Appendix E
Application: Topographic Survey of Beach Sections Adjacent to Tillamook North Jetty, Oregon (Portland District)

E-1. Purpose and Background

This is a survey of a 1,000 ft section of beach near the town of Tillamook, OR. Tillamook is a small community in Northern Oregon on the Pacific Ocean. The jetty protects the entrance to Tillamook Bay. The purpose of the survey was to satisfy permitting requirements imposed by the state of Oregon prior to construction of a revetment protecting the root of the North Jetty. A Purchase Order was issued to Chase-Jones and Associates, Inc to perform the survey in September 2004. The contractor laid out the baseline and collected the topographic data in two days. The field data was processed and a MicroStation DGN file created by Portland District personnel.

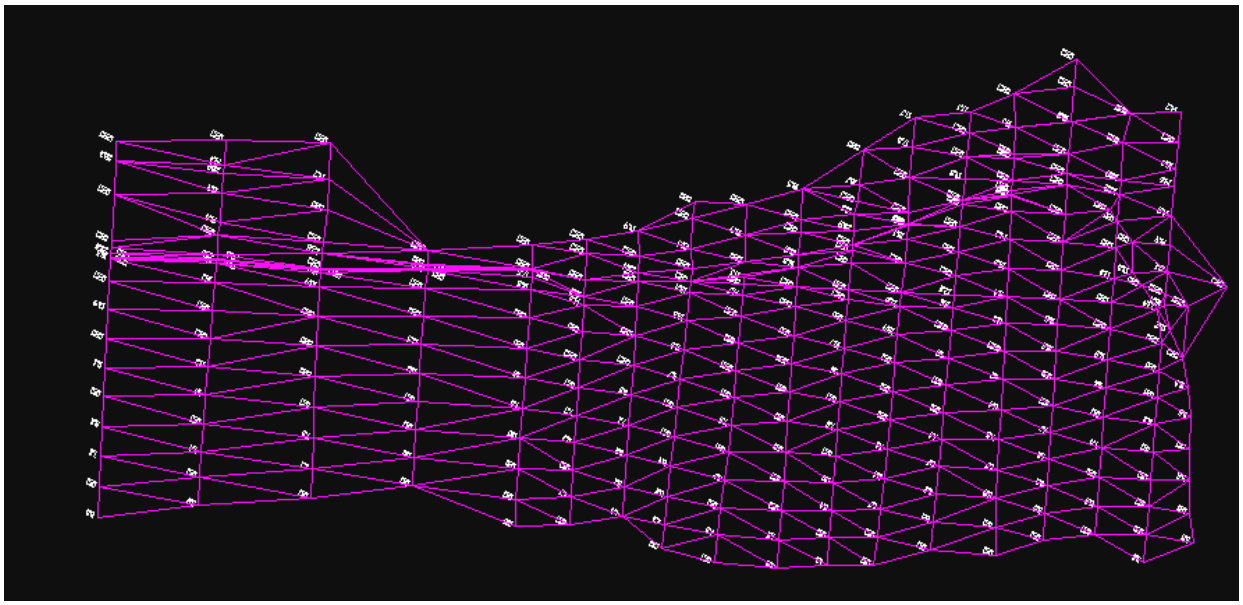

Figure E-1. TIN/DTM of surveyed cross-sections showing 18 cross-sections spaced at 50 ft and 100 ft C/C

E-2. Scope of Work

The following scope of work was drafted by the Survey Section in the Portland District.

Scope of Work
Tillamook North Jetty Cross Sections
Contract Number DACW57-02-0007
09/03/2004

1.0 General

The project is located on the beach adjacent to the North Tillamook Jetty near the town of Tillamook in the State of Oregon.

This task order is for the production of fieldwork only. Data reduction and mapping will be completed by the government from the raw data supplied by the contractor.

2.0 General Tasks:

2.1 Layout and tie a 1000-foot baseline approximately perpendicular to the jetty and a minimum of 100 feet inland of the vegetation line. The end of the baseline shall be monument as directed by the government. Station 0+00 shall be immediately adjacent to the north jetty.

