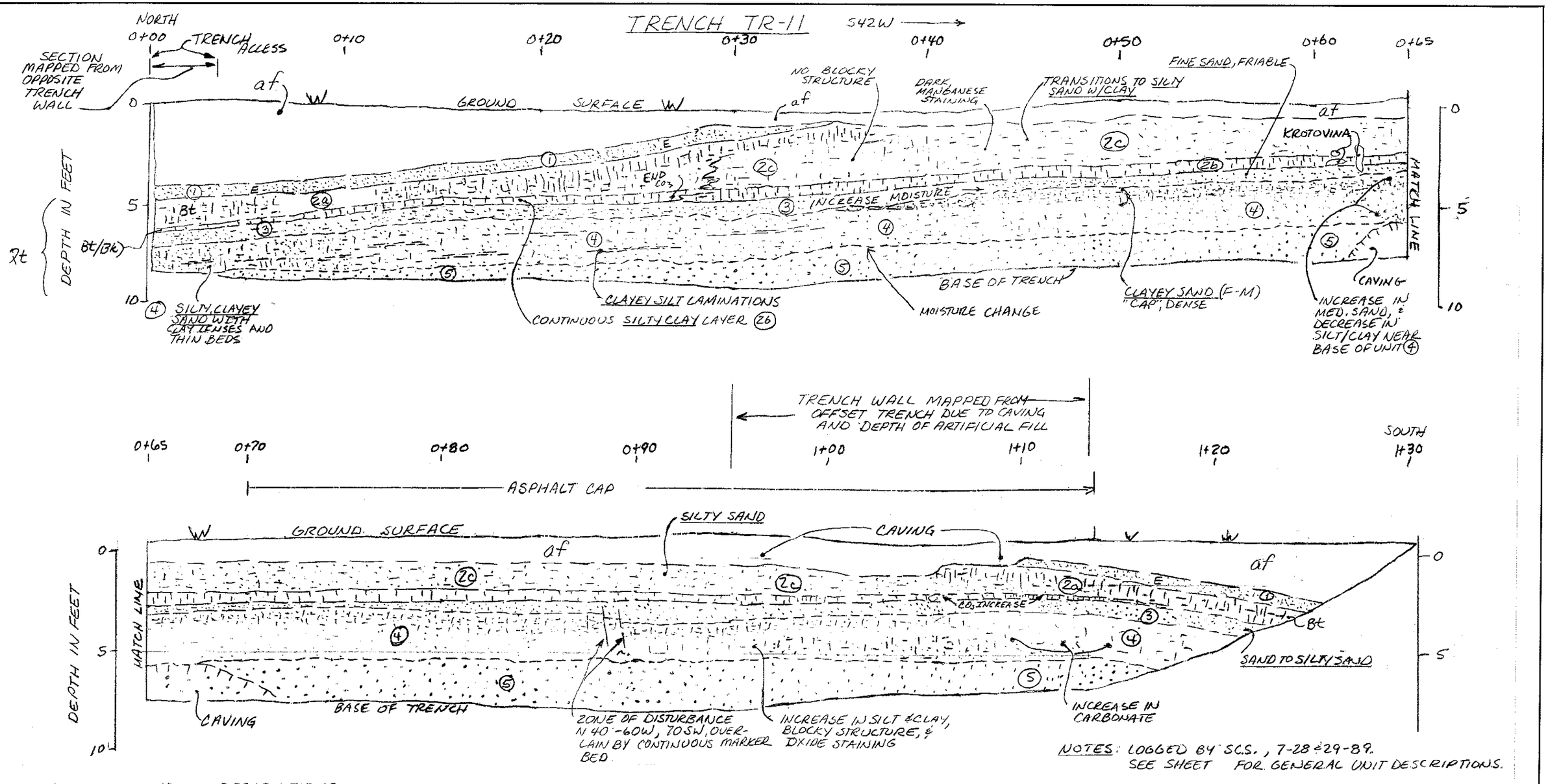
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-10
(Station Numbers 2+90 to 4+01)

TRENCH TR-11



NOTES: LOGGED BY S.C.S., 7-28 & 29-89.
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

UNIT DESCRIPTIONS

1 SILTY SAND (SM), FINE TO MEDIUM, MEDIUM DENSE, BROWN (10YR 5/3) DRY, ROOT HAIRS, POROUS. "E" SOIL HORIZON

2a/2c SILTY CLAYEY SAND (2a), FINE TO MEDIUM, MEDIUM DENSE-DENSE, DARK BROWN MOTTLED (7.5YR 4/4 - 3/2) DRY, BLOCKY STRUCTURE, SLIGHTLY POROUS, OXIDE STAINING. TRANSITIONS TO SILTY SAND (2c), DARK BROWN TO DARK YELLOW BROWN (7½YR-10YR 4/4)

2b SILTY CLAY, FIRM TO STIFF, YELLOWISH BROWN TO DK YELLOWISH BROWN (10YR 5/4 - 4/4) WITH DARK BROWN (10YR 3/3) MOTTLING, DRY TO SLI. MOIST, LOCALLY $CaCO_3$, OXIDE STAINING ALONG PARTINGS, ROOT HAIRS, POROUS.

3 SAND TO SILTY SAND (SP-SM), FINE TO MEDIUM, FRIABLE TO MEDIUM FRIABLE, YELLOWISH BROWN (10YR 5/4), SLI. MOIST - DRY, ABUNDANT KROTOVINA (NOT LOGGED), MINOR ROOT HAIRS, VERTICAL ROOT STAINING.

4 SILTY CLAYEY SAND (SC), FINE TO MEDIUM, DENSE TO MEDIUM DENSE, DARK YELLOWISH BROWN (10YR 4/4) WITH DARK BROWN STAINING (7.5YR 3/4), INCLUDES SILTY CLAY LAMINATIONS AND CLAYEY SAND "CAP", MINOR BLOCKY STRUCTURE WITH OXIDE STAINING, DECREASE IN SILT/CLAY IN LOWER PORTION.

5 SAND (SP) FINE TO MEDIUM, TO SILTY SAND, LOOSE TO MEDIUM DENSE, LIGHT BROWN GREY (10YR 6/2) TO PALE BROWN (10YR 6/3), MINOR $CaCO_3$ IN UPPER PORTION.

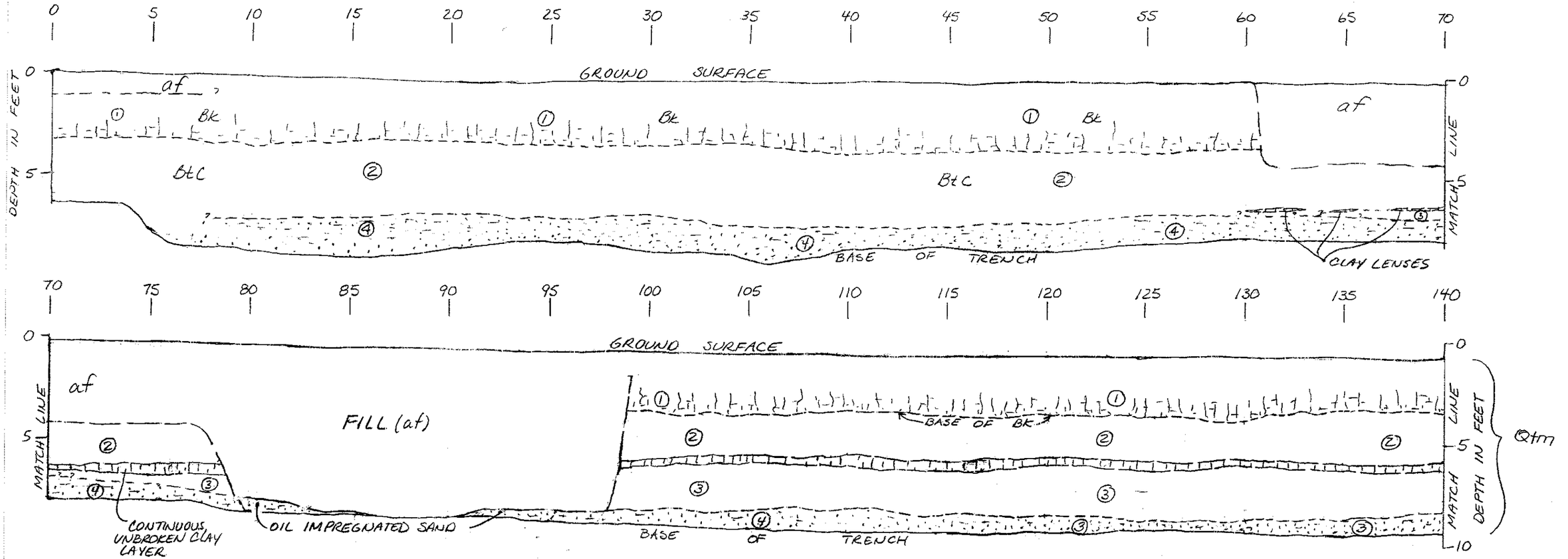
0 2.5 5 7.5
Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-11
(Station Numbers 0+00 to 1+30)

TRENCH TR-12



UNIT DESCRIPTIONS

1 CLAYEY SAND, DRY, DENSE, BROWN (10YR 5/3), CLAY FILMS, $CaCO_3$, BLOCKY WELL DEVELOPED PEDS, ROOTS

2 CLAYEY SAND, DRY - SLI. MOIST, DENSE, YELLOW BROWN (10YR 5/4) WITH DARK GREY BROWN (10YR 4/2) STAINING, VARIABLE % CLAY, $CaCO_3$, CLAY FILMS, W/ CONTINUOUS CLAY LAYER @ BASE.

3 SILTY CLAYEY SAND - SLI. MOIST, MEDIUM DENSE, YELLOWISH BROWN (10YR 5/4), LOCALLY A SILTY SAND, TRACE CLAY FILMS,

4 SAND - SLI MOIST, LOOSE, LIGHT YELLOWISH BROWN - YELLOW BROWN (10YR 6/4 - 6/5) FINE W/ SOME M-C SAND

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

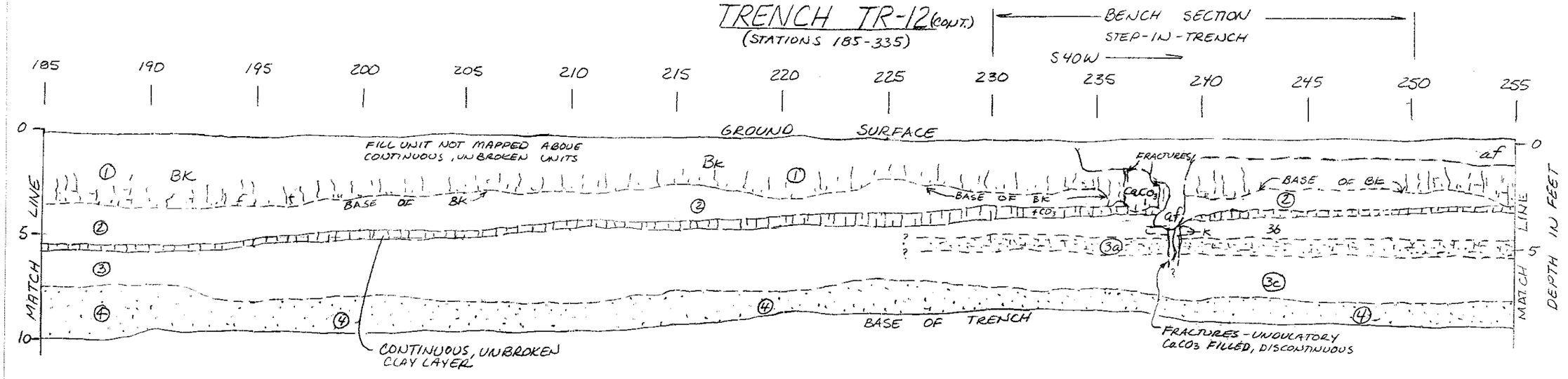
GMU GEOTECHNICAL, INC.

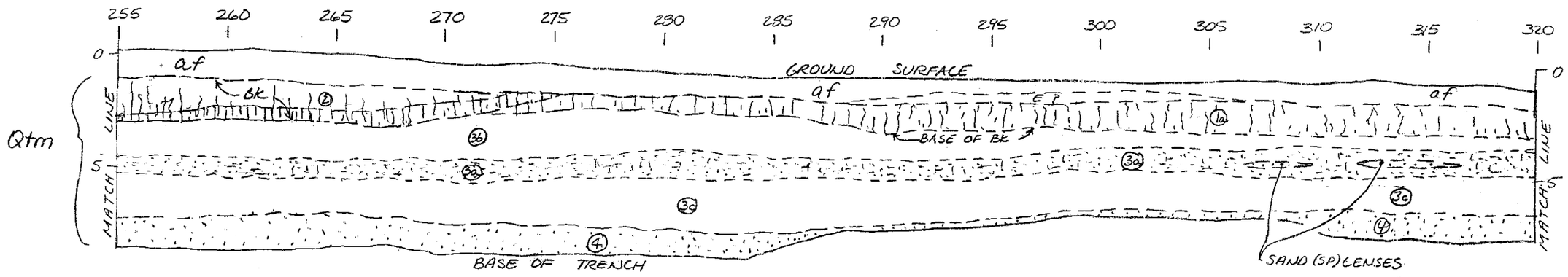
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

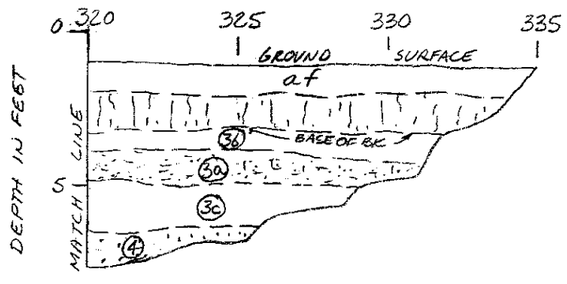
TRENCH TR-12
(Station Numbers 0+00 to 185+00)

TRENCH TR-12 (CONT.)

(STATIONS 185-335)







UNIT DESCRIPTIONS (CONT.)

3a SILTY SAND W/CLAY FILMS, SLI. MOIST, DENSE, LIGHT YELLOWISH BROWN - YELLOW BROWN (10YR 6/4 - 5/4), TRACE $CaCO_3$, SOME BLOCKY STRUCTURE, MANGANESE STAINING, POROUS.

3b SILTY SAND, FINE, LOOSE TO MEDIUM DENSE, BROWN (10YR 5/3), DRY - SLI. MOIST

3c SILTY SAND, FINE W/SOME M-C SAND, DENSE, BROWN TO YELLOWISH BROWN (10YR 5/3-5/4), DRY TO SLI. MOIST.

NOTES: LOGGED BY PD & SCS 7/12 & 6/5-6/98.
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

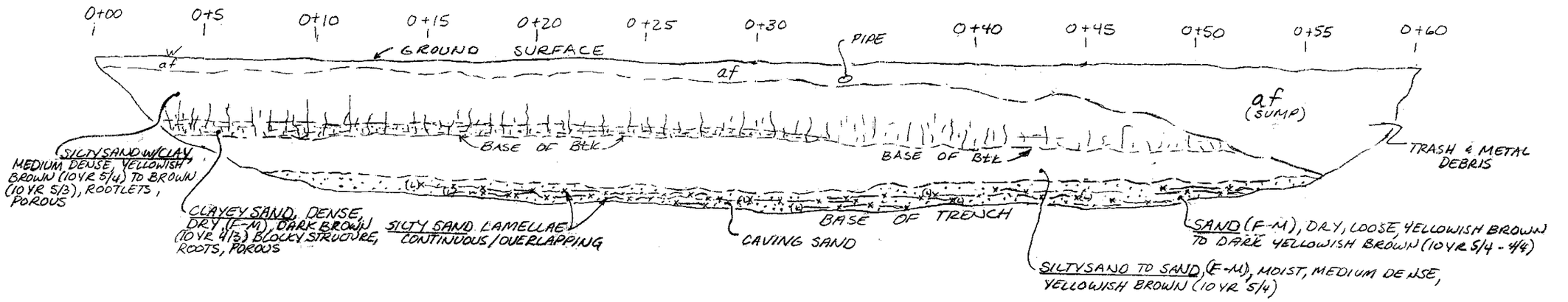
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	**TRENCH TR-12** (Station Numbers 185+00 to 335+00)
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-12a

S20W



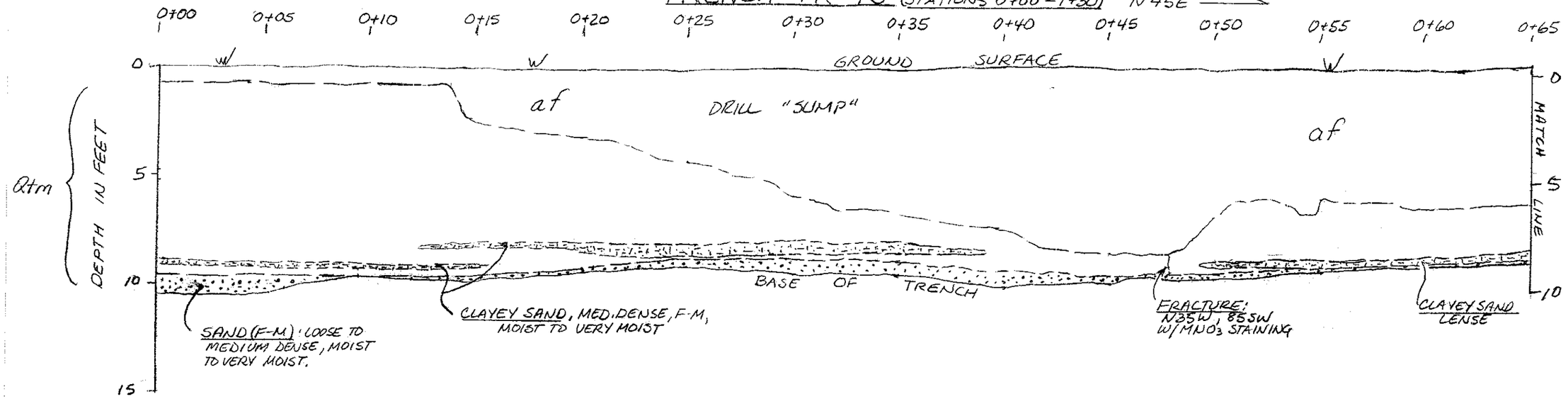
NOTES: LOGGED BY SCS 8-6-98.
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

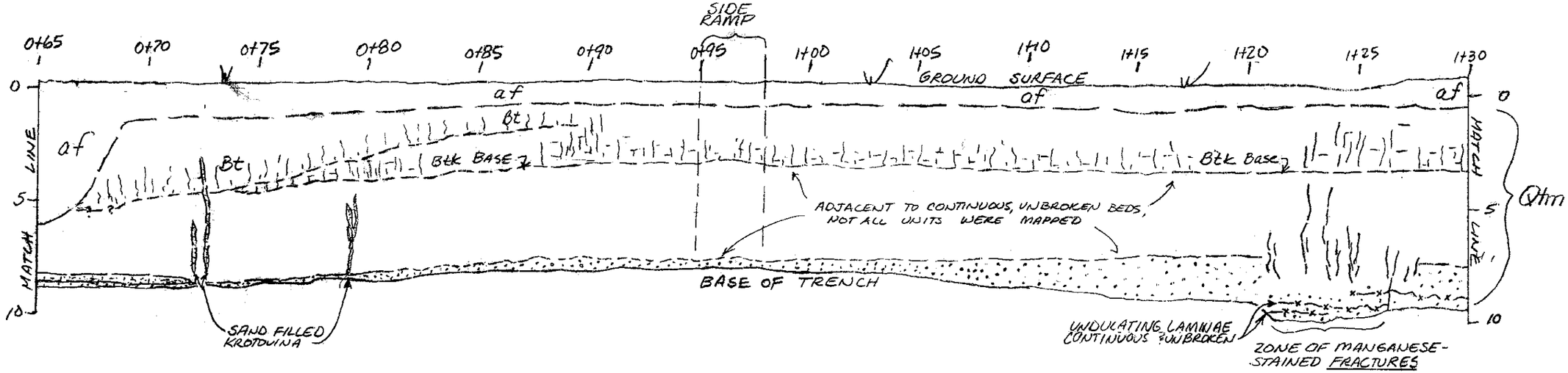
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	**TRENCH TR-12a** (Station Numbers 0+00 to 0+60)
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-13 (STATIONS 0+00 – 1+30) N45E →





UNIT DESCRIPTIONS

1 SILTY FINE SAND, MEDIUM DENSE, SLI. MOIST, YELLOWISH BROWN (10 YR 5/4) TO DARK YELLOWISH BROWN (10 YR 4/4), ROOTS, POROUS, "E" SOIL HORIZON.

2 CLAYEY SAND, FINE TO MEDIUM, DENSE, SLI. MOIST, DARK BROWN (7½ YR 3/2-3/4) W/ BLACK MANGANESE STAINING, POROUS, "Bt" SOIL HORIZON, LOCALLY $CaCO_3$ = "Btk" SOIL HORIZON. BLOCKY STRUCTURE. WELL DEFINED PEDS.

3 CLAYEY SAND, FINE GRAINED, DENSE, SLI MOIST, DARK YELLOW BROWN (10YR 4/4) WITH VERY DARK GREYISH BROWN (10YR 3/2) STAINING, BLOCKY STRUCTURE.

4 SILTY TO SANDY CLAY, FINE GRAINED, STIFF, SLI MOIST TO MOIST, DARK BROWN (10YR 3/3) WITH VERY DARK GREY BROWN MOTTLING, (10YR 3/2), BLOCKY, MODERATELY WELL-DEVELOPED PEDS.

5 SILTY SAND TO SANDY SILT, VERY FINE TO FINE GRAINED, FIRM TO MEDIUM DENSE, MOIST, YELLOW BROWN TO DARK YELLOW BROWN (10YR 5/4-4/4) WITH DARK BROWN STAINING.

