

Real Time Monitoring of Subsidence SR2, Ottawa County, Ohio

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Doug Rogers, P.E., ODOT District 2*

**Geohazards Impacting Transportation
in the Appalachian Region
Beckley, West Virginia, August 2012**



Site Location and Conditions

8/3/2012



gypsum road, gypsum OH - Google Maps - Microsoft Internet Explorer provided by Geotechnical Consultants Inc.

http://maps.google.com/maps?hl=en&tab=wl

gypsum road, gypsum OH

gypsum road, gypsum OH - Google Maps

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Google gypsum road, gypsum OH

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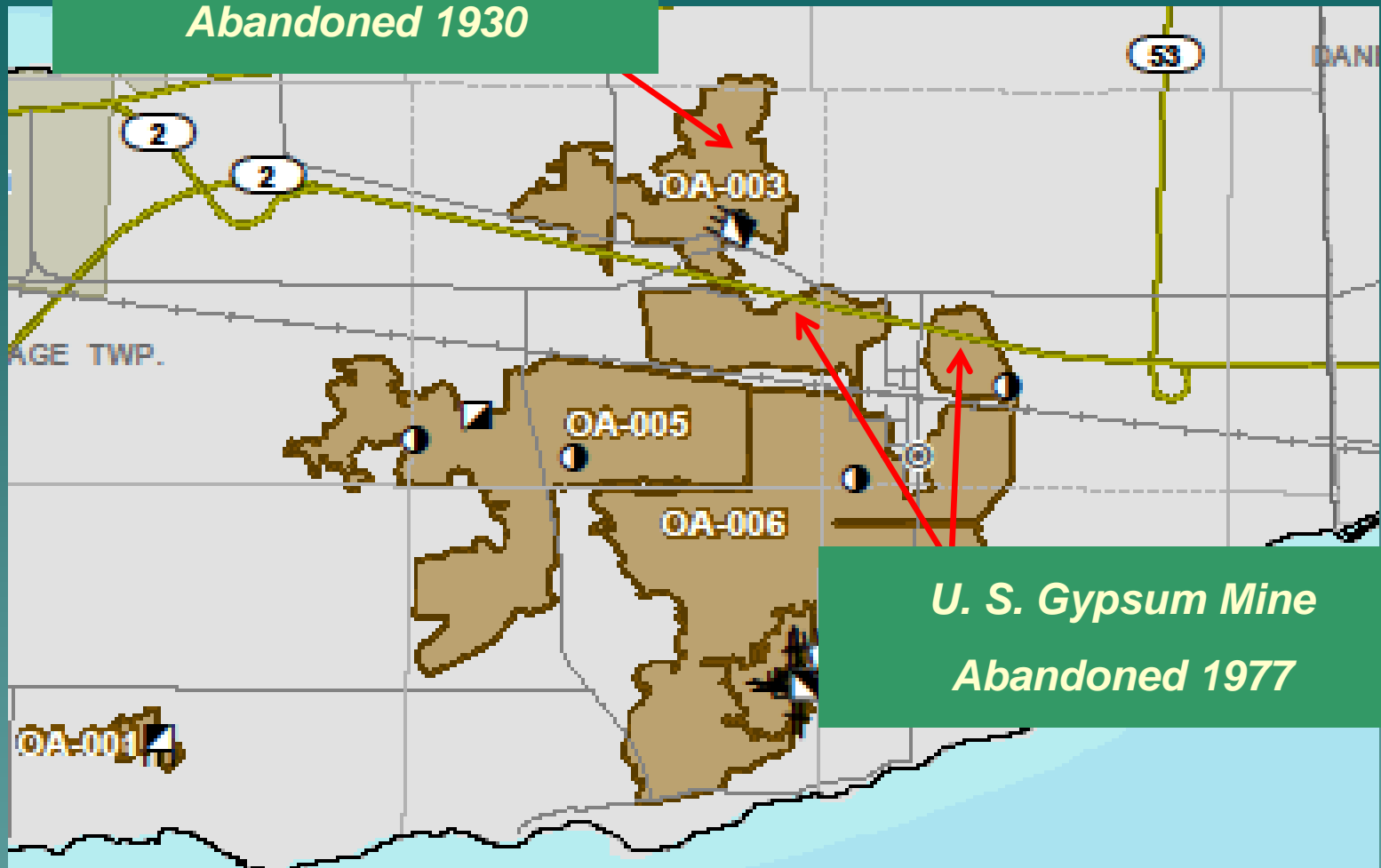
Internet 100%

start Inboxes - Microsoft Out... gypsum road, gypsu...

