USACE SPN Geomatics

SPATIAL NAVIGATION ASSET SURVEYING & MAPPING

DREDGING WORKSHOP II

U.S. ARMY CORPS OF ENGINEERS®
(USACE)

SOUTH PACIFIC DIVISION (SPD)

DREDGING WORKSHOP II

SPATIAL NAVIGATION ASSET SURVEYING & MAPPING

BY

STEPHEN P. KILMON, P.S.M., CHIEF

GEOMATICS SECTION

CONSTRUCTION BRANCH

SAN FRANCISCO DISTRICT (SPN)

(0900-1200, 11 MAY 2010 @ BAY MODEL SAUSALITO, CA)

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

AGENDA

Survey Control
Horizontal & Vertical Field Survey Markers

GPS Survey Technology
3D RTK-GPS Survey Technology

Hydrographic Surveying
Singlebeam / Multibeam Survey Technology

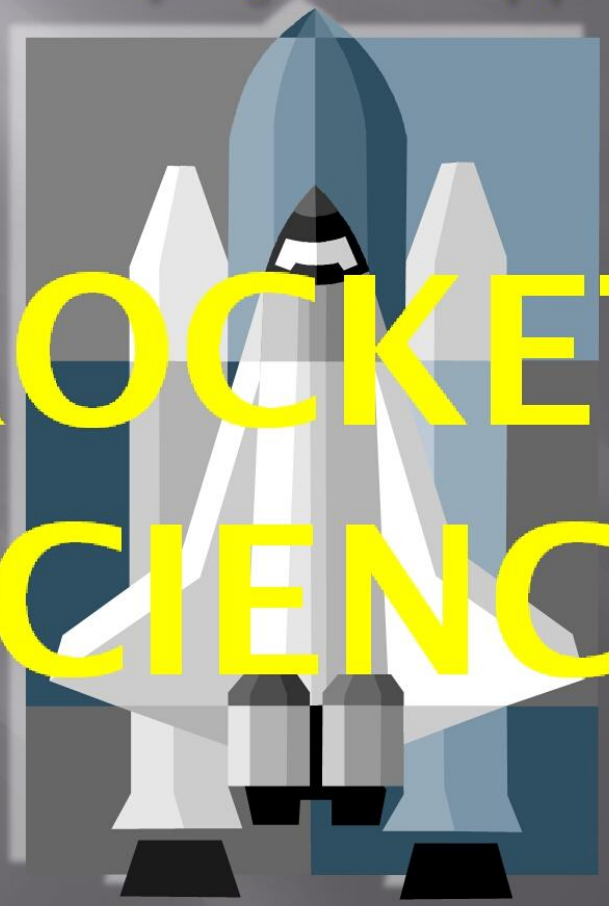
Data Post-Processing
QC-QA / Filter / DTM / Cross-Sections

Digital Terrain Modeling (DTM)
Average-End Area / Prismoidal Volume

USACE SPN Geomatics

Spatial Navigation Asset

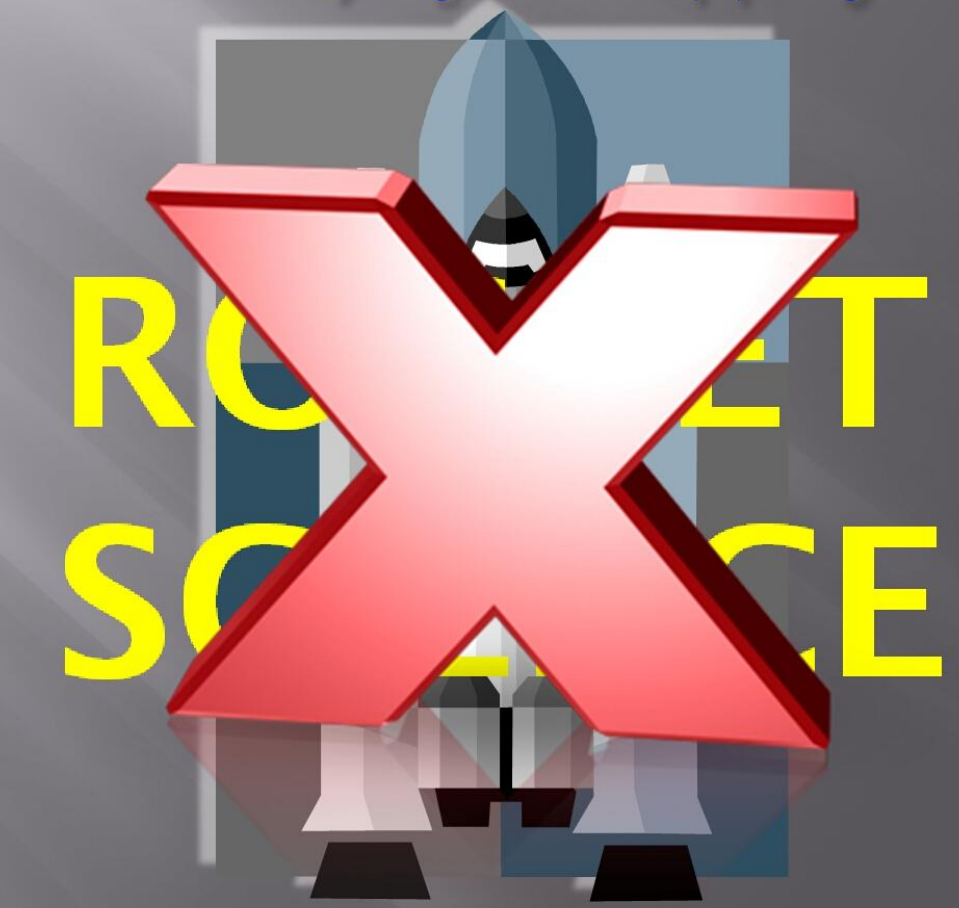
Surveying & Mapping



ROCKET SCIENCE

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

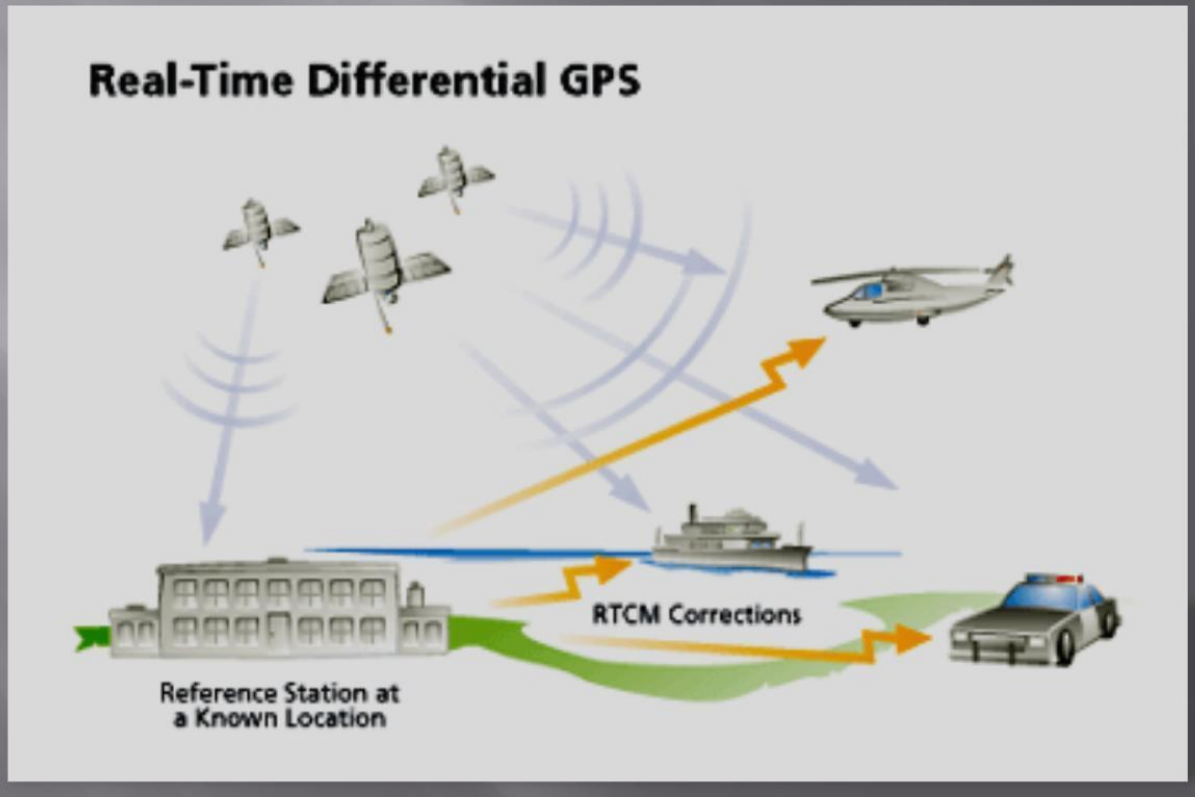


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

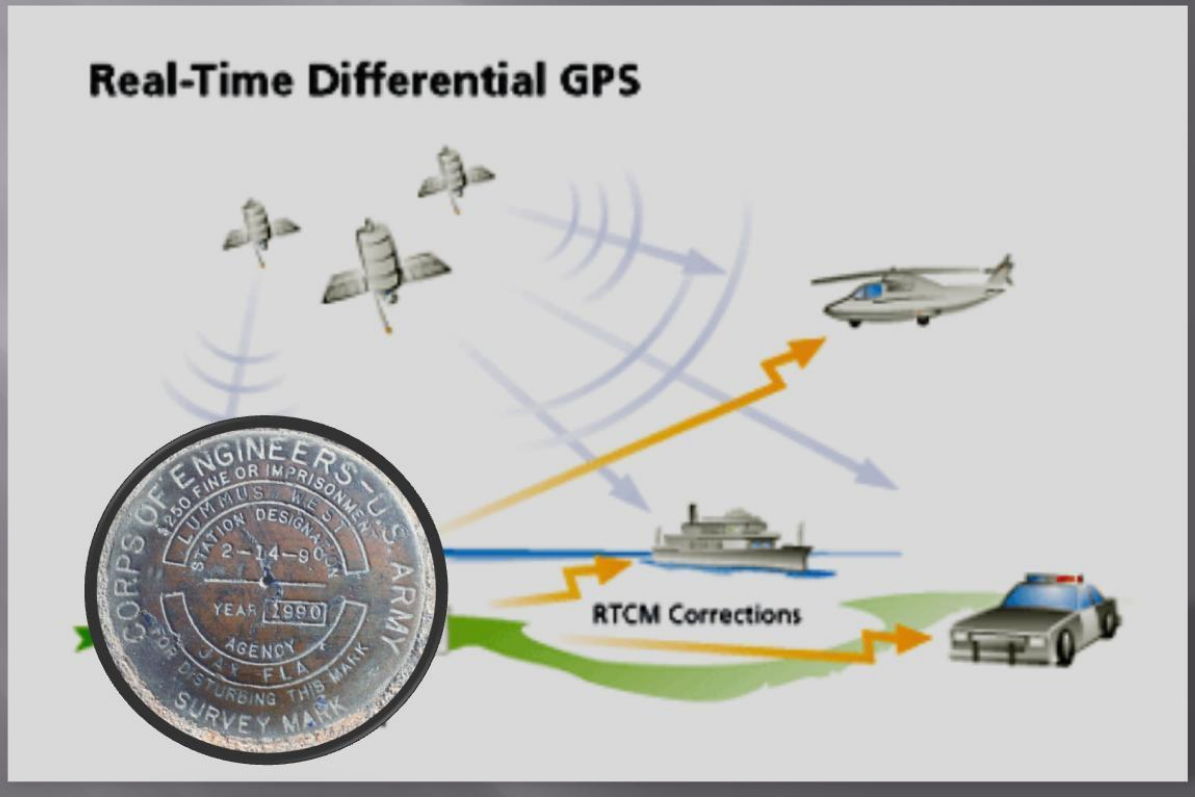


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

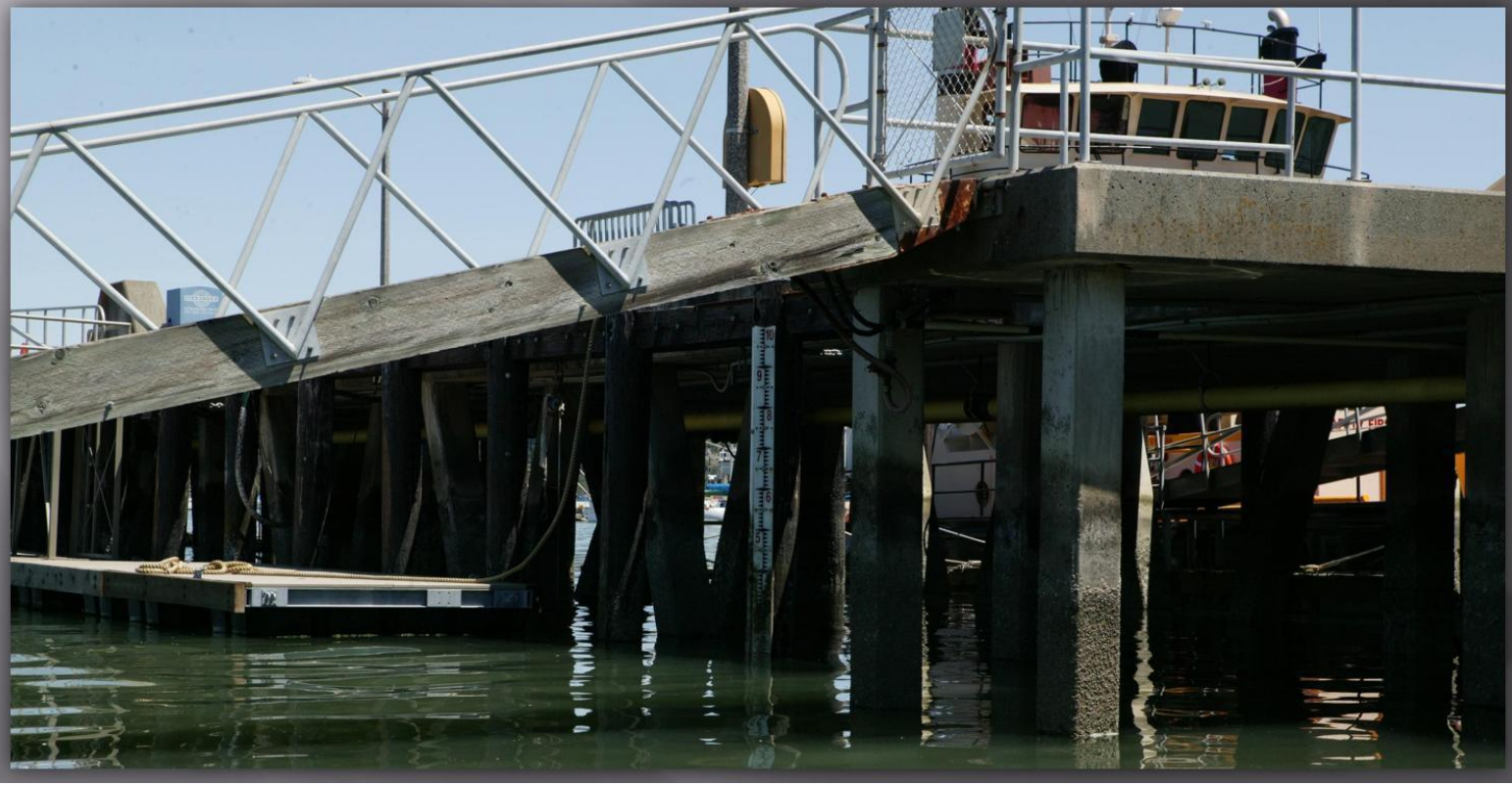


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

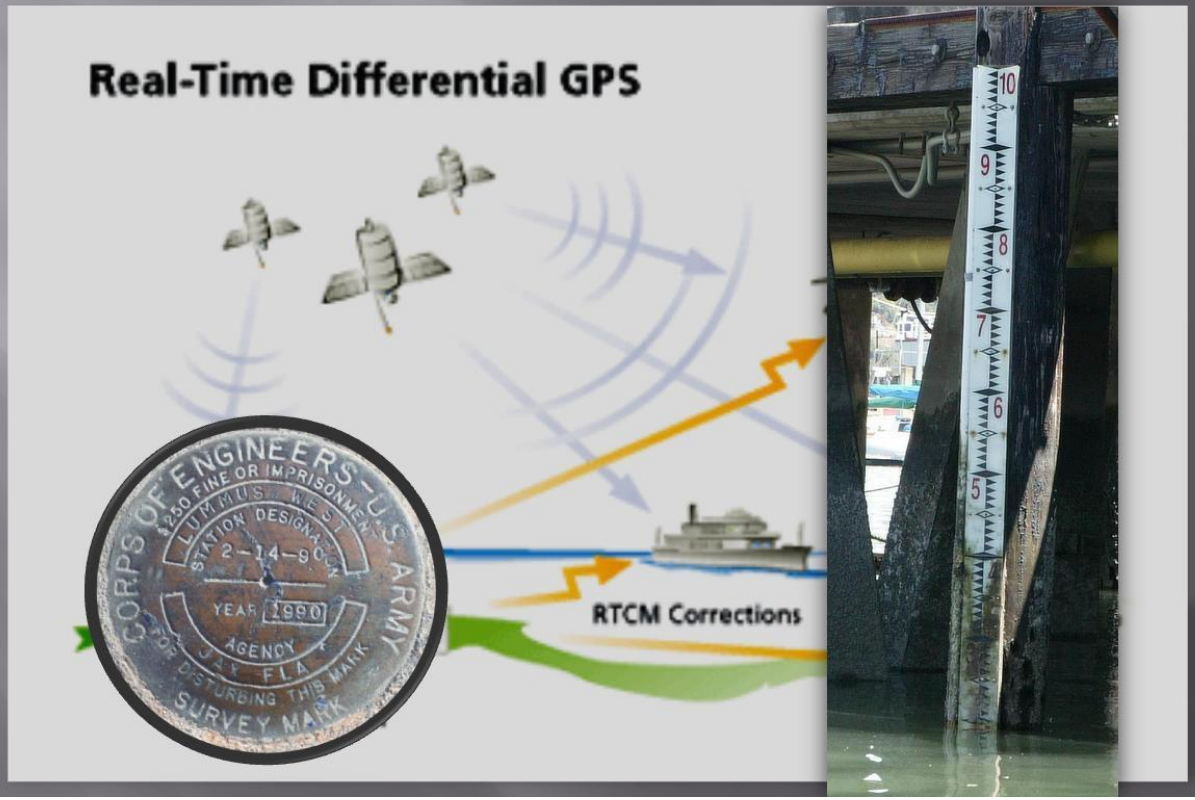


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

ACCURACY

Vertical Marker

Error 0.02' +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

ACCURACY

Vertical Marker Error 0.02' +/-

Tide Gauge Error 0.25' +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

ACCURACY

Vertical Marker — Error 0.02' +/-

Tide Gauge — Error 0.25' +/-

Single/Multi/Salt Water — Error 0.15' +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

ACCURACY

Vertical Marker — Error 0.02' +/-

Tide Gauge — Error 0.25' +/-

Single/Multi/Salt Water — Error 0.15' +/-

Fluid Mud/Natural Bottom — Error 0.05' +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Survey Control

Horizontal Differential (DGPS) & Tide Gauges

ACCURACY

Vertical Marker	Error 0.02’ +/-
Tide Gauge	Error 0.25’ +/-
Single/Multi/Salt Water	Error 0.15’ +/-
Fluid Mud/Natural Bottom	Error 0.05’ +/-

Accumulative Error 0.5’ +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

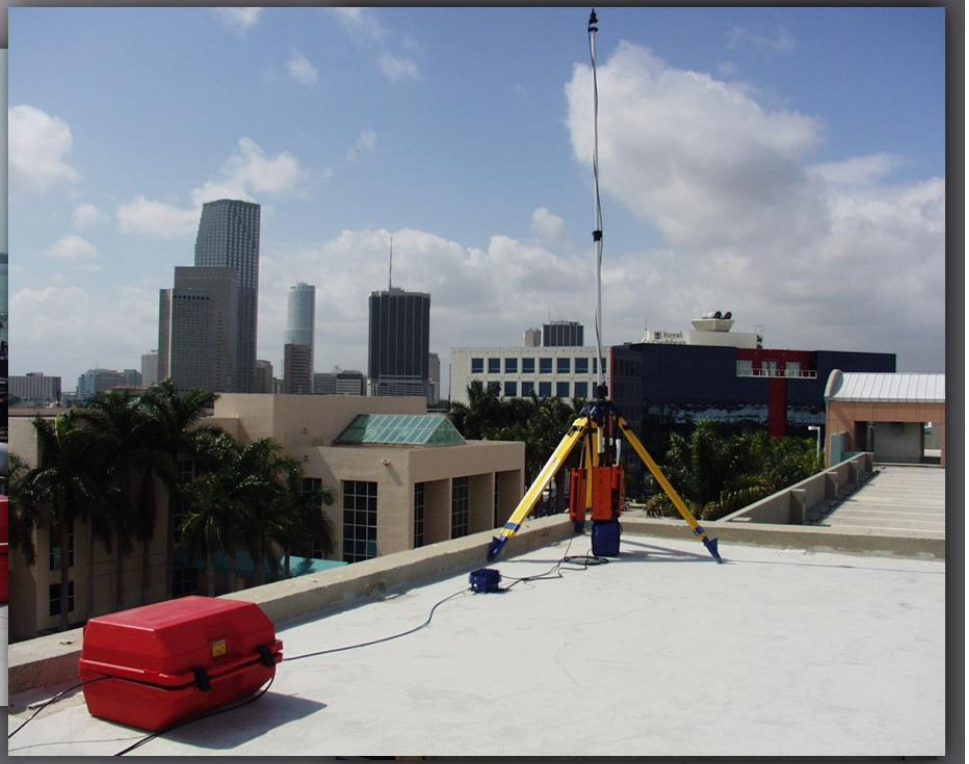
3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Survey Vessel

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Survey Vessel

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

ACCURACY

- Primary Survey Control Monuments
- 3D RTK-GPS
- Multibeam / Singlebeam
- Fluid Mud
  Natural Bottom

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

ACCURACY

Horiz./Vert. Marker **Error 0.02' +/-**

- Primary Survey Control Monuments
- 3D RTK-GPS
- Multibeam / Singlebeam
- Fluid Mud
  Natural Bottom

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

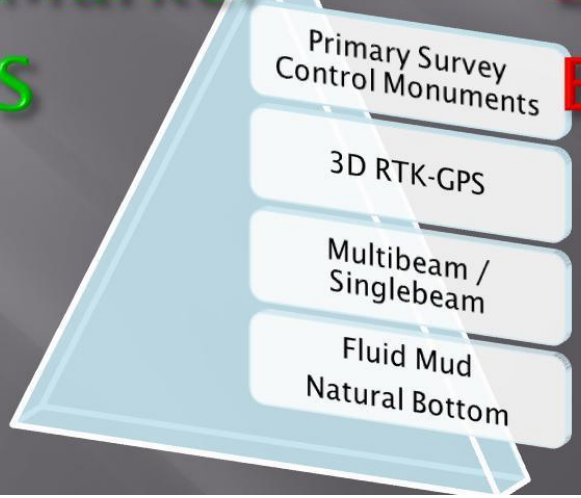
ACCURACY

Horiz./Vert. Marker

3-D RTK-GPS

Error 0.02' +/-

Error 0.03' +/-



USACE SPN Geomatics

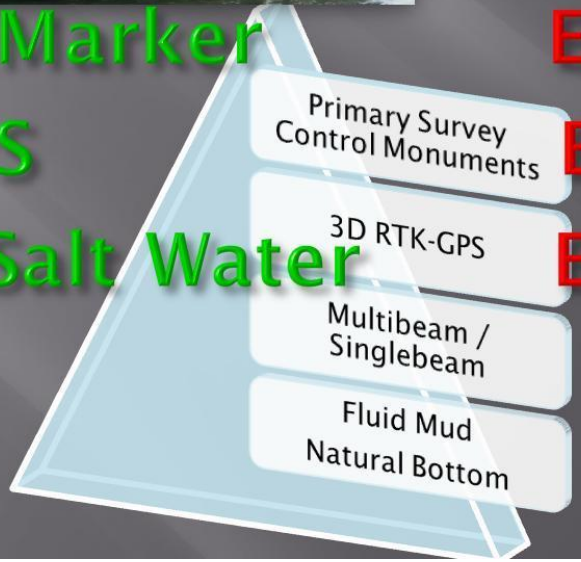
Spatial Navigation Asset Surveying & Mapping

ACCURACY

Horiz./Vert. Marker — Error 0.02' +/-

3-D RTK-GPS — Error 0.03' +/-

Single/Multi/Salt Water — Error 0.15' +/-



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

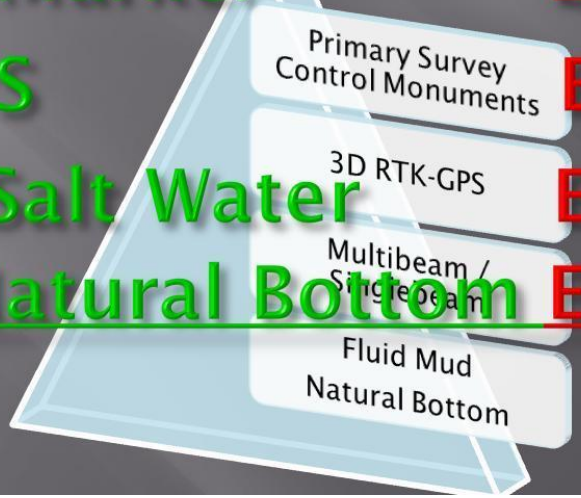
ACCURACY

Horiz./Vert. Marker — Error 0.02' +/-

3-D RTK-GPS — Error 0.03' +/-

Single/Multi/Salt Water — Error 0.15' +/-

Fluid Mud/Natural Bottom — Error 0.05' +/-



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

ACCURACY

Horiz./Vert. Marker — Error 0.02’ +/-

3-D RTK-GPS — Error 0.03’ +/-

Single/Multi/Salt Water — Error 0.15’ +/-

Fluid Mud/Natural Bottom — Error 0.05’ +/-

Accumulative Error 0.25’ +/-

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

Singlebeam Survey Vessel

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

Singlebeam Survey Vessel

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

Multibeam Survey Vessel

Singlebeam Survey Vessel

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

GPS Survey Technology

3D RTK-GPS Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

Singlebeam

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

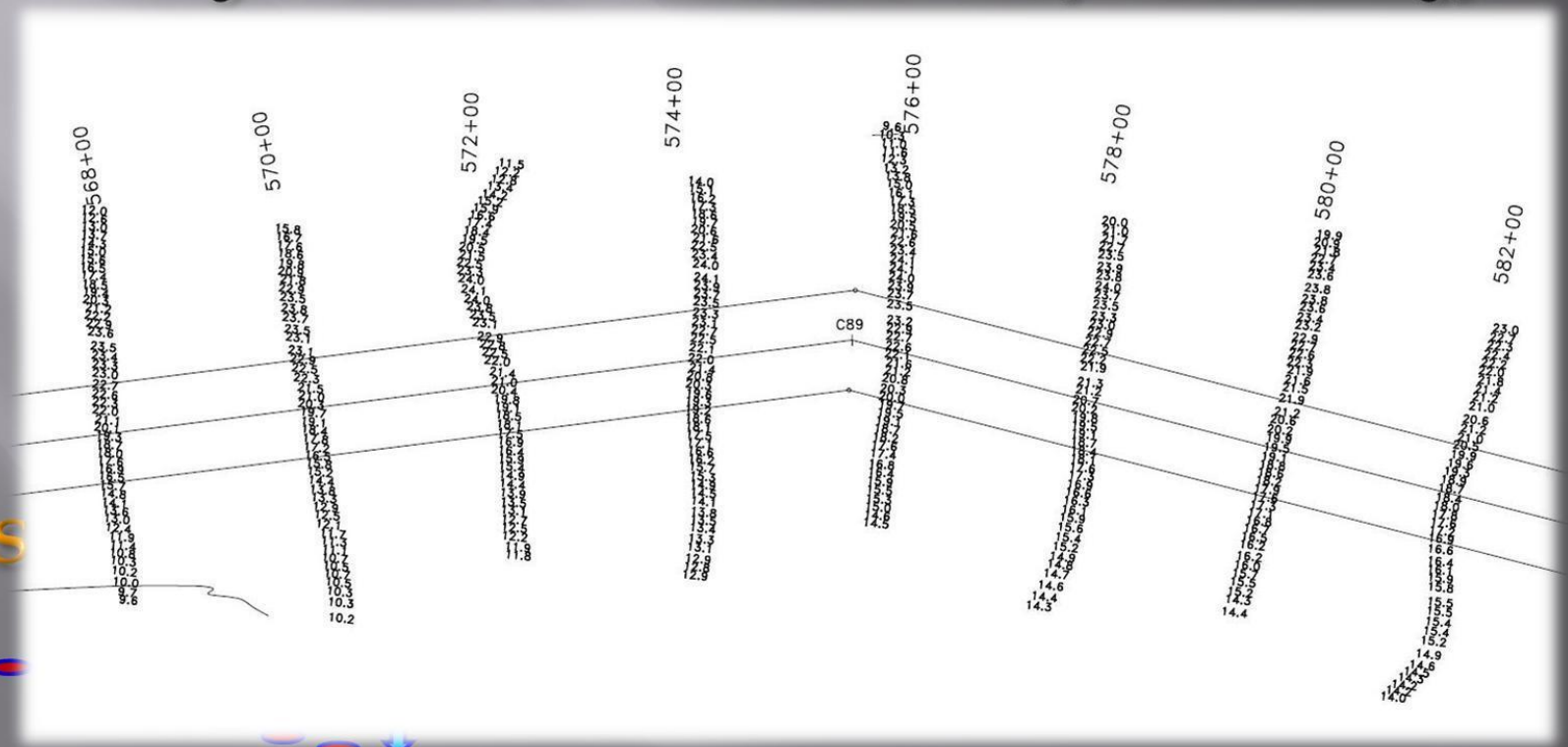
Singlebeam / Multibeam Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