2.2 Collect Topographic profile parallel to the baseline at the mid-tide line.

2.3 Collect topographic cross-sections at 50 foot spacings between baseline station 0+00 and 6+00 (13 Cross-Sections)

2.4 Collect topographic cross-sections at 100 foot spacings between baseline station 6+00 and 10+00. (4 cross-sections)

2.5 Provide Digital photos of the set monuments, Cross-sections and profiles.

3.0 Exhibits and Materials

The Government will furnish the following items:

3.1 Control Diagram showing recently established project control monuments
3.2 Proposed cross section layout
3.3 Pertinent manuals as needed can be obtained from the internet at
http://www.usace.army.mil/inet/usace-docs/eng-manuals
3.5 Photos and Maps of the project area

4.0 Field Procedure

4.1 All work shall be completed in accordance with the Engineer Manual for Topographic Surveying EM 1110-1-1005 dated 31 August 1994

4.2 Access. The survey areas should not present any right-of-entry problems

5.0 Office Procedures

This task is for the production of fieldwork only. Develop a narrative detailing project approach and any complications. Include all Field-crew daily reports and reports of safety meetings.

6.0 Data Submission Standards.

1. The Contractor shall submit data as electronic data. Supplemental data shall be submitted in field books. Electronic data shall be formatted in Leica Corporations GSI format and submitted on a Compact Disk (CD). Format for field notebook shall be supplied upon request.

2. For each CD submitted provide a text file with the following data: Serial Number and type of instrument used, names of the crewmembers, dates of the survey, and weather. The intention is to provide the same information recorded in a field book. This data is essential. In addition provide a text file for each CD with directory and file information.

3. Paper print outs of the electronic data shall not be submitted as a substitute for the electronic data.

4. Leveling measurements shall be submitted digitally. Data shall be formatted in Leica Corp. GSI format.

5. Raw digital Radiation data shall be "coded" for input into either Listech Corp. Liscad Version 6.x software or Leica Corporations Wildsoft software. Raw data shall be submitted in Leica Corp. GSI format.

6. Field books and hand written forms used for data collections shall be scanned and submitted on a CD. The intention is to provide an electronic record for archival. Place all scanned field book pages in one file formatted in Adobe Acrobat. PDF

7. Information shall be dated and submitted in a neat, consecutive and organized manner. The outside of the CD as well as the case shall be clearly marked (labeled) with the following information:

Job Name
Contractors Name
Contract Number Task Order
Date

8. Narrative data submitted shall be submitted in Microsoft Word format.

9. Provide a Final “Surveyor’s Report.” Provide the report in Adobe Acrobat. PDF format.

7.0 Deliverables and Completion of Work

Field work shall be completed by 13 Sep 2004. Deliver all relevant items delivered no later than 14 calendar days after Notification to Proceed.

End of Scope

E-3. Level Line Data Files and Adjustment

Levels were run from BM SCOTT HIXON (AKA SCOTTH)--elevation 19.040 ft NAVD 88--to baseline station (-) 0+20, then to baseline station (+)10+00, then looped back to SCOTTH.