12:44 PM



*Certainteed Mine
Abandoned 1930*



*U. S. Gypsum Mine
Abandoned 1977*

Christy Chapel Rd
STA 1294+00





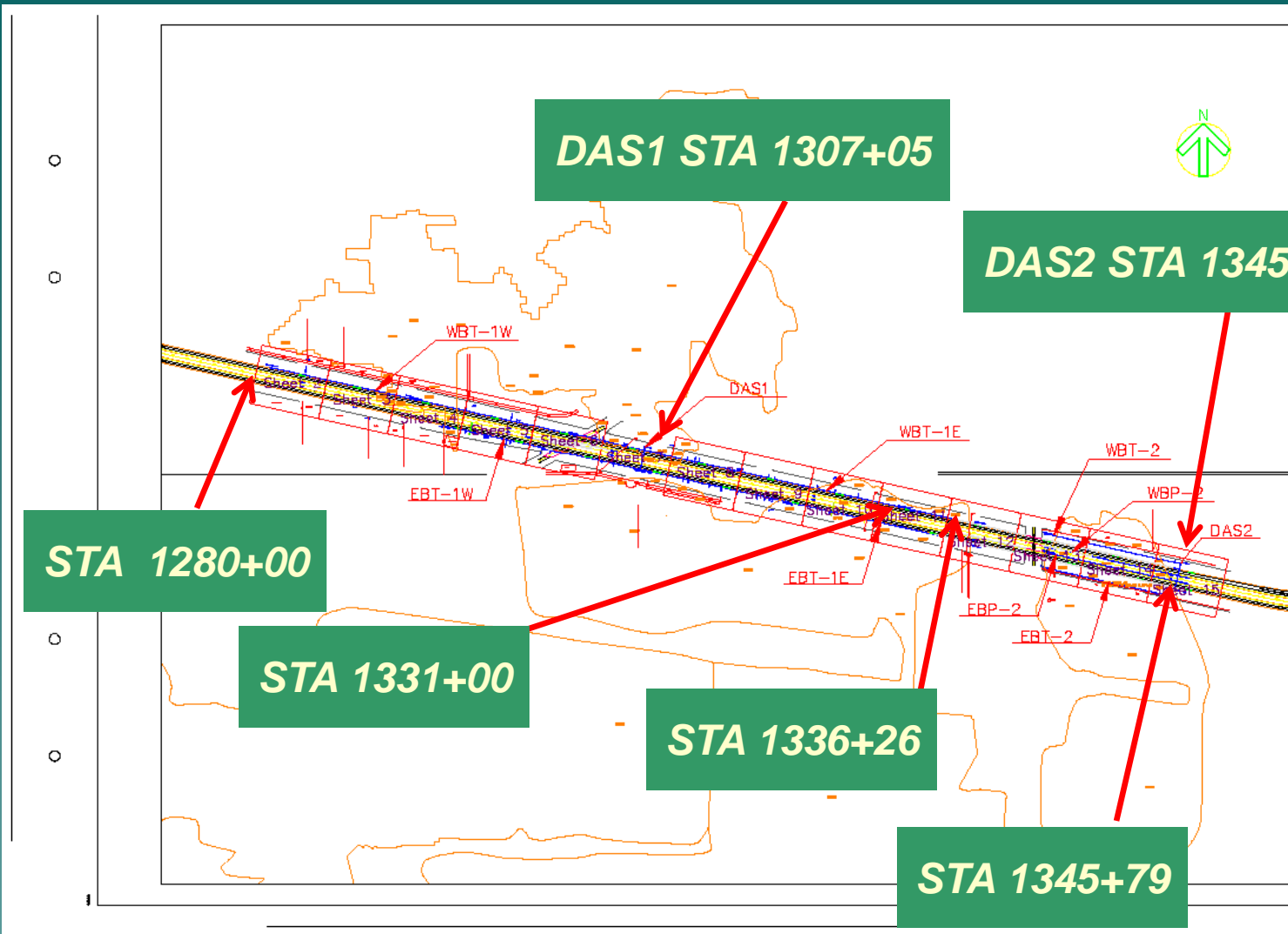
8/3/2012





*Looking South
along Gypsum Rd*

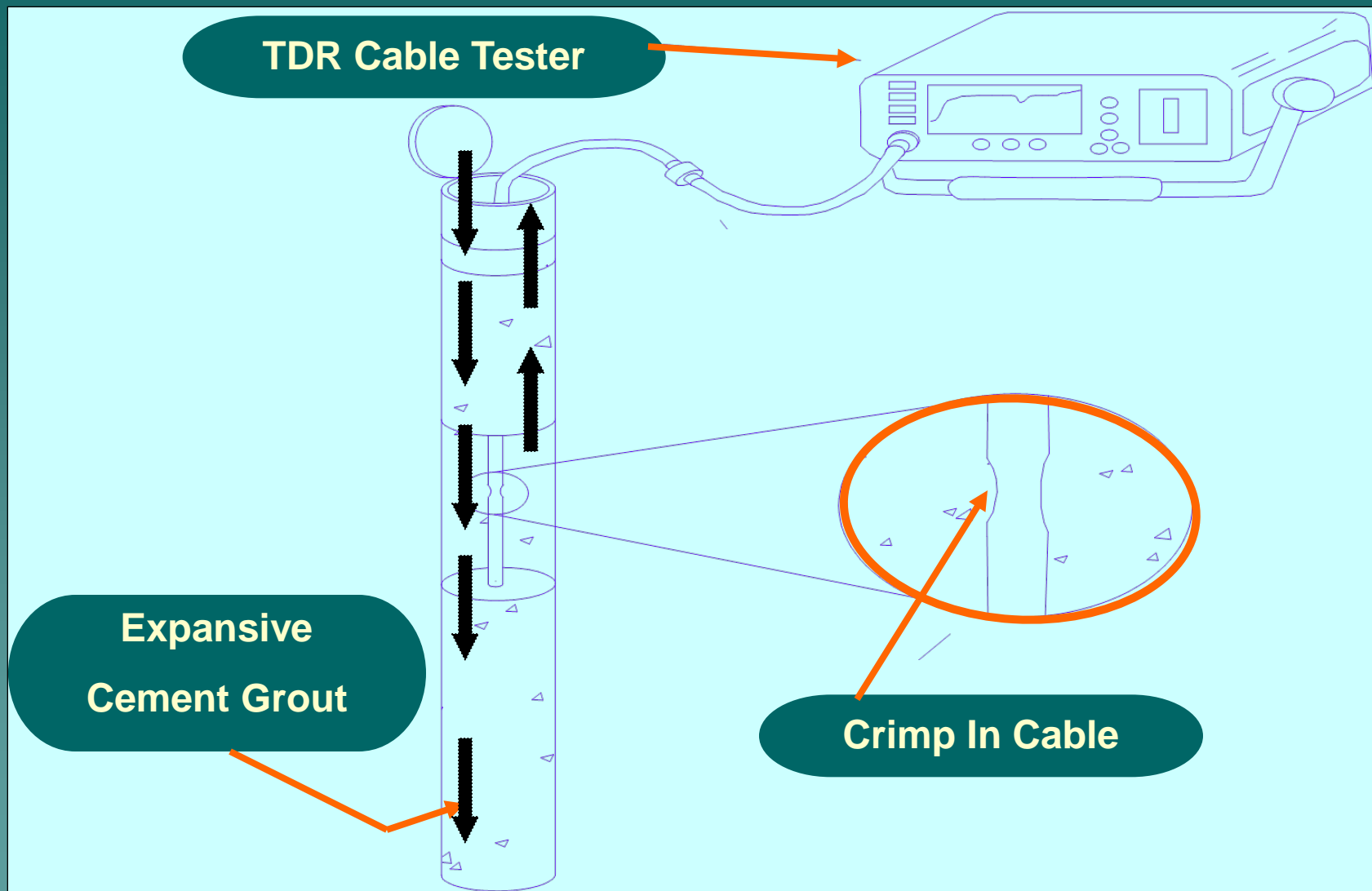




TDR Principle, Trenching, and Cable Installation



Cables can be grouted into boreholes or trenches to monitor deformation