6 SAND TO SAND WITH SILT, FINE, MEDIUM DENSE, FRIABLE, SLI. MOIST, YELLOWISH BROWN (10YR 5/4), WITH BROWN, SILTY SAND LAMELLAE

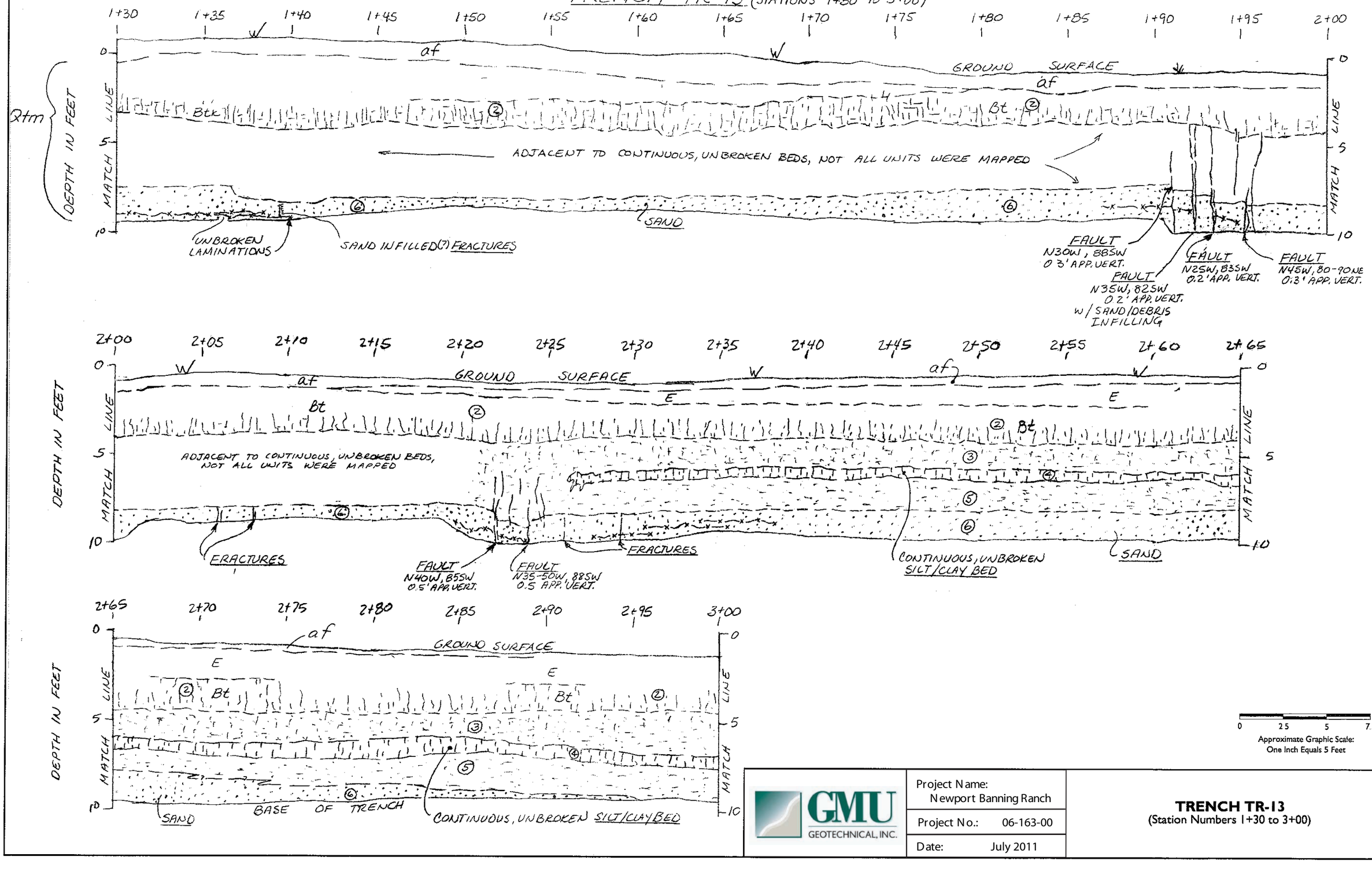
0 2.5 5 7.5
Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-13
(Station Numbers 0+00 to 1+30)

TRENCH TR-13 (STATIONS 1+30 TO 3+00)



0 2.5 5 7.5

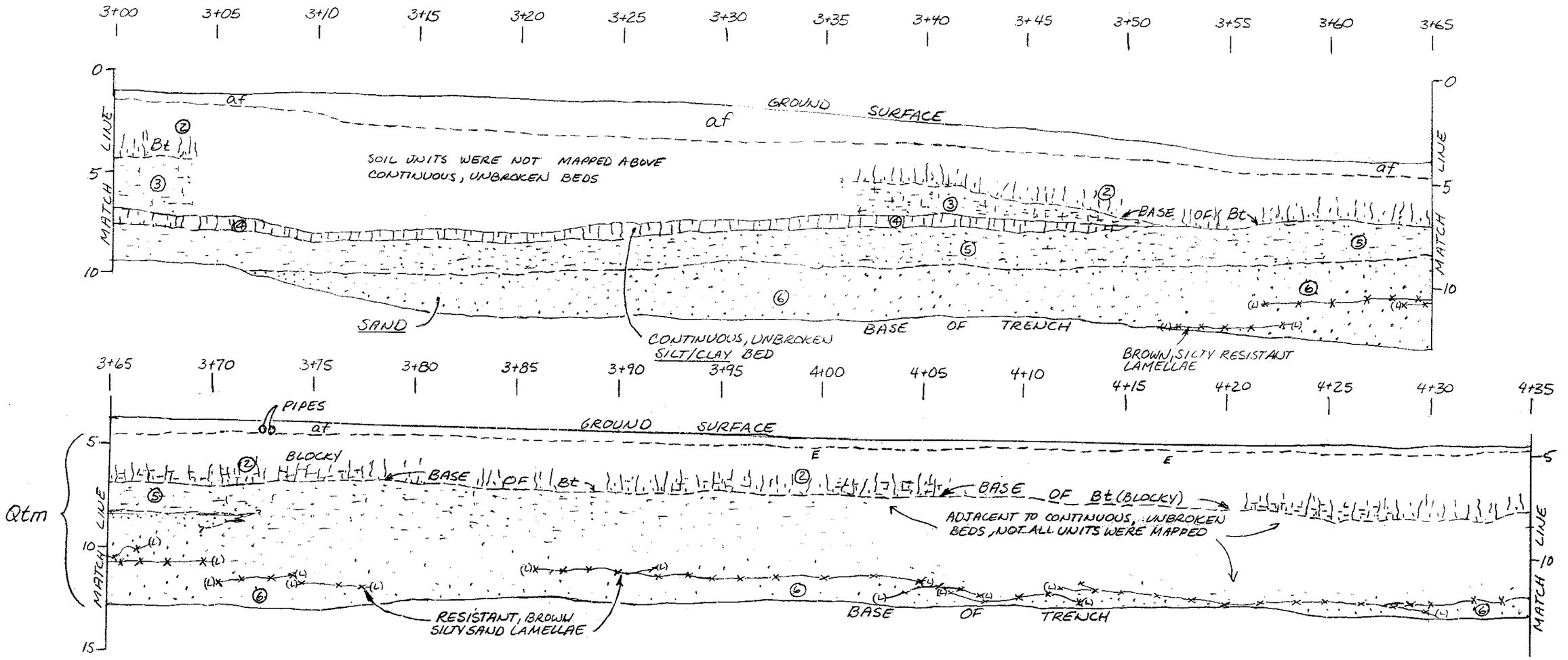
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-13
(Station Numbers 1+30 to 3+00)

TRENCH TR-13 (CONT) (STATIONS 3+00 TO 5+05)



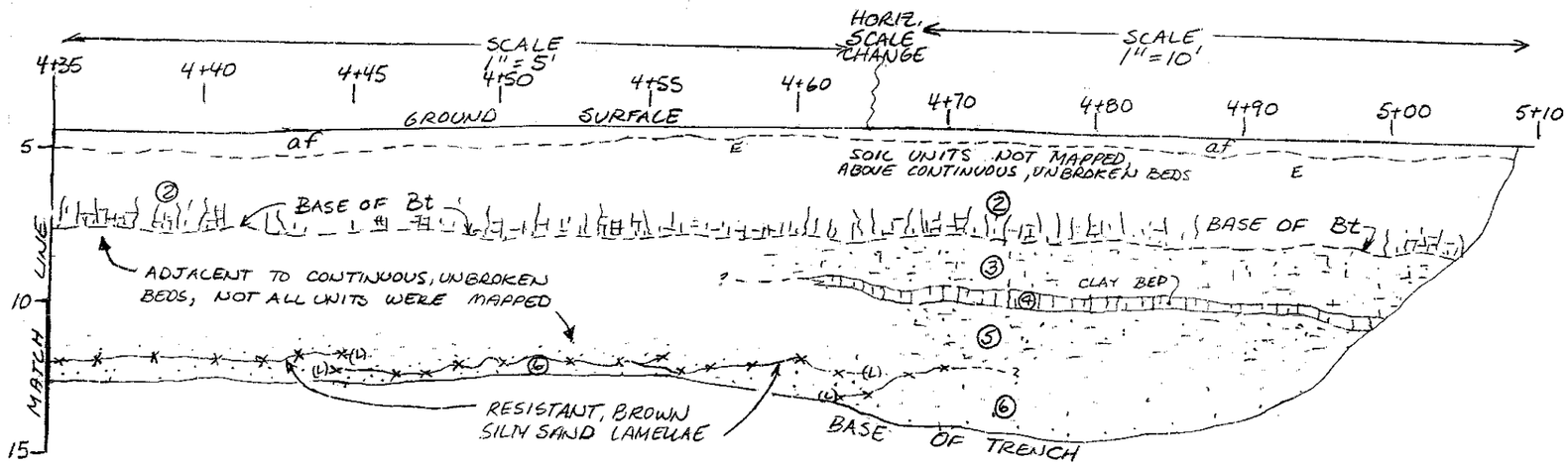
0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-13
(Station Numbers 3+00 to 4+35)



0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch

Project No.: 06-163-00

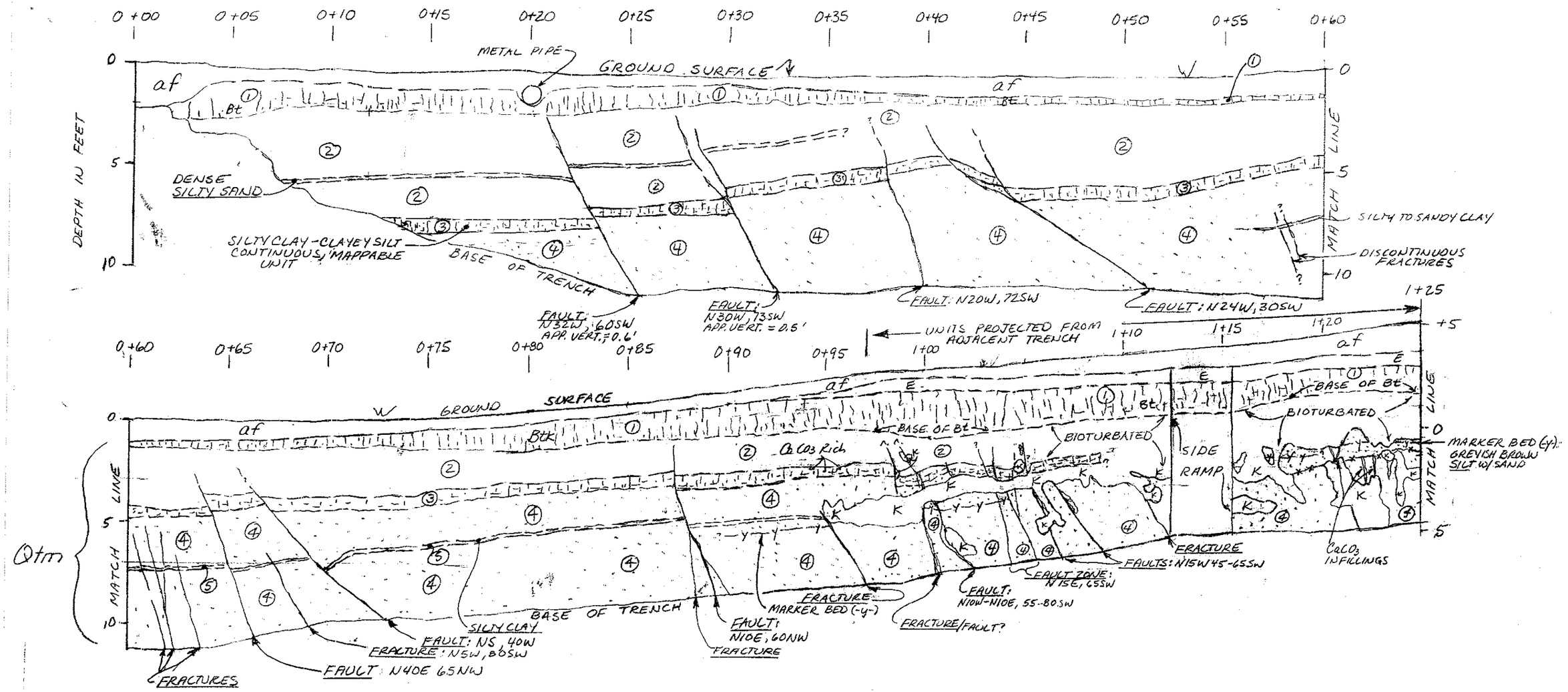
Date: July 2011

TRENCH TR-13
(Station Numbers 4+35 to 5+10)

TRENCH TR-14

(STATIONS 0+00 to 1+25)

S 75 W →



UNIT DESCRIPTIONS

SILTY SAND, FINE, DENSE TO LOOSE,

SANDY SILTY CLAY TO CLAYEY SAND, FINE-MED., DENSE, SLI. MOIST, DARK BROWN (10YR 4/3) TO DARK YELLOWISH BROWN (10YR 4/4) WITH VERY DARK GREY BROWN MINERAL STAINING, W/ $CaCO_3$ (Btk) LOCALLY, BLOCKY STRUCTURE (Bt)

SILTY SAND, FINE, DENSE, SLI. MOIST, DARK BROWN TO DARK YELLOWISH BROWN (7.5YR-10YR 4/4), TRACE CLAY, W/ ORANGE & BLACK MINERAL STAINING, SOME BLOCKY STRUCTURE.

SILTY CLAY-CLAYEY SILT, FIRM, MOIST, BROWN (10YR 5/3) TO YELLOW BROWN (10YR 5/4) MOTTLED W/ DK MINERAL STAINING, LAMINATED.

SILTY SAND TO SAND, FINE, MED. DENSE, CT. YELLOW BROWN (10YR 6/4), LAMINATED TO THICKLY BEDDED, LAMELLAE, ORANGE OXIDE STAINING, HIGHLY MICACEOUS, LOCALLY $CaCO_3$ stringer (4a) SILTY TO CLAYEY SAND, FINE, DARK BROWN (7.5YR 4/4), DENSE.

SILT TO CLAY WITH SOME VERY FINE SAND, STIFF, SLI MOIST, LIGHT YELLOWISH BROWN (10YR 6/4) TO BROWNISH YELLOW (10YR 6/6).

0 2.5 5 7.5

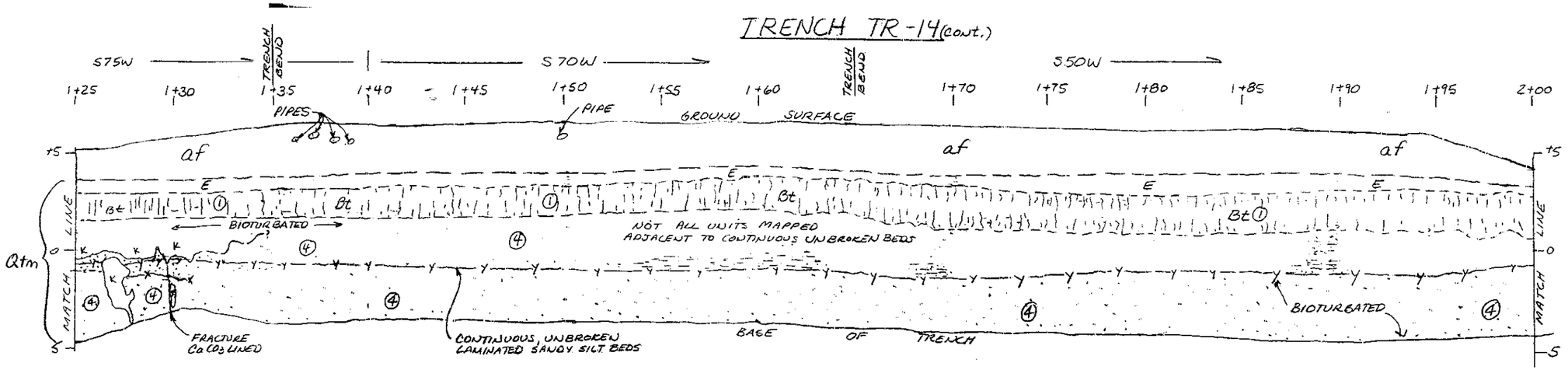
Approximate Graphic Scale:
One Inch Equals 5 Feet

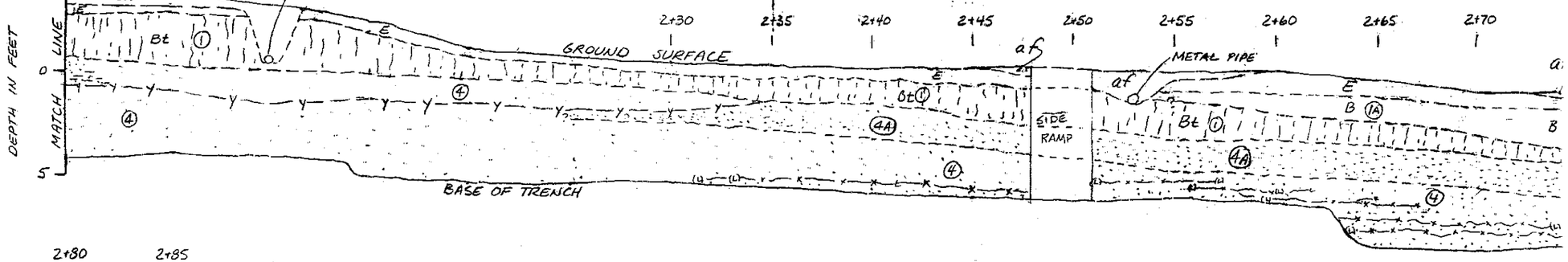
GMU GEOTECHNICAL, INC.

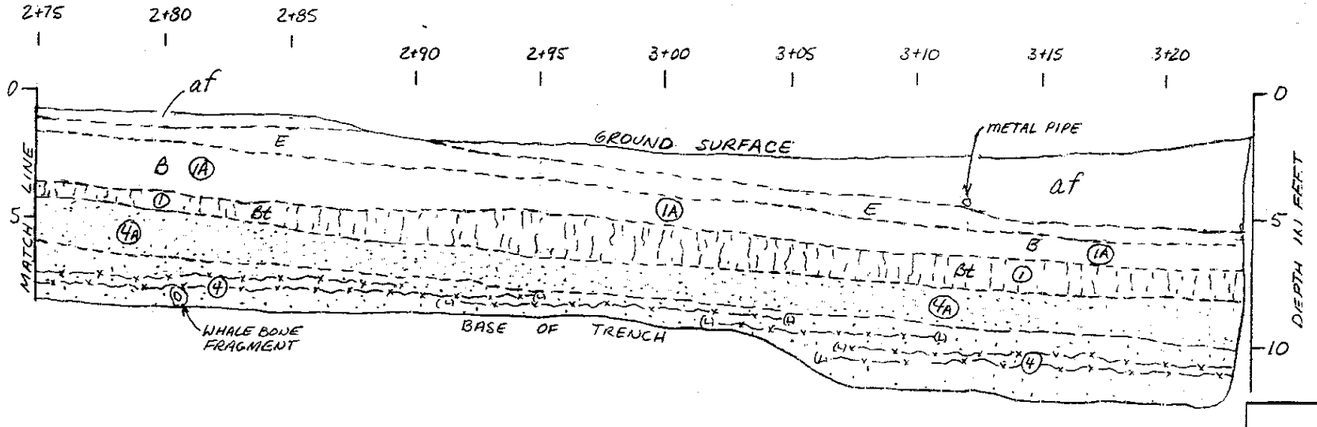
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-14
(Station Numbers 0+00 to 1+25)

TRENCH TR-14 (cont.)







UNIT DESCRIPTIONS (cont)

(1A) SILTY SAND W/TRACE CLAY, DENSE, DRY, DARK YELLOWISH BROWN (10YR 4/4) TO DARK BROWN (10YR 4/3), WEAK, SCATTERED CLAY FILMS, POROUS.

(4A) CLAYEY SAND, FINE, SLI. MOIST TO MOIST, DARK BROWN (7.5YR 4/4) W/ DARK BROWN (7.5YR 4/2) STAINING, TRACE $CaCO_3$.

0 2.5 5 7.5

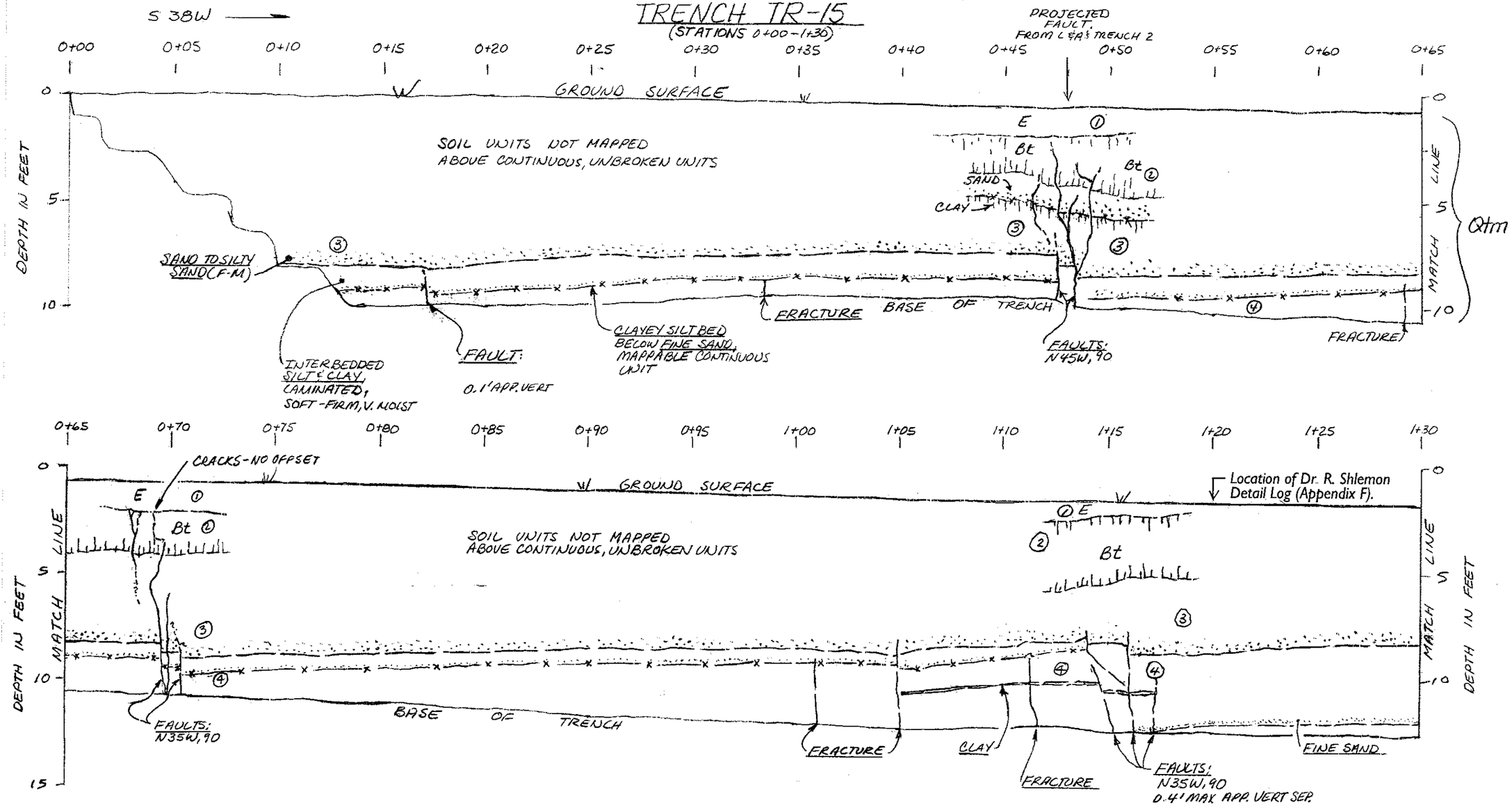
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-14
(Station Numbers 1+25 to 3+20)

TRENCH TR-15
(STATIONS 0+00 – 1+30)



UNIT DESCRIPTIONS

1. "E" FINE SANDY SILT, DRY, FIRM, PALE BROWN TO BROWN (10YR 6/3 - 5/3), ROOTHAIRS, POROUS.
2. "Bt" CLAYEY SAND TO SANDY CLAY (F-M), DRY - SLI MOIST, DENSE, LIGHT YELLOWISH BROWN TO YELLOW BROWN (10YR 6/4 - 5/4), SLI POROUS, ROOTHAIRS, DARK BROWN MINERAL STAINING (10YR 4/3) ALONG PORES.
3. CLAYEY SAND TO SILTY SAND W/CLAY, DRY - SLI MOIST, MED. DENSE - DENSE, DARK YELLOW BROWN (10YR 4/4 - 4/6) WITH VERY DARK GREY BROWN STAINING (10YR 3/2), MINOR ROOTHAIRS, TRACE CO. SAND.
4. CLAYEY SILT TO SILTY CLAY, MOIST, FIRM, LIGHT BROWNISH GREY (2.5 YR 6/2) WITH YELLOWISH BROWN STAINING (10YR 5/6), LAMINATED TO THINLY BEDDED, W/ DARK BROWN CLAY FILMS (10YR 4/3).

NOTES: LOGGED BY P.D.,
SEE SHEET FOR GENERAL EXPLANATION.