Levels were run with a Leica NA 2002 digital level. Following is the raw datafile from the digital level output.

```
        BM/TP    BM Elev/dist/dist            BS/FS          Elev

410001+?......1
110002+00000001 83..11+00019040
110003+00000001 32..01+00030170 331101+00005899 52..07+0003+001
110004+00000001 32..01+00027130 332101+00004081 52..07+0003+001
110005+00000001 573..1+00003030 574..1+00057300 83..01+00020858
110006+00000001 32..01+00151790 331101+00003892 52..07+0003+006
110007+00000002 32..01+00144020 332101+00010116 52..07+0003+002
110008+00000002 573..1+00010800 574..1+00353120 83..01+00014634
110009+00000002 32..01+00169970 331101+00004230 52..07+0003+004
110010+00000003 32..01+00162490 332101+00004199 52..07+0003+004
110011+00000003 573..1+00018280 574..1+00685580 83..01+00014666
110012+00000003 32..01+00176190 331101+00004580 52..07+0003+016
110013+00000004 32..01+00163280 332101+00004149 52..07+0003+002
110014+00000004 573..1+00031190 574..1+01025050 83..01+00015097
110015+00000004 32..01+00069300 331101+00012085 52..07+0003+000
110016+00000005 32..01+00072260 332101+00004164 52..07+0003+000
110017+00000005 573..1+00028230 574..1+01166600 83..01+00023018
110018+00000005 32..01+00072230 331101+00004093 52..07+0003+002
110019+00000006 32..01+00069300 332101+00012014 52..07+0003+001
110020+00000006 573..1+00031160 574..1+01308130 83..01+00015097
110021+00000006 32..01+00133360 331101+00004053 52..07+0003+001
110022+00000007 32..01+00155650 332101+00005042 52..07+0003+005
110023+00000007 573..1+00008870 574..1+01597150 83..01+00014108
110024+00000007 32..01+00152030 331101+00004162 52..07+0003+002
110025+00000008 32..01+00148150 332101+00004834 52..07+0003+004
110026+00000008 573..1+00012750 574..1+01897330 83..01+00013436
110027+00000008 32..01+00089820 331101+00009545 52..07+0003+001
110028+00000009 32..01+00022370 332101+00001346 52..07+0003+001
110029+00000009 573..1+00080200 574..1+02009510 83..01+00021635
410030+!....332
110031+00000009 32..01+00083730 332101+00008085 52..07+0003+003
110032+00000009 573..1+00018830 574..1+02070880 83..01+00014896
110033+00000009 32..01+00104820 331101+00009404 52..07+0003+001
110034+00000010 32..01+00146140 332101+00005265 52..07+0003+001
110035+00000010 573..1-00022490 574..1+02321850 83..01+00019034
```

The following file shows the reduced field notes that were generated from the above raw datafile. This report was generated by Leica Geosystem's LevelPak Software.

LevelPak Level Line Report

Project : BaseLineLevels
Generated : 17/09/2004 at 07:21:18
Unit : US Feet
Level Line: levels Line 001
Heights : Calculated

Active	Pt Name	Back	Tp.	Intmdt.	Fore	Dist	Height	Comments
x	100						19.040	Scott Hixon (AKA ScottH)
x	100	5.8990				30.17		
x	1				4.0810	27.13		
x	1						20.858	-0+22 AL Cap
x	1	3.8920				151.79		
x	2				10.1160	144.02		
x	2						14.635	
x	2	4.2300				169.97		
x	3				4.1990	162.49		
x	3						14.667	
x	3	4.5800				176.19		
x	4				4.1490	163.28		
x	4						15.099	
x	4	12.0850				69.30		
x	5				4.1640	72.26		
x	5						23.020	10+00 Al Cap
x	5	4.0930				72.23		
x	6				12.0140	69.30		
x	6						15.099	
x	6	4.0530				133.36		
x	7				5.0420	155.65		
x	7						14.111	
x	7	4.1620				152.03		
x	8				4.8340	148.15		
x	8						13.440	
x	8	9.5450				89.82		
	9				1.3460	22.37		
x	9						21.635	
x	9				8.0850	83.73		
x	9						14.900	
x	9	9.4040				104.82		
x	100				5.2650	146.14		
x	100						19.040	ScottH

Level Line Memo:

1. Level line start point '100'
2. Level line end point '100'
3. Detected level loop
4. Checking completed

E-4. Horizontal Control Observations--LISCAD Baseline Report

Horizontal control for the baseline was established by total station observations from two nearby control points--BAR and SCOTTH. Ties were made to each end of the marked baseline (stations (-) 0+22 and 10+00).

The following file (xsections.fld) contains a sample portion the reformatted total station observations, from the original raw Leica "xsections.gsi"data file. A total of 299 ground shots were taken on this project (point numbers 100-399). This file below shows the initial control observations in establishing the baseline end points (i.e. lines 10-39). Actual ground shots begin at line 42 (Shot # 100 on cross-section 0+00--approx 183 ft ESE of baseline). The total station occupied point "(-) 0+22" (shown on plate below) and was backsighted on 10+00 (dashed line from 0+22 to NE).