10/25/2011

8/3/2012

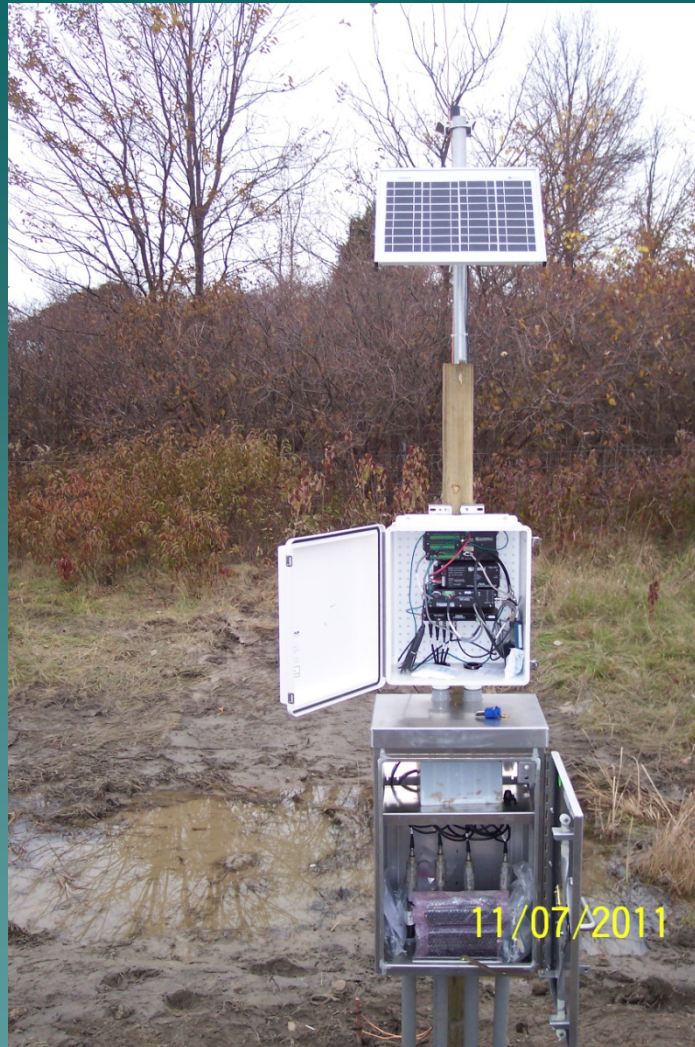


TDR System

8/3/2012







TDR Cable Tester

Modem

Programmable Data Logger

Coaxial Multiplexer

System Calibration

8/3/2012



18

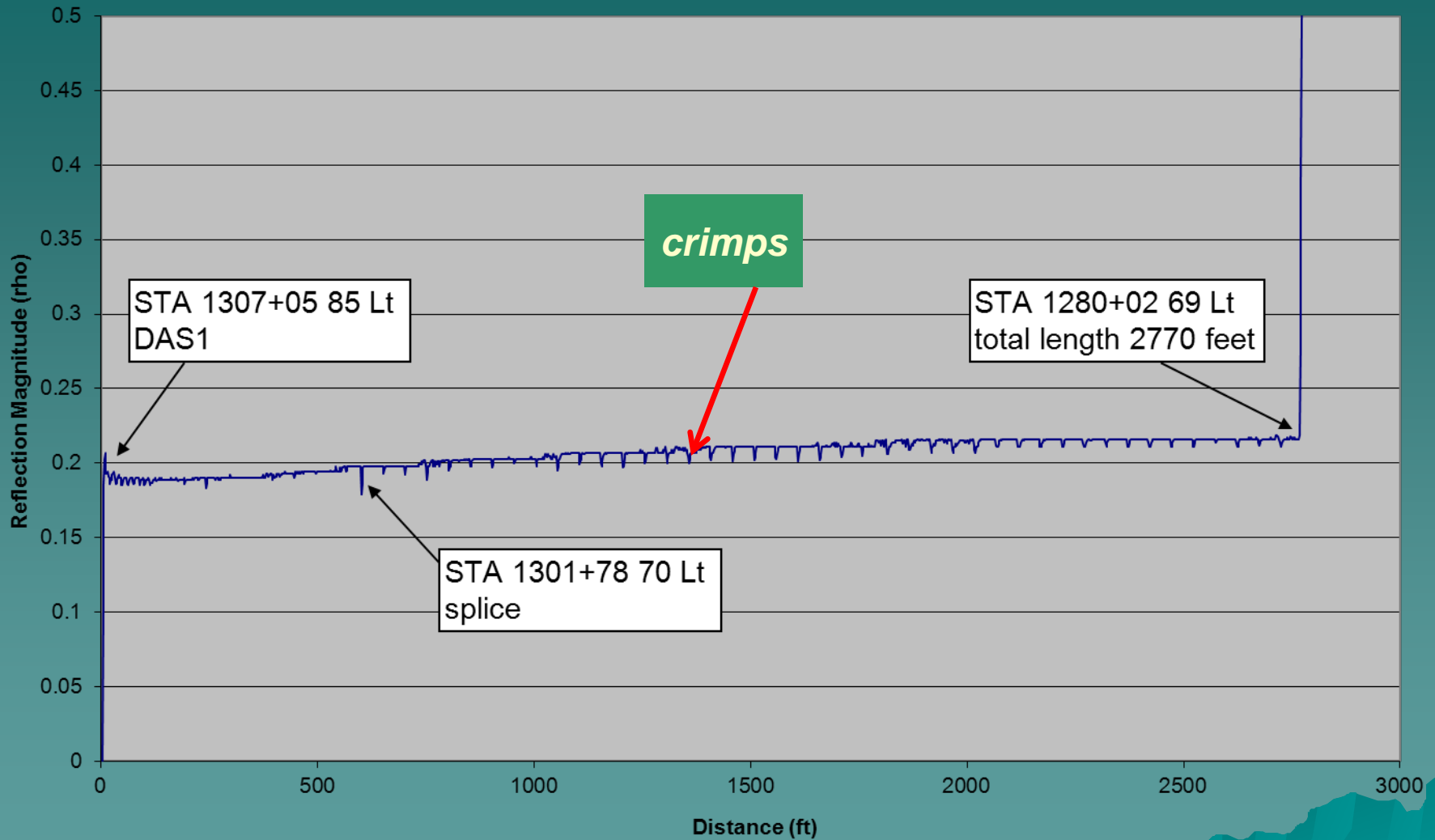


05/06/2010





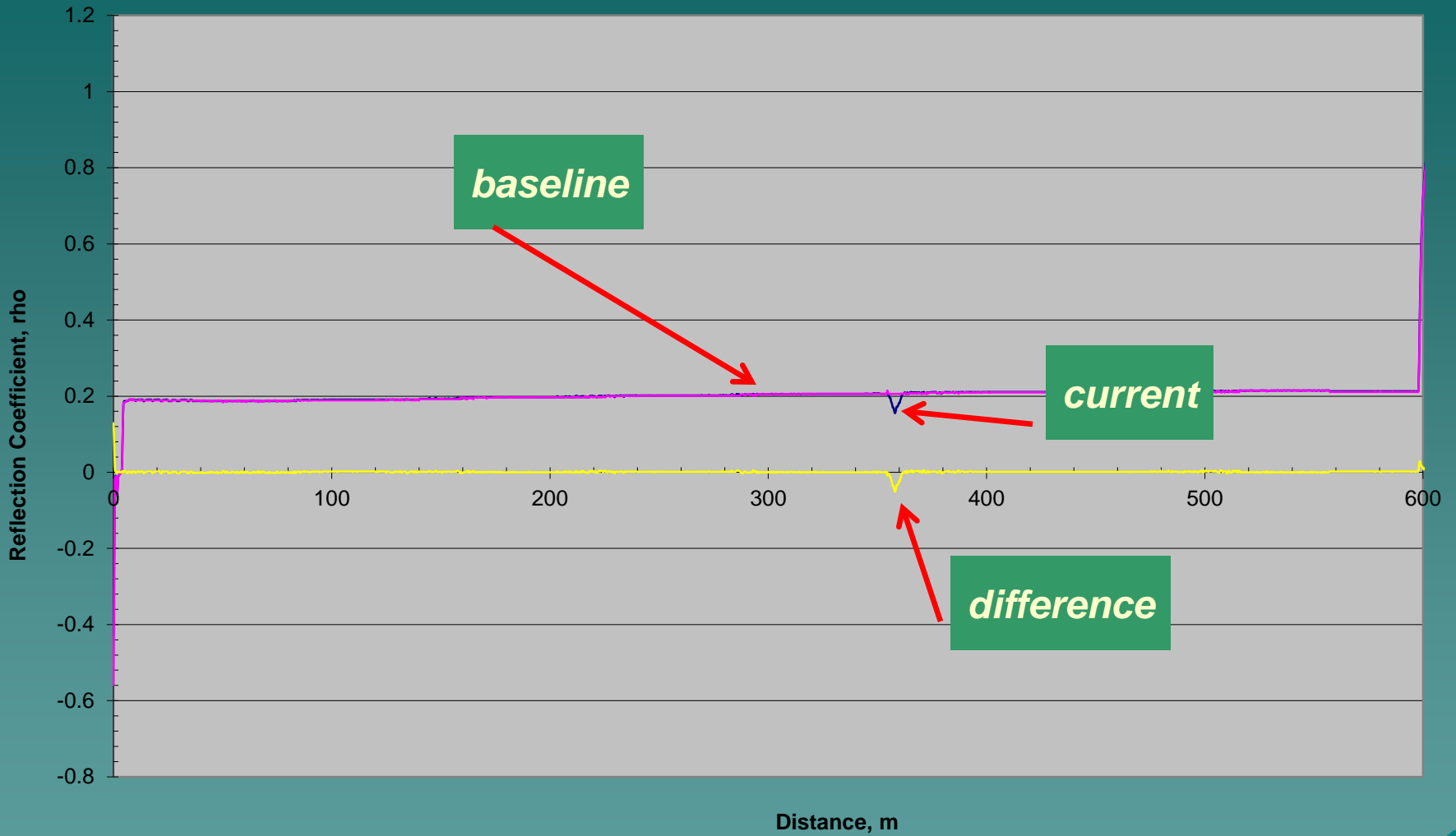
SR2 Westbound Travel Lane STA 1307+05 to 1280+02
West of DAS1 (Cable WBT-1W)