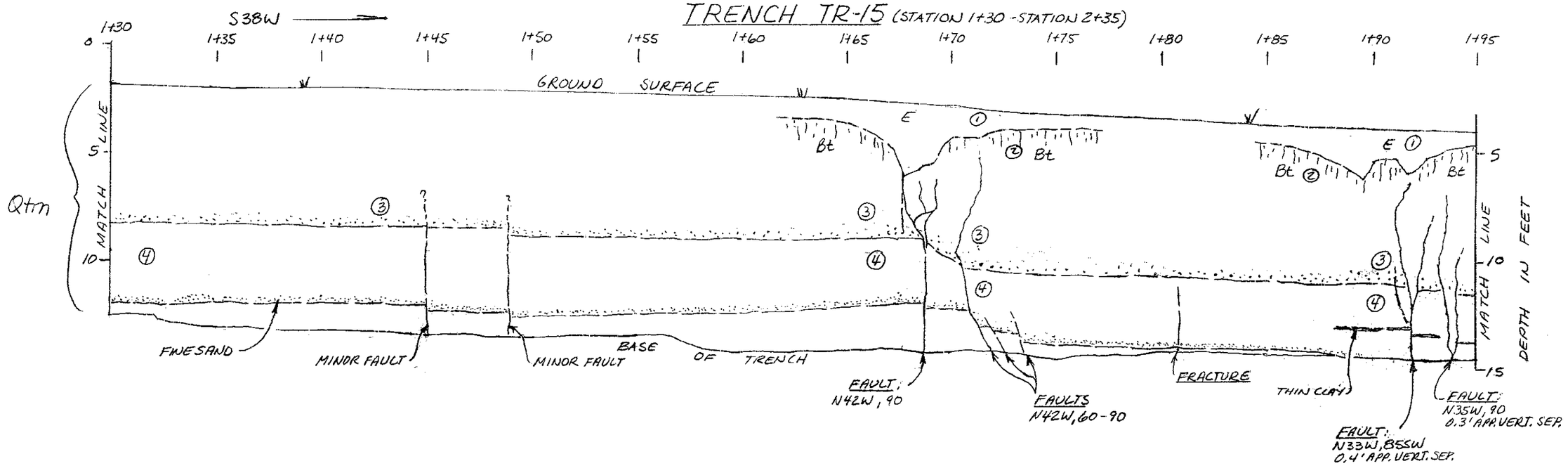
0 2.5 5 7.5
Approximate Graphic Scale: One Inch Equals 5 Feet

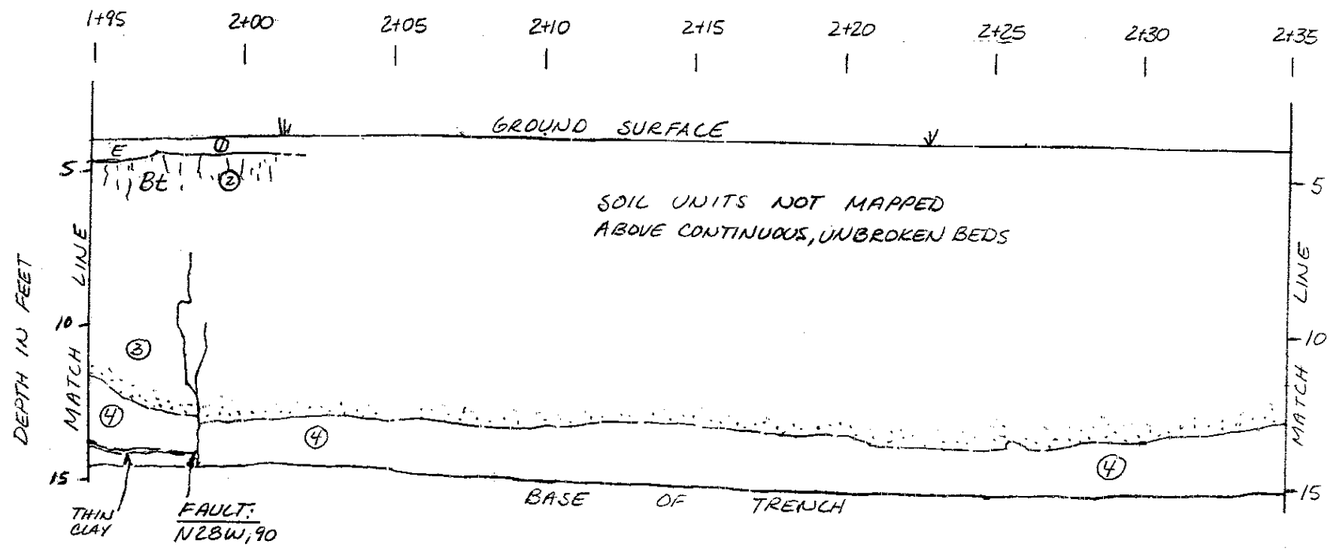
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-15
(Station Numbers 0+00 to 1+30)

TRENCH TR-15 (STATION 1+30 - STATION 2+35)





0 2.5 5 7.5

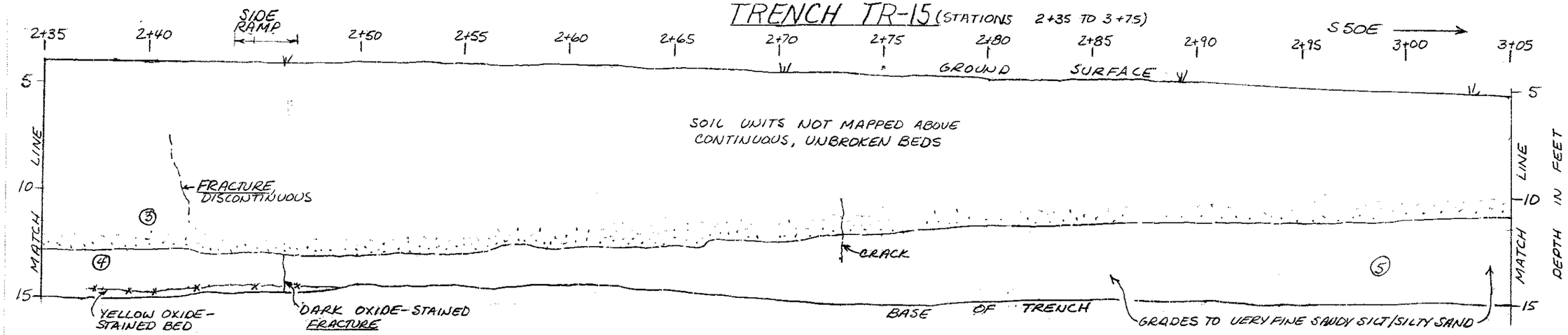
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-15
(Station Numbers 1+30 to 2+35)

TRENCH TR-15 (STATIONS 2+35 TO 3+75)



UNIT DESCRIPTIONS (CONT. — SEE FIG. FOR REMAINING UNIT DESCRIPTIONS)

5. SANDY SILT TO SILTY SAND (VF), MOIST, FIRM, LIGHT YELLOWISH BROWN (2.5Y 6/4) WITH SOME YELLOWISH BROWN (10YR 5/8) STAINING.

6. FINE SAND (F), MOIST, MEDIUM DENSE, FRIABLE, LIGHT GREY (2.5YR 7/2)

7. CLAYEY TO SILTY SAND (F), MOIST, MEDIUM DENSE, STRONG BROWN TO YELLOWISH BROWN (7.5YR - 10YR 5/6), WEAKLY CEMENTED, GRADES TO DRY-SLI MOIST, LOOSE SAND

8. SILTY SAND (F-M), DRY, MEDIUM DENSE, FRIABLE, YELLOWISH BROWN (10YR 5/4),

0 2.5 5 7.5

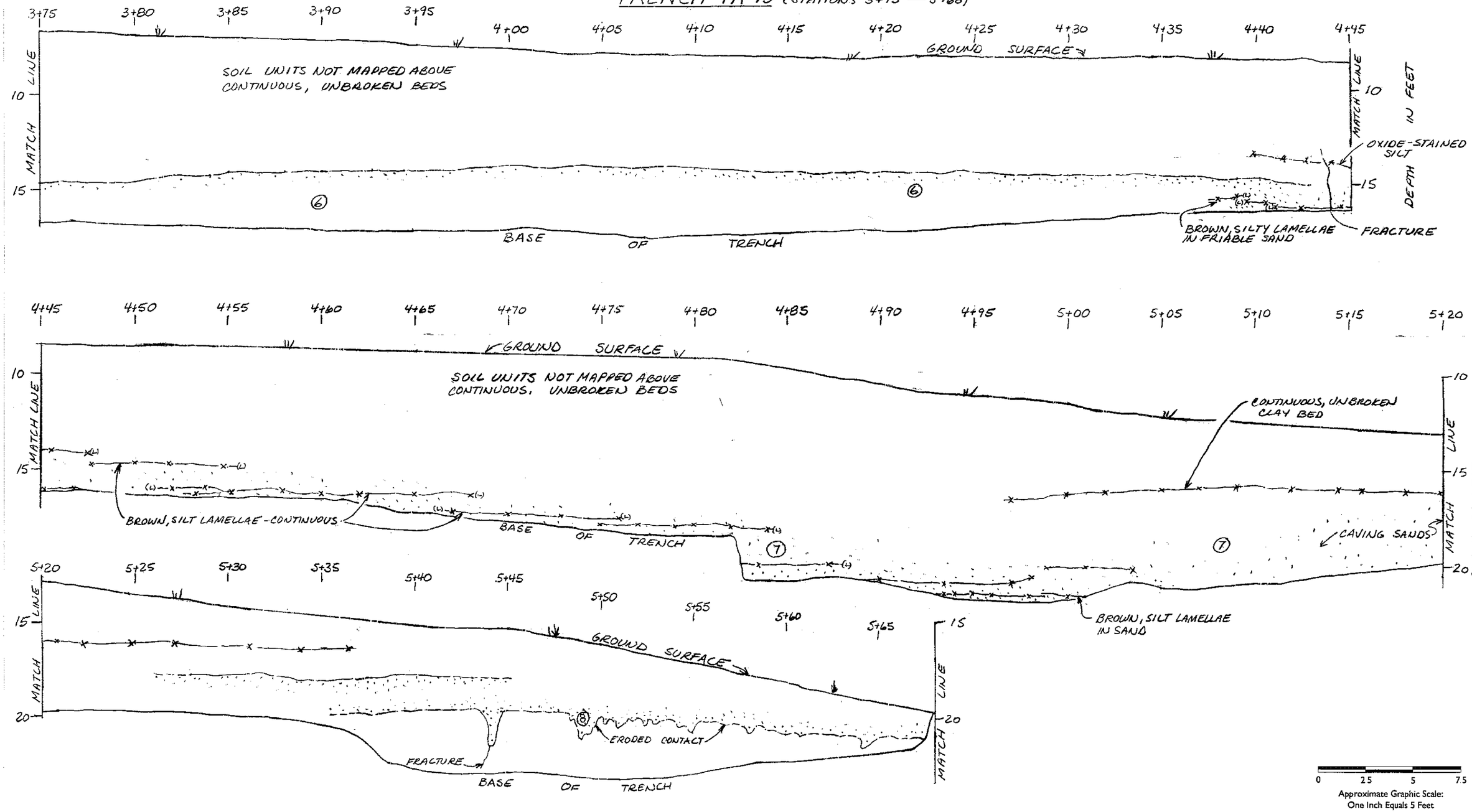
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-15
(Station Numbers 2+35 to 3+75)

TRENCH TR-15 (STATIONS 3+75 — 5+68)

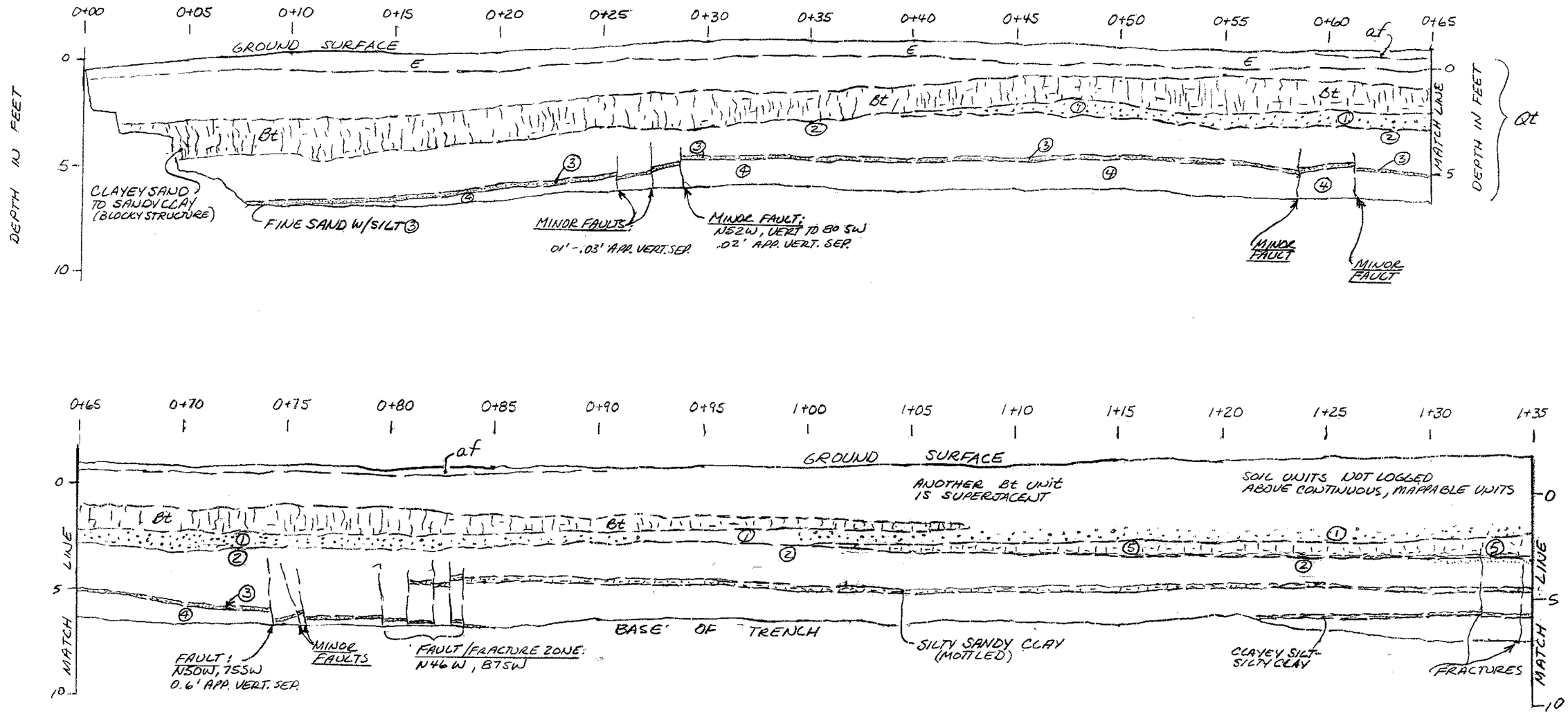


GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-15
(Station Numbers 3+75 to 5+68)

TRENCH TR-16



NOTES: LOGGED BY

SEE SHEET FOR GENERAL EXPLANATION.

SELECTED UNIT DESCRIPTIONS

1. SILTY SAND TO SAND (M-F), DRY, DENSE, YELLOWISH BROWN (10YR 5/4) WITH VERY DARK GREYISH BROWN STAINING, SLI. FRIABLE, SLI. POROUS, GRADES INTO THE "OVERLYING" CLAYEY SAND "Bt" UNIT, LOCALLY CLAYEY.
2. CLAYEY SAND (F), DRY, DENSE, DARK BROWN TO DARK YELLOWISH BROWN (10YR 4/3 - 4/4) W/SOME VERY DARK GREY STAINING (10YR 3/1), MOTTLED, CLAY FILMS, TRACE FINE PORES.
3. VERY FINE SANDY SILT TO SILTY SAND, DENSE, DRY - SLI. MOIST, BROWNISH YELLOW (10YR 6/6) TO YELLOWISH BROWN (10YR 5/4), MOD. POROUS, DK MINERAL STAINING ALONG PORES.
4. VERY FINE SILTY SAND TO SAND W/SOME F-M SAND, DRY-SLI. MOIST, MEDIUM DENSE, BROWNISH YELLOW (10YR 6/6) TO YELLOWISH BROWN (10YR 5/6), FRIABLE.
5. CLAYEY SILT W/CLAYEY SAND INTERBEDS, SLI. MOIST - MOIST, DENSE, DARK BROWN TO DARK YELLOWISH BROWN (10YR 4/3 - 4/4) WITH VERY DARK GREYISH BROWN STAINING (10YR 3/2), CLAY FILMS, SLI. POROUS, BASAL CLAY LAYER.

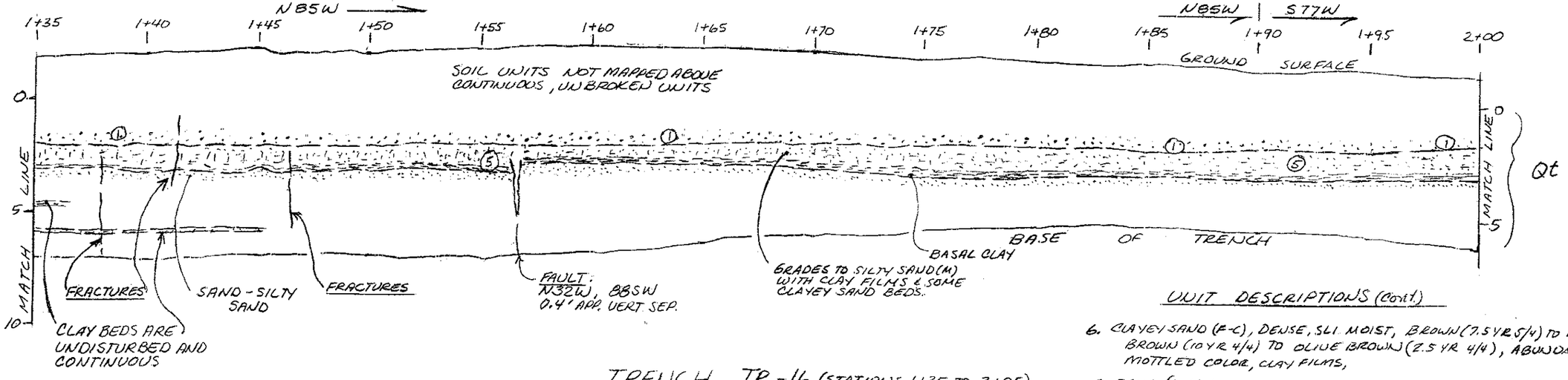
0 25 5 75

Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

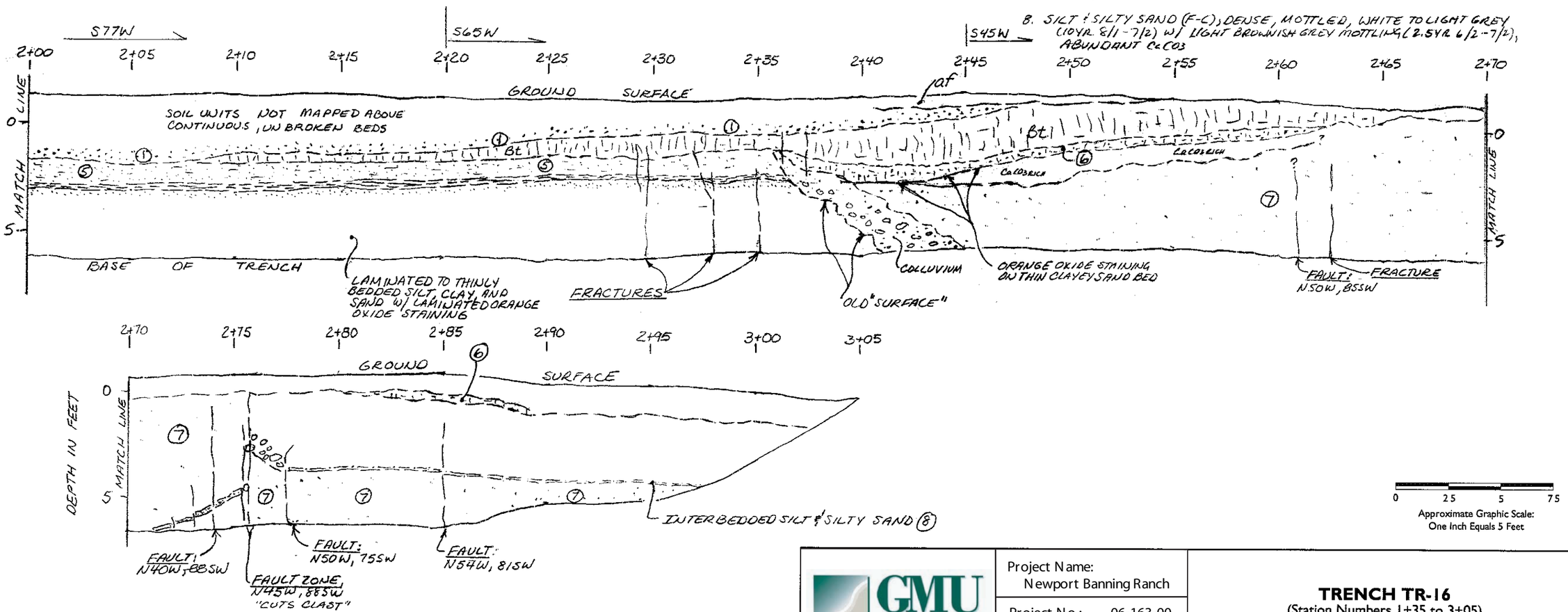
TRENCH TR-16
(Station Numbers 0+00 to 1+35)



TRENCH TR-16 (STATIONS 1+35 TO 3+05)

UNIT DESCRIPTIONS (Cont'd)

6. CLAYEY SAND (F-C), DENSE, SLI. MOIST, BROWN (7.5YR 5/4) TO DK YELLO BROWN (10YR 4/4) TO OLIVE BROWN (2.5 YR 4/4), ABUNDANT $CaCO_3$, MOTTLED COLOR, CLAY FILMS,
7. SAND (M-C), MED. DENSE, MOIST, WHITE TO LIGHT GREY (10YR 8/1-7/1), FRIABLE, SLIGHTLY CEMENTED, THINLY BEDDED, CROSS BEDDED, $CaCO_3$, ROOTS.
8. SILT & SILTY SAND (F-C); DENSE, MOTTLED, WHITE TO LIGHT GREY (10YR 8/1-7/2) W/ LIGHT BROWNISH GREY MOTTLING (2.5YR 6/2-7/2), ABUNDANT $CaCO_3$



0 2.5 5 7.5

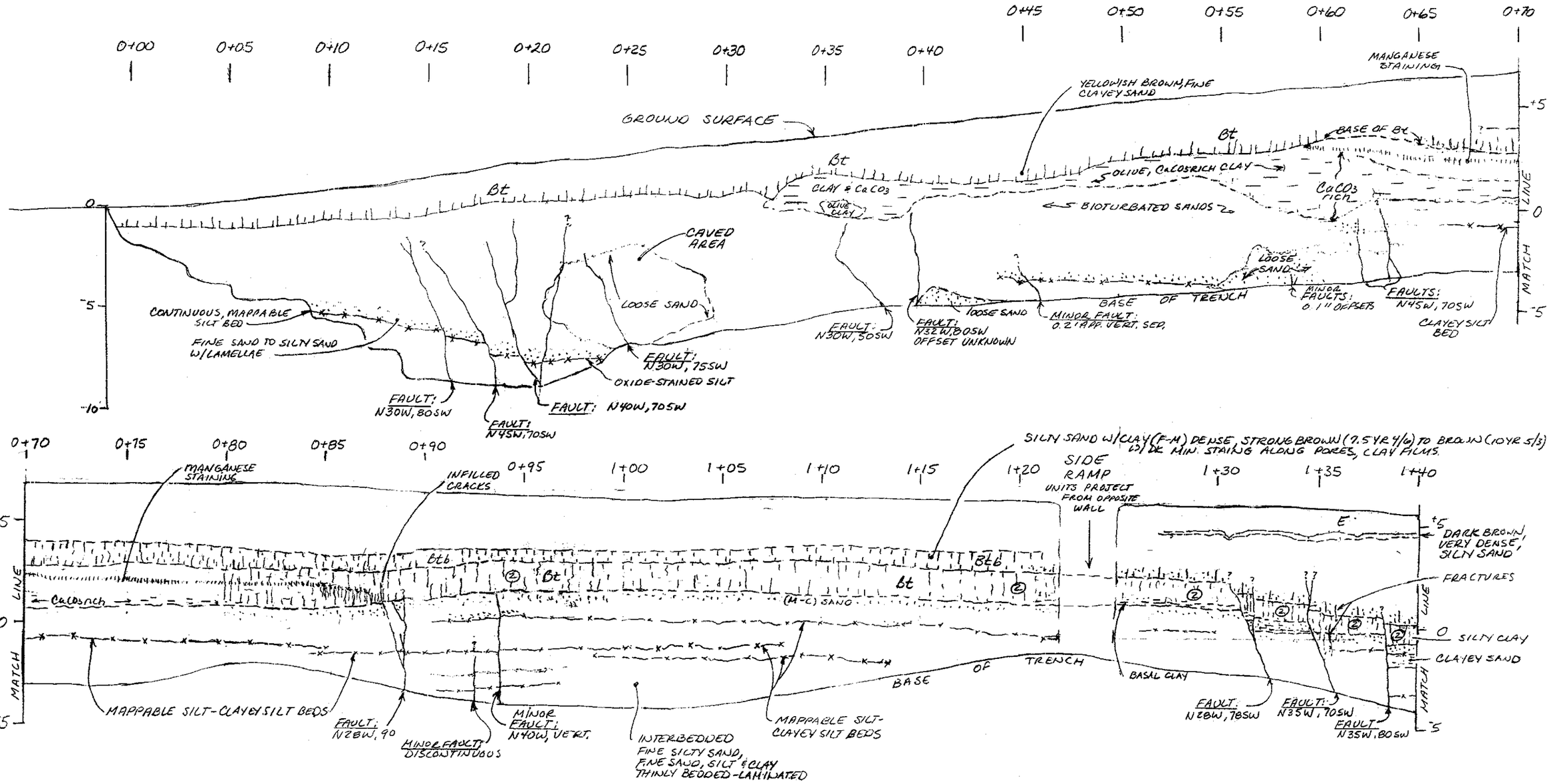
Approximate Graphic Scale: One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-16
(Station Numbers 1+35 to 3+05)