Singlebeam

Multibeam

USACE SPN Geomatics

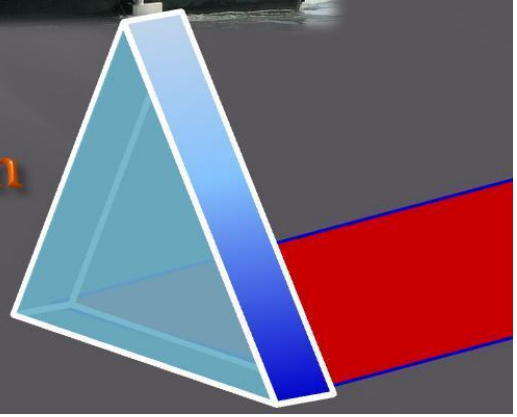
Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology

Singlebeam

Multibeam

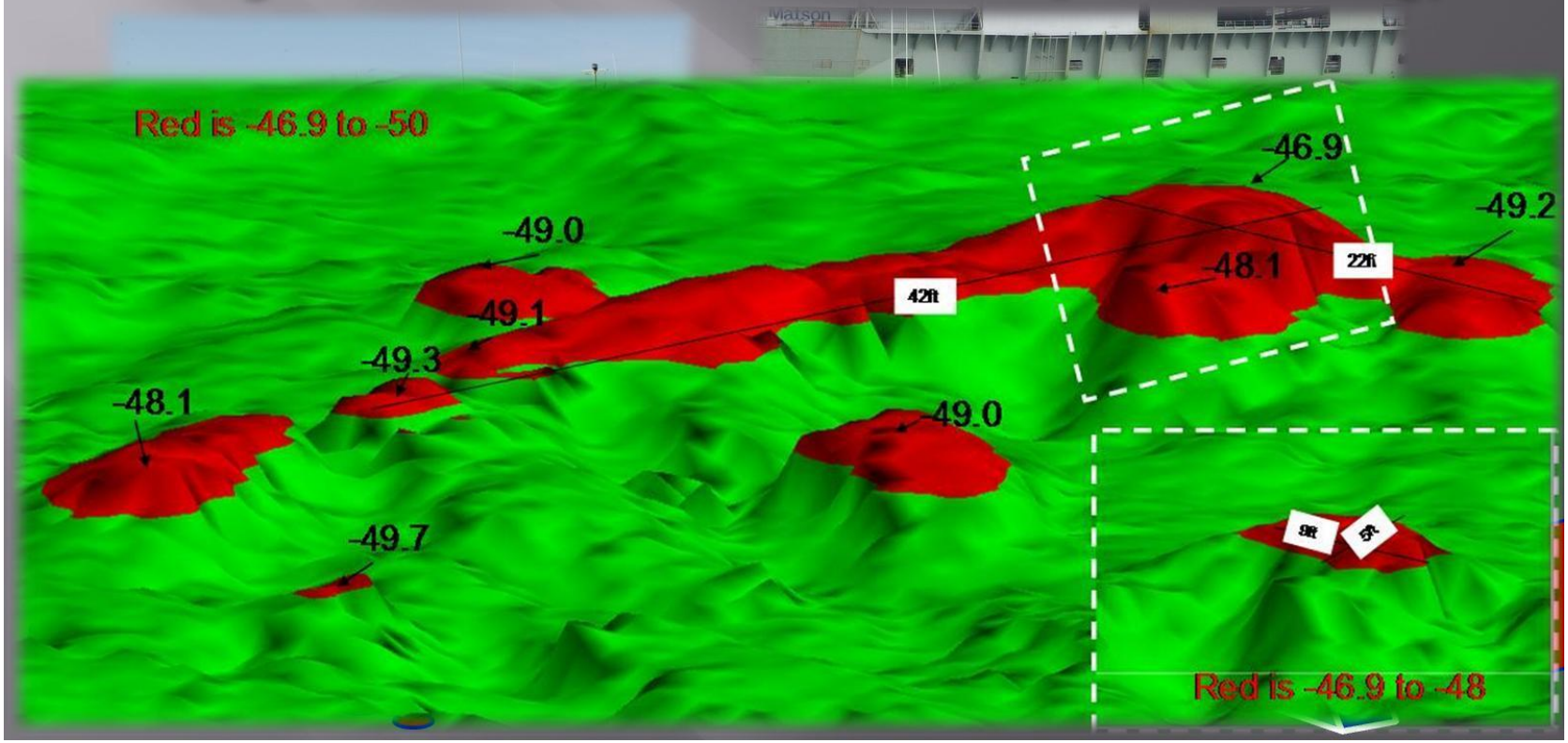


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Hydrographic Surveying

Singlebeam / Multibeam Survey Technology



USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume

Points Site Limits

Surface Build

Triangular Irregular Network (TIN)

TIN Edit

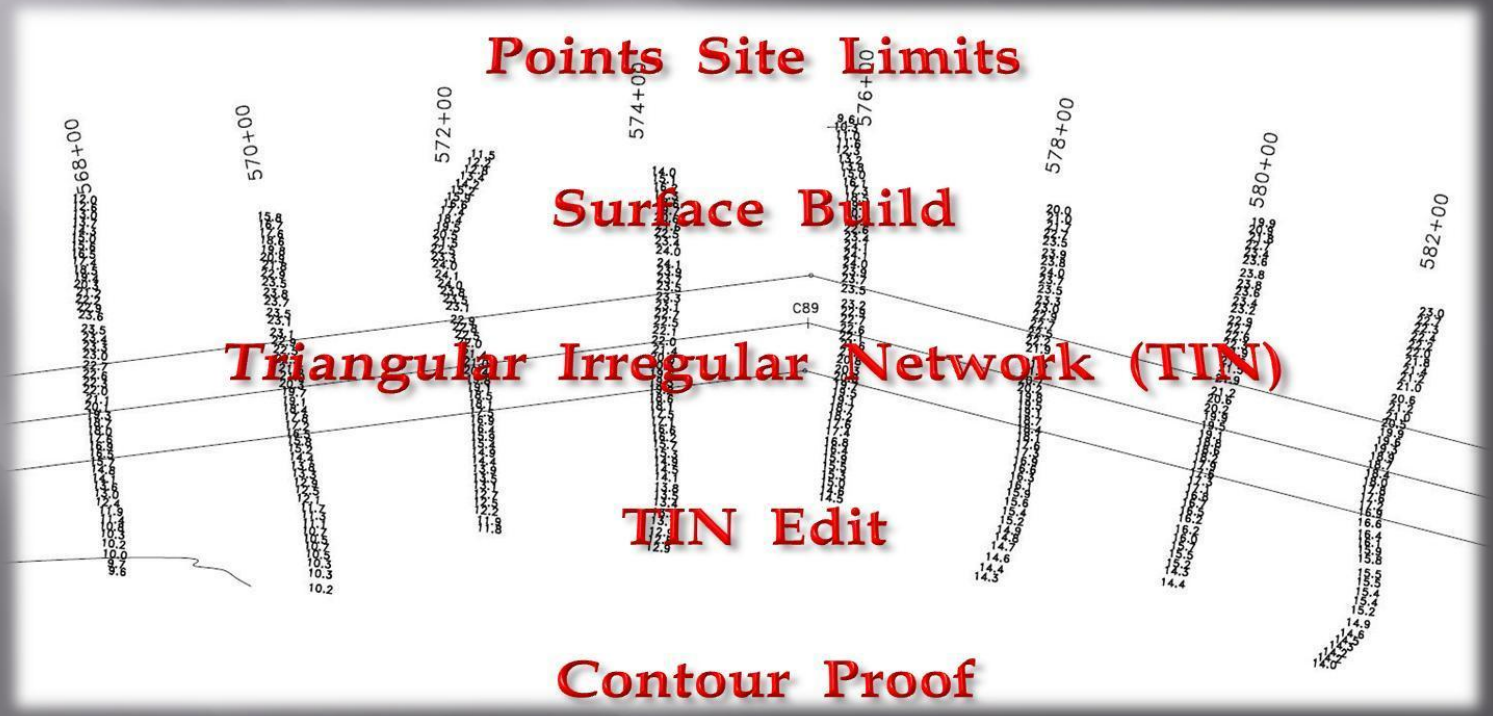
Contour Proof

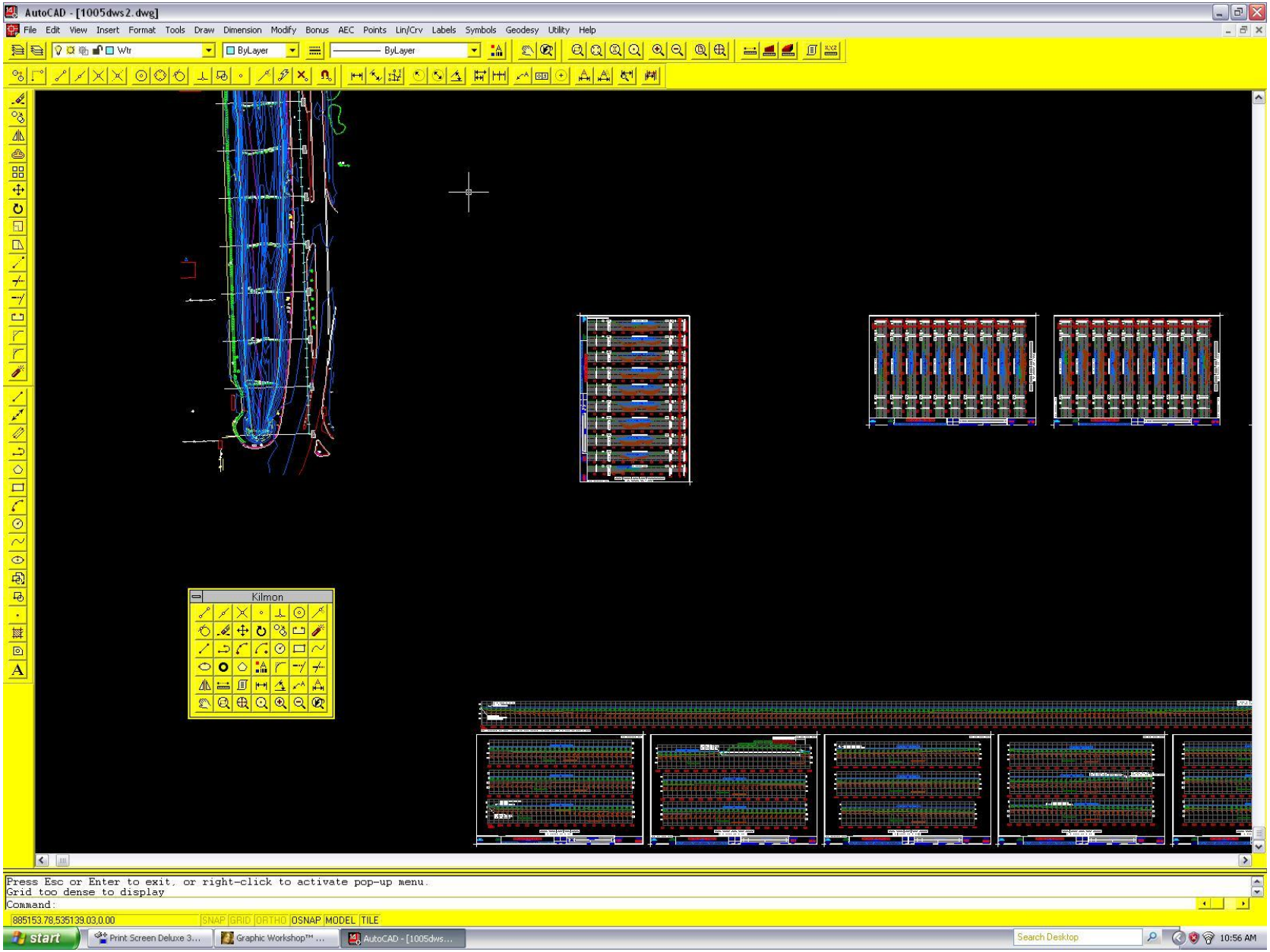
USACE SPN Geomatics

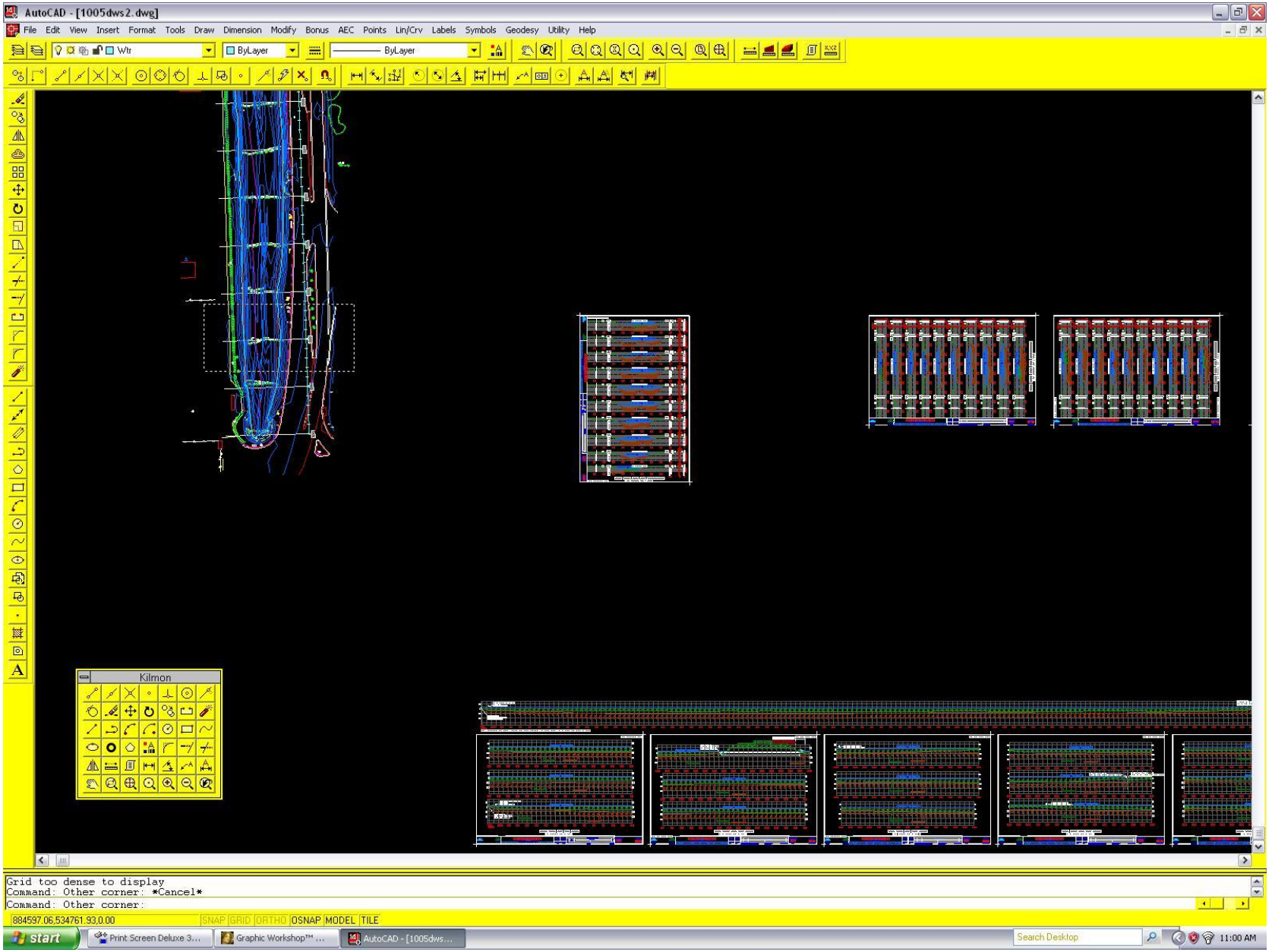
Spatial Navigation Asset Surveying & Mapping

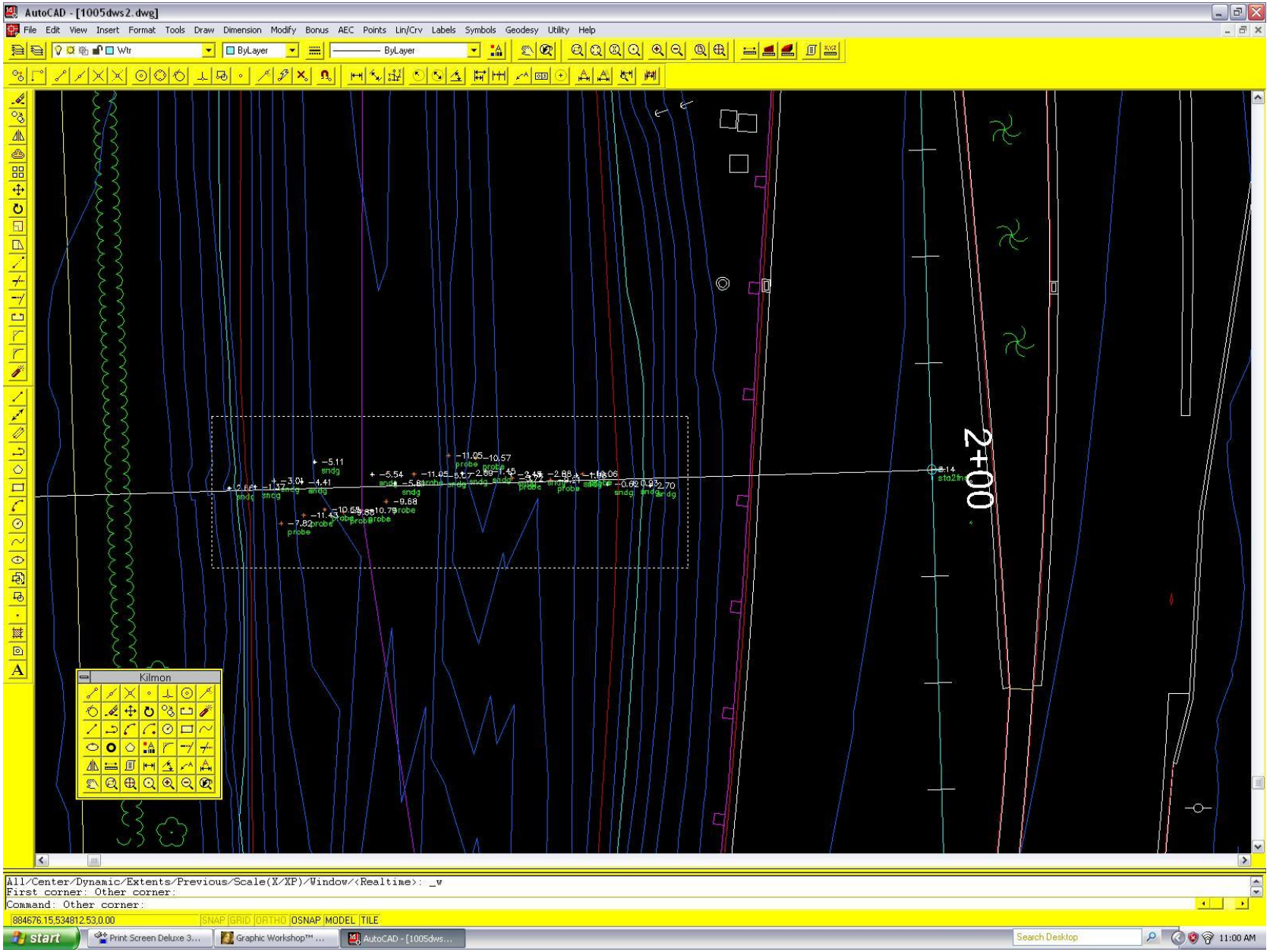
Digital Terrain Modeling (DTM)

