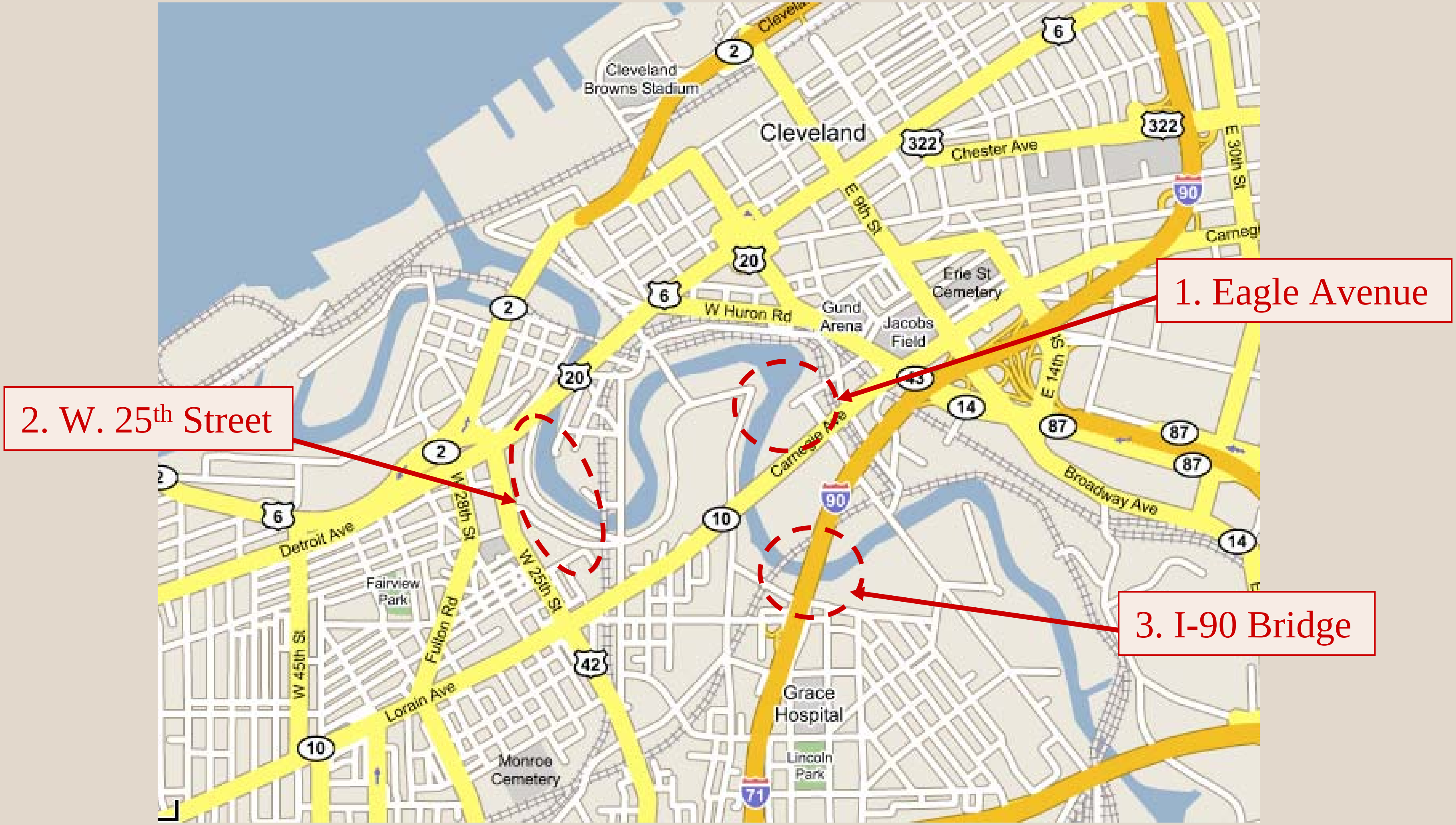
Geologic History and Resulting Unstable Slopes in the Cuyahoga River Valley

BBC&M ENGINEERING, INC.
6190 Enterprise Court
Dublin, OH 43016

Donald C. Wotring, Ph.D.
Stephen C. Pasternack, Ph.D., P.E.