TRENCH TR-17A (STA. 0+00 - 1+40)



0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

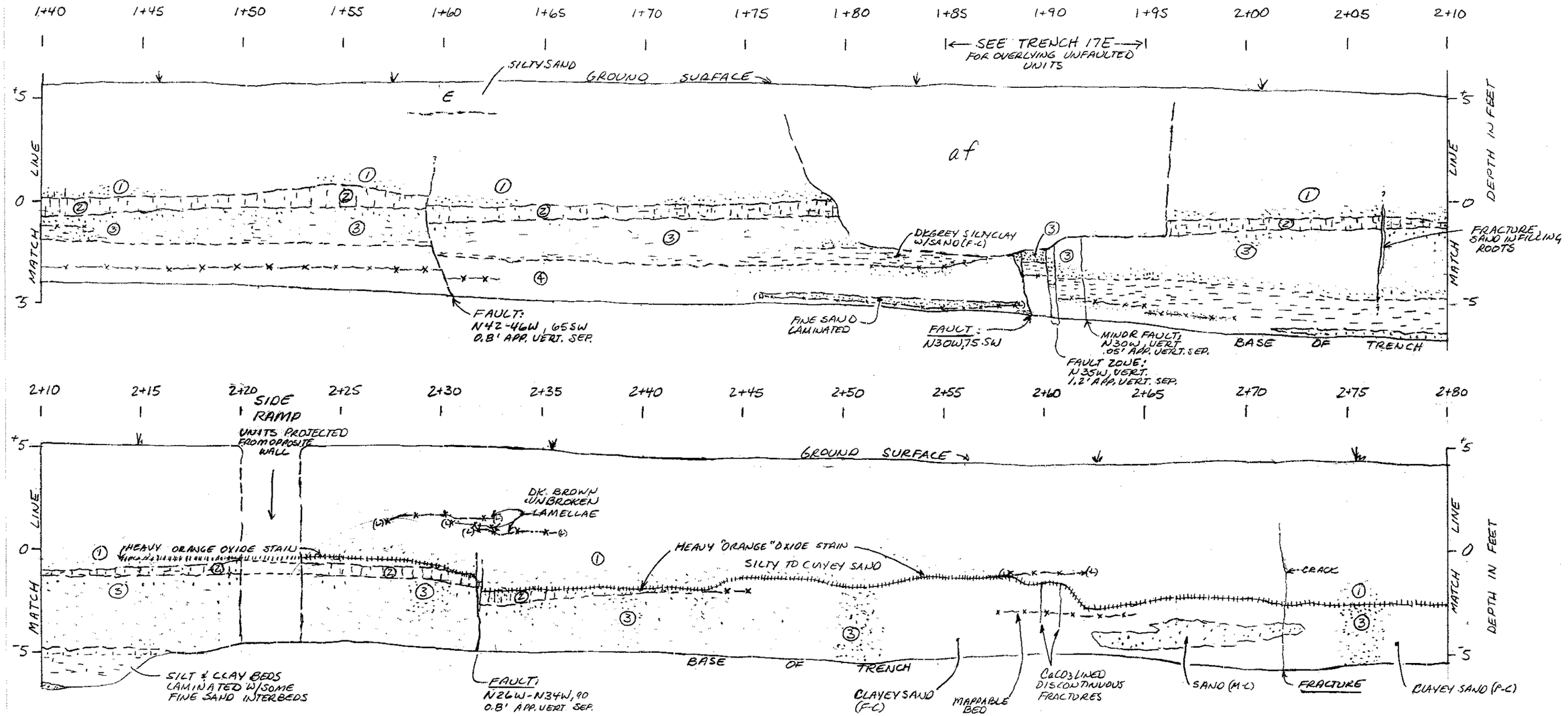
NOTES: SEE SHEET FOR NUMBERED UNIT DESCRIPTIONS
- LOGGED BY P.D & AOM 8/20 - 9/2
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17a
(Station Numbers 0+00 to 1+40)

TRENCH TR-17a
(STATIONS 1+40 THROUGH 2+80)



UNIT DESCRIPTIONS

1. SILTY SAND W/CLAY (F-M), DENSE, DRY-SLI. MOIST, DARK GREYISH BROWN (10YR 4/2) TO DARK YELLOWISH BROWN (10YR 4/4) MOTTLED, SLI POROUS. SOME CLAY FILMS, WITH DK BROWN, WEAKLY CEMENTED SILTY SAND LAMELLAE.
2. FINE SANDY CLAY, DENSE, DRY-SLI MOIST, DARK GREYISH BROWN (2.5Y 4/2) WITH SOME DARK BROWN STAINING (7.5YR 4/4). TRACE PORES
3. CLAYEY SAND (M-C) DENSE, MOIST, DARK GREY (10YR 4/1) TO DARK BROWN (10YR 4/3) MOTTLED, W/SOME BLACK (10YR 2/1). STAINING, ABUNDANT $CaCO_3$ W/ STIFF GREY BASAL CLAY.
4. SILTY SAND (F-C) LOCALLY CLAYEY. MEDIUM DENSE, MOIST, DARK YELLOWISH BROWN (10YR 4/4) WITH SOME DARK BROWN MOTTLING (7.5YR 3/4), TYPICAL SAND WITH THIN INTERBEDS OF SANDY SILT, AND CLAYEY SAND, LOCALLY FRIABLE SAND.

NOTES: LOGGED BY P.D. & A.M.
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

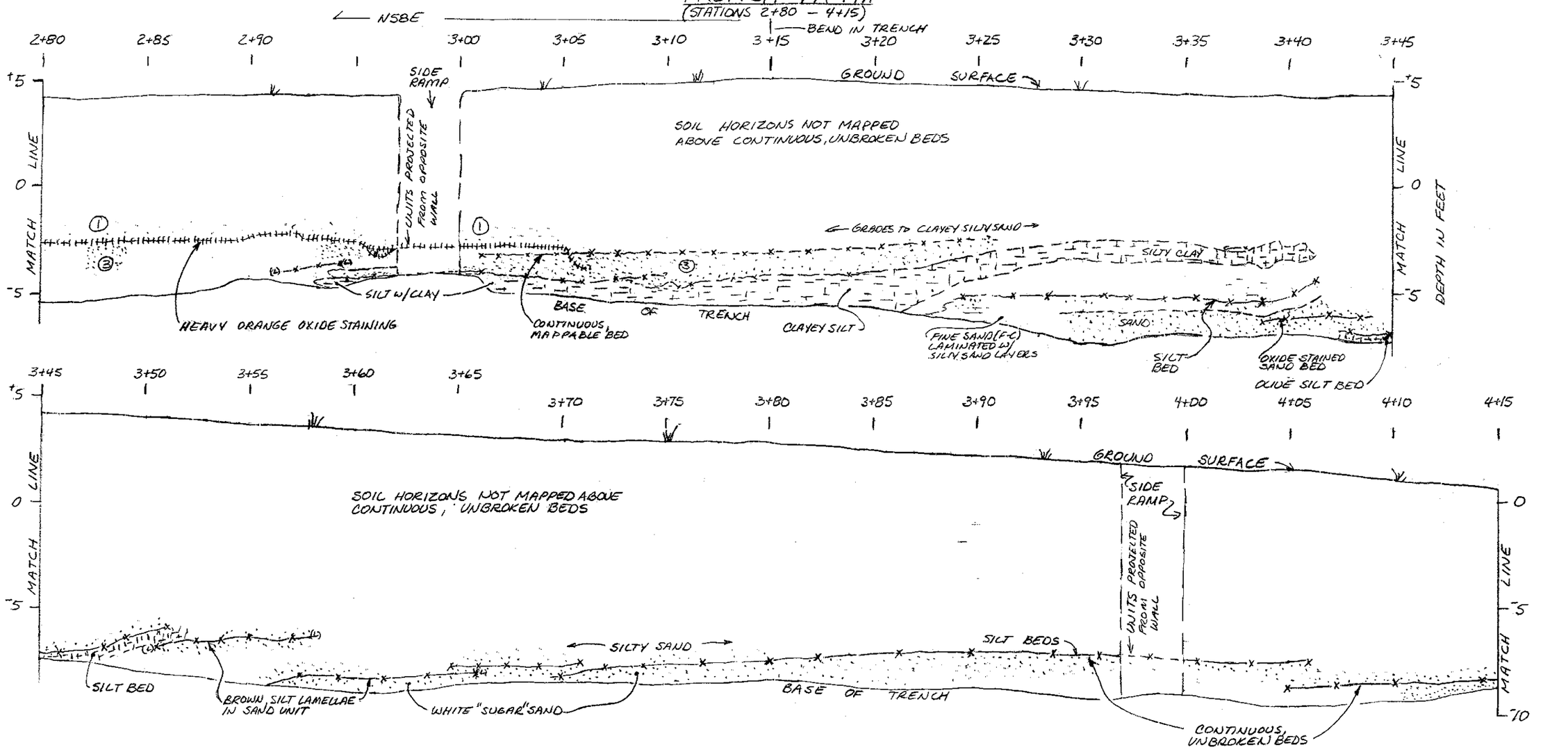
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17a
(Station Numbers 1+40 to 2+80)

TRENCH TR-17A

(STATIONS 2+80 – 4+15)



0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

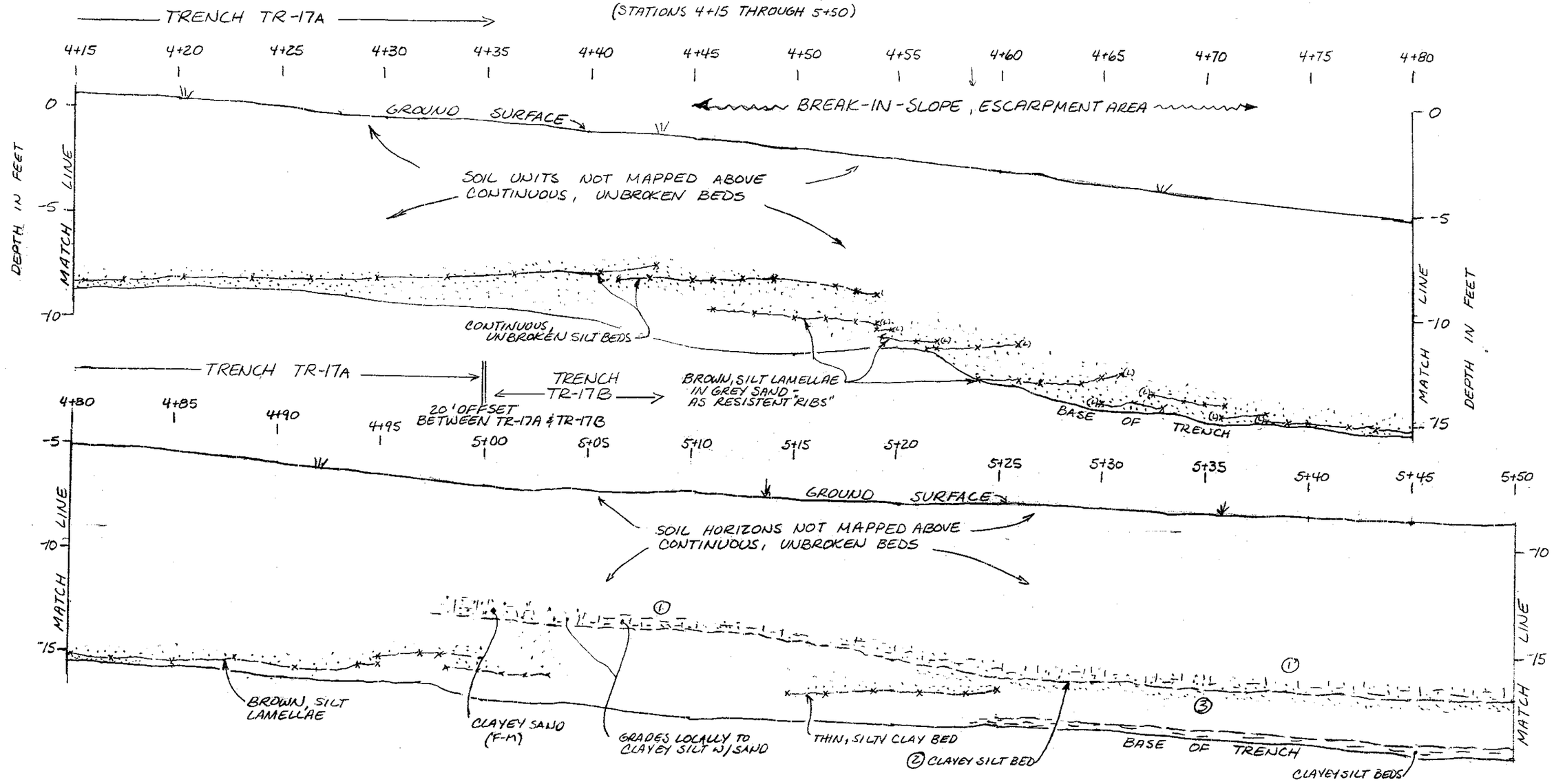
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17a
(Station Numbers 2+80 to 4+15)

TRENCH TR-17A,B

(STATIONS 4+15 THROUGH 5+50)



0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

UNIT DESCRIPTIONS

1. SILTY SAND (F) W/ CLAY LOCALLY, DENSE, DRY, YELLOWISH BROWN (10YR 5/4) WITH SOME DK. BROWN (10YR 4/3) STAINING. POROUS,
2. CLAYEY SILT TO SILTY CLAY W/SOME FINE SAND, FIRM, MOIST, LIGHT OLIVE BROWN (2.5YR 5/4) TO YELLOWISH BROWN (10YR5/4) WITH SOME DK. YELLOWISH BROWN (10YR 4/4) STAINING, NUMEROUS FINE PORES, ROOTLETS.
3. SILTY SAND TO SANDY SILT (V.F.), MED. DENSE, MOIST, BROWN (10YR 5/3) TO LIGHT OLIVE BROWN (2.5Y 5/4) MOTTLED, W/SOME YELLOWISH BROWN (10YR 5/4) STAINING.
4. SILTY CLAY - CLAY, STIFF, MOIST, GREY (10YR5/1 TO 5Y6/1) W/ SOME YELLOWISH BROWN STAINING, THINLY BEDDED - LAMINATED, INDURATED

GMU GEOTECHNICAL, INC.

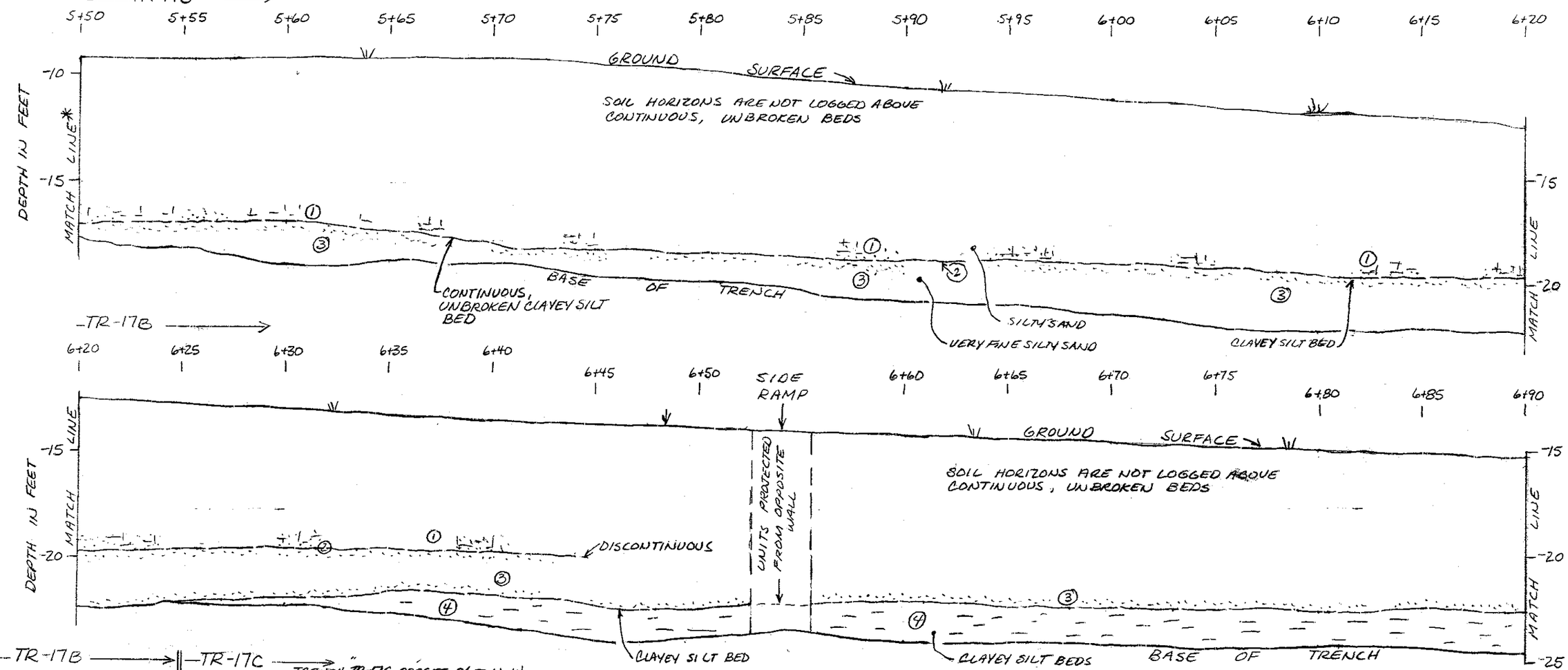
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

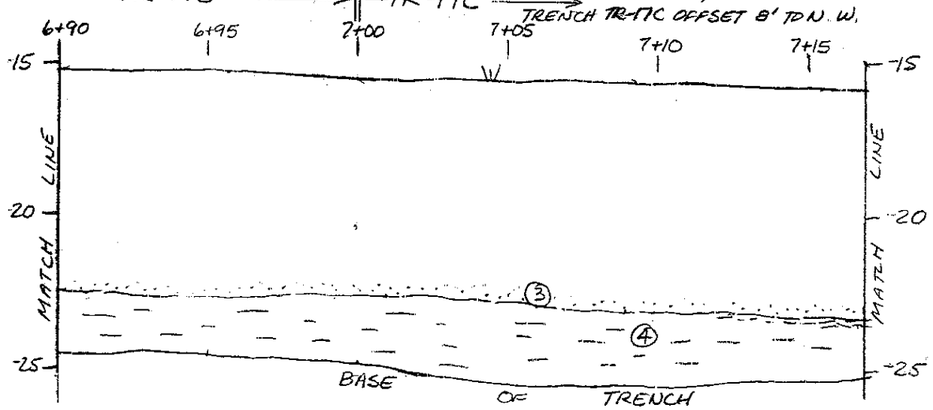
TRENCH TR-17a,b
(Station Numbers 4+15 to 5+50)

TRENCH TR-17B,C

(STATIONS 5+50 THROUGH 7+28)

* BETWEEN STATIONS 5+50 & 5+60 TWO PARALLEL TRENCHES WERE LOGGED AT A ROAD CROSSING. GROUND SURFACES AND "BASE OF TRENCH" DIFFER.





NOTES: • TR-17C LOGGED BY PD 8/20-9/2

• SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

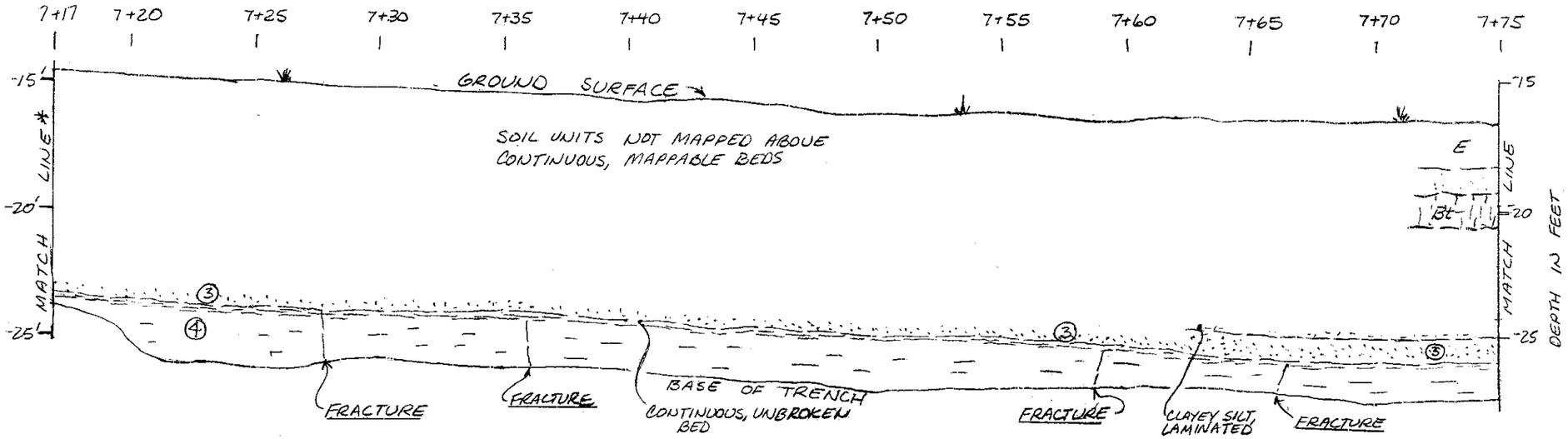
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

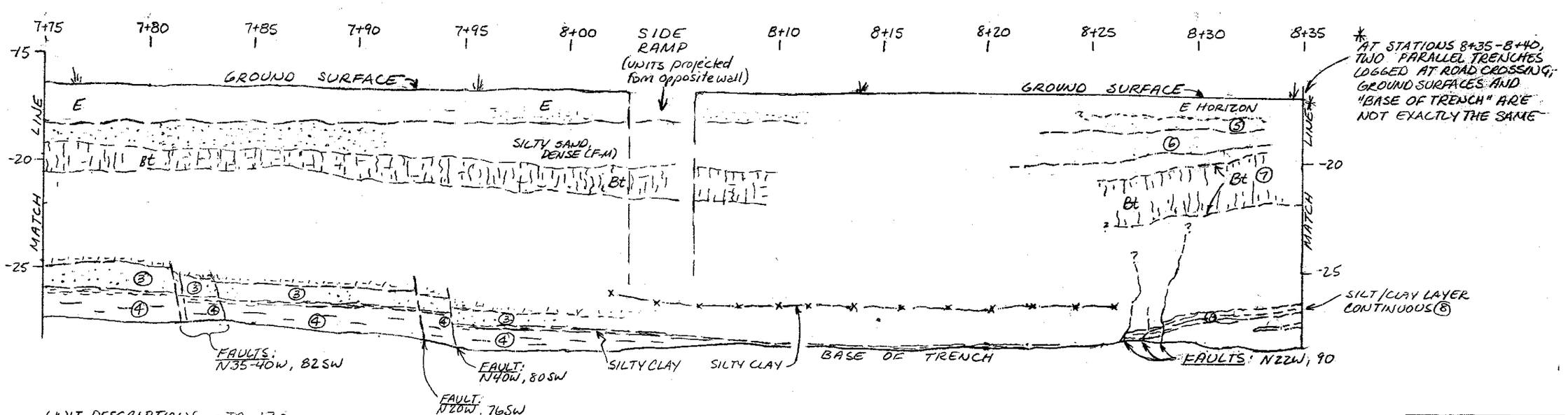
TRENCH TR-17b,c
(Station Numbers 5+50 to 7+17)

TRENCH TR-17c
(STATIONS 7+10 – 8+35)

*BETWEEN STATIONS ≈ 7+10 AND 7+25 TWO PARALLEL TRENCHES WERE LOGGED TO ACCOMODATE AN ACCESS ROAD; GROUND SURFACES AND "BASE OF TRENCH" DIFFER.