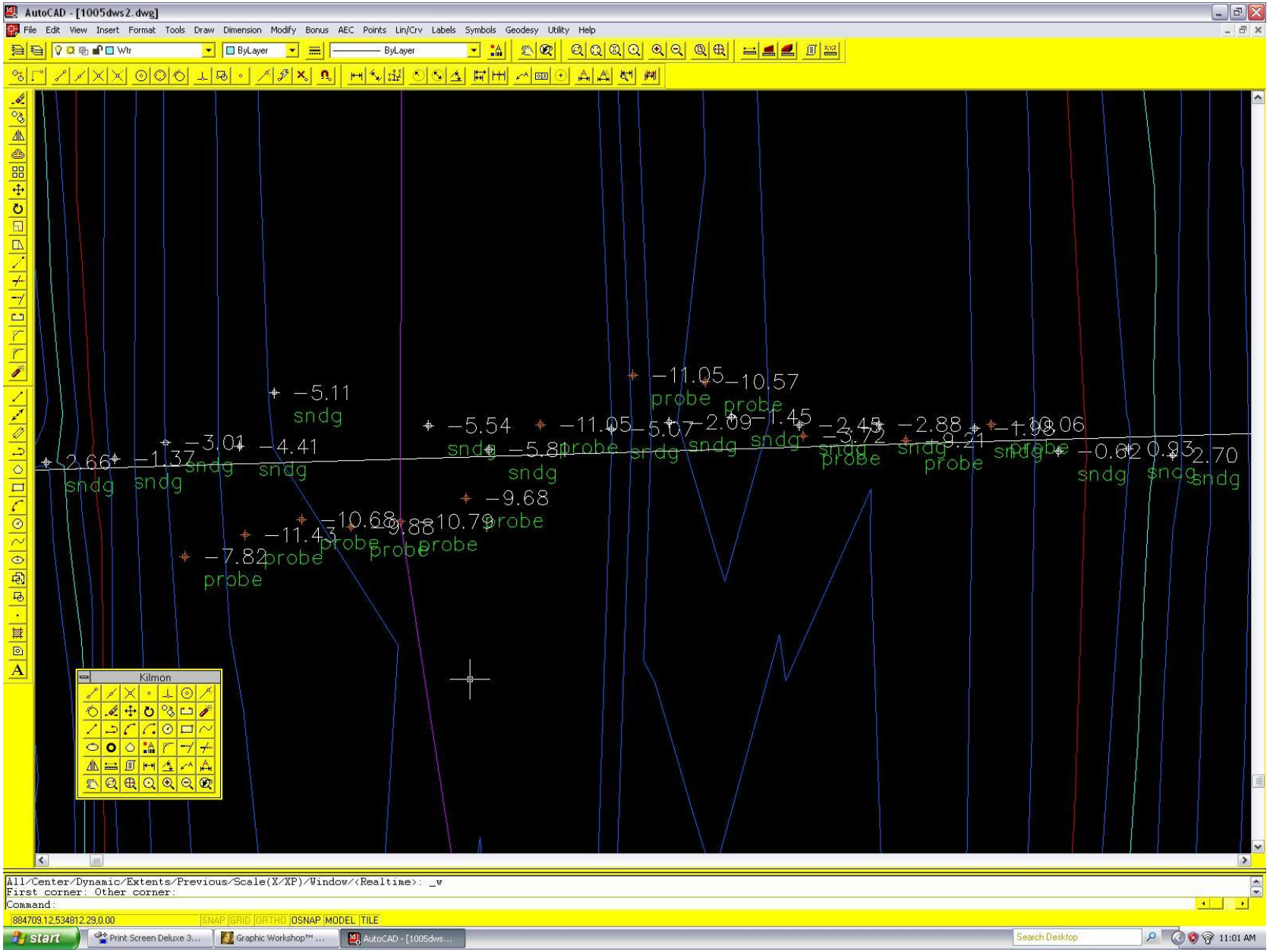
Average-End Area / Prismoidal Volume

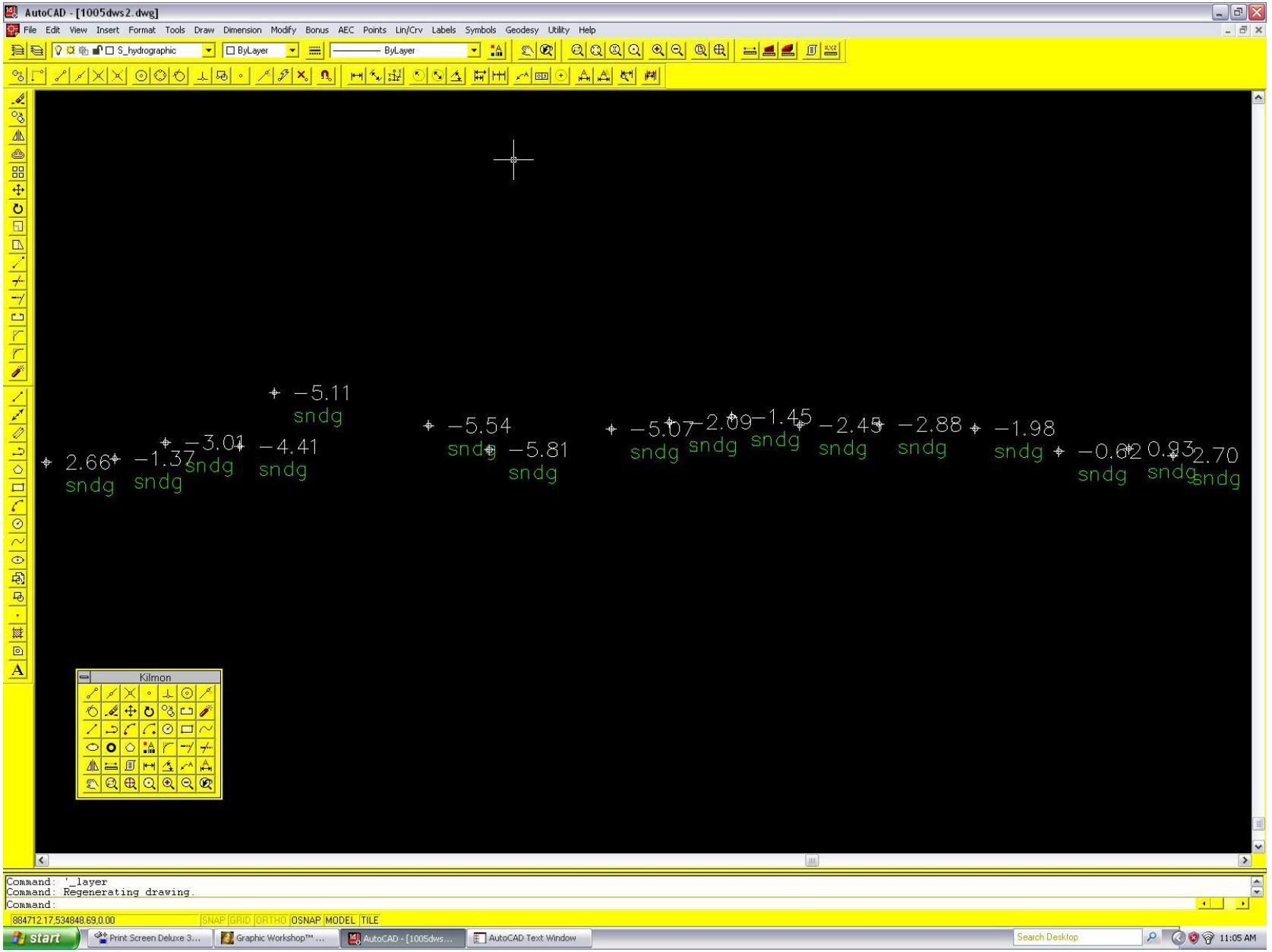


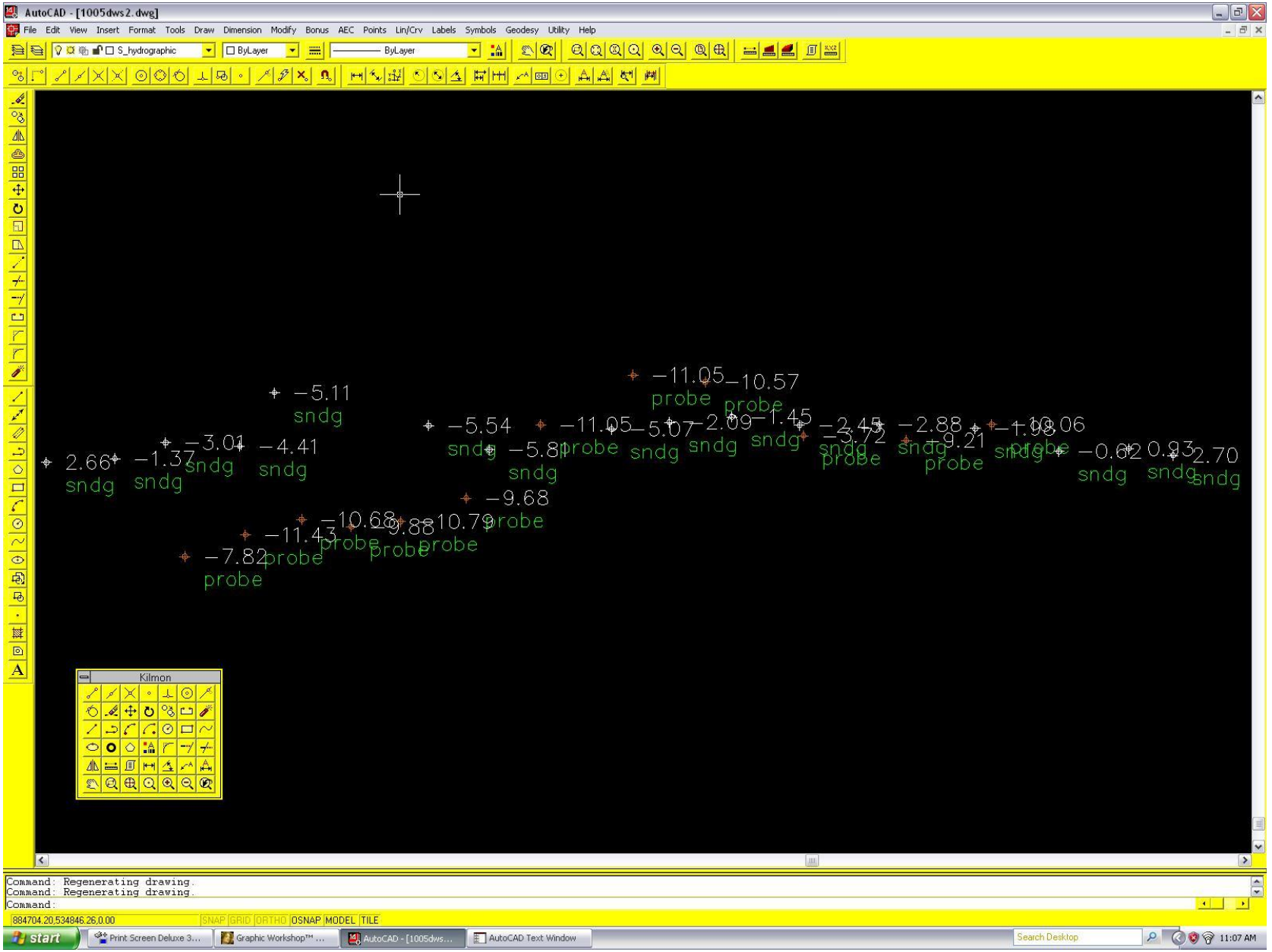

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
Kilmon
Press Esc or Enter to exit, or right-click to activate pop-up menu.
Grid too dense to display
Command:
885153.78,535139.03,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
10:56 AM

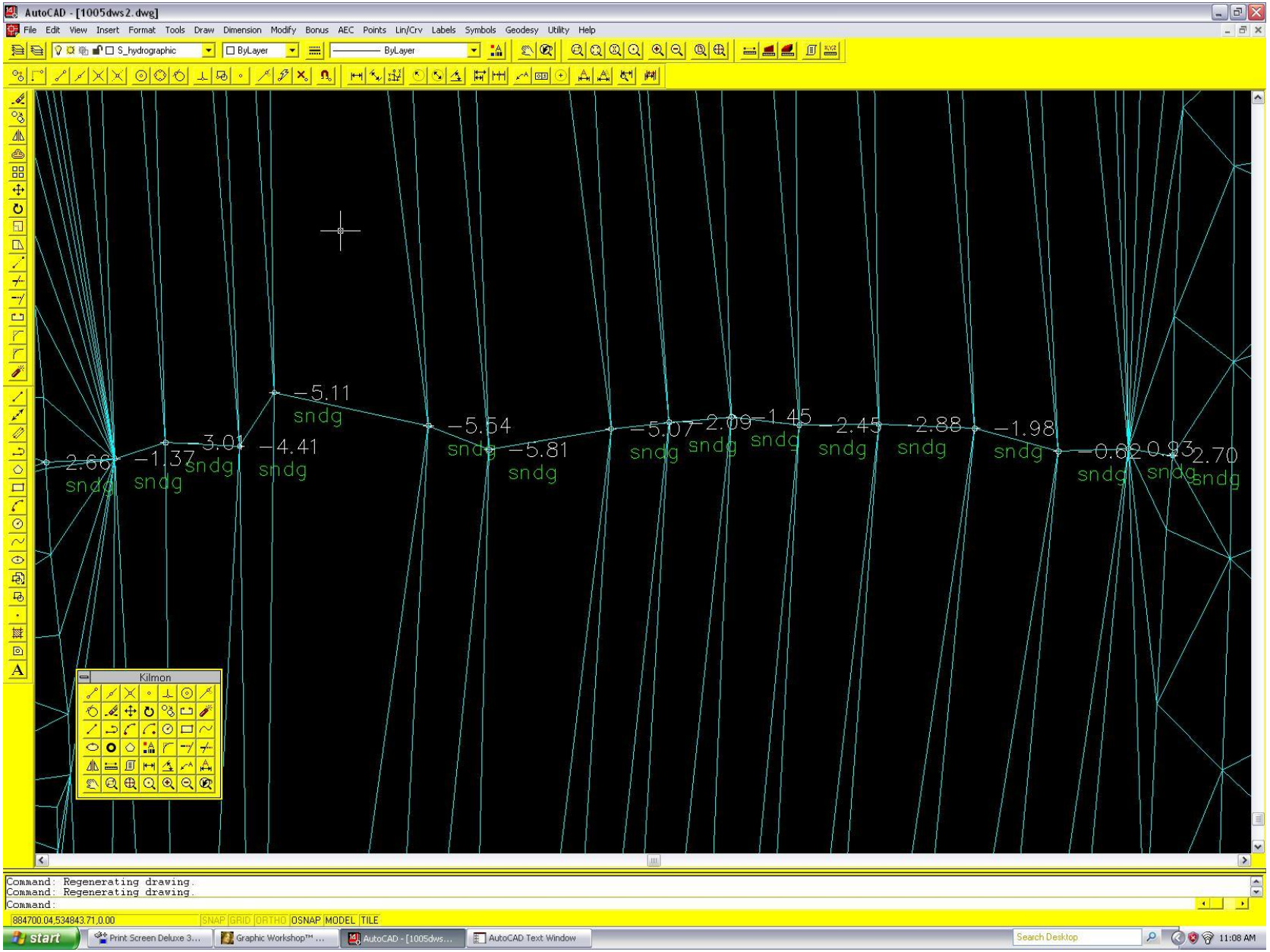

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Wtr
ByLayer
ByLayer
Kilmon
Grid too dense to display
Command: Other corner: *Cancel*
Command: Other corner:
884597.06,534761.93,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:00 AM

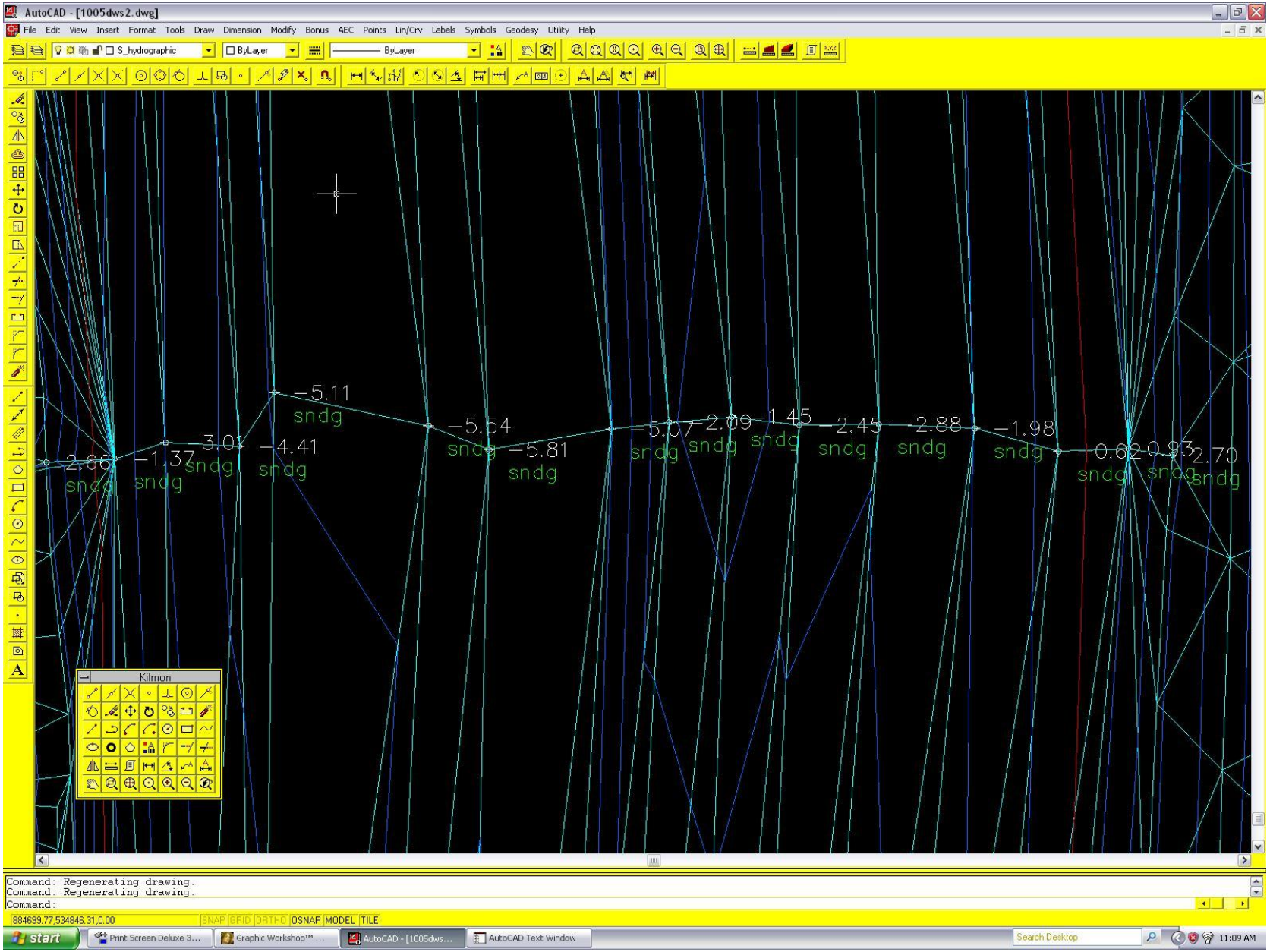

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
2+00
Kilmon
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _w
First corner: Other corner:
Command: Other corner:
884676.15,534812.53,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:00 AM

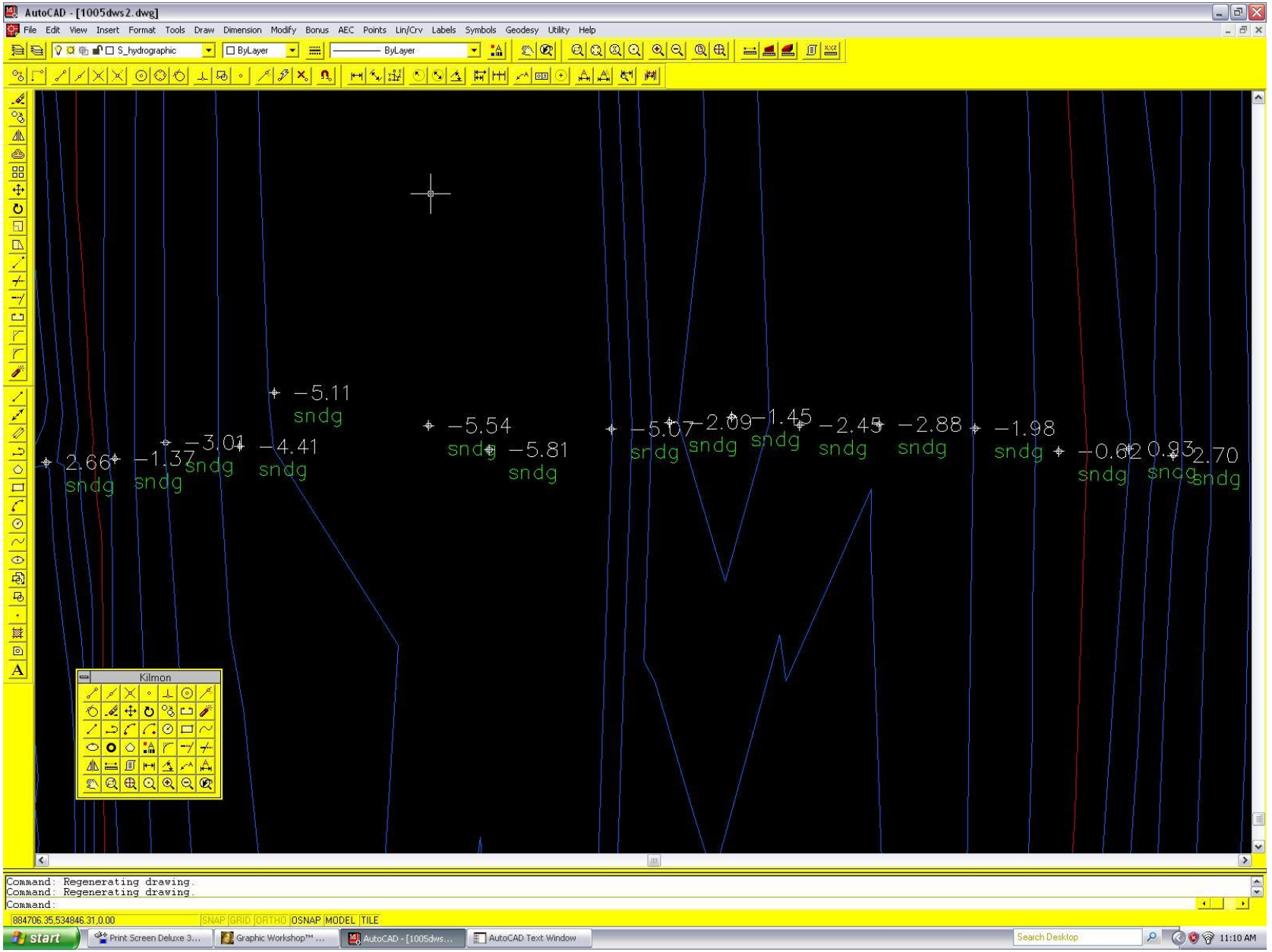

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Wtr
ByLayer
ByLayer
−5.11
sndg
−3.01
sndg
−4.41
sndg
−2.66
sndg
−1.37
sndg
−5.54
sndg
−5.81
sndg
−9.68
probe
−11.43
probe
−7.82
probe
−10.68
probe
−9.88
probe
−10.79
probe
−11.05
probe
−10.57
probe
−11.05
probe
−5.07
sndg
−2.09
sndg
−1.45
sndg
−2.45
sndg
−3.72
probe
−2.88
sndg
−9.21
probe
−10.06
sndg
−0.62
sndg
0.93
sndg
2.70
sndg
Kilmon
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _w
First corner: Other corner:
Command:
884709.12,534812.29,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:01 AM

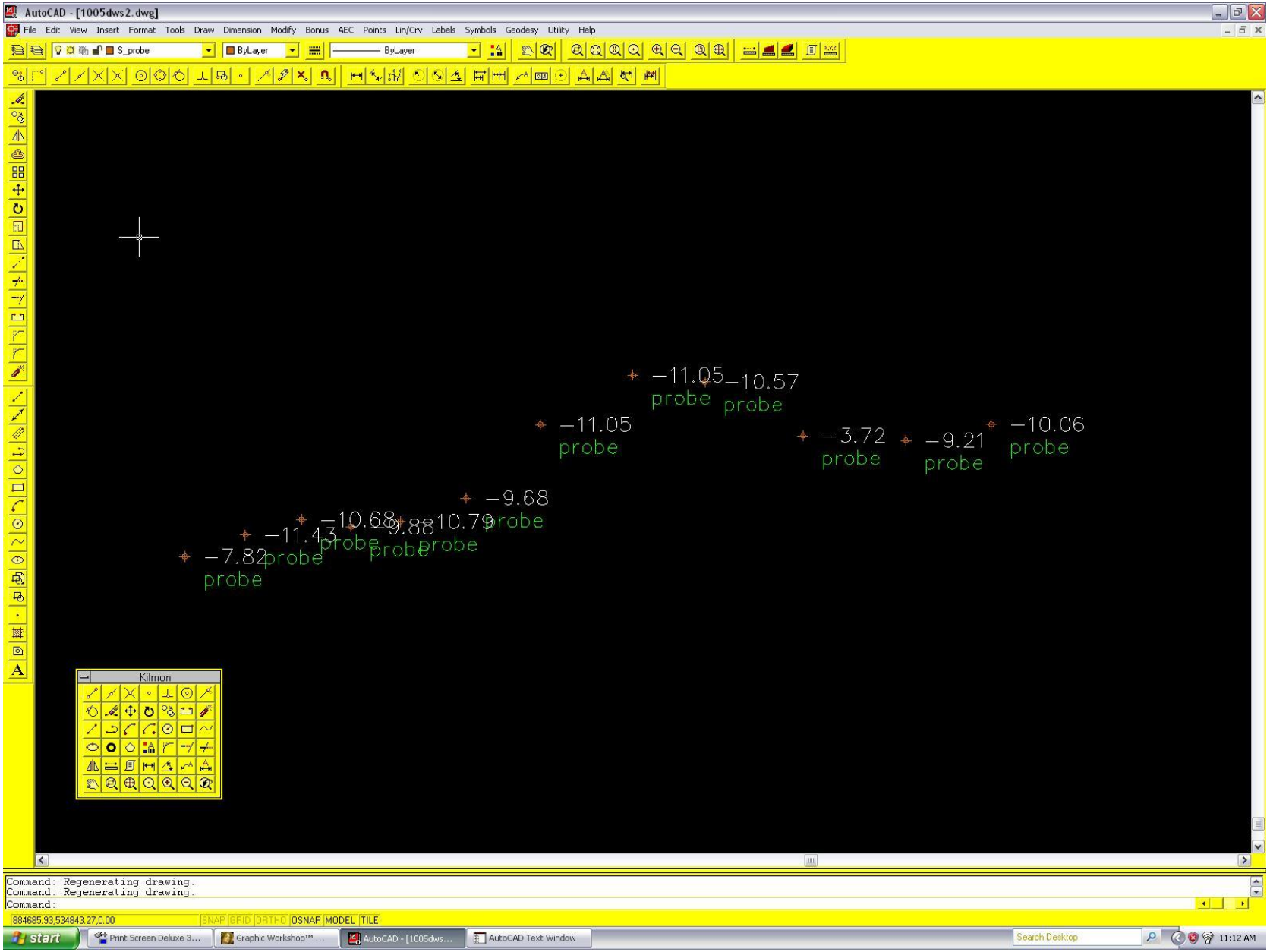

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
−5.11
sndg
−3.01
−4.41
2.66
−1.37
sndg
sndg
sndg
−5.54
sndg
−5.81
sndg
−5.07
sndg
−2.09
sndg
−1.45
sndg
−2.45
sndg
−2.88
sndg
−1.98
sndg
−0.62
sndg
0.83
sndg
2.70
sndg
Kilmon
Command: '_layer
Command: Regenerating drawing.
Command:
884712.17,534848.69,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:05 AM

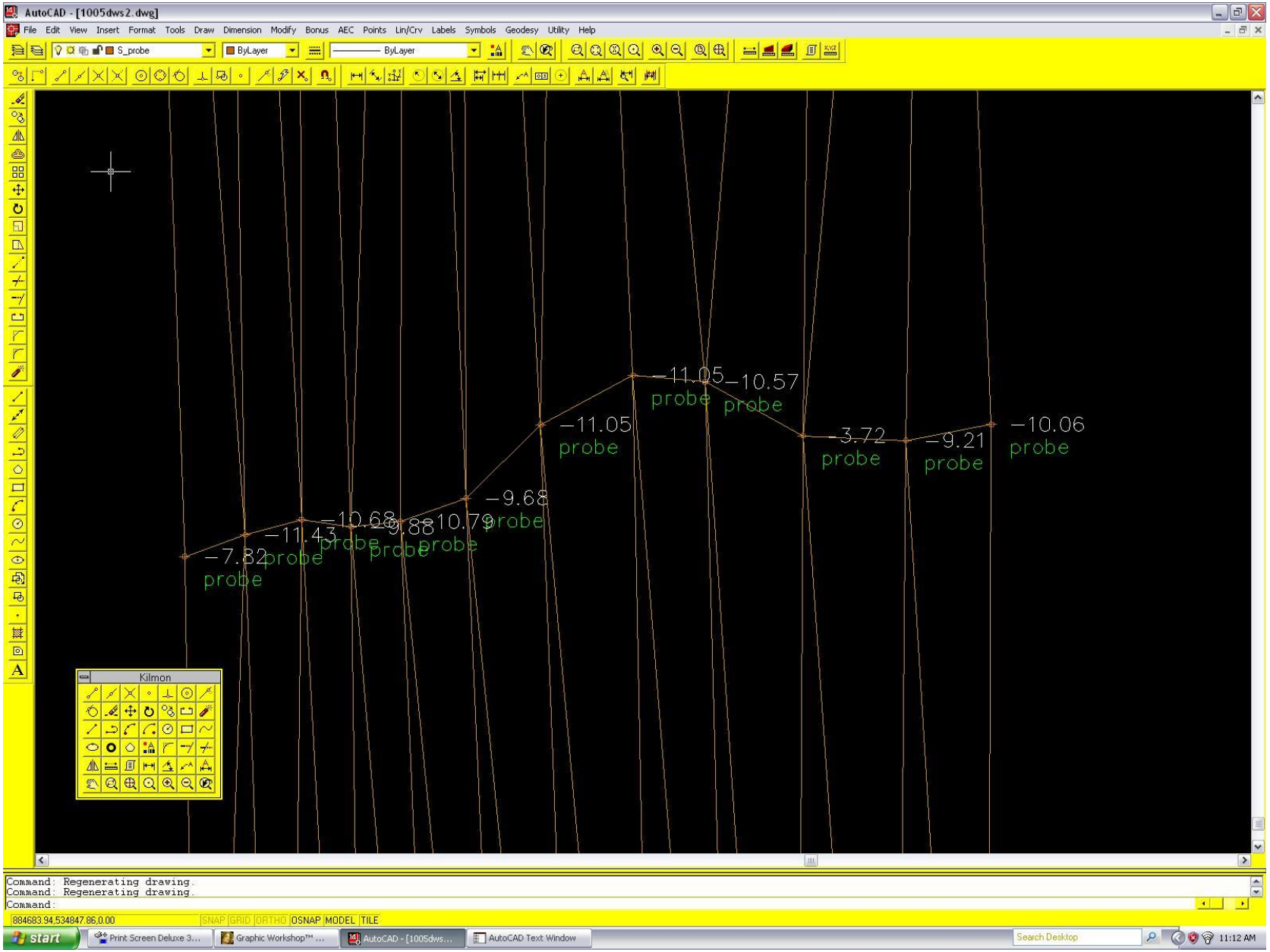

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
−5.11
sndg
−11.05
probe
−10.57
probe
−5.54
sndg
−11.05
probe
−5.07
sndg
−2.09
sndg
−1.45
sndg
−2.45
sndg
−3.72
probe
−2.88
sndg
−9.21
probe
−1.98
sndg
−10.06
probe
−0.62
sndg
0.93
sndg
2.70
sndg
2.66
sndg
−1.37
sndg
−3.01
sndg
−4.41
sndg
−5.81
sndg
−9.68
probe
−10.68
probe
−9.88
probe
−10.79
probe
−11.43
probe
−7.82
probe
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884704.20,534846.26,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:07 AM

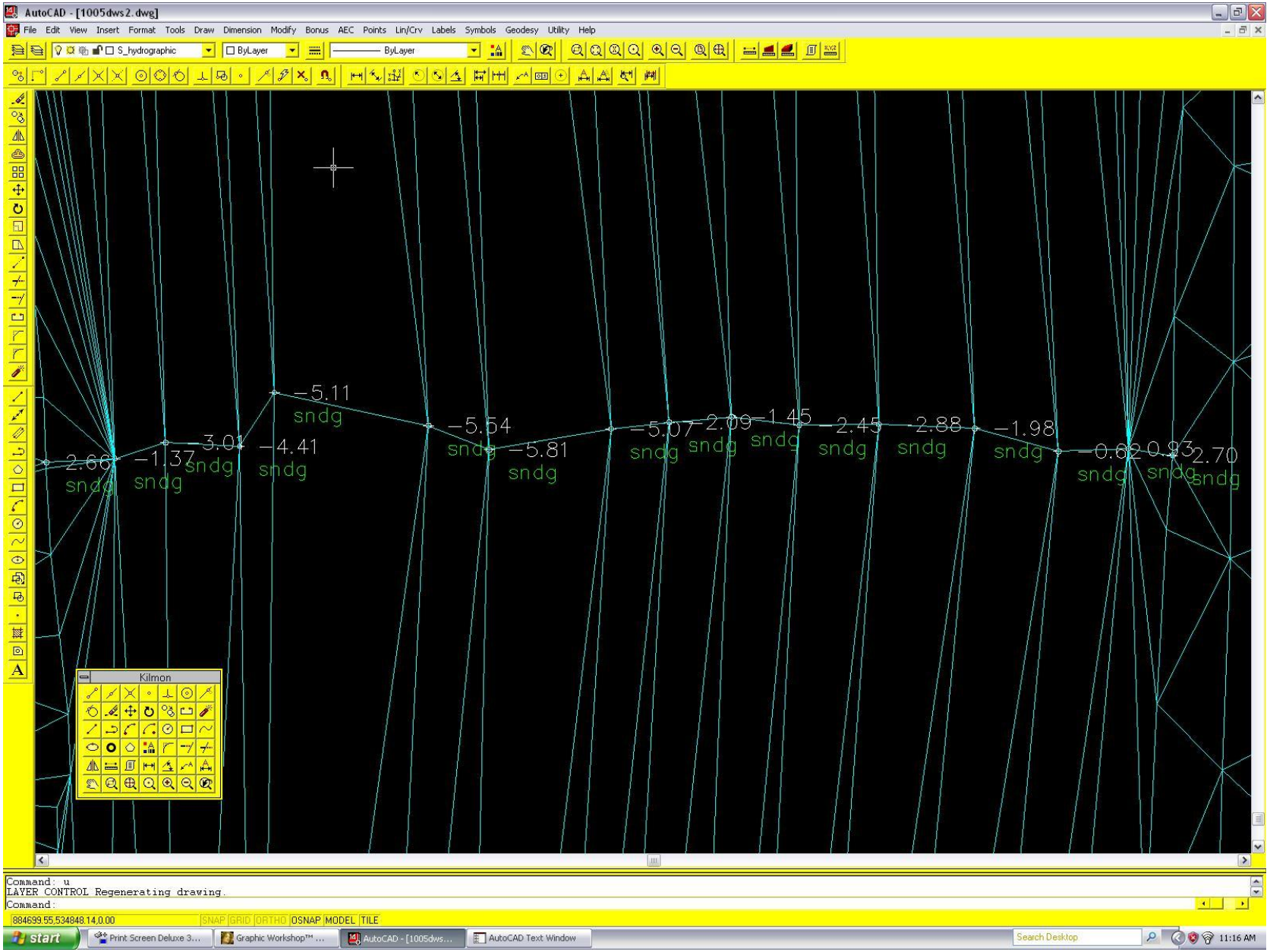

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
2.66
sndg
-1.37
sndg
-3.01
sndg
-4.41
sndg
-5.11
sndg
-5.54
sndg
-5.81
sndg
-5.07
sndg
-2.09
sndg
-1.45
sndg
-2.45
sndg
-2.88
sndg
-1.98
sndg
-0.62
sndg
-0.93
sndg
-2.70
sndg
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884700.04,534843.71,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:08 AM