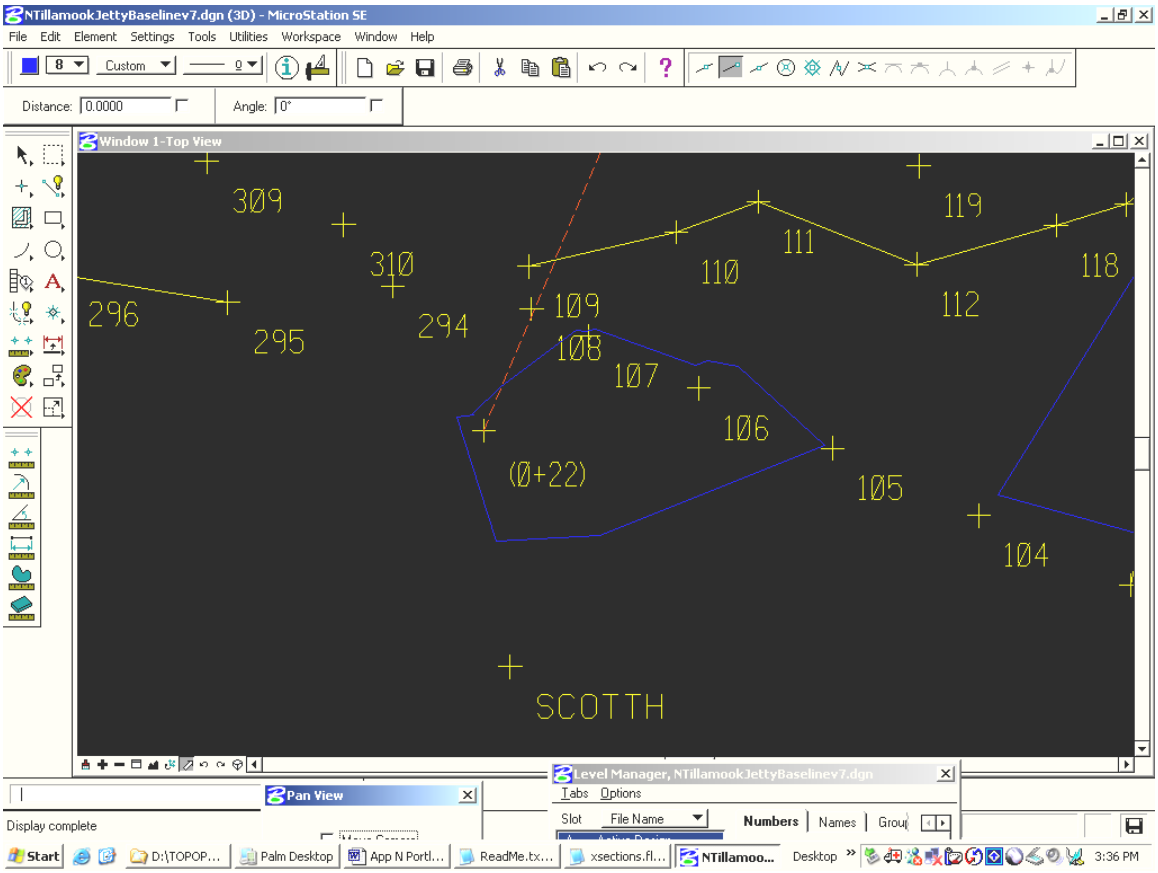

Figure E-2. Total Station occupied Point "0+22"

```
1    010  Leica TPS-1100 Series   xsections.gsi
2    011  Friday, September 17, 2004
3    051 DM
4    053 F
5    021 YX
6    ; Reformatting error... 410001+00000001
7    ;
8    102     BAR  5.3100  5.2500   SCOTTH   0.00010
9    105   5.2500
900   160   1 6 0
10    111     SCOTTH   0.00010  90.32020 314.7850 00500
11    111     (0+22) 352.42230  90.03010 303.7050 00500
12    111     (0+22) 172.42200 269.56310 303.7050 00500
13    111     SCOTTH 180.00030 269.27440 314.7850 00500
14    111     SCOTTH   0.00000  90.32060 314.7850 00500
15    111     (0+22) 352.42260  90.03070 303.7050 00500
16    111     (0+22) 172.42250 269.56500 303.7050 00500
17    111     SCOTTH 179.59590 269.27520 314.7850 00500
18    111     SCOTTH   0.00010  90.32080 314.7850 00500
19    111    (0+22) 352.42250  90.03130 303.7050 00500
20    111    (0+22) 172.42240 269.56420 303.7050 00500
21    111    SCOTTH 180.00060 269.27450 314.7850 00500
210   161
22    ;
23    102     BAR  5.3100  5.2500   SCOTTH   0.00020
24    105   5.5200
240   160   1 6  0
25    111    SCOTTH   0.00020  90.32100 314.7860 00500
26    111    10+00 294.29320  89.53310 1148.9360 00500
27    111    10+00 114.29310 270.06200 1148.9360 00500
28    111    SCOTTH 180.00020 269.27480 314.7850 00500
29    111    SCOTTH   0.00010  90.32070 314.7860 00500
30    111    10+00 294.29340  89.53310 1148.9360 00500
31    111    10+00 114.29320 270.06200 1148.9360 00500
32    111    SCOTTH 180.00000 269.27400 314.7850 00500
33    111    SCOTTH   0.00010  90.32070 314.7850 00500
34    111    10+00 294.29310  89.53270 1148.9360 00500
35    111    10+00 114.29320 270.06250 1148.9360 00500
36    111    SCOTTH 180.00020 269.27460 314.7850 00500
360   161
37    ;
38    102    (0+22)  5.2500  5.0000     10+00   0.00000