BBCM

Cleveland Downtown Vicinity



Geologic History – Cuyahoga River Valley

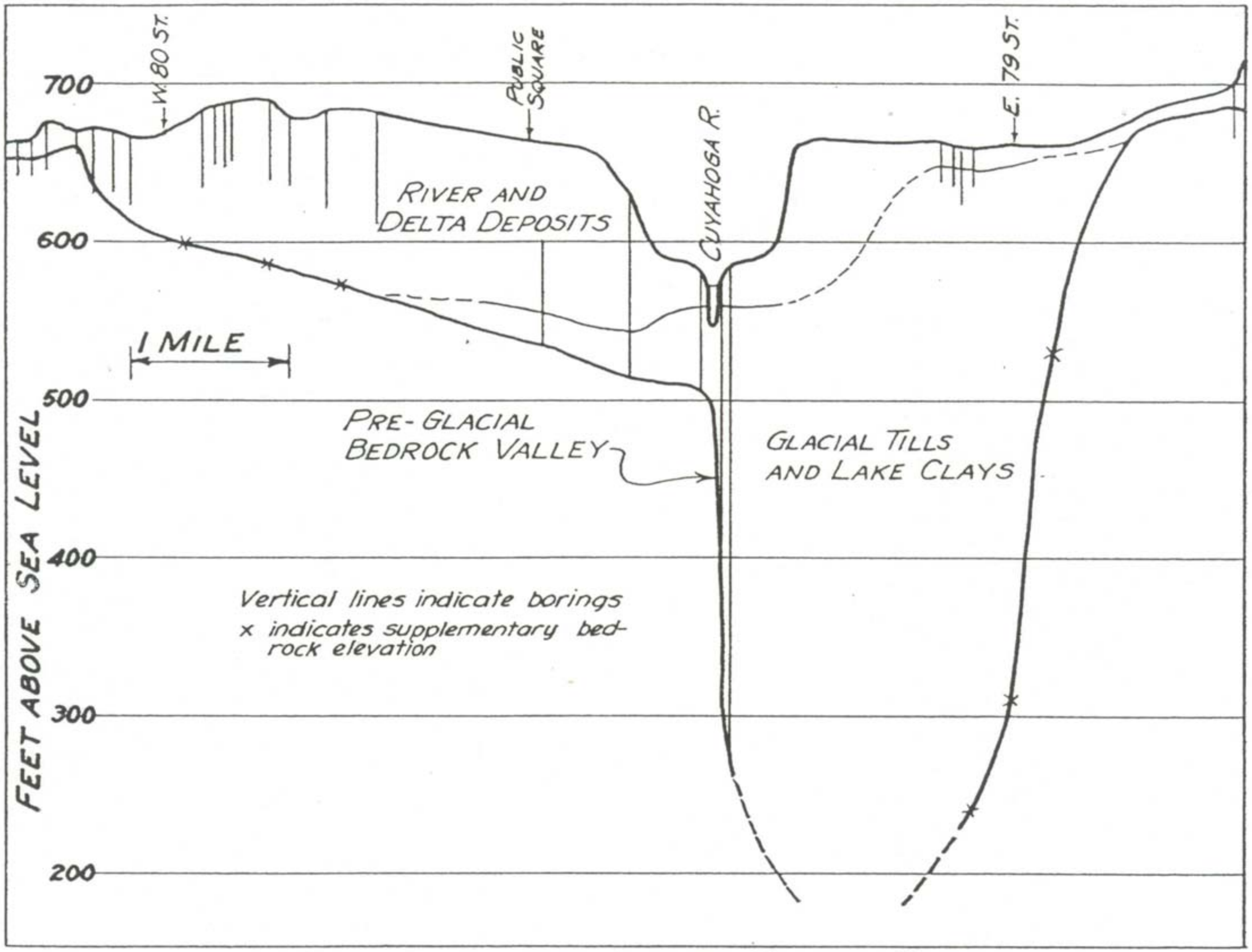
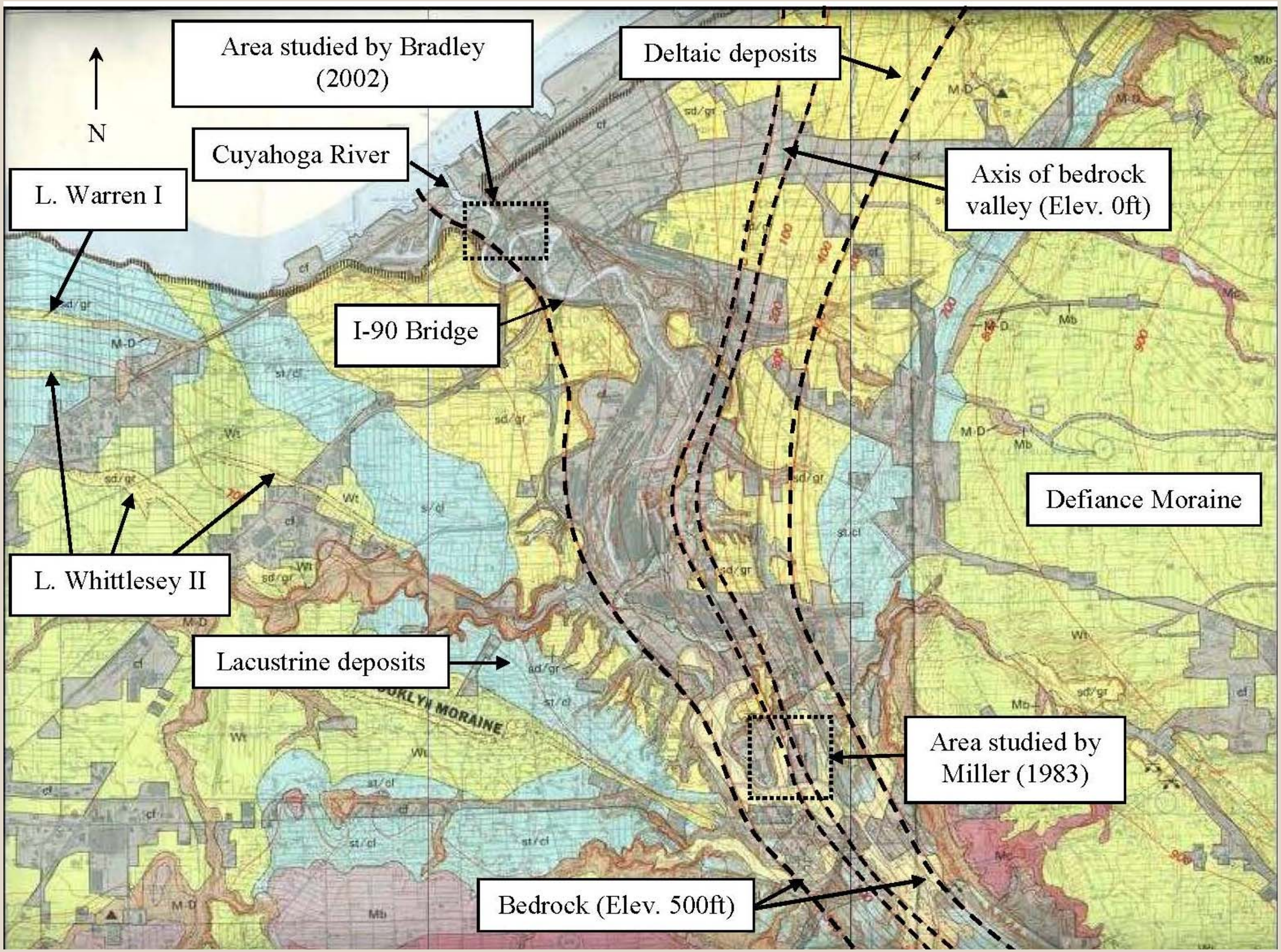