S65W





0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

UNIT DESCRIPTIONS – TR-17c

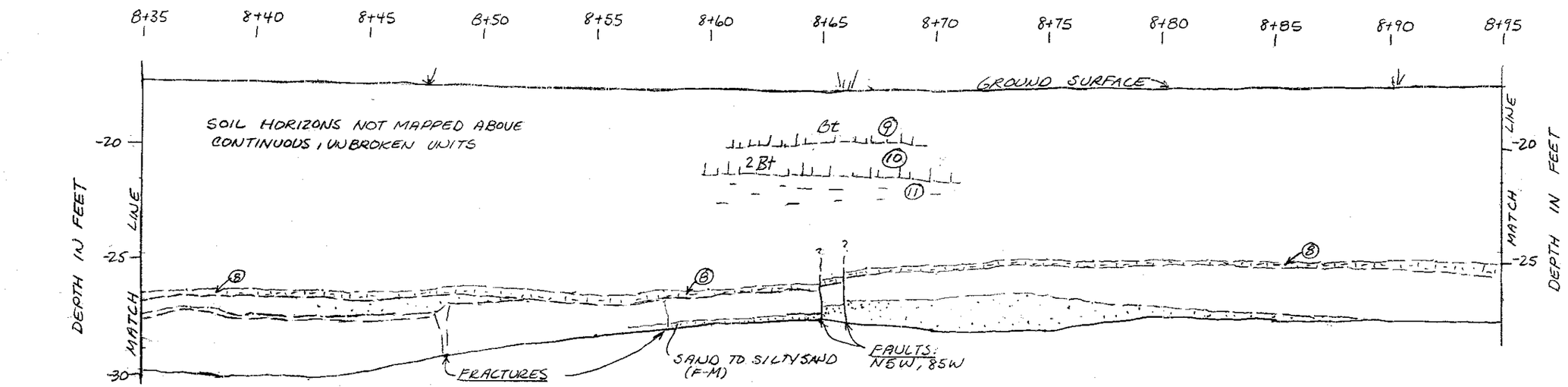
5. SILTY SAND (VF) MED. DENSE, MOIST, DARK GREY-BROWN (10YR 4/2) W/ DARK YELLOWISH BROWN STAINING; NUMEROUS FINE PORES.
6. SILTY SAND, TO SANDY SILT (V.F.), MEDIUM DENSE – FIRM, MOIST, DARK BROWN (10YR 4/3), POROUS
7. "Bt" SANDY CLAY, STIFF, DRY, DARK BROWN (10YR 3/3), CLAY FILMS, V. FINE PORES.
8. SILTY CLAY – CLAYEY SILT: FIRM, MOIST, GREY TO DARK GREY (2.5Y 5/0 – 4/0), POROUS

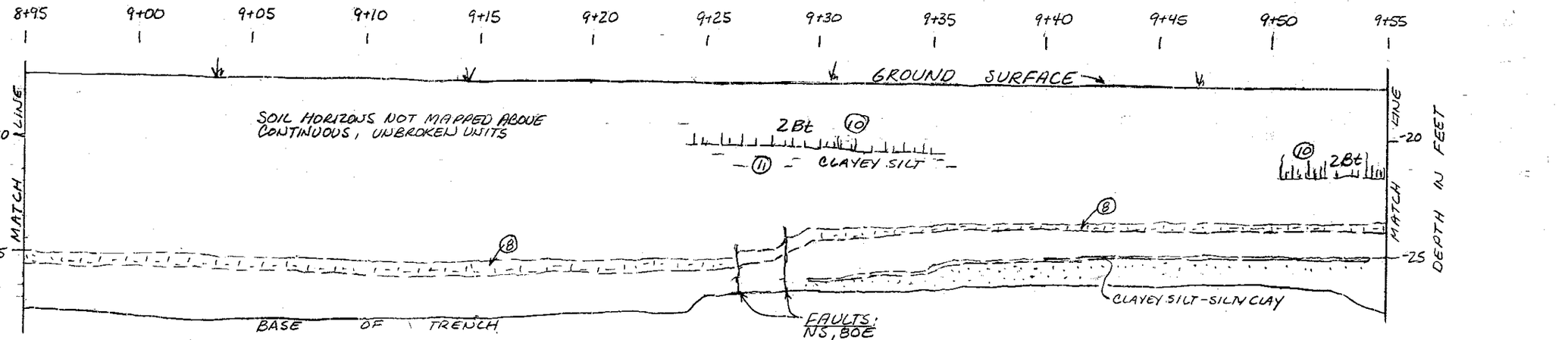
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17c
(Station Numbers 7+17 to 8+35)

TRENCH TR-17c
(STATIONS 8+30 - 9+50)





UNIT DESCRIPTIONS -TR-17c

9 "Bt" CLAY, STIFF, MOIST, DARK BROWN (10YR 3/3) CLAY FILMS, POROUS.

10 "2Bt" SILTY CLAY, STIFF, DRY, DARK YELLOWISH BROWN (10YR 4/4), CLAY FILMS, POROUS.

11. CLAYEY SILT W/SAND, FIRM, MOIST, DARK YELLOWISH BROWN (10YR 4/4).

0 25 5 75
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

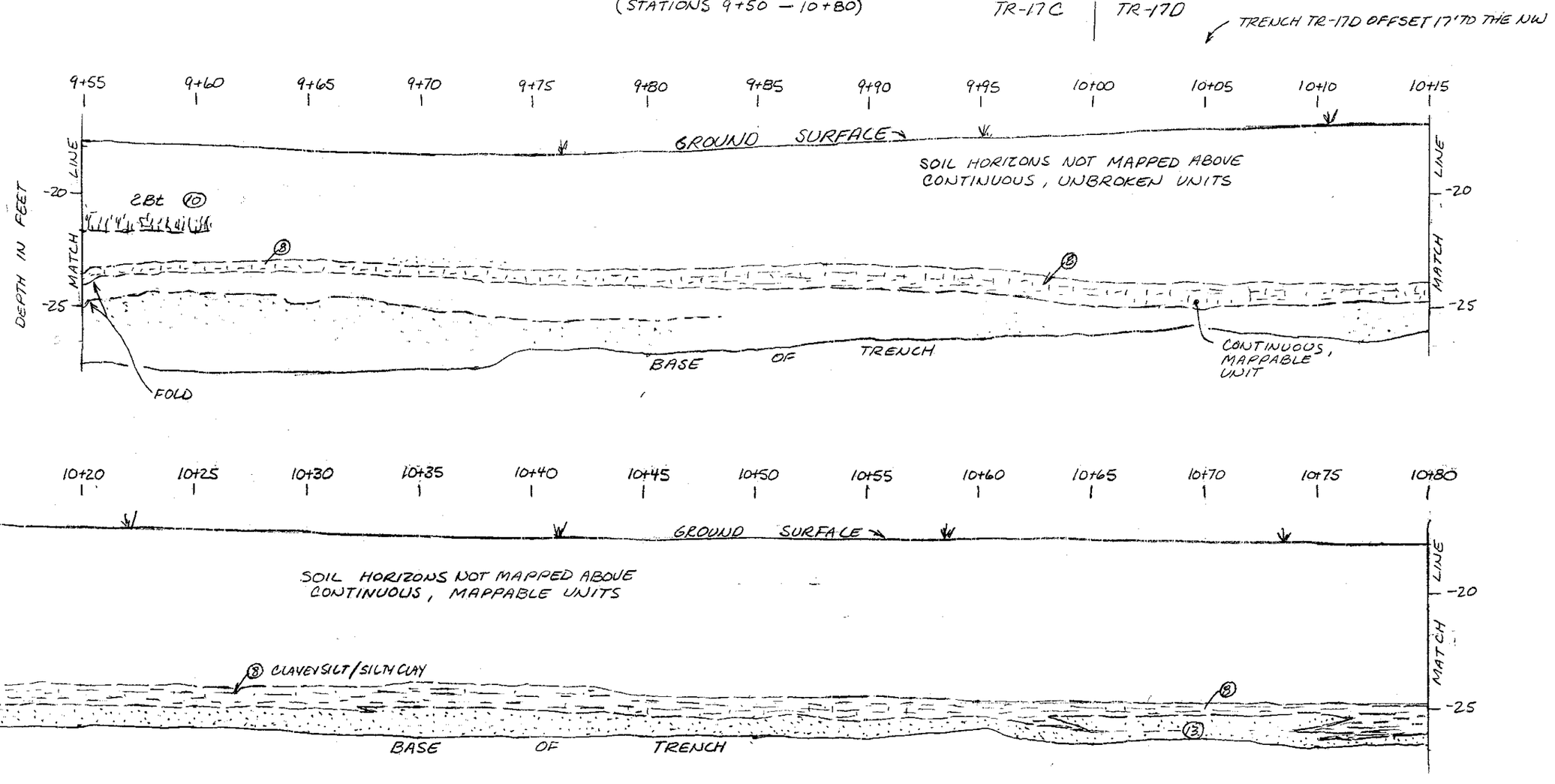
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17c
(Station Numbers 8+35 to 9+55)

TRENCHES TR-17C & TR-17D

(STATIONS 9+50 – 10+80)

TR-17C | TR-17D



0 2.5 5 7.5

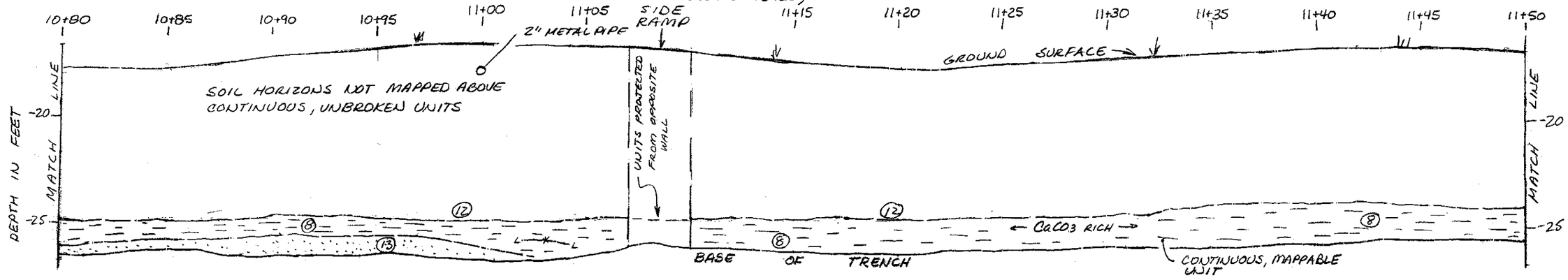
Approximate Graphic Scale:
One Inch Equals 5 Feet

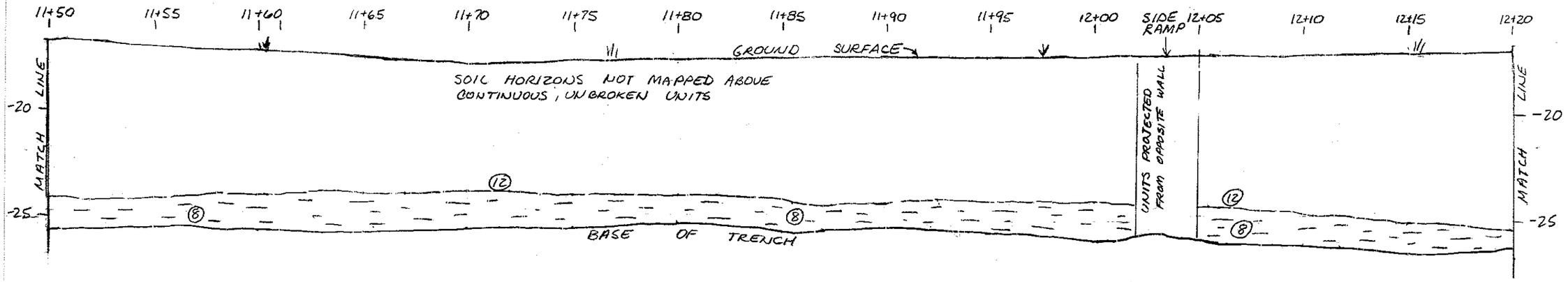
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17c
(Station Numbers 9+55 to 10+15)
TRENCH TR-17d
(Station Numbers 10+15 to 10+80)

TRENCH TR-17D
(STATIONS 10+80 - 12+20)





UNIT DESCRIPTIONS -TR-17D

(GRADES FROM TR17C) 8. FINE SANDY CLAY, STIFF, SLI MOIST, DARK BROWN (10YR 4/3) WITH VERY DARK GREYISH BROWN (10YR 3/2) AND DARK YELLOWISH BROWN (10YR 4/4) STAINING, SOME CLAY FILMS, SLI. POROUS, LOCALLY $CaCO_3$ RICH.

12. VERY FINE SILTY SAND, MEDIUM DENSE, MOIST, YELLOWISH BROWN TO DARK YELLOWISH BROWN (10YR 5/4 TO 4/4), POROUS.

13 VERY FINE SILTY SAND TO SAND, MEDIUM DENSE, SLI MOIST, DARK YELLOWISH BROWN (10YR 4/4 - 4/6) TO BROWN (10YR 5/3).

TRENCH TR-17D NOTES:
- LOGGED BY P.D. & SCS 8/20 - 9/2.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

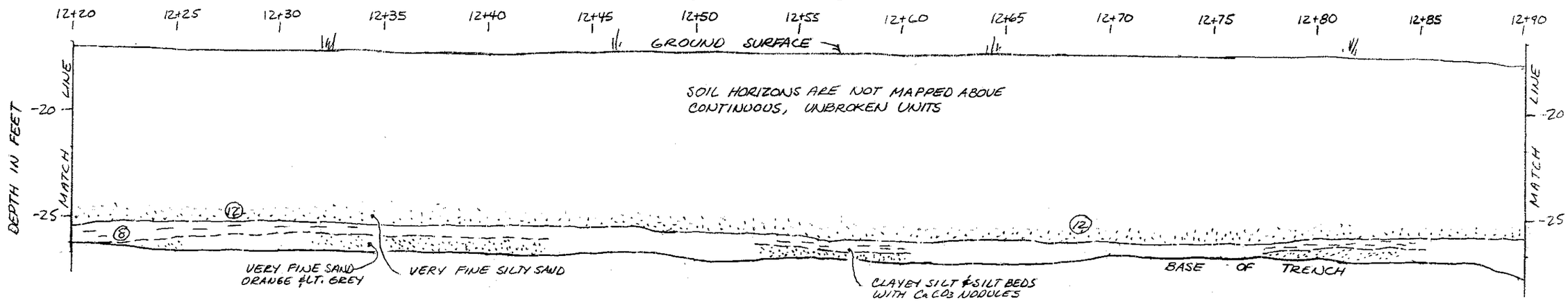
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

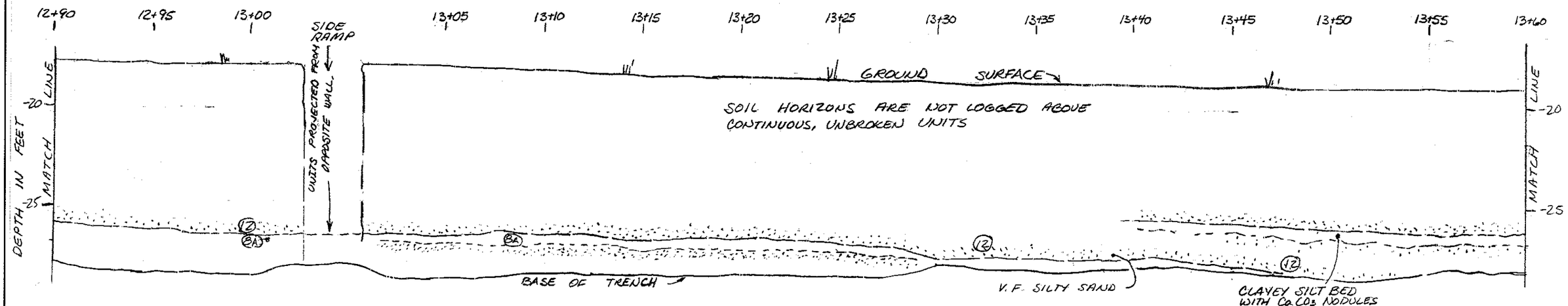
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17d
(Station Numbers 10+80 to 12+20)

TRENCH TR-17D
(STATIONS 12+20 - 13+60)





UNIT DESCRIPTIONS -TR-17D

(8A) (STATION 13+00) SANDY SILT TO SILTY SAND (V.F), MEDIUM DENSE, MOIST, STRONG BROWN (7.5YR 4/6), YELLOW BROWN (10YR 5/4) AND GREYISH BROWN (2.5YR 5/2) MOTTLED. SILTS ARE TYPICALLY GREYISH BROWN, THINLY BEDDED, INTERBEDDED SAND & SILT.

(12) STATION (13+00) SILTY SAND (V.F.), MEDIUM DENSE, SLI MOIST, YELLOWISH BROWN (10YR 5/4) WITH SOME DARK YELLOWISH BROWN STAINING (10YR 4/4), POROUS.

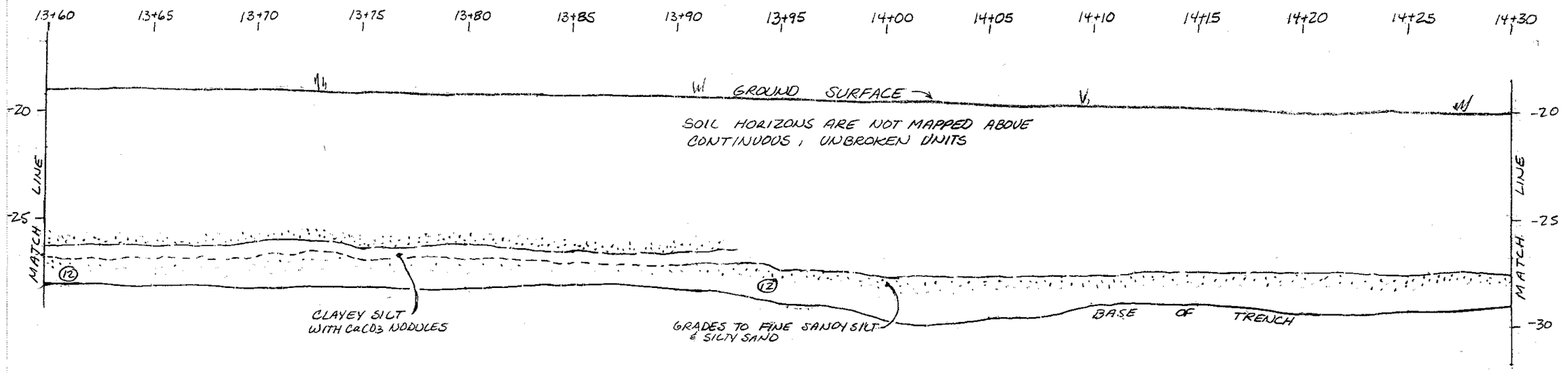
0 25 5 75
Approximate Graphic Scale:
One Inch Equals 5 Feet

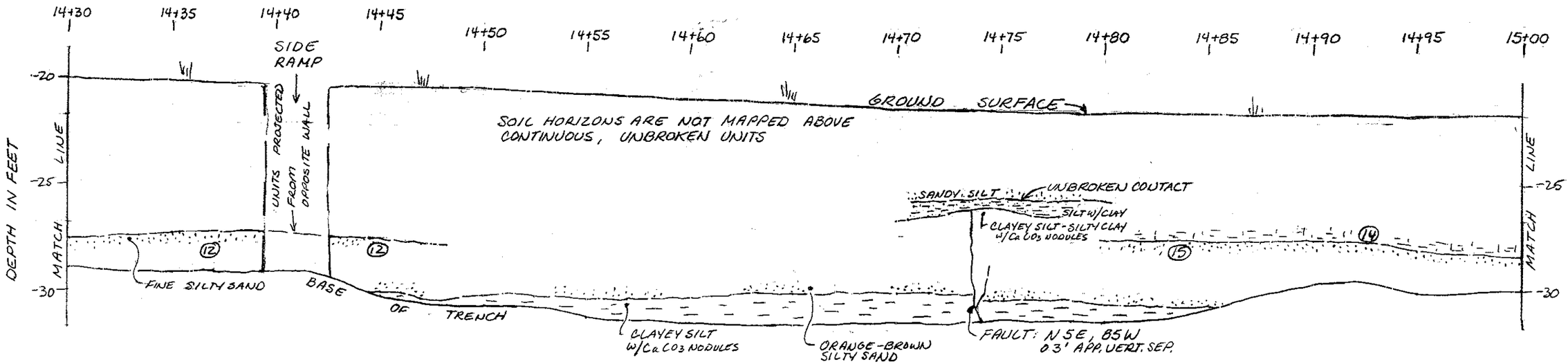
GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17d
(Station Numbers 12+20 to 13+60)

TRENCH TR-17D





UNIT DESCRIPTIONS-TR-17D

14. SILTY CLAY, STIFF, SLI. MOIST, DARK BROWN (10YR 3/3), CLAY FILMS, POROUS.

15. VERY FINE SANDY SILT TO SILTY SAND, MEDIUM DENSE, MOIST, DARK YELLOW BROWN (10YR 4/4) WITH SOME DARK BROWN (10YR 3/3) MOTTLING, POROUS. MAY BE SAME AS UNIT (12).

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

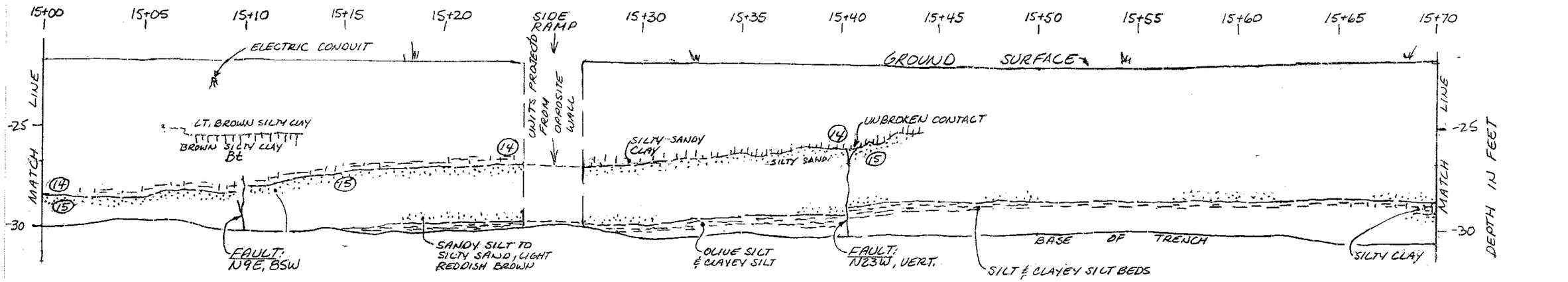
GMU GEOTECHNICAL, INC.

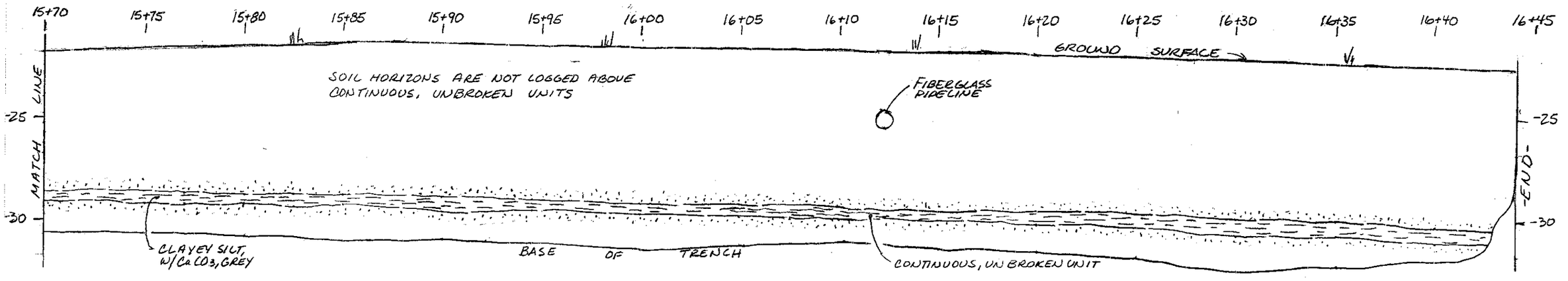
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17d
(Station Numbers 13+60 to 15+00)

TRENCH TR-17D

(STATIONS 15+00 TO 16+45)





UNIT DESCRIPTIONS TR-17D

14. (@ STA 15+40) FINE SANDY CLAY, DENSE, SLI. MOIST, DARK YELLOWISH BROWN (10YR 4/4) WITH SOME DARK BROWN (10YR 3/3) MOTTLING, CLAY FILMS, BLOCKY STRUCTURE, POROUS.