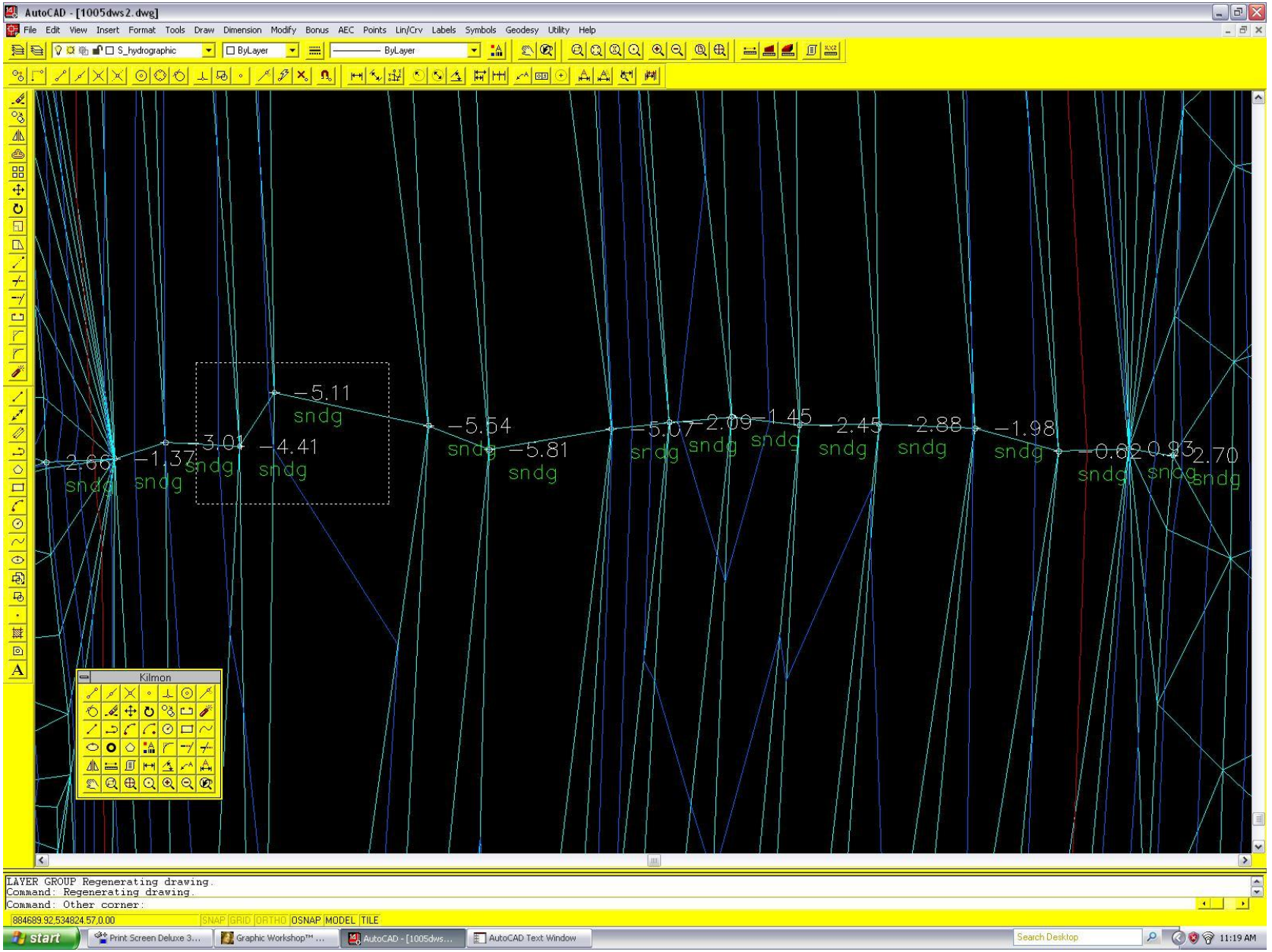

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
2.66
sndg
-1.37
sndg
-3.01
sndg
-4.41
sndg
-5.11
sndg
-5.54
sndg
-5.81
sndg
-5.07
sndg
-2.09
sndg
-1.45
sndg
-2.45
sndg
-2.88
sndg
-1.98
sndg
-0.62
sndg
0.93
sndg
2.70
sndg
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884699.77,534846.31,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:09 AM

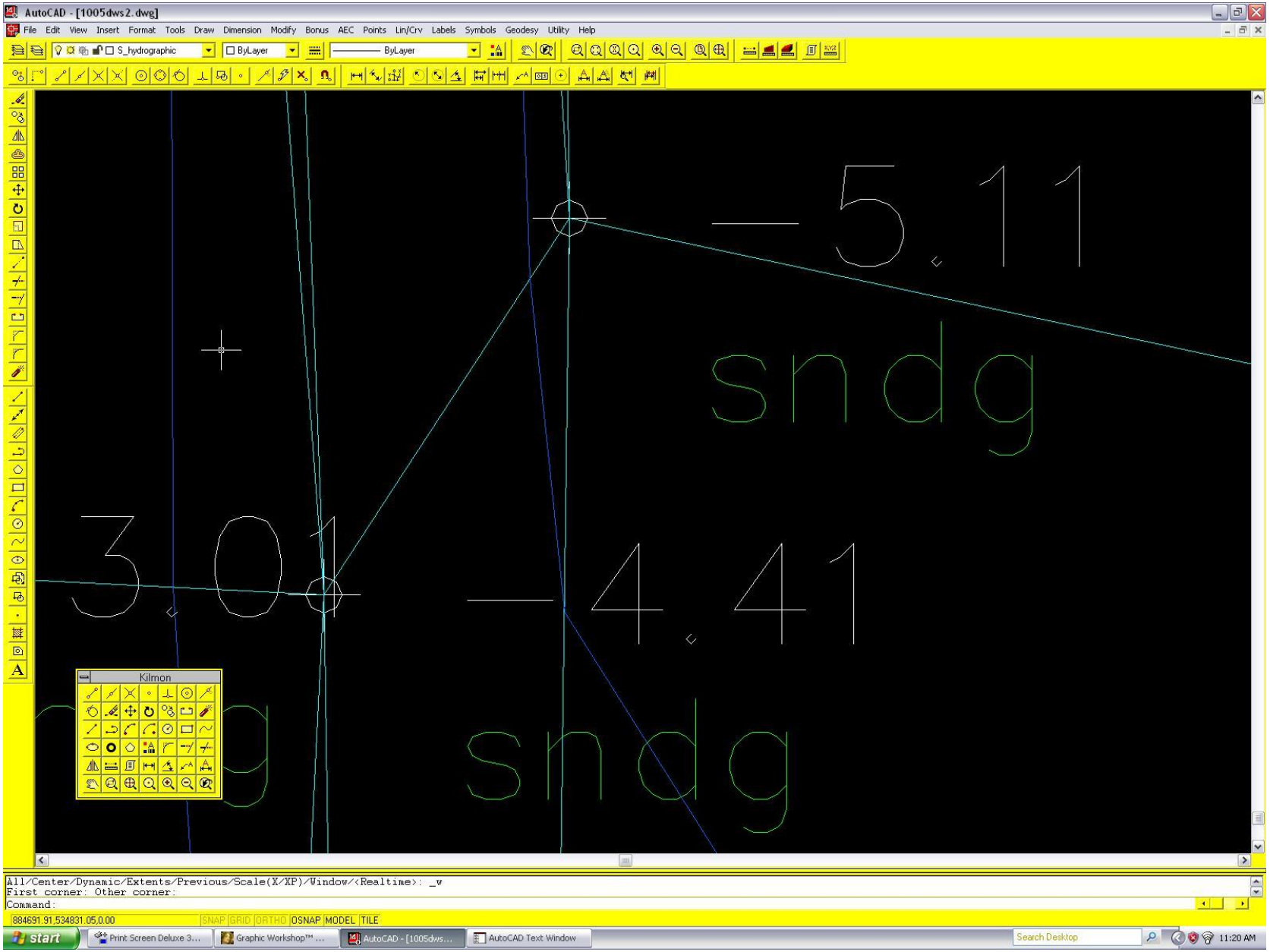

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
−5.11
sndg
−5.54
sndg
−5.81
sndg
−5.07
sndg
−2.09
sndg
−1.45
sndg
−2.45
sndg
−2.88
sndg
−1.98
sndg
−0.62
sndg
0.93
sndg
2.70
sndg
−3.01
sndg
−4.41
sndg
2.66
sndg
−1.37
sndg
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884706.35,534846.31,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:10 AM

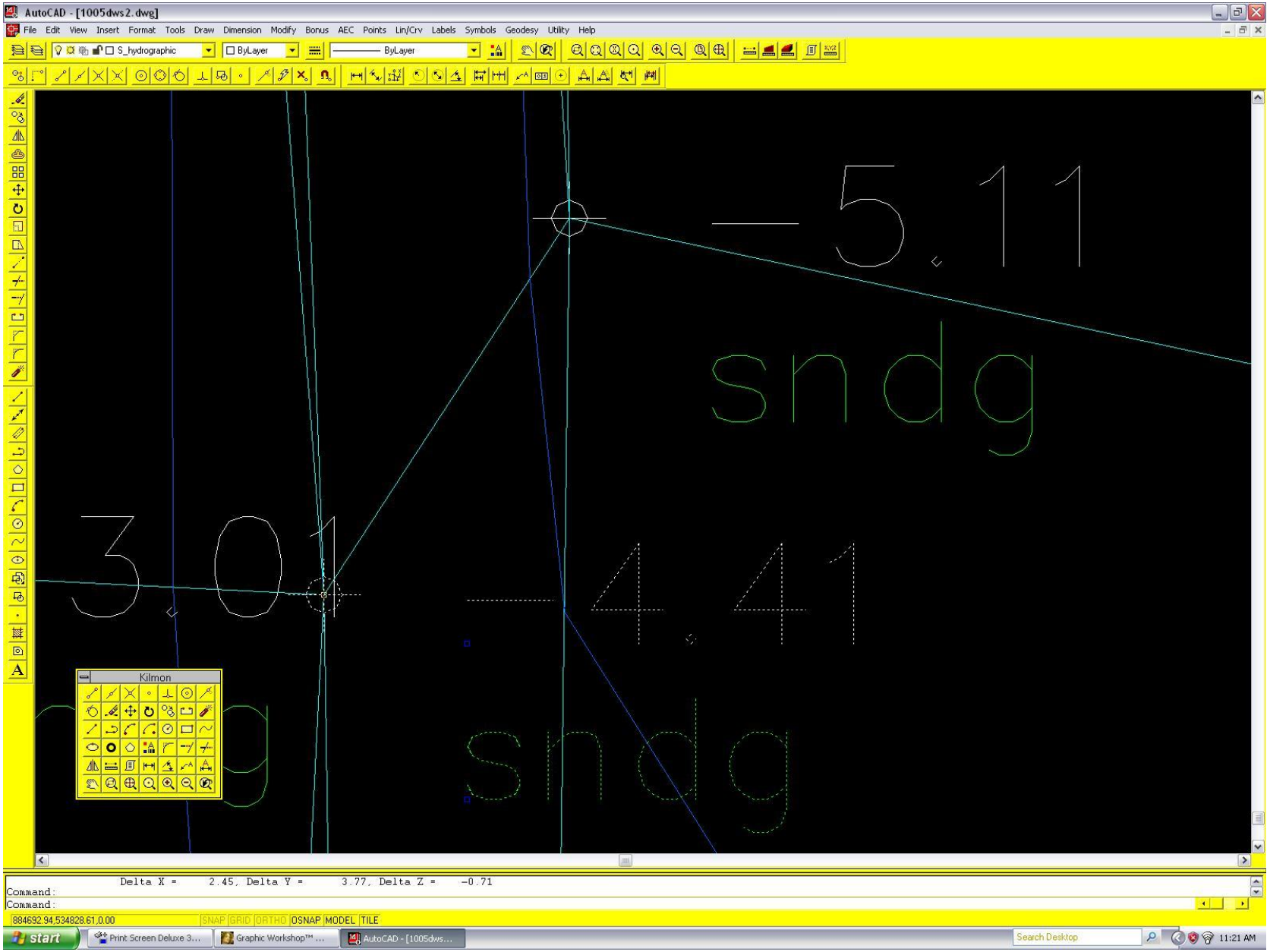

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_probe
ByLayer
ByLayer
−11.05
probe
−11.05
probe
−10.57
probe
−3.72
probe
−9.21
probe
−10.06
probe
−9.68
probe
−10.68
probe
−9.88
probe
−10.79
probe
−11.43
probe
−7.82
probe
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884685.93,534843.27,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:12 AM

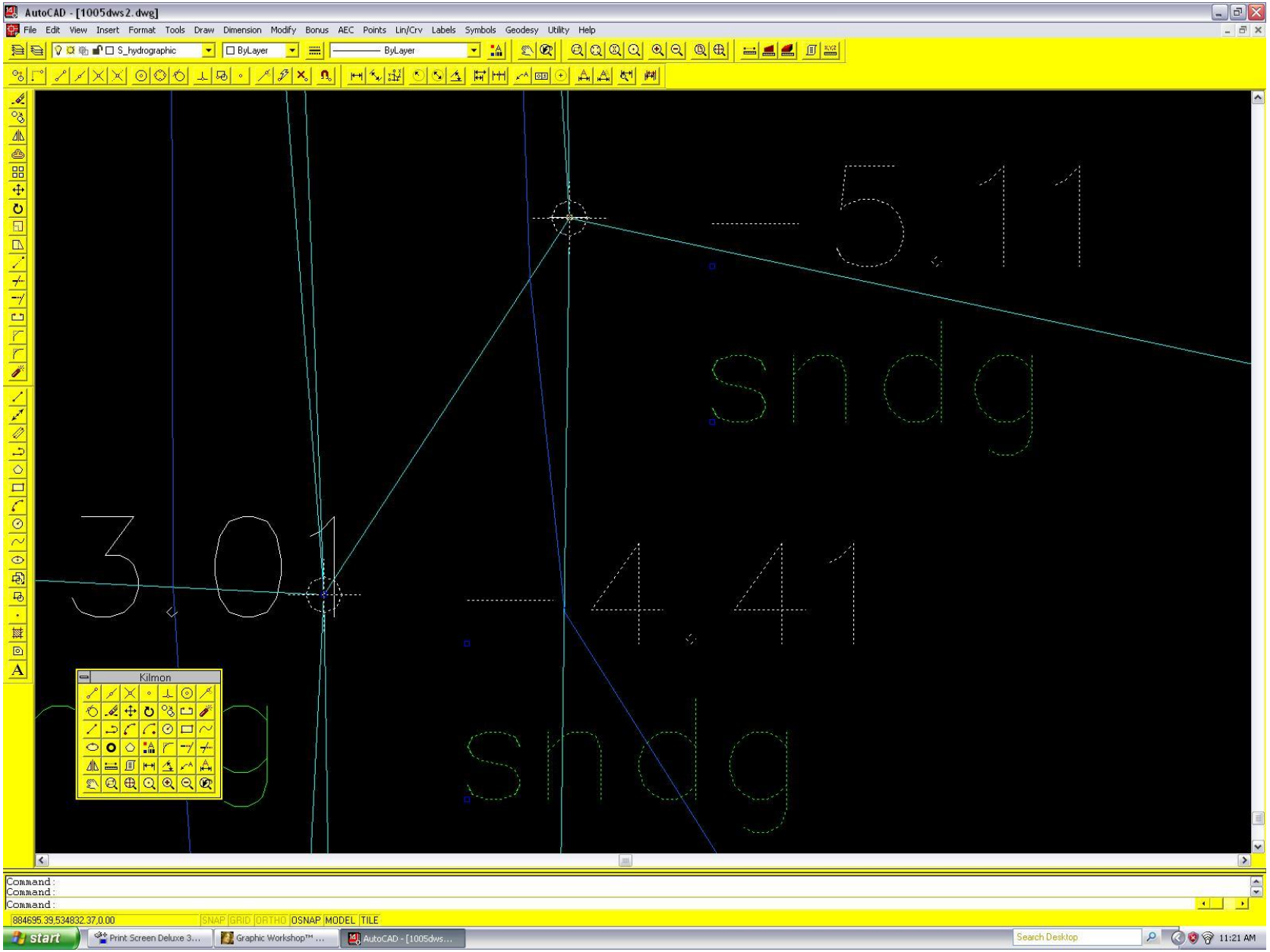

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_probe
ByLayer
ByLayer
−7.82 probe
−11.43 probe
−10.68 probe
−9.88 probe
−10.79 probe
−9.68 probe
−11.05 probe
−11.05 probe
−10.57 probe
−3.72 probe
−9.21 probe
−10.06 probe
Kilmon
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884683.94,534847.86,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:12 AM

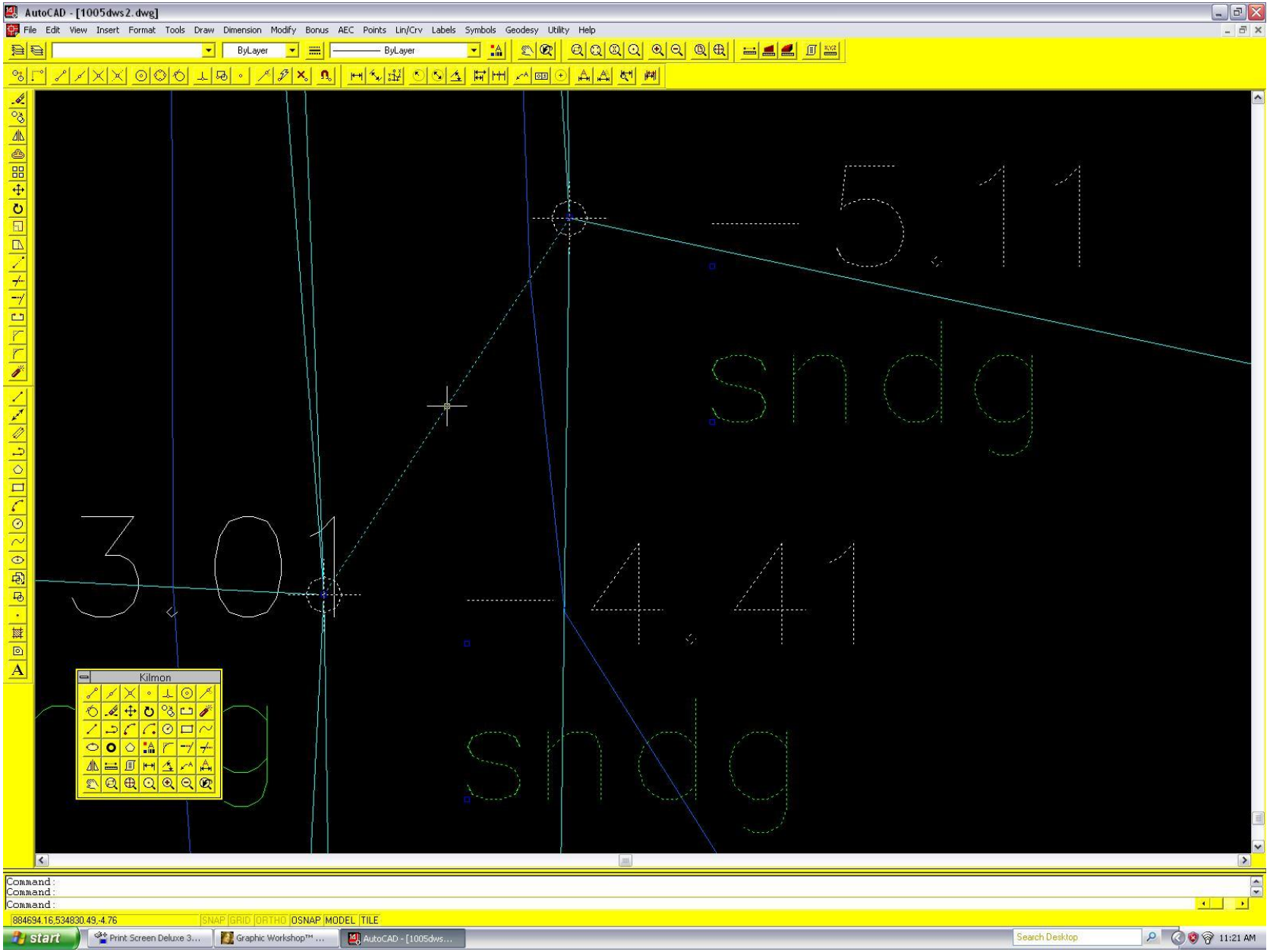

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
2.66
sndg
-1.37
sndg
-3.01
sndg
-4.41
sndg
-5.11
sndg
-5.54
sndg
-5.81
sndg
-5.07
sndg
-2.09
sndg
-1.45
sndg
-2.45
sndg
-2.88
sndg
-1.98
sndg
-0.62
sndg
0.93
sndg
2.70
sndg
Kilmon
Command: u
LAYER CONTROL Regenerating drawing.
Command:
884699.55,534848.14,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:16 AM

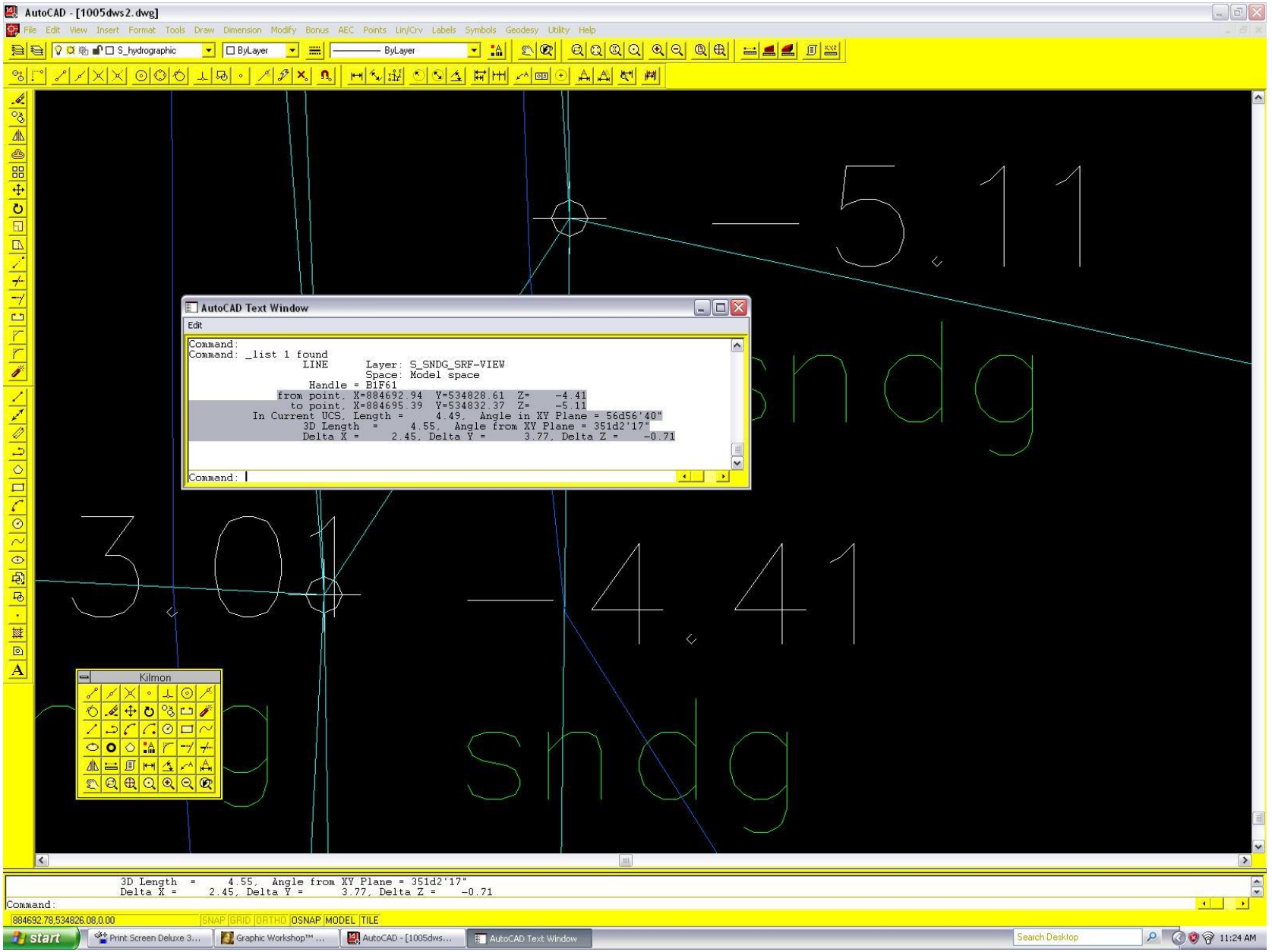

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
-2.66 sndg
-1.37 sndg
-3.01 sndg
-4.41 sndg
-5.11 sndg
-5.54 sndg
-5.81 sndg
-5.07 sndg
-2.09 sndg
-1.45 sndg
-2.45 sndg
-2.88 sndg
-1.98 sndg
-0.62 sndg
-0.93 sndg
-2.70 sndg
Kilmon
LAYER GROUP Regenerating drawing.
Command: Regenerating drawing.
Command: Other corner:
884689.92,534824.57,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:19 AM