39    111    10+00   0.00000  89.51420 1022.1050 00500
40    401  8  7  8
41    105   5.0000
42    111    100  84.52270  92.09240 183.1380 00501
43    111    101  83.34080  92.18390 154.8770 00501
44    111    102  81.57570  91.52030 130.3390 00503
45    111    103  80.32470  90.46510 114.6400 00502
46    111    104  76.53190  90.52480  86.4980 00505
47    111    105  70.04020  91.07120  60.1440 00505
48    111    106  56.02270  90.03340  37.7470 00505
49    111    107  25.11530  91.32280  24.3200 00502
50    111    108 358.33460  96.58450  22.6920 00505
51    401  7  7  7
52    111    109 352.36010 103.45150  30.2010 00503
53    111    110  21.20190  98.37400  48.1060 00503
54    111    111  27.24050  96.46480  61.9660 00503
55    111    112  46.10570  92.49320  79.9320 00503
56    123    (0+22)    112  0.0000  0.0000 -2.0000
57    111    113  47.47160  92.12560 117.4570 00503
58    401  8  7  8
59    111    114  70.24380  91.03230 189.8970 00501
60    111    115  65.10300  90.35100 166.4560 00501
61    111    116  59.08430  90.27550 134.8910 00501
62    111    117  55.45390  89.29020 124.0940 00502
63    111    118  47.28260  92.42590 104.8100 00503
64    111    119  35.54060  94.07520  87.9200 00501
65    111    120  17.53450  95.40390  75.4540 00501
```

The horizontal adjustment of the baseline end points (-) 0+22 and 10+00 is shown on the following report. BAR and SCOTTH were fixed in position. LISCAD is a Engineering and Surveying software program by Listech Inc. and distributed by Leica Geosystems, Inc. Input data for the adjustment was taken from xsections.fld file. Station BAR was occupied and 3 sets were observed to (-)0+22 and 10+00 (relative to SCOTTH), and the directions meaned in the LISCAD software. Both ends of the baseline were then occupied, but only distances were observed for adjustment.