15 (@ STA 15+40) VERY FINE SILTY SAND - SANDY SILT, DENSE, SLI. MOIST, YELLOWISH BROWN (10YR 5/4) TO DARK YELLOWISH BROWN (10YR 4/4), POROUS.

0 2.5 5 7.5

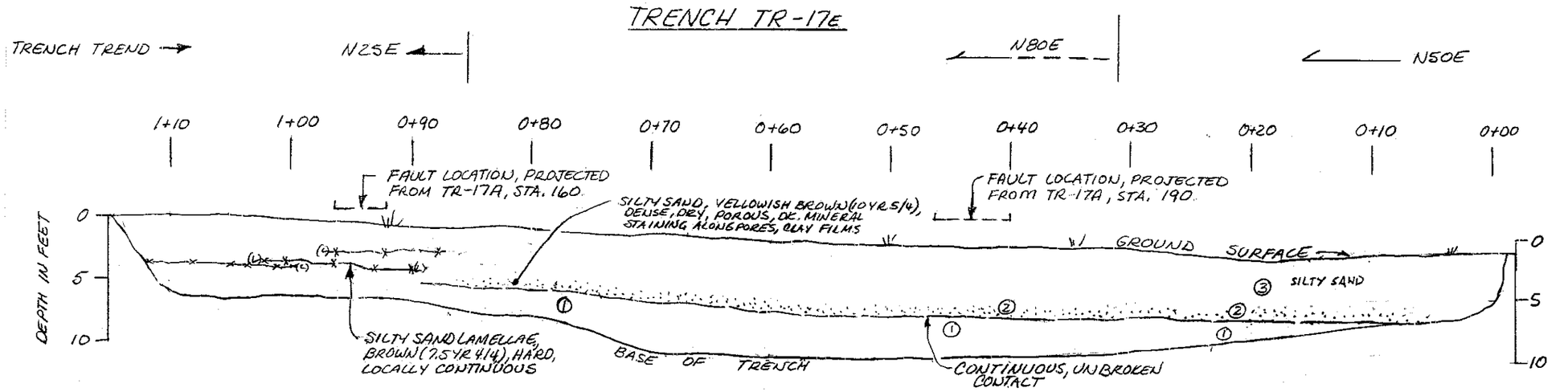
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-17d
(Station Numbers 15+00 to 16+45)

TRENCH TR-17E



UNIT DESCRIPTIONS

1. SILTY SAND (F), VERY DENSE, YELLOWISH BROWN (10YR 5/4) TO DARK YELLOWISH BROWN (10YR 4/4).
2. SAND (F), MOIST, MEDIUM DENSE, DARK YELLOWISH BROWN (10YR 4/4)
3. SILTY SAND (F) DRY, DENSE, YELLOWISH BROWN (10YR 5/4) WITH SOME DARK YELLOWISH BROWN (10YR 4/4) STAINING, SLIGHTLY POROUS, ROOT HAIRS

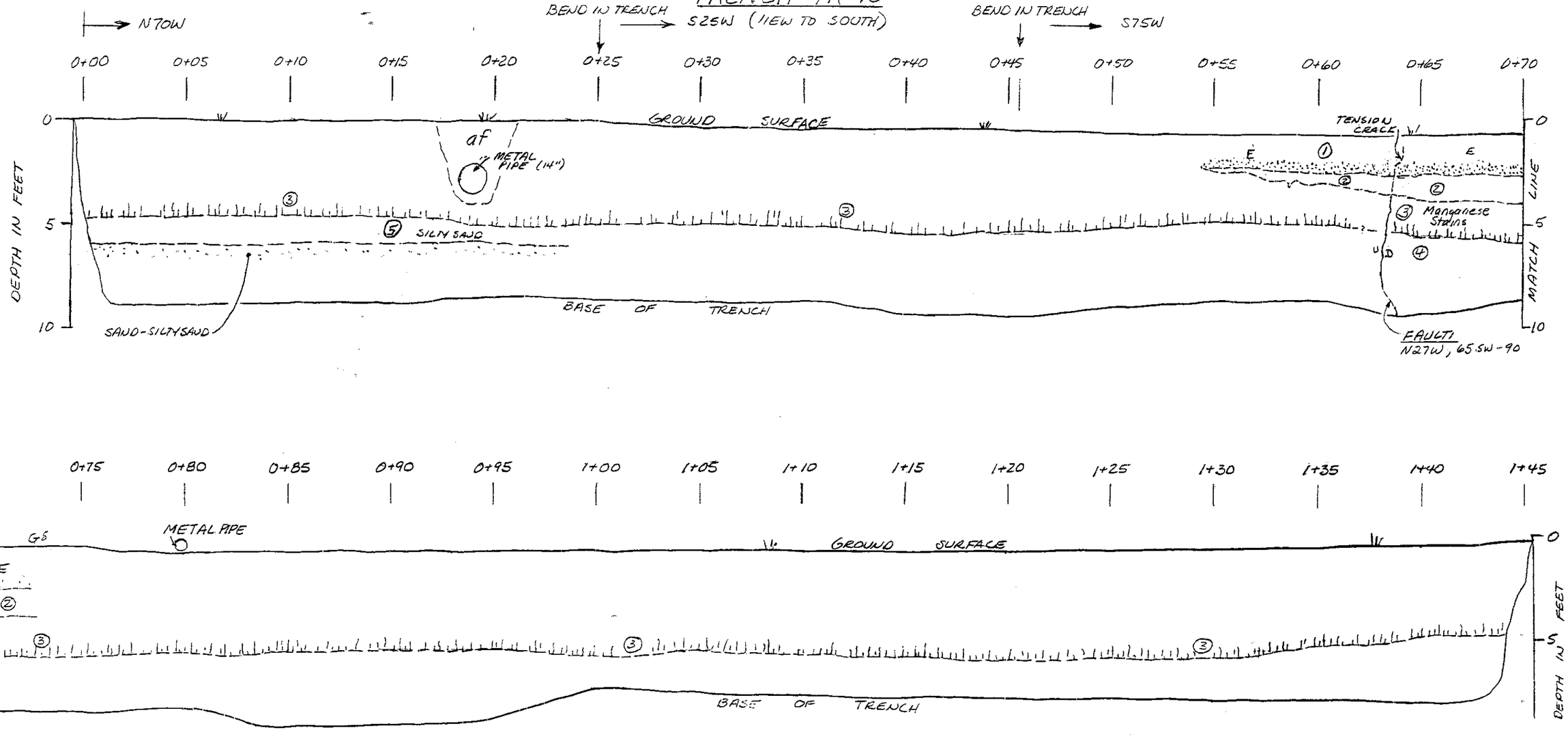
NOTES: LOGGED BY P.O
SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	**TRENCH TR-17e** (Station Numbers 0+00 to 1+10)
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-18



UNIT DESCRIPTIONS

① "E" VERY FINE SANDY SILT W/ CLAY, STIFF, DRY, PALE BROWN - BROWN (10YR 6/3 - 5/3), POROUS.

② SANDY CLAY - CLAYEY SAND (F-M), STIFF, DRY, MOTTLED PALE BROWN (10YR 6/3) TO DARK BROWN (10YR 4/3) - VERY DARK BROWN (10YR 4/2), ROOT HAIRS POROUS.

③ CLAYEY SAND (VF-F) DENSE, DRY, MOTTLED, BROWN (10YR 5/3), DARK BROWN (10YR 4/3), STRONG BROWN (7.5YR 6/4), TO VERY DARK GREY BROWN (10YR 3/2), POROUS, TRACE CLAY FILMS.

④ CLAYEY SAND (F) DENSE, SL. MOIST, YELLOWISH BROWN (10YR 5/4) TO DARK YELLOWISH BROWN (10YR 4/4) CLAY FILMS, ROOT HAIRS, POROUS.

⑤ SILTY SAND (V.F) DENSE, SL. MOIST, LIGHT YELLOWISH BROWN (10YR 6/4) TO YELLOWISH BROWN (10YR 5/4) W/ SOME DARK YELLOWISH BROWN STAINING (10YR 4/4).

0 2.5 5 7.5

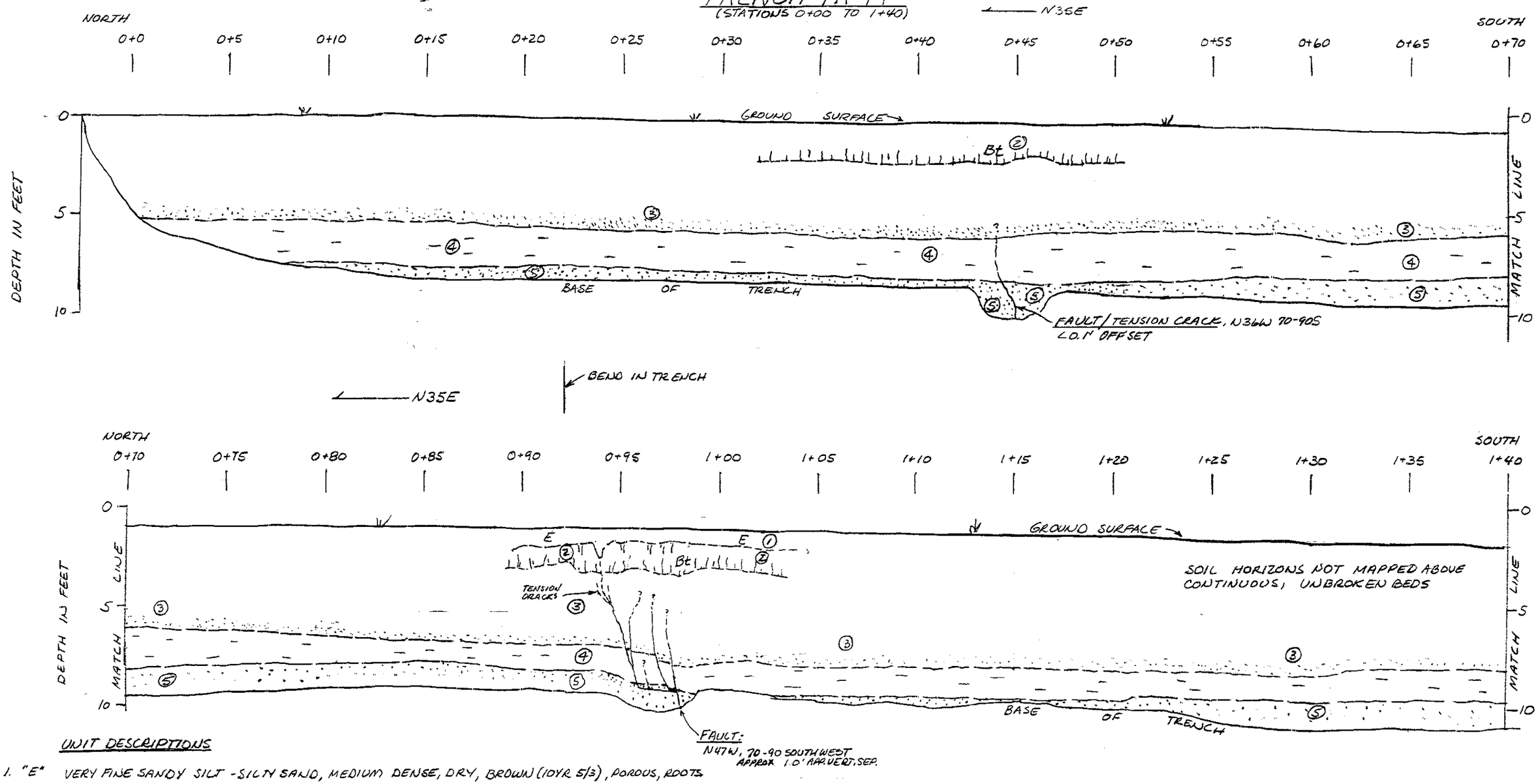
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-18
(Station Numbers 0+00 to 1+45)

TRENCH TR-19
(STATIONS 0+00 TO 1+40)



UNIT DESCRIPTIONS

1. "E" VERY FINE SANDY SILT - SILTY SAND, MEDIUM DENSE, DRY, BROWN (10YR 5/3), POROUS, ROOTS.
2. "Bt" CLAYEY SAND - SANDY CLAY (f-m), DENSE, DRY, DARK BROWN (7.5YR 4/4) WITH SOME VERY DARK GREYISH BROWN (10YR 3/2) STAINING, CLAY FILMS, POROUS, MOD. BLOCKY STRUCTURE.
3. CLAYEY SAND TO SILTY SAND (f), DENSE, DRY, YELLOWISH BROWN (10YR 5/4), POROUS.
4. SILT - CLAYEY SILT; FIRM, MOIST, MOTTLED, OLIVE BROWN (2.5Y 4/4) WITH DARK BROWN (7.5YR 3/4) CLAY FILMS, POROUS,
5. VERY FINE SAND W/SILT, MEDIUM DENSE, DRY, FRIABLE, LIGHT YELLOWISH BROWN (10YR - 2.5Y. 6/4), WEAKLY CEMENTED.

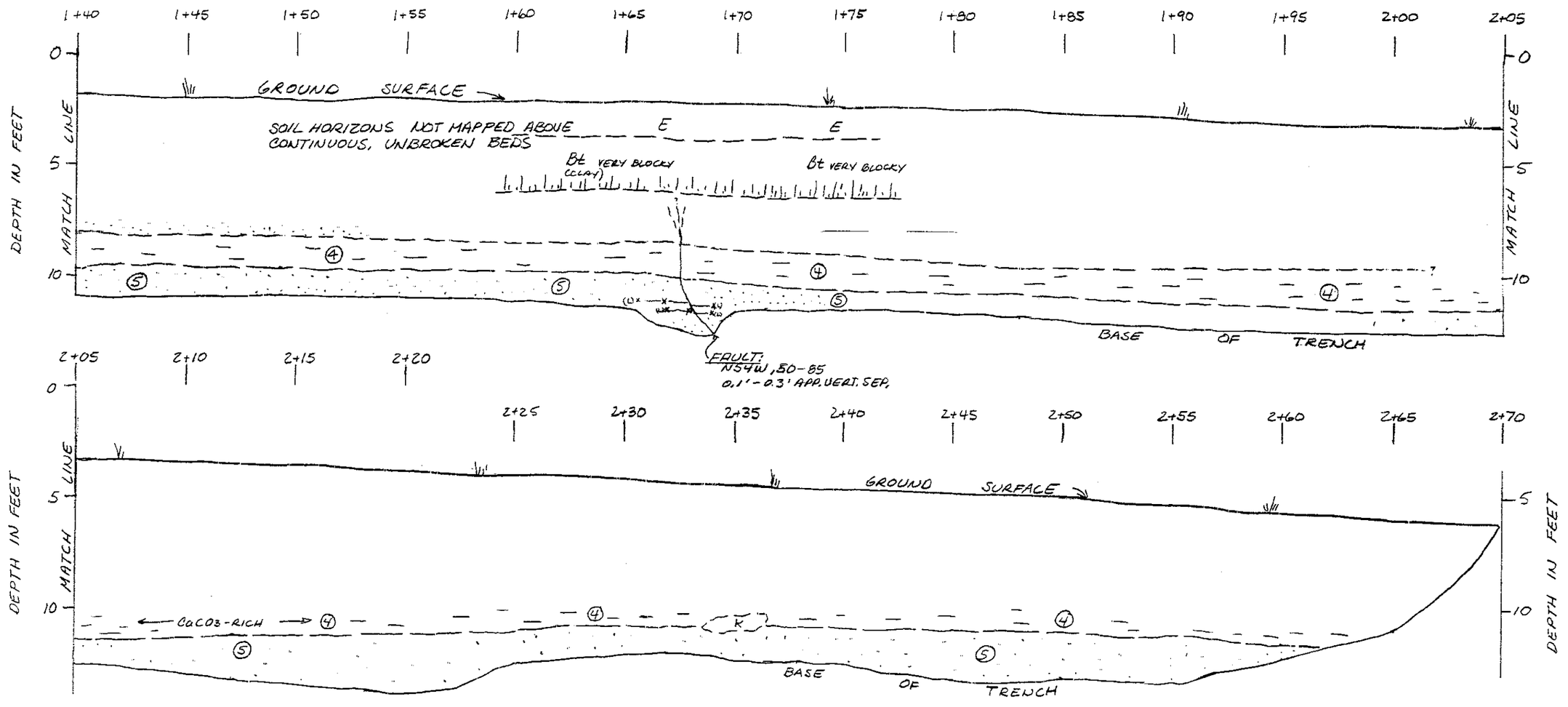
0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-19
(Station Numbers 0+00 to 1+40)

TRENCH TR-19
(STATIONS 1+40 TO 2+70)



NOTES: • LOGGED BY P.D. & A.M. ON
• SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

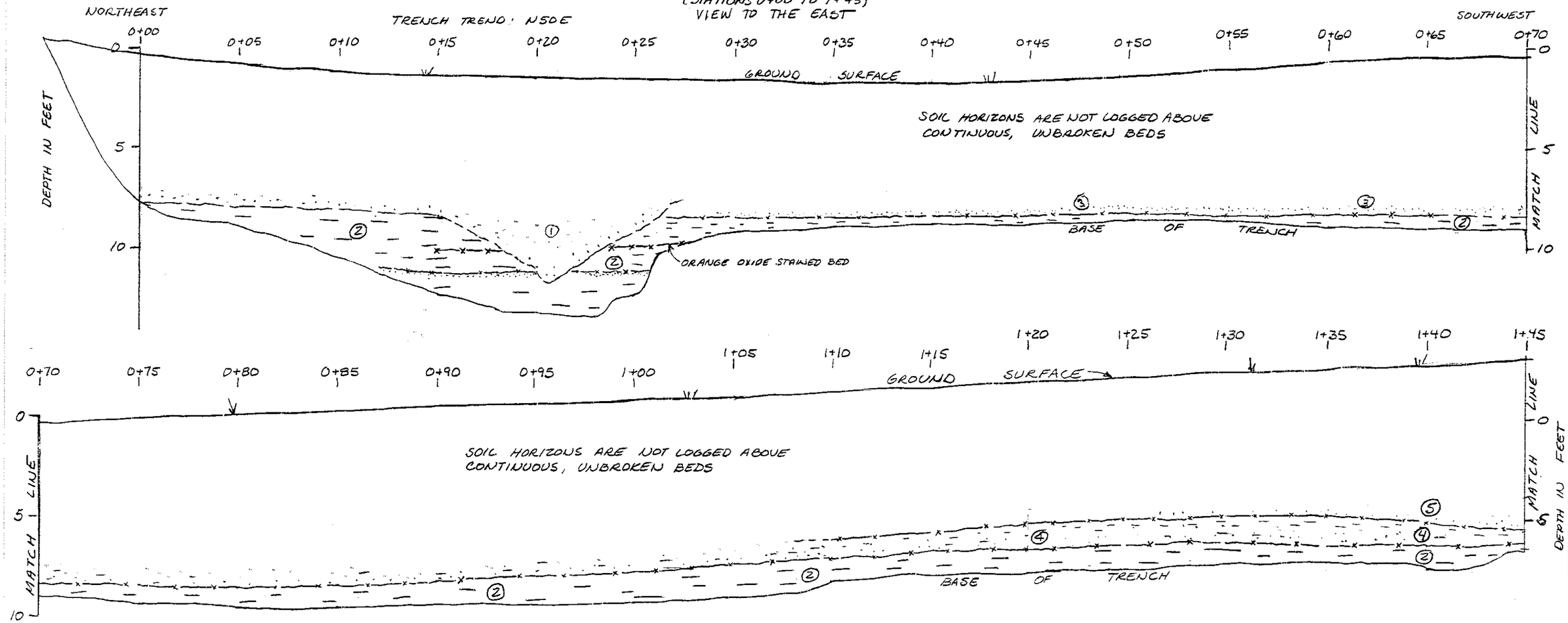
GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-19
(Station Numbers 1+40 to 2+70)

TRENCH TR-20

(STATIONS 0+00 TO 1+45)
VIEW TO THE EAST



UNIT DESCRIPTIONS

1. SILTY SAND w/CLAY (f) MED. DENSE, MOIST, MOTTLED BROWN (7.5YR 5/4 w/ DARK BROWN (7.5YR 3/4 TO 10YR 4/4), TRACE TINY PORES.
2. CLAYEY SILT, FIRM, MOIST, LIGHT YELLOWISH BROWN (2.5Y 6/4) w/ DARK BROWN (10YR 4/3) TO OLIVE BROWN (2.5Y 4/4) CLAY FILMS/STAINING, CLAY FILMS SLI. POROUS, BIOTURBATED.
3. SILTY SAND (V.F.) DENSE, DRY, YELLOWISH BROWN (10YR 5/4 - 5/6), POROUS, GRADES TO SILTIER UNIT TO SOUTHWEST (4)
4. SILT TO (V.F.) SILTY SAND, FIRM, MOIST, DARK GREYISH BROWN (2.5Y 4/2) WITH SOME OLIVE BROWN (2.5Y 4/4), AND DARK BROWN (7.5YR 4/4) STAINING, LAMINATED TO V. THINLY BEDDED, SLI POROUS.
5. SAND (V.F.) MED DENSE, DRY, FRIABLE, LIGHT OLIVE BROWN (2.5Y 5/4), WEAKLY CEMENTED.
6. SILTY SAND w/ CLAY TO CLAYEY SAND, DENSE, DRY, YELLOWISH BROWN (10YR 5/4) WITH SOME DARK BROWN (7.5YR 4/4) CLAY FILMS, POROUS.
7. SILT, FIRM TO STIFF, MOIST, LAMINATED TO THINLY BEDDED, OLIVE (2.5Y 4/4),
5A. SAND (V.F.) LIGHT BROWNISH GREY TO GREYISH BROWN WITH SOME YELLOWISH BROWN (10YR 5/6).

NOTES:
- LOGGED BY P.O.
- SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5
Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

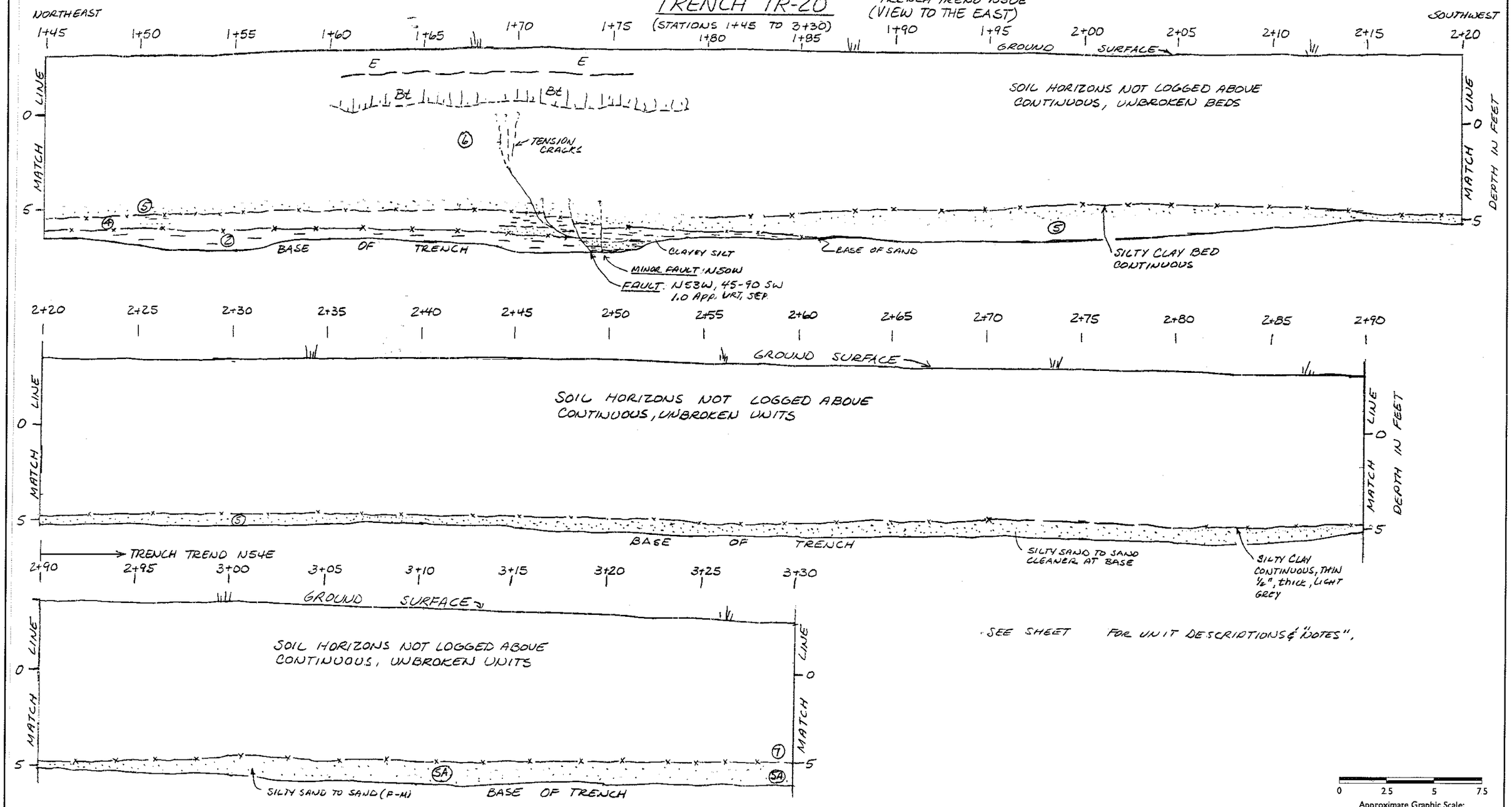
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-20
(Station Numbers 0+00 to 1+45)

TRENCH TR-20

(STATIONS 1+45 TO 3+30)

TRENCH TREND N50E
(VIEW TO THE EAST)



SEE SHEET FOR UNIT DESCRIPTIONS & "NOTES".