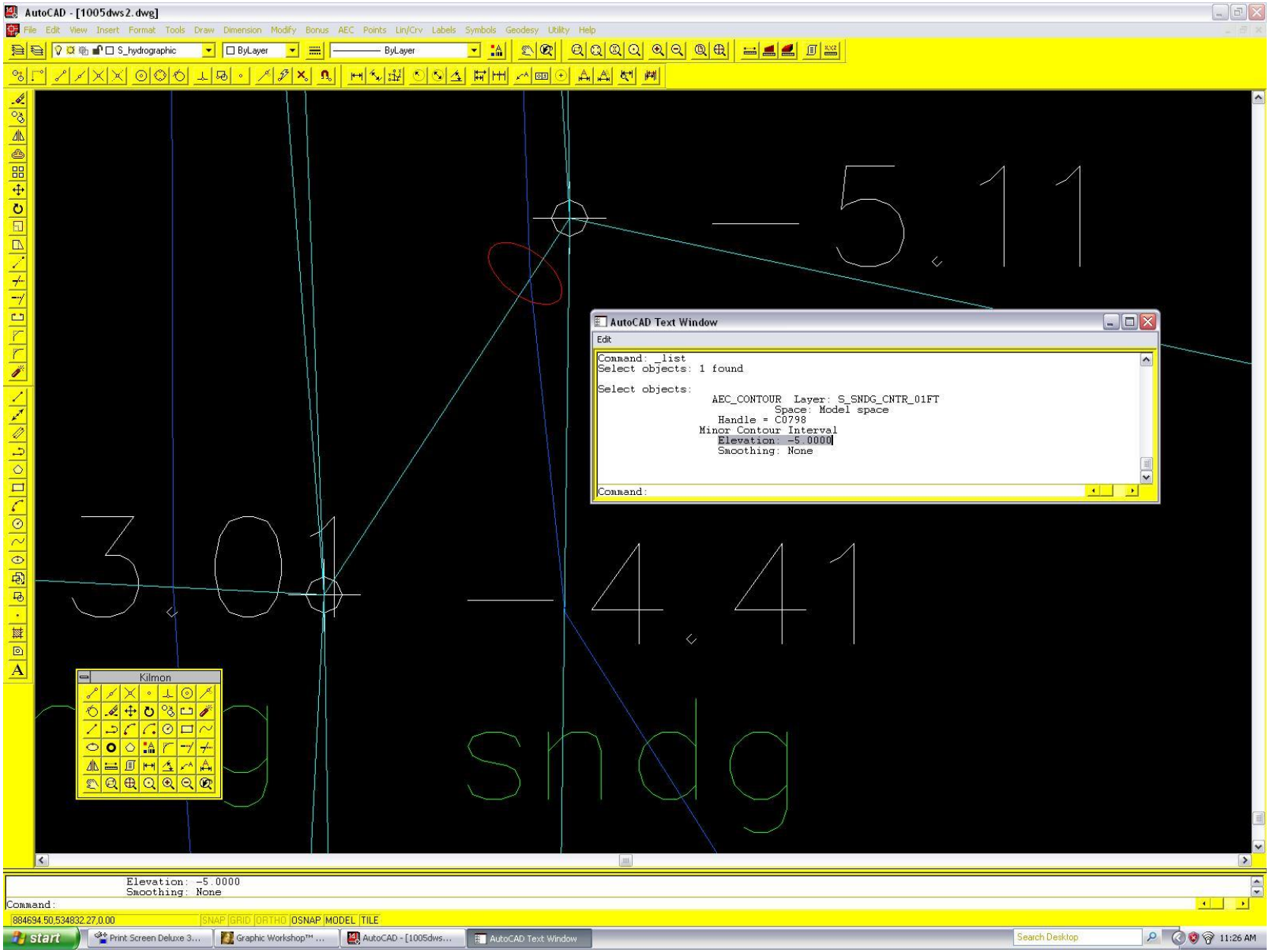

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
5.11
sndg
3.01
4.41
sndg
Kilmon
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _w
First corner: Other corner:
Command:
884691.91,534831.05,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:20 AM

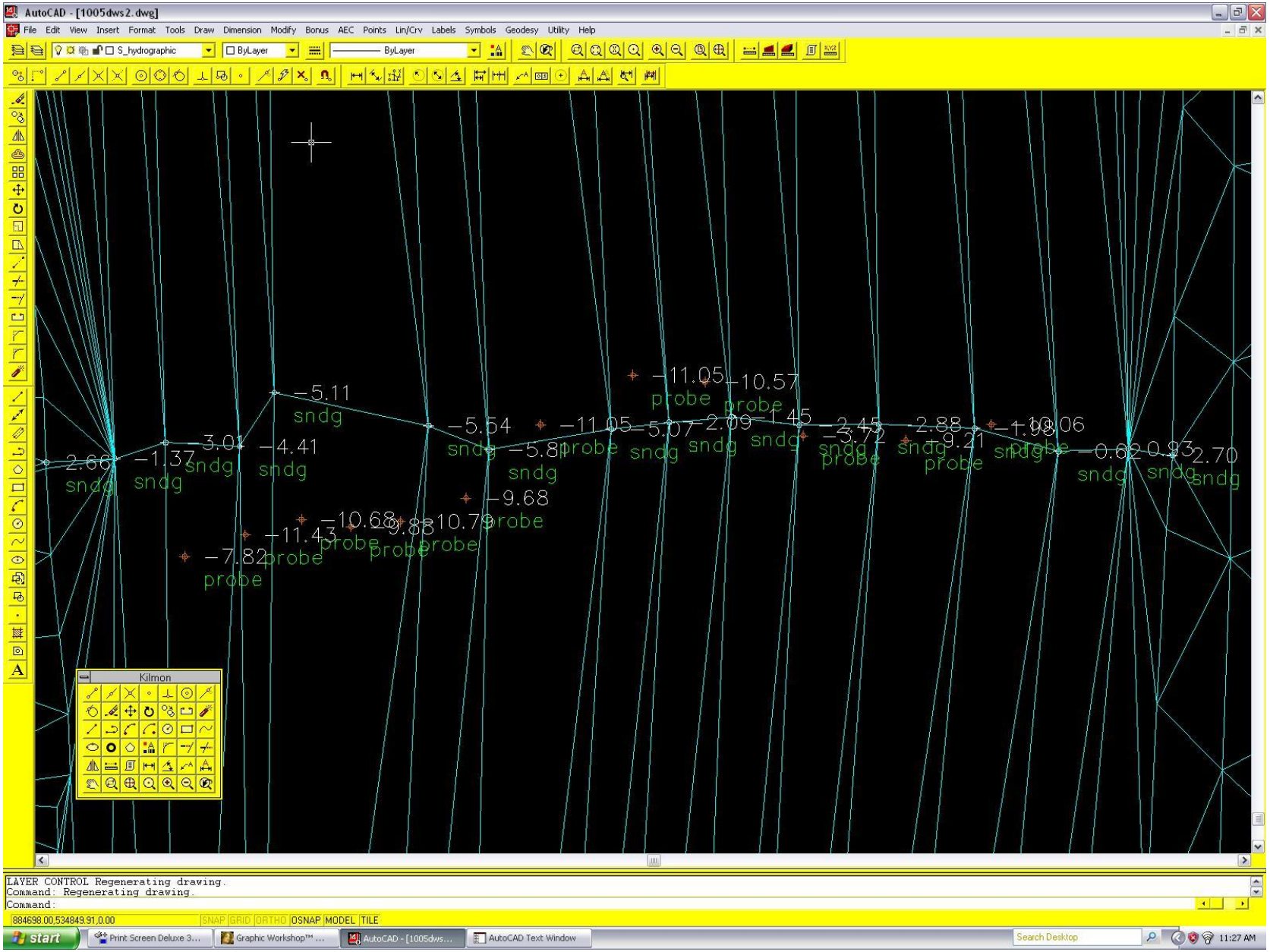

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
5.11
sndg
3.01
4.41
sndg
Kilmon
Delta X = 2.45, Delta Y = 3.77, Delta Z = -0.71
Command:
Command:
884692.94,534828.61,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:21 AM

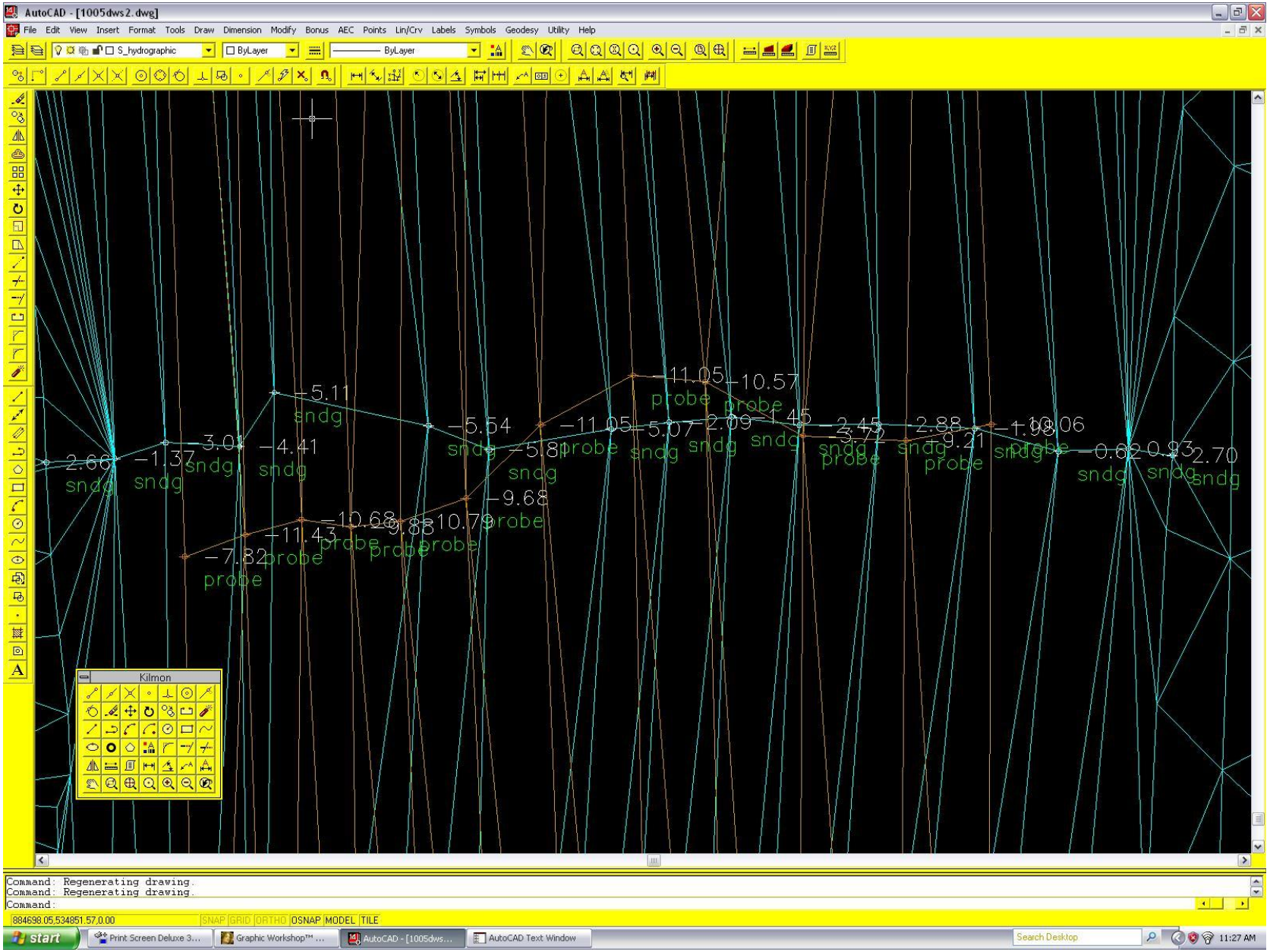

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
5.11
sndg
3.01
4.41
sndg
Kilmon
Command:
Command:
Command:
884695.39,534832.37,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:21 AM

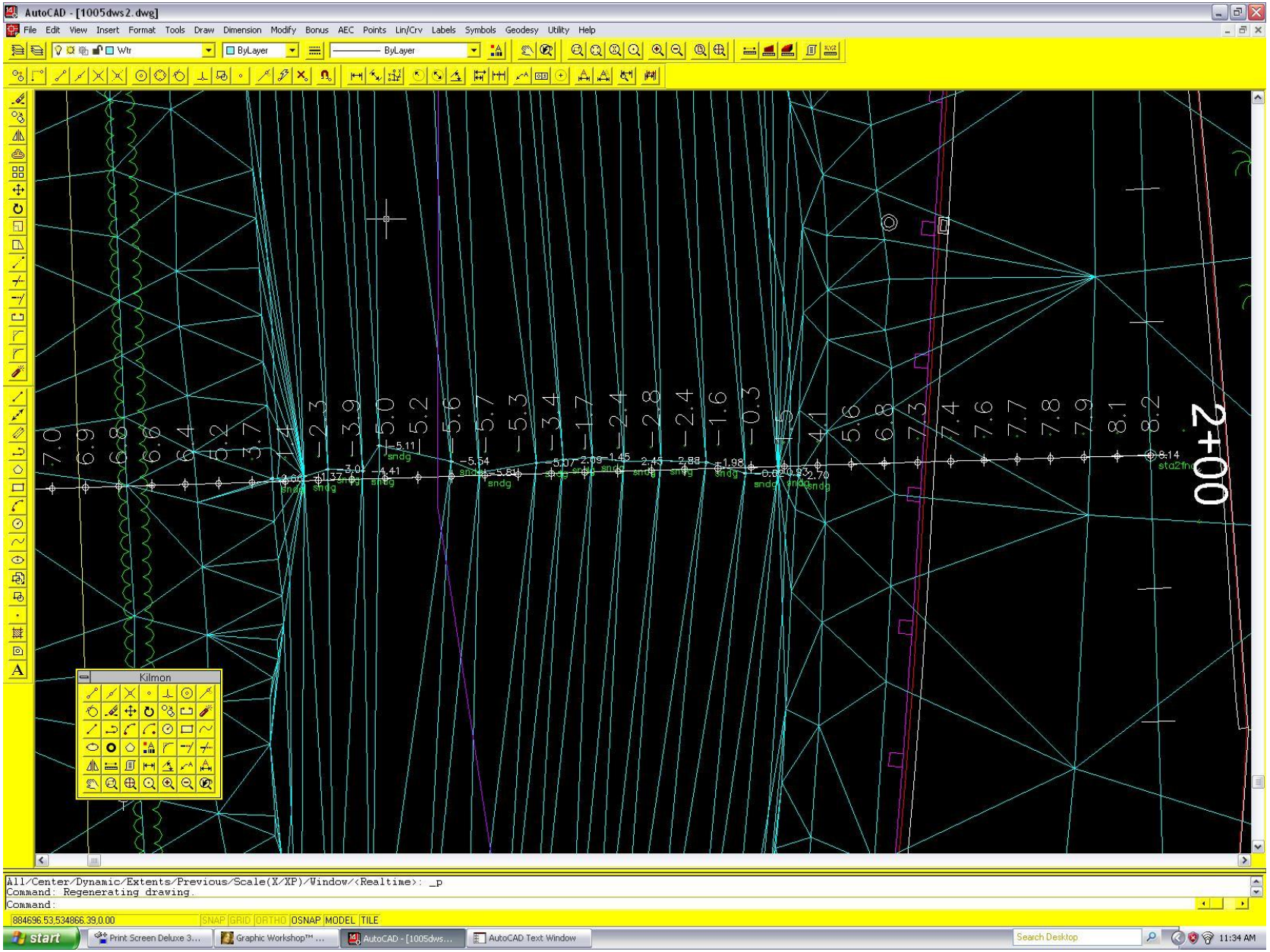

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
5.11
sndg
3.01
4.41
sndg
Kilmon
Command:
Command:
Command:
884694.16,534830.49,-4.76
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
Search Desktop
11:21 AM

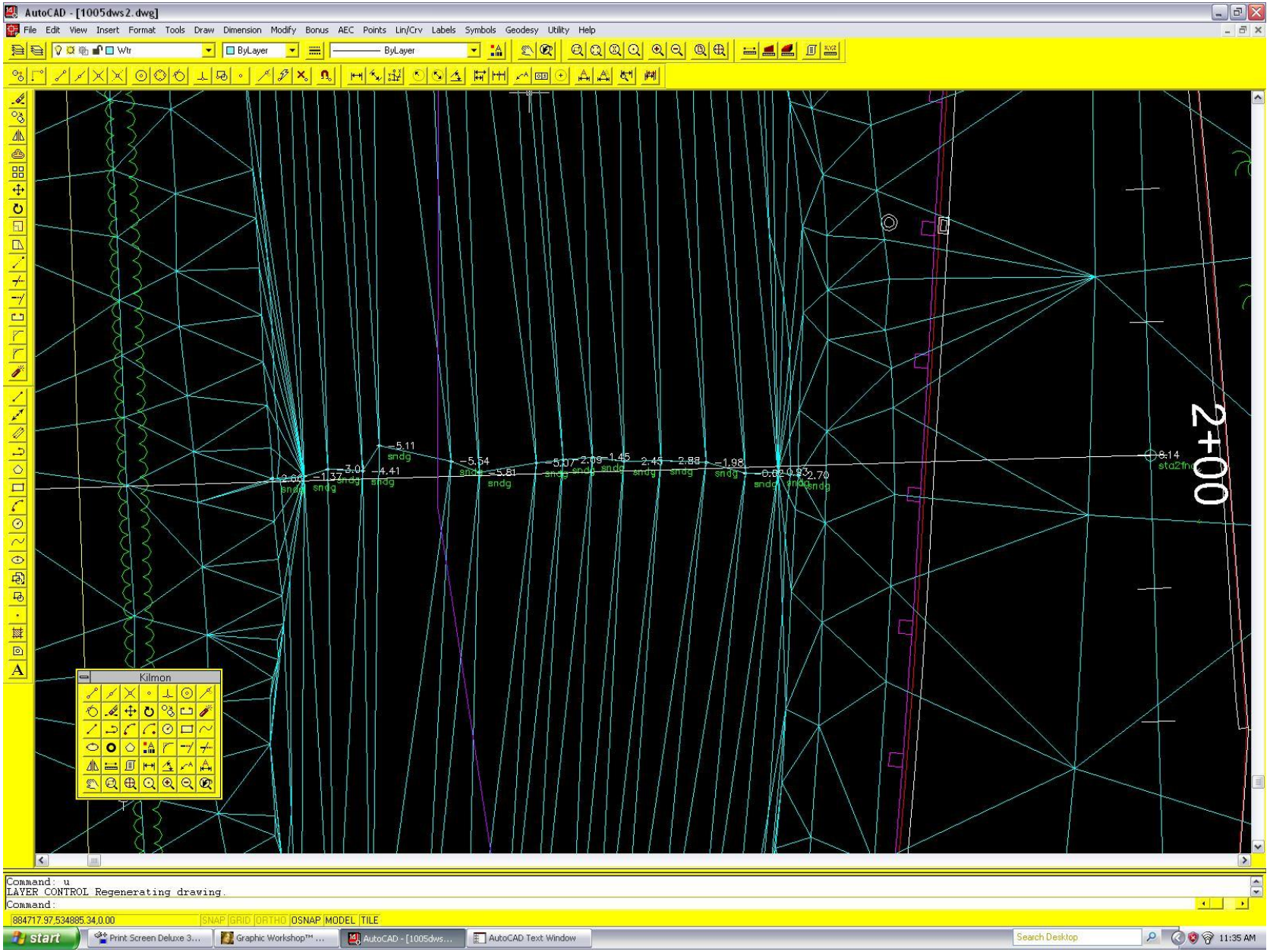

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
AutoCAD Text Window
Edit
Command:
Command: _list 1 found
LINE Layer: S_SNDG_SRF-VIEW
Space: Model space
Handle = B1F61
from point, X=884692.94 Y=534828.61 Z= -4.41
to point, X=884695.39 Y=534832.37 Z= -5.11
In Current UCS, Length = 4.49, Angle in XY Plane = 56d56'40"
3D Length = 4.55, Angle from XY Plane = 351d2'17"
Delta X = 2.45, Delta Y = 3.77, Delta Z = -0.71
Command:
5.11
sndg
3.01
4.41
sndg
Kilmon
3D Length = 4.55, Angle from XY Plane = 351d2'17"
Delta X = 2.45, Delta Y = 3.77, Delta Z = -0.71
Command:
884692.78,534826.08,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:24 AM

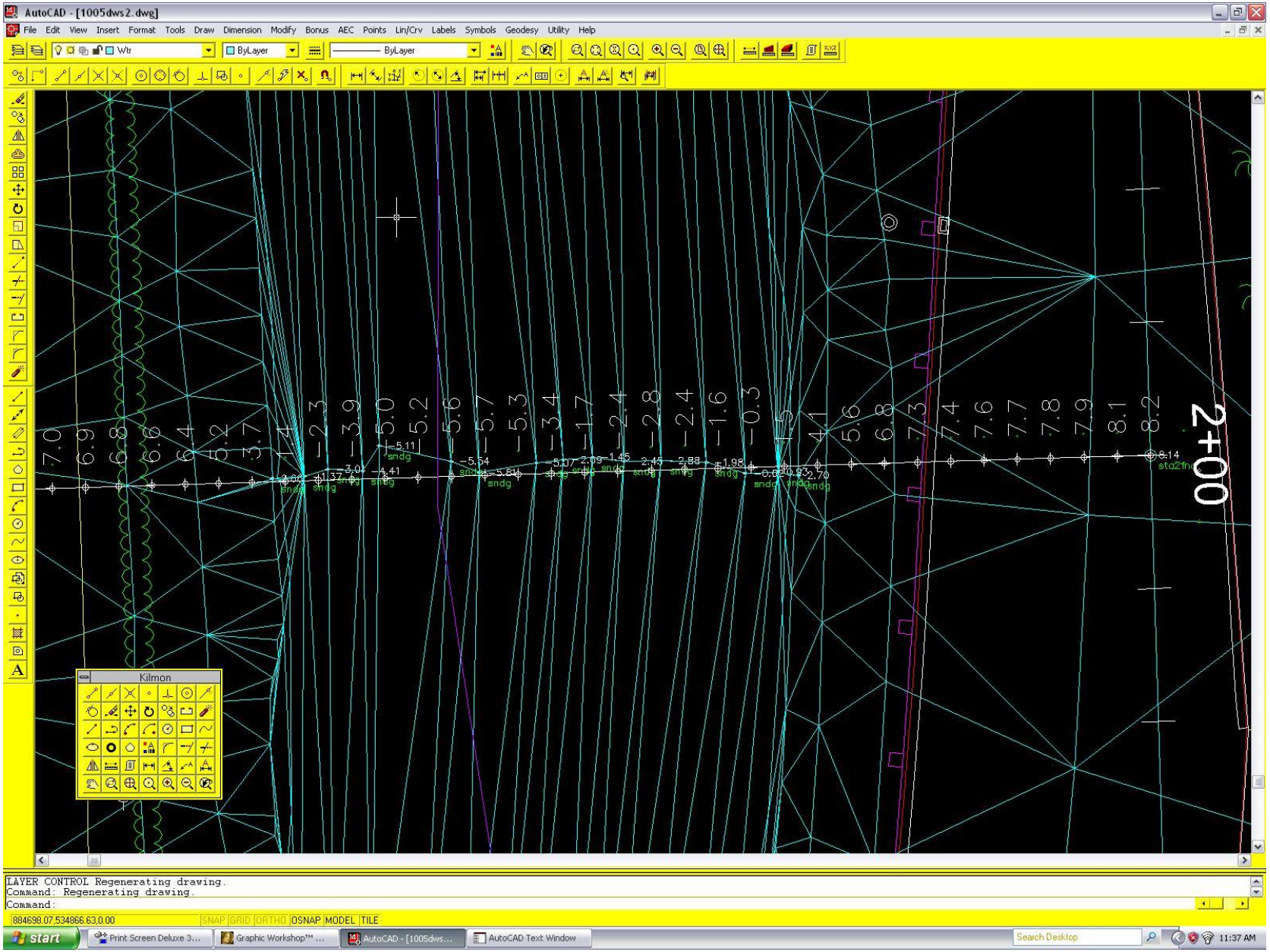

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
5.11
3.01
4.41
sndg
AutoCAD Text Window
Edit
Command: _list
Select objects: 1 found
Select objects:
AEC_CONTOUR Layer: S_SNDG_CNTR_01FT
Space: Model space
Handle = C0798
Minor Contour Interval
Elevation: -5.0000
Smoothing: None
Command:
Kilmon
Elevation: -5.0000
Smoothing: None
Command:
884694.50,534832.27,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:26 AM

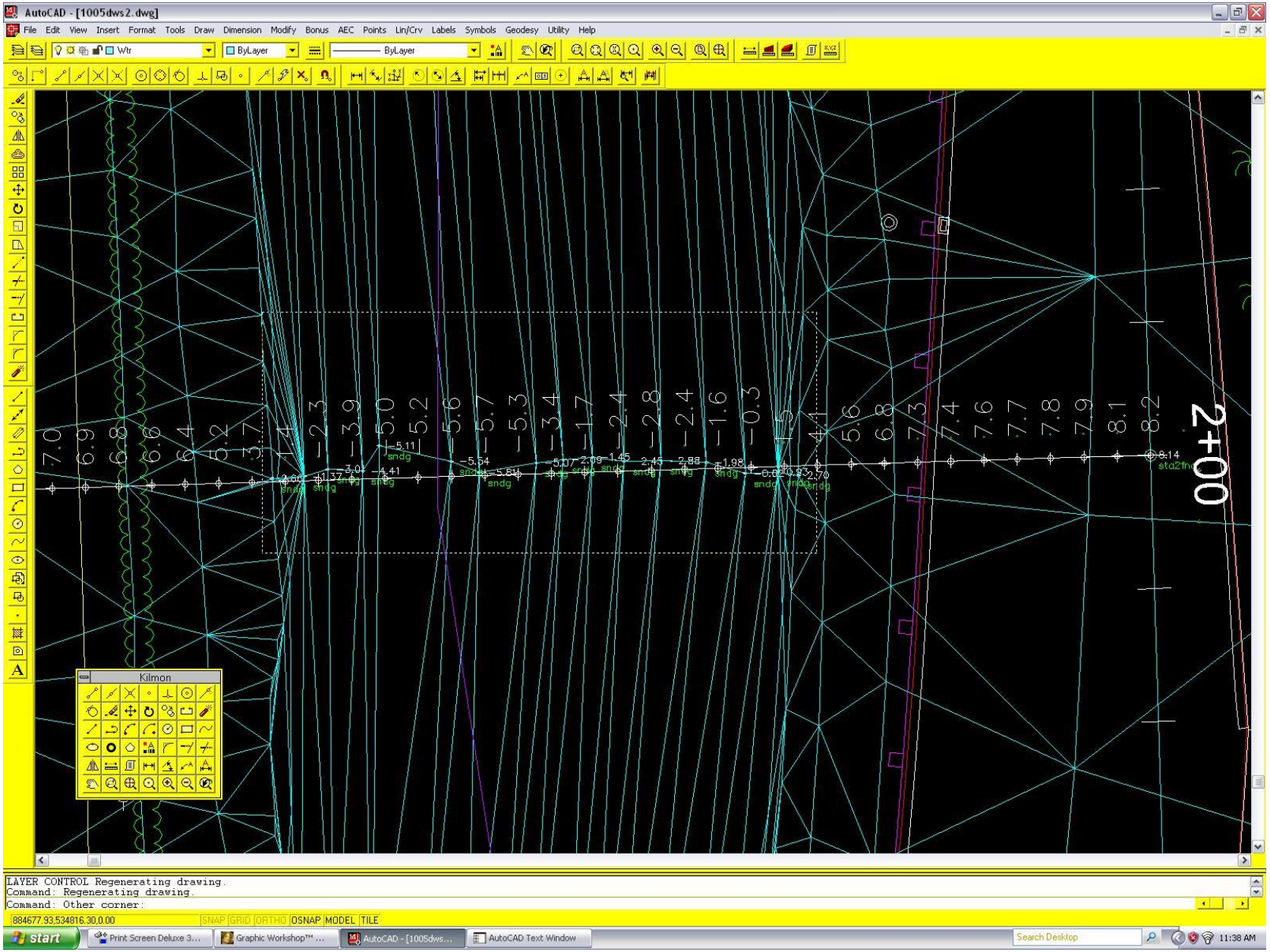

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
-5.11
sndg
-5.54
sndg
-11.05
probe
-10.57
probe
-2.66
sndg
-1.37
sndg
-3.01
sndg
-4.41
sndg
-5.81
sndg
-5.07
sndg
-2.09
sndg
-1.45
sndg
-2.45
sndg
-3.72
probe
-2.88
sndg
-9.21
probe
-1.98
sndg
-10.06
probe
-0.62
sndg
0.93
sndg
2.70
sndg
-9.68
probe
-10.68
probe
-9.88
probe
-10.79
probe
-11.43
probe
-7.82
probe
Kilmon
LAYER CONTROL Regenerating drawing.
Command: Regenerating drawing.
Command:
884698.00,534849.91,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:27 AM