LISCAD Report: Rounds Report
Friday, September 17, 2004 08:38

```
File: NTillamookJettyBaseline
Projection: Oregon NAD83 North 3601
File Date: Friday, September 17, 2004

Units
=====
     Angle: Degrees Minutes Seconds
     Distance: US Feet

At BAR
 To SCOTTH (Backsight reduced to zero)
  Horizontal                            Vertical  Face Diff.    Residual
     0 00 00                            90 32 09     0 00 14    -0 00 00
     0 00 00                            90 32 07     0 00 02    -0 00 02
     0 00 00                            90 32 12     0 00 07     0 00 02
Mean of Sets.
  Horizontal                            Vertical   SD. Vert.       Range
     0 00 00                            90 32 09     0 00 02     0 00 04
    Distance    SD Dist.       Range
     314.785       0.000       0.000

 To 0+22
  Horizontal       Split    Residual    Vertical  Face Diff.    Residual
   352 42 19    -0 00 05    -0 00 03    90 03 15     0 00 28     0 00 02
   352 42 26     0 00 00     0 00 04    90 03 08     0 00 03    -0 00 04
   352 42 21    -0 00 06    -0 00 01    90 03 15     0 00 05     0 00 02
Mean of Sets.
  Horizontal     SD Dir.       Range    Vertical   SD. Vert.       Range
   352 42 22     0 00 03     0 00 07    90 03 13     0 00 04     0 00 07
    Distance    SD Dist.       Range
     303.705       0.000       0.000


At BAR
 To SCOTTH (Backsight reduced to zero)
  Horizontal                            Vertical  Face Diff.    Residual
     0 00 00                            90 32 11     0 00 02    -0 00 01
     0 00 00                            90 32 13     0 00 13     0 00 02
     0 00 00                            90 32 10     0 00 07    -0 00 01
Mean of Sets.
  Horizontal                            Vertical   SD. Vert.       Range
     0 00 00                            90 32 12     0 00 02     0 00 03
    Distance    SD Dist.       Range
     314.785       0.000       0.001

 To 10+00
  Horizontal       Split    Residual    Vertical  Face Diff.    Residual
   294 29 29    -0 00 01    -0 00 01    89 53 35     0 00 09     0 00 01
   294 29 33    -0 00 01     0 00 02    89 53 35     0 00 09     0 00 01
   294 29 30     0 00 00    -0 00 01    89 53 31     0 00 08    -0 00 03
Mean of Sets.
  Horizontal     SD Dir.       Range    Vertical   SD. Vert.       Range
   294 29 31     0 00 02     0 00 03    89 53 34     0 00 03     0 00 04
    Distance    SD Dist.       Range
    1148.936       0.000       0.000
```

LISCAD Report: Least Squares Adjustment Report -
Friday, September 17, 2004 08:39

File: NTillamookJettyBaseline
Projection: Oregon NAD83 North 3601
File Date: Friday, September 17, 2004

Units
=====
Angle: Degrees Minutes Seconds
Distance: US Feet

Earth constants
==========
Refraction constant: 0.070

Average elevation: 0.0
Geoidal separation: 0.0

Fixed Coordinates

Point ID	North	East	Latitude	Longitude	Grid Conv.	P.S.F.
BAR	712957.055	7316648.559	45^34 12.92	-123^57 31.16	-2^27 10	0.99991911
SCOTTH	712886.399	7316955.291	45^34 12.35	-123^57 26.81	-2^27 07	0.99991909

Adjusted Coordinates

Point ID	North	East	Latitude	Longitude	Grid Conv.	P.S.F.
0+22	712927.013	7316950.750	45^34 12.75	-123^57 26.89	-2^27 07	0.99991911
10+00	713868.924	7317347.359	45^34 22.21	-123^57 21.89	-2^27 04	0.99991943

Observations

Directions

At	To	Direction	+/-SD	Residual	Orientation	Fwd. Proj. Geo. Az.
BAR	SCOTTH	0°00'00"	0°00'04"	0°00'01"	102°58'18"	102°58'19"
BAR	0+22	352°42'22"	0°00'04"	-0°00'01"		95°40'39"
BAR	SCOTTH	0°00'00"	0°00'04"	-0°00'01"	102°58'20"	102°58'19"
BAR	10+00	294°29'31"	0°00'04"	0°00'01"		37°27'51"
0+22	10+00	0°00'00"	0°00'10"	0°00'00"	22°50'04"	22°50'04"
10+00	0+22	0°00'01"	0°00'10"	0°00'00"	202°50'03"	202°50'04"
10+00	0+22	0°00'00"	0°00'10"	0°00'00"	202°50'04"	202°50'04"
0+22	10+00	359°59'59"	0°00'10"	0°00'00"	22°50'05"	22°50'04"