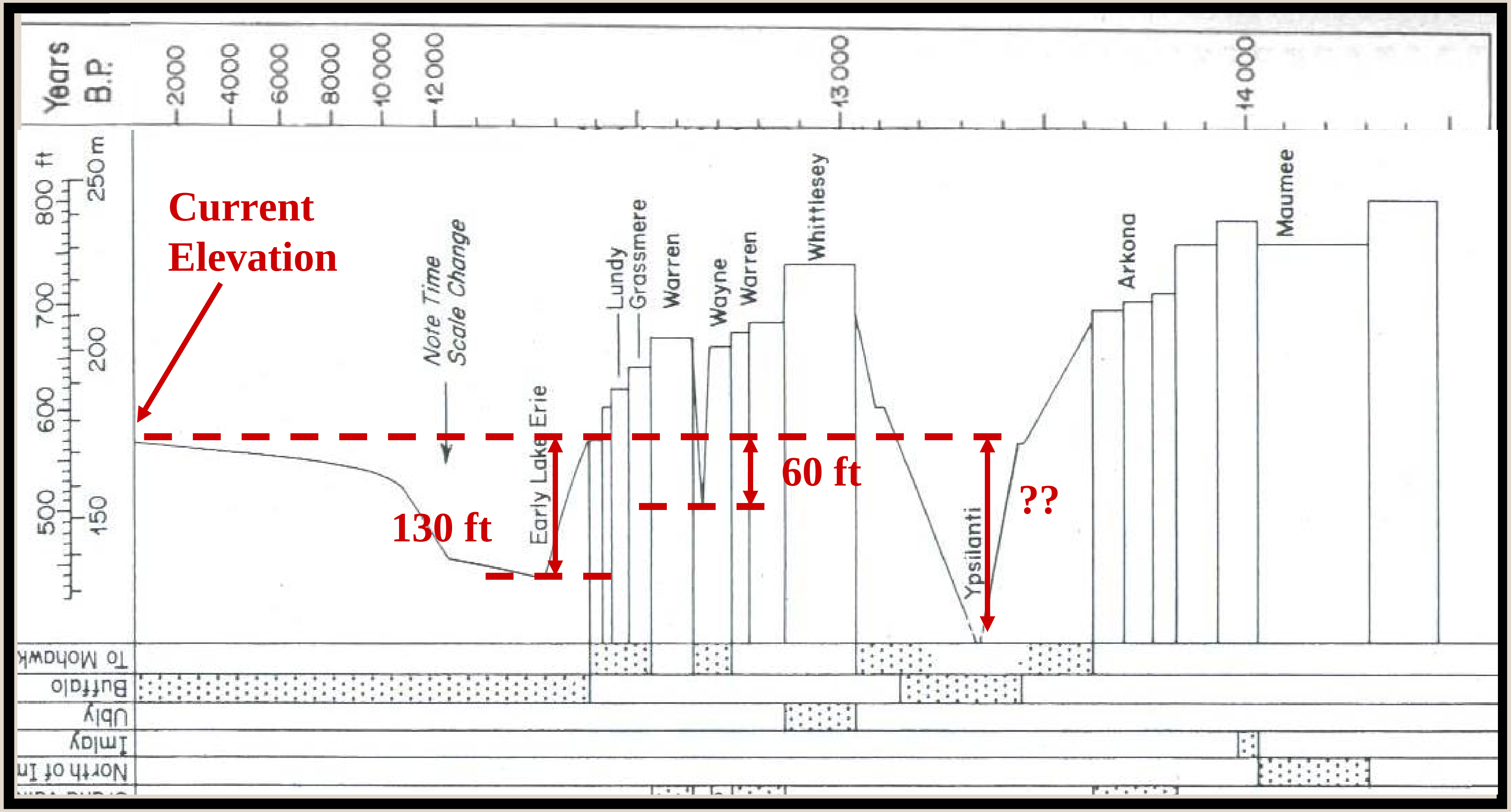
FIG. 2. EAST-WEST SECTION THROUGH VALLEY