Activity Monitoring



EB Passing Lane Trench B



— Current — Baseline — Difference



RTMC Run-time - [C:\Campbellsci\RTMC\Ohio SR2 alarm_event_test_2.rtc2]

File Edit View Window Help

Click to resume auto tabbing

Activity Locations DAS1 Activity History DAS1 Activity Locations DAS2 Activity History DAS2 Battery & Voltage

DAS1

WB Travel 1W Activity

Difference, rho

Distance, m

This graph shows activity for WB Travel 1W. The y-axis is 'Difference, rho' (0 to 1) and the x-axis is 'Distance, m' (550 to 800). A red dot is visible at approximately 800m with a difference of about 0.2.

WB Travel 1E Activity

Difference, rho

Distance, m

This graph shows activity for WB Travel 1E. The y-axis is 'Difference, rho' (0 to 1) and the x-axis is 'Distance, m' (100 to 700). Multiple red dots are visible between 650m and 700m, with differences ranging from 0.2 to 0.8.

EB Travel 1W Activity

Difference, rho

Distance, m

This graph shows activity for EB Travel 1W. The y-axis is 'Difference, rho' (0 to 1) and the x-axis is 'Distance, m' (500.5 to 502). A red dot is visible at 502m with a difference of about 0.8.

EB Travel 1E Activity

Difference, rho

Distance, m

This graph shows activity for EB Travel 1E. The y-axis is 'Difference, rho' (0 to 1) and the x-axis is 'Distance, m' (400 to 800). Multiple red dots are visible between 750m and 800m, with differences ranging from 0.2 to 0.8.

Data Source Status

start | Inbox - kconnor@gc... | ODOT District 2 Training | ODOT District 2 Traini... | Document1 - Microsof... | LoggerNet Admin 4.1 ... | RTMC Run-time - [C:\... | 11:41 AM



RTMC Run-time - [C:\Campbellsci\RTMC\Ohio SR2 alarm_event_test_2.rtc2]

File Edit View Window Help

Click to resume auto tabbing

Activity Locations DAS1 Activity History DAS1 Activity Locations DAS2 Activity History DAS2 Battery & Voltage

DAS1

WB Travel 1W Activity

WB Travel 1E Activity

EB Travel 1W Activity

EB Travel 1E Activity

Data Source Status

start | Inbox - kconnor@gc... | ODOT District 2 Training | ODOT District 2 Traini... | Document1 - Microsof... | LoggerNet Admin 4.1 ... | RTMC Run-time - [C:\... | 11:40 AM



Real Time Monitoring with Time Domain Reflectometry (TDR)

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GeoTDR, Inc.
Westerville, Ohio
www.geotdr.com