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

GMU GEOTECHNICAL, INC.

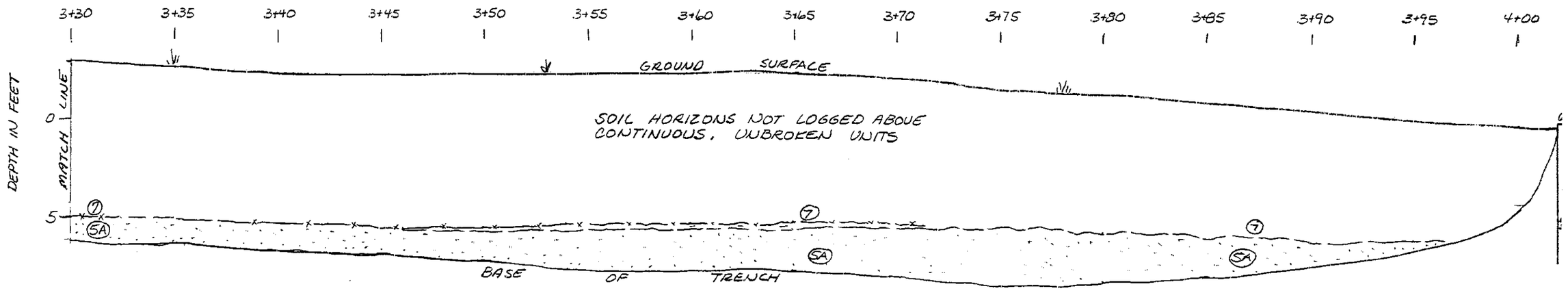
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-20
(Station Numbers 1+45 to 3+30)

TRENCH TR-20

(STATIONS 3+30 TO 4+02)

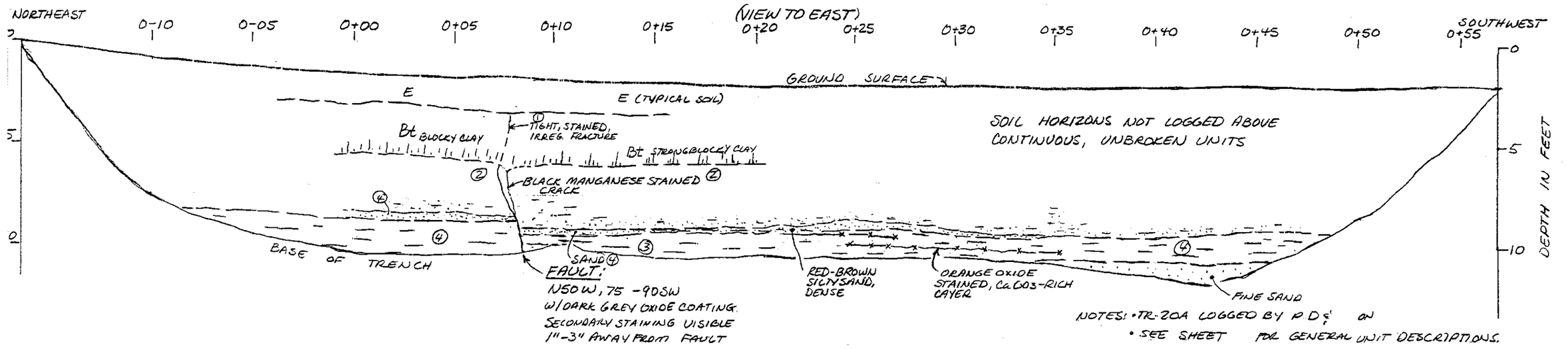
(VIEW TO EAST)



TRENCH TR-20A

TRENCH TREND - N39E

(VIEW TO EAST)



NOTES: • TR-20A LOGGED BY P.D.S. ON

• SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

UNIT DESCRIPTIONS - TR 20A

1. FAULT/FRACTURE, CLAYEY SAND TO SANDY CLAY, DENSE, DRY, DARK YELLOWISH BROWN TO DK. BROWN (10 YR - 7.5 YR 4/4), CLAY FILMS, POROUS, ROOTS.
2. SILTY SAND W/CLAY (V. F-F.), DENSE, DRY, MOTTLED, YELLOWISH BROWN (10YR 5/4) TO BROWN (7.5YR 5/4) WITH SOME DARK BROWN (7.5YR 4/4) CLAY FILMS WEAKLY DEVELOPED. POROUS,
3. CLAYEY SILT - SILT, STIFF, SLIGHTLY MOIST, LIGHT YELLOWISH BROWN (2.5Y 6/4) TO LIGHT OLIVE BROWN (2.5Y 5/4) WITH DARK BROWN (10YR 4/3 - 4/4) CLAY FILMS, POROUS, BIOTURBATED, WITH CHUNCKS OF STIFF SILT IN A MASSIVE MATRIX.
4. VERY FINE SAND TO SAND W/SILT, MEDIUM DENSE, SLI MOIST, FRIABLE, LIGHT YELLOWISH BROWN (2.5Y 6/4 - 10YR 4/4) MOTTLED, SLI. POROUS.

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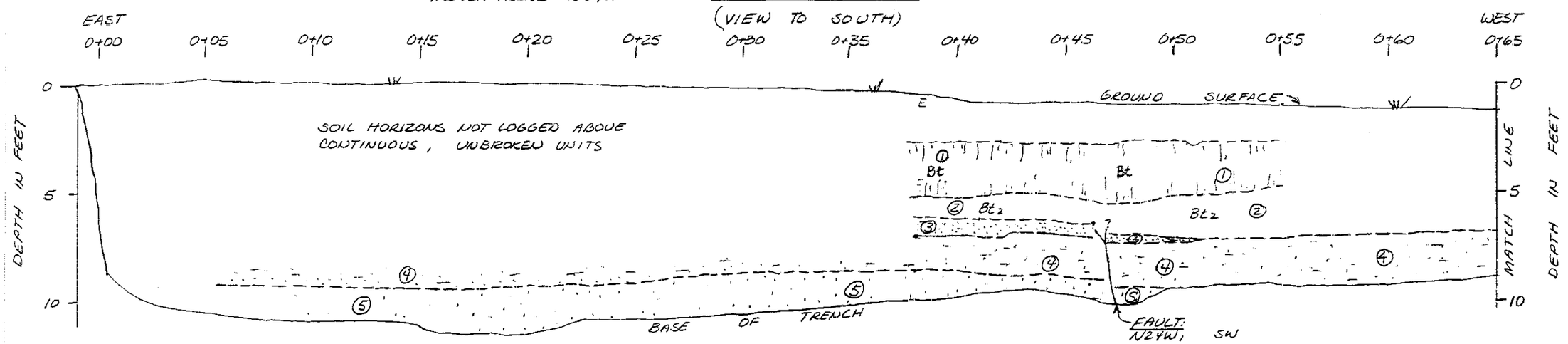
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-20
(Station Numbers 3+30 to 4+02)
TRENCH TR-20A
(Station Numbers 0-10 to 0+55)

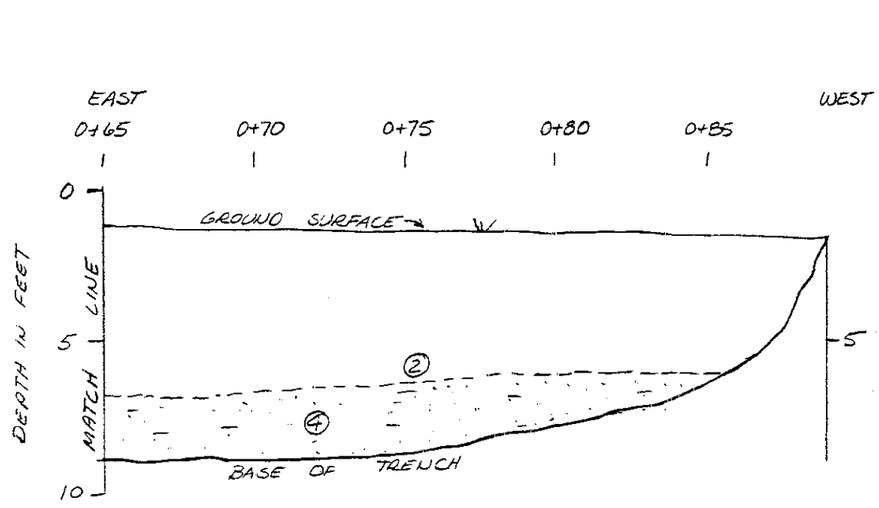
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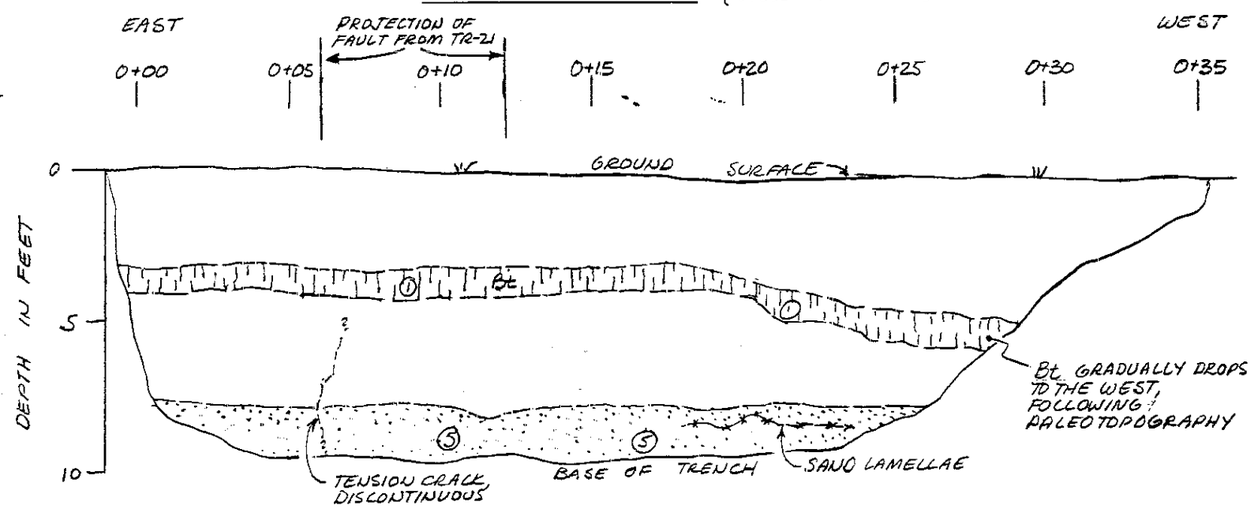
TRENCH TREND - N74W

(VIEW TO SOUTH)



TRENCH TR-21A (VIEW TO SOUTH)





UNIT DESCRIPTIONS TR-21 & TR21A

1. "Bt" CLAYEY SAND(F-C), DENSE, DRY, YELLOWISH BROWN (10YR 5/4) WITH DARK BROWN (10YR 4/4 - 7.5YR 4/4) STAINING, ROOTS, CLAY FILMS, SLI. POROUS.
2. "Bt2" CLAYEY SAND - SILTY SAND W/CLAY, DENSE, DRY, DARK YELLOWISH BROWN (10YR 5/4) W/ DARK BROWN (7.5YR 4/4) STAINING, POROUS, ROOTS.
3. SILTY SAND W/ CLAY, DENSE, DRY, YELLOWISH BROWN (10YR 5/4), SLI. POROUS.
4. SILTY SAND W/CLAY, DENSE, SLI. MOIST, MOTTLED, DARK BROWN (7.5YR 4/4), YELLOWISH BROWN (10YR 5/4) AND DARK YELLOWISH BROWN (10YR 4/4), ROOTS, POROUS, LOCALLY A V.F. SANDY SILT.
5. SILTY SAND (f-m), DENSE, DRY, TRACE CLAY, YELLOWISH BROWN (10YR 5/4), POROUS.

0 2.5 5 7.5

Approximate Graphic Scale:
One Inch Equals 5 Feet

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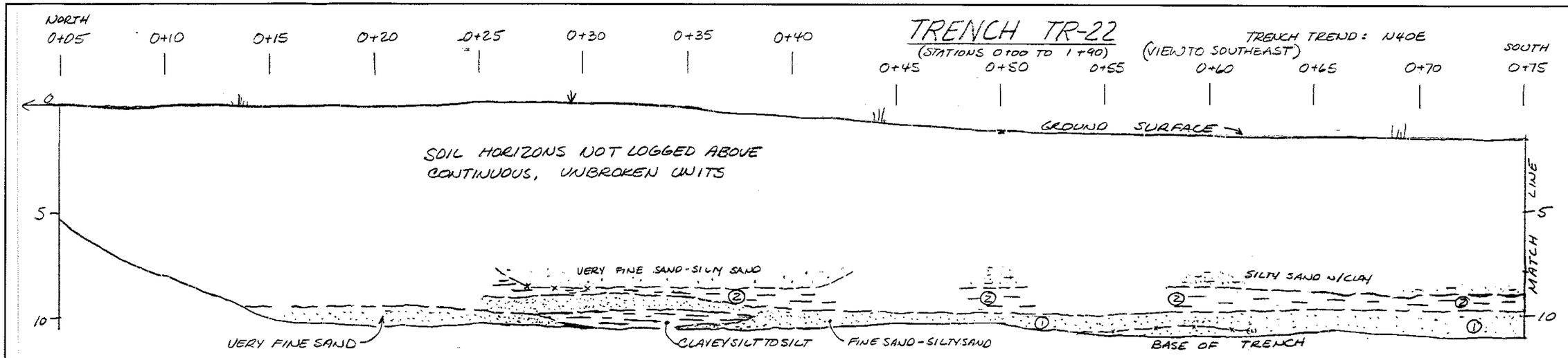
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(Station Numbers 0+00 to 0+85)
TRENCH TR-21A
(Station Numbers 0+00 to 0+35)

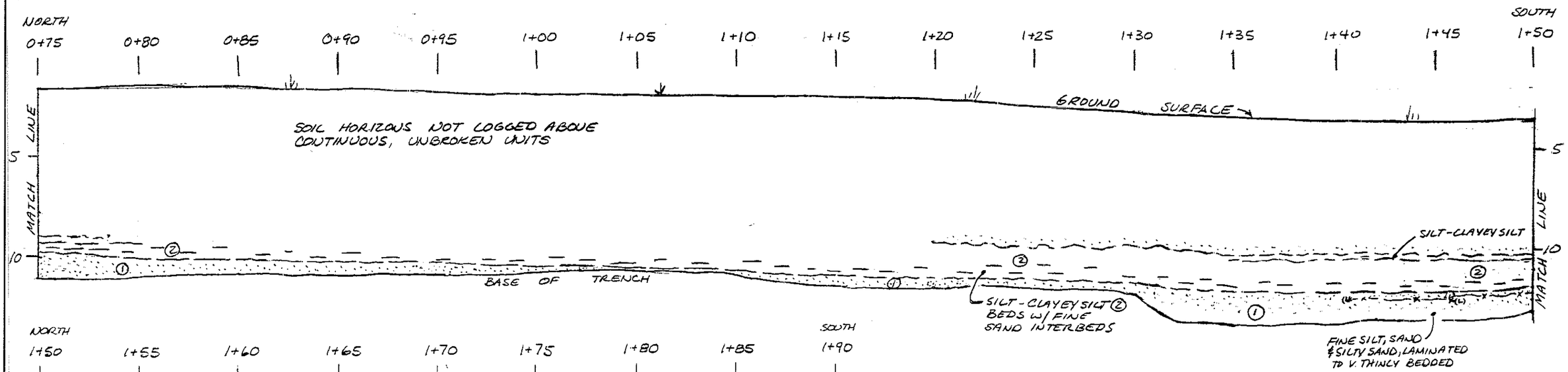
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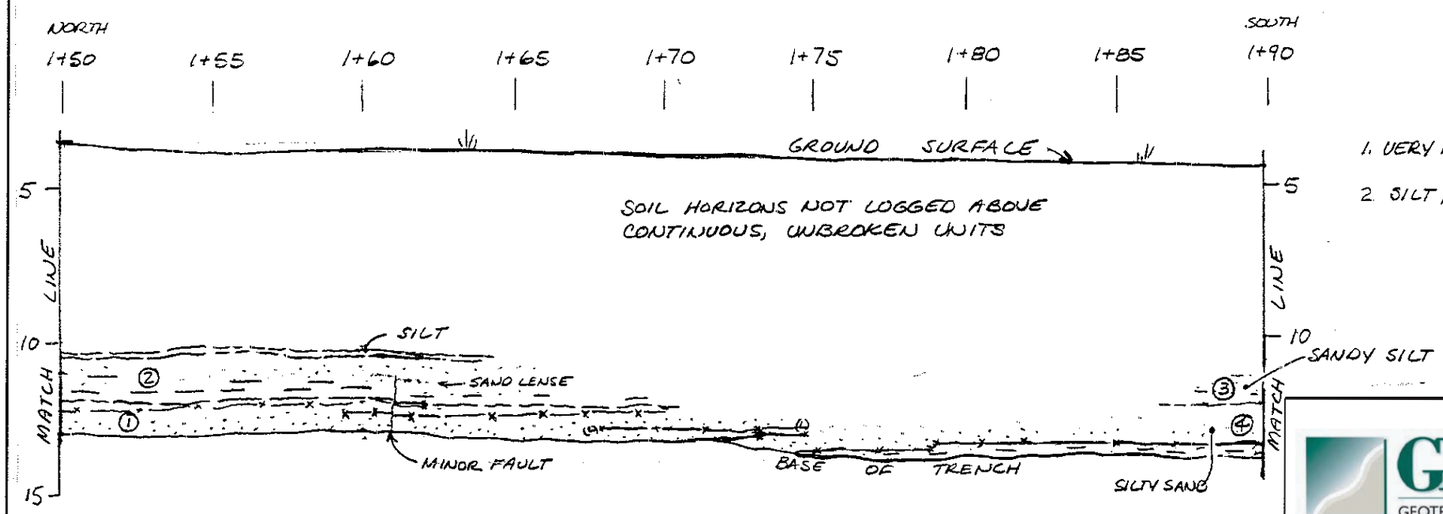
(STATIONS 0+00 TO 1+90)

TRENCH TREND: N40E

(VIEW TO SOUTHEAST)







UNIT DESCRIPTIONS (see sheet for additional descriptions)

1. VERY FINE SAND TO SILTY SAND, MED. DENSE, SLI. MOIST, FRIABLE, LIGHT YELLOWISH BROWN (2.5Y 6/4) WITH YELLOWISH BROWN (10YR 5/8) STAINING.
2. SILT, STIFF, SLI. MOIST, LIGHT BROWNISH GREY (2.5Y 6/2) TO LIGHT YELLOWISH BROWN (2.5Y 6/4) w/ OLIVE BROWN (2.5Y 4/4) AND DARK YELLOWISH BROWN (10YR 4/4) STAINING, CLAY FILMS, POROUS, LAMINATED TO V. THINLY BEDDED.

0 2.5 5 7.5

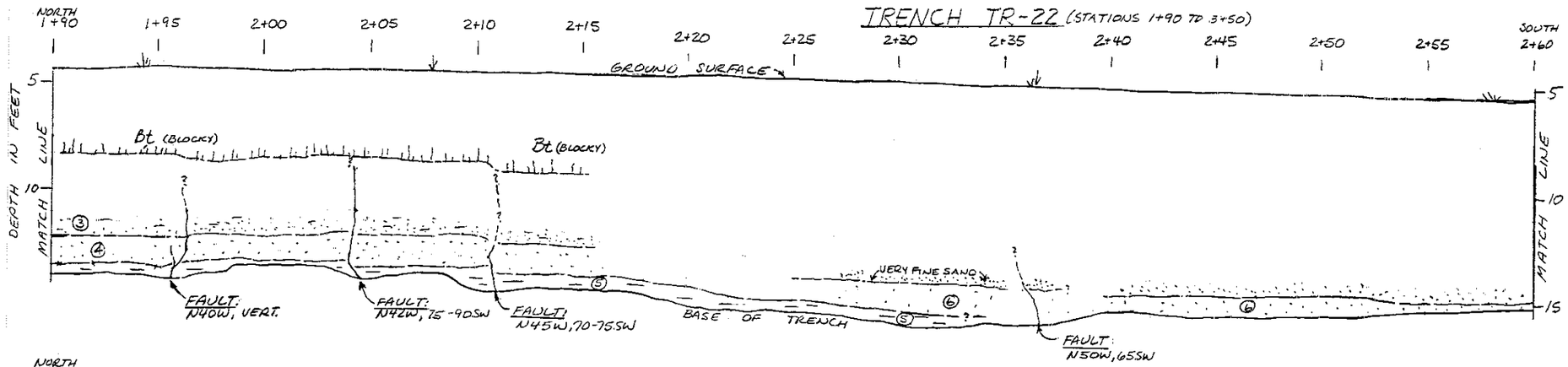
Approximate Graphic Scale:
One inch Equals 5 Feet

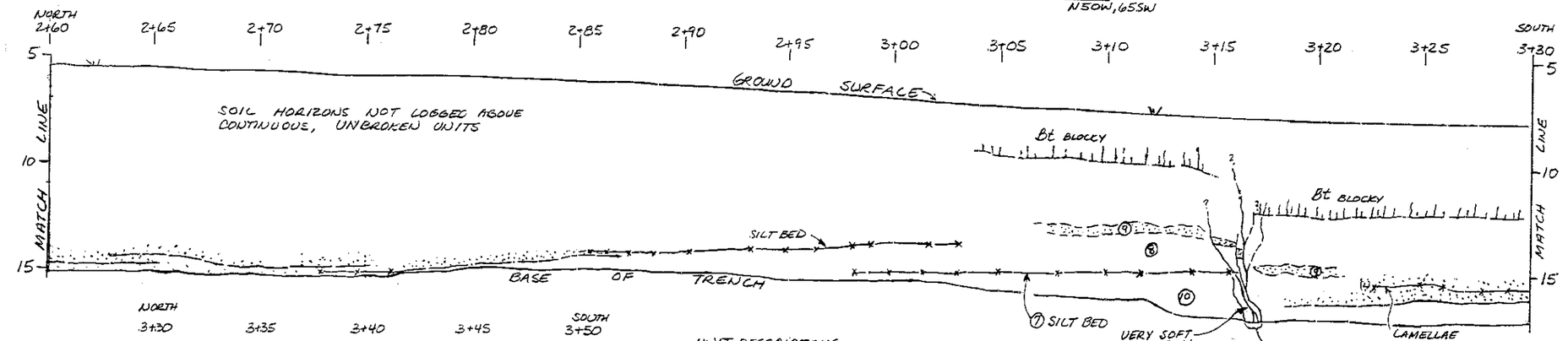
GMU GEOTECHNICAL, INC.