Geologic History – Glacial Deposits



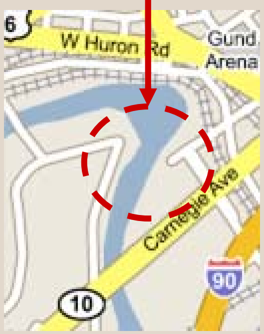
BBCM

Glacial Lake Erie History

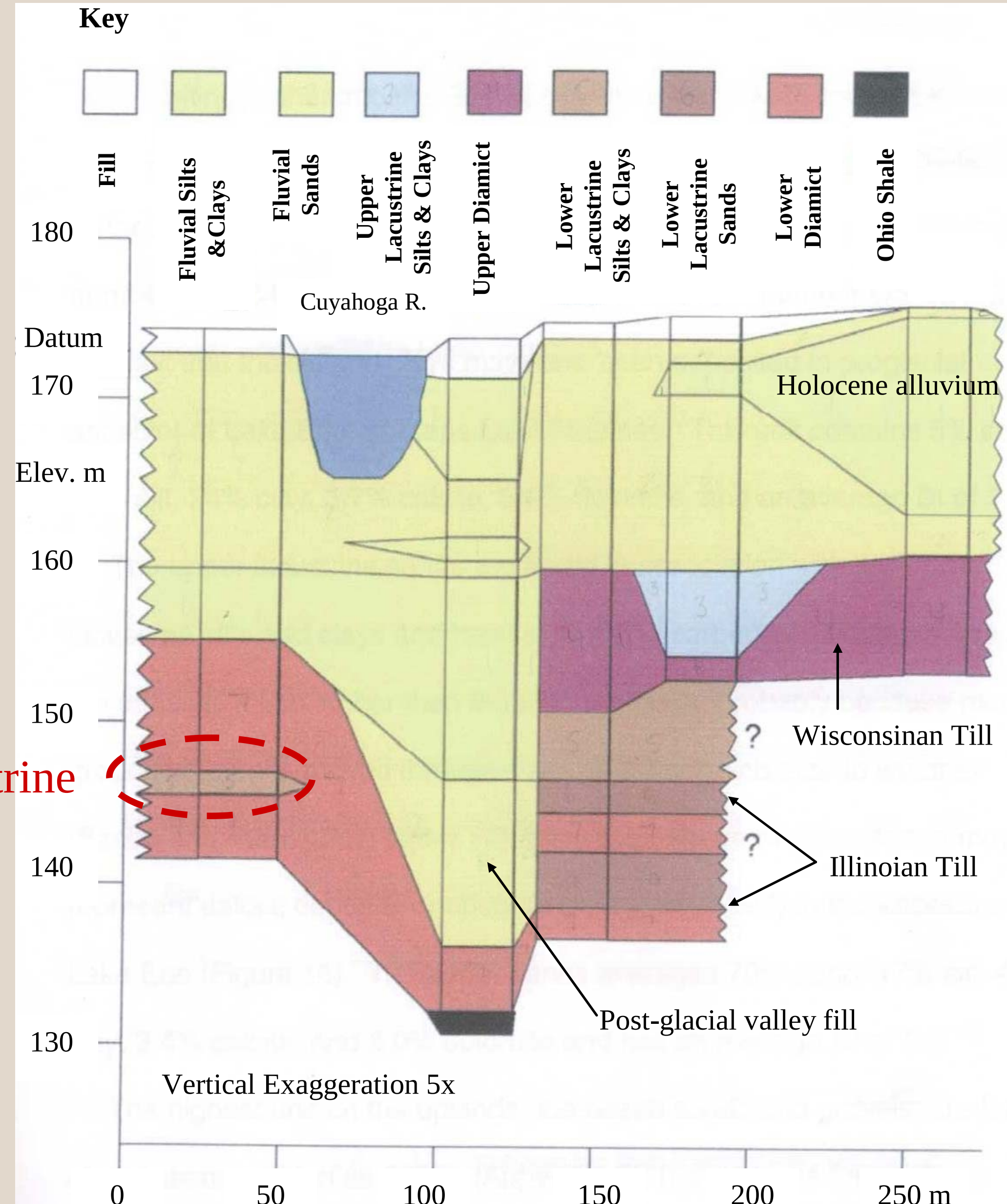


1. Eagle Avenue – Geological Cross Section

1. Eagle Avenue

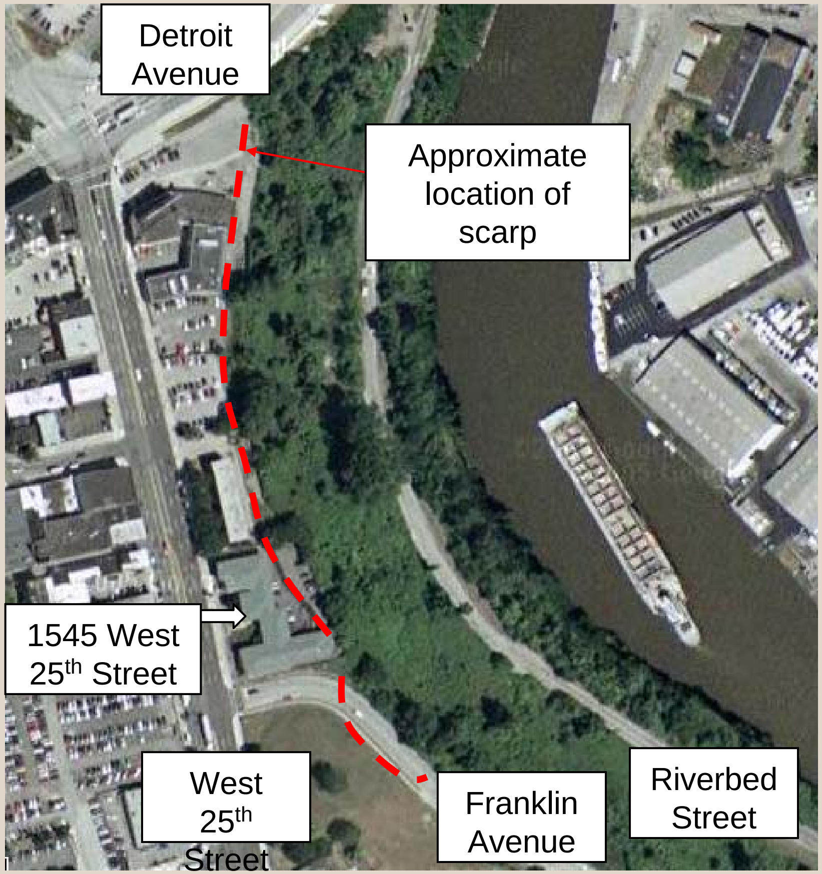


