PRACTICAL APPLICATION OF ODOT'S PLAN OF ACTION DATABASE TO ASSIST MAINTENANCE DISTRICTS DURING FLOODING EVENTS

by

John Woodroof, ODOT Bridge Hydraulics Engineeer

Don Newkirk, ODOT Database Administrator – Hydraulics Unit

Ken Farrimond, Chief Surveyor – Hydraulics Unit

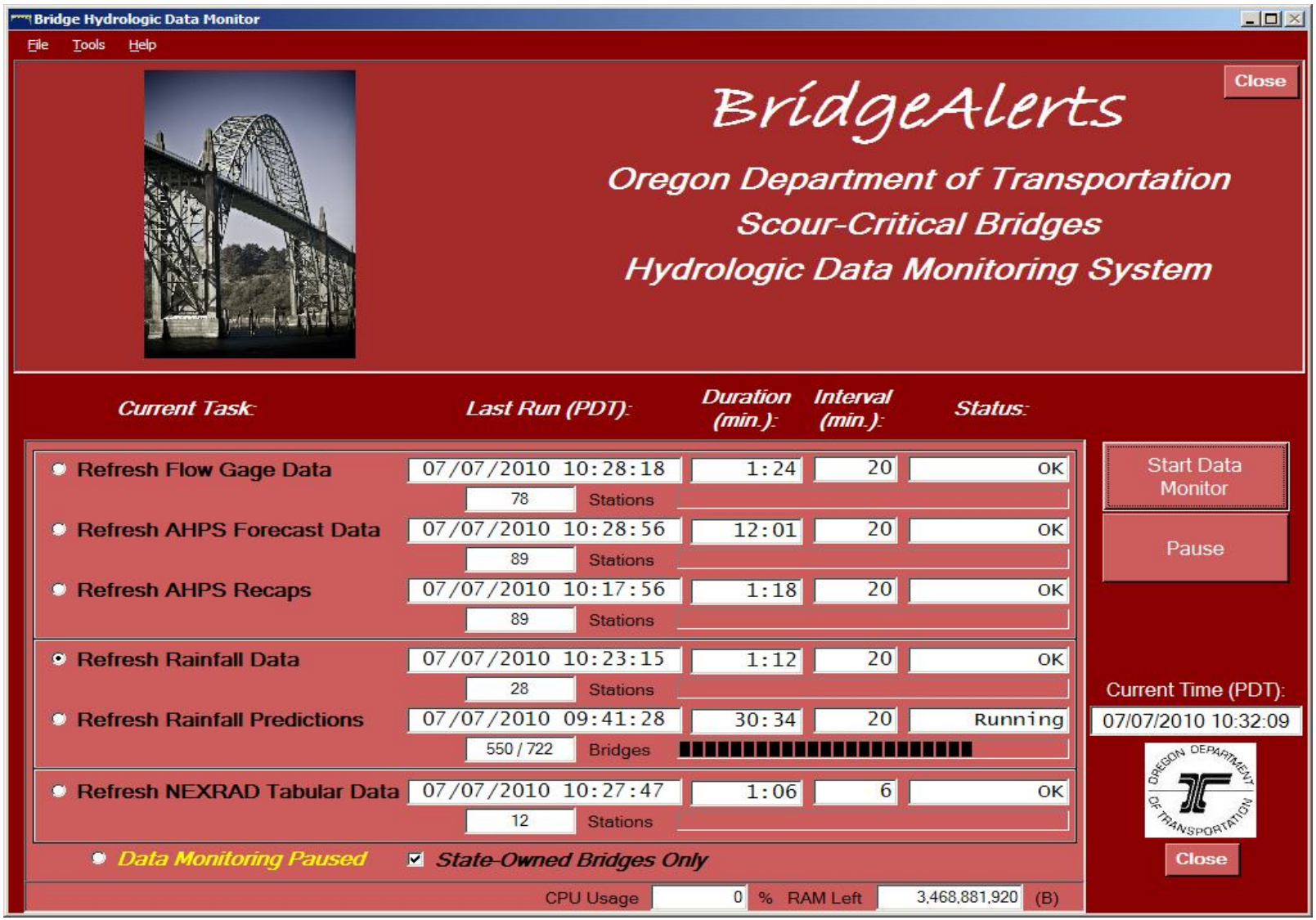
REAL – TIME MONITORING OF SCOUR CRITICAL BRIDGES

Two computers collect and analyze incoming data 24-hrs a day. Each serves as a back-up for the other.

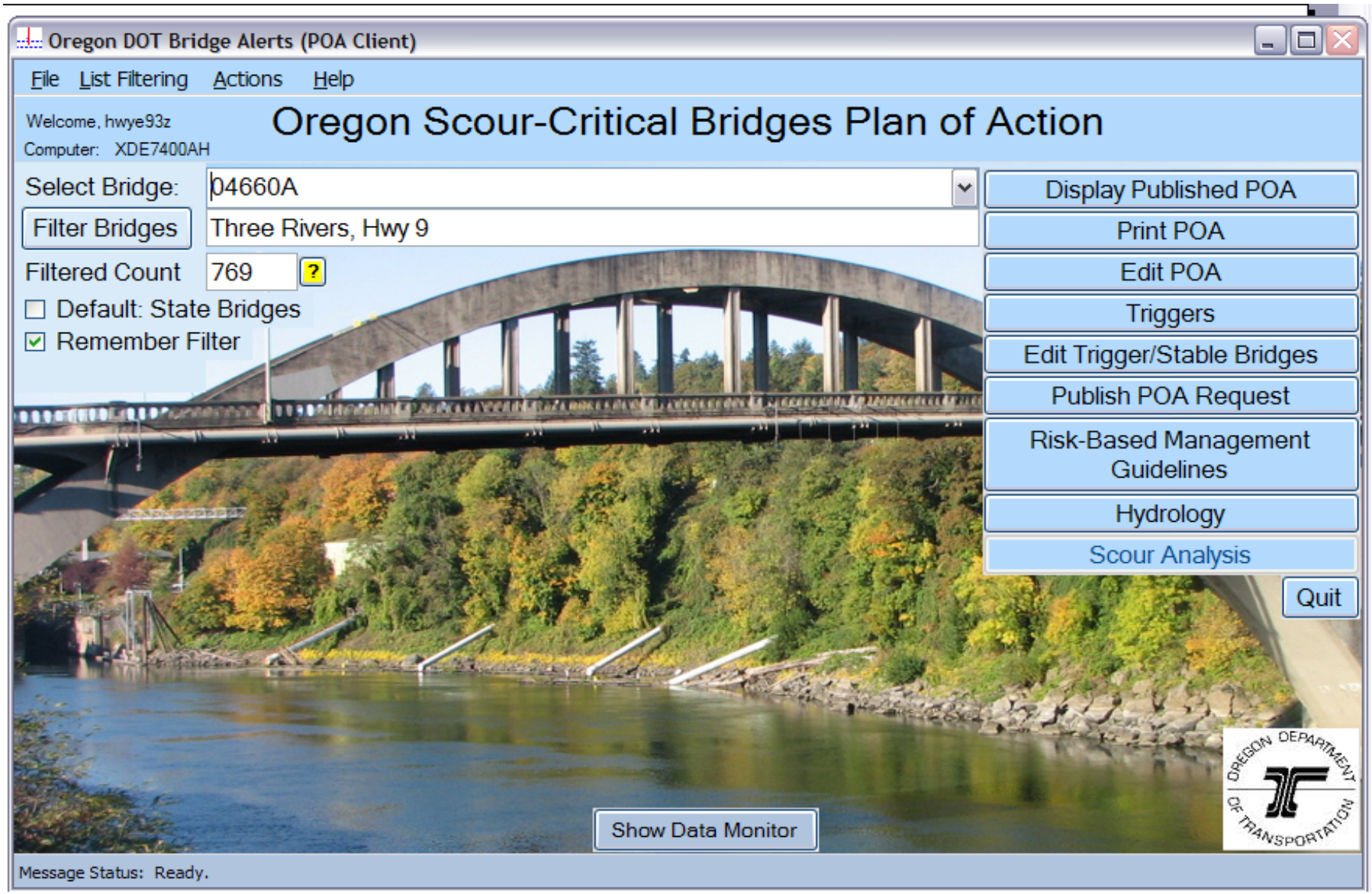
Computers monitor:

