Murphy, Nate

From: Christopher Byrum <chris.byrum1037@yahoo.com>
Sent: Tuesday, November 9, 2021 9:17 AM
To: Berkholz, Aaron; Murphy, Nate
Subject: C. Byrum summary memo - Grove Rd second opinion
Attachments: Grove Rd Creep - Byrum Sketches.pdf

[External Sender]

Hello Aaron and Nate – This email summarizes my data analysis and evaluation of the creeping river bank slope and sheet pile wall on Grove Road near Ypsilanti, Michigan. In general, I understand the creeping slope had damaged the previous edge of roadway and storm outlet utilities in this area. A design team was hired a few years ago to develop a solution to the problem. a large steel sheet pile wall was installed on the river side of the roadway in the creep area in attempt to stop the ongoing creep movements of the roadway and sidewalk. I understand creep deformations have continued and the top of the new sheet pile wall has now moved outward by about 3-4 inches and slope slough creep is continuing to occur. The active wedge of soil retained by the wall has shifted and is starting to extend into the recently repaired roadway, causing settlements and cracking of the paved lane and curb line. A newer watermain exists under the sidewalk that is settling and creeping towards the river. In general, this ongoing slope and wall creep is a result of the slope and retaining wall system having too low of a factor of safety, too close to 1.0, resulting in the observed slow creep type deformations.

In my opinion, there are a few factors adding together to cause this low factor of safety condition and resulting creep deformations at this site. After a review of the data provided by your office, I offer the following comments and observations:

1. There appears to have been and over-estimate of the passive resistance available in front of the sheeting. This may be related to soil strength assumptions being too high for the passive wedge material and/or the slope angle on the passive wedge being steeper than the designers assumed.
2. There may be an under-estimation of the active force pushing on the sheet pile wall. This could be caused by a build-up of water behind the sheeting and/or by soil strength assumptions being too high. The assumed long term drained angle of internal friction for the site clays was assumed as 32 degrees in the geotechnical report for the design. In my opinion this is too high for medium plasticity silty clays having moisture content, sand content, and plasticity index data as described in the geotechnical report.
3. The natural flow of groundwater seepage and surface run off would tend to be towards the river in this area. The sheet pile wall may be acting somewhat as a dam, causing water pressure head to build up behind the wall while depriving the passive wedge zone of water lowering the pressure head in the passive wedge zone. This could cause the effective water pressure on the wall to increase to levels higher than were assumed in the design.
4. The watermain under the sidewalk in the creep deformation zone is at risk. If a leak forms in this watermain, it would rapidly cause a large increase in water pressure behind the sheet pile wall, possibly rising almost to the top of sheeting elevation. This could cause creep rates to increase or even cause a sudden larger movement. Take action to re-route this water supply and turn off the pressure in this main.
5. As of our site visit together on November 3, the roadway ride quality was not critically affected but cracking at the back of the active wedge is starting to move into the roadway, as confirmed by your recent inclinometer readings from an inclinometer casing installed in the roadway lane. Some minor settlement of the curb line and outer couple of feet of the paved lane has occurred. The curb line sealant has ripped open, and the concrete curb is beginning to rotate towards the river and separate from the pavement.
6. The new storm water outlet pipe is at risk near the hole through the sheeting. Significant settlement of the ground in front of the sheeting and around the outlet pipe has occurred and is an indication that large shear

7. force may be developing on the pipe right at the sheet pile wall hole as the pipe is pressed onto the sheeting from the settlements. This pipe should be inspected up near the sheeting opening.
   Some larger trees have been affected and are rotating or falling. As these trees fall they can sometimes leave large stump holes in the steep slope, which can further affect slope movements in odd ways.

I have attached a pdf file containing my generalized interpretation of the limits and nature of the slope creep zone. Some recommendations we discussed are as follows:

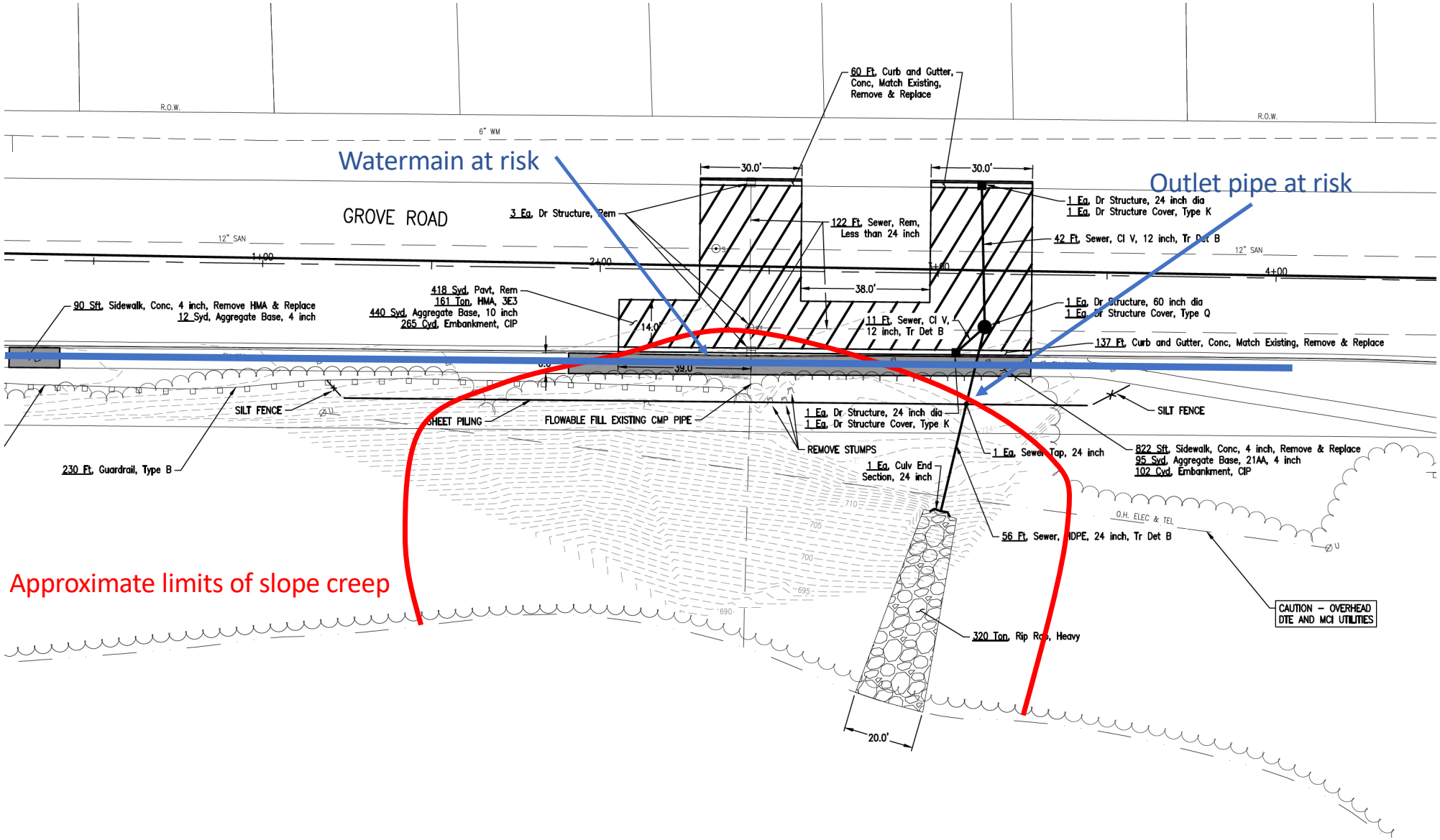
1. Obtain detailed slope cross section information in the critical area. Extend the cross sections into the river so the global stability modeling can accurately simulate the existing slope angles and shapes.
2. Take action to turn off the critical watermain now before they start piling snow on it.
3. Investigate what it will take for WCRC to clear and grub and then establish 1:2 or flatter slopes in front of the existing sheeting.
4. Investigate two general "repair of the repair" options. Option one would be to use a ground anchor system installed through the existing sheeting and using a whaler and anchor head type detail along the front of the wall. Option two would be to use a combination of lightweight fills and geogrid/geotextile reinforcements behind the wall without using a ground anchor system.