Lacustrine



BBCM

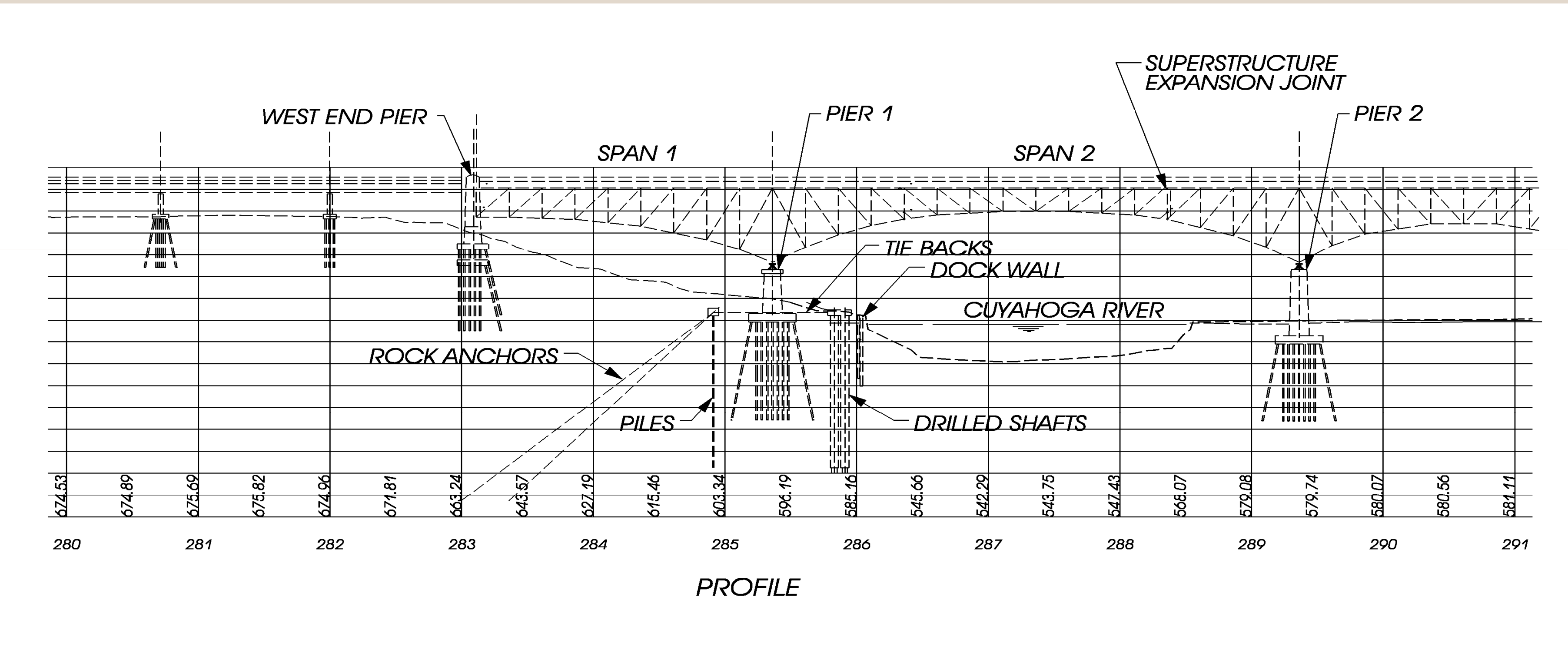
2. West 25th Street



BBCM

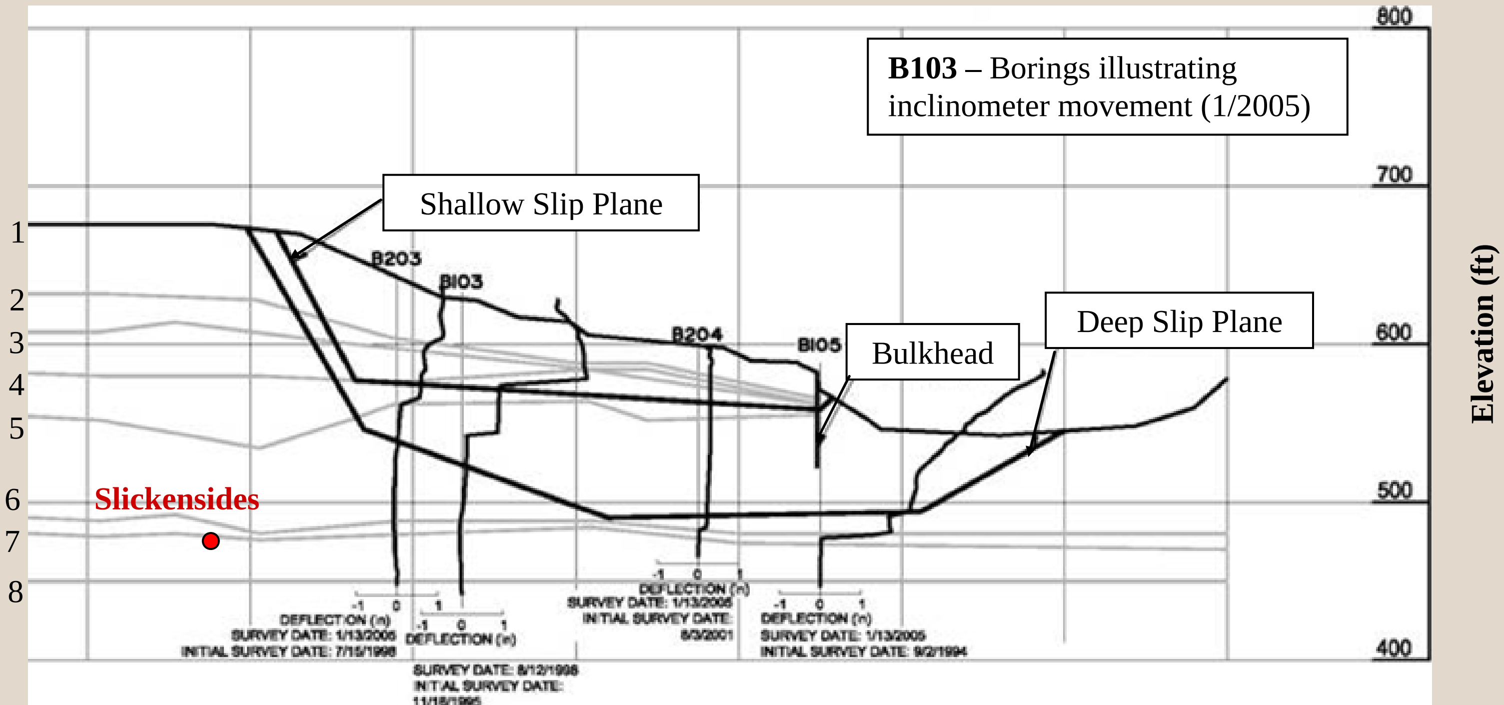
3. I-90 Bridge

3. I-90 Bridge – Cross Section



3. I-90 Bridge – Inclinometer Movement

Centerline of I-90 – 35' W from West End Pier South Leg