- USGS Stream flow data
- AHPS (Advanced Hydrologic Prediction Service) forecast data
- NWS (National Weather Service) rainfall data
- NWRFC (Northwest River Forecast Center) data
- National Climatic Data Center NEXRAD (Next Generation Radar) data

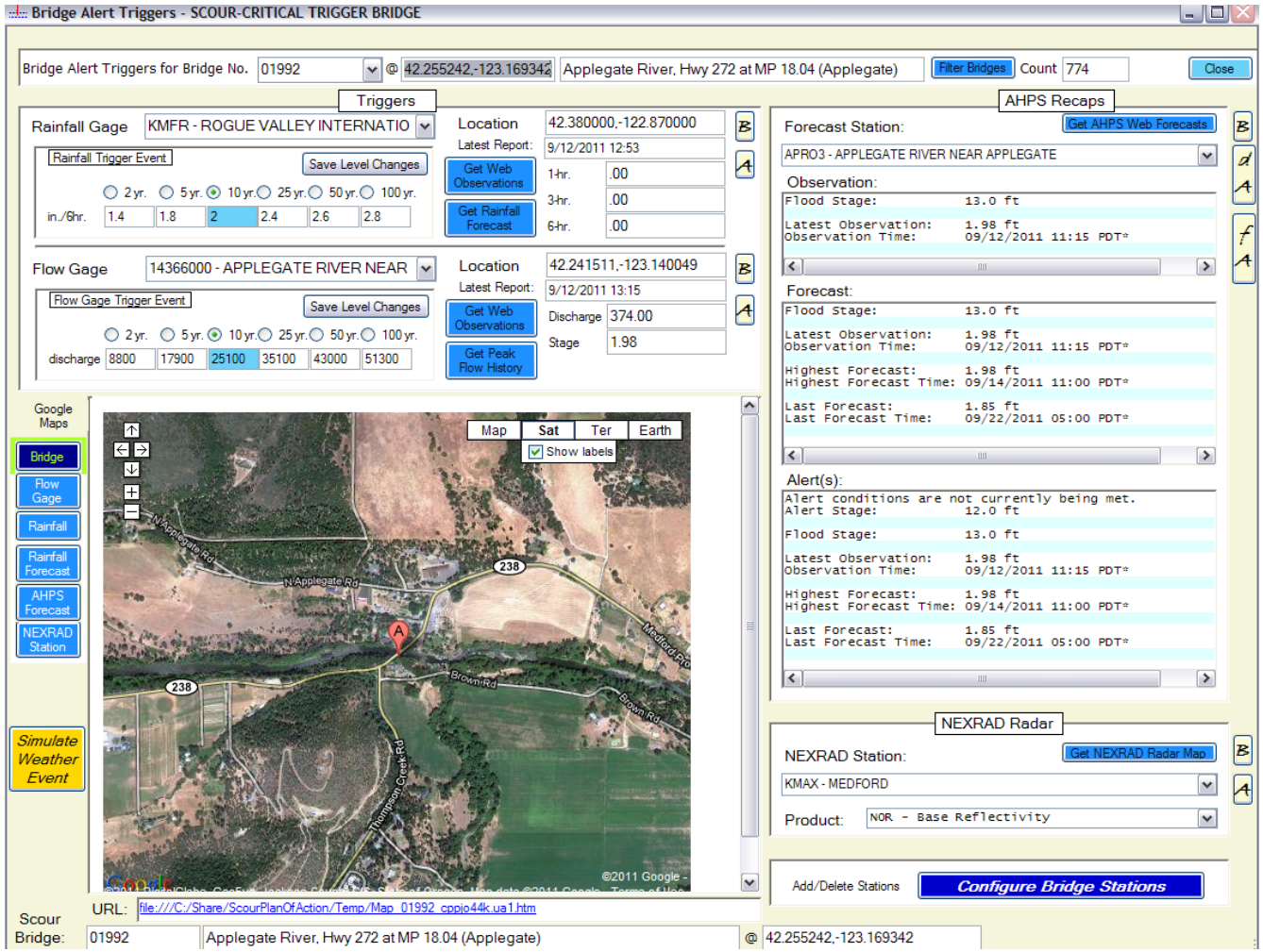
Real-Time Monitoring of hydrologic data.



Home page for the Plan of Action database



Hydrologic stations associated with each bridge. (trigger page)



Real time data is used to alert maintenance staff of potentially hazardous conditions

Each scour–critical bridge has been associated with hydrologic stations best suited to indicate potential scour problems.

When a discharge, rainfall, or event forecast exceeds a predetermined threshold, a text-message and e-mail are sent to the maintenance personnel responsible for that bridge.

These events are called trigger events, with the defaults set for 10 year recurrence-interval events.

Trigger Bridge

Definition:

- **A trigger bridge is representative of scouring conditions at all scour-critical bridges in the drainage basin it is within.**
- **It is used as a field indicator of scour risk during flooding in its basin.**
- **On site monitoring of the water surface elevation marked on each trigger bridge will cause specific actions to take place.**
  - **Generally, the first action would be to inspect all of the bridges located in that drainage basin for scour damage**

Why are trigger bridges necessary?

- **Real time monitoring data is regional in nature.**
- **Seldom are the monitored hydrologic sites very accurate indicators of what is actually happening at a specific bridge**
- **By physically observing the time when the trigger elevation is reached the values of the monitored hydrologic data can be determined and their values changed to trigger at these new values.**
- **The change is made in an attempt to better determine when the water surface elevation trigger will be reached.**
- **The assumption is that by matching the regional data to the actual trigger events each scour-critical bridge will have more accurate alerts.**