8/3/2012



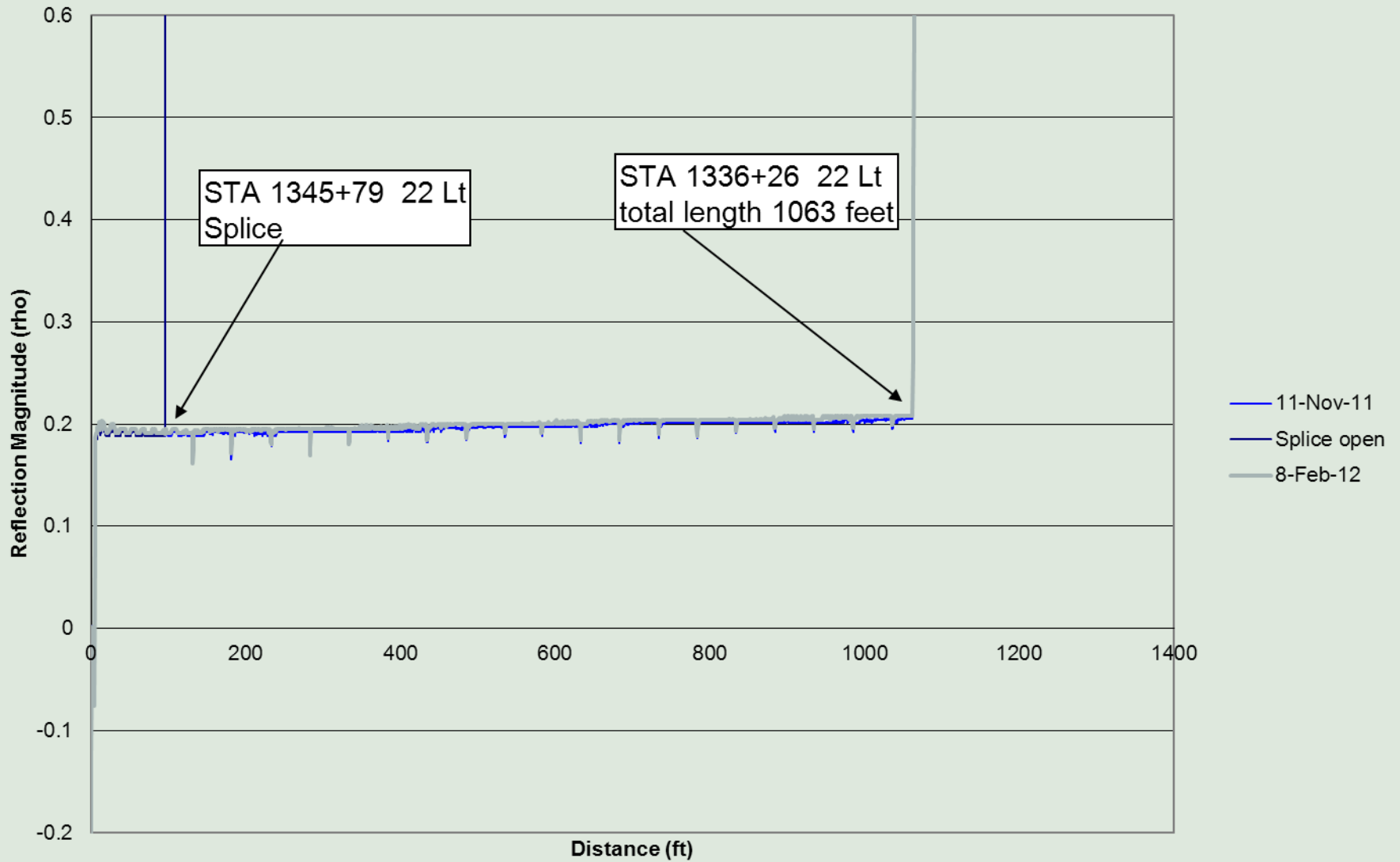
8/3/2012



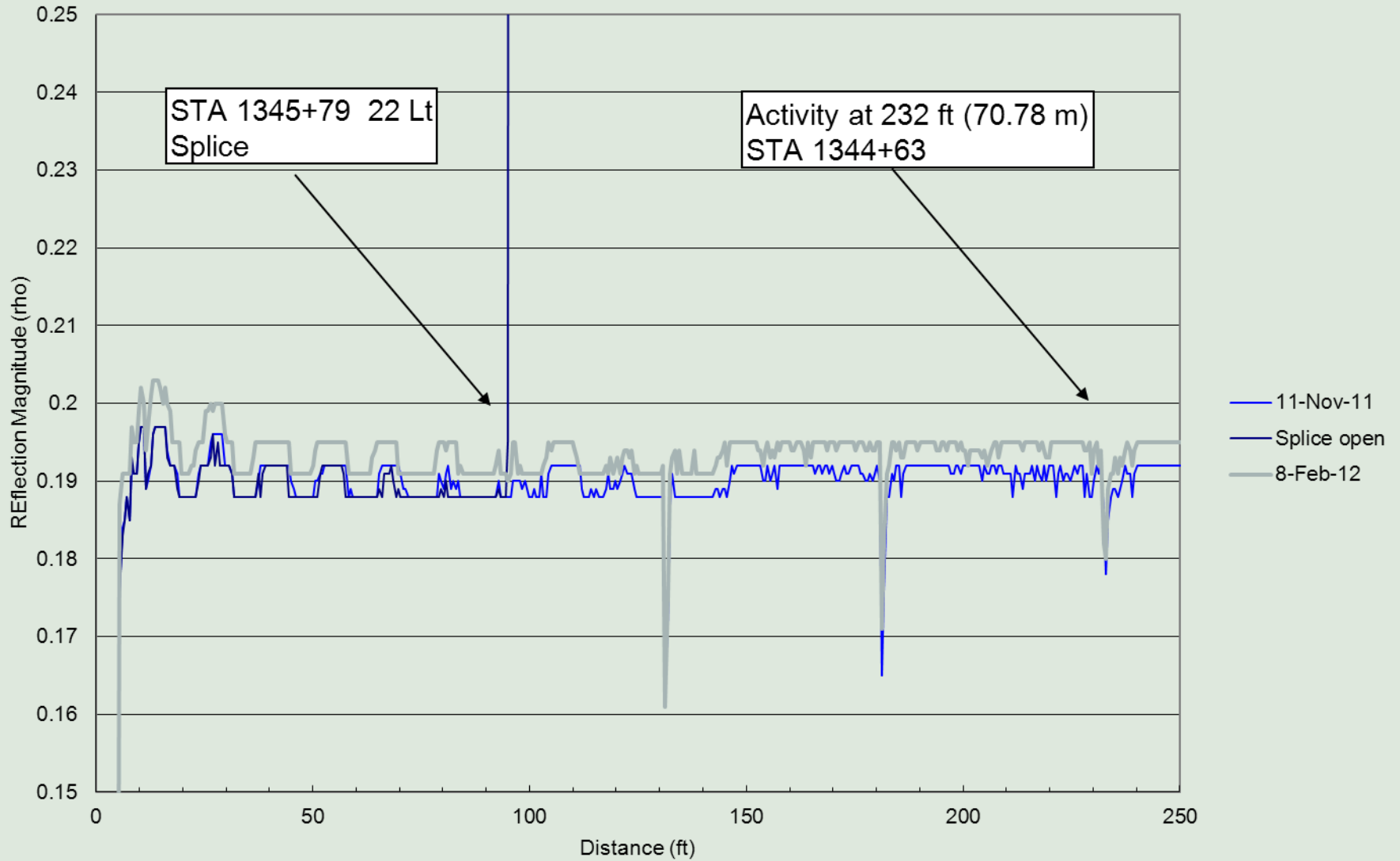
Activity near Westbound STA 1345+00



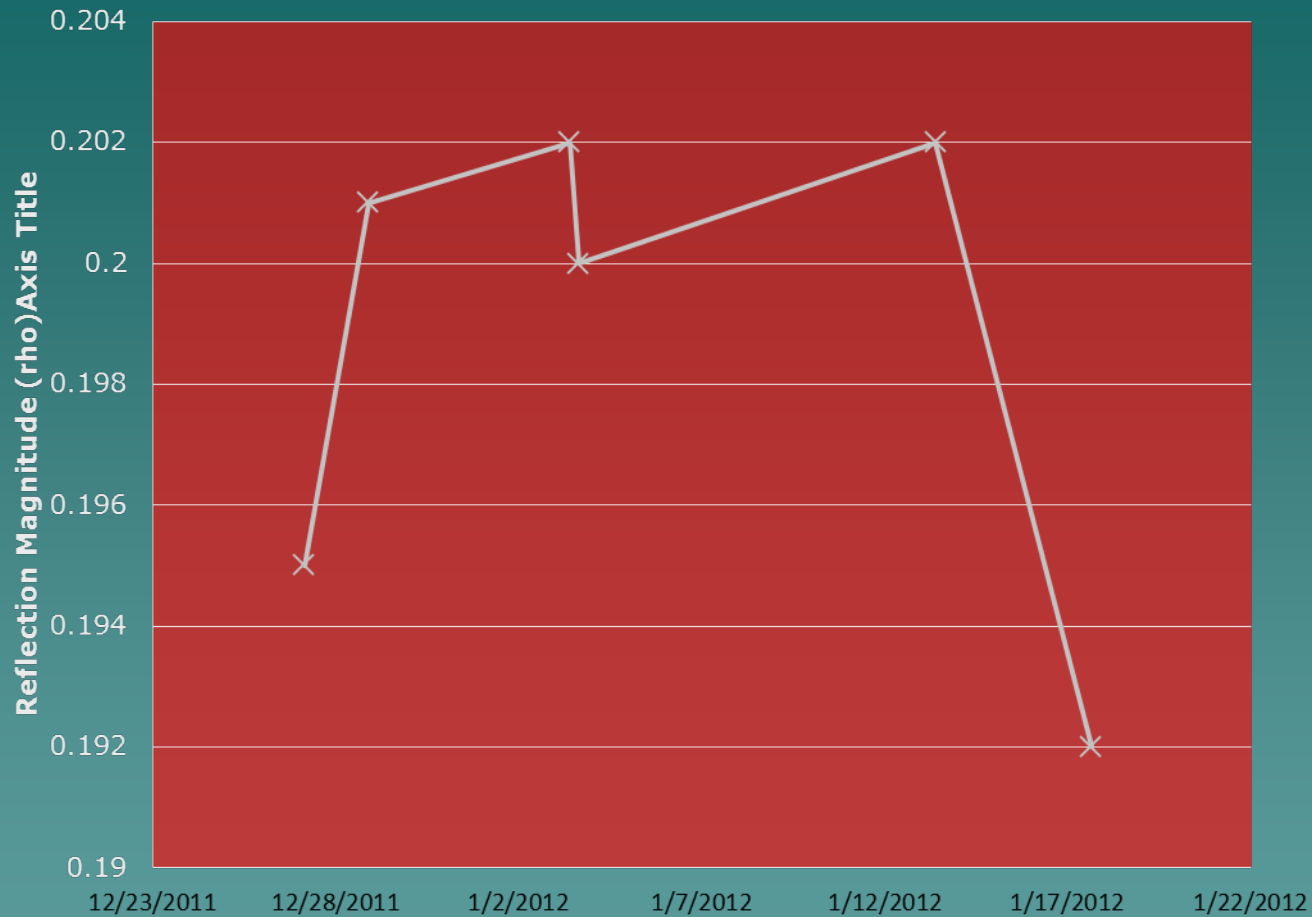
SR2 Westbound Passing Lane STA 1345+79 to 1336+26
DAS2 (Cable WBP-2)