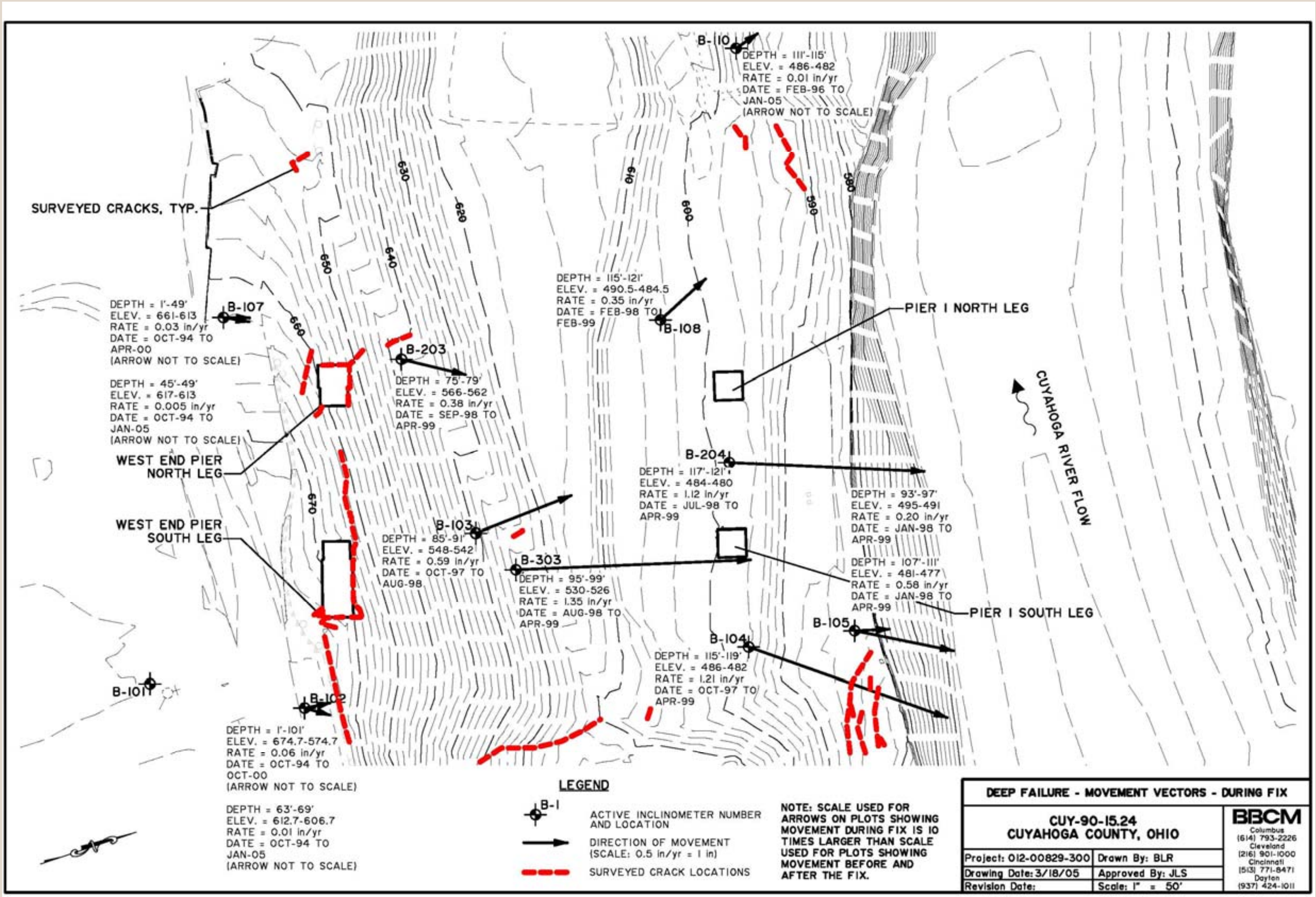


Soil Description

1, 2	Wisconsinan Deltaic and Beach Deposits (Lake Warren)	**6**	Wisconsinan (?) Silt
3, 4, 5	Wisconsinan Lacustrine Silty Clay (Lake Maumee)	**7**	Illinoian Silty Clay Till
		8	Devonian Ohio Shale