Trigger Bridge Marked

Advantages and Disadvantages

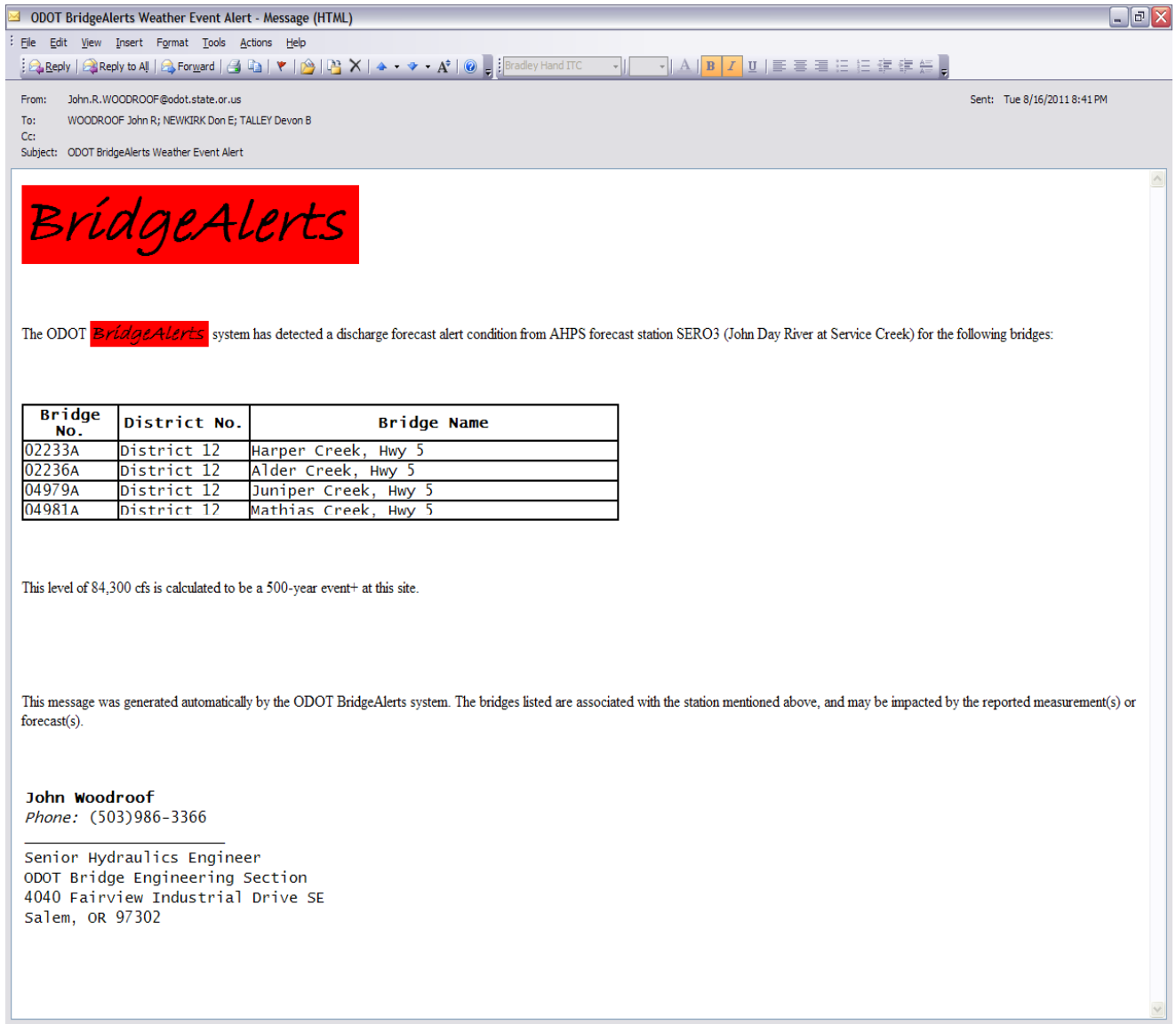
Advantages:

- **When several drainage basins are flooding, maintenance personnel can concentrate their field inspections to the basins triggered.**
- **The bridges used as basin triggers were chosen by the maintenance personnel responsible for the basin.**
- **The actual trigger elevations are determined with the help of the hydraulics unit.**

Disadvantage:

- **Actual field review is required before the trigger alert is activated.**
  - **Remote monitors do exist that will be put in place on each trigger bridge as funding becomes available**
- **Hydrologic monitoring stations are more regional in their coverage.**

e-mails sent when alert event occurs



ODOT BridgeAlerts Weather Event Alert - Message (HTML)

File Edit View Insert Format Tools Actions Help

Reply | Reply to All | Forward

From: John.R.WOODROOF@odot.state.or.us
Sent: Tue 8/16/2011 8:41 PM
To: WOODROOF John R; NEWKIRK Don E; TALLEY Devon B
Cc:
Subject: ODOT BridgeAlerts Weather Event Alert

BridgeAlerts

The ODOT BridgeAlerts system has detected a discharge forecast alert condition from AHPS forecast station SERO3 (John Day River at Service Creek) for the following bridges:

Bridge No.	District No.	Bridge Name
02233A	District 12	Harper Creek, Hwy 5
02236A	District 12	Alder Creek, Hwy 5
04979A	District 12	Juniper Creek, Hwy 5
04981A	District 12	Mathias Creek, Hwy 5

This level of 84,300 cfs is calculated to be a 500-year event+ at this site.

This message was generated automatically by the ODOT BridgeAlerts system. The bridges listed are associated with the station mentioned above, and may be impacted by the reported measurement(s) or forecast(s).

John Woodroof
Phone: (503)986-3366
Senior Hydraulics Engineer
ODOT Bridge Engineering Section
4040 Fairview Industrial Drive SE
Salem, OR 97302

Sent Alerts are verified by hydraulics engineer for accuracy

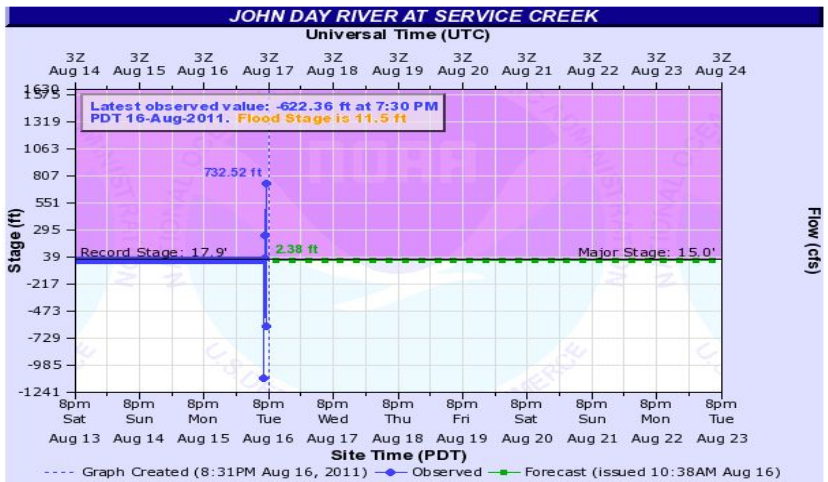
Discharge event at AHPS site SER03, John Day River at Sevice Creek - Message (HTML)

File Edit View Insert Format Tools Actions Help

Reply | Reply to All | Forward

From: Don Newkirk [don.newkirk@gmail.com]
To: TALLEY Devon B
Cc: WOODROOF John R
Subject: Discharge event at AHPS site SER03, John Day River at Sevice Creek

This event appears to be bogus.



I've consulted with John Woodroof, and we believe this is a broken gauge, for now. More tomorrow morning.

Good Night.