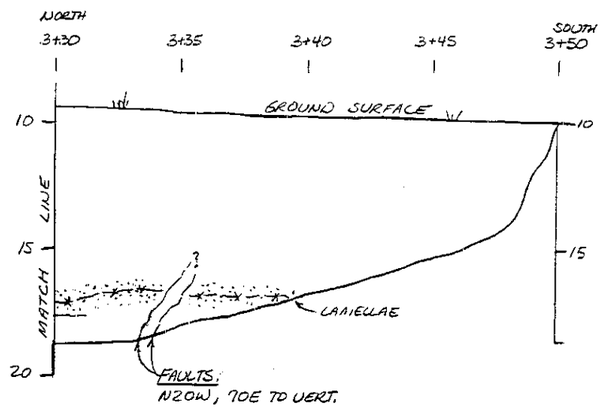
Project Name:	Newport Banning Ranch
Project No.:	06-163-00
Date:	July 2011

TRENCH TR-22
(Station Numbers 0+05 to 1+90)

TRENCH TR-22 (STATIONS 1+90 TO 3+50)







UNIT DESCRIPTIONS

3. SILT W/ V.F. SAND, FIRM, MOIST, DARK BROWN (10YR 4/3), LIGHT OLIVE BROWN (2.5Y 5/4) AND LIGHT GREY (2.5Y 7/2) MOTTLED, WEAK CLAY FILMS, POROUS, BIOTURBATED.
4. SILTY SAND (F-V.F) SLI. CLAYEY, DENSE, SLI. MOIST, DARK YELLOWISH BROWN (10YR 4/4) W/SOME DK. BROWN (10YR 4/3) STAINING, POROUS.
5. SILT W/SOME FINE SAND, FIRM TO STIFF, MOIST, LIGHT OLIVE BROWN (2.5Y 5/4) W/SOME DARK YELLOWISH BROWN STAINING (10YR 4/3-4/4), TRACE CLAY FILMS, BIOTURBATED
6. SILTY SAND TO SAND (V.F.), MED. DENSE, SLI. MOIST, FRIABLE, LIGHT, YELLOWISH BROWN (2.5Y 6/4) W/SOME DARK BROWN LAMELLAE (10YR 4/3)
7. SILT W/INTERBEDS OF V.F. SILTY SAND DENSE, SLT. MOIST, LIGHT BROWNISH GREY (2.5Y 6/2-6/4) TO LIGHT YELLOWISH BROWN (2.5Y 6/4) W/SOME DARK YELLOWISH BROWN (10YR 6/6) STAINING, SLI. POROUS, LAMINATED TO VERY THINLY BEDDED.
8. SILTY FINE SAND TO SANDY SILT, DENSE, DRY, LIGHT OLIVE BROWN (2.5Y 5/6) WEAK. CLAY FILMS, POROUS, MOTTLED, BIOTURBATED, W/TRACE OF CLAY.
9. SAND TO SILTY SAND (V.F.), MED. DENSE, DRY, FRIABLE, PALE BROWN (10YR 6/3) WEAKLY CEMENTED.
10. SILT TO CLAYEY SILT & FINE SAND INTERBEDS, STIFF, SLI. MOIST, LIGHT BROWNISH GREY (2.5Y 6/2), W/SOME DARK GREYISH BROWN STAINING. LAMINATED TO THINLY BEDDED, SLI. POROUS

NOTES: • LOGGED BY A.D. & A.M.
• SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

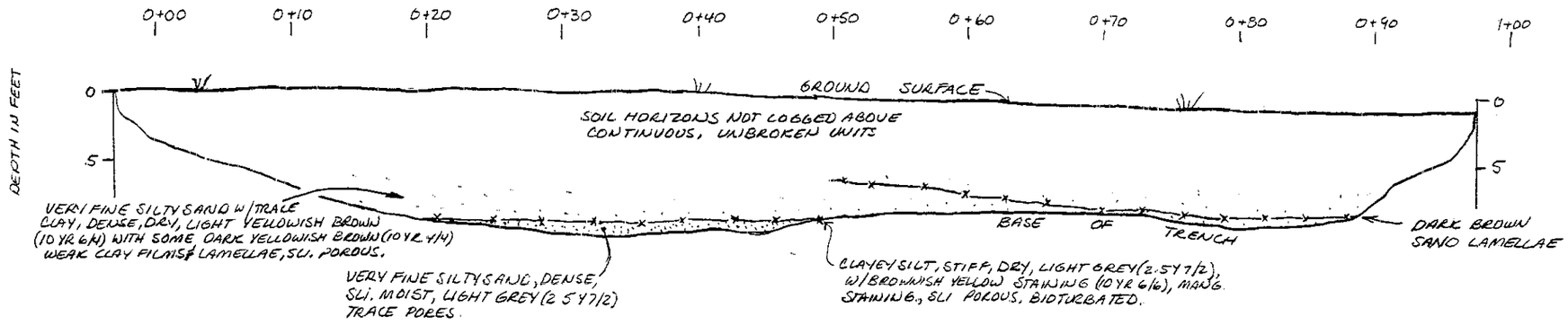
0 3 6 9
Approximate Graphic Scale:
One Inch Equals 6 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	**TRENCH TR-22** (Station Numbers 1+90 to 3+50)
Project No.: 06-163-00	
Date: July 2011	

TRENCH TR-23

VIEW TO SOUTH



NOTES: • LOGGED BY PD
• SEE SHEET FOR GENERAL UNIT DESCRIPTIONS.

0 5 10 15
Approximate Graphic Scale:
One Inch Equals 10 Feet

GMU GEOTECHNICAL, INC.

Project Name: Newport Banning Ranch	**TRENCH TR-23** (Station Numbers 0+00 to 1+00)
Project No.: 06-163-00	
Date: July 2011	

APPENDIX F

Age Dating Techniques, Representative Soil Profiles

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APPENDIX F

FAULT DATING TECHNIQUES APPLICABLE TO THE NEWPORT BANNING RANCH (NBR) DEVELOPMENT AREA

INTRODUCTION

A myriad of Newport-Inglewood (NIFZ) North Branch faults were encountered during investigations at the NBR development area. As exposed in trenches and outcrops, most faults proved to be pre-Holocene in age, and hence "inactive" according to present State of California definition. However, the newly identified "Newport Mesa North" and "Newport Mesa South" segments could not be proved inactive; to a great degree based on the presence, age and apparent displacement of soil-stratigraphic (pedogenic) markers. The following briefly describe various fault-dating technique applicable to the NBR development area. Specifically pointed out are: (1) various techniques traditionally used to date Quaternary sediments, and hence relative fault activity; (2) the approximate age of on-site and nearby geomorphic surfaces, and marine terrace and fluvial deposits; and (3) the paleoclimatic and fault-dating character of strongly developed relict and buried paleosols, typical soil-stratigraphic markers that cap much of the Newport Mesa.

FAULT-DATING TECHNIQUES

Determining the relative activity of a fault (time of last near-surface displacement) has now developed into a distinct scientific discipline known as "paleoseismicity" (Serva and Slemmons, 1995; McCalpin, 1996). A key component of such analysis is dating sediments that may either be -- as observed and documented in natural exposures or in trenches -- offset by, or lie unbroken over a fault (Shlemon, 1985; Easterbrook, 1988). The dating methods generally fall into two classes: numeric and relative.

Numeric dating methods, when unambiguous, are generally more desirable, for they provide quantitative ages, usually based on laboratory analyses of site-specific samples. For example, detrital charcoal, wood or bone are amenable to radiocarbon assay, the collection methodology and uncertainties of which are well known to the geological community (Basu and Hart, 1996). Additionally, U/Th dating of carbonates may be locally possible, depending on formation, preservation and contaminant history of a particular sampling locality. Also, in certain circumstances, thermoluminescence (TL) or even electron-spin-resonance (ESR) techniques have been used to date sediments and fault gouge, respectively. Nevertheless, despite their desired quantification, all numeric dating techniques are inherently subject to uncertainties, ranging from the typical lack of encountering materials amenable to such dating, to the high

probability of post-diagenic contamination by modern or paleo-groundwater and vegetation, and of potential of anthropic site disturbance (Costa and others, 1995).

In contrast, relative dating methods enjoy wide popularity in paleoseismic analyses. Though generally providing an age range, relative methods are usually adequate to determine whether or not last fault displacement occurred during the Holocene ("active" according to State of California definition). For example, if the relative age of geomorphic surfaces or specific sediment assemblages (fluvial or marine) can be ascertained at one locality, then such ages may well be "extrapolated" to another site where the deposition and erosional history may have been similar. This is well exemplified in a wide variety of modern and paleo-climatic regimes. Thus, nested alluvial-fan assemblages in desert areas are relatively dated and correlated by their respective elevations above local base level, by degree of geomorphic dissection, by preservation and development of desert pavement and varnish (patina), and by degree of soil profile (pedogenic) development (Shlemon, 1978; Weide, 1985; Cook and others, 1993). So likewise, fluvial or marine terrace sediments, as in NBR development area, are relatively dated by degree of geomorphic preservation (lack of dissection), by presence of stonelines or grossly fining-upward depositional cycles, by association with regional climatic and base-level change, and -- most often -- by the degree of relative soil profile development (Shlemon, 1985; Reinhardt and Sigleo, 1988).

DATING NBR DEVELOPMENT AREA FLUVIAL AND MARINE SEDIMENTS

Santa Ana River Fluvial Sediments

As shown on various geological maps that accompany the narrative section of this document, the western part of the NBR development area is underlain by fluvial deposits laid down by modern and ancestral channels of the lower Santa Ana River. Based on borings, cone penetration tests (CPT) data, and radiocarbon dates, the top of an old, gravel-filled channel occurs about 80 feet below the modern floodplain, approximately 70 feet below present sea level (Poland and others, 1956; Law/Crandall, 1993). These gravels, locally known as the "Talbert Aquifer," are up to 100 feet thick. They were deposited about 12 to 20 ka (i.e., 12 to 20 thousand years) ago when sea level was glacio-eustatically lowered about 350 feet (marine oxygen-isotope stage 2). With the onset of worldwide deglaciation and the Holocene rise in sea level, stream competence was reduced, and gravel (braided stream) deposition gave way to sand, and eventually to overbank silt and clay sedimentation. The "gravel-to-sand-to-clay" deposits therefore form a climatically controlled, grossly fining-upward sedimentary sequence that, in toto, is relatively dated as ranging in age from latest Pleistocene through the Holocene (Shlemon, 1994). These deposits thus provided the basis for dating approximate Holocene recurrence along various NIFZ North Branch faults identified in the subsurface near and west of the Banning Ranch (Barrows, 1974; Bryant, 1988; Law/Crandall, 1993; Shlemon and others, 1995; Grant and others, 1997).

Marine Terrace Deposits

The eastern or Newport Mesa portion of the NBR development area is underlain by at least four distinct units: the "San Pedro" sands (oldest), the so-called older and younger regressive marine deposits, and the overlying thin, but very diagnostic mixed eolian sand, silt and locally derived colluvial deposits (see accompanying geologic map).

The San Pedro consists of fossiliferous sand and silt exposed in some trenches and at the base of bluffs that form the eastern escarpment of the Santa Ana River floodplain (see Trench logs, Appendix E). The formation is generally assigned a "middle Pleistocene" age based on stratigraphic position and on amino-acid dating of fossil assemblages (Lajoie and others, 1991; Ponti and Lajoie, 1992). Accordingly, based on stratigraphic position -- unconformably overlain by "older" marine terrace deposits -- the San Pedro is relatively dated in the NBR development area Ranch area as probably more than about 300 ka old (see also section "Soil-Stratigraphic Dating").

The older NBR development area marine terrace deposits, exposed in Newport Mesa trenches, cut across and were laid down on the San Pedro. These are mainly medium-grained sands, the approximate age of which is generally deduced by stratigraphic position -- above the San Pedro and below the upper marine deposits -- and by the very strong development of a capping buried paleosol (Table 1). This soil probably formed during an "interglacial" weathering epoch that took place ~200 ka ago, equated to stage 7 of the marine oxygen-isotope stage chronology (Guptil and others, 1981; Freeman and others, 1992; Earth Consultants International, 1997). In brief, an interglacial, transgressing sea, somewhat more than about 200 ka ago, cut across the San Pedro. When the sea regressed during onset of stage 6 (~180 ka ago), nearshore deposits were successively laid down to the south (seaward). During this epoch of relative landscape stability, soil formation took place on much of the Newport Mesa. However, by about the middle of stage 6 (~150 ka), when the continental shelf adjacent to the NBR development area was exposed and when probable braided stream deposits of an ancestral Santa Ana River graded to the lower base level, a few feet of eolian fine sand and silt were deposited onto, and locally buried, the strongly developed, stage 7 soil. Locally, the eolian deposition was sufficiently slow such that the new sediments were "incorporated" into the existing soil; in essence, forming a cumulic profile (Soil Survey Staff, 1975; Soil Survey Division Staff, 1993).

The younger NBR development area marine terrace deposits were cut into and laid down on the older deposits ~125 ka ago during a later interglacial high-stand of sea level ("Sangamon", substage 5e). The contact of the older and younger terrace deposits is marked on the Newport Mesa by a low escarpment, less than a few feet high, that generally parallels on-site projections of the NI North Branch faults. However, this escarpment was trenched several years ago (Earth Technology Corporation, 1986), and again during this investigation (see, for example, location and logs of Trench 15), and demonstrated to be a depositional contact rather than a geomorphic expression of a fault.

The younger terrace deposits, mainly in the southwestern part of the site, are similarly relatively dated; in this case by their upper stratigraphic position, by association with the isotope stage chronology, and by the strong degree of soil profile development. They are thus judged to have been laid down during early sea-level transgression ~ 130 ka (stage 6); and their capping soils formed mainly during the last major interglacial epoch ~80 - 125 ka (stage 5). However, as documented in Table 1, stage 5 soils in the northeastern part of the NBR development area that formed on the few-foot-thick cap of mixed eolian and colluvial deposits also extended through and were superimposed on the underlying stage 7 profile, giving rise to a "two-story" or composite paleosol.

SOIL STRATIGRAPHIC DATING

Soil stratigraphy proved to be the most useful technique to date the NBR development area faults. Indeed, it is perhaps the most widely used, relative technique for dating Quaternary sediments and faults (see summaries in Shlemon, 1985). The principles of soil formation are well documented in Jenny (1980) and in Birkeland (1984). The terminology used for soil-stratigraphic dating is generally that of the pedologist (see, for example, Soil Survey Staff, 1975; Soil Survey Division Staff, 1993; and Birkeland, 1984). And, as indicated in previous sections, soil-stratigraphy has been a key factor to date the geomorphic surfaces on the Newport Mesa (Guptil and others, 1989; Freeman and others, 1992; Earth Consultants International, 1997).

Of particular importance is the presence, development and thickness of argillic (clay-rich) horizons as observed and documented in the many trenches emplaced across the NBR development area. A soil profile measurement and description, representative of the Newport Mesa, is provided in Table 1, described from a Trench 15 "T-cut" exposure near station 0+120 (see trench log, Appendix E).

Trench 15, almost 12 feet deep, exposed four discrete geologic units (soil parent material). The upper, Geologic Unit 1, approximately 2.3 feet thick, is a bioturbated mixture of probable eolian sand, silt and locally derived colluvium. Its capping soil has an incipient argillic subsoil (Btj horizon), the typical yellowish brown color of which has now been "bleached" by the downward and lateral migration of somewhat acidic gravitational water. This has thus formed a superposed eluvial (E) horizon that reflects perching of modern water on underlying argillic horizons of the buried paleosol that caps Geological Unit 2 (Table 1). The E horizon also locally extends into the paleosol, mainly along ped faces and locally along probable tectonic slip surfaces, an observation leading to a potential Holocene age assessment for the Newport Mesa North and Newport South fault segments (see discussion in report narrative; and trench logs in Appendix E).

The eolian component of the Geologic Unit 1 parent material was likely derived from the nearby continental shelf and possibly from Santa Ana River braided stream deposits (Talbert Aquifer) when exposed during the last glacio-eustatic low-stand of sea level. Such airborne additions to coastal soils are now well documented from the Channel Islands (Erlandson et al., 2005; Muhs et al., 2008). The mixture of eolian and colluvial sediments is apparent in T-15 and other NBR development area trenches by the presence of up to 2 inches of local relief (Table 1; base of horizon E/Btj). Accordingly, based on relative soil profile development, and on stratigraphic position, Geologic Unit 1 is estimated to be no more than about 18 ka (isotope stage 2).

Geologic Unit 2, at a depth of 2.3 to 6.0 feet (Table 1), varies in thickness. Locally it is up to 4 feet thick, particularly on the "downslope" side of now-buried paleo-channels; elsewhere it is missing, owing to post-depositional erosion.

This deposit similarly owes its origin to a mixture of eolian sand, silt and local reworked colluvium. It bears a very strongly developed buried paleosol, replete with multiple, reddish-brown argillic horizons (Table 1). Where covered by Unit 1 in the northeastern part of the Newport Mesa, the soil is a "buried paleosol;" where forming directly on younger marine terrace in the southwestern part of the Mesa (see geologic maps), the soil is a "relict paleosol" (Ruhe, 1965), for it reached most of its development under environmental conditions of the past.

From stratigraphic position and strong profile development, Geologic Unit 2 is an estimated ~150 ka (stage 6). Its capping soil formed during a following epoch of relative landscape stability, about 80-120 ka (stage 5).

Geologic Unit 3, between 6.0 and 8.4 feet (Table 1), is a medium-grained terrace sand that similarly bears a very strongly developed soil. Illuvial, clay-lined ped faces abound; and locally relatively soluble carbonate nodules occur within the profile (e.g., horizon 3Bt1kb). Likewise, from stratigraphic position, geomorphic setting and relative soil development, the age of Geologic Unit 3 is an estimated ~250 ka (stage 8). Its capping relict paleosol formed ~200 ka (stage 7).

Geologic Unit 4 is an olive-grey, thinly bedded sequence of silt and fine sand. This unit is interpreted to be an estuarine deposit, comparable in environment to the modern Newport Bay. The beds are unconformably overlain by Unit 3 marine terrace sands. Accordingly, from stratigraphic position, Unit 4 is presumed to be at least 300 ka, perhaps a facies of the San Pedro Formation (stage 9?).

The two, locally superimposed, strongly developed paleosols on the Newport Mesa provide excellent stratigraphic control for dating faults. As documented on trench logs (Appendix E), many NI North Branch faults displace neither the base of the ~200 ka (stage 7) nor the ~80-120 ka (stage 5) paleosols. These faults are thus clearly pre-Holocene. Elsewhere, as discussed in narrative sections of this report, the base of the paleosols is displaced; and in several cases

apparent vertical separation extends upward through (usually "flowering") into Geological Unit 1 (youngest) with its characteristic eluvial (E) horizon. Accordingly, it is conservatively assumed herein that last surface displacement along these faults occurred in Holocene time, the main reason to recommend structural setback zones for segments of the Newport Mesa North and Newport Mesa South segment faults (Plates 7, 9, 9.1, and 9.2).

In sum, the strongly developed paleosols that cap both the older and younger terrace deposits proved to be excellent, relatively datable markers to assess timing and recurrence of NI North Branch faults now identified in the NBR development area.

Table 1

Soil Profile Measurement and Description
Representative Composite Relict Paleosol, Newport Mesa

Banning Ranch Trench 15 (Station 0+120 "T-Trench")

Depth (ft)	Horizon	Description
0.0 - 0.5	A1E	Pale brown (10YR 6/3) to pink (7.5 YR 7/3) when moist silty clay loam; weak fine to medium subangular blocky structure; soft, friable, slightly sticky and non-plastic; common fine vertical roots; many fine pores; gradual wavy boundary.
0.5 - 0.8	A2E	Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 3/4) when moist clayey silt; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine vertical roots; common fine pores; abrupt smooth boundary.
0.8 - 1.2	A3E1-B1	Yellowish brown (10YR 5/4) to dark yellowish brown (10YR 3/6) when moist silty clay; moderate medium angular blocky structure; hard to very hard, firm, slightly sticky and slightly plastic; few medium random roots; gradual wavy boundary.
1.2 - 1.5	E2-B2	Light yellowish brown (10YR 6/4) to dark brown (7.5YR 3/2) when moist clayey silt; weak medium to coarse angular blocky structure; very hard, firm, sticky and slightly plastic; common medium random roots; gradual smooth boundary.
1.5 - 2.3	E3/Btj	Pale brown (10YR 6/3) to dark brown (10YR 3/3) when moist silty clay; strong medium coarse angular blocky structure; very hard, very firm, sticky and plastic; few very fine clay films lining ped faces and filling root pores; grades to distinct E/B near base; local relief ~2 inches; abrupt wavy boundary (unconformity).
2.3 - 3.5	2Bt1b	**Buried Paleosol:** Brown (7.5YR 5/4) to dark brown (7.5YR 3/4) when moist silty clay; strong medium to coarse angular blocky structure; extremely hard, extremely firm, sticky and plastic; common fine dark brown (7.5YR 3/2) clay films lining ped faces and bridging mineral grains; gradual smooth boundary.

Table 1 (continued)

Depth (ft)	Horizon	Description
3.5 - 4.4	2Bt2b	Brown to dark brown (7.5YR 4/4) to dark brown (7.5YR 3/3) when moist loamy medium sand; extremely hard, extremely firm, sticky and plastic; common to many reddish brown (5YR 4/3) clay films lining ped faces, bridging mineral grains and filling root pores, decreasing with depth; gradual wavy boundary.
4.4 - 6.0	2Btk1b	Strong brown (7.5YR 4/6) to yellowish brown (10YR 5/4) when moist fine sandy loam; massive to medium very coarse angular blocky to weak medium prismatic structure; very hard, very firm, sticky and slightly plastic; common very fine, strong brown (7.5 4/6) clay films lining ped faces and filling root pores, decreasing near base; laterally discontinuous 2-3 inch thick carbonate nodules near base; abrupt wavy boundary (unconformity).
6.0 - 7.4	3Btk2b	**Buried Paleosol:** Brown (7.5YR 4/4) to dark brown (7.5YR 3/2) when moist fine sandy loam; massive to medium angular blocky structure; hard, firm, sticky and slightly plastic; few to common dark reddish brown (5YR 3/2) clay films lining ped faces and bridging mineral grains; clay films decreasing near base; common thin manganese staining on ped faces near base; few fine carbonate nodules near base, locally in beds to 3-inches thick; abrupt smooth boundary.
7.4 - 8.4	3B1b	Strong brown (7.5YR 4/6) to brown to dark brown (7.5YR 4/3) when moist loam sand; moderate medium subangular blocky structure; hard, friable, slightly sticky and non-plastic; few thin, dark reddish brown (5YR 3/2) clay films lining ped faces; few thin clay films filling root pores and root channels; abrupt wavy boundary (unconformity).
8.4 - 11.5+	3B-Cb	**Estuarine Deposits:** Light olive brown (2.5Y 5/4) to olive brown (2.5Y 4/3) when moist clayey silt; massive to moderate medium blocky structure; hard, firm, sticky and plastic; common manganese stains at upper horizon boundary; laminated silt and clay beds ~0.5-inches thick to base of trench.

Notes: Trench 15 Soil-Stratigraphic Section:

1. Measurement by RJS, 18 August 1998; Banning Ranch, Newport Mesa (see Appendix E for trench logs; Plate 7 for trench location).

2. Terminology follows that of Soil Conservation Service (1993), Birkeland (1984) and Soil Survey Staff (2006). Marine oxygen-isotope stage chronology, as applied to soil stratigraphy, is described in Shlemon (1985).

3. Soil profile is composite, forming on four distinct geological units:

   Geologic Unit 1: (0.0 - 2.3 ft): mixture of eolian fine sand, silt and locally derived colluvium; bears incipient argillic horizon (Btj) and superimposed eluvial horizons (E) owing to gravitational water perching on underlying buried paleosol argillic horizons; estimated age less than about 18 ka (isotope stage 2).

Geologic Unit 2: (2.3 - 6.0 ft): eolian fine sand, silt and locally derived, bioturbated colluvium; bears strongly developed buried paleosol formed ~80-125 ka (isotope stage 5); parent material laid down ~150 ka (isotope stage 6), derived from exposed shelf and possibly from adjacent, incised lower Santa Ana River braided stream deposits.

Geologic Unit 3: (6.0 - 8.4 ft): medium, well sorted, regressive marine sands laid down ~250 ka (isotope stage 8); bears strongly developed buried paleosol forming ~200 ka (isotope stage 7).

Geologic Unit 4: Unit 4 (8.4 - 11.5+ ft): "reduced color," laminated silt and clay estuarine deposits; est. ~300-350 ka (San Pedro equivalent [?]; possibly isotope stage 9.

4. Composite soil in part cumulic owing to local, surficial colluvial and eolian aggradation; gives rise to exceptionally thick argillic horizons, a reflection of stage 5 sediments and soils superimposed on stage 7 buried paleosol.