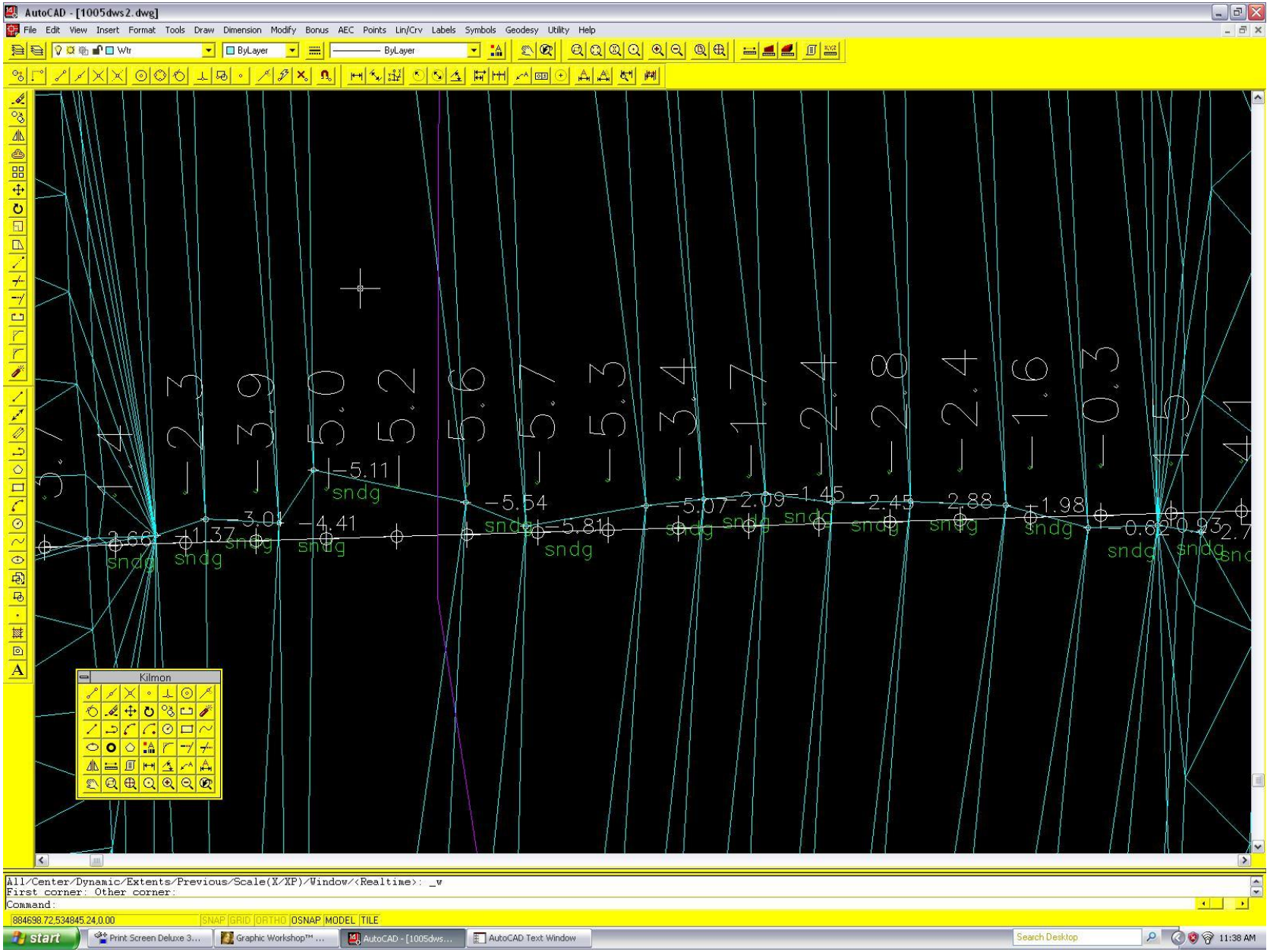

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
S_hydrographic
ByLayer
ByLayer
Kilmon
2.66 sndg
-1.37 sndg
-3.01 sndg
-4.41 sndg
-5.11 sndg
-5.54 sndg
-5.8 sndg
-9.68 sndg
-11.05 probe
-10.57 probe
-5.07 sndg
-2.09 sndg
-1.45 sndg
-2.45 sndg
-3.72 probe
-2.88 sndg
-9.21 probe
-1.98 sndg
-10.06 probe
-0.82 sndg
0.93 sndg
2.70 sndg
-10.68 probe
-9.88 probe
-10.79 probe
-11.43 probe
-7.82 probe
Command: Regenerating drawing.
Command: Regenerating drawing.
Command:
884698.05,534851.57,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:27 AM

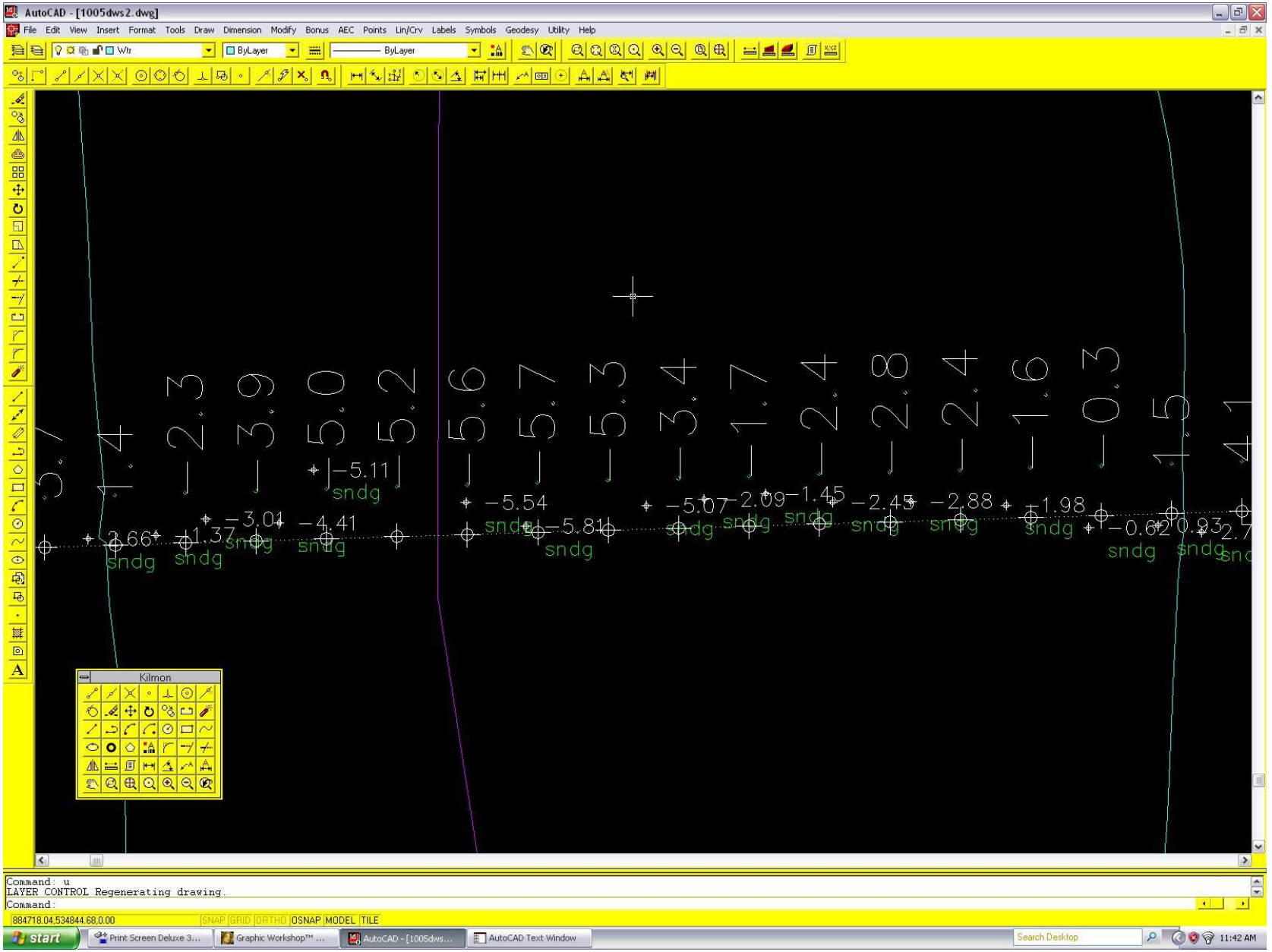

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
2+00
Kilmon
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _p
Command: Regenerating drawing.
Command:
884696.53,534866.39,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:34 AM

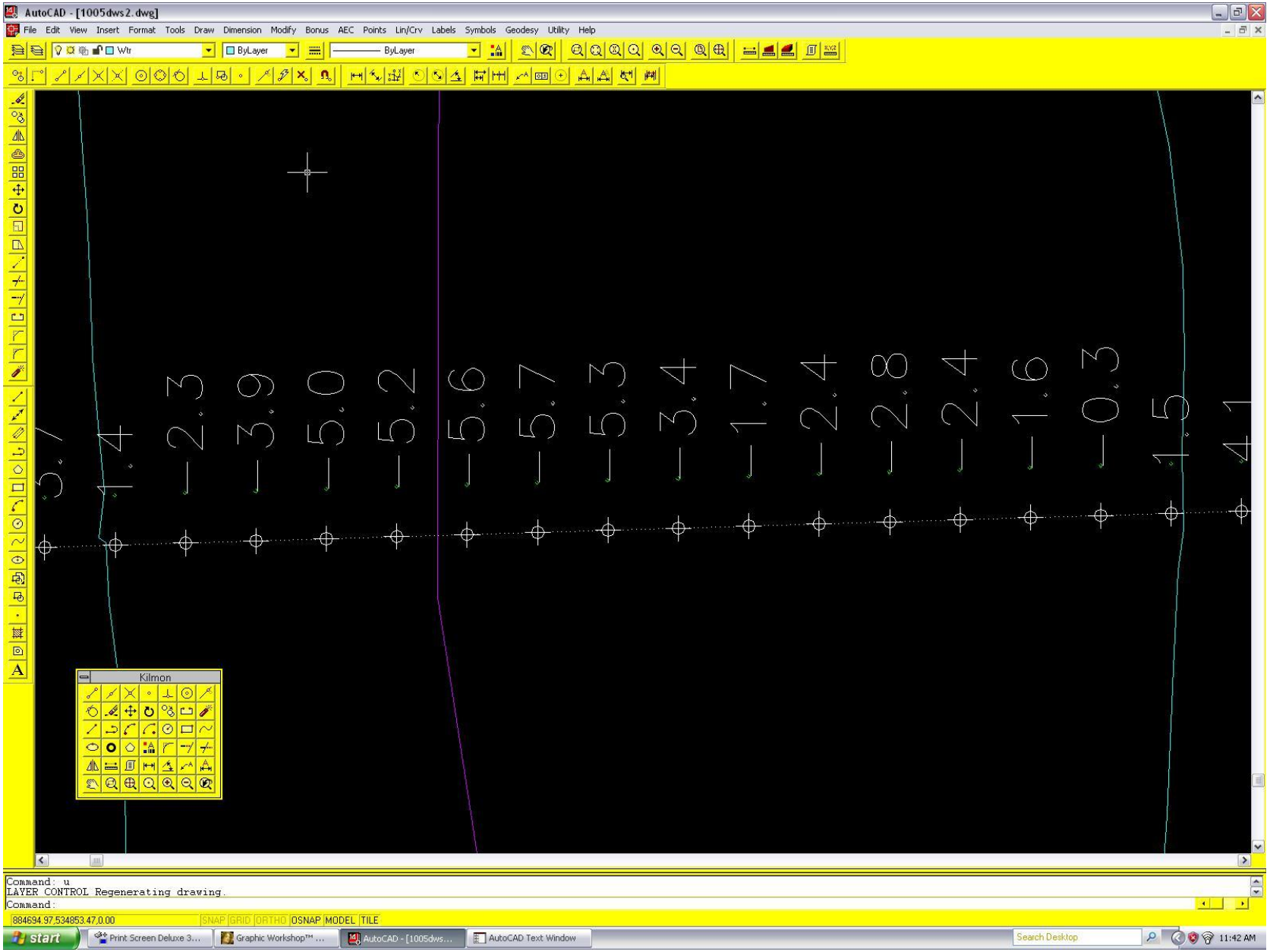

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
2+00
Kilmon
Command: u
LAYER CONTROL Regenerating drawing.
Command:
884717.97,534885.34,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:35 AM

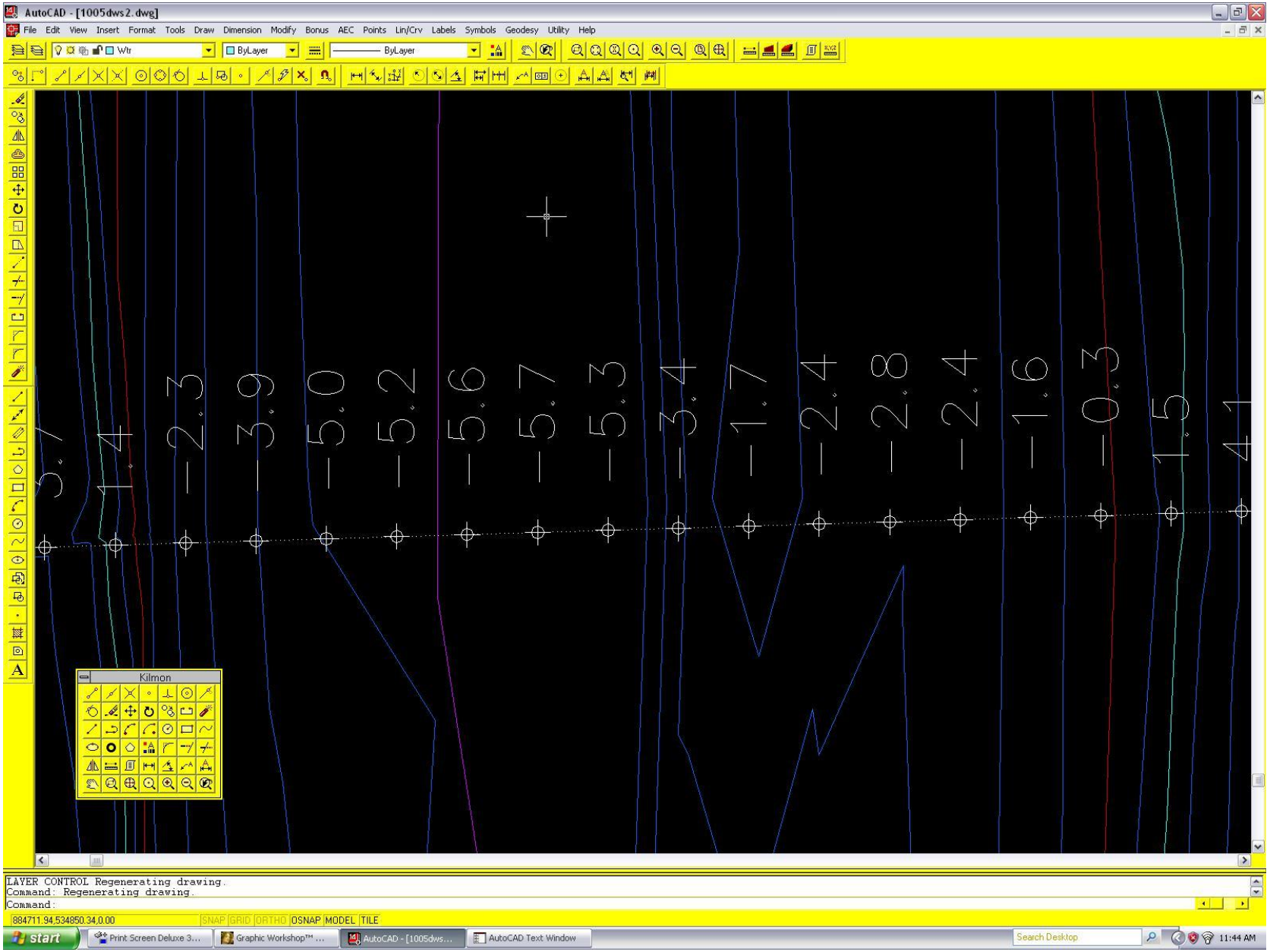

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
2+00
LAYER CONTROL Regenerating drawing.
Command: Regenerating drawing.
Command:
884698.07,534866.63,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:37 AM

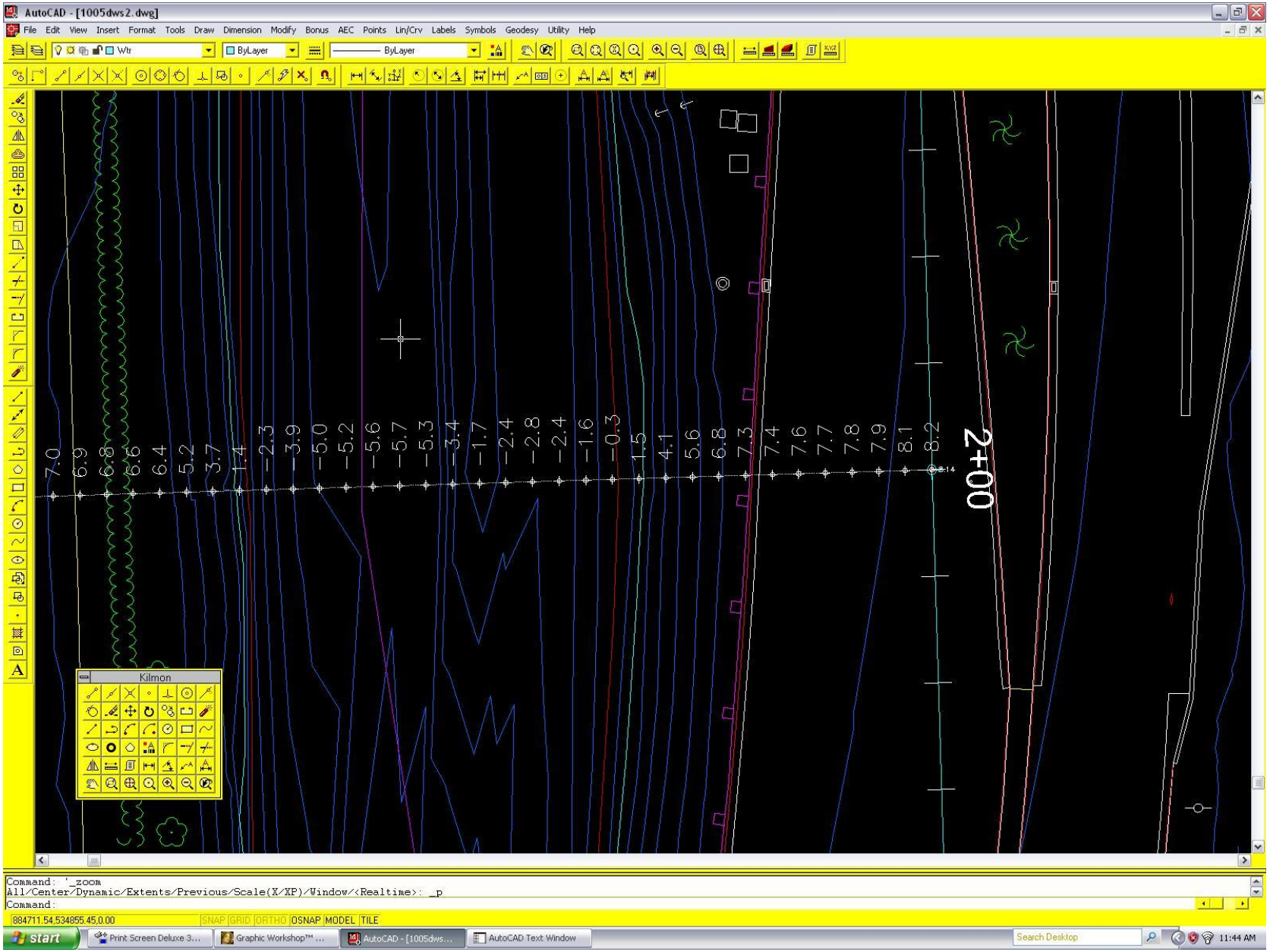

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
2+00
LAYER CONTROL Regenerating drawing.
Command: Regenerating drawing.
Command: Other corner:
884677.93,534816.30,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:38 AM

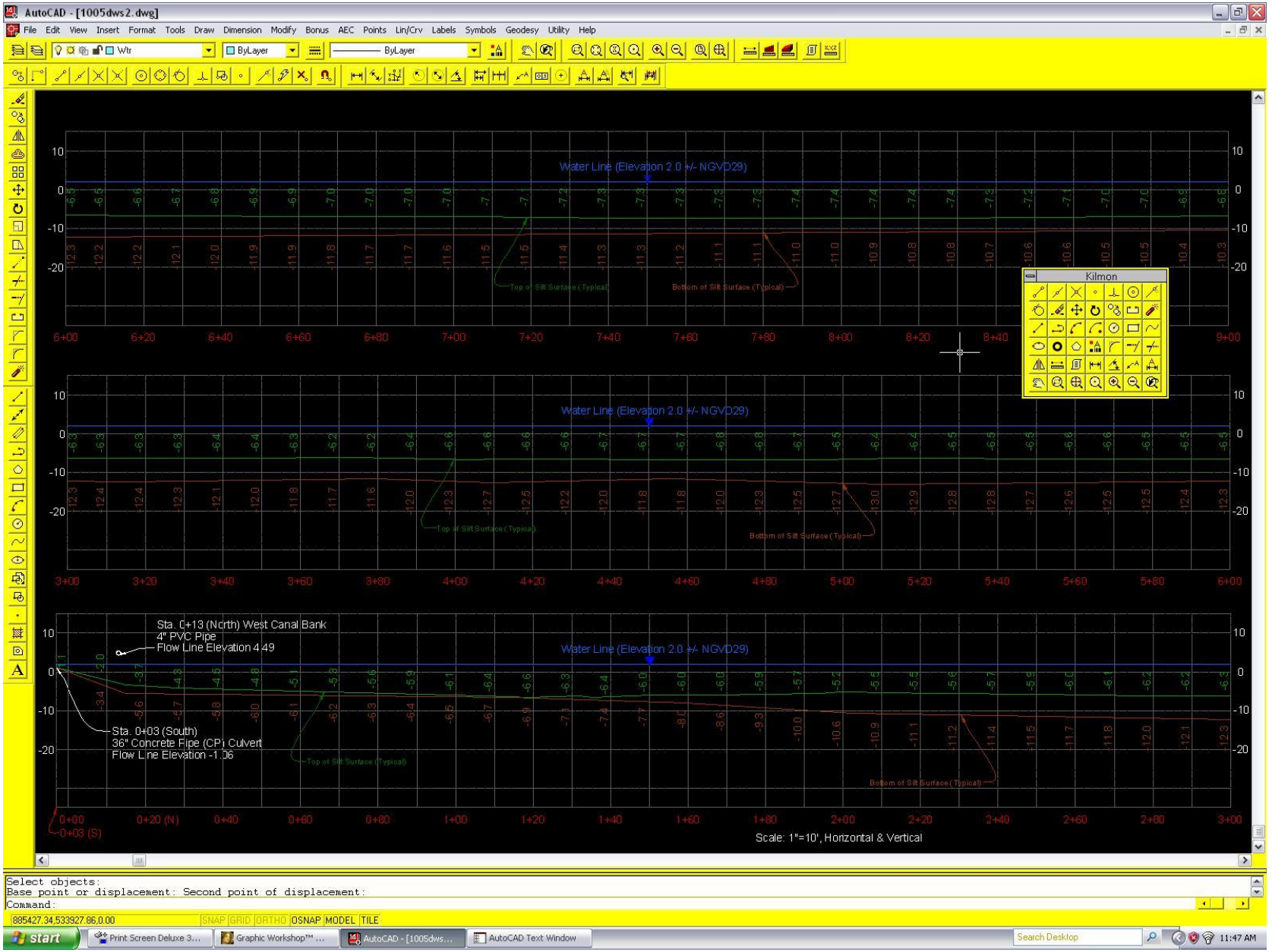

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
-2.3
-3.9
-5.0
-5.2
-5.6
-5.7
-5.3
-3.4
-1.7
-2.4
-2.8
-2.4
-1.6
-0.3
-5.11
sndg
-5.54
-5.81
-5.07
2.09
1.45
2.45
2.88
1.98
0.62
0.93
3.66
1.37
3.04
4.41
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _w
First corner: Other corner:
Command:
884698.72,534845.24,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:38 AM

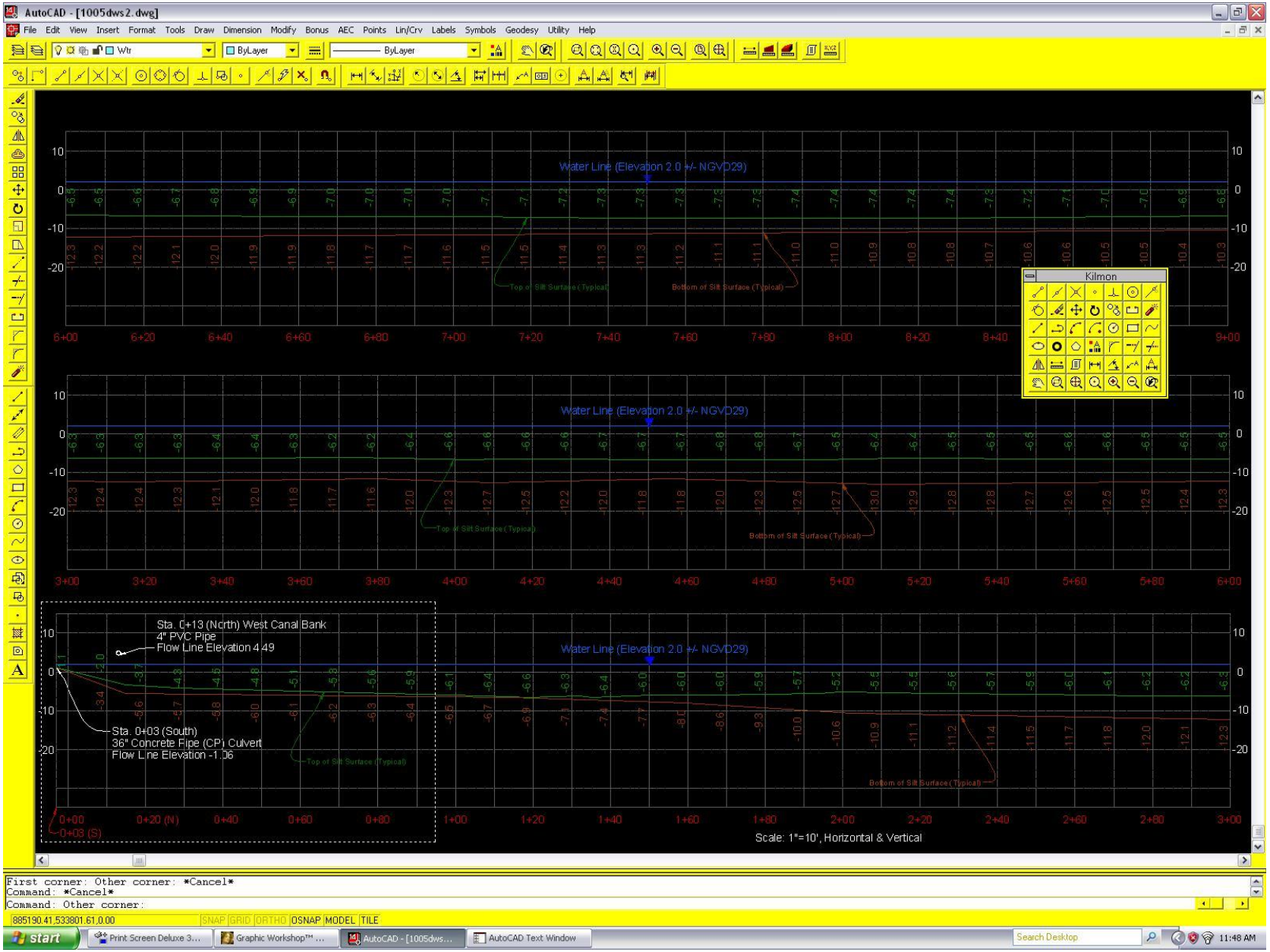

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
5.7 4.4 2.3 3.9 5.0 5.2 5.6 5.7 5.3 3.4 1.7 2.4 2.8 2.4 1.6 0.3 1.5 4.1
-5.11
sndg
-5.54
-5.81
-5.07
-2.09
-1.45
-2.45
-2.88
1.98
-0.62
0.93
2.7
3.66
1.37
-3.01
-4.41
Kilmon
Command: u
LAYER CONTROL Regenerating drawing.
Command:
884718.04,534844.68,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:42 AM