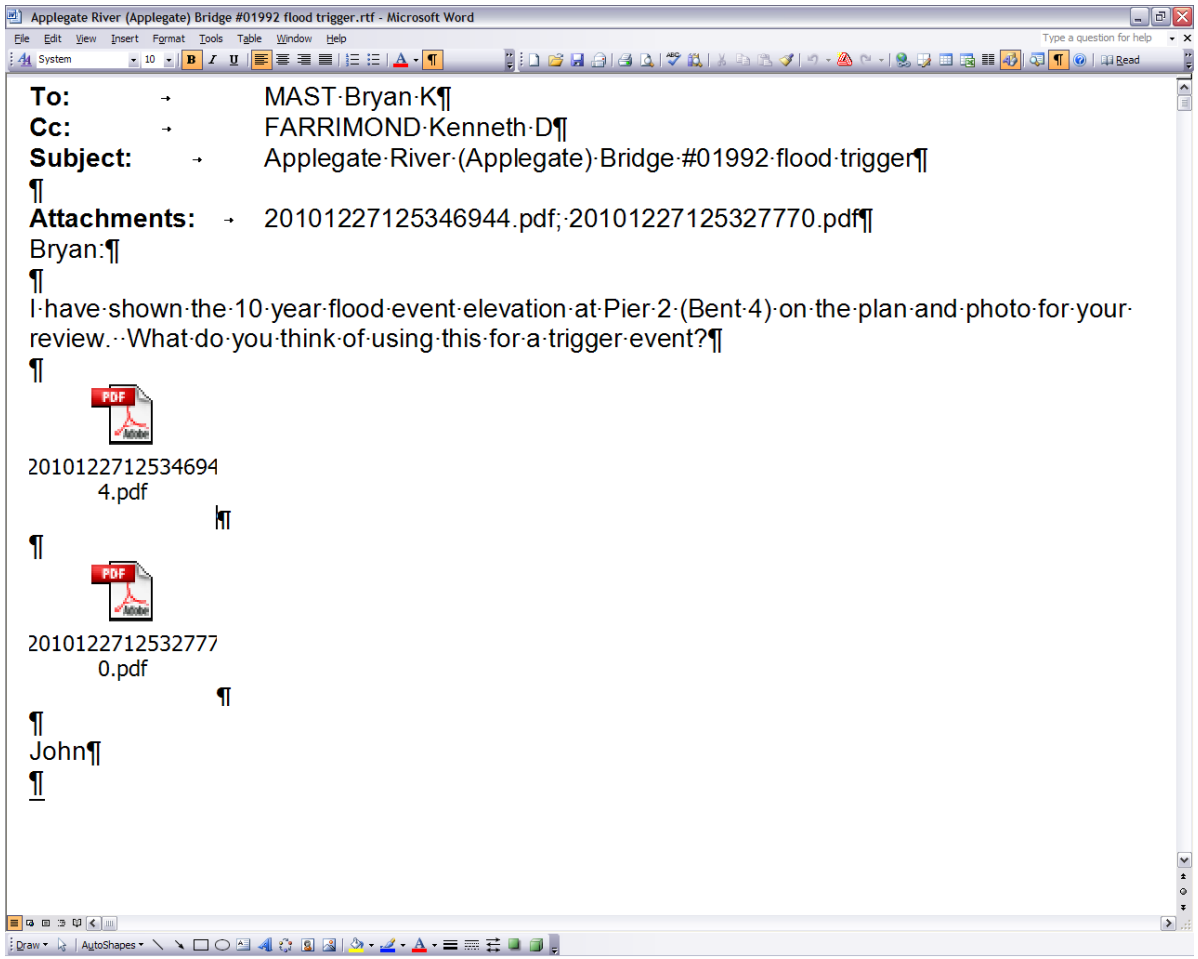
Don E. Newkirk

3021 13th Street SE
Salem, OR 97302-1580

ph. 503.851.8696

- **Trigger Bridge Creation**

E-mail between maintenance and headquarters regarding proposed trigger bridge



Applegate River (Applegate) Bridge #01992 flood trigger.rtf - Microsoft Word

File Edit View Insert Format Tools Table Window Help

To: MAST·Bryan·K¶
Cc: FARRIMOND·Kenneth·D¶
Subject: Applegate·River·(Applegate)·Bridge·#01992·flood·trigger¶
¶
Attachments: 20101227125346944.pdf;·20101227125327770.pdf¶
Bryan:¶
¶
I·have·shown·the·10·year·flood·event·elevation·at·Pier·2·(Bent·4)·on·the·plan·and·photo·for·your·review.··What·do·you·think·of·using·this·for·a·trigger·event?¶
¶