Distances

At	To	Distance	+/-SD	Residual	S.L.C.	Grid	L.S.F.
BAR	SCOTTH	314.771	0.007	0.019	0.000	314.765	0.99991910
BAR	0+22	303.705	0.007	0.001	0.000	303.681	0.99991911
BAR	SCOTTH	314.772	0.007	0.019	0.000	314.765	0.99991910
BAR	10+00	1148.934	0.009	-0.004	0.001	1148.837	0.99991927
10+00	0+22	1022.106	0.022	-0.018	-0.000	1022.006	0.99991927
10+00	0+22	1022.071	0.022	0.018	-0.000	1022.006	0.99991927
0+22	10+00	1022.068	0.022	0.021	-0.000	1022.006	0.99991927

```
Statistics
----------
Degrees of Freedom: 3
Fixed Coordinates: 2
Floating Coordinates: 2
Observations: 13
Directions: 8
Orientation: 6
Distances: 5
Number of Iterations: 2

Error Analysis
--------------
Variance Factor: 5.38
                 Adjusted Coordinates   +/- 95% Confidence Limits         Error Ellipse
   Point ID    North          East         North          East    Semi Major Semi Minor Orient
     0+22    712927.013   7316950.750      0.057         0.053      0.057      0.053   164°18'33"
    10+00    713868.924   7317347.359      0.128         0.183      0.216      0.058   123°22'51"
```

The following plate depicts individual ground shots and breaklines at top of bank and toe of bank.

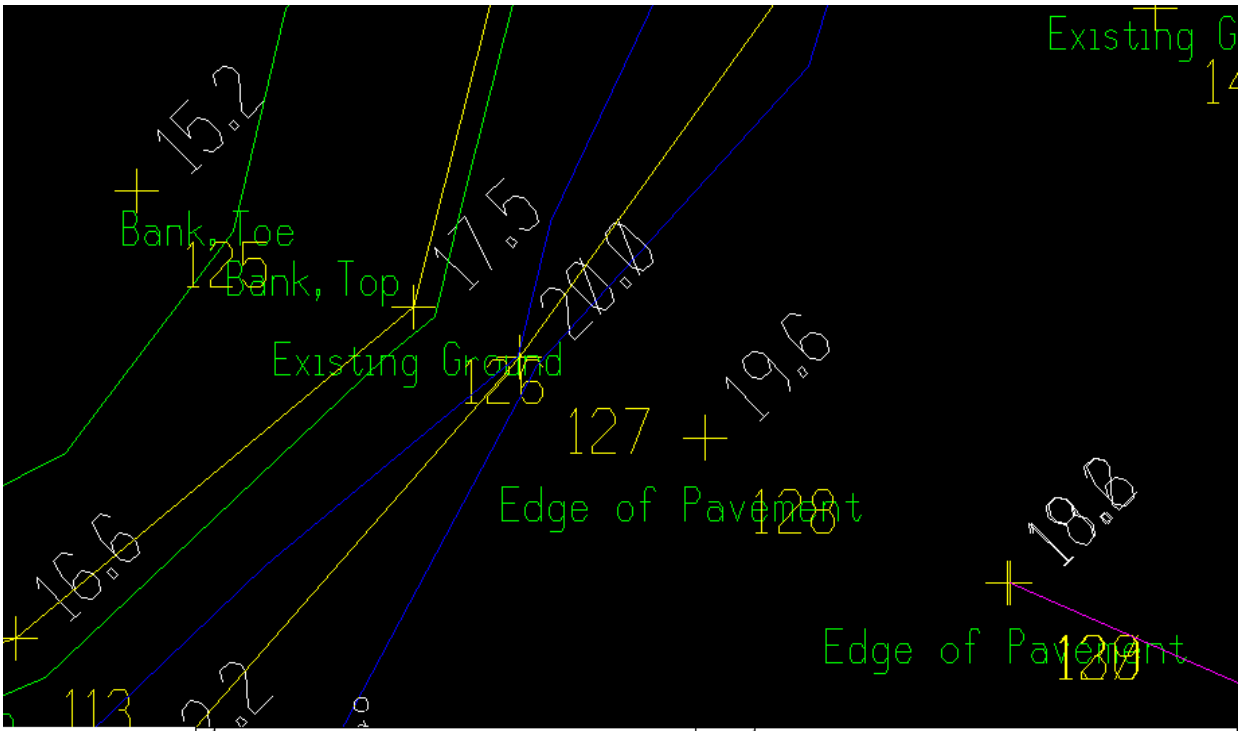

Figure E-3. Breaklines