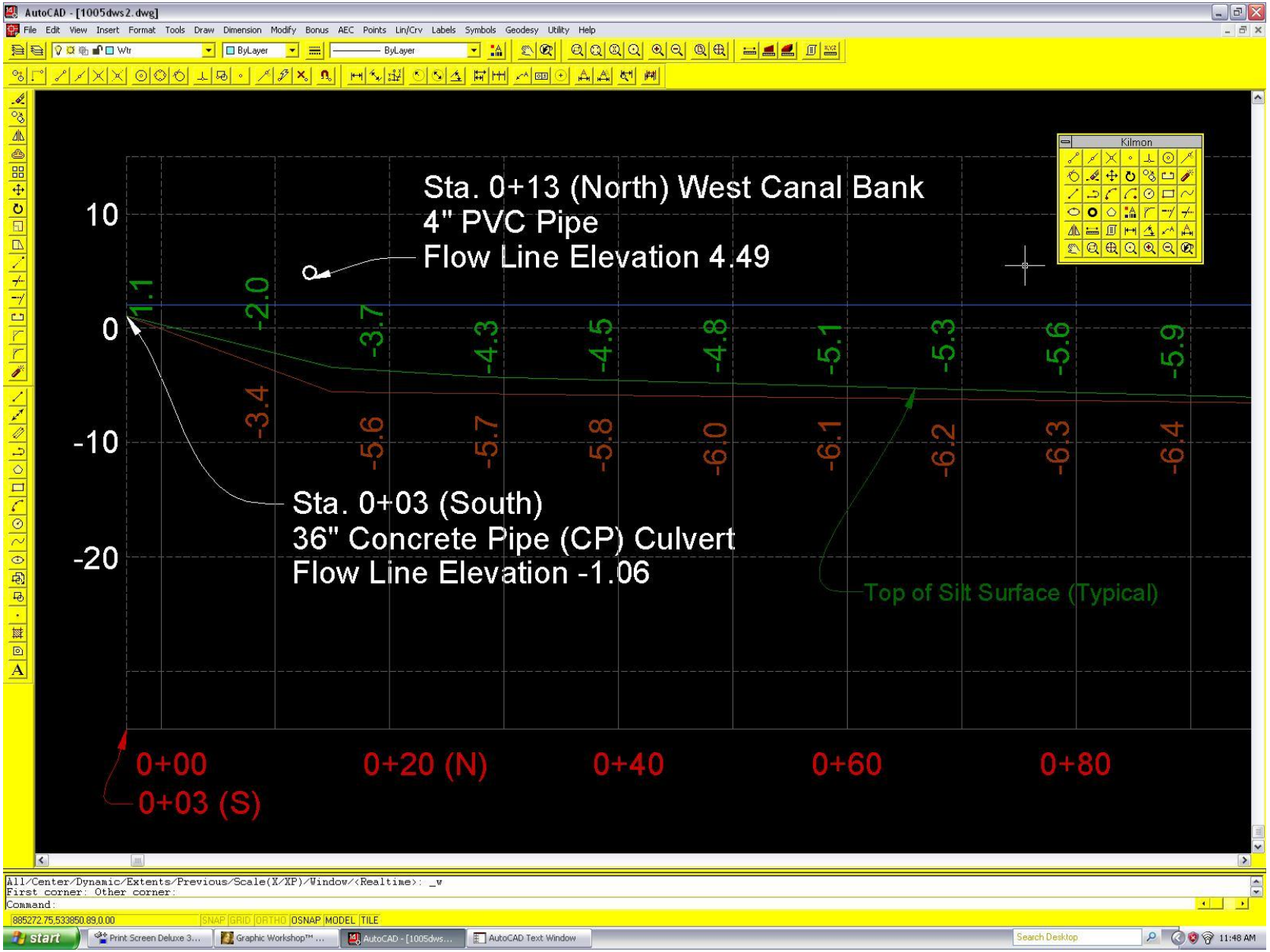

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
-3.7
-1.4
-2.3
-3.9
-5.0
-5.2
-5.6
-5.7
-5.3
-3.4
-1.7
-2.4
-2.8
-2.4
-1.6
-0.3
1.5
4.1
Kilmon
Command: u
LAYER CONTROL Regenerating drawing.
Command:
884694.97,534853.47,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:42 AM

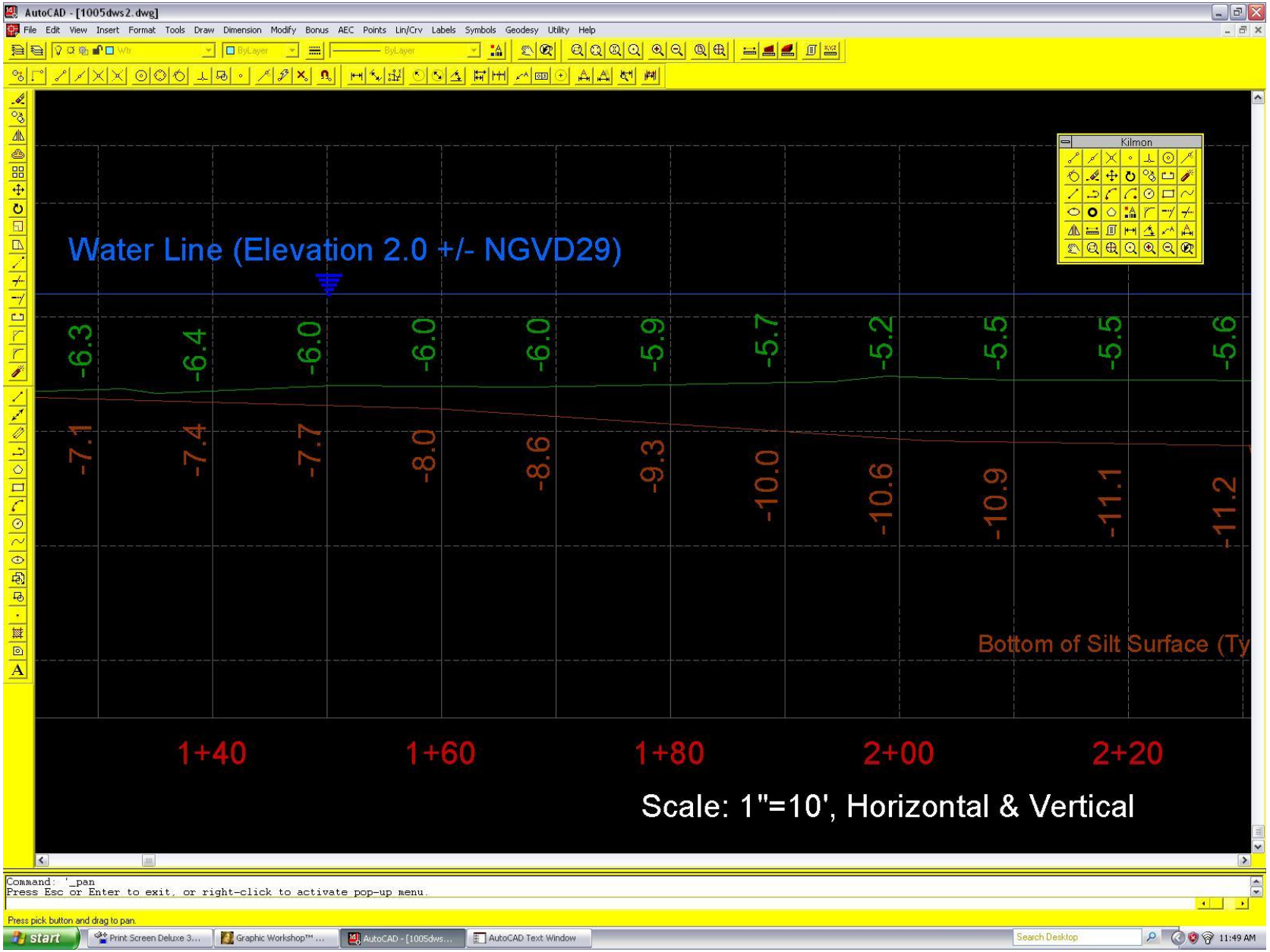

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
-0.7
-1.4
-2.3
-3.9
-5.0
-5.2
-5.6
-5.7
-5.3
-3.4
-1.7
-2.4
-2.8
-2.4
-1.6
-0.3
-1.5
-4.1
Kilmon
LAYER CONTROL Regenerating drawing.
Command: Regenerating drawing.
Command:
884711.94,534850.34,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:44 AM

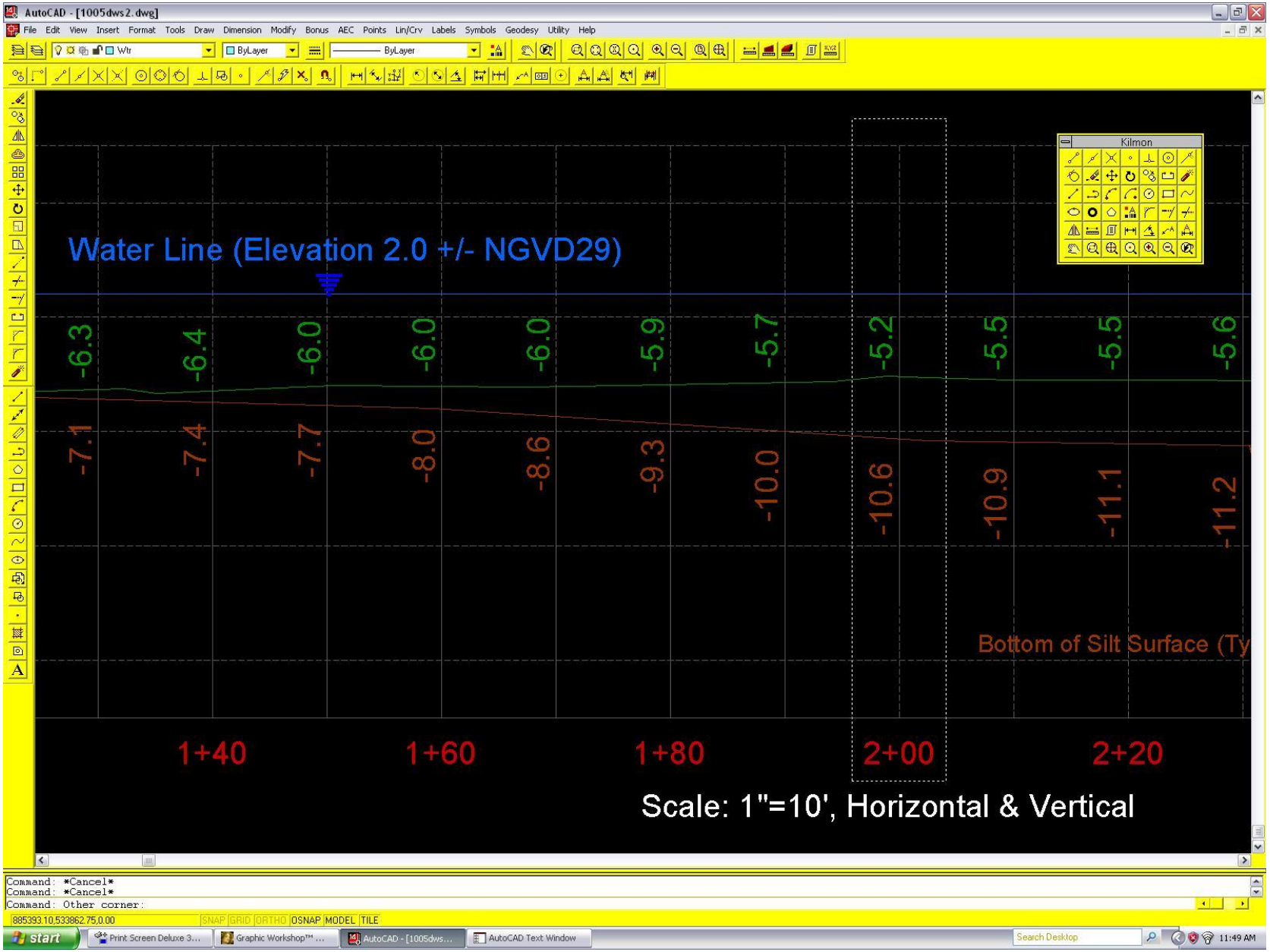

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
ByLayer
ByLayer
7.0 6.9 6.8 6.6 6.4 5.2 3.7 1.4 -2.3 -3.9 -5.0 -5.2 -5.6 -5.7 -5.3 -3.4 -1.7 -2.4 -2.8 -2.4 -1.6 -0.3 1.5 4.1 5.6 6.8 7.3 7.4 7.6 7.7 7.8 7.9 8.1 8.2
2+00
Kilmon
Command: '_zoom
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _p
Command:
884711.54,534855.45,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:44 AM

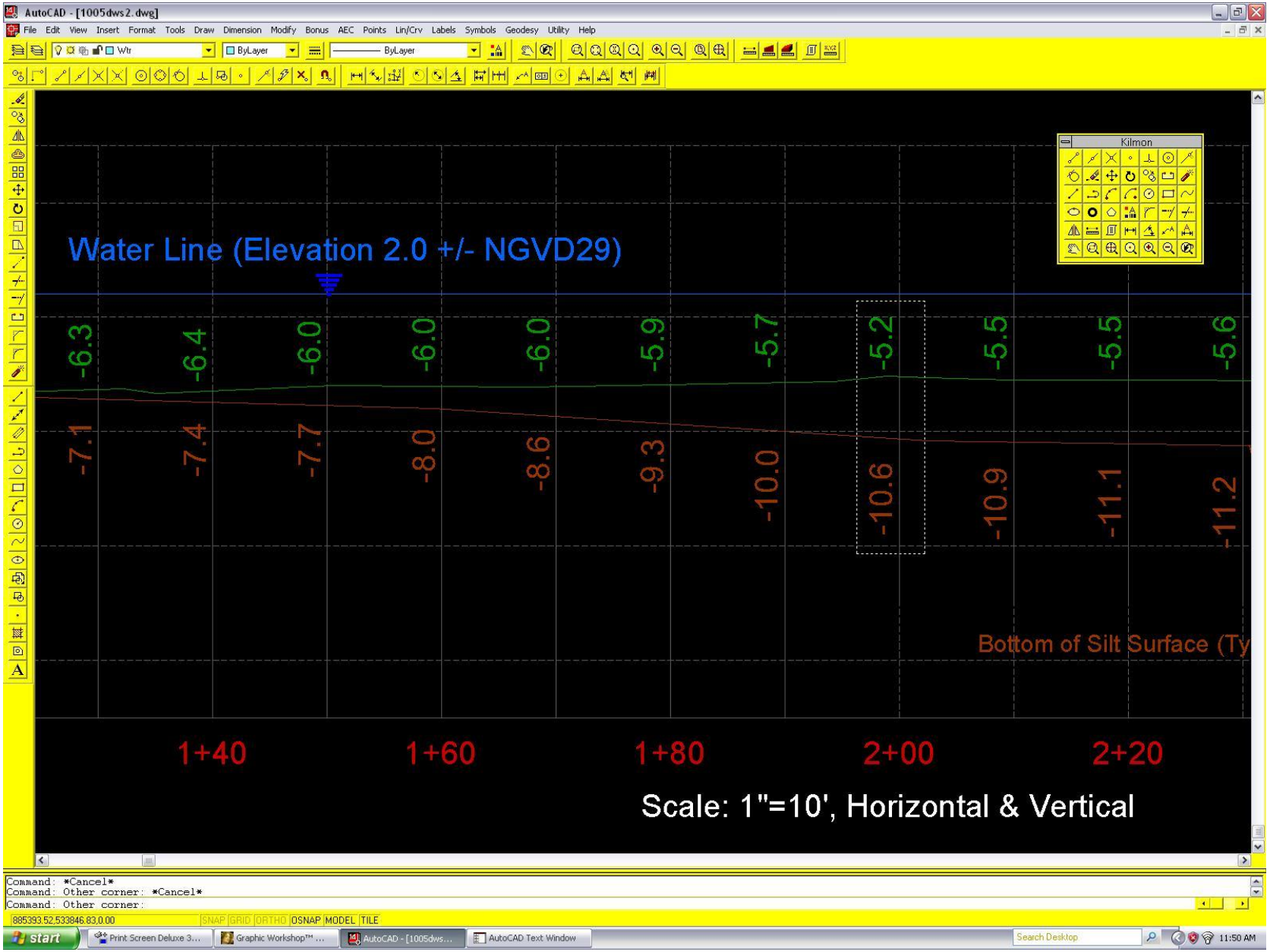

AutoCAD - [1005dws2.dwg]
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Kilmon
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Sta. 0+13 (North) West Canal Bank
4" PVC Pipe
Flow Line Elevation 4.49
Water Line (Elevation 2.0 +/- NGVD29)
Sta. 0+03 (South)
36" Concrete Pipe (CP) Culvert
Flow Line Elevation -1.06
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Scale: 1"=10', Horizontal & Vertical
Select objects:
Base point or displacement: Second point of displacement:
Command:
885427.34,533927.86,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:47 AM

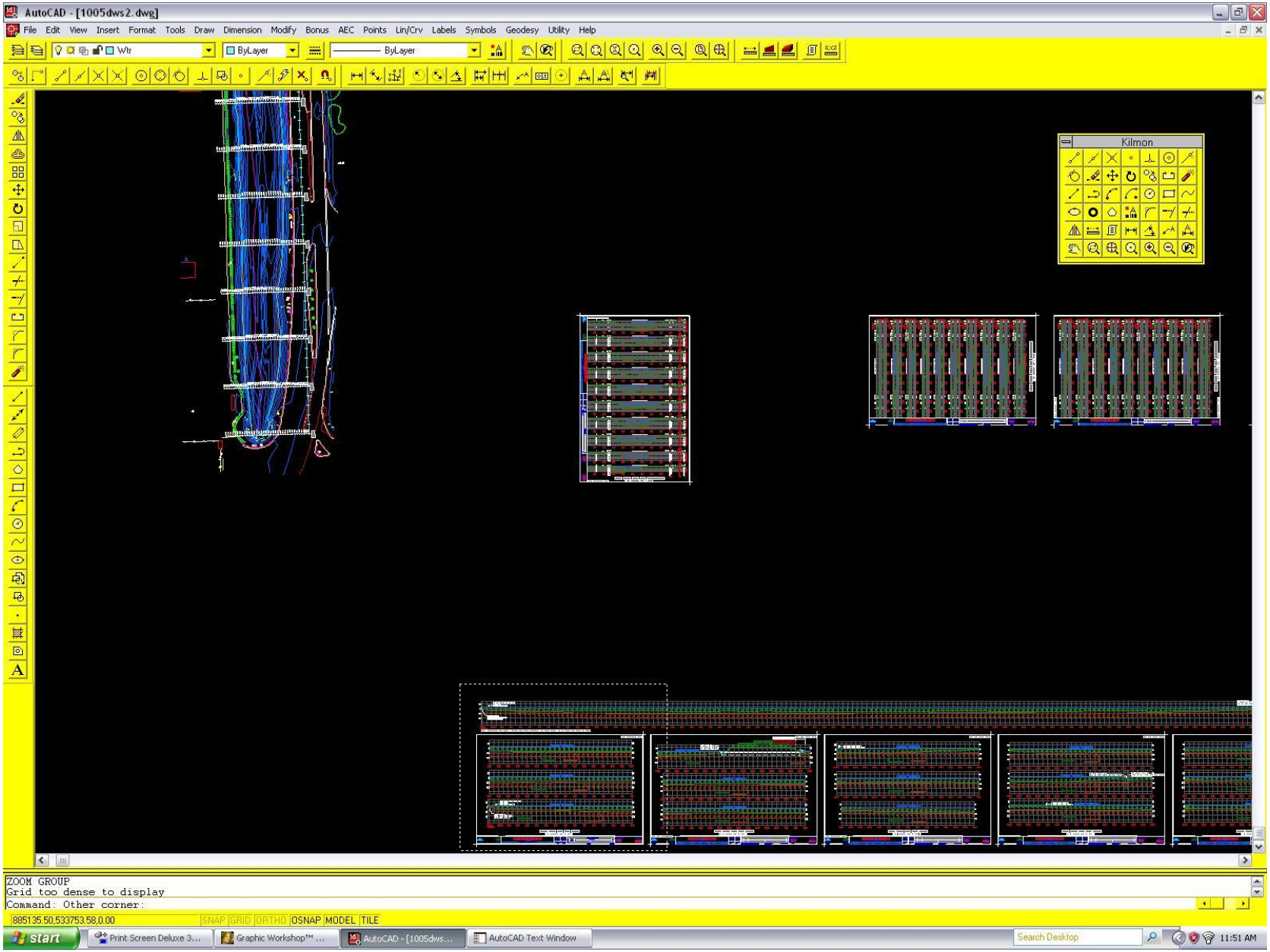

AutoCAD - [1005dws2.dwg]
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Kilmon
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Sta. 0+13 (North) West Canal Bank
4" PVC Pipe
Flow Line Elevation 4.49
Water Line (Elevation 2.0 +/- NGVD29)
Sta. 0+03 (South)
36" Concrete Pipe (CP) Culvert
Flow Line Elevation -1.06
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Scale: 1"=10', Horizontal & Vertical
First corner: Other corner: *Cancel*
Command: *Cancel*
Command: Other corner:
885190.41,533801.61,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:48 AM

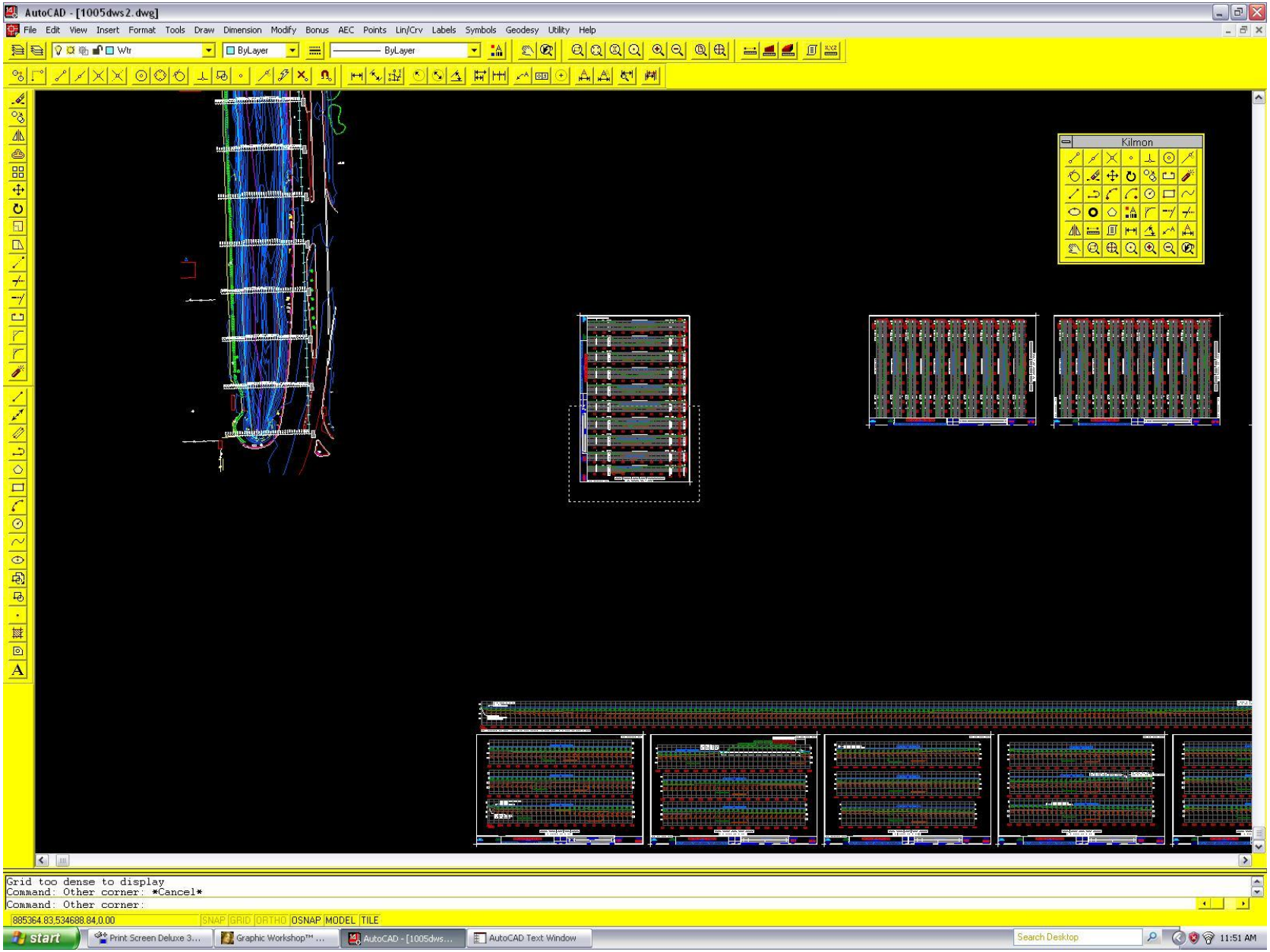

AutoCAD - [1005dws2.dwg]
Sta. 0+13 (North) West Canal Bank
4" PVC Pipe
Flow Line Elevation 4.49
Sta. 0+03 (South)
36" Concrete Pipe (CP) Culvert
Flow Line Elevation -1.06
Top of Silt Surface (Typical)
10
0
-10
-20
-1.1
-2.0
-3.7
-4.3
-4.5
-4.8
-5.1
-5.3
-5.6
-5.9
-3.4
-5.6
-5.7
-5.8
-6.0
-6.1
-6.2
-6.3
-6.4
0+00
0+03 (S)
0+20 (N)
0+40
0+60
0+80
Kilmon
All/Center/Dynamic/Extents/Previous/Scale(X/XP)/Window/<Realtime>: _w
First corner: Other corner:
Command:
885272.75,533850.89,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:48 AM