20101227125346944.pdf¶

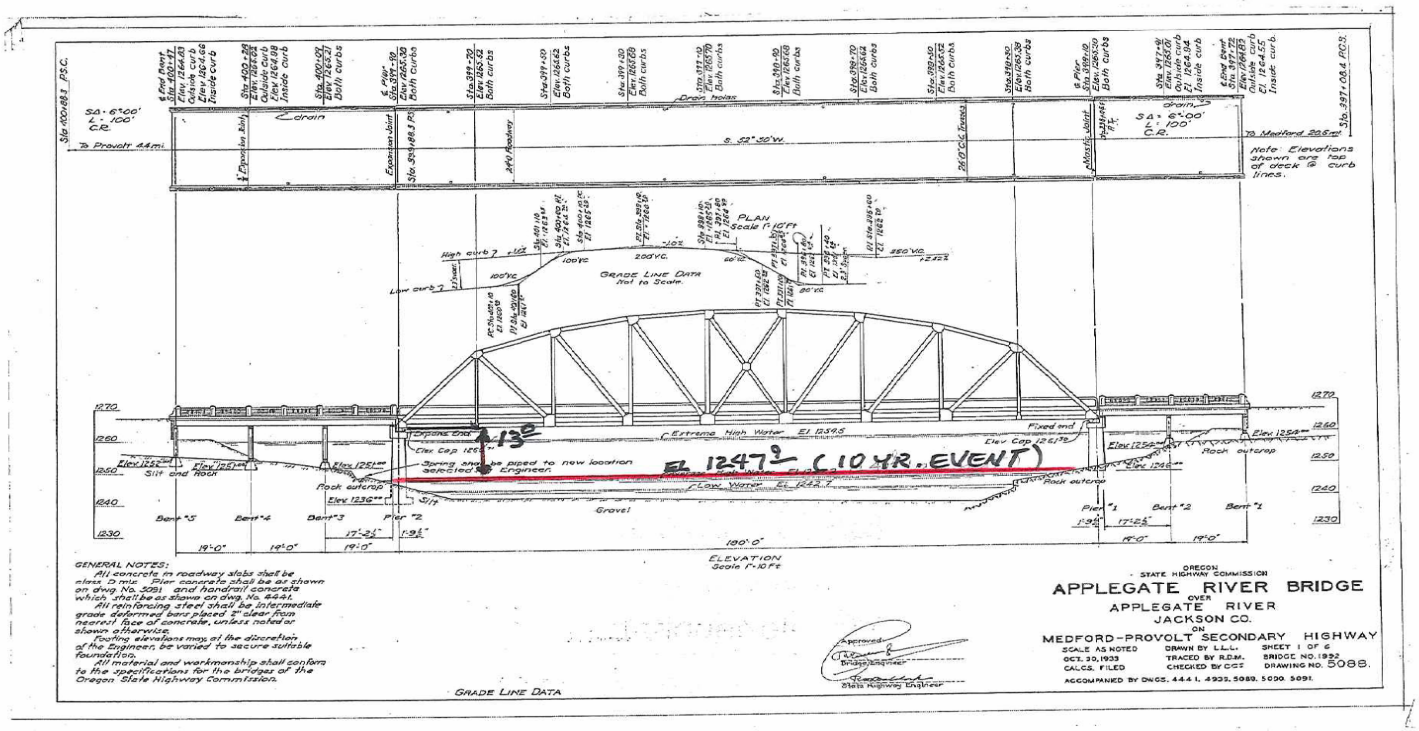
¶

20101227125327770.pdf¶

¶
John¶
¶

Plan and Elevation showing proposed trigger elevation

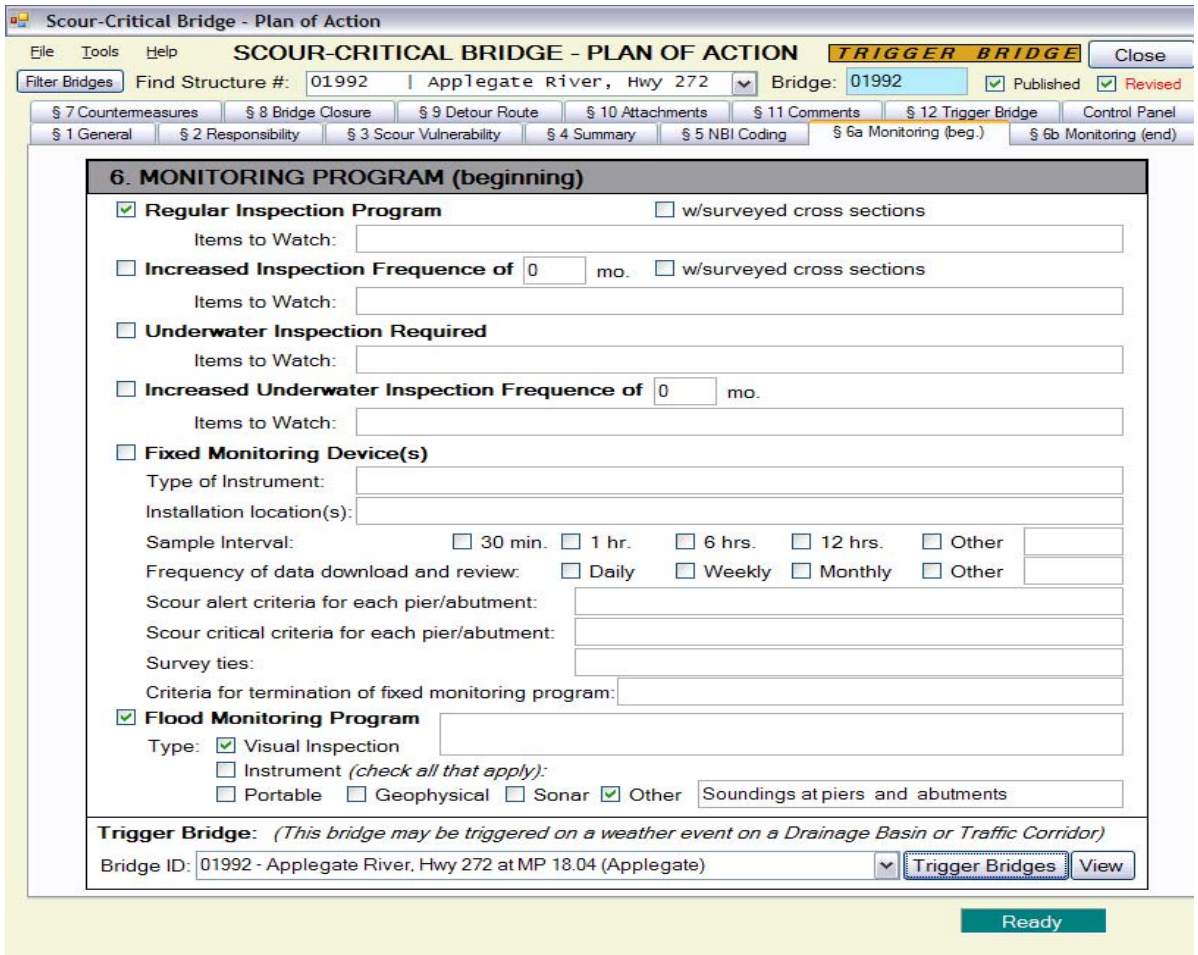
Plan and Elevation with proposed trigger elevation shown



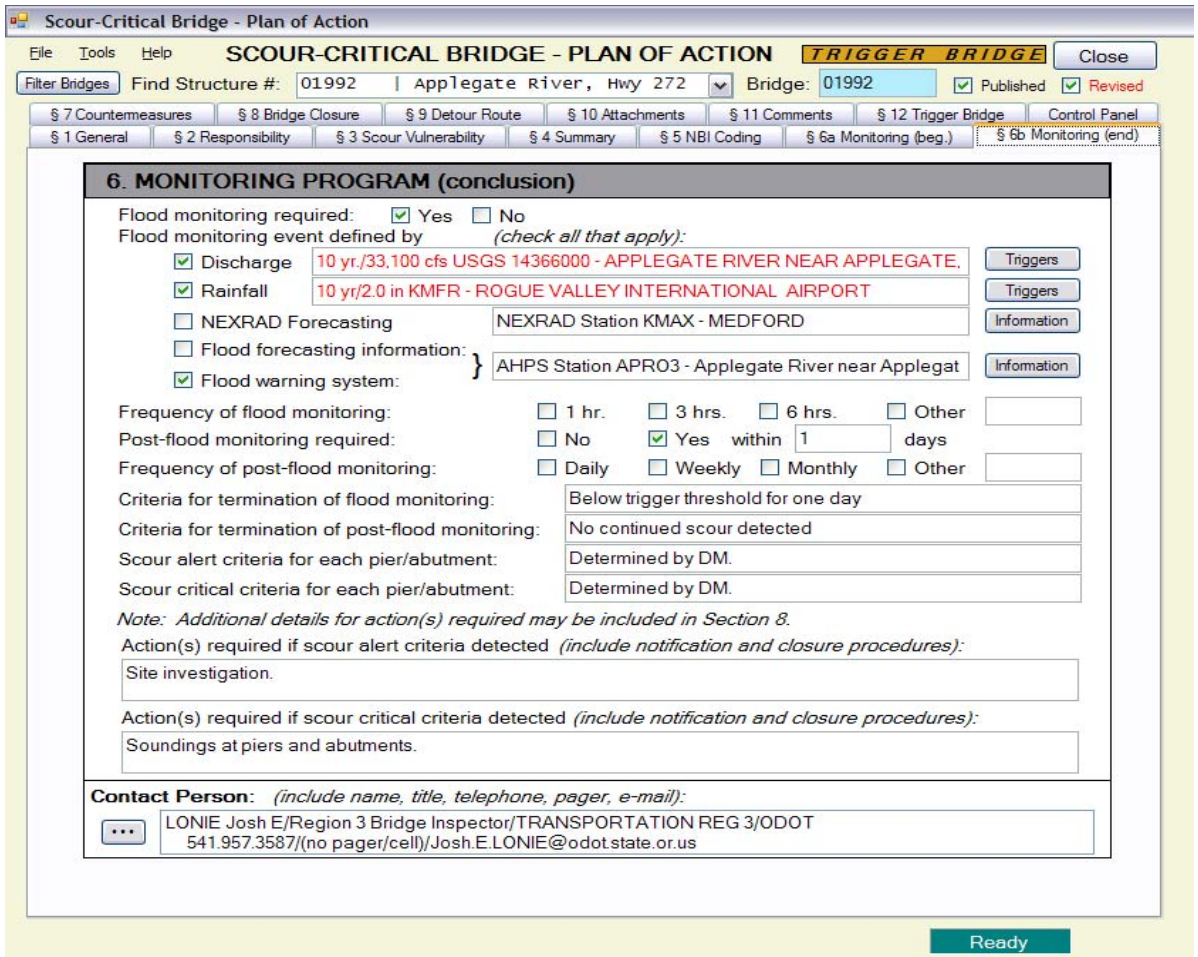
Elevation photo showing proposed trigger elevation