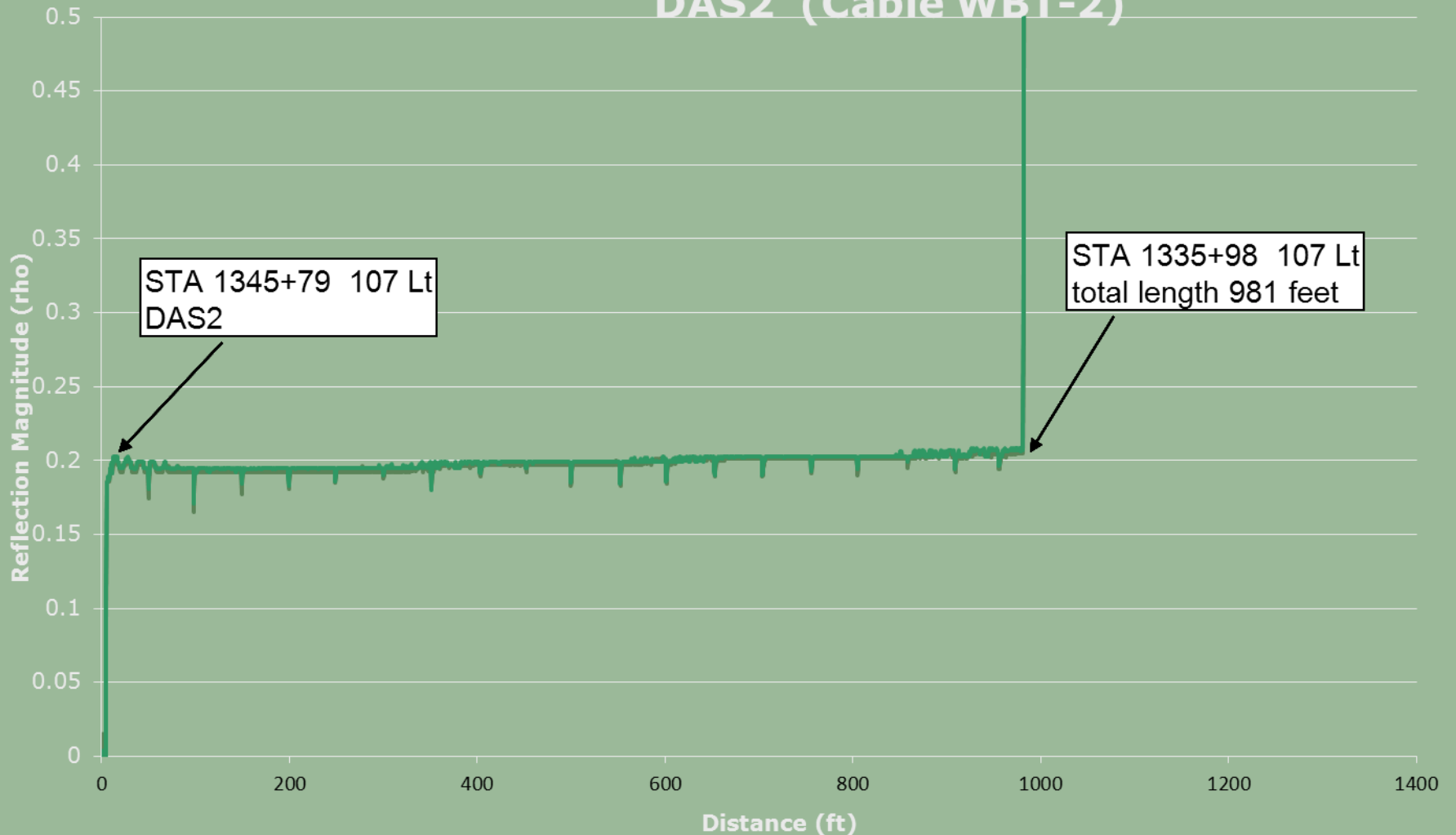
SR2 Westbound Passing Lane STA 1345+79 to 1336+26
DAS2 (Cable WBP-2)