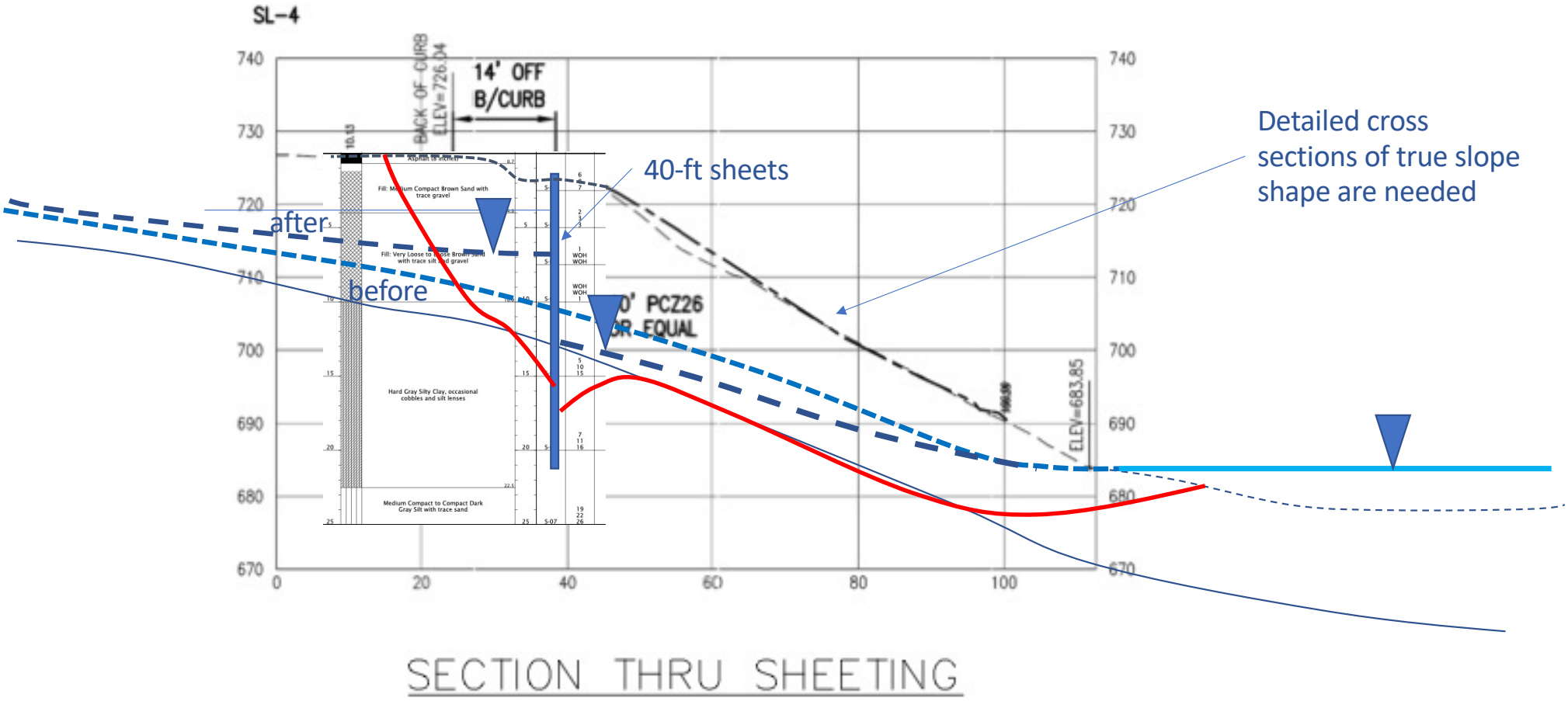
This memo concludes my initial services for a second opinion on this issue. Per our discussions I can assist you with the next phase of analyzing in detail further repair options and developing pre-plans designs for the two general repair approaches described above. I spoke with Mahmoud El-Gamal at INTERTEK-PSI on this issue and INTERTEK-PSI has agreed to team with us for these services. We are working on a proposal for these services and will contact you soon.

Sincerely,

Christopher R. Byrum, PhD, PE
BYRUM RESEARCH AND DESIGN
517-993-4316


Grove Rd


Watermain at risk
Outlet pipe at risk
Approximate limits of slope creep
GROVE ROAD
R.O.W.
R.O.W.
6" WM
12" SAN
12" SAN
1+00
2+00
3+00
4+00
60 Ft, Curb and Gutter, Conc, Match Existing, Remove & Replace
3 Ea, Dr Structure, Rem
122 Ft, Sewer, Rem, Less than 24 inch
30.0'
30.0'
38.0'
1 Ea, Dr Structure, 24 inch dia
1 Ea, Dr Structure Cover, Type K
42 Ft, Sewer, Cl V, 12 inch, Tr Det B
1 Ea, Dr Structure, 60 inch dia
1 Ea, Dr Structure Cover, Type Q
137 Ft, Curb and Gutter, Conc, Match Existing, Remove & Replace
418 Syd, Pavt, Rem
161 Ton, HMA, 3E3
440 Syd, Aggregate Base, 10 inch
265 Cyd, Embankment, CIP
90 Sft, Sidewalk, Conc, 4 inch, Remove HMA & Replace
12 Syd, Aggregate Base, 4 inch
14.0'
11 Ft, Sewer, Cl V, 12 inch, Tr Det B
39.0'
SILT FENCE
SHEET PILING
FLOWABLE FILL EXISTING CMP PIPE
1 Ea, Dr Structure, 24 inch dia
1 Ea, Dr Structure Cover, Type K
REMOVE STUMPS
1 Ea, Culv End Section, 24 inch
1 Ea, Sewer Tap, 24 inch
822 Sft, Sidewalk, Conc, 4 inch, Remove & Replace
95 Syd, Aggregate Base, 21AA, 4 inch
102 Cyd, Embankment, CIP
230 Ft, Guardrail, Type B
56 Ft, Sewer, HDPE, 24 inch, Tr Det B
O.H. ELEC & TEL
CAUTION – OVERHEAD DTE AND MCI UTILITIES
320 Ton, Rip Rap, Heavy
20.0'
710
705
700
695
690



Approximate nature of the slip zone near center of mass