Trigger bridge after it has been marked

Plan of Action Monitoring page



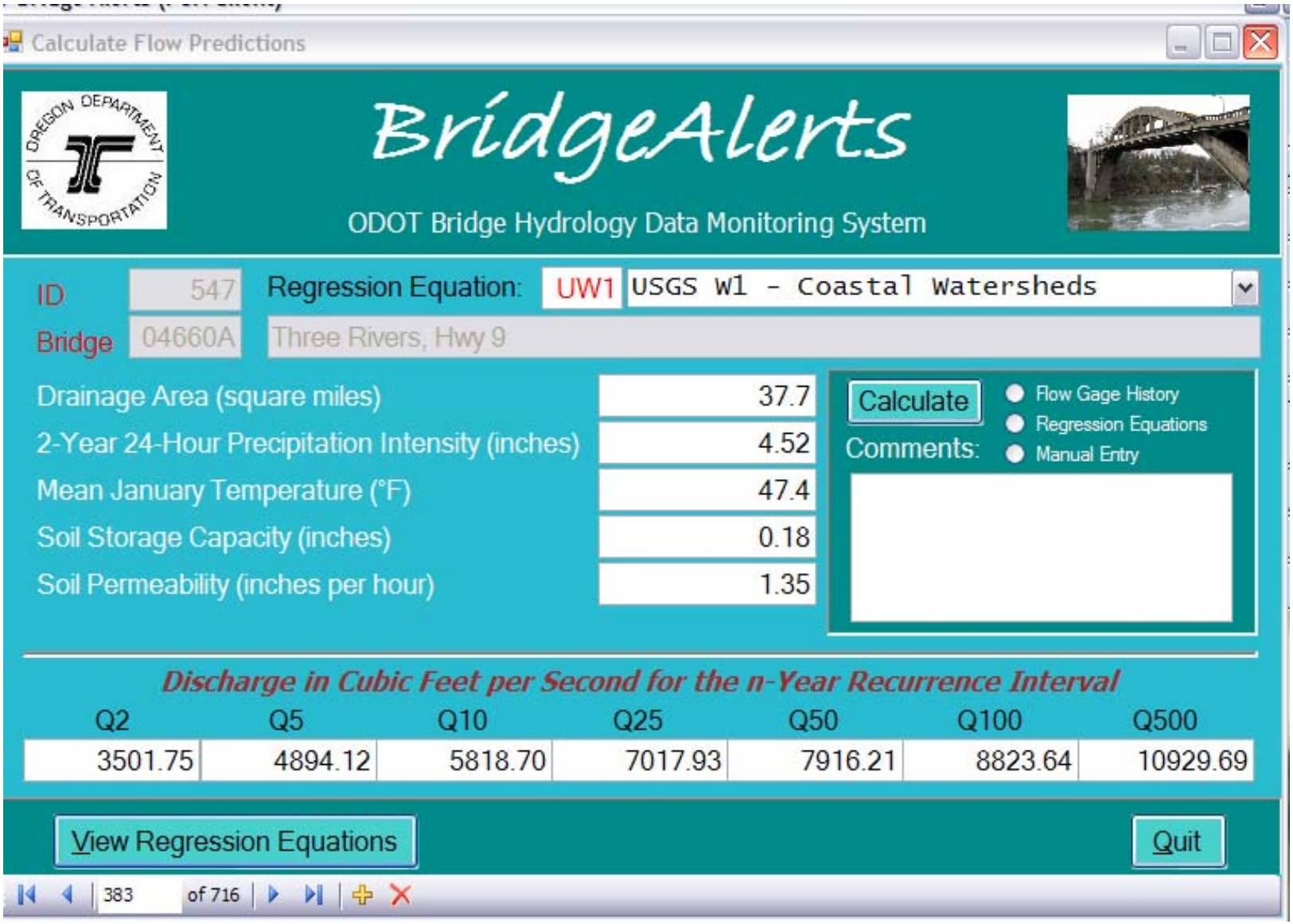
2nd page of Monitoring information



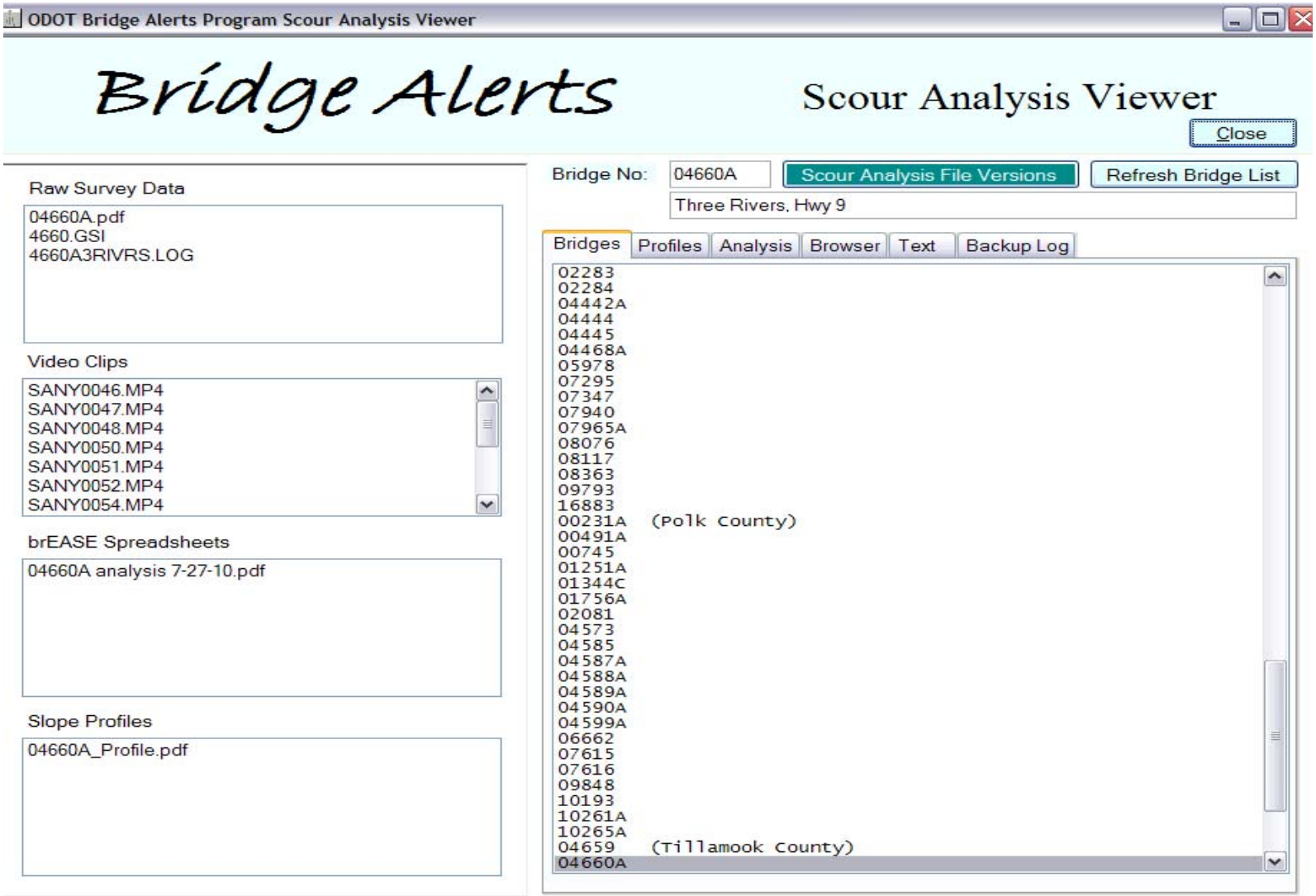
Scour Evaluation

- Points are surveyed along the stream channel by a survey crew
- Data collected is used to determine hydraulic grade line of the stream.
- Videos are taken at the bridge and at each point surveyed to gather enough information to do a preliminary hydraulic analysis