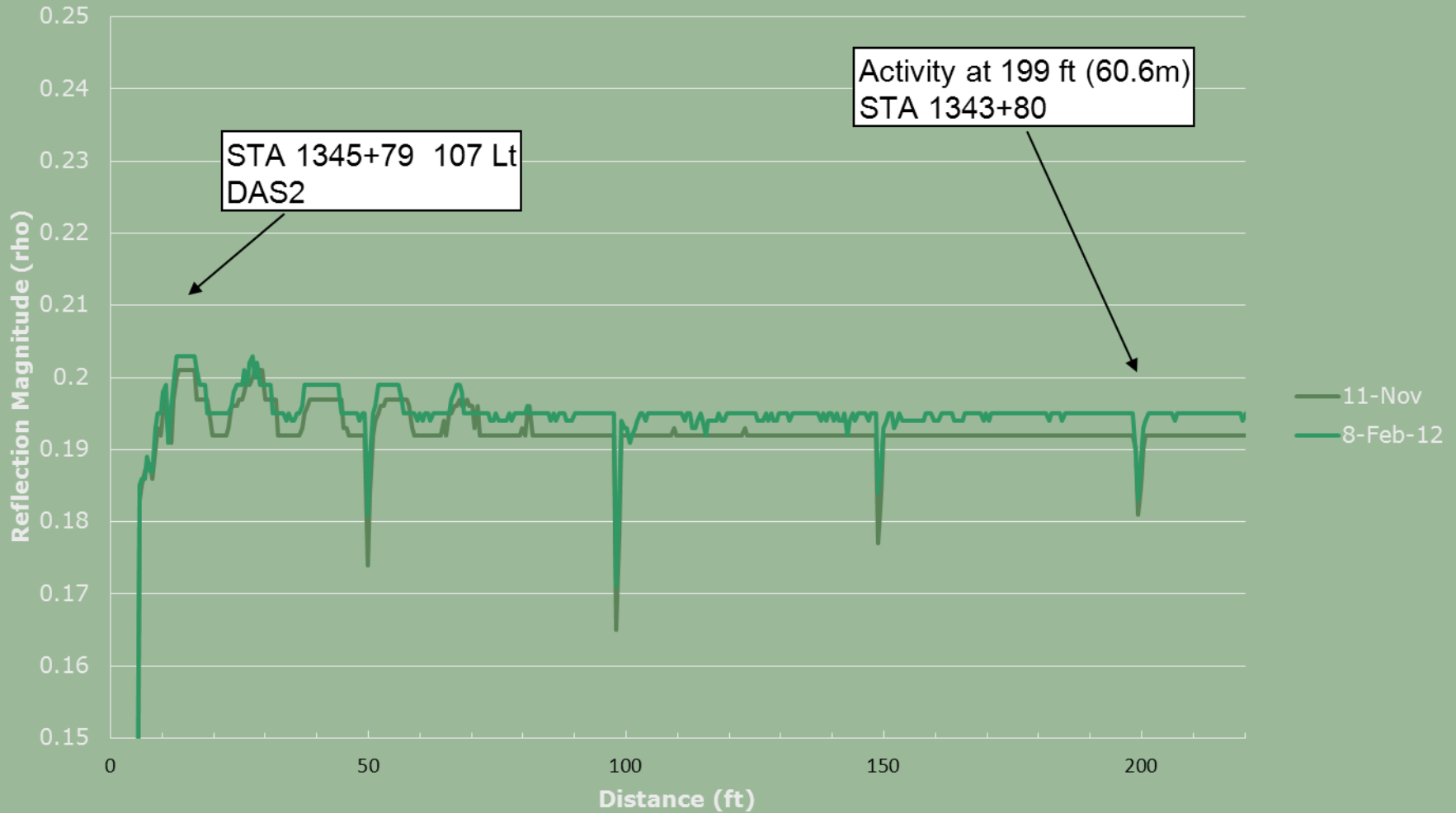
WBP2 Activity at 70.78 m



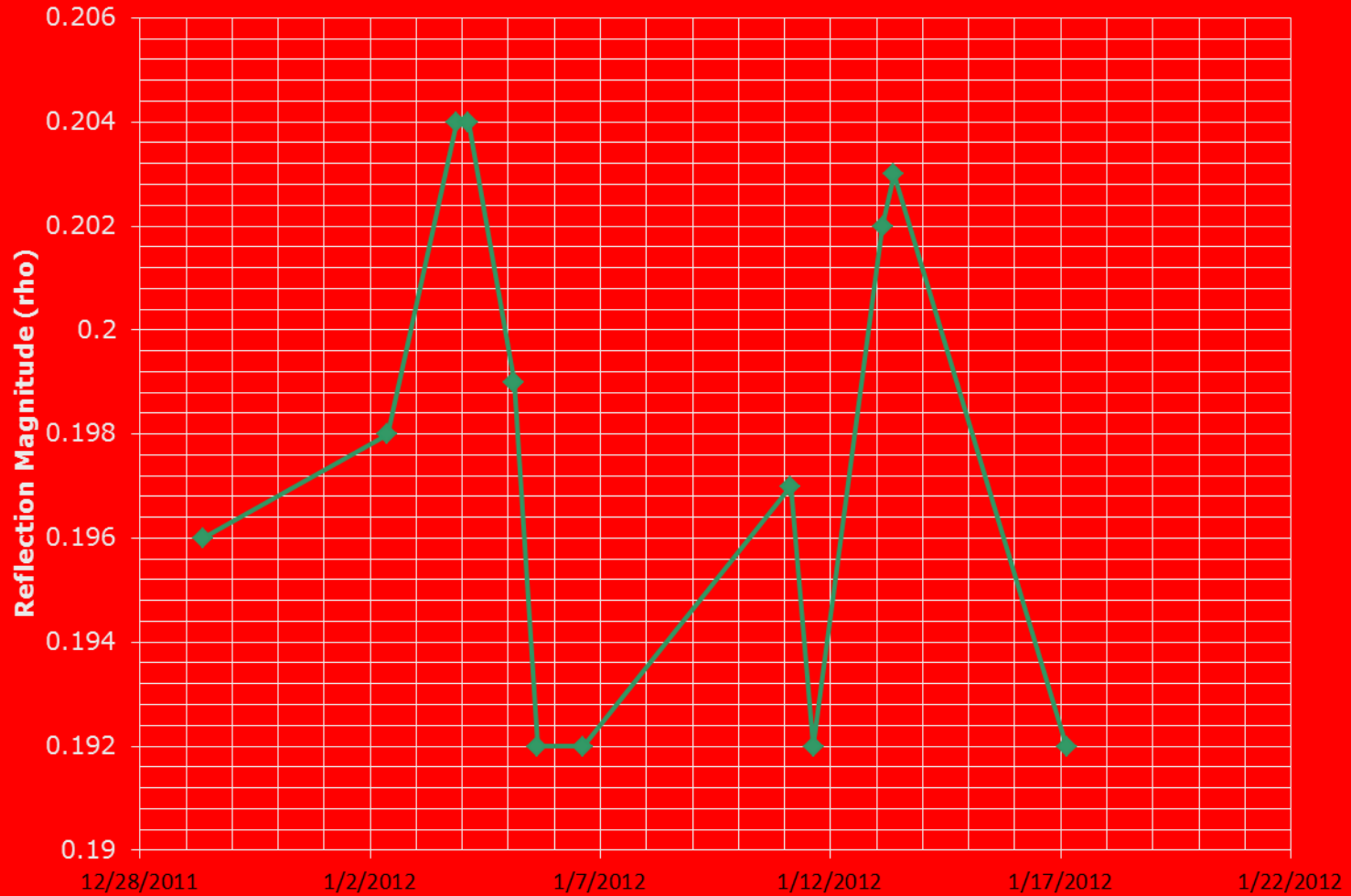
SR2 Westbound Travel Lane STA 1345+79 to 1335+98 DAS2 (Cable WBT-2)