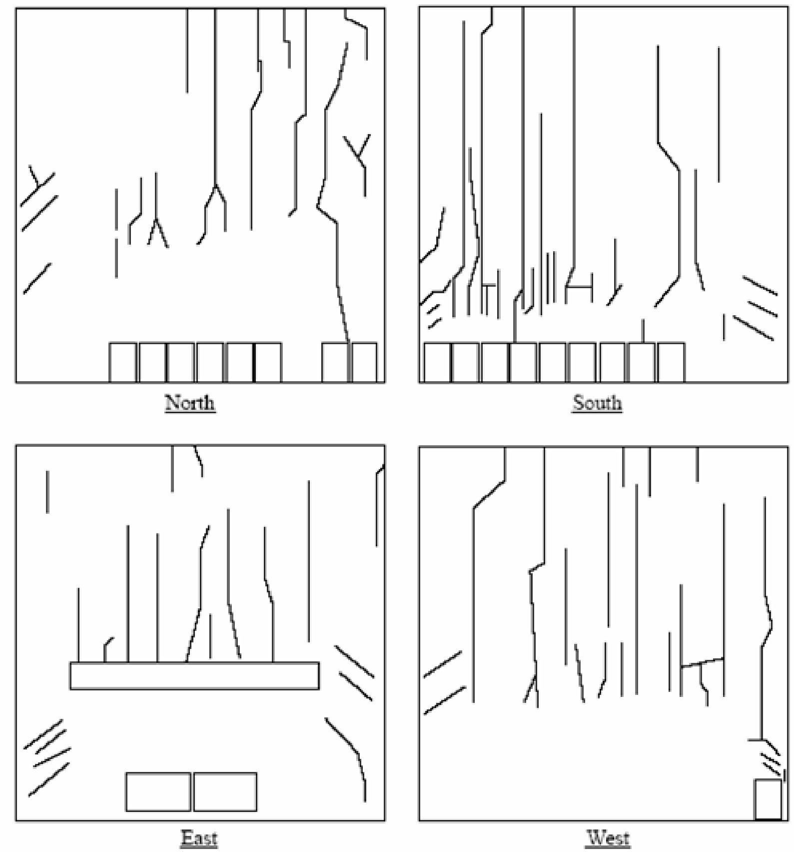
BBCM

3. I-90 Bridge – Inclinometer Movement



3. I-90 Bridge - Field Reconnaissance

Plate 46: Warehouse (cold storage) west of I-90 on University Avenue, point 9. Photo is looking at the east wall of the warehouse.



Address/Location:	Warehouse (cold storage) west of I-90 on University Avenue		
Type of Surface:	R. Concrete	Plate #'s: 46-55	
Date: 8/2/2005	Employee:DCW, EAA	Crack Width: 1-5mm	Crack Length: 10-100 ft

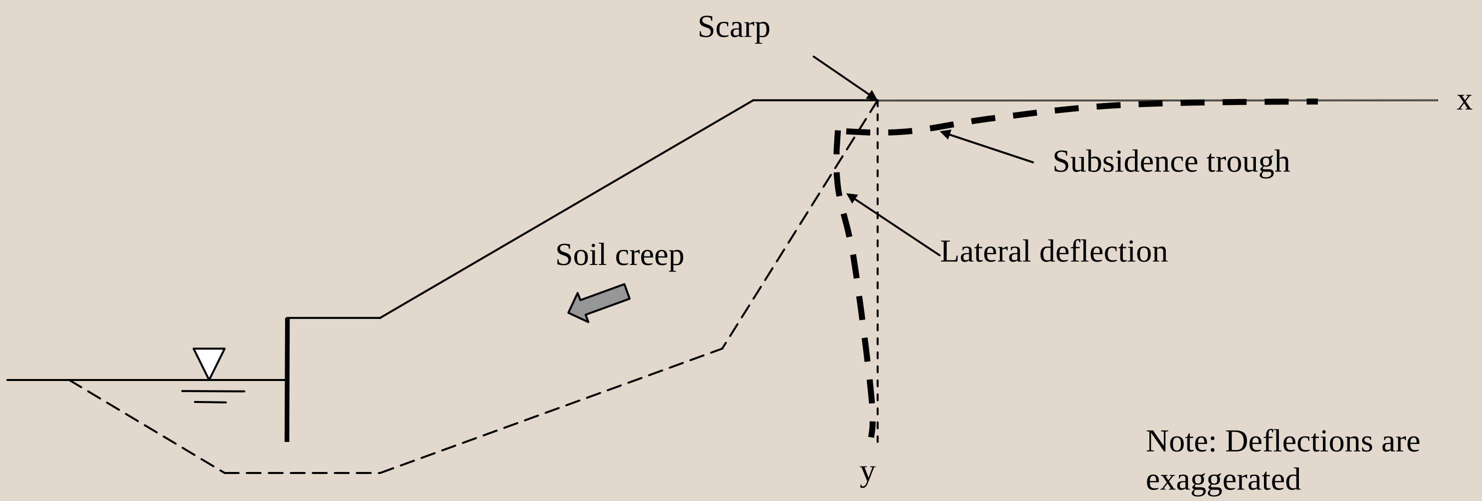
Plate 45: Crack mapping for the warehouse (cold storage) west of I-90 on University Avenue, point 9. The location and extent of the cracking is approximate only.