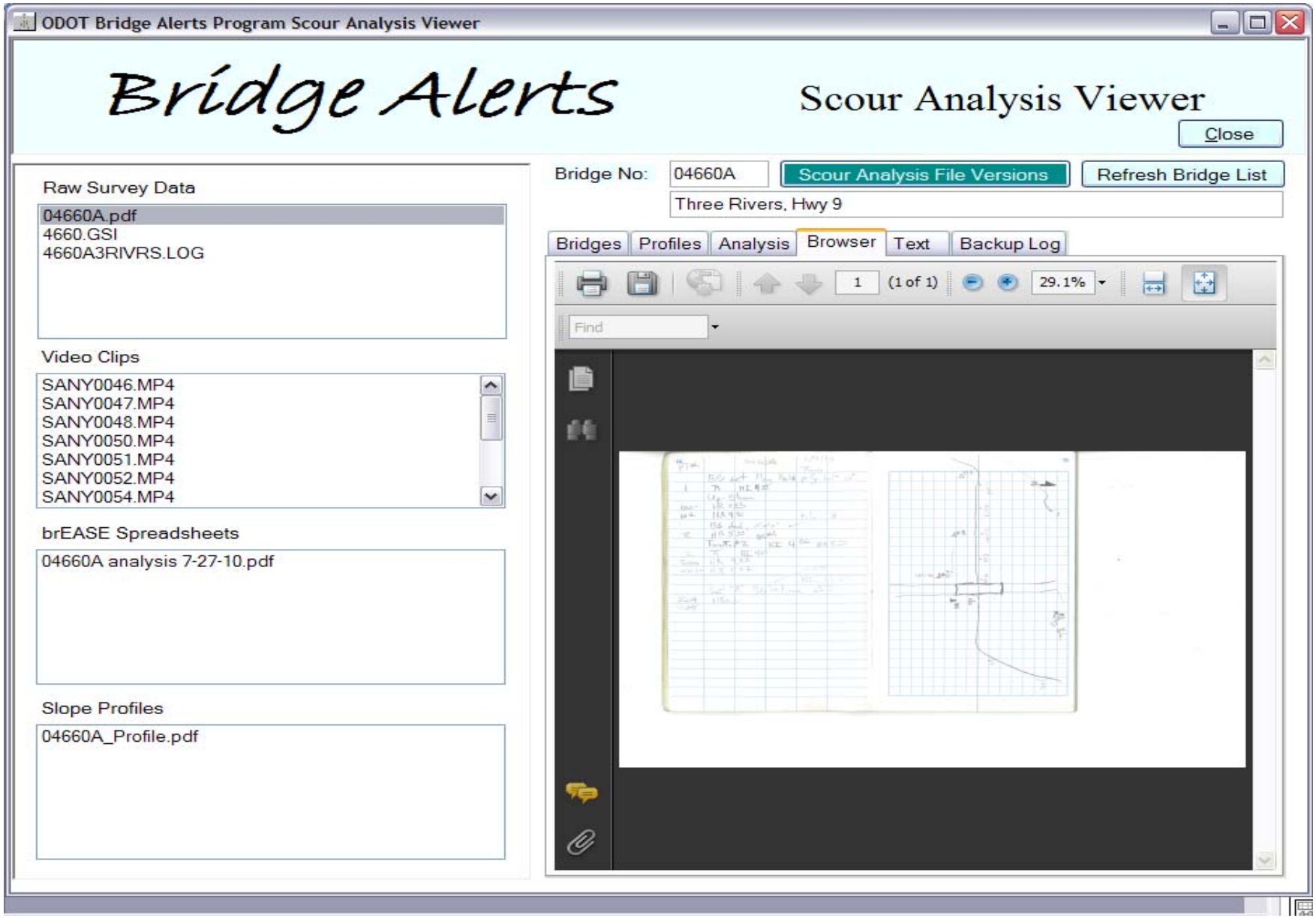
Hydrology determined from ODOT Regression Equations or from USGS "Stream - Stats" program