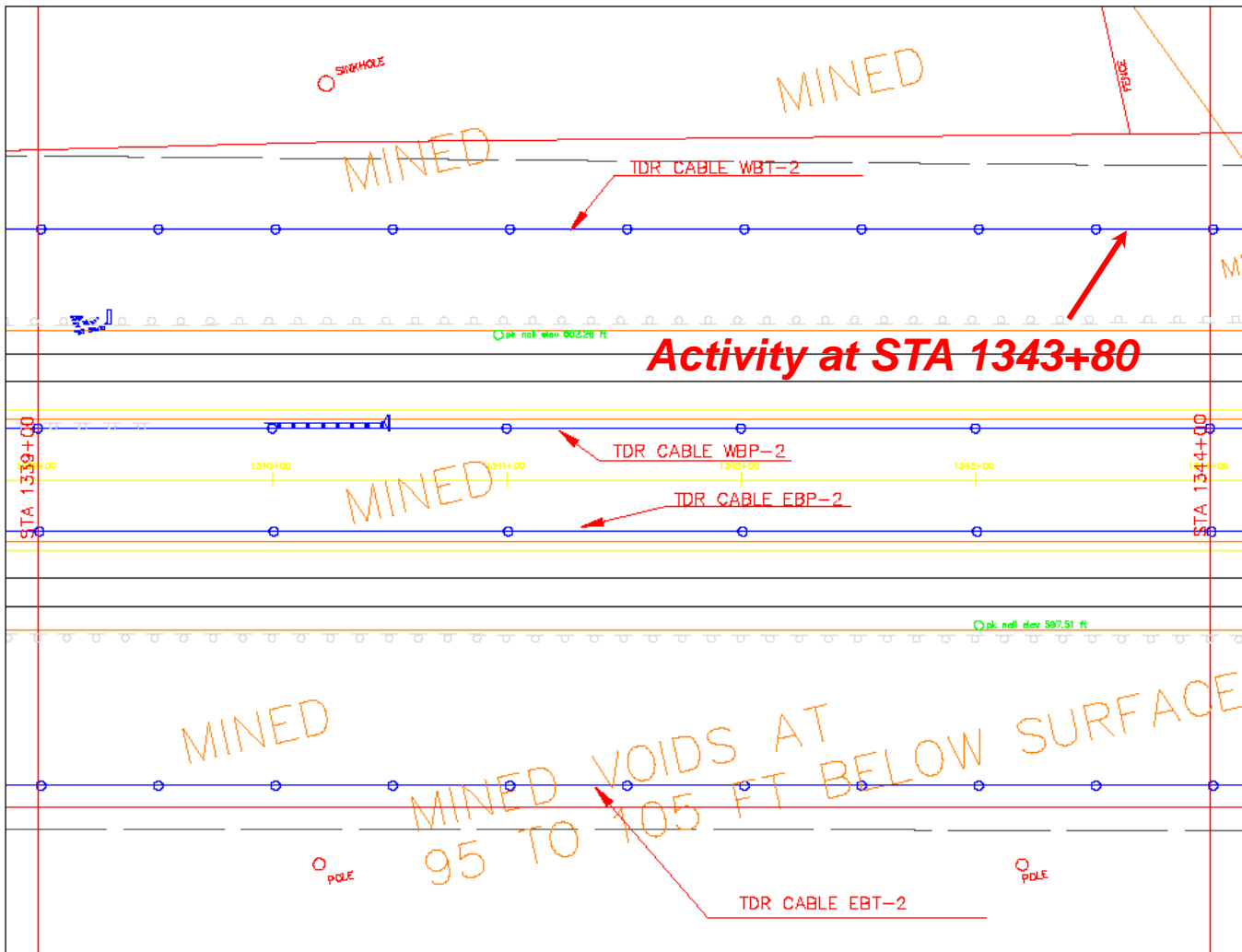


SR2 Westbound Travel Lane STA 1345+79 to STA 1335+98 DAS2 (Cable WBT-2)



WBT2 Activity at 60.55 m





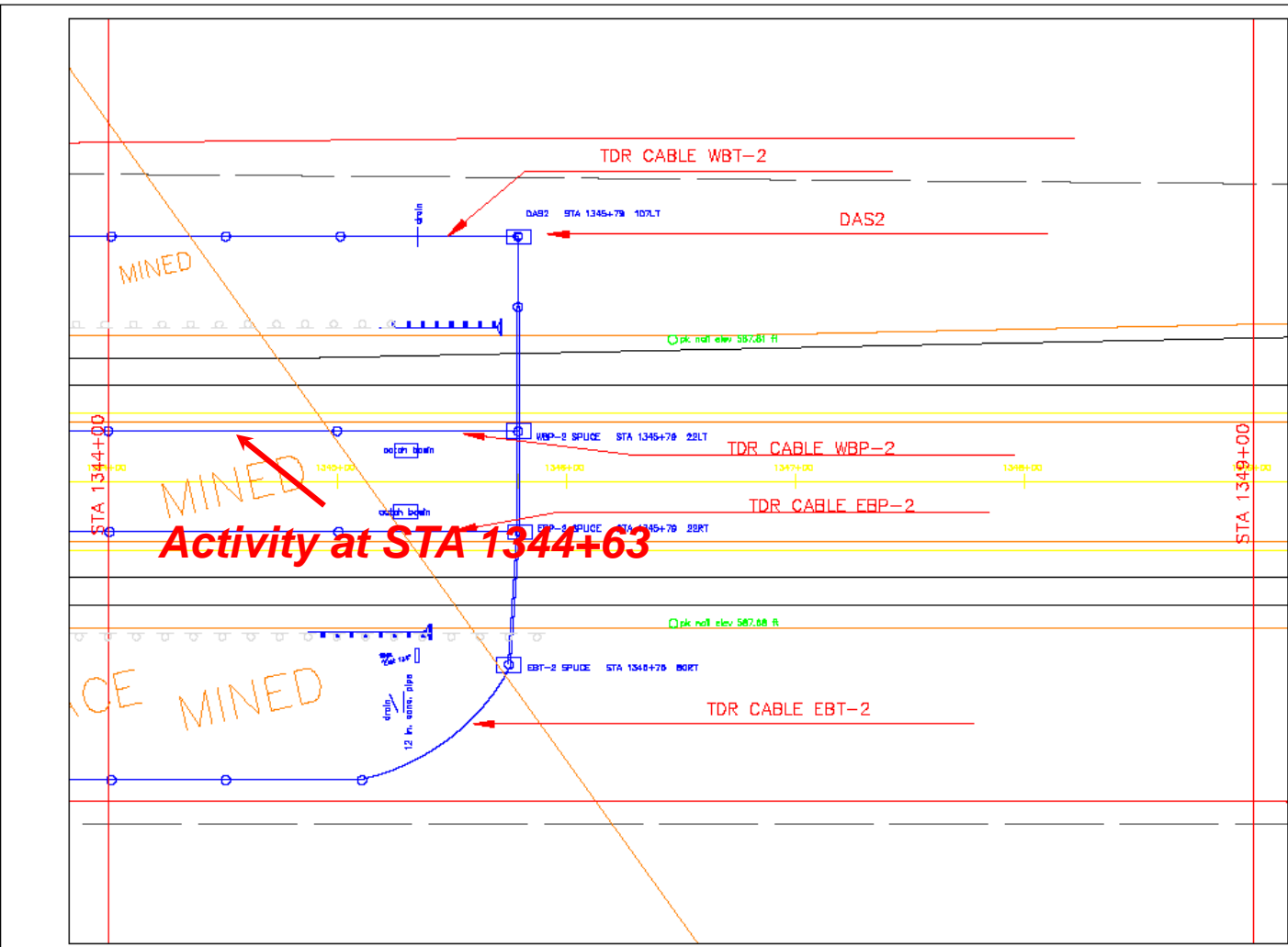


QUALITY
CHECKED
DATE

DATE
SCALE 1"=100'

PLAN: S.R. 2
STA 1344+00 TO 1349+00

OTI-2-24.24
MINE MONITOR





STA 1343+41

01/31/2012





8/3/2012



Action Plan

- ◆ At preset times or whenever a user wishes, the TDR cables are interrogated and the data is compared to a baseline that is stored in the data logger.
- ◆ At any location where the difference between the baseline and the current reading exceeds a predetermined magnitude an entry is made in an activity log.



Action Plan (cont)

- ◆ The Activity Log file of each cable will be a running list of cable deflection events that exceed the magnitude criterion.
- ◆ The TDR system will send out a Notification of Alert when it has detected cable deflection that meets alert levels based on criteria programmed in the data logger.
- ◆ Alerts will be in the form of emails.



Action Plan (cont)

- ◆ Criteria for Levels of Alert will be based on the amount of deflection, and the rate of change of deflection when assigning an alert level.
- ◆ The Ohio DOT will develop action plans (response, remediation, and further investigation) based on the level of alert, on-site evaluation and log file evaluation.