3. I-90 Bridge - Field Reconnaissance

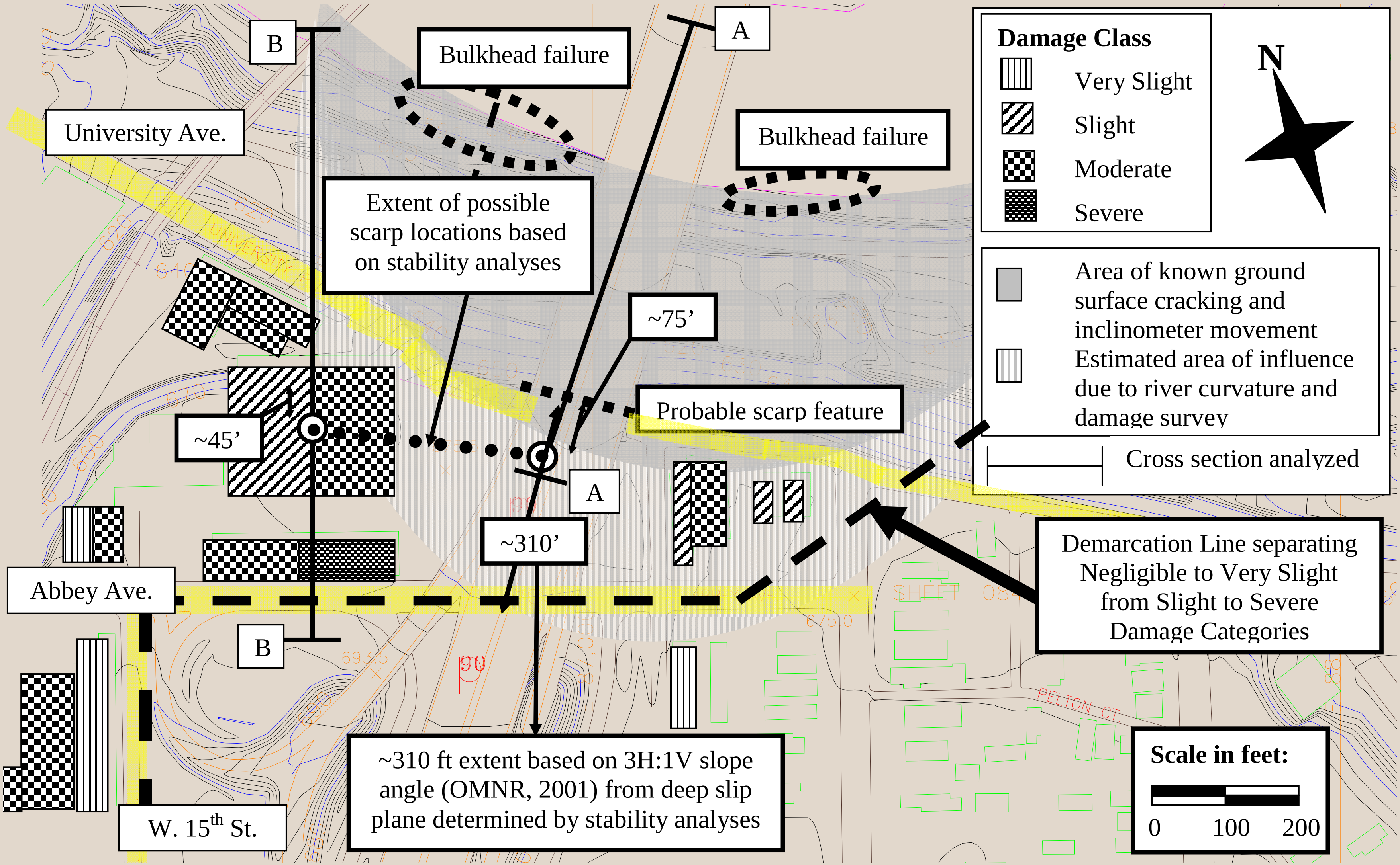
Plate 23: 1201 University Avenue (Sokolowski's University Inn), point 4. Photo is taken from inside looking at the north-west corner of the building. This photo illustrates settlement that occurred approximately 5 years ago. The maximum vertical displacement is at least 9-inches.

BBCM

3. I-90 Bridge - Behavior in Zone of Influence



3. I-90 Bridge – Results Summary



BBCM

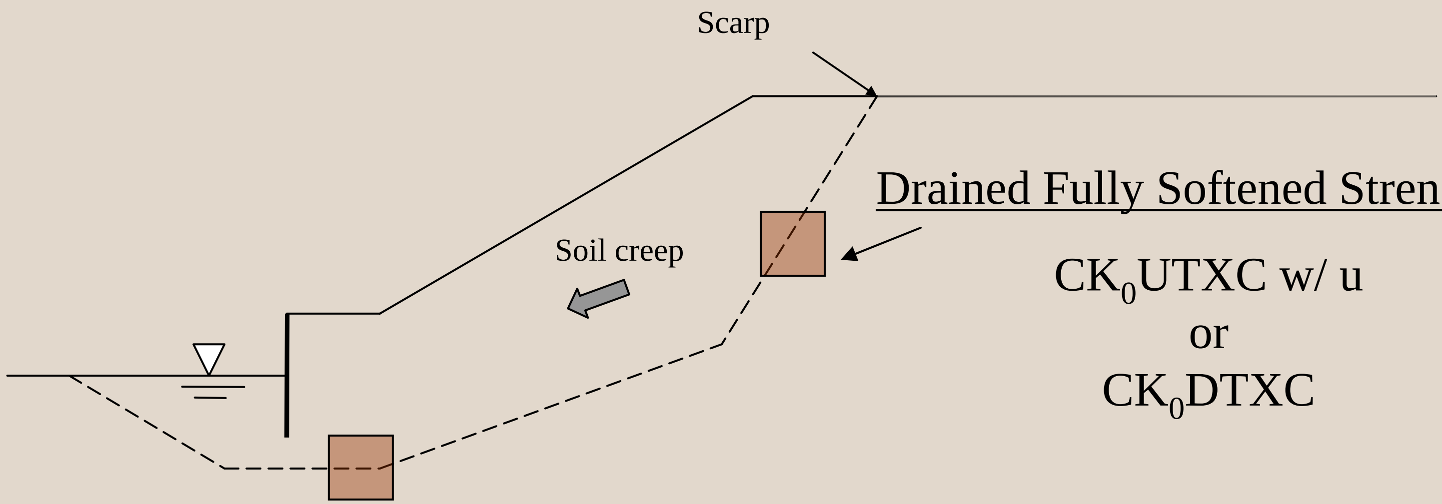
Conclusions from Geology

1) Deep river incision →steep bluffs;
2) Pre-sheared planes and creep;
3) Pre-sheared planes → residual strength conditions;
4) Fluvial deposits aggraded, which buried pre-sheared planes; and
5) Trapped natural gas pockets → locally high soil pore pressure → reduces shear strength → increases creep rate

Approach to Geotechnical Investigations

1) Field reconnaissance looking for signs of instability and creep movement;
2) Ideally, perform CPT testing prior to SPT to locate pre-sheared planes and profile pore pressure;
3) Perform continuous SPT sampling in the vicinity of the anticipated pre-sheared planes and look for slickensides;
4) Obtain 'undisturbed' samples (piston sampler) from pre-sheared plane(s);
5) Install inclinometers and piezometers based on CPT and SPT boring results;
6) Perform field monitoring for sufficient time necessary depending on the field conditions.
7) Test soil for fully softened (CUTXC, CUDSS) and residual strength (TRS); and,
8) Model slope stability with soil shear strength and at a minimum take into consideration mode of shear along the modeled failure plane.

Slope Model for Creeping Slope in Clay



Drained Fully Softened Strength

CK_0UTXC w/ u
or
CK_0DTXC

Drained Residual Strength

CK_0UDSS
or
Torsional Ring Shear

THANK YOU! – Questions?

Cuyahoga National Forest