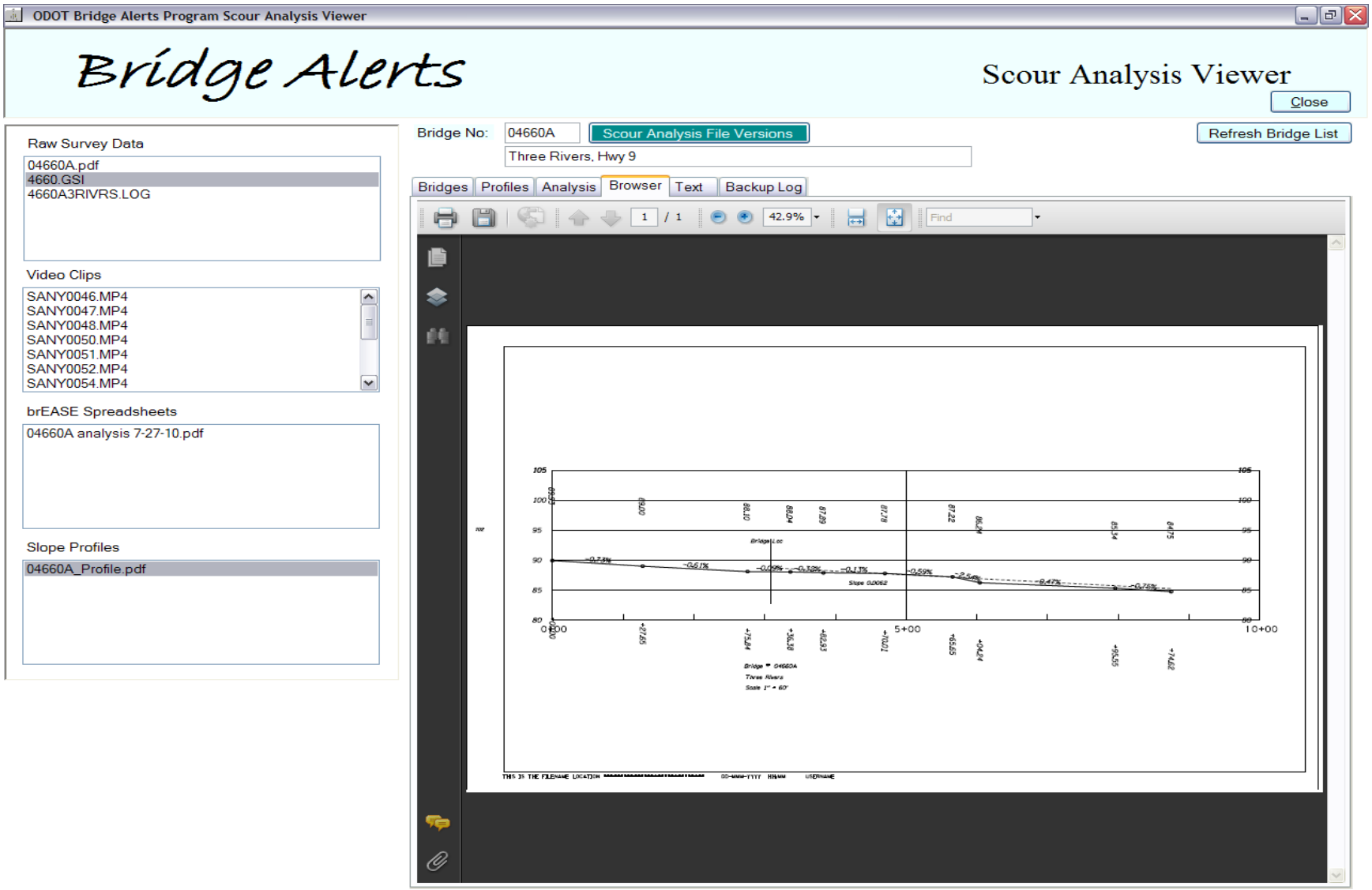
Three Rivers Bridge scour viewer



Scour Analysis Viewer

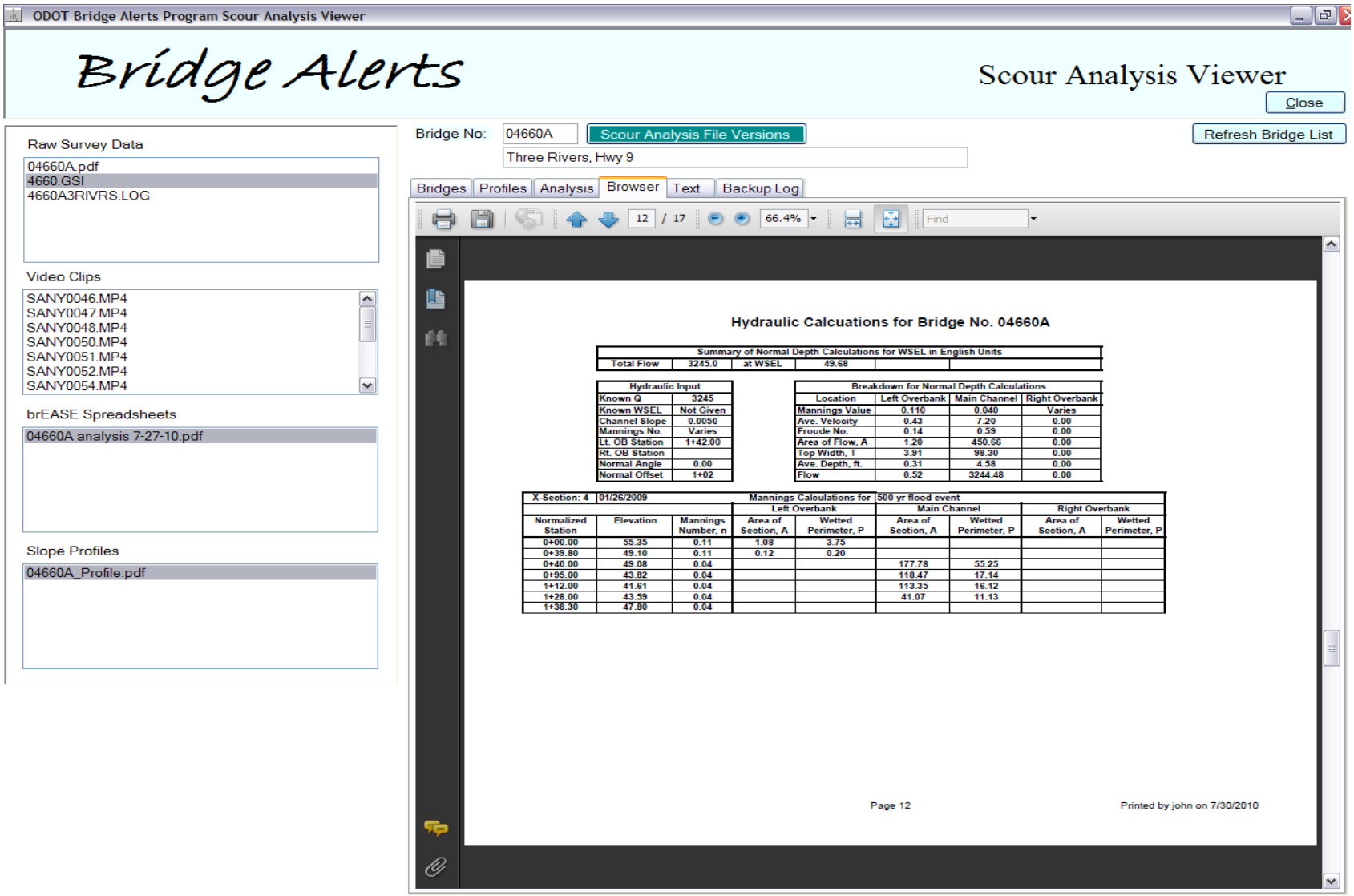


Stream profile is plotted using Micro-Station



Typical Video taken at each point surveyed

Hydraulics Calculation Summary



Preliminary Scour Analysis Summary

Raw Survey Data

04660A.pdf
4660.GSI
4660A3RIVRS.LOG

Video Clips

SANY0046.MP4
SANY0047.MP4
SANY0048.MP4
SANY0050.MP4
SANY0051.MP4
SANY0052.MP4
SANY0054.MP4

brEASE Spreadsheets

04660A analysis 7-27-10.pdf

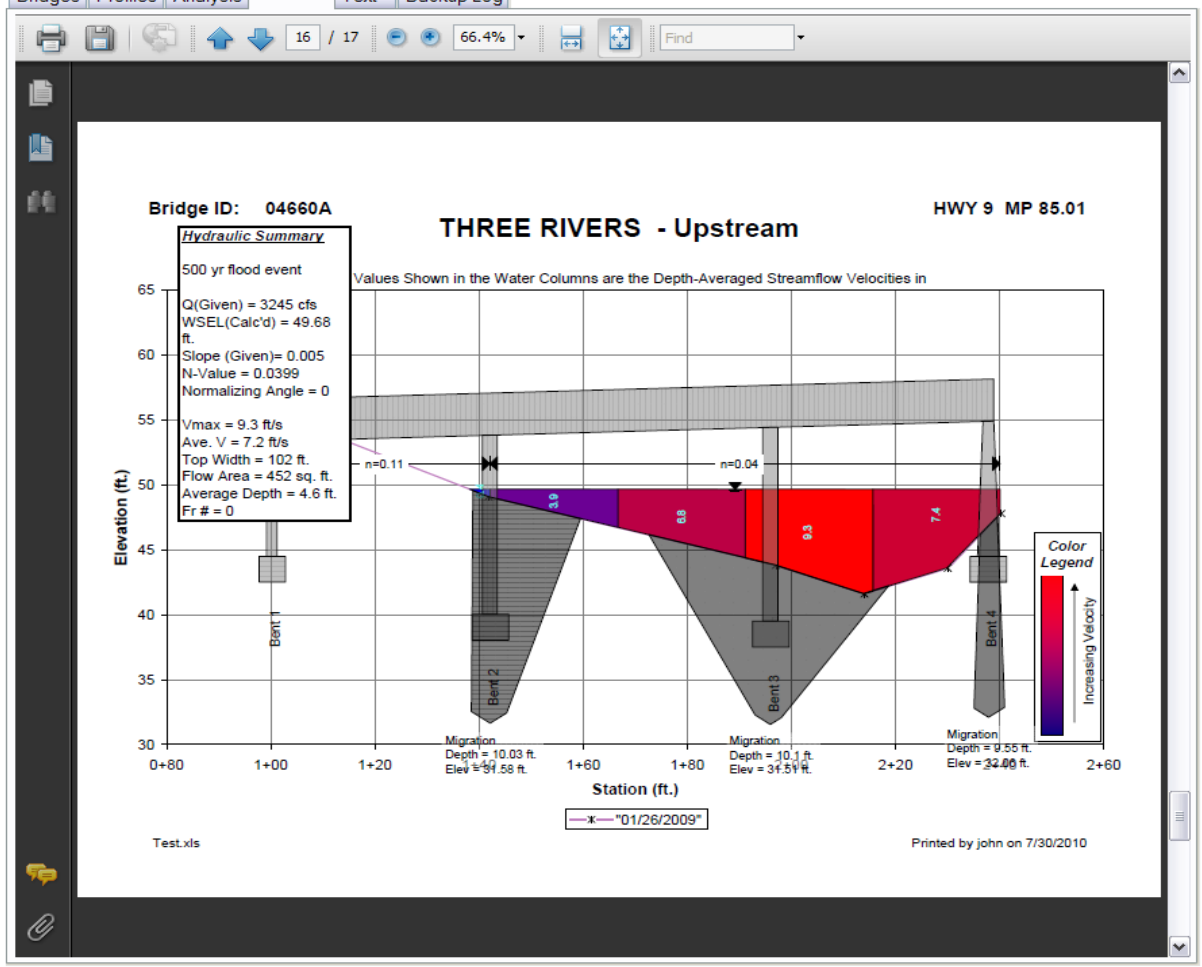
Slope Profiles

04660A_Profile.pdf

Bridge No: 04660A | Scour Analysis File Versions | Refresh Bridge List

Three Rivers, Hwy 9

Bridges | Profiles | Analysis | Browser | Text | Backup Log



Scour Code Revision

Given:

1. The preliminary hydraulics analysis for scour
2. Geotechnical information
3. Structural input
4. The scour code can be changed if necessary

What about unknown foundation bridges?

- ODOT treats them as scour critical.
- Each unknown foundation bridge has a Plan of Action and is in the Bridge Alerts System.
- NCHRP document 107 (Risk Based Management Guidelines for Scour Critical Bridges with Unknown Foundations) has had its proscribed process transferred to a flow chart for reference.

Unknown Foundation Flowchart