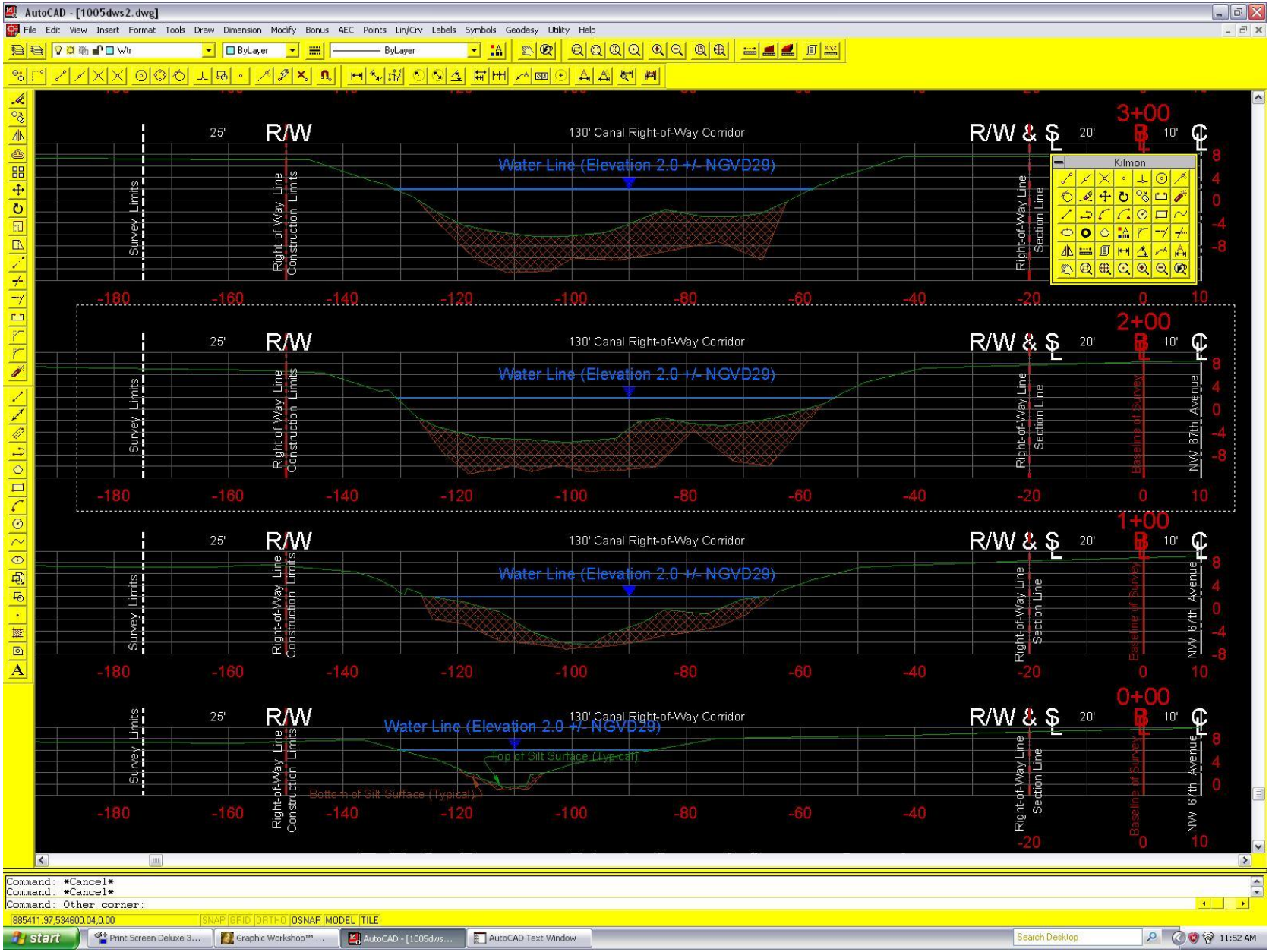

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
Water Line (Elevation 2.0 +/- NGVD29)
-6.3
-6.4
-6.0
-6.0
-6.0
-5.9
-5.7
-5.2
-5.5
-5.5
-5.6
-7.1
-7.4
-7.7
-8.0
-8.6
-9.3
-10.0
-10.6
-10.9
-11.1
-11.2
Bottom of Silt Surface (Ty
1+40
1+60
1+80
2+00
2+20
Scale: 1"=10', Horizontal & Vertical
Command: '_pan
Press Esc or Enter to exit, or right-click to activate pop-up menu.
Press pick button and drag to pan.
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:49 AM

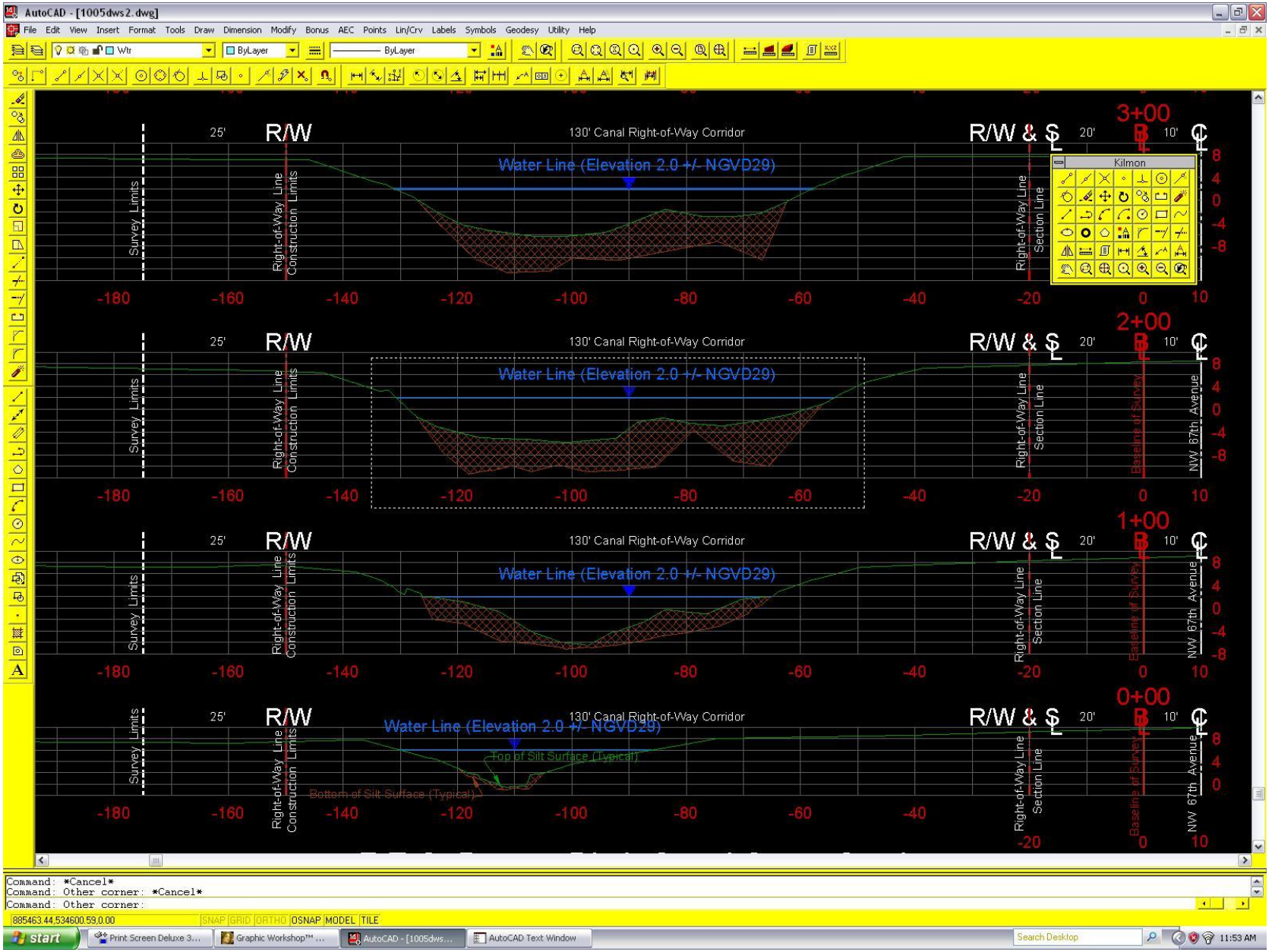

AutoCAD - [1005dws2.dwg]
Water Line (Elevation 2.0 +/- NGVD29)
-6.3
-6.4
-6.0
-6.0
-6.0
-5.9
-5.7
-5.2
-5.5
-5.5
-5.6
-7.1
-7.4
-7.7
-8.0
-8.6
-9.3
-10.0
-10.6
-10.9
-11.1
-11.2
Bottom of Silt Surface (Ty
1+40
1+60
1+80
2+00
2+20
Scale: 1"=10', Horizontal & Vertical
Kilmon
Command: *Cancel*
Command: *Cancel*
Command: Other corner:
885393.10,533862.75,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:49 AM

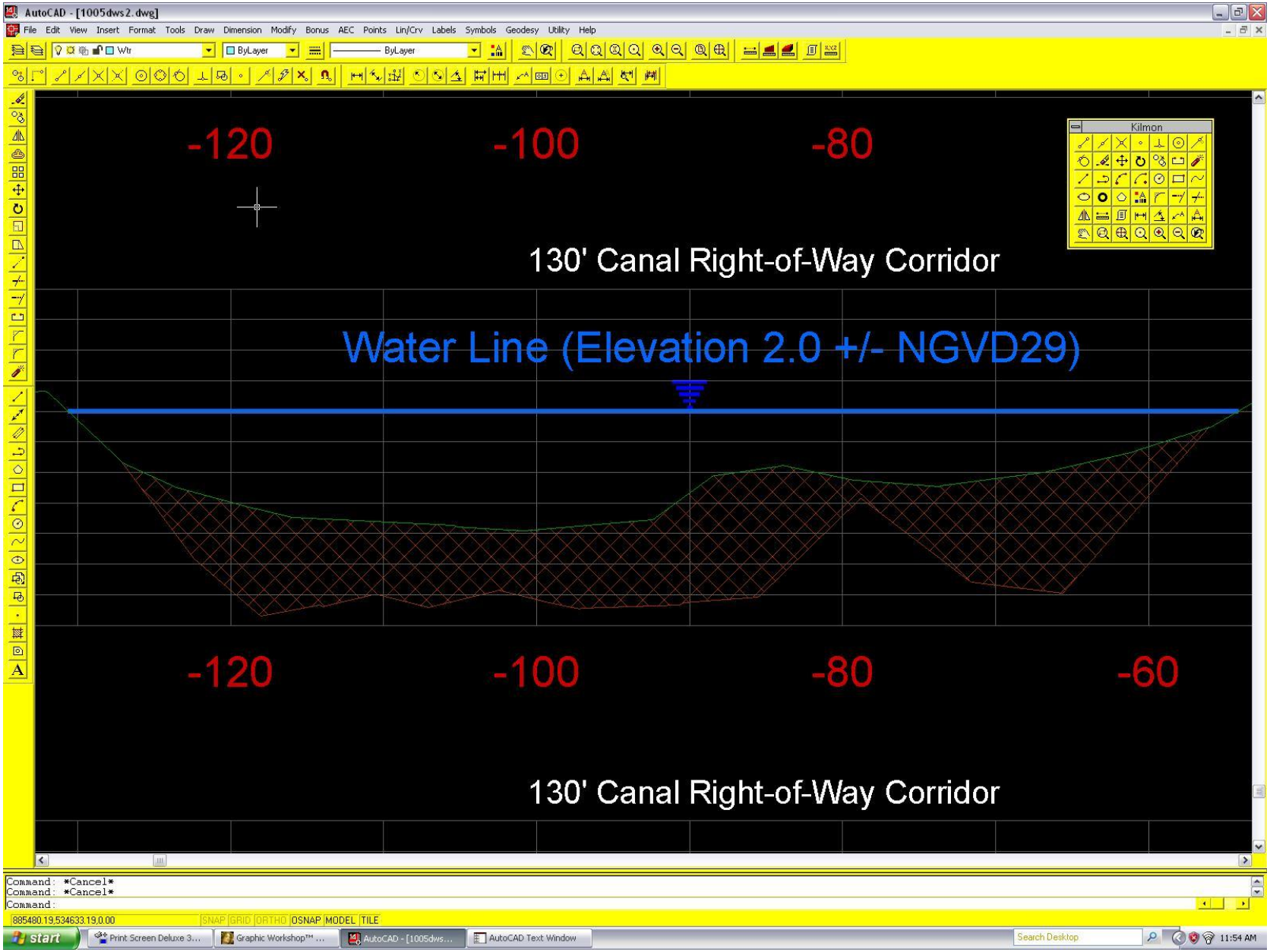

AutoCAD - [1005dws2.dwg]
Water Line (Elevation 2.0 +/- NGVD29)
-6.3
-6.4
-6.0
-6.0
-6.0
-5.9
-5.7
-5.2
-5.5
-5.5
-5.6
-7.1
-7.4
-7.7
-8.0
-8.6
-9.3
-10.0
-10.6
-10.9
-11.1
-11.2
Bottom of Silt Surface (Ty
1+40
1+60
1+80
2+00
2+20
Scale: 1"=10', Horizontal & Vertical
Kilmon
Command: *Cancel*
Command: Other corner: *Cancel*
Command: Other corner:
start
AutoCAD Text Window
11:50 AM

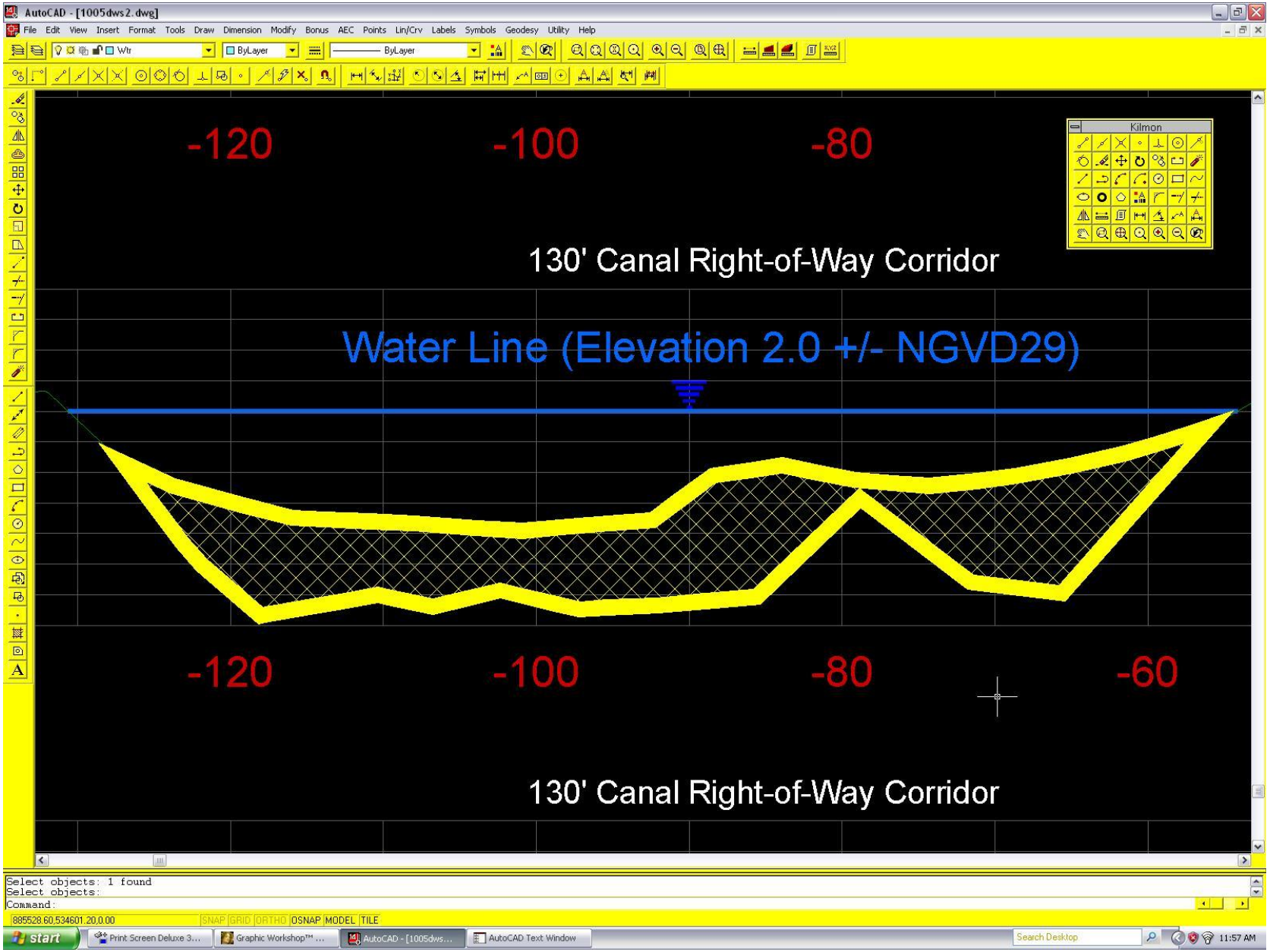

AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
ZOOM GROUP
Grid too dense to display
Command: Other corner:
885135.50,533753.58,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:51 AM


AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
Kilmon
Grid too dense to display
Command: Other corner: *Cancel*
Command: Other corner:
885364.83,534688.84,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:51 AM


AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
3+00
2+00
1+00
0+00
25'
R/W
130' Canal Right-of-Way Corridor
R/W & ℄
20'
10'
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Survey Limits
Right-of-Way Line
Construction Limits
Section Line
Baseline of Survey
NW 67th Avenue
Kilmon
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 10
8 4 0 -4 -8
Command: *Cancel*
Command: *Cancel*
Command: Other corner:
885411.97,534600.04,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:52 AM


AutoCAD - [1005dws2.dwg]
File Edit View Insert Format Tools Draw Dimension Modify Bonus AEC Points Lin/Crv Labels Symbols Geodesy Utility Help
3+00
2+00
1+00
0+00
25'
R/W
130' Canal Right-of-Way Corridor
R/W & ℄
20'
10'
Water Line (Elevation 2.0 +/- NGVD29)
Top of Silt Surface (Typical)
Bottom of Silt Surface (Typical)
Survey Limits
Right-of-Way Line
Construction Limits
Section Line
Baseline of Survey
NW 67th Avenue
Kilmon
-180 -160 -140 -120 -100 -80 -60 -40 -20 0 10
8 4 0 -4 -8
Command: *Cancel*
Command: Other corner: *Cancel*
Command: Other corner:
885463.44,534600.59,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:53 AM


AutoCAD - [1005dws2.dwg]
-120
-100
-80
Kilmon
130' Canal Right-of-Way Corridor
Water Line (Elevation 2.0 +/- NGVD29)
-120
-100
-80
-60
130' Canal Right-of-Way Corridor
Command: *Cancel*
Command: *Cancel*
Command:
885480.19,534633.19,0.00
SNAP GRID ORTHO OSNAP MODEL TILE
start
Print Screen Deluxe 3...
Graphic Workshop™ ...
AutoCAD - [1005dws...
AutoCAD Text Window
Search Desktop
11:54 AM


AutoCAD - [1005dws2.dwg]
-120
-100
-80
Kilmon
130' Canal Right-of-Way Corridor
Water Line (Elevation 2.0 +/- NGVD29)
-120
-100
-80
-60
130' Canal Right-of-Way Corridor
Select objects: 1 found
Select objects:
Command:
start
11:57 AM

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume

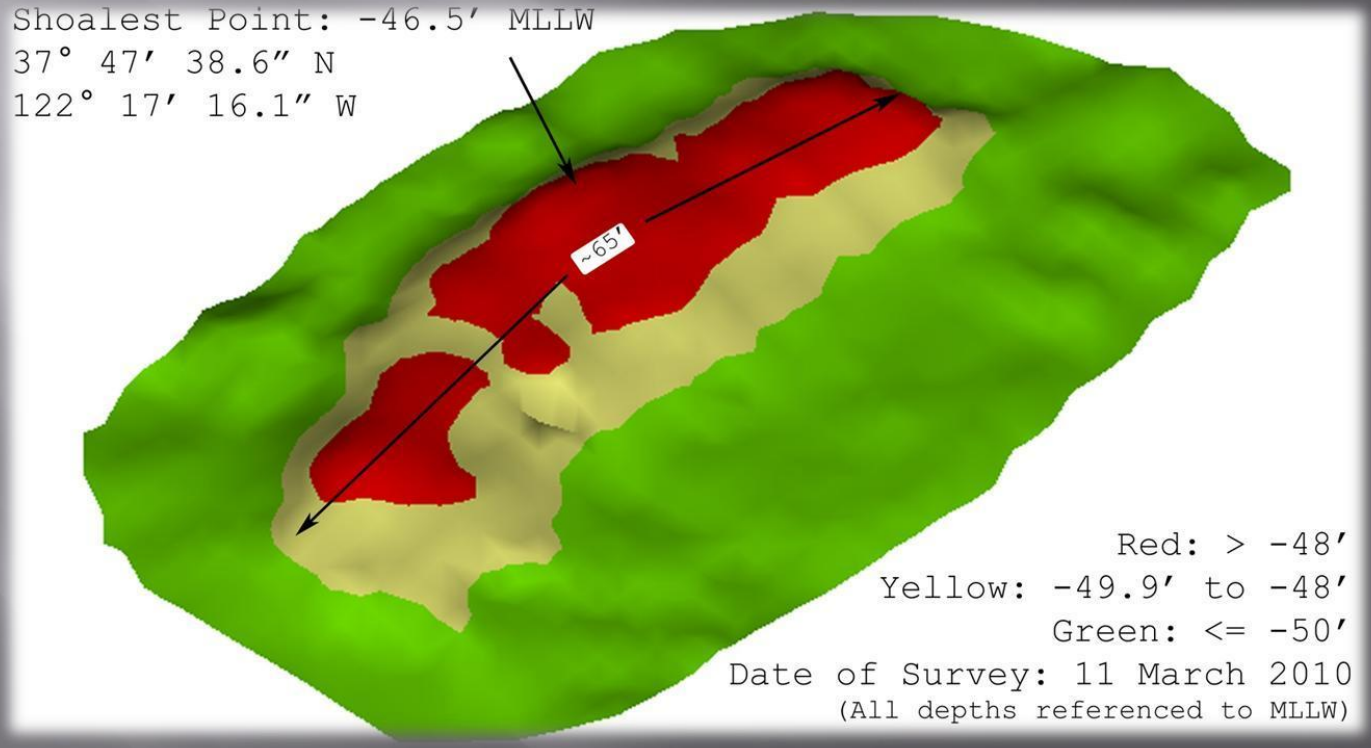
ADVISORY

USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume

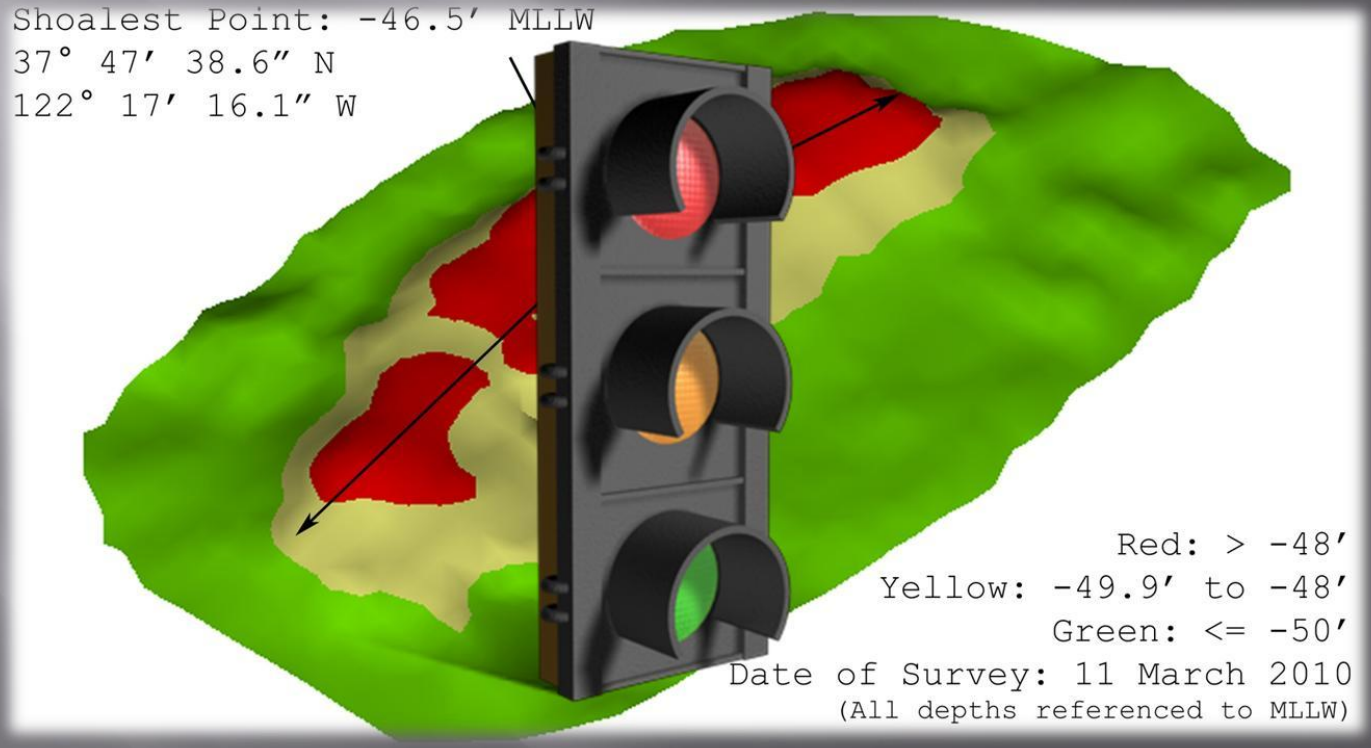


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume

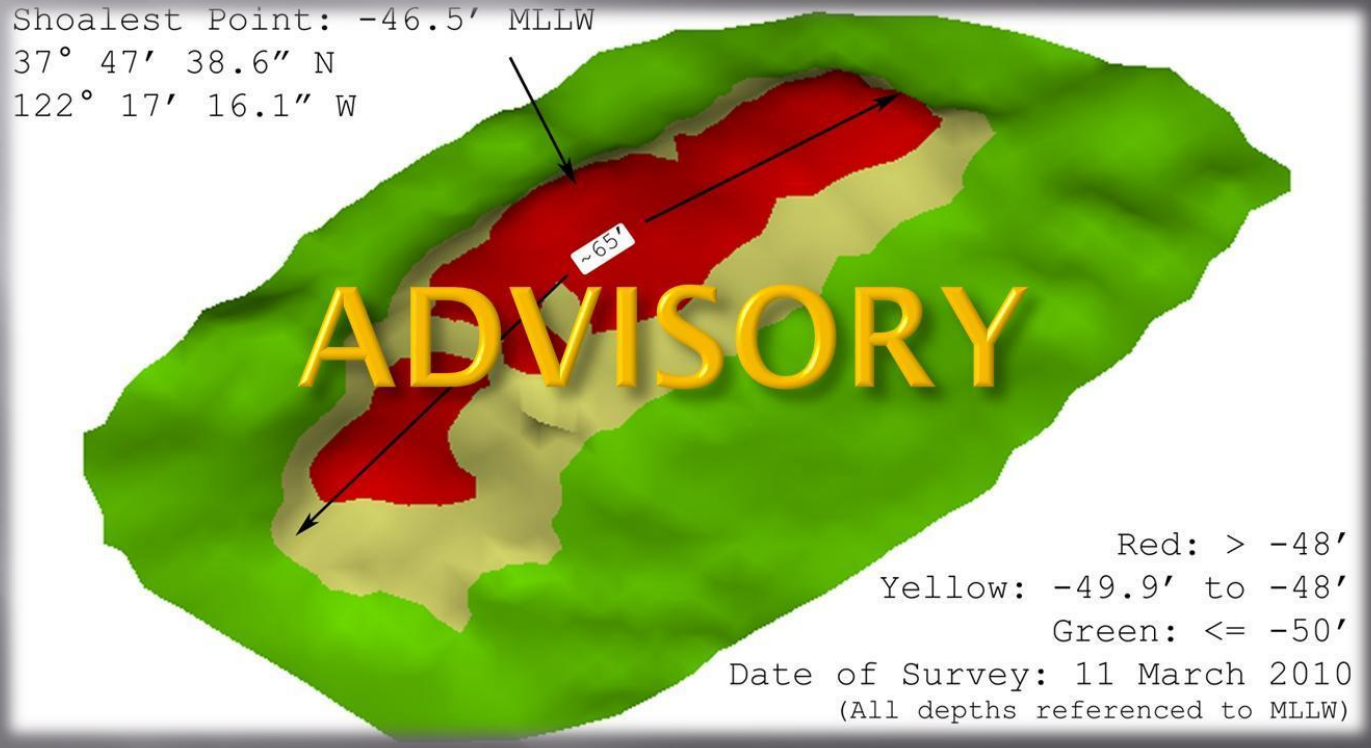


USACE SPN Geomatics

Spatial Navigation Asset Surveying & Mapping

Digital Terrain Modeling (DTM)

Average-End Area / Prismoidal Volume



U.S. ARMY CORPS OF ENGINEERS®
(USACE)

SOUTH PACIFIC DIVISION (SPD)

DREDGING WORKSHOP II

SPATIAL NAVIGATION ASSET SURVEYING & MAPPING

BY

STEPHEN P. KILMON, P.S.M., CHIEF

GEOMATICS SECTION

CONSTRUCTION BRANCH

SAN FRANCISCO DISTRICT (SPN)

(0900-1200, 11 MAY 2010 @ BAY MODEL SAUSALITO, CA)